

IXSeg2Segy Instruction Manual

Version 1.2

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ABOUT THIS MANUAL

This manual is a PDF version of the Windows Help file that comes with IXSeg2Segy. It was created by importing the Windows Help pages into Microsoft Word and importing the pictures separately, with some additional formatting.

Text which is shown in red (such as “**Creation of data by spreadsheet entry**”) indicates an item which is a link in the corresponding Windows Help file. Using the Windows Help file, either alone or from the IXSeg2Segy menu, will allow you to click on this link and go to the section of the help file to which it points.

The purpose of this manual is to offer an alternative medium to the Windows Help, and especially one that can be easily printed in its entirety so that it can be read in circumstances where a computer is not relatively available or being used for some other task.

Please contact Interpex Limited by e-mail at info@interpex.com if you have any concerns about possible errors or omissions in this manual.

Overview

IXSeg2Segy is a seismic data file viewing, picking and format conversion shareware package. It is designed to import various SEG-1 data formats as well as SEG-2 and SEG-Y formats and export trace data as SEG-2 and SEG-Y format files. Time picks can be exported in an ASCII format with trace number and time pick value.

Files can also be imported from the [command line](#).

In addition to menu commands and toolbar buttons, there are several hot keys which control the display. Page keys open the next/last file in sequence, +/- control trace overlap, G, T and A switch gain method to Global max, Trace max or AGC, N and P switch trace axis to trace number or trace position.

It also allows for simple refraction interpretation, using the slope-intercept method, in terms of a flat earth with 2 layers. Interpretation is automatic. It also allows for simple reflector interpretation, using the NMO equation to fit a parabola to a reflector in the record. And there is a diffraction interpretation that works in a similar fashion.

Currently supported import formats are for files created using instruments or software by ABEM, Bison, FIRSTPIX, Geometrics and Oyo, as well as SEG-2 and SEG-Y formats. These formats are automatically detected as described in [File/Import](#). In addition, there are imports for non-compliant SEG-Y, ASCII or CSV data files, as well as a user-defined format.

For SEG-Y, multiple records per file is supported. For other formats, only one record per file is supported. When importing SEG-Y, only one of the records in the file can be supported at one time.

If data are imported from SEG-Y format and then exported in SEG-Y format, the original reel and trace headers are preserved, except for format choice. Modifications are made, however, if the shot header is edited or if the data are resampled or truncated.

Trace data can be exported as SEG-2 or SEG-Y. For SEG-2, export can be LSB first or MSB first (Least Significant Bit or Most Significant bit first). For SEG-Y, the 3200 byte header can be written as ASCII or EBCDIC. On import, these parameters are automatically detected as described in [File/Import](#).

IXSeg2Segy also provides for file merging. With file merging, a number of files are selected and imported, then the first traces from each file are combined to make a new output file. This is also done with the second, third and all subsequent files. For instance, if you merge 5 files with 24 traces each, you will end up with 24 new files with 5 traces each. See [File/Merge](#).

IXSeg2Segy also provides for file combining. With file combining, a number of input files are combined into a single SEG-Y file with multiple records. Each file to be combined must have the same number of traces and samples and the same sample rate as all other files being combined. See [File/Combine](#).

IXSeg2Segy also provides for file concatenation. With file concatenation, a number of records in a SEG-Y file are combined into a SEG-Y file with a single record. See [File/Concatenate](#)

IXSeg2Segy also provides for file conversion. With file conversion, a number of files are selected by the user along with the output parameters. Then the files are read one by one and exported to the required format without user intervention. When SEG-Y files containing multiple records are converted, each record in a multi-record SEG-Y file creates a separate output file. Converting a multiple record SEG-Y file to SEG-Y format results in multiple files, each containing one record from the original file. See [File/Convert to SEG-2](#) or [File/Convert to SEG-Y](#).

Editing consists of [Pick Parameter](#) editing, [Record Header](#) editing, [Truncation](#), [Resampling](#) of the traces, [Removal](#) of some of the traces in the record, trace gaining and trace equalization.

Processing consists of [differentiation](#), [integration](#), [linear trend removal](#) and [DC level removal](#).

Filtering consists of [single bandpass filter](#) and [F-K velocity](#) filter.

There is a separate command under processing to display the **Frequency Spectrum** in a separate window.

Interpretation tools include simple reflection interpretation using **NMO correction**, **Refraction Interpretation** and a simple 2-layer **refraction interpretation**.

Picking is both automatic and manual. Manual picking is by point and click with the mouse. Automatic picking is carried out using one of four different methods, simple pick, Hatherly pick, Box pick or Wavelet pick, as described in the **Pick** menu.

Right-clicking on a trace allows you to kill the trace, flip the trace, gain the trace or write the trace to an ASCII file.

Graphics can be exported as DXF, CGM or WMF files.

CAUTION!! although multiple copies of IXSeg2Segy can be run simultaneously, this creates a danger of losing the registration and having to reregister the software. Please keep a backup copy of IXSeg2Segy.INI if you desire to run multiple copies simultaneously. This file is found in the directory containing the IXSeg2Segy.EXE file.

Installation

IXSeg2Segy is installed by running the setup file found on the distribution CD or downloaded from the Internet. Usually it is installed into C:\Program files\IXSeg2Segy. The executable file is called IXSeg2Segy.exe.

After installing, use Windows Explorer to open the C:\Program files\IXSeg2Segy directory and drag the IXSeg2Segy.exe from there to the desktop using the RIGHT mouse button. When released, select "Create shortcut here". Position the shortcut according to your preferences and rename it to IXSeg2Segy.

If you have selected "Hide extensions for known file types" in Tools/folder options/view in the Windows Explorer, the EXE extension will not be shown. It will be the file with the InterpeX "IX" logo and the trace with break on top of it.

Right-click on the shortcut and select properties. Change the "Start in:" field to the location where you will be storing your trace data files. IXSeg2Segy remembers which directory you last used and takes you back there, but if it forgets now you will at least start in a reasonable place.

To update IXSeg2Segy to a new version, download the zip file containing the updates from www.interpex.com and unzip that file into the C:\Program files\IXSeg2Segy directory. you need WinZip to do this. You can find WinZip at www.winzip.com. If you want to save your present version (just to be safe), rename it to include the version, for instance IXSeg2Segy311 for version 3.11.

The Help file for IXSeg2Segy is in the C:\Program files\IXSeg2Segy directory. You can access it through Help/Contents in IXSeg2Segy or you can drag it onto the desktop using the RIGHT mouse button and create a shortcut just as you did for the executable.

Check the Interpex web site periodically for updates, particularly if you are having problems. Always run the most recent before reporting any problems with the software.

SUPPORT

Support for IXSeg2Segy is obtained by sending e-mail to support@interpex.com.

For registered users, we are normally willing to add formats or improve the performance, usability and scope of currently supported import and output formats.

Problems with reading currently supported formats should include a sample file with which you are having difficulties.

Requests for additional formats or format modification would require sample files in addition to format documentation.

Requests which are of a unique nature and not suitable for a wide audience of users might be added at an additional cost to the requesting user.

REFERENCES

Barry, K. M., Cavers, D. A. and Kneale, C. W., 1975, Report on recommended standards for digital tape formats: Geophysics, Soc. of Expl. Geophys., **40**, 344-352.

Dobrin, M. B., 1960, Geophysical prospecting: McGraw-Hill, pp 71-73.

Pullan, S. E., 1990, Recommended standard for seismic (/radar) files in the personal computer environment: Geophysics, Soc. of Expl. Geophys., **55**, 1260-1271.

Running IXSeg2Segy from the Command Line

1) IXSeg2Segy will convert a seismic data file to ASCII from the command line. This is the same as using **File/Import** followed by **File/Export ASCII**. Usage is

IXSeg2Segy C:\InPath\Datain.SG2 ASCII Dataout.DAT

If you omit the second and third arguments, it will simply open the file and wait for the user to respond.

If you omit the third argument, it will create a file **C:\InPath\Datain.TXT**

If you specify an existing directory as part of the name for the output file, it will be written there:

IXSeg2Segy C:\InPath\Datain.SG2 ASCII C:\OutPath\Dataout.DAT

2) IXSeg2Segy will convert a ASCII data file to a SEG-Y file from the command line after converting from 2-byte unsigned integer. This is the same as using **File/Import ASCII File** followed by **Edit/Convert from unsigned 2-byte integer** and **File/Export ASCII**. Usage is

IXSeg2Segy C:\InPath\Datain.TXT IMPORT UNSIGNED

The file will be exported with the same name as the imported file and the extension SGY. You can omit the path and the default path (the last one used before closing IXSeg2Segy) will be used. **This operation should be performed once manually so that the required parameters will be saved in the INI file.**

Notes: There is a limit of 256 characters for the file names, including path.

The input file name does not need to have any particular extension.

If you export one file manually and close IXSeg2Segy, the parameters you select will be saved in the INI file and subsequent imports and exports by command line will use those as the defaults.

3) IXSeg2Segy will convert a ASCII data file to a SEG-Y file from the command line. This is the same as using **File/Import ASCII File** followed by **File/Export ASCII**. Usage is

IXSeg2Segy C:\InPath\Datain.TXT IMPORT

The file will be exported with the same name as the imported file and the extension SGY. You can omit the path and the default path (the last one used before closing IXSeg2Segy) will be used. This operation should be performed once manually so that the required parameters will be saved in the INI file.

Notes: There is a limit of 256 characters for the file names, including path.

The input file name does not need to have any particular extension.

If you export one file manually and close IXSeg2Segy, the parameters you select will be saved in the INI file and subsequent imports and exports by command line will use those as the defaults.

Associating a file extension with IXSeg2Segy

In Windows Explorer, you can use Tools/Folder Options, then select the File Types tab. Here you can use the **NEW** and/or **Change** buttons to associate a file extension with IXSeg2Segy so that double clicking in Windows Explorer will open the file with IXSeg2Segy.

Open

Invoking the File/Open command is designed to read a file written by IXSeg2Segy in its own proprietary format. This format is designed using keywords, versions and length information to save various strings of data pertaining to a particular trace gather. The traces and header information are saved as well as the view parameters and other information.

Select a file to open from the File Open dialog. The data are displayed after they are read.

Older file versions can be read with newer versions of IXSeg2Segy. In many cases, newer file versions can be read with older versions of IXSeg2Segy, skipping the data which is provided by the newer file version..

Save

Invoking the File/Save command creates a file in IXSeg2Segy proprietary format. This format is designed using keywords, versions and length information to save various strings of data pertaining to a particular trace gather. The traces and header information are saved as well as the view parameters and other information.

The name of the file is the name of the data set which is shown on the top of the graphic display. To save under a different name, use **Save As**.

Save As

Invoking the File/Save As command creates a file in IXSeg2Segy proprietary format. This format is designed using keywords, versions and length information to save various strings of data pertaining to a particular trace gather. The traces and header information are saved as well as the view parameters and other information.

The name of the file becomes the name of the data set which is shown on the top of the graphic display. To save under the same name as is already displayed, simply use the **Save**.

Importing Data

File Import asks for a **file name** and then attempts to determine the format of the file. Format determination is carried out mostly by finding key words, phrases or bytes in the file as follows:

Files which begin with "C 1" or "C01" are determined to be SEG-Y format (ASCII header). If the number of traces per record is specified as less than or equal to zero in the binary header, the user is prompted for the number of traces per record. Default is 24 or the last user entry in this session. The total number of records in the file is determined by the number of traces per record, number of samples per trace, the format and the file size. If more than one record is present, the user is prompted for which record to read.

Files which have 3A Hex in byte 1 and 55 Hex in byte 2 or which have 55 Hex in byte 1 and 3A Hex in byte 2 are determined to be SEG-2 format.

Files which begin with "ABEM" are determined to be ABEM Terraloc Mark-3 format.

Files which have the first occurrence of "BISON-1" starting at byte 28 are determined to be BISON Geopro-1 8000 series format.

Files which have the first occurrence of "BISON-2" starting at byte 117 are determined to be BISON Geopro-2 5000, 7000 and 9000 series format.

Files which have "12" in bytes 287 and 288 are determined to be EG&G Geometrics 1200 series (Seisview) format.

Files which have 47 Hex in byte 1 and 45 Hex in byte 2 are determined to be EG&G Geometrics 2401 format.

Files which have "OYO" in the first 3200 characters are determined to be OYO McSeis format. Different flavors of OYO format are determined while the file is being read.

Files which have the first occurrence of "Scintrex-1" starting at byte 79 are determined to be SCINTREX S-2 Echo format.

Files which have an extension of .TF are determined to be multiplexed .TF format.

Files which have an extension of .SDT, .ADT, .CDT, .RDT, or .DDT are determined to be in Doolang format.

Files which have an extension of .FPX and have first two bytes of 0 Hex and 14 Hex are determined to be in Interpex FIRSTPIX format.

Files which have 47 Hex in byte 1 and 45 Hex in byte 2 are determined to be EG&G Geometrics 2401 format.

