USER MANUAL

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Geo2View

seismic viewer by Geo2X

version 1.85 (April 2024)

Geo2X

Geophysics for Geology

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1 Geo2View overview

Geo2View is a software developed by Geo2X SA for seismic data visualization. It supports standard file types `SEG-Y rev 0/1/2`, `SU` and `SEG-2`. The software offers visualization of seismic data as well as some processing features.

- Visualize data by taking advantage of scaling, zoom features and wiggle or wavelet color schemes.
- Improve image quality through gain control.
- Display and plot header data.
- Sort, shift and resample traces.
- Export or import trace header data.
- Design filters to remove unwanted frequencies.
- Plot amplitude spectra.
- Display an X–Y map view based on source/receiver coordinates.

2 Installation and loading of seismic files

To install Geo2View, double-click on the executable file `Geo2View_v1.85.exe`, which can be downloaded here.

Note If you encounter problems running `Geo2View_v1.85.exe`, run it as an administrator.

Once installed and running, the home pane will be displayed (**Fig. 2.1**). Data can be loaded using File > Load Seismic File(s). Up to several thousand files can be loaded at once, and the software supports simultaneous loading of different file types, as well as loading traces of varying length in terms of sampling interval and number of samples. When loading files, the "Delay Recording Time" header (positive or negative) of each seismic trace is always taken into account.

Note With the `SEG-2` format, instrument gain (`DESCALING_FACTOR` keyword) is always applied.

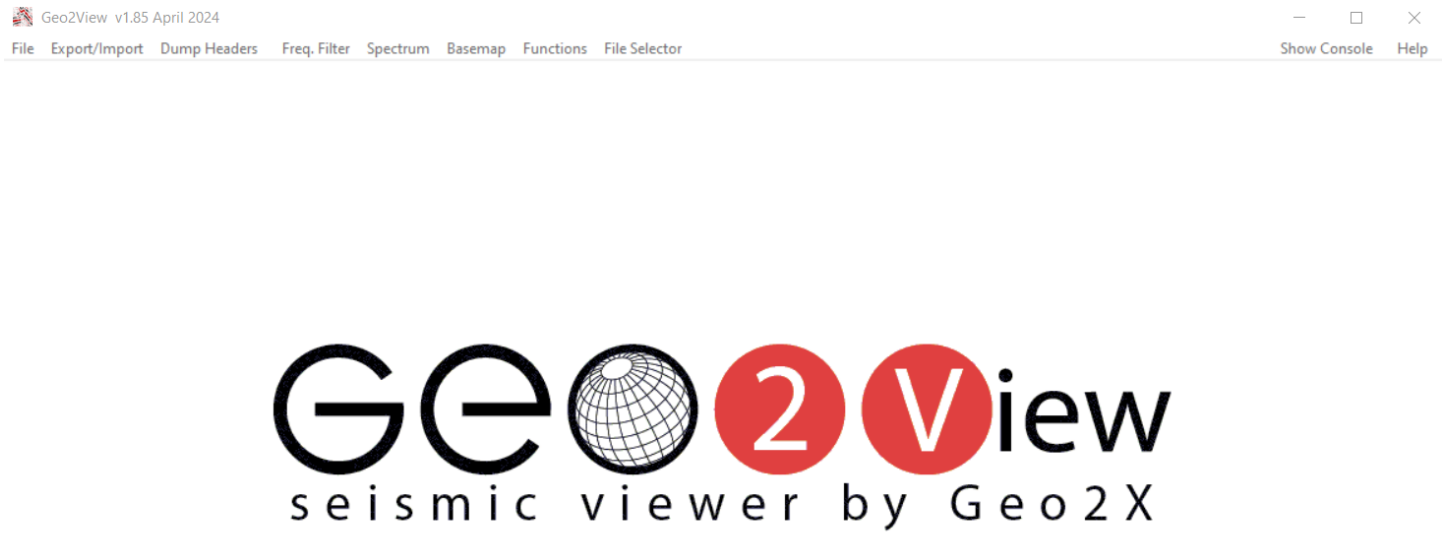


Figure 2.1 – Geo2View home pane.

The File Selector menu shows all supported seismic files inside the current directory in a floating window (**Fig. 2.2**) and allows filtering of files based on their name. The navigation between files is done by single click or via keyboard ↑ and ↓ keys. When switching from a file to another from the File Selector menu, display settings are kept constant if possible. An automatic sorting of seismic traces within the current directory can be applied by checking the Sort checkbox.

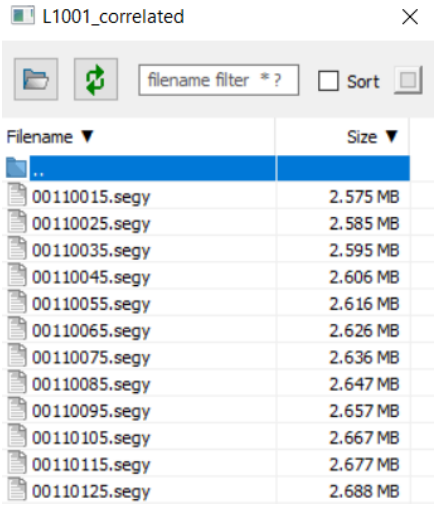


Figure 2.2 – File selector floating window.

Note If the Amplitude Spectrum and Basemap windows are open, they will automatically update upon loading of a new file into memory.

The top left button of the File Selector menu allows selection of the current directory, while the top right button refreshes the list of files within the current directory. There is no real-time tracking of modifications inside a directory.

3 Changing visualization settings

Once a seismic file has been loaded into memory, the visualization pane will be shown and Display Settings commands can be accessed on the left-side panel (**Fig. 3.1**).

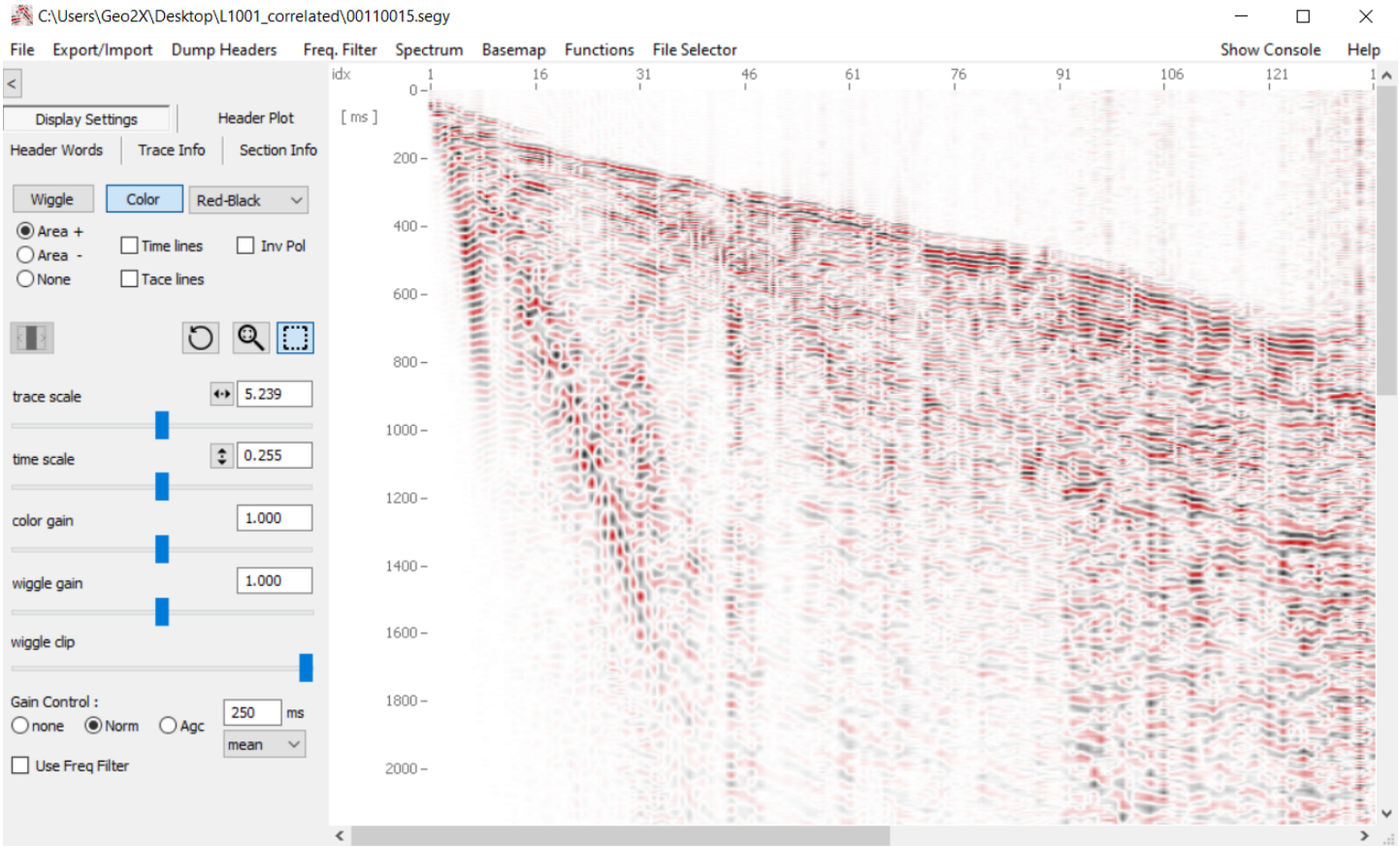
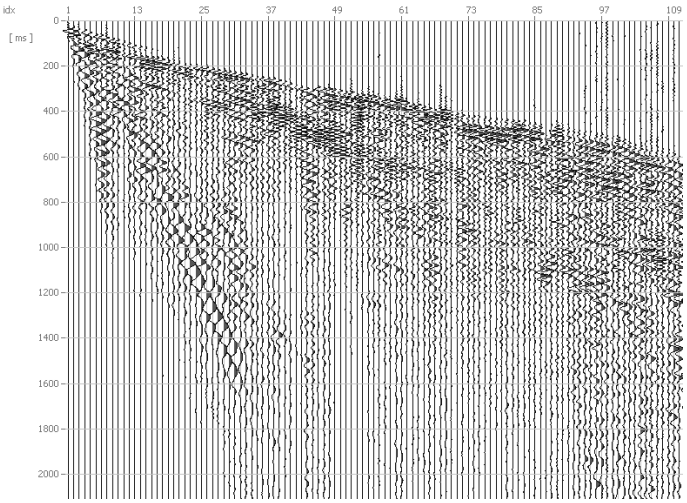
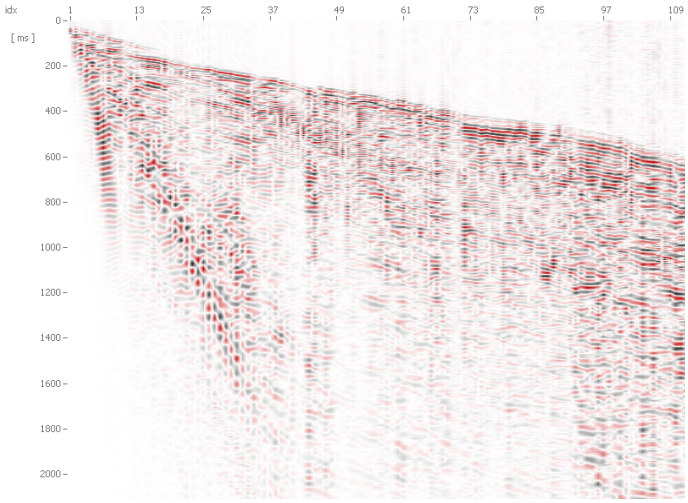


