

# Main news of the REFLEXW version 6.0 from 01.04.2011

## I. 2D-dataanalysis

### 1.general

GPS synchronization (also in Reflex2DQuick):



A new option named GPS has been included which allows to control the display of the current profile by GPS-coordinates coming through the serial port. The option opens a new panel where you can enter the necessary parameters for the serial port. The option activate synchronization starts the synchronization with the NMEA strings. Each time a NMEA string has been recognized at the entered com port the programs skips to the position given within the NMEA coordinates. The radio group box GPS trace at allows you to define where the trace with the found GPS coordinates is situated either at the start, at the middle or at the end. The position will be marked by a blue rectangle. The scroll type box allows you to define a stepwise or a smooth skipping. If smooth has been activated you can choose a delay value in order to adapt the scrolling. Together with the option ScrollSize within the global settings menu you may achieve a more or less continuous scrolling.

The NMEA string must have the following form:

```
$GPGGA,095656,3757.3888,N,02348.9613,E,1,09,1.3,914.8,M,34.4,M,,0000*4A
```

new options **1./2.** and **2.** which replace the old option sec. for the use with the next and prev. buttons: With **1./2.** 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. With **2.** activated only the secondary profile will be updated when using the next and prev. buttons. The specified filefilter for the secondary file will be used. The primary profile remains unchanged.

### View:

- option **show profile line:**

- new option **show shot positions** - if activated the shot positions stored within the traceheaders are displayed in addition in green (blue for 2.line) color.
- new option **use lineparts** - if activated the coordinates lines will be displayed under consideration of the line parts (if the ensemble number changes the coordinates will not be combined using a line).
- new option **show all coordinates** - if activated all coordinates will be plotted. Deactivating the option means that the coordinate line will be resampled based on the max. number of 1000 for the display.

- new option **act sample informations** - if active a window opens near the actual cursor position showing the actual trace and sample number, the amplitude, the distance and the time.

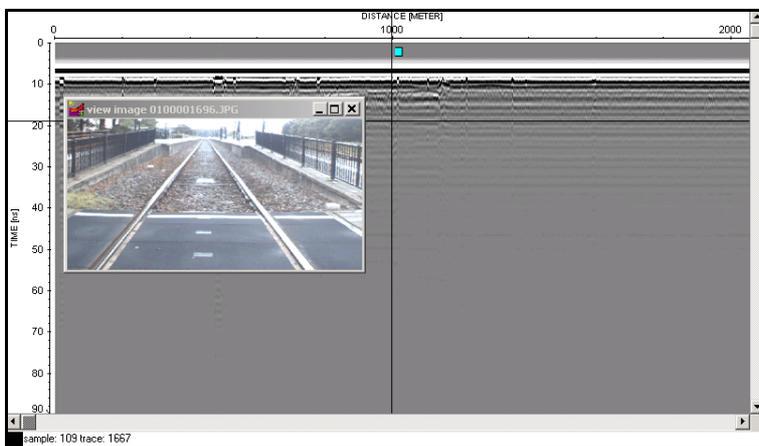
- new option **view camera images**: if activated camera images are shown based on the actual cursor positions within a freely moveable and scalable window. Two options are available: marker and tracenumber.

If **tracenumber** has been chosen the filenames of the camera image are directly connected to the tracenumbers of the profile. After having activated the option the camera image files must be selected (multiple file choice using the strg or shft key). The filenames of the camera images must have the following form:

The last 8 characters of the filename specify the trace number position within the profile, e.g.:

0100003396.jpg - the string 00003396 is used in order to determine the tracenumber position of the camera image.

If **marker** has been selected one file within the camera directory must be chosen in order to determine the path where the camera image files which have been stored within the comment markers in a step before are present. All comment markers of the profile which text has an extension are assumed to represent a camera filename stored within the chosen path (see option edit comment markers/create based on filenames).



The advantage using this procedure in order to view the camera images is that processing steps which change the trace number may be applied on the data.

While moving through the profile the camera image next to the actual cursor position will be plotted. The position of the camera image will be marked as a blue rectangle at the top of the profile.

