

# Main news of the REFLEXW version 5.5 from 01.01.2010

## I. 2D-dataanalysis

### 0.general

#### **load files:**

- **int.choice**: new option **plot chosen lines** which allows to plot the actually chosen profiles without closing the interactive choice menu.
- Now the procddata filefilters can be chosen independently for both the primary and the secondary file.
- new option **sec.** for the use with the next and prev. buttons: if activated the secondary profile will be correspondingly updated when using the next and prev. buttons. The specified filefilter for the secondary file will be used.

#### **View:**

- new option **show xyz-traceheader coordinates**: shows the actual x-, y- and z-traceheader coordinates (xc, yc and zc) within a new listbox on the upper right corner.
- option **show profile line**:
  - new option **show other lines** which allows to show the xy-locations of other profiles.
  - The option **reset choice** resets this display of the other profiles.
  - new option **show 2. line position** which displays the xy-position of the secondary file using the same distance coordinate.
  - **Zooming** and **copy to clipboard** possibility included.
  - The profile lines will be automatically updated when using the next or prev. buttons.

#### **Analyse:**

- new option **sum amplitudes for each trace**: sums all amplitudes (absolute values) for each trace and stores the sum within an ASCII file together with the corresponding distance of the trace. The data can be viewed using the option add. 2 colum data under view.

#### **Core files:**

new options to be found within the global settings menu:

- autom. load: if activated the corefile with the same filename like the primary file will be loaded automatically
- quality factor: radio box defines how the quality factors within the core files will be used:

ignore: the quality factors will be ignored

show: if activated a second bar is shown indicating a quality factor stored within the core datafile. The following colors are used: 1 - white, 2-yellow, 3-red.

use f.colors: if activated the colors for the layer bars will not be assigned to the layer number but to the quality factor using the layershow colors assignment.



**x-dist.:** new option which allows to measure the distance between 2 points in horizontal (x) direction.

new keyboard shortcuts **F4** and **F5** which increase and decrease the actual pick code by 1.

Now the **number font** will be used for the comment marker, the core labelling and the layershow legend (before the symbol font had been used).

## 1. Display

### **plotoptions:**

- new option **ikomp** - if activated the secondary color will be used for traces with  $ikomp = 2$
- new option **disregard colorbar sign**: if activated the sign above the color bars will be disregarded. Activate this option if the sign does not fit correctly.
- new speed options which allow to load a new **palette file** from disk  or to save the actual palette file on disk using any name .

## 2. Import

**filename specification:** new specification **automatic long name** which allows a filename specification based on the fileheader coordinates taken into account up to 7 places and 2 decimal places. Thereby also UTM-coordinates can be handled.

**Update traceheaders/gps coordinates:** new optionbox which allows you to automatically update the geophone-, shot- and CMP-coordinates either based on the distance coordinates of the file header (coordinates in profile direction and in profile constant) or based on a GPS ASCII-file. The option is the same like given within the edit several fileheaders menu.

The option utm-conversion includes the following utm-conversion possibilities:

UTM-conversion

UTM-DEGREE-conversion

RD-conversion (netherlands)

**SEG2:** new header word COLOUR - the corresponding value will be stored within the Reflexw traceheader flag ikomp. Together with the plotoption ikomp this allows you to use the secondary color for the display with a value of 2 for COLOUR.

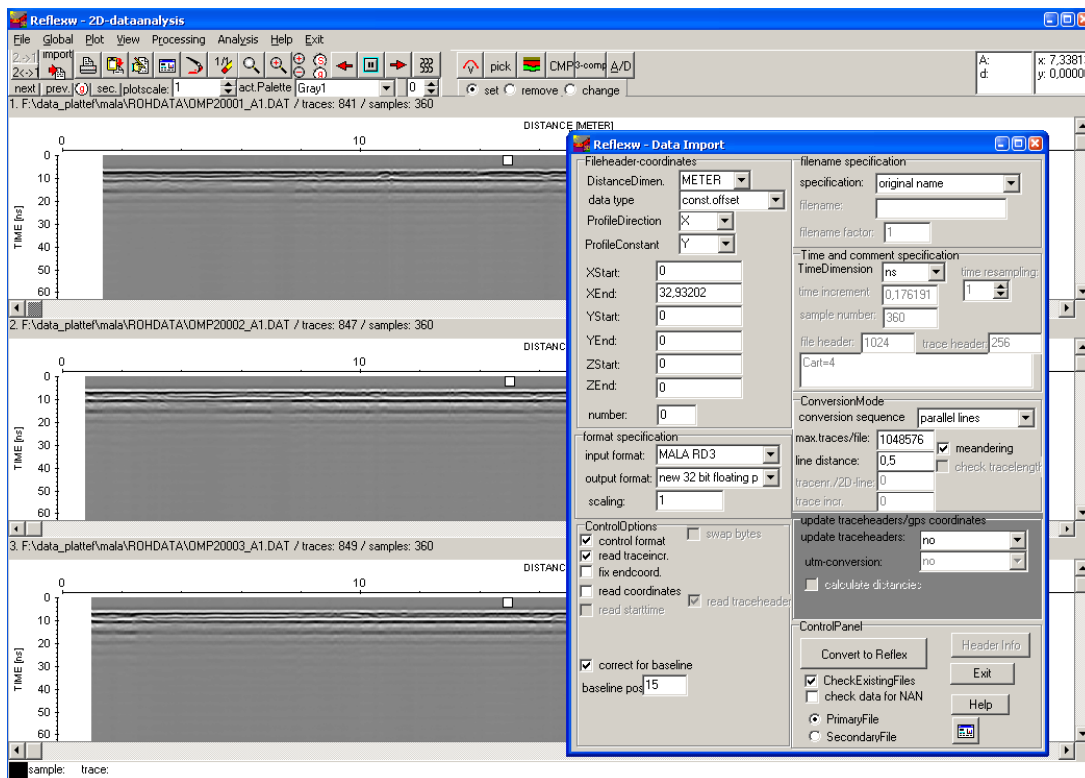
**Free64Bit:** new import format which allows to import 64 double precision data.

