

Release notes Rayfract® versions 2.61 to 3.09 :

Version 2.61 released in March 2005 :

- Improved robustness of WET tomography implementation.
- Maximum number of WET iterations increased to 999.
- Updated and optimized database subsystem.
- Correctly regard “off end” shots during WET inversion, located at a distance of up to two station spacings, from first/last profile receiver.
- Mapping of traces to refractors in Midpoint breaks display (Refractor|Midpoint breaks) now works as advertised in our manual, with spread type “13: 48 every 2nd” and a station spacing of half the true receiver separation. See <http://rayfract.com/tutorials/line2.pdf> .

Version 2.62 released in August 2005 :

- Significantly improved Delta-t-V internal static corrections. During a second pass of statics computation, ray emergence angles are now regarded.
- Additional Delta-t-V setting “Suppress velocity anomalies”. Use for medium to high coverage profiles, to suppress noise and processing artifacts.
- New Delta-t-V setting “Process every CMP offset”. Use for medium to high coverage profiles, high S/N ratio and flat subsurface layering, for increased vertical resolution.
- SEG-2 import routine now supports importing 32-bit floating point traces generated with Interpex IXSEG2SEGY utility.
- Numeric field entry always allows adding more digits without first having to delete the whole entry.
- When toggling Delta-t-V static correction methods “surface consistent” and “CMP gather specific”, just one subsequent run of the Delta-t-V inversion is required, for stable output.
- A few minor bugs have been fixed.

Version 2.63 released in December 2005 :

- WET grid caching algorithm correctly decides whether to cache all receiver grids in RAM, or whether to write all grids to disk, depending on the amount of free RAM available.
- Integrated optimized memory manager (MicroQuill SmartHeap version 8), for improved data processing performance.
- Inversion will recognize if a profile is too long, and will recommend splitting the profile into two parts. This may happen e.g. in case of many short overlapping receiver spreads, and short maximum offset between shot point and receiver.
- New edit field “Profile start offset” in Header|Profile. Use this field to specify a horizontal inline offset different from 0.0, for the first profile receiver. This start offset value will be used by subsequent Delta-t-V and WET imaging, and is shown on the horizontal X axis.
- New WET setting “Write grids for every iteration”.
- The maximum imaged depth has been extended to 70 km, and there is not any longer a limit on the maximum first break pick time.
- The “Annotation parameters” dialog allows selection of X/Y axis Line type “Dashed line”/“Dotted line”/“No line” and ticks type “Major & Minor”/“Major ticks”/“No ticks”.

Version 2.64 released in May 2006 :

- Delta-t-V inversion once again works fine with parameter “Regression over offset stations” set to values higher than 7. This was broken in version 2.62.
- Displaying and picking shot traces with up to 10,000 samples now works correctly. Previously, this did not always work, with more than 5,000 samples per trace.
- Data import routine supports merging of binary trace data files with ASCII first break picks as supplied in GEOMETRICS .BPK pick files, even if columns 5 and 6 of the .BPK are not separated by white space characters. Column 5 is assumed to contain “0.0” (without the enclosing “”).
- “Import shots” dialog offers new option “Detect shifted 32-bit floating point sample data start”. This option was implicitly enabled up to now, but did not always work. Use this option if imported binary shots don’t show any coherent signal, in Trace|Shot gather.
- SEG-2 import routine supports DMT SUMMIT 32-bit floating point traces.
- Improved support for import option “Limit offset”. Use for improved imaging of shallow subsurface (e.g. weathering layer), if the data was recorded with too long receiver spreads and too many channels.
- New function “Reverse polarity” in menu “Trace processing”.
- When opening or moving any other window on top of trace gather window, mouse cursor is not reset any longer when the underlying trace gather is repainted.