## 2. Display

new option **zoom sec. lines**: the zoom for the secondary lines can be deactivated using the following suboptions no, x or y. With no activated no zoom will be done for both axis, with x activated no zoom will be done for the x(distance)-axis and with y activated no zoom will be done for the y(time)-axis.

View **3. and 4. profile**: now **autoscroll** available and scroll supported for rotated display.

### **3. Import**

**SEG Y:** new option **unsigned** - if activated 16 bit integer SEG Y data (format code = 3) are assumed to be unsigned. Data from the Coda system may have been stored as unsigned 16 bit data. It must be controlled manually if this holds true as no unique informations are given within the Coda SEG Y-header.

New option **unsigned** for the **SEG Y-coordinates** - if activated the 32 bit integer SEG Y coordinates are assumed to be unsigned. Data from the Knudsen system may have been stored as unsigned 32 bit data. It must be controlled manually if this holds true.

**read trace increment:** the SEG Y-format does not directly specify the traceincrement. Until now the traceincrement has been determined from the distance between the first and second trace. Because of rounding problems this may lead to an incorrect end distance. Therefore now the mean traceincrement will be determined from the distance between the first and last trace which has been calculated from the receiver positions defined within the SEG Y-traceheaders if available.

**SEG2:** new option **ignore stringlengths** -if activated the trace strings will be interpreted even if the stringlengths are set to 0 (a different method for discriminating the individual SEG2-traceheader strings will be used). Activate the option if problems occur during reading the SEG2-traceheaders ,e.g. no timeincrement has been detected.

**RADAN:** now the import of **32 bit data** are supported which are generated by the newest GSSI-systems like the SIR-30. These data are normally unprocessed and must be stored within Reflexw using the 32 bit floating point output format in order to preserve the full data resolution.

**ASCII-3D-Koehler:** import ASCII format for a 3D-dataacquisition. The datatype within the import menu will be automatically set to 3D-const.offset. The acquisition direction must be in x-direction.

There is an header in front of the data of 25 lines:

```
1..9. line will be overwritten
10.line: xmin [mm]:          145.000
11.line: xmax [mm]:          320.000
12.line: traceincrement:     7.000
13.line: number of x-lines:  26.000
14.line: ymin [mm]:          325.000
15.line: ymax [mm]:          500.000
16.line: profile increment:  7.000
17.line: number of y-lines:  26.000
18..22. line will be overwritten
23.line: timeincrement:      0.031250
24.line: number of samples:  1761
25.line: time measured:      55.031250
26.line .... n.line data
```

Each data line contains a complete trace with data written in ASCII-format.

New data types **single shot/boreholes** and **single shot/VSP** can be used for a borehole/borehole geometry and borehole/surface geometry. Both types offer an easier input for the necessary geometry.

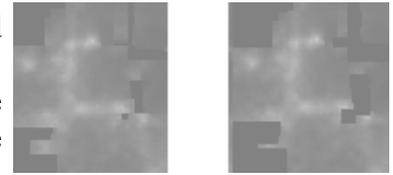
Conversion sequence **inline lines:** new options move receivers and move shots which allow to specify whether the shots and/or the receivers are moved by the constant distance (parameter line distance).

## 4. Dataprocessing

- **constrain borders:** new option under 2D-filter - the option checks the non covered range and sharpens the borders depending on the entered parameters. The option should only be applied on timeslices.

The parameters **nr. of traces (x)** and **nr. of samples (y)** define the range for sharpening and may for example coincide with the interpolation range used for the calculation of the timeslices (see below).

The option might be useful if an interpolation has been used for generating the timeslices and due to this interpolation the borders of the acquisition area have been enlarged and smoothed. This might be critical if the acquisition area has some obstacles like walls and the interpolation ranges into these (picture on the left). The option now allows you to sharpen the acquisition borders and to remove the extrapolation into non desired ranges (picture on the right).

