

Seismic Processing Workshop

SPW™

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 **Parallel Geoscience Corporation**

About This Manual

This manual is organized into two sections. The first section is a user's manual for the SPW Flowchart application. The second section is a reference manual that describes each of the processing steps and associated parameters in the SPW Processing library.

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Introduction to SPW

Welcome to Seismic Processing Workshop (SPW). SPW is a seismic processing solution written by Parallel Geoscience Corporation. SPW was originally written for the Macintosh computer platform and has been redesigned and rewritten for the third time (version 3) using the Qt by Nokia cross platform framework. SPW is currently available and has been tested on the Windows 10, Windows 7, Windows Vista, Windows XP, Windows 2003 Server, and Windows 2008 HPC Server operating systems. Linux, and Macintosh OSX versions will be available sometime in 2014.

The SPW version 3 Flowchart has adopted a project model for data management. Flowchart allows you to create or select a project, build processing flows, set the parameters for the processing steps and display seismic data and maps. Another significant change in SPW is the use of SEG Y format as the default native format for processing data. A simple graphical user interface reduces the learning curve and accelerates your analysis and processing time

The SPW system is designed to be user expandable. Parallel Geoscience Corporation will release the programming API interfaces for the SPW Flowchart version 3 to all SPW users in 2014. Since Qt is available with an open source license, this will allow for easily adding customized processing algorithms and data formats to the SPW system.

This document is split into two main parts; the first gives an overview of the main features of the SPW Flowchart – that is the main dialog in which processing flows are built, seismic and other data are displayed and analyzed, picks are made and where “wizards” are accessed for velocity analysis. The second part of the document contains the help information for the processing steps that are built up to make flows.

Product Support

For solutions to questions about SPW, first look in this manual or consult the release notes file accompanying every software release. If you cannot find answers in the documentation, contact Parallel Geoscience Corporation via E-mail (support@parallelgeo.com), or for time critical issues by phone (+1.541.421.3127). The support email account is monitored daily by several people. It is the best way to get a response, since it is checked even when no one is in the office. Please be ready to provide the following information:

- Your name.
- Your company name.
- The SPW version you are using.
- The operating system you are using.
- The type of hardware you are using.
- What you were doing when the problem occurred.
- The exact wording of any error messages appearing on your screen.
- Any other pertinent data set information.

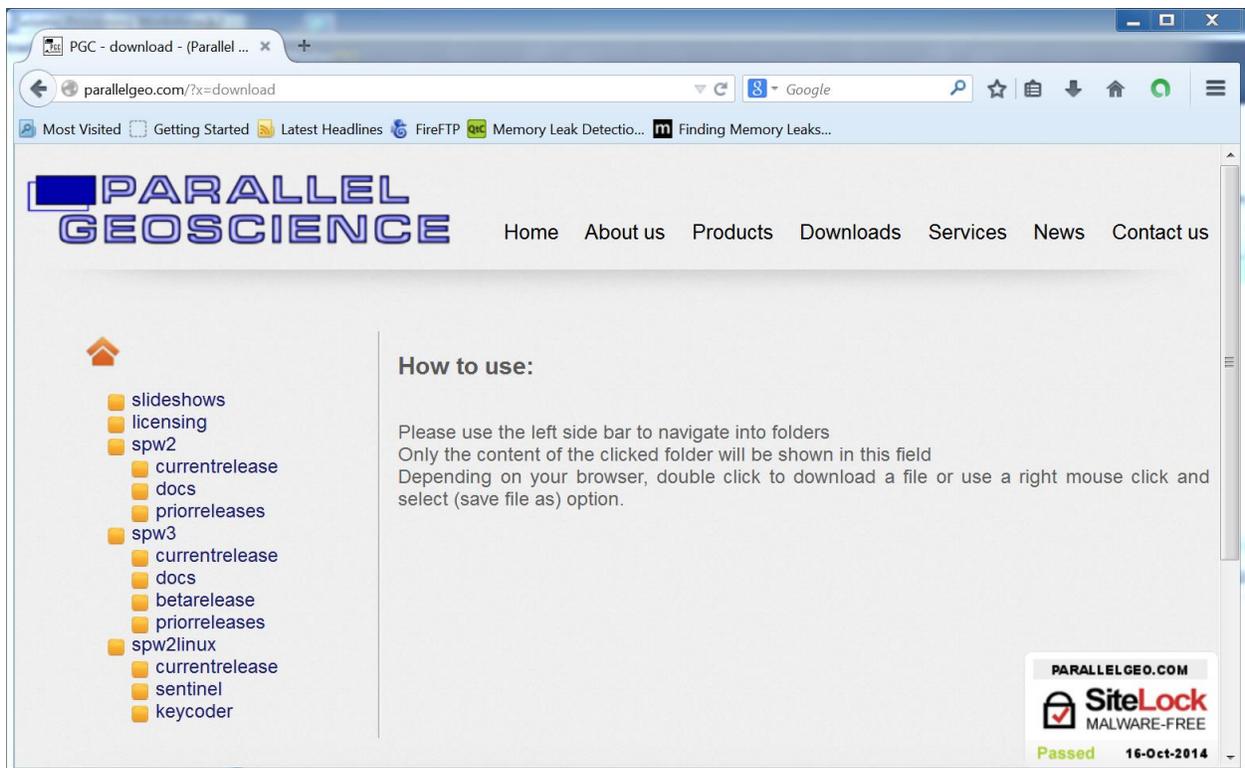
SPW Flowchart

SPW Installer Available Online

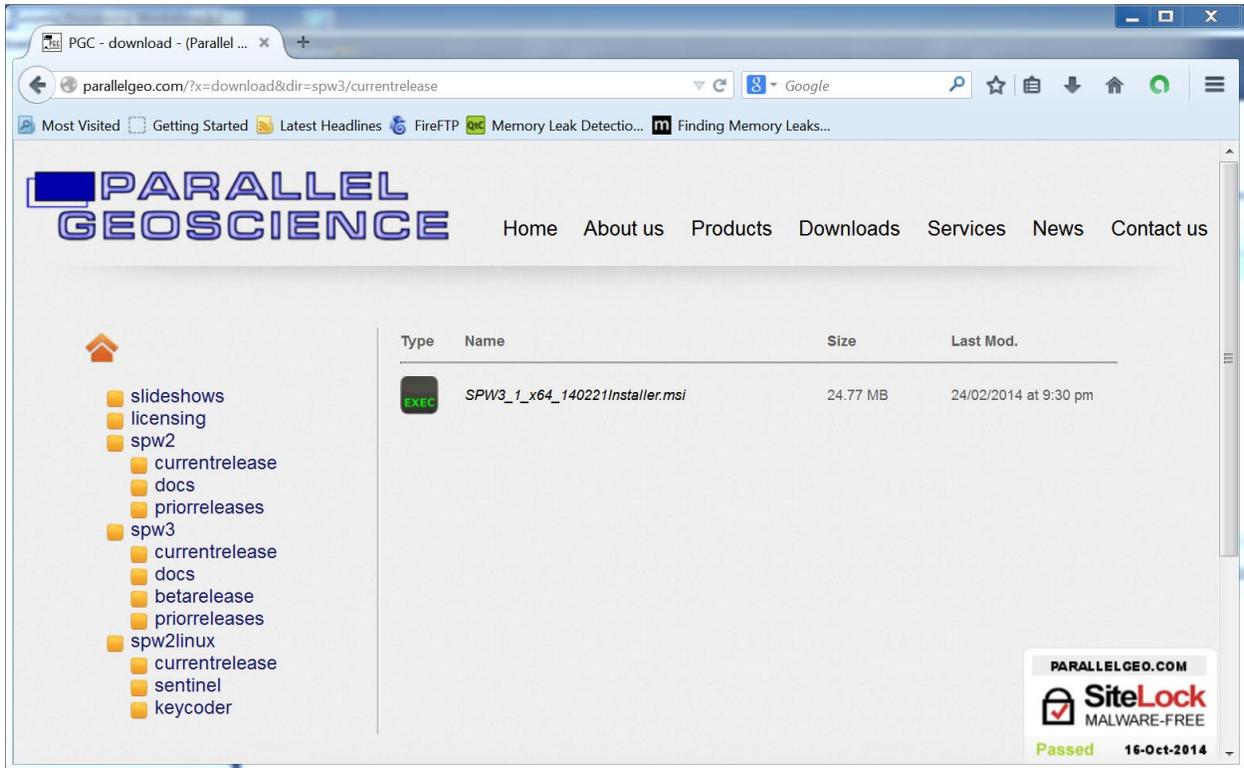
The SPW installer package (.msi) is available on the Parallel Geoscience web site. To access the web site, point your browser at:

www.parallelgeo.com

Select the Downloads tab and navigate to the SPW3 installer package either inside the currentrelease or betarelease directory.



You will see a directory listing as shown below.



SPW 3 Current Release Directory

Finally, download and save the SPW3 msi file to your computer.

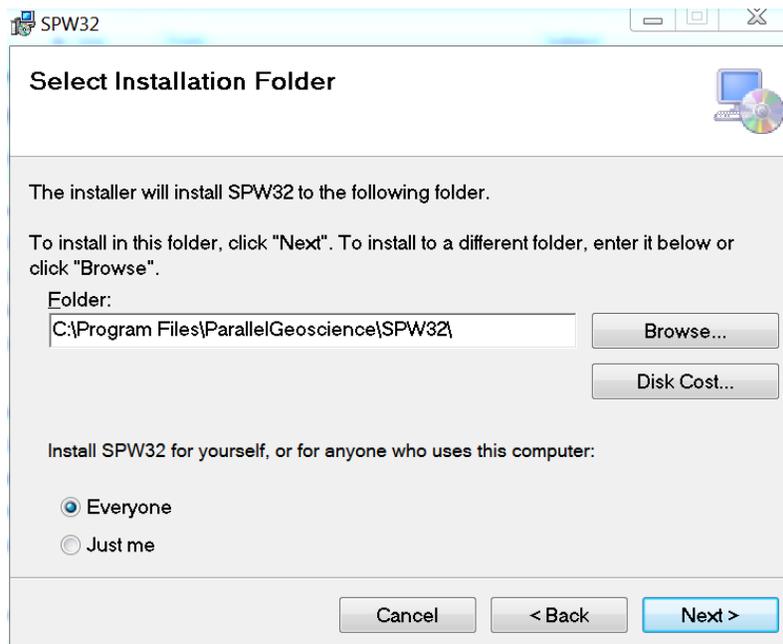
Installing SPW on Windows

Run the SPW installer package (.msi) that has been downloaded from our ftp site or delivered on CD-ROM or DVD-ROM. Please note that you must uninstall any previous version of SPW 3 before you can install a new version. Do so using the Windows control panel for applications.



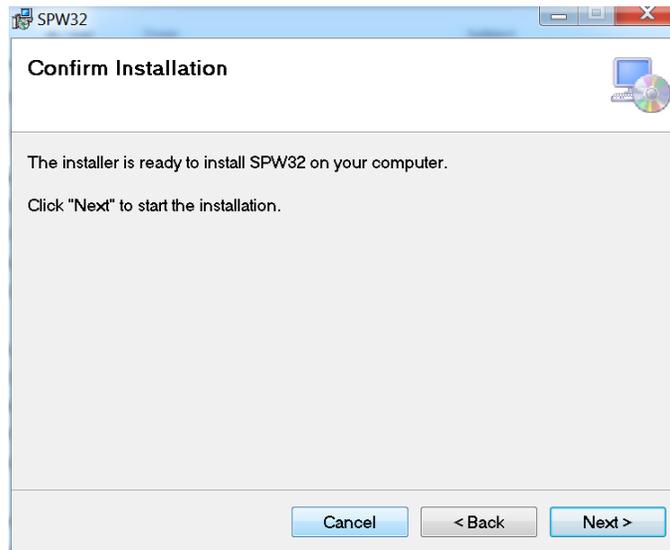
SPW Installer First Dialog

Click on the Next button then you will be prompted to select the installation directory.



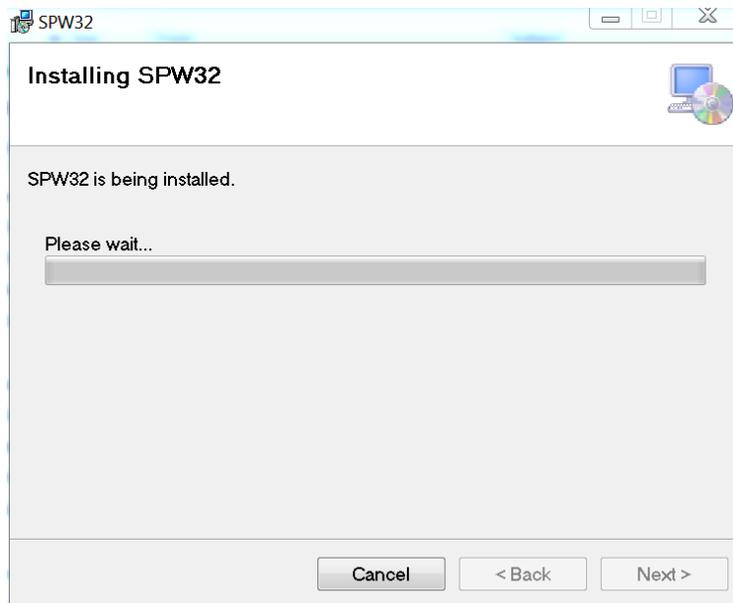
SPW Installation Directory

Click on the Next button then you will be prompted to confirm the installation.



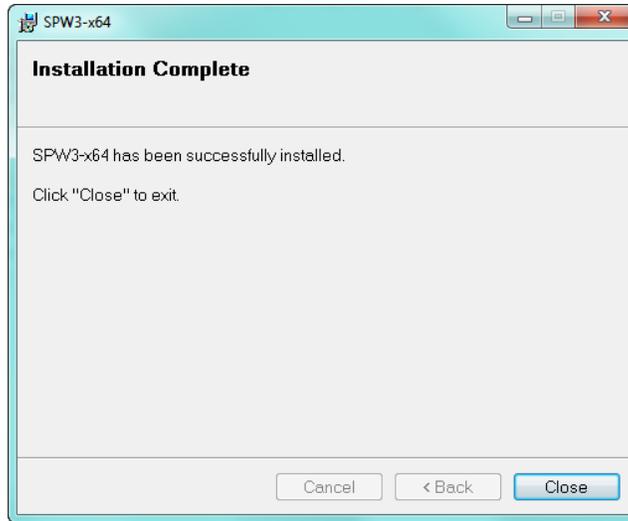
SPW Installation Confirmation

Click on the Next button then the installation will be performed and you will show the status of the installation.



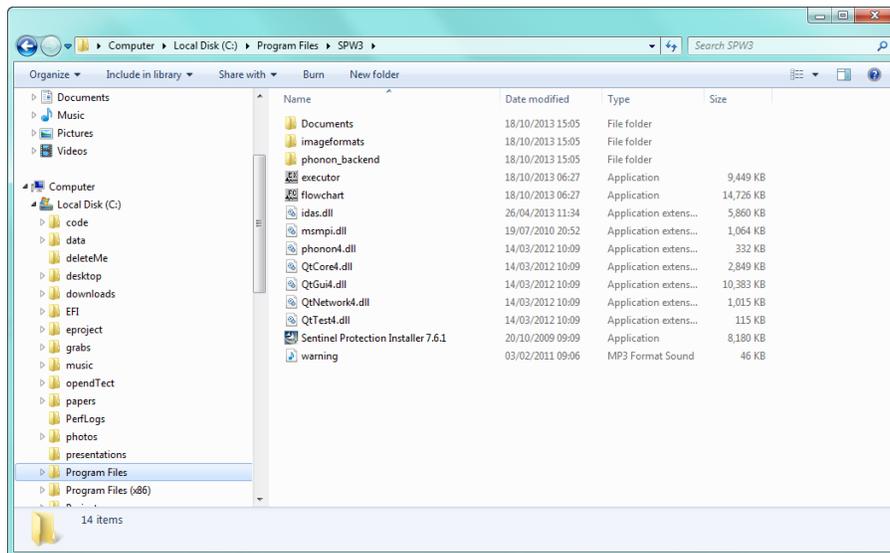
SPW Installation Status

Finally, the Installation Complete message will be shown. Now SPW is ready for use.



SPW Installation Complete

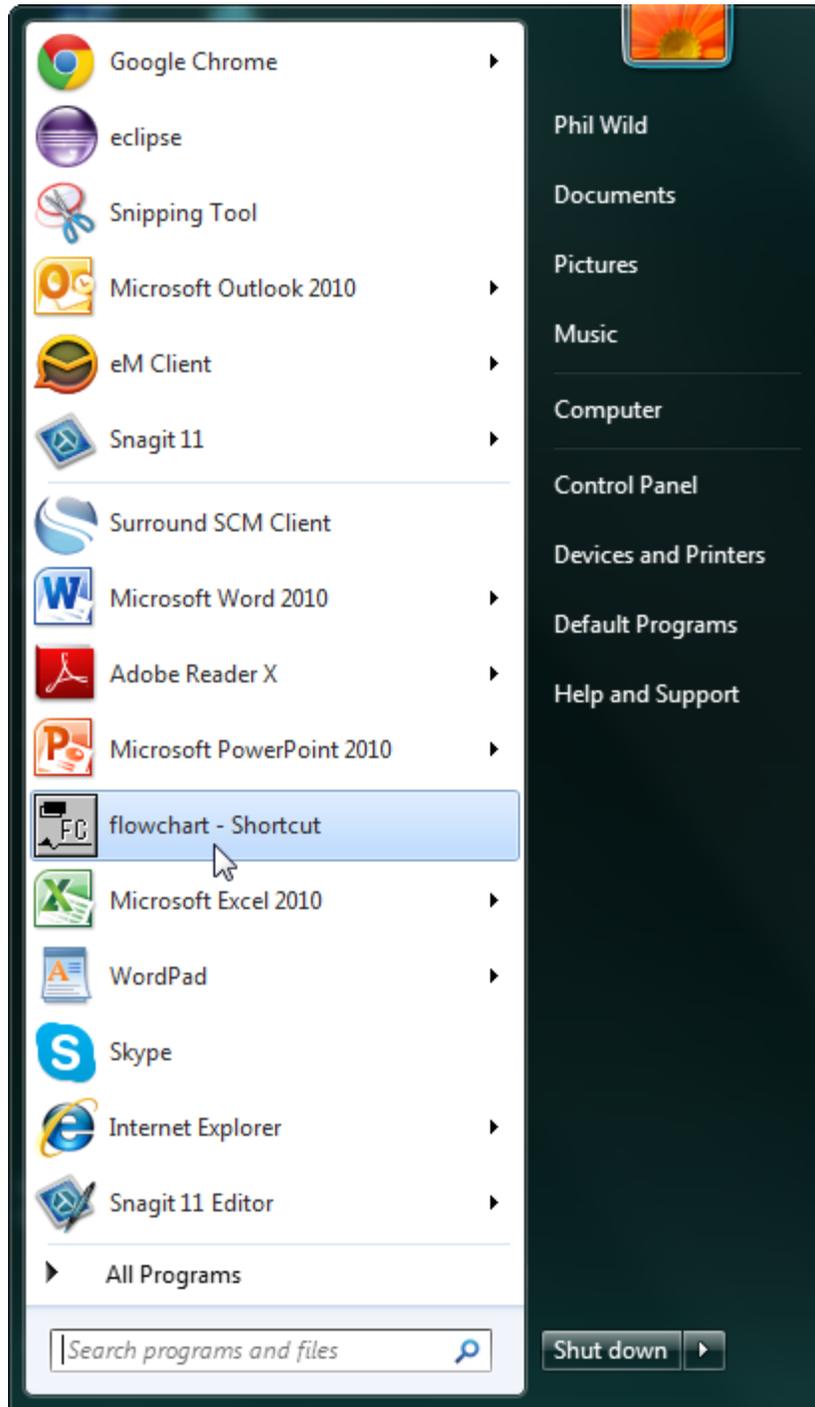
When the installation has finished, your SPW directory will be populated with the files and dll libraries required for running SPW.



SPW 3 Install Directory

If you do not have the Sentinel software driver installed on your system, please install it by running the Sentinel Protection Installer executable (.exe) in the SPW3 directory. This driver is required to recognize and access the Sentinel USB security key used for licensing of SPW.

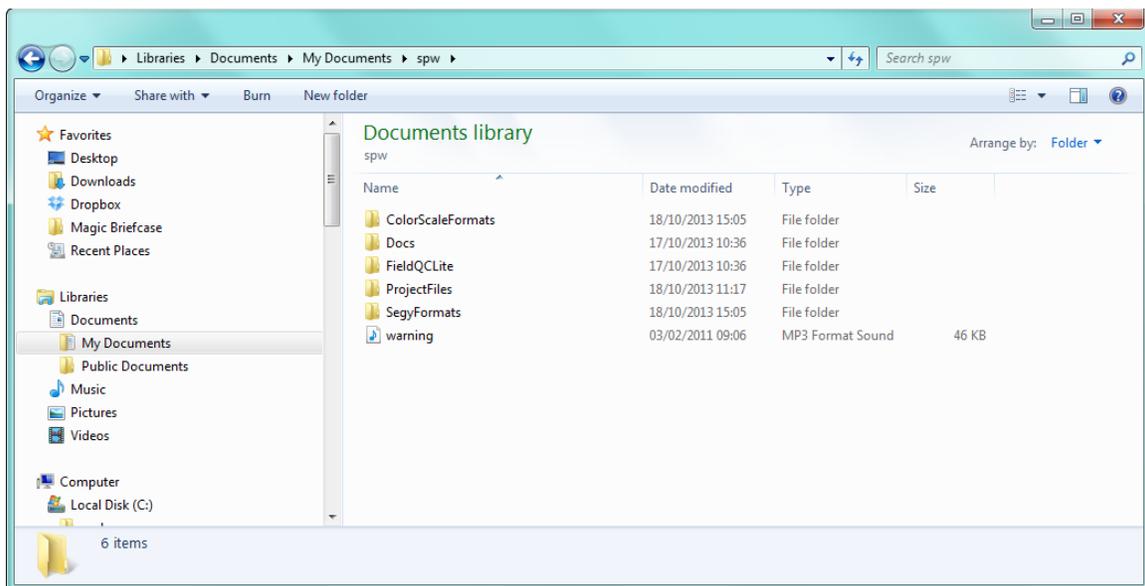
The SPW installation automatically creates a menu item to run Flowchart.exe.



Flowchart Menu Item

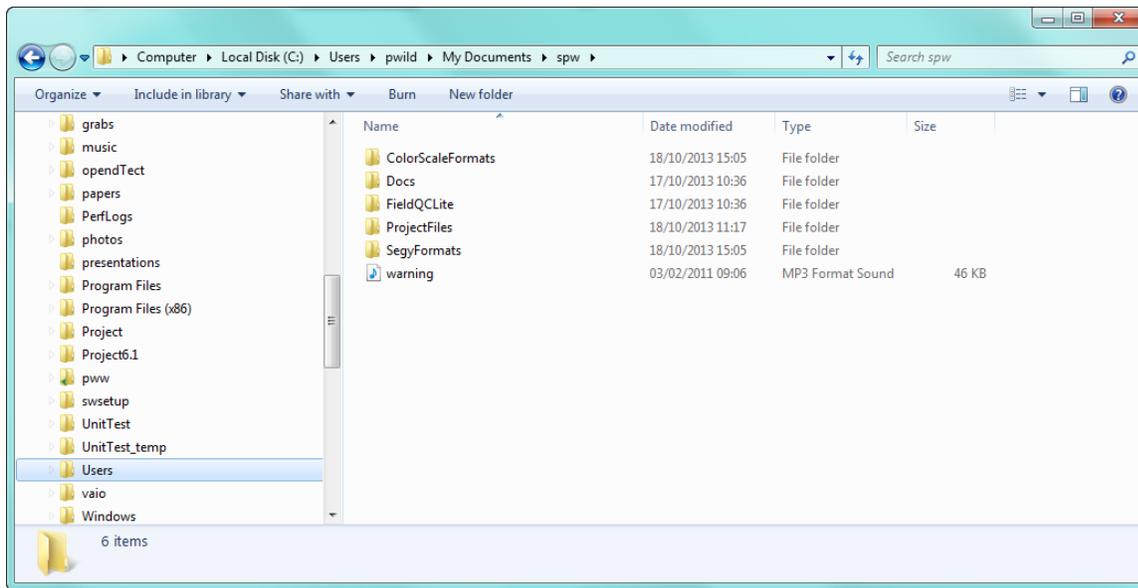
SPW User Directory

The first time the Flowchart application is executed after the installation, a number of directories and files are copied to the documents home directory on Windows. This location is different for each version of Windows and also is different depending on the operating system language. The images shown here are all for Windows 7 UK English version.



Files Installed into SPW Documents Home Directory

The files written into the .../SPW3/Documents/SPW3InstallBackupFiles are original backup copies of all the color scales, the online documentation, a SPW3 Project directory (more about projects later), a default SEG Y format definition file and a mp3 file that is played as a warning in several processing steps inside SPW3. When Flowchart.exe is executed, any of these files and directories that do not already exist in the user's home documents directory will be automatically copied to the users home documents directory.

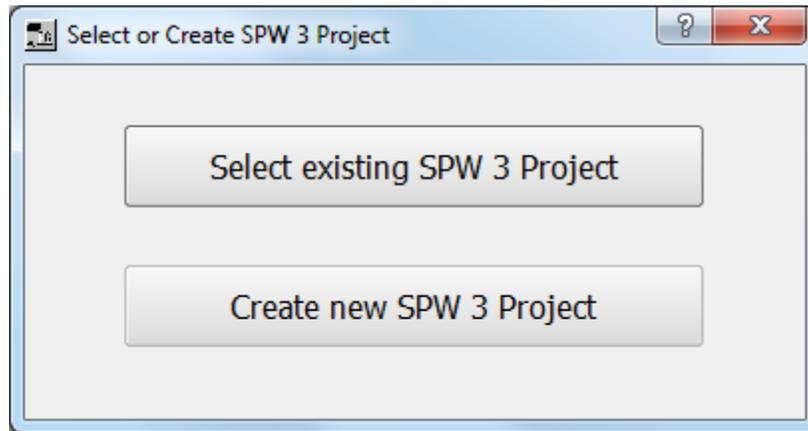


Files in the Users Home Directory (MyDocuments/spw)

If you have previously modified or edited any of the files or projects in a prior SPW 3 installation, these modified files in the home directory are retained and will not be overwritten during subsequent installations.

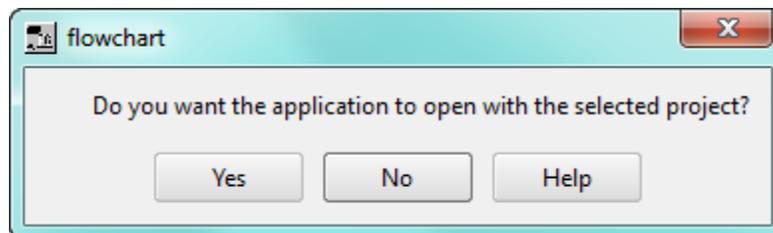
Creating or Selecting a Project

The Flowchart application requires you to either select an existing project or to create a new project when it is first started before you can start building processing flows and analyzing data.



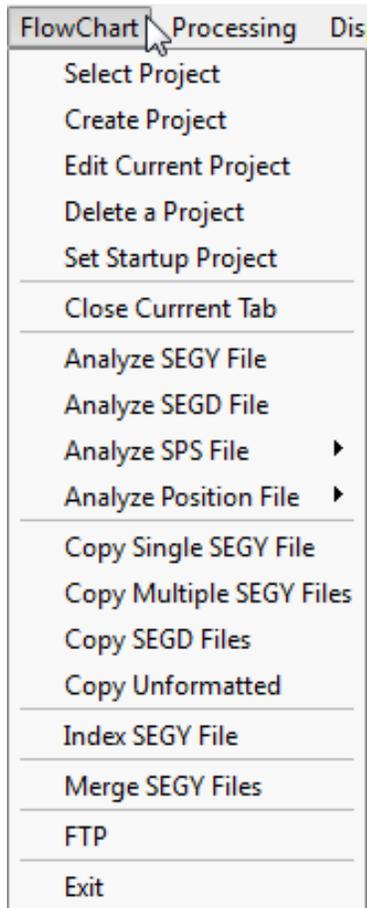
Flowchart Startup

After the first time you run Flowchart, there is usually a default project defined, which is automatically set at startup, and this dialog will not appear. Whenever you select a project or create a new project, you will be prompted, if you wish, to set this project as your default.



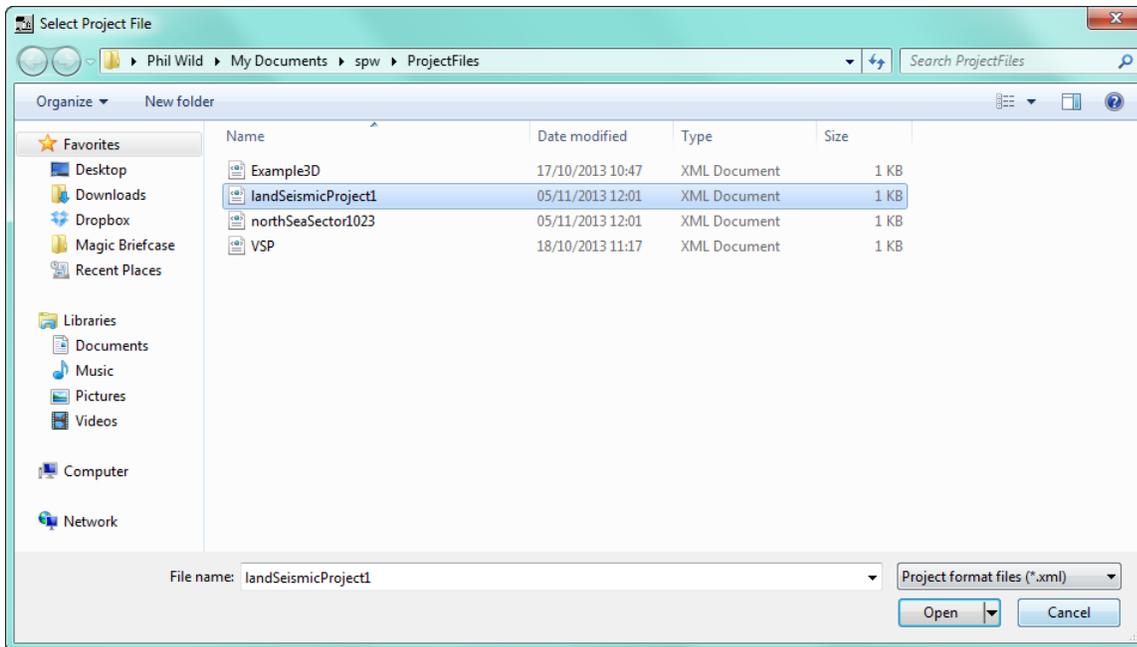
Set As Default

To change the current project or to create a new project, choose either the Select Project or the Create Project command from the FlowChart menu.



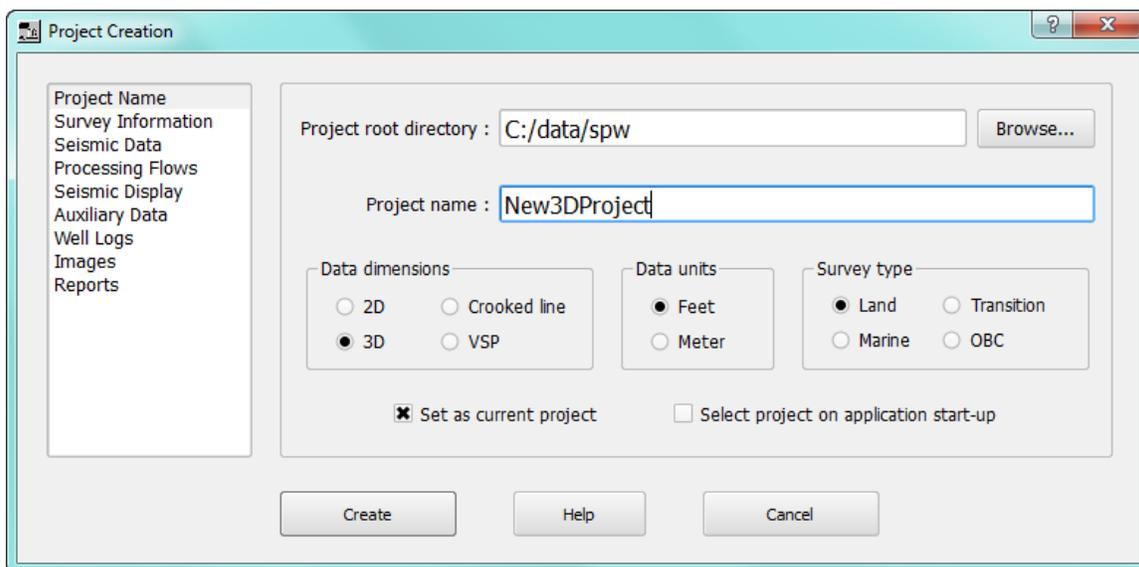
Select and Create Project Menu Commands

When you perform the Select Project command, a list of the project xml files available in your ProjectFiles directory will be shown. Select the project you wish to work on and Open the project.



Select Project XML File

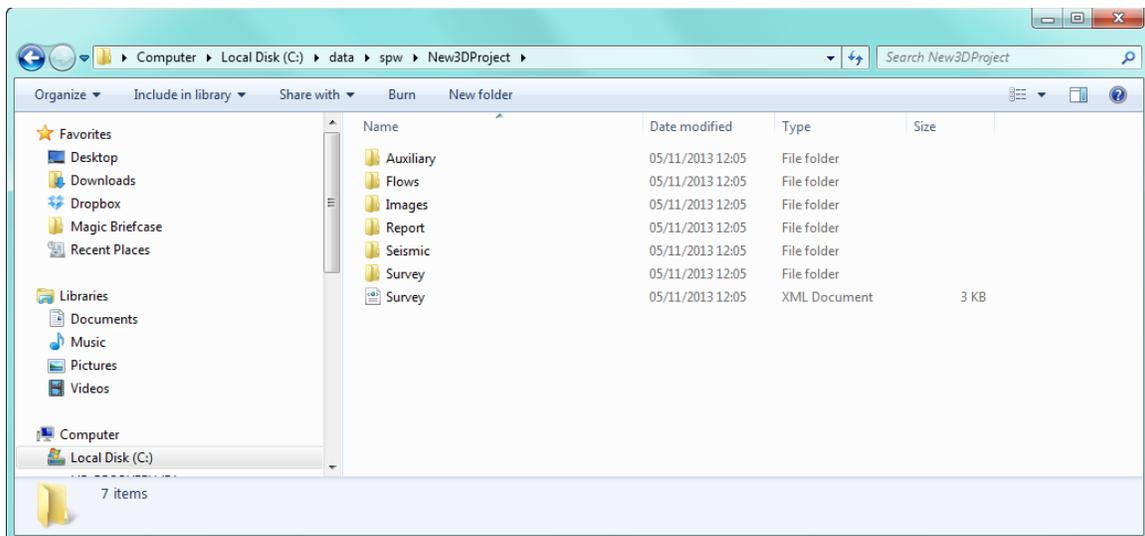
If you are starting in a new area or starting FlowChart for the first time, you will need to choose the Create Project command from the FlowChart menu. When you issue this command, the following dialog will appear. The main project directory (in this case New3DProject), will be created inside the selected project root directory. The project root directory can be any mounted disk on your system including networked disk drives.



Create Project Dialog

It is important the Data dimensions, Units and Survey type are entered correctly since these affect how further options are presented and how some of the data functions operate. Data units must be specified as either feet or meters; there is no mixing of these units in SPW. These project settings can be updated later using the Edit Project option.

The Create Project feature builds the directory structure shown below:



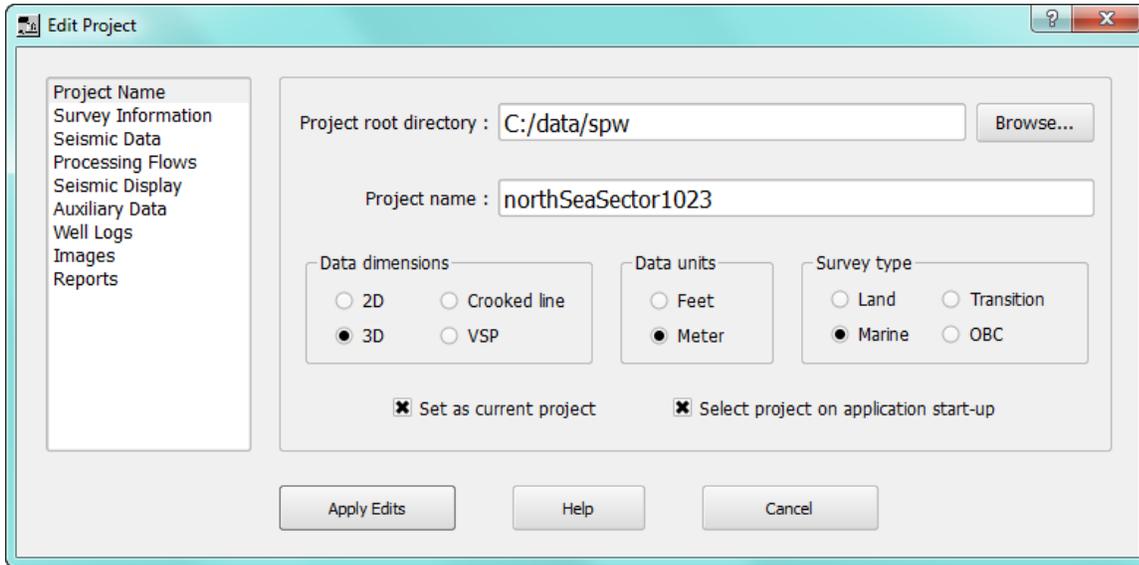
Project Directory Structure

The directories are used to store project files, data, etc.,

- Auxiliary – velocity file, statics files, etc.,
- Flows – flowcharts,
- Images – any output image files (jpg, png, bmp, gif, etc.).
- Report – reports output by the analysis processing steps,
- Seismic – output seismic data files generated during processing are automatically stored here. The corresponding output data index files are stored here too.
- Seismic.FieldData – place input field data files (SEG Y, SEG D, SEG 2, etc.) here. The corresponding field data index files are stored here too.
- Survey – SPS or UKOOA files are placed here so that the project can recognize them and to be able to generate basemaps which are also placed here. Usually, the SPS files have

extensions of .sps for Source Survey files, an extension of .rps for Receiver Survey files and an extension of .xps for the Cross-reference (observers' notes) files. Corresponding survey data index files are stored here too.

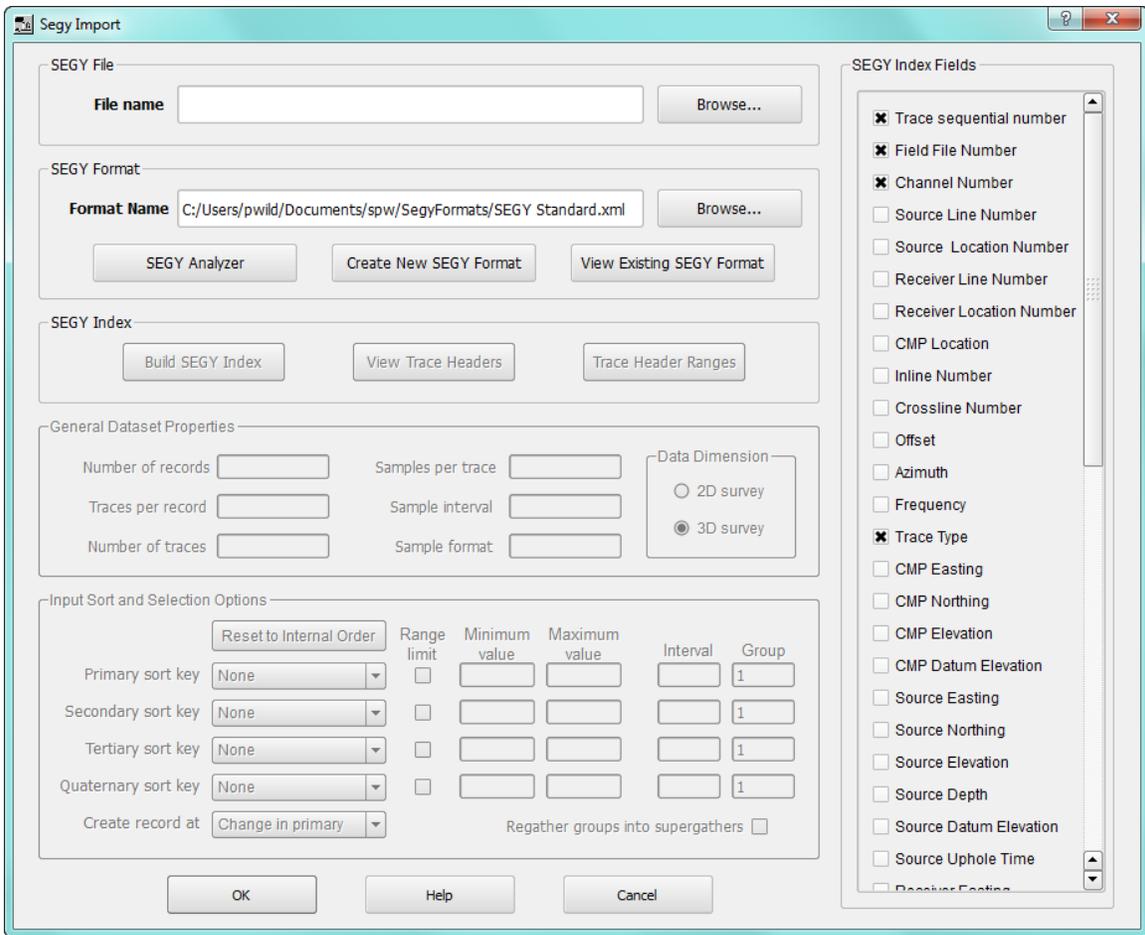
The Edit Project command allows you to easily move projects. As an example, if you have built a project on a portable disk and then mount the disk again but it is a different drive letter, you can edit the project settings and define the new project root directory. All references to files in the project directories are relative to the root directory path.



Edit Project Dialog

SEG Y Processing Format

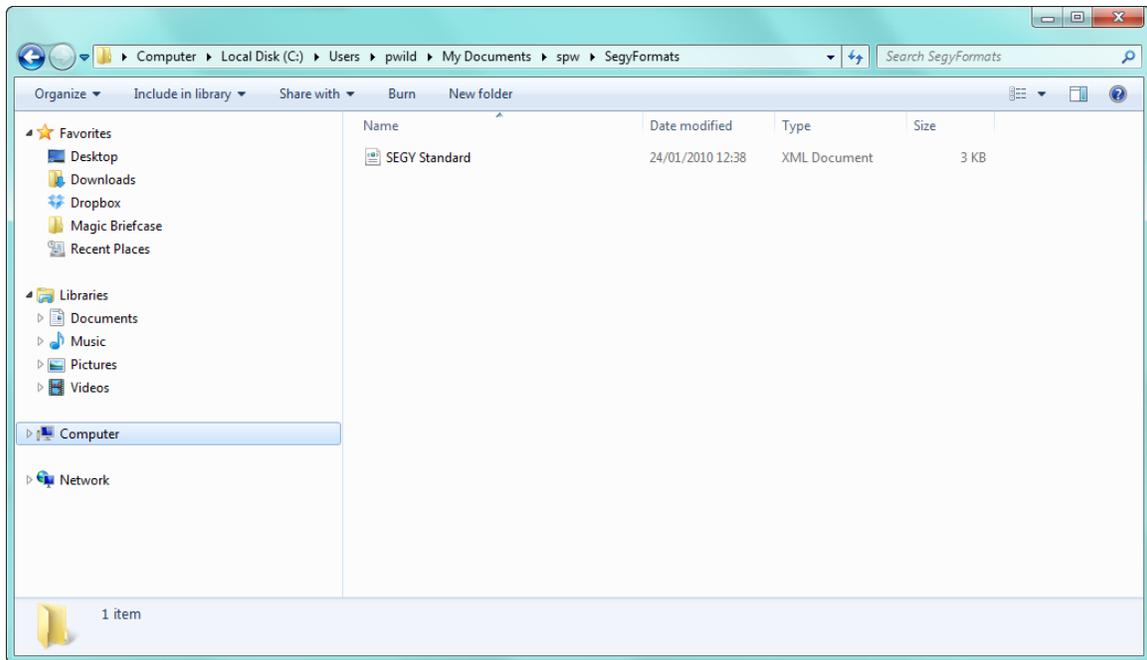
SPW uses the SEG Y format as its internal processing file format. Of course data may be read in from other formats, such as SEG 2 and SEG D, but the internal files used in the processing are SEG Y. SEG Y files may be input directly from recording systems or from other seismic software and SEG Y files written by SPW may be read directly by other software such as interpretation packages which use SEG Y. By default, the SEG Y Standard format file delivered as part of the SPW installation is used for decoding the SEG Y files. You can select any SEG Y format file existing in the SegyFormats or you can build a customized format file to read non-standard SEG Y files.



SEG Y Import Dialog – available from the SEG Y Import processing step.

An index file is created for each SEG Y file used in SPW. These files contain important information used in the processing and are required to be present for processing and displays. If they are not present, they will be created by the processing or you may create them by using the Build Index command in the SEG Y Import parameter dialog. Note that the Sorting keys must be set to valid header fields before you press the Build SEG Y Index button and build the index file.

The SEG Y file format is defined by mappings of the SEG Y binary and trace header positions and these are saved in XML file format. A default prebuilt SEG Y format definition files is delivered with SPW (others are available via the Parallel Geoscience web site (www.parallelgeo.com)).



SegyFormats Directory

You can create new format definitions by modifying existing file using the Create format file command in the SEG Y Analyzer or using the Create New SEG Y Format command in the SEG Y Import dialog:

SEG Y Format Viewer

Format name

Format description

Add to format list Set as default format

Endian order

Get from data Big endian
 Little endian

Text header

Header size in bytes

Text format EBCDIC ASCII

Binary header

Header size in bytes

	Start byte	Data type	Override	Value
Samples interval	<input type="text" value="0"/>	1-byte int	<input type="checkbox"/>	0.0000
Samples per trace	<input type="text" value="0"/>	1-byte int	<input type="checkbox"/>	0
Sample format	<input type="text" value="0"/>	1-byte int	<input type="checkbox"/>	IBM Float

Trace header

Header size in bytes

Header name	Start byte	Data type	Read
Field File Number	<input type="text" value="0"/>		<input type="checkbox"/>
Channel Number	<input type="text" value="0"/>		<input type="checkbox"/>
CMP	<input type="text" value="0"/>		<input type="checkbox"/>
Inline	<input type="text" value="0"/>		<input type="checkbox"/>
Crossline	<input type="text" value="0"/>		<input type="checkbox"/>
Offset	<input type="text" value="0"/>		<input type="checkbox"/>

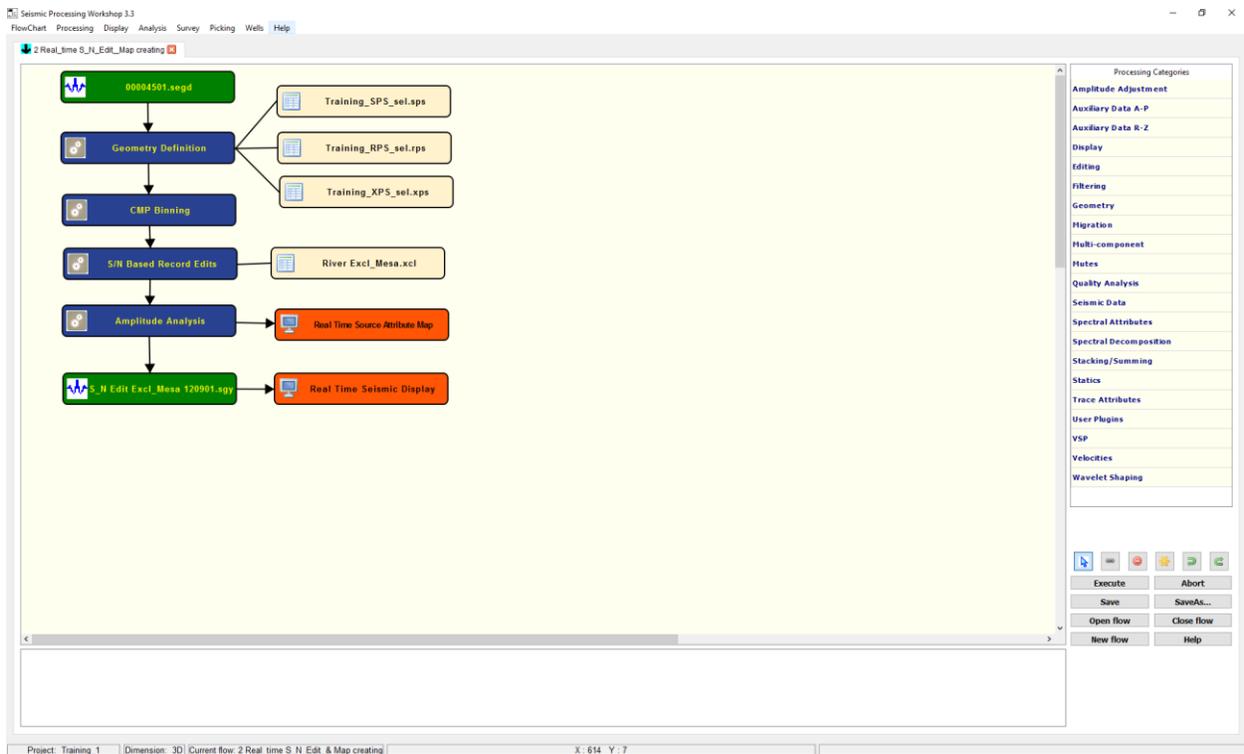
Open Format **Save Format**

OK **Cancel**

Create SEG Y Format Dialog

Main Flowchart Window

The SPW FlowChart application allows you to build processing sequences commonly referred to as flows, set the parameters for processing steps, run the flows you have created, and create displays of maps and seismic data. The FlowChart application is a tabbed interface where multiple processing flows, seismic displays and map displays may be open at the same time. The FlowChart graphical user interface simplifies the process of building a processing flow to a few mouse clicks.

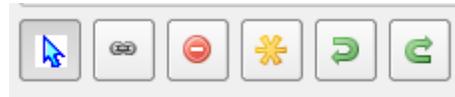


FlowChart User Interface

Tool Bar

The Tool Bar contains tools for controlling the building and selecting of flowchart items. The function of the tools from left to right are – Select, Link, Delete, Select All, Undo, Redo. Clicking on a tool will change the interface mode, enabling you to use that tool. The tab key allows you to quickly switch between Select and Link. The selection and linking tools are used in building a

processing flow and Delete allows for deleting either flow items or flow links from a processing flow.



Tool Bar



Selection Tool – can select either a processing step or the link between the processing steps. When selected, the Selection Tool button will appear depressed and the step or link can be selected by clicking the left mouse button with the pointer over the item to be selected. Selected items then appear highlighted. Multiple items can be selected by clicking with the left mouse button and then dragging the pointer – this is illustrated in the flow shown below where the Apply Normal Moveout, Automatic Gain Control and the Apply Early Mute items have been selected along with two pick files that apply to selected processing steps.



Linking Tool – allows you to define the data flow between items on the flowchart. When selected, the Linking Tool button will appear depressed. To link between two steps, click in the first step and then click in the second step. You may switch between the Selection and Linking tools by either clicking on the icons on the Tool Bar or by pressing the Tab key on the keyboard.



Delete Tool –removes selected items or links from the flowchart. Once selected, you can remove an item or a link by either clicking on the Delete Tool on the tool bar or by pressing the delete key on the keyboard. On many Windows keyboards the backspace key is defined as the delete key. If your delete key does not work then try the backspace key instead. Note: all selected items will be deleted.



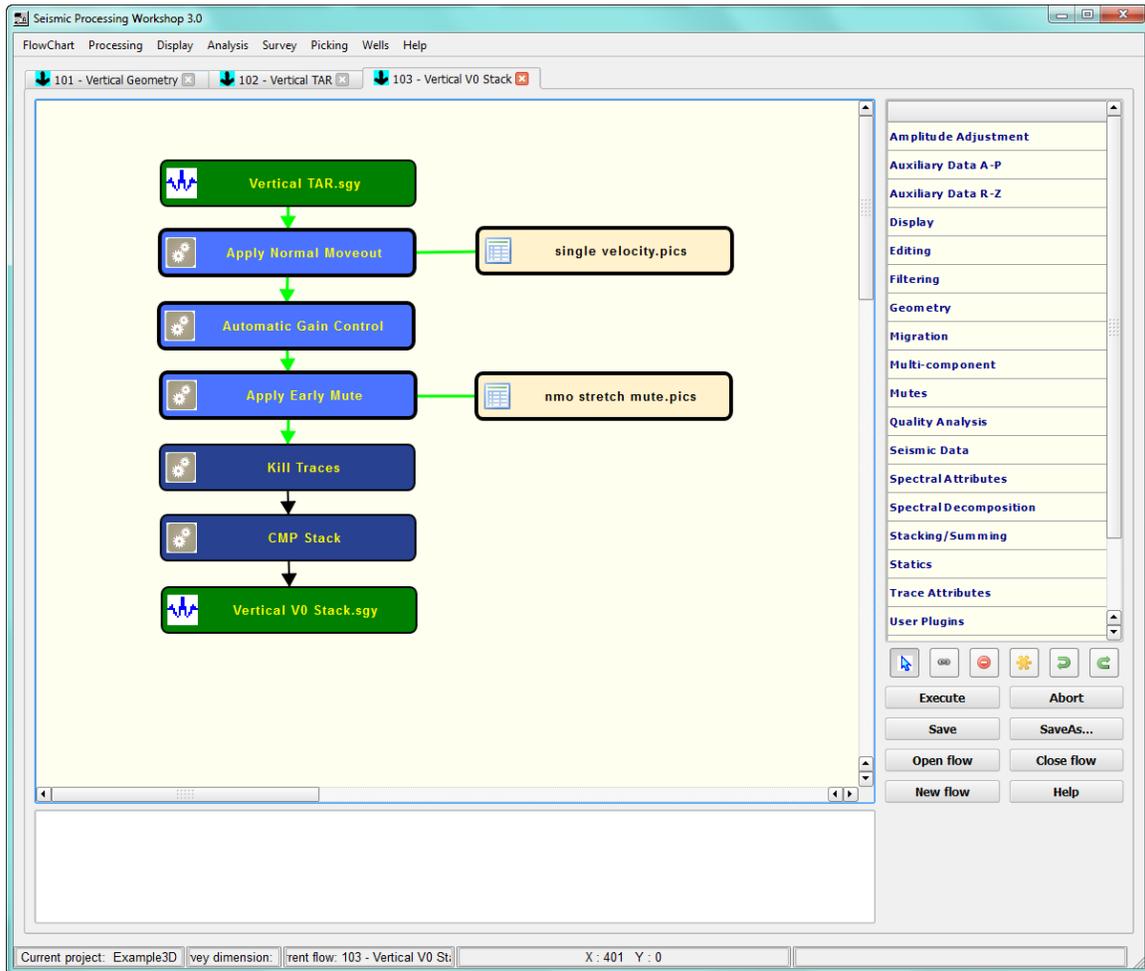
Select All – selects all items on the flowchart; all items will be selected and highlighted; the links will become bright green, and the flow items will be enclosed by a dark black box and shown in light blue, the auxiliary data items will also be enclosed by dark black box.



Undo – *Not Implemented.*



Redo – *Not Implemented.*

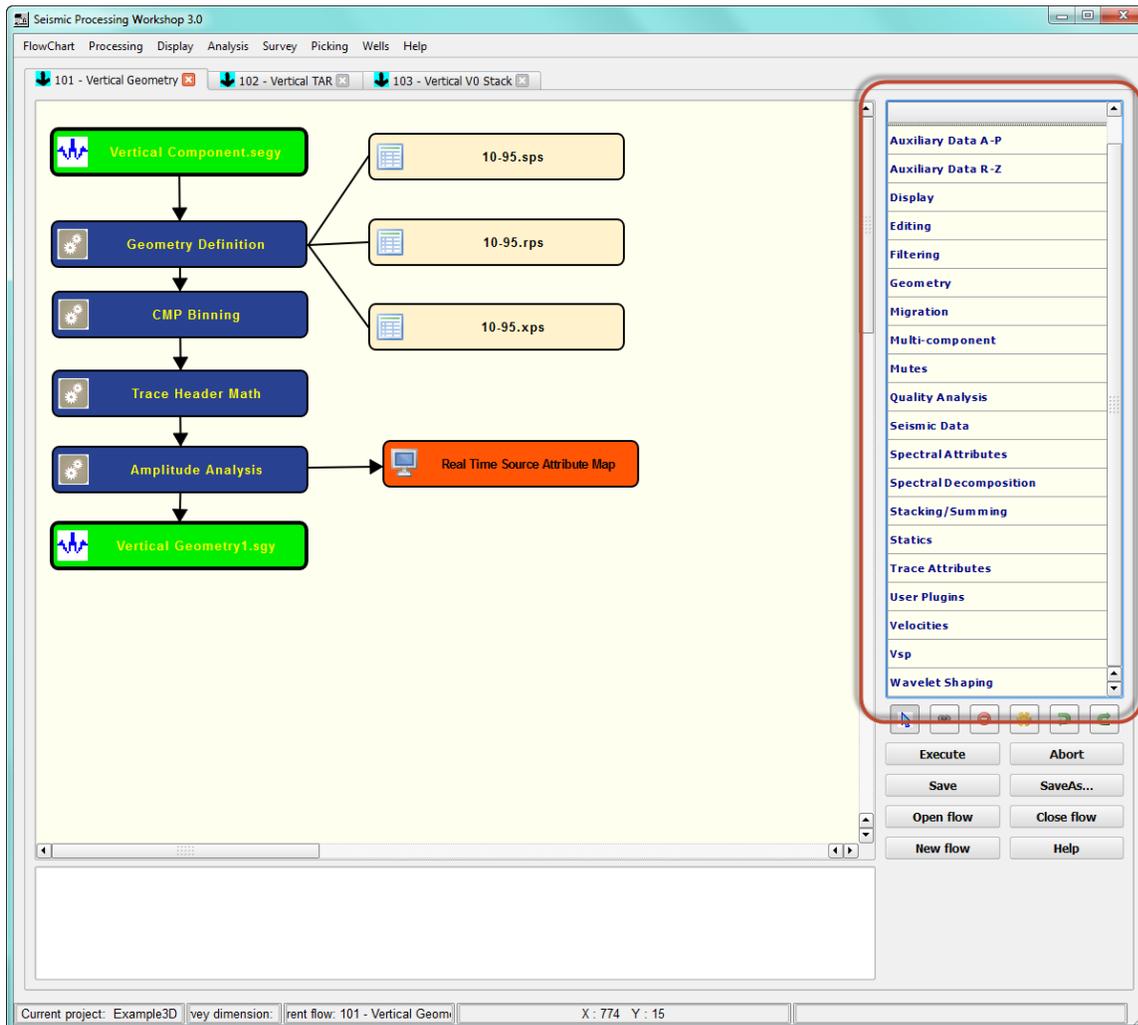


Selecting Items and Links

Once selected, you can remove an item or a link by either clicking on the Delete Tool on the tool bar or by pressing the delete key on the keyboard. On many Windows keyboards the backspace key is defined as the Delete. If your Delete key does not work then try the Backspace key instead. Note: all selected items will be deleted.

Processing Categories

The Processing Categories on the right side of the flowchart window (enclosed within the red rectangle) contains the categories of processing steps available in SPW.

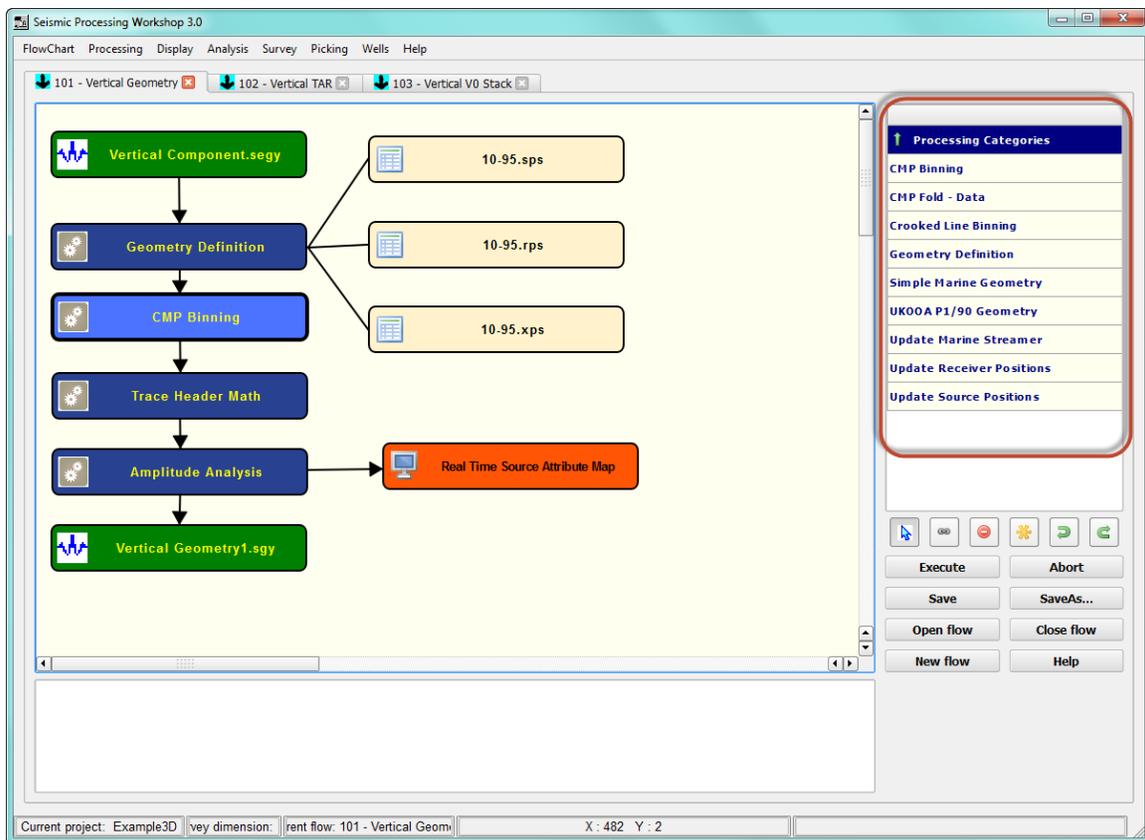


The Processing Categories

When you click on a button in the Processing Categories, such as Geometry, the list of processing steps in that category will appear in place of the Processing Categories list. To navigate back to the Processing Categories list, simply click on the Processing Categories button containing an up arrow at the top of the Processing List.

Processing Steps Lists

When you click on the desired processing step button, it will appear highlighted in light blue as shown below. To place the item on the flowchart, select it with a single mouse click, and then click on the flowchart where you wish to place the item. You may also double mouse click on the item in the processing step list and it will be placed below the last item you selected on the flowchart. The item may then be dragged on the flowchart to correctly position it into your processing sequence.

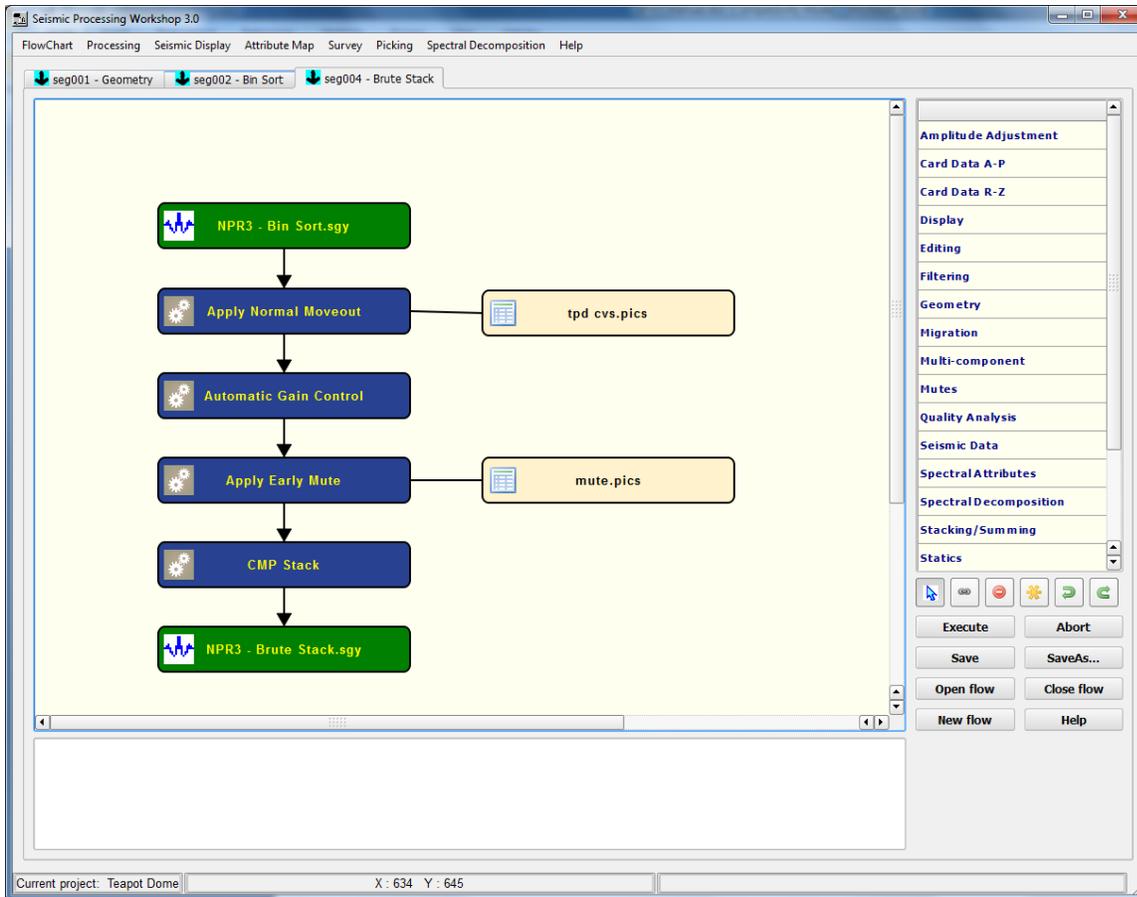


Processing Step List

Building Processing Flows

To build a flow, start by selecting the steps you wish to use in the processing step lists and placing them on your flowchart. Next, using the Link Tool, connect each item in the flow as you wish for the data to move through the processing sequence. The process for using the Link Tool involves

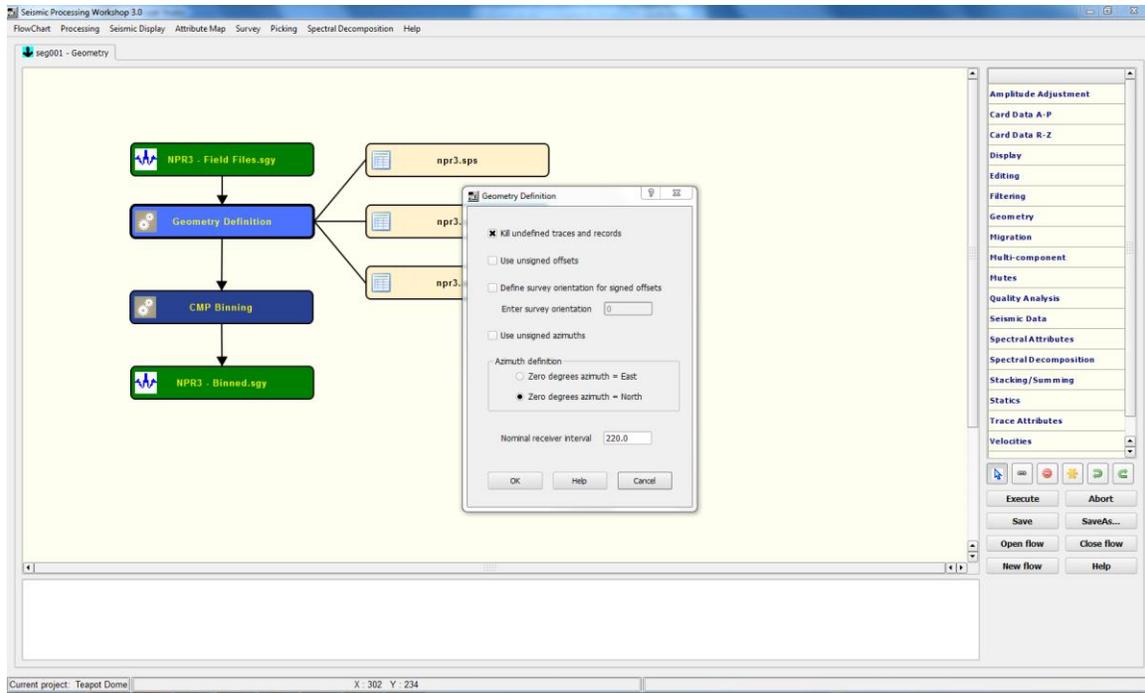
two steps: after selecting the Link Tool by clicking on it, click once on the point of origin, then click once on the destination, and the arrow will appear.



Example Processing Flow in the Main FlowChart Window

Setting Processing Step and Data Step Parameters

To set the parameters for a processing step, double left click on the step itself. This will display the dialog for setting the processing step parameters. Each dialog contains the parameters specific to that step. These parameters are set using numeric data entry fields, radio button controls, check boxes and drop down list boxes.



Step Parameter Dialog

Running a Flow

To run a flow, first select one of the steps in the flow (or press the “select all” button ) , and then press the Execute button. A check is then made to ensure that the flow is correctly set up (e.g. that any step requiring input or output files has these set and that the links between flows are in place) before the flow is saved and then executed.

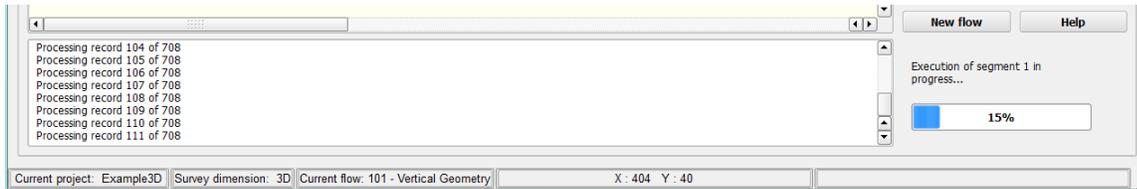
Flows can be terminated by pressing the Abort button (or the End Job button).

Flows can also be saved before they are executed by pressing the Save button.

Console Display

The Console Display, at the bottom of the flowchart, shows the messages from the execution of your flows. The first messages will show the list of processing steps being executed, followed by

any output warnings and the status while the processing steps are executed. Critical messages may be highlighted in red in the console window.

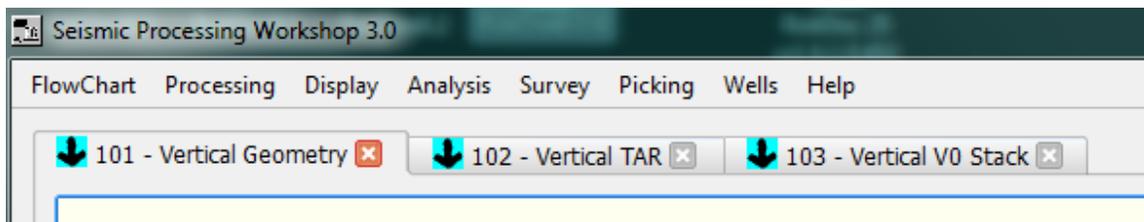


The FlowChart Console Display

Menu Items

The SPW application menu bar contains the following sub menus:

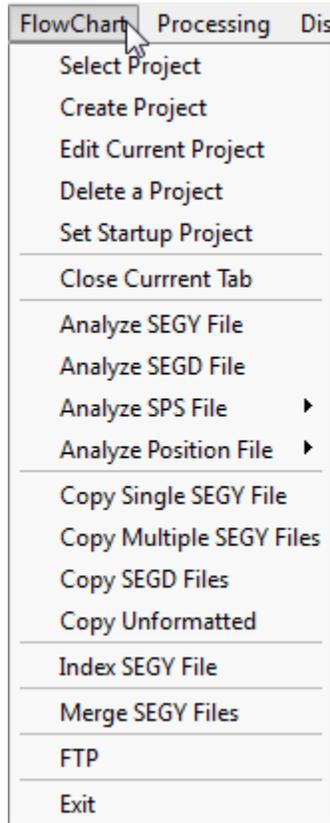
- FlowChart
- Processing
- Display
- Analysis
- Survey
- Picking
- Wells
- Help



SPW Menu

FlowChart Menu

The FlowChart menu shown below has a number of tools available for project management.



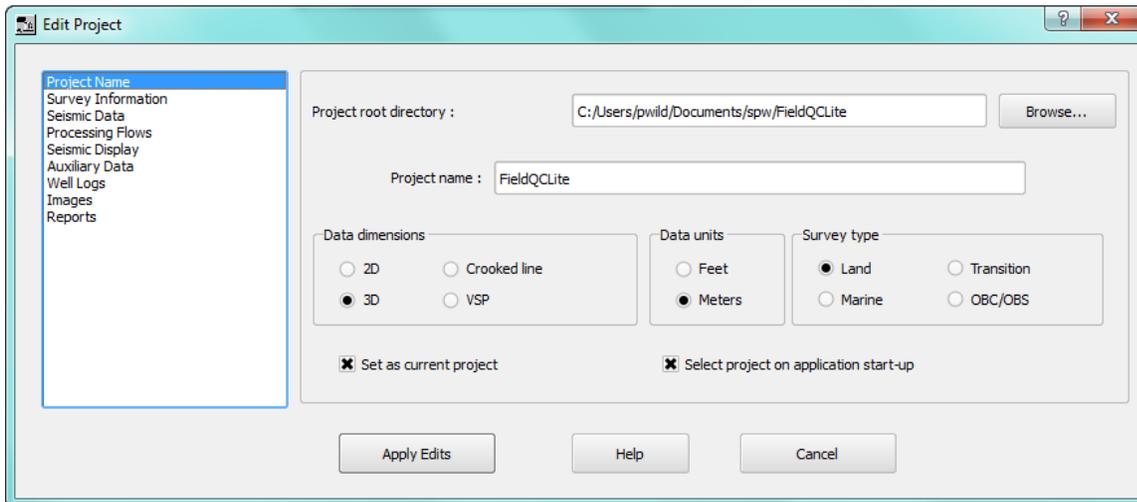
FlowChart Menu

The Select Project and Create Project commands let you select an existing project or create a new project. The Edit Current Project command allows you to edit the currently selected project, whereas Delete a Project will open a file selector from where a selected project can be deleted. The Set startup project defines the default project to be used when the application launches. Close Current Tab will close the active tab in the interface.

The remaining Flow Chart menu items are discussed below.

Edit Current Project

The Edit Current Project option is available which can be selected and which will open the “Edit Project” dialog. Usually, the project will have been configured and this option shouldn’t be needed, but it can be used to set up items such as the directory of the FieldQCLite project and the project’s depth and distance units.

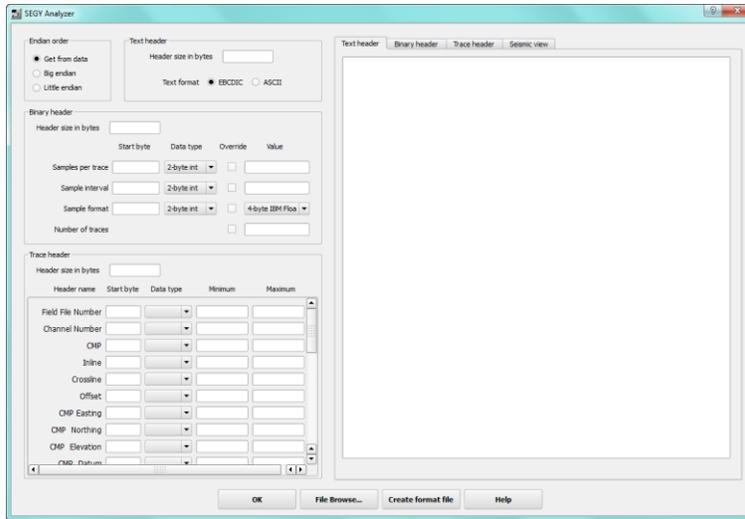


The Edit Project Dialog

On the left of the Edit Project dialog are several different options – click on these (e.g. Survey Information) to change the parameters that can be configured.

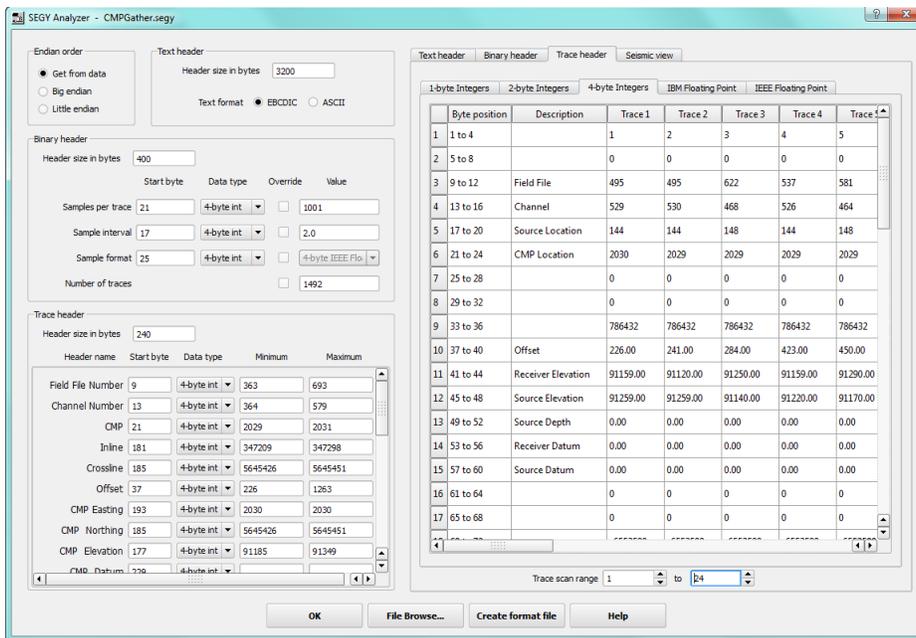
SEG Y Analyzer

The SEG Y Analyzer allows you to quickly and efficiently open and investigate a SEG Y format file.



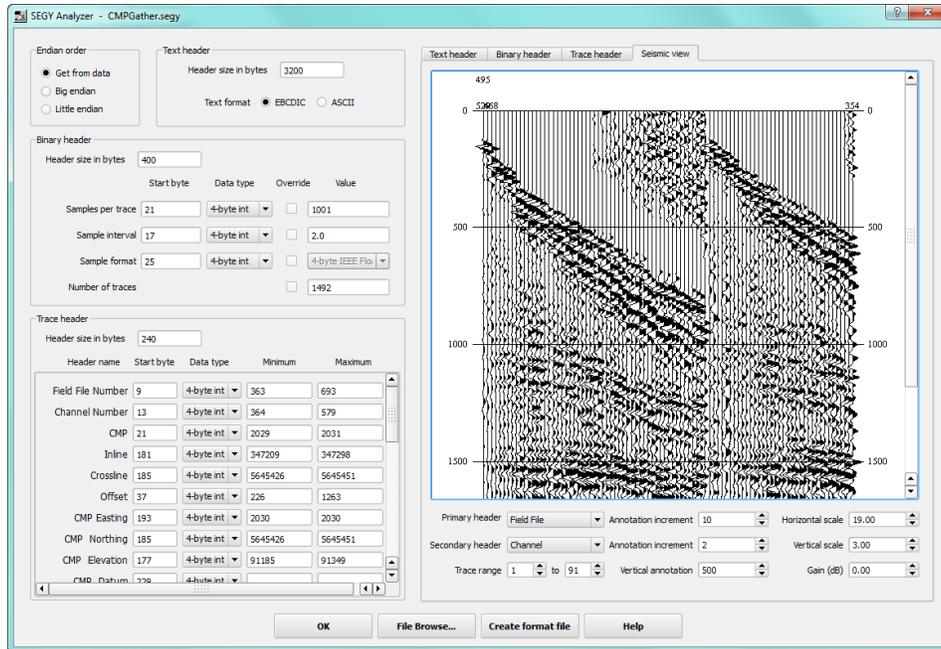
SEG Y Analyzer

After you use the File Browse to select a file, then the Analyzer entries are populated with the information retrieved from the dataset.



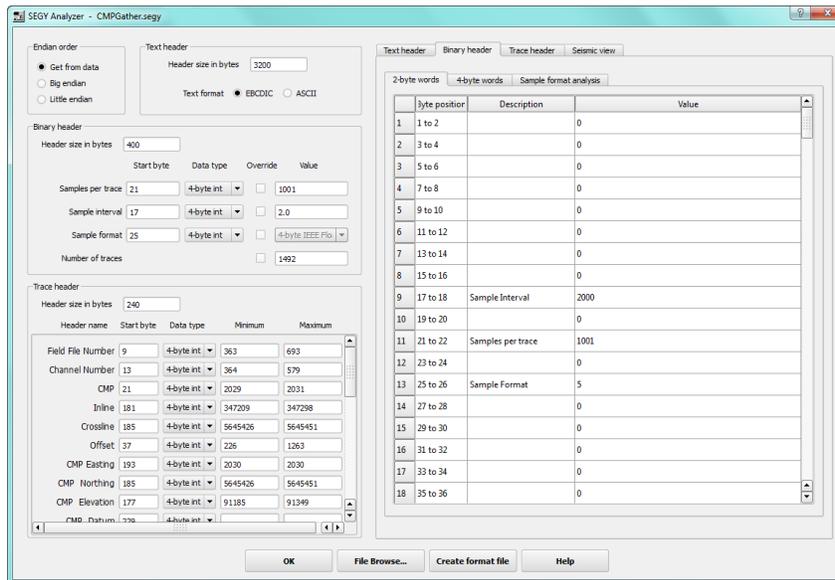
SEG Y Analyzer – Trace Headers tab

Using the tabs in the dialog, you can display the SEG Y text header (also referred to as the EBCDIC header), the binary header, multiple selected trace headers or a display of the seismic traces.



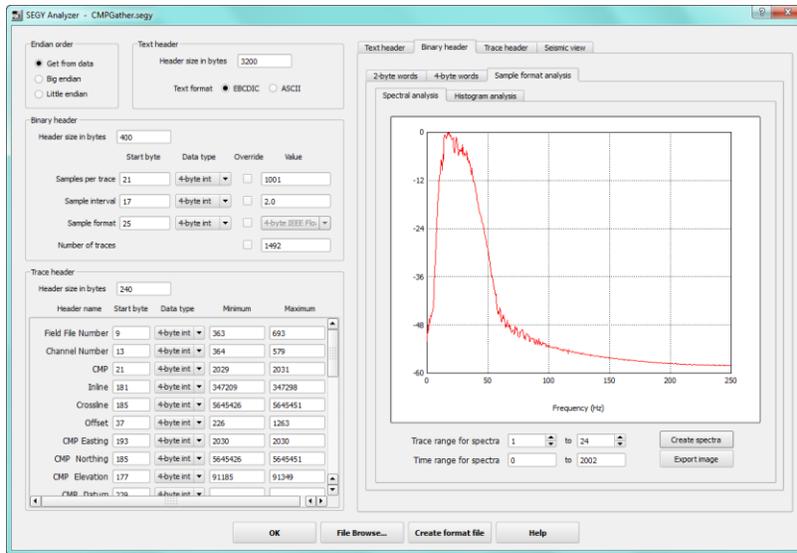
SEG Y Analyzer – Seismic View tab

The display of the Binary Header allows you to look at the values as either 2 byte or 4 byte words.



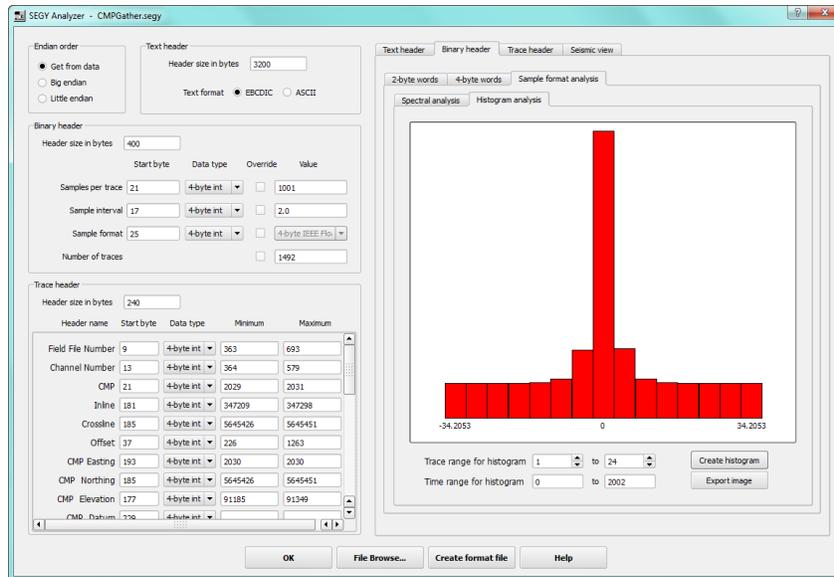
Binary Header Values Display

You also can also create a spectrum of a selected range of traces in the Sample format analysis tab of the Binary header display



Spectra Display

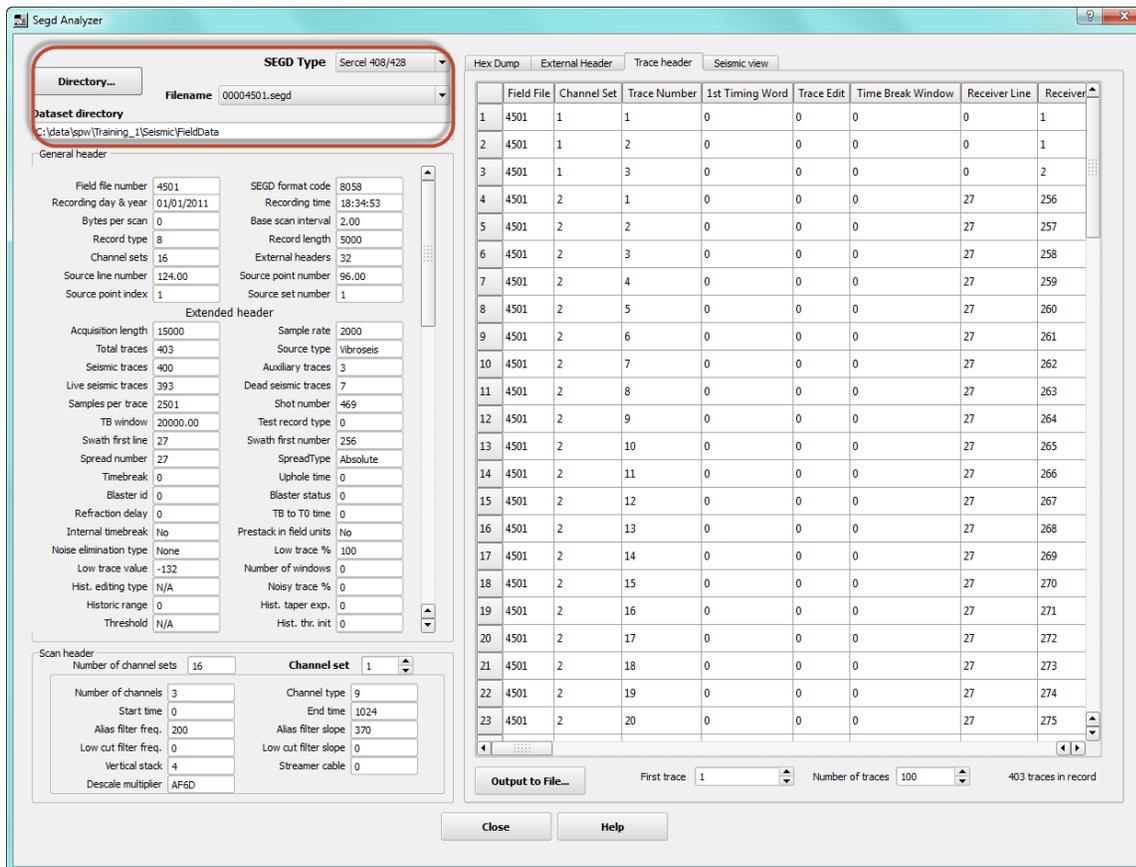
The Histogram analysis tab allows you to see the amplitude distribution of the selected data traces and verify the data has correct and valid amplitudes.



Histogram Analysis Display

SEG D Analysis

The SEG D Analyzer has a similar to the SEG Y Analyzer and allows you to analyze the various parts of a SEG D file structure.

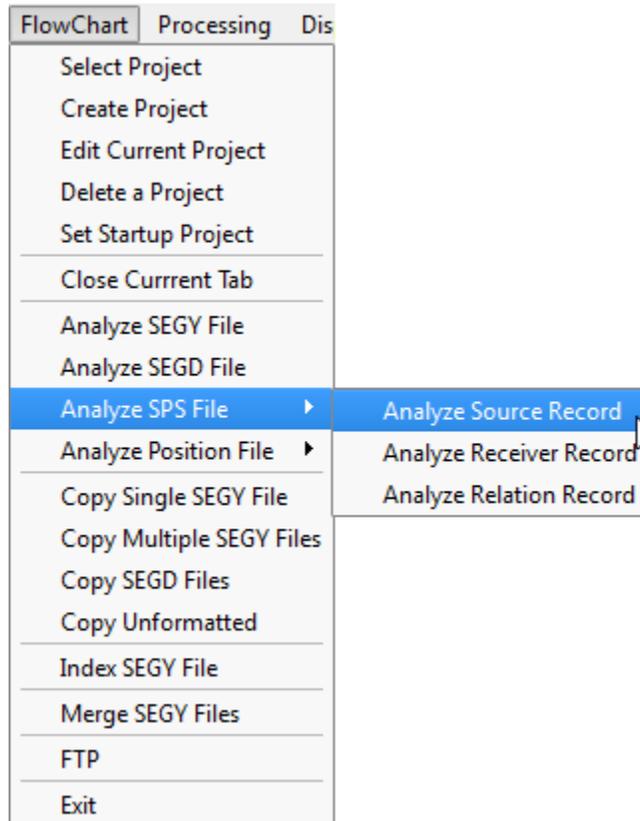


SEG D Analyzer

Unlike the SEG Y Analyzer, when using the SEG D Analyzer you first select the directory containing the SEG D files and then use the Filename combo box (see highlighted red rectangle above) to select individual SEG D files to analyze.

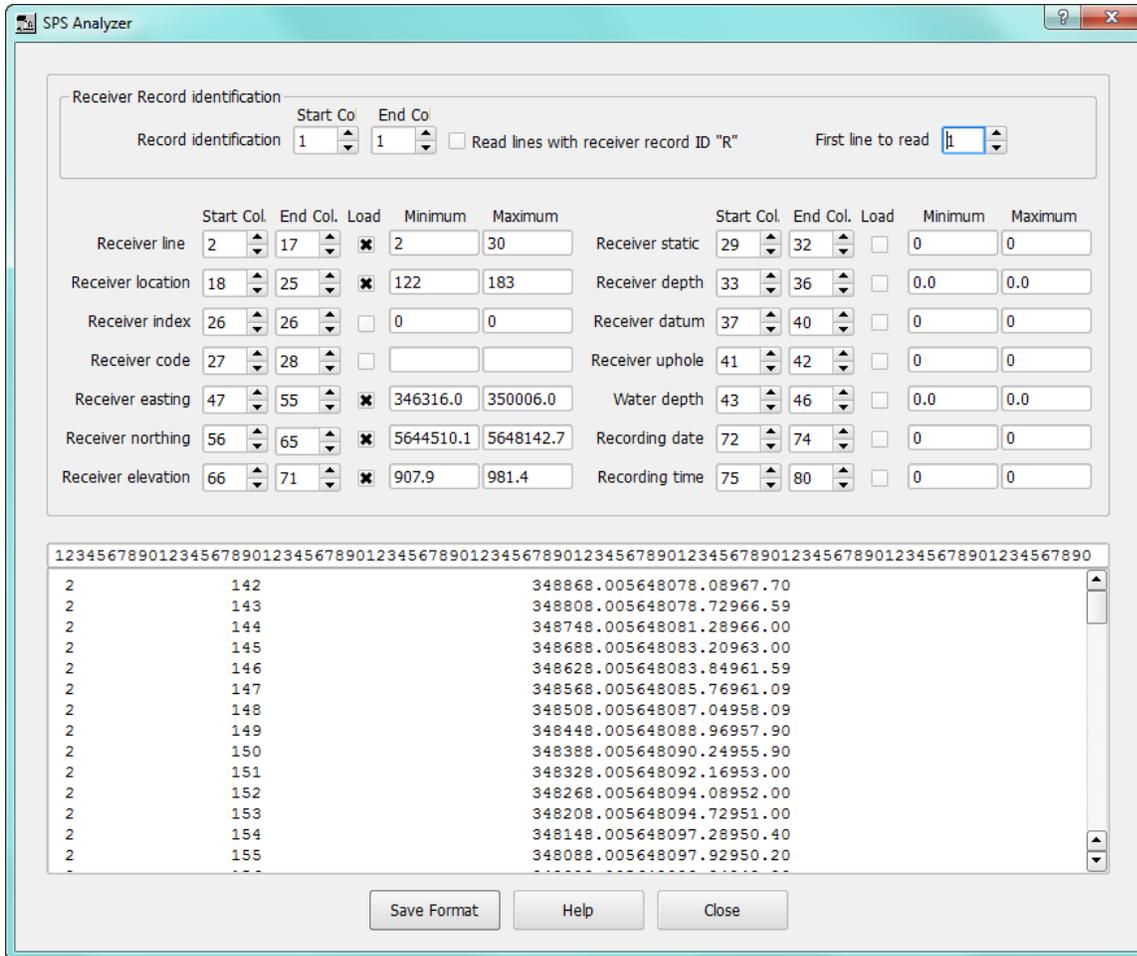
SPS Analysis

The SPS Analyzer allows you to analyze source, receiver and relation SPS files and to define the formats of these files.



SPS Analyzer Menu

The SPS Analyzer defines the column positions of the SPS format and shows you the definitions of the columns as well as the data value ranges for each column as you edit the format. When finished, Save the format and it is automatically associated with this specific SPS file. Every time this file is read, the format file will be used to decode the data in the file.



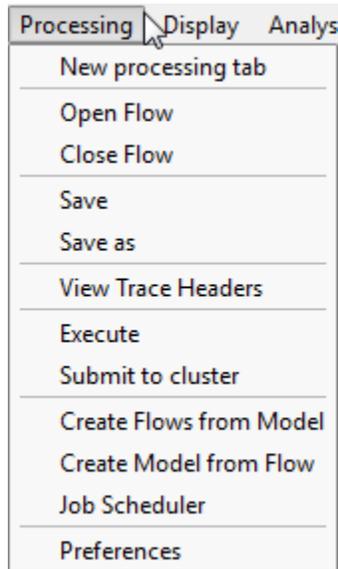
SPS Analyzer

Additional SPS analysis is available as Flowchart steps within the Auxiliary Data (R-Z) section of the processing steps. These are described in the “Displaying Spreadsheets of Auxiliary Data” section further down this first part of the manual.

Further SPS tools such as the database and producing maps are available in the “Survey Menu” section, described further below. Tools for formatting the SPS files are described in the “Displaying Spreadsheets of Auxiliary Data” section of this manual.

Processing Menu

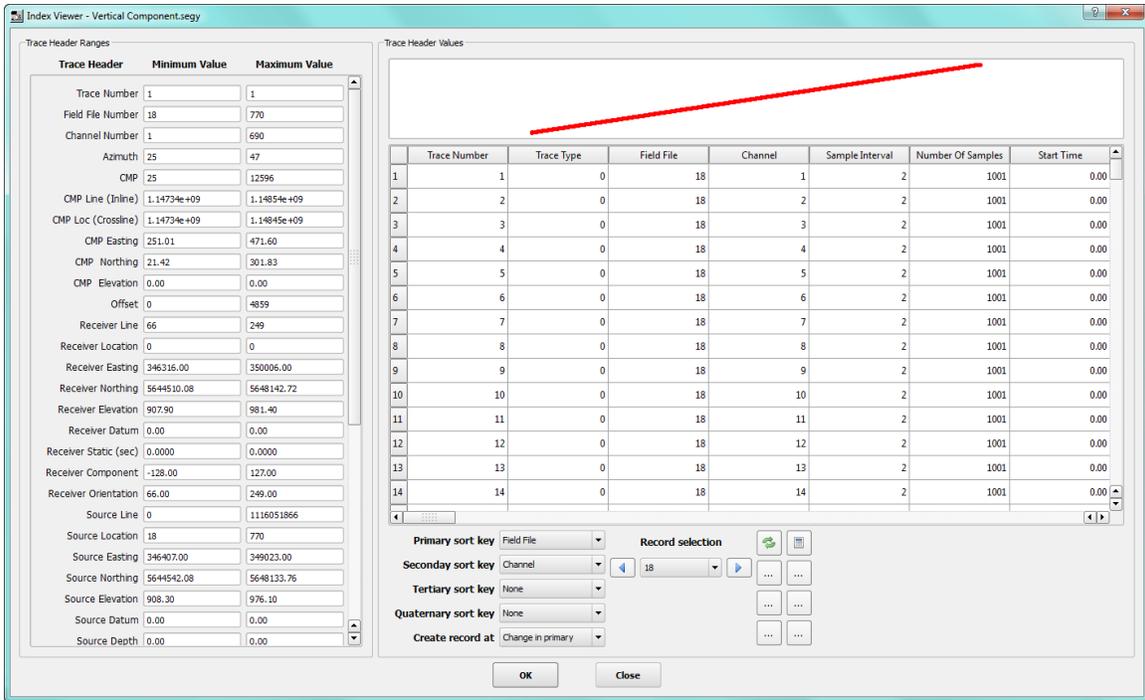
The Processing menu contains the commands for working with the flowcharts.



Processing Menu

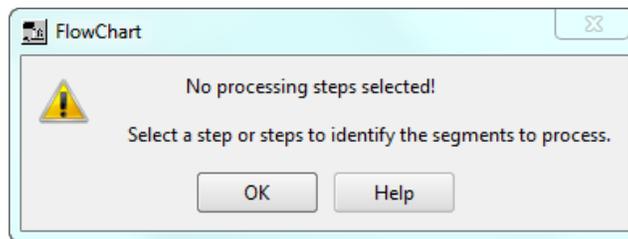
The New processing tab command creates tabbed windows for opening or building flowcharts. The Open flow command will open an existing flow in the current flowchart tab (flows are read from the project's Flows directory). The Close flow command closes the current flowchart but leaves the tab open. The Save command saves the current flow (a check is made before saving to ensure that the flow is valid, e.g. that the required input and output links are made and that input and output files have been specified). If it is an existing file, then it is overwritten. If it has not been named then it issues the Save As command and you are then prompted for a file name.

The View trace headers command opens a spreadsheet view of the trace headers of a selected SEG Y file (you select a SEG Y file by selecting the Seismic File in the flowchart). If you do not have a SEG Y file currently selected it does nothing



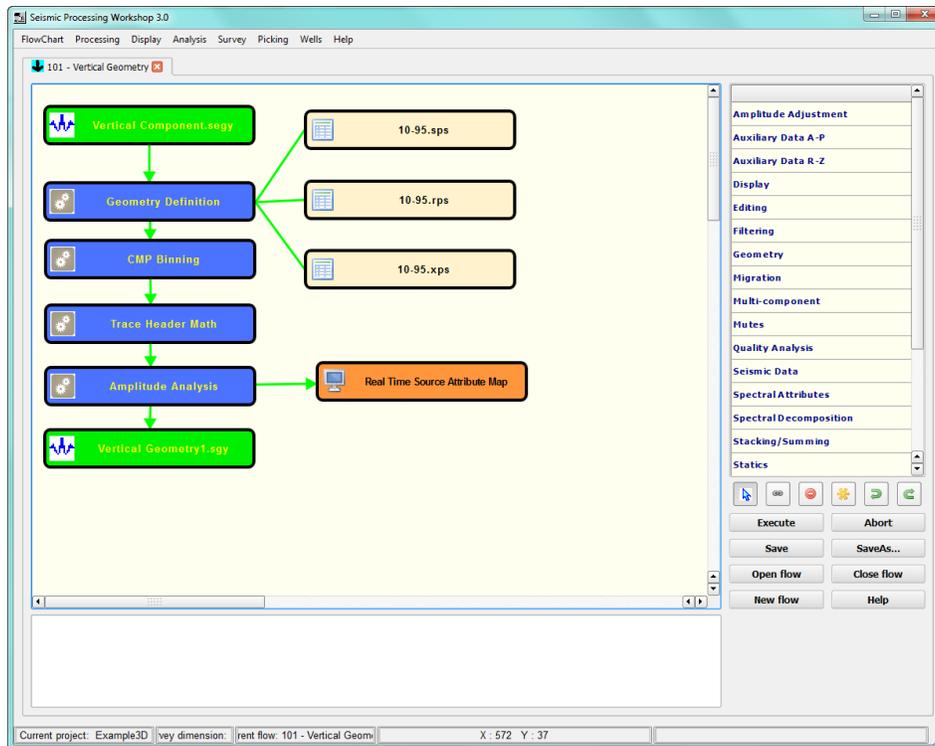
View Trace Headers

The Execute command runs the selected flow. Currently, only one flow segment is allowed in a flowchart. A flow segment is defined as a part of a flow originating with an input seismic disk file and ending in an output seismic disk file. If a flow segment has not been selected then then a warning message will be given when Execute is pressed:



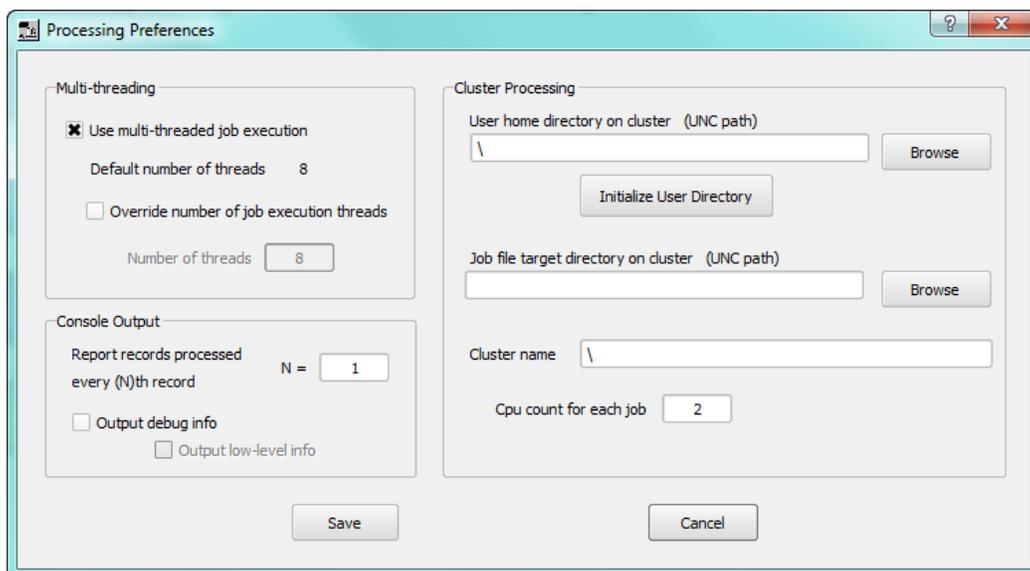
FlowChart Error Message when no flow segment has been selected

The Submit to cluster command sends the job to a remote cluster system. The job Scheduler command, the Parameter Testing command and the Configure real time displays command are currently disabled and are in the process of being implemented.



Executing a flow segment

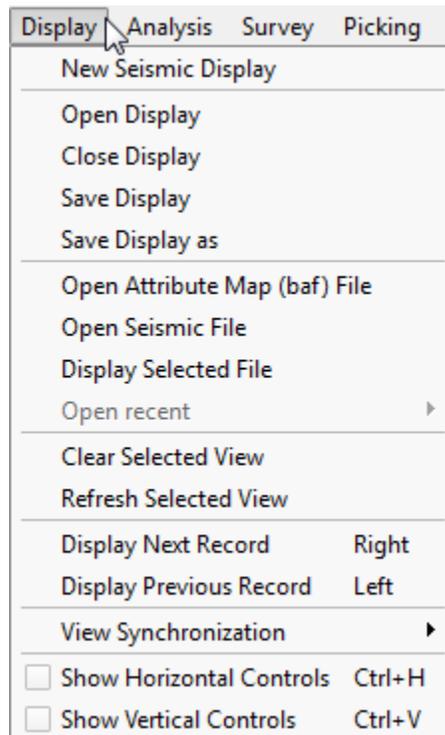
The Preferences command displays the Processing Preferences dialog. This dialog is used to control the threading for local execution and the number of cpus used for remote cluster execution. Also, there are controls on the reporting of processing information into the console.



Processing Preferences Dialog

The Display Menu

The Display menu contains commands that allow you to display your seismic data and control the display.

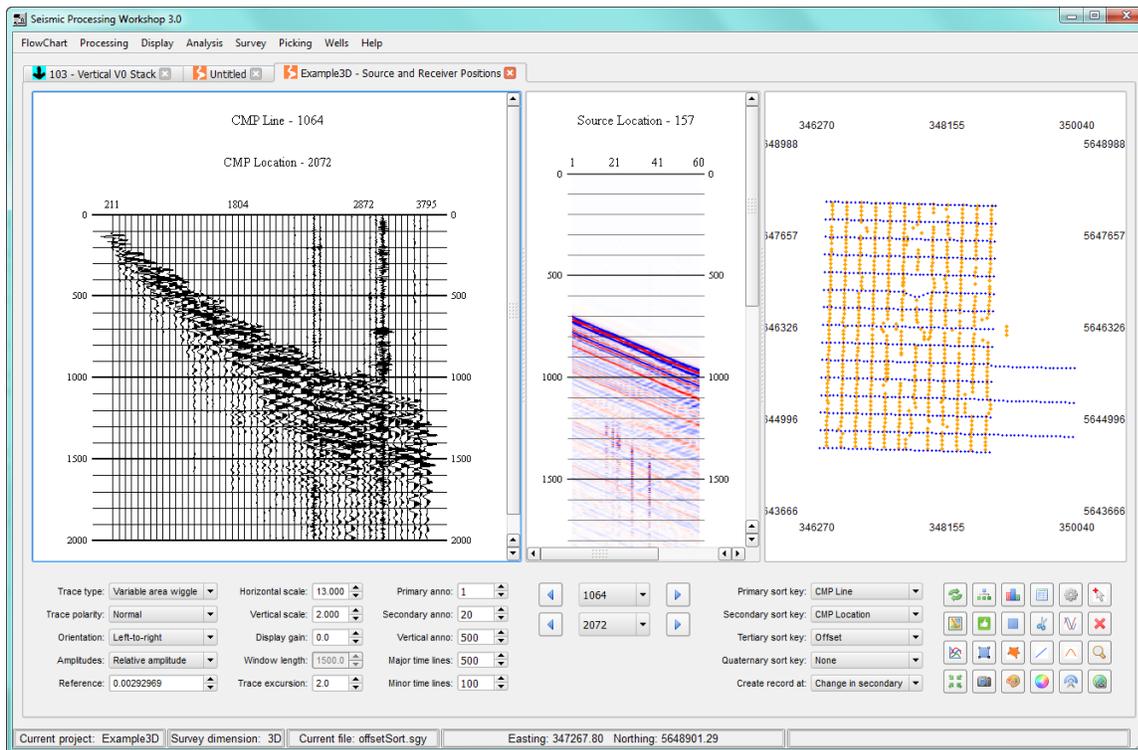


The Seismic Display Menu

The New Seismic Display command creates a new display tab in the Flowchart Window. The Close Display command removes the current active display tab from the SPW Window.

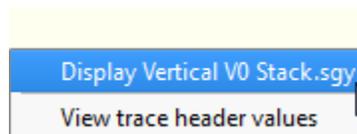
Displaying Seismic Data

Seismic data are displayed in a Display page within the main Flowchart dialog. The display page can split into two or more views, either located side by side or above each other, so that two or more seismic files (or multiple views of the same file) can be viewed simultaneously. The Display page can also show views containing other plots such as SEG Y headers, map views, bin coverage plots, etc. More than one Display page can be open – click on the Display tab to select the page to view.



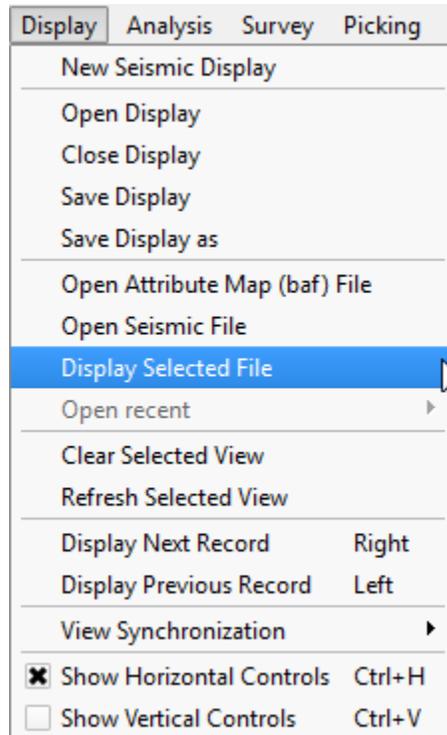
A Display page showing three views containing data sorted into inline/crossline, a near offset VSP and a base map generated from SPS data.

There are two ways to select a SEG Y file for display, either directly from a seismic data item in a flow chart, or by using a File Selection dialog to locate and open a file. From the flowchart, first locate a seismic data item, then click on it and choose the Display <filename> option.



Context Menu for Seismic Display

Alternatively, click on the seismic item in the Flowchart and then from the Display menu, select Display Selected File (you must have the flow chart displayed for this option to work).

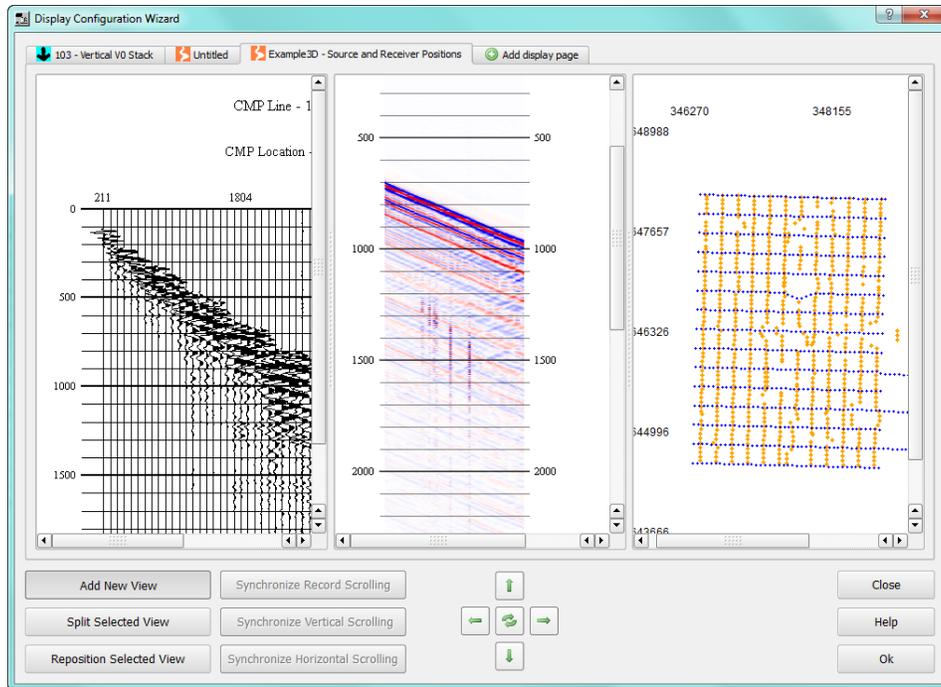


Display Selected File Command

To locate and open a SEG Y file directly without using a Flowchart item, select Open Seismic File from the above Display menu. This brings up a file selector dialog that you can use to locate and open the SEG Y file directly.

The Display Configuration Wizard

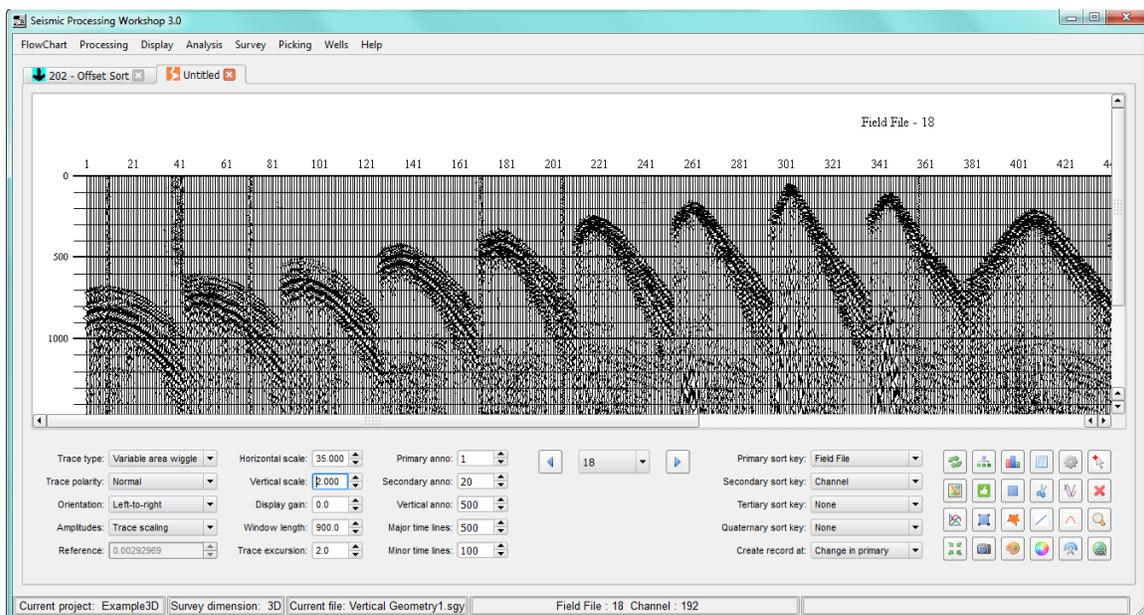
When you open a seismic file for display, whether via the Flowchart or from the Display menu and no Display page is currently open in the Flowchart dialog, a new Display Page is automatically opened and the display view added. If one or more Display pages exist then the Display Configuration Wizard is opened which enables you to select where the new display view will be placed. The view can be added to a new display page (select “Add Display Page” from the viewer, or the view can be added within an existing page. Use the “Add New View” button to place the page to the right of the existing pages, or the arrow buttons to select where to locate the view.



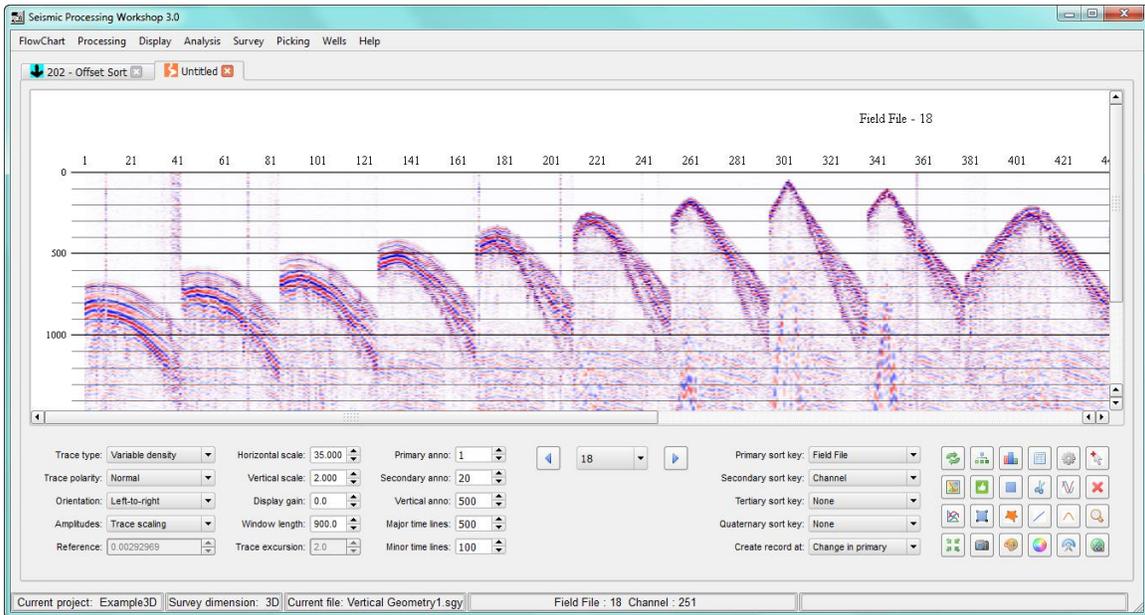
The Display Configuration Wizard

The Seismic Display

The SPW Seismic Display is a very simple but powerful display tool allowing you to freely adjust the display parameters and step through, or scroll through, your data set.

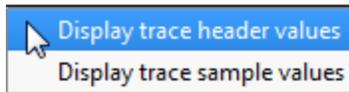


Variable Area Wiggle Seismic Display



Variable Density Seismic Display

When traces are displayed, move the pointer over a trace and right click to show a popup menu that allows you to view the samples or header values of the selected trace:



Description	Value
Field file	18
Channel number	21
Source line	29
Source location	132
Receiver line	2
Receiver location	162
CMP line	1087
CMP location	2054
Offset	1992.84
Azimuth	340.324
Source Easting	348340.00
Source Northing	5646232.32
Source Elevation	929.59
Receiver Easting	347669.00
Receiver Northing	5648108.80
Receiver Elevation	945.70
CMP Easting	348004.50
CMP Northing	5647170.50
CMP Elevation	937.64
Shot Depth	0
Uphole Time	19
Src Static	0

Buttons: Text Dump, Help, Close

Trace Header Values Popup Dialog

Seismic Display Control Panel

The SPW 3 Seismic Display Control Panel gives you options to select, set, or adjust parameters to best view your data.

Trace type: Variable area wiggle
 Trace polarity: Normal
 Orientation: Left-to-right
 Amplitudes: Trace scaling
 Reference: 0.19108640

Horizontal scale: 24.00
 Vertical scale: 300
 Display gain: 0.0
 Window length: 500.0
 Trace excursion: 2.0

Primary anno: 1
 Secondary anno: 20
 Vertical anno: 500
 Major time lines: 500
 Minor time lines: 100

Primary sort key: Field File
 Secondary sort key: Channel
 Tertiary sort key: None
 Quaternary sort key: None
 Create record at: Change in primary

Seismic Display Control Panel

Left Side of the Seismic Display Control Panel

The screenshot shows the left side of the Seismic Display Control Panel with the following settings:

Trace type: Variable area wiggle	Horizontal scale: 24.00	Primary anno: 1
Trace polarity: Normal	Vertical scale: 300	Secondary anno: 20
Orientation: Left-to-right	Display gain: 0.0	Vertical anno: 500
Amplitudes: Trace scaling	Window length: 500.0	Major time lines: 500
Reference: 0.19108640	Trace excursion: 2.0	Minor time lines: 100

Left Side of the Seismic Display Control Panel

Trace type – interactively adjusts the seismic display by type using a drop down menu.

Variable area is a “standard” black and white wiggle display with area fill.

Variable density is a color display, usually shown with a red-white-blue color scale, although you can change and setup new color scales with the color scale editor and selectors described below.

Trace polarity – interactively adjusts the seismic display by polarity using a drop down menu.

Normal trace polarity interactively retains the polarity of seismic data on a trace-to-trace basis.

Reverse trace polarity interactively reverses the polarity of seismic data on a trace-to-trace basis.

Orientation – interactively adjusts the seismic display by orientation using a drop down menu.

Left-to-right displays the traces in ascending order starting from the left.

Right-to-left displays the traces in ascending order starting from the right.

Amplitudes – interactively adjusts the seismic display by amplitude using a drop down menu.

True amplitude displays the data at absolute input amplitude – usually millivolts.

Relative amplitude scales each trace to the same maximum amplitude.

Trace scaling applies an AGC to the trace using the Window length parameter.

Reference – interactively adjusts the seismic display by reference using up and down arrows, or numerical data entry.

Horizontal scale – interactively scales seismic data horizontally on a trace-to-trace basis using up and down arrows, or numerical data entry.

Vertical scale – interactively scales seismic data vertically on a trace-to-trace basis using up and down arrows, or numerical data entry.

Display gain – interactively gains seismic data on a trace-to-trace basis using up and down arrows, or numerical data entry.

Window length – interactively adjusts the length of the seismic display window using up and down arrows, or numerical data entry.

Trace excursion – interactively adjusts how far the seismic data extends on a trace-to-trace basis using up and down arrows, or numerical data entry.

Primary Anno – interactively changes the horizontal annotation of the seismic data according to the primary sort key display using up and down arrows, or numerical data entry.

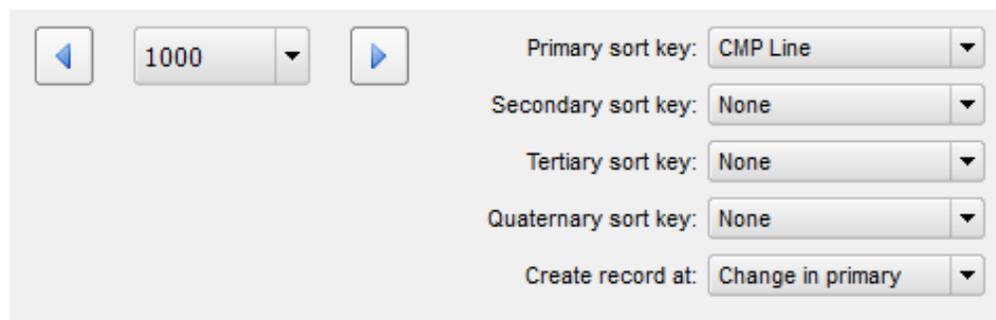
Secondary Anno – interactively changes the horizontal annotation of the seismic data according to the secondary sort key display using up and down arrows, or numerical data entry.

Vertical Anno – interactively changes the vertical annotation of the seismic data display using up and down arrows, or numerical data entry.

Major Time Lines – interactively adjusts how frequently the major (bold) timing lines annotate the seismic data display using up and down arrows, or numerical data entry.

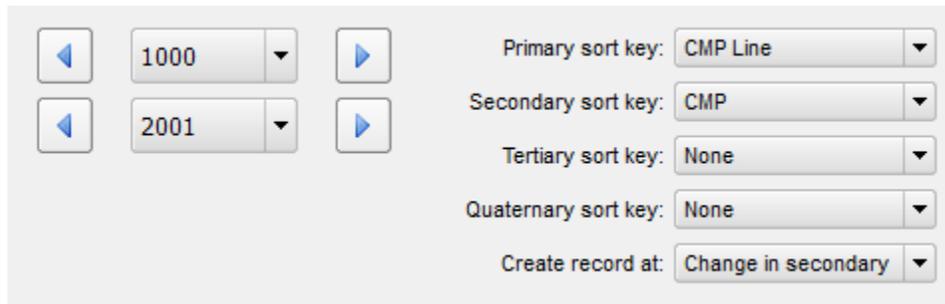
Minor Time Lines – interactively adjusts how frequently the minor (fine) timing lines annotate the seismic data display using up and down arrows, or numerical data entry.

Center of the Seismic Display Control Panel – Sort Keys



Primary Sort Key Selected.

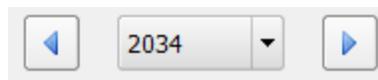
A sort key number selector will be shown for each sort key that you select. Here there's one since only a primary sort has been chosen. Below, a secondary sort has been selected, with the Create Record At option set to "Change in secondary", so two sort key number selectors are shown (the data used in this example had been sorted into CMP bins).



Primary and Secondary Sort Keys Selected.

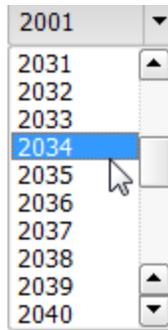
When you change the sort, you will need to select the sort key to implement the sorted selection . To quickly change the sort, you may find the Quick Sort option  useful (button located in the far right button panel in the Seismic Display).

Select Sort Key Number



Select Sort Key Number

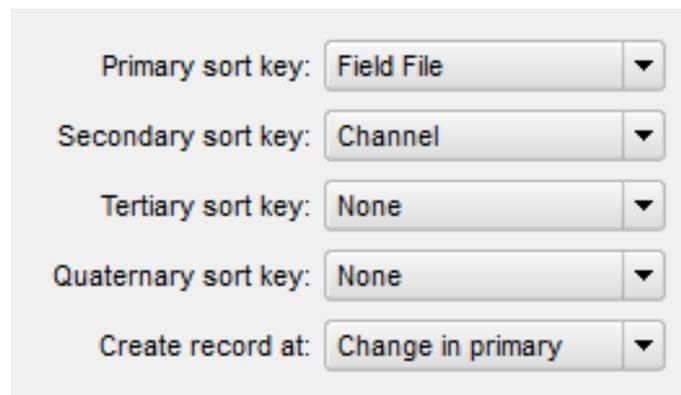
The select sort key number allows you to step through the entire list of records one by one, forwards or backwards. It also allows you to select an arbitrary primary, secondary, etc., sort key number by means of a drop down list displaying each one for quick selection anywhere in the data set.



Arbitrary Primary Number Drop-down List

Sorting Keys

To the right of the display control panel are drop down menus for selecting primary, secondary, etc., sort keys.



Display Sort Keys

Primary sort key – interactively adjusts the seismic display by using a drop down menu to select the first order in sequence by which the data will be sorted.

Secondary sort key – interactively adjusts the seismic display by using a drop down menu to select the second order in sequence by which the data will be sorted.

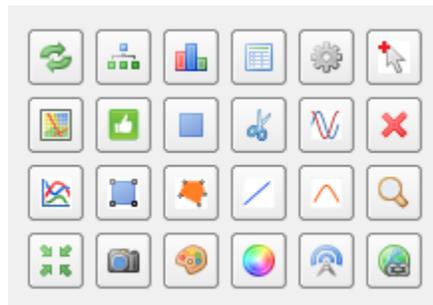
Tertiary sort key – interactively adjusts the seismic display by using a drop down menu to select the third order in sequence by which the data will be sorted.

Quaternary sort key – interactively adjusts the seismic display by using a drop down menu to select the fourth order in sequence by which the data will be sorted.

Create record at – interactively creates a record by change in primary, secondary, tertiary, quaternary, each trace, or last trace.

Data and Display Tools

There are 24 tools on the right side of the Seismic Display Control Panel which facilitate the manipulation of your data display. These are described below:



Data and Display Tools



Sort Data Using Current Sort Key – Clicking on this button changes the sort order of your data using current sort keys. When new sort keys are selected from the right side of the seismic display control panel, clicking on this button implements the selection.



Quick Sort Options – Use to quickly sort the data based on popular sorts. This will update the Primary and Secondary sort keys as necessary to yield the selected quick sort (see discussion below).



Add Trace Header Plot – Use as a toggle button to place a header display above the currently selected view. Reveals a panel at the top right of the display panel where you can select the header to plot and options to configure the header plot.



View Trace Headers – Use the right click option Trace Header Values Popup Dialog, described above.



Display Processing – Opens the Display Processing Tool which allows you to add processing steps between reading the seismic file and displaying it. Toggle the button off to remove the processing step.



Seismic Picker – Opens the picking menu panel to the right of the display panel.



Show Location Map – opens a popup Locator Map dialog.



Geometry Quality Control – Shows a calculated first arrival based on the offset and a velocity. Aim is to QC offsets to ensure that the near trace aligns with the data first breaks.



View LMO Guided Windows – To use, enter a velocity, start time and end time and the window will be shown in color on the data. This option is particularly useful for designing deconvolution operators that move out with offset.



Edit Seismic Traces – when toggled on use the pointer and MB1 to select trace groups to mute out. This is a temporary mute, to reverse the mute move the display record forward and back.



Reverse Trace Polarity – toggle on and off to reverse the trace polarity.



Show Dead Traces In Red – toggle on and off.



Calculate Individual Trace Spectra – when toggled on, use the pointer and MB1 to select trace groups. A popup display of the spectra of the selected traces is then shown. Toggle off to remove the selection facility.



Calculate Spectra in a Rectangular Window – when toggled on, use the pointer and MB1 to select a trace/time window. A popup display of the spectra of the selected and gated traces is then shown. Toggle off to remove the selection facility.



Calculate Spectra in a Polygonal Window – when toggled on, use the pointer and MB1 to select a polygon. A popup display of the spectra of the trace samples within the window is then shown. Toggle off to remove the selection facility.



Estimate Linear Velocity – when toggled on, use the pointer to select two points on the display. The linear velocity is then shown as an overlay on the display. Toggle off to remove the linear velocity selection and clear the velocity text. Requires an offset sort.



Estimate Hyperbolic Velocity – when toggled on, use the pointer to select two points on the display. The hyperbolic velocity is then shown as an overlay on the

display. Toggle off to remove the hyperbolic velocity selection and clear the velocity text. Requires and offset sort.



Zoom – when toggled on, use the central mouse button or mouse tracker ball to zoom the currently selected view in or out.



Range Limit Data In the Display – when toggled on this will a panel at the top right of the display panel will be shown giving options for selecting sort keys and setting the display ranges of the keys. Multiple sort ranges can be set. Toggle off to remove the range limit and to reset the ranges applied to each key.



Capture an Image – Opens the Setup Image Dialog box (described below).



Select or View a Current Color Scale – Opens the Select Color Tool dialog from which you can view currently available color scales and select a different scale to view (described below).



Create a New Color Scale or Edit an Existing One – Opens the Color Scale Editor dialog (described below).



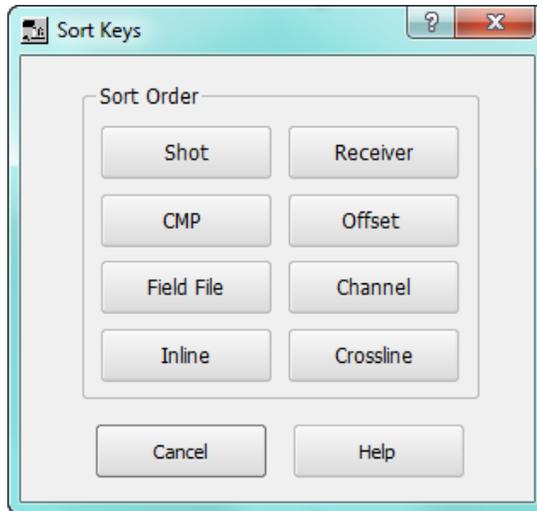
Propagate Display Settings – click to propagate the display settings of the currently selected view to other views in the same display panel.



Synchronize Scrolling – click to synchronize the horizontal and vertical scrolling. You can use this in collaboration with the Display menu's Synchronize options. The sorts need to match for the synchronizing to operate.

Quick Sort Options

When the Quick Sort button is pressed, there are a number of sort options to choose from. The sorts available depend on whether the project is set for surface seismic data (the default) or VSP data.



Surface Seismic Quick Sort Options

The quick sorts are set using the following keys:

Quick Sort	Primary Key	Secondary Key	Tertiary Key
Shot	Source Line	Source Location	
Receiver	Receiver Line	Receiver Location	
CMP	CMP Line	CMP Location	Offset
Offset	Offset	CMP Line	CMP Location
Field File	Channel	Field File	
Channel	Field File	Channel	
Inline	CMP Line	CMP Location	
Crossline	CMP Location	CMP Line	

VSP data can be sorted into Source and Downhole gathers.



VSP Sort Options

The VSP quick sorts use the following keys:

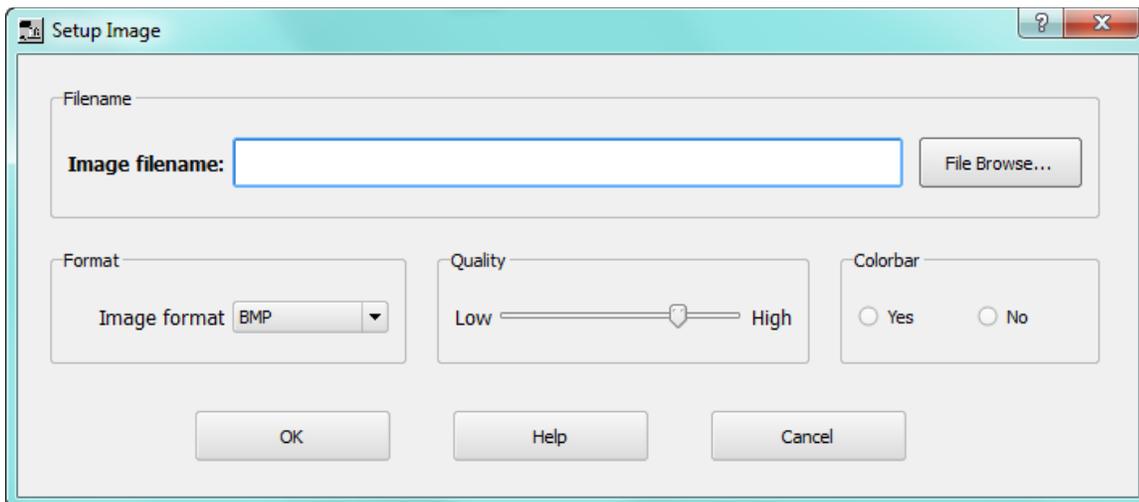
Quick Sort	Primary Key	Secondary Key	Tertiary Key
Surface Gather	Source Line	Source Location	VSP Depth
Downhole Gather	Receiver Line	Receiver Location	VSP Depth

Capture an Image Tool

The Capture an image tool button allows you to create an image file of your seismic data display



. When you click on the button the Setup Image dialog box appears.

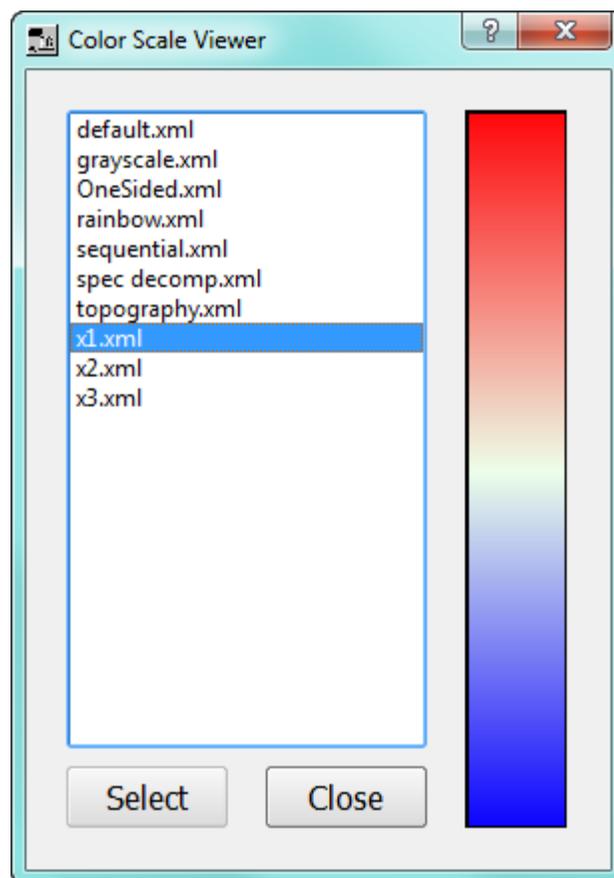


Setup Image Dialog Box

Specify a name for the image file and browse for the destination. Then specify the format (BMP, JPEG, TIFF, PNG) from the Image format drop-down list. Set the image quality on the Low-High sliding continuum, and determine whether or not to use the Colorbar. Clicking OK captures the image and stores it in the project image folder.

Select Color Scale Tool

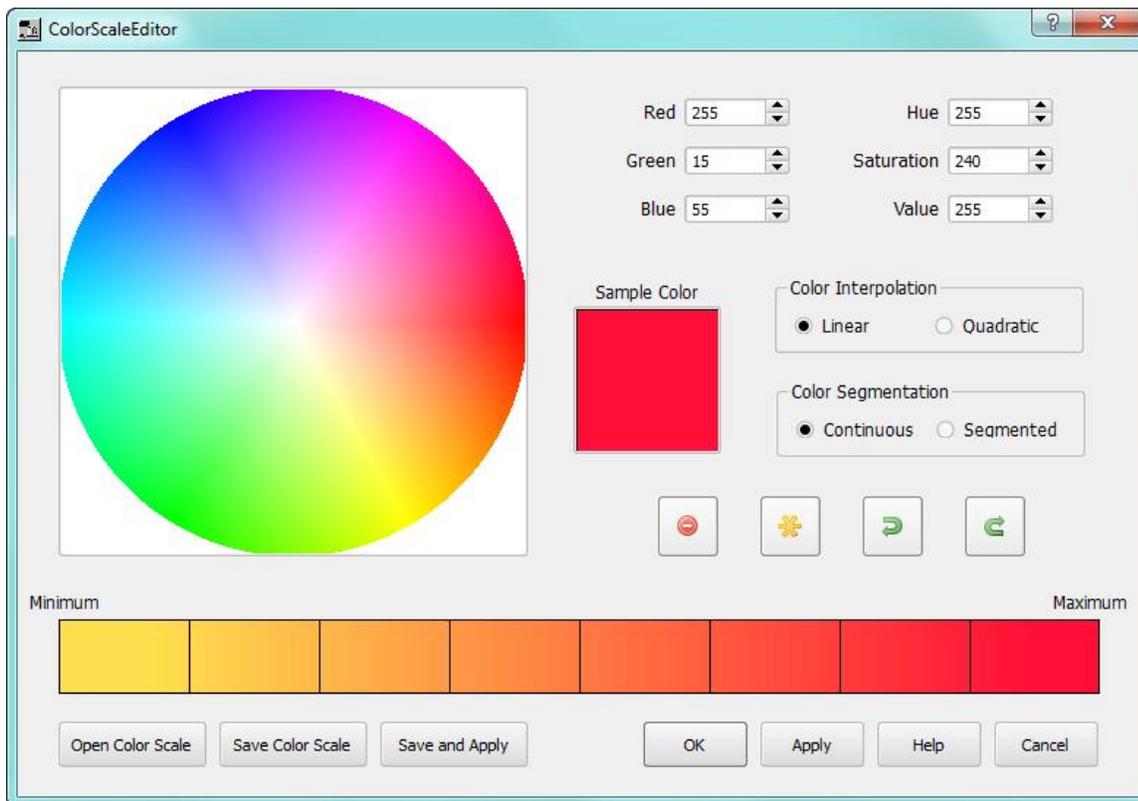
The Select color scale tool button allows you to select from a variety of color scales to apply to your data . When you click on this button the Color Scale Viewer dialog box opens from which you can select your preferred color scale.



Color Scale Viewer Dialog Box

Create Color Scale Tool

The Create color scale tool button allows you to design your own color scale to apply to your data . When you click on this button the ColorScaleEditor dialog box opens from which you can design your own color scale.

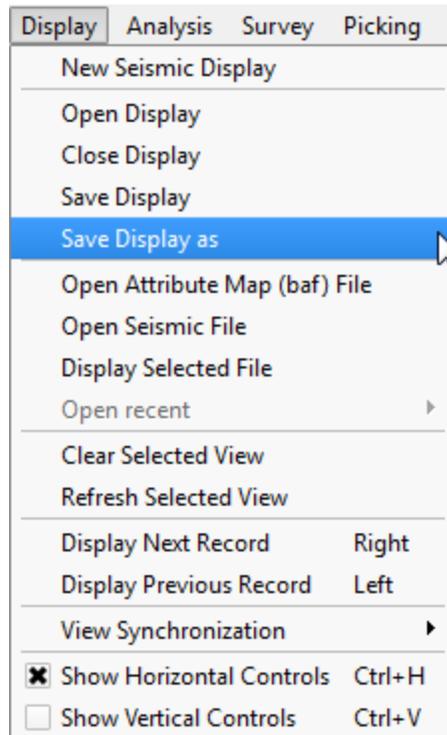


Color Scale Editor Dialog Box

Click on the color wheel to begin and adjust by using up and down arrows, or numerical data entry in the primary color boxes and the color feature boxes. Save your scales and apply using the Save and Apply button, or use the Select Color Scale Tool from which you can select your preferred color scale.

Opening and Saving the Seismic Display

When you have created a Seismic Display containing one or more display views, you can save the view into an Xml file stored within your project for future use. For example, you may have configured your display with different sorts, data ranges, display options, etc. From the Display menu, select Save Display as to save the current configuration with the project files.



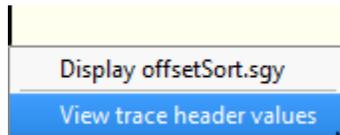
The Save and Open Display Options

To open a previously saved display configuration, select Open Display; this gives you access to a file selector pointing to the Displays directory of your current project. Once a display is open, you can continue to make changes to the display configuration; if you select Save Display these changes will be updated in the display file for future use.

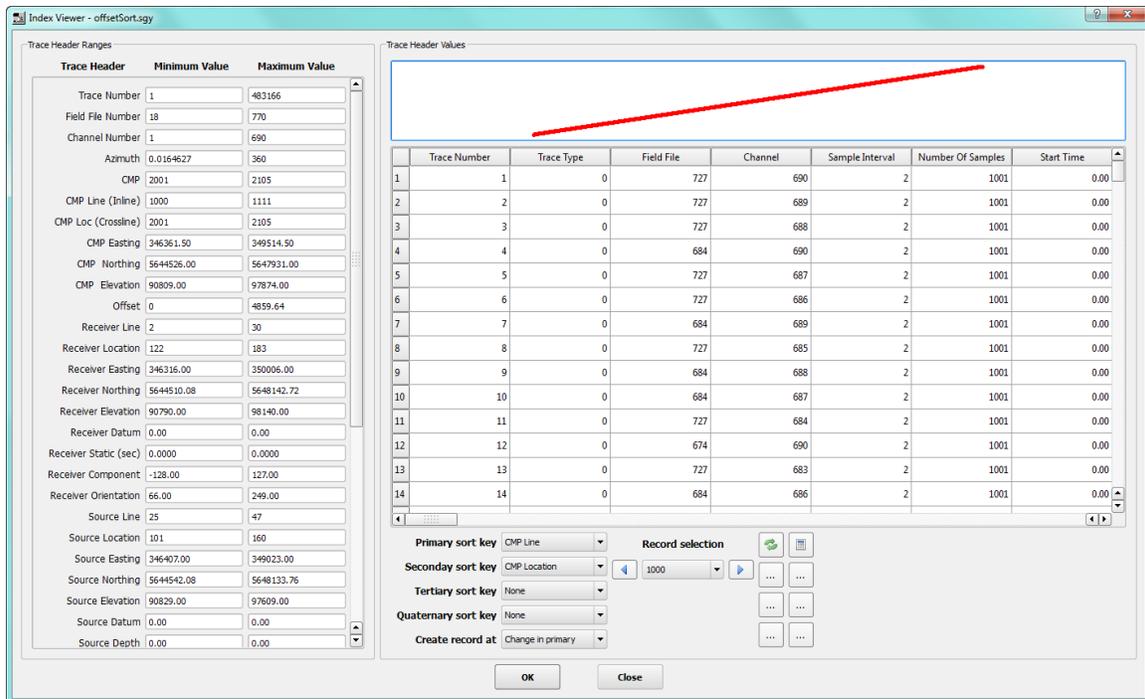
The command “Close Display” will close the currently selected Seismic Display tab.

Displaying Seismic Headers Spreadsheets

You may display the trace headers by first right clicking on a seismic data item on the flowchart, then second by selecting the View trace header values from the context menu.



Context menu for Seismic File



The screenshot shows the "Index Viewer - offsetSort.sgy" window. It is divided into two main sections: "Trace Header Ranges" on the left and "Trace Header Values" on the right. The "Trace Header Ranges" section contains a table with columns for "Trace Header", "Minimum Value", and "Maximum Value". The "Trace Header Values" section contains a table with columns for "Trace Number", "Trace Type", "Field File", "Channel", "Sample Interval", "Number Of Samples", and "Start Time". A red diagonal line is drawn across the top of the "Trace Header Values" table. Below the table, there are controls for "Primary sort key", "Secondary sort key", "Tertiary sort key", "Quaternary sort key", and "Create record at".

Trace Header	Minimum Value	Maximum Value
Trace Number	1	483166
Field File Number	18	770
Channel Number	1	690
Azimuth	0.0164627	360
CMP	2001	2105
CMP Line (Inline)	1000	1111
CMP Loc (Crossline)	2001	2105
CMP Easting	346361.50	349514.50
CMP Northing	5644526.00	5647931.00
CMP Elevation	90809.00	97874.00
Offset	0	4859.64
Receiver Line	2	30
Receiver Location	122	183
Receiver Easting	346316.00	350006.00
Receiver Northing	5644510.08	5648142.72
Receiver Elevation	90790.00	98140.00
Receiver Datum	0.00	0.00
Receiver Static (sec)	0.0000	0.0000
Receiver Component	-128.00	127.00
Receiver Orientation	66.00	249.00
Source Line	25	47
Source Location	101	160
Source Easting	346407.00	349023.00
Source Northing	5644542.08	5648133.76
Source Elevation	90829.00	97609.00
Source Datum	0.00	0.00
Source Depth	0.00	0.00

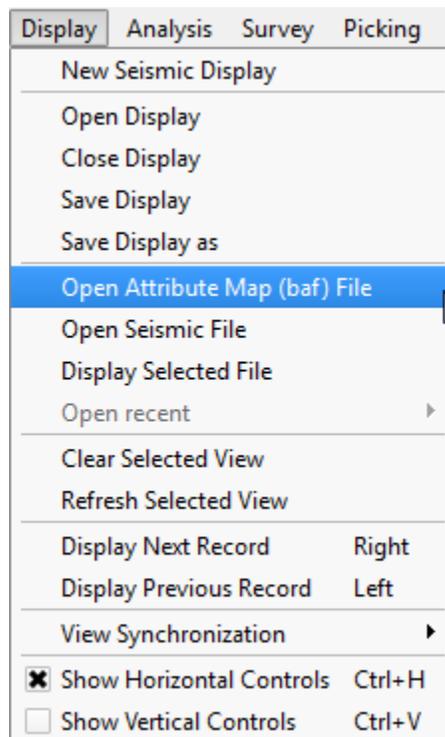
Trace Number	Trace Type	Field File	Channel	Sample Interval	Number Of Samples	Start Time	
1	1	0	727	690	2	1001	0.00
2	2	0	727	689	2	1001	0.00
3	3	0	727	688	2	1001	0.00
4	4	0	684	690	2	1001	0.00
5	5	0	727	687	2	1001	0.00
6	6	0	727	686	2	1001	0.00
7	7	0	684	689	2	1001	0.00
8	8	0	727	685	2	1001	0.00
9	9	0	684	688	2	1001	0.00
10	10	0	684	687	2	1001	0.00
11	11	0	727	684	2	1001	0.00
12	12	0	674	690	2	1001	0.00
13	13	0	727	683	2	1001	0.00
14	14	0	684	686	2	1001	0.00

Spreadsheet Display of Seismic Trace Headers

In the seismic trace header display, the headers are displayed in gather order and split by gathers. The Record selection (see directional arrows at the bottom of the display) allows you to move through the gathers or jump to a specific gather by number.

Attribute Maps

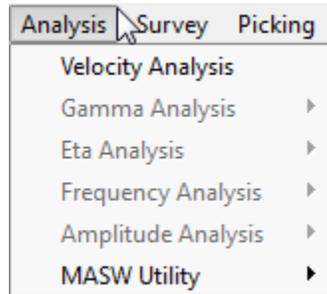
Attribute maps can be generated from seismic files to show the variation of certain properties of the data in a map view. Amplitude and frequency attributes are commonly used to quality control data. The Amplitude Analysis and Frequency Analysis processing steps are commonly used to generate these attributes and save them in the seismic trace headers. Attributes can be displayed in a Seismic Display by selecting “Open Attribute Map File” from the Display menu:



The Display Menu

Velocity Analysis Menu

The Analysis menu contains for the seismic analysis tools in SPW. The Velocity Analysis tool and the Multi-Channel Surface Wave (MASW) utility are available in the current version.

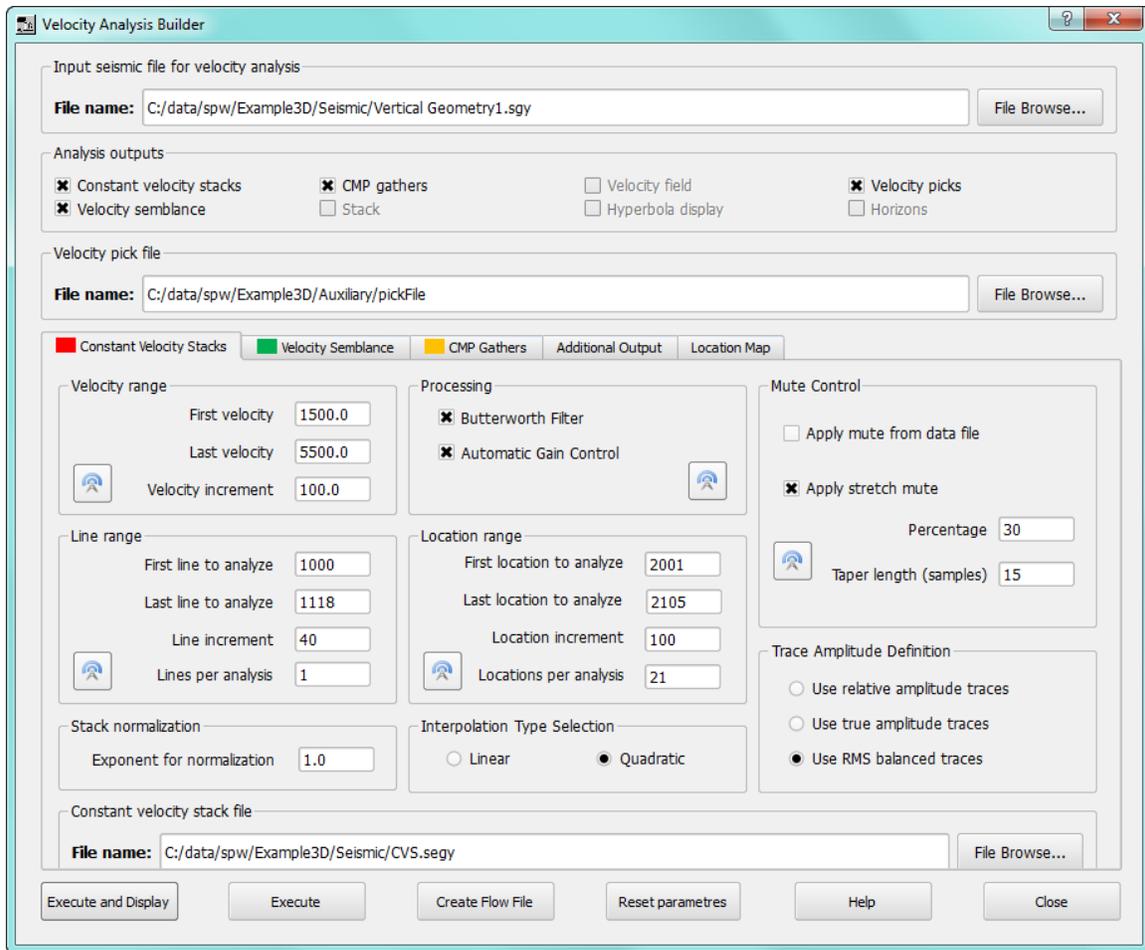


Analysis Menu

Velocity Analysis Builder

The velocity analysis wizard will build the flows and display panel necessary for creating the RMS velocity fields used to perform normal moveout (NMO) correction. The input is a file of CMP gathered seismic data and the output, after the velocity analysis has been completed, is a file of the NMO corrected data, together with the RMS velocities. The wizard builds and initiates three flows: a constant velocity stack flow, a velocity semblance flow and a flow to compute the CMP gathers.

The wizard opens with the following multi-tab dialog:

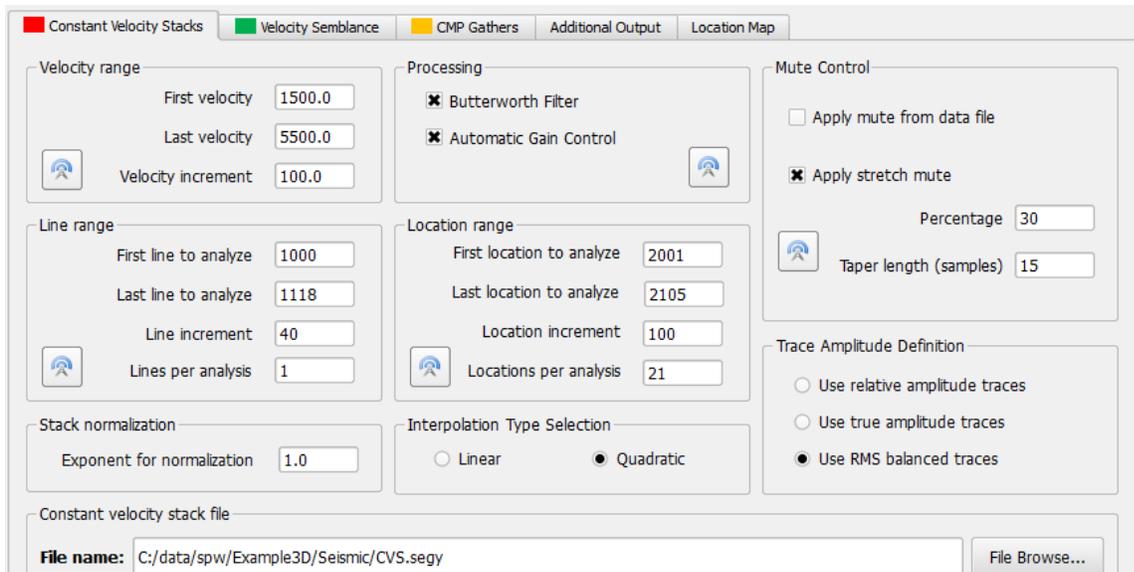


Velocity Analysis Builder (Wizard)

Select an input CMP sorted SEG Y file, which is used as the input to all three analysis flows. Also select the flows you want to run, which would usually be “Constant Velocity Stacks”, “Velocity Semblance” and “CMP gathers”. The “Velocity picks” can also be saved to enable the NMO flow to be run separately at a later time, perhaps after some editing of the picks has been made.

Constant Velocity Stacks flow

Select the Constant velocity stacks checkbox in the dialog and set the following parameters:



Constant Velocity Stacks flow parameters

Velocity range: select a range of velocities and an increment large enough to encompass expected range in the survey area.

Processing and Mute Control: prior to displaying the data, you can add a filter and AGC options along with mutes to help in identifying events for picking.

Line and Location Range: select the inline and crossline ranges and the increments of the data set that you wish to analyze. Each stack displayed will require picking so you may want to choose a coarse data selection to begin with.

Trace Amplitude Definition: select from relative, true or RMS amplitude scaling.

Stack normalization: enter the scaling exponent. Traces will be scaled by the fold^{Exp}.

Interpolation Type Selection: select the interpolation type (linear or quadratic). The moveout operator will cause trace data samples to be moved in time to new locations, which will not usually be exactly at the sample interval of the data. Here the data is interpolated to be evenly sampled at the correct interval. See, for example, the description of the Apply Normal Moveout step in the Processing Steps of this manual for further details.

Constant velocity stack file: enter the name for SEG Y in which the constant velocity stacks will be saved.



The broadcast button  should be pressed to send the parameter values and processing options to the semblance and gather flows.

Velocity Semblance flow

The velocity semblance flow shares many of the same parameters as the constant velocity stacks flow. It is recommended that the parameters set for the Constant Velocity Stacks flow are broadcast to here.

Velocity Semblance flow parameters

The unique parameters to the semblance flow are:

Semblance length: enter the length (ms) of the semblance calculation window.

Semblance file: enter the name for SEG Y in which the semblance traces will be saved.

CMP Gathers flow

The CMP gathers flow applies to the velocity picks to the input CMP stacked data to create stacks of NMO corrected data.

The screenshot shows the 'CMP Gathers' flow parameters dialog box. It features several sections for configuring the processing of CMP stacked data:

- Normal Moveout:** Includes checkboxes for 'Apply NMO using velocity pick file', 'Apply mute from file after NMO', and 'Apply stretch mute after NMO'. It also has input fields for 'Percentage' (set to 30) and 'Taper length (samples)' (set to 15).
- Processing:** Includes checked checkboxes for 'Butterworth Filter', 'Automatic Gain Control', and 'Sum common offset in supergathers'.
- Line range:** Includes input fields for 'First line to output' (1000), 'Last line to output' (1118), 'Line increment' (40), and 'Width in lines' (1).
- Location range:** Includes input fields for 'First location to output' (2001), 'Last location to output' (2105), 'Location increment' (100), and 'Width in locations' (1).
- CMP gathers file:** Includes a 'File name' field with the path 'C:/data/spw/Example3D/Seismic/CMPGather.segy' and a 'File Browse...' button.

CMP Gathers flow parameters

Set the following parameters:

Normal Moveout: use the parameters here for how to apply the NMO and whether mutes should be applied to the data – see the description of the Apply Normal Moveout step in the Processing Steps of this manual for further details of the mutes and the percentage and taper length parameters used by the stretch mute.

Processing: processing steps for filtering, AGC and the creation of supergathers can be added to the traces when creating stacks of NMO corrected data.

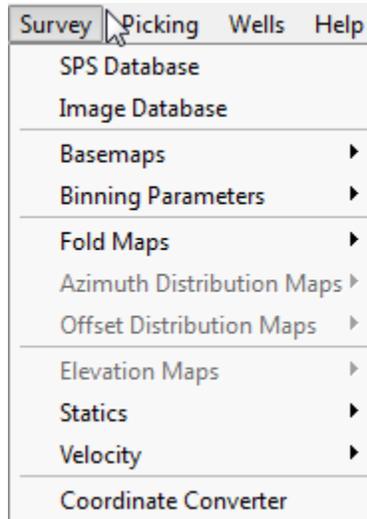
Line and location range – generally these will have been broadcast from the Constant Velocity Stacks and Velocity Semblance flows.

Execution

Once the selected analysis output flows (velocity stacks, semblance, CMP gathers) have been parameterized, you can now execute these flows and interactively make velocity picks. Press Execute to build the flows and start them. Once the flows are executed, the FlowChart window will be refreshed with tabs containing the selected flows and a display tab showing the CMP gather, semblance display and constant velocity stacks.

The Survey Menu

The Survey menu contains commands for displaying maps of the data locations, defining the 3D coordinate binning information and quality checking of the geometry information.

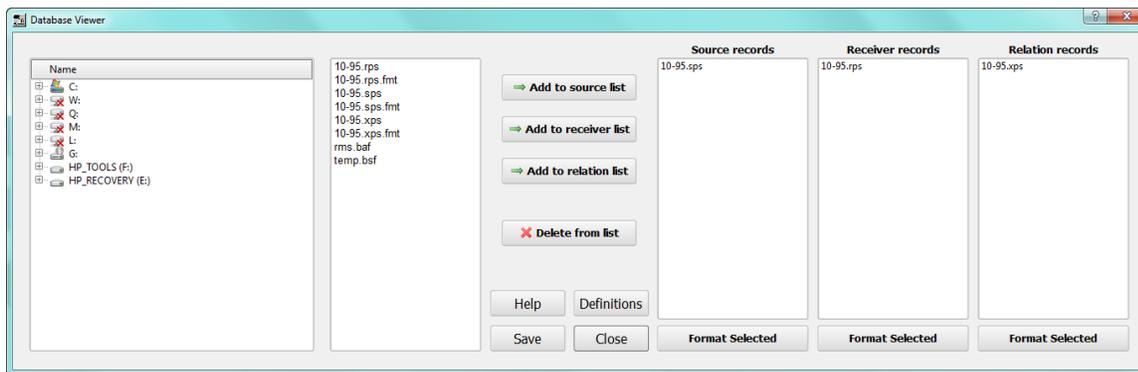
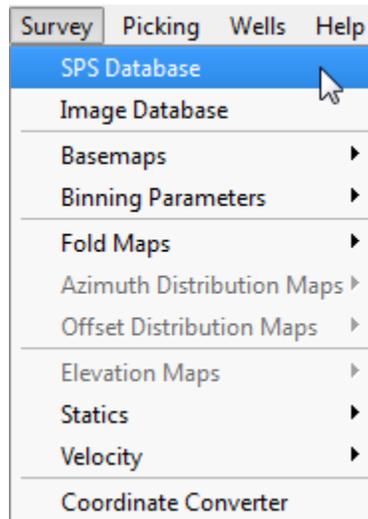


The Survey Menu

To use the map options in this menu, the survey files (SPS files) should be stored in the current project's Survey directory.

The SPS Database

SPS files are tied to the current project using the SPS Database.



SPS Database Definition

Select SPS files and add them to the correct column based on their data type. Individual formats may be defined to correctly read each SPS file (see section describing SPS Analysis).

The Image Database

Image files are tied to the current project using the Image Database.

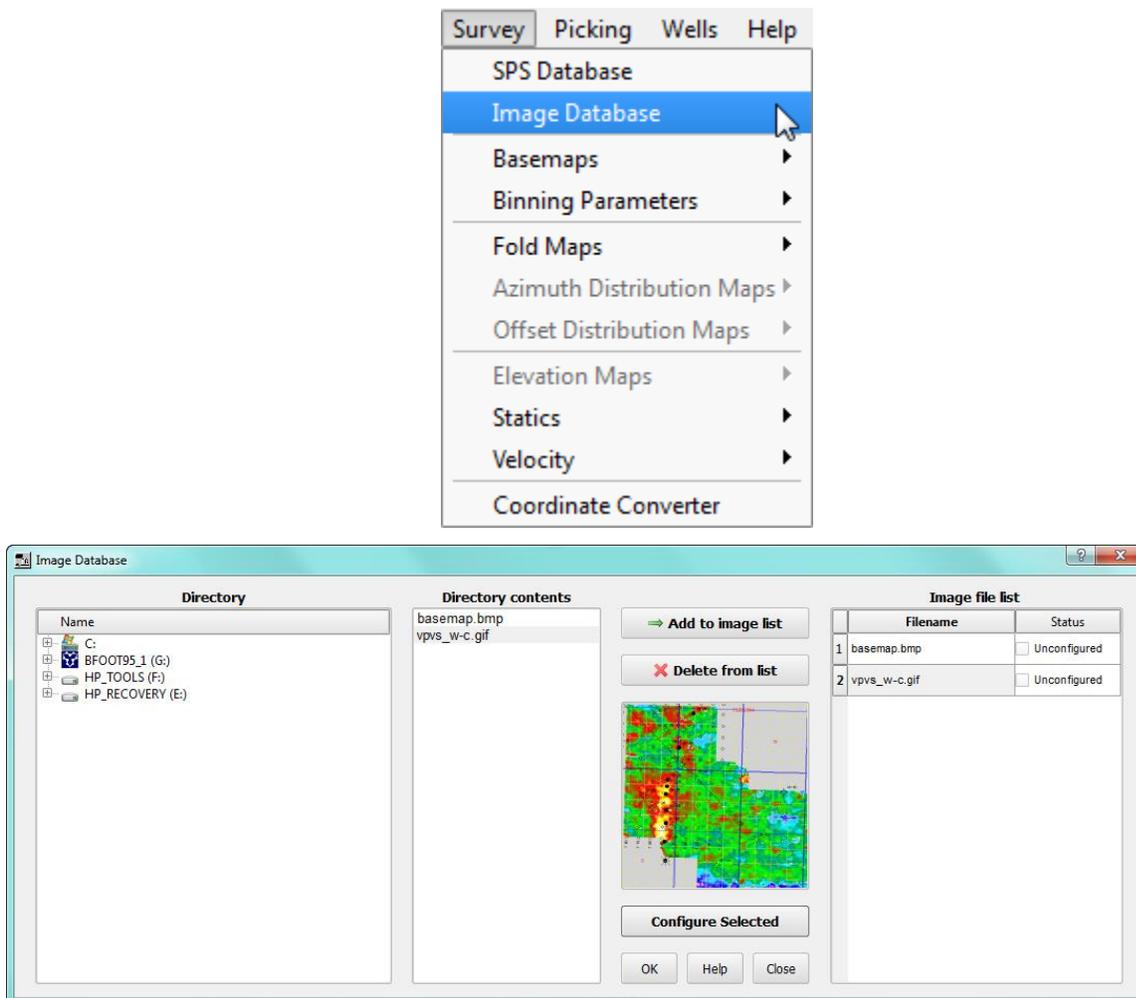


Image Database Definition

Select your background image files and add them to the project. Then you can select each image and configure the coordinates for the image to be drawn on maps.

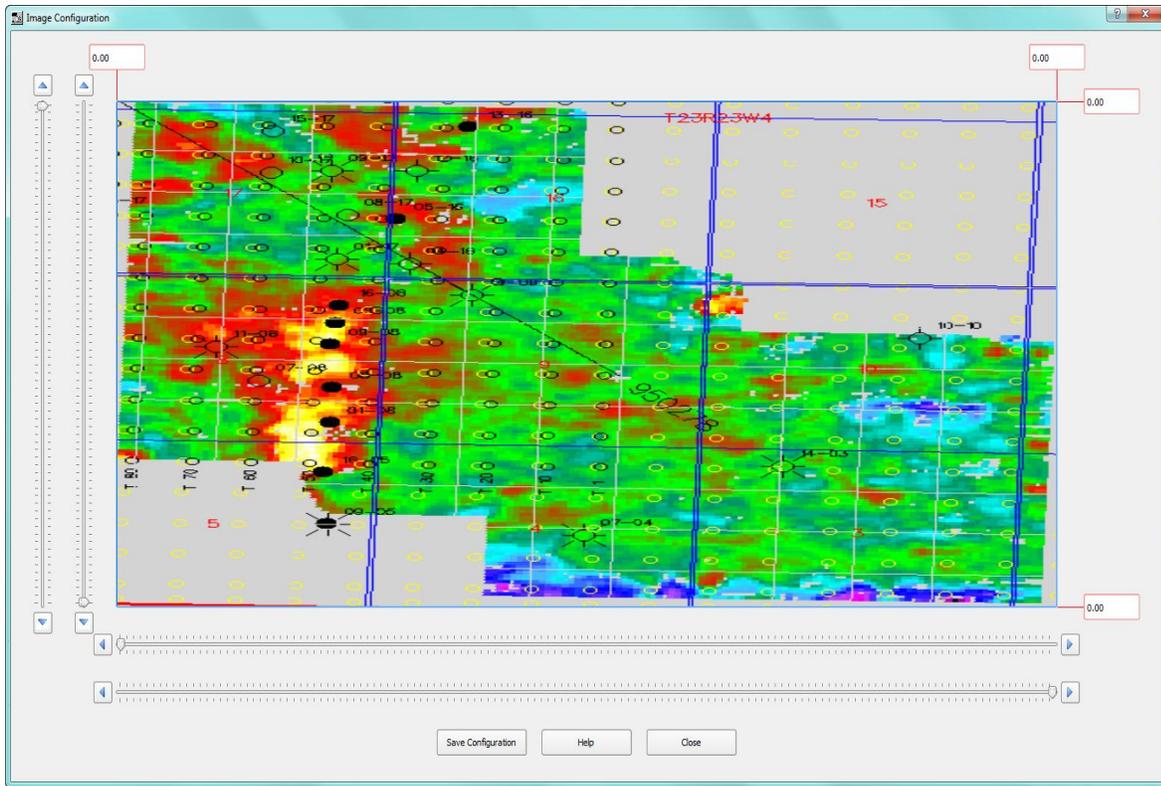


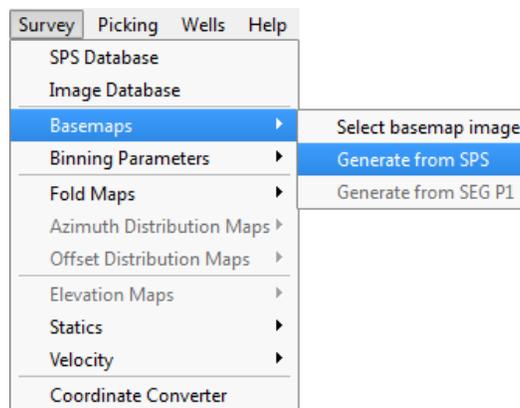
Image Database Configuration

Map Displays

Map displays are new in SPW 3. There are a number of different types including base maps, fold maps and attribute maps.

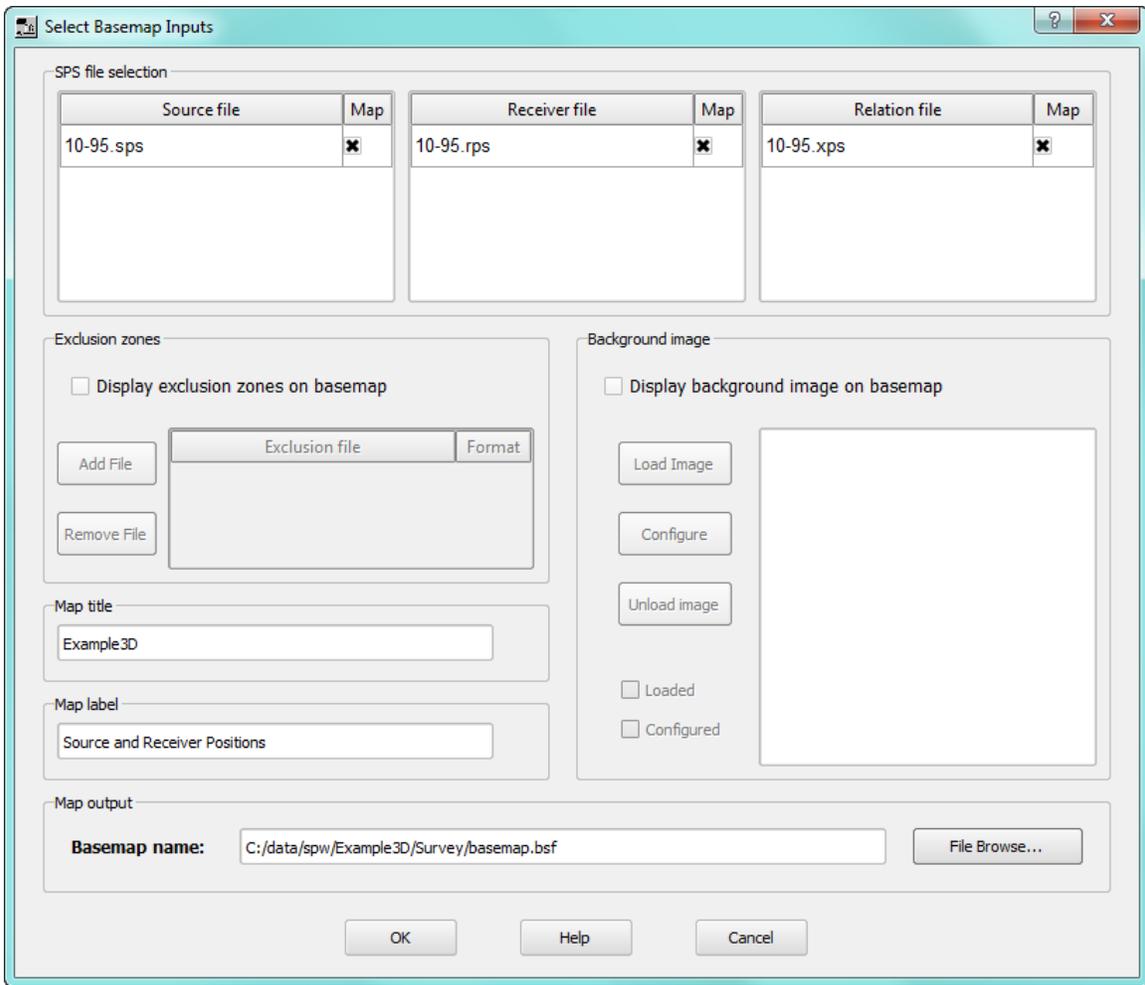
The Basemap

Previously computed basemaps can be selected and new ones generated from SPS geometry files. The geometry files must be in the Survey directory of a project. To generate one select “Generate from SPS” from the Basemaps menu:

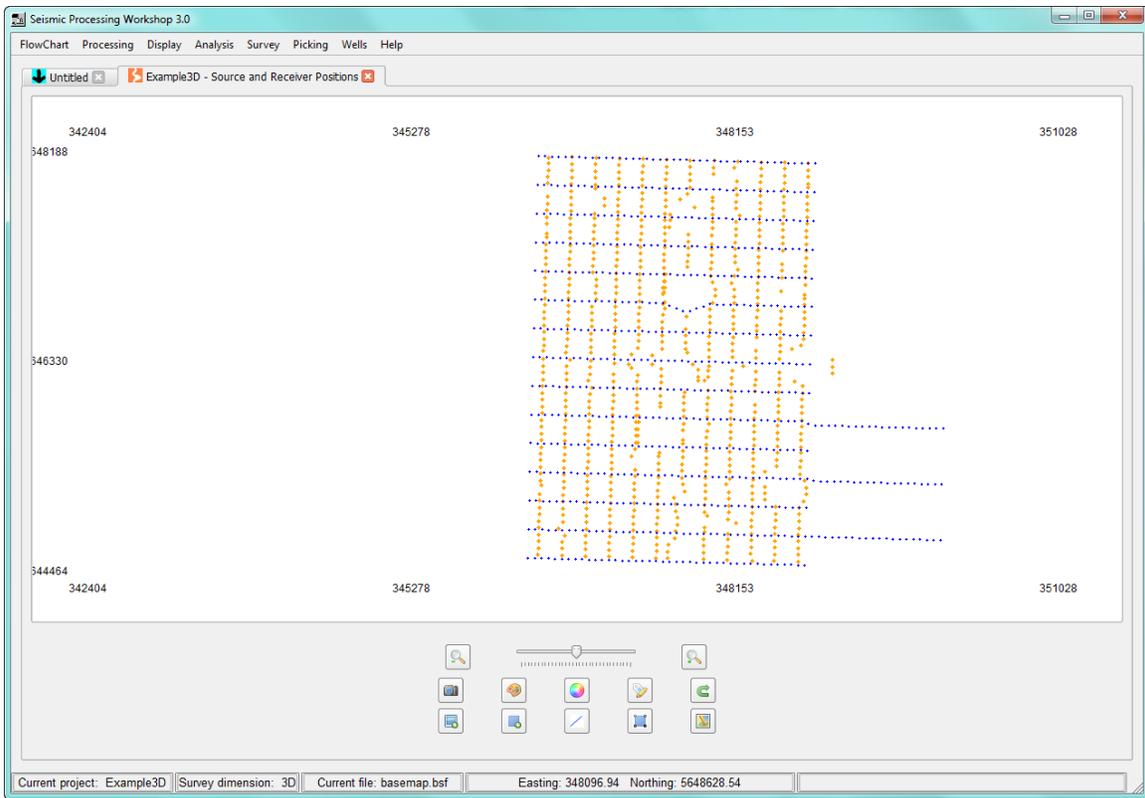


Basemaps menu

This opens the Select Basemap Inputs from which you select the SPS input files from the SPS database and where you can select a background image and any exclusion zones. The basemap is created and saved to file – use “Select basemap image” to redisplay any previously created image files.

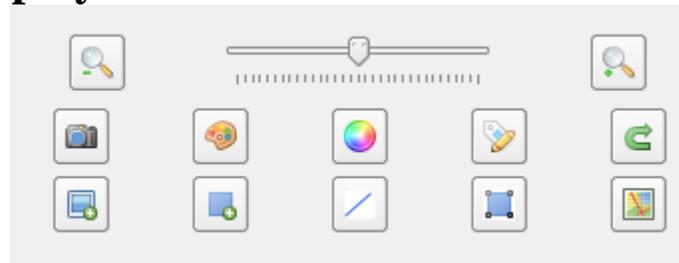


Survey 3D Basemap Dialog



Survey 3D Basemap Display

Base Map Display Control Panel



Zoom In & Zoom Out – Click on the buttons to zoom the image in or out. Also use the slider bar to change the level of zoom. Use the **Reset to Original Scale** button to reset the zoom level. Clicking on this button changes the sort order of your data using current sort keys. When new sort keys are selected from the right side of the seismic display control panel, clicking on this button implements the selection.



Capture an Image – Opens the Setup Image Dialog box (this is described along with the seismic view description, above).



Select or View a Current Color Scale – Opens the Select Color Tool dialog from which you can view currently available color scales and select a different scale to view (this is described along with the seismic view description, above).



Create a New Color Scale or Edit an Existing One – Opens the Color Scale Editor dialog (this is described along with the seismic view description, above).



Customize Map Annotations – Click to open the annotation panel where you can configure the size, color and shape of the source and receiver points.



Reset to Original Scale – resets the zoom.



Measure Distance Between Points – Click the pointer in two places on the map view to measure the distance and azimuth between points.



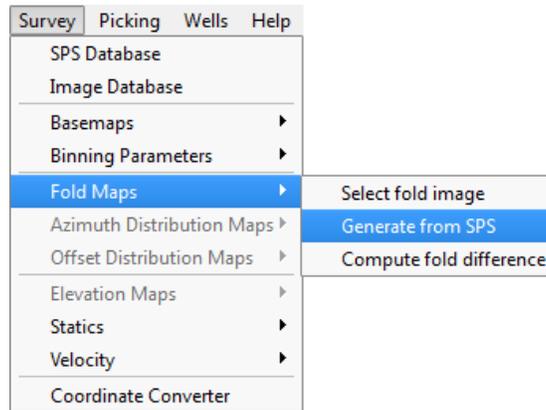
Measure Areas – Click, drag and then release the pointer to create an rectangular area – the area within the shape will be displayed.



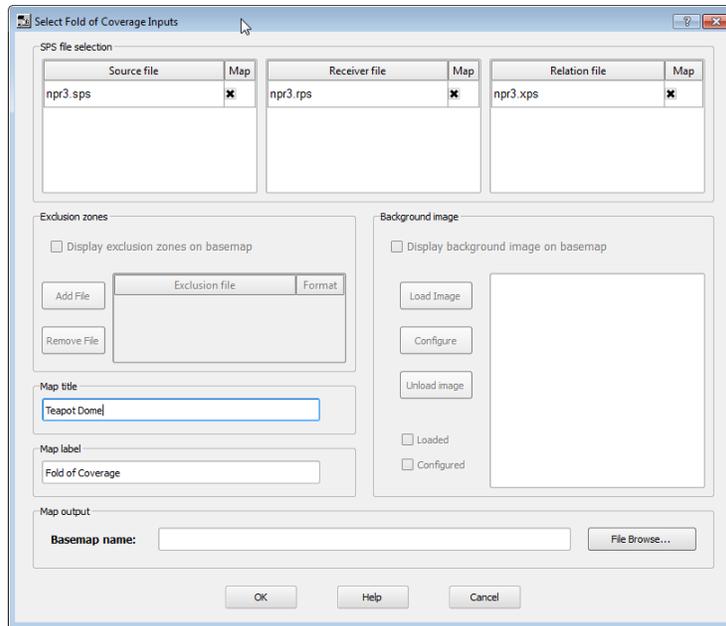
Redraw Map – Redraws the map.

Fold Maps

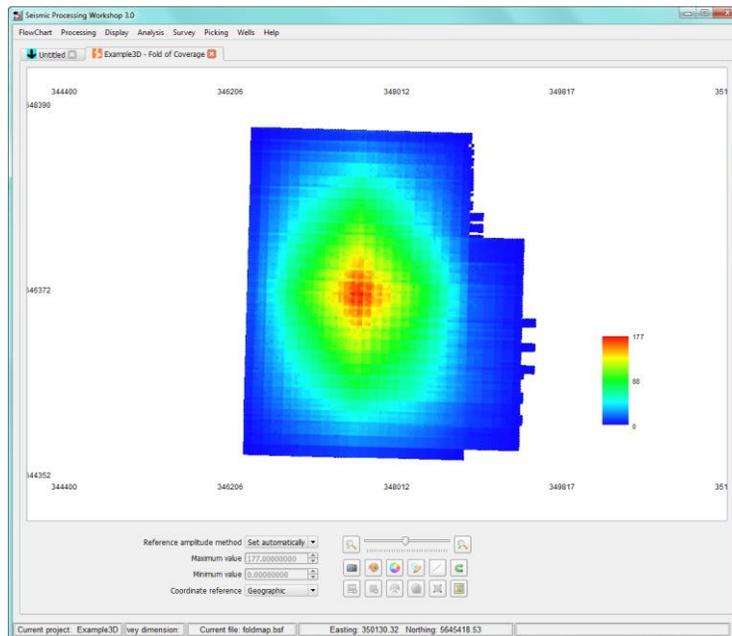
Previously computed fold maps can be selected and new ones generated from SPS geometry files. The geometry files must be in the Survey directory of a project. To generate one select “Generate from SPS” from the Fold Maps menu:



When you select the Fold->Generate fold from SPS command, for a 3D dataset, you will see the parameter dialog shown below for creating a fold map. The fold map is created and saved to file – use “Select fold image” to redisplay any previously created image files.



Selecting the appropriate SPS files and any background and/or exclusion zones that you wish to display will result in creating an annotated fold map as is shown below.

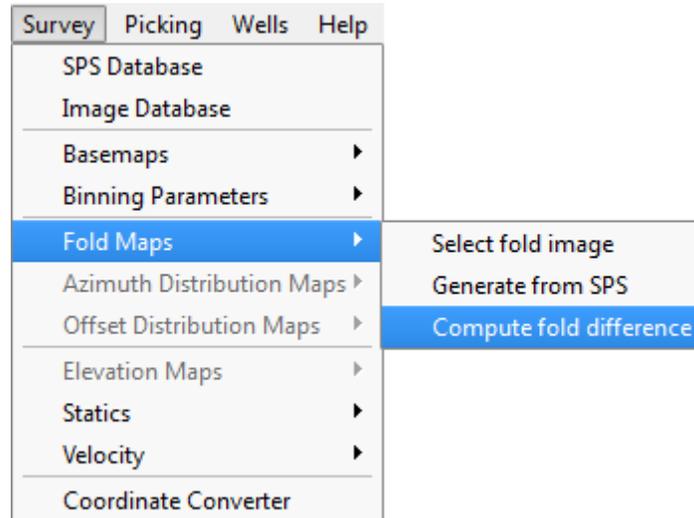


Survey 3D Fold Map Display

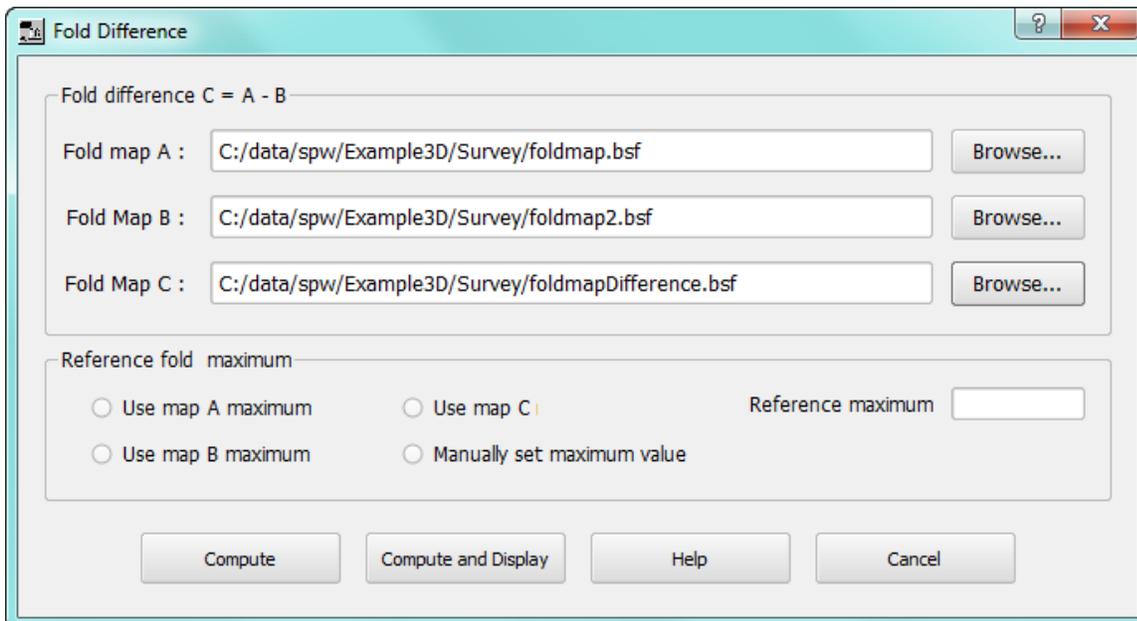
The display control map parameters are similar to those used for the basemap display and are described above.

Compute Fold Difference

Two fold maps can be used to create a difference map. Select “Compute fold difference” to open the Compute Fold Difference dialog from which the difference map can be computed and saved. Previously computed difference maps can be re-displayed using Select Fold Image.



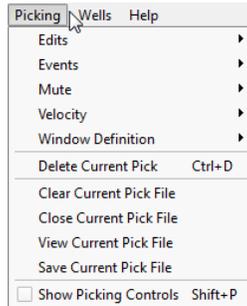
Compute Fold Difference



Fold Difference Dialog

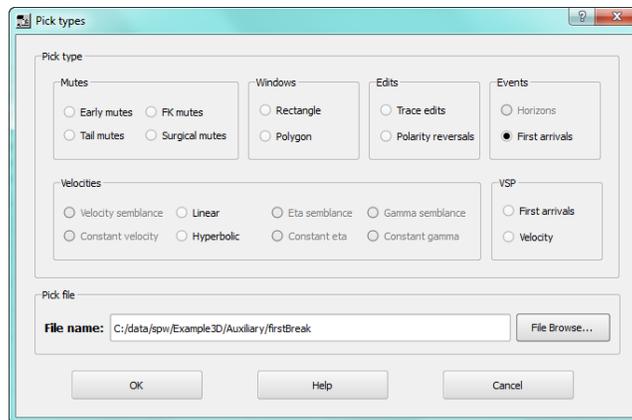
The Picking Menu

The Picking menu contains commands for picking various auxiliary data including first breaks, horizons, velocities, or mutes.



The Picking Menu

The picking options should be used in conjunction with the display of seismic data. One workflow for picking first arrivals is to open the seismic display and to select the picking button , which will open the Pick Types dialog.



Pick Types Dialogs

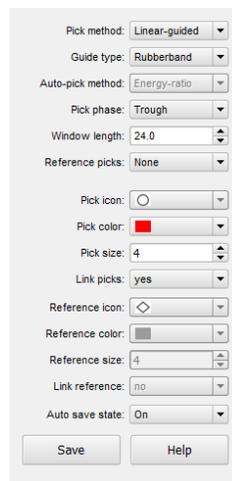
Select “First Arrivals” and then use the File Browse... button to create a new file to store the picks in or an existing file. By default, pick files are stored in the Auxiliary directory of your current project. The different picking options, Mute, Events, etc., are limited to particular data sorts. For example, the First Arrivals requires source, receiver or CMP sorts:



The Picking's Sort Keys Dialog

When an existing file is selected for storing the pick outputs, a check is made to ensure that the file already contains picks of the required type – for example you can't mix velocity picks with first break picks. While picking is progress a backup pick file (ending .bak) is created that will contain the previously saved picks.

Picking is controlled by the options in the picking panel which is shown to the right the display:



The Picking Panel

The Picking options include:

Pick Method – select from single trace, linear guided or automatic methods.

Guide Type – used for the guided method to select rubberband or Two-Point methods.

Auto-Pick Method – used for the automatic pick methods.

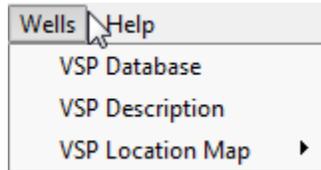
Pick phase – select peaks and troughs, zero crossings or no auto selection.

Window length – control the search in the picking phase.

Other options control the colors, sizes and shapes of the picking markers.

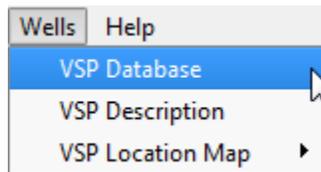
The Wells Menu

The wells menu items are used for setting up well data and a VSP survey geometry, and are used in conjunction with the VSP processing flow steps.

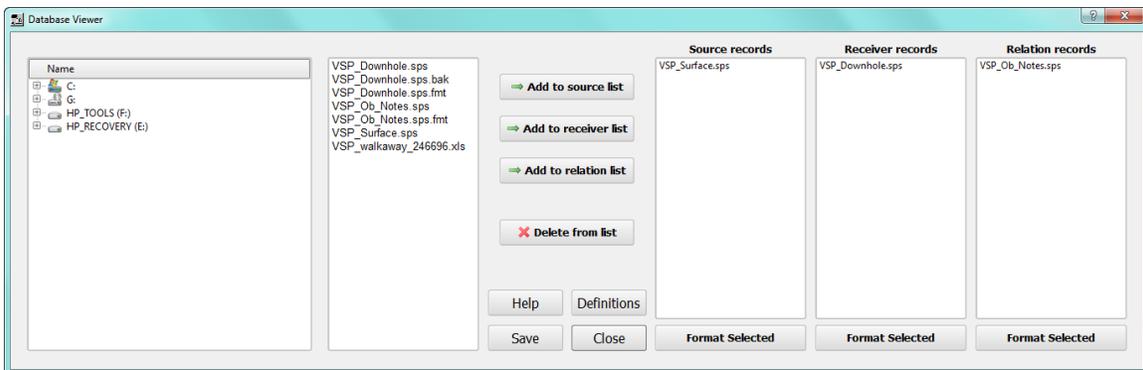


The Wells Menu

The VSP Database is used to set SPS source, receiver and relation records and for defining any SPS formats. Use VSP Database to open the Database Viewer:



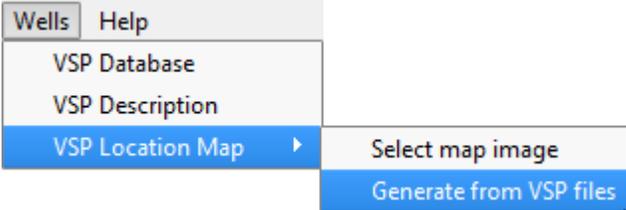
VSP Database



VSP Database Viewer Dialog

The VSP Database Viewer operates in a similar manner to the SPS Survey Menu, described above, with source, receiver and relations files needed to be defined and the formats set.

A Location map can be constructed from the VSP Database and previously created location maps opened (use VSP Location Map > Generate from VSP files and VSP Location Map > Select map image, respectively):



VSP Location Map options

The location and datums of your well are specified in the VSP Description. This option opens the following dialog:

VSP Information

Well Description

Well name

Well number

Well easting

Well northing

Well location

Kelly bushing

Ground elevation

Seismic reference datum

Mean sea level

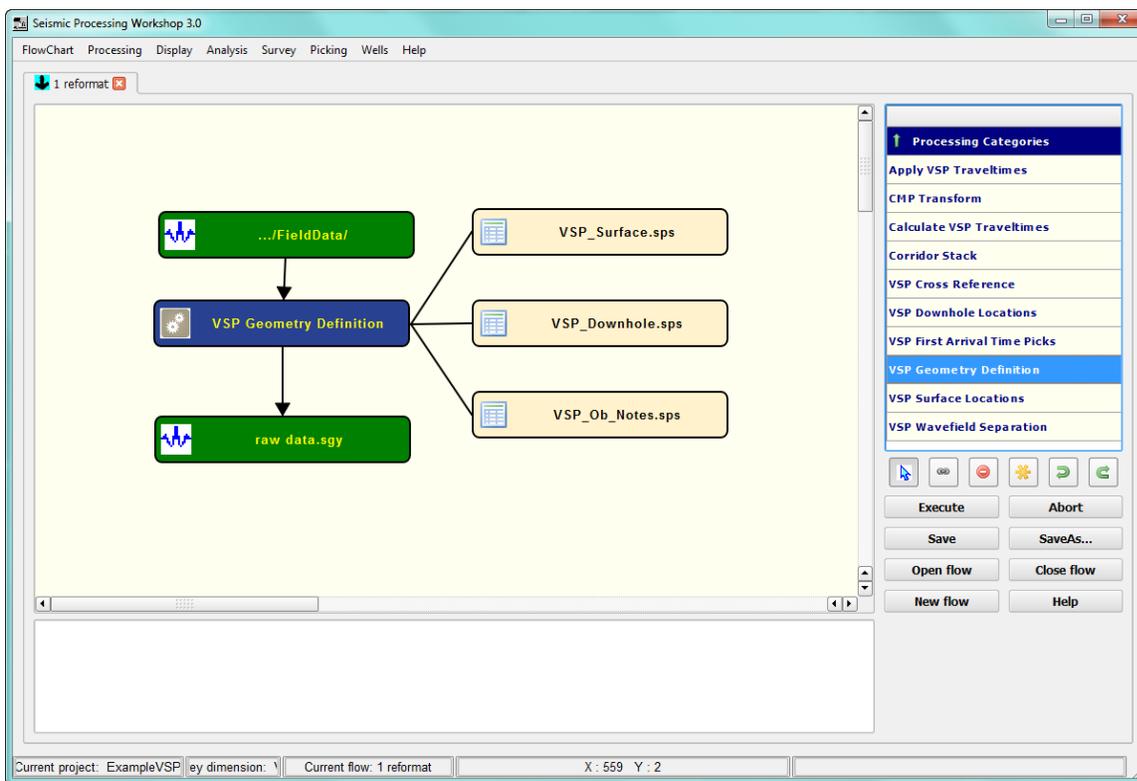
Save Help Close

VSP Description Dialog

VSP Geometry Definition

Once set up these items can be used for creating a Location Map and when importing VSP data using the VSP processing step: VSP Geometry Definition.

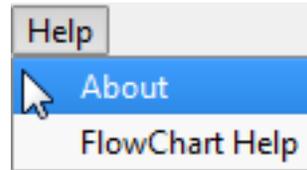
A simple processing flow for reading VSP data from input files, merging with the VSP SPS data and outputting to a new SEG Y file is shown below. Key header values that must be set in the field data before the merge can take place are the field file ID and the channel number which are cross referenced with the record number and the channel numbers in the SPS relations file.



VSP Geometry Definition processing step.

The Help Menu

The Help menu contains commands for displaying the current information about the installed version of SPW and the licensing and access to the Flowchart help files.



