S&P Global
Commodity Insights

Energy Upstream

GeoSyn® User Manual

May 2023

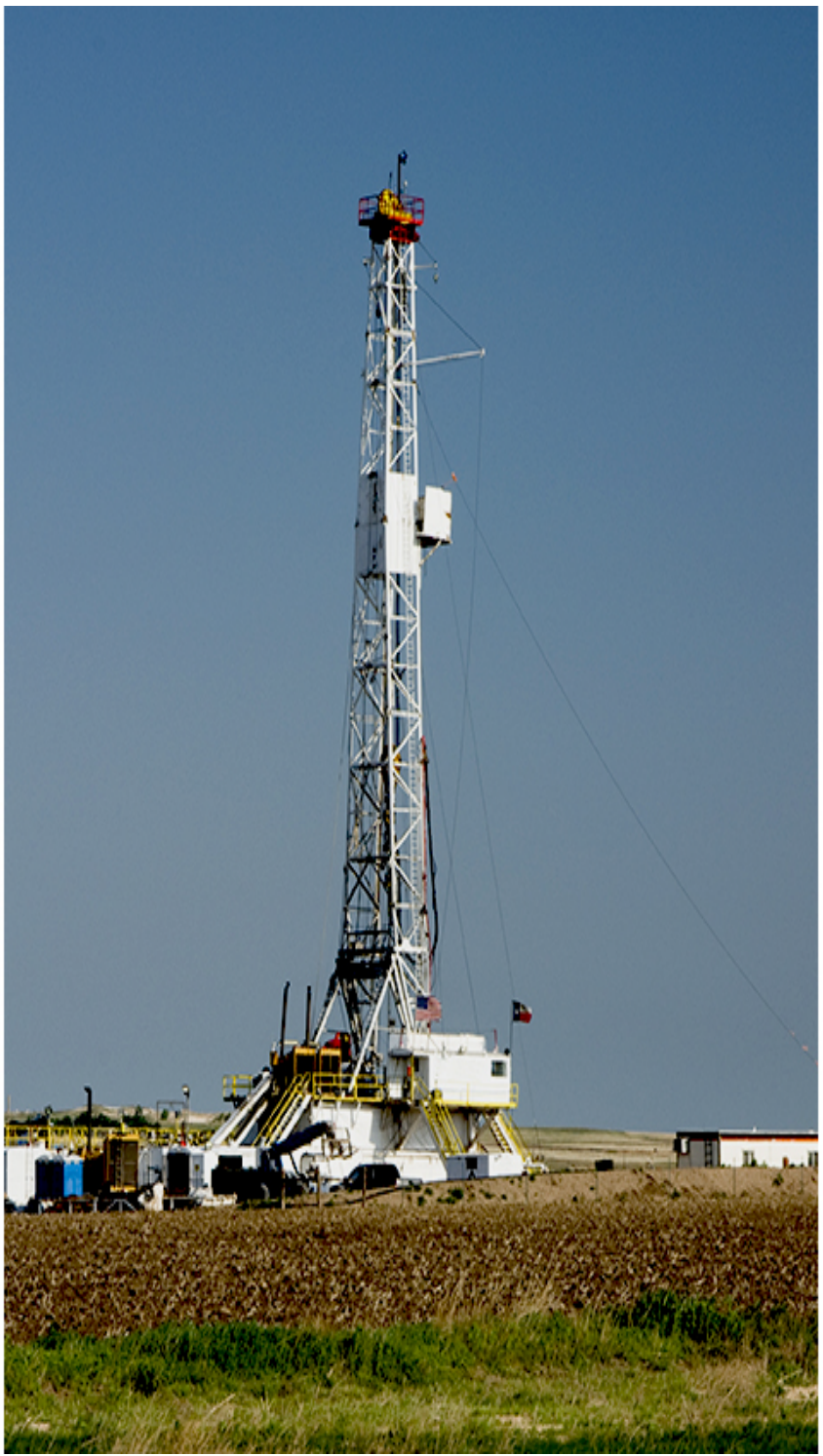

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Table Of Contents

About GeoSyn

GeoSyn 1D enables you to create one-dimensional and offset sythetic models. Logs can be edited, stretched, squeezed, shifted, and more.

Synthetics creation

A synthetic can be created in several ways:

- Open a previously saved GeoSyn synthetic with a *.syn* extension.
- Import raw log data from LAS or GeoSyn synthetic files.
- Launch GeoSyn from Kingdom, AccuMap or PetraSeis applications.
- Download digitized logs from the IHS Information Hub or AccuMap
- Create a blocked log suite.

Layout templates

GeoSyn enables you to create multiple templates that control the display and placement of elements in the main synthetic display including color palettes, directory paths, and display presentations for logs, traces, and models.

As well, the main synthetic display includes drag and drop, and right-click functionality for working with individual synthetic elements.

File management

GeoSyn includes a Directory Browser that displays GeoSyn and LAS format files in either the current directory or the current directory and its sub-directories too. All files are displayed in one central view sorted by UWI. Filter the display by extension, UWI column, or geographic coordinates.

Export capability

Export tops, directional surveys, logs, synthetic models, and more into ASCII text, LAS, and SEGY format as applicable. All exports are managed through a central export manager dialog box with each data type displayed on separate tabs.

As well, any element that appears in the main synthetic display can be copied to the Windows clipboard and pasted into other applications to create a montage.

GeoSyn includes batch printing and reformatting, which enables you to simultaneously convert or print multiple LAS or GeoSyn format files.

Tops management

When you create a new synthetic or launch an existing one, GeoSyn automatically downloads the latest system tops and user tops from your local AccuMap database. Configure top lithology and save various tops in different lists that you import, export, and display in a tops table in the main synthetic display.

Information in the tops table can be exported as ASCII text or as an image file for use with other applications.

Seismic

Import and display single-trace and multi-trace seismic data saved in SEGY format and display the file in a stand-alone SEGY Viewer before importing to review file format and contents. Imported seismic can be tied to models for correlation.

IHS Kingdom Integration

Create a GeoSyn synthetic using a well or seismic data from IHS Kingdom. Read a time depth chart directly from the Kingdom database, apply the data to a GeoSyn model, and then save the time/depth data back to the Kingdom database. GeoSyn can be launched directly from Kingdom and the resulting GeoSyn files can be saved within the Kingdom Project directory.

Modelling (traces)

Create zero-offset, multi-offset, or derived models. GeoSyn also enables you to create blocked log models to eliminate tuning effects that sometimes occur when using actual logs.

Cross-Plotting

Create crossplots using data from logs, seismic, and models that appear in the synthetic for the X and Y axes.

Following are some of the more common crossplots you might create:

- Offset trace along the x axis and an amplitude trace along the y axis.
- Incident angle along the x axis and the amplitude from the seismic along the y axis
- Gradient on one axis and intercept on the other.

Recommended system specifications

The recommended system specifications for GeoSyn are:

Hardware

Minimum	64-bit quad-core machine with 8 GB of physical RAM
Recommended	64-bit processor with 8 CPU cores and 16 GB of physical RAM or higher
Graphics card (Recommended)	Video cards that support CUDA 4.x, have at least 1 GB of graphic card memory

Operating System

OS	Install	Supported
Windows 7 SP1 (64-bit)	Yes	Yes
Windows 8	Yes *	Yes *
Windows 10	Yes	Yes
Windows 2008 R2 Server (Citrix based Applications)	Yes *	Yes *
Windows 2012 Server (Citrix based Applications)	Yes *	Yes *
* Basic support; we do not certify on these operating systems but will provide Customer Care support and consider bugs found during installation		

Related topics

"Contacting customer care" on the facing page

Contacting customer care

Contact IHS Customer Care for assistance with any questions or problems not answered in this help system.

To forward your GeoSyn license file to Customer Care, from the **File** menu, click **License** to display the *Current License Status* dialog box and click **Email License File to IHS** to launch your native email program and automatically attach the license file to a new message.

Phone	1 800 IHS-CARE (1 800 447-2273) Mon. to Fri. 8:00 AM to 6:00 PM
Email	Kingdom users: kingdom_support@ihsmarkit.com Non-Kingdom users: support.cdn@ihsmarkit.com
Web site	www.ihs.com/products/oil-gas-geosyn-software.html

When reporting a difficulty, please include any information that might help us diagnose the problem including the following:

- Version of GeoSyn (and AccuMap, if installed)
- Windows operating system
- Circumstances and steps that led to the problem
- Complete text from any error messages

Related topics

"Recommended system specifications" on the previous page

About Displaying Synthetics

GeoSyn generates synthetics in its own proprietary format. A GeoSyn synthetic can be the product of filtering and or other variables that differs from raw data used to create synthetics.

There are several ways to open a synthetic in GeoSyn:

- Open a previously saved GeoSyn synthetic with a *.syn* extension.
- Import raw log data from LAS file or GeoSyn synthetic files.
- Open a GeoSyn synthetic linked to a Kingdom synthetic
- Creating a blocked sonic log.
- Download digitized logs from the IHS Information Hub using either:
  - The online data search wizard
  - Clicking the desired well in AccuMap and selecting **GeoSyn Viewer** from the popup menu.

Directory Browser

When importing LAS or GeoSyn files and when launching GeoSyn synthetics, you can launch the Directory Browser tool that displays an index of LAS and GeoSyn files located in directories and sub-directories. Directory Browser enables you to sort and manage numerous files based on Unique Well Identifier (UWI) instead of file name.

Related topics

Configuring GeoSyn defaults

The Properties dialog box is used to set the configuration defaults and control how imported logs, seismic, and tops files are interpreted and displayed in current and future GeoSyn sessions.

The Configuration properties dialog provides separate tabs for:

- GeoSyn configuration defaults
  - File locations
  - Support addresses
  - Log in credentials
- Log library

- Import defaults
- Statistics

To configure GeoSyn defaults:

1. Open the Properties configuration dialog. **Edit > Configuration properties**
2. Click the **Edit** button beside the **Working** box to specify a different location where GeoSyn looks for and saves synthetic layout templates, color palettes, and more.
3. If your subscription to the IHS Information Hub is charged by the transaction, select the **Show transaction warning prompt** check box to be notified before digits are downloaded and charges incurred.
4. Click **Close** to apply the changes or click a different tab.

Note:	Configuration changes are automatically applied to this and future GeoSyn sessions.

Related topics

"Changing import defaults" on page 12
"Changing log defaults" on page 54
"Contacting customer care" on page 5

Opening GeoSyn synthetics

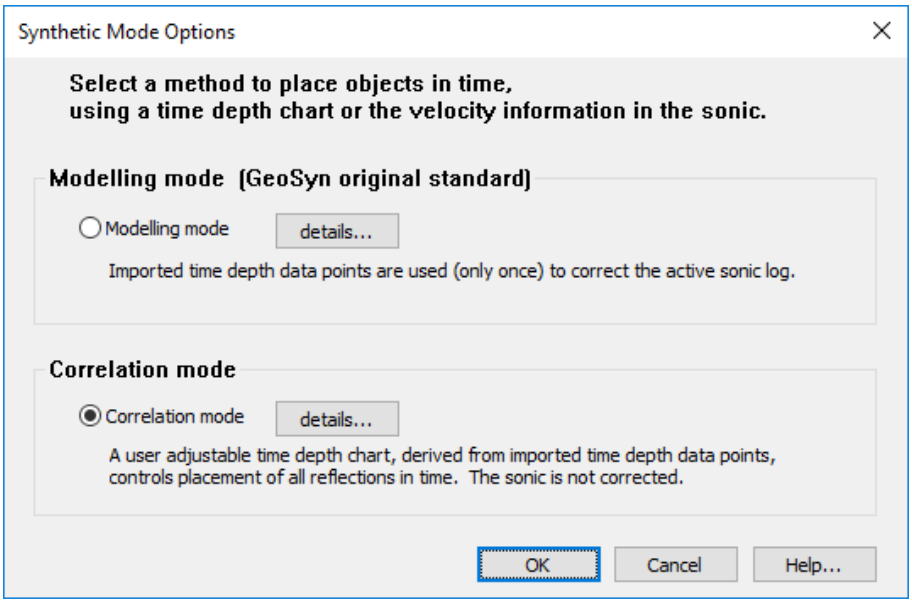
Each time you open a synthetic, GeoSyn pulls the formation tops defined in the well from your local AccuMap system tops and AccuMap user tops databases. There are several ways to open a GeoSyn file depending on your need:

- Dragging a GeoSyn synthetic file (*.syn) onto the current GeoSyn display or, use the GeoSyn Directory Browser to filter existing GeoSyn files.
- Synthetic mode options
- Importing a well from Kingdom
- Importing a LAS or GeoSyn file
- From AccuMap
- Download Logs from the IHS Information Hub

Synthetic Generation Modes

GeoSyn offers two different modes when generating a synthetic:

- Modelling mode — Time objects are placed by referencing velocity fields from a sonic log. The active sonic is edited by the user, however imported check shot surveys or time depth charts are only referenced (once) to correct the sonic and are then discarded.
- Correlation mode — Time objects are placed by referencing velocity fields from a saved time depth chart.Objects are moved in time by altering the saved time/depth chart, not the sonic.



Refer to the chart below for the advantages and disadvantages of each mode.

Mode	Advantages	Disadvantages
Modeling mode	Allows accurate "What if "log models to be to generated because log editing will change reflection coefficients as well as time spacing (tuning effect).	Tightly spaced, mis-picked check shots, or badly designed time depth charts can generate dramatic excursions during the correction operation. Generally, time /depth correction data should be coarsely spaced and quality controlled for valid velocities.
Correlation mode	Correlating seismic is simplified. Reflection coefficients are readily moved by manipulating the time/depth chart.	With unlimited flexibility, it is easy to introduce unreasonable or impossible velocity regimes. GeoSyn provides tools to monitor for this.

Related topics

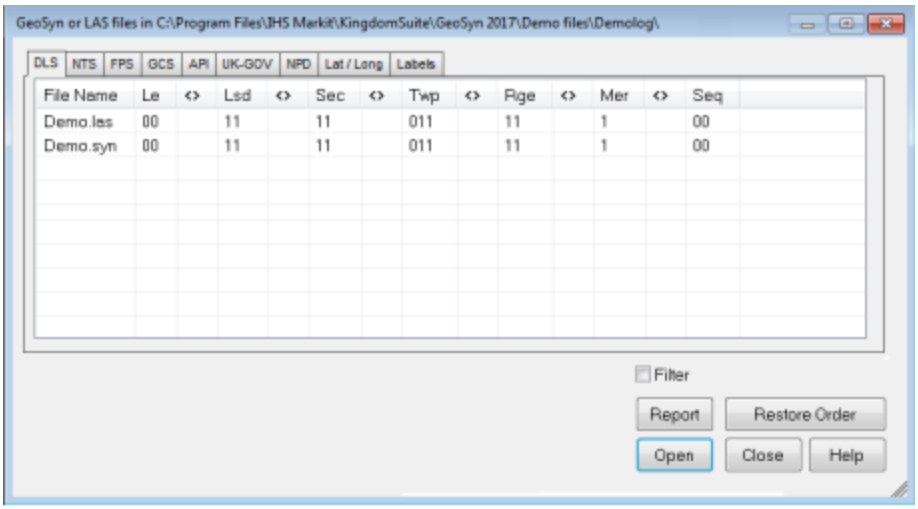
"Importing wells from Kingdom" on page 29

Using Directory Browser

The GeoSyn Directory Browser displays and sorts the contents of LAS and GeoSyn files by UWI rather than file name in selected directories and associated sub-directories. Sorting by UWI instead of a file name allows users to:

- Filter files by geographic coordinates
- Sort by various UWI columns

- View basic details about the individual files before opening or importing



UWIs are listed in the appropriate survey system tab separated into columns representing each coordinate group of the survey system. Log files with missing or invalid UWIs are only listed in the **Labels** tab

Cataloging files

The first time it reads a directory, the Directory Browser creates a catalog file (`.cat`)of all (`.las`) and GeoSyn files in the selected directories . Depending on the volume of files, this can take several minutes as each file is read and cataloged. As a best practice and to reduce time, search directories should only include.`.las` and `.syn` files.

Note: Corrupt GeoSyn files in the target directory may cause Directory Browser to crash.

To use Directory Browser

1. Depending on whether you are searching for an existing synthetic or creating a new one:
   - **File > Open.**, working with existing GeoSyn synthetic.
   - **File > Import > Log Data**, creating a new synthetic from an imported `.las` file.
2. Select a directory path from the resulting dialogs Look in: folder drop down list .
3. Click one of the action buttons at the bottom of the dialog:

- **Browse dir**, Opens the Directory Browser with files in current directory only.
- **Browse sub-dir**, Opens Directory Browser with files in current directory and sub directories
- **Import**or **Open**, Immediately opens the selected file without opening Directory Browser.
- **File Viewer**, Displays selected .las files in text editor for viewing without Directory Browser.

The Directory Browser opens listing all UWIs in the selected path under the appropriate survey system tab.

4. Select the desired survey system tab and then click a column header to sort rows based on the values in that column or change the column order by clicking transpose () between two columns to swap.

   To remove UWIs that appear outside of a certain geographic boundary, select **Filter** then click **Edit** to display the *Edit a UWI* dialog box and specify the coordinates for the area within which to display UWIs.
5. Right-click a row to view a popup window with basic log details.
6. Select the row to open or import into GeoSyn file and click **Open**. Additionally you can:

- Click a column header to sort rows based on column values
- Change the column order by clicking transpose between two columns to swap
- Remove UWIs that appear outside of a certain geographic boundary
- Select **Filter** then click **Edit** to display the Edit a UWI dialog box and specify the coordinates for the pane within which to display UWIs.
- Right-click a row to view a popup window with basic log details.
- Click **Report** to display the *Browser report* dialog box.

Related topics

"Opening GeoSyn synthetics" on page 8

"Importing LAS or GeoSyn files" on page 14

Changing import defaults

Import the control path settings and display parameters for everything in a new synthetic except logs from a default file. Log default settings are instead

controlled by a centralized log database with one exception: when you update a default file with settings from the current synthetic, settings for the logs in the current synthetic are also saved to the import defaults file and override, but don't overwrite settings in the log defaults database. For details on changing log display, see *Related topics* below.

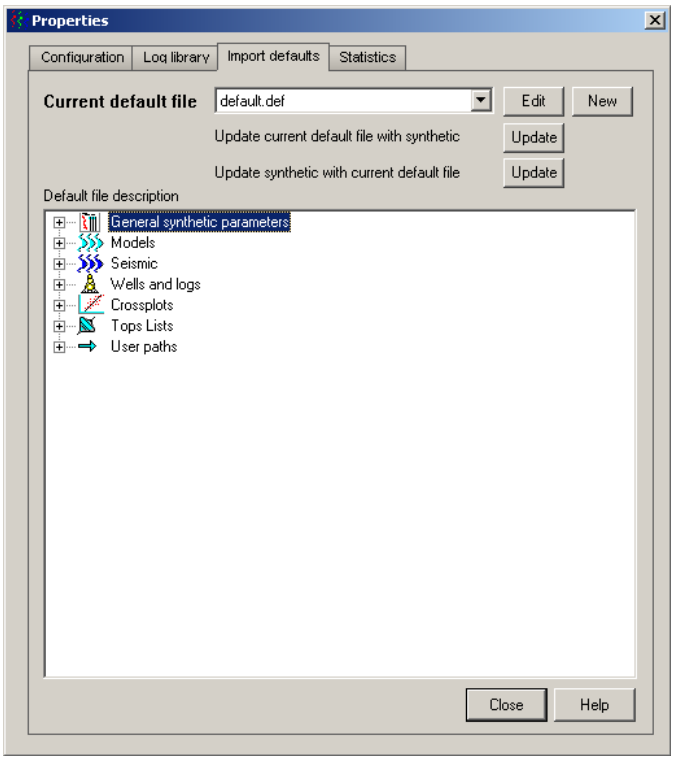
Create multiple import default files with a *.def* extension in the GeoSyn *Working* directory and then apply these defaults to a given synthetic when you launch it. For example, you could create unique default files for several different projects with differing criteria, or several default files for the same project that you switch between to view different scenarios.

Defaults can either be applied to the current model, or the parameters set in the current model can be applied to a default file that you then save for future use.

To change import defaults:

1. From the **Edit** menu, select **Default synthetic properties** (Def) > **Import Defaults**.

The Properties: Import Defaults dialog box opens.



2. Select an import defaults file to modify in the *Current default file* drop-down list or click **New** to display the *New default file name* dialog box and type a name for the file you will create. The new import defaults file inherits the settings of the current synthetic.

To apply changes that you've made in the current synthetic to the default file that other GeoSyn synthetics use, select the file in the *Current default file* box, then click **Update** beside the *Update current default file with model* label.

To apply parameters from a default file to the current synthetic, select the default file in the *Current default file* box, then click **Update** beside the *Update synthetic with current default file label*.

The nodes in the import defaults file tree display settings from the selected file. Click to expand nodes and view their settings.

3. From the *Edit Specific parameters* drop-down list, select the synthetic properties to change (general synthetic, model, seismic, well, crossplot, tops, and user paths).

4. Configure the properties as desired then click **OK** to return to the *Properties: Import Defaults* tab.

5. Click **Close** to return to the main synthetic display with your changes applied.

The import defaults file listed in the *Current default file* drop-down list is automatically selected next time you launch GeoSyn and applies to all future synthetics derived from imported logs.

Related topics

- Configuring GeoSyn Defaults
- Changing Log Defaults
- Reformatting GeoSyn and LAS Files

Importing LAS or GeoSyn files

GeoSyn enables you to create a synthetic by importing raw log data from LAS or GeoSyn files. Creating synthetics from a GeoSyn file is different than opening a GeoSyn synthetic because only log information and no formatting is saved in the imported file.

When you import a GeoSyn or LAS file, GeoSyn renders the file using the settings in the import defaults file and loads the formation tops defined in the well from your local AccuMap system tops and AccuMap user tops databases.

There are two ways to import log data into GeoSyn:

- Drag and drop a single LAS file onto the main GeoSyn display.
- Use the Import log data wizard

To import LAS or GeoSyn files using the Iog import wizard:

1. Start the log import wizard, **FIle > Import >Log data...**. This opens the Import log data dialog box
2. Select the root directory or drive from the **Look in** drop-down list then double-click folders in the display pane and browse to the directory that contains either the desired files or the subdirectories with those files. To filter the type of files displayed, from the **File filter** drop-down list, select a file format extension.

3. Either click **Browse dir.** or **Browse sub-dir** to launch *Directory Browser*, or simply select the desired file in the display pane.

   - For LAS files, you can inspect the raw data in an ASCII text editor before importing the file by clicking **File Viewer**.

When you select the file, details appear in the *LAS* or *GeoSyn format file* pane.

4. In the well tree, select whether to import specific logs. A check mark (✓) appears beside logs that will import, a cross (✗) beside those that won't. For wells with numerous logs, toggle the group by clicking **All** (✓ or ✗) depending on whether to import or ignore the majority of logs, then toggle the individual logs to import or ignore.

5. Specify whether the selected log(s) is in Measured Depth or True Vertical Depth units so that GeoSyn correctly places the formation tops from the AccuMap system tops and user tops databases, and then click **Import**.

If you ignore the sonic log or one isn't available, GeoSyn automatically creates a straight line (constant velocity) sonic log. For details on manually editing logs, see *Related topics* below.

If the import file has missing or invalid data such as an invalid UWI or log alias, GeoSyn enables you to correct it during the import. For details, see *Related topics* below.

Related topics

"Opening GeoSyn synthetics" on page 8
"Changing import defaults" on page 12
"Using Directory Browser" on page 10
"Changing log display properties" on page 52
"Correcting invalid data when importing" on page 27
"Reformatting GeoSyn and LAS files" on page 188
"Drawing straight edge and freehand curves" on page 59
"Clipping or filtering logs" on page 75
"Applying math equations to logs" on page 77
"Cutting logs" on page 80

Importing directional surveys

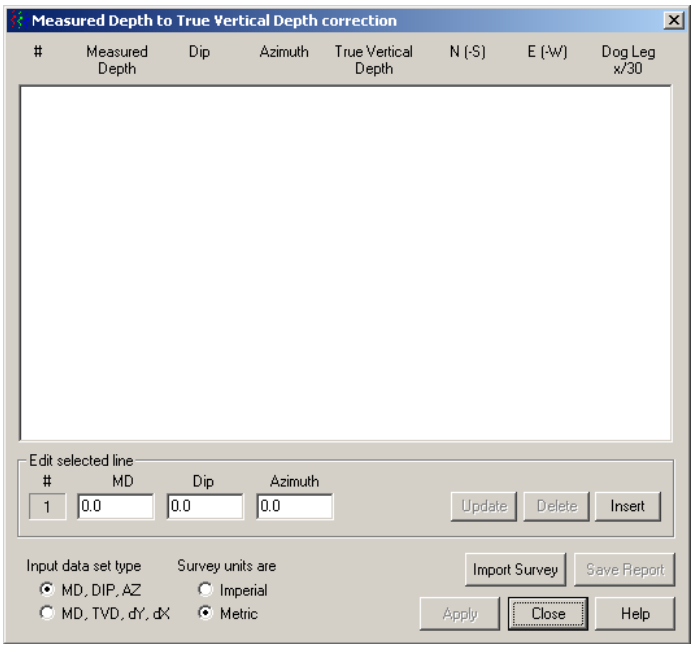
Import and modify a directional survey saved in ASCII, GeoGraphix, or Open Works format, or create one from scratch by typing measured depth, dip, and azimuth values.

If a well from the IHS Information Hub has a directional survey available and you're licensed to access them, you can save it to disk while downloading the log and then import it into GeoSyn. For details, see *Related topics* below.

To import a directional survey:

1. From the **File** menu, select **Import** > **Directional survey**.

The Measured Depth to True Vertical Depth correction dialog box opens.



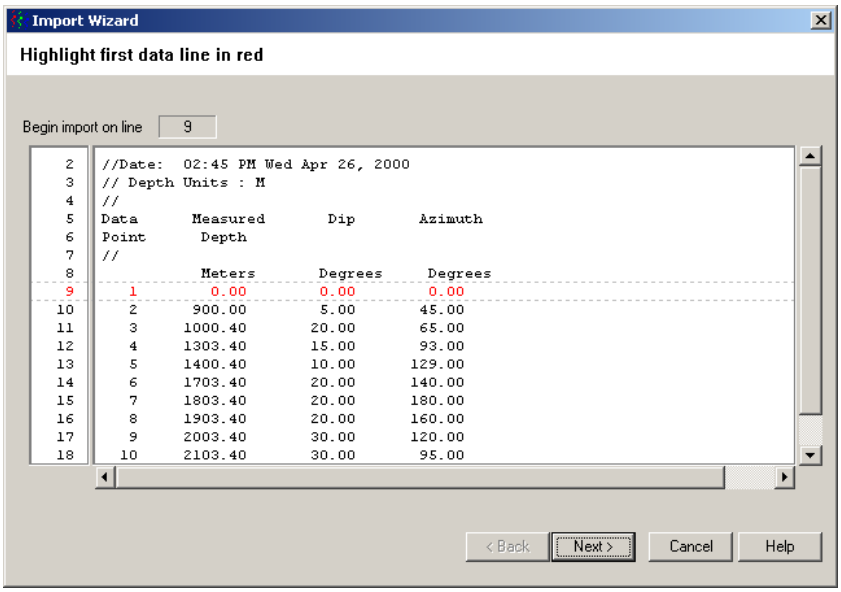
2. Either click **Import Survey** and browse for the desired directional survey file or type individual depth, dip, and azimuth values in the dialog box above and click **Insert**.

If importing a check shot file, complete the bulleted steps otherwise continue to **step 3**.

The *Import Directional Survey* dialog box opens. You can also launch this dialog box from the *Well Properties: Well properties* tab.

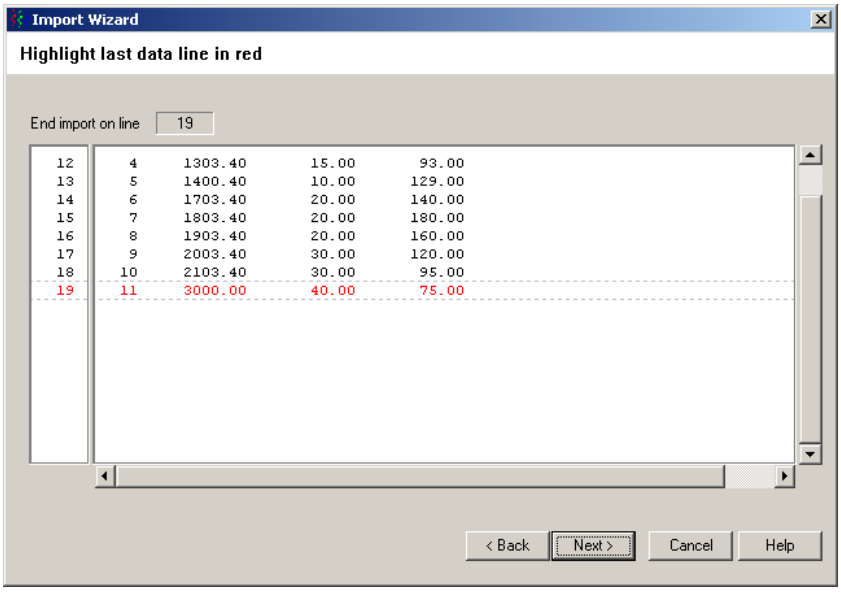
Browse to the file to import then click **Open**.

The Highlight first line dialog box opens.



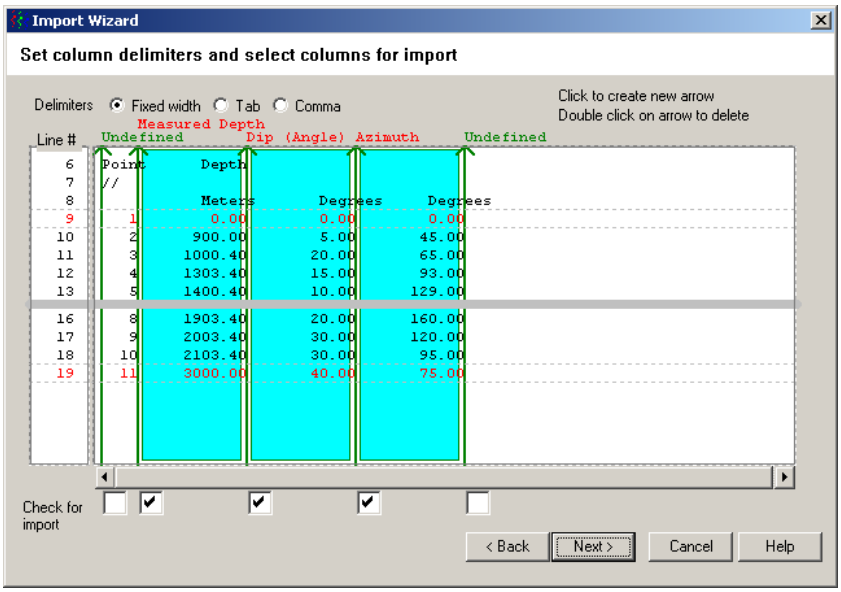
Select the first line to import and click **Next**.

The Highlight last line dialog box opens.



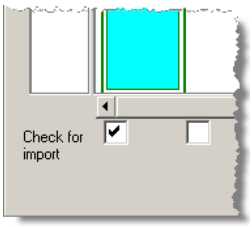
Select the last line to import and click **Next**.

The Set column delimeters dialog box opens.

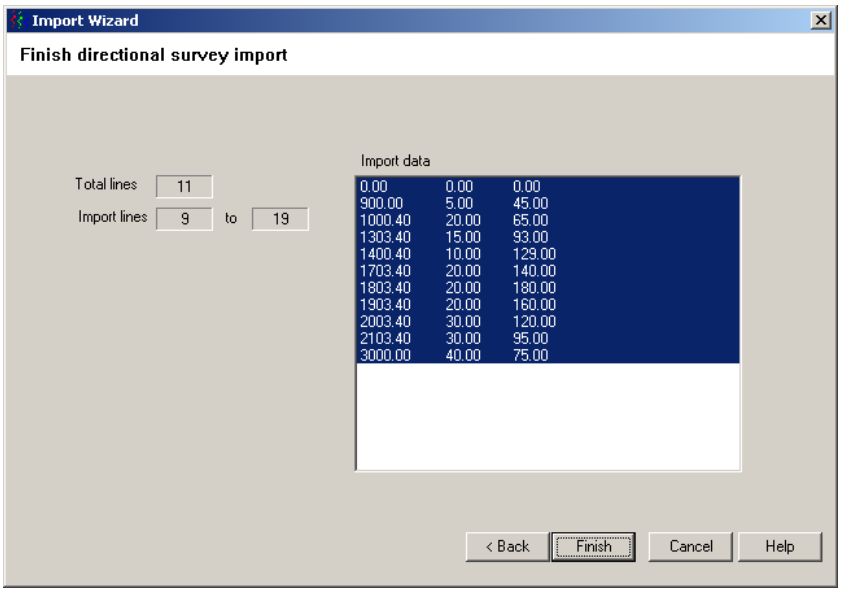


Set the column delimeters (↑) by clicking in the display pane between required columns. The green line cannot bisect a data column. Double-click column delimiters to delete.

Click the box that appears below each delimeter to display the *Select from List* dialog box and identify the data type then click **Next**.

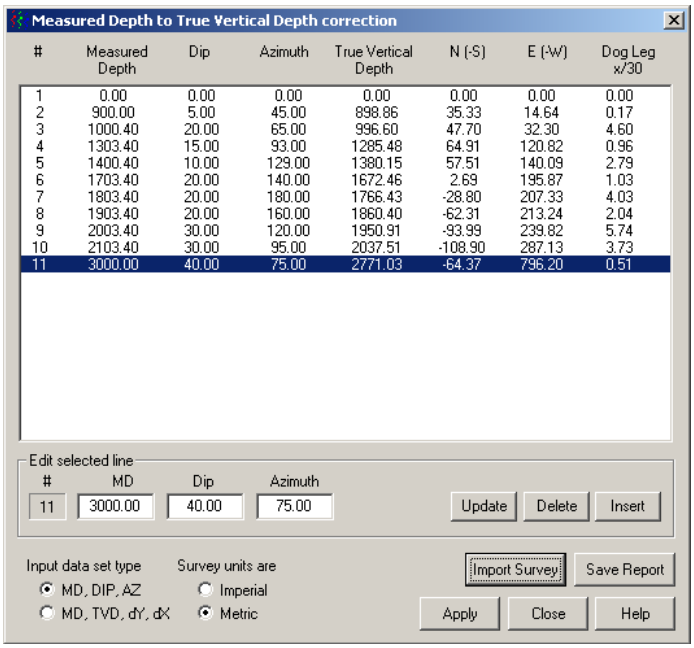


The Finish dialog box opens.



Click **Finish**.

The Measured Depth to True Vertical Depth correction dialog box opens, populated with the typed or imported values.



3. Do any of the following:

To modify or add values, select the row to replace, or type values in the **MD**, **Dip**, and **Azimuth** boxes, and then click either **Update** or **Insert**.

To delete a row, select it in the display pane and click **Delete** or click **All** to clear the entire display pane.

To save the display pane to an ASCII format file, click **Save Report**.

4. Click **Apply** and **Close**to complete the import.

GeoSyn imports the data and displays the deviated synthetic in the main synthetic display, where you can adjust the azimuth of the projection using the *Well Properties: Directional Survey* tab. For details see *Related topics* below.

Related topics

"Viewing deviated well properties" on page 51

"Downloading logs from the IHS information hub" on page 41

- placeholder
- All Files

You are here:

Importing check shot surveys and vertical seismic profiles

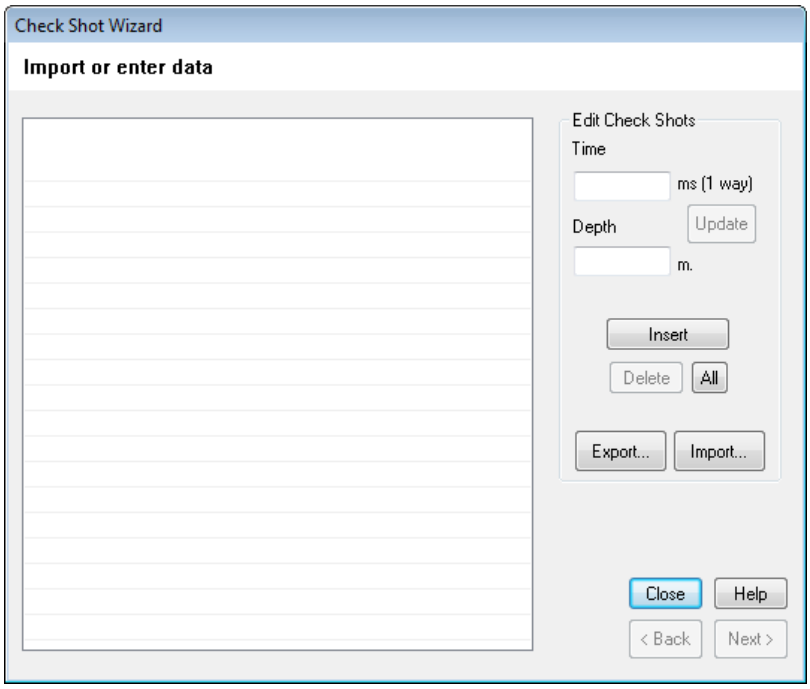
Apply a check shot correction to a GeoSyn synthetic by importing an ASCII format file or create one from scratch by typing time and depth values for individual check shot pairs.

If the well to be check shot corrected also requires a directional survey correction, apply the directional survey first. For details, see *Related topics* below.

To import check shot surveys and VSPs:

1. From the **File** menu, select **Import** >**Check Shot or VSP Survey**.

The Import Data dialog box opens.



2. Either click **Import** and browse for the desired check shot survey file or type individual time depth pairs in the **Time** and **Depth** boxes, and then click **Insert**.

a. If importing a check shot file, complete the bulleted steps otherwise continue to **step 3**.

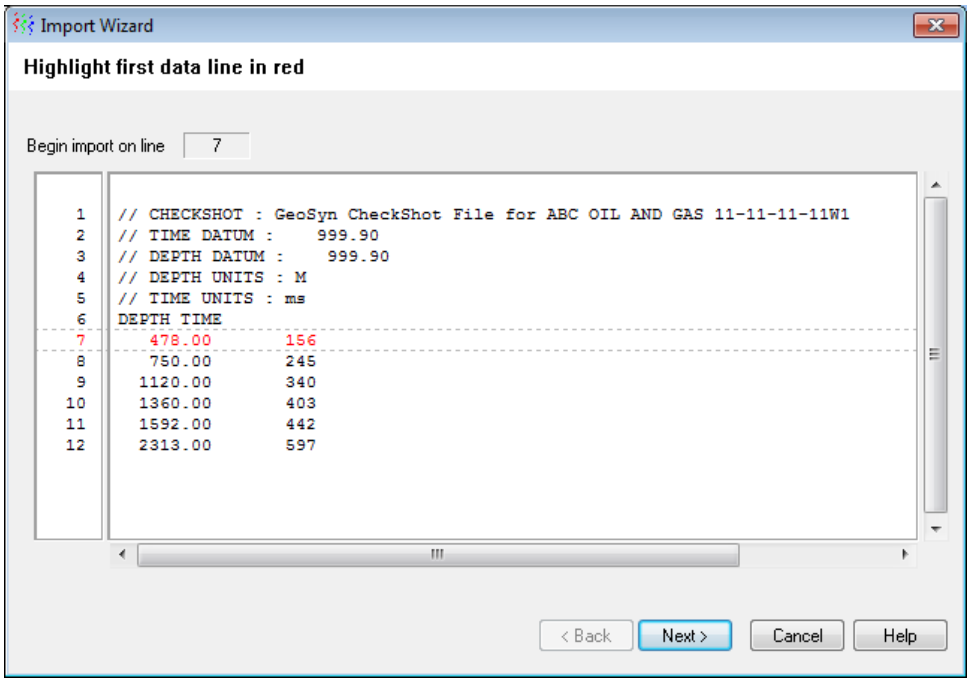
The *Import Check Shots* dialog box opens.

- Browse to the desired file.

To view and modify the contents of an ASCII file before importing, click **File Viewer** to display the file contents in an ASCII text editor.

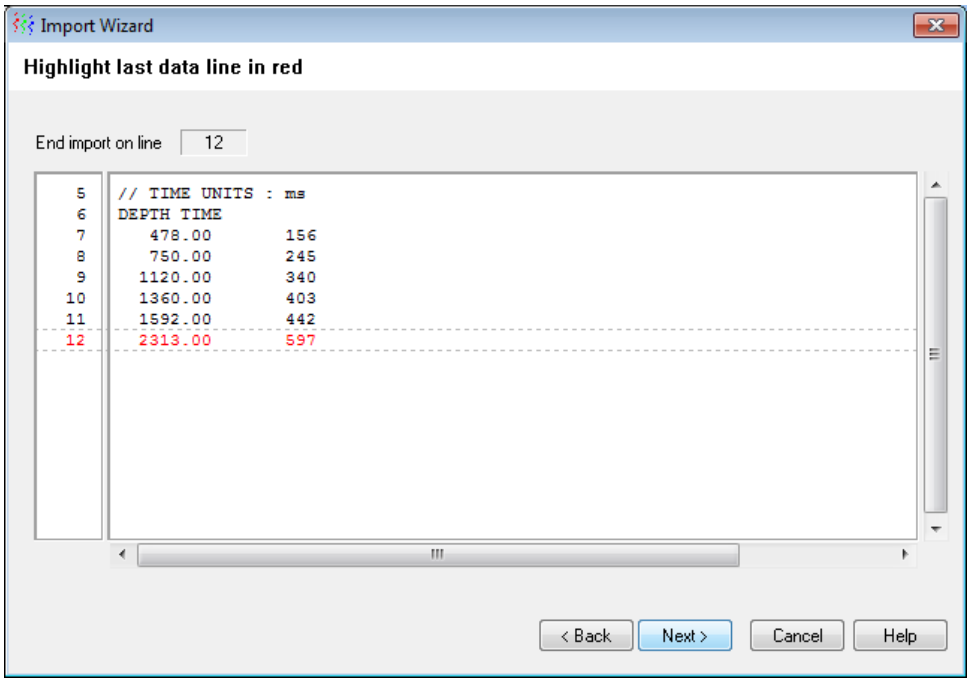
- Browse to the file to import then click **Open**.

The Highlight first line dialog box opens.



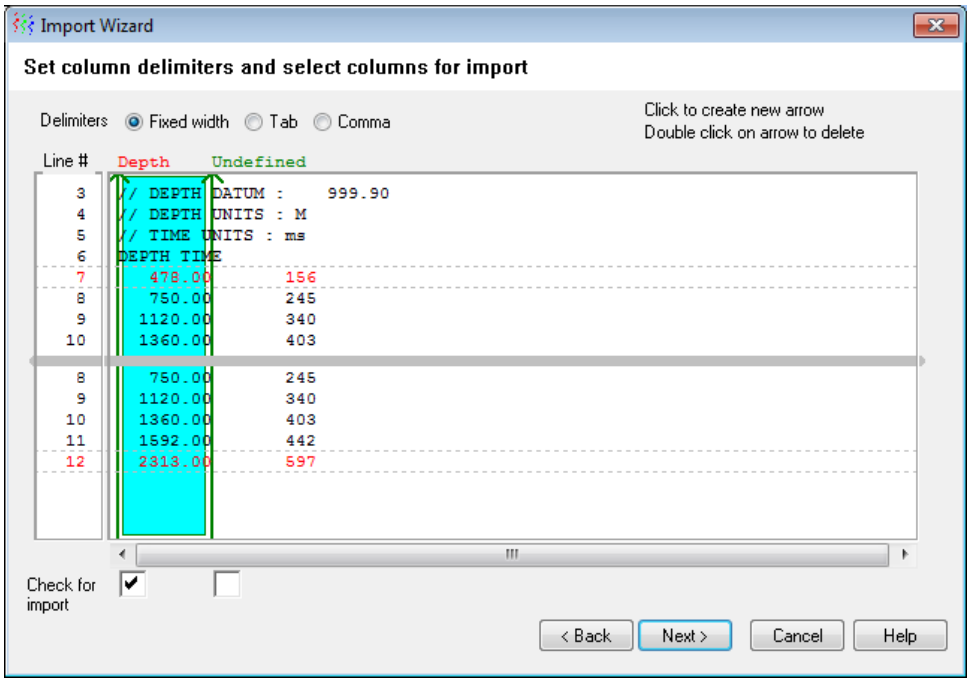
b. Select the first line to import and click **Next**.

The Highlight last line dialog box opens.



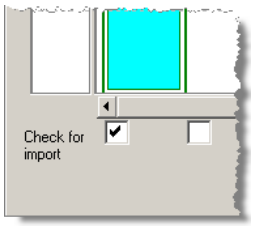
Select the last line to import and click **Next**.

The Set column delimeters dialog box opens.

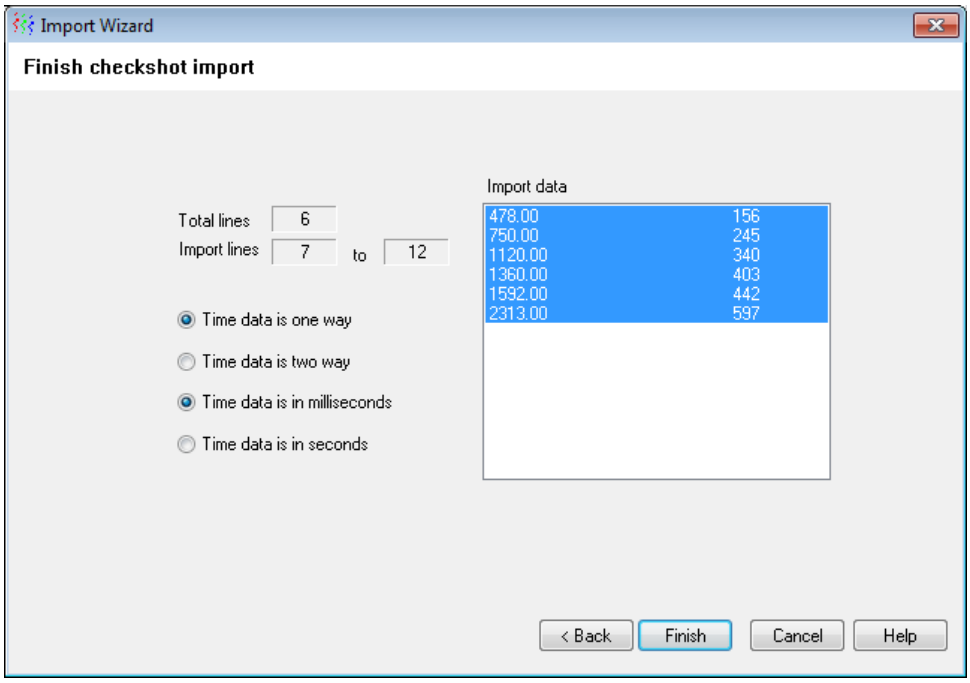


Set the column delimeters (↑) by clicking in the display pane between required columns. The green line can't bisect a data column. Double-click column delimiters to delete.

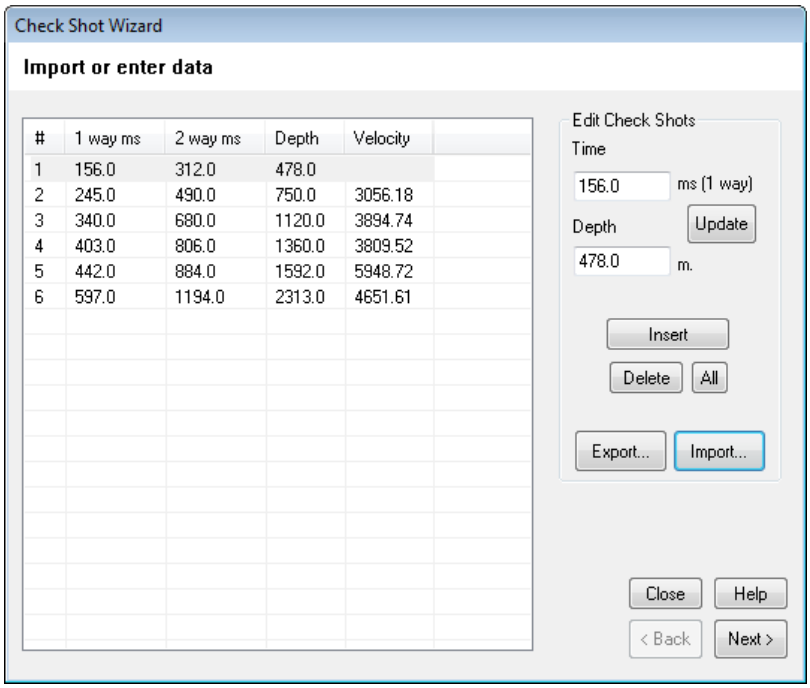
Click the box that appears below each delimeter to display the *Select from List* dialog box and identify the data type then click **Next**



The Finish dialog box opens.



Click **Back** to change any previous selections or click **Finish**.
The Import Data dialog box opens, populated with the typed or imported values.



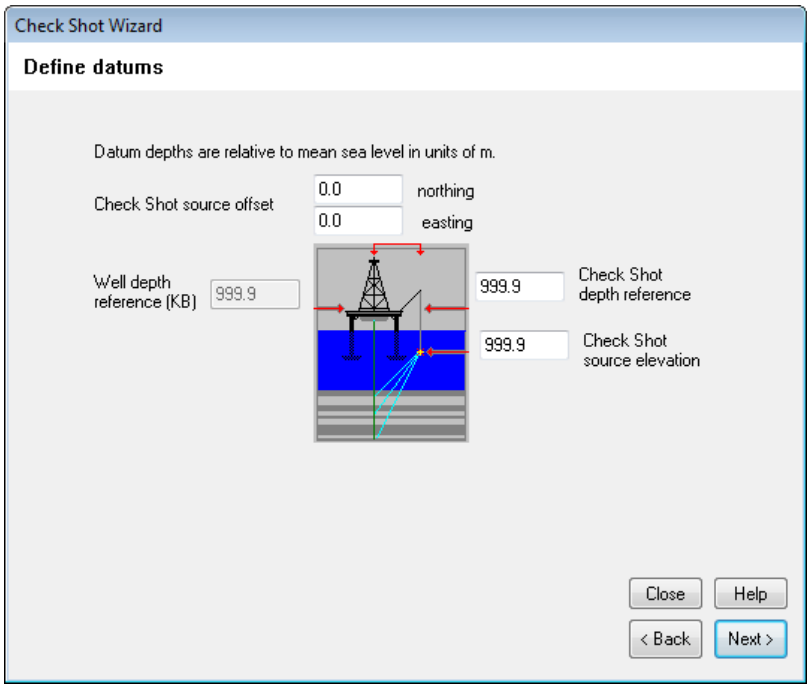
3. Do any of the following:

- To modify or add values, select the row to replace, or type values in the **Time** and **Depth** boxes, and then click either **Update** or **Insert**.

- To delete a row, select it in the display pane and click **Delete** or click **All** to clear the entire display pane.
- To save the display pane to an ASCII format file, click **Export**.

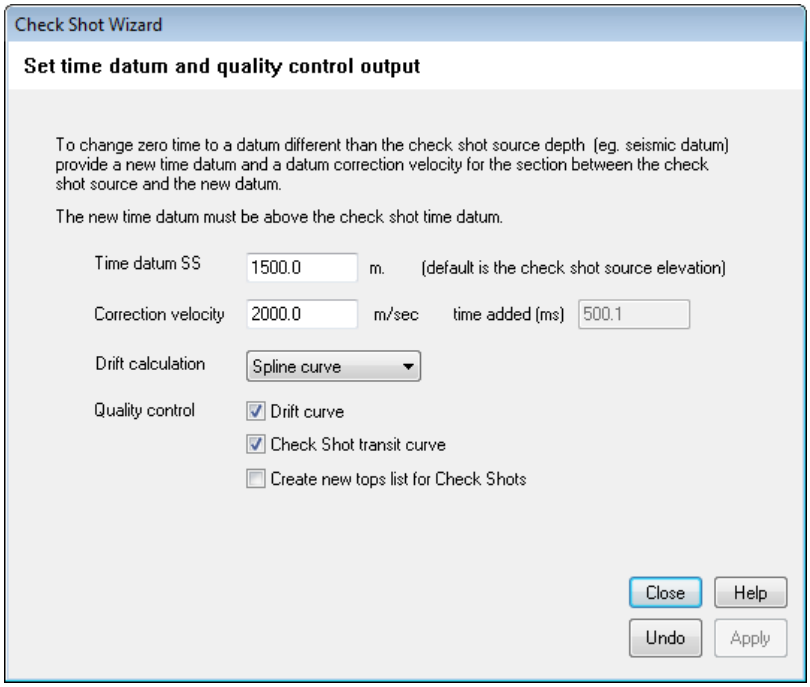
4. Click **Next**.

   The Define Datums dialog box opens. It's very important to properly define the datum parameters of the check shot data.



5. Define the datum parameters then click **Next**.

The Shift Time Zero dialog box opens. If you don't change the datum, synthetic time zero will be at the check shot time datum.



6. Select the appropriate options then click **Apply** and **Close** to complete the import.

Click **Undo** in the above dialog box to go back and select different settings.

Note: The changes applied above are also visible in the *Time Datum Properties* dialog box. If a layer was already added above the model using the *Time Datum Properties* dialog box, the check shot import process adds an additional zone to that dialog box. See *Related topics* for details.

Related topics

Importing directional surveys
Changing time datum properties
Check shot computation

Correcting invalid data when importing

Warning messages allow you to correct information during an import if:

- kelly bushing or depth increment of the imported file and the current synthetic don't match.
- the UWI is missing or invalid
- specific logs are missing
- log aliases are missing or unrecognized
- sonic and density log units don't match

Note: You can change general synthetic display properties if you don't want to be notified of missing or an invalid UWI or unrecognized log aliases.

Problem	Resolution
Kelly bushing and the current synthetic don't match.	GeoSyn offers to automatically depth shift the imported log to match the kelly bushing depth of logs in the current synthetic. Alternately, you can change the kelly bushing depth for the current synthetic:
Missing or invalid UWI	• Modify the UWI and or labels before continuing. • Ignore the UWI and build the synthetic.
Missing or invalid log alias	Logs associated with the *GENERAL* alias may not display correctly and GeoSyn won't recognize them as logs of importance (sonic, density, etc).
The sonic log is missing	GeoSyn can create a constant velocity sonic log.
The sonic log has invalid data.	GeoSyn can either reduce the sample rate until the integrated sonic data falls below the program limits or abandon the import.
The sonic and density units don't match.	GeoSyn issues a warning and automatically corrects the problem.
Importing data into a pre-existing synthetic with different parameters (different KB, different depth increment, etc.) than the imported file.	GeoSyn issues a warning and can correct all the problems before you import the data.

Related topics

"Importing LAS or GeoSyn files" on page 14
"Configuring GeoSyn defaults" on page 6
"Changing log defaults" on page 54
"Downloading logs from the IHS information hub" on page 41
"Launching GeoSyn using AccuMap" on page 34

Importing wells from Kingdom

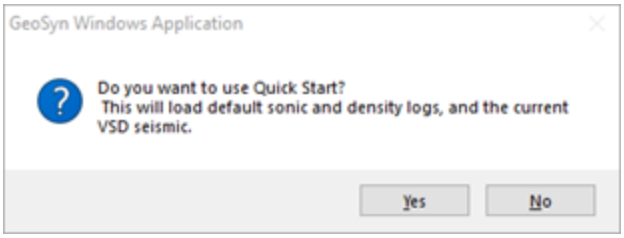
Import a well into GeoSyn from IHS Kingdom in order to create synthetic models based on Kingdom wells or seismic.

When launched from Kingdom, a sub directory named *GeoSyn* is created under the Kingdom project directory. All GeoSyn data associated with the created model is written to this location.

To import well(s) from Kingdom:

1. From within Kingdom:

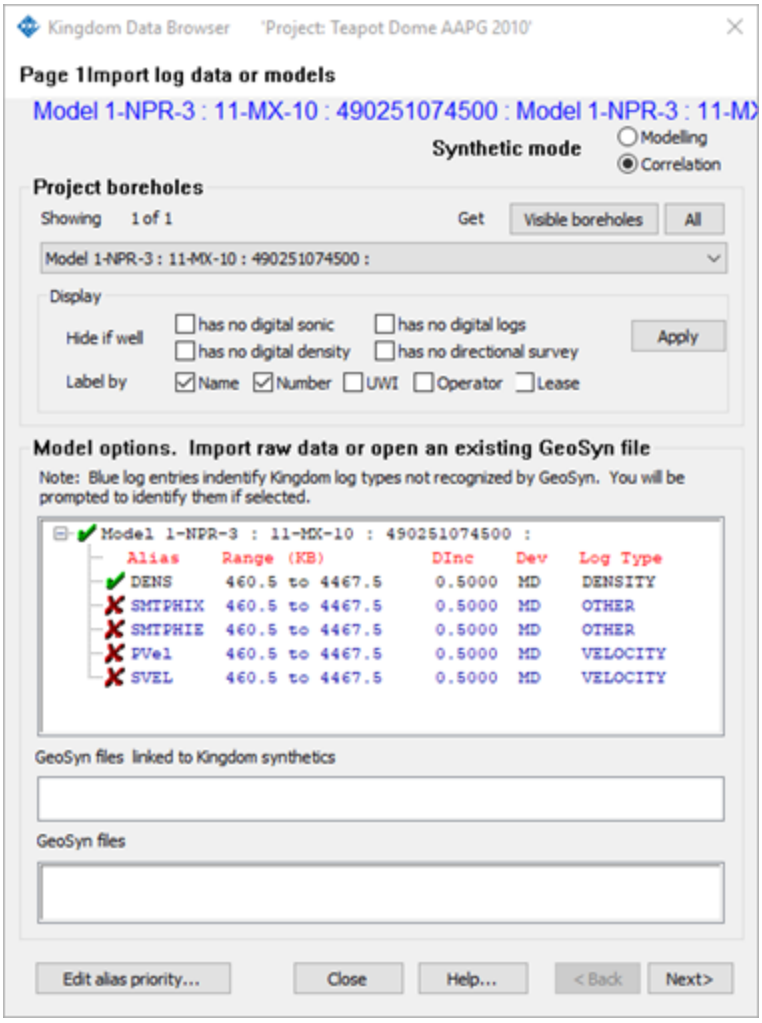
   - Right-click on a single well on the base map or *Project Tree* and select GeoSyn from the context menu. This will launch GeoSyn and give you the option of importing the well using *Quick Start*.



     - Select **Yes** to automatically import the well using the default sonic, VSD seismic, and density logs bypassing the need to manually enter the information.
     - Select **No** to import the well and manually enter your information using the procedure described below.
   - From the Kingdom ribbon **Project > Launch > More > GeoSyn.**

Opening GeoSyn from the Kingdom ribbon (Project > Launch > More > GeoSyn) imports data for all of the wells on the Kingdom project's visible well list. Some of the wells on the Kingdom base map may be hidden, but can still be retrieved using GeoSyn at any time.

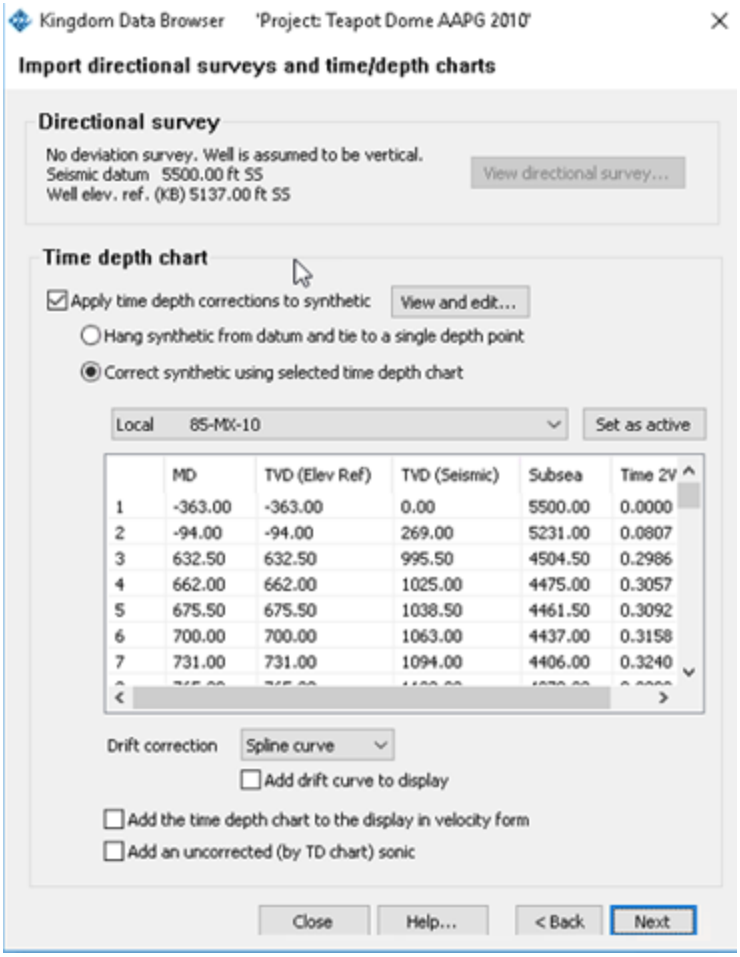
The Kingdom Data Browser dialog box opens.



1. Filter the results displayed in the drop-down list near the top of the dialog in which you select the wells by clicking check boxes to the right of the *Hide if well* label, and select the columns to display in the *Model Options* pane by clicking check boxes to the right of the *Identify by* label.

- Where the well includes a directional survey, select whether to convert it to true vertical depth.
- If you selected a model above, an **Open** button appears in the bottom-right of the above dialog box and when clicked, immediately opens a new or existing GeoSyn synthetic.
- If you selected **Log(s)** above, the **Next** button appears in the bottom-right of the above dialog box that when clicked, displays the Kingdom

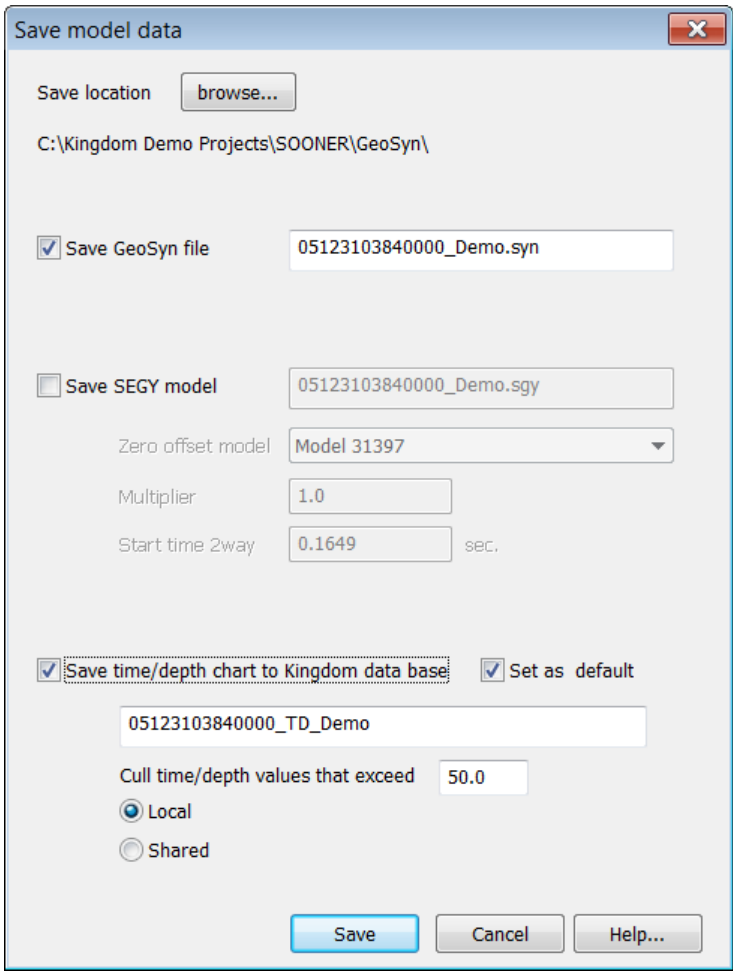
Data Browser dialog box, where you apply corrections to the data and select display options for the resulting model before launching GeoSyn.



- Make selections in the dialog box above and then click **Apply**. If you tie the synthetic to a single depth point, click **View and Edit** to display the Time/Depth Quality Control dialog boxes where you apply changes to the time depth curve before applying it to the sonic.
  Note: In order for changes made using the *Time/Depth Quality Control* dialog boxes to be applied, upon exiting that dialog box, when the *Save Modified Time/Depth Chart* dialog box opens, you must click **Save**.
- The synthetic is created based on the well imported above. The above dialog box remains visible and the **Apply** button changes to an **Undo** button in case you want to apply different data correction options or select a different depth chart. The **Back** button also remains active in the above dialog box so that you can add additional logs to the model. If importing additional logs, GeoSyn warns you so that you don't inadvertently apply the same time depth chart twice.

2. Tie the imported seismic section to a model (for details, see *Related topics* below).
3. From the **File** menu, click **Save**.
   This option is only available in GeoSyn when it's launched from Kingdom.

The Save Model Data dialog box opens.



4. Specify the outputs to save that can be used by Kingdom, and then click **Save**.

Related topics

"Tying seismic to models" on page 164

"Importing check shot surveys and vertical seismic profiles" on page 21

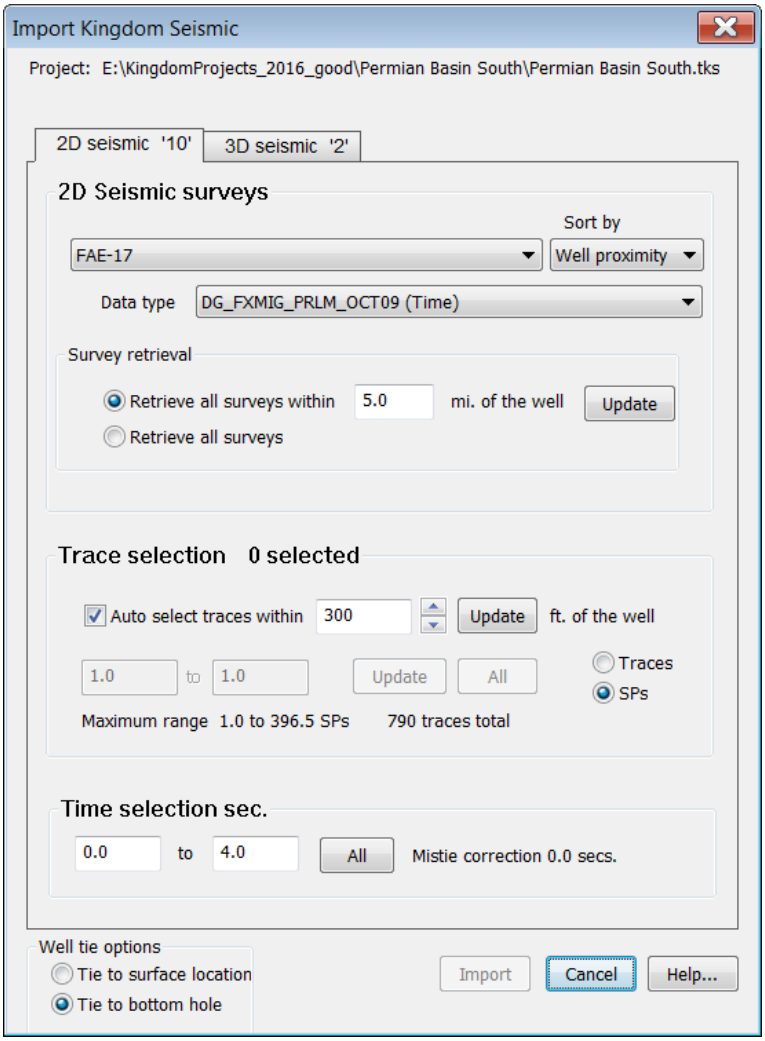
"Importing LAS or GeoSyn files" on page 14

Importing seismic from Kingdom

Import Kingdom data into GeoSyn to create a synthetic. Tie the seismic data to a well and extract a wavelet. Before importing seismic from Kingdom, you first import a well. For details on importing a well, see *Related topics* below.

To import Seismic from Kingdom:

1. From the **File** menu, click **Kingdom Import** and then **Seismic Data**. The Import Kingdom Seismic dialog box will open.



2. Select either the 2D seismic or 3D seismic tab depending on the type of seismic to import. The number of seismic sections available is denoted in the label of the tab.

3. Populate the dialog box fields, and then click **Import**.

Related topics

"Import Kingdom Seismic: 2D" on page 219
"Import Kingdom seismic: 3D" on page 220
"Changing seismic properties" on page 162
"Importing seismic data" on page 158
"Importing wells from Kingdom" on page 29

Launching GeoSyn using AccuMap

Right-click a well that appears in AccuMap and launch GeoSyn. If the well you select doesn't have a sonic log, GeoSyn generates a constant velocity sonic log that you can manually edit later. For details, see *Related topics* below.

To launch GeoSyn using AccuMap:

1. In AccuMap, with the desired Detail Map and the Wells layer displayed, click the button below the **Inspect** tool and select **Wells** (

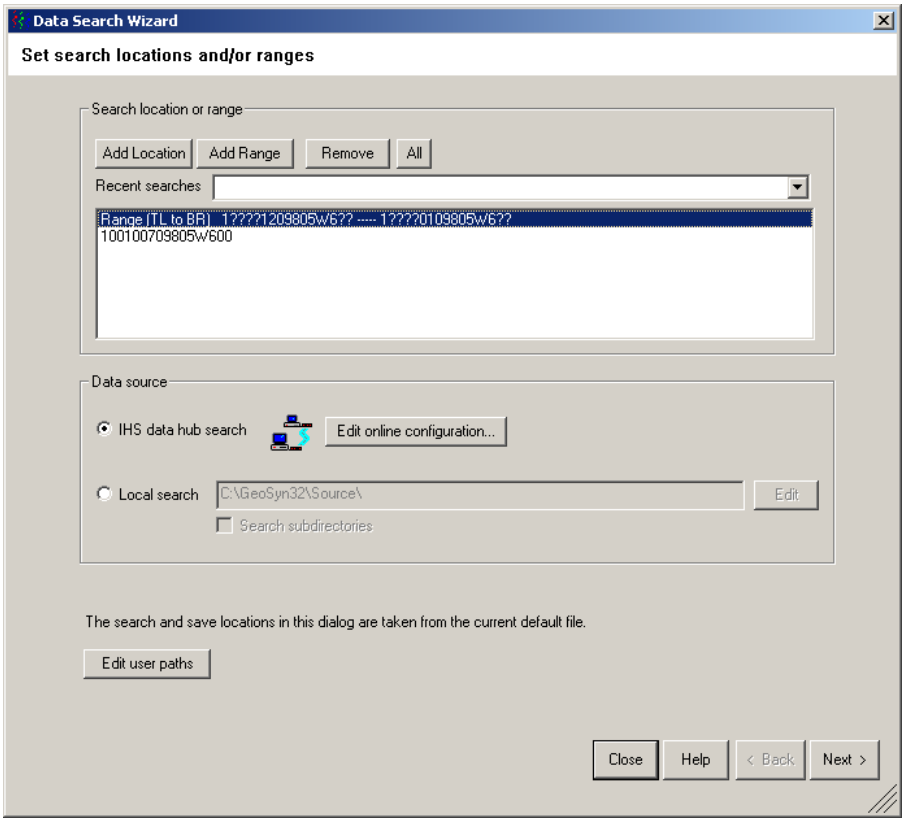
).

2. Click the **Inspect** tool to activate Inspect mode.

The cursor changes to a magnifying glass (🔍).

3. Right-click the desired well and select **GeoSyn Launch** from the popup menu.

The Define search range dialog box opens.

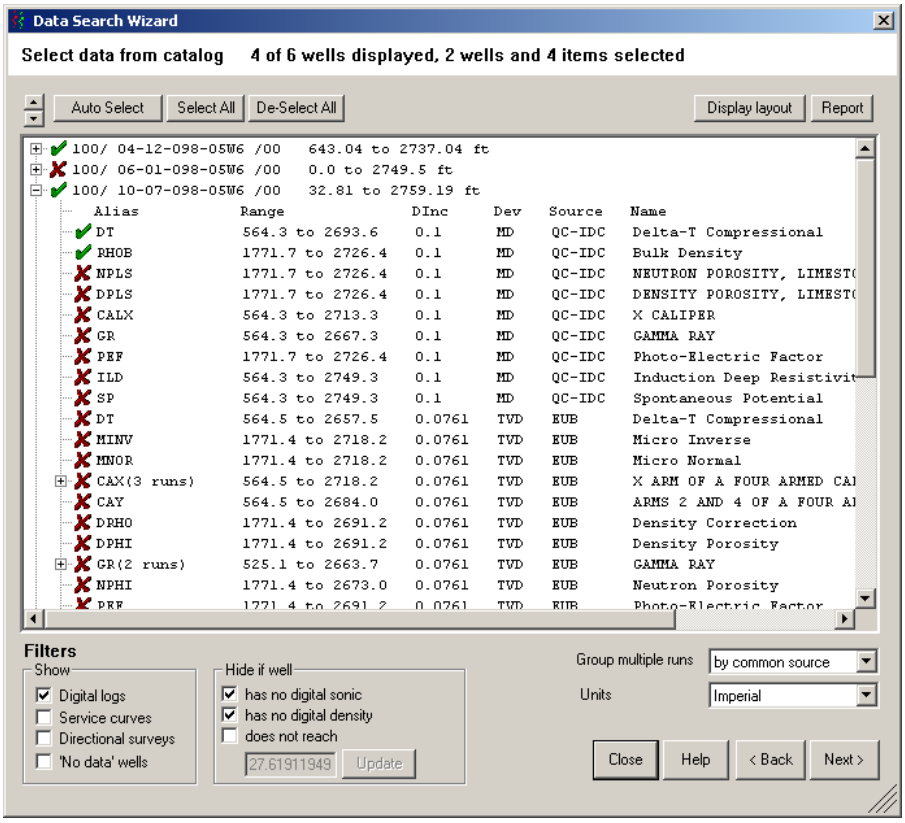


4. Click either **Add Location** or **Add Range** to display the Edit a UWI dialog box and specify the survey system and coordinates of the well(s) for which to retrieve logs.

To change your IHS Information Hub connectivity parameters or GeoSyn default directories, click **Edit online configuration** to display the Configuration tab. For network installations, hub connectivity parameters affect all GeoSyn users.

5. Click **Next**.

The Select data from catalog dialog box opens.

