

Fig. 1 : Velocity tomogram obtained with Smooth inversion with default settings and 20 WET iterations. Layer-based Plus-Minus refractors are plotted in magenta and brown, see Fig. 3 below.

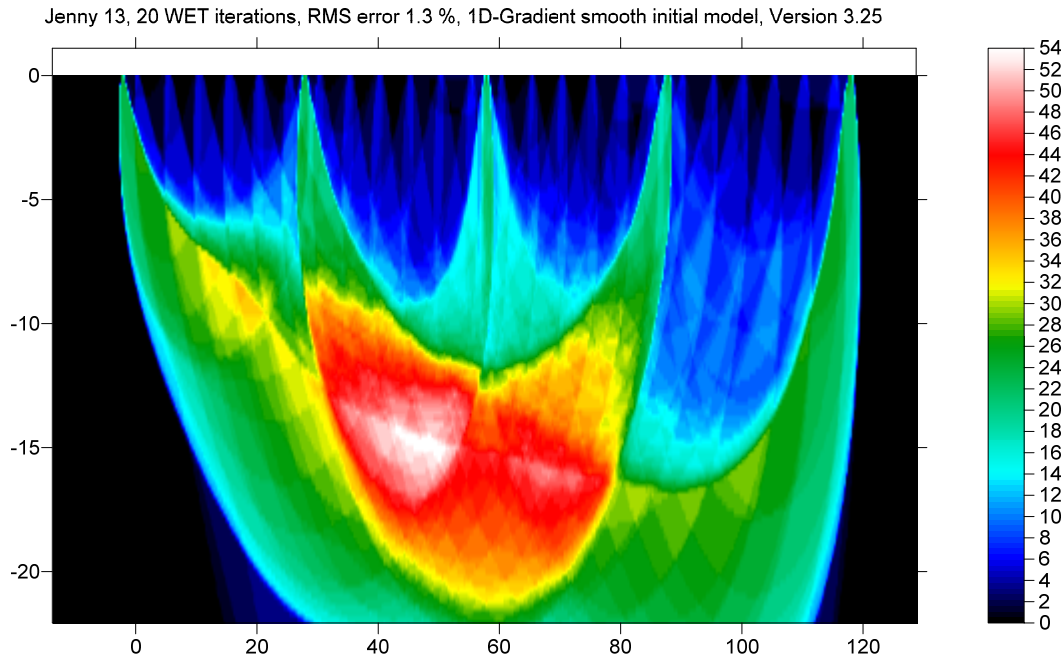


Fig. 2 : WET wavepath coverage plot obtained with tomogram shown in Fig. 1

We recommend shooting at every 3rd receiver, not just every 6th receiver. Import the data into a Rayfract® profile and run our *Smooth inversion* and *Plus-Minus* methods, with our [free trial](#) :

- create a new profile with *File|New Profile...*, set *File name* to JENNY13 and click *Save button*
- unzip [jenny13.zip](#) in \RAY32\JENNY13\INPUT directory
- specify a *Station spacing* of 5m in *Header|Shot*, before [importing the data](#)
- uncheck *File|Import Data Settings|Allow missing traces*
- check *File|Import Data Settings|Profile start is default layout start*

- check *File|Import Data Settings|Default layout start is 1.0*
- select *File|Import Data...* and specify *Import data type SEG-2*
- click upper *Select* button, navigate into *\RAY32\JENNY13\INPUT* and select *2001.DAT*
- set *Default spread type* to *01: 24 channels*
- click *Open* button and *Import shots* button
- leave *Layout start* at 1 for all shots
- specify *Shot pos. [station no.]* -5.5, 0.5, 6.5, 12.5, 18.5, 24.5, 30.5, click *Read* for shots 1 to 7
- select *File|Update header data|Update First Breaks...*
- navigate into *\RAY32\JENNY13\INPUT* directory and select file *BREAKS.LST*, click *Open*
- select *Smooth invert|WET with 1D-gradient initial model...*
- confirm prompts for 1D starting model, WET tomogram and wavepath coverage (Fig. 1, Fig. 2)

Iteratively vary [mapping of traces to refractors](#) in *Refractors|Shot breaks*, select *Depth|Plus-Minus* and *Velocity|Plus-Minus* until *Plus-Minus interpretation* (Fig. 3) matches *Smooth inversion tomogram* (Fig. 1).