- The “original input file” displayed in the title bar of the Trace|Shot gather window is out of sync with the actual shot no. displayed. This is shown correctly in Refractor|Shot breaks. Rest assured that this display bug does not affect geometry handling and inversion of your data in any way.
- The Surfer(tm) Kriging gridding method sometimes generates artefacts, such as false high velocity anomalies directly below the topography. If you want to experiment with different algorithms than the default Kriging method, please download archive <http://rayfract.com/common/scripts.zip> to a temporary directory e.g. C:\TEMP. Now unzip the archive in C:\TEMP and proceed as described in the included README.TXT. We offer scripts for gridding methods "Natural Neighbor", "Nearest Neighbor", "Delaunay Triangulation" and "Minimum Curvature".
- For optimum coverage of the subsurface with seismic energy, we recommend to employ overlapping receiver spreads. See <http://rayfract.com/help/overlap.pdf> and <http://rayfract.com/help/overlap.txt> .
- To suppress velocity artefacts, we strongly recommend using our Smooth inversion method. See http://rayfract.com/pub/srt_evaluation.pdf and <http://rayfract.com/tutorials/broadepi.pdf> .
- Wavefront and Plus-Minus inversion may abort with a message saying "Refractor coverage may be too low or too short". Please record more (far offset) shots for this profile, and use a shorter receiver spacing. Also, use longer receiver spreads, with more channels. Our Plus-Minus and Wavefront inversions include a preliminary processing step called "traveltime field regression" which reduces basement refractor first breaks to a single set of forward and reverse traveltime curves (Brückl 1987). This data reduction step requires a certain data density. If too few shots were recorded, or the receiver spacing was too wide and/or receiver spreads were too short, this reduction algorithm may not be able to reduce the data set.
- The traveltime field regression algorithm works best if all sources and receivers are positioned at whole station numbers. So you may want to reimport your shots into a new profile, with a more appropriate "Receiver spread type", e.g. "13: 48 every2nd".
- Also, overburden refractor first breaks are interpreted with the conventional intercept time method, for adjacent reversed shot pairs. This step requires a certain data density as well. Please note that such low coverage problems do not arise with our Smooth inversion and Delta-t-V and WET inversion, since these methods do not require you to map traces to refractors at all.
- When importing first breaks from Interpex Gremix .GRM files or ASCII.ASC files, these files need to specify first break pick times for all receivers specified in the spread type used. If a trace cannot be picked (data is too noisy or the trace is dead), please specify a time of -1, meaning “not picked”.
- Import of ASCII.ASC shots may show an error message “Shot position of shot nr. ... is not at traveltime curve minimum !” The import routine detects for inline shots the two channels with the smallest first break picks. If the shot is not positioned between these two channels, above message is shown and the shot is not imported. You may want to repick traces or edit the .ASC such that the shot position is located between the two smallest first break times. You may need to introduce “artificial” picks for near-shot traces which you did not pick previously.
- To update the Windows help file topics shown in menu “Help”, please proceed as follows :
 - Download <http://rayfract.com/help/rayfract.hlp> to a directory on your PC, e.g. C:\TEMP.
 - Open a Windows Explorer window via Start|Run..., enter “Explorer” and hit RETURN.
 - Navigate to your C:\TEMP directory. Select file RAYFRACT.HLP with left mouse key.
 - Press CTRL-C or select Edit|Copy .
 - Navigate to your \RAY32\HELP directory, e.g. C:\RAY32\HELP.
 - Press CTRL-V or select Edit|Paste . Confirm the “Confirm File Replace” prompt.

Context sensitive popup help (in dialogs) will work for a recently updated Rayfract™ installation only.

- If the word feet or meter is contained in a header line of a .PRN, .SHO or .COR file, the shot and receiver positions and coordinates in that file are assumed to be specified in that distance unit. See <http://rayfract.com/help/ln14feet.zip> for sample files, specified in feet.
- You may want to limit the maximum Delta-t-V velocity to a value lower than the default 5,000 m/s. Use “Export Option” parameter “Max. velocity exported”, in Delta-t-V|Interactive Delta-t-V. This parameter is regarded by both pseudo-2D inversion and Smooth inversion.

Version 2.65 released in September 06 :

- The "original input file" name is shown correctly again, in Refractor|Shot breaks.
- Forward modeling of traveltimes with our optimized Eikonal Solver runs about 15% faster.
- Our SEG-2 binary trace data import routine now should correctly import most trace data files, even if the trace data start is not rounded up to the next a 32-bit (double word) block boundary, as prescribed by the SEG-2 standard.
- We offer a new "Image and contour velocity and coverage grids..." function, in menu "Grid". Use this function for imaging of Surfer(tm) grid files as generated during previous inversions.

