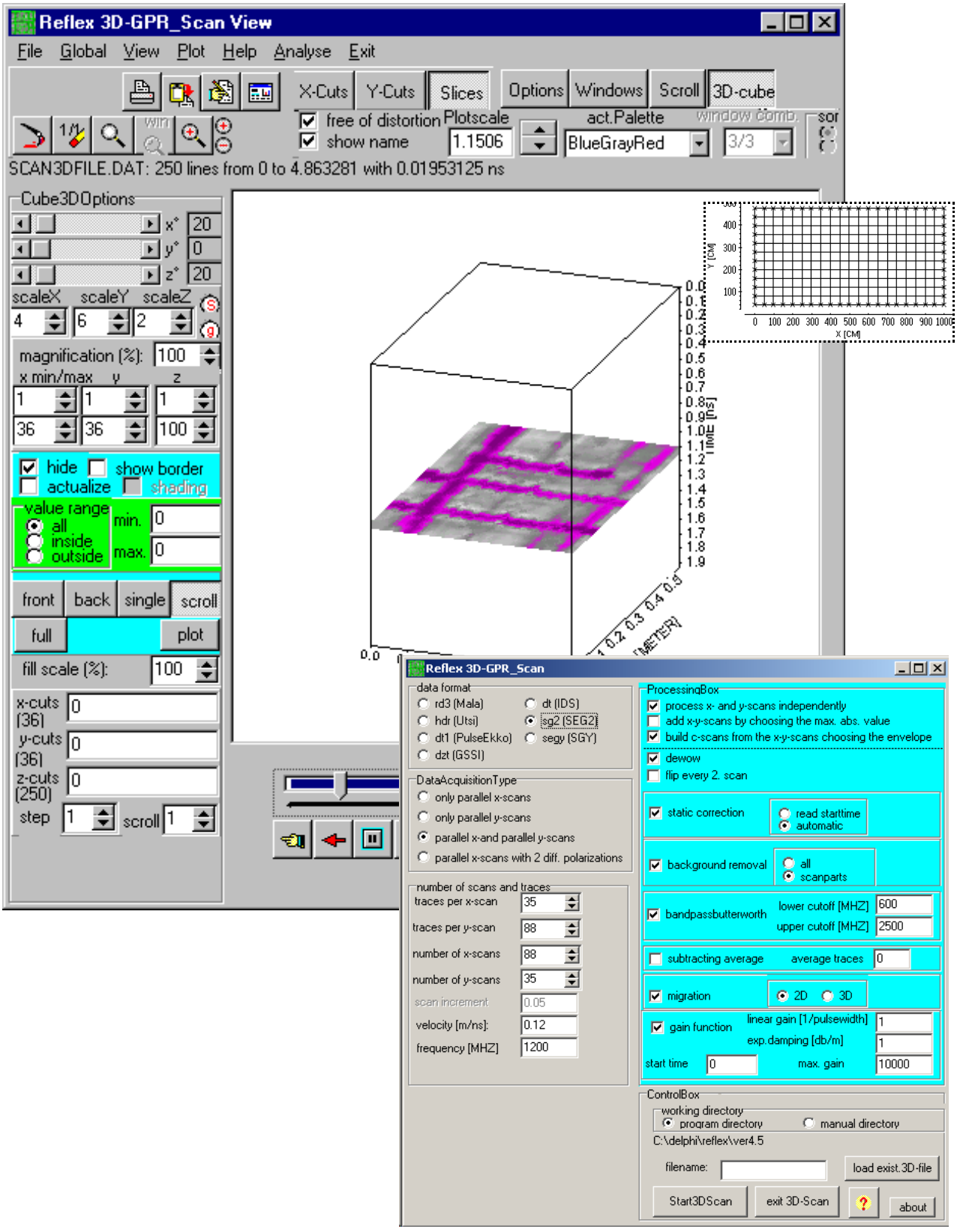
# Reflex 3D-Scan

The program **Reflex 3D-Scan** allows to import and to analyse automatically rectangular 3-dimensional GPR-data which have been acquired along 2D-parallel lines in one or two perpendicular directions.

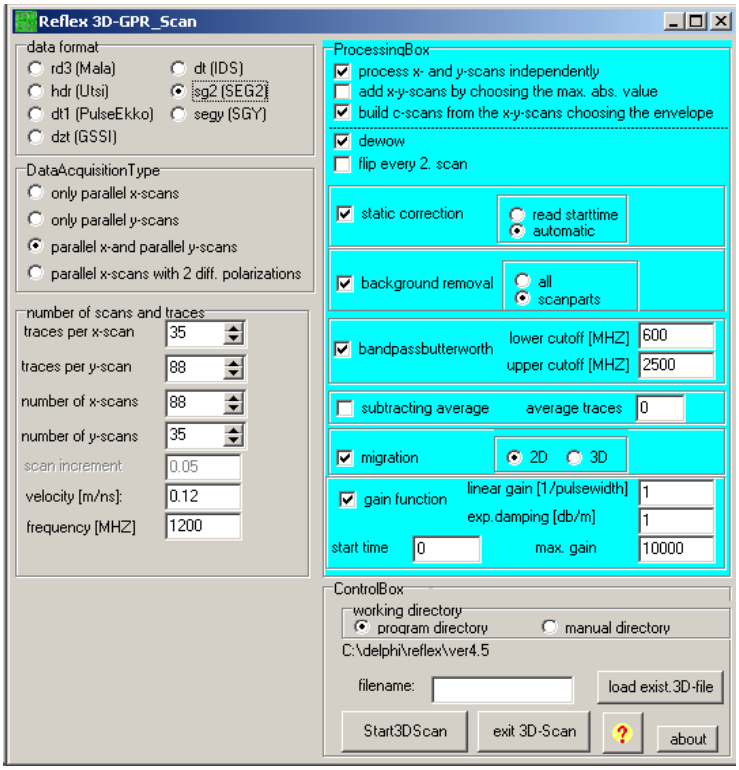
If the preconditions (see chap. 1) are satisfied the 3D-scan program allows a **very fast interpretation of your 3D-data**.



## contents

# 1. Geometry and processing menu

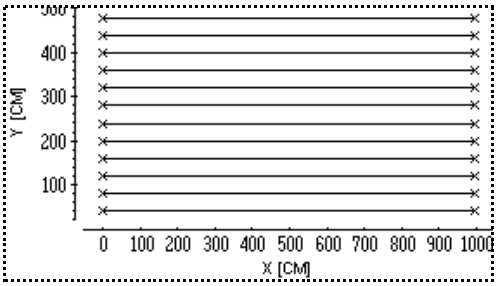
Precondition is that the data have been acquired along equidistant parallel 2D-lines on a regular rectangular grid. This means that the traceincrement in one direction (x or y), the number of traces into this direction, the start- and endpositions of the 2D-lines and the scan increment between the 2D-lines must be equal.
The **traceincrement** must be given within the original data.
In addition if the data have been acquired in two perpendicular directions the increment between the parallel lines **(scan increment**) must equal the traceincrement.
If these preconditions are satisfied the 3D-scan program allows a very fast interpretation of your 3D-data.



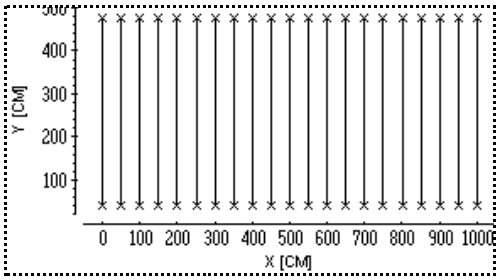

The program supports the **dataformats** of the following GPR-manufactures:
Mala (rd3 files), Utsi (hdr files), PulseEkko (dt1 files), GSSI (dzt files) and IDS (dt files). In addition the SEG2- and the SEGY-dataformat are supported. The dataformat must be specified within the **data format box**.
For both the SEG2 and the SEGY-format the data are assumend to be in ns. In the case of SEGY-data the timeincrement is assumend to be in ps.

It is possible to analyse parallel lines in one direction or two perpendicular directions. This has to be specified within the **DataAcquistionType box**.

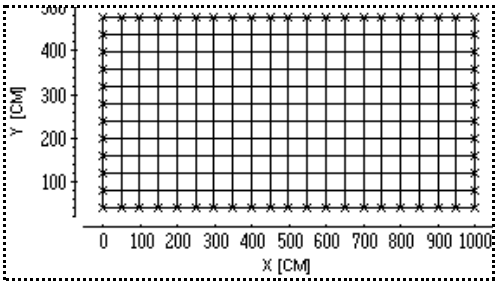
Choose *only parallel x-scans* if you only have acquired parallel lines in x-direction.



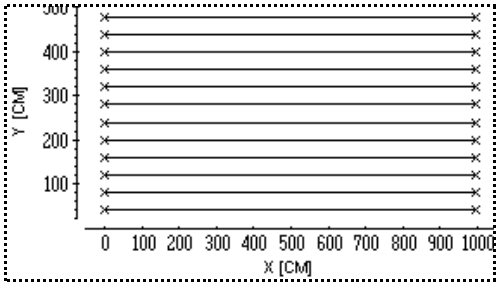

Choose *only parallel y-scans* if you only have acquired parallel lines in y-direction.




Choose *parallel x- and parallel y-scans* if you have acquired both parallel lines in x-direction and y-direction.




Choose *parallel x-scans with 2 diff. polarizations* if you have acquired parallel lines in x-direction with 2 different antenna polarizations - the first one perpendicular to the scan direction (equal y) and the other one parallel to the scan direction (equal x).




