Improved interpretation of "Dipping" model synthetic data with Rayfract™ Delta-t-V and WET Tomography inversion, as presented at SEG 2003 Dallas in the talk and abstract

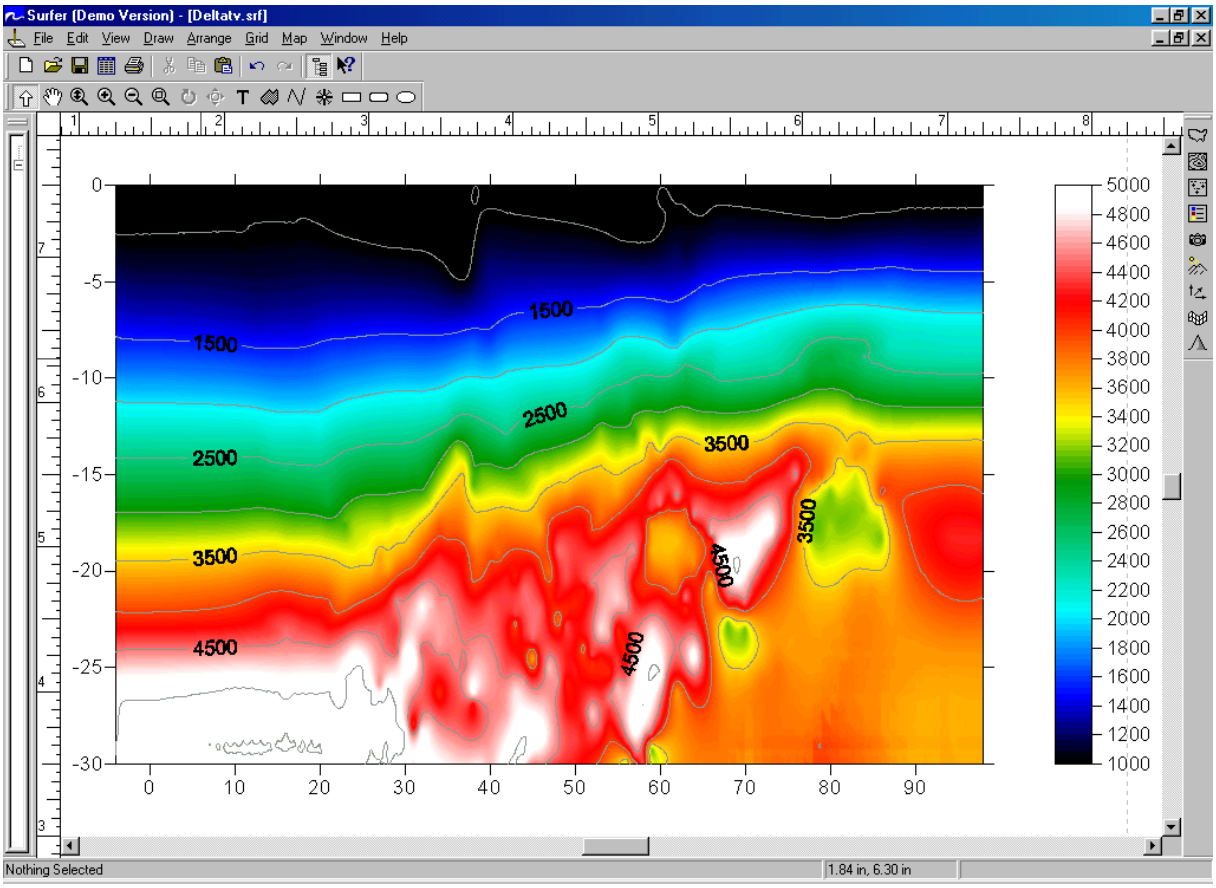
Evaluation of refraction tomography codes for near-surface applications (Jacob Sheehan et al., SEG Dallas 2003 abstract; Adobe Acrobat)

Prior to version 2.47 of our Rayfract™ software, our Delta-t-V method was not optimized for very low coverage surveys (i.e. with a shot spacing of more than 6 receivers) and a systematically dipping basement. Consequently, the Delta-t-V output as shown at SEG Dallas 2003 for the „Dipping" basement model synthetic data (5 shots into 48 receivers, shot spacing of 11 receivers) showed strong artefacts.