- Interactive Delta-t-V export settings dialog offers a new option “Gridding method”. Select one of "Natural Neighbor", "Nearest Neighbor", “Delaunay Triangulation” and "Minimum Curvature".
- Menu “Grid” offers another new function “Grid and image Delta-t-V .CSV file...”. This function regards the current setting of Delta-t-V export option “Gridding method”. So you may grid the same .CSV with alternative methods, without having to redo the Delta-t-V inversion.
- If you disable the new setting "File|Import Data Settings|Keep same layout start for consecutive shot trace files", layout start and shot position are determined directly from SEG-2 trace header fields SOURCE_LOCATION and RECEIVER_LOCATION. The layout start is rounded to an integer station number, and the shot position is shifted by the resulting offset (less than half a station spacing).
- We recommend the latest version 3.22 of the INTERPEX IXSEG2SEGY utility, for frequency filtering and picking of traces. This version now correctly preserves SEG-2 trace header fields SOURCE_STATION_NUMBER and RECEIVER_STATION_NUMBER. See <http://www.interpex.com>. These fields override fields SOURCE_LOCATION and RECEIVER_LOCATION.
- We have deprecated our pseudo-2D Delta-t-V inversion, and now recommend to always at least trying our Smooth inversion method, based on a 1D gradient initial model. See e.g.

<http://rayfract.com/help/manual.pdf>

<http://rayfract.com/tutorials/palmfig3.pdf>

<http://rayfract.com/tutorials/depress.pdf>

<http://rayfract.com/tutorials/broadepi.pdf>

Version 2.66 released in November 06:

- We offer a new Grid menu command "Convert elevation to Depth below topography..." for conversion of elevation section grids to depth sections grids.
- Also, the station header V0 (weathering velocity) is now updated automatically, when remapping traces to refractors in Refractor|Shot breaks, and when smoothing crossover distances in Refractor|Midpoint breaks. If consecutive Wavefront or Plus-Minus interpretation fails saying “Bad travelttime field” after 10,000 regression iterations, please proceed as follows :
 - select Refractor|Shot breaks or Refractor|Midpoint breaks
 - disable Trace mapping|Automated updating of v0
 - proceed as described in above manual.pdf, chapters 1.8 & 1.9 (Shot breaks) or chapters 1.12 and 1.13 (Midpoint breaks)
- In menu WET Tomo|WET tomography Settings, we offer a new option "Update imaged grid depth". This option is enabled by default. If enabled, the grid depth will be updated after each tomography iteration. Otherwise, the imaged grid depth will stay the same as for the initial model.
- Wavefront and Plus-Minus modeling parameters "Overburden filter" and "Base filter width" can now be set to maximally 20 and 30 station numbers, respectively.

Version 2.70 released in November 06 :

- We have adapted our WET imaging such that the topography is now imaged correctly, for receivers beyond the first/last shot position. Please note that imaged velocity shown below such receivers is not very meaningful, since the all-important weathering velocity and thickness can't be determined below these receivers. Since there are no shot points positioned close to these receivers.
- This version features a first try at our implementation of the XTV inversion as described by Roland A. Winkelmann in his 1998 thesis. See Delta-t-V settings submenu. Use for high coverage surveys and at your own risk only.
- The SEIS32.BLN blanking file generated during Delta-t-V inversion will now be corrected for a non-zero "Profile start offset" as specified in Header|Profile.
- Also, our Rayfract(tm) software now correctly imports extrapolated shot branches generated during conventional Wavefront and Plus-Minus interpretation of profiles with a minimum receiver separation of two or more station numbers.

Version 2.71 released in December 06 :

- This updated version features a new XTV parameters dialog, in menu Delta-t-V. You may enable modeling of constant velocity layers with a modified Dix inversion, and/or with Intercept time layer inversion. The XTV method also supports modeling of constant velocity gradient layers (with our existing Delta-t-V method), and has been described by Roland A. Winkelmann in his 1998 thesis, as

done with Professor Helmut Gebrande in Munich. We recommend enabling XTV inversion for high coverage profiles only.

- Once you have specified your preferred XTV parameters in above dialog, you may then carry out a pseudo-2D inversion, with our existing Delta-t-V menu item "Interactive Delta-t-V". This inversion algorithm has been generalized and now supports the XTV method.
- The XTV parameters are now correctly loaded from the profile database, when displaying the XTV dialog. Also, the valid range of the three numeric parameters has been changed. The minimum velocity ratio required for application of the Intercept time layer inversion now ranges from 1.01 to 2.5. And the sum of the two velocity step parameters may not exceed 100 percent.
- XTV parameters chosen are now written to the .PAR file, during Delta-t-V inversion. And the inversion type used for each layer is written to the last column of the .CSV file.
- We have improved our automated database revision routine. The revision log is now written to file SEIS32.REP in the profile database directory.