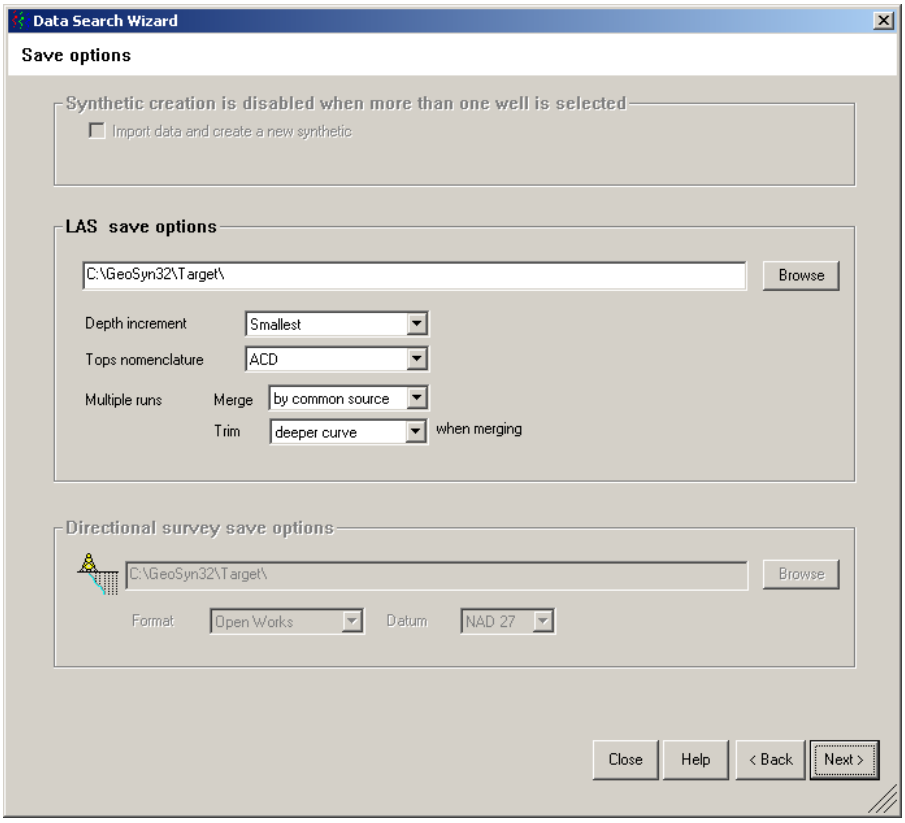


6. Click **Display layout** to configure the options with which to sort and filter the wells that appear above. For example, by column order, row order, by the presence of digital sonic and density logs, and by depth range.

A check mark (✓) appears beside logs that will import, a cross (✗) beside those that won't. Logs with true vertical depths and measured depths can't be selected for the same import.

7. Click **Next**.

The Define save options dialog box opens.



8. Select the locations in which to save downloaded files and whether to convert downloaded logs into GeoSyn format using the import defaults options. These options are defined in the *Properties: Import Defaults* dialog box, which can be accessed by clicking **Edit Defaults** above.

9. Click **Next**.

The specified logs are downloaded from the IHS Information Hub and the results are listed in a summary report dialog box that can be saved to an ASCII format file to log downloads.

10. Click **Close**.

Related topics

"Changing import defaults" on page 12
"Importing LAS or GeoSyn files" on page 14

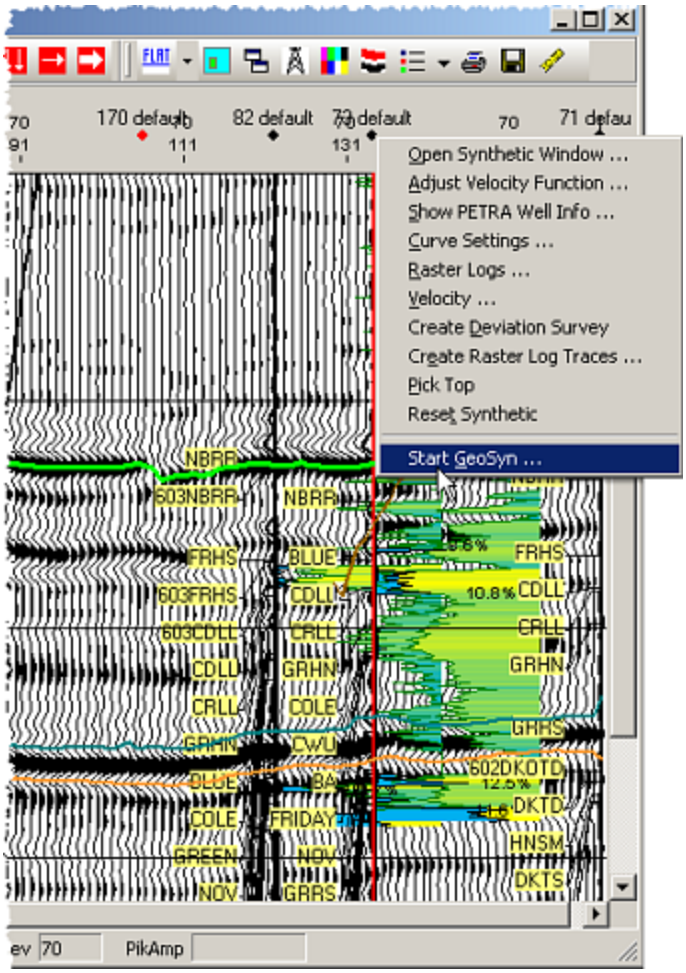
Launching GeoSyn using PetraSeis

Right-click a well in PetraSeis for which to create a synthetic in GeoSyn. Using PetraSeis, you specify the curves and tops to include in your synthetic. You can also include a seismic line and a directional survey.

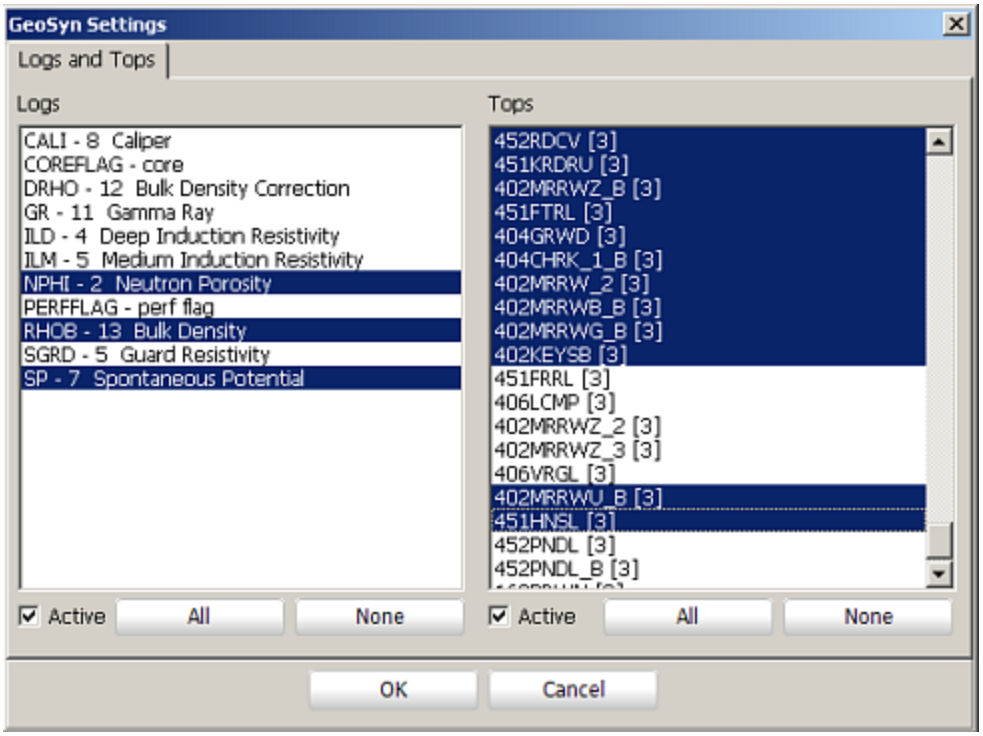
GeoSyn projects you launch using PetraSeis can be exported back to PetraSeis from GeoSyn. For details, see *Related topics* below.

To launch GeoSyn using PetraSeis:

1. Using the PetraSeis application, right-click the well for which to launch GeoSyn and select **Start GeoSyn**.

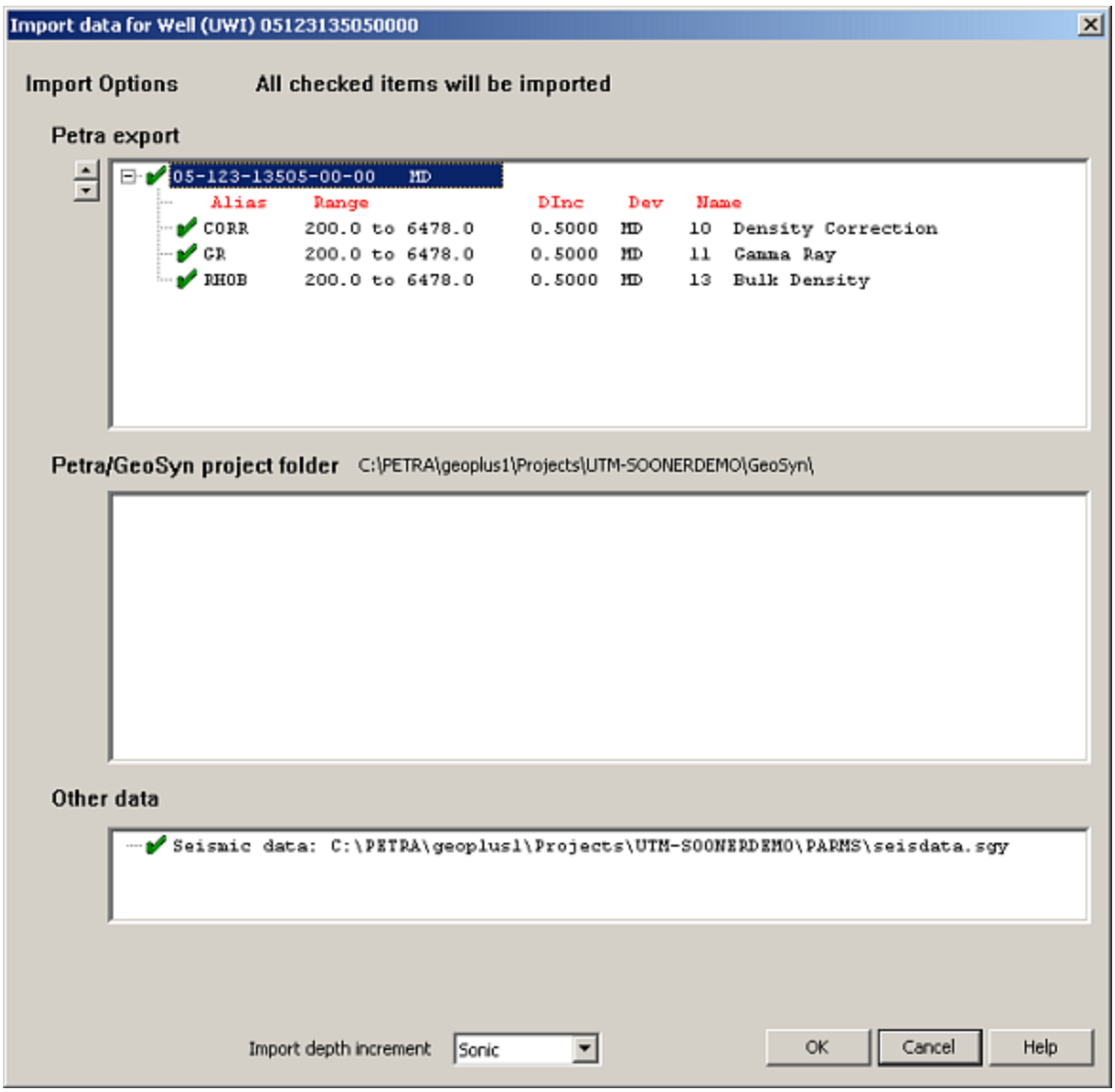


The GeoSyn Settings dialog box opens.



2. Select the desired log(s) and tops to import into GeoSyn, and then click **OK**.

The Import data for Well dialog box opens.



Any data that PetraSeis includes that can be used in GeoSyn appears in this dialog.

3. Verify the import options, select a log from which to use the depth increment, and then click **OK**.

Depending on whether you're importing a seismic line or a directional survey, either the *Set time and range for* or the *directional survey* dialog box opens. For details on importing seismic or directional surveys, see *Related topics* below.

Related topics

"Importing seismic data" on page 158

"Importing directional surveys" on page 16
"Exporting to Petra" on page 197

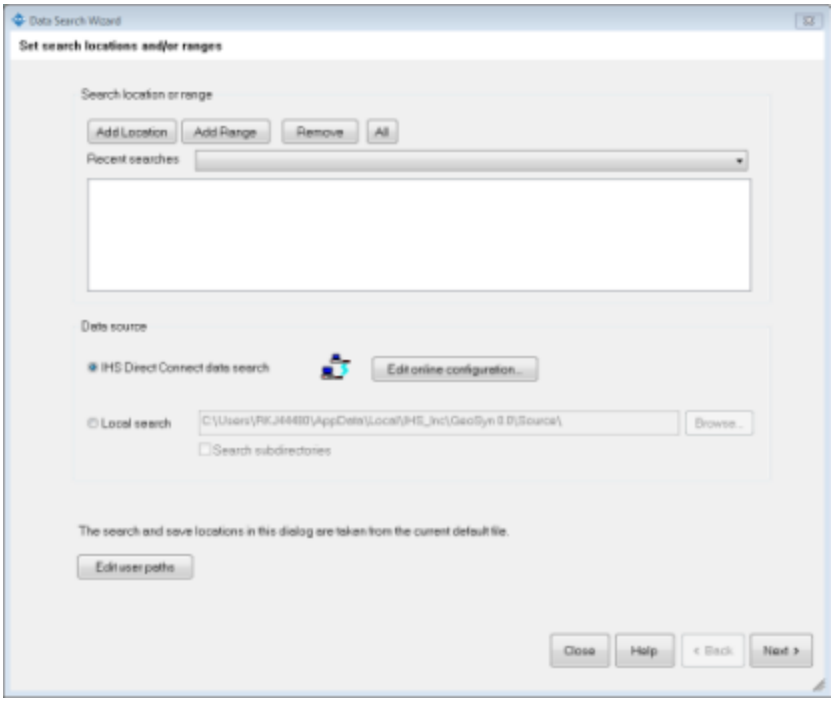
Downloading logs from the IHS information hub

With a subscription to the IHS Information Hub, you can select a specific UWI or a range defined by NW and SE corners from which to download select logs. Licensed users can also download directional surveys and request IHS digitize service curves.

Note: If your subscription is transactional, GeoSyn can warn you before downloading digits from the hub to eliminate unexpected charges.

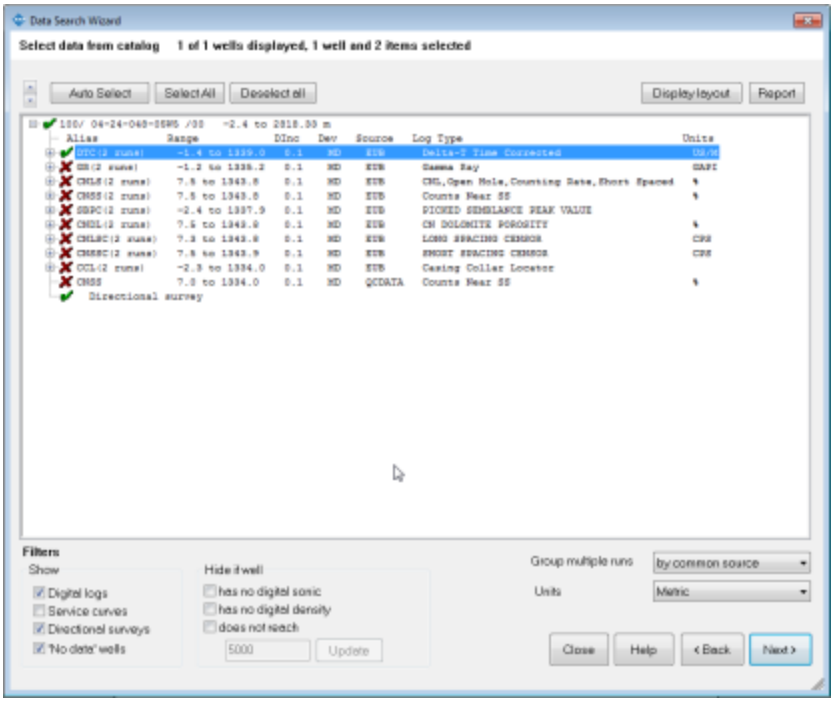
To download logs from the IHS information hub:

1. Launch the Data Search Wizard: **File > Import > DataSearch wizard**



2. Select a location or range of logs to retrieve and click **Next**.
   - Click **Add Location** or **Add Range** to open a UWI dialog to enter specific UWI or range of UWIs.
   - Select a previous UWI search from the drop down list.

3. Select UWI or range from results box.
4. Select IHS Direct Connect data for your data source and click **Next**. Search results are displayed Select data from catalog dialog box opens with search results.



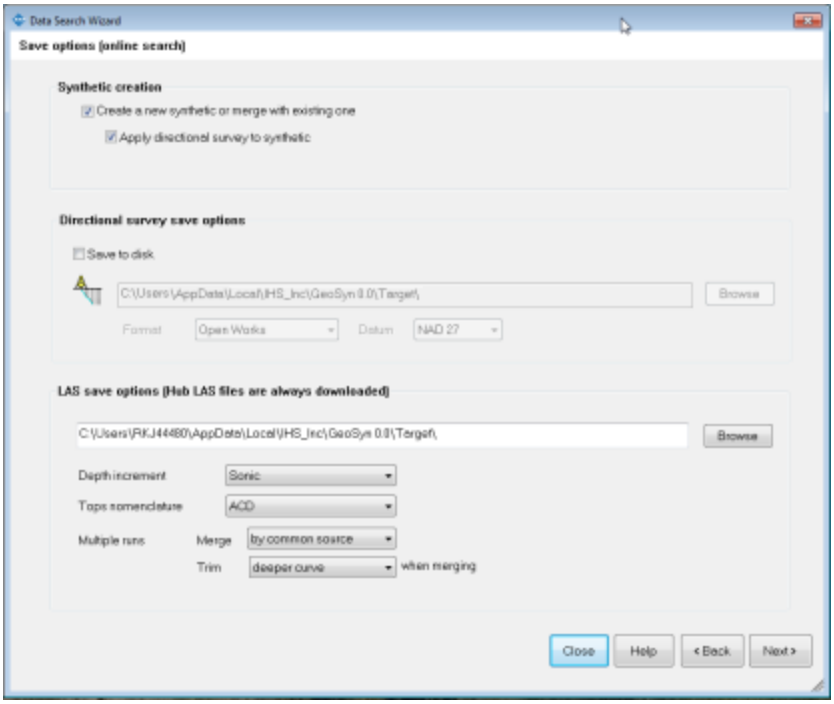
4. Click **Display Layout** to show and configure filter options.

A check mark (✓) appears beside logs that will be imported.

Logs with true vertical depths and measured depths can't be selected during the same import.

5. Click **Next**.

The Define save options dialog box opens.



6. Select the location to save downloaded files and whether to convert downloaded logs into GeoSyn synthetic format during the download. The above options are defined in the *Properties: Import Defaults* dialog, which can be accessed by clicking **Edit Defaults** above.

Note: If you save logs to disk and then import them into the model from disk, you can restrict the depth range.

7. Click **Next**.

The specified logs are downloaded from the IHS Information Hub and the results are listed in a summary report dialog box that you can save to an ASCII format file to log downloads.

8. Click **Close**.

Related topics

"Changing import defaults" on page 12
"Launching GeoSyn using AccuMap" on page 34
"Importing LAS or GeoSyn files" on page 14

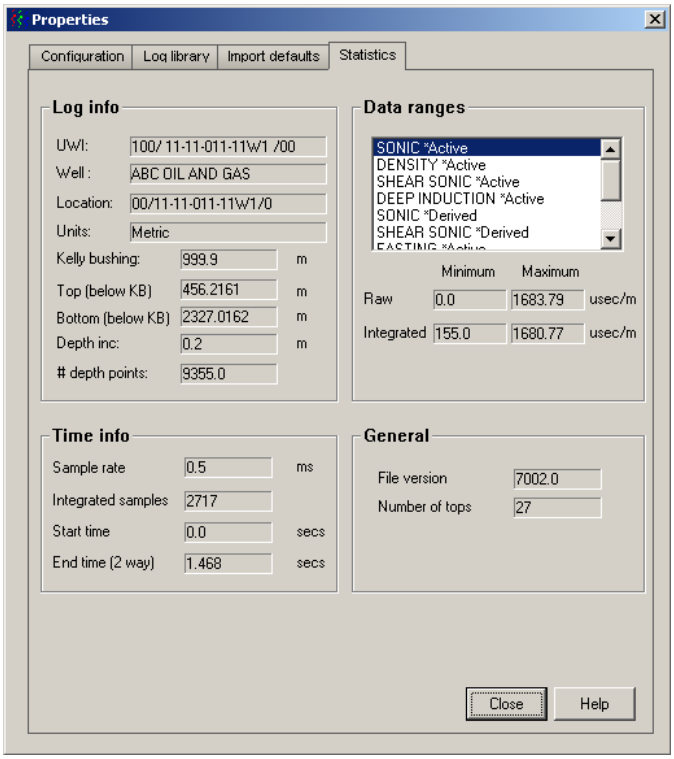
Viewing synthetic statistics

View statistics about imported logs including the original raw data and the resulting integrated data following import. The minimum and maximum raw values enable you to determine whether there are spikes in the imported log that influenced your synthetic that you can subsequently remove using the Log Editor.

To view project statistics:

1. From the **Edit** menu, select **Default properties** (Def) > **Statistics**.

The Properties: Statistics tab appears.



2. Click the appropriate log in the**Data Ranges** list and view the Raw and Integrated values.

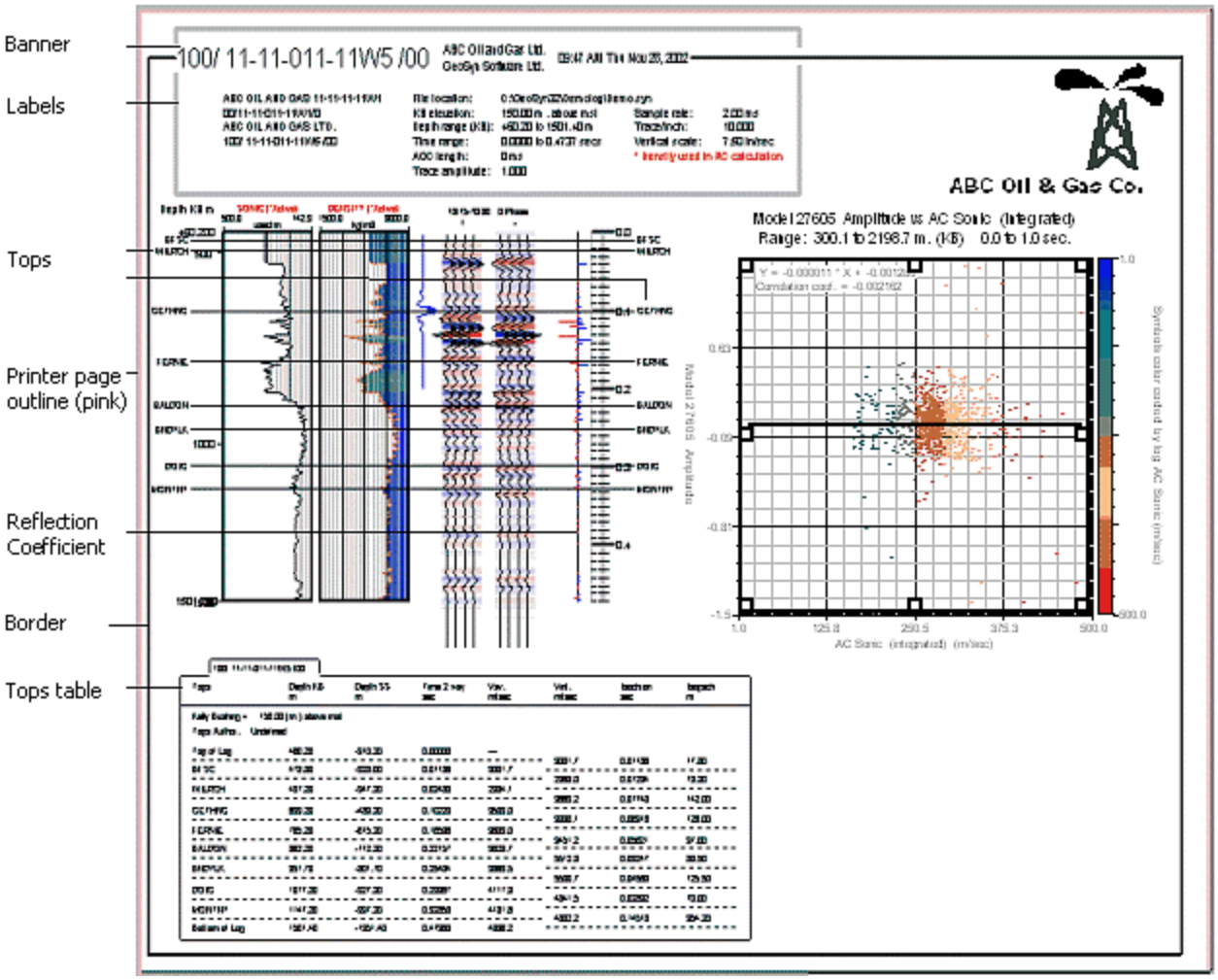
3. Click **Close**.

Related topics

"Changing the main synthetic display" on page 46
"Importing LAS or GeoSyn files" on page 14
"Opening GeoSyn synthetics" on page 8
"Launching GeoSyn using AccuMap" on page 34

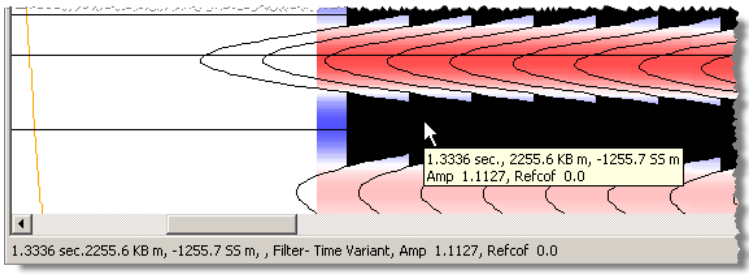
About the Main Synthetic Display

The main synthetic display is where you do analysis. When you launch GeoSyn, the main synthetic display appears as a blank canvas. After you import a log image or launch an existing GeoSyn synthetic, labels, logs, a tops table, and traces appear as depicted below.



Elements in the main synthetic display can be moved, copied to and from the Windows clipboard, hidden, deleted, resized, and configured. Right-click, double-click, or use the main menu to configure individual elements. Drag and drop to reposition them on the canvas. If you resize an element larger than the canvas, the canvas automatically resizes to accommodate the new size.

The status bar beneath the main synthetic display shows time, both kelly bushing and subsea depth, and details about the synthetic element beneath the cursors current position. For example, if the cursor is over a top, the top name appears. If the cursor is over a trace, the filter and phase appears. To toggle the status bar, from the **View >Statusbar**.



Any number of logs defined as sonic or density may be included in a synthetic, but GeoSyn only uses a single sonic and a single density to create the synthetic. These logs are called the active sonic and active density, and are clearly labeled on the main synthetic display. The active sonic and density logs control the generation of the synthetic.

Transfer the active status to any log (not just other sonic or density logs). Transferring the active status is ideal for modeling purposes, because it enables you to rapidly shift between sonic and density logs representing different geological scenarios.

Related topics

"Changing well display properties" on page 50
"Changing the main synthetic display" below

Changing the main synthetic display

Configure general options in the main synthetic display including:

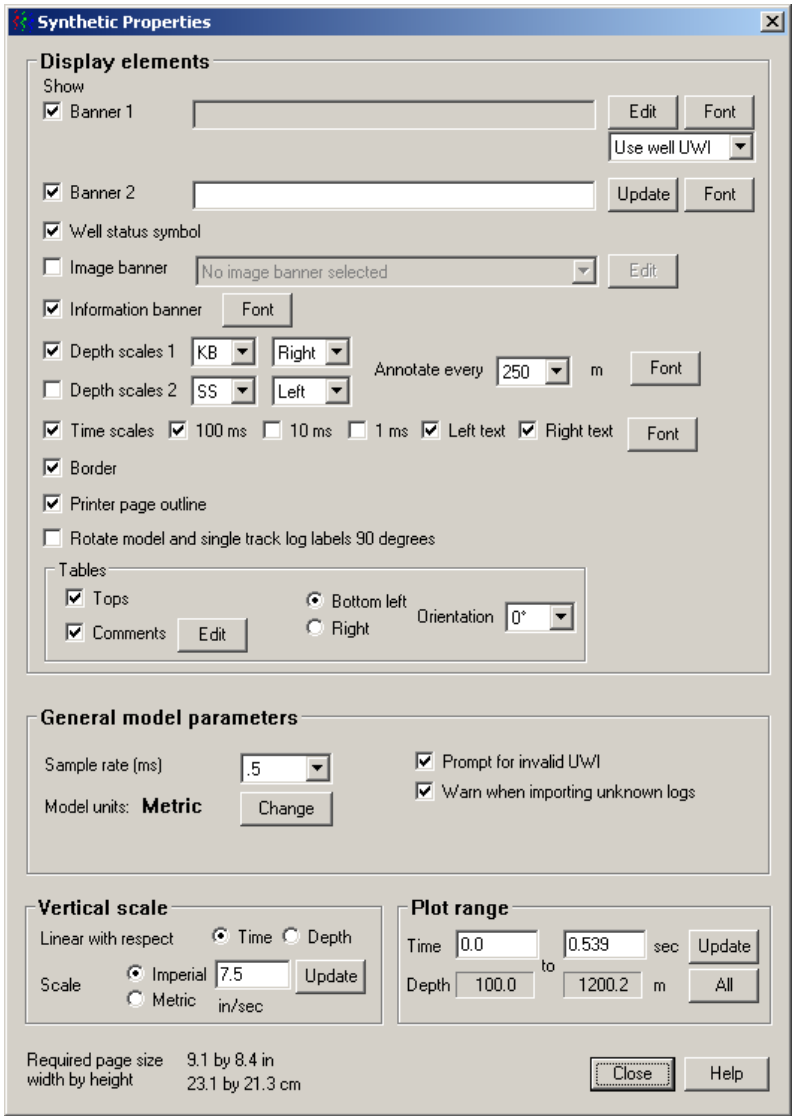
- elements to display
- vertical scale properties
- zone of interest
- number of undo levels.

Once the synthetic has been configured, you can save those display options to the import default file and apply them to all new synthetics. For details, see *Related topics* below.

To change the main synthetic display:

1. Open the Synthetic Properties dialog box:

   - Menu: **Synthetic properties**
   - Toolbar: ( )
   - Main display well header : Right click and select**Synthetic properties**..



2. In the **Display elements** pane, select what informational elements appear in the main synthetic display. To import a company logo, beside the **Image banner** box, click **Edit**.

3. In the **General model parameters** pane, specify sample rates, up to 10 undo limits, and whether the import process prompts you when either missing or invalid UWIs or aliases are found in the import file.
4. In the **Vertical scale** pane, select either the time or depth and in the **Plot range** pane, type the top and bottom of the zone of interest to display.
5. Click **Close** to apply the changes to the main synthetic display. These changes only apply to the current synthetic.

Related topics

"About the Main Synthetic Display" on page 45
"Changing import defaults" on page 12

Zooming

Draw the boundary upon which to zoom in the main synthetic display.

To zoom:

1. From the **View** menu, select **Zoom In** ( ).

The cursor changes to a magnifying glass ( ).

2. Click and hold one of the corners that will become your zoom extents then drag the zoom rectangle to the opposite corner and release the mouse button.

3. Either repeat the above steps to zoom in further or from the **View** menu, select **Zoom Out** ( ) to return to the previous view. If you've zoomed in multiple times, each time you zoom out returns to the previous view. To return to the original unzoomed view, from the **Edit** menu, select **Undo** ( ).

Related topics

"About the Main Synthetic Display" on page 45
"Changing the main synthetic display" on page 46

Undoing and redoing changes

An operation can be undone even if you saved the synthetic after performing the operation that you now wish to undo. Undo () and redo () buttons appear both on the main toolbar and on the Log Editing toolbar. Note that the undo and redo buttons on the Log Editor toolbar affect any operation done throughout GeoSyn, not just those that were done using the Log Editor. To hone in on a specific change to either undo or redo, click Edit > Undo or Redo.

Related topics

"About the Main Synthetic Display" on page 45
"Changing the main synthetic display" on page 46

Display Properties

There are several ways to output GeoSyn data:

"Changing well display properties" below	Well display properties include UWI, labels, and depth parameters.
	Modify directional properties after importing a directional survey.

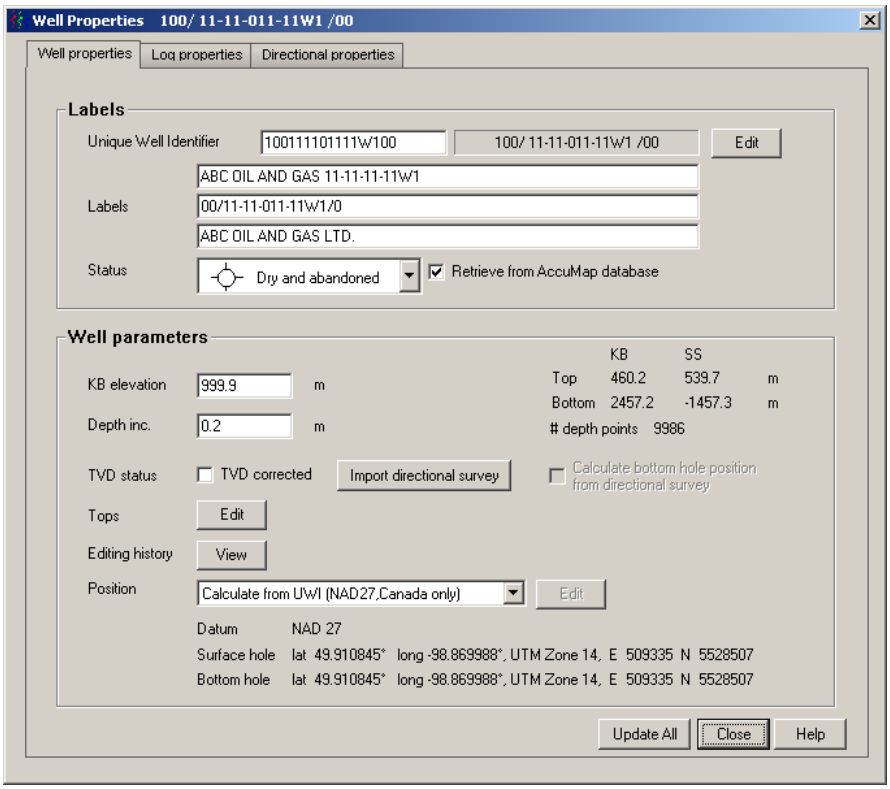
Changing well display properties

Change well display properties including the UWI, labels, and depth parameters.

To adjust well display properties:

1. From the **Edit** menu, select **Well and Log Properties** ( ).

The Well Properties: Well properties dialog box opens.



To change label text, simply type it in the adjacent field, click **Edit** to display the Edit a UWI dialog box, or select a different well symbol from the **Status** drop-down list.

To import a directional survey in *.txt* format or to create one from scratch, click **Import directional survey**. For details, see *Related topics* below.

To change tops display properties, click **Edit** to display the Tops Properties dialog box. For details, see *Related topics* below.

2. Select the desired options then click **Update All**.

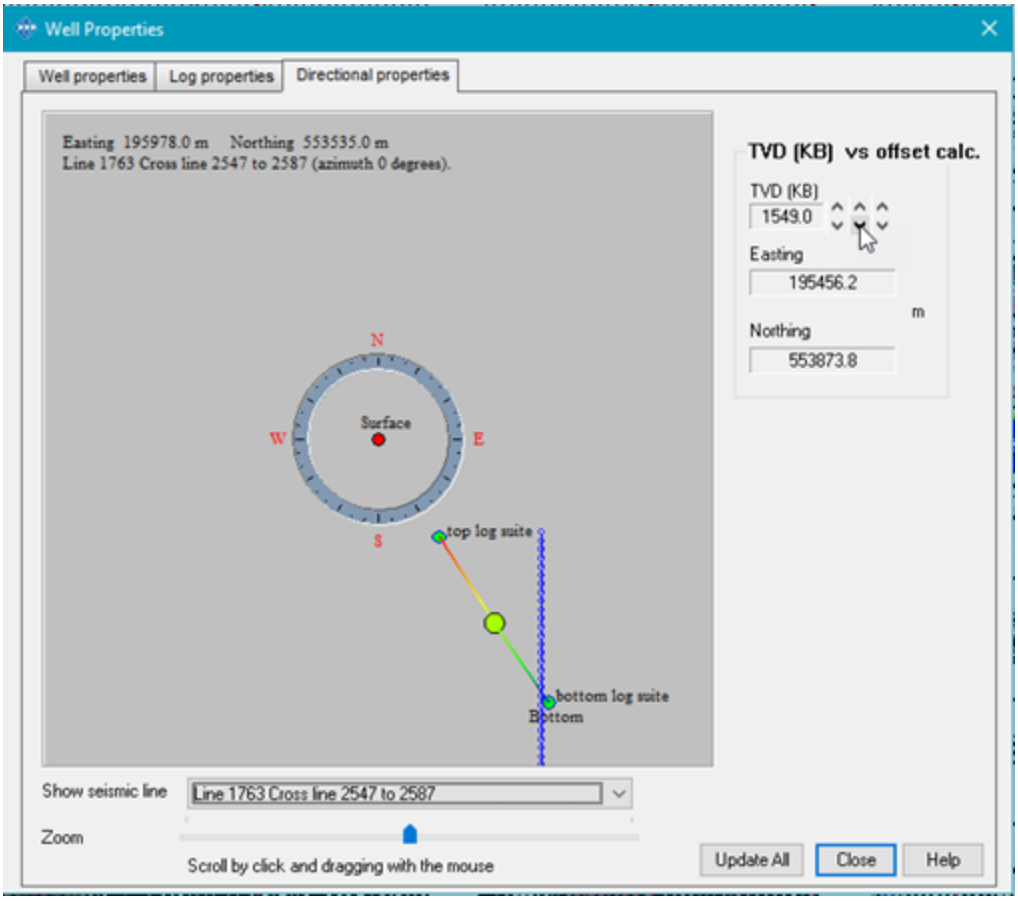
Related topics

"Viewing deviated well properties" below
"Changing tops properties" on page 89
"Importing directional surveys" on page 16

Viewing deviated well properties

The Directional properties tab provides a view of a selected seismic line relative to the well bore. The view provides the option to select individual traces or none from a drop down list.

The calculated offset between the TVD and the KB is represented by a colored dot along the well bore. The dots color changes according to the depth of the calculated offset.



Related topics

Changing Well Display Properties

Changing log display properties

Change the display properties of logs in the current synthetic including label information, which logs are the active sonic and density, and other details. The term *Active* denotes the log upon which the synthetic is based. If you have several sonic logs with different geological scenarios in one synthetic, for example, you can switch which of the sonic logs is the active one to see what affect it has on the model.

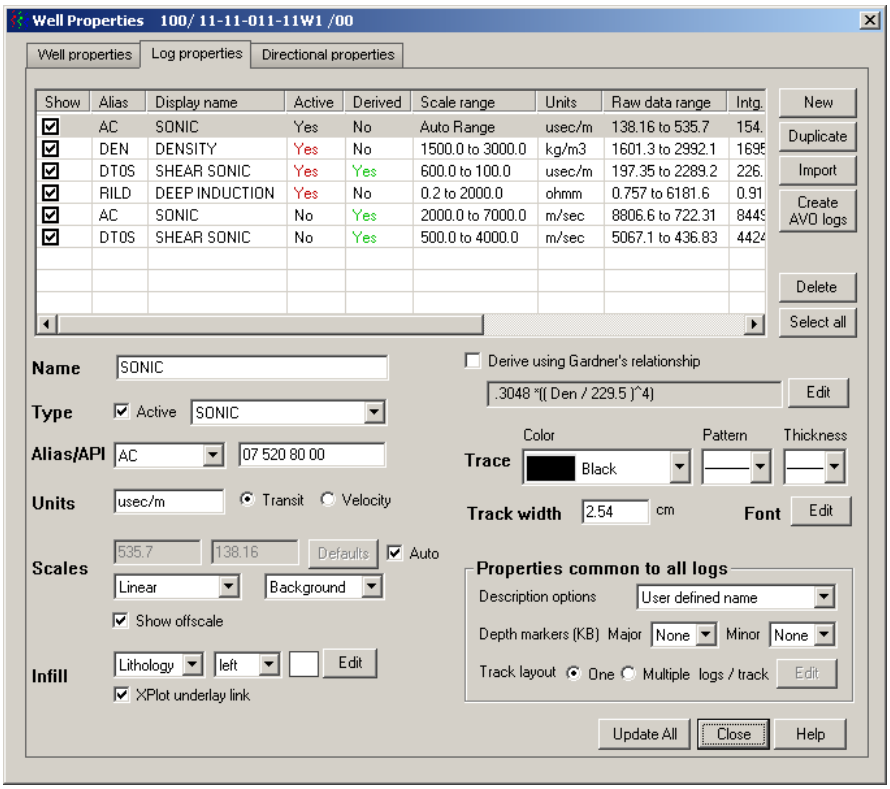
You can also create new logs or duplicate and modify existing logs. For example, you can apply a mathematical equation to a log to derive a log that's useful for AVO modelling and that would otherwise not be available. Changes you apply

affect only the current synthetic, not log defaults for new synthetics. For details on changing log defaults and import defaults, see *Related topics* below.

To change log display properties:

1. From the **Edit** menu, select **Well and Log Properties** (🔔) > **Log Properties**.

   The Well Properties: Log properties dialog box opens.



2. In the display pane, select the log(s) to modify using the controls below. SHIFT+CLICK or CTRL+CLICK for multiple selection.

   Duplicate and modify selected logs, and also clear logs in the *Show* column to save them with the synthetic but hide them from the main synthetic display.

3. In the **Properties common to all logs** pane, specify label and scale information and whether multiple logs are combined in the same track. For details on combining logs in the same track, see *Related topics* below.

   If the synthetic layout is only a single log per track, specify track and infill colors. For details on editing color, see *Related topics* below.

4. In the **Log properties** pane, specify log associations such as the type of log, whether it's the active sonic or density, and whether it measures transit time or velocity, and then click **Close**.

Related topics

"Changing log defaults" below
"Changing import defaults" on page 12
"Changing color palettes" on page 131
"Combining logs in tracks" on page 62

Changing log defaults

GeoSyn maintains a centralized database of log defaults for all log types. Customize settings for track widths, scales, aliases, color fills, and more. These setting apply to new synthetics where log settings aren't already defined in the import defaults file.

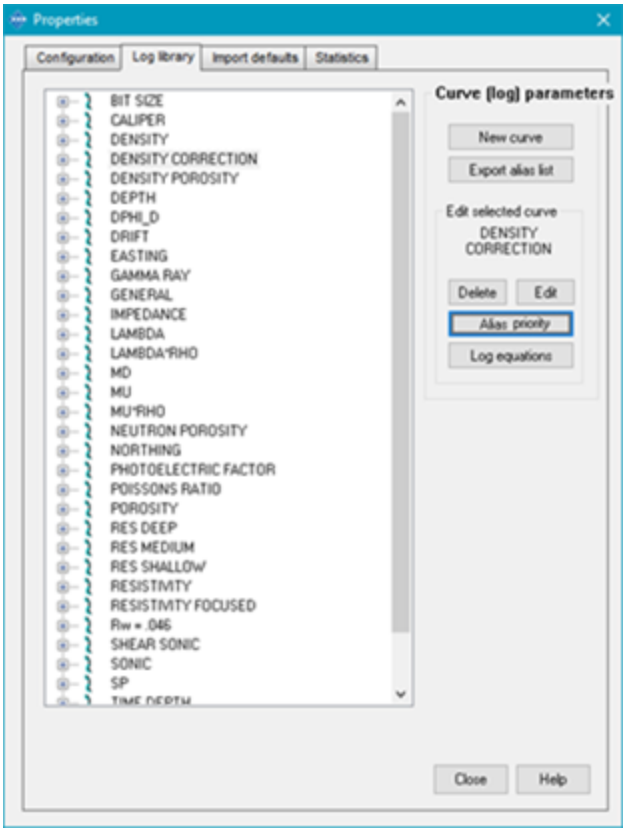
The import defaults file generally contains all default settings except those that apply to logs, but when you update the import defaults file with settings from the current synthetic, settings for log types in the current synthetic are also written to it. Log settings in the import defaults file override, but don't overwrite settings in the log defaults database.

When GeoSyn creates a synthetic, it first checks whether display settings for the log upon which the synthetic will be based exist in the current import defaults file. If they do, GeoSyn uses them instead. For details on changing import defaults, see *Related topics* below.

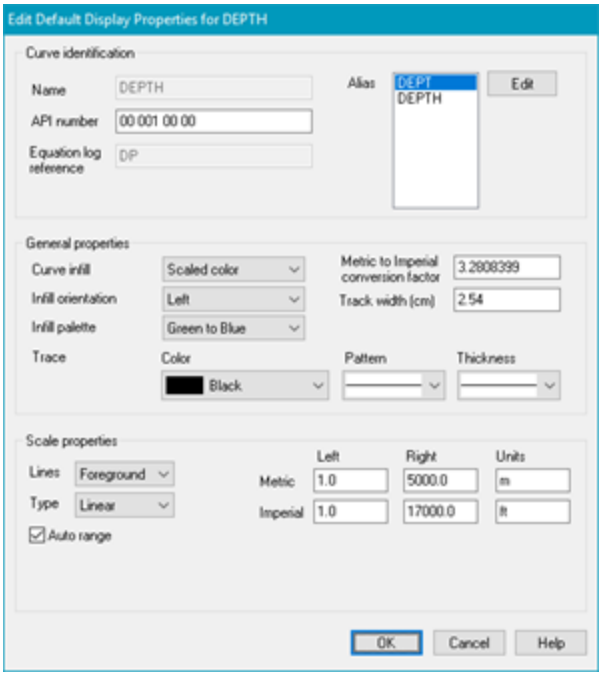
The log database is the *LogInit50.gld* file in the GeoSyn *Working* directory.

To change log defaults:

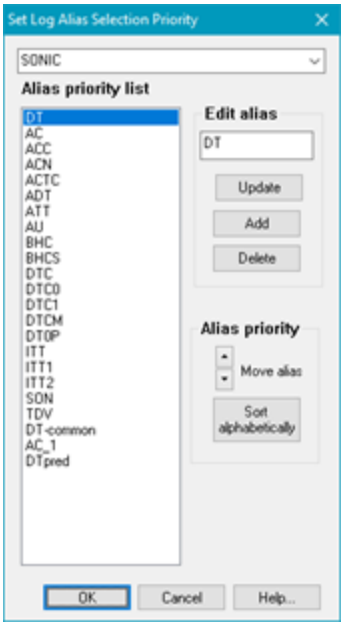
1. From the **Edit** menu, select **Default log properties** > **Log Library**to open the Properties: Log Library dialog box.



2. In the tree display, click the plus sign (**+**) beside the appropriate node to expand it and view current configuration details.
3. Click **Edit** to open the Edit Default Display Properties dialog box.



4. Configure the curve properties then click OK to return to the *Properties: Log Library* tab.
5. Click Alias priority to open the Set Log Alias Selection Priority dialog box.



6. Configure the default import priority for Alias (Type) of individual logs then click OK to return to the *Properties: Log Definitions* tab.
7. Click **Close** to return to the main synthetic display. The changes you made are applied to future synthetics providing a different setting doesn't exist in the import defaults file for that synthetic.

Related topics

"Changing import defaults" on page 12

Building equations using the log equation library

A library of standard functions or equations ships with GeoSyn. While you can't overwrite the default equations in this library, you can copy them as user functions and then modify or delete them. Because the function library is centralized, any GeoSyn synthetic can access the equations you create.

GeoSyn users with their own equations created with versions of GeoSyn before the function library was introduced can open the synthetics that contain these equations and save the equations to the function library so that they're available to all synthetics.

The general Log Equation Library dialog box, which is used to create equations for any log type, is accessed through several different dialog boxes available from the Edit menu. You can also invoke the Log Equation Library dialog box for only a specific log using the Well Properties > Log Properties dialog box.

To create log equations:

1. Launch the Log Equation Library dialog box by selecting one of the following:

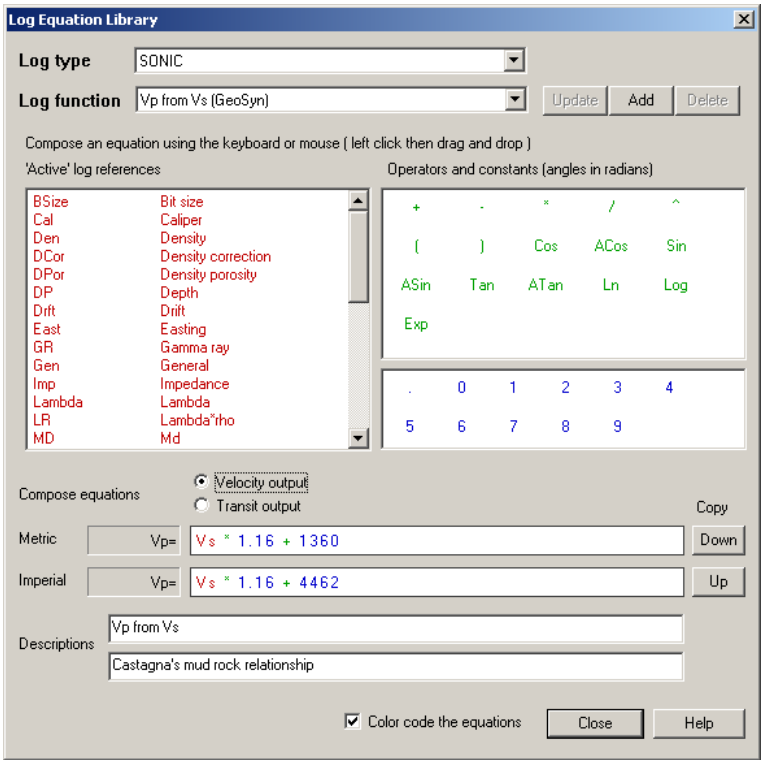
Edit > **Log Editing** > **Log Math** (), and then click **Edit**.

Edit > **Configuration Properties** > **Log Library**, and then click **Edit Curve Equations**.

Edit > **Default Synthetic** > **Log Library**, and then click **Edit Curve Equations**.

Edit > **Default Log Properties** > **Log Library**, and then click **Edit Curve Equations**.

The Log Equation Library dialog box opens.



2. From the Log type drop-down list, select the log type with which to associate the equation you create. The equation is grouped under this log type to facilitate selection from drop-down lists.

3. Do one of the following:

Select an existing equation upon which to base your new equation from the Log function drop-down list and then modify the equation parameters using either of the next two options.

Drag equation elements from the three equation panes into either the Metric or Imperial boxes.

Simply type your equation directly in the Metric or Imperial boxes.

4. Depending on whether you created your equation in the Metric or the Imperial box, click Down or Up to copy it to the adjacent box and then modify your equation with a conversion factor.

5. In the first box of the Descriptions, type a description of the equation function. You may even want to paste the equation from the Metric or Imperial box into

here as a description. What you type here populates the Log function box when you click either Update or Add.

You may want to type additional details in the second description box. Text you type here only appears in the Log Equation Library dialog box.

6. Click **Add** (if you're updating a previous user equation instead of creating a new one, you can click Update instead). And then click **Close** to exit the *Log Equation Library* dialog box.

Related topics

Applying Math Equations to Logs

Drawing straight edge and freehand curves

Draw a single segment straight line or multi-segment freehand line to replace a curve portion.

To draw straight edge and freehand curves:

1. From the **Edit** menu, select **Log editing** ( ).

OR

Double-click the log

OR

Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. Click either the straight line ( ) or freehand tool ( ).

3. Hover the cursor (or) over the location at which to draw a line. The cursor position appears in the banner of the *Log Editor*.

4. Starting at the top or bottom of the log portion to change, drag to draw the line.

5. Click **End Draw** in the popup dialog box to complete the line.

Related topics

"Creating blocked log models" on page 65

Inserting log sections using log editor

Create a section of log with a constant value and insert it at a specific depth to provide a time datum shift or to provide room for new geological section. You can also specify whether to raise or lower the log start depth or stop depth to accommodate the insertion.

When you insert a section in any log, new data is inserted in all logs throughout the synthetic. Specify different constant values to insert in each of the individual logs. An option to doing the below process is to add one or more invisible zones above the log, the sum of which is recognized in all related GeoSyn calculations such as AVO analysis. Invisible zones are added using the Edit > Time Datum option. For details, see *Related topics* below.

To insert log sections using Log Editor:

1. From the **Edit** menu, select **Log editing** ().

OR

Double-click the log

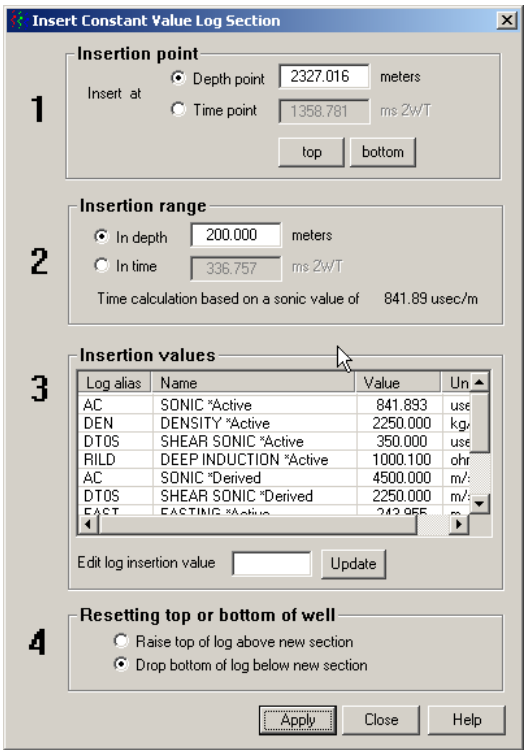
OR

Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. Select the tab for the log in which to insert a log section and in the Log Editor toolbar, click the **Insert Section** tool ().

The Insert Constant Value Log Section dialog box opens.



3. Hover the cursor (⟵|) at the top of the zone at which to insert a log section. The cursor position appears in the banner of the *Log Editor*.

4. Drag to the bottom of the zone.

5. In the Insertion point pane, type a more precise depth at which to insert the log section or click **top** or **bottom** to select the absolute top or bottom of the log.

6. In the Insertion range box, type the thickness to insert. This section is inserted in every log throughout the synthetic.

7. In the Insertion values display pane, select a log to display the constant value that will be inserted in the Edit log insertion value box and each of the logs. Type a different constant value if desired.

8. Select whether to raise the start depth or lower the stop depth and click **Apply**.

Related topics

"Cutting logs" on page 80
"Shifting logs" on page 84
"Changing time datum properties" on page 111

Combining logs in tracks

Logs can either occupy separate tracks in the main synthetic display or can share tracks to save work space. GeoSyn enables you to specify the logs to display in up to ten tracks and can display an unlimited number of logs in any track. The same log can be repeated in multiple tracks.

With a left and right log defined in the same track, select the *Show cross over* option and adjust the horizontal placement of the logs to infill areas where the two logs overlap, or where the curves exceed a given value.

Save composite log layouts with different configurations as templates with a *.tpl* extension in the GeoSyn *Working* directory.

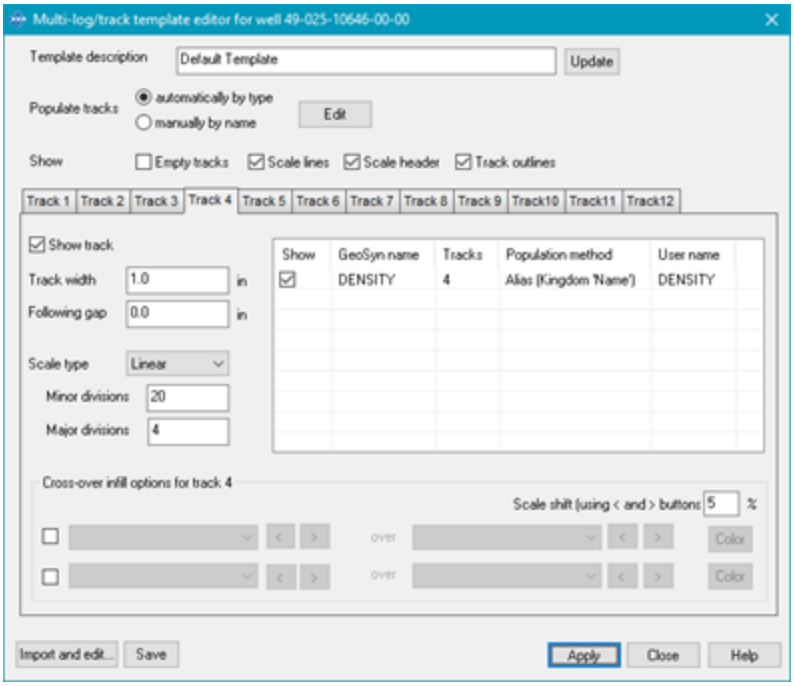
To combine logs in tracks:

1. Do either of the following:

If your current synthetic displays multiple logs per track, right-click the track and select **Multi-log per track Template properties**.

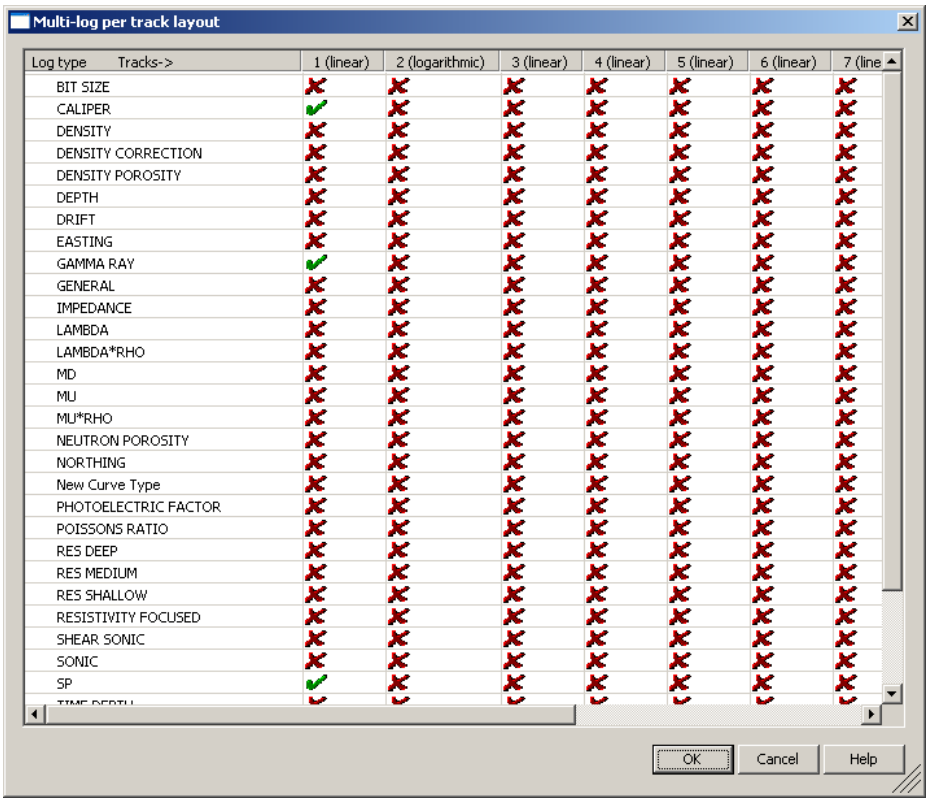
If your current synthetic displays only single logs per track, from the **Edit** menu, select **Well and log properties** () > **Log properties** to display the Log properties tab and in the *Properties common to all logs* pane, select **Multiple logs / track** then click the adjacent **Edit** button.

The Multi-log per Track Template dialog box opens.



2. For the Populate tracks radio buttons, select either **automatically by type** (sonic, density, etc), or **manually by name** (Delta-T, Bulk Density, etc.) depending on the degree of control you want over which logs appear, and then click **Edit**.

The Multi-log per track layout dialog box opens.



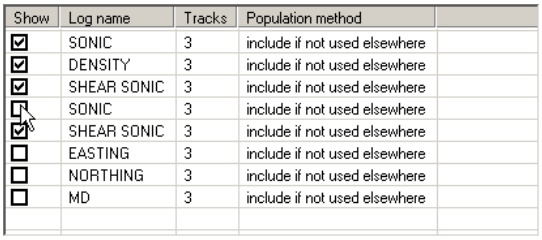
3. For each of the track columns, click the log type to display, and then click **OK**.

> To ensure a log doesn't get dropped, click the *All unselected linear logs* and the *All unselected logarithmic logs* options.

The log types selected above are displayed in the various track tabs of the main *Multi-log per Track Edit* dialog box.

4. Using the *Multi-log per Track Edit* dialog box, for the tracks to display, click the Track tab, specify whether to show the track and select other criteria such as the track width, scale type, and so on.

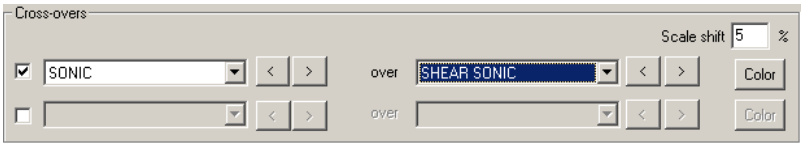
5. In the log display pane click or clear **Show** as depicted below to display or hide a log in a given track.



Show	Log name	Tracks	Population method
☑	SONIC	3	include if not used elsewhere
☑	DENSITY	3	include if not used elsewhere
☑	SHEAR SONIC	3	include if not used elsewhere
☐	SONIC	3	include if not used elsewhere
☑	SHEAR SONIC	3	include if not used elsewhere
☐	EASTING	3	include if not used elsewhere
☐	NORTHING	3	include if not used elsewhere
☐	MD	3	include if not used elsewhere

The Tracks column above displays the tracks in which a log appears. In the example above, the density log can be displayed in track 1. It also appears in track 3. The column to the right of the Log name column specifies whether the log appears in a track by default or was deliberately designated to appear in that track.

To fill areas where curve readings for two or four curves intersect within the same track, select the check box to the left of the drop-down lists in the *Cross overs* section and then select either logs that appears in your model or select **fixed value** depending on whether you want to infill where curves intersect, or where a curve exceeds a given value. Manually shift a curve by clicking < > to the right of the curve drop-down list to enhance the cross over, or type a percentage by which to shift the log scales.



6. Type a descriptive name in the **Template name** box and click **Save** to write the file to the current GeoSyn *Working* directory with the name *GSTemplateX.tpl* where *X* is an incrementing number based on the number of template files already in the *Working* directory. When importing the template file in the future, whatever is typed in the **Template name** box appears as the file description.

7. Click **Apply** to update the current synthetic with your changes.

Related topics

"Changing log display properties" on page 52

Creating blocked log models

Create log models consisting of simple blocked sections that may be useful when modelling complex, tuned geology using the Model Builder Wizard. Also block sections of existing logs using Log Editor so that GeoSyn, working within the

highlighted zone, applies the mean, median, or RMS value between two tops to each set of tops.

Separate procedures for each appear below.

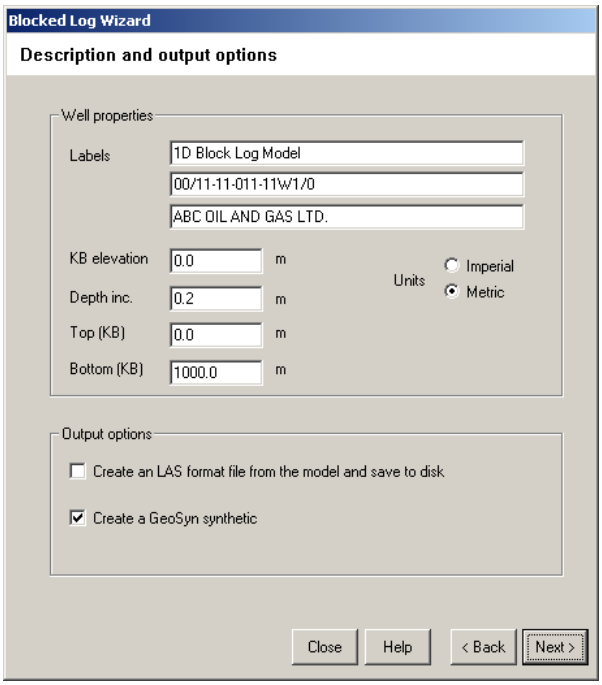
To create blocked log models:

1. From the **File** menu, select **Import** > **Make a blocked log well**.

An informational dialog box opens.

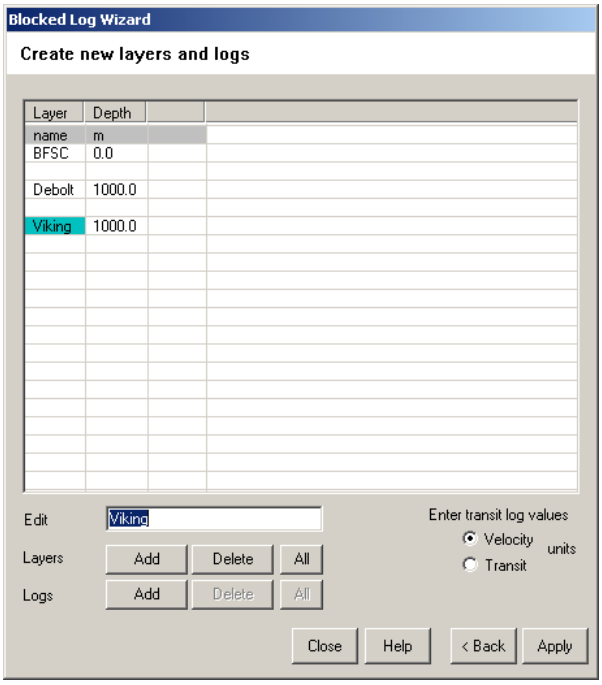
2. Click **Next**.

The Description and Output Options dialog box opens.



3. Type any label changes for the log, specify depth and measurement details, and whether to write the blocked log to an LAS file or display it in a synthetic, and then click **Next**.

The Create New Layers and Logs dialog box opens.



4. To define the zone of interest, beside the **Layers** label, click **Add** and then select the newly added cell in the **Layer** column and type the name of the first formation top in the **Edit** box. Click the adjacent cell in the **Depth** column and type the corresponding kelly bushing depth in the **Edit** box.

5. In the **Layers** pane, click **Add** to insert a row below the formation just added then complete the above steps for the inserted row.

6. Beside the **Logs** label, click **Add** to display the *Select from List* dialog box and select the type of log(s) to create for the zone of interest defined above and click **OK** to return to the *Blocked Log Wizard* dialog box.

7. Click **Apply**.

The blocked log appears in your synthetic.

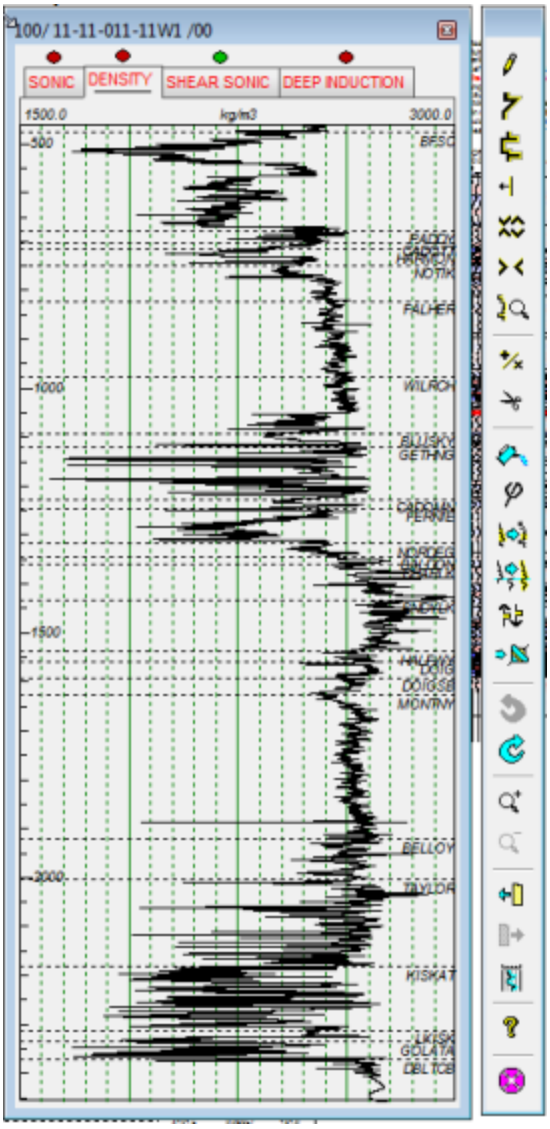
To block portions of existing logs using Log Editor:

1. From the **Edit** menu, select **Log editing** ( ).

OR

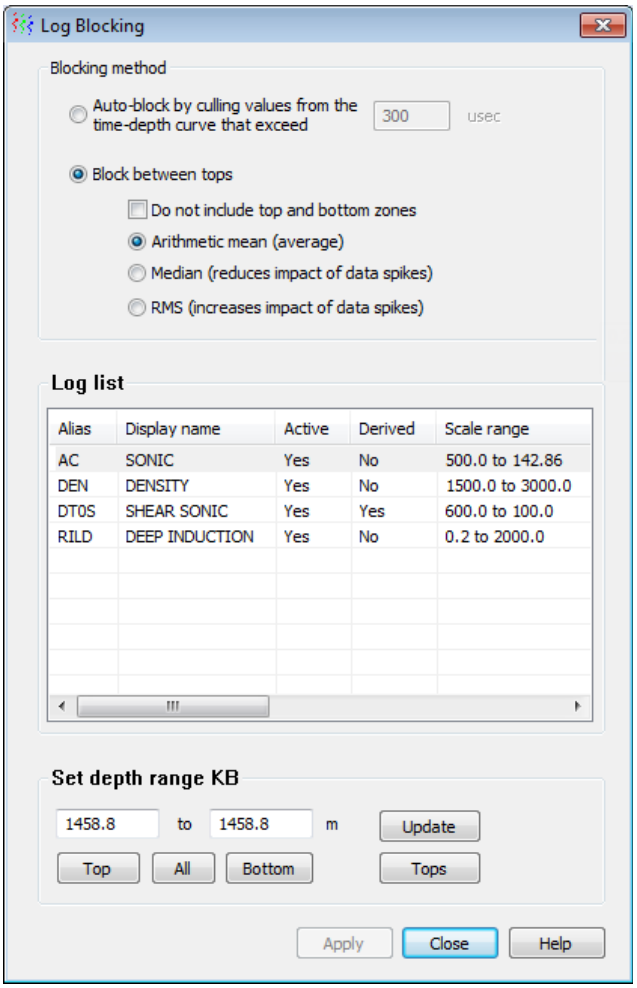
Right-click the log and select **Log editing**.

The Log Editor dialog box opens.



2. In the toolbar beside the Log Editor, click the **Blocking** tool ( ).

The Log Blocking dialog box opens.



3. Select the algorithm used to derive a constant value, which can be used across the log or to the zone between shallowest and deepest tops within your selection. GeoSyn automatically connects your selection to the nearest top.

4. Select the log(s) to block. CTRL+CLICK or SHIFT+CLICK for multiple selection.

5. Do one of the following:

Drag the cursor ( ) on the Log Editor log display pane to select a range to block.

Type values in the Depth range KB pane for the start and stop depth and click **Update**

Click either **Top** or **Bottom** to accept the absolute depth from the log or click **All** to accept both.

Click **Depths from tops** to display the *Depth Range from Tops* dialog box and then select the formation tops that signify your zone of interest from the drop-down lists and click **OK**.

6. Click **Apply**.

Related topics

"Drawing straight edge and freehand curves" on page 59
"Inserting log sections using log editor" on page 59
"Clipping or filtering logs" on page 75
"Cutting logs" on page 80
"Applying math equations to logs" on page 77
"Shifting logs" on page 84

Stretching and squeezing logs

Stretch and squeeze a selected log portion in either time or depth using the Log Editor, which displays the log view in depth, or stretch it in time using the Correlation Window, which enables you to hover the log over seismic.

Stretch and squeeze functionality is also available when tying seismic to models or by specifying values when importing check shot surveys. For details, see *Related topics* below.

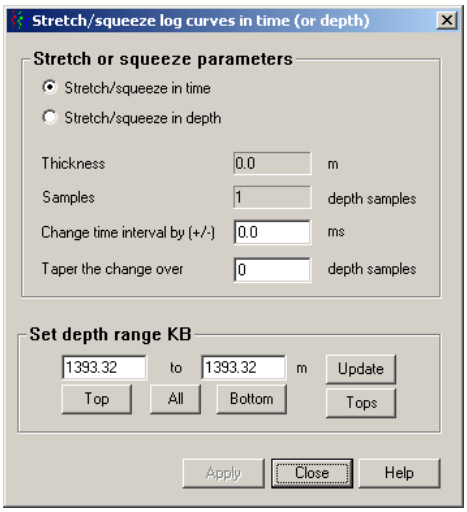
To stretch and squeeze logs:

1. From the **Edit** menu, select **Log editing** ().
OR
Double-click the log
OR
Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. Select the tab for the log to stretch or squeeze and in the Log Editor toolbar, click the **Stretch Squeeze** tool ().

The Stretch/Squeeze log curves in time dialog box opens.



3. Select whether to stretch or squeeze the log in time or depth.

4. Do one of the following:

Drag the cursor ( ) on the Log Editor log display pane to select a range to stretch or squeeze. The cursor position appears in the banner of the *Log Editor*.

Type values in the Set depth range KB pane for the start and stop depth and click **Update**

Click either **Top** or **Bottom** to accept the absolute depth from the log or click **All** to accept both.

Click **Depths from tops** to display the *Depth Range from Tops* dialog box and then select the formation tops that signify your zone of interest from the drop-down lists and click **OK**.

5. Do one of the following:

If you selected depth above, type the desired thickness of the zone defined above after stretching or squeezing. If the value is less than the difference between the start and stop depth, the log will be squeezed. If more, the log will be stretched.

If you selected time above, type a value by which to adjust the transit times for the zone defined above and the number of samples over which to taper the change.

6. Click **Apply**.

Related topics

"Changing import defaults" on page 12
"Changing log display properties" on page 52
"Exporting log aliases" on page 194

Merging logs

Merge an upper run with a lower run using the Merge Log Runs tool () on the Log Editor by importing

a log in either LAS or GeoSyn format. You can also use the Math tool or the Composite Log tool to merge runs; however, the Merge Log Runs tool is the simplest and quickest method.

To merge logs:

1. From the **Edit** menu, select **Log editing** ().

OR

Double-click the log

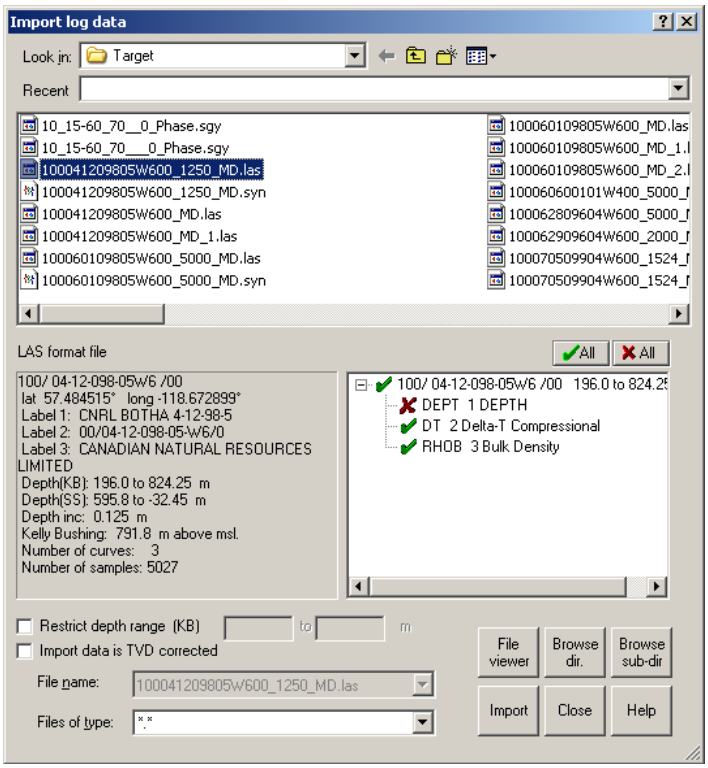
OR

Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. Using the Log Editor toolbar, click the **Merge Log Runs** tool ().