**MALA RD3:** new option **correct for baseline** which allows to correct the start positions of parallel 2D profiles based on a baseline. The **baseline pos.** must be entered. An ASCII file with the extension obm must exist which includes the actual cross positions and angles of the profiles with the baseline. Following an example of this ASCII file is given. The program performs a shift of the start coordinates of each 2D-profile based on the given cross position with the baseline (parameter X\_LENGTH). If meandering has been activated each second 2D-profile will be flipped. In this case the angles within the ASCII-file will be used in order to check whether they are consistent with the datafile choice.

```
VERSION:1
NUMBER_OF_BASELINES:1
BASELINE:1
START_X:    0.000
START_Y:    0.000
STOP_X:     0.000
STOP_Y:    -28.000
NUMBER_OF_PROFILES: 53
OMP20001_A1
X_LENGTH:  13.6461
X_ANGLE:270
X_DIST2BASE:  2.0000
OMP20002_A1
X_LENGTH:  17.5558
X_ANGLE:  90
X_DIST2BASE:  2.5000
OMP20003_A1
X_LENGTH:  14.0220
X_ANGLE:270
X_DIST2BASE:  3.0000
```

It is recommended to check whether the repositioning has been successful. This can easily be done by

comparing the different 2D-files using the plotoptions man. scaling and show marker. The baseline is shown by a marker and should be at the correct entered position for each datafile.



### **3. Dataprocessing**

- **merge**: new suboptions 3D-files and 3D-files meand. These options allow to merge the actually loaded 3D-file with different 3D-files which have been acquired e.g. using a multi antenna array or which have been acquired in order to condense the grid. Precondition is that each 3D-datafile consists of parallel 2D-lines with the same ensemble numbers for each set of 2D-lines and that the first 2D-line within the actually loaded 3D-datafile represents the start 2D-line.

Example four antenna array: the data have been acquired along parallel 2D-lines which have been stored within one single datafile for each antenna. The result are four different 3D-datafiles. Precondition for the use of the merge option is the existence of the correct (same) ensemble number for each 2D-line within each 3D-datafile. The resulting 3D-datafile after the merge option consists of the following ensembles:

1. Ensemble (2D-line) of the first 3D-datafile
1. Ensemble (2D-line) of the second 3D-datafile
1. Ensemble (2D-line) of the third 3D-datafile
1. Ensemble (2D-line) of the fourth 3D-datafile
2. Ensemble (2D-line) of the first 3D-datafile
2. Ensemble (2D-line) of the second 3D-datafile
2. Ensemble (2D-line) of the third 3D-datafile
2. Ensemble (2D-line) of the fourth 3D-datafile
- ..... and so on

The option 3D-files meand. allows a meandering sorting of the antenna array. The resulting 3D-datafile after the merge option consists of the following ensembles:

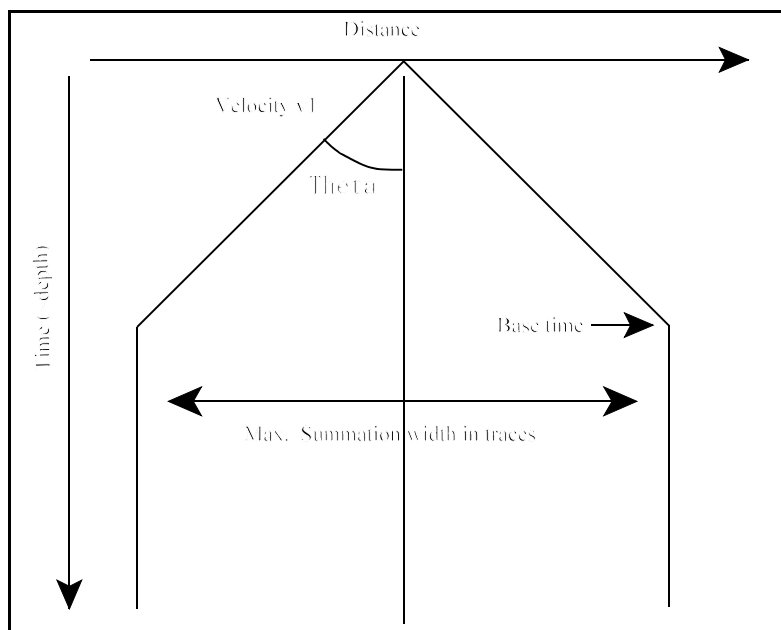
1. Ensemble (2D-line) of the first 3D-datafile
1. Ensemble (2D-line) of the second 3D-datafile
1. Ensemble (2D-line) of the third 3D-datafile
1. Ensemble (2D-line) of the fourth 3D-datafile
2. Ensemble (2D-line) of the fourth 3D-datafile
2. Ensemble (2D-line) of the third 3D-datafile
2. Ensemble (2D-line) of the second 3D-datafile
2. Ensemble (2D-line) of the first 3D-datafile
3. Ensemble (2D-line) of the first 3D-datafile
3. Ensemble (2D-line) of the second 3D-datafile
3. Ensemble (2D-line) of the third 3D-datafile
3. Ensemble (2D-line) of the fourth 3D-datafile
4. Ensemble (2D-line) of the fourth 3D-datafile
4. Ensemble (2D-line) of the third 3D-datafile
4. Ensemble (2D-line) of the second 3D-datafile
4. Ensemble (2D-line) of the first 3D-datafile