In *Depth|Plus-Minus*, press **ALT+M** keyboard shortcut and decrease *Base filter width [station nos.]* to 5, from default value 10. Hit ENTER key to recompute and redisplay *Plus-Minus* depth and velocity sections.

See our [release notes](#) for version 3.36 and *Grid menu options* (Fig. 6) for plotting of refractors on WET tomograms. To redisplay the WET tomogram with Plus-Minus refractors :

- select *Depth|Plus-Minus* and *File|Export header data|Export ASCII Model of depth section...*
- click *Save* button to export Plus-Minus refractors and layer velocities to file *PLUSMODL.CSV*
- select *Grid|Select ASCII .CSV layer model for refractor plotting...* and above *PLUSMODL.CSV*
- check *Grid menu options* for refractor plotting as shown in Fig. 6
- select *Grid|Image and contour velocity and coverage grids...*
- select tomogram grid file *\RAY32\JENNY13\GRADTOMO\VELOIT20.GRD* to obtain Fig. 1

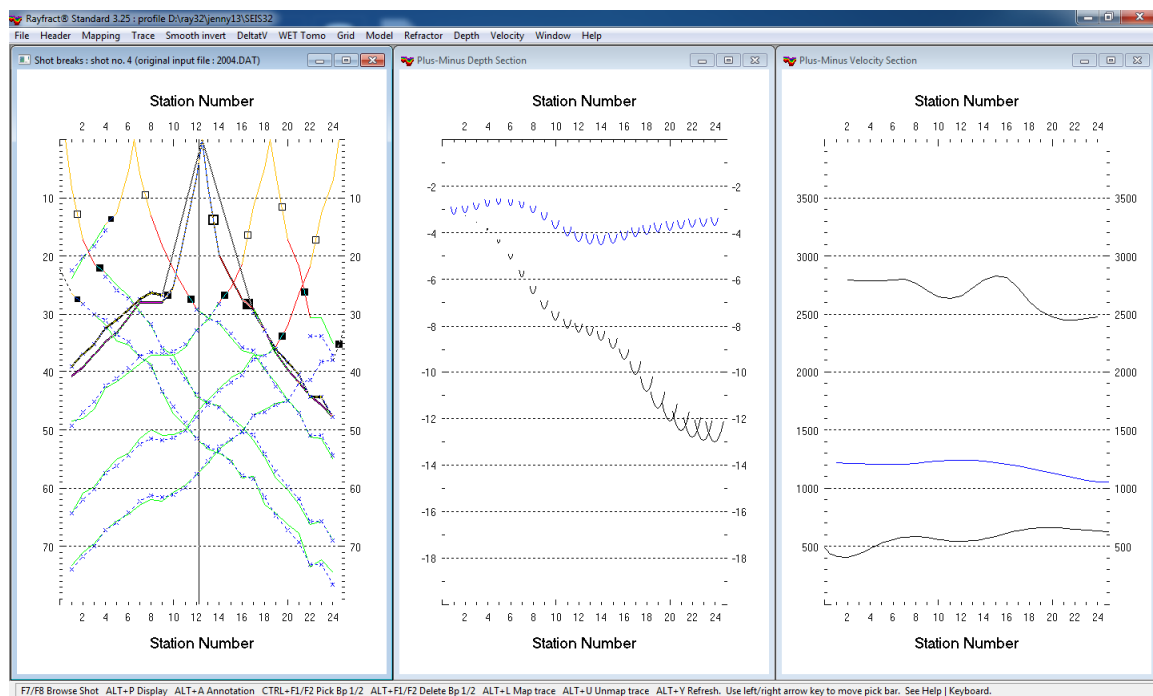


Fig. 3 : Layer-based Plus-Minus refraction interpretation, 3 layers. Left : interactively map traces to refractors. Center : Depth section obtained with Plus-Minus method. Right : Plus-Minus Velocity section.