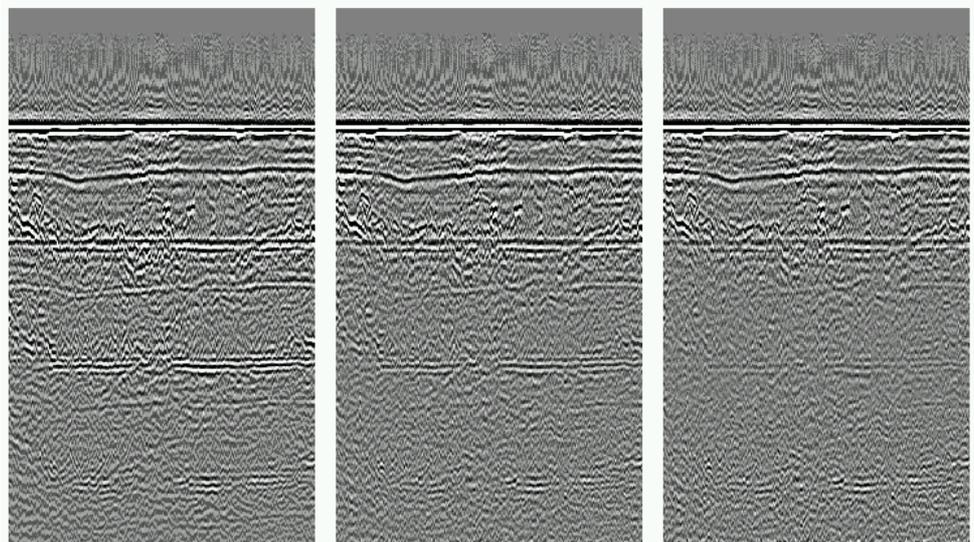


- **Mov. window spectrum** under complex trace interpolation: new option **apply on each trace separately** which allows to apply the moving spectrum for each trace separately without any summing. After having started the option the overall filename must be entered. An automatic labelling is added to the filename depending on the trace number of the original file. Example with 100 different independent files: entered new overall filename: test - the new filenames will be: test0001.00t, test0002.00t,.....,test0100.00t. The files are stored under the subdirectory prodata with the extension 00t.

- **Swap 2 timeblocks** under edit traces: new option which allows to swap two datablocks in timedirection. Example: the trace consists of 4096 samples. After having applied the option the timeblock of sample 1 to 2048 and the timeblock of sample 2049 to 4096 will be swapped, this means old sample 1 will be located at sample 2049 and old sample 2049 at position 1 and so on. Use this option if some traces are swapped for some reasons.

- **Merge in time dir.** under edit traces: new possibility to manually load the wanted files which shall be merged in timedirection together with the primary file. With **manual choice** activated the chosen profiles will be automatically sorted in alphabetic order with the primary file at the first position. Within the sequence processing only the automatic file choice is available.

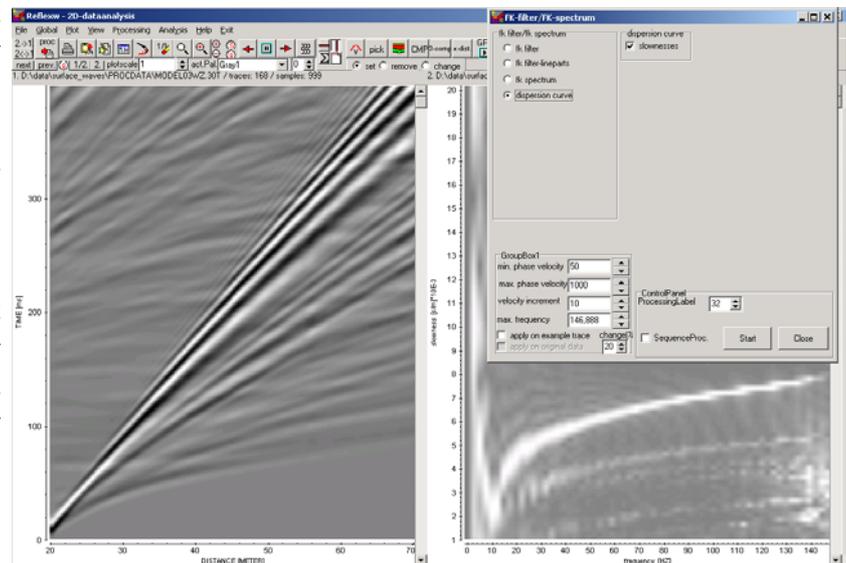
- **Deconvolution/shaping** under 1D-filter: new option **runs** which allows to apply the deconvolution several times using the same parameters. The picture on the left shows the original data showing distinct multiples from the surface. The middle picture shows the result after one predictive deconvolution, the right panel shows the result after 7 runs.



