

JOANNEUM OT0608 refraction line : Smooth inversion vs. 1.5D XTV inversion :

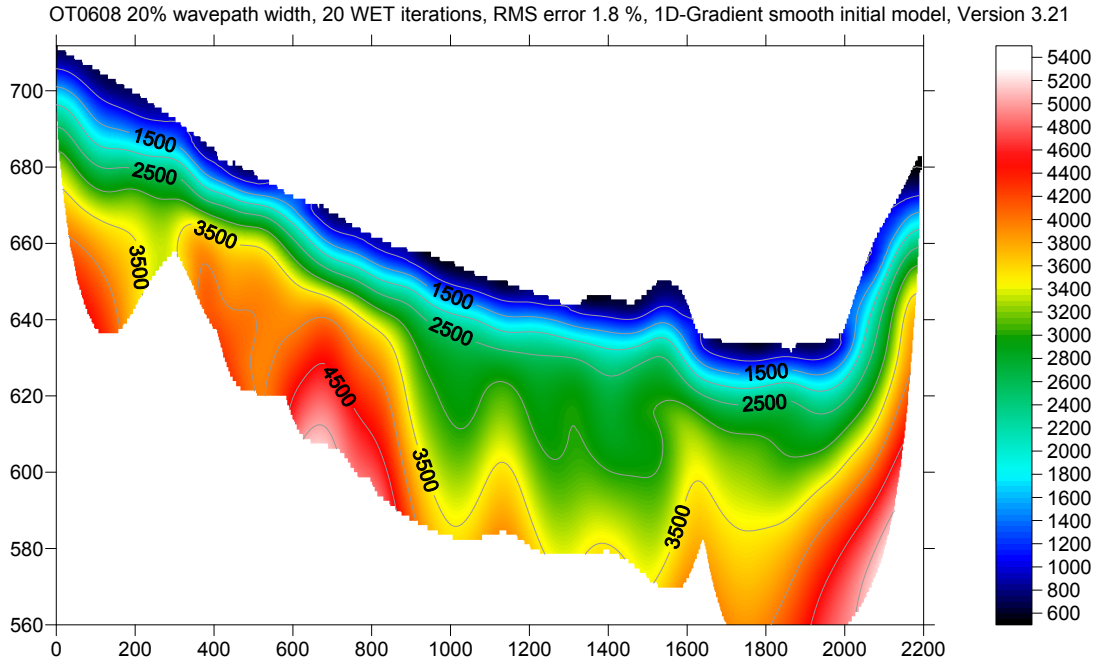


Fig. 1 : Smooth inversion 3.20, wavepath width 20%, 20 WET iterations. Fig. 3 shows 1D initial model used for Fig. 1.