Version 2.72 released in January 2007 :

- We have implemented "File" menu functions for export/import of receiver spread types. Please note that you need to open any profile e.g. LINE14 first, to enable this. Also, whenever you define a new spread type, all spread types are exported to file \RAY32\REF\MYSPREAD.SPR. Spread types are stored in the reference database (directory \RAY32\REF, files SEISRF32.*), and not in the individual profile databases. So any custom spread type defined or import is available for all profile databases.
- We offer a new Header|Profile field "Min. horizontal separation [%]". This field defines the minimum horizontal station offset applied during coordinate interpolation, in percent of the inline station offset. You may want to leave this field at its default value of 25%, for most recording geometry situations.
- Also, we now support posting and labeling of shot points. See new options at bottom of Grid menu.
- Our software supports again reading of .PAR parameter files generated with version 2.64 and earlier versions.

Version 2.73 released in May 2007 :

- Supports Microsoft Windows® Vista™, Windows XP, Windows 2000, Windows 98 SE. Follow Vista instructions on how to download and install WINHLP32.EXE, to enable Rayfract® help file display.
- Allows import of Optim LLC SeisOpt files. You may generate SeisOpt data files e.g. with W_GeoSoft WinSism 10. For Rayfract® import of SeisOpt files, disable File|Import Data Settings item "Default distance unit is meter" to specify distance unit feet. Disable setting "Default time unit is seconds", to specify time unit milliseconds.
- If there are dead traces missing from SeisOpt or Interpex Gremix input data files, these missing traces are regenerated during import automatically for the active part of the receiver spread type specified.
- You now can browse/add/import/export receiver spread types in menu File without opening a database.
- If during import of data files with File|Import Data... Rayfract® shows an error message and you switch to another application, the cursor may display as an hour glass when you try to reactivate Rayfract®. Be sure to click once or twice on the Rayfract™ icon shown in the task bar at the bottom of your display, to reset the cursor to the normal arrow and to unlock our software. This issue has been fixed for version 2.73.
- We recommend to refine Smooth inversion WET output by increasing the WET iteration count to e.g. 100 or 200 iterations. See our tutorials
<http://rayfract.com/tutorials/line01pt.pdf>
<http://rayfract.com/tutorials/line2.pdf>
- For a recent survey imaging subsurface velocity below a street using Rayfract® pseudo-2D Delta-t-V and Smooth inversion, see http://rayfract.com/samples/street_crossing.pdf
- For a recent study comparing a published Palmer GRM interpretation with Rayfract® Smooth inversion, see <http://rayfract.com/papers/eg374whiteleyditchcheck.pdf> . This paper also includes interpretation of a low coverage synthetic data set, with four different methods.

Version 2.74 released in July 2007 :

- Improved compatibility with Microsoft Windows® Vista™. Axis ticks are now always labeled correctly, in time/depth/velocity sections.
- Comes with latest version 5.20b of WIBU-KEY dongle driver software.
- To activate Setup, Context and Update tabs in the WIBU-KEY control panel applet 5.20, left-click on the small icon to the left of the dialog title bar and select "Advanced Mode".

- We now display the current WET iteration number, at left bottom of Rayfract® main window.
- WET Tomo menu options are now enabled before starting with first Smooth inversion or pseudo-2D Delta-t-V and WET inversion.
- The receiver spread layout start is now always rounded correctly to the nearest whole integer station number, when importing shots into a profile database.
- When importing multiple e.g. Interpex Gremix .GRM files in one session, the layout start for each shot in each .GRM file is now determined correctly, based on receiver locations specified in the .GRM files.
- When updating from version 2.72 or 2.73 to version 2.74, your custom receiver spread types are now imported automatically during installation of 2.74, from file \RAY32\REF\MYSPREAD.SPR .
- Every time you open a profile database and spread types referenced have been validated, these are exported automatically to file MYSPREAD.SPR in your profile directory. Also, MYSPREAD.SPR is updated whenever you import one or more additional shots into the same profile database.
- Version 2.74 has been recompiled with Microsoft Visual C++ 2005. Smooth inversion for our sample profile LINE14 runs about 10% faster as a consequence.
- Also, 2.74 comes with updated versions of Birdstep RDM database utilities, for initializing, checking, revising, import into and export from profile databases.
- Use our Trace|Offset Gather display to check your first breaks for consistency regarding reciprocal traveltimes. For the same offset and midpoint (station number), first breaks picked (red crosses) should collapse onto a single pick. If these are displayed on the same trace but vertically offset from each other, such picks violate the travelttime reciprocity principle which states that travelttime is invariant to exchanging source and receiver between two constant measuring stations.
- For a short description of the mathematical theory behind our Delta-t-V and XTV inversions, see http://rayfract.com/xtv_inversion.pdf
- A recent Karst study done at University of Florida compares Rayfract® Smooth inversion with Geometrics SeisImager™, Optim LLC SeisOpt® Pro and core data. See <http://rayfract.com/07-2353.pdf>
- For a few comments on the Univ. of New South Wales thesis of Ramin Nikrouz, see <http://rayfract.com/tutorials/nikrouz.pdf>
- For a recent USGS publication comparing GeoTomo LLC GeoCT-II with Rayfract® see <http://pubs.usgs.gov/sir/2006/5166/>