- **Dispersion curve**: new option under processing/fk-filter. Frequency. The output is either within the frequency-phase velocity (f-v) or frequency-phase slowness (f-p) domain (option slownesses activated). As input parameters the **min. and max. phase velocities** as well as the **velocity increment** and the **max. frequency** must be entered. Default values are given for the phase velocity window. The default value of the max. frequency will be automatically determined from the data or from the nominal frequency given within the fileheader (3 \* nominal frequency).

The option **slownesses** controls if the dispersion curve output is within the f-v or f-p (option activated) domain. In the f-p domain the data normally shows less smearing at lower frequencies. Different algorithms are used for the two domains - therefore no interpolation is necessary for a subsequent transformation.

The dispersion curve output can be used to analyze the phase velocity frequency behaviour of a single shot record. Picking the fundamental or higher modes allows to invert a velocity depth model (normally shear wave) within a subsequent step using an appropriate method.



- **reverse polarity** under edit traces: new suboption **use lineparts**. Activating this option might be useful especially for a multi shot file where e.g. one geophone of a moving line always exhibits the wrong polarity.

- **resort-traceheader** under edit traces: new suboptions **distancies** and **times collected** - now the resorting of the data in x-direction can be done either based on the distancies or on the collected times stored within the individual trace headers.

- **correct 3Dtopography** under static correction - new suboptions **project x-axis** and **make equidistant**. With the option **project on x- or y-axis** activated the geometries of the shots and the receivers are recalculated based on the topographic xyz-values for profiles which are strictly orientated into the x- or y-direction. It is assumed that the original x- or y-coordinates do not represent the correct x- and y-coordinates but had been determined directly on the topographic interface. The program automatically determines the positions of all shots and receivers on the given topography and calculates the x- or y-(for profiles which are orientated into the y-direction) projections of these positions respectively. The x- and y-coordinates of the topographically corrected data represent the true x- and y-coordinate within the xyz-coordinate system.

The projection normally leads to a reduction of the total length of the profile. The mean trace increment as well as the end coordinate in profile direction will be updated. The traceheader coordinates as well as the traceheader distancies contain the true coordinates. With the suboption **make equidistant** equidistant traces will be created based on the traceheader distancies. The mean traceincrement will be used for the construction. The use of this option is not recommended for data with a quite large increment and changing source/receiver increments like e.g. seismic refraction data as the necessary interpolation for creating equidistant data will be done for identical time values (horizontal interpolation).

## **5. Edit fileheader**

**nominal frequency:** new option **get** which calculates the nominal frequency from all traces of the actual profile.

## **6. Edit traceheader**

**interpolation 0-data:** new suboption **ignore time collect** - if activated the 0 data interpolation (extrapolation) will be also done for those traces for which a value for **timecollect** has been specified.

**correct for offset in profile direction:** if the distances within the traceheader are specified the correction is done based on these trace header distances (see also update option **calculate distances**). This means that the corrected values follow exactly the track of the GPS-unit. If an extrapolation is necessary at the end or at the start of the profile (depending on the **correct** value) 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. If no distances are stored within the traceheaders this procedure will be applied for all traces.

**second profile marker positions:** new update option which allows to copy the traceheader coordinates and times from a secondary profile at the given marker positions of both profiles. After having activated the option the filename of the secondary profile will be queried. Precondition is that the marker positions are identical. An application might be the synchronization of a newer acquisition system using a gps unit and an older system which cannot be synchronized with a gps unit.