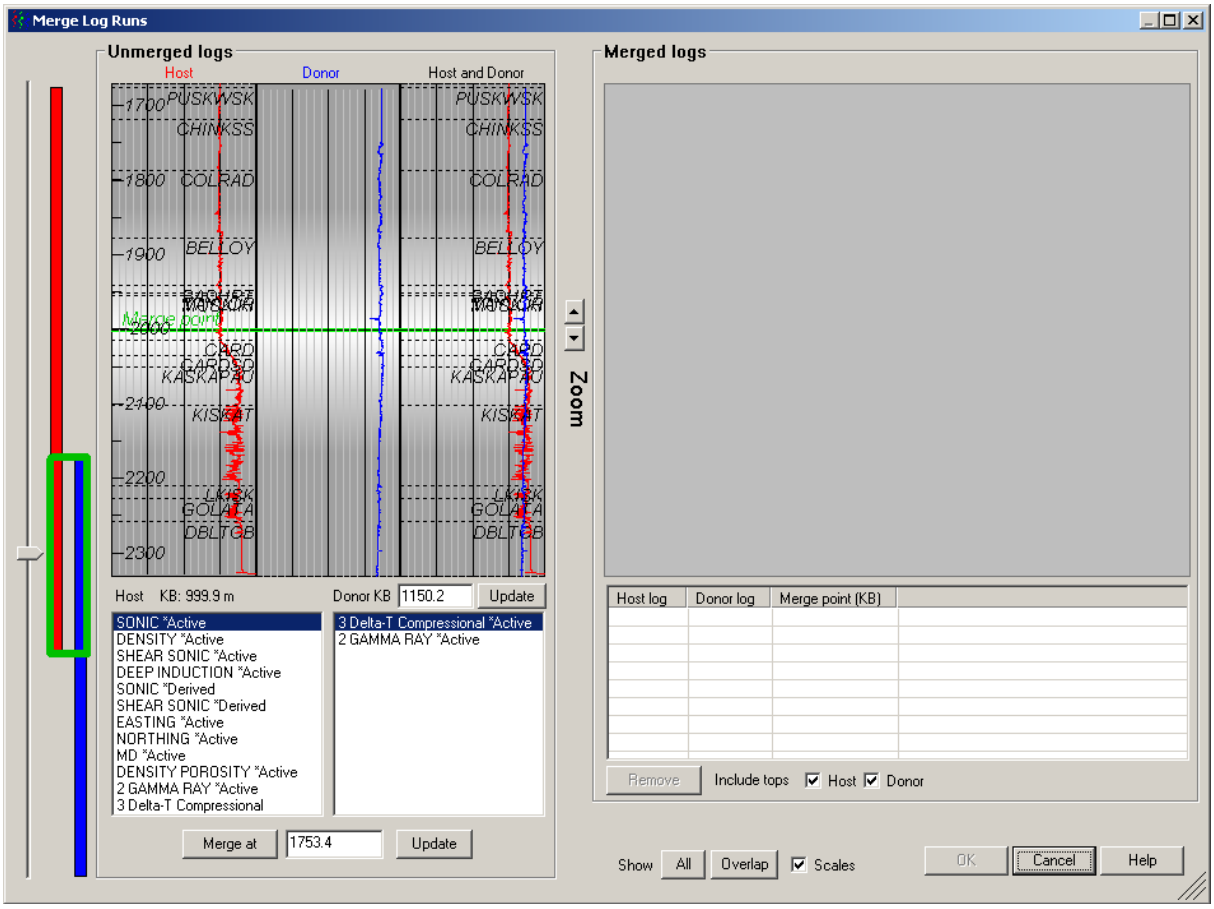
The Import Log Data dialog box opens.



3. Select the log file to merge with the existing log, and then click **Import**.

A warning dialog may appear warning of a mismatching kelly bushing depth between the two logs. Continue to import the log file and change the kelly bushing depth of the imported well using the *Merge Log Runs* dialog box that appears below.

The Merge Log Runs dialog box opens.



4. Using the Host and Donor panes that appear in the bottom-left of the Merge Log Runs dialog box, select the log to merge with and the imported log to merge in either pane.

The display in the Unmerged Logs display pane updates to reflect the relationship of the two selected logs.

To set the area of interest, to the left of the *Show* label at the bottom of the *Merge Log Runs* dialog box, specify whether to show the entire depth of both log runs in the *Unmerged Logs* display pane, or just the depth where they overlap.

To clarify the display, enable or disable the *Scales* check box to specify whether horizontal and vertical scale lines appear in the *Unmerged Logs* display pane. Click the Zoom buttons to the right of the Unmerged logs display pane to change the zoom resolution.

To set the specific point at which to merge the logs, either drag the slider to the left of the *Unmerged Logs* pane (or drag the display pane), or type a specific depth in the box to the right of the **Merge at** button below the *Unmerged Logs* display pane and then click **Update**.

Specify whether to include tops from either (or both) the host or donor well.

5. Click **Merge at** to perform the actual log splice.

The spliced log appears in the Merged Logs pane in the right portion of the Merge Log Runs dialog box with merge details in the table below the Merged Logs display pane.

6. Either complete the above steps for additional logs to merge in the GeoSyn well,
OR
Click **OK** to return to the Log Editor.

Related topics

"Creating log composites" on page 81
"Applying math equations to logs" on page 77

Clipping or filtering logs

Clip the data of either an entire log or a zone of interest within that log to remove data spikes or incorrect data.

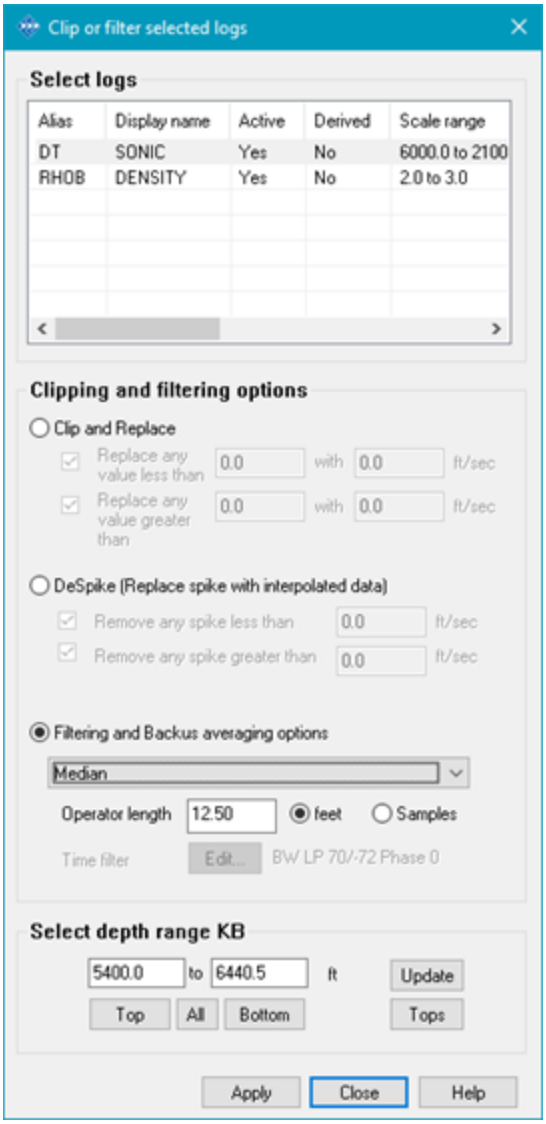
To clip or filter logs:

1. From the **Edit** menu, select **Log editing** ( ).
OR
Double-click the log
OR
Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. In the toolbar beside the *Log Editor*, click the **Clip** tool ( ).

The Clip or filter the log dialog box opens.



3. Select whether to clip and filter by substituting values, removing spikes, or using filtering methods.

4. Do one of the following:

- Drag the cursor on the Log Editor log display pane to select a range to clip or filter.
- Type values in the Select depth range KB pane for the start and stop depth and click **Update**. Click either **Top** or **Bottom** to accept the absolute depth from the log or click **All** to accept both.

- Click **Depths from tops** to display the *Depth Range from Tops* dialog box and then select the formation tops that signify your zone of interest from the drop-down lists and click **OK**.

5. Click **Apply**.

Related topics

"Applying math equations to logs" below
"Creating blocked log models" on page 65

Applying math equations to logs

The Log Math dialog box enables you to generate derived logs based on readings from other logs as inputs. To derive these logs, you can use either industry-standard equations provided by GeoSyn in the Log Equation Library, or you can create your own customized equations that are then saved to the Log Equation Library.

Any log can be used as an input for the derived log equation. For example, you can use a common sonic log, or derive a log and then use that derived log as an input in the equation from which you derive yet another log. For details about merging log runs, see *Related topics* below.

About the Function Library

A library of standard functions or equations ships with GeoSyn. While you can't overwrite the default equations in this library, you can copy them as user functions and then modify or delete them. Because the function library is centralized, any GeoSyn synthetic can access the equations you create.

GeoSyn users with their own equations created with versions of GeoSyn before the function library was introduced can open the synthetics that contain these equations and save the equations to the function library so that they're available to all synthetics.

The general Log Equation Library dialog box, which is used to create equations for any log type, is accessed through several different dialog boxes available from the Edit menu. You can also invoke the Log Equation Library dialog box for only a specific log using the Well Properties > Log Properties dialog box.

To apply math equations to logs:

1. From the **Edit** menu, select **Log editing** ( ).

OR

Double-click the log

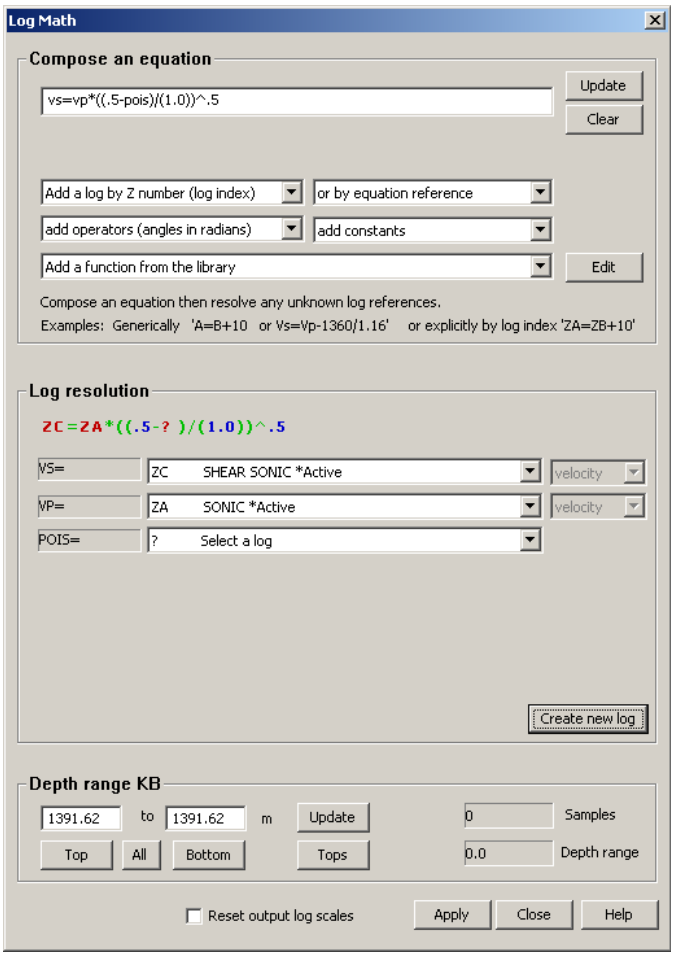
OR

Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. In the toolbar beside the *Log Editor*, click the **Math** tool ( ).

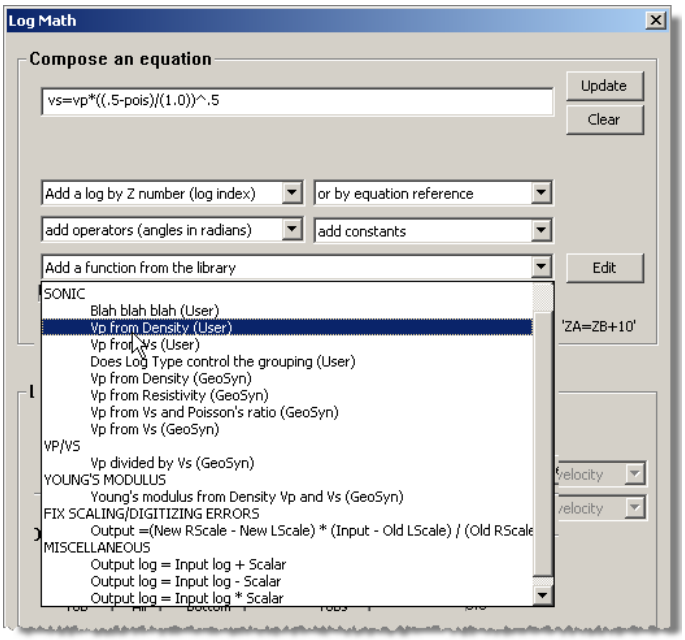
The Log Math dialog box opens.



To copy a portion of one log to another, enter the following equation XX=YY, (where XX is the recipient log and YY is the source log) drag the interval to copy in the source log, and then click **Apply**.

3. Do either of the following:

To build an equation based an equation in the function library, select the equation from the Add a function from the library drop-down list,



and then do either of the following to modify the equation. If the desired function doesn't appear, click Edit to the right of the drop-down list to launch the *Log Equation Editor* dialog box and create it.

Type equation terms directly in the top box of the Compose an equation pane.

Select equation terms from the drop-down lists above the Add a function from the library drop-down list.

4. Using the Log Resolution pane, select a log from each drop-down list to the right of each equation term to associate a log with each term.

5. Do one of the following:

Drag the cursor (↵+/−) on the Log Editor log display pane to select a range to which to apply the mathematical equation.

Type more precise values in the Depth range KB pane for the start and stop depth and click **Update** Click either **Top** or **Bottom** to accept the absolute depth from the log or click **All** to accept both.

Click **Depths from tops** to display the *Depth Range from Tops* dialog box and then select the formation tops that signify your zone of interest from the drop-down lists and click **OK**.

6. Click **Apply**.

Related topics

"Building equations using the log equation library" on page 57
"Creating blocked log models" on page 65
"Clipping or filtering logs" on page 75
"Merging logs" on page 72

Cutting logs

Cut a section from a log and then either lower the start depth or raise the stop depth so that either the tops below or above the cut maintain accurate depths.

You can also insert a constant value log section the same thickness as the section removed. For details, see *Related topics* below.

To cut logs:

1. From the **Edit** menu, select **Log editing** ( ).

OR

Double-click the log

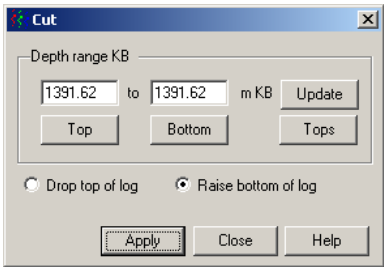
OR

Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. In the toolbar beside the *Log Editor*, click the **Cut** tool ( ).

The Cut dialog box opens.



3. Do one of the following:

Drag the cursor ( ) on the Log Editor log display pane to select a range to cut.

Type more precise values in the Depth range pane for the start and stop depth and click **Update**

Click either **Top** or **Bottom** to accept the absolute depth from the log.

Click **Depths from tops** to display the *Depth Range from Tops* dialog box and then select the formation tops that signify your zone of interest from the drop-down lists and click **OK**.

4. Click **Apply**.

Related topics

"Inserting log sections using log editor" on page 59

Creating log composites

Take a range of data from a donor well and either insert it into or replace part of a host well.

Log data from the specified depth range of the donor well is copied to the corresponding log type in the host well. Logs in the donor well without corresponding logs in the host well are ignored unless you manually associate them with logs in the host well. For details about merging log runs, see *Related topics* below.

To create log composites:

1. From the **Edit** menu, select **Log editing** ( ).

OR

Double-click the log

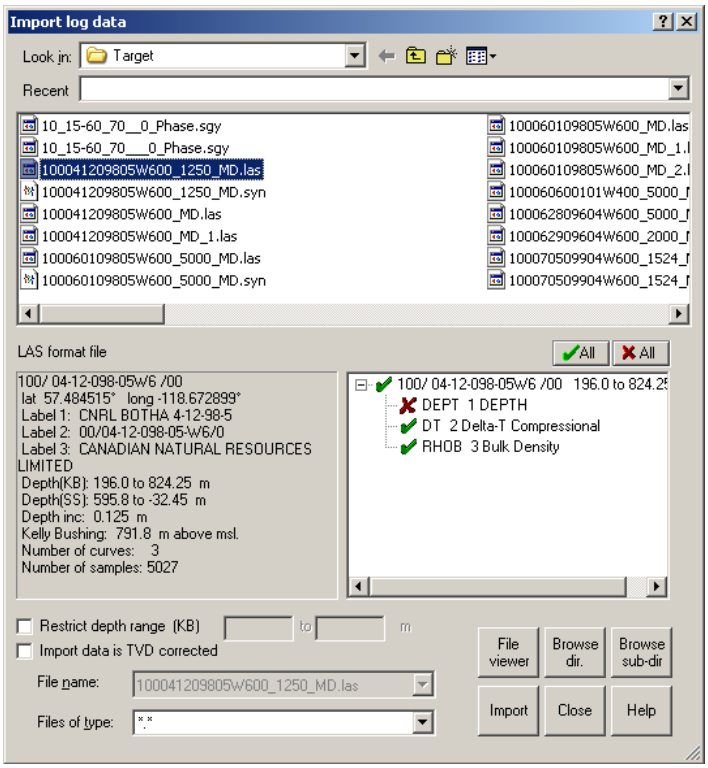
OR

Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. In the toolbar beside the *Log Editor*, click the **Composite** tool ( ).

The Import log data dialog box opens.



3. Select the root directory or drive from the **Look in** drop-down list then double-click folders in the display pane to browse to the directory that contains either the desired files or the subdirectory with those files. To filter the type of files displayed, from the **File filter** drop-down list, select a file format extension.

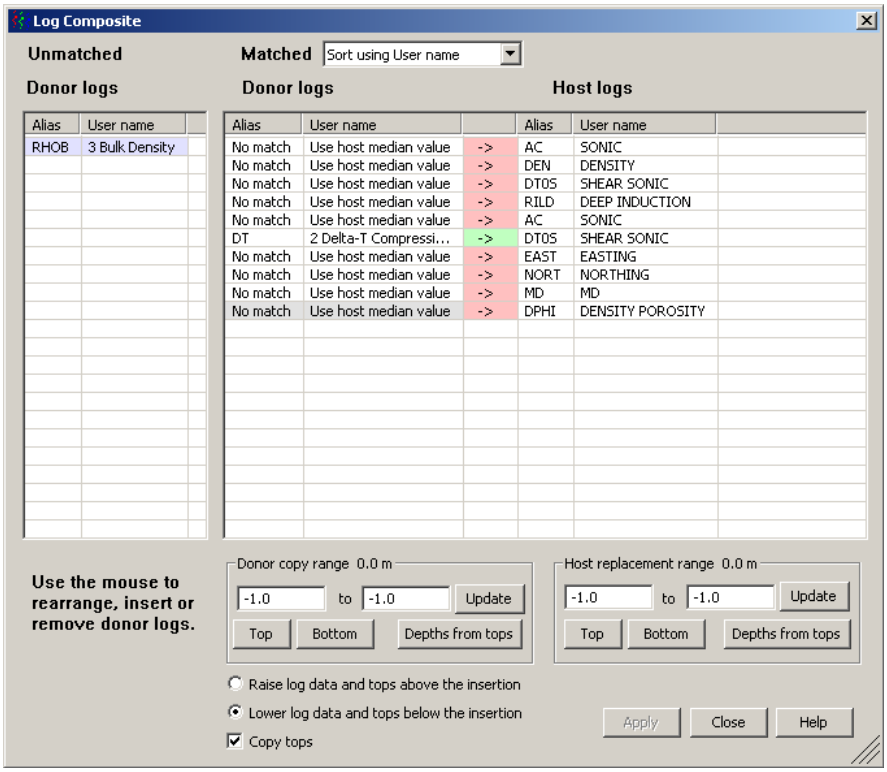
4. Either click **Browse dir.** or **Browse sub-dir** to launch *Directory Browser* displaying LAS and GeoSyn files sorted by UWI, or simply select the desired file in the display pane. For details on using *Directory Browser*, see *Related topics* below.

For LAS files, you can inspect and modify the raw data in an ASCII text editor before importing it by clicking **File Viewer**.

When you select the file, details appear in the *format file* pane.

5. In the well tree, select whether to import specific logs. A check mark (✓) appears beside logs that will import, a cross (✗) beside those that won't. For wells with numerous logs, toggle the group by clicking **All** (✓, ✗) depending on whether to import or ignore the majority of logs then toggle the individual logs to import or ignore and click **Import**.

The Log Composite dialog box opens displaying which logs from the donor well will be inserted into logs of the host well.



6. Logs that match appear in the pane to the right. Logs that don't completely align and for which some constant values will need to be applied are colored red in the cell between the donor and recipient log.

Drag a log from the *Unmatched* pane into the *Matched* pane in the left-most cell of the row that lists the desired recipient log, or drag it from the Matched pane to the Unmatched pane if you don't want it to be a donor log.

Drag the alias in the left-most column of the Matched pane to change the default recipient log.

7. Do one of the following:

Type precise values in the Copy range and Replacement range boxes and then click **Update.**

Click **Top** and **Bottom** to accept the absolute depth from the log.

Click **Depths from tops** to display the *Depth Range from Tops* dialog box and then select the formation tops that signify your zone of interest from the drop-down lists and click **OK**.

8. Click **Apply** and then click **Close**.

Related topics

"Clipping or filtering logs" on page 75
"Using Directory Browser" on page 10
"Inserting log sections using log editor" on page 59
"Merging logs" on page 72

Shifting logs

Correct log depths with cable stretch and other errors by adding a segment to the top or bottom of one or multiple logs in the current synthetic. New data points added to the top or bottom of logs are extrapolated using the last available data point. If the top or bottom value is anomalous, it will be propagated and may require further editing.

GeoSyn requires that all logs have the same top and bottom, so when one log is shifted in depth, GeoSyn adds data to the top or bottom of all logs to compensate.

The time datum can also be changes using the Edit > Time Datum menu option. For details, see *Related topics* below.

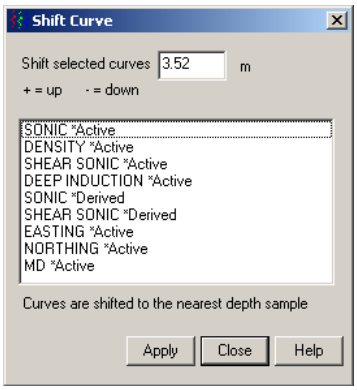
To shift logs:

1. From the **Edit** menu, select **Log editing** ( ).
OR
Double-click the log
OR
Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. In the toolbar beside the *Log Editor*, click the **Shift** tool ( ).

The Shift Curve dialog box opens.



3. In the display pane, select the logs to shift. SHIFT+CLICK or CTRL+CLICK for multiple selection.

4. Type a signed value to shift the log(s) in the **Shift selected curves** box then click **Apply**.

Related topics

"Cutting logs" on page 80
"Drawing straight edge and freehand curves" on page 59
"Inserting log sections using log editor" on page 59
"Changing time datum properties" on page 111

Changing log editor display

Change the minimum and maximum values that define the scale range for logs. Configure which logs appear in each track. The same log can be repeated in multiple tracks selected by log type.

To change log editor display:

1. From the **Edit** menu, select **Log editing** ( ).

OR

Double-click the log

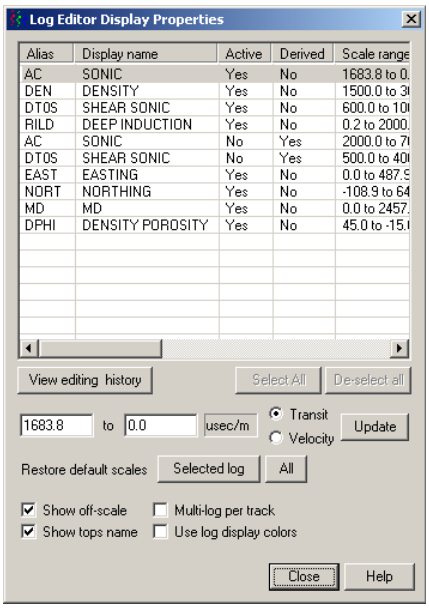
OR

Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. In the toolbar beside the *Log Editor*, click the **Set log editor scales** tool ( ).

The Log Editor Display Properties dialog box opens.



3. In the display pane, select the log and type minimum and maximum scale values in the boxes below the display pane then click **Close**.

These changes apply to only the current synthetic. To change the default scale for a log in all future synthetics, see *Related topics* below.

Related topics

"Changing log defaults" on page 54

Inspecting logs

View the range over which data falls in a given log and narrow the selected range by either depth and top. The narrowed range can be output to the Crossplot wizard.

To inspect logs:

1. From the **Edit** menu, select **Log editing** ( ).

OR

Double-click the log

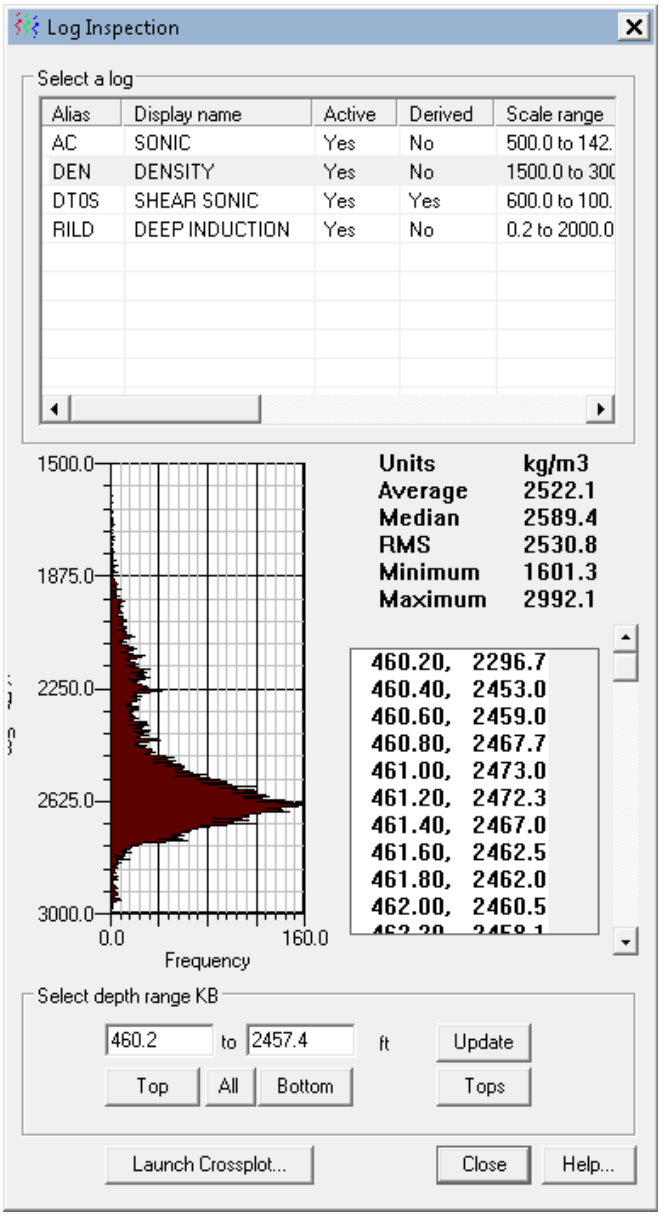
OR

Right-click the log and select **Log editing**.

The Log Editor dialog box opens.

2. In the toolbar beside the *Log Editor*, click the **Log Inspection**tool ( ).

The Log Inspection dialog box opens.



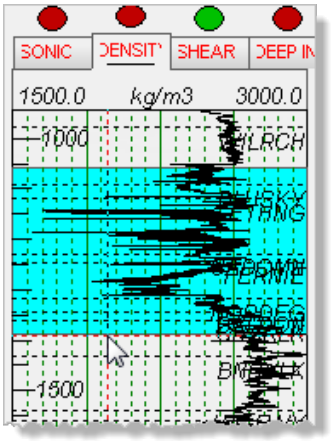
Click different log tabs in the *Log Editor* to change the log that appears in the *Log Inspection* dialog box.

3. To set the data range to interrogate, do one of the following:

Using the Log Inspection dialog box, in the *Select depth range* pane, type in the boxes, or click the **Tops** button to display the *Depth Range from Tops* dialog box

and then select the upper and lower tops that bound the range in the model, and then click **Update**.

Using the Log Editor, drag the interrogation range as depicted below.



To reset the range, click either **Top** or **Bottom** (to move only one element of the range), or click **All**.

Click **Launch Crossplot** to display the *Crossplot wizard* with only the data range specified above.

4. Click **Close** to return to the model.

Related topics

"Creating crossplots" on page 170

Tops Lists

GeoSyn includes three default lists for tops:

- **Generic** — the tops that appear in logs of the current synthetic.
- **AccuMap System Tops** — the tops that are loaded from your local AccuMap database when you create a new synthetic or launch an existing one. Information forthese tops may change following AccuMap data loads.
- **AccuMap User Tops**, which are always loaded from your local AccuMap user tops database when you create a new synthetic or launch an existing one. Information for these tops changes based on your changes.

Create an unlimited number of tops lists with customized display properties that are hidden or shown in the main synthetic display, populate tops lists with check shot or directional survey values, copy tops amongst lists, and delete individual tops in lists. You cannot delete the three default lists above, but you can delete the tops within.

Related Topics

"Changing tops properties" below
"Duplicating tops lists" on page 91
"Inserting tops" on page 94
"Importing tops from GeoSyn files" on page 96
"Importing tops from delimited files" on page 97
"Importing tops from fixed width files" on page 99
"Importing tops from LAS and ASCII Files" on page 104

Changing tops properties

When you create a new synthetic or launch an existing one, GeoSyn automatically downloads the latest system tops and user tops from the local AccuMap database or the IHS Online Information Hub. If importing an LAS or GeoSyn file, you specify whether the well is in measured depth or true vertical depth units so the tops are placed at the correct depths.

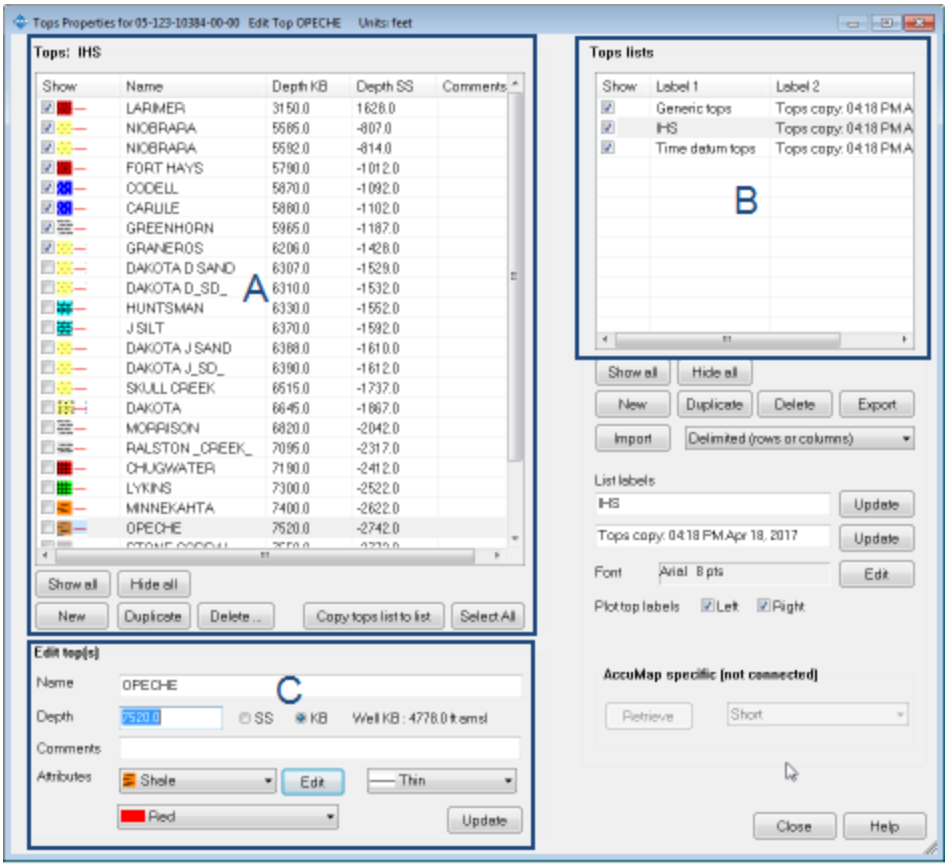
The display properties of tops including formation name, depth, marker attributes, and lithology can be modified. Customized tops can be copied to multiple tops lists and displayed in the main synthetic display.

Important:	Changes you make in the GeoSyn user tops list in aren't updated in the AccuMap user database and will be over-written by the AccuMap user database the next time you launch the synthetic. To change the value in the AccuMap user database, use AccuMap Tops Manager. To prevent the changed depth from being overwritten without changing the depth in the AccuMap user database, copy the top to the *Generic tops* list.

To change a tops properties:

1. Launch the Tops Properties dialog box:
   - Menu: **Edit >Tops properties**
   - Toolbar: ( )
   - Main display tops table: Right click and select **Tops properties**.

   The Top Properties dialog box opens.



2. Select a list to display from *Tops lists* (B).
3. Choose a top to change from the selected list *Tops: List name* (A).
4. Change the tops display properties in the *Edit top(s)*section(C).

5. Click **Close** to return to the main synthetic display with the changes applied.

Related topics

"Importing tops from GeoSyn files" on page 96
"Exporting tops lists" on page 200
"Tops Lists" on page 89
"Importing tops from fixed width files" on page 99
"Importing tops from GeoSyn files" on page 96
"Importing LAS or GeoSyn files" on page 14

Duplicating tops lists

Duplicate and then customize an entire list of tops or copy only select tops from one list to another. Tops copied from one list to another don't overwrite tops with the same name in the recipient list.

To duplicate tops lists:

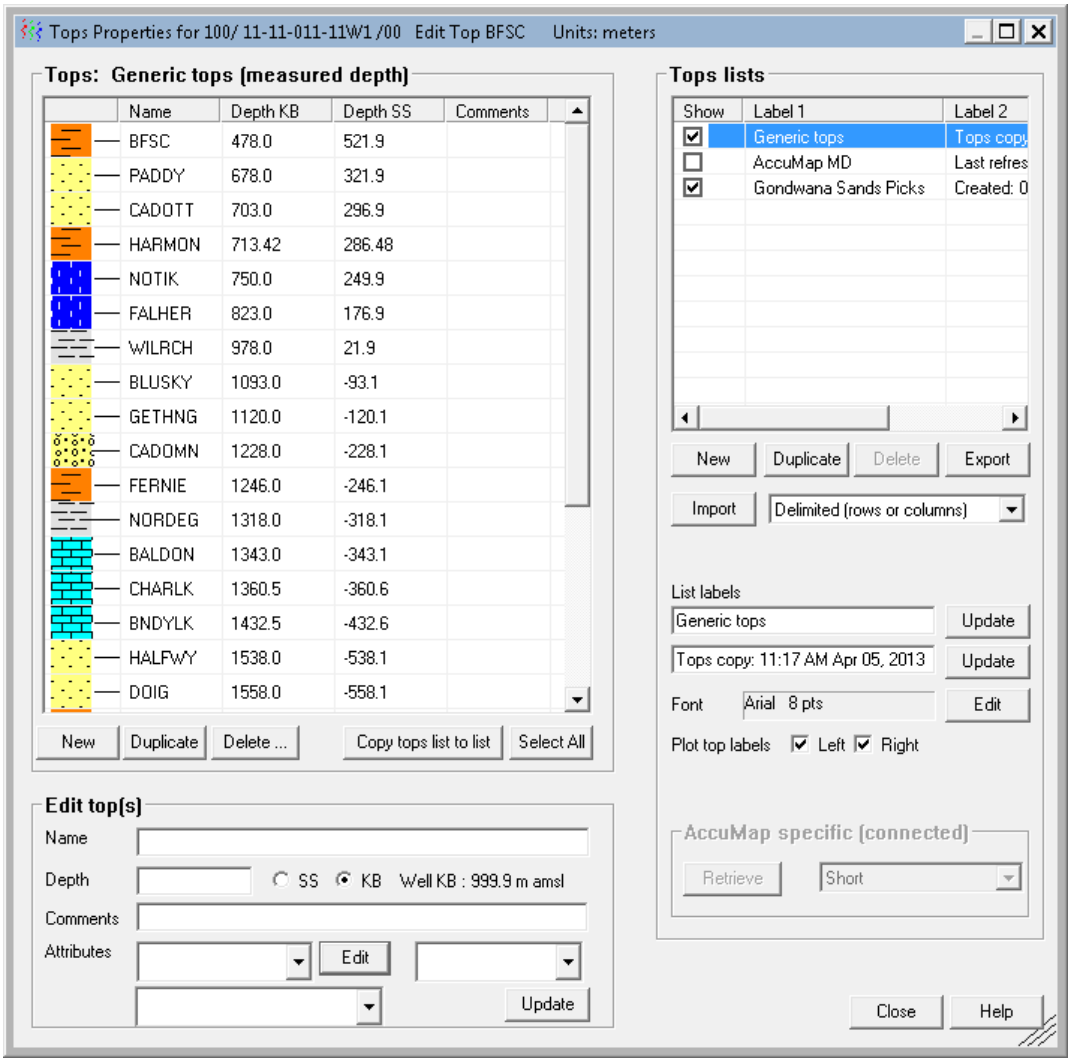
1. From the **Edit** menu, select **Tops properties** ( )

OR

Right-click the tops table in the main synthetic display and select **Tops properties**.

To display the tops table in the main synthetic display, from the **Edit** menu, select **Synthetic properties** ( ) and in the **Display elements** pane, select **Tops table**.

The Top Properties dialog box opens.



2. In the *Tops lists* pane, select the tops list to copy then click **Duplicate**.

To copy only select tops to an existing list instead, in the **Tops for list** display pane, select the tops to copy (SHIFT+CLICK or CTRL+CLICK for multiple selection) then click **Copy selected tops to another list** to display the *Select a recipient tops list* dialog box and select the receiving tops list.

The tops names, depths, and lithology are copied to a new file that appears below the existing tops lists in the **Tops lists** pane.

3. Select the duplicate tops list to display its tops in the **Tops for list** pane and select a row that contains a top to change, duplicate, or below which to add a new row and do one of the following in the boxes below the Tops for list display:

To change an existing top, type and select the desired details then click **Update**.

To make a copy of a top to modify, select the top below which to place the copy and click **Duplicate**.

To add a blank row where you can type new top details, select the top below which to add a blank row, click **New**, type top details, then click **Update**.

Related topics

"Tops Lists" on page 89
"Importing tops from LAS and ASCII Files" on page 104
"Importing tops from LAS and ASCII Files" on page 104
"Importing tops from delimited files" on page 97
"Importing tops from fixed width files" on page 99

Inserting tops

Insert a top at a location on a log you click. When inserting, you can specify the tops list to which to write the top information so that you can update it, correlate it, and so on.

To insert tops:

1. From the **Edit** menu, select **Log editing** ().

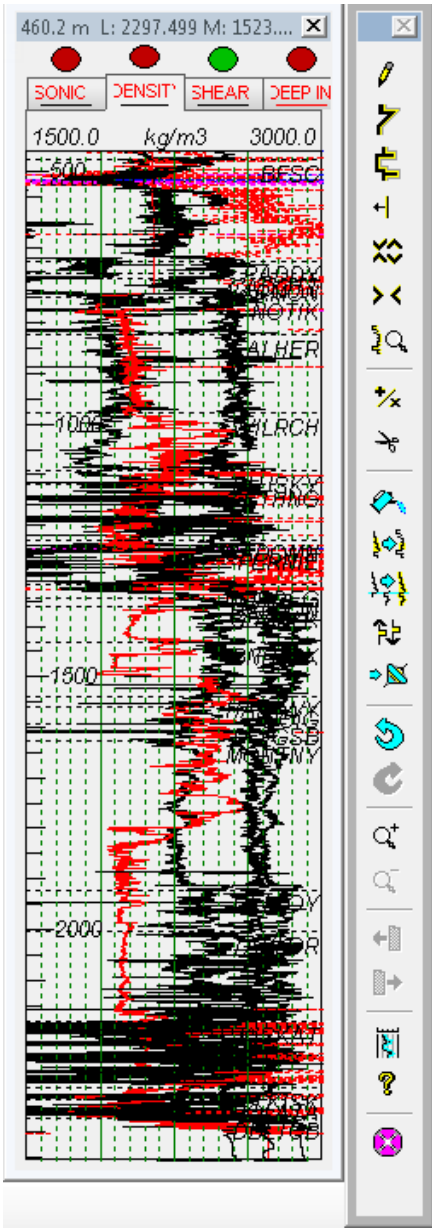
OR

Double-click the log

OR

Right-click the log and select **Log editing**.

The Log Editor dialog box opens.



2. Select the tab for the log in which to insert a top and in the Log Editor toolbar, click the **Insert a Top**tool ( ).

3. Click the cursor ( ) at the location on the log at which to insert a top.
The *Insert Top in Selected List* dialog box opens.

4. Select the list in which the name and depth of the top you insert will be saved, and then type a name for the top and click **OK**.

Related topics

"Tops Lists" on page 89

"Changing tops properties" on page 89

Importing tops from GeoSyn files

Import tops lists saved in GeoSyn format into the GeoSyn tops list to make them available to your current model.

When importing tops, you have the option of overwriting existing tops in the list, if you keep the current tops, imported tops with the same name appear alongside them.

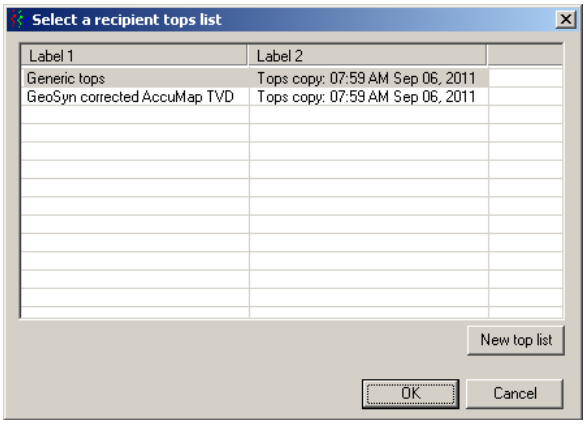
To duplicate and then modify an existing tops list within GeoSyn, see *Related topics* below.

To import tops from GeoSyn files:

1. From the **File** menu, point to **Import**, click **Tops**, and then select **GeoSyn file**.

2. Browse to the desired GeoSyn file and select the depth placement options, units, and whether to delete current tops if importing into a tops list that's already populated, and then click **OK**.

The *Select a recipient tops list* dialog box opens.



3. Select the list to which to import the tops or click **New top list** and define a new tops list, and then click **OK**. Shift+Click or Ctrl+Click to select more than one tops list into the list of tops.

Related topics

"Duplicating tops lists" on page 91
"Tops Lists" on page 89
"Importing tops from delimited files" below
"Importing tops from LAS and ASCII Files" on page 104
"Importing tops from fixed width files" on page 99

Importing tops from delimited files

Import tops lists saved in delimited ASCII format files into GeoSyn tops lists so that they are available to your current synthetic. Delimiters can include commas, tabs, or spaces.

Delimited format is different than fixed width columns. All entries in fixed width columns align on the left-edge of the column. Delimited simply includes one or more delimiters between entries, but the items may not align neatly in columns.

When importing tops, you have the option of overwriting existing tops in the list. If you keep the current tops, imported tops with the same name appear alongside them.

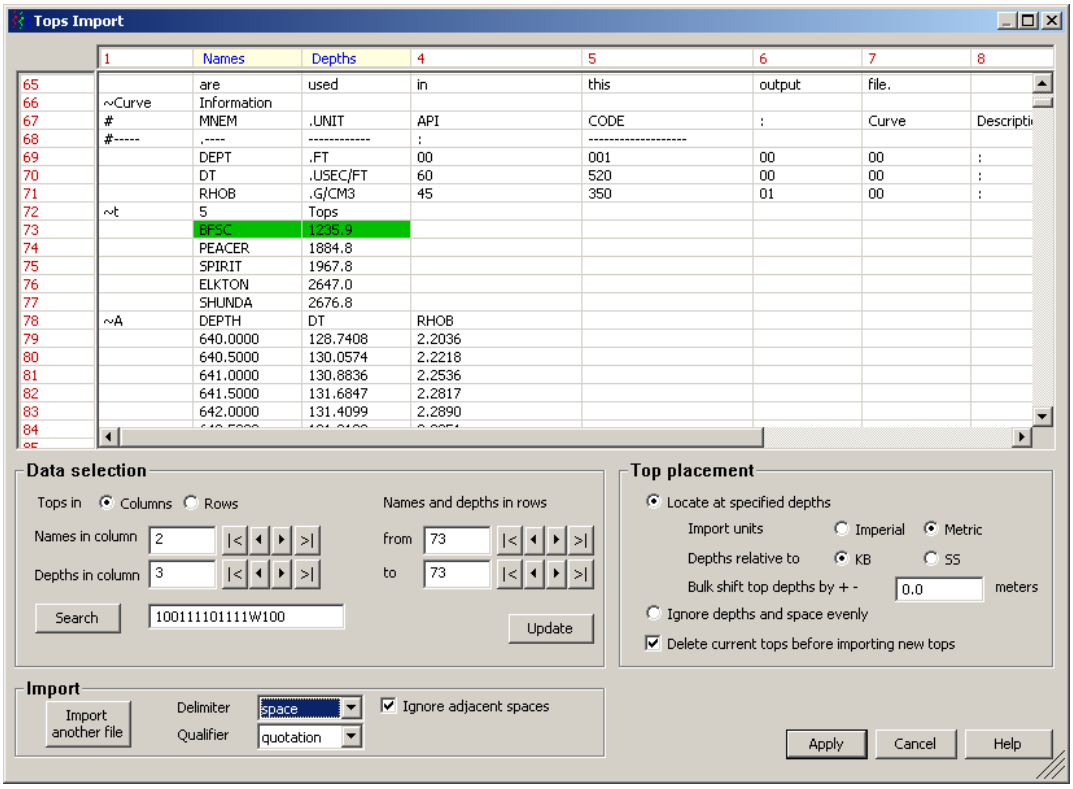
To duplicate and then modify an existing tops list within GeoSyn, see *Related topics* below.

To import tops from delimited files:

1. From the **File** menu, point to **Import**, click **Tops**, and then select **Delimited**.

2. Browse to the desired tops file, and then click **Open**.

The Tops Import dialog box opens.



GeoSyn automatically searches in the file you selected above for a UWI that matches the one in your GeoSyn file and highlights the row in which it appears in the tops source file.

3. Using the display pane, verify whether the tops in the source file are ordered in rows (formation top names run horizontally along a single row), or columns (formation top names run vertically down a single column).
Your selection above is saved and applied the next time you launch the *Tops Import* dialog box.

4. Using the *Names in row* or *column* and the *Depths in row* or *column* (depending on whether you selected *Tops in rows*or *Tops in columns* above), specify the row or column in which the formation top names and depths appear.

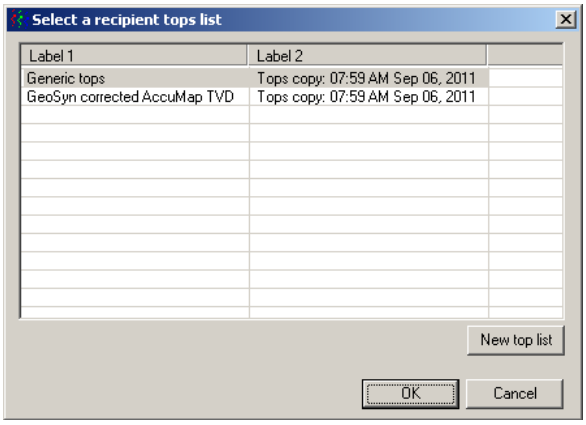
5. In the *from* and *to* boxes, specify the range to import.
OR
Drag in the display pane to select the tops to import.
Rows are highlighted gray simply to show the columns and rows in which formation top names and depths appear. Rows and columns highlighted green are those that will be imported into GeoSyn.

Verify the delimeter GeoSyn chose is correct. GeoSyn attempts to determine the correct delimeter by reading the source file.

In the *Top placement* pane, select the desired processing options.

6. Click **Apply**.

The *Select a recipient tops list* dialog box opens.



9. Select the list to which to import the tops, or click **New top list**, define a new tops list, and then click **OK**. Shift+Click or Ctrl+Click to select more than one tops list into which to import into the tops.

Related topics

"Duplicating tops lists" on page 91
"Tops Lists" on page 89
"Importing tops from fixed width files" below
"Importing tops from GeoSyn files" on page 96
"Importing tops from LAS and ASCII Files" on page 104

Importing tops from fixed width files

Fixed width columns format is different than delimited format. All entries in fixed width columns align on the left-edge of the column. Delimited simply includes one or more delimiters between entries, but the items may not align neatly in columns.

When importing tops, you have the option of overwriting existing tops in the list, if you keep the current tops, imported tops with the same name appear alongside them.

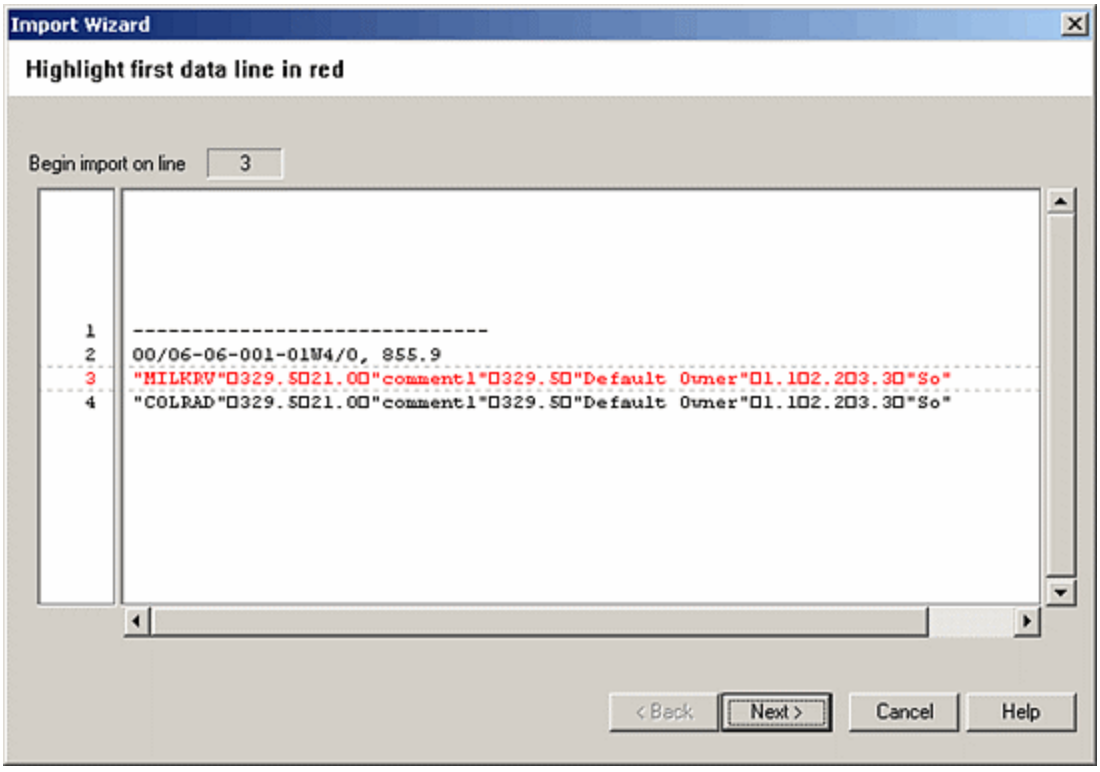
To duplicate and then modify an existing tops list within GeoSyn, see *Related topics* below.

To import tops from fixed width files:

1. From the **File** menu, point to **Import**, click **Tops**, and then select **fixed width, delimited**.

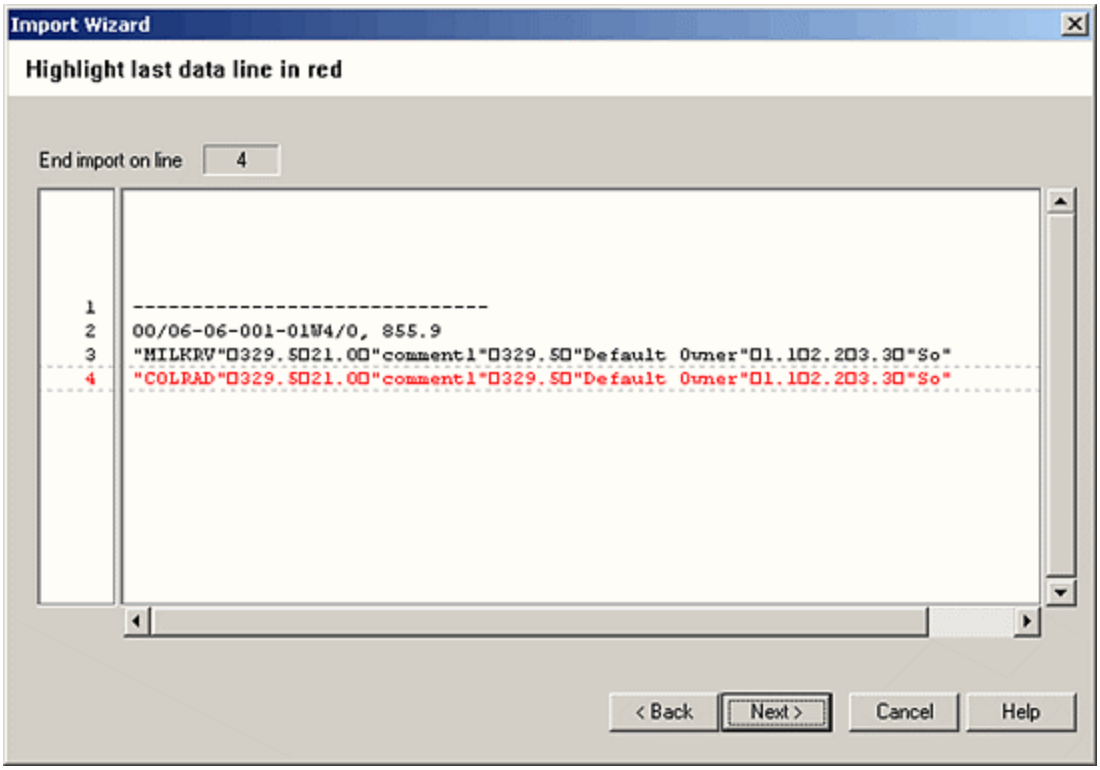
2. Browse to the desired tops file and select the depth placement options, units, and whether to delete current tops if importing into a tops list that's already populated, and then click **OK**.

The Highlight first line dialog box opens.



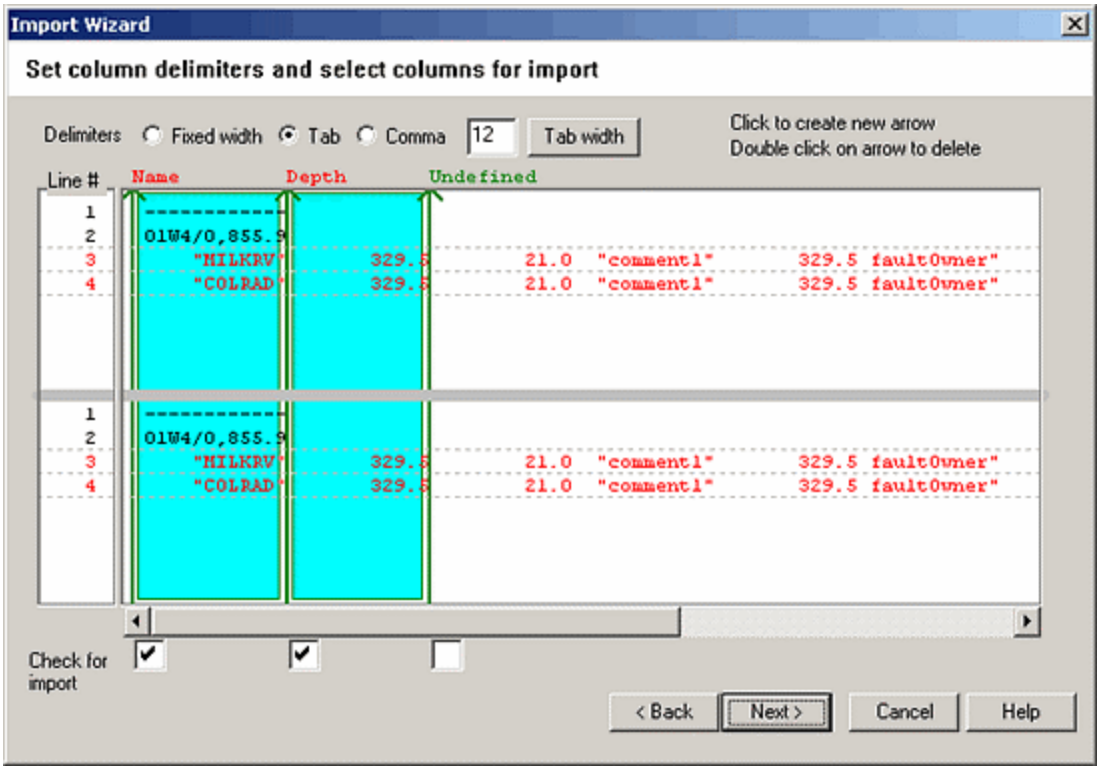
3. Select the row in which the first top appears, and then click **Next**.

The Import Wizard: Highlight Last Line dialog box opens.



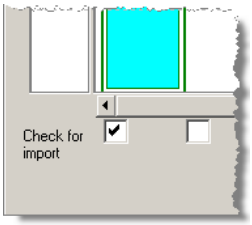
4. Select the row in which the last top appears, and then click **Next**.

The Import Wizard: Set Column Delimeters dialog box opens.

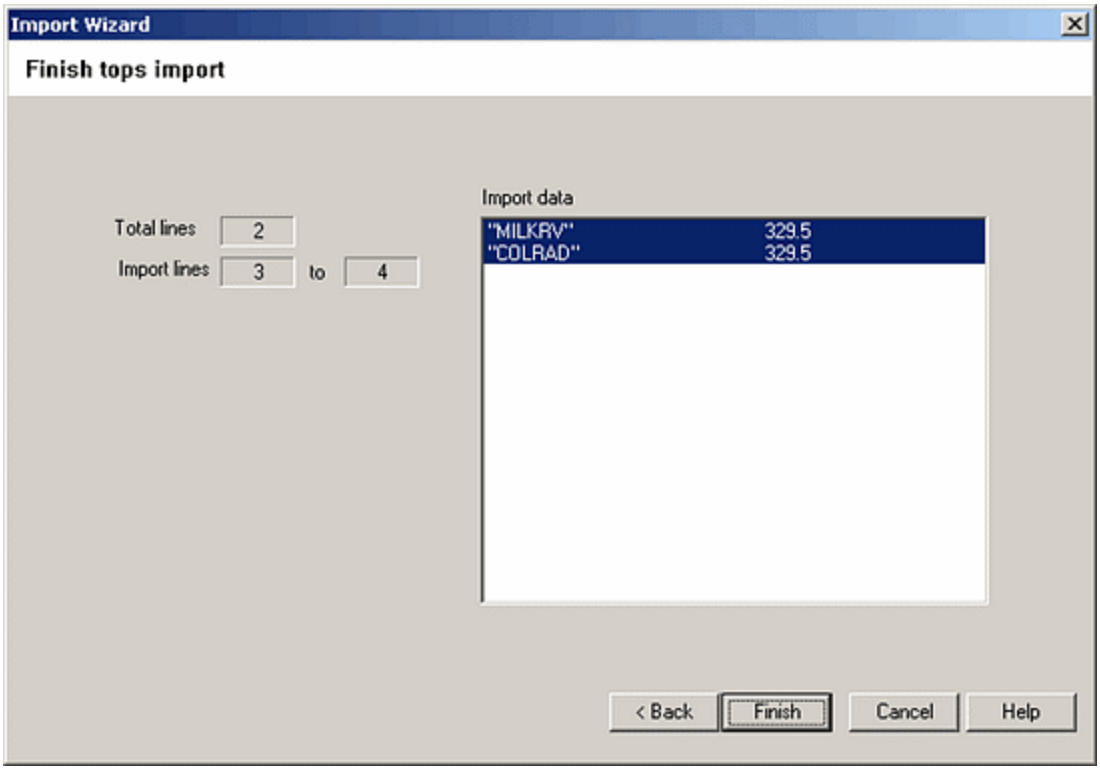


Set the column delimeters (↑) by clicking in the display pane between required columns. The green line cannot bisect a data column. Double-click column delimiters to delete.

Click the box that appears below each delimeter to display the *Select from List* dialog box and identify the data type then click **Next**.

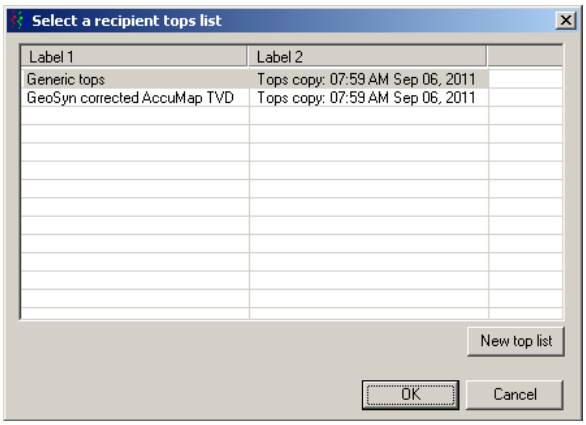


The Import Wizard: Finish dialog box opens.



5. Click **Finish**.

The *Select a recipient tops list* dialog box opens.



6. Select the list to which to import the tops or click **New top list** and define a new tops list, and then click **OK**. Shift+Click or Ctrl+Click to select more than one tops list to import into the list of tops.

Related topics

"Duplicating tops lists" on page 91

"Tops Lists" on page 89

"Importing tops from delimited files" on page 97
"Importing tops from GeoSyn files" on page 96
"Importing tops from LAS and ASCII Files" below

Importing tops from LAS and ASCII Files

Import tops lists saved in LAS, or ASCII format into the GeoSyn tops list so that they're available to your current synthetic.

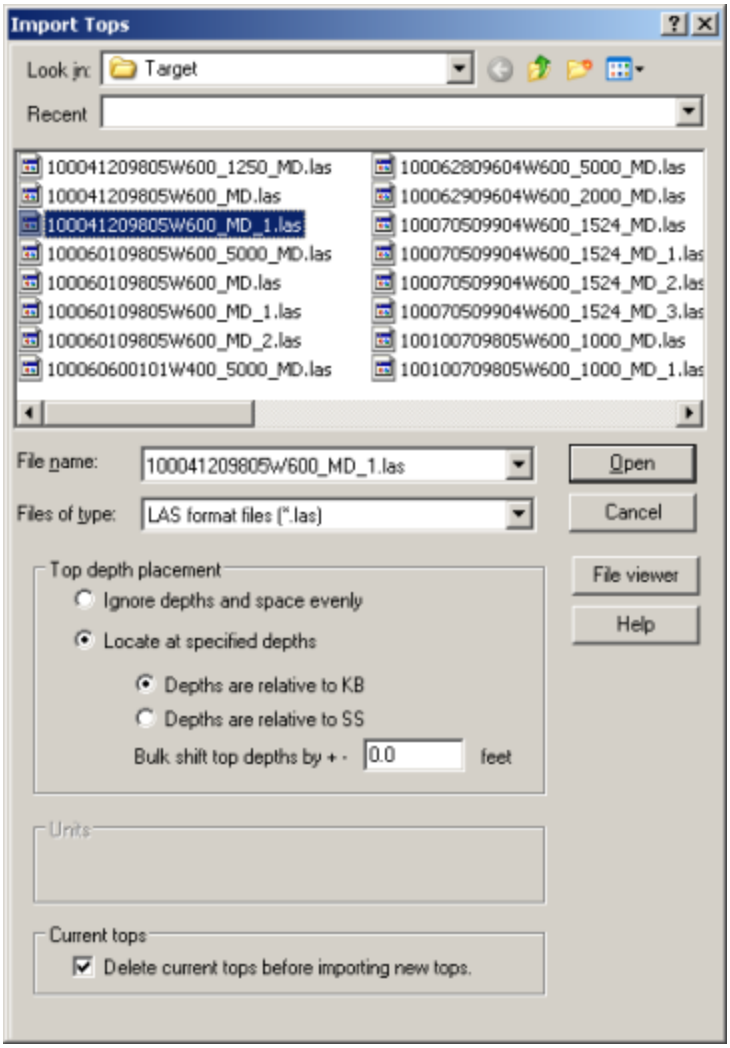
When importing tops, you have the option of overwriting existing tops in the list, if you keep the current tops, imported tops with the same name appear alongside them.

To duplicate and then modify an existing tops list within GeoSyn, see *Related topics* below.

To import tops from LAS and ASCII files:

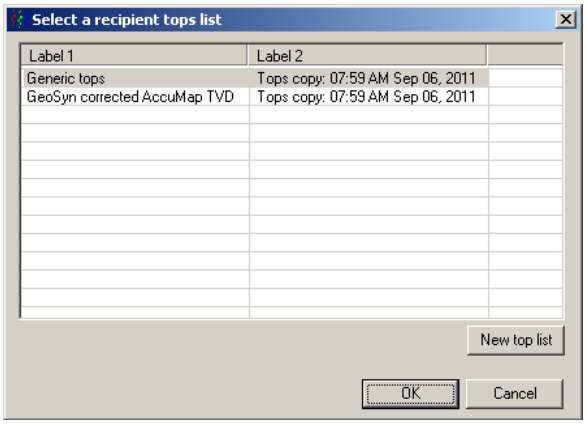
1. From the **File** menu, point to **Import**, click **Tops**, and then select **LAS file**.

The Import Tops dialog box opens.



2. Select the desired LAS file and select the depth placement options, units, and whether to delete current tops if importing into a tops list that's already populated, and then click **Open**.

The *Select a recipient tops list* dialog box opens.



3. Select the list to which to import the tops or click **New top list** and define a new tops list, and then click **OK**. Shift+Click or Ctrl+Click to select more than one tops list to import into the list of tops.

Related topics

"Duplicating tops lists" on page 91
"Tops Lists" on page 89
"Importing tops from delimited files" on page 97
"Importing tops from GeoSyn files" on page 96
"Importing tops from fixed width files" on page 99

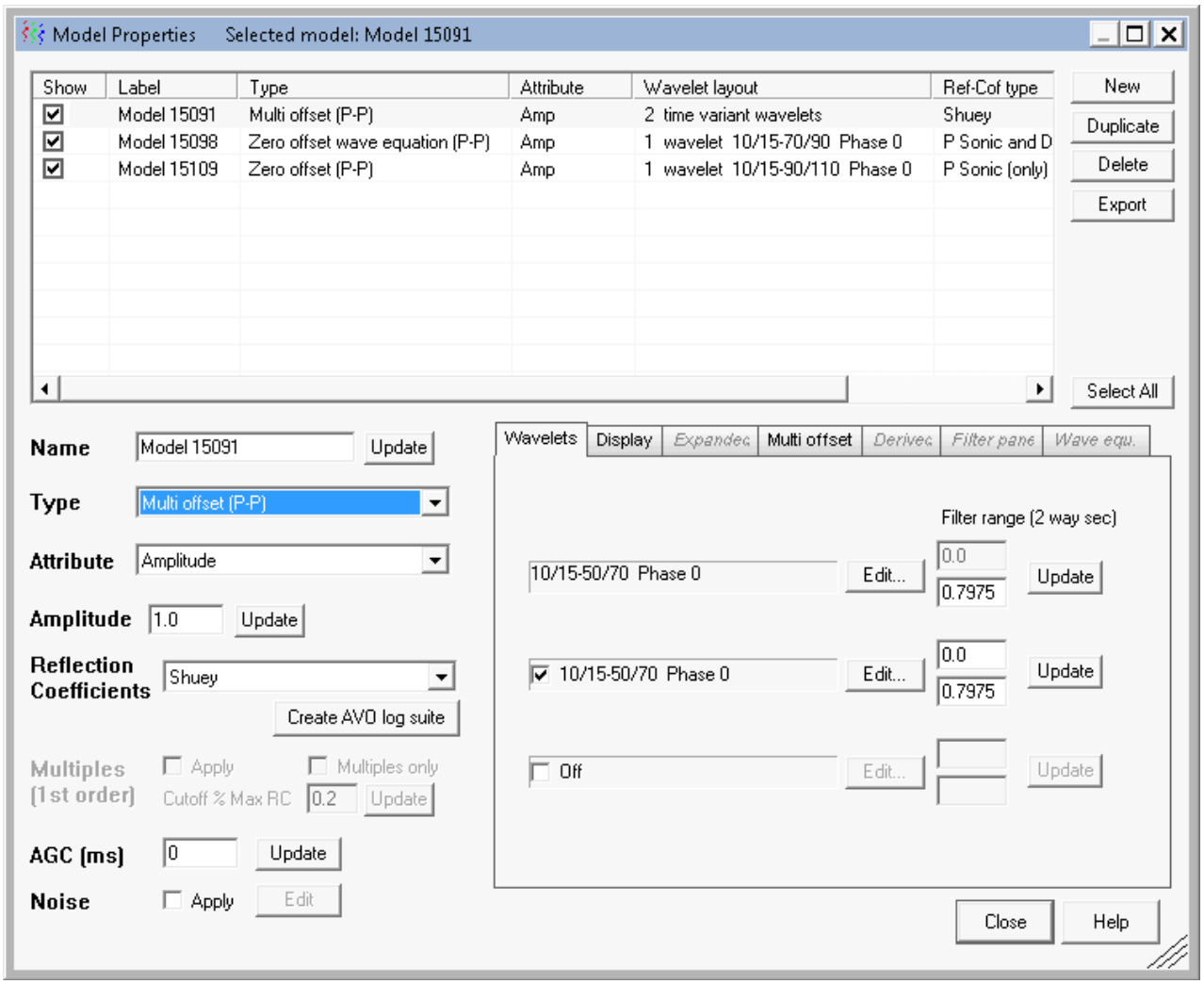
Creating models

Create a synthetic model to investigate the seismic response to a given geological situation. The response may be studied in zero or multiple offset mode with several reflection coefficient dependency options.

To create models:

1. From the **Edit** menu, select **Model Properties** ( ).

The Model Properties dialog box opens.



2. In the display pane, either click an existing trace and click **Duplicate** or simply click **New**.

A new row appears as the last entry in the display pane with either a random number or a *copy of* identifier depending on your selection above.

3. In the box below the display pane, type a more descriptive name for the trace selected in the display pane above, and then click **Update**.

4. Select the model type and trace properties. Depending on the model type and attributes you select, corresponding tabs right of the model default properties become active and one of the following tab display: Wavelets, Display, Expanded, Multi offset, Derived, or Filter Panel.

For details on using the various tabs, see *Related topics* below.

Related topics

"Changing wavelet properties" on page 143
"Changing wavelet expansion properties" on page 145
"Changing derived properties" on page 128
"Creating AVO logs" on page 112
"Changing multi-offset properties" on page 129
"Changing color palettes" on page 131

Applying multiple filters across a group of traces

Filter the low and high frequency across a group of traces.

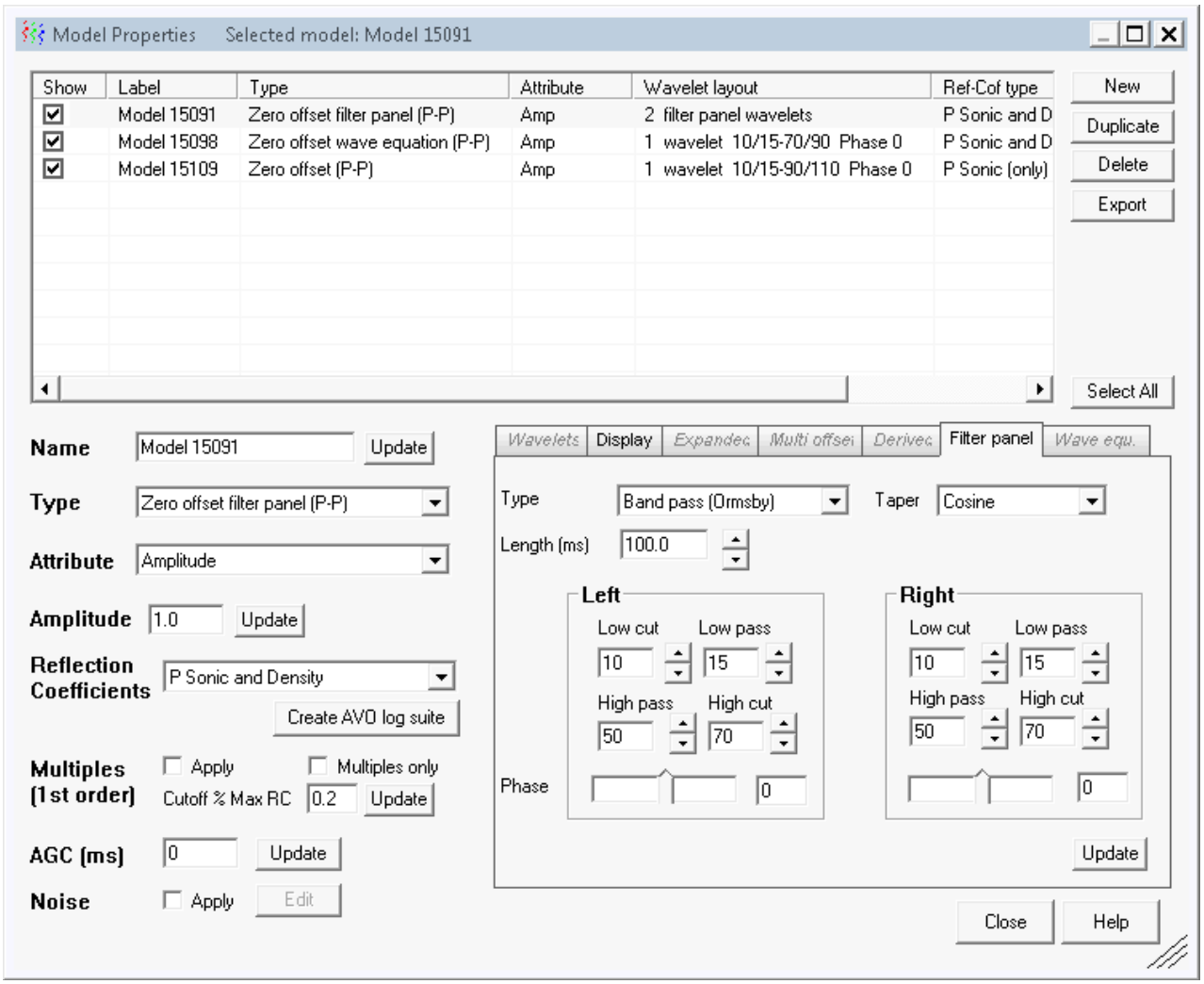
For zero offset models, apply one filter starting at the left-most trace of a group of traces and a second filter to starting at the right-most trace with both filters working towards the middle of the group of traces.

The two filters must share the same type, taper, and operator length, but the low and high cut and pass, and the phase can be unique for each.