Figure 3.1 – Visualization pane with display settings shown on the left.

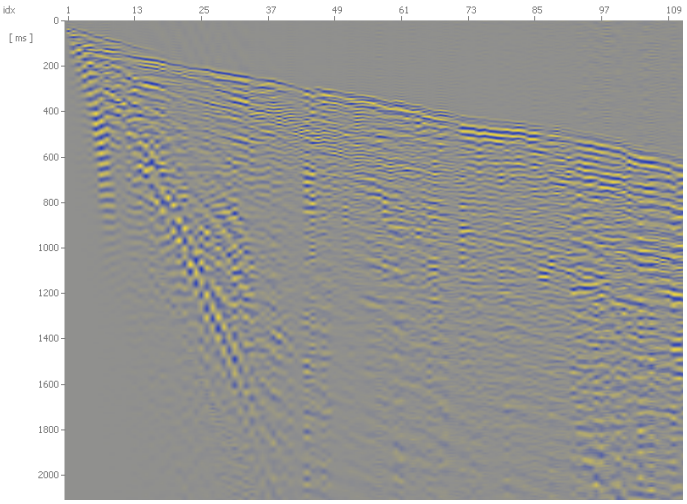
By selecting the Wiggle feature, the data will be displayed in wiggle mode. Alternatively, pressing the Color button will display the data using one of four color schemes (**Fig. 3.2**) that can be selected from the drop-down menu (**Fig. 3.3**).



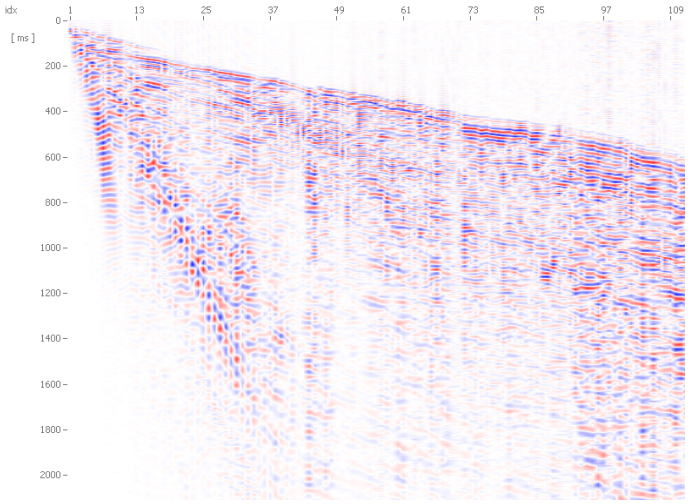
(a) Wiggle mode.



(b) Red-Black mode.



(c) Blue-Yellow mode.



(d) Red-Blue mode.

Figure 3.2 – Available options for seismic trace display.

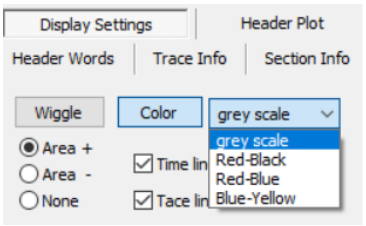


Figure 3.3 – Drop-down menu for selecting color scheme.

The Display settings control panel provides the following options.

Wiggle gain	Control the gain applied to the wiggles when in wiggle mode.
Area + / Area - / None	Switch between filling the positive or negative lobes of wiggles, or no filling.
Color gain	Control the contrast of the image.
Wiggle gain	In wiggle mode, apply a set gain to the wiggles.
Trace scale	Control the scale of all traces.
Time scale	Control the time scale of the seismic traces.
Gain control	Choose between no gain, normal gain control or automatic gain control (AGC).
Use Freq Filter	Checking the box applies the designed frequency filter (*cf.* **Chapter 9**).
Inv Pol	Checking the box switches from normal (American) to reverse (European) polarity.
Cross Lines Cursor	Displays trace index, SMP, time and value for the currently selected trace/time point.
Trace Header Words	Displays trace headers for the selected trace.

Additionally, some mouse/keyboard combinations allow control of the visualization pane.

RMB + Drag	Zoom in on the selected area.
Esc	Unzoom or undo.
⇧ + RMB + Drag	Select the area on which to perform spectral analysis.
← ↑ ↓ →	Pan the zoomed window.

If traces have previously been sorted (see **Section 12.1**), the button will become clickable and the user will be able to display traces according to the first sorting key (**Fig. 3.4**). The ◂ ▸ buttons allow the user to move between sorted files.