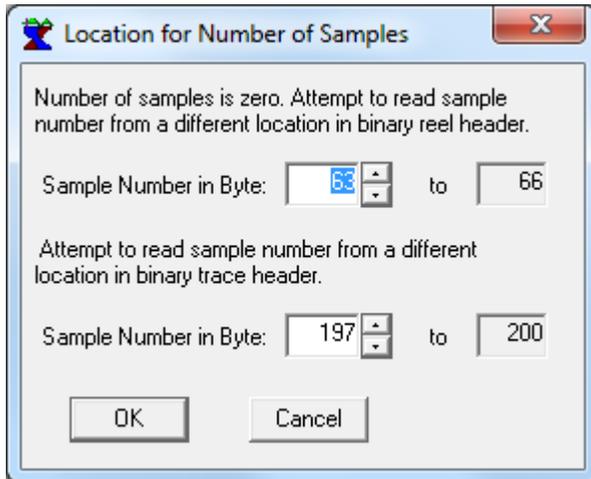
Files which have the first occurrence of "SUSPENS" starting at byte 5 are determined to be oyo suspension pslog file format. **Please note** that this format contains both horizontal and vertical sensor data and that these can be sampled at different sample rates. If the sample rates are different, then using import will set the sample rate to the horizontal value and the sample rate for the vertical channels will be incorrect. This format is strictly meant only for merging data from several files to produce files containing only horizontal or vertical geophone data. In this case, the sample rates for the merged files will be correct.

Files which begin with "C 1" or "C01" after conversion from EBCDIC to ASCII are determined to be SEG-Y format (EBCDIC header).

These tests are made in the sequence shown and the first test which passes determines the format. If none of these tests pass, the format is unsupported or something is wrong with the file. Byte count starts with the first byte in the file being 0.

If you are reading SEG-Y files and the format is undetermined, check to see if the EBCDIC or ASCII header is blank (EBCDIC blank is "@" in ASCII). If the file is SEG-Y but does not conform enough to pass the test for SEG-Y, try reading using **Import Non-Compliant SEG-Y** to import the file.

If you are reading SEG-Y files and the file contains more than 32,767 data samples, this does not fit in the specified 2-byte integers in the SEG-Y format definitions. Some SEG-Y format variants circumvent this problem by placing 0 for the number of samples and writing the actual number of samples in a 4-byte integer elsewhere in the headers. If the number of samples is zero in the 400-byte reel header, the user is asked for the alternate positions, one in the reel header and one in the trace headers:



The byte index you enter is from 1-397 for the reel header and 1-237 for the trace header. This is saved in the INI file when you close IXSeg2Segy. You are asked for each file you try to import that has zero samples in the reel header.

If none of the tests pass and you know something about the format of the file, you may be able to read it using **Import User-Defined Format**.

Once the format has been determined, the appropriate code is used to import the file. If the first breaks are not read from the file, the breaks are picked automatically using the Simple Pick method.

If you encounter an error in reading the file, please try to view the file with a hexadecimal editor or viewer to be sure that the file is not corrupted.

Finally, the trace data are displayed.

Once a file is imported, files can be imported in sequence by using the Page Up key to import the next file and the Page Down key to import the previous file. For example, if the current file is File024.DAT, pressing Page Up will import File025.DAT and pressing Page Down will import File023.DAT. When page keys are used the existing graph scale is retained.

Import File Names

File name extensions which are recognized by IXSeg2Segy and searched for on import are as follows:

- DAT - Generic "data" extension
- ORG - "Original" data extension - used by OYO.
- ABM - ABEM file extension
- BSN - Bison Instruments file extension
- EGG - EG&G Geometrics file extension
- OYO - OYO file extension

SG2 - SEG-2 file extension
SGY - SEG-Y file extension
FPX - FIRSTPIX (Interpex) file extension

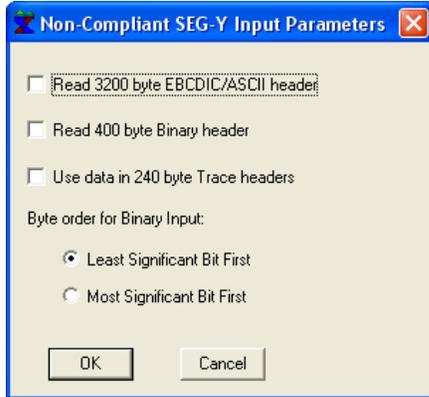
Some data files will have different extensions or may have no extension at all. In this case, the names will not show up in the file open selection window. You can force them to show by typing in explicit file names or filters and pressing <enter>. For instance

CH000001 - Open the file CH000001 explicitly (no extension).
*.FFF - Show all files with the extension FFF.
CH00* - Show all files with names beginning with CH00 and having any (or no) extension.
* or *.* Show all files.

Another way to handle this situation is to rename your files so that they have one of the recognized extensions. It is better to use a recognized extension than no extension at all.

Importing non-Compliant SEG-Y

Using the Import Non-Compliant SEG-Y command will attempt to import a file as SEG-Y format with some data skipped as desired. Tests are not made for file format, and the file is assumed to be in SEG-Y format. After a file is selected from the file open dialog, a dialog is presented which offers the following options:



Read 3200-byte ASCII/EBCDIC Header

Read 400-byte binary header

Use data in 240-byte trace headers

Byte order for binary input: LSB first, MSB first.

If there is a 3200 byte character header in the file, check the box to read it.

If there is a 400 byte binary header, check the box to read it.

If the data in the 240-byte trace headers is meaningful, check the box to read it.

If the data are in PC format, check the LSB first box, if they are in workstation/mainframe format, check the MSB first box.

Press OK to continue reading.

Next you are presented with a dialog box for reading the shot header. This allows you to select the appropriate values for the sample interval, delay time, uphole time, shot number, position, elevation and depth. You can also edit the number of traces, number of samples per trace and the first trace which you wish to read. At this point you also need to select the trace format.

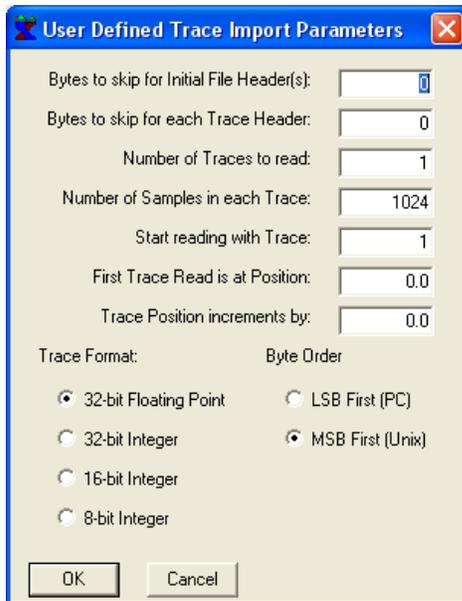
If the 400-byte binary header was used, the information was loaded from this header.

After the dialog is closed, the file is read and a new dialog is presented offering the user the chance to edit the geophone locations and elevations as described in [Edit Shot Header](#).

After editing the header, close the dialog and the data will be displayed.

Importing User-Defined Formats

Selecting Import User Defined format allows binary trace data to be imported with user specification of trace data location and all recording parameters. When this command is invoked, a dialog appears containing the following:



Bytes to skip for initial file header(s). For SEG-Y data, for instance, this would be 3600 bytes (3200 for EBCDIC header plus 400 for binary header). Number must be non-negative.

Bytes to skip for each trace header. For SEG-Y data, for instance, this would be 240 bytes. Number must be non-negative.

Number of traces to read. Number must be positive.

Number of samples in each trace. Each trace must be the same length. Number must be positive.

Start reading with trace. If this is not set to 1, some traces will be skipped. Number must be positive.

First trace read is at position. This sets the geographical location of the first geophone.

Trace position increments by. This sets the increment in the geophone position.

Trace format can be 32-bit float, 32-bit integer, 16-bit integer or 8-bit integer. Integers are signed. Only PC floating format is supported. Integer format is two's complement.

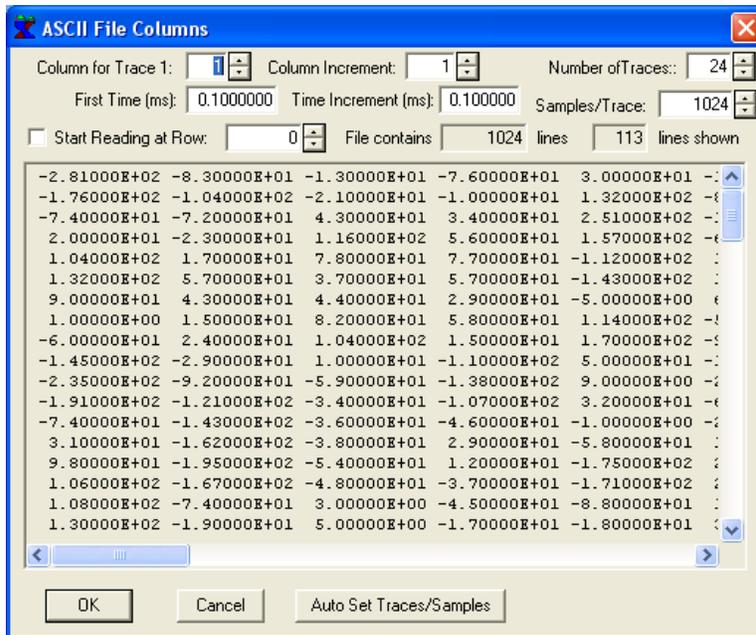
LSB first or MSB first (PC or workstation/mainframe format).

After the dialog is closed, the file is read and a new dialog is presented offering the user the chance to edit the geophone locations and elevations as described in [Edit Shot Header](#).

After editing the header, close the dialog and the data will be displayed.

Importing ASCII files

Selecting Import ASCII file allows ASCII trace data to be imported from a flat ASCII or CSV file with user specification of trace data location and all recording parameters. When this command is invoked, a dialog appears containing the following:



The number of lines in the file and the number of lines shown is also displayed.

Column for trace 1: this is then number of the column for the first trace.

Column increment: this is the increment between trace columns. For instance if columns are trace1, trace2, trace3 ... this would be 1. If columns are time1, trace1, time2, trace2,... this would be 2.

Number of traces to read. Number must be positive.

First time (ms): this is the time of the first sample. For no time delay, this would be equal to the sample interval.

Time increment (ms): this is the time between samples.

Number of samples in each trace. Each trace must be the same length. Number must be positive.

Start reading at row: if this box is checked, the row number is used and rows before this are skipped. If this box is not checked, the start row number is ignored.

Pressing the Auto Set Traces/Samples button sets the number of traces to the number of columns and the number of samples to the number of lines in the file.

After the dialog is closed, the file is read and a progress bar indicates the progress of the read. Pressing Cancel on this dialog cancels the operation.

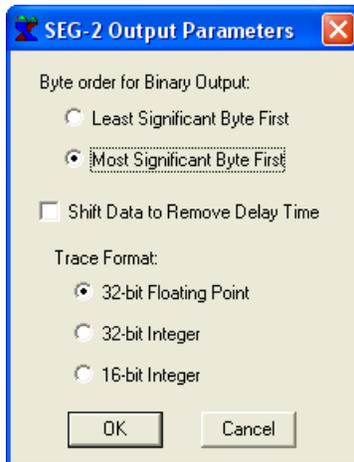
Finally, a new dialog is presented offering the user the chance to edit the geophone locations and elevations as described in [Edit Shot Header](#).

After editing the header, close the dialog and the data will be displayed.

Exporting Data to SEG-2

Selecting Export SEG-2 takes the current data in memory (which is displayed on the screen) and writes it to a file in SEG-2 format. The extension of the file is .SG2. The format is described by [Pullan, 1990](#).

After entering or selecting a file name, a dialog appears which allows you to select byte order, delay time treatment and data format:



Byte order is MSB first (Mainframe/Workstation format) or LSB first (PC format). Trace data formats can be 32-bit floating point, 32 bit integer or 16-bit integer. Integer formats are two's complement. Integer formats are almost universally compatible, but 32-bit floating format is IEEE standard and may not be compatible with some older mainframe or mini computers.

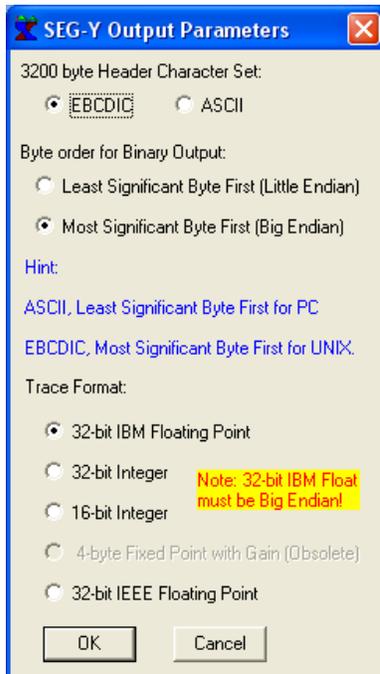
If the box "Shift Data to Remove Delay Time" is checked and the delay time is not zero, then traces will be shifted by the nearest integer to $(\text{delay time})/(\text{sample interval})$, the new values created will be zero filled and the delay time will be written out as zero. For instance, if the sample interval is 4 ms, and the delay time is -16 ms, the traces will be shifted by -4 points (the first 4 points of each trace will be lost) and the last 4 points in each trace will be set to zero.