The original data may be stored on individual 2D-files or on one 3D-file with the 2D-lines sequentially stored.
To be considered: The data must start with the x-scans at the 0-position until the last position of the x-scans and then the y-scans follow.
If the data have been acquired on different files the program automatically sorts the files after the filenaming in alphabetical order. Therefore the naming of the individual filenames must have been done in such way that the above sorting condition holds true.
Example 1: 2 3D-files: filex.rd3 (parallel x-scans) and filey.rd3 (parallel y-scans). The sorting condition holds true because filex.rd3 will be the first file after the filename sorting.
Example 2: 20 2D-files in x-direction and 15 2D-files in y-direction: file01x.rd3 - file20x.rd3 and file01y.rd3 - file15y.rd3. Again the sorting condition holds true.

Depending on the chosen dataacquistion type you have to specify the number of scans and traces in x- and/or y-direction within the **number of scans and traces box**. Here you also may specify the mean velocity of the underground (necessary for example for the migration and for the depth axis), the nominal frequency (necessary for exampe for the static correction) and the scan increment perpendicual to the scan direction. The traceincrement will be read from the original data. If both x-

and y-scans have been acquired the scanincrement must be equal to the traceincrement.
The program automatically controls if the total number of traces of the original data equals the entered total number (traces per x-scan*number of x-scans + traces per y-scan*number of y-scans). If the numbers differ a warning message appears and you may cancel the interpretation or not. There might be different causes for the difference:
1. The entered number of scans and traces is wrong - please cancel the process and enter the correct numbers.
2. The data have been stored on individual 2D-files and the number of traces per scan is not exactly the same for all 2D-lines although a wheel has been used. In this case a reinterpolation of the individual 2D- lines might be okay in order to compensate for the errors. The program automatically performs such an interpolation if the process has not been cancelled by the interpreter. This is possible if the original data have been stored on individual 2D-files because in this case the endposition of each scan is fixed.
3. The data have been stored on a 3D-file and the number of traces per scan is not exactly the same for all 2D-lines within the 3D-file although a wheel has been used. In this case no reinterpolation of the individual scans can be done because the endpositions of the 2D-scans are not know. Therefore cancelling of the process is recommended.

Optionally some filter steps are automatically performed. These must be defined within the **ProcessingBox**. They are: dewow, static correction, background removal, migration (2D and 3D) and gain in timedirection.
Dependent on the original data different processing steps must be chosen. The data from Mala, Utsi, PulseEkko and IDS are normally raw data, this means no analog gain or filter has been applied during the data acquistion. Therefore the dewow filter and the gain should always be used. Often a static correction is useful for all dataformats and the migration should be used if diffractions are present. The background removal may significantly increase the data quality but in some cases the opposite effect may happen. Therefore there is no general rule if and how to use this filter.

**dewow:** With this option activated a running mean value is calculated for each value of each trace. This running mean is subtracted from the central point. The time window for the calculation of the running mean value is calculated from the entered frequency given in MHZ. This filter may be used for eliminating a possible low frequency part (dewow). The filter may not be enabled if a high pass filter has already been applied during the data acquisition.
**flip every 2. scan:** With this option activated every 2. scan will be flipped in scan direction. This allows you to process and interprete data which have been acquired in a meandering manner (forth and back).
**static correction:** With this option activated a static, this means a time-independent correction for each trace in time direction will be done. The time shift will either be read from the original data (option read starttime activated) or will be automatically determined from the data (option automatic activated). The data above the time shift level will be lost.
With the suboption automatic activated the timeshifts are automatically determined. For that purpose the first significant first arrival (the amplitudes must exceed 10 % of the max. value within the trace) will be searched which gives the timeshifts for each trace.
**background removal:** This filter performs a subtracting of an averaged trace, a so called background removal. With this option you can eliminate temporally consistent noise from the whole profile and therefore possibly make signals visible, previously covered by this noise. This filter method also suppresses horizontally coherent energy. Its effect is also to emphasize signals which vary laterally (e.g. diffractions).
The average trace will be built either from the complete 3D-data (suboption all activated) or for each 2D-line within the 3D-datavolume separateley (suboption scanparts activated) over the complete timerange.
attention: it might happen that the filter causes non real signals. This holds true when the averaged

time series contains energy which is not present within any part(s) of the profile.
**bandpass butterworth:** Here you can apply a bandpass filtering in the time domain using a recursive filter. The filter band is specified by the setting of two frequency values. The first point determines the lower cutoff frequency, the second one the higher cutoff frequency. The frequency spectrum below the low cut and above the high cut frequency is set to zero. By the corresponding choice of the points of the bandpass either a lowpass or a highpass can be approximately realized.
Noise can be suppressed with the bandpass filter when it differs from the signal in its frequency content.
**subtracting average:** The filter performs a subtracting average over a choosable number of traces for each time step. The filter performs a so called sliding background removal. The subtracting average is performed over a number of traces (parameter average traces). The max. bandwidth is restricted to 256 traces to be averaged. For a bandwidth of 4 the current sample, the next two in horizontal direction to the left and the next two in horizontal direction to the right, i.e. five samples for each time value, are taken into account. From these five samples the mean value is calculated. This mean value is subtracted from the value of the current sample and the result is assigned to the current sample as new value. The filter is the more effective the smaller the selected bandwidth.
This filter method suppresses horizontally coherent energy. Its effect is to emphasize signals which vary laterally (e.g. diffractions).
**migration:** A 2D or 3D fast fk-migration on the basis of a constant velocity is performed. The profile must represent a so called zero-offset profile, i.e. shot and receiver have to be at the same location. The goal of the migration is to trace back the reflection and diffraction energy to their "source". A zero offset section often does not represent the "true" position of the reflectors mainly for steep layers. After the migration often a better approximation to the reality is given. If strong diffractions are present the migration tries to contract these diffractions to a minimum. This is useful for an interpretation using timeslices for example.
The method works in the frequency-wavenumber (fk) range (see also fk spectrum). Within the fk-range a variable transform is done based on the entered constant velocity (frequency is transformed onto the vertical wavenumber). First the x-t data are tranformed into the f-k-range. After having done the transformation the migration process will be done and after that the back transformation into the x-t-range is performed.
**gain function:** The filter facilitates the possibility of multiplying the data points by a given function g(y) or g(t) respectively. The function g(t) consists of a linear and an exponential part: $g(t)=(1+a*t)*e^{(b*t)}$ with a=a'/pulse width and b=b'*v/8.69 with v=0.1 m/nsec or 1.0 m/msec respectively. The pulse width is automatically taken from the nominal frequency if given (see option FileHeader Edit). Otherwise, the nominal frequency is automatically determined from the first arrival. The two filter parameters a'(linear gain) and b'(exp. damping) must be entered. a': not dimension except for the case of non set nominal frequency; b': input in dB/meter. Default values are 1 for the linear gain and 5 for exp. damping. In addition you have to enter the start time (the filter starts at that time with value 1) and the max. gain.
The data are multiplied by this function in order to compensate for possible damping or geometric spreading losses.

If you have acquired both x- and y-scans you also may choose if the x- and y-scans may be processed independently and how the adding of the x- and y-scans shall be done. Activating the option ***add x-y scans by choosing the max. abs. value*** means that the x- and y-scans are not simply added but the max. absolute value will be determined and this value is taken as the sum value. This has the advantage that no information will be lost when the two different scans are added.
Activating the option ***build c-scans from the xy-scans choosing the envelope*** means that the c-scans(timeslices) are built independently choosing the envelope of the original data.

The program automatically creates some datafiles under the working directory for storing the intermediate results. They are Scan3DFile.dat, Scan3DFileSec.Dat, Scan3DFileX.00t and

Scand3DFileY.00t. These datafiles are always overwritten.
By default the **working directory** is the program directory. You may change the working directory (option manual directory activated). This setting is stored within Reflex3DScan Ini-File.

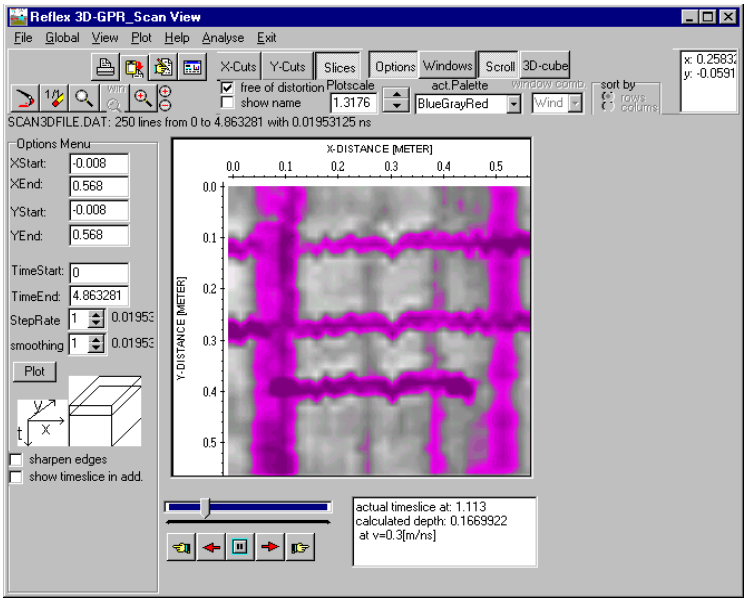
After having started the 3D-scan program (option **start3DScan**) the original data are queried (multiple file choice using the key str of shift). The default path for the original data is the actual program directory or the actual projectdirectory if started within Reflexw but you may load the data from any other path. Then the import, data sorting and processing will be done automatically and the **3D-GPR_ScanView** module opens. By default the Reflexw 3D-data are stored under the filename Scan3DFile.dat under the actual program directory.