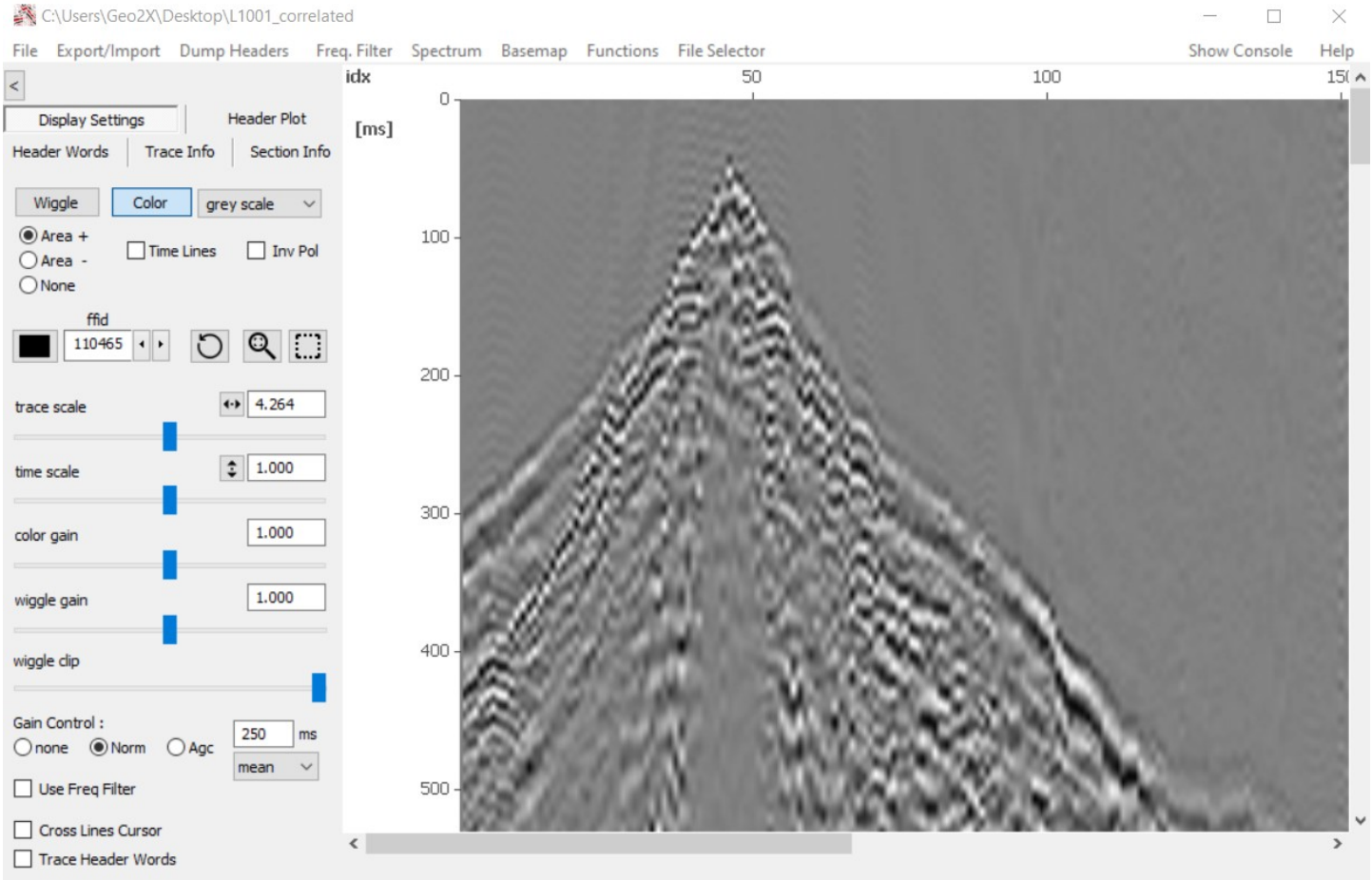


Figure 3.4 – Displaying traces by FFID after sorting by field recorder number (first sorting key) and trace sequence number (second sorting key).

4 Plotting header data

The Header Plot menu can be used to plot the information contained in the header of each trace (**Fig. 4.1**). The headers to plot are selected from the drop-down menu. Up to three headers can be shown simultaneously in different colors. Shape and size of the header plot can be controlled by the following features.

Window Height	Adjust window height.
Vert Margins	Adjust vertical margins of the plot.
Pen Thickness	Adjust line thickness.
Num Major Ticks	Set the number of ticks and tick lines.

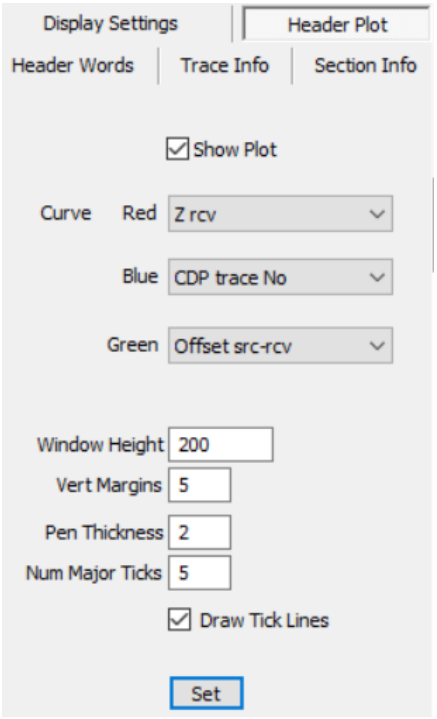


Figure 4.1 – Header plot window.

The plot is updated upon pressing Set and is displayed in the top part of the visualization pane (**Fig. 4.2**). The Y axis can be switched between the three available curves by clicking on the curve label. A curve can be masked by using Shift + LMB on the curve label.

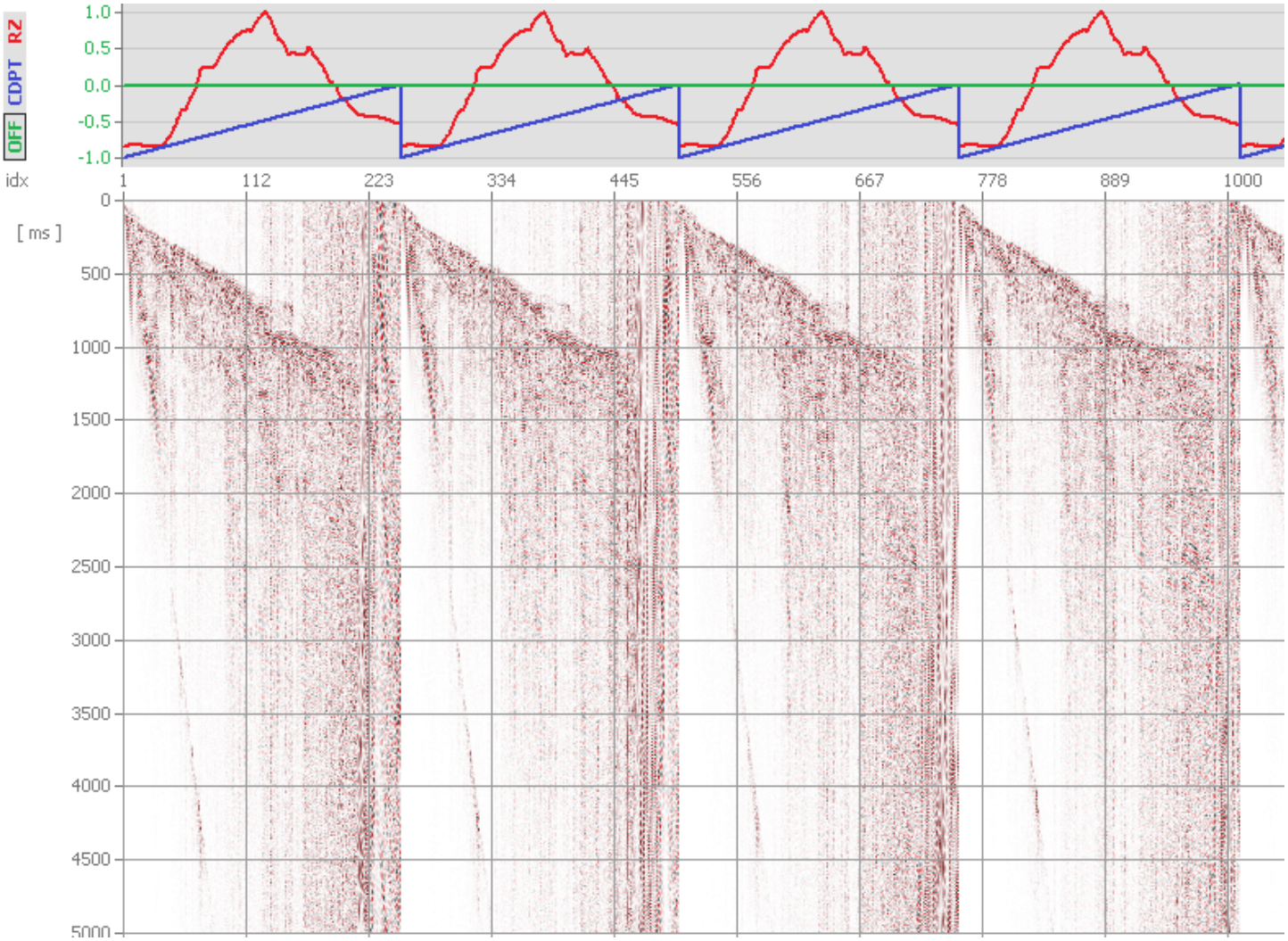


Figure 4.2 – Plotting seismic trace headers: receiver Z elevation (red), CDP trace number (blue) and offset (green).

5 Showing trace headers

By default, only trace indexes are shown above the visualization pane. Using the Header Words menu on the left-hand pane, the user can select further headers to display textually (**Fig. 5.1**). The order of header words can be rearranged using the Up and Down buttons, and the header words display will be updated upon pressing Apply.