The Help Menu

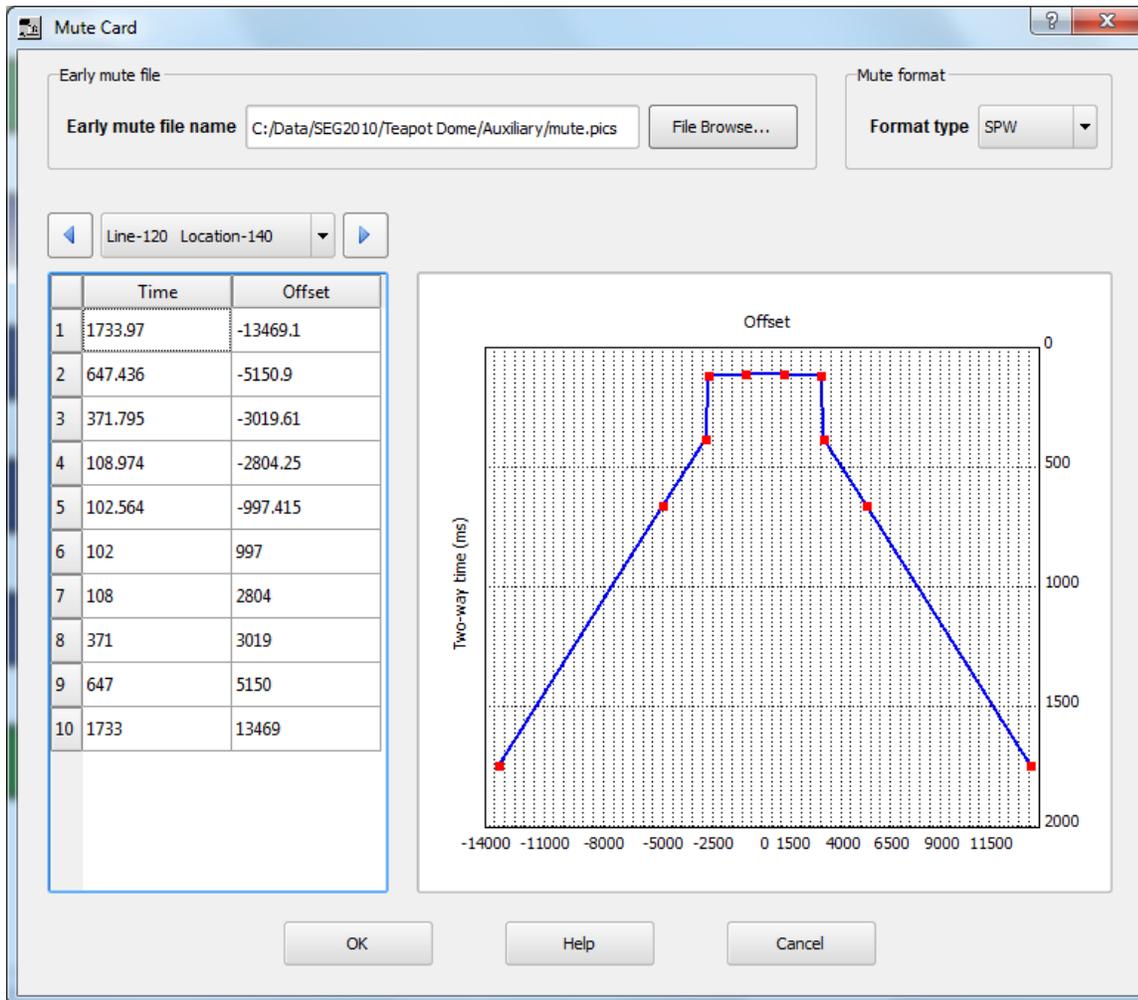
Displaying Spreadsheets of Auxiliary Data

Each of the Auxiliary data types has a unique display and spreadsheet view which is customized for that spreadsheet's specific data type and contents. The following pages show examples of the spreadsheet views for a number of the data types. Each spreadsheet also has controls allowing you to move between displays. For example, Velocity Functions exist in multiple locations in a 3D survey at specific CMP Line and CMP Location positions. You can move between control points using the control at the top of the spreadsheet where it shows the Line and Location.

To open an auxiliary dialog, you can select an appropriate Auxiliary Data step from the Flowchart steps (double click or right click on the step to open the file selection dialog). Alternatively you can view a dialog when you select a step in the flowchart which requires auxiliary data as input. For example the receiver and source statics dialogs can be opened from the Statics processing steps, time picks can be opened from the First Arrivals Statics step, velocity function files can be opened and displayed from the Apply Normal Moveout step. These are just some of the many examples of where auxiliary data files can be opened; the following gives examples of some of these dialogs.

Early Mute Functions

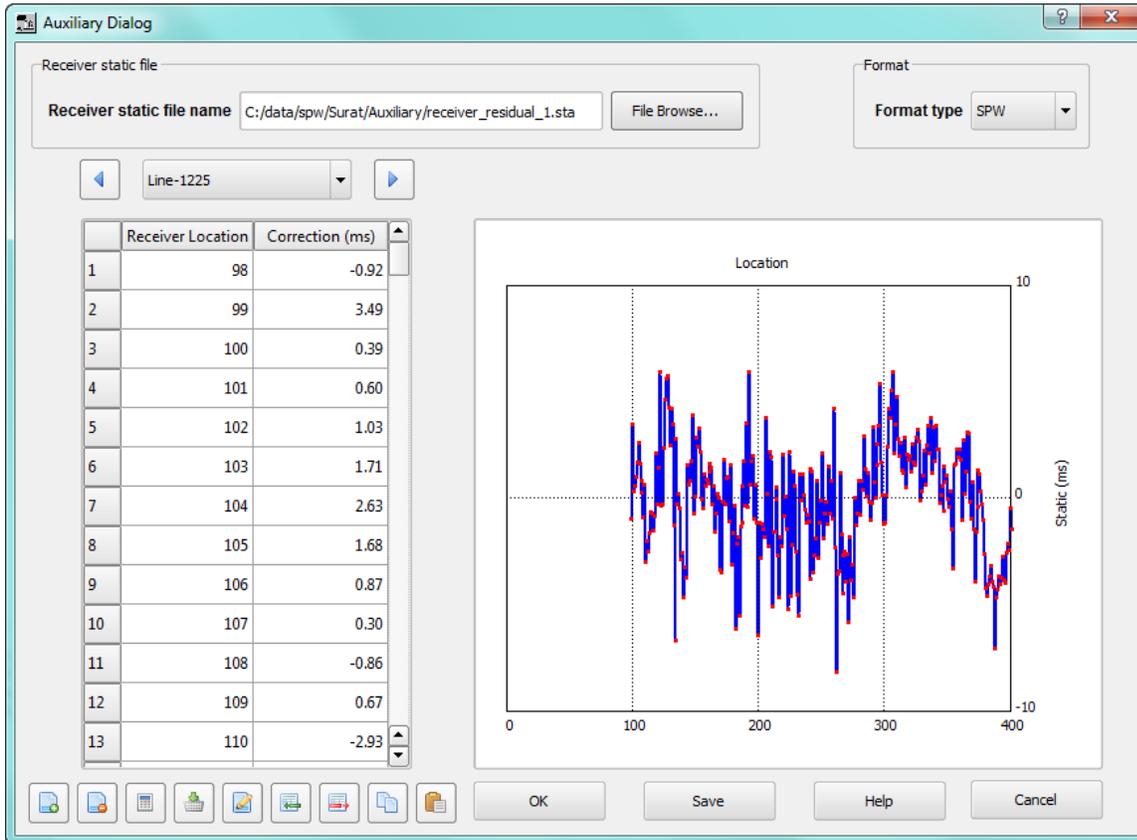
Mute functions are defined by time offset pairs. They are usually picked on a few gathers in the dataset and interpolated between these control points.



SPW Early Mute Function Spreadsheet

Receiver Statics

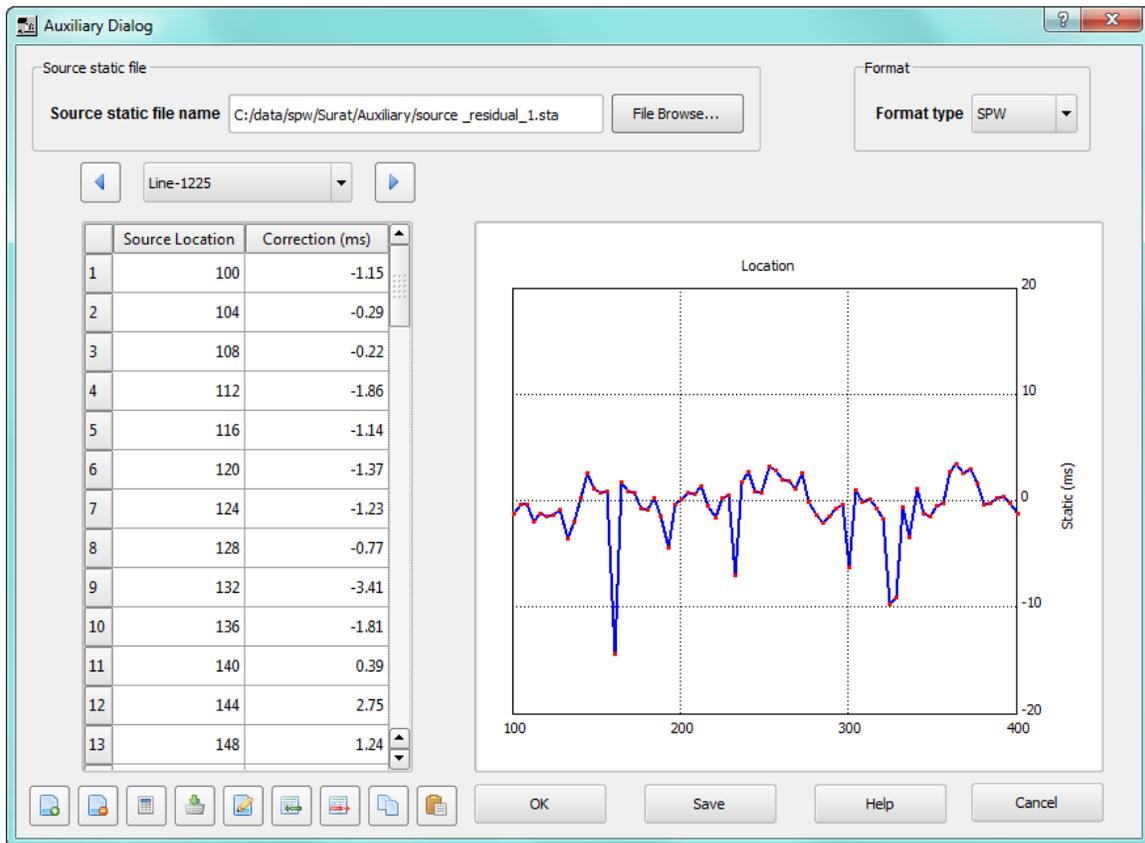
The receiver statics are displayed on a line by line basis. You can move through the lines in a 3D survey by selecting the lines above the spreadsheet columns using the directional arrows.



SPW Receiver Statics

Source Statics

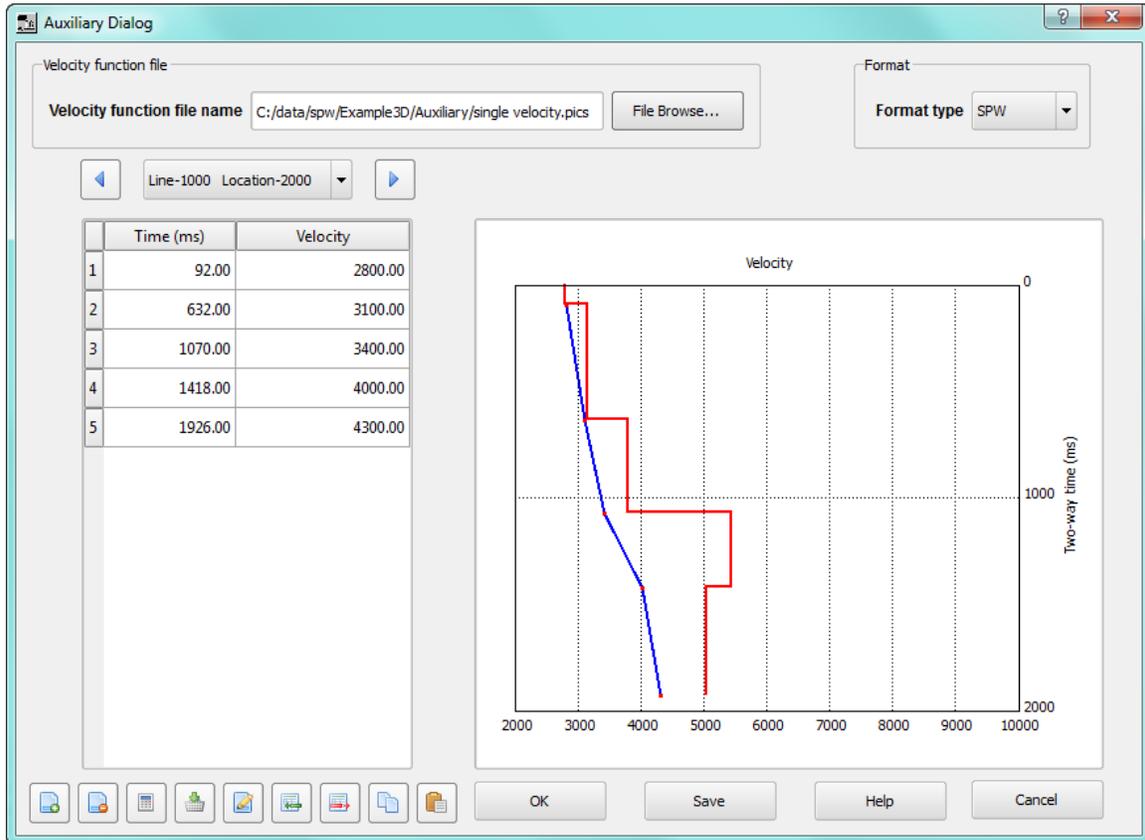
The source statics are displayed on a line by line basis. You can move through the lines in a 3D survey by selecting the lines above the spreadsheet columns using the directional arrows.



SPW Source Statics

Velocity Functions

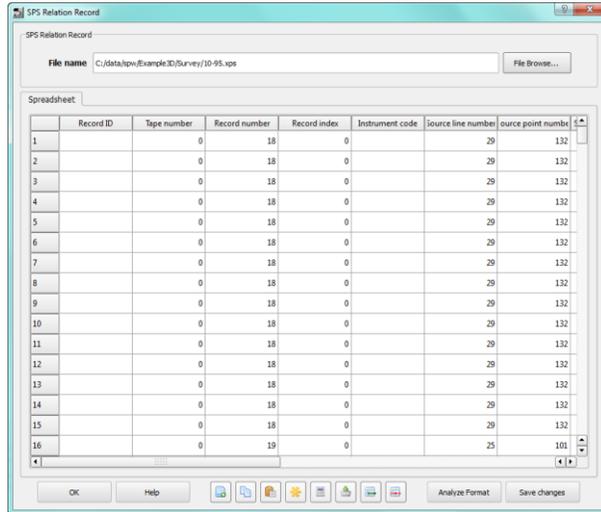
Velocity functions are defined by time offset pairs. They are usually picked on selected gathers throughout the dataset and interpolated between these control points.



SPW Velocity Function Spreadsheet

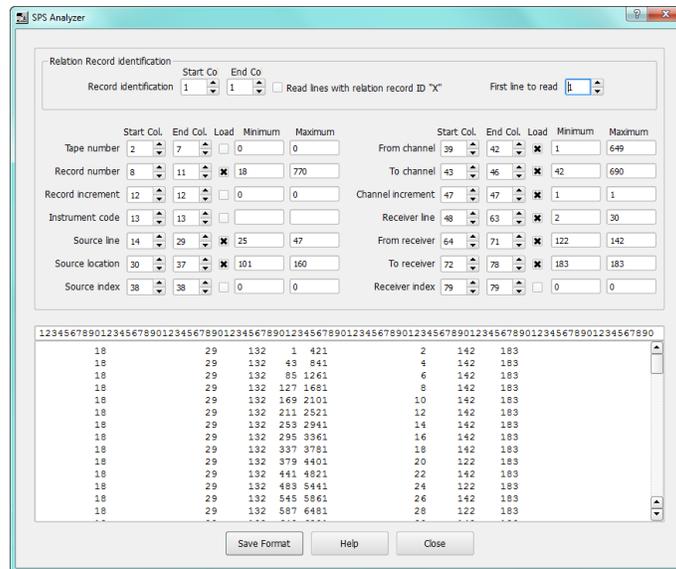
SPS Observers Notes

The SPS Relation Record displays Observers Notes in a tabbed worksheet. Use the File Browse to select your XPS file and the spreadsheet will open displaying the contents. If it is not correct or nothing is displayed then you should use the Analyze Format button at the bottom of the display to define how these data are read.



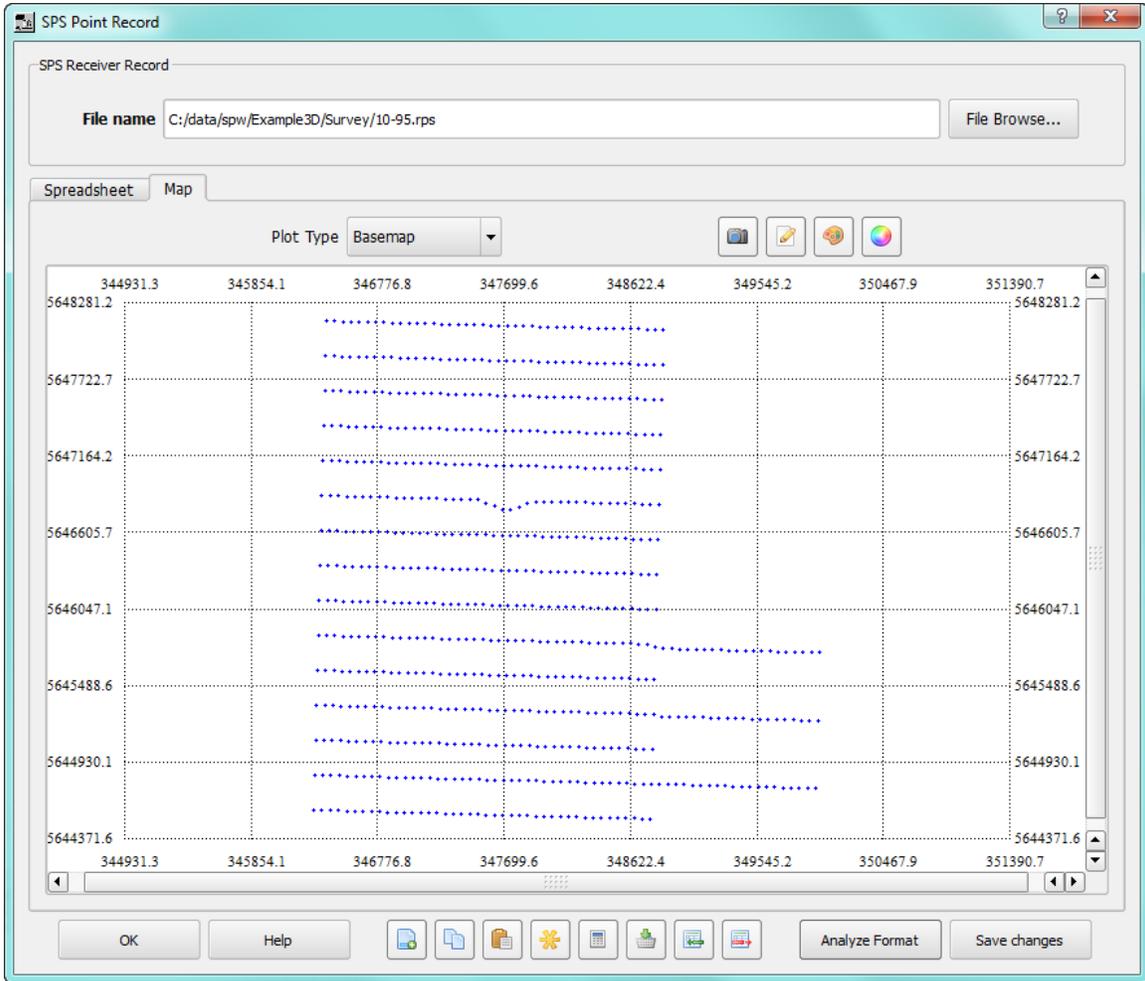
SPS Relation Record: Spreadsheet Tab

The SPS Analyzer allows you to specify how the data will be read and decoded from this sps file. When the format is correctly defined, be sure to Save.



SPS Relation Record: Record Analysis Tab

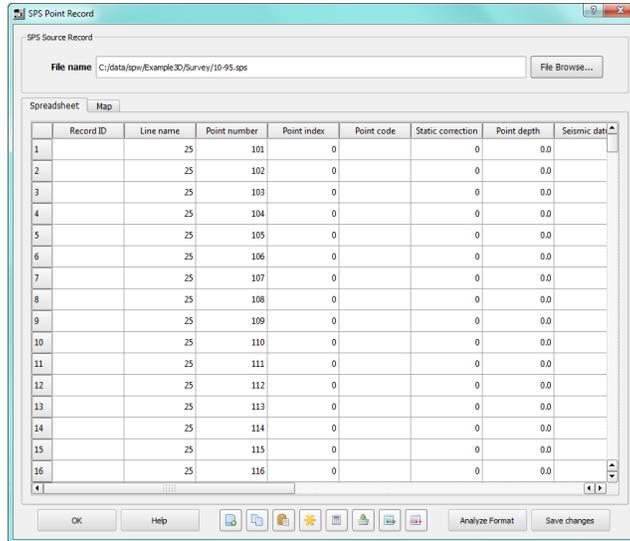
The SPS Point Record also has a tab for map display. The Map tab allows you to specify the Plot Type. The default is Basemap, other options include elevation.



SPS Receiver Record: Basemap

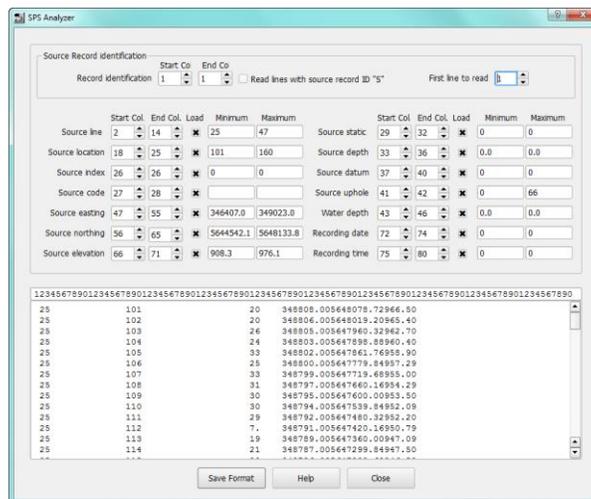
SPS Source Locations

The SPS Point Record displays Source Locations in a tabbed worksheet. Use the File Browse to select your SPS file and the spreadsheet will open displaying the contents. If it is not correct or nothing is displayed then you should use the Analyze Format button at the bottom of the display to define how these data are read.



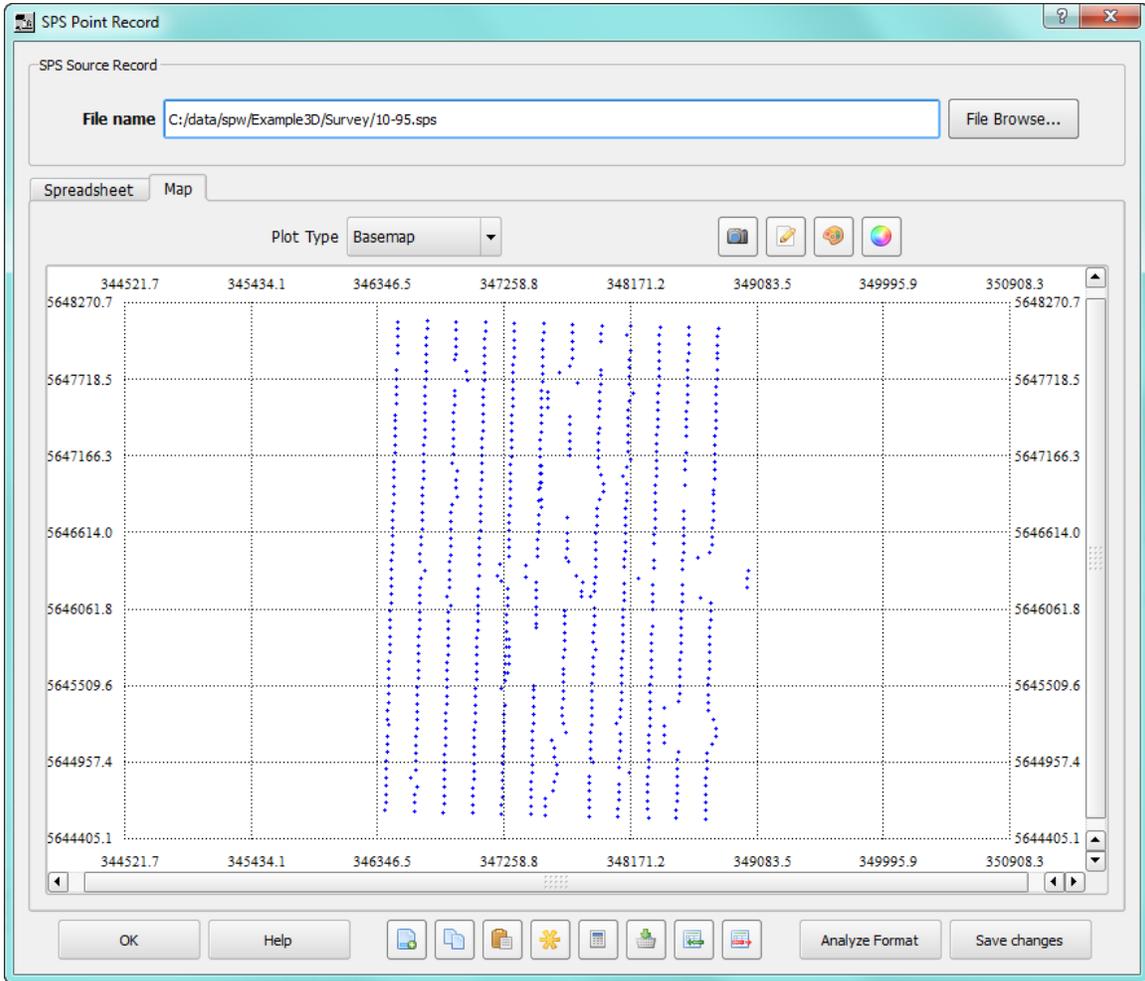
SPS Source Record: Spreadsheet Tab

The SPS Analyzer allows you to specify how the data will be read and decoded from this sps file. When the format is correctly defined, be sure to Save.



SPS Source Record: Record Analysis Tab

The SPS Point Record also has a tab for map display. The Map tab allows you to specify the Plot Type. The default is Basemap, other options include elevation.



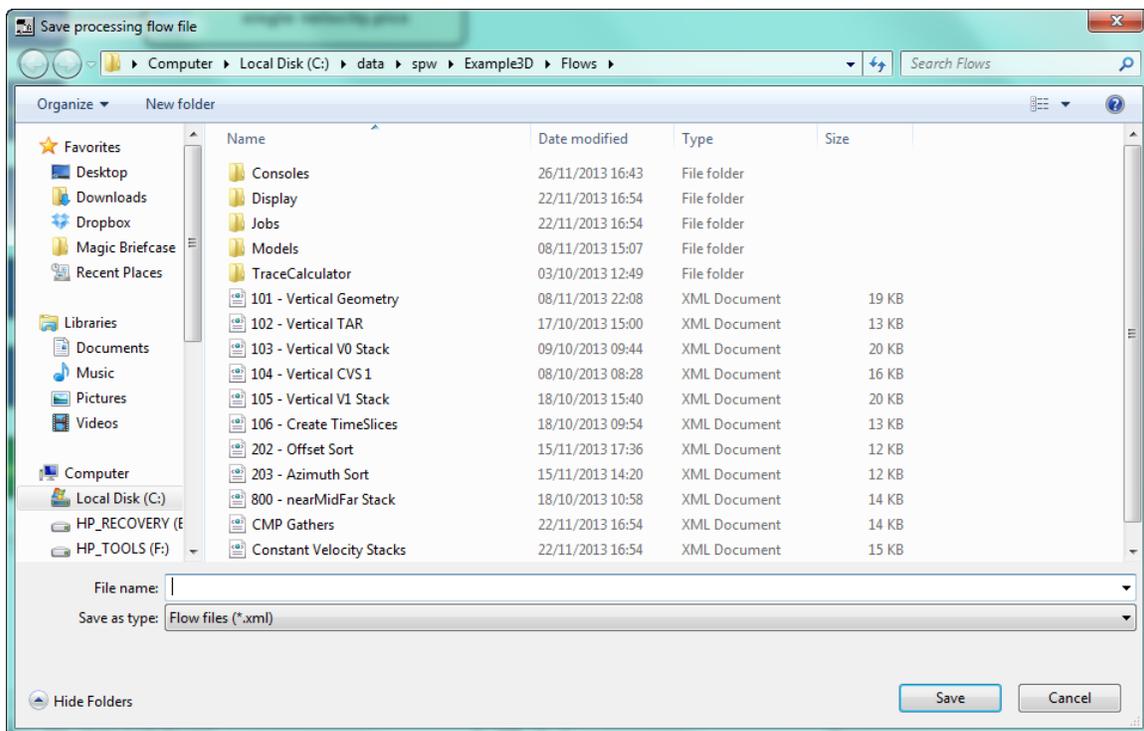
SPS Source Record: Basemap

Running the Flowchart

Once you are satisfied with the flow you have constructed, you need to name and execute the flow to complete your processing.

Naming and Saving a Flow

First, you must give the flow a name and save it. To name a flow document, use the Save... or the Save As... commands in the File menu. By default the flow will be saved into the project Flows directory. You will want to assign a meaningful name to the flow document. Flows are saved in XML format so you can view them with any text editor or web browser as well as opening the graphical view in SPW.

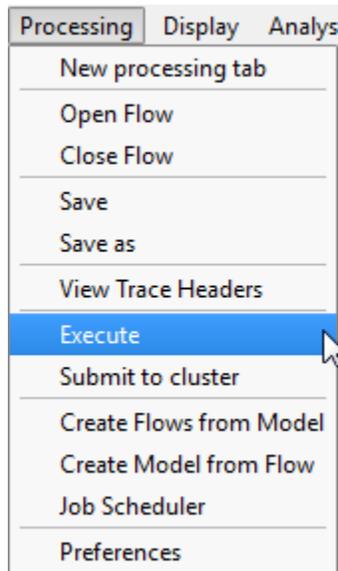


Save Flowchart XML File

If you try to compile a job that has not been named and saved, the Save as Flowchart dialog will automatically appear and you will be prompted to give the flow chart a name. If you do not give the flow chart a valid name and save it, then you will not be able to execute it.

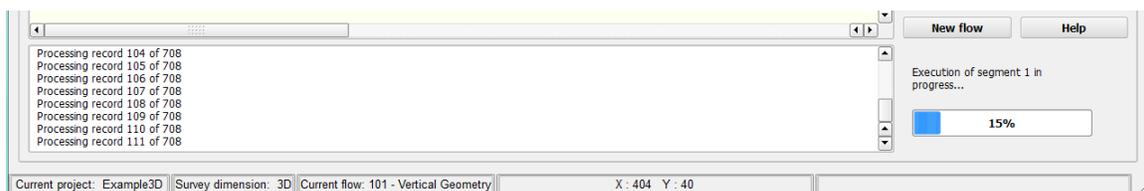
Executing a Flow inside the Flowchart

Running a flow is a simple matter of selecting a processing step on the flowchart and pressing the Execute button or selecting the Execute command from the Processing menu.



Execute Command

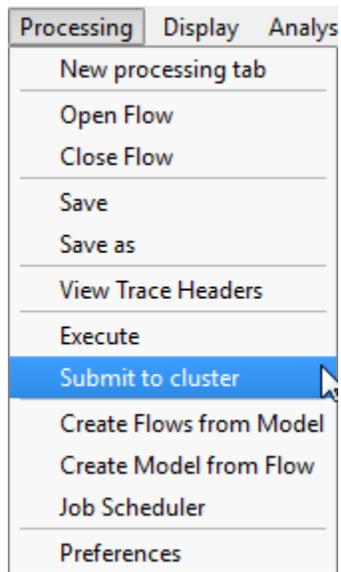
Below is a display of the console area at the bottom of the flowchart display. The console will show any errors or warnings. It also shows messages about the status of the job execution. The execution of the flow is done on a separate thread from the flowchart, seismic and map displays so you can continue working during a job execution.



Execution Console

Executing a Flow on a Cluster

A flow can be executed on a cluster. Select the Submit to cluster command from the Processing menu.

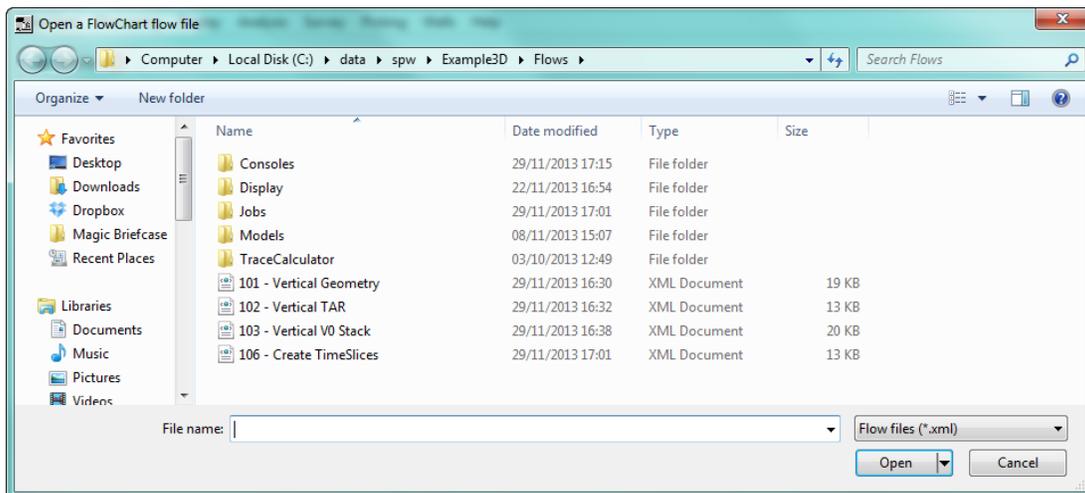
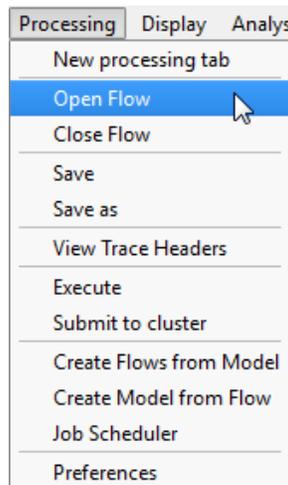


Submit to Cluster command

Example 3D Processing Flows

This section describes the main processing flows that takes the field data from Blackfoot land seismic 3D survey (vertical receiver components) and passes it through flows that merge the location data with the field seismic, that stacks into CMPs, that applies NMO correction and finally gives you a stacked CMP data volume and time slices. Screen grabs of the flows are given along with some description of the principal processing steps; full details of each processing step can be found later in this manual.

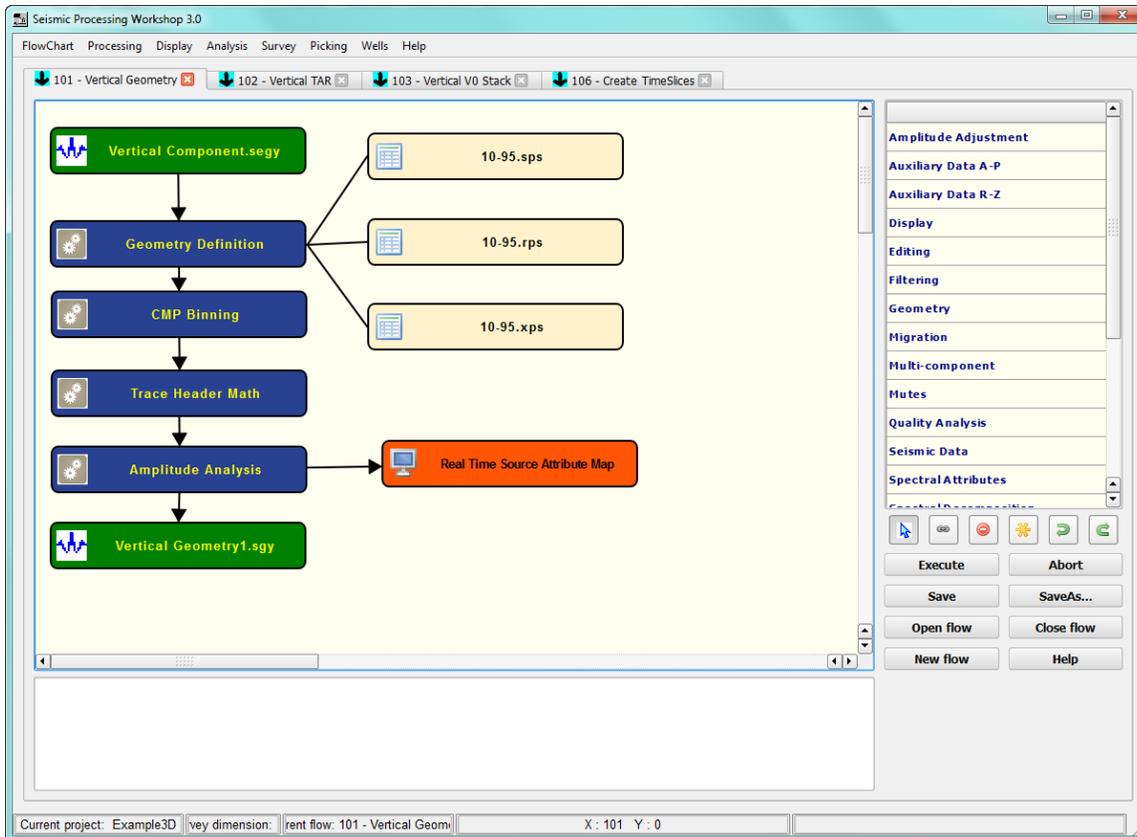
The naming convention of the processing flows appends 101, 102, etc., in front of the flow name so that when you display the list of flows saved in a directory they appear in a logical order. The flows, listed below in the File Selection Dialog when you open a flow are:



3D Processing Flows

Flow 1 - Vertical Geometry

This flow is used to take the vertical component field data of the Blackfoot 3D land seismic survey, to merge it with the SPS field source, receiver and relation records and to stack it into common mid-point (CMP) bins.



Vertical Geometry Processing Flow

SEG Y Import

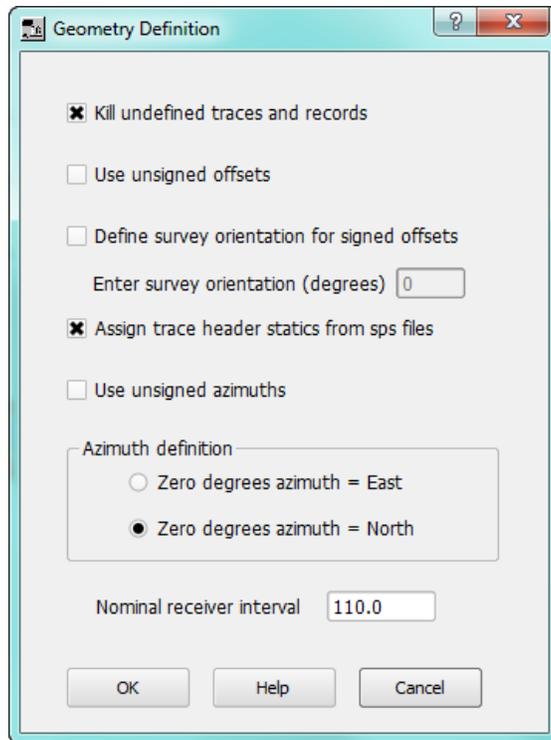
The input SEG Y file is sorted by Field File number and Channel Number, with the number and ranges shown in the screen grab of the SEG Y Import dialog below.

Primary sort key	Reset to Internal Order	Range limit	Minimum value	Maximum value	Interval	Group
Field File	<input type="checkbox"/>	<input type="checkbox"/>	18.0	770.0	1	1
Channel	<input type="checkbox"/>	<input type="checkbox"/>	1.0	690.0	1	1
None	<input type="checkbox"/>	<input type="checkbox"/>				1
None	<input type="checkbox"/>	<input type="checkbox"/>				1

SEG Y Import Dialog

Geometry Definition

The geometry is imported from the Source, Receiver and Relation components of the SPS files which, by default, should have been stored in the project's Survey directory. Screen grabs of each of these, together with information about setting the format descriptions for each SPS data file are given in the SPS section of the Display Auxiliary Data section of this manual, above. This processing flow step will merge the SPS data and populate the trace headers of seismic data with shot and receiver numbers. You could run a simple flow here by saving the output from the geometry definition into a separate SEG Y file rather than passing it onto the CMP Binning flow. This would give you a SEG Y output file, sorted by field and channel numbers, but with the shot and receiver numbers, locations, offsets, etc., added to the headers.



Geometry Definition Dialog

CMP Binning

This Geometry step is used to carry out the binning of the field data into CMP bins. The survey extents are entered together with the desired bin sizes (here 30 by 30 metres). This is a 3D survey so the Survey Dimensions : 3D button is selected. The grid definition would generally be set from data taken from a survey planning package. You can obtain this information from a Fold Map or a Source Location map, using the mouse pointer readout to give you Easting and Northing data points.

The image shows a software dialog box titled "CMP Binning". It is divided into several sections. The top section, "Grid definition", contains two columns of input fields. The left column has "Corner 1 - Easting" (346316.00), "Corner 1 - Northing" (5644574.72), "Corner 2 - Easting" (349884.00), "Corner 2 - Northing" (5644481.72), "Corner 3 - Easting" (346409.00), and "Corner 3 - Northing" (5648142.72). The right column has "Inline bin size" (30.00), "Crossline bin size" (30.00), "First inline number" (1000), "Inline increment" (1), "First crossline number" (2000), and "Crossline increment" (1). Below this are three sections: "Coordinate definition" with radio buttons for "Corner points define bin center:" (unselected) and "Corner points define bin corners:" (selected); "Survey dimensions" with radio buttons for "2D" (unselected) and "3D" (selected); and "Project updates" with two buttons: "Update from project" (with a blue antenna icon) and "Update project" (with an orange antenna icon). At the bottom are "OK", "Help", and "Cancel" buttons.

CMP Binning Dialog

Two project update buttons are available:



Update from project – updates the corner points from the SPS data that has been associated with the project using the Survey > SPS Database menu.

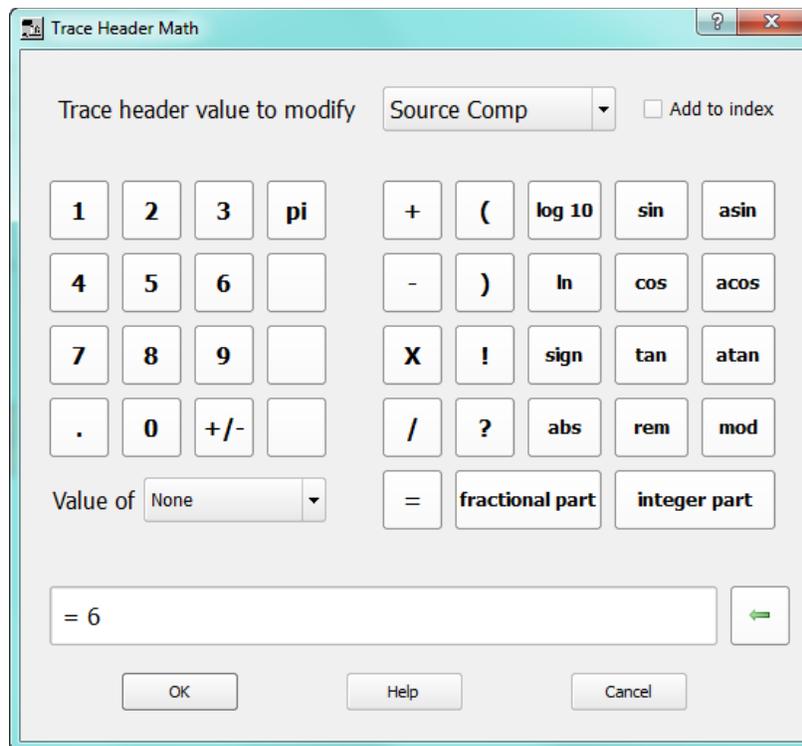


Update project – use this to broadcast the corner points so that they can be used by to set the Easting and Northing ranges of plotting functions, such as the Attribute Map used later in this flow.

The co-ordinate units are set as either feet or meters in the Edit Project dialog.

Trace Header Math

Trace headers often need editing or inserting. As an example, this flow uses the Trace Header Math (from the Editing steps) step to assign the value of 6 to the trace header : Source Comp. Remember, once the output seismic file has been created, you can right click on the file in the flow and select “View Trace Header Values” to display a spread sheet of the header values where you can verify that your trace header edit has been made.

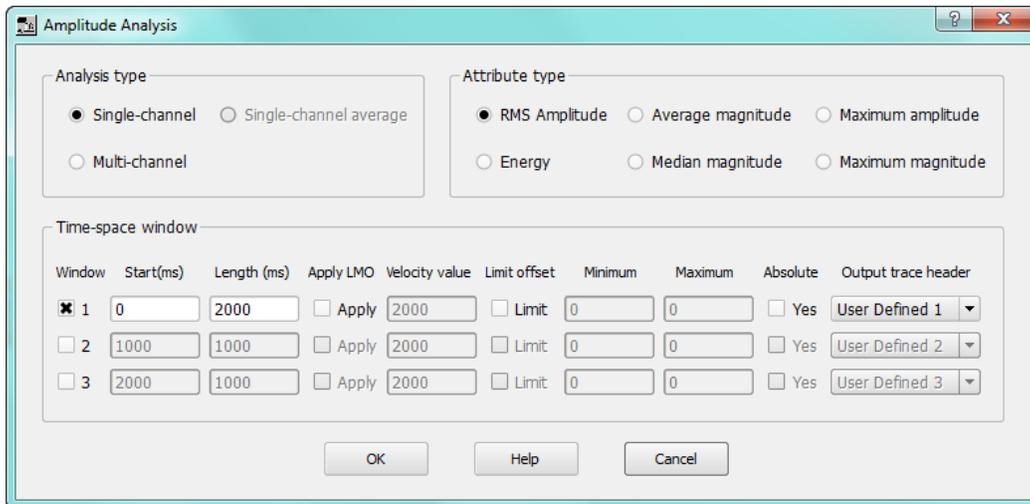


Trace Header Math Dialog

This step to set the Source Component has been added because this data set is part of a 3 component survey; a Source Component of 6 defines the Vertical Component according to the SEG Y standard.

Amplitude Analysis

This Quality Analysis step is added as a means of making a quick quality control analysis of each shot. The step computes an average RMS value for each shot, computed within a 2000ms time gate over all the traces that are associated with each shot. As each trace RMS value is computed it is stored in the trace header: User Defined 1.

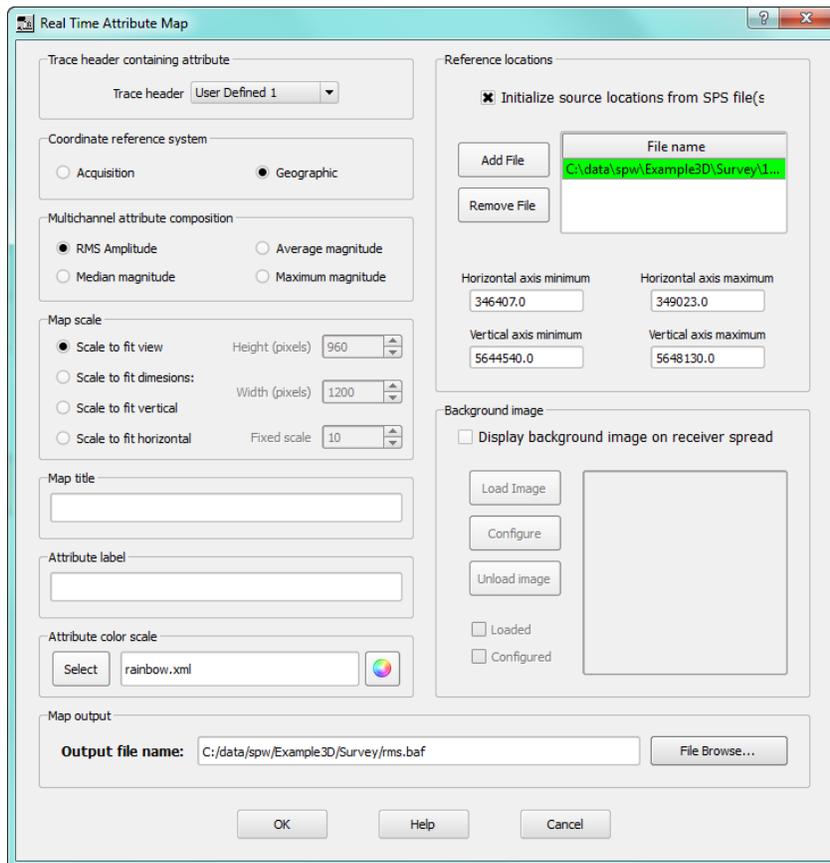
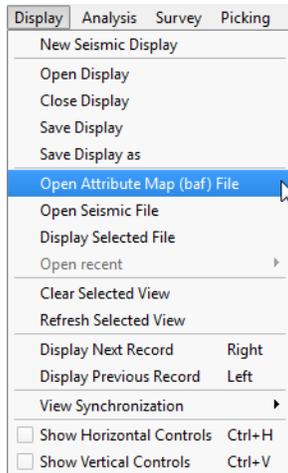


Amplitude Analysis Dialog

The RMS values can be displayed as amplitude map which is updated as the flow progresses. The Display category's Real Time Source Attribute Map has its input attached to an optional output of the Amplitude Analysis step. Options such as color scales and a file to store the attribute map in can be set from this steps popup dialog.

Remember to use the broadcast button in the CMP Binning dialog to set the Eastings and Northings range for the amplitude map.

A previously computed attribute map can be opened by selecting Open Attribute (baf) File from the Display menu.



Real Time Attribute Map Dialog

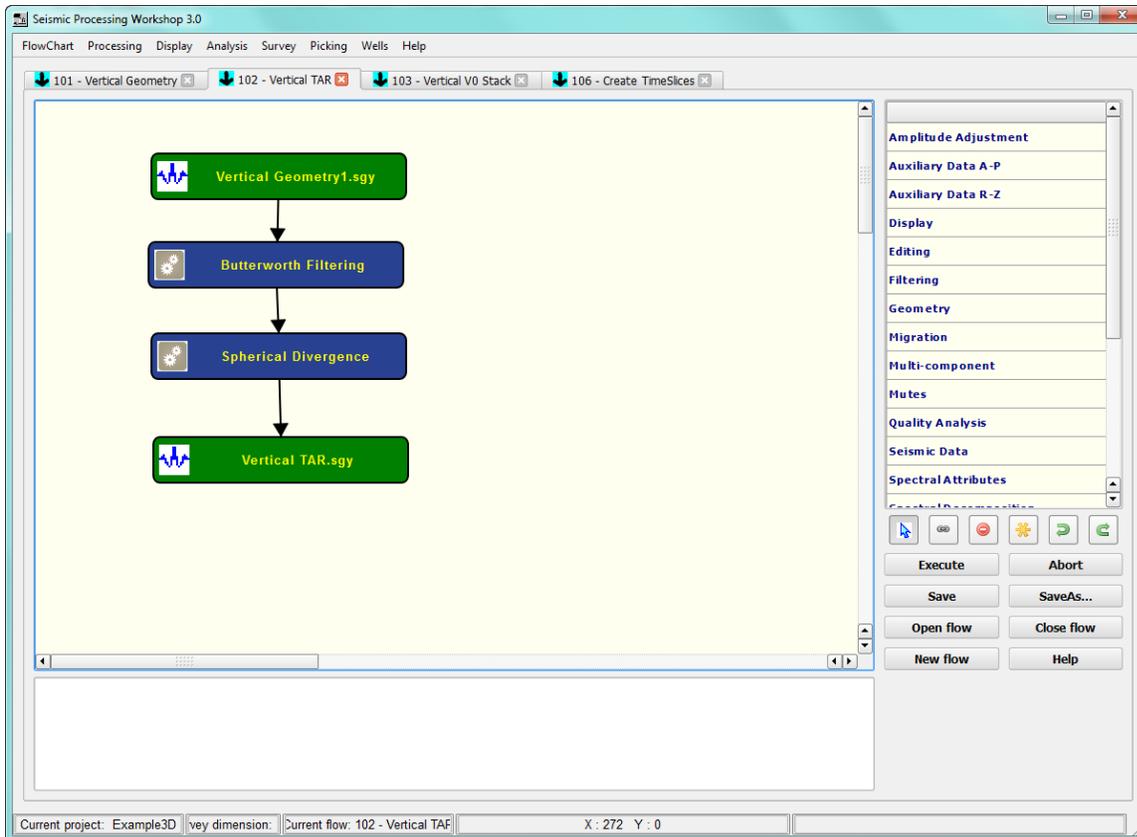
Seismic File

Finally, the a Seismic File step (from the Seismic Data steps) is used to create a new SEG Y file which is used to store the CMP binned data. The data are sorted in this file with CMP Line, CMP Location and Offset sorts for the Primary, Secondary and Tertiary sorts, respectively.

To run the flow, use the pointer to select the flow (or use the Select All Items button) and then press Execute. The time for the flow to execute is determined by the processor speed, number of cores and speed of the disk access. Flows can sometimes take longer to run the first time than on subsequent running because of how data is cached by the computer. While running, the real time amplitude map is updated with the average RMS values for each source location.

Flow 2 – Bandpass Filtering and Spherical Divergence Correction

This flow gives examples of two processing steps that can be applied to the trace data: bandpass filtering and spherical divergence correction.



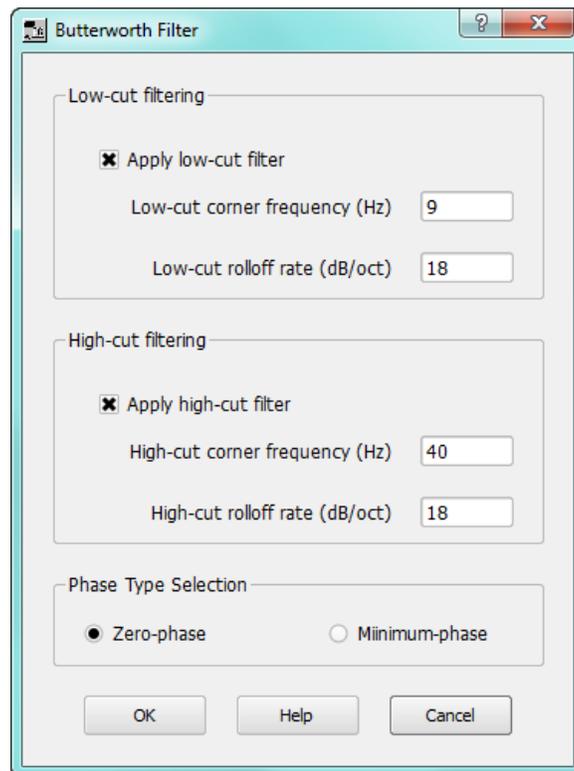
Spherical Divergence Correction Flow

Seismic File

Use the Seismic File step to open the CMP gathered data created by the previous flow.

Butterworth Filtering

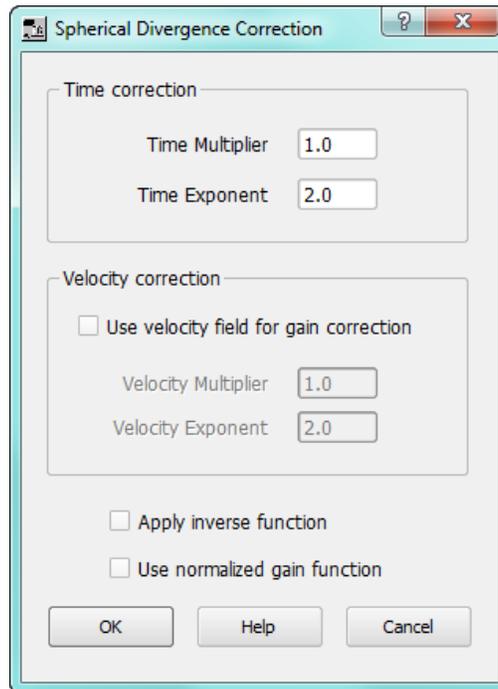
The Filtering steps contain filters that can be applied to traces or groups of traces. Here the Butterworth Filtering step is used to create a bandpass filter (low cut and high cut filter) that is applied to all traces in the dataset.



Butterworth Filter used as a Bandpass filter.

Spherical Divergence

A simple mathematical operator is applied to each trace to boost the amplitude of trace samples to correct for the spherical divergence that occurs as the seismic signal travels further from its source (see discussion of this step in the Processing Library description). This step, found in the Amplitude Adjustment steps, is parameterized as:



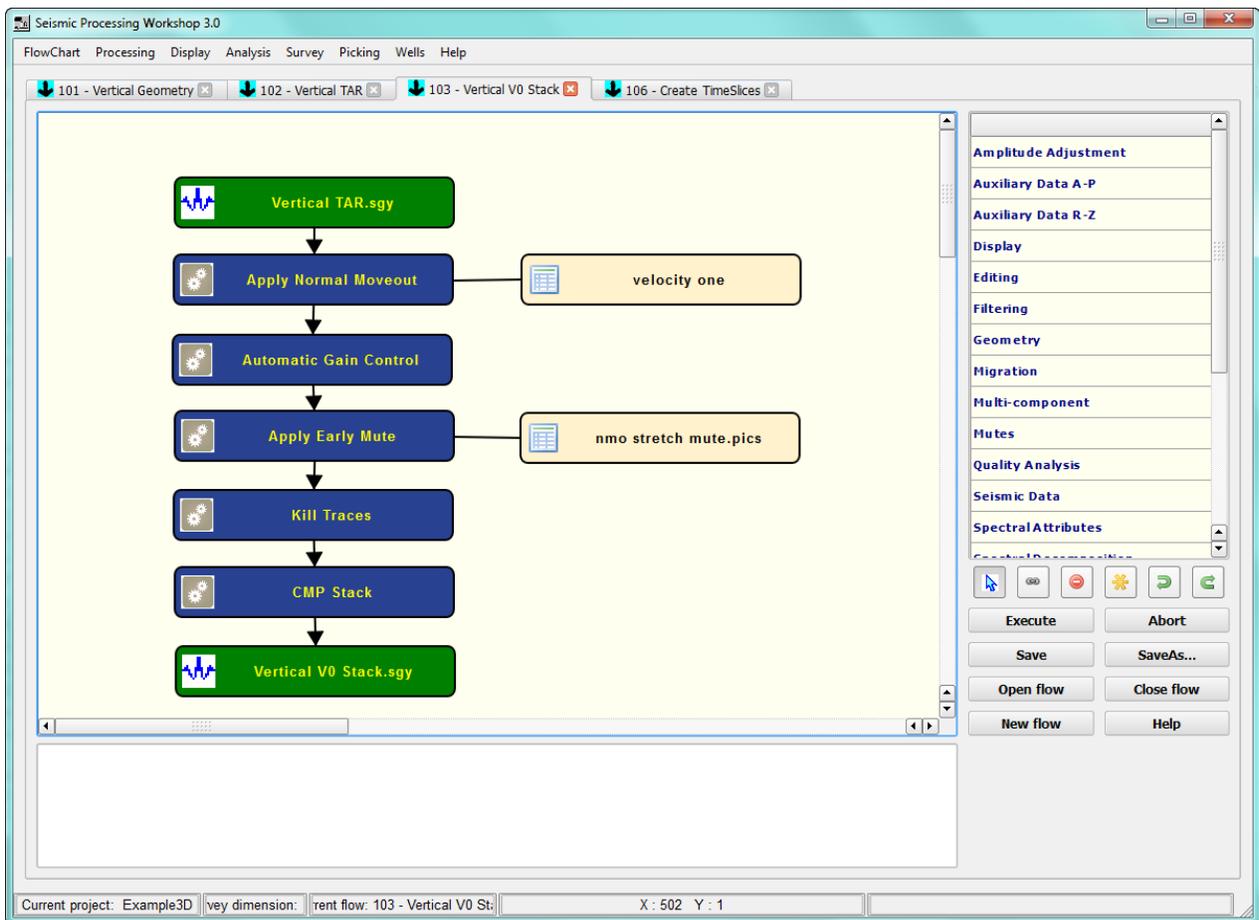
Spherical Divergence step

Seismic File

Use the Seismic File step to save the filtered and divergence corrected data set to a new seismic file.

Flow 3 – Normal Moveout Correction and Vertical Stacking

This flow combines together a normal moveout correction with a simple CMP stack to produce a file of inline and crossline stacked traces – i.e. one stacked trace per CMP location. Additional steps to apply an Automatic Gain Control (AGC), an early mute and to kill traces are applied.



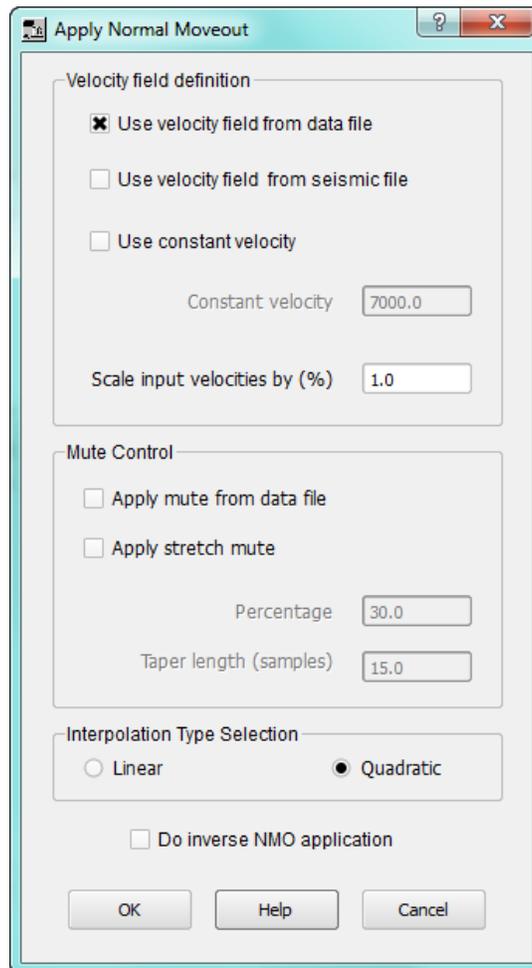
Normal Moveout Correction and Vertical Stacking Flow

Seismic File

Use the Seismic File step to open the filtered and spherical divergence corrected data created by the previous flow.

Apply Normal Moveout

The normal moveout correction step is located within the Velocities group of processing steps and is explained in more detail in the Processing Library description. In this flow it takes its input from the CMP stacked and filtered seismic file, together with a velocity field from a data file created using the Velocity wizard described further back in this manual.



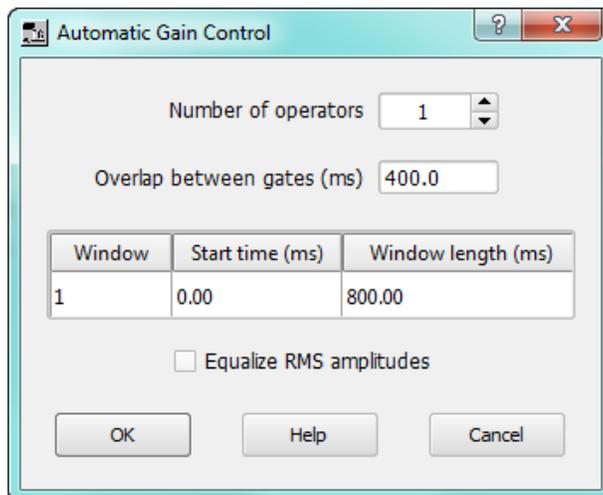
Apply Normal Moveout processing step

The velocity field was created for a number of the CMP locations; it is interpolated for missing CMPs. By default, the field needs only one set of velocity picks from a single CMP, but in practice picks would be made at regular intervals across the CMP survey area.

The velocity fields are interpolated using Delaunay triangulation for a 3D survey or linear interpolation for a 2D survey.

Automatic Gain Control

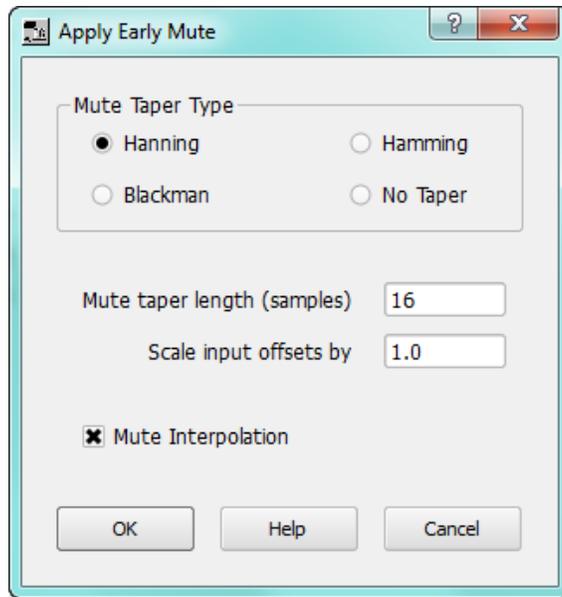
An Automatic Gain Control step (see Amplitude Adjustment steps) has been applied to boost lower amplitude arrivals prior to making the brute stack in the CMP stack below. Such a step would not be applied if any amplitude analysis was expected to be made; instead a step such as surface consistent amplitude balancing would be used.



Automatic Gain Control Dialog

Apply Early Mute

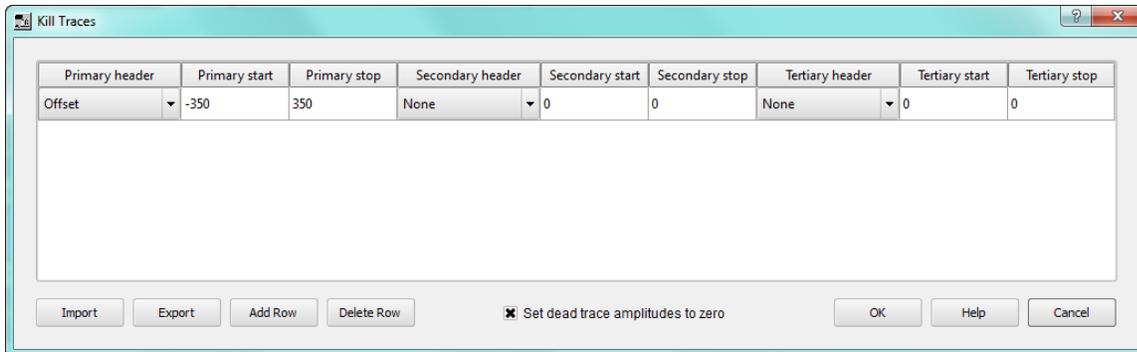
The early mute step (from the Mute group of processing steps) is used to remove any noise or NMO artifacts present in the data before the useful signal. The mutes are interpolated so picks can be made at regular intervals across the survey. Mutes are read in from an early mute picked file.



Early Mute Dialog

Kill Traces

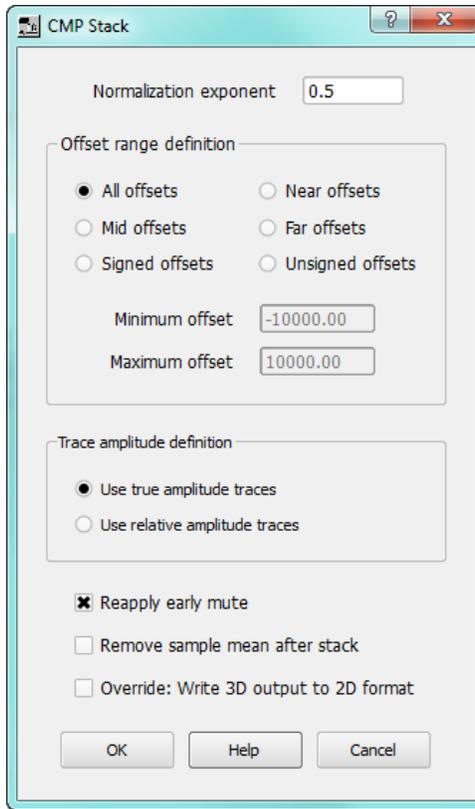
Because there is some ground roll evident in the near offset traces, a simple kill trace mute is applied to any trace with an offset of between +/- 350 feet.



Kill Trace Dialog

CMP Stack

Once the CMP data has been NMO corrected, it can be stacked using the CMP Stack step (see the Stacking group of processing steps). We could stack into various offsets (e.g. near, mid and far) but in this step a single stack is made over the full offset range.



CMP Stack Dialog

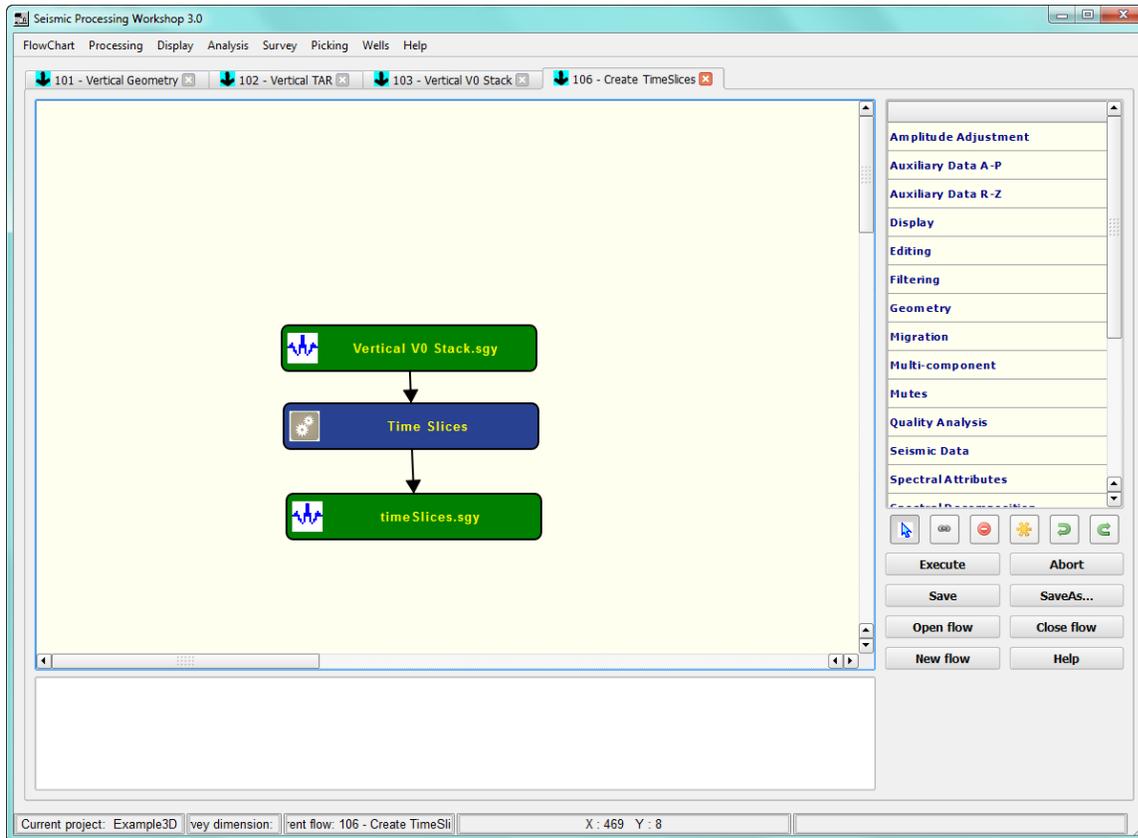
Seismic File

Use the Seismic File step to save the stacked traces to a new seismic file. The seismic file will contain one trace per CMP bin, so will be considerably smaller than the input data. The file can be displayed by sorting on CMP Line or CMP Location.

Flow 4 – Create Time Slice

The Create Time Slice flow is used to make a special seismic file that contains several time slices cut through the stacked seismic file created in the previous flow. The output file can then be

displayed using the seismic viewer showing amplitude maps at regular spacing down through the stacked traces.



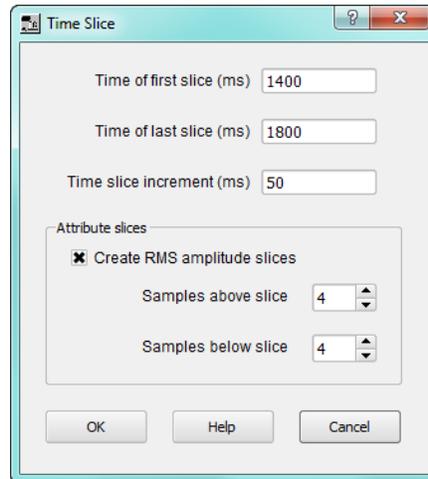
Create Time Slice Flow

Seismic File

Use the Seismic File step to open the stacked file created in the previous step.

Time Slices

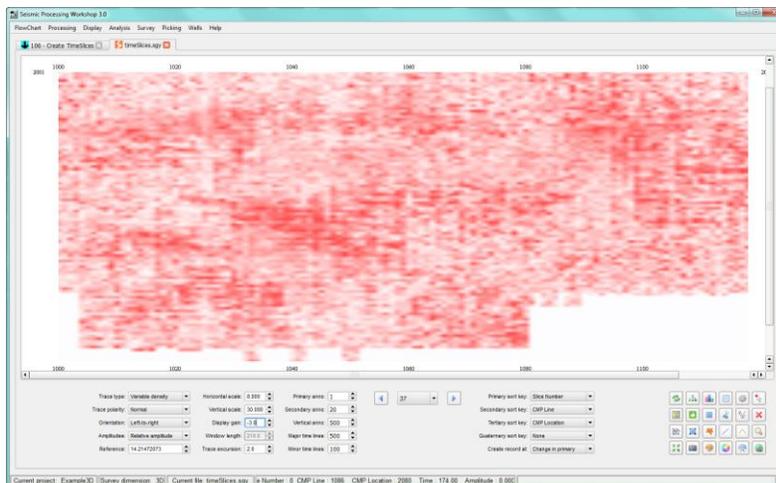
The Time Slices step is located in the Display group of Processing Steps and contains options for setting how many and the location of slices that will be extracted from the stacked seismic file.



Time Slice Dialog

Seismic File

Use the seismic file step to store the output from the Time Slice step. The time slice seismic file can be displayed in a Seismic Display, such as below:



Time Slice at 1600ms

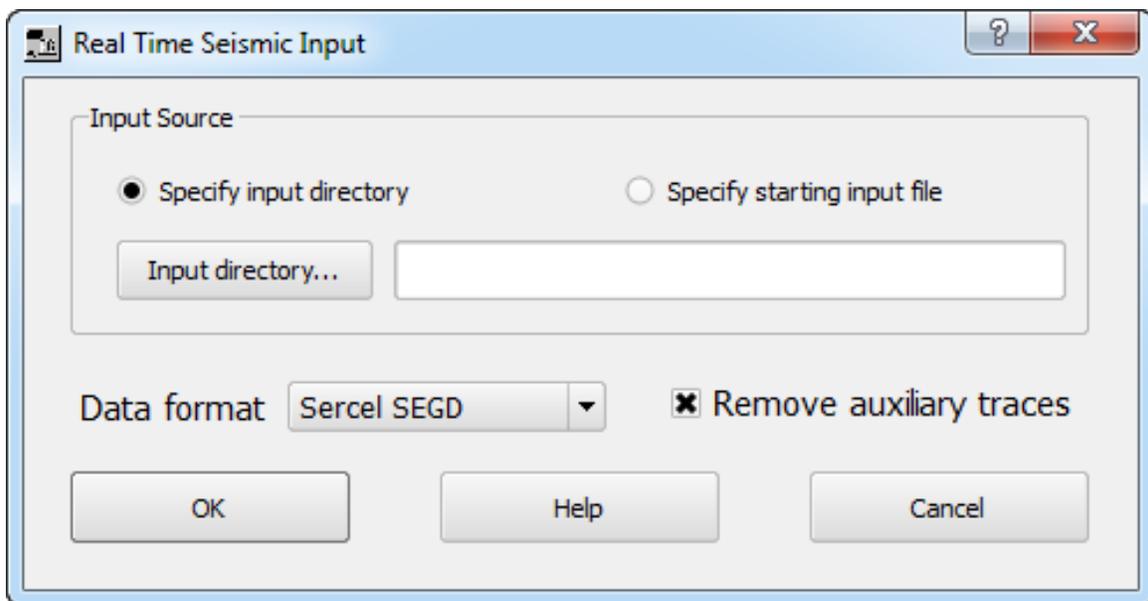
As before, to run the flow, use the pointer to select the flow (or use the Select All Items button) and then press Execute.

Instantaneous Field QC Capabilities and Procedures

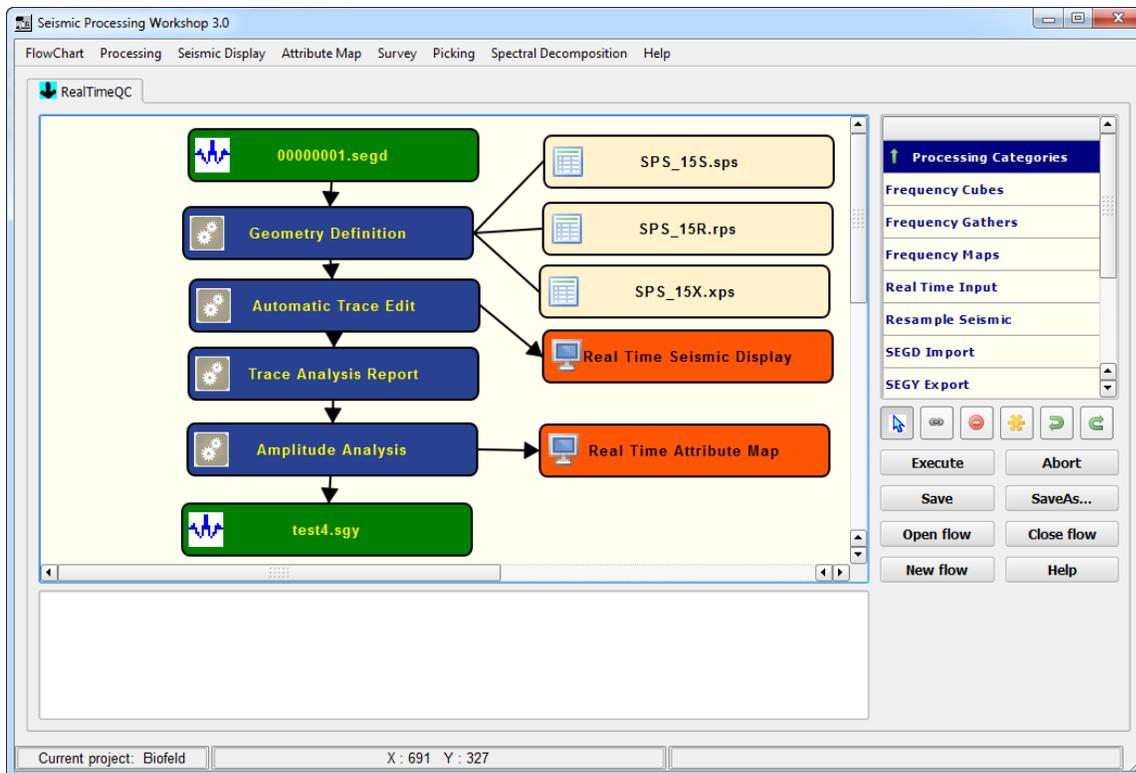
A focus of the development of this version of SPW has been to simplify and automate field quality control. Multiple new map displays have been implemented to enable rapid visualization of your survey. Real time input of data direct from seismic recorders has been incorporated and simplified. Real time displays of seismic data, attribute maps and survey information are some of the new capabilities.

Real Time Processing

Real time processing starts with the input from the seismic recorder. SPW currently supports ARAM SEG Y format, Sercel SEG D format, Hydroscience SEG D format, Standard SEG D format, and SEG 2 format. Other formats and recording instrument specifications will be added as needed in the future. The implementations of these formats read in all of the extended headers and if the geometry information is present in the headers, it is always input.

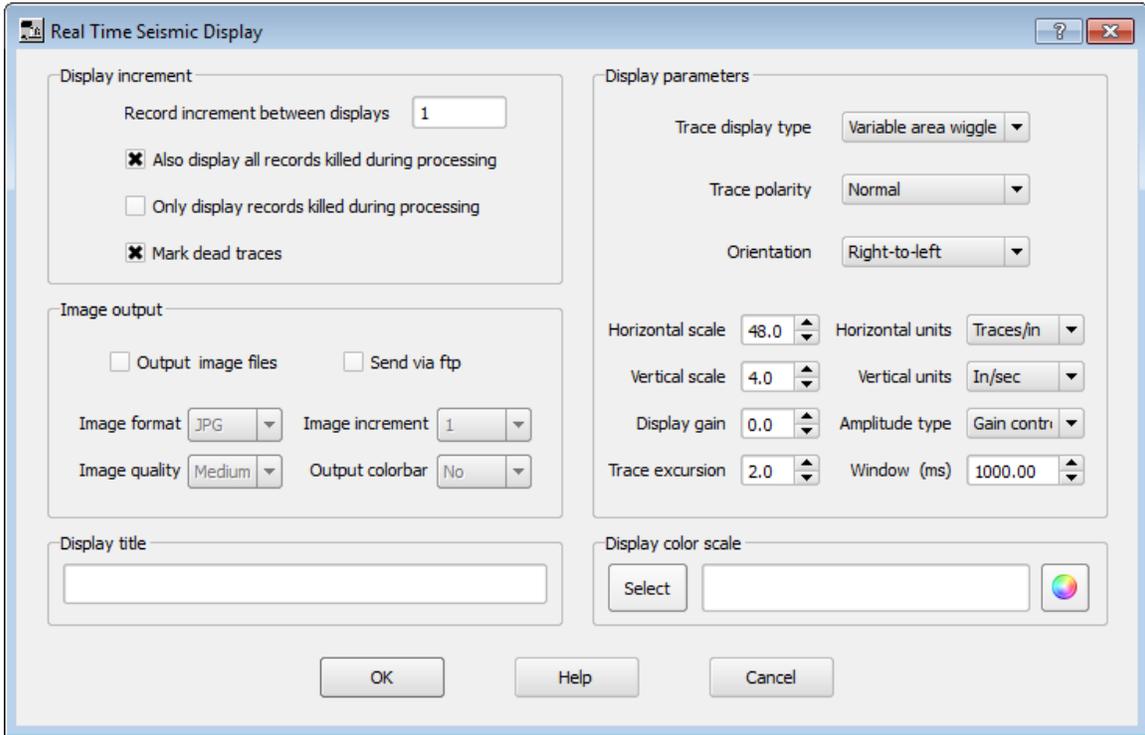


Real Time Seismic Input Dialog



A Simple Real Time Processing Flowchart

Real Time Seismic Displays



Real Time Seismic Display Dialog

Real Time Map Displays

Real Time Attribute Map

Trace header containing attribute
Trace header: User Defined 1

Coordinate reference system
 Acquisition Geographic

Multichannel attribute composition
 RMS Amplitude Average magnitude
 Median magnitude Maximum magnitude

Map scale
 Scale to fit view Height (pixels): 960
 Scale to fit dimensions: Width (pixels): 1200
 Scale to fit vertical Fixed scale: 10
 Scale to fit horizontal

Map title
National Petro Reserve -- Teapot Dome

Attribute label

Attribute color scale
Select default.xml

Map output
Output file name: C:/Teapot Dome/Survey/SourceAmplitude.baf File Browse...

Reference locations
 Initialize source locations from SPS file(s)

Add File Remove File

File name	
C:\Teapot Dome\Survey\mpr3.sps	

Horizontal axis minimum: 788340.0 Horizontal axis maximum: 809249.0
Vertical axis minimum: 939328.0 Vertical axis maximum: 976916.0

Background image
 Display background image on receiver spread

Load Image Configure Unload image

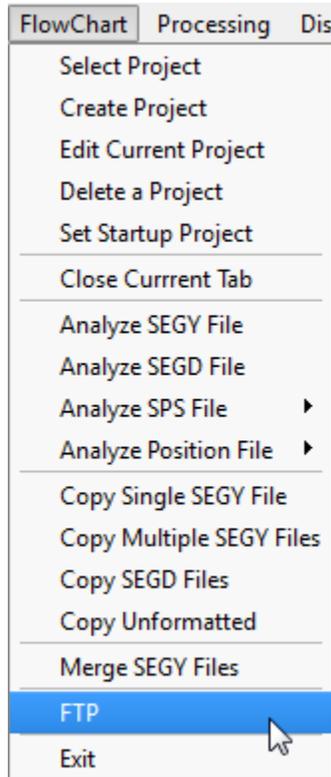
Loaded Configured

OK Help Cancel

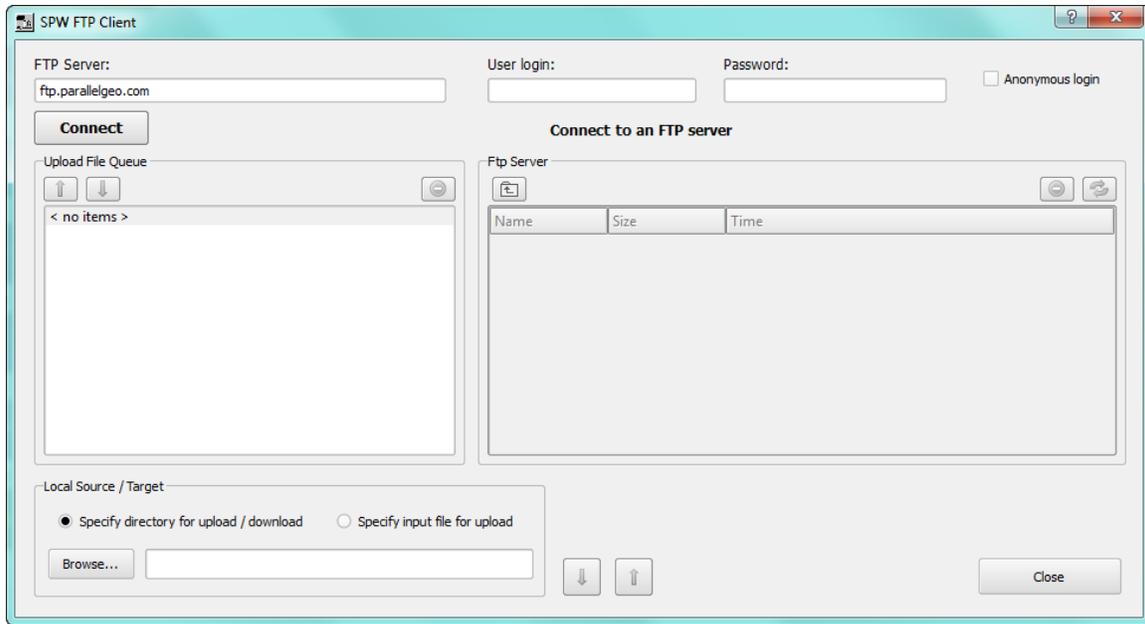
Real Time Attribute Map Display Dialog

FTP Connection

***Note – FTP capability is temporarily disabled (October 2014) due to low level library changes.



Open the FTP Client



FTP Client Window

Using the SPW ftp client, either complete directories or single files may be sent to an ftp server. Simply open a connection to the ftp server and then select the directory or the files to transfer.

Sending Reports via FTP in Real Time

Several reports on record and trace kills may be sent automatically to an ftp server during the execution of a flow. This feature allows experienced personnel in the office to assist in evaluating noisy or problem data by being able to review the same information available to the field personnel. To enable this option, the ftp connection must be initiated using the ftp client from the Flowchart menu. After the connection is established then selecting the Sent file via ftp option will automatically send the report file after each record is processed.

Signal to Noise for Editing Records

Report file
 C:/Teapot Dome/Report/SignalToNoiseReport.txt
 Send file via ftp Append to existing file

Amplitude definition
 Average power Average absolute value
 Average RMS

Signal definition method
 Enter signal window
 Import signal window

Noise definition method
 Enter noise window
 Import noise window

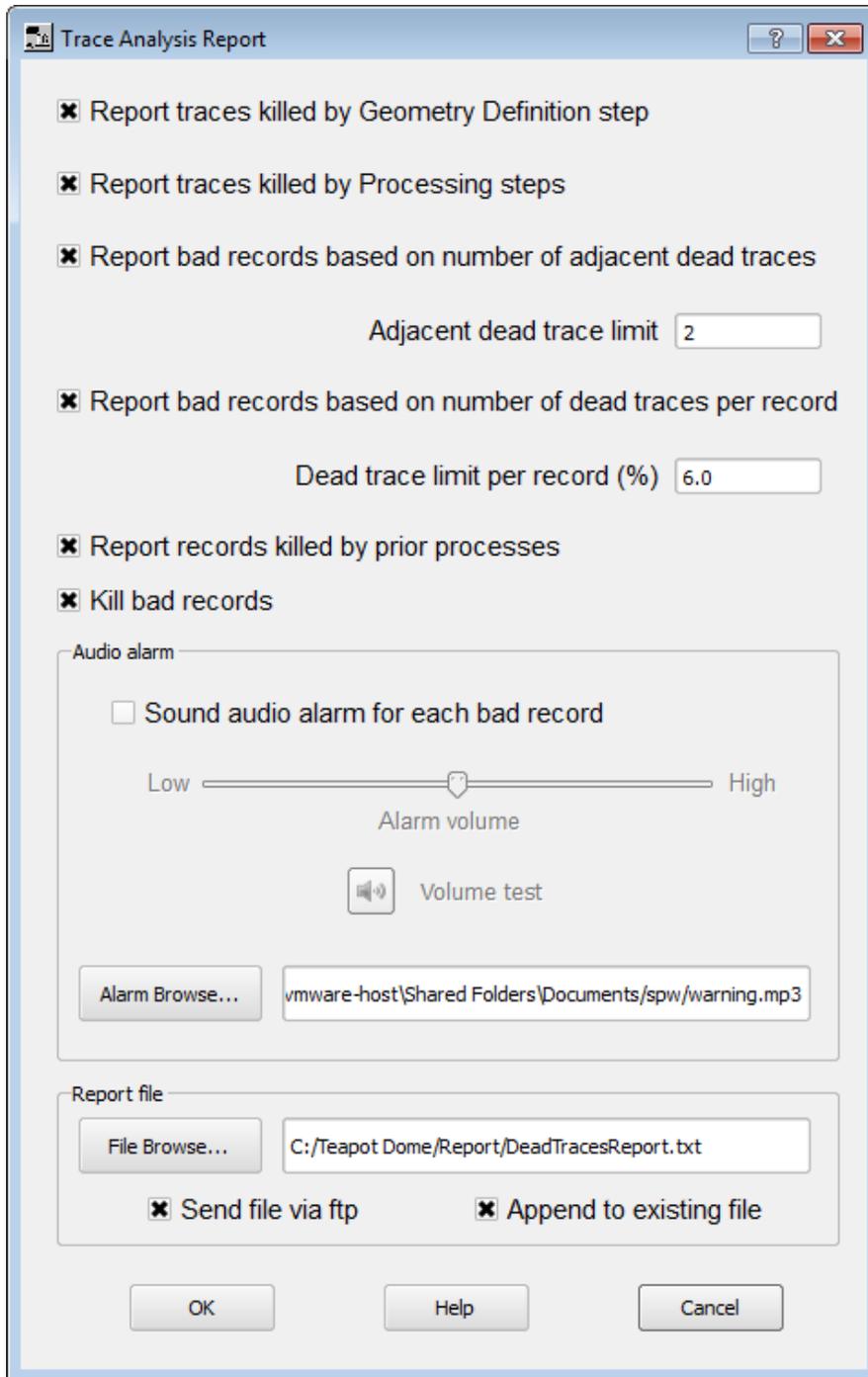
Spatial application
 Apply to all data
 Reference Exclusion Zone file
 Apply inside exclusion zones
 Apply outside exclusion zones

Record edit criteria
 Fails all windows Fails any window

Ratio	Signal Start time (ms)	Signal End time (ms)	Signal Start Offset	Signal End Offset	Noise Start time (ms)	Noise End time (ms)	Noise Start Offset	Noise End Offset	S/N Minimum	S/N Output header
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	None

Minimum live traces per analysis window

Signal to Noise for Killing Records



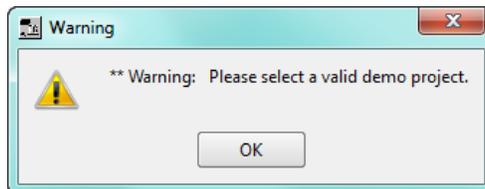
Send Trace Analysis Report via FTP

Sending Image Files via FTP in Real Time

Troubleshooting

No License Key Available

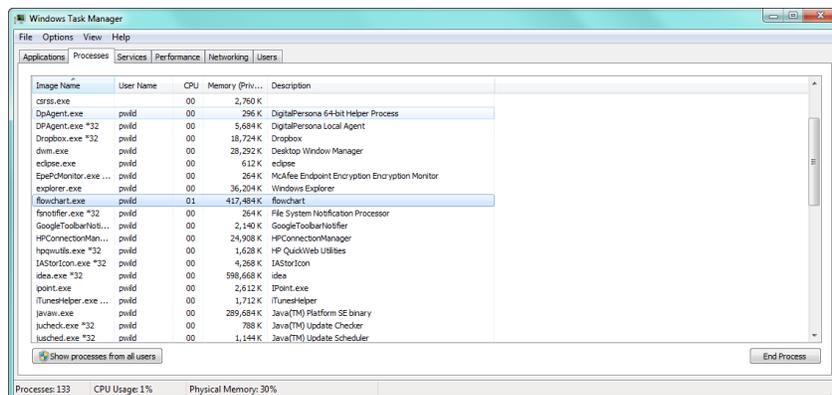
If you start the Flowchart without a valid licence key available, you may get the following popup error message:



Check that the license key is correctly inserted into a USB port on the computer and there are sufficient days left in the license (use the Help > About dialog for this).

Killing the Flowchart Process

Occasionally, it is necessary to close the Flowchart while a process is executing, for example if you have started a flow by mistake that is going to take a long time to execute. Usually, the flowchart process will be killed when the flowchart is closed, but sometimes this doesn't happen. In this case you can use the Windows Task Manager to "End Process" the flowchart.exe process:



Windows Task Manager showing the flowchart.exe processes highlighted.

If a flowchart process is already running, you will be prevented from opening a new Flowchart until the previous flowchart process has ended.

Details of how to obtain support from Parallel Geocience are given at the start of this user manual.

The Processing Library:

Overview

The library of processing steps is separated into categories. The categories are as follows:

Amplitude Adjustment
Auxiliary Data A-P
Auxiliary Data R-Z
Display
Editing
Filtering
Geometry
Migration
Multi-component
Mutes
Quality Analysis
Seismic Data
Spectral Attributes
Spectral Decomposition
Stacking/Summing
Statics
Trace Attributes
User Plugins
Velocities
Vsp
Wavelet Shaping

Not all processing steps from SPW 2 are available in SPW 3.

The standard use of each processing step will be described in the pages that follow. If the step is enabled for only 2-D or only 3-D, it will be explicitly annotated as such; otherwise the process may be used with both 2-D and 3-D data. Each of the Processing Step descriptions lists the mandatory and optional input and output links required for execution, and contains an illustration of an example flow chart. References are given for some processing steps based upon specific published techniques or algorithms. An image of the processing step's parameter dialog is also displayed for your reference. Finally, you will find a description of each parameter for each processing step. At the end of each parameter description, the valid range for each parameter is shown in brackets { }.

Abbreviations for the parameters are as follows –

- - Greater than
- <= - Less than or equal to
- < - Less than
- >= - Greater than or equal to
- #,# - Range of values from first number to last number

Parameter range checking is enabled for some of the processing step parameters. Additional parameter range checking will be enabled in the future.

Note: For processing parameters with spatial units such as feet, meters, feet per second, meters per second, etc., SPW assumes that you are consistent in your use of spatial units for the entire data set. If your geometry information is in meters then you should consistently use metric units as your unit of measure for the SPW processing parameters applied to that data set. If your geometry information is in feet then you should consistently use English units as your unit of measure for the SPW processing parameters applied to that data set. Combining English and metric units of measure when processing in SPW will yield erroneous results.

Amplitude Adjustment Steps

This section documents the processing steps available for *Amplitude Adjustment*. Processing steps currently available are:

Amplitude Adjustment
↑ Processing Categories
AVA Calculator
Amplitude Equalization
Amplitude versus Angle
Angle Gather
Apply Gain
Automatic Gain Control
Clipping
Offset Amplitude Corrections
Random Noise
Spherical Divergence
Surface Consistent Gain Corrections
Trace Header Amplitude Math
Windowed AGC
Windowed Trace Balance

AVA Calculator

Usage:

The *AVA Calculator* step computes traditional Amplitude Versus Angle (AVA) operations using estimates of AVA intercept (A) and gradient (B)

Input Links:

- 1) Seismic data in any sort order (mandatory).

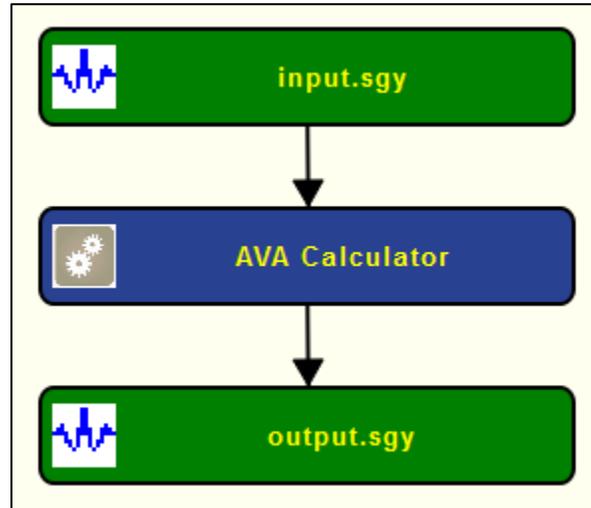
Output Links:

- 1) Seismic data in same sort order as input (mandatory).

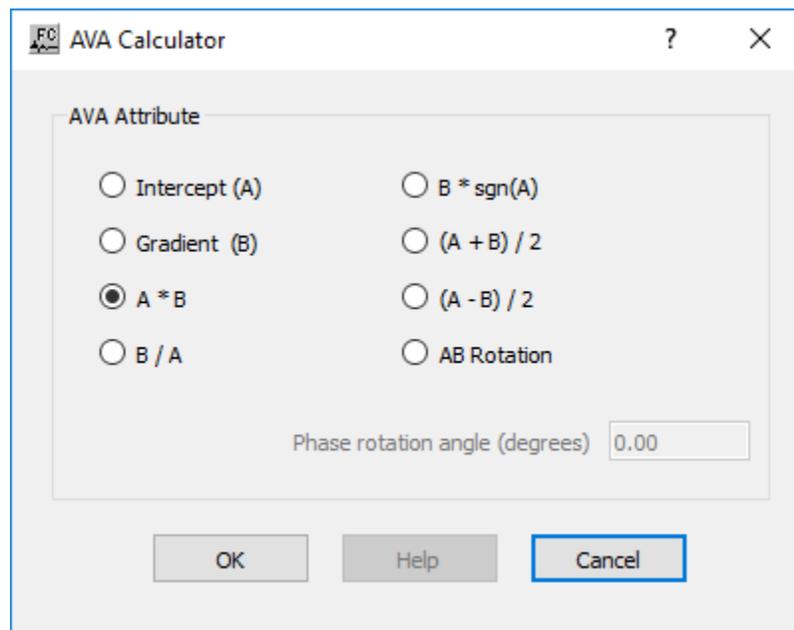
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Intercept (A) – If selected, compute AVA Intercept.

Gradient (B) – If selected, compute Gradient.

A * B – If selected, compute AVA Intercept and AVA Gradient and multiplies both.

B/A – If selected, compute the division between the AVA Gradient with the AVA Intercept.

B * sign(A) – If selected, compute the AVA Gradient and multiplies it by the signed AVA Gradient.

(A+B)/2 – If selected, computes the average between AVA Intercept and Gradient.

(A-B)/2 – If selected, computes the difference between AVA Intercept and Gradient and divides by two.

AB Rotation – If selected, sums AVA Intercept and Gradient after input traces being rotated by the Phase rotation angle (degrees).

Phase rotation angle (degrees) – Enabled if AB Rotation is selected. Enter constant angle in degrees used to rotate the phase of each trace.

Amplitude Equalization

Usage:

The *Amplitude Equalization* step allows you to balance the RMS values of your data traces to a constant specified RMS level. You can also clip your data at a specified level. You can specify the data window to use in calculating the RMS amplitudes, the output RMS and clipping levels, and the method of amplitude equalization, which may be either trace constant or record constant.

Input Links:

1) Seismic data in any sort order (mandatory).

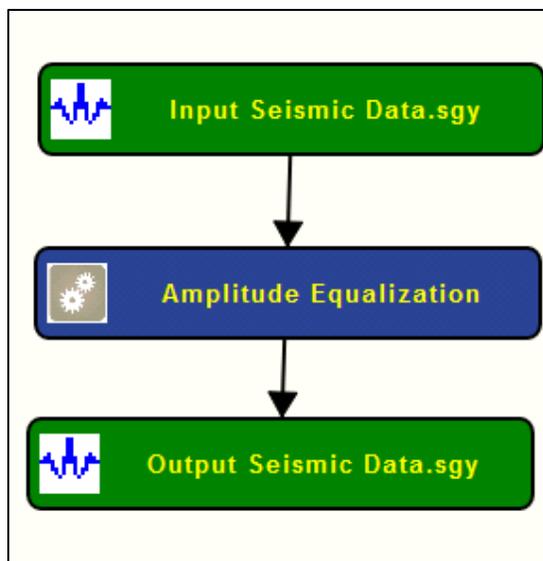
Output Links:

1) Seismic data in same sort order as input (mandatory).

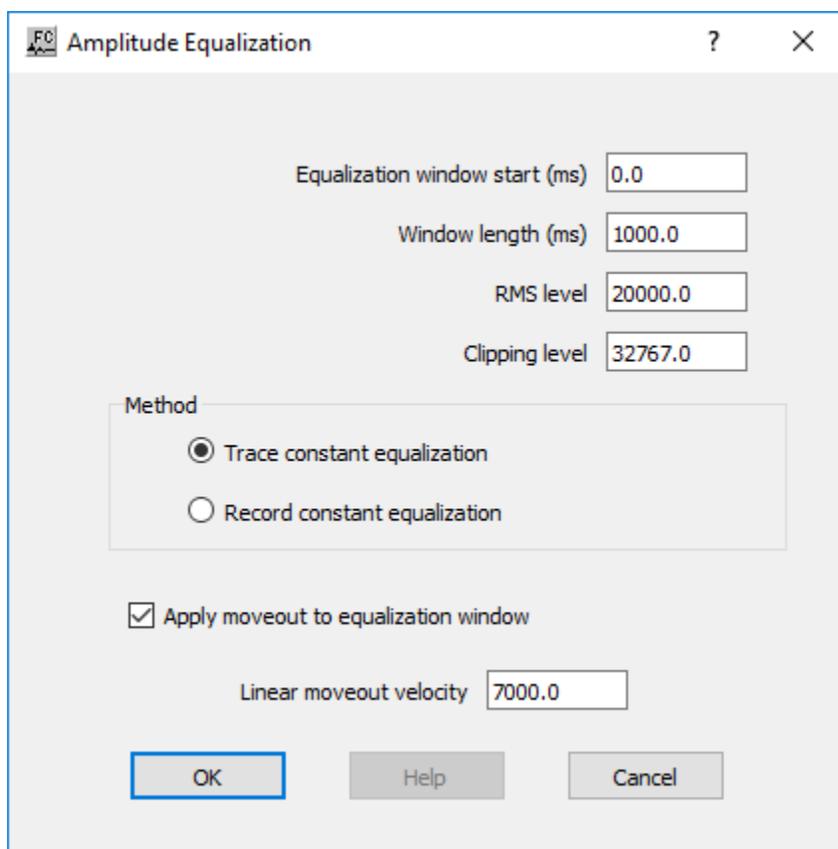
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Equalization window start (ms) — Enter the start time in milliseconds of the window to be used in calculating the trace amplitude. {=>0}

Window length (ms) — Enter the length in milliseconds of the window to be used in calculating the trace amplitude. {>0.0}

RMS level — Enter the output RMS level of the data window specified. {>0.0}

Clipping level — Enter the clipping level of the trace data. {>0.0}

Method: Specify whether to apply the equalization on a trace by trace basis or to maintain relative amplitudes and level the RMS value of the entire record.

Trace constant equalization — If selected, your data will be equalized on a trace by trace basis.

Record constant equalization — If selected, your data will be equalized on a record by record basis, which will depend on the sort order of the input data.

Apply moveout to equalization window — If checked, the equalization will be performed after linear moveout at the specified velocity. The window start time will shift by: $\text{delta time} = \text{offset/velocity}$.

Linear moveout velocity — Enabled in **Apply moveout to equalization window** is checked. Enter the constant moveout velocity. {>0.0}

Amplitude Versus Angle

Usage:

The *Amplitude Versus Angle* step allows you to map seismic reflection information in the biangular domain using various methods to interpret the amplitude values. You may also define the velocity field, select the ray tracing type, specify the angle range, and choose the velocity curve fit type.

Input Links:

1) Seismic data in any sort order (mandatory).

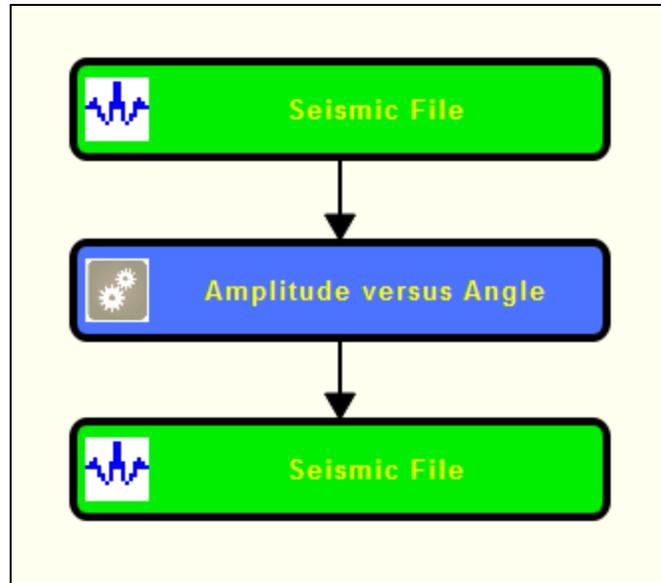
Output Links:

1) Seismic data in any sort order (mandatory).

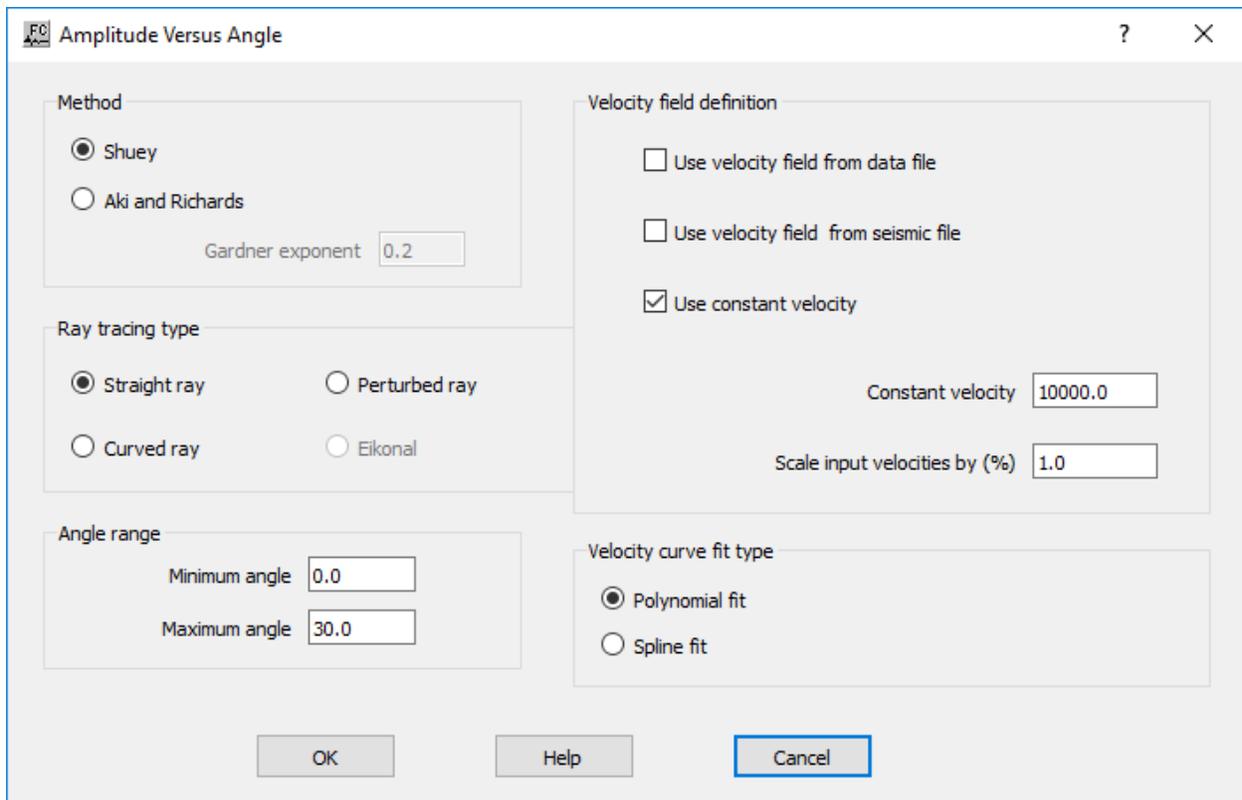
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Method: Select an approximation to the Zoeppritz equation that will be used to interpret the amplitude values. The Shuey method is accurate out to approximately 30 degrees, whereas the Aki and Richards method can be considered accurate out to 40 degrees.

Shuey — If selected, the Shuey approximation will be used.

Aki and Richards — If selected, the Aki and Richards approximation will be used.

Gardner exponent — Enter the value to be used for the exponent in the Gardner equation. The value may be set to 0.0 and the default (0.25) only applies if the Aki and Richards method is selected.

Velocity field definition: Define the velocity field to be used.

Use velocity field from data file — If checked, the velocity field will be used from the data file.

Use velocity field from seismic file — If checked, the velocity field will be used from the seismic file.

Use constant velocity — If checked, a constant velocity will be used.

Constant velocity — If **Use constant Velocity** is checked, enter a constant velocity.

Scale input velocities by (%) — Enter a percentage to scale input velocities. { 1.0 = 100% }

Ray tracing type: Define the ray tracing method used in the estimation of propagation angles.

Straight ray — If selected, rays will be traced using a straight ray algorithm.

Perturbed ray — If selected, rays will be traced using a perturbed ray algorithm.

Curved ray — If selected, rays will be traced using a curved ray algorithm.

Eikonal ray — If selected, rays will be traced using an eikonal ray algorithm.

Angle range: Define the minimum and maximum angles used in the calculation of AVA attributes.

Minimum angle — Enter the minimum angle.

Maximum angle — Enter the maximum angle.

Velocity curve fit type: Define the procedure to interpolate velocities between time-velocity pairs specified in the linked velocity file.

Polynomial fit — If selected, velocities will be interpolated with a polynomial interpolator.

Spline fit — If selected, velocities will be interpolated with a spline interpolator.

Angle Gather

Usage:

The *Angle Gather* step produces angle domain common image gathers, allowing you to specify the angle range to calculate AVA attributes. You may also define the velocity field, select the ray tracing type, and choose the velocity curve fit type.

Input Links:

1) Seismic data in any sort order (mandatory).

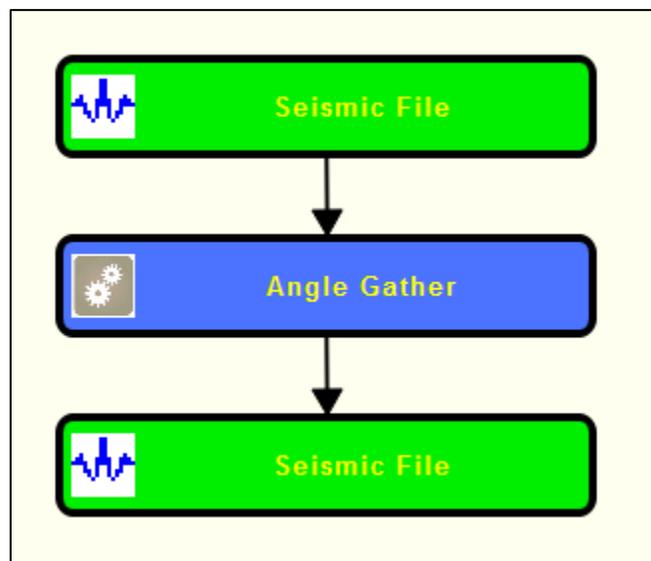
Output Links:

1) Seismic data in any sort order (mandatory).

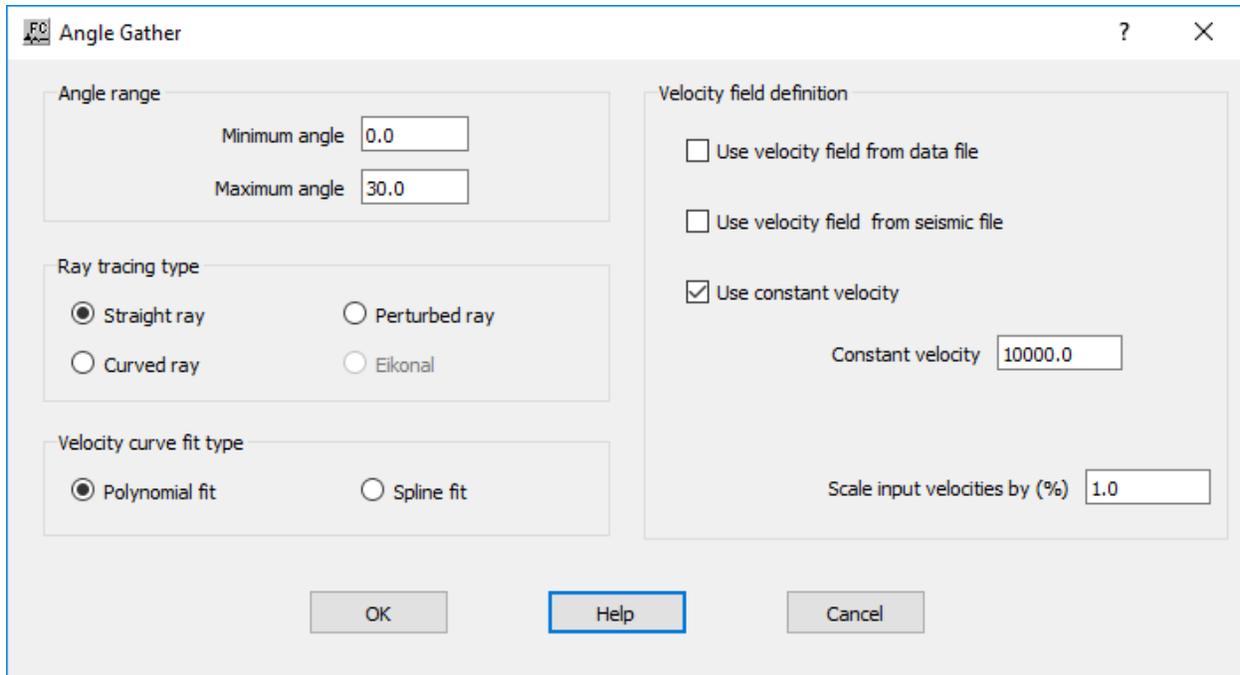
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Angle range: Define the minimum and maximum angles used in the calculation of AVA attributes.

Minimum angle — Enter the minimum angle.

Maximum angle — Enter the maximum angle.

Velocity field definition: Define the velocity field using the check boxes.

Use velocity field from data file — If checked, the velocity field will be used from the data file.

Use velocity field from seismic file — If checked, the velocity field will be used from the seismic file.

Use constant velocity — If checked, a constant velocity will be used.

Constant velocity — Enter a constant velocity.

Scale input velocities by (%) — Enter a percentage to scale input velocities. { 1.0 = 100% }

Ray tracing type: Define the ray tracing method used in the estimation of propagation angles.

Straight ray — If selected, rays will be traced using a straight ray algorithm.

Perturbed ray — If selected, rays will be traced using a perturbed ray algorithm.

Curved ray — If selected, rays will be traced using a curved ray algorithm.

Eikonal ray — If selected, rays will be traced using an eikonal ray algorithm.

Velocity curve fit type: Define the procedure to interpolate velocities between time-velocity pairs specified in the linked velocity file.

Polynomial fit — If selected, velocities will be interpolated with a polynomial interpolator.

Spline fit — If selected, velocities will be interpolated with a spline interpolator.

Apply Gain

Usage:

The *Apply Gain* step allows you to apply gain function curves to your seismic data. Any or all source, receiver, offset or gain card data may be applied. Gain curves may also be applied from the data file. Additionally, gain may be applied by entering dB/second. Gain curves are specified as time – dB pairs and are linearly interpolated to each location along the line. A constant gain multiplier may also be applied to the data.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Source Gain Corrections cards (optional).
- 3) Receiver Gain Corrections cards (optional).
- 4) Offset Gain Corrections cards (optional).
- 5) Gain Curves cards (optional).

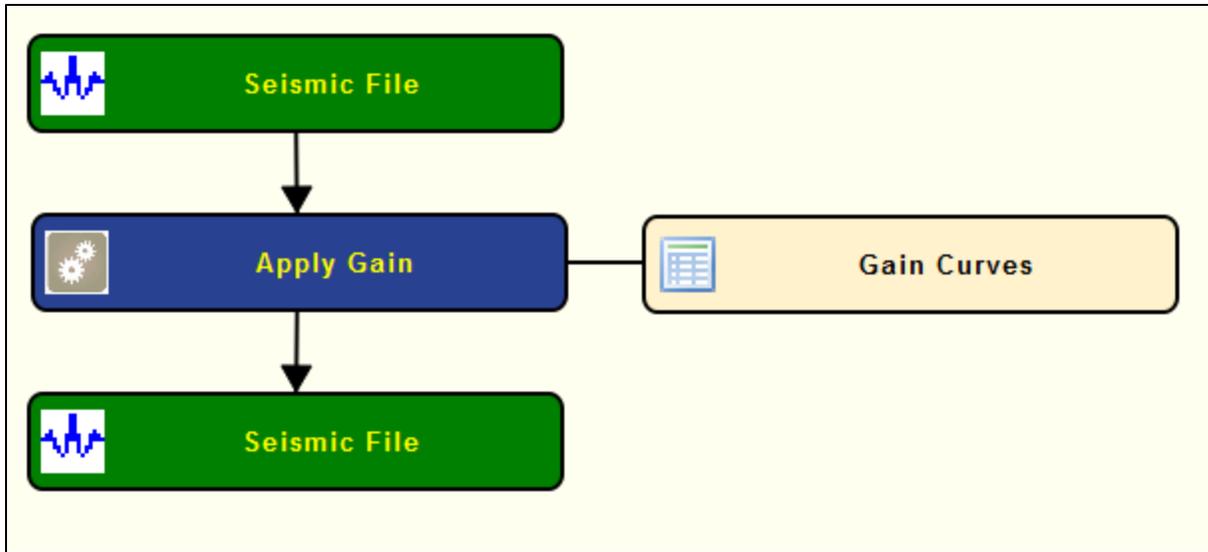
Output Links:

- 1) Seismic data in same sort order as input (mandatory).

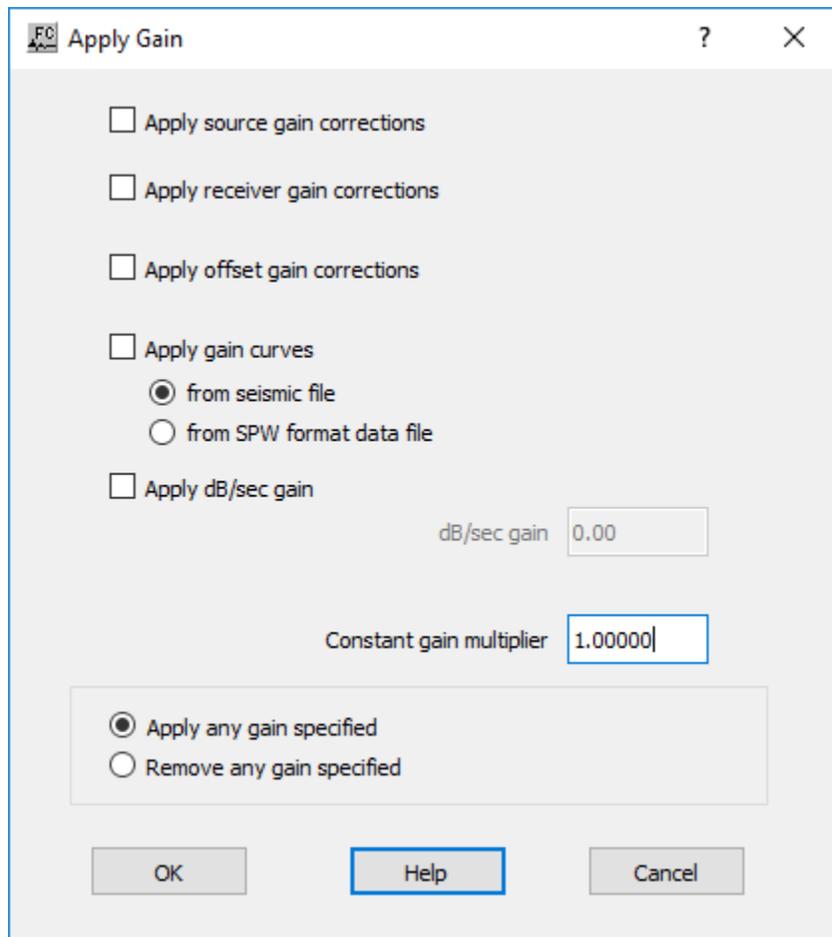
Reference:

-

Example Flow chart:



Step Parameter Dialog:



Parameter Description:

Apply source gain corrections — If checked, source gain corrections will be applied to the seismic data from a source gain correction auxiliary file.

Apply receiver gain corrections — If checked, receiver gain corrections will be applied to the seismic data from a receiver gain correction auxiliary file.

Apply offset gain corrections — If checked, offset gain corrections will be applied to the seismic data from an offset gain correction auxiliary file.

Apply gain curves from data file — If checked, gain curves will be applied to the seismic data from a gain curves auxiliary file.

Apply dB/sec gain — If checked, gain will be applied to the data in decibels per second.

dB/sec gain — Enter the gain in decibels per second.

Constant gain multiplier — Enter a constant gain multiplier by which value each trace data sample will be multiplied.

Apply any gain specified — If selected, apply specified gain to the seismic data.

Remove any gain specified — If selected, remove specified gain from the seismic data.

Automatic Gain Control

Usage:

The *Automatic Gain Control* step allows you to apply up to five sliding window gain functions to each data trace. You specify the number of gated windows, the overlap between the gated windows, and the start time and length of each gate. The calculated gain functions may be output to an optional seismic file, which allows you the option to remove the AGC functions prior to subsequent processing steps.

Input Links:

1) Seismic data in any sort order (mandatory).

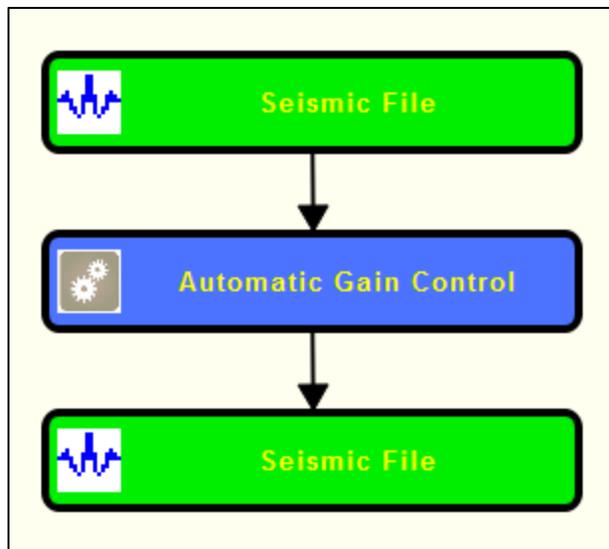
Output Links:

1) Seismic data in same sort order as input (mandatory).

Reference:

-

Example Flowcharts:



Step Parameter Dialog:

Automatic Gain Control

Number of operators: 5

Overlap between gates (ms): 50.0

Output type:

- Data after application of AGC
- Gain functions only

Window	Start time (ms)	Window length (ms)
1	0.00	500.00
2	450.00	500.00
3	900.00	500.00
4	1350.00	500.00
5	1800.00	500.00

Equalize RMS amplitudes

OK Help Cancel

Parameter Description:

Number of operators — Enter the number of operators to design and apply on each trace. Each trace will be divided into this number of time gates (windows). {1,5}

Overlap between gates (ms) — Enter the overlap between gates in milliseconds. Longer overlap between gates results in a smoother transition between the gated windows. {=>0}

Output type: Select the type of output after applying this processing steps.

Data after application of AGC — If selected, output the seismic reflection data after the AGC.

Gain functions only — If selected, output only the gain functions that might be applied to the seismic data using *Apply Gain* processing step.

Start time (ms) — Enter the start time in milliseconds for each gate. {=>0.0}

Length (ms) — Enter the operator length in milliseconds for each gate. {=>0.0}

Equalize RMS amplitudes — If checked, the trace RMS amplitude prior to AGC and after AGC will be the same.

Clipping

Usage:

The *Clipping step* is used to remove high-amplitude sample values from the input data and replace them with a user supplied threshold sample value. The largest positive and largest negative acceptable sample amplitudes are provided by the user. Values outside of this range are replaced by the threshold value.

Input Links:

1) Seismic data in any sort order (mandatory).

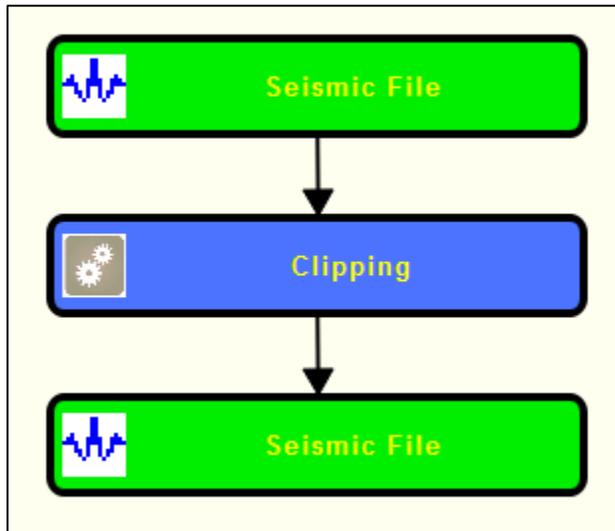
Output Links:

1) Seismic data in same sort order as input (mandatory).

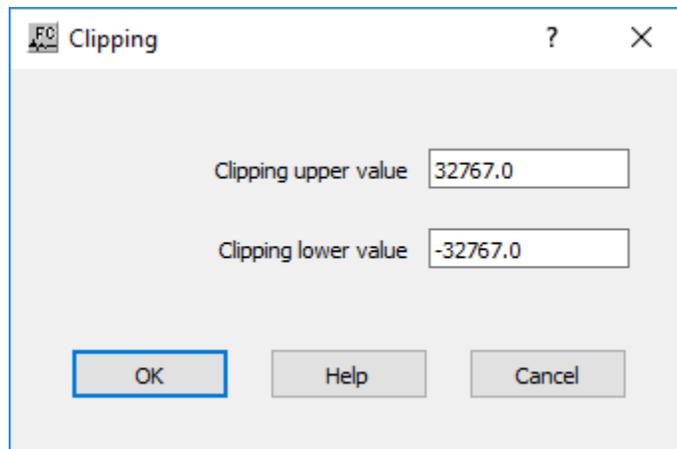
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Clipping upper value — Specify the largest acceptable positive value. Positive values larger than the clipping upper limit are replaced with the clipping upper limit.

Clipping lower value — Specify the largest acceptable negative value. Negative values greater than the clipping lower limit are replaced with the clipping lower limit.

Offset Amplitude Corrections

Usage:

The *Offset Amplitude Corrections* step allows you to correct the amplitude values of your seismic reflection data with the offset. You need to specify a function of gain with the offset.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Offset Gains cart data (mandatory).

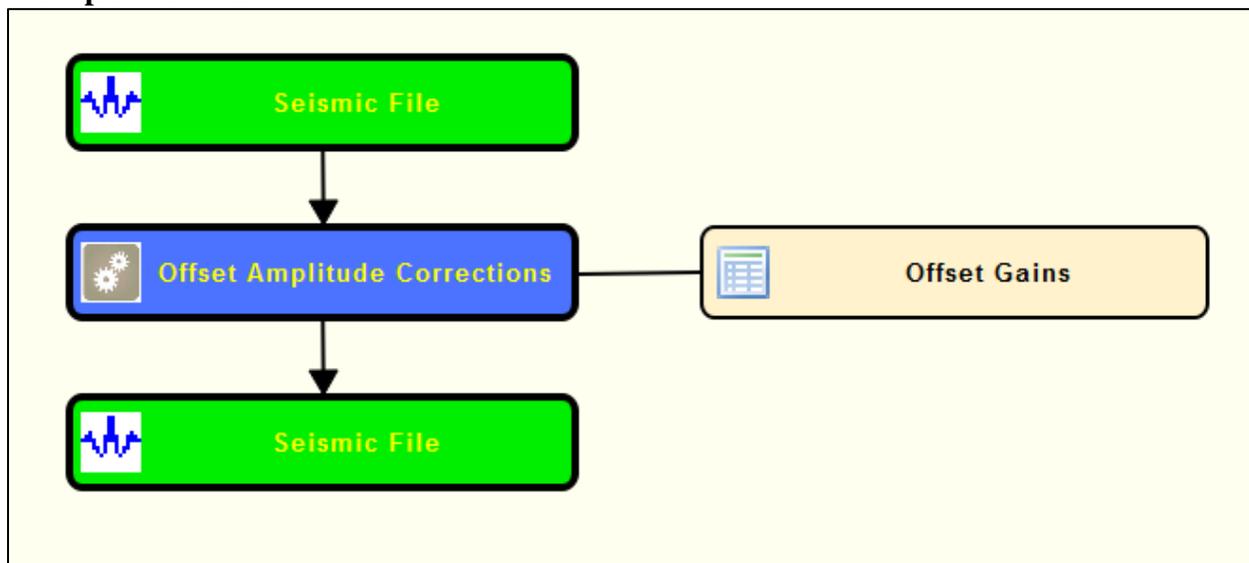
Output Links:

- 1) Seismic data in same sort order as input (mandatory).

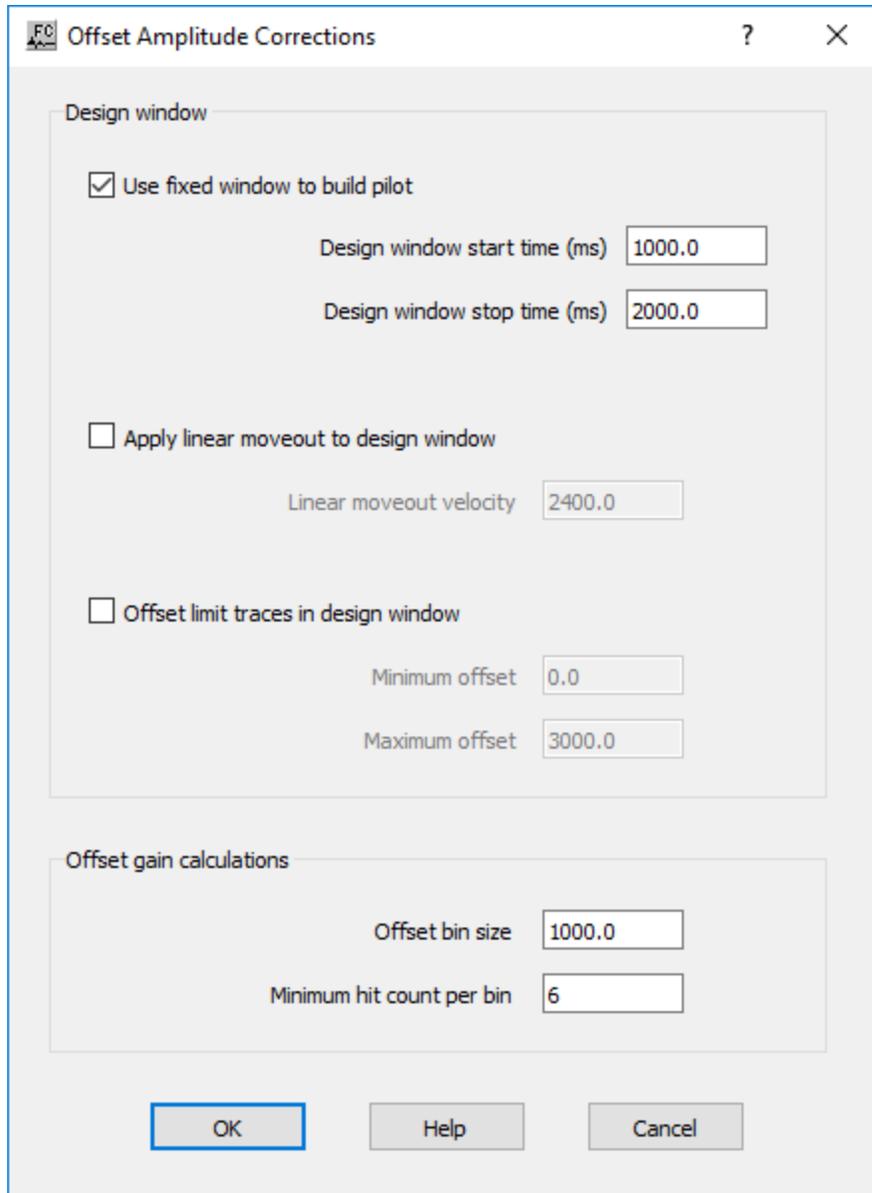
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Define Window: Define window configuration where the correction is going to be applied. The window may be defined within a constant time gate, and/or by applying a linear moveout and/or by limiting the traces in the calculation by the offset.

Used fixed window to build pilot — If checked, the pilot window is defined within a time gate.

Design window start time (ms) — Enter the start time for the design window.

Design window stop time (ms) — Enter the end time for the design window.

Apply Linear moveout to design window — If checked, apply a linear moveout to the design window with a constant velocity as defined in **Linear moveout velocity**.

Linear moveout velocity (m/s) — Enter velocity to apply the linear moveout to the design window.

Offset limit traces in design window — If checked, the traces considered to the design window are limited by offset.

Minimum offset — Enter the minimum offset to be considered in the design window.

Maximum offset — Enter the maximum offset to be considered in the design window.

Offset gain calculations: Define parameters related with the gain calculation.

Offset bin size — Enter bin size to compute offset gain.

Minimum hit count per bin — Enter minimum hit count per bin.

Random Noise

Usage:

The *Random Noise* step estimates the signal level then generates random noise to add to the data at a specified Signal to Noise ratio. It is useful for creating noise in model data.

Input Links:

1) Seismic data in any sort order (mandatory).

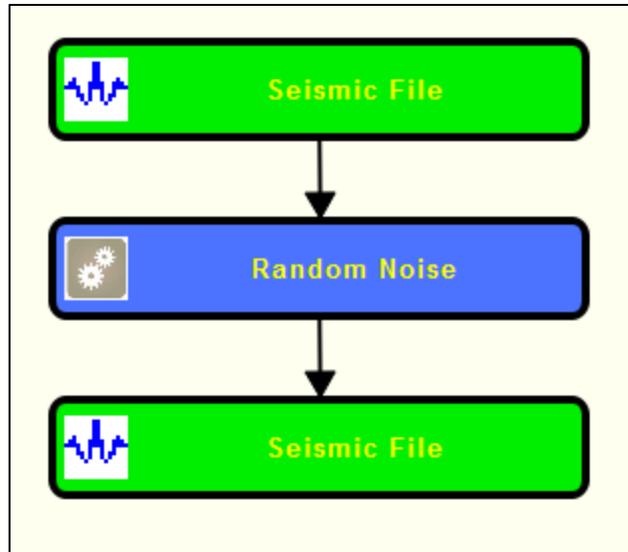
Output Links:

1) Seismic data in same sort order as input (mandatory).

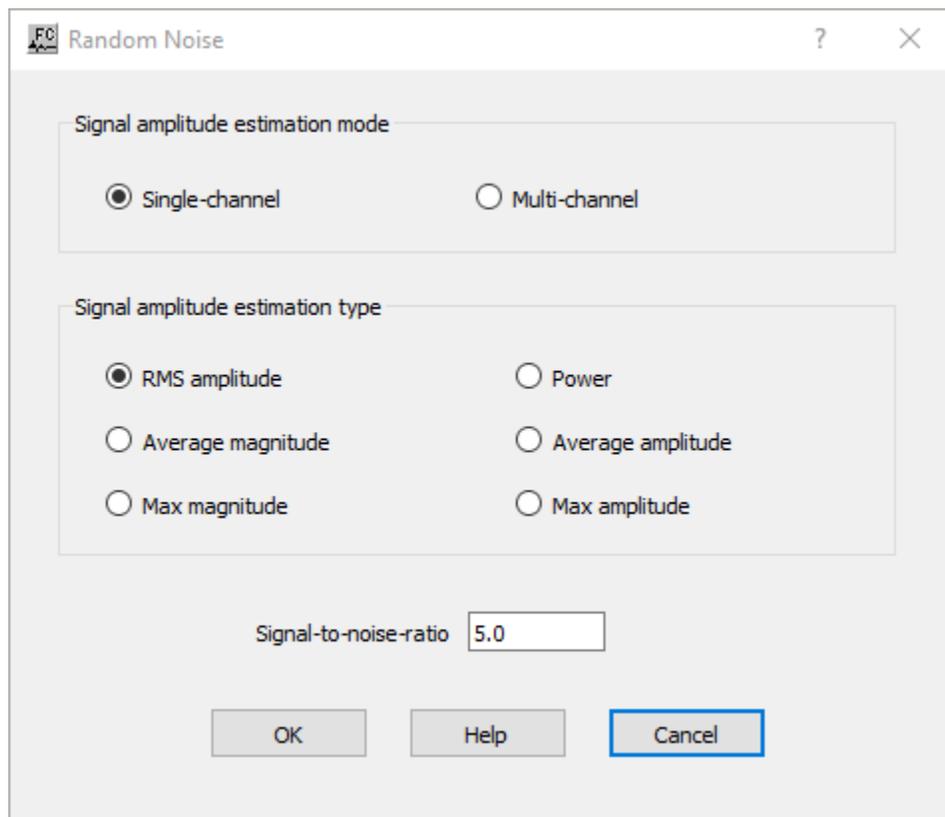
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Signal amplitude estimation mode: Estimate signal amplitude either on a single channel or on multi channel.

Signal-channel — If selected, use a single channel to estimate the signal amplitude.

Multi-channel — If selected, use multi-channel to estimate the signal amplitude.

Signal amplitude estimation type: Select the type of signal amplitude estimation.

RMS amplitude — Signal amplitude is estimated by RMS amplitude.

Average magnitude — Signal amplitude is estimated by average magnitude.

Max magnitude — Signal amplitude is estimated by maximum magnitude.

Power — Signal amplitude is estimated by the power of amplitude.

Average amplitude — Signal amplitude is estimated by average amplitude.

Max amplitude — Signal amplitude is estimated by maximum amplitude.

Signal-to-noise ratio — Enter the desired signal to noise ratio.

Spherical Divergence

Usage:

The *Spherical Divergence* correction step is designed to compensate for the decrease in seismic amplitude as a wavefront propagates away from the source location. The Spherical Divergence Correction step allows you to apply a gain to the data traces based on the equation:

$$\text{Gain} = T_Multiplier * (\text{Time} ** T_Exponent) * V_Multiplier * (\text{Velocity}(\text{Time}) ** V_Exponent).$$

The T_Multiplier and the V_Multiplier are constant gain factors and the T_Exponent and the V_Exponent vary the gain with time. Multipliers of one (1) and an exponent of two (2) are commonly used for the spherical divergence correction since energy from a point source dissipates in proportion to the square of distance traveled. To apply the spherical divergence correction as a function of both time and velocity, you must supply the optional velocity function. Otherwise, the velocity terms in the above equation will be ignored and the spherical divergence correction will only be applied as a function of time. You also have the option to apply the inverse spherical divergence correction function to your data.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Velocity field card (optional).

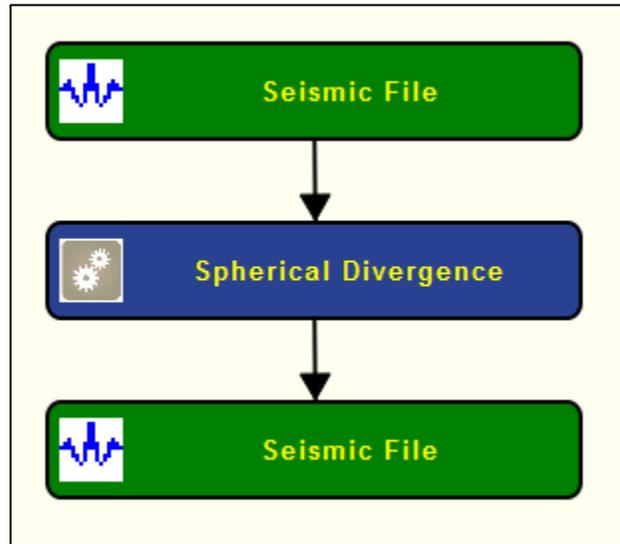
Output Links:

- 1) Seismic data in same sort order as input (mandatory).

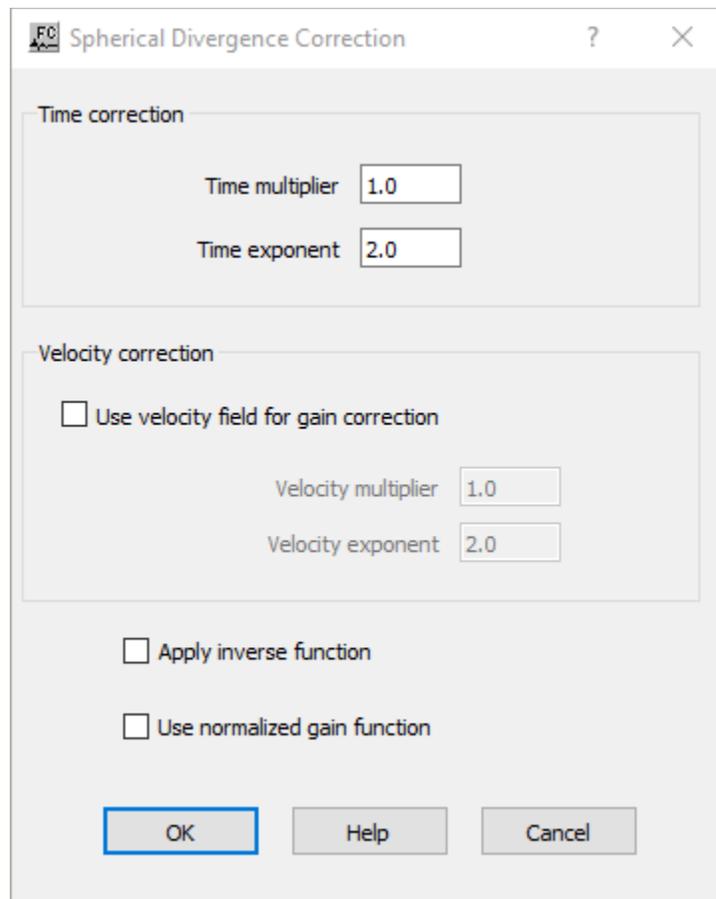
Reference:

Claerbout, Jon F., 1985, Fundamentals of Geophysical Data Processing: Blackwell Scientific Publications.

Example Flowcharts:



Step Parameter Dialog:



Parameter Description:

The Gain equation for the following definitions is:

$$\text{Gain} = T_Multiplier * (\text{Time} ** T_Exponent) * V_Multiplier * (\text{Velocity}(\text{Time}) ** V_Exponent).$$

Time correction: Define parameters related with spherical correction based on time.

Time multiplier — Enter the time multiplier in the gain equation.

Time exponent — Enter the time exponent in the gain equation.

Velocity correction: Define parameters related with spherical correction based on velocity.

Use velocity field for gain correction — If checked, spherical correction is applied based on a velocity field.

Velocity multiplier — Enter the velocity multiplier in the gain equation.

Velocity exponent — Enter the velocity exponent in the gain equation.

Apply inverse function — If checked, an inverse spherical divergence correction will be applied to your data.

Use normalize gain function — Normalize the gain function to be applied.

Surface Consistent Gain Corrections

Usage:

The *Surface Consistent Gain Corrections* step calculates source and receiver amplitude variations in a surface consistent manner. Gain curves must be specified for source and receiver.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Source Gain Corrections cards (mandatory).
- 3) Receiver Gain Corrections cards (mandatory).

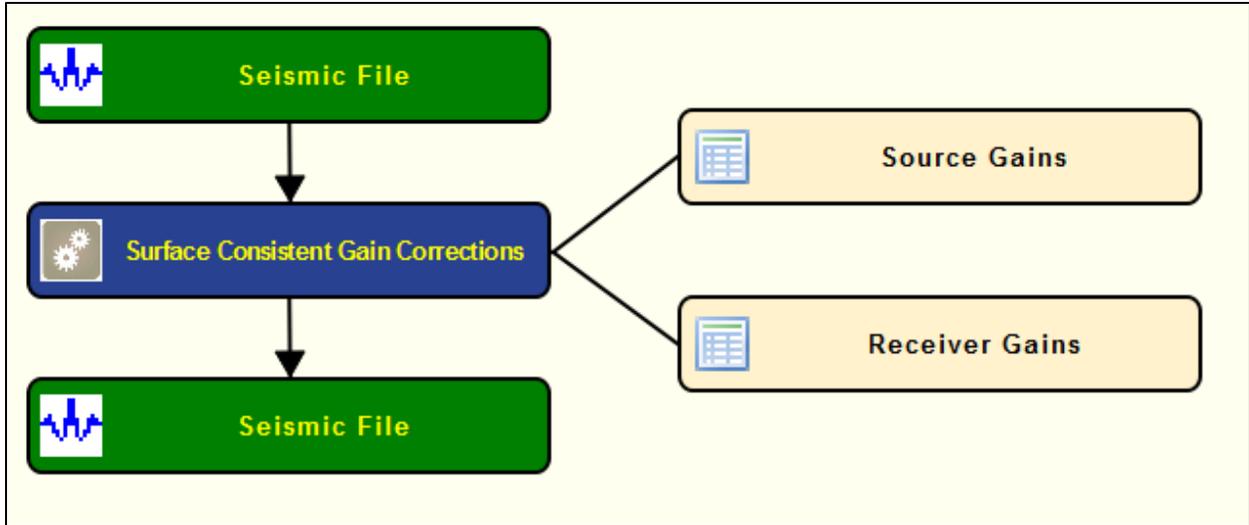
Output Links:

- 1) Seismic data in same sort order as input (mandatory).
- 2) Source Gain Corrections cards (optional).
- 3) Receiver Gain Corrections cards (optional)
- 4) Offset Gain Corrections cards (optional).

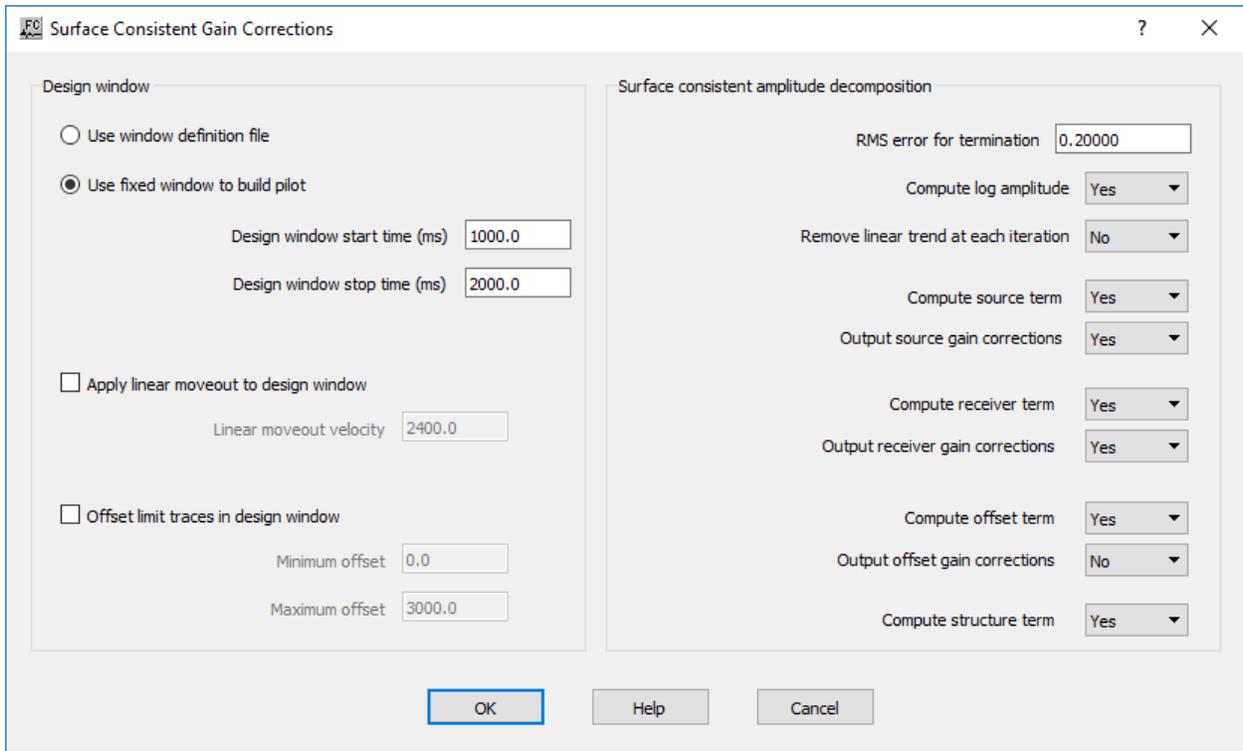
Reference:

Taner, M. T., and Coburn, K. W., 1980, Surface consistent estimation of source and receiver response functions: 50 th International Meeting of Soc. Expl.Geophy., Expanded Abstract.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Design window:

Use window definition file — If selected, the pilot area is defined with a **Window Definition** card.

Use fixed window to build pilot — If selected, the pilot area is defined within a fixed time gate.

Design window start time (ms) — Enter the window starting time in ms.

Design window stop time (ms) — Enter the window ending time in ms.

Apply linear moveout to desing window — If checked, the window is defined variable based on a linear moveout with the velocity defined in **Linear moveout velocity**.

Linear moveout velocity — Enter the linear moveout velocity in m/s.

Offset limit traces in design window — If checked the window definition is limited by a **Minimum** and **Maximum offset** values.

Minimum offset — Enter the minimum offset in field units to build the window.

Maximum offset — Enter the minimum offset in field units to build the window.

Surface consistent amplitude decomposition:

RMS error for termination —

Compute log amplitude —

Remove linear trend at each interation —

Compute source term —

Output source gain corrections —

Compute receiver term —

Output receiver gain corrections —

Compute offset term —

Output offset gain corrections —

Compute Structure term —

Trace Header Amplitude Math

Usage:

The *Trace Header Amplitude Math* step use used to modify sample values using mathematical operations on trace header fields. Any of the trace header fields can be used.

Input Links:

1) Seismic data in any sort order (mandatory).

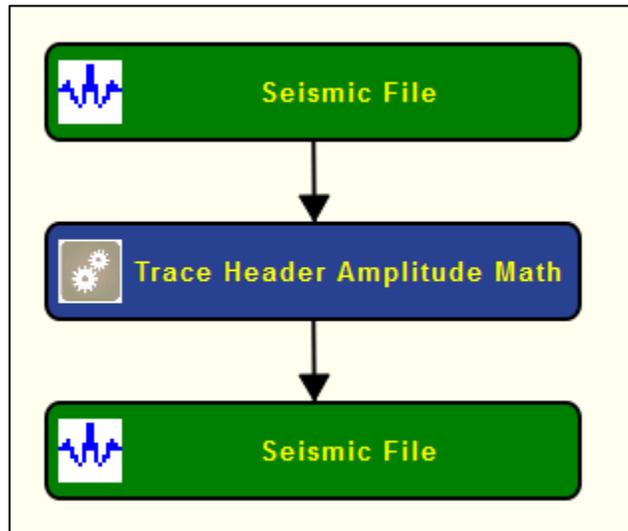
Output Links:

1) Seismic data in same sort order as input (mandatory).

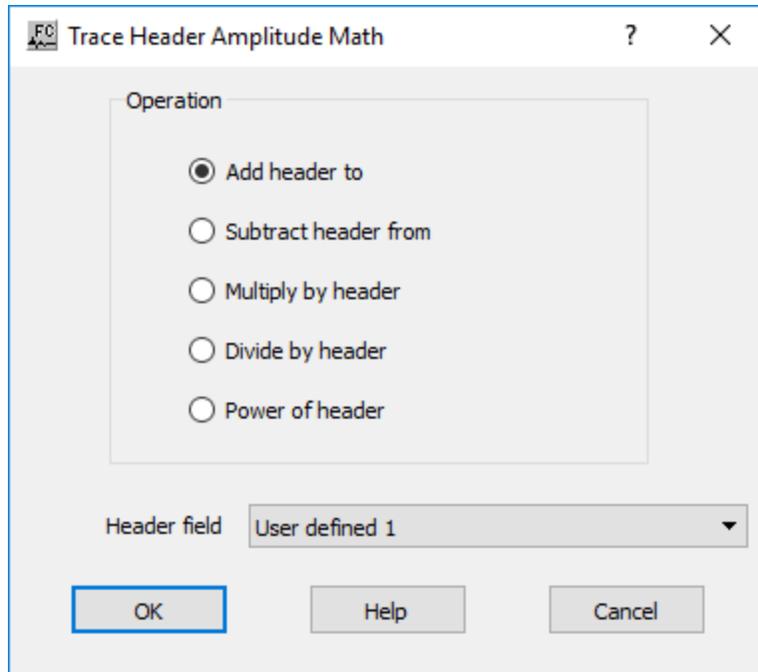
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Operations: Select the mathematical operation that will modify the seismic amplitude values based on value specified on a user-defined header.

Add header to — add header value to each seismic amplitude value.

Subtract header from — subtract header value to each seismic amplitude value.

Multiply by header — multiply each seismic amplitude value by header.

Divide by header — divide each seismic amplitude value by header.

Power of header — compute the power of each seismic amplitude value by an exponent as defined in header.

Header Field — Select the trace header field that will modify the seismic amplitude values.

Example: If the Multiply by header operator is selected and the Header field is set to offset, then the sample values in each input trace will be multiplied by the value of offset in the corresponding trace header.

Windowed AGC

Usage:

The *Windowed AGC* step allows you to apply window gain functions to each data trace based on user-defined windows. You specify the number of windows by setting the start time and length

of each gate. The calculated gain functions may be output to an optional seismic file, which allows you the option to remove the AGC functions prior to subsequent processing steps.

Input Links:

- 1) Seismic data in any sort order (mandatory).

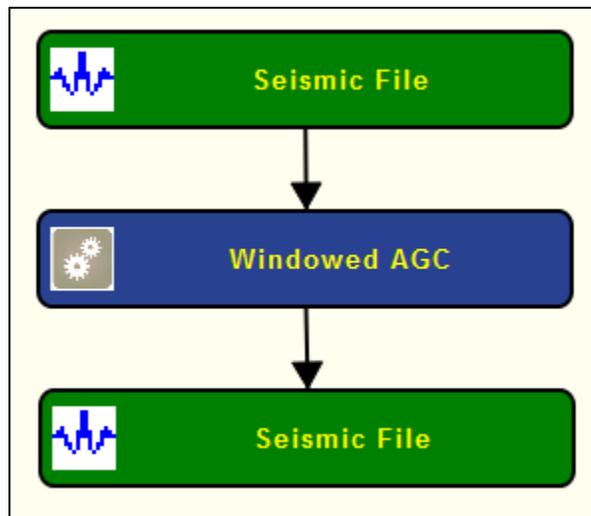
Output Links:

- 1) Seismic data in same sort order as input (mandatory).
- 2) Gain functions (optional).

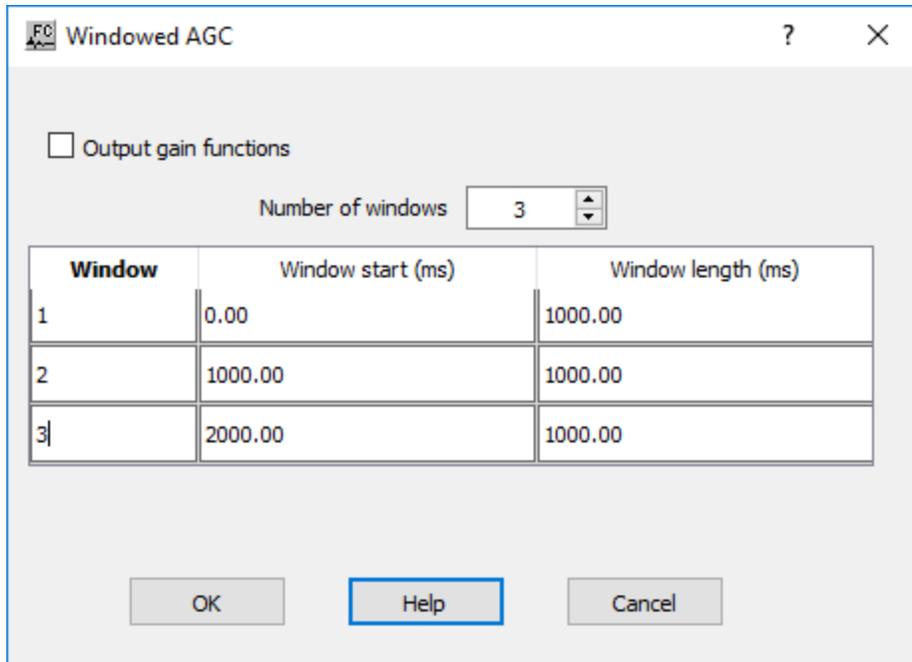
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Output gain functions — If checked, output the gain functions to a gain functions card. This allows removing the AGC effect later on the processing flow.

Number of Windows — Define number of different windows where the AGC is going to be applied. Each window is defined by its starting time and length, both in ms.

Windowed Trace Balance

Usage:

The *Windowed Trace Balance* step allows you to balance the seismic amplitudes within user-defined windows based on RMS amplitude or Mean amplitude within each window

Input Links:

- 1) Seismic data in any sort order (mandatory).

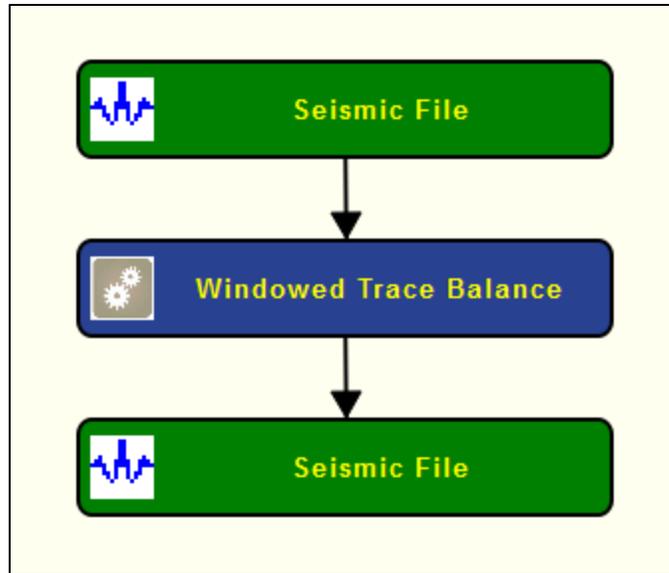
Output Links:

- 1) Seismic data in same sort order as input (mandatory).

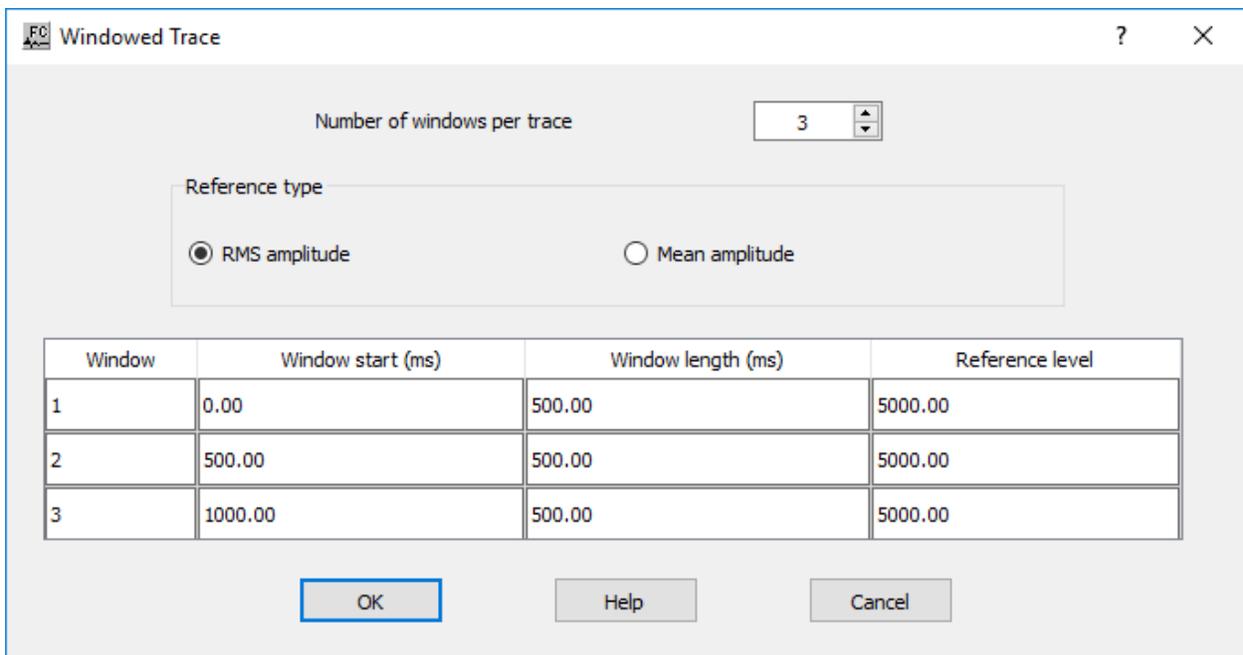
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Reference type: Select whether the traces will be leveled according to RMS or mean amplitude.

Number of windows per trace — Enter the number of balancing windows per data trace.

Window start (ms) — Enter the start time in milliseconds for the balancing window.

Window length (ms) — Enter the length in milliseconds for the balancing window. The window will extend from the start time to start time + length.

Reference level — Enter the reference level for the balancing window. On output, the RMS or mean amplitude of the data trace will be equal to the specified value.

Creating and Editing Auxiliary Data File

This section documents the support information available as Auxiliary Data. Auxiliary data may be imported from foreign data formats or output as foreign data formats. Auxiliary Data items currently available may be selected from the processing list below (A-P or R-Z):

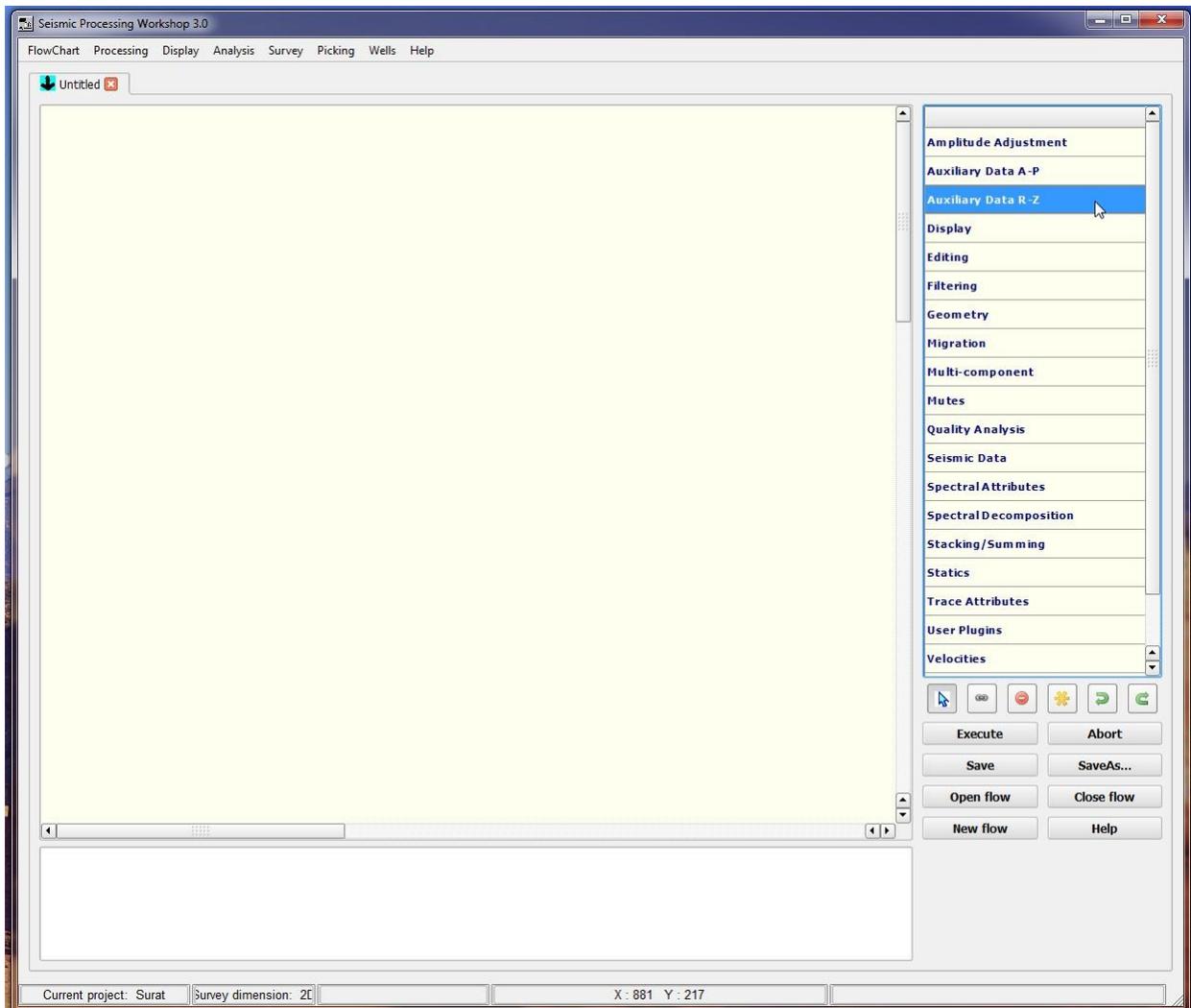
Auxiliary Data A-P	Auxiliary Data R-Z
↑ Processing Categories	↑ Processing Categories
CMP Flex Locations	Receiver Gain Corrections
CMP Statics	Receiver Statics
Early Mutes	SPS Observer Notes
Exclusion Zones	SPS Receiver Locations
FK Mutes	SPS Source Locations
Field File Statics	Source Gain Corrections
First Break Times	Source Statics
Gain Curves	Surgical Mutes
Horizon File	Tail Mutes
Line Definition File	UKOOA P1 90
Offset Gain Corrections	Velocity Function
PP NHMO Eta Function	Window Definition
PS NHMO Gamma Function	
Polygon Definition	

Creating and Editing Auxiliary Data Files

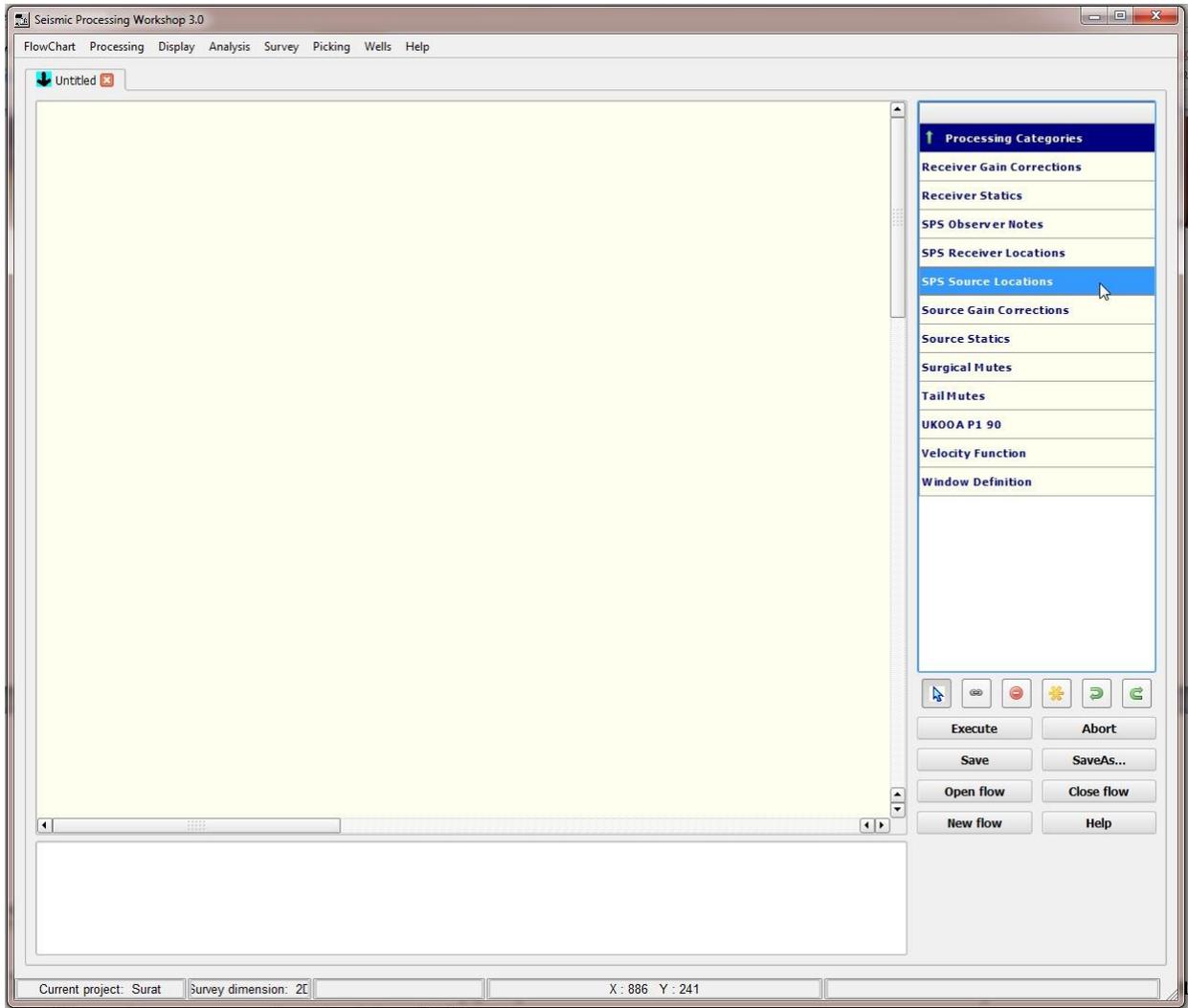
Each of the auxiliary data types can be created and edited within Flowchart. Following are two examples: in the first example, we manually create and write a source SPS file; in the second example, we will retrieve and edit an existing source SPS file.

In this first example, we create and write a new SPS file in SPW.

Step 1. Click on Auxillary Data R-Z from the list of Processing Categories.

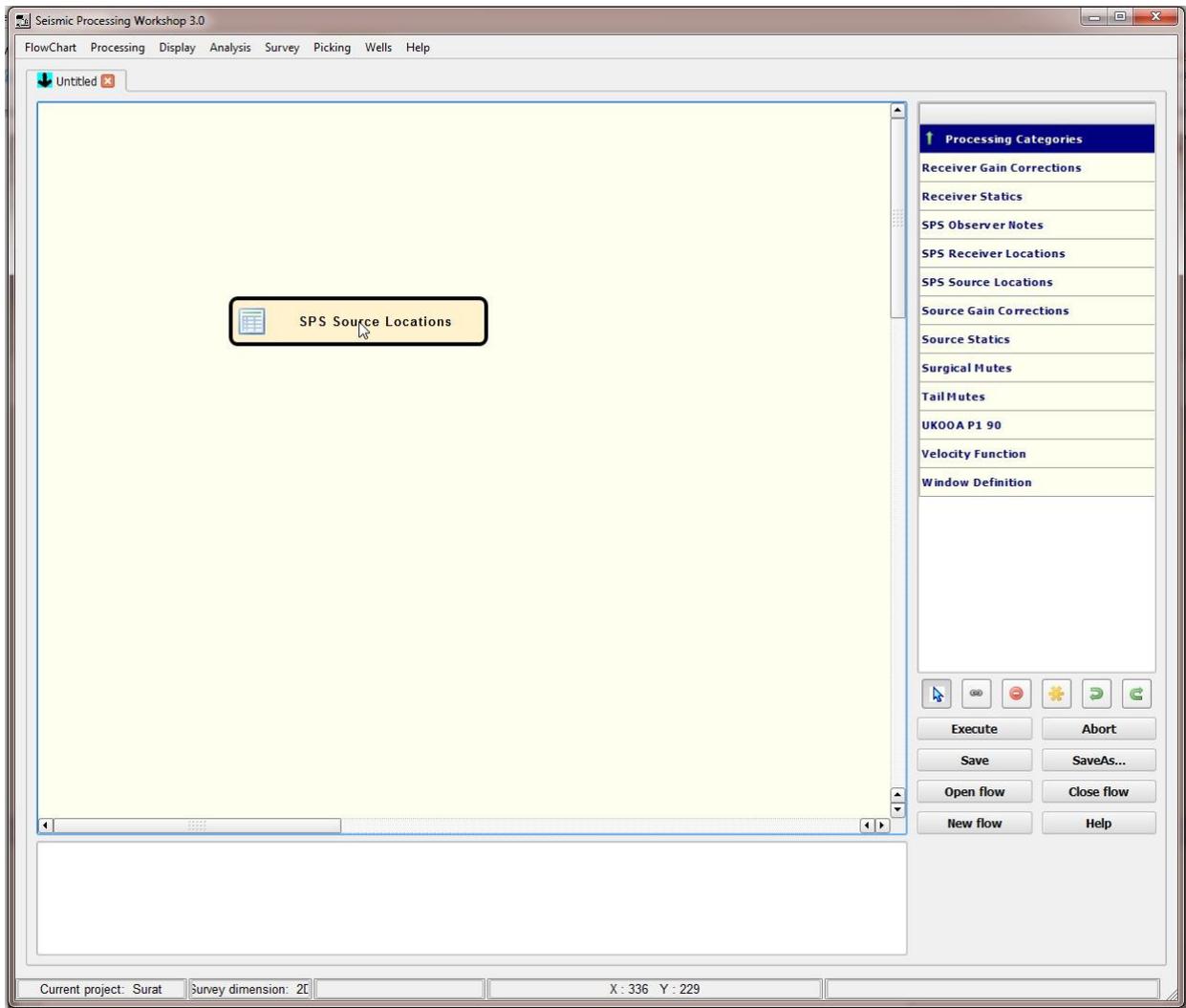


Step 2. Click on the SPS Source Locations auxillary card data file from the list.

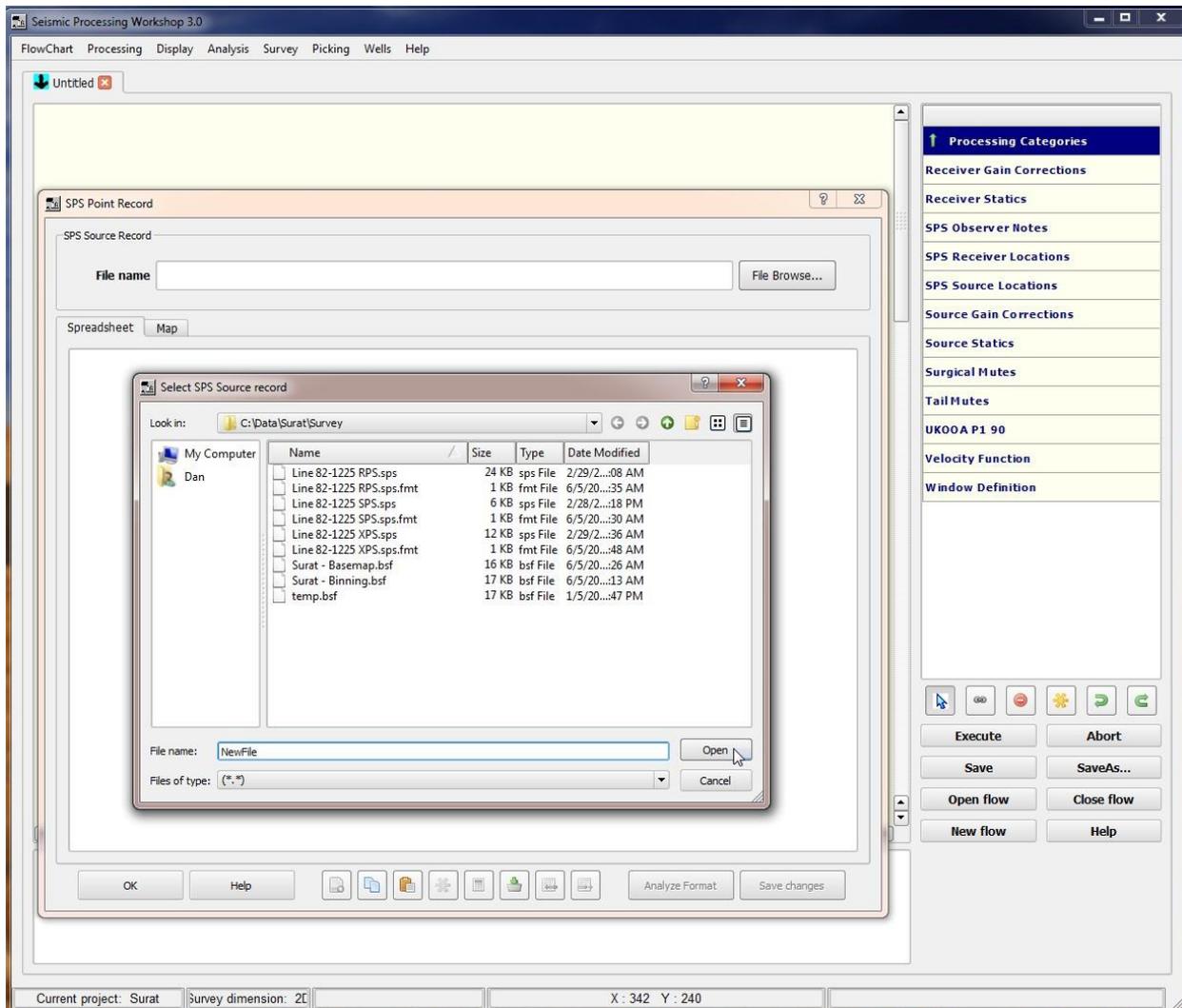


An example of selecting the SPS Source Locations auxillary data file.

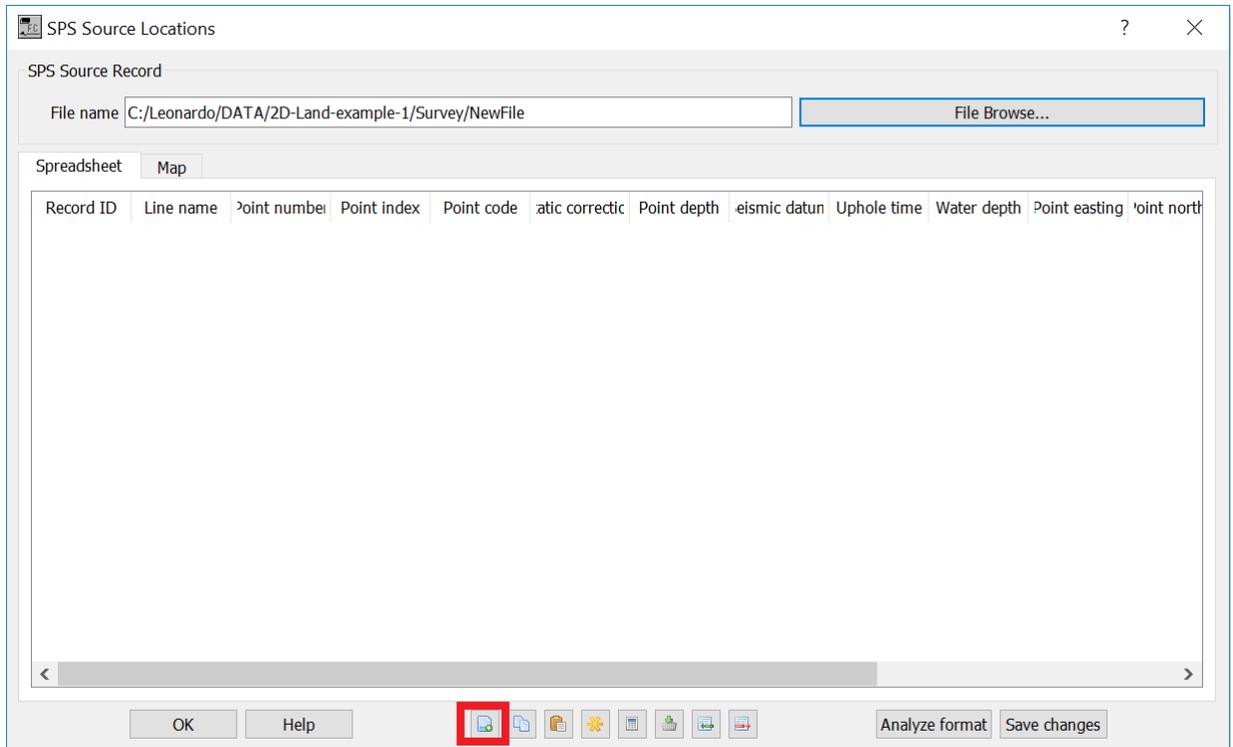
Step 3. Click on the FlowChart canvas to place the SPS Source Locations icon. You may click and drag the icon to relocate it. Double click on the SPS Source Locations auxillary card data file to open it.



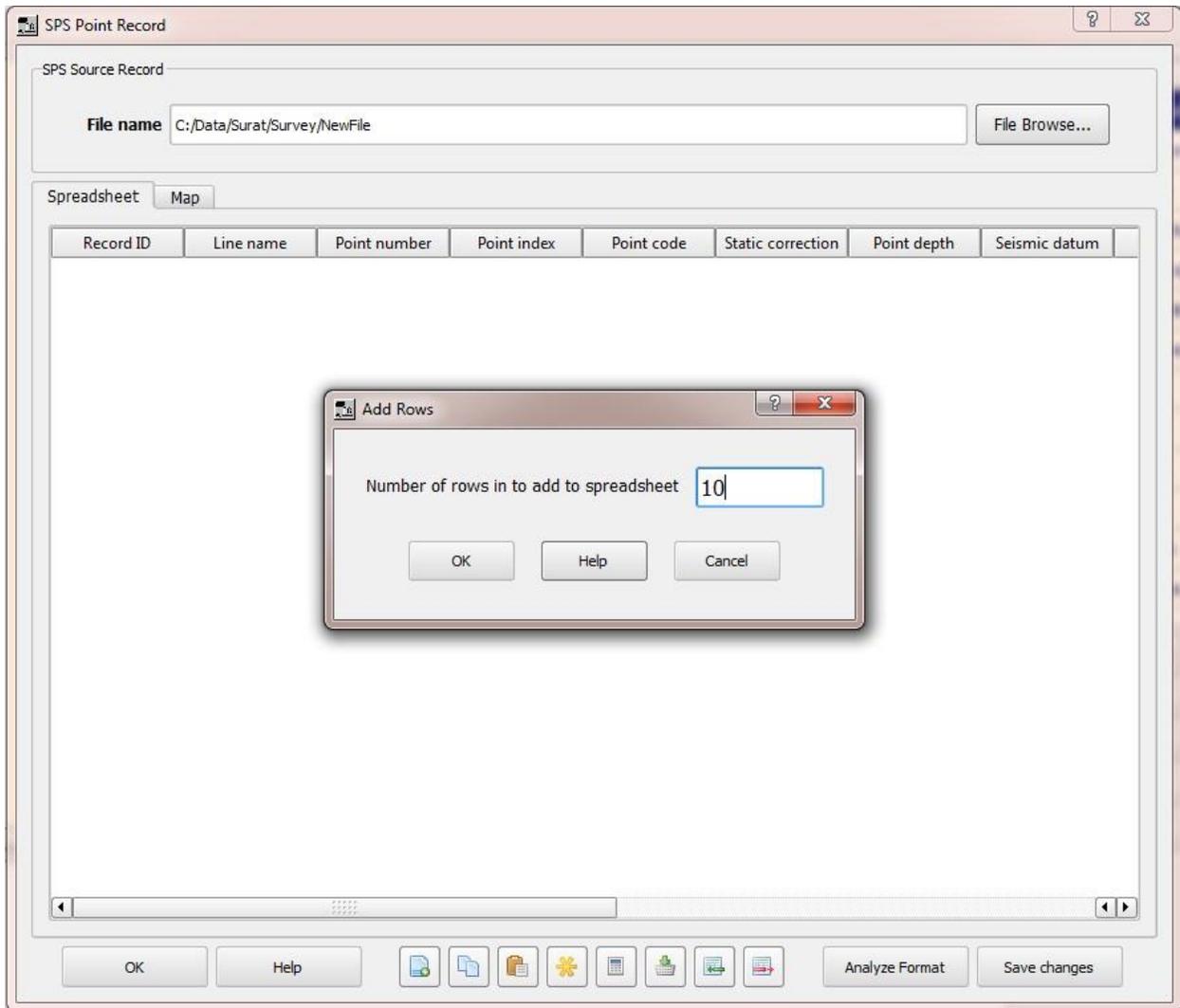
Step 4. To create a new SPS Source Point Record, click on the File Browse... button. A dialog box allows you to enter a desired name for your new file (e.g. NewFile) in the File name: text entry box and clicking Open.



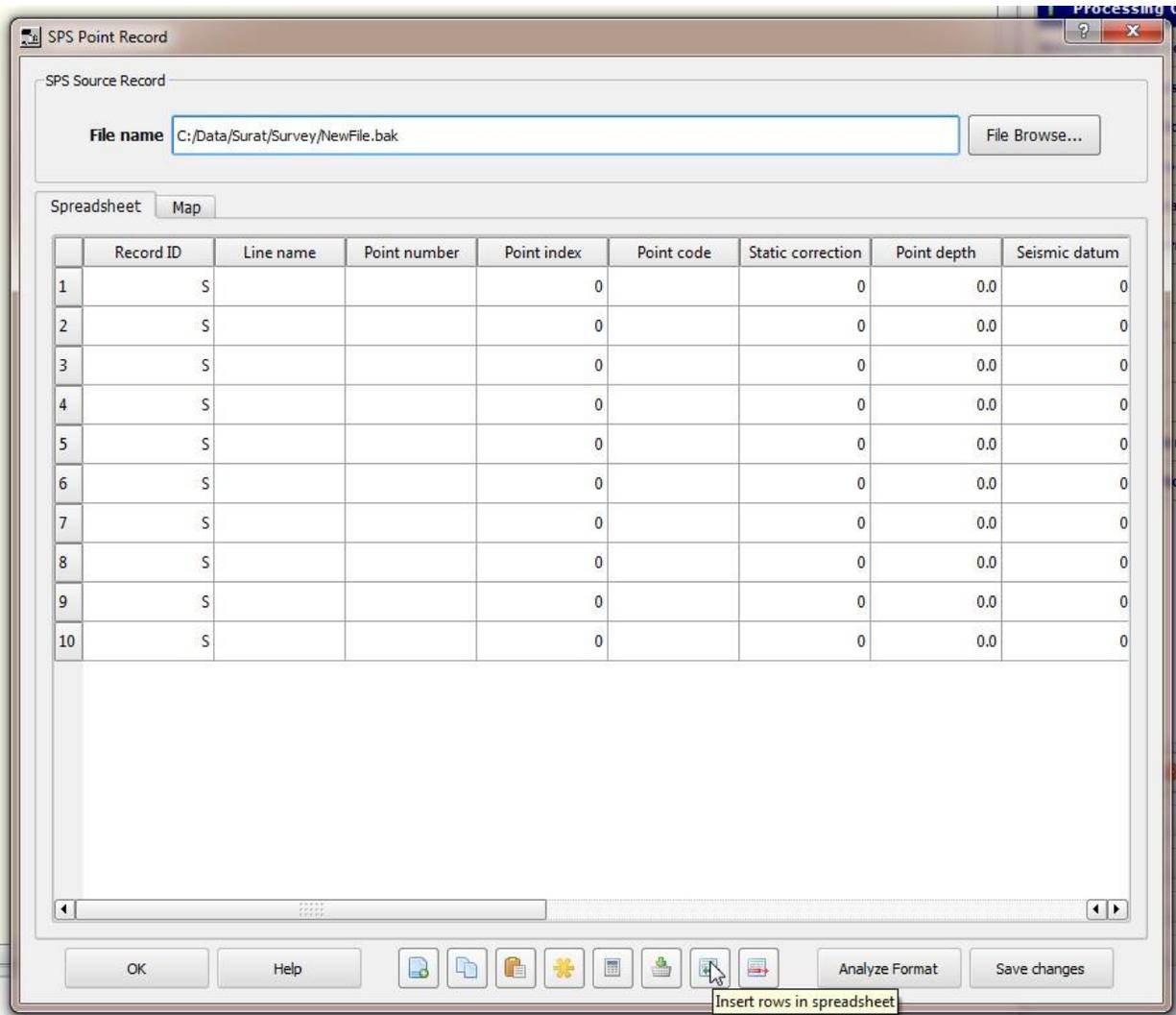
Step 5. Click on Save changes. Notice that the directory path is automatically saved to the Survey directory. Notice also the empty columns.



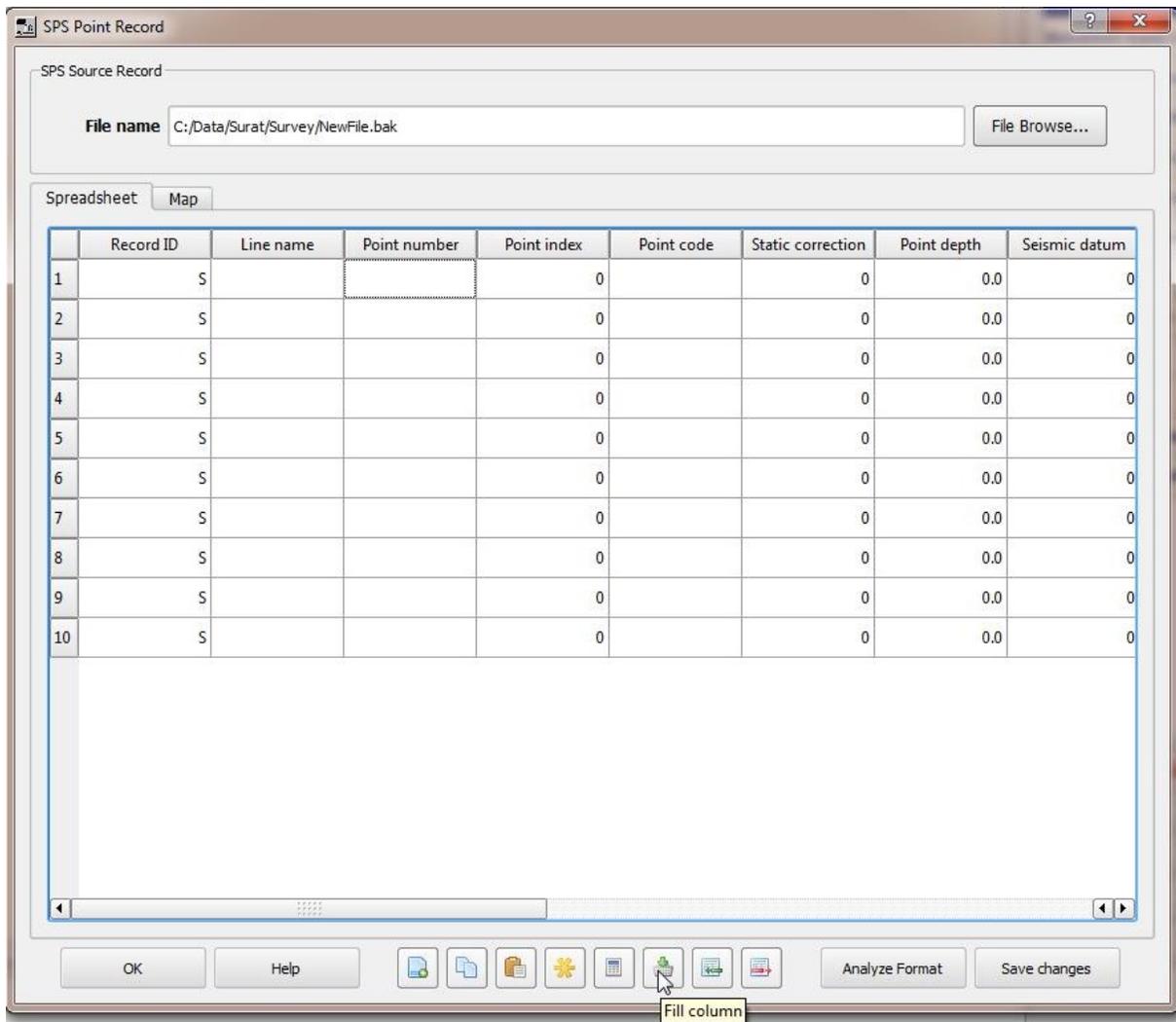
Step 6. Select adds rows to create a spreadsheet for data entry. When the Add Rows dialog box comes up, enter the number of rows desired, click OK and then Save changes.



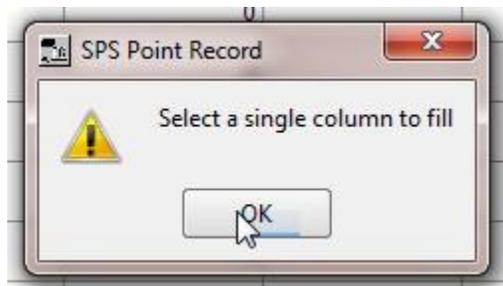
Step 7. Click on the Insert rows in spreadsheet button at the bottom of the SPS Source Point Record to add a single row one at a time if desired.



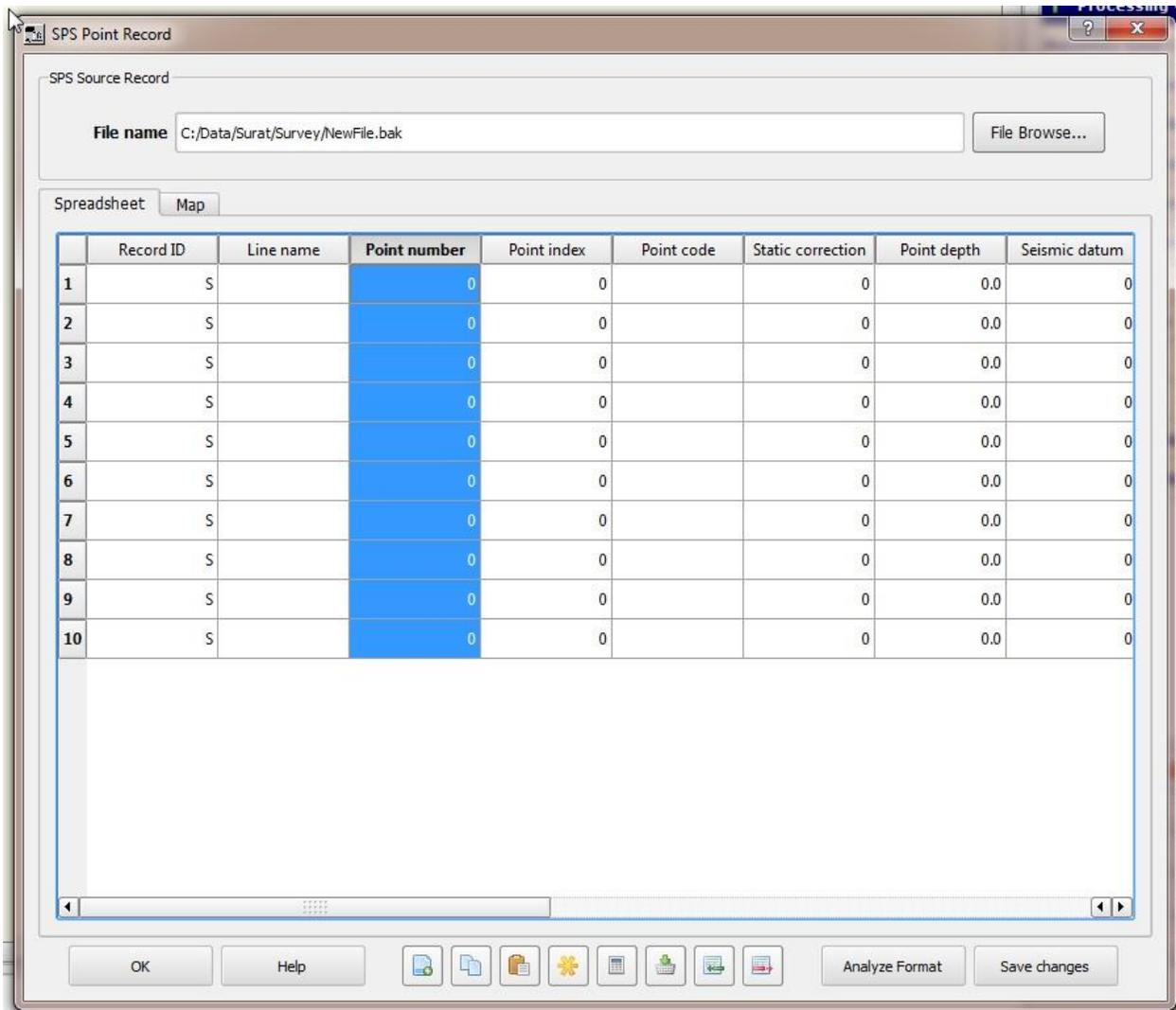
Most values may be entered in the spreadsheet by using the fill column function.