The profile increment will be automatically updated (divided by the number of 3D-datafiles).

- **AGC-gain**: new options max.gain, normalize and max. normalize value. The option max. gain can be used in order to restrict the gain for each sample. The option normalize performs a trace normalization. If this option is active the max. normalize value must be entered. This option is by default set to 2048. Each value can be entered but if the data had been stored using one of the 16 bit integer formats the max. value should be within the 16 bit integer range and should not be less than 2048.

- **scaled windowgain(x)**: new option box whole profile and line parts. If line parts has been chosen, the scaling will be done for each ensemble independently.

- **diffraction stack and Kirchhoff migration**: new option adapt width - if active the summation width will be automatically adapted to the depth. The parameter max. angle (theta in degrees) controls the max. angle for the summation. As a result the summation width becomes time dependent (linear increase with time) and reaches the entered max. summation width at that time which is defined by the entered max. angle, the summation width and the velocity. This base time is shown at right of the entered angle and will be updated if any of these parameters will be changed. Activating the option adapt width allows a larger max. summation width and may be useful if the real diffractions exhibit a smaller width at smaller times due to the source and receiver characteristics.



- **fk filter**: new option single velocity. Activating this option the filter range will be determined from one single velocity. Depending on the settings of bandpass or notchfilter all velocities greater than the entered velocity will be kept (bandpass activated) or removed (notchfilter activated).

- **diffraction 2D-veloc and Kirchhoff 2D-veloc**: now it can be chosen between whole profile and lineparts as already possible for the constant velocity migrations diffraction stack and Kirchhoff migration.

- **trace spectrum**: new suboption taperlength (in the given time dimension) which allows to enter a taper range at the beginning and at the end of the specified timerange.

- **expand 3D-file**: new option which allows to expand a 3D-file perpendicular to the profile direction. The option corresponds to the option interpolate current 3D-file but only allows to expand the data in that one direction. The number of 2D-lines building up the 3D-file changes accordingly and also the line increment will be changed according to the entered parameter factor (line-perp.). The start and end coordinates will not be changed. Therefore the number of 2D-lines only changes to  $(\text{old number} - 1) * (\text{factor}) + 1$ .

- **prestack migration**: new option which allows to trace back the wavefield of single shots to their "source". For that purpose traveltimes for each transmitter-receiver pair are calculated on the base of a constant velocity or of a 2D-velocity field. Based on these traveltimes a summation for each underground point (x,z) is performed. Several methods will be used:

**const.velocity**: the base for the calculation of the traveltimes curves is a constant velocity. This suboption can only be used if a quite homogeneous velocity distribution is given or for a first overview.

**2D-velocity**: the base for the traveltimes calculation is a 2D-velocity field. The current VRMS- or average velocity for each underground point (x,z) is determined from the 2D-distribution and the traveltimes are calculated using this velocity. This is only a valid approximation if the summation branches do not extend over a large laterally heavily fluctuating area.

**curved ray slow** and **curved ray fast**: the base for the traveltimes calculation is a 2D-velocity field. The traveltimes for each underground point are calculated using a Finite Difference approximation of the Eikonal equation (Vidale, 1988, see also modelling module) which has been proved to be very exact even for extremely complicated media. In the case of the option curved ray slow the number of different single calculations is equal the number of receivers. In the case of activated option curved ray fast the number equals the number of receivers multiplied with the number of gridpoint in z-direction and the calculation is therefore much slower. For most cases the accuracy using the option curved ray slow is high enough. Only if very strong velocity contrasts are given within the used 2D-velocity field the option curved ray slow may be a useful alternative. The radio groupbox **2D-velocity model** allows you to specify whether the 2D-velocity distribution is obtained from the **CMP-analysis** (see also CMP 2D-model) or from the **hyperbola adaptation** (see also velocity

adaptation) or directly read from a Reflexw formatted **rasterfile**. The rasterfile may either contain the mean velocities (option **rasterfile mean**) or the layervelocities (option **rasterfile layer**). The velocities (amplitudes) must be in m/ns or epsilon for GPR data and in m/s for seismic or acoustic data. The rasterfile may either be a depth model (y-axis always meter) or a twoway travelttime model (y-axis corresponds to the two way travelttime). The x-axis is always the distance.