Graduate Step	Define the distance between ticks on the X axis.
Hgrad Vgrad	Control the density of X and Y ticks.

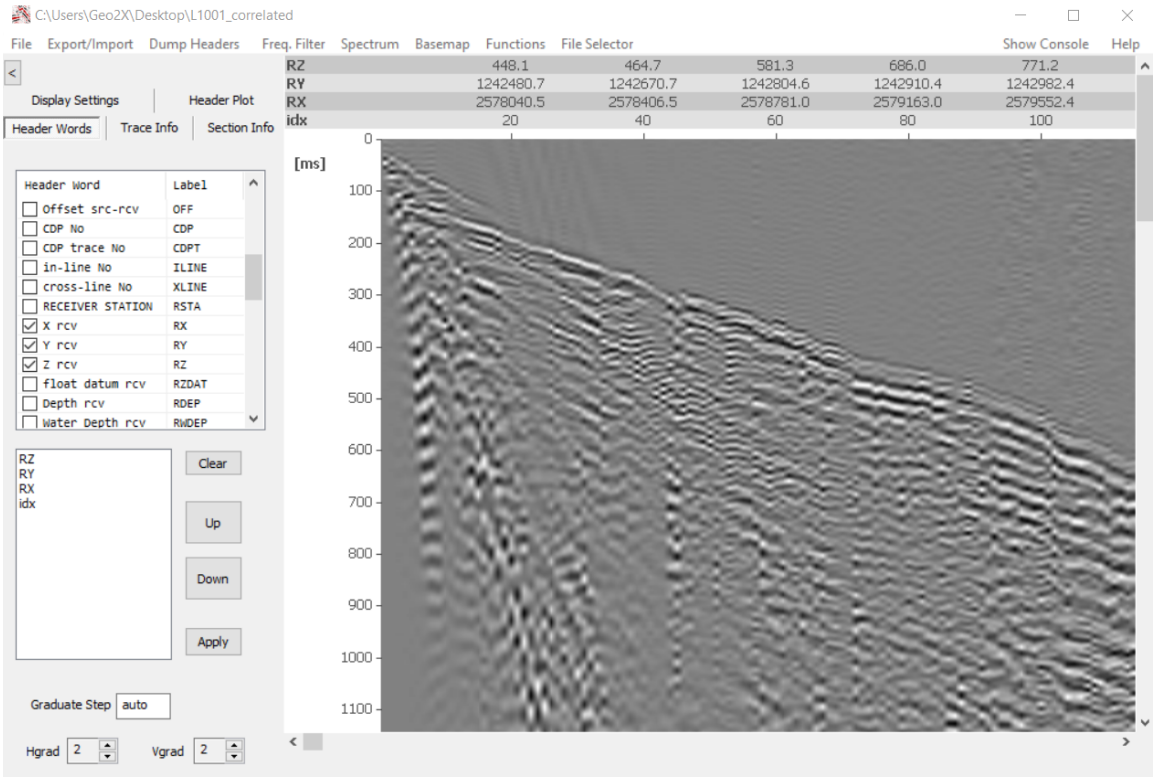


Figure 5.1 – Showing trace headers in the visualization pane.

6 Showing trace and section information

The Trace Info menu gives information on the currently selected trace (**Fig. 6.1**). A trace can be selected by passing the mouse over it on the visualization pane. Alternatively, using ⇧+LMB on a specific trace will highlight it and lock it as current trace. Highlighting can be removed with ⇧+RMB.

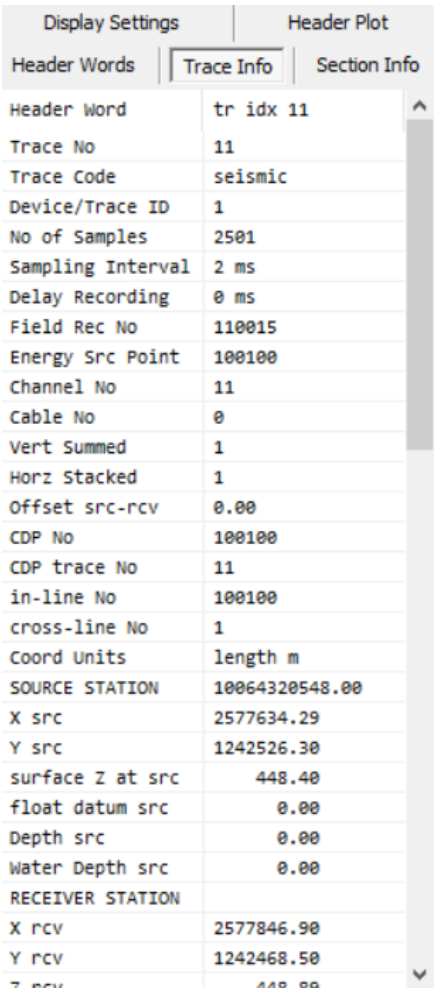


Figure 6.1 – Trace information panel.

The Section Info pane displays the information encoded in the currently selected file (**Fig. 6.2**).

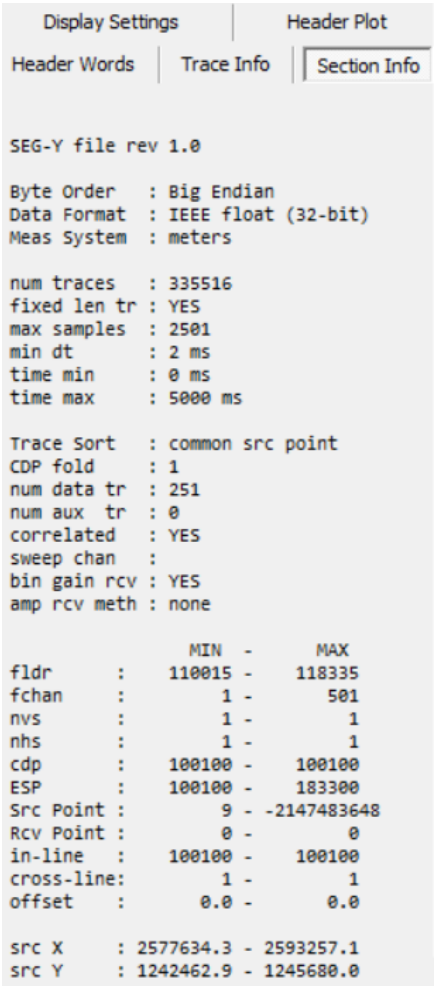


Figure 6.2 – Section information panel.

7 Exporting and importing trace headers

The Export/Import menu allows the user to export and import trace headers (**Fig. 7.1**). Both export and import are limited to SEG-Y rev 0/1 or SU files.

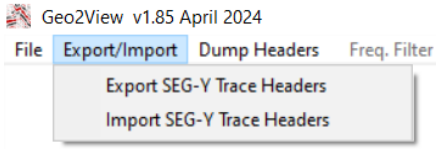


Figure 7.1 – Export/Import menu.

Note Export/Import doesn't work with the seismic dataset uploaded to memory, but to (export) and from (import) an external file.

7.1 Exporting

Data is exported to a .csv or .txt file, strictly according to the SEG-Y standard. The first column of the output file is the trace index given in the source file, and the first line is the header keyword identifier. Export is done on a user-specified trace interval. The headers to be exported can be individually selected, or a full export of all headers can be done by pressing the Select All key. Data is exported upon pressing the Export button (**Fig. 7.2**).

Seismic File > Set	Select the file containing headers to export.
Header Words Text File > Set	Set the name of the output file, ending in .csv or .txt.
Export from trace	Optionally select a range of traces from which to export headers.
Field Separator	Select the separator for the output file.
Select All	Extract all headers available from the seismic file.
Export	Start the export process.