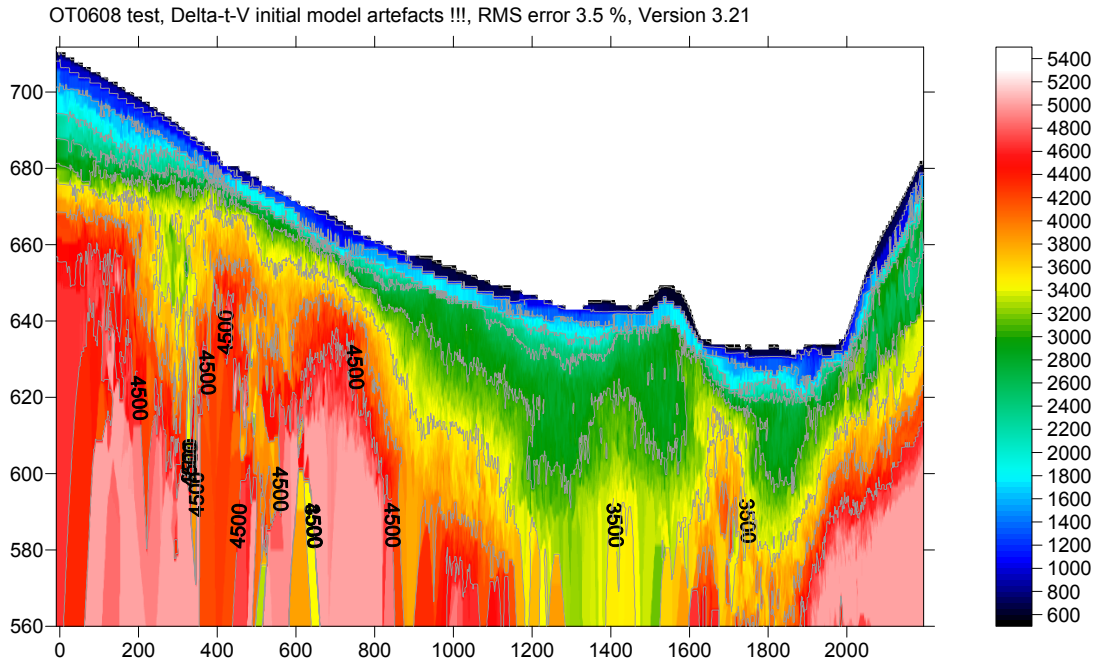


Fig. 2 : XTV inversion OT0608, with Rayfract® version 3.20 . CMP stack width 150, Inverse CMP offset power 0.20, Surface-consistent static corrections. Enabled Dix inversion, Intercept-time inversion in addition to DeltatV inversion for gradient layers. See http://rayfract.com/xtv_inversion.pdf . For all parameter settings see XTV .par file in [ot0608.zip](#) .

We thank Dr. Grassl, JOANNEUM RESEARCH Forschungsges.mbH, Austria, for making available this dense and consistently picked data set, with 275 shots into 200 or more channels. For .ASC, .COR and .SHO files see [ot0608.zip](#) . Process as [gs0801.pdf](#) . Set *Station spacing* to 3m in *Header/Profile*, then import .ASC , and update with .COR and .SHO.

See Fig. 3 for 1D initial model, obtained during Smooth inversion and resulting in Fig. 1. Fig. 4 shows WET wavepath coverage, also obtained with Smooth inversion and Fig. 1.

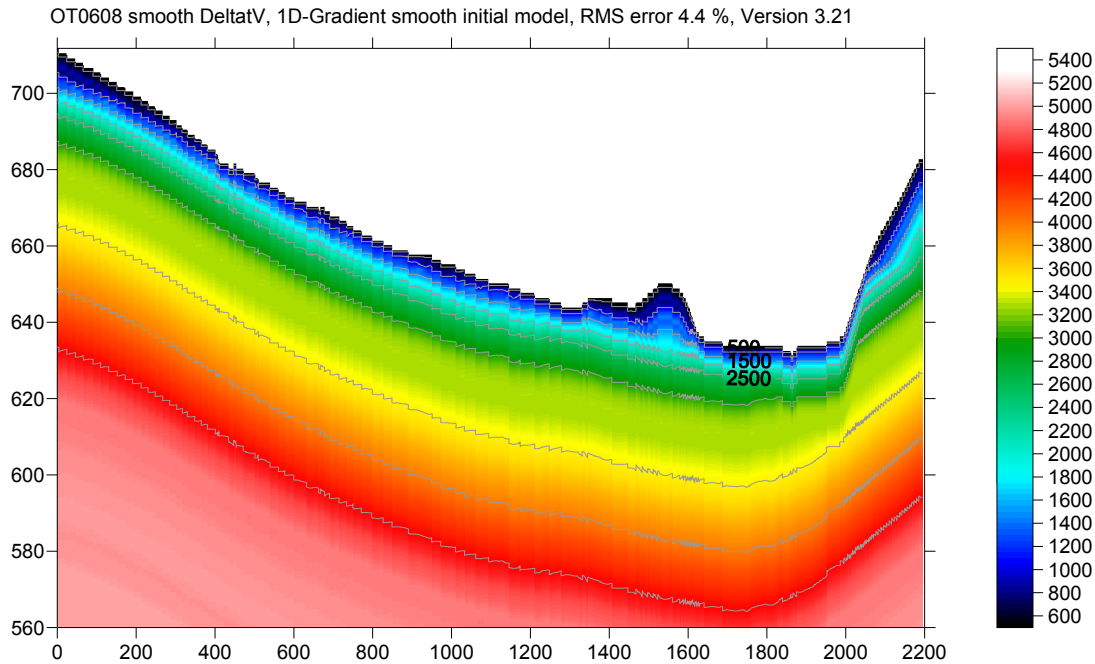


Fig. 3 : 1D initial model used for Fig. 1, with Smooth inversion. Lateral DeltatV averaging, smooth DeltatV settings.