You may specify the **filename** of the resulting 3D-file. The option **load exist.3D-file** allows to read an existing Reflexw 3D-file. In this case no processing will be done and the program directly enters the 3D-GEPR_ScanView module.

The input parameters of the Reflex 3D-GPR_Scan menu as well as the fonts and the color palettes are automatically stored when leaving the program under the file ref3dscan.fil under the program directory.

## 2. 3D-GPR_ScanView

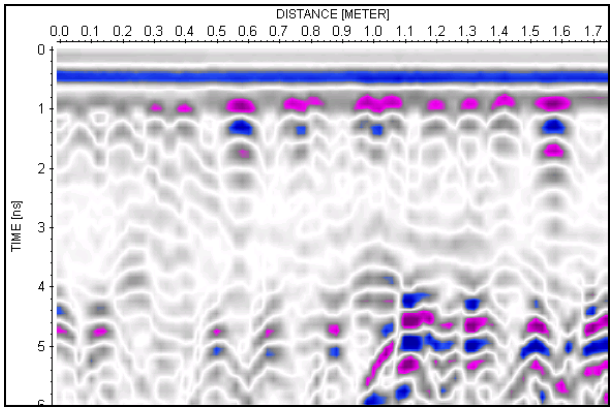
After all the sorting and processing steps have been finished the **3D-GPR_ScanView menu** opens (see picture on the right). This module allows the interpretation of the 3-dimensional data by displaying x-, y- or z-slices or the full 3D-data volume.

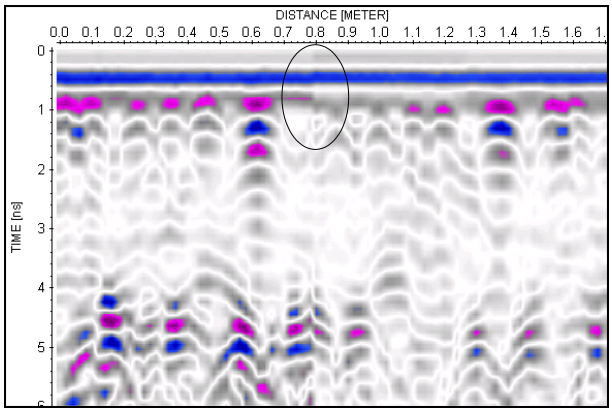



The 3D-data are completely loaded into the RAM of the computer whereby a fast visualization of the data is possible. The max. number of points in each direction (x, y and z or t) is 1024.Three different display options are available (option **windows**, option **scroll** and option **3D-cube**).

Use the options **X-Cuts(y-scans)**, **Y-Cuts(x-scans)** and **Slices** to determine which 2D-cut of the 3D-file you want to be shown. With X-Cuts(y-scans) activated all existing cuts perpendicular to the x-direction (y-scans) may be chosen. With Y-Cuts(x-scans) activated all existing 2D-cuts perpendicular to the y-direction (x-scans) may be chosen. With Slices activated all existing 2D-cuts along the time-direction may be chosen. The actual 2D-cut within the total 3D-cube is shown within the lower image of the option menu.
With slices activated the data are shown using the envelope for each trace.

When clicking on X-Cuts or Y-Cuts each cut must contain the correct number of traces. A wrong trace number entered within the Scan3D menu causes a wrong sorting of the 3D-dataset and the complete assignment will become incorrect. One check is done during the data sorting whre the program automatically controls if the total number of traces of the original data equals the entered total number (traces per x-scan*number of x-scans + traces per y-scan*number of y-scans). If the numbers differ a warning message appears. Nevertheless you always should manually control whether the data have been correctly sorted. An example shows how it should look like.




The left image is correct whereby the right image shows a significant vertical jump at about 0.8 m indicating the beginning of a new 2D-scan which should always be at 0 m. In the right image obviously the wrong trace number resulting in a wrong sorting has been used. Such a vertical jump indicating the beginning of a new 2D-scan can be best recognized within the first arrival - therefore this test should be done for unprocessed data.
The following options are availabe for all display options:

 Use this option if you want to print out the data.
With the option **scroll** activated either the actual 2D cut (2D-line) is printed or the total number of 2D cuts (2D-lines) actually chosen within the option box are printed (activated option print several files within the print menu).
With the option **window** activated the actually chosen 2D-cuts (2D-lines) are printed out on one paper sheet using the actual window combination. After having finished the Print Menu the complete size of the print output and a corresponding query (okay or not) are shown.
With **print filecomment** activated both the comment stored in the fileheader of the 3D-file and an additional comment about the actual position of the 2D-cut are printed out. See also online Print Menu help.

 copy actual data bitmap to the clipboard. A clipboard scale factor is queried. A factor larger than 1 allows you to increase the size of the bitmap to be transferred and therefore to increase the resolution.

 enter FileHeader Edit

 enter PlotOptions

 replot actual line with actual zoom parameters

 resets the x- and y-scale values (zoomvalues) to 1 and replots the actual line

**Plotscale:** The minimum and maximum amplitude values are controlled by the multiplication factor Amplitudescale. With a value of 1 for Amplitudescale the amplitudes range from -2048 to 2048 for unnormalized data and from -1 to 1 for tracenormalized data. With a Value of 0.0625 the amplitudes range from -32768 to 32768 (see also Amplitudescale under Pointmodeattributes).

**Processing:** here you may enter the type of display for the 3D-file. By default envelope timeslices only has been activated.
**no** means that the data are displayed as they are.
**absoluteValues:** if activated the absolute values are calculated and shown. Activating this option is useful for slices for example.
**envelope:** if activated the envelope of each trace of the 3D-file is calculated and shown. Activating this option is useful for slices for example.
**envelope timeslices only:** with this option activated the envelope of each trace of the 3D-file is calculated and shown for the timeslices only (option slice activated). For the other cuts (x-cuts and y-cuts) the "normal" traces will be shown.

The following options only concern the display modes scroll and windows:

 enable magnifying glass function

 enable manual zoom - With the option ZOOM an arbitrary area of the data set can be selected and plotted in full screen size.

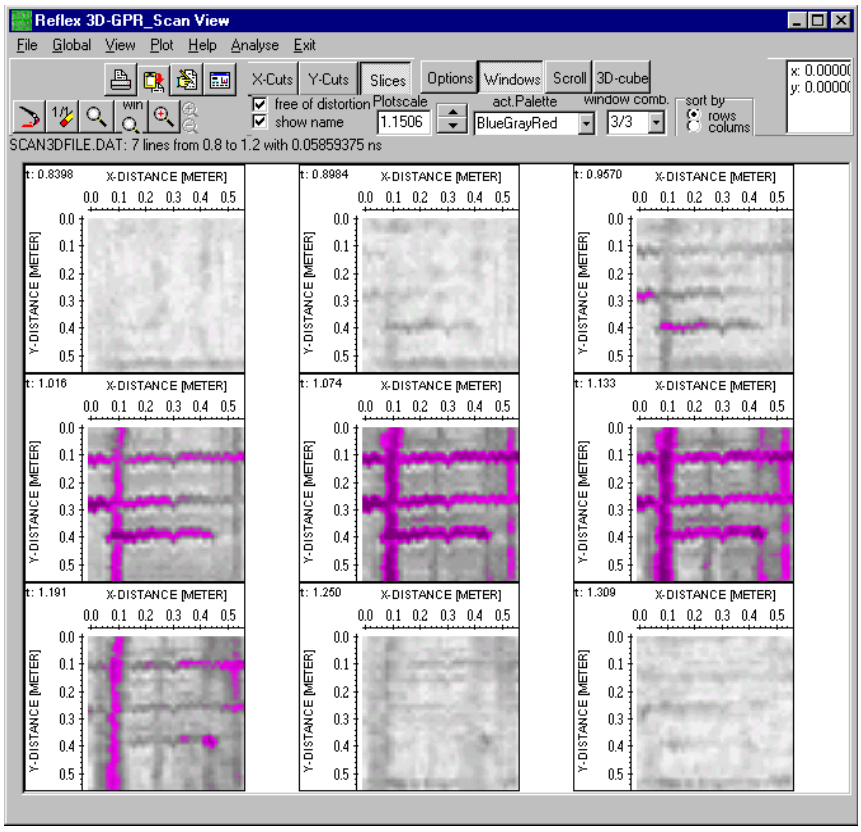
With the option **show name** activated the filename or the actual slice is shown at the top of each cut (line).
**free of distortion:** activate this option if you want the display of the slices to be free of distortion, this means the axis in x- and y-direction have the same scale. The option is only active for slices.

**create MPEG-file:** option under analyse allows to create a MPEG moviefile for the later use with a MPEG-player. The MPEG moviefile may only be created for the Scroll and the Cube3D mode. After having activated the option a new window named create MPEG-file opens which stays on the top. First you must enter the filename (without extension). The MPEG-file will be stored under the actual projectdirectory with the extension mpg. The compression/quality relation may be changed as well as the frequency. Start the recording by pressing the record button. Now the other 3 buttons (play, pause

and stop) are enabled. The play button will be automatically activated and the first slide is added to the MPEG movie. As long as the play button is activated each new slide will be added (e.g. when using the scroll bars or when using the plot option). The actual slide number is shown. If you want to interrupt the MPEG-construction use the button pause. The button stop finishes the construction and the MPEG-file will be closed.