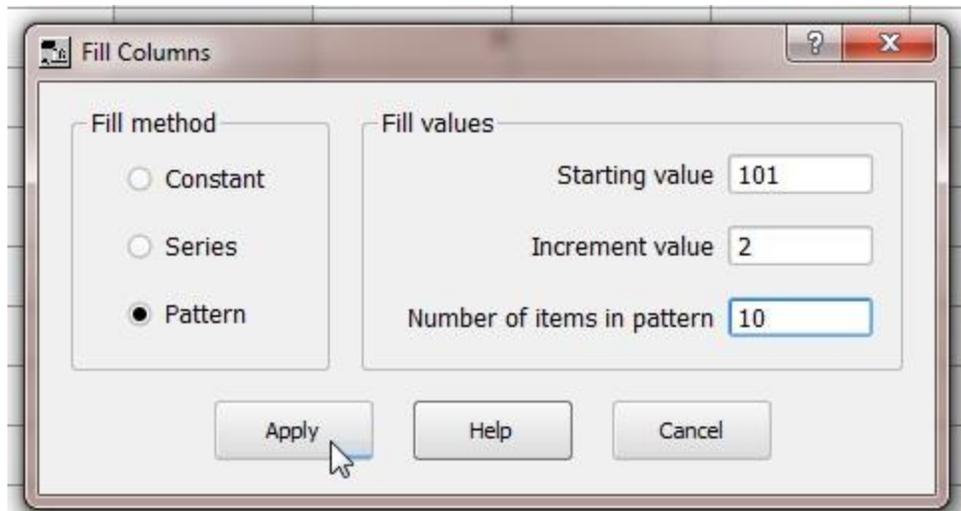
If a column is not selected, an error check dialog box will prompt you to select a single column to fill.



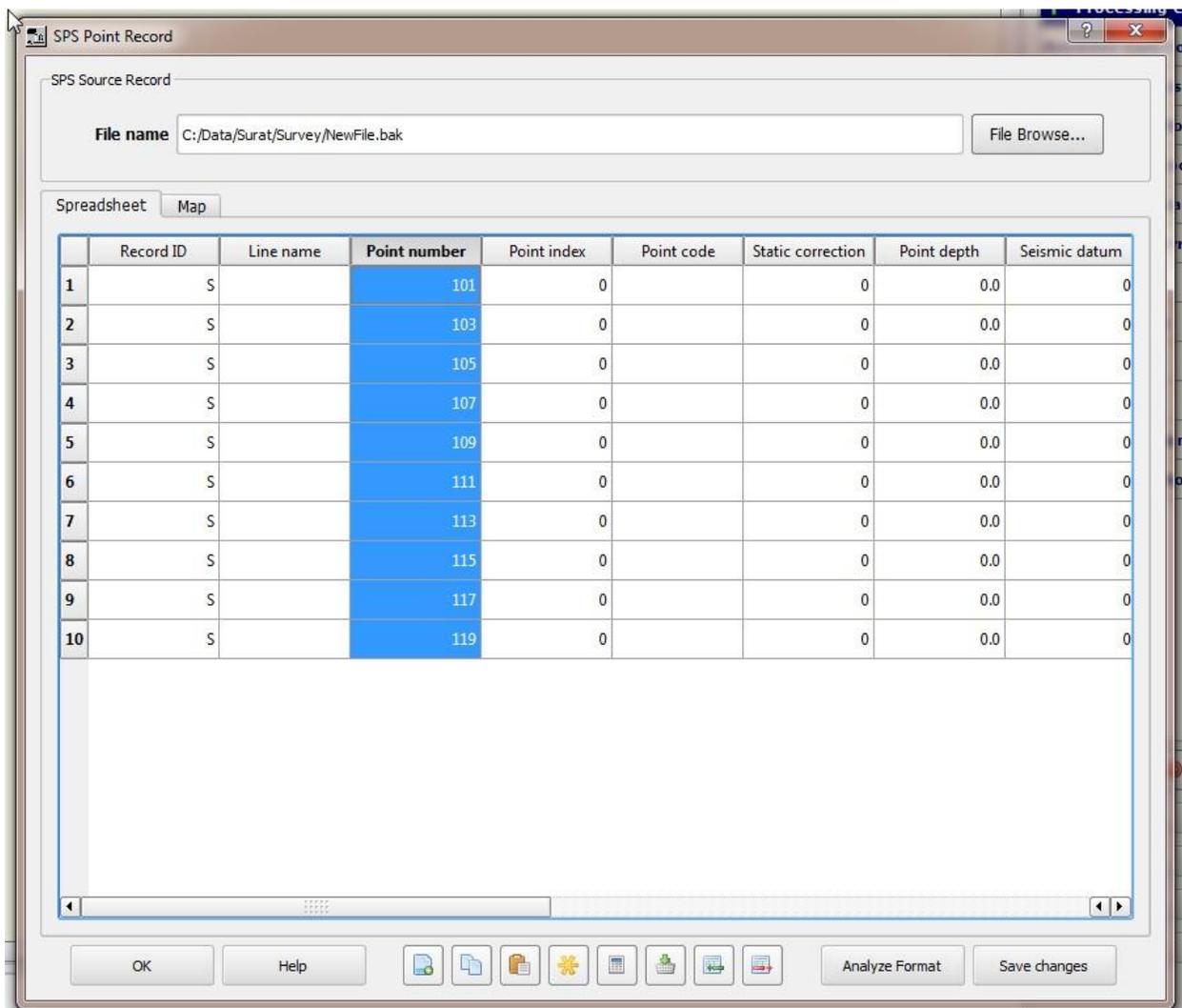
Step 8. Select a column to fill in the spreadsheet by clicking on the column header (e.g. Point number).



Step 9. Enter the Starting value, the Increment value and the Number of items in pattern and click Apply to fill the column you have selected.

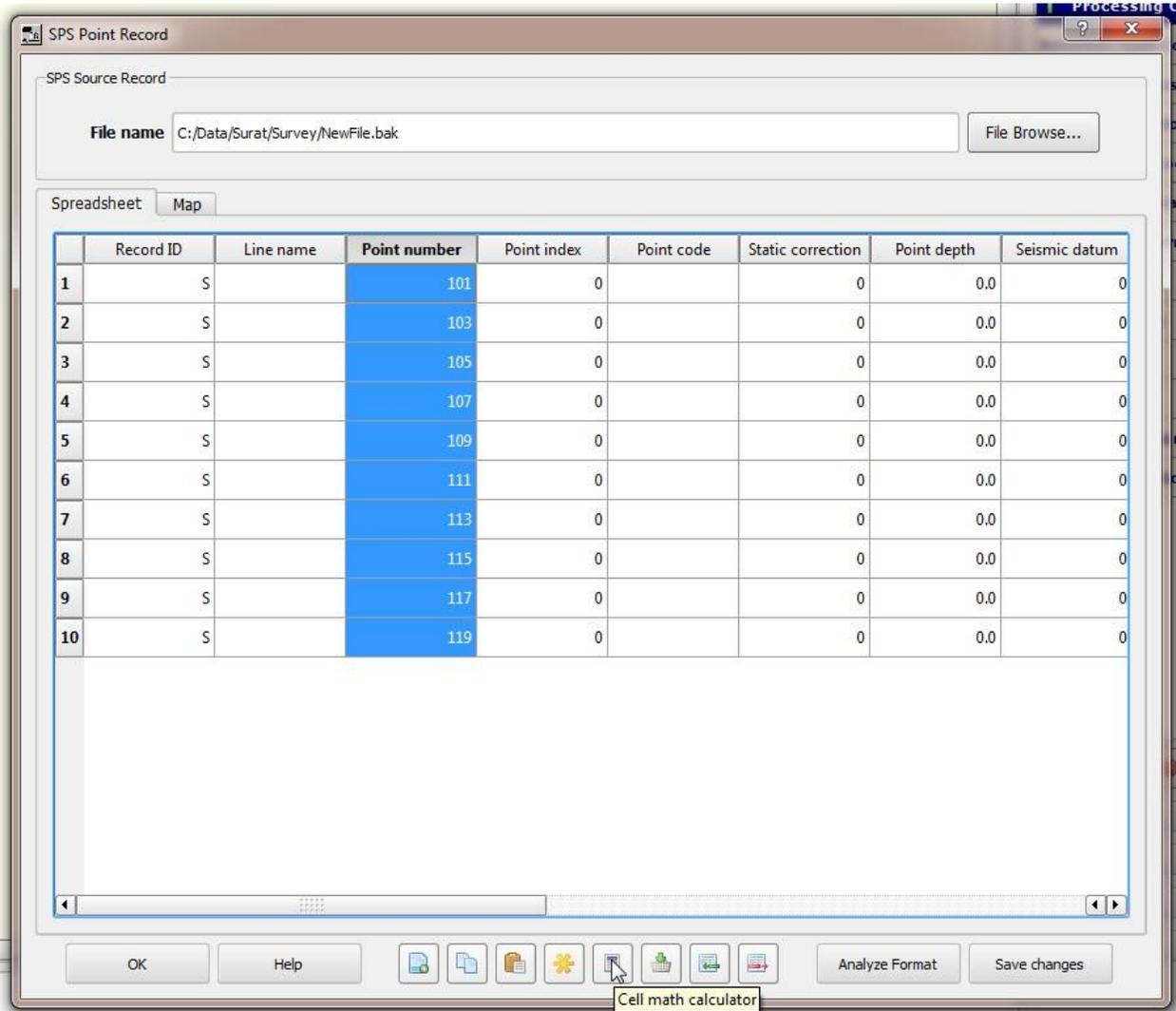


Example of using the Fill Columns dialog box.



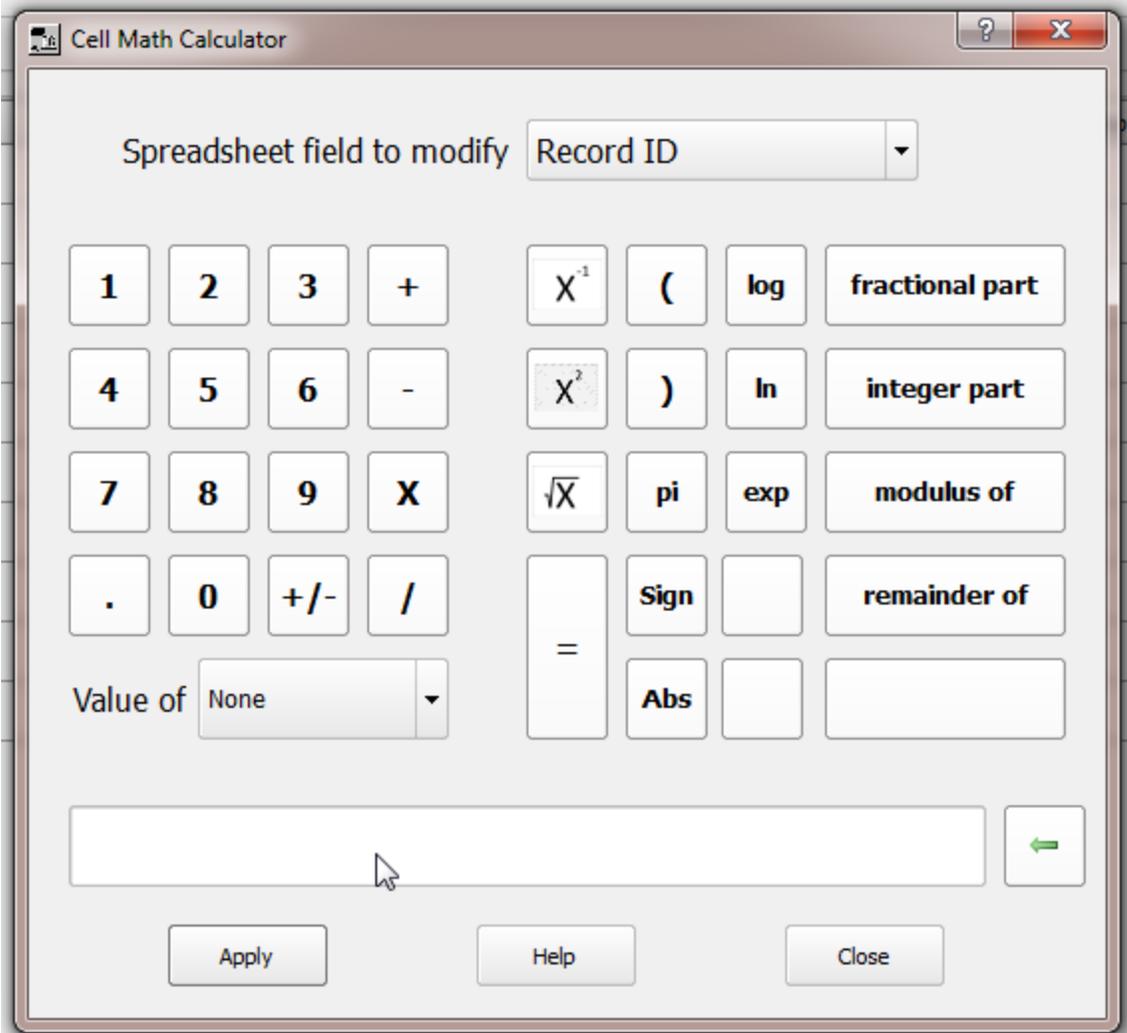
Cell Math may also be used to edit information in the SPS Source Point Record.

Step 10. Click on the Cell math calculator button to view the functions available with the Cell Math Calculator.



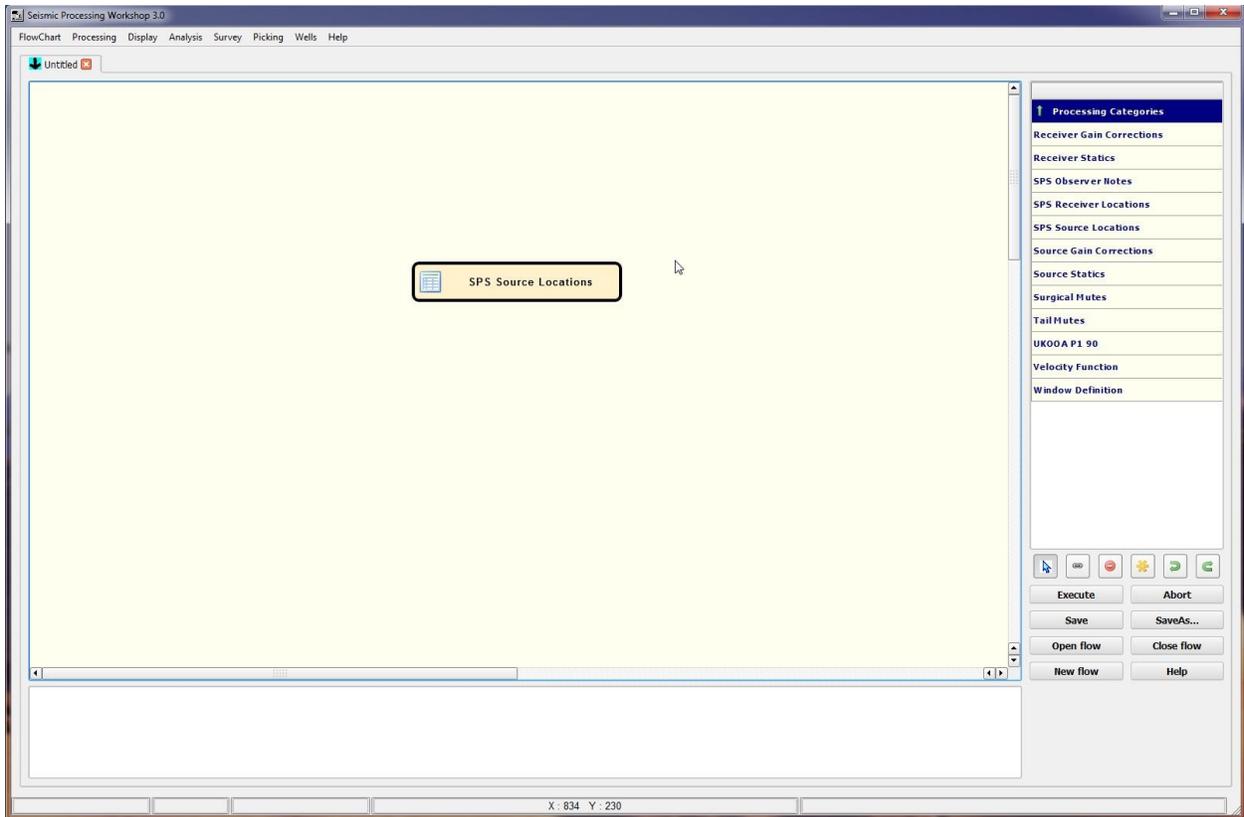
An example of selecting the Cell math calculator button.

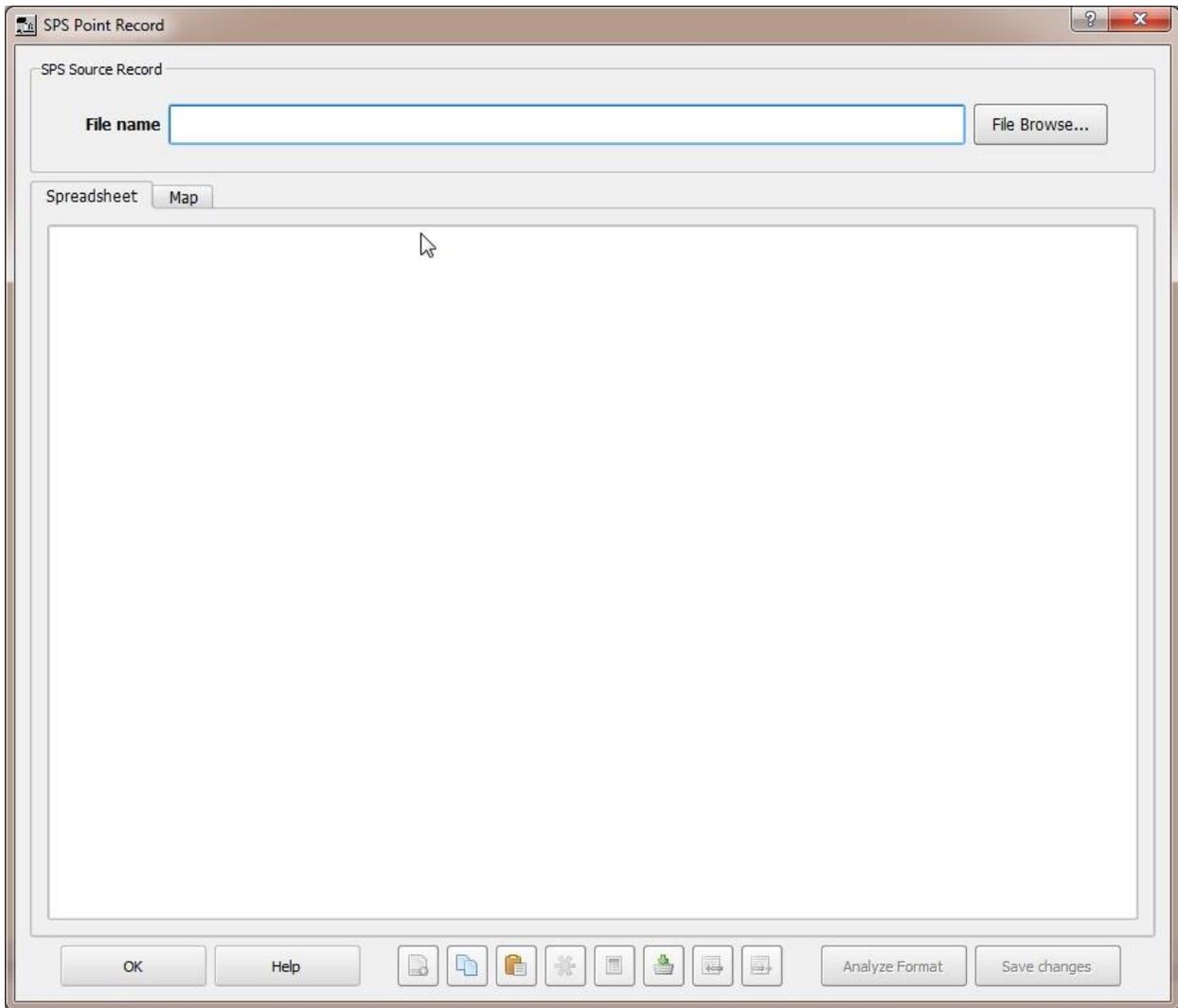
The Cell Math Calculator consists of intuitive functions that can be used to edit the values in card data spreadsheet.



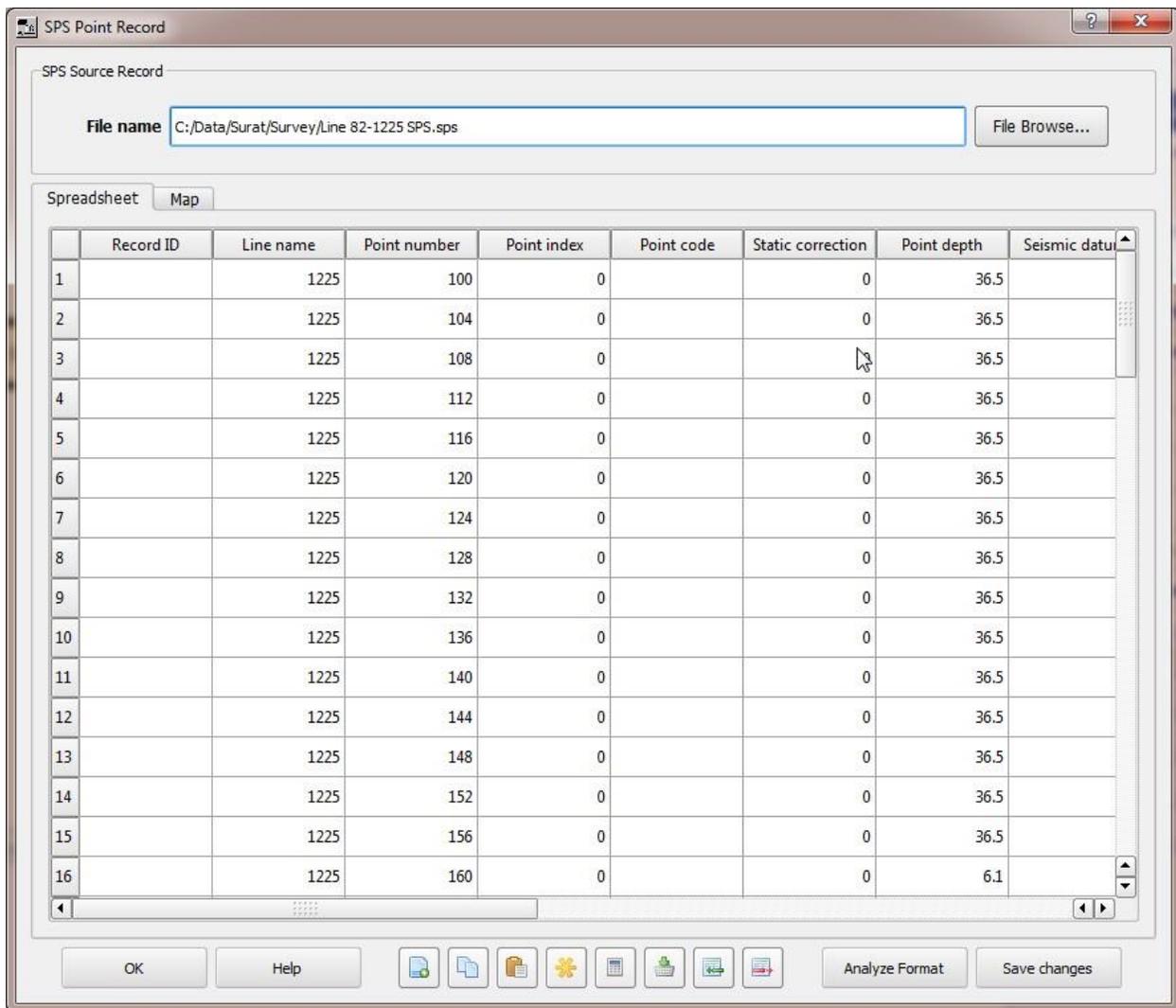
Click on the Apply button then Close to exit when finished with the Cell Math Calculator. When finished in the spreadsheet, be sure to Save changes and click OK to exit.

In this second example, we will locate and manually edit an existing SPS file in SPW.

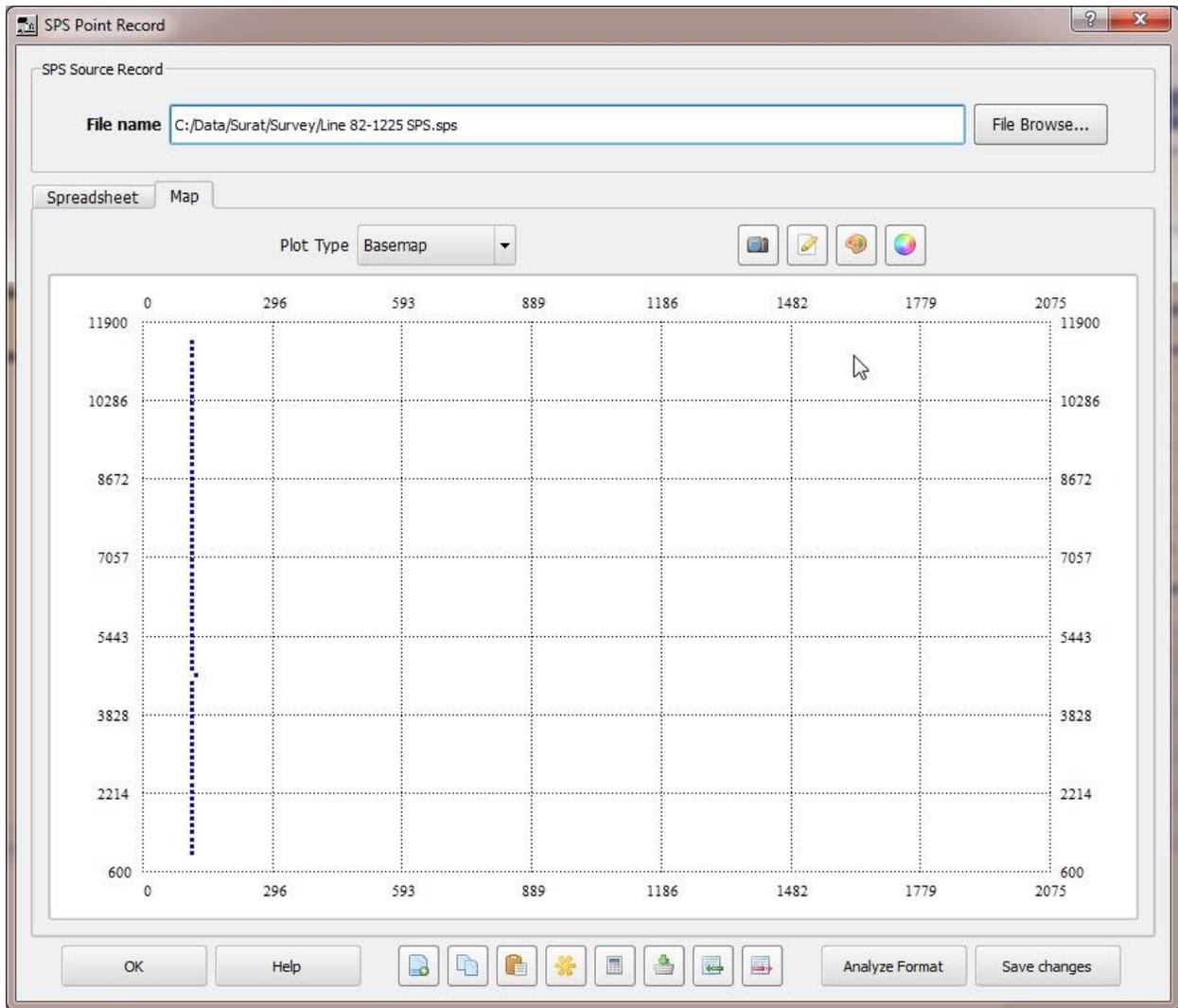




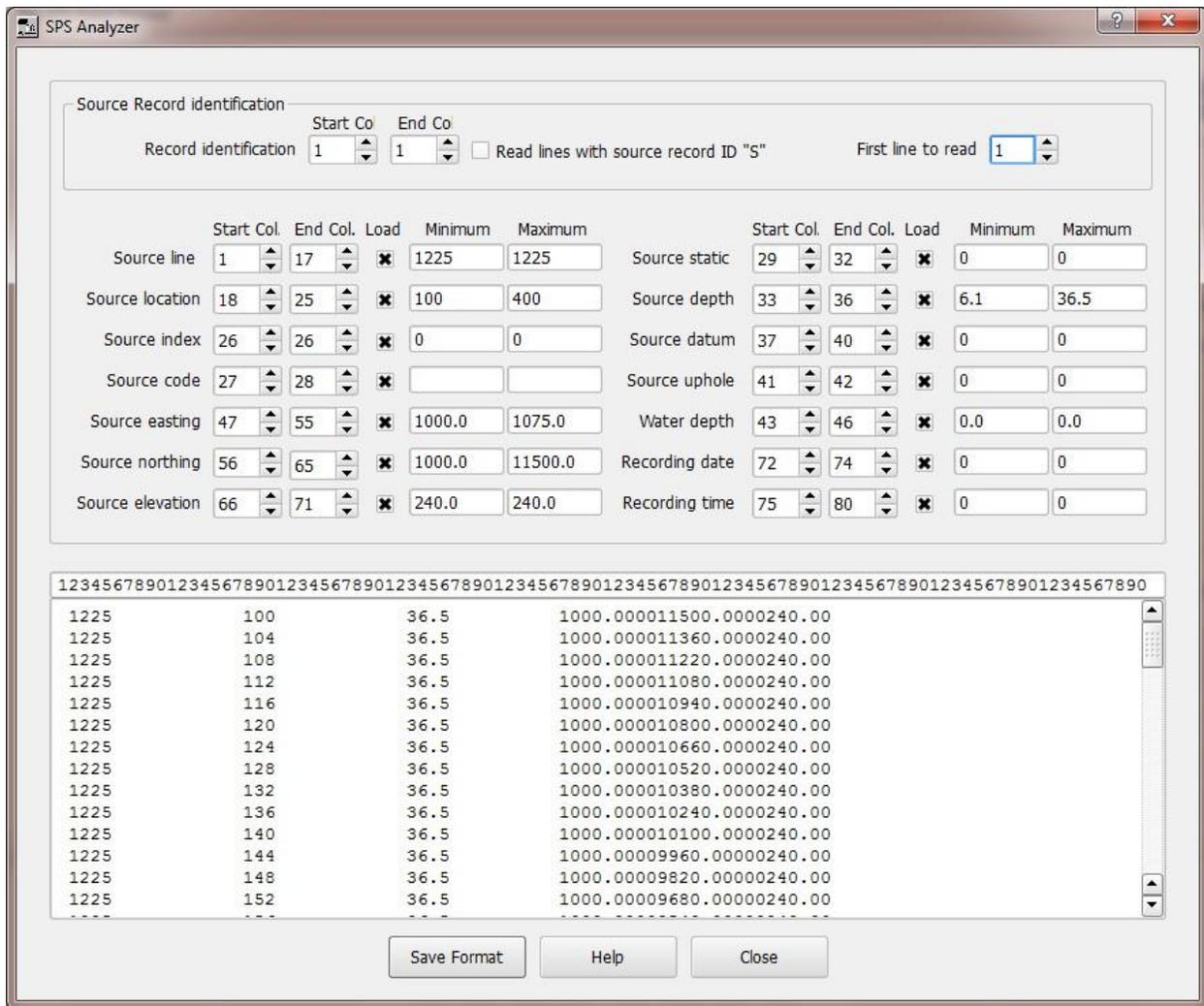
Step 1. Select the File Browse button to call an existing Source Locations – SPS Format auxiliary card data file into the Flowchart.



Step 2. Select the Map tab to view the basemap of the same file.



Step 3. To view and analyze the data format click on the Analyze Format button in the lower right portion of the SPS Source Point dialog box.



SPS Receiver Point Records may be created and edited in the same way as SPS Source Point Records or they may be created in Microsoft Excel and then copied and pasted into SPW.

Below is an excerpt from SPW Help for specifying an SPS Point Record.

SPS Point Record

General description:

The SPS Point Record is used to describe shot and receiver positions in a land seismic survey. In the case of a shot location, the point record contains details regarding the position of the shot at the time of recording. In the case of a receiver location, the point record contains details regarding the position of the receiver at the time of the first shot recorded into that receiver.

Point Record Specification:

Field definition	Columns	Format	Minimum & Maximum
Record ID	1-1	ASCII	“R” or “S”
Line name	2-17	ASCII	Free form
Point number	18-25	ASCII	Free form
Point index	26-26	Integer	1-9
Point code	27-28	ASCII	
Static correction	29-32	Integer	-999 to +999
Point depth	33-36	Floating point	0 to 99.9
Seismic datum	37-40	Integer	-999 to + 9999
Uphole time	41-42	Integer	0 to 99
Water depth	43-46	Floating point	0 to 99.9 or 0 to 999
Easting	47-55	Floating point	None
Northing	56-65	Floating point	None
Elevation	66-71	Floating point	-999.9 to + 9999.9
Day of year	72-74	Integer	1 to 999
Time of day	75-80	Integer	0 to 235959

Point Record Description:

Record ID: “R” identifies the record as a receiver record. “S” identifies the record as a shot record

Line name: Identifier for the shotpoint or receiver line.

Point number: Identifier for the shotpoint or receiver group number.

Point index: Index of the shotpoint or receiver number. In the case of shotpoints, 1 indicates the first shot at the specified location. The value of the index is incremented by 1 for each additional shot at the specified location. In the case of receivers, 1 indicates the first positioning of the receiver at the specified location. The value of the index is incremented by 1 each time the receiver group is moved or repositioned.

Point code: A code that characterizes the shot or receiver used at the point.

Static correction: The shot or receiver static, in units of milliseconds, that has been computed in the field to correct the seismic recording for the effects of elevation, weathering thickness, or weathering velocity at the point. The correction is referenced to the seismic datum specified in field 8.

Point depth: The depth of the shot or receiver.

Seismic datum: Elevation of the seismic datum.

Uphole time: In the case of a shot, this is the vertical traveltime from the charge to surface, in units of milliseconds. The value is always positive.

Water depth: The measured height of the water surface above the seafloor or water bottom. In the case of shotpoints, the value should be the depth at the time of recording. In the case of receivers, the value should be the depth at the time of recording the first shot into the receiver.

Easting: Map easting for the point. The coordinate system is defined in header H13 of the point record.

Northing: Map northing for the point. The coordinate system is defined in header H13 of the point record.

Elevation: Surface elevation with respect to the datum defined in header H17 of the point record. Elevations above datum are positive. In the case of shotpoints, the value should be the elevation at the time of recording. In the case of receivers, the value should be the elevation at the time of recording the first shot into the receiver.

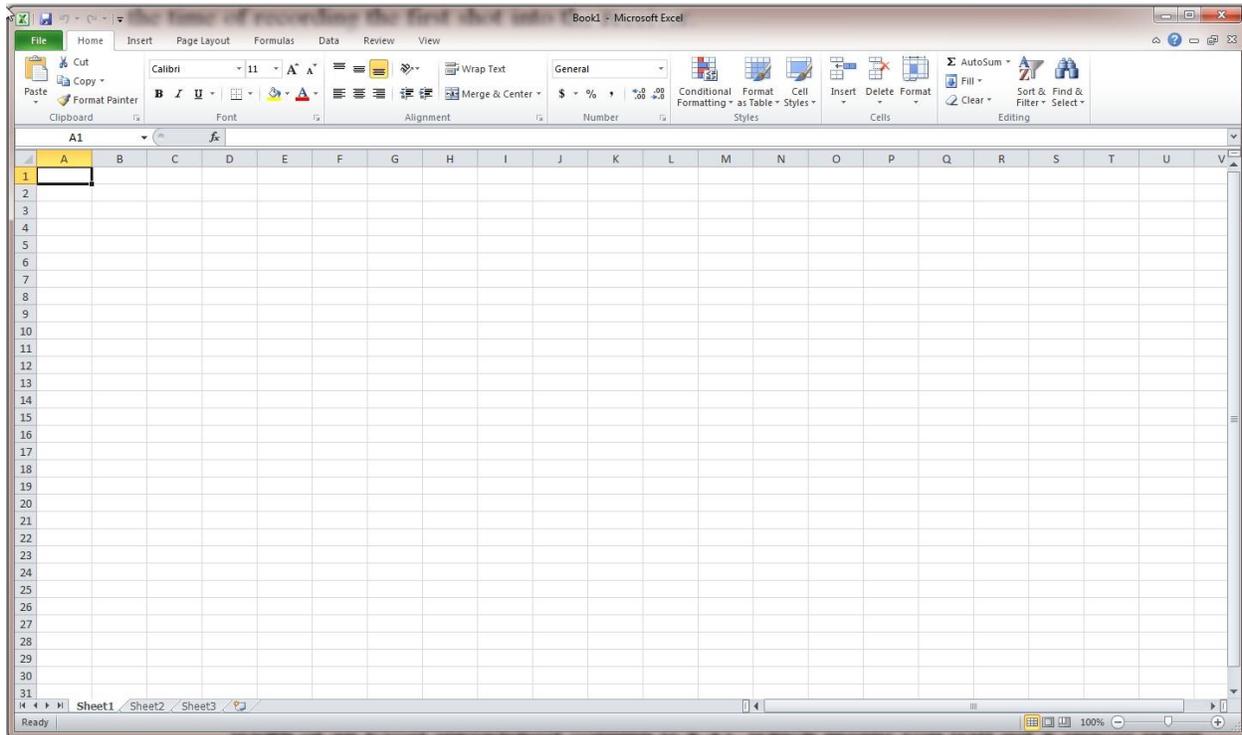
Day of year: Julian day of recording. In the case of shotpoints, the value should be the day of recording the shot. In the case of receivers, the value should be the day of recording the first shot into the receiver.

Creating Card Data Using Excel

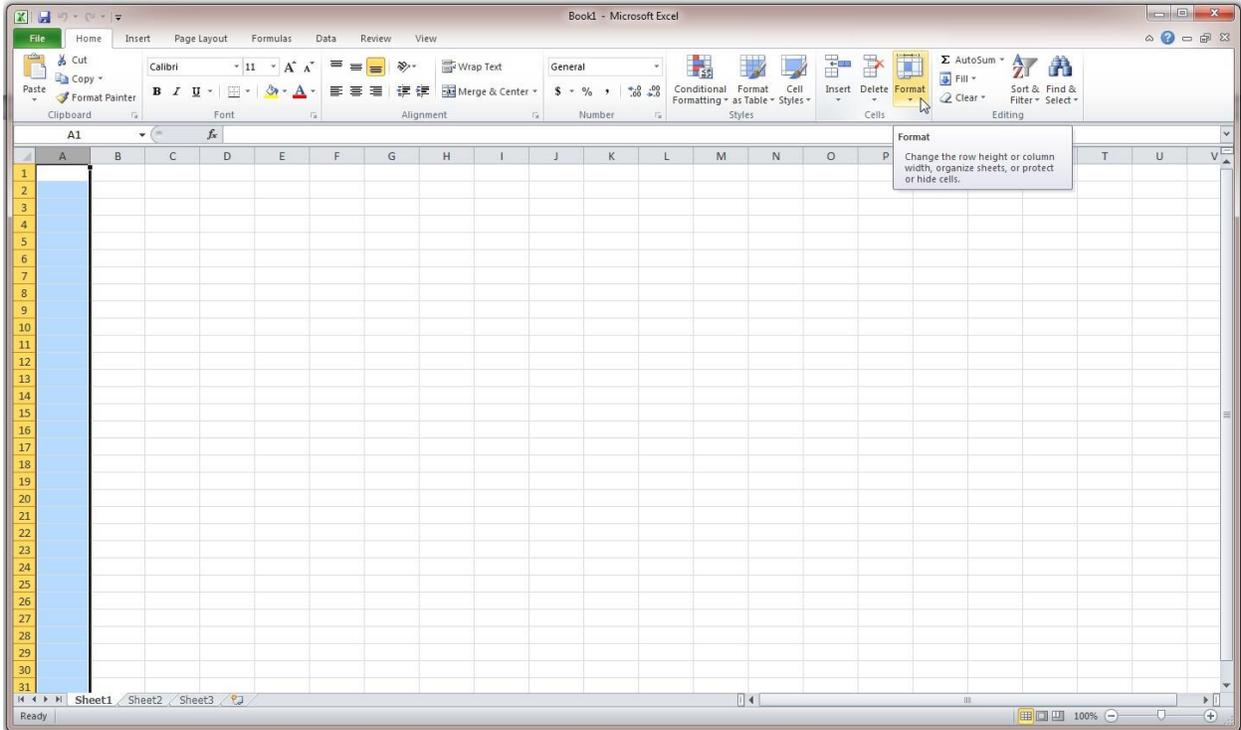
In addition to calling existing files into or creating new data files within SPW, you may create data in a Microsoft Excel spreadsheet and transfer these data into any auxiliary card data record spreadsheet. To transfer a few data values, simply copy and paste from the Excel spreadsheet to the SPW card data file spreadsheet. However, the array of data you cut from Excel must match in size the area you select in the SPW spreadsheet prior to pasting.

To transfer an entire file, you will need to reformat the Excel file as an SPW card data file. The following example will demonstrate how to create a SPS Receiver Point Record in Excel and format the file for use in the SPW Flowchart.

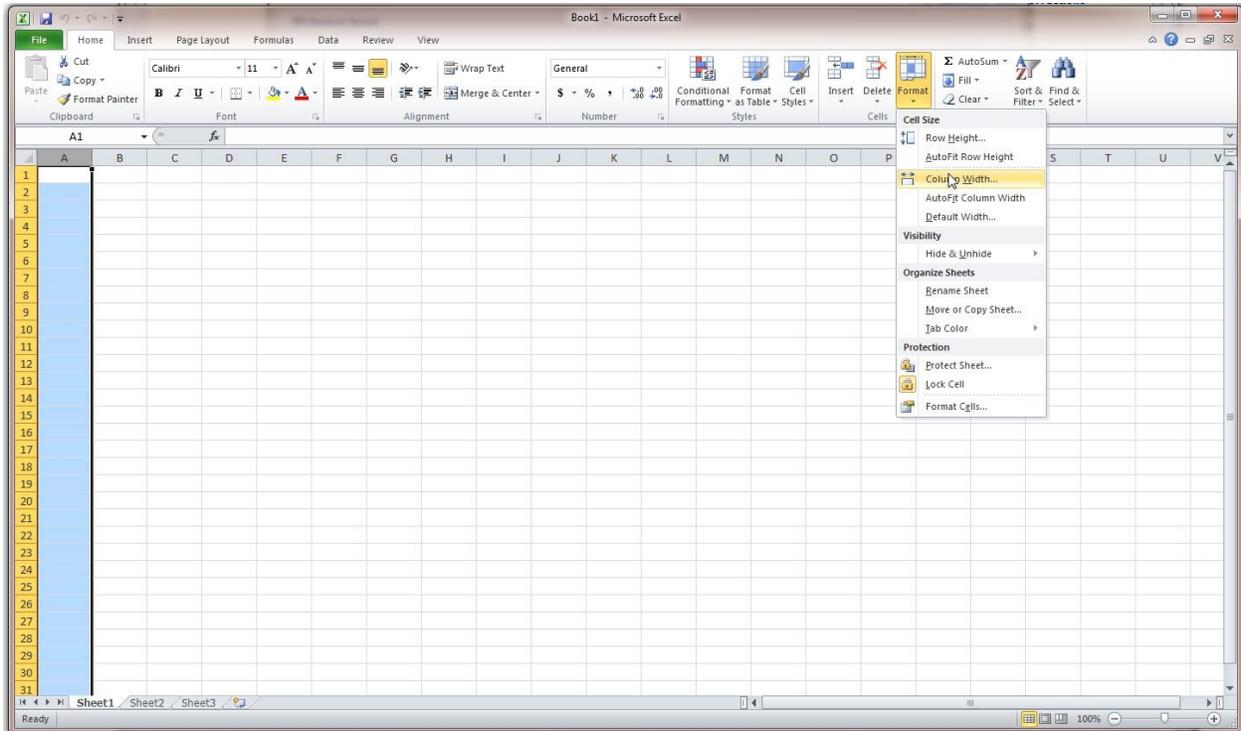
Step 1. Open the Excel application.



Step 2. Determine or set the width of the required amount of columns. Locate the format dropdown list on the right side of the tool bar above the spreadsheet.



Step 3. The column width is set by clicking on the Format menu and selecting Column Width.



The default width of an Excel spreadsheet column is 8.43, which means you will get 8 spaces if you save the file as a space delimited text file).

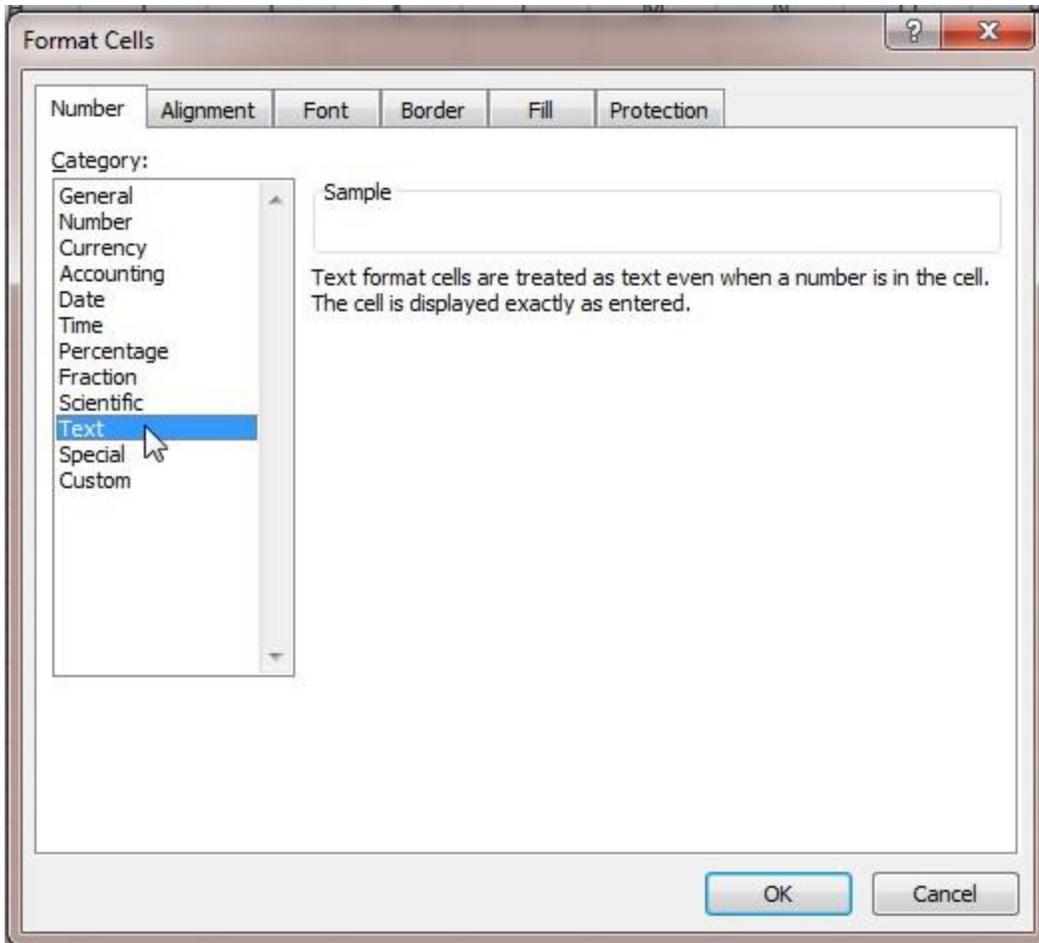


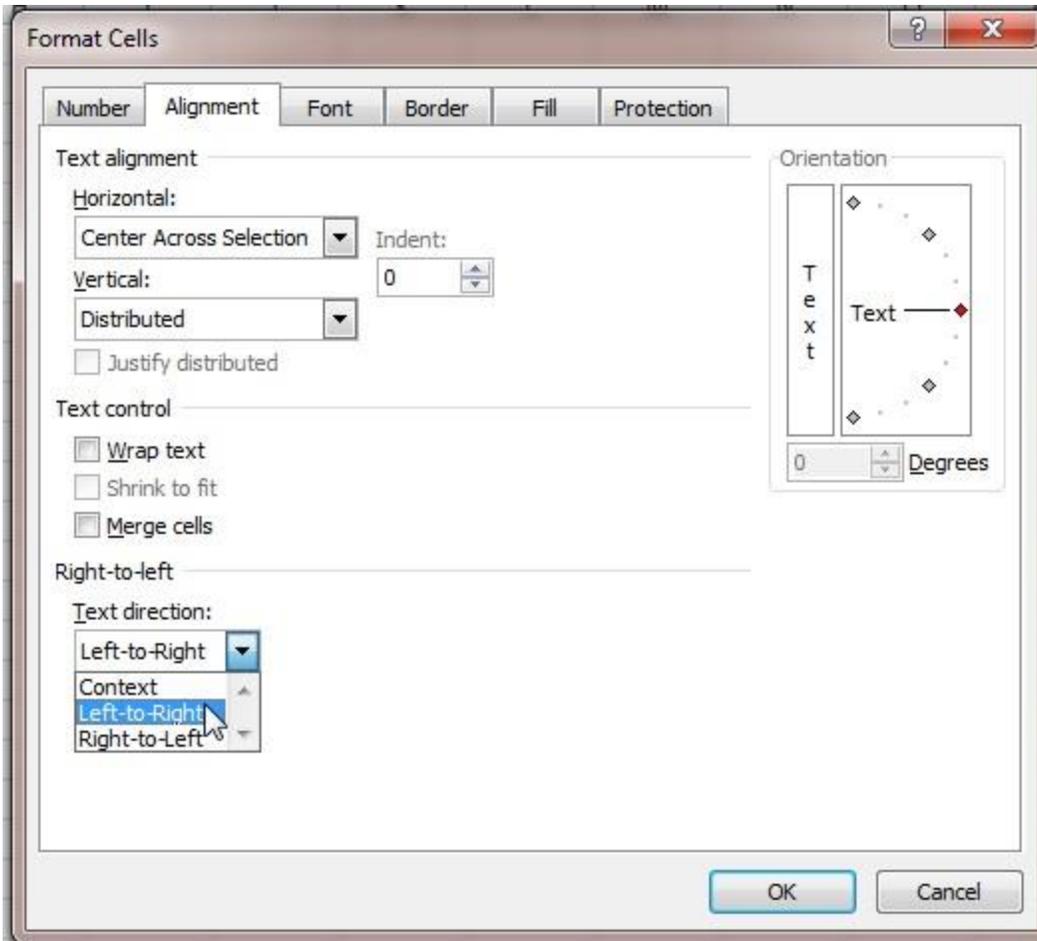
Step 4. You can format each column from the Point Record Specification list (see above). Since the first column is defined for identifying the field record for either source or receiver card data (“R” or “S”) and uses only 1 column, set the column width to 1 and click OK.

Field definition	Columns	Format	Minimum & Maximum
Record ID	1-1	ASCII	“R” or “S”



Step 5. Click on the Format dropdown menu and select Format Cells and set the format to Text (ie. ASCII) on the Number tab. Set all text left-to-right.





Field definition	Columns	Format	Minimum & Maximum
Record ID	1-1	ASCII	“R” or “S”
Line name	2-17	ASCII	Free form
Point number	18-25	ASCII	Free form
Point index	26-26	Integer	1-9
Point code	27-28	ASCII	
Static correction	29-32	Integer	-999 to +999
Point depth	33-36	Floating point	0 to 99.9

Seismic datum	37-40	Integer	-999 to + 9999
Uphole time	41-42	Integer	0 to 99
Water depth	43-46	Floating point	0 to 99.9 or 0 to 999
Easting	47-55	Floating point	None
Northing	56-65	Floating point	None
Elevation	66-71	Floating point	-999.9 to + 9999.9
Day of year	72-74	Integer	1 to 999
Time of day	75-80	Integer	0 to 235959

- Step 3: Left justify each of the columns that will contain numeric values.
- Step 4: Enter data values. In the case of a receiver SPS file there are five columns, which from column 1 to column 5 are labeled as Receiver Line, Receiver Location, Receiver Easting, Receiver Northing, and Receiver Elevation.
- Step 5: Save the file as a space delimited text file. To save a space delimited text file go to the File menu and select Save As. Open the Save as type drop down menu in the Save As dialog and select Formatted Text (Space delimited). The default extension for Formatted Text files is *.prn.
- Step 6: In Flowchart, select the appropriate auxillary data item (in this case **SPS Receiver Locations**) from the **Auxilliary Data R-Z** category in the **Processing Catefories** list and place the item on the SPW FlowChart.
- Step 7: Locate the Formatted Text file created in Excel. To locate the file, double click on the card data icon in Flowchart and a Format File dialog will appear. Click on the Browse button and a Select File dialog will appear that allows you to maneuver through your directory structure and locate the file.
- Step 8: Customize the file format so that SPW can properly read your text file. To customize the file, click on the Customize button in the Format File dialog, and a Customize Format dialog will appear. In the case of the receiver SPS file created in Excel, we will load five columns (Line, Location, Easting, Northing, and Elevation), each of which is 8 characters wide. The starting column for Line number is 1 and the length of the Line field is 8. The

starting column for the Location number is 9 and the length of the Location field is 8....
The starting column for the Elevation field is 33 and the length of the Elevation field is 8. When the appropriate parameters have been entered, select OK.

Step 9: View the card data spreadsheet to verify the data values.

Auxiliary Data A-P

CMP Flex Locations

Usage:

The CMP Flex Location card data item is used to store the location of flex binned location as computed by *CMP Binning* processing step.

Step Parameter Dialog:

Parameter descriptions:

File Browse — Browse for file to store CMP flex locations

Append to existing dataset — If checked, new flex locations will be added to existing file.

Scan file — Select to scan existing file where data will be appended.

Current Records: Specify parameters related with existing file in terms of *Field File ID range*, *Trace ID range*, *Offset range*, *CMP Line numbers* and *CMP Location numbers*.

Flex binning specification: Specify flex binning parameters related with existing file in terms of *Inline % bin flex*, *Inline % offset flex*, *Crossline % bin flex* and *Crossline % offset flex*.

Fold file output: Specify parameters related with fold file output.

Include flex traces — If checked, include flex traces in output file.

Trace selection method: Specify parameters for trace selections.

All trace offsets — If selected, all offsets are selected for flex binning.

Maximum traces per bin — Enter the maximum number of traces per bin.

One trace per offset interval — If selected, only one trace per offset is selected for flex binning.

Offset interval — Enter the offset interval to be considered for flex binning.

Specify line range — If checked, line range are defined manually.

CMP Lines — Enter the CMP line range to be considered for the flex binning.

Specify locations range — If checked, location range are defined manually.

CMP Locations — Enter the CMP location range to be considered for the flex binning.

Fold file browse — Select file to store fold information.

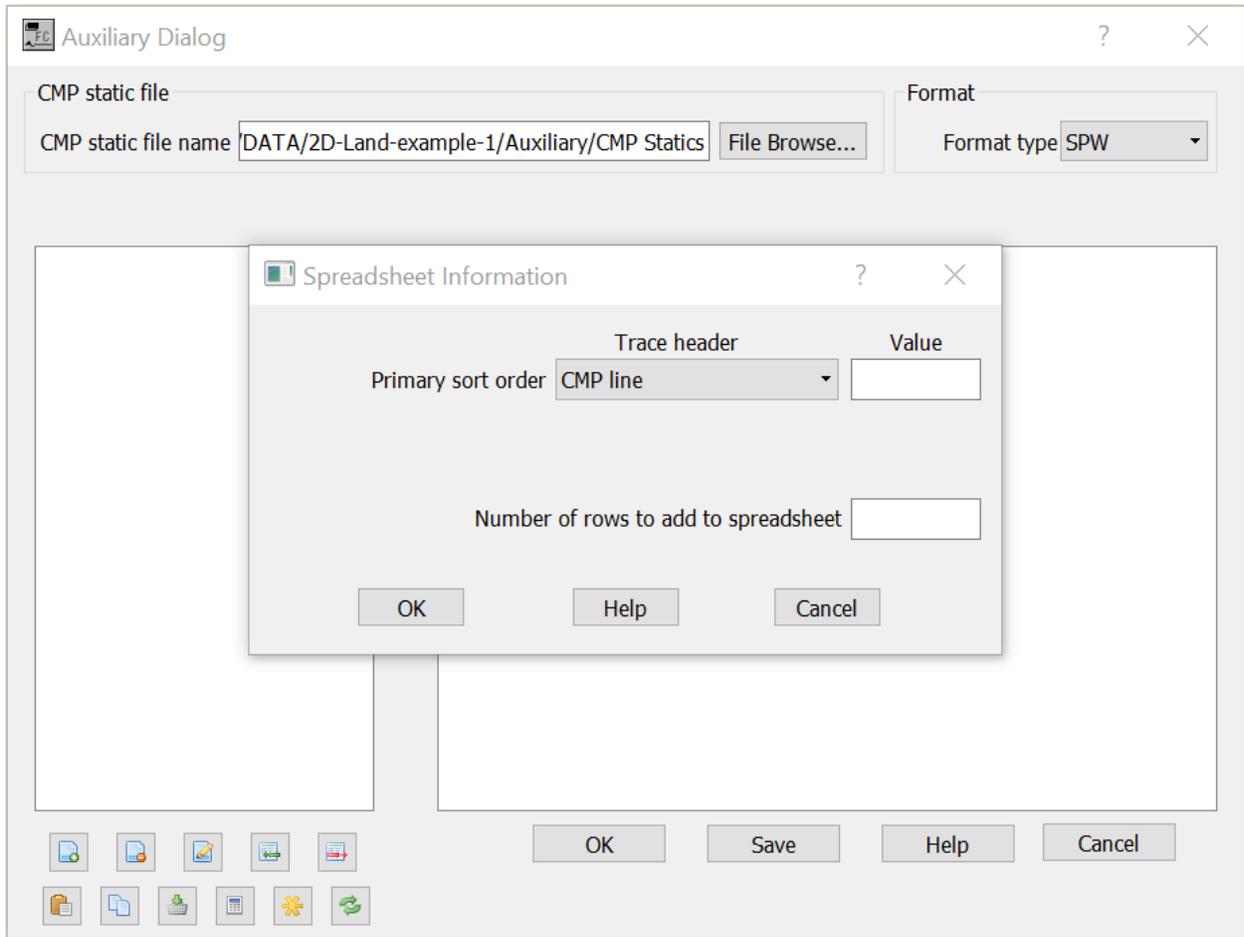
Make fold file — Not yet implemented.

CMP Statics

Usage:

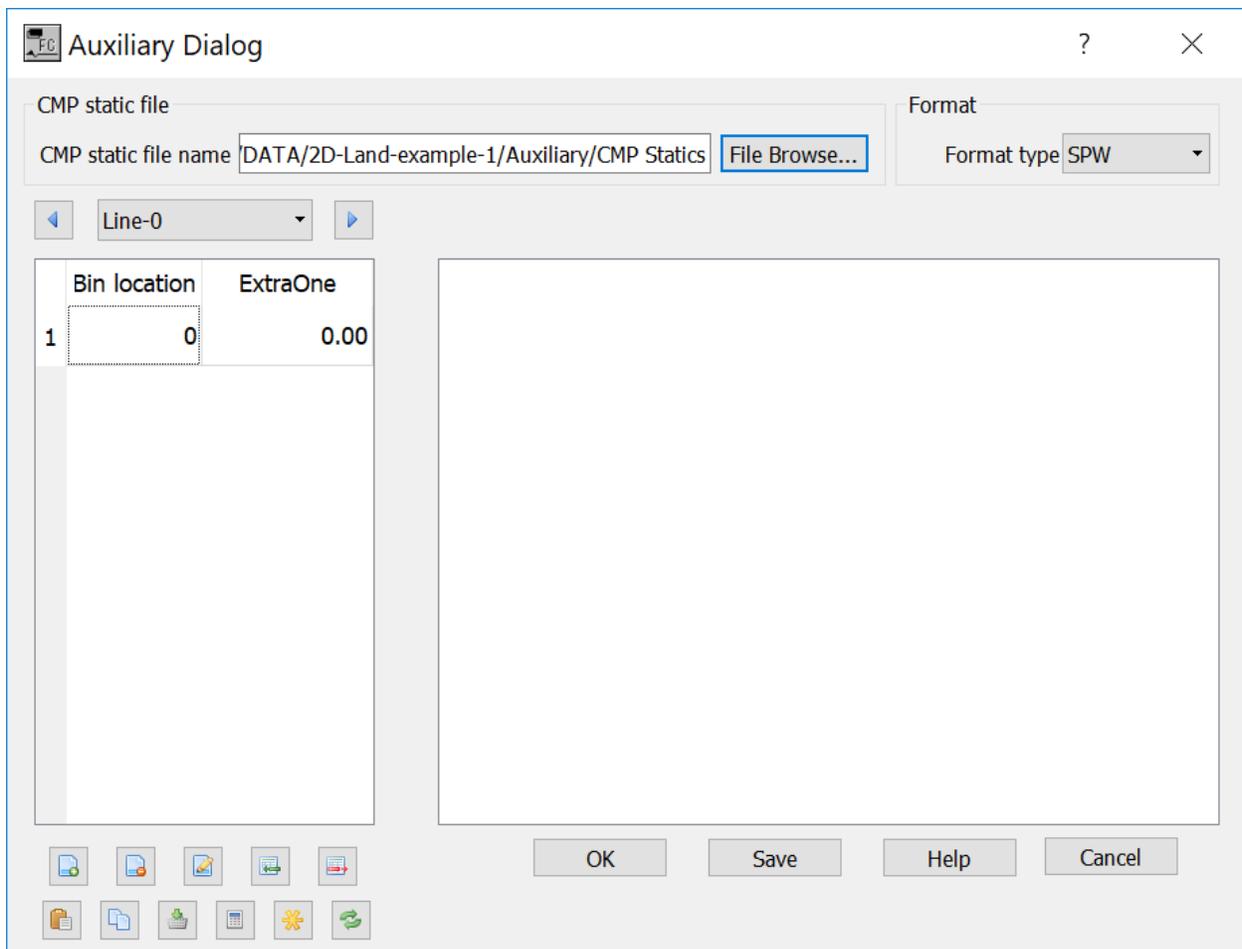
The *CMP Statics* card data item is used to store CMP based static shift values in milliseconds.

Step Parameter Dialog:



CMP Statics card data file may be sorted in *CMP Line*, *Source Line*, *Receiver Line* or *Offset*.

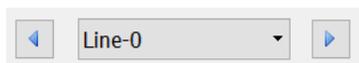
Example Card Data:



Parameter descriptions:

File Browse — Select to browse for existing *CMP Statics* file or to define the name of a new file to be saved.

Format Type — Select format type.


 — Navigate through record.

Bin location — Enter the location of the bin.

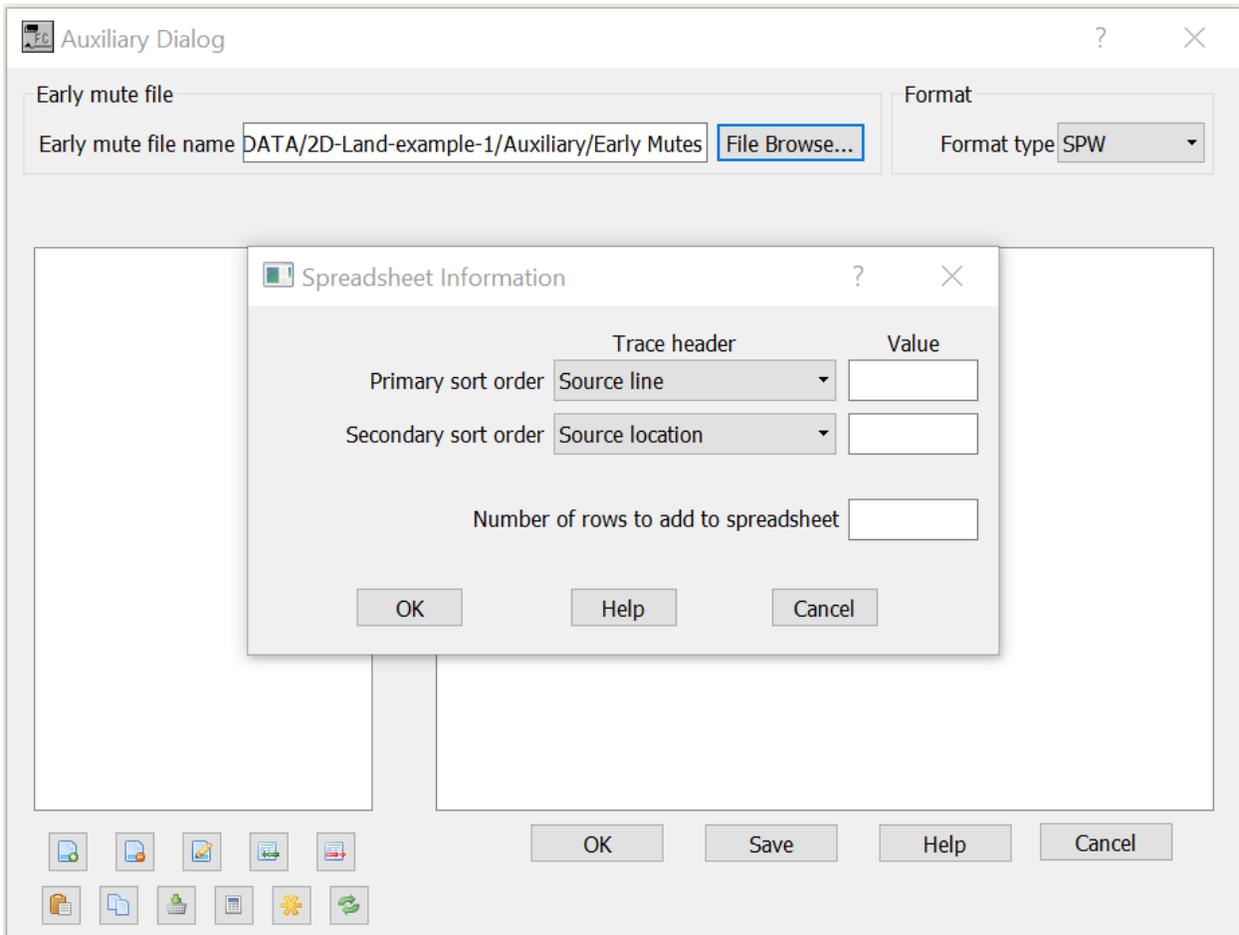
ExtraOne — Enter the value of the statics for the corresponding *Bin Location* at the current record as defined in *Line-0*.

Early Mutes

Usage:

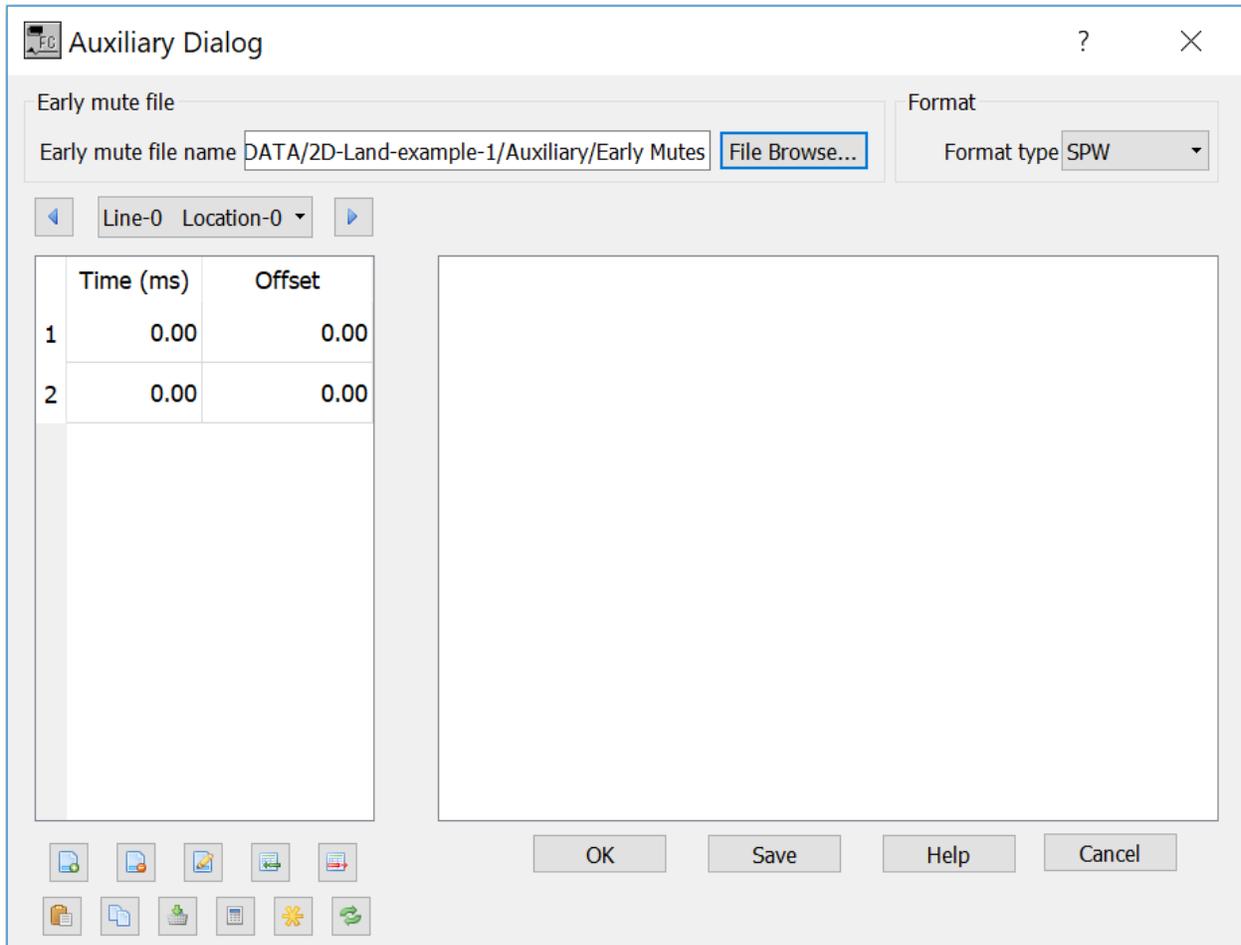
The *Early Mutes* card data item is used to store the mute definition for early (top) mutes. Mute times are in units of seconds. Early mutes may be interactively built in a seismic display using the *Seismic Picker* tool located in the seismic view at the lower right corner. Picks may be manually adjusted using the *Early Mutes* card data.

Step Parameter Dialog:



Early Mutes need two sort keys. Primary sort key may be *CMP Line*, *Source Line*, *Receiver Line* or *Offset*. Secondary sort key may be *CMP Line*, *Source Line*, *Receiver Line*.

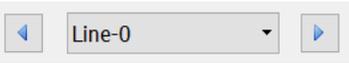
Example Card Data:



Parameter descriptions:

File Browse — Select to browse for existing *Early Mute* file or to define the name of a new file to be saved.

Format Type — Select format type.


 — Navigate through record.

Time (ms) — Enter the two-way-traveltime for the pick at the current record for a given *Offset*.

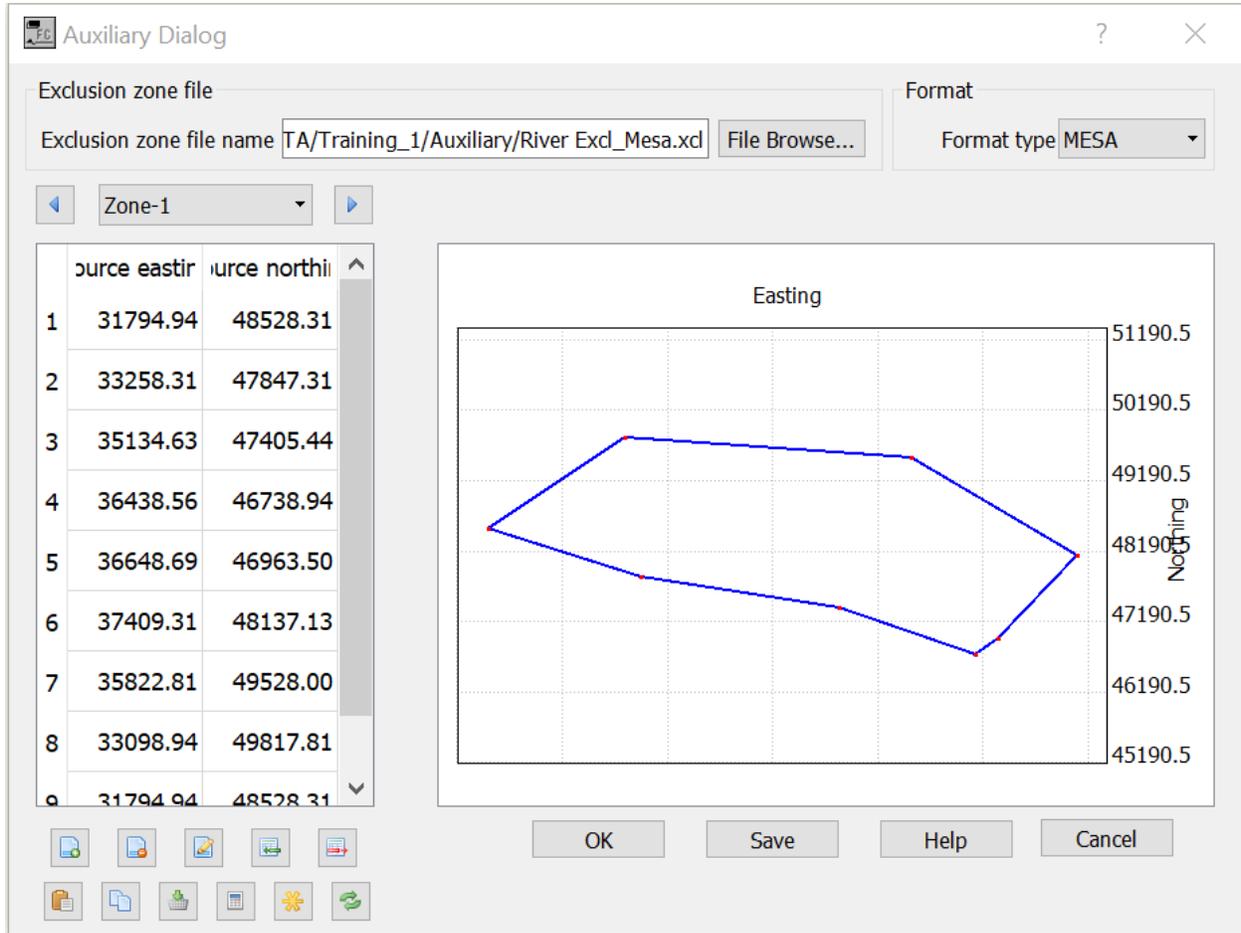
Offset — Enter the value of the offset of the pick.

Exclusion Zones

Usage:

The **Exclusion Zones** card data item is used to define exclusion zones (i.e., exclusion polygons) to be used for example in map displays. Accepted formats are *MESA*, *SPW* and *PIKESA*.

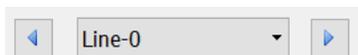
Example Card Data:



Parameter descriptions:

File Browse — Select to browse for existing **Exclusion Zones** file or to define the name of a new file to be saved.

Format Type — Select format type. Available formats are *MESA*, *SPW* and *PIKESA*.


 — Navigate through record.

Source Easting — Enter the Easting coordinates of each point of the exclusion polygon.

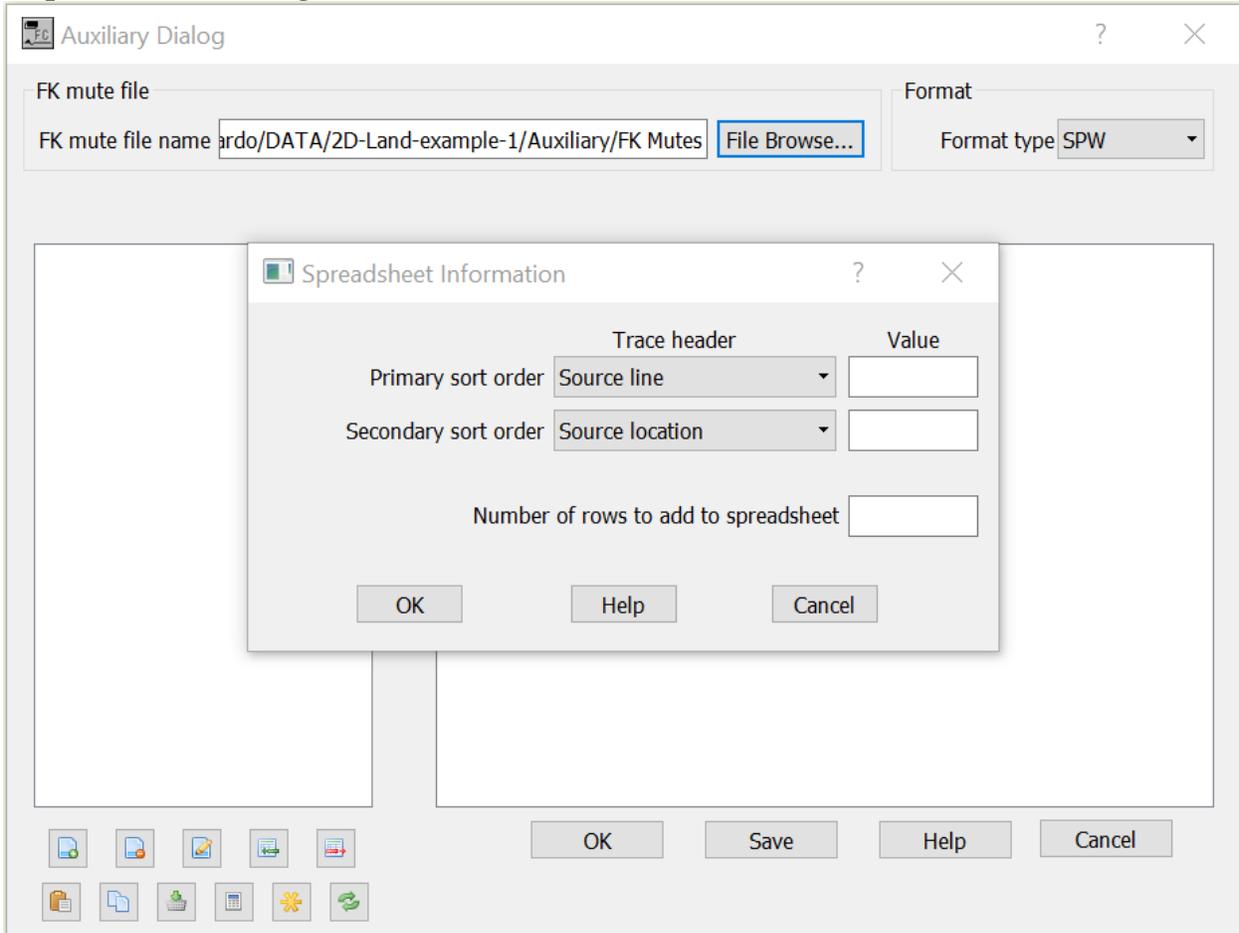
Source Northing — Enter the Northing coordinates of each point of the exclusion polygon.

FK Mutes

Usage:

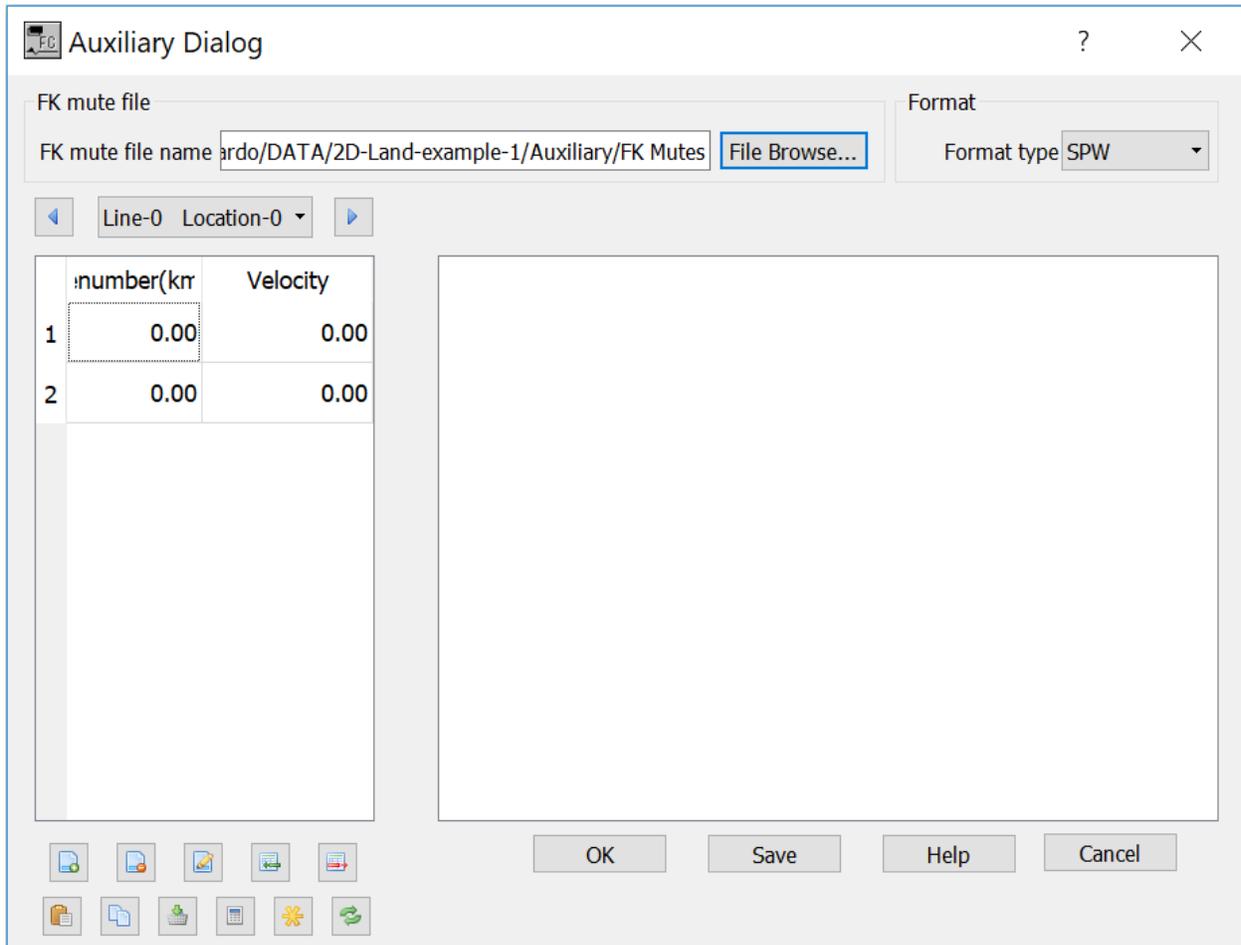
The **FK Mutes** card data item is used to store the mute definition for mutes in the FK domain. Mute are defined in wavenumber (k) and velocity. FK mutes may be interactively built in a FK spectrum display using the **Seismic Picker** tool located in the seismic view at the lower right corner. Picks may be manually adjusted using the **FK Mutes** card data.

Step Parameter Dialog:



FK Mutes need two sort keys. Primary sort key may be **CMP Line**, **Source Line**, **Receiver Line** or **Offset**. Secondary sort key may be **CMP Line**, **Source Line**, **Receiver Line**.

Example Card Data:



Parameter descriptions:

File Browse — Select to browse for existing *FK Mutes* file or to define the name of a new file to be saved.

Format Type — Select format type.


 — Navigate through record.

Wavenumber (k) — Enter the value for the wavenumber of the pick.

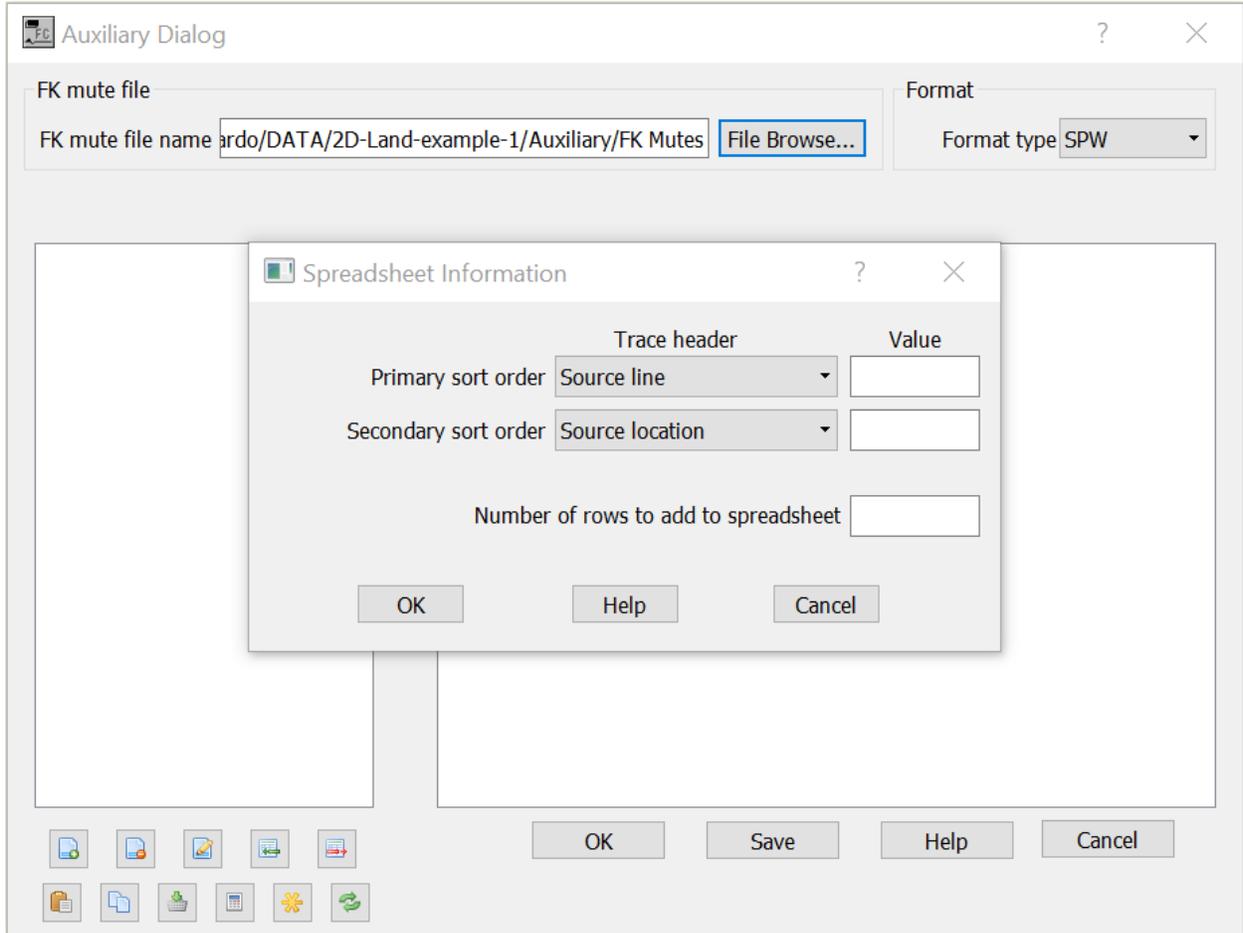
Velocity — Enter the value of the velocity of the pick.

Field File Statistics

Usage:

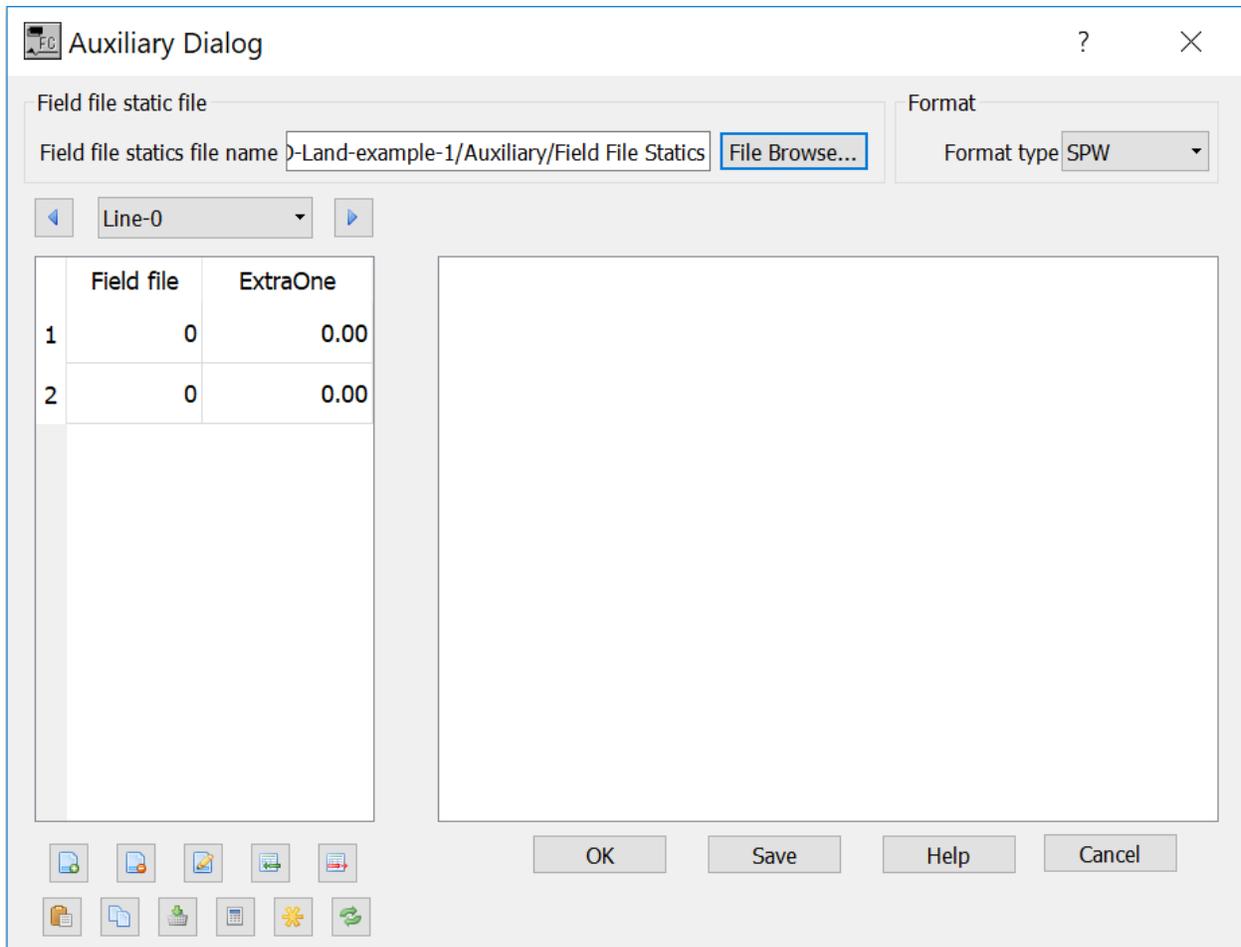
The *Filed File Statics* card data item is used to store static shifts for records corresponding to Field Files.

Step Parameter Dialog:



Field File Statics card data file may be sorted in *CMP Line*, *Source Line*, *Receiver Line* or *Offset*.

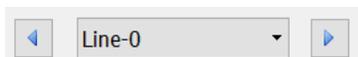
Example Card Data:



Parameter descriptions:

File Browse — Select to browse for existing *Filed File Statics* file or to define the name of a new file to be saved.

Format Type — Select format type.


 — Navigate through record.

Bin location — Enter the location of the bin.

ExtraOne — Enter the value of the statics for the corresponding *Bin Location* at the current record as defined in *Line-0*.

First Break Times

Usage:

The *First Break Time Picks* card data item is used to store the first break time picks (in milliseconds). First break may be picked interactively in a seismic display using the *Seismic Picker* tool located in the lower left corner of the seismic display.

Step Parameter Dialog:

First break picks might be viewed in a table and edited manually:

First Arrival Times

First arrival times file

File name: C:/Leonardo/DATA/2D-Land-example-1/Auxiliary/fb.pix

File Browse...

First break times | First break viewer

	Field file	Source line	Source location	Source easting	Source north	Source elevation	Source depth
1	464	1225	100	1000.00	11500.00	240.00	0.40
2	464	1225	100	1000.00	11500.00	240.00	0.40
3	464	1225	100	1000.00	11500.00	240.00	0.40
4	464	1225	100	1000.00	11500.00	240.00	0.40
5	464	1225	100	1000.00	11500.00	240.00	0.40
6	464	1225	100	1000.00	11500.00	240.00	0.40
7	464	1225	100	1000.00	11500.00	240.00	0.40

Save changes | Help | Analyze format | Close

Primary sort key: Source line | 1225

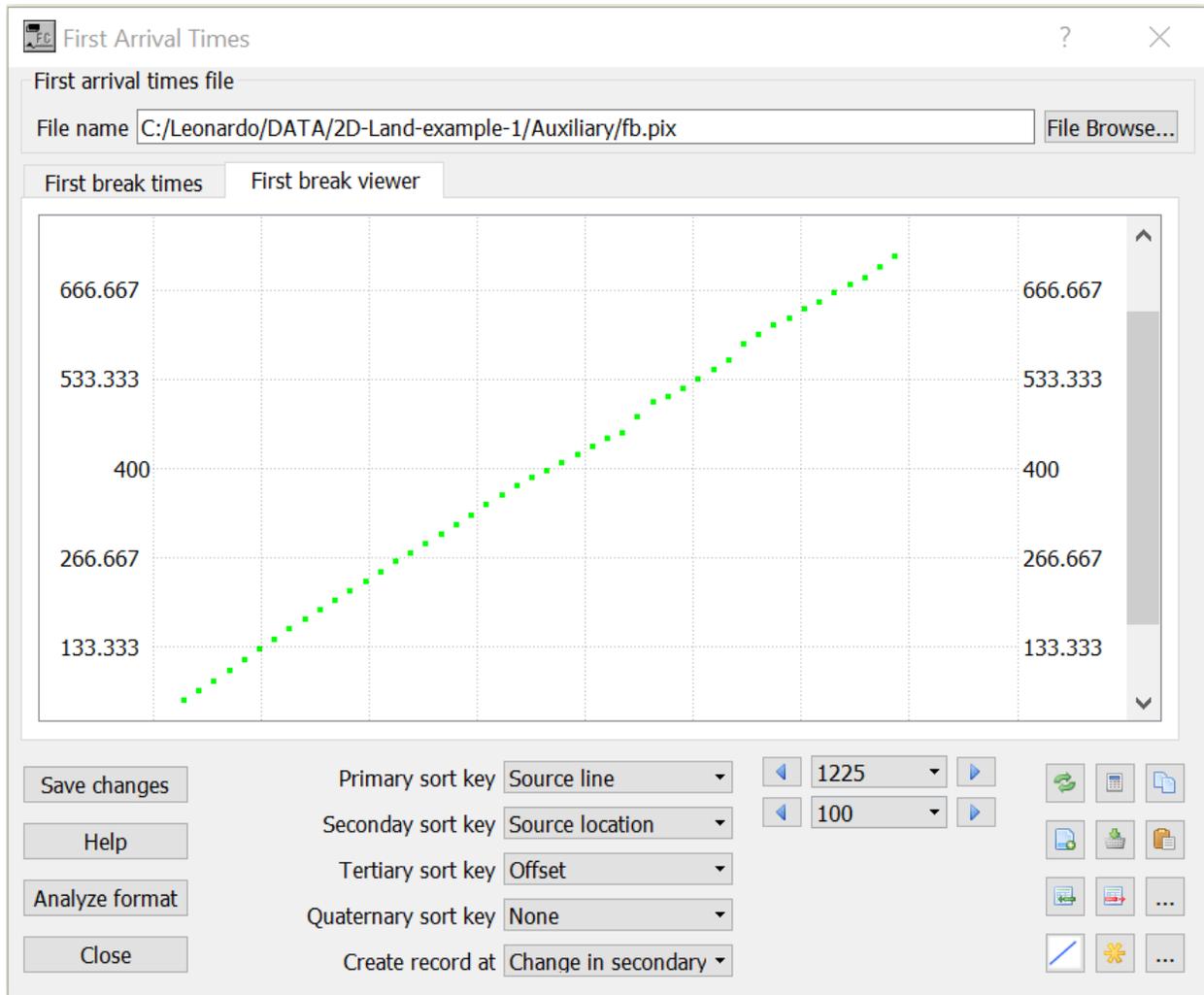
Secondary sort key: Source location | 100

Tertiary sort key: Offset

Quaternary sort key: None

Create record at: Change in secondary

First break picks might be plotted in offset versus TWT. This allows the screening of possible picking errors.



Parameter descriptions:

File Browse — Select to browse for existing *First Break Times* file or to define the name of a new file to be saved.

Primary sort key — Select the primary sort key to be used in the navigation from record to record.

Secondary sort key — Select the secondary sort key to be used in the navigation from record to record.

Tertiary sort key — Select the tertiary sort key to be used in the navigation from record to record.

Quaternary sort key — Select the quaternary sort key to be used in the navigation from record to record.

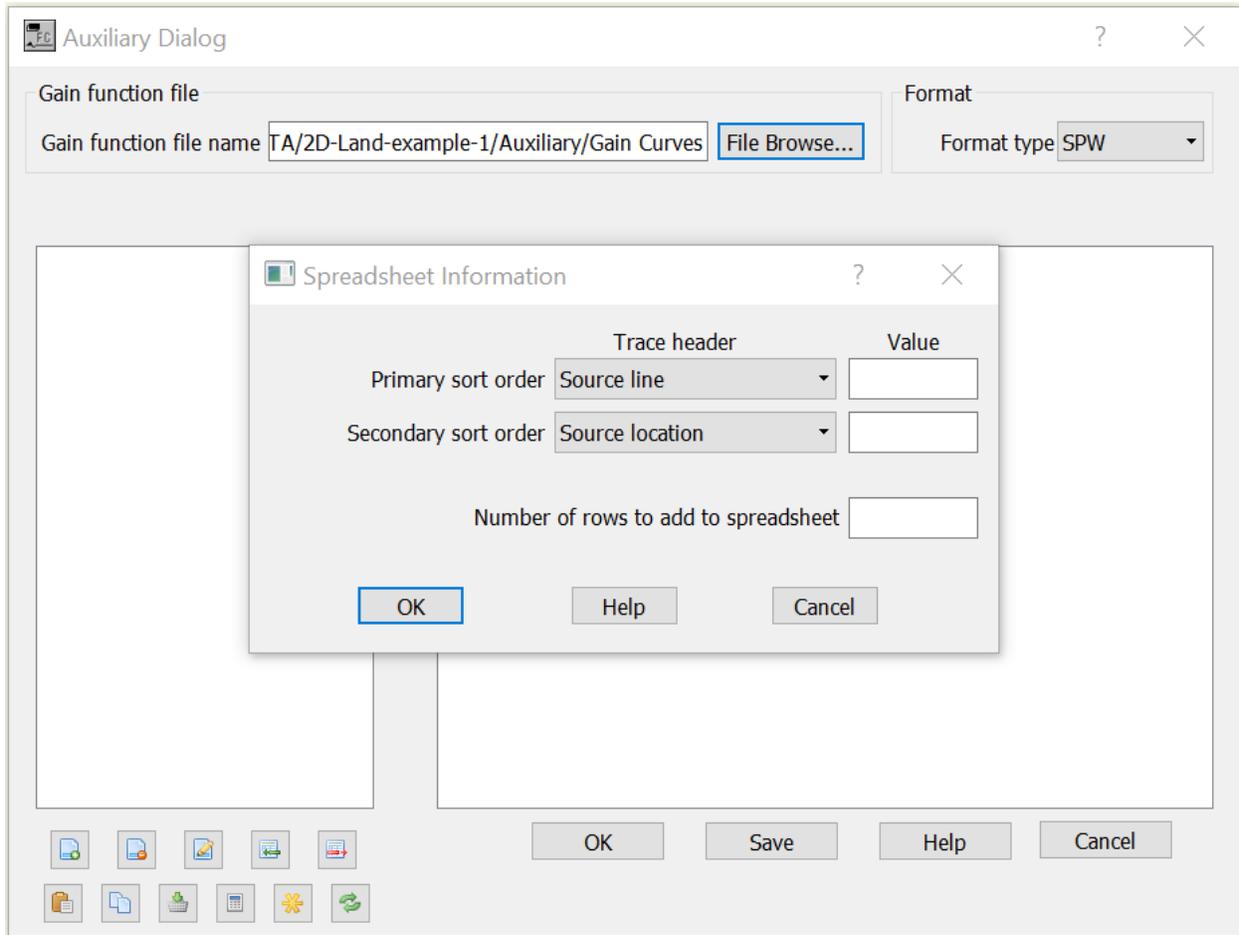
Create record at — Select the sort key used to create records.

Gain Curves

Usage:

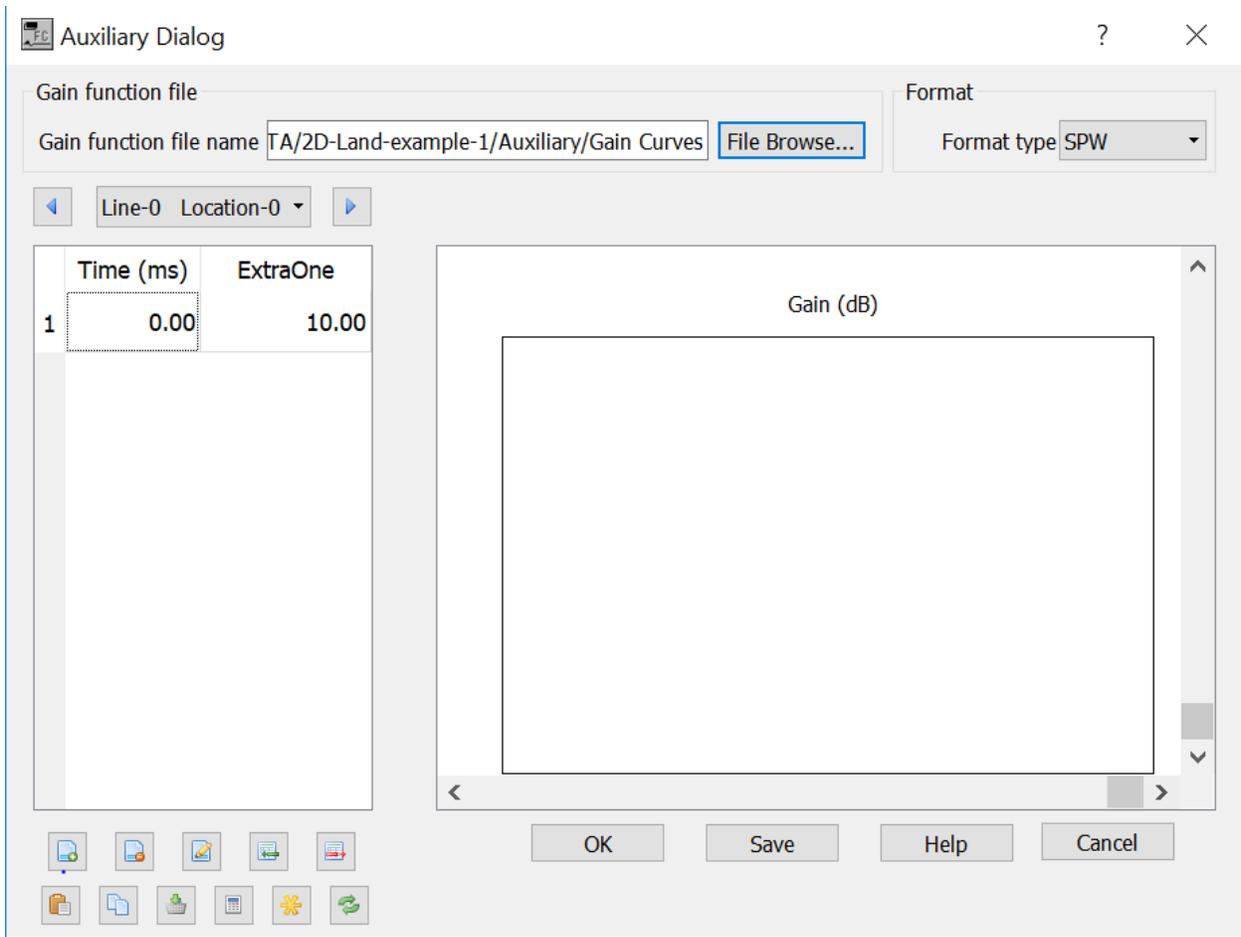
The *Gain Curves* card data item is used to store time-decibel gain pairs. A gain of 0 dB is equivalent to scalar multiplication by a factor of 1, a gain of 6 dB by a factor of 2, a gain of 12 dB by a factor of 4, a gain of 18 dB by a factor of 8, and so on. Time is in milliseconds.

Step Parameter Dialog:



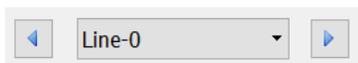
Gain functions card data file may be sorted in *CMP Line*, *Source Line*, *Receiver Line* or *Offset*.

Example Card Data:



Parameter descriptions:

Format Type — Select format type.


 — Navigate through record.

Bin location — Enter the location of the bin.

ExtraOne — Enter the value of the statics for the corresponding **Bin Location** at the current record as defined in **Line-0**.

Time (ms) — Enter the start column and the number of columns allocated to write the two-way time (in milliseconds) associated with a given gain value in the output gain file.

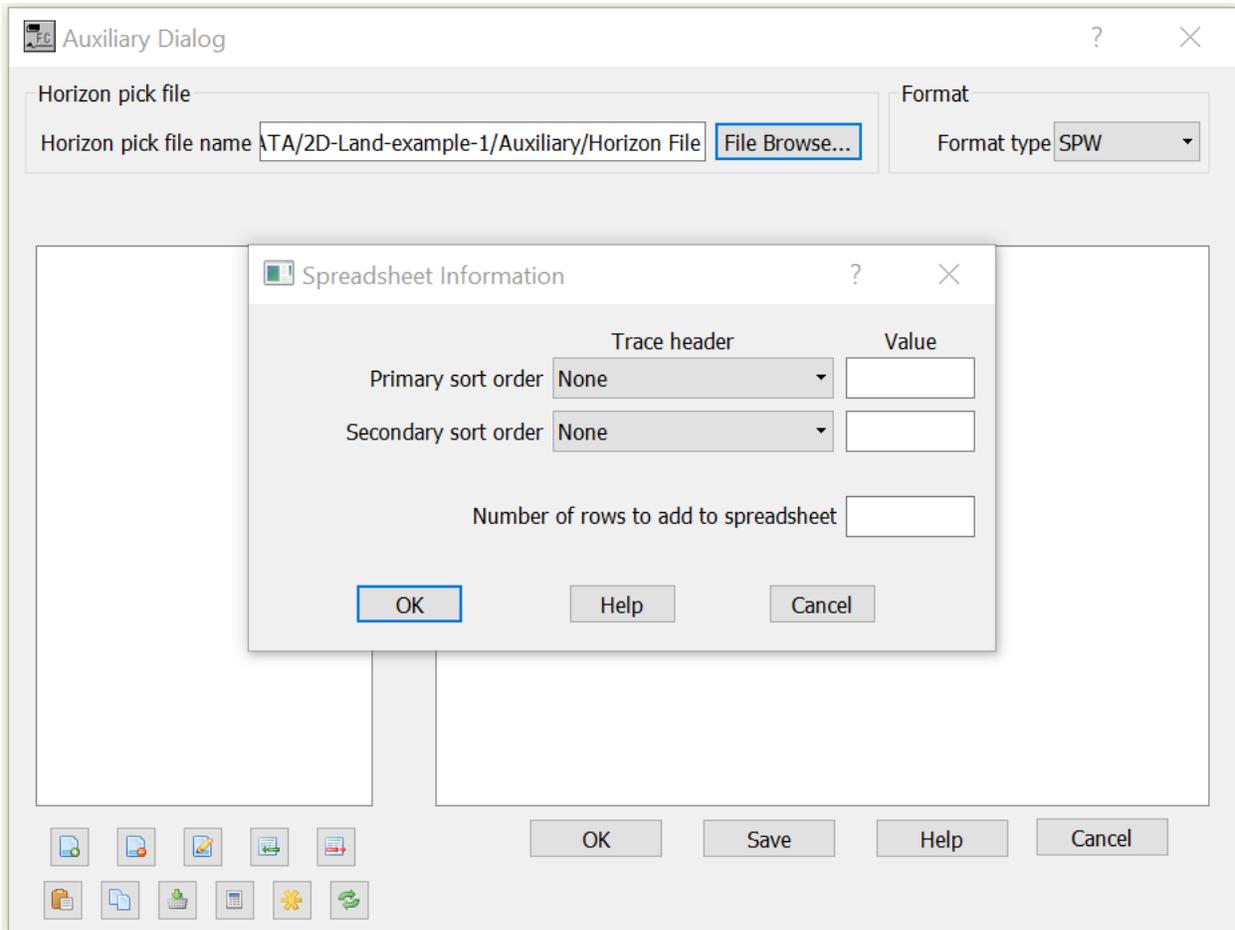
ExtraOne — Enter the start column and the number of columns allocated to write the gain in dB associated with a given two-way travel time in the output gain file.

Horizon File

Usage:

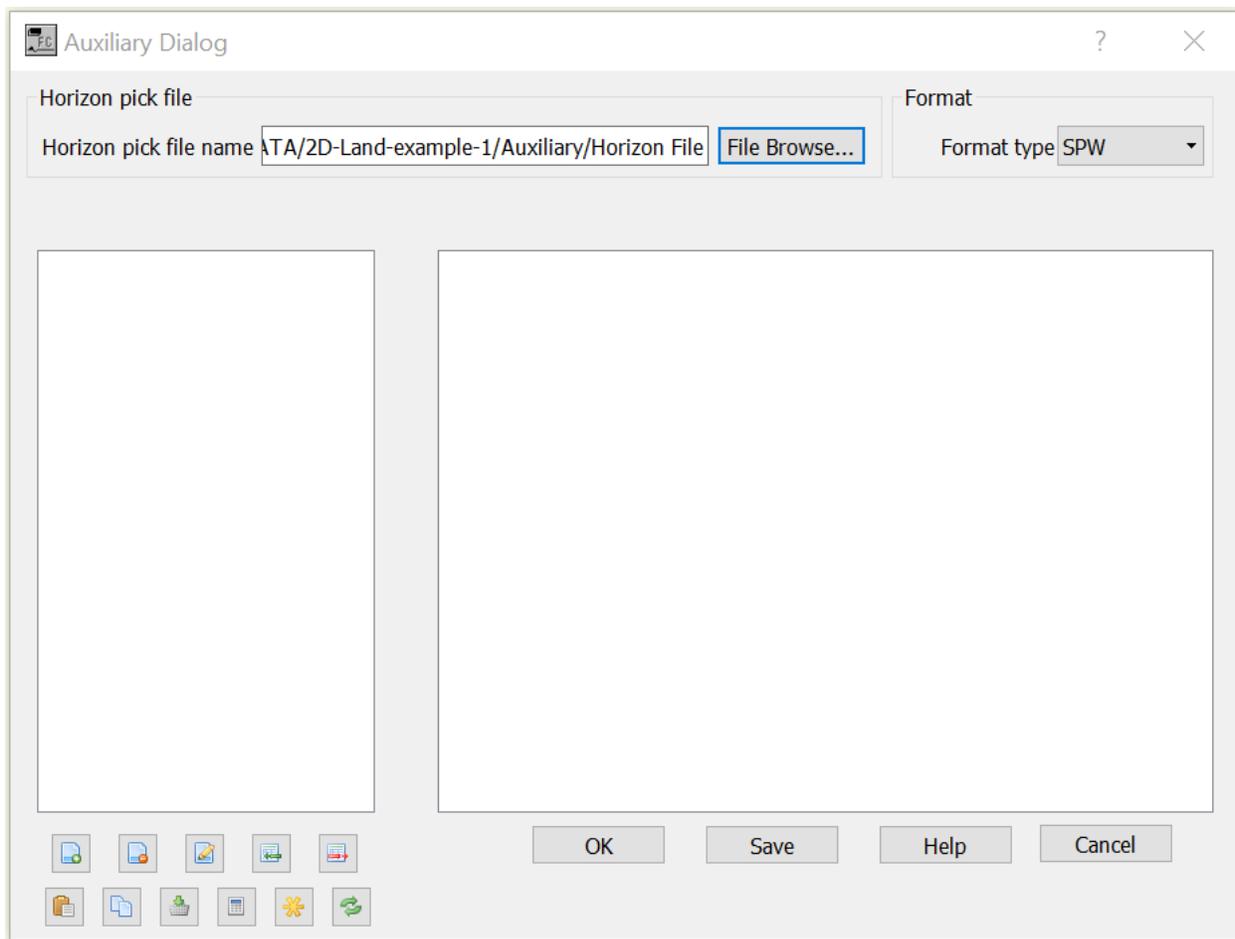
The *Horizon File* card data item is used to store horizon time picks. Horizon event picking may be performed interactively in a seismic display using the *Seismic Picker* tool located in the Picking menu.

Step Parameter Dialog:



Horizon File card data file may be sorted in *CMP Line*, *Source Line*, *Receiver Line* or *Offset*.

Example Card Data:



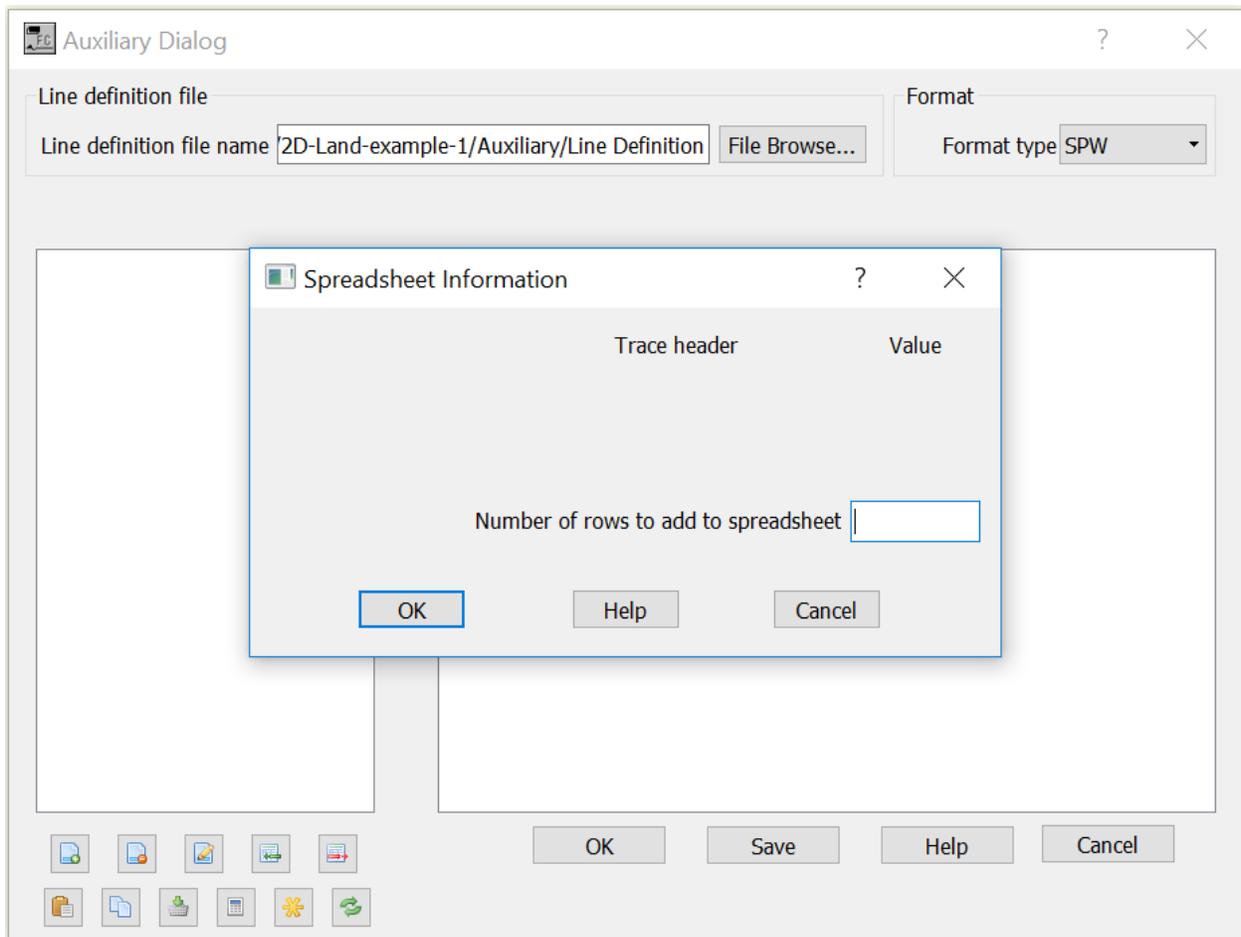
Parameter descriptions:

Line Definition File

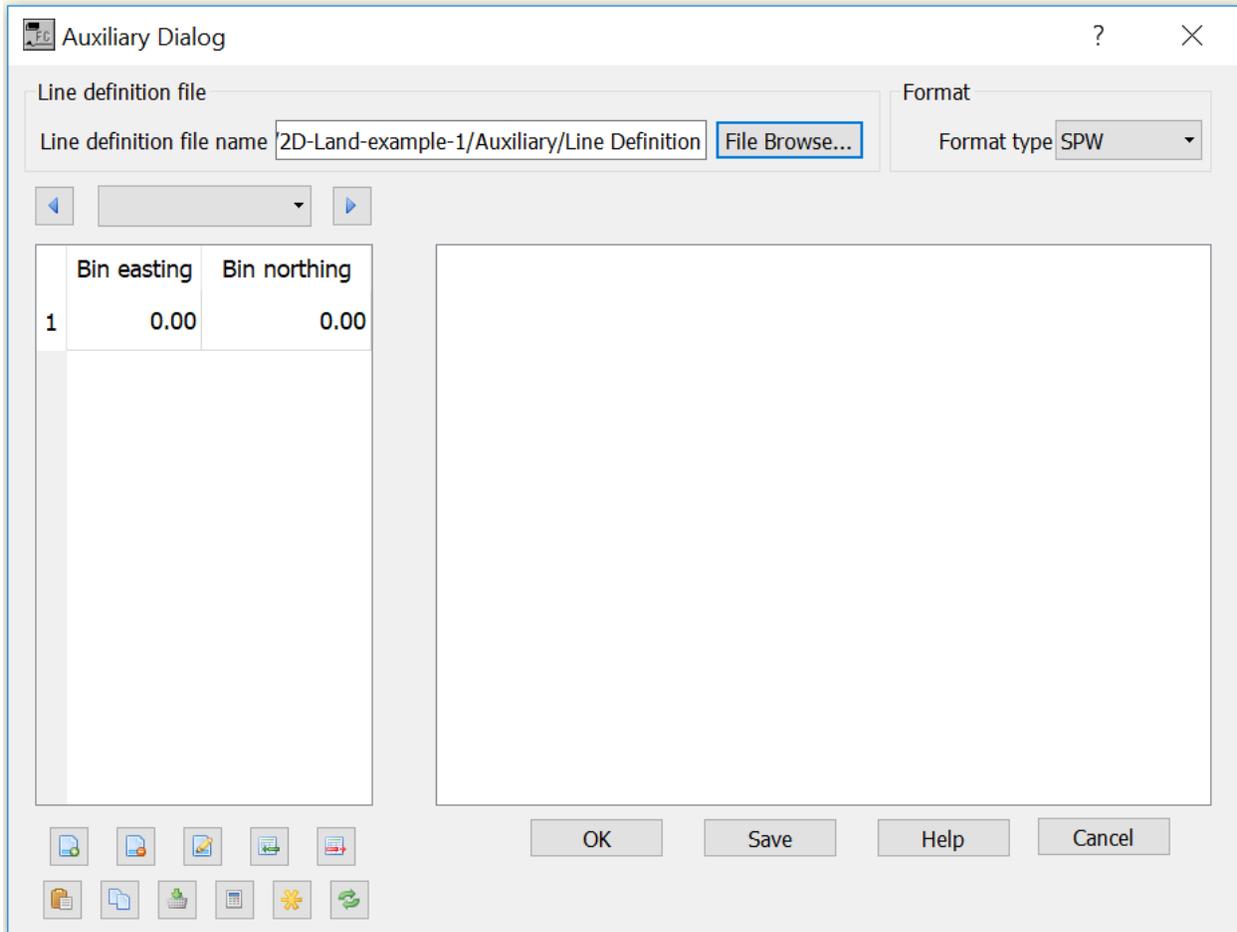
Usage:

The *Line Definition File* card data is used to (1) store the best fit line to the scatter of CMP resulting from a crooked line seismic survey, and (2) to specify, and ultimately extract a random 2-D line from a 3-D data volume

Step Parameter Dialog:



Example Card Data:



Parameter descriptions:

File Browse — Select to browse for existing *Line Definition File* file or to define the name of a new file to be saved.

Format Type — Select format type.



— Navigate through record.

Bin Easting — Enter the start column and the number of columns allocated to write the easting associated with a given coordinate pair in the output line definition file.

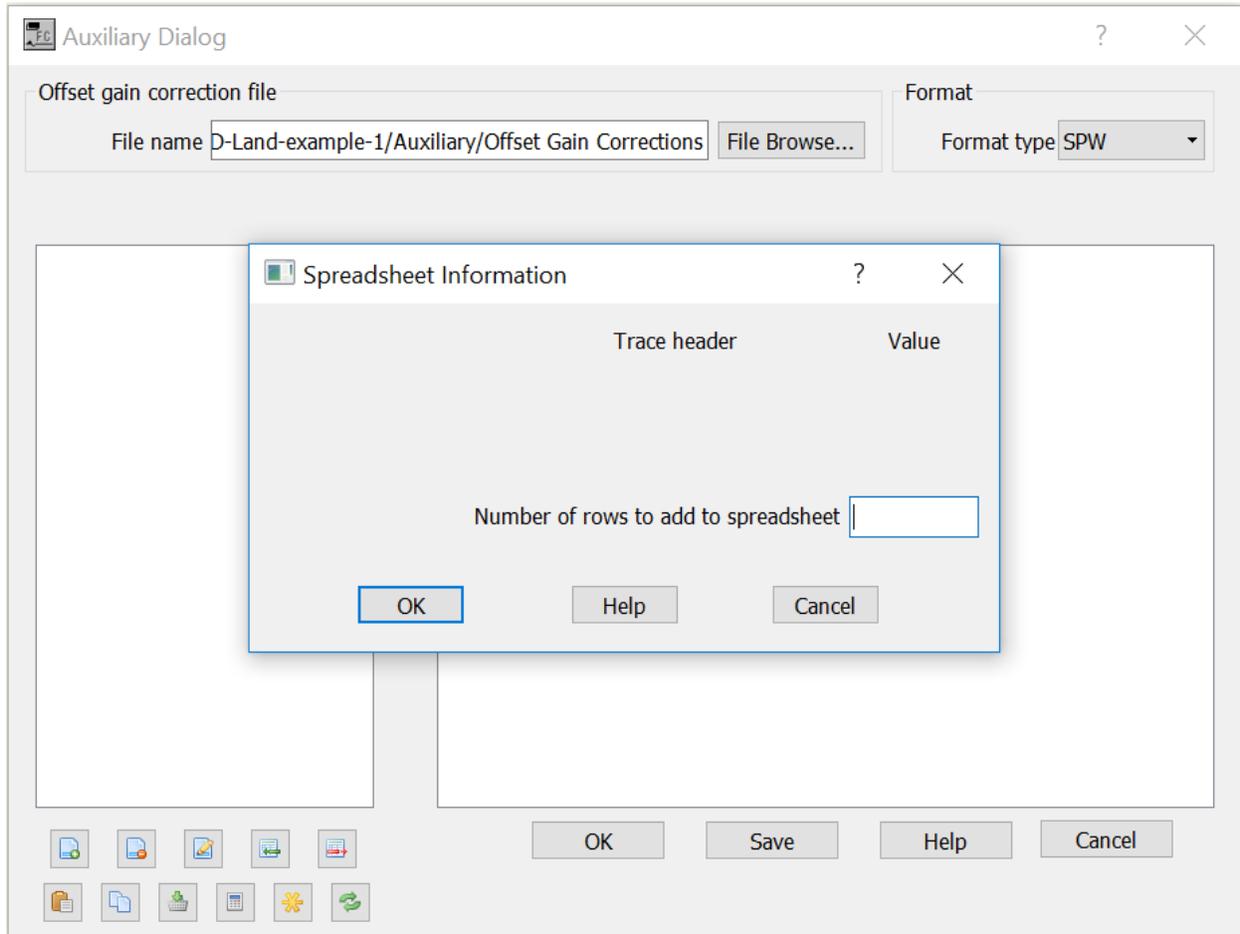
Bin Northing — Enter the start column and the number of columns allocated to write the northing associated with a given coordinate pair in the output line definition file.

Offset Gain Corrections

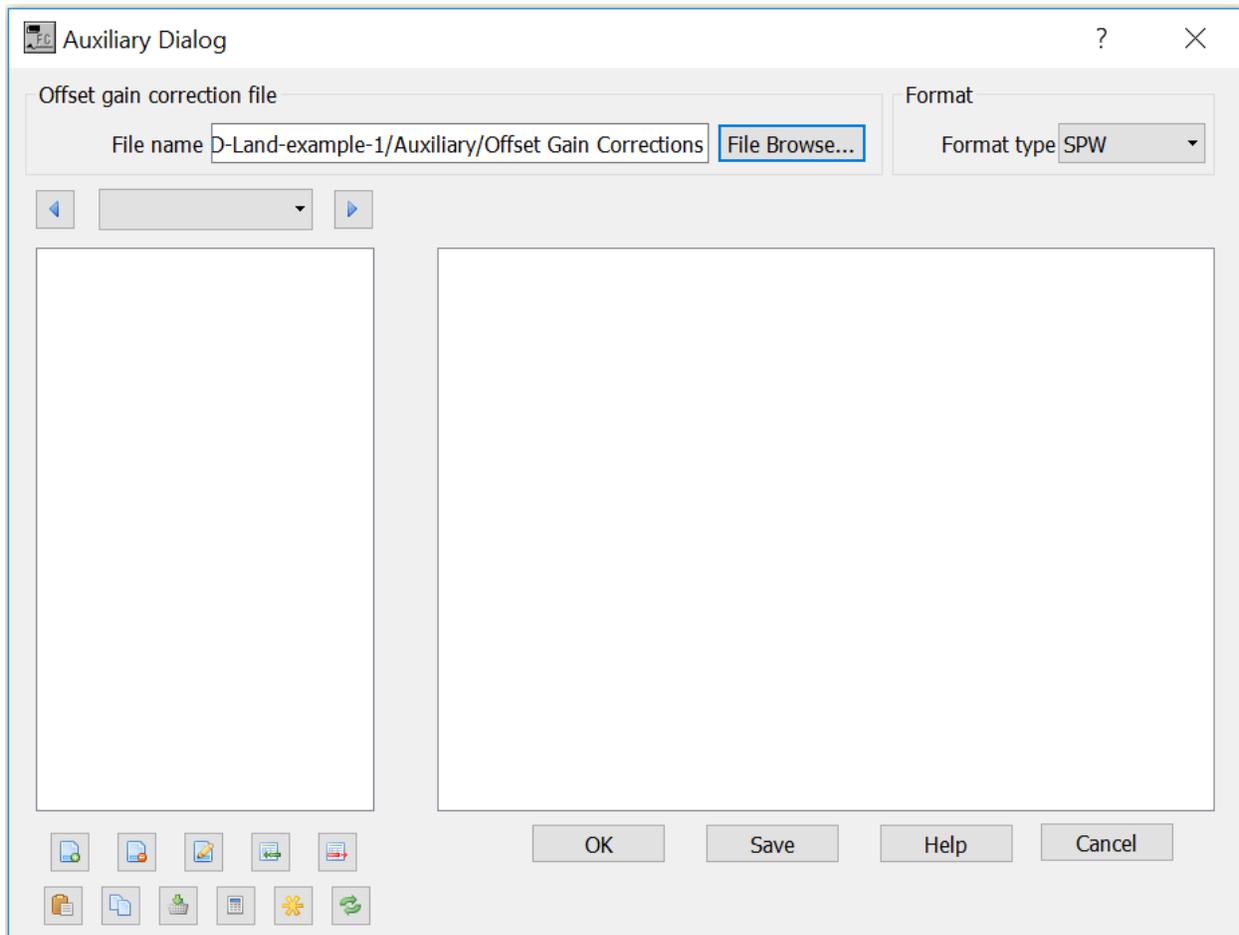
Usage:

The *Offset Gain Corrections* auxiliary card data allows definint offset varying functions for gain correction.

Step Parameter Dialog:



Example Card Data:



Parameter descriptions:

File Browse — Select to browse for existing *Offset Gain Corrections* file or to define the name of a new file to be saved.

Format Type — Select format type.

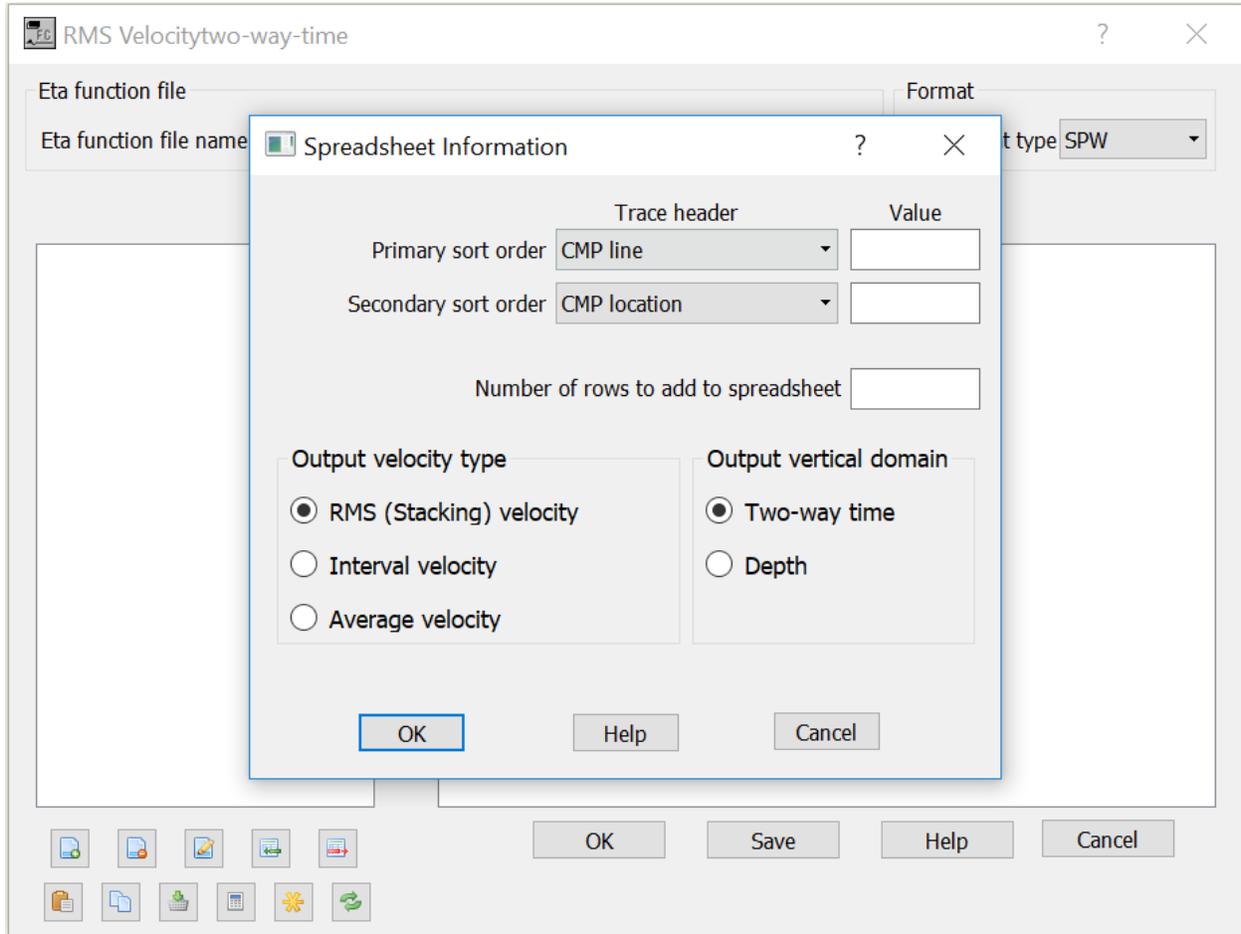

 — Navigate through record.

PP NHMO Eta Function

Usage:

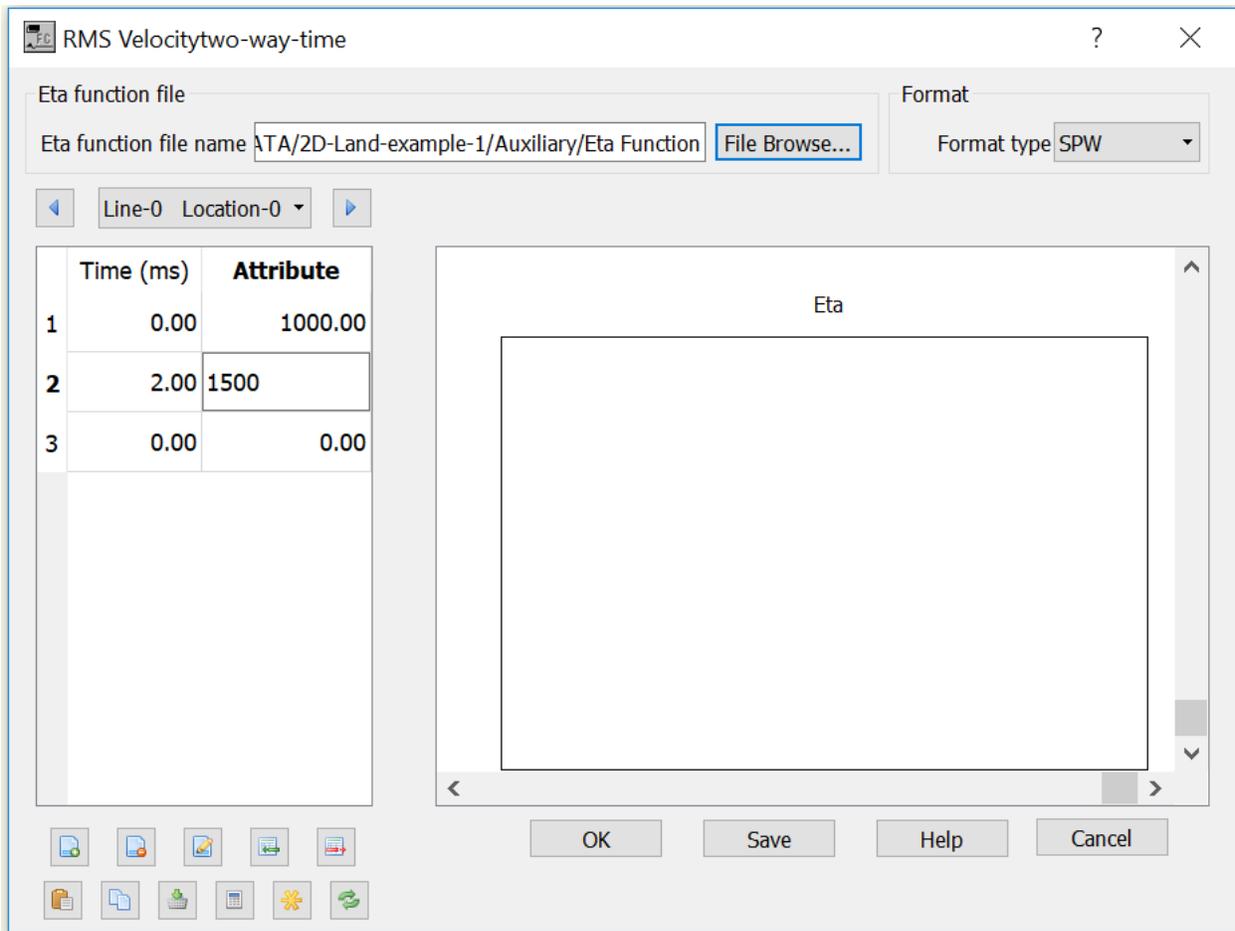
The *PP Nhmo Eta Function* card data item is used to store time-eta pairs for the case of P-wave non-hyperbolic moveout, where Eta is a parameter that characterizes the anisotropy in transversely isotropic media. Once the short-spread P-wave stacking velocity function has been picked, corresponding Eta functions may be picked interactively in SeisViewer on Eta Semblance gathers. The PP Nhmo Eta Function card has the same structure as a Velocity Function card.

Step Parameter Dialog:



Primary sort key may be *CMP Line*, *Source Line*, *Receiver Line* or *Offset*. Secondary sort key may be *CMP Line*, *Source Line*, *Receiver Line*. Select output velocity type from *RMS (Stacking) velocity*, *Interval velocity* or *Average Velocity*. Velocity field may be defined in the *Two-way time* or *Depth* domain.

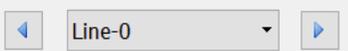
Example Card Data:



Parameter descriptions:

File Browse — Select to browse for existing *PP NHMO Eta Function* file or to define the name of a new file to be saved.

Format Type — Select format type.


 — Navigate through record.

Time (ms) — Enter the start column and the number of columns allocated to write the two-way travel time (in milliseconds) associated with a given velocity pick in the velocity file.

Attribute — Enter the start column and the number of columns allocated to write the RMS or interval velocity value associated with a given velocity pick in the velocity file.

PP NHMO Gamma Function

Usage:

The *PP Nhmo Gamma Function* card data item is used to store time-gamma pairs for the case of PS-wave (i.e. converted wave) non-hyperbolic moveout, where Gamma is the effective V_p/V_s ratio down to the event being analyzed. Once the short-spread P-wave stacking velocity function has been picked, corresponding Gamma functions may be picked interactively in SeisViewer on Gamma Semblance gathers. The PP Nhmo Gamma Function card has the same structure as a Velocity Function card.

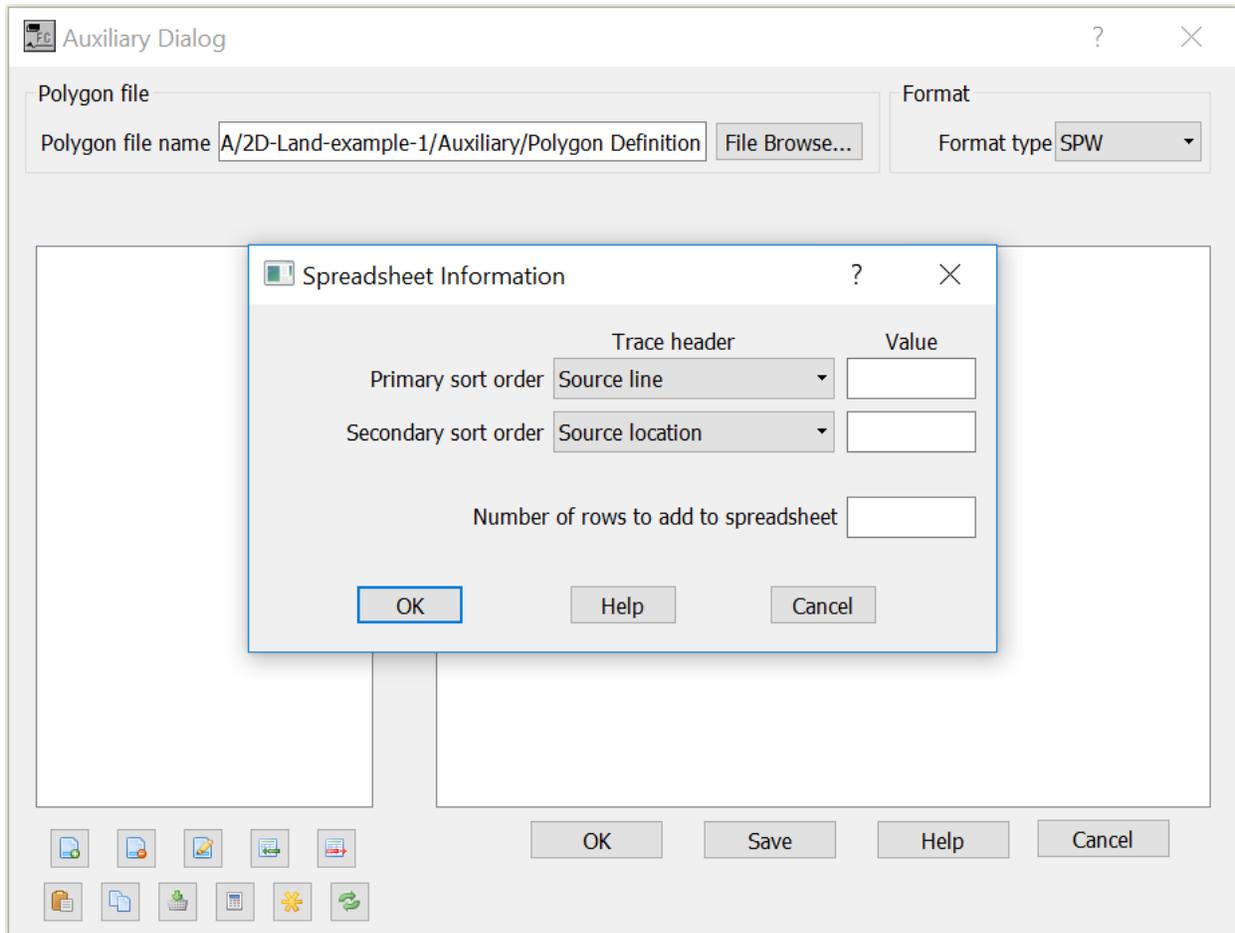
Primary sort key may be *CMP Line*, *Source Line*, *Receiver Line* or *Offset*. Secondary sort key may be *CMP Line*, *Source Line*, *Receiver Line*.

Polygon Definition

Usage:

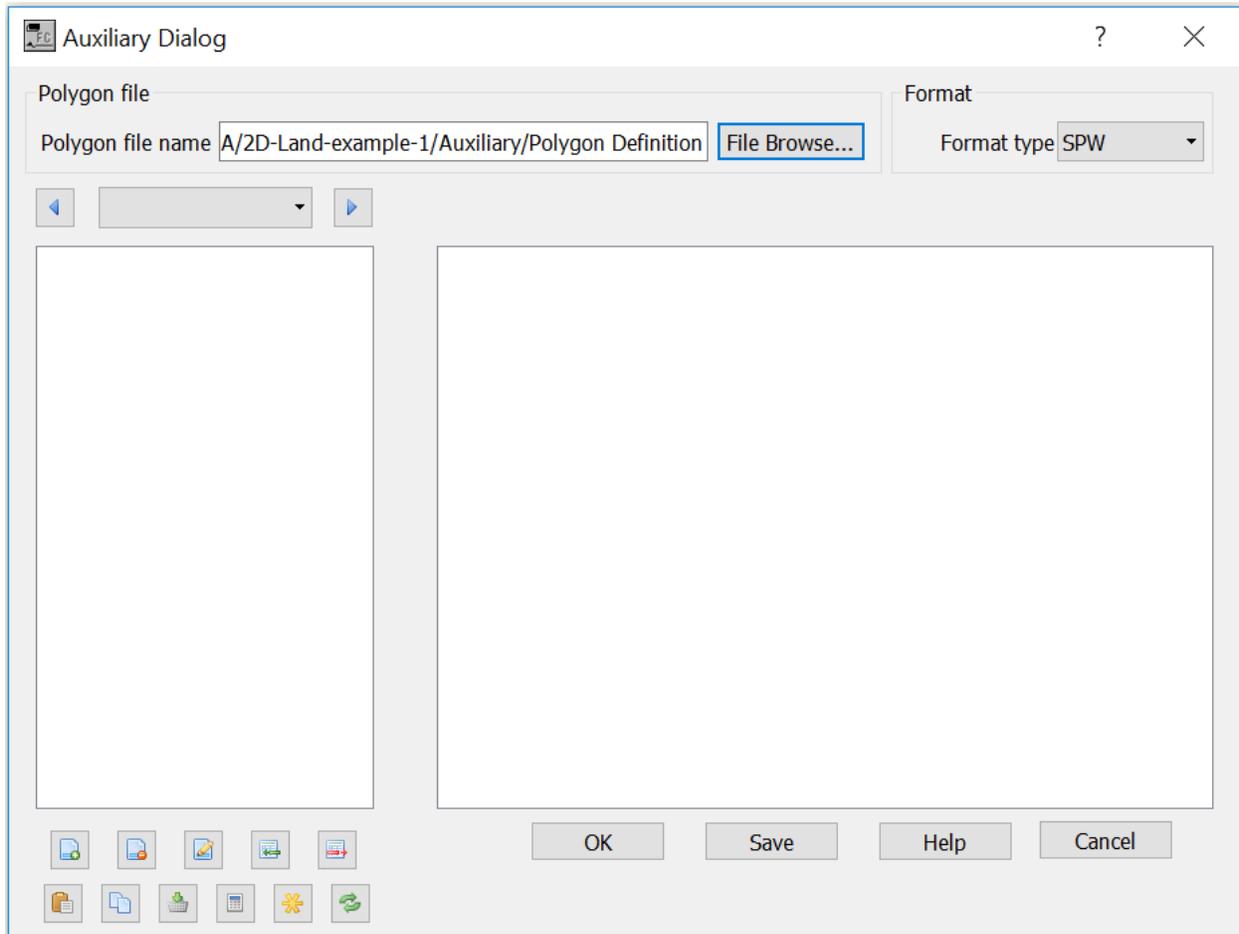
The *Polygon Definition* card data item is used to specify the coordinates of a polygon that will be used to select data from a seismic volume. The Polygon Definition File may be used to selectively input data in conjunction with the SPW Tape Utility or may be linked to the Select Traces processing step for the same purpose.

Step Parameter Dialog:



Polygon Definition need two sort keys. Primary sort key may be *CMP Line*, *Source Line*, *Receiver Line* or *Offset*. Secondary sort key may be *CMP Line*, *Source Line*, *Receiver Line*.

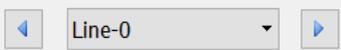
Example Card Data:



Parameter descriptions:

File Browse — Select to browse for existing *Polygon Definition* file or to define the name of a new file to be saved.

Format Type — Select format type.


 — Navigate through record.

X (first key value) — Enter the start column and the number of columns allocated to write the X coordinate associated with a given coordinate pair in the output polygon definition file.

Y (second key value) — Enter the start column and the number of columns allocated to write the Y coordinate associated with a given coordinate pair in the output polygon definition file.

Auxiliary Data R-Z

Auxiliary Data R-Z
↑ Processing Categories
Receiver Gain Corrections
Receiver Statics
SPS Observer Notes
SPS Receiver Locations
SPS Source Locations
Source Gain Corrections
Source Statics
Surgical Mutes
Tail Mutes
UK00A P1 90
Velocity Function
Window Definition

Receiver Gain Corrections

Usage:

The Receiver Gains card data item is used to store surface consistent gains associated with receiver locations.



Step Parameter Dialog:

Example Card Data:

receiver gain

<< < > >> Add Row Del Row Add Sheet Del Sheet

Cell Math Sheet 1 of 1

Line	Location	Gain
43	146.000000	0.417000
44	147.000000	0.313000
45	148.000000	0.001000
46	149.000000	0.576000
47	150.000000	0.110000
48	151.000000	0.235000
49	152.000000	4.829000
50	153.000000	3.293000
51	154.000000	0.194000

Card Data Customization Parameter Dialog:

Customize Receiver Gains

No. of comment records preceeding data

File header field	Start column	Length
Number of lines (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
Receiver line number	<input type="text" value="1"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Location number	<input type="text" value="1"/>	<input type="text" value="9"/>
Gain	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of receiver lines in the receiver gain file.

Sheet Header field:

Receiver line number — Enter the start column and the number of columns allocated to write the receiver line number in the output receiver gain file.

Number of rows — Enter the start column and the number of columns allocated to write the number of receiver positions per receiver line in the output receiver gain file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the receiver location number in the receiver gain file.

Gain — Enter the start column and the number of columns allocated to write the receiver gain in the receiver gain file.

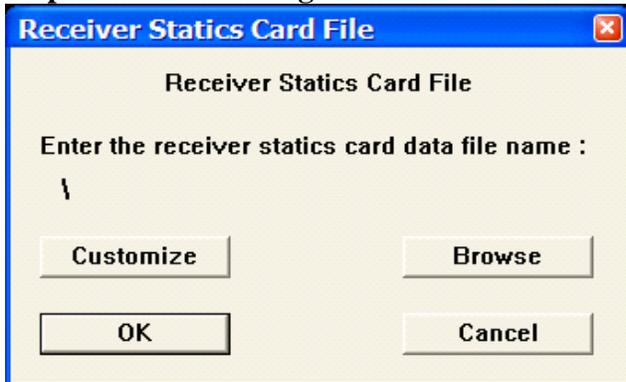
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the receiver gains file.

Receiver Statics

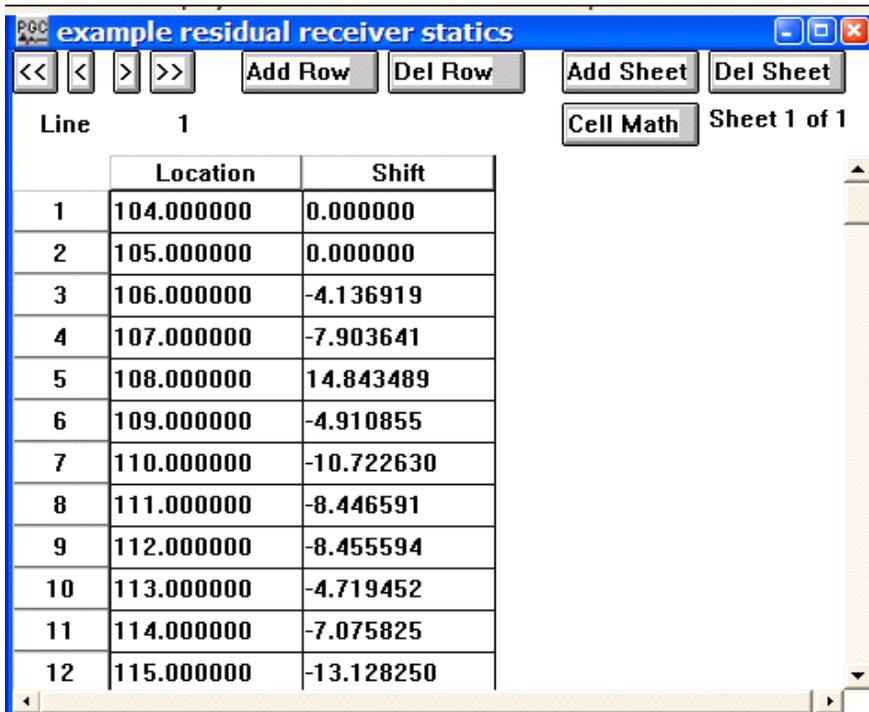
Usage:

The Receiver Statics card data item is used to store receiver static information in units of milliseconds.

Step Parameter Dialog:



The dialog box is titled "Receiver Statics Card File". It contains a text input field with the label "Enter the receiver statics card data file name :". The input field contains a backslash character (\). Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".



The spreadsheet shows a table with 12 rows and 3 columns. The columns are labeled "Line", "Location", and "Shift". The "Line" column contains integers from 1 to 12. The "Location" column contains values from 104.000000 to 115.000000 in increments of 1. The "Shift" column contains values from 0.000000 to -13.128250 in increments of -1.36919.

Line	Location	Shift
1	104.000000	0.000000
2	105.000000	0.000000
3	106.000000	-4.136919
4	107.000000	-7.903641
5	108.000000	14.843489
6	109.000000	-4.910855
7	110.000000	-10.722630
8	111.000000	-8.446591
9	112.000000	-8.455594
10	113.000000	-4.719452
11	114.000000	-7.075825
12	115.000000	-13.128250

Example Card Data:

Card Data Customization Parameter Dialog:

Field	Start column	Length
Number of comment records preceeding data	1	
File header field		
Number of lines (sheets)	1	9
Sheet header field		
Receiver line number	1	9
Number of rows	11	9
Data header field		
Location number	1	9
Time	11	9
Enter the length of each record in the file in bytes		80

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of receiver lines in the receiver statics file.

Sheet Header field:

Receiver line number — Enter the start column and the number of columns allocated to write the receiver line number in the output receiver statics file.

Number of rows — Enter the start column and the number of columns allocated to write the number of receiver positions per receiver line in the output receiver statics file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the receiver location number in the receiver statics file.

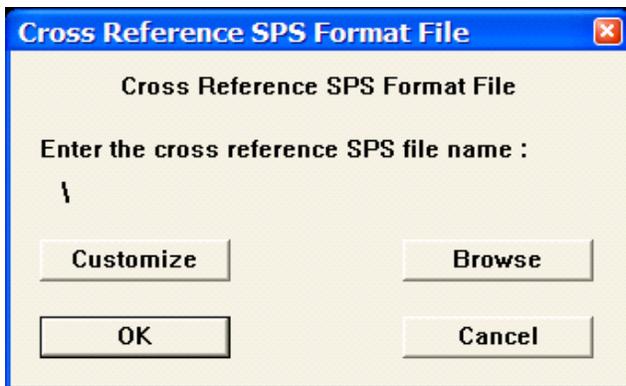
Time — Enter the start column and the number of columns allocated to write the receiver static (in milliseconds) in the receiver static file.

Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the receiver statics file.

SPS Observer Notes

Usage:

The Observer Notes card data item is used to store the relational acquisition geometry information for sources and receivers. In the SPS lingo this is referred to as the Cross Reference file. An example seismic survey with the corresponding source, receiver, and observer SPS files is illustrated in the Geometry Definition step (p. 243).



Step Parameter Dialog:

	Field File	FFN Incr.	Src. Line	Src. Loc	First Channel	Last Channel	Channel Incr.	Recv. Line	First Recv.	Last Recv.	Recv. Incr.
1	15		1	129	1	24	1	1	104	127	1
2	15		1	129	25	48	1	1	131	154	1
3	16		1	131	1	24	1	1	106	129	1
4	16		1	131	25	48	1	1	133	156	1
5	17		1	133	1	24	1	1	108	131	1
6	17		1	133	25	48	1	1	135	158	1
7	18		1	135	1	24	1	1	110	133	1
8	18		1	135	25	48	1	1	137	160	1
9	19		1	137	1	24	1	1	112	135	1
10	19		1	137	25	48	1	1	139	162	1
11	20		1	139	1	24	1	1	114	137	1
12	20		1	139	25	48	1	1	141	164	1

Example Card Data:

Cross Reference SPS File

Cross Reference SPS Format File

Column	Load	Start col.	Length
Tape	<input type="checkbox"/>	2	6
Field file	<input checked="" type="checkbox"/>	1	3
Field file incr	<input checked="" type="checkbox"/>	9	3
Source line	<input checked="" type="checkbox"/>	17	3
Source loc	<input checked="" type="checkbox"/>	25	3
First channel	<input checked="" type="checkbox"/>	33	3
Last channel	<input checked="" type="checkbox"/>	41	3
Channel incr	<input checked="" type="checkbox"/>	49	3
Receiver line	<input checked="" type="checkbox"/>	57	3
First receiver	<input checked="" type="checkbox"/>	65	3
Last receiver	<input checked="" type="checkbox"/>	73	3
Receiver incr	<input checked="" type="checkbox"/>	81	1

'X' record id present in column 1

Record in the file in bytes

OK Cancel

Card Data Customization Parameter Dialog:

Parameter descriptions:

Load – If checked, indicates the existence of the entity in the file.

Tape — Enter the start column and the number of columns allocated to write the tape number (disk or physical) associated with a given record in the Cross Reference SPS file.

Field file — Enter the start column and the number of columns allocated to write the field file number associated with a given record in the Cross Reference SPS file.

Field file incr. — Enter the start column and the number of columns allocated to write the increment between field files in the Cross Reference SPS file.

Source line — Enter the start column and the number of columns allocated to write the source line number associated with a given record in the Cross Reference SPS file.

Source location — Enter the start column and the number of columns allocated to write the source location number associated with a given record in the Cross Reference SPS file.

First channel — Enter the start column and the number of columns allocated to write the first channel associated with a given record in the Cross Reference SPS file.

Last channel — Enter the start column and the number of columns allocated to write the last channel associated with a given record in the Cross Reference SPS file.

Channel incr — Enter the start column and the number of columns allocated to write the increment between channels associated with a given record in the Cross Reference SPS file.

Receiver line — Enter the start column and the number of columns allocated to write the receiver line number associated with a given record in the Cross Reference SPS file.

First receiver — Enter the start column and the number of columns allocated to write the first receiver associated with a given record in the Cross Reference SPS file.

Last receiver — Enter the start column and the number of columns allocated to write the last receiver associated with a given record in the Cross Reference SPS file.

Receiver incr — Enter the start column and the number of columns allocated to write the increment between receivers associated with a given record in the Cross Reference SPS file.

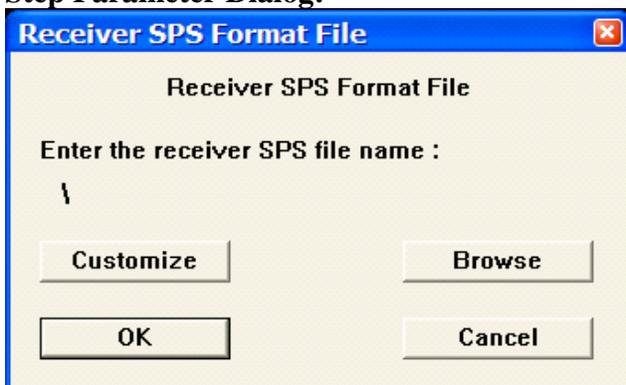
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the SPS Observer Notes file.

SPS Receiver Locations

Usage:

The Receiver Locations – SPS Format card data item is used to store positional receiver location information. An example seismic survey with the corresponding source, receiver, and observer SPS files is illustrated in the Geometry Definition step (p. 243).

Step Parameter Dialog:



Example Card Data:

	Recv. Line	Recv. Loc	Easting	Northing	Elevation
1	1	101	0.000000	0.000000	2140.000000
2	1	102	0.000000	110.000000	2139.000000
3	1	103	0.000000	220.000000	2137.000000
4	1	104	0.000000	330.000000	2137.000000
5	1	105	0.000000	440.000000	2137.000000
6	1	106	0.000000	550.000000	2136.000000
7	1	107	0.000000	660.000000	2136.000000
8	1	108	0.000000	770.000000	2135.000000
9	1	109	0.000000	880.000000	2135.000000
10	1	110	0.000000	990.000000	2134.000000

Card Data Customization Parameter Dialog:

Receiver SPS Format File

Column	Load	Start col.	Length	Implied decimal	Digits after decimal
Line	<input checked="" type="checkbox"/>	2	3	<input type="checkbox"/>	0
Location	<input checked="" type="checkbox"/>	18	8	<input type="checkbox"/>	0
Lat	<input type="checkbox"/>	56	10	<input type="checkbox"/>	1
Long	<input type="checkbox"/>	47	9	<input type="checkbox"/>	1
Easting	<input checked="" type="checkbox"/>	47	9	<input type="checkbox"/>	1
Northing	<input checked="" type="checkbox"/>	56	10	<input type="checkbox"/>	1
Elevation	<input checked="" type="checkbox"/>	66	6	<input type="checkbox"/>	1
Static	<input type="checkbox"/>	29	4	<input type="checkbox"/>	0
Depth	<input type="checkbox"/>	33	4	<input type="checkbox"/>	1
Datum	<input type="checkbox"/>	37	4	<input type="checkbox"/>	0
Up hole	<input type="checkbox"/>	41	2	<input type="checkbox"/>	0
Water depth	<input type="checkbox"/>	43	4	<input type="checkbox"/>	1
Date	<input type="checkbox"/>	72	3	<input type="checkbox"/>	0
Time	<input type="checkbox"/>	75	6	<input type="checkbox"/>	0

'R' or 'S' record id present in column 1

Enter the length of each record in the file in bytes

Parameter descriptions:

Load – If checked, indicates the existence of the entity in the file.

Line — Enter the start column and the number of columns allocated to write the receiver line associated with a given record in the Receiver SPS file.

Location — Enter the start column and the number of columns allocated to write the receiver location associated with a given record in the Receiver SPS file.

Latitude — Enter the start column and the number of columns allocated to write the receiver latitude associated with a given record in the Receiver SPS file.

Longitude — Enter the start column and the number of columns allocated to write the receiver longitude associated with a given record in the Receiver SPS file.

Easting — Enter the start column and the number of columns allocated to write the receiver easting associated with a given record in the Receiver SPS file.

Northing — Enter the start column and the number of columns allocated to write the receiver northing associated with a given record in the Receiver SPS file.

Elevation — Enter the start column and the number of columns allocated to write the receiver elevation associated with a given record in the Receiver SPS file.

Static — Enter the start column and the number of columns allocated to write the receiver static associated with a given record in the Receiver SPS file.

Depth — Enter the start column and the number of columns allocated to write the receiver depth associated with a given record in the Receiver SPS file.

Datum — Enter the start column and the number of columns allocated to write the elevation of the datum at a receiver station associated with a given record in the Receiver SPS file.

Uphole — Enter the start column and the number of columns allocated to write the interpolated uphole time (ms) at a receiver station associated with a given record in the Receiver SPS file.

Water depth — Enter the start column and the number of columns allocated to write the water depth at a receiver station associated with a given record in the Receiver SPS file.

Date — Enter the start column and the number of columns allocated to write the Julian day on which the receiver station was initially deployed in the Receiver SPS file.

Time — Enter the start column and the number of columns allocated to write the time of day on which the receiver station was initially deployed in the Receiver SPS file.

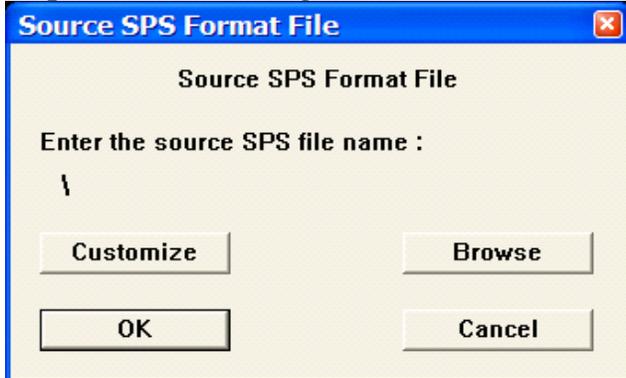
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the SPS receiver file.

SPS Source Locations

Usage:

The Source Locations – SPW Format card data item is used to source location geometry information. An example seismic survey with the corresponding source, receiver, and observer SPS files is illustrated in the Geometry Definition step (p. 243).

Step Parameter Dialog:



Source SPS Format File

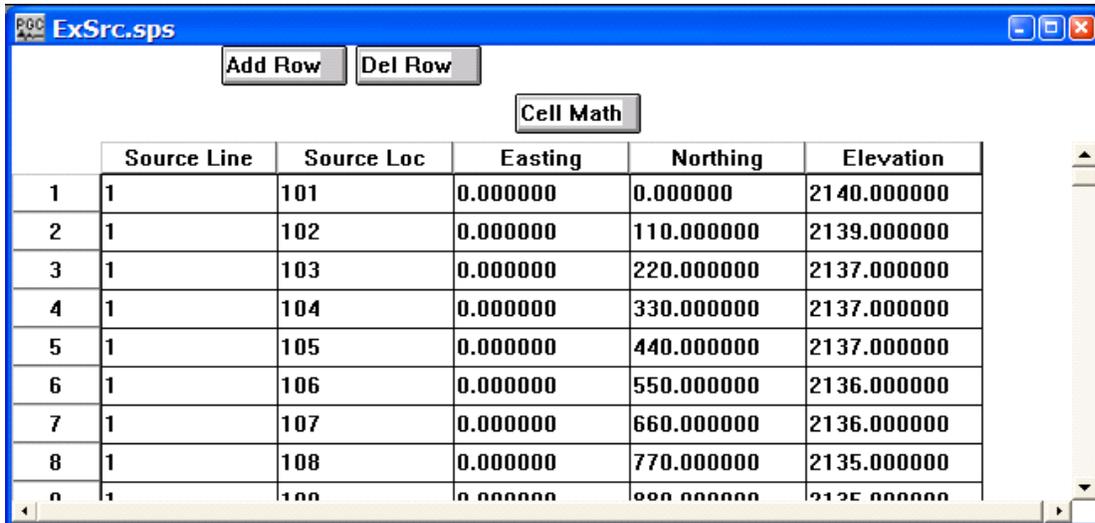
Enter the source SPS file name :

\

Customize Browse

OK Cancel

Example Card Data:



	Source Line	Source Loc	Easting	Northing	Elevation
1	1	101	0.000000	0.000000	2140.000000
2	1	102	0.000000	110.000000	2139.000000
3	1	103	0.000000	220.000000	2137.000000
4	1	104	0.000000	330.000000	2137.000000
5	1	105	0.000000	440.000000	2137.000000
6	1	106	0.000000	550.000000	2136.000000
7	1	107	0.000000	660.000000	2136.000000
8	1	108	0.000000	770.000000	2135.000000
9	1	109	0.000000	880.000000	2135.000000

Customize SPS Format

Source SPS Format File

Column	Load	Start col.	Length	Implied decimal	Digits after decimal
Line	<input checked="" type="checkbox"/>	2	3	<input type="checkbox"/>	0
Location	<input checked="" type="checkbox"/>	18	8	<input type="checkbox"/>	0
Lat	<input type="checkbox"/>	56	10	<input type="checkbox"/>	1
Long	<input type="checkbox"/>	47	9	<input type="checkbox"/>	1
Easting	<input checked="" type="checkbox"/>	47	9	<input type="checkbox"/>	1
Northing	<input checked="" type="checkbox"/>	56	10	<input type="checkbox"/>	1
Elevation	<input checked="" type="checkbox"/>	66	6	<input type="checkbox"/>	1
Static	<input type="checkbox"/>	29	4	<input type="checkbox"/>	0
Depth	<input type="checkbox"/>	33	4	<input type="checkbox"/>	1
Datum	<input type="checkbox"/>	37	4	<input type="checkbox"/>	0
Up hole	<input type="checkbox"/>	41	2	<input type="checkbox"/>	0
Water depth	<input type="checkbox"/>	43	4	<input type="checkbox"/>	1
Date	<input type="checkbox"/>	72	3	<input type="checkbox"/>	0
Time	<input type="checkbox"/>	75	6	<input type="checkbox"/>	0

'R' or 'S' record id present in column 1

Enter the length of each record in the file in bytes

OK Cancel

Card Data

Customization Parameter Dialog:

Parameter descriptions:

Load – If checked, indicates the existence of the entity in the file.

Line — Enter the start column and the number of columns allocated to write the source line associated with a given record in the Source SPS file.

Location — Enter the start column and the number of columns allocated to write the source location associated with a given record in the Source SPS file.

Latitude — Enter the start column and the number of columns allocated to write the source latitude associated with a given record in the Source SPS file.

Longitude — Enter the start column and the number of columns allocated to write the source longitude associated with a given record in the Source SPS file.

Easting — Enter the start column and the number of columns allocated to write the source easting associated with a given record in the Source SPS file.

Northing — Enter the start column and the number of columns allocated to write the source northing associated with a given record in the Source SPS file.

Elevation — Enter the start column and the number of columns allocated to write the source elevation associated with a given record in the Source SPS file.

Static — Enter the start column and the number of columns allocated to write the source static associated with a given record in the Source SPS file.

Depth — Enter the start column and the number of columns allocated to write the source depth associated with a given record in the Source SPS file.

Datum — Enter the start column and the number of columns allocated to write the elevation of the datum at the source station associated with a given record in the Source SPS file.

Uphole — Enter the start column and the number of columns allocated to write the uphole time (ms) at a source station associated with a given record in the Source SPS file.

Water depth — Enter the start column and the number of columns allocated to write the water depth at a source station associated with a given record in the Source SPS file.

Date — Enter the start column and the number of columns allocated to write the Julian day on which the source station was occupied in the Source SPS file.

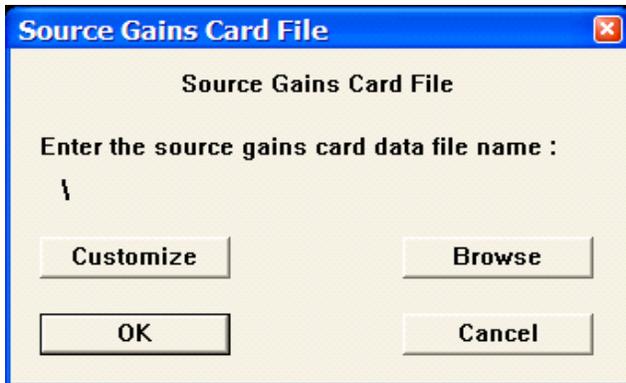
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the SPS source file.

Source Gain Corrections

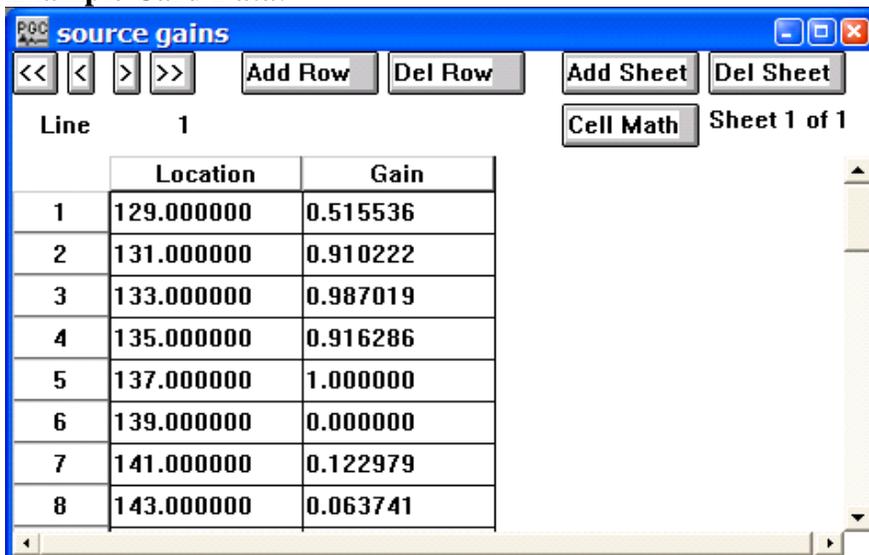
Usage:

The Source Gains card data item is used to store gains associated with source locations.

Step Parameter Dialog:



Example Card Data:



The "source gains" application window shows a table with 8 rows and 3 columns. The columns are labeled "Line", "Location", and "Gain". The "Line" column contains integers from 1 to 8. The "Location" column contains values from 129.000000 to 143.000000 in increments of 2. The "Gain" column contains values from 0.515536 to 0.063741. The window also features navigation buttons (left and right arrows) and action buttons: "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". The status bar indicates "Sheet 1 of 1".

Line	Location	Gain
1	129.000000	0.515536
2	131.000000	0.910222
3	133.000000	0.987019
4	135.000000	0.916286
5	137.000000	1.000000
6	139.000000	0.000000
7	141.000000	0.122979
8	143.000000	0.063741

Card Data Customization Parameter Dialog:

Customize Source Gains

No. of comment records preceeding data

File header field	Start column	Length
Number of lines (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
Source line number	<input type="text" value="1"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Location number	<input type="text" value="1"/>	<input type="text" value="9"/>
Gain	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of source gain pairs in the source gain file.

Sheet Header field:

Source line number — Enter the start column and the number of columns allocated to write source line number in the output source gain file.

Number of rows — Enter the start column and the number of columns allocated to write the number of source positions per source line in the output source gain file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the source location number in the source gain file.

Gain — Enter the start column and the number of columns allocated to write the source gain in the source gain file.

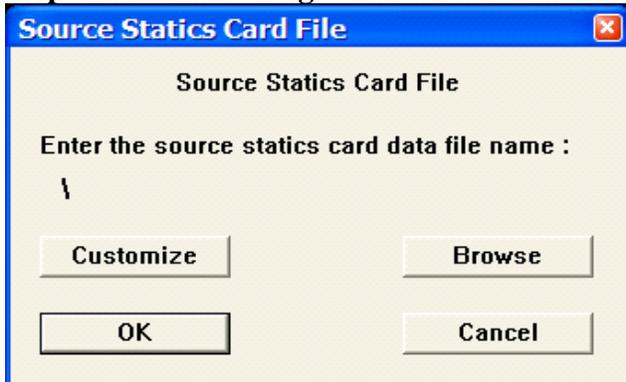
Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the source gains file.

Source Statics

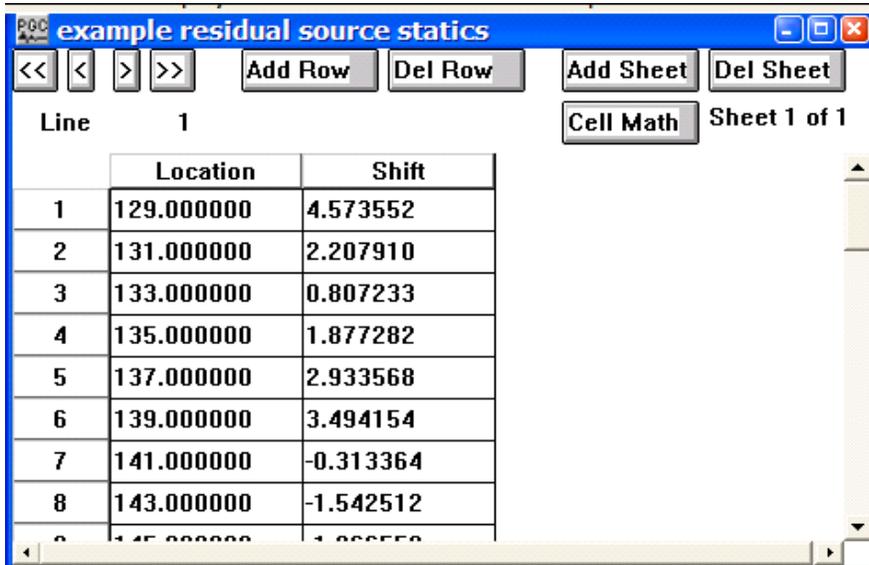
Usage:

The Source Statics card data item is used to store source statics information in units of milliseconds.

Step Parameter Dialog:



The dialog box is titled "Source Statics Card File" and contains a text input field with the label "Enter the source statics card data file name :". The input field contains a backslash character. Below the input field are four buttons: "Customize", "Browse", "OK", and "Cancel".



The window title is "example residual source statics". It features a toolbar with navigation arrows, "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math" buttons. The main area displays a table with the following data:

Line	Location	Shift
1	129.000000	4.573552
2	131.000000	2.207910
3	133.000000	0.807233
4	135.000000	1.877282
5	137.000000	2.933568
6	139.000000	3.494154
7	141.000000	-0.313364
8	143.000000	-1.542512

Example Card Data:

Customize Source Statics

Number of comment records preceding data

File header field	Start column	Length
Number of lines (sheets)	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
Source line number	<input type="text" value="1"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="11"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Location number	<input type="text" value="1"/>	<input type="text" value="9"/>
Time	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Card Data Customization

Parameter Dialog:

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of lines — Enter the start column and the number of columns allocated to write the number of source lines in the source statics file.

Sheet Header field:

Receiver line number — Enter the start column and the number of columns allocated to write source line number in the output source statics file.

Number of rows — Enter the start column and the number of columns allocated to write the number of source positions per source line in the output source statics file.

Data header field:

Location number — Enter the start column and the number of columns allocated to write the source location number in the source statics file.

Time — Enter the start column and the number of columns allocated to write the source static (in milliseconds) in the source static file.

Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the source statics file.

Surgical Mutes

Usage:

The Surgical Mutes card data item is used to store surgical mute data. Mute times are in units of seconds. Surgical mutes may be defined interactively in SeisViewer using the Pick Traces tool located in the Picking menu.

Step Parameter Dialog:



Surgical Mute Card File

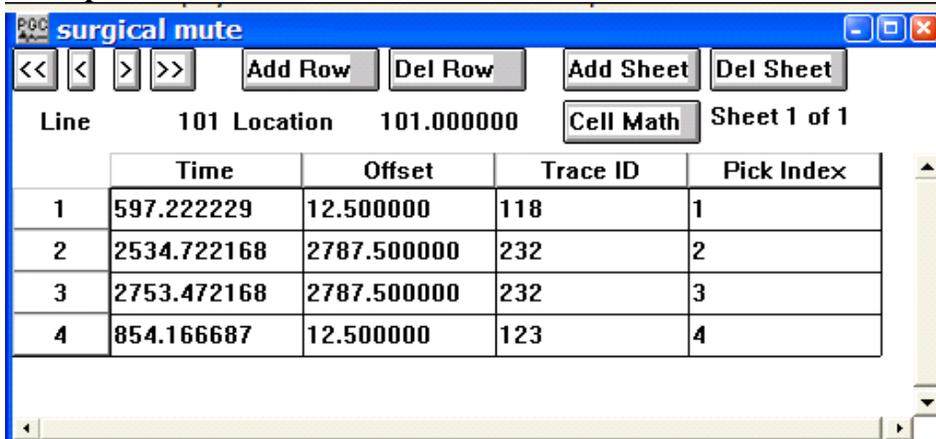
Enter the surgical mute card data file name :

\

Customize Browse

OK Cancel

Example Card Data:



Line	Time	Offset	Trace ID	Pick Index
1	597.222229	12.500000	118	1
2	2534.722168	2787.500000	232	2
3	2753.472168	2787.500000	232	3
4	854.166687	12.500000	123	4

Card Data Customization Parameter Dialog:

Customize Surgical Mute		
Number of comment records preceding data	1	
File header field	Start column	Length
Number of mute locations (sheets)	1	9
Sheet header field	Start column	Length
CMP line number	1	9
CMP location number	11	9
Number of rows	21	9
Sort order	31	9
Data header field	Start column	Length
Time	1	9
Offset	11	9
Unique trace number	21	9
Pick order index	31	9
Enter the length of each record in the file in bytes	80	

OK Cancel

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of mute locations — Enter the start column and the number of columns allocated to write the number of mute locations in the output mute file.

Sheet Header field:

CMP line number — Enter the start column and the number of columns allocated to write CMP line number in the output mute file.

CMP location number — Enter the start column and the number of columns allocated to write CMP location number in the output mute file.

Number of rows — Enter the start column and the number of columns allocated to write the number of CMP positions in the CMP line in the output mute file.

Sort — Enter the start column and the number of columns allocated to write the sort order (e.g. common source, CMP, etc...) of the data file on which the early mute was picked.

Data header field:

Time — Enter the start column and the number of columns allocated to write the mute time (in seconds) at a specified offset and trace number in the output mute file.

Offset — Enter the start column and the number of columns allocated to write the source receiver offset corresponding to a specified mute time and trace number in the output mute file.

Unique trace number — Enter the start column and the number of columns allocated to write the unique trace number corresponding to a specified mute time and source-receiver offset in the output mute file.

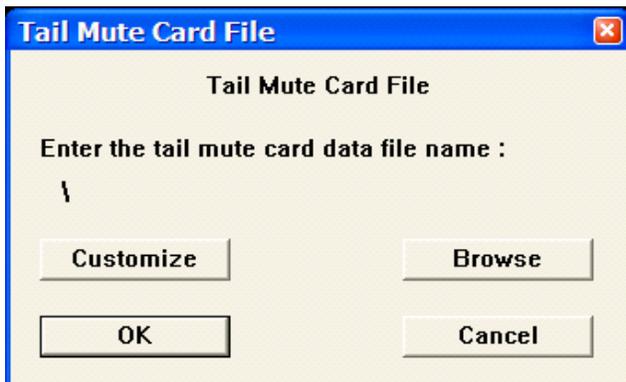
Pick order index — Enter the start column and the number of columns allocated to write the pick index corresponding to a specified mute time, source-receiver offset, and unique trace number in the output mute file.

Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the surgical mute file.

Tail Mutes

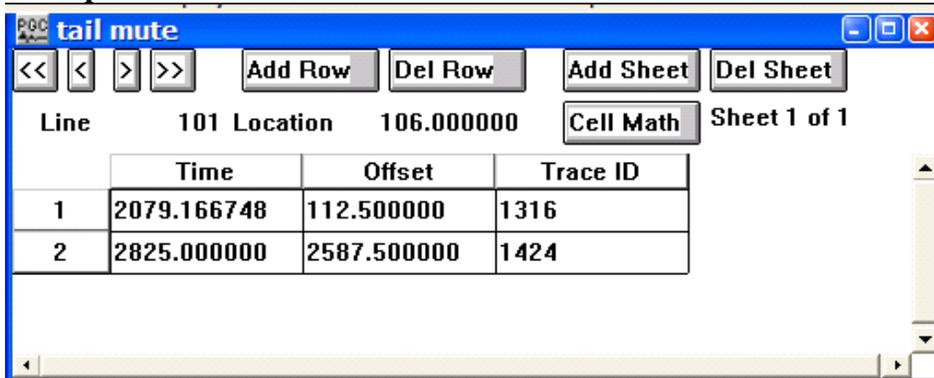
Usage:

The Tail Mutes card data item is used to store tail or end mute data. Mute times are in units of seconds. Tail mutes may be interactively defined in SeisViewer using the Pick Traces tool located in the Picking menu.



Step Parameter Dialog:

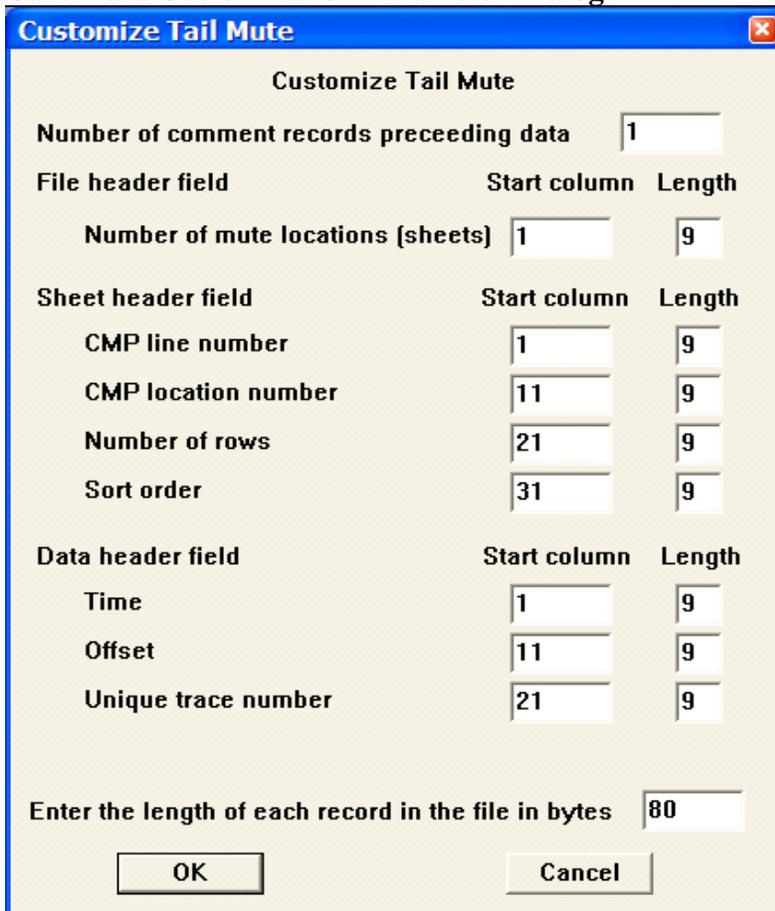
Example Card Data:



The screenshot shows a window titled "tail mute" with a menu bar and several buttons: "<<<", "<", ">", ">>>", "Add Row", "Del Row", "Add Sheet", "Del Sheet", and "Cell Math". Below the buttons, the text "Line 101 Location 106.000000" is displayed. A table with the following data is shown:

	Time	Offset	Trace ID
1	2079.166748	112.500000	1316
2	2825.000000	2587.500000	1424

Card Data Customization Parameter Dialog:



The "Customize Tail Mute" dialog box contains the following fields and controls:

- Number of comment records preceding data:
- File header field: Start column, Length
- Number of mute locations (sheets):
- Sheet header field: Start column, Length
- CMP line number:
- CMP location number:
- Number of rows:
- Sort order:
- Data header field: Start column, Length
- Time:
- Offset:
- Unique trace number:
- Enter the length of each record in the file in bytes:
- Buttons: OK, Cancel

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of mute locations — Enter the start column and the number of columns allocated to write the number of mute locations in the output mute file.

Sheet Header field:

CMP line number — Enter the start column and the number of columns allocated to write CMP line number in the output mute file.

CMP location number — Enter the start column and the number of columns allocated to write CMP location number in the output mute file.

Number of rows — Enter the start column and the number of columns allocated to write the number of CMP positions in the CMP line in the output mute file.

Sort — Enter the start column and the number of columns allocated to write the sort order (e.g. common source, CMP, etc...) of the data file on which the early mute was picked.

Data header field:

Time — Enter the start column and the number of columns allocated to write the mute time (in seconds) at a specified offset and trace number in the output mute file.

Offset — Enter the start column and the number of columns allocated to write the source receiver offset corresponding to a specified mute time and trace number in the output mute file.

Unique trace number — Enter the start column and the number of columns allocated to write the unique trace number corresponding to a specified mute time and source-receiver offset in the output mute file.

Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the tail mute file.

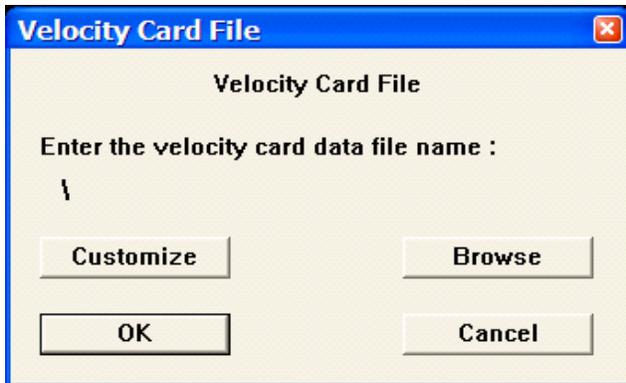
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Velocity Function

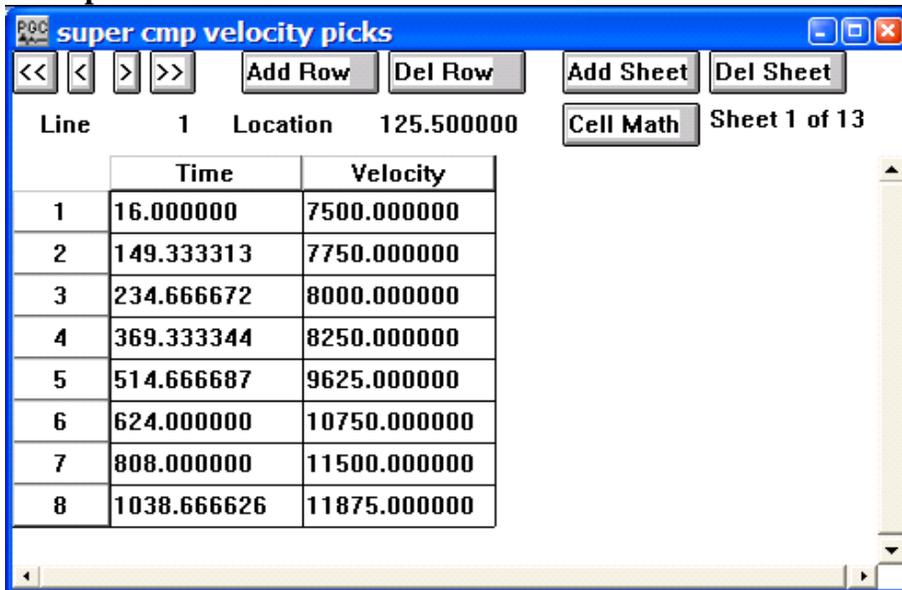
Usage:

The Velocity Function card data item is used to store time-velocity pairs. Stacking velocities may be picked interactively in SeisViewer using the Pick Traces tool located in the Picking menu..

Step Parameter Dialog:



Example Card Data:



Card Data Customization Parameter Dialog:

Customize Velocity

Customize Velocity File Format

Number of comment records preceding data

File header field	Start column	Length
No. of velocity locations [sheets]	<input type="text" value="1"/>	<input type="text" value="9"/>

Sheet header field	Start column	Length
CMP line number	<input type="text" value="1"/>	<input type="text" value="9"/>
CMP location number	<input type="text" value="11"/>	<input type="text" value="9"/>
Number of rows	<input type="text" value="21"/>	<input type="text" value="9"/>

Data header field	Start column	Length
Time	<input type="text" value="1"/>	<input type="text" value="9"/>
Velocity	<input type="text" value="11"/>	<input type="text" value="9"/>

Enter the length of each record in the file in bytes

Parameter descriptions:

Number of comment records preceding data: – Indicates the number of lines in the output file reserved for writing comment cards. These are the first lines in the file. A minimum of one line is required.

File Header field:

Number of velocity locations — Enter the start column and the number of columns allocated to write the number of velocity locations in the velocity file.

Sheet header field:

CMP line number — Enter the start column and the number of columns allocated to write the CMP line number associated with a velocity function in the velocity file.

CMP location number — Enter the start column and the number of columns allocated to write the CMP location number associated with a velocity function in the velocity file.

Number of rows — Enter the start column and the number of columns allocated to write the CMP locations per CMP line in the velocity file.

Data header field:

Time — Enter the start column and the number of columns allocated to write the two-way travel time (in milliseconds) associated with a given velocity pick in the velocity file.

Velocity — Enter the start column and the number of columns allocated to write the RMS or interval velocity value associated with a given velocity pick in the velocity file.

Enter the length of each record in the file in bytes – Enter the length in bytes of one line of the velocity function file.

Window Definition

Display Steps

This section documents the processing steps available for *Display*. Processing steps currently available are:

Display
↑ Processing Categories
Frequency Slices to Time Traces
Real Time Amplitude Spectrum Plot
Real Time Data Quality Analysis
Real Time Near Trace Display
Real Time Quality Analysis Statistics Map
Real Time Quality Analysis Statistics Plot
Real Time Receiver Attribute Map
Real Time Receiver Spread
Real Time Seismic Display
Real Time Source Attribute Map
Real Time Stack Display
Real Time Trace Header Map
Time Slices
Time Slices to Traces

Frequency Slices to Time Traces

Usage:

Frequency Slices to Time Traces is a process used to convert frequency slices required for some specific frequency domain processes such as *F-X-Y Median Filter* and *FKK Domain Spectral Shaping* back into the standard time trace domain data.

Input Links:

- 1) Seismic data in sorted by CMP Line (record key) and Slice Number (mandatory).
- 2) 'Original' seismic data CMP Line (record key) and CMP Location (3D) or CMP (2D) (optional).

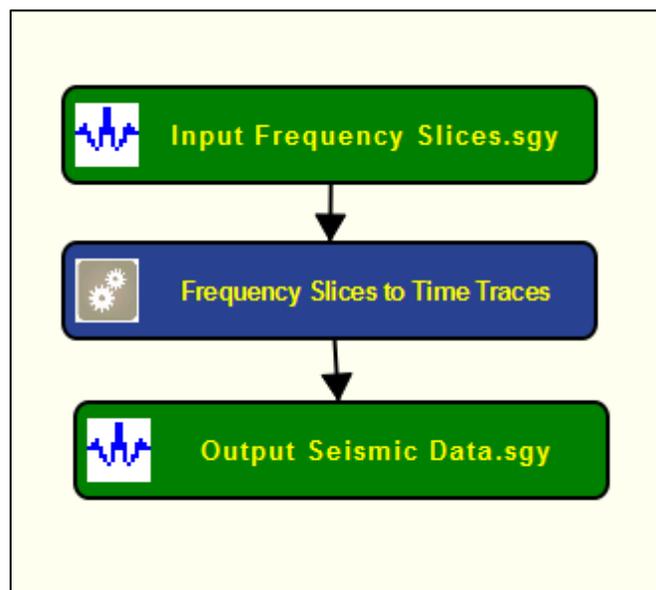
Output Links:

- 1) Seismic data (mandatory).

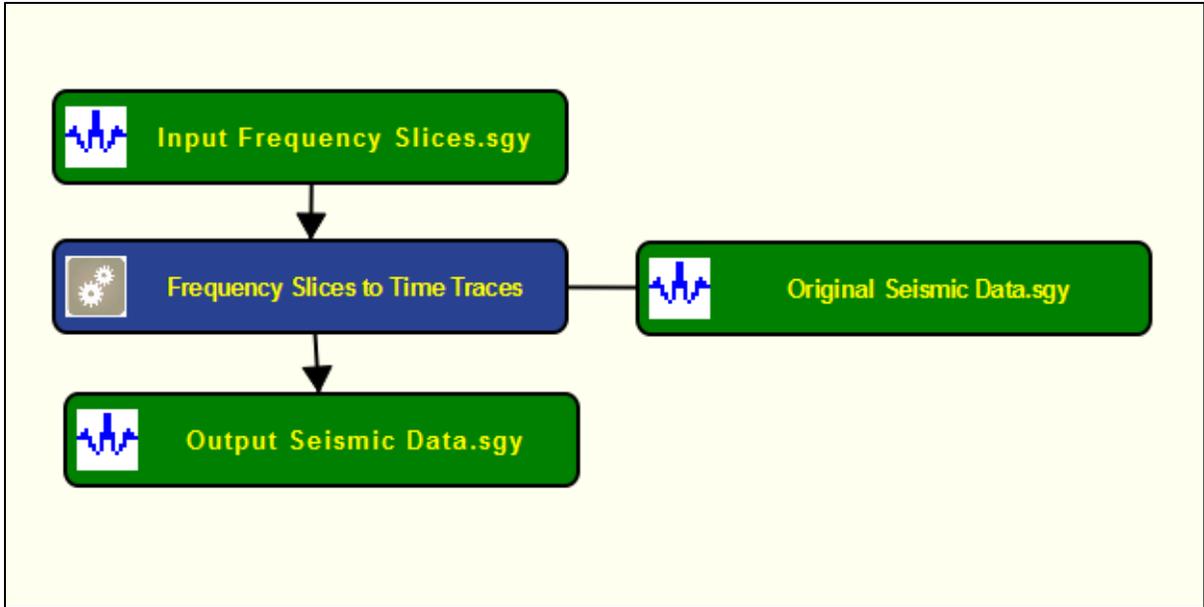
Reference:

-

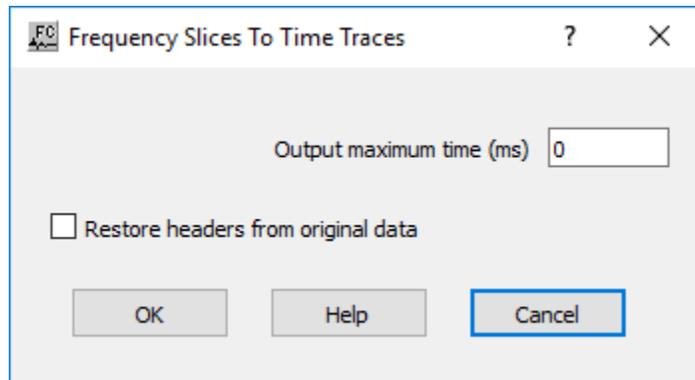
Example Flowchart a:



Example Flowchart b:



Step Parameter Dialog:



Parameter Description:

Output maximum time (ms) — Enter maximum time of the output in time.