The seismic or GPR data can be expressed as a convolution of the impulse response of the underground and the source signal. The calculated traveltimes will be determined on the base of the impulse response of the underground. Therefore the summation is only correct for the first arrival. With activated option **smooth** the summation is done over a depth range corresponding to the real wavelength. This significantly may increase the data focussing.

With activated option **Kirchhoff** weighted factors are used for the summation.

The option **semblance** allows to calculate the semblance along the summations paths and multiplies the resulting semblance section with the migrated section. The option might be useful to enhance low amplitude reflections which exhibit a high semblance.

There are two possibilities to restrict the **offset range** for the summation. The min. and max. offsets are given in the distance dimension. Offset 1 means the min. and max. distance between the real transmitter- and receiver coordinates. Offset 2 means the min. and max. Distance between underground point and shot- and receiver position.

The migration is a **depth migration** - therefore the result is a depth-distance section. Optionally the depth section may be transformed into two way traveltimes for the case of the constant and 2D-velocity methods (radio box type set to **time migration**).

## 4. Pick

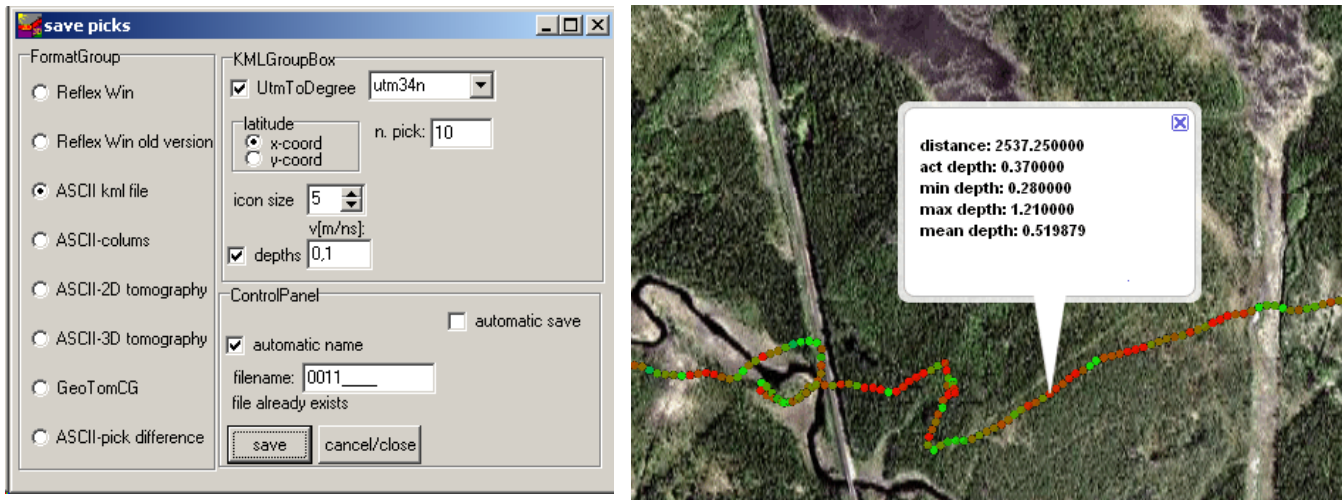
### save picks:

- new format **ASCII kml file** which allows to save the picks using the Google kml format.

The following options must be entered:

UTMToDegree: activate this option if the xy-coordinates are not given in degrees but in UTM meter coordinates. Then you must enter the correct utm-zone and the xy-coordinates will be automatically transformed into degrees.

The groupbox latitude defines where the latitude values have been stored (either on x- or y-coordinates).



The icon size defines the size of the icons. The option n. pick allows to export only each n. pick.

If depths has been activated the traveltimes will be transformed into depths using the velocity listed on the right. Each datapoint within the KML-file contains an information box about the distance, actual, min., mean and max. depth. A red-green-blue color scheme for the icons will be used with red corresponding to the smallest values and blue to the largest depth values.

- the **Reflexw Win data format** now uses the **double precision** format for the **xy-coordinates** of the picks. Pick which will be saved using the Reflex Win format cannot be loaded from older Reflexw version (up to version 5.0.8). For that purpose the format Reflex Win old version must be used.

- new option **automatic save**: Activating this option allows you to automatically save the actual picks using the Reflex Win format and/or the ASCII-columns format if a new profile will be loaded or if the pick option will be left. The automatic filenames will be activated - the pickfilename is automatically determined from the filename of the current profile. The actual settings of the ASCII-columns format will be used. The option export several existing picks into 1 ASCII-file for the ASCII-columns format is not supported and will be automatically disabled if activated.

### autopick:

- **first arrivals**: new options max. timediff and search size. The program controls whether the timeshift between the actual pick and the median value within the given search size (symmetrical around the pick position) does not exceed a given value (option max.timediff).