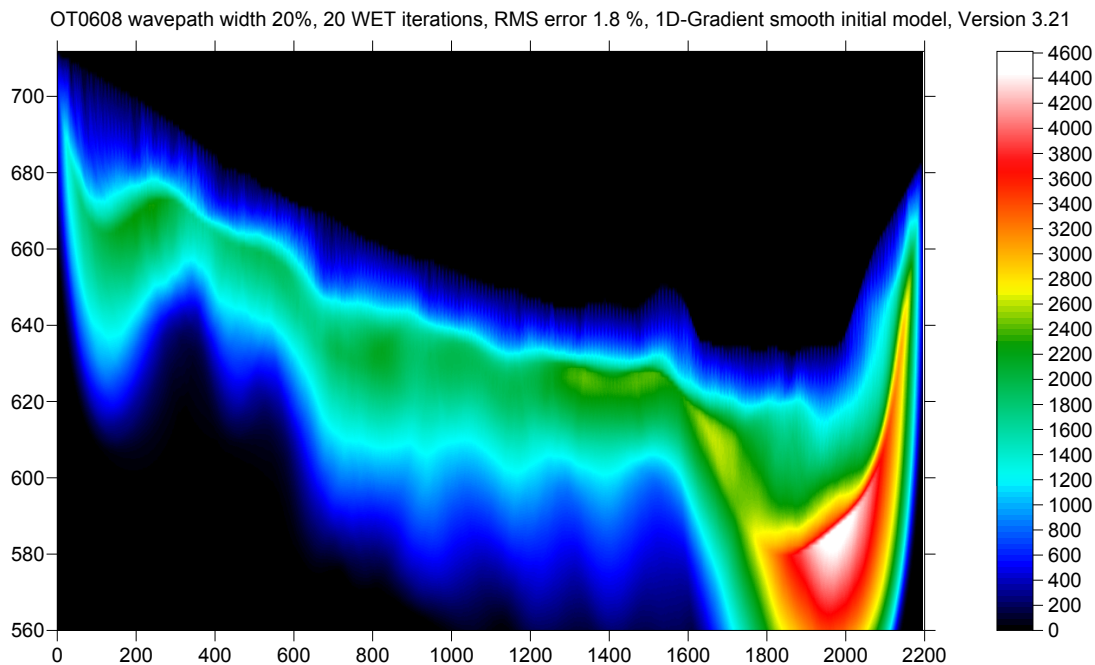


Fig. 4 : WET wavepath coverage, obtained with Smooth inversion (Fig. 1). Coverage of subsurface with first break energy.

Note the low wavepath coverage at offset 1000m and elevation 580m (Fig. 4). This is the only location where Fig. 1 and Fig. 2 differ. Low wavepath coverage means locally higher uncertainty, in the obtained WET velocity tomogram (Fig. 1). Wavepaths are almost vertical, similar to reflected rays (Fig. 4).

Processing time for default Smooth inversion (Fig. 1) was about 1 hour on an Intel Core i3. Fig. 2 was obtained in minutes. But DeltatV parameters need to be tuned, to approach Smooth inversion output. So DeltatV imaging is an iterative and more interactive process, when compared to Smooth inversion.

The good match between Fig. 1 and Fig. 2 confirms these two interpretations, obtained with quite different methods.

On the next page, we detail all processing steps required to obtain above output :

First, import the data and review shot-sorted traveltimes curves :

- Start up Rayfract® via desktop icon. Select *File|New Profile...*
- Set *File name* to OT0608 and click *Save button*
- Specify *Station spacing* of 3 m in *Header|Profile*
- Unzip archive [ot0608.zip](#) in directory \RAY32\LINE8\INPUT
- Uncheck *File|Import Data Settings|Round shot station to nearest whole station number*
- Select *File|Import Data...* and specify *Import data type* ASCII column format
- Click *button Select* and select file OT0608_ASCII.asc in directory \RAY32\OT0608\INPUT
- Check option *Batch import* . This option is supported for ASCII.ASC files only.
- Leave *Default spread type* at *10: 360 channels*
- Click *button Import shots*, and confirm prompt
- *File|Update header data|Update Station Coordinates...* with \RAY32\OT0608\INPUT\OT0608_COR.COR
- *File|Update header data|Update Shotpoint coordinates...* with \RAY32\OT0608\INPUT\OT0608_SHO.SHO
- Select *Refractor|Shot breaks* to display traveltimes curves

Now run Smooth inversion, with default parameters :

- Select *Smooth invert|WET with 1D-gradient initial model*, and obtain 1D initial model
- Confirm prompts, for default WET output after 20 iterations (Fig. 5 and 6)
- Note artefact in Fig. 5, at offset 500m and elevation 600m. This is due to low wavepath coverage (Fig. 6).