## 2.1 Windows option

Using the option **windows** the cuts are displayed in manually scalable windows.
Activating one of the three different **cuts** (X-Cuts, Y-Cuts or Slices) allows to display several 2D-cuts of the 3D-cube, placed in freely choosable manner within the working window.
The **coordinate** parameters within the Options Menu are automatically set. The max. number of cuts to be displayed simultaneously is 25. The program automatically calculates the StepRate for the given cut range (in this example TimeStart and TimeEnd) and calculates the increment. You may manually change these parameters.
The option **window comb.** allows to choose the combination of the windows to be subdivided in horizontal and vertical direction. the possible combinations are automatically predefined. If you have 24 different cuts to be displayed you may choose the combination 8/3 - this means the screen is subdivided into 8 horizontal and 3 vertical cuts.
The options **sort by rows** and **sort by columns** define the sorting. With sort by rows activated the first cuts are displayed within the first row, the next ones within the second row and so on. With sort by columns activated the first cuts are displayed within the first column, the next ones within the second column and so on.
The option **Options** can be deactivated. In this case the OptionsMenu disappears and the full screen is visible.



The following options control the contrast of the images:

**sharpen edges:** if activated an algorithm will be applied for the plotting which sharpens the edges of the different elements within each image.

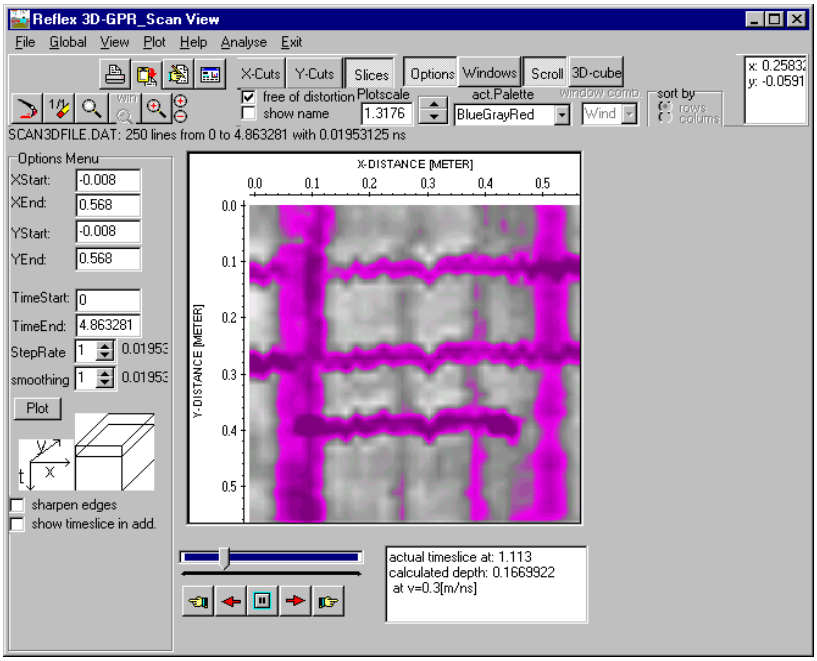
**contrast stretching:** if activated a contrast stretching will be applied. Contrast stretching is a simple image enhancement technique that attempts to improve the contrast in the image by `stretching' the range of intensity values it contains to span a desired range of values. It differs from the more sophisticated histogram equalization in that it can only apply a linear scaling function to the image pixel values. As a result the `enhancement' is less harsh. If activated the function drastically changes the amplitude distribution within the slice. Therefore no significant statement over the original amplitude distribution is posbbile any more.

**histogram equalization:** if a activated a histogram equalization will be applied. The histogram shows the occurrences of each intensity value in the image. Histogram equalization is a technique by which the dynamic range of the histogram of the image is increased. Histogram equalization assigns the intensity values of pixels in the input image such that the output image contains a uniform distribution of intensities. It improves contrast and the goal of histogram equalization is to obtain a uniform histogram. If activated the function drastically changes the amplitude distribution within the slice. Therefore no significant statement over the original amplitude distribution is posbbile any more.

The following option allows to export the current cut:

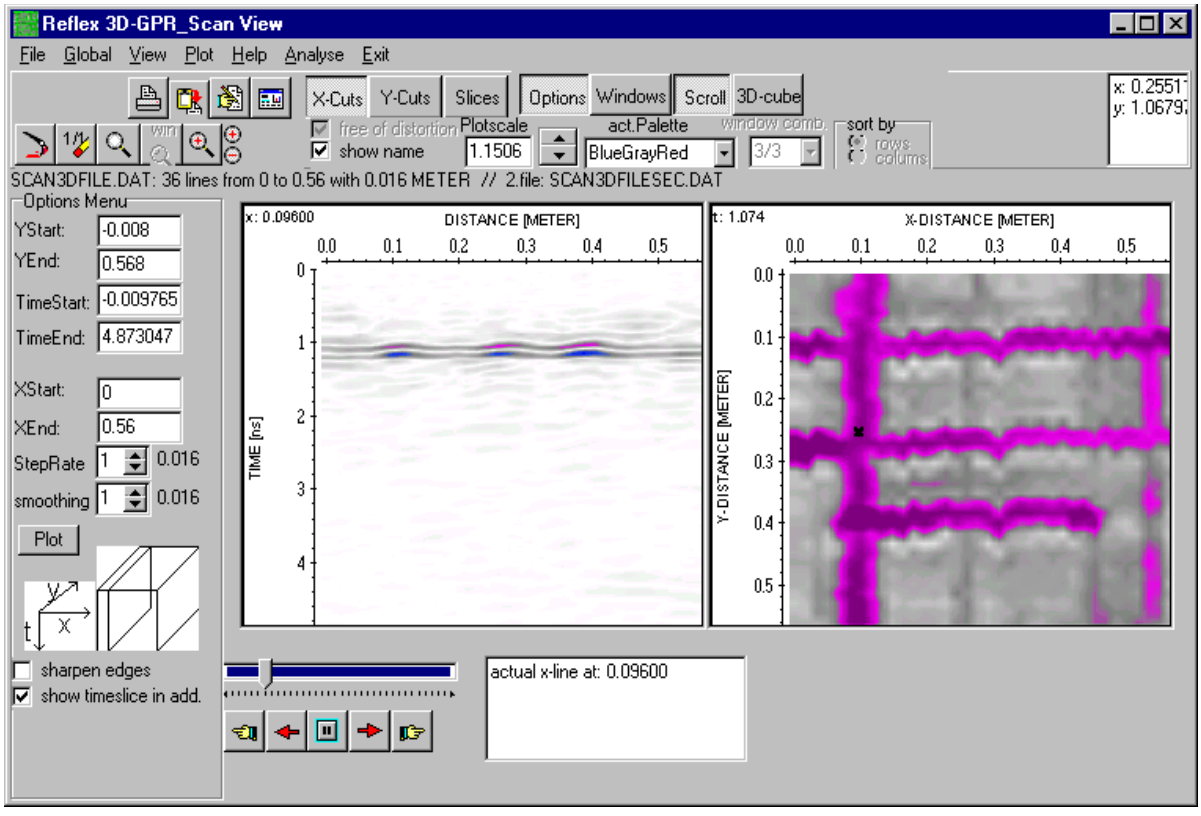
**GeoTiff export:** allows to export the current cut to a tiff file together with a tfw world file. The x- and y-coordinates within the world file should be ignored either only one cut has been plotted.The format of the world file is:
pixel X size
rotation about the Y axis (usually 0.0)
rotation about the X axis (usually 0.0)
negative pixel Y size
X coordinate of upper left pixel center
Y coordinate of upper left pixel center
The tiff file size corresponds to the actual window size and the following plotoptions are automatically used:
no axis (plotoption showaxis automatically deactivated)
max. y-value on top (plotoption flip y-axis automatically activated)
A clipboard scale factor is queried. A factor larger than 1 allows you to increase the size of the bitmap to be transferred and therefore to increase the resolution.
The filename is automatically determined from the 3D-datafilename and the last current cut shown within the window. Example:
3D-datafilename: file01_3D.00t
last current cut: sclice: 0.58
resulting tiff-filename: file01_3Dt_ 0_58.tif
resulting word file: file01_3Dt_ 0_58.tfw

## 2.2 Scroll option




Using the option **scroll** you may continuously move through the 3D-cube either in x- (X-Cuts), y- (Y-Cuts) or z- (Slices) direction using the track bar or the arrows.
The coordinate parameters within the Options Menu are automatically set. The option StepRate allows you to change step rate for scrolling. Every step range 2D-cut will be plotted when scrolling.
The option smoothing allows to enter a value for smoothing the data in the scroll direction. A value of 1 means no smoothing. A value of 2 means that 2D-cuts are summed up and the mean values are calculated. The smoothing parameter is independent from the StepRate parameter.

With the option **show timeslice in add.** activated the actual timeslice depending on the mouse position is shown in a second window for the scroll mode and for x- or y-cuts. The timeslice is shown based on the envelope data. The actual cursor position is marked by a cross within the timeslice. The screen is either split vertically or horizontally depending on the settings within the plotoptions. The option will be automatically deactivated if one switches to the windows or the 3D-cube mode. The left mouse button allows to scroll one cut forwards and the right mouse button to scroll backward (precondition: pick option deactivated).



The following options control the contrast of the images:

**sharpen edges:** if activated an algorithm will be applied for the plotting which sharpens the edges of the different elements within each image.

**contrast stretching:** if activated a contrast stretching will be applied. Contrast stretching is a simple image enhancement technique that attempts to improve the contrast in the image by `stretching' the range of intensity values it contains to span a desired range of values. It differs from the more sophisticated histogram equalization in that it can only apply a linear scaling function to the image pixel values. As a result the `enhancement' is less harsh. If activated the function drastically changes the amplitude distribution within the slice. Therefore no significant statement over the original amplitude distribution is posbbile any more.

