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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 $\boxed{\text{File}}$ <u>Load Seismic File(s)</u>. 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.

🛐 Ge	o2View v1.85	April 2024								_		\times
File E	xport/Import	Dump Headers	Freq. Filter	Spectrum	Basemap	Functions	File Selector			Show C	onsole	Help



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 \uparrow and \downarrow 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.

L1001_correlated	×
filename filter * ?	Sort
Filename 🔻	Size 🔻
🔤	
🖹 00110015.segy	2.575 MB
00110025.segy	2.585 MB
00110035.segy	2.595 MB
00110045.segy	2.606 MB
00110055.segy	2.616 MB
00110065.segy	2.626 MB
00110075.segy	2.636 MB
00110085.segy	2.647 MB
00110095.segy	2.657 MB
00110105.segy	2.667 MB
00110115.segy	2.677 MB
00110125.segy	2.688 MB

Figure 2.2 – File selector floating window.

Noto	If the Amplitude Spectrum and	Basemap	windows	are open,	they wil	I automatically	update upor	1 loading
NOLE	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 - V isualization 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).





(d) Red-Blue mode.

Figure 3.2 – Available options for seismic trace display.

Display Sett	tings	Header Plot				
Header Words	fo	Sectio	n Info			
Wiggle	Color	grey	scale	\sim		
Area + Area - None	Time lin	grey Red-I Red-I Blue-I	scale Black Blue Yellow			

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 (<i>cf.</i> 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 mou	use/keyboard combinations allow control of the visualization pane.



g Zoom in on the selected area.

Unzoom or undo.

Select the area on which to perform spectral analysis.

Pan the zoomed window.

If traces have previously been sorted (see Section 12.1), the II button will become clickable and the user will be able to display traces according to the first sorting key (Fig. 3.4). The \checkmark 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 <u>Header Plot</u> 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.

Display Settin	gs 🛛	Header Plot
Header Words	Trace Info	Section Info
	Show Plot	
Curve Red	Z rcv	\sim
Blue	CDP trace No	\sim
Green	Offset src-rcv	~
Window Heigh Vert Margins Pen Thickness Num Major Ticks	t 200 5 5 5 2 5 5 7 Draw Tick I	ines
	Set	

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.



🕺 C:\Users\Geo2X\D	esktop\L1001_corr	related							- 🗆	\times
File Export/Import	Dump Headers	Freq. Filter	Spectrum	Basemap	Functions	File Selector			Show Console	Help
		RZ			448.1	464.7	581.3	686.0	771.2	^
		R¥			1242480.7	1242670.7	1242804.6	1242910.4	1242982.4	
Display Settings	Header Plot	RX			2578040.5	2578406.5	2578781.0	2579163.0	2579552.4	
Header Words Trac	e Info Section I	Info idx			20	40	60	80	100	
· · · · · · · · · · · · · · · · · · ·			0 100							
		[ms]		-						
Header Word	Label ^	`	100 -	100						
Offset src-rcv	OFF		1.1	-						
CDP NO	CDP		1	200	-					
CDP trace No	CDPT		200 -	<u>9985</u>	-					
in-line No	ILINE		- 12	0005		-				
cross-line No	XLINE		300 -	1992	1000	and the second				
RECEIVER STATIC	ON RSTA			1. C.C.	6.800	100 100				
X rcv	RX			K 5-13	200					
Y rcv	RY		400 -	10.00	2000			-		
Z rcv	RZ			6400	1000					
float datum rcv	/ RZDAT		500	CARD.	0.000	and the second	and the second s	States in case		
Depth rcv	RDEP		300 -	600C	1005	10 Mar		and the second s		
Water Depth rcv	/ RWDEP *			6200	00.00		and the second second	10000		
P7			600 -	00	ACCESS OF		Contraction of	Contract of the		-
RY	Clear			1000	1.576	and the second second		the same of		
RX			700	- 10 A	10,000	Concerns of the		Contraction of the		26
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	Up			600	1000	1	2000			200
			800 -	0.5	N 90		20.00	and the second		200
	Down				No. an		all and the	and the second	100 100	200
			000		cac	AC 199	Contraction of the			100
			900 -		1000	a summer of	Contraction of the local distance of the loc		1000 C	200
	Apply				800 W		and the second		000	
			1000 -		56 A D	all the second	20000		and the second	-
			_		460.7	Cart Same	2200		2.20	
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a double only dut	-		1100 -		CONT.A.	Contraction of the local division of the loc	COLUMN AND	Contraction of the		
Hgrad 2	Vgrad 2	<								>

Figure 5.1 – Showing trace headers in the visualization pane.

6 Showing trace and section information

The <u>Trace Info</u> 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 1 + LMB on a specific trace will highlight it and lock it as current trace. Highlighting can be removed with 1 + RMB.

