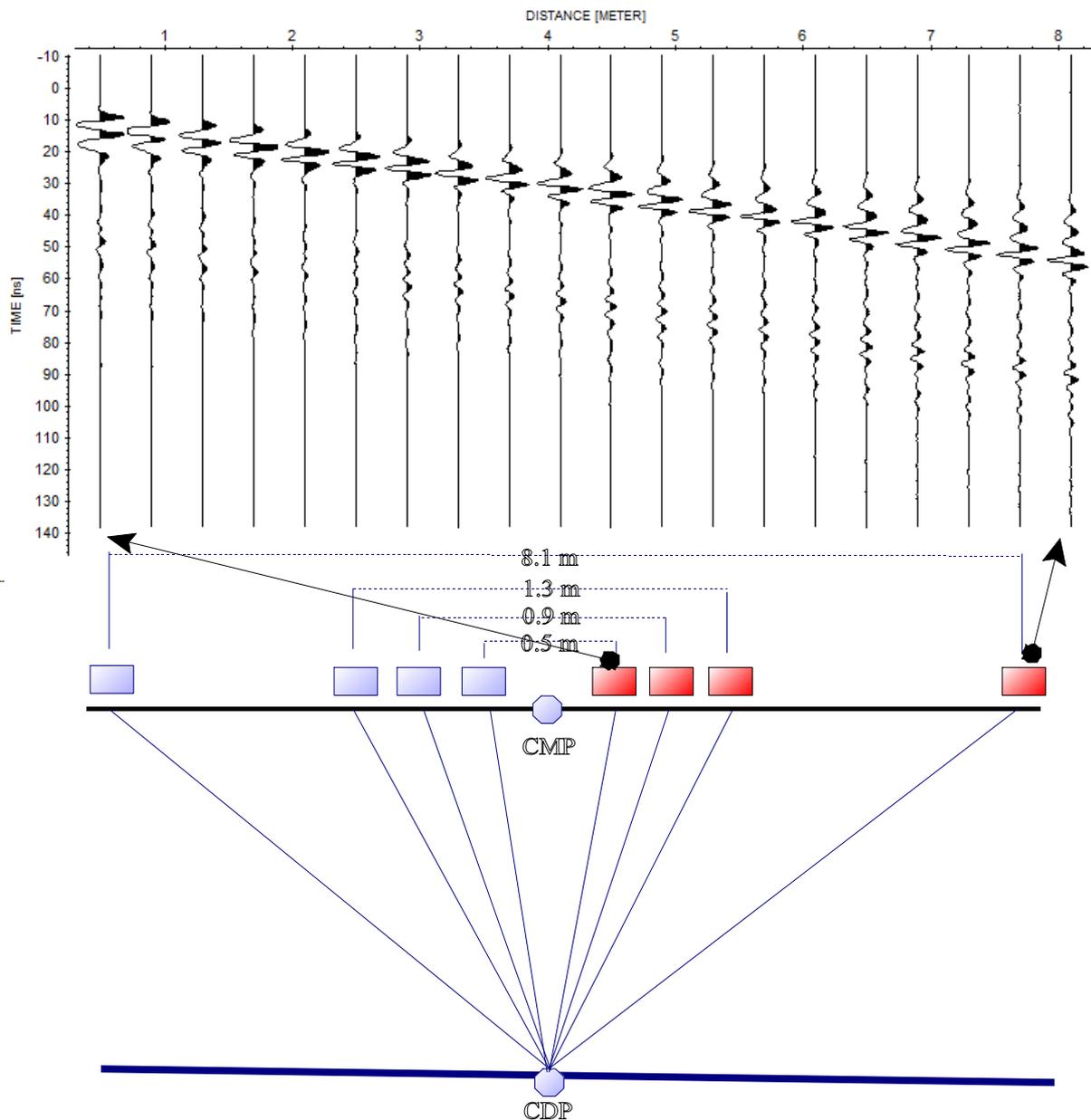


## Import and analysis for a single or several independent CMP-files

A single CMP data may be recorded along a zero-offset line at any position in order to get informations about the velocity distribution with depth. These informations may be used afterwards e.g. for performing a migration or a timedepth-conversion of the zero-offset line. Of course those measurements may also be performed as standalone measurements. The CMP measurement may be performed with moving source and receiver positions as shown below or by fixing the source and moving the receivers or using a receiver group. The import, processing and analysis are identical for all configurations.



Single CMP gather with a shot-receiver separation starting at 0.5 m and an increment of 0.4 m for the following configurations up to an offset of 8.1 m for the last trace.