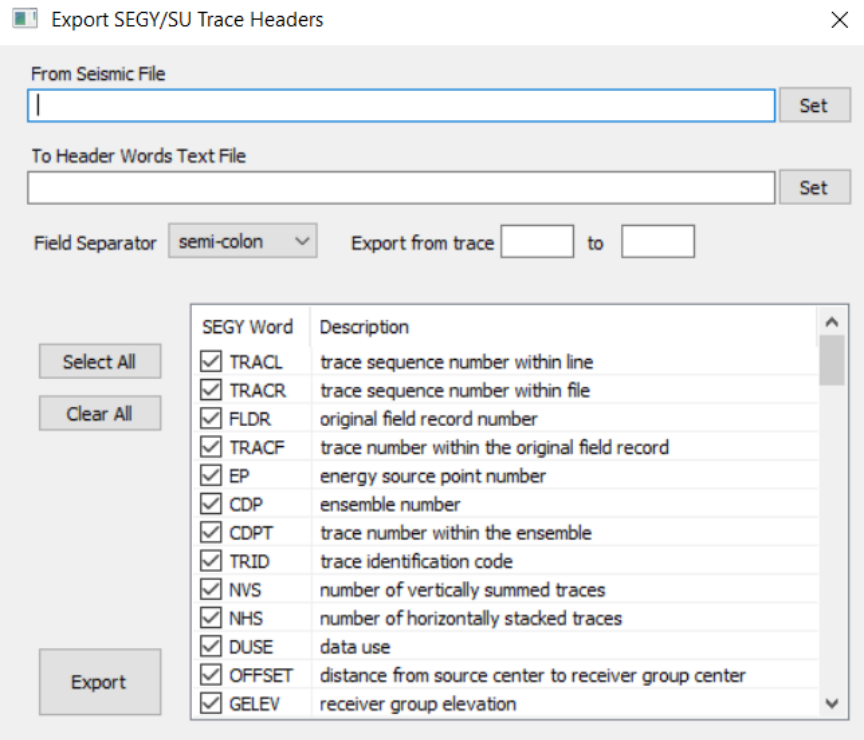


Figure 7.2 – Trace headers export window.

7.2 Importing

Geo2View also allows importing seismic trace headers from a `.csv` or `.txt` file through Export/Import › Import SEG-Y Trace Headers. The import file must be written according to the SEG-Y standard. Import is done individually for each trace index and each header keyword present in the import file. Upon clicking the Import button, the headers are written on the desired seismic file (**Fig. 7.3**).

Header Words Text File › Set — Select the `.csv` or `.txt` file containing headers to import.

Seismic File › Set — Select the seismic file on which trace headers must be written.

Import — Start writing headers on the seismic file.

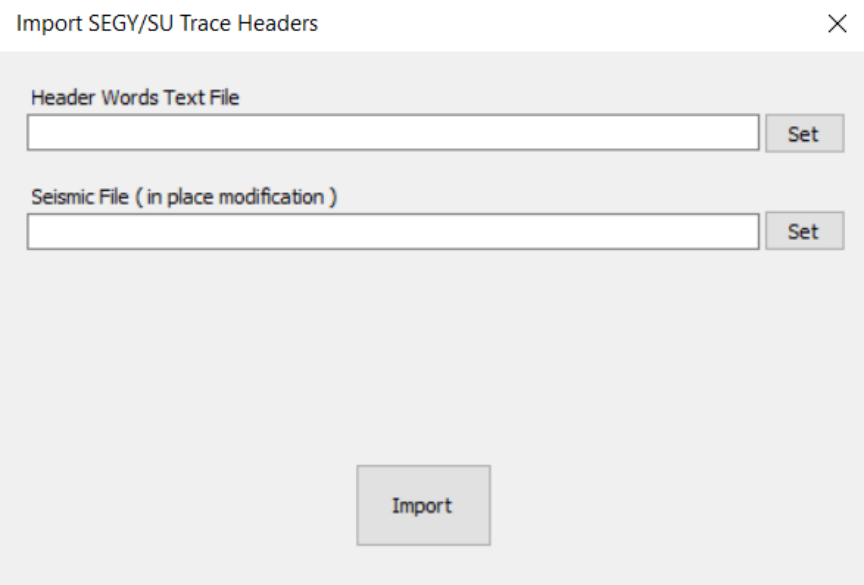


Figure 7.3 – Trace headers import window.

8 Dumping of headers into console

The Dump Headers menu prints the headers for the desired file and traces in the console (**Fig. 8.1**). This function supports SEG-Y and SEG-2 file formats.

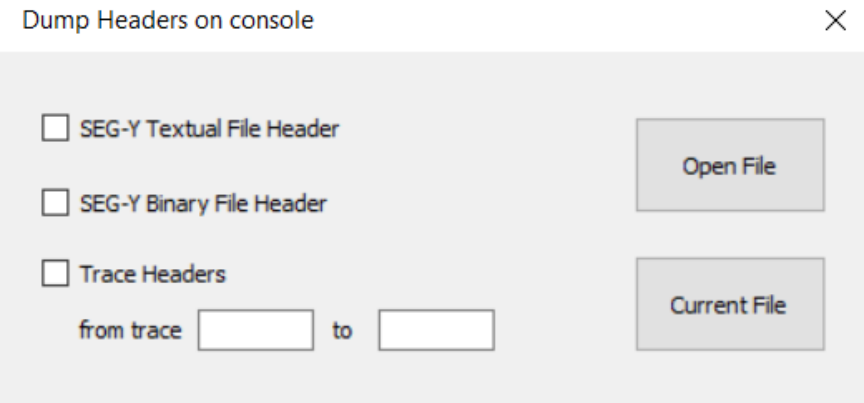


Figure 8.1 – Dump headers window.

Headers can be dumped either from the file loaded into memory using the Current File button, or from an external file using Open File. The Current File option is only intended for use with the SEG-Y Textual File Header checkbox.

SEG-Y Textual File Header > Open File	Select and open the header file in the console.
SEG-Y Binary File Header > Open File	Select and open the binary file in the console.
Trace Headers > Open File	Select and open the trace headers from a specific file.
Current File	Print the header of the file in memory.

Warning

Dumping of headers from the file loaded into memory will not produce any meaningful output as header data from the memory file is no longer in the original format but in an interpreted format. To read headers from the file in memory, use the Trace Info menu.

9 Frequency filtering

Geo2View supports design of low pass, high pass, band pass and notch filters (**Fig. 9.1**). All of these are implemented as Infinite Impulse Response (IIR) filters. Filter type can be selected from the drop-down menu and can be either Butterworth, Chebyshev or Elliptic (**Fig. 9.2**).

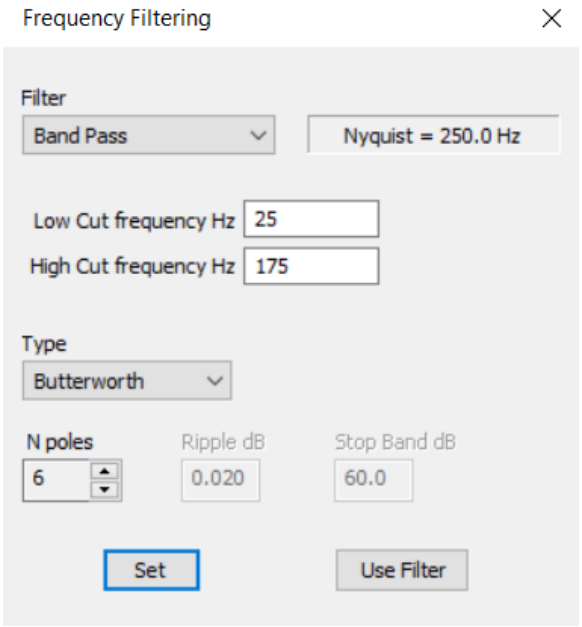
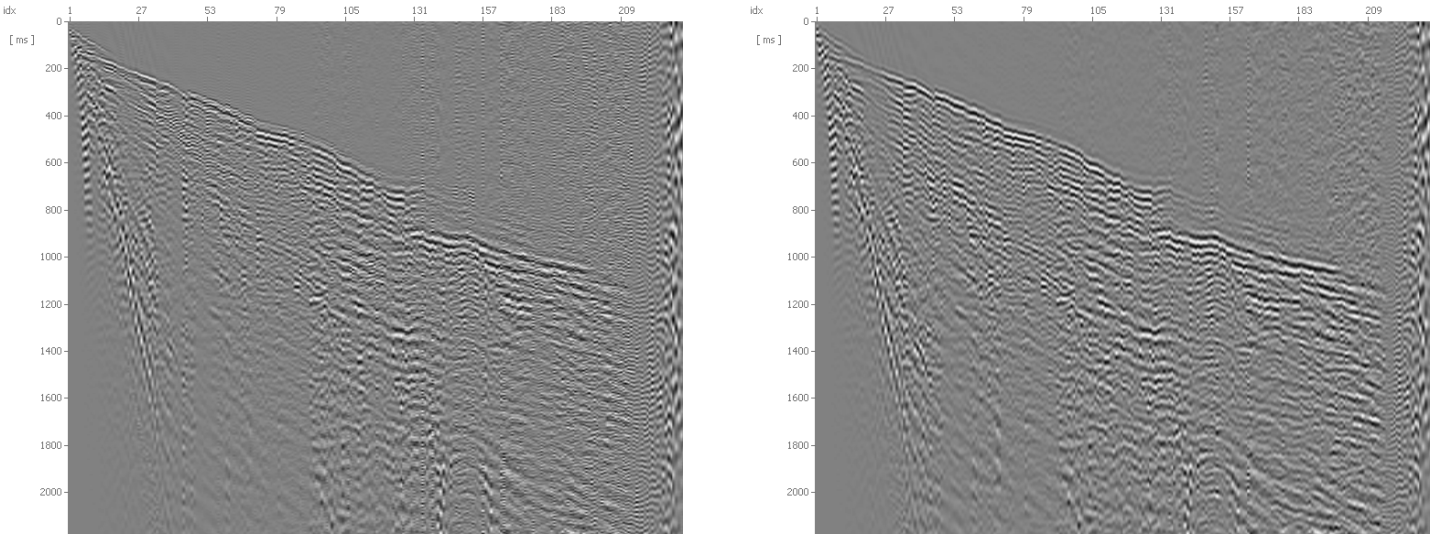


Figure 9.1 – Frequency filtering window.