To apply multiple filters across a group of traces:

1. From the **Edit** menu, select **Model Properties** ().

The Model Properties dialog box opens.



2. In the display pane, click a trace(s) with which to apply the filter. You can also duplicate or create a new curve by clicking **Duplicate** or **New**.

3. In the *Type* box to the left below the display pane, select **Zero offset filter panel (P-P)**.
A default setting of 20 traces per group is applied. Trace settings can be changed using the Display tab.

4. Using the Filter panel tab, specify the type, taper, operator length, and then different filter settings for the left and right traces, which taper towards the middle of the group of traces. The phase can also be shifted separately for the left and right traces.

Related topics

"Creating models" on page 106

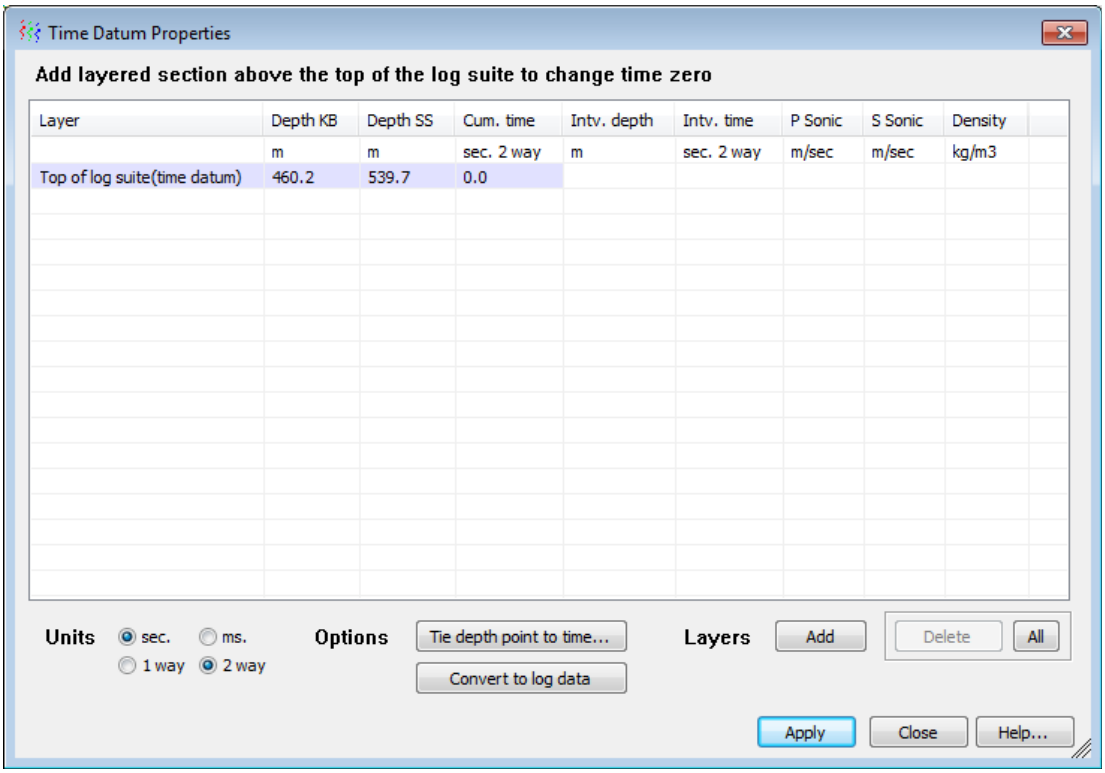
Changing time datum properties

Add zones above the sonic log to lower it to the same depth as the seismic section (time zero). These zones can be hidden in the main display but still exert their effect on the main display. The added zones are helpful when doing AVO analysis instead of using the Log Editor to manually add visible sections to the top of the log.

To change time datum properties

1. From the **Edit** menu, click **Time Datum** (T_0).

The Time Datum Properties dialog box opens. If the model was built by importing data from Kingdom, a zone is automatically created to account for the difference between the top of seismic section and the top of the sonic log.



2. To the right of the *Layers* label, click **Add** to create a default zone with a thickness of zero to the top of the *Add Layered Section...* pane of the *Time Datum Properties* dialog box.

3. Hover the cursor over fields in the newly created row until the cursor appears as follows: , click to type details for a given field, and then press **ENTER** or click a different location in the pane.

4. Select from the following options:

Tie depth point to time - click to display the Tie to Datum dialog box where you correlate a sonic log depth to a time point on the seismic section. This tie point is honored throughout GeoSyn, for example, whey you export SEGY data.

Convert to log data - click to convert the otherwise invisible section to a visible part of the log in the main display.

Related topics

Importing Wells from Kingdom

Creating AVO Logs

Inserting Log Sections using Log Editor

Creating AVO logs

Create an entire suite of logs that can be used for AVO analysis using reflection coefficients. Instead of creating each type of log individually, one selection from the Reflection Coefficients drop-down list enables you to create them with a single click.

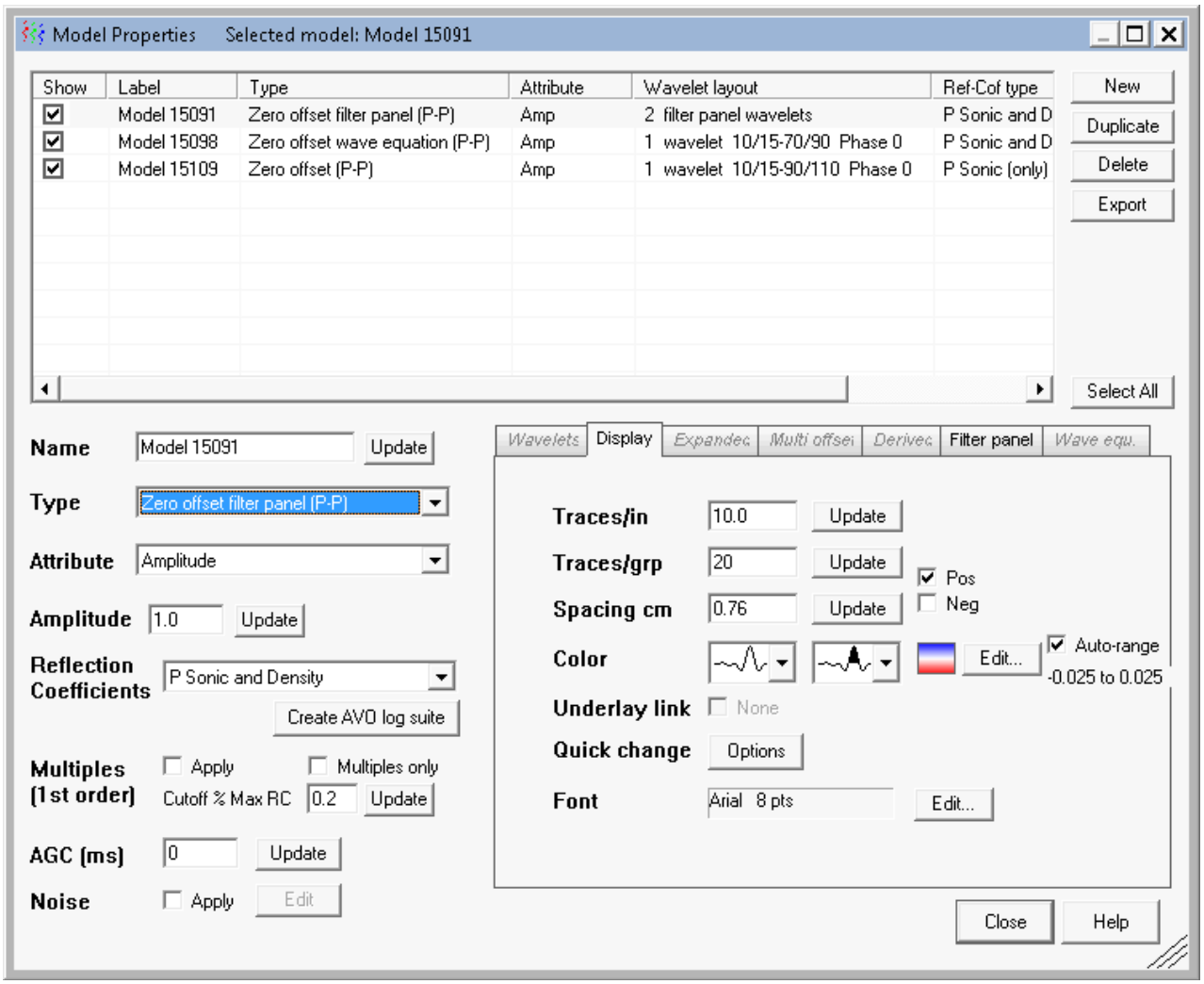
Access more general log creation functionality from the *Well Properties: Log Properties* dialog box or create a new log populated with values from an equation that uses existing logs using the Math dialog box. For details, see *Related topics* below.

Use the Edit > Time Datum dialog box to add zones above the log to push the log down to time zero so that it matches the seismic. For details, see *Related topics*.

To create AVO logs:

1. From the **Edit** menu, select **Model Properties** ().

The Model Properties: Display dialog box opens.



2. Select the desired model(s) in the display pane, and then select a reflection coefficient equation from the drop-down list.

3. Select the logs upon which to base your derived logs, and then click **Create AVO log suite**.

The *AVO log suite* dialog box opens.

4. Select the log types to create, and then click **OK**.

5. In the main *Model Properties* dialog, click **Close** to return to the main synthetic display with the changes applied.

Related topics

"Creating models" on page 106

"Changing multi-offset properties" on page 129
"Changing log display properties" on page 52
"Applying math equations to logs" on page 77

Modelling fluid replacement

In Amplitude vs. Offset modelling, as seismic waves reflect off an interface, the amplitude of the reflected wave is affected by the amount and type of fluid that occupies the pore space of the rock.

GeoSyn applies Gassman's equation to model this using a P sonic, shear sonic, and density log. You change the water saturation to apply different scenarios to your model. The available pore space not saturated with water is assumed to contain oil and gas.

Click for in-depth details on how fluid replacement modelling is implemented in GeoSyn.

To model fluid replacement:

1. From the **Edit** menu, select **Log editing** ().

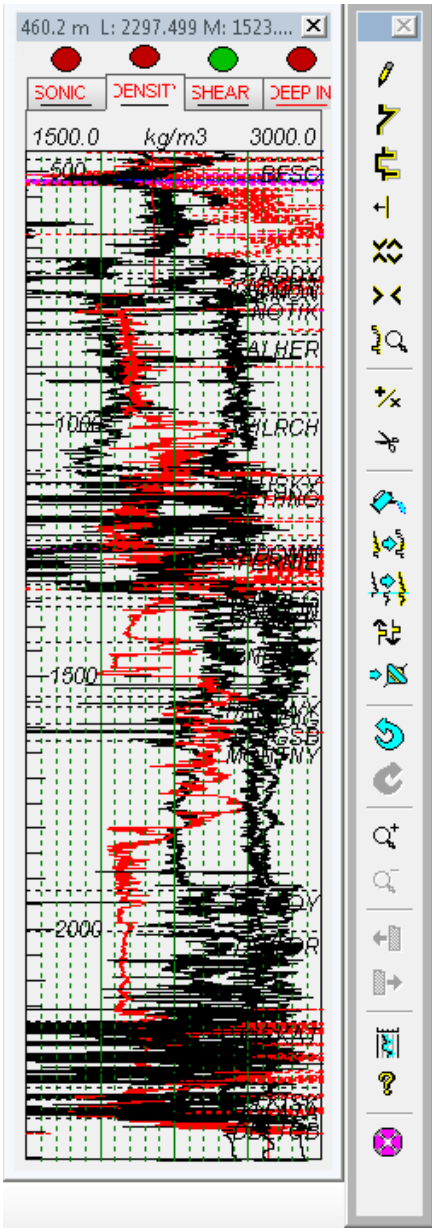
OR

Double-click the log

OR

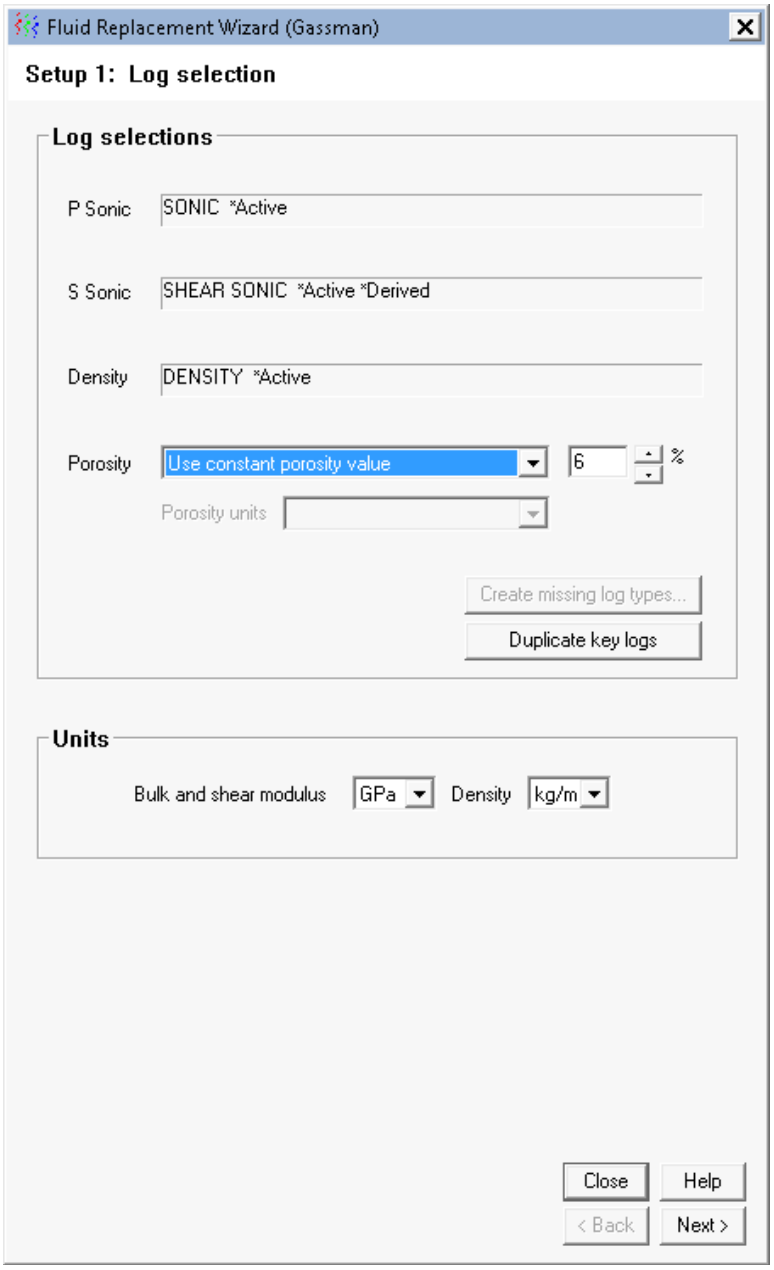
Right-click the log and select **Log editing**.

The Log Editor dialog box opens.



2. In the toolbar beside the *Log Editor*, click the **Fluid Replacement Modelling** tool ( ).

The Fluid Replacement Wizard (Input and output logs, depth range) dialog box opens.



3. GeoSyn automatically populates the Input logs and Output logs drop-down lists if the required logs are available in your model; otherwise, click **Create Missing Log Types** to display the *Generate Logs for Well...* dialog box and select the log types to create, and then click **Create** after noting the following:

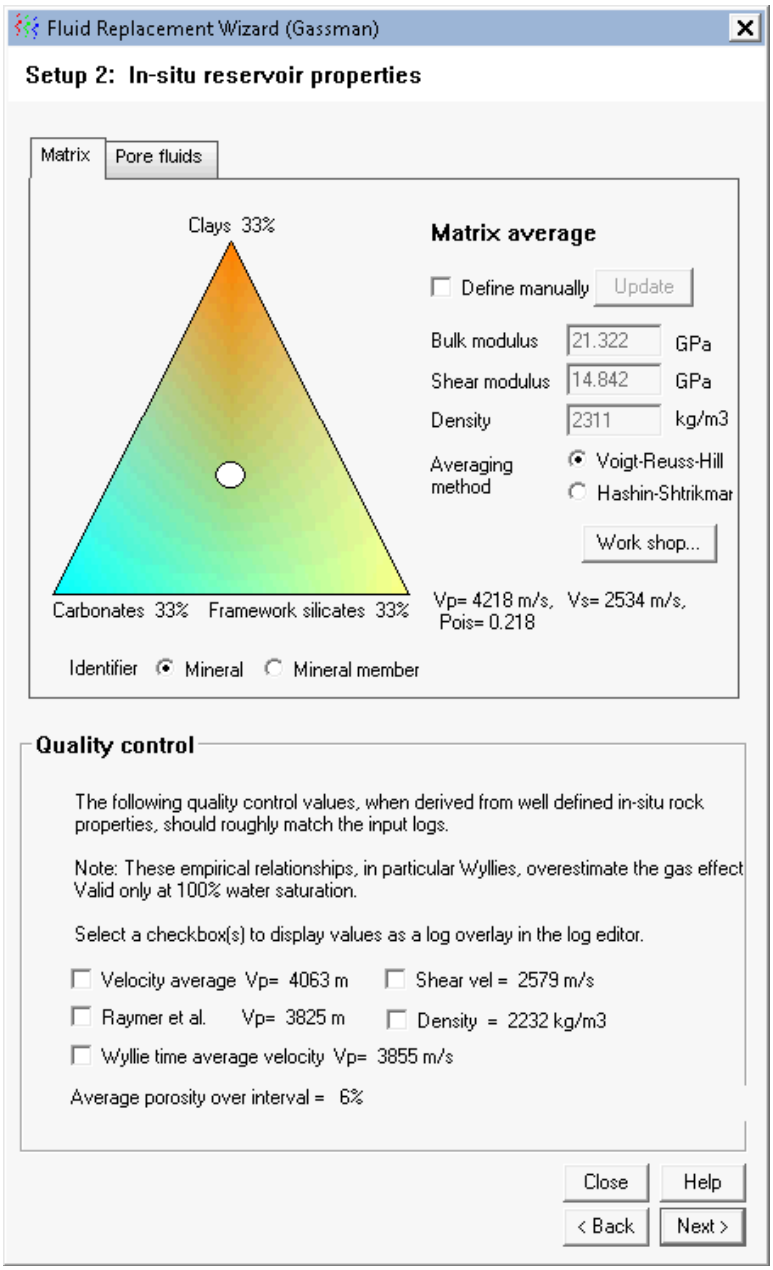
Click the log types to create in the left column and ensure **Maintain link** check box is cleared so that changes made to the derived log aren't overwritten by the parent log.

Click **Edit** to the right of a log type to display the Edit the Derivation Equation for Log dialog box and modify the equation used to derive the log.

Click **Duplicate Key Logs** to create exact copies of existing logs in your model for the input logs. You might do this if you want to keep a pristine copy of the original logs.

4. Click **Next**.

The Fluid Replacement Wizard (In-situ reservoir properties) dialog box opens.



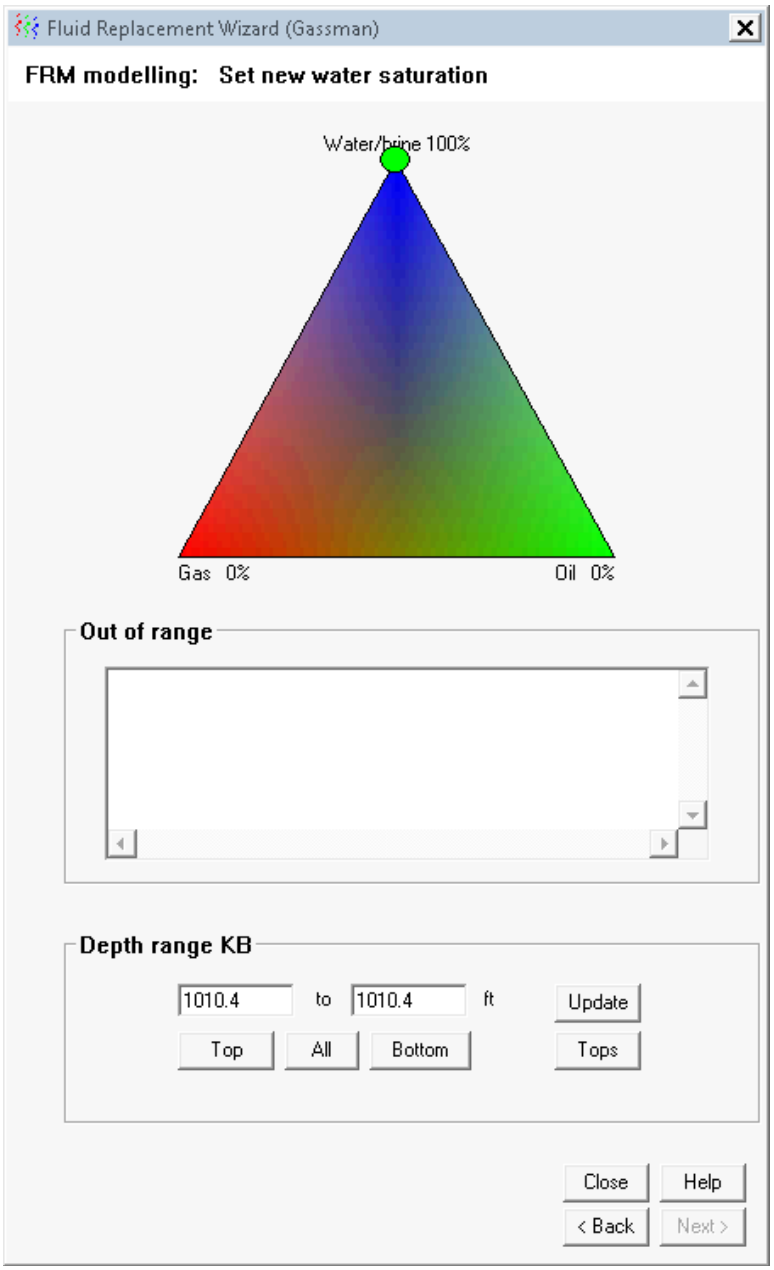
5. Using the image in the top-left of the *Matrix* and *Pore Fluids* tabs, click to place the white circle in the mineralogy and pore fluid zones that most closely define the rock properties in the subsurface.

Click **Workshop** to display either the Minerals Calculator or the Batzle and Wang Fluid Properties Calculator dialog boxes and select criteria more specific to your zone of interest.

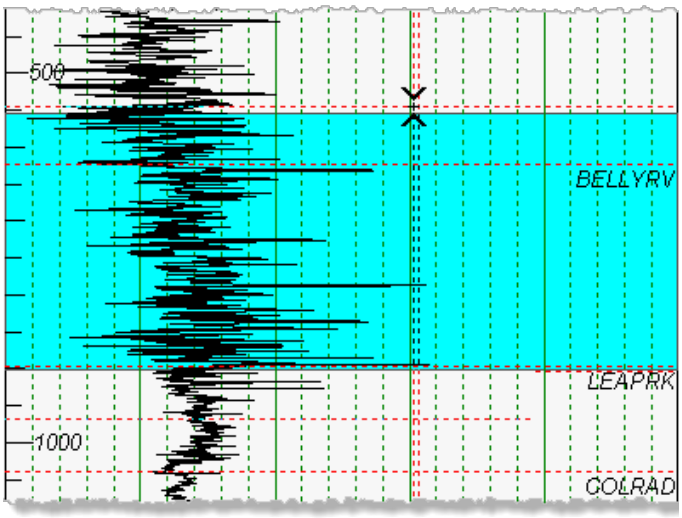
6. Click **Next**.

The Fluid Replacement Wizard (Calibrate shear log for water saturations < 100%) dialog box opens if the water saturation defined using the previous dialog box is less than 100%. This option compensates for the fact that the shear log is frequently derived from a sonic log using Castagna's formula. Castagna's formula requires a correction when gas is present in the zone of interest. Select the check box and click **Next**.

The Fluid Replacement Wizard (FRM Modelling: Set new water saturation) dialog box opens.



7. Ensure the above dialog box doesn't overlap the *Log Editor* displaying the well for which you're modifying water saturation, and then using the *Log Editor*, drag the mouse to select the area of interest as depicted below.



The *Depth Range* fields are updated in the *Fluid Replacement Wizard*.

To define the area of interest using formation tops instead, click **Tops** to display the *Depth Range from Tops* dialog box, where you select the top and bottom formations for the zone.

8. Click the thumbnail or drag the green circle to the desired fluid composition and then click **Close** to complete the wizard and apply the changes.

Related topics

"Changing log display properties" on page 52
"Notes on GeoSyn fluid replacement " on page 124

Changing model porosity

Porosity is modeled by changing a well logs density and or velocity.

- Sonic porosity(Vp) is calculated using one of three selectable equations:
  - Wyllies time average $$V_p = \frac{1}{(\frac{\emptyset}{V_{fl}} + \frac{(1-\emptyset)}{V_m})}$$
  - Velocity average $$V_p = (1 - \emptyset)\, V_m + \emptyset V_{fl}$$
  - Raymers et al. $$V_p = (1 - \emptyset)^2\, V_m + \emptyset V_{fl}$$

  (m) mineral matrix, (fl) pore fluid

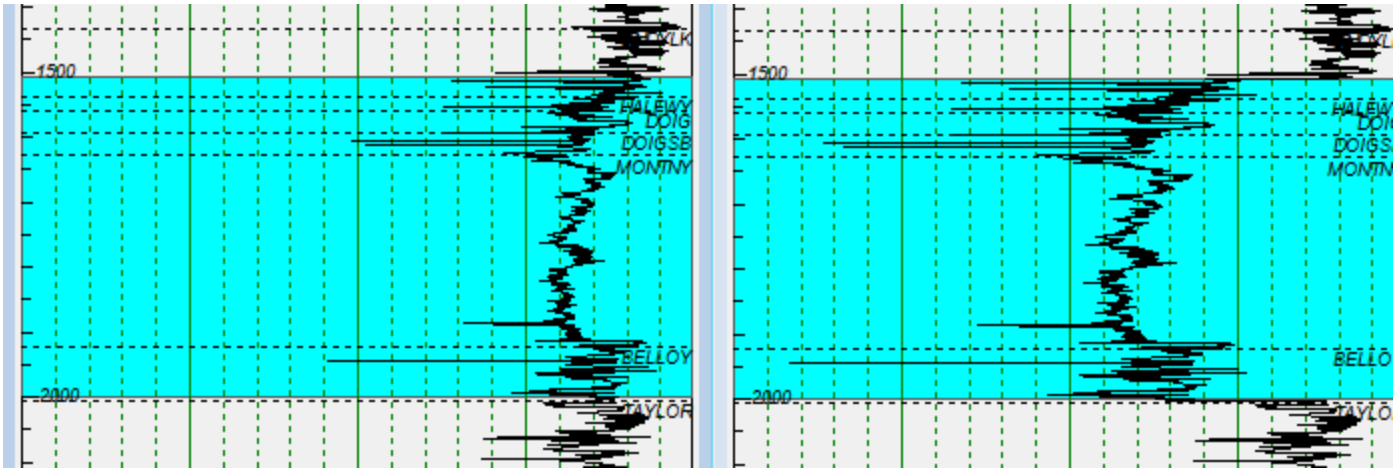
- Density porosity (ρ_B) is calculated as a simple volumetric average of the densities.

$$\rho_B = (1-\phi)\rho_m + \phi\rho_{fl}$$

(m) mineral matrix, (fl) pore fluid

Note: Mineral matrix velocities are calculated internally by solving the velocity equation for mineral velocity followed by plugging in the VP and fluid velocities. Once mineral matrix velocities are known then the equation is reset to solve for Vp and porosity may be adjusted, which changes VP.

Below is an example of changing the porosity from 13% to 30% using the model porosity tool.

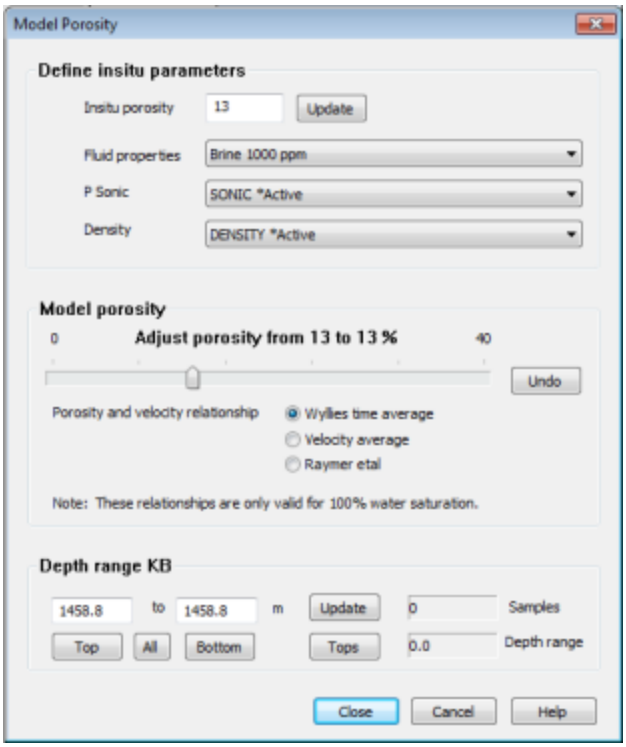


Insitu porosity = 13% Model porosity = 30%

To model the porosity of a log:

Modify the percentage of porosity to a selected portion of a log using the Log Editor.

1. Open the Log Editor.
2. Click the **Model porosity tool** ( ) on the Log Editor toolbar to open the Model Porosity dialog.



3. Enter the logs **Insitu** porosity value and click **Update**. This creates a starting point for the porosity model.
4. Select a value for the fluid property from the drop down list.
5. Select a **P Sonic** and or **Density** log.
6. Select a velocity equation to apply to the model. See equations above.
7. Set the depth range. Once set, the number of samples and a measurement for the selected depth range will be updated on the dialog. The depth range will also be highlighted in on the log in cyan . The depth range is set using one of four methods:

- Click and drag the Log editor cursor to select a depth range.
- Type values in the depth fields and click **Update**
- Click **Top** or **Bottom** to accept the absolute depth from the log or click **All** to accept both
- Click **Depths from tops** to display and select formation tops that signify your zone of interest from a drop-down lists .

8. Use slider to change percentage of porosity. Changes made will be reflected on the selected Sonic and density logs.
9. Click **Close** to apply changes or **Cancel** to discard changes.

Related topics

"Model porosity dialog" on page 276

Notes on GeoSyn fluid replacement

Introduction

GeoSyn uses the Biot-Gassman fluid substitution method.

There are other approaches to fluid substitution (empirical and heuristic) which avoid the porous frame calculations but often do not yield reliable results. GeoSyn provides some empirical Vp information (Wyllie's time average, Average Velocity and Raymers equation) as a check for consistency between the modelled log data and the in-situ rock parameters. In general, and in particular for Wyllie's equation, these empirical relationships fall down when substituting gas for water and cannot be used reliably for fluid substitution.

The following overview is based largely on the bible of the field "The Rock Physics Handbook."

Some basic equations

The mechanics of fluid substitution on the density and shear logs is simple. For the density log, fluid substitution can be written:

$$\rho_{b2} = \rho_{b1} - (\emptyset\rho_{f1} - \emptyset\rho_{f2})_{(1)}$$

where ρ_{b1} is the initial rock bulk density, ρ_{b2} is the bulk rock density after fluid substitution, ρ_{f1} is the initial fluid density, ρ_{f2} is the density of the substituting fluid,

and φ is the porosity. The substituted rock density ρ_{b2} is simply the fractional difference attributable to the fluid change in the pore space.

Given the fact that in Biot-Gassmann's model the shear modulus μ is independent of the pore fill, the substituted Vs depends only on the change in density:

$$V_{s2} = \sqrt{\frac{\mu}{\rho_{b2}}} \quad (2)$$

This means, of course, that substitution of hydrocarbon for water will result in a lowering of bulk density and an increase in Vs.

Calculating the fluid substitution effect on the compressional wave velocity V_p, as measured by the sonic log, is not so straightforward because it depends not only on the substituted density and the shear modulus, but also on the saturated bulk modulus Ksat:

$$V_p = \sqrt{\frac{K + \frac{4\mu}{3}}{\rho}} \quad (3)$$

In turn, the bulk modulus of the new rock $Ksat$ requires knowledge of the mineral modulus K_m, the fluid modulus K_{fl} and the bulk modulus of the unsaturated rock K_{dry} (Mavko and Mukerji, 1995; Avseth et al., 2005):

The Biot-Gassman equations

$$Ksat = K_{dry} + \frac{(1 - \frac{K_{dry}}{K_m})^2}{\frac{\emptyset}{K_{fl}} + \frac{1-\emptyset}{K_m} - \frac{K_{dry}}{K_m{}^2}} \quad (4)$$

Solving for K_{dry}

$$K_{dry} = \frac{Ksat\,(\frac{\emptyset K_m}{K_{fl}} + 1 - \emptyset) - K_m}{\frac{\emptyset K_m}{K_{fl}} + \frac{Ksat}{K_m} - 1 - \emptyset} \quad (5)$$

$$\mu_{dry} \cong \mu_{sat}$$

The shear modulus is the same dry or saturated.

Where

V_s = shear wave velocity

V_p =compressional wave velocity

K_{dry}=effective bulk modulus of dry rock

$Ksat$=effective bulk modulus of the rock with pore fluid

K_m=bulk modulus of mineral material making up rock

K_{fl}=effective bulk modulus of pore fluid

$\emptyset$=porosity (fractional)

μ_{dry}=effective shear modulus of dry rock

μ_{sat}=effective shear modulus of rock with pore fluid

Performing the fluid substitution

In plain terms the Biot-Gassman relationship allows one to calculate the saturated bulk modulus and resultant Vp (equation 3) from a combination of the dry bulk modulus K_{dry}, the fluid bulk modulus K_{fl} and the mineral bulk modulus K_m.

Modeling the changes from one fluid type to another requires that the effects of the starting fluid first be removed prior to modeling the new fluid. i.e. calculate K_{dry}. In practice, the rock is drained of its initial pore fluid, and the moduli (bulk and shear) and bulk density of the porous frame are calculated. Once the porous frame properties are properly determined, the rock is saturated with the new pore fluid, and the new effective bulk modulus and density are calculated.

A direct result of Gassmann's equations is that the shear modulus for an isotropic material is independent of pore fluid, and therefore remains constant during the fluid substitution process. In the case of disconnected or crack like pores, however, this assumption may be violated. Once the values for the new effective bulk

modulus and bulk density are calculated, it is possible to calculate the compressional and shear velocities for the new fluid conditions.

A two-step calculation is required. In-situ saturation to dry saturation followed by dry saturation to new fluid saturation.

1. Calculate the dry bulk modulus using the in-situ saturated bulk modulus $Ksat$ and in-situ fluid modulus K_{fl}. $Ksat$ is calculated using equation 3, which is where the original log data V_p is used.

2. Calculate the new saturated bulk modulus $Ksat$ using the dry bulk modulus K_{dry} and a new fluid modulus K_{fl} reflecting the changes in gas/water saturation. With the new $Ksat$ and using equation 3 a new V_p can be calculated.

What can a GeoSyn user take from this?

The in-situ reservoir parameters for matrix bulk and shear modulus and density must be correct for the log section being analyzed.

For example you could incorrectly describe an extremely high modulus matrix then apply it to a log section of very slow velocity. In reality such a rock should be quite fast. The equations will fail.

GeoSyn provides several empirical relationships to give users a ball park theoretical Vp based on the reservoir parameters. The Vp calculated from one or all of these equations should roughly match the Vp of the log data or something is wrong and the Biot-Gassman equations will not work properly. Note that these empirical relationships are not reliable when gas is the pore fluid. If they were reliable then the trouble and trickiness of using the Biot-Gassman equations would be unnecessary.

$V_m$is calculated using equation 3

Wyllies time average equation

$$V_p = \frac{1}{\left(\frac{\emptyset}{V_{fl}} + \frac{(1-\emptyset)}{V_m}\right)}$$

Velocity average equation

$$V_p = (1 - \emptyset) V_m + \emptyset V_{fl}$$

Raymers equation

$$V_p = (1 - \emptyset)^2 V_m + \emptyset V_{fl}$$

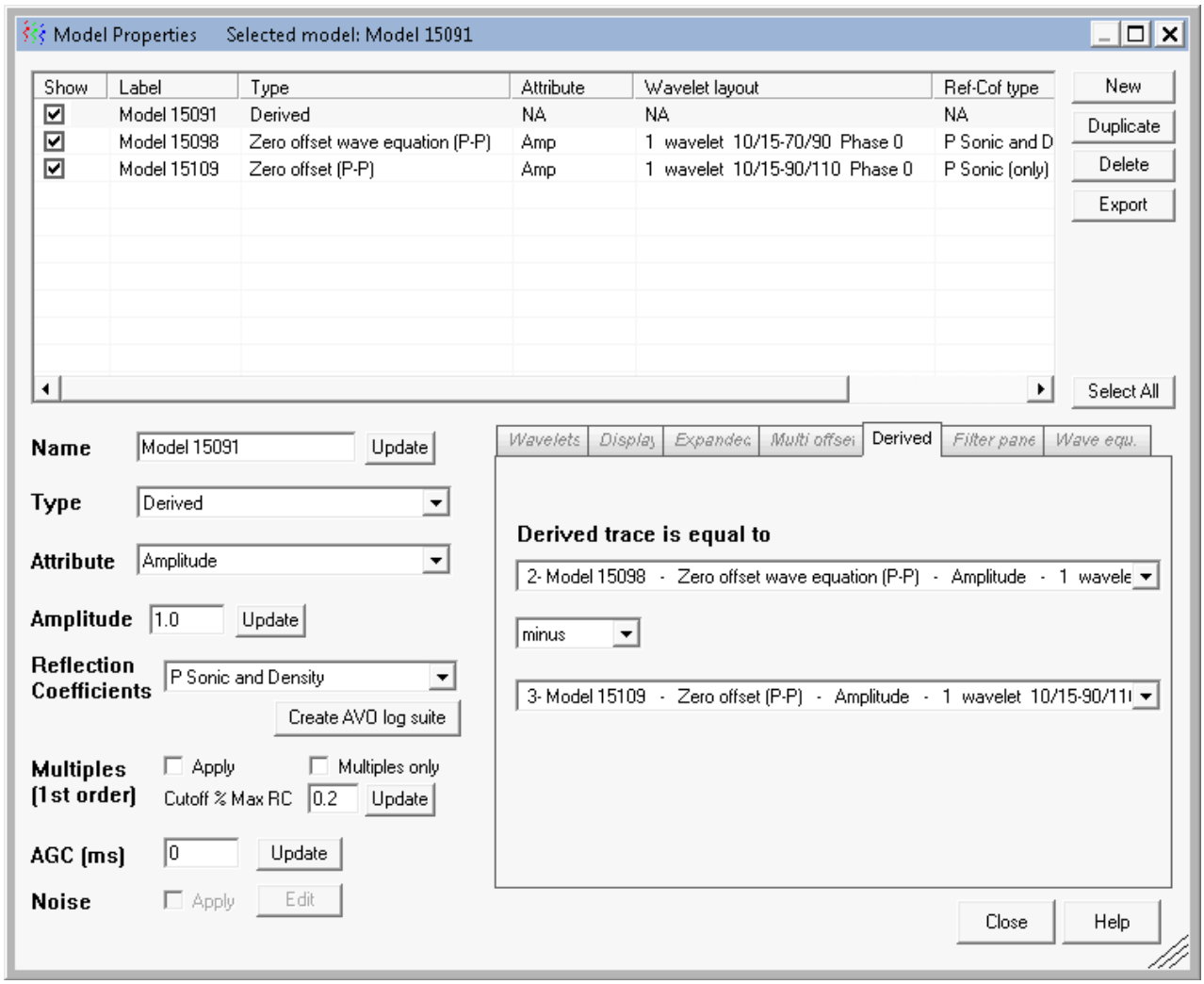
Changing derived properties

Generate a trace based on the results of a mathematical operation performed on two traces in the current synthetic.

To change derived properties:

1. From the **Edit** menu, select **Model Properties** ().

The Model Properties: Derived dialog box opens.



2. Select the desired model(s) in the display pane and select **Derived**from the Type drop-down list.
3. Using the drop-down lists in the Derived tab, select the trace and mathematical operator. The result of this equation becomes the derived trace.
4. In the main *Model Properties* dialog, click **Close** to return to the main synthetic display with the changes applied.

Related topics

"Creating models" on page 106

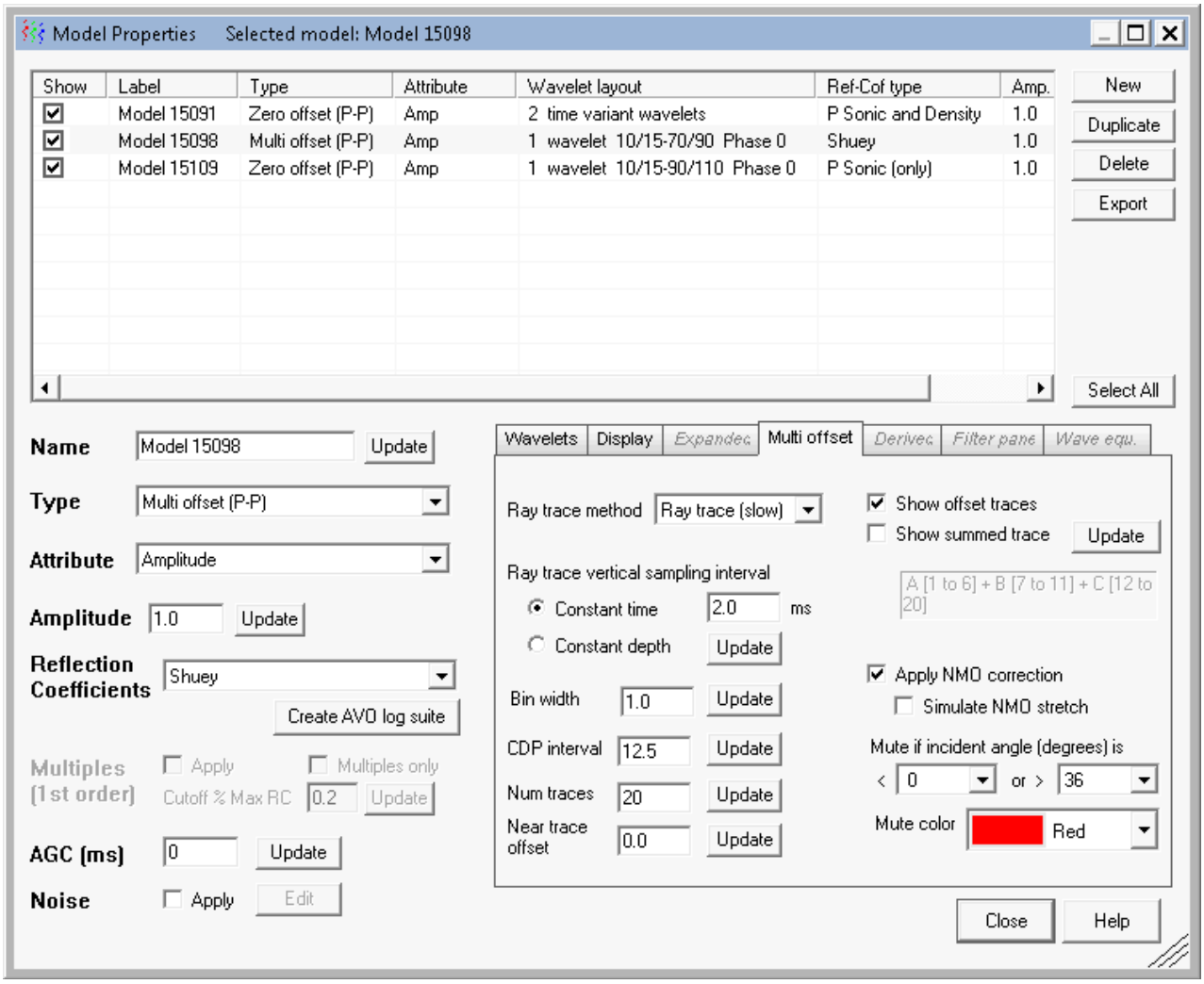
Changing multi-offset properties

Create multi-offset models for amplitude offset analysis. If summing traces, you can define groups of traces (near, middle, far) and then do mathematical operations between the three groups, which enables you to filter or enhance certain portions of the offset trace. For example, you might subtract the far traces from the near traces and then multiply the difference by the far traces to enhance the far offset amplitude.

To change multi-offset properties:

1. From the **Edit** menu, select **Model properties** ( ).

The Model Properties: Multi offset dialog box opens.



2. Select the desired model in the display pane and select **Multi offset** from the **Type** drop-down list.

3. Click the **Multi offset** tab and select the criteria.

If using summed traces, click **Edit** to display the Sum Options dialog box where you select the traces that make up the near, middle, and far group of traces, and then define an equation to process the groups.

4. In the main *Model Properties* dialog, click **Close** to return to the main synthetic display with the changes applied.

Related topics

"Creating models" on page 106

Changing color palettes

Specify color fills for logs and traces in seismic, logs, cross plots, models, and more. Color schemes can be loaded from stock color palettes that ship with GeoSyn, or from color templates you save in the GeoSyn *Working* directory with a *.pal* extension. Templates can be quickly applied to any synthetic and can be shared amongst GeoSyn users.

Color schemes can also be configured for the current synthetic without creating a template and automatically saved with individual GeoSyn files.

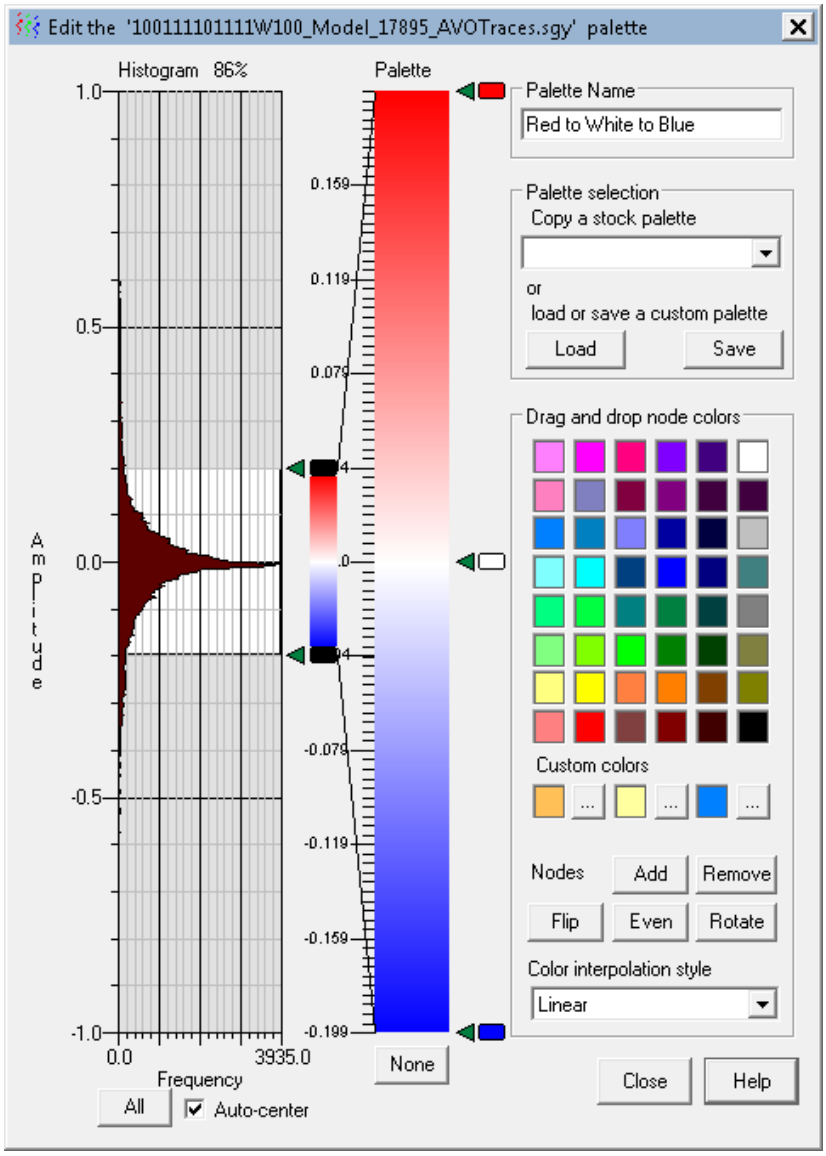
To automatically apply a color scheme to all new synthetics, apply it to the current synthetic then update the import defaults file with the current synthetic options.

When working with models and certain types of crossplots, you can drag the min max color nodes that appear at the top and bottom of the histogram to tighten them to the desired amplitude range so that a fuller color spectrum is displayed in GeoSyn. This option isn't available for cross plot properties with a depth-based color reference type, or for logs, as typically a certain color represents a certain log value and is related to lithology.

To change color palettes:

1. Open the Edit color palette:
   - *Well Properties: Log Properties*, select **Edit** adjacent to the Infill display ().
   - *Model Properties* dialog box, select **Edit** adjacent to the color display ().
   - *Seismic Properties* dialog box, select **Edit** adjacent to the Color underlay display ().

The Edit color palette dialog box opens. The top and bottom of the color bar represent the fixed extremes in the data values of the selected log or trace. Nodes along the display bar associate a color to a particular data value.



2. Choose a palette:

- **Copy a stock palette** drop-down list
- **Load** import a previously saved custom palette .
- **None** remove all colors

To create a custom color palette:

1. Creating a custom color bar can be done in several ways:

- Drag and drop color on existing node.
- Drag and drop color on the color bar. GeoSyn creates a corresponding node for each color you drop.
- Create a custom color

2. Type a unique name for this color configuration in the **Palette Name** box then click **Save** to save it in the GeoSyn *Working* directory.

Related topics

"Changing seismic properties" on page 162
"Changing log display properties" on page 52
"Creating models" on page 106
"Changing import defaults" on page 12
"Creating crossplots" on page 170

Displaying comments

Type comments about the processing applied to a synthetic that help clarify your interpretation. Actual operations that have been performed on a synthetic are stored in a GeoSyn file and can be automatically pasted into the Comments dialog box where you edit them.

The comments you create appear as an object in the main page of the synthetic anchored below the Tops table, or below where the Tops table would appear if the Tops table is hidden. When you move the Tops table, the Comments object moves too.

Once comments are displayed in the main synthetic, double-click (or right-click and select Edit) to change them.

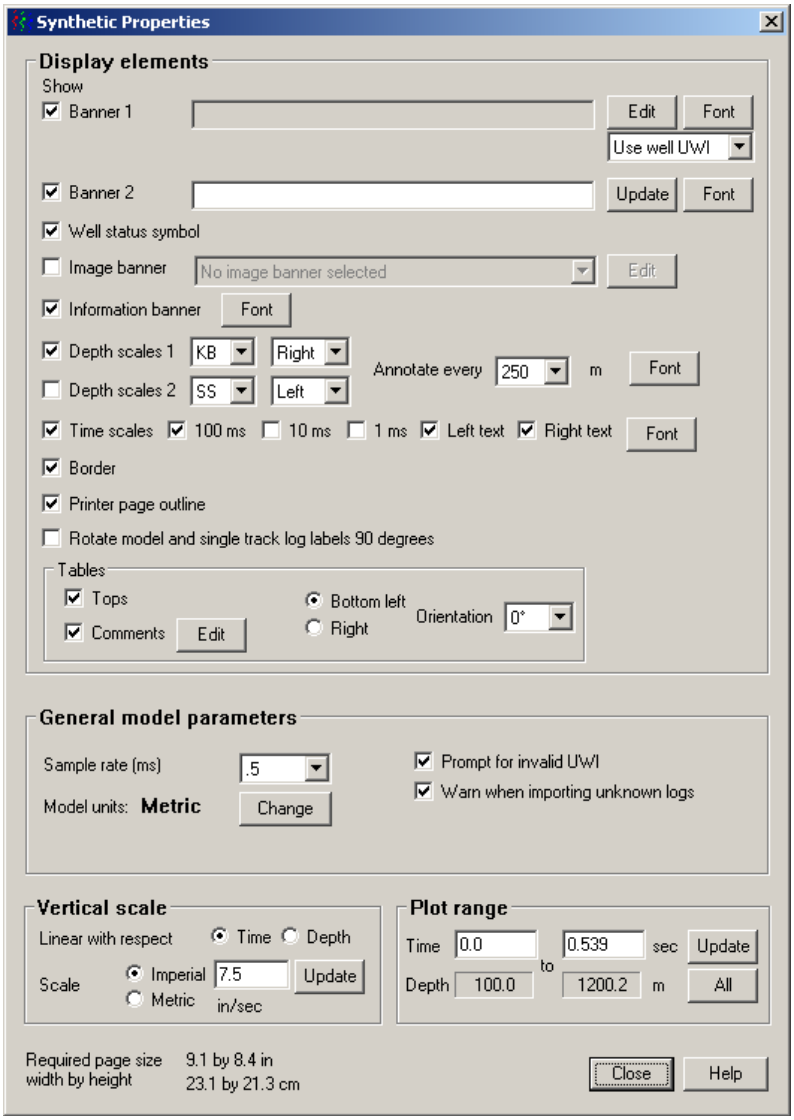
To display comments:

1. From the **Edit** menu, select **Synthetic properties** ( )

OR

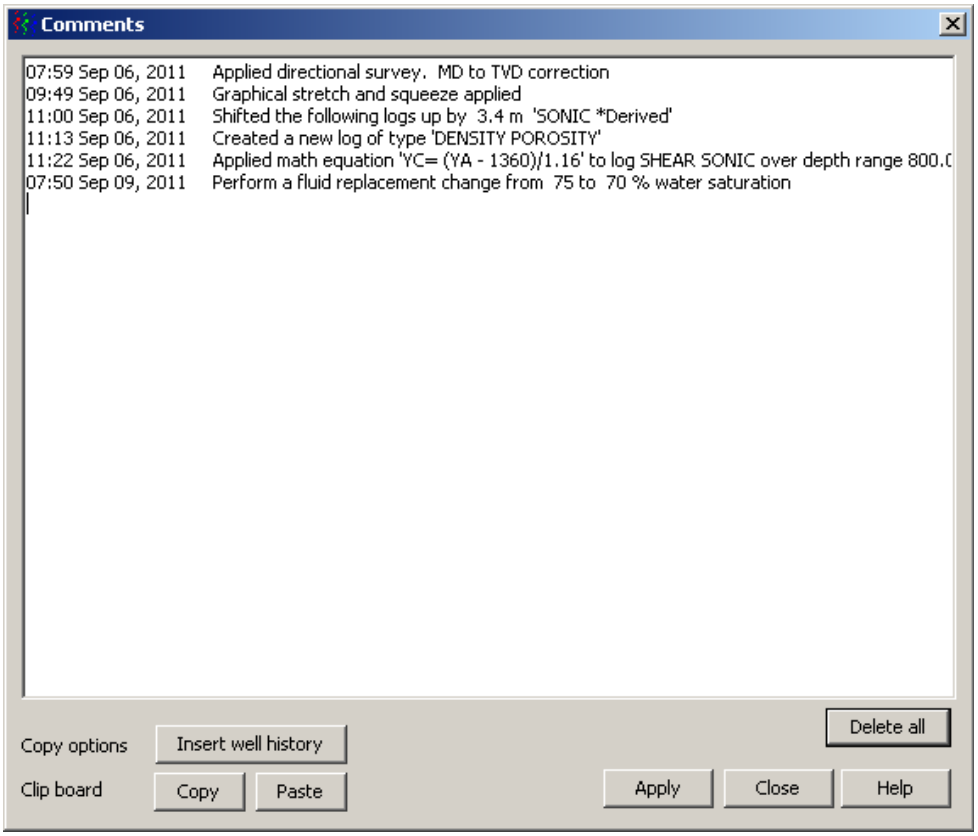
Right-click the well header and select **Synthetic properties**.

The Synthetic Properties dialog box opens.



2. Using the Tables pane, ensure the **Comments** check box is enabled, and then click **Edit**.

The Comments dialog box opens.



3. Do any of the following:

Type directly in the display pane.

Click **Insert Well History** to paste the operations performed on this synthetic into the display pane and then edit them.

Select text that appears in the display pane and click **Copy**, and then paste it in another program.

With text to paste copied to the Windows Clipboard from GeoSyn or a third-party application, click **Paste**.

4. Click **Apply** and then **Close** to display the Comments in the main synthetic immediately below the Tops table.

Like the Tops table, the Comments box that appears in the main display can be dragged to the desired location. The Tops table moves along with the comments box.

To change the comments displayed, double-click the Comments box that appears on the main display (or launch it using the steps above).

Related topics

"Changing the main synthetic display" on page 46

Importing wavelets and wavelet sets

Import wavelets in ASCII or SEGY format and import wavelet sets in *.wav* format. Wavelets can be saved and imported using a centralized library of wavelets you create. The wavelet library is shared by all GeoSyn projects.

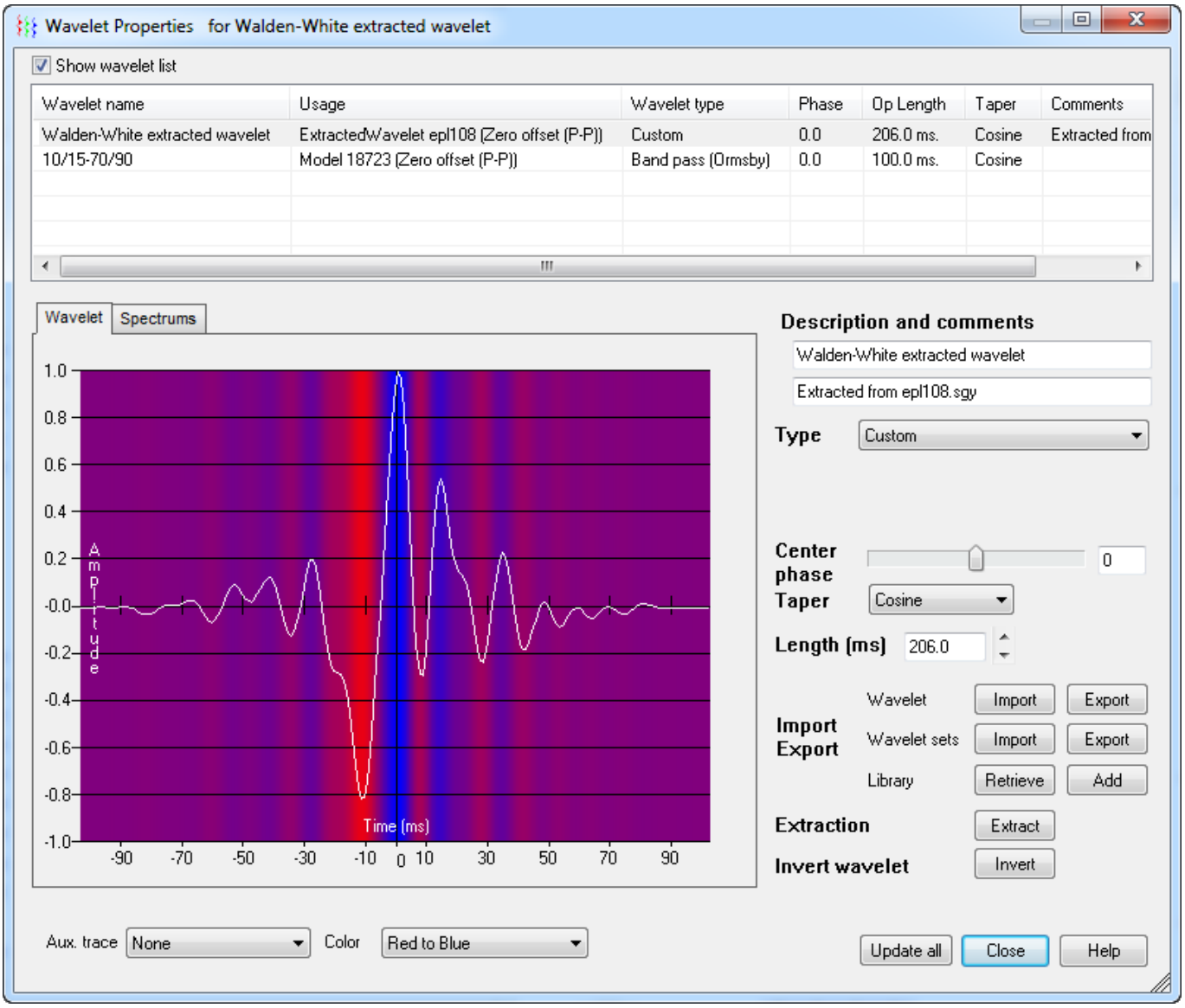
To avoid aliasing, GeoSyn doesn't extract frequency information that is higher than the Nyquist frequency of either the import data or the current synthetic, whichever is lowest.

Separate procedures for importing wavelets and wavelet sets appear below.

To import wavelets:

1. From the **Edit** menu, select **Wavelet properties** ().

The Wavelet Properties dialog box opens.

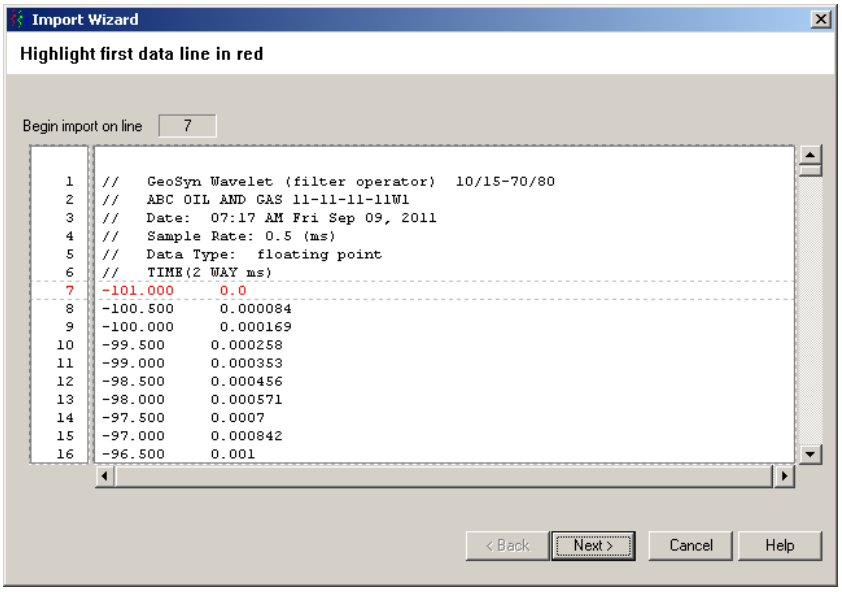


2. In the **Import/Export** pane, click **Import** to the right of the wavelet label to import a wavelet from disk. Alternately, import wavelets from a centralized wavelet library used by all GeoSyn models by clicking **Retrieve** to the right of the *Library* label to display the Wavelet Library dialog box, where you select the wavelet and then click **Import wavelet**; otherwise, continue with the below steps.

The *Import time data* dialog box opens.

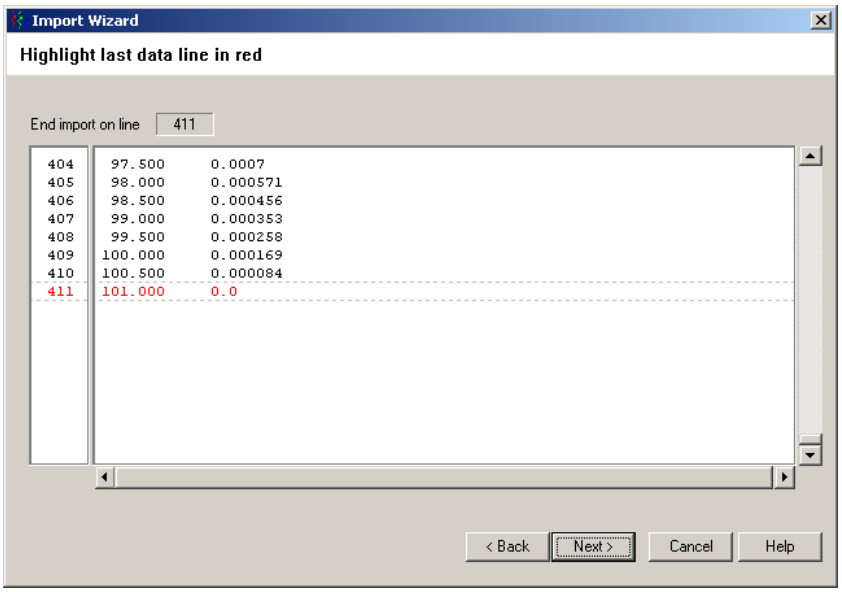
3. In the **Files of type** drop-down list, select whether to import SEGY or ASCII data then browse to and select the file.

If you select a SEGY file, the Import Wavelet Processing Flow dialog box opens; otherwise, if you select ASCII, the Highlight First Line dialog box opens.



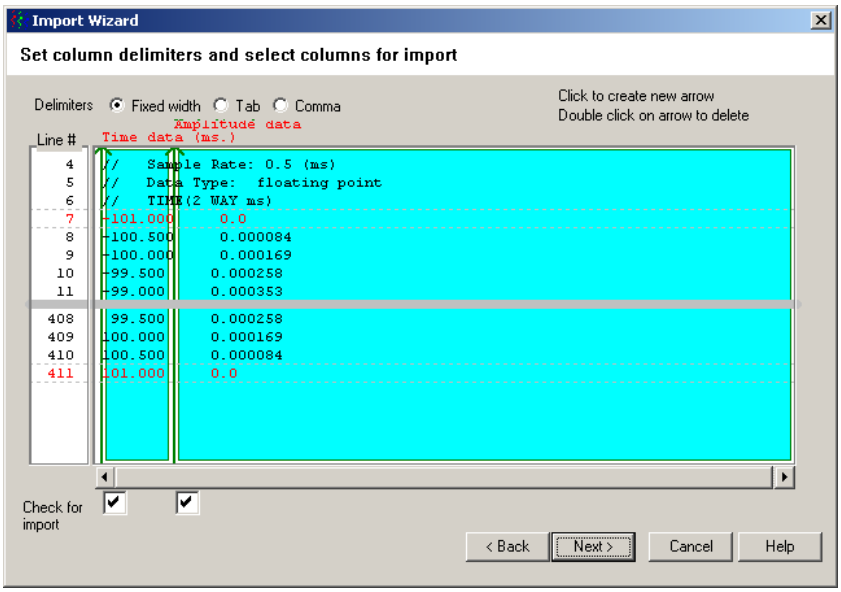
4. Select the first line to import then click **Next**.

The Highlight Last Line dialog box opens.



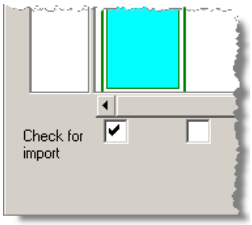
5. Select the last line to import the click **Next**.

The Set Column Delimeters dialog box opens.



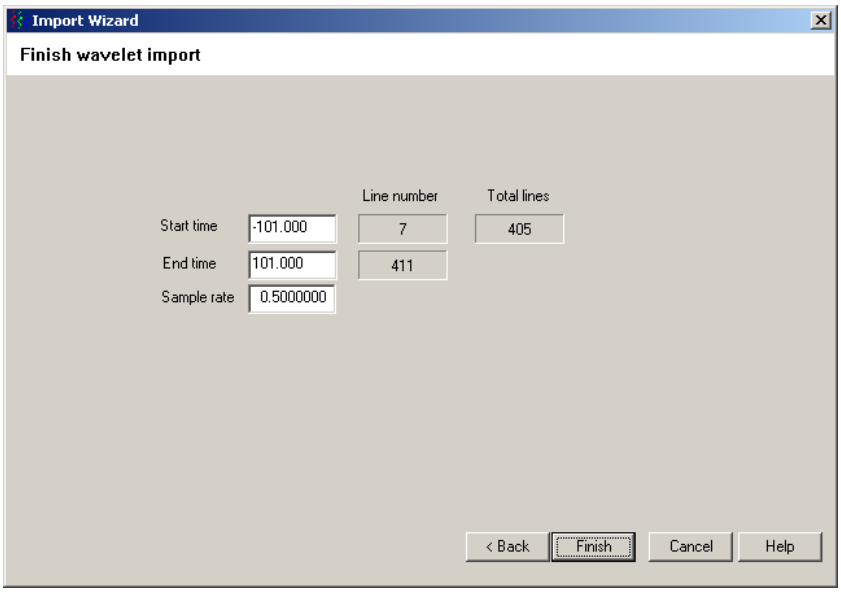
6. Set the column delimeters (↑) by clicking in the display pane between required columns. The green line can't bisect a data column. Double-click column delimiters to delete.

7. Click the box that appears below each delimeter to display the *Select from List* dialog box and identify the data type.



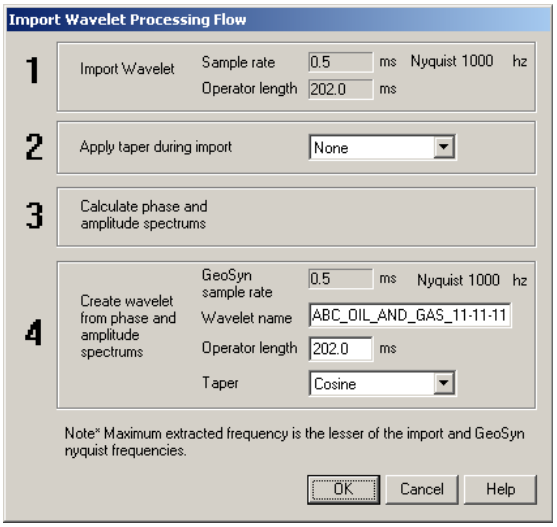
8. Click **Next**.

The Finish dialog box opens.



9. Click **Back** to change any previous selections or click **Finish**.

The Import Wavelet Processing Flow dialog box opens.



10. Specify whether to taper the file on import, the name by which to identify the wavelet, the length of the operator, and then click **OK**.

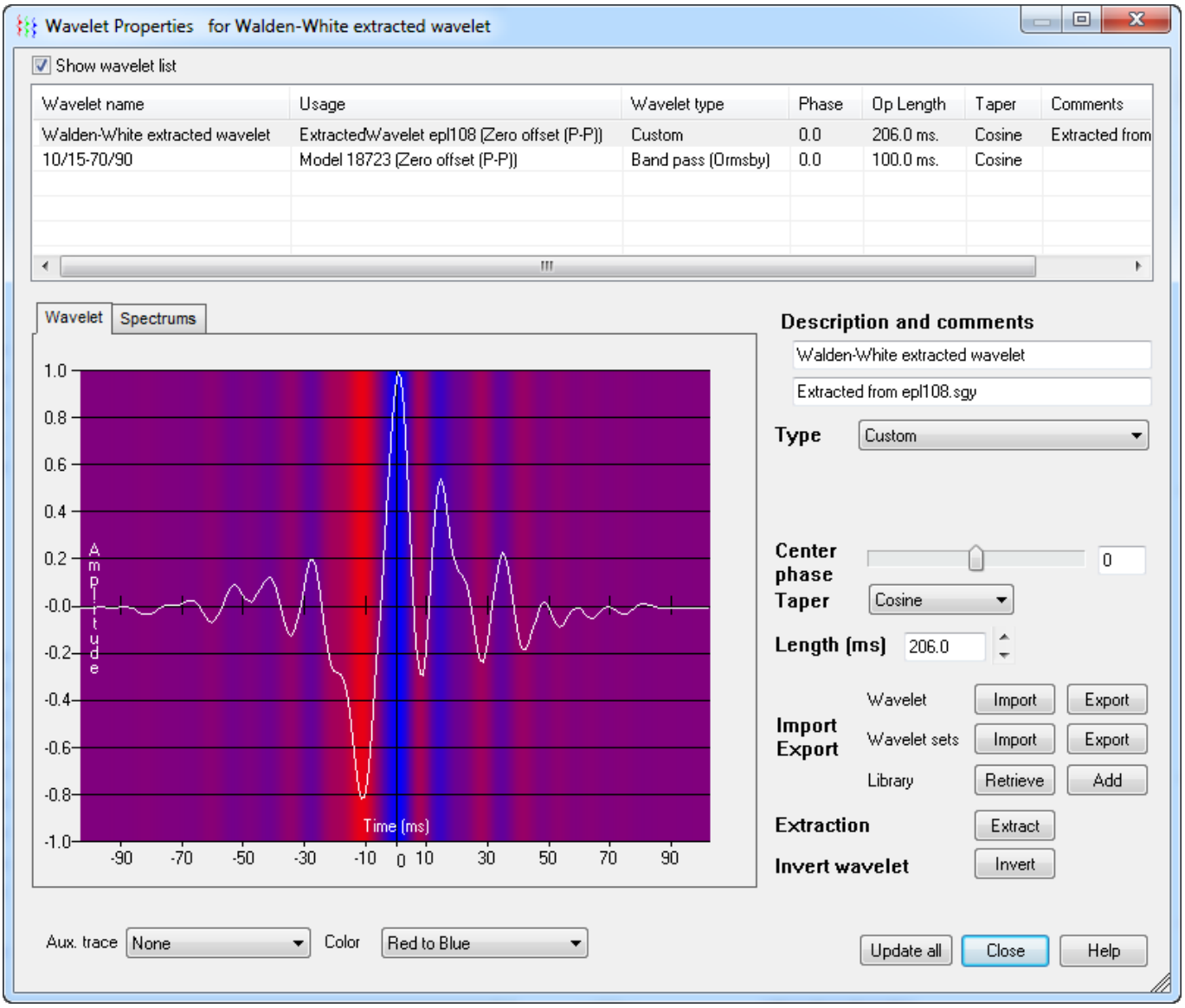
To import wavelet sets

1. From the **Edit** menu, select **Wavelet properties** ( )

OR

Right-click a wavelet and select **Wavelet properties** from the popup menu.

The Wavelet Properties: Wavelet dialog box opens.



2. In the **Import/Export** pane, click **Import** to the right of the *Wavelet Sets* label. Alternately, import wavelets from a centralized wavelet library used by all GeoSyn models by clicking **Retrieve** to the right of the *Library* label to display the Wavelet Library dialog box, where you select the wavelet and then click **Import wavelet**; otherwise, continue with the below steps.

The *Import a wavelet set* dialog box opens.

3. Browse to and select the wavelet file in *.wav* format then click **OK**.

The *Import Wavelet Groups from Wavelet Set* dialog box opens.