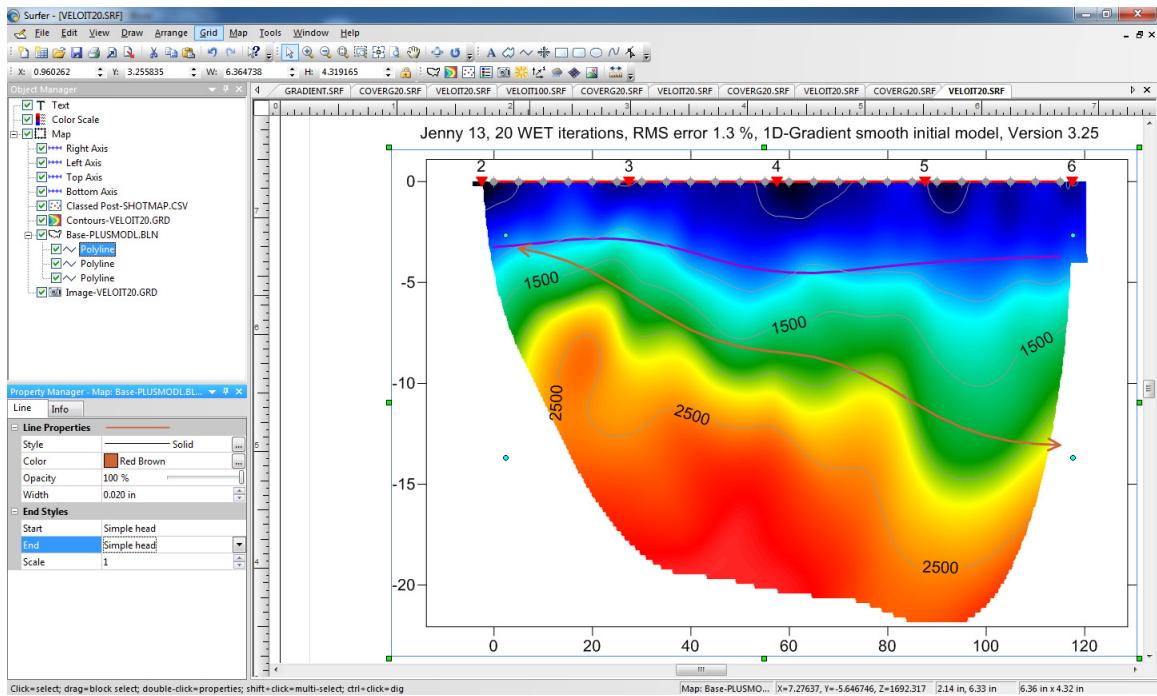


Fig. 4 : Edit Base map and refractor polyline properties in Surfer's Object Manager.