**histogram equalization:** if a activated a histogram equalization will be applied. The histogram shows the occurrences of each intensity value in the image. Histogram equalization is a technique by which the dynamic range of the histogram of the image is increased. Histogram equalization assigns the intensity values of pixels in the input image such that the output image contains a uniform distribution of intensities. It improves contrast and the goal of histogram equalization is to obtain a uniform histogram. If activated the function drastically changes the amplitude distribution within the slice. Therefore no significant statement over the original amplitude distribution is posbbile any more.

The following options allow to export the current cut:

**ASCII-export:** allows to export the current cut to ASCII GRD-format (see also Dataexport, chap. 1.6). The data are written out sample after sample (option x-(distance)-direction activated within chap. 1.6). The second line contains the number of traces and of samples. The third line contains the start and end-position in x-direction, the fourth line the start and end-position in y-direction. Each of the following lines contains all amplitude values of one y-sample. The option is only enabled within the scroll mode. The ASCII-filename is automatically determined from the 3D-datafilename and the current cut. Example:
3D-datafilename: file01_3D.00t
current cut: x: 0.58
resulting ASCII-filename: file01_3Dx_ 0_58.grd

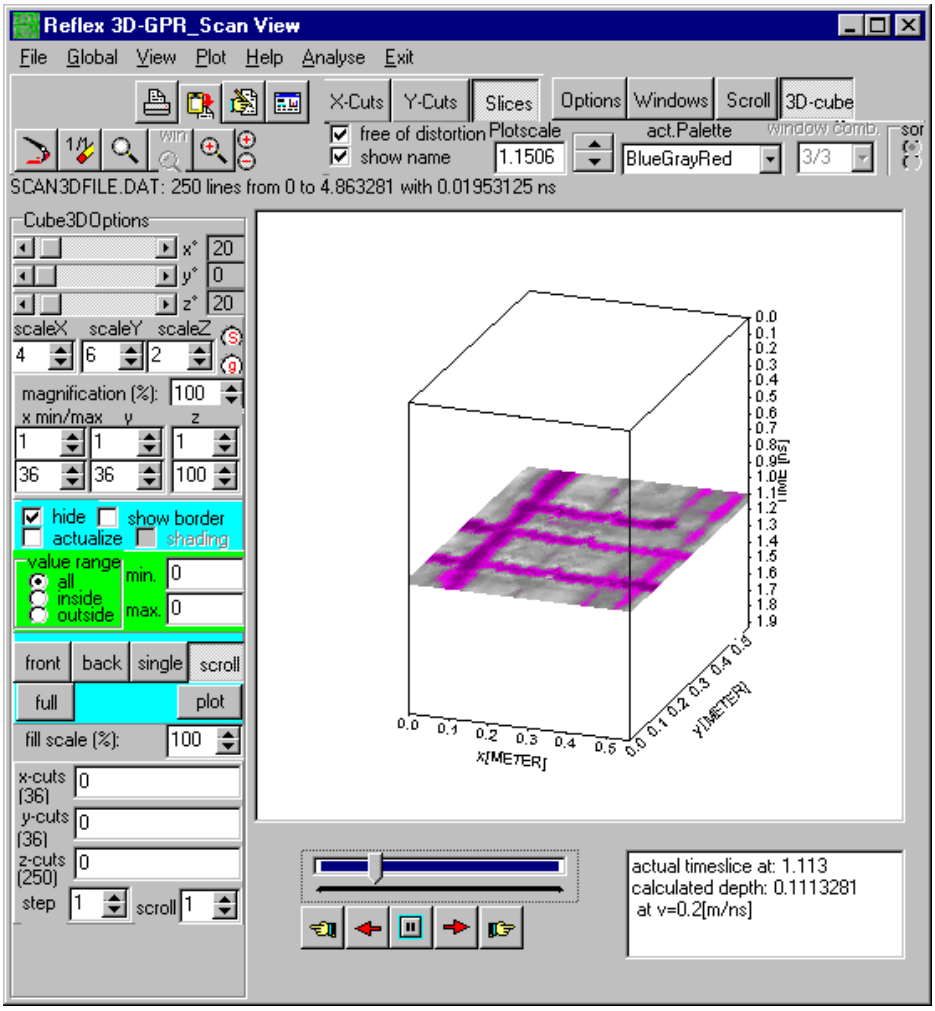
**GeoTiff export:** allows to export the current cut to a tiff file together with a tfw world file. A world file file is a plain ASCII text file consisting of six values separated by newlines. The format is:
pixel X size
rotation about the Y axis (usually 0.0)
rotation about the X axis (usually 0.0)
negative pixel Y size
X coordinate of upper left pixel center
Y coordinate of upper left pixel center
The tiff file size corresponds to the actual window size and the following plotoptions are automatically used:
no axis (plotoption showaxis automatically deactivated)
max. y-value on top (plotoption flip y-axis automatically activated)
A clipboard scale factor is queried. A factor larger than 1 allows you to increase the size of the bitmap to be transferred and therefore to increase the resolution.
The filename is automatically determined from the 3D-datafilename and the current cut. Example:
3D-datafilename: file01_3D.00t
current cut: sclice: 0.58
resulting tiff-filename: file01_3Dt_ 0_58.tif

resulting word file: file01_3Dt_ 0_58.tfw

**Reflex 2D-file:** generates a Reflex 2D-file of the actual cut. The filename is automatically determined from the 3D-datafilename and the current cut and will be stored under the path rohdata under the actual projectdirectory. Example:
3D-datafilename: file01_3D.00t
current cut: x: 0.58
resulting Reflex 2D-filename: file01_3Dx_ 0_58.dat

## 2.3 3D-cube option

Using the option **3D-cube** allows the three-dimensional plotting of the 3D-data volume within predefinable spatial limits and an arbitrarily definable observation point. Thus you have the possibility to look at the cube from different angles, e.g. from the front side, the back side or from the side.
The **size** of the 3D-cube is determined from the number of the points into the different directions x, y and z(time). The point numbers are displayed within the options min/max for x, y and z. Here you also may restrict the range. The axis scales of the 3D-cube are based on these values and do not correspond to the real coordinates. This may significantly differ for example if the 3D-datafile has been created without interpolation (traceincrement and lineincrement differ significantly). It is possible to change the axis scales using the options **ScaleX**, **ScaleY** and **ScaleZ**.
You have the possibility to look at the cube from different angles, e.g. from the front side, the back side or from the side. The angles can be changed manually within the options **x°**, **y°** and **z°** or using the mouse with pressed left mouse button within the 3D-cube display. The options and allow the saving of the current 3D-cube display parameters(angles and scaling values and the magnification) and to read them from the disk (filename cube3Dpar.txt).
You have different display possibilities. You may select if only the front or back planes of the data cube are displayed (options **front** and **back**) or the full 3D-data volume (option **full**). In addition you only may select single cuts (option **single**) and scroll (option **scroll**) through the cube in one distinct direction.



It is possible to restrict the datavalue range to be considered. Within the **value range** radiobox you may select if all data points (parameter **all** activated) or if only a special datavalue range (parameter **inside** or **outside** activated) is considered. The datavalue range is defined within the editfields **min.** and **max.**. With the parameter inside activated all data values lying inbetween the specified min. and max. value are considered. With the parameter outside activated all data values lying outside of the specified min. and max. value are considered.

The parameter **fill scale (%)** allows you to control the filling of the cuts. The option is not available for the full plot mode. By default the value is set to 100 %. The value range is restricted between 100 and 200 %.
It might happen that certain parts of a cut may not fully be covered by the used interpolation scheme. This results in white points normally arranged in a distinct pattern. In this case you may increase the fill scale parameter in order to avoid this problem. To be considered: Increasing the fill scale parameter results in a decrease of the resolution.

The option **hide** controls if not visible parts of profiles are covered (option activated) or not (option deactivated). With the option deactivated the max. amplitude value will be displayed.

The option **actualize** controls if the cube display is always actualized when changing a parameter like roatation degree or scaling.

The option **plot** enables the plotting of the 3D-data volume based on the actual settings.

With the option **front** activated only the front planes of the data cube are displayed when pressing the plot option. In addition you may select a distinct **cornerpoint** which serves as the starting point for a cutting out of the cube. The size of this cube sector in the 3 directions (options x, y and z) can be changed individually or jointly (option synchronize activated). With the option **synchronize** activated the size in the other 2 directions are automatically changed when changing the size of any direction.

With the option **back** activated only the back planes of the data cube are displayed when pressing the plot option. In addition you may select a distinct **cornerpoint** which serves as the starting point for a cutting out of the cube. The size of this cube sector in the 3 directions (options x, y and z) can be changed indiviudally or jointly (option synchronize activated). With the option **synchronize** activated the size in the other 2 directions are automatically changed when changing the size of any direction.

With the option **single** activated it is possible to plot any combination of x-,y- or z-cuts. You may enter single numbers separated by commas, blocks with dash or combination of the two (e.g. 5,6,7,10-20). The option step is used when the cuts
are defined using numbers separated by a dash (e.g. 10-20, step rate: 2 - the following cuts are plotted: 10, 12, 14, 16, 18, 20).