4. Select the wavelet group(s) to import then click **OK**.

Related topics

"Changing wavelet properties" on the facing page
"Inverting wavelets" on page 146

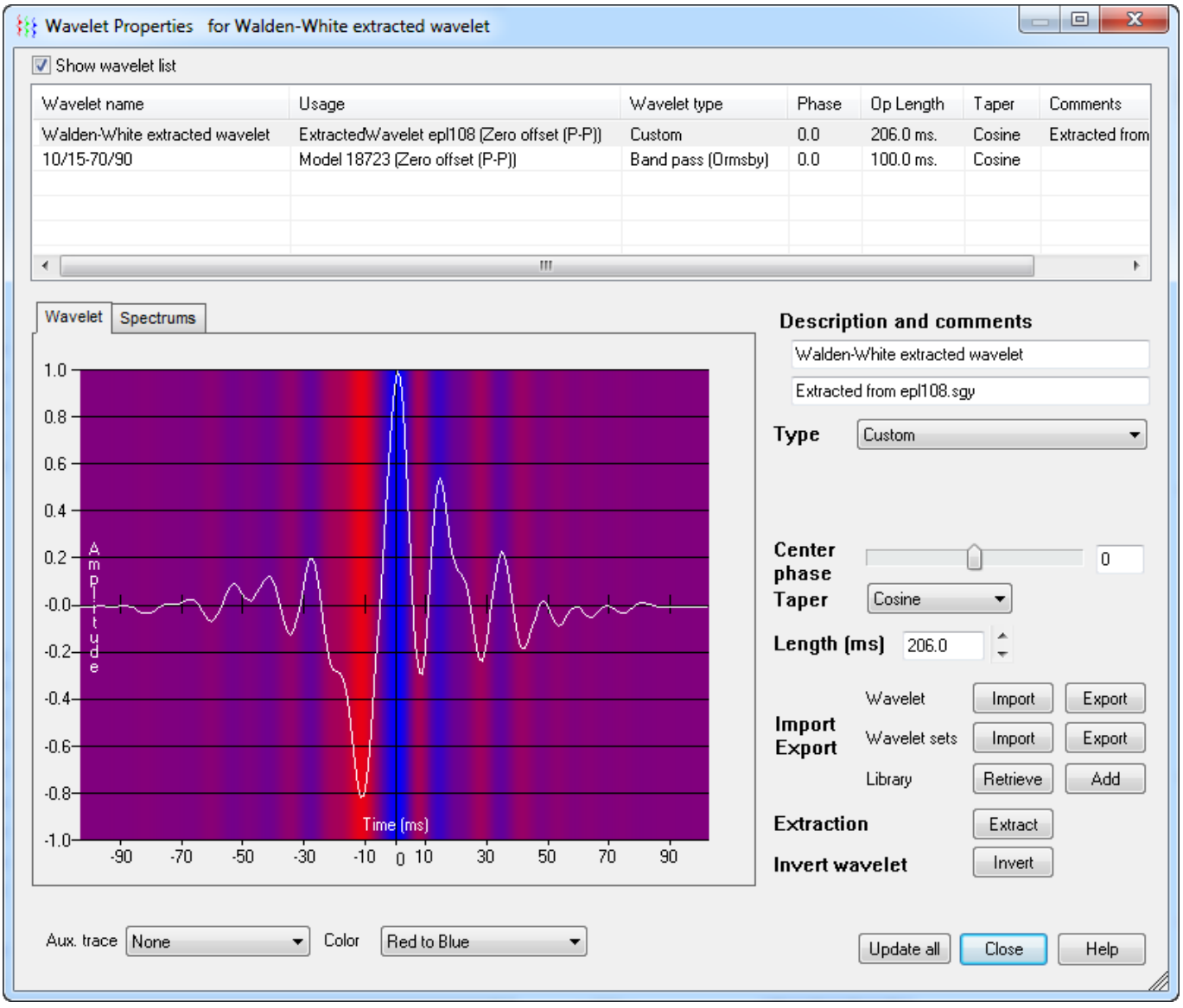
Changing wavelet properties

Apply up to three filters to different segments of a model and specify the amount of overlap between filters. Wavelets can be saved and imported using a centralized library of wavelets you create. The wavelet library is shared by all GeoSyn projects.

To change wavelet properties:

1. From the **Edit** menu, select **Wavelet properties** ( ).

The Wavelet dialog box opens.



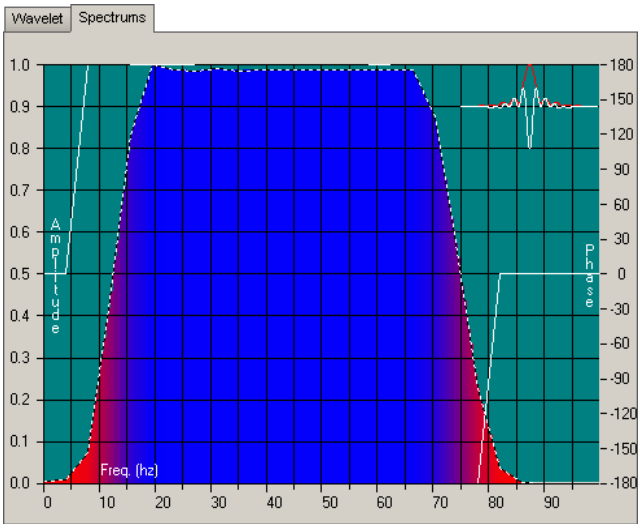
2. From the **Aux. trace** drop-down list, select whether to display a background trace to which to correlate the displayed trace and from the **Background** drop-down list, select whether to display a different color scheme.

3. Type a value in the **center phase** box or drag the slider below it.

4. Type a length for the operator, which controls the sample size displayed in the window.

5. To customize the amplitude or phase spectrum of the selected wavelet, click the **Spectrums** tab.

The Spectrums tab appears.



6. Hover your cursor over the amplitude display then click to define points that describe the modified spectrum.

7. Click either **Amp** or **Phase** to apply the defined points to either, or click **Clear** (or press **ESC**) to exit drawing mode without applying changes.

8. Click the horizontal arrows at the bottom of the view window to change the amount of frequency shown.

9. Click the **Wavelet** tab to review how the changes will appear then click **Close** to apply them to the main display.

Related topics

"Extracting wavelets" on page 149
"Inverting wavelets" on page 146
"Importing wavelets and wavelet sets" on page 136

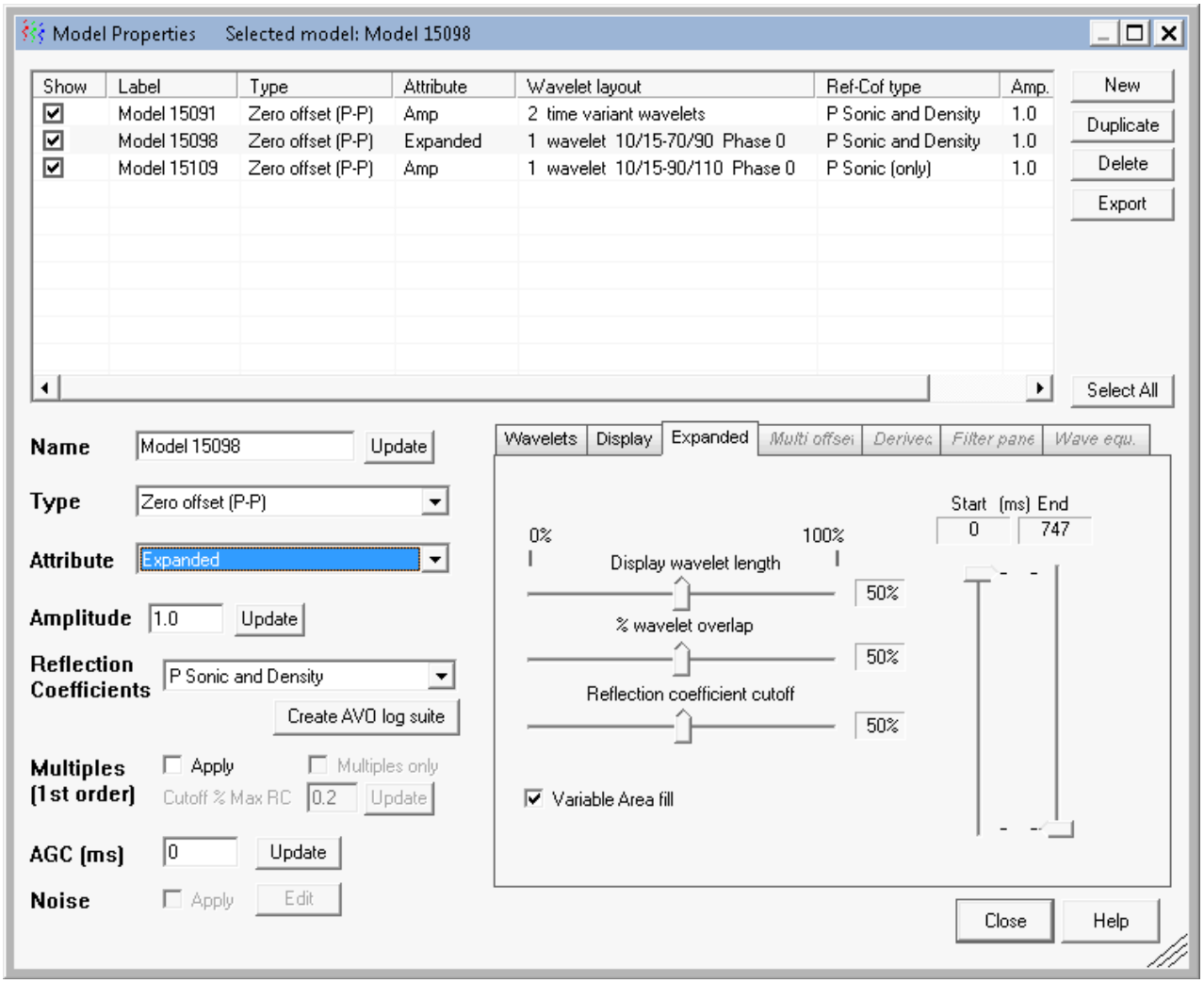
Changing wavelet expansion properties

Change the lengths, percentage of overlap, and reflection coefficient of individual wavelets.

To change wavelet expansion properties:

1. From the **Edit** menu, select **Model Properties** ( ).

The Model Properties: Expanded dialog box opens.



2. Select the desired wavelet(s) in the display pane, Derived from the Type drop-down list, and then select **Expanded** from the *Attribute* drop-down list.

3. Modify the parameters that control wavelet generation and placement then in the main *Model Properties* dialog box, click **Close**.

Related topics

"Changing wavelet properties" on page 143

Inverting wavelets

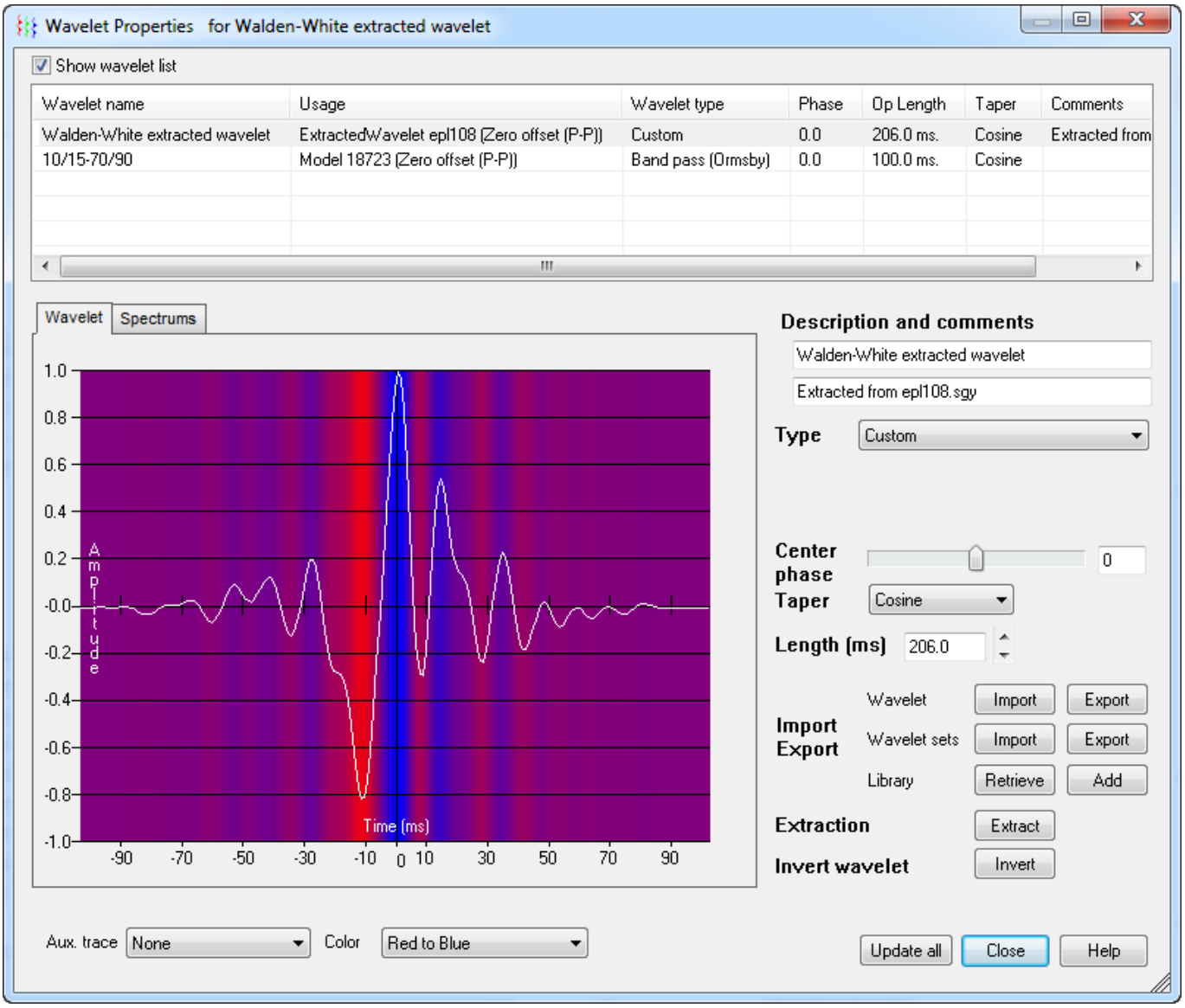
Invert a wavelet and then import it into GeoSyn (or another seismic program such as Kingdom) to deconvolve (filter) a seismic section.

Deconvolving a seismic section using an inverted wavelet removes phase and amplitude distortions that are introduced by various earth processes. These distortions prevent the peak of a wavelet from aligning with zero time.

To invert wavelets:

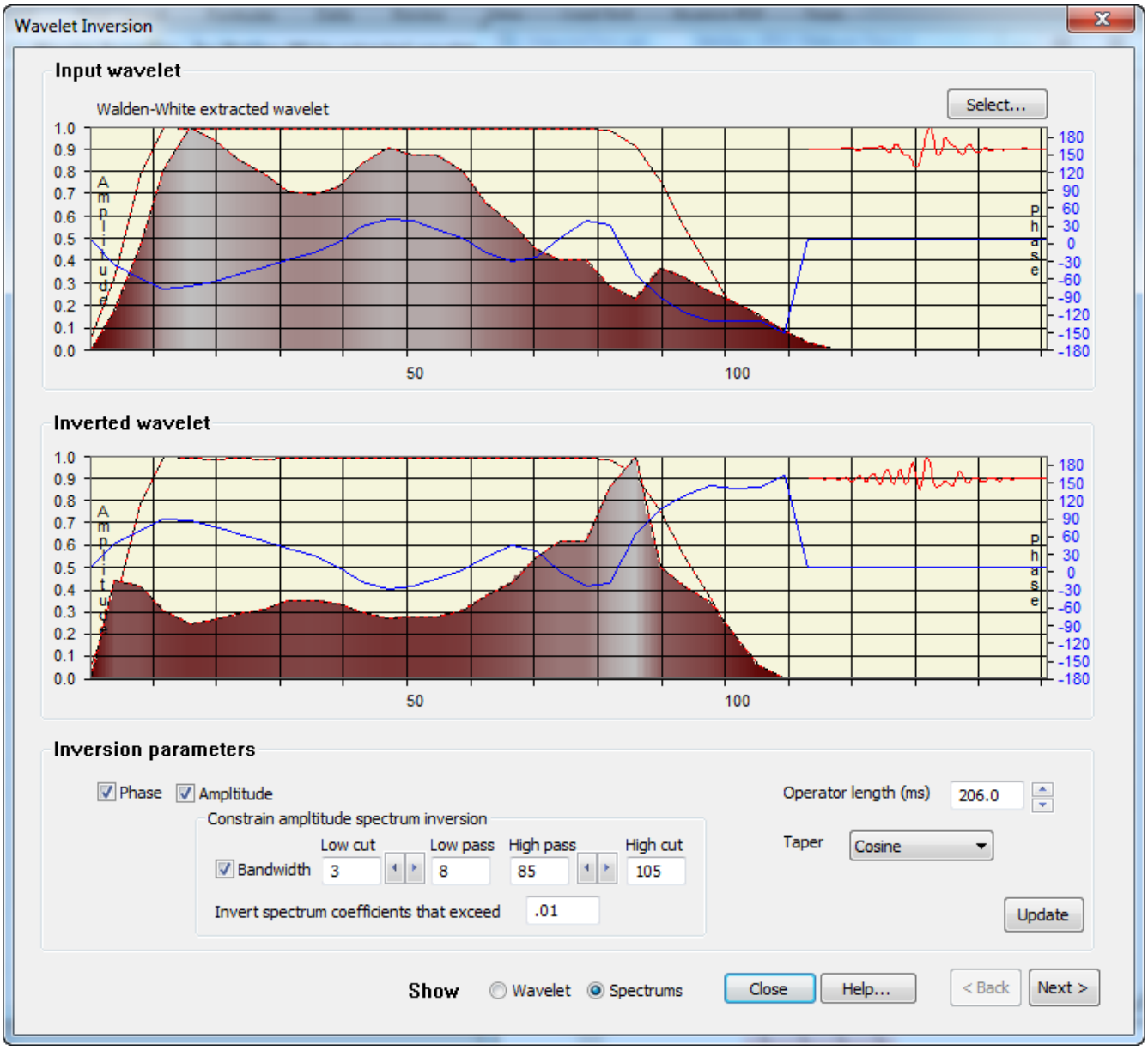
1. From the **Edit** menu, select **Wavelet properties** ().

The Wavelet Properties dialog box opens.



2. Click **Invert** to the right of the *Invert Wavelet* option.

The Wavelet Inversion dialog box opens.



3. In the top-right of the dialog box, click **Select** and choose an existing wavelet to invert from the GeoSyn project.

4. Alter the *Inversion Parameters* to apply inversion criteria, clicking **Update** to see what change a given setting has on the preview wavelet displayed in the *Inverted Wavelet* pane.

The **Show** radio buttons enable you to display either a wavelet or spectrum i the *Wavelet Inversion* dialog box.

5. Click **Next** to save the wavelet to either the GeoSyn library or to disk.

6. Using the Wavelet Inversion Save dialog box, type wavelet details and then click either **Add to Library** or **Export to File**, and then click **Close**.

7. From the **Edit** menu in the main GeoSyn display, select **Seismic Properties**.

The Seismic Properties dialog box opens.

8. Using the *Seismic Properties* dialog box, click the *Processing* tab, and then to the right of the *Deconvolve using Inverted Wavelet* option, click either **Library** or **Import** and then import the inverted wavelet created above.

It is automatically applied to your seismic.

Related topics

"Changing wavelet properties" on page 143
"Importing wavelets and wavelet sets" on page 136

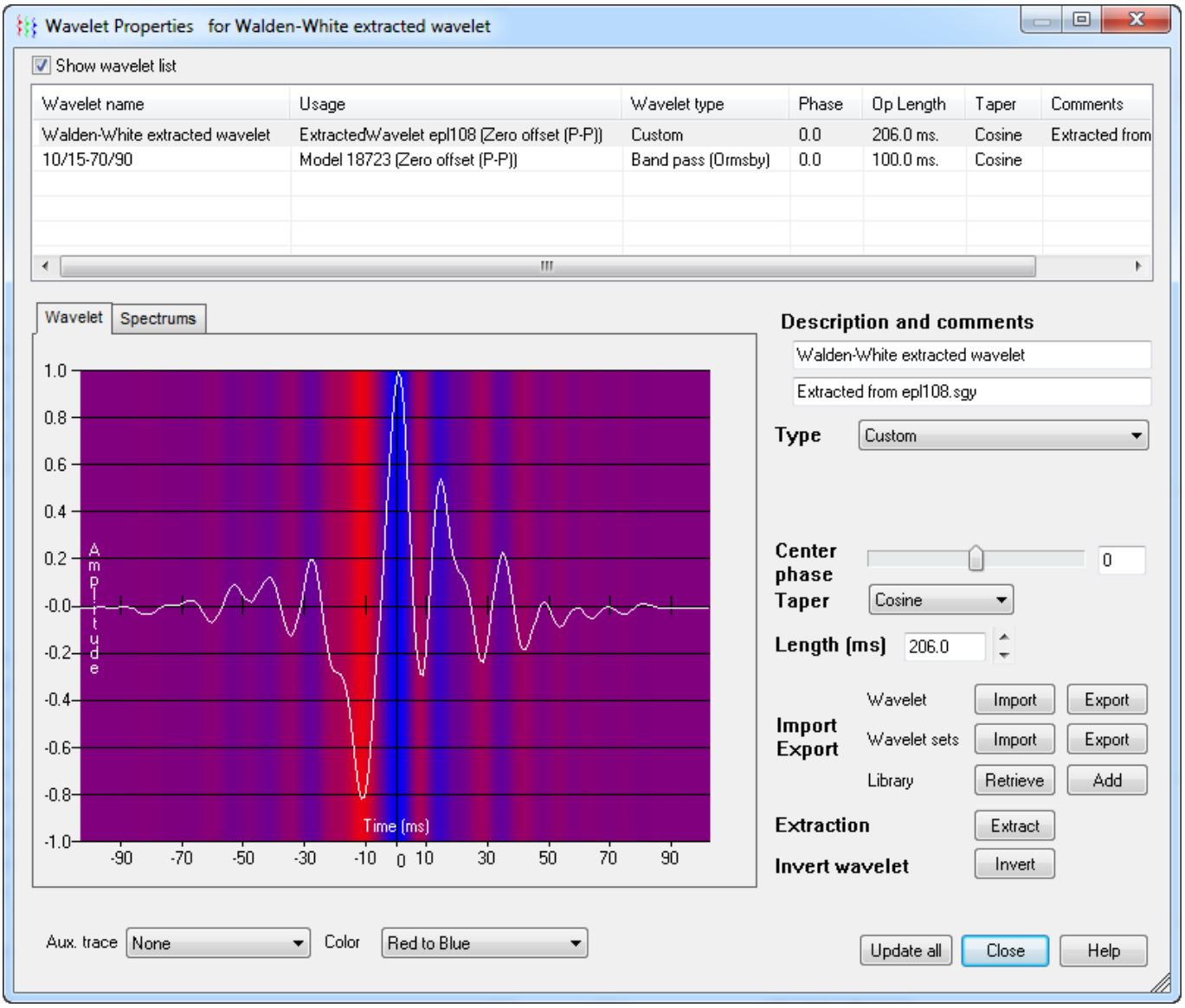
Extracting wavelets

Import seismic data and extract a wavelet from it. Apply this wavelet to a model to improve the tie between the seismic and the model.

To extract wavelets:

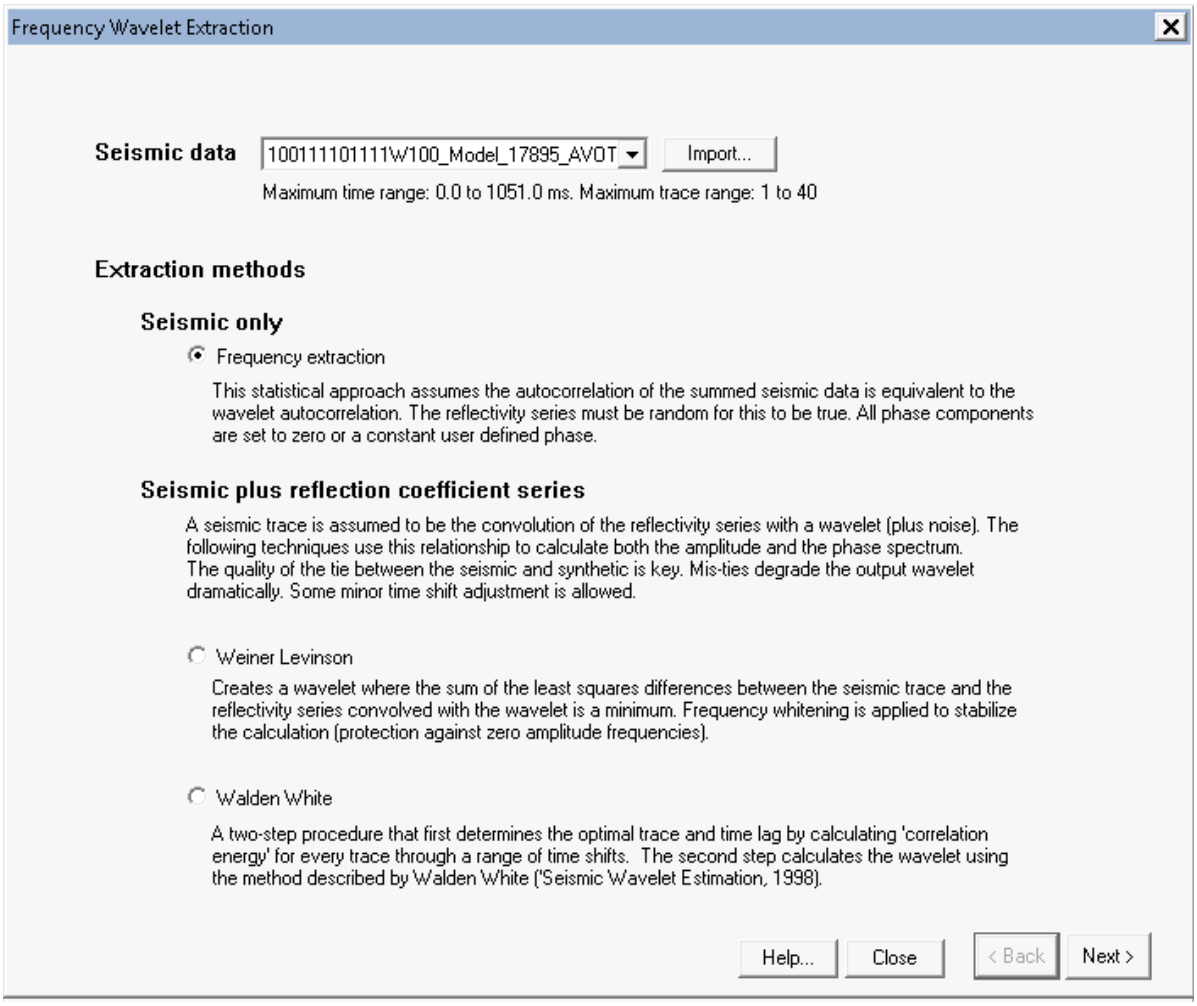
1. From the **Edit** menu, select **Wavelet** ().

The Wavelet dialog box opens.



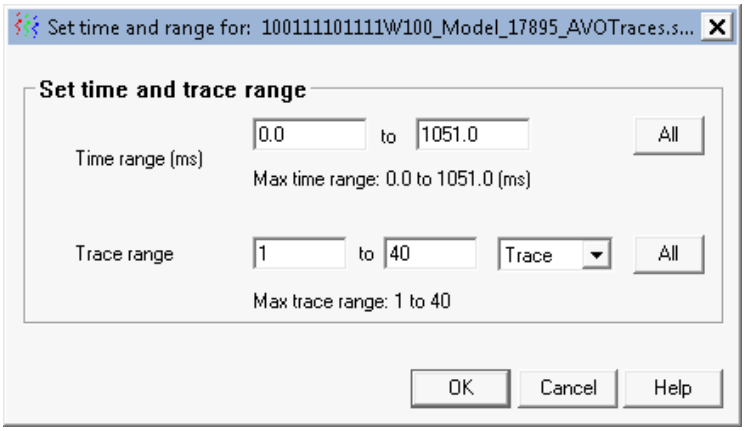
2. Beside the *Extraction*label, click **Extract**.

The Wavelet Extraction dialog box opens.

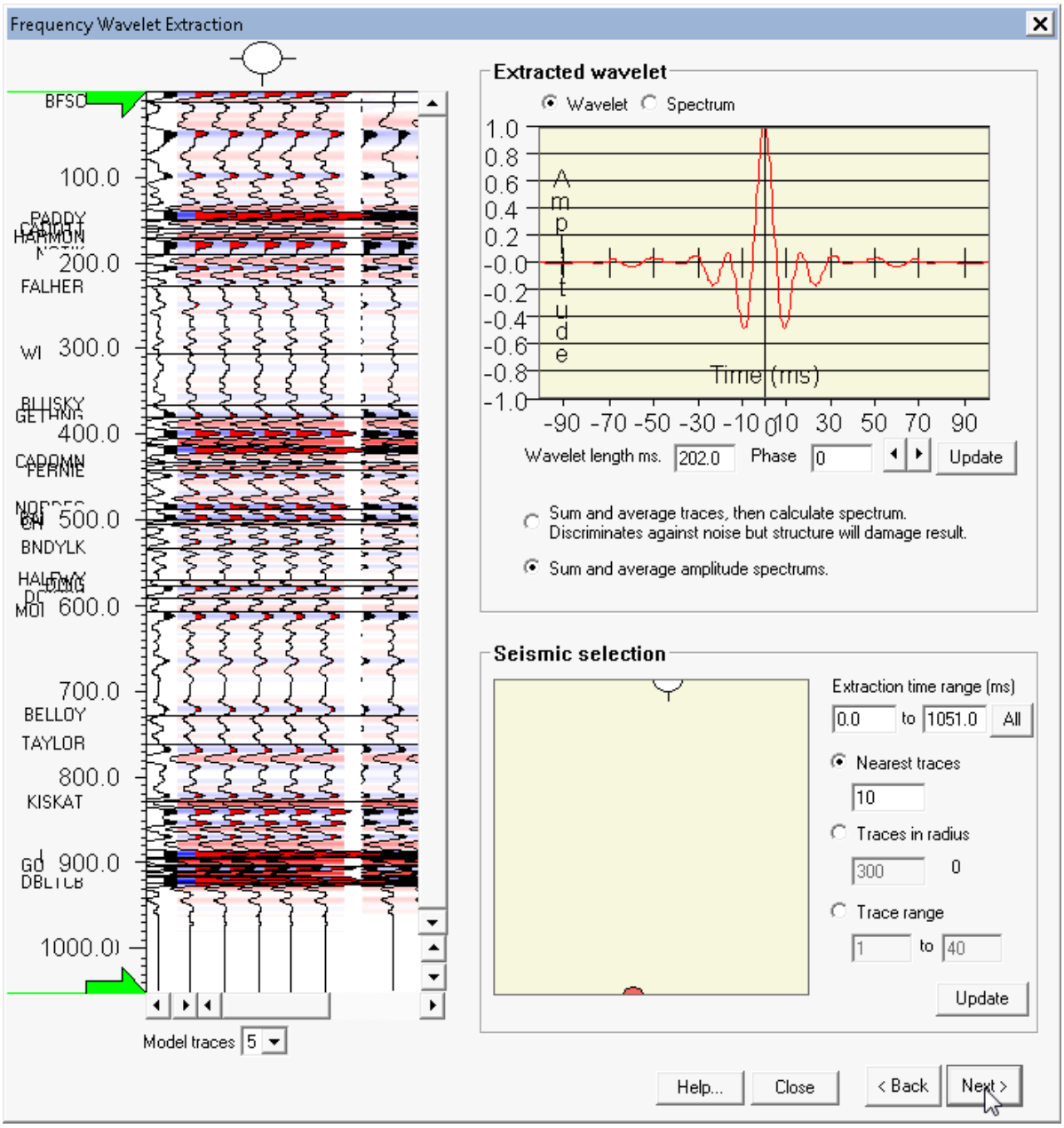


3. Click **Import** and navigate to the seismic section upon which to base the extracted wavelet. If you launch the above dialog box from the *Seismic Properties* dialog box or there are already seismic lines in the model, the *Seismic Data* drop-down list is already populated.

The Set Time Range dialog box opens, where you specify the time range and number of traces to sum, and then click **OK**.



4. Using the *Frequency Wavelet Extraction* dialog box, specify the extraction method, and then click **Next** to display the Extracted Wavelets panes.



In the above dialog box, in the pane to the left, the GeoSyn model trace is displayed with a portion of the seismic section on either side. In the Seismic Selection pane, a bird's eye view of the well header with respect to the seismic is displayed. In the Extracted Wavelet pane in the top-right, the wavelet that will be extracted is displayed.

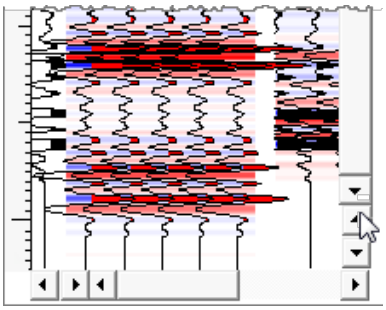
5. Modify the processing options as follows:

To restrict the extracted range, using the left pane, drag the green arrows () up from the bottom or down from the top of the range.

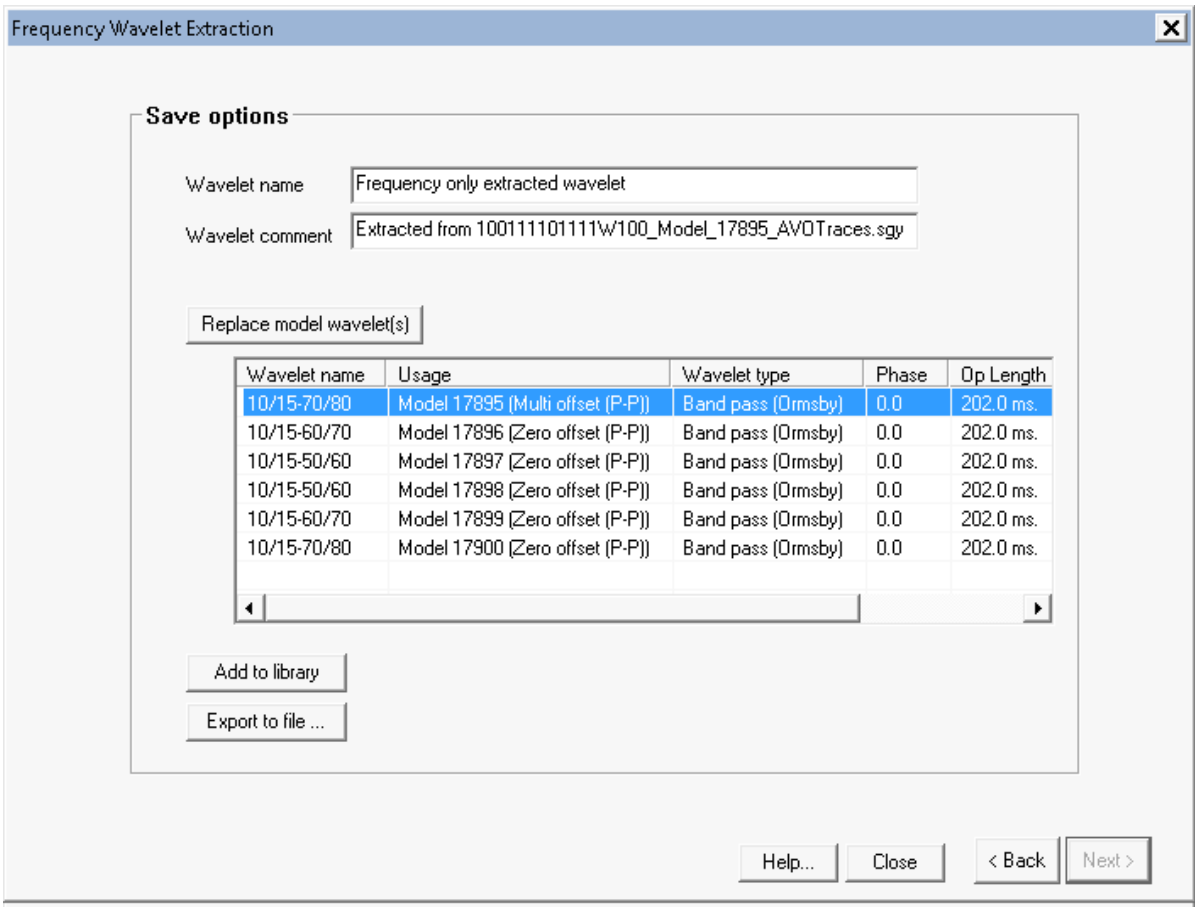
OR

Type the top and bottom of the extraction range in the *Seismic Selection* pane in the bottom-right of the *Frequency Wavelet Extraction* dialog box.

Click the arrows in the bottom-left of the model display pane to zoom.



6. Click **Next** to display the Save Options dialog box.



7. Select from the following options:

Select a current model(s) in the display pane, and then click Replace Model Wavelet to overwrite its wavelets. CTRL+Click or SHIFT+Click for multiple selection.

Add to Library to save wavelets that can then be imported using a centralized library of wavelets you create. The wavelet library is shared by all GeoSyn projects.

Export to a SEGY file.

Related topics

"Changing wavelet properties" on page 143
"Importing wavelets and wavelet sets" on page 136
"Exporting wavelets" on page 199
"Tying seismic to models" on page 164
"Generating models using wavelet equations" below

Generating models using wavelet equations

Create a new synthetic model using a process based on Maxwell's wave equations, which state that amplitude in time equals acceleration in space.

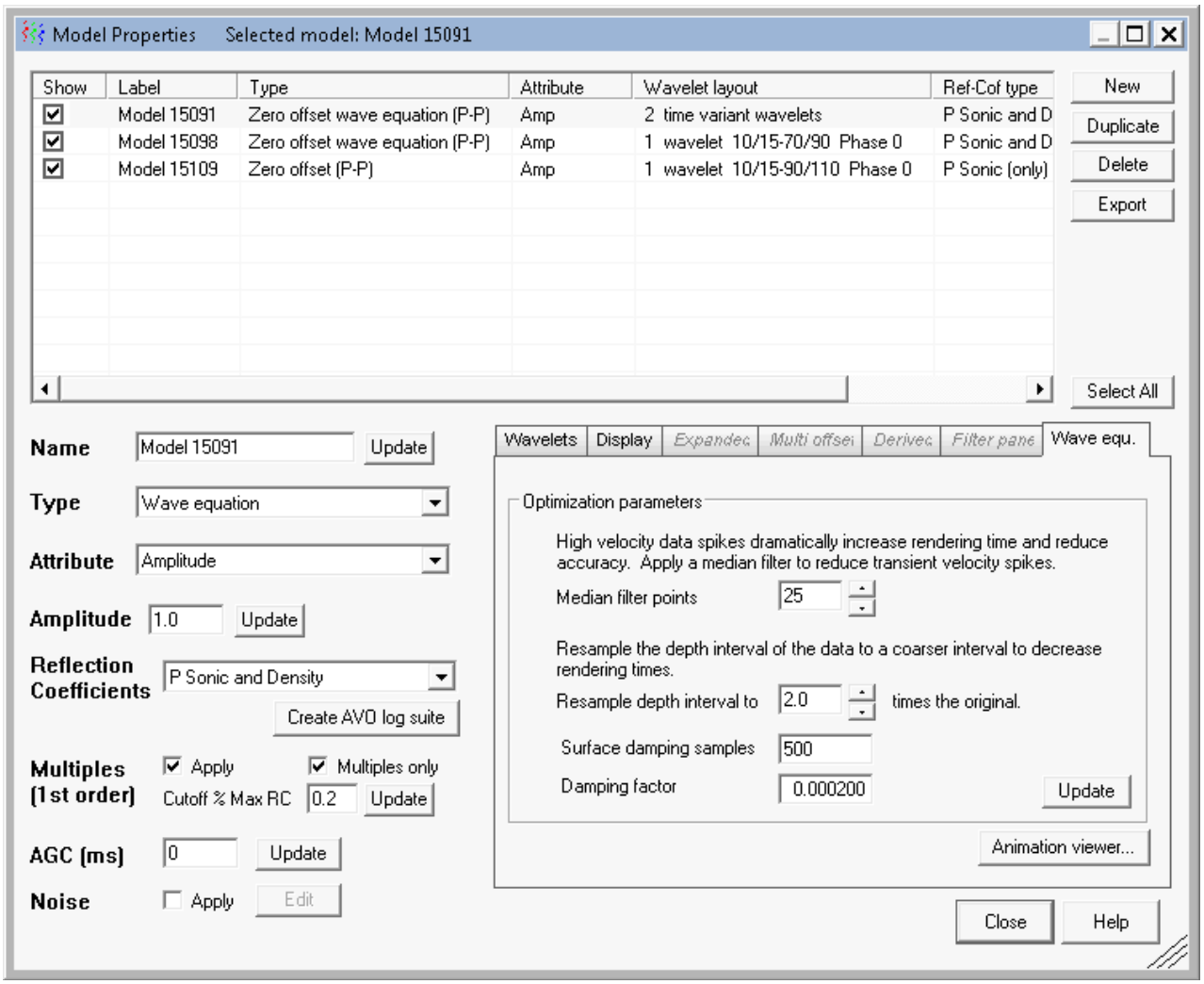
Standard models are calculated using reflection coefficients based on density and velocity contrasts by placing them in time using the time/depth curve, and convolving them with a wavelet.

Maxwell's equation more closely resembles what's happening when the wave is progressing through the earth -hitting reflectors, bouncing up, and continuing onward. The signal is digitized and a time increment of microseconds is used.

To generate models using wavelet equations:

1. From the **Edit** menu, select **Model Properties** ().

The Model Properties: Wave Equ dialog box opens.

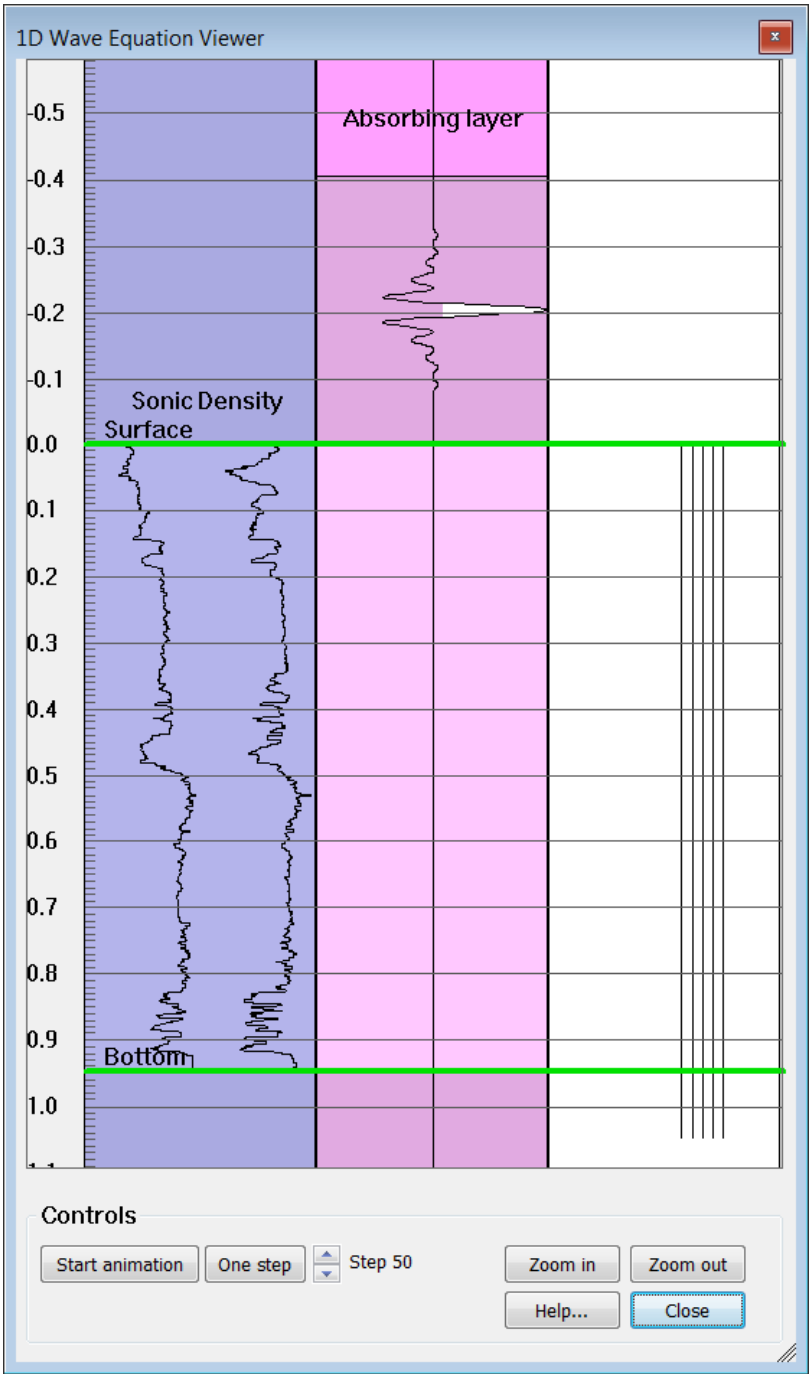


2. Select the desired model(s) in the display pane, and then select **Wave Equation**from the *Type* drop-down list.

3. Select *Median Filter Points* and *Resample Depth Interval* options in the *Wave Equ* tab, and then click **Animation Viewer** to display the *1D Wave Equation Viewer* dialog box, where you animate how the sonic pulse given the above settings will impact the model.

Reducing the *Median Filter Points* and *Resample Depth Interval* above can alleviate some of the processing burden on your PC's CPU.

The 1D Wave Equation Viewer dialog box opens.



In this time-based dialog box, the left-most frame displays the original sonic and density logs. The middle pane represents the earth. And the right-most pane displays the synthetic that results from running the animation.

The Absorbing area above the Surface marker cancels reflections that move upward and that bounce off of the surface when the initial pulse activates. An

accompanying noise cancellation buffer is not required below the Bottom marker as the synthetic finishes drawing before the pulse that travels through the Bottom marker can enter back into the model.

4. Use the *Up*and *Down* arrows to increase or decrease the speed at which the pulse proceeds through the earth, and then click **Start Animation**. Once clicked, the button label displays *Stop Animation* and you can click to stop the pulse.

Click *One Step* to increment the pulse through the earth by one step each time you click .

Zoom to magnify details that appear int he 1D Wave Equation Viewer dialog box.

Related topics

"Changing wavelet properties" on page 143
"Importing wavelets and wavelet sets" on page 136
"Exporting wavelets" on page 199
"Extracting wavelets" on page 149
"Tying seismic to models" on page 164

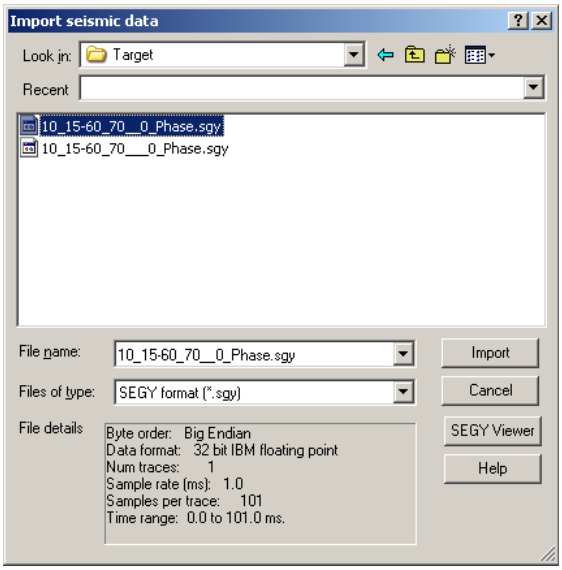
Importing seismic data

Import and display single-trace and multi-trace seismic data saved in SEGY format. Before importing the file, display it in a stand-alone SEGY Viewer to review its format and contents.

To import seismic:

1. From the **File** menu, select **Import** > **Seismic**.

The Import seismic data dialog box opens.

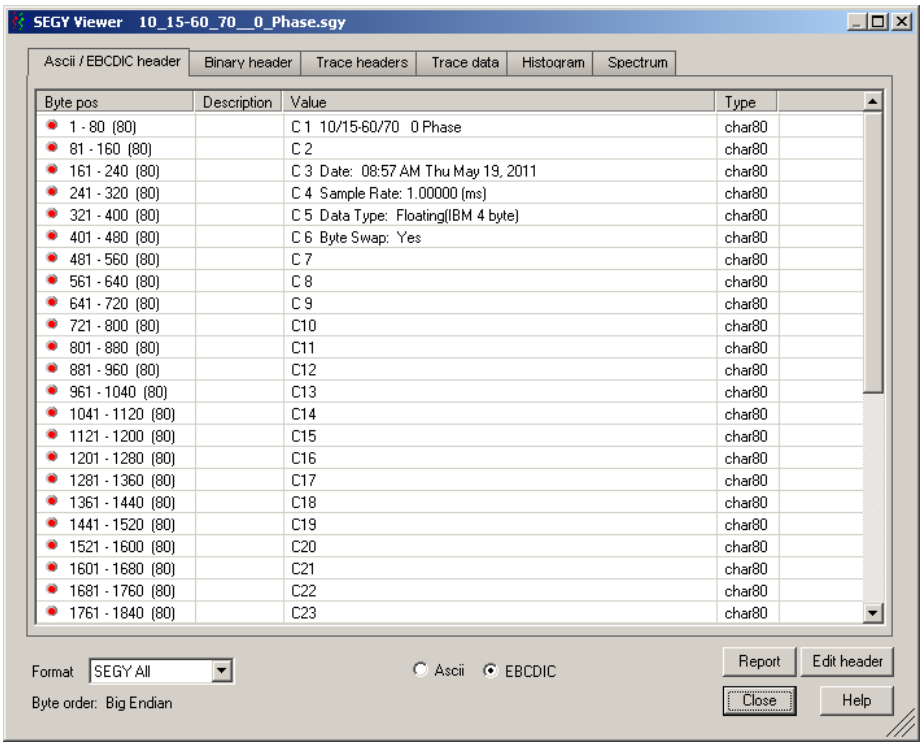


2. Browse to and select the desired SEGY file.

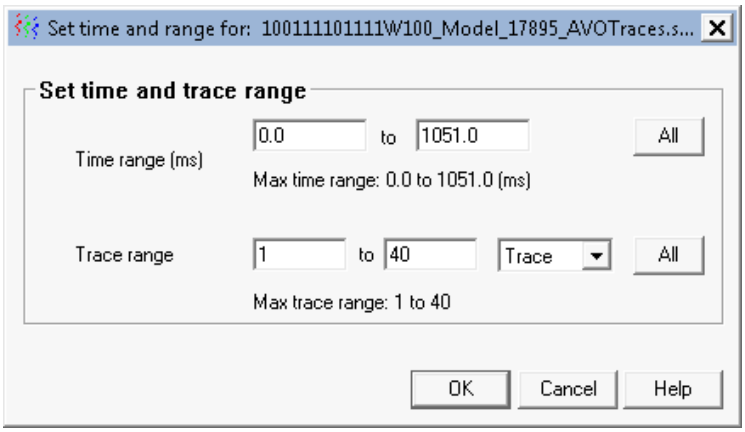
General file information appears in the *File details* pane. Click either **Import** or **SEGY Viewer** to review more file details before importing.

If you click **SEGY Viewer**, the SEGY Viewer dialog box opens. Click various tabs to view the file data and select various formats in which to display the data in the

viewer.



3. When you click **Import**, the Set time and range for dialog box opens.



4. Type a time and trace range then click **OK**.

The trace(s) appears in the main synthetic display.

Related topics

"Changing seismic properties" on page 162

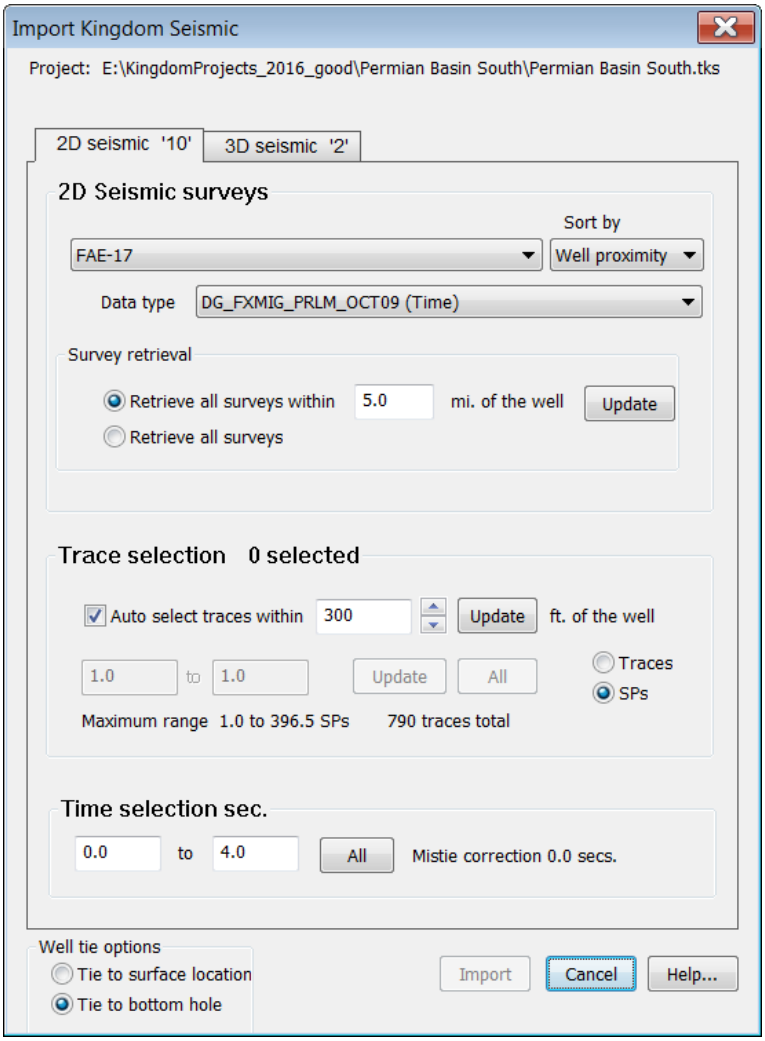
"Importing seismic from Kingdom" on the facing page

Importing seismic from Kingdom

Import Kingdom data into GeoSyn to create a synthetic. Tie the seismic data to a well and extract a wavelet. Before importing seismic from Kingdom, you first import a well. For details on importing a well, see *Related topics* below.

To import Seismic from Kingdom:

1. From the **File** menu, click **Kingdom Import** and then **Seismic Data**. The Import Kingdom Seismic dialog box will open.



2. Select either the 2D seismic or 3D seismic tab depending on the type of seismic to import. The number of seismic sections available is denoted in the label of the tab.

3. Populate the dialog box fields, and then click **Import**.

Related topics

"Import Kingdom Seismic: 2D" on page 219
"Import Kingdom seismic: 3D" on page 220
"Changing seismic properties" below
"Importing seismic data" on page 158
"Importing wells from Kingdom" on page 29

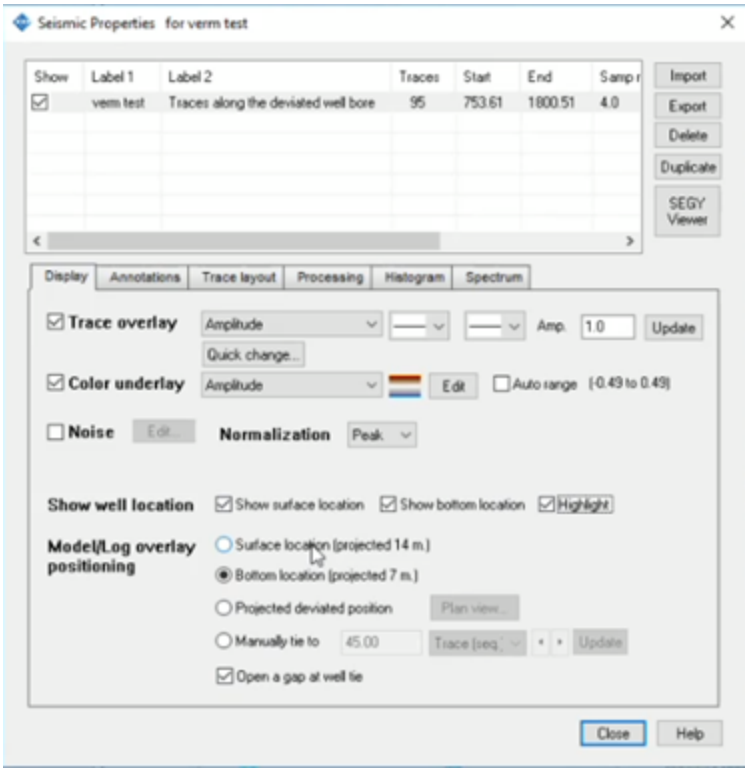
Changing seismic properties

Change seismic display options including which samples to display, how to display them, label text, and more.

To change seismic properties:

1. From the **Edit** menu, select **Seismic properties** ( ).

The Seismic Properties: Display dialog box opens.



2. In the display pane, select the seismic trace(s) for which to configure label and layout properties. SHIFT+CLICK or CTRL+CLICK for multiple selection.

3. Use the tabs to configure trace display properties as follows:

Display, overlay and underlay properties.

Annotations, trace name and label frequency.

Trace Layout, number of traces to display.

Processing, trace processing options including summing raw traces using common offset points.

Histogram, plot density of data.

Spectrum, graphical display of frequencies and their amplitudes.

4. In the main *Seismic Properties* dialog box, click **Close** to return to the main synthetic view with the changes applied.

Related topics

"Importing seismic data" on page 158
"Changing color palettes" on page 131
"Tying seismic to models" on the next page

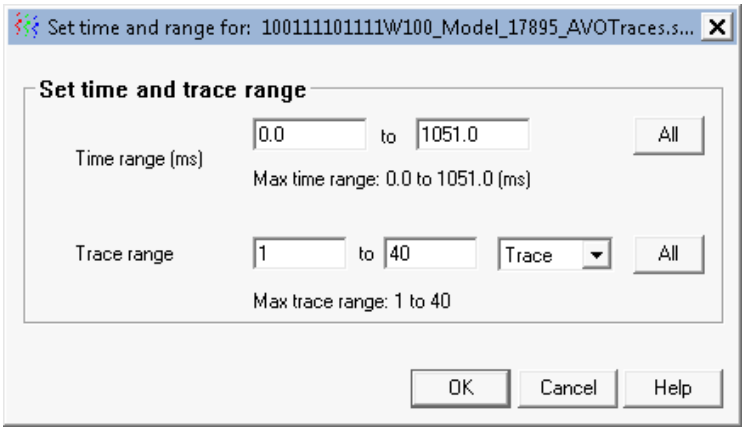
Tying seismic to models

Tie seismic to a model in the current synthetic for correlation purposes and for reverse AVO modelling.

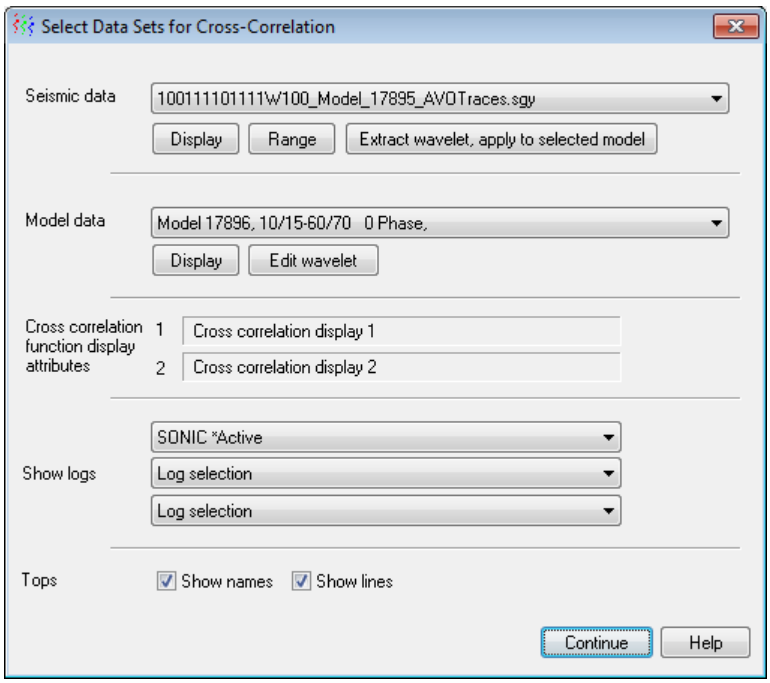
Kingdom users tie the seismic using GeoSyn, and then save the resulting time/depth chart back to Kingdom to assist with the creation of future synthetics.

To tie seismic to models:

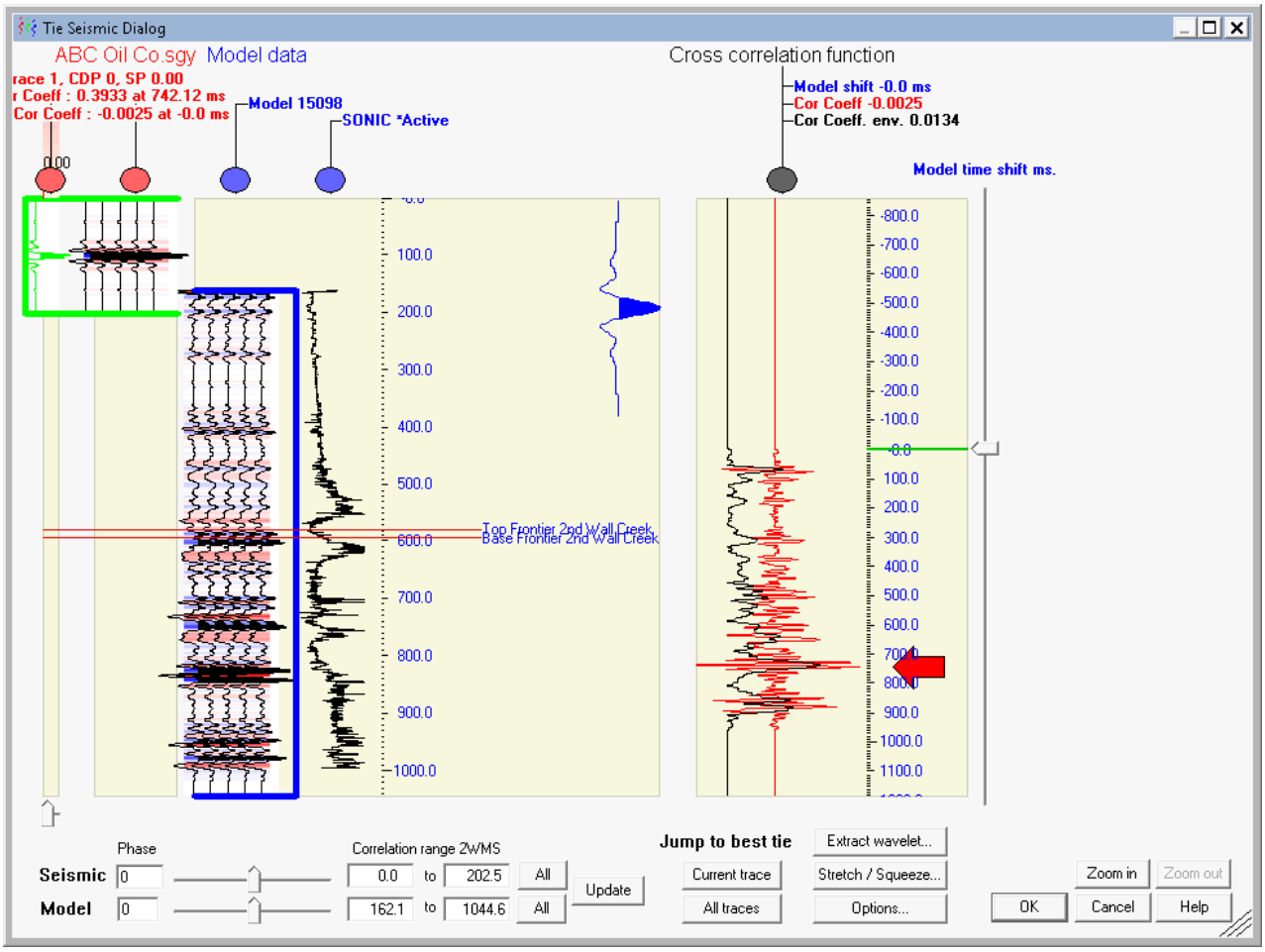
1. Right-click the seismic trace and select **Tie Seismic to a Model** from the popup menu.
   The Set time and range for dialog box opens.



2. Select the time and trace range that includes the well from which the synthetic is created, and then click **OK**.
   The Select Data Sets for Cross-Correlation dialog box opens.



3. In the **Model Data** drop-down list, select a model to which to tie the seismic trace, and then click **Continue**.
   The Tie Seismic dialog box opens.



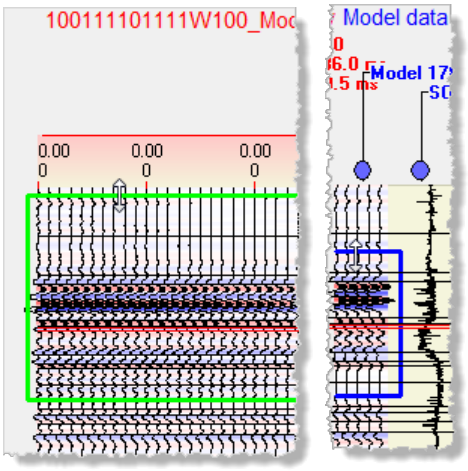
4. Select from the following options:

   GeoSyn automatically aligns the seismic trace and model trace at the point of best fit. To move the point of best fit to another seismic trace, drag the slider at the bottom of the seismic sample left or right.

   To move the seismic trace up or down in relation to the model trace, in the *Cross correlation function* pane, drag the vertical slider up or down. The amplitude values for the Amplitude and the Amplitude Envelope appear to the right of the slider.

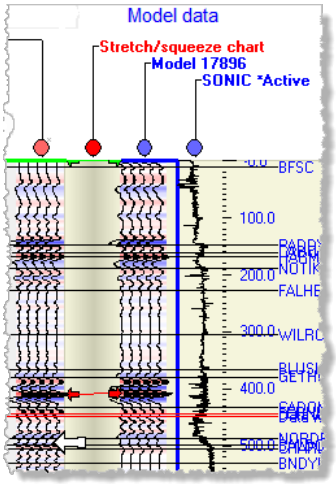
   Drag the green and the blue horizontal lines that limit the data range to exclude unwanted data that appears at the top or bottom of the model or the

seismic, which may interfere with the selection of the best tie.



To change the seismic phase or the model phase, drag the sliders or type values in the boxes below the *Phase* label in the bottom-left of the dialog box. The results appear in the *Cross Correlation Function* area of the dialog box where the red signal represents the seismic pulse and the black signal represents the amplitude envelope.

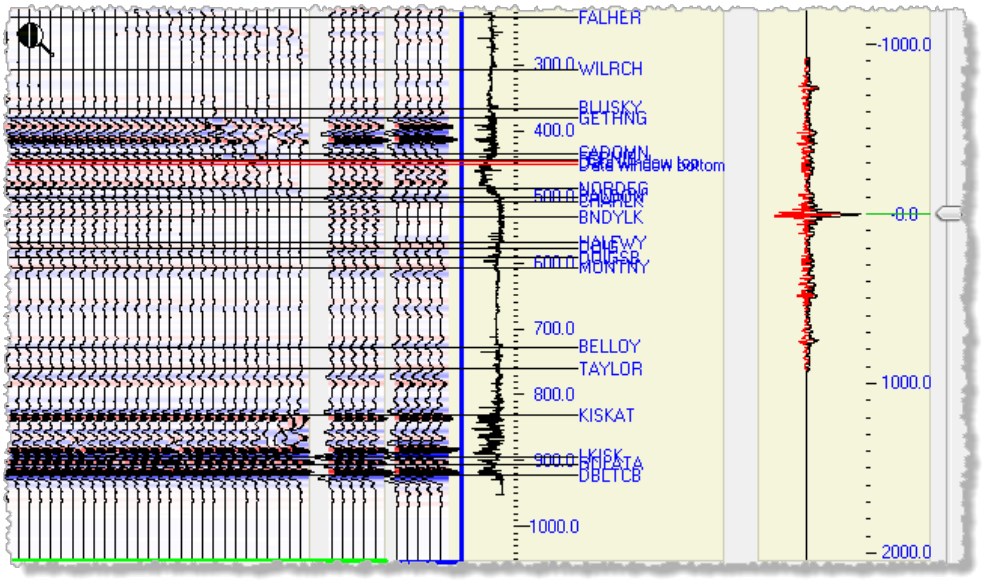
To stretch and squeeze the sonic to improve the tie with the sonic, click **Stretch/Squeeze** to display the Stretch and Squeeze dialog box. Hover the cursor over the seismic at the point to tie. Click to set the first tie anchor, and then hover the cursor over the correlating tie point on the model. Click to place the second anchor, which ties the seismic to the model.



Select multiple points using the above process. For details on stretching and squeezing traces, see *Correlating Logs and Traces* below.

To zoom the seismic pane, click **Zoom In** and then move the cursor over the seismic section (the cursor changes to a magnifying glass ( )), and then drag the extents to zoom. Once you've zoomed in, use the **Zoom Out** option

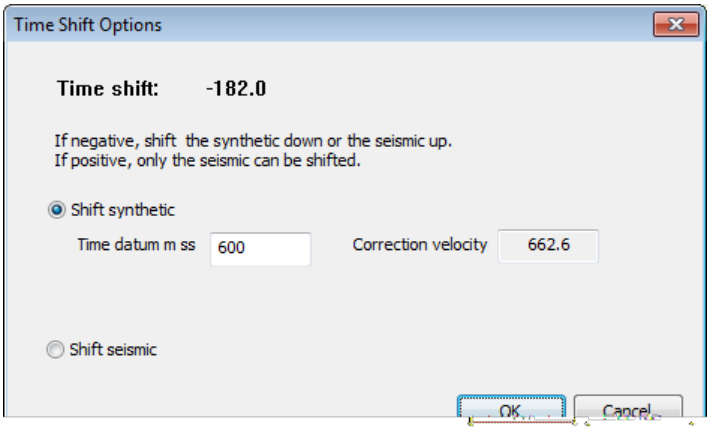
to restore the original screen extents. You can Zoom in multiple times to increase magnification and improve accuracy



To change the trace pane displayed in the *Tie Seismic* dialog box in either the **Model data** or the **Cross correlation function** pane, hover the cursor ( ) over the display to move then click and hold while dragging the display pane up or down.

5. Click **OK** to close the *Tie Seismic* dialog box.

   The Time Shift Options dialog box opens.



6. Select whether to shift the synthetic or the seismic (bulk shift), and then click **OK**.

Related topics

"Changing seismic properties" on page 162

"Stretching and squeezing logs" on page 70

"Correlating logs and traces" on page 180
"Importing seismic from Kingdom" on page 161

Analyzing velocity and depth

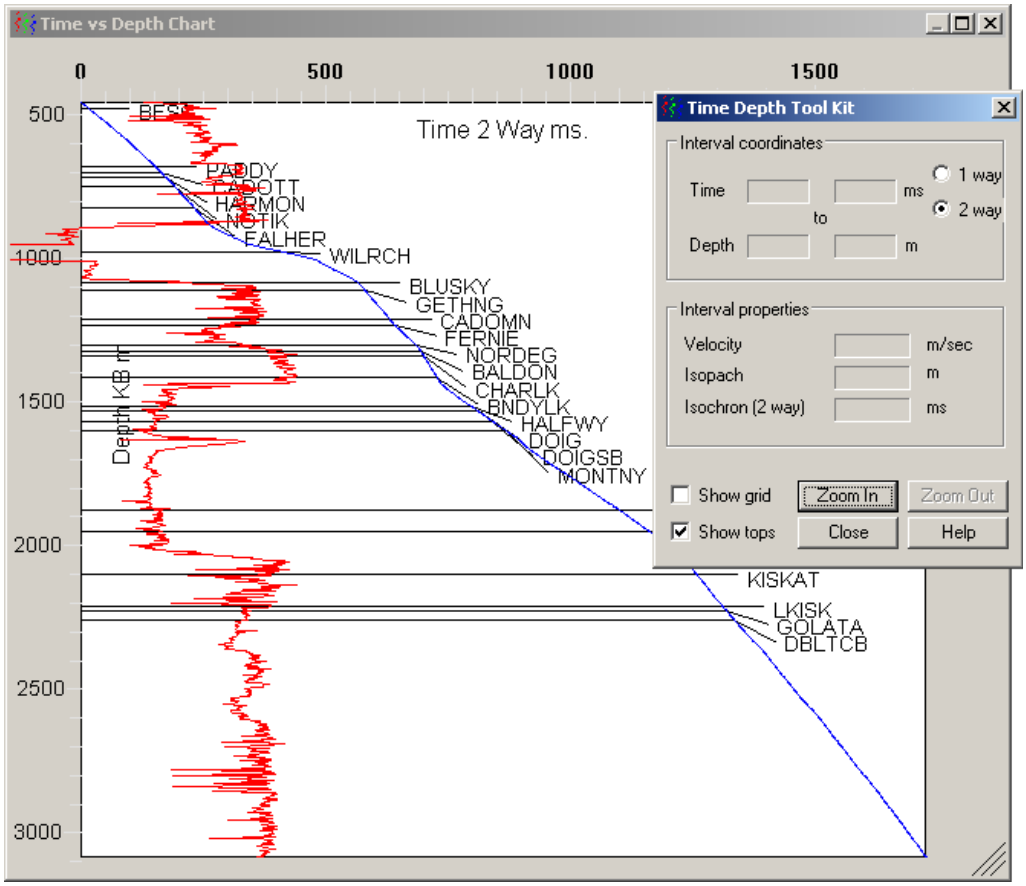
Contained in the chart are the time depth log in blue, the sonic transit log in red, and tops in black. By default, time is two-way, though you can change it to one-way.

As you move your cursor time depth, isochron, isopach, and interval velocity information appears in a corresponding dialog box.

To analyze velocity and depth:

1. From the **Utilities** menu, select **Time vs. Depth**.

The Time vs. Depth Chart dialog box opens.



2. Click **Zoom In** then click and hold the mouse button on the chart where you want to begin zooming, drag a zoom rectangle around the area of interest, then release the mouse button.

3. Use the check boxes in the lower-left of the Time Depth Toolkit dialog box to select whether to display a basic depth / time grid and the tops in the Time vs. Depth Chart.

Related topics

"Drawing straight edge and freehand curves" on page 59
"Applying math equations to logs" on page 77
"Clipping or filtering logs" on page 75

Creating crossplots

Create crossplots using data from logs, seismic, and models.

Following are some of the more common crossplots you might create:

offset trace along the x axis and an amplitude trace along the y axis.

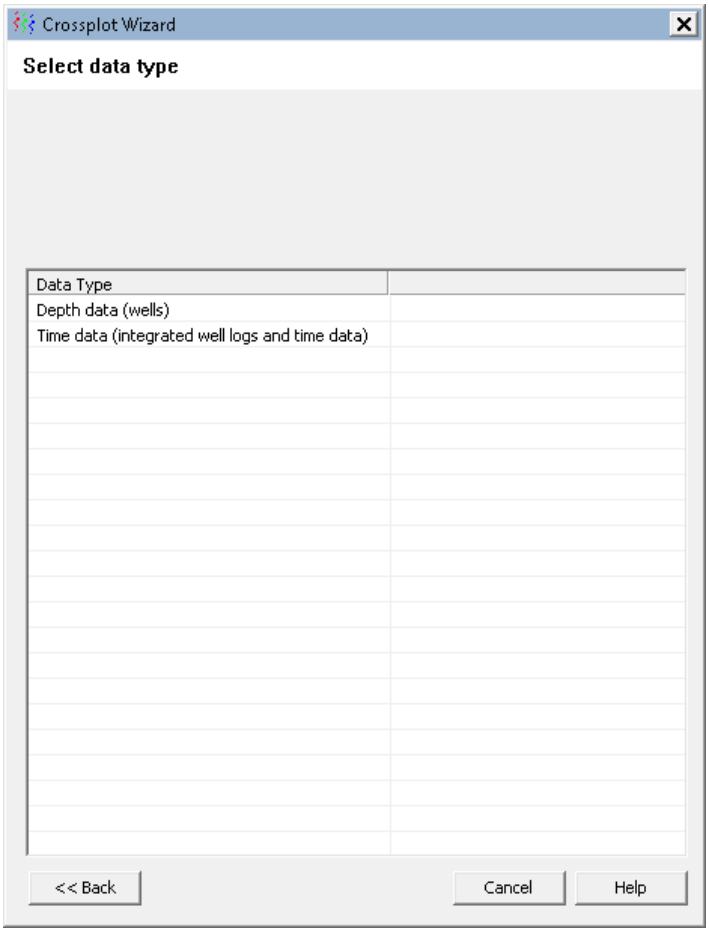
incident angle along the x axis and the amplitude from the seismic along the y axis.

gradient on one axis and intercept on the other.