When IXSeg2Segy is first started, there is no data resident and this command is not available.

Exporting Data to SEG-Y

Selecting Export SEG-Y takes the current data in memory (which is displayed on the screen) and writes it to a file in SEG-Y format. The extension of the file is .SGY. The format is described by [Barry, et al, 1975](#).

After entering or selecting a file name, a dialog appears which allows you to select header character format, byte order and data format:



Header format is EBCDIC or ASCII. EBCDIC headers are compatible with most older mainframes (particularly IBM) and ASCII is more compatible with modern machines. The SEG-Y format does specify an EBCDIC card image block header (but it also specifies 9-track tape).

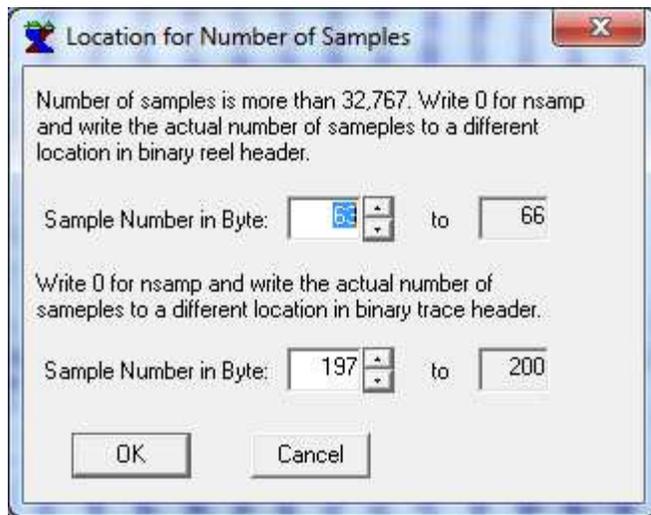
Byte order is MSB first (or Big-Endian, Mainframe/Workstation format) or LSB first (or Little-endian, PC format).

Trace data formats can be 32-bit IBM floating point, 32 bit integer, 16-bit integer or 32-bit IEEE floating point. Integer formats are two's complement. Integer formats are almost universally compatible, but 32-bit IEEE standard floating format will not be compatible with some older mainframe or mini computers.

When IXSeg2Segy is first started, there is no data resident and this command is not available.

If data are imported from SEG-Y format, the original reel and trace headers are preserved, except for format choice.

If the data in memory have more than 32,767 samples, the number of samples cannot be stored in the standard 2-byte place in the reel header and trace headers. In this case, 4 bytes are required and a second dialog appears:



The defaults are either the program defaults or the last positions you used when reading or writing SEG-Y files with too many samples. In this case the normal place for storing the number of samples will be written as zero and the actual number of samples will be written into the places specified.

Exporting Picks to ASCII

First break picks can be exported to a flat ASCII file by selecting File/Export Picks. This creates a file with the name of the data set and the extension .PCK. A different file name can be entered by the user when the file Save As dialog appears. The data set name appears on the first line of the file and the trace number and pick is written on each subsequent line, one line for each trace in the file. A sample file (101.PCK) looks like

```

101
 1  22.250
 2  39.750
 3  34.500
 4  37.750
 5  38.250
 6  35.000
 7  35.500
...  .....
...  .....
...  .....

44  3.500
45  8.500
46  19.500
47  10.750
48  0.250

```

Exporting Shots to GRM Format

IXSeg2Segy can export shot data to GRM format for import into GREMIX and other software which reads this format. It does not export the reciprocal times, uphole times, system delay times and it writes blank lines for the header information. It does export each shot in the correct GREMIX GRM file format.

It is the user's responsibility to be sure that the data exported does not contain too many shots or receivers for the target software.

To use this feature, Import each shot, pick the breaks and **save** as a binary IXSeg2Segy TRX file. When you have picked all the trace files you wish to include in the GRM file, select File/Export GRM Format, select all the trace (TRX) files to be included in the GRM file, and then select the name of the GRM file to export. Remember you are selecting multiple files and the order of output is the reverse of the order of selection. Right clicking on the file selection dialog and sorting files by date or name might be useful in selecting files.

You do not need to have a shot record loaded to use this menu option.

Merging Files

Merge files takes several files and merges them to make new files. Files to be merged should have the same number of traces. The new files will contain as many traces as there were merged files. There will be as many merged files as there were traces in the original files.

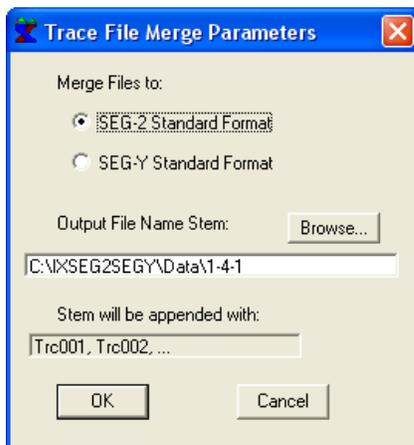
Merge files only reads the first record from each file. If you have a SEG-Y file with multiple records, use **Convert SEG-2** or **Convert SEG-Y** to split the multi-record file into many single record files. Please note that SEG-Y files can be converted to SEG-Y files. After merging, you can use **Combine Files** to create a single multi-record SEG-Y file from the merged records.

For instance, you may have several files which are shot gathers and you want to create common offset gathers. Lets say there are 15 shots with 12 traces each. Common offset gathers will contain 15 traces, and there would be 12 possible offsets to choose from. In this case, merging files will create 12 new files with 15 traces each; each file will be a constant offset because it will contain the same trace from each of the 15 original files.

Merging files can also be used in cases where a recording contains different traces. For instance, the SUSPENS format contains t sets of two opposed horizontal recordings and one vertical recording, for a maximum of six traces. Merging these files will create a file for each of the horizontal recordings (4 files) and one for each of the vertical recordings.

The order of traces in the merged files will be the reverse of file selection. Watch the file selection dialog. If your files are in order, select the last file, hold <shift> and then select the first file. If they are not in order, select the last, next to last and so on, up to the first.

After selection there is a dialog allowing you to select SEG-2 or SEG-Y output:



This also allows you to select the output file stem. The stem will be appended as shown to create the merged file names. For SUSPENS files, this will be H1, H1R, V1, H2, H2R and V2. For other files it will be Trc001, Trc002, and so on. Selecting the stem selects both the output directory and the first part of the merged file names. For instance, if the original files were in C:\Shots\Original and the first file name were SHOT_010, you might select C:\Shots\Merged\SHOT for the stem. This would put the merged shots in directory C:\Shots\Merged and call them SHOTTrc001, SHOTTrc002, ...

Next you will be able to select the output parameters, as described in **Export SEG-2** or in **Export SEG-Y**.

Finally the names of the output (merged) files will be presented, one by one. You can edit the file name here if desired. Pressing Cancel will abort the creation of this file and all subsequent files, but those already created will remain.

Appending Files

Append Files/Samples takes several files and appends them to make a new record containing all samples from the input files. Files to be appended should have the same number of traces. The new files will contain as many traces as in the original files. There will be as many samples in the appended files as there were total samples in the original files. Samples from the first file appear at the beginning, followed by samples from the second file and so on. This would be useful if two instruments were used to record data from the same geophones with one delayed by the record length of the first.

Append Files/Traces takes several files and appends them to make a new record containing all traces from the input files. Files to be appended should have the same number of samples. The new files will contain as many samples as in the original files. There will be as many traces in the appended files as there were total traces in the original files. This would be useful if two instruments were used to record two strings of geophones, one string following the other (1-12, 13-24, for example).

Append Files/Interleave takes several files and appends them to make a new record containing all traces from the input files. Traces are interleaved so that the first traces from each file appear first, followed by the second trace from each file, and so on. Files to be appended should have the same number of samples and traces. The new files will contain as many samples as in the original files. There will be as many traces in the appended files as there were total traces in the original files. This would be useful if two instruments were used to record two strings of geophones that were staggered such that the resulting record would have half the spacing of the original strings.

Append files only reads the first record from each file. If you have a SEG-Y file with multiple records, use Convert SEG-2 or Convert SEG-Y to split the multi-record file into many single record files. Please note that SEG-Y files can be converted to SEG-Y files. After merging, you can use Combine Files. to create a single multi-record SEG-Y file from the appended records. SEG-Y files with only one trace per record are automatically concatenated.

For instance, you may have several files which are pieces of a continuous record but have been split into smaller files for convenience of size. File 1.dat may be from 0 to 100 ms, File2.dat from 101 to 200 ms, and so on through file5 which is from 401 to 500 ms. Using Append Files and selecting the last file (File5.dat), holding <shift> and clicking on File1.dat will select all 5 files. These will then be appended into a record which contains the same number of traces but the samples are appended so the new file goes from 0 to 500 ms.

The order of samples in the appended files will be the reverse of file selection. Watch the file selection dialog. If your files are in order, select the last file, hold <shift> and then select the first file. If they are not in order, select the last, next to last and so on, up to the first.

This does not create a file, but just creates a record in memory. Now you can export the data, as described in Export SEG-2 or in Export SEG-Y.

Combining Files to SEG-Y

Combine Files takes several files and combines them to make a single SEG-Y file with multiple records. Files to be combined must have the same number of traces, samples and sample rate. The new file will contain as many records as there were records in the combined files. SEG-Y files with multiple records will have all records copied to the new file.

The order of records in the combined file will be the reverse of file selection. Watch the file selection dialog. If your files are in order, select the last file, hold <shift> and then select the first file. If they are not in order, select the last, next to last and so on, up to the first. For SEG-Y files having multiple records, the records will be in the same order as they were in the original SEG-Y file.

Next you will be able to select the output parameters, as described in [Export SEG-Y](#).

If data are imported from SEG-Y format, the original reel and trace headers are preserved, except for format choice.

Concatenating SEG-Y Records

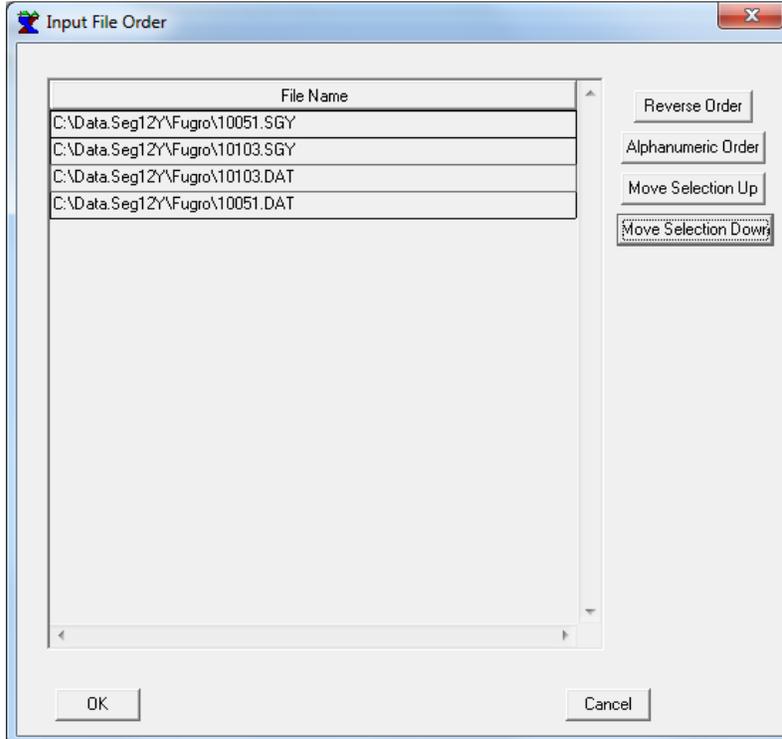
Concatenate will read all records in a single SEG-Y file and combine them into a single record, ignoring the value of the number of traces per record in bytes 3213-3214 of the file (bytes 13-14 of the reel header). The number of traces is determined by trace length (bytes 21-22 of the reel header) and sample size, determined from the format (bytes 25-26 of the reel header), taking into account the 240-byte trace header length.

This menu option is useful for cases where the SEG-Y file contains only one record but the record length is not correctly specified.

Appending Records

Append Files allows you to append data from two or more records. There are three options for Append: Samples, Traces or Interleave. Appending Samples will keep the same number of traces but increase the number of samples to the total number of samples from the appended files. Appending Traces will keep the same number of samples but increase the number of traces. Interleave will keep the same number of samples but increase the number of traces. In this case, the first trace will be pulled from each of the input files, then the second traces will be appended, then the third traces and so on. For Append Samples, the number of traces in each file must be the same, for Append Traces and Interleave, the number of samples must be the same.

Once the files are selected, you are given the opportunity to verify or change the order of the files to be appended:



Place the cursor in the box for the file in question, move it up or down as needed. Or use one of the order buttons, then press OK to proceed with the append operation.