In reaction to this, we have improved our Delta-t-V inversion implementation for versions 2.47 and later of our Rayfract™ software mainly in two regards :

- the CMP stack width is now automatically increased for low coverage surveys
- individual first breaks are weighted by the inverse square root of the offset (in station nrs.) between the stack CMP and the trace CMP

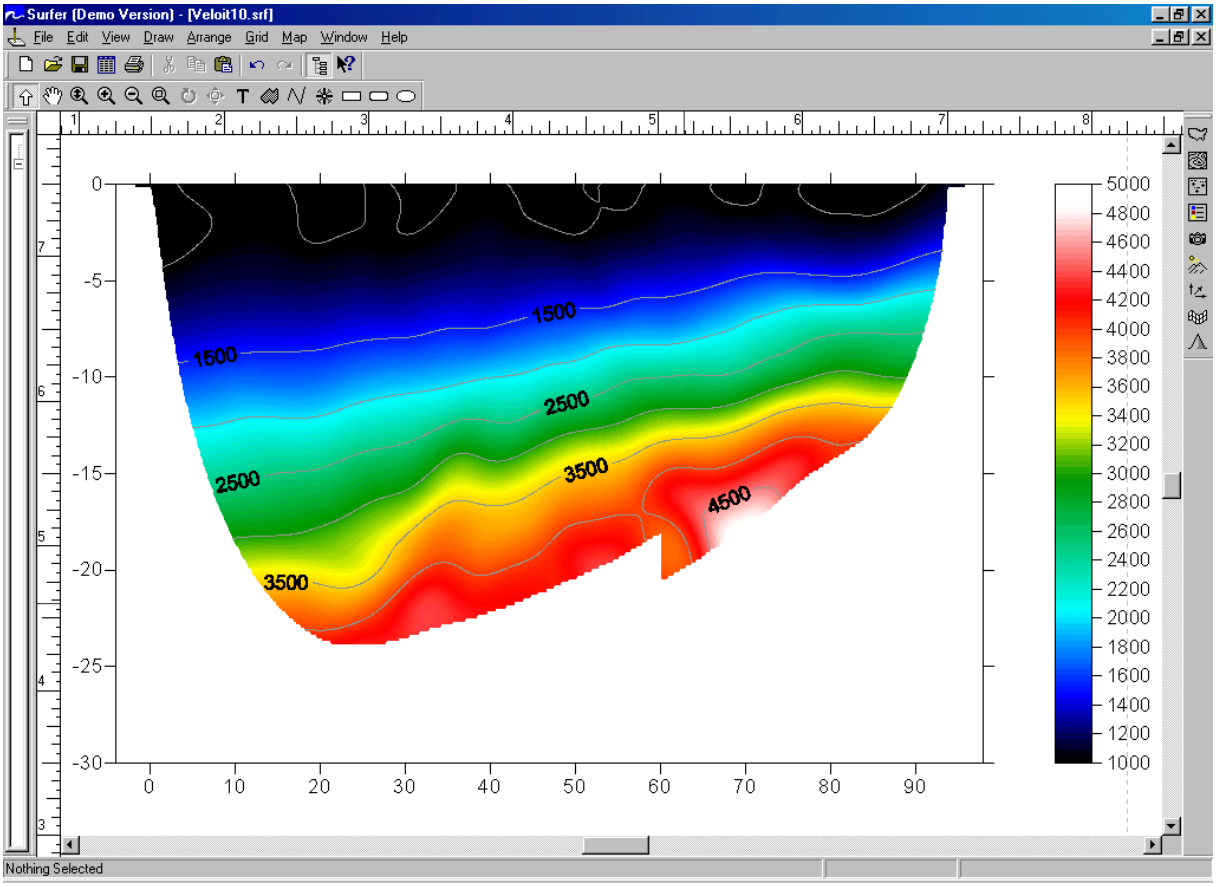
As a consequence, Delta-t-V output (with default Delta-t-V parameter settings) for the „Dipping" synthetic data set now looks much better, as shown here :



The synthetic data set as made available by Jacob Sheehan, Oak Ridge National Laboratory is available at

http://rayfract.com/samples/dipping.zip .

After 10 WET Tomography iterations, starting with above initial model (using default WET parameters), the following tomogram is obtained :



Please note the degree to which remaining Delta-t-V artefacts have been removed from the interpretation, by WET Tomography processing. Also, the „Dipping“ model assumes a constant velocity overburden (1000 m/sec.) and a constant velocity basement (4000 m/sec.). In a more realistic model, the velocity in the overburden would increase with depth, e.g. linearly.

We would like to thank Mr. Sheehan for his thourough testing of our Rayfract™ tomography processing and for making available synthetic data sets at this opportunity. He has given us objective criteria by which to prioritize and judge present and future improvements. Also, he has helped us to recognize that Delta-t-V and subsequent WET inversion are both needed for reliable interpretations. Applying just one inversion and skipping the other one will often result in inferior output.

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