Restore headers from original data — If checked, a secondary input data stream will be required, sorted by CMP Line (record key) and CMP Location (3D) or CMP (2D) (example flowchart b). This secondary input data will be used to supply the headers to be attached to the output data, and the data extent must be set to match the extent of the output data.

Real Time Amplitude Spectrum Plot

Usage: The *Real Time Amplitude Spectrum Plot* step is a real time plot of the amplitude spectrum for a group traces as defined by the user. **This step is not ready available yet.**

Input Links:

1) Seismic data in sorted by CMP Line (record key) and Slice Number (mandatory).

Output Links:

-

Reference:

-

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Real Time Data Quality Analysis

Usage:

The *Real Time Data Quality* step is a real time display that allows plotting the information generated by the *Spectral Comparison* processing step (under *Quality Analysis* category). It generates a real time map using as horizontal axis the header value defined under the **Trace header containing horizontal coordinate** and as vertical axis the header value located under the **Trace header containing vertical coordinate**. The map is then colored by the values defined under the **Trace header containing attribute for display**. In the *Spectral Comparison* case, we can select either the spectral semblance value of the dead/live flag.

Input Links:

1) Seismic file (mandatory). Normally this step is applied together with *Spectral Comparison* for real time quality control.

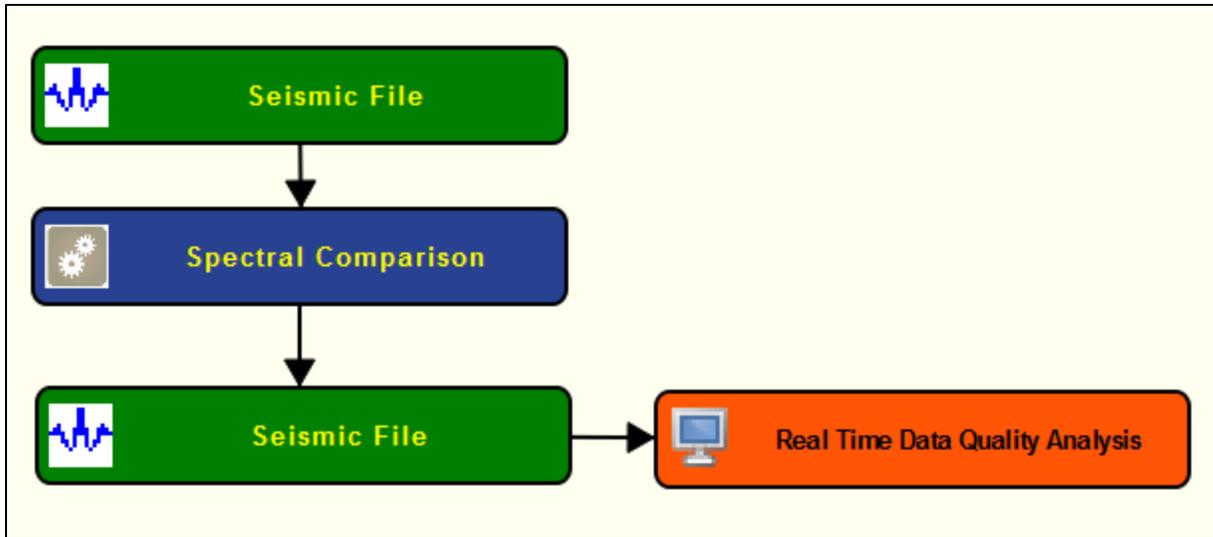
Output Links:

-

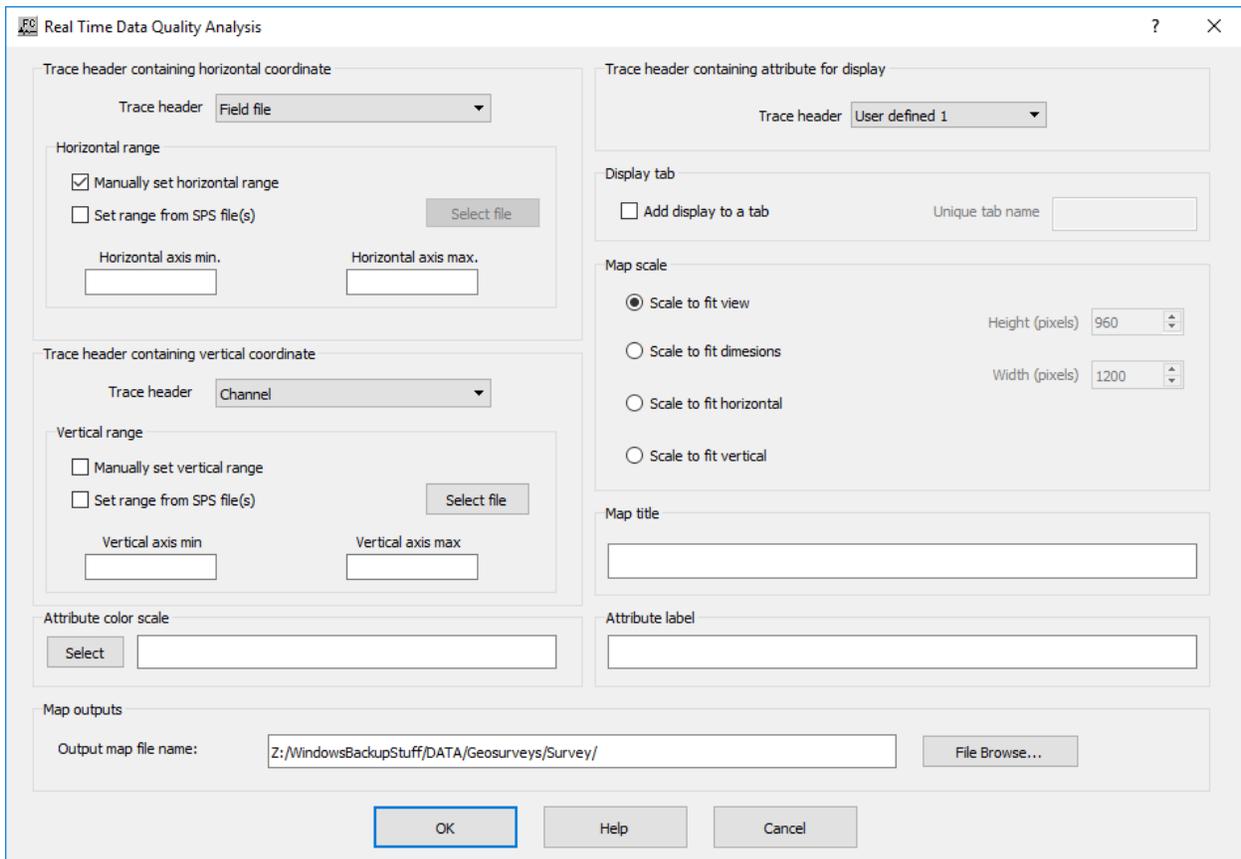
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Trace header containing horizontal coordinate: It generates a real time map using as horizontal axis the header value defined under the *Trace header*.

Trace header — Select trace header to be used as horizontal axis for the real time map.

Horizontal range: In the current version of this real time display, it is mandatory to define the horizontal range of the map either by using user-defined minimum and maximum values or by using an auxiliary SPS geometry file.

Manually set horizontal range — If checked, the minimum and maximum horizontal ranges are user-defined and set as specified under **Horizontal axis min.** and **Horizontal axis max.**. The maximum value for the horizontal coordinate will be automatically updated if the current horizontal trace header value is larger than what is pre-defined.

Set range from SPS file(s) — If checked, the minimum and maximum horizontal ranges are specified by an auxiliary SPS geometry file selected under browse button.

Horizontal axis min. — Enter minimum value of the horizontal coordinate to be displayed.

Horizontal axis max. — Enter maximum value of the horizontal coordinate to be displayed.

Trace header containing vertical coordinate: It generates a real time map using as vertical axis the header value defined under the *Trace header*.

Trace header — Select trace header to be used as horizontal axis for the real time map.

Vertical range: In the current version of this real time display, it is mandatory to define the vertical range of the map either by using user-defined minimum and maximum values or by using an auxiliary SPS geometry file. The maximum value for the vertical coordinate will be automatically updated if the current horizontal trace header value is larger than what is pre-defined.

Manually set vertical range — If checked, the minimum and maximum horizontal ranges are used-defined and set as specified under **Vertical axis min.** and **Vertical axis max.**

Set range from SPS file(s) — If checked, the minimum and maximum horizontal ranges are specified by an auxiliary SPS geometry file selected under browse button.

Vertical axis min. — Enter minimum value of the vertical coordinate to be displayed.

Vertical axis max. — Enter maximum value of the vertical coordinate to be displayed.

Attribute color scale — The map of the real time display is displayed with the color scale bar as defined using the select button. By default the information is plotted with the default color bar (rainbow).

Trace header containing attribute for display: Select the trace header with the information to be colored in the real time map. With the *Spectral Comparison* step, we can select either the spectral semblance value of the dead/live flag.

Trace header — Select the trace header to be used to color the real time map.

Display tab: This real time display allows plotting simultaneously more than one map within the same tab view. This is a useful option to plot, for example, the value of the spectral semblance along with the dead/live flag.

Add display to a tab — If checked, the map is added to a display tab already open.

Unique tab name — Enter unique tab name where the map is going to be displayed.

Map scale: The real time map can be plotted using different types of scale.

Scale to fit view — If selected, the map is automatically scaled to fit the current view.

Scale to fit dimensions — If selected, the map is automatically scaled to fit the dimensions defined by the user.

Height (in pixels) — Enter the height of the map in number of pixels.

Width (in pixels) — Enter the width of the map in number of pixels.

Scale to fit horizontal — If selected, the map is automatically scaled to fit the current view horizontally.

Scale to fit vertical — If selected, the map is automatically scaled to fit the current view horizontally.

Map title — Enter map title to be displayed in the display tab.

Attribute label — Enter attribute label.

Output map file name — Enter, or browse, the name of the file where the map is going to be saved. The map final map will be stored in a .baf format.

Real Time Near Trace Display

Usage:

The *Real Time Near Trace Display* step is a real time display that allows plotting continuously the near offset trace, as defined under **Channel number of the near offset group**, of the current record from the input seismic data file.

Input Links:

- 1) Seismic file (mandatory). Normally this step is applied together with *Spectral Comparison* for real time quality control.

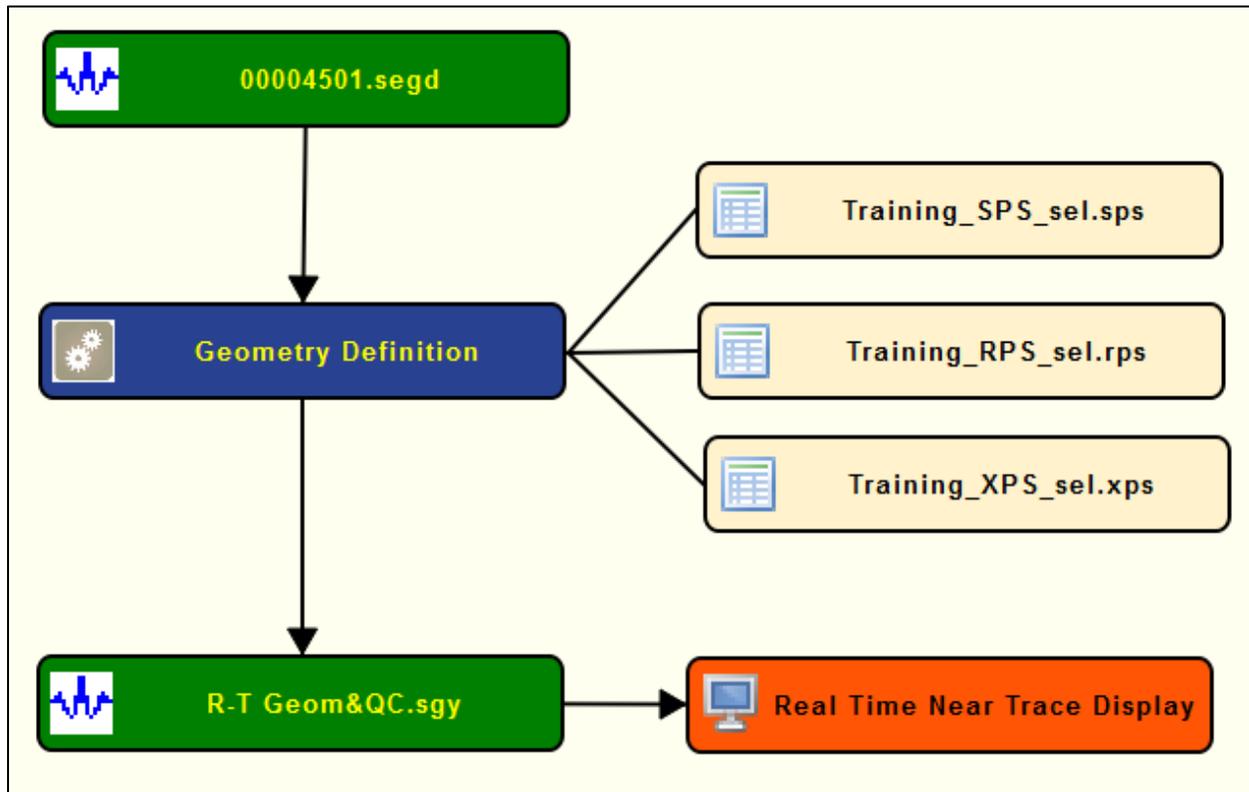
Output Links:

-

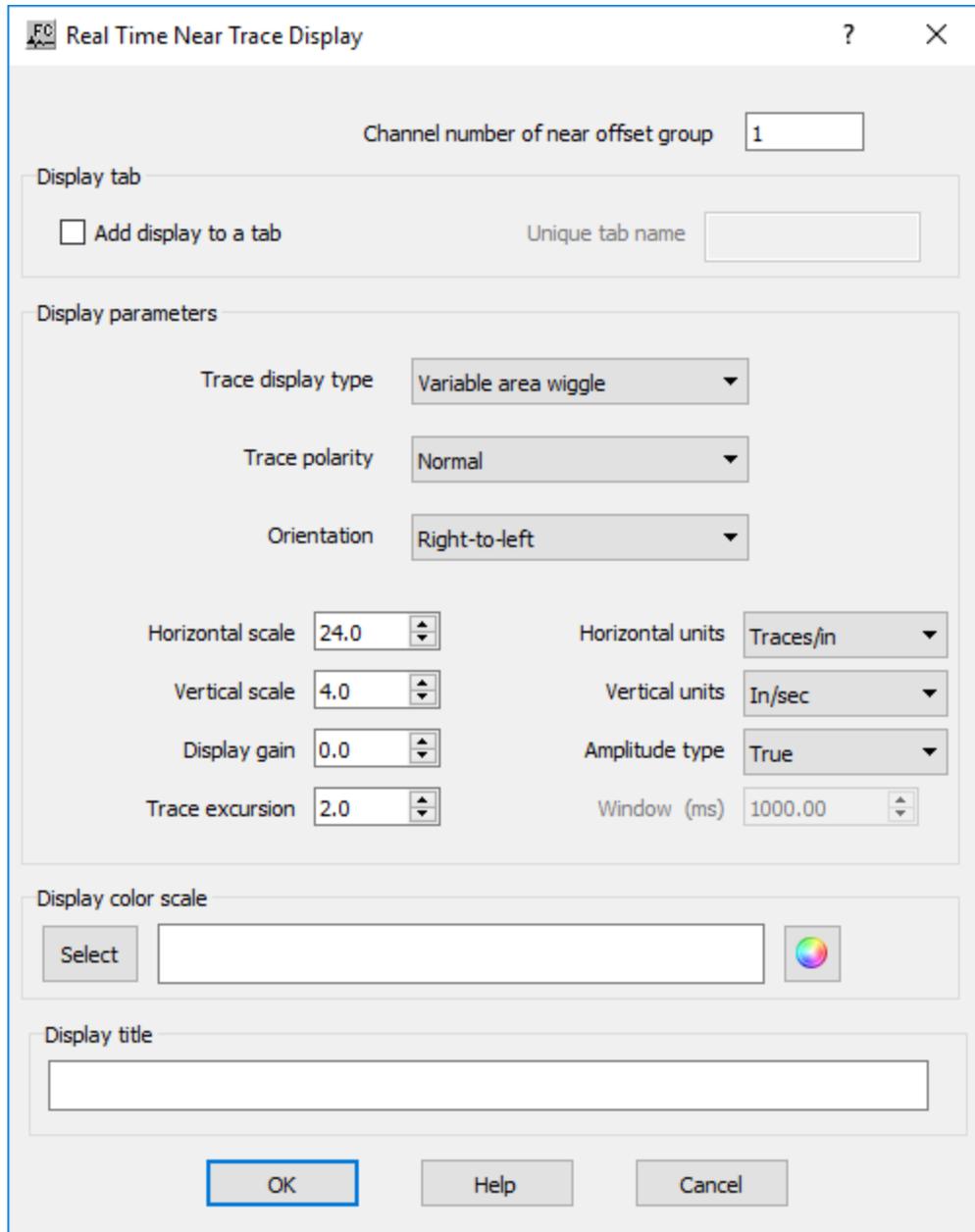
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Channel number of near offset group — Enter the number of the channel number corresponding to the near offset group to be plotted in real time.

Display tab: This real time display allows plotting simultaneously more than one display within the same tab view. This is a useful option to plot simultaneously several data for QC.

Add display to a tab — If checked, the map is added to a display tab already open.

Unique tab name — Enter unique tab name where the map is going to be displayed.

Display parameters: Define the parameters related with the real time of the near offset trace.

Trace display type — Select the type of the seismic display. The user can select between **Variable area wiggle** or **Variable density**.

Trace polarity — Select the type of polarity for the seismic display. The user can select between **Normal** or **Reverse**.

Orientation — Select the orientation of the seismic display. The user can select between **Right-to-left** or **Left-to-right**.

Horizontal scale — Enter the horizontal scale for the seismic display, with the units as specified in **Horizontal Units**.

Vertical scale — Enter the vertical scale for the seismic display, with the units as specified in **Vertical Units**.

Display gain — Enter the display gain of the seismic display.

Trace excursion — Enter the trace excursion gain of the seismic display

Horizontal units — Select the horizontal units to be used for the **Horizontal scale**. Units can be defined in Traces per inch or Traces per cm.

Vertical units — Select the horizontal units to be used for the **Vertical scale**. Units can be defined in inch per second or centimeter per second.

Amplitude type — Select the amplitude type for the seismic display. The near offset record may be displayed in **True amplitude**, **Relative amplitude** or **Gain control** with a window size defined in **Window**.

Window (ms) — Enter the window size in ms for **Gain control**.

Display color scale: Select the display color scale to be used in the real time plot.

Select — Use the button to select the display color bar for the real time seismic plot.

Display title — Enter display title to be displayed in the display tab.

Real Time Quality Analysis Statistics Map

Usage:

The *Real Time Quality Analysis Statistics Map* step is a real time display that allows plotting the information generated by the *Signal to Noise Attribute* (under *Quality Analysis*). It generates a real time map like a bar chart where the S/N ratio and dead/live flags can be plotted simultaneously for the three different signal-to-noise ratio estimates with the *Signal to Noise Attribute*.

Input Links:

- 1) Seismic file (mandatory). Normally this step is applied together with *Signal to Noise Attribute* for real time quality control.

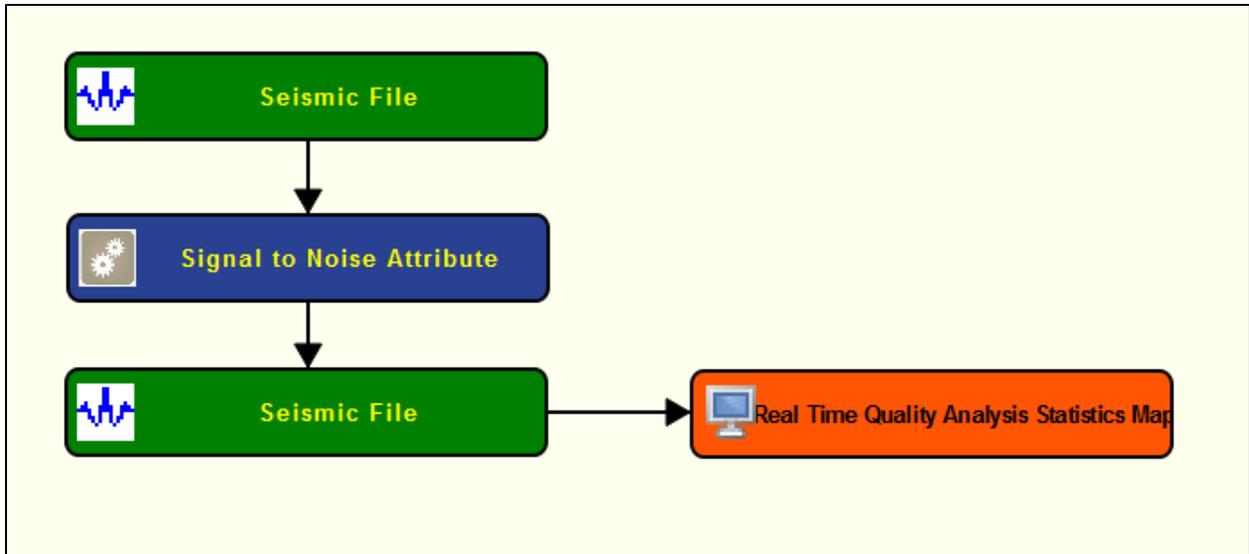
Output Links:

-

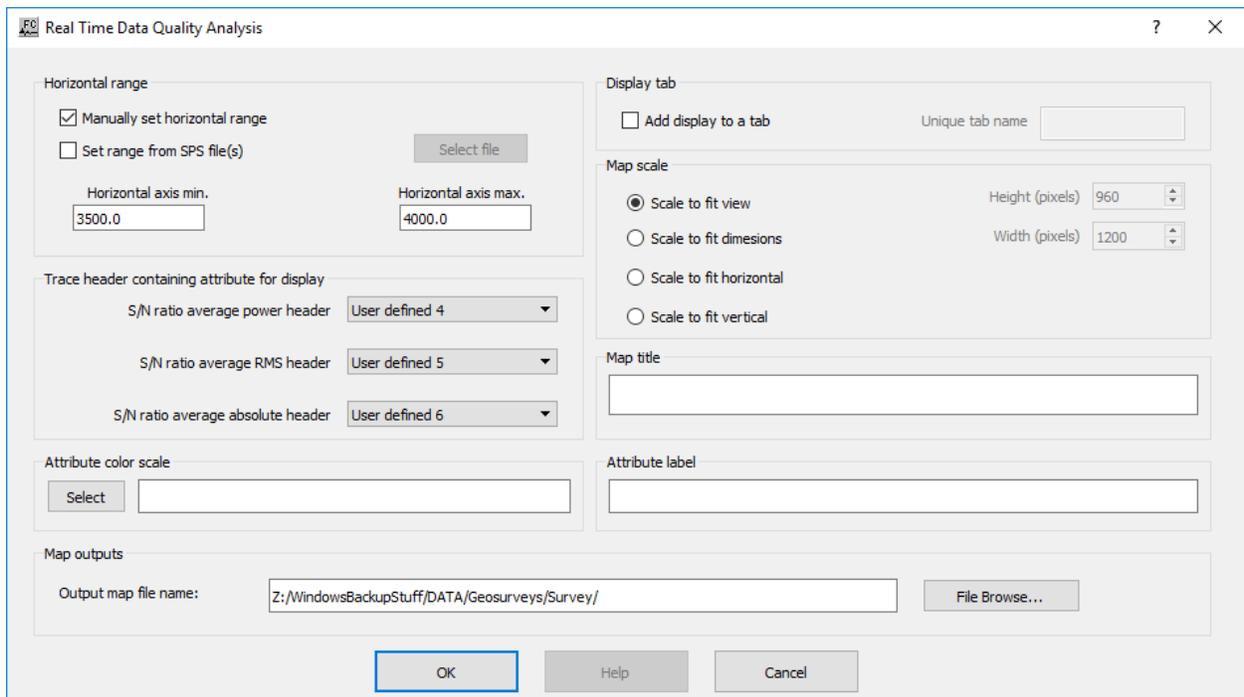
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Horizontal range: In the current version of this real time display, it is mandatory to define the horizontal range of the map either by using user-defined minimum and maximum values or by using an auxiliary SPS geometry file.

Manually set horizontal range — If checked, the minimum and maximum horizontal ranges are used-defined and set as specified under **Horizontal axis min.** and **Horizontal axis max.**. The maximum value for the horizontal coordinate will be automatically updated if the current horizontal trace header value is larger than what is pre-defined.

Set range from SPS file(s) — If checked, the minimum and maximum horizontal ranges are specified by an auxiliary SPS geometry file selected under browse button.

Horizontal axis min. — Enter minimum value of the horizontal coordinate to be displayed.

Horizontal axis max. — Enter maximum value of the horizontal coordinate to be displayed.

Trace header containing attribute for display: Select the trace header with the information to be colored in the real time map. With the *Signal to Noise Attribute* step, the user can select between the Signal-to-Noise ration computed with the average power, average RMS and average absolute.

S/N ratio average power header — Select the trace header where the corresponding type of S/N ratio was stored by the *Signal to Noise Attribute* step.

S/N ratio average RMS header — Select the trace header where the corresponding type of S/N ratio was stored by the *Signal to Noise Attribute* step.

S/N ratio average absolute power — Select the trace header where the corresponding type of S/N ratio was stored by the *Signal to Noise Attribute* step.

Attribute color scale — The map of the real time display is displayed with the color scale bar as defined using the select buttn. By default the information is plotted with the default color bar (rainbow).

Display tab: This real time display allows plotting simultaneously more than one map within the same tab view. This is a useful option to plot, for example, the value of the spectral semblance along with the dead/live flag.

Add display to a tab — If checked, the map is added to a display tab already open.

Unique tab name — Enter unique tab name where the map is going to be displayed.

Map scale: The real time map can be plotted using different types of display.

Scale to fit view — If selected, the map is automatically scaled to fit the current view.

Scale to fit dimensions — If selected, the map is automatically scaled to fit the dimensions defined by the user.

Height (in pixels) — Enter the height of the map in number of pixels.

Width (in pixels) — Enter the width of the map in number of pixels.

Scale to fit horizontal — If selected, the map is automatically scaled to fit the current view horizontally.

Scale to fit vertical — If selected, the map is automatically scaled to fit the current view horizontally.

Map title — Enter map title to be displayed in the display tab.

Attribute label — Enter attribute label.

Output map file name — Enter, or browse, the name of the file where the map is going to be saved. The map final map will be stored in a .baf format.

Real Time Quality Analysis Statistics Plot

Usage:

The *Real Time Quality Analysis Statistics Plot* step is a real time display that allows plotting the information generated by the *Signal to Noise Attribute* (under *Quality Analysis*). It generates a real time map like a linear where the S/N ratio can be plotted simultaneously for the three different signal-to-noise ratio estimates with the *Signal to Noise Attribute* with a statistical measurement of the *n*th previous records as defined in the **Number of records in moving window**.

Input Links:

- 1) Seismic file (mandatory). Normally this step is applied together with *Signal to Noise Attribute* for real time quality control.

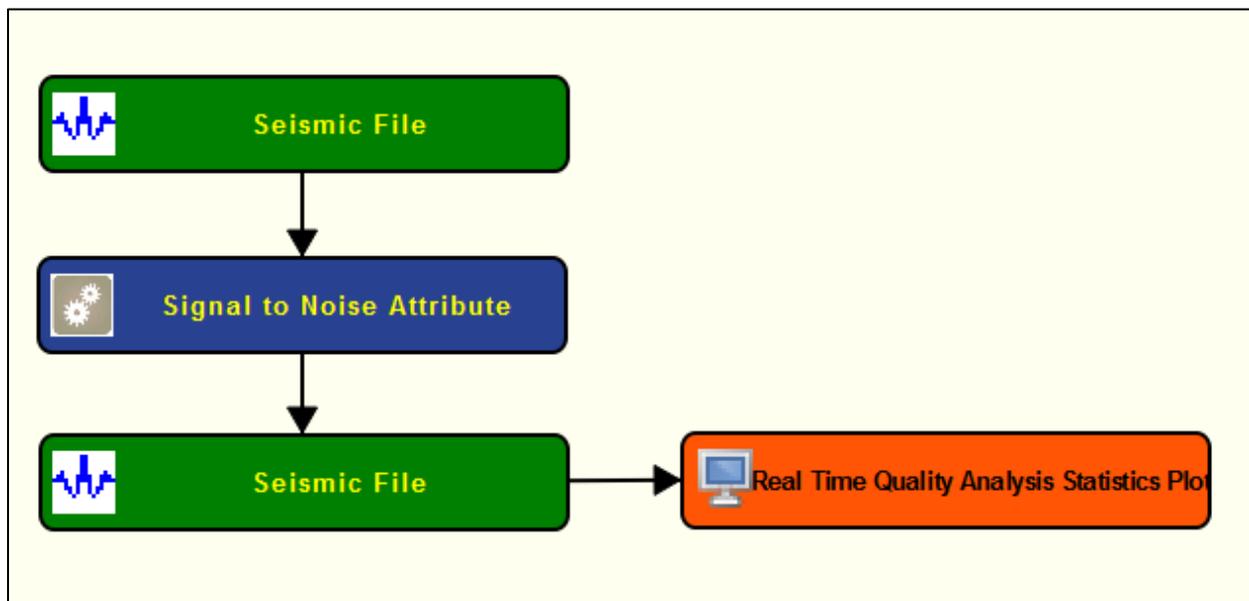
Output Links:

-

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Parameter Description:

Horizontal range: In the current version of this real time display, it is mandatory to define the horizontal range of the map either by using user-defined minimum and maximum values or by using an auxiliary SPS geometry file.

Manually set horizontal range — If checked, the minimum and maximum horizontal ranges are user-defined and set as specified under **Horizontal axis min.** and **Horizontal axis max.**. The maximum value for the horizontal coordinate will be automatically updated if the current horizontal trace header value is larger than what is pre-defined.

Set range from SPS file(s) — If checked, the minimum and maximum horizontal ranges are specified by an auxiliary SPS geometry file selected under browse button.

Horizontal axis min. — Enter minimum value of the horizontal coordinate to be displayed.

Horizontal axis max. — Enter maximum value of the horizontal coordinate to be displayed.

Trace header containing attribute for display: Select the trace header with the information to be colored in the real time map. With the *Signal to Noise Attribute* step, the user can select between the Signal-to-Noise ration computed with the average power, average RMS and average absolute.

S/N ratio average power header — Select the trace header where the corresponding type of S/N ratio was stored by the *Signal to Noise Attribute* step.

S/N ratio average RMS header — Select the trace header where the corresponding type of S/N ratio was stored by the *Signal to Noise Attribute* step.

S/N ratio average absolute power — Select the trace header where the corresponding type of S/N ratio was stored by the *Signal to Noise Attribute* step.

Attribute color scale — The map of the real time display is displayed with the color scale bar as defined using the select button. By default the information is plotted with the default color bar (rainbow).

Display tab: This real time display allows plotting simultaneously more than one map within the same tab view. This is a useful option to plot, for example, the value of the spectral semblance along with the dead/live flag.

Add display to a tab — If checked, the map is added to a display tab already open.

Unique tab name — Enter unique tab name where the map is going to be displayed.

Map scale: The real time map can be plotted using different types of display.

Plot statistics: This real time display allow plotting with the current signal to noise attribute along with the selected statistical measurement of the *nth* previous records as defined in the **Number of records in moving window**.

Plot average S/N ratio — If selected, plot the average S/N ratio of the *nth* previous records as defined in the **Number of records in moving window**.

Plot median S/N ratio — If selected, plot the median S/N ratio of the *nth* previous records as defined in the **Number of records in moving window**.

Plot mode S/N ratio — If selected, plot the mode S/N ratio of the *nth* previous records as defined in the **Number of records in moving window**.

Number of records in moving window — Enter the number of previous records in the calculation of the statistical measurement.

Scale to fit view — If selected, the map is automatically scaled to fit the current view.

Scale to fit dimensions — If selected, the map is automatically scaled to fit the dimensions defined by the user.

Height (in pixels) — Enter the height of the map in number of pixels.

Width (in pixels) — Enter the width of the map in number of pixels.

Scale to fit horizontal — If selected, the map is automatically scaled to fit the current view horizontally.

Scale to fit vertical — If selected, the map is automatically scaled to fit the current view horizontally.

Map title — Enter map title to be displayed in the display tab.

Attribute label — Enter attribute label.

Output map file name — Enter, or browse, the name of the file where the map is going to be saved. The map final map will be stored in a .baf format.

Real Time Receiver Attribute Map

Usage: The *Real Time Receiver Attribute Map* step builds a real time map of the locations of receivers colored by a given receiver attribute for each record. Often this step is used with *Amplitude Analysis* (under *Quality Analysis*).

Input Links:

- 1) Seismic file (mandatory). Normally this step is applied together with *Amplitude Analysis* for real time quality control.

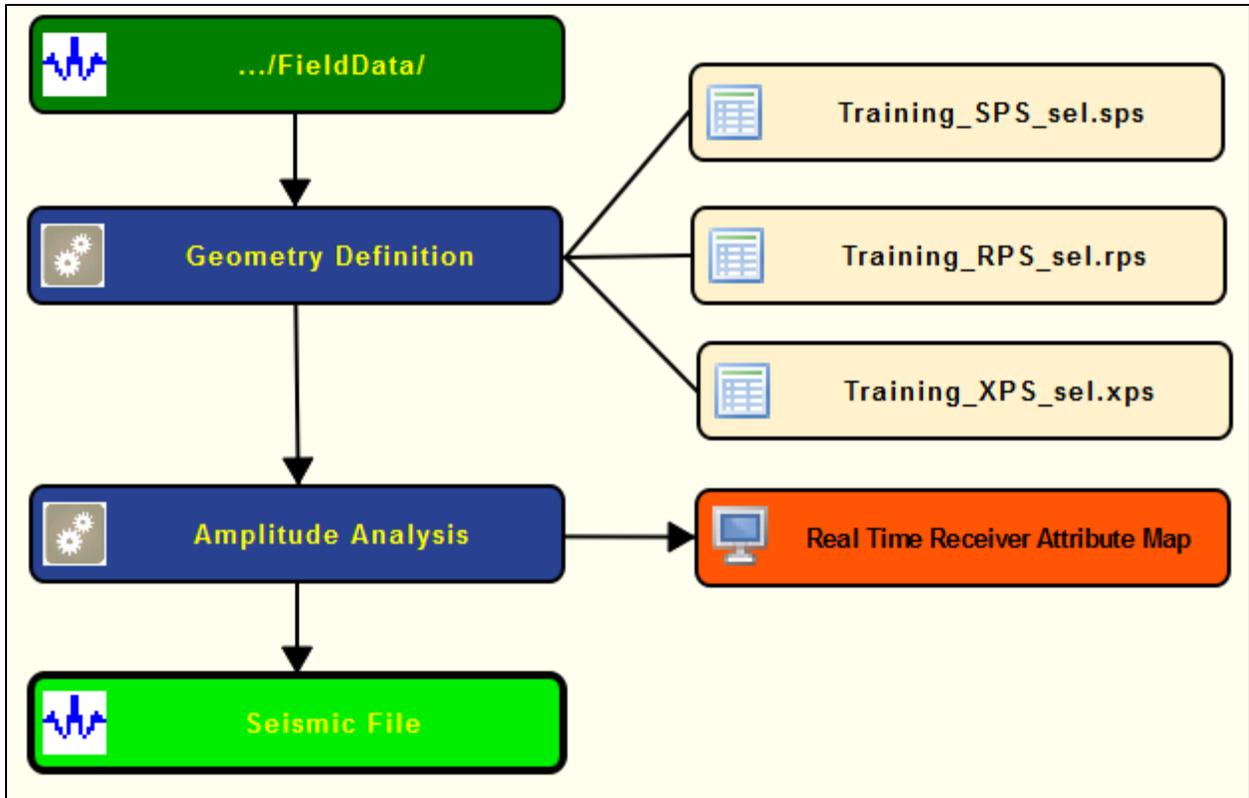
Output Links:

-

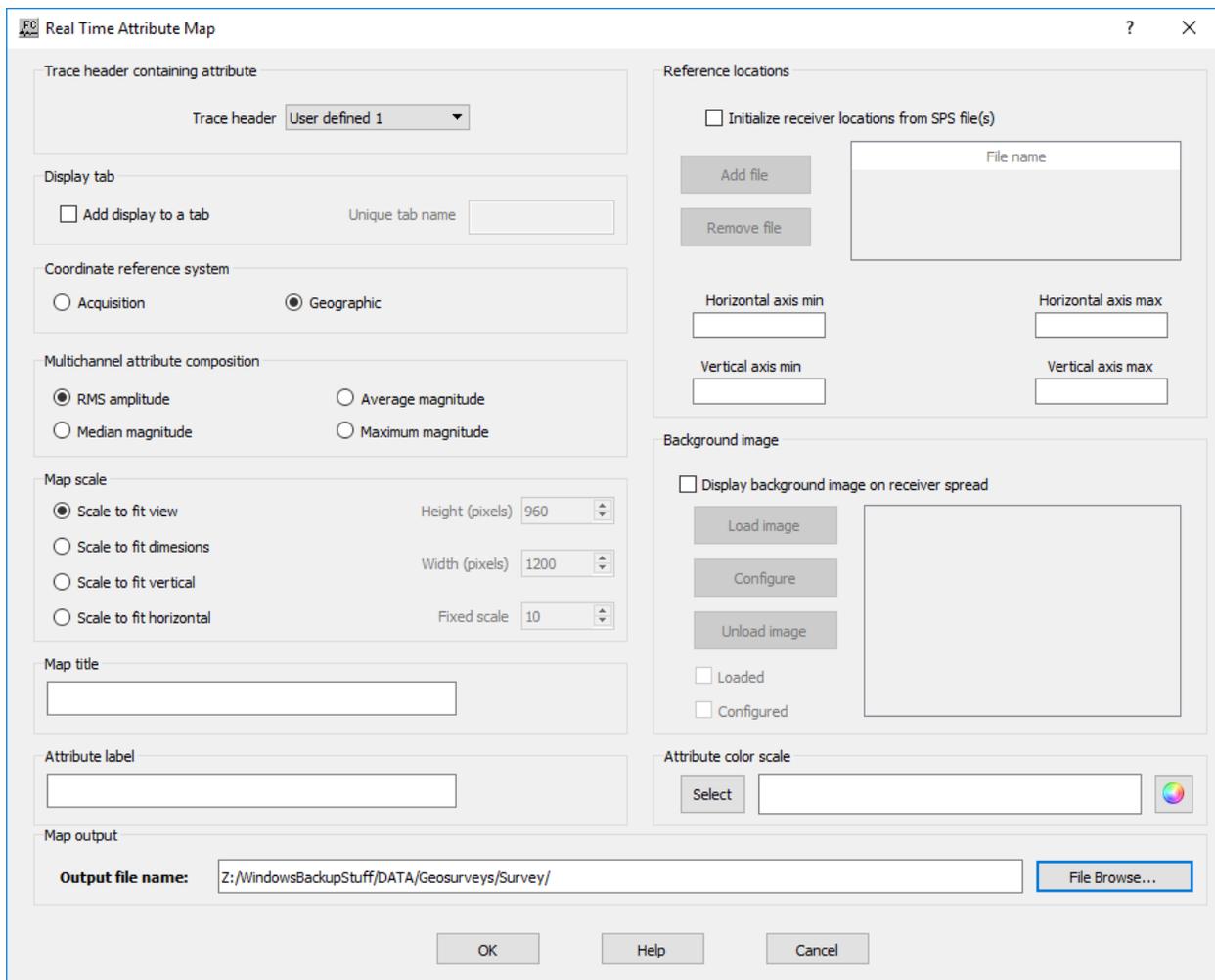
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Trace header containing attribute: It generates a real time map of receiver attribute using as horizontal axis the header value defined under the *Trace header*.

Trace header — Select trace header to be used as colored attribute for the real time map.

Display tab: This real time display allows plotting simultaneously more than one real time display within the same tab view. This is a useful option to plot different quality control displays.

Add display to a tab — If checked, the map is added to a display tab already open.

Unique tab name — Enter unique tab name where the map is going to be displayed.

Coordinate reference system: Defines the coordinate systems to be used for the real time map.

Acquisition — Use relative coordinates from the acquisition geometry.

Geographic — Use real world coordinates.

Multichannel attribute composition: this real time display allow plotting different attributes regarding the data received at each active channel group.

RMS amplitude — If selected, plots the RMS amplitude as defined in the *Amplitude Analysis* step.

Median magnitude — If selected, plots the RMS amplitude as defined in the *Amplitude Analysis* step.

Average magnitude — If selected, plots the RMS amplitude as defined in the *Amplitude Analysis* step.

Maximum magnitude — If selected, plots the RMS amplitude as defined in the *Amplitude Analysis* step.

Map scale: The real time map can be plotted using different types of scale.

Scale to fit view — If selected, the map is automatically scaled to fit the current view.

Scale to fit dimensions — If selected, the map is automatically scaled to fit the dimensions defined by the user.

Height (in pixels) — Enter the height of the map in number of pixels.

Width (in pixels) — Enter the width of the map in number of pixels.

Scale to fit horizontal — If selected, the map is automatically scaled to fit the current view horizontally.

Scale to fit vertical — If selected, the map is automatically scaled to fit the current view horizontally.

Map title — Enter map title to be displayed in the display tab.

Attribute label — Enter attribute label.

Reference locations: The real time map needs a reference spatial location in order to plot the location of each channel group. These reference locations are updated if during the survey the objects to be displayed are outside the pre-defined area.

Initialize receiver locations from SPS file(s) — If checked, the reference locations are loaded directly from a SPS geometry file. More than one SPS files may be used to define the reference locations.

Add file — Select to browse for a SPS file to be used as reference locations. The SPS file will automatically be scanned and added to the nearby box. The reference location may be defined with more than one file. In this case **Horizontal axis min**, **Horizontal axis max**, **Vertical axis min**, **Vertical axis max** are automatically filled in according to the SPS files.

Remove file — The SPS file highlighted in the nearby box is going to be removed and the reference locations updated accordingly.

Horizontal axis min — Enter minimum value of the horizontal coordinate to be displayed.

Horizontal axis max — Enter maximum value of the horizontal coordinate to be displayed.

Vertical axis min — Enter minimum value of the vertical coordinate to be displayed.

Vertical axis max — Enter maximum value of the vertical coordinate to be displayed.

Background image: The real time map may use a background image with cultural data.

Display background image on receiver spread — If checked the real time map uses a background image of the area.

Load image — Select to browse for the image file to be used as background image. The image file is automatically loaded and added to the box nearby.

Configure — Select to configure the coordinates of the background image.

Unload image — Select if you want to unload the background image from the real time map.

Loaded — Automatically checked if the background image was loaded successfully.

Configured — Automatically checked if the background images was configure successfully.

Attribute Color scale — The map of the real time display is displayed with the color scale bar as defined using the select buttn. By default the information is plotted with the default color bar (rainbow).

Map Output file name — Enter, or browse, the name of the file where the map is going to be saved. The map final map will be stored in a .baf format.

Real Time Receiver Spread

Usage: The *Real Time Receiver Spread* processing step is a real time map that allows plotting the location of each channel group color coded by an acceptance criterion (green if true, red if false) based on a trace header key. This real time map is normally used to plot active and dead receiver locations.

Input Links:

- 1) Seismic file (mandatory).

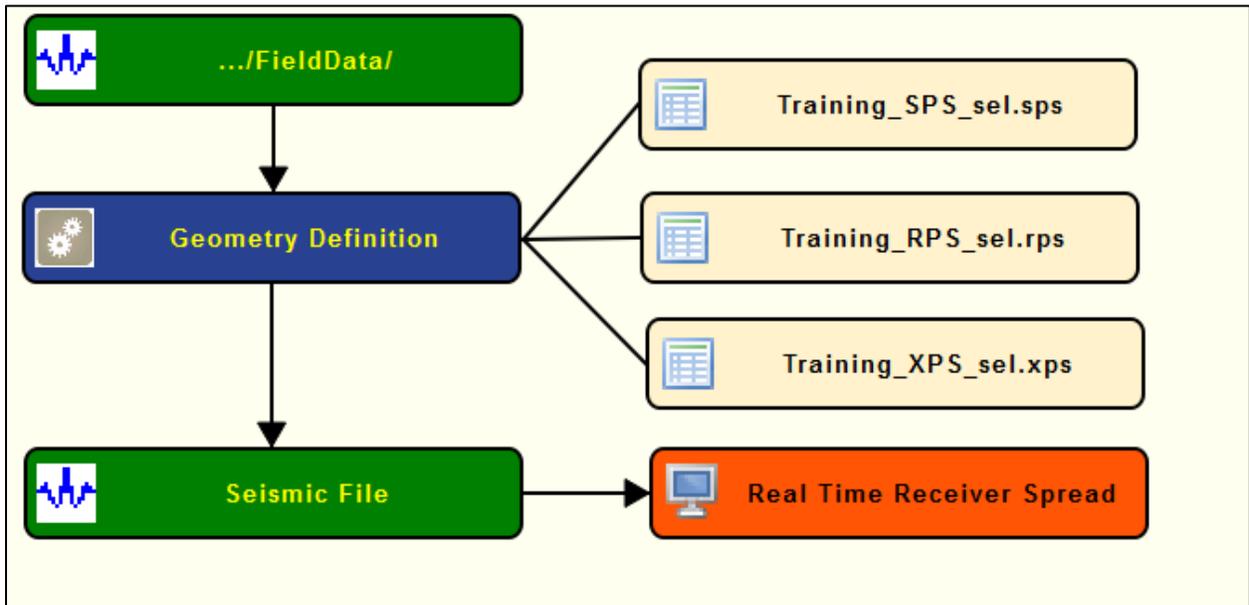
Output Links:

-

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Parameter Description:

Trace header to monitor containing receiver status: Defines the trace header where the receiver status is being stored.

Monitor header — Select trace header to be used as monitor header.

Display tab: This real time display allows plotting simultaneously more than one real time display within the same tab view. This is a useful option to plot different quality control displays.

Add display to a tab — If checked, the map is added to a display tab already open.

Unique tab name — Enter unique tab name where the map is going to be displayed.

Receiver acceptance criteria: Select the logical operator that you want to use as acceptance criteria. This logical operator is going to be applied to the selected monitor header.

Monitor header — Select trace header key to monitor. Enter the value for the acceptance criteria.

Coordinate reference system: Defines the coordinate systems to be used for the real time map.

Acquisition — Use relative coordinates from the acquisition geometry.

Geographic — Use real world coordinates.

Map scale: The real time map can be plotted using different types of scale.

Scale to fit view — If selected, the map is automatically scaled to fit the current view.

Scale to fit dimensions — If selected, the map is automatically scaled to fit the dimensions defined by the user.

Height (in pixels) — Enter the height of the map in number of pixels.

Width (in pixels) — Enter the width of the map in number of pixels.

Scale to fit horizontal — If selected, the map is automatically scaled to fit the current view horizontally.

Scale to fit vertical — If selected, the map is automatically scaled to fit the current view vertically.

Map title — Enter map title to be displayed in the display tab.

Reference locations: The real time map needs a reference spatial location in order to plot the location of each channel group. These reference locations are updated if during the survey the objects to be displayed are outside the pre-defined area.

Initialize receiver locations from SPS file(s) — If checked, the reference locations are loaded directly from a SPS geometry file. More than one SPS files may be used to define the reference locations.

Add file — Select to browse for a SPS file to be used as reference locations. The SPS file will automatically be scanned and added to the nearby box. The reference location may be defined with more than one file. In this case **Horizontal axis min**, **Horizontal axis max**, **Vertical axis min**, **Vertical axis max** are automatically filled in according to the SPS files.

Remove file — The SPS file highlighted in the nearby box is going to be removed and the reference locations updated accordingly.

Horizontal axis min — Enter minimum value of the horizontal coordinate to be displayed.

Horizontal axis max — Enter maximum value of the horizontal coordinate to be displayed.

Vertical axis min — Enter minimum value of the vertical coordinate to be displayed.

Vertical axis max — Enter maximum value of the vertical coordinate to be displayed.

Display background image on receiver spread — If checked the real time map uses a background image of the area.

Load image — Select to browse for the image file to be used as background image. The image file is automatically loaded and added to the box nearby.

Configure — Select to configure the coordinates of the background image.

Unload image — Select if you want to unload the background image from the real time map.

Loaded — Automatically checked if the background image was loaded successfully.

Configured — Automatically checked if the background images was configure successfully.

Attribute label — Enter attribute label.

Attribute Color scale — The map of the real time display is displayed with the color scale bar as defined using the select buttn. By default the information is plotted with the default color bar (rainbow).

Map Output file name — Enter, or browse, the name of the file where the map is going to be saved. The map final map will be stored in a .baf format.

Real Time Seismic Display

Usage:

The *Real Time Seismic Display* step is used to display seismic records during the processing flow. It also can output image files and automatically ftp these image files to a server on an active internet connection.

Input Links:

1) Seismic data in any sort order (mandatory).

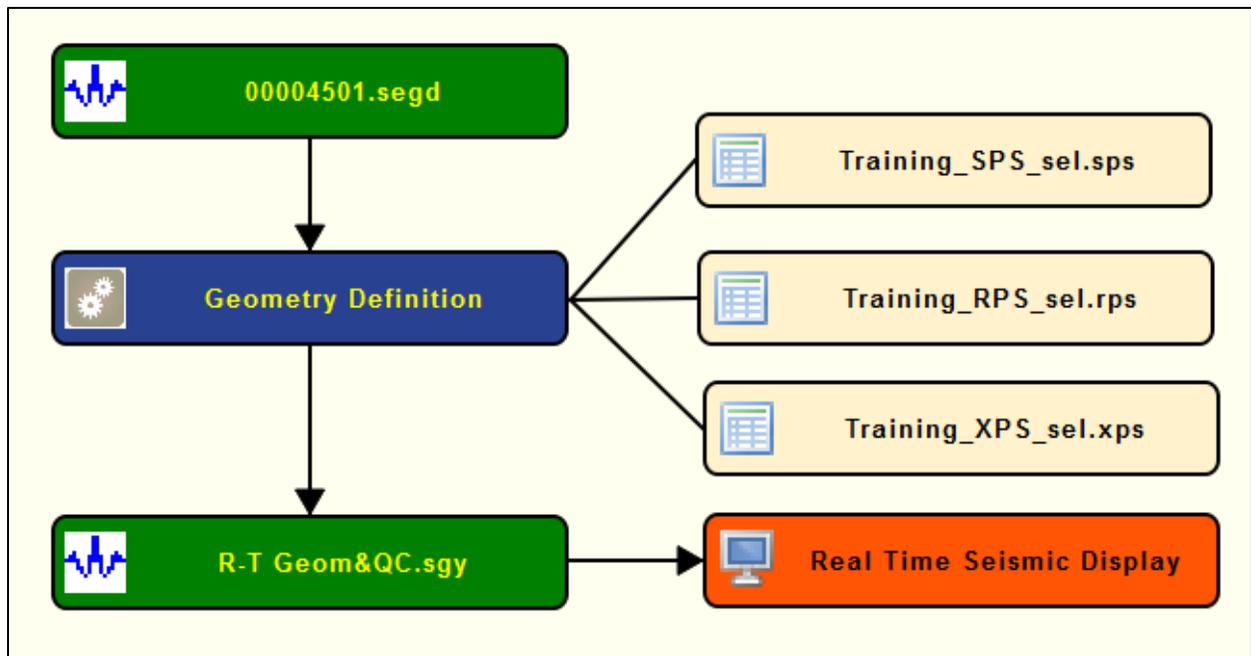
Output Links:

-

Reference:

-

Example Flowchart:



Step Parameter Dialog:

The screenshot shows the 'Real Time Seismic Display' dialog box with the following settings:

- Display increment:** Record increment between displays: 1.
 - Also display all records killed during processing
 - Only display records killed during processing
 - Mark dead traces
- Display tab:**
 - Add display to a tab. Unique tab name: []
- Image output:**
 - Output image files. Send via ftp.
 - Image format: JPG. Image increment: 1.
 - Image quality: Medium. Output colorbar: No.
- Display parameters:**
 - Trace display type: Variable area wiggle
 - Trace polarity: Normal
 - Orientation: Right-to-left
 - Horizontal scale: 24.0. Horizontal units: Traces/in
 - Vertical scale: 4.0. Vertical units: In/sec
 - Display gain: 0.0. Amplitude type: True
 - Trace excursion: 2.0. Window (ms): 1000.00
- Real time options:**
 - Plot signal and noise windows.
 - Select signal polygon: [] File Browse...
 - Select noise polygon: [] File Browse...
- Display title:** []
- Display color scale:** Select [] [Color wheel icon]

Buttons at the bottom: OK, Help, Cancel.

Parameter descriptions:

Display increment: This real time display plots the input seismic data along with either killed records during the processing selecting, using a given increment between records, or the records killed by the processing.

Record increment between displays — Enter the increment between records to be plotted in the real time display. If **Only display records killed during processing** is selected this option is disabled.

Also display records killed during processing — If checked, plot with the input seismic file the records killed during the processing.

Only display records killed during processing — If checked, plot only records that have been killed by the processing.

Mark dead traces — If checked, plot dead traces in red.

Display tab: This real time display allows plotting simultaneously more than one map within the same tab view. This is a useful option to plot, for example, the value of the spectral semblance along with the dead/live flag.

Add display to a tab — If checked, the map is added to a display tab already open.

Unique tab name — Enter unique tab name where the map is going to be displayed.

Image output: Each plot of the real time display may be stored in an image file.

Output image files — If checked, the display of the real time display is stored in an image file.

Send via ftp — If checked, the image output is send directly via FTP.

Image format — Select the image format. The image may be stored in BMP, JPG or PNG.

Image quality — Select the quality of the output image. The output image may be saved with Low, Medium or High quality.

Image increment — Select, from 1 to 10, the increment between records that is going to be used to save the image.

Output colorbar — Select if the colorbar is saved within the image.

Real time options: A noise and/or signal window, represented by a rectangle, may be plotted overlaying the current seismic record.

Plot signal and noise windows — If checked plot overlaying the real time seismic display a polygon representing signal and noise windows. Signal window is plotted in green while noise window is plotted in red.

Select signal polygon — Enter signal polygon card file location.

Select noise polygon — Enter noise polygon card file location.

Display paramters: Define the parameters related with the real time of the near offset trace.

Trace display type — Select the type of the seismic display. The user can select between **Variable area wiggle** or **Variable density**.

Trace polarity — Select the type of polarity for the seismic display. The user can selecte between **Normal** or **Reverse**.

Orientation — Select the orientation of the seismic display. The user can selecte between **Right-to-left** or **Left-to-right**.

Horizontal scale — Enter the horizontal scale for the seismic display, with the units as specified in **Horizontal Units**.

Vertical scale — Enter the vertical scale for the seismic display, with the units as specified in **Vertical Units**.

Display gain — Enter the display gain of the seismic display.

Trace excursion — Enter the trace excursion gain of the seismic display

Horizontal units — Select the horizontal units to be used for the **Horizontal scale**. Units can be defined in Traces per inch or Traces per cm.

Vertical units — Select the horizontal units to be used for the **Vertical scale**. Units can be defined in inch per second or centimeter per second.

Amplitude type — Select the amplitude type for the seismic display. The near offset record may be displayed in **True amplitude**, **Relative amplitude** or **Gain control** with a window size defined in **Window**.

Window (ms) — Enter the window size in ms for **Gain control**.

Display title — Enter display title to be displayed in the display tab.

Display color scale — Select color scale bar for the display.

Real Time Source Attribute Map

Usage:

The *Real Time Source Attribute Map* step is used to display maps of source attributes (amplitudes, frequency attributes) during the processing flow.

Input Links:

1) Seismic data in any sort order (mandatory).

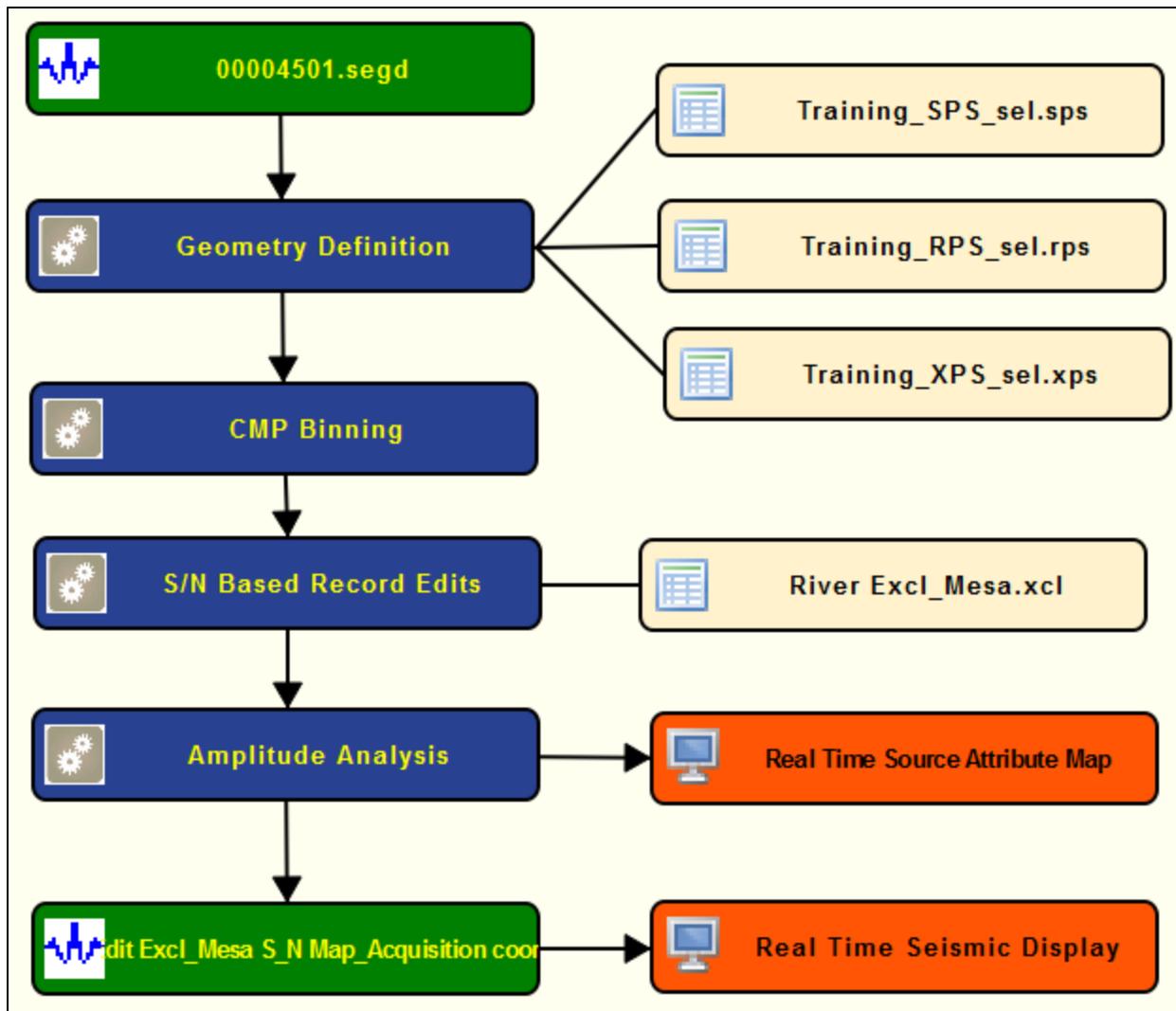
Output Links:

-

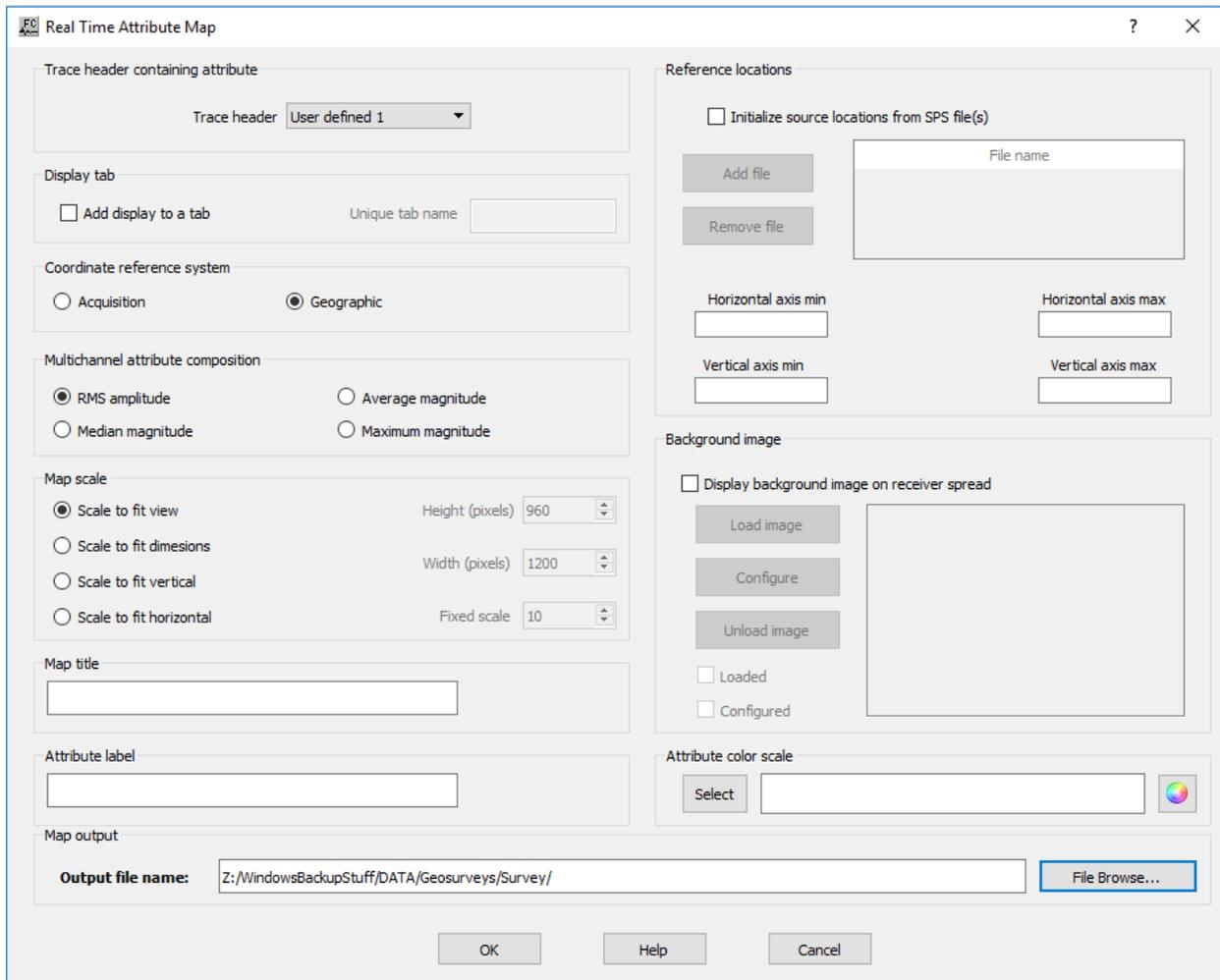
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter descriptions:

Trace header containing attribute: It generates a real time map of source attribute using as horizontal axis the header value defined under the *Trace header*.

Trace header — Select trace header to be used as colored attribute for the real time map.

Display tab: This real time display allows plotting simultaneously more than one real time display within the same tab view. This is a useful option to plot different quality control displays.

Add display to a tab — If checked, the map is added to a display tab already open.

Unique tab name — Enter unique tab name where the map is going to be displayed.

Coordinate reference system: Defines the coordinate systems to be used for the real time map.

Acquisition — Use relative coordinates from the acquisition geometry.

Geographic — Use real world coordinates.

Multichannel attribute composition: this real time display allow plotting different attributes regarding the data received at each active channel group.

RMS amplitude — If selected, plots the RMS amplitude as defined in the *Amplitude Analysis* step.

Median magnitude — If selected, plots the RMS amplitude as defined in the *Amplitude Analysis* step.

Average magnitude — If selected, plots the RMS amplitude as defined in the *Amplitude Analysis* step.

Maximum magnitude — If selected, plots the RMS amplitude as defined in the *Amplitude Analysis* step.

Map scale: The real time map can be plotted using different types of scale.

Scale to fit view — If selected, the map is automatically scaled to fit the current view.

Scale to fit dimensions — If selected, the map is automatically scaled to fit the dimensions defined by the user.

Height (in pixels) — Enter the height of the map in number of pixels.

Width (in pixels) — Enter the width of the map in number of pixels.

Scale to fit horizontal — If selected, the map is automatically scaled to fit the current view horizontally.

Scale to fit vertical — If selected, the map is automatically scaled to fit the current view horizontally.

Map title — Enter map title to be displayed in the display tab.

Attribute label — Enter attribute label.

Reference locations: The real time map needs a reference spatial location in order to plot the location of each channel group. These reference locations are updated if during the survey the objects to be displayed are outside the pre-defined area.

Initialize receiver locations from SPS file(s) — If checked, the reference locations are loaded directly from a SPS geometry file. More than one SPS files may be used to define the reference locations.

Add file — Select to browse for a SPS file to be used as reference locations. The SPS file will automatically be scanned and added to the nearby box. The reference location may be defined with more than one file. In this case **Horizontal axis min**, **Horizontal axis max**, **Vertical axis min**, **Vertical axis max** are automatically filled in according to the SPS files.

Remove file — The SPS file highlighted in the nearby box is going to be removed and the reference locations updated accordingly.

Horizontal axis min — Enter minimum value of the horizontal coordinate to be displayed.

Horizontal axis max — Enter maximum value of the horizontal coordinate to be displayed.

Vertical axis min — Enter minimum value of the vertical coordinate to be displayed.

Vertical axis max — Enter maximum value of the vertical coordinate to be displayed.

Background image: The real time map may use a background image with cultural data.

Display background image on receiver spread — If checked the real time map uses a background image of the area.

Load image — Select to browse for the image file to be used as background image. The image file is automatically loaded and added to the box nearby.

Configure — Select to configure the coordinates of the background image.

Unload image — Select if you want to unload the background image from the real time map.

Loaded — Automatically checked if the background image was loaded successfully.

Configured — Automatically checked if the background images was configure successfully.

Attribute Color scale — The map of the real time display is displayed with the color scale bar as defined using the select butt. By default the information is plotted with the default color bar (rainbow).

Map Output file name — Enter, or browse, the name of the file where the map is going to be saved. The map final map will be stored in a .baf format.

Real Time Stack Display

Usage: The *Real Time Stack Display* step generates a real time stack built from an input seismic file after being corrected for the Normal Moveout effect with *Apply Normal Moveout* step. The *Real Time Stack Display* step must have the option *Display in real time* checked (figure below).

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Real time CMP stack (mandatory).

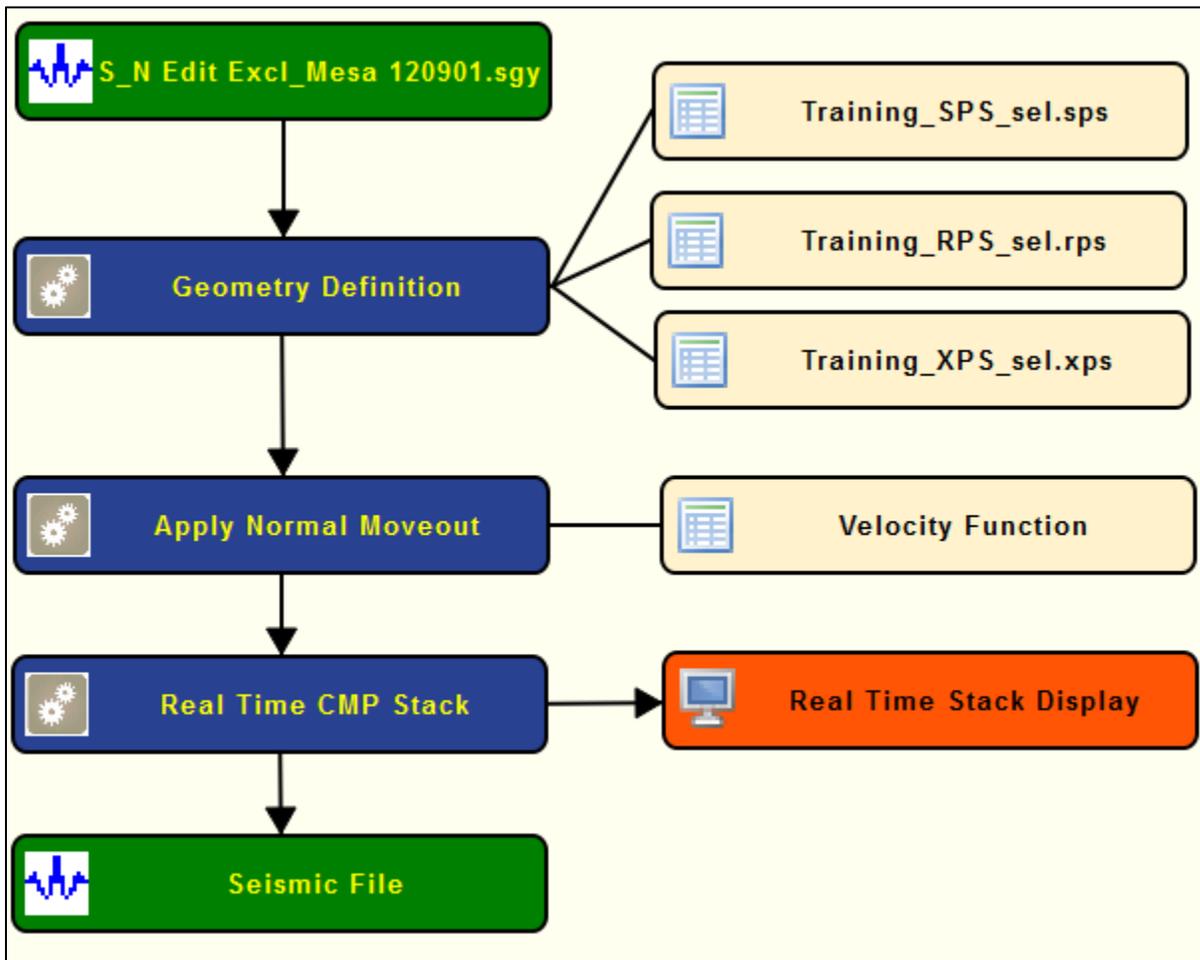
Output Links:

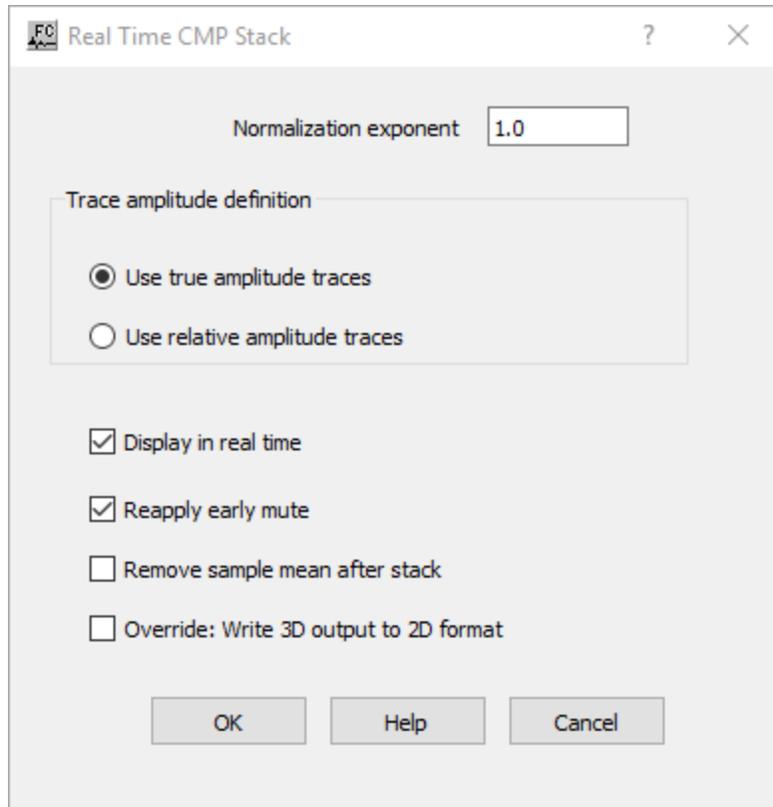
- 1) Seismic data in any sort order (mandatory).

Reference:

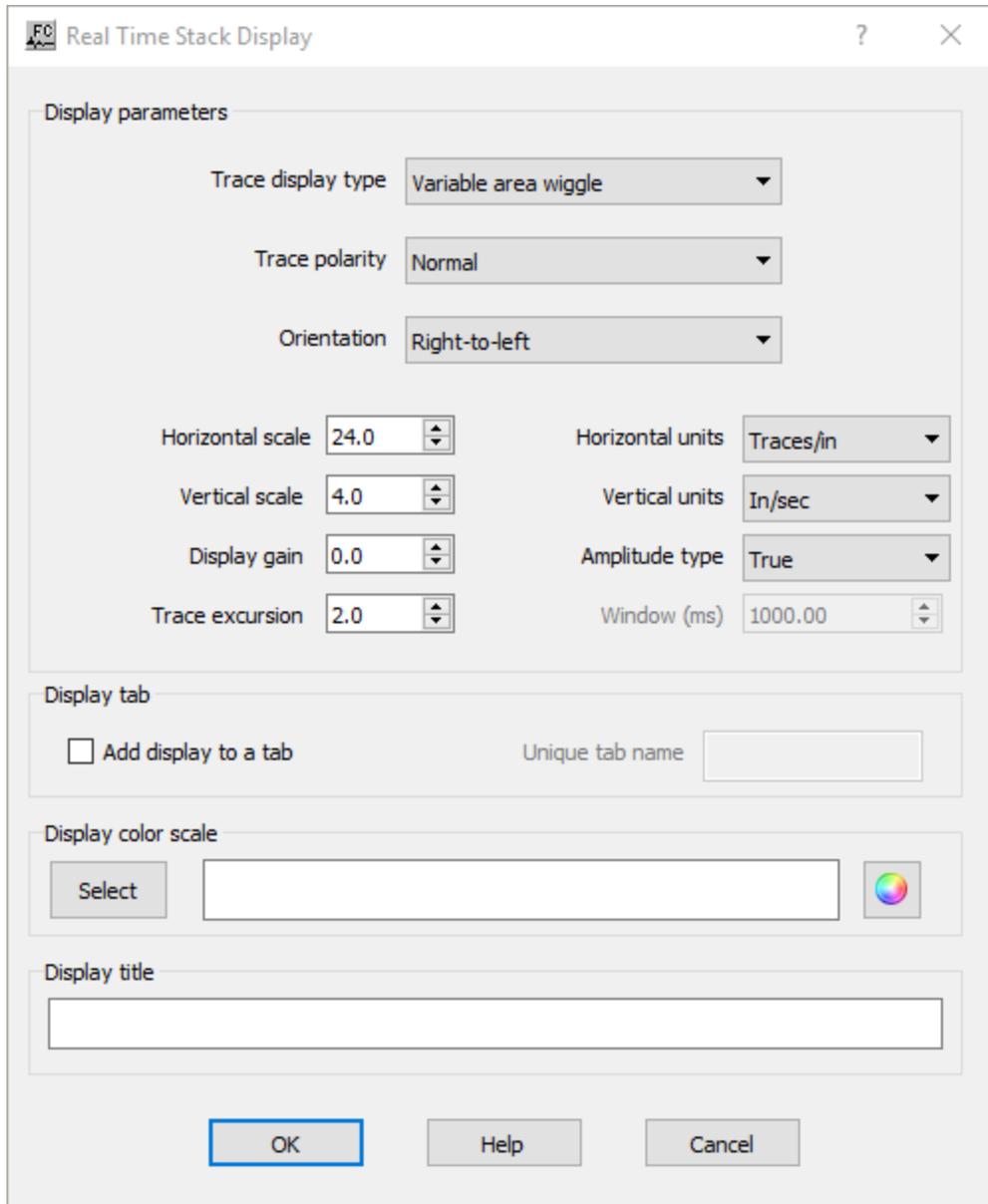
-

Example Flowchart:





Step Parameter Dialog:



Parameter Description:

Trace display type — Select the type of the seismic display. The user can select between **Variable area wiggle** or **Variable density**.

Trace polarity — Select the type of polarity for the seismic display. The user can select between **Normal** or **Reverse**.

Orientation — Select the orientation of the seismic display. The user can select between **Right-to-left** or **Left-to-right**.

Horizontal scale — Enter the horizontal scale for the seismic display, with the units as specified in **Horizontal Units**.

Vertical scale — Enter the vertical scale for the seismic display, with the units as specified in **Vertical Units**.

Display gain — Enter the display gain of the seismic display.

Trace excursion — Enter the trace excursion gain of the seismic display

Horizontal units — Select the horizontal units to be used for the **Horizontal scale**. Units can be defined in Traces per inch or Traces per cm.

Vertical units — Select the horizontal units to be used for the **Vertical scale**. Units can be defined in inch per second or centimeter per second.

Amplitude type — Select the amplitude type for the seismic display. The near offset record may be displayed in **True amplitude**, **Relative amplitude** or **Gain control** with a window size defined in **Window**.

Window (ms) — Enter the window size in ms for **Gain control**.

Display title — Enter display title to be displayed in the display tab.

Display color scale — Select color scale bar for the display.

Real Time Trace Header Map

Usage: The *Real Time Trace Header Map* step creates a real time map with the trace location colored by an user-defined attribute as stored in a given trace header.

Input Links:

- 1) Seismic data in any sort order (mandatory).

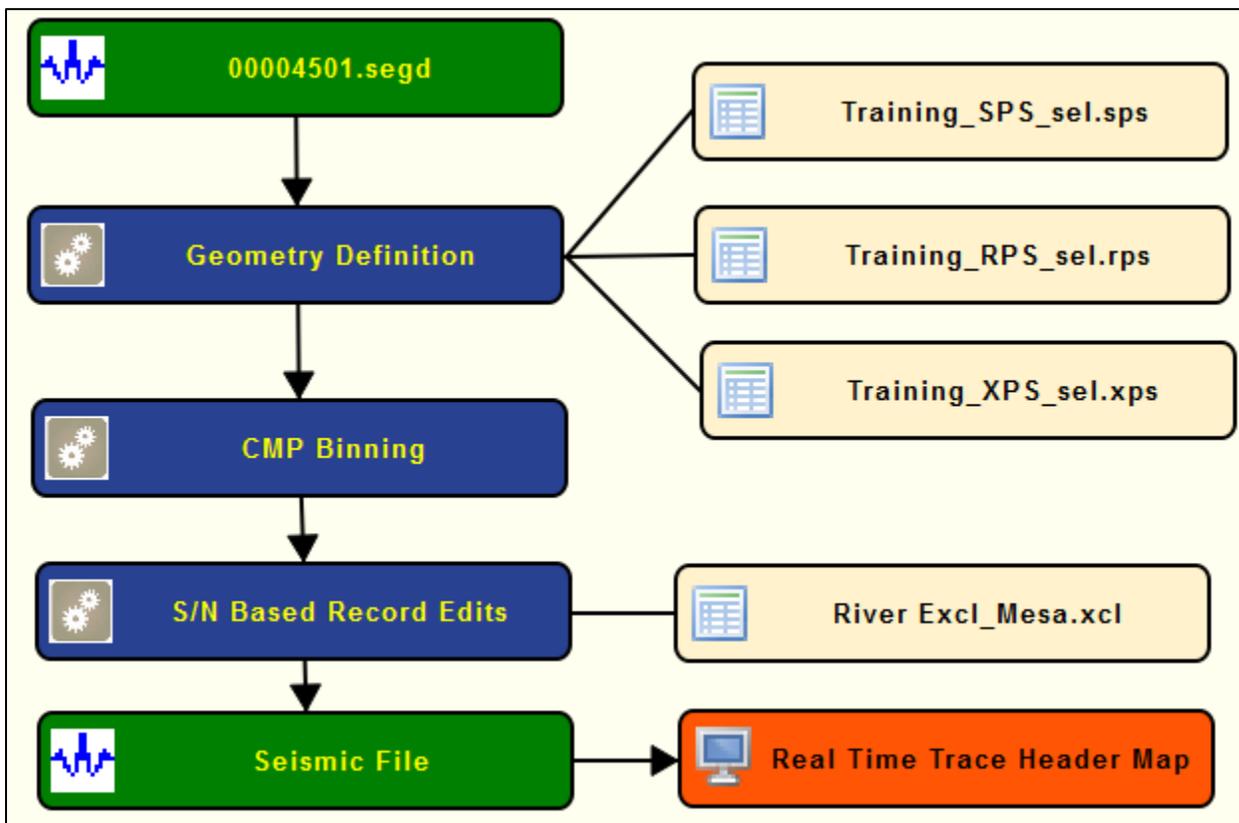
Output Links:

-

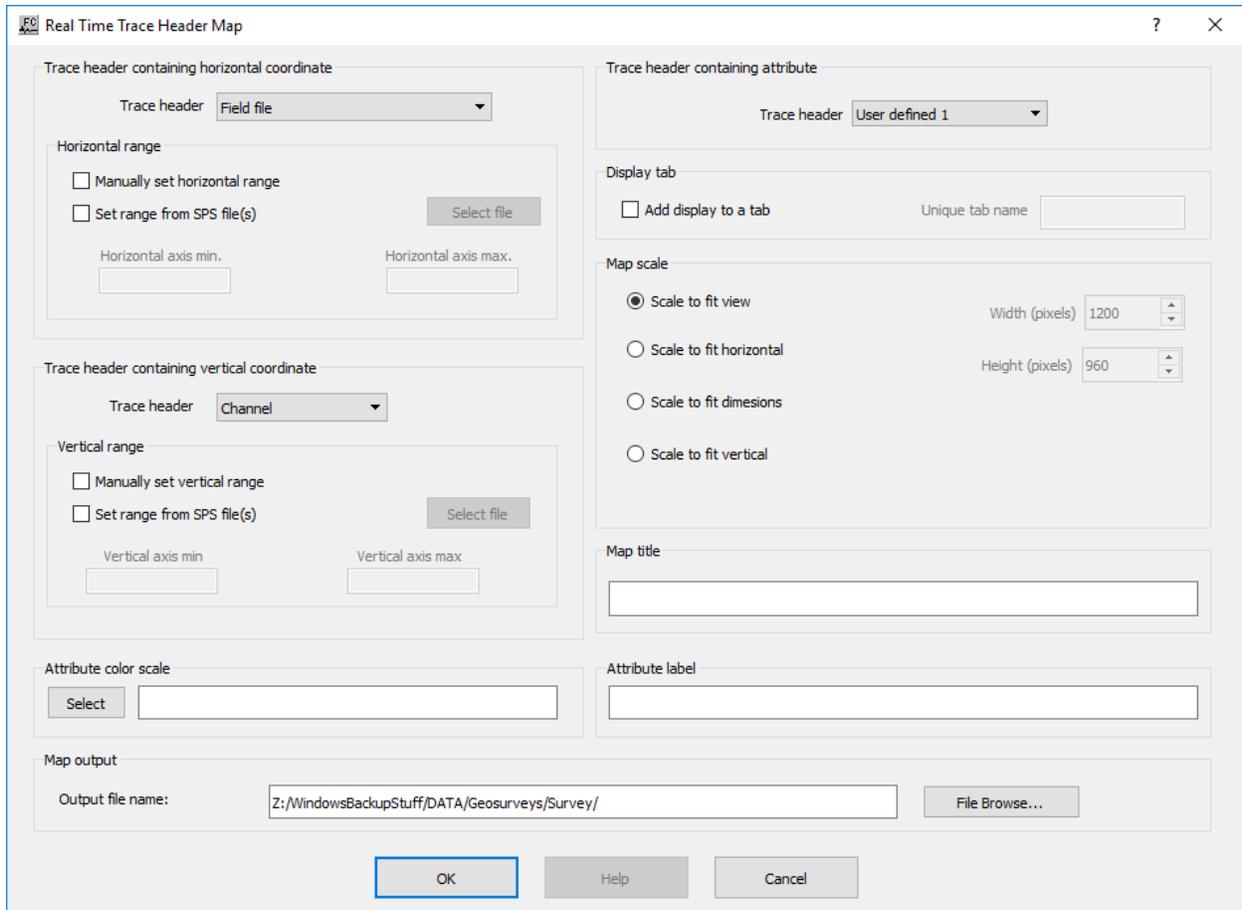
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Trace header — Select trace header to be used as horizontal axis for the real time map.

Horizontal range: In the current version of this real time display, it is mandatory to define the horizontal range of the map either by using user-defined minimum and maximum values or by using an auxiliary SPS geometry file.

Manually set horizontal range — If checked, the minimum and maximum horizontal ranges are user-defined and set as specified under **Horizontal axis min.** and **Horizontal axis max.**. The maximum value for the horizontal coordinate will be automatically updated if the current horizontal trace header value is larger than what is pre-defined.

Set range from SPS file(s) — If checked, the minimum and maximum horizontal ranges are specified by an auxiliary SPS geometry file selected under browse button.

Horizontal axis min. — Enter minimum value of the horizontal coordinate to be displayed.

Horizontal axis max. — Enter maximum value of the horizontal coordinate to be displayed.

Trace header containing vertical coordinate: It generates a real time map using as vertical axis the header value defined under the *Trace header*.

Trace header — Select trace header to be used as horizontal axis for the real time map.

Vertical range: In the current version of this real time display, it is mandatory to define the vertical range of the map either by using user-defined minimum and maximum values or by using an auxiliary SPS geometry file. The maximum value for the vertical coordinate will be automatically updated if the current horizontal trace header value is larger than what is pre-defined.

Manually set vertical range — If checked, the minimum and maximum horizontal ranges are used-defined and set as specified under **Vertical axis min.** and **Vertical axis max..**

Set range from SPS file(s) — If checked, the minimum and maximum horizontal ranges are specified by an auxiliary SPS geometry file selected under browse button.

Vertical axis min. — Enter minimum value of the vertical coordinate to be displayed.

Vertical axis max. — Enter maximum value of the vertical coordinate to be displayed.

Attribute color scale — The map of the real time display is displayed with the color scale bar as defined using the select buttn. By default the information is plotted with the default color bar (rainbow).

Trace header containing attribute for display: Select the trace header with the information to be colored in the real time map. With the *Spectral Comparison* step, we can select either the spectral semblance value of the dead/live flag.

Trace header — Select the trace header to be used to color the real time map.

Display tab: This real time display allows plotting simultaneously more than one map within the same tab view. This is a useful option to plot, for example, the value of the spectral semblance along with the dead/live flag.

Add display to a tab — If checked, the map is added to a display tab already open.

Unique tab name — Enter unique tab name where the map is going to be displayed.

Map scale: The real time map can be plotted using different types of scale.

Scale to fit view — If selected, the map is automatically scaled to fit the current view.

Scale to fit dimensions — If selected, the map is automatically scaled to fit the dimensions defined by the user.

Height (in pixels) — Enter the height of the map in number of pixels.

Width (in pixels) — Enter the width of the map in number of pixels.

Scale to fit horizontal — If selected, the map is automatically scaled to fit the current view horizontally.

Scale to fit vertical — If selected, the map is automatically scaled to fit the current view horizontally.

Map title — Enter map title to be displayed in the display tab.

Attribute label — Enter attribute label.

Output map file name — Enter, or browse, the name of the file where the map is going to be saved. The map final map will be stored in a .baf format.

Time Slices

Usage:

Time Slices is a process used for either display of selected time slices as a display option, or as a tool to convert the data into a form suitable for specific processing.

Input Links:

1) Seismic data in sorted by CMP Line (record key) and CMP Location (mandatory).

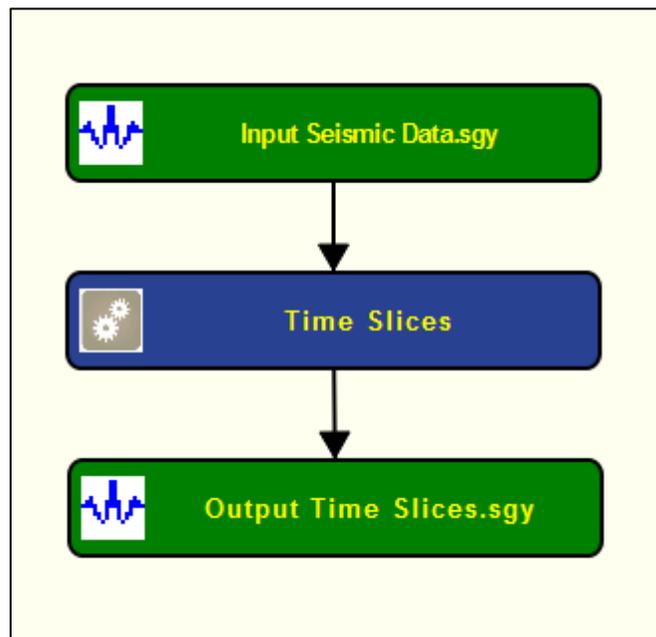
Output Links:

1) Seismic data sorted by Slice Number and CMP Line (mandatory).

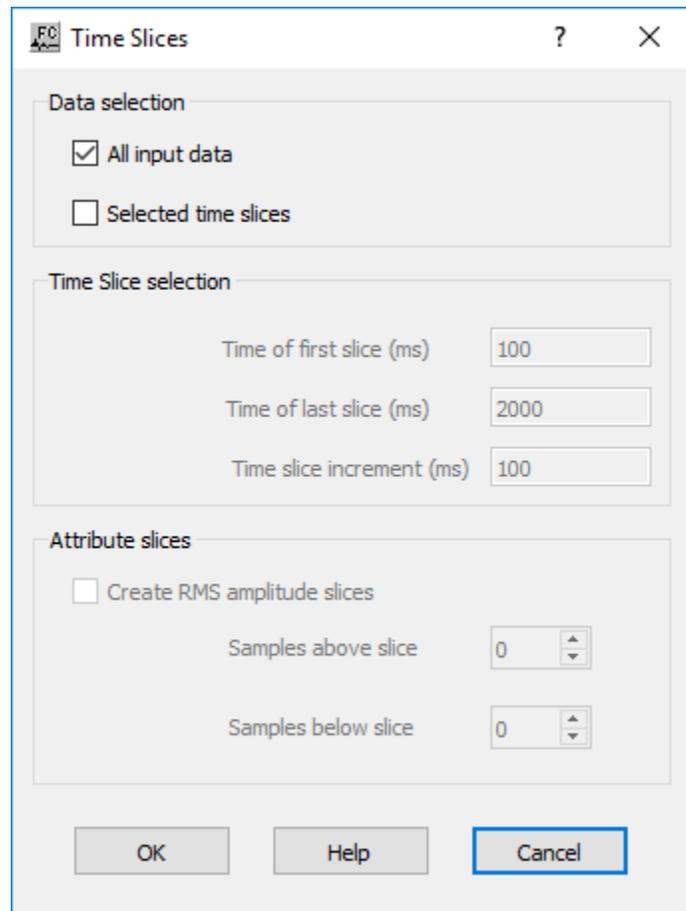
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

All input data — If checked, time slices will be made from all of the data. This is likely to be the most suitable option for further processing of the data.

Selected time slices — If checked, those time slices specified by the following parameter values will be output. This is likely to be the best data display option.

Time of first slice (ms) — The first slice output will be drawn from the data samples at the specified time.

Time of last slice (ms) — The last slice output will be drawn from the data samples at the specified time.

Time slice increment (ms) — Time slices will be output with the specified time increment (to the nearest sample)..

Create RMS amplitude slices — If checked, each output time slice sample value will be the root mean square value of all the specified samples above and below the that sample.

Samples above slice — The number of samples above each output slice sample that will be used to calculate the RMS amplitude.

Samples below slice — The number of samples below each output slice sample that will be used to calculate the RMS amplitude.

Time Slices to Traces

Usage:

Time Slices to Traces is a process used to convert time slices required for some specific processes such as *PSPI Migration* and *Footprint Filter* back into the standard time trace domain data.

Input Links:

- 1) Seismic data in sorted by CMP Line (record key) and Slice Number (mandatory).
- 2) 'Original' seismic data CMP Line (record key) and CMP Location (3D) or CMP (2D) (optional).

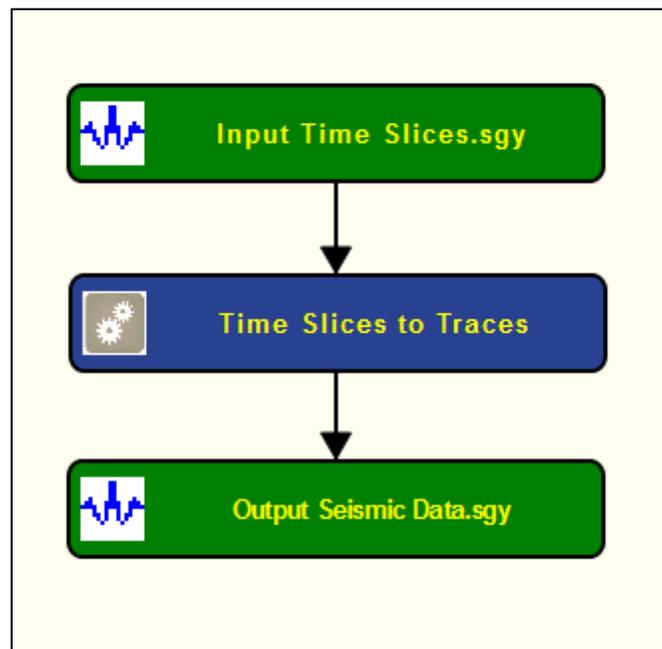
Output Links:

- 1) Seismic data (mandatory).

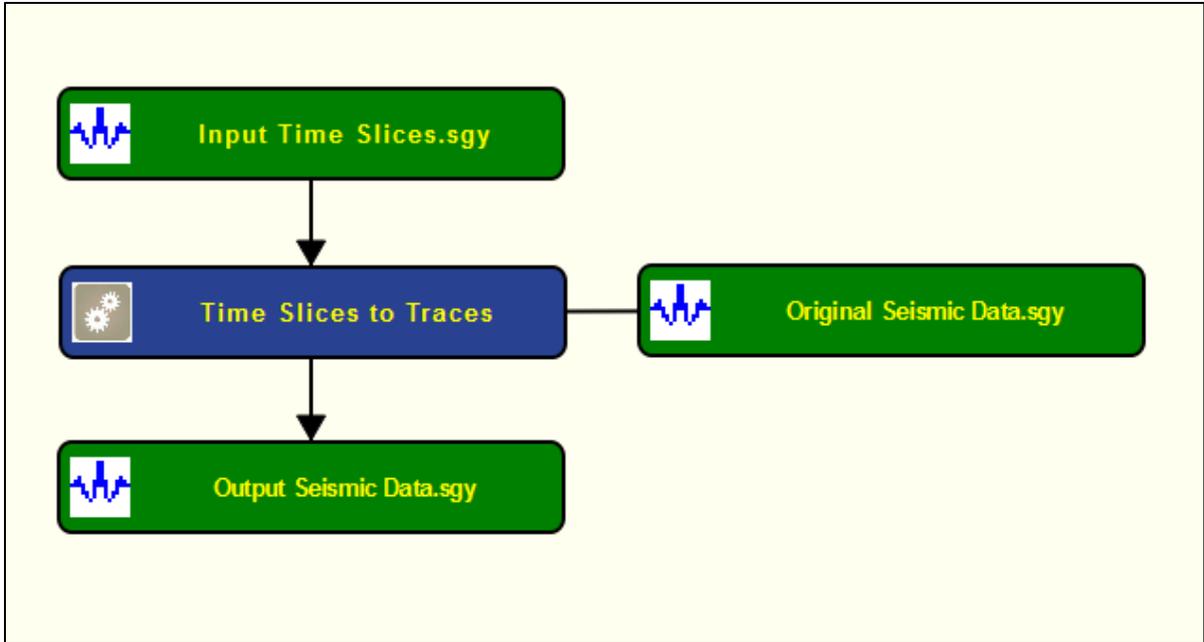
Reference:

-

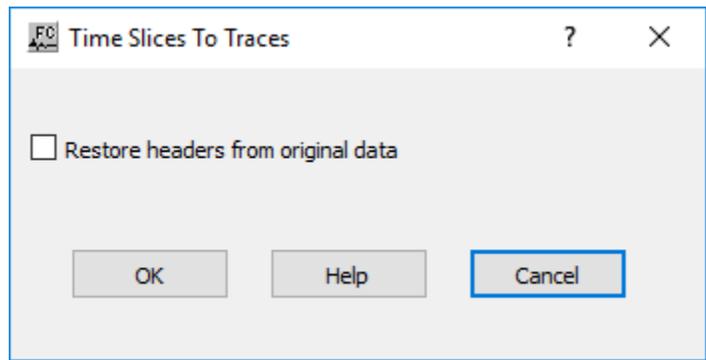
Example Flowchart a:



Example Flowchart b:



Step Parameter Dialog:



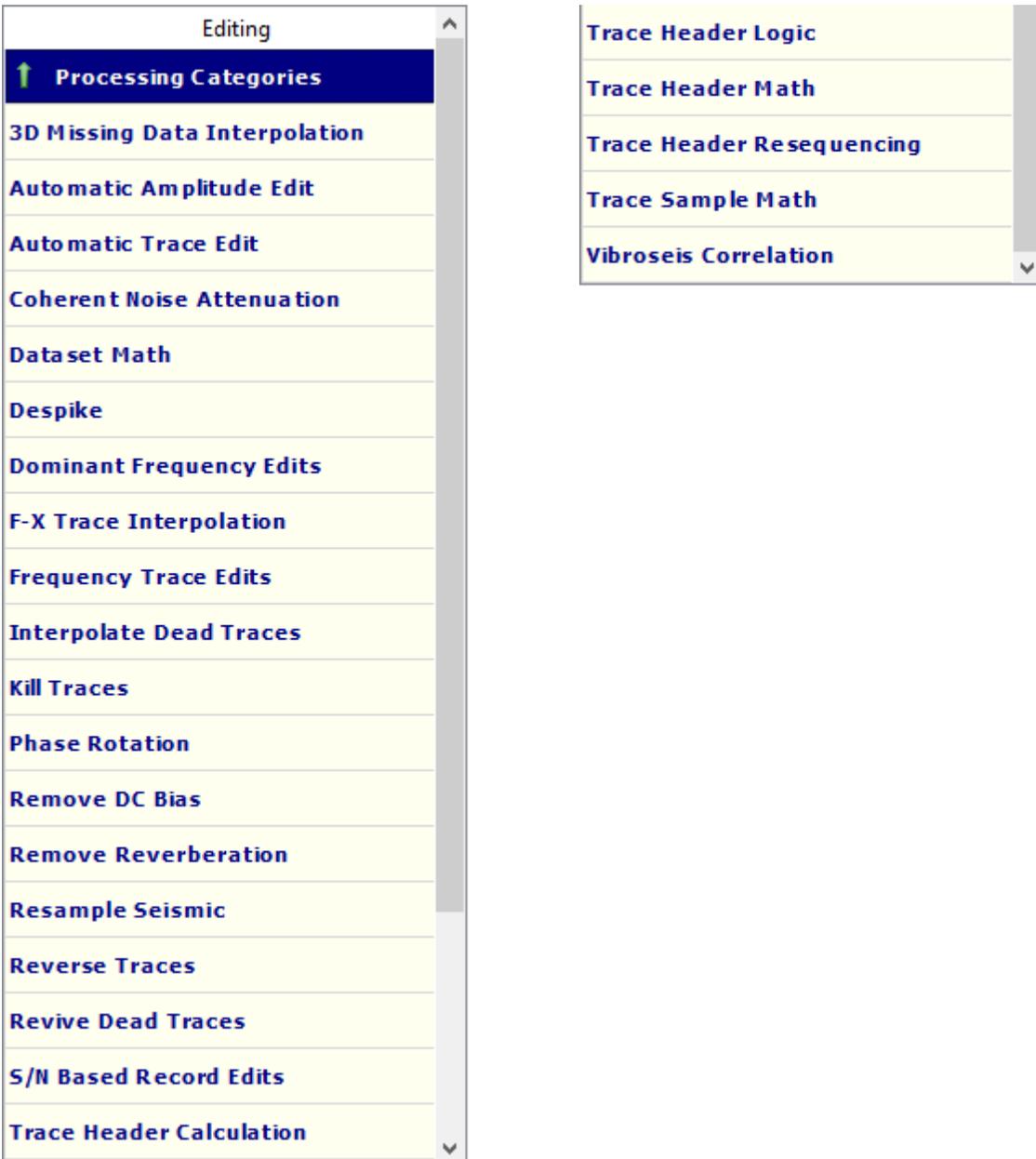
Parameter Description:

Restore headers from original data — If checked, a secondary input data stream will be required, sorted by CMP Line (record key) and CMP Location (3D) or CMP (2D) (example flowchart b). This secondary input data will be used to supply the headers to be attached to the output data, and the data extent must be set to match the extent of the output data.

Editing Steps

This section documents the processing steps available in the Editing Steps category.

Processing steps currently available are:



3D Missing Data Interpolation

Usage:

3D Missing Data Interpolation is a fast and pragmatic way to fill missing traces by means of inverse-distance weighted interpolation from near traces.

For 3D pre-stack interpolation of missing data, the data should be ordered as 3D common offset gathers, so that (binned) Offset is the primary key, CMP Line the secondary and record key, and CMP location the tertiary key.

Input Links:

1) Seismic data in any sort order (mandatory).

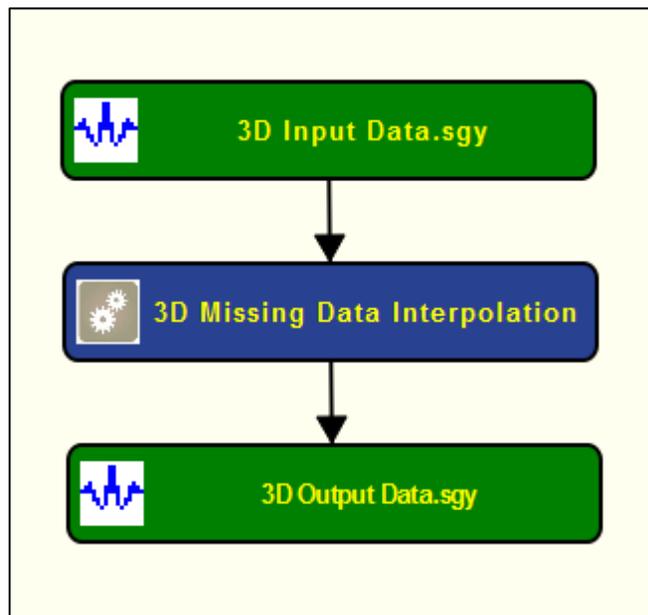
Output Links:

1) Seismic data in any sort order (mandatory).

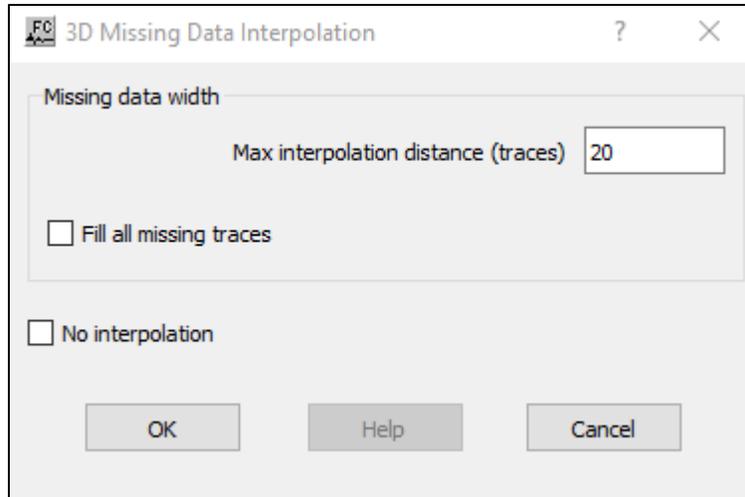
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Missing data width: Define maximum distance for interpolation and what happens to traces outside the region of interest.

Max interpolation distance (traces) — Enter the maximum distance in traces for the near-neighbors of a missing trace to be located.

Fill all missing traces — If checked, any traces that are outside the specified **Max interpolation distance** from live traces will be filled by using the values of the nearest trace.

No interpolation — If checked, no interpolation of missing data will be performed. This flag is for test purposes only!

Automatic Amplitude Edit

Usage:

The *Automatic Amplitude Edit* step allows to mark traces dead or alive based on the RMS amplitude content of a group of traces.

Input Links:

1) Seismic data in any sort order (mandatory).

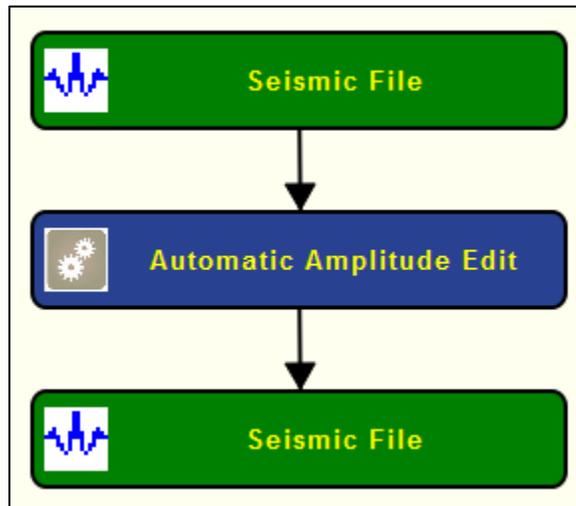
Output Links:

1) Seismic data in any sort order (mandatory).

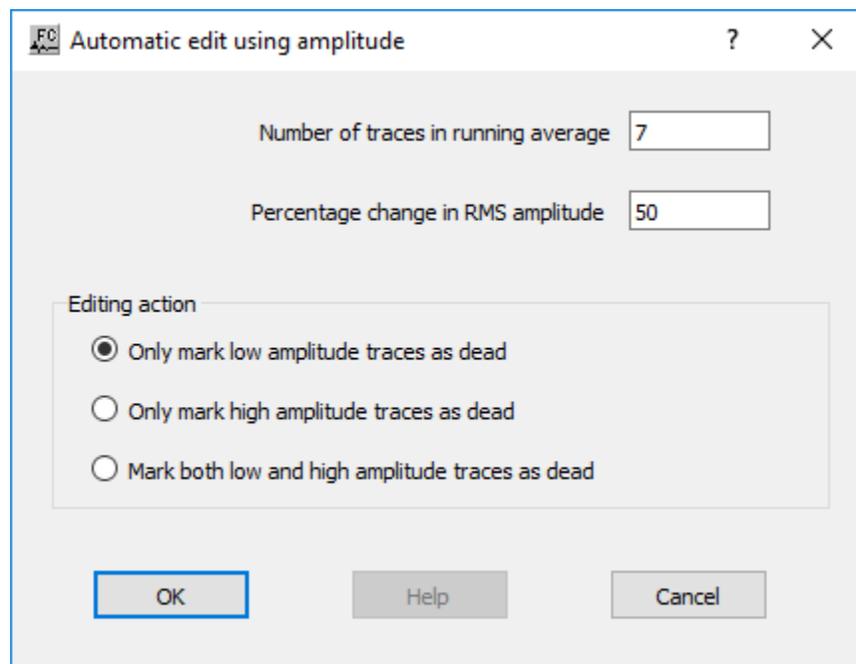
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Number of traces in running average — Enter the number of traces in the moving window where the RMS amplitude is going to be computed.

Percentage change in RMS amplitude — Enter the percentage change in RMS amplitude to consider the traces dead of live.

Editing action: Select how seismic traces are marked based on the RMS amplitude content of a group of traces within a moving window.

Only mark low amplitude traces as dead — If selected, low RMS amplitude traces are marked as dead.

Only mark high amplitude traces as dead — If selected, high RMS amplitude traces are marked as dead.

Mark both low and high amplitude traces as dead — If selected, both low and high RMS amplitude traces are marked as dead.

Automatic Trace Edit

Usage:

The *Automatic Trace Edit* step allows you to automatically remove invalid or noisy traces from your data set based on user-defined criteria.

Input Links:

1) Seismic data in any sort order (mandatory).

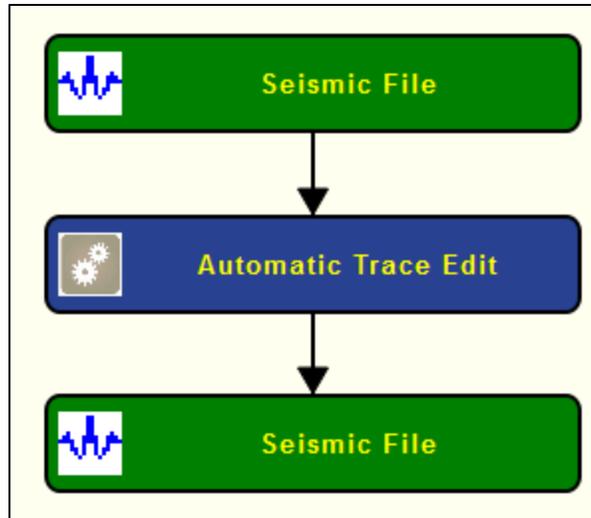
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Automatic Trace Edit

Trace edit method

Spectral semblance Power ratio
 Both methods Either method

Power ratio decay cutoff (dB)

Spectral semblance cutoff (percent)

Calculate spectral semblance on receiver line basis
 Calculate spectral semblance using a time window

Spectral semblance window

Start time in ms of the window

End time in ms of the window

Filtering

Apply low-cut filter
 Low-cut corner frequency (Hz)
 Low-cut rolloff rate (dB/oct)

Apply high-cut filter
 High-cut corner frequency (Hz)
 High-cut rolloff rate (dB/oct)

Define top window for power ratio
Top window power ratio parameters
 Start time in ms of the top window
 End time in ms of the top window
 Apply moveout velocity

Define bottom window for power ratio
Bottom window power ratio parameters
 Start time in ms of the bottom window
 End time in ms of the bottom window
 Apply moveout velocity

Output kills to Trace Edit auxiliary file

OK Help Cancel

Parameter Description:

Trace Edit Method: Select the analysis method(s) to be used to determine if a trace will be killed.

Spectral semblance — The spectral semblance method uses the semblance between a single trace's power spectrum and the average power spectrum of the gather as the basis for killing a trace.

Power ratio — The power ratio method uses the ratio of trace energy in the upper part of a trace to that in the lower part of a trace as the basis for killing a trace. This is often an effective means of editing traces that are contaminated with 60 Hz powerline noise, which does not decay as a function of record time.

Both methods — Traces will be killed only if they fail BOTH the power ratio test AND the spectral semblance test.

Either method — Traces will be killed if they fail EITHER the power ratio test OR the spectral semblance test.

Calculate spectral semblance on receiver line basis — If checked, the spectral semblance will be calculated on a receiver line basis.

Calculate spectral semblance using a time window — Enabled if *Spectral Semblance* option is selected. If checked, spectral semblance is computed within a time gate defined by its top and base in ms.

Spectral semblance window: Define the start and end time of the time window where the spectral semblance is calculated.

Start time in ms of the window — Enter the start time of the window to compute the spectral semblance. Time in ms.

End time in ms of the window — Enter the end time of the window to compute the spectral semblance. Time in ms.

Power ratio decay cutoff (dB) — If you choose the power ratio method, enter the minimum decay of trace energy in decibels that you expect between the first and second half of the trace.

Define top window for power ratio — Enabled if *Power ratio* option is selected. If checked, select parameters to define the top window where the calculation is done.

Top window power ratio parameters: Define the start and end time of the top time window where the power ratio is calculated.

Start time in ms of the window — Enter the start time of the window to compute the power ratio. Time in ms.

End time in ms of the window — Enter the start time of the window to compute the power ratio. Time in ms.

Apply moveout velocity — If selected, the normal moveout correction with a constant velocity is applied to the record before computing the power ratio. Enter the velocity for the normal moveout correction.

Define bottom window for power ratio — Enabled if *Power ratio* option is selected. If checked, select parameters to define the bottom window where the calculation is done.

Bottom window power ratio parameters: Define the start and end time of the bottom time window where the power ratio is calculated.

Start time in ms of the window — Enter the start time of the window to compute the power ratio.
Time in ms.

End time in ms of the window — Enter the end time of the window to compute the power ratio.
Time in ms.

Apply moveout velocity — If selected, the normal moveout correction with a constant velocity is applied to the record before computing the power ratio. Enter the velocity for the normal moveout correction.

Output kills to Trace Edit auxiliary file – If selected outputs killed traces based on the selected measurement to an auxiliary file.

Spectral semblance cutoff (percent) — If you choose the spectral semblance method, enter the minimum semblance value you expect for each trace's power spectrum relative to the power spectrum for the gather.

Coherent Noise Attenuation

Usage:

The *Coherent Noise Attenuation* step edit coherent noise between adjacent traces based on variations (in percentage) of the seismic amplitudes within a time trace window.

Input Links:

1) Seismic data in any sort order (mandatory).

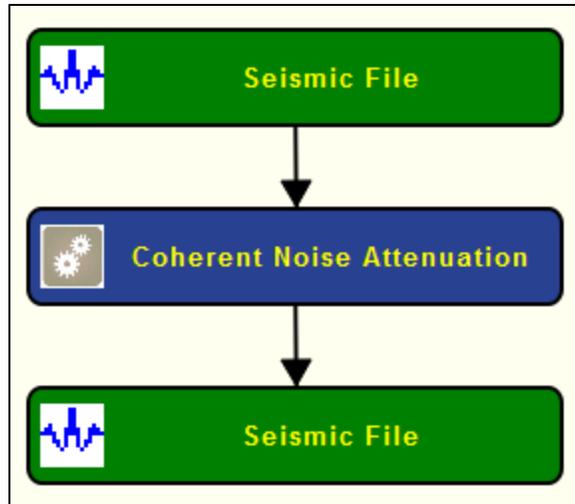
Output Links:

2) Seismic data in any sort order (mandatory).

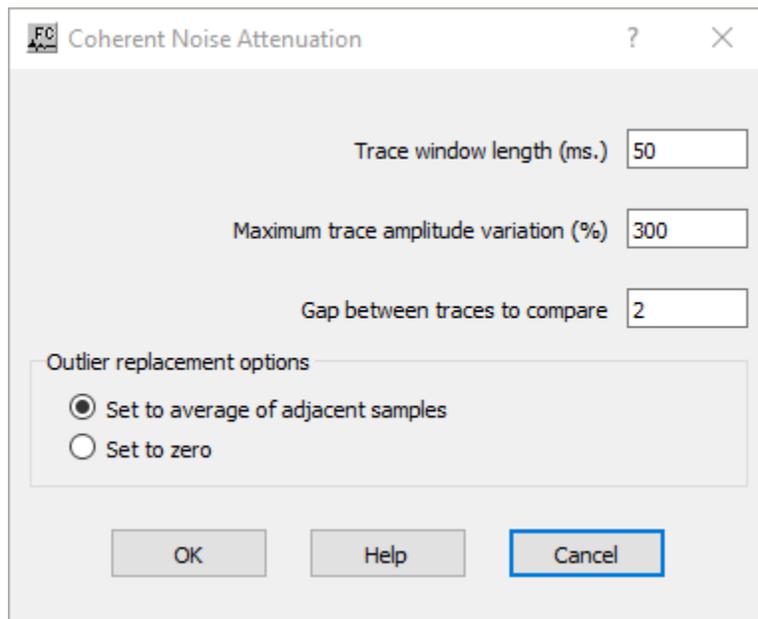
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Trace window length (ms) — Enter the length of the window, in ms, where the estimation of the reference amplitude is calculated.

Maximum trace amplitude variation (%) — Enter the maximum trace amplitude variation, in percentage, to consider a given sample noise.

Gap between traces to compare — Enter the number of traces to skip for trace comparison.

Outlier replacement options: Define what happens to seismic samples considered noise.

Set to average of adjacent samples — If selected, the values of the seismic samples considered noise are replaced by the average value of adjacent samples.

Set to zero — If selected, the value of the seismic samples considered noise are set to zero.

Dataset Math

Usage:

The *Dataset Math* step will add, subtract, multiply, divide or do adaptive subtraction between the samples of one data file from the corresponding samples of a second data file and output the result to a seismic file.

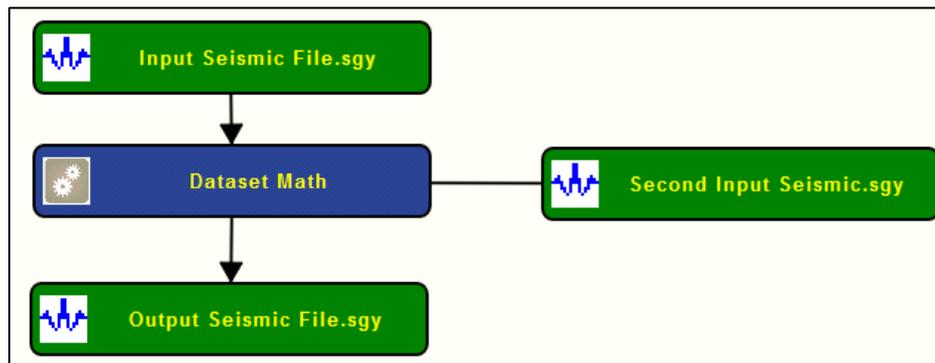
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data in any sort order (mandatory) – must match the first dataset.

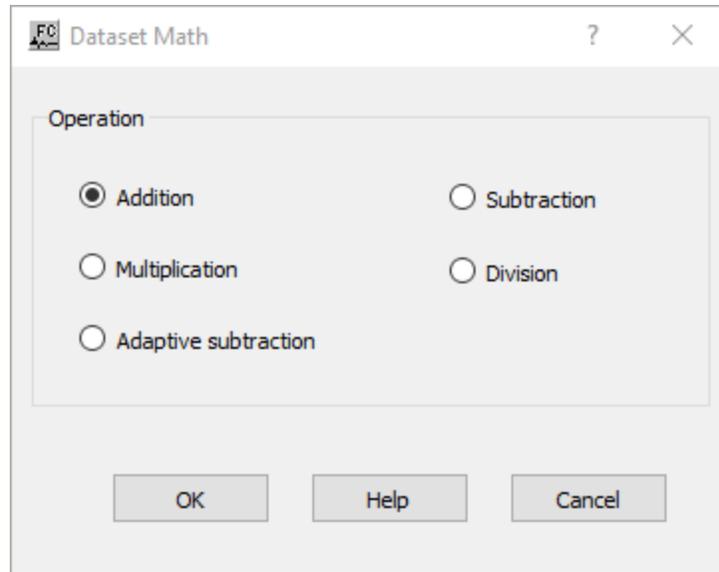
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Operation: Specify the math operation to perform between the samples of the two datasets.

Addition — If selected, perform addition between the samples of the two datasets.

Subtraction — If selected, perform subtraction between the samples of the two datasets.

Multiplication — If selected, perform multiplication between the samples of the two datasets.

Division — If selected, perform division between the samples of the two datasets.

Adaptive subtraction — If selected, perform adaptive subtraction between the samples of the two datasets.

Despike

Usage:

The *Despike* step removes spikes of amplitude related with bursts of energy based on the variance estimate of a given seismic sample when compared against its neighbours.

Input Links:

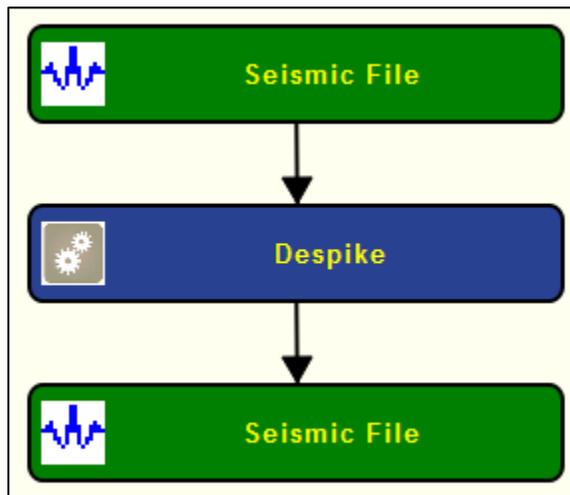
1) Seismic data in any sort order (mandatory).

Output Links:

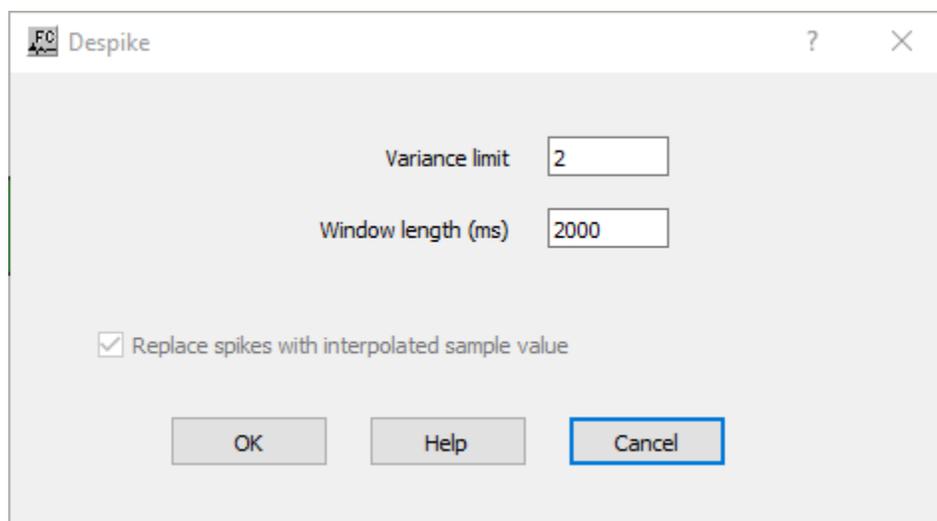
1) Seismic data in any sort order (mandatory).

Reference:

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Variance limit — Enter the number of variance allowed for a seismic sample be considered signal.

Window length (ms) — Enter the window length, in ms, where the statistical measures (variance) are going to be computed and used as reference to detect spikes.

Replace spikes with interplated sample value — If checked, seismic samples marked as noise are going to be replaced by an interpolated sampled value from its neighbours. If unchecked, marked seismic samples are replaced by zero.

Dominant Frequency Edits

Usage:

The *Dominant Frequency Edits* step marks dead records based on an estimate of its dominant frequency computed within a user-defined window on a trace-by-trace basis or considering the entire records as a whole. More than one window is allowed and the failing criteria may be defined taking into consideration simultaneously all windows or each window separately. A report file is automatically generated.

Input Links:

1) Seismic data in any sort order (mandatory).

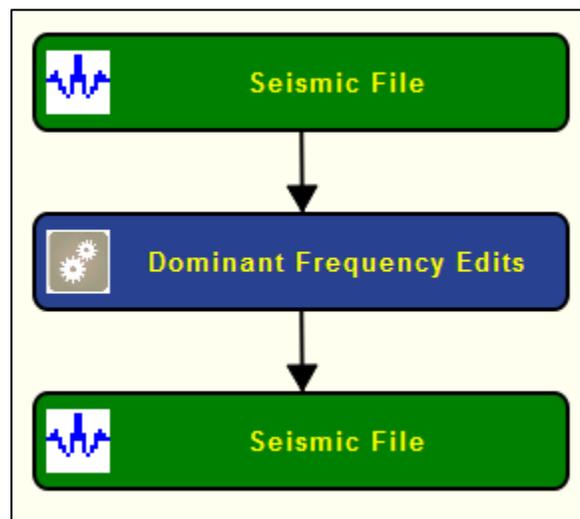
Output Links:

1) Seismic data in any sort order (mandatory).

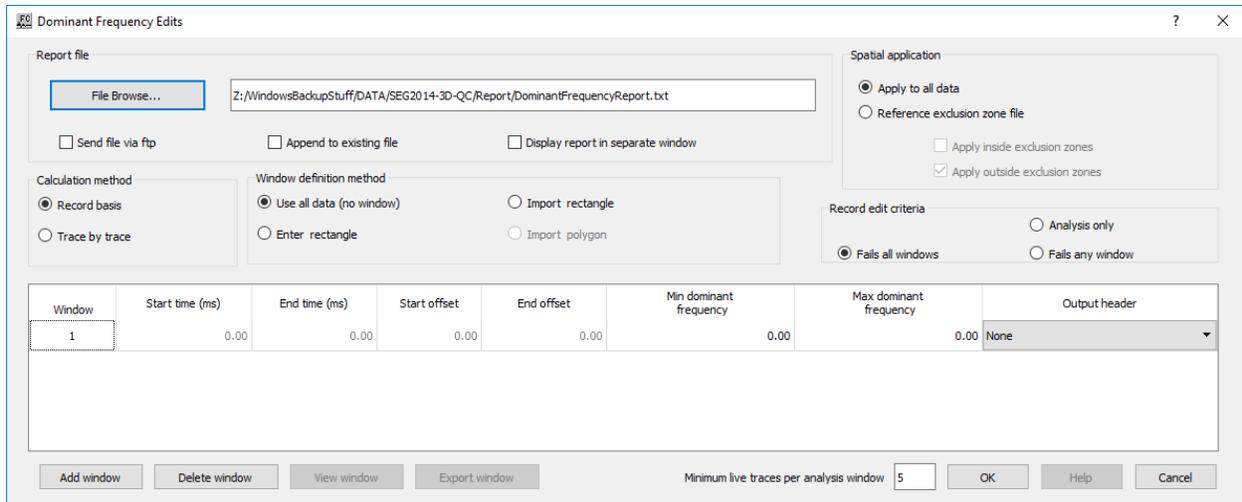
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Report file: Define parameters related with the report file automatically generated by this processing step.

File Browse — Browse for the file where the report file is going to be written. By default, existing report files are overwritten.

Send file via FTP — If checked, send the report file automatically via FTP.

Append to existing file — If checked, append current report file to an existing file.

Display report in separate window — If checked, the report file is shown in real time in a pop-up window.

Spatial application: Define the spatial extent where the processing step is going to be applied.

Apply to all data — If selected, this step is applied to the entire input seismic data.

Reference exclusion zone file — If selected, the application of this step is constrained spatially as defined by an auxiliary exclusion zone data file, the input seismic data is not considered entirely.

Apply inside exclusion zone — If checked, only the data inside the exclusion zone is considered for the calculations.

Apply outside exclusion zone — If checked, only the data outside the exclusion zone is considered for the calculations.

Calculation method: This processing step may be applied either on a record basis or trace-by-trace basis.

Record basis — If selected, the dominant frequency is computed for the entire record as a whole.

Trace by trace — If selected, the dominant frequency is computed considering each trace individually.

Window definition method: The estimate might be computed within a user-defined window, or windows, defined by its start and end time and offset. Seismic samples outside these windows are not considered.

Use all data (no window) — If selected, all seismic samples are considered. There are no constraints in terms of time or offset.

Enter rectangle — If selected, enables the table below where the user can define the top, bottom, start and end offset of each window considered.

Import rectangle — If selected, the windows are defined by an auxiliary rectangle data file.

Import polygon — Not yet available.

Record edit criteria: Define the criteria to consider a good or bad record.

Fails all windows — If selected, the record is considered dead if it fails in all the defined windows simultaneously.

Analysis only — If selected, any recorded is marked as dead. This processing step is considered just an analysis tool.

Fails any window — If selected, the record is considered dead if it fails in on of the defined windows.

Window: Define the extent of each window where the estimate of the dominant frequency is computed.

Start time (ms) — Enter the start time, in ms, for each window.

End time (ms) — Enter the end time, in ms, for each window.

Start offset — Enter the start offset for each window.

End offset — Enter the end offset for each window.

Min dominant frequency — Enter the minimum dominant frequency that a given window must have for the record to be considered good.

Max dominant frequency — Enter the maximum dominant frequency that a given window must have for the record to be considered good.

Output header — Select the header location where the flag for good/bad records is stored.

Add window — Select if more than one window per record is going to considered.

Delete window — Select to remove an existing window.

View window — Not yet available.

Export window — Not yet available.

Minimum live traces per analysis window — Enter the minimum number of live traces that must exit within each window for the estimation.

F-X Trace Interpolation

Usage:

The *F-X Trace Interpolation* step performs a 2-to-1 f-x domain interpolation of the input gather. Trace headers of the interpolated traces are equal to the average of their two neighbors. The Trace Flag header field of the interpolated traces will be equal to 28 on output.

Input Links:

- 1) Seismic data in any sort order (mandatory).

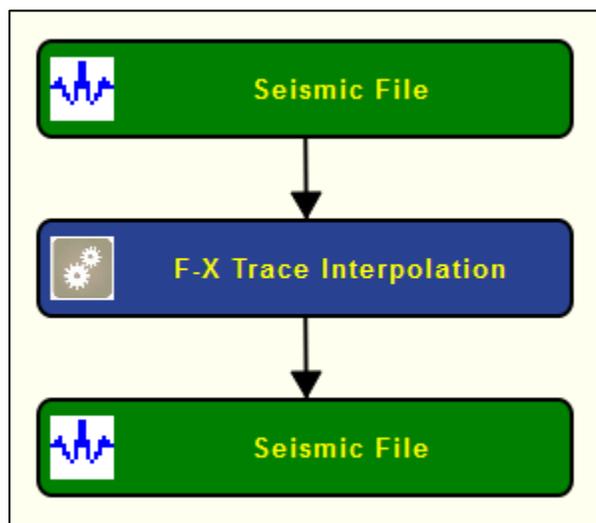
Output Links:

- 1) Seismic data with interpolated traces.

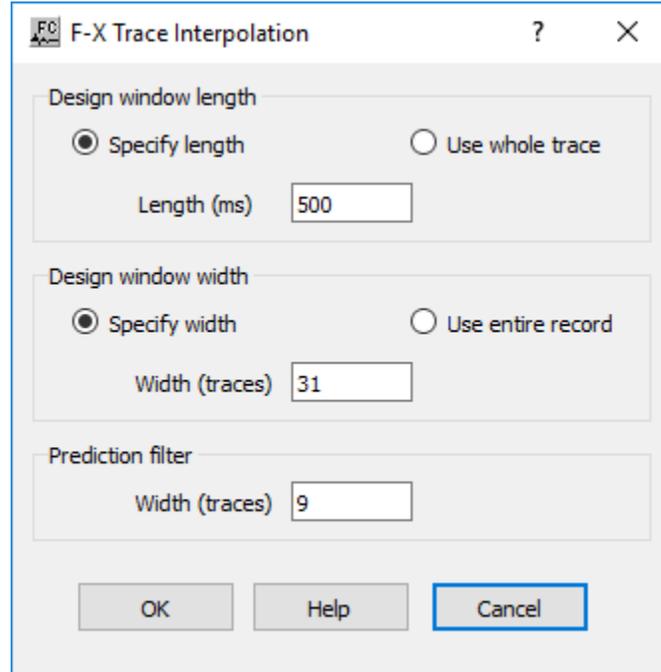
Reference:

Spitz, S., 1991 Seismic trace interpolation in the f-x domain, *Geophysics*, 56, p. 785.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Design window length: parameterize window length.

Use whole trace — If selected, the design length is to equal the record length.

Specify length — If selected, uses a fixed design width as defined in *Length (ms)*.

Design window length (ms) — Enter the length of the design window in units of milliseconds

Design window width: parameterize window width.

Use full trace length — If selected, allows the window width to vary with changes in fold for pre-stack trace interpolation.

Specify design window length — Use this option to enter a fixed design length

Design window width (traces) — Enter the width of the design window in units of traces

Prediction filter: specify the number of traces used in the prediction filter.

Width (traces) — enter the number of traces to be used by the prediction filter.

Frequency Trace Edits

The *Frequency Trace Edits* step marks dead records based on an estimate of its frequency computed content within a user-defined window on a trace-by-trace basis or considering the entire records as a whole. More than one window is allowed and the failing criteria may be defined taking into consideration simultaneously all windows or each window separately. A report file is automatically generated.

Input Links:

1) Seismic data in any sort order (mandatory).

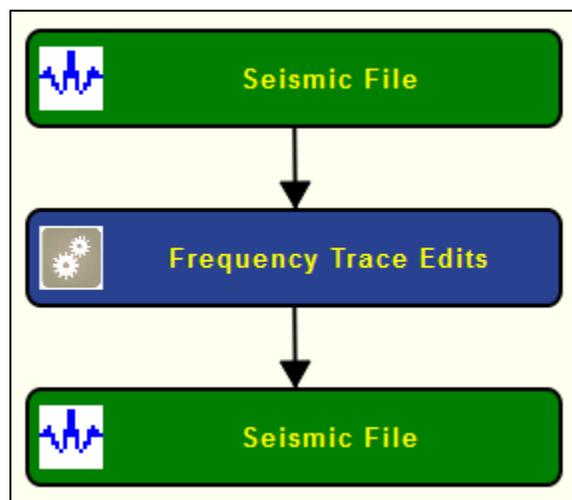
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Ratio	Start time (ms)	End time (ms)	Start offset	End offset	Minimum frequency	Maximum frequency	Minimum frequency output header	Maximum frequency output header
1	0.00	0.00	0.00	0.00	0.00	0.00	None	None

Parameter Description:

Report file: Define parameters related with the report file automatically generated by this processing step.

File Browse — Browse for the file where the report file is going to be written. By default, existing report files are overwritten.

Send file via FTP — If checked, send the report file automatically via FTP.

Append to existing file — If checked, append current report file to an existing file.

Display report in separate window — If checked, the report file is shown in real time in a pop-up window.

Spatial application: Define the spatial extent where the processing step is going to be applied.

Apply to all data — If selected, this step is applied to the entire input seismic data.

Reference exclusion zone file — If selected, the application of this step is constrained spatially as defined by an auxiliary exclusion zone data file, the input seismic data is not considered entirely.

Apply inside exclusion zone — If checked, only the data inside the exclusion zone is considered for the calculations.

Apply outside exclusion zone — If checked, only the data outside the exclusion zone is considered for the calculations.

Calculation method: This processing step may be applied either on a record basis or trace-by-trace basis.

Record basis — If selected, the dominant frequency is computed for the entire record as a whole.

Trace by trace — If selected, the dominant frequency is computed considering each trace individually.

Window definition method: The estimate might be computed within a user-defined window, or windows, defined by its start and end time and offset. Seismic samples outside these windows are not considered.

Use full trace — If selected, all seismic samples are considered. There are no constraints in terms of time or offset.

Enter rectangle — If selected, enables the table below where the user can define the top, bottom, start and end offset of each window considered.

Import rectangle — If selected, the windows are defined by an auxiliary rectangle data file.

Import polygon — Not yet available.

Record edit criteria: Define the criteria to consider a good or bad record.

Fails all windows — If selected, the record is considered dead if it fails in all the defined windows simultaneously.

Analysis only — If selected, any recorded is marked as dead. This processing step is considered just an analysis tool.

Fails any window — If selected, the record is considered dead if it fails in on of the defined windows.

Window: Define the extent of each window where the estimate of the dominant frequency is computed.

Start time (ms) — Enter the start time, in ms, for each window.

End time (ms) — Enter the end time, in ms, for each window.

Start offset — Enter the start offset for each window.

End offset — Enter the end offset for each window.

Min frequency — Enter the minimum dominant frequency that a given window must have for the record to be considered good.

Max frequency — Enter the maximum dominant frequency that a given window must have for the record to be considered good.

Output header — Select the header location where the flag for good/bad records is stored.

Add window — Select if more than one window per record is going to considered.

Delete window — Select to remove an existing window.

View window — Not yet available.

Export window — Not yet available.

Minimum live traces per analysis window — Enter the minimum number of live traces that must exit within each window for the estimation.

Interpolate Dead Traces

Usage:

The *Interpolate Dead Traces* step interpolates traces marked as dead based on a simple arithmetic average of the neighbor traces not marked as dead.

Input Links:

- 1) Seismic data in any sort order (mandatory).

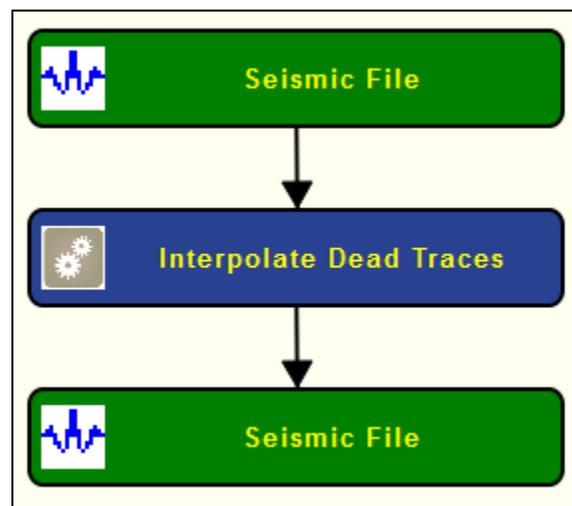
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

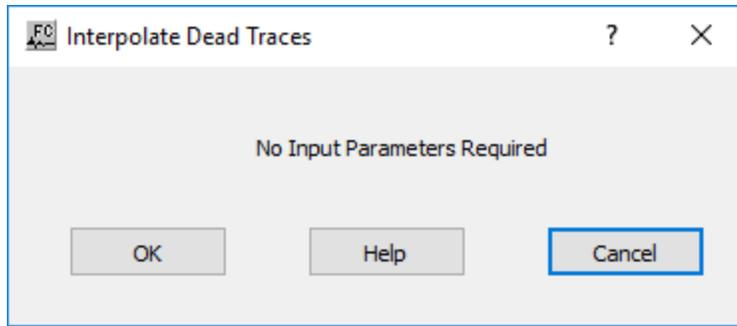
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

This processing setp does not require any parameterization since dead traces are automatically interpolated with an arithmetic average.

Kill Traces

Usage:

The Kill Traces step kills traces according to specified trace header values and ranges.

Input Links:

- 1) Seismic data in any sort order (mandatory).

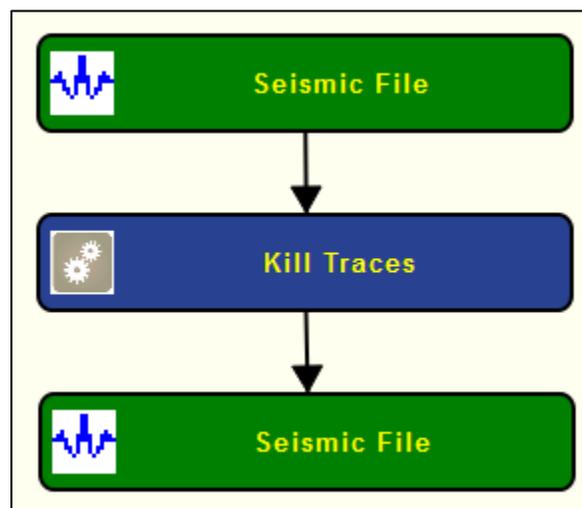
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

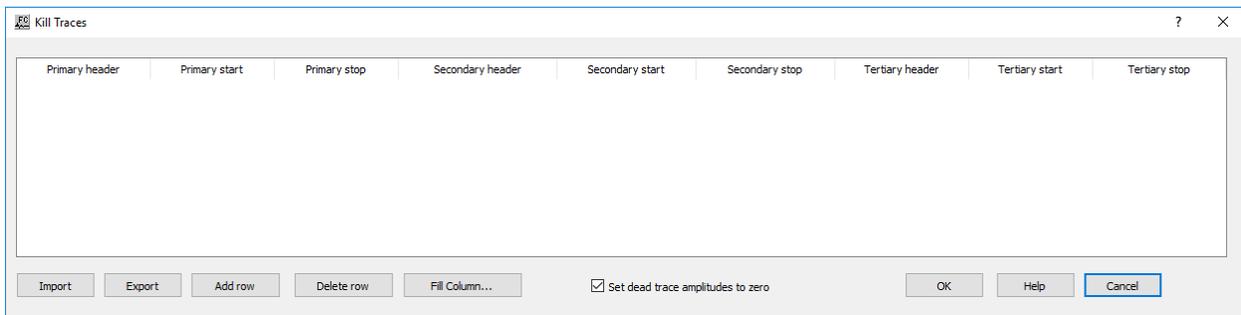
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Primary header — Select the first trace header field to use for killing traces. This is combined with the other selected header key values to determine the set of traces to kill.

Primary start — Enter the start value for the first selected header field.

Primary stop — Enter the end value for the first selected header field.

Secondary header — Select the second trace header field to use for killing traces. This is combined with the other selected header key values to determine the set of traces to kill.

Secondary start — Enter the start value for the second selected header field.

Secondary stop — Enter the end value for the second selected header field.

Tertiary header — Select the third trace header field to use for killing traces. This is combined with the other selected header key values to determine the set of traces to kill.

Tertiary start — Enter the start value for the third selected header field.

Tertiary stop — Enter the end value for the third selected header field.

Import — Import a set of picked trace kills from a Trace Kills auxiliary dataset.

Export — Export the entered trace kills into a Trace Kills auxiliary dataset.

Add Row — Add a row to dialog.

Delete Row — Delete a row from the dialog.

Set dead trace amplitude to zero — If checked, fill dead traces with zeros.

Phase Rotation

Usage:

The **Phase Rotation** step allows you to rotate your seismic traces by a constant phase angle from -180 to $+180$ degrees. Values outside this range will be wrapped back into this range (i.e. 240 degrees is equivalent to -60 degrees).

Input Links:

1) Seismic data in any sort order (mandatory).

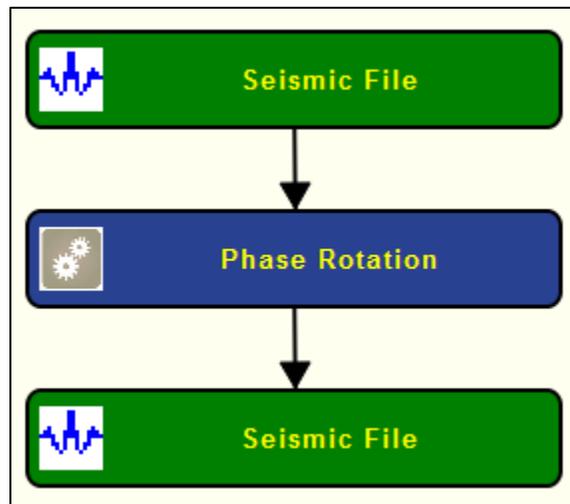
Output Links:

1) Seismic data in same sort order as the input (mandatory).

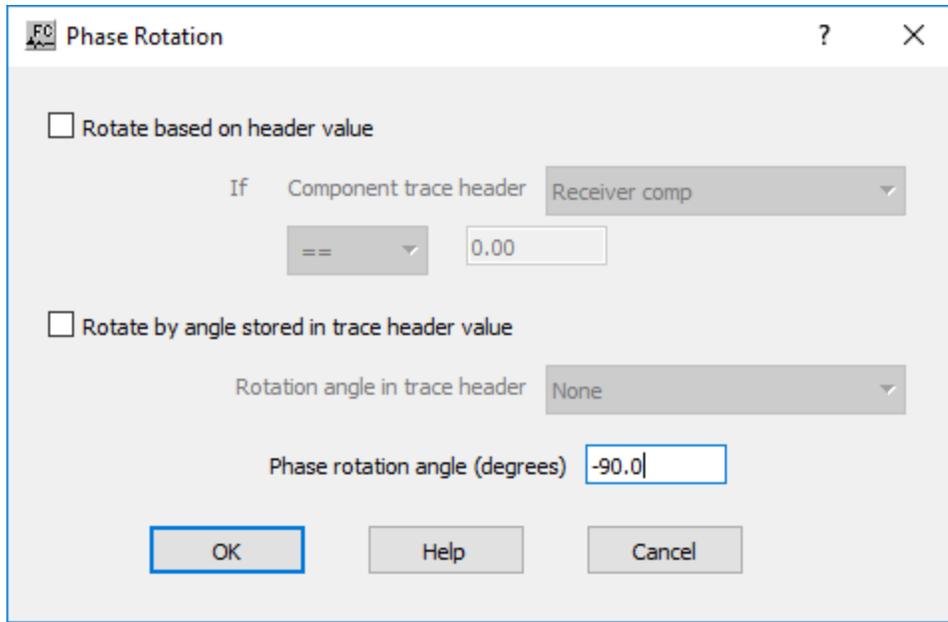
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Rotate based on header value — If checked, the phase rotation is only applied to some traces in the dataset, then a trace header value may be used to control which traces are rotated. An example of where this is useful is transition zone seismic where some receivers in a line are geophones and some are hydrophones. Rotating the hydrophone by -90 matches the data from the geophone.

If Component trace header — Select the trace header to be used for controlling the operation.

== — Select the logic operator (<, <=, ==, >, >= or !=) to be used in determining the traces to used in the operation and enter the value of the logical condition.

Rotate by angle stored in trace header value — If checked, does a constant phase rotation, a header value (degrees) may be used.

Rotation angle in trace header — Select the trace header word containing the rotation angle (degrees).

Phase rotation angle (degrees) — Enter the constant phase rotation angle to apply to all the seismic data traces unless Rotate by angle stored in trace header value is checked.

Remove DC Bias

Usage:

The **Remove DC Bias** step removes the average, median or mean DC bias on a trace-by-trace basis or based on a moving average window which may run per channel or gather. The calculation window may be limited within a user-defined time gate.

Input Links:

- 1) Seismic data in any sort order (mandatory).

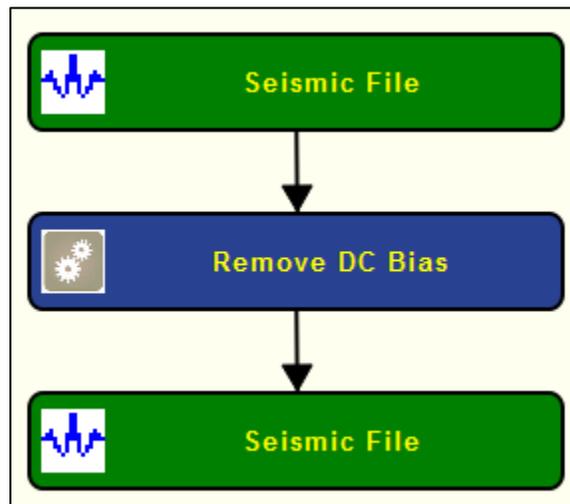
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

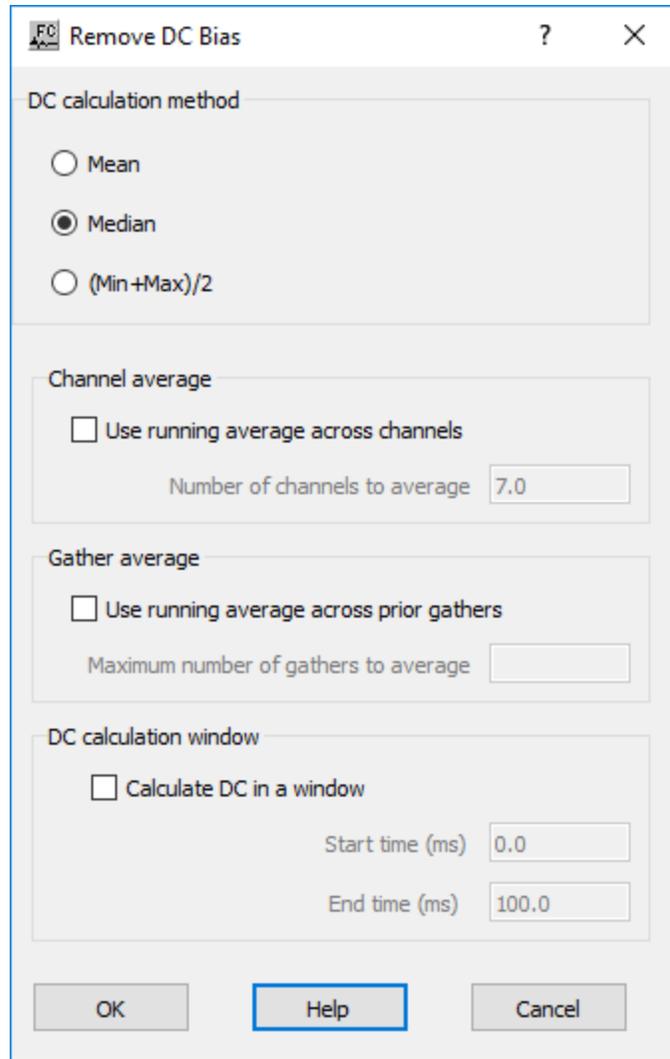
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

DC calculation method: select the method to estimate the DC bias.

Mean — If selected, estimates the DC bias as the mean of the seismic samples considered.

Median — If selected, estimates the DC bias as the median of the seismic samples considered.

(Min+Max)/2 — If selected, estimates the DC bias as central value between the min and max of the seismic samples considered.

Chanel Average: DC bias may be estimated using a moving window running through channels in order to increase the reliability of the estimate.

Use running average across channels — If checked the DC bias is estimate taking into account a moving window computed across channels.

Number of channels to average — Enter the number of channels that belong to the moving window.

Gather Average: DC bias may be estimated using a moving window running through gathers (or records) in order to increase the reliability of the estimate.

Use running average across prior gathers — If checked the DC bias is estimate taking into account a moving window computed across prior gathers.

Number of gathers to average — Enter the number of gathers that belong to the moving window.

DC calculation window: define the time gate where the calculation is going to be computed.

Calculate DC in a window — If checked, only the entered window of each trace will be used to calculate the DC.

Minimum time (ms) — Enter the start time of the window to be used for calculating the DC value.

Maximum time (ms) — Enter the ending time of the window to be used for calculating the DC value.

Remove Reverberation

Usage:

The *Remove Reverberation* step searches for reverberations in the signal and attempts to remove these using an adaptive filtering technique.

Input Links:

1) Seismic data in any sort order (mandatory).

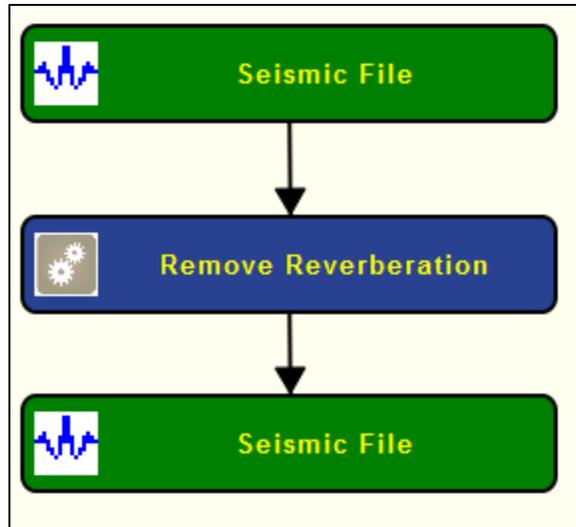
Output Links:

1) Seismic data in same sort order as the input (mandatory).

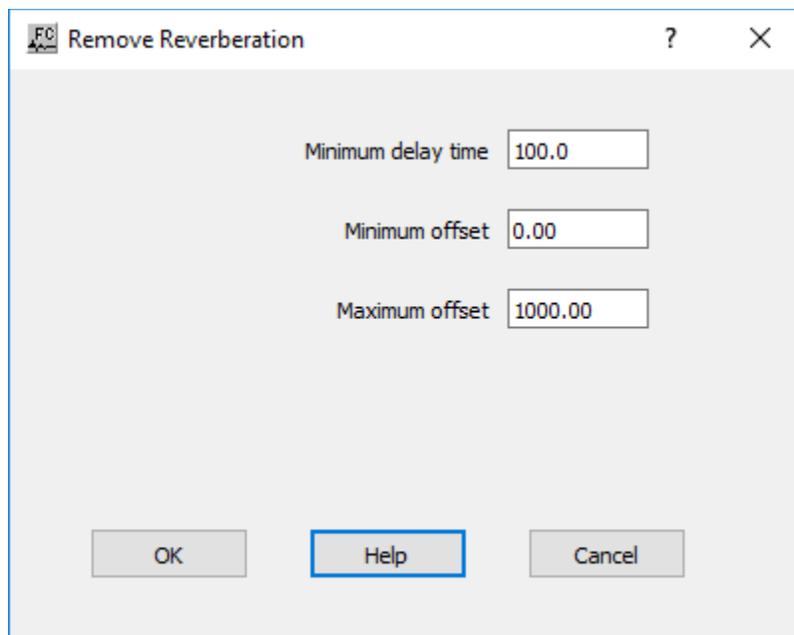
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Minimum delay time — Enter the minimum delay time to use in searching for the reverberation.

Minimum offset — Enter the minimum offset to use in searching for the reverberation.

Maximum offset — Enter the maximum offset to use in searching for the reverberation.

Resample Seismic

Usage:

The *Resample Seismic* step creates a copy of a data set with options to (1) resample to a specified sample interval, and (2) change the start time and trace length of the data on the fly.

Input Links:

1) Seismic data in any sort order (mandatory).

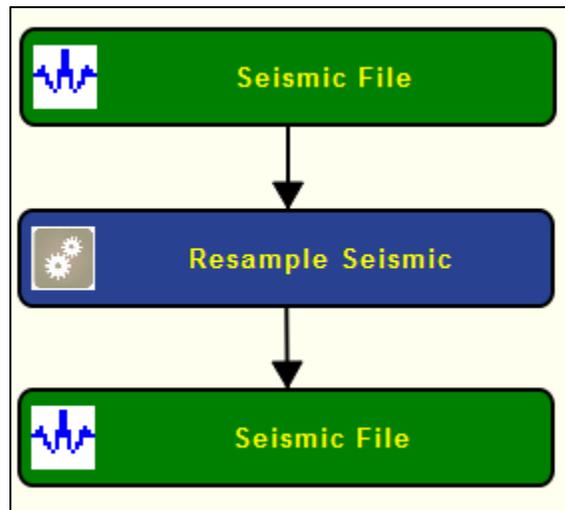
Output Links:

1) Seismic data in any sort order (mandatory).

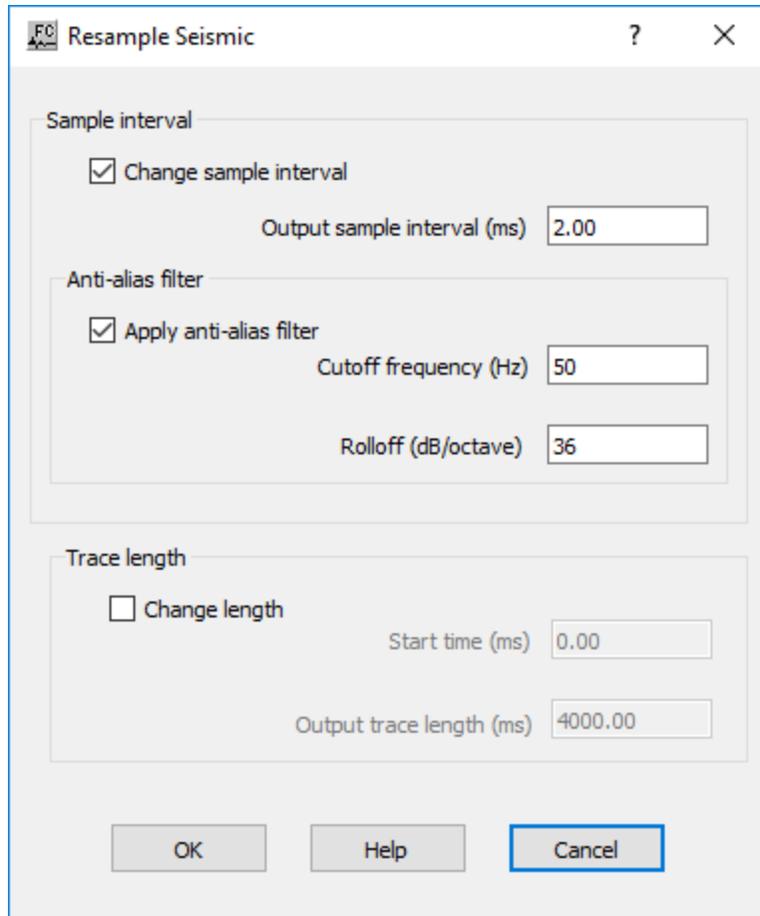
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Sample interval: modify the sample interval of the input seismic data.

Change sample interval — If checked, the traces will be resampled to the specified sample interval.

Output sample interval (ms) — Enter the new sampling interval in ms.

Anti-alias Filter: apply an anti-alias filter to the data after the resampling.

Apply anti-alias filter — If checked, apply an anti-alias filter after the resampling.

Cutoff (%Nyquist) — Enter the percentage of the Nyquist frequency at which an anti-alias filter is applied.

Rolloff (db/Octave) — Enter the rolloff of the filter in dB/Octave.

Trace length: modify the original length of the input seismic traces.

Change Length — If checked, the traces will be truncated or extended to the specified length.

Start time (ms) — Enter the start time of the trace to output in milliseconds.

Length (ms) — Enter the length of the trace to output in milliseconds

Reverse Traces

Usage:

The *Reverse Traces* step allows you to invert the polarity of traces according specified trace header values and ranges.

Input Links:

- 1) Seismic data in any sort order (mandatory).

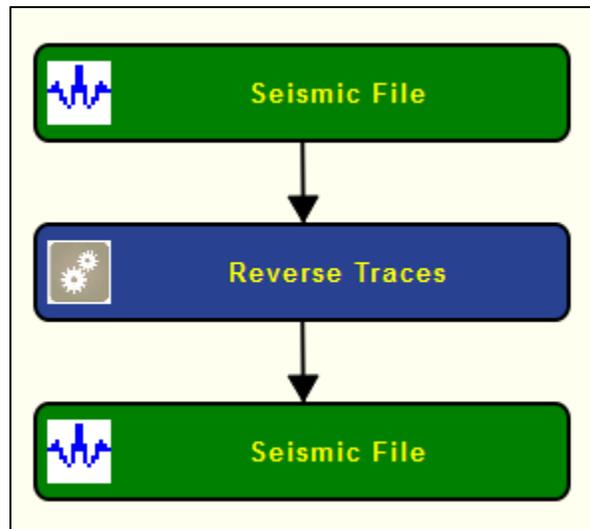
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Primary header	Primary start	Primary stop	Secondary header	Secondary start	Secondary stop	Tertiary header	Tertiary start	Tertiary stop
None	0	0	None	0	0	None	0	0

Parameter Description:

Primary header — Select the first trace header field to use for reversing traces. This is combined with the other selected header key values to determine the set of traces to reverse.

Primary start — Enter the start value for the first selected header field.

Primary stop — Enter the end value for the first selected header field.

Secondary header — Select the second trace header field to use for reversing traces. This is combined with the other selected header key values to determine the set of traces to reverse.

Secondary start — Enter the start value for the second selected header field.

Secondary stop — Enter the end value for the second selected header field.

Tertiary header — Select the third trace header field to use for reversing traces. This is combined with the other selected header key values to determine the set of traces to reverse.

Tertiary start — Enter the start value for the third selected header field.

Tertiary stop — Enter the end value for the third selected header field.

Import — Import a set of picked trace reversals from a Trace Reversals auxiliary dataset.

Export — Export the entered trace reversals into a Trace Reversals auxiliary dataset.

Add Row — Add a row to dialog.

Delete Row — Delete a row from the dialog.

Revive Dead Traces

Usage:

The *Revive Dead Traces* step modifies marked seismic traces into live traces given a minimum adjacent dead traces.

Input Links:

1) Seismic data in any sort order (mandatory).

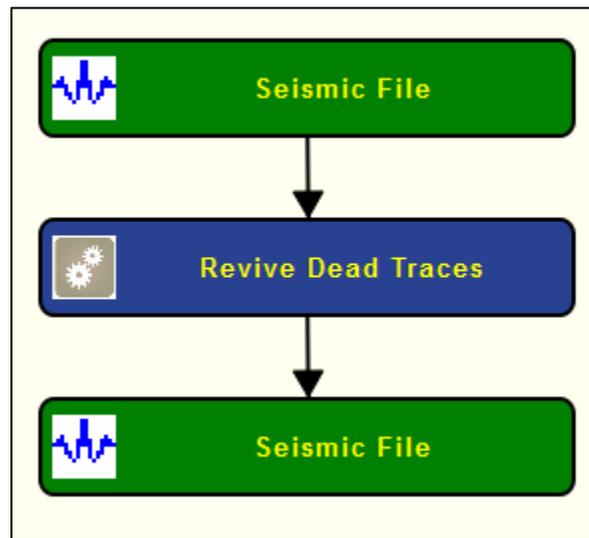
Output Links:

1) Seismic data in same sort order as the input (mandatory).

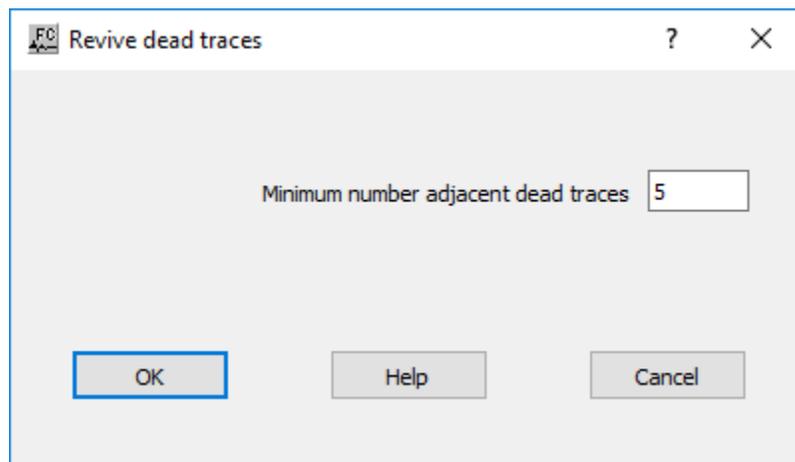
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Minimum number adjacent traces — Enter the minimum number of adjacent dead traces that must exist to be modified into live traces.

S/N Based Record Edits

Usage:

The *S/N Based Record Edits* step marks dead records based on an estimate of its signal-to-noise ratio computed within a user-defined window on a trace-by-trace basis or considering the entire records as a whole. More than one window is allowed and the failing criteria may be defined taking into consideration simultaneously all windows or each window separately. A report file is automatically generated.

Input Links:

1) Seismic data in any sort order (mandatory).

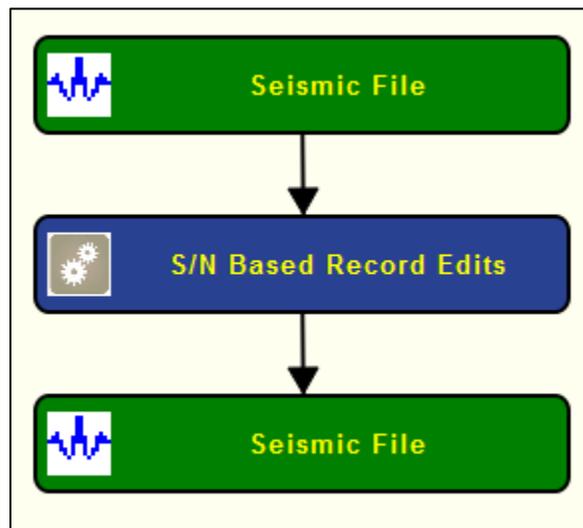
Output Links:

1) Seismic data in same sort order as the input (mandatory).

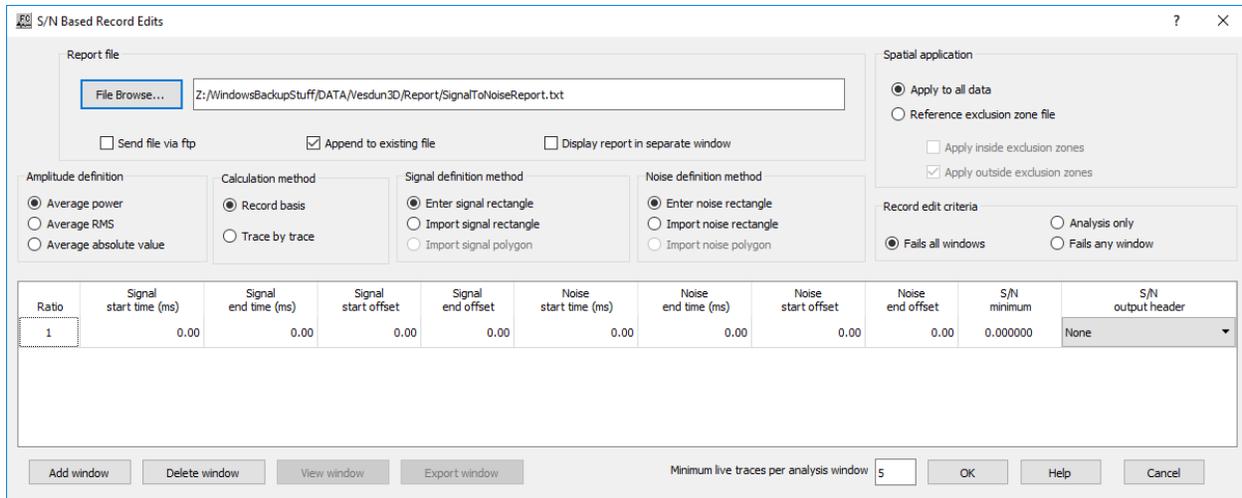
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Report file: Define parameters related with the report file automatically generated by this processing step.

File Browse — Browse for the file where the report file is going to be written. By default, existing report files are overwritten.

Send file via FTP — If checked, send the report file automatically via FTP.

Append to existing file — If checked, append current report file to an existing file.

Display report in separate window — If checked, the report file is shown in real time in a pop-up window.

Spatial application: Define the spatial extent where the processing step is going to be applied.

Apply to all data — If selected, this step is applied to the entire input seismic data.

Reference exclusion zone file — If selected, the application of this step is constrained spatially as defined by an auxiliary exclusion zone data file, the input seismic data is not considered entirely.

Apply inside exclusion zone — If checked, only the data inside the exclusion zone is considered for the calculations.

Apply outside exclusion zone — If checked, only the data outside the exclusion zone is considered for the calculations.

Amplitude Definition: Select the type of amplitude to be computed during this editing processing step.

Average power — If selected, compute the average power of the input seismic amplitudes.

Average RMS — If selected, compute the average RMS of the input seismic amplitudes.

Average absolute value — If selected, compute the average of the absolute value of the input seismic amplitudes.

Calculation method: This processing step may be applied either on a record basis or trace-by-trace basis.

Record basis — If selected, the dominant frequency is computed for the entire record as a whole.

Trace by trace — If selected, the dominant frequency is computed considering each trace individually.

Window definition method: The estimate might be computed within a user-defined window, or windows, defined by its start and end time and offset. Seismic samples outside these windows are not considered.

Use all data (no window) — If selected, all seismic samples are considered. There are no constraints in terms of time or offset.

Enter rectangle — If selected, enables the table below where the user can define the top, bottom, start and end offset of each window considered.

Import rectangle — If selected, the windows are defined by an auxiliary rectangle data file.

Import polygon — Not yet available.

Record edit criteria: Define the criteria to consider a good or bad record.

Fails all windows — If selected, the record is considered dead if it fails in all the defined windows simultaneously.

Analysis only — If selected, any recorded is marked as dead. This processing step is considered just an analysis tool.

Fails any window — If selected, the record is considered dead if it fails in on of the defined windows.

Window: Define the extent of each window where the estimate of the dominant frequency is computed.

Start time (ms) — Enter the start time, in ms, for each window.

End time (ms) — Enter the end time, in ms, for each window.

Start offset — Enter the start offset for each window.

End offset — Enter the end offset for each window.

Min dominant frequency — Enter the minimum dominant frequency that a given window must have for the record to be considered good.

Max dominant frequency — Enter the maximum dominant frequency that a given window must have for the record to be considered good.

Output header — Select the header location where the flag for good/bad records is stored.

Add window — Select if more than one window per record is going to be considered.

Delete window — Select to remove an existing window.

View window — Not yet available.

Export window — Not yet available.

Minimum live traces per analysis window — Enter the minimum number of live traces that must exit within each window for the estimation.

Trace Header Calculation

Usage:

The *Trace Header Calculation* step allows calculate a selected trace header from existing trace headers.

Input Links:

1) Seismic data in any sort order (mandatory).

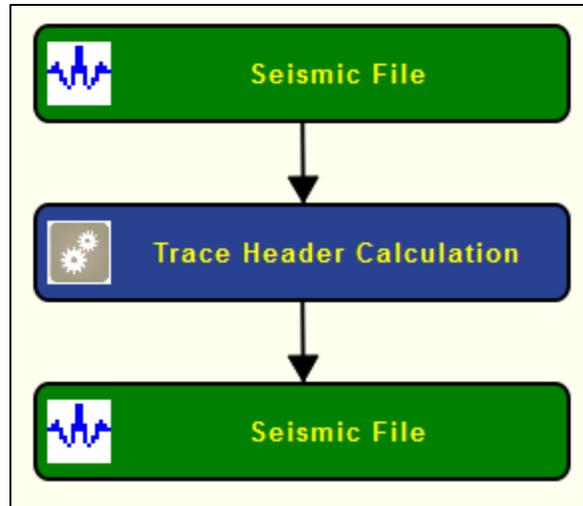
Output Links:

1) Seismic data in same sort order as the input (mandatory).

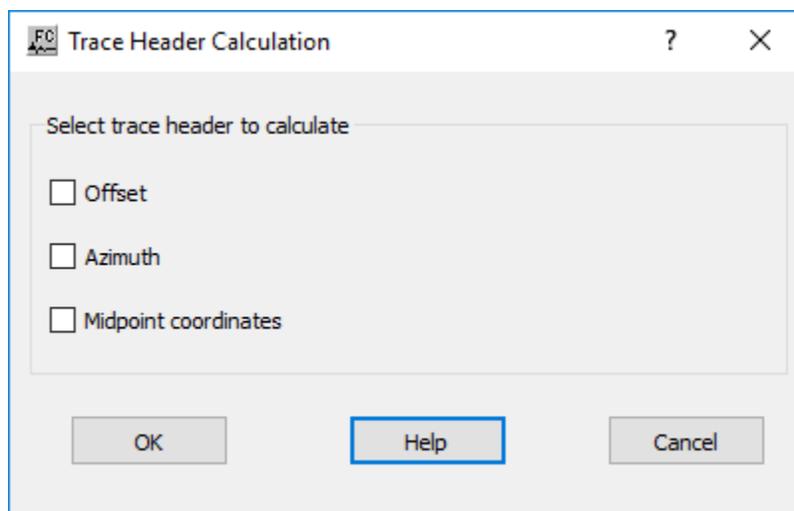
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Select trace header to calculate: select the trace header to be calculated.

Offset — If checked, calculates the offset and updates the corresponding trace header.

Azimuth — If checked, calculates the azimuth and updates the corresponding trace header.

Midpoint coordinates — If checked, calculates the midpoint coordinates and updates the corresponding trace header.

Trace Header Logic

Usage:

The *Trace Header Logic* step allows you modify the trace header values of a seismic trace using the relational operators and logic conditions characteristic of an If - Then – Else statement.

Input Links:

1) Seismic data in any sort order (mandatory).

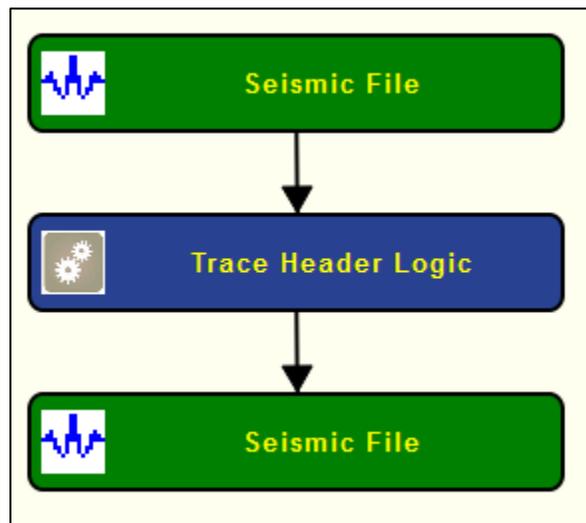
Output Links:

1) Seismic data in same sort order as the input (mandatory).

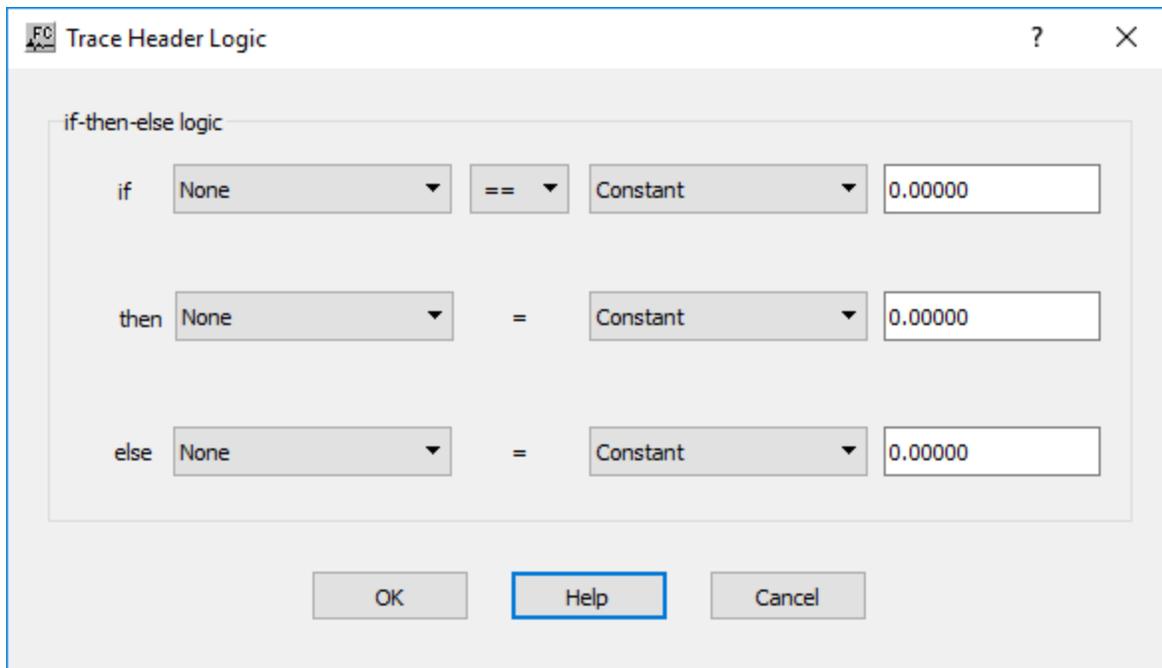
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

if — Select the relational and logic conditions for which the then statement will be executed.

Header Field — Select the primary trace header field to be tested.

Relation — Select the primary relational operator

Header Field — If selected, the primary trace header field will be evaluated against the chosen header field using the primary relational operator.

Constant — If selected, the primary trace header field will be evaluated against the user-supplied constant using the primary relational operator.

Logic — If checked, the Logic option allows selection of a secondary header field using and/or logic.

Header Field — Select the secondary trace header field to be tested.

Relation — Select the secondary relational operator

Header Field — If selected, the primary trace header field will be evaluated against the chosen header field using the secondary relational operator.

Constant — If selected, the primary trace header field will be evaluated against the-user supplied constant using the secondary relational operator.

then — Define the trace header operation to be performed in the case that the if conditions are satisfied.

Header Field — Select the trace header field to be modified in the case that the if conditions are satisfied.

Header Field — If selected, the header field selected above will be set equal to the chosen header field.

Constant — If selected, the header field selected above will be set equal to the user-supplied constant.

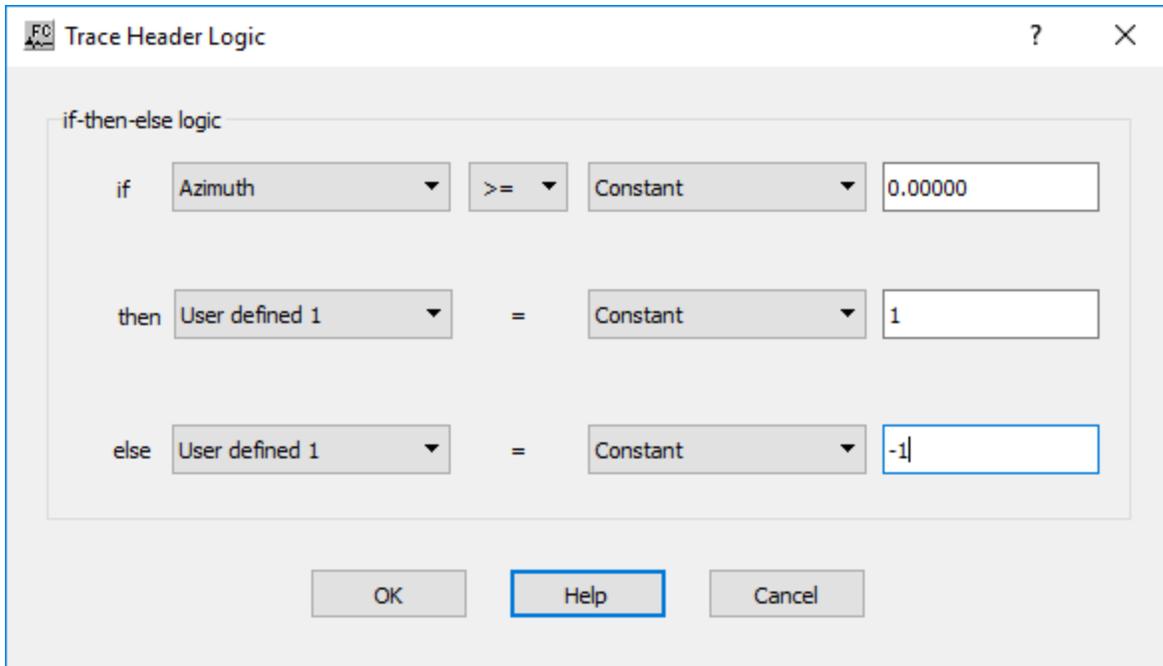
else — Define the trace header operation to be performed in the case that the if conditions are not satisfied.

Header Field — Select the trace header field to be modified in the case that the if conditions are not satisfied.

Header Field — If selected, the header field selected above will be set equal to the chosen header field.

Constant — If selected, the header field selected above will be set equal to the user-supplied constant.

Example: If the source-receiver azimuth is greater than or equal to zero, set the User Def 1 field equal to +1. Otherwise, set the User Def 1 field equal to -1.



Trace Header Math

Usage:

The *Trace Header Math* step allows you modify the trace header values of a seismic trace using standard mathematical operations.

Input Links:

1) Seismic data in any sort order (mandatory).

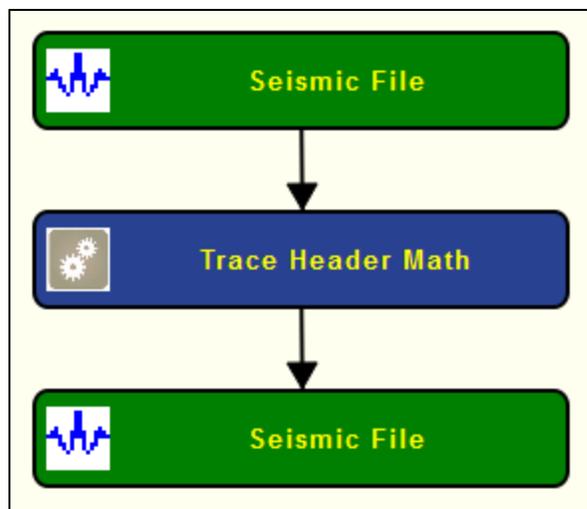
Output Links:

1) Seismic data in same sort order as the input (mandatory).

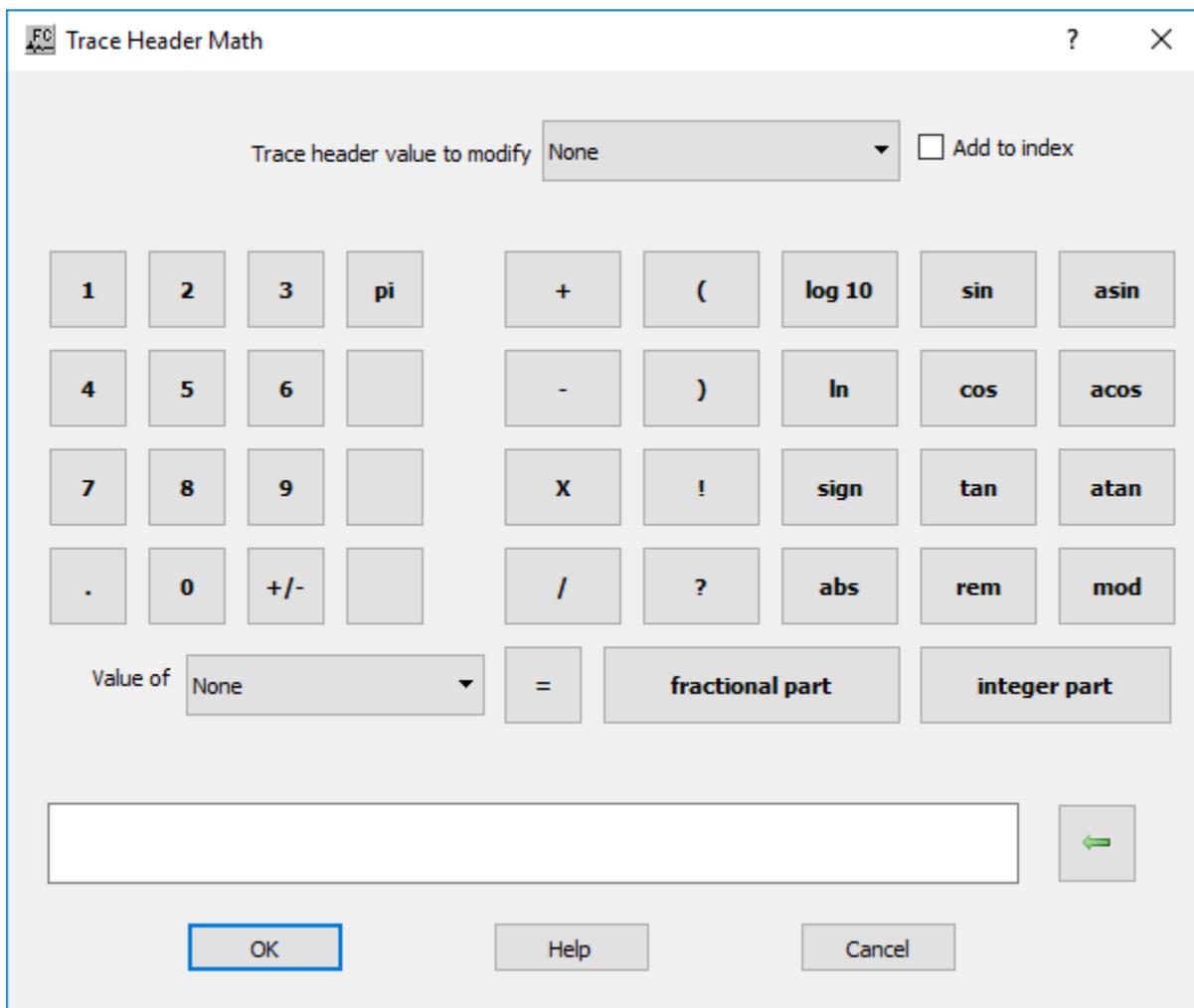
Reference:

-

Example Flowchart:



Step Parameter Dialog:



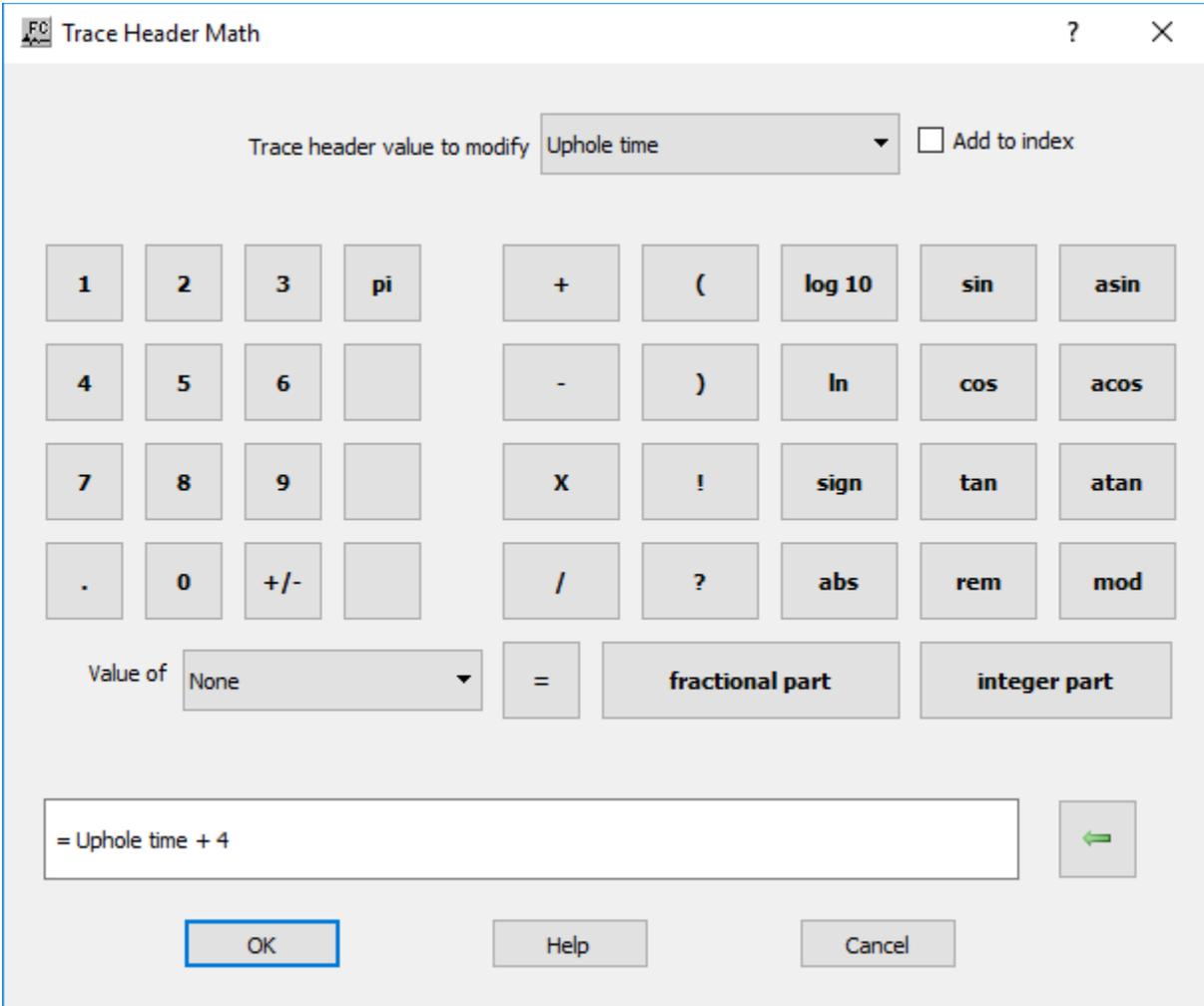
Parameter Description:

Trace header value to modify — Select trace header location to be modified.

Add to index — I checked, changed trace header is automatically updated in the index file.

The rest of the parameters are just like a regular calculator.

Example: Add 40 to the existing value of the Uphole time.



Trace Header Resequencing

Usage:

The *Trace Header Resequencing* step is used to modify trace header values based on changes in other trace header values.

Input Links:

1) Seismic data in any sort order (mandatory).

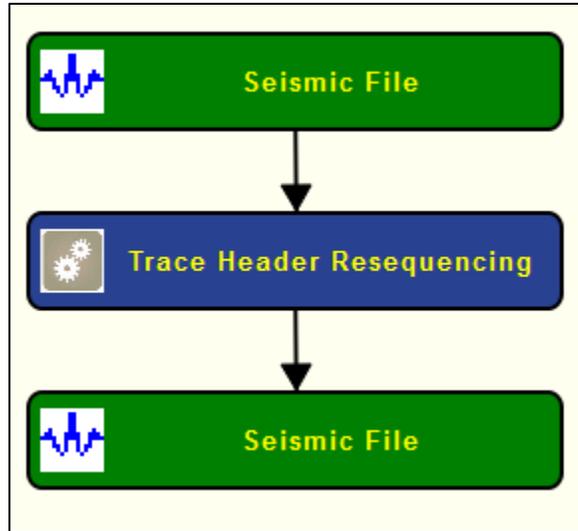
Output Links:

1) Seismic data file containing the duplicated trace (mandatory).

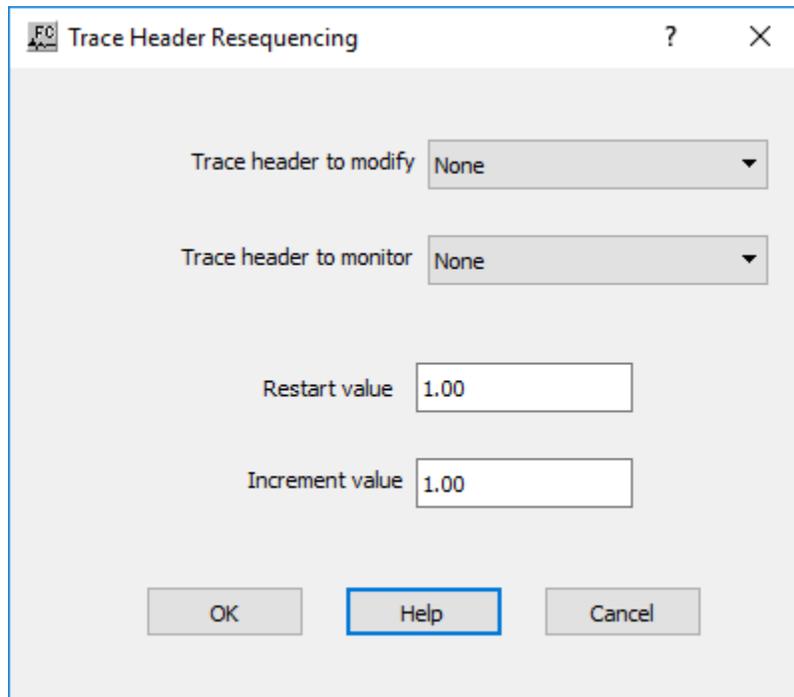
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Trace Header to Modify — Select the trace header field that will be modified.

Monitor Trace Header — Select the monitor trace header field. A change in value of the Monitor Trace Header will result in a change in value of the Trace Header to Modify based on the following two values:

Restart value — This value will be placed in the Trace Header to Modify whenever there is a change in the Monitor Trace Header.

Increment value — This value will be added to the Restart value for each trace header in which the Trace Header to Modify does not change.

Trace Sample Math

Usage:

The *Trace Sample Math* step allows you operate at the trace seismic samples using some pre-defined mathematical operations and two user-defined values.

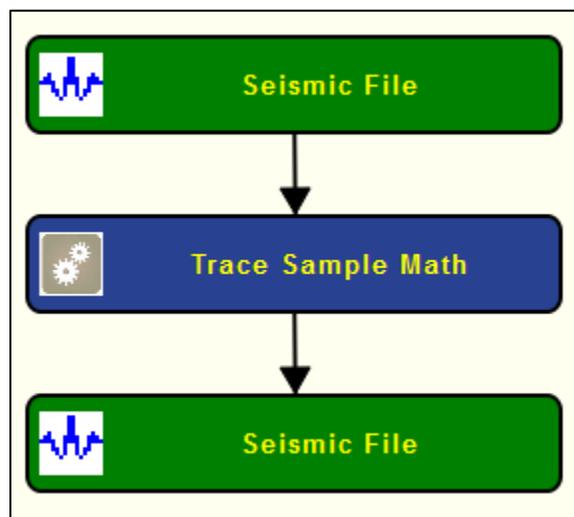
Input Links:

1) Seismic data in any sort order (mandatory).

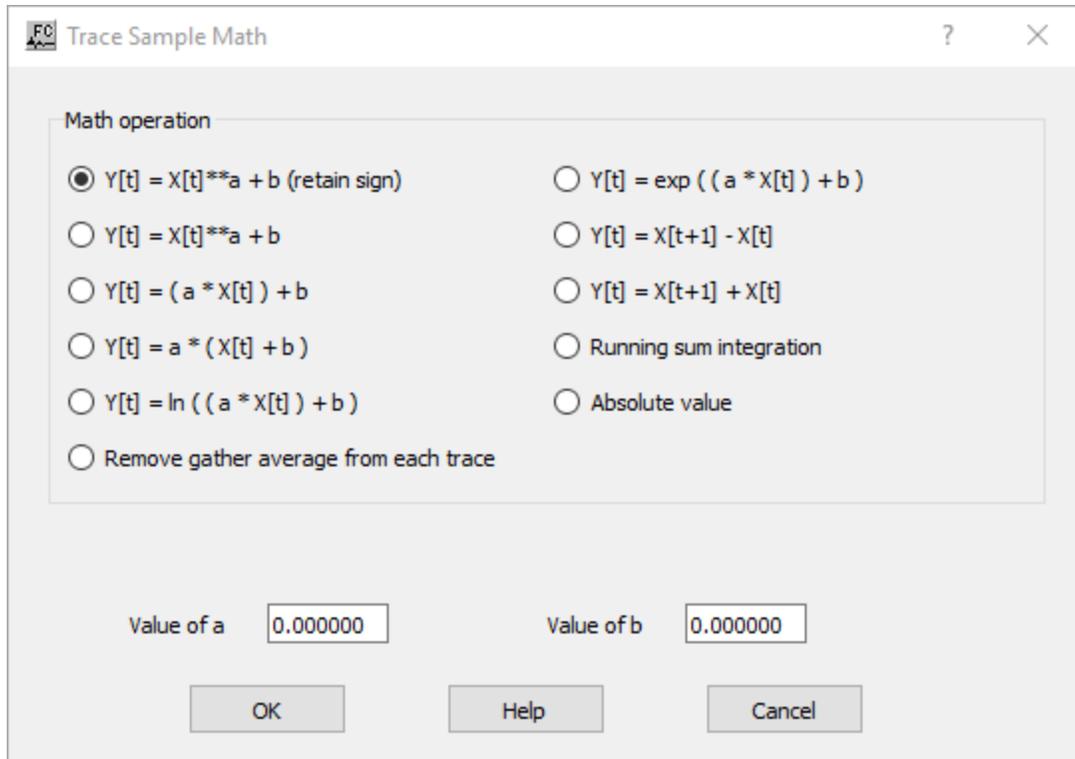
Output Links:

1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Math operation: Select pre-defined mathematical operations to be applied to the trace seismic samples of the input seismic file.

Value of a — Enter a value to be used in the selected mathematical operation replacing *a*.

Value of b — Enter a value to be used in the selected mathematical operation replacing *b*.

Vibroseis Correlation

Usage:

The *Vibroseis Correlation* step cross correlates uncorrelated seismic data acquired with the Vibroseis™ method with the corresponding vibroseis sweep. The correlated output data should be considered zero phase.