**Geode-GPS:** new option under update which allows to read the GPS coordinates using the format of the Geode software. One GPS file with the extension **log** must exist. Each block of the file starts with a line containing the trace number. A header with 2 or more lines may exist followed by a number of GPS blocks consisting of one line containing the GPS coordinates and one line containing the FFID number (field record number) which is used for the assignment to the traceheader field record number of the original data. Following an example of one GPS-block is shown:

```
$GPGGA,162241.00,4625.938360,N,000950.727816,E,2,10,1.0,2635.9,M,45.6,M,5.0,0120*46
```

```
FFID 3783 (Stack 1, Shot Loc: 0 Meters) 16:22:41.00 09/28/2010 160 KBytes SAVED IN 3782.SGY
```

Within the \$GPGGA line the following fields will be interpreted:

field 3: 4625.938360 - geographic latitude in *ddmm.mmmmmmm* format (46 degrees and 25.938360 minutes)

field 5: 000950.727816 - geographic longitude in *dddmm.mmmmmmm* format (9 degrees and 50.727816 minutes)

field 10: 2635.9 - antenna height above MSL (mean sea level) reference (2635.92 m)

The coordinates will be assigned to those traces which field record number within the traceheader is identical to 3783.

The latitude and the longitude are stored in degrees within the x- and y-receiver traceheader positions. REFLEXW stores the latitude, the longitude and the altitude into the traceheaders using a 32 or 64 bit floating format depending on the output format during the import of the data. If there are consecutive identical coordinates in the gps-file these coordinates are automatically be replaced with an interpolation. An interpolation or extrapolation is also done where no coordinates are defined (missing tracenumbers) or where the GPS-coordinates are not defined.

The option is also available within the import menu.

**Gps-times:** new suboption **use lineparts** - if activated only the times stored for the first ensemble will be used for the synchronization with the external GPS-file. The found coordinates will be transferred to the

corresponding traceheaders of the other ensembles. Activate this option if the file is a 3D-datafile consisting of parallel 2D-files stored sequentially. As a result all 2D-ensembles will have the same coordinates - this means that the offset between the 2D-lines will not be taken into account.

## **7. Edit traceheader tabella**

Now 12 places are used for the data representation within the tabella.

New option **smooth rec. xy-coord.** which allows to perform a running smooth of the xy-receiver coordinates over an adjustable range of traces. The option might be useful for GPS-data especially if the option update distancies (see below) shall be used afterwards.

New option **view rec. geometry** which allows to display the receiver coordinates within and an additional window (any curvature of the line coordinates is displayed). With the option **free of distortion** activated the x- and y-axis are equally scaled for display. With the option **show shot positions** activated the shot positions stored within the traceheaders are displayed in addition in green (blue for 2.line) color. **Zooming** and **copy to clipboard** possibilities are included.

## **8. Edit several fileheaders**

New option **interpolate** which allows to interpolate between two given values. The interpolation is only possible within one column (for example trace-inr.). The option may also be used in order to change all values to new single one.

## **9. Edit comment markers**

new option **filenames** under create: the option allows to save the filenames (without path) of e.g. camera images within the comment markers. The filenames must have the following form:

The last 8 characters of the filename specify the trace number position within the profile, e.g.:

0100003396.jpg - the string 00003396 is used in order to determine the tracenummer position of the filenames stored as a comment marker. The option might be used for example for viewing camera images (option view/view camera images/marker).

A warning message appears if two or more markers have been found for the same trace number. In this case either the option keep exist. must be deactivated or the individual markers at this same positions must be removed.

New option **keep exist.:** if active the existing comment markers will be kept if new markers will be created.

New option **distance based** for **save 2.lines:** if activated the comment markers will be saved for the 2. lines based on the distancies instead of the tracenumbers.

## **10. Pick**

Save **picks** under **ASCII-columns** using the option **export several ex....**: now also n. pick is active.