## Import the data:

Enter the following parameters within the import menu:

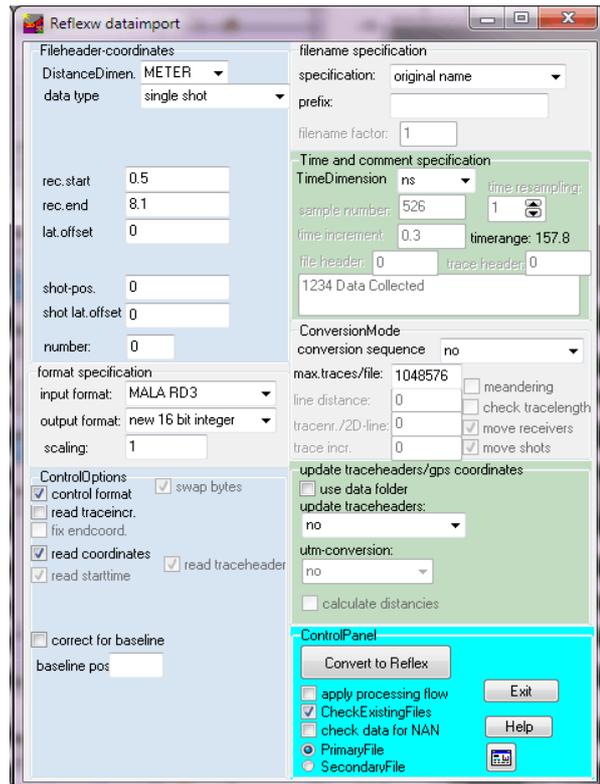
- data type: single shot

rec.start, rec.end and shot start must be entered as if the data had been acquired with a fixed shot position and a moving receiver. Therefore shot pos. corresponds to the CMP-position and rec.start “CMP-position plus the first shot-receiver separation” and rec.end “CMP position plus the last shot-receiver separation”. Assuming CMP-position is given at 0 then the following values for the above example must be entered:

- rec.start: 0.5 m (first shot/receiver separation)

- rec.end: 8,1 m (last shot/receiver separation)

shot start: 0 m (position of the CMP)



After having converted the data to Reflexw the edit traceheader menu opens. If the traceheader coordinates are not taken from the original data click on update from fileheader and save the changes. Close this window.

trace-nr.	distance	shot-x	shot-y	shot-z	rec.-x	rec.-y	rec.-z	time delay	gain	time collect
1	0.5	0	0	0	0.5	0	0	0	1	0
2	0.900000005	0	0	0	0.900000005	0	0	0	1	0
3	1.300000011	0	0	0	1.300000011	0	0	0	1	0
4	1.700000017	0	0	0	1.700000017	0	0	0	1	0
5	2.100000023	0	0	0	2.100000023	0	0	0	1	0
6	2.500000029	0	0	0	2.500000029	0	0	0	1	0
7	2.900000035	0	0	0	2.900000035	0	0	0	1	0
8	3.300000041	0	0	0	3.300000041	0	0	0	1	0
9	3.700000047	0	0	0	3.700000047	0	0	0	1	0
10	4.100000053	0	0	0	4.100000053	0	0	0	1	0
11	4.500000059	0	0	0	4.500000059	0	0	0	1	0
12	4.900000065	0	0	0	4.900000065	0	0	0	1	0