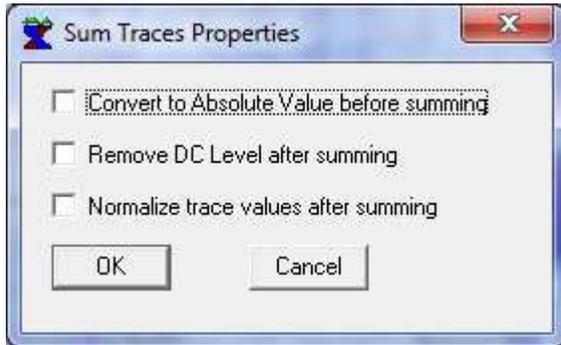
Subtract Second Trace File

Selecting Subtract Second Trace File requires that both the record in memory and the record in the selected file have the same number of traces and samples. You will be prompted for a file name, then this file is read and the value of each sample in the input file is subtracted from the record in memory. Then the result is displayed.

Sum Files

Selecting Sum Files allows you to select a group of files to be summed together. All files to be summed must have the same number of traces and samples. The files are then summed together, sample by sample, and displayed. The result can then be exported to SEG-2 or SEG-Y.

The following dialog is presented before the summing operation:

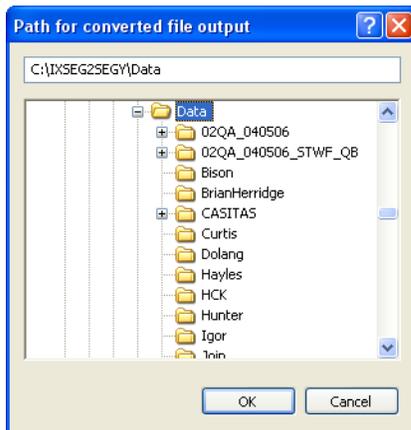


Checking "Convert to Absolute Value before summing" results in the summation of the absolute values of the samples. Checking "Remove DC Level after summing" calculates the DC level of each trace and then removes it from the trace after the summation of the trace is complete. Checking "Normalize trace values after summing" results in the calculation of the average instead of the sum. This would be used if the actual magnitude of the trace values were important.

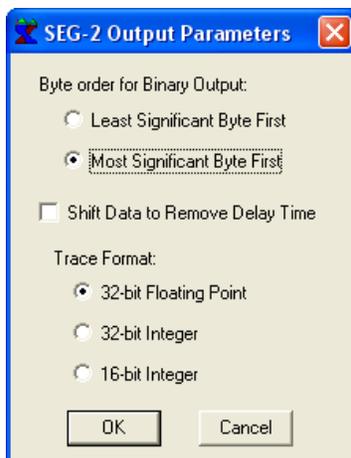
Batch Conversion to SEG-2

Selecting Convert File(s) to SEG-2 allows the user to select multiple trace data files and convert them to SEG-2 format. The extension of the file is .SG2. The format is described by [Pullan, 1990](#).

After selecting one or more file names, a dialog appears which allows you to select the destination directory of the converted files. Files are named the same name as the input file, but with the extension .SG2:



After selecting the destination directory, the dialog appears which allows you to select byte order, delay time treatment and data format. Byte order is MSB first (Mainframe/Workstation format) or LSB first (PC format). Trace data formats can be 32-bit floating point, 32 bit integer or 16-bit integer. Integer formats are two's complement. Integer formats are almost universally compatible, but 32-bit floating format is IEEE standard and may not be compatible with some older mainframe or mini computers.



If the box "Shift Data to Remove Delay Time" is checked and the delay time is not zero, then traces will be shifted by the nearest integer to $(\text{delay time})/(\text{sample interval})$, the new values created will be zero filled and the delay time will be written out as zero. For instance, if the sample interval is 4 ms, and the delay time is -16 ms, the traces will be shifted by -4 points (the first 4 points of each trace will be lost) and the last 4 points in each trace will be set to zero.

Files are read one by one and converted to SEG-2 format. Input format is automatically detected, as with File/Import.

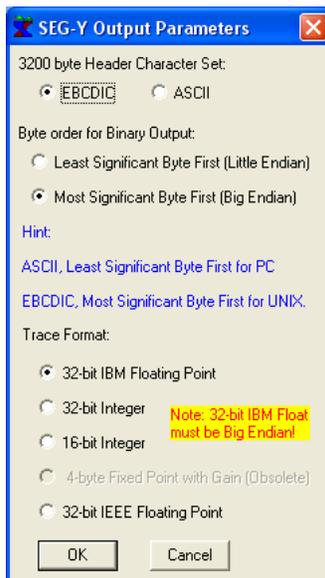
Batch Conversion to SEG-Y

Selecting Convert File(s) to SEG-Y allows the user to select multiple trace data files and convert them to SEG-Y format. The extension of the file is .SGY. The format is described by [Barry, et al, 1975](#).

After selecting one or more file names, a dialog appears which allows you to select the destination directory of the converted files. Files are named the same name as the input file, but with the extension .SGY:



After selecting the destination directory, the dialog appears which allows you to select header character format, byte order and data format:



Header format is EBCDIC or ASCII. EBCDIC headers are compatible with most older mainframes (particularly IBM) and ASCII is more compatible with modern machines. The SEG-Y format does specify an EBCDIC card image block header (but it also specifies 9-track tape).

Byte order is MSB first (Mainframe/Workstation format) or LSB first (PC format).

Trace data formats can be 32-bit IBM floating point, 32 bit integer, 16-bit integer or 32-bit IEEE floating point. Integer formats are two's complement. Integer formats are almost universally compatible, but 32-bit IEEE standard floating format is not be compatible with some older mainframe or mini computers.

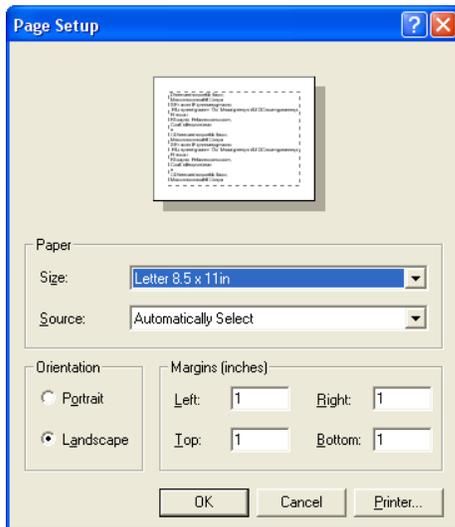
Files are read one by one and converted to SEG-Y format. Input format is automatically detected, as with File/Import. If the number of traces per record is specified as 0 or less, you will be prompted each time the file is read for the number of traces per record.

SEG-Y format allows for multiple records per file. IXSeg2Segy determines the number of records from the number of traces per record, number of samples and the format (2 or 4 bytes). For multiple record files, a separate output file will be created for each record in the original file. File names are the original file name appended by the record. For instance, for 10-99 records in a file, names will be FileName01 through FileName99.SG2. IXSeg2Segy supports files with up to 99,999 records at this time.

Converting a multiple record SEG-Y file to SEG-Y will split the original multi-record file into multiple single record files.

Printing

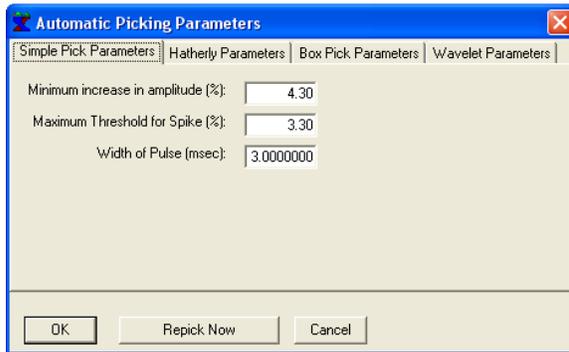
Selecting File/Print brings up the print dialog, allowing selection of the paper orientation, margins, size and selection of the printer, etc:



When OK is pressed, the graphic which is shown on the screen is reproduced on the printer, auto-scaled according to the paper and margins selected.

Editing the Picking Parameters

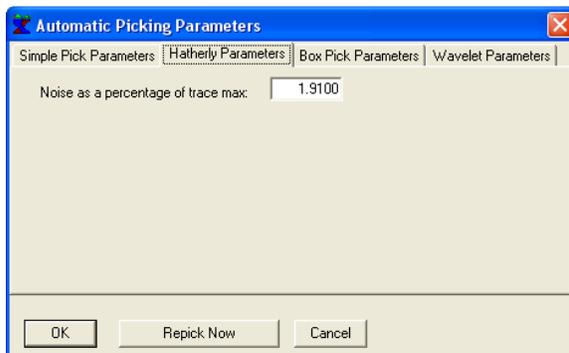
Selecting Edit/Edit Pick Parameters brings up the tabbed automatic picking parameters dialog:



Tabs are for Simple Pick, Hatherly Pick, Box Pick and Wavelet Pick.

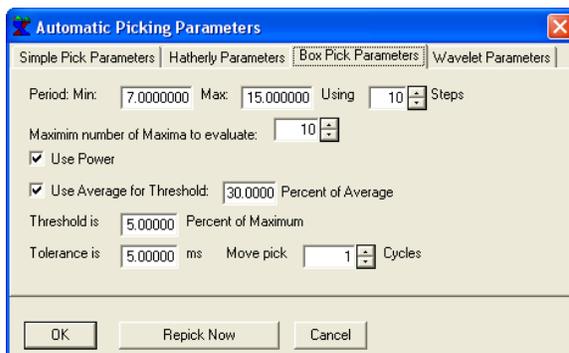
The Simple Pick uses a minimum increase in amplitude over a ten-point window. Spikes are rejected with a maximum threshold and the pulse width sought is specified. this pulse width is normalized to the sample interval.

The Hatherly Pick uses an estimate for noise as a percentage of the trace max:

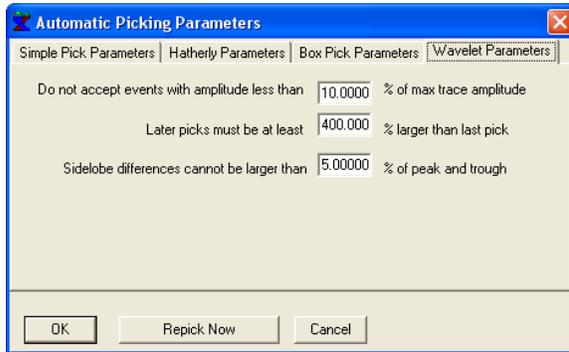


The Box Pick convolves a boxcar with the trace, varying the period of the boxcar from a min to a max value in a specified number of steps. No more than the specified number of maxima will be evaluated. Power (rather than amplitude) can be used.

The threshold can be peak value or averaged and the pick can be moved a certain number of cycles:



The Wavelet Pick requires the user to select a wavelet (see [Select Wavelet](#)). Events less than a percentage of trace max amplitude are rejected. Once a pick is found, a later pick will replace it only if it is greater than the present pick by a specified percentage. Sidelobe rejection is also specified as a percentage:



The tabbed dialog allows for auto picking using the selected tab with the specified parameters. Once the Repick Now button is pressed, those parameters are made permanent. Up to then, Cancel reverts back to the current parameters.

It is best to experiment with values for given data sets and see which parameters give the best results.

Editing the Shot Header

Invoking the command Edit/Shot Header allows you to edit the shot header:

Shot Header Editor

Sample Interval (ms): Shot Number:

Delay Time (ms): Shot Position Easting:

Uphole Time (ms): Shot Position Northing:

Shot Depth: Shot Elevation:

Traces with Samples per trace Aux Traces

Geophone (Receiver) Positions

Number	Easting	Northing	Elevation
1	3330.0	0.0	0.0
2	3340.0	0.0	0.0
3	3350.0	0.0	0.0
4	3360.0	0.0	0.0
5	3370.0	0.0	0.0
6	3380.0	0.0	0.0
7	3390.0	0.0	0.0
8	3400.0	0.0	0.0

Create Geometry
Open Geometry
Save Geometry
Save Geometry As
Add To
Multiply By

OK Cancel

The number of traces or samples and the number of Aux traces cannot be edited.

Geometry can be created and saved, and saved geometries can be retrieved. Creating a geometry brings up the following dialog:

Create Geophone Layout Geometry

Constant Spacing
 Symmetric Tapered Spread
 Asymmetric Tapered Spread

Constant Geophone Spacing:

Beginning of Spread: Azimuth:

	No. Spacings	Spacing
1		
2		
3		
4		
5		
6		
7		
8		

Center of Spread:

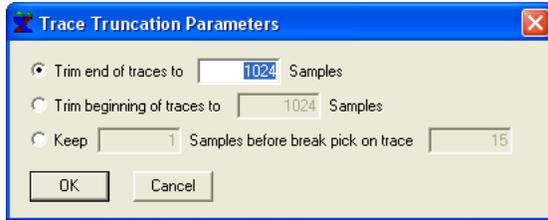
OK Last Spacing Repeated as Needed Cancel

Created geometry starts with the first easting value and only applies to the easting value.

Values can be copy/pasted from/to other spreadsheets, for example Excel.

Truncating Traces

Selecting Truncate traces asks for a number of samples and a method of truncation. The entered value must be less than the present trace length. The trace length is truncated so that the samples beyond the entered value are discarded:

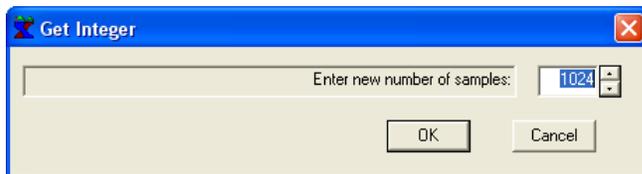


Trimming end of traces removes samples from the end, trimming the beginning removes samples from the beginning and keeping samples before the break on a particular trace will trim only the beginning of a single trace, depending on the first break pick.