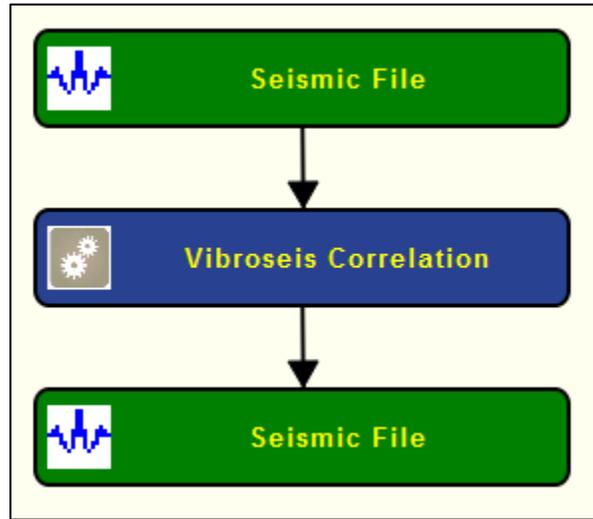
Input Links:

1. Seismic data in any sort order (mandatory).
- 2) Seismic data — Vibroseis™ pilot sweeps (optional).

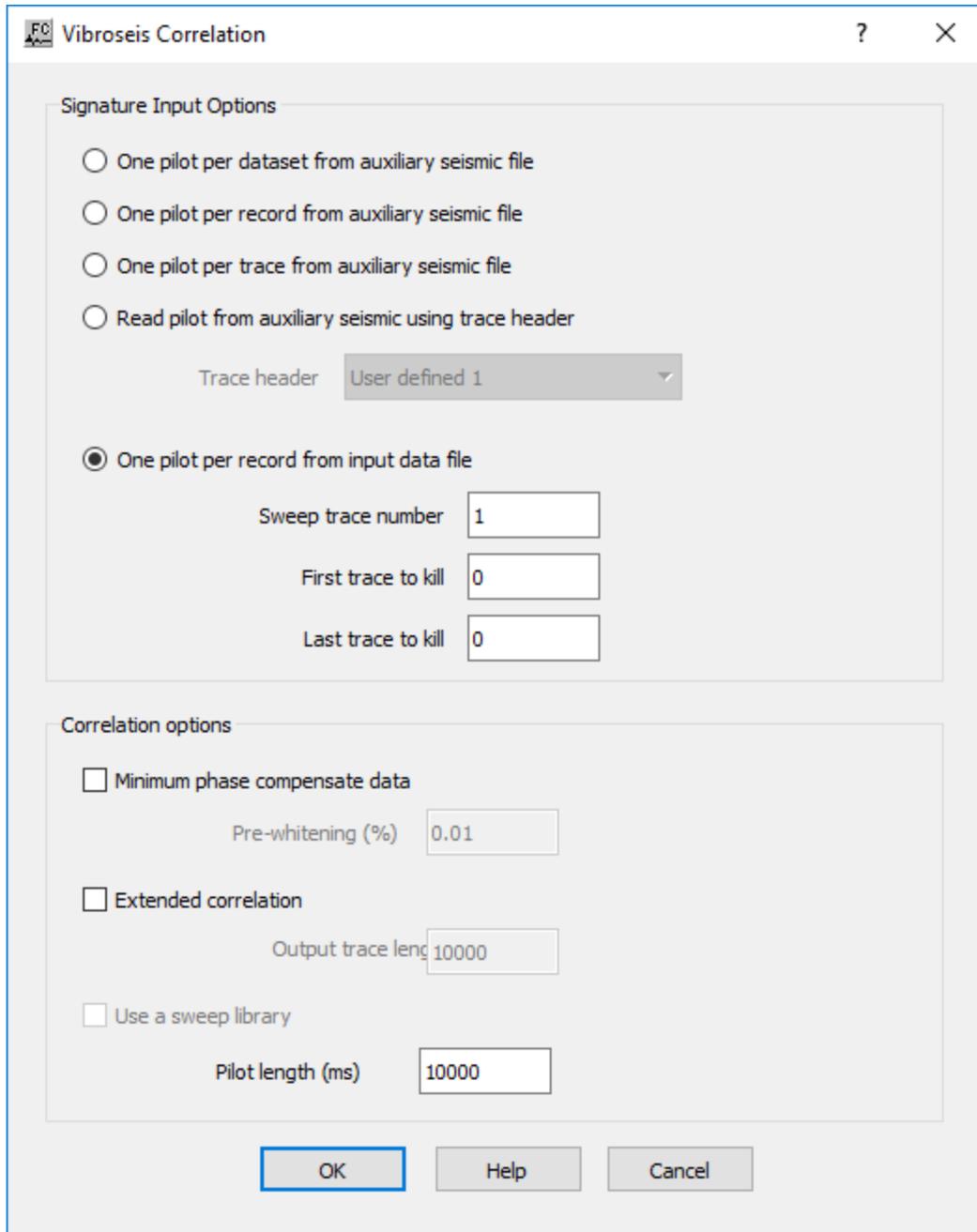
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Signature Input Options: Select the method of accessing the Vibroseis pilot sweep.

One pilot per dataset from an auxiliary file — Select the seismic file that contains the Vibroseis pilot.

One pilot per record from an auxiliary file — This option inputs one pilot trace in sequential order from an auxiliary file and crosscorrelates that pilot signature with the respective sequential record. Therefore, number of pilot traces should equal the number of input records.

One pilot per trace from an auxiliary file — This option inputs one pilot trace in sequential order from an auxiliary file and crosscorrelates that pilot signature with the respective sequential trace. Therefore, number of pilot traces should equal the number of input traces.

One pilot from auxiliary seismic using trace header — This option inputs one pilot trace based on the selected traced header from an auxiliary file and crosscorrelates that pilot signature with the respective sequential trace. Therefore, number of pilot traces should equal the number of input traces.

Trace header — Select trace header to be used to select the pilot.

One pilot per record from input data file — This option uses one trace from the each of the uncorrelated input records as the pilot trace for that record.

Sweep trace number — Enter the trace number to use as the pilot sweep.

First trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the pilot sweep, you may wish to kill these auxiliary traces so that they do not appear on output. Enter the first trace number to kill.

Last trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the pilot sweep, you may wish to kill these auxiliary traces so that they do not appear on output. Enter the last trace number to kill.

Pilot length (ms) — Enter the length of the pilot sweep in milliseconds.

Minimum phase compensate data — If checked, a minimum phase compensation filter will be calculated and applied so that the correlated data will be minimum phase on output.

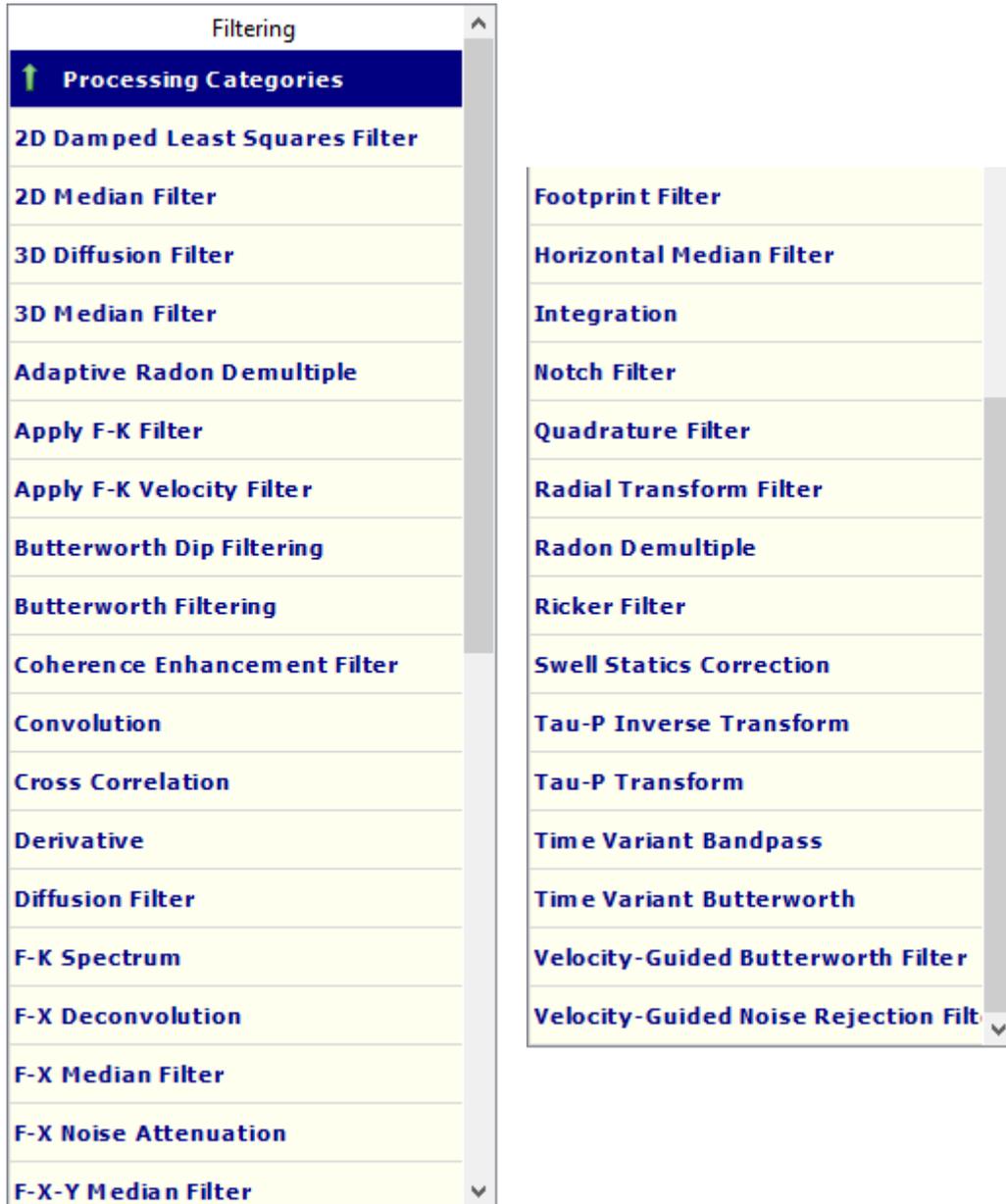
Extended Correlation — If checked, an extended correlation will be done using the entered trace output length.

Output trace length (ms) — Enter the output length of the result of the cross correlation.

Filtering Steps

This section documents the processing steps available in the Filtering Steps category.

The processing steps currently available are:



2D Damped Least Squares Filter

Usage:

The *2D Damped Least Squares Filter* step minimizes the weighted sum of (1) the deviation between the smooth velocity and the original one, and (2) the first derivative of the given signal.

This minimization is equivalent to a second-order differential equation that can be solved very efficiently.

Unlike conventional smoothing techniques (convolutional type) this method is independent of length of the smoothing operator, thus very efficient with long smoothing operators. This filter is very suitable for smoothing a 2D/3D velocity model before being used in migration or ray tracing. This step is multi-thread enabled.

Input Links:

- 1) Seismic data in any sort order (mandatory).

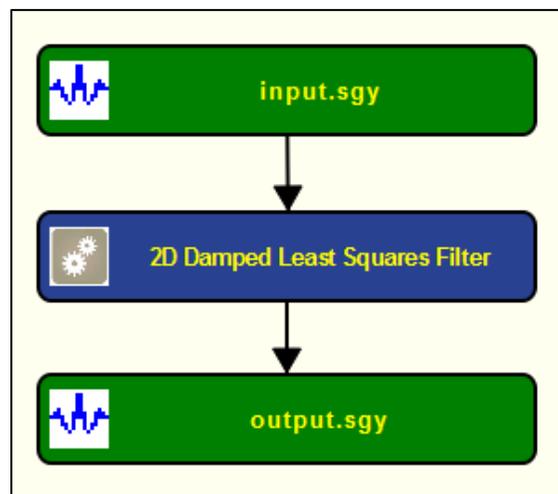
Output Links:

- 1) Seismic data in any sort order (mandatory).

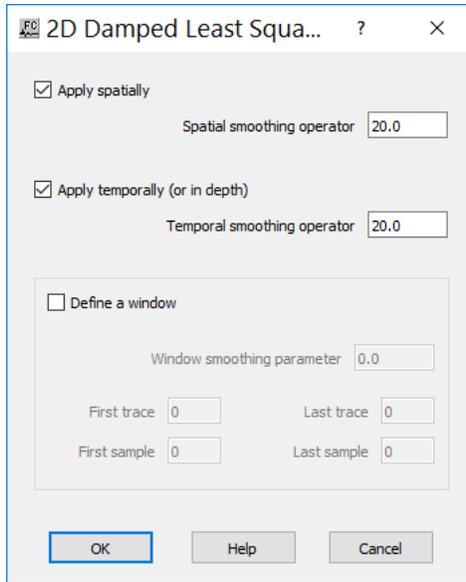
References

Zhenyue L., A Velocity Smoothing Technique Based on Damped Least Squares, Colorado school of mines.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Apply spatially — If checked, the filter is applied in the horizontal direction.

Spatial smoothing operator — Enter the degree of the smoothing operator in the horizontal direction.

Apply temporally (or depth) — If checked, the filter is applied in the vertical direction.

Temporal smoothing operator — Enter the degree of the smoothing operator in the vertical direction.

Define a window — If checked, the smoothing will be applied only within the specified window

Window smoothing parameter — Enter the smoothing operator value between the window and the rest of the record.

First trace — first trace defining the window.

Last trace — last trace defining the window.

First sample — first sample defining the window.

Last sample — last sample defining the window.

2D Median Filter

Usage:

The *2D Median Filter* step is a single channel filter that may be used to remove spikes from your data or any other features, such as the wow in radar, which may be filtered by a median operator.

You enter the side-length in samples and traces of the square window used for calculating the median value.

Input Links:

1) Seismic data in any sort order (mandatory).

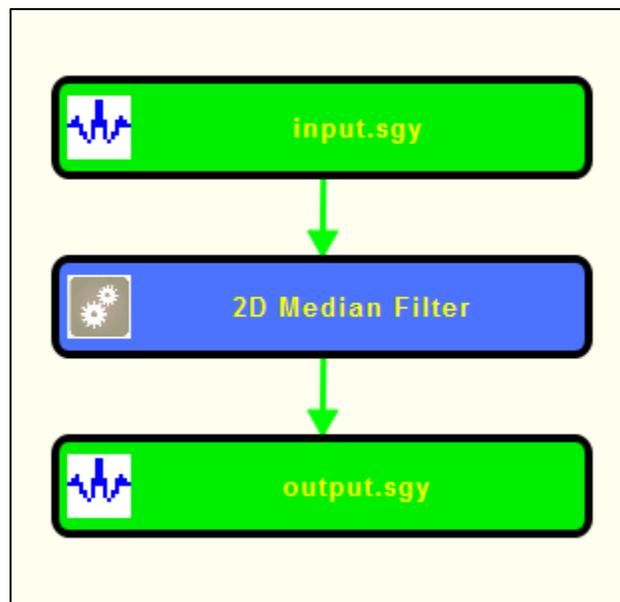
Output Links:

1) Seismic data in any sort order (mandatory).

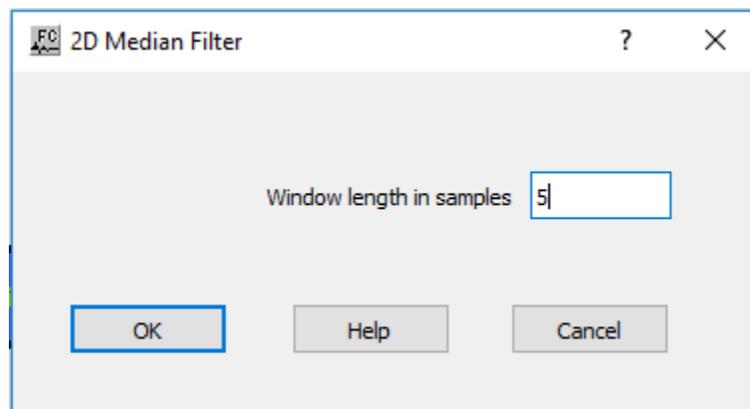
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Window length in samples — Enter the number of samples in the window over which the median will be calculated. The sample at the windows center will be replaced by the calculated median value.

3D Diffusion Filter

Usage:

The *3D Diffusion Filter* step is an anisotropic diffusion filter which performs edge-preserving smoothing in three dimensions. It is intended to be used to enhance post-stack 3D data.

The input data in the form of time traces does not require prior slicing or transformation.

Anisotropic diffusion is applied following structure in three dimensions using the Kuwahara filter. For this reason, estimation of the dip field is a required integral initial step. Parameters to control dip estimation are therefore required in addition to the diffusion parameters.

Due to parallel data handling, the output from *3D Diffusion Filter* must be written directly to disk using *Seismic File* without further processes in that job flow.

Input Links:

1) 3D seismic data ordered by CMP Line and CMP Location (mandatory).

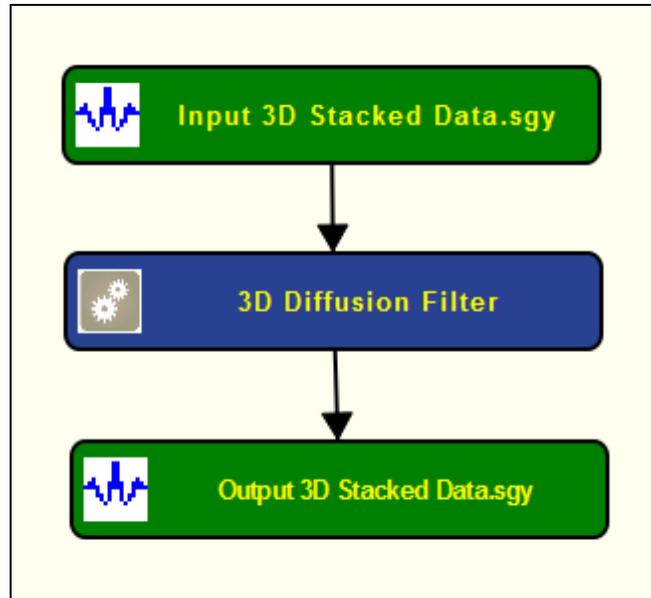
Output Links:

1) 3D seismic data ordered by CMP Line and CMP Location (mandatory).

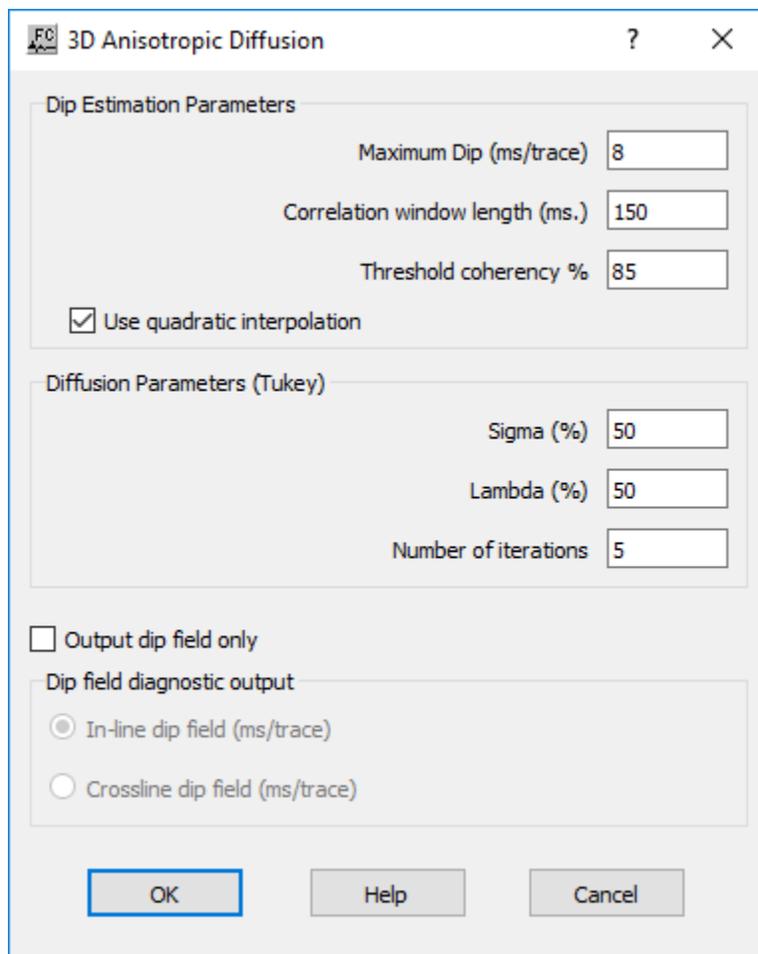
Reference:

Fehmers, G.C, and Hocker, C.F.W., 2003, Fast structural interpretation with structure-oriented filters, *Geophysics*, vol. 68, no. 4, p. 1286-1293.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Dip estimation parameters: define the parameters for dip estimation that is used for the edge preserving filter.

Maximum Dip (ms/trace) — Enter the maximum dip to be considered in the filter.

Correlation window length (ms.) — Enter the correlation window length for the dip scanning. An initial stage of dip estimation is cross-correlation of adjacent traces. This length should be sufficient to obtain stable dip estimates without being so long as to lose local structure changes.

Threshold coherency % — Enter a normalised correlation values must exceed this % for the estimated dip at a point to be considered valid.

Use quadratic interpolation — If checked, the dips are better estimated using a quadratic estimation formula.

Diffusion parameters (Tukey): define parameters that allow distinguish noise from signal.

Sigma (%) — Enter the noise threshold as a percentage of standard deviations

Lambda (%) — Enter the percentage of new values to add on each filter iteration

Number of iterations — Enter the number of filter iteration to apply to the input data.

Output dip field only — If checked, only the estimated inline or cross-line dip field will be output. This is for diagnostic use: If the estimated dip field output is not smooth and contain spikes then the diffusion process will not be optimal. In this case the dip estimation parameters should be modified until a reasonable dip field is output.

In-line dip field (ms/trace) — If checked, the dip field output will be the estimated in-line dip field.

Crossline dip field (ms/trace) — If checked, the dip field output will be the estimated crossline dip field.

3D Median Filter

Usage:

The *3D Median Filter* step is a filter with multiple uses which may be used for both single and multi-channel processing.

The input data in the form of time traces does not require prior slicing or transformation.

In ‘Apply’ mode, *3D Median Filter* replaces the input data samples with the median value of the surrounding values as specified by the filter size. In this mode the filter may be used to enhance

post-stack 3D, common offset or pre-stack data by the application of short length median filters. For example, for post-stack 3D data the default filter 3-3-3 will replace the value of every sample with the median of its 27 surrounding samples.

In 'Remove' mode, **3D Median Filter** subtracts from the input data samples the median value of the surrounding values as specified by the filter size. In this mode the filter may be used to remove low frequency noise. For example the filter 1-1-41 will act as a trace independent low frequency removal filter, or 1-1-5 as a high frequency removal filter.

One and two dimension median filters in any orientation (using a length of one in the other dimension(s)) will be quite fast. Filters which are long in all three dimensions are not recommended!

Input Links:

1) Seismic data in any sort order (mandatory).

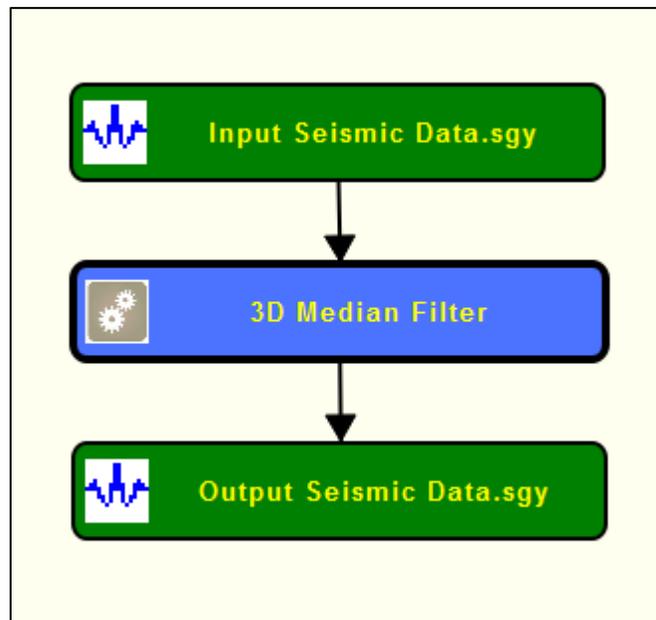
Output Links:

1) Seismic data in any sort order (mandatory).

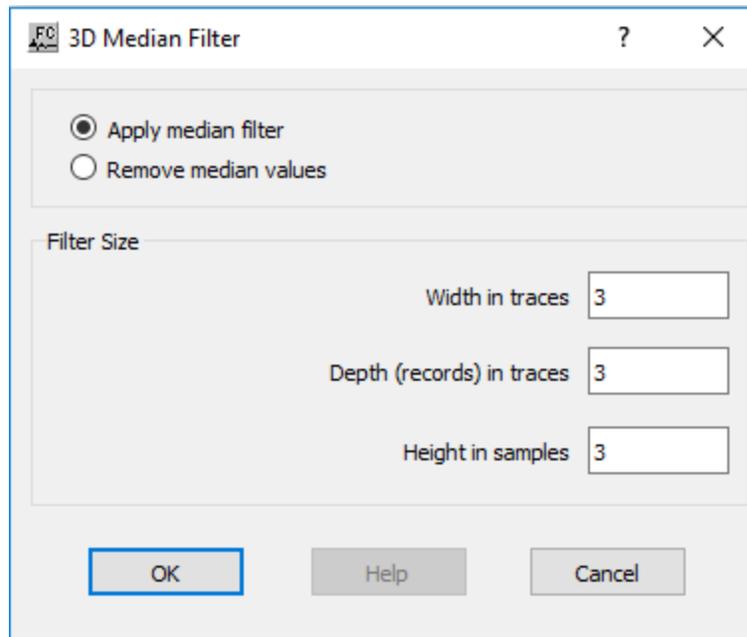
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Apply median filter — If selected, the data will be replaced by the median values as calculated by the specified filter. Use to enhance the data by removing random noise with a short filter in two or three dimensions.

Remove median filter — If selected, the median values as calculated by the specified filter will be subtracted from the input data. Use to remove low frequency noise with a long filter in one or two dimensions

Filter size: define the size of the filter to be applied.

Width in traces — Enter the number of traces within each record used to estimate median values.

Depth (records) in traces — Enter the number of neighboring records used to estimate median values. Note: this assumes sufficient similarity of adjacent records such as use in post-stack 3d data.

Height in samples — Enter the median filter length in the trace direction.

Adaptive Radon Demultiple

Usage:

The Adaptive Radon Demultiple step performs parabolic radon demultiple through a modeling of primaries, multiples, and noise in the parabolic radon domain followed by subtraction of multiples and noise in the time domain. You specify the transform type, the range of ray parameters in the

output transform, a percentage of multiples plus noise to subtract, and the spatial and temporal taper lengths used to generate the transform.

Input Links:

1) Seismic data in any sort order (required).

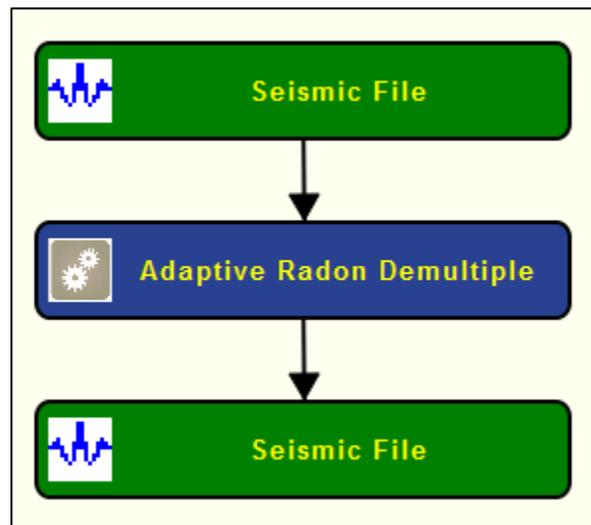
Output Links:

1) Seismic data in any sort order (required).

Reference:

Hampson, D., 1991, Inverse velocity stacking for multiple elimination, Journal of the Canadian Society of Exploration Geophysics, 22, p. 44-55.

Example Flowchart:



Step Parameter Dialog:

Adaptive Radon Demultiple [?] [X]

Time window

Limit application time

Start time referenced to horizon

Multiplier for time horizon

Use constant start time

Start time (ms)

Length of taper zone (ms)

Ray parameters

Set number of ray parameters

Number of ray parameters

Bandpass filter

Low cut (Hz)

Low pass (Hz)

High pass (Hz)

High cut (Hz)

Model moveout

Use differential moveout

Minimum

Maximum

Minimum multiple

Define maximum reference offset

Maximum reference offset

Use velocity

Minimum moveout

Maximum moveout

Minimum multiple moveout

Reference time (sec)

Additional parameters

Percent add-back

Percent pre-whitening

Minimum live traces

AGC window

Apply and remove AGC

AGC operator length (ms)

Type of output

Estimated primaries

Multiple model

OK Help Cancel

Parameter Description:

Time window: Specify time parameters.

Limit application time — If checked, the application time for the filter may be limited by using an input horizon or by using a constant time.

Start time referenced to horizon — If selected, reference start time to a horizon for the filter.

Multiplier for time horizon — Enter the multiplier for time horizon.

Use constant start time — If selected, a constant time for limiting the application zone for the filter.

Start time (ms) — Enter the start time in milliseconds for the application window of the filter.

Length of taper zone (ms) — Enter the taper length for the transition zone for the windows. A Hanning taper is used.

Ray parameters: Specify ray parameters.

Set number of ray parameters — If checked, the number of ray parameters to be calculated will be the number entered below. If not checked, the number of ray parameters will be equal to the number of traces in the input gather.

Number of ray parameters — Enter the constant number of ray parameters to calculate for each gather.

Bandpass filter: Specify bandpass filter parameters.

Low cut (Hz) — Enter the low cut frequency in Hertz for the bandpass filter.

Low pass (Hz) — Enter the low pass frequency in Hertz for the bandpass filter.

High pass (Hz) — Enter the high pass frequency in Hertz for the bandpass filter.

High cut (Hz) — Enter the high cut frequency in Hertz for the bandpass filter.

Model moveout: Set the range of parabolas that will generate the primary and multiple models.

Use differential moveout — If selected, specify the radon parameters in terms of differential moveout at far offset.

Minimum — Enter the minimum differential moveout for calculation of the radon transform expressed in milliseconds on the far-offset trace. The primary model is generated with parabolas from the <minimum differential moveout> to the <minimum multiple moveout>.

Maximum — Enter the maximum differential moveout for the calculation of the radon transform expressed in milliseconds on the far-offset trace. The multiple model is generated with parabolas from the <minimum multiple moveout> to the <maximum differential moveout>.

Minimum multiple — Enter the minimum multiple differential moveout for the radon filter expressed in milliseconds on the far-offset trace. All data between the minimum multiple differential moveout and the maximum differential moveout will be removed by the filter. The multiple model is generated with parabolas from the <minimum multiple moveout> to the <maximum differential moveout>.

Use velocity — If selected, specify the radon filter parameterization using velocities.

Minimum moveout — Enter the minimum (negative usually) velocity for the radon transform calculation.

Maximum moveout — Enter the maximum velocity for the radon transform calculation.

Minimum multiple moveout — Enter the minimum multiple moveout velocity for the radon filter. The filter will remove data between the minimum multiple moveout velocity and the maximum multiple moveout velocity.

Define maximum reference offset — If checked, a constant maximum offset will be used for the calculation of the radon transform. The differential moveouts will be the delta times at this specified offset.

Maximum reference offset — Enter a constant maximum offset to be used for the calculation of the radon transform. The differential moveouts will be the delta times at this specified offset.

Reference time (sec) — Enter the reference time in seconds where the velocities are specified. This is used to convert the velocities to differential moveout for the radon algorithm.

Additional parameters: Specify additional parameters.

Percent add-back — Enter the percentage of the original data to be blended with the output filtered data.

Percent pre-whitening — Enter the percentage of pre-whitening to apply to the data for stabilizing the algorithm.

Minimum live traces — Enter the minimum number of live traces per gather for applying the filter. Gathers with fewer traces will be passed through to the output with no filtering applied.

AGC window — Set the parameters for an AGC window.

Apply and remove AGC – If checked, apply an AGC before the filter and remove the same AGC after the filter.

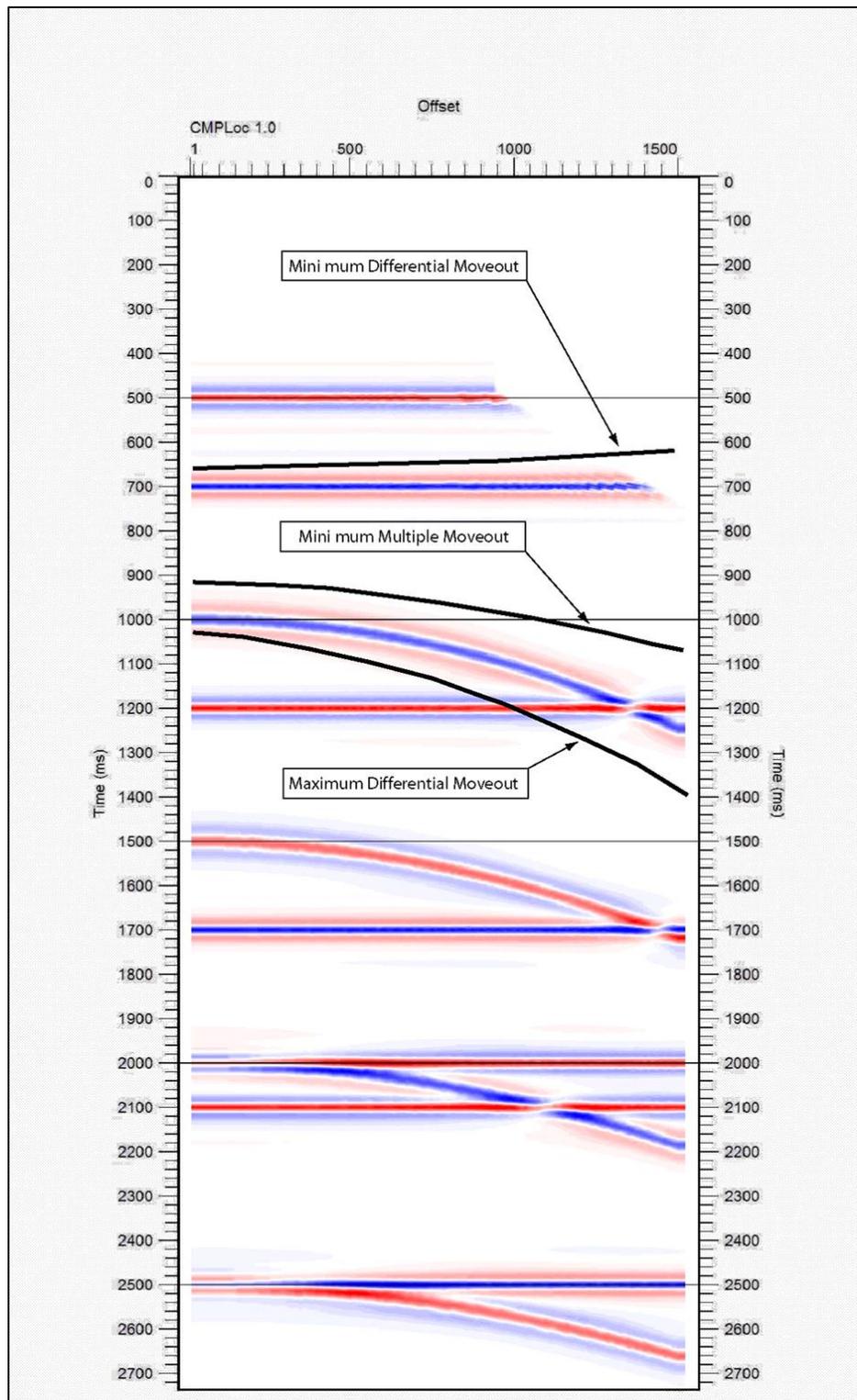
AGC operator length (ms) — Enter the AGC operator length in milliseconds.

Type of output — If selected, the type of output desired.

Estimated primaries — If selected, output the estimated primaries.

Multiple model – Output the multiple data.

Example of Adaptive Radon Demultiple:



Apply F-K Filter

Usage:

The **Apply F-K Filter** step transforms T-X domain data to the F-K domain, applies a specified F-K reject filter, and returns the data to the T-X domain. F-K Filters are picked interactively as Surgical Mutes in SeisViewer using the Pick Traces tool located in the Picking menu.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Surgical Mutes cards (mandatory).

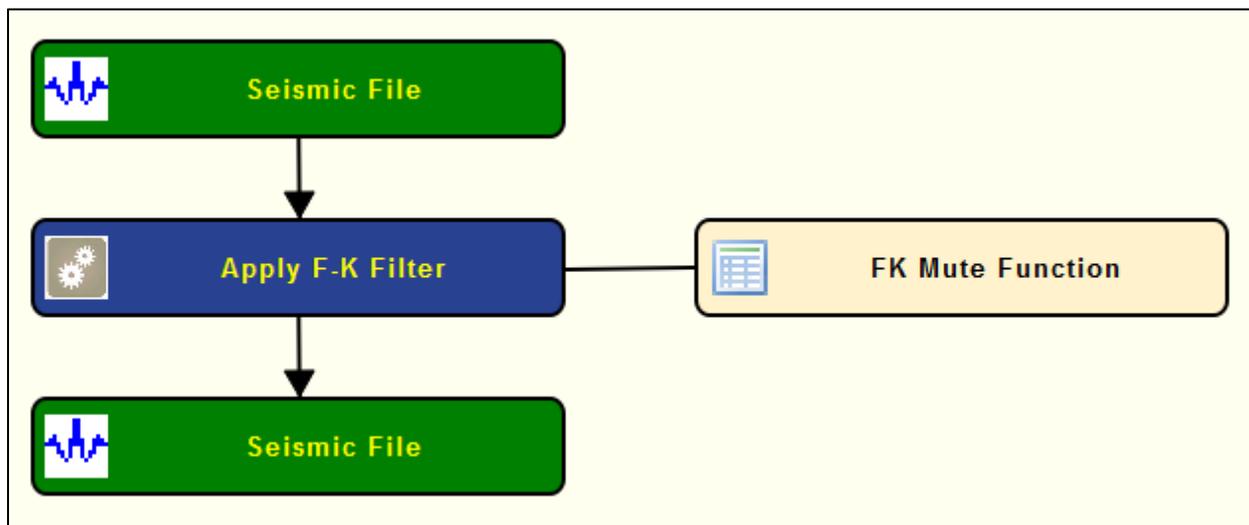
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

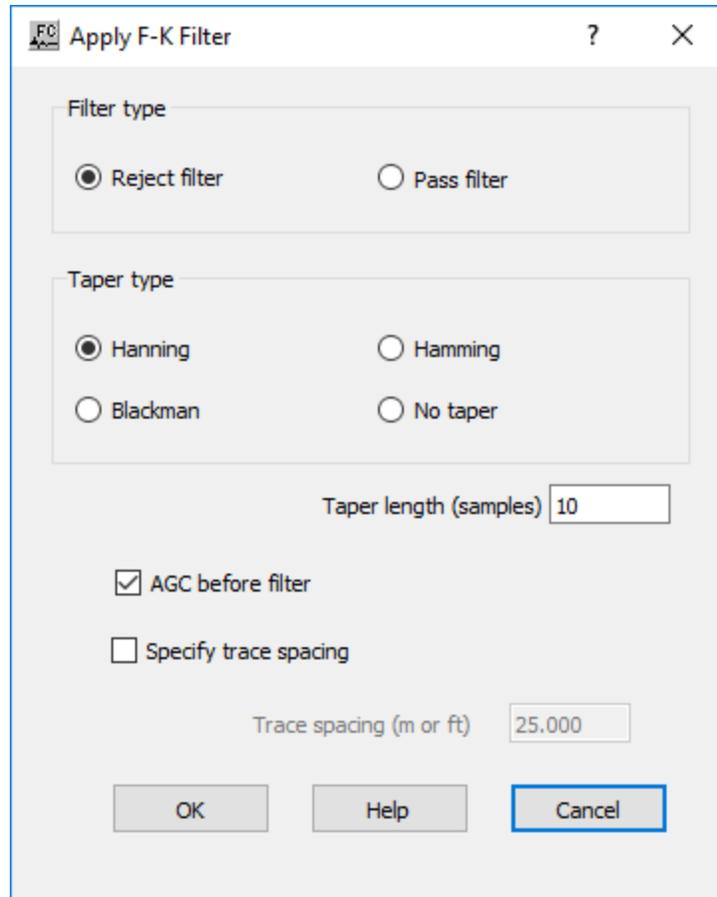
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Filter type: Define the type of F-K Filter.

Reject filter — If selected, the polygon area is rejected.

Pass filter — If selected, passes the polygon area.

Taper Type: Select the type of taper to use when applying the F-K mute function.

Hanning — A Hanning taper is specified by the equation : $x(n) = 0.5 - 0.5 * \cos (2*\pi*n/N)$.

Hamming — A Hamming taper is specified by the equation : $x(n) = 0.54 - 0.46 * \cos (2*\pi*n/N)$.

Blackman — A Blackman taper is specified by the equation : $x(n) = 0.42 - 0.5 * \cos (2*\pi*n/N) + 0.08 * \cos (4*\pi*n/N)$

No taper — No taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

AGC before filter — If checked, an AGC is applied to each trace before filtering. The AGC gain function is removed after filtering.

Specify trace spacing — If checked, specify manually the space between traces in record. Otherwise uses the trace spacing from headers. By default, the group interval is read from the seismic data and the trace-to-trace spacing is calculated from the group interval. If the Geometry Definition step has not been applied to the data, the seismic data will not contain information regarding the group interval and this option should be used.

Trace spacing (m or ft) — Enter the trace interval in m or ft, depending on the project units.

Apply F-K Velocity Filter

Usage:

The *Apply F-K Velocity Filter* step transforms T-X domain data to the F-K domain, applies an F-K pass or reject filter, and returns the data to the T-X domain. A user-specified minimum and maximum velocity defines the pass or reject zone.

Input Links:

- 1) Seismic data in any sort order (mandatory).

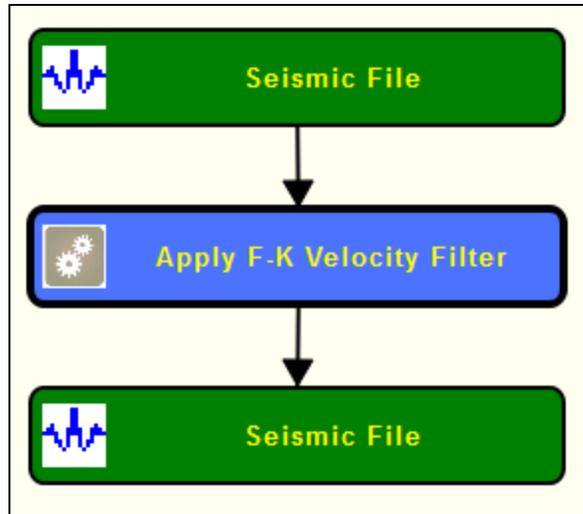
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

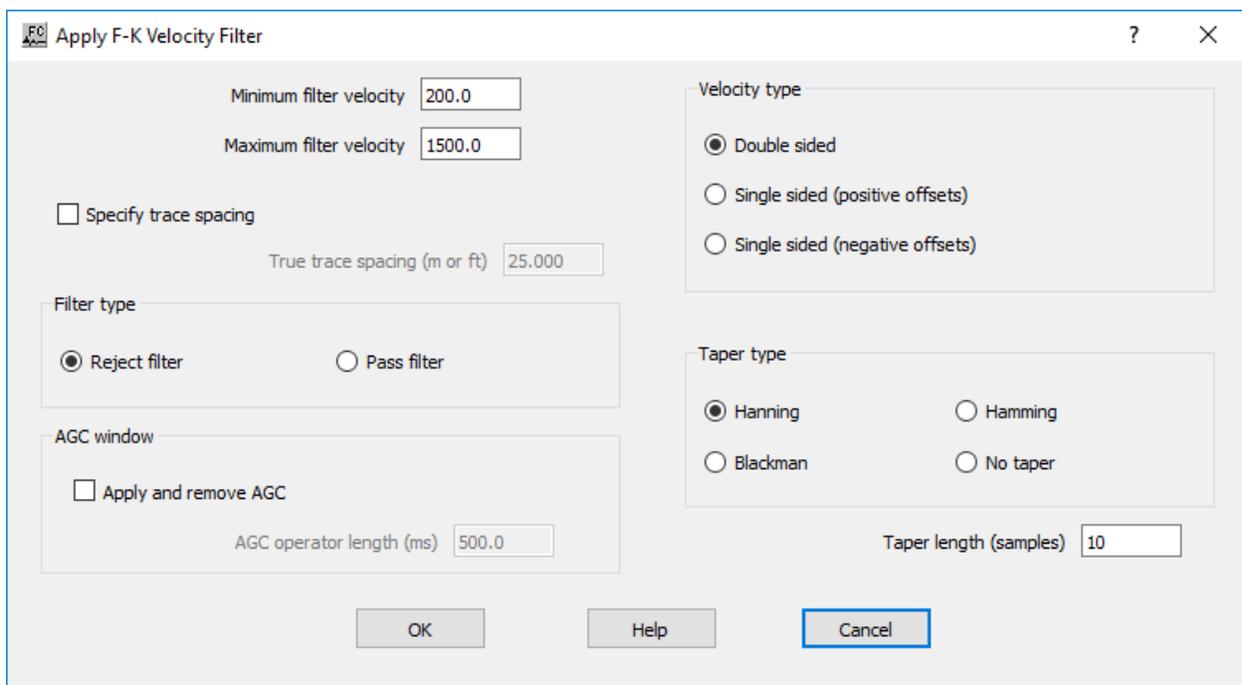
-

Example Flowchart:



Example Flowchart:

Step Parameter Dialog:



Parameter Description:

Enter minimum velocity — Enter the minimum velocity of the pass or reject zone.

Enter maximum velocity — Enter the maximum velocity of the pass or reject zone.

Specify trace spacing — If checked, manual set the trace-to-trace spacing in the record to be filtered. By default, the group interval is read from the seismic data and the trace-to-trace spacing is calculated from the group interval. If the Geometry Definition step has not been applied to the data, the seismic data will not contain information regarding the group interval and this option should be used.

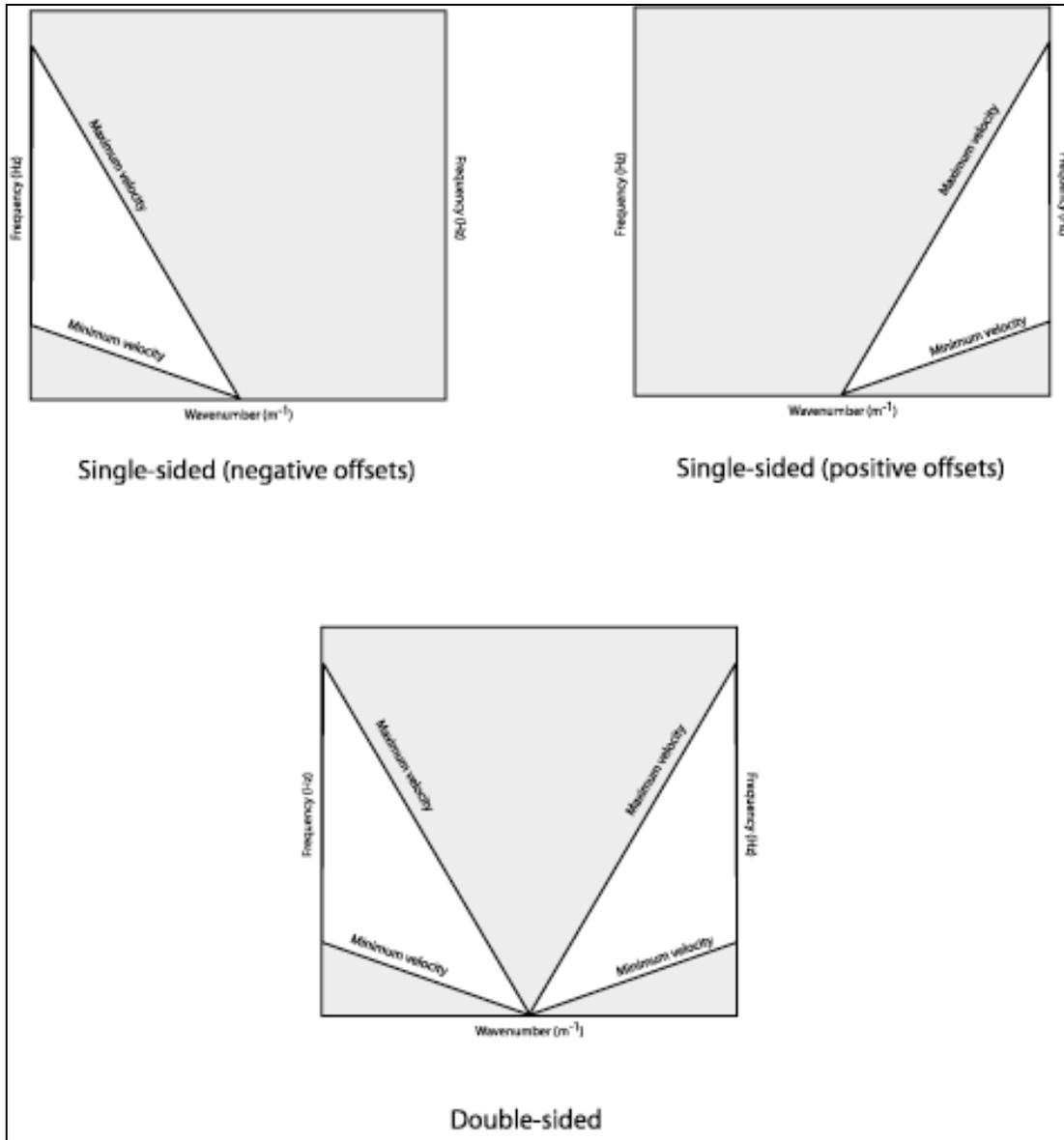
Trace spacing (m or ft) — Enter the trace interval in m or ft, depending on the project units.

Velocity type: Specify whether the applied F-K filter will be symmetrical or asymmetrical. See Figure below.

Double sided — If selected, the specified minimum and maximum velocities will be used to create a double-sided, or symmetrical F-K filter.

Single sided (positive offsets) — If selected, the specified minimum and maximum velocities will be used to pass or reject energy propagating in the direction of increasingly positive source-to-receiver offset.

Single sided (negative offsets) — If selected, the specified minimum and maximum velocities will be used to pass or reject energy propagating in the direction of increasingly negative source-to-receiver offset.



Filter type: Specify whether the minimum and maximum velocity values specify a pass or a reject zone.

Reject filter — If selected, the portion of F-K space defined by the minimum and maximum velocities will be rejected.

Pass filter — If selected, the portion of F-K space defined by the minimum and maximum velocities will be passed.

Taper Type: Select the type of taper to use when applying the F-K mute function.

Hanning — A Hanning taper is specified by the equation: $x(n) = 0.5 - 0.5 * \cos(2 * \pi * n / N)$.

Hamming — A Hamming taper is specified by the equation: $x(n) = 0.54 - 0.46 * \cos (2*\pi*n/N)$.

Blackman — A Blackman taper is specified by the equation: $x(n) = 0.42 - 0.5 * \cos (2*\pi*n/N) + 0.08 * \cos (4*\pi*n/N)$

No taper — No taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

AGC Window: Define parameter for AGC filter.

Apply and remove AGC — If checked, and AGC filter is applied before the F-K Velocity filter and removed from the output seismic file. The AGC filter is used exclusively internally to improve the performance of the F-K filter.

AGC operator length — Enter the AGC operator length in ms.

Taper length (ms) — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Butterworth Dip Filtering

Usage:

The *Butterworth Dip Filtering* step is a single channel filter that may be used to pass or reject dipping data.

The data is transformed to the frequency domain, where the Butterworth dip filter is applied.

Common usage includes suppression of dipping noise from pre-stack data.

Input Links:

1) Seismic data in any sort order (mandatory).

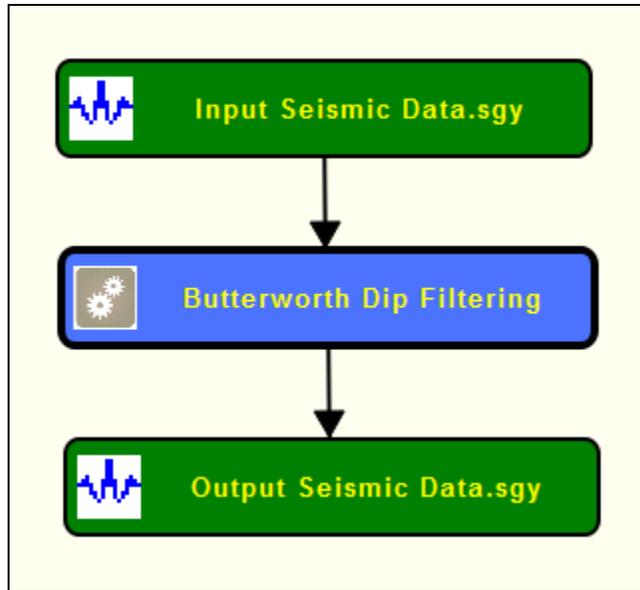
Output Links:

1) Seismic data in any sort order (mandatory).

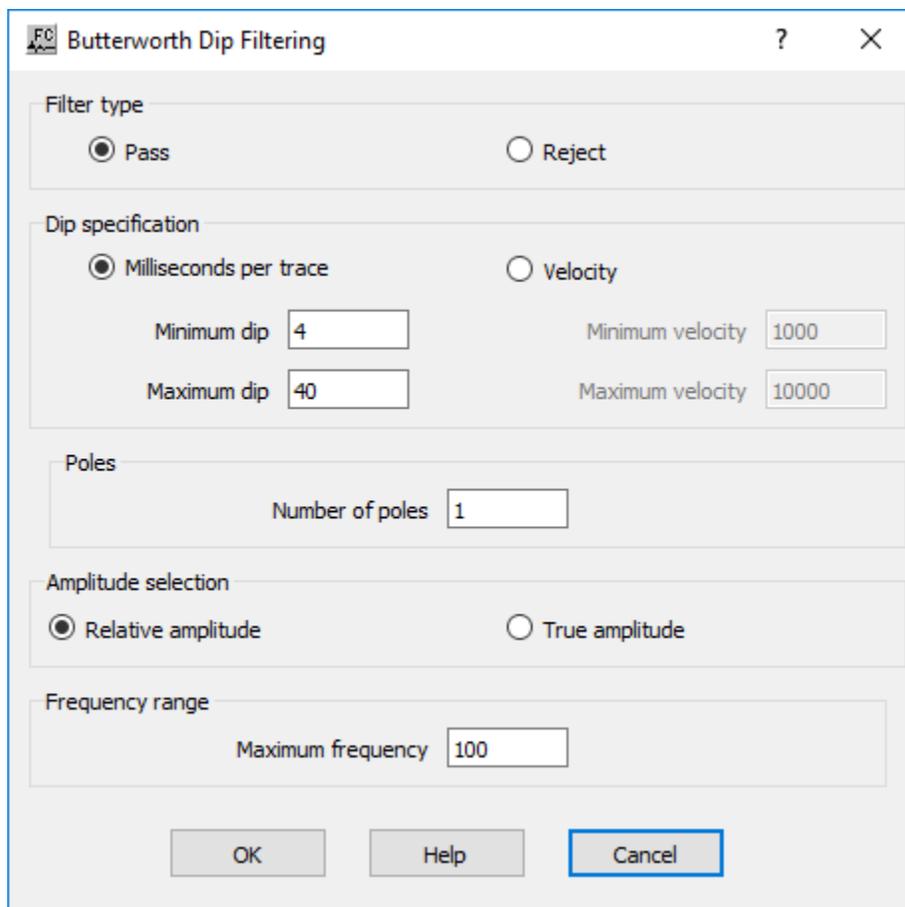
Reference:

Hale, D. and Claerbout, J.F., 1983, Butterworth dip filters, *Geophysics*, v. 48, p. 1033-1038.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Filter type: Define type of filter to be applied.

Pass — If checked, the filter will pass dipping data over the specified range of dips.

Reject — If checked, the filter will reject dipping data over the specified range of dips.

Dip specification: Specify parameters related with dip estimation

Milliseconds per trace — If checked, the range of dips required must be input in terms of milliseconds per trace.

Velocity — If checked, the range of dips required must be input in terms of apparent velocity.

Poles: Define number of poles in the filter.

Number of poles – Enter the number of poles for the Butterworth dip filter. A larger number of poles for a sharper cut-off of the pass or reject zone.

Amplitude selection: Select type of amplitude.

Relative amplitude – If checked, the data is equalized to relative amplitude before application of the filter.

True amplitude – If checked, the filter is directly applied to the frequency domain data.

Frequency range: Specify the frequency range of the filter.

Maximum frequency – Enter the maximum frequency to be used. The greatest frequency that is to be maintained and dip filtered.

Butterworth Filtering

Usage:

The *Butterworth Filtering* step allows you to apply recursively a Butterworth filter to your trace data in the time domain. You specify the low pass, high pass and high and low rolloff rates in decibels (dB) for the filter. You may choose to apply the filter as either a zero phase or minimum phase filter.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data or auxiliary text file with filter (mandatory).

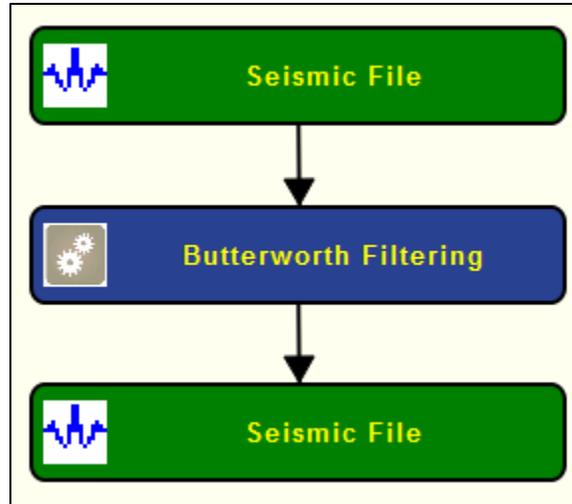
Output Links:

- 1) Seismic data in any sort order (mandatory).

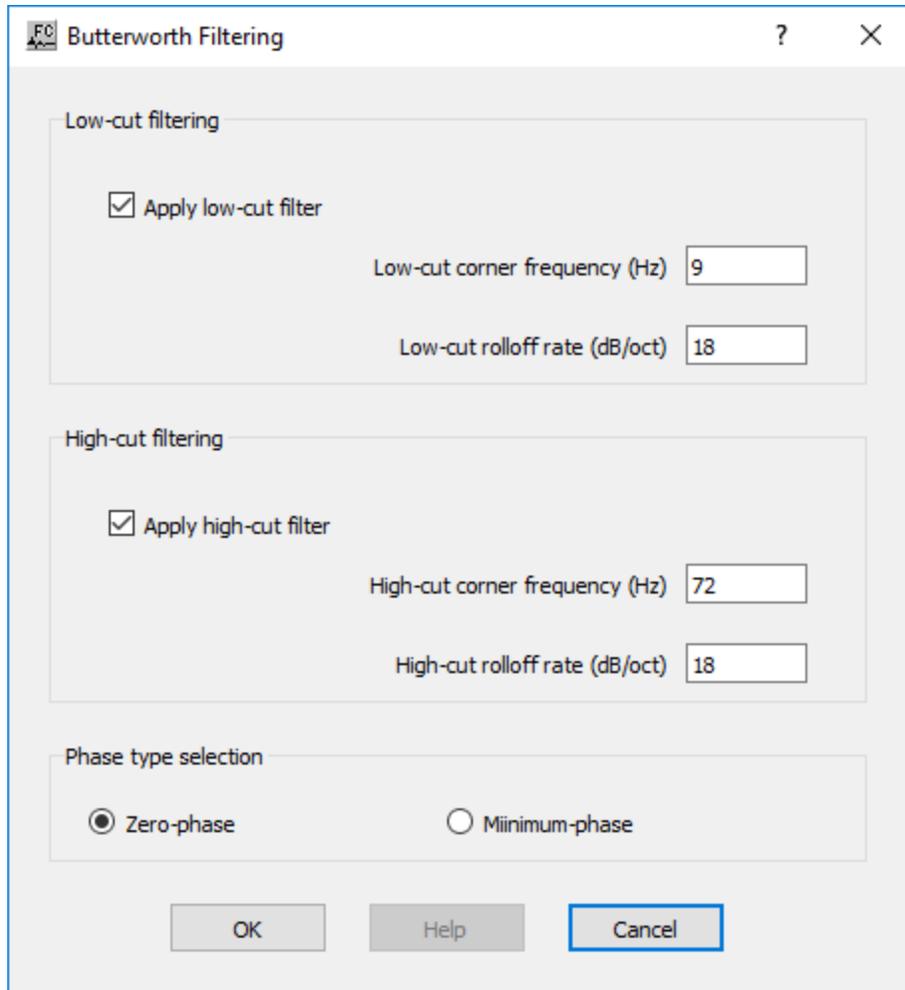
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Low-cut filtering: Specify low-cut filter parameters.

Apply low-cut filter — If checked, a low-cut filter will be applied to your data.

Low-cut corner frequency (Hz) — Enter the low half-power frequency in Hertz to be applied to your data. The amplitude of this frequency will be reduced by a factor of two relative to the input.

Low-cut rolloff rate (dB/oct) — Enter the low rolloff filter slope in decibels per octave to be applied to your data. Higher numbers give steeper rolloff.

High-cut filtering: Specify high-cut filter parameters.

Apply high-cut filter — If checked, a high-cut filter will be applied to your data.

High-cut corner frequency (Hz) — Enter the high half-power frequency in Hertz to be applied to your data. The amplitude of this frequency will be reduced by a factor of two relative to the input.

High-cut rolloff rate (dB/oct) — Enter the high rolloff filter slope in decibels per octave to be applied to your data. Higher numbers give steeper rolloff.

Phase selection: Select the phase type of the filter.

Zero — Zero-phase filter selected.

Minimum — Minimum-phase filter selected.

Coherence Enhancement Filter

Usage:

The Coherence Enhancement Filter is used to accentuate the visual coherence of seismic events.

Input Links:

1) Seismic data in any sort order (mandatory).

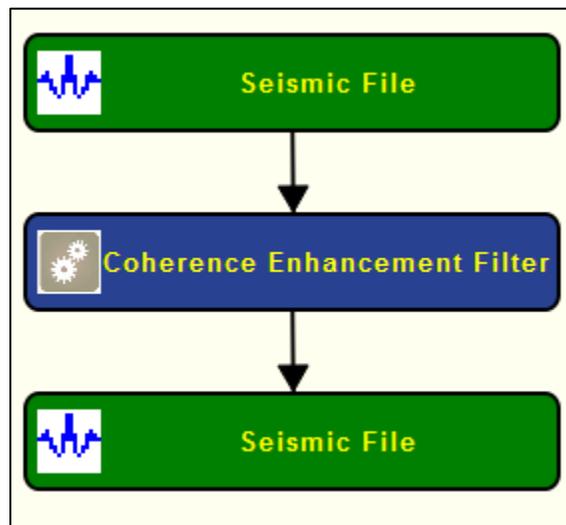
Output Links:

1) Seismic data in any sort order (mandatory).

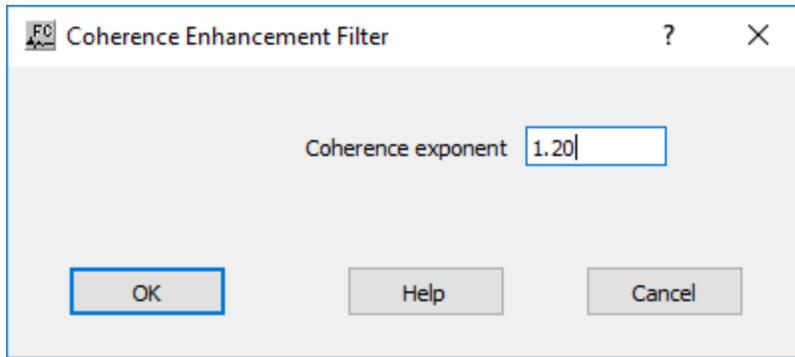
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Coherence Exponent — Enter the coherency filter exponent. Values of 1 to 1.5 are usually used. A value of 1 does nothing. A value of 1.5 significantly increases coherency. The exponent is applied to the data in the F-K domain.

Convolution

Usage:

The *Convolution* step is used to convolve traces in a seismic data file with a filter function specified in an auxiliary data set define as seismic file or auxiliary text file.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Auxiliary file in any sort order (mandatory).

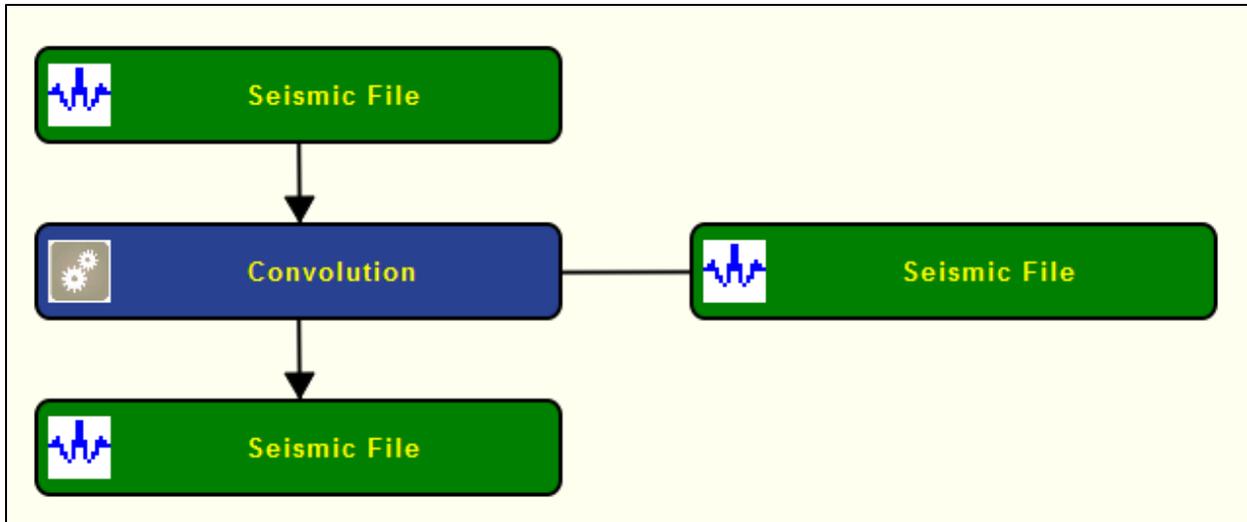
Output Links:

- 1) Seismic data in any sort order (mandatory).

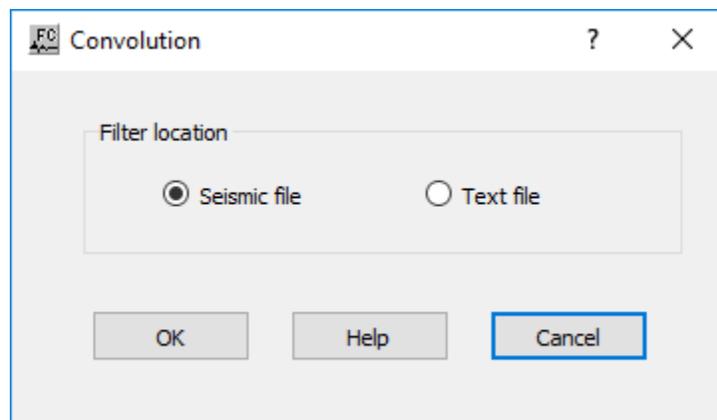
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Filter location: Specify the location of the filter to be convolved.

Seismic file — If selected, the filter is defined in an auxiliary seismic file.

Text file — If selected, the filter is defined in an auxiliary text file.

Cross Correlation

Usage:

The *Cross Correlation* step computes the cross correlation between an input seismic data and an auxiliary seismic data.

Input Links:

- 1) Seismic data in any sort order (mandatory).

2) Auxiliary Seismic data in any sort order (mandatory).

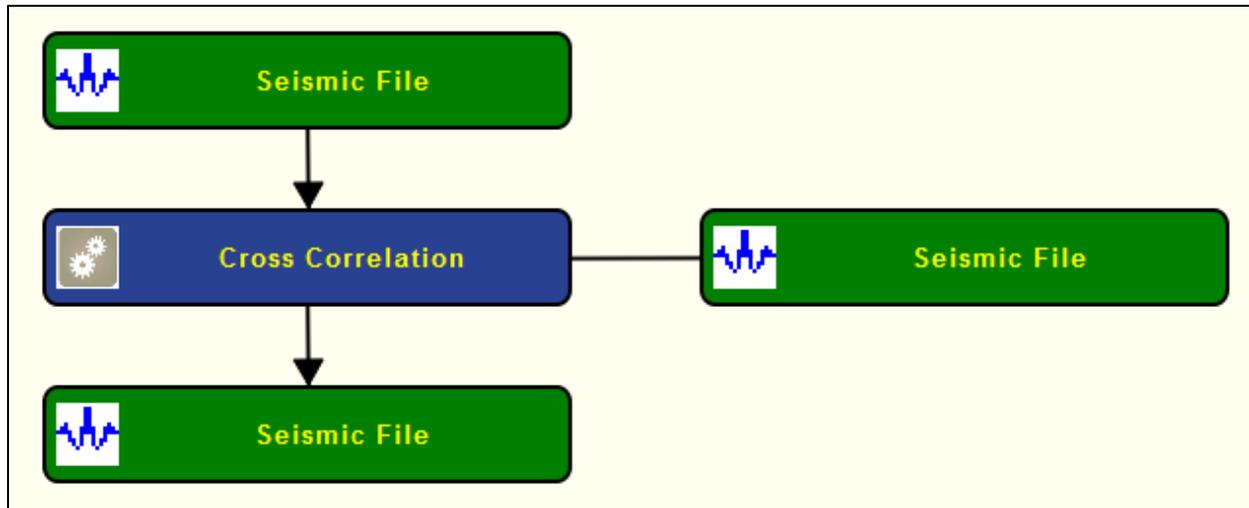
Output Links:

1) Seismic data in any sort order (mandatory).

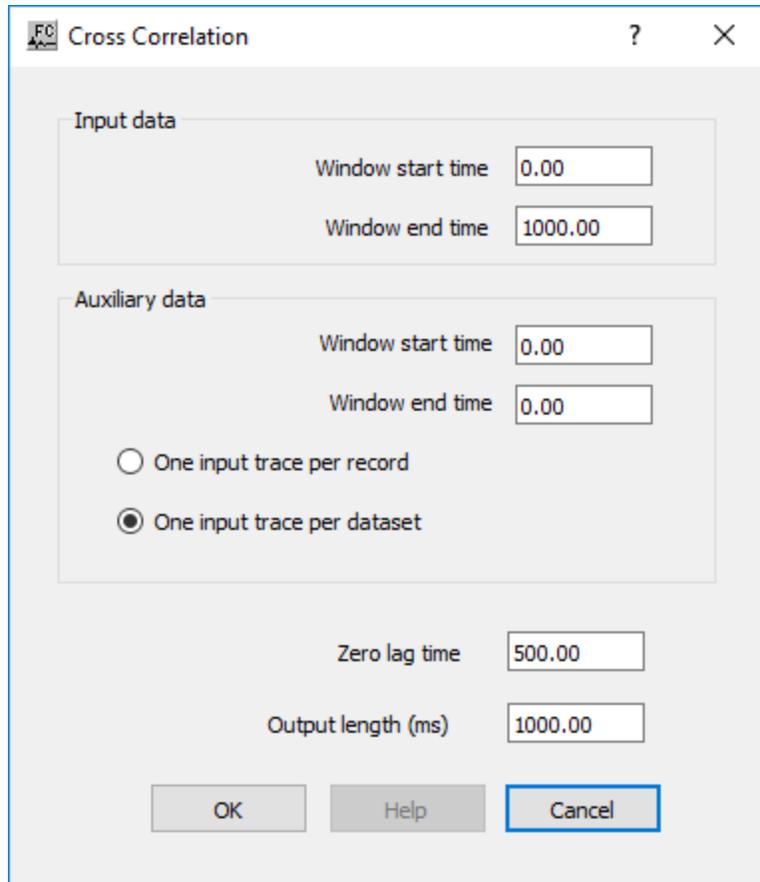
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input data: Specify parameters for input seismic file.

Window start time — Enter the window start time for input seismic file in milliseconds.

Window end time — Enter the window end time for input seismic file in milliseconds.

Auxiliary data: Specify parameters for input seismic file.

Window start time — Enter the window start time for auxiliary seismic file in milliseconds.

Window end time — Enter the window start time for auxiliary seismic file in milliseconds.

One input trace per record — If selected, the auxiliary data is considered to have one input trace per record.

One input trace per dataset — If selected, the auxiliary data is considered to have one input trace per record.

Zero lag time — Enter the zero lag time for the cross correlation.

Output length (ms) — Enter the output length of the cross correlation in milliseconds.

Derivative

Usage:

The *Derivative* step computes the derivative of the data samples in each input seismic trace.

Input Links:

3) Seismic data in any sort order (mandatory).

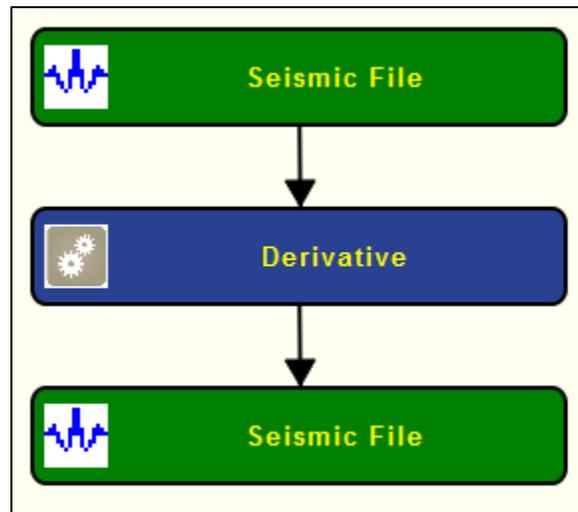
Output Links:

2) Seismic data in any sort order (mandatory).

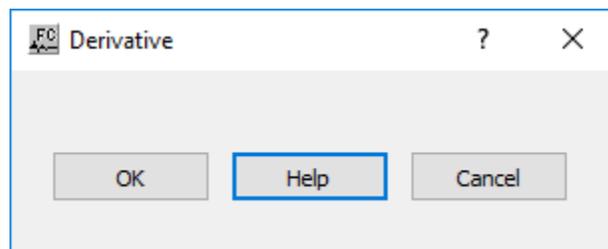
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no defined parameters for this step.

Diffusion Filter

Usage:

The *Diffusion Filter* is a noise reduction filter based on the diffusion equation. The filter performs both smoothing and edge preservation.

The most common usage is to enhance post-stack 3D data by applying *Diffusion Filter* to time slices.

Use *Time Slice* (Processing Category *Display*) in a prior job flow to convert such data to time slices for input to *Diffusion Filter*.

After *Diffusion Filter*, use *Time Slice to Trace* (Processing Category *Display*) in a further job flow to revert the filtered data to normal order.

An alternative to *Diffusion Filter* for enhancing post-stack 3D data is use of *3D Diffusion Filter*.

Input Links:

1) Seismic data in any sort order (mandatory).

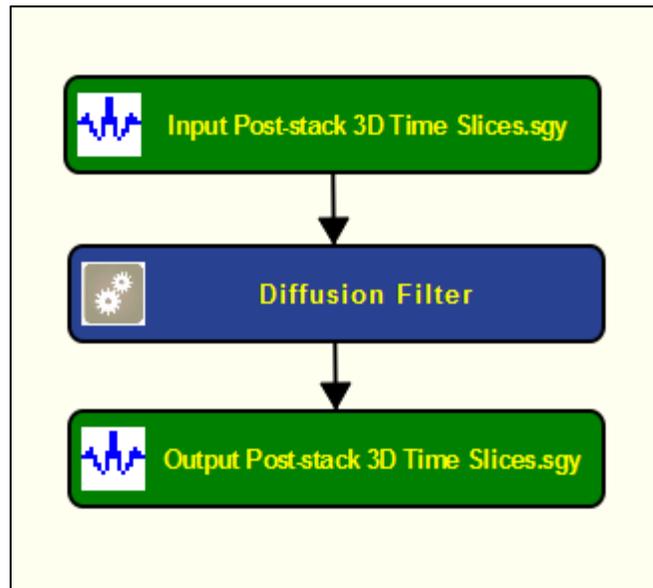
Output Links:

1) Seismic data in any sort order (mandatory).

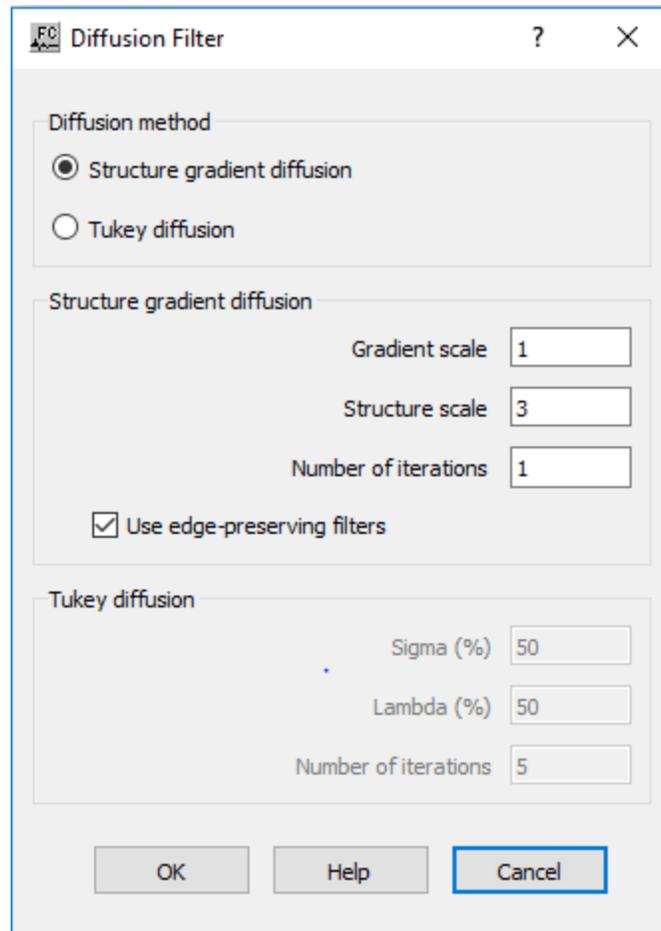
Reference:

Fehmers, G.C, and Hocker, C.F.W., 2003, Fast structural interpretation with structure-oriented filters, *Geophysics*, vol. 68, no. 4, p. 1286-1293.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Diffusion method: Define the diffusion method.

Structure gradient diffusion — If selected, use structure-oriented filtering (Fehmers & Hocker)

Tukey diffusion — If selected, use an anisotropic diffusion using the Kuwahara filter

Structure gradient diffusion: specify the structure gradient diffusion.

Gradient scale — Enter the number of standard deviation of 2D Gaussian filter used for smoothing the input data prior to gradient calculation.

Structure scale — Enter the number of standard deviation of 2D Gaussian filter used for smoothing the gradient tensors prior to eigendecomposition.

Number of iterations — Enter the number of filter iteration to apply to the input data.

Use Edge-preserving filters — If checked, a continuity (coherence) factor is calculated that inhibits diffusion across edges.

Sigma (%) — Noise threshold as a percentage of standard deviations

Lambda (%) — Percentage of new values to add on each filter iteration

Number of iterations — Number of filter iteration to apply to the input data.

F-K Spectrum

Usage:

The *F-K Spectrum* step allows you to create F-K spectrum image plots of your seismic data for designing F-K filters. Alternatively, the F-K spectrum can be directly created in SeisViewer from a selected seismic file.

Input Links:

1) Seismic data in any sort order (mandatory).

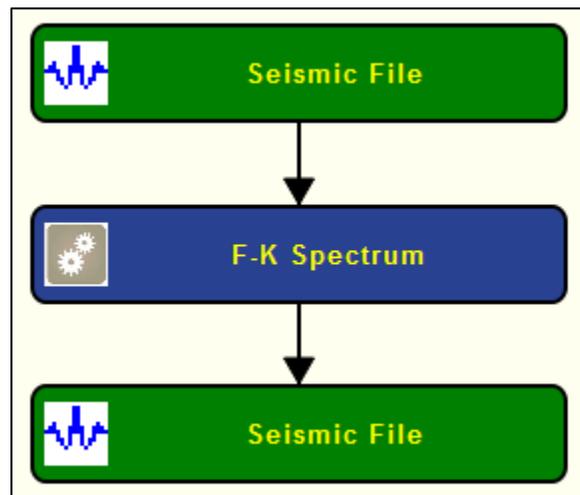
Output Links:

1) Seismic data containing F-K spectrum (mandatory).

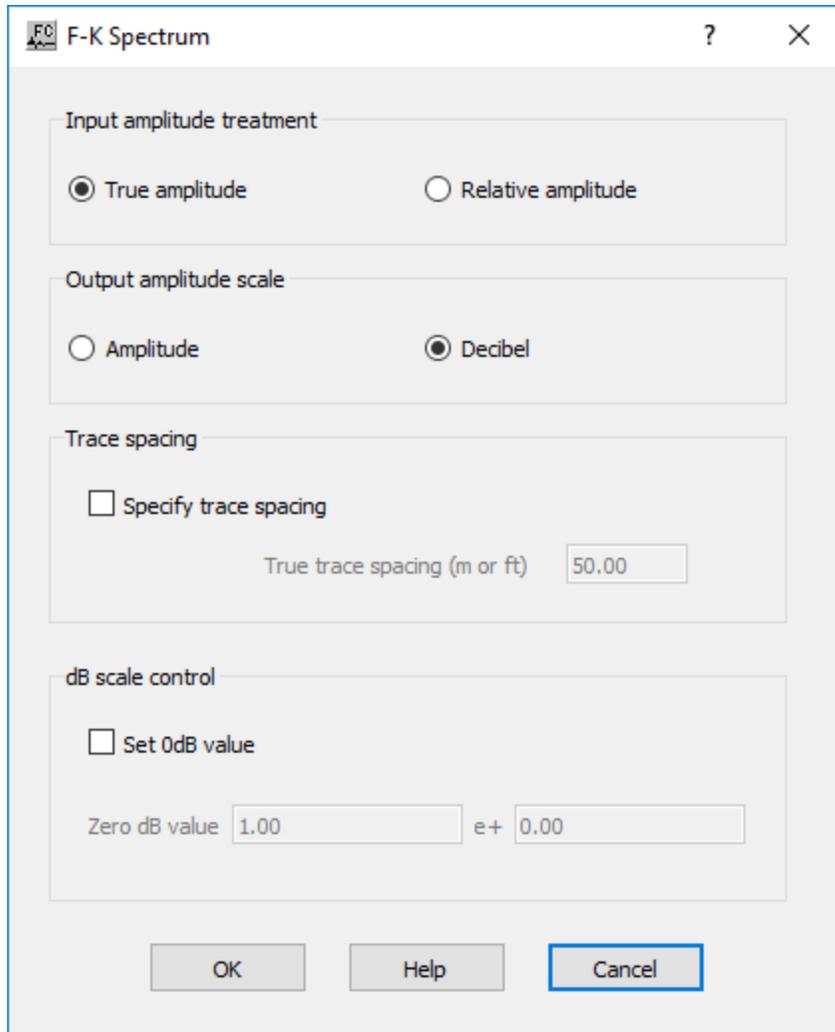
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input amplitude treatment: The amplitude to use as input to the F-K transform, either relative or true amplitude

True amplitude — If selected, use the true seismic amplitude as in the input seismic traces for the analysis. True amplitude traces are scaled by one common factor per record.

Relative amplitude — If selected, use relative seismic amplitude scaled traces in the analysis. Relative amplitude traces are scaled independently of one another.

Output amplitude scale: Select the output amplitude scale, either absolute amplitude or dB down from the maximum.

Amplitude — If selected, the output amplitude scale is set absolute amplitude.

Decibel — If selected, the output amplitude scale is set in dB down from the maximum.

Specify trace spacing — If checked, specify manually the space between traces in record. Otherwise uses the trace spacing from headers. By default, the group interval is read from the seismic data and the trace-to-trace spacing is calculated from the group interval. If the Geometry Definition step has not been applied to the data, the seismic data will not contain information regarding the group interval and this option should be used.

Trace spacing (m or ft) — Enter the trace interval in m or ft, depending on the project units.

dB scale control: Set zero dB amplitude for comparison of two dB scale iamges.

Set 0dB value — If checked, the zero dB amplitude value may be entered. Using this option allows you to compare two dB scale images.

Zero dB value — Enter the Zero dB value and its exponent.

F-X Deconvolution

Usage:

The *F-X Deconvolution* step is a 2D multi-channel noise filter designed to attenuate random noise. This time-variant, adaptive filter removes the non-predictable part of the data using the assumption that the signal portion of the data is predictable and the noise portion of the data is inherently random, and therefore non-predictable. You specify the length of the filter window, in samples, the width of the filter window, in traces, and the filter adaptation percent.

Input Links:

1) Seismic data in any sort order (mandatory).

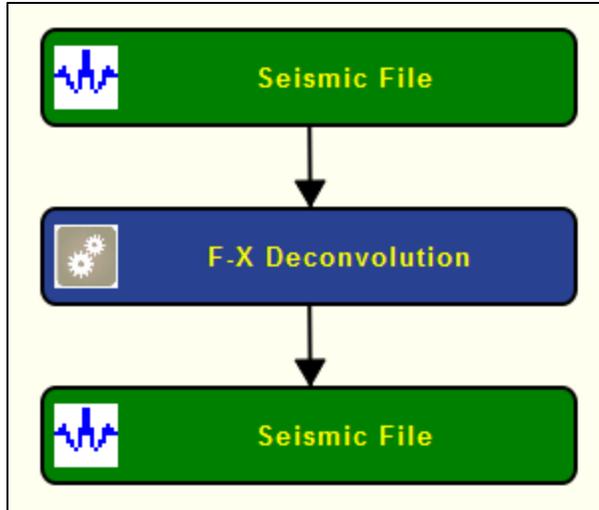
Output Links:

1) Seismic data in any sort order (mandatory).

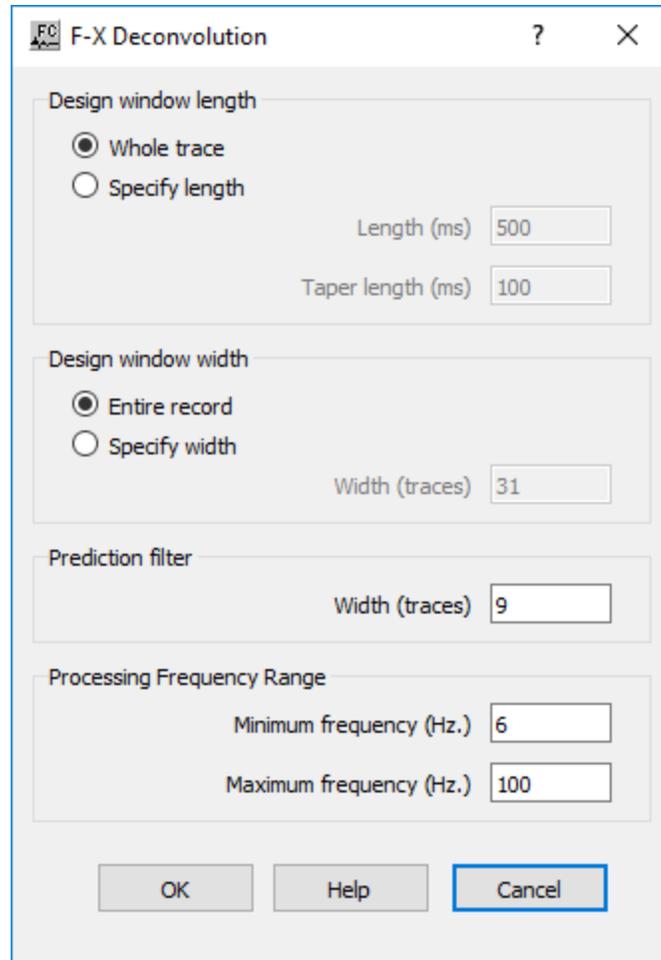
Reference:

Hornbostel, S., 1991, Spatial prediction filtering in the t-x and f-x domain, *Geophysics*, v. 56, no 12, p. 2019-2026.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Design window length: Specify the length of the window of the filter.

Whole trace — If checked, the length of the filter is equal to the length of the input seismic trace.

Specify length — If checked, the length of the filter is defined manually.

Length (ms) — Enter the length of the filter in ms.

Taper length (ms) — Enter the taper length of the filter in ms.

Design window width: Specify the width of the filter.

Entire record — If checked, uses the width filter is equal to the number of traces of the input record.

Specify width — If checked, uses the width filter is manually defined.

Width (traces) — Enter the width of the filter in number of traces.

Prediction filter: Specify the size of the prediction filter.

Width (traces) — Enter the width of the prediction filter in number of traces.

Processing Frequency Range: Specify the frequency band where the filter is going to be applied.

Minimum frequency (Hz.) — Enter the minimum frequency value in Hz of the frequency band.

Maximum frequency (Hz.) — Enter the maximum frequency value in Hz of the frequency band.

F-X Median Filter

Usage:

The *F-X Median Filter* step is a single channel filter that may be used to remove spikes or other noise from your data without damaging dipping data. The operator is applied in the temporal frequency domain using fully overlapping cosign-tapered window panes of specified height. A horizontal 1D median filter is applied to the frequency amplitudes whilst leaving the phase unchanged. Either the entire dataset or a specified tapered time window may be filtered

The input data in the form of time traces and does not require prior slicing or transformation.

Input Links:

1) Seismic data in any sort order (mandatory).

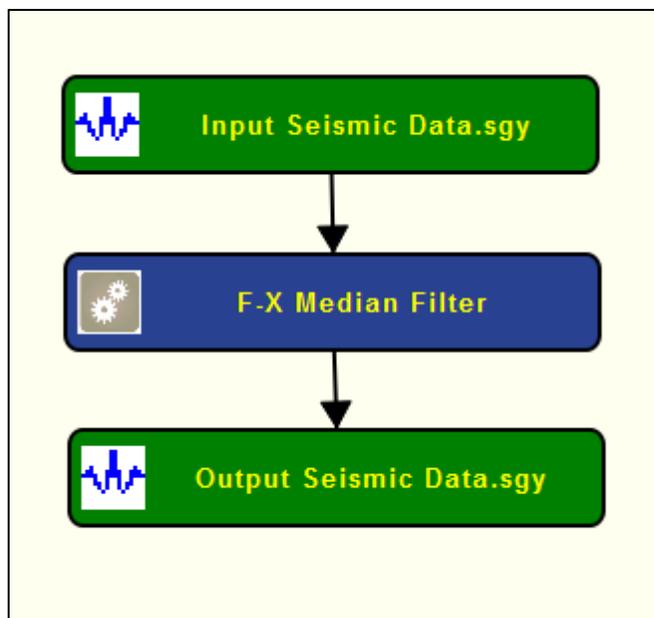
Output Links:

1) Seismic data in any sort order (mandatory).

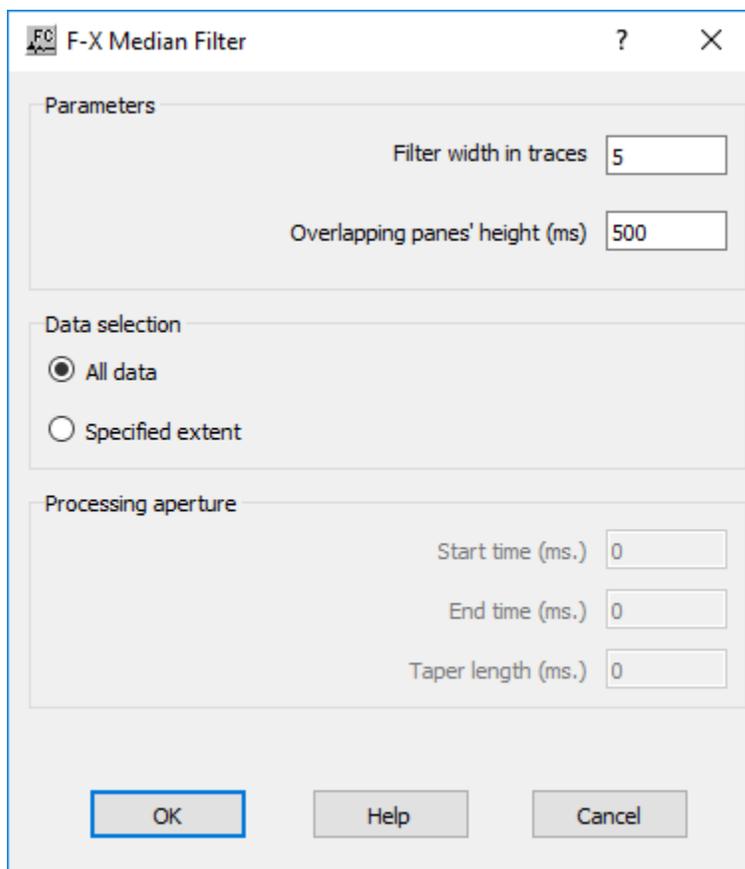
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Parameters: Specify the median filter parameters.

Filter width in traces — Enter the width in number of traces of the spacial median filter to be applied to each temporal frequency component.

Overlapping panes' height (ms.) — Enter the height in milliseconds of each of the fully-overlapping cosine-tapered panes from which frequency components are derived. In general, shorter panes will exhibit more filtering, but these should be sufficiently long to allow realistic longer frequency estimation.

Data selection: Specify the size of the data input for the median filter.

All data — If checked, the entire data length will be filtered.

Specified extent — If checked, the specified data aperture will be filtered.

Start time (ms.) — Enter the required time at which filtering is to begin.

End time (ms.) — Enter the required time at which filtering is to end.

Taper length (ms.) — Enter the length of the start and end tapers used to taper in the filtered data to the input data.

F-X Noise Attenuation

Usage:

The *F-X Noise Attenuation* step is a random noise attenuation technique in the frequency-space domain. This filtering method predicts the signal with spatial changes in dir or amplitude using the F-X domain.

Input Links:

1) Seismic data in any sort order (mandatory).

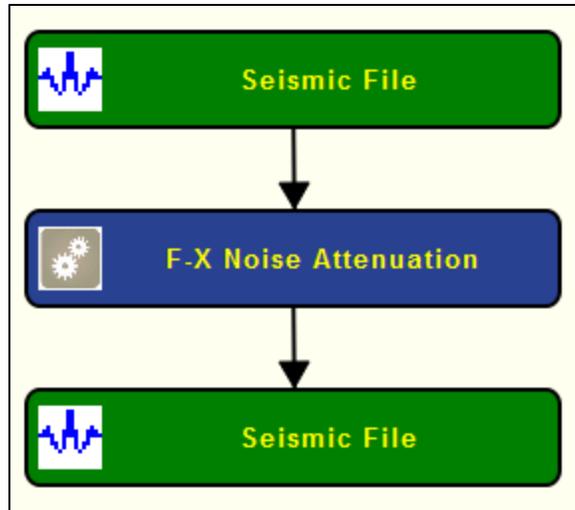
Output Links:

1) Seismic data in any sort order (mandatory).

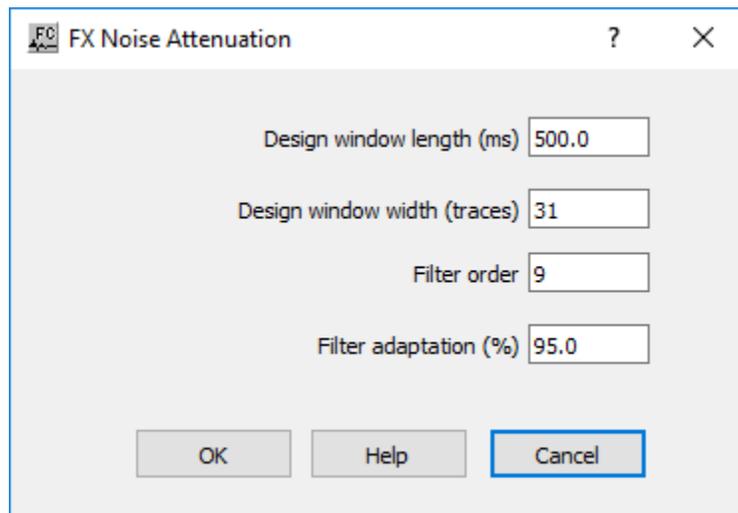
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Design window length (ms) —Enter the filter length in ms.

Design window width (traces) — Enter the width of the filter in number of traces.

Filter order — Enter the filter order.

Filter adaptation (%) — enter the filter adaptation in percentage.

F-X-Y Median Filter

Usage:

The *F-X-Y Median Filter* step is a multi-channel filter that may be used to remove spikes or other noise from your data without damaging dipping data. The operator is applied in the temporal frequency domain using fully overlapping cosign-tapered window panes of specified height. A horizontal 2D median filter is applied to the frequency amplitudes whilst leaving the phase unchanged. Either the entire dataset or a specified tapered time window may be filtered.

The input data in the form of time traces and does not require prior slicing or transformation.

Note: This filter will be most often used with 3D post-stack data sorted by CMP line and CMP location, but it may be used with other data provided adjacent records are sufficiently similar for median filtering across records to make sense.

Due to parallel data handling, the output from *F-X-Y Median Filter* must be written directly to disk using *Seismic File* without further processes in that job flow.

Input Links:

1) Seismic data in any sort order (mandatory).

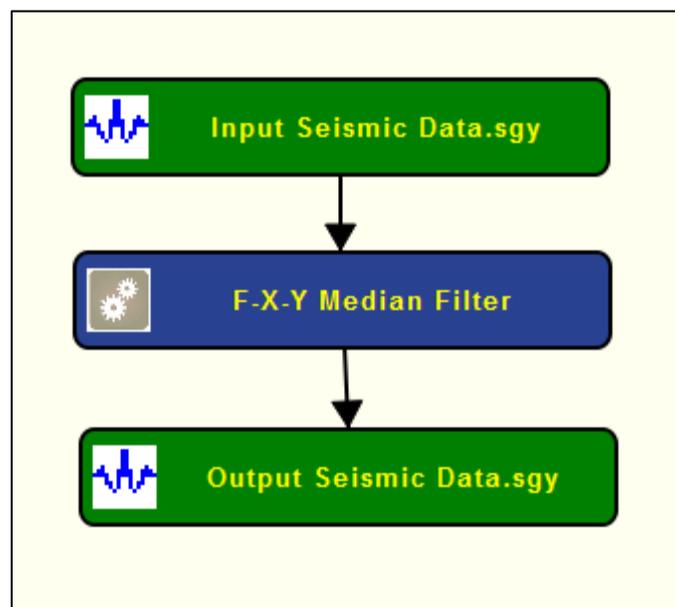
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

The screenshot shows a dialog box titled "F-X-Y Median Filter". It contains three main sections:

- Parameters:** Two input fields. "Filter width in traces" is set to 5. "Overlapping panes' height (ms)" is set to 500.
- Data selection:** Two radio buttons. "All data" is selected.
- Processing aperture:** Three input fields. "Start time (ms.)" is 0, "End time (ms.)" is 0, and "Taper length (ms.)" is 0.

At the bottom of the dialog are three buttons: "OK", "Help", and "Cancel".

Parameter Description:

Parameters: Specify the filter parameters.

Filter width in traces — Enter the width of the spacial median filter to be applied to each temporal frequency component.

Overlapping panes' height (ms.) — Enter the height in milliseconds of each of the fully-overlapping cosine-tapered panes from which frequency components are derived. In general, shorter panes will exhibit more filtering, but these should be sufficiently long to allow realistic longer frequency estimation.

Data selection: Specify data to be used to define the filter.

All data — If checked the entire data length will be filtered.

Specified extent — If checked the specified data aperture will be filtered.

Start time (ms.) — Enter the required time at which filtering is to begin.

End time (ms.) — Enter the required time at which filtering is to end.

Taper length (ms.) — Enter the length of the start and end tapers used to taper in the filtered data to the input data.

Footprint Filter

Usage:

The *Footprint Filter* step is a KK filtering technique for application to 3D post-stack data that is focused on attenuating acquisition footprint noise.

Two techniques are available:

- 1) Application of a global high cut KK filter. Seismic signal generally displays most of its energy in the KK domain close to zero, whereas the jitter sometimes seen due to acquisition will have high KK amplitudes. This filter is then simple, effective and fast.
- 2) A local adaptive noise removal algorithm for when the acquisition footprint exhibits in the KK domain as spikes. The seismic signal energy is protected with an exclusion zone around the origin. This technique is significantly more time-consuming and should be used only when the first technique does not address the type of acquisition noise seen.

Footprint Filter is applied to post-stack 3D data which has been converted to time slices.

Use *Time Slice* (Processing Category *Display*) in a prior job flow to convert such data to time slices for input to *Footprint Filter*.

After *Footprint Filter*, use *Time Slice to Trace* (Processing Category *Display*) in a further job flow to revert the filtered data to normal order.

Input Links:

- 1) Seismic data sorted by Slice Number (record key) and CMP Line (mandatory).

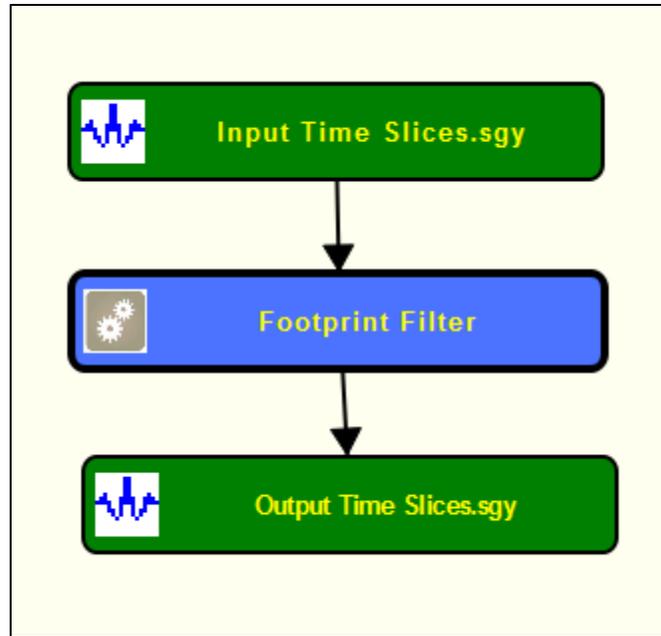
Output Links:

- 1) Seismic data sorted by Slice Number (record key) and CMP Line (mandatory).

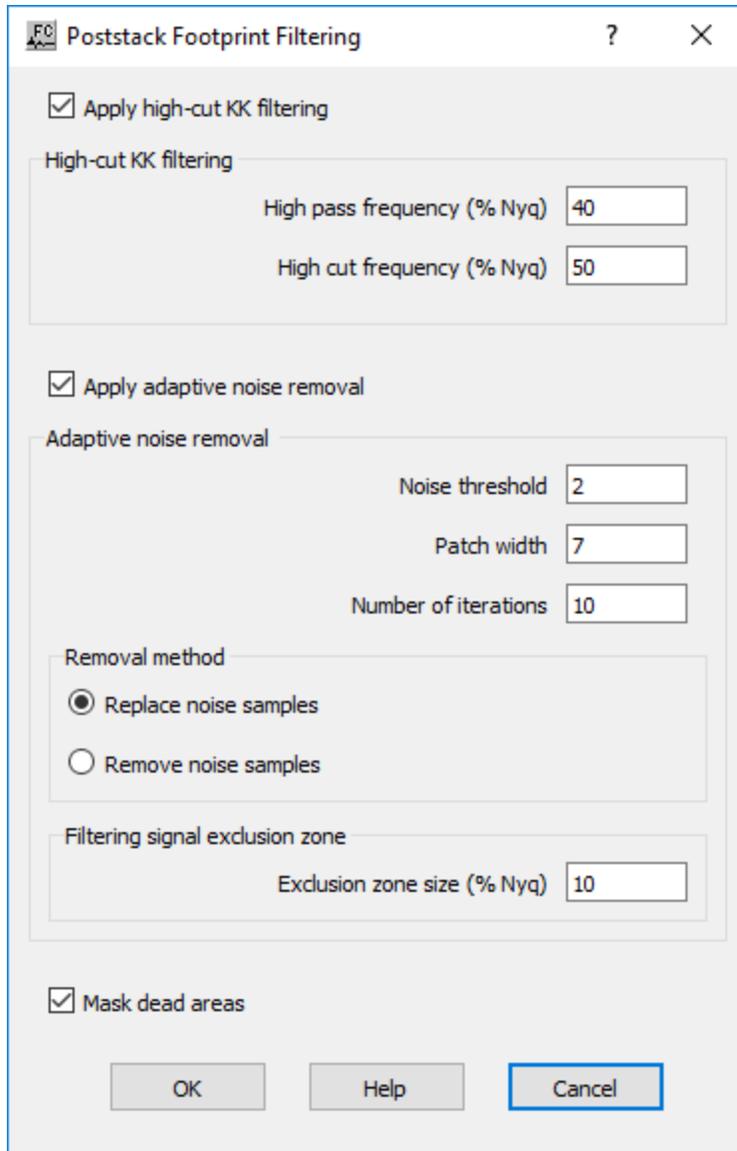
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Apply high-cut KK filtering — If checked, a high-cut KK cosine filter as specified will be applied.

High-cut KK filtering: Specify the high-cut KK filter.

High pass frequency (% Nyq) — Enter the KK taper-off beginning frequency.

High cut frequency (% Nyq) — Enter the KK taper-off ending frequency.

Apply adaptive noise removal — If checked, an adaptive noise removal filter will be applied.

Adaptive noise removal: Specify the adaptive noise removal parameters.

Noise threshold — Enter the number of standard deviations of a sample amplitude above the standard deviation of the sample amplitudes within a local area or ‘patch’ for that sample to be regarded as noise.

Patch width — Enter the KK plane is divided into overlapping ‘patches’ to be analyzed for noise spikes. This parameter is the side length of each square patch.

Number of iterations — Enter the number of iterations of the adaptive noise removal algorithm.

Removal method: Select the removal method for the KK filter.

Replace noise samples — If selected, the amplitude of a noise sample will be replaced by the average value within the patch.

Remove noise samples — If selected, the amplitude of a noise sample will be set to zero.

Filtering signal exclusion zone: Specify a signal exclusion zone based on the percentage of the Nyquist.

Exclusion zone size (% Nyq) — Enter the size of the area around the KK origin to be protected from the adaptive filter so as to preserve the signal.

Mask dead areas — If checked, then input data dead zones will be masked after application of the KK filtering.

Horizontal Median Filter

Usage:

The *Horizontal Median* step allows you to apply a horizontal median filter across the data traces of a gather or stack. This process is very useful in processing VSP data for separation of up-going and down-going events.

Input Links:

1) Seismic data in any sort order (mandatory).

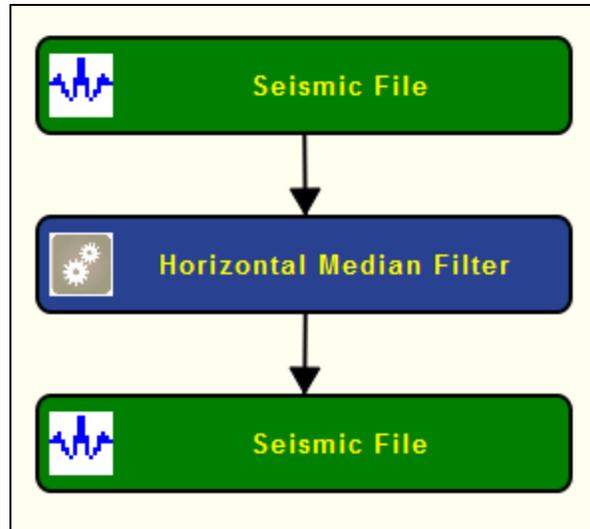
Output Links:

1) Seismic data in any sort order (mandatory).

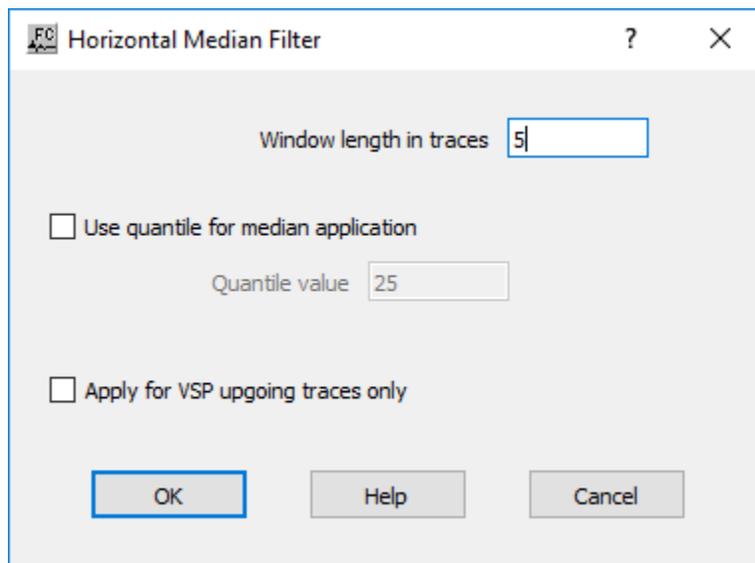
References:

Hardage, B. A., 1983, Vertical Seismic Profiling, Geophysical Press.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Window length in traces — Enter the number of traces in the spatial window.

Use quantile for median application — If checked, the median value is computed over the selected quantile.

Quantile value — Enter the quantile value to calculate the median.

Apply for VSP upgoing traces only — If checked, the horizontal median filter is only applied to seismic traces marked as VSP upgoing traces.

Integration

Usage:

The *Integration* step integrates data samples in each input seismic data trace.

Input Links:

- 1) Seismic data in any sort order (mandatory).

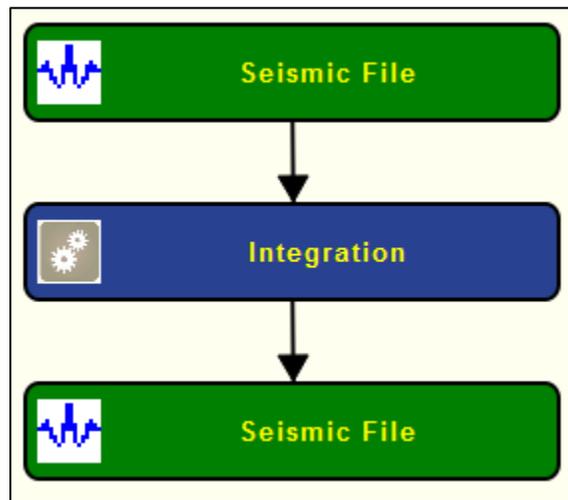
Output Links:

- 1) Seismic data in same sort order as the input (mandatory).

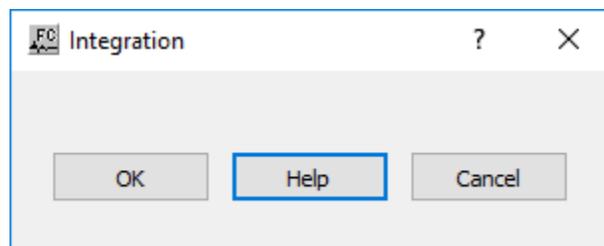
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

There are no parameters for this step.

Notch Filter

Usage:

The *Notch Filter* step applies a frequency domain notch filter to the input data. The filter is specified by describing the frequency notch and the width of the notch. Options exist to (1) apply the filter as a function of header word flags, (2) parameterize the notch as a function of header word flags.

Input Links:

- 1) Seismic data in any sort order (mandatory).

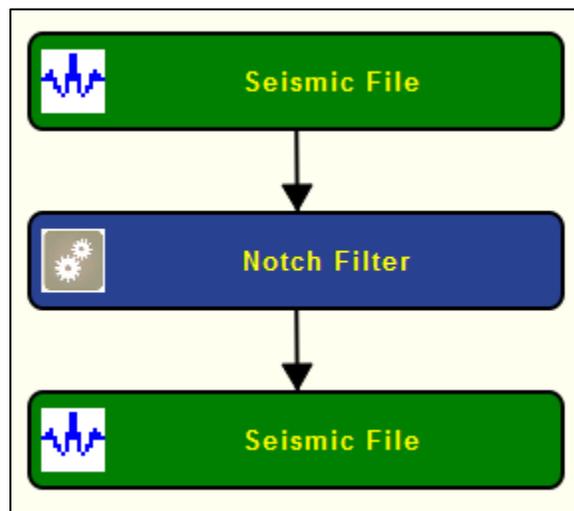
Output Links:

- 1) Seismic data in any sort order (mandatory).

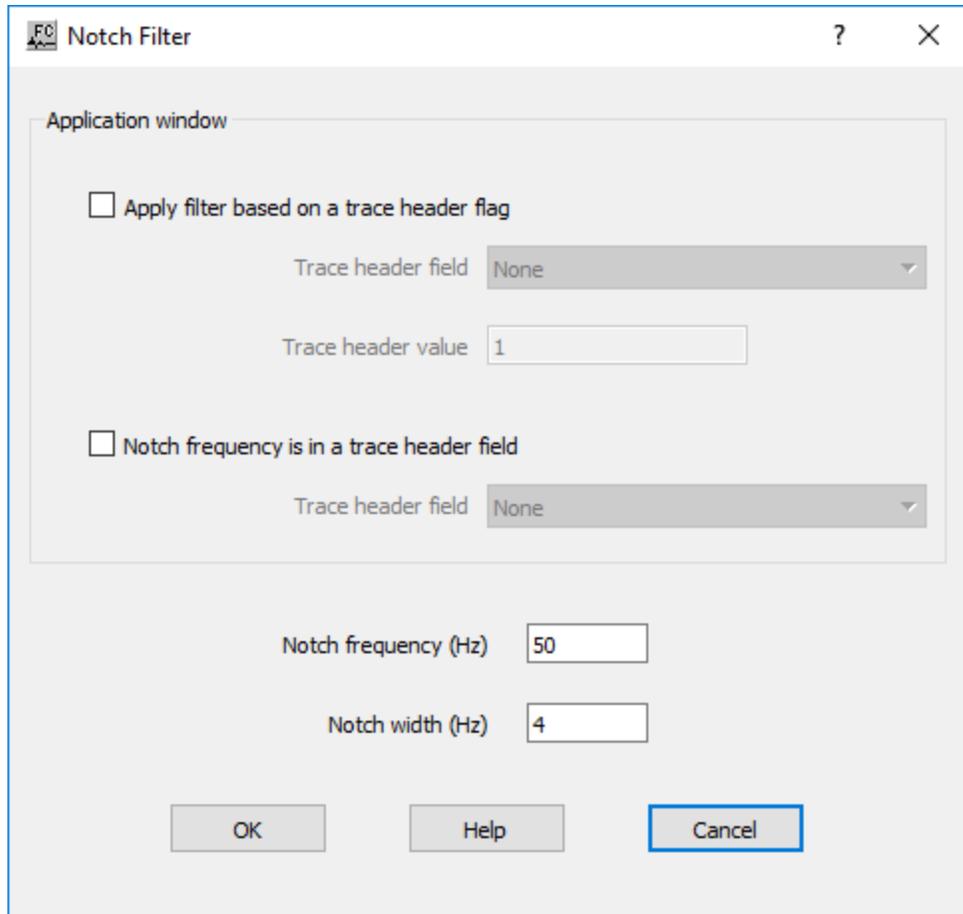
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Application window: Specify the window of application for the notch filter.

Apply filter based on a trace header flag — If checked, the application of the filter is to be controlled by the value of a trace header flag.

Trace header field — Enter the value of a trace header flag, select the trace header from the drop down menu.

Trace header value — Enter the value of a trace header flag, set the value of the trace header. When the value of the trace header equals the specified value, the filter will be applied. Otherwise, the filter will not be applied.

Notch frequency is in a trace header field — If checked, the value of the notch frequency is to be controlled by the value of a trace header field.

Trace header field — Enter the value of a trace header field, select the trace header from the drop down menu.

Notch frequency (Hz) — Enter the value of the notch frequency in Hertz.

Notch width (Hz) — Enter the width of the notch frequency in Hertz.

Quadrature Filter

Usage:

The *Quadrature Filter* step computes the Hilbert transform of the input seismic data. Quadrature filters are usually applied to enhance the presence of discontinuities and reveal the structure of the seismic image.

Input Links:

1) Seismic data in any sort order (mandatory).

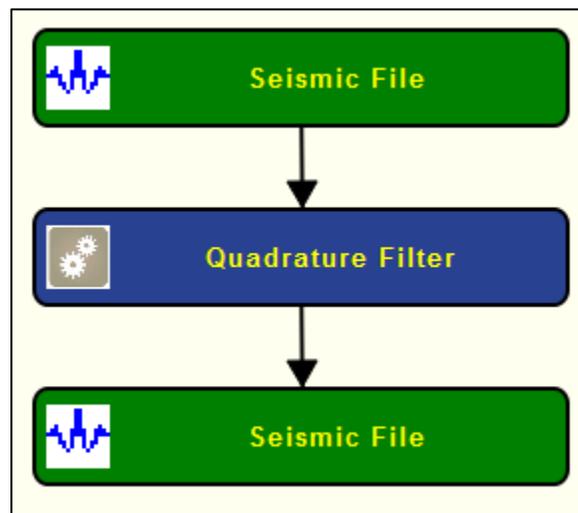
Output Links:

1) Seismic data in any sort order (mandatory).

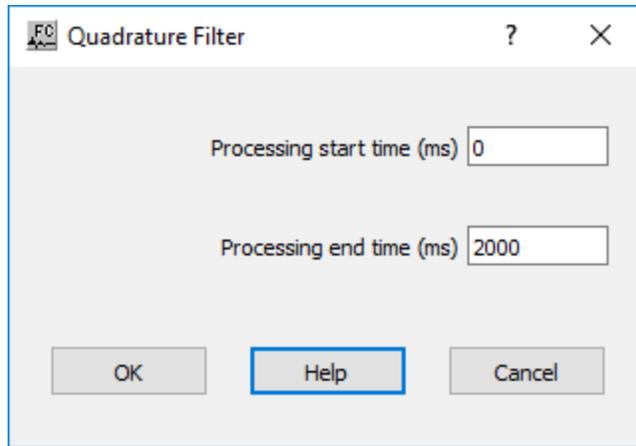
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the processing start time in ms.

Processing end time (ms) — Enter the processing start time in ms.

Radial Transform Filter

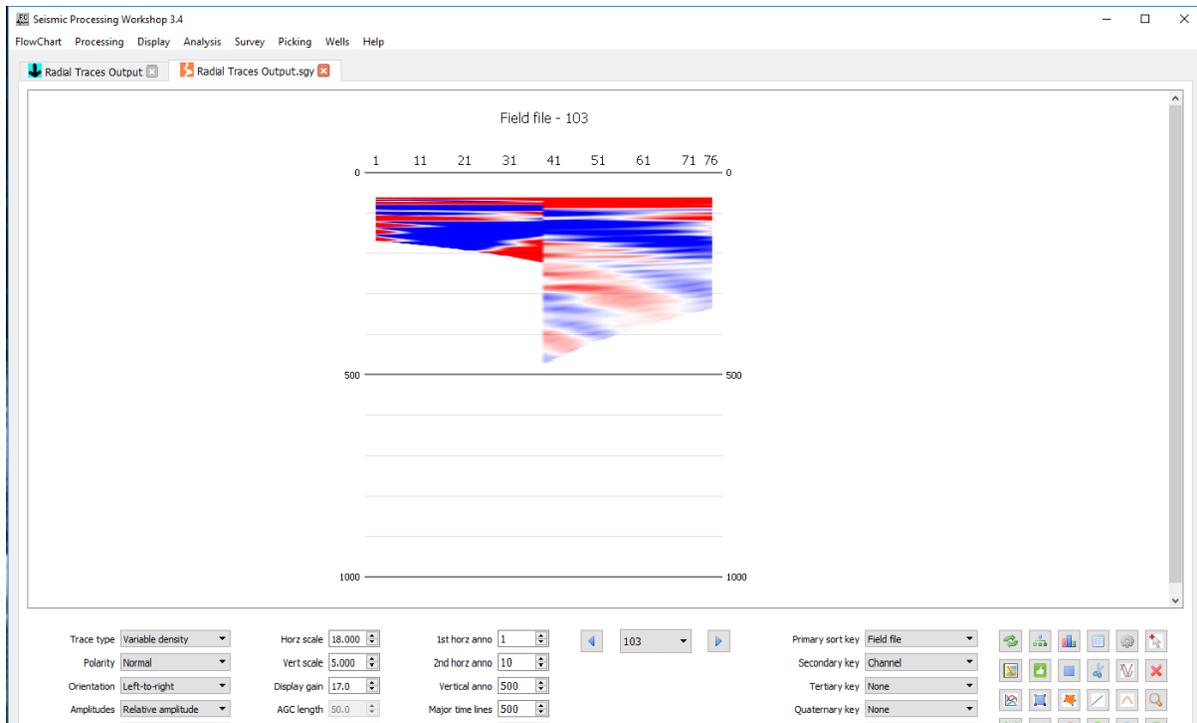
Usage:

The *Radial Transform Filter* step is a 2D pre-stack single channel filter for attenuation of noise originating from a point source with a specific apparent velocity by means of the radial transform. For example, shot generated noise may be attenuated by application of *Radial Transform Filter* to common shot gathers.

Each input record must be ordered by offset.

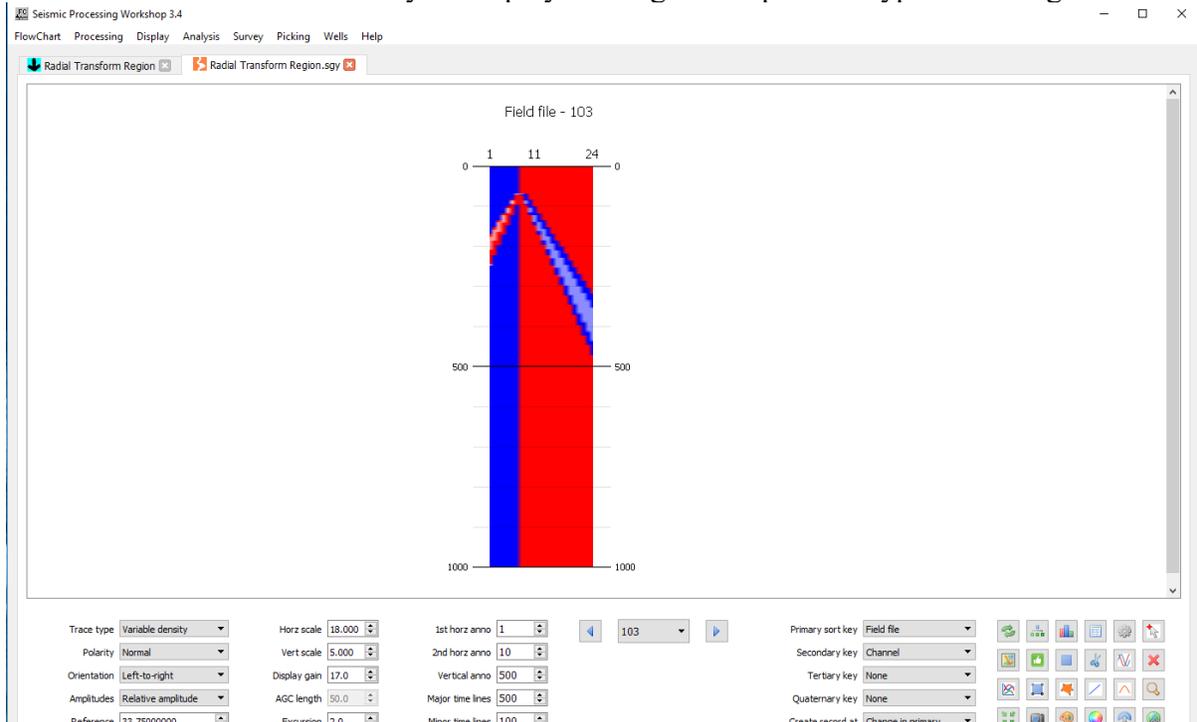
The input 2D record is first converted to the radial domain such that each radial trace represents a different apparent velocity within the range of interest, radiating from a start time (usually zero) at zero offset.

Using the output data type 'Radial traces', these traces may be output and displayed:



Coherent noise of particular apparent velocity will appear as low frequency in this domain, and can be attenuated by use of a low frequency filter or a median reject filter.

Untampered data remains untouched by the radial transform. The region of the input data records which will be filtered may be displayed using the output data type 'Filter region model':



Input Links:

1) 2D Seismic data offset-sorted records (mandatory).

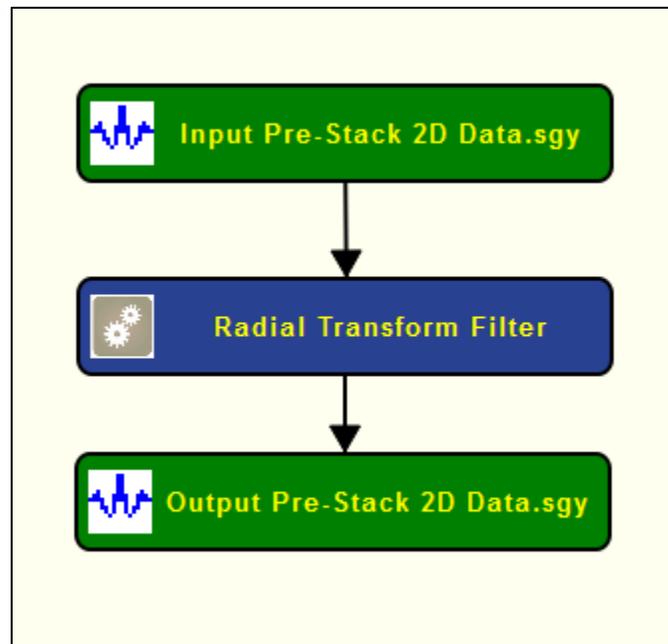
Output Links:

1) 2D Seismic data offset-sorted records (mandatory).

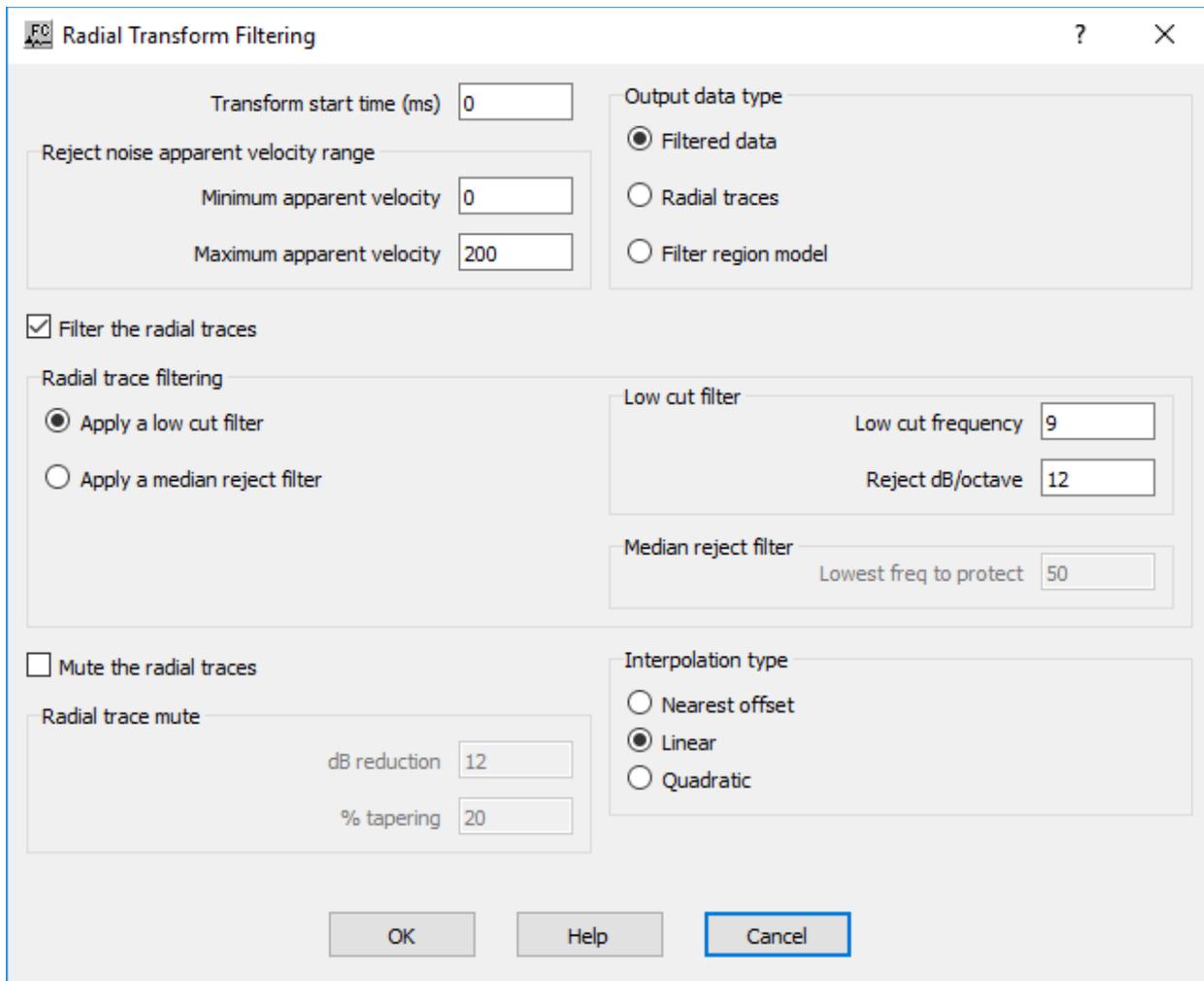
Reference:

Henley, D., 2008, A Convenient Truth: Radial Trace Filtering – Simple and Effective, CSEG Recorder, vol. 34, no 1.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Transform start time (ms) — Enter the time of the origin for the radial transform. This will often be zero, but sometimes a positive value can give better noise attenuation.

Output data type: Specify type of output of the Radon Transform.

Filtered data — If selected, the output data will be Radial Transform filtered data.

Radial traces — If selected, the output will be the radial transformed traces, filtered or unfiltered depending on the parameter settings (See **Usage** above).

Filter region model — If selected, the output will allow display of the exact region of the input data which will be filtered by *Radial Transform Filter* in its **Filtered data** mode (See **Usage** above).

Filter the radial traces — If checked, the radial traces will be filtered.

Radial trace filtering: Specify type of rejection filter.

Apply a low cut frequency — If selected, a low cut filter will be applied.

Low cut filter: Specify low cut parameters

Low cut frequency— Specify the low cut frequency of the Butterworth filter.

Reject dB/octave — Specify the rate of fall-off of the filter.

Apply a median reject filter — If selected, a median reject filter will be applied.

Median reject filter: Specify median reject filter parameters. Low frequencies are attenuated by subtracting the median filtered data from the data.

Lowest freq to protect — Specify the lowest frequency that will not be attenuated by the median reject filter. The median filter length used will be the wavelength of this frequency in samples.

Mute the radial traces — If checked, the radial traces will be attenuated.

Radial trace mute: Specify the radial trace mute parameters.

dB reduction — All data within the radial traces will be attenuated by the specified amount.

% tapering — Specify the percentage of the radial trace zone(s) which will be tapered.

Interpolation type: Deriving the radial traces from the input data requires interpolation of the data. Nearest offset is the fastest, while linear and quadratic interpolation may give a smoother result and better radial domain low frequency attenuation.

Nearest offset — If selected, radial traces will be constructed by picking nearest offset samples.

Linear — If selected, linear interpolation will be used to construct radial traces.

Quadratic — If selected, quadratic interpolation will be used to construct radial traces.

The above parameters may be adjusted by trial and error to obtain the best attenuation, or by inspection of the radial traces.

Radon Demultiple

Usage:

The *Radon Demultiple* step performs parabolic radon demultiple through a modeling of multiples in the parabolic radon domain followed by subtraction of those multiples in the time domain. You

specify the transform type, the range of ray parameters in the output transform, and the spatial and temporal taper lengths used to generate the transform.

Input Links:

1) Seismic data in any sort order (mandatory).

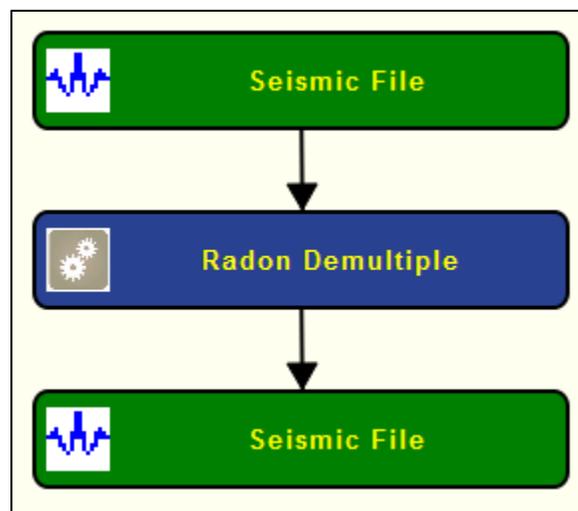
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

Hampson, D., 1991, Inverse velocity stacking for multiple elimination, *Journal of the Canadian Society of Exploration Geophysics*, **22**, p. 44-55.

Example Flowchart:



Step Parameter Dialog:

Time window

Limit application time

Use constant start time
Start time (ms)

Start time referenced to horizon
Multiplier for time horizon
Length of taper zone (ms)

Offset window

Define maximum reference offset
Maximum reference offset

AGC window

Apply and remove AGC
AGC operator length (ms)

Type of output

Estimated primaries Multiple model

Model moveout

Minimum differential moveout
Maximum differential moveout
Minimum multiple moveout

Ray parameters

Set number of ray parameters
Number of ray parameters

Bandpass filter

Low cut (Hz)
Low pass (Hz)
High pass (Hz)
High cut (Hz)

Additional parameters

Percent pre-whitening
Minimum live traces

OK Help Cancel

Parameter Description:

Time window:

Limit application time —

Use constant start time —

Start time (ms) —

Start time referenced to horizon —

Multiplier for time horizon —

Length of taper zone (ms) —

Model moveout: Set the range of parabolas that will generate the primary and multiple models.

Minimum differential moveout — Enter the minimum differential moveout, expressed in milliseconds on the far-offset trace. The primary model is generated with parabolas from the <minimum differential moveout> to the <minimum multiple moveout>.

Maximum differential moveout — Enter the maximum differential moveout, expressed in milliseconds on the far-offset trace. The multiple model is generated with parabolas from the <minimum multiple moveout> to the <maximum differential moveout>.

Minimum multiple moveout — Enter the minimum multiple moveout, expressed in milliseconds on the far-offset trace. The multiple model is generated with parabolas from the <minimum multiple moveout> to the <maximum differential moveout>.

Ray parameters: Specify ray parameters

Set number of ray parameters — If checked, the number of ray parameters is determined manually. By default, the number of ray parameters is determined internally.

Number of ray parameters — set the number of ray parameter.

Offset window: Specify parameters for window definition.

Define maximum reference offset — If checked, limit the input seismic data by a maximum reference offset

Maximum reference offset — Enter the reference maximum offset. Maximum offset of the input record that is going to be used.

AGC Window: Define parameter for AGC filter.

Apply and remove AGC — If checked, and AGC filter is applied before the F-K Velocity filter and removed from the output seismic file. The AGC filter is used exclusively internally to improve the performance of the F-K filter.

AGC operator length — Enter the AGC operator length in ms.

Bandpass filter: Specify bandpass filter parameters, as defined in a trapezoid, to be applied during the processing.

Low cut (Hz) — enter low cut frequency in Hz.

Low pass (Hz) — enter low pass frequency in Hz.

High pass (Hz) — enter high pass frequency in Hz.

High cut (Hz) — enter high cut frequency in Hz.

Additional parameters: Specify additional parameters to stabilize the *Random Demultiple*.

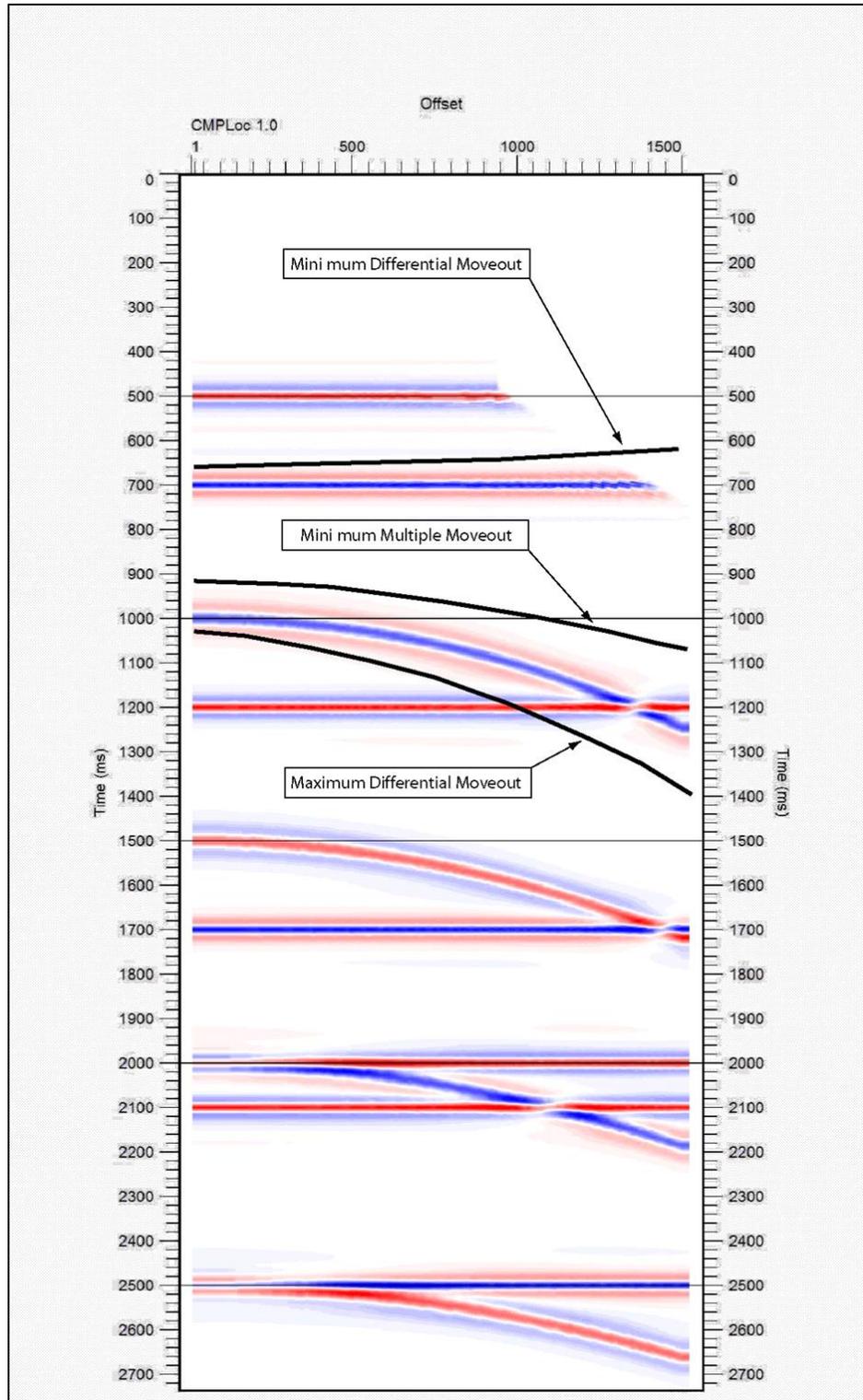
Percent pre-whitening — Enter the amount of pre-whitening used to stabilize the least-squares inversion in the presence of noise.

Minimum live traces — Enter the minimum number of live traces that must be present in a gather in order to transform that gather.

Type of output: Specify type of output form *Radon Demultiple*.

Estimated primaries — If selected, output estimated primary reflections.

Multiple model — If selected, output modelled multiple reflection. This multiple model can then be subtracted to the input seismic data.



Ricker Filter

Usage:

The *Ricker Filter* step applies a ricker filter to the input seismic file. The Ricker filter is completely determined by the center frequency of the Ricker wavelet.

Input Links:

1) Seismic data in any sort order (mandatory).

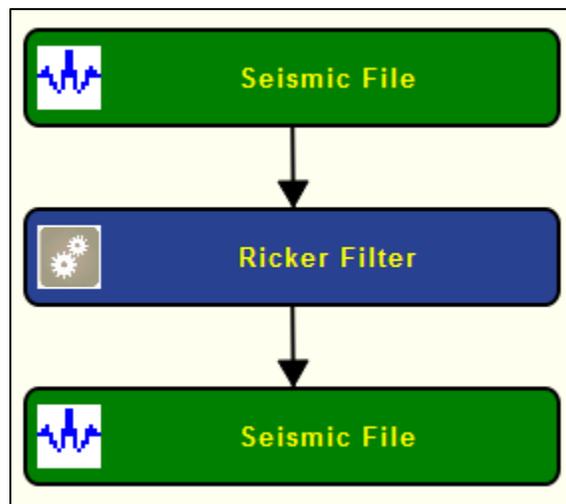
Output Links:

1) Seismic data in any sort order (mandatory).

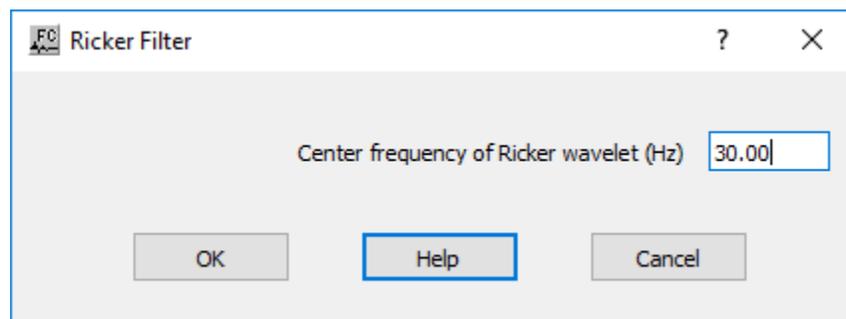
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Center frequency (Hz) — Specify the center frequency of the Ricker wavelet.

Swell Statics Correction

Usage:

The *Swell Statics Correction* step is a moving average filter designed for marine data used to attenuate statics originated by marine swell.

Input Links:

- 1) Seismic data in any sort order (mandatory).

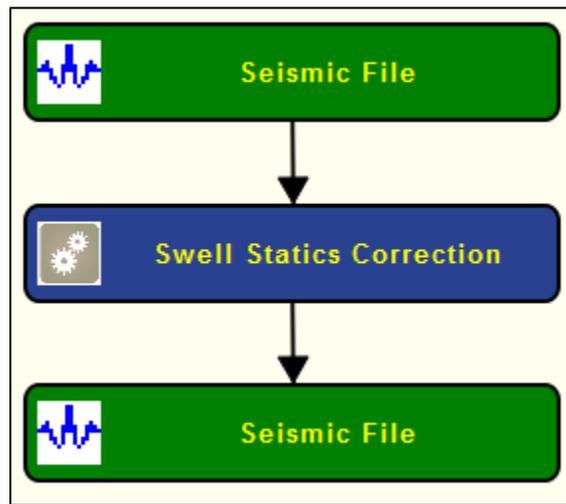
Output Links:

- 1) Seismic data in any sort order (mandatory).

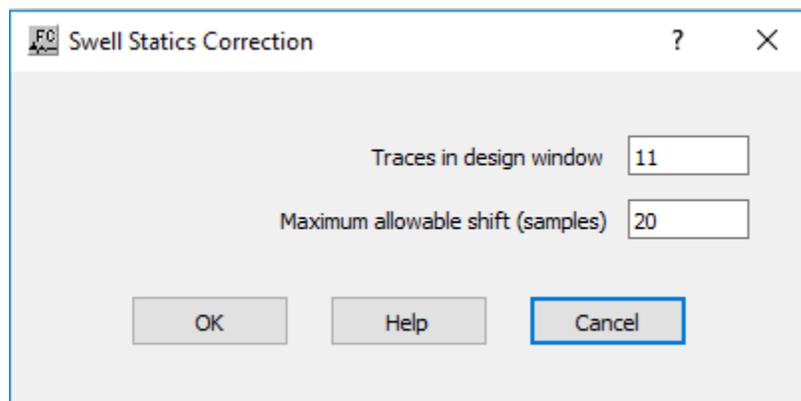
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Traces in design window — Enter the number of traces to be used in the window filter.

Maximum allowable shift (samples) — Enter the maximum allowable shift, in number of seismic samples, that a sample may suffer while being filtered.

Tau-p Inverse Transform

Usage:

The *Tau-P Inverse Transform* step transforms 2D Tau-P domain pre-stack data back to the time-offset domain after conversion to this domain after the use of *Tau-P Transform*.

Input Links:

- 1) 2D Seismic pre-stack Tau-P domain data records ordered by Ray Parameter (mandatory).
- 2) Auxiliary seismic data file: the original offset-time shot records for restoration of headers to the inverted data.

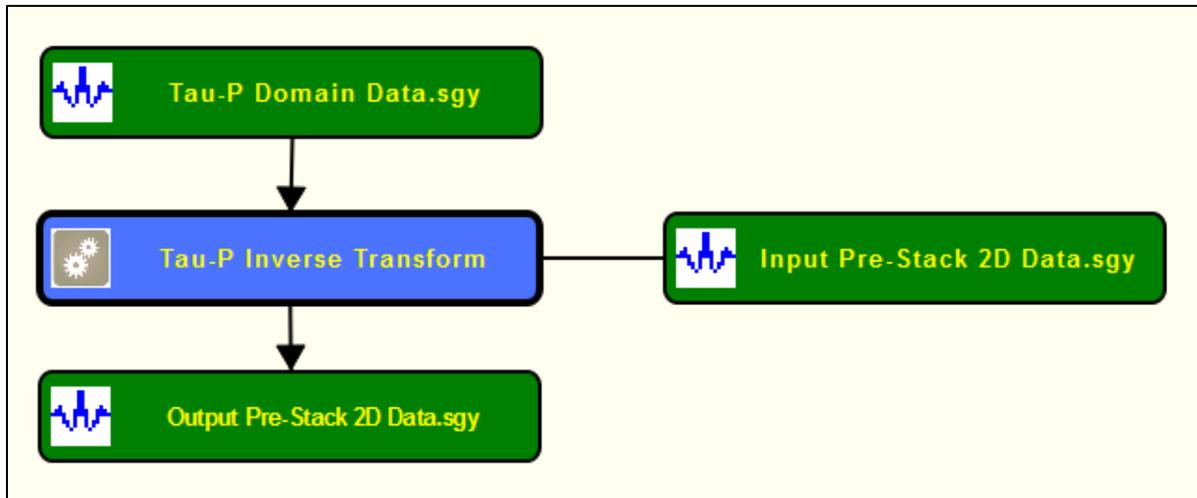
Output Links:

- 1) 2D Seismic pre-stack data records ordered by offset (mandatory).

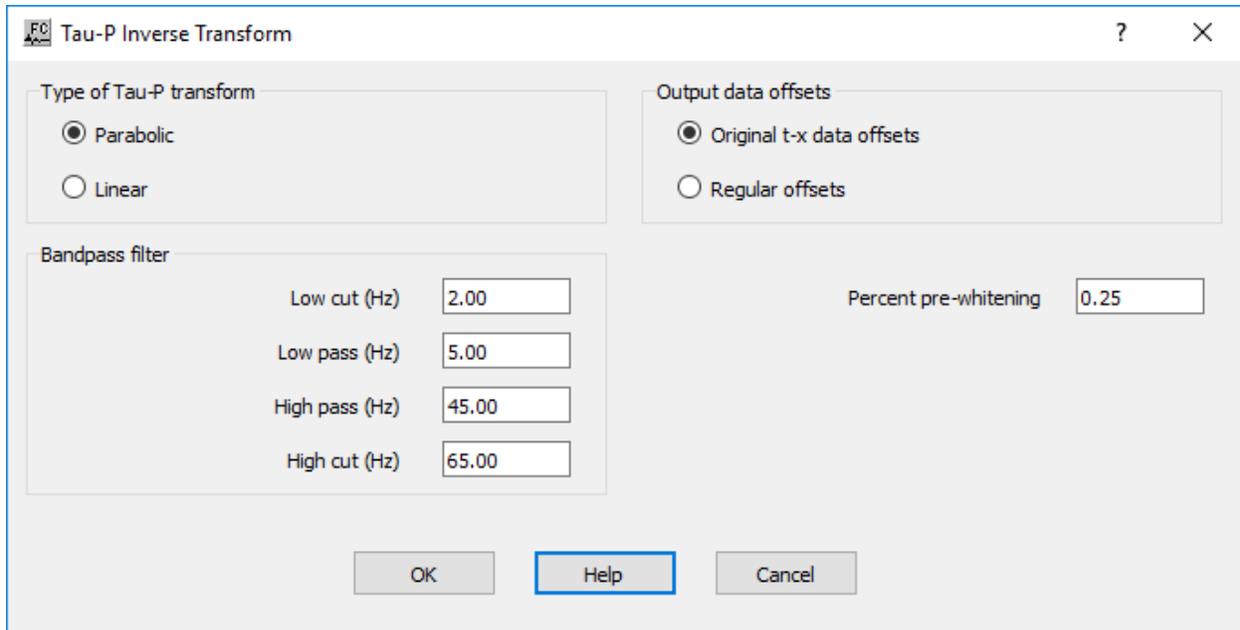
Reference:

Kostov, C., 1990, Toeplitz Structure in Slant-Stack Inversion: 60th Annual Internat..Mtg., Soc. Expl. Geophys., Expanded Abstracts, 1618-1621.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Type of Tau-P transform: Specify the function of offset used for the Tau-P transform.

Parabolic — If selected, a parabolic inverse transform will be performed. This must be the same as was used for the forward transform.

Linear — If selected, a linear inverse transform will be performed. This must be the same as was used for the forward transform.

Output data offsets: Specify whether to use the original t-x data to obtain the offsets to be inverted, or to specify regular offsets.

Original t-x data offsets — If selected, an auxiliary input file will be required. This should be the original t-x data before forward Tau-P transform. The offsets returned will match those on this file.

Regular offsets — If selected, the inverse transformed records will contain regular offsets.

Bandpass filter: A bandpass filter will be applied to the data, before inverse Tau-P transformation. It is sensible if the same frequency range is inverted as specified for the forward transform, but not essential. If aliasing noise is a problem on inversion, then the inversion high pass or high cut frequencies may be decreased.

Low cut (Hz) — Enter the bandpass low cut frequency in Hz.

Low pass (Hz) — Enter the bandpass low pass frequency in Hz.

High pass (Hz) — Enter the bandpass high pass frequency in Hz.

High cut (Hz) — Enter the bandpass high cut frequency in Hz.

Percent pre-whitening — Enter the percentage of pre-whitening. A Toeplitz matrix inversion is used for the Tau-P inversion of each frequency. A small amount of white noise added may be needed to stabilize the inversion. A fraction of one percent is often sufficient, and decreases the smearing sometimes seen when larger values are used.

Tau-p Transform

Usage:

The *Tau-P Transform* step transforms 2D pre-stack data to the Tau-P domain for further processing. The Tau-P domain data may be inverted to the time-offset domain by the use of *Tau-P Inverse Transform*.

The input traces of each record are time-shifted according to their offsets, and then a low-cut spatial frequency filter is applied. This will attenuate much of the noise energy at that particular apparent velocity. The time-shifted data is then restored.

Input Links:

- 1) 2D Seismic pre-stack data records ordered by offset (mandatory).

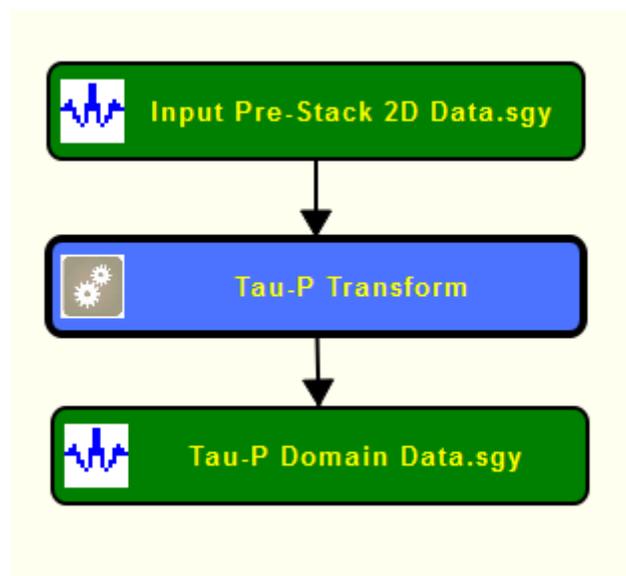
Output Links:

- 1) 2D Seismic pre-stack Tau-P domain data records ordered by Ray Parameter (mandatory).

Reference:

Kostov, C., 1990, Toeplitz Structure in Slant-Stack Inversion: 60th Annual Internat..Mtg., Soc. Expl. Geophys., Expanded Abstracts, 1618-1621.

Example Flowchart:



Step Parameter Dialog:

Parabolic transform parameters:

The image shows a software dialog box titled "Tau-P Transform". It contains several sections for configuring seismic data processing parameters:

- Type of Tau-P transform:** Radio buttons for "Parabolic" (selected) and "Linear".
- P values specification:** Radio buttons for "Use Velocity" (selected) and "Specify a differential moveout range".
- Split-spread (-ve offsets?):** A checked checkbox.
- Velocity P values range specification:** Input fields for "Minimum moveout velocity" (40.00), "Maximum moveout velocity" (10000.00), and "Reference time (sec)" (1.00).
- Time P values range specification:** Input fields for "Min differential moveout (ms.)" (100.00), "Max differential moveout (ms.)" (2000.00), and "Reference max offset" (0.00).
- Bandpass filter:** Input fields for "Low cut (Hz)" (2.00), "Low pass (Hz)" (5.00), "High pass (Hz)" (65.00), and "High cut (Hz)" (85.00).
- Ray parameters:** Input field for "Number of ray parameters" (400).

At the bottom of the dialog are three buttons: "OK", "Help" (highlighted with a blue border), and "Cancel".

Linear transform parameters:

Parameter Description:

Type of Tau-P transform: Specify the function of offset used for the Tau-P transform.

Parabolic — If checked, a signed offset squared function will be used. This transform type yields the best inversion back to the original domain

Linear — If checked, the function used will be offset itself.

P values specification: Specify which method will be used to specify the range of P values to be calculated.

Use Velocity — If checked, the range of P values to be calculated will be determined by the minimum and maximum velocities specified. In the case of the **Parabolic** transform, these velocities will be moveout velocities. In the case of the **Linear** transform, these velocities will be apparent velocities.

Specify a differential moveout range — If checked, the minimum P value will be calculated from the maximum time shift at the specified max offset. The maximum P value will be calculated from the minimum time shift at the specified max offset.

Split-spread (-ve offsets)? — If checked, the P-values calculated will be a negative P-value range and a positive P-value range.

Minimum live traces — Enter the minimum number of live traces read for a record to be transformed to the Tau-P domain.

Velocity P values range specification: Specify the range of P values to be calculated by means of velocity.

Minimum moveout velocity (Parabolic transform) — Enter the minimum moveout velocity. The maximum P value will be calculated from this and the specified reference time.

Maximum moveout velocity (Parabolic transform) — Enter the maximum moveout velocity. The minimum P value will be calculated from this and the specified reference time.

Minimum apparent velocity (Linear transform) — Enter the minimum apparent velocity. The maximum P value to calculate will be the inverse of this velocity.

Maximum apparent velocity (Linear transform) — Enter the maximum apparent velocity. The minimum P value to calculate will be the inverse of this velocity.

Reference time (sec) — (Parabolic transform only). Enter the time in seconds at which the moveout velocity is measured.

Time P values range specification: Specify the range of P values to be calculated by means of differential moveout.

Min differential moveout (ms.) (Parabolic transform) — Enter the minimum differential moveout at the specified reference time. The minimum P value to calculate will be calculated from this value.

Max differential moveout (ms.) (Parabolic transform) — Enter the maximum differential moveout at the specified reference time. The maximum P value to calculate will be calculated from this value.

Min slope (ms./1000') (Linear transform) — Enter the minimum slope in milliseconds per thousand metres/feet. The minimum P value to calculate will be calculated from this value.

Max slope (ms./1000') (Linear transform) — Enter the maximum slope in milliseconds per thousand metres/feet. The maximum P value to calculate will be calculated from this value.

Reference max offset (Parabolic transform only) — Enter the offset for the minimum and maximum differential moveouts specified.

Ray parameters: Specify ray parameters.

Number of ray parameters — Enter the number of P values to be calculated. If split-spread, half of these will be used for negative P values and half for positive. The number required depends on the total range of ray parameters. These P-values will be regularly spaced. If the increment multiplied by the offset is greater than half a wavelength of a frequency, then aliasing noise on inverse transform may result. The inversion execution time depends on this parameter, and testing with a few shot records is recommended to determine the smallest value possible without undue aliasing noise.

Bandpass filter: Both the forward and inverse Tau-P transforms perform calculation in the frequency domain. A bandpass filter is applied to the data, and the frequency range specified here should be based on the signal spectrum and minimization of aliasing noise.

Low cut (Hz) — Enter the bandpass low cut frequency in Hz.

Low pass (Hz) — Enter the bandpass low pass frequency in Hz.

High pass (Hz) — Enter the bandpass high pass frequency in Hz.

High cut (Hz) — Enter the bandpass high cut frequency in Hz.

Time Variant Bandpass

Usage:

The *Time Variant Bandpass* step allows you to apply up to five (5) different time-variant bandpass filters to your trace data. You specify the low cut, low pass, high pass and high cut, filter points for each filter and the starting time for application of the filter. You also specify the filter taper length, which allows you to control the smoothness of the transition between adjacent filters.

Input Links:

1) Seismic data in any sort order (mandatory).

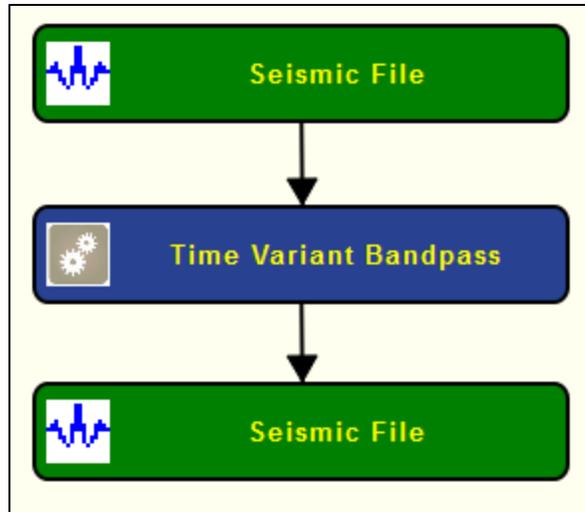
Output Links:

1) Seismic data in any sort order (mandatory).

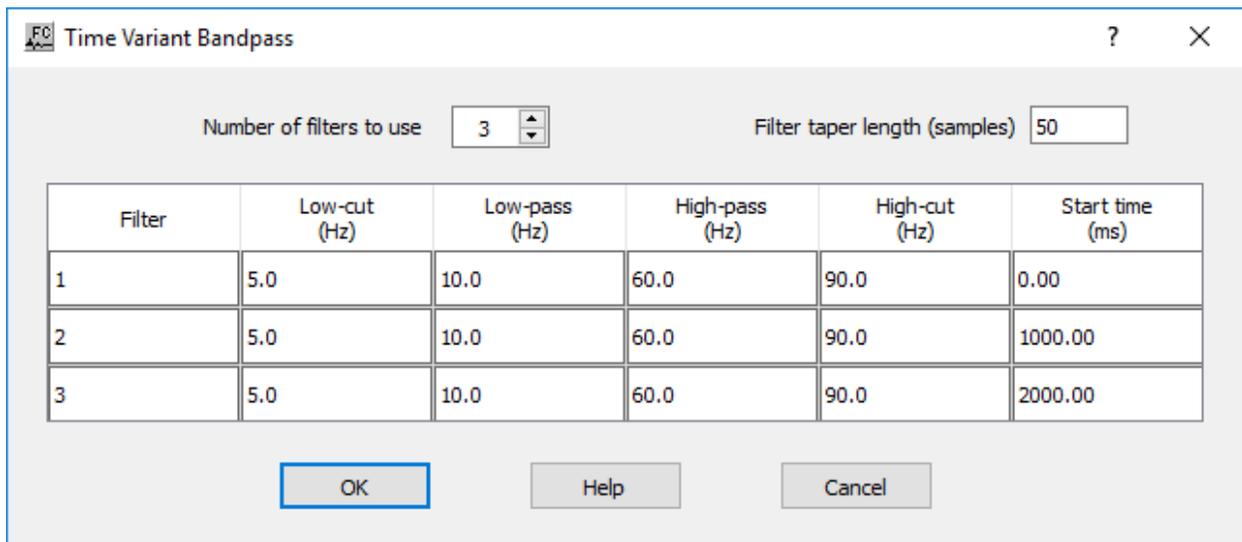
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Number of filters to use — Enter the number of filters to apply.

Filter taper length — Enter the length of the filter taper in samples. The longer the filters taper length, the smoother the transition between adjacent filters.

Low cut — Enter the low cut frequency of the bandpass filter in Hertz.

Low pass — Enter the low pass frequency of the bandpass filter in Hertz.

High pass — Enter the high pass frequency of the bandpass filter in Hertz.

High cut — Enter the high cut frequency of the bandpass filter in Hertz.

Start time (ms) —Enter the start time in milliseconds to start the application of each filter.

Time Variant Butterworth

Usage:

The *Time Variant Butterworth* step allows you to apply up to five (5) different time-variant Butterworth filters to your trace data. You specify the low pass, high pass and low and high rolloff rates in decibels (dB) for each filter, as well as the starting time for application of the filter. You also specify the filter taper length, which controls the smoothness of the transition between adjacent filters.

Input Links:

1) Seismic data in any sort order (mandatory).

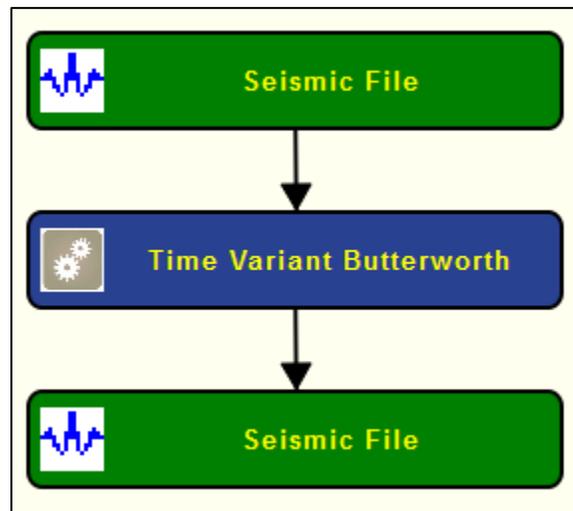
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Time Variant Butterworth

Number of filters to use: 3 Filter taper length (samples): 50

Filter	Low-pass (Hz)	High-pass (Hz)	Low-rolloff (dB/oct)	High-rolloff (dB/oct)	Start time (ms)
1	9.0	72.0	18.0	18.0	0.00
2	9.0	72.0	18.0	18.0	1000.00
3	9.0	72.0	18.0	18.0	2000.00

OK Help Cancel

Parameter Description:

Number of filters to use — Enter the number of filters to apply.

Filter taper length — Enter the length of the filter taper in samples. The longer the filter taper length, the smoother the transition between adjacent filters.

Low frequency — Enter the low pass frequency of the Butterworth filter in Hertz.

Low rolloff rate — Enter the low pass rolloff rate in dB/Octave. Higher numbers give a steeper filter rolloff.

High frequency — Enter the high pass frequency of the Butterworth filter in Hertz.

High rolloff rate — Enter the high pass rolloff rate in dB/Octave. Higher numbers give a steeper filter rolloff.

Start Time (ms) — Enter the start time in milliseconds to the start application of each filter.

Velocity-Guided Butterworth Filter

Usage:

The *Velocity-Guided Butterworth Filter* step is a 2D pre-stack single channel filter for Butterworth filter with a particular apparent velocity in the offset-time domain.

The input traces of each record are time-shifted according to their offsets, and then a low-cut spatial frequency filter is applied. This will attenuate much of the noise energy at that particular apparent velocity. The time-shifted data is then restored.

Input Links:

- 1) 2D Seismic pre-stack data records ordered by offset (mandatory).

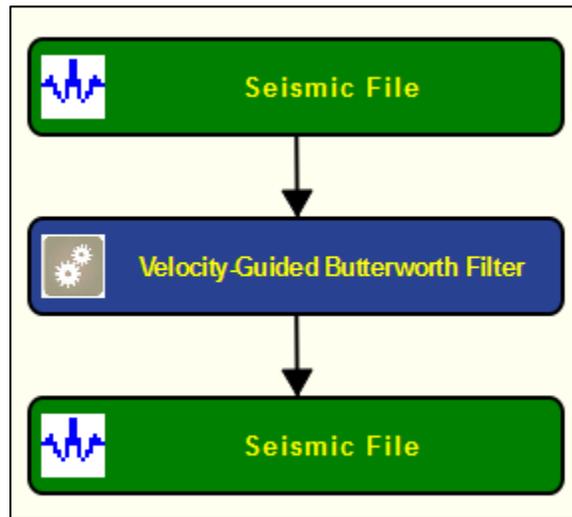
Output Links:

- 1) 2D Seismic pre-stack data records ordered by offset (mandatory).

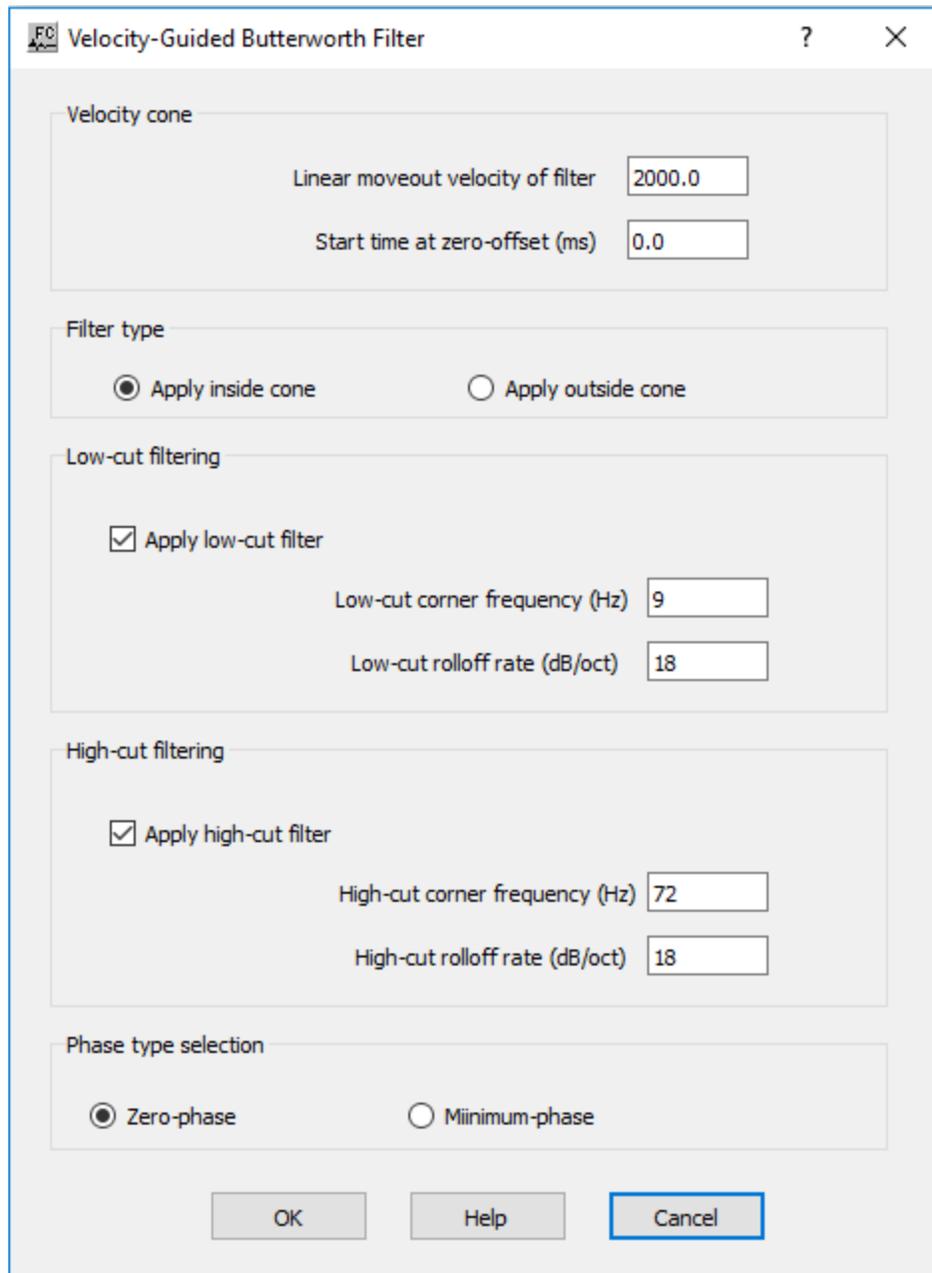
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Velocity cone: Specify velocity parameters.

Linear moveout velocity filter — Enter linear moveout velocity for the Butterworth filter in m/s or ft/s.

Start time at zero-offset (ms) — Enter the start time at zero-offset in milliseconds

Filter type: Specify filter type.

Apply inside cone — If selected, apply the Butterworth filter inside the defined velocity cone.

Apply outside cone — If selected, apply the Butterworth filter outside the defined velocity cone.

Low-cut filtering: Specify low-cut Butterworth filter parameters.

Apply low-cut filter — If checked, apply a Butterworth filter with a low-cut.

Low-cut corner frequency (Hz) — Enter the low pass frequency of the Butterworth filter in Hertz.

Low-cut rolloff rate (dB/oct) — Enter the low pass rolloff rate in dB/Octave. Higher numbers give a steeper filter rolloff.

High-cut filtering: Specify high-cut Butterworth filter parameters

Apply high-cut filter — If checked, apply a Butterworth filter with a low-cut.

High-cut corner frequency (Hz) — Enter the high pass frequency of the Butterworth filter in Hertz.

High-cut rolloff rate (dB/oct) — Enter the high pass rolloff rate in dB/Octave. Higher numbers give a steeper filter rolloff.

Velocity-Guided Noise Rejection Filter

Usage:

The *Velocity-Guided Noise Rejection Filter* step is a 2D pre-stack single channel filter for attenuation of noise with a particular apparent velocity in the offset-time domain.

The input traces of each record are time-shifted according to their offsets, and then a low-cut spatial frequency filter is applied. This will attenuate much of the noise energy at that particular apparent velocity. The time-shifted data is then restored.

Input Links:

2) 2D Seismic pre-stack data records ordered by offset (mandatory).

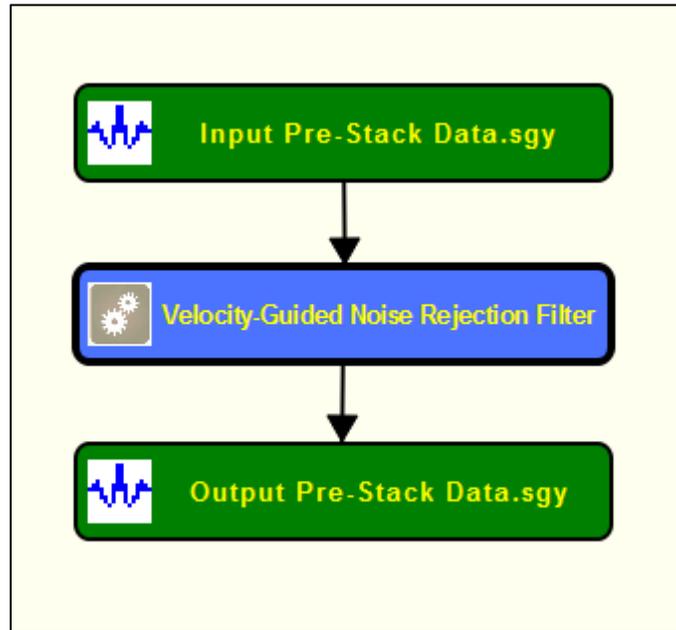
Output Links:

2) 2D Seismic pre-stack data records ordered by offset (mandatory).

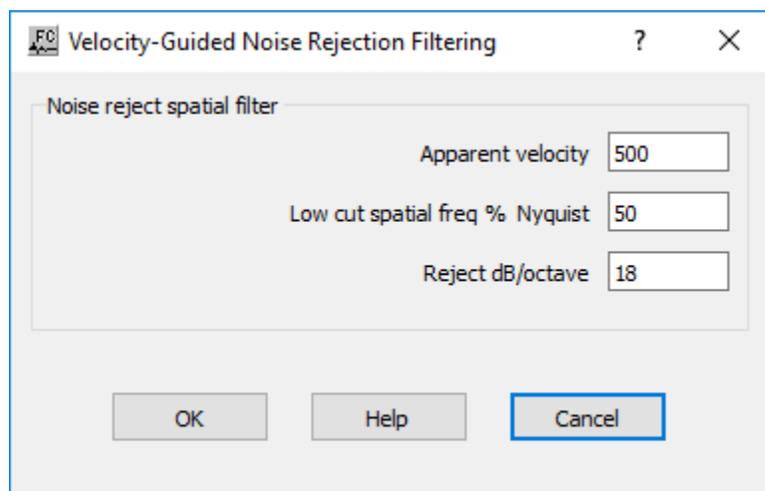
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Apparent velocity — Enter the apparent velocity at which the noise is to be attenuated.

Low cut spatial freq % Nyquist — Enter the low-cut point as a percentage of the Nyquist frequency of the spatial frequency filter to be used.

Reject dB/octave — Enter the cut-off attenuation rate of the low-cut Butterworth filter to be used.

Geometry Steps

This section documents the processing steps available in the Geometry category.

Processing steps currently available are:

Geometry
↑ Processing Categories
Bin Fold Limit
CMP Binning
CMP Fold - Data
Coordinate Conversion
Crooked Line Binning
Extract Geometry
Geometry Definition
OBS Positioning
Offset Binning
Simple Marine Geometry
UK00A P1/90 Geometry
Update Geometry
Update Marine Streamer
Update Receiver Positions
Update Source Positions

Note Trace Header Geometry Application

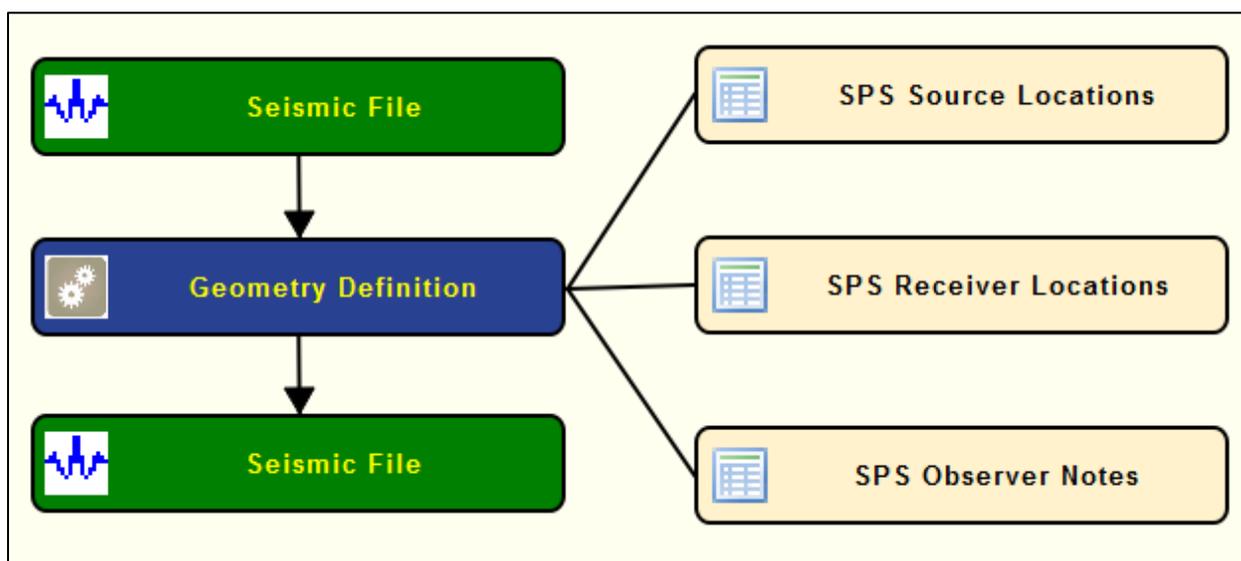
The first step in the majority of processing sequences is to update the seismic field headers with the acquisition geometry information. This information is required to perform basic data analysis and to execute almost all multi-channel processing steps.

There are three basic structures for the processing flow that is used to update the seismic trace header with the acquisition geometry information. The structure you use will depend on the nature of the seismic survey. The three seismic surveys and their associated processing flows can be classified as follows;

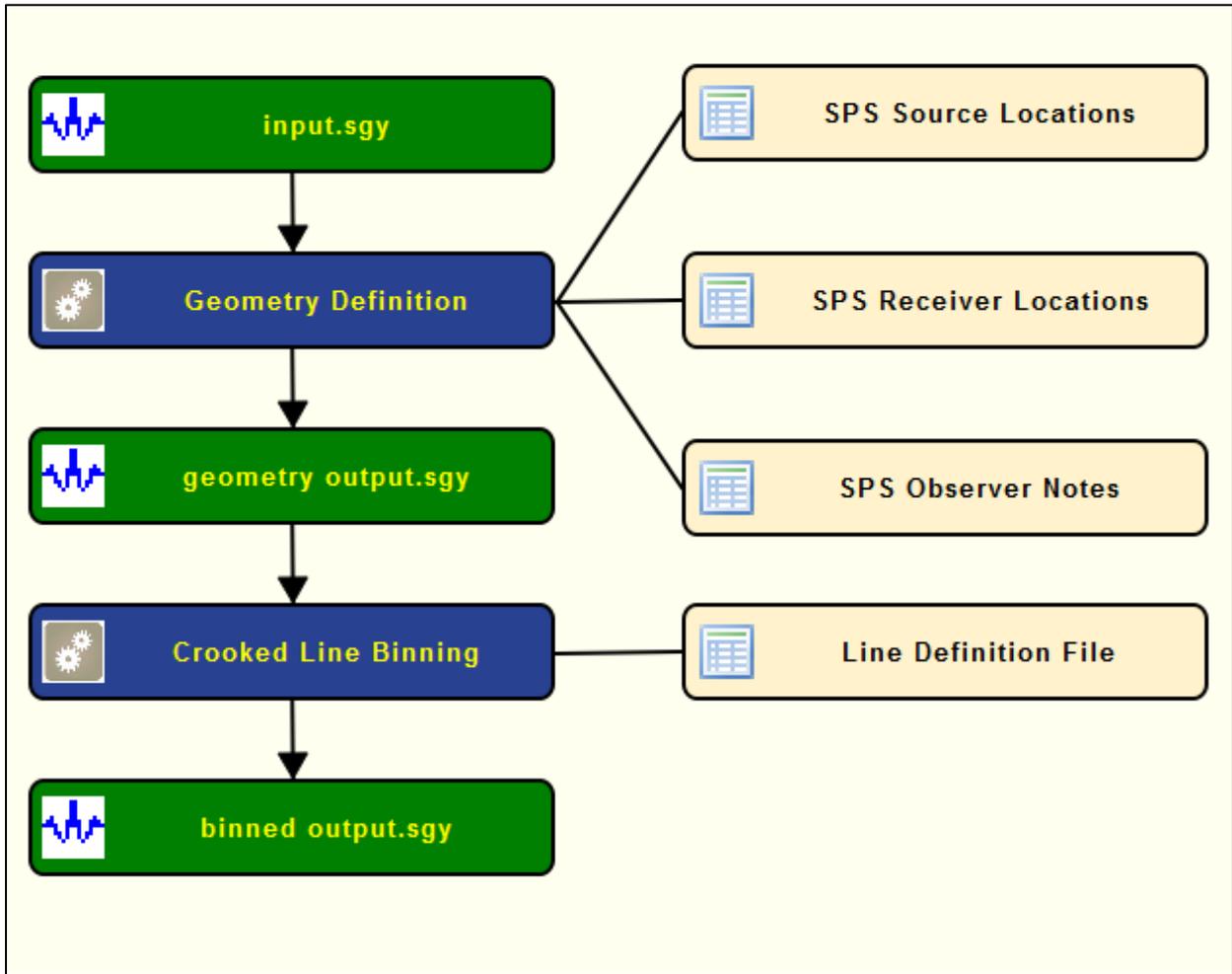
1. 2D seismic. In SPW, 2D seismic surveys are those in which the sources and receivers are laid out on the same 2D line and the CMP number can be computed as $CMP = (Source\ Location + Receiver\ Location) / 2$. This implies that source location 101 and receiver location 101 are co-located (i.e. have the same X,Y coordinates).
1. Crooked line 2D seismic. In SPW, Crooked line 2D seismic surveys are those that will be processed as a single CMP line, though the sources and receivers are not necessarily laid out along the same line. This implies that source location 101 and receiver location 101 need not be co-located (i.e. are not required to have the same X,Y coordinates).
1. 3D seismic. In SPW, 3D seismic surveys are those in which the sources and receivers are laid out areally and the data will be organized in terms of inlines and crosslines.

An example of each of these three types of processing flows can be found in the Templates library under the Geometry category.

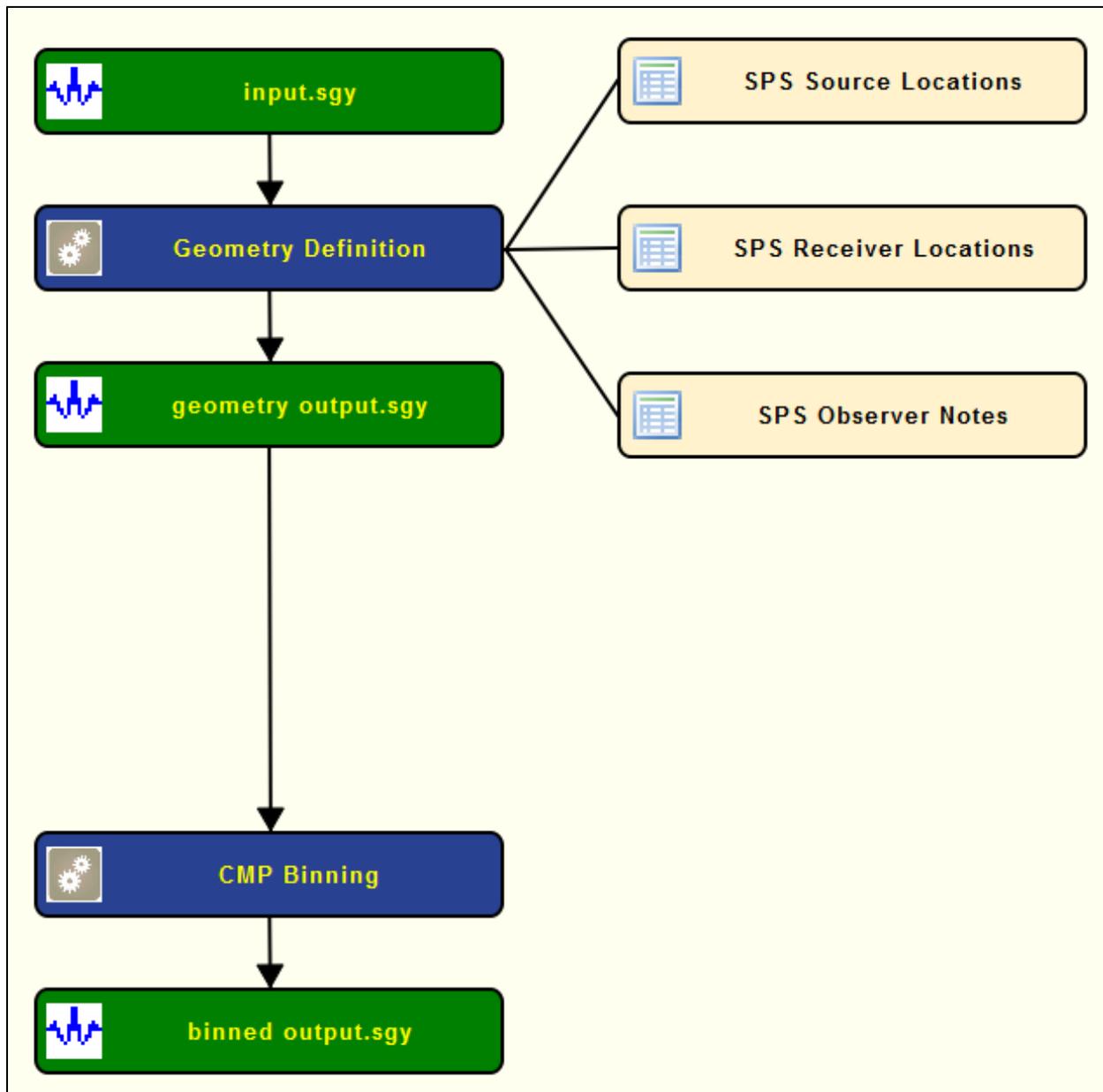
Example Flowchart for a 2D seismic survey:



Example Flowchart for a crooked line 2D seismic survey:



Example Flowchart for a 3D seismic survey:



Bin Fold Limit

Usage:

The *Bin Fold Limit* step adds extra flex traces to input binned data from an input Flex Table as output from *CMP Binning* in flex mode. Flex traces are selected from the flex table locations as specified by the *Bin Fold Limit* parameters.

An alternative to using *CMP Binning* in flex mode and *Bin Fold Limit* to improve coverage is to interpolate the binned data with, for example, *3D Missing Data Interpolation*.

Input Links:

- 1) 3D Seismic data sorted by CMP Line and CMP Location, with CMP Location as the record key (mandatory).
- 2) Flex Table as output by **CMP Binning** with flex trace location data.

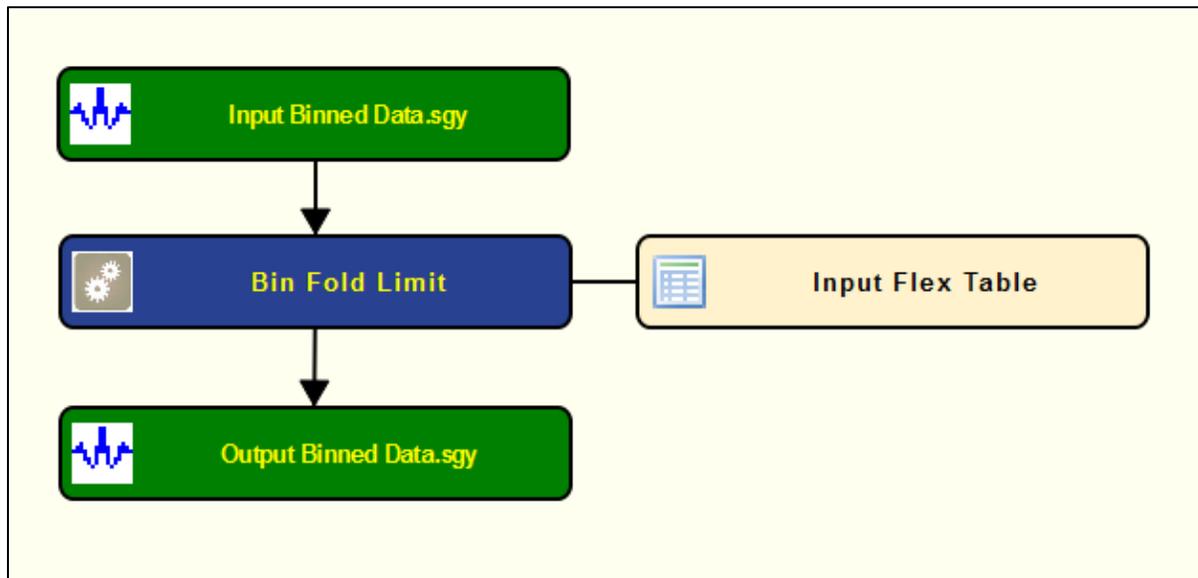
Output Links:

- 1) 3D Seismic data sorted by CMP Line and CMP Location (mandatory).

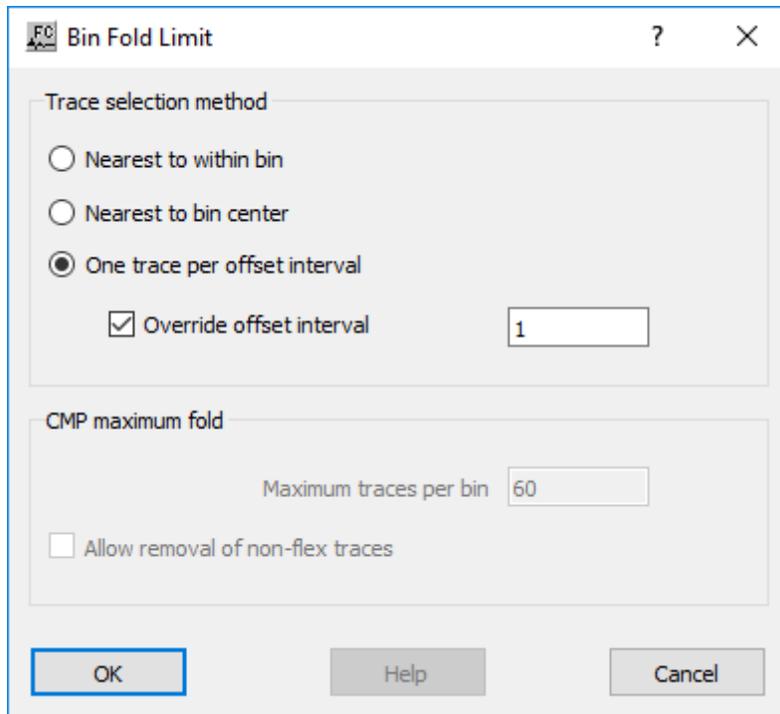
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Trace selection method: Specify the criterion by which traces are selected from both the input data and the flex traces whose locations are specified by the input flex file.

Nearest to within bin – If selected, traces will be selected for inclusion in a bin by their distances from the bin boundary.

Nearest to bin center – If selected, traces will be selected for inclusion in a bin by their distances from the center of the bin.

One trace per offset interval – If selected, this option aims to provide a full range of offsets within each bin by allowing just one trace per offset interval.

Override offset interval – If checked, the required offset interval may be overridden in the adjacent box.

CMP maximum fold: This option does not apply when traces are selected for inclusion in a bin by one per offset interval.

Maximum traces per bin – Specify the total number of traces that may be included in each bin.

Allow removal of non-flex traces – If checked, and there are more (non-flex) traces assigned to a bin than the specified. **Maximum traces per bin**, then those furthest from the bin center will be removed. If not checked, then only flex traces which fall within the box will be de-selected.

CMP Binning

Usage:

The *CMP Binning* step assigns CMP line and location numbers according to user specified coordinate parameters. If a 2D survey is specified, you will be prompted to define the line. If a 3D survey is specified, you will be prompted to define the grid.

The option of Flex binning allows each bin to contain more traces, by increasing the effective size of each bin and thereby including traces which also fall into neighboring bins. The amount of flex can also be proportional to the trace offset. The flex traces may be added immediately to the output data flow, or else their locations may be output to a flex file. This option allows stacking in of the flex traces without extra sorting overhead.

Input Links:

- 1) Seismic data in any sort order (mandatory).

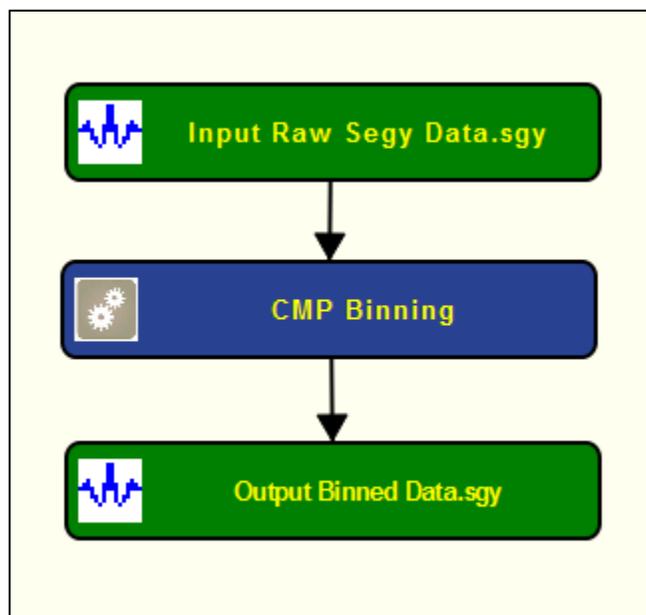
Output Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Flex table when flex binning (optional).

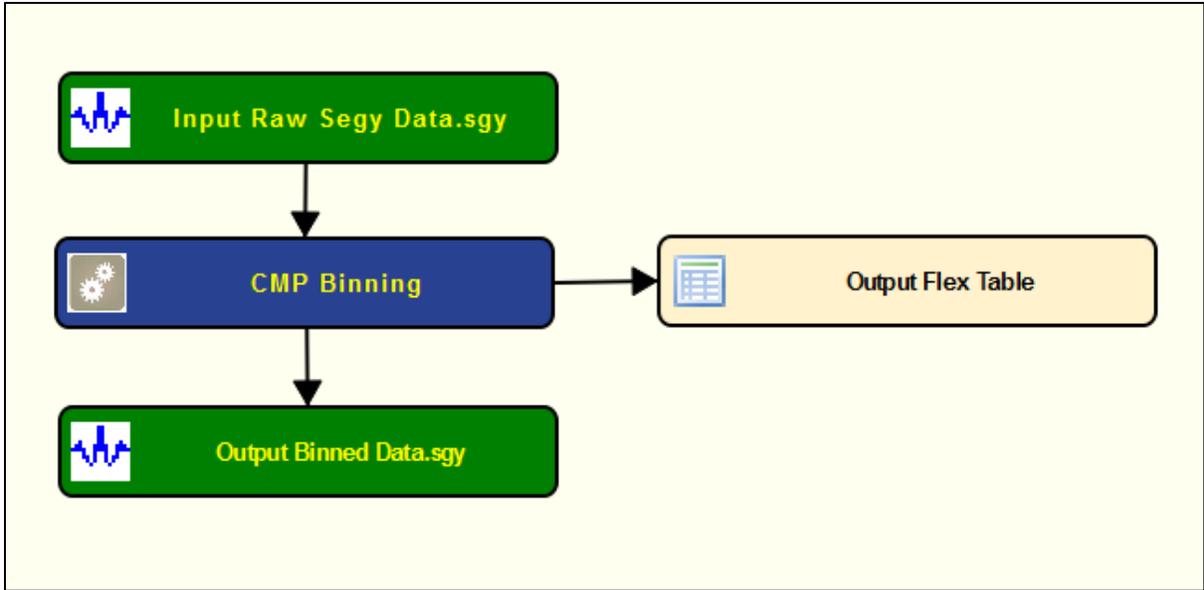
Reference:

-

Example Flowchart:



Example Flowchart for Flex Binning:



Step Parameter Dialog for 2D:

CMP Binning [?] [X]

Line Definition

Start of line easting Line number

Start of line northing Line azimuth

End of line easting First midpoint number

End of line northing Common midpoint increment

Common midpoint size

Coordinate definition

Corner points define bin centers

Corner points define bin corners

Survey dimensions

2D

3D

Project updates

 Update from project

 Update project

Binning type specification

No flex binning

Output flex traces directly

Output flex locations to a flex file

Flex binning specification

Inline % bin flex Inline % Offset flex

Crossline % bin flex Crossline % Offset flex

Step Parameter Dialog for 3D:

CMP Binning [?] [X]

Grid definition

Corner 1 - Easting	<input type="text" value="1000000.00"/>	Inline bin size	<input type="text" value="25.00"/>
Corner 1 - Northing	<input type="text" value="1000000.00"/>	Crossline bin size	<input type="text" value="25.00"/>
Corner 2 - Easting	<input type="text" value="1000000.00"/>	First inline number	<input type="text" value="1000"/>
Corner 2 - Northing	<input type="text" value="1000000.00"/>	Inline increment	<input type="text" value="1"/>
Corner 3 - Easting	<input type="text" value="1000000.00"/>	First crossline number	<input type="text" value="2000"/>
Corner 3 - Northing	<input type="text" value="1000000.00"/>	Crossline increment	<input type="text" value="1"/>

Coordinate definition

Corner points define bin centers
 Corner points define bin corners

Survey dimensions

2D
 3D

Project updates

Update from project
 Update project

Binning type specification

No flex binning
 Output flex traces directly
 Output flex locations to a flex file

Flex binning specification

Inline % bin flex	<input type="text" value="0"/>	Inline % Offset flex	<input type="text" value="0"/>
Crossline % bin flex	<input type="text" value="0"/>	Crossline % Offset flex	<input type="text" value="0"/>

Step Parameter Dialog for 3D Flex Binning:

CMP Binning [?] [X]

Grid definition

Corner 1 - Easting	<input type="text" value="1000000.00"/>	Inline bin size	<input type="text" value="25.00"/>
Corner 1 - Northing	<input type="text" value="1000000.00"/>	Crossline bin size	<input type="text" value="25.00"/>
Corner 2 - Easting	<input type="text" value="1000000.00"/>	First inline number	<input type="text" value="1000"/>
Corner 2 - Northing	<input type="text" value="1000000.00"/>	Inline increment	<input type="text" value="1"/>
Corner 3 - Easting	<input type="text" value="1000000.00"/>	First crossline number	<input type="text" value="2000"/>
Corner 3 - Northing	<input type="text" value="1000000.00"/>	Crossline increment	<input type="text" value="1"/>

Coordinate definition

Corner points define bin centers
 Corner points define bin corners

Survey dimensions

2D
 3D

Project updates

Update from project
 Update project

Binning type specification

No flex binning
 Output flex traces directly
 Output flex locations to a flex file

Flex binning specification

Inline % bin flex	<input type="text" value="0"/>	Inline % Offset flex	<input type="text" value="0"/>
Crossline % bin flex	<input type="text" value="0"/>	Crossline % Offset flex	<input type="text" value="0"/>

Parameter Description:

Line definition (for 2D): Define line parameters. These parameters are exclusive for 2D surveys.