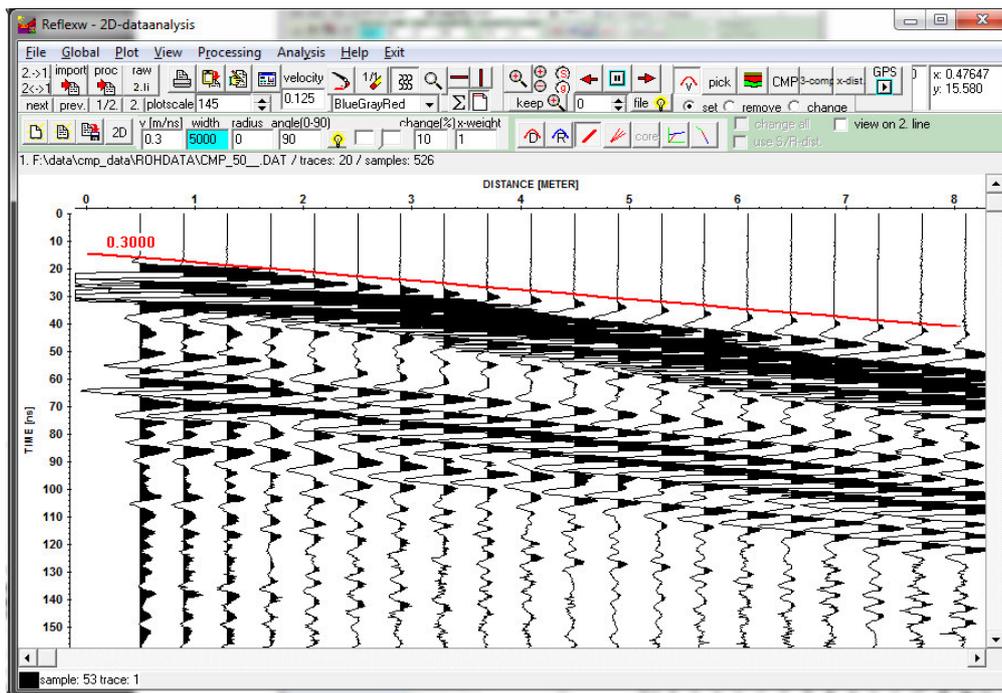
The dialog box also contains several control groups:

- TopographyGroupBox:** 'topography (x,z values)', 'update shot z-pos.', 'update receiver z-pos.', 'use x-traceheadercoord.', 'apply x-z topography', 'get distance along topography'.
- EditGroupBox:** 'apply borehole deviations', '3D-view of boreholes', 'smooth rec. xy-coord.', 'factor f.smooth: 4', 'smooth shot coord.', 'source <-> rec.', 'rec. -> source', 'x <-> y', 'y <-> z', 'project on x', 'interpolate', 'interpolate all'.
- fileheader coordinates:** 'data type: single shot', 'shot-pos: 0', 'shot-offset: 0', 'rec.start: 0.5', 'rec.end: 8.1', 'ec.offset: 0', 'non equidistant spread', 'update only shot coord.'.
- UpdateGroupBox:** 'load from AsciiFile', 'save on AsciiFile', 'update from fileheader', 'update fileheader', 'update distancies', 'reload from file', 'save changes', 'close'.

## Processing GPR CMP:

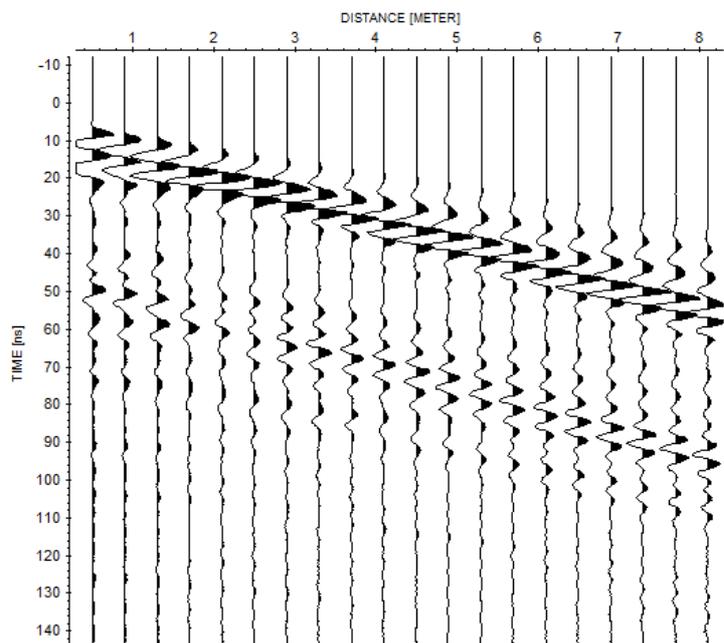
Apart from other possible necessary processing steps the main problem with GPR CMP'S is given by the fact that the start time normally is not exactly given. Therefore the start time must be defined manually. If a direct air wave is present this direct air wave allows you to define the start time, this means the time the wave has been transmitted.

Expand the visible distance range by the first shot/receiver separation using the plotoption manual scaling (in this case xmin has been set to 0, the other values had been kept) and enter the interactive velocity adaptation and choose the straight line adaptation. Choose a velocity of 0.3 m/ns and adapt the direct air. The crossing point at distance 0 yields the time at which the wave has been transmitted - in this case 15 ns. This values now may be entered as a negative value within the fileheader. If no air wave is visible you may use the direct ground wave instead. Of course the velocity of the direct ground wave first must be determined.