The sample interval is unchanged but the total trace length is shorter than before, according to the requested length.

Resampling Traces

Resampling the traces prompts for a trace length in number of samples. If the length entered is the same as the present trace length, nothing is changed. If it is different, the traces are resampled to the requested number of samples. The total length of the trace in time is unchanged and the sample interval is changed to provide the new number of samples:



Interpolation is linear between existing samples. No extrapolation is used.

Removing Traces

Edit/Remove Traces allows you to remove traces from the record. This can be applied several times if necessary.

You are prompted for the first and last trace to be removed, number of traces to be removed, as well as the increment:



For example:

To remove the first 12 traces from a 24-shot record, enter 1, 12, 1, 1 for the first and last trace to be removed, number to be removed and increment.

To remove the last 12 traces from a 24-shot record, enter 13, 24, 1, 1 for the first and last trace to be removed, number to be removed and increment.

To remove the first 6 and the last 6, leaving the middle 12 traces, apply Edit/Remove Traces twice:

First remove traces 19-24 by entering 19, 24, 1, 1. Second remove traces 1-6 by entering 1, 6, 1, 1. Now you are left with traces 7-18.

To keep only every fourth trace in a record with 200 traces, enter 1, 200, 3, 4 to remove groups of 3 traces and increment by 4 traces.

Gaining the Traces

Traces can be gained (multiplied by a constant value) using Edit/Gain Traces. Enter the constant value to be applied (multiplied) to the traces:

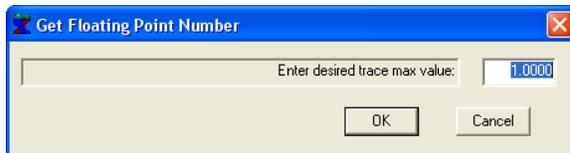


Note this will not change the appearance of the display as the trace max and global max will be gained as well.

Right-clicking on a trace and selecting **Gain Trace** enables you to change the gain on that particular trace, and this will change the display.

Equalizing the Traces

Traces can be equalized using Edit/Equalize Traces. Equalizing traces makes each trace have the same trace max, so that viewing the traces with trace max or global max looks the same. Enter the constant value you wish to be the final global/trace max.:



After equalizing traces, traces can be individually gained by right-clicking on the trace and selecting **Gain Trace** from the pop-up menu.

Zooming the Display

If the Zoom menu item is checked, then the graphical display can be adjusted using a rubber band box to zoom in or out. Point the mouse cursor at one corner (for example, the upper left) of the desired display area. Press the left button, hold it and drag the mouse to the opposite corner (for example, the lower right) of the desired display area. Release the button to display.

The selected area will be auto-scaled upwards so that round numbers are used for axes parameters.

Using the View Zoom menu command toggles the state of the zoom. When the Zoom menu item is not checked, dragging the mouse with the left button depressed does nothing.

Right clicking on the graphic pops up the View Properties dialog.

Autoscaling the Display

Unzoom auto-rescales the trace display so that all traces are displayed and that their full length is displayed.

Using Unzoom disables the Pan menu items (see [Pan](#)).

Panning the Zoomed Display

When the display is zoomed, it can be panned.

Pan Left moves the display window left, so that the data which are to the left of the current display window and occupying the same size as the current display window, are now displayed.

Pan Right moves the display window right, so that the data which are to the right of the current display window and occupying the same size as the current display window, are now displayed.

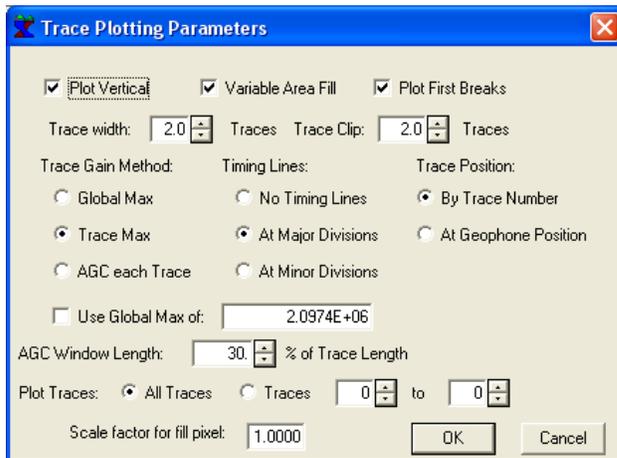
Pan Up moves the display window up, so that the data which are to above the current display window and occupying the same size as the current display window, are now displayed.

Pan Down moves the display window down, so that the data which are below the current display window and occupying the same size as the current display window, are now displayed.

Using the Zoom feature (not just selecting the menu item View/Zoom, but actually dragging the mouse with the left button down to zoom the display) will enable the Pan menu items and buttons. Using Unzoom will disable all Pan buttons.

View Properties

Selecting View/Properties or right clicking on the graphic display and selecting Properties brings up the Trace Plotting Parameters dialog:



This allows for editing of the trace display parameters.

Traces can be plotted vertically or horizontally. Vertical plotting is recommended.

Variable area fill fills the positive areas of the traces if selected.

First breaks are plotted if they exist and are selected.

Trace width and clip both default to 2.0 trace widths. Selecting width of 1.0 means there will be no overlap between any traces. Selecting width more than 1 but selecting clip of 1.0 means that traces will be amplified to overlap but none of the overlapping sections will be displayed.

When this dialog is not displayed, trace width can be increased or decreased by a factor of $\sqrt{2}$ by pressing + or – respectively.

Gain methods are global max (max value of all traces combined), trace max (max of trace being plotted) or AGC for each trace. AGC window is specified as percentage of trace length. When this dialog is not displayed, the gain method can be switched rapidly by using the hot keys G, T and A.

Timing lines can be plotted at major divisions, major and minor divisions, or not at all.

Trace position can be by trace number or at geophone position.

All traces can be plotted or, optionally, a section of the record can be displayed by selecting "Traces i to j", specifying I and J with I less than J. This is different from zooming the trace display as traces outside the range I through J are not displayed, even if they would normally appear on the display.

Whenever a new record is imported, the display reverts back to All Traces as a default.

Scale factor for fill pixel is designed mostly for making printed displays look good. The value to use will be dependent on your printer. This number cannot be greater than 1. If the variable area fill on your printer has gaps in it, reduce this value.

Manual Picking

Manual picking of first breaks or other time marks is carried out by placing the mouse cursor at the trace and point where you want to pick and clicking the left mouse button. Automatic picking is done by selecting a pick method from the Pick menu.

Automatic Picking

Simple Pick uses a simple method of finding a step function. It comes from Geometrics SeisView program, written in the mid 1980's.

Hatherly Pick uses a method developed by Hatherly, a colleague of Dereke Palmer in Australia.

Box Pick uses a method involving convolution with a boxcar function.

Wavelet Pick uses a method which convolves a user-selected wavelet with the trace, looking for matches.

Each of the automatic picking methods has at least one parameter which may effect the accuracy of the picks and will probably be data dependent.

Wavelet Selection

The Wavelet Pick requires that a wavelet be present. In order to select a wavelet, use the menu option Pick/Select Wavelet. This pops up a dialog which instructs you to hold left mouse button and drag mouse to draw an elastic box around the wavelet you wish to pick. Release the mouse button to view selected wavelet. Click mouse to return to trace display.

Now you are able to use Wavelet Pick.

If you are not happy with the wavelet, repeat this procedure.

You may want to zoom the display to focus on the area of interest before selecting the wavelet.

Note that the vertical extent of the elastic box is used to select the time range of the wavelet. The horizontal extent is used to select the trace from which the wavelet is taken. If the elastic box is wider than a single trace, the trace from which the wavelet is taken may be unpredictable and is near the center of the box.

Pick/View Wavelet will show a display of the currently selected wavelet. Click mouse to return to the trace display.

Selecting the Wavelet

Before using the Wavelet Pick, you must select a wavelet. Using the Select Wavelet menu option first shows a dialog with the following text:

"To select wavelet:

1. Hold left button and drag Mouse to place elastic box around wavelet to select.
2. Release mouse button to view selected wavelet.
3. Click mouse to return to shot display

Now you can use Wavelet Pick."

You might want to zoom the display before selecting the wavelet.

Be sure your selection does not overlap more than one trace, otherwise the selection process will be ambiguous.

The selection applies only to a single trace and a range of time. All data for that trace in the selected time range are selected, regardless of whether or not the elastic selection box actually includes all points in the trace.

The wavelet as selected can be viewed again after initial viewing by using **View Wavelet**.

Wavelet Display

Using Pick/View Wavelet will display the current wavelet. Click the mouse to return to the shot display.

This command is not available if there is no wavelet selected.

Differentiation

Selecting Process/Differentiate causes all traces in the currently loaded record to be differentiated. That is, all trace values are replaced by the difference between the previous value and the present value, divided by the sample interval. The first sample is set to zero.

Integration

Integration of traces replaces the values by the sum of all values to that point. The first value remains the same. Subsequent values are replaced by the sum of all values up to and including that value.

Differentiation followed by integration will change the DC level of the traces.

Removing Linear Trends

Detrending removes linear trends from the traces. For each trace, a linear regression analysis is used to fit a straight line to the trace in a least squares sense. Then, the values predicted from this linear trend are removed from the trace.

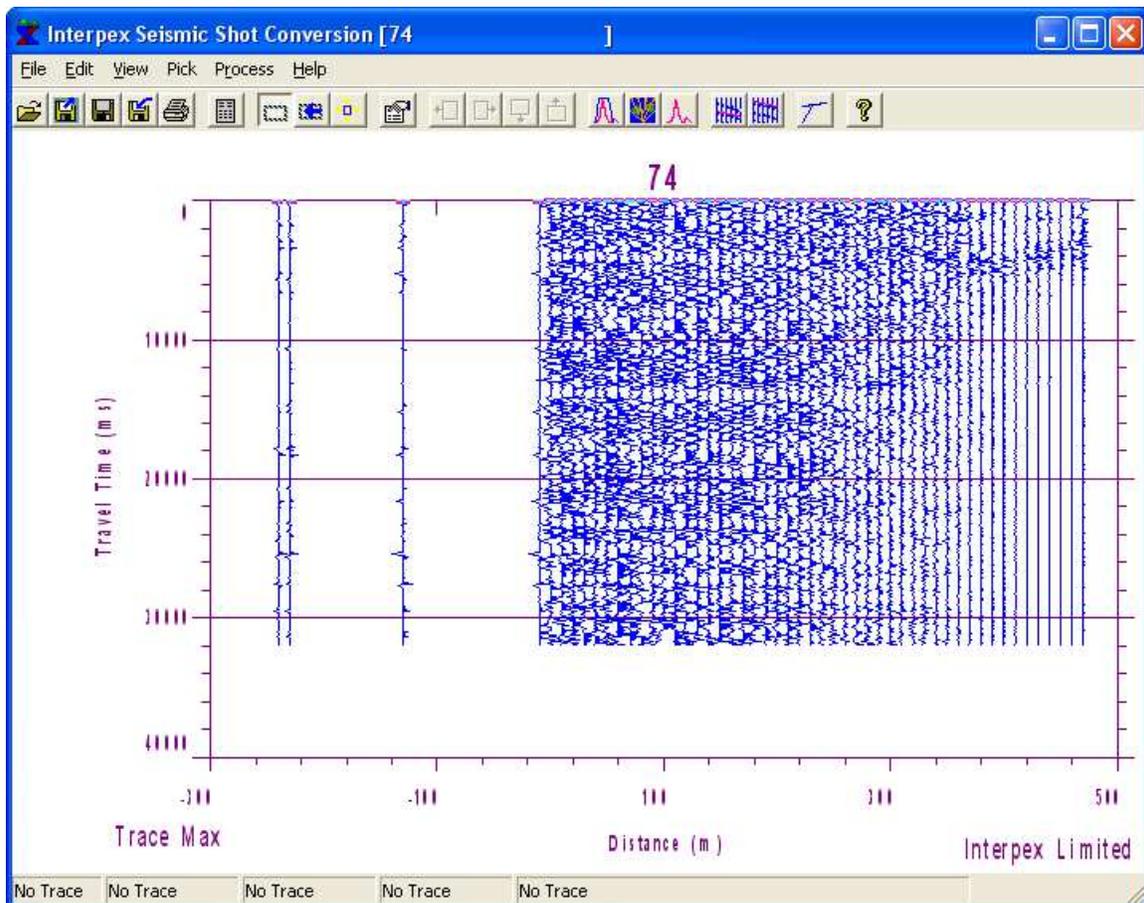
Removing the DC Level

Removing the DC level from the traces calculates the average value of each trace and then subtracts that value from each sample in the trace.