- with the options **show cursor in 2. window** (under 2D-datanalysis/view) and the option **plot on 2.line** (global settings menu) activated the actual picks will be continuously displayed within the secondary profile

## 5. Edit traceheader

new update option **correct for offset in profile direction** which allows to correct an offset in profile direction for the xy-GPS coordinates. The option might be useful if there exists an **offset** between the geophones/shots and the GPS-unit, e.g. a data acquisition on a ship with a boomer and hydrophones. The program calculates the actual direction of the profile from the difference of the actual GPS-coordinate and the previous one. It is possible to select a **smooth** range for the definition of the profile direction. The option is also available within the Edit several fileheaders menu.

New update option **UTM-DEGREE-conversion** which allows to convert UTM-coordinates into degrees. You must enter the correct utm-zone and the xy-coordinates will be automatically transformed into degrees or arcsecs.

New update option **NWI-GPS** with the format  
tracenummer dummy date time longitude latitude  
17 (0) 28.04.2009 15:48:26 <644.482580><5357.605670>(2)  
The option is also available within the import menu.

**Fileheader** update: now the **S/R distance** will be taken into account for const.offset profiles. The S/R distance is added to the source coordinates in the given profile direction. This allows you to easily define the geometry for multi common offset data, e.g. GPR data with different antenna separations.

**Utm-conversion:** if distancedimension = **'foot'** the utm-conversion now gives foot-values instead of meter values.

**Gps-Times:** new format **ASCII-MapSource**. Two different formats for UTM-data and Gauss Krüger data are supported.

UTM:

```
Trackpoint 32 U 471164 5443567 24.11.2009 17:15:53 103 m 5.03 m 00:00:05 3.6 kph 162° true  
Trackpoint 32 U 471159 5443560 24.11.2009 17:15:58 105 m 8.56 m 00:00:05 6.2 kph 213° true
```

Gauss Krüger:

```
Trackpoint 3 471229 5445306 24.11.2009 17:15:53 103 m 5.03 m 00:00:05 3.6 kph 162° true  
Trackpoint 3 471224 5445299 24.11.2009 17:15:58 105 m 8.56 m 00:00:05 6.2 kph 213° true
```

The seconds within the time may also have decimal places.

Now the program also supports the use if the GPS acquisition times (in secs after midnight) are not stored within the file traceheader. For that purpose the following assumptions must hold true:

- the data have been acquired using an equidistant timebase (traces per second are identical within the complete profile)

- the start and end time of the profile is identical to the start and end time of the GPS data

If necessary the start and end time of the GPS data must be adapted manually.

Two different types of interpolation are supported:

- with the option pure linear interpolation active the interpolation is linear for all data

- with the option pure linear interpolation deactivated the interpolation is linear if the mean acquisition velocities between two successive GPS time marks do not vary more than 10 %. Otherwise the program performs an interpolation based on a constant acceleration. The option check accelerations smoothes the calculated accelerations. Activate this option if the resulting interpolations show too strong undulations.

New option **apply x-z topography** within the topography (x-z values) box within the traceheader tabella: if activated the geometries of the shots and the receivers are recalculated based on the topographic xz-values. The program automatically determines the positions of all shots and receivers on the given topography and calculates the x- and z-projections of these positions. The option is identical to the option apply x-z topography within the travelttime analysis module with the difference that the z-values must be given as depths. It is assumed that the x-values of the data do not represent the correct x-coordinates but are determined directly on the topographic interface. The program automatically determines the positions of all receivers on the given topography and calculates the x- and z-projections of these positions.

The topographic xz-values are read from an ASCII-file whereby each line of the ASCII-file contains one pair of xz-values. The x-coordinate within the ASCII-file represents the true x-coordinate within the xz-coordinate



system. The following assumptions must hold true:

1. The topography file must contain the values for  $x=0$  (fixed point) because this value serves at the starting point for determining the corrections. All corrections are relative to the value at  $x=0$ .
2. The profile direction is pure  $x$ , this means that the  $y$ -coordinates of all shots and receivers are equal.
3. The original  $x$ -values are taken directly on the topographic interface.

The application of this option is useful if you want to introduce a topography for the wavefront-inversion or for the raytracing (chap. 4.7).

## **6. Edit fileheader**

new group box **data format**: the option **save data** allows to change the dataformat of the primary file given within the option **new data format**. The option **batch save data** allows to change the dataformat for a selectable number of Reflexw files.

If given within the original data (e.g. DZT files) the scans per seconds will be displayed within the fileheader menu.

Fileheader coordinates: now most operations concerning the fileheader coordinates use double precision. Thereby also utm-coordinates can be used within the fileheader even with a traceincrement smaller than 0.1 m.

## **7. Edit several fileheaders**

Now the **S/R distance** can be changed for common offset profiles.

**Update traceheader** now supports the option NWI-GPS and correct for offset in profile direction.

## **8. 3-component analysis**

If picks had been loaded within the 3-component analysis the actual angles can be exported together with the picks when using the ASCII-columns format (option angles activated).

## **9. Export**

new option **addition for output filename** for the automatic filenaming: enter an additional specification for the outputfilename which will be added at the end.

New option **load and save pick values** for **SEG-Y** and **SEG-Y-DOS** export. If activated the picks stored under the same filename (option automatic name within the save pick menu) will be saved within the SEG-Y traceheader bytes 237-240 in next smaller timedimension ( $\mu$ s if original timedimension is ms or ps if original timedimension is ns).