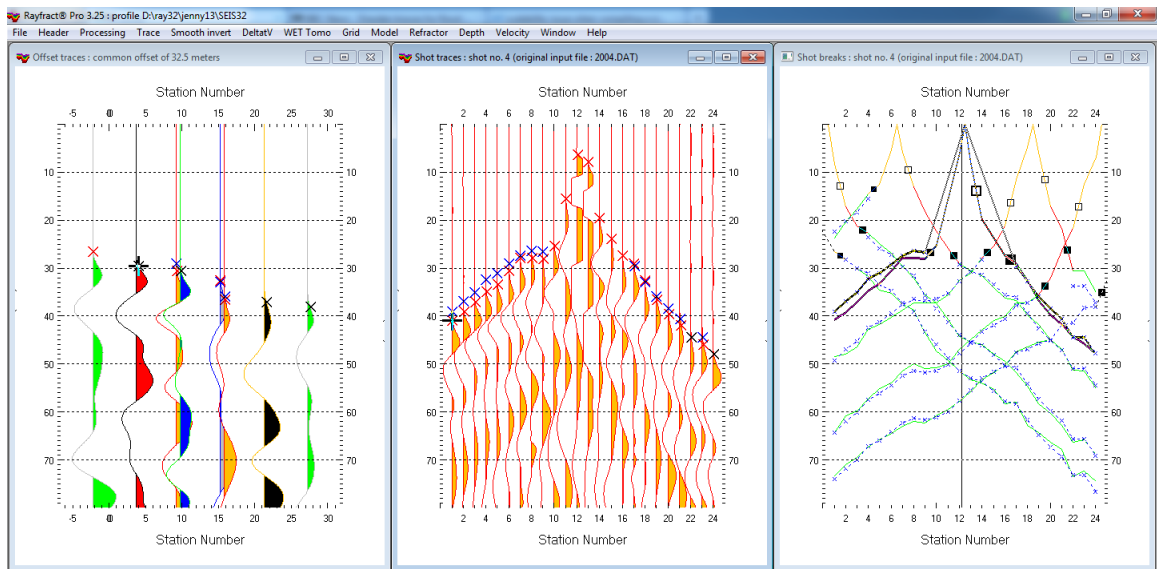


Fig. 5 : *Trace|Offset gather* (left), *Trace|Shot gather* (center), *Refractor|Shot breaks* (right). Browse offset gathers with F7/F8 in *Trace|Offset gather*, to quality-check for reciprocal traveltimes errors. Note asymmetry of first breaks for shot no. 4 (center), relative to shot point (station no. 12.5). This indicates a dipping basement refractor, as indicated in *Trace|Offset gather* (left) and *Refractor|Shot breaks* (right).

Quality-check your first break picks for reciprocal traveltimes errors in *Trace|Offset gather*, see Fig. 5. and [rivala8](#) tutorial. Browse common-offset sorted trace gathers with F7/F8 function keys.

Edit refractor polyline properties line style, color, width and end styles as in Fig. 4, in Golden Software Surfer's Object Manager.

Our layer-based Plus-Minus refraction (Fig. 3), Wavefront refraction and CMP Intercept-time refraction methods can use **far-offset shots** no. 1 and no. 7 positioned at station nos. -5.5 and 30.5.

Offset shots no. 1 and no. 7 cannot be used for 2D WET inversion, since there are no receivers near these shot points, at station no. -5.5 and 30.5 . Use [overlapping receiver spreads](#), for our WET inversion to be able to use profile-internal offset shots.

Also see our [pdf reference](#) topics [Mapping traces to refractors](#), [Time-to-depth conversion](#) and [Overlapping receiver spreads](#).