The fileheader dialog box contains the following information:

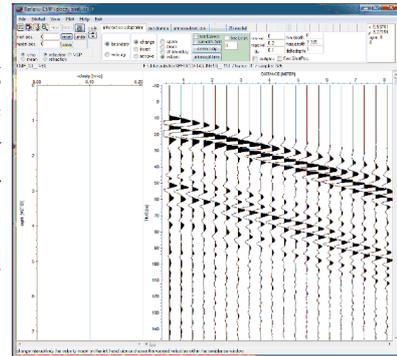
- Coordinates: DistanceDimen: METER
- rec.start: 0.5
- rec.end: 8.10000113
- lat.offset: 0
- FixTraceIncrement:
- fix endcoordinate:
- trace increment: 0.4
- trace number: 20
- line increment: 0
- number: 0
- time specification: TimeDimension: ns
- time increment: 0.3
- sample number: 526
- start time: -15
- fileheader input1: data type: single shot
- S/R-distance: 0
- Shot(CMP)-position: 0
- shot lateral offset: 0
- nominal frequency: 200
- comment: 1234 Data Collected
- acquisition date: GainValues: scans/s: 0, channel number: 1
- data format: actual data format: new 16 bit integer, new data format: new 16 bit integer
- save data: batch save data
- ControlPanel: comment marker: position: 0, MarkerRelocate: number: 1
- ShowTraceHeader: update from traceheader
- Buttons: SAVE, CANCEL, Help



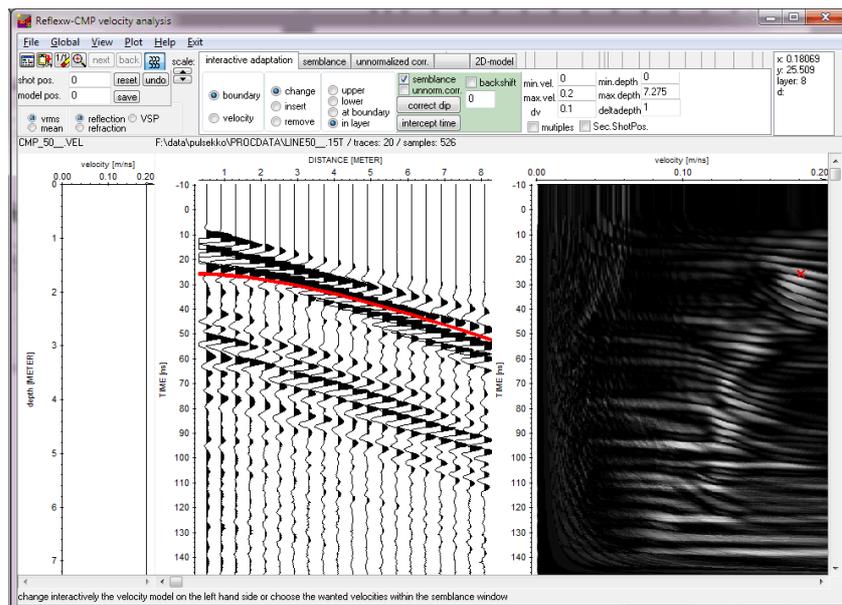
## velocity analysis:

In the following the use of the velocity adaptation for a single or several independent CMP-files is described.