(a) Unfiltered seismic section.

(b) After application of a Butterworth filter.

Figure 9.2 – Seismic section before and after frequency filtering.

Butterworth filters are designed to have a steep roll-off without creating ripples in the passband. Chebyshev filters achieve a steeper roll-off than Butterworth filters at the cost of ripples in either the passband (Type 1) or the stopband (Type 2). Elliptic filters have ripples in both the passband and the stopband but improved selectivity compared to Chebyshev filters.

Filters are designed by setting the following parameters.

Low Cut Frequency Hz	Set lower bound in Hz.
High Cut Frequency Hz	Set upper bound in Hz.
N Poles	Set the number of poles.
Ripple dB	Set the amount of rippling allowed (only for Chebyshev and Elliptic filters).
Stop Band dB	Set the amount of stopband attenuation (only for Elliptic filters).

The number of poles defines the slope of the filter beyond the cut-off frequency. The higher the number of poles, the closer is the designed filter to an ideal filter. The ripple percentage determines the amount of rippling allowed in the filter response as well as the steepness of the roll-off.

10 Amplitude spectrum analysis

Through the Spectrum menu, the frequency content of a specific trace, a range of traces or the entire seismic section can be visualized (**Fig. 10.1**).

Selected Trace	Show the frequency content of the currently selected trace.
Whole Section	Show the frequency content of the whole seismic section (all traces).
Apply Gain	Show the frequency spectrum before and after applying the gain.
Filtered Trace	Show the frequency spectrum before and after applying the designed filter.

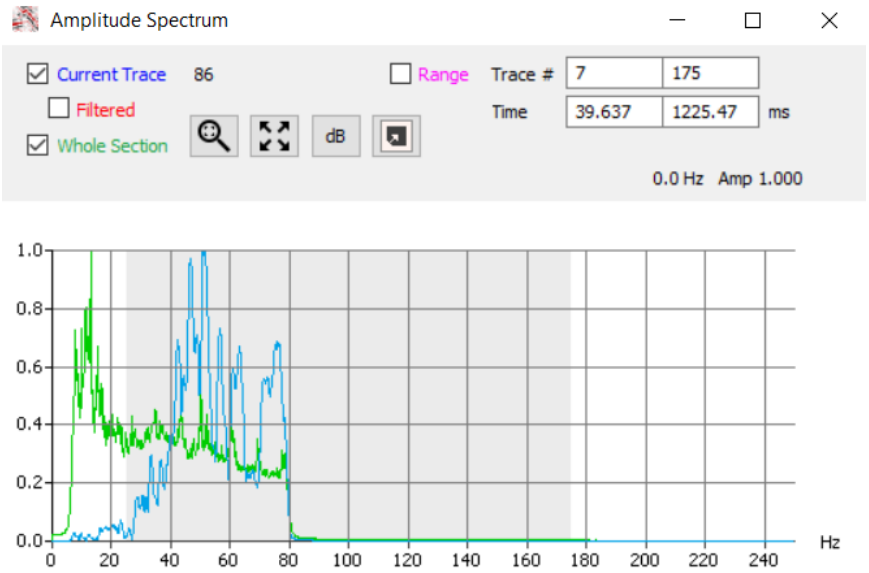
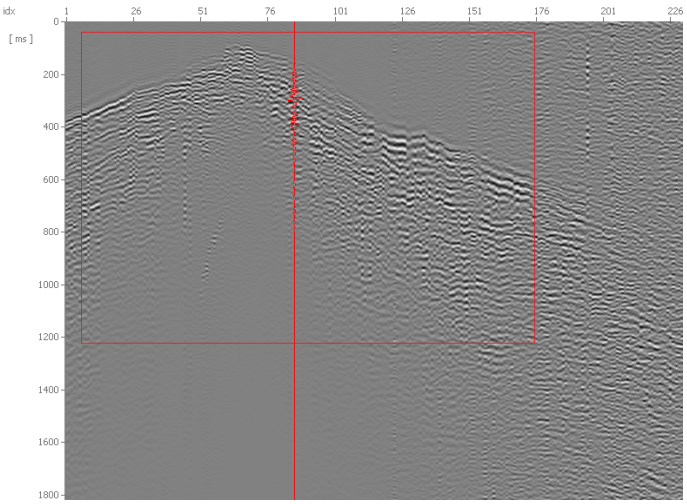


Figure 10.1 – Frequency content of trace 86 (blue curve) and the entire seismic section (green curve).

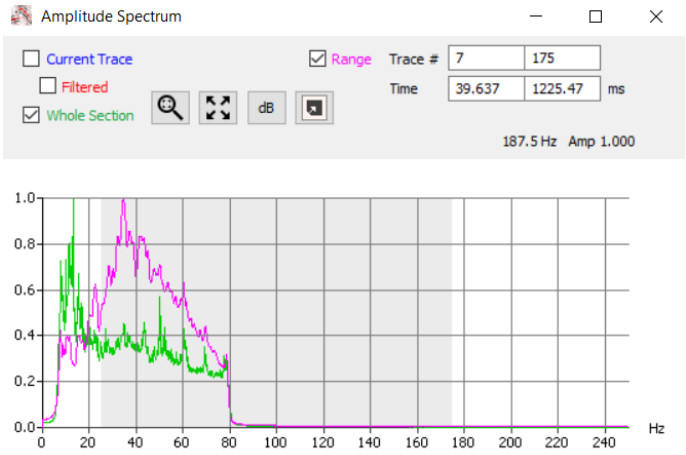
When showing the frequency content of the current trace, both the filtered and unfiltered spectra can be shown simultaneously. When showing the spectrum of the entire section or a time/trace interval, only the unfiltered content can be shown.

A specific trace can be highlighted by pressing ⇧+LMB, and highlighting can be removed with ⇧+RMB. The user can zoom on a portion of the spectral plot with Ctrl+RMB+Drag. The amplitude scale can be switched between linear and logarithmic by selecting or unselecting the dB button.

The spectrum of the complete seismic section can be restricted to a range of traces and a time interval by inputting the upper and lower bounds. The range is validated upon pressing the ↵ key. Instead of manually inputting the limits, the trace/time range to be analyzed can be drawn as a rectangular area on the visualization pane by pressing Ctrl+RMB+Drag (**Fig. 10.2**).



(a) Selection of the traces/time range to analyze.



(b) Frequency content of traces within the red box (red curve) and the entire seismic section (green curve).

Figure 10.2 – Showing the frequency content of a range of traces/time.

11 Sources, receivers and CDPs X–Y plotting

The Basemap menu gives the user the possibility to plot the position of receivers, shots and CDPs in a X–Y plot (**Fig. 11.1**). X–Y coordinates are taken from the file uploaded to memory. The X–Y map offers a zoom function by using the magnifying glass or by selection of a rectangular area through Ctrl + RMB + Drag.

