

REFLEXW is the new WindowsNT/9X/2000 software generation of REFLEX for the 2-dimensional processing and interpretation of Ground Penetrating Radar (GPR), reflection and refraction seismic.

This 2-D GPR Data Analysis Module described below can be upgraded to perform 3-D Data Interpretation

2D data-analysis

The module 2D data-analysis allows the complete 2-dimensional processing of single shots, zero offset lines or multi-shot gathers. The module is useful for the following applications (right):

Import data

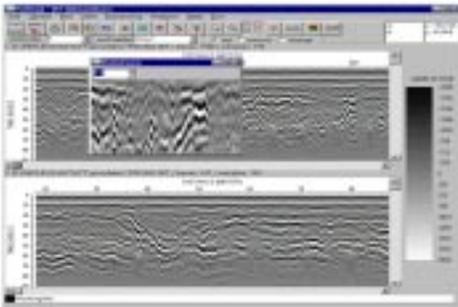
An import option allows the loading of the data for almost all existing GPR and seismic data formats. Single sections as well as a profile sequence (automatic assembling and storing of the sections under one single datafile or automatic generation of datafiles for parallel and inline-sections) may be imported

ReflexW

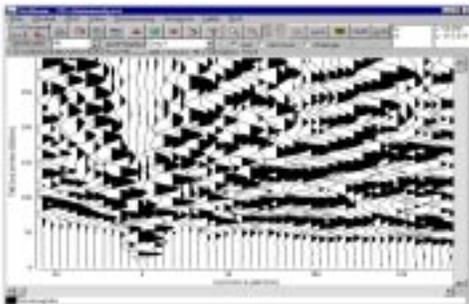
2-D GPR Data Analysis Module

- * **GPR (Ground penetrating radar)**
- * **reflection seismics**
- * **refraction seismics**
- * **borehole-borehole wave data**

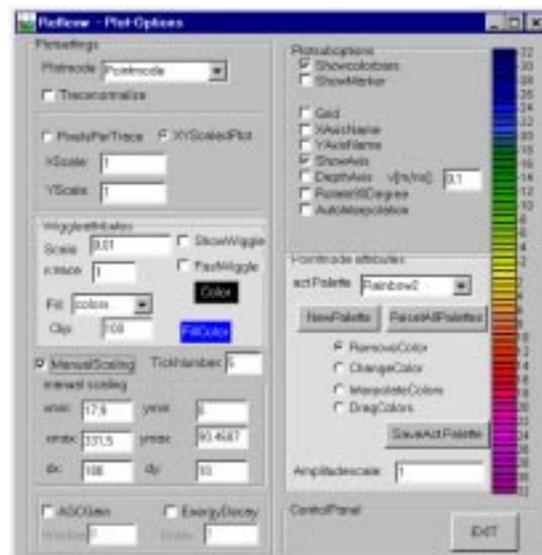
The data display and printing possibilities



Example of the pointmode display of 2 different GPR-lines and the additional magnifying zoom option