Correlating Traces

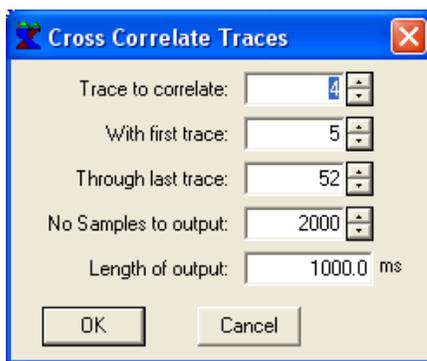
Cross correlation of traces is necessary in cases where the seismic source was non impulsive, such as a chirp or pseudo-random source. In this case, data are recorded for a much longer time than is desired in the output, much longer than would be recorded in the case of an impulsive source.

An example of a record taken with a pseudo-random source is shown here:



In this record, traces 1-4 are recorded at the source, and trace 4 is the vertical motion recording that is to be used for the correlation. Note there are 32 seconds of data.

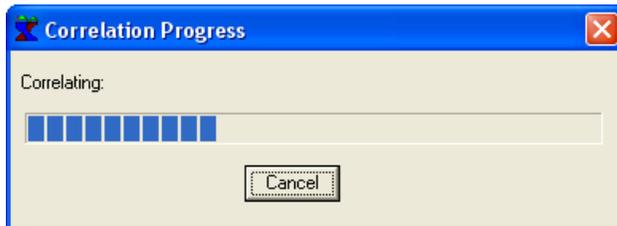
Using Process/Correlate Traces brings up a dialog box:



In this example, we will use trace 4 as the pilot trace for the correlation. The data reside in traces 5 through 52 (48 traces total). We will output only 1000 msec of data (1 second). Press OK to proceed with the correlation or Cancel to abort it.

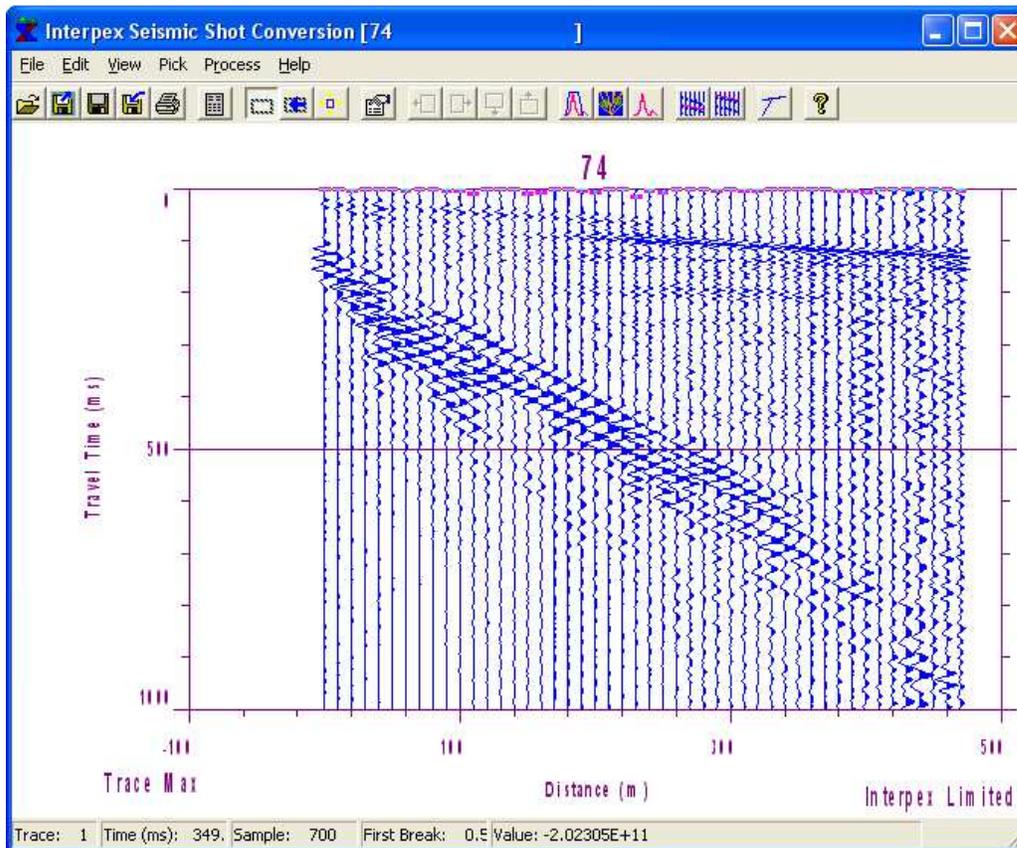
The process will be carried out as follows:

The last 1,000 msec (2,000 points) of the pilot trace will not be used. The first 63,000 samples (31 seconds) will be cross correlated with each trace to give the first 2,000 points of output. The result is divided by the zero-lag autocorrelation of the pilot trace. A progress dialog is shown during the correlation:



Pressing Cancel will stop the operation and leave the original traces intact.

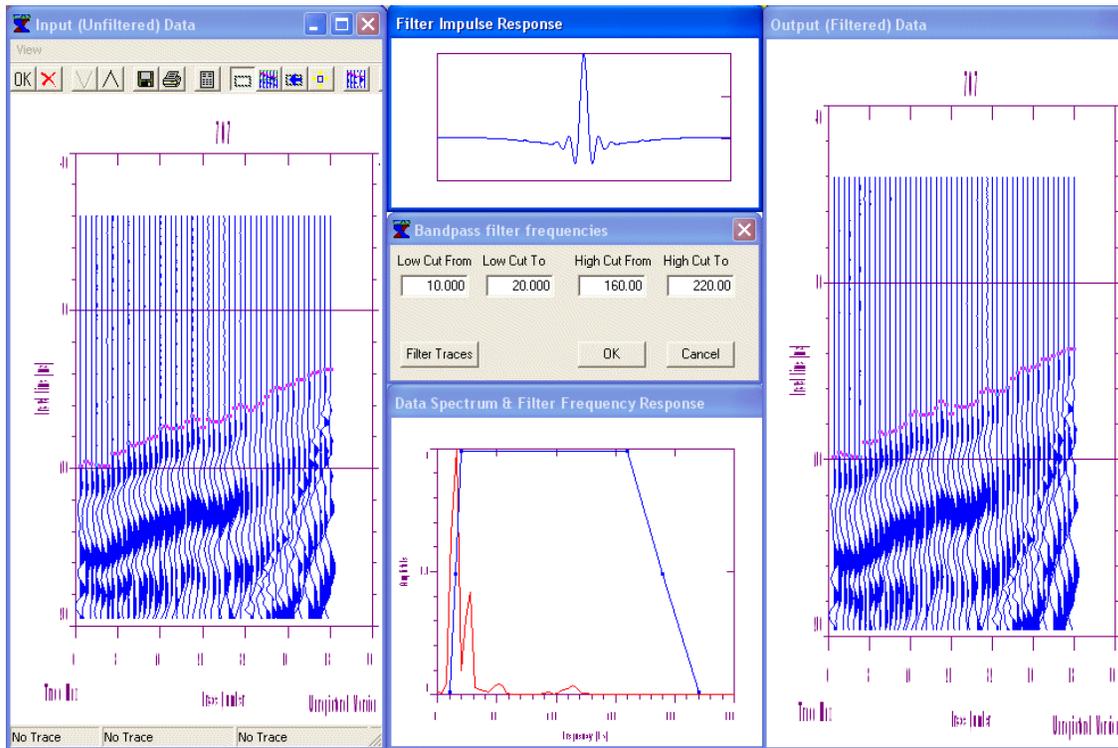
The output will consist only of traces 5 through 52, renumbered to 1 through 48:



The original data will be lost, so be sure to keep a backup copy.

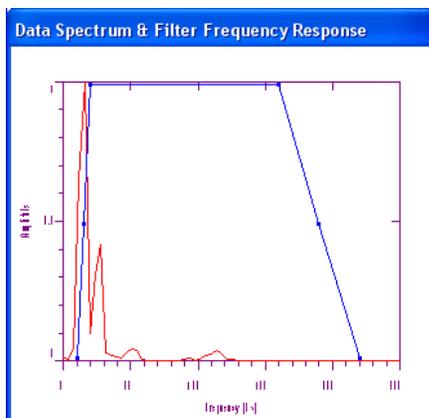
Band Pass Filter

Bandpass filtering allows the data to be filtered in the frequency domain by a trapezoidal filter. Once this menu command is invoked, five windows are displayed on the screen:

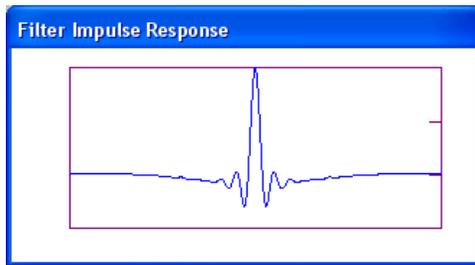


The Input window shows the original traces. The output window shows the output traces. Originally, these are the same as the input traces.

The Spectrum window shows the average frequency spectrum from all traces and the trapezoidal filter:



The Filter Impulse Response window shows the impulse response of the trapezoidal filter:



Finally, the Bandpass filter frequencies dialog box shows the four corner frequencies of the trapezoidal filter:

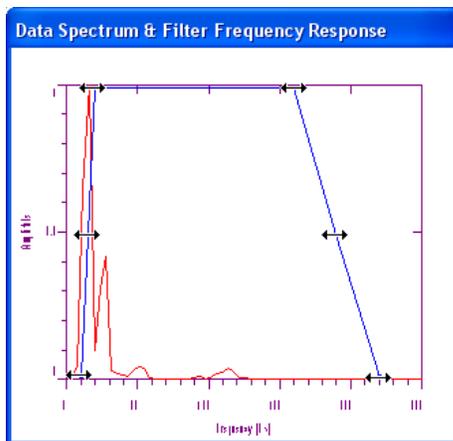
 A dialog box titled "Bandpass filter frequencies" with a close button (X) in the top right. It contains four input fields arranged in a 2x2 grid:

Low Cut From	Low Cut To	High Cut From	High Cut To
10.000	20.000	160.00	220.00

 Below the input fields are three buttons: "Filter Traces", "OK", and "Cancel".

You can change the corner frequencies by selecting the field in the dialog and entering a new value. Pressing the filter button will filter the traces in the input box and display the result in the output box. Filter applications are not cumulative; each time you press Filter, the input traces are used again as the input. Pressing OK will copy the output traces permanently to the trace data area and close the bandpass filter session. Pressing Cancel will close the bandpass filter session leaving the traces as they are displayed in the input box.

The trapezoidal filter response shows boxes at the four corners and at the midpoint on the up- and down-slopes. Moving the mouse cursor near one of these points will change the cursor to an east-west arrow:



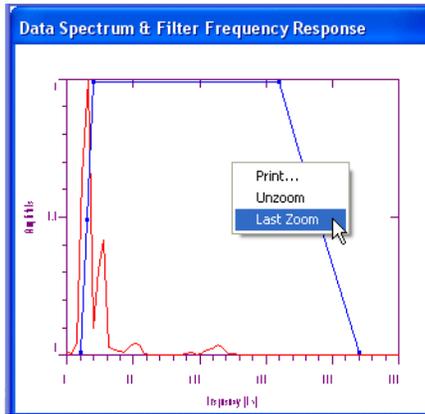
When this is displayed, you can move the corner or side by pressing the left mouse button and moving the mouse to move the point or side. You cannot move the point or side to an illegal value. The filter corner frequencies are updated in the Bandpass filter frequencies dialog box and the filter impulse response are updated as you move.

Moving the first point (lower left) changes the beginning of the low cut (first field in the dialog).
 Moving the second point (middle left) changes the beginning and the end of the low cut (first two fields in the dialog).
 Moving the third point (upper left) changes the end of the low cut (second field in the dialog).
 Moving the fourth point (upper right) changes the beginning of the high cut (third field in the dialog).
 Moving the fifth point (center right) changes the beginning and the end of the high cut (last two fields in the dialog).
 Moving the sixth point (lower right) changes the end of the high cut (fourth and last field in the dialog).

Remember that a wide filter with shallow slopes will give a compact impulse response, while a filter with steep slopes or narrow width will give a very wide impulse response.

The spectrum window is initially auto-scaled to include the trapezoidal filter and to include any value in the spectrum which is within 1% of the peak value.

All windows except the dialog box can be zoomed, un-zoomed, last zoomed or printed. Right click on the display to show a pop-up menu:



For trace displays, you can also change the trace display properties, which are the same properties used for the main window trace display. Changing the properties will cause both input and output windows to be redisplayed with the new properties.

Zooming can be carried out when the View Zoom menu option is checked. Just draw a rubber-band box to indicate the area for zooming. The area can extend outside of the drawn graph. Un-zooming autoscales the data and last zoom returns the display to the state before the last time it was changed.