Next, configure smoother DeltatV settings (Fig. 7) :

- Check *Smooth invert|Smooth inversion Settings|Wide CMP stack for 1D-gradient initial model*
- Check *Smooth invert|Smooth inversion Settings|Allow unsafe pseudo-2D Delta-t-V inversion*
- Check *DeltatV|DeltatV Settings|Enforce monotonically increasing layer bottom velocity*
- Check *DeltatV|DeltatV Settings|Suppress velocity artefacts*
- Check *DeltatV|DeltatV Settings|Process every CMP offset*
- Check *DeltatV|DeltatV Settings|Smooth CMP traveltimes curves*

Select *DeltatV|Interactive DeltatV...* and confirm prompt. Configure smoother *DeltatV Static corrections* (Fig. 8) :

- Click *button Static corrections*
- Check *Surface consistent corrections*
- Increase *Weathering crossover* to 20 stations
- Increase *Topography filter* to 200 stations
- Decrease *Inverse CMP offset power* to 0.2, click *Accept button*
- Click Esc key, to exit from *interactive DeltatV inversion* without running it

Redo Smooth inversion with **smoother DeltatV initial model**, and **increased WET wavepath width 20%** :

- Select *Smooth invert|WET with 1D-gradient initial model*, obtain 1D initial model (Fig. 3)
- When prompted to continue with *WET tomography*, click *No button*
- Select *WET Tomo|Interactive WET tomography...*
- Set *Wavepath width* to 20%, click *button Start tomography processing*
- Confirm prompts to obtain smooth WET output with 20 iterations (Fig. 1 and 4)
- Note **removed artefact** at offset 500m and elevation 600m. Also note **deeper imaging**, compared to Fig. 5.
- Uncheck *DeltatV|DeltatV Settings|Enforce monotonically increasing layer bottom velocity*

Select *DeltatV|XTV parameters for constant-velocity layers*, and configure *XTV options* as follows (Fig. 9) :

- Check *Enable Modified Dix layer inversion*
- Check *Enable Intercept time layer inversion*
- Check *Allow adjacent Intercept layer inversion*
- Check *Prefer measured layer top velocity over inverted*

Select *DeltatV|Interactive DeltatV...* and confirm prompt. Reconfigure *DeltatV Static corrections* (Fig. 8) :

- Click *button Static corrections*
- Leave *Surface consistent corrections* checked
- Reset *Weathering crossover* to 10 stations
- Reset *Topography filter* to 100 stations
- Leave *Inverse CMP offset power* at 0.2, click *Accept button*

Now configure and run *DeltatV inversion*, with XTV inversion enabled :

- Set *CMP curve stack width* to 150
- Set *Export Options|Gridding method* to *Nearest Neighbor*, click *Accept button*
- Click *button DeltatV inversion*, and confirm prompts, to obtain Fig. 2