Example of the wigglemode display of a seismic refraction section



Example of the plot options panel

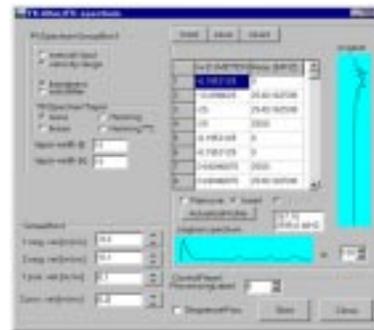
- Display of the data either in wiggle (see right figure above) or filled area point mode
- "Normal" reflection (time axis from top to bottom) or refraction (time axis from bottom to top) display
- Continuous display of the current mouse position parameters including time, distance, amplitude and depth
- The user may switch between two different scale modes:
 1. The data are completely plotted into the actual window with subsequent free zooming and moving possibilities
 2. Trace based scale: the user chooses the pixel size for each trace. If the line is not completely plotted into the window moving possibilities are available.
- Zoom- and autoscroll possibilities
- Loading of a secondary profile, horizontal or vertical split-mode or overlapping of the profiles
- Interactive magnifying glass option (see left figure above) with choosable zoom factor - a freely choosable data part is continuously magnified when moving the mouse
- Interactive color amplitude assignment for point mode - display of the profiles in the point and wiggle mode
- Many different plot options, e.g. rotated display, combination of wiggle and point mode, free choosable axis and so on (see central figure above)
- Easy transfer of the data to the clipboard
- Printing out the data with freely choosable scale either in cm or scale like 1:1000; support of banner output (continuous printing on printers which support banner output, e.g. HP Deskjet 1120 C).
- Stack printing of a complete set of 2D-lines using the same printing parameters
- Oscilloscope-function - wiggle plot of the actual trace with the indication of the actual amplitude, time and frequency
- Comprehensive context sensitive online help

The dataprocessing possibilities

A single radargram or seismogram section can be interactively processed. Primary and secondary profile are displayed simultaneously. The batch mode allows the automatic processing for a choosable number of lines. A sequence of processing steps will be applied on an arbitrary number of profiles. The batch mode runs totally automatically. Primary and secondary profile will be displayed, whereby a direct control of the result is given. All processing steps are stored for each profile and can be edited at any time. The dataprocessing is completely interactive. The effect of the filter is online controlled when changing the filter parameters by showing both the original and filtered trace. All edit inputs may be entered either interactively in the original profile or using the table input.



Example of a processing function panel



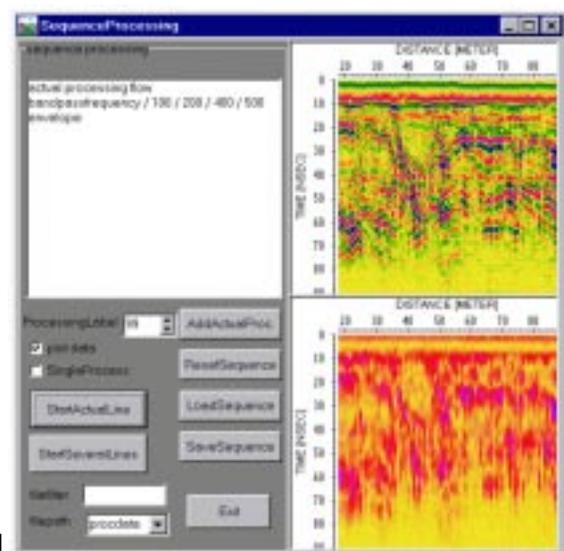
Example of a 1D-filter panel

An overview of the different processing functions:

- * Editing functions (like removing, extracting of single traces/trace ranges, muting, stacking, subtracting or adding of profiles and much more).
- * Horizontal scaling of the data, automatically or manually or by a combination of both.
- * Flipping the profile in x-direction or y-direction.
- * Static correction (interactive input of the correction values, slant stack correction and so on).
- * Gain-functions in horizontal und vertical direction, AGC (AutomaticGainControl), automatic trace balancing, linear and exponential gain function, automatic gain based on mean amplitude decay curve (see left figure on page 2)
- * A great variety of 1D-filters like bandpass, notch-filter, timedependent bandpass, crosscorrelation, arithmetic function, averaging, median-filter, deconvolution, complex trace analysis (instantaneous frequency, phase, envelope), time-depth conversion, background removal, declipping and so on.
- * Spectral analysis - single spectra, moving-window-analysis.
- * Migration - 2D Kirchhoff, 2D fk-migration, 2D Finite Difference migration with lateral varying velocities, 3D Kirchhoff.
- * Some other 2D-filters like subtracting average, running average, compress and expand and so on.
- * F-k-filter with the possibility of manually input the filter range within the fk- spectrum or by defining a velocity fan. Different tapers and taper width are available (see right figure on Page 2).
- * and much more possibilities
- * All processing steps are stored in the header of each profile and can be asked for at any time