**SEG2**: new header word **Y\_AXIS** specifying **TIME** or **DEPTH** depending on the timedimension.

## II. 3D-datainterpretation

### general:

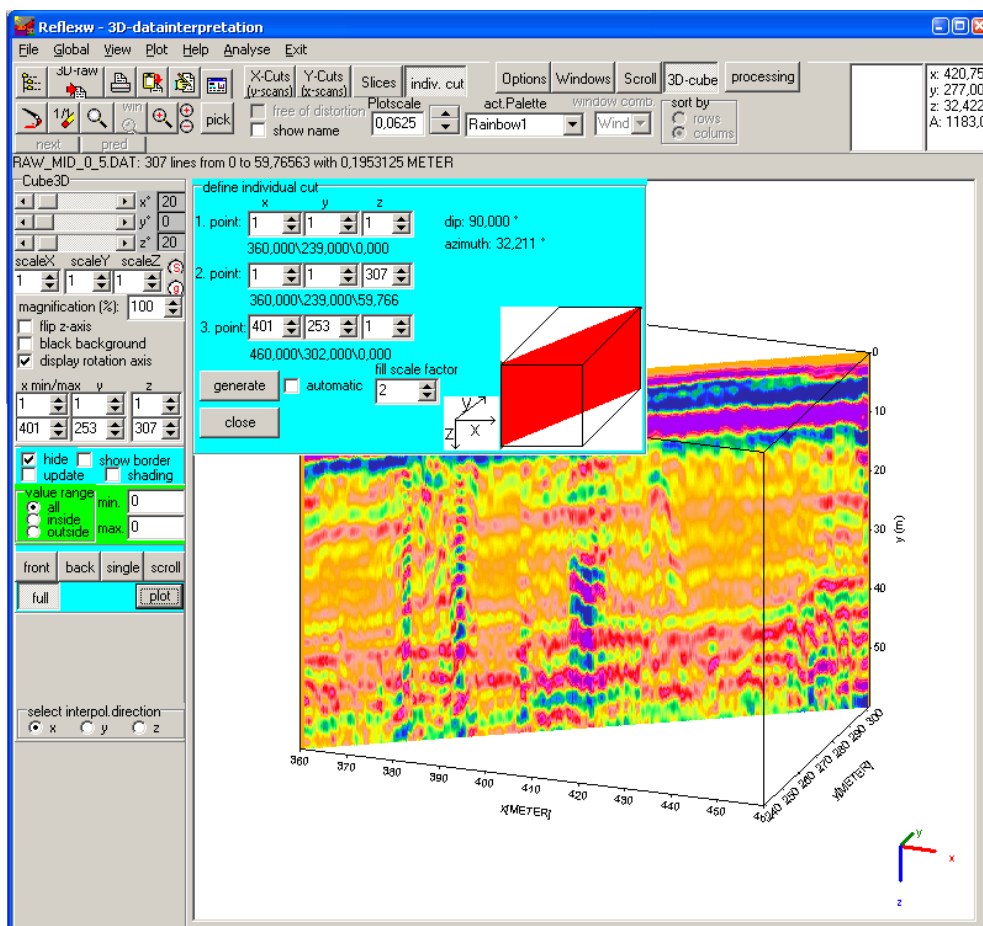
- the **max. number of points** for 3D-file has been increased to 2048 in all 3 directions.

- save and load cube parameters - now the parameter file Cube3DPar.txt will be saved and loaded from the actual project directory (former program directory).

**View/model contours:** now different models can be loaded for the primary and the secondary 3D-datafile. If only one model has been loaded either using the options primary file or secondary file the model contours of this model will be displayed for both 3D-datafiles.

**indiv. cut** - the option allows the definition and the display of an individual cut. The definition is done by defining 3 points of the plane. The definition is given in samples in x-, y- and z-direction. The corresponding coordinates are automatically updated below as well as the dip and the azimuth. The azimuth is calculated from the intersection of the plane with the xy-plane and the x-direction.

Activating the option generate shows the actual cut plane within the sketch cube. If automatic is active the sketch cube will be updated automatically when changing any cut point. The fill scale factor is set to 1 by default. If the plane will not be completely filled the fill scale factor must be increased until the filling is complete. The individual cut will be plotted into the 3D-cube using the option plot with the 3D-cube plotoption full activated.



**shift-3d-cuts:** new option which allows to shift the cuts against each other. The option might be useful if the cuts exhibit a special zig-zag pattern (shift mode set to shift every 2. cut) due to e.g. a meandering data acquisition (see picture on the right) or an overall shift of special xy-ranges (shift mode set to shift every cut). The zig-zag pattern can only be removed if no interpolation has been used when defining the 3D-datafile.

It is possible to define up to 100 different rectangular xy-ranges (parameter number) whereby it is only possible to restrict the range perpendicular to the direction of the acquired profiles. The shift is only possible in the direction of the acquired profiles (not perpendicular to them). The shift will be displayed interactively as soon as any change of the parameters has been done. For that purpose the data should be displayed using the slices. It is possible to save the new 3D-datafile using the option analyse/shift-3D-cuts.