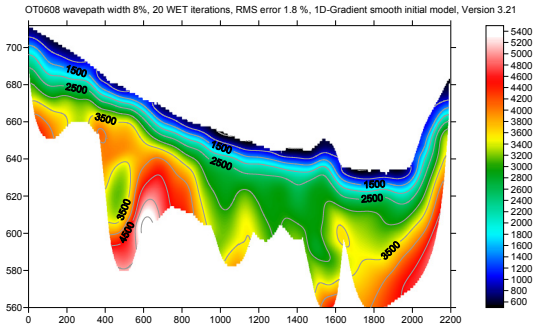


Fig. 5 : Default *Smooth inversion*, wavepath width 8%

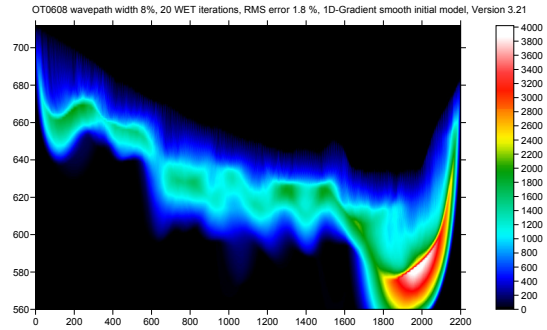


Fig. 6 : wavepath coverage obtained with Fig. 5

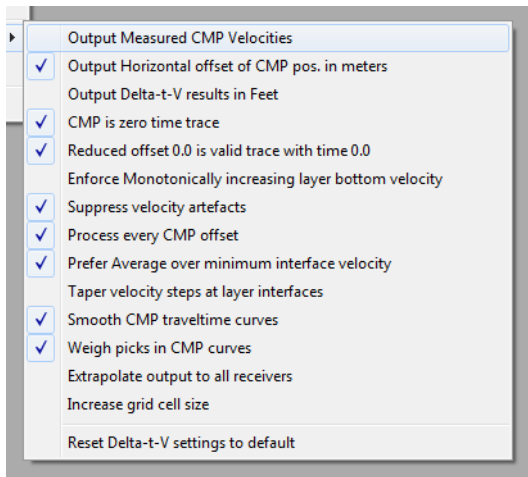


Fig. 7 : *DeltatV|DeltatV settings*

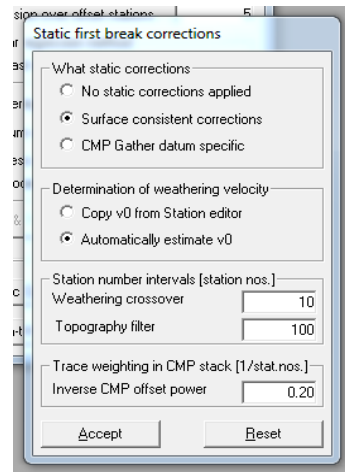


Fig. 8 : *DeltatV|Interactive DeltatV...|Static Corrections*

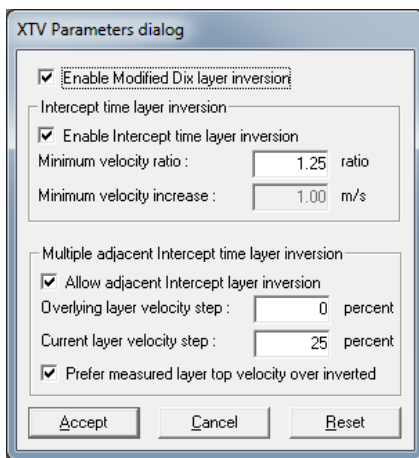


Fig. 9 : *DeltatV|XTV parameters*

For Wavefront refraction method interpretation :

- Select *Refractor|Midpoint breaks*
- Press ALT+M, to edit *Mapping dialog* (Fig 10)
- Click *Map traces button*, confirm prompt
- Press ALT+G, to edit *Crossover dialog* (Fig. 11)
- Click *Accept*, to smooth refractors (Fig. 10)
- Check *Depth|Depth conversion Settings|Link traveltimes curves for Wavefront*
- Select *Depth|Wavefront...* (Fig. 13)
- ALT+P, set *min./max. elevation* to 580/700m
- ALT+M, edit *Wavefront parameters* (Fig. 12)
- Select *Velocity|Wavefront...* (Fig. 13)
- ALT+P, set *maximum velocity* to 5000 m/s

Note the good match between Wavefront refraction (Fig. 13), WET inversion (Fig. 1) and XTV (Fig. 2).