Batch Processing

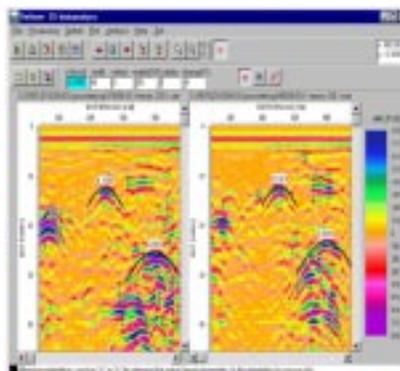
The batch-processing (see figure) facilitates a completely automatic sequence of processing steps for a choosable number of profiles. Primary and secondary section are displayed simultaneously, whereby a direct control of the result is given. You may choose between the so called sequence mode and the single processing mode with the possibility of applying the processing steps individually on the primary profile.



Example of the sequence processing panel

Velocity Analysis

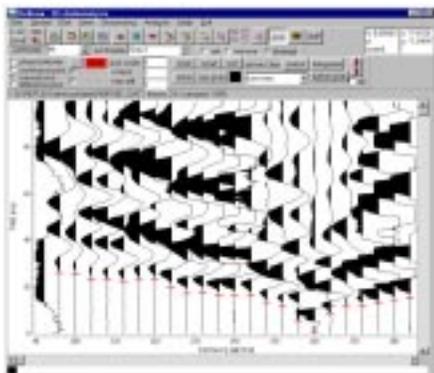
An interactive hyperbola-adaptation for a simple determination of the average velocity from a zero-offset or CMP profile is integrated. It is possible to adapt diffractions (see figure), reflections and straight lines. You may change the velocity, the radius of the target, the angle between the profile line and the target and the width of the calculated diffraction or reflection hyperbola. There is also the possibility of fitting linear features either by changing a line interactively or by setting two points. The option core allows to vary interactively the velocities of the single layers of the individual cores stored within an ASCII-file. In addition an interactive use of the intercept time method for seismic refraction data is included (see figure). The option enables to get a first 1D-model very quickly. The velocities may be stored on file and may be reloaded at any time. The velocities are combined into a 2D-model by using a special interpolation. Such a 2D-velocity distribution may be used in a subsequent step for the migration or the time-depth conversion.



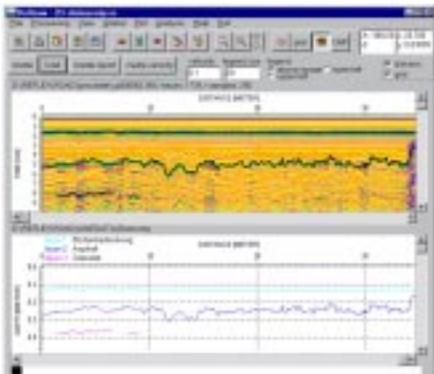
Use of the diffraction adaptation for 2 different GPR-lines



Use of the intercepttime method for refraction data



Picking of the first arrivals of a refraction data set



Example of a layer show

Picking the onsets/first arrivals

The picking option allows to pick the traveltime and the amplitude of different onsets like reflectors or hyperbola or the first arrivals (see figure). You have the choice between manual picking, continuous picking and a semi-automatic picking using a phase follower (manual editing is always possible). The picked values may be corrected to the extrema or the zero-crossing. In addition a time/distance correction to the maximum value within a given window is available. This allows you for example to pick the hyperbola cusps very quickly. It is possible to export the picks into an ASCII-format together with the 3 space coordinates for a subsequent interpretation. The so called layer-show (see figure) offers the possibility to combine individual pick files, to plot them together with the wiggle-files and to output them in report form on printer or file containing the depths, velocities and amplitudes of the individual layers. The time-depth conversion of the picks is either based on a constant velocity for each layer or on a 2-dimensional velocity distribution allowing to take into account vertical and lateral velocity changes.