## **11. Layer-show**

new option **2.line/lay**: allows to load a second line together with a layershow. Accordingly to the possibility of load up to 4 different profiles the display can be splitted into pure vertical split, pure horizontal split or both vertically and horizontally (hor./ver.split or ver./hor.split activated).

**Create report** - activated option **summary comment data**: now the summing up can be chosen from average, median and mode to be found under summary over.

## 12. CMP-processing

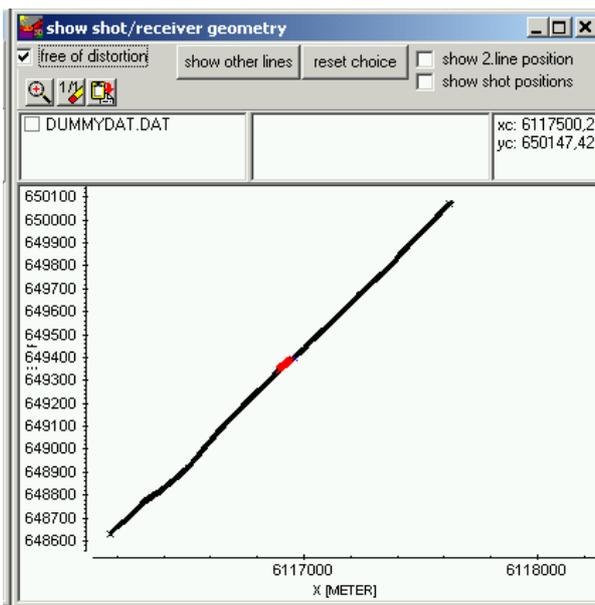
standard geometry: new standard line direction **GPS-position**. Precondition is that GPS-coordinates are present within the traceheaders for each field record. You may enter a moving line relative to these GPS-coordinates. The input of this relative geometry is the same like for x-direction but the option shot-increment is replaced by offset smooth. This parameter is used for the automatic definition of the profile direction from the given GPS-positions.

The example shows a standard geometry with the GPS-unit located on the ship and the shots 30 m behind this unit with a lateral offset of 6 m. The first receiver is located 15 m and the last receiver 84 m behind the shot. The option show stand.geometry allows to sketch this geometry. The shot and receiver traceheader coordinates contain the coordinates of the GPS-unit. After applying this standard geometry with 24 channels the shot and receivers positions for each trace have been calculated.

The option view geometry allows to view the geometry of all shots. For this purpose click on any shot number within the table. The actual shot (in blue) and the receivers (in red) are highlighted. You can use the up/down cursors in order to move through all shots.

| shot no | 1.trace | last trace | shot x  | shot y   | recx start | recx end | recy start | recy end |
|---------|---------|------------|---------|----------|------------|----------|------------|----------|
| 1       | 1       | 24         | 6116253 | 648709,5 | 6116253    | 6116253  | 648709,5   | 648709,5 |
| 2       | 25      | 48         | 6116256 | 648712,6 | 6116256    | 6116256  | 648712,6   | 648712,6 |
| 3       | 49      | 72         | 6116260 | 648715,6 | 6116260    | 6116260  | 648715,6   | 648715,6 |
| 4       | 73      | 96         | 6116263 | 648718,2 | 6116263    | 6116263  | 648718,2   | 648718,2 |
| 5       | 97      | 120        | 6116267 | 648720,9 | 6116267    | 6116267  | 648720,9   | 648720,9 |
| 6       | 121     | 144        | 6116270 | 648723,2 | 6116270    | 6116270  | 648723,2   | 648723,2 |
| 7       | 145     | 168        | 6116273 | 648726,6 | 6116273    | 6116273  | 648726,6   | 648726,6 |
| 8       | 169     | 192        | 6116276 | 648728,8 | 6116276    | 6116276  | 648728,8   | 648728,8 |
| 9       | 193     | 216        | 6116280 | 648732,1 | 6116280    | 6116280  | 648732,1   | 648732,1 |
| 10      | 217     | 240        | 6116282 | 648734,7 | 6116282    | 6116282  | 648734,7   | 648734,7 |
| 11      | 241     | 264        | 6116286 | 648738   | 6116286    | 6116286  | 648738     | 648738   |
| 12      | 265     | 288        | 6116289 | 648740,5 | 6116289    | 6116289  | 648740,5   | 648740,5 |
| 13      | 289     | 312        | 6116293 | 648744,2 | 6116293    | 6116293  | 648744,2   | 648744,2 |
| 14      | 313     | 336        | 6116295 | 648746,8 | 6116295    | 6116295  | 648746,8   | 648746,8 |