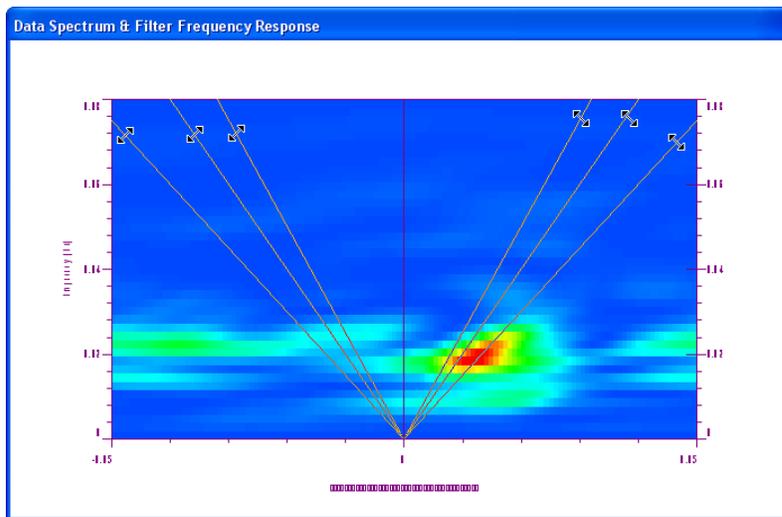
Adjust the filter settings and filter the data. Repeat as necessary until you are satisfied with the results, then press OK. If you cannot obtain satisfactory results, press Cancel.

F-K Velocity Filter

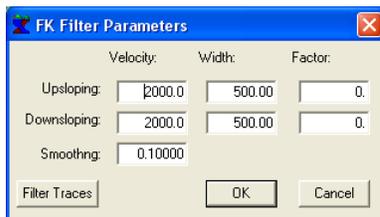
F-K Velocity filtering allows the data to be filtered in the frequency-wavenumber domain by wedge filters. Once this menu command is invoked, five windows are displayed on the screen:

The Input window shows the original traces. The output window shows the output traces. Originally, these are the same as the input traces.

The Spectrum window shows the 2-D frequency-wavenumber (F-K) spectrum from the record and the wedge filters. There is one wedge filter for downsloping velocities (later times to right) on the left and another for upsloping velocities (later times to left) on the right. Three lines are shown: one for the center frequency and two representing the width (center plus or minus half-width):



Finally, the F-K filter Parameters dialog box shows the four velocity, width and factor for the up- and down-going velocities plus the smoothing which is used to keep the filter from ringing. The smoothing is used to smooth the trace ends with a Hamming window before performing the FFT on each trace (in the time to frequency direction). The factor is the enhancement for the space inside the filter wedges. Using an enhancement of 1 does nothing and using an enhancement of 0 removes the events. An enhancement of 2 doubles the amplitude of the event:



You can change the F-K filter Parameters by selecting the field in the dialog box and changing the value. When the mouse cursor is positioned near one of the velocity lines, the mouse cursor changes to a NW-SE or NE-SW arrow, depending on the direction of the velocity line. Pressing on the left mouse button and holding it while moving the mouse allows the velocity or the width to be adjusted graphically. Moving the center line changes the value of the center velocity and moves the lines indicating the width along with the center. Moving either of the outer lines of the wedge changes the value of the velocity width and moves the other line making up the wedge. Widths cannot be made negative.

The Factor is used to attenuate or amplify the spectral response within the velocity wedge. A cosine window is applied to prevent ringing. Using a factor of 1.0 will leave the spectrum unchanged. Using a factor of 0.0 will completely attenuate the response at the central velocity line but leave it unchanged at the

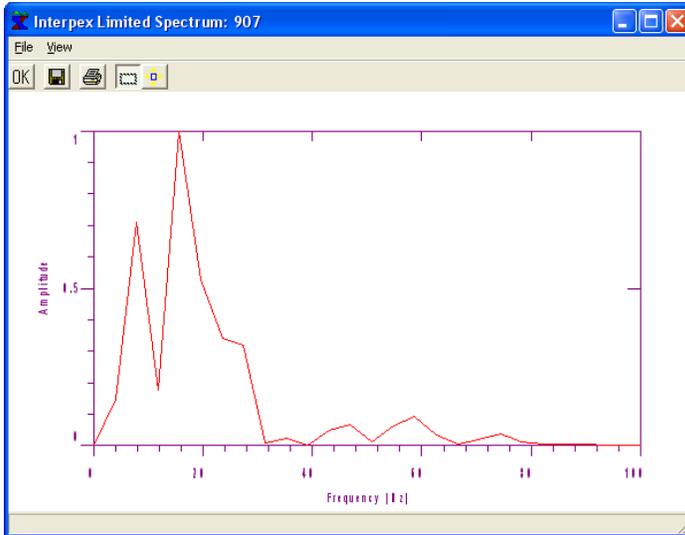
wedge edges. Using 2.0 will amplify the response to twice the original at the central velocity line but leave it unchanged at the wedge edges.

To see the effect on the spectrum, first make sure there is a copy of the original that you can reimport so that the original is not lost. Perform the filtering and press OK. Then use Process/FK Filter, and the new spectrum shown will reflect the changes made by the filtering in the previous session.

Please note that some of the data on the trace display could be aliased and might not respond to F-K filtering as you might expect. For instance, ground roll or air blasts might be slow enough that there is no overlap of trace peaks and troughs from trace to trace and these features will need to be removed using a mute as they will not respond to F-K filtering.

Frequency Spectrum Display

Selecting Process/Spectrum or pressing the corresponding toolbar button displays the frequency spectrum for the data shown on the display:



That is to say that zooming the display to show different time ranges or different traces will affect the spectrum displayed as data which is not displayed is not used to calculate the spectrum.

Zooming to different areas of the trace data allows for analysis of different sections of the data or of the noise which precedes the first breaks.

The spectrum is displayed in a separate window. A menu and toolbar offers the following options:

Save the spectrum as an ASCII file, comma separated value.

Print the spectrum graphic.

Toggle Zoom mode.

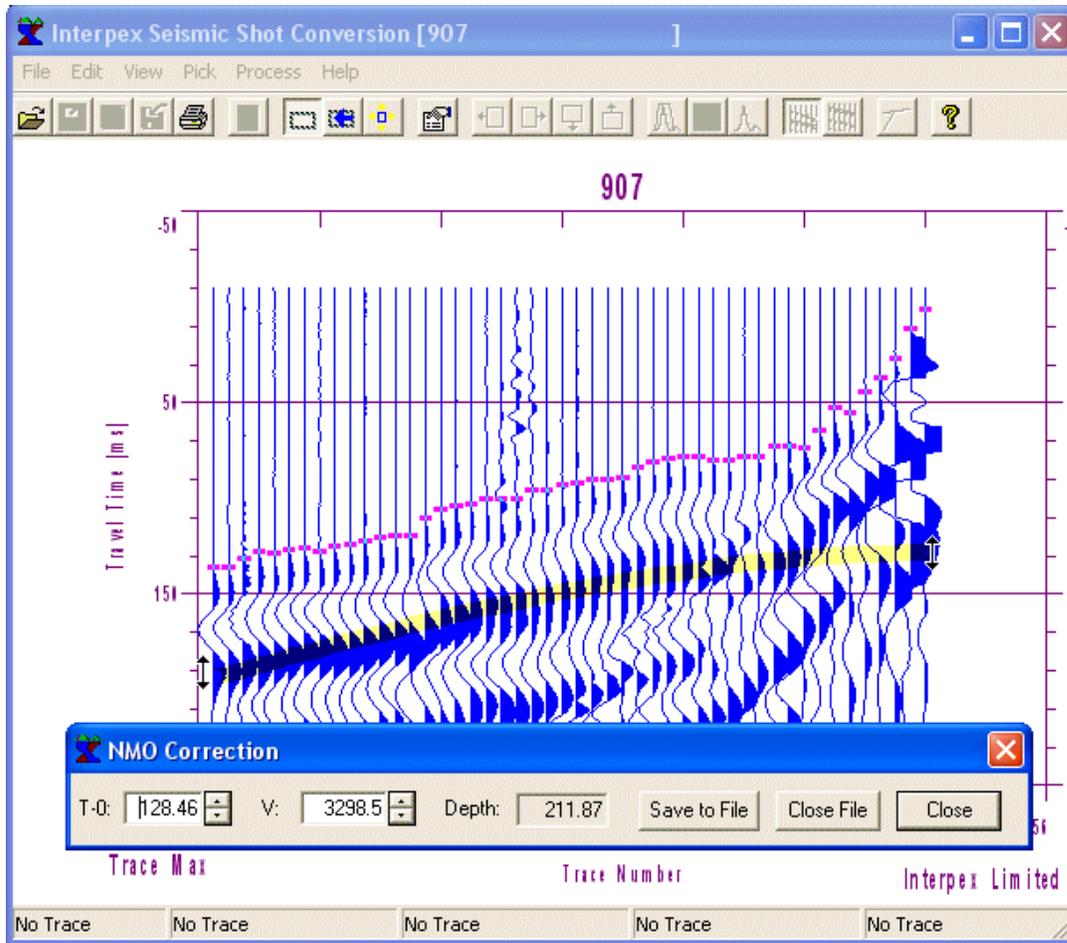
Zoom the display.

Unzoom (autoscale) the display.

Close the window.

NMO Display

The Normal Move-Out (NMO) Correction feature allows for the user to estimate the velocity and depth of a reflector, using the apparent NMO velocity (V) and zero-offset time (t₀). Selecting the NMO Correction from the menu or tool bar displays the NMO curve for the present values of zero-offset time and velocity. The depth is also displayed:



NMO Correction is best used with traces displayed by position, rather than by trace number.

The NMO equation for a geophone at offset x from the source is

$$t(x) = \text{SQRT}(t_0^2 + (x/v)^2)$$

And the depth is calculated from

$$d = 0.5 * V * t_0$$

The ends of the NMO curve (at trace 1 and trace n) can be grabbed with the mouse and moved up or down. When the mouse cursor is sufficiently close to one of the end points, the cursor changes to a double up-down arrow as shown in the picture. Press the left mouse button and hold it as you move the mouse vertically to adjust the times at these points.

For forward shots, adjusting the point at trace 1 adjusts the zero-offset time, while adjusting the point at trace n adjusts the velocity. For reverse shots (shot positions to the right of the geophone spread), adjusting the point at trace n adjusts the zero-offset time, while adjusting the point at trace 1 adjusts the velocity.

For interior shots, there is an additional point near the shot position that can be grabbed with the mouse and dragged up or down to change the zero-offset time. Grabbing either of the end points will adjust the velocity.

A window displays t_0 , V and d . You can change t_0 and V by entering new values, but d is always calculated from t_0 and V and cannot be adjusted. These can be saved to an ASCII text file.

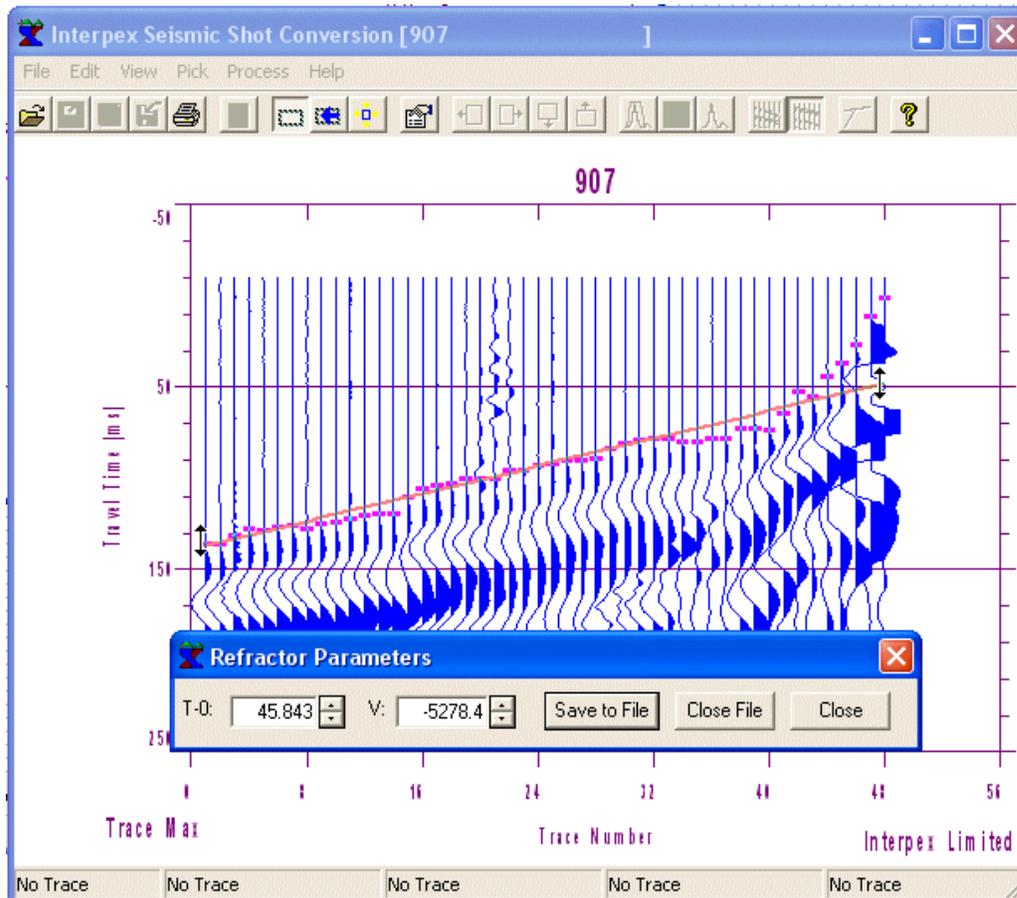
Pressing Save to File saves the shot name and the reflector data to an ASCII text file which you can import into Excel, for example. If no file is open, a dialog appears to select a file to open. Data are appended if the file already exists.