Input parameters:



number: number of the xy-range

Start x-cut or start y-cut: first cut number for the actual xy-range

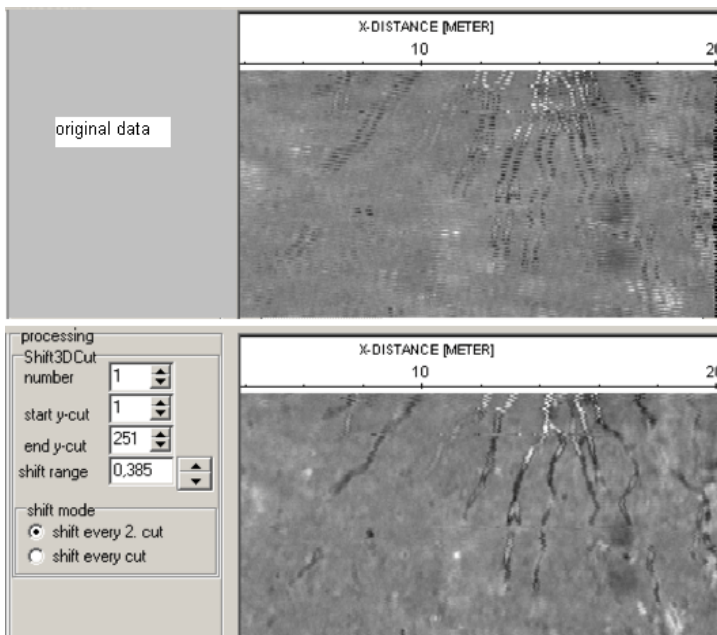
end x-cut or y-cut: last cut number for the actual xy-range

Shift range: input of the shift range using the given distance dimension.

shit mode: enter whether every 2. cut or every cut shall be shifted starting at start cut respectively.

The actual shift parameters can be saved on a file shift3DCuts.fil under the project directory using the option . Those parameters can also be reloaded using the option .

Using the option analyse/Shift 3D-cuts a new 3D-datafile containing the shifted cuts can be saved. For that purpose a processing label must be entered. The option is equivalent to the processing option Shift-3DFile under processing/trace interpolation within the 2D-dataanalysis which however uses the complete xy-range for the entered shift parameters.



**Normalize 3d-cuts:** allows an energy normalization for up to 10 different rectangular xy-ranges. The option might be reasonably employed if e.g. the timeslices show distinct stripe patterns which indicate different coupling conditions (see picture on the right).

The energy normalization will be displayed interactively as soon as any change of the parameters has been done. For that purpose the data should be displayed using the slices.

Input paramters:

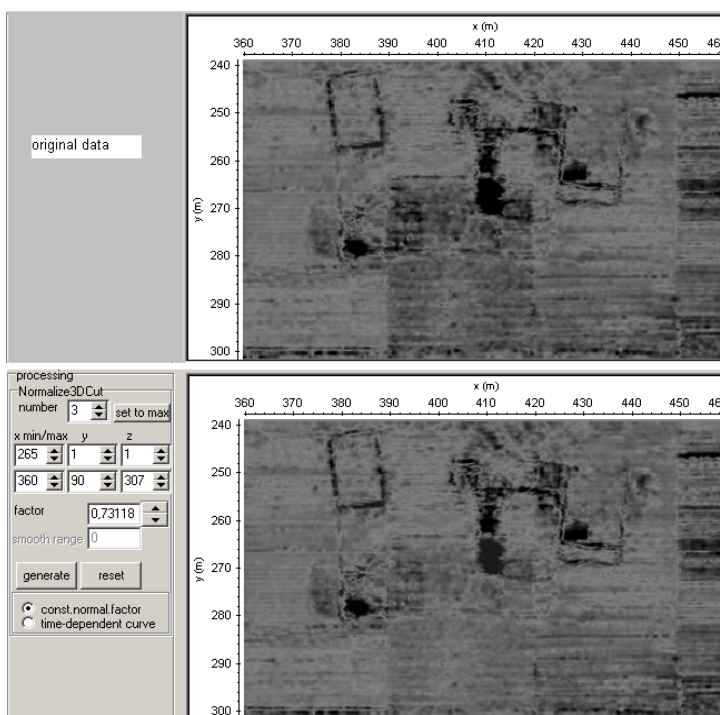
number: enter the number (max. 10) of the xy-range to be normalized

The xy-range is defined within the editfields **min.** and **max.**

The z-range has been set to the max. range by default. It can be decreased for the normalization based on the constant normalizing factor.



Set to max: set the x/y cuts to the max. values for the actual 3D-profile

**constant normalizing factor:** one single scaling factor is used for all values lying within the



chosen xy-range. Activating the option **generate** the scaling factor will be calculated from the quotient of the overall mean energy value of the 3D-datafile and the total energy value of the chosen xy-range. The mean energy values will be determined within the given timewindow (options min/max. z cuts). The factor can also be entered (changed) manually.