Display Settings	Header Plot
Header Words	ace Info Section Info
Header Word	tr idx 11 ^
Trace No	11
Trace Code	seismic
Device/Trace ID	1
No of Samples	2501
Sampling Interval	2 ms
Delay Recording	0 ms
Field Rec No	110015
Energy Src Point	100100
Channel No	11
Cable No	0
Vert Summed	1
Horz Stacked	1
Offset src-rcv	0.00
CDP No	100100
CDP trace No	11
in-line No	100100
cross-line No	1
Coord Units	length m
SOURCE STATION	10064320548.00
X src	2577634.29
Y src	1242526.30
surface Z at src	448.40
float datum src	0.00
Depth src	0.00
Water Depth src	0.00
RECEIVER STATION	
X nov	2577846.90
Y nev	1242468.50
7 0.04	440.00

Figure 6.1 – Trace information panel.

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

Display Settings	Header Plot
Header Words Trace Info	Section Info
SEG-Y file rev 1.0	
Byte Order : Big Endian	
Data Format : IEEE float	(32-bit)
Meas System : meters	
num traces + 335516	
fixed len tr : YES	
max samples : 2501	
min dt : 2 ms	
time min : 0 ms	
time max : 5000 ms	
Trace Sort : common src	point
CDP fold : 1	
num data tr : 251	
num aux tr :0	
correlated : YES	
sweep chan :	
bin gain rcv : YES	
amp rcv meth : none	
MIN -	MAX
fldr : 110015 -	118335
fchan : 1 -	501
nvs : 1 -	1
nhs : 1 -	1
cdp : 100100 -	100100
ESP : 100100 -	183300
Src Point : 9:	2147483648
Rcv Point : 0 -	0
in-line : 100100 -	100100
cross-line: 1 -	1
offset : 0.0 -	0.0
SPC X 1 2577524 3 20	02257 1
SPC Y : 1242462.9 - 12	245680.0

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 FileSetSelect the file containing headers to export.Header Words Text FileSet the name of the output file, ending in .csv or .txt.SetSetExport from traceOptionally select a range of traces from which to export headers.Field SeparatorSelect the separator for the output file.Select AllExtract all headers available from the seismic file.ExportStart the export process.

Export SEGY/S	U Trace Heade	ers	>
From Seismic File			
1			Set
To Header Words	Text File		
			Set
Field Separator	semi-colon 🗸	Export from trace to	
	SEGY Word	Description	^
Select All	TRACL	trace sequence number within line	
	TRACR	trace sequence number within file	
Clear All	FLDR	original field record number	
	TRACE	trace number within the original field record	
	EP EP	energy source point number	
	CDP	ensemble number	
	CDPT	trace number within the ensemble	
	TRID	trace identification code	
	V NVS	number of vertically summed traces	
	NHS	number of horizontally stacked traces	
	DUSE	data use	
Export	OFFSET	distance from source center to receiver group center	
Export	CELEV	receiver group elevation	

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 Seismic File Import Select the .csv or .txt file containing headers to import.

Select the seismic file on which trace headers must be written. Start writing headers on the seismic file.

Import SEGY/SU Trace Headers	×
Header Words Text File	Set
Seismic File (in place modification)	
	Set
Import	

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.

Dump Headers on console		\times
SEG-Y Textual File Header	Open File	
SEG-Y Binary File Header	opennie	
Trace Headers		
from trace to	Current File	

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**).

Frequency Filtering	×
Filter Band Pass V	Nyquist = 250.0 Hz
Low Cut frequency Hz 25	
High Cut frequency Hz 175	
Type Butterworth V	
N poles Ripple dB	Stop Band dB
6 • 0.020	60.0
Set	Use Filter

Figure 9.1 – Frequency filtering window.



(a) Unfiltered seismic section.

(b) After application of a Butterworth filter.



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
Whole Section
Apply Gain
Filtered Trace

Show the frequency content of the currently selected trace. Show the frequency content of the whole seismic section (all traces). Show the frequency spectrum before and after applying the gain.

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 1 + LMB, and highlighting can be removed with 1 + 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 \checkmark 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).

Binning	\times
Source-Receiver Midpoints and Offsets Compute	
Max src-rcv offset 1000 Show 78301 / 342533 MPs retained	
Max distance to profile 100	
Bin size 25	
2D Binning	

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.

Traces Sorting	×
Key 1 Crossline (XLINE) \checkmark Ascending \checkmark	
Key 2 TraceSeq FFID (TRACF) \checkmark Ascending \checkmark	
Key 3 None ~ Ascending ~	
Sort Revert	

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.

Resample Traces	×
Current Sampling Interval 2 ms	
New Sampling Interval ms	
Resample	

12 Functions

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.

Time Shift All Traces	×
+/- Shift Time þ ms	
DELRT Trace Header Word	
O Reset To Zero	
Left As	
Follows Shift Time	
Neg Shift Taper 8 samples	
🗹 Keep Trace Lenght Constant	
OK	

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.

Hardcopy	\times
Bitmap dpi	
From Trace 1 To 236	
Time Axis Step ms	
Main Trace Header Word Step	
Set Param From Viewer	
OK	

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.