With the option **scroll** activated it is possible to continuously move through the 3D-cube either in x-, y- or z-direction using the track bar. The **scroll** rate is freely choosable.
The control panel below the track bar allows an automatic scrolling through the 3D-cube:


scroll to smaller cuts


stop scrolling


scroll to higher cuts

Use the options **X-Cuts**, **Y-Cuts** and **Slices** in the upper control panel to determine which 2D-cut of

the 3D-file you want to scroll. With X-Cuts activated all existing cuts perpendicular to the x-direction may be chosen. With Y-Cuts activated all existing 2D-cuts perpendicular to the y-direction may be chosen. With Slices activated all existing 2D-cuts along the time-(z-)direction may be chosen.
It is possible to plot a "background" in addition. For that purpose you may define any x-, y- or z-cuts.You may enter single numbers separated by commas, blocks with dash or combination of the two (e.g. 5,6,7,10-20) - see also option single.

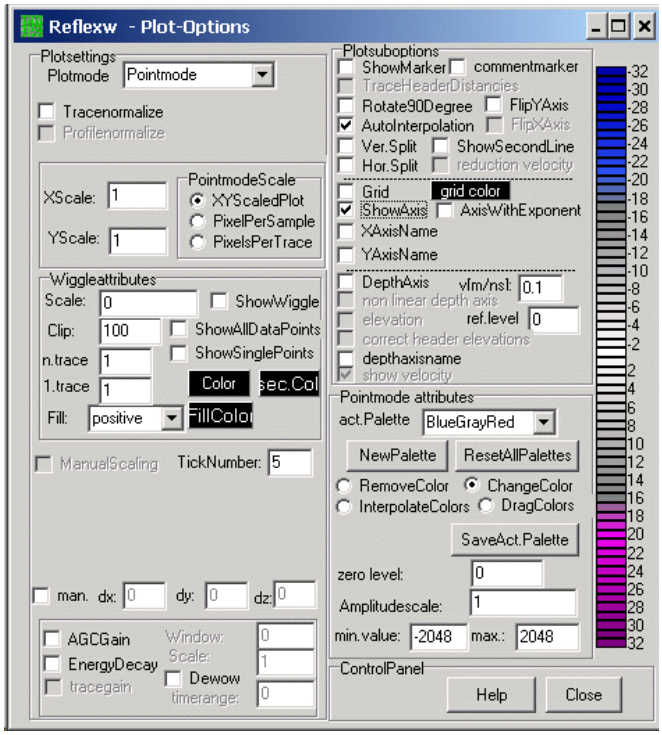
With the option **full** activated all the data of the 3D-cube are displayed. There are two possibilities to plot the whole data:

1. With the option **hide** activated and a **threshold** chosen, the data with having firstly an amplitude higher than the chosen threshold and secondly the smallest distance to the observation point will be plotted: By this means a possibility is given to "look through" certain parts of the 3D-data volume, whose amplitude values are smaller than the chosen **threshold** value.
   Using the option **shading** in addition a shading algorithm is used to give certain objects a contour. Shading is based on the spatial derivatives of the distances from the observation point. Data points with a small change rate are lightened whereas data points with a high rate are darkened. The min. and max. change rates are taken from the data. In many cases some very high change rates will occur. Therefore filtering of the change rates is necessary (box **use filter for shading**). You may choose between **no** (no filtering), **sqrt** (square root), **ln** (natural logarithm) or **median** (the max. value is restricted to twice the median), which is the standard filter option.
   To display the data, it is possible to use the **actual color palette** together with a contrast value or a **gray shade palette** from bright to dark. If you are using the gray shade palette the data points with the smallest distance change rates are white and the data points with the highest change rates are black. If you are using the actual color palette you must enter the **contrast** value. The color associated with the actual data point is brightened or darkened according to the relative change rate and the entered contrast. The max. contrast value is 255.

2. With the option **hide** deactivated the maximum amplitude will be plotted by taking into consideration only the chosen **threshold** and not the distances to the observation point. Therefore, no shading is possible in this case.
   For instance, this option can be used to "cut open" line or point diffractors, respectively, in migrated data. Assuming that the energy increases up to the middle of the diffractor and then decreases again, a point diffractor, e.g., will be displayed in plane view (x-y-plane, e.g.) as concentric circles with increasing amplitudes up to the middle.

# 3. PlotOptions

Within this menu you may change the current plot settings.




## 3.1 Plotsettings

**Plotmode:** The option allows the specification of the plottype. You may choose between pointmode and wigglemode.
**Pointmode** means that the data are plotted with colored pixels according to the predefined color-amplitude configuration (see also pointmodeattributes).
**Wigglemode** means that each trace of the profile is plotted as a polygonal line. The size of the deflections of each wiggle is controlled by the parameter scale (see also Wiggleattributes).
The two modes might be used together if the pointmode is chosen together with the activated option **ShowWiggle**.

Three different scale modes are incorporated:

**XYScaledPlot:** Activating this option means that the data are completely plotted into the current window provided that the two scale options **XSCALE** and **YSCALE** are set to 1. Increasing the number of the scale options means a zooming up, decreasing means a zooming down. This mode is recommended.

**PixelsPerSample:** Activating this option means that the plotting size of each data point is given in screen pixels. The size in x-(distance) direction and y-direction can be changed using the option **XSCALE** and **YSCALE** respectively.

**PixelsPerTrace:** Activating this option means that the distance between successive traces is given in screen pixels (option **XSCALE)**. In every case the complete time series of each trace is plotted corresponding to the size of the current window. This means no zooming possibilities in y-(normally time-)direction are given for that scale mode.

**XScale:** enter a value for the window scaling in x-(normally distance-)direction. If PixelsPerTrace or PixelPerSample is activated, the parameter gives the distance between successive traces in pixels. If XYScaledPlot is activated, the parameter gives the x-zooming value corresponding to the current profile window (e.g. a value of 2 means that half of the traces are plotted into the current window).

**YScale:** enter a value for the window scaling in y-(normally time-)direction. If PixelPerSample is activated, the parameter gives the range between successive points in pixels. If PixelsPerTrace is activated, the parameter has no meaning. If XYScaledPlot is activated, the parameter gives the y-zooming value corresponding to the current profile window (e.g. a value of 2 means that half of each trace length is plotted into the current window).

**Tracenormalize:** Activate this option if you wish the data to be plotted amplitude normalized for each trace. With the option profilenormalize deactivated (see below) the maximum amplitude of each

visible trace is normalized to 1. Like that a plotting is guaranteed, where all traces are well visible. Deactivate this option if you want to plot the data with real amplitudes. For the **wigglemode** the size of the individual deflections is controlled by the parameter Scale (tracenormalize: Scale = Size in Pixels, no tracenormalize: current amplitude * Scale = Size in Pixels). For the **pointmode** the parameter Amplitude scale controls the amplitude color assignment. For the display of timeslices the tracenormalize option should be deactivated.

**Profilenormalize:** with this option activated the normalization is not done based on the max. amplitudevalue of each trace but on the mean amplitudevalue of the complete profile. Thereby amplitude variations from trace to trace within one profile will remain but it is possible to compare profiles with different value scales. The option is only available with the option tracenormalize activated. To be considered for
Wigglemode: The entered wiggle size corresponds to the mean amplitude. Therefore you must enter a clip value greater than 100 for the greater amplitudes. Otherwise these amplitudes will be clipped. By default a clip value of 200 is set.
Pointmode: by default the amplitudescale is set to 0.5 - this means that the color amplitude assignment includes all amplitude values until twice the mean amplitude. Higher amplitude values are assigned to the max. color(s).

**Man.:** if activated the manual subdivision of the axis (options dx, dy and dz, see also chap. chap. 3.4 - manual scaling and incrementation) will be enabled - if deactivated the program automatically chooses a suitable incrementation.

**TickNumber:** Enter the number of ticks between the axis marks.

## 3.2 Pointmodeattributes

This group box controls the attributes for the pointmode. The color amplitude assignment consists of 128 different colors which are linearly distributed between a minimum and maximum amplitude value. The minimum and maximum amplitude values are controlled by the multiplication factor **Amplitude scale**. With a value of 1 for Amplitude scale the amplitudes range from -2048 to 2048 for unnormalized data and from -1 to 1 for tracenormalized data. With a Value of 0.0625 the amplitudes range from -32768 to 32768.

**act.palette:** load the wanted color palette from the stored palettes. The following palettes are predefined: Rainbow1, Rainbow2, Gray1, Gray2, Gray3, BlueGrayRed. You may add any changed or created palette by activating the option **SaveActPalette**.

**NewPalette:** enter this option for defining a new palette. Please choose 16 different colors from the color dialogue menu. Between these 16 colors a linear interpolation is automatically done in order to define the 128 different colors. The new color palette is shown in the color bar on the right-hand side.

**ResetAllPalettes:** this option resets all palettes to the default ones.

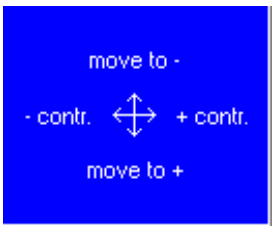
**SaveAct.Palette:** this option allows to save the current palette on disk with a freely choosable name.

**RemoveColor:** with this option activated you may remove any color from the color bar on the right-hand side by clicking on the corresponding color using the left mouse key.

**ChangeColor:** with this option activated you may change any color from the color bar on the right-hand side by clicking on the corresponding color using the left mouse key. The new color must be defined in the opened color dialogue menu.

**InterpolateColor:** with this option activated you may interpolate the colors between two choosable colors. Click on the two colors in the color bar using the left mouse key. After having chosen the second color, the in-between colors are linearly interpolated.

**DragColor:** two possibilities to interactively drag the colors are given




- a blue panel opens (see picture on the right) which allows to interactively change the colors when moving the mouse with pressed left mouse key within the panel. Starting from the midpoint increases the contrast to the right and decreases it to the left. The color table is moved to the colors which are assigned to negative amplitude values when moving to the top and vice versa when moving to the bottom. The changes are instantaneously shown within the loaded profile.
- you may continuously move a linearly interpolated color range. After having activated this option, please click on two different colors. In-between these colors a linear interpolation is done. The trackbar below may be used in order to increase or to decrease this color range.