**time-dependent normalizing curve:** a timedependent scaling curve will be calculated from the overall mean envelope curve of the complete 3D-file and the mean envelope curve of the chosen xy-range using the option **generate**. The envelope curves will be determined over the total timerange and summed up over all traces. Then this mean envelope (energy) curve will be smoothed over the given timerange (option **smooth range**). The option changes the energy distribution with respect to the timeaxis. For example: if a high reflection energy area exists within a special timerange within the chosen xy-range the option will lower the energy within this timerange for this range.

The actual normalize parameters can be saved on a file `normalize3DCuts.fil` under the project directory using the option . Those parameters can also be reloaded using the option .


It is possible to save the new 3D-datafile containing the actual `normalize3DCuts` changes using the option `analyse/shift-3D-cuts`.

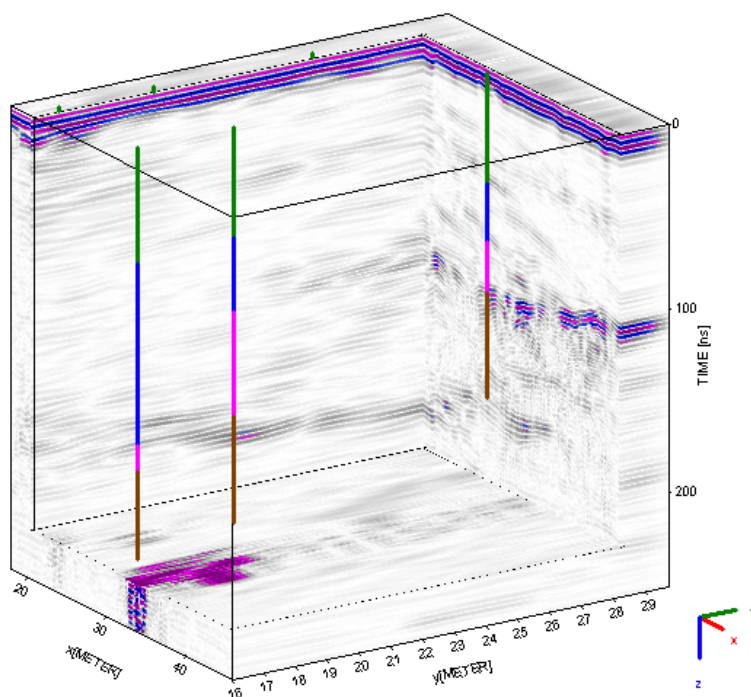
**core data/1D-models** - new option under view which allows to view and adapt 3D-coredata. In addition to the 2D-core data the y-position of the coredata must have been specified in addition within the second line of each core (see example below 28 m).

```
CORE 4 - NAME4
  30.0000  28.0000
  1  2.500000  1  0.083  0.083
  2  1.500000  1  0.087  0.096
  3  2.000000  1  0.101  0.146
  4  2.000000  1  0.091  0.070
```

The boreholes will be displayed both within the individual cuts and within the 3D-cube.

An option box named `core adapt` opens when a `coredata` file has been loaded. Within this box the velocities of all layers within the corefile or of a special layer can be adapted. It is only possible to adapt the single velocities of the core within the scroll display mode. Click on any layer bar which you want to adapt. The fill style of this layer bar changes. With the highlighted adaptation parameter `v` it is now possible to change the velocity of this distinct layer by pressing the key `<`

or `>` respectively or by entering a new value. With the option **change all** activated all `layervelocites` of all actual cores are changed simultaneously. This is possible for all display modes. The speedbutton  allows to save the adapted cores under the same filename.



### III. CMP velocity analysis

new option **correct dip**: allows to enter a dip angle in degrees for each layer which will be taken into account when calculating the reflection traveltimes.

## IV modelling

### 1. raytracing

**raytracing** based on **data traveltimes**: now also the geometry for transmission data is taken into account using **value** for source z and the receiver z locations. If value is chosen for both options the geometries are taken from the geometries given within the picked data traveltimes. The option **sec.coord.** defines whether the y-coordinates or the z-coordinates within the picked data traveltimes are taken into account.

The accuracy when dealing with a **topography** has been increased.

A check has been introduced if the calculated traveltimes exhibit a much too high value.

### 2. Tomography

new option **BatchStartTomo** which allows to make several tomographic inversions within one step using different tomographic parameters. After having started the option an ASCII batch file is queried which must have the following structure - example with 3 different parameter sets:

```
iterations: 10 12 14
threshold: 0.001 0.003 0.002
modelchangeA: 1 0.9 0.8
modelchangeB: 0.1 0.11 0.12
convergenceSearch: 5 6 7
maxdefchange: 200 150 100
basedonitermodel: 0 1 0
defdatavariance: 0.01 0.02 0.03
maxbeamwidth: 10 12 8
averageX: 0 2 4
averageZ: 0 1 2
statisticalcriterium: 1 0 1
checknorayarea: 1 1 0
beam: 1 0 0
weightedbeam: 0 1 1
force1iter: 1 0 1
```

The final models will be saved under the given final model name together with a running number (for this example `final_model1` .... `final_model3`).

### 3. Model input

**import (x,z)**: if the actual layer is 1 it is assumed that a topography will be introduced. The option **topography** will be automatically activated if deactive and an interpolation in x-direction of the nearest existing parameters will be done instead of simply using the most nearest ones. After having performed the option the model will be automatically updated.