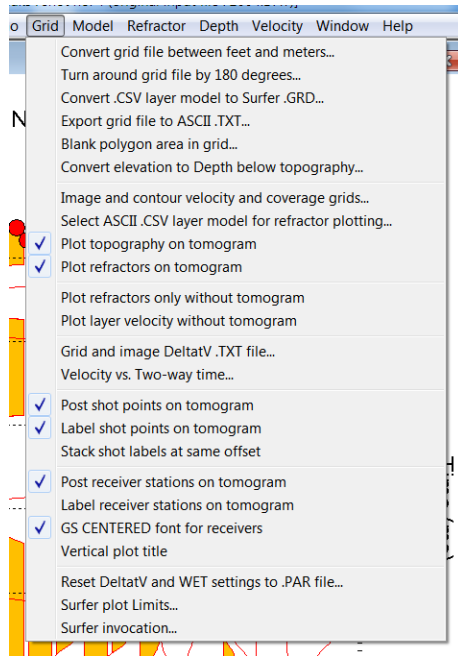


Fig. 6 : Grid menu options, for Rayfract® version 3.36

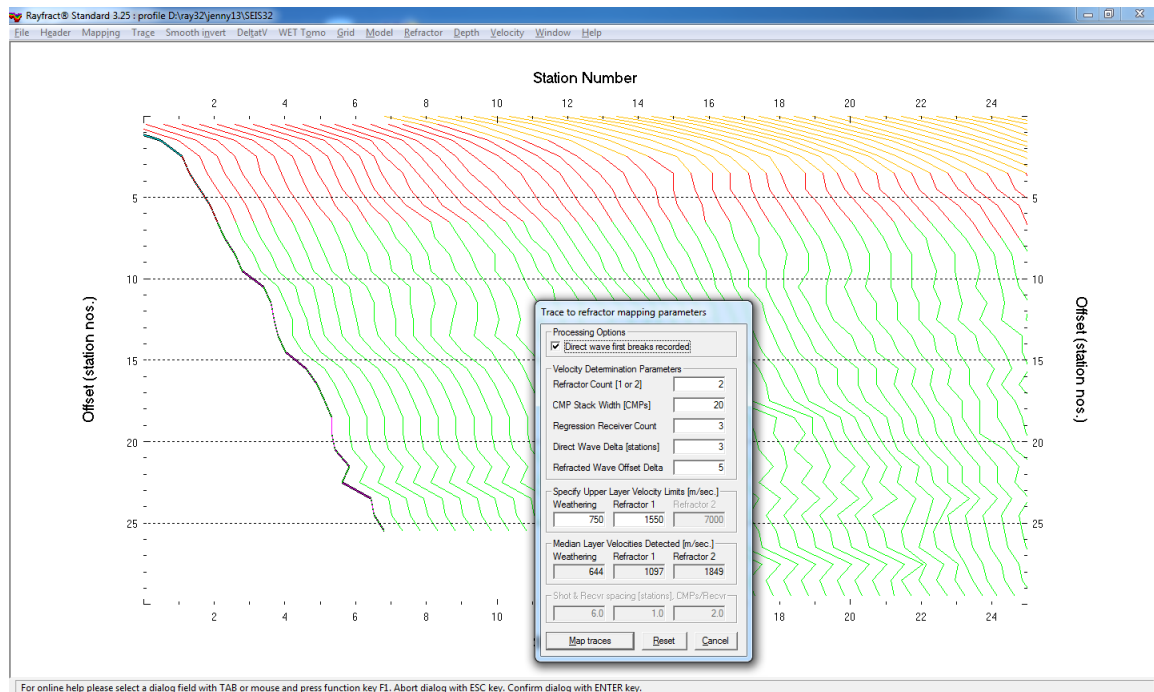


Fig. 7 : Refractor|Midpoint breaks, mapping traces to refractors with ALT+M and 1D velocity model