Version 2.75 released in August 2007 :

- Supports importing Geometrics SeisImager™ .VS files generated with Plotrefa and Pickwin modules. Specify distance unit feet by unchecking File|Import Data Settings|Default distance unit is meter.
- Import routine supports trace gaps with more than three adjacent missing traces
- Improved robustness of Wavefront method when processing low-coverage data sets
- WET tomography will regard a receiver station if traces have been picked for that station only
- File|Update header data|Update from Gremix .GRM allows for missing traces in .GRM files
- File|Update header data|Update First Breaks from .LST now matches .LST traces to profile database traces by station number instead of trace number. So you can
 - import e.g. SEG-2 shots (always all traces imported) into one profile
 - import e.g. SeisOpt files with missing traces into another profile
 - select File|Export header data|Export First Breaks to generate .LST file with SeisOpt picks
 - update first profile with File|Update header data|Update First Breaks.. and the .LST just generated.

Version 3.01 released in September 2007 :

- We now support crosshole travelttime tomography, based on a constant velocity initial model which is iteratively refined with WET Wavepath Eikonal Travelttime tomography processing.
- We have tested our new crosshole tomography routine with sample survey files made available by our Spanish client I.G.T. International Geophysical Technology. These files are formatted as Daryl Tweeton GeoTomCG .3DD files. See <http://rayfract.com/samples/borehole.zip>
- For instructions on crosshole data interpretation, see file BOREHOLE.TXT included in borehole.zip .
- We currently regard X and Z coordinates only for crosshole surveys. Y coordinates as specified in GeoTomCG input files are not regarded and are assumed to be all zero.
- If you want us to support your crosshole data format and samples, you are welcome to send us these files, as long as you have a current support contract.

- Also, we now support posting and labeling of both sources and receivers on WET velocity plots. See new items at bottom of Grid menu.
- We offer a new routine File|Update header data|Import synthetic breaks from .LST
- For IGTA13 crosshole data set (see above BOREHOLE.ZIP and BOREHOLE.TXT) a synthetic model is available at <http://rayfract.com/samples/swiss.zip> . This allows determination of vertical and lateral velocity resolution in WET output.

Version 3.02 released in October 2007 :

- Implements improved weighting/preconditioning for Smooth inversion of crosshole surveys. Velocity artefacts/anomalies at grid corners and at grid edges/directly adjacent to boreholes are suppressed. See Beydoun and Mendes 1989 “Elastic Ray-Born L_2 -Migration/Inversion” with abstract at <http://www.blackwell-synergy.com/doi/abs/10.1111/j.1365-246X.1989.tb00490.x> .
See also Luo and Schuster 1991 “Wave-equation Traveltime Inversion” Appendix B, with abstract at <http://link.aip.org/link/?GPY/56/645/1> . Luo and Schuster describe this weighting as “... Another modification is to use a preconditioned gradient (search) direction (formula). This preconditioning compensates for geometrical expansion (Beydoun and Mendes, 1989)”.
- The high sensitivity of WET to velocity variations directly at source/receiver is welcome for surface refraction surveys, since receivers are located close to the shot point in this case. For borehole surveys, the closest receiver is in the other hole. So velocity variation at source/receiver cannot be measured reliably in this case, and needs to be suppressed during tomography processing. More weight is given to the central portion of the subsurface section, located between the two boreholes. The fundamental assumption is that for borehole surveys, there are no “large” velocity variations, i.e. minimum velocity smaller than e.g. 50% of maximum velocity. For surface refraction surveys, minimum velocity (directly below topography) may be as small as 10% or less of maximum subsurface section velocity (in basement).
- Further optimized WET based inversion of surface refraction surveys. Smooth inversion of our LINE14 sample profile runs another 10% faster under Windows XP SP2 on an Intel Core 2 Duo processor.
- Channel numbers and station positions in Header|Receiver now always correspond to ASCII.ASC input file values, even when limiting the offset during import.
- Import option “Turn around spread” now works for all input file formats. Also, shot positions are inverted correctly, relative to the receiver spread.
- Import options “Turn around spread” and “Limit offset” may not be selected both at the same time.
- WET smoothing filter size now is determined based on average receiver spacing instead of the profile station spacing.