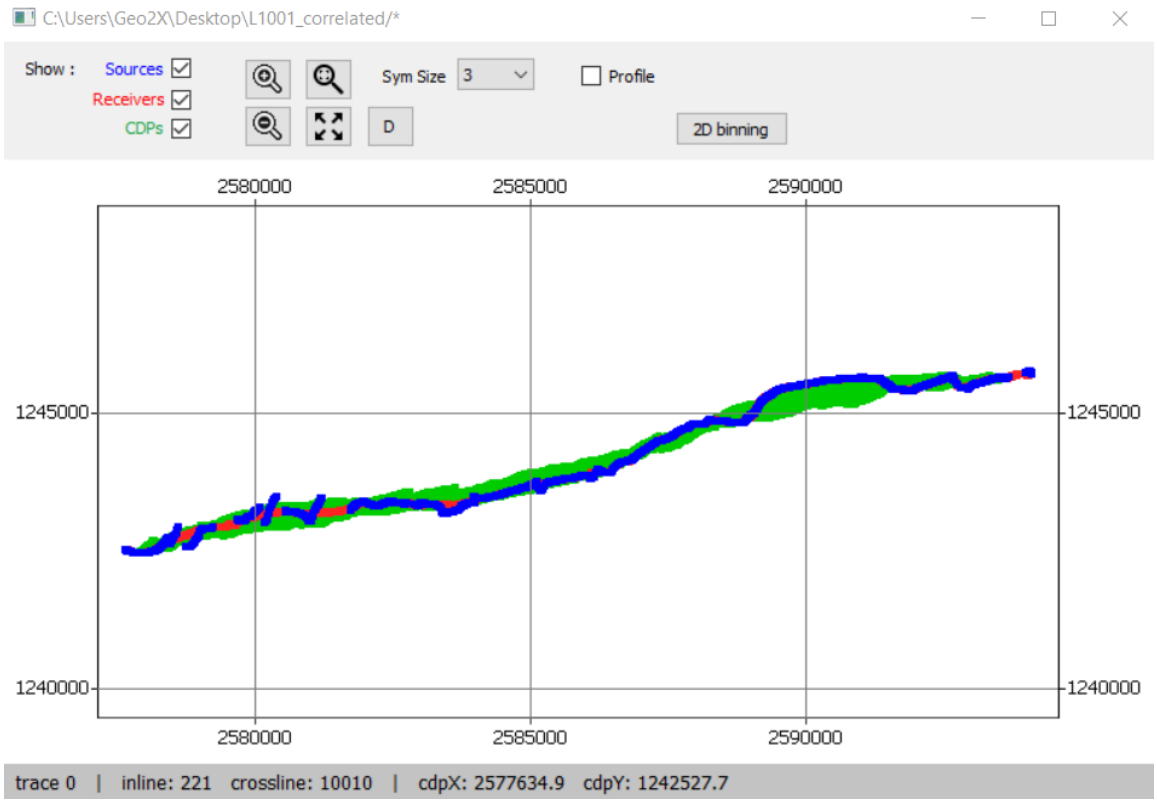


Figure 11.1 – X–Y map of receivers (green), shots (blue) and CDPs (red).

11.1 2D binning

Upon clicking the 2D binning menu in the Basemap floating window, a new window opens (**Fig. 11.2**), allowing the user to bin seismic traces according to maximum offset and maximum distance to profile. If the operation is successful, the output file can be saved and, upon saving, will be displayed in a new floating window (**Fig. 11.3**).

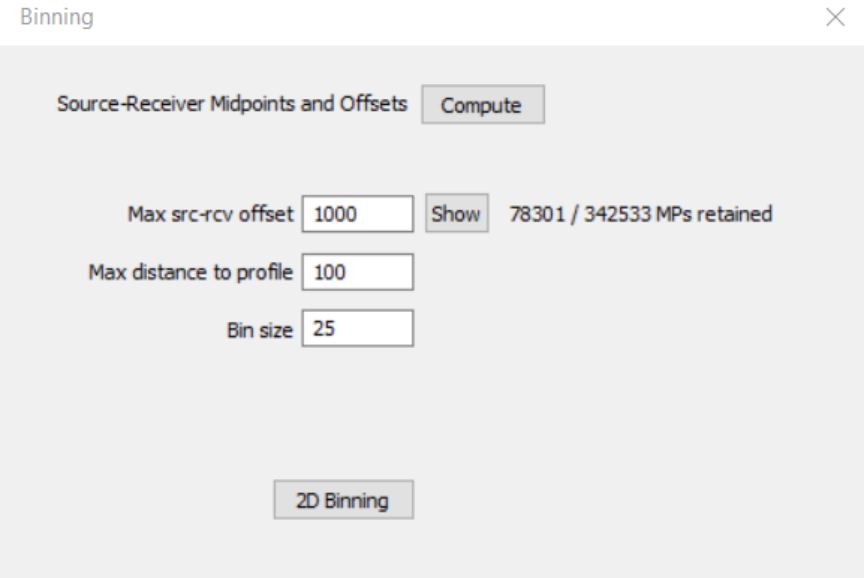


Figure 11.2 – Binning menu.

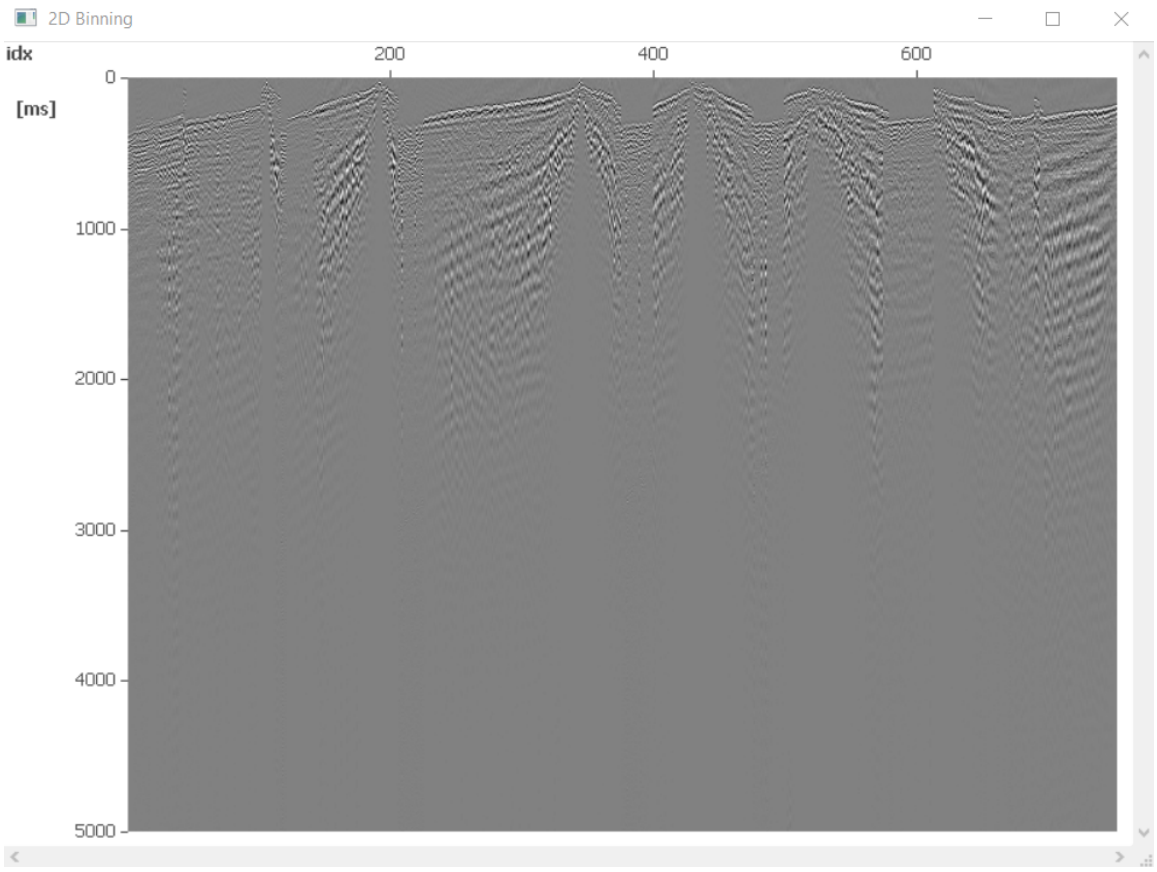


Figure 11.3 – Binning output file.

12 Functions

The Functions menu can be used to sort, resample or shift seismic traces, in addition to taking snapshots.

12.1 Sorting traces

Traces can be sorted through the Functions > Sort Traces menu. Up to three sorting keys can be nested, to be selected from an extensive list of header keywords (**Fig. 12.1**). The sorting order (descending or ascending) can be individually selected for each sorting key.

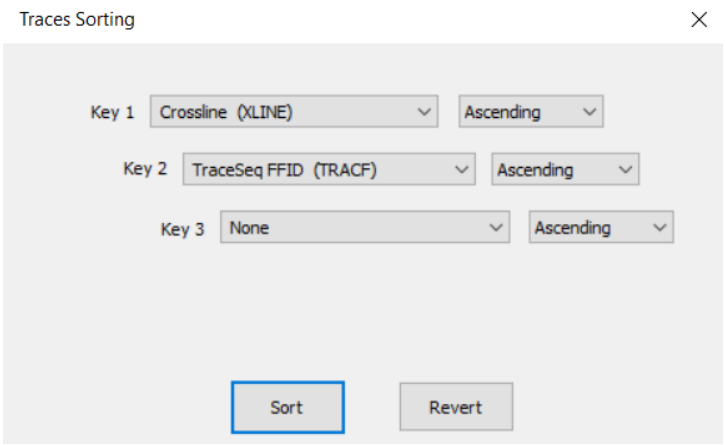


Figure 12.1 – Trace sorting window.