The wanted color palette must be saved for a later use. Otherwise the original palette will be reloaded whenever you are entering the profile.

**Zero level:** enter a zero amplitude level for the color-amplitude assignment. The mean level of the color amplitude assignment is shifted by this given level. Thereby the color amplitude assignment is defined by this parameters and the value given for the Amplitude scale. A value 0 for zero level is useful for “normal” seismic or GPR-data. A value different from 0 is useful e.g. for displaying data with only positive or negative amplitude values (e.g. timeslices calculated on the base of absolute or envelope data).

**Amplitude scale:** The minimum and maximum amplitude values are controlled by the multiplication factor Amplitude scale. With a value of 1 for Amplitude scale the amplitudes range from -2048 to 2048 for unnormalized data and from -1 to 1 for tracenormalized data. With a Value of 0.0625 the amplitudes range from -32768 to 32768 provided the value of zero level is set to 0. The min. and max. Amplitude values are shown within the options **min. value** and **max. value** which also may be used for defining the amplitude scale. If new values will be entered here both the amplitude scale and the zero level will be updated accordingly.

**autom.scale:** the option allows to automatically define the min./max. amplitude range for the color/amplitude assignment. If activated the program extracts the min. and max. amplitudes from the actual profile or slice and uses these values for setting the color palette. The amplitude scale cannot be changed in this case any more.

**auto 0-symmetry:** If the option autom.scale is activated the 0-level of the color palette may be different from profile (slice) to profile (slice) as the min./max. values may vary. The option auto 0-symmetry overcomes this problem. If activated the absolute max. value will be determined from the min./max. values and either the min. or the max. value will be set to the absolute max. value with the corresponding sign. Activating this option might be useful if "normal" profiles are displayed with positive and negative amplitudes whereas deactivating this option might be a good choice for plotting slices showing the envelope.

## 3.3 Wiggleattributes

**Scale:** enter a value for the size of the individual wiggle deflections. The size is calculated by: current amplitude * Scale = Size in Pixels. If the option Tracenormalize is activated, the current amplitude must be replaced by the value 1 - therefore the size directly corresponds to the wigglesize in pixels of the max. or mean (profilenormalize activated) amplitude.

**ShowWiggle:** activate this option if you want to display the polygonal line.
With the pointmode selected this option controls if the data are plotted in pointmode together with the wiggles or not.
With the Wigglemode selected the option controls if the polygonal line is plotted or not. With this option deactivated only the filled part is plotted in this case (see below).

**ShowAllDataPoints:** activate this option if you want to display all data points of the trace even if the number of data points per trace is larger than the pixel number of the current window. Deactivating the option means that every trace is resampled based on the current screen points. If the number of samples to be displayed is much larger than the screen point number aliasing may occur. In this case the option should be activated. This means that every data point is plotted.

**ShowSinglePoints:** if activated the datapoints are marked by a cross symbol in addition.

**n.trace:** only every n.trace is plotted in wiggle-mode. This option is for example useful if you want to plot a large data file in point mode together with the wiggles.

**1.trace:** specifies the first trace within each block to be plotted if n.trace is greater than 1. The value of 1.trace must be between 1 and n.trace.

**Color:** choose the color for the polygonal line of the wiggles.

**Fill:** controls the filling of the polygonal lines.

Entering **no**, means no filling.
Entering **positive**, means only the positive amplitudes are filled with the chosen FillColor.
**negative** means only the negative amplitudes are filled with the chosen FillColor.
**colors** means that the wiggles (positive and negative amplitudes) are filled with the current color amplitude assignment. In this representation correlated signal arrivals are very well recognizable.
**Pos./neg.** means that both the positive and negative wiggles are filled using the current fill color.

**Clip:** With the parameter clip all amplitudes, exceeding the value of clip in pixels, can be cut. A large value for width and a small value for clip thus facilitates to recognize signal arrivals of small amplitudes otherwise covered by phases with large amplitudes.

**FillColor:** choose the color for the filled areas of the polygonal lines. The Fill option must be set to positive or negative.

## 3.4 incrementation

**dx:** enter a value for the subdivision of the x-axis

**dy:** enter a value for the subdivision of the y-axis

**dz:** enter a value for the subdivision of the optional depth axis. If set to 0 the subdividion is automatically determined from dy.

### 3.5 PlotGain/Filter

This group box allows to specify a gain or filter function for the plotting of the data.

**AGCGain:** if activated an AGC (AutomaticGainControl) with the given **Window** value (enter the wanted window length in the current timedimension) is applied for plotting the data. AGC facilitates the creation of equally distributed amplitudes in y-direction (normally time axis) within a predefinable window. This option serves for emphasizing of low amplitude ranges against ranges with high amplitudes. The information of the true amplitude is lost, of course. The program calculates at first an average amplitude over the total time range for each trace. After that the program scales each amplitude value in that way that the mean amplitude has the same value for each selected window around the current value with in a trace. The size of the window determines the kind of amplitude equality distribution. A window size of only one sample increment means that each time sample within one trace receives the same amplitude value (no reasonable choice), a window size of the whole trace length causes no modification of the amplitude. Small window sizes cause a strong equality distribution, large windows a weak.Often it is necessary to apply a scaling factor (parameter **Scale** with which the data are multiplied after the application of the AGCGain) smaller than one because after the application of the AGCgain some amplitude values will exceed the maximum amplitude of the original profile. The optimal choice of this scaling factor enables that all amplitude values will not exceed the limit of 16 bit.

**EnergyDecay:** if activated the energy decay curve is applied for plotting the data. By activating this option a gaincurve in y-(time-)direction is applied on the complete profile based on the mean amplitude decay curve. First a mean decay curve is determined from all existing traces. After the application of a median filter on this curve every data point of each trace is divided by the values of the decay curve. Often it is necessary to apply a scaling factor (parameter **Scale** with which the data are multiplied after the application of the EnergyDecay curve) smaller than one because after the application of the gain some amplitude values will exceed the maximum amplitude of the original profile. The optimal choice of this scaling factor enables that all amplitude values will not exceed the limit of 16 bit.

## 3.6 Plotsuboptions

This group box controls the main plot settings.

**ShowMarker:** if activated the distance markers are shown as white rectangles.

**Commentmarker:** if activated the comment markers are shown as yellow rectangles together with the comment.

**TraceHeaderDistances:** if activated the profile is plotted based on the individual distances stored in the single traceheaders and not based on the equal trace increment of the fileheader. The option is only available within the wiggle plotmode.

**AutoInterpolation:** if activated an autointerpolation in x- and y-direction is done for the pointmode. Activate this option if your data density is smaller than the plotting area (for example when you did a large zooming). Plotting takes more CPU time when this option is activated.

**Rotate90Degree:** if activated the profile is rotated by 90 degrees.

**FlipYAxis:** activate this option if you want that the y-axis starts at the bottom.

**FlipXAxis:** activate this option if you want that the x-axis starts at the right. With this option activated it is not possible to do some analysis steps like picking.

**ShowAxis:** if activated the x- and y-axis are plotted.

**Grid:** if activated a grid is plotted. The option grid color specifies the color of the grid.

**XAxisName:** activate this option for a manual labelling of the x-axis. This manual labelling is stored in the INI file after terminating the program and is loaded when starting the program. If the option is deactivated, the x-axis name string stored in the fileheader of the current line is used for the labelling.

**YAxisName:**activate this option for a manual labelling of the y-axis. This manual labelling is stored in the INI file after terminating the program and is loaded when starting the program. If the option is deactivated, the y-axis name string stored in the fileheader of the current line is used for the labelling.

**AxisWithExponent:** if activated the axis labelling is done with exponential representation if the labelling values exceed some predefined values (e.g. values between 10000 and 30000 are displayed as 100*10**2 and 300*10**2).
If activated and no manual axis labelling (options XaxisName and YaxisName deactivated) is entered the following holds true in addition:
timeaxis: automatic display in µs instead of ns and ms instead of µs and s instead of ms if the timerange is bigger than 10000.
distanceaxis: automatic display in KM instead of METER if the distancerange is bigger than 10000.

**reduction velocity:** if activated the traces are plotted with a timeshift calculated from the trace-distance and the entered velocity. The option is useful for e.g. displaying refraction data.

**DepthAxis:** if activated an additional depth axis is plotted. The depth axis is calculated from the timeaxis and the given velocity (see below).

**v[m/ns]:** enter a value for the velocity for the calculation of the depth axis.

**Elevation:** With the option elevation activated the depth axis on the right hand side is replaced by an elevation axis showing the elevations based on the entered ref. level. The current elevation is calculated from: reference level - current depth value.

**correct header elevations:** if activated the traces are shifted based on the receiver and the shot elevation values stored within the traceheader of each trace and the entered elevation level. The shift levels are calculated from the difference of the entered elevation level and the individual traceheader elevation values. Based on the current velocity the traveltime shift value is calculated from the sum of the shot and the receiver elevation differences. The option is only enabled if the option elevation is activated.
To be considered: the range of the timeaxis will not be changed using this plot option. Therefore it can happen, that - depending on the chosen elevation level - information of some traces is not plotted because it is shifted to times outside of the time range.

**depthaxisname:** activate this option for a manual labelling of the depth-axis. This manual labelling is stored in the INI file after terminating the program and is loaded when starting the program. If the option is deactivated, the y-axis name string stored in the fileheader of the current line is used for the labelling.