Version 3.03 released in November 2007 :

- Profile creation and database update now work again correctly, on non-English language Microsoft Windows installations
- When running our software under Microsoft Windows® 2000, be sure to always uncheck File menu item "Call batch from PIF file", immediately after starting up Rayfract®. Otherwise database revision and spread type import/export routines will fail to complete.
- For instructions showing processing of a crosshole data set see <http://rayfract.com/tutorials/igta13.pdf> .
- To disable dynamic Beydoun weighting during WET inversion of borehole surveys, check Smooth invert menu option ”Precompute static Beydoun weight matrix”. Static weighting assumes that each pixel is affected by all wave paths. Dynamic weighting does not make this assumption. Static weighting is more conservative, and a compromise between dynamic weighting and no weighting at all.
- To specify elevations for all profile shot and receiver stations in a surface based refraction survey :
 - select Header|Station
 - browse station records with F7/F8 . If x/y/z are correct already exit with ESC key.
 - otherwise click on button “Reset coordinates and v0”
 - leave x/y coordinates empty for all stations
 - enter elevation z for a few non-adjacent stations
 - you do not need to enter z elevation for all stations
 - now click on button “Interpolate coordinates and v0”
 - Next you may reopen the station editor with Header|Station. Now browse station records with F7/F8 to check the interpolated elevations. Also, x/y coordinates have been generated automatically.

- To specify a known/fixed elevation at more stations before interpolation, you need to first click on “Reset coordinates and v0”. Then reenter the elevation at all relevant stations, and click again on “Interpolate coordinates and v0”.
- Alternatively, generate a COORDS.COR file with File|Export header data|Export Station Coordinates...
- edit the COORDS.COR e.g. with Wordpad or Notepad text editors
- reimport the edited COORDS.COR with File|Update header data|Update Station Coordinates...
- To display Daryl Tweeton GeoTomCG .3DD files in a readable way, please proceed as follows :
 - select Start|Run
 - enter "Wordpad.exe" without the enclosing "" and click OK
 - select File|Open in Wordpad program
 - navigate to your \RAY32\DOC directory and select e.g. IGTA13.3DD
- To enable or disable posting and labeling of shot points and/or receivers on WET tomograms, check or uncheck the corresponding menu item in menu “Grid” before starting our Smooth inversion.
- You don’t have to redo the Smooth inversion to redisplay WET tomograms with/without posting and labeling of shot points and/or receivers. Proceed as follows instead :
 - check or uncheck corresponding items at bottom of menu “Grid”
 - select Grid|Image and contour velocity and coverage grids...
 - select desired WET tomogram grid file e.g. VELOIT20.GRD (output after 20 WET iterations), stored in profile subdirectories GRADTOMO (Smooth inversion), BOREHOLE (crosshole survey) or TOMO (pseudo-2D Delta-t-V initial model).
- To find relevant information regarding our Rayfract® software on the web, we recommend using yahoo.com or ask.com search engines instead of google.com .
- To visualize individual wavepaths between one receiver and one source, please :
 - run our Smooth inversion with menu Smooth invert, e.g. for sample profile C:\RAY32\LINE14
 - select WET Tomo|Interactive WET tomography...
 - click on button “Edit grid generation”
 - set “Write wavepaths to disk for shot nr.” e.g. to value of 2 for shot no. 2
 - click on “Accept parameters” and then “Start tomography processing”
 - start up Surfer® and select File|New... Specify form type “Plot document”.
 - select Surfer menu item Map|Image Map...
 - select e.g. grid file C:\RAY32\LINE14\GRADTOMO\W002-024.GRD (shot no. 2, trace no. 24)
 - double click on the generated black-and-white plot
 - left-click on “Colors” scale and “Load” button
 - select C:\Program Files\Golden Software\Surfer8\Samples\Rainbow2.CLR color scale
 - click on “Open” and confirm with “OK”
 - check “Interpolate Pixels” and “Show color scale”. Set “Missing Data” to white color and click “OK”.
 - select Surfer menu item View|Fit to Window
 - you will then obtain a color plot of wavepath from shot no. 2 to receiver no. 24. The wavepath is centered on (black) time value of 0 milliseconds.
 - save Surfer® plot with File|Save As... , as file C:\RAY32\LINE14\GRADTOMO\W002-024.SRF
- To generate a desktop shortcut for easy Rayfract® startup :
 - Left-click Start menu, All Programs, Rayfract32
 - right-click menu item Rayfract32 and select "Copy" command
 - minimize all windows
 - right-click on Desktop and select "Paste Shortcut" command

Version 3.04 released in December 2007 :

- More robust routines for database creation and automated revision of old profiles
- Improved automatic determination of default wavepath width, for very shallow refraction surveys with a short receiver spacing / for closely spaced boreholes.