| shot no | 1.trace | last trace | shot x  | shot y   | recx start | recx end | recy start | recy end |
|---------|---------|------------|---------|----------|------------|----------|------------|----------|
| 1       | 24      | 1          | 6116235 | 648684,8 | 6116169    | 6116220  | 648632,2   | 648679   |
| 2       | 48      | 25         | 6116238 | 648687,9 | 6116172    | 6116223  | 648635,3   | 648682,1 |
| 3       | 72      | 49         | 6116242 | 648690,9 | 6116176    | 6116227  | 648638,3   | 648685,1 |
| 4       | 96      | 73         | 6116245 | 648693,4 | 6116179    | 6116229  | 648640,9   | 648687,6 |
| 5       | 120     | 97         | 6116249 | 648696,2 | 6116183    | 6116234  | 648643,6   | 648690,4 |
| 6       | 144     | 121        | 6116252 | 648698,5 | 6116186    | 6116237  | 648645,9   | 648692,7 |
| 7       | 168     | 145        | 6116255 | 648701,9 | 6116189    | 6116240  | 648649,3   | 648696,1 |
| 8       | 192     | 169        | 6116258 | 648704   | 6116192    | 6116243  | 648651,5   | 648698,3 |
| 9       | 216     | 193        | 6116262 | 648707,4 | 6116196    | 6116247  | 648654,8   | 648701,6 |
| 10      | 240     | 217        | 6116265 | 648709,9 | 6116199    | 6116249  | 648657,4   | 648704,2 |
| 11      | 264     | 241        | 6116268 | 648713,3 | 6116203    | 6116253  | 648660,7   | 648707,5 |
| 12      | 288     | 265        | 6116271 | 648715,8 | 6116205    | 6116256  | 648663,2   | 648710   |
| 13      | 312     | 289        | 6116275 | 648719,5 | 6116209    | 6116260  | 648666,9   | 648713,7 |
| 14      | 336     | 313        | 6116277 | 648722   | 6116212    | 6116262  | 648669,5   | 648716,3 |



If a CMP-stacking shall be done afterwards the CMP-bin must be set to a sufficiently large value (e.g. half the mean shot increment) because normally the individual CMP's do not exactly fit if GPS-coordinates are used. The distance axis of the resulting stack also starts at 0 if GPS coordinates are used and an optional smoothing of the coordinates will be done if the distances significantly deviate from the linear distance.

## II. modelling

### 1. raytracing

modelling: raytracing without raster. Now also a Reflexw file can be used as rasterfile for the subsequent raytracing.

### 2. tomography

new option **restrict to covered area** - if activated the velocities (values) outside the area covered by rays will be set to 0.

## III. CMP-velocity analysis

- new options for a fast switch between wiggle and point mode and changing the amplitude scale.

- new option **backshift** which allows to take into account a backshift timevalue which compensates the effect when using delayed wavelet maxima for the **semblance** or **unnormalized crosscorrelation** analysis. The timeshift must be chosen in such a way that the resulting reflection curve stems from the very first arrival.

## IV. 3D-datainterpretation

generate **3D-file from 2D-lines** with type use interpolation scheme for freely distributed 2D-lines:

New option **data scaling** which allows to enter a scaling factor with which the resulting 3D-datafile values will be multiplied. This might be necessary because during the 3D-datafile generation the data will be stored as 16 bit integer values and consequently may fall out of the binary data representation if the original data exhibit small or very large values. A corresponding data scaling value can be used in order to rescale the data in order to be able to be represented as 16 bit integer.