Start of line easting (for 2D) — Enter the start of line easting.

Start of line northing (for 2D) — Enter the start of line northing.

End of line easting (for 2D) — Enter the end of the line easting.

End of line northing (for 2D) — Enter the end of the line northing.

Line number (for 2D) — Enter the line number.

Line azimuth (for 2D) — Enter the line azimuth.

First midpoint number (for 2D) — Enter the first midpoint number.

Common midpoint increment (for 2D) — Enter the common midpoint increment.

Common midpoint size (for 2D) — Enter the common midpoint size.

Grid definition (for 3D) — Define the 3D grid. These parameters are exclusive for 3D surveys.

Corner 1 – Easting (for 3D) — Enter the easting (x) coordinate of the first corner of your survey.

Corner 1 – Northing (for 3D) — Enter the northing (y) coordinate of the first corner of your survey.

Corner 2 – Easting (for 3D) — Enter the easting (x) coordinate of the second corner of your survey.

Corner 2 – Northing (for 3D) — Enter the northing (y) coordinate of the second corner of your survey.

Corner 3 – Easting (for 3D) — Enter the easting (x) coordinate of the third corner of your survey.

Corner 3 – Northing (for 3D) — Enter the northing (y) coordinate of the third corner of your survey.

Inline bin size (for 3D) — Enter the size in distance units of the in-line side (1 to 2) of each bin.

Crossline bin size (for 3D) — Enter the size in distance units of the cross-line side (1 to 3) of each bin.

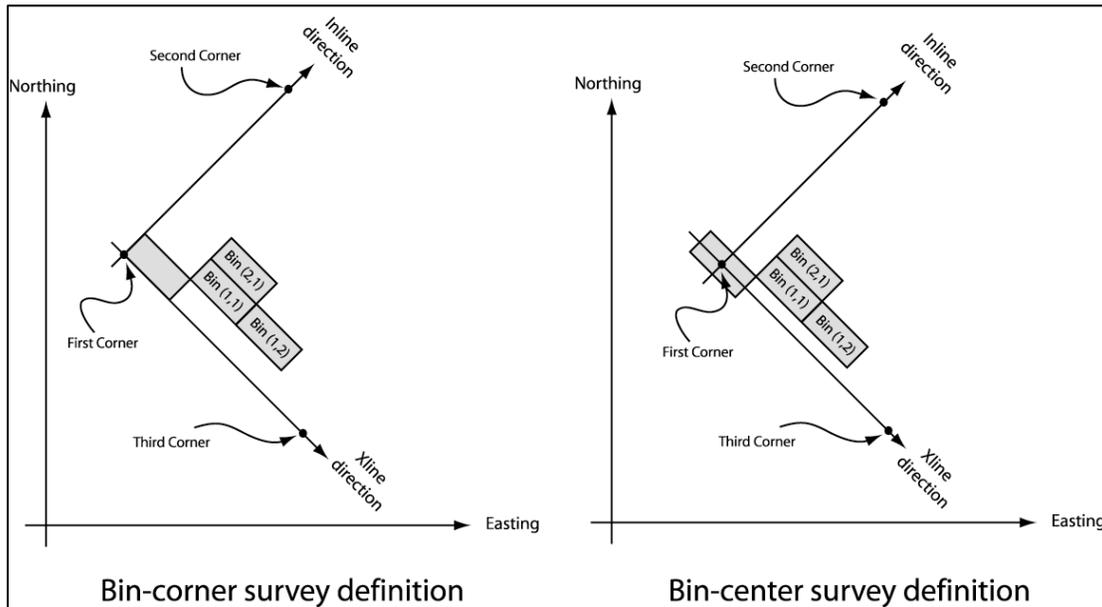
First inline number (for 3D) — Enter the first inline number. This line number is assigned to all the bins along the side of the survey from corner 1 to corner 2.

Inline increment (for 3D) — Enter the increment in line numbers between adjacent CMP lines.

First crossline number (for 3D) — Enter the first crossline number. This location number is assigned to all the bins along the side of the survey from corner 1 to corner 3.

Crossline increment (for 3D) — Enter the increment in locations between adjacent CMP locations.

Coordinate definition: Specify whether the corner points define the bin centers or corners following the figure below.



Corner points define bin centers — If selected, specify that corner points define bin centers.

Corner points define bin corners — If selected, specify that corner points define bin corners.

Survey dimensions: Specify whether the dimensions of the survey are 2D or 3D.

2D — If selected, specify 2D line survey.

3D — If selected, specify a 3D grid survey.

Project updates: Specify project updates.

Update from project — Select to update from the project.

Update project — Select to update the project.

Binning type specification: Specify standard binning or the type of flex binning.

No flex binning — If selected, a standard binning, with no extra traces added, is going to be performed.

Output flex traces directly — If selected, add flex traces to the output binned traces.

Output flex locations to a flex file — If selected, add the locations of flex traces to an additional output flex file. The flex traces may then be added using **Bin Fold Limit** at a later stage.

Flex binning specification: Specify standard binning or the type of flex binning.

Inline % bin flex — Enter the percentage increase of each bin size in the inline direction to include extra ‘flex’ traces.

Crossline % bin flex — Enter the percentage increase of each bin size in the crossline direction to include extra ‘flex’ traces.

Inline % Offset flex — Enter the increase of each bin size as the percentage increase of the trace inline offsets.

Crossline % Offset flex — Enter the increase of each bin size as the percentage increase of the trace crossline offsets.

Note: The bin flex and Offset flex options are additive – the bin size used will be the maximum size of the bin flex and Offset flex options.

CMP Fold - Data

Usage:

The *CMP Fold – Data* step extracts information related with the CMP fold from the seismic data trace headers.

Input Links:

1) Seismic data in any sort order (mandatory).

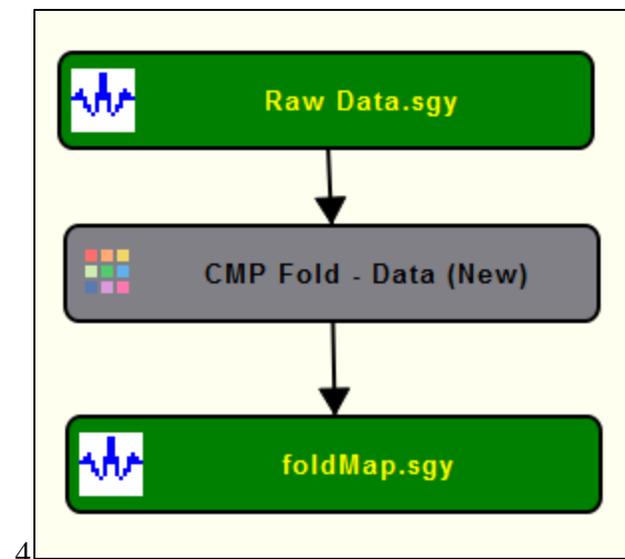
Output Links:

None

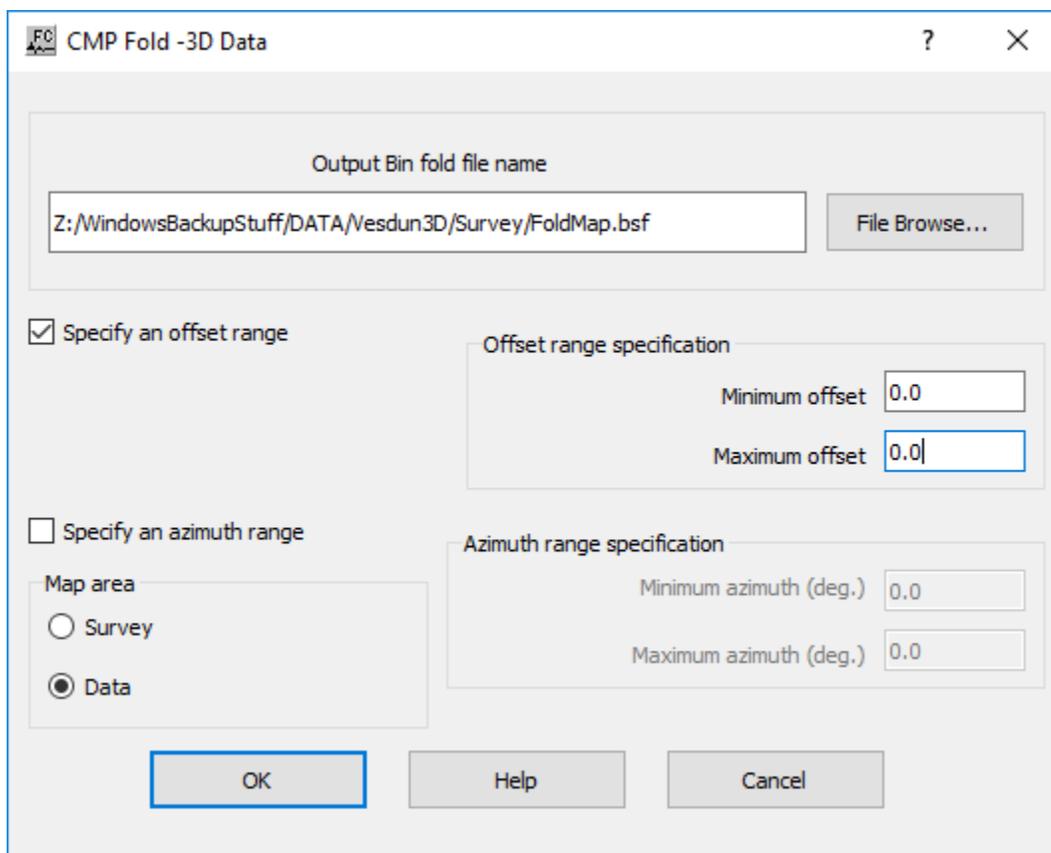
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Bin fold file name — Select file to save the bin fold map in *bsf* form.

Specify an offset range — If checked, CMP fold map is limited by minimum and maximum offset distance as it is written in the trace headers.

Minimum offset — Enter the minimum offset considered to build the CMP fold map.

Maximum offset — Enter the maximum offset considered to build the CMP fold map.

Specify an azimuth range — If checked, CMP fold map is limited by minimum and maximum azimuth defined in degrees from the North.

Minimum azimuth (deg.) — Enter the minimum azimuth considered to build the CMP fold map.

Maximum azimuth (deg.) — Enter the maximum azimuth considered to build the CMP fold map.

Map area: Define map area either by survey of data.

Survey — If selected, the CMP fold map is built from survey geometry.

Data — If selected, the CMP fold map is built from data geometry.

Coordinate Conversion

Usage:

The *Coordinate Conversion* step allows converting the coordinates stored in the seismic traces headers between geographic (latitude/longitude), Transverse Mercator, UTM or UPS. This step allows converting the source, receiver and CMP coordinates simulatenously or individually.

Input Links:

1) Seismic data in any sort order (mandatory).

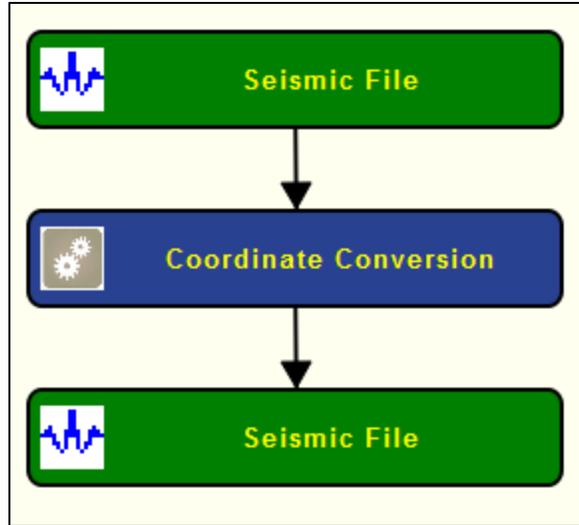
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Coordinate Conversion

Input file coordinate system

Geographic (Lat-Long)

Geographic Units: Decimal

Geographic datum: WGS 84

Orientation - longitude: West

Hemisphere - latitude: Northern

Override input geographic datum values

Override input central meridian

Input central meridian: []

Equatorial radius (m): 6378137.000000000

Polar radius (m): 6356752.314200000

Mean radius (m): 6367435.679693565

Flattening: 0.003352811

Flattening Reciprocal: 298.257223563

Scale factor: 0.9996

Eccentricity: 0.0818192

Output file coordinate system

UTM - Universal Transverse Mercator

Geographic Units: Decimal

Geographic datum: WGS 84

Orientation - longitude: West

Hemisphere - latitude: Northern

Override output geographic datum values

Override output central meridian

Output central meridian: []

Equatorial radius (m): 6378137.000000000

Polar radius (m): 6356752.314200000

Mean radius (m): 6367435.679693565

Flattening: 0.003352811

Flattening Reciprocal: 298.257223563

Scale factor: 0.9996

Eccentricity: 0.0818192

Convert source coordinates Convert receiver coordinates Convert CMP coordinates

OK Help Cancel

Parameter Description:

Input file coordinate system: Specify the coordinate system of the input seismic file.

Geographic (Lat-Long) — Select the coordinate system. The user may choose between **Geographic (latitude/longitude)**, **Transverse Mercator**, **UTM – Universal Transverse Mercator** or **UPS – Universal Polar Stereographic**.

Geographic units (only for Geographic (Lat-Long)) — Select if the geographic coordinates are in **Decimal** or **DD MM SS**.

Geographic datum — Select the datum of the selected coordinate system. Only available for **Transverse Mercator, UTM and UPS**.

Orientation – longitude — Select between **East** or **West**.

Hemisphere – latitude — Select the hemisphere of the coordinate system.

Override input geographic datum values — If checked, overrides the standard parameters of the selected coordinate reference system.

Equatorial radius (m) — Enter the value in meters for the user-defined equatorial radius.

Polar radius (m) — Enter the value in meters for the user-defined polar radiues.

Mean radius (m) — Enter the value in meters for the user-defined mean radius.

Flattening — Enter the value for flattening.

Flattening reciprocal — Enter the flattening reciprocal values.

Scale — Enter the scale factor.

Eccentricity — Enter the eccentricity value.

Override input central meridian — If checked, overrides the central meridian for the input coordinate reference system.

Input central meridian — Enter the value for the user-defined central meridian.

Output file coordinate system: Specify the coordinate system of the input seismic file.

Geographic (Lat-Long) — Select the coordinate system. The user may choose between **Geographic (latitude/longitude)**, **Transverse Mercator**, **UTM – Universal Transverse Mercator** or **UPS – Universal Polar Stereographic**.

Geographic units (only for Geographic (Lat-Long)) — Select if the geographic coordinates are in **Decimal** or **DD MM SS**.

Geographic datum — Select the datum of the selected coordinate system. Only available for **Transverse Mercator**, **UTM** and **UPS**.

Orientation – longitude — Select between **East** or **West**.

Hemisphere – latitude — Select the hemisphere of the coordinate system.

Override output geographic datum values — If checked, overrides the standard parameters of the selected coordinate reference system.

Equatorial radius (m) — Enter the value in meters for the user-defined equatorial radius.

Polar radius (m) — Enter the value in meters for the user-defined polar radiues.

Mean radius (m) — Enter the value in meters for the user-defined mean radius.

Flattening — Enter the value for flattening.

Flattening reciprocal — Enter the flattening reciprocal values.

Scale — Enter the scale factor.

Eccentricity — Enter the eccentricity value.

Override output central meridian — If checked, overrides the central meridian for the output coordinate reference system.

Output central meridian — Enter the value for the user-defined central meridian.

Convert source coordinates — If checked, apply coordinate conversion to source coordinates.

Convert receiver coordinates — If checked, apply coordinate conversion to receiver coordinates.

Convert CMP coordinates — If checked, apply coordinate conversion to CMP coordinates.

Crooked Line Binning

Usage:

The *Crooked Line Binning* step selects those traces from an input 3D pre-stack seismic data file whose source-receiver mid-points fall sufficiently close to the centers of bins following a crooked line defined by 3D locations in a Line Definition card data file. The input data mid-points are calculated from the source and receiver eastings and northings placed in the trace headers through the use of SPS files by *Geometry Definition*. The Line Definition card data file contains the eastings and northings of crooked line CMP positions of a best-fit line determined by *Crooked Line Fit*.

Input Links:

- 1) 3D Seismic data in any sort order (mandatory).
- 2) Line Definition card data file (mandatory).

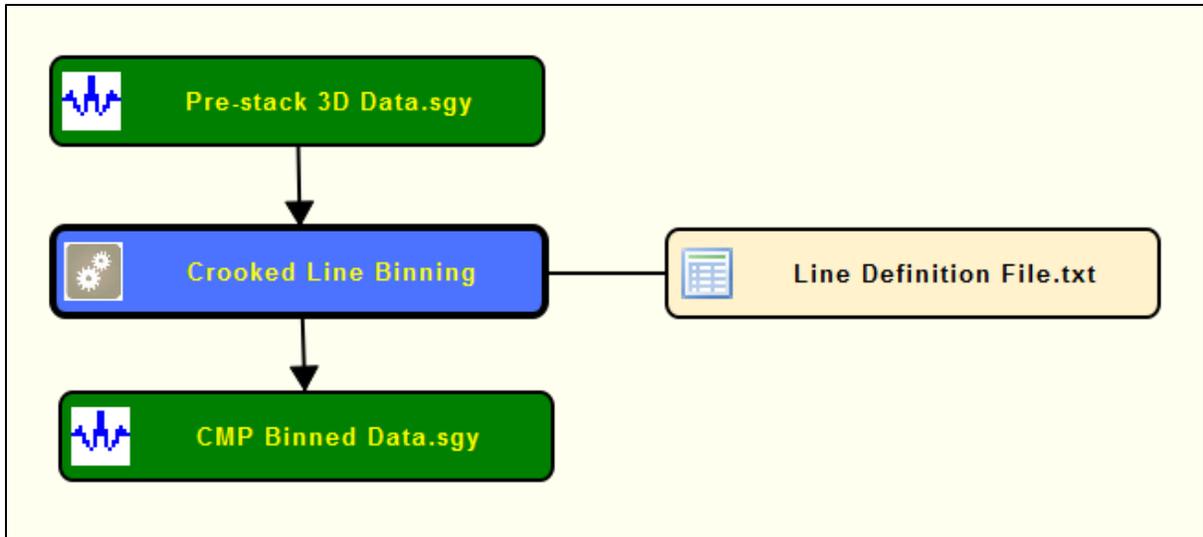
Output Links:

- 1) Crooked line 2D CMP binned seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

The screenshot shows a software dialog box titled 'Crooked Line Binning'. It contains several input fields and checkboxes:

- Number of first midpoint:** 1000
- Inline bin dimension:** 25.00
- Line width:** 200.00
- Project updates:** Two buttons, 'Update from project' and 'Update project', each with a refresh icon.
- Output data cmp coordinates:** Two radio buttons, 'Bin coordinates' (selected) and 'Source-receiver midpoints'.
- Source and receiver binning:** Two checkboxes, 'Bin source locations' and 'Bin receiver locations', both currently unchecked.
- Flex binning:** A checkbox 'Use flex binning' (unchecked) and an input field 'Inline % flex' set to 100.

At the bottom of the dialog are three buttons: 'OK', 'Help' (highlighted with a blue border), and 'Cancel'.

Parameter Description:

Number of first midpoint — Enter the number of the first midpoint.

In line bin dimension (ft or m) — Enter the inline bin dimension.

Line width (ft or m) — Enter the crossline bin dimension.

Project updates: These keys allow values to be read from the project, or alternatively to update the project.

Update from project — Select to update from the project.

Update project — Select to update the project.

Output data CMP coordinates: Specify if output coordinates are bin coordinates or source-receiver midpoints.

Bin coordinates — If selected, those traces which fall into crooked line bins and output will be given CMP coordinates which reflect the center points of the bins.

Source-receiver coordinates — If selected, those traces which fall into crooked line bins and output will be given CMP coordinates equal to their source-receiver mid-points.

Source and Receiver Binning: Specify if the binning is performed at source or receiver locations.

Bin source locations — If checked, those traces whose source locations fall into crooked line bins will be output.

Bin receiver locations — If checked, those traces whose receiver locations fall into crooked line bins will be output.

Flex Binning: Specify the flex binning parameters.

Use flex binning — If checked, those traces whose source locations fall into or sufficiently close to crooked line bins will be output.

In-line % flex — Enter the percentage distance from a trace mid-point to the boundary of a bin as compared to the bin width for that trace to be considered valid and output as a flex trace.

Extract Geometry

Usage:

The *Extract Geometry* step extracts geometry information from the seismic trace header and create source, receiver SPS card data files or UKOOA P190 Locations card data file.

Input Links:

- 1) Seismic data in any sort order (mandatory).

Output Links:

- 1) Source SPS card data file (mandatory).
- 2) Receiver SPS card data file (mandatory).

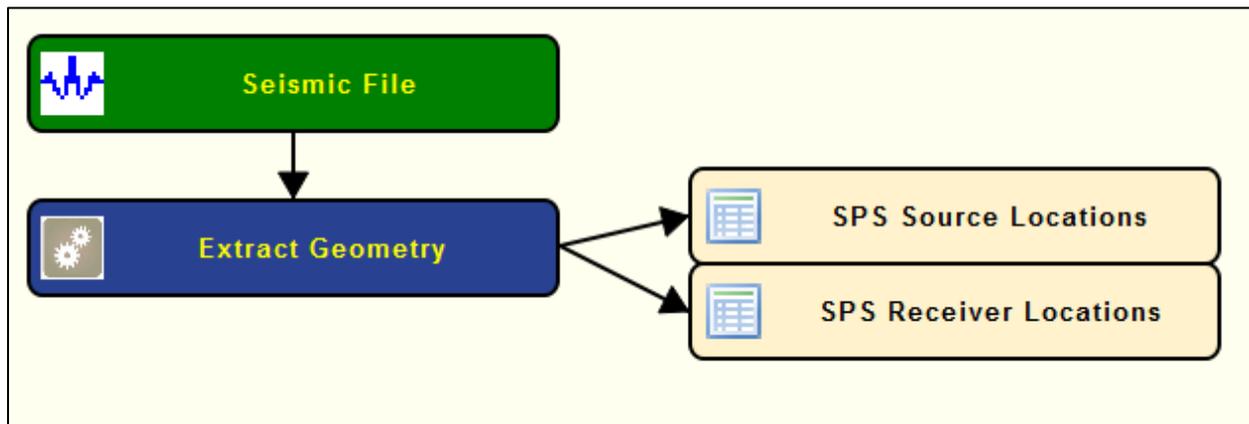
Or

- 3) Observer SPS card data file (UKOOA P190 Locations).

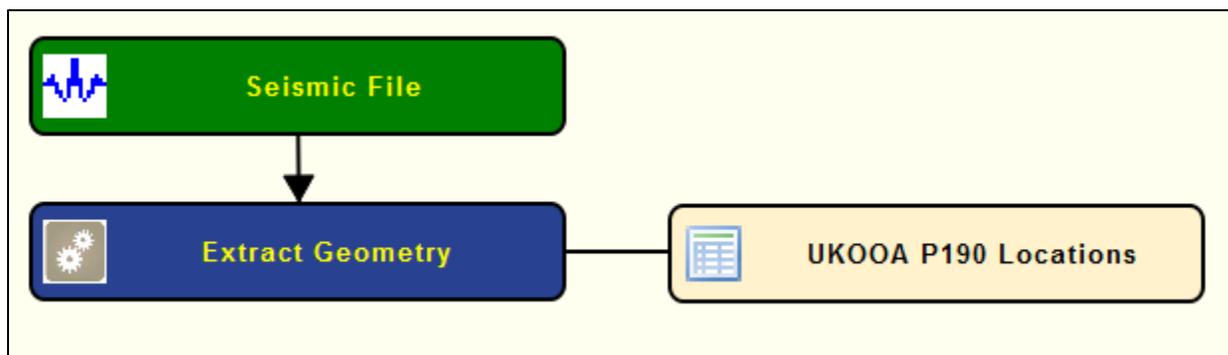
Reference:

-

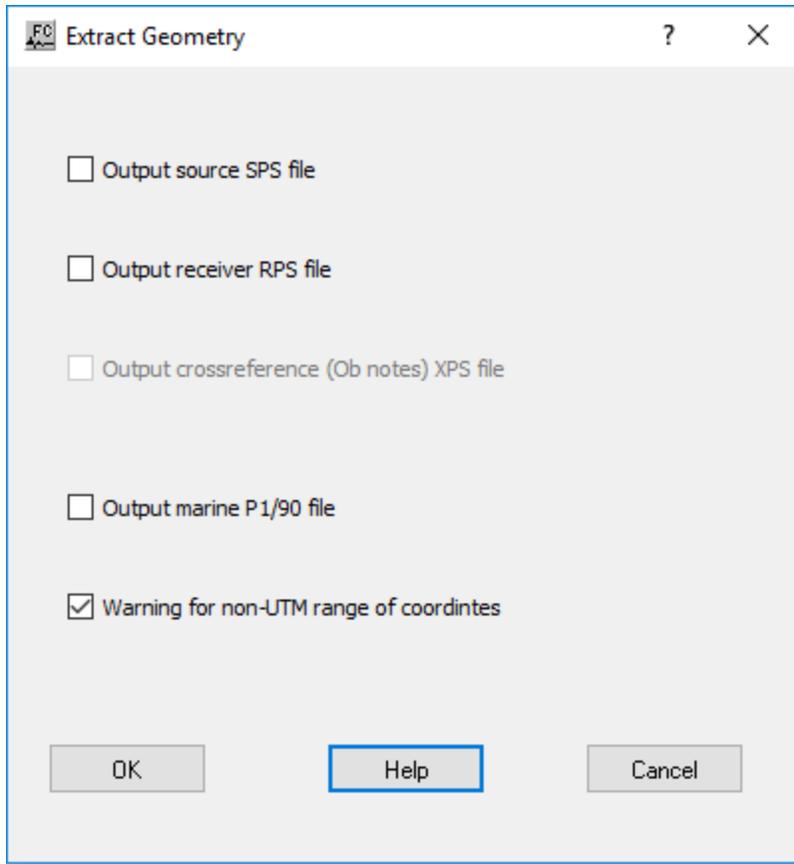
Example Flowchart:



Or



Step Parameter Dialog:



Parameter Description:

Output source SPS file — If checked, output source coordinates of the input seismic file in a source SPS card data file.

Output receiver SPS file — If checked, output receiver coordinates of the input seismic file in a receiver SPS card data file.

Output marine P1/90 file — If checked, output coordinates of the input seismic file in a marine UKOOA P190 card data file.

Warning for non-UTM range of coordinates — If checked, warns if the UTM range of coordinates is null.

Geometry Definition

Usage:

The *Geometry Definition* step assigns survey information to the trace headers based on the source, receiver, and observer notes SPS files. The *Geometry Definition* step assigns CMP number based on the source and receiver numbers using the following formula: $CMP\ Location = (Source\ Location + Receiver\ Location)$. Therefore, for 2D lines it is imperative that source and receiver locations as defined in the SPS files share the same coordinate system. This implies that Source

location 1 has the same X,Y position as Receiver location 1, and that Source location 2 has the same X,Y position as Receiver location 2, etc... In the case of 3D data, this is not an issue, as CMP Line and Location will be labeled by the CMP Binning step.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Observers Notes – SPS Format cards (mandatory).
- 3) Receiver Locations – SPS Format cards (mandatory).
- 4) Source Locations – SPS Format cards (mandatory).

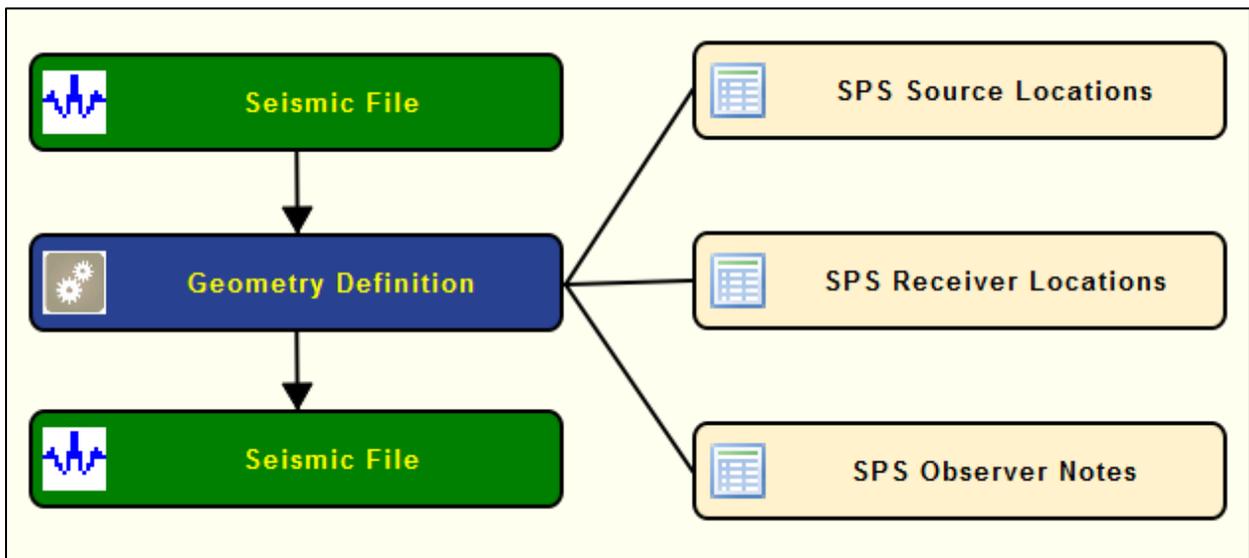
Output Links:

- 1) Seismic data in any sort order (mandatory).

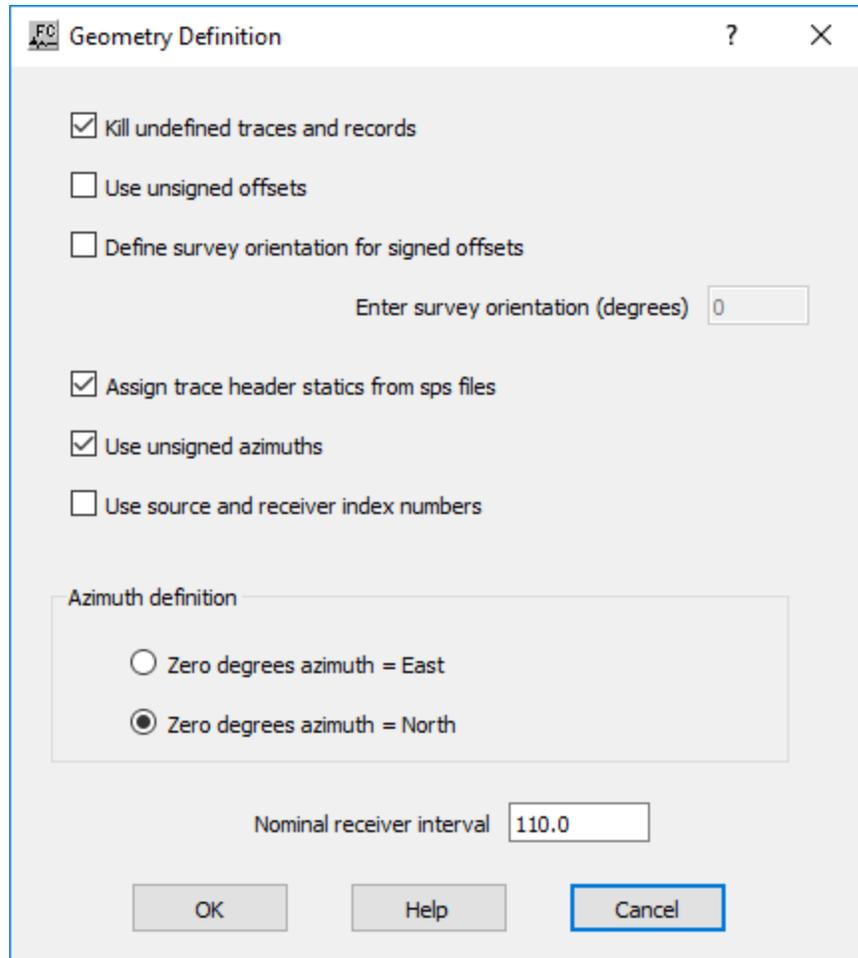
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Kill undefined traces and records — If checked, any traces or records that are not represented in the SPS files will be marked as dead.

Use unsigned offsets — If checked, the offset values written to the seismic header will be unsigned.

Define survey orientation for signed offsets — If checked, the sign on offset values will be adjusted for the orientation of the dominant receiver line azimuth, such that offset up-the-spread will be positive, and offsets down-the-spread will be negative.

Enter survey orientation (degrees) — Enter the value of the survey orientation in degrees.

Assign trace header statics from SPS files — If checked, trace header statics are assigned from auxiliary SPS files.

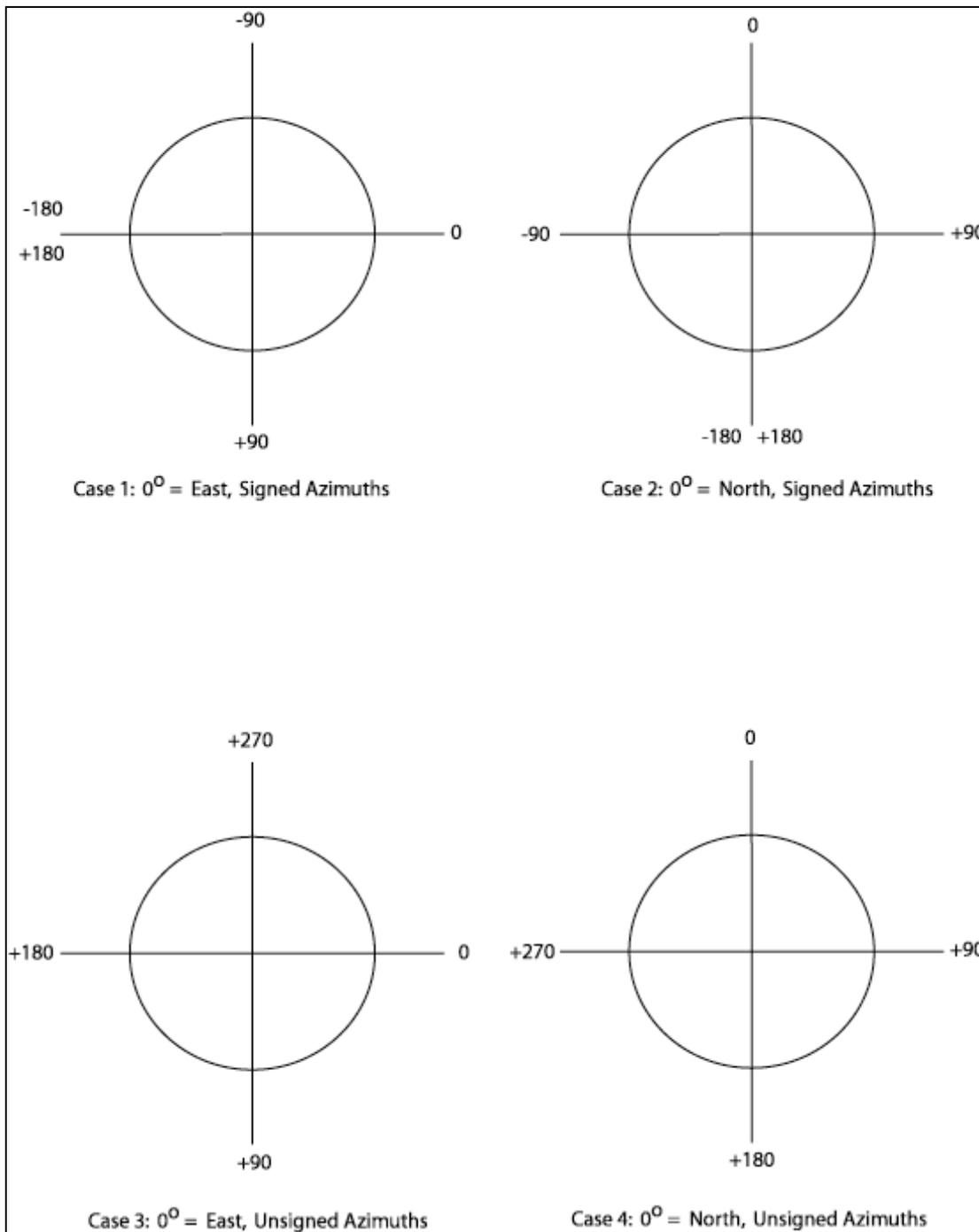
Use unsigned azimuths — If checked, the azimuth values written to the seismic header will range from 0 to 360 degrees, with zero degrees of azimuth equal to the user-specified direction. By default, azimuth values are signed and range from 0 to +/-180 degrees, with zero degrees of azimuth equal to the user-specified direction.

Use source and receiver index number — Define source and receiver by its index number.

Azimuth definition: Specify the origin of azimuth.

Zero degrees azimuth = East — If selected, then zero degrees of source-receiver azimuth will be set equal to due East.

Zero degrees azimuth = North — If selected, then zero degrees of source-receiver azimuth will be set equal to due North.



Definition of azimuths using the Geometry Definition parameters.

Nominal receiver interval — Enter the nominal interval between receiver stations in distance units.

Geometry Definition Example:

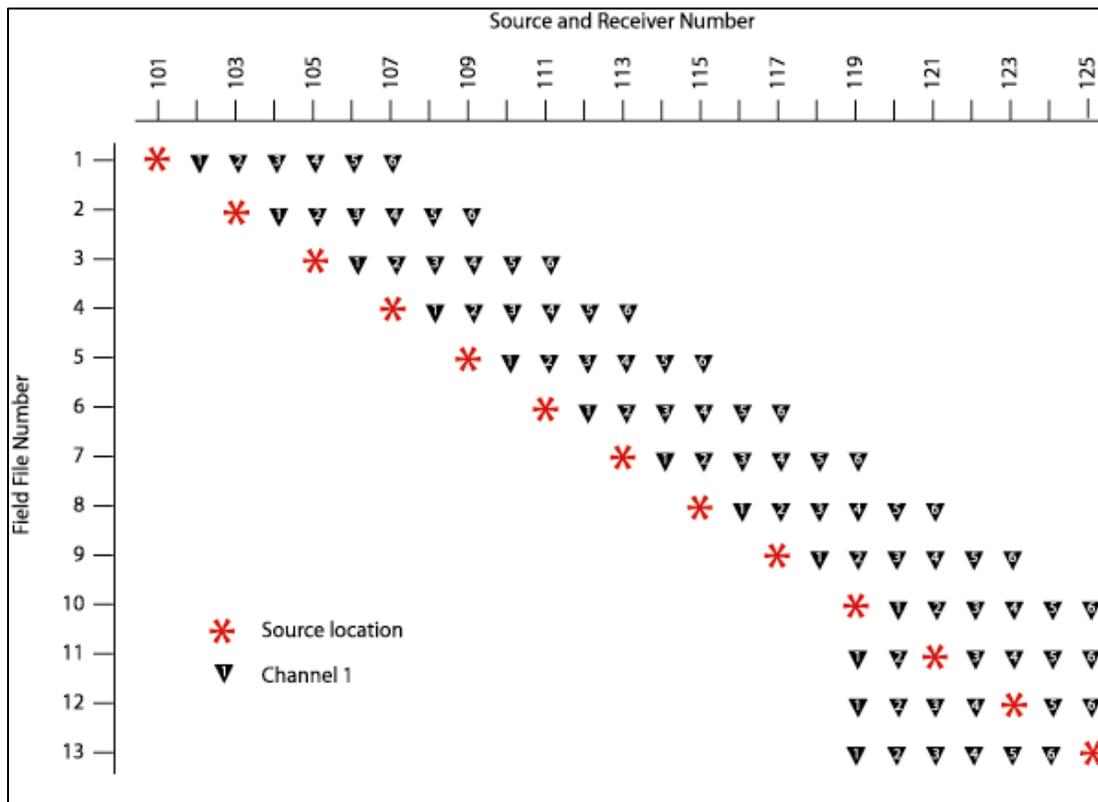


Figure 1. 2D seismic survey consisting of a 6-channel spread and a 25-m station interval. The spread “rolls-off” at the end of the line.

SPS Source Locations

SPS Source Record

File name: C:/Leonardo/DATA/Geosurveys3D/Survey/SourceLocations

File Browse...

Spreadsheet Map

Record ID	Line name	Point number	Point index	Point code	Static correct	Point depth	Seismic datum	Uphole time	Water depth	Point easting	Point northing	Surface elevati	Day of year	Time of day
1	S	1	100	0		0	0.0	0	0	1000.0	1000.0	100.0	0	0
2	S	1	102	0		0	0.0	0	0	1000.0	1050.0	100.0	0	0
3	S	1	104	0		0	0.0	0	0	1000.0	1100.0	100.0	0	0
4	S	1	106	0		0	0.0	0	0	1000.0	1150.0	100.0	0	0
5	S	1	108	0		0	0.0	0	0	1000.0	1200.0	100.0	0	0
6	S	1	110	0		0	0.0	0	0	1000.0	1250.0	100.0	0	0
7	S	1	112	0		0	0.0	0	0	1000.0	1300.0	100.0	0	0
8	S	1	114	0		0	0.0	0	0	1000.0	1350.0	100.0	0	0
9	S	1	116	0		0	0.0	0	0	1000.0	1400.0	100.0	0	0
10	S	1	118	0		0	0.0	0	0	1000.0	1450.0	100.0	0	0
11	S	1	120	0		0	0.0	0	0	1000.0	1500.0	100.0	0	0
12	S	1	122	0		0	0.0	0	0	1000.0	1550.0	100.0	0	0
13	S	1	124	0		0	0.0	0	0	1000.0	1600.0	100.0	0	0

OK Help Analyze format Save changes

Source SPS file corresponding to the survey illustrated in figure 1.

SPS Receiver Locations

SPS Receiver Record

File name: C:/Leonardo/DATA/Geosurveys3D/Survey/ReceiverLocation

File Browse...

Spreadsheet | Map

Record ID	Line name	Point number	Point index	Point code	Static correct	Point depth	Seismic datum	Uphole time	Water depth	Point easting	Point northing	Surface elevati	Day of year	Time of day
1	R	1	1	0	0	0.0	0	0	0	1000.0	1000.0	100.0	0	0
2	R	1	2	0	0	0.0	0	0	0	1000.0	1025.0	100.0	0	0
3	R	1	3	0	0	0.0	0	0	0	1000.0	1050.0	100.0	0	0
4	R	1	4	0	0	0.0	0	0	0	1000.0	1075.0	100.0	0	0
5	R	1	5	0	0	0.0	0	0	0	1000.0	1100.0	100.0	0	0
6	R	1	6	0	0	0.0	0	0	0	1000.0	1125.0	100.0	0	0
7	R	1	7	0	0	0.0	0	0	0	1000.0	1150.0	100.0	0	0
8	R	1	8	0	0	0.0	0	0	0	1000.0	1175.0	100.0	0	0
9	R	1	9	0	0	0.0	0	0	0	1000.0	1200.0	100.0	0	0
10	R	1	10	0	0	0.0	0	0	0	1000.0	1225.0	100.0	0	0
11	R	1	11	0	0	0.0	0	0	0	1000.0	1250.0	100.0	0	0
12	R	1	12	0	0	0.0	0	0	0	1000.0	1275.0	100.0	0	0
13	R	1	13	0	0	0.0	0	0	0	1000.0	1300.0	100.0	0	0
14	R	1	14	0	0	0.0	0	0	0	1000.0	1325.0	100.0	0	0
15	R	1	15	0	0	0.0	0	0	0	1000.0	1350.0	100.0	0	0
16	R	1	16	0	0	0.0	0	0	0	1000.0	1375.0	100.0	0	0
17	R	1	17	0	0	0.0	0	0	0	1000.0	1400.0	100.0	0	0
18	R	1	18	0	0	0.0	0	0	0	1000.0	1425.0	100.0	0	0
19	R	1	19	0	0	0.0	0	0	0	1000.0	1450.0	100.0	0	0
20	R	1	20	0	0	0.0	0	0	0	1000.0	1475.0	100.0	0	0
21	R	1	21	0	0	0.0	0	0	0	1000.0	1500.0	100.0	0	0
22	R	1	22	0	0	0.0	0	0	0	1000.0	1525.0	100.0	0	0
23	R	1	23	0	0	0.0	0	0	0	1000.0	1550.0	100.0	0	0
24	R	1	24	0	0	0.0	0	0	0	1000.0	1575.0	100.0	0	0
25	R	1	25	0	0	0.0	0	0	0	1000.0	1600.0	100.0	0	0

OK Help Analyze format Save changes

Figure 3. Receiver SPS file corresponding to the survey illustrated in figure 1.

Record ID	Tape number	Record number	Record index	Instrument code	Source line number	Source point number	Source point index	From channel	To channel	Channel increment	Receiver line number	From receiver	To receiver	Receiver index
1	X	1	1		1	101	1	1	6	1	1	102	107	1
2	X	2	1		1	103	1	1	6	1	1	104	109	1
3	X	3	1		1	105	1	1	6	1	1	106	111	1
4	X	4	1		1	107	1	1	6	1	1	108	113	1
5	X	5	1		1	109	1	1	6	1	1	110	115	1
6	X	6	1		1	111	1	1	6	1	1	112	117	1
7	X	7	1		1	113	1	1	6	1	1	114	119	1
8	X	8	1		1	115	1	1	6	1	1	116	121	1
9	X	9	1		1	117	1	1	6	1	1	118	123	1
10	X	10	1		1	119	1	1	6	1	1	120	125	1
11	X	11	1		1	121	1	1	6	1	1	119	120	1
12	X	11	0		1	121	1	1	6	1	1	122	125	1
13	X	12	1		1	123	1	1	6	1	1	119	122	1
14	X	12	1		1	123	1	1	6	1	1	124	125	1
15	X	13	1		1	125	1	1	6	1	1	119	124	1

Figure 4. Observer SPS file corresponding to the survey illustrated in figure 1.

OBS Positioning

Usage:

The **OBS Positioning** step accurately estimate the Ocean Bottom Seismometer (OBS) position (x,y,z) from knowledge of the sources locations and the picked first arrivals.

Input Links:

- 1) Seismic file from receiver gathers recorded with the OBS instrument, with source Easting/Northing/Elevation header information (mandatory).
- 2) First Break times - Pick First arrival picks (optional).

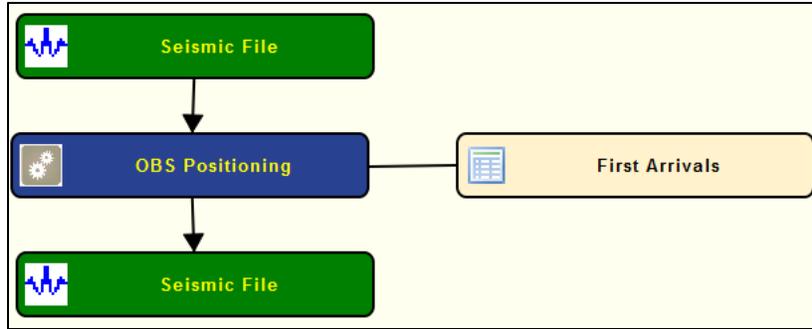
Output Links:

- 1) Seismic file from receiver gathers with the computed receiver Easting/Northing/Elevation (mandatory).

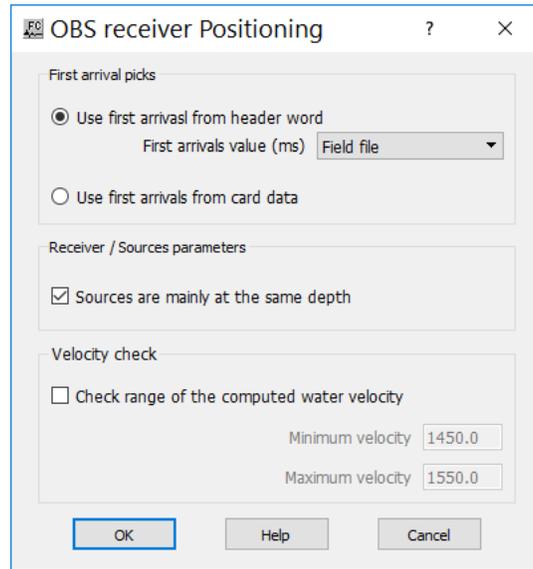
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

First arrival picks: Specify first arrival times picks parameters.

Use first arrivals from header word — if checked select the header word containing the first arrivals information.

Use first arrivals from card date — if checked a first arrivals card data will connect to the step.

Receiver/Source paramters: Specify source elvation parametes.

Sources are mainly at the same depth — if checked all sources are at the same depth range.

Velocity check: Specify range of water velocity.

Check range of the computed water velocity — return a warning message if the inverted velocity exceeds a range specified by the Minimum/Maximum velocities.

Minimum velocity — Enter minimum velocity for water column.

Maximum velocity — Enter maximum velocity for water column.

Offset Binning

Usage:

The *Offset binnig* step bins the input seismic file by the offset defined in the header of the seismic traces.

Input Links:

1) Seismic data in any sort order (mandatory).

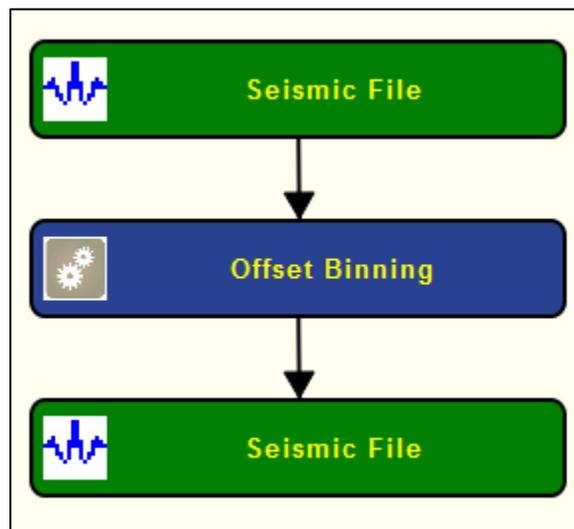
Output Links:

1) Seismic data in any sort order (mandatory).

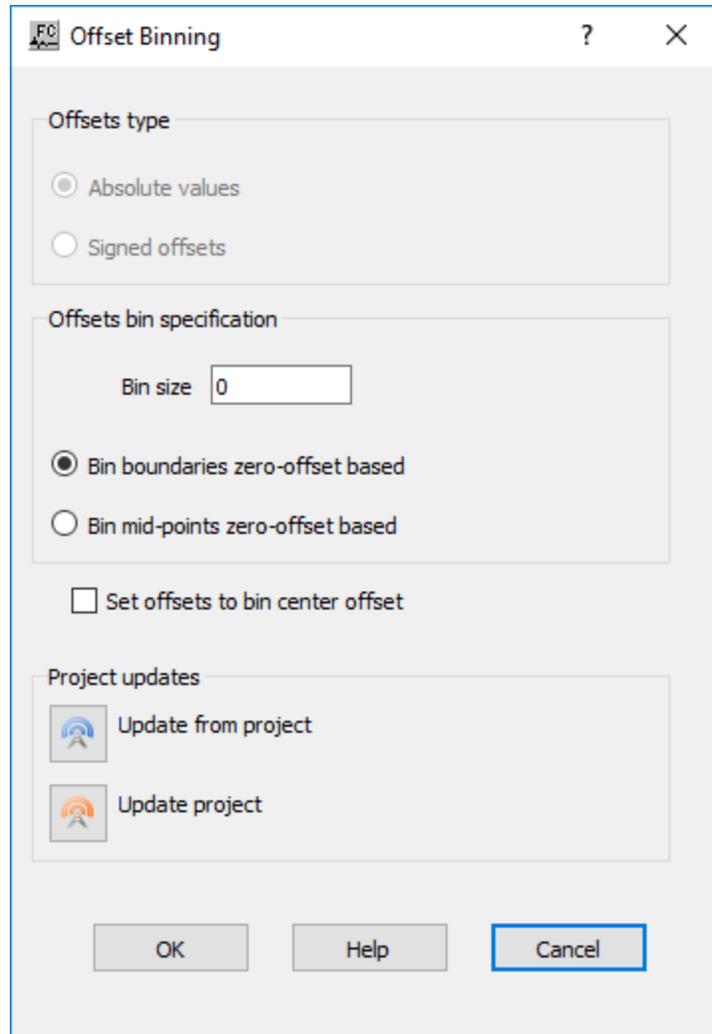
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Offsets type:

Absolute values —

Signed offsets —

Offsets bin specification:

Bin size —

Bin boundaries zero-offset based —

Bin mid-point zero-offset based —

Set offsets to bin center offset —

Project updates: Specify project updates.

Update from project — Select to update from the project.

Update project — Select to update the project.

Simple Marine Geometry

Usage:

The *Simple Marine Geometry* step assigns geometry information to the seismic trace headers based for simple 2D marine seismic acquisition.

Input Links:

1. Seismic data in any sort order (mandatory).
2. Streamer Definition card data (mandatory).

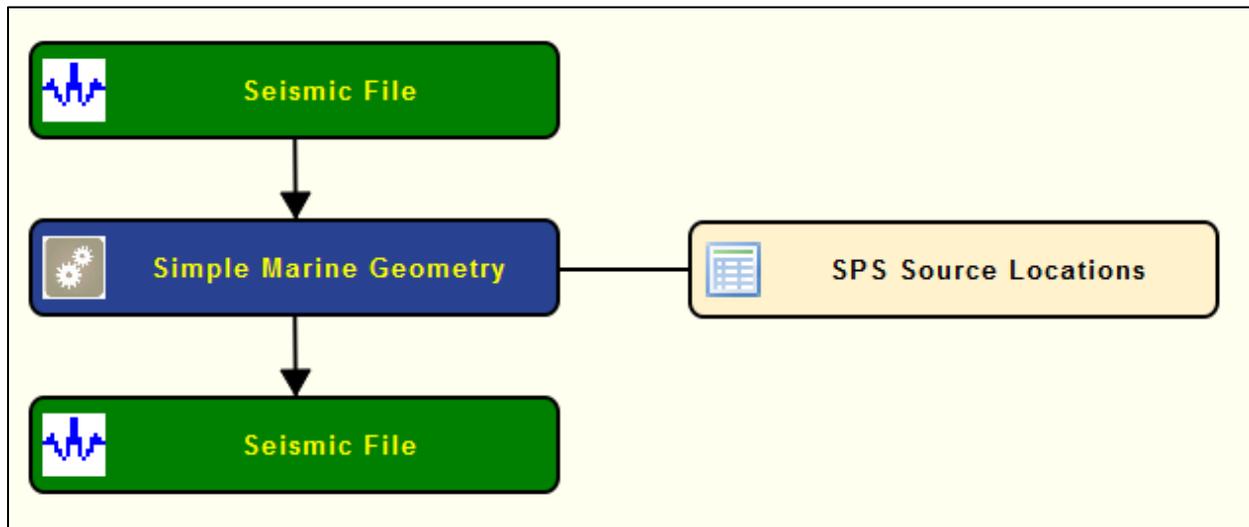
Output Links:

- 1) Seismic data in any sort order (mandatory).

References:

-

Example Flowchart:



Step Parameter Dialog:

Simple Marine Geometry

Source locations

Source location equals field file number
 Use trace header source location number, northing, easting
 Manually define source location numbers
 Use SPS formatted observers (XPS) file

Source line number

Source location number of first field file

Source location increment

Distance between shots (ft or m)

Source-to-near-channel offset (ft or m)

Lateral source offset (perpendicular)

Group interval (ft or m)

Channel number of near offset group

Channel number increment

Number of channels

Receiver location increment

Use SPS formatted source locations file

OK Help Cancel

Parameter Description:

Source locations: Specify location of sources.

Source location equals field file number — If selected, source locations are set equal to field file number from seismic trace headers.

Use trace header source location number, northing, easting — If selected, source locations are set equal to source location (number, northing and easting) from the trace headers.

Manually define source location numbers — If selected, source locations are defined manually from the parameters below.

Use SPS formatted observers (XPS) file — If selected, source locations are set as defined in the auxiliary observers (XPS) card data file.

Source line number — Enter the source location line number.

Source location number of first field file — Enter the location of the source for first field file number.

Source location increment — Enter the source location increment. This value must be an integer value.

Distance between shot (ft or m) — Enter the distance between shots in ft or m, depending on the units defined for the project.

Source-to-near-channel offset (ft or m) — Enter the near offset, distance between source and the near channel. Distance defined in ft or m, depending on the units defined for the project.

Lateral source offset (perpendicular) — Enter the offset distance in the direction perpendicular to the streamer.

Group interval (ft or m) — Enter the distance between each group. Distance defined in ft or m, depending on the units defined for the project.

Channel number of near offset group — Enter the number of the near offset group.

Channel number increment — Enter the increment between channels.

Number of channels — Enter total number of channels in the streamer.

Receiver location increment — Enter the increment between receiver locations.

Use SPS formatted source locations file — If checked, source locations are extracted from an auxiliary source SPS card data file.

UKOOA P1/90 Geometry

Usage:

The *UKOOA P1/90 Geometry* step assigns survey information to the trace headers based on a geometry file as defined in an auxiliary UKOOA P1/90 card data file.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) UKOOA P1 90 card data file (mandatory).

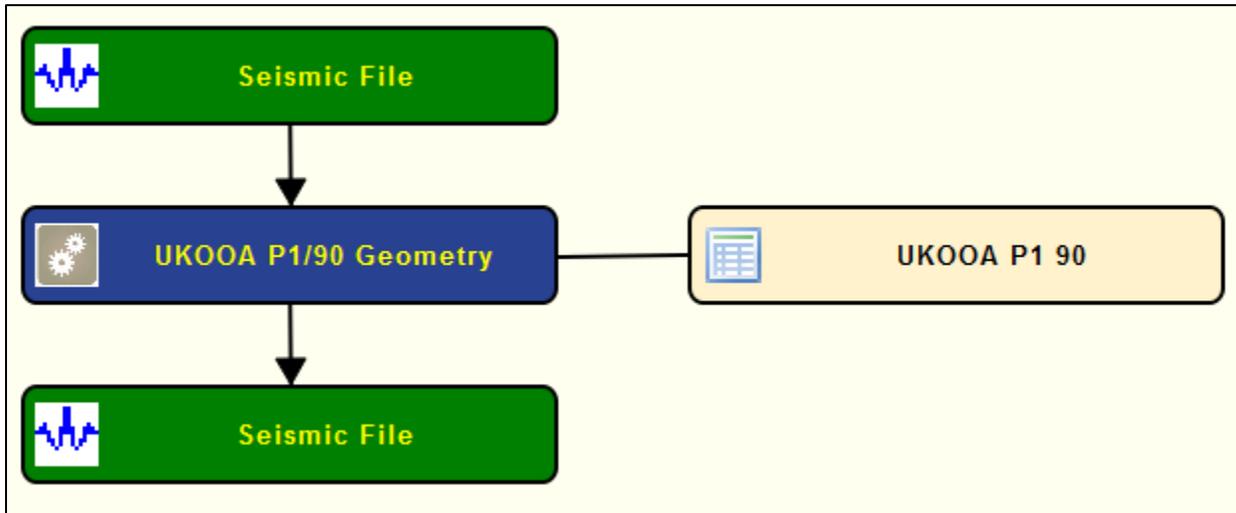
Output Links:

1) Seismic data in any sort order (mandatory).

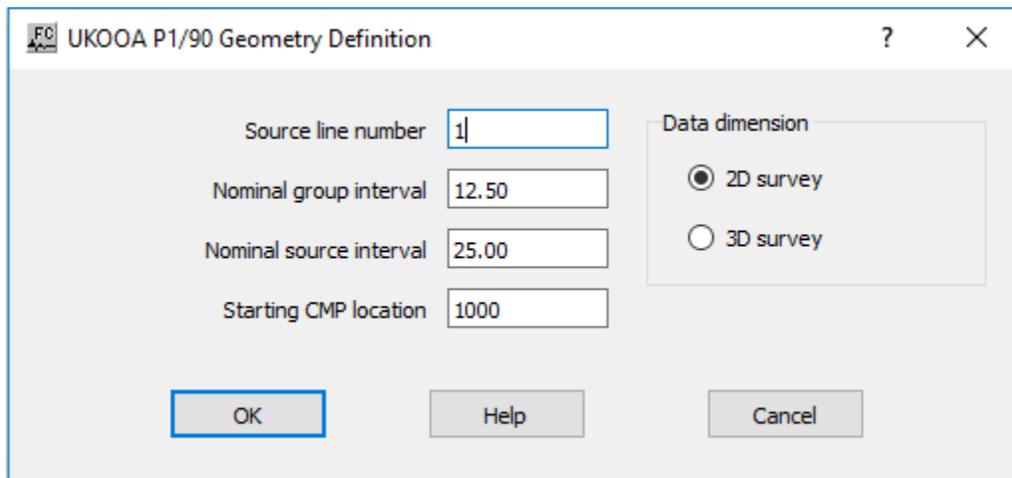
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Source line number — Enter the source/sail line number corresponding to the selected P1/90 coordinate file.

Nominal channel interval — Enter the spacing between channels on the cable.

Nominal source interval — Enter the spacing between sources.

Starting CMP location — Enter the initial CMP location.

Data dimension: Specify data dimensions.

2D survey — If selected, input seismic file is a 2D survey.

3D survey — If selected, input seismic file is a 3D survey.

Update Marine Streamer

Usage:

The *Update Marine Streamer* step allows the update of the streamer configuration of an existing geometry already defined on the input seismic data.

Input Links:

1) Seismic data in any sort order (mandatory).

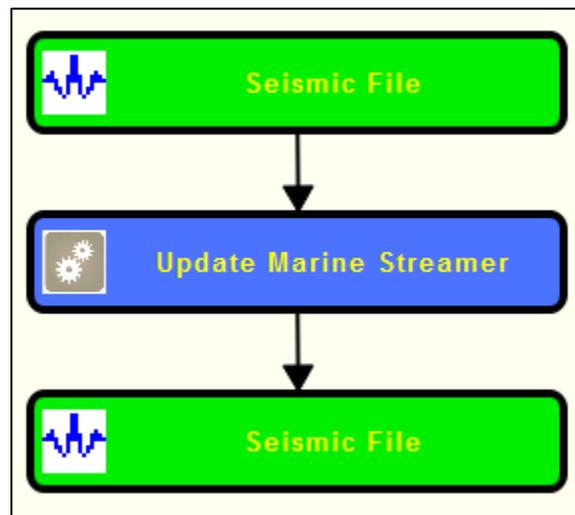
Output Links:

1) Seismic data in any sort order (mandatory).

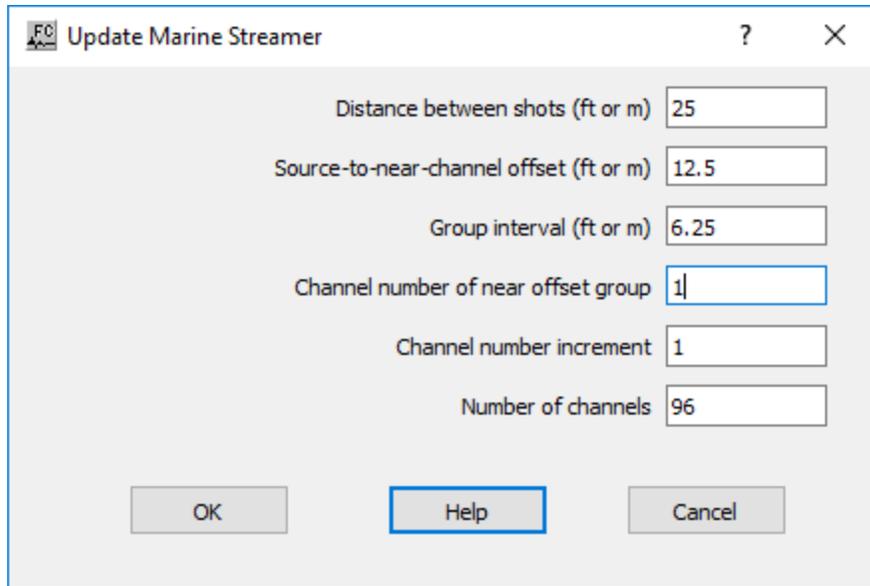
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Distance between shots (ft or m) — Enter the distance between shots. Distance defined in ft or m, depending on the units defined for the project.

Source-to-near channel offset (ft or m) — Enter the distance between source and the near channel. Distance defined in ft or m, depending on the units defined for the project.

Group interval (ft or m) — Enter the distance between groups. Distance defined in ft or m, depending on the units defined for the project.

Channel number of near offset group — Enter the number of the channel for the near offset group.

Channel number increment — Enter the increment between the channel number.

Number of channels — Enter the total number of channels.

Update Receiver Positions

Usage:

The *Update Receiver Positions* step allows updating the position of the receivers, as defined in the auxiliary *SPS Receiver Locations* card data file, of the input seismic data file.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Auxiliary SPS Receiver Locations card data file (mandatory).

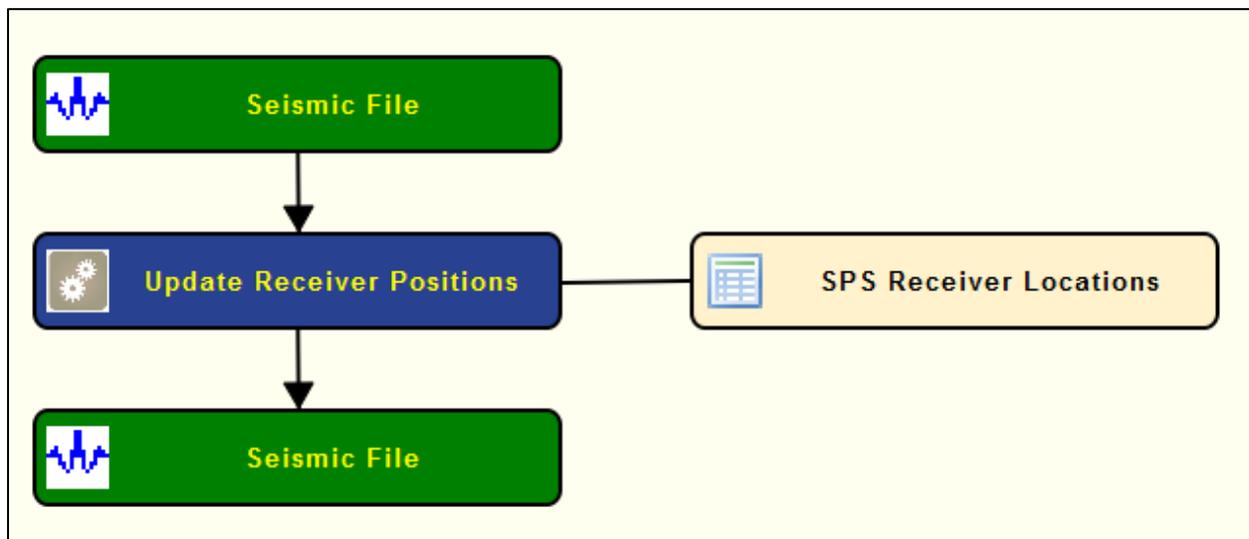
Output Links:

- 1) Seismic data in any sort order (mandatory).

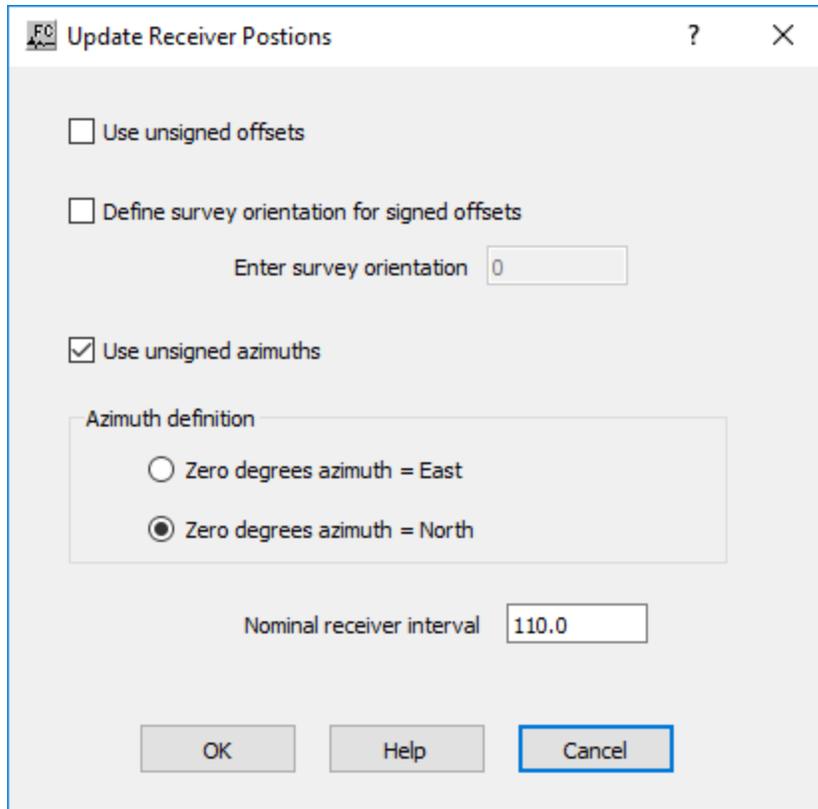
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Use unsigned offsets — If checked, the offset values written to the seismic header will be unsigned.

Define survey orientation for signed offsets — If checked, the sign on offset values will be adjusted for the orientation of the dominant receiver line azimuth, such that offset up-the-spread will be positive, and offsets down-the-spread will be negative.

Enter survey orientation (degrees) — Enter the value of the survey orientation in degrees.

Use unsigned azimuths — If checked, the azimuth values written to the seismic header will range from 0 to 360 degrees, with zero degrees of azimuth equal to the user-specified direction. By default, azimuth values are signed and range from 0 to +/-180 degrees, with zero degrees of azimuth equal to the user-specified direction.

Azimuth definition: Specify the origin of azimuth.

Zero degrees azimuth = East — If selected, then zero degrees of source-receiver azimuth will be set equal to due East.

Zero degrees azimuth = North — If selected, then zero degrees of source-receiver azimuth will be set equal to due North.

Nominal receiver interval — Enter the nominal interval between receiver stations in distance units.

Update Source Positions

Usage:

The *Update Source Positions* step allows updating the position of the sources, as defined in the auxiliary *SPS Source Locations* card data file, of the input seismic data file.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Auxiliary SPS Source Locations card data file (mandatory).

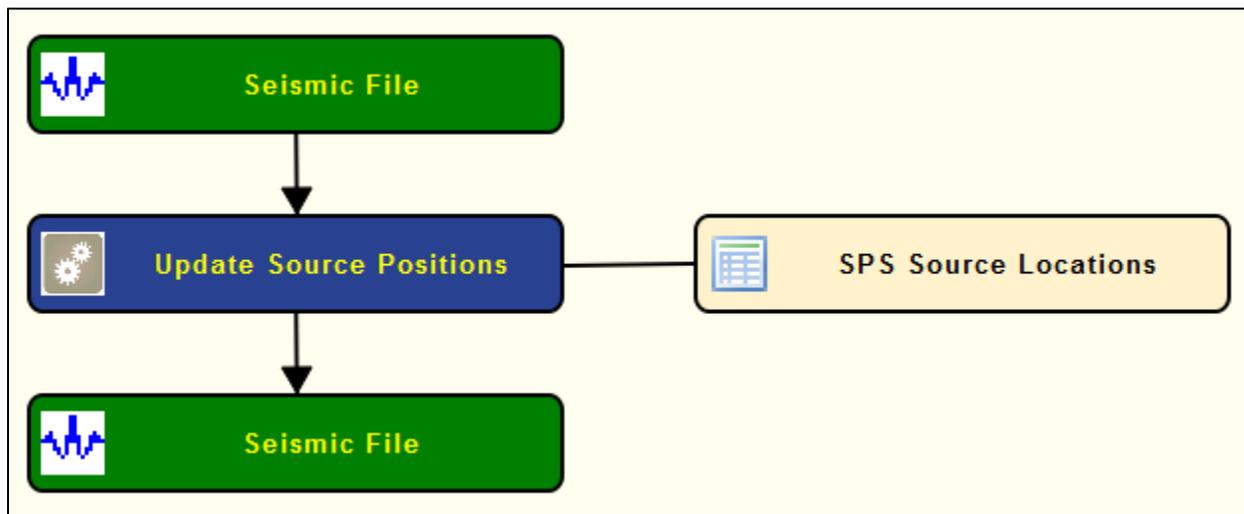
Output Links:

- 1) Seismic data in any sort order (mandatory).

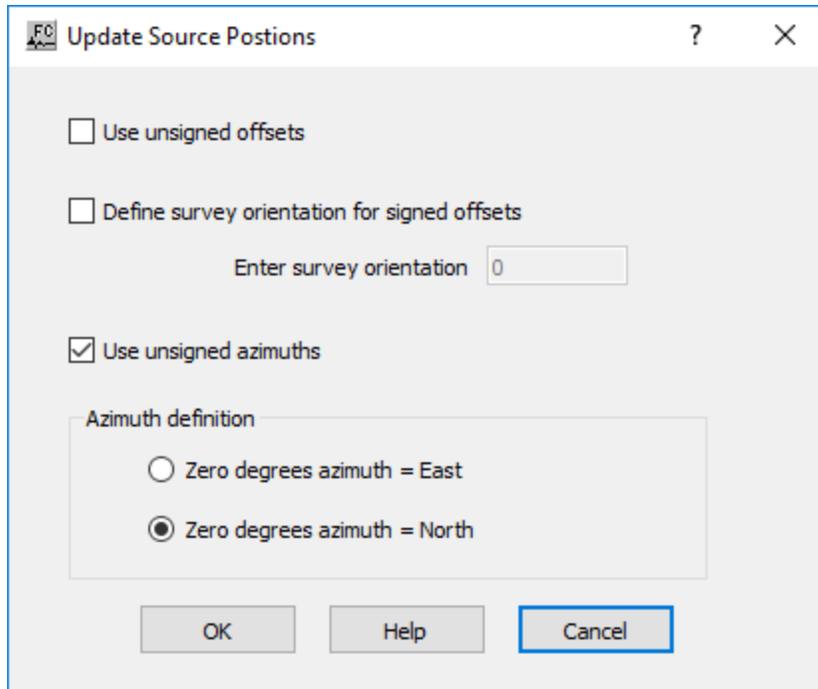
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Use unsigned offsets — If checked, the offset values written to the seismic header will be unsigned.

Define survey orientation for signed offsets — If checked, the sign on offset values will be adjusted for the orientation of the dominant receiver line azimuth, such that offset up-the-spread will be positive, and offsets down-the-spread will be negative.

Enter survey orientation (degrees) — Enter the value of the survey orientation in degrees.

Use unsigned azimuths — If checked, the azimuth values written to the seismic header will range from 0 to 360 degrees, with zero degrees of azimuth equal to the user-specified direction. By default, azimuth values are signed and range from 0 to +/-180 degrees, with zero degrees of azimuth equal to the user-specified direction.

Azimuth definition: Specify the origin of azimuth.

Zero degrees azimuth = East — If selected, then zero degrees of source-receiver azimuth will be set equal to due East.

Zero degrees azimuth = North — If selected, then zero degrees of source-receiver azimuth will be set equal to due North.

Migration Steps

This section documents the processing steps available in the Migration category.

The types of migration currently available are:

Migration
↑ Processing Categories
2D Paraxial Ray Tracing
2D Pre-Stack PSPI Migration
3D Finite Differences Ray Tracing
Constant Velocity PSKTM
Convert Time to Depth
FK Dip Moveout
PSPI Migration
Phase Shift Migration
Post-Stack Kirchhoff Time Migration
Pre-Stack Kirchhoff Depth Migration
Pre-Stack Kirchhoff Time Migration
Stolt (FK) Migration

2D Paraxial Ray Tracing

Usage:

The **2D Paraxial Ray Tracing** step is an asymptotic wave method, which uses quantities (local wavefront curvature and spreading information) determined along a central ray via dynamic ray tracing, to evaluate approximately the seismic wave field in its vicinity rather than just on the ray itself (Cerveny et al. 1984). This implementation is designed to run in single thread or in parallel, giving it the possibility to take full advantage of multiple processors at the same time.

Input Links:

-

Auxiliary dataset:

- 1) Interval Velocity-Field file, created using the step *Create Velocity Field* under the velocity category (mandatory).
- 2) Pre-stack dataset, used to get source and receivers geometry (mandatory).

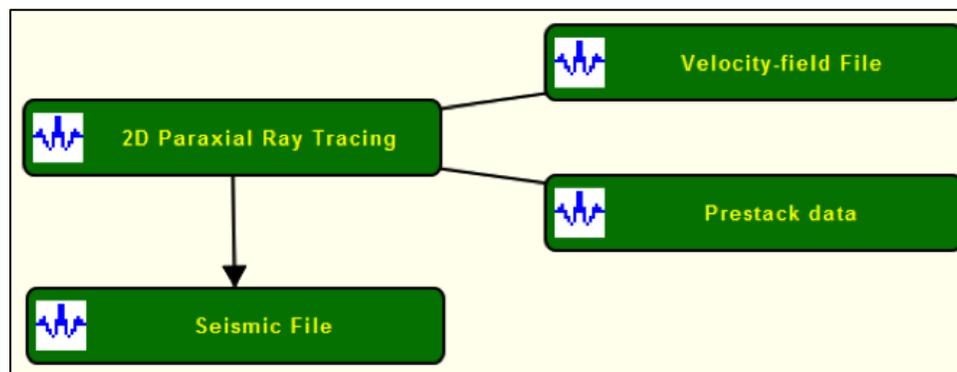
Output Links:

- 1) Seismic file where the computed source or receiver travel-time tables will be saved (mandatory).

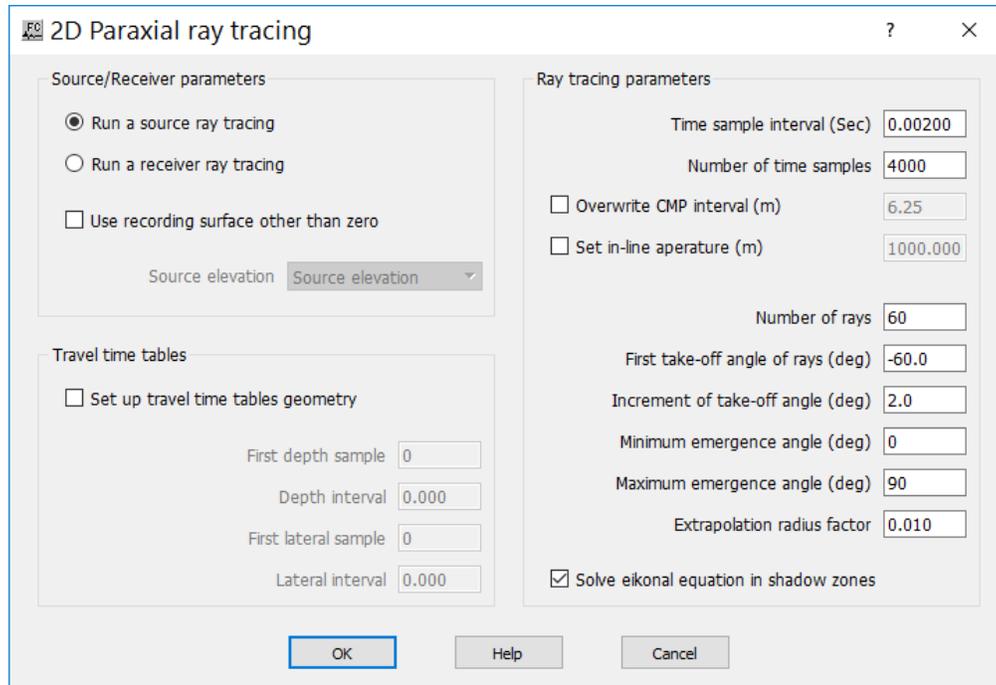
References:

Cerveny V, Klimes L, Psencik I (1984) Paraxial ray approximations in the computation of seismic wavefields in inhomogeneous media. *Geophys J R Astron Soc* 89–104.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Source/Receiver parameters: Specify source or receiver parameters.

Run a source ray tracing — If selected, shoot rays at source locations.

Run a receiver ray tracing — If selected shoot rays at receiver locations.

Use Recording surface other than zero — If checked, specify the header word containing the source elevation information.

Source elevation — Select the trace header word containing the elevation information.

Travel-time tables: Specify the geometry related with the travel time table used for the 2D paraxial ray tracing.

Set up travel-time tables geometry — If checked, defines the travel-time tables geometry. If not checked, the geometry of the input velocity file information is used as reference.

First depth sample — Enter the first depth sample in the travel-time table.

Depth interval — Enter the depth interval in the travel-time table.

First lateral sample — Enter the first lateral sample in the travel-time table.

Lateral interval — Enter the lateral interval in the travel-time table.

Ray tracing parameters: Specify the ray tracing parameters.

Time sample interval — Enter the time sample interval in ray tracing.

Number of time samples — Enter the number of time samples in ray tracing.

Number of rays — Enter the number of rays.

Set in-line aperture — Define the setting for the in-line aperture. If not checked, the maximum aperture is used, which require more compute time.

In-line aperture — Enter the ray tracing aperture for the in-line direction.

First take-off angle of rays (deg.) — Enter the first take-off angle of the rays in degrees.

Increment of take-off angle — Enter the increment of the take-off angle.

Minimum emergence angle — Enter the minimum emergence angle.

Maximum emergence angle — Enter the maximum emergence angle.

Extrapolation radius factor — Enter the factor to determine the radius for extrapolation.

Solve eikonal equation in shadow zones — If checked implements the eikonal equation in the shadow zones.

2D Pre-Stack PSPI Migration

Usage:

The *2D Pre-Stack PSPI Migration* step is only available for 2D seismic data and is a 2D ‘Phase Shift Plus Interpolation’ seismic data migration. The input data must be in the form of frequency slices of CMP v Offset. Convert the CMP and offset-sorted data to frequency slices by the use of *Frequency Slices* step in a prior job flow.

The output data will be in standard trace order and not requiring further transformation.

Input Links:

1) Frequency slices ordered by **Slice Number** and **CMP** (mandatory).

Output Links:

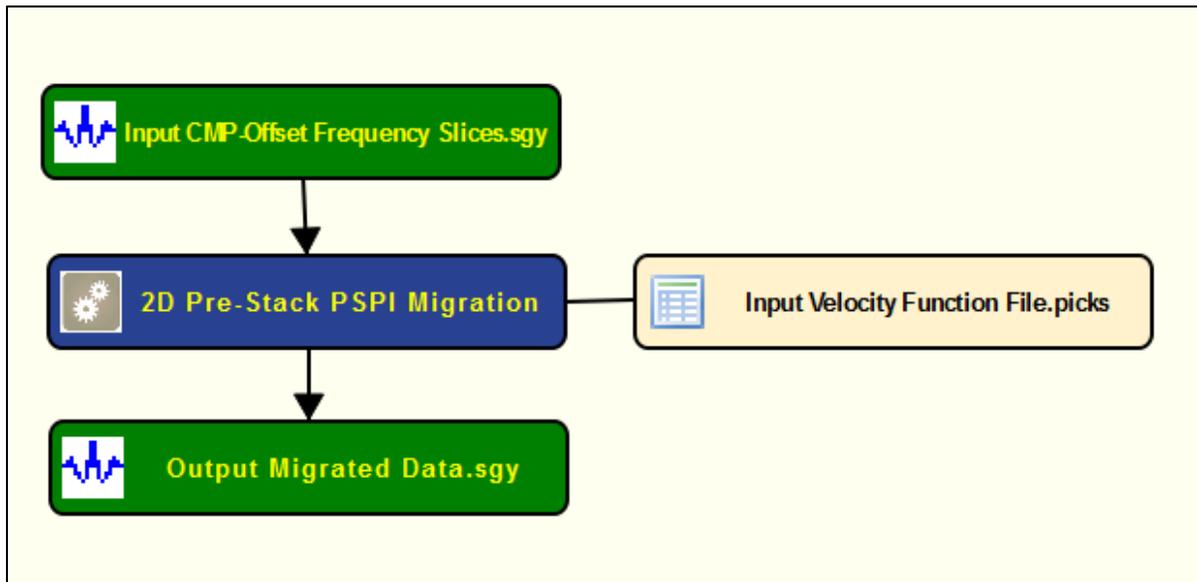
1) Time traces sorted by **CMP and Offset** (mandatory).

Reference:

Gasdag, J, and Sguazzero P., 1984, Migration of seismic data by phase shift plus interpolation, Geophysics, vol. 49, no. 2, p. 124-131.

Popovici, A.M., 1996, Pre-stack migration by split-step DSR, Geophysics, vol. 61, no. 5, p. 1412-1416..

Example Flowchart:



Step Parameter Dialog:

Migration mode: Specify migration domain and output format.

Time Migration — If checked, time migration will be performed.

Output maximum time(ms) — Enter the maximum time of the output migrated data in milliseconds. The time sampling will be the same as that of the input data.

Depth Migration — If checked, depth migration will be performed.

Output maximum depth(ft/m) — Enter the maximum depth of the output migrated data.

Output depth sampling (ft/m) — Enter the depth sampling interval of the output migrated data.

Migration velocity field: Specify parameters related with the velocity field used for migration.

Use velocity field from data file — If checked, then the file name of an auxiliary input file must be specified which contains the velocity field picks.

Use constant migration velocity — If checked, then the migration velocity to be used should be specified in the adjacent box.

Scale input velocities by — The migration velocities may be scaled by a constant factor if required.

Velocity sampling: Specify velocity sampling parameters.

Use CMP velocity — If selected, then velocity will be CMP dependent only. This is the normal assumption when performing time migration.

[**Use velocity from CMP and offset** — If selected, then velocity field will be expected to be dependent both on CMP and on offset. This is likely to be the case when performing depth migration. **This option is not currently available.**]

Migration step size: Specify migration step size.

Number of output samples — Enter the number of output migration slices to be output with each iteration of the migration. Every migration iteration takes a roughly constant execution time, so the total execution time can be significantly reduced if several output slices are calculated at once. There may be a degradation in the migration of dipping data if this parameter is set too high. Consequently, this parameter is data-dependent and may require testing.

Frequency filtering: Specify filtering parameters. The output migrated data will be Hanning (cosine) tapered.

Low cut Frequency (Hz.) — Enter the low cut frequency of the output migrated data.

Low pass Frequency (Hz.) — Enter the low pass frequency of the output migrated data.

High pass Frequency (Hz.) — Enter the high pass frequency of the output migrated data.

High cut Frequency (Hz.) — Enter the high cut frequency of the output migrated data.

Alias energy removal: Specify alias energy removal.

Evanescient damping factor — Enter the amount of suppression of energy which is not a real solution of the acoustic wave equation, as a value between zero and one. A value of 0.5 is recommended.

Spatial padding width (traces) — Enter how many additional traces are to be added (in both CMP line and location directions in the case of 3D migration). These extra traces plus spatial tapering help to minimize interference of migrated energy from one end of the data into migrated data on the other side.

Override trace spacing: Specify if the original trace spacing is override by a user defined distance. If the trace spacing cannot be read from or is incorrect in the trace headers, then it may be specified in the following parameter fields:

Specify the CMP spacing— If checked, then the user must enter the distance between CMP locations in the adjacent field.

3D Finite Differences Ray Tracing

Usage:

The *3D Finite Differences Ray Tracing* step is a wavefront tracing technique, and a robust alternative to conventional ray tracing. This method relies on the application of Huygens' Principle in the finite difference approximation. That is, every point reached by a wave becomes a secondary source; the sum of these secondary waves determines the form of the wave at any subsequent time. This method accurately computes travel-time information even with step velocity contrast as high as 1:10 regardless of the sharpness of the velocity anomaly. This implementation is designed to run in single thread or in parallel, giving it the possibility to take full advantage of multiple processors at the same time.

Input Links:

-

Auxiliary dataset:

- 1) 3D Interval Velocity-Field file, created using the step *Create Velocity Field* under the velocity category (mandatory).
- 2) Pre-stack dataset, used to get source and receivers geometry (mandatory).

Output Links:

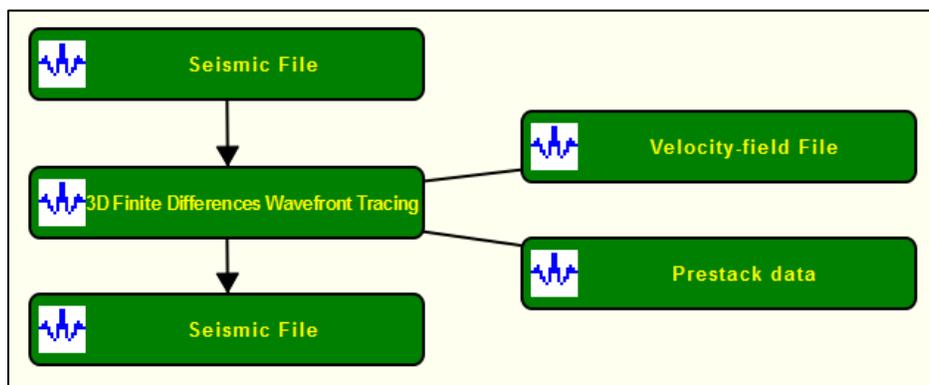
- 1) Seismic file where the computed source or receiver travel-time cubes will be saved (mandatory).

References:

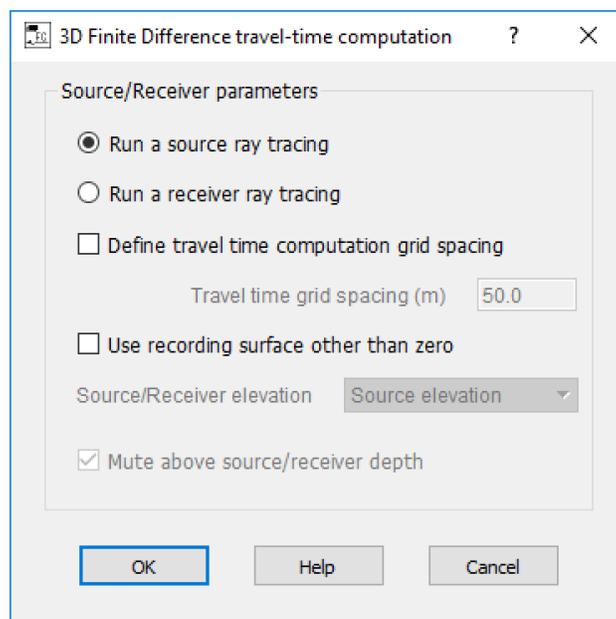
Podvin P, L. I (1991) Finite difference computation of traveltimes in very contrasted velocity models: a massively parallel approach and its associated. *Geophys J Int* 105:271–284.

Huygens wavefront tracing: A robust alternative to conventional ray tracing. *SEP Report*, 95, 101-113 (1997)

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Source/Receiver parameters: Specify source or receiver parameters.

Run a source ray tracing — If selected, shoot rays at source locations.

Run a receiver ray tracing — If selected, shoot rays at receiver locations.

Define the travel time computation grid (m) — If checked, specify the grid spacing on which the computation is carried; the output grid is exactly the same as the velocity grid.

Travel time grid spacing (m) — Enter the travel time grid spacing.

Use Recording surface other than zero — If checked, specify the header word containing the source elevation information.

Source/Receiver elevation — Select header word with source elevation information.

Mute above the source/receiver depth — This option is only enabled if the recording surface is other than zero.

Constant Velocity PSKTM

Usage:

The *Constant Velocity PSKTM* step is a migration velocity analysis tool; it runs multiple Pre-Stack Kirchhoff Migrations around the velocity model given as input to pick the velocity that migrate best the data. This implementation is designed to run in single thread or in parallel, giving it the possibility to take full advantage of multiple processors at the same time.

Input Links:

- 1) Pre-Stack seismic dataset with geometry applied to it and preferably some pre-processing as well (mandatory).

Auxiliary dataset:

- 1) Velocity model/function (mandatory).

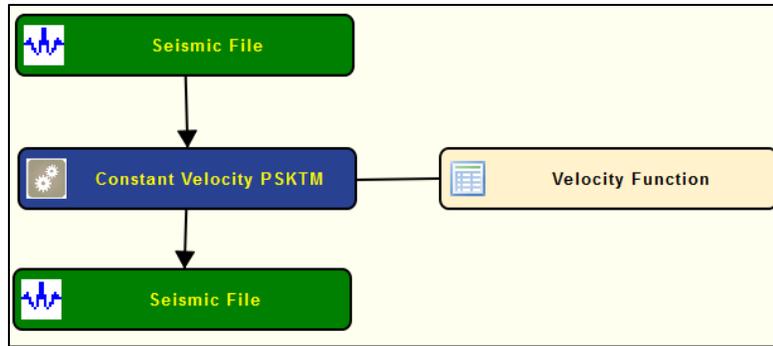
Output Links:

- 1) Seismic file where the Constant Velocity PSKTM will be saved (mandatory).

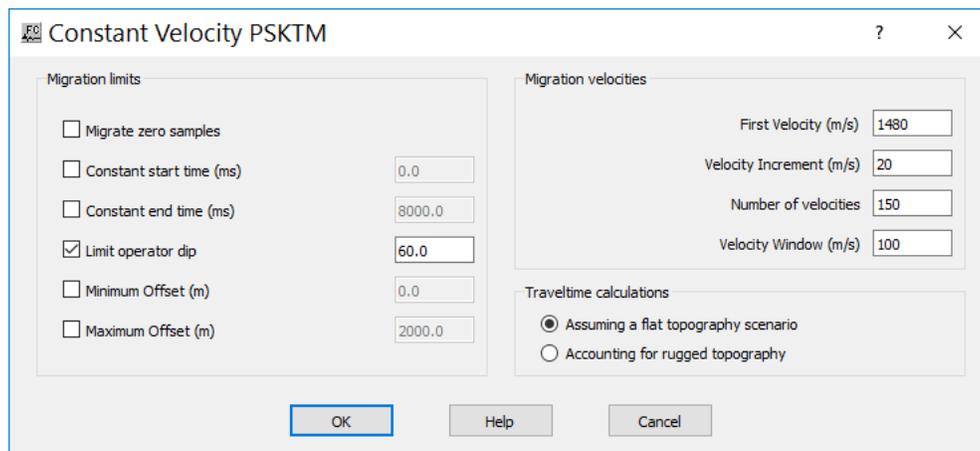
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Migration limits: Specify the migration limits for the constant velocity migrations.

Migrate zero samples — If checked, samples with amplitudes value zero will be migrated as well.

Constant Start time (ms) — If checked, defines a constant migration start time.

Constant end time (ms) — If checked, defines a constant migration end time.

Limit operator dip — If checked, limits the dip angle of the migration operator.

Minimum offset (m) — If checked, defines a minimum offset for the migration operator.

Maximum offset (m) — If checked defines a maximum offset for the migration operator.

Migration velocities: Specify the parameters related with the velocities.

First Velocity (m/s) — Enter the first velocity to be considered for migration.

Velocity Increment (m/s) — Enter the velocity increment.

Number of Velocities — Enter the number of velocities to be tested.

Number of Velocities — Enter the number of velocities to be tested.

Velocity window (m/s) — Enter a window around the input velocity model.

Traveltime calculations: Specify parameters for traveltime calculations.

Assuming a flat topography scenario — If selected, assume a flat recording surface when computing travel-time information.

Accounting for rugged topography — If selected, assume a rugged recording surface when computing travel-time information.

Convert Time to Depth

Usage:

The *Convert Time to Depth* step does a vertical time to depth conversion of a seismic file using an input set of interval velocities. The input velocities are assumed to be in units of feet or meters per second. If the input file to be depth converted is a GPR image, and the input velocity file is in units of feet or meters per nanosecond, you must first multiply the velocity values by 1×10^{-9} .

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Velocity Function cards (optional).

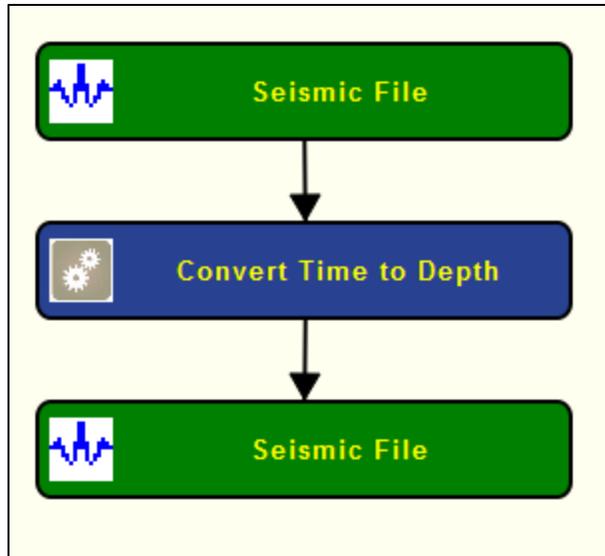
Output Links:

- 1) Seismic data in any sort order (mandatory).

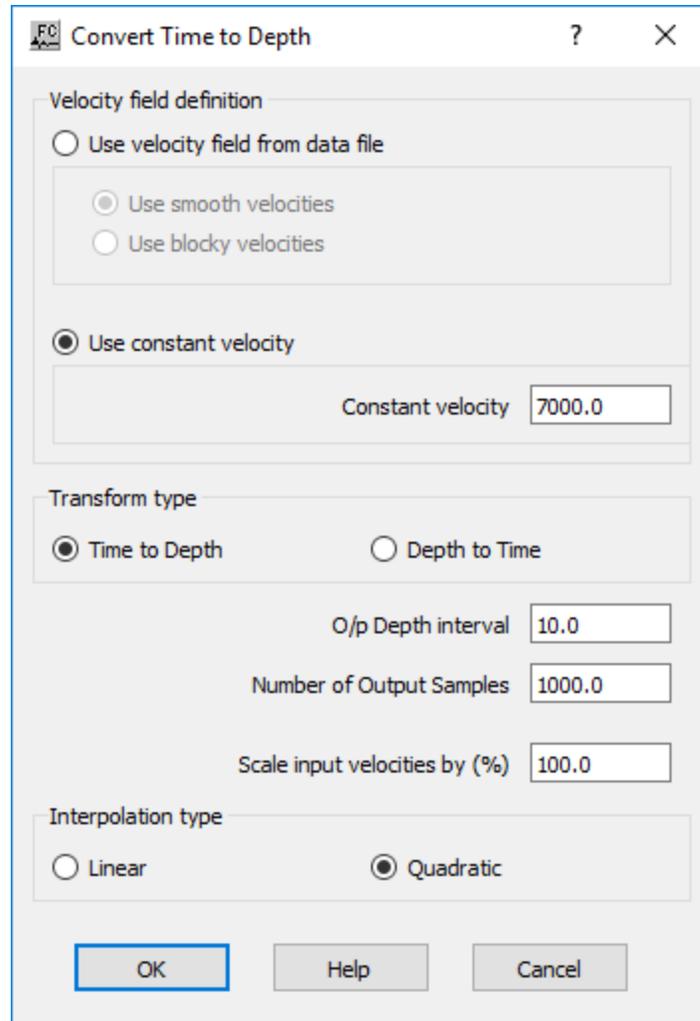
References:

See Technical Note TN-DpthConv.doc

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Velocity field estimation: Specify velocity field.

Use velocity field from data file — If selected, the velocity field used for the time to depth conversion is from an auxiliary velocity field card data.

Use smooth velocities — If selected, input velocities are smoothed horizontally and vertically.

Use blocky velocities — If selected, input velocities are converted into interval velocities.

Correction velocity — Enter the correction velocity (ft/sec or m/sec) to be used in the conversion. This constant velocity will be used unless a velocity function is connected to the step. In the case of GPR data, convert this value to the appropriate units.

Output depth interval — Enter the depth interval in your spatial units. To obtain an estimate of the output depth interval, first employ the formula $X = VT$, where X = estimated depth of section, V = average velocity of section, and T = one-way time of the section (i.e. record length divided by two). Second, employ the formula output depth interval = $\Delta X = X/(\text{number of samples} - 1)$.

Number of output samples — Enter the number of samples to output.

Interpolation Type Selection — Select the type of interpolator to use. This interpolator is used to resample the data to the specified depth interval.

Do inverse correction — If checked, a depth to time conversion will be performed.

FK Dip Moveout

Usage:

Input Links:

Output Links:

Reference:

-

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

PSPI Migration

Usage:

The *PSPI Migration* step is a post-stack ‘Phase Shift Plus Interpolation’ seismic data migration. Input data may be 2D or 3D, and both time migration and depth migration are options.

The input data must be in the form of frequency slices – data can be converted to frequency slices by the use of *Frequency Slices* in a prior job flow.

The output data will be in the form of time slices – convert the time slices back to standard trace order in a subsequent job flow after the migration with the use of *Time Slices to Traces*.

Input Links:

1) Frequency slices ordered by **Slice Number** and **CMP Line** (3D) or by **Slice Number** (2D) (mandatory).

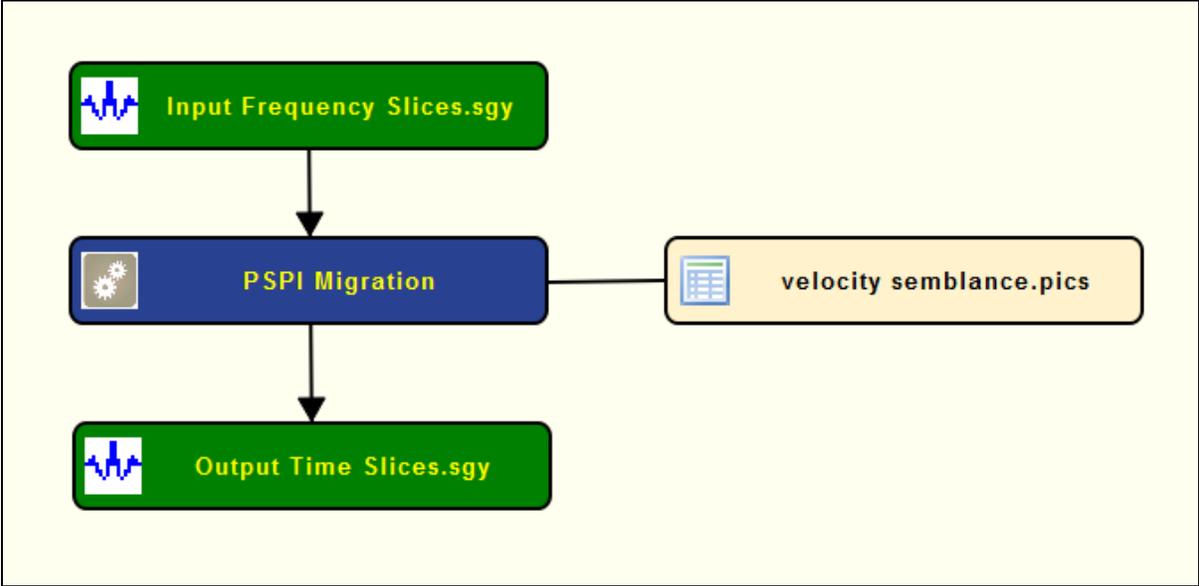
Output Links:

1) Time slices (or depth slices) ordered by **Slice Number** and **CMP Line** (3D) or by **Slice Number** (2D) (mandatory).

Reference:

Gasdag, J, and Sguazzero P., 1984, Migration of seismic data by phase shift plus interpolation, Geophysics, vol. 49, no. 2, p. 124-131.

Example Flowchart:



Step Parameter Dialog:

Time Migration — If checked, time migration will be performed.

Output maximum time(ms) — Enter the maximum time of the output migrated data in milliseconds. The time sampling will be the same as that of the input data.

Depth Migration — If checked, depth migration will be performed.

Output maximum depth(ft/m) — Enter the maximum depth of the output migrated data.

Output depth sampling (ft/m) — Enter the depth sampling interval of the output migrated data.

Migration velocity field: Specify the type of velocity field to be applied during the migration.

Use velocity field from data file — If checked, then the file name of an auxiliary input file must be specified which contains the velocity field picks.

Use constant migration velocity — If checked, then the migration velocity to be used should be specified in the adjacent box.

Scale input velocities by — The migration velocities may be scaled by a constant factor if required.

Output velocity field only— If checked, then only the interpolated and fully sampled migration velocity will be output. This flag is for test purposes only.

Migration step size: Specify the step size for the migration.

Number of output samples — Enter the number of output migration slices to be output with each iteration of the migration. Every migration iteration takes a roughly constant execution time, so the total execution time can be significantly reduced if several output slices are calculated at once. There may be a degradation in the migration of dipping data if this parameter is set too high. Consequently, this parameter is data-dependent and may require testing.

Frequency filtering: Specify and parameterizer the frequency filter to be applied to the migrated data. The output migrated data will be Hanning (cosine) tapered.

Low cut Frequency (Hz.) — Enter the low cut frequency of the output migrated data.

Low pass Frequency (Hz.) — Enter the low pass frequency of the output migrated data.

High pass Frequency (Hz.) — Enter the high pass frequency of the output migrated data.

High cut Frequency (Hz.) — Enter the high cut frequency of the output migrated data.

Alias energy removal: Specify parameters related with alias energy removal.

Evanescent damping factor — Enter the amount of suppression of energy which is not a real solution of the acoustic wave equation, as a value between zero and one. A value of 0.5 is recommended.

Spatial padding width (traces) — Enter how many additional traces are to be added (in both CMP line and location directions in the case of 3D migration). These extra traces plus spatial tapering help to minimize interference of migrated energy from one end of the data into migrated data on the other side.

Override trace spacing: If the trace spacing cannot be read from or is incorrect in the trace headers, then it may be specified in the following parameter fields.

Specify the trace spacing — If checked, enter the distance between trace locations.

Specify the line spacing — If checked, enter the the distance between lines (for 3D data only).

Phase Shift Migration

Usage:

The *Phase Shift Migration* step implements a constant velocity or a depth-variable velocity post stack phase shift time migration in the frequency domain. The input velocity field is assumed to be the stacking velocity field derived from velocity analysis of the pre-stack data. **This step is currently only available for 2D data.**

Input Links:

- 1) Seismic data in stacked order (mandatory).
- 2) Velocity Function cards (optional).

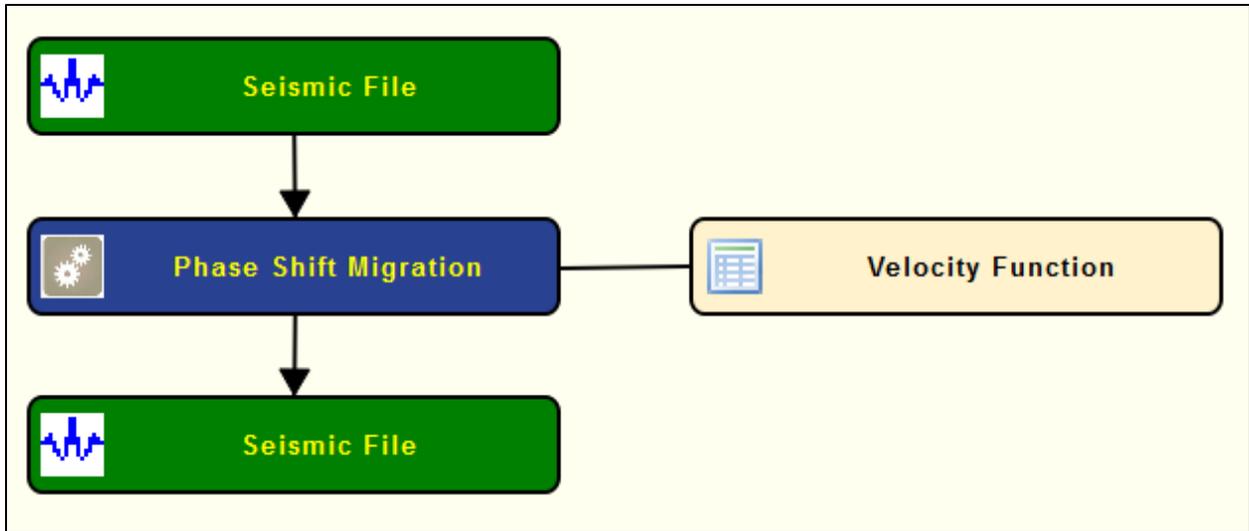
Output Links:

- 1) Seismic data in stacked order (mandatory) and sampled in time.

Reference:

Gazdag, J, 1978, Wave-equation migration by phase shift, *Geophysics*, v. 43, p. 1342-1351.

Example Flowchart:



Step Parameter Dialog:

Phase Shift Migration

Migration velocity function

Use velocity function from data file

Use average velocity function

Select velocity function

Line number

Location number

Use constant velocity

Constant migration velocity

Scale input velocities by

Length of taper (traces)

Specify trace spacing

True trace spacing (m or ft)

Remute to first non-zero stack sample

Algorithm adapted from Seismic Unix,
Copyright (c) Colorado School of Mines

OK Help Cancel

Parameter Description:

Migration velocity function: Specify type of velocity to be used for the migration.

Use velocity function from data file — If checked, velocity function is defined from an auxiliary velocity card data file.

Use average velocity function — If selected, use average of the velocity field defined in the velocity card data file.

Select velocity function — If selected, use a velocity function as defined in a specific location from the input velocity card data.

Line number — Enter line number for the location of the velocity function.

Location number — Enter location number for the location of the velocity function.

Use constant velocity — If checked, a constant velocity value will be used as the migration velocity if no velocity cards are linked.

Constant migration velocity — Enter constant velocity value to be used for migration.

Scale input velocities by — The input velocities are multiplied by this number. This scalar is used for adjusting the input velocities if they are interval velocities derived using Dix's equation rather than true interval velocities.

Length of taper (traces) — Enter the length of the taper to be used for the migration in number of traces.

Specify trace spacing — If checked, overwrite trace spacing by defined value.

True trace spacing (m or ft) — Enter trace spacing in ft or m to overwrite geometry.

Remute to first non-zero stack sample — If checked, mute for all traces individually all samples before non-zero.

Post-Stack Kirchhoff Time Migration

Usage:

The *Post-Stack Kirchhoff Time Migration* step implements a diffraction summation migration of the Kirchhoff type on a post-stack section, which is capable of handling vertically and laterally varying velocity fields. The input velocity field is assumed to be the stacking velocity field derived from velocity analysis of the pre-stack data.

Input Links:

Stacked seismic data (mandatory).

Auxiliary dataset:

Velocity Function cards (mandatory).

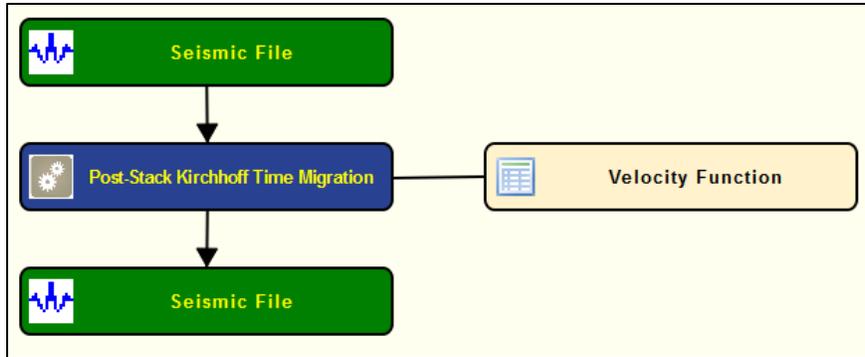
Output Links:

Seismic file where the migrated section will be saved (mandatory).

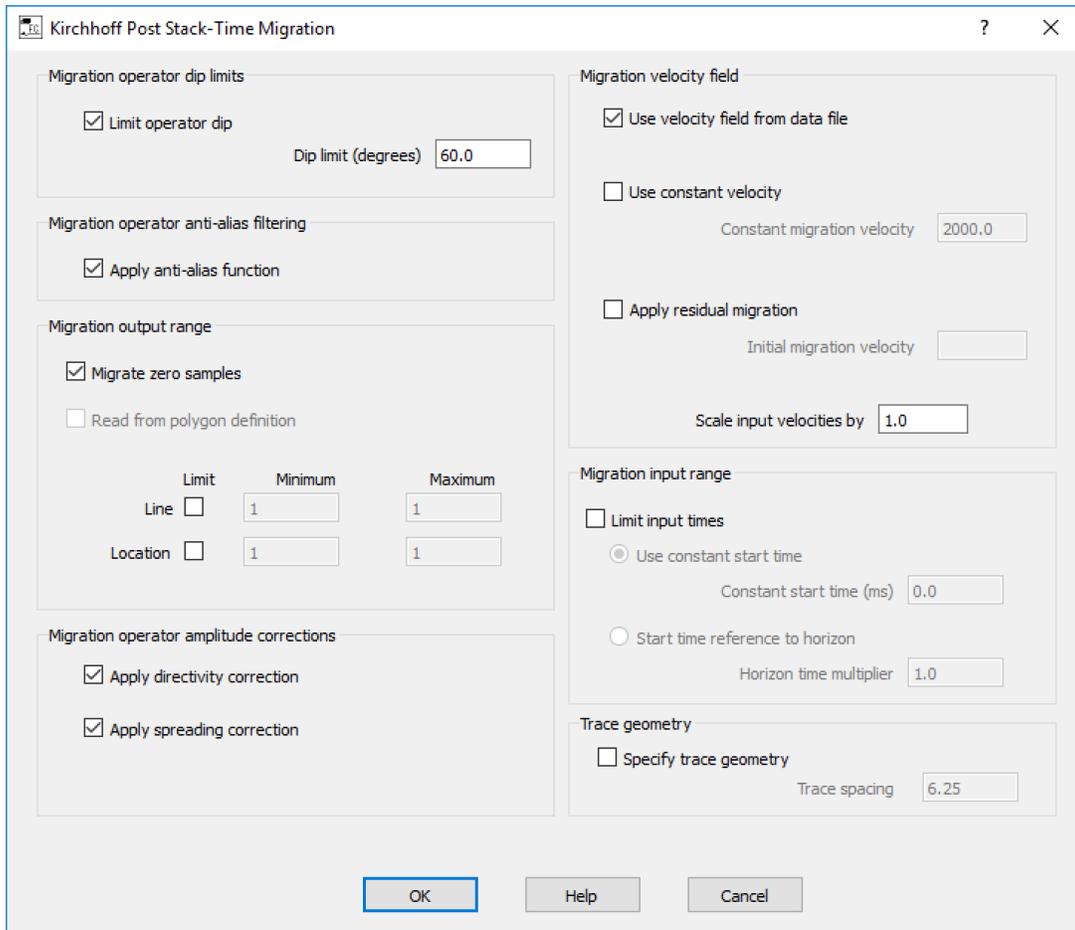
Reference:

Schneider, W. A., 1976, Integral formulation for migration in two and three dimensions, Geophysics, 43, p. 49-76.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Migration operator dip limits: Specify if any dip limit will be used for the migration.

Limit Operator Dip — If checked, limits the dip angle to be migrated.

Dip limit (degrees) — Enter the dip angle of the migration operator.

Migration operator anti-alias filter: Specify operator of the anti-alias filter to be applied during the migration.

Apply anti-alias function — If checked, apply an anti-aliasing measure to the migration operator.

Migration output range: Specify output range of the migrated data.

Migrate zero samples — If checked, samples with amplitudes value zero will be migrated as well.

Line (Min/Max) — If checked, allows you to limit the range of the migrated CMP lines.

Location (Min/Max) — If checked, allows you to limit the range of the migrated CMP locations.

Migration operator amplitude correction: Specify how migrated amplitudes are handled.

Apply directivity correction — If checked, applies directivity correction to the amplitudes of the migrated data.

Apply spreading correction — If checked, applies spreading correction to the amplitudes of the migrated data.

Migration velocity field: Specify velocity model used for migration.

Use velocity field from data file — If checked, connect a velocity function to the migration step as input migration RMS velocities.

Use constant velocity — If checked, uses a constant velocity model for migration.

Constant migration velocity — Enter the constant velocity value to be used for migration.

Apply residual migration — **not yet implemented.**

Initial migration velocity — **not yet implemented.**

Scale velocity input — Enter a scaling factor for the input velocities, or else 1.

Migration input range: Specify input range of the data for the migration.

Limit input times (ms) — If checked, input data is limited by time windows.

Use constant start time — If selected, defines a constant migration start time.

Constant start time (ms) — Enter migration start time.

Start time reference to horizon — **not yet implemented.**

Horizont time multiplier — **not yet implemented.**

Trace geometry: Specify trace spacing.

Specify trace geometry — If checked, specifies trace spacing in meters.

Trace spacing — Enter trace spacing in m or ft.

Pre-Stack Kirchhoff Depth Migration

Usage:

The *Pre-Stack Kirchhoff Depth Migration* step implements a diffraction summation migration of the Kirchhoff type on a pre-stack shot gathers. As opposed to the time version, the depth implementation of the Kirchhoff migration does not compute travel time with a straight ray propagation assumption. Instead, it uses travel-time tables that were precomputed using methods like the 2D Paraxial Ray Tracing or the 3D Finite Difference wavefront tracing. This method handles more accurately vertical and lateral changes in the velocity fields and dipping reflectors. This implementation is designed to run in single thread or in parallel, giving it the possibility to take full advantage of multiple processors at the same time.

Input Links:

- 1) Pre-Stack seismic data in shot gather order (mandatory).
- 2) Source travel-time tables (mandatory).
- 3) Receiver travel-time tables (mandatory).

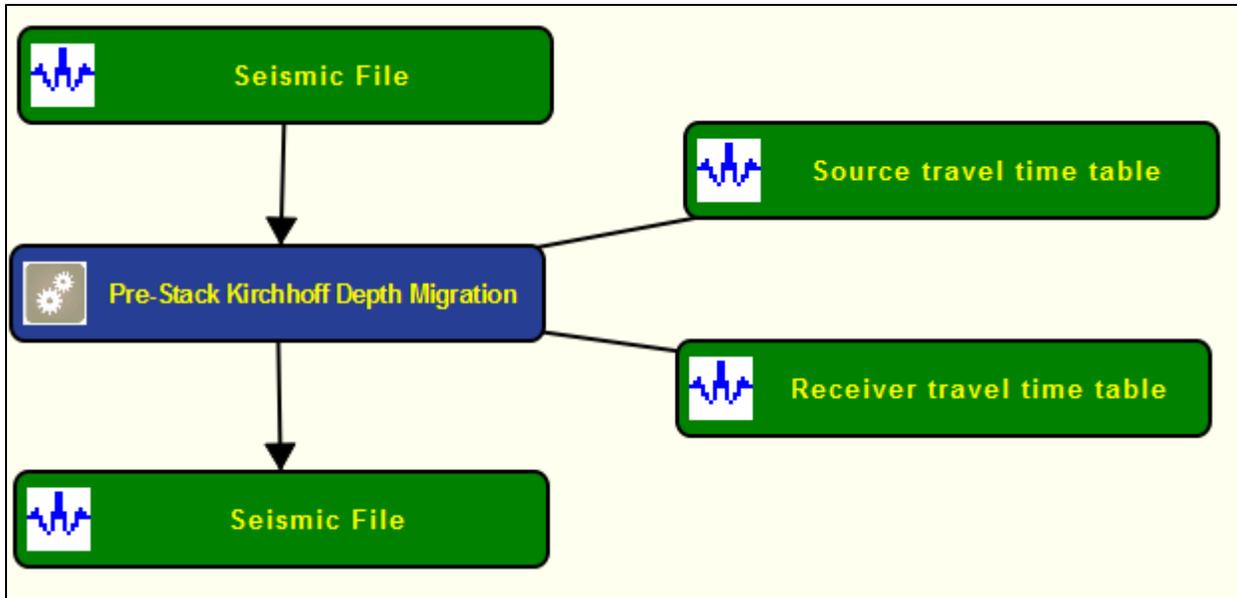
Output Links:

- 1) Seismic file where the migrated seismic data will be saved (mandatory).

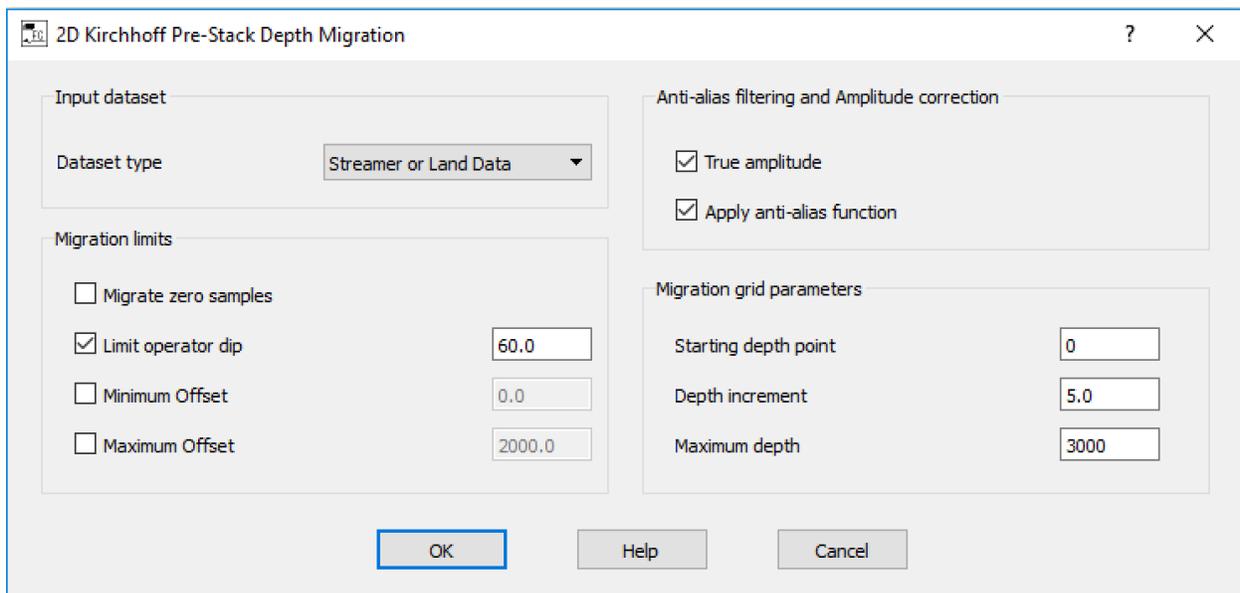
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input Dataset: Specify if the input data is from a streamer/land acquisition or OBS recording.

Migration limits: Specify spatial extent of data to be migrated.

Migrate zero samples — If checked, samples with amplitudes value zero will be migrated as well.

Limit operator dip — If checked, limits the dip angle of the migration operator. Enter dip limit in degrees.

Minimum offset (m) — If checked, enter the minimum offset for the migration operator.

Maximum offset (m) — If checked, enter the maximum offset for the migration operator.

Anti-alias filtering and Amplitude correction: Specify if an anti-alias filter is applied to the migration operator and how amplitude will be handled.

True amplitude — If checked, uses a weight function to approximate true amplitude.

Apply anti-alias filtering — If checked. applies an anti-aliasing measure to the migration operator.

Migration grid parameters: Specify migration grid parameters.

Starting depth point — Enter the first depth point to be migrated in meters.

Depth increment — Enter the depth increment of the migration in meters.

Maximum depth — Enter the last depth point to be migrated in meters.

Pre-Stack Kirchhoff Time Migration

Usage:

The *Pre-Stack Kirchhoff Time Migration* step implements a diffraction summation migration of the Kirchhoff type on a pre-stack shot gathers, which is capable of handling vertically and laterally varying velocity fields and deals with the energy smear caused by dipping reflectors. The input velocity field is assumed to be the RMS velocity derived from either the conventional velocity analysis (Semblance/CVS) or from the migration velocity analysis tool. This implementation is designed to run in single thread or in parallel, giving it the possibility to take full advantage of multiple processors at the same time.

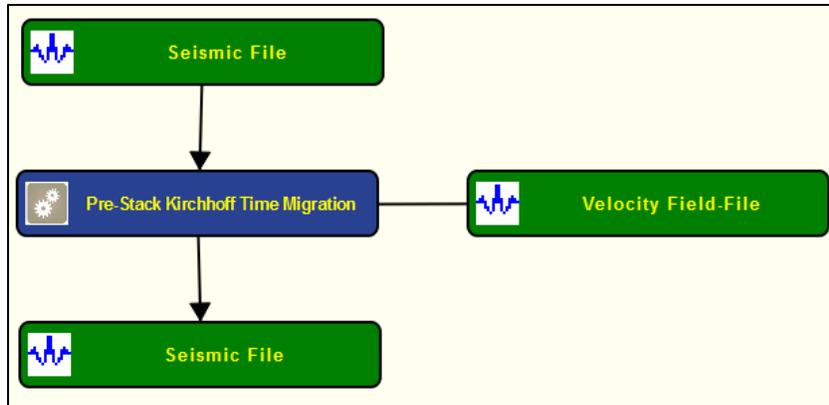
Input Links:

- 4) Pre-Stack seismic data in shot gather order (mandatory).
- 5) Velocity model or velocity function cards (mandatory).

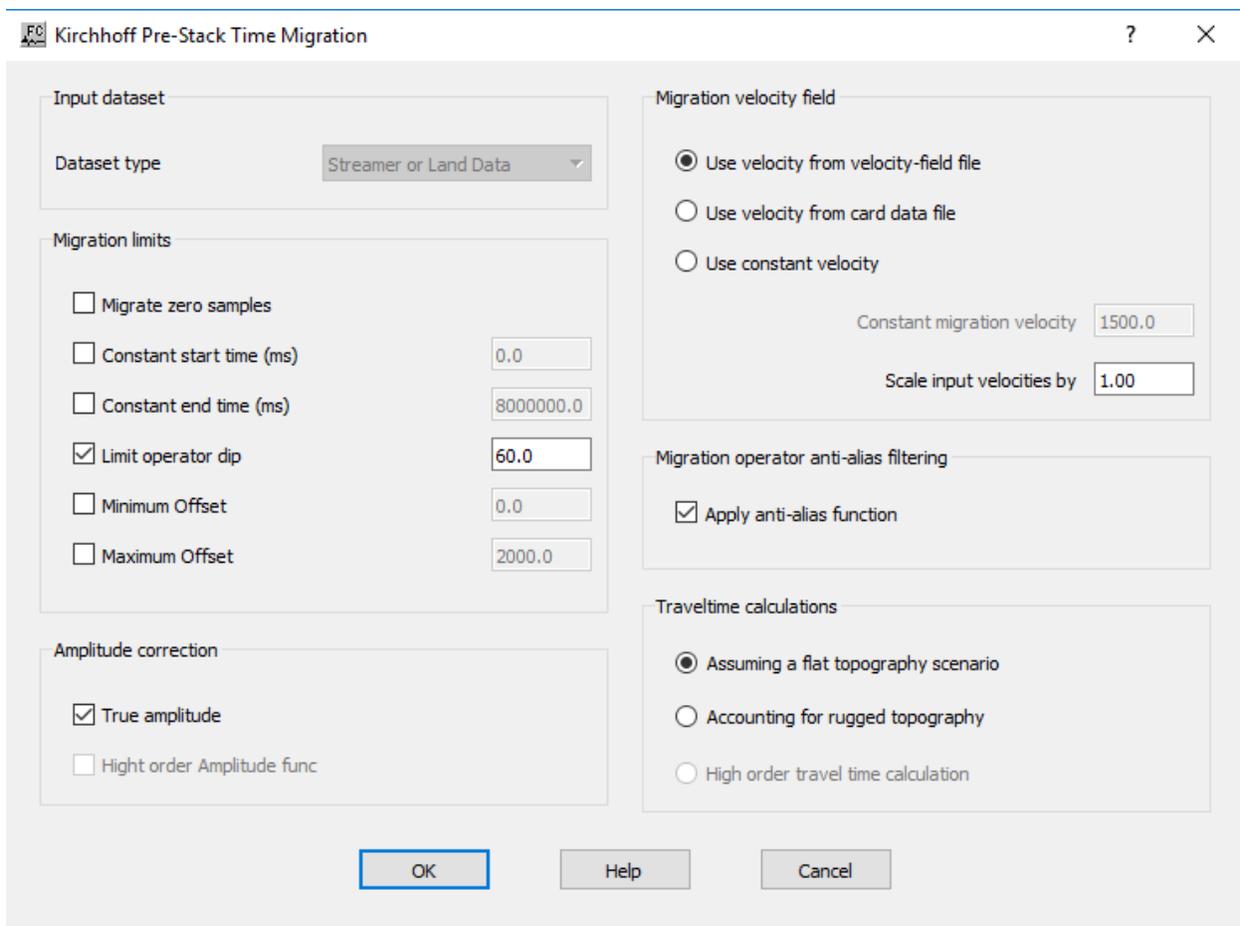
Output Links:

- 1) Seismic file where the migrated seismic data will be saved (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input Dataset: Specify if the input data is from a streamer/land acquisition or OBS

Dataset type — **Select type of data to be migrated (Not yet implemented).**

Migration limits: Specify limits of the migration.

Migrate zero samples — If checked, samples with amplitudes value zero will be migrated as well.

Constant Start time (ms) — If checked, defines a constant migration start time.

Constant end time (ms) — If checked, defines a constant migration end time.

Limit operator dip — If checked, limits the dip angle of the migration operator.

Minimum offset (m) — If checked, defines a minimum offset for the migration operator.

Maximum offset (m) — If checked, defines a maximum offset for the migration operator.

Amplitude correction: Specifies how amplitudes are handled during migration.

True amplitude — if checked to use a weight function to approximate true amplitude.

High order amplitude function — (Not yet implemented).

Migration velocity field: Specify velocity field to be used by the migration.

Use velocity from velocity-field file — If selected, connects an auxiliary velocity-field file as input velocity model.

Use velocity from card data file — If selected, connects an auxiliary velocity function card as input velocity model.

Use constant velocity — If selected, uses a constant velocity migration.

Constant migration velocity — Enter constant velocity value for migration.

Scale velocity input — enter a scaling factor for the input velocities, or else 1.

Migration operator anti-alias filter: Specifies anti-alias filter parameters.

Apply anti-alias function — If checked, applies an anti-aliasing measure to the migration operator.

Traveltime calculations: Specify how traveltimes for Kirchhoff migration are calculated.

Assuming a flat topography scenario — If selected, assume a flat recording surface when computing travel-time information.

Accounting for rugged topography — If selected, Assume a rugged recording surface when computing travel-time information.

High order travel-time calculation — (Not yet implemented).

Stolt Migration

2-D only

Usage:

The *Stolt Migration* step implements a constant velocity or depth variable Stolt migration algorithm for post-stack time migration. This migration scheme can accommodate a vertically varying velocity field in the form of one SPW velocity function card. This velocity field is assumed to be the stacking velocity field derived from velocity analysis of the pre-stack data. The user designates a Stolt stretch factor, a maximum frequency to migrate, and temporal and spatial tapers. An option allows the input velocity function to be scaled. Finally, you can override the SPW calculated trace spacing and specify the true trace spacing of your data in your spatial units of choice. By default, SPW calculates the trace spacing for the stack as the group interval, as you defined it in the geometry definition, divided by two (2).

Input Links:

- 1) Seismic data in stacked order (mandatory).
- 2) Velocity Function cards (optional).

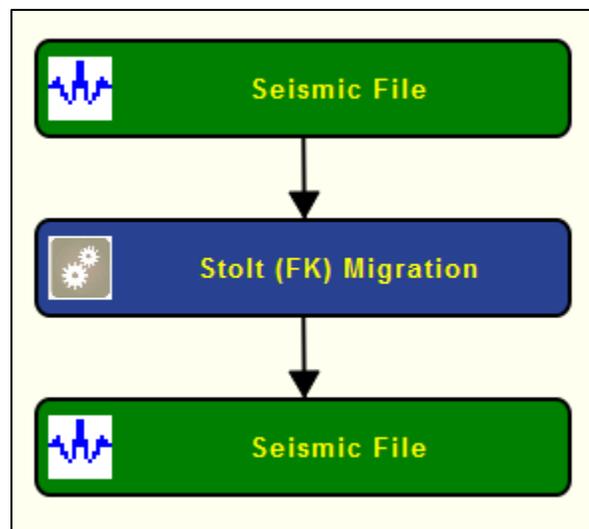
Output Links:

- 1) Seismic data in stacked order (mandatory) and sampled in time.

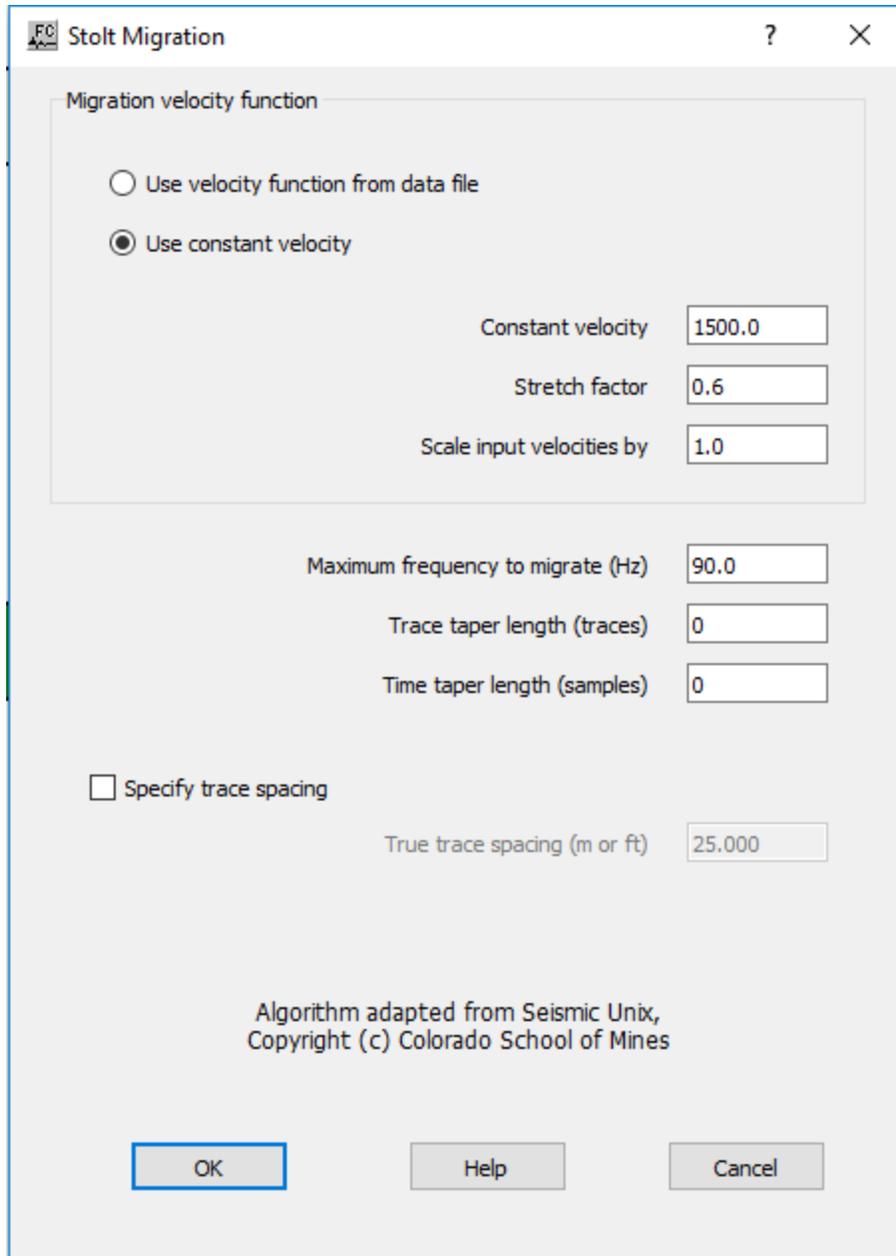
Reference:

Stolt, R.H, 1978, Migration by Fourier transform, Geophysics, v. 43, no 1., p. 23-48.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Migration velocity function: Specify velocity model parameters for migration.

Use velocity unction from data file — If selected, migrates data with a velocity field defined in an auxiliary velocity card data.

Use Constant velocity — If selected, uses a constant velocity value for migration.

Constant velocity — Enter a constant velocity value for the entire stack. This velocity will be used as the constant migration velocity if no velocity cards are linked.

Stretch factor — In the case of a time-variable velocity field, the Stolt stretch factor is designed to stretch the time axis so that the data appear to have propagated through a constant-velocity earth. Values of 0.5 to 1 are typical.

Scale input velocities by — The input velocities are multiplied by this number. This scalar may be used for adjusting the input velocities if they are interval velocities derived using Dix's equation rather than true interval velocities.

Maximum frequency to migrate — Enter the maximum frequency component in the data to be migrated.

Trace taper length (traces) — Number of traces to over which to taper traces at the start and end of the line prior to migration.

Time taper length (samples) — Number of samples to over which to taper at the start and end of each trace prior to migration.

Specify trace spacing — If checked, allows for manual specification of the trace spacing. By default, SPW calculates the trace spacing for the stack as the group interval, as you defined it in the geometry definition, divided by two (2).

True trace spacing (m or ft) — Enter trace spacing. This value will overwrite the parameters in geometry.

Multi-component Steps

This section documents the processing steps available in the Multi-Component category.

The multi-component processing steps currently available are:

Multi-component
↑ Processing Categories
Apply PS Nonhyperbolic Moveout
CCP Binning - Asymptotic
CCP Binning - Dynamic
Constant Gamma Stacks
Converted Wave Receiver Statics
Crooked Line Asymptotic CCP Binning
Crooked Line Dynamic CCP Binning
Horizontal Component Rotations

Note on Multi-component trace header values

Receiver types and Receiver component trace header values

Receiver Type	Receiver component trace-header value
Hydrophone or pressure sensor	11
Vertical-component receiver	12
Crossline-component receiver	13
Inline component receiver	14
Rotated vertical-component receiver	15
Rotated transverse-component receiver	16
Rotated radial-component receiver	17
Summed vertical component receiver	28

Source types and Source component trace header values

Source Type	Source component trace-header value
Vertical-component source	22
Crossline-component source	23
Inline component source	24
Rotated vertical-component source	25
Rotated transverse-component source	26
Rotated radial-component source	27

Apply PS Non-hyperbolic Moveout

Usage:

The *Apply PS Non-hyperbolic Moveout* step uses the combination of P-wave stacking velocities and Gamma functions to correct for non-hyperbolic moveout. Converted wave travel-times are not a hyperbolic function of offset. The total moveout of a converted wave reflection can be described accurately with the double square root (DSR) equation. This equation gives the complete travel time correction as a function of offset, bounce point and gamma, where gamma is defined as the ratio of compressional-wave to shear-wave velocity.

Input Links:

1. Seismic data in any sort order (mandatory).
2. PS Nhma Gamma Function card data file containing gamma pics (optional).
3. Velocity Function card data file containing P-wave velocity pics (optional).

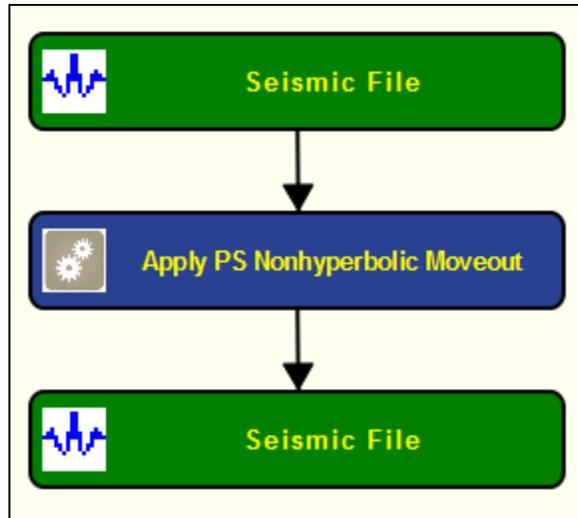
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

Yilmaz, 2001, 'Seismic Data Analysis', 2nd Ed. p.1946-1959.

Example Flowchart:



Step Parameter Dialog:

Apply PS Nonhyperbolic Moveout

Gamma field definition

Use gamma functions from data file

Use gamma field from seismic file

Use constant gamma

Constant gamma

Scale input gamma values by (%)

P-wave velocity field definition

Use velocity functions from data file

Use velocity field from seismic file

Use constant velocity

Constant velocity

Scale input velocities by (%)

Mute control

Apply stretch mute

Percentage

Taper length (samples)

Interpolation type selection

Linear Quadratic

Do inverse moveout application

OK Help Cancel

Parameter Description:

Gamma field definition: Specify gamma field description for PS nonhyperbolic moveout.

Use gamma functions from data file — If checked, an auxiliary card data file with the gamma field description will be automatically linked into the process.

Use gamma field from seismic file — If checked, an auxiliary seismic file with the gamma field description will be automatically linked into the process.

Use constant gamma — If checked, a constant gamma value will be used for the moveout correction.

Constant gamma — Enter the constant gamma value to be used for the moveout correction.

Scale input gamma values by (%) — Enter a value to be used to scale the input gamma field.

P-wave velocity field definition: Specify P-wave velocity field description for PS nonhyperbolic moveout.

Use velocity functions from data file — If checked, an auxiliary card data file with the P-wave velocity field description will be automatically linked into the process.

Use velocity field from seismic file — If checked, an auxiliary seismic file with the P-wave velocity field description will be automatically linked into the process.

Use constant gamma — If checked, a constant P-wave velocity value will be used for the moveout correction.

Constant gamma — Enter the constant P-wave velocity value to be used for the moveout correction.

Scale input gamma values by (%) — Enter a value to be used to scale the input P-wave velocity field.

Mute control: Specify stretch mute parameters.

Apply stretch mute — If checked, apply a stretch mute after the moveout correction.

Percentage — Enter the percentage of stretch mute to be applied.

Taper length (samples) — Enter the taper length for the stretch mute in number of samples.

Interpolation Type Selection: Specify the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not usually exactly at the sample interval of the data, the data is interpolated to be evenly sampled at the correct sample interval.

Linear — If selected, uses a linear interpolation following the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — If selected, uses a quadratic interpolation following the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

CCP Binning - Asymptotic

Usage: The *Common-Conversion Point (CCP) Binning – Asymptotic* processing step will split a converted wave (P-S) trace into pieces and place each piece into the correct 2D or 3D bin location. The Gamma value (normally about 2.0) is used to calculate the curve defining the conversion P to S wave points.

Input Links:

- 1) Seismic file containing 3C or 4C data (mandatory)

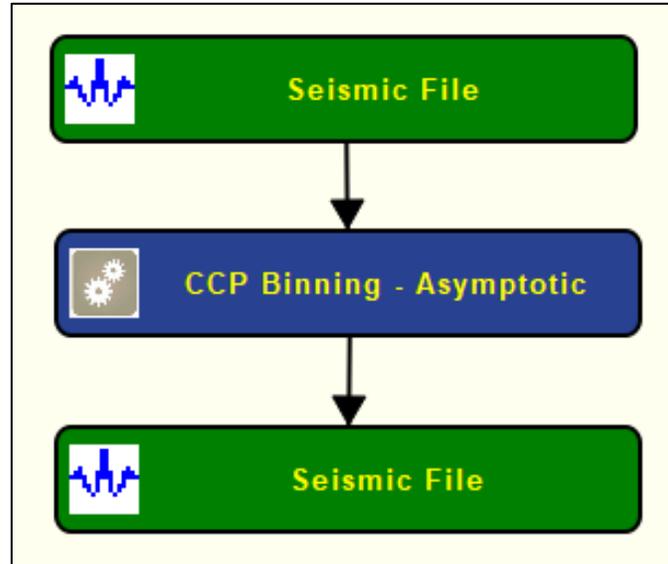
Output Links:

- 1) Seismic file containing 3C or 4C data with traces binned into common conversion points (mandatory).

Reference:

Yilmaz, 2001, 'Seismic Data Analysis', 2nd Ed.

Example Flowchart:



Step Parameter Dialog:

CCP Binning - Asymptotic

Corner 1 - Easting: 100000.00
 Corner 1 - Northing: 100000.00
 Corner 2 - Easting: 100000.00
 Corner 2 - Northing: 200000.00
 Corner 3 - Easting: 200000.00
 Corner 3 - Northing: 100000.00

Inline bin size: 25.00
 Crossline bin size: 25.00
 First inline number: 1000
 Inline increment: 1
 First crossline number: 2000
 Crossline increment: 1

Update from project

Gamma: 2

Coordinate definition:
 Corner points define bin centers
 Corner points define bin corners

Survey dimensions:
 2D
 3D

OK Help Cancel

Parameter Description:

Line definition (for 2D): Define line parameters. These parameters are exclusive for 2D surveys.

Start of line easting (for 2D) — Enter the start of line easting.

Start of line northing (for 2D) — Enter the start of line northing.

End of line easting (for 2D) — Enter the end of the line easting.

End of line northing (for 2D) — Enter the end of the line northing.

Line number (for 2D) — Enter the line number.

Line azimuth (for 2D) — Enter the line azimuth.

First midpoint number (for 2D) — Enter the first midpoint number.

Common midpoint increment (for 2D) — Enter the common midpoint increment.

Common midpoint size (for 2D) — Enter the common midpoint size.

Grid definition (for 3D) — Define the 3D grid. These parameters are exclusive for 3D surveys.

Corner 1 – Easting (for 3D) — Enter the easting (x) coordinate of the first corner of your survey.

Corner 1 – Northing (for 3D) — Enter the northing (y) coordinate of the first corner of your survey.

Corner 2 – Easting (for 3D) — Enter the easting (x) coordinate of the second corner of your survey.

Corner 2 – Northing (for 3D) — Enter the northing (y) coordinate of the second corner of your survey.

Corner 3 – Easting (for 3D) — Enter the easting (x) coordinate of the third corner of your survey.

Corner 3 – Northing (for 3D) — Enter the northing (y) coordinate of the third corner of your survey.

Inline bin size (for 3D) — Enter the size in distance units of the in-line side (1 to 2) of each bin.

Crossline bin size (for 3D) — Enter the size in distance units of the cross-line side (1 to 3) of each bin.

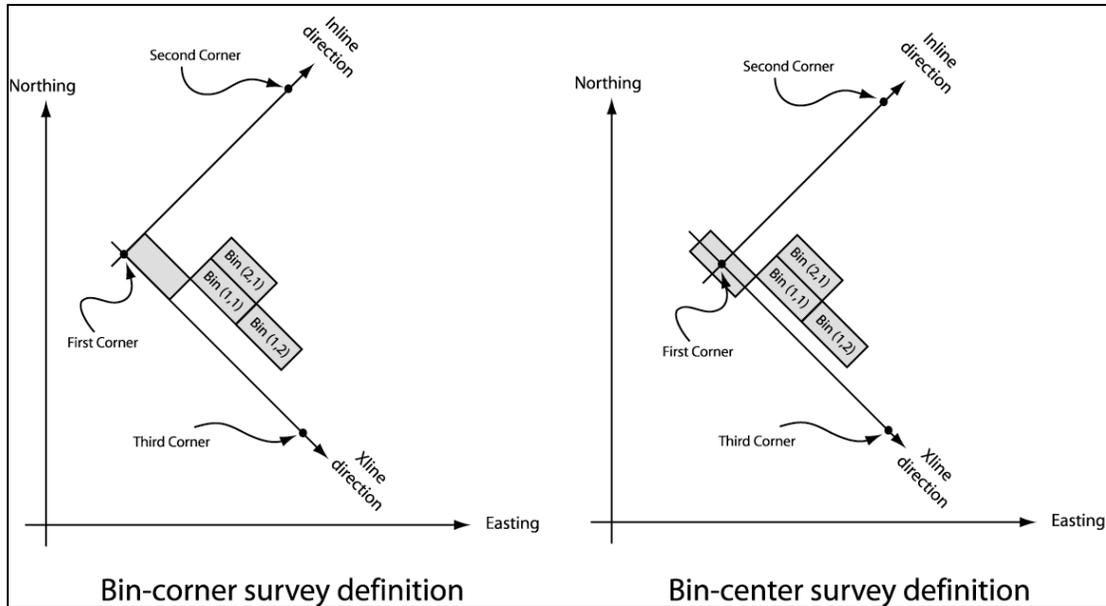
First inline number (for 3D) — Enter the first inline number. This line number is assigned to all the bins along the side of the survey from corner 1 to corner 2.

Inline increment (for 3D) — Enter the increment in line numbers between adjacent CMP lines.

First crossline number (for 3D) — Enter the first crossline number. This location number is assigned to all the bins along the side of the survey from corner 1 to corner 3.

Crossline increment (for 3D) — Enter the increment in locations between adjacent CMP locations.

Coordinate definition: Specify whether the corner points define the bin centers or corners following the figure below.



Corner points define bin centers — If selected, specify that corner points define bin centers.

Corner points define bin corners — If selected, specify that corner points define bin corners.

Survey dimensions: Specify whether the dimensions of the survey are 2D or 3D.

2D — If selected, specify 2D line survey.

3D — If selected, specify a 3D grid survey.

Project updates: Specify project updates.

Update from project — Select to update from the project.

Gamma — Enter the gamma parameter value. Gamma is the ratio of V_p/V_s velocities. This parameter defines the curve of the conversion point.

CCP Binning - Dynamic

Usage: The *Common-Conversion Point (CCP) binning - Dynamic* step assigns CCP numbers to mode-converted PS data as a function of the source-receiver offset and a constant or time-variable V_p/V_s ratio (gamma).

Input Links:

- 1) Converted wave data volume in any sort order (mandatory).
- 2) Nhmo gamma function card (optional).

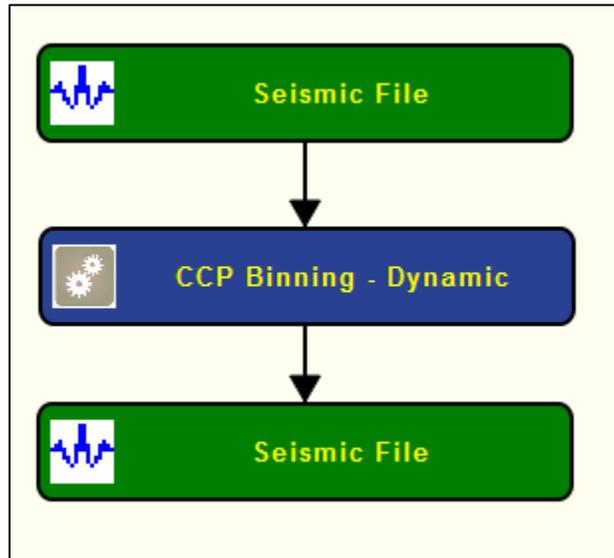
Output Links:

1) Converted wave data volume in any sort order (mandatory).

Reference:

Yilmaz, 2001, 'Seismic Data Analysis', 2nd Ed.

Example Flowchart:



Step Parameter Dialog:

CCP Binning - Dynamic

Corner 1 - Easting Inline bin size

Corner 1 - Northing Crossline bin size

Corner 2 - Easting First inline number

Corner 2 - Northing Inline increment

Corner 3 - Easting First crossline number

Corner 3 - Northing Crossline increment

Update from project Offset bin size

Coordinate definition

Corner points define bin centers

Corner points define bin corners

Survey dimensions

2D

3D

Parameter Description:

Corner 1 - Easting — Enter the easting (x) of the first corner of the bin grid (2D or 3D).

Corner 1 - Northing — Enter the northing (y) of the first corner of the bin grid (2D or 3D).

Corner 2 - Easting — Enter the easting (x) of the second corner of the bin grid (2D or 3D).

Corner 2 - Northing — Enter the northing (y) of the second corner of the bin grid (2D or 3D).

Corner 3 - Easting — Enter the easting (x) of the third corner of the bin grid (3D).

Corner 3 - Northing — Enter the northing (y) of the third corner of the bin grid (3D).

Inline bin size — Enter the size of a bin in the inline direction in meters or feet (2D or 3D).

Crossline bin size — Enter the size of a bin in the crossline direction in meters or feet (3D).

Line number — Enter the line number (2D).

First inline number — Enter the first inline number (3D).

Inline increment — Enter the inline increment (3D).

First CMP number — Enter the first CMP number (2D).

First crossline number — Enter the first crossline number (3D).

CMP increment — Enter the CMP increment (2D).

Crossline increment — Enter the crossline increment (3D).

Offset bin size — Enter the offset bin size (2D or 3D).

Corner points define bin centers — If selected, specify that corner points define bin centers.

Corner points define bin corners — If selected, specify that corner points define bin corners.

Survey dimensions: Specify whether the dimensions of the survey are 2D or 3D.

2D — If selected, specify 2D line survey.

3D — If selected, specify a 3D grid survey.

Constant Gamma Stacks

Usage:

The *Constant Gamma Stack* step generates a file of constant gamma stack traces, where gamma is defined as the V_p/V_s ratio. A P-wave stacking velocity field must be supplied, and you choose the number of gammas with which to stack your data, the first gamma to apply, and the last gamma to apply. You have the option to apply a stretch mute, if you so desire. With the series of constant gamma stack traces, you page through these stacked panels in Display and interactively pick gamma functions that result in the most coherent stacked sections.

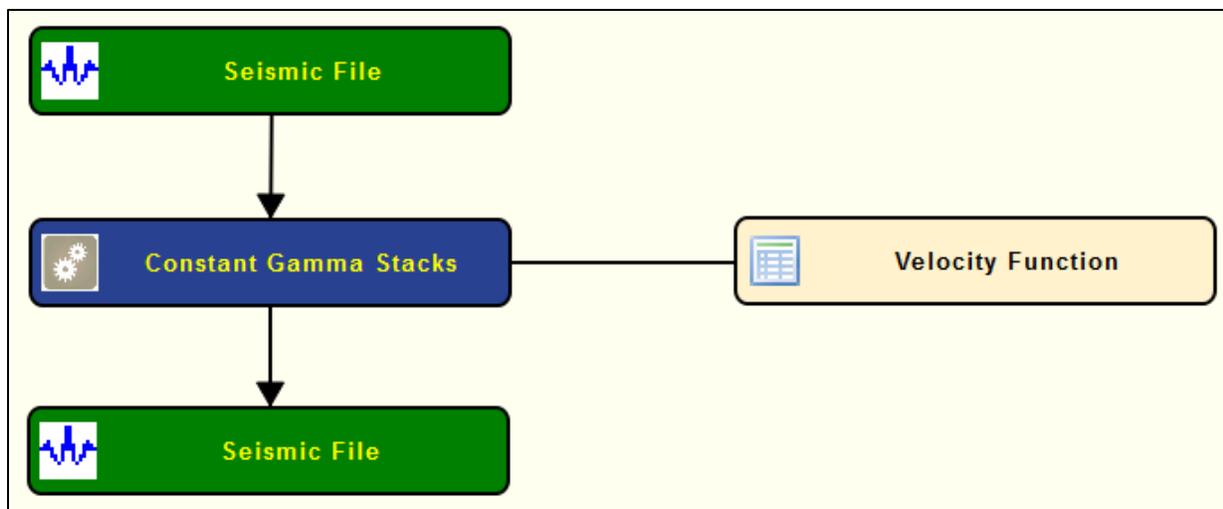
Input Links:

1. Seismic data pre-stack, in CMP sort order (mandatory).
2. Velocity card data file containing p-wave stacking velocity functions (mandatory).

Output Links:

1. Seismic data pre-stack, in CMP sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

The dialog box contains the following sections and parameters:

- Gamma range:**
 - First gamma: 1.8
 - Last gamma: 4.0
 - Gamma increment: 0.2
- Line range:**
 - First line to analyze: 1
 - Last line to analyze: 1
 - Line increment: 1
- Mute Control:**
 - Apply mute from data file
 - Apply stretch mute
 - Percentage: 30
 - Taper length (samples): 15
- P-wave velocity field definition:**
 - Use velocity functions from data file
 - Use velocity field from seismic file
 - Use constant velocity
 - Constant velocity: 7000.0
 - Scale input velocities by (%): 1.0
- Location range:**
 - First location to analyze: 100.0
 - Last location to analyze: 200.0
 - Location increment: 50.0
 - Locations per analysis: 7
- Interpolation Type Selection:**
 - Linear
 - Quadratic
- Trace Amplitude Definition:**
 - Use relative amplitude traces
 - Use true amplitude traces
- Exponent for normalization:** 1.0

Buttons: OK, Help, Cancel

Parameter Description:

Gamma range: Specify the range of gammas to use in the analysis. A stacked section is calculated for each gamma linearly interpolated between the starting and ending input gamma. The gamma increment will be: $G_{inc} = (\text{last gamma} - \text{first gamma}) / (\text{Number of gammas} - 1)$.

First gamma — Enter the starting gamma for the analysis. This gamma will be used for non-hyperbolic NMO on the first output stack. {>0.0}

Last gamma — Enter the ending gamma for the analysis. This gamma will be used for non-hyperbolic NMO on the last output stack. {>0.0}

Gamma increment — Enter the number of velocities to use in the analysis. A stacked section is calculated for each velocity linearly interpolated between the starting and ending input velocities. The velocity increment will be: $inc = (last\ velocity - first\ velocity) / (Number\ of\ velocities - 1)$.

P-wave velocity field definition: Define the P-wave velocity field.

Use velocity functions from data file — If checked, velocity functions will be applied from a data file.

Use velocity field from seismic file — If checked, a velocity field will be applied from a seismic file.

Use constant velocity — If checked, a constant velocity will be applied to the data.

Constant velocity — Enter the NMO velocity. This constant velocity will be used if a set of velocity function cards is NOT linked to the NMO correction step.

Scale input velocities by (%) — Enter the amount by which the input velocities are scaled up or down. A value of 1.0 does not alter the velocity field.

Line range: Specify the line range.

First line to analyze — Enter the first CMP line number to analyze.

Last line to analyze — Enter the last CMP line number to analyze.

Line increment — Enter the CMP line increment between lines to analyze.

Location range: Specify the location range.

First location to analyze — Enter the first CMP location to analyze.

Last location to analyze — Enter the last CMP location to analyze.

Location increment — Enter the CMP location increment between groups of CMP locations to analyze.

Locations per analysis — Enter the number of CMP locations in each analysis panel. At each CMP location a range of constant velocity stacks will be generated from the first velocity to the last velocity in increments of V_{inc} .

Mute Control: Specify the parameters for the stretch mute definition.

Apply mute from data file — If checked, a mute will be applied to the NHMO corrected data from a data file.

Apply stretch mute — If checked, a stretch mute will be applied to the NHMO corrected data. Stretch muting restricts the stretching of the data due to the NMO correction. If not checked, the stretch mute must be supplied by an Early Mute card linked to the Constant Gamma Stack step.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length (samples) — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Interpolation Type Selection: Specify the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data samples between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data samples between or beyond existing data.

Trace Amplitude Definition: Specify the trace amplitude definition.

Use relative amplitude traces — Relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Selects the use of true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

Converted Wave Receiver Statics

Usage:

The *Converted Wave Receiver Statics* step uses a cross correlation and least squares fitting to calculate receiver statics for converted wave traces (P=S).

Input Links:

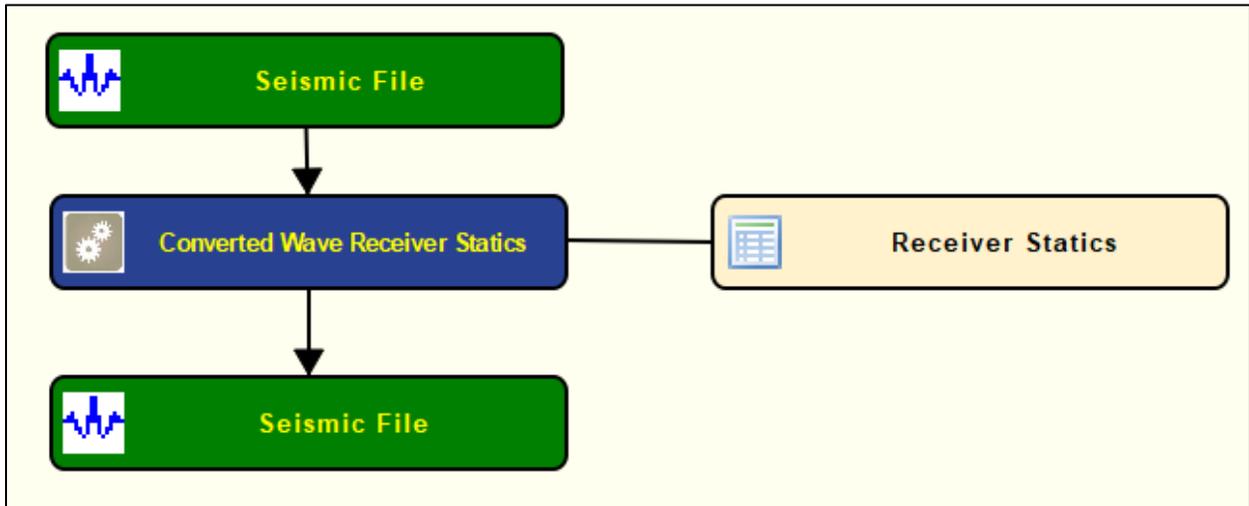
- 1) Seismic file containing converted wave data traces sorted in receiver order (mandatory).

Output Links:

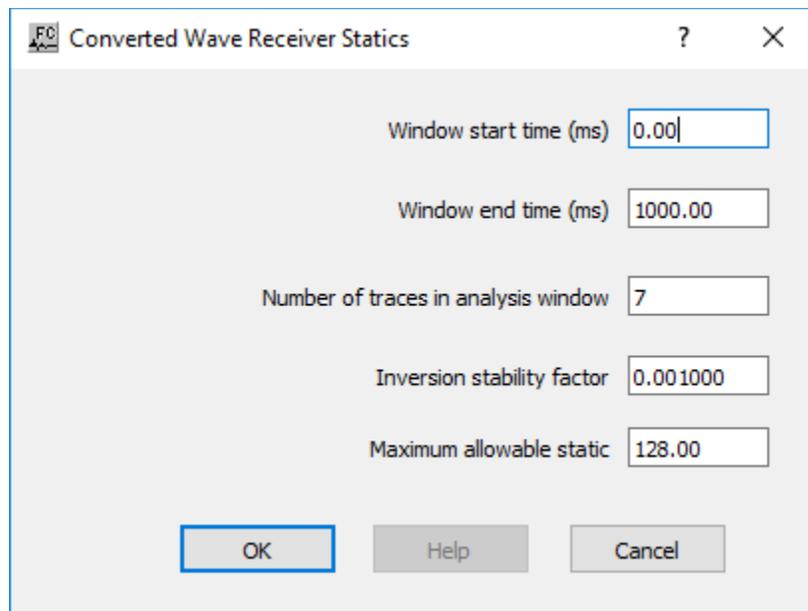
- 1) Seismic file containing converted wave data traces sorted in receiver order (mandatory).
- 2) Receiver statics file containing the calculated receiver statics (mandatory).

Reference:

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Window start time (ms) — Enter the start time for the analysis.

Window end time (ms) — Enter the end time for the analysis.

Number of traces in analysis window — Enter the minimum number of traces considered for the converted waver receiver statics.

Inversion stability factor — Enter a small value used to stabilize the matrix inversion and prevent inverting zeros which causes instability

Maximum allowable static — Enter the maximum amount of static correction.

Crooked Line Asymptotic CCP Binning

Usage:

The *Crooked Line Asymptotic Common-Conversion Point (CCP) Binning* step will split a converted wave (P-S) trace into pieces and place each piece into the correct crooked line bin location. The Gamma value (normally about 2.0) is used to calculate the curve defining the conversion P to S wave points.

Input Links:

- 1) Seismic file containing 3C or 4C data (mandatory)
- 2) Line Definition File containing the crooked line fit information (mandatory)

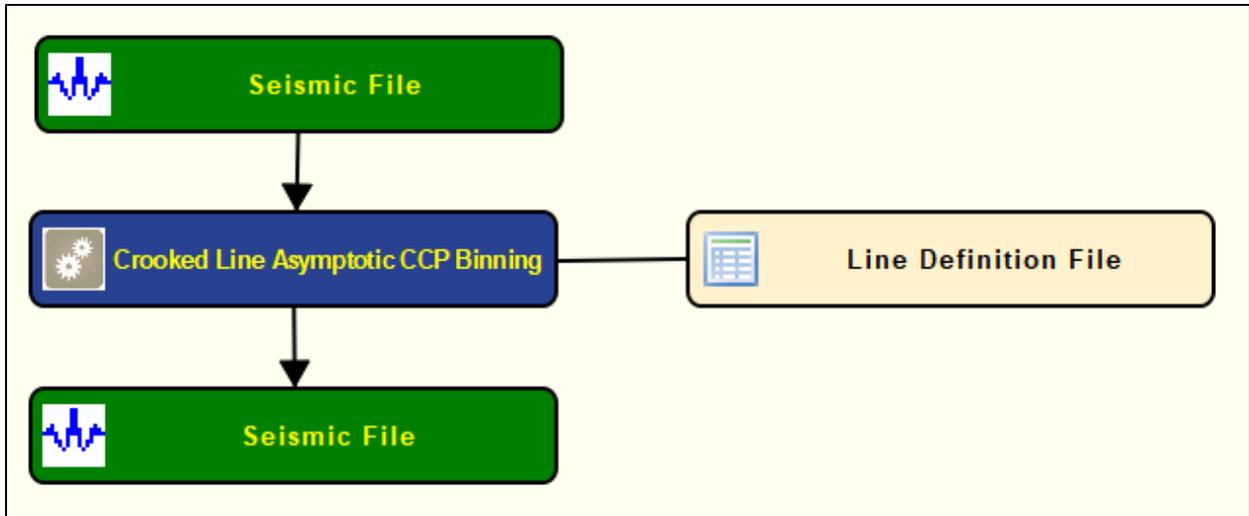
Output Links:

- 1) Seismic file containing 3C or 4C data with traces binned into common conversion points (mandatory)

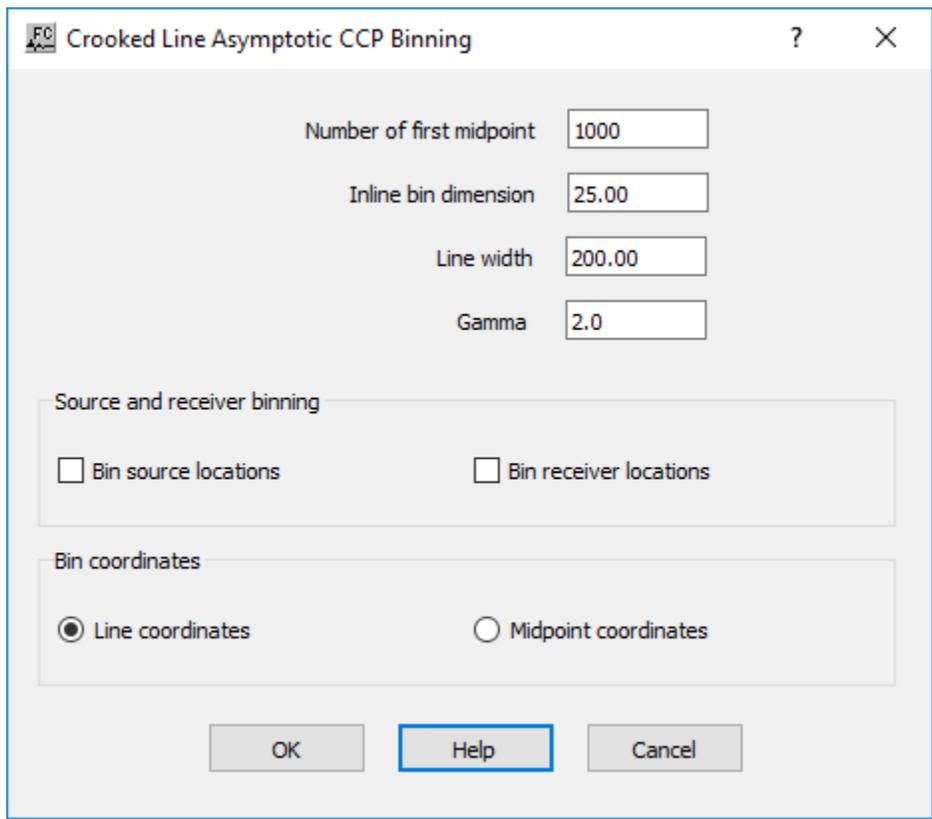
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Number of first midpoint — Enter the first midpoint to be considered for the Asymptotic CCP binning.

Inline bin dimension — Enter the bin dimension in the inline direction.

Line width — Enter the line width to be considered for the asymptotic CCP.

Gamma — Enter a value for gamma parameter as defined by V_p/V_s ratio.

Source and receiver binning: Define bin for sources and/or receiver locations.

Bin source locations — If checked, bin source locations.

Bin receiver locations — If checked, bin receiver locations.

Bin coordinates: Define bin coordinates. Bin coordinates can be either defined as line of midpoints.

Line coordinates — If selected, bin coordinates are line coordinates.

Midpoint coordinates — If selected, bin coordinates are midpoint coordinates.

Crooked Line Dynamic CCP Binning

Usage: The *Crooked Common-Conversion Point (CCP) binning - Dynamic* step assigns CCP numbers to mode-converted PS data as a function of the source-receiver offset and a constant or time-variable V_p/V_s ratio (gamma) for 2D crooked lines.

Input Links:

- 1) Converted wave data volume in any sort order (mandatory).
- 2) Line definition file (mandatory).
- 3) Auxiliary gamma card data file (optional).
- 4) Auxiliary P-wave velocity card data file (optional).

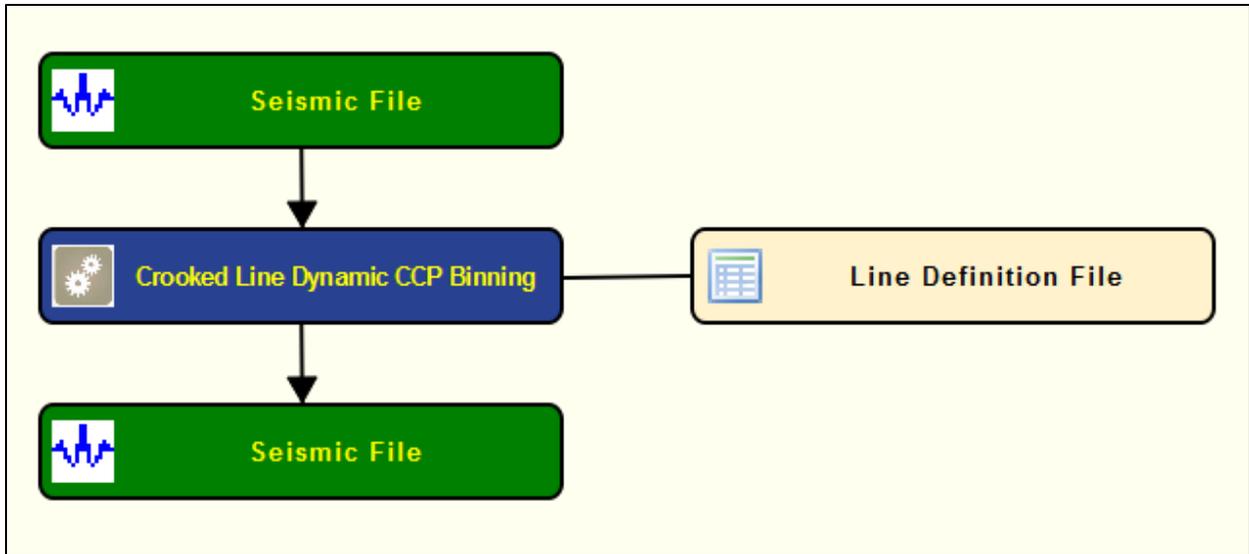
Output Links:

- 1) Seismic file (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Crooked Line Dynamic CCP Binning

Number of first midpoint

Inline bin dimension

Line width

Offset bin size

Gamma

Use gamma field from data file

Use constant gamma

Constant gamma

Compressional-wave velocity

Use velocity field from data file

Use constant velocity

Constant velocity

Source and receiver binning

Bin source locations Bin receiver locations

Bin coordinates

Line coordinates Midpoint coordinates

OK Help Cancel

Parameter Description:

Number of first midpoint — Enter the number of the first midpoint to be binned.

Inline bin dimension — Enter the bin dimension in the inline direction.

Line width — Enter the line width for the binning.

Offset bin size — Enter the offset bin size.

Gamma: Define parameters related with the gamma parameter. Gamma is defined as the V_p/V_s ratio.

Use gamma field from data file — If checked, use gamma field from an auxiliary data file.

Use constant gamma — If checked, use a constant gamma value.

Constant gamma — Enter constant gamma value.

Compressional-wave velocity: Define parameters related with the P-wave velocity.

Use velocity field from data file — If checked, use a velocity P-wave file.

Use constant velocity — If checked, use a constant P-wave velocity for the entire survey.

Constant velocity — Enter the value for the constant P-wave velocity.

Source and receiver binning: Define bin for sources and/or receiver locations.

Bin source locations — If checked, bin source locations.

Bin receiver locations — If checked, bin receiver locations.

Bin coordinates: Define bin coordinates. Bin coordinates can be either defined as line of midpoints.

Line coordinates — If selected, bin coordinates are line coordinates.

Midpoint coordinates — If selected, bin coordinates are midpoint coordinates.

Horizontal Component Rotations

Usage:

The *Horizontal Component Rotations* step rotates the horizontal components of a multi-component data volume through rotation angles determined by the Two Component Horizontal Rotation step. The rotation angles are read from a Rotation Card file. In the case of 2D data acquisition with field oriented 3C receivers, an option exists to limit the rotation angle to a user-specified range.

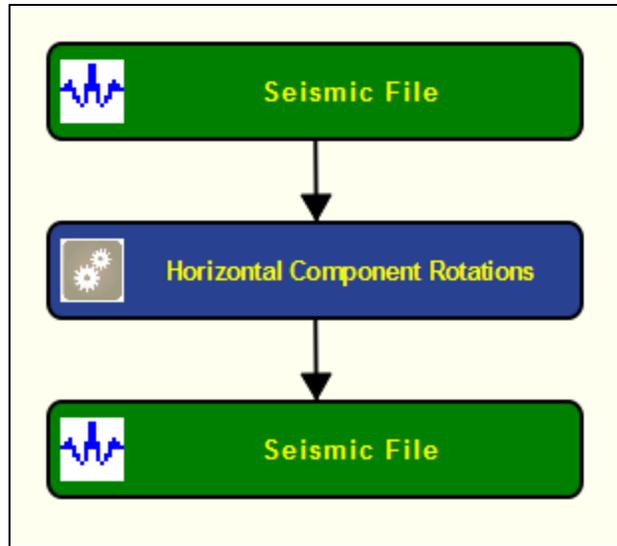
Input Links:

- 1) Seismic data in common receiver order (mandatory). The trace header must be updated with source-receiver azimuth and source- and receiver-component types. The common-receiver gathers should be sorted by (1) receiver number; (2) source-receiver offset; (3) receiver component.
- 2) Rotation Card file containing the estimated rotation angles (optional).

Output Links:

- 1) Seismic data in common receiver order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Horizontal Rotations ? X

Input type

Three components Two horizontal components

Orientation type

Fixed orientation Orientation defined in header

Orientation angles

Orientation of inline component (deg)

Orientation of crossline component (deg)

Orientation trace header

Orientation units

Component labels

Vertical component value

Inline component value

Crossline component value

Radial component value

Transverse component value

OK Help Cancel

Parameter Description:

Input type: Define the type of multicomponent data.

Three components — If selected, the input multi-component seismic data is three components.

Two horizontal components — If selected, the input multi-component seismic data is considered two horizontal components.

Orientation type: Define the type or orientation.

Fixed orientation — If selected, entire data has a fixed orientation.

Orientation defined in header— If selected, the orientation of the data varies and must be defined in the header.

Orientation angles: Define the orientation angles.

Orientation of inline component (deg.) — If fixed orientation, enter the orientation (azimuth) of the inline component in degrees.

Orientation of crossline component (deg.) — If fixed orientation, enter the orientation (azimuth) of the crossline component in degrees.

Orientation trace header — If orientation defined in header, select the location of the header key word with the orientation (azimuth) value.

Orientation units — If orientation defined in header, select the units for orientation (azimuth) (degrees or radians)

Component labels: Define the components labels.

Vertical component value — Enter the label value corresponding to the vertical component.

Inline component value — Enter the label value corresponding to the inline component.

Crossline component value — Enter the label value corresponding to the crossline component.

Radial component value — Enter the label value corresponding to the radial component.

Transverse component value — Enter the label value corresponding to the transverse component.

Mutes Steps

This section documents the processing steps available in the Mutes category.

The types of mutes currently available are:

Mutes
↑ Processing Categories
Apply Early Mute
Apply Surgical Mute
Apply Tail Mute
Build Mask Model

Apply Early Mute

Usage:

The *Apply Early Mute* step allows you to apply mute definitions to your data from different sources. You may choose to interpolate mute functions for the records between the picked mute records or to just mute the records associated with the picked mutes. Mute function may be defined by auxiliary mute card data file or using a constant velocity linearly versus offset. You have a choice of applying a Hanning, Hamming, or Blackman type of mute taper, or none at all. You may also specify in samples the length of the mute taper and scale the input offsets by a value. Early mutes may be interactively defined using first the Display menu to select the file, then the Picking menu to select the type of mute.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Early Mute Function card (optional).

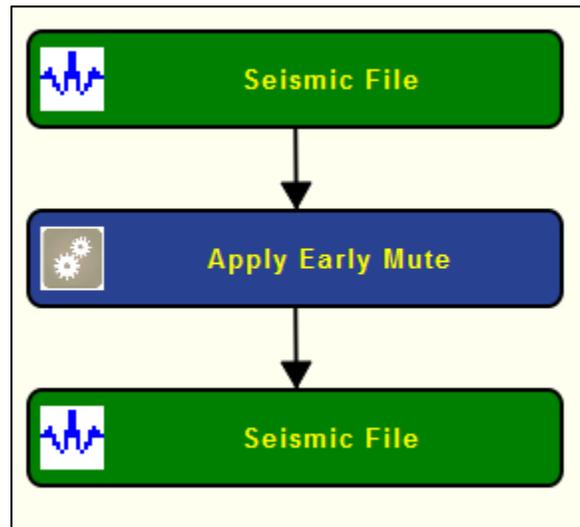
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Apply Early Mute

Mute definition

Velocity Velocity

Early mute file

First arrivals files

VSP first arrivals files

Samples shift at zero offset

Samples shift at maximum offset

Apply value from header

Mute header

Mute taper type

Hanning Hamming

Blackman No taper

Mute taper length (samples)

Mute record interpolation

Mute interpolation between input records

Field File order Receiver order

Source order CMP order

Scale input offsets by

OK Help Cancel

Parameter Description:

Mute definition: Specify the parameterization for the mute function.

Velocity — If selected, the mute function is defined linearly with the offset using a constant velocity.

Velocity — Enter the constant velocity value to be used to define the mute functions.

Early mute file — If selected, an auxiliary *Early Mute* auxiliary card data file is used to define the mute definition.

First arrivals files — If selected, an auxiliary *First Break Times* auxiliary card data file is used to define the mute function.

VSP first arrivals files — If selected, an auxiliary *VSP First Arrival Time Picks* auxiliary card data file is used to define the mute function.

Samples shift at zero offset — Enter the number of samples to be shifted at the zero-offset when applying the mute.

Samples shift at maximum offset — Enter the number of samples to be shifted at the maximum offset when applying the mute.

Apply value from header — If selected, the mute function is defined by values stored in a specific trace header locations.

Mute header — Select the location of the trace header with the mute value.

Mute Taper Type: Specify the type of taper to use when applying the mute function.

Hanning — Is selected, a Hanning taper is specified by the equation: $x(n) = 0.5 - 0.5 * \cos(2 * \pi * n / N)$.

Hamming — Is selected, a Hamming taper is specified by the equation: $x(n) = 0.54 - 0.46 * \cos(2 * \pi * n / N)$.

Blackman — Is selected, a Blackman taper is specified by the equation: $x(n) = 0.42 - 0.5 * \cos(2 * \pi * n / N) + 0.08 * \cos(4 * \pi * n / N)$.

No taper — Is selected, no taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

Mute taper length (samples) — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Mute record interpolation: Specify interpolation parameters of the mute function.

Mute interpolation between input records — If checked, the early mutes will be interpolated between the control points where picks were made.

Field File order — If selected, interpolation between input records is done in the field file order.

Receiver order — If selected, interpolation between input records is done in the receiver order.

Source order — If selected, interpolation between input records is done in the source order.

CMP order — If selected, interpolation between input records is done in the CMP order.

Scale input offsets by — Enter a value to scale the input offsets.

Apply Surgical Mute

Usage:

The *Apply Surgical Mute* step allows you to apply mute definitions to your data from the attached Surgical Mute Function auxiliary card data file. You may choose to interpolate mute functions for the records between the picked mute records or to just mute the records associated with the picked mutes. You have a choice of applying a Hanning, Hamming, or Blackman type of mute taper, or none at all. You may also specify in samples the length of the mute taper and scale the input offsets by a value. Surgical mutes may be interactively defined using first the Display menu to select the file, then the Picking menu to select the type of mute.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Surgical Mute Function card (mandatory).

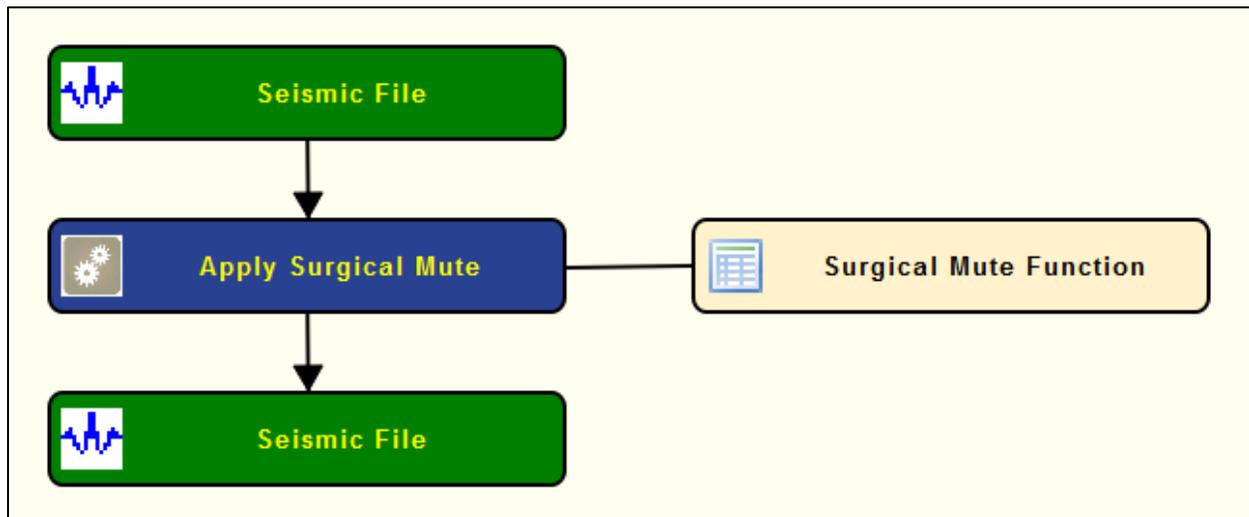
Output Links:

- 1) Seismic data in any sort order (mandatory).

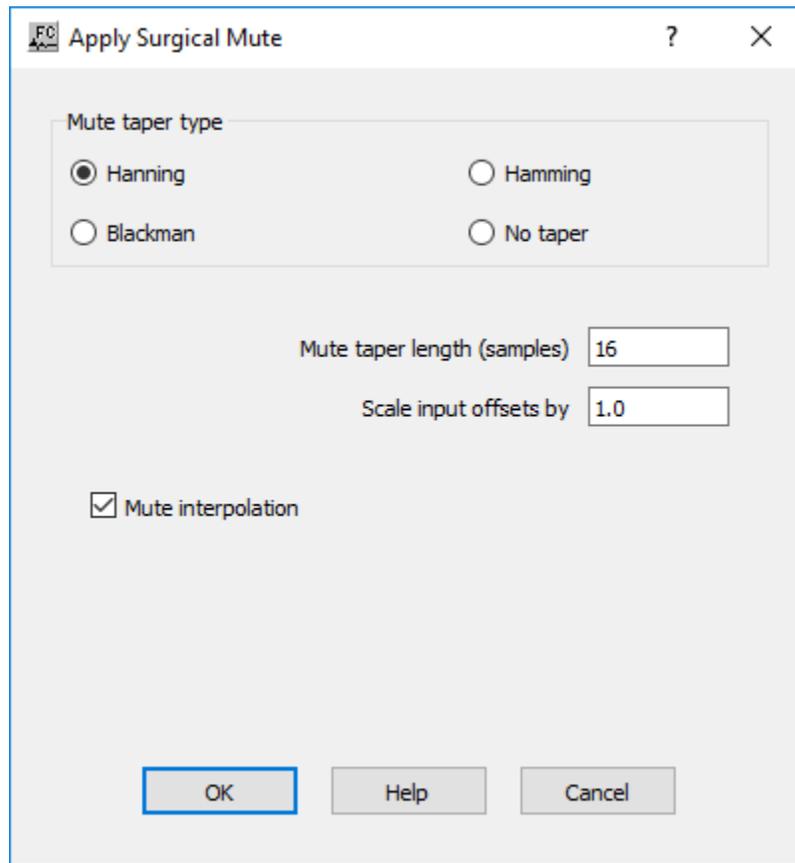
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Mute taper type: Specify the type of taper to use when applying the mute function.

Hanning — A Hanning taper is specified by the equation : $x(n) = 0.5 - 0.5 * \cos (2*\pi*n/N)$.

Hamming — A Hamming taper is specified by the equation : $x(n) = 0.54 - 0.46 * \cos (2*\pi*n/N)$.

Blackman — A Blackman taper is specified by the equation : $x(n) = 0.42 - 0.5 * \cos (2*\pi*n/N) + 0.08 * \cos (4*\pi*n/N)$.

No taper — No taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

Mute taper length (samples) — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Scale input offsets by — Enter a value to scale the input offsets.

Mute Interpolation — If checked, the surgical mutes will be interpolated between the control points where picks were made.

Apply Tail Mute

Usage:

The *Apply Tail Mute* step allows you to apply mute definitions to your data from the attached Tail Mute Function auxiliary card data file or using a linear function of constant velocity versus offset. You may choose to interpolate mute functions for the records between the picked mute records or to just mute the records associated with the picked mutes. You have a choice of applying a Hanning, Hamming, or Blackman type of mute taper, or none at all. You may also specify in samples the length of the mute taper and scale the input offsets by a value. Tail mutes may be interactively defined using first the Display menu to select the file, then the Picking menu to select the type of mute.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Surgical Mute Function card (optional).

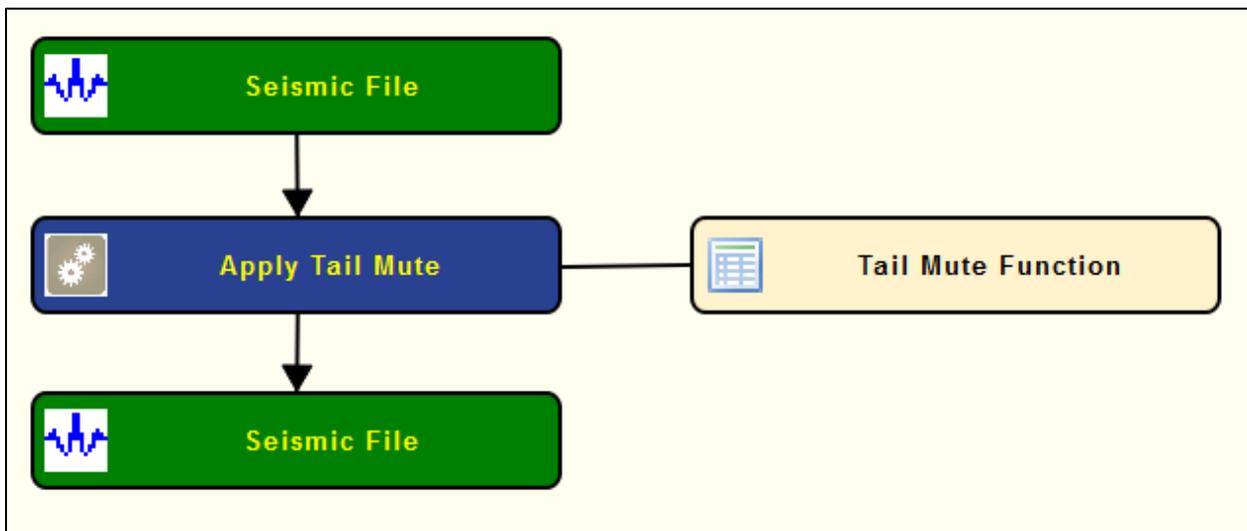
Output Links:

- 1) Seismic data in any sort order (mandatory).

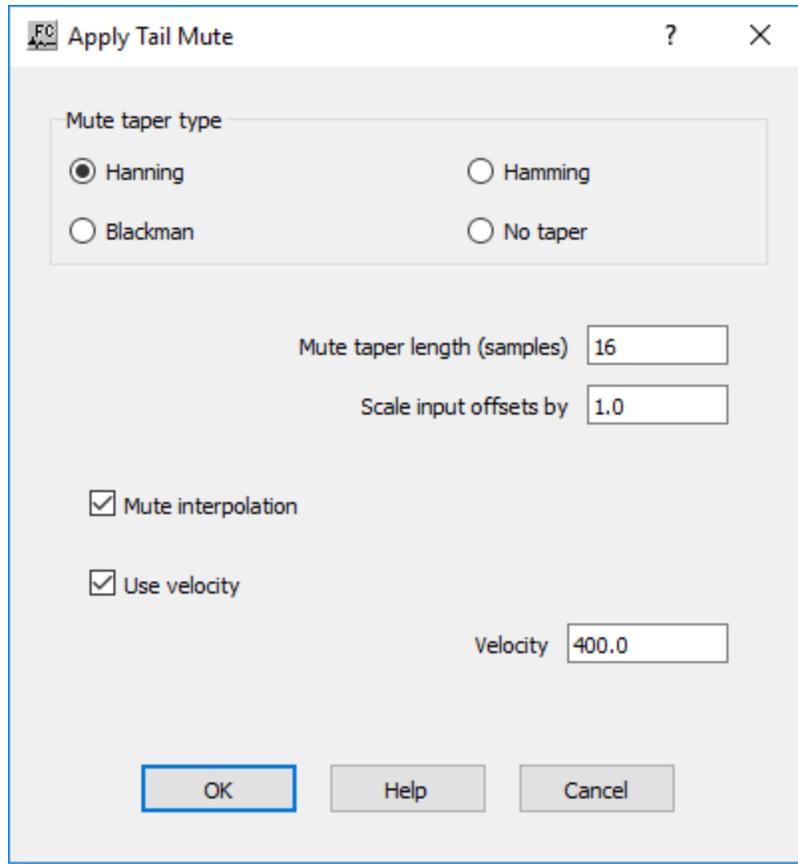
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Mute taper type: Specify the type of taper to use when applying the mute function.

Hanning — A Hanning taper is specified by the equation : $x(n) = 0.5 - 0.5 * \cos (2*\pi*n/N)$.

Hamming — A Hamming taper is specified by the equation : $x(n) = 0.54 - 0.46 * \cos (2*\pi*n/N)$.

Blackman — A Blackman taper is specified by the equation : $x(n) = 0.42 - 0.5 * \cos (2*\pi*n/N) + 0.08 * \cos (4*\pi*n/N)$.

No taper — No taper will be applied to the mute. This may result in problems in later processing steps due to Gibbs effect.

Mute taper length (samples) — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Scale input offsets by — Enter a value to scale the input offsets.

Mute Interpolation — If checked, the surgical mutes will be interpolated between the control points where picks were made.

Velocity — If selected, the mute function is defined linearly with the offset using a constant velocity.

Velocity — Enter the constant velocity value to be used to define the mute functions.

Build Mask Model

Usage: The *Build Mask Model* step allows you to build an output seismic file with zeros and ones that can be used to set to null specific samples or as auxiliary file for the *Simultaneous Iterative Refraction Tomography* (SIRT) analysis. The geometry of the output file may be defined manually or by an auxiliary seismic file. The masked region may be defined using a surgical mute card file.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data in any sort order to define geometry (optional).
- 3) Surgical Mute Function card (optional).

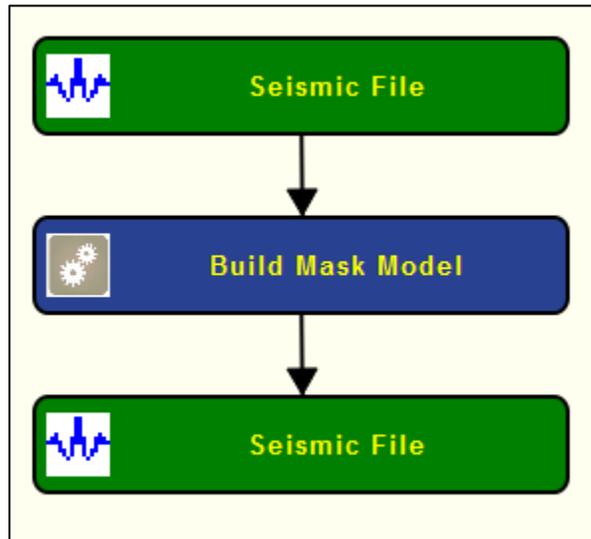
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Build mask model

Define geometry

Define geometry manually

Number of lines Number of locations

Sampling interval (ms) Number of samples

Define geometry from auxiliary seismic file

Define masked interval

Use constant time gate

Top limit (ms)

Bottom limit (ms)

Use surgical mute file

Define masked area

Mask inside Mask outside

OK Help Cancel

Parameter Description:

Define geometry: Specify parameters related with the geometry of the output seismic file.

Define geometry manually — If selected, the output seismic file with the mask has a geometry as defined manually with the parameters below.

Number of lines — Enter the number of line.

Number of locations — Enter the number of locations.

Sampling interval (ms) — Enter the sampling interval in milliseconds.

Number of samples — Enter number of samples.

Define geometry from auxiliary seismic file — If selected, the geometry of the output seismic file with the mask will have the geometry of an auxiliary seismic file.

Define masked interval: Specify the spatial extent of the mask (locations defined with zero values).

Use constant time gate — If selected, masked interval is defined with a time gate defined by constant top and bottom.

Top limit (ms) — Enter the location of the top boundary of the time gate in milliseconds.

Bottom limite (ms) — Enter the location of the bottom boundary of the time gate in milliseconds.

Use surgical mute file — If selected, masked interval is defined with an auxiliary surgical mute card data file.

Define masked area: Specify if mask inside or outside the are defined in the masked interval

Mask inside — If selected, mask inside the region.