- For S-wave surveys and slow P-wave surveys with max. time picked for inline shots exceeding 200 msec. you may need to decrease WET wavepath width interactively by 35%. Otherwise WET output may show wavepaths following a high-speed “skeleton” with slow background velocity “cells” in overburden, especially with a high number of WET iterations. Also, decreasing the WET wavepath width may result in a better match between picked and modelled times.
- Improved startup diagnostics. If the RAYFRACT32.EXE is started up in the wrong directory, or the prototype database schema \RAY32\REF\PROTO32.DBD is invalid, the software will display an according error message. Once you dismiss this message, the software will shut down again.
- Menu "Smooth invert" contains new borehole survey option "Beydoun weighting for borehole WET" to enable/disable Beydoun weighting.
- Menu “Smooth invert” offers new borehole survey option “Coverage grid shows unweighted hit count”. If unchecked, the coverage grid shows the hit count of each grid cell, scaled by Beydoun weighting.
- To generate Daryl Tweeton GeoTomCG .3DD input files required by our new crosshole tomography routine, we recommend using **TomTime picking software**, available from GeoTom LLC. Contact Daryl Tweeton at tweetond@tc.umn.edu or at dtweeton@giscogeo.com . TomTime reads all common seismograph formats, and offers versatile frequency filtering and display options. See

<http://giscogeo.com/pages/seixgott.html>

for more information.

Version 3.05 released in January 2008 :

- automatic adjustment of WET wavepath width for each trace, based on the picked time. For low coverage surveys (wide shot spacing), you may want to disable this new option in menu “WET Tomo”.
- WET parameter "Degree of differentiation of Ricker wavelet" has been changed to the new default value 0 (former default value 1). Also, the Ricker wavelet weighted wavepath modeling has been corrected, for value 0.
- these improvements lead to more robust WET output, even with difficult data sets showing e.g. velocity inversions in overburden and at a high WET iteration number. Also, the weathering layer is better resolved, and basement velocity is imaged more reliably.
- to restore **pre-3.05 WET default parameters** :
 - uncheck WET Tomo|Adjust wavepath width
 - select WET Tomo|Interactive WET tomography...
 - for a new profile, click on button “Reset” to reset the WET wavepath width
 - reset “Degree of differentiation of Ricker wavelet” to 1
 - Adapt other WET parameters such as WET iteration count and velocity smoothing
 - click on button “Start tomography processing” and continue as usual
- pre-3.05 WET default parameters may work better for some special applications, such as cavity imaging and with a wide shot spacing (higher than 6 average receiver separations).
- we now correct first breaks for lateral shotpoint offsets, during WET inversion and forward modeling over Surfer .GRD files.
- two new “Refractor mapping” menu options, for coloring of shot sorted traveltime curves. You may display all curves in gray, or color each shot curve by source type, as selected in Header|Shot.
- to adjust minimum/maximum velocities used for Surfer® color coding of velocities :
 - start up Surfer e.g. via desktop icon
 - select Surfer menu item File|Open...
 - select WET tomogram e.g. VELOIT20.SRF file, located in \RAY32\ - GRADTOMO (Smooth inversion) or
 - BOREHOLE (Crosshole survey) or
 - TOMO (Pseudo-2D Delta-t-V initial model based inversion).
 - select Surfer menu item View|Object Manager
 - double-click on *Image Map* label shown at left of Surfer® VELOIT20.SRF plot
 - click on *Colors* color bar
 - Set *Minimum* to e.g. 500 m/s, *Maximum* to e.g. 5000 m/s and click on OK twice
 - select Surfer menu item File|Save to store edited VELOIT20.SRF tomogram
- our new tutorial <http://rayfract.com/tutorials/sapri12.pdf> shows interpretation of a Geometrics SeisImager™ PickWin .VS file, with version 3.05 Smooth inversion.

- when creating new spread types with File|New Spread type..., MYSREAD.SPR is written to \RAY32\REF again instead of \RAY32\BIN
- resets interactive WET wavepath width to default value, when importing new data or when running our Smooth inversion.