If the result of the sort is unstable, it may be necessary to introduce another sorting key. For example, a sort of traces by shot number must be accompanied by a second key such as channel number.

12.2 Resampling traces

The Functions > Resample menu allows downsampling or oversampling of existing seismic traces (**Fig. 12.2**). Resampling is performed through sinc interpolation. Before downsampling, a low pass filter is applied at 90 % of the new Nyquist frequency.

Warning When using the resampling function, original traces are replaced by resampled ones.

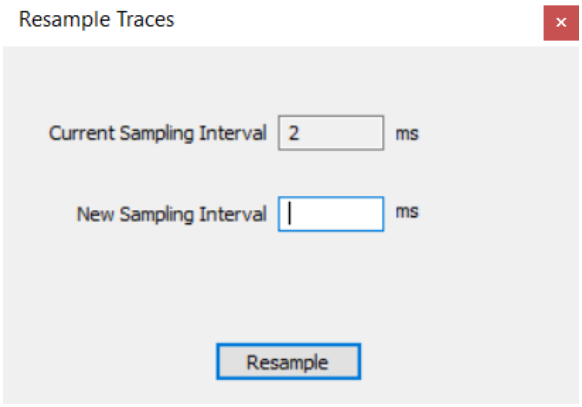


Figure 12.2 – Trace resampling window.

12.3 Shifting traces

If traces must be of constant length, the Functions > Shift Traces menu can be used to shift all traces (**Fig. 12.3**). Traces can be shifted either

— backward (negative shift), by truncating trace starts and filling trace ends with null values;

— forward (positive shift), by truncating trace ends and filling trace starts with null values.

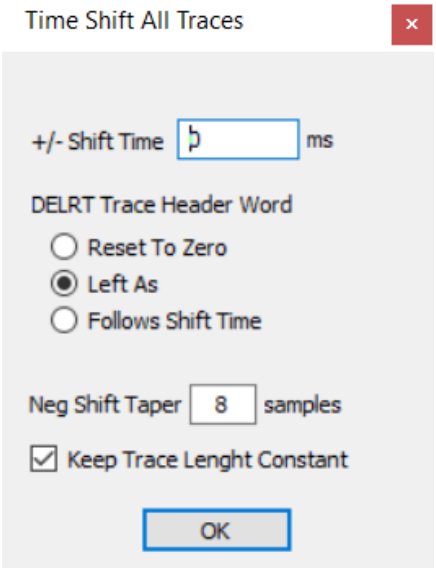


Figure 12.3 – Trace shifting window.

12.4 Image export

Upon pressing the Functions > Snapshot menu or the F5 key, a new window opens, allowing the user to create a snapshot of the current display window as a `.png` file (**Fig. 12.4**). After pressing the OK button, the name and path of the snapshot can be specified. The snapshot

Warning When saving a snapshot, be sure to specify the file extension `.png` in the file name.

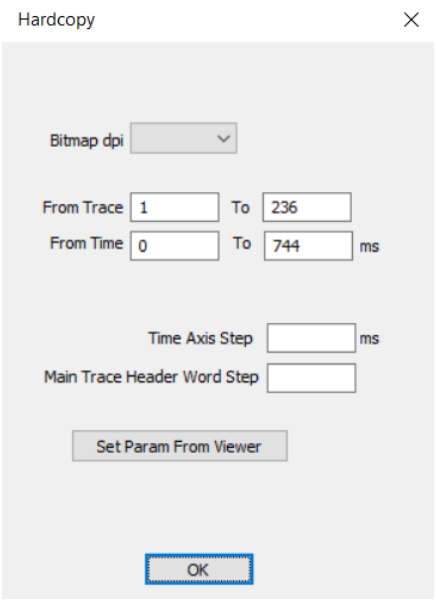


Figure 12.4 – Snapshot window.

13 Selective stacking

In the File > Selective Stack menu, the user has the option to stack multiple SEG-Y or SEG-2 files, provided that all selected files have the same number of traces. If stacking is successful, the output file will be shown in the main visualization pane (**Fig. 13.1**). The stacking output can be saved as a SEG-Y file through RMB > Save Stacks.

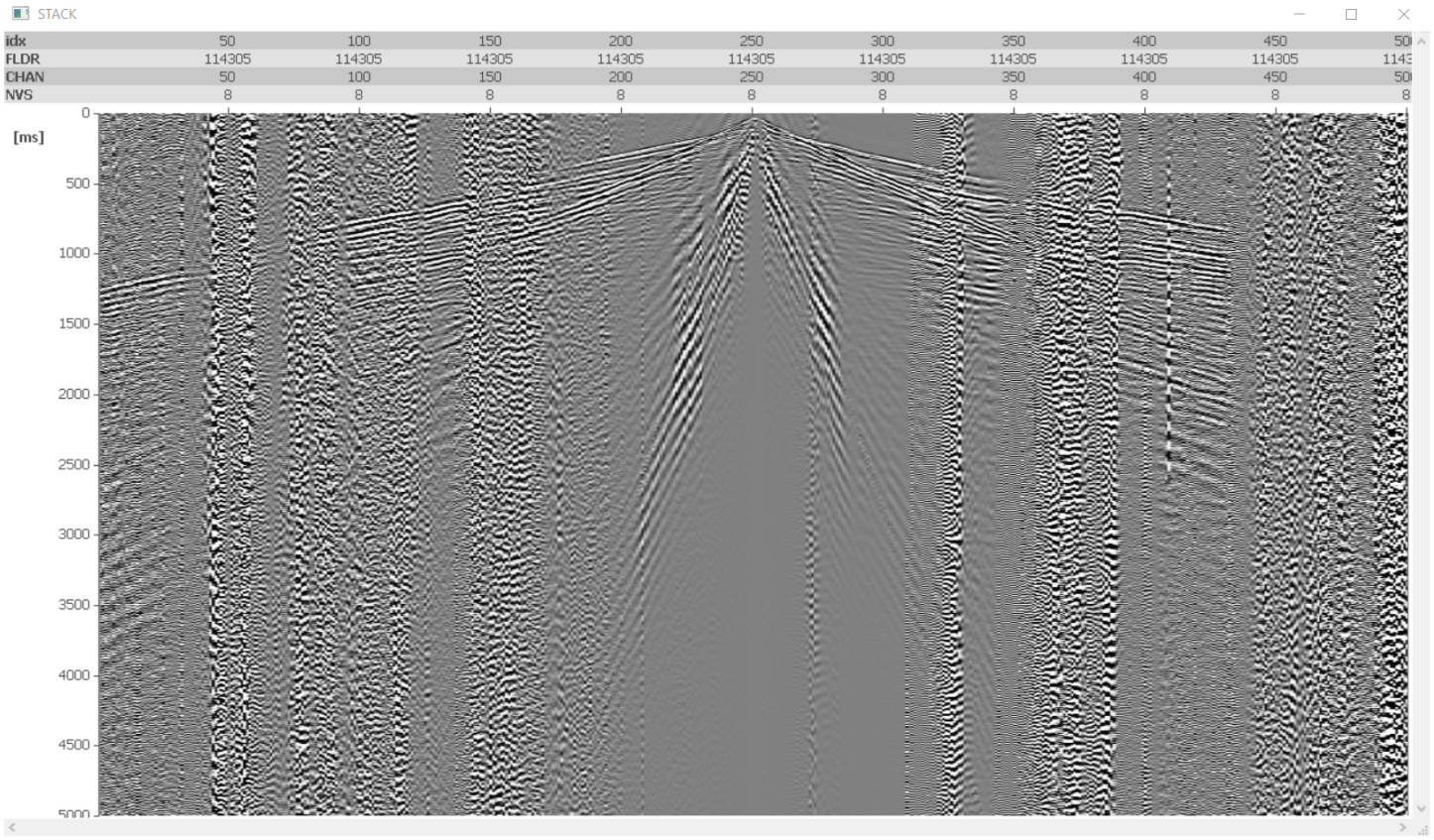


Figure 13.1 – Output of stacking multiple shots.

The user can zoom on a portion of the stack by using RMB + Drag, and zooming can be undone with Esc.

14 Saving a seismic dataset

A seismic dataset can be saved through File > Save Dataset into either `SEG-Y rev 1`, `SU` or `SEG-2` filetypes. When saving, the user is given the option to apply the active frequency filter and define a time and/or trace crop. Traces can be cropped either by inline/crossline number, X and Y coordinates of CDPs, CDP and line number, FFID and trace number or source/receiver offset.