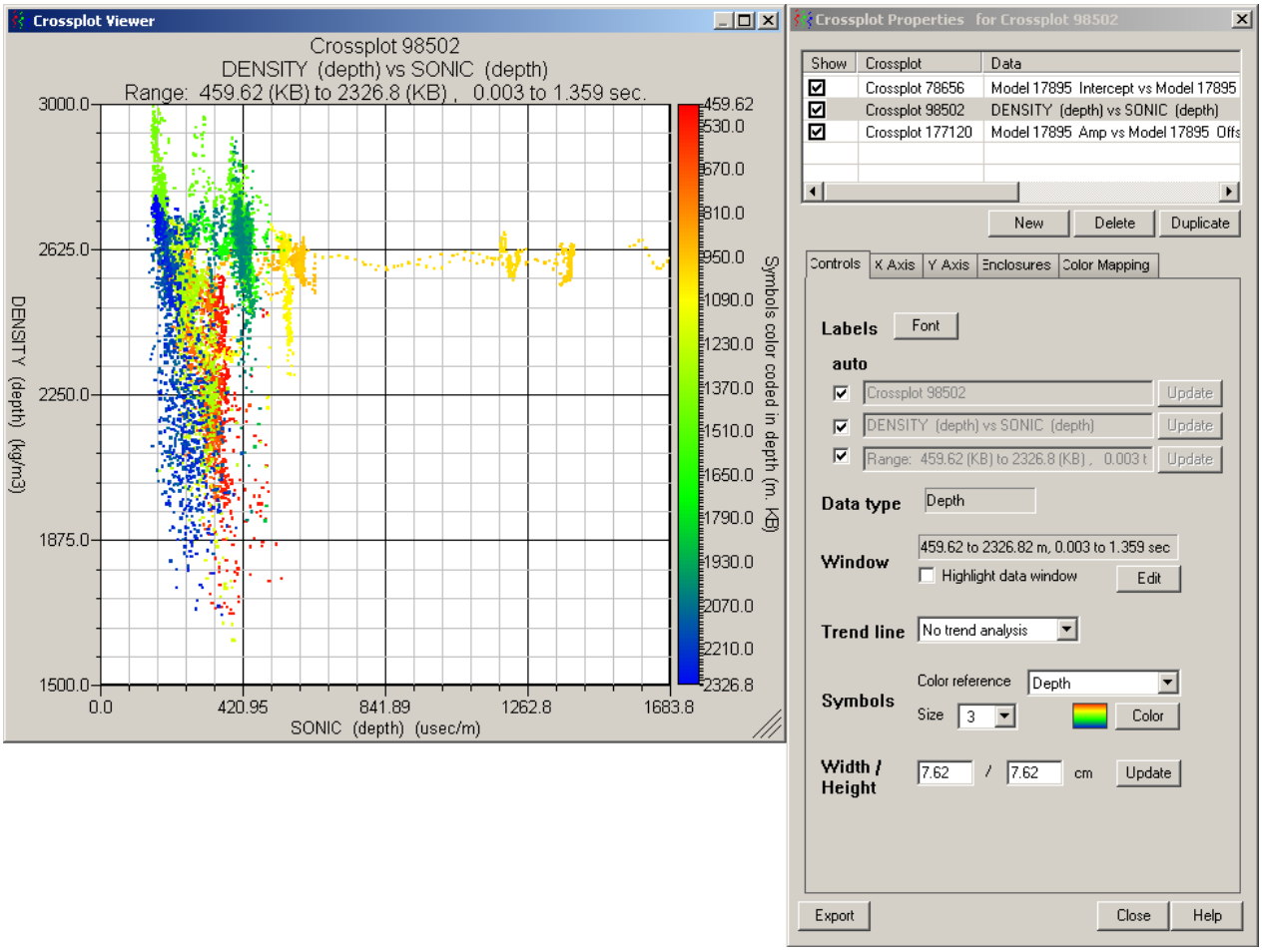
To create crossplots:

1. From the **Edit** menu, select **Cross Plots** ().

If there isn't already a crossplot in the main synthetic display, the Crossplot Wizard: Select Data Type dialog box opens.

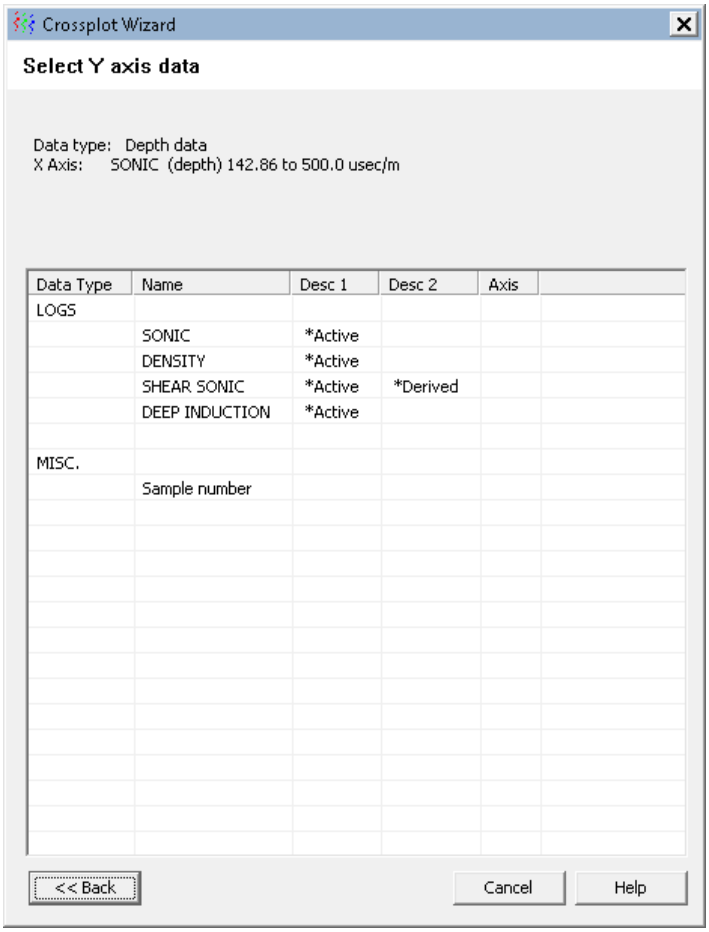


Otherwise, the *Crossplot Viewer* and Crossplot Properties dialog box opens, and you must click **New** to display the above dialog box.



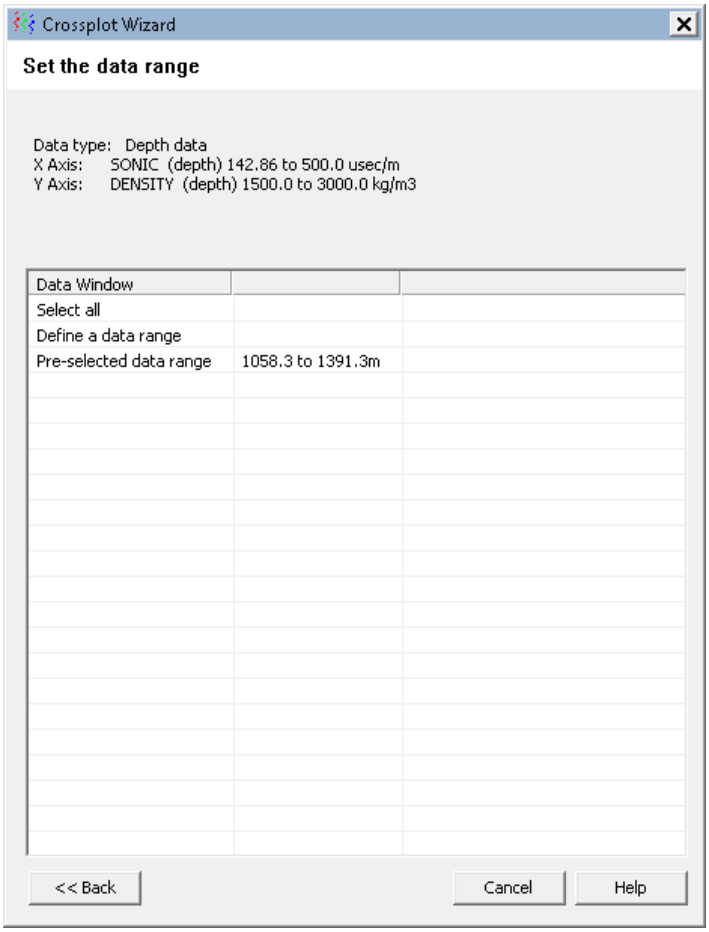
2. Select whether to base the crossplot on time or depth.

The Crossplot Wizard: Select axis data dialog box opens.

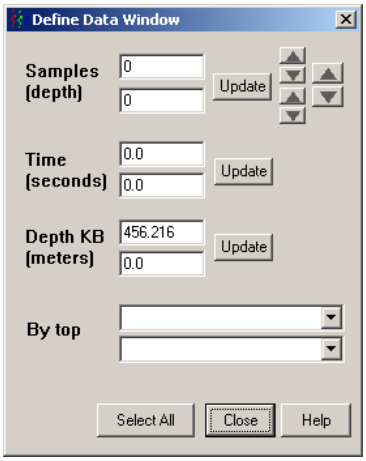


3. Select the logs to plot along first the X axis and then the Y axis.

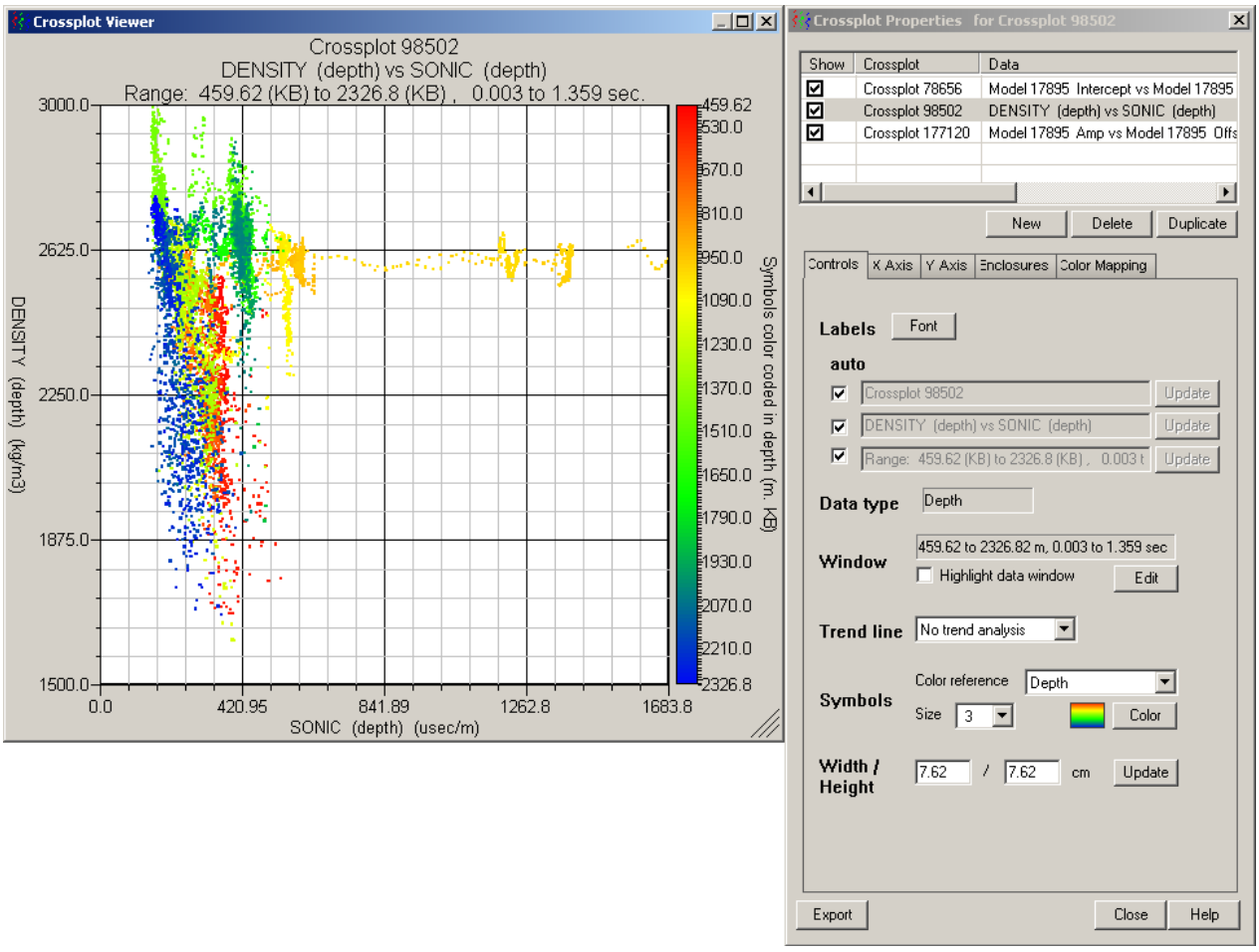
The Crossplot Wizard: Set the data range dialog box opens.



4. Click either **Select All**, or click **Define a data range** to display the Define Data Window dialog box where you select the sampling (milliseconds for time plots and depth samples for depth data), and the overall duration or depth.



The *Crossplot Viewer* and Crossplot Properties dialog box opens.



5. Configure display options using the Crossplot Properties: Controls, Crossplot Properties: X and Y Axis, Crossplot Properties: Enclosures, and Crossplot Properties: Color Mapping tabs.

Related topics

"Annotating crossplots" on the next page
"Color mapping crossplots" on page 178
"Exporting crossplots" on page 192
"Changing color palettes" on page 131
"Inspecting logs" on page 86

Annotating crossplots

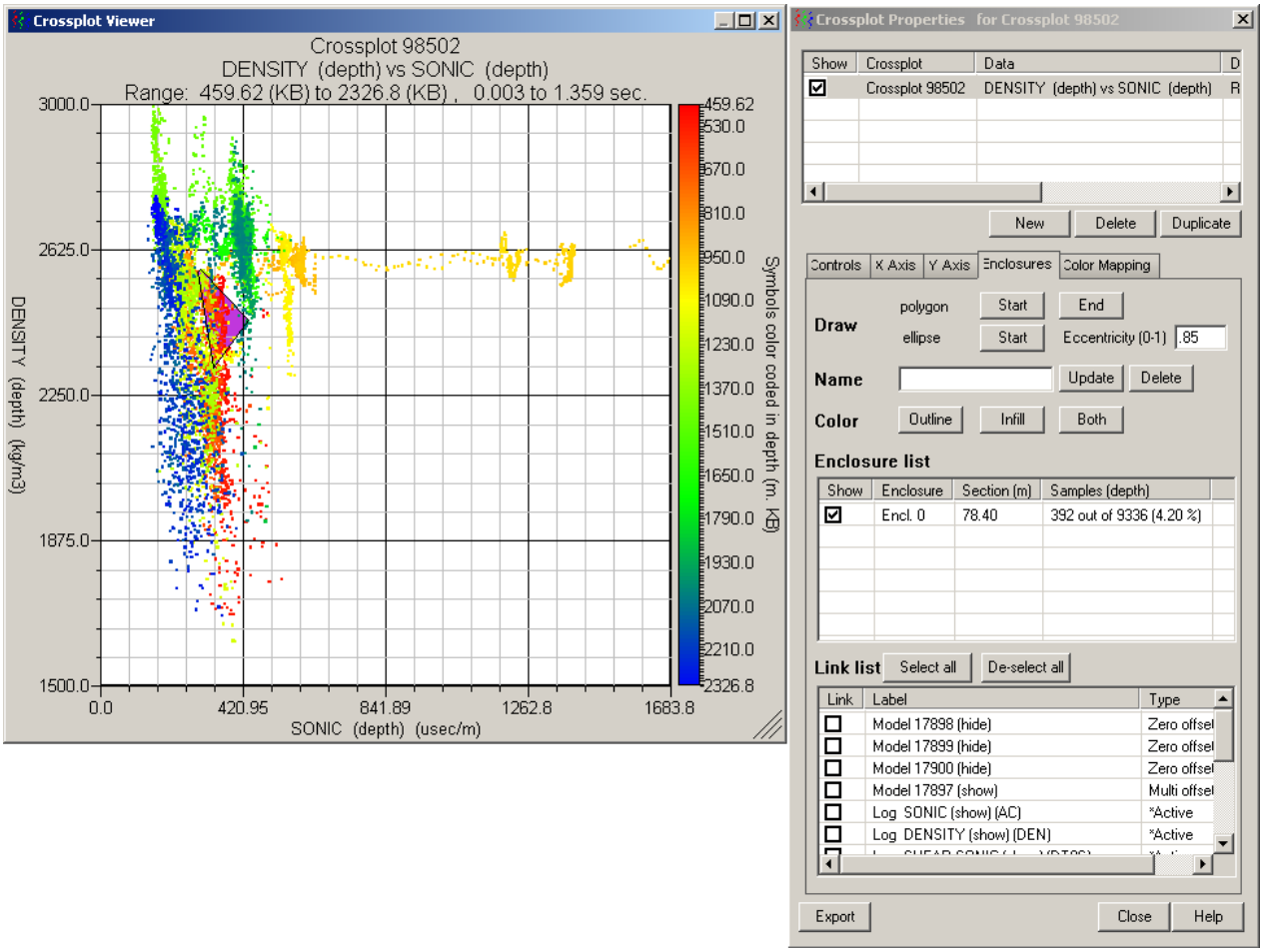
Highlight crossplot features by drawing either a polygon or ellipse in the Crossplot Viewer and then changing the default annotation display properties. The data points that fall within the polygon you draw are highlighted on the synthetic. This enables you to see where data points of interest that are on the crossplot come from. For details on creating a crossplot, see *Related topics* below.

When drawing an ellipse, you can specify an eccentricity of 0 to 0.99 where 0 represents a circle and 0.99 represents the narrowest (most eccentric) ellipse. Typing 1 draws a line instead of an ellipse.

To annotate crossplots:

1. With at least one crossplot created in the main synthetic display, from the **Edit** menu, select **Crossplot properties** ( ).

   The *Crossplot Viewer* and *Crossplot Properties: Enclosures* dialog box opens.



2. Click the **Enclosures** tab.
3. Do either of the following:
   - **To draw a polygon**, click **Start**, and then click to define the anchor points for the polygon segments in the Crossplot Viewer. Click **End** to complete and automatically enclose the polygon.
   - **To draw an ellipse**, type a decimal value from 0 to 0.99 in the eccentricity box. Click **Start** and then click to anchor one end of the ellipse. Move your mouse across from the start anchor point to the desired end point and then click to anchor that point.

As you draw polygons and ellipses, they're added to the Enclosure list below the drawing controls. Draw multiple annotations to encompass different features.

4. In the Enclosure List, select the annotation with which to work (SHIFT+CLICK or CTRL+CLICK for multiple selection).
   In the Name box, type a descriptive name for the annotation(s) selected above.
5. Select from the following display properties:
   - **Outline** to specify the annotation border color.
   - **Infill** to specify the annotation fill color within the annotation border.
   - **Both** to select one color for both the annotation border and fill.
6. In the Link List pane, click the synthetic or log on which to display the data point highlighting.
   To hide an annotation from the Crossplot Viewer, clear the check box in the Show column of the Enclosure list. You can also select the enclosure and then press **Delete**.

Related topics

"Creating crossplots" on page 170
"Color mapping crossplots" on the next page

Color mapping crossplots

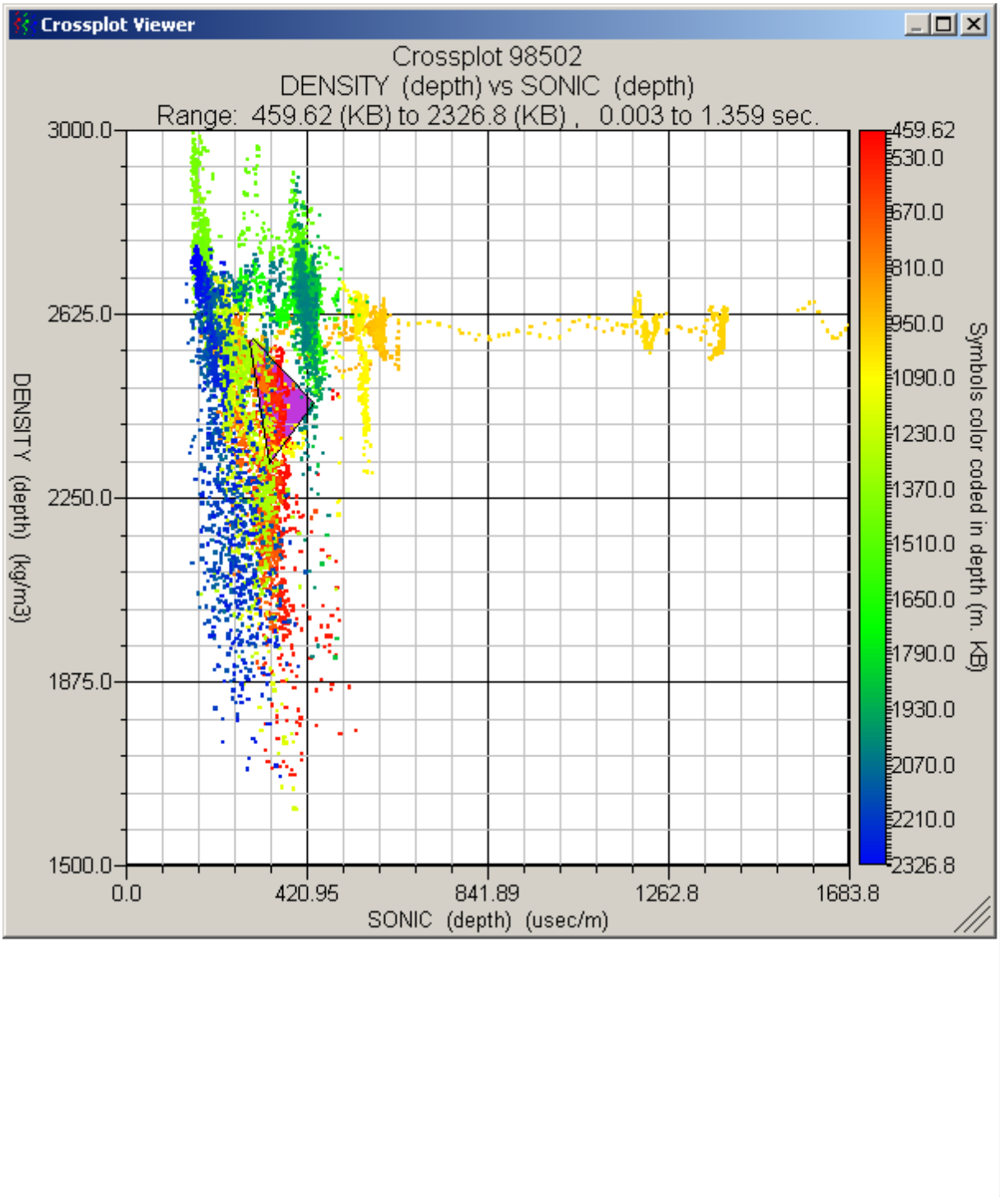
Select areas of the crossplot to color. Either work with a color gradient to change the default palette, or use a block fill to change the color of desired cells on the grid. The color you apply is also displayed for the data points on the log or synthetic that also fall within that cell.

This functionality is similar to drawing annotations that encompass desired data points. For details, see *Related topics* below.

To color map crossplots:

1. With at least one crossplot created in the main synthetic display, from the **Edit** menu, select **Crossplot properties** ().

The *Crossplot Viewer* and *Crossplot Properties: Color Mapping* dialog box opens.



2. Click the **Color Mapping** tab.

3. Select either of the following:

Gradational, to apply a color to one of the four quadrants that blends with the colors from the surrounding three quadrants.

Blocked, to fill individual cells you click with a solid color. In the Columns and Rows boxes, type the number of segments into which to divide the overall Crossplot Viewer canvas size. For example, if you type 2 in both boxes, the Crossplot viewer canvas is divided into four quadrants. If you type 100 in both boxes, the Crossplot viewer canvas is divided into a 100 x 100 grid.

4. Click **Brush** to select the desired color.

5. In the Link List pane, click the synthetic or log on which to display the data point highlighting.

To hide color coding from the Crossplot Viewer, clear the **Enable color coding** check box.

Related topics

"Creating crossplots" on page 170
"Annotating crossplots" on page 176

Correlating logs and traces

Overlay a GeoSyn correlation on a seismic section displayed on a seismic workstation.

Correlation windows and all dialog boxes opened from them float above all application windows, not just those in GeoSyn. You can drag them over a seismic display in any program for comparison.

Open any number of correlation windows. Multiple correlation windows open locked together, and some operations such as zooming or scrolling affect them all.

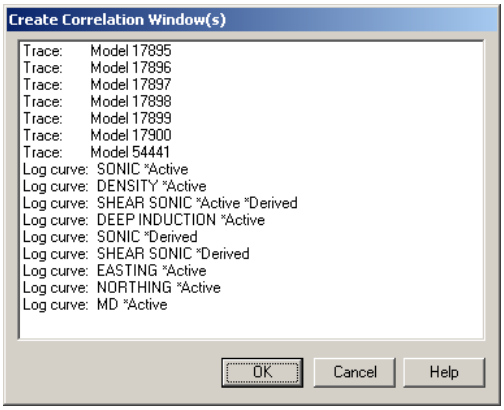
To maximize clarity and minimize clutter, obvious controls in correlation windows are only available when you right-click the correlation window.

Using the *Vertical Scale* pane that appears in the *Synthetic Properties* dialog box, select whether the linear scale displayed in the Correlation window is based on time or depth. Viewing synthetics in depth can be useful to verify the velocity functions upon which a synthetic is derived are accurate.

To correlate logs and traces:

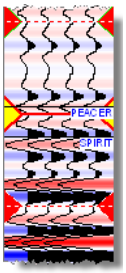
1. To open a single correlation window, right-click a log (displayed in a single track) or a trace and select **Correlation window** from the pop-up menu
OR
To open multiple correlation windows, from the **Utilities** menu, select **Create correlation window(s)**.

The Create Correlation Window(s) dialog box opens.



Select the traces or logs for which to create correlation windows then click **OK**. SHIFT+CLICK or CTRL+CLICK for multiple selection.

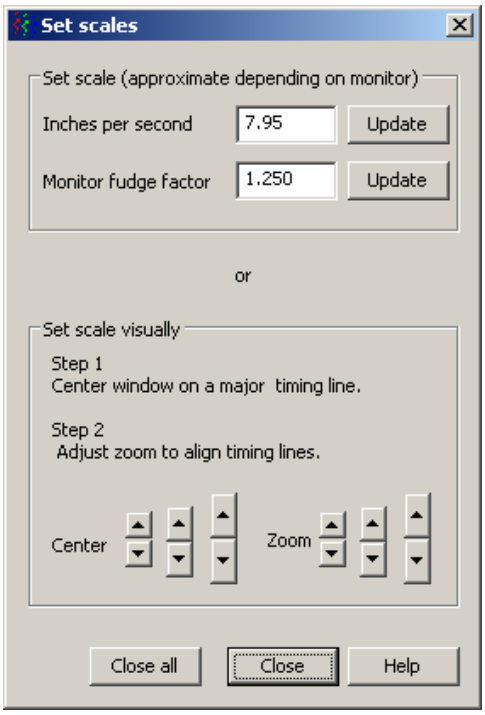
If you selected more than one Correlation window, they open locked together. A red horizontal line with yellow triangles at either end indicates the center of the correlation window.



2. Drag the Correlation window alongside the trace or log to match.

3. Right-click the window and click **Set vertical scale** from the shortcut menu.

The Set Scales dialog box opens.



4. Do either of the following, and then click **Close**:

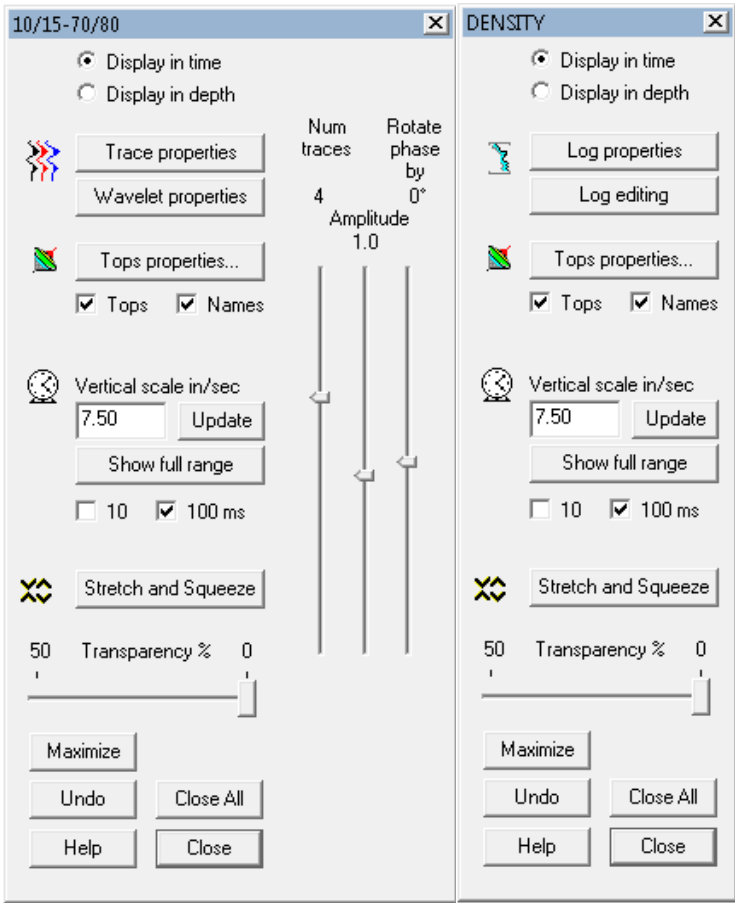
Type a specific increment in the *Inches per second* box. This distance may not equal physical measured distances because online display is defined in pixels and varies for different monitor resolutions, but the onscreen display should match the same setting defined in other seismic interpretation software.

Click the **Center** buttons to raise or lower the correlation on a pixel basis.

Click the **Zoom** buttons to change the distance between the timing lines in the Correlation window. The larger buttons move and zoom the correlation in larger pixel increments.

5. Right-click the Correlation window and click **Controls** from the shortcut menu.

Depending on whether you displayed the correlation window for a log or trace, either the Log or the Trace toolbar appears.



Use the log or trace Toolbar to access a number of dialog boxes, including *Log Properties*, *Display Properties*, *Tops Properties*, *Wavelet Properties*, and more. The available controls depend on whether a log or trace is selected. Change the controls by clicking a correlation window for either a log or trace.

6. Do any of the following:

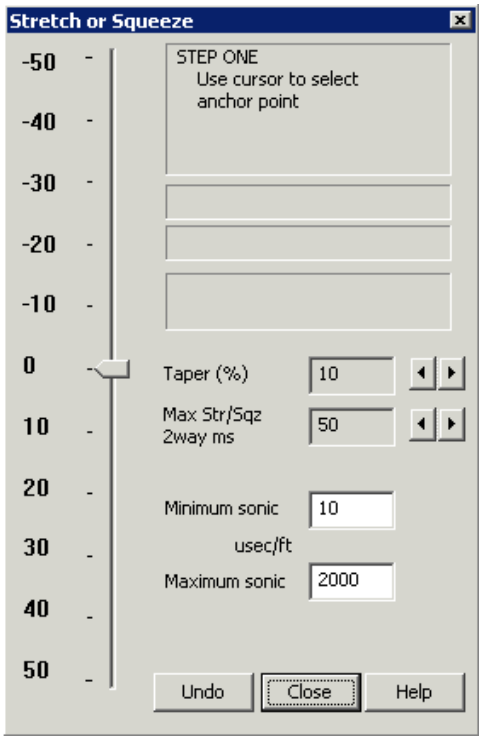
To move the log or trace vertically, click and hold the mouse button inside the correlation window and drag up or down.

To match the scale in the correlation window with that of the seismic display program, SHIFT+CLICK inside the correlation window and drag.

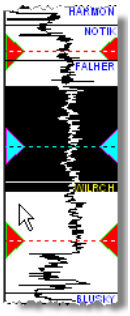
To change the trace amplitude, drag the sliders on the Toolbar.

7. Click **Stretch and Squeeze**.

The Stretch or Squeeze dialog box opens.



8. Using the model trace, click to define the top of the area on the model to stretch and squeeze, and then click the bottom of the area on the model to stretch and squeeze.



9. Using the *Stretch or Squeeze* dialog box, drag the slider to elongate or compress the trace within the window defined above.

Related topics

"Stretching and squeezing logs" on page 70
"Tying seismic to models" on page 164
"Importing check shot surveys and vertical seismic profiles" on page 21

GeoSyn output

There are several ways to output GeoSyn data:

Printing Synthetics	By default, a printed page outline appears on the main synthetic display bounding the pane that will fit on the paper size selected for the default printer.
Reformatting GeoSyn and LAS Files	Convert batches of LAS files to GeoSyn format or vice versa.
Importing and Exporting Images	Copy any individual element that appears in the main synthetic display (or the entire synthetic display) to the Windows clipboard then paste it into other applications to create a montage.
Exporting Crossplots	Export X and Y coordinates in .CSV format. Export a crossplot either using the Crossplot properties dialog box or the Export Manager:
Exporting Log Aliases	Export a list of all the aliases that GeoSyn uses to recognize imported logs.
Exporting Logs	Export depth logs in either SEGY binary format (for importing in geophysical workstations) or LAS format, and time logs in either SEGY or column-ordered ASCII format (for importing in spreadsheets).
Exporting Models	Export models are saved in either SEGY or ASCII format.
Exporting to Petra	Export GeoSyn data to Petra in various formats including .syn, .emf, LAS, and SEGY format. For LAS format, specify the logs to include in the LAS file.
Exporting Seismic	Export seismic files in SEGY format.
Exporting Wavelets	Export wavelets in SEGY or ASCII format.

Exporting Tops Lists	Save tops lists to disk in ASCII format.
Exporting Tops Tables	GeoSyn displays a list of tops in a tops table that can be exported in either .emf or ASCII text for other applications.
Exporting Time/Depth	Export as ASCII file showing times and equivalent depths.

Printing synthetics

By default, a printed page outline appears on the main synthetic display bounding the pane that will fit on the paper size selected for the default printer. Because most printers don't print right to the edge of the page, an additional three-quarters of an inch of image inside the print margin won't be printed.

Toggle whether the page outline appears in the main synthetic display using the Synthetic Properties dialog box.

If you change the paper size using the File > Print Setup dialog box, the page outline in the main synthetic display changes too.

Print either the current synthetic or select a group of GeoSyn synthetics saved to disk and print them in one batch. Separate procedures for each appear below.

To print current synthetics:

1. Verify how the current synthetic will appear when printed by selecting **File** > **Print Preview**.

The Print Preview dialog box opens.

2. From the **File** menu, select **Print**(), or click **Print** in the **Print Preview** dialog box above.

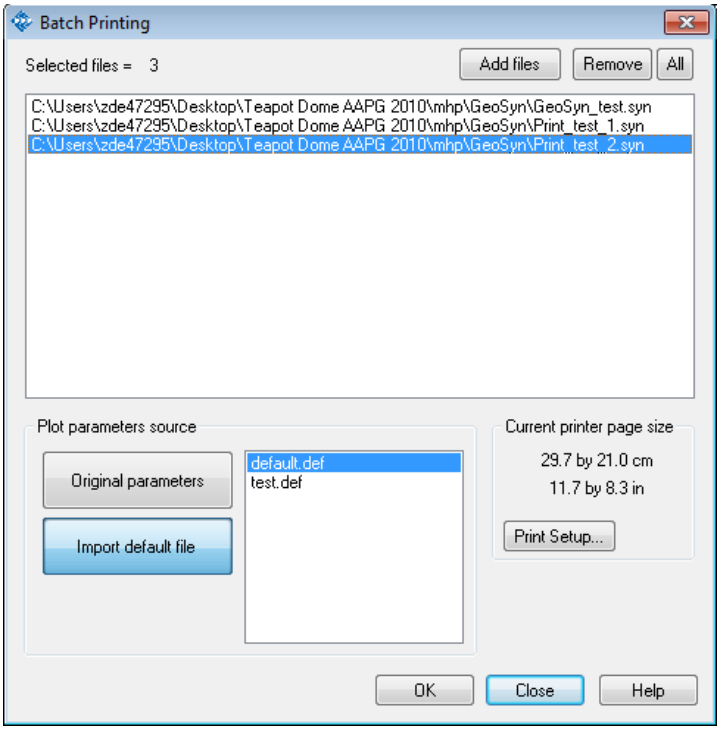
The Print dialog box opens.

3. Select the desired print options then click **OK**.

To print multiple GeoSyn files:

1. From the **File** menu, select **Printing**.

The Batch Printing dialog box opens.



2. Click **Add files**, browse to and select the desired file(s). SHIFT+CLICK or CTRL+CLICK for multiple selection.

To sort files by UWI, click either **Browse dir.** or **Browse sub-dir.** to launch Directory Browser. For details on using Directory Browser, see *Related topics* below.

3. In the *Open a ... format file* dialog box, click **Open**.

4. Select either **Original parameters** to print each file using display parameters specified in its own file, or **Import default file** to select a default file from the current GeoSyn *Working* directory from which to use parameters.

5. Click **OK**.

Related topics

"Using Directory Browser" on page 10
"Reformatting GeoSyn and LAS files" below

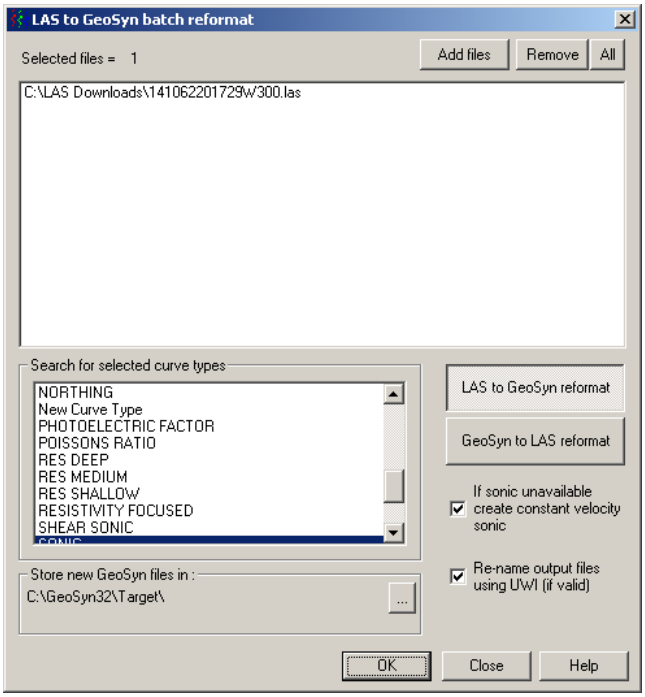
Reformatting GeoSyn and LAS files

Convert batches of LAS files to GeoSyn format or vice versa.

To reformat GeoSyn and LAS files:

1. From the **File** menu, select **Batch Reformat**.

The Batch Reformat dialog box opens.



2. Click either **LAS to GeoSyn reformat** or **GeoSyn to LAS reformat** then click **Add files**.

3. Browse to and select the desired file(s). SHIFT+CLICK or CTRL+CLICK for multiple selection.

To sort files by UWI, click either **Browse dir.** or **Browse sub-dir.** to launch Directory Browser. For details on using Directory Browser, see *Related topics* below.

If converting LAS to GeoSyn format, ensure you specify that GeoSyn create a constant velocity sonic if none is available, otherwise it ignores LAS files without sonic logs.

4. In the *Open a ... format file* dialog box, click **Open**

5. In the *Batch Reformat* dialog box, verify the target directory listed in the bottom-left is correct or click ... to select another then click **OK**.

Related topics

"Importing LAS or GeoSyn files" on page 14

"Using Directory Browser" on page 10
"Printing synthetics" on page 187

Importing and exporting images

Copy any individual element that appears in the main synthetic display (or the entire synthetic display) to the Windows clipboard then paste it into other applications to create a montage.

GeoSyn also enables you to paste *.emf* files from disk or from your Windows clipboard into the main synthetic display and control the placement, size, and visibility of all pasted images from one dialog box.

Images that appear in the above dialog box are saved with the synthetic file, even if they're hidden from the main synthetic display, and can be shown in the future.

Separate procedures for pasting Windows clipboard images and importing *.emf* images appear below.

To paste images from the Windows clipboard into GeoSyn:

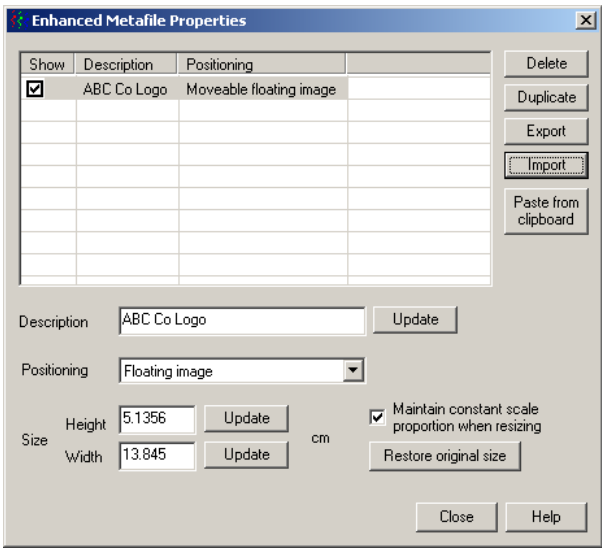
With the desired image copied to the Windows clipboard, from the **Edit** menu, select **Paste**.

The image appears in both the main synthetic display and in the *Enhanced Metafiles properties* dialog box detailed below.

To import *.emf* files into GeoSyn:

1. From the **Edit** menu, select **Metafile properties**.

The Enhanced Metafiles properties dialog box opens.



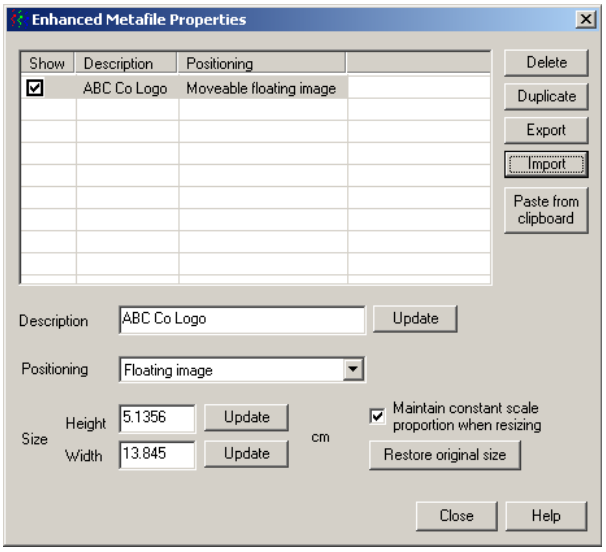
2. Click **Import from file**.

The image appears both in the main synthetic display and in the above dialog box display pane with an automatically generated ID.

To modify images pasted into GeoSyn:

1. From the **Edit** menu, select **Metafile properties**.

The Enhanced Metafiles properties dialog box opens.



2. To change the image ID to something more descriptive, select the row in which the image appears in the above display pane, then type a different name in the **Label** box and click **Update**.

3. From the **Positioning** drop-down list, specify whether the image appears in the top-right corner, can be dragged to a location where it offsets existing synthetic elements, or floats over synthetic elements without offsetting them.

4. In the **Show** column of the display pane, select whether the image is displayed in the synthetic or saved along with it for display in the future.

GeoSyn only imports files saved in *.emf* format. If the above image is pasted from the Windows clipboard and you want to use it in other synthetics without having to open this synthetic and copy it to the Windows clipboard, click **Export** and save it to disk with a *.emf* extension.

Related topics

"About the Main Synthetic Display" on page 45
"Changing the main synthetic display" on page 46

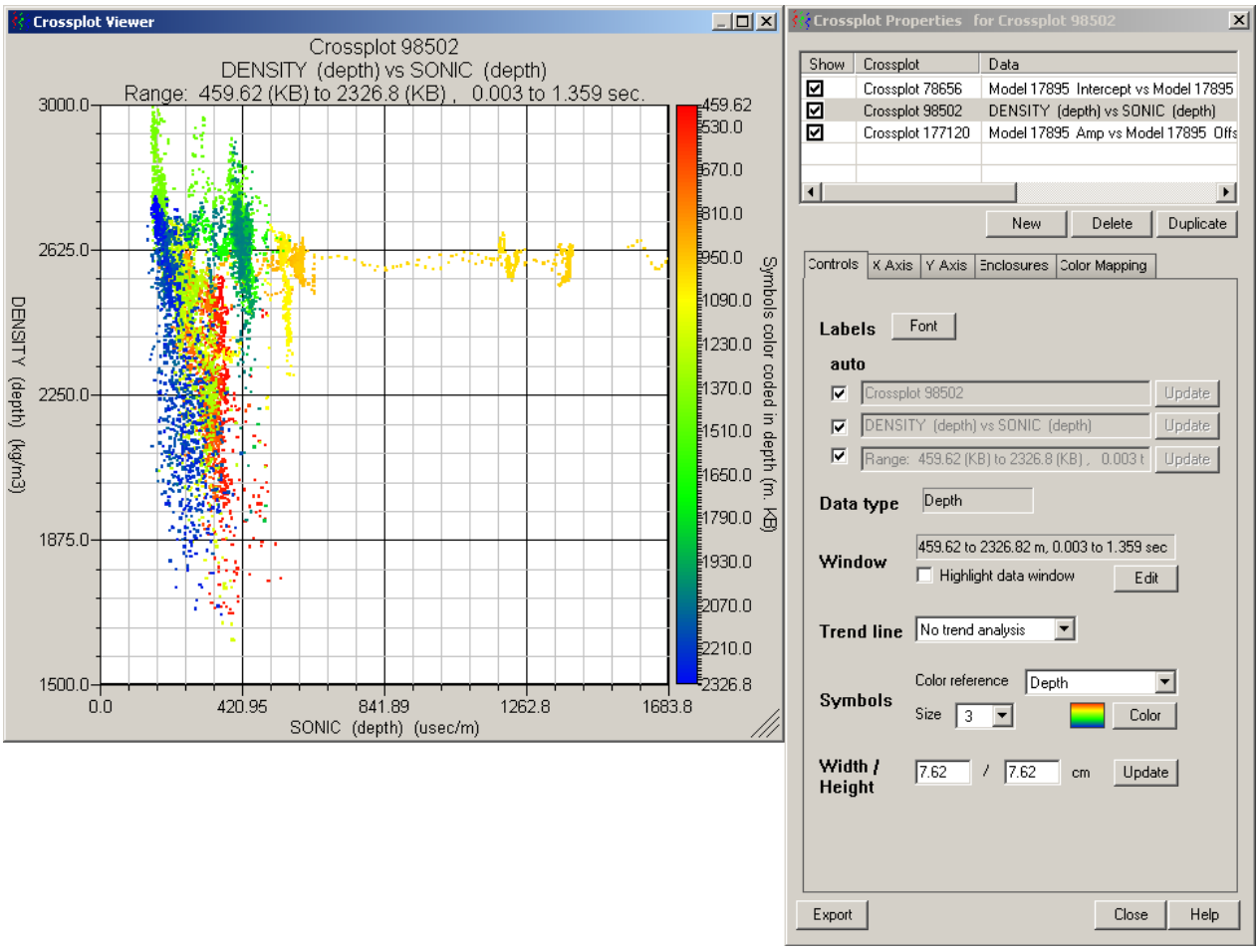
Exporting crossplots

Export X and Y coordinates in .csv format. Export a crossplot either using the Crossplot properties dialog box or the Export Manager: Crossplot dialog box. Procedures for both appear below.

To export crossplots using the Crossplot Properties dialog box:

1. From the **Edit** menu, select **Crossplot properties**.
OR
Right-click the crossplot and select **Crossplot Properties**.

The Crossplot properties dialog box opens.



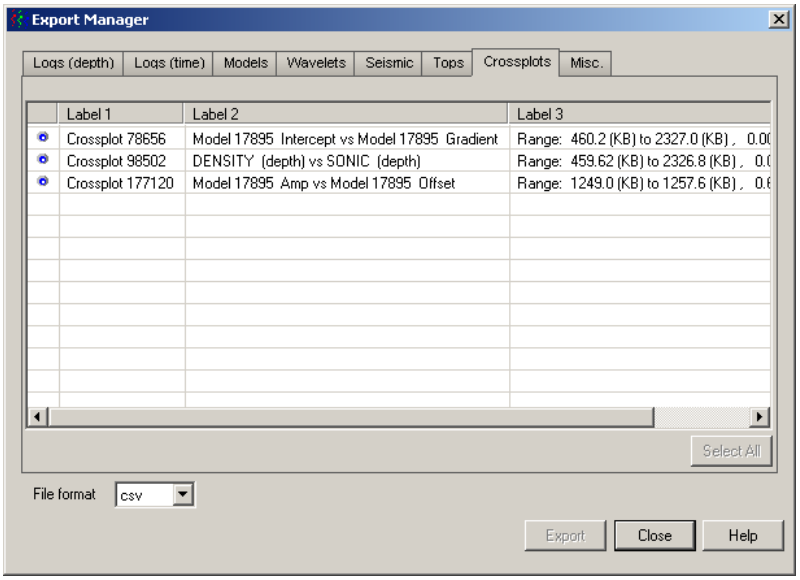
2. Click **Export**, select a location, and then click **Save**.

3. Click **Close** to exit the *Crossplot Properties* dialog box.

To export crossplots using the Export Manager dialog box:

1. From the **File** menu, select **Export**.

The Export Manager: Crossplots dialog box opens.



2. Select the crossplot to export in the display pane, and then click **Export**.

Related topics

"Creating crossplots" on page 170

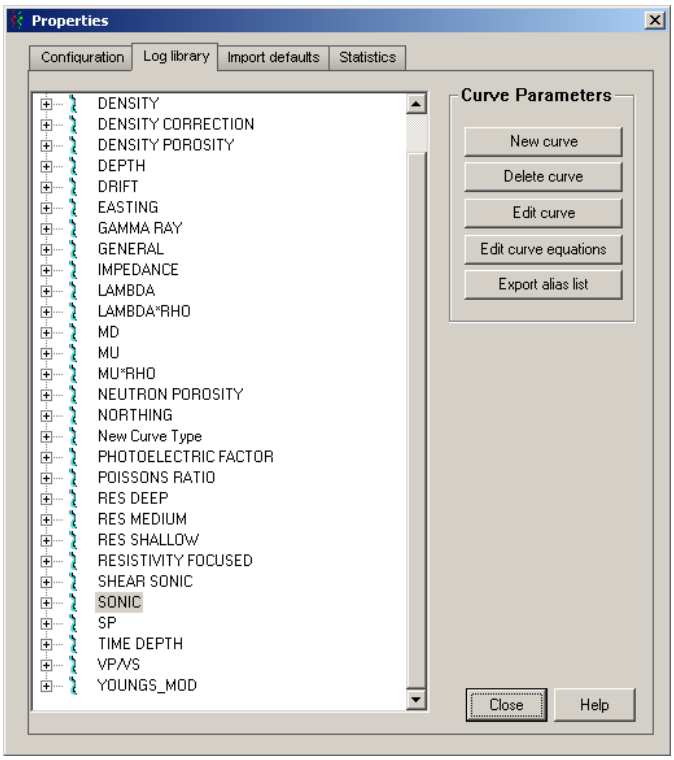
Exporting log aliases

Export a list of all the aliases that GeoSyn uses to recognize imported logs. The file is exported in ASCII format and you can view it using numerous third-party products to determine whether GeoSyn is using a desired alias.

To export log aliases:

1. From the **Edit** menu, select **Default Log Properties** (Def) > **Log Library**.

The Properties: Log Library tab appears.



2. Click **Export alias list**.

3. Browse to a location in which to save the file, and then click **Save**.

Now open the file using a third-party application such as Microsoft Excel or Windows Notepad.

Related topics

"Changing log defaults" on page 54

Exporting logs

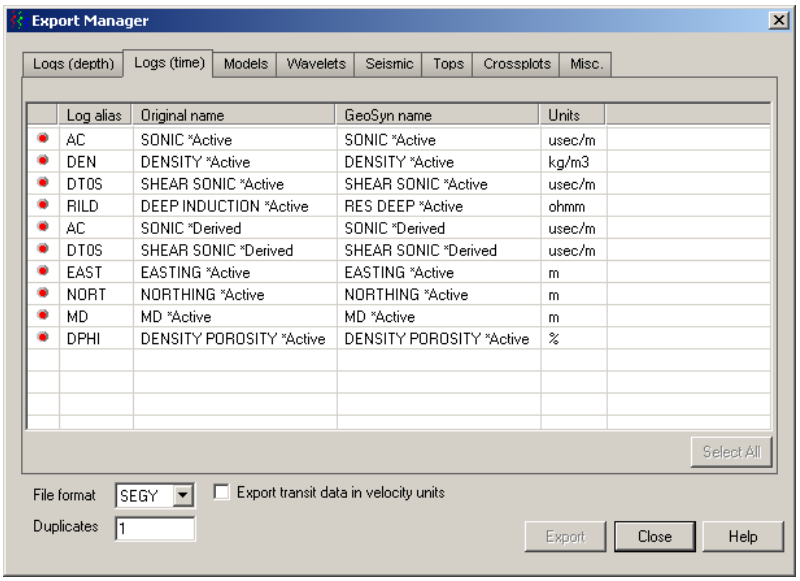
Export depth logs in either SEGY binary format (for importing in geophysical workstations) or LAS format, and time logs in either SEGY or column-ordered ASCII format (for importing in spreadsheets).

Depth logs are the original logs imported into GeoSyn. GeoSyn creates time logs when importing a sonic log. The time log can be used by other seismic applications.

To export logs:

1. From the **File** menu, select **Export** then click either the **Logs (depth)** or **Logs (time)** tab.

Depending on your selection, either the Export Manager: Logs (Time) or Export Manager: Logs (Depth) dialog box opens.



2. Select the row to export and from the **File format** drop-down list, select the file format for the exported file and click **Export**.

If exporting depth logs, you can further select whether to convert uncommon aliases to something more common to facilitate importing the log into other applications and whether to include a list of tops in the log file.

3. Browse to a disk location in which to save the file then click **Save**.

Related topics

"Importing LAS or GeoSyn files" on page 14
"Exporting to Petra" on the facing page

Exporting models

Export models are saved in either SEGY or ASCII format. Time depth information added using the Edit > Time Datum dialog box is preserved in the exported SEGY file.

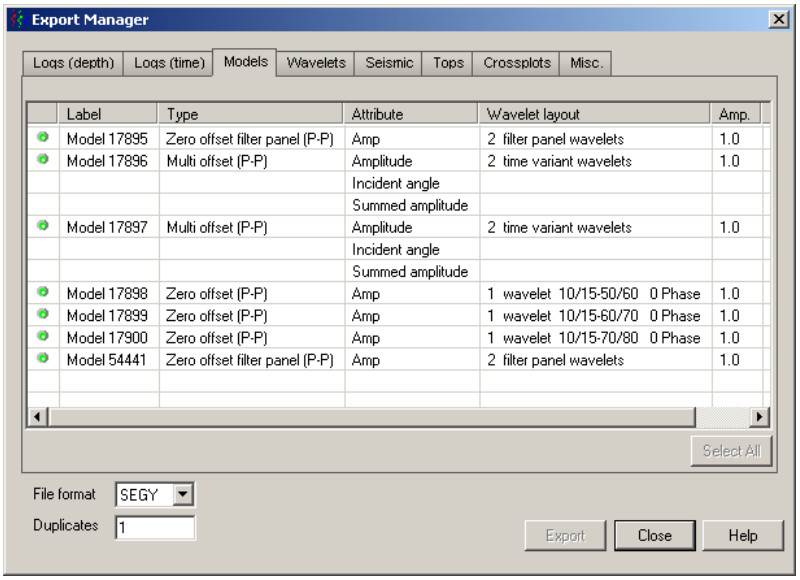
To export models:

1. From the **File** menu, select either **Export** > **Models**

OR

From the **Edit** menu, select **Model properties** () > **Export**.

The Export Manager: Models dialog box opens.



2. Select the row with the model to export and from the **File format** drop-down list, select the file format for the exported file and click **Export**.

3. Browse to a disk location in which to save the file then click **Save**.

Related topics

"Creating models" on page 106

Exporting to Petra

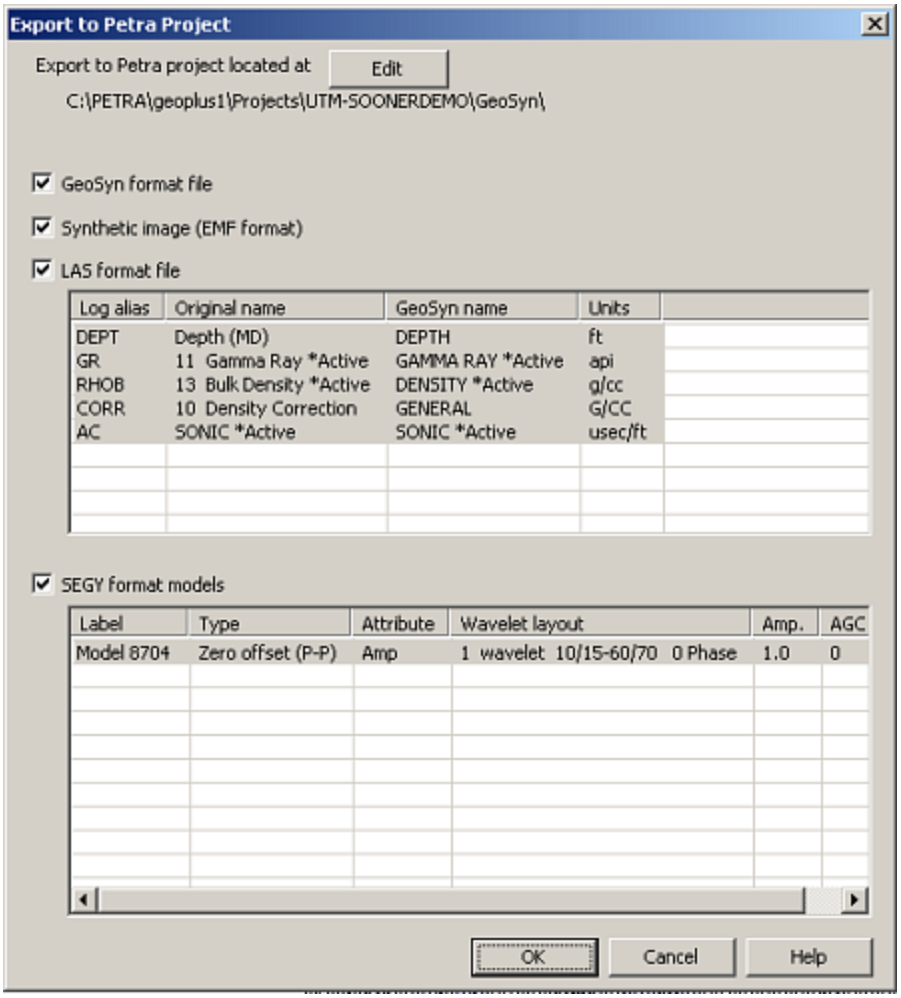
Export GeoSyn data to Petra in various formats including .syn, .emf, LAS, and SEGY format. For LAS format, specify the logs to include in the LAS file. For SEGY format, specify the GeoSyn models to include.

The Petra export option is only available if you created a GeoSyn project using PetraSeis. For details, see *Related topics* below.

To Export to Petra:

1. From the **File** menu, select **Petra Export**.

The Export to Petra Project dialog box opens.



2. Verify the location where to export the file, the format to include (Syn, EMF, LAS, SEGY), and then click **OK**.

Related topics

"Exporting seismic data" below

"Exporting logs" on page 195

"Launching GeoSyn using PetraSeis" on page 38

Exporting seismic data

Export seismic files in SEGY format. Time depth information added using the Edit > Time Datum dialog box is preserved in the exported SEGY file.

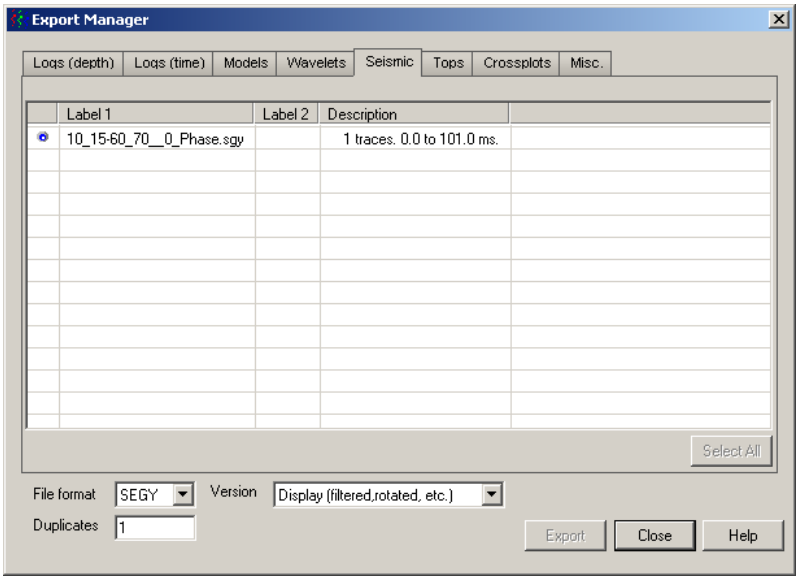
To export seismic:

1. From the **File** menu, select either **Export** > **Seismic**

OR

From the **Edit** menu, select **Seismic properties** () > **Export**.

The Export Manager: Seismic dialog box opens.



2. Select the row with the seismic trace to export then click **Export**.

3. Browse to a disk location in which to save the file then click **Save**.

Related topics

"Importing seismic from Kingdom" on page 161

"Exporting to Petra" on page 197

Exporting wavelets

Export wavelets in SEGY or ASCII format. For details on extracting a zero phase wavelet, see *Related topics* below.

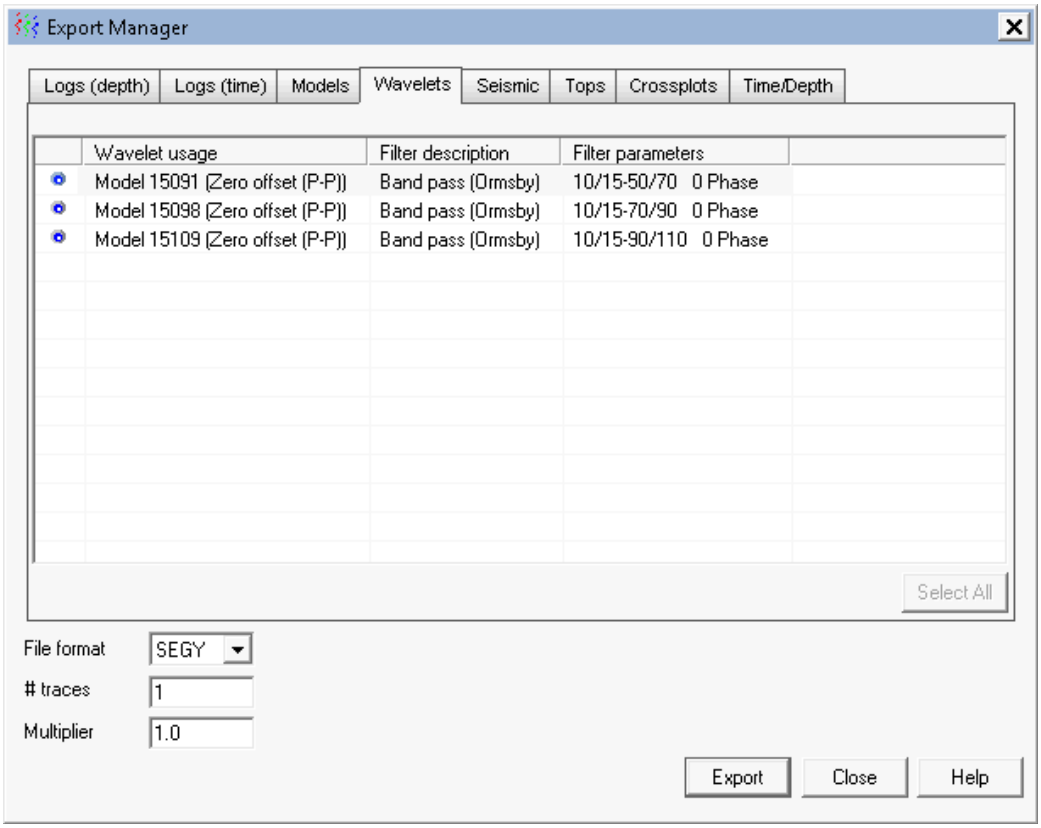
To export wavelets:

1. From the **File** menu, select either **Export** > **Wavelets**

OR

From the **Edit** menu, select **Wavelet properties** () > **Export**.

The Export Manager: Wavelets dialog box opens.



2. Select the row with the wavelet to export and from the **File format** drop-down list, select the file format for the exported file and click **Export**.

3. Browse to a disk location in which to save the file then click **Save**.

Related topics

"Creating models" on page 106

"Extracting wavelets" on page 149

Exporting tops lists

Save tops lists to disk in ASCII format. This file contains tops names, tops depths KB, a units flag, and the Kelly Bushing depth.

To merge tops from multiple lists into one list, either export each individual list to disk and then concatenate them using an ASCII text editor, or show all the tops in the tops table in the main synthetic display and copy this data to the Windows clip-board, then paste it into a spreadsheet application or ASCII text editor. For details, see *Related topics* below.

To export tops lists:

1. From the **File** menu, select either **Export** > **Tops**

OR

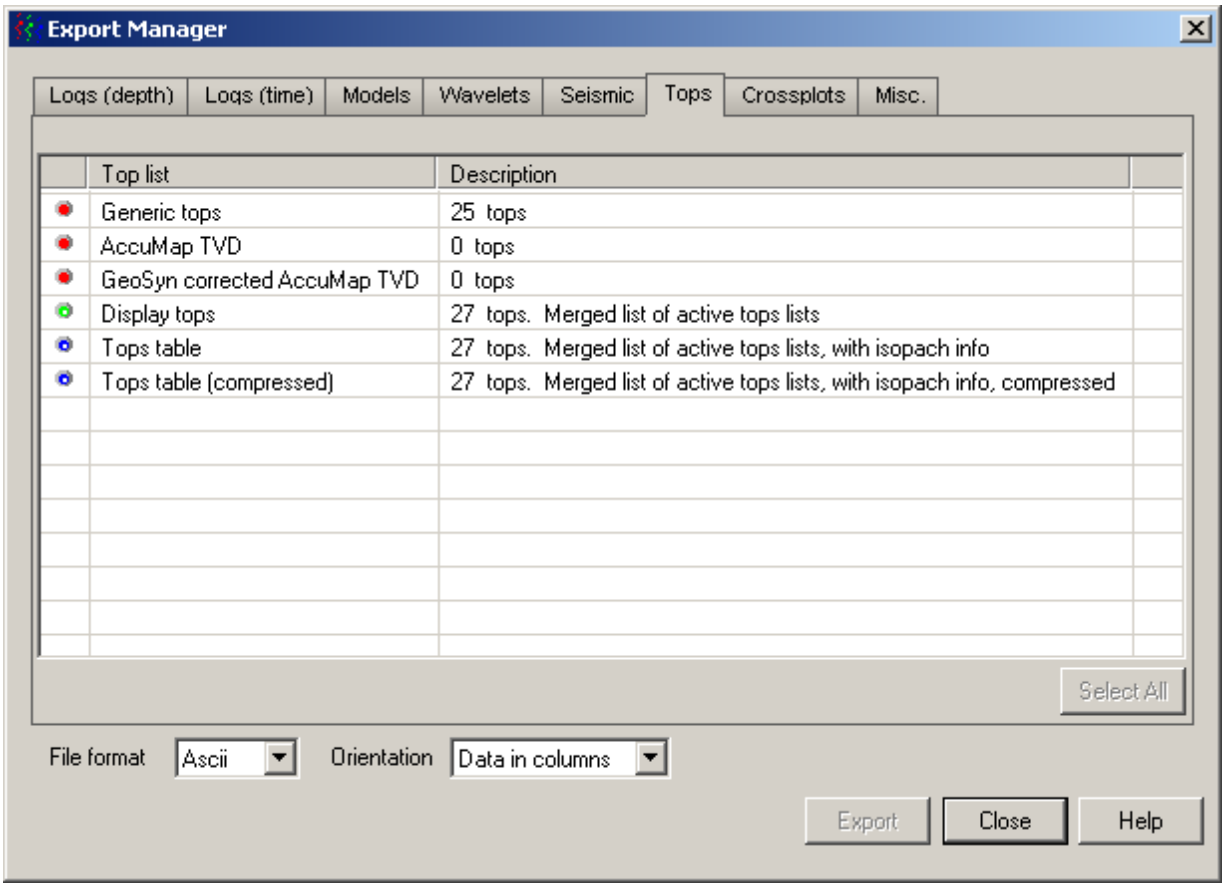
From the **Edit** menu, select **Tops properties** ( ) > **Export**

OR

Right-click the tops table and select **Tops properties** > **Export tops**.

To display the tops table in the main synthetic display, from the **Edit** menu, select **Synthetic properties** ( ) and in the **Display elements** pane, select **Tops table**.

The Export Manager: Tops dialog box opens.



2. Select the row with the list to export then click **Export**.

3. Browse to a disk location in which to save the file then click **Save**.

Related topics

"Tops Lists" on page 89

"Importing tops from GeoSyn files" on page 96

"Importing tops from delimited files" on page 97
"Importing tops from fixed width files" on page 99
"Importing LAS or GeoSyn files" on page 14

Exporting tops tables

GeoSyn displays a list of tops in a tops table that can be exported in either *.emf* or ASCII text for other applications. When multiple tops lists are shown in the main synthetic, all tops are grouped in one tops list. To display lists separately in the main synthetic display (such as a list of check shot values and a list of tops), show one of the lists in the main synthetic display and copy and paste it into GeoSyn, then hide the original list —not the pasted one, and show the other list.

Copy the data that appears in the tops table as either a static image or as ASCII text.

Tops tables copied as ASCII text can be pasted into other applications for modification including AccuMap Tops Manager, with which you update the AccuMap user tops database.

When the tops table is shown in the main synthetic display, it offsets other synthetic elements instead of floating over them. Tops tables copied as images can be pasted back into the main synthetic display as floating images without offsetting other synthetic elements or pasted into other applications to create a montage.

To export tops tables:

1. To display the tops table, from the **Edit** menu, select **Synthetic properties** ( ) and in the *Synthetic Properties* dialog box, select the **Tops table** check box and the adjacent position radio button.

2. Right-click the tops table and from the popup menu, select one of the following:

Copy tops table image to load an image in the Windows clipboard that can be pasted into other applications or pasted back into GeoSyn.

Copy name and md depth to load only top names and measured depth values into the Windows clipboard as ASCII text to paste into a text editor or spreadsheet application.

Copy all tops info to load all information that appears in the tops table into the Windows clipboard as ASCII text to paste into a text editor or spreadsheet application.

Export tops to display the *Export Manager* and write tops data to disk in ASCII format.

Related topics

"Duplicating tops lists" on page 91
"Importing check shot surveys and vertical seismic profiles" on page 21
"Importing directional surveys" on page 16
"Exporting tops lists" on page 200

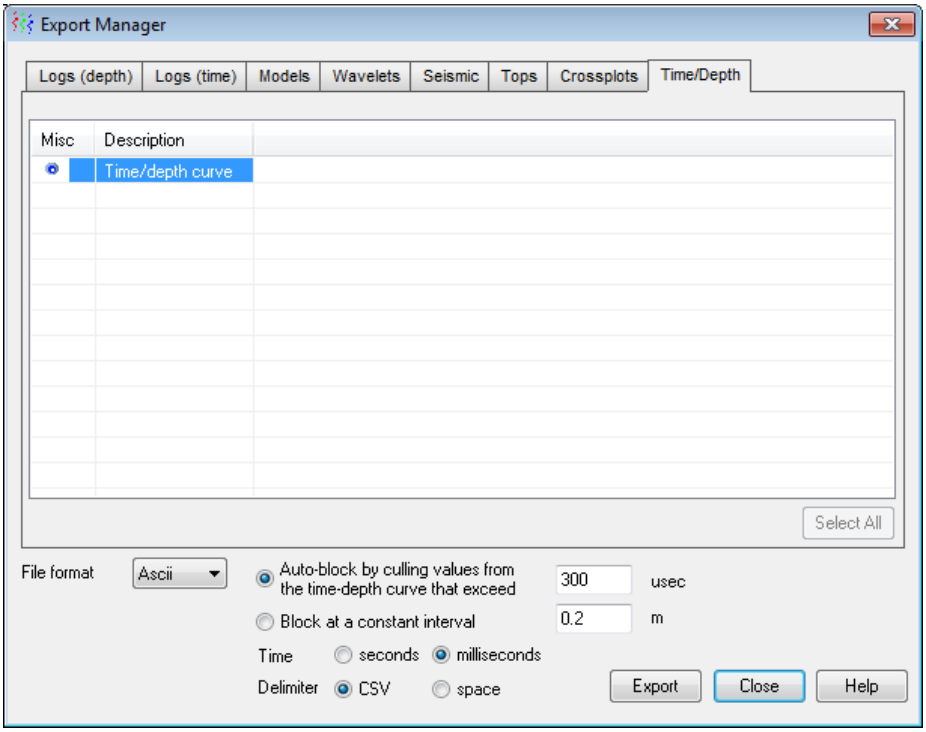
Exporting Time/Depth

Export as ASCII file showing times and equivalent depths. The time depth chart can be imported into third-party applications; however, for Kingdom, you can save the time depth chart directly to the Kingdom database using GeoSyn. For details, see *Related topics* below.

To export time/depth:

1. From the **File** menu, select **Export** > **Time/Depth**.

The Export Manager dialog box opens.



2. Select the row with the time/depth curve to export then click **Export**.

3. Browse to a disk location in which to save the file then click **Save**.

Related topics

"Importing seismic data" on page 158
"Importing seismic from Kingdom" on page 161
"Importing wells from Kingdom" on page 29
"Exporting to Petra" on page 197

Appendices

Basic AVO workflow	Guide for the use of the AVO functionality in GeoSyn
Check shot computation	Check shots to a synthetic computation
Supported file formats	.ihs, .syn, .las, .segy
Well symbol legend	Table of well symbols provided in GeoSyn
"Wizards and dialog boxes " below	Alphabetical listing of all user dialogs

Wizards and dialog boxes

The following pages provide descriptions and definitions of all the wizards and dialogs used in GeoSyn.

Blocked log wizard: Create new layers and logs

With this feature...	Do this...
Display pane	Select a formation top to change or remove or above which to insert a new formation.
Edit	Type the value to place in the cell selected in the display pane above. The depth is a positive value (kelly bushing).
Layers	Click one of the following: **Add** to insert a generic formation top row above the row selected in the display pane above. **Delete** to remove the row selected in the display pane above, or **All** to remove all tops columns.
Logs	Click one of the following: **Add** to display the **Select from list** dialog box and select a blocked log type to create. **Delete** to remove the column selected in the display pane above, or **All** to remove all logs columns.
Enter transit log values	Select the depth and time units for converting depth to time.