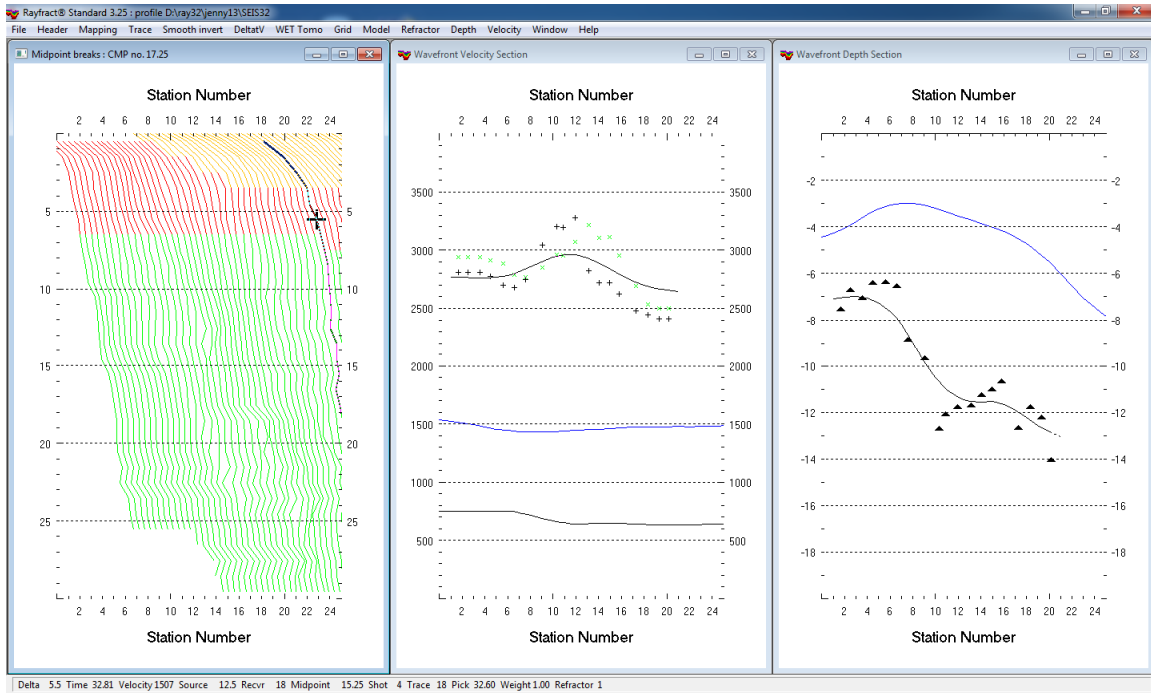


Fig. 8 : left : Refractor|Midpoint breaks, center : Velocity|Wavefront, right : Depth|Wavefront

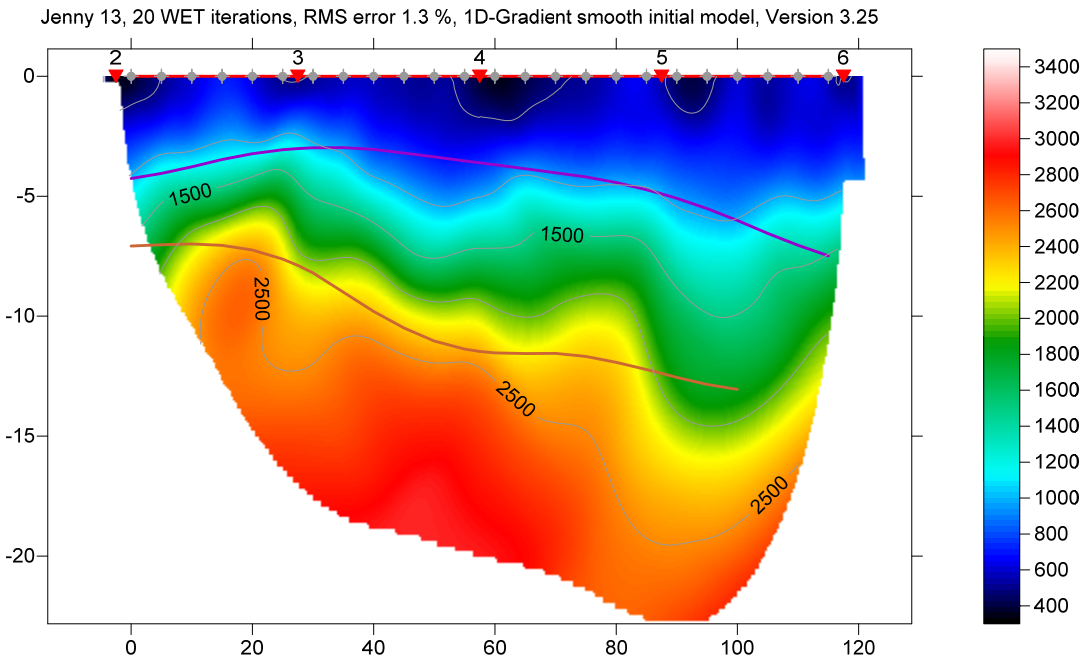


Fig. 9 : Velocity tomogram obtained with Smooth inversion with default settings and 20 WET iterations. Layer-based Wavefront method refractors are plotted in magenta and brown. Compare Fig. 8.