**showvelocity:** if activated the depth axis labelling containes the velocity or the velocity file which are the base for time-depth conversion.

## 4. Print Menu

This menu allows you to setup the parameters for printing a profile. Batch printing is supported - see PrintOptions2.The scale in x- and y-direction is freely choosable (see also PrinterSize). The scale is entered either by direct input of the scale or by entering the length of the individual x- and y-axis. A page blocking option is included (see also PrinterSize and PrintOptions1). Printing on banner paper (printing on continuous paper) is supported.

Following you find a detailed description of the print options:

**automatic center:** if activated the profile is automatically centered on the sheet. Automatic centering is automatically disabled if printing is done in the Printing on banner paper mode (continuous paper).

**X-scale output:** the given scale is used for determining the x-size of the output.

**Y-scale output:** the given scale is used for determining the y-size of the output.
With depth axis activated (see also Plotsuboptions) the scale is applied on the depth axis and not on the time axis of the profile.

**page blocking:** if activated only one block of the given profile length/page is printed on one page. The program automatically subdivides the profile into several parts of constant length which will be printed on individual sheets.
Page blocking is automatically disabled if printing is done in the Printing on banner paper (continuous paper).

**Landscape:** if activated the output is landscape. With deactivated option the output is portrait. The current settings within the printer setup for landscape or portrait are overwritten.

**use current zoom:** if activated the currently set zoom parameters are used for the printing. If deactivated the complete profile(s) is plotted.

**x-axis length[cm]:** enter the x-axis length of the output in cm. If page blocking is activated, this length specifies the x-axis size of one page block.

**x-scale[relation-1:?]:** enter the scale if the option x-scale output is activated. For example: profile length 200 m. You enter a x-scale of 1000: the output has a length of 20 cm.

**y-axis length[cm]:** enter the y-axis (normally timeaxis) length of the output in cm.

**y-scale[relation-1:?]:** enter the scale if the option y-scale output is activated (see also x-scale[relation-1:?]).

**upper border[cm]:** enter the upper border in cm.

**left border[cm]:** enter the left border in cm.

**profile length/page:** enter the length of the profile part bo be printed on one page if the option page blocking is activated.

**fast print:** if activated a fast algorithm is used for printing the data for the point mode. In some cases dependent from the printer this printing method fails (only the frame is printed or the colors are not correct) and you must deactivate the option in order to print out the data.

**print general comment:** print a general comment - this comment is printed at the upper left corner of the image.

**print frame:** print a frame around the output. Print frame is automatically disabled if printing is done in the banner mode (continuous paper).

**print filename:** print the filename on the top of each profile.

**print header boxes**: if activated the program asks for the header box file to be loaded after having activated the option print. For a detailed description of the header comment boxes see chap. print preview.

**Text Font:** enter the font for the text of the output.

**Number Font:** enter the font of the numbers of the output.

**Symbol Font:** enter the font for the symbols to be printed (e.g. picks or markers).

Please use only true type fonts because only these fonts are able to be rotated.

**Partitionscans:** enter the max. number contained within one single print bitmap. The program automatically subdivides the printer bitmap based on the entered number. If problems occur with the printing (e.g. something is missing) it might be helpful to decrease this number. The number does not restrict the total number of scans to be printed.

**PrinterSetup:** Enter the printer-setup menu.

**Preview:** Enter the print preview menu which allows a preview of the size of the printoutput and to define text boxes (for a detailed description see chap. 4.2).

**CANCEL:** break off printing

**PRINT:** start printing

**Printing on banner paper**

Banner printing (printing on continuous paper) is supported. The following restrictions are valid for banner printing:

- no automatic center
- no page blocking
- no print frame
- the border in banner direction is always set to 0

- because banner printing is still a page based printing the following problems may occur when switching to the next page:
- axis numbering is not correct
- the wiggles may be disturbed at this position

## 4.1 Print preview

The print preview menu allows you to preview the size and shape of the print output and to define a **print heade**r consisting of up to 30 different header comment boxes containing up to 6 different comments. The print area is whitened and a simple preview of the profile(s) is shown within this area. To be considered: The profile preview is only a simple bitmap transform from the screen and does not exactly respresent the print output especially concerning the axis size. Some print options like print general comment or print file comment and print frame are also not taken into account.

If the printing is done onto **several pages** different print headers for each page may be defined (see option page (max.)). In this case the profile itself is not shown but you only may define the print headers.

The following general options are available:


resets the x- and y-scale values (zoomvalues) to 1 and replots the print preview


replot with current zoom parameters


enable manual zoom - With the option ZOOM an arbitrary area of the print preview can be selected and plotted in full screen size. The area to be enlarged, a rectangle, has to lie within a data set. Pressing the left mouse button you determine a corner of this rectangle and by moving the mouse with pressed button the desired area is opened. Afterwards you may use the scroll buttons to scroll through the zoomed print area.

**close**: close the print preview window without printing.
**print**: does printing using the current comment box settings and closes the print preview window.

**reset act**: clear the current comment box.

**reset all**: clears all comment boxes.

**load**: loads an existing set of comment boxes from file.

**save**: saves the existing set of comment boxes on file. The file will have the extension hea and is stored under the path rohdata under the current project directory. You must store the set of comment boxes if you want to use the boxes without entering the print preview window (see option print header boxes).

**add:** add header boxes (one additional file) to the current ones

**page (max.)**: choose the wanted print page for defining the print headers

The **print header** is built up of up to **30 different header comment boxes** each containing up to **6 different comments**.

One **comment box** is characterized by the following values:

X-pos:enter the x-coordinate of the left corner in cm
Y-pos: enter the y-coordinate of the top corner in cm
width: width of the box in x-direction in cm
height: height of the box in y-direction in cm
degree°: specifies the rotation angle of the comment text - e.g. 0°: horizontal alignment, 90°: vertical

alignment
pen width: specifies the width of the box frame
frame: specifies the color of the box frame
fill: specifies the fill color of the box if transparent if deactivated
transparent: if activated the box is transparent, activate this option for example if you want to place some comments within your data
bitmap-file: if activated a bitmapfile can be loaded into the box, e.g. a logo.

The **actual box** is highlighted by a big frame. An existing box may be activated by pressing the left mouse button wihtin the wanted box. With pressed left mouse button the current box may be moved to any position.
The edit option **box nr.** shows you the number of the current box. This option also allows you to choose any of the existing boxes.

A **new box** is interactively defined by spanning up the wanted area. Click on the uppermost left corner of the area to be spanned up and drag the mouse to the wanted lowermost right corner with the left mouse button pressed.

Each comment box may contain up to **6 different comments**. Each comment is defined by the following parameters:
the comment text itself
font: enter the wanted font of the comment
X-Pos.: enter the x-position in cm within the comment box.You may use the up and down arrows for a fast replacement of the comment. The option change size defines the stepwise size of each redefinition.
Y-Pos.: enter the y-position in cm within the comment box. You may use the up and down arrows for a fast replacement of the comment. The opiton change size defines the stepwise size of each redefinition.

To be considered: A **horizontal** or **vertical line** is easily constructed by defining a new header box with a width (vertical line) or height (horizontal line) smaller than 0.05 cm.

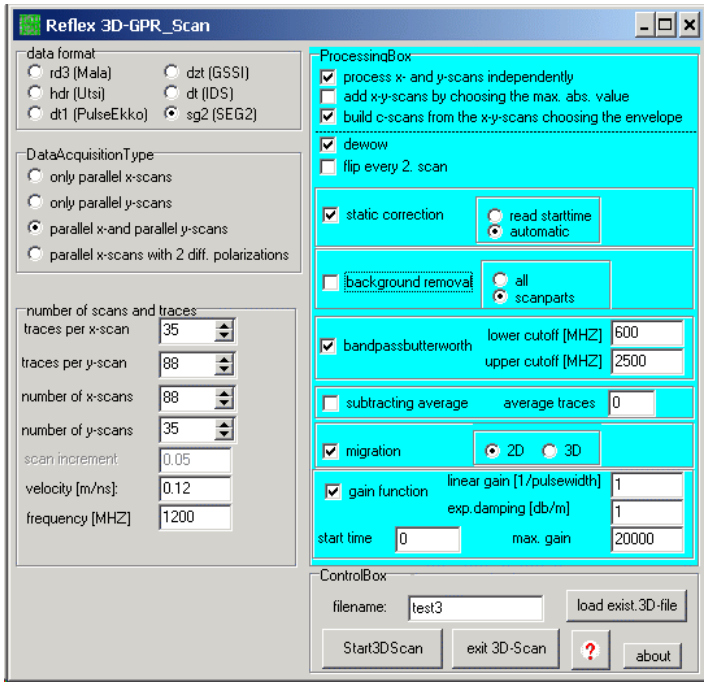
## 5. Demo-data

The program has automatically copied the following demo data files to the program directory:

Scan3DXY.sg2 - SEG2-formatted file containing a 3D-GPR dataset consisting of:
88 scans in x-direction and 35 traces/scan
antenna polarization in y-direction (perpendicular to the profile direction)

Scan3DYX.sg2 - SEG2-formatted file containing a 3D-GPR dataset consisting of:
35 scans in y-direction and 88 traces/scan
antenna polarization in x-direction (perpendicular to the profile direction)

Use the parameters mentioned on the right for the best processing of the demo-data.
The use of the background removal filter is not recommended for this dataset because some artifacts will be produced. Therefore the flat primary signal is still be present within the data when using this recommended processing flow.




The result within the 3D-GPR_ScanView menu is shown at the right side. The option slices with activated suboption free of distortion has been used for the scroll mode.