Mask outside — If selected, mask outside the region.

Quality Analysis Steps

This section documents the processing steps available in the Quality Analysis category.

The types of quality analysis currently available are:

Quality Analysis
↑ Processing Categories
Amplitude Analysis
Amplitude Spectrum
Auto correlation
Dead Traces Analysis
Frequency Analysis
Signal to Noise
Signal to Noise Attribute
Source Energy Estimation
Spectral Comparison
Trace Analysis Report

Amplitude Analysis

Usage:

The *Amplitude Analysis* step performs single- or multi-channel- or single-channel average analysis of sample amplitudes and updates a user specified trace header with the results of the analysis. Attribute types include RMS amplitude, Average magnitude, Maximum amplitude, Energy, Median magnitude, and Maximum magnitude. Results may be output to a report file.

Input Links:

1) Seismic data in any order (mandatory).

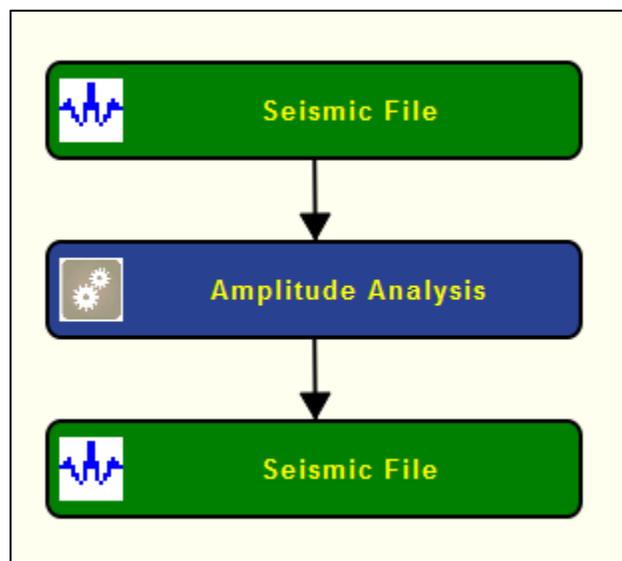
Output Links:

1) Seismic data in any order (mandatory).

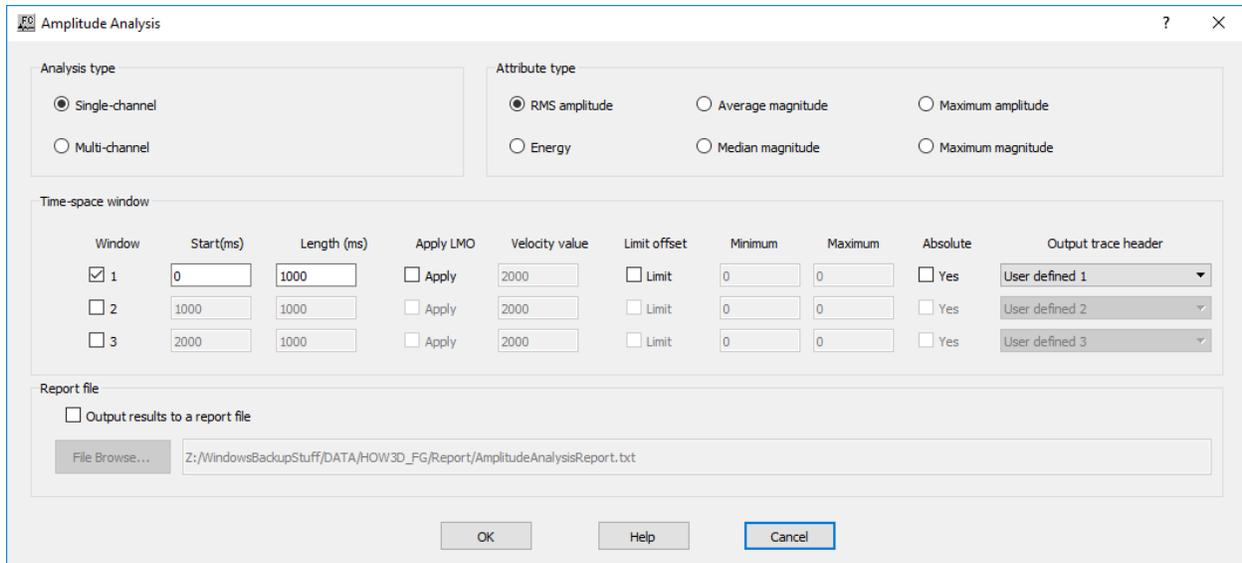
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Analysis type: Specify whether the amplitude analysis will be single-channel, multi-channel or single-channel average. Single-channel attributes are calculated per trace. Multi-channel attributes are calculated from the ensemble of traces in an input gather.

Single-channel — Select single-channel amplitude analysis.

Multi-channel — Select multi-channel amplitude analysis.

Attribute type: Specify the type of amplitude attribute.

RMS amplitude — If selected, calculate the root-mean-squared value in the analysis window.

Average magnitude — If selected, calculate the average of the absolute values in the analysis window.

Maximum amplitude — If selected, determine the maximum of the absolute values in the analysis window.

Energy — If selected, calculate the sum of the squares of sample values in the analysis window.

Median magnitude — If selected, determine the median value in the analysis window.

Maximum magnitude — If selected, determine the maximum value in the analysis window.

Time-space window: Specify the number of analysis windows per trace for a single- or multi-channel analysis.

Window — Specify the number of windows to use.

1 — The first window is checked by default for use in the calculations.

2 — Check to use a second window in the calculations.

3 — Check to use a third window in the calculations.

Start time (ms) — Enter the start time in milliseconds for the window to use.

Length (ms) — Enter the length in milliseconds for the window to use.

Apply LMO — Specify whether a linear moveout will be applied to the start time of the analysis window.

Apply — If checked, a linear moveout will be applied to the start time of the analysis window.

Velocity value — If linear moveout is to be applied, enter the moveout velocity.

Limit offset — If offset is to be limited, specify minimum and maximum values. Absolute values may be specified.

Limit — If checked, the offset will be limited, specify minimum and maximum values.

Minimum — Enter minimum offset value.

Maximum — Enter maximum offset value.

Absolute — Specify if absolute value is desired.

Yes — If checked, an absolute value will be used.

Output trace header — Select the trace header for each window that will be updated with the results of the analysis.

Report file — Specify whether to save results to a report file and browse to locate or create an amplitude analysis report file.

Output results to a report file — If checked, results will be saved to a report file.

Amplitude Spectrum

Usage:

The *Amplitude Spectrum* step inputs seismic data and outputs the amplitude spectrum of each trace into the output seismic file.

Input Links:

1) Seismic data in any order (mandatory).

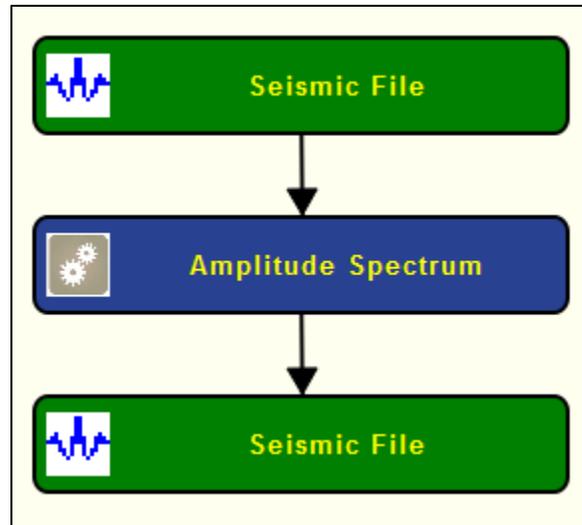
Output Links:

1) Seismic data amplitude spectrum attribute traces (mandatory).

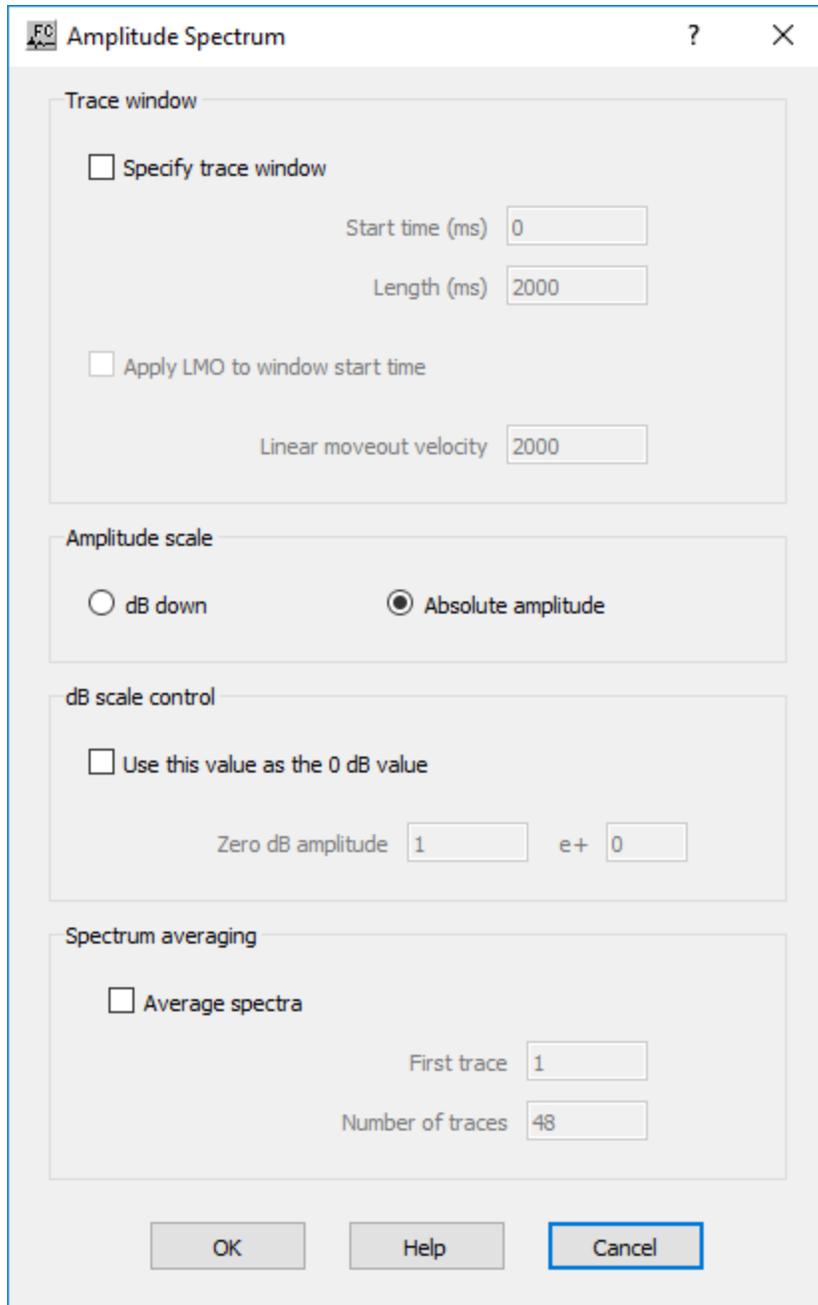
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Trace window: Specify the parameters related with the

Specify trace window — If checked, the specified trace window will be used for calculating the amplitude spectrum.

Start time (ms) — Enter the start time of the trace window to use in milliseconds.

Length (ms) — Enter the length of the trace window to use in milliseconds.

Apply LMO to window start time — If checked, a linear moveout will be applied to the start time of the trace window.

Linear moveout velocity — If linear moveout is to be applied, specify the moveout velocity.

Amplitude scale: Specify the amplitude scale of the spectra either amplitude or dB.

Amplitude scale — Select the amplitude scale in dB down or in absolute amplitude.

dB scale control — Control the dB scale by specifying a zero decibel value.

Use this value as the 0 dB value — If checked, the value entered will be used to control the dB scale.

Zero dB amplitude — Specify the zero decibel amplitude.

e+ — Enter the exponent (the number of tens) desired for multiplying the zero decibel value.

Spectrum averaging — Specify the number of spectra to be average based on the trace number.

Average spectra — If checked, the spectrums of the specified traces will be averaged.

First trace — Enter the first trace number in the window to be averaged.

Number of traces — Enter the number of traces to averaged.

Autocorrelation

Usage:

The *Autocorrelation* step computes a single trace autocorrelation for each input data trace. The autocorrelation trace will have the same length as the input trace, and the zero lag value can be shift in time if you want to view both positive and negative lags.

Input Links:

1) Seismic data in any sort order (mandatory).

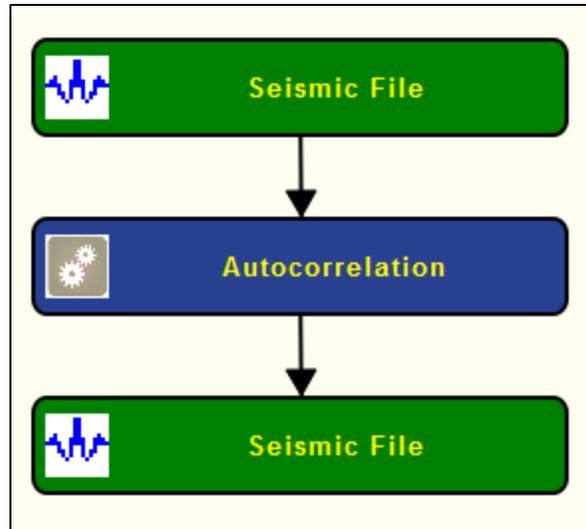
Output Links:

1) Seismic data in any sort order (mandatory).

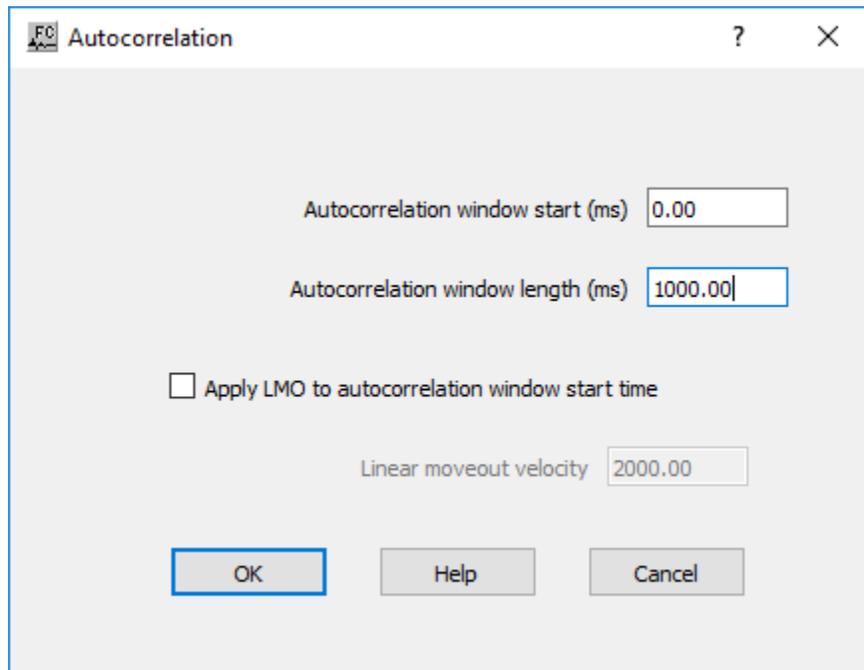
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Autocorrelation window start (ms) — Enter the start time in milliseconds for computing the trace autocorrelation.

Autocorrelation window length (ms) — Enter the length in milliseconds for computing the trace autocorrelation. The autocorrelation function will be generated from data samples between the start time and the start time + window length.

Apply LMO to autocorrelation window start time — If checked, the autocorrelation window start time will be a function of offset: $\text{Start time} = (\text{source-receiver offset} / \text{velocity}) + \text{Autocorrelation window start time}$.

Linear moveout velocity — Enter the linear moveout velocity.

Dead Trace Analysis

Usage:

The *Dead Trace Analysis* step allows to kill traces based on a user-defined trace header key word, and receiver lines or entire records based on the number and the relative location of dead traces.

Input Links:

1) Seismic data in any sort order (mandatory).

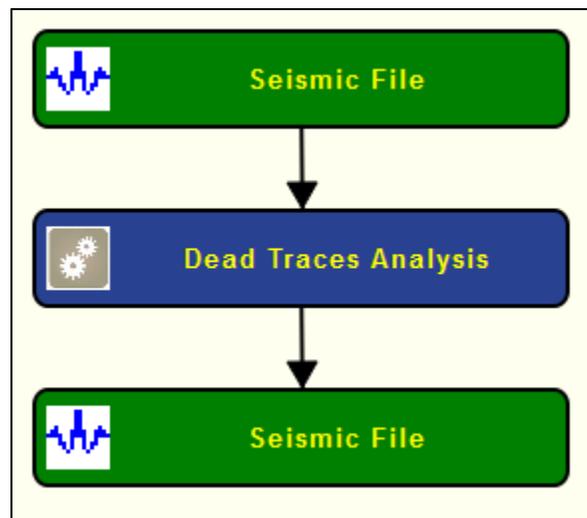
Output Links:

1) Seismic data in any sort order (mandatory).

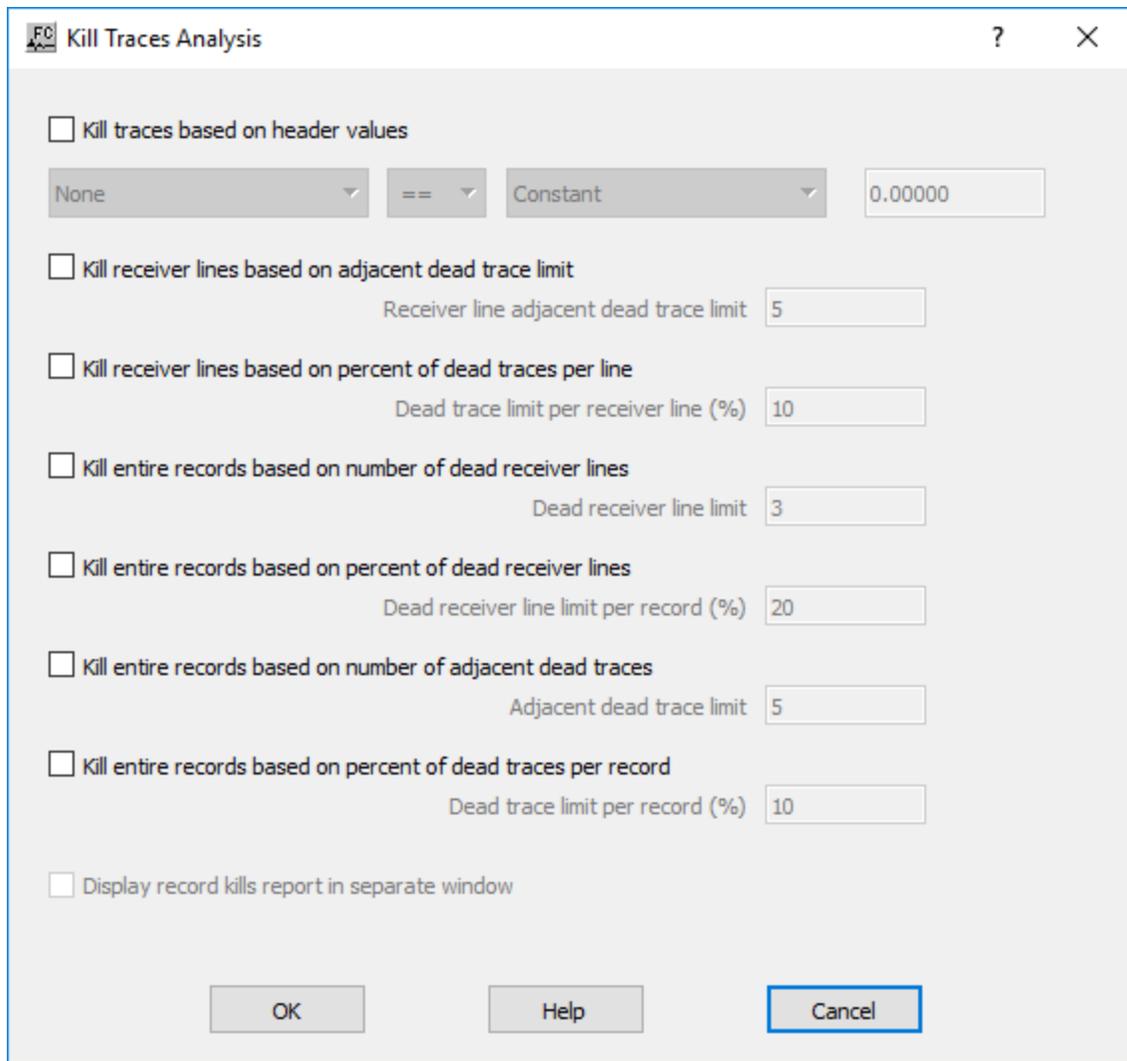
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Kill traces based on header values — If checked, traces will be killed based on the value stored on a user-defined trace header key word. Traces can be killed after some mathematical operations are performed with the selected traces header key word.

Kill receiver lines based on adjacent dead trace limit — If checked, receiver lines will be killed depending on a limit of consecutive dead traces.

Receiver line adjacent dead trace limit — Enter the minimum number of consecutive dead traces a receiver line must have to be killed.

Kill receiver lines based on percent of dead trace per line — If checked, receiver lines will be killed depending on the percentage of dead traces.

Dead trace limit per receiver line (%) — Enter the minimum percentage of dead traces a receiver line must have to be killed.

Kill entire records based on number of dead receiver lines — If checked, records are killed depending on the number of dead receiver lines.

Dead receiver line limit per record (%) — Enter the minimum percentage of dead receiver lines a record must have to be killed.

Kill entire records based on number of adjacent traces — If checked, records are killed depending on a limit of consecutive dead traces.

Adjacent dead trace limit — Enter the minimum number of consecutive dead traces a record must have to be killed.

Kill entire records based on percent of dead traces per record — If checked, records are killed depending on the percentage of dead traces per record.

Dead trace limit per record (%) — Enter the minimum percentage of dead traces a record must have to be killed.

Frequency Analysis

Usage: The *Frequency Analysis* step computes frequency related seismic attributes in distinct time windows from an input seismic file. Seismic attributes may be compute from single or multi-channel. Aavailable seismic attributes are dominant frequency, center frequency, average frequency, RMS frequency, bandwith or peak amplitude. Computed attributes can be stored in

Input Links:

1) Seismic data in any sort order (mandatory).

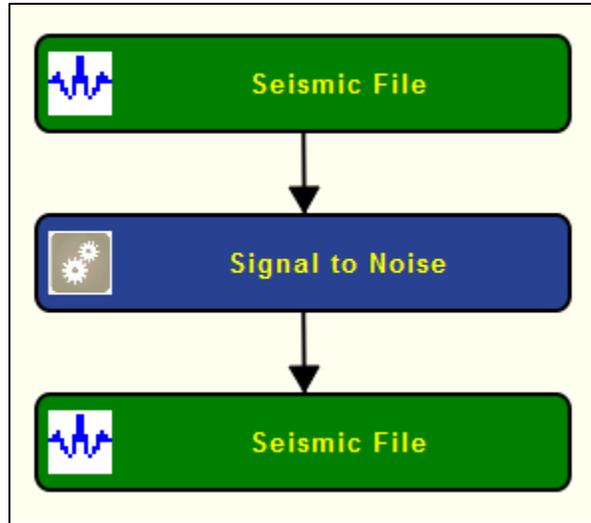
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Window	Start(ms)	Length (ms)	Apply LMO	Velocity value	Limit offset	Minimum	Maximum	Absolute	Output trace header
<input checked="" type="checkbox"/> 1	0	1000	<input type="checkbox"/> Apply	2000	<input type="checkbox"/> Limit	0	0	<input type="checkbox"/> Yes	User defined 1
<input type="checkbox"/> 2	1000	1000	<input type="checkbox"/> Apply	2000	<input type="checkbox"/> Limit	0	0	<input type="checkbox"/> Yes	User defined 2
<input type="checkbox"/> 3	2000	1000	<input type="checkbox"/> Apply	2000	<input type="checkbox"/> Limit	0	0	<input type="checkbox"/> Yes	User defined 3

Parameter Description:

Analysis Type: Specify if the analysis is to be performed in single- or multi-channel.

Single-channel — If selected, frequency analysis attribute will be computed on each single-channel of the current record.

Multi-channel — If selected, frequency analysis attribute will be computed on all the traces of the current record.

Single-channel average — **Not yet available.**

Attribute type: Specify the type of frequency attribute to be computed for the analysis.

Dominant frequency — If selected, computes the dominant frequency of the signal.

Center frequency — If selected, computes the center frequency of the signal.

Bandwidth — If selected, computes the bandwidth the signal.

Average frequency — If selected, computes the average frequency of the signal.

RMS frequency — If selected, computes the root mean square frequency of the signal.

Peak Amplitude — If selected, computes the peak amplitude of the signal.

Time space window: Specify the spatial/time extent where the calculation of the frequency attribute will be computed.

Window — Check how many windows will be used for the analysis. A maximum of three windows can be used.

Start (ms) — Enter the start time (upper boundary) in milliseconds where the calculation will be done.

Length (ms) — Enter the length of the time window in milliseconds where the calculation will be done.

Apply LMO — If checked a linear moveout (LMO) will be applied to the data before computing the analysis

Velocity value — Enter the velocity value to be used for the LMO correction.

Limit offset — If checked limit the selection of traces based on the offset.

Minimum — Enter the minimum offset where the calculation will be done.

Maximum — Enter the maximum offset where the calculation will be done.

Absolute — If checked uses the absolute value of the offset defined.

Output trace header — Select the trace header key word where the attribute calculation will be stored.

Signal to Noise

Usage:

The *Signal to Noise* step provides a statistical estimate of the signal to noise ratio of the selected seismic data. The results of the process are output into a user-defined trace header key word.

Input Links:

1) Seismic data in any sort order (mandatory).

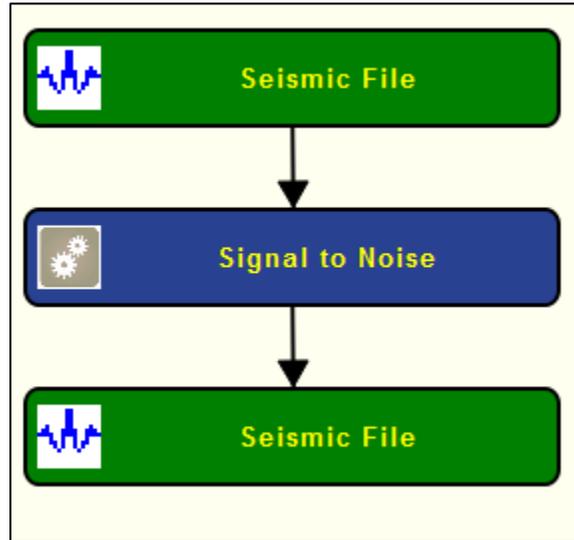
Output Links:

1) Seismic data in any sort order (mandatory).

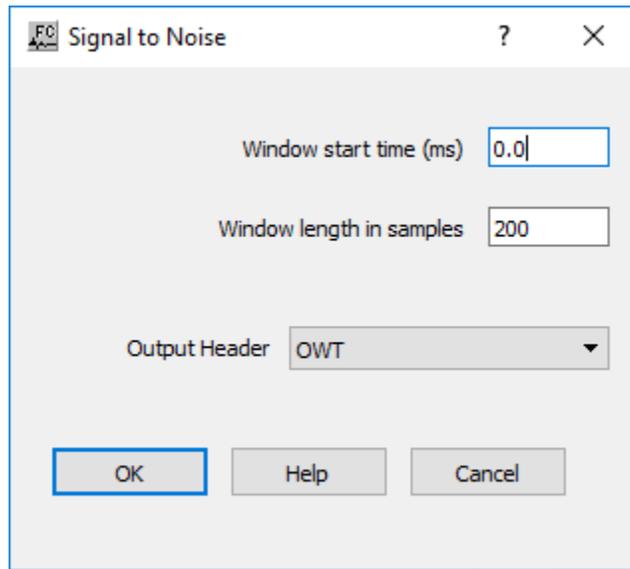
Reference:

Hatton, L., Worthington, M.H. and Makin, J. 1986, Seismic Data Processing, Theory and Practice.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Window start time (ms) — Enter the starting time of the analysis window on the trace data.

Window length in samples — Enter the length of the analysis window in samples.

Output Header — Select the trace header field to store the results of the signal to noise calculation.

Signal to Noise Attribute

Usage:

The *Signal to Noise Attribute* step provides a statistical estimate of the signal to noise ratio of the selected seismic data based on different metrics (average power, average RMS and average absolute) considering user-defined distinct signal and noise windows within the seismic data. The results of the process are output to user defined trace header locations and records can be automatically flagged depending on the computed attribute value.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data in any sort order corresponding to a noise record (optional).

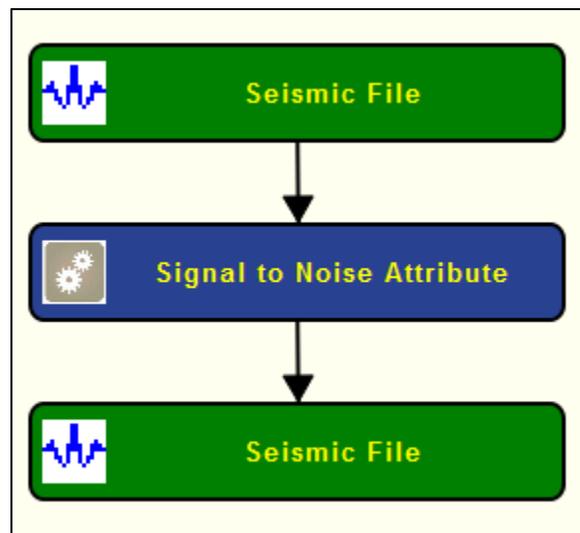
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

The screenshot shows the 'S/N Attribute' dialog box with the following settings:

- Parameterization method:**
 - Specify windows
 - Specify velocity
- Specify windows (selected):**
 - Signal window start time (ms): 0.00
 - Signal window end time (ms): 50.00
 - Noise window start time (ms): 50.00
 - Noise window end time (ms): 100.00
 - Signal window minimum channel group: 1.0
 - Signal window maximum channel group: 12.0
 - Noise window minimum channel group: 1.0
 - Noise window maximum channel group: 12.0
- Specify velocity (selected):**
 - Reference velocity: 1480.00
 - Signal window start time below velocity (ms): 0.00
 - Noise window start time below velocity (ms): 50.0
 - Signal window length (ms): 50.00
 - Noise window length (ms): 100.00
 - Signal window minimum channel group: 1.00
 - Noise window minimum channel group: 1.0
 - Signal window maximum channel group: 12.00
 - Noise window maximum channel group: 12.00
- Use auxiliary noise record:**
 - Signal window start time (ms): 0.00
 - Signal window end time (ms): 50.00
 - Signal window minimum channel group: 1.0
 - Signal window maximum channel group: 12.0
- Compare S/N ratio in the frequency domain:**
 - % of overlapping area: 0.75
 - Minimum frequency (Hz): 200.00
 - Maximum frequency (Hz): 2000.00
 - Signal window start time (ms): 0.00
 - Signal window end time (ms): 50.00
 - Noise window start time (ms): 50.00
 - Noise window end time (ms): 100.00
 - Signal window minimum channel group: 1.0
 - Signal window maximum channel group: 12.0
 - Noise window minimum channel group: 1.0
 - Noise window maximum channel group: 12.0
- Output headers:**
 - Top mute length (ms): 0.25
 - Bottom mute length (ms): 0.25
 - Minimum S/N ratio: 0.00
 - Output average power header: User defined 1
 - Output average power Flag: User defined 4
 - Output average RMS header: User defined 2
 - Output average RMS Flag: User defined 5
 - Output average absolute header: User defined 3
 - Output average absolute Flag: User defined 6
- Calculation method:**
 - Record basis
 - Trace by trace
 - Change noise window at each record
- Report file:**
 - File Browse...: Y:/WindowsBackupStuff/DATA/Geosurveys3D/Report/SignalToNoiseReport.txt
 - Append to existing file

Parameter Description:

Parameterization method: Specify the space/time extent of signal and noise windows.

Specify windows — If selected, specify signal and noise windows manually by defining start and end time interval and minimum and maximum channel group considered for the calculation. These windows will be fixed for all the records in the input seismic file.

Signal window start time (ms) — Enter the signal window start time (upper boundary) in milliseconds.

Signal window end time (ms) — Enter the signal window end time (lower boundary) in milliseconds.

Signal window minimum channel group — Enter the minimum channel to be considered in the signal window.

Signal window maximum channel group — Enter the maximum channel to be considered in the signal window.

Noise window start time (ms) — Enter the noise window start time (upper boundary) in milliseconds.

Noise window end time (ms) — Enter the noise window end time (lower boundary) in milliseconds.

Noise window minimum channel group — Enter the minimum channel to be considered in the noise window.

Noise window maximum channel group — Enter the maximum channel to be considered in the noise window.

Use auxiliary noise record — If selected, the noise window is computed from an auxiliary seismic file containing a single noise record. Signal window is defined manually and fixed for all input records.

Signal window start time (ms) — Enter the signal window start time (upper boundary) in milliseconds.

Signal window end time (ms) — Enter the signal window end time (lower boundary) in milliseconds.

Signal window minimum channel group — Enter the minimum channel to be considered in the signal window.

Signal window maximum channel group — Enter the maximum channel to be considered in the signal window.

Compare S/N ratio in the frequency domain — If selected, the signal-to-noise ratio is estimated from the overlap between the amplitude spectra of signal and noise windows.

% of overlapping area — Enter the percentage of overlapping area of frequency spectra where the estimate is going to be computed.

Minimum frequency (Hz) — Enter the minimum frequency in hertz of the spectra to be considered for the estimate.

Maximum frequency (Hz) — Enter the maximum frequency in hertz of the spectra to be considered for the estimate.

Signal window start time (ms) — Enter the signal window start time (upper boundary) in milliseconds.

Signal window end time (ms) — Enter the signal window end time (lower boundary) in milliseconds.

Signal window minimum channel group — Enter the minimum channel to be considered in the signal window.

Signal window maximum channel group — Enter the maximum channel to be considered in the signal window.

Noise window start time (ms) — Enter the noise window start time (upper boundary) in milliseconds.

Noise window end time (ms) — Enter the noise window end time (lower boundary) in milliseconds.

Specify velocity — If selected, signal and noise windows are defined based on a reference velocity varying linearly with the offset.

Reference velocity — Enter a reference velocity to be used to define the location of the start time of the signal and noise windows.

Signal window start time below velocity (ms) — Enter the start time in milliseconds below the initial time computed from the reference velocity

Signal window length (ms) — Enter the signal window length in milliseconds

Signal window minimum channel group — Enter the minimum channel to be considered in the signal window.

Signal window maximum channel group — Enter the maximum channel to be considered in the signal window.

Noise window start time below velocity (ms) — Enter the start time in milliseconds below the initial time computed from the reference velocity

Noise window length (ms) — Enter the signal window length in milliseconds

Noise window minimum channel group — Enter the minimum channel to be considered in the noise window.

Noise window maximum channel group — Enter the maximum channel to be considered in the noise window.

Calculation method: Specify how if the signal to noise ratio is computed either on a record or trace-by-trace basis.

Record basis — If selected, estimate is based on the current record as a whole.

Trace by trace — If selected, the estimate is based on a trace-by-trace calculation.

Change noise window at each record — If checked, the noise window changes at each record. If unchecked, noise window changes at each record.

Output headers: Specify the location of the trace header key words where the attribute will be stored.

Top mute length (ms) — Enter the length of the top mute to be applied to both windows.

Bottom mute length (ms) — Enter the length of the bottom mute to be applied to both windows.

Minimum S/N ratio — Enter the minimum signal-to-noise ratio for a record to be considered bad.

Output average power header — Select the trace header location where the signal-to-noise ratio computed using the average power will be stored.

Output average power flag — Select the trace header location where the record flag based on the signal-to-noise ratio computed using the average power will be stored.

Output average RMS header — Select the trace header location where the signal-to-noise ratio computed using the average RMS will be stored.

Output average RMS flag — Select the trace header location where the record flag based on the signal-to-noise ratio computed using the average RMS will be stored.

Output average absolute header — Select the trace header location where the signal-to-noise ratio computed using the average absolute will be stored.

Output average absolute flag — Select the trace header location where the record flag based on the signal-to-noise ratio computed using the average RMS will be stored

Report file — Specify whether to save results to a report file and browse to locate or create an amplitude analysis report file.

Append to existing file — If checked, append report to existing report file.

Source Energy Estimation

Usage:

The *Source Energy Estimation* step computes an estimate of the source energy-to-noise ratio based on an analysis of samples values prior to and following the arrival of first break energy. A text file is output that contains, for each source location, an estimate of (1) the energy-to-noise ratio, (2) the average energy, and (3) the average noise

Input Links:

1. Seismic data in source order (mandatory).
2. An Early Mute card containing reference times to the start of analysis. Typically, these would be picked at the time of the first arrivals. (mandatory).

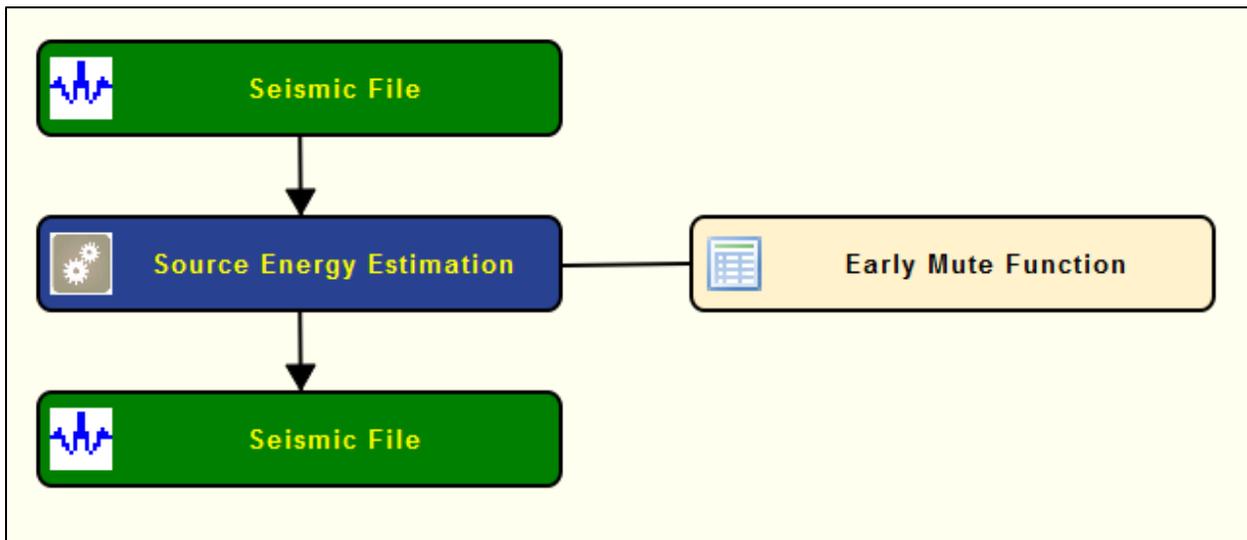
Output Links:

- 1) Seismic data in source order (mandatory).

References

-

Example Flowchart:



Step Parameter Dialog:

The dialog box titled "fcsourceenergyestimation" contains the following fields and controls:

- Noise window specification:**
 - Start time above mute (ms): 100.0
 - Window length in samples: 32
- Data window specification:**
 - Start time below mute (ms): 100.0
 - Window length in samples: 32
- Offset window specification:**
 - First offset in window: 0.000
 - Last offset in window: 1000.000
- Output header:** None (dropdown menu)
- Report file:**
 - Browse... button
 - Text field: ATA/HOW3D_FG/Report/SourceEnergyEstimationReport.txt
 - Display report in separate window
- Buttons:** OK, Help, Cancel

Parameter Description:

Noise window specification: Specify the window for the analysis of noise.

Start Time above mute (ms) — Enter the time above the mute to start the analysis.

Window length (samples) — Enter the number of samples used to determine the noise estimate.

Data window specification: Specify the window for the analysis of noise.

Start Time above mute (ms) — Enter the time above the mute to start the analysis.

Window length (samples) — Enter the number of samples used to determine the signal estimate.

Offset window specification: Specify the window in terms of offset for the analysis of noise.

First offset window — Enter the first offset where the noise analysis will be done.

Last offset window — Enter the last offset where the noise analysis will be done.

Output Header — Indicate the trace header field to store the results of the source-energy estimate.

Report file: Specify file name path for the report.

Browse — Specify the name of the text file (*.txt) that will contain the results of the analysis.

Display report in separate window — If checked, report file is automatically shown in a separate window.

Spectral Comparison

Usage:

The *Spectral Comparison* step computes the spectral semblance between an input seismic and a reference seismic trace as selected from the input record or from an auxiliary seismic file with a pilot signature. The comparison against a pilot signature can be done based on a user-defined trace header location. Traces are flagged as bad or good depending on the value of semblance.

Input Links:

- 1) Seismic data in source order (mandatory).
- 2) An auxiliary seismic file with a signature can be used for the comparison (optional).

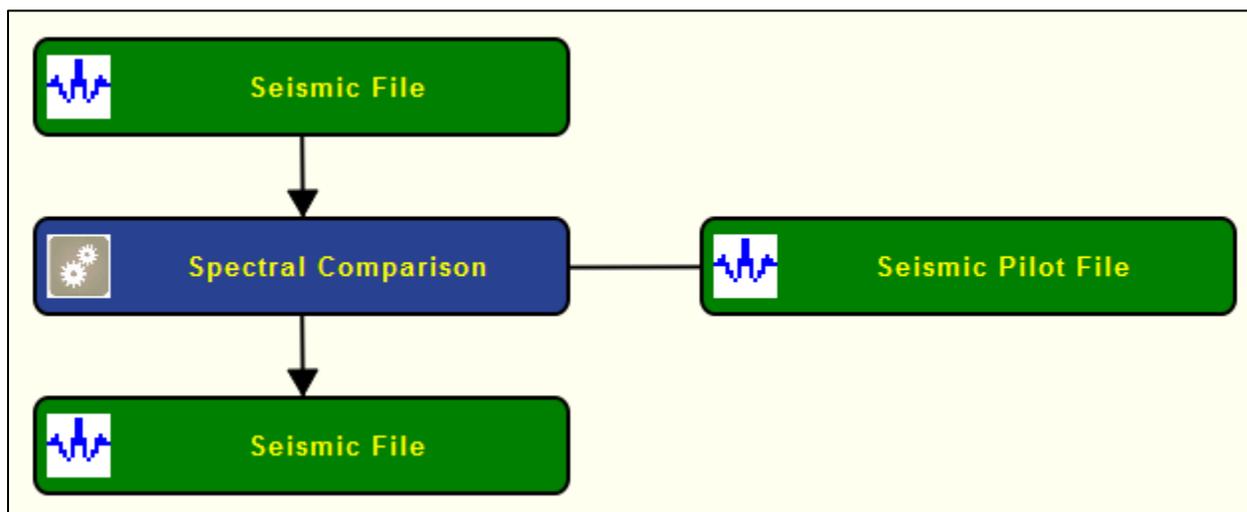
Output Links:

- 1) Seismic data in source order (mandatory).

References

-

Example Flowchart:



Step Parameter Dialog:

Signature comparison input

- One signature per dataset from auxiliary seismic file
- One signature per record from input data file
Input channel number: 1
- Match signature based on trace header
Select header location for source number: User defined 3
- Mean signature per record from input data file
Minimum channel number: 1
Maximum channel number: 1
- Compare to average of prior traces in dataset
Number of prior traces in rolling window: 10
- Calculate spectral semblance on receiver line basis
Start time for signature analysis (ms): 0.0
End time for signature analysis (ms): 2000.0

Remove DC bias

- Use remove DC bias filter
- DC calculation method:
 - Mean
 - Median
 - (Min+Max)/2
- Gather average:
 - Use running average across prior gathers
Maximum number of gathers to average: []
- Channel average:
 - Use running average across channels
Number of channels to average: 7.0
- DC calculation window:
 - Calculate DC in a window
Start time (ms): 0.0
End time (ms): 100.0

Filtering

- Apply low-cut filter
Low-cut corner frequency (Hz): 9
Low-cut rolloff rate (dB/oct): 18
- Apply high-cut filter
High-cut corner frequency (Hz): 72
High-cut rolloff rate (dB/oct): 18

Attribute

- Select output header location for spectral semblance: User defined 1
- Select output header location for quality flag: User defined 2

Scale spectra at reference dB level: -48

Spectral semblance cutoff (percent): 70.00

Start time for analysis (ms): 0.0
End time for analysis (ms): 2000.0

Report file

- Output Report File
- Append to existing file
- Display report in separate window

Audio alarm

Percent (%) limit of failed traces: 5.0

Volume test: [Speaker icon]

Low [Slider] High

Alarm volume

Alarm Browse... //vmware-host/Shared Folders/Documents/spw/warning.mp3

OK Help Cancel

Parameter Description:

Signature comparison input: Specify the signature to be used for comparison

One signature per dataset from auxiliary seismic file — If selected, signature is defined by the first trace of the auxiliary pilot seismic file.

One signature per record from input data file — If selected, the signature is defined by the channel number of the input record from input seismic file.

Input channel number — Enter the channel number to be used as signature.

Match signature based on trace header — If selected, signature is from an auxiliary pilot file and matched against current record based on the value of a user-defined trace header location.

Select header location for source number — Select the location of the header to be used as reference between signature and input seismic file.

Mean signature per record from input data file — If selected, signature is computed as the average of a user-defined range of traces.

Minimum channel number — Enter the minimum channel number to be used for the mean signature.

Maximum channel number — Enter the maximum channel number to be used for the mean signature.

Compare to average of prior traces in dataset — If selected, signature is defined as the average of the number of prior traces defined in a rolling window.

Number of prior traces in rolling window — Enter the number of prior traces in a rolling window to be used for the average of the signature.

Calculate spectral semblance on receiver line basis — If selected, signature is defined as the average along a receiver line.

Start time for signature analysis (ms) — Enter the start time (upper boundary) in milliseconds of the time window for the signature analysis.

End time for signature analysis (ms) — Enter the end time (lower boundary) in milliseconds of the time window for the signature analysis.

Remove DC bias: Specify if a DC remove bias filter will be applied to the input seismic file before computing the spectral semblance.

Use remove DC bias filter — If checked applies a *Remove DC bias* step to the input seismic file. The filter is not stored in the output seismic file, it is only applied before the calculations of the spectral semblance.

DC calculation method: select the method to estimate the DC bias.

Mean — If selected, estimates the DC bias as the mean of the seismic samples considered.

Median — If selected, estimates the DC bias as the median of the seismic samples considered.

(Min+Max)/2 — If selected, estimates the DC bias as central value between the min and max of the seismic samples considered.

Channel Average: DC bias may be estimated using a moving window running through channels in order to increase the reliability of the estimate.

Use running average across channels — If checked the DC bias is estimate taking into account a moving window computed across channels.

Number of channels to average — Enter the number of channels that belong to the moving window.

Gather Average: DC bias may be estimated using a moving window running through gathers (or records) in order to increase the reliability of the estimate.

Use running average across prior gathers — If checked the DC bias is estimate taking into account a moving window computed across prior gathers.

Number of gathers to average — Enter the number of gathers that belong to the moving window.

DC calculation window: define the time gate where the calculation is going to be computed.

Calculate DC in a window — If checked, only the entered window of each trace will be used to calculate the DC.

Start time (ms) — Enter the start time of the window to be used for calculating the DC value.

End time (ms) — Enter the end time of the window to be used for calculating the DC value.

Filtering:

Apply low-cut filter — If checked applies to the input seismic file a zero-phase Butterworth filter to the input seismic data before computing the spectral semblance. The filter is only applied to the input file and not store in the output seismic file.

Low-cut filtering: Specify low-cut filter parameters.

Apply low-cut filter — If checked, a low-cut filter will be applied to your data.

Low-cut corner frequency (Hz) — Enter the low half-power frequency in Hertz to be applied to your data. The amplitude of this frequency will be reduced by a factor of two relative to the input.

Low-cut rolloff rate (dB/oct) — Enter the low rolloff filter slope in decibels per octave to be applied to your data. Higher numbers give steeper rolloff.

High-cut filtering: Specify high-cut filter parameters.

Apply high-cut filter — If checked, a high-cut filter will be applied to your data.

High-cut corner frequency (Hz) — Enter the high half-power frequency in Hertz to be applied to your data. The amplitude of this frequency will be reduced by a factor of two relative to the input.

High-cut rolloff rate (dB/oct) — Enter the high rolloff filter slope in decibels per octave to be applied to your data. Higher numbers give steeper rolloff.

Attribute: Specify the trace header location where the spectral semblance and flags will be stored.

Select output header location for spectral semblance — Select the trace header location where the value of spectral semblance will be store.

Select output header location for quality flag — Select the trace header location where the flag of good or bad trace will be stored.

Scale spectra at reference dB level — If checked, spectra of inut and signature are scaled at a refecence level.

Spectral semblance cutoff (percent) — Enter the semblance cutoff value in percentage to distinguish between good and bad traces.

Start time for analysis (ms) — Enter the start time (upper boundary) in milliseconds of the time window for the analysis of the input seismic file.

End time for analysis (ms) — Enter the end time (lower boundary) in milliseconds of the time window for the analysis of the input seismic file.

Report file: Specifies if a report file is generated

Output Report file — If checked, outputs a report file with a unique name idenfier.

Audio alarm: Specifies alarm depending on the number of traces flagged as bad traces.

Percent (%) limit of failed traces — Enter the percent of failed traces to trigger the alarm

Alarm volume — Use slider to define the alarm volume

Alarm browse — Select an audio file to be used as alarm.

Trace Analysis Report

Usage:

The Trace Analysis Report creates a text file that contains list bad records, and optionally, a list of traces that were killed in the geometry application step.

Input Links:

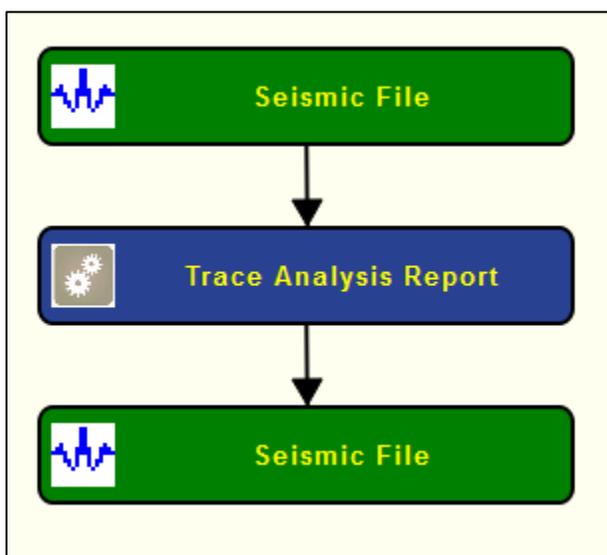
- 1) Seismic data in any sort order (mandatory).

Output Links:

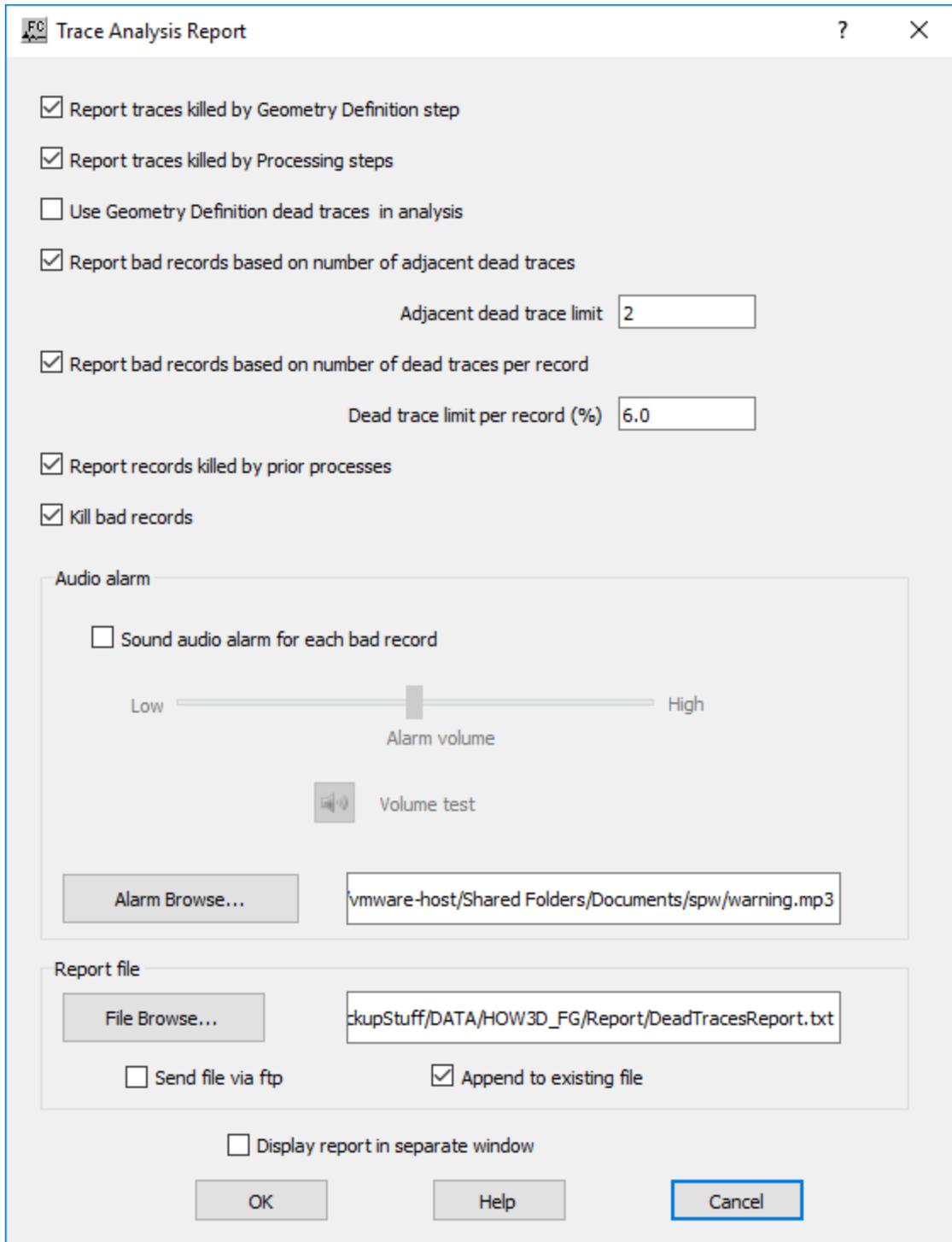
- 1) Seismic data in source order (mandatory).

References

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Step Parameter Dialog:



Parameter Description:

Report traces killed by Geometry Definition step — If checked, traces killed by a previous *Geometry Definition* step will be reported.

Report traces killed by processing steps — If checked, report traces killed by processing steps.

Use Geometry Definition dead traces in analysis — If checked, dead traces from *Geometry Definition* will be included in the analysis.

Report bad records based on adjacent dead traces — If checked, bad records are to be identified according to the number of adjacent dead traces.

Adjacent dead trace limit — Enter the number of adjacent dead traces that will cause the record to be considered “bad”, and therefore listed in the trace analysis report.

Report bad records based on number of dead traces per record — If checked, bad records are to be identified according to the number of adjacent dead traces.

Dead trace limit per record — Enter the maximum percentage of dead traces that will cause the record to be considered “bad”, and therefore listed in the trace analysis report.

Report records killed by prior process — If checked, traces killed by previous steps, e.g. by geometry definition, will be included in the report.

Kill bad records — If checked, bad records are killed from the input seismic file.

Audio alarm: Specifies alarm depending on the number of traces flagged as bad traces.

Percent (%) limit of failed traces — Enter the percent of failed traces to trigger the alarm

Alarm volume — Use slider to define the alarm volume

Alarm browse — Select an audio file to be used as alarm.

Report file — Specify whether to save results to a report file and browse to locate or create an amplitude analysis report file.

Append to existing file — If checked, append report to existing report file.

Seismic Data Steps

This section documents the seismic data types in SPW and the processes currently available for creating those data types.

Seismic Data
↑ Processing Categories
AutoSeis Real Time Seismic Input
AutoSeis Seismic Input
AutoSeis Seismic Output
Create Model Data
Frequency Cubes
Frequency Gathers
Frequency Maps
Real Time Seismic Input
SEG2 Import
SEGD Import
SEGY Export
SEGY Field Files Export
SEGY Field Files Import
SEGY Import
Seismic File
Select Traces
TCPIP Data Input
Update SEG Y Textheader
Virtual Tape Input

AutoSeis Real Time Seismic Input

Usage:

The *AutoSeis Real Time Seismic Input* step allows import AutoSeis seismic data format from the field into a single seismic file. Field data is imported automatically from a root directory. The output seismic files are by default set for nodes (receiver order).

Input Links:

None.

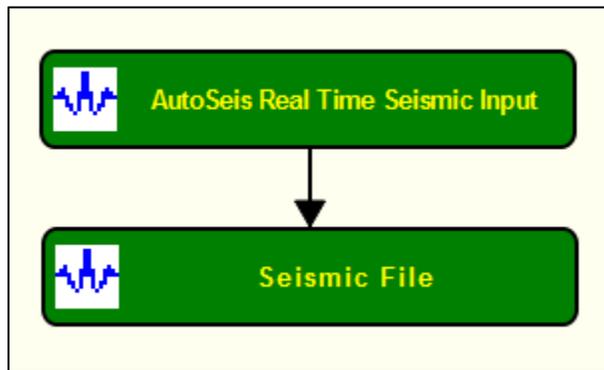
Output Links:

1) Seismic data in any sort order (mandatory).

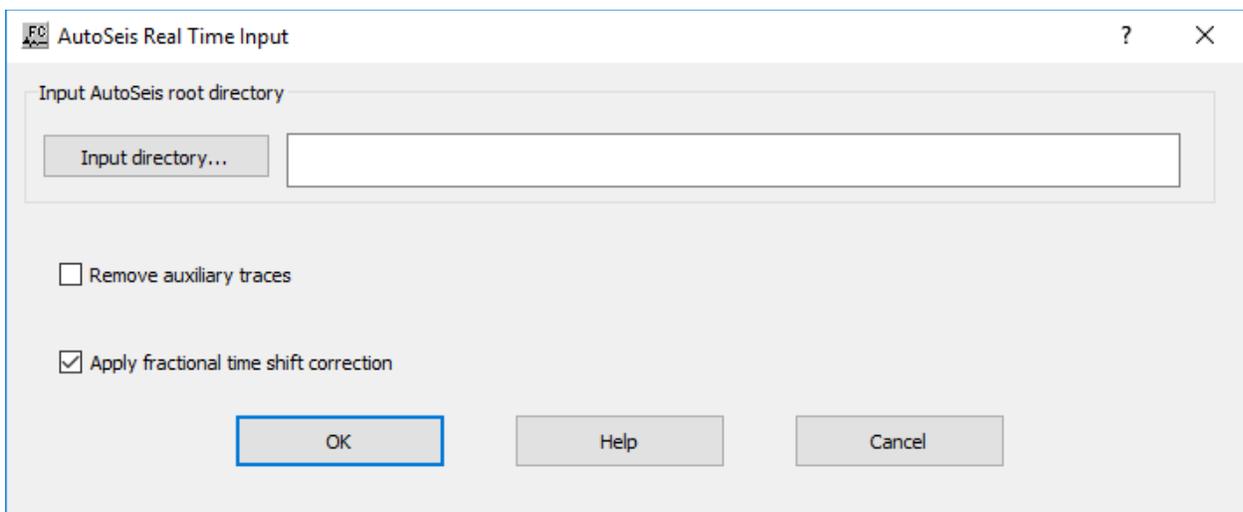
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input AutoSeis root directory: Specify AutoSeis root directory.

Input directory... — Browse for the directory where AutoSeis files are stored.

Remove auxiliary traces — If checked, auxiliary traces present in the input data are automatically removed from the output seismic file.

Apply fractional time shift correction — If checked apply fractional time shift correction to the input data.

AutoSeis Seismic Input

Usage:

The *AutoSeis Seismic Input* step allows import AutoSeis seismic data format from the field into a single seismic file. Field data is imported automatically from a root directory. The output seismic files are by default set for nodes (receiver order).

Input Links:

None.

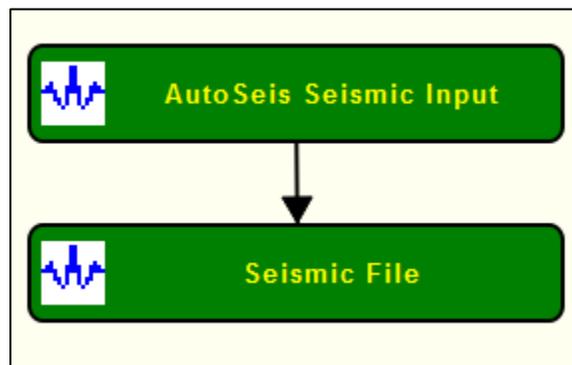
Output Links:

1) Seismic data in any sort order (mandatory).

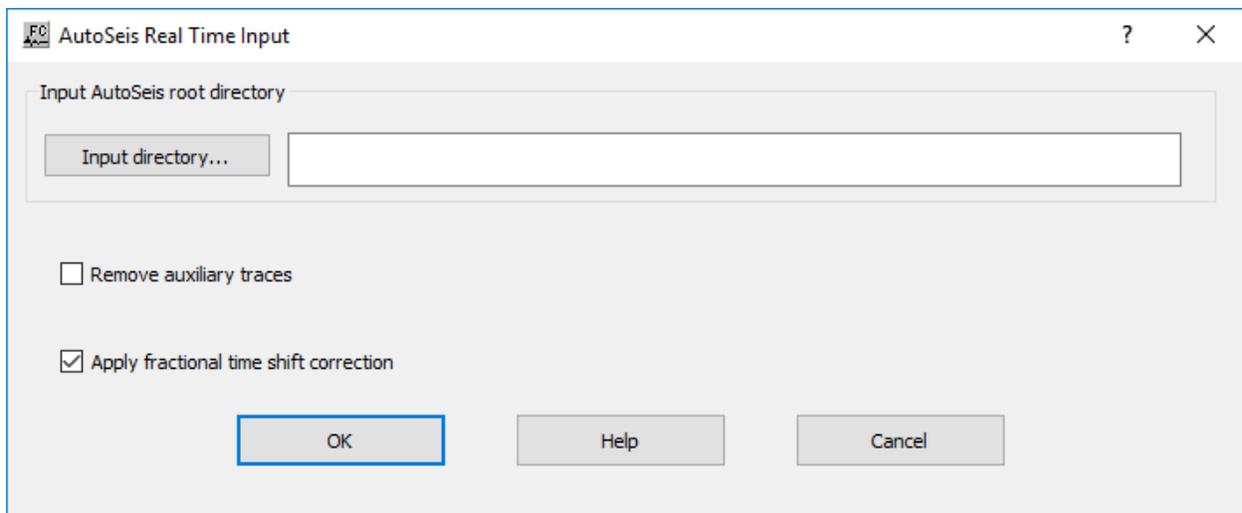
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input AutoSeis root directory: Specify AutoSeis root directory.

Input directory... — Browse for the directory where AutoSeis files are stored.

Remove auxiliary traces — If checked, auxiliary traces present in the input data are automatically removed from the output seismic file.

Apply fractional time shift correction — If checked apply fractional time shift correction to the input data.

AutoSeis Seismic Output

Create Model Data

Usage:

The *Create Model Data* step is a utility for testing purposes. It allows you to create synthetic data with specific number of events per record, the wavelet type, the number of records, the number of traces per record, the sample interval, the trace length, record and trace labeling parameters, and wavelet parameters for setting filtering frequencies.

Input Links:

None.

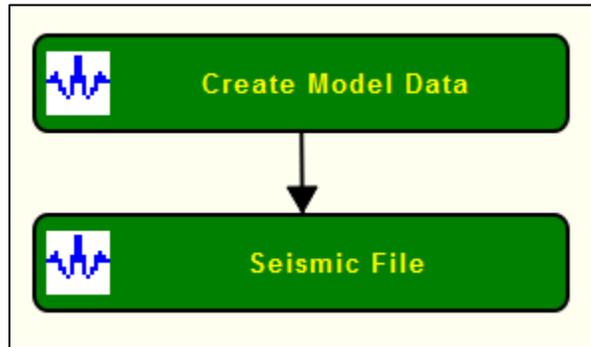
Output Links:

1) Seismic data in any sort order (mandatory).

References:

-

Example Flowchart:



Step Parameter Dialog:

Create Model Data

Number of events per record Wavelet type

General data parameters

Number of records Sample interval (ms)
Traces per record Trace length (ms)

Labelling parameters

First field file number First channel number
Field file increment Channel number increment

Wavelet parameters

Lo-cut frequency (Hz) Hi-cut frequency (Hz)
Lo-cut rolloff (dB/oct) Hi-cut rolloff (dB/oct)

Event	Start channel	Stop channel	Start time	Stop time	Amplitude
1	1	48	500.00	500.00	1.00

OK Help Cancel

Parameter Description:

Number of events per record — Enter the number of events per record to create.

Wavelet type — Select the wavelet type to use.

General data parameters: Specify the general data parameters.

Number of records — Enter the number of data records.

Sample interval (ms) — Enter the sample interval of the traces in milliseconds.

Traces per record — Enter the number of traces per record.

Trace length (ms) — Enter the trace length in milliseconds.

Labelling parameters: Specify labelling parameters for field files and channels.

First field file number — Enter the first field file number.

Field file increment — Enter the field file increment number.

First channel number — Enter the first channel number.

Channel number increment — Enter the channel number increment.

Wavelet parameters: Specify wavelet parameters.

Lo-cut frequency (Hz) — Enter the lo-cut filter frequency in Hertz.

Lo-pass frequency (Hz) — Enter the lo-pass filter frequency in Hertz.

Hi-pass frequency (Hz) — Enter the Hi-pass filter frequency in Hertz.

Hi-cut frequency (Hz) — Enter the Hi-cut filter frequency in Hertz.

Frequency Cubes

Usage:

The *Frequency Cubes* step computes frequency volumes from input seismic of SEG-Y files at specific frequencies. The output cubes are generated at specific frequencies inferred directly from the input seismic file or at user-defined frequencies. The output frequency volumes can also be sorted using user-defined sort order.

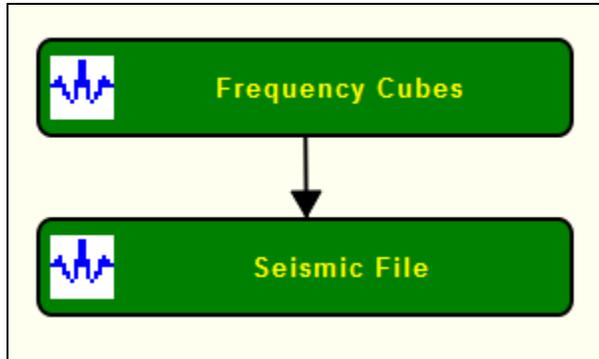
Input Links:

None.

Output Links:

- 1) Seismic data in selected processing sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Parameter Description:

Seismic file: Specify the location of the input seismic or SEG-Y file.

File Browse... — Select the input root file name. All the files sharing the same root name will be used as input.

SEG-Y format: Specify the input SEG-Y format.

Format Browse... — Select saved SEG-Y format. Browse for format file.

Create new SEG-Y format — Select to create a new SEG-Y format.

View existing SEG-Y format — Select to view current SEG-Y format.

SEG-Y index: Specify SEG-Y index parameters. If needed index file parameterization may be changed here.

Customize Index Map — Select to customize the index map of the input SEG-Y file.

View trace headers — Select to view the trace headers of the input SEG-Y file.

View trace header map — Select to view trace header map of the input SEG-Y file.

Save headers to a file — Select to save headers from input SEG-Y file into a file.

General dataset properties: Specify general properties of the input SEG-Y dataset. All these properties may be overwritten by the user. User-defined parameters will be used as parameter for the output seismic file.

Number of frequency cubes — Enter number of frequency cubes to be generated.

Number of traces per cube — Enter the number of traces per cube.

First output frequency — Enter first output frequency.

Last output frequency — Enter last output frequency.

Output frequency increment — Enter output frequency increment.

Sample format — Enter sample format.

Sample interval — Enter sample interval in milliseconds.

Samples per trace — Enter number of samples per trace.

Start time (ms) — Enter start time of the input dataset in milliseconds.

End time (ms) — Enter end time of the input dataset in milliseconds.

Processing sort order: Specify processing sort order. Output dataset will have selected sort order.

Primary sort key — Select primary sort key to be used during processing.

Limit Range — If checked, limit range based on primary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Secondary sort key — Select secondary sort key to be used during processing.

Limit Range — If checked, limit range based on secondary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Tertiary sort key — Select tertiary sort key to be used during processing.

Limit Range — If checked, limit range based on tertiary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Quaternary sort — Select quaternary sort key to be used during processing.

Limit Range — If checked, limit range based on quaternary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Create record at — Select criteria to create record.

Frequency Gathers

Usage:

The *Frequency Gather* step computes frequency gathers from input seismic of SEG-Y files at specific frequencies. The output cubes are generated at specific frequencies inferred directly from the input seismic file or at user-defined frequencies. The output frequency volumes can also be sorted using user-defined sort order.

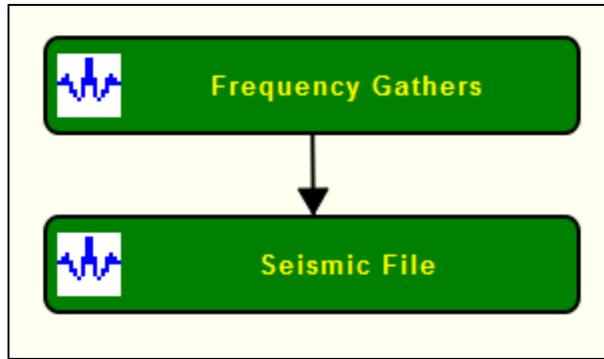
Input Links:

None.

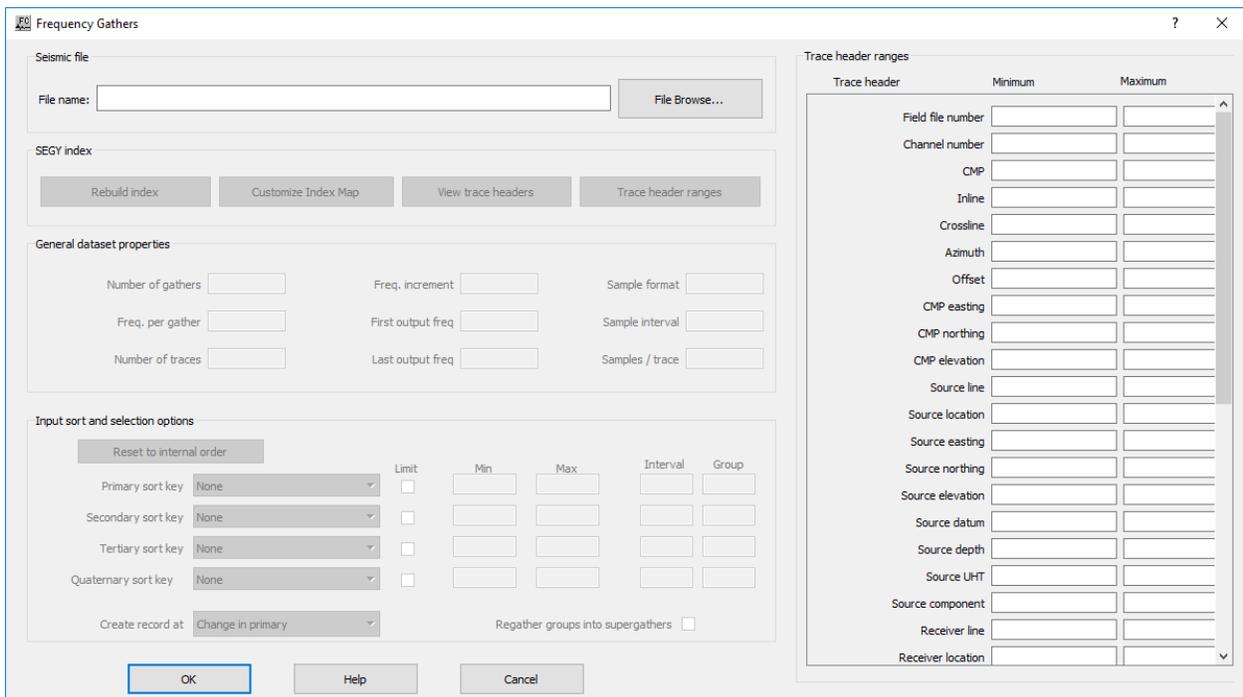
Output Links:

1) Seismic data in selected processing sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Seismic file: Specify the location of the input seismic file.

File Browse... — Select the input file name to be used in the analysis.

SEG-Y index: Specify SEG-Y index parameters. If needed index file parameterization may be changed here.

Rebuild index — Select to rebuild the index file of the input seismic file.

Customize index map — Select to customize the index map of the input seismic file.

View trace header — Select to view trace headers.

Trace header ranges — Select to update trace header ranges in *Trace header ranges*.

Trac header ranges: Specify the trace headers map into the index files and its ranges.

General dataset properties: Specify general properties of the input dataset. All these properties may be overwritten by the user. User-defined parameters will be used as parameter for the output seismic file.

Number of gathers — Enter the number of gathers of input seismic file.

Freq. per gather — Enter the number of frequencies per gather.

Number of traces — Enter the number of traces of the input seismic file to be analyzed

Freq. increment — Enter the frequency increment.

First output freq. — Enter the first output frequency.

Last output freq. — Enter the last output frequency

Sample format — Enter the sample format of the input seismic file.

Sample interval — Enter the sample interval of the input seismic file.

Samples/Trace — Enter the number of samples per trace.

Input sort and selection option: Specify the input sort order.

Reset internal order — Select to reset the sort order to the internal sort order of the input seismic file.

Primary sort key — Select primary sort key to be used during processing.

Limit Range — If checked, limit range based on primary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Secondary sort key — Select secondary sort key to be used during processing.

Limit Range — If checked, limit range based on secondary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Tertiary sort key — Select tertiary sort key to be used during processing.

Limit Range — If checked, limit range based on tertiary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Quaternary sort — Select quaternary sort key to be used during processing.

Limit Range — If checked, limit range based on quaternary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Create record at — Select criteria to create record.

Regather groups into supergathers — If checked, groups are regathers into supergathers.

Frequency Maps

Usage:

The *Frequency Maps* step computes frequency maps from input seismic of SEG-Y files at specific frequencies. The output cubes are generated at specific frequencies inferred directly from the input seismic file or at user-defined frequencies. The output frequency volumes can also be sorted using user-defined sort order.

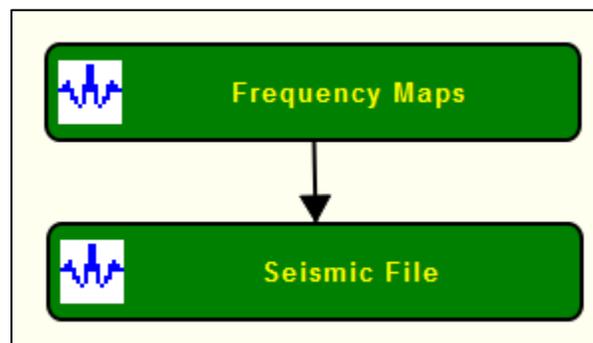
Input Links:

None.

Output Links:

1) Seismic data in selected processing sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Parameter Description:

Seismic file: Specify the location of the input seismic or SEG-Y file.

File Browse... — Select the input root file name. All the files sharing the same root name will be used as input.

SEG-Y format: Specify the input SEG-Y format.

Format Browe... — Select saved SEG-Y format. Browse for format file.

Create new SEG-Y format — Select to create a new SEG-Y format.

View existing SEG-Y format — Select to view current SEG-Y format.

SEG-Y index: Specify SEG-Y index parameters. If needed index file parameterization may be changed here.

Customize Index Map — Select to customize the index map of the input SEG-Y file.

View trace headers — Select to view the trace headers of the input SEG-Y file.

View trace header map — Select to view trace header map of the input SEG-Y file.

Save headers to a file — Select to save headers from input SEG-Y file into a file.

General dataset properties: Specify general properties of the input SEG-Y dataset. All these properties may be overwritten by the user. User-defined parameters will be used as parameter for the output seismic file.

Sample format — Enter sample format.

Sample interval — Enter sample interval in milliseconds.

Samples per trace — Enter number of samples per trace.

Number of times — Enter the number of times where the analysis is going to be performed.

Number of traces per map — Enter the number of traces per map.

Number of frequency cubes — Enter number of frequency cubes to be generated.

First output frequency — Enter first output frequency.

Last output frequency — Enter last output frequency.

Processing sort order: Specify processing sort order. Output dataset will have selected sort order.

Primary sort key — Select primary sort key to be used during processing.

Limit Range — If checked, limit range based on primary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Secondary sort key — Select secondary sort key to be used during processing.

Limit Range — If checked, limit range based on secondary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Tertiary sort key — Select tertiary sort key to be used during processing.

Limit Range — If checked, limit range based on tertiary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Quaternary sort — Select quaternary sort key to be used during processing.

Limit Range — If checked, limit range based on quaternary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Create record at — Select criteria to create record.

Real Time Seismic Input

Usage:

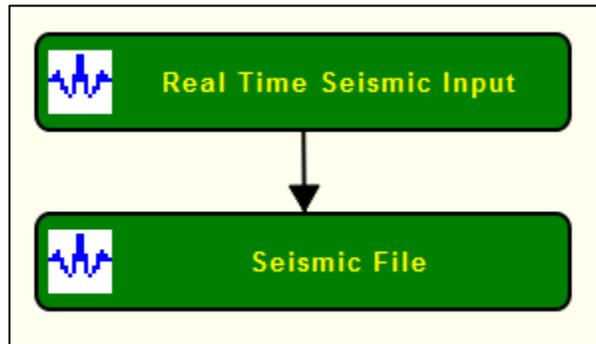
Input Links:

None.

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Parameter Description:

Input source: Specify either the input seismic is all the files at a given directory or at a specific file within the directory

Specify input directory — If selected, input data is defined as all the seismic files in the *Input directory*. Files will be loaded sequentially as defined in *File ordering*.

Specify input virtual tape device — Not yet implemented.

Specify starting input file — If selected, input data is defined starting from a user-defined seismic file. Files will be loaded sequentially as defined in *File ordering*.

Input directory... — Browse for input directory where seismic files are stored.

File ordering: Specify the sequential order used to load the seismic files.

Order files by timestamp — If selected, seismic files will be loaded by its timestamp, from older to newer.

Order files by name — If selected, seismic files will be loaded by alphabetically by its name.

Sum common shots on input — If checked, records with the same FFID will be summed together during the input.

Timing delay: Specify time delay of the input.

Delay processing of new records during real-time input — If checked, a delay will be added to the input of new records.

Check time sync... — Select to check time sync between acquisition and data input.

Length of time delay for each new file — Enter the delay time in seconds.

Data format — Enter the input data format from a set of standard data formats.

Remove auxiliary traces — If checked, traces flagged as auxiliary will be removed during the input.

SEG 2 Import

Usage:

The *SEG2 Import* step allows for direct input of SEG-2 formatted data from a disk file.

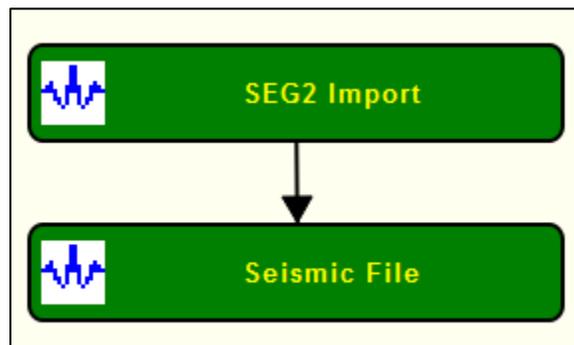
Input Links:

None. The SEG-2 disk file is selected in the SEG2 File dialog by means of a Browse button.

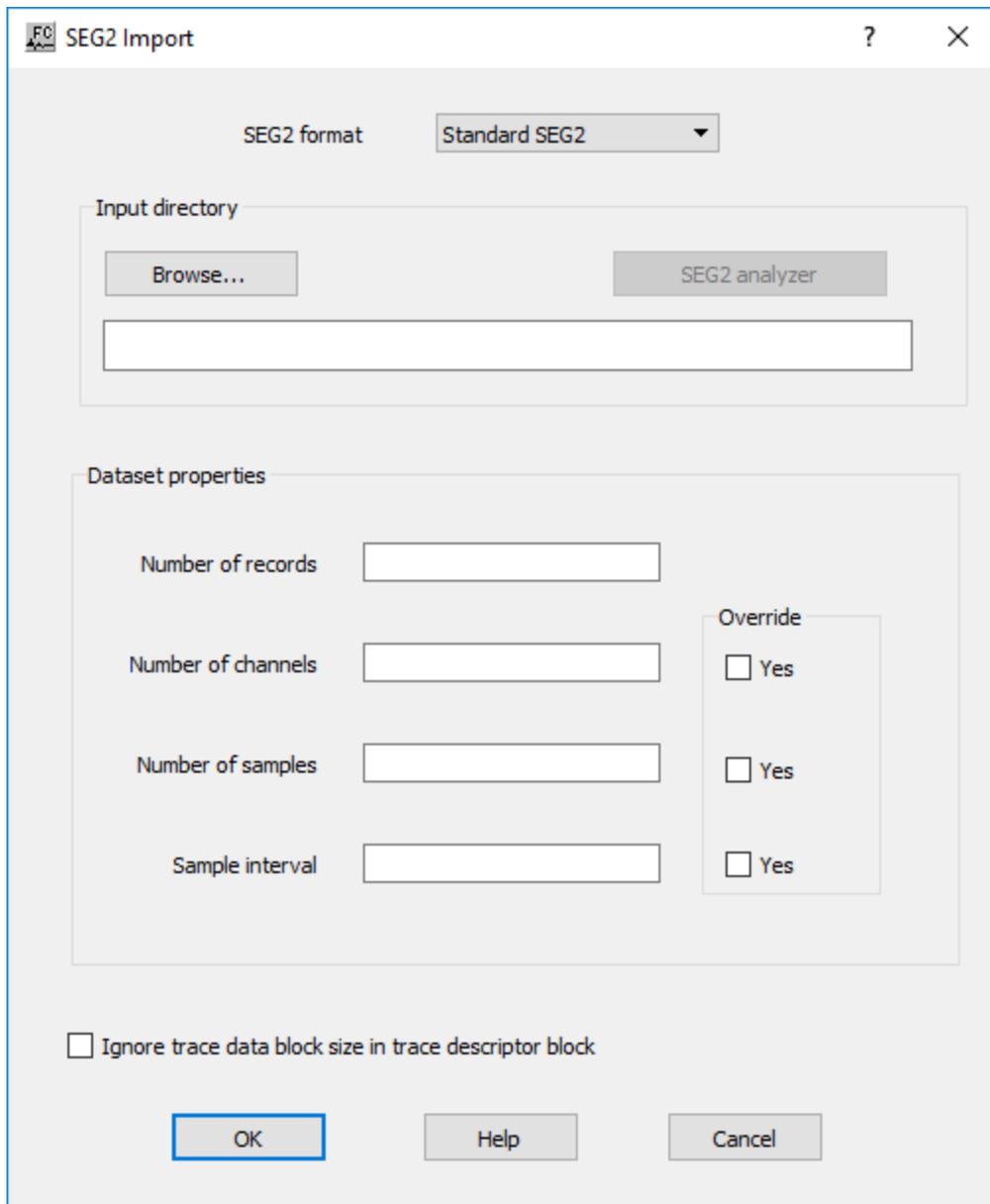
Output Links:

1) Seismic data file (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input directory: Specify input parameters.

Browse... — Select the SEG-2 disk file and set the input parameters. Click on the Browse button to select the SEG-2 disk file. Once the file has been selected, the values in the SEG-2 trace header indicating the number of records, the number of traces per record, the sample interval, and the number of samples per trace will be displayed in the SEG-2 File dialog. Be sure to confirm the verity of these values. If they are not as expected, an option exists to override these values so that the SEG-2 file may be successfully reformatted.

Dataset properties: Specify parameters related with the input SEG-2 file.

Number of records — Enter the number of records in the SEG-2 disk file inferred from the SEG-2 file header.

Number of channels — Enter the number of traces per record stored in bytes 6 and 7 of the SEG-2 file descriptor block.

Override — If checked, enter a value to overwrite the number of traces per record stored in the input file.

Number of samples — Indicates the number of samples per trace stored in bytes 8-11 of the SEG-2 trace descriptor block.

Override — If checked, enter a value to overwrite the number of samples per trace stored in the input file.

Sample interval (ms) — Indicates the sample interval stored in the appropriate sub-string of the SEG-2 file descriptor block.

Override — If checked, enter a value to overwrite the sample interval in milliseconds stored in the input file.

Ignore trace data blocks size in trace descriptor block — If checked, ignore trace data blocks size as defined in trace descriptor block.

SEG D Import

Usage:

The *SEG D Import* step allows for direct input of SEG-D formatted data from a disk file. Different standard SEG-D formats are available for import.

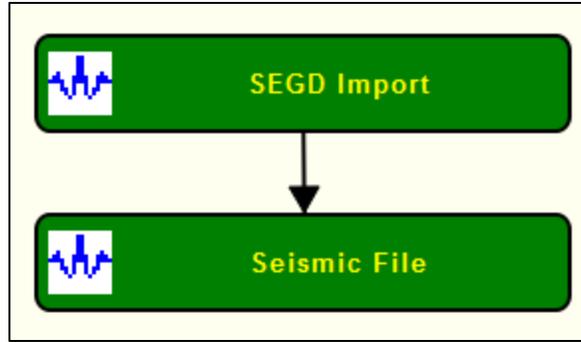
Input Links:

None. The SEG-2 disk file is selected in the SEG2 File dialog by means of a Browse button.

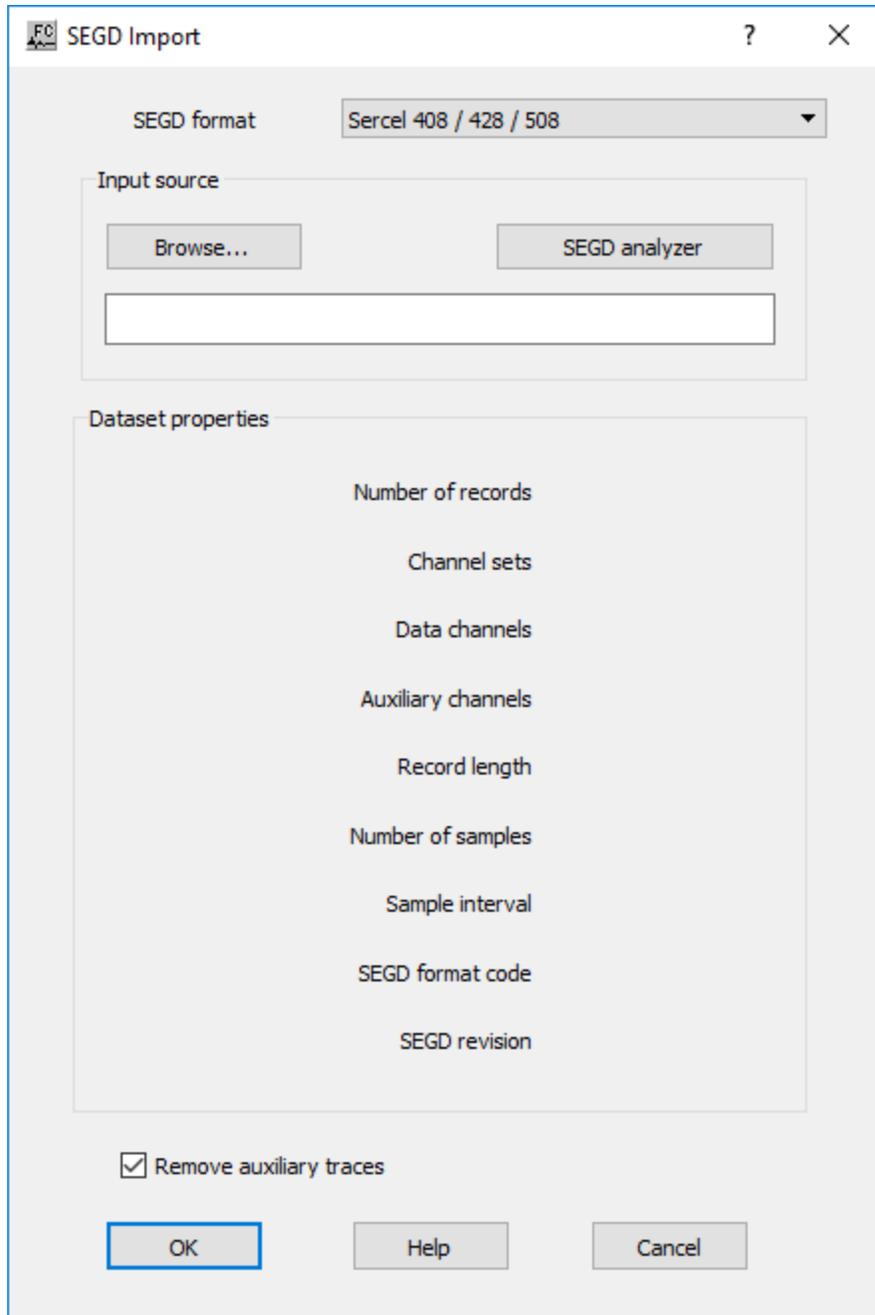
Output Links:

1) Seismic data file (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

SED Format — Select the SEG-D format available for data import. Available formats are *Sercel 408 / 428 / 508*, *Hydrosience NTRS S1*, *Geometrics*, *Farfield Nodal*, *Hydrosience NTRS SEG-D*, *GeoRes SEG-D*, *INOVA G3i*.

Browse... — Select the SEG-D disk file and set the input parameters. Click on the Browse button to select the SEG-D disk file. Once the file has been selected, the values stored in the SEG-D trace header indicating the number of records, channel stes, data channels, auxiliary channels, record length, number of samples, sample interval, SEG format code, SEG revision are displayed in the *Dataset properties* box.

SEG Y Export

Usage:

The *SEG Y Export* allows for direct output of seismic files into a formatted data SEG-Y.

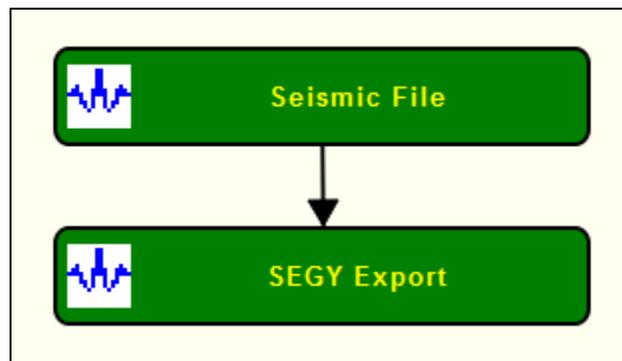
Input Links:

1) Seismic data file (mandatory).

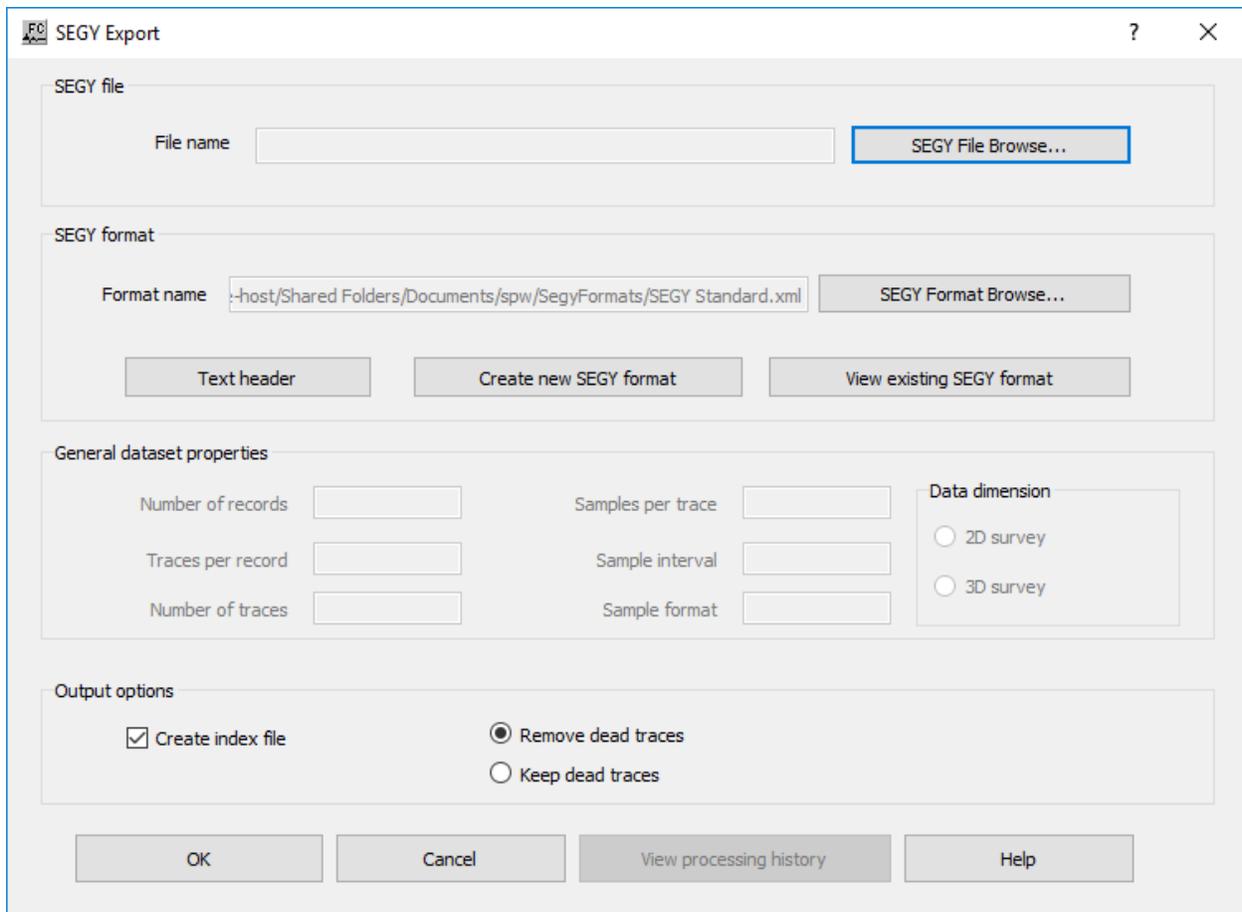
Output Links:

None.

Example Flowchart



Step Parameter Dialog:



Parameter Description:

Seismic file: Specify the location and name for the output seismic file.

File Browse... — Browse for the output directory and define output file name.

SEGY format: Specify the input SEG-Y format.

SEGY Format Browse... — Select saved SEG-Y format. Browse for format file.

Create new SEGY format — Select to create a new SEG-Y format.

View existing SEGY format — Select to view current SEG-Y format.

General dataset properties: Specify general properties of the input dataset. All these properties may be overwritten by the user. User-defined parameters will be used as parameter for the output seismic file.

Number of records — Enter the number of records in the input seismic file.

Traces per record — Enter the number of traces per record.

Number of traces — Enter the number of traces in the input seismic file.

Samples per trace — Enter the number of samples per trace in the input seismic file.

Sample interval — Enter the sample interval of the input seismic file in milliseconds

Sample format — Enter the sample format of the input seismic file.

Data dimesion: Specify the dimension of the input data.

2D survey — If selected, input data is two-dimensional.

3D survey — If selected, input data is three-dimensional.

Output options: Specify options of the output SEG-Y file.

Create index file — If checked, create index file for output SEG-Y file.

Remove dead traces — If checked, traces flagged as dead are removed from the outpu SEG-Y file.

Keep dead traces — If checked, traces flagged as dead are not removed from the output SEG-Y file.

SEG Y Field Export

Usage:

The *SEG Y Field Export* step allows for direct output of SEG Y formatted data from specific trace header fields of an input seismic file. It exports seismic files as field SEG-Y data

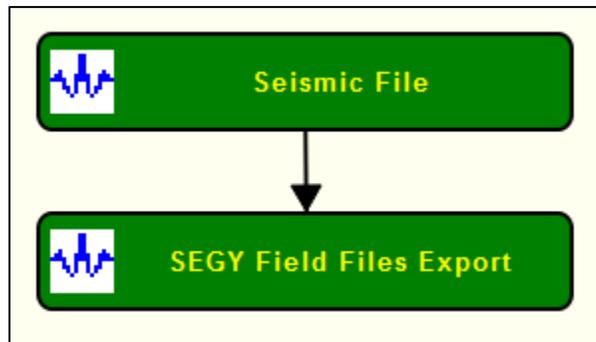
Input Links:

1) Seismic data file (mandatory).

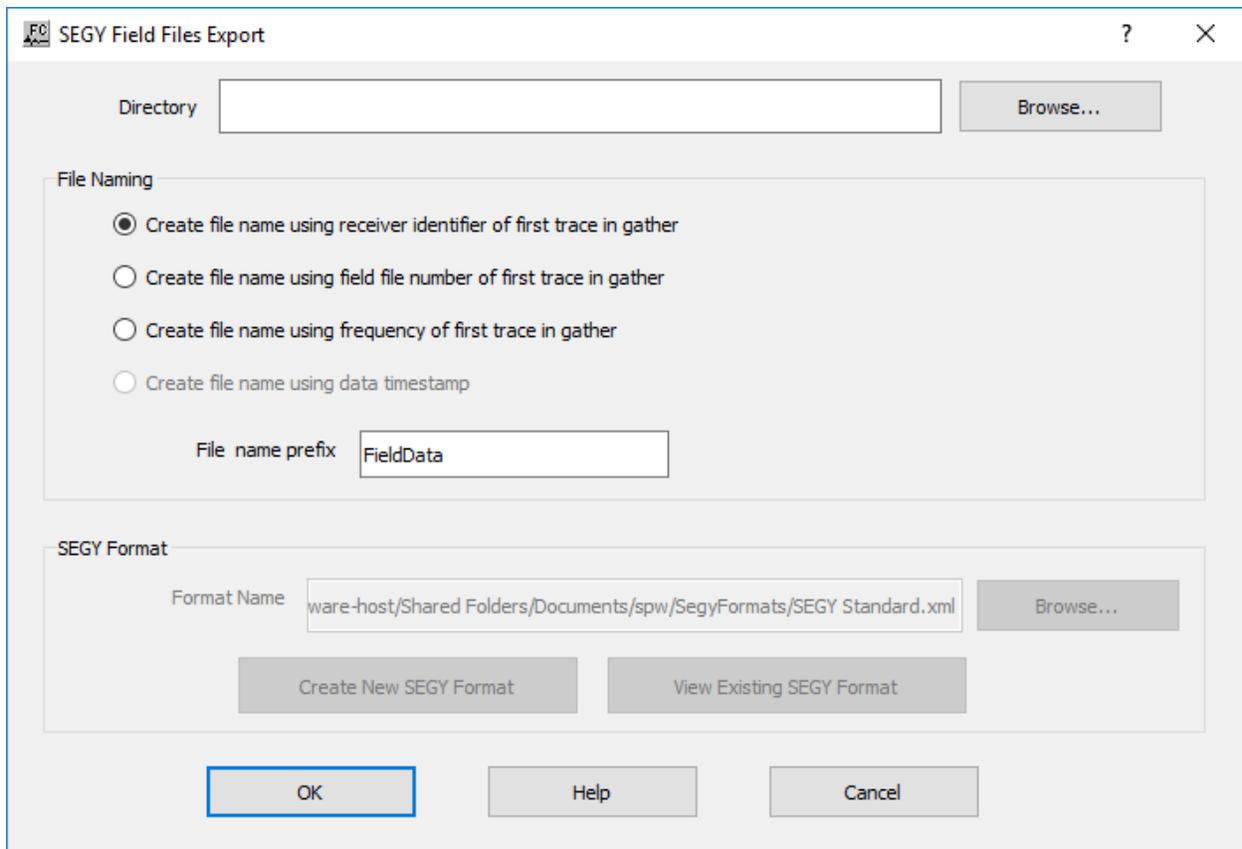
Output Links:

None.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Browse... — Browse for the directory where the output SEG-Y files will be stored.

File naming: Specify common file name for the output seismic files.

Create file name using receiver identifier of first trace in gather — If selected, file name of the output SEG-Y files uses the receiver number of the first trace in the gather as identified.

Create file name using field file number of first trace in gather — If selected, file name of the output SEG-Y files uses the field file number of the first trace in the gather as identified.

Create file name using frequency of first trace in gather — If selected, file name of the output SEG-Y files uses the frequency number of the first trace in the gather as identified.

Create file name using data timestamp — Not yet implemented.

File name prefix — Enter the file name prefix of the output SEG-Y files that will be written in the hard-drive.

SEG-Y Format: Specify SEG-Y format of the output SEG- files.

Browse... — Browse for an existing SEG-Y format file.

Create new SEG-Y format — Select to create a new SEG-Y format.

View existing SEG-Y format — Select to view current SEG-Y format.

SEG Y Field Import

Usage:

The *SEG Y Field Import* step allows importing field SEG Y formatted data from a disk file into a seismic file.

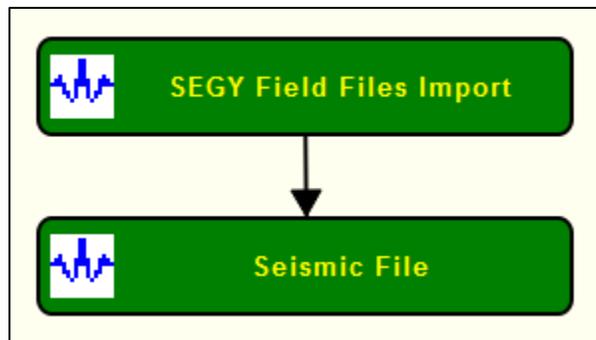
Input Links:

None.

Output Links:

1) Seismic data file (mandatory).

Example Flowchart:



Step Parameter Dialog:

Parameter Description:

SEG-Y file: Specify either the input seismic is all the files at a given directory or at a specific file within the directory

Select input directory — If selected, all files in directory will be imported sequentially in alphabetic order.

Select starting input file — If selected, input data is defined starting from a user-defined seismic file sequentially in alphabetic order.

Directory browse... — Browse for input directory where seismic files are stored.

SEG-Y Format: Specify SEG-Y format of the output SEG- files.

Browse... — Browse for an existing SEG-Y format file.

SEG-Y analyzer — Select to access properties of the input SEG-Y file.

Create new SEG-Y format — Select to create a new SEG-Y format.

View existing SEG-Y format — Select to view current SEG-Y format.

General dataset properties: Specify general properties of the input dataset. All these properties may be overwritten by the user. User-defined parameters will be used as parameter for the output seismic file.

Number of records — Enter the number of records in the input seismic file.

Traces per record — Enter the number of traces per record.

Number of traces — Enter the number of traces in the input seismic file.

Samples per trace — Enter the number of samples per trace in the input seismic file.

Sample interval — Enter the sample interval of the input seismic file in milliseconds

Sample format — Enter the sample format of the input seismic file.

Sample format — Enter the record length of the input SEG-Y file in milliseconds.

Set field file number from input file name — If checked, field file number is retrieved from the name of the input file name.

Set line number from EBCDIC header (C 3 LINE) — If checked, line number is retrieved from the SEG-Y text header (EBCDIC header) at line position C3.

SEG Y Import

Usage:

The *SEG Y Import* step allows for direct input of SEG Y formatted seismic data from a disk file into a seismic file in SPW format. It allows to select the SEG-Y trace header keys to be mapped into the index file which stores this information as part of the SPW format.

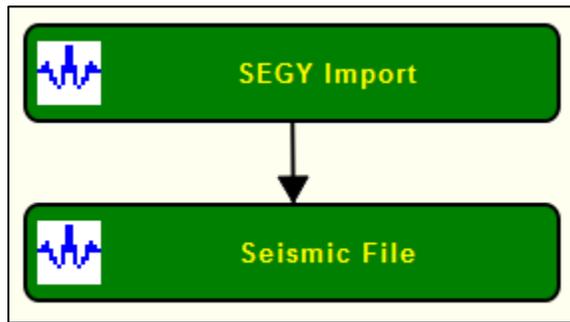
Input Links:

None.

Output Links:

1) Seismic data file (mandatory).

Example Flowchart:



Step Parameter Dialog:

The screenshot shows the "Segy Import" dialog box with several sections:

- SEG-Y file:** Includes a "File name" field with a "Browse..." button.
- SEG-Y format:** Includes a "Format name" field with a "Browse..." button and buttons for "SEG-Y analyzer", "Create new format", and "View existing format".
- SEG-Y index:** Includes buttons for "Build SEG-Y Index", "View trace headers", and "Trace header ranges".
- General dataset properties:** Includes fields for "Number of records", "Traces per record", "Number of traces", "Samples per trace", "Sample interval", "Sample format", and "Dimension" (radio buttons for 2D and 3D).
- Input sort and selection options:** Includes a "Reset to internal order" button, dropdown menus for "Primary sort key", "Secondary sort key", "Tertiary sort key", and "Quaternary sort key", and input fields for "Range limit", "Max", "Min", "Interval", and "Group".
- SEG-Y index fields:** A list of checkboxes for various fields: Trace sequential number, Field file number, Channel number, Source line number, Source location number, Receiver line number, Receiver location number, CMP location, Inline number, Crossline number, Offset, Azimuth, Gather index, Frequency, Trace type, CMP easting, CMP northing, CMP elevation, CMP datum elevation, Source easting, Source northing, Source elevation, Source depth, Source datum elevation, and Source uphole time.
- Trace header ranges:** A table with columns "Trace header", "Minimum", and "Maximum". It lists various trace headers such as Field file number, Channel number, CMP, Inline, Crossline, Azimuth, Offset, Gather index, CMP easting, CMP northing, CMP elevation, Source line, Source location, Source easting, Source northing, Source elevation, Source datum, Source depth, Source UHT, Source component, Receiver line, and Receiver location.

At the bottom of the dialog are "OK", "Help", and "Cancel" buttons.

Parameter Description:

SEG-Y File: Specify input SEG-Y file by browsing it.

Browse... — Browse for the input SEG-Y file.

SEG-Y Format: Specify the input SEG-file format Y format and map trace headers to be stored in the SPW index file.

Browse... — Browse for an existing SEG-Y format file.

SEG-Y analyzer — Select to access properties of the input SEG-Y file.

Create new format — Select to create a new SEG-Y map format.

View existing format — Select to view the existing format, *SEG-Y index fields* are automatically updated.

SEG-Y index fields — Check/Uncheck SEG-Y trace headers to be mapped into the SPW index file.

SEG-Y index: Specify SEG-Y index parameters. If needed index file parameterization may be changed here.

Build SEG-Y index — Select to build the index file using the current SEG-Y format for the selected input SEG-Y file.

View trace headers — Select to view original trace headers from the input SEG-Y file.

Trace header ranges — Select to update *Trace header ranges* table

Trace header ranges — Shows the range of the input SEG-Y trace headers

General dataset properties: Specify general properties of the input dataset. All these properties may be overwritten by the user. User-defined parameters will be used as parameter for the output seismic file.

Number of records — Enter the number of records in the input seismic file.

Traces per record — Enter the number of traces per record.

Number of traces — Enter the number of traces in the input seismic file.

Samples per trace — Enter the number of samples per trace in the input seismic file.

Sample interval — Enter the sample interval of the input seismic file in milliseconds

Sample format — Enter the sample format of the input seismic file.

Dimension: Specify the dimension of the input data.

2D survey — If selected, input data is two-dimensional.

3D survey — If selected, input data is three-dimensional

Input sort and selection option: Specify the input sort order.

Reset internal order — Select to reset the sort order to the internal sort order of the input seismic file.

Primary sort key — Select primary sort key to be used during processing.

Limit Range — If checked, limit range based on primary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Secondary sort key — Select secondary sort key to be used during processing.

Limit Range — If checked, limit range based on secondary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Tertiary sort key — Select tertiary sort key to be used during processing.

Limit Range — If checked, limit range based on tertiary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Quaternary sort — Select quaternary sort key to be used during processing.

Limit Range — If checked, limit range based on quaternary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Create record at — Select criteria to create record.

Regather groups into supergathers — If checked, groups are regathers into supergathers.

Seismic File

Usage:

The *Seismic File* step allows you to select or create a SPW format seismic file on disk. It is the input SPW seismic format file and/or the output SPW seismic format file for almost all the processing steps.

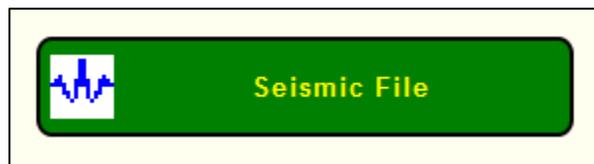
Input Links:

The Seismic File may receive input links from any processing step that requires an output seismic data file. In this case, execution of the flow will require that the user provides a file name for the Seismic File by left-clicking on the icon to open the Seismic File dialog and creating the output file name with the Browse button.

Output Links:

Output links from the Seismic File may be directed to any processing step that requires as input a seismic data file. In this case, execution of the flow will require that the user provides a file name for the Seismic File by left-clicking on the icon to open the Seismic File dialog and selecting the input file name with the Browse button.

Example Flowchart:



Step Parameter Dialog:

Seismic file: Specify location and name of the seismic file. Browse for existing file if seismic file is going to be used as input for other processing step or write select directory and write file name if seismic file is going to be used as output fo a processing step.

File Browse... — Select to browse for input or output location and select file.

SEGY index: Specify parameters related with the index file used as part of the SPW seismic formatl.

Rebuild index — Select to rebuild index file. Due to SPW updates there may be the need to update an existing index file.

Customize Index Map — Select to customize the index file. With this option the user can select which fields are stored in the index file.

View trace headers — Select to view trace header values with its ranges.

Trace header ranges — Select to open a table with the ranges for all the trace header in the seismic file.

General dataset properties: Specify general properties of the input dataset. All these properties may be overwritten by the user. User-defined parameters will be used as parameter for the output seismic file.

Number of records — Enter the number of records in the input seismic file.

Traces per record — Enter the number of traces per record.

Number of traces — Enter the number of traces in the input seismic file.

Samples per trace — Enter the number of samples per trace in the input seismic file.

Sample interval — Enter the sample interval of the input seismic file in milliseconds

Sample format — Enter the sample format of the input seismic file.

Dimension: Specify the dimension of the input data.

2D survey — If selected, input data is two-dimensional.

3D survey — If selected, input data is three-dimensional

Input sort and selection option: Specify the input sort order.

R — Select to sort the seismic file by common receiver order: *Primary sort key* is set to none; *Secondary sort key* is set to none; *Tertiary sort key* is set to Offset; *Quaternary sort key* is set to none; *Create record at* is set to *Change in secondary*.

O — Select to sort the seismic file by common offset order: *Primary sort key* is set to Offset; *Secondary sort key* is set to none; *Tertiary sort key* is set to none; *Quaternary sort key* is set to none; *Create record at* is set to *Change in primary*.

C — Select to sort the seismic file by common midpoint order: *Primary sort key* is set to Offset; *Secondary sort key* is set to none; *Tertiary sort key* is set to none; *Quaternary sort key* is set to none; *Create record at* is set to *Change in primary*.

S — Select to sort the seismic file by common source order: *Primary sort key* is set to FFID; *Secondary sort key* is set to Channel; *Tertiary sort key* is set to none; *Quaternary sort key* is set to none; *Create record at* is set to *Change in primary*.

Reset internal order — Select to reset the sort order to the internal sort order of the input seismic file.

Primary sort key — Select primary sort key to be used during processing.

Limit Range — If checked, limit range based on primary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Secondary sort key — Select secondary sort key to be used during processing.

Limit Range — If checked, limit range based on secondary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Tertiary sort key — Select tertiary sort key to be used during processing.

Limit Range — If checked, limit range based on tertiary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Quaternary sort — Select quaternary sort key to be used during processing.

Limit Range — If checked, limit range based on quaternary sort key.

Minimum value — Enter minimum value to limit the range

Maximum value — Enter the maximum value to limit the range.

Create record at — Select criteria to create record.

Regather groups into supergathers — If checked, groups are regathered into supergathers.

Output options: Specify options related with the output seismic file.

Append to existing dataset — If checked, current input file will be appended to existing file as defined in *Seismic file*.

Do not overwrite and existing output file — If checked, if the output file already exists this will not be overwritten. Instead a new name will be automatically given to the output file.

Export full input header — If checked, the full trace header information will be exported along with the seismic data.

Remove dead traces — If checked, traces from the input file flagged as dead will be removed and not written in the output seismic file.

Keep dead traces — If checked, traces from the input file flagged as dead will not be removed and will be written in the output seismic file.

Do not write data into file — If checked, no data will be written in the output file, only information related with the trace headers will be written.

Do not output index file — If checked, the index file will not be written.

Select Traces

Usage:

The *Select Traces* step allows selecting a user-defined range of traces from the input seismic file. The selection of traces is defined based on the ranges of primary, secondary and tertiary sort keys.

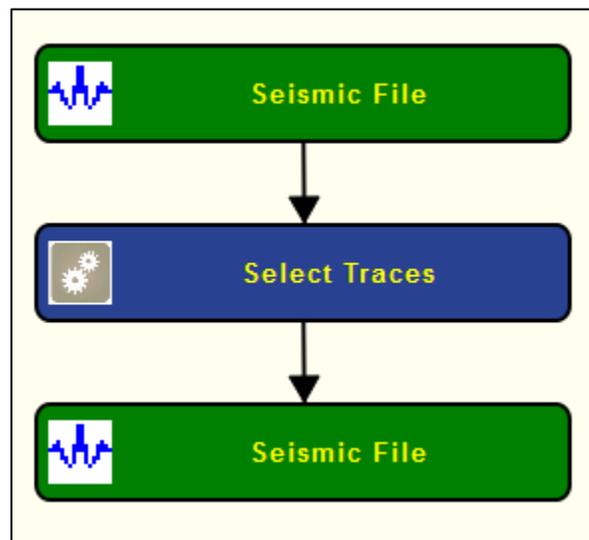
Input Links:

1) Seismic file in any sort order (mandatory).

Output Links:

1) Seismic file in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Primary header	Primary start	Primary stop	Secondary header	Secondary start	Secondary stop	Tertiary header	Tertiary start	Tertiary stop
None	0	0	None	0	0	None	0	0

Buttons: Import, Export, Add Row, Delete Row, OK, Help, Cancel

Parameter Description:

Import — Select to import a *Trace Select* auxiliary card data file to be used as selection of traces from input seismic file.

Export — Select to export into a *Trace Select* auxiliary card data file the list of traces selected by the table above.

Add Row — Select to add a row to the list of selected traces.

Primary header — Select the primary header key to be used for the trace selection as defined in the *Primary start* and *Primary Stop*.

Primary start — Enter the primary header key start value.

Primary stop — Enter the primary header key end value.

Secondary header — Select the secondary header key to be used for the trace selection as defined in the *Secondary start* and *Secondary Stop*.

Secondary start — Enter the secondary header key start value.

Secondary stop — Enter the secondary header key end value.

Tertiary header — Select the tertiary header key to be used for the trace selection as defined in the *Tertiary start* and *Tertiary Stop*.

Tertiary start — Enter the tertiary header key start value.

Tertiary stop — Enter the tertiary header key end value.

Delete Row — Select to delete last row of the list of selected traces.

TCPIP Data Input

Usage:

The *TCPIP Data input* step allows creating a SPW seismic file directly from the field through a TCP/IP protocol. Data received directly from the acquisition system and transmitted using the TCP/IP is then written as a seismic file along with its index file. Currently this processing allows receiving data from *Silixa* and *Georesources* systems.

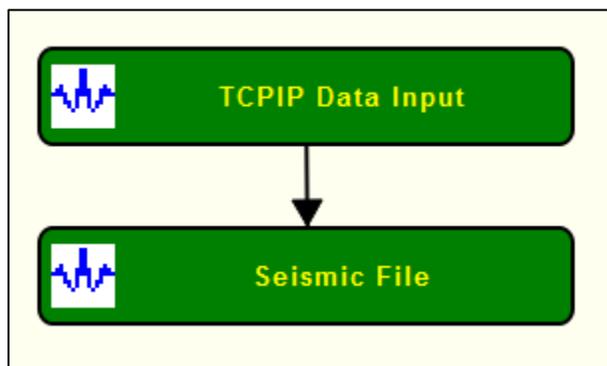
Input Links:

None

Output Links:

1) Seismic data in any sort order (mandatory). This seismic file will be sorted as the field data.

Example Flowchart:



Step Parameter Dialog:

TCPIP Input Field Data

TCP/IP address

127.0.0.1

Input from Geosource system

Geosource parameters

Overwrite dataset parameters

Sample Format: 5

Number of Samples: 500

Keep recording when skipped shots:

Continuous recording:

Incremental index starting at: 842150451

Dismiss Aux Channels:

Upper limit: None

Lower limit: None

Sample Interval (ms): 0.1

Number of Channels: 24

Number of Aux Channels: 0

Connection timeout (ms): 8000

Data read delay (ms): 3000

Number of shots to skip: 1

Average water layer velocity: 1500

First arrivals window size: 20

Output ASCII log

Input from Silixa system

Silixa parameters

Apply surface geometry

Apply VSP geometry

Output SEG Y files containing geometry

Perform vibroseis correlation

Output correlated SEG Y files

Sum common shot records

Geometry parameters...

Output directory...

Vib parameters...

Output directory...

Summing parameters...

OK Help Cancel

Parameter Description:

TCP/IP address — Enter TCP/IP address where the acquired data will be transmitted.

Input from Georesources system — If selected, input data is from a Georesource system.

Georesources parameters: Specify input parameters regarding input data.

Overwrite dataset parameters — If checked, overwrite data acquisition parameters.

Sample format — Enter sample format of the input data.

Number of Samples — Enter number of samples of input data.

Keep recording when skipped shots — If checked, output seismic file will have skipped shots.

Sample interval (ms) — Enter sample interval in milliseconds.

Number of Channels — Enter number of channels of input data.

Number of Aux. Channels — Enter number of auxiliary channels.

Continuous recording — If checked, the TCP/IP stop signal will be ignored and the record will continue.

Incremental index start at — Enter the start value for the incremental index of each record.

Dismiss Aux Channels — If checked, auxiliary traces are not store in output seismic file.

Connection timeout (ms) — Enter a time value in milliseconds for the connection to be considered timedout.

Data read delay (ms) — Enter a delay value in milliseconds for the data to be read.

Number of shots to skip — Enter the number of shots to skip during the recording.

Upper limit — Enter the

Lower limit —

Average water layer velocity — Enter a value in meters per second of the average water velocity. This value will be used to automatically pick the first arrivals.

First arrivals window size — Enter the window size in milliseconds for the first arrival picking.

Output ASCII log — If checked, an ASCII log with the acquisition report will be generated.

Input from Silixa system — If selected, input data is from a Silixa system.

Silixa parameters: Specify Silixa real time acquisition parameters.

Apply surface geometry — If checked, applies in real time the surface geometry to the data.

Geometry parameters... — Select to define the parameters related with the acquisition geometry.

Apply VSP geometry — If checked, apply VSP geometry to the data acquired in real time.

Output SEG-Y files containing geometry — If selected, outputs SEG-Y files with geometry applied.

Output directory... — Select to browse for the output directory of SEG-Y with geometry

Perform vibroseis correlation — If checked, performs real-time vibroseis correlation of the acquired data.

Vib parameters... — Select vibroseis related parameters.

Output correlated SEG-Y files — If checked, outputs vibroseis correlated SEG-Y files.

Output directory... — Select to browse for the output directory of vibroseis correlated SEG-Y files

Sum common shot records — If checked, sum common shot records in real-time.

Summing paramters... — Select to define the parameters related with the real-time summing.

Update SEG-Y Textheader

Usage:

The *Update SEG-Y Textheader* step adds a EBCDIC text header into a SEG-Y seismic file. The text header needs to be stored in an auxiliary text file.

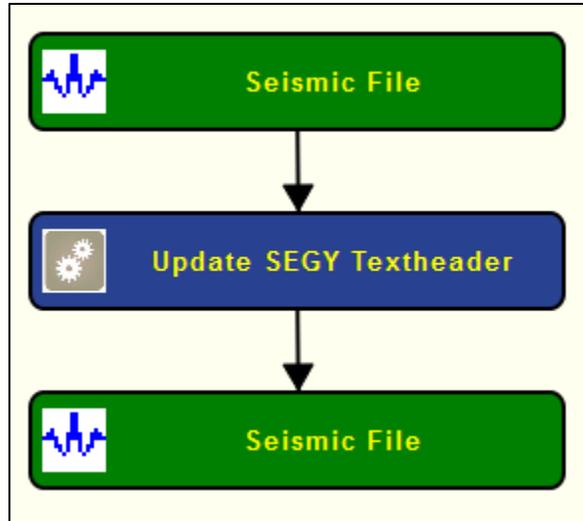
Input Links:

- 1) Seismic data file in any sort order (mandatory).

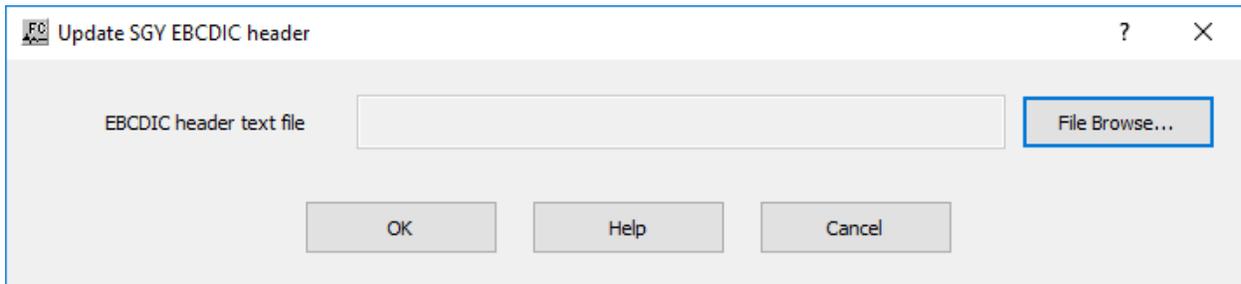
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

File Browse... — Browse for the location of the text file with the EBCDIC header to be included in the seismic file.

Virtual Tape Input

Usage:

The *Virtual Tape Input* step allows importing seismic data from tapes into a seismic file. In order to access this step a tape drive must be connected using a SCSI connection.

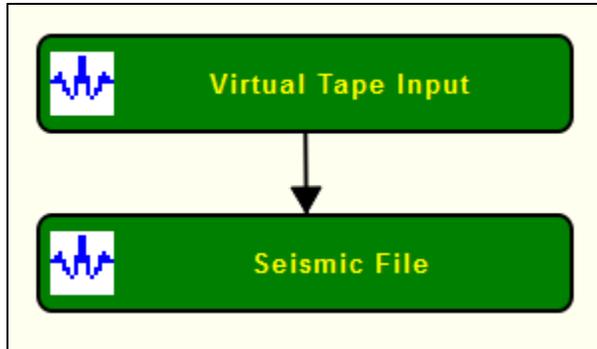
Input Links:

None.

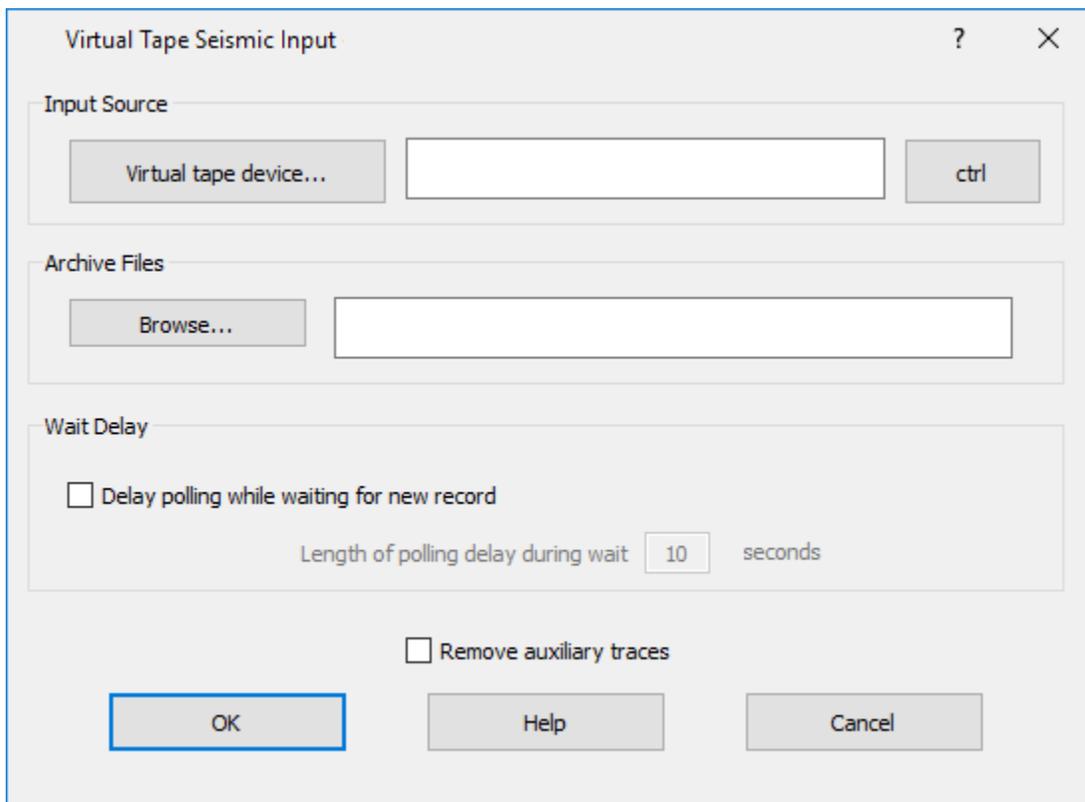
Output Links:

- 1) Seismic file in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input Source: Specify the virtual tape device.

Virtual tape device... — Browse for the virtual tape device.

Ctrl — Select to test control parameters of the virtual tape.

Archive Files: Specify archive location.

Browse... — Browse for archive location.

Wait Delay: Specify delay during reading.

Delay polling while waiting for new record — If checked, delays polling while waiting for a new record.

Length of polling delay during wait ... seconds — Enter the length fo the polling delay in seconds.

Remove auxiliary traces — If checked, removes auxiliary traces from the input seismic data.

Spectral Attributes Steps

This section documents the processing steps available in the Spectral Attributes Steps category.

The types of Spectral Attributes Steps currently available are:

Spectral Attributes
↑ Processing Categories
Bandwidth
Center Frequency
Kurtosis
Mean Amplitude
Minimum Amplitude
Peak Amplitude
Peak Amplitude Above Mean
Peak Frequency
Phase at Peak Frequency
RMS Frequency
Skewness
Spectral Variance

Bandwidth

Usage:

The **Bandwidth** step estimates the bandwidth of spectrally decomposed seismic data computed for example with **Wigner-Ville Decomposition** step using a user-defined time and frequency window.

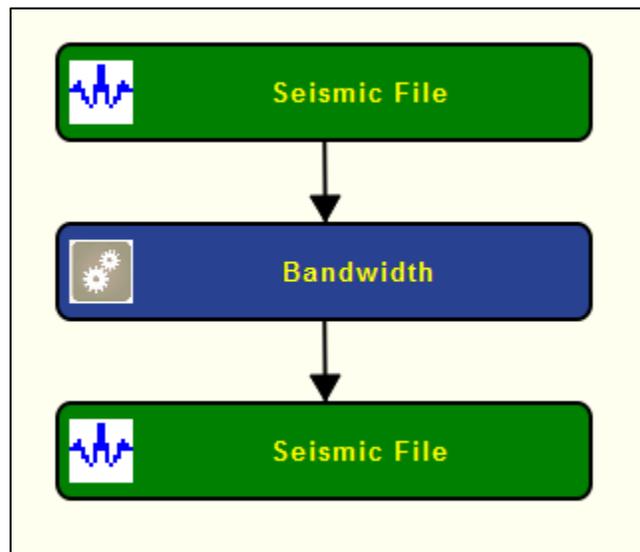
Input Links:

- 1) Spectrally decomposed seismic data (mandatory).

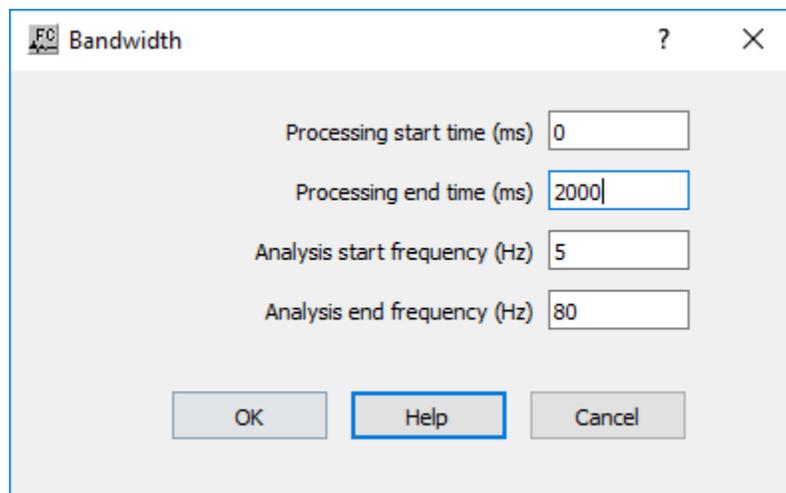
Output Links:

- 2) Spectrally decomposed seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the bandwidth analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the bandwidth analysis.

Center Frequency

Usage:

The *Center Frequency* step estimates the center frequency of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

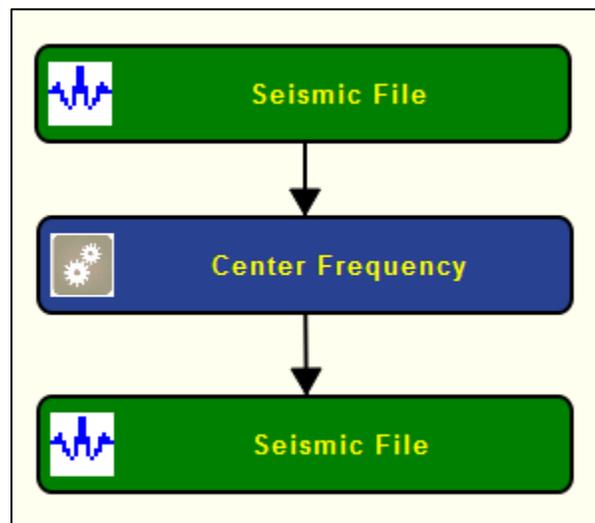
Input Links:

1) Spectrally decomposed seismic data (mandatory).

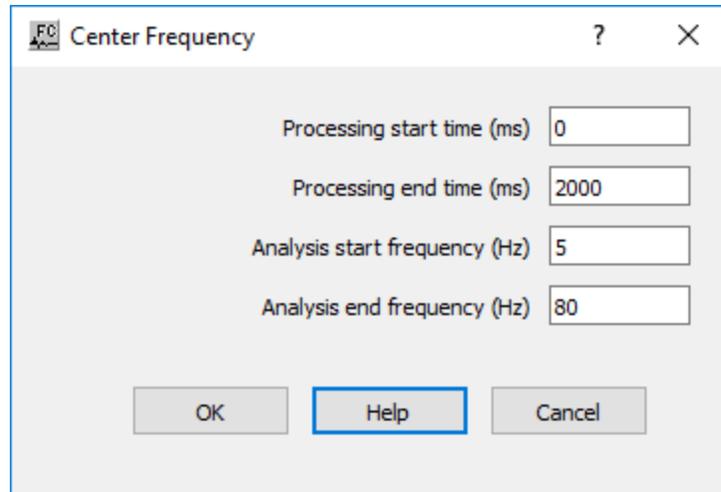
Output Links:

1) Spectrally decomposed seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the center frequency analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the center frequency analysis.

Kurtosis

Usage:

The *Kurtosis* step estimates the kurtosis (measure of the "tailedness" of the spectra) of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

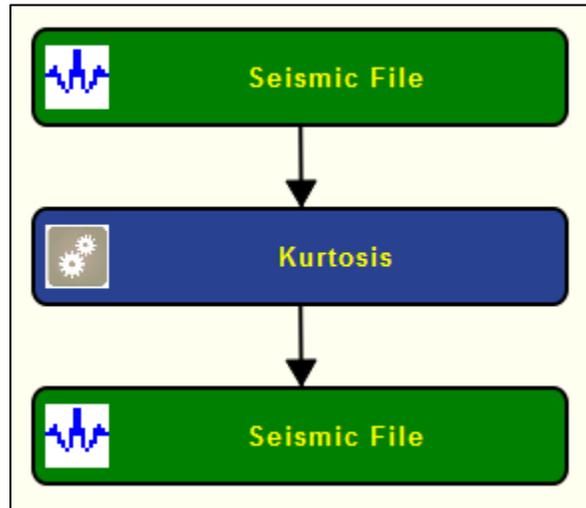
Input Links:

1) Spectrally decomposed seismic data (mandatory).

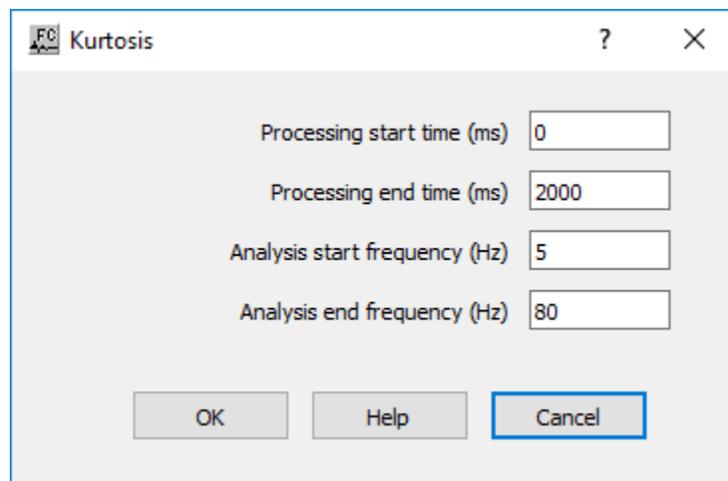
Output Links:

1) Spectrally decomposed seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the kurtosis analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the kurtosis analysis.

Mean Amplitude

Usage:

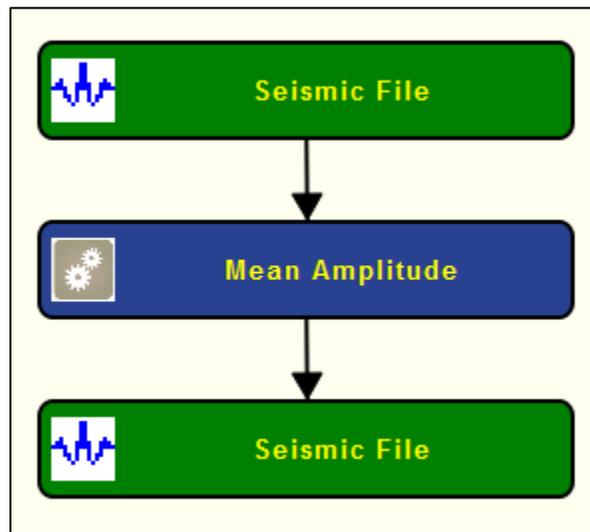
The *Mean amplitude* step estimates the mean amplitude value of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

Input Links:

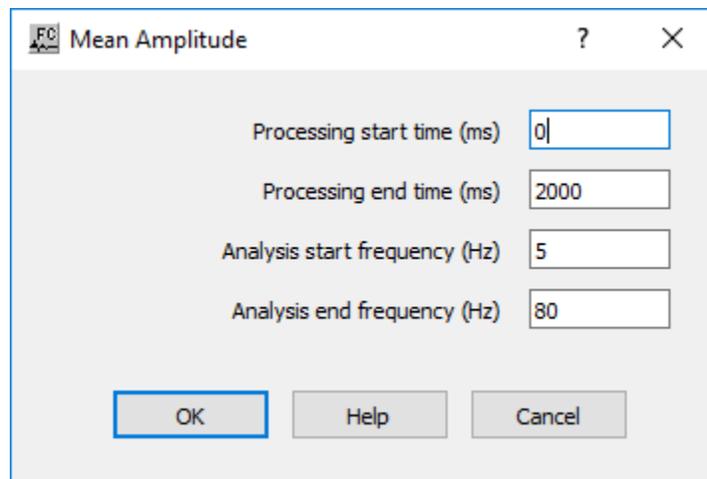
2) Spectrally decomposed seismic data (mandatory).

Output Links:

2) Spectrally decomposed seismic data (mandatory).



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the mean amplitude analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the mean amplitude analysis.

Minimum Amplitude

Usage:

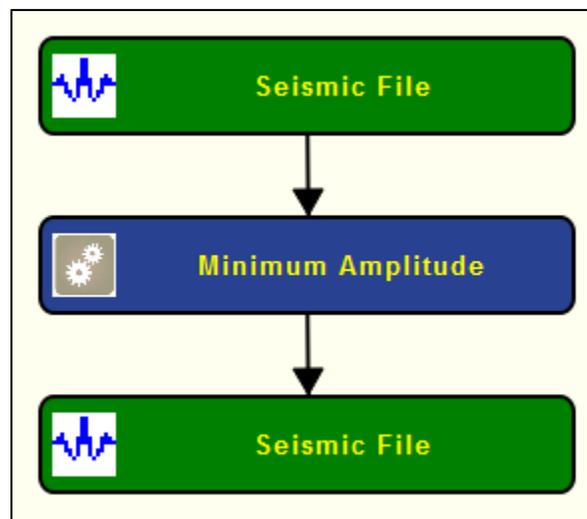
The *Minimum amplitude* step estimates the minimum amplitude value of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

Input Links:

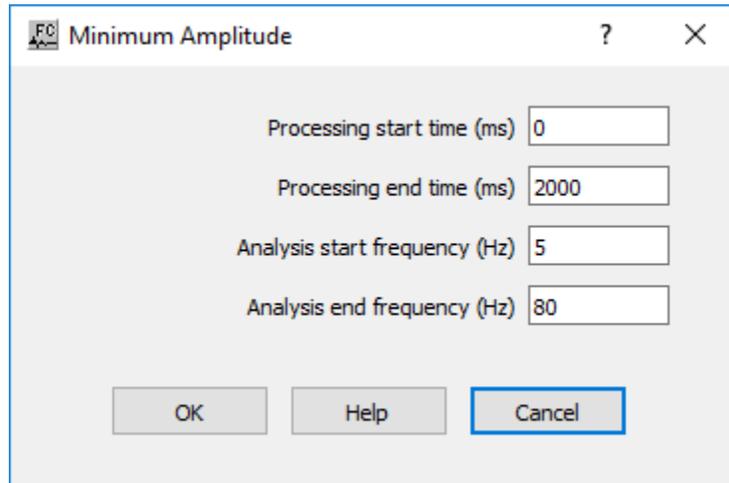
1) Spectrally decomposed seismic data (mandatory).

Output Links:

1) Spectrally decomposed seismic data (mandatory).



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the minimum amplitude analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the minimum amplitude analysis.

Peak Amplitude

Usage:

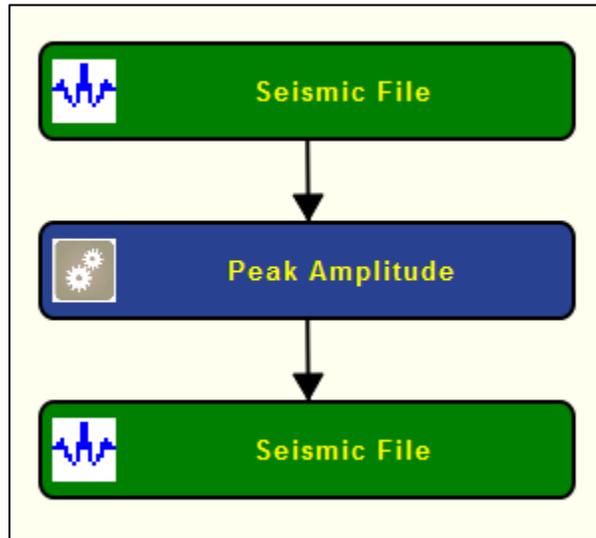
The *Peak amplitude* step estimates the peak (maximum) amplitude value of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

Input Links:

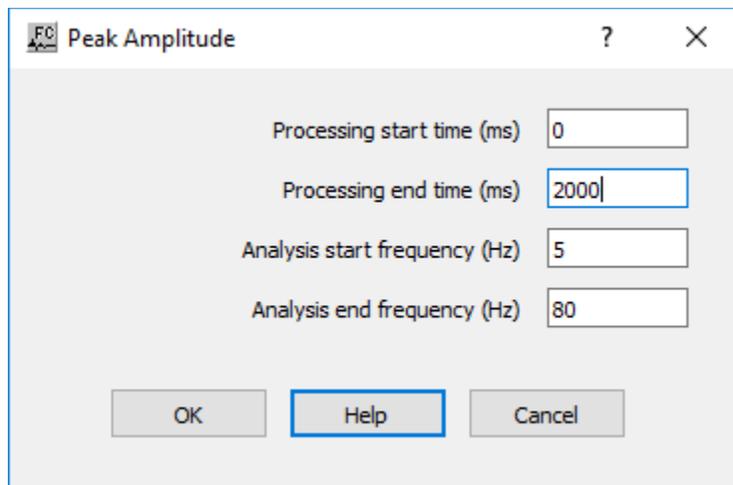
- 1) Spectrally decomposed seismic data (mandatory).

Output Links:

1) Spectrally decomposed seismic data (mandatory).



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the maximum amplitude analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the maximum amplitude analysis.

Peak Amplitude Above Mean

Usage:

The *Peak Amplitude amplitude* step estimates the maximum amplitude above the mean of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

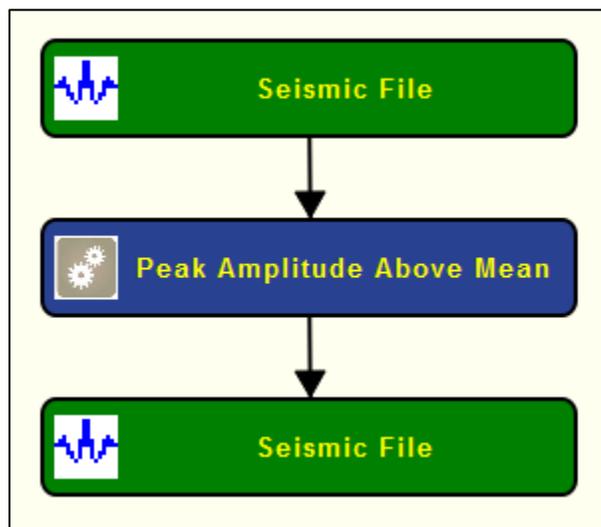
Input Links:

1) Spectrally decomposed seismic data (mandatory).

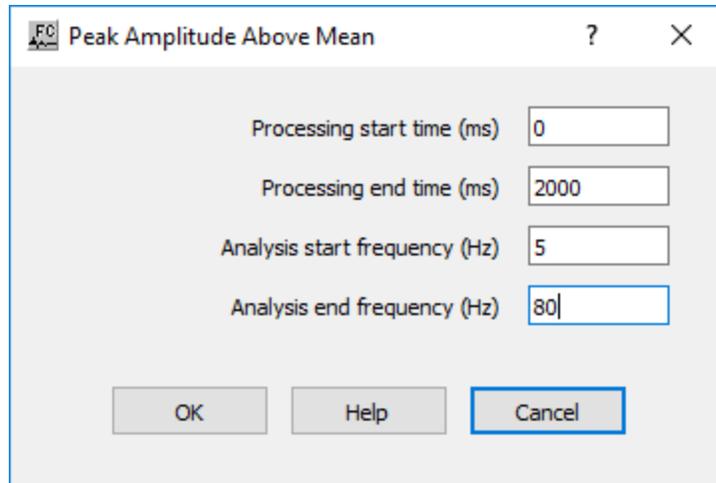
Output Links:

1) Spectrally decomposed seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the peak amplitude above mean analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the peak amplitude above mean analysis.

Peak Frequency

Usage:

The *Peak Frequency* step estimates the dominant frequency value of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

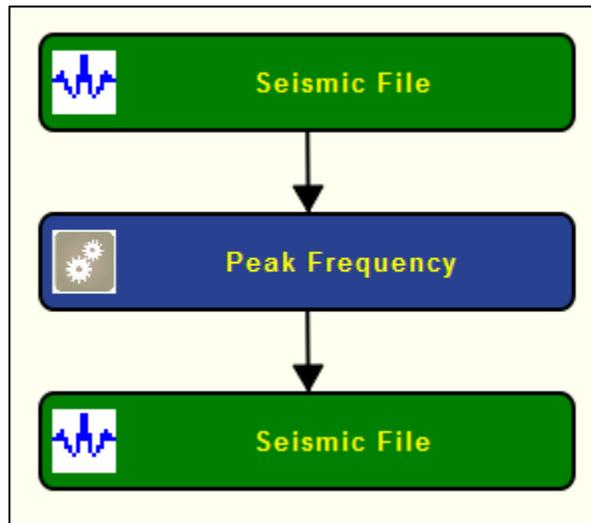
Input Links:

- 1) Spectrally decomposed seismic data (mandatory).

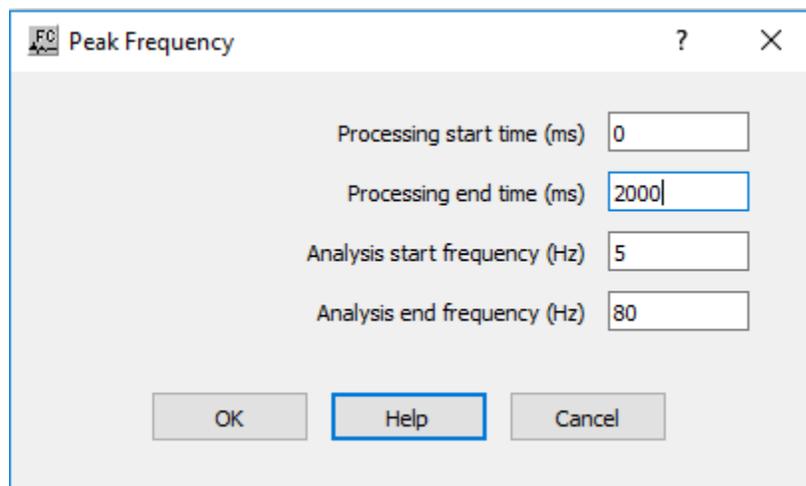
Output Links:

- 1) Spectrally decomposed seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the peak frequency amplitude analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the peak frequency analysis.

Phase at Peak Frequency

Usage:

The *Phase at Peak Frequency* step estimates the phase of the dominant frequency of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

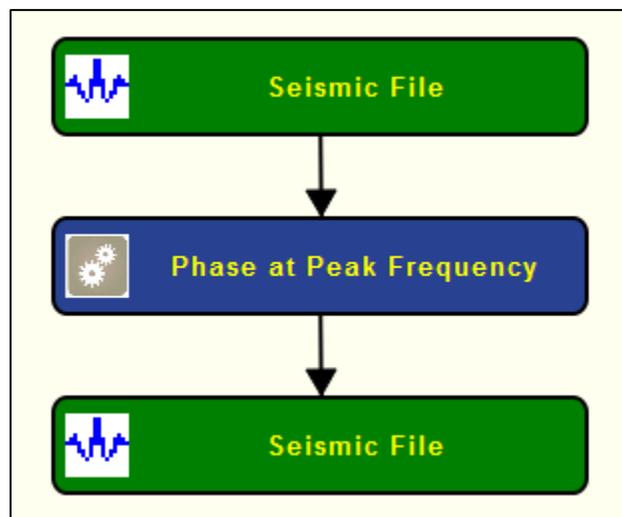
Input Links:

- 1) Spectrally decomposed seismic data (mandatory).

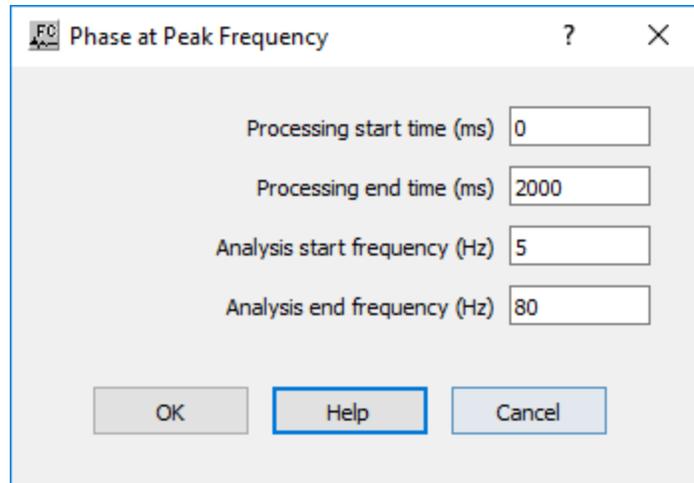
Output Links:

- 1) Spectrally decomposed seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the phase at peak frequency analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the phase at peak frequency analysis.

RMS Frequency

Usage:

The *RMS Frequency* step estimates the root mean square of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

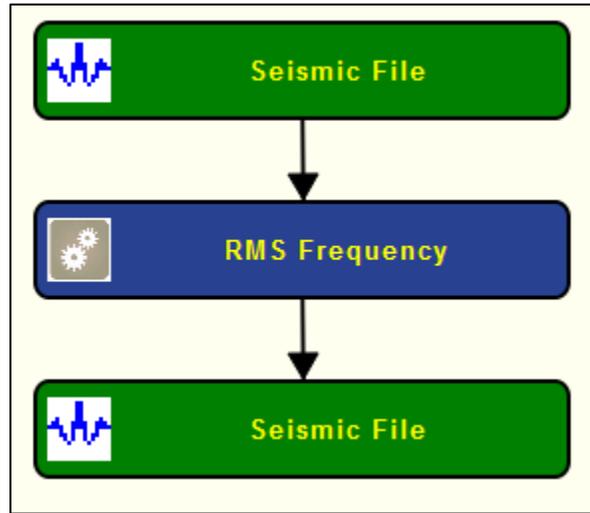
Input Links:

- 1) Spectrally decomposed seismic data (mandatory).

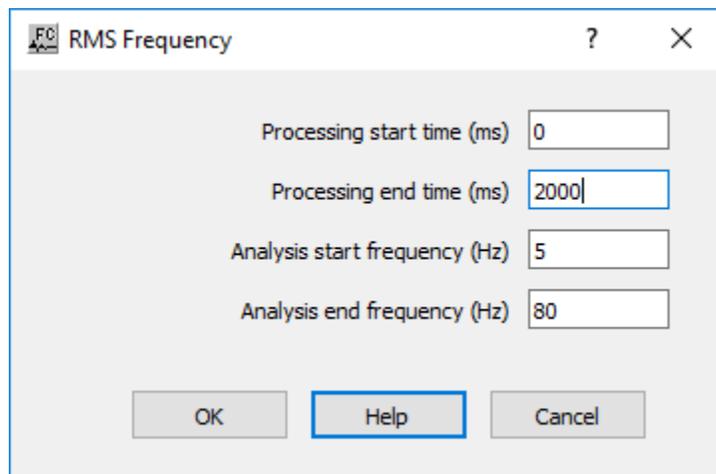
Output Links:

- 1) Spectrally decomposed seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the RMS frequency analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the RMS frequency analysis.

Skewness

Usage:

The *Skewness* tep estimates the skewness of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

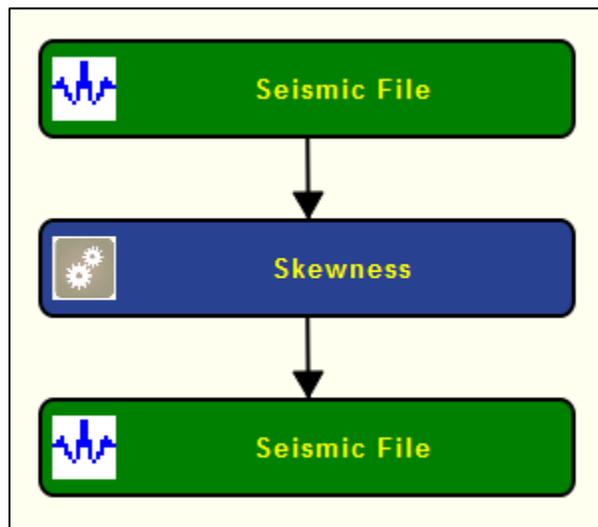
Input Links:

- 1) Spectrally decomposed seismic data (mandatory).

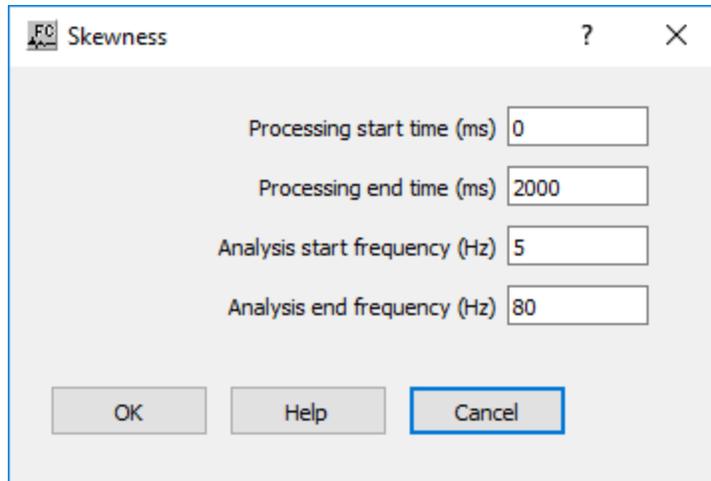
Output Links:

- 1) Spectrally decomposed seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the skewness amplitude analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the skewness amplitude analysis.

Spectral Variance

Usage:

The *Spectral Variance* step estimates the variance of spectrally decomposed seismic data computed for example with *Wigner-Ville Decomposition* step using a user-defined time and frequency window.

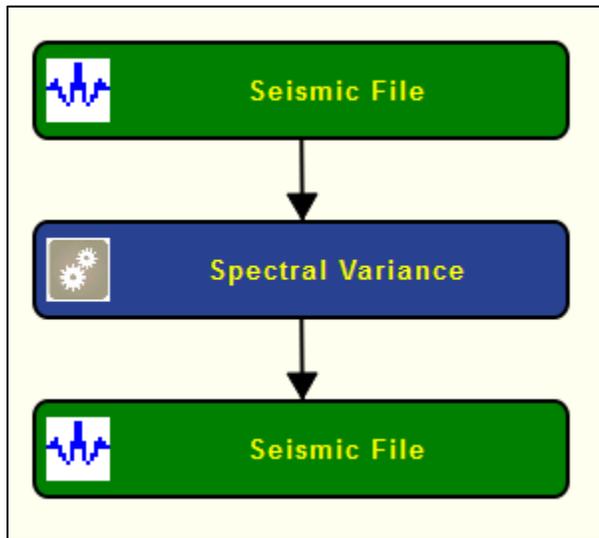
Input Links:

- 1) Spectrally decomposed seismic data (mandatory).

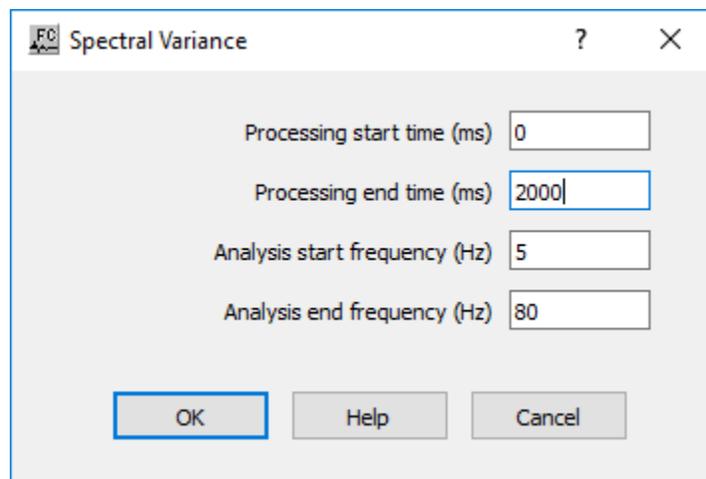
Output Links:

- 1) Spectrally decomposed seismic data (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) of the analysis in milliseconds.

Processing end time (ms) — Enter the end time (lower boundary) of the analysis in milliseconds.

Analysis start frequency (Hz) — Enter the minimum frequency used in the spectral variance analysis.

Analysis end frequency (Hz) — Enter the maximum frequency used in the spectral variance analysis.

Spectral Decomposition Steps

This section documents the processing steps available in the Spectral Decomposition Steps category.

Processing steps currently available are:

Spectral Decomposition
↑ Processing Categories
Band Aid
Bandwidth Enhancement
Cohen's Class
Short-Time Fourier Transform
Stockwell Transform
Wavelet Recom position
Wavelet Transform
Wigner-Ville Decom position
Windowed Wigner-Ville Decom position

Band Aid

Usage:
Input Links:

Auxiliary dataset:

Output Links:

References:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Bandwidth Enhancement

Usage:

Input Links:

Auxiliary dataset:

Output Links:

References:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Cohen's Class

Usage:

Input Links:

Auxiliary dataset:

Output Links:

References:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Short-Time Fourier Transform

Usage:

Input Links:

Auxiliary dataset:

Output Links:

References:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Stockwell Transform

Usage:

Input Links:

Auxiliary dataset:

Output Links:

References:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Wavelet Recomposition

Usage:

Input Links:

Auxiliary dataset:

Output Links:

References:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Wavelet Transform

Usage:

Input Links:

Auxiliary dataset:

Output Links:

References:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Wigner-Ville Decomposition

Usage:

Input Links:

Auxiliary dataset:

Output Links:

References:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Windowed Wigner-Ville Decomposition

Usage:

Input Links:

Auxiliary dataset:

Output Links:

References:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

Stacking Summing Steps

This section documents the processing steps available in the Stacking and Summing Steps category.

Processing steps currently available are:

Stacking/Summing
↑ Processing Categories
CMP Stack
Horizontal Trace Sum
Median Stack
Real Time CMP Stack
Receiver Order Stack
Source Order Stack
Trace Mixing

CMP Stack

Usage:

The **CMP Stack** step generates a CMP stack seismic file from CMP sorted input data. You may choose among stacking all offsets, the near 1/3 offsets, or the mid 1/3 offsets, the far 1/3 offsets. You may also choose to stack signed (positive and negative) or unsigned (absolute value of positive and negative) offsets. For the signed or unsigned offset cases you specify the minimum and maximum offsets to stack. You may apply a scaling exponent for scaling of your traces. Traces are scaled by the fold of your data raised to the power of the chosen exponent (i.e. fold ** EXP). You also specify whether you want to sum relative or absolute amplitude traces.

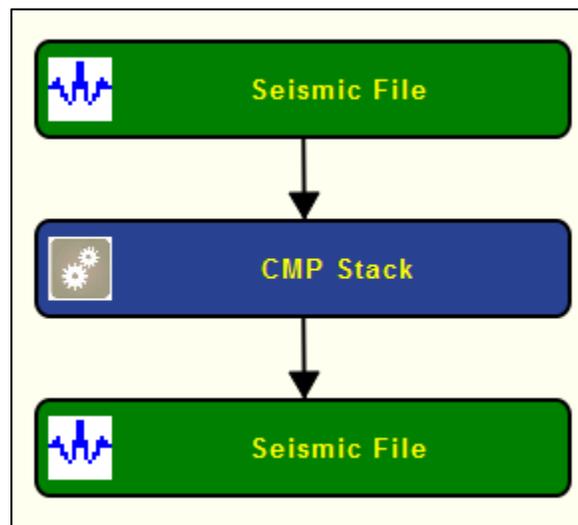
Input Links:

- 1) Seismic data in any CMP order (mandatory).

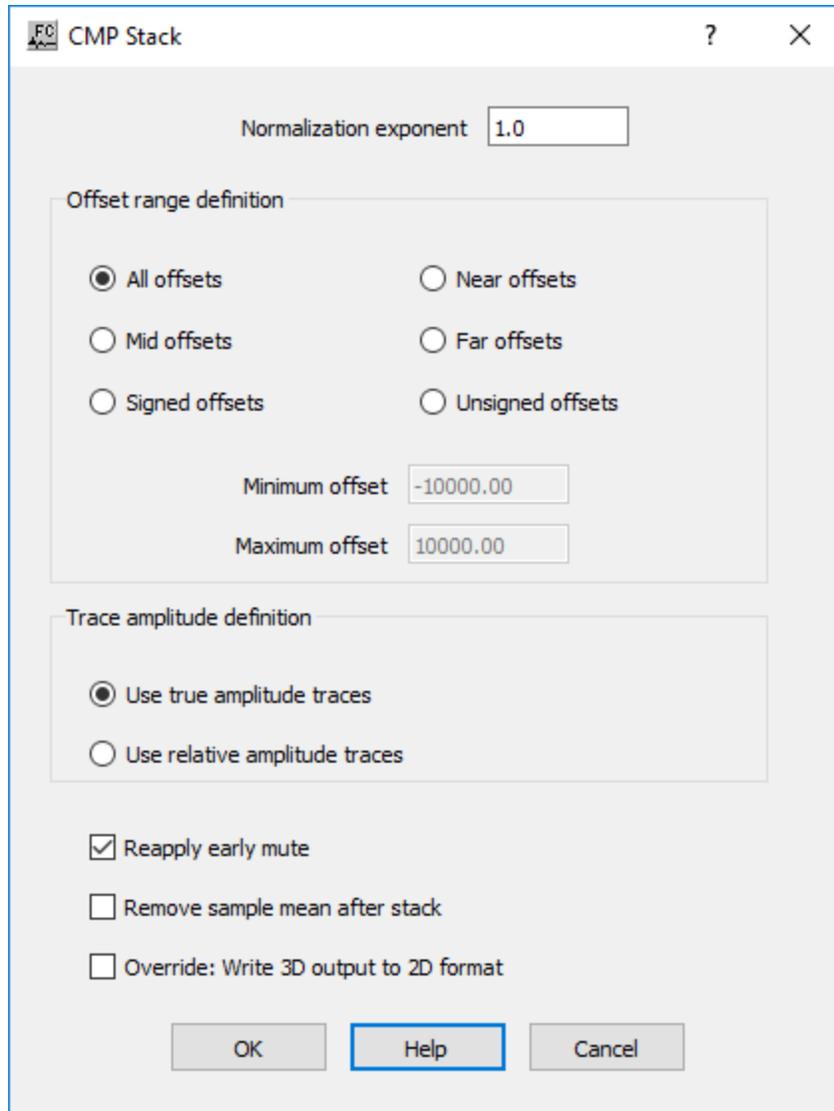
Output Links:

- 1) Seismic data as a stack (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Normalization exponent — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Offset range definition: Specify the offset range for the stack.

All offsets — If selected, all offsets will be stacked.

Near offsets — If selected, the near 1/3rd offsets will be stacked.

Mid-range — If selected, the mid 1/3rd offsets will be stacked.

Far offsets — If selected, the far 1/3rd offsets will be stacked.

Signed offset — If selected, offsets in the signed (both positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Unsigned offset — If selected, offsets in the unsigned (absolute value of positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Minimum — Enter the minimum offset range to stack.

Maximum — Enter the maximum offset range to stack.

Trace amplitude definition: Specify type of amplitudes to be used for the stack.

Use true amplitude traces — If selected, the absolute amplitude will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Use relative amplitude traces — If selected, relative amplitude will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Reapply early mute — If checked, reapplies an early mute after stacking the data

Remove sample mean after stack — If checked, removes the average DC bias from each stacked trace.

Override: Write 3D output to 2D format — If checked, writes the output as a 2D seismic file.

Horizontal Trace Sum

Usage:

The *Horizontal Trace Sum* step is used to perform a horizontal sum of multiple input traces into a single output trace on the basis of either the sequential or the offset order of the input traces.

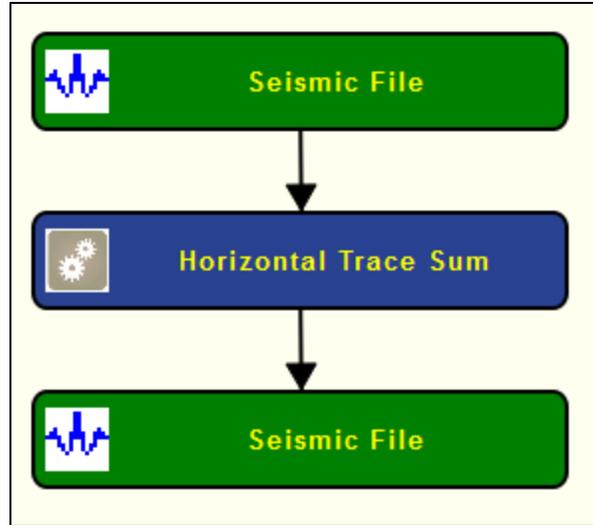
Input Links:

1) Seismic data in any sort order (mandatory).

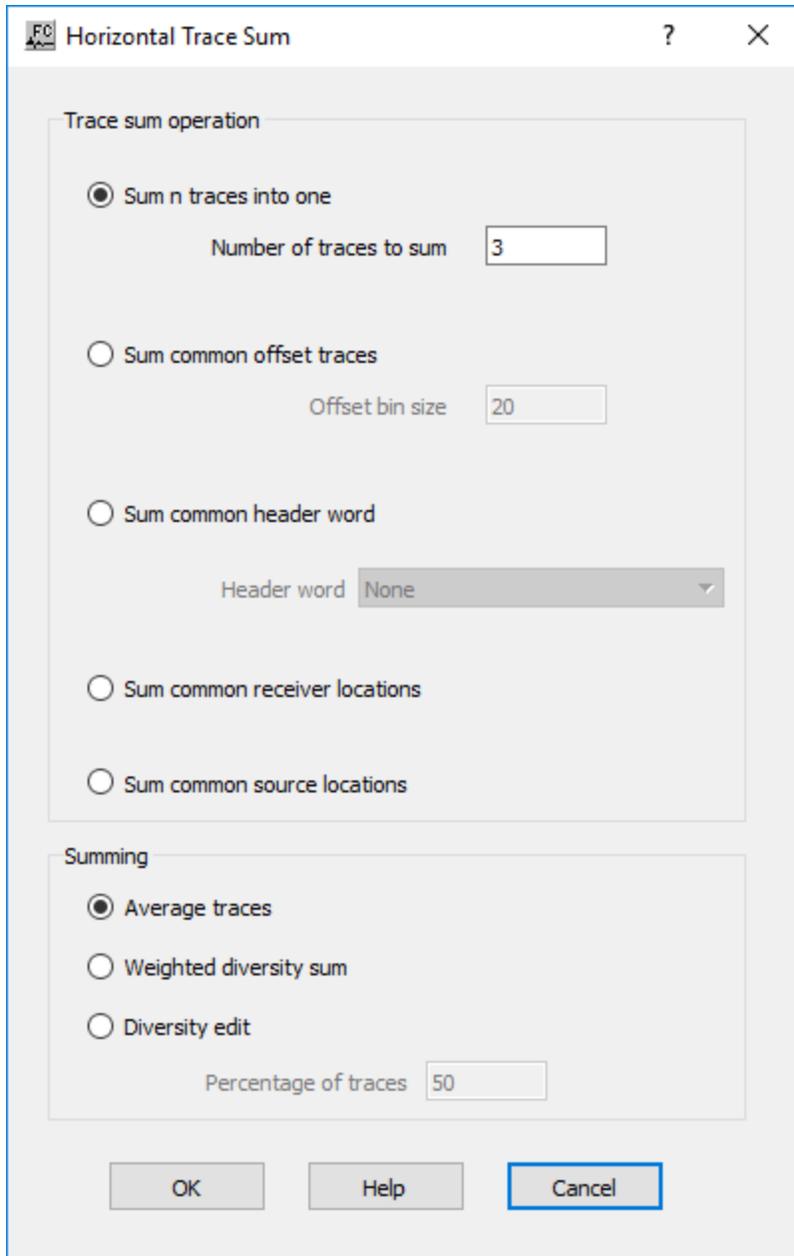
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Trace Sum Operation: Specify whether to sum traces sequentially or by common offset bin.

Sum n traces into one — If selected, sum n consecutive seismic traces into a single output trace.

Number of traces to sum — Enter the number of sequential input traces to sum into a single output trace.

Sum common offset traces — If selected, sum seismic traces within a specified offset bin size.

Offset bin size — Enter the offset bin size over which input traces will be summed into a single output trace. All input trace offsets falling between $(n) * \text{offset bin size}$ and $(n+1) * \text{offset bin size}$ will be summed into a single output trace.

Sum common header word — If selected, sum traces with a common header work as defined in *Header word*

Header word — Selected the header word location to be used to sum traces.

Sum common receiver locations — If selected, sum traces with common receiver locations into a single output trace.

Sum common source locations — If selected, sum traces with common source locations into a single output trace.

Summing: Specify how selected traces are summed.

Average traces — If selected, average horizontally all traces selected with equal weights for all traces.

Weighted diversity sum — If selected, each trace is scaled by the inverse of its average power prior to stacking. The composite trace is then renormalized by dividing by the sum of the scalers used.

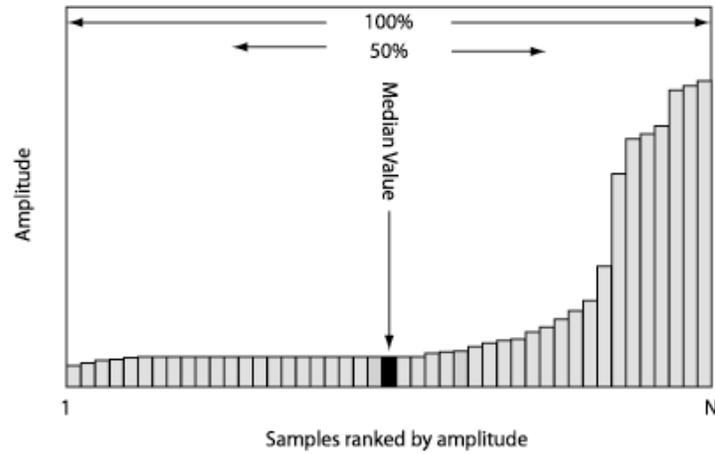
Diversity edit — If selected, only a percentage of traces as defined in the *Percentage of traces* is summed.

Percentage of traces — Enter the percentage of traces from the selected range to be summed.

Median Stack

Usage:

The *Median Stack* step performs a sample by sample horizontal stack using a specified percent of the samples centered on the median sample.



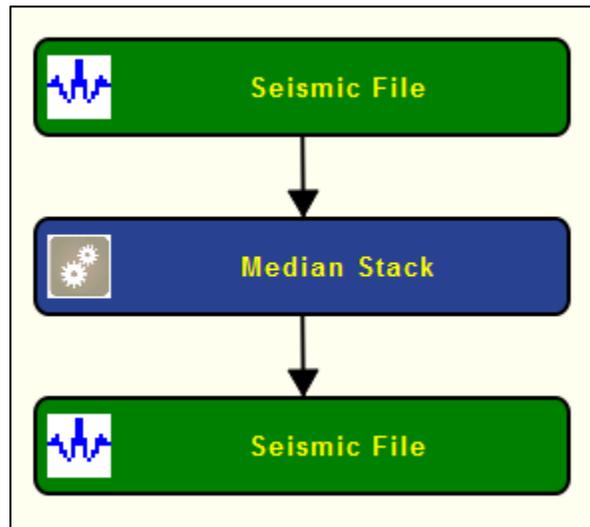
Input Links:

- 1) Seismic data in any sort order (mandatory).

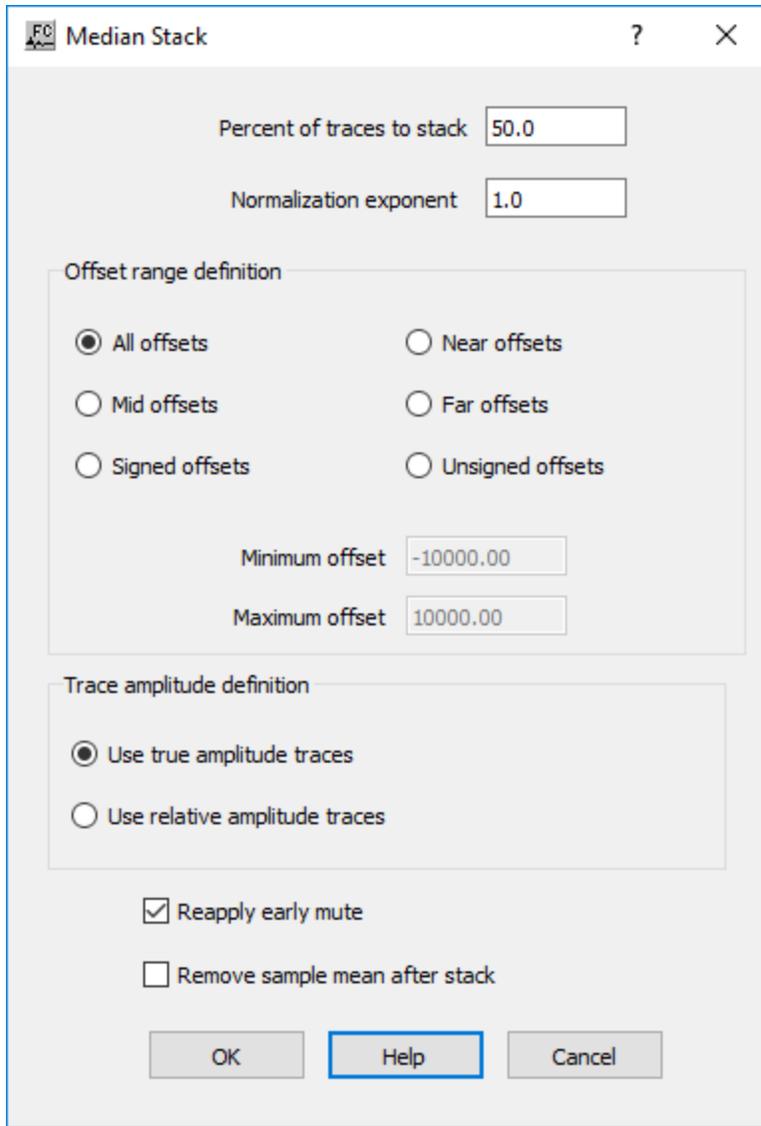
Output Links:

- 1) Seismic data as a stack (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Percent of traces to stack — Enter the percentage of traces to sum into each resulting output trace. A number such as 50 indicates that 50 % of the samples centered on the median sample value will contribute to the summed output sample.

Normalization exponent — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Offset range definition: Specify the offset range for the stack.

All offsets — If selected, all offsets will be stacked.

Near offsets — If selected, the near 1/3rd offsets will be stacked.

Mid-range — If selected, the mid 1/3rd offsets will be stacked.

Far offsets — If selected, the far 1/3rd offsets will be stacked.

Signed offset — If selected, offsets in the signed (both positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Unsigned offset — If selected, offsets in the unsigned (absolute value of positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Minimum — Enter the minimum offset range to stack.

Maximum — Enter the maximum offset range to stack.

Trace amplitude definition: Specify type of amplitudes to be used for the stack.

Use true amplitude traces — If selected, the absolute amplitude will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Use relative amplitude traces — If selected, relative amplitude will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Reapply early mute — If checked, reapplies an early mute after stacking the data

Remove sample mean after stack — If checked, removes the average DC bias from each stacked trace.

Browse — Select this button to set the output seismic file name.

Real Time CMP Stack

Usage:

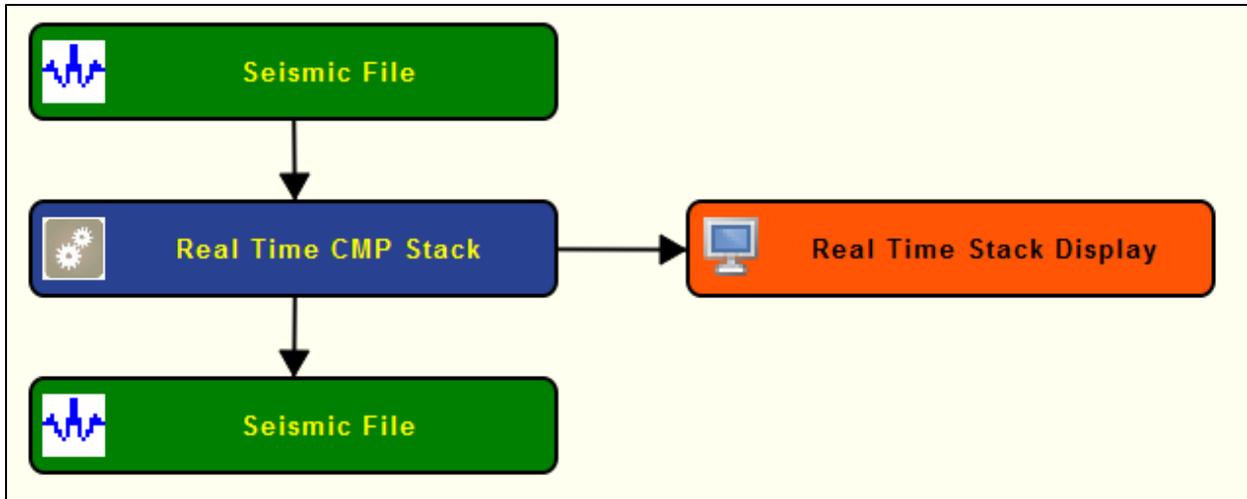
The *Real Time CMP Stack* step generates a CMP fullstack seismic file from CMP sorted input data with a real time input. This step allows to display the resulting stack in real time using a *Real Time Stack Display*. The output stack is stored in an output seismic file.

Input Links:

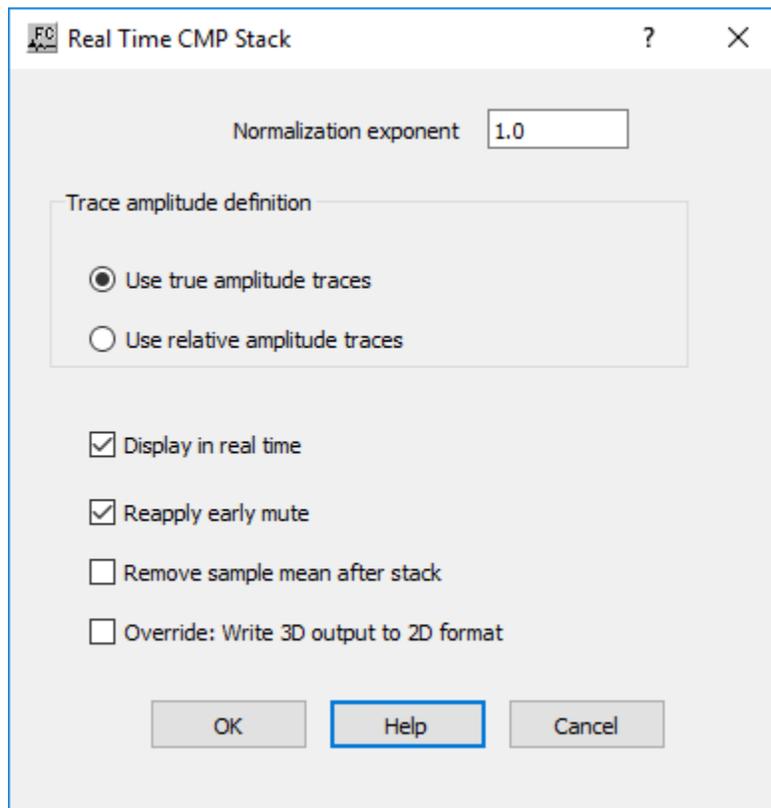
1) Seismic data in any CMP order (mandatory).

Output Links:

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Normalization exponent — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Trace amplitude definition: Specify type of amplitudes to be used for the stack.

Use true amplitude traces — If selected, the absolute amplitude will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Use relative amplitude traces — If selected, relative amplitude will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Display in real time — If checked, the input data is stacked in real time and a real time display is generated as defined in *Real Time Stack Display* step.

Reapply early mute — If checked, reapplies an early mute after stacking the data

Remove sample mean after stack — If checked, removes the average DC bias from each stacked trace.

Override: Write 3D output to 2D format — If checked, writes the output as a 2D seismic file.

Receiver Order Stack

Usage:

The *Receiver Order Stack* step allows you to input data sorted in common receiver order and output a common receiver stack seismic file. You may apply a scaling exponent for scaling of your traces. Traces are scaled by the fold of your data raised to the power of the chosen exponent (i.e. $\text{fold}^{**} \text{EXP}$). You also specify whether you want to sum relative or absolute amplitude traces.

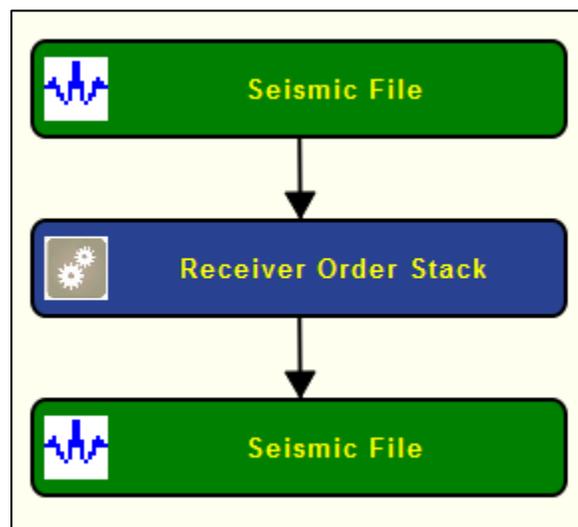
Input Links:

1) Seismic data in common receiver sort order (mandatory).

Output Links:

1) Seismic data as a stack (mandatory).

Example Flowchart:



Step Parameter Dialog:

Receiver Order Stack

Normalization exponent

Offset range definition

All offsets Near offsets

Mid offsets Far offsets

Signed offsets Unsigned offsets

Minimum offset

Maximum offset

Trace amplitude definition

Use true amplitude traces

Use relative amplitude traces

Reapply early mute

Remove sample mean after stack

Override: Write 3D output to 2D format

Parameter Description:

Normalization exponent — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Offset range definition: Specify the offset range for the stack.

All offsets — If selected, all offsets will be stacked.

Near offsets — If selected, the near 1/3rd offsets will be stacked.

Mid-range — If selected, the mid 1/3rd offsets will be stacked.

Far offsets — If selected, the far 1/3rd offsets will be stacked.

Signed offset — If selected, offsets in the signed (both positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Unsigned offset — If selected, offsets in the unsigned (absolute value of positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Minimum — Enter the minimum offset range to stack.

Maximum — Enter the maximum offset range to stack.

Trace amplitude definition: Specify type of amplitudes to be used for the stack.

Use true amplitude traces — If selected, the absolute amplitude will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Use relative amplitude traces — If selected, relative amplitude will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Reapply early mute — If checked, reapplies an early mute after stacking the data

Remove sample mean after stack — If checked, removes the average DC bias from each stacked trace.

Override: Write 3D output to 2D format — If checked, writes the output as a 2D seismic file.

Source Order Stack

Usage:

The *Source Order Stack* step allows you to input data sorted in common source order and output a common source stack seismic file. You may apply a scaling exponent for scaling of your traces. Traces are scaled by the fold of your data raised to the power of the chosen exponent (i.e. fold ** EXP). You also specify whether you want to sum relative or absolute amplitude traces.

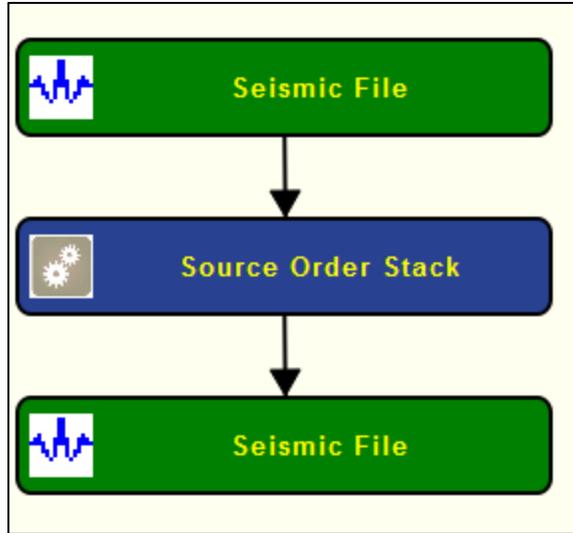
Input Links:

1) Seismic data in common source sort order (mandatory).

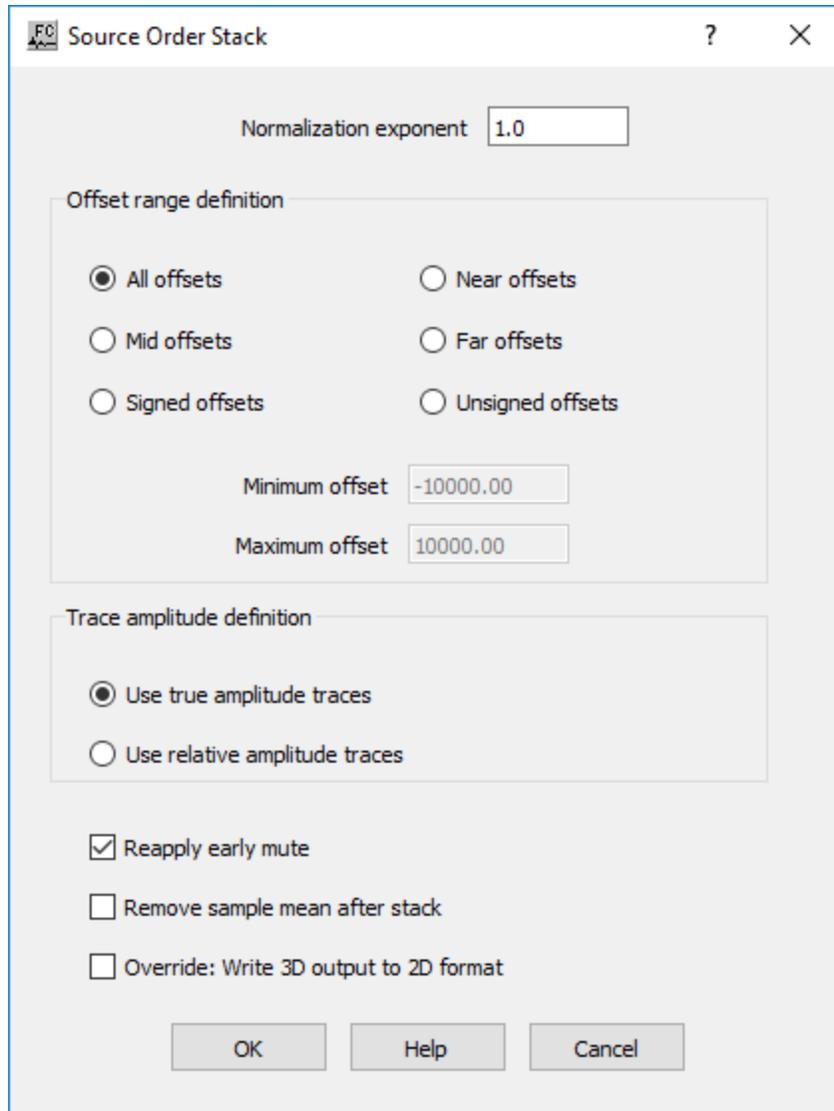
Output Links:

1) Seismic data as a stack (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Normalization exponent — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Offset range definition: Specify the offset range for the stack.

All offsets — If selected, all offsets will be stacked.

Near offsets — If selected, the near 1/3rd offsets will be stacked.

Mid-range — If selected, the mid 1/3rd offsets will be stacked.

Far offsets — If selected, the far 1/3rd offsets will be stacked.

Signed offset — If selected, offsets in the signed (both positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Unsigned offset — If selected, offsets in the unsigned (absolute value of positive and negative offsets) range will be stacked. Specify the minimum and maximum offsets to be used.

Minimum — Enter the minimum offset range to stack.

Maximum — Enter the maximum offset range to stack.

Trace amplitude definition: Specify type of amplitudes to be used for the stack.

Use true amplitude traces — If selected, the absolute amplitude will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Use relative amplitude traces — If selected, relative amplitude will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Reapply early mute — If checked, reapplies an early mute after stacking the data

Remove sample mean after stack — If checked, removes the average DC bias from each stacked trace.

Override: Write 3D output to 2D format — If checked, writes the output as a 2D seismic file.

Trace Mixing

Usage:

The *Trace Mixing* step is used to perform a weighted horizontal sum of up to fifteen (15) sequential input traces into a single output trace.

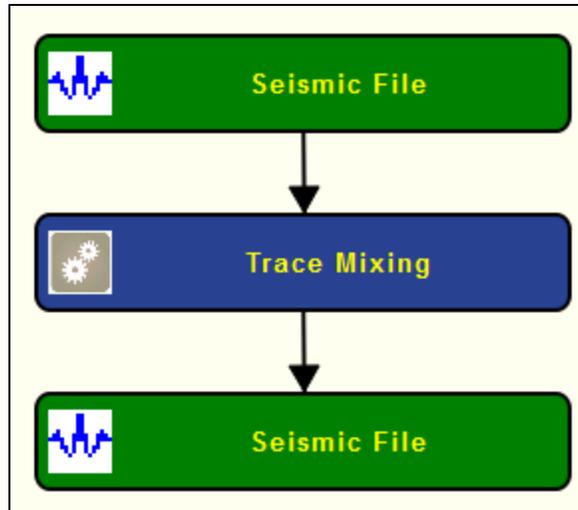
Input Links:

1) Seismic data in any sort order (mandatory).

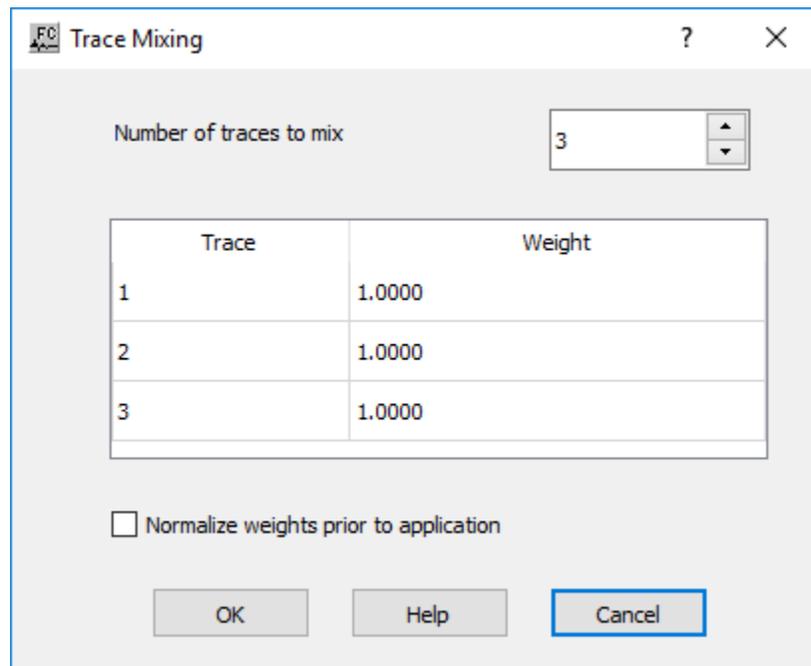
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Number of traces to mix — Enter the number of traces to mix (blend) into each output trace.

Weight — The relative value of the weight for each trace in the m

Statics Steps

Statics
↑ Processing Categories
Apply Static Shifts
Datum Statics
First Arrival Picking
First Break Auto-Picking
Flat Datum Statics
Stack-Power Optimization Statics
Surface Consistent Residual Statics
Trim Statics

Apply Statics Shift

Usage:

The *Apply Static Shifts* step allows you to apply source, receiver, CMP, and trace statics calculated by the various statics processing steps. The static shift values can be applied in either a coarse grain mode or fine grain mode. The coarse grain mode applies static shifts by shifting the trace to the nearest sample in the time domain. The fine grain mode uses a phase shift in the frequency domain to apply the shift, allowing an efficient method of shifting your data in increments less than the sample interval.

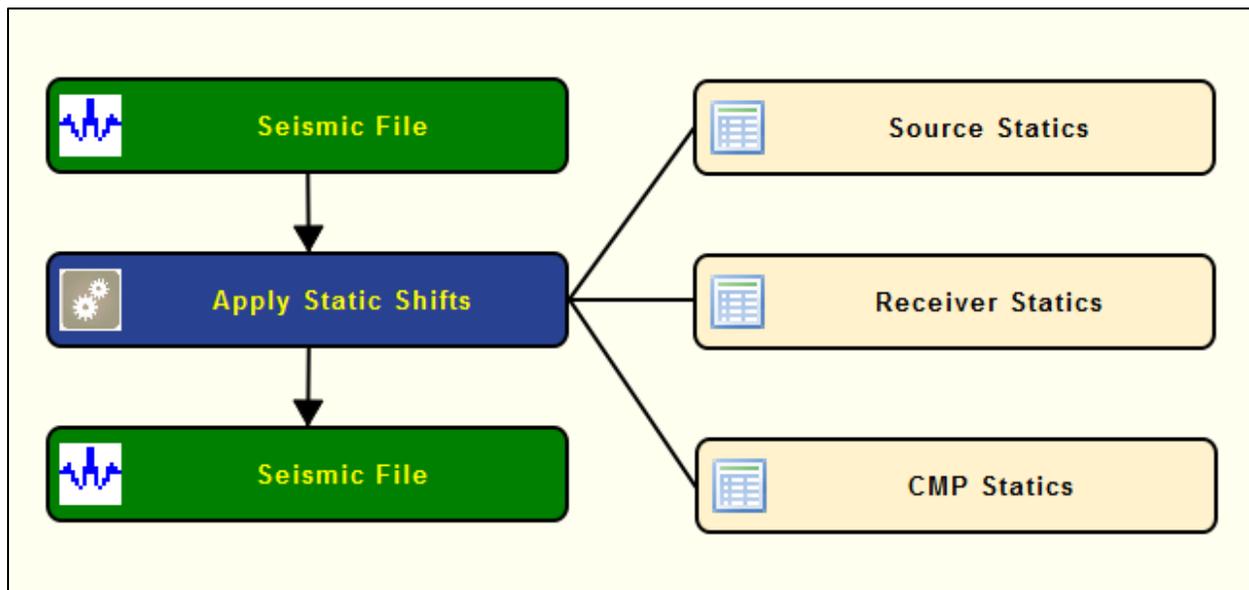
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) CMP Statics cards (optional).
- 3) Receiver Statics cards (optional).
- 4) Source Statics cards (optional).
- 5) Trace Statics cards (optional).