Parent Topics

"Creating blocked log models" on page 65

Blocked log wizard: Description and output options

With this feature...	Do this...
Labels	Type the labels that appear in the main synthetic display.
KB elevation Depth inc.	Type values for the kelly bushing elevation, the depth increment, and the top and bottom of the zone.
Top Bottom	Type the top and bottom depth of the log
Create an LAS format file from the model and save to disk	Toggle whether to create an LAS file for the blocked log that you can subsequently import into GeoSyn and other applications.
Create a GeoSyn synthetic	Toggle whether to automatically create a synthetic or select the option above instead and then import the LAS file.

Parent Topics

"Creating blocked log models" on page 65

"Blocked log wizard: Create new layers and logs" on the previous page

Check shot wizard: Import data

With this feature...	Do this...
Display pane	Select the check shot time depth pair to modify.
Time Depth	Type a time and depth pair for a new or existing row.
Insert Update Delete All	Select a check shot in the display pane above and click one of the following: **Insert** to add a new row with the time depth values typed in the Time and Depth boxes. Regardless of the row selected, the inserted row is placed according to its depth. **Update** to apply the values typed to the selected row.

	Delete to remove the row or **All** to clear the entire display pane.
Export Import	Click to save or load a file in ASCII format.

Parent Topics

"Importing check shot surveys and vertical seismic profiles" on page 21

"Check shot wizard: define datums" below

Check shot wizard: define datums

With this feature...	Do this...
Check shot source offset	Type the check shot offset coordinates.
Check shot depth reference	Type the subsea depth from which the check shot depths are measured (typically the same as the log KB).
Check shot source elevation	Type the subsea depth at which the check shot energy source is located. Typically it's deeper than the log KB. In a marine setting, the air guns are a few meters below sea level.

Parent Topics

"Importing check shot surveys and vertical seismic profiles" on page 21

"Check shot wizard: Import data" on the previous page

"Check shot wizard: shift time zero" below

Check shot wizard: shift time zero

With this feature...	Do this...
Time Datum SS	Change the default check shot source elevation, which by default is the top of the sonic log, to align with the seismic time zero. The check shot data is typically at the KB whereas seismic data is at the highest elevation above the seismic survey to account for variations in surface topography.
Correction Velo-	Specify a velocity that matches the speed of the sub-

city	surface material found in the surface elevations. This correction is applied to surface valleys to correct the subsurface readings for distortions caused by varying surface topography. The change in time is the difference between the check shot time datum and the value in the **Time Datum** box divided by the datum velocity. GeoSyn calculates a check shot correction without reference to this value, then as a final step, adds or subtracts section to correct the new time datum.
Drift Calculation	Select either a **Spline curve** or **Linear** correction type.
Quality control	Select from the following: **Drift Curve** A record of the transit correction applied to each sample of the original active sonic. Inspect this log for large drift corrections. **Check Shot Transit Curve** A record of the velocity field observed by the check shot. This log should be a rough approximation of the sonic log and is particularly useful for spotting datum errors, such as an incorrect well KB or check shot depth datum. **Create New Tops List for Check Shots** to import the check shot depth time pairs as tops. You can then check the position of these tops in time on the synthetic against the check shot time values. These times differ if the synthetic is moved to a new datum.

Parent Topics

"Importing check shot surveys and vertical seismic profiles" on page 21

"Check shot wizard: define datums" on the previous page

Crossplot wizard: Select data type

With this feature...	Do this...
Depth data Time data	Select whether to base the crossplot on depth or time readings.

Parent Topics

"Creating crossplots" on page 170

"Crossplot wizard: Select data type" above

Crossplot wizard: Select axis data

With this feature...	Do this...
Display pane	Click the log upon which to base first the X and then the Y axis.

Parent Topics

"Creating crossplots" on page 170

"Crossplot wizard: Select data type" on the previous page

Crossplot wizard: Set the data range

With this feature...	Do this...
Display pane	Click the data upon which to base the cross-plot based on the following: ▪ **Select all** to select the entire log depth. ▪ **Define a data range** to display the **Define Data Window** dialog box and specify the portion of the log. ▪ **Pre-selected Data Range** to use the depth range specified in the *Log Inspection* dialog box, which is launched from the Log Editor.

Parent Topics

"Creating crossplots" on page 170

"Define data window" on page 244

"Crossplot wizard: Select axis data" on page 209

Data search wizard: Search locations and ranges

With this feature...	Do this...
Add Location | Add Range	Click to display the **Edit a UWI** dialog box and select the survey system then type coordinates within which to retrieve logs.
Remove | All	Select the specific location or range in the display pane and click **Remove**, or click **All** to clear all locations and ranges from the list.
Recent Searches	Select a search you previously conducted from the drop-down list.
Data Source	Select whether to retrieve logs from the IHS Information Hub or from a local or networked drive. Click **Edit online configuration** to display the **Properties: Configuration** dialog box and change folders in which downloaded logs are saved and your connectivity parameters for the IHS Information Hub. For GeoSyn network installations, connectivity parameters (except user name) affect all GeoSyn users.
Edit user paths	Click to display the **Set Source and Target directories** dialog box where you select the source to search for data and the location in which to save downloaded files.

Parent Topics

"Downloading logs from the IHS information hub" on page 41

"Launching GeoSyn using AccuMap" on page 34

"Data search wizard: Select data from catalog" on the facing page

Data search wizard: Select data from catalog

With this feature...	Do this...
Node expansion buttons ()	Click to expand or contract all well nodes in the display pane.
Auto Select	Click to display the *Auto Curve Selection dialog* where you specify the curve type, author, and other details with which to select rows. To select all logs for a well, simply click the well.
Select all | Deselect all	Select all | Deselect all
Display Layout	Before specifying the **Selection criteria** above, click to display the **Catalog display options** dialog box and specify the parameters under which wells appear in the display pane.
Report	Click to output the information that currently appears in the display pane to an ASCII text file.
Display pane	Click **+** and **-** to expand or contract individual nodes and select the desired logs. To select all logs for a well, simply click the well.

Show	Toggle whether wells with digital sonic, digital density, and a specific depth appear in the display pane. GeoSyn automatically creates a constant velocity sonic log if none is available in the downloaded log. Specify whether undigitized logs and directional surveys appear in the display pane. If you try to download an undigitized log, an online digitization request form appears that you submit to IHS. Showing wells without data enables you to at least determine that a well UWI exists in the data.
Hide if well	Click whether wells with digital sonic or density, or that don't reach a certain depth appear in the display pane.
Group multiple runs	Select whether to merge the overlapping portions of curves. Further merge options such as whether to merge only curves from a common source and whether to trim the shallower or deeper curve appear in the **Data Search Wizard: Save Options** dialog box, which appears after you click **Next**. By default, data on the IHS Information Hub is metric, but it can be converted to Imperial.

Parent Topics

"Downloading logs from the IHS information hub" on page 41
"Launching GeoSyn using AccuMap" on page 34
"Data search wizard: Search locations and ranges" on page 212
"Data search wizard: Define save options" below

Data search wizard: Define save options

With this feature...	Do this...
Synthetic creation...	When importing logs from a single well, toggle whether to automatically: Create and launch a synthetic. Apply directional survey (if applicable)
Directional survey	When you select a dir-

save options	ectional survey in the **Online Data Search Wizard: Select Data from Catalog** dialog box, specify the folder and format in which to save it. For directional surveys to be visible in **Data Search Wizard: Select Data from Catalog** dialog box, ensure **Service curves** is selected in the Show pane.
LAS save options	Specify whether downloaded curves are saved to the default target directory. **Depth increment** - select the depth increment with which curves will be resampled. If you select **User defined** a second drop-down list appears where you type the desired depth increment. Using a larger depth increment may mute some curve details in curves with a small depth increment. Using a smaller depth increment may add some undue influences in curves with a large depth increment. **Tops nomenclature** - select the naming terminology for your tops. **Multiple runs** - select whether to merge only curves from the same source and for curves that are merged, whether to use the portion from the

	shallower curve (trim deep) or use the portion from the deeper curve (trim shallow).

Parent Topics

- "Downloading logs from the IHS information hub" on page 41
- "Launching GeoSyn using AccuMap" on page 34
- "Properties: Import defaults" on page 294
- "Data search wizard: Select data from catalog" on page 213

Fluid replacement wizard (Input and output logs, depth range)

With this feature...	Do this...
Log tool kit	Click to display the **Fluid Replacement Tool Kit** dialog box to populate the input and output logs.
Input logs (P Sonic, S Sonic, Density)	GeoSyn automatically populates these boxes with P wave, shear sonic, and density logs if they're present in your model. Otherwise, click **Log Took Kit** above to derive them from other logs. The input logs are the source logs for Gassman's equation.
Porosity	Select either a constant porosity percent (most common), or derive the porosity percent from a density log. Note that a porosity log derived from a density log may not be accurate for zones in which gas is present.
Porosity units	Select a scale of either 0-10 or 0-100. GeoSyn analyses the data extents and picks the units that seem most likely, but you can override them if some aberrant data values cause GeoSyn to select the wrong units.
Create Missing Log Types	Click to display the *Generate Logs for Well* dialog box and derive the logs required as input logs for fluid replacement modelling from other logs in your model. For example, the shear log is typically derived from the sonic log.
Duplicate Key Logs	Click to create exact copies of existing logs in your model for the input logs. You might do this if you want to

	keep a pristine copy of the original logs.
Output logs	Initially, these are copies of the input logs, to which you then apply fluid replacement changes. Specify ***Active** logs in the drop-down lists so that fluid replacement changes are automatically reflected in the current model.
Depth range KB	Do one of the following: Type start and stop depths and click **Update**. Click either **Top** or **Bottom** to select an absolute depth from the log, or click **All** to select both. Click **Range from tops** to select a zone of interest using the formation top names that also appear in the tops list selected in the **Top Properties** dialog box. **Tip:** You can also use your mouse pointer to drag a specific zone on the *Log Editor* to specify a zone of interest.

Parent Topics
"Modelling fluid replacement" on page 115

Fluid replacement wizard (In-situ reservoir properties)

With this feature...	Do this...
Matrix	Click the thumbnail or drag the white circle to the area in the thumbnail that most closely matches the subsurface matrix. To type these values directly, clear the Define Manually check box. If you click **Workshop**, the *Minerals Calculator* dialog box opens, where you type the mineralogy for a given zone. Use the Identifier radio buttons to specify whether the mineral group (Carbonate), or a specific member of that group (Calcite) appear in labels for the thumbnail. The mineral group and members are specified in the Minerals Calculator.
Pore Fluids	Click the thumbnail or drag the white circle to the area in the thumbnail that most closely matches the subsurface pore fluids. For detailed derivations, click **Workshop** to display the *Batzle and Wang Fluid Properties Calculator* dialog box where you specify more precise values for your zone of interest.

Workshop	With the Batzle Wang check box enabled, click **Calculator** to display the *Batzle and Wang Fluid Properties Calculator* dialog box and specify values specific to your zone of interest.
Averaging Method	Select **Reuss iso-stress** if fluid ratios are consistent in pores throughout the zone of interest; otherwise, select **Voight iso-strain**.
Quality Control	Select check boxes to display values as log overlays in the Log Editor.

Parent Topics

"Modelling fluid replacement" on page 115
"Batzle and Wang fluid properties calculator" on page 232
"Minerals calculator" on page 275
"Fluid replacement wizard (Input and output logs, depth range)" on page 216

Fluid replacement wizard (Calibrate shear log for water saturations < 100%)

This dialog box only appears if the water saturation defined using the previous dialog box is less than 100%.

With this feature...	Do this...
Apply correction using Mavko's Procedure	It's recommended that you select this to compensate for the fact that the shear log is frequently derived from a sonic log using Castagna's formula. Castagna's formula requires a correction when gas is present in the zone of interest.
Edit	Click to display the **Edit the Derivation Equation for log** dialog box and change the formula.

Parent Topics

"Modelling fluid replacement" on page 115

Fluid replacement wizard (FRM Modelling: Set new water saturation)

With this feature...	Do this...
Thumbnail	Drag the green circle while viewing the effect in the **Log Editor** dialog box and in the Out of Range box. Click **Apply** to save these changes to the log.
Depth Range	Drag the cursor in the Log Editor to select the area of interest.
Tops	Click to display the *Depth Range from Tops* dialog box, where you select the top and bottom formations for the zone.

Parent Topics

"Modelling fluid replacement" on page 115

"Fluid replacement wizard (In-situ reservoir properties)" on page 217

Import Kingdom Seismic: 2D

With this feature...	Do this...
Seismic Survey	Select the name of the seismic survey. To change the order in which options in this list are displayed, use the *Sort by* option. To reduce the actual volume of seismic sections from which to choose, refer to the *Survey Retrieval* option below.
Data Type	Select from the various versions of the seismic line that may be available. Entries in this list include versions that may have been migrated, to which particular filters are applied, etc.
Survey Retrieval	Specify an are around the wellbore around which to retrieve the surveys where increasing the radius increases the volume of selections available in the top-left drop-down list of the Import Kingdom Seismic dialog box.
Trace Selection	Select whether to automatically pull traces or surface positions from the seismic for a given line that fall within

	a certain distance from the well. These can either be selected by line or cross line sequentially (every N^{th} trace or surface point). Unlike shot point, surface position is not sequential. If the *Auto select* option is cleared, type the min/max range for the traces to select.
Time Selection	Type the duration of data to retrieve from Kingdom. The maximum duration is up to 4 seconds of data. 4 seconds is a large volume of data, perhaps 100,000 feet down. 2 seconds is likely a more appropriate volume of data.
Well Tie Options	Select whether to tie the data to the surface or bottom hole location. The bottom hole location is typically closest to the reservoir target.

Parent Topics

"Importing seismic from Kingdom" on page 161

Related topics

"Import Kingdom seismic: 3D" below

Import Kingdom seismic: 3D

With this feature...	Do this...
Seismic Survey	Select the name of the seismic survey. To change the order in which options in this list are displayed, use the *Sort by* option. To reduce the actual volume of seismic sections from which to choose, refer to the *Survey Retrieval* option below.
Data Type	Select from the various versions of the seismic line that may be available. Entries in this list include versions that may have been migrated, to which particular filters are applied, etc.
Survey Retrieval	Specify an are around the wellbore around which to retrieve the surveys where increasing the radius increases the volume of selections available in the top-left drop-down list of the Import Kingdom Seismic dialog box.

Trace Selection	Select whether to automatically pull traces or surface positions from the seismic for a given line that falls within a certain distance from the well. These can either be selected by line and opposing cross line, the entire line or cross line within a range, or by a given radius around the well, which will include both lines and cross lines. If the *Select data within* check box is cleared, data can be retrieved from only a line or cross line instead of a radius. Refer to the Kingdom base map for line and cross line numbering.
Time Selection	Type the duration of data to retrieve from Kingdom. The maximum duration is up to 4 seconds of data. 4 seconds is a large volume of data, perhaps 100,000 feet down. 2 seconds is likely a more appropriate volume of data.
Well Tie Options	Select whether to tie the data to the surface or bottom hole location. The bottom hole location is typically closest to the reservoir target.

Parent Topics

"Importing seismic from Kingdom" on page 161

Related topics

"Import Kingdom Seismic: 2D" on page 219

Import wizard: Highlight first data line in red

With this feature...	Do this...
Display pane	Click the first line of data (not column headers) to import.

Parent Topics

"Importing tops from fixed width files" on page 99
"Importing directional surveys" on page 16
"Import Wizard: Highlight last data line in red" on the next page
"Importing wavelets and wavelet sets" on page 136

Import Wizard: Highlight last data line in red

With this feature...	Do this...
Display pane	Click to define the last line of data to import.

Parent Topics

"Import wizard: Highlight first data line in red" on the previous page
"Importing directional surveys" on page 16
"Import wizard: Set column delimiters" below
"Importing wavelets and wavelet sets" on page 136

Import wizard: Set column delimiters

With this feature...	Do this...
Fixed width Tab Comma	Select the character used to separate values in the file being imported.
Display pane	Click to place a column delimeter (↑) before a column of data to import or double-click to remove an existing delimeter. Delimeters need to be placed on both the left and right of columns to import.
Identify for Import	Click and select the column type from the **Select from list** dialog box. Columns without headers aren't imported.

Parent Topics

"Importing directional surveys" on page 16
"Importing wavelets and wavelet sets" on page 136
"Import Wizard: Highlight last data line in red" above
"Import wizard: Finish" on the facing page

Import wizard: Finish

With this feature...	Do this...
Display pane (for tops, check shot, and directional survey imports)	Review the data that will be imported and click **Back** to make any changes.
Start time End time Sample rate (for wavelet imports) Time data...	Type the interval time and sample frequency.

Parent Topics

"Importing tops from fixed width files" on page 99

"Importing directional surveys" on page 16

"Import wizard: Set column delimiters" on the previous page

Kingdom Data Browser (Import log data or models)

Synthetic mode	• **Modeling:** Time objects are placed by reference to a velocity field derived from the sonic log. Time data points are discarded after import. Click **Details...** button for advantages and dis-advantages of this option. • **Correlation:** Time objects are placed by reference to a velocity field derived from saved time depth charts. The correlating seismic procedure is simplified but users should restrain from over editing the time depth chart. Click **Details...** button for advantages and dis-advantages of this option.
Get	• **Visible well list** - wells that appear on the Kingdom base map. Wells may be hidden from the Kingdom base map using Kingdom. • **All** - all wells in the project database. **Note**: A large volume of wells may be associated with a given project.
Hide if Well	Filter the wells displayed in the well drop-down list above using the data associated with each well, and then click **Apply**.
Identify by	Select the columns to display in the *Model Options: Create a new model* box, and then click **Apply**. The order in which the columns appear can't be changed; however, to display a column as the left most column, clear the check box for all other columns so that only the desired column remains.
Create a New Model	Select the log to import into GeoSyn and upon which to base the synthetic.
Open a Geosyn Model	View models you've already created in GeoSyn for the existing well.

Parent Topics

"Importing wells from Kingdom" on page 29

Kingdom data browser (Import directional surveys and time depth charts)

With this feature...	Do this...
View Directional Survey	Click to view the directional survey that's automatically applied to the well (if available in the data).
Apply Time Depth Corrections to Synthetic	Apply a time depth chart that is created when working in a given area by tying logs to seismic using Kingdom. The time depth chart corrects the sonic log automatically created by GeoSyn by adjusting the sonic's time depth points. Click **View and Edit** to display the Time Datum dialog where you add an invisible log section above the synthetic. Alternatively, select **Hang synthetic...** and then click **Edit** to select a single depth on the wellbore to tie to the time on the seismic section. Selecting this option requires that you add an invisible log section above the synthetic in order to move it down, as logs don't typically run to surface where time zero is marked.
Set as Default	Select a well from the drop-down list from which to create the model and whether to use this well for future models.
Drift Correction	Correct the sonic by applying the variation between the time depth curve vs. the actual sonic and apply this to the synthetic using one of several methods.
Add Drift Curve to Display	For quality control, select whether to show the drift curve in the main synthetic window; otherwise it only exists temporarily in the computer's RAM.
Add the Time Depth Chart...	For quality control, select whether to convert the time depth points to depth vs. velocity and display the results in the main synthetic window. The resulting chart can be overlaid on the sonic to detect discrepancies between the two.

Parent Topics

"Importing wells from Kingdom" on page 29

"Import log data" on page 259

Service log wizard: Digitizing order information

With this feature...	Do this...
Contact Details	Type your contact information in the related fields.

Parent Topics

"Downloading logs from the IHS information hub" on page 41

Service log wizard: Comments and curve selection

With this feature...	Do this...
Select curve type	Select the desired mnemonic from the drop-down list.
Additional curves, remarks	Type any special instructions.

Parent Topics

"Downloading logs from the IHS information hub" on page 41

Service log wizard: Select curves and digitizing range

With this feature...	Do this...
Digitizing range	Type the depth to digitize.
Digitize all curves on this service log	Click to digitize every curve on the service log.

Parent Topics

"Downloading logs from the IHS information hub" on page 41

Wavelet extraction (Extraction methods)

With this feature...	Do this...
Import	Click to launch the *Import Seismic Data* dialog box and navigate to a SEGY file to import. Once you select the SEGY file and click OK, the Set Time Range dialog box opens where you specify the time range and number of traces to sum.
Extraction Methods	Seismic Only - this is the default method that has historically been available in GeoSyn. Seismic Plus Reflection Coefficient Series - the tie between the seismic and the synthetic, which is created using the *Tie Seismic* dialog box, must be accurate before selecting either of these options.
Next	Click to display the Wavelet Extraction (Processing Display) dialog box.

Parent Topics

"Extracting wavelets" on page 149

"Wavelet properties: Wavelet" on page 329

Wavelet Extraction (Processing Display)

With this feature...	Do this...
Trace pane	View the model displayed in between a section of seismic on its left and right. Drag the green arrows () up from the bottom or down from the top of the range. For Walden White method, a bird's-eye view of the well surrounded by the seismic velocity appears above the model.
Model Traces	Select the number of traces to include from the model. For either of the Seismic Plus Reflection Coefficient Series options, use the check box to specify whether to include the optimum shift determined by GeoSyn.
Extracted Wavelet pane	Display the wavelet or a spectrum. Select the length of the wavelet to display. Phase can be changed for *Frequency Extraction* method only.

	Select whether to use both the Sonic and Density logs to derive the wavelet. Clear one of these check boxes where the resulting log is inaccurate. For Seismic Only method, select how to sum and average traces. For Weiner Levinson method, drag the *Time Shift...* slider to shift the log relative to the seismic in order to improve the tie. As you drag the slider, the model shifts in relation to the seismic in the left-most display pane of the Frequency Wavelet Extraction dialog box.
Seismic Selection pane	Type a range in the *Extraction Time Range* boxes to change the length of the wavelet to extract. This same functionality is available by dragging the green arrows () up or down in the *Trace* pane above. Select whether the seismic traces that are used from the seismic section are those that appear closest to the well of all the traces in the seismic, and then type the number of traces to use. Specify a specific radius from which to accept traces to omit traces that are too far away. This is the most common option. A number appears to the left of the box where you typed that indicates how many traces fall within that range. Or click *Trace Range* and search in a range that does not necessarily include the nearest traces.
Next	Click to display the *Wavelet Extraction (Save Options)* dialog box.

Parent Topics

"Extracting wavelets" on page 149
"Wavelet properties: Wavelet" on page 329
"Wavelet extraction (Extraction methods)" on the previous page

Wavelet extraction (Save options)

With this feature...	Do this...
Wavelet Name and Comment	Type the name and comment associated with this wavelet in various places throughout GeoSyn.
Replace Model	Select a current model(s) in the display pane below, and

Wavelet(s)	then click to overwrite its wavelets. CTRL+Click or SHIFT+Click for multiple selection.
Add to Library	Add to the wavelet library.
Export to File	Export to a SEGY file.
Apply time shift	This option appears when the model is moved in relation to the seismic using the slider at the bottom of *Extracted Wavelet* pane in the prior dialog box. This shift can be permanently applied to the synthetic or simply used to extract the wavelet and then abandoned.

Parent Topics

"Extracting wavelets" on page 149
"Exporting wavelets" on page 199
"Wavelet Extraction (Processing Display)" on page 227
"Wavelet properties: Wavelet" on page 329
"Importing wavelets and wavelet sets" on page 136

Model properties (Wavelet equation)

With this feature...	Do this...
Median Filter Points	Filters the sonic. This is the same filter that is available in the Log Editor. It is used to reduce high-velocity spikes. A high velocity spike can substantially affect processing time. It is recommended that this setting be at most, 25.
Resample Depth Interval To	Reduces the number of depth points in the log. By default, this is set to 2.

Surface Damping Samples	This refers to the buffer area above the surface marker in the 1D Wave Equation Viewer that prevents the signal from distorting the model. It uses a mathematical equation to cancel out the return pulse. A buffer is not required below the bottom horizon because recording is stopped before an echo from below the bottom horizon affects the log.
Damping Factor	This works in conjunction with the Surface Damping Samples option above to cancel out reflections arising up from the surface. It is recommended that you do not change these settings.
Animation Viewer	Click to display the *Animation Viewer*, which is an animated view of how the above settings will influence a sonic pulse moving through the earth in time.

Parent Topics

"Extracting wavelets" on page 149

AVO log suite

With this feature...	Do this...
Log type	Select the log type to create.
Derive from	Select to derive the log using industry standard formulas, which you can modify by clicking Edit to display the Edit the Derivation Equation for log dialog box. Clearing both the Derive from and Maintain link check boxes, creates a straight line log.
Maintain link	Ensure this check box is cleared so that the parent log doesn't overwrite changes you make to the derived log.

Parent Topics

"Modelling fluid replacement" on page 115

Batch printing

With this feature...	Do this...
Add files	Click to browse for GeoSyn files to print.
Remove All	In the display pane, select files to delete and click **Remove**, or click **All** to clear the entire display pane.
Display pane	Click **Add files** to populate this pane and if required, select files to remove then click **Remove**. SHIFT+CLICK or CTRL+CLICK for multiple selection.
Original parameters	Click to print the synthetic using the default file that was automatically saved along with the synthetic. The default file includes key parameters such as layout, sample rate, vertical plotting scale, and more.
Import default file	Click to display a list of default files in the GeoSyn *Working* directory and select one to apply to the entire batch of files while printing to ensure consistent presentation. This file won't alter the saved GeoSyn files.
Print Setup	Click to display the *Print Setup* dialog box and select printing options.

Parent Topics

"Print setup" on page 292
"Printing synthetics" on page 187
"Opening GeoSyn synthetics" on page 8
"Open an LAS format file" on page 290
"Directory Browser" on page 245

Batch reformat

With this feature...	Do this...
Add files	Click to display the **Open an LAS format file** or **Open a GeoSyn format file** dialog box and browse for the files to reformat.
Remove All	Either select individual files In the display pane and click **Remove**, or click **All** to clear the entire display

	pane.
Display pane	Click **Add files** to populate this pane and if required, select files to remove then click **Remove**. SHIFT+CLICK or CTRL+CLICK for multiple selection.
Search for selected curve types	If you selected **LAS to GeoSyn reformat**, select the log type(s) to include in the final GeoSyn file. SHIFT+CLICK or CTRL+CLICK for multiple selection.
LAS to GeoSyn reformat GeoSyn to LAS reformat	Select whether to convert LAS files to GeoSyn format or to convert GeoSyn files to LAS format. LAS files contain raw log data and no formatting information.
If sonic unavailable create constant velocity sonic	If you selected **LAS to GeoSyn reformat**, select to create a constant velocity sonic log. If GeoSyn can't find a sonic log in a selected file and this option is cleared, it ignores the entire file.
Rename output files using UWI	Select whether to replace the file name with the UWI. To determine which UWI formats GeoSyn converts, select **Edit** > **Well and log properties**, and then click **Edit** beside the UWI box.
Store new GeoSyn files in	Accept the default directory or click browse () to select a different location to write the reformatted files.

Parent Topics

"Reformatting GeoSyn and LAS files" on page 188
"Open an LAS format file" on page 290
"Open a GeoSyn format file" on page 290

Batzle and Wang fluid properties calculator

With this feature...	Do this...
Top portion of dialog box	Specify the pressure, temperature, and salinity of the reservoir.
Hydrocarbon	Specify whether the reservoir includes gas (most common), and the specific gravity for the hydrocarbons. To simulate dead oil (oil without the presence of gas), reduce the GOR to zero. **Note:** Click **Close** to preserve the values you've spe-

	cified, or click **Cancel** to restore the previous values.

Parent Topics

"Modelling fluid replacement" on page 115

"Fluid replacement wizard (In-situ reservoir properties)" on page 217

Catalog display options

Feature	Description
Curve Information Options	Select data type to display. A check mark (✓) appears beside logs that will be imported.
Well Sorting Order	• No sort, (Original order). Default view • Sort by UWI, Sorting order can be arranged using swap buttons between columns • Sort by sub sea (SS) depth • Sort by kelly bushing (KB) depth.

Parent Topics

"Downloading logs from the IHS information hub" on page 41

"Data search wizard: Select data from catalog" on page 213

Clip or filter the log

With this feature...	Do this...
Select Logs	Select the log to clip or filter.
Clip and Replace	Select to replace values outside of a defined range with specified minimum and maximum values.
DeSpike	Select to replace spikes outside of a defined range with data values interpolated from the last good data point.
Filtering and Backus averaging options	Select the method to average the number of samples defined in the **Operator length** box by: • Median—exact middle value of window sorted from smallest to largest • Arithmetic mean— average value of selected window

	• Harmonic mean—average time value of selected window • Triangular—average value in a triangular weighted window. • Sequential Backus averaging (sliding window)—averaging rock properties of a group of thin layers to approximate the properties of a single thick layer • Blocked Backus averaging—averaging rock properties of a group of thin layers to approximate the properties of a single thick layer. Each sample of the block will have that same average value.
Time filter	Select to filter log at seismic resolution. Click **Edit** to set filter parameters: type, center freq, phase, taper and length.
Select depth range KB	Do one of the following: Type start and stop depths and click **Update**. Click either **Top** or **Bottom** to select an absolute depth from the log or click **All** to select both. Click **Depths from tops** to select a range using the formation top names that also appear in the tops list selected in the **Top Properties** dialog box.

Parent Topics

"Clipping or filtering logs" on page 75

Comments

With this feature...	Do this...
Insert Well History	Click to place a listing of the historic operations that have been performed on a well into the display pane. Modify, supplement, and remove details as required using the display pane.
Copy | Paste	Pasted items saved to the Windows Clipboard or select text in the display pane and press Copy to then paste

	them into a third-party application.
Delete All	Clear the display pane.

Parent Topics

"Displaying comments" on page 133

Common offset stack

With this feature...	Do this...
Time range	Type the start and stop time range to import.
Trace range	Type the trace range to import. For example, to include traces in a specific pane such as near a well. You may need a shot point map to determine the range to include.
Offsets	Select whether to move in positive, negative, or both directions when summing the traces. Instead of summing traces with matching sub-surface points, GeoSyn sums traces with matching offsets.

Parent Topics

"Importing seismic data" on page 158

"Changing seismic properties" on page 162

Composite templates in working directory

With this feature...	Do this...
Delete	Delete selected template from working directory.
Import	Load an existing template from the GeoSyn working directory.

Correlation window stretch and squeeze

With this feature...	Do this...
Slider	After defining the top and bottom of the area to stretch or squeeze by clicking on the correlation display window, drag the slider to elongate or compress the selected area by time or depth.
Taper	Select the percentage of samples over which to apply a taper. This prevents the creation of a new reflection coefficient (and therefore reflection) at the top and bottom of the window. The number of samples is defined by the start and stop depth selected.
Max Str/Sqz 2way ms	Increase the amount that the correlation can be stretched and squeezed.
Minimum Sonic | Maximum sonic	Type limits the sonic transit value should not exceed while stretching or squeezing.

Parent Topics

"Correlating logs and traces" on page 180

Correlation window: log

With this feature...	Do this...
Display in Time | Display in Depth	Select whether to display in time or depth regardless of the mode selected in the main display.
Log properties	Click to display the *Well Properties: Log Properties* dialog box and adjust log display properties.
Log editing	Click to display the **Log Editing** dialog box and modify log readings.
Tops properties	Click to display the **Top Properties** dialog box and adjust tops properties.
Names | Tops	Click whether formation top names and markers appear in the **Correlation window**. After clicking once to display the top name, you can click the button a second time to highlight the names so

	they're easier to see.
Vertical scale | Show full time range	Type the amount by which to expand or contract the trace to fit the current **Correlation window** height, and whether to use a scale of 10 or 100 milliseconds. You can control whether the linear scale is based on time or depth using the *Vertical Scale* pane of the *Synthetic Properties* dialog box.
Stretch and Squeeze	Click to display the **Stretch and Squeeze** dialog box and adjust the log length and width.

Transparency	Drag the slider to change the opacity of the Correlation window to control whether details underlying the Correlation window are visible.
Maximize	Set the Correlation window to the full size allowed by the monitor.

Parent Topics

"Correlating logs and traces" on page 180
"Synthetic properties" on page 311

Correlation window: Trace

With this feature...	Do this...
Display in Time | Display in Depth	Select whether to display in time or depth regardless of the mode selected in the main display.
Trace properties	Click to display the **Model Properties** dialog box and adjust model display properties.
Wavelet properties	Click to display the **Wavelet Properties** dialog box and adjust wavelet display properties.
Tops properties	Click to display the **Top Properties** dialog box and adjust tops properties.
Names | Tops	Click whether formation top names and markers appear in the **Correlation window**. After clicking once to display the top name, you can click the button a second time to highlight the names so they're easier to see.
Vertical scale | Show full time	Type the amount by which to expand or contract the trace to fit the current **Correlation window** height,

range	and whether to use a scale of 10 or 100 milliseconds. You can control whether the linear scale is based on time or depth using the *Vertical Scale* pane of the *Synthetic Properties* dialog box.
Stretch and Squeeze	Click to display the **Stretch and Squeeze** dialog box and adjust the trace length and width.
Transparency	Drag the slider to change the opacity of the Correlation window to control whether details underlying the Correlation window are visible.
Maximize	Set the Correlation window to the full size allowed by the monitor.
Phase sliders	Click and hold a slider while dragging to change the amplitude and phase.

Parent Topics

"Correlating logs and traces" on page 180
"Synthetic properties" on page 311
"Stretch/squeeze log curves in time" on page 308

Create correlation window(s)

With this feature...	Do this...
Display pane	Select the traces or logs to display in a correlation window. SHIFT+CLICK or CTRL+CLICK for multiple selection. Multiple correlation windows are locked and some operations performed on one affect all.

Parent Topics

"Correlating logs and traces" on page 180

…Create new curve type

With this feature…	Do this…
Name	Type a descriptive name that appears above the log in the main synthetic display.
API number	Type the API number.
Edit Alias	Opens "Set log alias selection priority" dialog.
Curve infill	Select whether to display a scaled color or lithology. For lithology to appear in the main synthetic display, formation lithologies must also be configured in the **Top Properties** dialog box.
Infill orientation Infill palette Trace	Select whether to fill the left or right side of the log, the color palette to use (if scaled color is selected instead of lithology above), and display properties for the trace line itself.
Metric to Imperial conversion factor	Type a conversion factor.
Track width	Type the desired track width to display in the main synthetic display.
Lines Type	Select the line type to display and whether to display them in the foreground, background, or not at all.
Auto range	Select to automatically adjust scales to actual data limits.

Parent Topics

"Correcting invalid data when importing" on page 27
"Well properties: Log properties" on page 331

Crossplot properties: Controls

With this feature…	Do this…
Labels	Clear the check box and type different text you want to appear in the main display.
Highlight data win-	Select whether an outline in the main display shows the

dow	portion of the synthetic on which the crossplot is based. Click **Edit** to display the *Define Data Window* dialog box and specify the depth or time upon which to base the crossplot.
Trend line	Select whether to display a linear regression trend line on the crossplot.
Symbols	Select the symbol size, color scheme, and data to which to link scatter points. Depending on the Color Reference type selected, when you click **Color** to display the *Edit Color Palette* dialog box, a Histogram pane in the *Edit Color Palette* dialog box enables you to set the min max color nodes and thus control how much of the color spectrum is used across the data. When *Depth* is specified as the *Color reference*, the histogram doesn't appear in the *Edit Color Palette* dialog box.
Width/Height	Type the crossplot dimensions and click **Update**.

Parent Topics

"Creating crossplots" on page 170
"Exporting crossplots" on page 192
"Edit color palette" on page 248

Crossplot properties: color mapping

With this feature...	Do this...
Enable color mapping	Select whether to display the Gradational or Blocked color coding in the Crossplot Viewer.
Brush	Click to display a dialog box from which you select the desired color for either the gradational or block fill (depending on your selection above).
Columns Rows	Type the number of segments into which to divide the canvas horizontally and vertically.
Link list	Click the synthetic or log on which to display the data point highlighting.

Parent Topics

"Creating crossplots" on page 170

Crossplot properties: Enclosures

With this feature...	Do this...
polygon	Click **Start** and then click to define the anchor points of your polygon on the crossplot canvas. Click **End** to complete and automatically enclose the polygon.
ellipse	Type a value in the eccentricity box below then click **Start** and click to anchor one end of the ellipse. Move your mouse to the other desired end of the ellipse and click to anchor that point.
Eccentricity	Type a decimal value from 0.01 to 0.99 where 0 represents a circle and 0.99 represents an ellipse. Typing 1 draws a line instead of an ellipse.
Name	Type a meaningful name for the selected annotation(s), and then click **Update**.
Color	Click **Outline**, **Infill**, or **Both** and select the desired color for the selected annotation(s).
Enclosure list	Click **Show** to display the selected annotation in the Crossplot Viewer.
Link list	Click the synthetic or log on which to highlight the data points encompassed by an annotation.

Parent Topics

"Annotating crossplots" on page 176

"Creating crossplots" on page 170

Crossplot properties: X and Y axis

With this feature...	Do this...
Data	Click Edit to select different series data for the X or Y axis.
Swap axis	Click to switch the X and Y axis.
Auto	Clear to specify a axis label, units, values, grid options, and scale type other than that automatically calculated by GeoSyn based on the crossplot data.

Parent Topics

"Creating crossplots" on page 170

Cut

With this feature...	Do this...
Depth range	Type the start and stop depth to remove from the log, click **Top** or **Bottom** to select either the absolute top or bottom of the log, or click **Depths from tops** to specify a zone of interest using tops selected for display in the **Tops Properties** dialog box.
Drop top of log Raise bottom of log	Select whether to lower the start depth or raise the stop depth to compensate for the cut portion. Depending on your selection, all log data either above or below the cut portion is shifted.

Parent Topics

"Cutting logs" on page 80

Define data window

With this feature...	Do this...
Sample	Select a sample range to plot. Time samples are used for time plots and depth samples are used for depth plots.
Time	Select a time range to plot.
Depth	Select a depth range to plot based on Kelly Bushing depth.
Top	Select a depth range to plot based on formation tops.

Parent Topics

"Creating crossplots" on page 170

"Crossplot properties: Controls" on page 241

Directory Browser

With this feature...	Do this...
Survey system tabs	Click to select the appropriate survey system. All files with either a *.syn* or *.las* extension (depending on how you launched this dialog box) appear in the *Labels* tab, regardless of whether they include a valid UWI.
Display pane	Click a column header to sort rows based on the values in that column. Click **<>** to transpose the columns on either side of it. Right-click a file to view basic log details in a popup window.
Filter	Select then click **Edit**, which appears beside the **Filter** box, to display the *Edit a UWI* dialog box and specify the geographic coordinates within which to display UWIs in the *Directory Browser* display pane.
Report	Click to display the *Browser report* dialog box then click **Save Report** to save the above display to an ASCII format file.
Restore order	Click to restore the original horizontal and vertical column order.
Open	Click to open the file selected in the display pane above. If *Directory Browser* is opened from the *Import log data* or *Open a GeoSyn format file* dialog boxes, you can only select one file. If it's launched from the *Batch printing* or *Batch reformat* dialog boxes, you can select multiple files. SHIFT+CLICK or CTRL+CLICK for multiple selection.

Parent Topics

"Using Directory Browser" on page 10
"Opening GeoSyn synthetics" on page 8
"Importing LAS or GeoSyn files" on page 14
"Import log data" on page 259

Edit a UWI

With this feature...	Do this...
Survey system pane	Click the desired survey system tab and enter coordinates for a UWI or UWI range (depending on how you launched this dialog box). Type **??** as a wildcard when a specific value is unknown.

Parent Topics

"Changing well display properties" on page 50
"Using Directory Browser" on page 10
"Directory Browser" on the previous page
"Launching GeoSyn using AccuMap" on page 34
"Downloading logs from the IHS information hub" on page 41
"Synthetic properties" on page 311
"Well properties: Well properties" on page 333

Log Equation Library

With this feature...	Do this...
API number	Type the API number.
Alias	Either type an alias in the box above the Add button and then click **Add** to include it in the **Alias** list, or select an alias in the **Alias** list and click **Delete**. Deleting aliases may prevent GeoSyn from recognizing the aliases of imported logs in the future.
Curve infill	Select whether the log is colored with a scaled gradient or based on lithology. Even with lithology selected, the lithology of formation tops must be configured in the *Top Properties* dialog box before it appears in the main synthetic display.
Infill orientation Infill palette	Select whether the positive or negative portion of the log is colored. Custom color palettes aren't available for default curve types.

Trace	Select the display properties.
Metric to Imperial conversion factor	Type the factor with which to convert Metric to Imperial.
Track width	Type the desired track display width.
Lines Type	Select whether lines appear on the log and whether they're log-arithmic or linear.
Auto range	Select to automatically adjust scales to data limits or clear and type custom minimum and maximum values.
Display in velocity units (for sonic logs)	Select whether to display the log in velocity units and type the range.

Parent Topics

"Changing log defaults" on page 54

Edit color palette

With this feature...	Do this...
Histogram (appears for models and some cross plots)	View where amplitudes in the selected model fall. A histogram is a density graph, with amplitude range along the vertical scale and bins along the horizontal scale. Seeing where the amplitudes cluster enables you to tailor the color display accordingly so that a fuller color spectrum is expressed in the model or cross plot. This is done by dragging the min max colors closer to the bottom and top of where most of the amplitude data falls. Note that for cross plots, the color reference type specified in the cross plot dialog box determines whether the histogram pane appears. For logs, colors are typically associated with particular values based on lithology so it's not possible to override this by dragging the min max color nodes for logs.
Palette	Hover the cursor over an adjacent node until the cursor becomes a square then click and hold the mouse button while dragging the color node up or down to move the corresponding color.
Palette Name	Type a unique name by which to save the current palette configuration in the GeoSyn *Working* directory then click **Save**.
Palette selection	Either select a default palette that shipped with GeoSyn or click **Load** to browse to and select a custom palette you previously created.
Drag and drop node colors	Click and hold the mouse button on a color then drag it onto either the color bar or onto a node adjacent to the color bar and release the mouse button. If you release the color on the color bar, a new corresponding node for that color appears beside the color bar.
Custom colors	Click  to display the *Custom Colors* dialog box where you click the color to set as a custom color, and then drag the color to the desired location on the Palette strip to apply it. Custom colors are set in the registry so that they persist across GeoSyn sessions.

Nodes	Select from the following: **Add** to place additional nodes beside the color bar on which you can drop colors. **Remove** to delete the last node placed. **Flip** to flip the color bar on its center horizontal axis. **Even** to evenly disperse the existing nodes along the color bar. **Rotate** to shift all the colors one node down. The bottom node becomes the top node.
Color Interpolation style	Select whether to display a color gradient or solid color blocks.
Frequency	Select so that the center of the palette is anchored to the center of the amplitude data. Clear to skew the coloring of the amplitude points. You might choose to skew the coloring for logs, but not likely for models. Click **All** to return the min max colors to the bottom and top of the histogram.
None	Click to remove all color from the color bar.

Parent Topics

"Changing color palettes" on page 131
"Changing log display properties" on page 52
"Creating models" on page 106
"Creating crossplots" on page 170

Edit default display properties

With this feature...	Do this...
API number	Type the API number.
Equation log reference	Displays the log reference. It's this name that you select when building equations using the Log Equation library.
Edit equations	Click to launch the *Log Equation Library* dialog box where you can apply mathematical equations to the current curve type.
Alias	Either type an alias in the box above the Add button and

	then click **Add** to include it in the **Alias** list, or select an alias in the **Alias** list and click **Delete**. Deleting aliases may prevent GeoSyn from recognizing the aliases of imported logs in the future.
Curve infill	Select whether the log is colored with a scaled gradient or based on lithology. Even with lithology selected, the lithology of formation tops must be configured in the **Top Properties** dialog box before it appears in the main synthetic display.
Infill orientation Infill palette	Select whether the positive or negative portion of the log is colored. Custom color palettes aren't available for default curve types.
Trace	Select the display properties.
Metric to Imperial conversion factor	Type the factor with which to convert Metric to Imperial.
Track width	Type the desired track display width.
Lines Type	Select whether lines appear on the log and whether they're logarithmic or linear.
Auto range	Select to automatically adjust scales to data limits or clear and type custom minimum and maximum values.
Display in velocity units (for sonic logs)	Select whether to display the log in velocity units and type the range.

Parent Topics

"Using Directory Browser" on page 10
"Opening GeoSyn synthetics" on page 8
"Importing LAS or GeoSyn files" on page 14
"Import log data" on page 259

Edit EBCDIC Header

With this feature...	Do this...
Display pane	Select a value to change and then click **Update**.

Parent Topics

"SEGY viewer" on page 298

"Import seismic data" on page 260

Edit Lithology

With this feature...	Do this...
Display pane	Select the lithology for which to change the color.
Edit color	Click to display the *Color* palette and using the *Color* palette, click the desired color for the lithology selected in the Edit Lithology display pane above. You can also click **Define Custom Colors** to create a color that doesn't already appear in the *Basic colors* options. The new color is applied to the lithology type throughout this and future cross sections.

Parent Topics

"Changing tops properties" on page 89
"Top properties" on page 322
"Duplicating tops lists" on page 91
"Importing tops from delimited files" on page 97
"Importing tops from fixed width files" on page 99
"Importing tops from GeoSyn files" on page 96
"Importing tops from LAS and ASCII Files" on page 104

Edit the derivation equation

With this feature...	Do this...
Equation options panes	Drag terms into the Metric or Imperial equation box or simply use the panes for reference as you type directly in the Metric and Imperial boxes.
Velocity | Transit output (only appears for Sonic and Shear sonic curve types)	Select the output type. Internally, GeoSyn interprets sonic logs in transit format.
Metric | Imperial	Drag terms from the equation options panes or simply type in these boxes. You must define each of these,

	although they can be identical. Click **Down** or **Up** under the Copy option to quickly copy a created equation into the blank box so that you can modify it.
Description	Type a description for the equation.
Equation library reference	Select a function from the library to modify. The first drop-down list box is relevant to the current log. The second drop-down list box includes all equations in the library, which may not be relevant to the current log.
Edit library	Click to display the *Log Equation Library* dialog box.
Add to library	Click to add this equation as a user equation in the function library. This is particularly helpful to add equations you've created in the past to the function library without having to retype the entire equation from scratch.
Color code the equations	Select whether equation terms are colored red, green, and blue. If selected, when you type terms in the Metric or Imperial boxes, GeoSyn applies the default colors to what you type.

Parent Topics

"Applying math equations to logs" on page 77

"Log equation library" on page 270

Edit the derivation equation for log

With this feature...	Do this...
Equation	Modify the formula.
Function library	Select a different library to display a different formula, or if you've modified the equation, select a library to revert to the original formula.

Parent Topics

"Modelling fluid replacement" on page 115

"AVO log suite" on page 230

"Fluid replacement wizard (Calibrate shear log for water saturations < 100%)" on page 218

Enhanced meta-files properties

With this feature...	Do this...
Display pane	Click the **Show** column to toggle whether an image appears in the current synthetic or is merely saved along with it for future use. Select a row to change, delete, duplicate, or export the corresponding image. SHIFT+CLICK or CTRL+CLICK to select multiple rows.
Duplicate	Click to make a second copy of the image selected in the display pane in the current synthetic.
Export	Click to output the image selected in the display pane to disk in *.emf* format.
Import Paste from clipboard	Click to import a file from disk saved in *.emf* format, or to paste a metafile image copied to your Windows clipboard from any application when you pressed **ALT+PRINT SCRN**.
Label	Type a more descriptive reference for the image selected in the display pane above.
Positioning	Select whether the image is fixed in the upper right corner (banner), movable but wrapped by adjacent items, or movable and layered over other synthetic elements.
Size	Toggle whether to maintain the image proportions then type a desired height or width, or click and hold the mouse button while dragging one of the image's handles in the main synthetic display. You can click **Restore original size** even after resizing an image multiple times to restore it to the originally imported size.

Parent Topics

"Importing and exporting images" on page 190
"Changing the main synthetic display" on page 46
"Synthetic properties" on page 311

Export manager: Crossplots

With this feature...	Do this...
Display pane	Select the crossplot to write to a .csv file of X Y coordinates. You can only export one crossplot at a time.

Parent Topics

"Exporting crossplots" on page 192

Export Manager: Logs depth

With this feature...	Do this...
Display pane	Select the log to write to an ASCII LAS or SEGY format file. You can only export one log at a time.
Export transit data in velocity units	Select whether to display units in microseconds per meter for a velocity curve or meters per second for standard LAS format.
Reset log aliases to workstation friendly	Select to set the alias for exported sonic, density, and gamma ray logs to DT, RHOB, and GR to facilitate importing those logs into other applications. For example, if the alias for a sonic in GeoSyn is DTXY, selecting **Workstation friendly** converts it to DT on export.
Include tops list in file	Select whether to write the current top names and depths to the export file.
Include GeoSyn well editing history (LAS export only)	Select whether the date, time, and description of changes made to a log using the Log Editor are written in the non-standard section of the exported LAS file below the header.

Parent Topics

"Exporting logs" on page 195

Export Manager: Logs time

With this feature...	Do this...
Display pane	Select the log to write to an LAS or SEGY format file. You can only export one log at a time.
File format	Select whether to export the log as a fixed format, column-ordered, ASCII format file for importing into spreadsheets, or as a SEGY binary file for importing into a geophysical workstations.
Duplicates	Type a value greater than one to export a number of traces to a SEGY file that you then import into GeoSyn.
Export transit data in velocity units	Select whether to display units in microseconds per meter for a velocity curve or meters per second for standard LAS format.

Parent Topics

"Exporting logs" on page 195

Export Manager: Time/Depth

With this feature...	Do this...
Display pane	Select the row with the time/depth log to write to an ASCII format file.
Depth Increment	Type the depth increment along which readings are plotted.
Auto-block by Culling Values from the Time-Depth Curve that Exceed	Type the sonic log values above which to block when creating the time/depth chart. This function is based on sonic transit time calculations and uses the time depth log generated from the main sonic log. Culling works as follows: GeoSyn first works down the log to determine the average velocity, and then working down the log again, sums the time. While drawing the log as blocks, where the actual time minus the calculated time over a given depth range using the average velocity exceeds the culling value, the current log block is ended and a new block is started.

Block at a Constant Interval	Type a depth interval increment at which to ignore values in order to create a coarser time depth chart.
Time	Specify whether the time scale is seconds or milliseconds.
Delimiter	Select whether a comma or space defines individual data items in the file.

Parent Topics

"Exporting Time/Depth" on page 203

Export Manager: Models

With this feature...	Do this...
Display pane	Select the model to write to an ASCII or SEGY format file. You can only export one model at a time.
File format	Select whether to export the model as a fixed format, column-ordered, ASCII format file for importing into spreadsheets, or as a SEGY binary file for import into a geophysical workstation.

Parent Topics

"Exporting models" on page 196

Export Manager: Seismic

With this feature...	Do this...
Display pane	Select the seismic trace to write to a SEGY format file. You can only export one seismic trace at a time.

Parent Topics

"Exporting seismic data" on page 198

Export Manager: Tops

With this feature...	Do this...
Display pane	Select the row with the list of tops to write to an ASCII format file. You can only export one tops list at a time.

Parent Topics

"Exporting tops lists" on page 200

Export Manager: Wavelets

With this feature...	Do this...
Display pane	Select the wavelet to write to an ASCII or SEGY format file. You can only export one wavelet at a time.
File format	Select whether to export the wavelet as a fixed format, column-ordered, ASCII format file for importing into spreadsheets, or as a SEGY binary file for import into a geophysical workstation.

Parent Topics

"Exporting wavelets" on page 199

Export to Petra project

With this feature...	Do this...
Export to Petra project located at	Click **Edit** and select the directory to which to export the project. The default project is the project directory specified by PetraSeis when you used PetraSeis to create a synthetic in GeoSyn.
GeoSyn format file	Select whether to export a .syn file.

Synthetic image	Select whether to export an .emf file.
LAS format file	Select whether to export an LAS file , and if so, select the logs to include in the LAS file using the LAS display pane.
SEGY format models	Select whether to include a SEGY file, and if so, select the model to include in the SEGY file using the SEGY display pane.

Parent Topics

"Exporting to Petra" on page 197

GeoSyn settings

With this feature...	Do this...
Logs	Select the Log(s) to export to GeoSyn. SHIFT+Click and CTRL+Click for multiple selection.
Tops	Select the tops to export to GeoSyn. SHIFT+Click and CTRL+Click for multiple selection.
Active	Select whether to include only the active curves and horizons, providing they are already defined in Petra.

Parent Topics

"Launching GeoSyn using PetraSeis" on page 38

Import data for well

With this feature...	Do this...
Petra export	Select the well and logs to import into GeoSyn.
Petra/GeoSyn project folder	Select any data included in the PetraSeis folder that may be used in GeoSyn.
Other data	Select data such as seismic lines, and directional surveys.
Import depth increment	Select the imported log from which to use the desired depth increment.

Parent Topics

"Launching GeoSyn using PetraSeis" on page 38

Import log data

With this feature...	Do this...
Recent	Displays the last five logs imported.
Display pane	Select the LAS or GeoSyn file with data to import.
GeoSyn/LAS format file	View basic log details about the file selected in the display pane above.
Restrict depth range	Click to display the actual depth specified in the file and then type different values in the adjacent boxes to change the zone of interest.
Import data is TVD corrected	Select whether the log is recorded in Measured Depth or True Vertical Depth so GeoSyn places the tops loaded from the local AccuMap system and user databases at the correct depth.
File filter	To limit the file types in the display pane above, from the drop-down list select either ***.syn** or ***.las**.
File viewer	If importing data from an LAS file, click to launch the file selected in the display pane above in an ASCII text editor to verify or modify its contents before importing.
Browse dir. Browse sub-dir	Click to display Directory Browser displaying LAS and GeoSyn files in either the current directory or in the current directory and all its subdirectories too.
Import	Create a synthetic using the file selected in the display pane above and based on the import defaults file settings.

Parent Topics

"Using Directory Browser" on page 10

"Importing LAS or GeoSyn files" on page 14

"Creating log composites" on page 81

Import seismic data

With this feature...	Do this...
Recent	Displays the last five seismic files imported.
Display pane	Select the *.sgy* file to import.
File details	Basic file information appears for the file selected in the display pane above.
Import	Click to import the file selected in the display pane above.
SEGY Viewer	Click to launch a SEGY Viewer to view header, trace, and format data for the file before importing, or to locate problems that affected a previous import. Seismic file data can't be modified using this viewer.

Parent Topics

"Importing seismic data" on page 158

Import tops

With this feature...	Do this...
Recent	Displays the last five Tops files imported.
Top depth placement	Select whether to space tops evenly or according to the kelly bushing or subsea. If based on depth. tops outside of the depth range of the model aren't placed.
Bulk shift top depths by + -	Type a negative or positive value by which to shift the top depth.
Import top depths units	Select the measurement system GeoSyn is using.
Delete current tops before importing new tops	Select to delete all tops in the tops list to which tops will be imported. If this check box is cleared, tops with the same name in the donor and recipient list appear twice in the recipient list.
File viewer	If importing an ASCII format file, select the file and then click to display the file contents in an ASCII text editor.

Parent Topics

"Importing tops from LAS and ASCII Files" on page 104
"Importing tops from GeoSyn files" on page 96

Import Wavelet Processing Flow

With this feature...	Do this...
Apply taper during import	Select whether to apply tapering during import. Although optional, if non-zero data is encountered near the end of an imported trace, spurious high-frequency energy may appear in the wavelet.
Wavelet name	Type the name by which to identify the wavelet in the main display.
Operator length	Type the operator length (longer operators include more detail) at which to extract wavelets. Extracting wavelets using a long operator enables you to shorten the wavelet length later without damaging the detail of the amplitude spectrum. GeoSyn saves only the amplitude and phase spectrums, and calculates time wavelets as required.
Taper	Select the taper method to apply to the operator that's extracted from the import trace after it's auto-correlated.

Parent Topics

"Importing wavelets and wavelet sets" on page 136

Insert constant value log section

With this feature...	Do this...
Insert at	Select either depth or time and then either type a depth below or above which to insert a log section or click **Top** or **Bottom** to select the absolute top or bottom of the log.
Insertion range	Select either depth or time and then type a depth thick-

	ness to insert.
Insertion values	To adjust the value inserted in various logs, select the desired row and type a constant value to insert in the **Edit log insertion value** box.
Resetting top or bottom of well	Select whether to raise the start depth or lower the stop depth to accommodate the insertion.

Parent Topics

"Inserting log sections using log editor" on page 59

Kingdom import horizon picks

Drop down list	List of available surveys tied to selected well
Visible only	Selects only active surveys
2D search radius	Custom search radius setting for 2D seismic lines
Retrieve 1 picks	Select either: • Time picks • Depth picks
Tie to well	Select picks from either: • Surface • Bottom (default)
Visible horizons only	Display only active horizons
Depths in KB	Toggles pick listbetween KB or SS
Horizon list	List of available horizon picks to import
Import	Imports selected horizon picks. **Note:** Kingdom time picks are converted to depth picks in order to display in GeoSyn as a top.

Parent Topics

Top Properties

Kingdom import tops by author

With this feature...	Do this...
Author list	Click which author(s) to import tops from.

Parent Topics

Top Properties

Log blocking

With this feature...	Do this...
Auto-Block by Culling...	Cull values that exceed the reading specified in the adjacent box. Culling works as follows: GeoSyn first works down the log to determine the average velocity, and then working down the log again, sums the time. While drawing the log as blocks, where the actual time minus the calculated time over a given depth range using the average velocity exceeds the culling value, the current log block is ended and a new block is started. This option faithfully reproduces the velocity field, but more coarsely, which can be useful for AVO analysis when you want to simplify the geologic model by removing tuning effects.
Block Between Tops	Select whether to apply a mean, median, or RMS constant average to the log portion between the shallowest and deepest top within your selection.
Log list	Select the log to block.
Set depth range KB	Do one of the following: • Type start and stop depths and click **Update**. • Click either **Top** or **Bottom** to select an absolute depth from the log or click **All** to select both. • Click **Get range from tops** to select a range using the formation top names that also appear in the tops list selected in the **Top Properties** dialog box.

Parent Topics

"Creating blocked log models" on page 65

Log Composite

With this feature...	Do this...
Unmatched	Drag logs that weren't automatically matched to the desired host log in the Matched pane or drag matched logs from the Matched pane into the Unmatched pane to remove the association.
Matched	Drag the left-most cell up or down to a different log to change an association.
Resort	Select either Alias or GeoSyn name. Typically the most accurate option is GeoSyn name.
Range	Do one of the following: • Type start and stop depths and click **Update**. • Click either **Top** or **Bottom** to select an absolute depth from the log. • Click **Depths from tops** to select a range using the formation top names that also appear in the tops list selected in the **Top Properties** dialog box. The selected donor depth range must fall within the host depth range. To add the donor log section to the base of the host well, in the **Host replacement depth range**, click **Bottom** to display the exact base of the host well and then type this value in the donor well **Top** box.
Raise log data and tops above the insertion | Lower log data and tops below the insertion	Select whether to move overlapping data in the host log above or below the insertion.
Copy tops	Select whether to copy tops from the donor well to the host well. These tops are copied to the *Generic* tops list.

Parent Topics

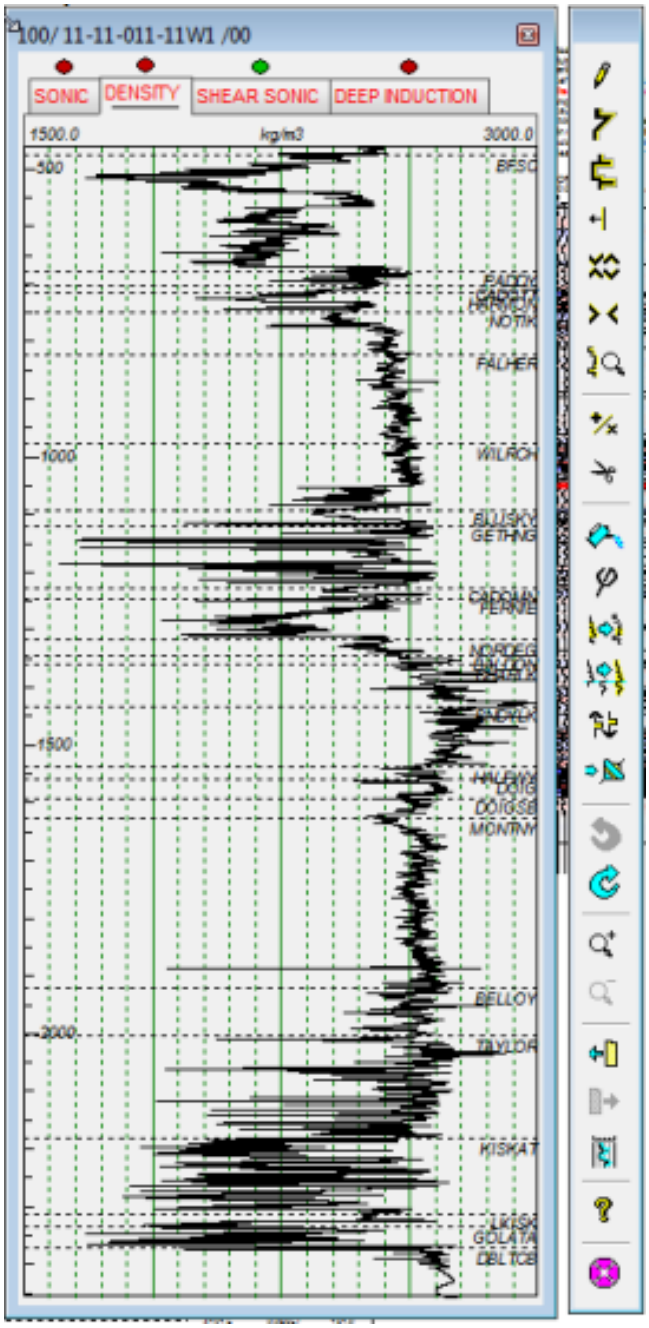
"Creating log composites" on page 81

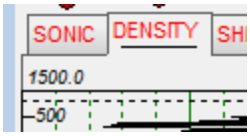
Log Editor

The Log Editor allows you to edit and manipulate well logs.

To open the Log Editor:

- **Edit > Log editing**
- Double click on a log in the model.
- Right-click on a log and select **Log editing**.



	Log tabs across the top—Click to view and work with different logs. Drag tabs left or right to change order.
	Draw a free-hand line.
	Draw a straight line.
	Redraw all or some of the log as blocks using an averaging or a culling method.
	Insert a new log section.
	Stretch or squeeze a log.
	Clip or filter a log.
	Apply a math equation to a log.
	Remove a segment from a log.
	Model different water saturation effects on the log.
	Model different porosity levels on the log.

		Create a log composite by inserting log data from another well.
		Merge two logs.
		Shift a log relative to other logs by depth.
		Insert a top at a location you click on the log.
		Undo and redo previous changes.
		Zoom a log portion in or out.
		Expand or contract the Log Editor tab display.
		Change the minimum maximum values of the log scale.
		Close the *Log Editor*

Related Topics

- "Drawing straight edge and freehand curves" on page 59
- Inserting log sections using log editor
- "Creating blocked log models" on page 65
- "Inserting tops" on page 94
- "Stretching and squeezing logs" on page 70
- "Clipping or filtering logs" on page 75
- "Applying math equations to logs" on page 77

"Cutting logs" on page 80
"Modelling fluid replacement" on page 115
"Shifting logs" on page 84
"Creating log composites" on page 81
"Changing log editor display" on page 85
"Log Editor display properties" below

Log Editor display properties

With this feature...	Do this...
Show	Select a row to modify its scale. You can't modify multiple log scales simultaneously.
View editing history	Click to display a list of all changes made to the curve. Saved changes span multiple GeoSyn sessions.
Restore Defaults	Restore one or more logs using the main synthetic.
Scale range	Type minimum and maximum values for the log scale and then click **Update**.
Velocity Transit	If a sonic log is selected in the display pane above, select whether it displays velocity or transit units.
Restore default scales	Reapply the default scales with which GeoSyn ships to either the current log or to all log types.
Show off-scale	Select whether red lines appear in Log Editor beside amplitudes that exceed the minimum and maximum scale values.
Show tops name	Select whether to display formation top names in the **Log Editing** dialog box. The **Show** check box must also be selected in the **Top Properties** dialog box for the tops to appear.
Multi-log per track	Select whether to display multiple logs per track based on the log types defined in the **Well Properties: Log Properties** dialog box.
Use log display colors	Select whether to display the colors defined using the settings in the **Well Properties: Log Properties** dialog box.

Parent Topics

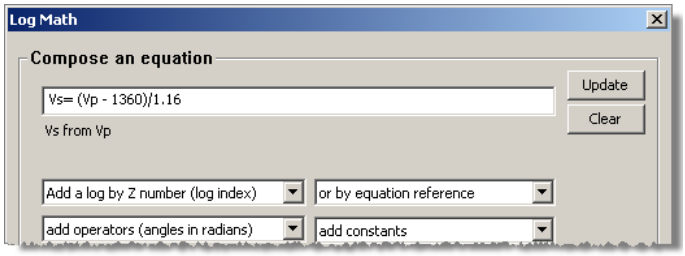
"Changing log editor display" on page 85

Log equation library

With this feature...	Do this...
Log type	Select the log type under which the equation will be grouped in the Log Equation Library.
Log function	Displays the name of the equation with which you're currently working. If you've already clicked **Add**, the term (User) follows the equation name. User equations appear first in this drop-down list.
Update | Add | Delete	GeoSyn prevents you from overwriting default library equations, thus **Update** and **Delete** are inactive until you click **Add** to create a copy of a modified default equation. Once the copy is made, Update and Delete become available. When you click **Add**, GeoSyn verifies your equation is valid.
Equation options panes	Drag terms into the **Metric** or **Imperial** equation box or simply use the panes for reference as you type directly in the **Metric** and **Imperial** boxes.
Velocity | Transit output (only appears for Sonic and Shear sonic curve types)	Select the output type. Internally, GeoSyn interprets sonic logs in transit format.
Metric | Imperial	Drag terms from the equation options panes or simply type in these boxes. You must define each of these, although they can be identical. Click **Down** or **Up** under the Copy option to quickly copy a created equation into the blank box so that you can modify it.
Descriptions	In the first box, type a description to differentiate this equation from other similar equations. The description you type appears in the Log function box when you click **Update** or **Add** and it is this description that you use to select the equation from others in a drop-down list when applying the equation to a log.
Color code the equations	Select whether equation terms are colored red, green, and blue. If selected, when you type terms in the Metric or Imperial boxes, GeoSyn applies the default colors to what you type.

Parent Topics
"Applying math equations to logs" on page 77
"Building equations using the log equation library" on page 57

Log math

With this feature...	Do this...
Compose an equation	Type directly in the box and then click **Update**, or add terms to the equation by selecting them in the following drop-down lists: 
Equation terms	Select terms to add to the equation, which appears in the top box of the Compose an Equation pane, by selecting terms from the drop-down lists.
Function Library	Either select a function to modify from the Log Equation Library, or click **Edit** to launch the *Log Equation Library* dialog box with which you compose the desired equation.
Log resolution	Associate logs with equation variables defined above and after selecting the desired depth range below, click **Create New Log**.

Log Type	Variables you typed in your equation above that haven't been defined yet appear here.
Depth Range KB	Do one of the following: Type start and stop depths and click **Update**. Click either **Top** or **Bottom** to select an absolute depth from the log or click **All** to select both. Click **Depths from tops** to select a range using the formation top names that also appear in the tops list selected in the *Top Properties* dialog box.
Reset Output Log Scales	Select to reset the log scales based on the resulting data range. This will reset the log scale so that the resulting display isn't blank. Clear this option to maintain a preferred or industry-standard log scales as you might with sonic logs, for example.

Parent Topics

"Applying math equations to logs" on page 77
"Log equation library" on page 270

Log inspection

With this feature...	Do this...
Select a Log	Click to select the log to display in the Log Inspection dialog box.
Histogram	View the where the log data falls. The individual data values are listed in the pane to the right, and a statistical summary appears above the data range pane.
Select a Depth Range	select the depth range to interrogate. This can be done by typing in the boxes, or by clicking the **Tops** button to display the *Depth Range from Tops* dialog box and then selecting the upper and lower tops that bound the range in the model, and then click **Update**. You can also drag the desired range using the Log Editor dialog box and the Log Inspection dialog box is automatically updated. To reset the range, click either **Top** or **Bottom** (to move only one element of the range), or click **All**.
Launch Crossplot	Click to display the *Crossplot wizard*, which only uses the data range specified above.

Parent Topics
"Inspecting logs" on page 86
"Creating crossplots" on page 170

Measured depth to true vertical depth correction

With this feature...	Do this...
Display pane	Select the row to adjust.
Insert Update Delete	Select a row in the display pane above and click one of the following: **Insert** to add a new row with the values typed in the MD, Dip, and Azimuth boxes. Regardless of the row selected, the inserted row is placed according to its depth. **Update** to apply the values typed in the MD, Dip, and Azimuth boxes to the selected row. **Delete** to remove the row.
Delete	Click to remove the row selected in the display pane.
Input data set type	Select from the following: **MD, AZ, DIP** for data that includes azimuth and dip data **MD, TVD, dX, dY** for data that includes True Vertical Depth, Delta X, and Delta Y. Delta X and Delta Y values are optional.
Survey units are	Select the units used in the import file. The default is the unit type in which the synthetic is displayed.
Import survey	Click to display the **Import a Directional Survey** dialog box and browse to the file to import. Imported files overwrite values in the display pane above.
Save report	Save the display pane as an ASCII text file.

Parent Topics
"Importing directional surveys" on page 16

Merge Log Runs

With this feature...	Do this...
Unmerged Logs	This pane is divided into three vertical portions: the host, donor, and spliced views. Preview the host, donor log relationship as you click host and donor curves in the *Host* and *Donor* panes below this pane. Either drag the display or drag the slider to the left of the *Unmerged Logs* display pane to change where the merge point (indicated by the green line running horizontally through the *Unmerged Logs* pane) appears. Click the **Zoom** buttons to the right of the pane to increase or decrease the zoom scale.
Host pane | Donor pane	Click the logs to merge. Based on the host or donor log you click, GeoSyn attempts to match the most likely prospect in the opposite pane.
Donor KB	Type a kelly bushing that matches the kelly bushing of the host log.
Merge at	Either drag the *Unmerged Logs* pane to change the depth at which the two log runs are merged, or type a value and then click **Update**. To complete the merge operation, click **Merge at**.
Merged Logs	After **Merge at** in the bottom left of the *Merge Log Runs* dialog is clicked, the resulting merged log appears in this pane.
Include Tops check box	Select whether to keep or import (or both) tops from the host and donor log. GeoSyn enables you to show multiple instances of the same top in a well, so if tops from both logs are included and the same top exists in both the donor and the host log, the merged log will include both.
Show	Select whether to display the entire log runs or just the portion of the logs that overlap in the *Unmerged Logs* and *Merged Logs* panes.
Scales	Select whether horizontal and vertical scale lines appear in the *Unmerged Logs* and *Merged Logs* panes.

Parent Topics

"Merging logs" on page 72

Mineral selector

With this feature...	Do this...
Rock Properties	Click the mineral with which to populate the selected field in the *Minerals Calculator* dialog box.
References	If uncertain why to pick one member over another in the Rock Properties tab, note the number for each in the Reference column and then click the References tab and scroll to the corresponding number for a text and page reference that describes the unique properties of each.

Parent Topics

"Modelling fluid replacement" on page 115

Minerals calculator

With this feature...	Do this...
Mineral	Click **Select** to display the *Mineral Selector* dialog box for up to five minerals for which GeoSyn calculates an average using either the Voight-Reuss-Hill or Hashin-Shtrikman formulas specified.
Volume	Type the percentage of pore volume this mineral occupies. Note that you can't proceed beyond this dialog box until the combined volume of the minerals you've selected equals 100%.
Matrix Averaging Formula	Select **Voight-Reuss-Hill** if the matrix is fairly homogenous for a straight arithmetic averaging formula, or select **Hashin-Shtrikman** if the matrix is more complex.

Parent Topics

"Modelling fluid replacement" on page 115

"Fluid replacement wizard (In-situ reservoir properties)" on page 217

"Mineral selector" above

Model porosity dialog

Insitu porosity	Enter the logs Insitu porosity value
Fluid properties	Select a salinity level
P Sonic	Select active sonic or none
Density	Select active density log or none
Model Porosity Slider	Slider adjusts porosity value according to selected equation
Wylies time average	$V_p = \frac{1}{(\frac{\emptyset}{V_{fl}} + \frac{(1-\emptyset)}{V_m})}$
Velocity Average	$V_p = (1 - \emptyset) V_m + \emptyset V_{fl}$
Raymer etal	$V_p = (1 - \emptyset)^2 V_m + \emptyset V_{fl}$

Depth range KB	Set the depth range using one of the following methods: • Enter top and bottom depths and click **Update**. • Click and drag on a the log editors log to select a depth range. • Click **Top** or **Bottom** to accept the absolute depth from the log or click **All** to accept both. • Click **Tops** to display and select formation tops that signify your zone of interest.
Samples	Number of samples in depth range. Value is automatically populated once the depth range has been established.
Range	Overall depth measurement. Value is automatically populated once the depth range has been established.

Parent Topics

"Changing model porosity" on page 122

Model properties: Derived

With this feature...	Do this...
Display pane	Select a model(s) to modify (SHIFT+CLICK or CTRL+CLICK for multiple selection), then click either **New** or **Duplicate**.
Name	Type a more descriptive name for the model.
Type	Select from the following: **Zero offset** **Multi offset**

	Derived based on a mathematical operation performed on two other models in the current synthetic.
Attribute	Select the mathematical transformation used to explain the data.
Amplitude	Type the display amplitude of the trace data.
Reflection Coefficients	Select the source curve and method to use when creating the AVO logs. Click **Create AVO Log suite** to create numerous types of logs to use in AVO analysis.
Multiples	Select whether to display simulated first order multiples alongside primary reflections, or to just display multiples and not the primary reflection. First order multiples are the first reflection of a primary reflection.
Cutoff % Max RC	Type the maximum percent for the reflection coefficient below which multiples are not shown. GeoSyn calculates the maximum reflection coefficient in the model, uses a percentage of that, and ignores all reflection coefficients less than that.
AGC	Type a value for the automatic gain control.
Noise	Select the **Apply** check box and then click **Edit** to display the **Noise Parameters** dialog box, where you apply noise type.
Derived trace is equal to	From the drop down lists select the traces and mathematical operator for the equation. The result of which is the derived trace.

Parent Topics

"Changing derived properties" on page 128
"Creating models" on page 106
"Creating AVO logs" on page 112

Model properties: Display

With this feature...	Do this...
Display pane	Select a model(s) to modify (SHIFT+CLICK or CTRL+CLICK for multiple selection), then click either **New** or **Duplicate**.
Name	Type a more descriptive name for the model.
Type	Select from the following: • **Zero offset** • **Multi offset** • **Derived** based on a mathematical operation performed on two other models in the current synthetic.
Attribute	Select the mathematical transformation used to explain the data.
Amplitude	Type the display amplitude of the trace data.
Reflection Coefficients	Select the source curve and method to use when creating the AVO logs. Click **Create AVO Log suite** to create numerous types of logs to use in AVO analysis.
Multiples	Select whether to display simulated first order multiples alongside primary reflections, or to just display multiples and not the primary reflection. First order multiples are the first reflection of a primary reflection.
Cutoff % Max RC	Type the maximum percent for the reflection coefficient below which multiples are not shown. GeoSyn calculates the maximum reflection coefficient in the model, uses a percentage of that, and ignores all reflection coefficients less than that.

AGC	Type a value in milliseconds for the automatic gain control.
Noise	Select the **Apply** check box and then click **Edit** to display the *Noise Parameters* dialog box, where you apply noise type.
Display tab	Specify the following: • **Traces/in** - The number of traces to display per inch in the main window. • **Traces/grp** - The number of traces to display in a group and whether to display both positive and negative groups. • **Spacing** - The amount of space between groups of traces. • **Color** - A line style and color and then click **Edit** to display the *Edit Color Palette* dialog box. • **Underlay link** - Shows whether the current trace displays highlights from a crossplot using the *Crossplot Viewer: Color Mapping* tab. • **Quick change** - Apply multiple changes simultaneously. These options are groups of individual options that also appear in the Attribute drop down list above. • **Font** - Click **Edit** and specify a font for model labels.