To obtain Fig. 9 overlaying Wavefront method refractors on WET tomogram :

- select *Refractor|Midpoint breaks*, press ALT+M. Edit *mapping parameters* as in Fig. 7
- set *Refracted Wave Offset Delta* to 5, *Weathering* to 750 m/s and *Refractor 1* to 1550 m/s
- hit ENTER key to map traces to refractors.
- press ALT+G for *Crossover distance processing dialog*, edit as in Fig. 10
- leave *Basement filter [station nos.]* at 10, click *Accept button* to smooth crossover distance
- press CTRL+F1 to zoom dip of CMP curves in Fig. 7
- select *Depth|Wavefront*, press ALT+M, edit model parameters as in Fig. 11

- set both *Overburden filter* and *Base filter width* to 6 station number intervals
- hit ENTER key to recompute Wavefront depth section using above parameters
- select *Velocity|Wavefront* and *Window|Tile* to obtain Fig. 8
- select *Depth|Wavefront* and *File|Export header data|Export ASCII Model of depth section...*
- click *Save button* to export Wavefront refractors and layer velocities to file WAVEMODL.CSV
- select *Grid|Select ASCII .CSV layer model for refractor plotting...* and above WAVEMODL.CSV
- check *Grid menu options* for refractor plotting as shown in Fig. 6
- select *Grid|Image and contour velocity and coverage grids...*
- select tomogram grid file \RAY32\JENNY13\GRADTOMO\VELOIT20.GRD to obtain Fig. 9

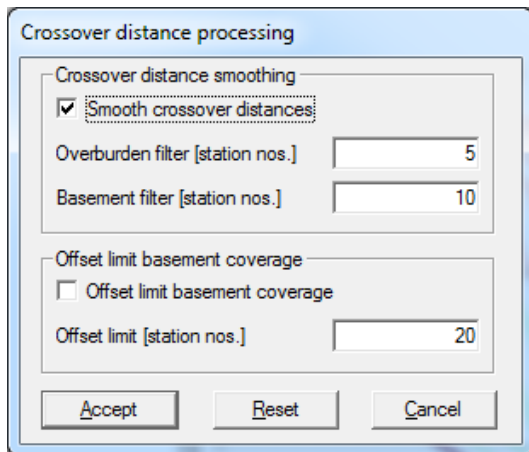


Fig. 10 : Crossover distance processing

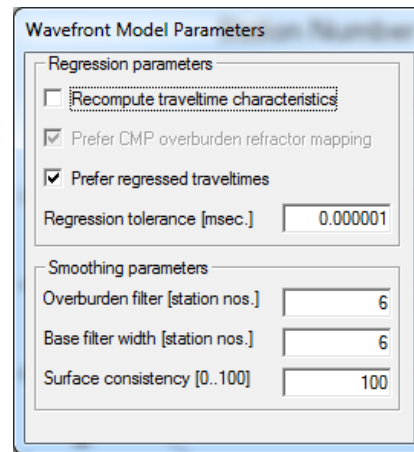


Fig. 11 : Wavefront model parameters

For an explanation of *Refractor|Midpoint breaks* display of CMP sorted traveltimes curves (Fig. 7) see our [DeltatV paper](#), Fig. 2. The steeper the local dip of a CMP sorted traveltimes curve, the higher the local apparent velocity.

See [jenny10.pdf](#) for our interpretation of a synthetic layer-based data set.

We thank our reseller Jacques Jenny at [Geo2X](#) in Switzerland for making available these data sets.

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