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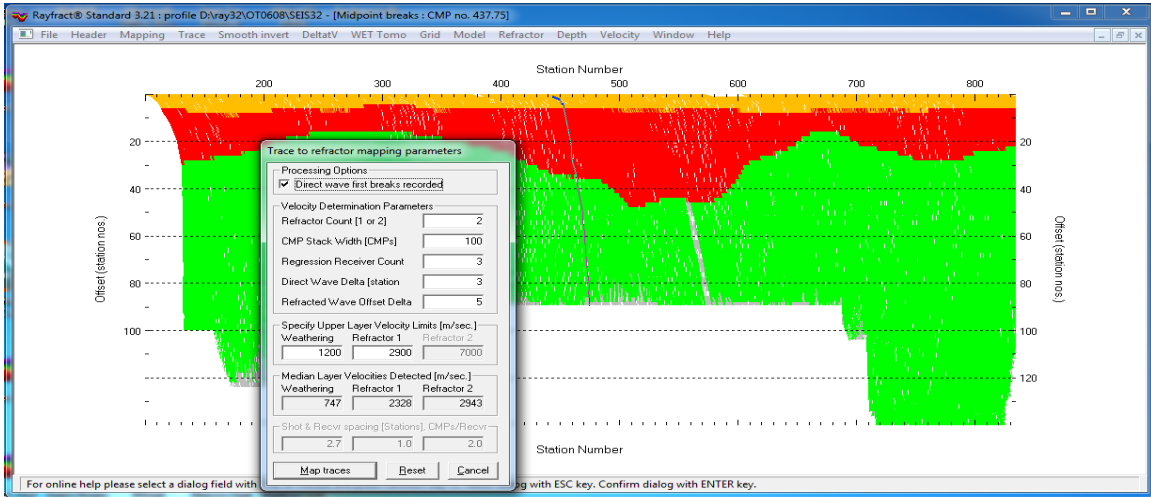


Fig. 10 : Refractor|Midpoint breaks, press ALT+M to edit mapping dialog

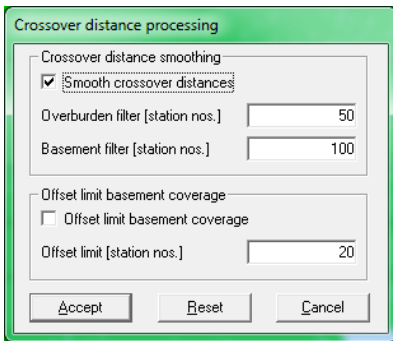


Fig. 11 : press ALT+G to edit crossover dialog

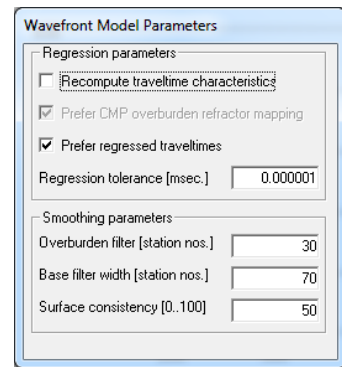


Fig. 12 : ALT+M for Wavefront params.

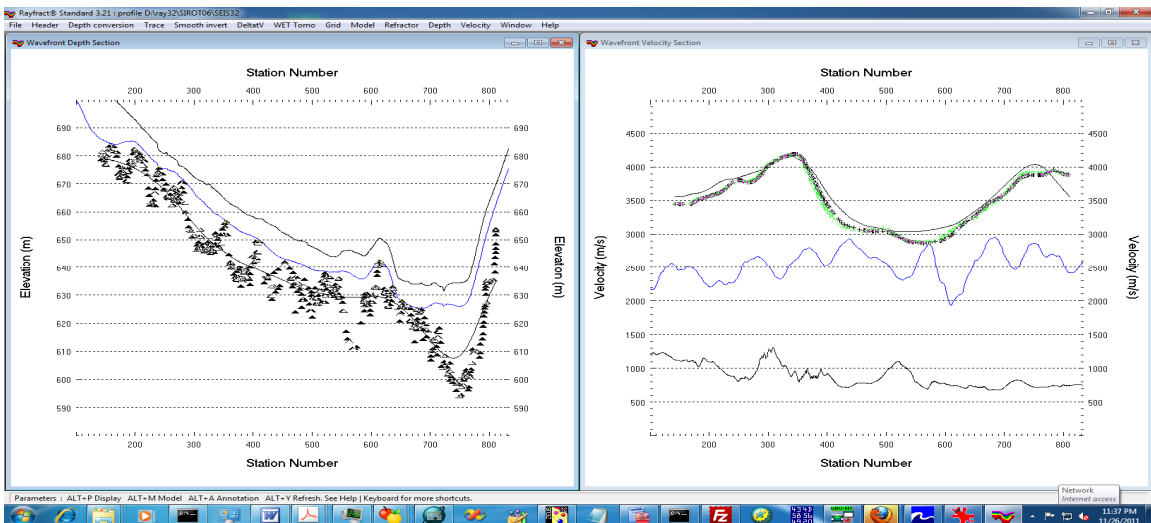


Fig. 13 : Wavefront|Depth (left), Wavefront|Velocity (right). Note good match with WET (Fig. 1) and XTV (Fig. 2).