Version 3.06 released in February 2008 :

- scales WET smoothing filter height, with depth below topography. This ensures better resolution of weathering layer, and fewer artefacts at bottom of WET tomograms. Also, the misfit between modeled and picked first breaks decreases faster during WET inversion (with fewer iterations).
- startup diagnostics allow for date change across time zones when validating database schema \RAY32\REF\PROTO32.DBD .
- all recently added Smooth inversion and WET settings are appended to .PAR files.
- Shot point symbols (inverted red triangles) are now plotted on top of receiver symbols (grey diamonds), on WET tomograms. See Grid menu options.
- File|Update header data|Update from Gremix .GRM files... correctly matches .GRM shot and receiver positions with profile database station numbers.
- for Smooth inversion 3.06 of an Optim LLC SeisOpt® data set made available by FUGRO WEST see <http://rayfract.com/tutorials/clud1.pdf> .
- for imaging of a reactivated landslide in Austria see <http://rayfract.com/tutorials/g0801.pdf> .

Version 3.07 released in March 2008 :

- shows Root Mean Square RMS error (standard deviation) of misfit between modeled and picked times. Both mean and RMS error of signed and unsigned misfit are displayed after WET inversion or forward modeling, and written to VELOITXX.FIT files (VELOIT10.FIT for VELOIT10.GRD).
- correctly imports topography from Geometrics PlotRefa .VS files if unpicked traces missing from .VS , or if .VS contains shots recorded with not just one spread but multiple overlapping receiver spreads .
- when importing uphole shots, the traveltime curve minimum position may deviate from the hole position, by up to the depth of the shot. Specify shot depth in ASCII.ASC column or during import.
- topography now is always imaged correctly (no blank pixels below topography) on WET tomograms, even with widely spaced shots and receivers.
- Grid menu transformations “Convert grid file between feet and meters” and “Turn around grid file by 180 degrees” now correctly transform both the velocity tomogram VELOITXX.GRD and the corresponding coverage grid COVERGXX.GRD .
- File|Import Data Settings|Keep same Layout start for consecutive shot trace files is now disabled (unchecked) per default. With this option disabled, our import routine determines layout start and shot position directly from the SEG-2 trace headers. See above, notes for version 2.65 . SEG-2 trace header fields SOURCE_STATION_NUMBER and RECEIVER_STATION_NUMBER override fields SOURCE_LOCATION and RECEIVER_LOCATION.
- Trace menu items Shot gather, Midpoint gather and Offset gather now show trace cursor attributes at bottom of display, when moving the pick cursor with left/right/up/down arrow keys. We show station, trace, shot, channel, sample, time and amplitude attributes .

Version 3.08 released in April 2008 :

- uncheck File|Import Data Settings|Keep same Layout start for consecutive shots, to determine layout start and shot position station numbers by division of positions specified in Geometrics SeisImager .VS, Interpex Gremix .GRM, Optim LLC SeisOpt and Tweeton GeoTomCG .3DD files, with the station spacing as specified in Header|Profile .
 - WET continuation prompt is displayed on top of all other windows, and cannot get "lost" any longer.
 - Smooth invert|Scale WET filter height is now supported for crosshole surveys, but is unchecked per default. Option WET Tomo|Adjust wavepath width is not allowed for crosshole surveys any longer.
 - Both of these options are activated when you create a new refraction spread profile.
 - updated PDF help topics available at <http://rayfract.com/help/rayfract.pdf>
 - You may rerun our Smooth inversion with a slightly different 1D gradient initial model :
- shut down Rayfract
 - Rename directory \RAY32\<profile name>\GRADTOMO to ... \DFLTGRAD, in Windows Explorer
 - restart Rayfract, reopen profile database

- check Delta-t-V|Delta-t-V Settings|Process every CMP offset, for sharper layer boundaries
- select Smooth invert|WET with 1D gradient initial model
- proceed as in chapter 1.4 of our manual at <http://rayfract.com/help/manual.pdf>
- once WET inversion finishes, open both VELOIT10.SRF or VELOIT20.SRF (as stored in subdirectories ...\\DFLTGRAD and ...\\GRADTOMO) in Surfer and tab through them.

Version 3.09 released in May 2008 :

- WET options are now correctly initialized, when creating a new borehole spread/line profile database. To ensure correct settings for 3.08, create profile with File|New.... Now reopen with File|Open... .
- we now support travelttime tomography of first breaks recorded for **Walkaway VSP surveys, with a constant-velocity initial model**. See <http://rayfract.com/tutorials/walkaway.pdf>
- our *refractor display parameter dialog* (invoke wit ALT-P, in Refractor|Shot breaks) now allows entering a negative *Maximum station number*.
- Refractor|Shot breaks does not link travelttime curves to shot station any longer, for borehole spreads.

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