Pressing Close File closes the present file and a new one is opened on the next save.

Pressing Close in the NMO Correction window or selecting the NMO Correction menu option again removes the NMO Correction dialog and the NMO curve from the display.

Flat Refractor Interpretation

The Refraction interpretation feature allows for the user to estimate the velocity of a refractor, using the apparent velocity (V) and an intercept time (t_0). Selecting the Refraction Interpretation from the menu or tool bar displays the apparent velocity line for the present values of intercept time and velocity:



Refraction Interpretation is best used with traces displayed by position, rather than by trace number.

The velocity equation for a geophone at offset x from the source is

$$t(x) = t_0 + (x/v)$$

The ends of the apparent velocity line (at trace 1 and trace n) can be grabbed with the mouse and moved up or down. When the mouse cursor is sufficiently close to one of the end points, the cursor changes to a double up-down arrow as shown in the picture. Press the left mouse button and hold it as you move the mouse vertically to adjust the times at these points.

For forward shots, adjusting the point at trace 1 adjusts the intercept time, while adjusting the point at trace n adjusts the velocity. For reverse shots (shot positions to the right of the geophone spread), adjusting the point at trace n adjusts the intercept time, while adjusting the point at trace 1 adjusts the velocity.

For interior shots, there is an additional point near the shot position that can be grabbed with the mouse and dragged up or down to change the zero-offset time. Grabbing either of the end points will adjust the velocity.

A window displays t_0 and V . You can change t_0 and V by entering new values. These can be saved to an ASCII text file.

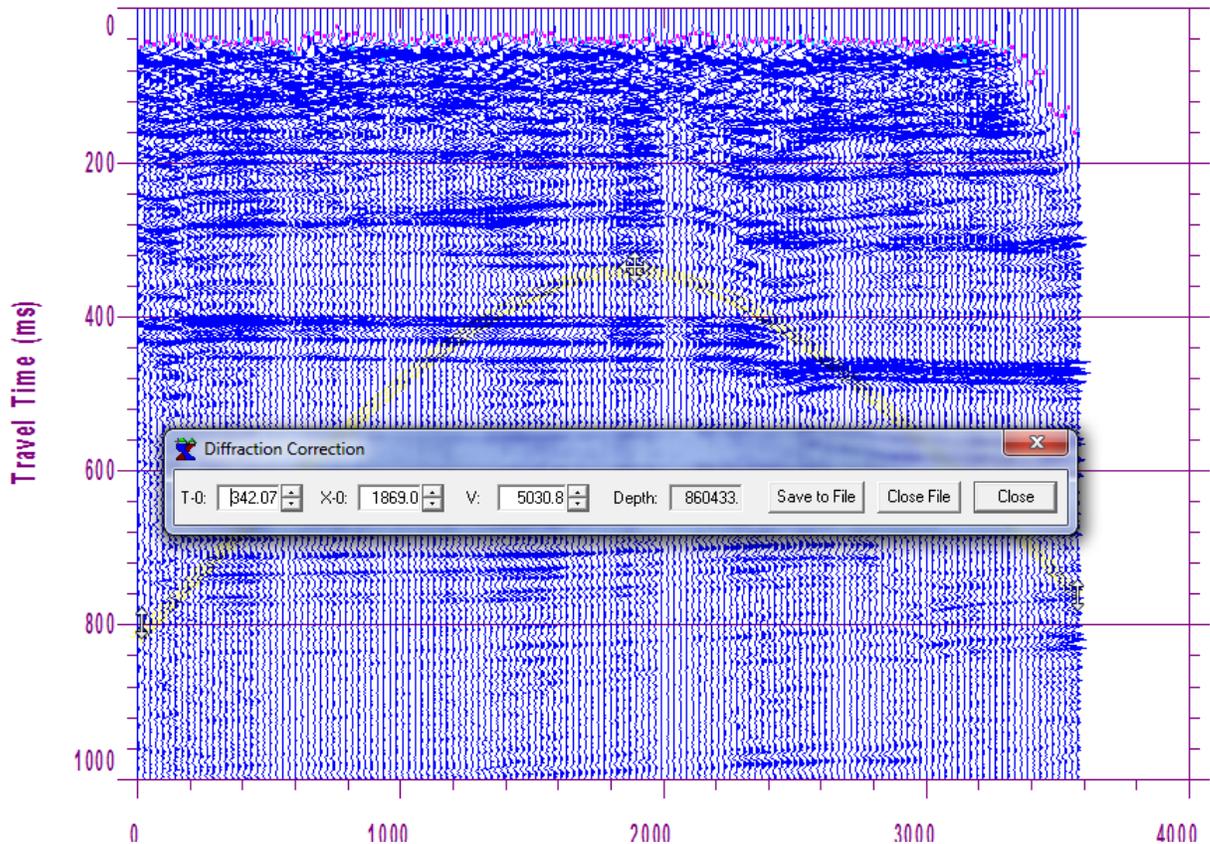
Pressing Save to File saves the shot name and the reflector data to an ASCII text file which you can import into Excel, for example. If no file is open, a dialog appears to select a file to open. Data are appended if the file already exists.

Pressing Close File closes the present file and a new one is opened on the next save.

Pressing Close in the Refraction interpretation window removes the Refraction Interpretation dialog and the apparent velocity line from the display.

Diffraction Interpretation

The Diffraction interpretation feature allows for the user to estimate the position of a diffractor and the velocity of the host, using the apparent velocity (V) and the position in x (x_0) and time (t_0). Selecting the Diffract Interpretation from the menu or tool bar displays the diffraction parabola for the present values of position, time and velocity:



Diffraction Interpretation is best used with common offset gathers or a stacked section displayed by position, rather than by trace number.

The diffraction parabola equation for a geophone at offset x from the diffractor position is

$$t(x) = \text{SQRT}(t_0^2 + ((x-x_0)/v)^2)$$

The ends of the parabola (at trace 1 and trace n) can be grabbed with the mouse and moved up or down. When the mouse cursor is sufficiently close to one of the end points, the cursor changes to a double up-down arrow as shown in the picture. Press the left mouse button and hold it as you move the mouse vertically to adjust the times at these points.

The top of the parabola (where the diffractor is located) can be moved either in time or distance to change the position of the diffractor. Pointing at the top changes the mouse cursor to a size all cursor as shown in the graphic. Grabbing either of the end points will adjust the velocity.

A window displays t_0 , x_0 , V and depth. Depth is calculated as $V*t_0$. You can change t_0 , x_0 and V by entering new values. These can be saved to an ASCII text file.

Pressing Save to File saves the shot name and the reflector data to an ASCII text file which you can import into Excel, for example. If no file is open, a dialog appears to select a file to open. Data are appended if the file already exists.

Pressing Close File closes the present file and a new one is opened on the next save.

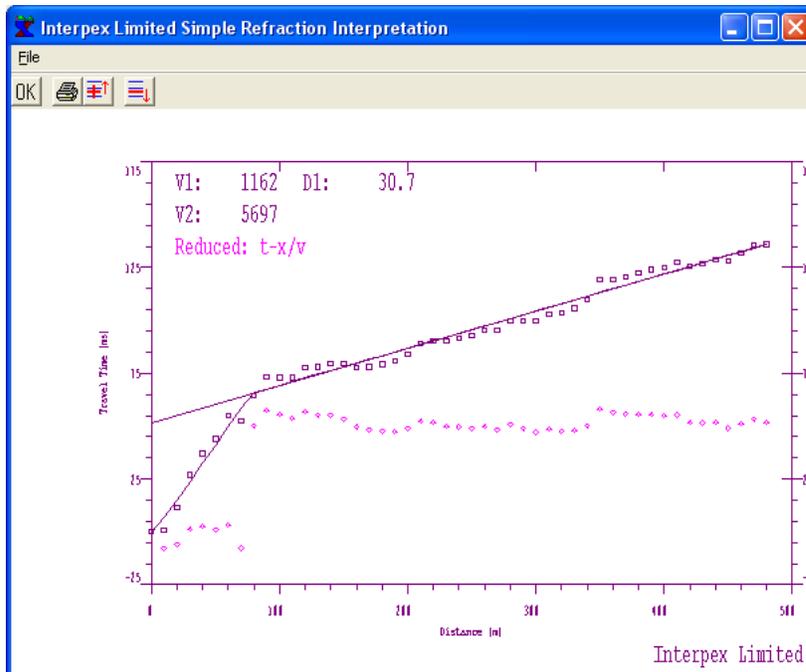
Pressing Close in the Diffraction interpretation window removes the Diffraction Interpretation dialog and the diffraction parabola from the display.

2-Layer Flat Refraction Interpretation

The Refraction interpretation option under Processing allows the currently loaded shot to be interpreted in terms of a single flat refractor using the slope-intercept method (see, for example, [Dobrin, 1960](#)).

Selecting this option takes the current first arrivals and tests the fit to a linear regression straight line using points 2 through n-1 as a pivot point. The one which fits the best is selected and the slopes are used to calculate the first and second layer velocities. The intercept time for the second segment (where it intersects the shot) is used to calculate the refractor depth.

The shot is then displayed as a forward shot in the T vs X mode with the two velocities and depths labeled:



Updating the picks reinterprets the data. If the slopes are such that the second velocity is slower than the first, a message is displayed and no interpretation is made.

If the shot is not an end shot, no interpretation is made:



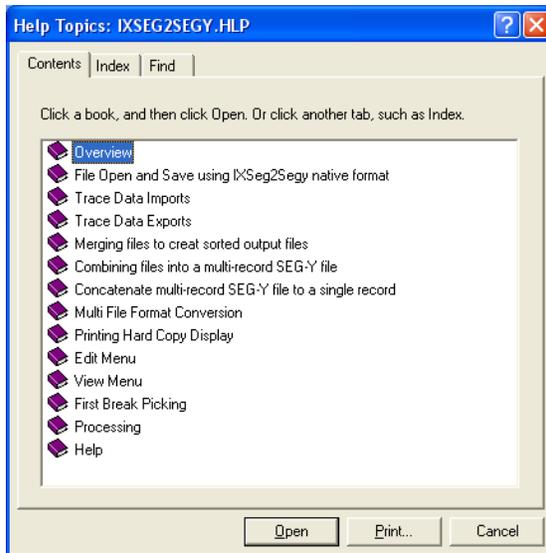
Using File/Save to File saves the shot name and the refraction data to an ASCII text file which you can import into Excel, for example. If no file is open, a dialog appears to select a file to open. Data are appended if the file already exists.

Using File/Close File closes the present file and a new one is opened on the next save.

This is only available in registered versions.

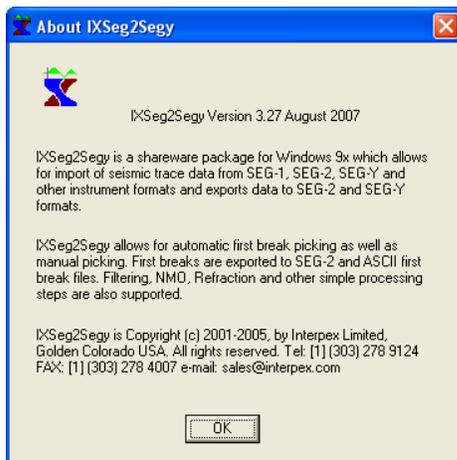
Help Contents

The Help Contents command displays this help file and allows the user to read it using the Microsoft Help System:



Help About

Help About displays the version and the date of the IXSeg2Segy software package, gives some brief description of what it does, displays the copyright notice and gives the phone number, fax number and e-mail address for Interpex:



Registering the Software

Help/Register requires a user name and a registration code:



The registration code is obtained by furnishing a user name and payment in full of the license fee to Interpex, who will then send a registration code.

The user name must be entered exactly as specified, including spaces, punctuation and case. The registration code must also be entered exactly as specified.

Entry of a valid username and registration code unlocks the package so it runs at full capability. Unregistered versions will not perform certain tasks, including multi file conversion, export of data imported using non-compliant SEG-Y import, export of break picks, file merging, printer output or saving of last directory used and other parameters in the IXSeg2Segy.INI file. Unregistered versions will not export more than three times in a single session. You will have to close IXSeg2Segy and restart it in order to export more than three files.

Pressing the Registration Information button opens NotePad with the file Order.TXT which contains the order form you need to print out and send in with your payment. Alternatively, the form can be sent by FAX with a credit card number, or you can e-mail it and provide you credit card number by phone.

Do not send a credit card number in an e-mail!

Help/Register to CPU allows the package to be registered by entering an access key which is tied to your program code:



The program code is generated from your computer's serial number. To use this registration feature, you need to install and run IXSeg1Segy and go to Help/Register. Copy the Program Code and paste it into an e-mail to Interpex (sales@interpex.com). After payment is received or other negotiations are completed, an access key will be e-mailed back to you. Copy this from the e-mail and paste into the access key section of the dialog.

Enter your user name as desired. In this case the user name is not tied to the access key as it is tied to the serial number described above. You will need to reenter the access key every time you want to change your user name.