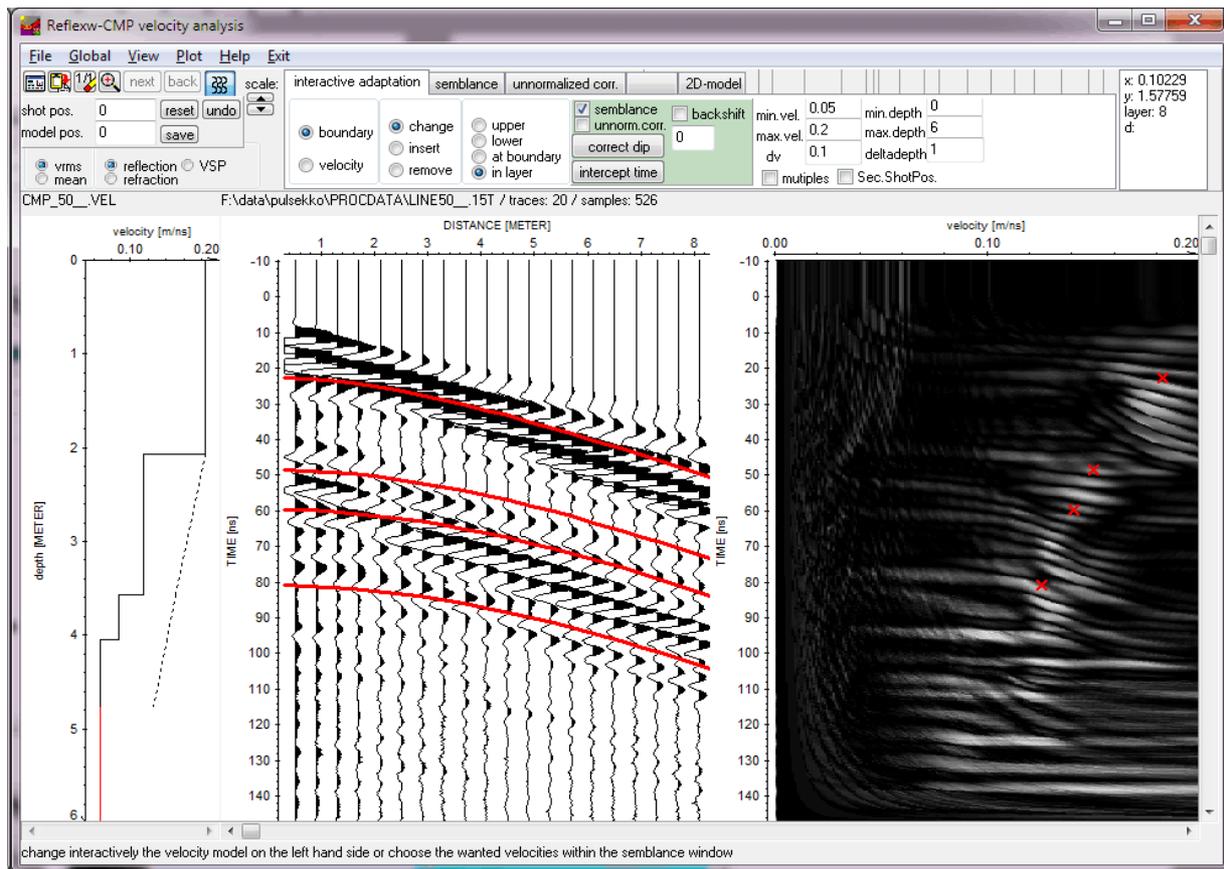
1. Enter the CMP-module and load the wanted cmp-file using the option **file/open**. The file is plotted together with a simple one layer startmodel on the left handside. By default the velocity for the first layer is set to 0.1 m/ns for GPR or 3000 m/s for seismics respectively. The default max. modeldepth is calculated from this velocity and the max. time of the loaded cmp-file.



2. activate the options **unnormalized cor.** or **semblance** and use for example the following input parameters for the min. and max. vel. and the vel.interval. Click on start and on the right hand side the correlation histogram is shown. Within this correlation histogram you may choose the best adapted velocities. Click on the chosen velocity within the correlation histogram and the current 1D-model will be updated. Choose the next best velocity for the next reflection and a second layer will be created and so on. The solid lines define the layer velocities, the dashed ones the mean (vrms) velocities. To be considered: the mean velocities correspond to those velocities which come from the interactive velocity adaptation within the 2D-data analysis. To be considered especially for GPR data: Only the first-breaks yield correct vrms and layer-velocities. If a later arrival (e.g. the second or third half-cycle) is used for the analysis too low vrms velocities result. Especially the semblance analysis may lead to these wrong velocities because the maximum semblance response normally relates to later arrivals



3. After having created all layers you still can change interactively (option **interactive adaptation** active) the layer boundaries and/or velocities by simply clicking on the boundary and drag it with pressed mouse key. The same is possible for the velocity within the layer (option **velocity** activated). A new layer boundary can be inserted (option **insert** activated) and an existing one can be removed (option **remove** activated). The current 1D-model can be stored using any filename. The option **model pos.** defines the position of the 1D-model along the distance axis. This parameter is important for creating a subsequent 2D-model consisting of different 1D-models.



4. If several CMP's are present you may do the same procedure for each CMP. Then you may create a **2D-model** using the option 2D-model. Click on create and choose the wanted 1D-models. Enter the filename for the 2D-model. This 2D-model can be used for a subsequent 2D-migration or depth-conversion (option CMP-analysis within the 2D-velocity model groupbox). If only one CMP is present you still must create a 2D-model for the use within the migration or time-depth conversion. In this case you simply choose one 1D-model when creating the 2D-model. A laterally homogeneous 2D-model will be created.