Parent Topics

"Changing wavelet expansion properties" on page 145
"Creating models" on page 106
"Creating AVO logs" on page 112
"Edit color palette" on page 248
"Noise parameters" on page 289

Model Properties: Expanded

With this feature...	Do this...
Display pane	Select a model(s) to modify (SHIFT+CLICK or

	CTRL+CLICK for multiple selection), then click either **New** or **Duplicate**.
Name	Type a more descriptive name for the model.
Type	Select from the following: **Zero offset** **Multi offset** **Derived** based on a mathematical operation performed on two other models in the current synthetic.
Attribute	Select the mathematical transformation used to explain the data.
Amplitude	Type the display amplitude of the trace data.
Reflection coefficients	Select the source curve and method to use when creating the AVO logs. Click **Create AVO Log suite** to create numerous types of logs to use in AVO analysis.
Multiples	Select whether to display simulated first order multiples alongside primary reflections, or to just display multiples and not the primary reflection. First order multiples are the first reflection of a primary reflection.
Cutoff % Max RC	Type the maximum percent for the reflection coefficient below which multiples are not shown. GeoSyn calculates the maximum reflection coefficient in the model, uses a percentage of that, and ignores all reflection coefficients less than that.
AGC	Type a value in milliseconds for the automatic gain control.
Noise	Select the **Apply** check box and then click **Edit** to display the **Noise Parameters** dialog box, where you apply noise type.
Expanded tab	Drag the sliders to select the width of the desired display size, the reflection coefficient cutoff, and the wavelet fill pane.

Parent Topics

"Changing wavelet expansion properties" on page 145

"Creating AVO logs" on page 112

"Creating models" on page 106

Model properties: Filter panel

With this feature...	Do this...
Display pane	Select a model(s) to modify (SHIFT+CLICK or CTRL+CLICK for multiple selection), then click either **New** or **Duplicate**.
Name	Type a more descriptive name for the model.
Type	Select from the following: **Zero offset** **Zero Offset Filter Panel** to enable the Filter Panel tab where you apply filters to the left and right edges of a group of traces that resolve (average out) in the middle trace of the group. **Multi offset** **Derived** based on a mathematical operation performed on two other models in the current synthetic.
Attribute	Select the mathematical transformation used to explain the data.
Amplitude	Type the display amplitude of the trace data.
Reflection Coefficients	Select the source curve and method to use when creating the AVO logs. Click **Create AVO Log suite** to create numerous types of logs to use in AVO analysis.
Multiples	Select whether to display simulated first order multiples alongside primary reflections, or to just display multiples and not the primary reflection. First order multiples are the first reflection of a primary reflection.
Cutoff % Max RC	Type the maximum percent for the reflection coefficient below which multiples are not shown. GeoSyn calculates the maximum reflection coefficient in the model, uses a percentage of that, and ignores all reflection coefficients less than that.
AGC	Type a value for the automatic gain control.
Noise	Select the **Apply** check box and then click **Edit** to display the **Noise Parameters** dialog box, where you apply noise type.
Type	Select the type of trace, which applies to the entire group of traces.

Taper	Select the method by which to taper the operator extracted from the center of the summed and tapered traces.
Length	Select the longest operator possible to ensure the amplitude spectrum retains as much detail as possible.
Low cut | Low pass | High pass | High cut	Modify the energy shape either by typing the actual source values provided with the seismic data or by modifying the wavelet shape to visually match the seismic data.
Phase	Drag the slider or type a value for the phase.

Parent Topics

"Creating models" on page 106

"Applying multiple filters across a group of traces" on page 108

Model properties: Multi offset

With this feature...	Do this...
Display pane	Select a model(s) to modify (SHIFT+CLICK or CTRL+CLICK for multiple selection), then click either **New** or **Duplicate**.
Name	Type a more descriptive name for the model.
Type	Select from the following: **Zero offset** **Multi offset** **Derived** based on a mathematical operation performed on two other models in the current synthetic.
Attribute	Select the mathematical transformation used to explain the data.
Amplitude	Type the display amplitude of the trace data.
Multiples	Select whether to display simulated first order multiples alongside primary reflections, or to just display multiples and not the primary reflection. First order multiples are the first reflection of a primary reflection.
Cutoff % Max RC	Type the maximum percent for the reflection coefficient below which multiples are not shown. GeoSyn calculates

	the maximum reflection coefficient in the model, uses a percentage of that, and ignores all reflection coefficients less than that.
AGC	Type a value for the automatic gain control.
Noise	Select the **Apply** check box and then click **Edit** to display the **Noise Parameters** dialog box, where you apply noise type.
Ray trace method	Select **Dix NMO** for a preliminary fast view, or **Ray trace** for improved accuracy using a full Snell's law ray-tracing algorithm.
Ray trace vertical sampling interval	Select whether sampling frequency is based on time (constant time) or depth (constant depth) and type an increment.
Bin Width	Set the threshold within which reflecting seismic rays will be included in a trace. A larger bin number will include more rays but the resulting trace will be less accurate.
CDP interval	Type a value that matches the common depth point interval of the seismic to which the model will be compared. CDP is half of the surface offset.
Num traces	Type the total number of traces to display in the model.
Near trace offset	Type the distance from the source at which the nearest receiver appears. The distance to other receivers is calculated using this value, the CDP interval, and the Num traces values above.

Show offset traces Show summed trace	Select whether to show individual traces for each receiver and whether to sum all the traces into one trace displayed to the left of the model. Click **Edit** to display the **Sum Options** dialog box where you define groups of traces (near, middle, far) and then do mathematical operations between the three groups, which enables you to filter or enhance certain portions of the offset trace. For example, you might subtract the far traces from the near traces and then multiple the result by the far traces to enhance the far offset amplitude.
Apply NMO correction	Simulate the normal move-out stretch.
Mute if incident angle is	Apply an inside or outside angle outside of which data won't be included in the trace. The incident angle is calculated at each sample. The mute line is drawn on your synthetic to show where data is being cutoff. Select the color in which this line is drawn using the Mute color drop-down list.

Parent Topics

"Changing multi-offset properties" on page 129
"Creating AVO logs" on page 112
"Creating models" on page 106
"Sum options" on page 310

Model properties (Wavelet equation)

With this feature...	Do this...
Median Filter Points	Filters the sonic. This is the same filter that is available in the Log Editor. It is used to reduce high-velocity spikes. A high velocity spike can substantially affect processing time. It is recommended that this setting be at most, 25.
Resample Depth Interval To	Reduces the number of depth points in the log. By default, this is set to 2.
Surface Damping Samples	This refers to the buffer area above the surface marker in the 1D Wave Equation Viewer that prevents the signal from distorting the model. It uses a mathematical equa-

	tion to cancel out the return pulse. A buffer is not required below the bottom horizon because recording is stopped before an echo from below the bottom horizon affects the log.
Damping Factor	This works in conjunction with the Surface Damping Samples option above to cancel out reflections arising up from the surface. It is recommended that you do not change these settings.
Animation Viewer	Click to display the *Animation Viewer*, which is an animated view of how the above settings will influence a sonic pulse moving through the earth in time.

Parent Topics

"Extracting wavelets" on page 149

Model properties: Wavelets

With this feature...	Do this...
Display pane	Select the wavelet with which to work. Clear **Show all wavelets** if you're already working with the desired wavelet to increase the work space in this dialog box.
Name	Type a name with which the wavelet is identified in the main synthetic display.
Type	Select a predefined filter to apply to the wavelet selected in the display pane. Controls to specify the cut and pass frequencies appear below based on your selection.
Attribute	Select the mathematical transformation used to explain the data.
Amplitude	Type the display amplitude of the trace data.
Reflection Coefficients	Select the source curve and method to use when creating the AVO logs. Click **Create AVO Log suite** to create numerous types of logs to use in AVO analysis.
Multiples	Select whether to display simulated first order multiples alongside primary reflections, or to just display multiples and not the primary reflection. First order multiples are the first reflection of a primary reflection.

Cutoff % Max RC	Type the maximum percent for the reflection coefficient below which multiples are not shown. GeoSyn calculates the maximum reflection coefficient in the model, uses a percentage of that, and ignores all reflection coefficients less than that.
AGC	Type a value for the automatic gain control.
Noise	Select the **Apply** check box and then click **Edit** to display the **Noise Parameters** dialog box, where you apply noise type.
Wavelets	Click **Edit** to display the **Wavelet Properties** dialog box, where you change wavelet and spectrum properties.

Parent Topics

"Changing wavelet properties" on page 143
"Importing wavelets and wavelet sets" on page 136
"Exporting wavelets" on page 199
"Extracting wavelets" on page 149
"Wavelet properties: Spectrums" on page 328
"Creating AVO logs" on page 112

Multi-Log per Track Layout

With this feature...	Do this...
Log name	Select the name or type of log to display in a given track. Click **All unselected linear logs** or **All unselected logarithmic logs** to ensure none of the available logs are dropped.

Parent Topics

"Combining logs in tracks" on page 62 "Multi-log per track template" below

Multi-log per track template

With this feature...	Do this...
Template name	Type a descriptive name for the template to distinguish it from others you create. The template file is saved in the GeoSyn *Working* directory with the associated description you type.
Populate tracks	Select whether to populate tracks of a given log type by type (sonic, density, etc.) or by log name (delta-T, Bulk Density, etc.). Even if **manually by name** is selected as your method by which to populate tracks, when GeoSyn saves your track population preferences to the default file for the first time, it saves the log type, not the log name, as logs can have numerous esoteric names which are difficult for GeoSyn to correlate back to a log type. Click **Edit** to display the *Multi-log per track layout* dialog box where you select the log types or log names to display in a given track.

Show empty tracks	Select to display tracks regardless of whether they contain logs and provided that **Show Track** is also selected on each individual tab below.
Show track	Select to display the selected track provided it contains a log. To ensure the selected track appears regardless of whether it contains a log, also select **Show empty tracks** above.
Track width | Following gap	Type the width of the track and the space between tracks.
Scale type	Select either **Linear** or **Logarithmic** scale display types.
Minor divisions | Major divisions	Depending on the scale type selected above, type either the minor and major scale increments, or the left and right scale.
Cross overs	Click the check box to the left of the drop-down list and then select either a log that appears in the model or select **Fixed value**, depending on whether to infill curves where the two intersect or to infill where a curve exceeds a given value. Shift the log scales by either typing a value directly in the *shift scales by* box or by clicking ‹ ›.
Color	Click to display the *Edit Color Palette* dialog box and select either a solid color or color gradient with which to highlight the cross over.
Import and edit	Click to either load a template from the GeoSyn *Working* directory or to edit existing template.

Parent Topics

"Combining logs in tracks" on page 62

"Well properties: Log properties" on page 331

Noise parameters

With this feature...	Do this...
Signal to Noise	Adjust the signal to noise ratio.
Noise Type	Select the noise type to apply to the model. Select from White or Gaussian.

Band Limiting	Select a predefined filter to apply to the model.

Parent Topics

"Creating AVO logs" on page 112

"Creating models" on page 106

Open a GeoSyn format file

With this feature...	Do this...
Display pane	Select a GeoSyn file to display general file information in the *GeoSyn format file* pane below.
GeoSyn format file pane	View basic location, label, depth, and log details for the file selected in the display pane above.
Browse dir. Browse sub-dir	Click to display Directory Browser displaying LAS and GeoSyn files in either the current directory or the current directory and its subdirectories too.
Open	Create a synthetic using the file selected in the display pane above.

Parent Topics

"Reformatting GeoSyn and LAS files" on page 188

"Opening GeoSyn synthetics" on page 8

"Using Directory Browser" on page 10

"Directory Browser" on page 245

"Batch reformat" on page 231

Open an LAS format file

With this feature...	Do this...
Display pane	Select the LAS file with data to import.
LAS format file	View basic log details about the file selected in the display pane above.
Restrict depth range	Click to display the actual depth specified in the file and then type different values in the adjacent boxes to change the zone of interest.

Import data is TVD corrected	Select whether the log is recorded in Measured Depth or True Vertical Depth so GeoSyn places the tops loaded from the local AccuMap system and user databases at the correct depth.
File filter	To limit the file types in the display pane above, from the drop-down list select ***.las**.
File viewer	Click to launch the file selected in the display pane above in an ASCII text editor to verify or modify its contents before importing.
Browse dir. Browse sub-dir	Click to display Directory Browser displaying LAS and GeoSyn files in either the current directory or in the current directory and all its subdirectories too.
Import	Create a synthetic using the file selected in the display pane above and based on the import defaults file settings.

Parent Topics

"Reformatting GeoSyn and LAS files" on page 188
"Batch reformat" on page 231
"Directory Browser" on page 245

Print

With this feature...	Do this...
Name	Select a printer or plotter.
Properties	Click to set print properties. Options in the **Properties** dialog box are unique to various printers, so we don't discuss them here. Refer to the printer documentation for details. If using a plotter, to customize the page size, click the **Paper Size** tab then click **Properties** > **More Sizes**.
Print range	Type the page number range to print.
Copies	Select the number of copies to print.

Parent Topics

"Printing synthetics" on page 187

Print preview

With this feature...	Do this...
Print	Click to display the **Print** dialog box and print directly from the current dialog box.
Next page prev (previous) page	If printing a multi-page layout, click to navigate through the pages.
Zoom in Zoom out	Click to zoom. **Zoom Out** is grayed out until you zoom in one level.
Two Page | One Page	Click to specify whether this dialog box displays one or two pages at a time.

Parent Topics

"Printing synthetics" on page 187

Print setup

With this feature...	Do this...
Name	Select the printer model.
Properties	Click to display the **Properties** dialog box where you select options unique to your printer. Note that if you are using a plotter, you are not limited to the paper sizes shown in the **Size** box of the *Print Setup* dialog box. To customize your page size, click the **Paper Size** tab then click **Properties** > **More Sizes**.
Paper	Select the **Size** and **Source** options specific to your printer. For example, if you select a plotter, you will see some large paper sizes in the **Size** list. If you are printing Letter size paper, you can also select which paper tray you want to print from in **Source**.
Orientation	Select **Portrait** or **Landscape** orientation.
Network	This function is not discussed as it is specific to your computer network.

Parent Topics

"Printing synthetics" on page 187

Properties: Configuration

With this feature...	Do this...
Executables	View the directory where GeoSyn operational files are located. For standalone installations, the *Executables* and *Working* directories are the same. For networked configurations, the *Executables* directory is shared. Changing this directory may prevent GeoSyn from locating both the licensing file it requires to launch, and the IHS Information Hub download parameters.
Working	View the directory where customizable files such as color palette, log import defaults, and user default files are located or click **Edit** to change it. To maintain the integrity of each users' custom settings, it's recommended that the *Working* directory not be shared.
GeoSyn Addresses	View GeoSyn contact information and click **EMail** to write an email message or click **Open** to launch the IHS web site.
IHS Online Data Retrieval Info	View information required to connect to the IHS Online Data Hub. For network installations, these settings affect all users. If you don't have a subscription to download online digits, leave these boxes blank. Changing this connectivity information may prevent GeoSyn from downloading online digits.
User name | Show transaction warning prompt	View or type your user name and toggle whether to display a warning message when downloading digits may incur a charge.

Parent Topics

"Configuring GeoSyn defaults" on page 6
"Downloading logs from the IHS information hub" on page 41
"Launching GeoSyn using AccuMap" on page 34
"Data search wizard: Search locations and ranges" on page 212
"Properties: Import defaults" on the next page

Properties: Import defaults

With this feature...	Do this...
Current default file	From the drop-down list, select a default file to either modify or apply to the current synthetic, or click **New** to display the **New default file name** dialog box and type the name of the default file to create that inherits settings from the current synthetic. Default files are saved in the GeoSyn *Working* directory and as part of the current synthetic configuration.
Update current default file with synthetic	Write the configuration settings in the synthetic to the default file selected in the *Current default file* drop-down list above.
Update synthetic with current default file	Apply the configuration settings from the default file selected in the *Current default file* drop-down list above to the synthetic , overwriting any configurations you may have made in the current file.
Default file description	Double-click each heading or click **+** and **-** to expand and contract related properties beneath each node. The parameters in the default file tree display the settings of the default file selected above.

Parent Topics

"Changing import defaults" on page 12

"Import log data" on page 259

Properties: Log library

With this feature...	Do this...
Display pane	To view current default settings, double-click node text or click **+** and **-**.
New curve	Click to display the **Create New Curve Type** dialog box and specify default parameters for a new curve.
Export alias list	Click to export a list of all the aliases GeoSyn uses to recognize imported logs.
Delete	Click to delete the selected curve type. Curves that can

	be used as active logs (sonic, shear sonic, time depth, density, and poisson's ratio) can't be deleted. Deleting logs may prevent GeoSyn from recognizing imported log aliases.
Edit	Click to display the *Edit Default Display Properties*dialog box where you change curve display properties and create curve equations for only the current curve type. To change properties for any curve type, click **Edit Curve Equations** below.
Alias priority	Set import order priority of available log aliases
Log Equations	Click to display the *Log Equation Library* dialog box where you change curve display properties and create curve equations for any curve type.

Parent Topics

"Changing log defaults" on page 54
"Exporting log aliases" on page 194
"Log equation library" on page 270
"Edit default display properties" on page 249

Properties: Statistics

With this feature...	Do this...
Data ranges	Select the log and view its original raw data and the resulting converted values in GeoSyn following import.

Parent Topics

"Viewing synthetic statistics" on page 44

Save model data to Kingdom

With this feature...	Do this...
Save GeoSyn File	Select to save GeoSyn file.
Save Model	Check to enable Kingdom and SEGY save options.
Kingdom	Saves a dynamic version of

	the model with selected options to the Kingdom database. Once saved, edits made in GeoSyn are automatically updated to the Kingdom model.
SEGY file	Saves a single trace from the seismic file in SEGY format. Options include: name, multiplier and time shift value. Kingdom requires a SEGY file to maintain synchronization with the original GeoSyn model.
Amplitude multiplier	Enter a value to multiply the amplitude of the signal trace . The default is 1.0 .
Start Time two - way	Enter value for GeoSyn to time shift when the seismic section is tied to the model.
Save time/depth chart to Kingdom database	Select whether to save the time depth chart directly to the Kingdom database. If **Save as Active** is enabled, this time depth chart is associated with future wells you import from Kingdom into GeoSyn. This same file that can be saved from GeoSyn using the **File > Export > Time/Depth** option.

Cull time/depth values...	Enter the sonic log cut off value when creating the time depth chart.
Local | Shared	Select whether the time depth chart is only available to a specific well (local), or all wells (shared).
Save Location	Displays current path where files will be saved. A default sub-folder in the project directory is created when GeoSyn is launched from Kingdom. IHS recommends that the default path be used.

Parent Topics

"Importing wells from Kingdom" on page 29

Save modified time depth chart

With this feature...	Do this...
Name	Specify a name for the modified time-depth curve.
Chart Type	Select whether the time-depth curve is available to only this well or to all Kingdom wells in the current project.
Set As Default	Select whether the time-depth curve is available to all logs in the GeoSyn project.

Parent Topics

"Importing wells from Kingdom" on page 29

SEGY viewer

With this feature...	Do this...
Format	Select a format in which to display data in the viewer then click various tabs to view the following: • ASCII/EBCDIC - basic processing information. • Binary header - which values appear at specific byte positions. • Trace header - trace information. GeoSyn looks here for offsets, CDP intervals, and location. • Trace data - the specific data readings. • Histogram - the graphical display of frequency variation. • Spectrum - the array of amplitude and frequency variations.
Byte order	Select whether the file was saved in PC (ASCII) or mainframe (EBCDIC) format.
Edit EBCDIC Header	Click to display the Edit EBCDIC Header dialog box and change SEGY values in the file.

Parent Topics

"Importing seismic data" on page 158
"Seismic Properties: Annotations" below
"Seismic properties: Trace layout" on page 303
"Edit EBCDIC Header" on page 250

Seismic Properties: Annotations

With this feature...	Do this...
Display pane	Select the seismic trace(s) with which to work. SHIFT+CLICK or CTRL+CLICK for multiple selection.
Import | Export	Click to import or export a seismic file in SEGY format.
Duplicate	Click to create a second trace with the same values as

	the trace selected in the display pane above.
SEGY Viewer	Click to display the SEGY Viewer and view header, trace, and file format details.
Labels	Type a title and description that appear in the main synthetic display above the seismic data.
Annotations	Select the frequency and content of annotations on the wavelet, and whether to include the first and last traces.
Font	Click **Edit** to configure the label and trace display font.

Parent Topics

"Changing seismic properties" on page 162
"Changing import defaults" on page 12
"Exporting seismic data" on page 198

Seismic properties: Display

With this feature...	Do this...
Display pane	Select the seismic trace(s) with which to work. SHIFT+CLICK or CTRL+CLICK for multiple selection.
Import Export	Click to import or export a seismic file in SEGY format.
Duplicate	Click to create a second trace with the same values as the trace selected in the display pane above.
SEGY Viewer	Click to display the SEGY Viewer and view header, trace, and file format details.
Trace Overlay	Select the mathematical transformation to use to explain the data, the color and fill, and the extent of the trace.
Color Underlay	Select the mathematical transformation to use to explain the data, click **Edit** to display the **Edit Color Palette** dialog box, and either select auto range to base the scale on the data or clear that option and specify your own range.
Noise	Select the **Apply** check box and then click **Edit** to dis-

	play the **Noise Parameters** dialog box, where you apply noise type. Select a trace normalization option. **None** and **Peak** divide all values by the highest amplitude. **RMS** divides all values by the root-mean-square of the data
Show well location	Selectable display options for well location: • Show surface location • Show bottom location • Highlight
Model/Log overlay positioning	• Surface position — Places inserted item(s) at the surface position. • Bottom hole position — Places inserted item(s) at the bottom hole position. • Projected deviated position — Places inserted item (s) on the projected deviation position. • Manually tie to # — Select this option if the header date in the SEGY file isn't properly formatted.From the drop-down list select the desired trace number, surface position, or common depth point to which to tie the well. • Open a gap at well tie — Inserts a gap in the display between the inserted item(s) and the seismic lines to avoid covering up seismic data. **Note:** This option is not available when the insertion point is set to - Projected deviation position.

Parent Topics

"Changing seismic properties" on page 162
"Changing import defaults" on page 12
"Exporting seismic data" on page 198

Seismic properties: Histogram

With this feature...	Do this...
Display pane	Select the seismic trace(s) with which to work. SHIFT+CLICK or CTRL+CLICK for multiple selection.
Import | Export	Click to import or export a seismic file in SEGY format.
Duplicate	Click to create a second trace with the same values as the trace selected in the display pane above.
SEGY Viewer	Click to display the SEGY Viewer and view header, trace, and file format details.
Amplitude histogram	Select the type of data to be used. Select from Raw data or Display data.
Linear, Logarithmic	Select whether lines appear on the log and whether they're logarithmic or linear.
Include zeros	Click to include zeros within frequency.

Parent Topics

"Changing seismic properties" on page 162
"Changing import defaults" on page 12
"Exporting seismic data" on page 198

Seismic properties: Spectrum

With this feature...	Do this...
Display pane	Select the seismic trace(s) with which to work. SHIFT+CLICK or CTRL+CLICK for multiple selection.
Import | Export	Click to import or export a seismic file in SEGY format.
Duplicate	Click to create a second trace with the same values as the trace selected in the display pane above.
SEGY Viewer	Click to display the SEGY Viewer and view header, trace, and file format details.
Amplitude Spectrum	Select the type of data to be used. Select from Raw data or display Data.

Parent Topics

"Changing seismic properties" on page 162

"Changing import defaults" on page 12

"Exporting seismic data" on page 198

Seismic properties: Processing

With this feature...	Do this...
Display pane	Select the seismic trace(s) with which to work. SHIFT+CLICK or CTRL+CLICK for multiple selection.
Import | Export	Click to import or export a seismic file in SEGY format.
Duplicate	Click to create a second trace with the same values as the trace selected in the display pane above.
SEGY Viewer	Click to display the SEGY Viewer and view header, trace, and file format details.
Filter	Select the mathematical transformation to use to explain the data.
Deconvolve Using Inverted Wavelet	Click either **Library** or **Import** to deconvolve (filter) the seismic section in GeoSyn by applying an inverted wavelet that you created using the **Wavelet Properties** > **Invert Wavelet** option.
Rotate phase	Drag the slider to rotate the center phase of the seismic.
Common offset stack	If the seismic selected in the display pane above is unstacked data, click **Create** to display the Common Offset Stack dialog box where you generate a seismic trace in which the unstacked data is collated and summed.
Wavelet extraction	Click to extract a zero phase wavelet from the selected wavelet.
Tie to a model	Click to display the **Set time and range for** dialog box and specify the location at which to anchor the trace.

Link to AVO trace model	Select a model to link to the seismic for AVO analysis.
AGC	Type a value for the automatic gain control.
Sample rate	Select the frequency at which to sample the data when building the model.

Parent Topics

"Changing seismic properties" on page 162
"Changing import defaults" on page 12
"Exporting seismic data" on page 198
"Inverting wavelets" on page 146

Seismic properties: Trace layout

With this feature...	Do this...
Display pane	Select the seismic trace(s) with which to work. SHIFT+CLICK or CTRL+CLICK for multiple selection.
Import | Export	Click to import or export a seismic file in SEGY format.
Duplicate	Click to create a second trace with the same values as the trace selected in the display pane above.
SEGY Viewer	Click to display the SEGY Viewer and view header, trace, and file format details.
Bulk shift	Type a signed the amount to move the trace up or down.
Time	Type the start and stop depths for the sample interval.
Show traces	Select the range of samples to display in the main synthetic. For example, to exclude the first and last few samples.
Show	Select whether to display every sample.
Flip left to right	Select whether to invert the sample locations so that the sample furthest from the source becomes closest.
Duplicates	Type the number of duplicate traces to display.
Traces/in	Select the number of traces to display per inch.

Parent Topics

"Changing seismic properties" on page 162

"Changing import defaults" on page 12

"Exporting seismic data" on page 198

Seismic tie data properties

With this feature...	Do this...
Seismic data	From the drop-down list, select from the imported seismic. Click **Display** to show the **Display Properties** dialog box and **Range** to display the **Set time and range for** dialog box.
Model data	Select the model in your synthetic to which to tie the seismic trace.
Cross correlation function display attributes	Click **Display** to show the **Display Properties** dialog box.
Show logs	Select up to three logs from the synthetic to display alongside the tie in the **Tie seismic** dialog box.
Tops	Select whether to display names and lines in the **Select data sets for cross correlation** dialog box.

Parent Topics

"Creating crossplots" on page 170

"Tying seismic to models" on page 164

"Tie seismic" on page 313

Select data sets for cross-correlation

With this feature...	Do this...
Seismic Data	From the drop-down list, select the seismic data to tie to a model. Click **Display** to show the *Display Properties* dialog box to configure the display the same as the model, and the cross correlation data. Click **Range** to display the *Set time and range for* dialog box and reduce the number of traces.
Model Data	Select the model in your synthetic to which to tie the seismic data. Click **Display** to show the *Display Properties* dialog box to configure the display the same as the seismic and cross correlation data.
Cross Correlation Function...	Click **Display** to show the *Display Properties* dialog box to configure the display the same as the seismic and model data.
Show logs	Select up to three logs from the synthetic to display alongside the tie in the *Tie seismic* dialog box.
Tops	Select whether to display names and top markers in the *Tie seismic* dialog box.

Parent Topics

"Creating crossplots" on page 170

"Tying seismic to models" on page 164

Select insertion point

This dialog is available when dragging a item(s) (log, model or depth gauge) onto a seismic line.

With this feature...	Do this...
Surface position	Places inserted item(s) at the surface position.
Bottom hole position	Places inserted item(s) at the bottom hole position.
Projected deviated position	Places inserted item(s) on the projected deviation position.
Manually tie to #	Select this option if the header date in the SEGY file isn't properly formatted.From the drop-down list select the desired trace number, surface position, or common depth point to which to tie the well.
Open a gap at well tie	Inserts a gap in the display between the inserted item(s) and the seismic lines to avoid covering up seismic data. **Note:** This option is not available when the insertion point is set to - Projected deviation position.

Set location

With this feature...	Do this...
Datum	Select from numerous common datums.
Hemisphere | UTM	Select the reference point, and zone. Alternatively, click **Get UTM from lat/long**.
Copy surface position	Select whether to use the same coordinates for the bottom hole as the surface hole or type coordinates in the fields below. Alternatively, click **Get lat/long from UTM**.

Parent Topics

"Changing well display properties" on page 50

"Well properties: Well properties" on page 333

Set scales

With this feature...	Do this...
Inches per second	Type an increment that matches the increment on the seismic section to which you're correlating.
Monitor fudge factor	Type the percentage by which to multiply the monitor resolution. Ideally, you need to compare the changes that appear on screen to a fixed measurement by holding a ruler, for example, up to the monitor.
Center	Click the arrow buttons to move the correlation up or down until it aligns with a timing line on the seismic section. The larger arrow buttons move the correlation in larger increments.
Zoom	Click the arrow buttons to expand or condense the correlation. The larger arrow buttons zoom or unzoom the correlation in larger increments.

Parent Topics

"Correlating logs and traces" on page 180

Set time and range for

With this feature...	Do this...
Time range	Type the start and stop time range to import.
Trace range	Type the trace range to import. For example, to include traces in a specific pane such as near a well. You may need a shot point map to determine the range to include.

Parent Topics

"Importing seismic data" on page 158
"Select data sets for cross-correlation" on page 305
"Seismic tie data properties" on page 304
"Select data sets for cross-correlation" on page 305
"Seismic properties: Trace layout" on page 303
"Seismic Properties: Annotations" on page 298

Shift curve

With this feature...	Do this...
Shift selected curves	Type the amount by which to raise or lower the selected logs. A positive value raises the log and a negative value lowers it.
Display pane	Select the logs to shift. GeoSyn automatically shifts all logs in the synthetic when one log is shifted. SHIFT+CLICK or CTRL+CLICK for multiple selection.

Parent Topics

"Shifting logs" on page 84

Stretch/squeeze log curves in time

With this feature...	Do this...
Stretch/squeeze in time Stretch/squeeze in depth	Select either time or depth based on the following: **Time** to modify the transit values through the selected depth zone. The change in the sum of all the transit time changes must equal the desired stretch/squeeze value. **Depth** to stretch or squeeze the selected depth range to the thickness defined.
Thickness (when Stretch/squeeze in depth selected)	Type the desired thickness of the zone defined above after stretching or squeezing. If the value is less than the difference between the start and stop depth, the log will be squeezed. If more, the log will be stretched.

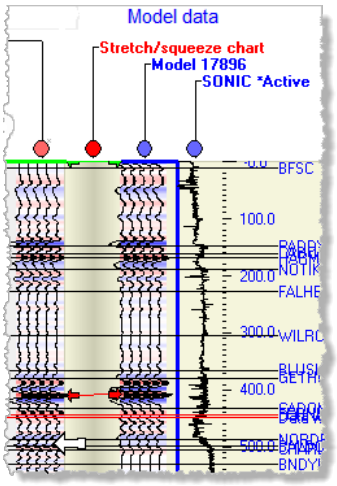
Change time interval by (when Stretch/squeeze in time selected)	Type a value by which to adjust the transit times for the zone defined above.
Taper the change over (when Stretch/squeeze in time selected)	Type the distance over which to taper the change. A transit modification must be tapered to avoid creating new reflection coefficients at the top and bottom of the stretch/squeeze zone. GeoSyn uses a linear taper at the top and bottom of the zone where the correction starts at zero and tapers up to a calculated value, then tapers down to zero again. The length of the taper is reported in depth samples and is the sum of the top and bottom tapers.
Set depth range	Do one of the following: Type a depth range over which to taper the change and click **Update**. Click either **Top** or **Bottom** to select the absolute top or bottom of the log, or click **All** to select both. Click **Depths from Tops** and select the top and bottom of your zone of interest using formation names.

Parent Topics

"Stretching and squeezing logs" on page 70
"Correlation window: log" on page 237
"Correlation window: Trace" on page 239

Stretch and squeeze (Seismic)

With this feature...	Do this...
Add	After adding at least one row to the display pane, click to place the times in the two boxes, type different times, and then click **Add**.
Display pane	In the **Tie Seismic** dialog box, hover the cursor over the seismic at the point to tie and click, and then hover the cursor over the correlating tie point on the model and click to tie the two.

	 Using the *Stretch and Squeeze* dialog box, click **Apply** to update the **Tie Seismic** dialog box.
Restore Original	Undo the above activity.
Snap to	Select the feature closest to the cursor at which to place the tie anchor. In this way, the cursor only has to be near, but not directly over one of the following features in order for GeoSyn to select it: **Peak** - the highest amplitude point. **Trough** - the lowest amplitude point. **Zero Crossing** - the point exactly between the peak and the trough. **None** - the tie anchor is not snapped to a feature, but is placed directly below the location of the cursor.

Parent Topics

"Tying seismic to models" on page 164

"Tie seismic" on page 313

Sum options

With this feature...	Do this...
Range definition	Either select **Auto** or specify the trace numbers to include in the near, middle, and far groups.
Range relationships	Using the drop-down lists, create mathematical expressions to filter or enhance traces.

Parent Topics
"Changing multi-offset properties" on page 129
"Model properties: Multi offset" on page 283

Synthetic properties

With this feature...	Do this...
Banner	Select whether the UWI or only a banner you type appears as the first banner. To modify the UWI, click **Edit** to display the **Edit a UWI** dialog box then select a survey system and type survey coordinates. There are additional options available from the drop-down list to the right of the *Banner 1* box for the well header such as **Well Label**, which can be one of three labels defined using the *Well Properties* tab of the *Well Properties* dialog box, or **User Defined**, with which you specify alphanumeric characters.
Well status symbol	Select whether the well status symbol appears. Click Well Symbol Legend for details.
Image banner	Select whether an image in enhanced metafile format appears. Click **Edit** to display the **Enhanced Metafiles Properties** dialog box then browse to and select the image, or with the image copied into the Windows Clipboard, click **Paste**.
Information banner	Select whether the banner that lists detailed synthetic information appears.
Depth scales	Select whether to display kelly bushing and subsea depths and on which side of the synthetic to display them.
Time scales	Select whether to display time scales, their measurement, and where to display them on the synthetic.
Border	Select whether a black border encompasses the synthetic display.
Printer page outline	Select whether to display a pink border that shows the portion of the synthetic that will print on a single page. This outline is based on the current settings of the default printer. To change the outline, change the default printer configuration.

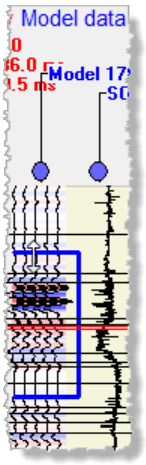
Rotate model and single track log labels 90 degrees	Flip labels for models and logs so the lettering runs vertical instead of horizontal.
Tables	Select whether the tops table appears in the main synthetic display and where. You can also rotate it 90 or 270 degrees depending on how you will orient the printed model. To display a text box on the main display in which you type details about operations you've performed on the synthetic and so on, with the Comments check box selected, click Edit to display the Comments box.
General model parameters	Select general properties based on the following: **Sample rate** The frequency at which to sample the data when building the model. **Model units** Click **Change** to display the **Unit conversion table** dialog box and specify the conversion factors to use when converting metric and Imperial units. **Prompts** Select whether GeoSyn notifies you when importing logs with either invalid UWIs or unknown aliases.
Vertical scale	Select whether the linear scale is based on time or depth. Depth is helpful when comparing a synthetic to a log, which is also depth-based. This option affects the *Correlation* window. Select the scale units and inches per second or feet per inch depending on whether the linear scale is based on time or depth.
Plot range	Based on whether **Time** of **Depth** is selected in the **Vertical scale** pane, type the start and end measurements of the zone of interest to display.

Parent Topics

"Changing the main synthetic display" on page 46
"Undoing and redoing changes" on page 49
"Changing import defaults" on page 12
"Displaying comments" on page 133

Tie seismic

With this feature...	Do this...
Seismic display pane	GeoSyn automatically picks the best tie on the trace closest to the well by default, but you can override this by dragging the slider left or right to move the green correlation line to a more similar seismic sample. Drag the green and the blue horizontal lines that control the data range to exclude unwanted data that appears in the model or in the seismic.
Cross correlation function	Drag the slider to the right of the display up or down to move the seismic trace along the model trace so the highest value for both are correlated. GeoSyn does this automatically, but you can change it.
Phase	Drag the sliders to the right of the Seismic and the Model boxes (or type directly in the boxes) to manually align the phase between the seismic phase or the model phase and the amplitude area. The outcome of the signals you adjust appears in the Cross Correlation Function area. The red signal is the seismic and model phase. The black signal is the amplitude envelope. Generally, the seismic phase should be changed to match the model instead of the model phase being changed to match the seismic.
Correlation Range	Select the range of data points to include in the active envelope. The active envelope is the vertical range that appears within the two horizontal green lines on the seismic section and within the two horizontal blue lines on the model. Note that instead of typing values in these two boxes, you can also simply drag the horizontal lines as depicted.

	 Data that falls outside of the active envelope is ignored when detecting the best tie point.
Jump to Best Tie	Move the tie to the best point in either of the following: **Current Trace** - a vertical point along the existing trace that's colored green and within the active correlation range specified above. **All Traces** - a vertical location amongst all of the traces that appear in the seismic section and within the correlation range specified.
Extract Wavelet	Click to display the Frequency Extraction Wavelet dialog box where you extract a wavelet using a seismic section in conjunction with a model.
Stretch/Squeeze	Click then select the top of the seismic zone to tie and the corresponding location on the model. Next, click the bottom of the seismic zone to tie and the corresponding location on the model. The *Stretch and Squeeze* dialog box opens where you can type more precise values for the tie points and click **Apply**.
Options	Click to display the **Select Data Sets for Cross-Correlation** dialog box.
Zoom in | Zoom out	Click **Zoom In** and then move the cursor over the seismic section (the cursor changes to a magnifying glass) and then drag the extents to zoom to zoom the overall dialog box. Supports multiple zooms when tying seismic to a model.

Parent Topics

"Tying seismic to models" on page 164

"Select data sets for cross-correlation" on page 305

Tie to datum

With this feature...	Do this...
Time Datum	Specify a depth that is above the top of the log so that the synthetic is pushed deeper. For Kingdom users, the datum is imported from Kingdom and applies to the entire project, so instead of changing the datum itself, change the time at a given depth point, which inserts the appropriate velocities in the log section added.
Well Tie Point	Specify a depth point on the sonic log to tie to time zero on the seismic section. The range from the top of the well to the new datum must be greater than zero.
Uncorrected Time Tie	Correlate the depth point tie to time using the top of the sonic log as time zero.
New Time Tie	Type a time that's greater than zero.
Time Units	Select the time units and time measurement system to use when making the tie. The units shown in the boxes above reflect the current selection.
Depth Datum	Select the depth units to use when making the tie. The units shown in the boxes above reflect the current selection.

Parent Topics

"Importing wells from Kingdom" on page 29

"Changing time datum properties" on page 111

"Kingdom data browser (Import directional surveys and time depth charts)" on page 225

"Time datum properties" on the next page

Time datum

With this feature...	Do this...
Apply Time Depth Corrections to Synthetic	Apply a time depth chart that is created when working in a given area by tying logs to seismic using Kingdom. The time depth chart corrects the sonic log automatically created by GeoSyn by adjusting the sonic's time depth points. Alternatively, select **Tie synthetic to a depth point** and then click **Edit** to select a single depth on the wellbore to tie to the time on the seismic section. Selecting this option requires that you add an invisible log section above the synthetic in order to move it down, as logs don't typically run to surface where time zero is marked. Use the Time Datum dialog to add an invisible log section above the synthetic.

Parent Topics

"Importing wells from Kingdom" on page 29

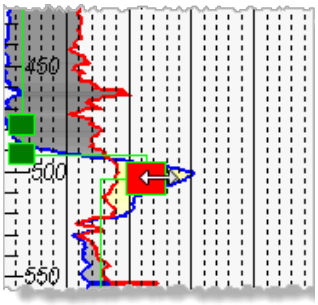
Time datum properties

With this feature...	Do this...
Add Layered Section...	Click **Add** to the right of the *Layers* label and then type details associated with section to add above the log. Note that multiple zones with different parameters can be added above the log.
Units	Specify the seismic units.
Options	Click either of the following: **Tie Depth Point to Time** - to display the Tie to Datum dialog box where you specify the point at which to tie the sonic log to the seismic section, which differs from the *Time Datum Properties* dialog box where you merely push the sonic log deeper. **Convert to Log Data** - to display the otherwise invisible log data at the top of the log in the main display.
Layers	Click either of the following: **Add** - to create a row where you add zone details in the layer display pane at the top of the dialog box. **Delete** | **All** - to remove the layers from the layer pane.

Parent Topics

"Changing time datum properties" on page 111

Time depth quality control

With this feature...	Do this...
Curve display pane	View the original (red) sonic curve, the correcting (green)time depth curve, and the corrected (blue) sonic curve that results from the time depth curve being applied to the original sonic curve. Drag a time-depth reading by velocity or depth, or type the desired values in the *Edit Options* pane.  Right-click to insert a new time-depth reading. Drag to select multiple time depth readings.
Chart: Grid	Select the time depth curve to use above the chart and select time depth readings to adjust in the *Edit Options* pane. CTRL+Click or SHIFT+Click for multiple selection.
Edit Options	Modify a reading selected in the grid (or clicked in the Curve Display pane), and then click **Update**, or click **New** to add an additional time depth reading.
Mouse Node Drag Options	Select whether to affect the velocity or the depth of the time-depth curve when you drag it using the *Curve Display* pane.
Single or Multi-Node Time Changes	Select whether to change the velocity above and below the selected node point or only above the selected node. The default option, *Lock all but selected node times* constrains the changes to the nodes immediately above and below the selected node preventing the remaining depths from changing. Generally, this is the preferred option.

Regenerate chart by culling times exceeding (usec)	Remove times above entered (usec) value and update TD chart.
Drift Correction Options	Select the method by which to apply the drift correction. *Spline curve* is the preferred method, as the correction is applied more gradually across the entire zone. Linear applies more drastic changes, which may cause additional reflection coefficients.
Display Options	Select the depth or velocity range to display and the preferred view that appears in the *Curve Display* pane.

Parent Topics

"Importing wells from Kingdom" on page 29

Time filter

With this feature...	Do this...
Type	Select a predefined filter to apply: • **Band pass (Ormsby)** -— computed from a trapezoidal frequency spectrum. • **Ricker** -— defined by its peak frequency. • **Butterworth** -— computed from low and high pass cutoff frequency values. • **Butterworth low-pass** -— computed from low pass cutoff frequency values. • **Lobeless** -— non-physically realizable wavelet with no side lobes. Used to investigate side lobe tuning effects.
Center freq.	Enter frequency value.
Center phase	Drag slider to change the center phase of the wavelet.
Taper	Select equation type to apply to taper : None, Cosine, Cosine squared, Hanning
Length (ms)	Enter value for length of sample time in ms.

Time shift options

This dialog appears when you close the *Tie Seismic* dialog box after specifying tie points.

With this feature...	Do this...
Shift Synthetic	Select whether to shift the synthetic relative to the seismic. This option is available where the slider control in the Cross Correlation Function of the Tie Seismic dialog box is dragged above the zero to a negative value.
Shift Seismic	Specify that the seismic shift relative to the synthetic.

Parent Topics

"Tying seismic to models" on page 164

"Tie seismic" on page 313

Time vs. depth chart

With this feature...	Do this...
1 Way | 2 Way	Select either one or two-way time.
Zoom In	Click and then draw a bounding box around the pane for which you want to zoom. You can only zoom in once so to zoom more, draw a smaller box.
Zoom Out	Click to undo the current zoom view.
Show Grid	Select whether to display a basic depth / time grid.
Show Tops	Select whether to display formation tops.

Parent Topics

"Analyzing velocity and depth" on page 169

Top properties

Tops:[list name]	Individual tops in selected tops list(s): • Check box—selects tops to show on model and tops table • Highlighting individual tops selects them for editing, deleting, or copying.
Show all	Shows all tops on model and table.
Hide all	Removes all tops from model and table.
New	Click to create a new top. **Note:** When a new top is created, the attributes in the Edit Top(s) fields are applied to the new top. Best practice is to enter the new tops attributes first in the fields before clicking **New**.
Duplicate	Duplicates highlighted top.
Delete	Delete **All** or **Highlighted** tops from list.
Copy tops list to list	Select the tops in the *Tops for list* pane and then click this button and select the destination list from the **Select a recipient tops list** dialog box.
Select All	Click to highlight all of the tops in current list.
Edit tops	Edit the display properties for the selected top.
Name	Highlighted tops name
Depth	Selected depth
Attributes	• Lithology • Color • Thickness
Tops lists	Available Tops lists to select tops from.
Show all	Displays tops from all tops lists on the synthetic display.
Hide all	Removes all tops lists them from synthetic display.
Export	Outputs the tops to an ASCII format file.

Import	Selects type and file for imports tops lists.
List Labels	Enter top label information.
Plot tops labels	Select side of logs that labels appear.
AccuMap specific	Requires licensed installation of AccuMap. See AccuMap documentation for additional information.
Kingdom specific	Imports and displays Kingdom specific data items for selected: • Horizon time or depth picks • Tops by specific authors

Parent Topics

"Changing tops properties" on page 89
"Changing import defaults" on page 12
"Exporting tops lists" on page 200
"Duplicating tops lists" on page 91
"…Create new curve type" on page 241
"Tops import" below
"Edit default display properties" on page 249
"Well properties: Well properties" on page 333
"Importing tops from delimited files" on page 97
"Importing tops from fixed width files" on page 99
"Importing tops from GeoSyn files" on page 96

Tops import

With this feature...	Do this...
Display Pane	Drag to select the tops to import into GeoSyn.
Tops in	Select whether the tops in the source file are ordered in rows (formation top names run horizontally along a single row), or columns (formation top names run vertically down a single column).
Names in row/-column Depths in row/column	Depending on your selection above, this field changes to support either rows or columns. Specify the row or column in which the formation names and depths

	appear. Click the directional arrows to either move forward or backward by one column or to move to the first or last column.
Search	GeoSyn automatically searches the formation tops import file for a UWI that matches the well currently displayed in GeoSyn and highlights it in red. Override this selection by typing a different UWI.
Import	Click to import the tops selected above into GeoSyn.
Delimiter Qualifier	GeoSyn automatically interprets this information from the source file. Override GeoSyn's comma, tab, or space selection. Delimiter is the character that denotes each individual item to import. Qualifiers are symbols that enclose items to ignore.
Locate at specified depths Ignore depths and space evenly	Select whether to space tops evenly or according to the kelly bushing or subsea. If based on depth. tops outside of the depth range of the model aren't placed.
Import units	Select the measurement system used in the file from which you're importing tops. GeoSyn will convert them to the unit system GeoSyn is using if required. The unit system GeoSyn is using appears after the *Bulk shift top depths by* option below.
Depths are relative to KB SS	Select whether to space tops according to the kelly bushing or subsea.
Bulk shift top depths by	Type a negative or positive value by which to shift the top's depths in GeoSyn.
Delete current tops before importing new tops	Select to delete all tops in the tops list to which tops will be imported. If this check box is cleared, tops with the same name in the donor and recipient list appear twice in the recipient list.

Parent Topics

"Importing tops from delimited files" on page 97
"Importing tops from GeoSyn files" on page 96
"Importing tops from fixed width files" on page 99
"Importing tops from LAS and ASCII Files" on page 104
"Import tops" on page 260
"Top properties" on page 322

Unit conversion table

With this feature...	Do this...
Curves	Select the log for which you want to change the conversion factor.
Unit conversion	Review the conversion factor for the selected log, and if desired, type a new conversion factor in the box below.
New units	Review the units to output for the selected log, and if desired, type a new output unit in the box below.

Parent Topics

"Changing the main synthetic display" on page 46

"Synthetic properties" on page 311

Wavelet inversion (Input)

With this feature...	Do this...
Select	Select the wavelet to display in the *Input Wavelet* pane.
Input Wavelet	View the wavelet that will be inverted. Click **Select** in the top-right to choose another.
Inverted Wavelet	View a preview of the inverted wavelet to apply to a seismic section.
Phase | Amplitude	Select whether to invert the phase or amplitude, or both.
Operator Length	Select the length of the operator to apply. By default, the operator length is the same duration as the wavelet selected from the GeoSyn model above; however, operators for inverted wavelets typically require a duration twice the many milliseconds as the sample wavelet.
Constrain Amplitude Spectrum Inversion	Enable the **Bandwidth** option to invert using the amplitude outline that appears in the *Inverted Wavelet* pane. Clear the *Bandwidth* option to apply a constant inversion to reflection coefficients that exceed a specific value you type.

Taper	Select the method by which to taper the wavelet edges.
Invert Spectrum Coefficients that Exceed	With the **Bandwidth** check box cleared, type a value that acts as a ceiling above which reflection coefficients are inverted.
Show	Select either **Wavelet** or **Spectrum**. Spectrum view includes a wavelet in the top-right corner of the *Input Wavelet* ad *Inverted Wavelet* panes for reference.

Parent Topics

"Inverting wavelets" on page 146

Wavelet inversion (Save)

With this feature...	Do this...
Add to Library	Library files are available in multiple locations throughout GeoSyn, which can be more convenient than saving to disk.
Export to File	Export the inverted wavelet as a seqy file, and then import it into an application such as Kingdom. Inverted wavelets can also be imported into GeoSyn using the *Seismic Properties* dialog box.

Parent Topics

"Inverting wavelets" on page 146

Wavelet library

With this feature...	Do this...
Display pane	Select the wavelet to apply tot he current model or to delete.
Show all	Click to automatically select all of the individual check boxes that control display options in the above grid, or click the individual check boxes.

Replace	Click to apply the wavelet selected above to the existing model.
Create	Create a new model based on the wavelet selected above.
Delete	Click to remove the wavelets selected above from the centralized wavelet library.

Parent Topics

"Importing wavelets and wavelet sets" on page 136
"Exporting wavelets" on page 199
"Wavelet properties: Wavelet" on page 329
"Wavelet properties: Spectrums" on the next page

Well symbol legend

	Location		Suspended
	Service or Drain		Oil
	Gas		Dry and Abandoned
	Heavy Oil		Suspended Oil
	Abandoned Oil		Suspended Gas
	Abandoned Gas		Abandoned Service
	Oil and Gas		Suspended Heavy Oil
	Abandoned Heavy Oil		Suspended Oil and Gas
	Abandoned Oil and Gas		Injection

Wavelet properties: Spectrums

With this feature...	Do this...
Display pane	Select the wavelet with which to work. Clear **Show sall wavelets** if you're already working with the desired wavelet to increase the work space in this dialog box.
Name	Type a name with which the wavelet is identified in the main synthetic display.
Type	Select a predefined filter to apply to the wavelet selected in the display pane. Controls to specify the cut and pass frequencies appear below based on your selection.
Low cut Low pass High cut High pass	Modify the energy shape either by typing the actual source values provided with the seismic data or by modifying the wavelet shape to visually match the seismic data.
Center phase	Type a value or drag the slider to move the wavelet relative to the center point displayed in the *Wavelet* tab.
Taper	Select whether to taper using an equation.
Operator length	Type the overall length of the sample to display in the adjacent window.
Import/Export	Beside either *Wavelet* or *Wavelet sets* (depending on whether to save a single wavelet or group of wavelets), click **Import** or **Export** to read or write the wavelet or wavelet set that appears in the display pane to or from disk. To save or import a wavelet(s) from a centralized wavelet library used by all GeoSyn models, beside the *Library* label select either **Add** to save the current wavelet to the library, or **Retrieve** to display the *Wavelet Library* dialog box where you apply one or more wavelets to the current synthetic.
Import Wavelet	Select either of the following and then click: **Replace wavelets in selected models** - overwrites the wavelets selected in the Show wavelet list pane of the Wavelet Properties dialog box with those selected in the *Wavelet Library* dialog box. Create new models - adds the selected wavelet alongside other wavelets available in the synthetic.
Extraction	Click **Extract** to load a wavelet saved in ASCII or SEGY

	format.
Left right arrows ()	Click to expand or compress the spectrum.
Show	Select whether to display the spectrum for power, amplitude, and phase.

Parent Topics

"Importing wavelets and wavelet sets" on page 136
"Inverting wavelets" on page 146
"Exporting wavelets" on page 199
"Extracting wavelets" on page 149
"Wavelet Extraction (Processing Display)" on page 227
"Wavelet properties: Wavelet" below
"Model properties: Wavelets" on page 286
"Changing wavelet properties" on page 143

Wavelet properties: Wavelet

With this feature...	Do this...
Display pane	Select the wavelet with which to work. Clear **Show all wavelets** if you're already working with the desired wavelet to increase the work space in this dialog box.
Name and Comments	Type a name with which the wavelet is identified in the main synthetic display.
Type	Select a predefined filter to apply to the wavelet selected in the display pane. Controls to specify the cut and pass frequencies appear below based on your selection.
Low cut Low pass High cut High pass	Modify the energy shape either by typing the actual source values provided with the seismic data or by modifying the wavelet shape to visually match the seismic data.
Center phase	Type a value or drag the slider to move the wavelet relative to the center point displayed in the *Wavelet* tab.
Taper	Select whether to taper using an equation.
Length	Type the overall length of the sample to display in the

	adjacent window.
Import | Export	Beside either *Wavelet* or *Wavelet sets* (depending on whether to save a single wavelet or group of wavelets), click **Import** or **Export** to read or write the wavelet or wavelet set that appears in the display pane to or from disk. To save or import a wavelet(s) from a centralized wavelet library used by all GeoSyn models, beside the *Library* label select either **Add** to save the current wavelet to the library, or **Retrieve** to display the *Wavelet Library* dialog box where you apply one or more wavelets to the current synthetic.
Extraction	Click **Extract** to open the *Frequency Wavelet Extraction* dialog box where you select the seismic trace and extraction method to load.
Invert Wavelet	Click **Invert** to display the Wavelet Inversion dialog box where you invert a wavelet that you import into GeoSyn (or another seismic application) to remove phase and amplitude distortions from a seismic section.
Aux. trace	Select an additional trace to display in the trace display pane and a color format. For example, the Amplitude Envelope shows where the wavelet energy is and helps you to align the wavelet phase.
Color	Select a background color for the display pane.

Parent Topics

"Wavelet properties: Spectrums" on page 328
"Importing wavelets and wavelet sets" on page 136
"Inverting wavelets" on page 146
"Exporting wavelets" on page 199
"Extracting wavelets" on page 149
"Wavelet Extraction (Processing Display)" on page 227
"Model properties: Wavelets" on page 286
"Changing wavelet properties" on page 143

Well properties: Directional properties tab

With this feature...	Do this...
TVD vs. offset calculator	Click the arrows to adjust the depth and off-set values by 1, 10, and 100 respectively.
Seismic selection drop down list	Select available seismic trace to display
Zoom scroll bar	Zoom in or out

Parent Topics

"Viewing deviated well properties" on page 51

Well properties: Log properties

With this feature...	Do this...
Display pane	Select the log to modify and either change its display properties or click **Duplicate** then change the display properties of the copied log. Click **New** to create a blank log type. SHIFT+CLICK or CTRL+CLICK for multiple selection, or click Select All.
Name	Type a descriptive name with which to overwrite the original log name.
Type	Select a log type from the drop-down list and whether to make it the active log upon which your synthetic is derived.
Alias / API	Select an alias and then type the API number.
Units	Type the unit suffix and for sonic logs either transit or velocity units.
Scales	Select whether to automatically adjust scales to data limits or type custom minimum and maximum values.
Show off-scale	Select whether portions of a log that over-run the horizontal width of the track are drawn on the other side of the track in a different color and different line style. Log portions that over-run more than one track are colored differently than logs that over-run only a single track.

Infill	If displaying a single log per track, click Edit to display the *Color Palette* dialog box where you specify a lithology fill and whether to fill the left or right portion of the trace.
XPlot underlay link	Select whether the color infill for the log is derived from a crossplot. This option is enabled using the *Crossplot Properties: Color Mapping* tab.
Derive using...	Select to apply a constant mathematical formula to the selected curves that persists despite changes to the log. Click **Edit** to specify different variables. Note that selecting this option will prevent you from doing some log editing functions.
Edit	Click to launch the *Edit the derivation equation* dialog box.
Trace	Select display properties for the logs selected in the display pane above.
Track Width	Specify the width at which the track will be printed.
Description Options	Select whether to use the log name that appears in the imported file, the GeoSyn log name, or the alias. To reduce the width of the overall synthetic, display the alias.
Depth Markers	Select the increments for major and minor depth markers.
Track Layout	Select whether to use one log per track or multiple logs per track. For single logs per track, configure the track display using the Infill options listed above. For multiple logs per track, click **Edit** to display the *Edit Multi-log per Track Template* dialog box and specify track criteria that can also be saved as template files.

Parent Topics

"Changing log display properties" on page 52

"Combining logs in tracks" on page 62

"Edit color palette" on page 248

Well properties: Well properties

With this feature...	Do this...
Unique Well Identifier	Click **Edit** to display the *Edit a UWI* dialog box then specify a survey system and survey coordinates. Both UWI labels update.
Labels	Type any log header information to show in the main synthetic display. Select which of the labels appear in the main synthetic using the drop-down list that appears to the right of the *Banner 1* box in the *Synthetic Properties* dialog box.
Status	Select a well status from the drop-down list and whether to update this status if it's changed in the AccuMap database. Click Well Symbol Legend for details.
KB elevation	Type the kelly bushing elevation.
Depth inc.	Type the depth increment.
TVD status	Select whether the well is measured in True Vertical Depth or Measured Depth. If Measured Depth, you can import an ASCII format directional survey file by clicking the adjacent button.
Import Directional Survey	Click to launch the *Measured Depth to True Vertical Depth correction* dialog box. Also select whether to calculate the bottom hole position based on the directional survey imported.
Tops	Click **Edit** to launch the *Top Properties* dialog box and configure tops lists and individual tops.
Editing History	Click **View** to display a list of the date, time, and description of changes made to the curve using Log Editor. Saved changes span multiple GeoSyn sessions.
Position	Select whether to use the default datum, the datum specified in the AccuMap database, or one based on another standard datum you select or coordinates that you type using the *Set Location* dialog box.

Parent Topics

"Changing well display properties" on page 50

"Changing import defaults" on page 12

"Importing directional surveys" on page 16
"Changing wavelet expansion properties" on page 145

Zero phase extraction processing flow

With this feature...	Do this...
Time range Sum traces	Select the time range and number of traces to sum.
Taper Apply taper to	Select the taper method and percentage of the summed traces to taper.
Wavelet name	Type the name by which the resulting wavelet is identified in GeoSyn.
Operator length	Select the longest operator possible to ensure the amplitude spectrum retains as much detail as possible.
Taper	Select the method by which to taper the operator extracted from the center of the summed and tapered traces.

Parent Topics

"Extracting wavelets" on page 149

Basic AVO workflow

The following is a very basic guide for the use of the AVO functionality in the new GeoSyn 1D program. This functionality is capable of both reverse and forward modeling. Reverse modeling requires seismic data of the common offset type.

Forward Modeling

1. Import well logs, P Sonic, Density and Shear sonic if available.

2. Re-datum the synthetic by adding new section at the top. This critical step is necessary to ensure that the incident angle for any given interface calculated within the GeoSyn ray tracing algorithm matches the seismic section. Ray tracing must be done from close to the surface where the seismic was acquired.

Two methods may be used to accomplish this. The older method, using the *Insert Section* dialog box in the *Log Editor*, is no longer recommended. A new dialog box, *Time Datum properties*', handles the problem much better.

Using the Time Datum properties dialog box

Open the *Time Datum Properties* dialog box, *Edit/Time Datum…* (T0). A single entry typically indicates that the top of the log suite is time zero. Click **Add a layer**, to create a new layer with zero thickness. Next change the *KB* or *SS* value of the top of the new layer and set it to near the elevation of the ground surface or seismic datum.
Update the velocity of the new zone to create enough time delay to push the GeoSyn models down in time to the correct position in time relative to observed seismic or checkshot data. Notice that the top of the visible model now has a time matching the bottom of this new layer. GeoSyn's AVO calculation honors this new zone (or zones) as if it were genuine log section added to the top of the log suite (as in the older method below).

Using the Insert Section dialog box

Calculating the amount of section to add: The depth datum of the seismic section should not be used to calculate this value, as the incident angle field in the seismic is a function of the shot point and receiver elevations, in other words, the ground surface. In the idealized case of flat stratigraphy and flat ground surface, the depth value of the first log sample (relative to the KB) is a decent value to use. Using the *Insert Section* dialog box, add this section to the top of the log suite.

Calculating the velocity of the new section: The velocity/transit value of the new section is also an issue. It must match the average velocity of the section from the top of the well log to the surface. Calculate this value before adding section to the well log.

Correlate the synthetic to the seismic and determine the difference, the time shift, between seismic zero and synthetic zero. Calculate the seismic time datum shift applied by the processor and remove this from the value. Divide the Time Shift by two to change from 2-way to 1-way.
Calculate the required average velocity or transit value by dividing the required amount of depth section by the Time Shift.

3. Assign AVO parameters to a model. Right click over a model and select the Model Parameters dialog. Set the model type to 'Multi Offset' and adjust the following parameters:

Ray trace method - Ray trace (slow). (Full Snell's law calculation).

Vertical sampling interval - Use 'Constant time'.

Geometry - CDP interval, Num traces and Near trace offset.

Adjust the three parameters, adding or subtracting traces, adjusting the CDP interval and offset until the required maximum offset is reached. Remember that the CDP interval is half the surface offset.

Apply NMO correction - Set to yes.

Mute - Something around 28 degrees or so will work.

4. Apply an offset dependency formula. By default when a multi-offset model is created the offset dependency for reflection coefficient calculation is set to none. To apply a dependency select the Reflection Coefficient (Ref Coef) tab of the Model Properties dialog and select one of the three options, Aki Richards 2 or 3 term or Shuey. If a shear sonic is unavailable GeoSyn will prompt you to create one based on Castagna's well known relationship between shear and p sonic curves.

Step 4 completes the basic setup for forward AVO modeling. The model is ready for cross plot analysis.

5. Cross Plot analysis. While some information may be gleaned from visual analysis of the model the best way to analyze the data is with a cross plot.
Cross plots of interest fall into two categories:

Analysis of a single or at most 2 or three sample points involving amplitude plotted against one of the following; offset, incident angle, sine incident angle or sine squared incident angle. This method is most appropriate for detailed analysis of an AVO response at a particular interface of interest.

Analysis of the entire data set, or significant portion of it, by using the gradient vs. intercept method. This method is convenient in a reconnaissance sense as the entire data set may be analyzed at once with a view toward identifying zones of interest.

Reverse Modeling

Reverse modeling is defined as a modeling effort involving real data.

1. Import well logs. P Sonic, Density and Shear sonic if available.

2. Import seismic offset data. A common offset stacked panel, sorted to display near trace on the left and far trace on the right, works well. Set the synthetic sampling rate to match the sample rate of the seismic.

3. Re-datum the synthetic by adding new section at the top. Please refer to step 2 in the Forward modeling section.

4. Tie seismic to synthetic. This critical step adjusts the time datum of the seismic section to tie the synthetic. Open the 'Tie seismic to model dialog by right clicking over the seismic or selecting from the Seismic properties dialog. This dialog initially requests a model to tie against then automatically calculates a best fit time shift.

5. Creating an AVO model using parameters from the seismic. Select an unused model using the 'Link to AVO trace model' list box in the Seismic properties dialog. The model will have its AVO properties automatically adjusted to match the seismic offset panel. If there is a problem reading the seismic headers the model properties must be set manually.

Step 5 completes the basic steps required to prepare a reverse model for analysis. The model is ready for cross plot analysis.

6. Cross Plot analysis. Please refer to step five in the Forward modeling section for instructions on cross plot usage. The cross plotting effort is identical except that all offset and angle selections must come from the model and all amplitude selections must come from the seismic.

Check shot computation

The application of check shots to a synthetic is, in theory, relatively straight-forward. In practice, it involves complicated datums and datum corrections. The following describes the basic check shot computation in GeoSyn:

A series of check shot time depth pairs are input to the program. The sonic log is integrated (i.e., converted to a time depth log), and a second set of time depth pairs that correspond in depth to the check shot time depth pairs are selected from it. A third set of time depth pairs are created by subtracting the sonic time depth pairs from the corresponding check shot time depth pairs. This third set represents the difference and therefore the correction between the sonic and the check shot at the depths defined by the check shots.

The next step is to calculate a best-fit cubic spline through the correction points. A cubic spline is a third-order polynomial log, with the added constraint that the second derivative of the log be continuous and smooth. Cubic splines tend to be more stable than polynomials, with less possibility of wild oscillation between the tabulated points. Future releases of GeoSyn will contain provision for polynomial fits of greater than 3 degrees.

The cubic spline function is used to calculate interpolated points corresponding to every depth sample from the integrated sonic log. These points are added to the integrated time at each integrated sonic depth point. A new sonic transit log is calculated by subtracting consecutive points from the corrected integrated log.

The final step involves adding new section at the top of the log to account for the difference between the top of the sonic log and the source datum elevation of the check shot survey. Check shots above the limits of the original log create block velocity zones in the newly expanded log.

File formats

The following supported file formats are defined below:

- IHS
- SYN
- LAS
- SEGY

IHS file format

The following is a truncated example of an IHS formatted ASCII file. One header card is required. It must contain an identifier string, the first depth, the last depth, the depth increment, and the units. If the units are missing, GeoSyn prompts you to select them. GeoSyn currently only supports single log files.

Test Well 204.0 1463.8 0.2000 M SONIC

204.0 364.76 361.88 360.86 363.92 369.15 374.39 379.62 382.22 381.31 379.54 10

206.0 377.76 375.93 373.71 371.16 368.62 366.78 367.17 369.08 370.99 372.90 10

208.0 374.99 377.58 380.46 383.34 386.22 389.10 393.41 399.86 407.72 414.99 10

210.0 415.48 410.51 405.55 400.58 396.70 394.32 392.52 390.89 389.36 388.62 10

212.0 388.59 388.57 388.54 388.51 388.49 388.41 388.18 387.87 387.56 387.25 10

...

1454.0 161.02 158.81 156.61 155.50 155.54 155.64 155.74 155.68 155.45 155.21 10

1456.0 155.12 155.99 157.66 159.33 161.00 162.67 164.10 165.21 166.24 167.27 10

1458.0 168.30 169.37 170.59 171.92 173.26 174.60 176.01 174.26 168.08 162.26 10

1460.0 161.92 165.63 169.59 173.82 178.37 183.10 187.84 182.83 168.57 160.55 10

1462.0 161.62 166.09 170.56 174.93 179.11 183.22 187.65 190.07 190.10 190.09 10

#TOPS# 5

Top1 258.0

Top2 348.0

Top3 481.0

Top4 599.5

Top5 684.0

KB 900.9

No special end of file characters are required.

SYN file format

After you have created and saved a new synthetic, the synthetic is saved to disk as a binary file with the optional extension *.syn*. This file contains all the information necessary to re-create the state of the synthetic as well as the raw log data.

LAS format

The Canadian Well Logging Society's Floppy Disk Committee has designed a standard format for log data on floppy disks. It is known as the LAS format (Log ASCII Standard). LAS consists of files written in ASCII and containing minimal header information. The LAS format has evolved over the years. GeoSyn currently supports the import of two versions, 2.0 and 1.2.

GeoSyn will read an attached tops file, although strictly speaking tops are not included in the official LAS format. Two styles of tops formats are supported in Version 2.0, and one format is supported in Version 1.2.

Truncated Example of LAS Version 2.0

~VERSION INFORMATIONVERS. 2.00:CWLS LOG ASCII STANDARD - VERSION 2.00WRAP. NO :One Line per depth step#~WELL INFORMATION#MNEM.UNIT DATA DESCRIPTION#--------- ---------- ---------- ---------- ----------STRT.M 249.7836 :START DEPTHSTOP.M 1254.2520 :STOP DEPTHSTEP.M 0.1520 :STEP LENGTHNULL. -999.2500 :NULL VALUECOMP. AnyCompany OIL & GAS LIMITED :COMPANYWELL. AnyCompany etal AnyWhere :WELLLOC . AnyWhere :LOCATION#~CURVE INFORMATION#MNEM.UNIT DATA DESCRIPTION#---------- ---------- ----------DEPT.M :1 DepthDT .US/M 7 520 80 00 :2 Sonic Travel TimeRHOB.G/C3 31 350 02 00 :3 Bulk Density#~PARAMETER INFORMATION#MNEM.UNIT DATA DESCRIPTION#--------- ---------- ----------EKB .M 300.0000 :Kelly bushing#~t 7 Tops //or ~T 7 TopsT0 647.98T1 800.89T2 1011.86Wabamun 1132.40Ireton 1536.64Slave Point 1812.01Pre Cambrian 1841.80#~A DEPT DT RHOB249.7836 410.825 1819.972249.9356 410.752 1791.029250.0876 410.679 1802.005250.2396 410.607 1869.852250.3916 410.534 1908.247250.5436 410.461 1958.225250.6956 410.388 1987.873250.8476 410.316 2014.986250.9996 410.249 2022.811...1253.4396 169.758 2730.6461253.5916 169.758 2730.6461253.7436 169.758 2730.6461253.8956 169.758 2730.6461254.0476 169.758 2730.6461254.1996 58.382 939.106No special end of file characters are required.**alternate tops format~Formation Tops Information#TOPS NAME . DEPTH:BR . 7221.0410:WPBI . 8034.6790:COLO . 8539.9220:CARD . 9553.6900:CARD . 9671.7980:L CA . 9743.9760:BKST . 9799.7500:

Truncated Example of LAS Version 1.2

~Version : LASOUT vs 1.20VERS. 1.20: CWLS Log ASCII Standard -VERSION 1.20WRAP. NO: One line per depth step~Well Information Block#MNEM.UNIT Data Type Information#----.---- ------------: ----------
STRT.M 250.0000: Start DepthSTOP.M 2413.0000: End DepthSTEP.M .2000: Depth IncrementNULL. -999.25:COMP. COMPANY:WELL. WELL: Dog Patch LAKE 5-4FLD . FIELD: Dog PatchLOC . LOCATION: 10-10-99-1w6PROV. PROVINCE: ALBERTASRVC. SERVICE COMPANY: FlyByNight LoggersDATE. LOG DATE: 1889/12/29UWI . UNIQUE WELL ID: 0101010101010~Parameter Information Block#MNEM.UNIT Value Description#----.---- ------------: ----------
BHT .DEGF .0000: Bottom Hole TemperatureBS .MM .0000: Bit SizeDFD .0000: Mud Weight (Density)DFV .0000: Mud ViscosityDFL . .0000: Mud Fluid LossDFPH .0000: Mud pHRM .OHMM .0000: Mud Resistivity
RMT .DEGF .0000: Mud Resistivity TemperatureRMFS.OHMM .0000: Mud Filtrate ResistivityRMFT.DEGF .0000: RMF TemperatureRMC .OHMM .0000: Mud Cake ResistivityRMCT.DEGF .0000: RMC TemperatureEKB .M 987.5000: Elevation Kelly BushingEGL .M 982.3000: Elevation Ground Level~Curve Information Block#MNEM.UNIT API CODE Curve Description#----.---- ------------: ----------
DEPT.M : 1 DEPTHDT .USM 60 520 0 1: 2RHOB.KM3 42 350 1 1: 3~A Depth DT RHOB250.0000 376.4800 1922.6000250.2000 345.2000 1998.4000250.4000 313.9200 2363.4000250.6000 282.6400 2512.2000250.8000 254.4400 2463.2000251.0000 275.8800 2392.0000...2411.2000 -999.2500 2715.90002411.4000 -999.2500 2713.90002411.6000 -999.2500 2712.40002411.8000 -999.2500 2707.20002412.0000 -999.2500 2691.00002412.2000 -999.2500 2674.80002412.4000 -999.2500 2658.60002412.6000 -999.2500 2640.70002412.8000 -999.2500 2683.40002413.0000 -999.2500 2730.9000No special end of file characters are required.

SEGY format

GeoSyn can export integrated time data (traces, wavelets, wells, rocs, etc.) in SEGY format. The format specification discussed here is a derivative of the SEGY 9-track standard. Because there is no official MS DOS standard, some liberties have been taken with respect to the original specifications. For a discussion of the 9-track SEGY format, refer to "Recommended Standards for Digital Tape Formats" K.M. Barry, D.A. Cavers, C.W. Kneale: *Geophysics*, Vol. 40 No. 2, p. 344-352.

A SEGY file consists of three sections or blocks:

- ASCII file identification header
- Binary file header
- Trace header

ASCII file identification header

The first 3600 bytes of the file is the File Identification Header and consists of a 3200-byte ASCII card image block followed by a 400-byte binary block. The 3200-byte ASCII section represents a deviation from the 9-track SEGY standard, which specifies that this section be in EBCDIC format. Both are text formats, but use of the ASCII format enables a user to read this portion of the SEGY file in any PC-based text editor. This deviation from the standard has no detrimental effects because most programs rely on the binary data for hard information.

The ASCII section consists of 40 lines of 80 characters each. Each line starts with a C and the line number. The following is an abridged example of the 3200-byte ASCII header for a typical GeoSyn SEGY file and describes the well name, sample rate, data type, and byte order. This same information is encoded in the 400-byte binary section.

```
C1 GeoSyn Synthetic Seismogram
C2 ABC OIL AND GAS 11-11-11-11W1
C3 Date: 11:35 AM Fri Dec 01, 1995
C4 Sample Rate: 2.00 (ms)
C5 Data Type: Integer(2 byte)
C6 Byte Swap: Yes
C7
.....
C36
C37
C38
C39
C40
```

Binary file header

The 400-byte binary file header follows the ASCII file header and is situated on bytes 3201 to 3600. GeoSyn does not require or make use of most of the space.

The following bytes are used:

3213 to 3214 Number of byte traces per record =1

3217 to 3218 Sample interval in microseconds

3221 to 3222 Number of samples per data trace

3225 to 3226 Data sample format code (will be either 1 or 3)

1=floating point (4bytes)

2=fixed point (4 bytes)

3=fixed point (2 bytes)

4=fixed point with gain code (4 bytes)

3261 to 3262 Total number of traces per line =1

3269 to 3270 Start time of data trace (can be negative in the case of a wavelet)

Trace header

The trace header is a 240-byte binary section that precedes each section of trace data. GeoSyn only writes one data curve, so there is one trace header in the file. The trace header occupies bytes 3601 to 3840. The bytes used by GeoSyn are tabulated below. Note that some values are 4 bytes long instead of 2-byte integer.

The following bytes are used:

3601 to 3604 Trace Number.

3629 to 3630 Trace identification code 1=seismic data, 2=dead trace.

3715 to 3716 Number of samples.

3717 to 3718 Sample interval in microseconds.

Trace Data

Trace data is stored in binary format and follows the 240-byte trace header. The binary data may be stored in one of two formats, 16-bit integer or IEEE floating point. The 16-bit integer format requires 2 bytes per amplitude value, whereas the floating point format requires 4 bytes.

Data Area

The data area follows the trace header and consists of a number of 2- or 4-byte numbers representing the amplitude data of the trace or wavelet. Note that the number of samples in this record will exceed the number of samples in the synthetic if a trace is being saved, because the roll out portion of the trace below the bottom of the log is included. The number of extra samples will equal the length of the trace plus half the length of the wavelet operator.

Well symbol legend

	Location		Suspended
	Service or Drain		Oil
	Gas		Dry and Abandoned
	Heavy Oil		Suspended Oil
	Abandoned Oil		Suspended Gas
	Abandoned Gas		Abandoned Service
	Oil and Gas		Suspended Heavy Oil
	Abandoned Heavy Oil		Suspended Oil and Gas
	Abandoned Oil and Gas		Injection