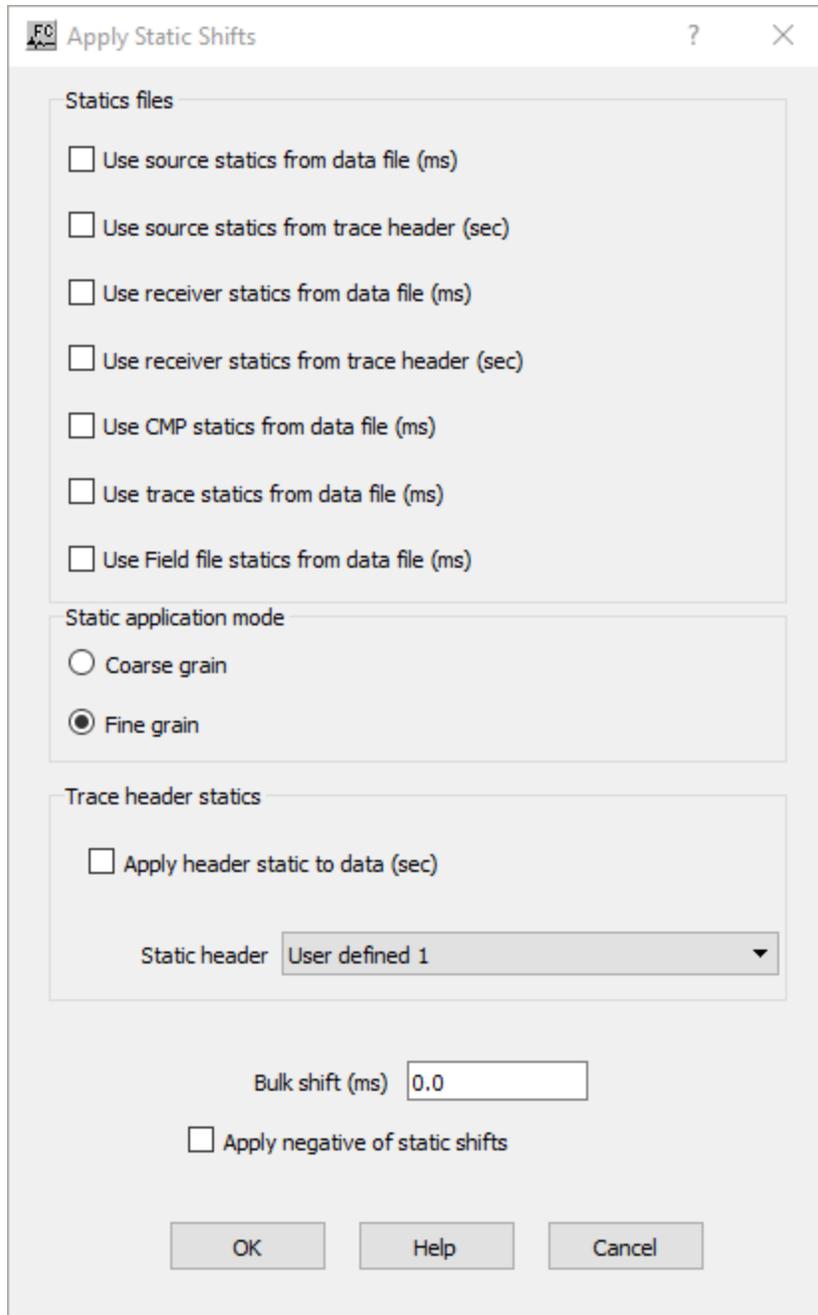
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Statics files: Specify the static shifts that will be applied from your selections.

Use source statics from data file (ms) — If checked, source statics shifts in milliseconds will be applied from a data file.

Use source statics from trace header (sec) — If checked, source statics shifts in seconds will be applied from a trace header.

Use receiver statics from data file (ms) — If checked, receiver statics shifts in milliseconds will be applied from a data file.

Use receiver statics from trace header (sec) — If checked, receiver statics shifts in seconds will be applied from a trace header.

Use CMP statics from data file (ms) — If checked, CMP statics shifts in milliseconds will be applied from a data file.

Use trace statics from data file (ms) — If checked, trace statics shifts in milliseconds will be applied from a data file.

Static application mode: Specify the mode of statics application.

Coarse grain — Statics shifts are applied to the nearest discrete sample position.

Fine grain — Statics shifts are applied as a precise phase shift operator in the Fourier domain.

Trace header statics: Specify the header location with statics to be applied to your data.

Apply header static to data — If checked, the value in the user selected trace header field will be applied to the seismic trace as a static shift.

Static header — Use the drop down menu to select the trace header field that will be applied to the trace as a static shift.

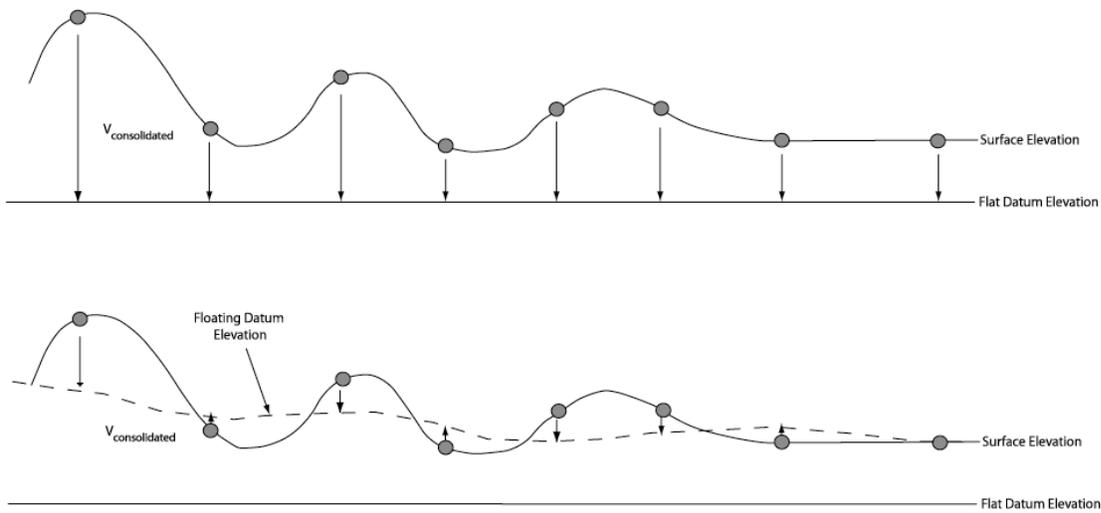
Bulk shift (ms) — Enter a constant statics shift in milliseconds to apply to all the seismic data traces.

Apply negative of static shifts — If checked, the negative of the static values will be applied.

Datum Statics

Usage:

The *Datum Statics* step inputs the trace headers from a Seismic Data file and outputs a set of Source and Receiver static files that adjust the data to a floating datum, and CMP static file that adjusts the data from the floating datum to a flat datum. Alternatively, the Source and Receiver statics can be computed that adjust the surface data directly to a flat datum. In both cases, the statics are applied using the *Apply Statics* step.



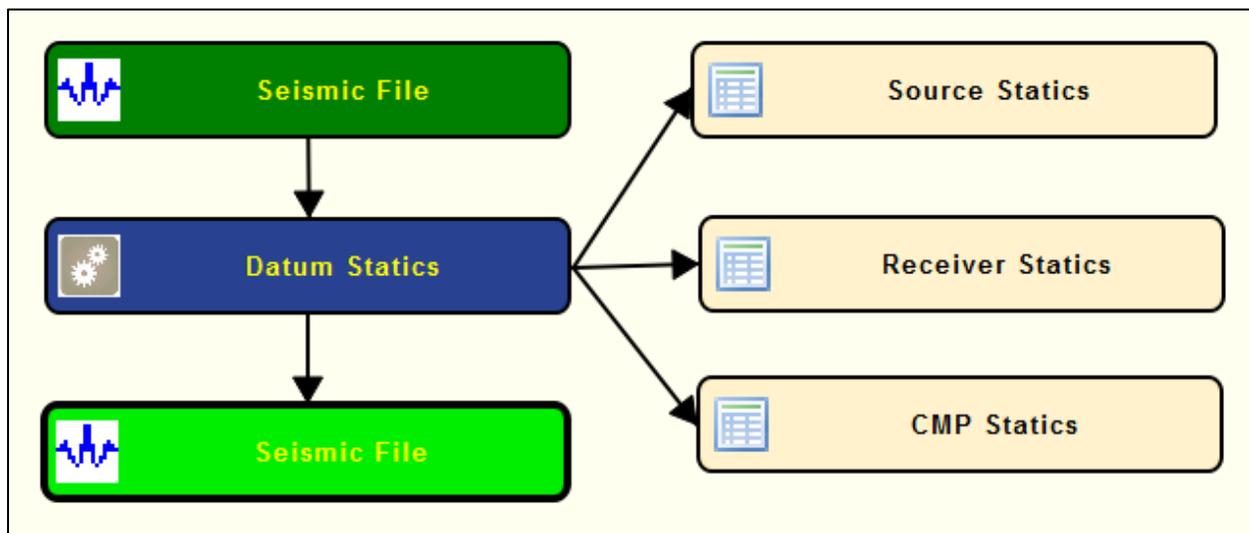
Input Links:

- 1) Seismic data file in any sort order (mandatory).

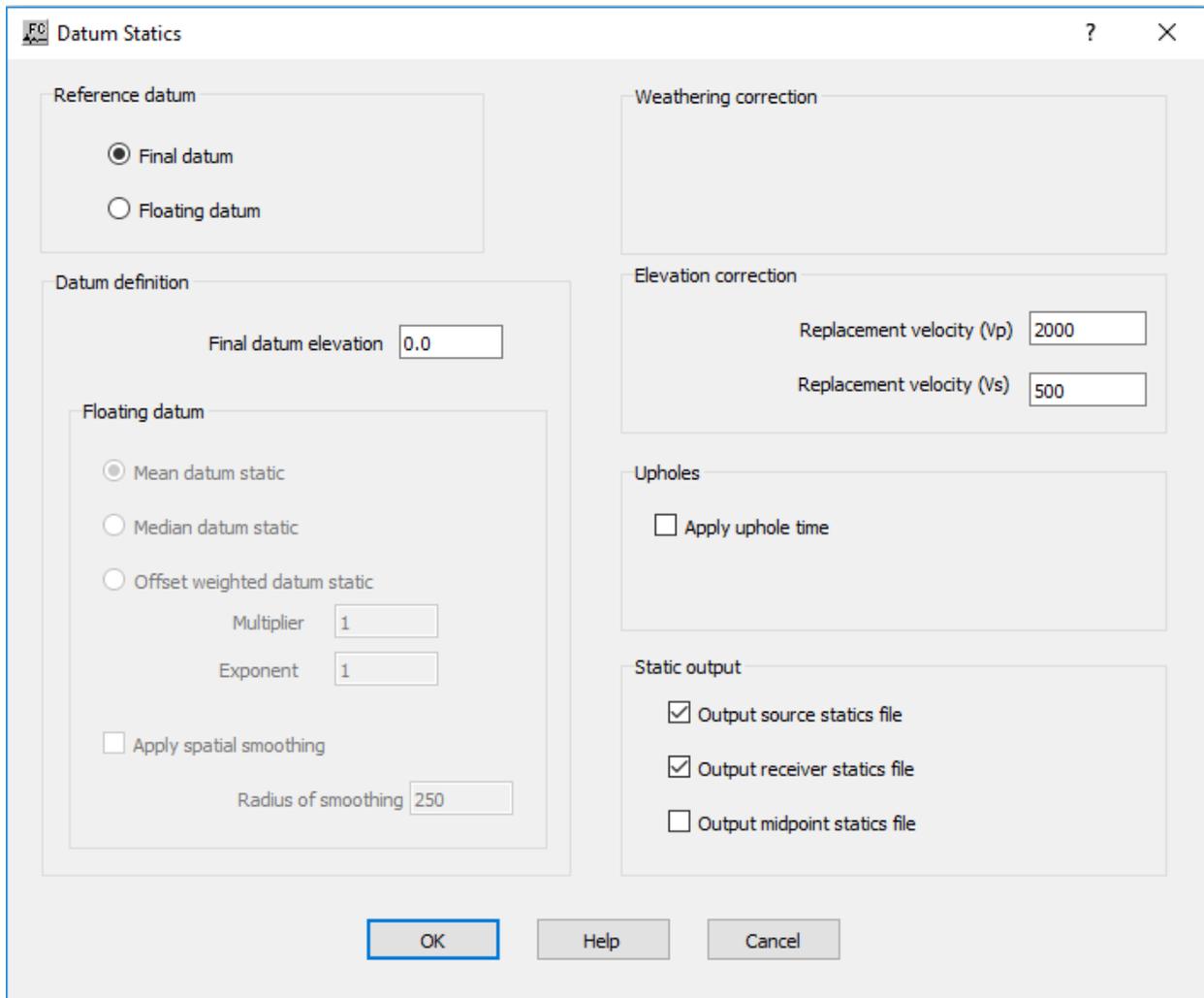
Output Links:

- 1) Source Statics cards (mandatory).
- 2) Receiver Statics cards (mandatory).
- 3) CMP Statics cards (optional, in the case of correction to a Floating Datum).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Reference datum: Specify datum preference.

Final datum — If selected final datum is considered.

Floating datum — If selected, a floating datum is considered.

Datum definition: Specify parameters that define your datum preference.

Final datum elevation — Enter a constant value for the elevation of the flat datum.

Floating datum: Specify the parameters for a floating datum function, if *Floating datum* is selected.

Mean datum static — If selected, an average operator for calculating the datum static will be used to define the datum.

Median datum static — If selected, a median smoothing operator for calculating the datum static will be used to define the datum.

Offset weighted datum static — If selected, a weighted CMP elevation function of the form $\text{weight} = \text{multiplier} * (\text{offset} ** \text{exponent})$ will be used to define the datum.

Multiplier — Enter the multiplier of the weighting function.

Exponent — Enter the exponent of the weighting function.

Apply spatial smoothing — If checked, apply spatial smoothing to the floating datum.

Radius of smoothing — Enter the radius of smoothing.

Elevation correction: Specify replacement velocities to correct the elevation.

Replacement velocity (Vp) — Enter a constant value to correct the traces to the final datum using the consolidated p-wave velocity.

Replacement velocity (Vs) — Enter a constant value to correct the traces to the final datum using the consolidated s-wave velocity.

Upholes: Specify whether to apply the uphole time.

Apply uphole time — If checked, the uphole static will be applied.

Static output: Specify how to output flat datum statics.

Output source statics file — If checked, source statics will be output as calculated from the surface to the flat datum.

Output receiver statics file — If checked, receiver statics will be output as calculated from the surface to the flat datum.

Output midpoint statics file — If checked, CMP statics will be output as zero.

First Arrival Picking

Usage:

Input Links:

Output Links:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

First Break Auto-Picking

Usage:

Input Links:

Output Links:

Example Flowchart:

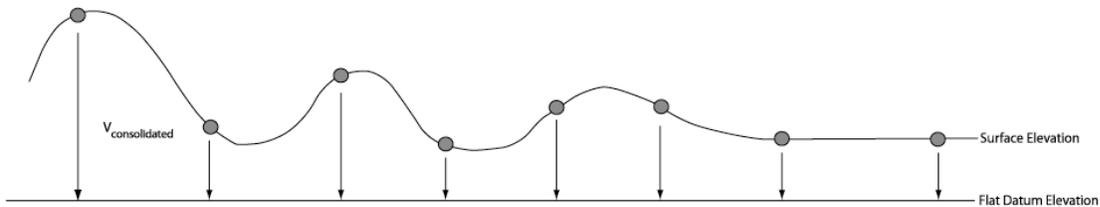
Step Parameter Dialog:

Parameter Description:

Flat Datum Statics

Usage:

The *Flat Datum Statics* applies a static shift correction to all the traces in reference to a flat datum as defined by its elevation.



Input Links:

1) Seismic data file in any sort order (mandatory).

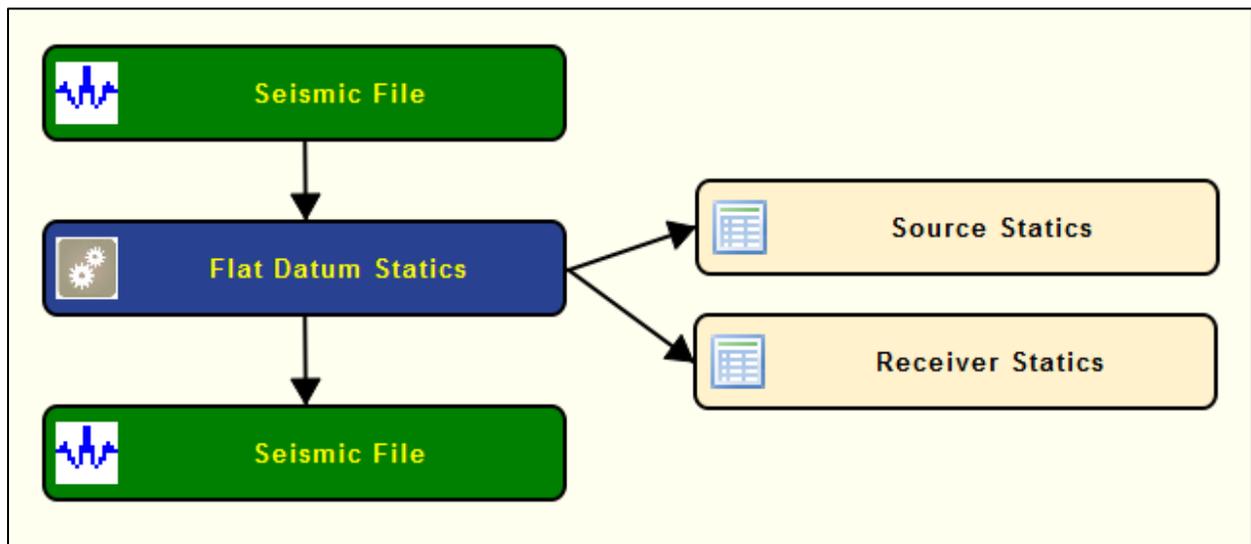
Output Links:

1) Seismic data file in any sort order (mandatory).

2) Source Statics cards (optional).

3) Receiver Statics cards (optional).

Example Flowchart:



Step Parameter Dialog:

The screenshot shows a dialog box titled "Flat Datum Statics". It has a title bar with a question mark and a close button. The dialog contains three input fields: "Consolidated P velocity" with the value "2000", "Consolidated S velocity" with the value "500", and "Flat datum elevation" with the value "0". Below these are three checkboxes: "Include uphole time" (unchecked), "Output source statics file" (checked), and "Output receiver statics file" (checked). At the bottom are three buttons: "OK", "Help", and "Cancel".

Parameter Description:

Consolidated P-velocity — Enter a constant value to correct the traces to the final datum using the consolidated P-wave velocity.

Consolidated S-velocity — Enter a constant value to correct the traces to the final datum using the consolidated S-wave velocity.

Final datum elevation — Enter a constant value for the elevation of the flat datum.

Include uphole time — If checked, the uphole static will be applied.

Output source statics file — If checked, source statics will be output as calculated from the surface to the flat datum.

Output receiver statics file — If checked, receiver statics will be output as calculated from the surface to the flat datum.

Stack-Power Optimization Statics

Usage:

The *Stack-Power Optimization Statics* step calculates surface consistent residual static time corrections by maximizing the power in the stack. Source and receiver super traces are cross-correlated with corresponding CMP super traces to determine a surface consistent static correction.

For 3-D, the input seismic file is required to be a CMP binned seismic volume. For 2-D, the input seismic file can be in any sort order, as long as Geometry Definition has been applied. Binning geometry for 3-D surveys should include all shot and receiver locations. Set the bin origin at the minimum source, receiver or CMP location.

Output stacks may be generated to evaluate the quality of the statics. The stacks show the sorted input file stacked in the analysis window with static corrections applied. The stacks are accumulated in the frequency domain and back transformed for the final stack trace. Numerical round off may cause slight variations when compared with stacks from the CMP Stack processing step. Stack type may be source, receiver or CMP.

Analysis stacks at specified intervals may be created to evaluate optimal convergence. The analysis stacks are a selected subset of source, receiver or CMP lines output to a specified directory. A unique filename suffix is assigned automatically for each iteration. Small subsets are recommended to reduce disk storage requirements. Full volume source, receiver and CMP stacks with user specified filename may be output for the final iteration.

An option exists to output to the console a summary of the static corrections generated at the end of each iteration. The source and receiver statics output by the Stack-Power Optimization Statics Step are applied with the *Apply Statics Shift* step.

Input Links:

- 1) Seismic data, 3-D binned or 2-D in any sort order with geometry applied (mandatory).

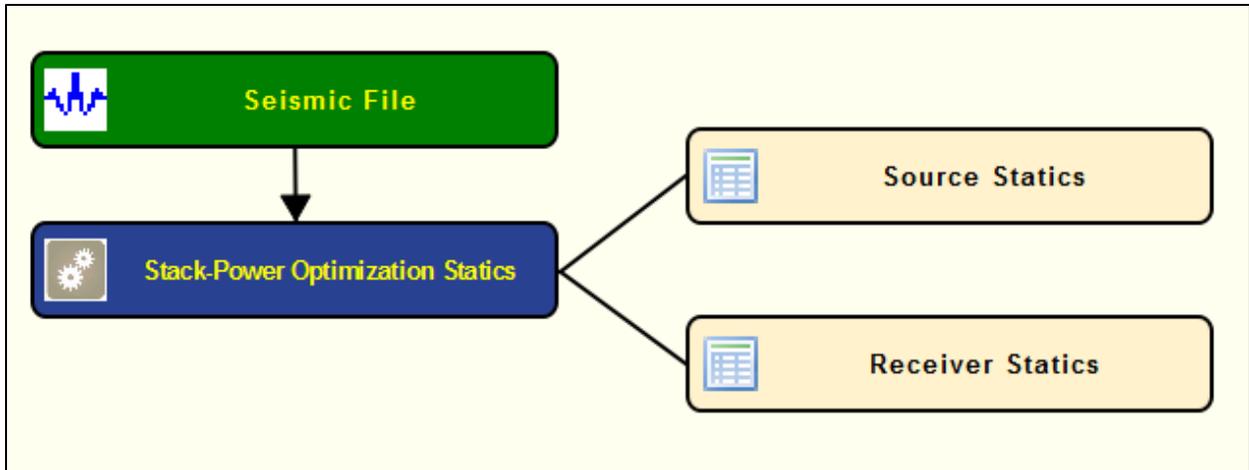
Output Links:

- 1) Source statics cards (mandatory).
- 2) Receiver statics cards (mandatory).
- 3) Selected stack analysis files (optional).
- 4) Selected stack volume (optional).

Reference:

Ronen J., and Claerbout, J., 1985, Surface-consistent residual statics estimation by stack-power maximization, *Geophysics*, vol. 50, no. 12, p. 2759-2767.

Example Flowchart:



Step Parameter Dialog:

Stack Power Optimization Statics

Pilot

Use input seismic stack for pilot traces

Use window definition file to build pilot

Use fixed window to build pilot

Correlation window start time (ms)

Correlation window stop time (ms)

Output pilot stacks

Statics calculation

Maximum allowable static (ms)

Maximum number of iterations

Minimum allowable fold

Percent stack power change for termination

Compute source term

Filter source term

Source term filter radius

Compute receiver term

Filter receiver term

Receiver term filter radius

Parameter Description:

Pilot — Specify type of pilot to be used in stack-power optimization statics.

Use input seismic stack for pilot traces — If checked, pilot traces are built from the input stack seismic data.

Use window definition file to build pilot — If checked, pilot traces are built from an auxiliary *Window definition* card data from the input seismic data.

Use fixed window to build pilot — If checked, pilot traces are built from a constant time gate from the input seismic data.

Correlation window start time (ms) — Enter the start time in milliseconds for the correlation window used to build the pilot.

Correlation window stop time (ms) — Enter the end time in milliseconds for the correlation window used to build the pilot.

Output pilot stacks — Select from the drop-down menu to output the pilot stacks used for the optimization. Stacks can be from the midpoint, source, receiver or any combination of these.

Statics calculation: Specify the statics calculation parameters.

Maximum allowable static (ms) — Enter a value in milliseconds for the maximum static shifts for each iteration. The final static is the sum of statics at each iteration. The total static may exceed the maximum allowable static per iteration.

Maximum number of iterations — Enter the maximum number of iterations for the processing step.

Minimum allowable fold — Enter the maximum allowable fold for the processing step.

Percent stack power change for termination — Enter the percentage value of the stack power change to terminate the optimization process.

Compute source term — Select from the drop-down menu to compute the statics for the source component.

Filter source term — Select from the drop-down menu to filter or not the source term component.

Source term filter radius — If filtering the source term, enter the filter radius.

Compute receiver term — Select from the drop-down menu to compute the statics for the receiver component.

Filter receiver term — Select from the drop-down menu to filter or not the receiver term component.

Receiver term filter radius — If filtering the receiver term, enter the filter radius.

Surface Consistent Residual Statics

Usage:

The *Surface Consistent Residual Statics* step calculates source and receiver residual statics using a Gauss-Seidel iterative method to solve for the source static, receiver static, structure term, and residual NMO) that provide a best fit to the linear traveltimes equations in a least-squares sense. linear inversion routine to decompose traveltimes equations into source, receiver, CMP, and offset related terms. The pick times input to the inversion are picked automatically using cross correlation in a specified time window. You control the window of data for analysis as well as the maximum allowable static that can be computed. A damping filter can be applied to suppress any long period effects associated with the residual statics solution. Options exist for removing either or both the residual normal moveout (RNMO) term and a linear trend from the statics solution. The source and receiver statics output by the Surface Consistent Residual Statics Step are applied with the Apply Statics step.

Input Links:

1) Seismic data - NMO corrected CMP gathers (mandatory).

Output Links:

1) Source Statics cards (mandatory).

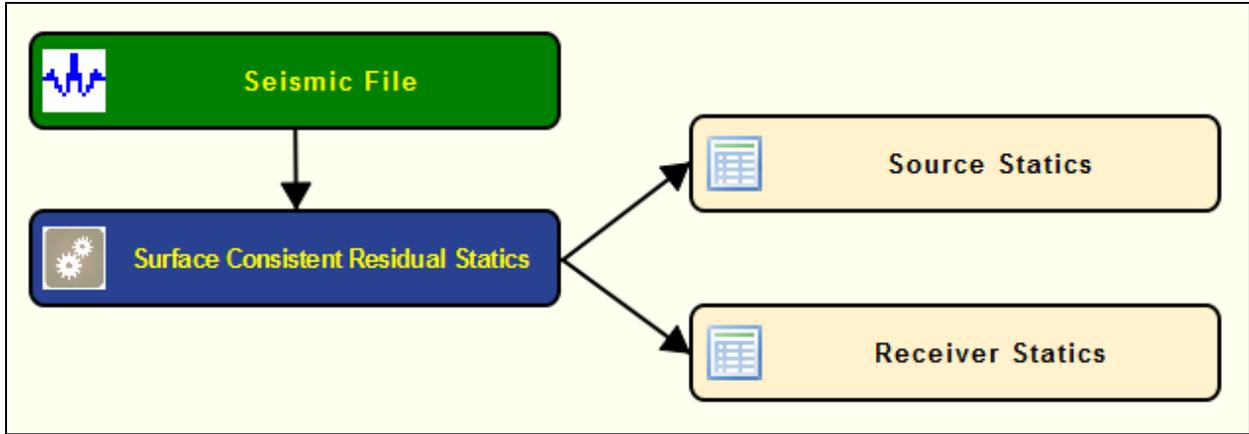
2) Receiver Statics cards (mandatory).

Reference:

Wiggins, R. A., et al., 1976, Residual statics analysis as a general linear inverse problem: Geophysics, vol. 50, no. 11, p. 2172ff.

See Technical Note TN-ResSt.doc

Example Flowchart:



Step Parameter Dialog:

Surface Consistent Residual Statics

Pilot

Use input seismic stack for pilot traces

Use window definition file to build pilot

Use fixed window to build pilot

Correlation window start time (ms)

Correlation window stop time (ms)

Build refined pilot

Output pilot

Statics calculation

Maximum allowable static (ms)

RMS error change for termination (ms)

Minimum allowable fold

Compute source term

Smooth source term

Source term smoothing radius

Compute receiver term

Smooth receiver term

Receiver term smoothing radius

Compute structure term

Smooth structure term

Structure term smoothing radius

Compute residual moveout (RNMO) term

Smooth RNMO term

RNMO smoothing radius

Parameter Description:

Statics calculation: Specify parameters related with the statics calculation.

Maximum allowable static (ms) — Enter the maximum allowable static shift in milliseconds.

RMS error change for termination (ms) — Error the minimum RMS error change from iteration to iteration for the optimization to be considered finished.

Minimum allowable fold — Enter the minimum fold allowable for the optimization.

Compute source term — Select from the drop-down menu to compute the statics for the source term.

Smooth source term — Select from the drop-down menu to filter or not the source term.

Smooth source term — If filtering the source term, enter the filter radius.

Compute receiver term — Select from the drop-down menu to compute the statics for the receiver term.

Smooth receiver term — Select from the drop-down menu to filter or not the receiver term component.

Receiver term smoothing radius — If filtering the receiver term, enter the filter radius.

Compute structure term — Select from the drop-down menu to compute the statics for the receiver component.

Smooth structure term — Select from the drop-down menu to filter or not the receiver term component.

Structure term smoothing radius — If filtering the structure term, enter the filter radius.

Compute residual moveout (RNMO) term — If checked, a least squares linear fit will be removed from the final statics solution.

Smooth RNMO term — Select from the drop-down menu to filter or not the RNMO term component.

RNMO smoothing radius — If filtering the RNMO term, enter the filter radius

Trim Statics

Usage:

The *Trim Statics* step calculates small CMP statics shifts for the data based on alignment of events within the specified window. You specify the start time and the length of the analysis window for

calculation and the maximum allowed static shift. The step finds the static shift within these limits using automatic picking of the peak of the cross-correlation amplitude between the trace and the stacked trace for the gather.

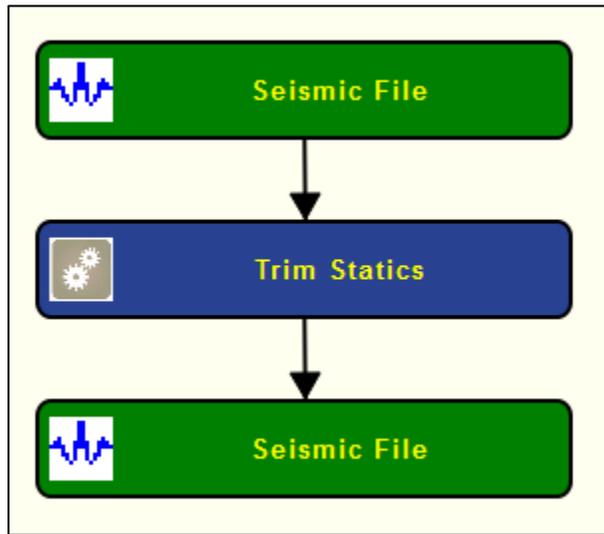
Input Links:

1) Seismic data in CMP sort order (mandatory).

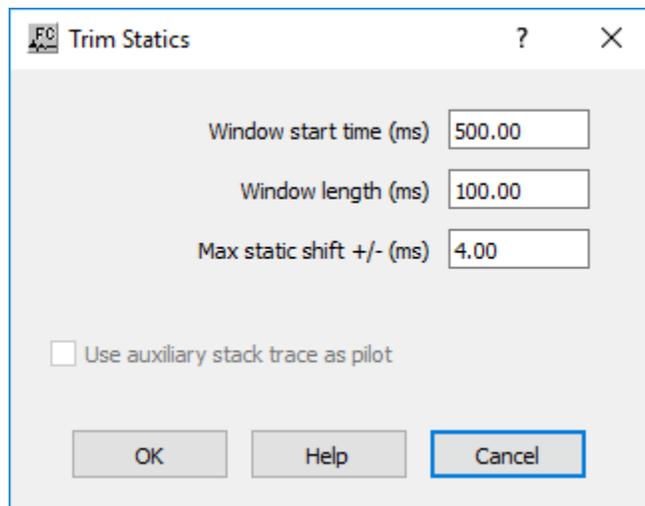
Output Links:

1) Seismic data in CMP sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Window start time (ms) — Enter the window start time in milliseconds for trim statics analysis.

Window length (ms) — Enter the length of the window in milliseconds for trim statics analysis.

Max static shift +/- (ms) — Enter the largest allowable static shift in milliseconds for trim statics analysis.

Use auxiliary stack trace as pilot — Not yet implemented.

Trace Attributes Steps

Trace Attributes	
	Processing Categories
	Instantaneous Amplitude
	Instantaneous Frequency
	Instantaneous Phase

Instantaneous Amplitude

Usage:

The *Instantaneous Amplitude* step calculates instantaneous amplitude attributes for each trace and outputs each as a seismic trace in the output seismic file. Instantaneous amplitude is a measure of the reflectivity strength of events on a seismic section.

Input Links:

1) Seismic data in any sort order (mandatory).

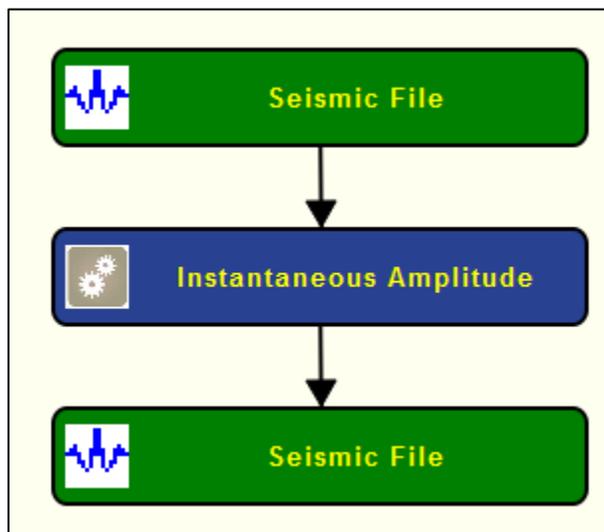
Output Links:

1) Seismic attribute data in any sort order (mandatory).

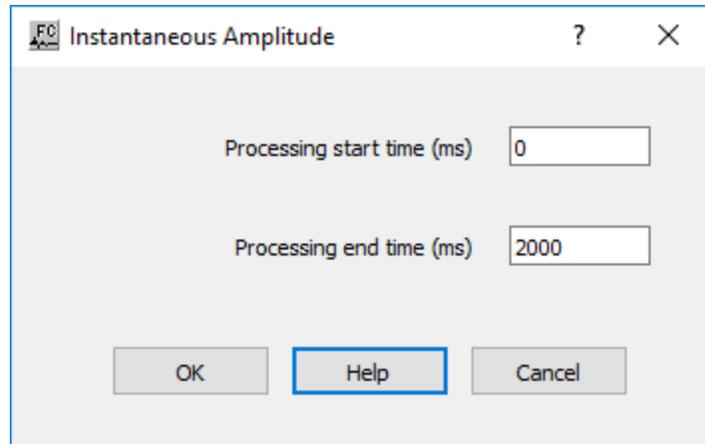
Reference:

Taner, M.T., Koehler, F., Sheriff, R.E., 1979, Complex Seismic Trace Analysis: Geophysics, v. 44, no. 6, p. 1041-1063.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) in milliseconds of the time gate where the calculation will start.

Processing end time (ms) — Enter the end time (lower boundary) in milliseconds of the time gate where the calculation will end.

Instantaneous Frequency

Usage:

The Instantaneous Frequency step calculates instantaneous frequency attribute for each trace and outputs each as a seismic trace in the output seismic file. This attribute is a measure of the frequency of events on a seismic section.

Input Links:

1) Seismic data in any sort order (mandatory).

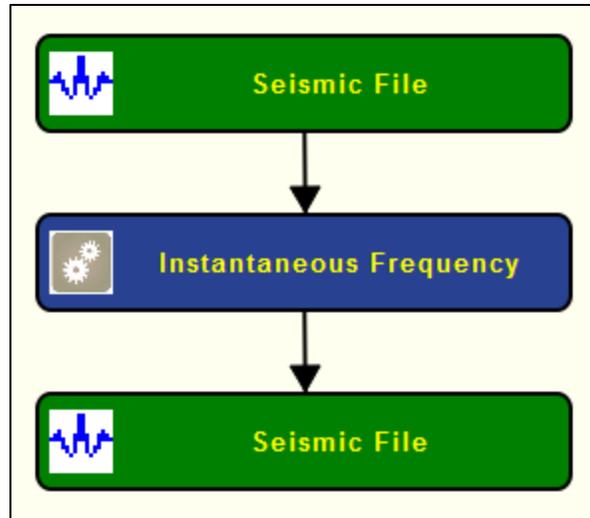
Output Links:

1) Seismic attribute data in any sort order (mandatory).

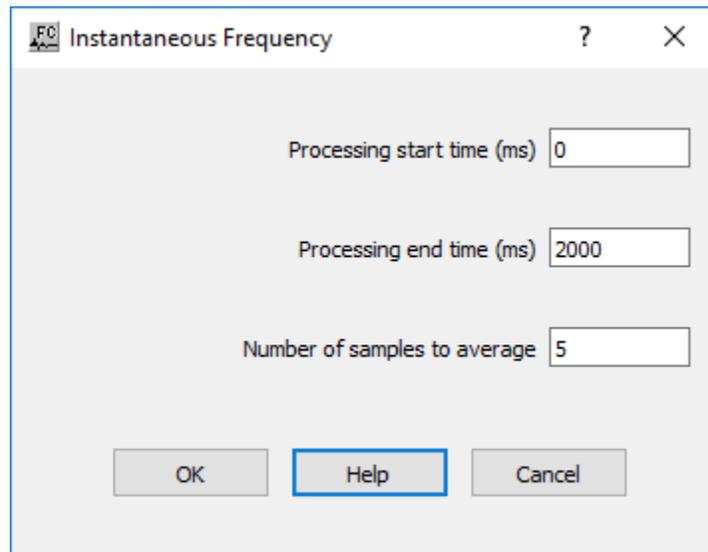
Reference:

Taner, M.T., Koehler, F., Sheriff, R.E., 1979, Complex Seismic Trace Analysis: Geophysics, v. 44, no. 6, p. 1041-1063.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) in milliseconds of the time gate where the calculation will start.

Processing end time (ms) — Enter the end time (lower boundary) in milliseconds of the time gate where the calculation will end.

Number of samples to average — Enter the number of seismic samples to be averaged during the calculation of the *Instantaneous Frequency* step.

Instantaneous Phase

Usage:

The Instantaneous Phase step calculates instantaneous phase attribute for each trace and outputs each as a seismic trace in the output seismic file. This attribute is a measure of the continuity of events on a seismic section.

Input Links:

1) Seismic data in any sort order (mandatory).

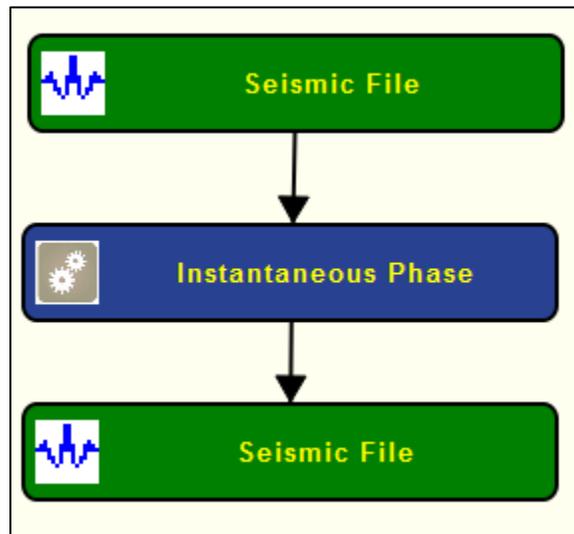
Output Links:

1) Seismic attribute data in any sort order (mandatory).

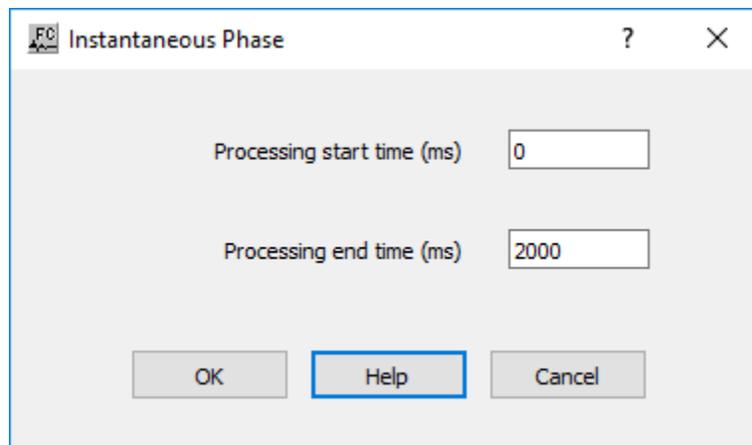
Reference:

Taner, M.T., Koehler, F., Sheriff, R.E., 1979, Complex Seismic Trace Analysis: Geophysics, v. 44, no. 6, p. 1041-1063.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Processing start time (ms) — Enter the start time (upper boundary) in milliseconds of the time gate where the calculation will start.

Processing end time (ms) — Enter the end time (lower boundary) in milliseconds of the time gate where the calculation will end.

VSP Steps

This section documents the processing steps available in the *VSP Steps* category.

Processing steps currently available are:

VSP
↑ Processing Categories
Apply VSP Traveltimes
Calculate VSP Traveltimes
VSP CMP Transform
VSP Corridor Stack
VSP Deconvolution
VSP Downhole Locations
VSP Extract Corridor
VSP First Arrival Time Picks
VSP Geometry Definition
VSP SPS Relation Records
VSP Surface Locations
VSP Wavefield Separation

Apply VSP Traveltimes

Usage:

The *Apply VSP Traveltimes* step applies the traveltimes corrections stored in the trace headers of the seismic file, as computed from *Calculate VSP Traveltimes*, so the gather can be flattened according to these corrections.

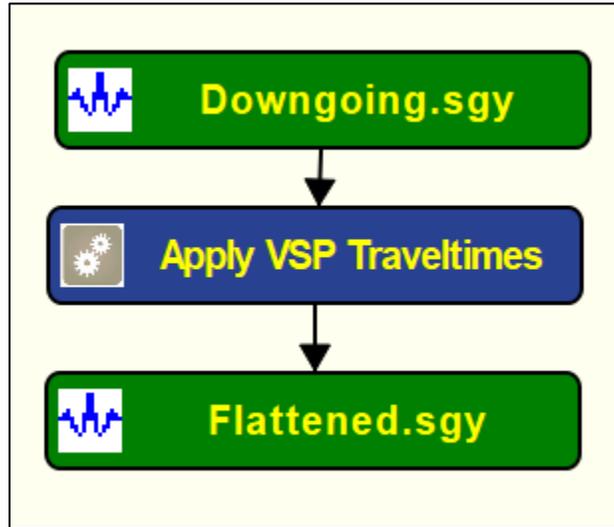
Input Links:

1) Seismic data in any sort order (mandatory).

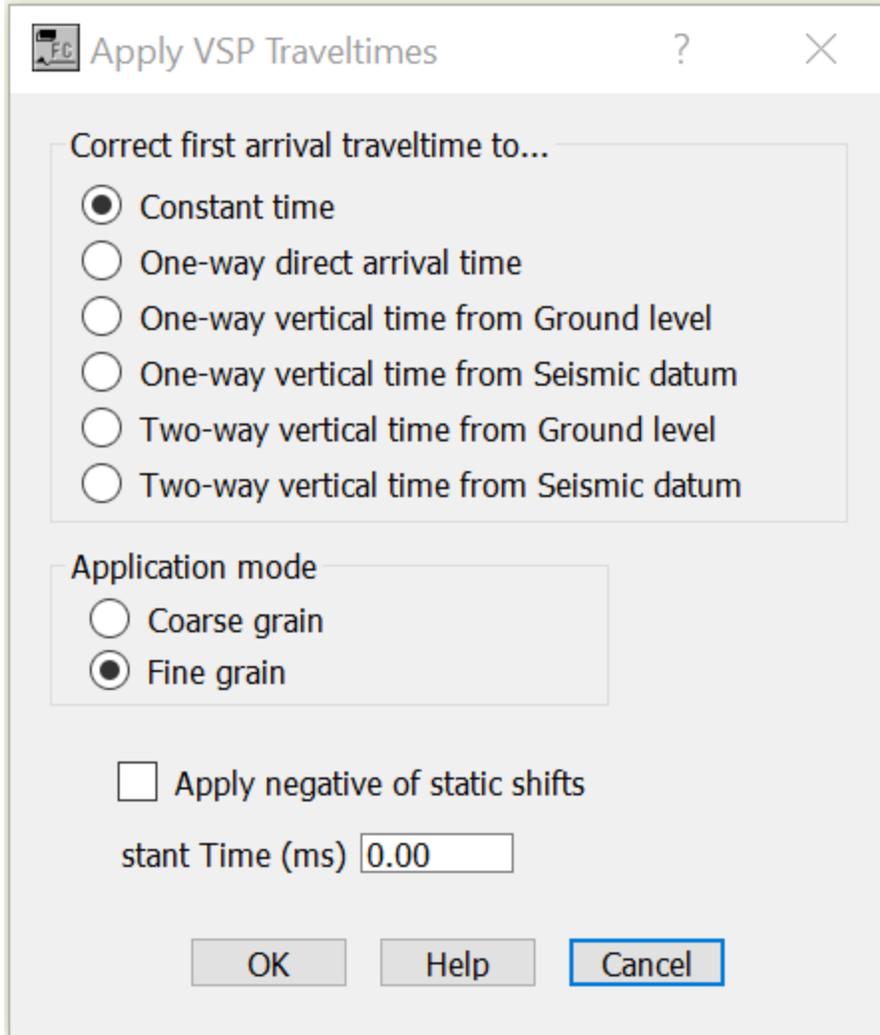
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Correct first arrival traveltimes to...: Specify where the VSP first arrival traveltimes will be corrected to.

Constant time — If selected, VSP first arrival traveltimes will be correct to a constant two-way time as defined in *Constat Time (ms)*.

One-way direct arrival time — If selected, VSP first arrival traveltimes will be correct to the one-way direct arrival time as defined in the picking file.

One-way vertical time from Ground level — If selected, VSP first arrival traveltimes will be corrected vertically to the one-way time corresponding to the ground level location.

One-way vertical time from Seismic datum — If selected, VSP first arrival traveltimes will be corrected vertically to the one-way time corresponding to the ground seismic reference datum.

Two-way vertical time from Ground level — If selected, VSP first arrival traveltimes will be corrected vertically to the two-way time corresponding to the ground level location.

Two-way vertical time from Seismic datum — If selected, VSP first arrival traveltimes will be corrected vertically to the two-way time corresponding to the seismic reference datum.

Application mode: Specify the mode of statics application.

Coarse grain — If selected, statics shifts are applied to the nearest discrete sample position.

Fine grain — If selected, statics shifts are applied as a precise phase shift operator in the Fourier domain.

Apply negative static shifts — If, checked apply a negative of the static shifts.

Constant time (ms)/ Bulk shift (ms) — Enter the constant time in millisecond to be used as reference if *Constant time* is selected. Enter a bulk shift value in milliseconds to shift all the data simultaneously with this value.

Calculate VSP Traveltimes

Usage:

The *Calculate VSP Traveltimes* step computes corrections for the travel times based on the picking of the first arrivals (auxiliary *VSP Frist* Arrivals card data). The output seismic file has the trace headers corresponding to VSP depths, times and velocities update accordingly. This file can then be used as input for the *Apply VSP Traveltimes* step in order to flatten the record.

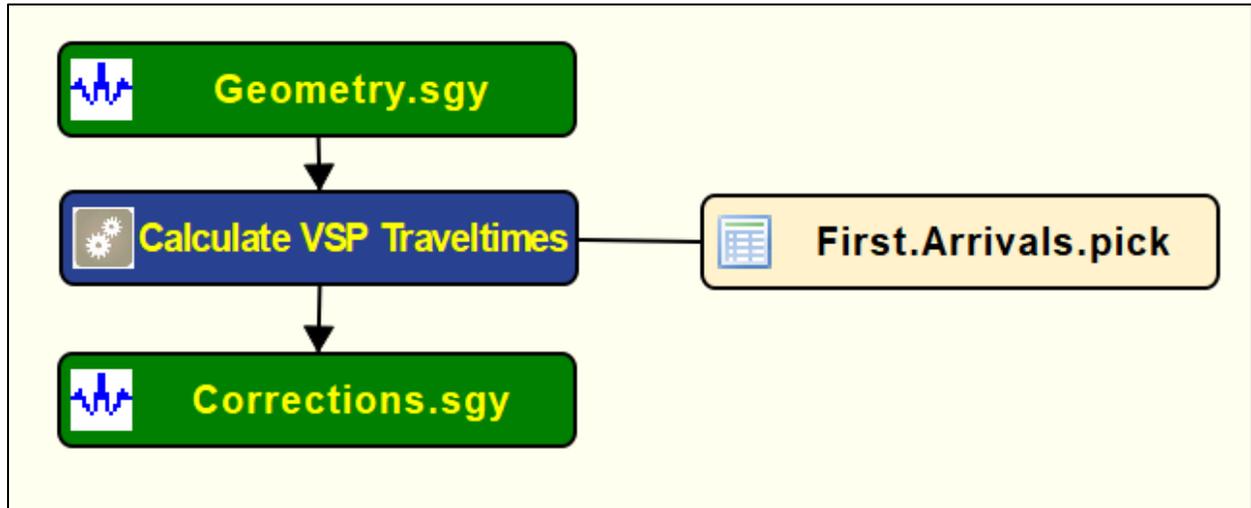
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) VSP First arrivals card data (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Calculate VSP Traveletimes

Well location

Kelly bushing Seismic reference datum

Ground elevation Mean sea level

Project updates

Update from project Update project

Near surface model

Weathering depth Marine VSP

Weathering velocity Fluid velocity

Replacement velocity

OK Help Cancel

Parameter Description:

Well location: Specify general parameter related with the well corresponding to the VSP.

Kelly bushing — Enter a value for the Kelly bushing (KB) of the well corresponding to the VSP. KB is defined in project units (m or ft).

Seismic reference datum — Enter a value for the seismic reference datum (SRD). SRD is defined in project units (m or ft).

Ground elevation — Enter a value for the ground elevation/level (GL). GL is defined in project units (m or ft).

Mean sea level — Enter a value for the mean sea level (MSL). MSL is defined in project units (m or ft).

Project updates: Specify either if the geometry is updated from the project or if the project settings will be updated with current parameterization.

Update from project — Updates the corner points from the SPS data that has been associated with the project using the Survey > SPS Database menu.

Update project — Use this to broadcast the corner points so that they can be used by to set the Easting and Northing ranges of plotting functions, such as the Attribute Map used later in this flow.

Near surface model: Specify parameters related with the near surface model.

Weathering depth — Enter a value for the total depth of the weathering layer. Depth defined in project units (m or ft).

Weathering velocity — Enter a value for the velocity of the weathering layer.

Replacement velocity — Enter a value for the replacement velocity to be used to compute the VSP traveltimes corrections.

Marine VSP — If checked, VSP is assumed to be acquired in marine environment.

Fluid velocity — Enter the fluid velocity if VSP was acquired in marine environment.

VSP CMP Transform

Usage:

The *VSP CMP Transform* step moves offset VSP data to the reflecting point location (approximately half the distance for the largest offset) assuming that there is no dip.

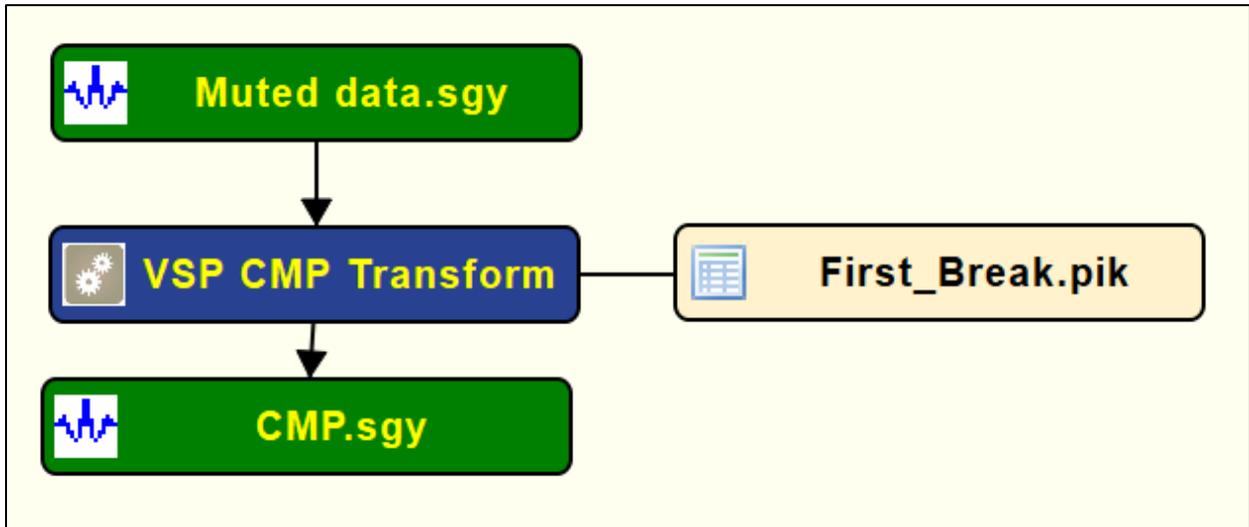
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) VSP First arrivals card data (mandatory).

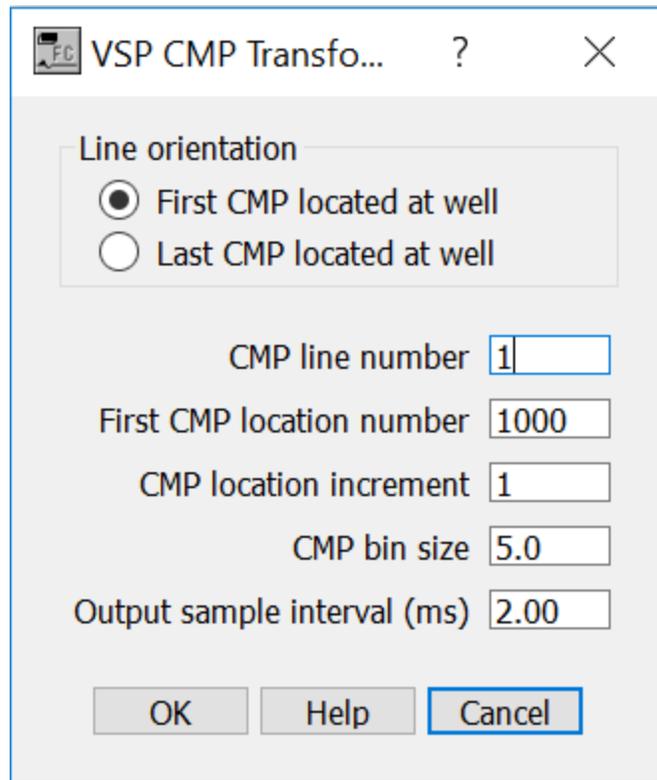
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Line orientation: Specify which CMP location is closer to the well head.

First CMP located at well — If selected, first CMP is assumed to be located at the well.

Last CMP located at well — If selected, last CMP is assumed to be located at the well.

CMP line number — Enter the CMP line number.

First CMP location number — Enter the first CMP location number.

CMP location increment — Enter the CMP location increment.

CMP bin size — Enter CMP bin size.

Output sample interval (ms) — Enter the sample interval of the output VSP data.

VSP Corridor Stack

Usage:

The *VSP Corridor Stack* stacks a VSP record after a corridor being extracted. The resulting VSP seismic file has the number of traces as defined in *Number of duplicate traces* parameter.

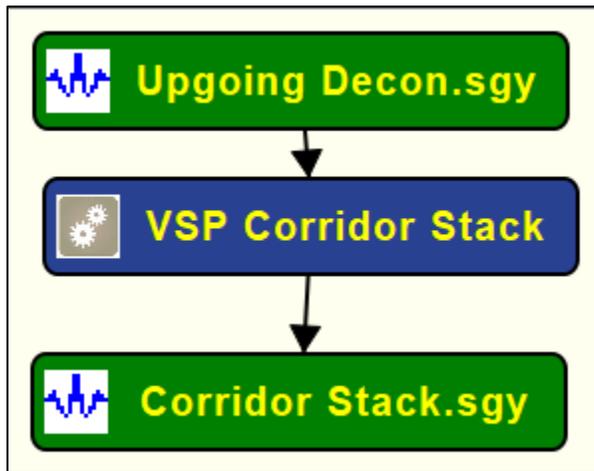
Input Links:

1) Seismic data in any sort order (mandatory).

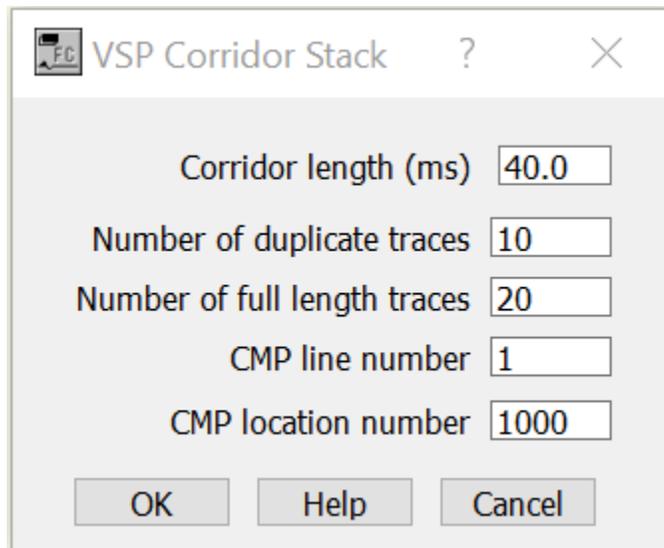
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Corridor length (ms) — Enter the length of the corridor of data to be extracted in milliseconds.

Number of duplicate traces — Enter the number of duplicated traces in the corridor stack.

Number of full length traces — Enter the number of full length traces to be extracted.

CMP line number — Enter the CMP line number corresponding to the VSP location.

CMP location number — Enter the CMP location number corresponding to the VSP location.

VSP Deconvolution

Usage:

The *VSP Deconvolution* step applies deconvolution operators using Wiener-Levinson algorithm to the VSP data. *VSP Deconvolution* is normally applied to records representing the downgoing or upgoing wavefields.

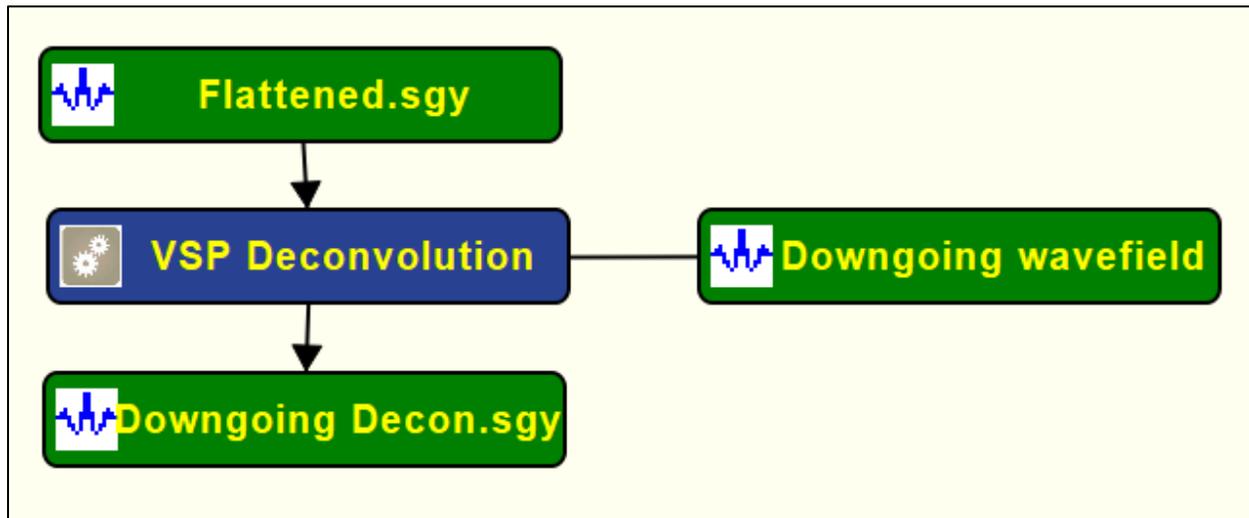
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Seismic data with downgoing wavefield (optional).

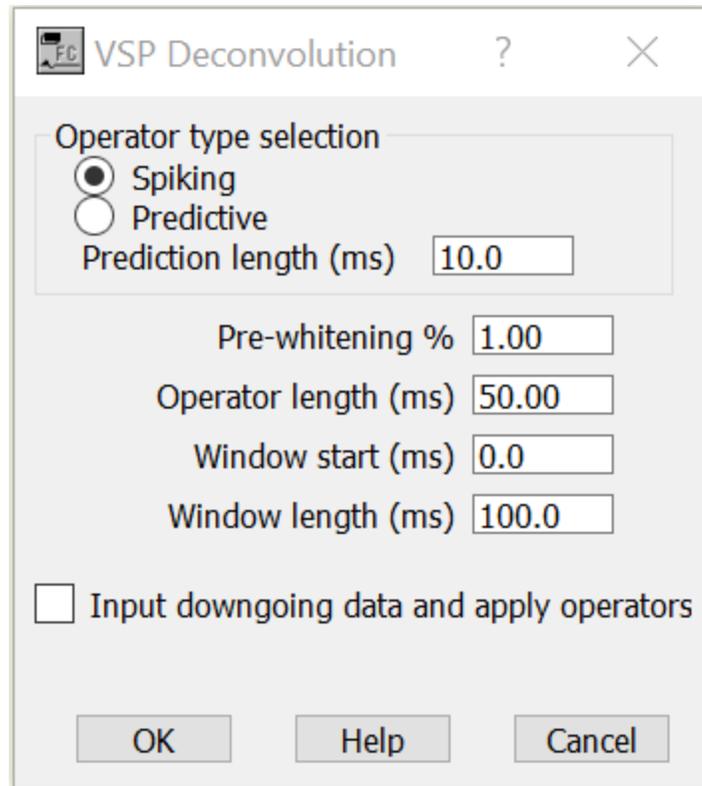
Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Operator type selection:

Spiking — If selected, applies a spiking deconvolution to the VSP data.

Predictive — If selected, applies a predictive deconvolution to the data.

Prediction length (ms) — Enter the prediction length of the predictive deconvolution operator.

Pre-whitening % — Enter the amount of white noise to add. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Operator length (ms) — Enter the length of the operator to be calculated and applied in milliseconds.

Window start (ms) — Enter the start time in milliseconds of the deconvolution design window.

Window length (ms) — Enter the length in milliseconds of the deconvolution design window.

Input downgoing data and apply operators — If selected, an auxiliary seismic file with the downgoing field is used as auxiliary data.

VSP Downhole Locations

Usage:

The *VSP Downhole Locations* card data is used to store the positional downhole receiver locations to be used by *VSP Geometry Definition* step.

Step Parameter Dialog:

VSP Surface Locations

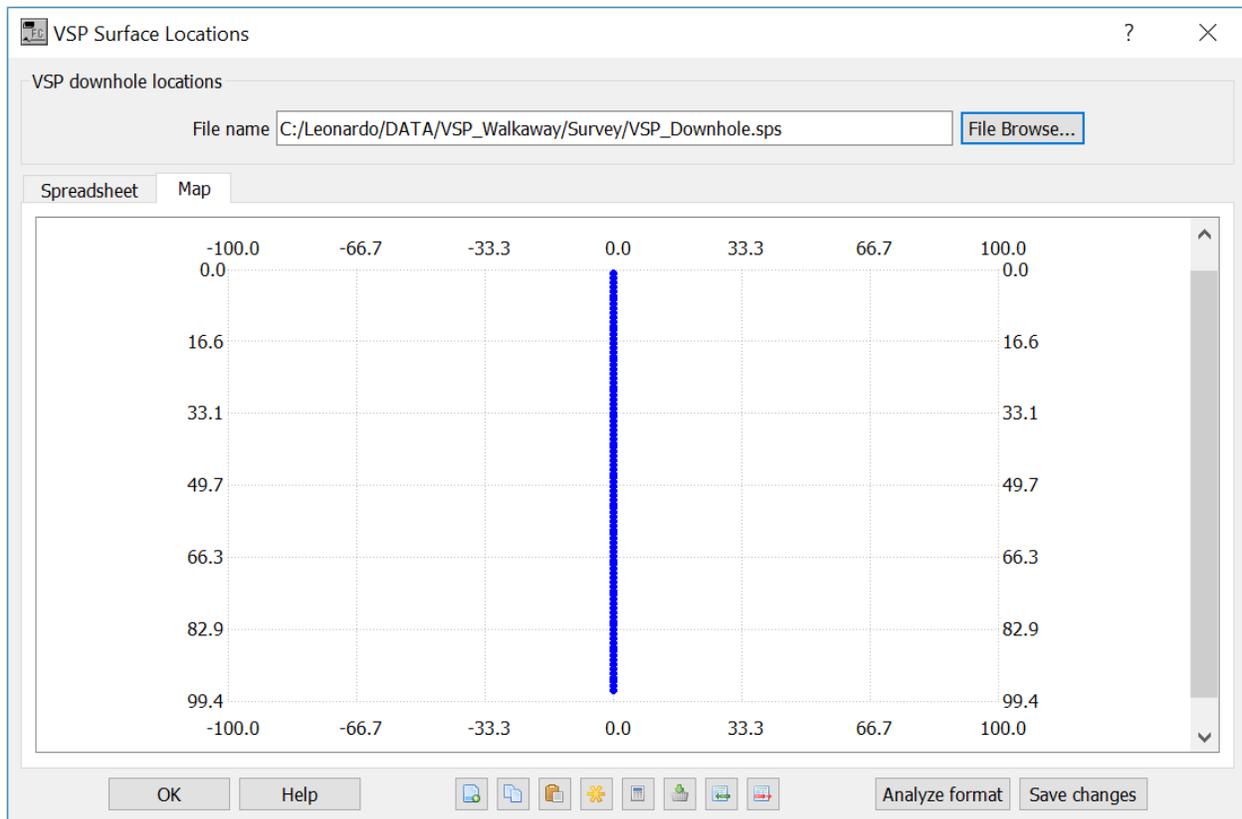
VSP downhole locations

File name: C:/Leonardo/DATA/VSP_Walkaway/Survey/VSP_Downhole.sps [File Browse...](#)

Spreadsheet | Map

Record ID	Downhole line	Downhole locat	Surface eastin	Surface northir	Surface elevatic	Measured dep
1	1	1	0.00	0.00	18.10	1.00
2	1	2	0.00	0.00	18.10	2.00
3	1	3	0.00	0.00	18.10	3.00
4	1	4	0.00	0.00	18.10	4.00
5	1	5	0.00	0.00	18.10	5.00
6	1	6	0.00	0.00	18.10	6.00
7	1	7	0.00	0.00	18.10	7.00
8	1	8	0.00	0.00	18.10	8.00
9	1	9	0.00	0.00	18.10	9.00
10	1	10	0.00	0.00	18.10	10.00

OK Help Analyze format Save changes



Parameter Description:

Downhole line — Enter the downhole lin value.

Downhole location — Enter the downhole location.

Surface Easting — Enter the surface Easting coordinate corresponding to the downhole location.

Surface Northing — Enter the surface Northing coordinate corresponding to the downhole location.

Surface elevation — Enter the surface elevation corresponding to the downhole location.

Measured depth — Enter the measured depth coordinate corresponding to the downhole location.

VSP Extract Corridor

Usage:

The *VSP Extract Corridor* step extracts a corridor of data base on the first arrival times. This allows removing noisy data and focus on reflections close to the well location.

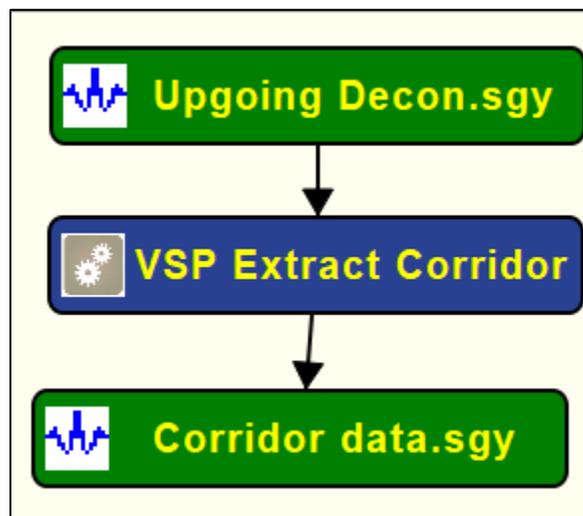
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

The screenshot shows a dialog box titled 'VSP Extract Corri...' with a standard Windows window header (minimize, maximize, close buttons). The dialog contains four input fields with corresponding labels:

- Corridor length (ms)
- Number of full length traces
- CMP line number
- CMP location number

At the bottom of the dialog are three buttons: 'OK', 'Help', and 'Cancel'.

Parameter Description:

Corridor length (ms) — Enter the length of the corridor of data to be extracted in milliseconds.

Number of full length traces — Enter the number of full length traces to be extracted.

CMP line number — Enter the CMP line number corresponding to the VSP location.

CMP location number — Enter the CMP location number corresponding to the VSP location.

VSP First Arrival Time Picks

Usage:

Input Links:

Output Links:

Example Flowchart:

Step Parameter Dialog:

Parameter Description:

VSP Geometry Definition

Usage:

The *VSP Geometry Definition* step assigns survey information to the VSP trace headers based on the source, receiver, and observer notes SPS files. The *VSP Geometry Definition* step assigns CMP number based on the source and receiver numbers using the following formula: $CMP\ Location = (Source\ Location + Receiver\ Location) / 2$. Therefore, for 2D lines it is imperative that source and receiver locations as defined in the SPS files share the same coordinate system. This implies that Source location 1 has the same X,Y position as Receiver location 1, and that Source location 2 has the same X,Y position as Receiver location 2, etc....

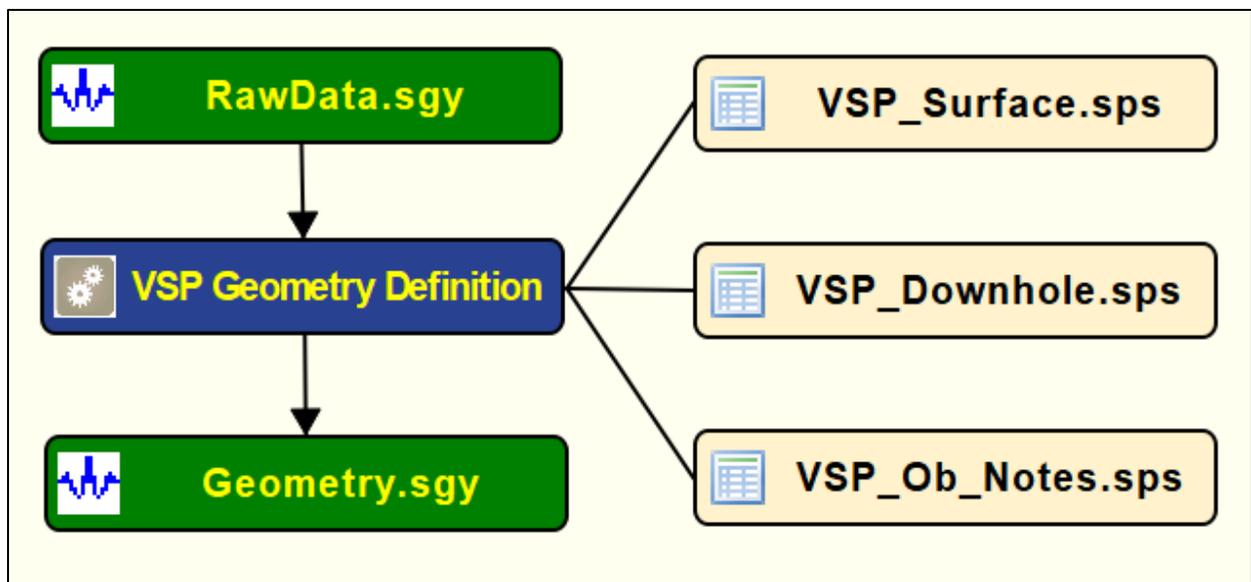
Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Observers Notes – SPS Format cards (mandatory).
- 3) Receiver Locations – SPS Format cards (mandatory).
- 4) Source Locations – SPS Format cards (mandatory).

Output Links:

- 1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

VSP Geometry Definition

Well description

Well name

Well number

Well easting

Well northing

Project updates

Update from project

Update project

Offset definition

Use unsigned offsets

Define survey orientation for signed offsets

Orientation (degrees)

Azimuth definition

Use unsigned azimuths

Zero degrees azimuth = East

Zero degrees azimuth = North

Kill undefined traces and records

Reverse VSP (source in well)

Nominal receiver spacing

OK Help Cancel

Parameter Description:

Well description: Specify general parameters related with the well.

Well name — Enter the name of the well corresponding to the VSP.

Well number — Enter well number corresponding to the VSP. Well number can be defined as the UWI.

Well Easting — Enter Easting coordinates of well head.

Well Northing — Enter Northing coordinates of well head.

Project updates: Specify either if the geometry is updated from the project or if the project settings will be updated with current parameterization.

Update from project — Updates the corner points from the SPS data that has been associated with the project using the Survey > SPS Database menu.

Update project — Use this to broadcast the corner points so that they can be used by to set the Easting and Northing ranges of plotting functions, such as the Attribute Map used later in this flow.
Azimuth definition: Specify the origin of azimuth.

Zero degrees azimuth = East — If selected, then zero degrees of source-receiver azimuth will be set equal to due East.

Zero degrees azimuth = North — If selected, then zero degrees of source-receiver azimuth will be set equal to due North.

Kill undefined traces and records — If checked, traces undefined after applying the geometry will be flagged as dead.

Reverse VSP (source in Well) — If checked, reverse VSP source location in well.

Norminal receiver spacing — Enter the nominal (in m or ft) distance between receivers within the well.

VSP SPS Relation Records

Usage:

The *VSP SPS Relation Locations* carda data is used to store the relationship between surface and downhole receiver locations to be used by *VSP Geometry Definition* step.

Step Parameter Dialog:

VSP SPS Relation Records

VSP SPS relation records

File name: C:/Leonardo/DATA/VSP_Walkaway/Survey/VSP_Ob_Notes.sps

Spreadsheet

	Record ID	Record number	Source line	Source location	From channel	To channel	Channel increment	Receiver line	From receiver	To receiver	Receiver increment
1	X	2009	1	100	13	24	1	1	75	97	2
2	X	2010	1	100	13	24	1	1	74	96	2
3	X	2011	1	100	13	24	1	1	52	74	2
4	X	2012	1	100	13	24	1	1	51	73	2
5	X	2013	1	100	13	24	1	1	29	51	2
6	X	2014	1	100	13	24	1	1	28	50	2
7	X	2015	1	100	13	24	1	1	6	28	2
8	X	2016	1	100	13	24	1	1	5	27	2
9	X	2017	1	110	13	24	1	1	75	97	2
10	X	2018	1	110	13	24	1	1	74	96	2
11	X	2019	1	110	13	24	1	1	52	74	2
12	X	2020	1	110	13	24	1	1	51	73	2
13	X	2021	1	110	13	24	1	1	29	51	2
14	X	2022	1	110	13	24	1	1	28	50	2
15	X	2023	1	110	13	24	1	1	6	28	2
16	X	2024	1	110	13	24	1	1	5	27	2
17	X	2025	1	120	13	24	1	1	75	97	2
18	X	2026	1	120	13	24	1	1	74	96	2
19	X	2027	1	120	13	24	1	1	52	74	2
20	X	2028	1	120	13	24	1	1	51	73	2
21	X	2029	1	120	13	24	1	1	29	51	2
22	X	2030	1	120	13	24	1	1	28	50	2
23	X	2031	1	120	13	24	1	1	6	28	2
24	X	2032	1	120	13	24	1	1	5	27	2
25	X	2033	1	130	13	24	1	1	75	97	2
26	X	2034	1	130	13	24	1	1	74	96	2
27	X	2035	1	130	13	24	1	1	52	74	2

OK Help Analyze format Save changes

Parameter Description:

Record number — Enter the record number. This value should correspond to the FFID store in the VSP seismic file.

Source line — Enter the source line as defined in *VSP Surface Locations*.

Source location — Enter the source location as defined in *VSP Surface Locations*.

From channel — Enter the number of the first active channel.

To channel — Enter the number of the last active channel.

Channel increment — Enter the channel increment.

Receiver line — Enter the receiver line as defined in *VSP Downhole Locations*.

From receiver — Enter the number of first receiver.

To receiver — Enter the number of last receiver.

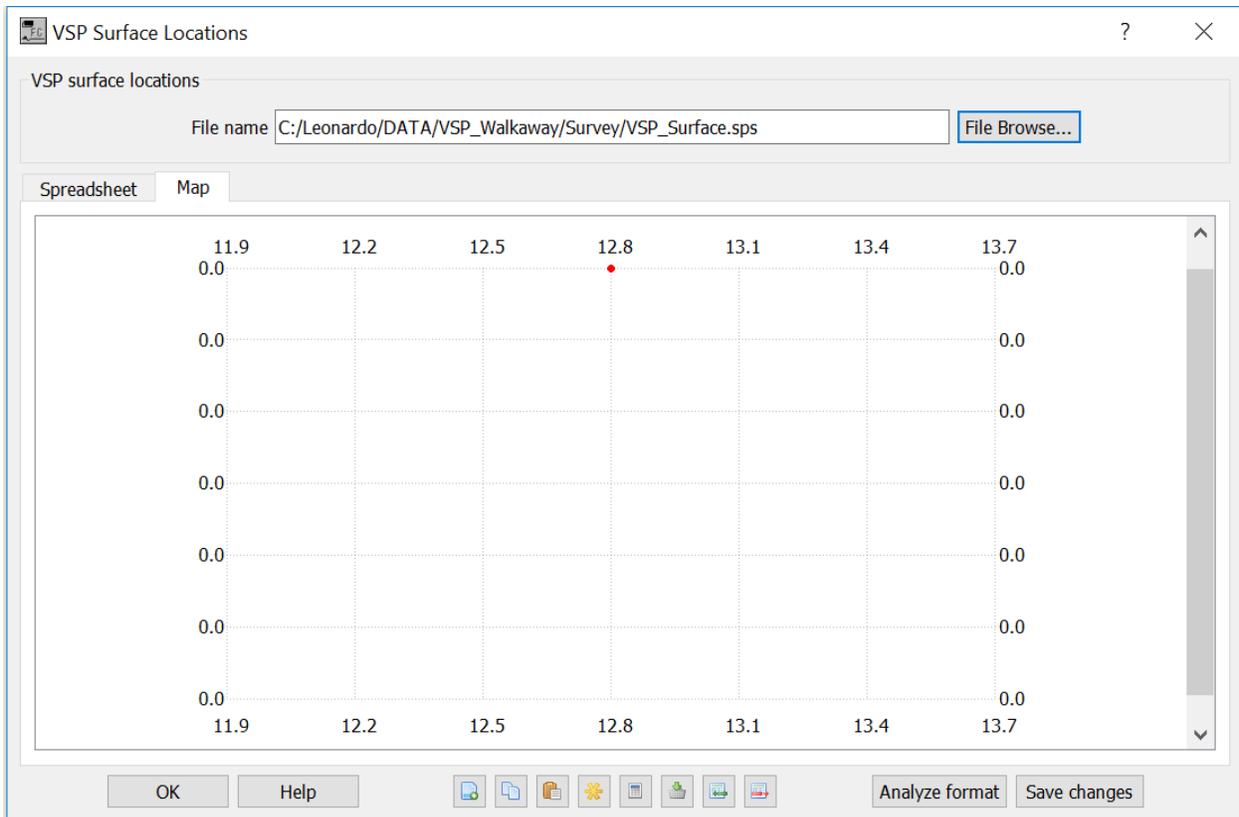
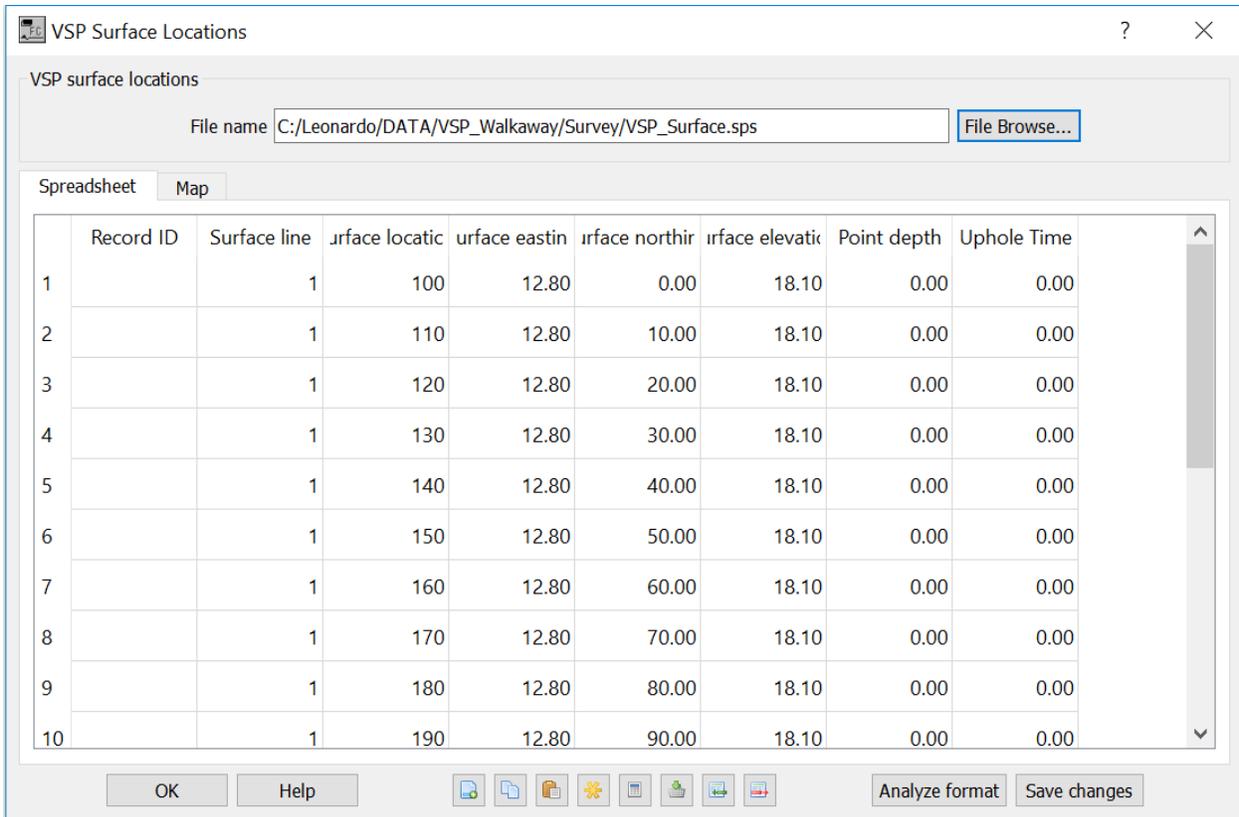
Receiver increment — Enter the receiver number increment.

VSP Surface Locations

Usage:

The *VSP surface Locations* card data is used to store the positional surface locations to be used by *VSP Geometry Definition* step.

Step Parameter Dialog:



Parameter Description:

Surface line — Enter the point lin value.

Surface location — Enter the point location.

Surface Easting — Enter the surface Easting coordinate corresponding to the point location.

Surface Northing — Enter the surface Northing coordinate corresponding to the point location.

Surface elevation — Enter the surface elevation corresponding to the point location.

Point depth — Enter the measured depth coordinate corresponding to the point location.

Uphole time — Enter the uphole time.

VSP Wavefield Separation

Usage:

The *VSP Wavefield Separation* steps allows filtering the downgoing or the upgoing wavefields by applying a moving average, a median or a F-K filter.

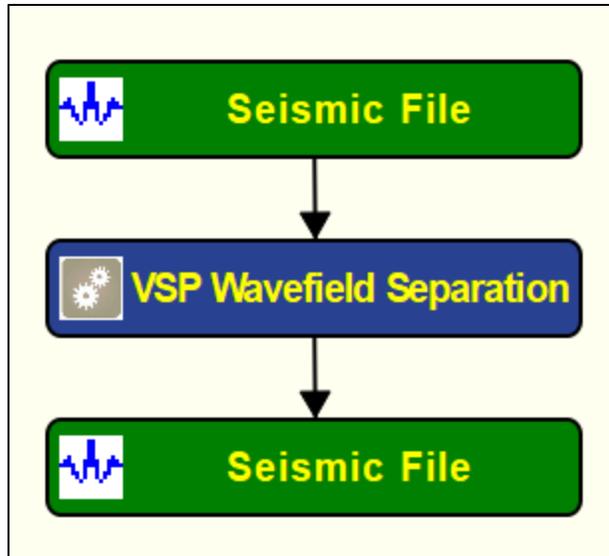
Input Links:

1) Seismic data in any sort order (mandatory).

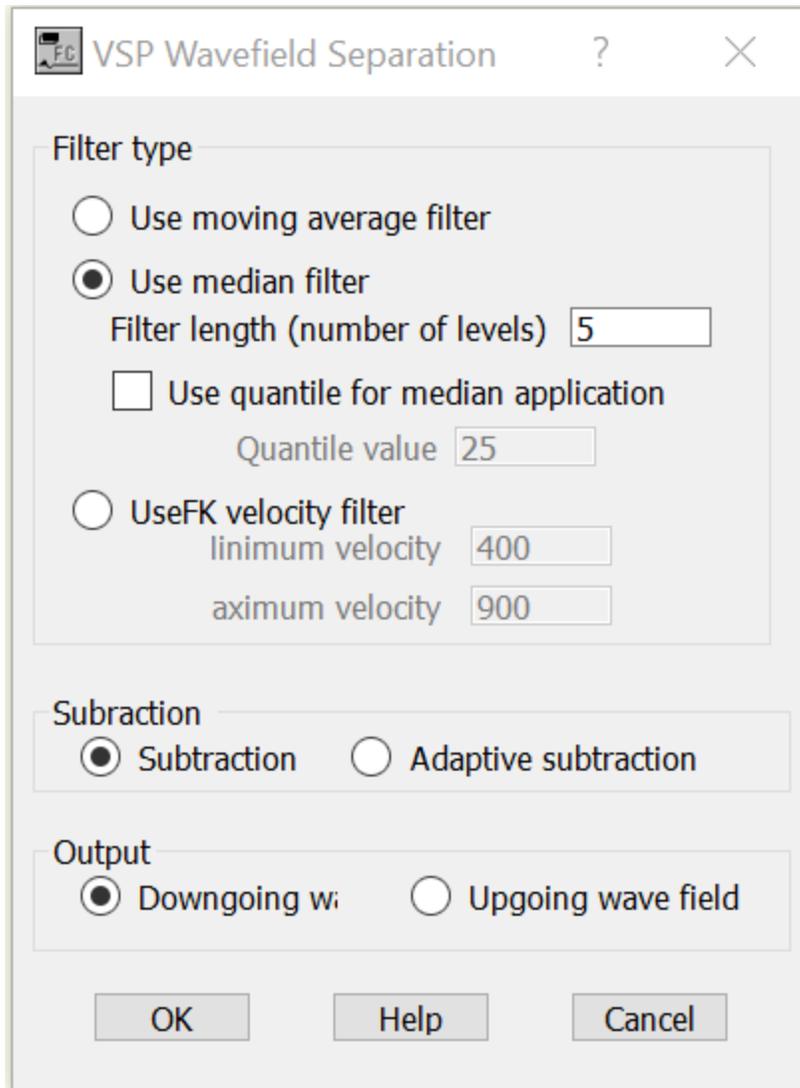
Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Filter type: Specify type of filter to be used for the wavefield separation.

Use moving average filter — If selected, uses a moving average filter to separate wavefields.

Use median filter — If selected, uses a median filter to separate wavefields

Filter length (number of levels) — Enter the filter length in number of levels.

Use quantile for median application — If checked, uses a quantile as defined in *Quantile value* to do the filtering.

Quantile value — Enter the quantile value.

Use FK velocity filter — If selected, uses a F-K velocity filter to separate wavefields.

Maximum velocity — Enter the maximum velocity to be considered in the FK velocity filter

Minimum velocity — Enter the minimum velocity to be considered in the FK velocity filter.

Subtraction: Specify type of subtraction between model and data.

Subtraction — If selected, applies a conventional sample-by-sample subtraction.

Adaptive subtraction — If selected, applies a subtraction as defined in *Dataset Math* step.

Output: Specify type of output.

Downgoing wavefield — If selected, outputs downgoing wavefield (filter upgoing wavefield).

Upgoing wavefield — If selected, outputs upgoing wavefield (filter downgoing wavefield).

Velocity Steps

Velocities
↑ Processing Categories
Apply Linear Moveout
Apply Normal Moveout
Apply PP Nonhyperbolic Moveout
Constant Velocity Stacks
Create Velocity Field
Extract Functions
Interpolate Field
MASW Calculation
Offset Dependent Linear Moveout
Residual Moveout Analysis
Residual Moveout Application
Velocity Semblance

Apply Linear Moveout

Usage:

The *Apply Linear Moveout* step allows you to apply a linear moveout function in either the forward or inverse direction. You specify the moveout velocity. You may also apply a constant static shift to your data. The moveout correction may be applied in a coarse or fine-grained application mode. A coarse grained static shift is applied to the nearest sample. Fine-grained static shifts are applied in the frequency domain by phase shifting your data.

Input Links:

1) Seismic data in any sort order (mandatory).

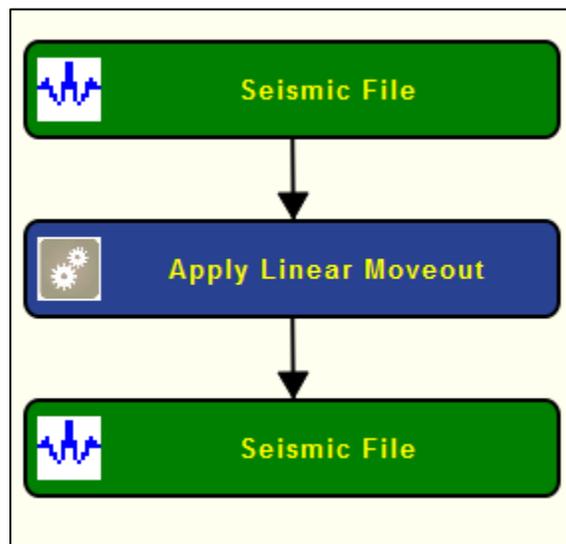
Output Links:

1) Seismic data in any sort order (mandatory).

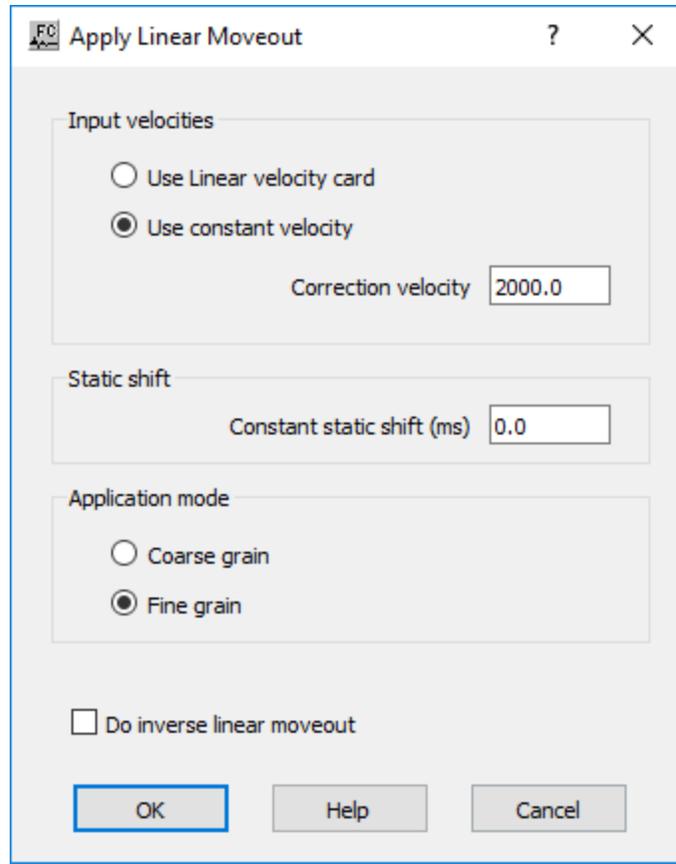
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Constant static shift (ms) — Enter a constant static shift in milliseconds.

Correction velocity — Enter the constant moveout velocity.

Application Mode: Specify the statics application mode.

Coarse grain — If selected, statics shifts are applied to the nearest discrete sample position.

Fine grain — If selected, statics shifts are applied as a precise phase shift operator in the Fourier domain.

Do inverse linear moveout application — If checked, inverse linear moveout will be applied to your data.

Apply Normal Moveout

Usage:

The *Apply Normal Moveout* step allows you to apply normal moveout corrections to your pre-stack data using a single velocity or a set of velocity function cards. You choose between a linear

or quadratic interpolation method for interpolating trace sample values back to even sample intervals after applying the moveout. You may also apply a stretch mute to your NMO corrected data. A constant velocity moveout may be accomplished by inputting a correction velocity in the dialog and not connecting any velocity function cards to the step. The NMO process automatically spatially interpolates the velocity over the entire range of CMPs in the line.

In the case of 3D data, the velocity functions are interpolated using a 2-D Delaunay triangulation weighting of evaluation points. Velocity function CMP locations are triangulated, then barycentric coordinates are used to compute weights between velocity functions. The interpolation is done laterally. No allowance is made for structure.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) Velocity Function as a card data file (optional).
- 3) Velocity Function as a seismic file (optional).

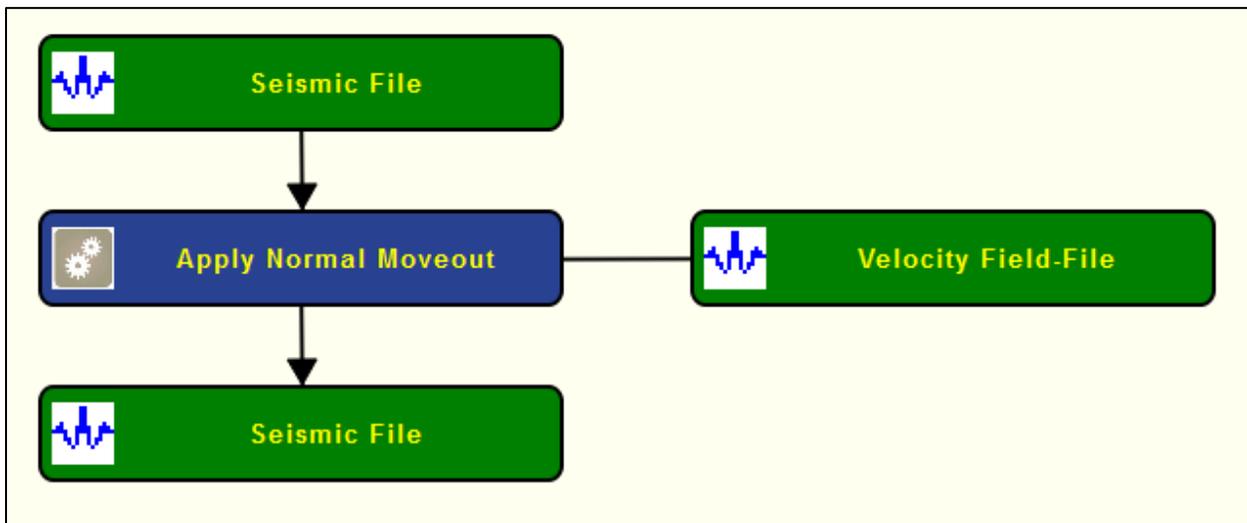
Output Links:

- 1) Seismic data in any sort order (mandatory).

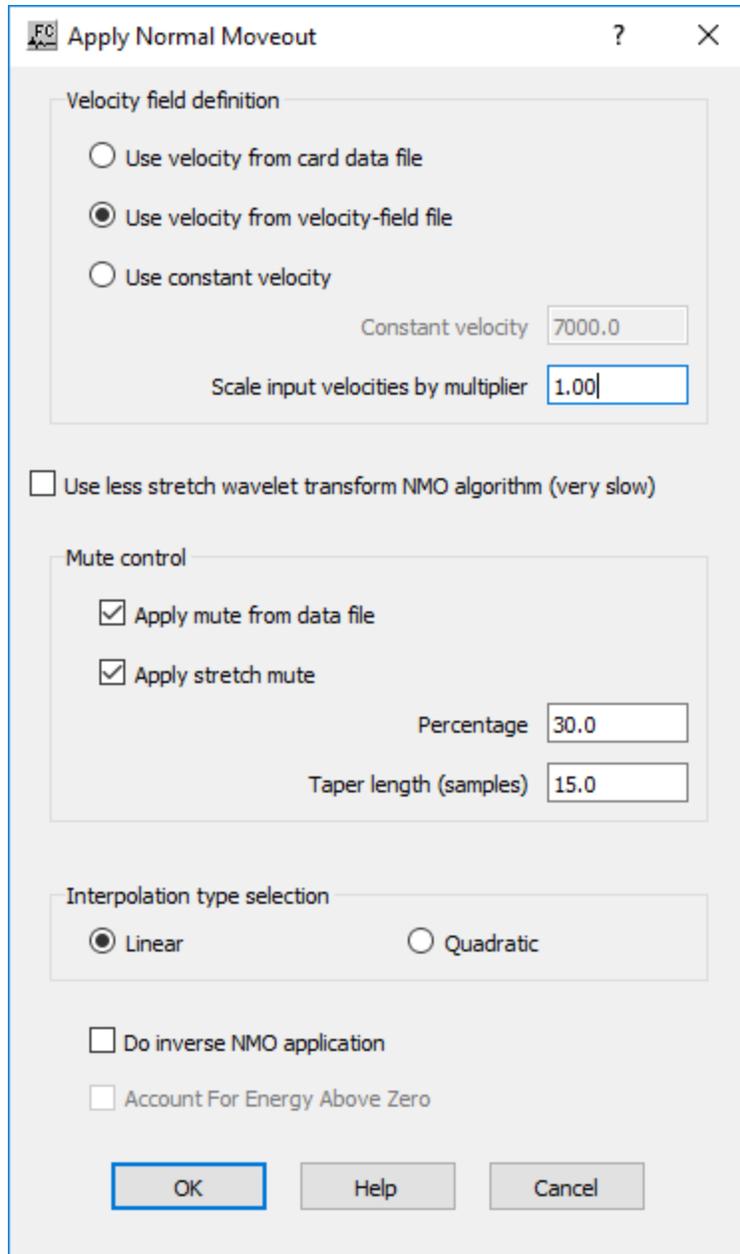
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Velocity field definition: Specify velocity field to be used to correct for hyperbolic moveout.

Use velocity field from data file — If checked, the velocity field from a card data file will be used.

Use velocity field from seismic file — If checked, the velocity field from a seismic file will be used.

Use constant velocity — If checked, a constant velocity will be used.

Constant velocity — Enter a constant NMO velocity. This constant velocity will be used if a set of velocity function cards is NOT linked to the NMO correction step.

Scale input velocities by (%) — Enter the amount by which the input velocities are scaled up or down. A value of 1.0 does not alter the velocity field.

Mute control: Specify the parameters for the stretch mute definition.

Apply mute from data file — If checked, a mute will be applied to the NMO corrected data from a data file.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting removes the stretching of the data due to the NMO correction.

Percentage — Enter the stretch mute percentage. The smaller the percent the more severe the mute function.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Interpolation type selection: Specify the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not usually exactly at the sample interval of the data, the data is interpolated to be evenly sampled at the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

Do inverse moveout application — If checked, the inverse NMO correction will be applied, instead of the usual forward NMO.

Apply PP Non-hyperbolic Moveout

Usage:

The *Apply PP Non-hyperbolic Moveout* step uses the travel-time equation for transversely isotropic (TI) media described by Alkhalifah and Tsvankin (1997). Non-hyperbolic P-wave moveout may become significant when source-receiver offsets are approximately equal to or greater than the depth of reflection. The resulting deviations from the hyperbolic traveltime equation may be attributed to one or more phenomena: (1) The standard hyperbolic travel-time equation is only a two-term, short-offset approximation of the full travel-time equation for P-wave reflections in layered media; (2) the earth media may be anisotropic. The resulting moveout is a function of the

zero-offset time, the source-receiver offset, P-wave short-spread stacking velocity, and η (eta), where eta is an effective anisotropy parameter that measures the ratio of horizontal to vertical P-wave velocity. The Apply PP Non-hyperbolic Moveout step uses the combination of Eta functions and P-wave stacking velocities to correct for non-hyperbolic moveout.

Input Links:

- 1) Seismic data in any sort order (mandatory).
- 2) PP Nhmo Eta Function card data file containing eta picks (optional).
- 3) PP Nhmo Eta Function seismic file containing eta picks (optional).
- 4) Velocity Function as a card data file (optional).
- 5) Velocity Function as a seismic file (optional).

Output Links:

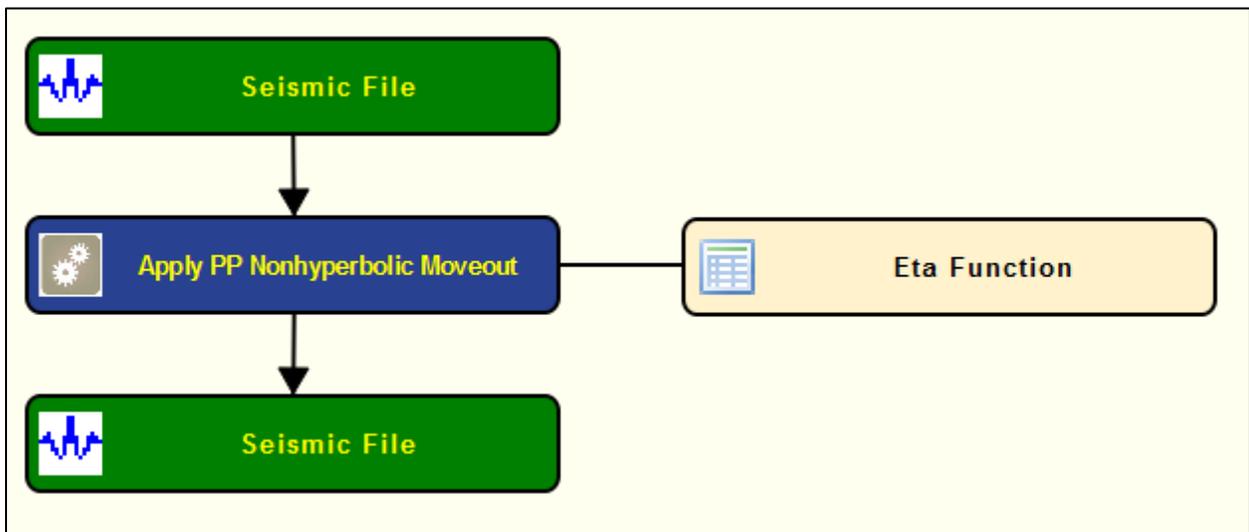
- 1) Seismic data in any sort order (mandatory).

Reference:

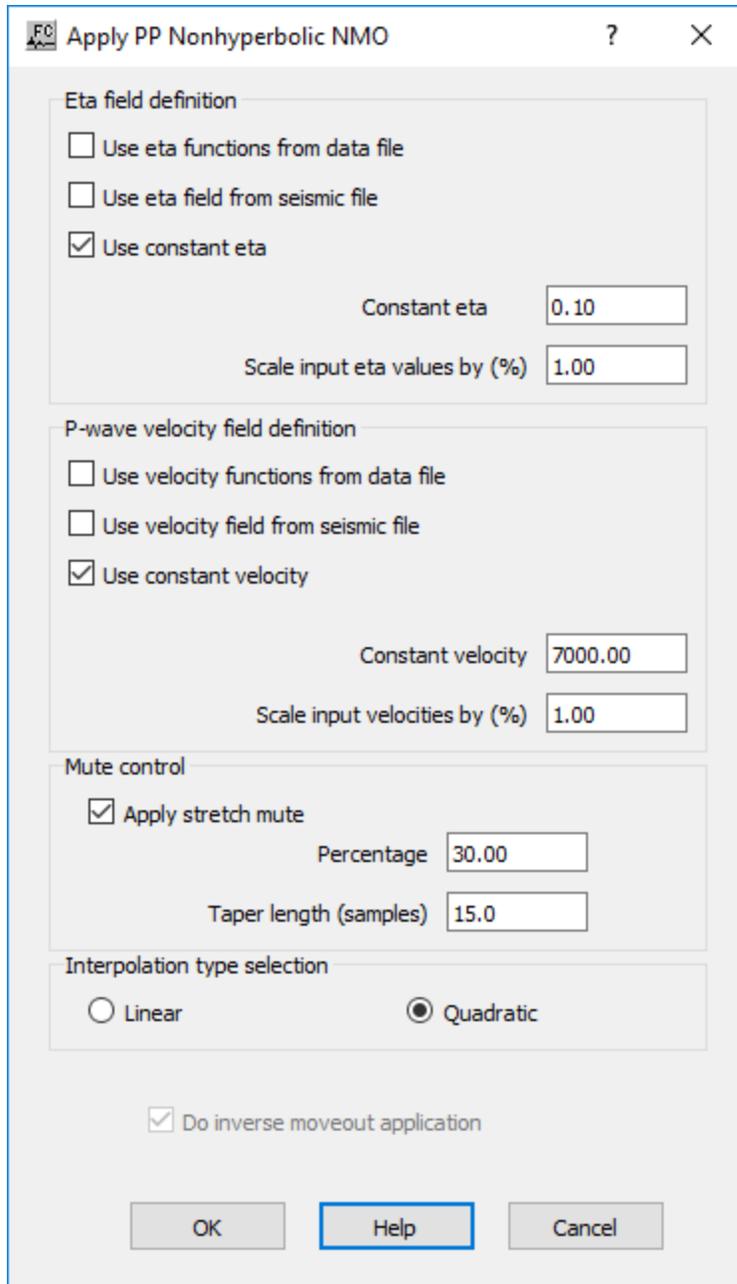
Alkhalifah, Tariq, 1997, Velocity analysis using nonhyperbolic moveout in transversely isotropic media: Geophysics, **62**, 1839-1854.

Alkhalifah, Tariq, and Tsvankin, Ilya, 1995, Velocity analysis for transversely isotropic media: Geophysics, **60**, 1550-1566.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Eta field definition: Specify how the Eta field will be defined by your selections and entries to correct for non-hyperbolic moveout.

Use eta functions from data file — If checked, the eta functions from a data file will be used.

Use eta field from seismic file — If checked, the eta field from a seismic file will be used.

Use constant eta — If checked, a constant eta will be used.

Constant eta — Enter constant eta value.

Scale input eta values by (%) — Enter a percentage to scale input eta values.

P-wave velocity field definition: Specify how the P-wave velocity field will be defined by your selections and entries to correct for non-hyperbolic moveout.

Use velocity functions from data file — If checked, the velocity functions from a data file will be used.

Use velocity field from seismic file — If checked, the velocity field from a seismic file will be used.

Use constant velocity — If checked, a constant velocity will be used.

Constant velocity — Enter the short-spread P-wave NMO velocity. This constant velocity will be used if a P-wave stacking velocity function is NOT selected.

Scale input velocities by (%) — Enter the amount by which the input velocities are scaled up or down. A value of 1.0 does not alter the velocity field.

Mute control: Specify the parameters for the stretch mute definition.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting removes the stretching of the data due to the NMO correction.

Percentage — Enter the stretch mute percentage. The smaller the percent the more severe the mute function.

Taper length — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Interpolation type selection: Specify the the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not usually exactly at the sample interval of the data, the data is interpolated to be evenly sampled at the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

Do inverse moveout application — If checked, the inverse NMO correction will be applied, instead of the usual forward NMO.

Constant Velocity Stacks

Usage:

The *Constant Velocity Stacks* step generates a file of constant velocity stack traces. You choose the number of velocities with which to stack your data, the first velocity to apply, and the last velocity. You have the option to apply a stretch mute, if you so desire. With the series of constant velocity stack traces, you may page through these stacked panels using Display and interactively pick velocity functions that result in the most coherent stacked sections.

Input Links:

1) Seismic data pre-stack, in CMP sort order (mandatory)

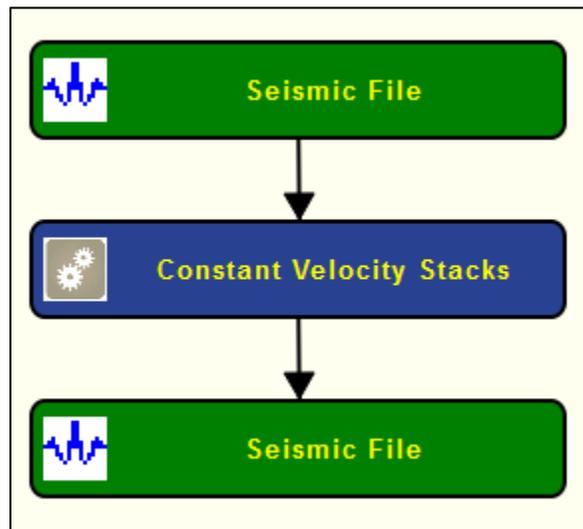
Output Links:

1) Seismic data pre-stack, in CMP sort order (mandatory)

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Parameter Description:

Velocity range: Specify the first and last velocities along with the velocity increment to calculate the number of velocities to use in the analysis. A stacked section is calculated for each velocity linearly interpolated between the starting and ending input velocities. The velocity increment will be:

$$V_{inc} = (\text{last velocity} - \text{first velocity}) / (\text{Number of velocities} - 1).$$

First velocity — Enter the starting velocity for the analysis. This velocity will be used for NMO on the first output stack. {>0.0}

Last velocity — Enter the ending velocity for the analysis. This velocity will be used for NMO on the last output stack. {>0.0}

Velocity increment — Enter the velocity increment number. This number will be used to linearly interpolate between the first and last velocities.

Line range: Specify the first and last lines along with the line increment to calculate the number of lines to use in the analysis.

First line to analyze — Enter the first CMP line number to analyze.

Last line to analyze — Enter the last CMP line number to analyze.

Line increment — Enter the CMP line increment between lines to analyze.

Location range: Specify the first and last locations along with the location increment to calculate the number of locations to use in the analysis. At each CMP location a range of constant velocity stacks will be generated from the first velocity to the last velocity in increments of V_{inc} .

First location to analyze — Enter the first CMP location number to analyze.

Last location to analyze — Enter the last CMP location number to analyze.

Location increment — Enter the CMP location increment between groups of CMP locations to analyze.

Locations per analysis — Enter the number of CMP locations in each analysis panel.

Mute control: Specify how the mute will be defined.

Apply mute from data file — If checked, a mute will be applied to the NMO corrected data.

Apply stretch mute — If checked, a stretch mute will be applied to the NMO corrected data. Stretch muting restricts the stretching of the data due to the NMO correction.

Percentage — Enter the stretch mute percentage. The smaller the percent the more severe the mute function.

Taper length (samples) — Enter the mute taper length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Interpolation type selection — Specify the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to the correct sample interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data samples between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data samples between or beyond existing data.

Trace amplitude definition — Specify the trace amplitude definition for relative or true amplitude.

Use relative amplitude traces — If selected, relative amplitude traces will be summed in the stacking process. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — If selected, uses true amplitude scaled traces in the analysis. True amplitude traces are scaled by one common factor per record.

Exponent for normalization — Enter the scaling exponent. Traces are scaled by (fold ** EXP).

Create Velocity Field

Usage:

Create Velocity Field is used to create a velocity-field file from a standard velocity function card, an interval velocity card, or a layer cake model completely from scratch. The constructed model is saved as a SEGY file and can be used either for display or for ray tracing and migration processes.

Input Links:

None.

Auxiliary dataset:

- 1) Velocity function card data file (optional).
- 2) Pre-Stack seismic data for geometry (optional).

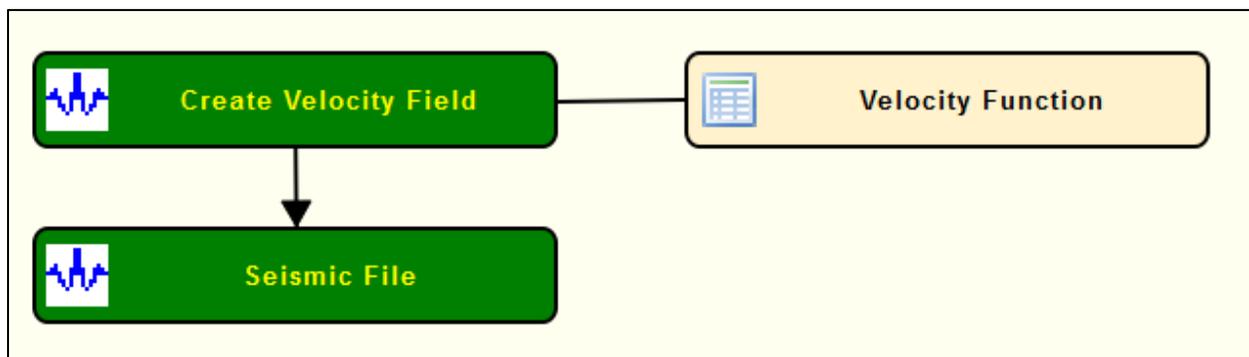
Output Links:

Seismic file where the velocity model is going to be saved (mandatory).

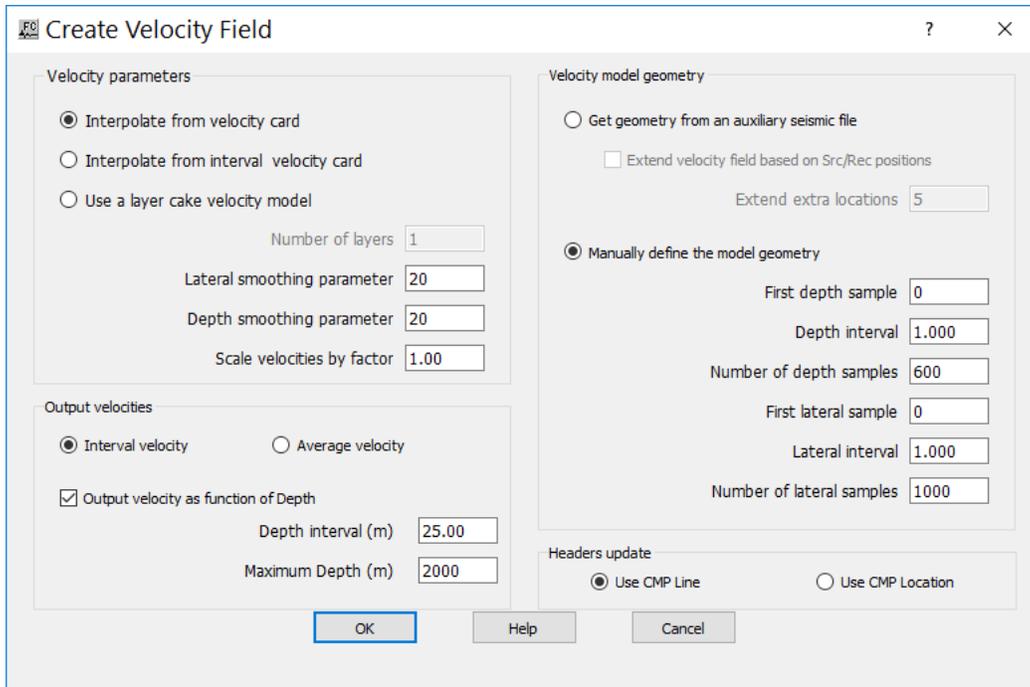
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Velocity parameters: Specify parameters related with input velocity

Interpolate from velocity card — If checked, connects a standard (RMS) velocity card to the step.

Interpolate from Interval velocity card — If checked, connects an interval velocity card to the step.

Use a layer cake velocity model — If checked, adds a table allowing the user to built his own layer cake model.

Number of layers — specify the number of layers to be considered.

Lateral smoothing parameter — Enter a lateral smoothing parameter, or else zero (uses the *Damped Least Square Filter* processing step for the smoothing).

Depth smoothing parameter — specify a depth smoothing parameter, or else zero (uses the damped least square filter for the smoothing).

Scale velocities by factor — enter a scaling factor for the input velocities, or else 1.

Velocity model geometry: Specifies the geometry of the output velocity model.

Get geometry from an auxiliary seismic file — If selected, get the geometry of the velocity model from an auxiliary seismic file.

Extend velocity field based on Src/Rec positions — If checked, extends the velocity model to cover all Src/Rec locations instead of just CMP locations.

Extend extra locations — Enter extra locations to extend.

Manually define model geometry — If selected, defines the velocity model geometry manually.

First depth sample — Enter the first depth sample of the model.

Depth interval — Enter the depth interval of the model.

Number of depth samples — Enter the last depth sample of the model.

First lateral sample — Enter the first lateral sample of the model.

Lateral interval — Enter the lateral interval of the model.

Number of lateral samples — Enter the last lateral sample of the model.

Headers Updates: Specifies each headers of the output velocity model will be updated.

Use CMP line — Update CMP line header word.

Use CMP location — Update CMP location header word.

Extract Functions

Usage:

The *Extract Functions* step extracts velocity, Eta or Gamma functions from auxiliary card data files at specific locations as user-defined along an existing seismic data file sorted by CMP.

Input Links:

- 1) Seismic file in CMP sort order (mandatory).
- 2) One of the following card data files: Velocity card data file, Eta card data file, Gamma card data file (mandatory).

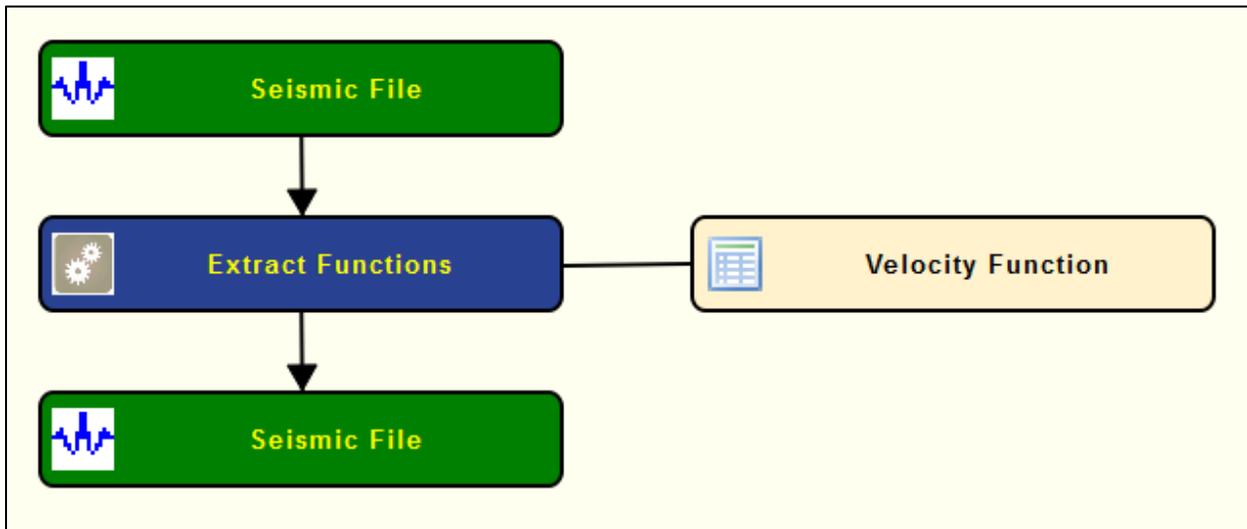
Output Links:

- 1) Seismic file with extracted functions (mandatory).

References:

-

Example Flowchart:



Step Parameter Dialog:

Extract Functions [?] [X]

Input seismic field type

- Velocity
- Eta
- Gamma

Input velocity field type

- RMS
- Interval
- Average

Output auxiliary file velocity type

- RMS
- Interval
- Average

Function selection

- Regularly spaced locations
- All trace locations

Line range

First line to extract:

Last line to extract:

Line increment:

Location range

First location to extract:

Last location to extract:

Location increment:

Vertical point selection

- Interface 'kneepoints'
- Regular intervals

Interface 'kneepoints'

Average points per function:

Regular intervals

Sampling interval (ms.):

[OK] [Help] [Cancel]

Parameter Description:

Input seismic field file: Specify type of auxiliary data type from where functions are going to be extracted.

Velocity — If selected, an auxiliary velocity card data type will be used.

Eta — If selected, an auxiliary Eta card data type will be used.

Gamma — If selected, an auxiliary Gamma card data type will be used.

Input velocity field type: Specify type of input velocities in the auxiliary card data file. Only available if *Input seismic field file* is set to *Velocity*.

RMS — If selected, input velocities are RMS velocities.

Interval — If selected, input velocities are Interval velocities.

Average — If selected, input velocities are average velocities.

Output auxiliary velocity type: Specify type of output velocities that will be written in output seismic file. Only available if *Input seismic field file* is set to *Velocity*.

RMS — If selected, input velocities are RMS velocities.

Interval — If selected, input velocities are Interval velocities.

Average — If selected, input velocities are average velocities.

Function selection: Specify how auxiliary card data files will be sampled.

Regularly spaced locations — If selected, auxiliary field will be sampled at regularly spaced locations as user-defined.

All trace locations — If selected, auxiliary field will be sampled for all the locations available.

Line Range: Specify the locations to be extract in the Line direction. Only available if *Function selection* is set to *Regularly spaced locations*.

First line to extract — Enter the value for the first line to be extracted.

Last line to extract — Enter the value for the last line to be extracted.

Line increment — Enter the value for the increment of the sampling in the line direction.

Location range: Specify the locations to be extract in the Location direction. Only available if *Function selection* is set to *Regularly spaced locations*.

First location to extract — Enter the value for the first location to be extracted.

Last location to extract — Enter the value for the last location to be extracted.

Location increment — Enter the value for the increment of the sampling in the location direction.

Vertical point selections: Specify how auxiliary fields are sampled vertically.

Interface ‘kneepoint’ — If selected, auxiliary fields will be sampled at the same vertical locations as the picking.

Average points per functions — Enter the desired average number of points per function in the vertical direction.

Regular intervals — If selected, auxiliary fields will be sampled vertically at a constant interval

Sampling interval (ms) — Enter the sampling interval along the vertical direction.

Interpolate Field

Usage:

The *Interpolate Field* step interpolates velocity, Eta or Gamma fields into a new user-defined geometry

Input Links:

- 1) Seismic file in CMP sort order (mandatory).
- 2) One of the following card data files: Velocity card data file, Eta card data file, Gamma card data file (mandatory).

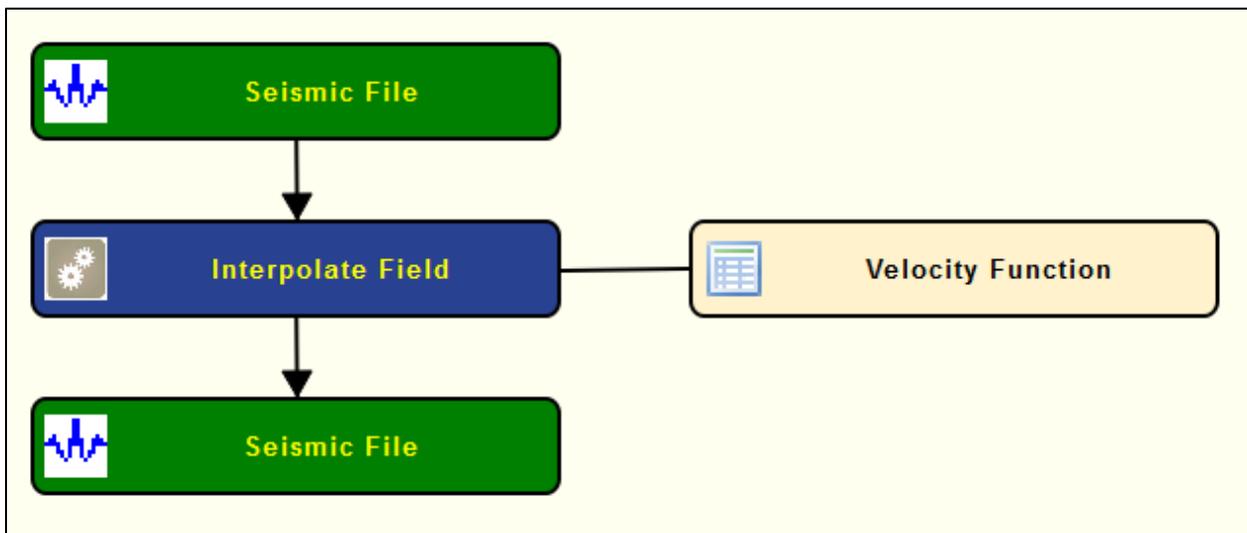
Output Links:

- 1) Seismic file with extracted functions (mandatory).

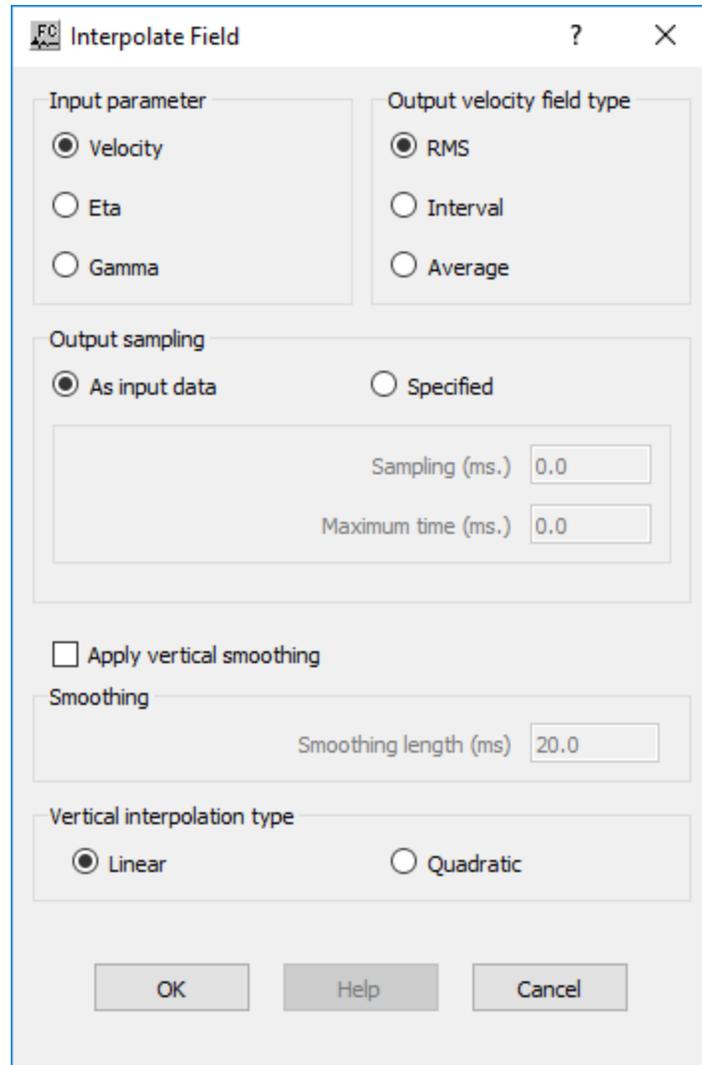
References:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Input parameter: Specify type of auxiliary data type from where functions are going to be extracted.

Velocity — If selected, an auxiliary velocity card data type will be used.

Eta — If selected, an auxiliary Eta card data type will be used.

Gamma — If selected, an auxiliary Gamma card data type will be used.

Output velocity field type: Specify type of output velocities in the auxiliary card data file. Only available if *Input parameter* is set to *Velocity*.

RMS — If selected, input velocities are RMS velocities.

Interval — If selected, input velocities are Interval velocities.

Average — If selected, input velocities are average velocities.

Output sampling: Specify sampling rate of output seismic file with interpolated field.

As input data — If selected, output seismic file will have the same sampling rate as input seismic file.

Specified — If selected, output seismic file will have user-defined sampling rate.

Sampling (ms) — Enter output sampling rate in milliseconds.

Maximum time (ms) — Enter maximum time of output in milliseconds.

Smoothing: Specify vertical smoothing of the input field.

Apply vertical smoothing — If checked applies a vertical smoothing to the input field.

Smoothing length (ms) — Enter smoothing length in milliseconds.

Vertical interpolation type: Specify type of vertical interpolation of the input field.

Linear — If selected, input field is vertically linearly interpolated.

Quadratic — If selected, input field is interpolated following a quadratic function.

MASW Calculation

Usage:

The *Multichannel analysis of surface waves (MASW)* step creates multi modal dispersion images, which shows a frequency vs. phase velocity space with pattern of energy accumulation that represents the actual dispersion curve. This implementation is designed to run in single thread or in parallel, giving it the possibility to take full advantage of multiple processors at the same time.

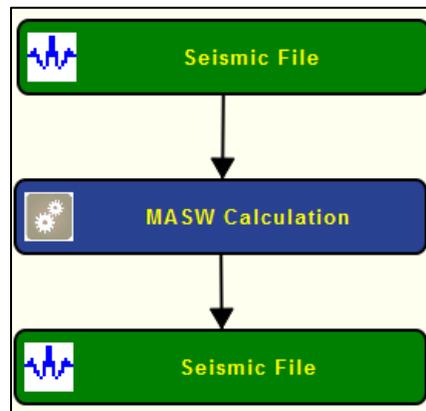
Input Links:

- 1) Multichannel seismic record.

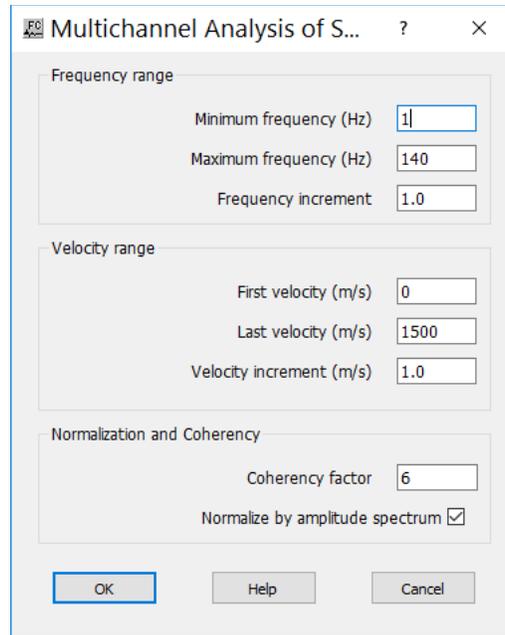
Output Links:

- 1) Seismic file where the Dispersion images are going to be stored.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Minimum Frequency (Hz) — enter minimum frequency to calculate in Hertz.

Maximum Frequency (Hz) — enter maximum frequency to calculate in Hertz.

Frequency increment (Hz) — enter the frequency increment.

First Velocity (m/s) — enter first velocity to calculate in meters per seconds.

Last Velocity (m/s) — enter last velocity to calculate in meters per seconds.

Velocity increment (m/s) — enter velocity increment in meters per seconds as well.

Coherency factor — enter enhanced coherency factor, choose 1 for brute image.

Normalize by amplitude spectrum — if checked normalizes amplitude spectrum.

Offset Dependent Linear Moveout

Usage:

The *Offset Dependent Linear Moveout* step applies a linear moveout correction dependent of the offset and a user-defined constant velocity to the input seismic data. The linear moveout may be applied within a user-defined range of offsets in multiple windows with different offsets. Within each offset window the entire length of each seismic trace is corrected accordingly with selected velocity.

Input Links:

1) Seismic data in any sort order (mandatory).

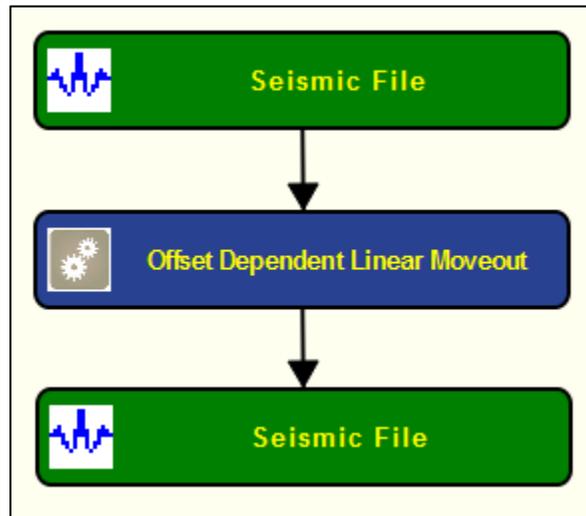
Output Links:

1) Seismic data in any sort order (mandatory).

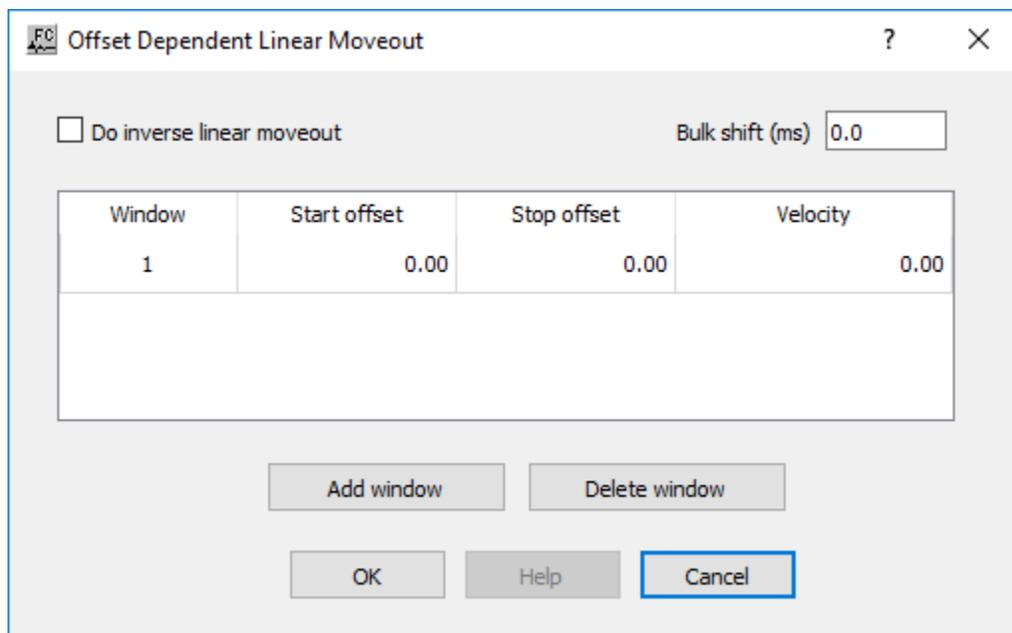
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Do inverse linear moveout — If checked, applies an inverse linear moveout as defined below in the window table.

Bulk shift (ms) — Enter a value in milliseconds corresponding to a vertical bulk shift of the entire data. If no bulk shift is desired use zero.

Window — Sequential number of the offset window where the offset dependent linear moveout will be applied.

Start offset — Enter the offset from where the linear moveout will be applied for that specific time window.

Stop offset — Enter the last offset where the linear moveout will be applied for that specific time window.

Velocity — Enter the velocity to be used in the offset dependent linear moveout for that specific time window.

Add window — Add a new offset window.

Delete window — Delete the last offset window in the table.

Residual Moveout Analysis

Usage:

Residual Moveout Analysis analyses pre-stack 2D or 3D CMP NMO-corrected gathers for errors in the moveout applied. The required residual moveout is parameterized as a CMP-varying ‘alpha’ function, using either a standard or a long offset moveout assumption. This parameter is determined fully-sampled using a fast semblance analysis and output as a segy file. A velocity field is not required for the analysis. The output parameter field may then be smoothed as required, using for example, **3D Median** with a 5-5-1 filter or similar.

As a final step use *Residual Moveout Application* with the derived or the smoothed parameter field as auxiliary input to correct the residual moveout errors.

Input Links:

1) CMP records of offset-sorted moveout-applied seismic data (mandatory).

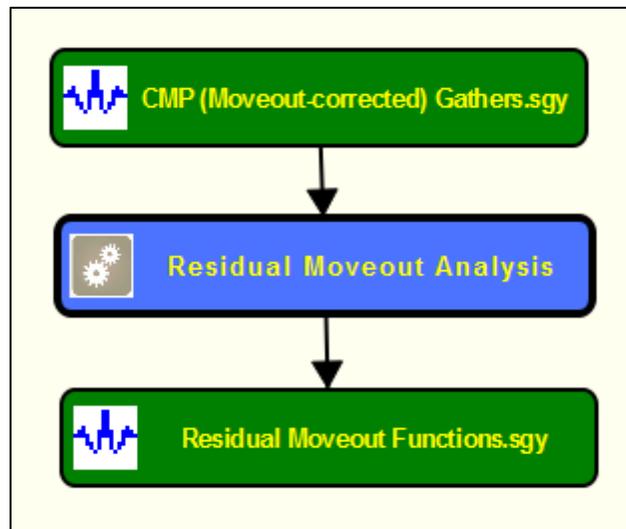
Output Links:

1) CMP-sorted ‘alpha’ parameter field (mandatory).

Reference:

Castle, R. J. 1994. A theory of normal moveout, *Geophysics*, Vol 59, No 6, June 1994, pp 983-999.

Example Flowchart:



Step Parameter Dialog:

Parameter Description:

Moveout correction type: Specify if the residual moveout correction should consider standard or long-offsets.

Standard — If checked, errors in the standard hyperbolic moveout will be analysed.

Long offsets — If checked, errors in the long offset quartic moveout equation will be analysed.

Reference offsets specification: (Used with *Long offsets* Moveout correction type only)
 With long offsets correction there will be an offset where the quartic and quadratic terms in offset balance, known as the ‘Reference offset’. The user may select a range of trial

reference offsets. The correction parameter will be optimized for each reference offset. The reference offset with best optimization will then be adopted.

To save execution time, the analysis of the best Reference offset could be carried out using a limited number of records, and then this Reference offset used with the entire dataset.

Minimum Ref. offset — Enter the smallest offset to use as a reference offset.

Maximum Ref. offset — Enter the largest offset to use as a reference offset.

Number of ref. offsets — Enter the number of reference offsets to try.

Shift high offsets only — If checked, then only offsets greater than the Reference offset will be shifted by the residual moveout. This can be useful when it is only the high offsets that need correction.

Correction limits control: Specify the maximum offset to be used in the analysis and the maximum vertical shift allowed.

Maximum offset — Enter the maximum offset to be used to determine the residual moveout to apply.

Maximum shift (ms.) — Enter the maximum trace shift in milliseconds that will be allowed at the specified **Maximum offset**.

Advanced — If selected, the semblance control parameters may be modified. This is set as an ‘advanced’ option as the default parameters are usually fine to use

Scan width — Enter the width of the scan for the semblance calculation.

Smoothing width (# scans) — Enter the number of scans to be smoothed together.

Max % data stretch — Enter the maximum percentage of data stretch allowed.

Semblance width (samps) — Enter the semblance width in number of samples.

Smoothing length (samps) — Enter the vertical smoothing length in number of samples.

Max initial peaks — Enter the maximum initial peaks values.

Output report file — If checked, a text report file will be generated giving a few statistics on residual moveout analysis of the specified offset.

Report file: Specify parameters regarding the report file.

Report Offset — Enter the offset for which statistics will be generated in the report file.

File Browse... — Click to specify a Report file location.

Append to existing file — If checked, the statistics for the specified offset will be tagged on to the end of any text already in the specified file. Otherwise, the contents of the file specified, if already existing, will be overwritten by the current text output.

Residual Moveout Applications

Usage:

Residual Moveout Application applies residual moveout to normal moveout-corrected gathers to correct for moveout errors due to use of incorrect velocities or the use of standard hyperbolic moveout when long offset moveout would have been better used.

To perform residual moveout, the Residual Moveout Functions file generated by *Residual Moveout Analysis* is required as auxiliary input. This fully-sampled parameter file with one time trace per CMP should be inspected and smoothed if necessary before used as auxiliary file to *Residual Moveout Application*.

Input Links:

- 1) CMP records of offset-sorted moveout-applied seismic data (mandatory).
- 2) Auxiliary Residual Moveout Functions file as generated by *Residual Moveout Analysis* (mandatory).

Output Links:

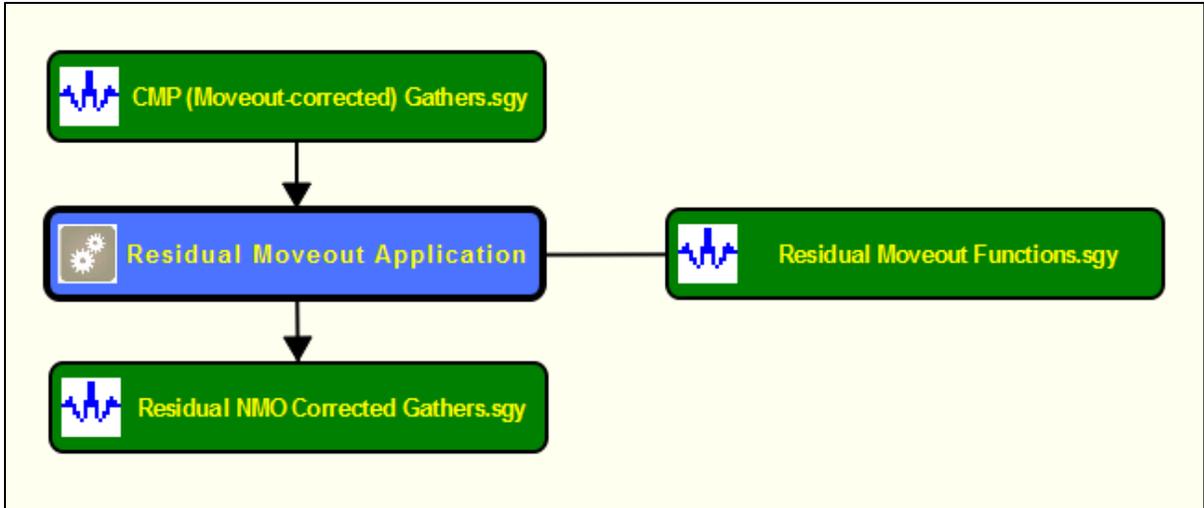
- 1) CMP-sorted 'alpha' parameter field (mandatory).

Reference:

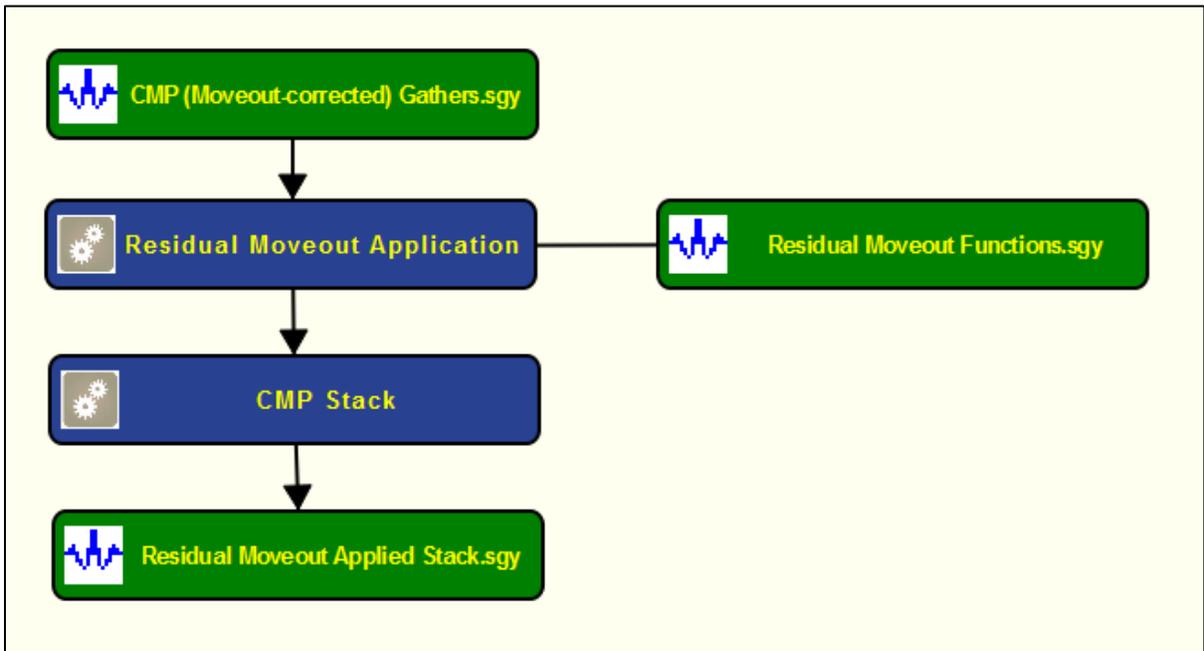
Castle, R. J. 1994. A theory of normal moveout, *Geophysics*, Vol 59, No 6, June 1994, pp 983-999.

Example Flowchart:

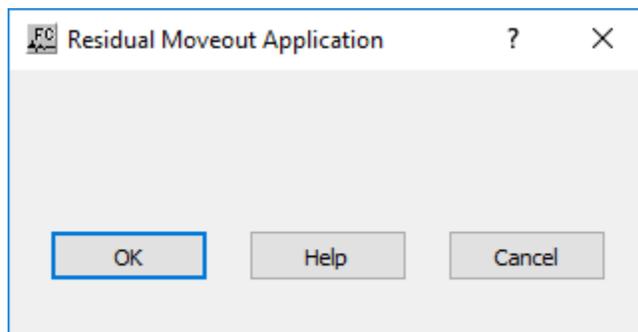
Residual Moveout Correction:



Residual Moveout Correction and Stack:



Step Parameter Dialog:



Parameter Description:

No parameters – All parameterization is specified in the prior analysis step *Residual Moveout Analysis*.

Velocity Semblance

Usage:

The *Velocity Semblance* step creates velocity semblance displays for the input CMP records. Stacking velocities may be picked interactively from this semblance display in SeisViewer. For semblance display generation, you designate the velocity range for semblance calculation by choosing the number of velocities, the starting velocity for this range, and the velocity increment. You may generate only one CMP semblance display for each input CMP gather. You may also control the time gate length around hyperbolic velocity paths for CMP summing in the semblance calculation using the “Semblance length” input parameter. Finally, the output semblance display may be windowed, and a stretch mute may be applied if so desired.

Input Links:

- 1) Seismic data in CMP sort order (mandatory).

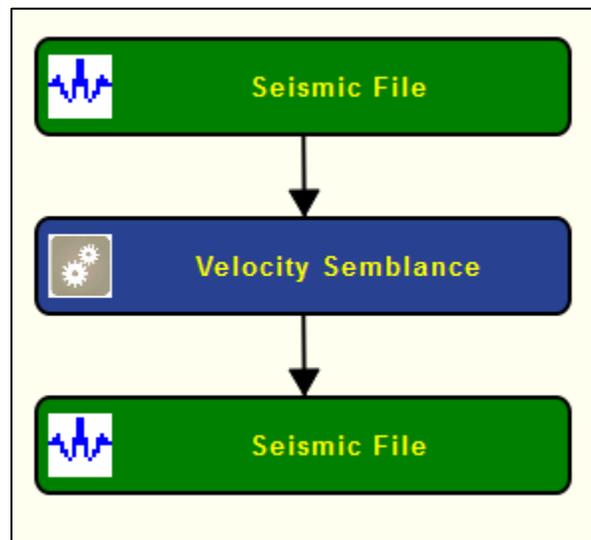
Output Links:

- 1) Seismic File (mandatory).

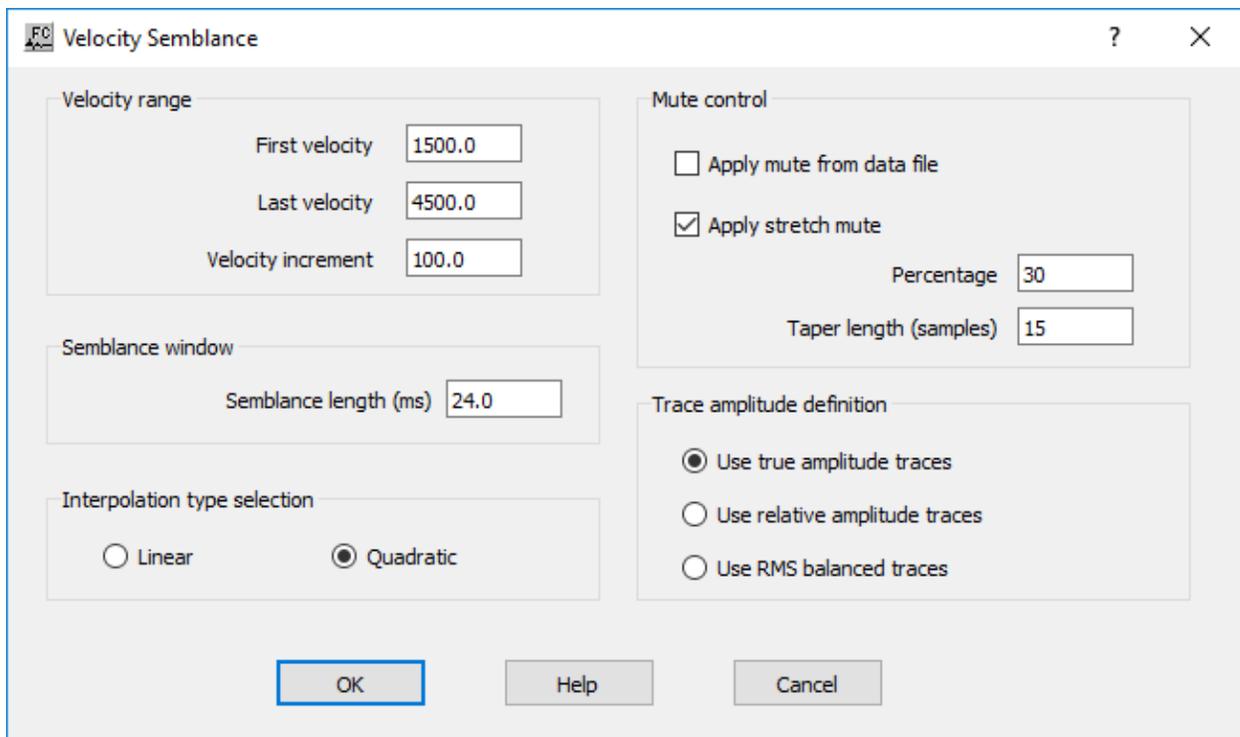
Reference:

Taner, M. and Kohler, 1969, Velocity spectra — digital computer derivation and applications of velocity functions, *Geophysics*, v. 34, no. 6, p. 859ff.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Velocity range: Specify the velocity range where the semblance will be computed.

First velocity — Enter the first velocity to scan.

Last velocity — Enter the first velocity to scan.

Velocity increment — Enter the value by which the velocity is incremented.

Semblance window: Specify the smoothing length of the semblance window.

Semblance length (ms) — Enter the length of the semblance calculation window in milliseconds.

Interpolation type selection: Specify the interpolation type (linear or quadratic). The moveout function causes trace data samples to be moved in time to new locations. Since these new time locations of the data sample values are not exactly at the sample interval of the data, the data is interpolated to even sampling at the correct interval.

Linear — Linear interpolation uses the equation of a line ($y = mx + b$) to interpolate data values between or beyond existing data.

Quadratic — Quadratic interpolation uses the equation of a quadratic ($y = ax^2 + bx + c$) to interpolate data values between or beyond existing data.

Mute Control: Specify the stretch mute control parameters.

Apply mute from data file — If checked, a stretch mute card data will be added to the flow and applied to the NMO corrected data

Apply stretch mute — If checked ,apply stretch mute as defined below.

Percentage — Enter the percent stretch mute. The smaller the percent the more severe the mute function.

Taper length — Enter the mute tape length in samples. Longer taper lengths result in a smoother transition from the mute zone to the data zone.

Trace Amplitude Definition: Specify amplitude summing selection.

Use relative amplitude traces — Selects the use of relative amplitude scaled traces in the analysis. Relative amplitude traces are scaled independently of one another.

Use true amplitude traces — Absolute amplitude traces will be summed in the stacking process. True amplitude traces are scaled by one common factor per record.

Use RMS balanced traces — Amplitude traces will be balanced using RMS.

Wavelet Shaping Steps

Wavelet Shaping
↑ Processing Categories
Deghosting
FKK Domain Spectral Shaping
Predictive Deconvolution
Predictive Multichannel Decon
Q Filter
Signature Deconvolution
Spectral Whitening
Spiking Deconvolution
Spiking Multichannel Decon
Surface Consistent Decomposition
Surface Consistent Deconvolution

Deghosting

Usage:

The *Deghosting* steps attempts to attenuate the ghost in pre-stack data by local prediction error filtering. The input data is partitioned temporally and spatially into overlapping blocks of data, and each block is minimised independently. A range of prediction filters are calculated using an averaged autocorrelation for each record, using the specified data time range. A reverse operator is optionally calculated and added to the forward operator before the filtering to approximate

zero phase filtering. The prediction filters with increasing gap lengths are applied to the data within each block. The o/p is minimised in the L1 sense.

Input Links:

- 1) Seismic data in any sort order (mandatory).

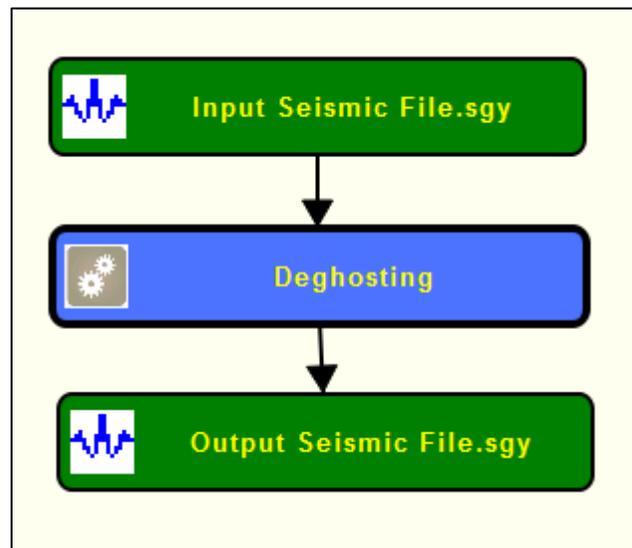
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Deghosting

Ghost delay range

Minimum ghost delay (ms)

Maximum ghost delay (ms)

Allow unfiltered data in output

Filter design

Design window start (ms)

Design window length (ms)

Filter length (ms)

Apply moveout

Moveout velocity

Percentage white noise

Overlapping deghosting windows

Window length (ms)

Window width (traces)

Reverse operator

Apply reverse operator

Ghost amplitude

OK Help Cancel

Parameter Description:

Ghost delay range: Specifies the range to determine the extent of the predictive gap lengths to include for attenuating the ghost.

Minimum ghost delay (ms) — Enter the smallest ghost delay time to include.

Maximum ghost delay (ms) — Enter the largest ghost delay time to include.

Allow unfiltered data in output — If checked, a possible output from the minimization within a block is the input data. [In data blocks where there is little evidence of the ghost this is a reasonable outcome].

Filter Design: Specifies the parameters from which the predictive gap operators will be calculated are specified here.

Design window start (ms) — Enter the initial data time to be used to extract data used to calculate the predictive gap operators from the data autocorrelation.

Design window length (ms) — Enter the data window length to be used as above.

Filter length (ms) — Enter the lengths of the filters to calculate in milliseconds (not including the predictive gaps).

Apply moveout – If checked, the moveout velocity may be overridden in the adjacent box. A moveout correction corresponding to the trace offset will then be applied before windowing the data according to the parameters above.

Percentage white noise – Specify amount of white noise (as a % of the autocorrelation zero lag) to add to stabilize the solution of the Toeplitz matrix in estimation of the filter.

Overlapping deghosting windows: Specify the overlap of blocks is set to 50%, using Hanning tapering between the blocks.

Window length (ms) — Enter the length in milliseconds of each deghosting window.

Window width (traces) — Enter the width in traces of each deghosting window.

Reverse Operator: Specifies if the operation adds in a time-reversed and scaled copy of the operator to act like a zero-phase filter.

Apply reverse Operator — If checked, a reverse operator will be added.

Ghost amplitude — Enter the scaling of the reverse operator to approximate the relative amplitude of the ghost.

FKK Domain Spectral Shaping

Usage:

The *FKK Domain Spectral Shaping* step is a spectral shaping filter primarily for application to post-stack and 3D migrated seismic data. The operator is applied in the 3D Fourier transformed FKK domain.

The process applies an integration filter to the data with an optional 90 degrees phase shift rotation to simulate acoustic impedance data. Applying such a process to migrated data can cause severe amplitude distortions, excessively amplifying dipping events, signal or noise. Therefore, in **replace** mode, this process simulates de-migration of the data, application of the integration filter

and then re-migration of the data. The result is an FKK filter that is thought to balance the spectrum and preserve low frequencies so as to be superior to many other FKK filters.

The input data must be in the form of frequency slices – convert the data to frequency slices by the use of *Frequency Slices* in a prior job flow.

After filtering, convert the frequency slices back to standard time traces in a subsequent job flow with the use of *Frequency Slices to Time Traces*.

Input Links:

1) Frequency slices sorted by **Slice Number** and **CMP Line** (mandatory).

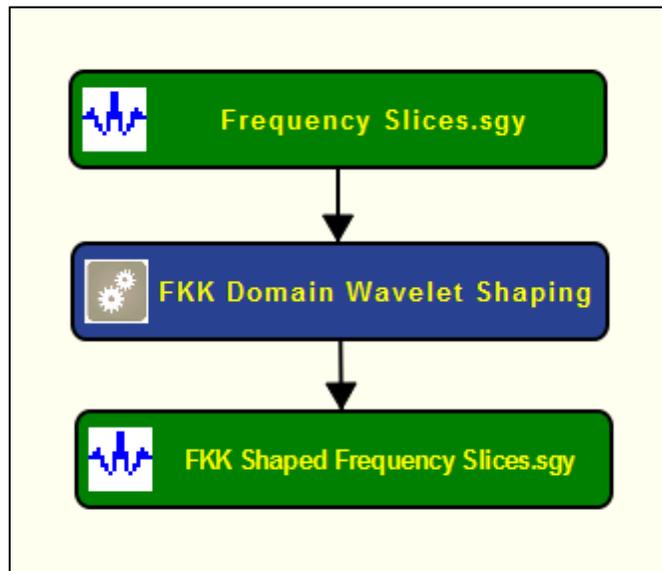
Output Links:

1) Frequency slices sorted by **Slice Number** and **CMP Line** (mandatory).

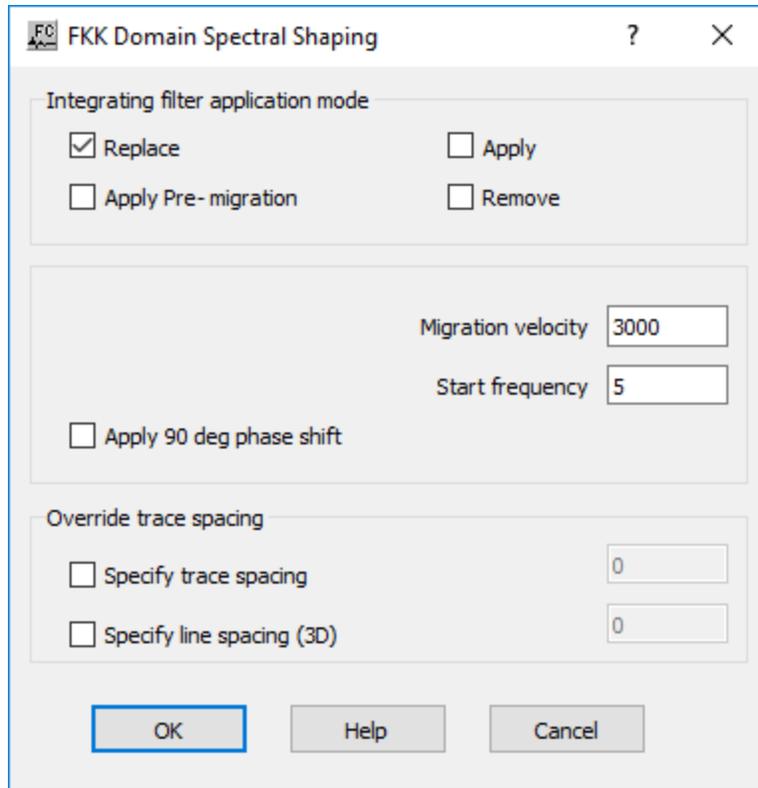
Reference:

Lazaratos, S, and David R., 2009, Inversion By Pre-Migration Spectral Shaping, SEG Annual Meeting, 2009.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Integrating filter application mode: Specify filter application mode.

Replace — If checked, simulates de-migration of the data, application of the integration filter and then re-migration of the data

Apply — If checked, apply the FKK spectral shaping to the data.

Apply pre-migration —If checked, applies the FKK spectral shaping before migration.

Remove — If checked, removes the FKK filter to the data

Migration velocity — Enter constant velocity to be used in the migration step.

Start frequency — Enter the start frequency to be analyzed.

Apply 90 deg. Phase shift — If checked, applies a 90 degrees phase shift to the input data to simulate acoustic impedance.

Override trace spacing: Specify if ones wishes to override trace space as defined in input seismic file.

Specify trace spacing — If checked, specify trace spacing entering the corresponding value.

Specify line spacing (3D) — If checked, specify line spacing entering the corresponding value. This option is only valid for three-dimensional dataset.

Predictive Deconvolution

Usage:

The *Predictive Deconvolution* step is a Wiener-Levinson algorithm for applying a predictive multi-gate deconvolution to your data. You choose the percent pre-whitening, filter length, number of operators, the overlap of the operator design windows, start time of each operator design window, and the design window lengths. For the predictive deconvolution method, you must specify the predictive length of your wavelet. You may also apply a linear moveout to your deconvolution design windows to allow a sliding window whose start time varies with offset.

Input Links:

- 1) Seismic data in any sort order (mandatory).

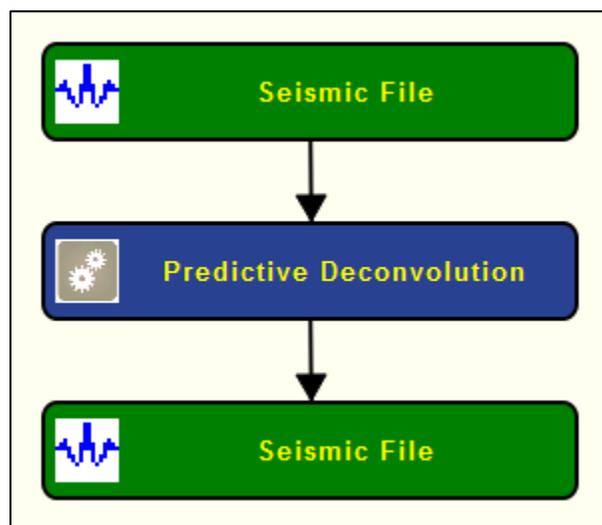
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Operator	Prewhitened %	Operator length (ms)	Prediction length (ms)	Moveout	Velocity	Window start (ms)	Window length (ms)
1	0.10	150.00	20.00	<input checked="" type="checkbox"/>	2000.00	0.00	1000.00

Parameter Description:

Number of operators — Enter the number of deconvolution operators to be used.

Overlap between operators (ms) — Enter the overlap in milliseconds between operators. This is the amount of the previous and/or next window to include in the calculation of the inverse filter for the current window.

Apply reverse operator — If checked, applies the reverse deconvolution operator to the data.

Ghost amplitude — Enter the amplitude value for the deconvolved ghost.

Operator — Sequential number of the operator to be used.

Prewhitened % — Enter the amount of white noise to add. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Operator length (ms) — Enter the length of the operator to be calculated and applied in milliseconds.

Moveout — If checked, a linear moveout will be applied to the deconvolution design window. The window start time will shift by: $\text{delta time} = \text{offset} / \text{velocity}$.

Velocity — Enter the velocity to be applied in the linear moveout.

Window start (ms) — Enter the start time in milliseconds of the deconvolution design window.

Window length (ms) — Enter the length in milliseconds of the deconvolution design window.

Predictive Multichannel Deconvolution

Usage:

The *Predictive Multichannel Deconvolution* step is a Wiener-Levinson algorithm for applying a multi-channel predictive multi-gate deconvolution to your data. You choose the percent pre-whitening, filter length, number of operators, the overlap of the operator design windows, start time of each operator design window, and the design window lengths. For the predictive deconvolution method, you must specify the predictive length of your wavelet. You may also apply a linear moveout to your deconvolution design windows to allow a sliding window whose start time varies with offset.

Input Links:

- 1) Seismic data in any sort order (mandatory).

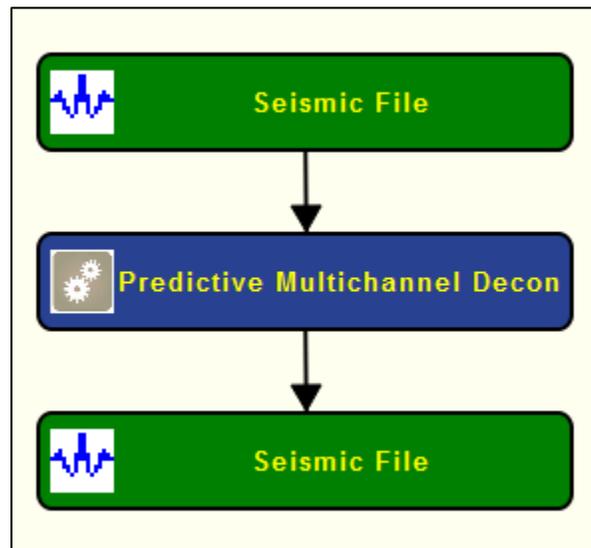
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Operator	Prewhitened %	Operator length (ms)	Prediction length (ms)	Moveout	Velocity	Window start (ms)	Window length (ms)
1	0.10	150.00	20.00	<input checked="" type="checkbox"/>	2000.00	0.00	1000.00

Parameter Description:

Number of operators — Enter the number of deconvolution operators to be used.

Overlap between operators (ms) — Enter the overlap in milliseconds between operators. This is the amount of the previous and/or next window to include in the calculation of the inverse filter for the current window.

Apply reverse operator — If checked, applies the reverse deconvolution operator to the data.

Ghost amplitude — Enter the amplitude value for the deconvolved ghost.

Range limit traces used in operator design — Limit the number of input traces used in the operator design based on a trace header key.

Range limit header field — Select the trace header key to be used in the trace limit.

Minimum range value — Enter the minimum range value.

Maximum range value — Enter the maximum range value.

Absolute value — If checked, consider the absolute value of the selected trace header key.

Operator — Sequential number of the operator to be used.

Prewhiten % — Enter the amount of white noise to add. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Operator length (ms) — Enter the length of the operator to be calculated and applied in milliseconds.

Moveout — If checked, a linear moveout will be applied to the deconvolution design window. The window start time will shift by: $\text{delta time} = \text{offset} / \text{velocity}$.

Velocity — Enter the velocity to be applied in the linear moveout.

Window start (ms) — Enter the start time in milliseconds of the deconvolution design window.

Window length (ms) — Enter the length in milliseconds of the deconvolution design window.

Q Filter

Usage:

The *Q Filter* step applies a frequency dependent “Q” attenuation compensation filter or an attenuation modeling filter to the input file. For both attenuation and modeling options, phase only or phase and amplitude filters may be applied.

Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

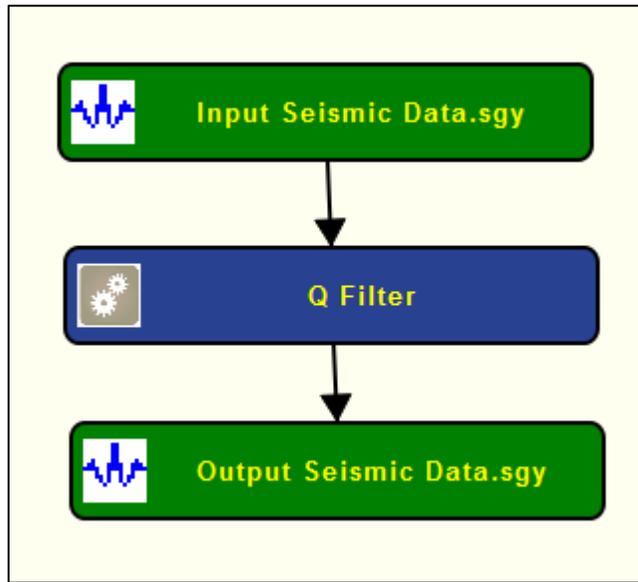
Reference:

Hargreaves, N. D., Calvert A. J., 1991, Inverse Q filtering by Fourier Transform, *Geophysics*, **56**, p. 519.

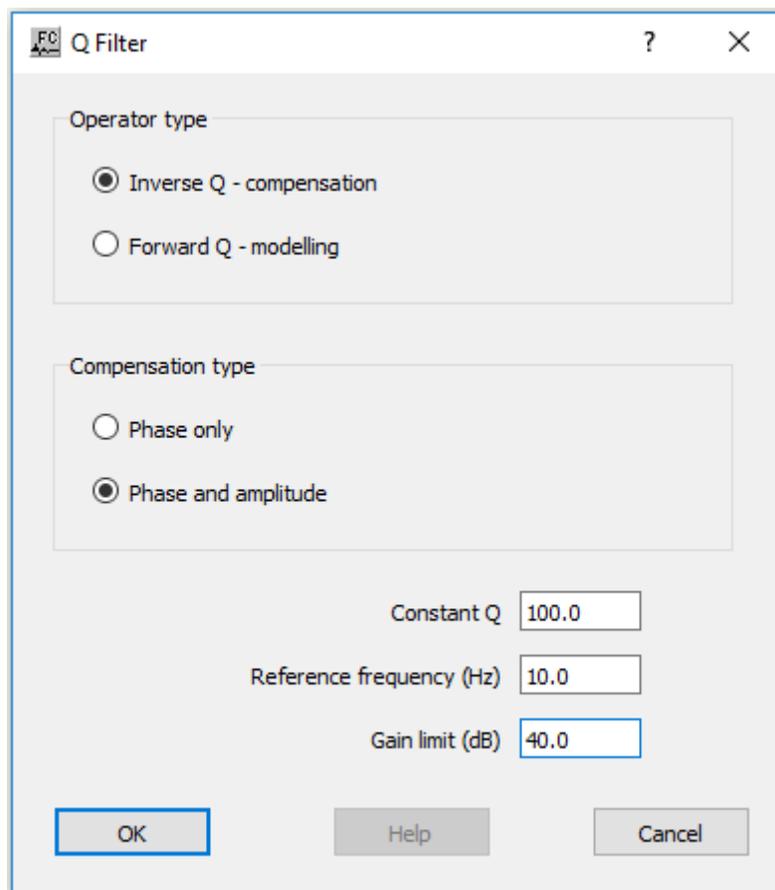
Hargreaves, N., 1992, Similarity and the inverse Q filter: Some simple algorithms for inverse Q filtering, *Geophysics*, **57**, p. 994.

Wang, Y., 2002, A stable and efficient approach of inverse Q filtering, *Geophysics*, **67**, p. 657.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Operator type: Specify the type of operator.

Inverse Q - compensation — If checked, attenuation will be removed from the input seismic traces.

Forward Q - modelling — If checked, the input seismic traces will have attenuation is to be introduced to.

Compensation type: Specify the compensation type.

Phase only — If selected, an allpass, phase-only filter is to be applied for forward or inverse Q filtering. This is a computationally efficient option.

Phase and amplitude — If selected, a phase and amplitude type filter is to be applied for forward or inverse Q filtering. This option is computer intensive.

Constant Q — Enter the value of Q for forward or inverse Q filtering.

Reference frequency (Hz) — Enter the reference frequency for forward or inverse Q filtering. There will be slight frequency dependent phase shifts with respect to this frequency.

Gain limit (dB) — Enter the maximum gain limit per frequency in the case of inverse Q filtering.

Signature Deconvolution

Usage:

The *Signature Deconvolution* step removes a seismic signature from your data traces by calculating the inverse of a supplied signature trace and then filtering your data by this signature inverse. This is a common technique for use in processing marine data to remove the signature of the airguns.

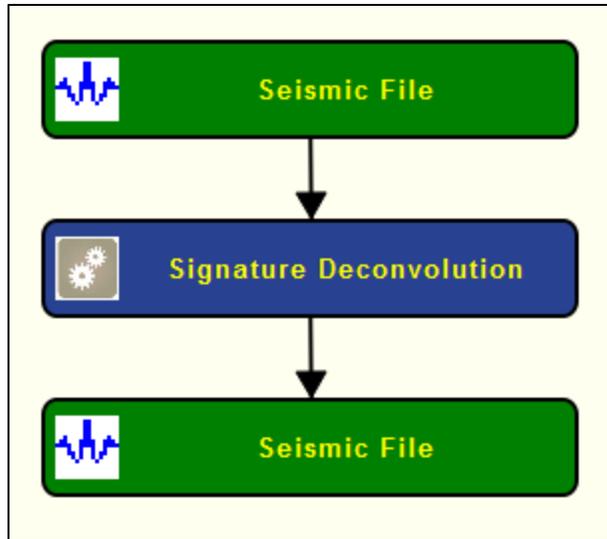
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Parameter Description:

Deconvolution parameters: Specify generic parameters of the deconvolution operator.

Pre-whitening percent — Enter the prewhitening multiplier. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Inverse filter length (ms) — Enter the length of the filter to be calculated and applied in milliseconds.

Input signature start time (ms) — Enter the start time of the input signatures in milliseconds.

Input signature length (ms) — Enter the length of the input signatures in milliseconds.

Time shift for output (ms) – Enter the time shift for the output trace following signature deconvolution

Signature Input Options: Specify the data input source of the signature trace or traces.

One signature from an auxiliary file — This option inputs one signature trace from an auxiliary input data and uses that trace as the signature trace for the entire data set.

One signature per record from an auxiliary data file — This option inputs one signature trace per record from an auxiliary input data set and uses that trace as the signature trace for all traces in the record in the signature deconvolution calculation.

One signature per trace from an auxiliary data file — This option inputs one signature trace from an auxiliary input data set per data trace and uses that trace as the signature trace for the corresponding data trace in the signature deconvolution calculation.

One signature per record in the data file — This option uses one trace from each data record and uses that trace as the signature trace for all seismic traces in the record in the signature deconvolution calculation.

Signature trace number — Enter the trace number to use as the signature trace.

Sweep trace number — Enter the number of traces in the sweep.

First trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the signature trace, you may wish to kill these auxiliary traces. Enter the first trace number to kill.

Last trace to kill — If you demultiplexed the data set with the auxiliary traces to recover the signature trace, you may wish to kill these auxiliary traces. Enter the last trace number to kill.

Spectral Whitening

Usage:

The *Spectral Whitening* step is a multi-banded spectral whitening method for balancing the energy of the selected frequency bands of your data. You specify the beginning and ending frequencies in the pass zone, the number of bands within this zone, and the length of the AGC operator. The individual band-pass filter cut off values are linearly interpolated based on the low and high pass frequencies and the number of bands that you choose. Each band is given a Butterworth third order slope with the midpoints of each slope being the half power points. Within each band every trace is AGC'ed with respect to the maximum amplitude in the window. All AGC'ed bands are then summed. Optionally, you may specify the Low Cut / Low Pass / High Pass / High Cut (LC,LP,HP,HC) filter points and associated weights for summing of up to ten filter bands. For optimal balancing of the energy of your frequency bands, your filters should be designed such that

the slopes of your filters exactly overlap as is illustrated below. Such a design optimally flattens the spectrum of your data without distorting the spectrum.

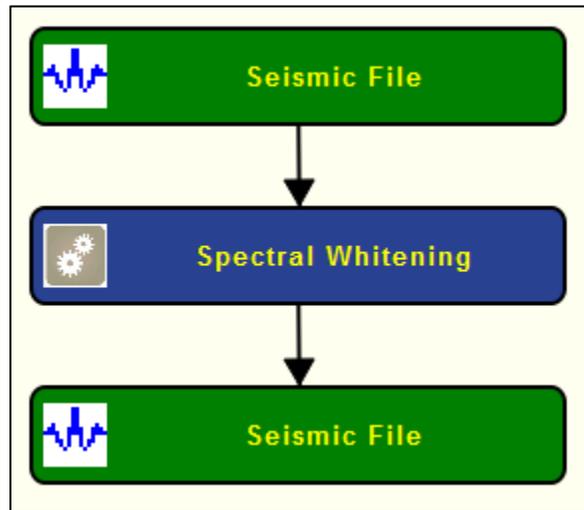
Input Links:

1) Seismic data in any sort order (mandatory).

Output Links:

1) Seismic data in any sort order (mandatory).

Example Flowchart:



Step Parameter Dialog:

Operator	Low cut	Low pass	High pass	High cut	Weights
1	4.0	5.0	30.5	34.8	1.0
2	30.5	34.8	60.2	64.5	1.0
3	60.2	64.5	90.0	94.2	1.0

Parameter Description:

Number of bands — Enter the number of frequency bands. Each trace is split into this number of frequency bands which are AGC'ed and then summed to create the output trace.

Start frequency (Hz) — Enter the low frequency pass band limit in hertz (Hz). This is the lowest frequency in the pass band.

End frequency (Hz) — Enter the high frequency pass band limit in hertz (Hz). This is the highest frequency in the pass band. It may not exceed one-half the Nyquist frequency.

AGC length — Enter the AGC operator length. This is the length of the AGC operator, which is applied to each frequency band.

Operator — Sequential number of the operator to be used.

Low Cut — Enter the filter low frequency cutoff point in hertz (Hz).

Low Pass — Enter the filter low frequency pass point in hertz (Hz).

High Pass — Enter the filter high frequency pass point in hertz (Hz).

High Cut — Enter the filter high frequency cutoff point in hertz (Hz).

Weights — Enter the filter band relative weight.

Spiking Deconvolution

Usage:

The *Spiking Deconvolution* step is a Wiener-Levinson algorithm for applying a spiking multi-gate deconvolution to your data. You choose the percent pre-whitening, filter length, number of operators, the overlap of the operator design windows, start time of each operator design window, and the design window lengths. For the predictive deconvolution method, you must specify the predictive length of your wavelet. You may also apply a linear moveout to your deconvolution design windows to allow a sliding window whose start time varies with offset.

Input Links:

- 1) Seismic data in any sort order (mandatory).

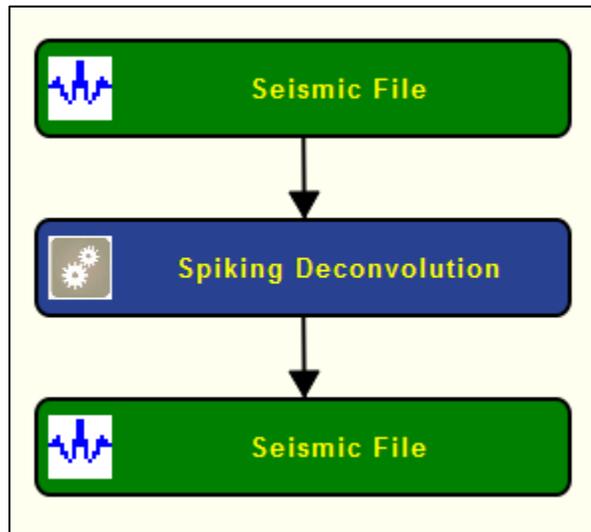
Output Links:

- 1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Operator	Prewhitened %	Operator length (ms)	Moveout	Velocity	Window start (ms)	Window length (ms)
1	0.10	150.00	<input checked="" type="checkbox"/>	2000.00	0.00	1000.00

Parameter Description:

Number of operators — Enter the number of deconvolutin operators to be used.

Overlap between operators (ms) — Enter the overlap in milliseconds between operators. This is the amount of the previous and/or next window to include in the calculation of the inverse filter for the current window.

Apply reverse operator — If checked, applies the reverse deconvolution operator to the data.

Ghost amplitude — Enter the amplitude value for the deconvolved ghost.

Operator — Sequential number of the operator to be used.

Prewhitened % — Enter the amount of white noise to add. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Operator length (ms) — Enter the length of the operator to be calculated and applied in milliseconds.

Moveout — If checked, a linear moveout will be applied to the deconvolution design window. The window start time will shift by: $\text{delta time} = \text{offset} / \text{velocity}$.

Velocity — Enter the velocity to be applied in the linear moveout.

Window start (ms) — Enter the start time in milliseconds of the deconvolution design window.

Window length (ms) — Enter the length in milliseconds of the deconvolution design window.

Spiking Multichannel Deconvolution

Usage:

The *Spiking Multichannel Deconvolution* step is a Wiener-Levinson algorithm for applying a multi-channel spiking multi-gate deconvolution to your data. You choose the percent pre-whitening, filter length, number of operators, the overlap of the operator design windows, start time of each operator design window, and the design window lengths. For the predictive deconvolution method, you must specify the predictive length of your wavelet. You may also apply a linear moveout to your deconvolution design windows to allow a sliding window whose start time varies with offset.

Input Links:

1) Seismic data in any sort order (mandatory).

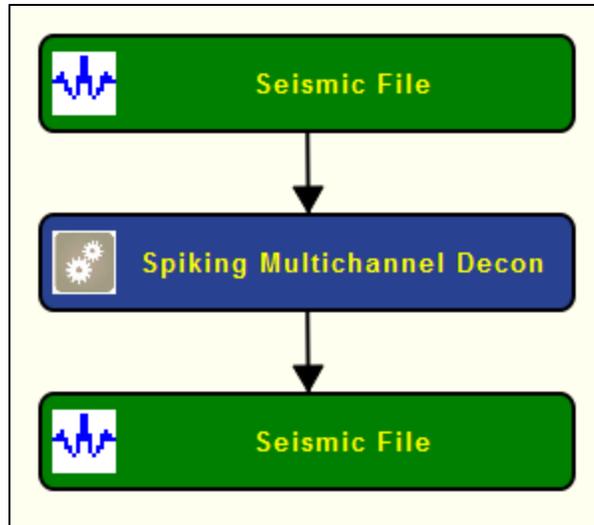
Output Links:

1) Seismic data in any sort order (mandatory).

Reference:

-

Example Flowchart:



Step Parameter Dialog:

Spiking Multichannel Deconvolution

Number of operators:

Overlap between operators (ms):

Apply reverse operator
Ghost amplitude:

Range limit traces used in operator design
Range limit header field:
Minimum range value:
Maximum range value:
 Absolute value

Operator	Prewhitened %	Operator length (ms)	Moveout	Velocity	Window start (ms)	Window length (ms)
1	0.10	150.00	<input checked="" type="checkbox"/>	2000.00	0.00	1000.00

OK Help Cancel

Parameter Description:

Number of operators — Enter the number of deconvolution operators to be used.

Overlap between operators (ms) — Enter the overlap in milliseconds between operators. This is the amount of the previous and/or next window to include in the calculation of the inverse filter for the current window.

Apply reverse operator — If checked, applies the reverse deconvolution operator to the data.

Ghost amplitude — Enter the amplitude value for the deconvolved ghost.

Range limit traces used in operator design — Limit the number of input traces used in the operator design based on a trace header key.

Range limit header field — Select the trace header key to be used in the trace limit.

Minimum range value — Enter the minimum range value.

Maximum range value — Enter the maximum range value.

Absolute value — If checked, consider the absolute value of the selected trace header key.

Operator — Sequential number of the operator to be used.

Prewhiten % — Enter the amount of white noise to add. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Operator length (ms) — Enter the length of the operator to be calculated and applied in milliseconds.

Moveout — If checked, a linear moveout will be applied to the deconvolution design window. The window start time will shift by: $\text{delta time} = \text{offset} / \text{velocity}$.

Velocity — Enter the velocity to be applied in the linear moveout.

Window start (ms) — Enter the start time in milliseconds of the deconvolution design window.

Window length (ms) — Enter the length in milliseconds of the deconvolution design window.

Surface Consistent Decomposition

Usage:

The *Surface Consistent Decomposition* step uses a Gauss-Seidel iterative method to perform a four-component surface-consistent decomposition of the amplitude spectra of the input seismic data into source, receiver, offset, and CMP components. Output component spectra can then be used as input to *Surface Consistent Deconvolution* step.

Input Links:

- 1) Seismic data in any sort order (mandatory).

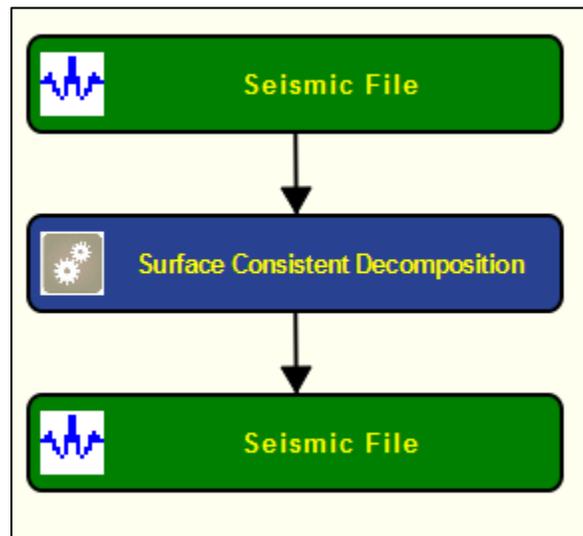
Output Links:

- 1) Seismic data in any sort order (mandatory).

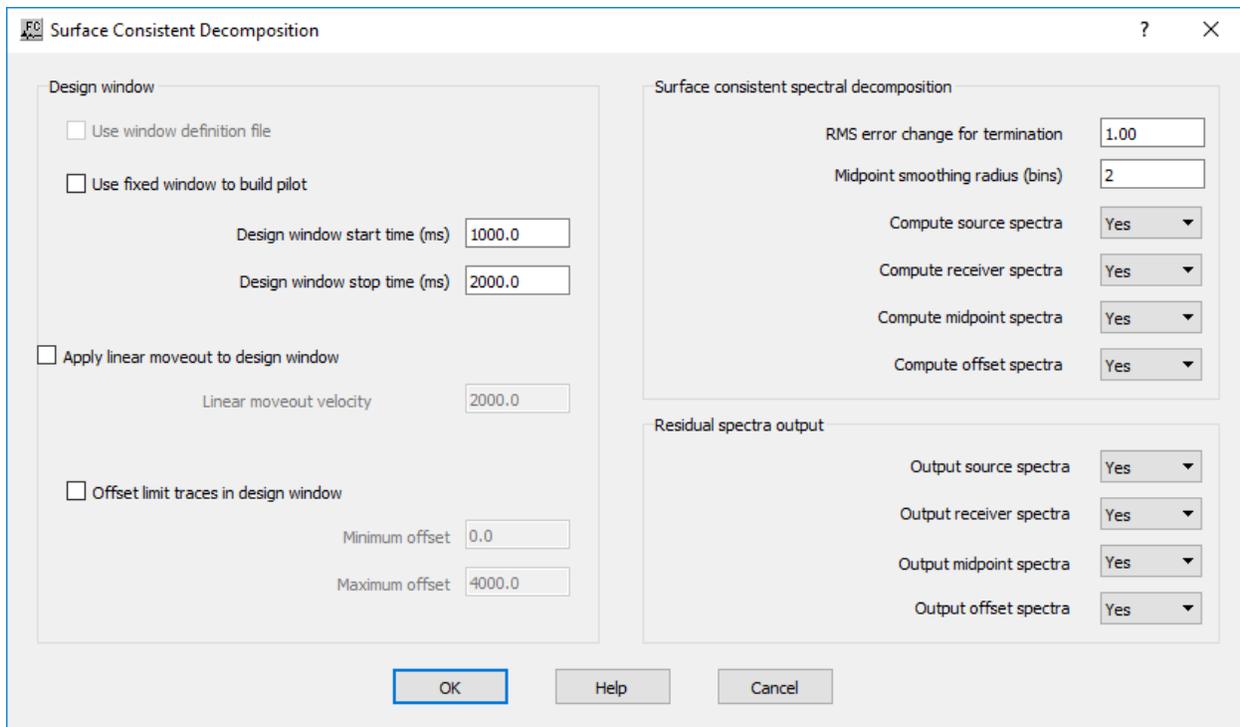
Reference:

-

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Design window: Specify window where surface-consistent decomposition will be performed.

Use fixed window to built pilot — If checked, use a fixed time window to build a pilot.

Design window start time (ms) — Enter start time of the pilot window in milliseconds.

Design window end time (ms) — Enter the end time of the pilot window in milliseconds.

Apply linear moveout to design window — If checked, design window is defined as an offset-dependent linear moveout.

Linear moveout velocity — Enter the linear moveout velocity.

Offset limit traces in design window — If checked, traces for the analysis are limited in terms of offset.

Minimum offset — Enter the minimum offset to be considered.

Maximum offset — Enter the maximum offset to be considered.

Surface consistent spectral decomposition: Specify consistent spectra decomposition parameters.

RMS error change for termination — Enter the minimum RMS error for the iterative procedure to be considered finished.

Midpoint smoothing radius (bin) — Enter the radius (in number of bins) of the midpoint smoothing operator.

Compute source spectra — Select yes to compute source spectra.

Compute receiver spectra — Select yes to compute receiver spectra.

Compute midpoint spectra — Select yes to compute midpoint spectra.

Compute offset spectra — Select yes to compute offset spectra.

Residual spectra output: Specify type of output.

Output source spectra — Select yes to output source spectra.

Output receiver spectra — Select yes to output receiver spectra.

Output midpoint spectra — Select yes to output midpoint spectra.

Output offset spectra — Select yes to output offset spectra.

Surface Consistent Deconvolution

Usage:

The *Surface Consistent Deconvolution* step uses a Gauss-Seidel iterative method to perform a four-component surface-consistent decomposition of the amplitude spectra of the input seismic data into source, receiver, offset, and CMP components. Deconvolution operators are constructed from the source and receiver components of this decomposition. The user specifies whether the deconvolution will be of the spiking or predictive type, the design window, operator length, and percent white noise.

Input Links:

1) data in any sort order (mandatory).

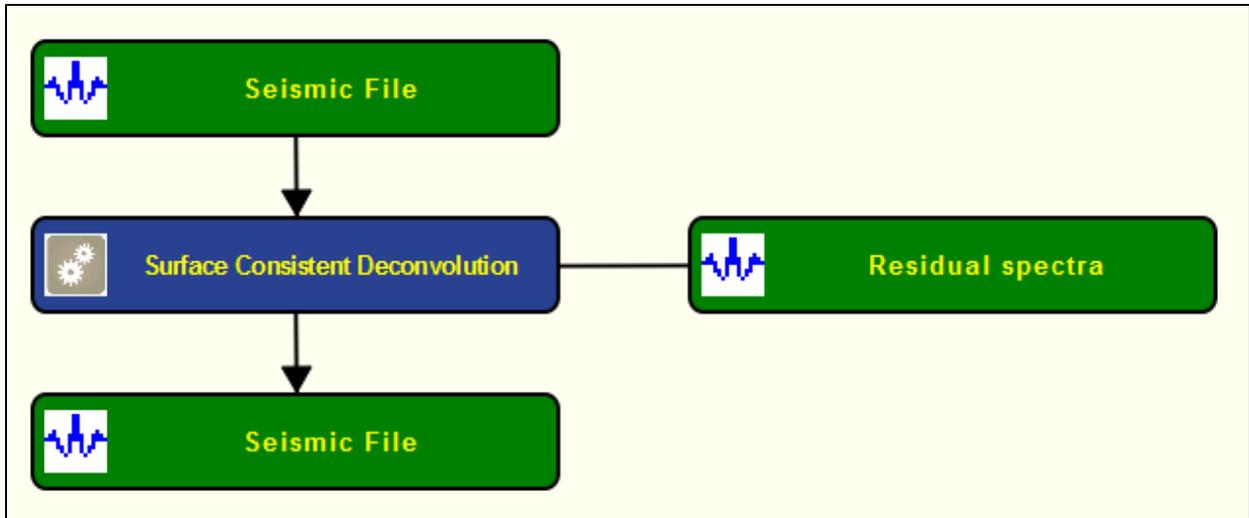
Output Links:

1) Seismic data in any sort order (mandatory).

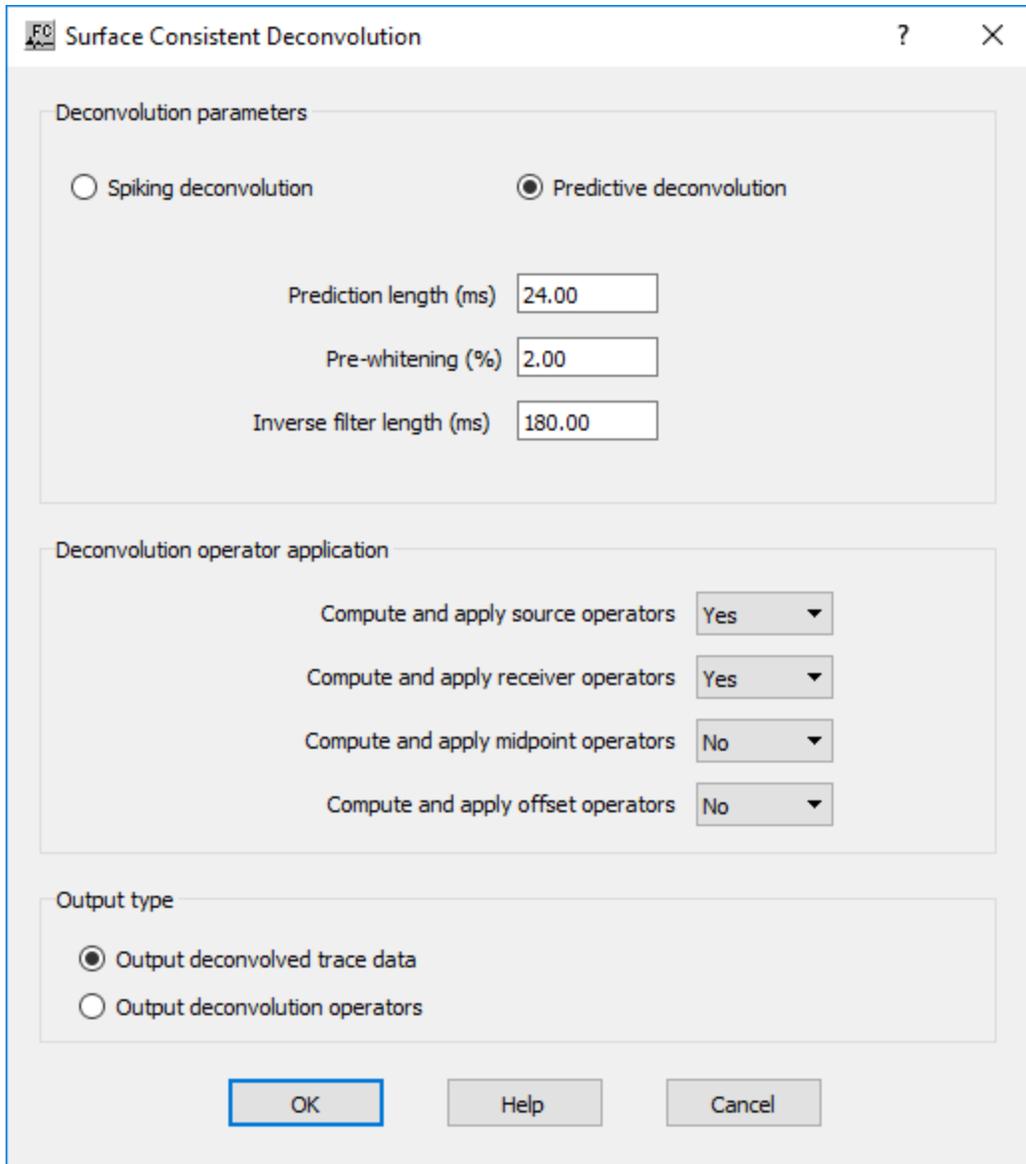
Reference:

Cary, P. M., and Lorentz, G. A., 1993, Four-component surface-consistent deconvolution: *Geophysics*, **58**, 383-392.

Example Flowchart:



Step Parameter Dialog:



Parameter Description:

Deconvolution parameters: Specify type of deconvolution to perform: Spiking or Predictive.

Spiking — If selected, use a spiking deconvolution.

Predictive — If selected, use a predictive or gapped deconvolution.

Prediction length (ms) — Enter the prediction length in milliseconds.

Pre-whitening percent — Enter the pre-whitening multiplier. The zero lag of the autocorrelation function is increased by this amount to induce stability in the matrix solution.

Inverse filter length (ms) — Enter the length of the filter to be calculated and applied in milliseconds.

Deconvolution operator application: Specify type of deconvolution operators to be applied to the data.

Compute and apply source operators — Select yes, to compute and apply source deconvolution operators.

Compute and apply receiver operators — Select yes, to compute and apply receiver deconvolution operators.

Compute and apply midpoint operators — Select yes, to compute and apply midpoint deconvolution operators.

Compute and apply offset operators — Select yes, to compute and apply offset deconvolution operators.

Output type: Specify type of output.

Output deconvolved trace data — If selected, deconvolution operators are applied to the output data.

Output deconvolution operators — If selected, deconvolution operators are the output and can be used in other processing steps. No deconvolution is applied to input data.