# WET tomographic inversion and dynamic Poisson's ratio imaging for data sets WAVE\_P and WAVE\_SH as sent by Dr. Anibaldi, Geomethodo s.r.l. in 2004 with Rayfract® 4.04 and Surfer 23 in June 2023 :

#### Data import into Rayfract<sup>™</sup> profile database

Download ASCII .ASC formatted files WAVE\_P.ASC and WAVE\_SH.ASC from our web site :

https://rayfract.com/tutorials/poisson.zip

Now create two new Rayfract<sup>TM</sup> profile databases named WAVE\_P and WAVE\_SH, as described in our short manual as available at <u>https://rayfract.com/help/manual.pdf</u>. When prompted in version 4.05 to force first receiver station number to 1 click *Yes* button (Fig. 24).

Specify a Station spacing of 5 meters in Header|Profile.

Then copy file WAVE\_P.ASC into directory \RAY32\WAVE\_P\INPUT, and copy WAVE\_SH.ASC into directory \RAY32\WAVE\_SH\INPUT using Windows Explorer.

Now import these ASCII .ASC files into their respective profile databases, as described in above manual. Specify import data type ASCII column format, and use the default receiver spread type 01: 24 channels. Check option "Batch import", so you don't need to confirm layout start and shot position etc. for each individual shot.

#### WET tomography processing WAVE\_P line with 1D-gradient initial model and 50 WET iterations

- > open profile C:\RAY32\WAVE\_P with *File\Open Profile*
- ▶ select *Header*|*Profile* and check box *Force grid cell size*. Set *Cell size* to 0.1m (Fig. 12)
- select Model WDVS Smoothing and uncheck option use WDVS (Fig. 13)
- > check option *Discard WET smoothing and WDVS smoothing after modeling*. Click button OK.
- select Smooth invert|Custom 1D-gradient velocity profile and edit as in Fig. 14
- ▶ check option *Force grid limits*. Set field *Grid bottom elevation [m]* to -12.5m. Click button OK.
- select Smooth invert|WET with 1D gradient initial model
- > confirm the following prompt to obtain our default interpretation based on 20 WET iterations
- select Grid|Surfer plot Limits and edit as in Fig. 15
- select WET Tomol Interactive WET tomography... and set parameter Number of WET tomography iterations to 50. Set Wavepath envelope width to 2% (Fig. 16).
- click button Start tomography processing. You will obtain the following P-wave tomogram :



WAVE\_P RMS error 2.6%=0.78ms 50 WET itr. 50Hz Width Z.0% jpitial GRADIENT.GRD v. 4.04

Fig. 1 : 50 WET iterations with 1D-gradient initial model for line WAVE\_P. Discard WET smoothing. WDVS disabled. Full WET smoothing (Fig. 16). WET frequency 50Hz. Wavepath width 7%. Envelope width 2%. WET wavepath coverage plot shown in Fig. 19.

#### Next we compute the S-wave tomogram with profile WAVE\_S opened

- > open profile C:\RAY32\WAVE\_SH with *File|Open Profile*
- ▶ select *Header*|*Profile* and check box *Force grid cell size*. Set *Cell size* to 0.2m (Fig. 12)
- select Smooth invert|WET with 1D gradient initial model
- > confirm the following prompt to obtain our default interpretation based on 20 WET iterations
- select Grid|Surfer plot Limits and edit as in Fig. 18.
- select WET Tomo|Interactive WET tomography... and set parameter Number of WET tomography iterations to 50 (Fig. 17)
- > click button *Start tomography processing*. You will obtain the following S-wave tomogram :

WAVE\_SH RMS error 1.3%=1.69ms 50 WET itr. 50Hz Width 21.0% initial GRADIENT GRD v. 4.04



Fig. 2 : 50 WET iterations with 1D-gradient initial model for line WAVE\_SH. Discard WET smoothing. WDVS disabled. Full WET smoothing. WET wavepath width 21%. WET frequency 50Hz. WET wavepath coverage plot shown in Fig. 20.

Surfer - GridInfoReport-PWAV	IT50	
File Edit		
Grid Information		
Sat Apr 22 00:04:10 2023		Ш
Grid File Name:	C:\RAY32\WAVE_P\GRAI	
Grid Size:	126 rows x 839 columns	
Total Nodes:	105/14	
NoData Nodes:	44688	
NoData Value	1 70141E+38	
Grid Geometry		
X Minimum	-15	
X Maximum	68.8	
X Spacing:	0.1	
Y Minimum:	-12.5	
Y Maximum:	0	
Y Spacing:	0.1	Ŧ
•	4	

Fig. 3 : Grid Info PWAVIT50.GRD

Surfer - GridInfoReport-VELO	IT50 📃 🗖 📈	
File Edit		
Grid Information		
Sat Apr 22 00:09:43 2023		=
Grid File Name: Grid Size: Total Nodes: Filled Nodes: NoData Nodes: NoData Value:	C:\RAY32\WAVE_SH\G 91 rows x 420 columns 38220 21152 17068 1.70141E+38	
Grid Geometry		
X Minimum: X Maximum: X Spacing:	-15 68.8 0.2	
Y Minimum: Y Maximum: Y Spacing:	-18 0 0.2	~
< III	Þ	.d



#### Construction of dynamic Poisson's ratio image map for lines WAVE\_P and WAVE\_SH

Here we show how to image dynamic Possion's ratio with Surfer 23 operations Extract Grid, Grid Mosaic and Grid Math. See your Surfer 23 manual for more details on these grid operations.

- > open a Windows Explorer window with Windows Start menu / magnifier search icon in Start menu
- change into directory \RAY32\WAVE\_P\GRADTOMO and copy file VELOIT50.GRD to PWAVIT50.GRD.
- change into directory \RAY32\WAVE\_SH\GRADTOMO and copy file VELOIT50.GRD to SHWVIT50.GRD.
- start up Surfer 23 via desktop icon
- > in box Search commands and help at top of Surfer main window enter search term grid info
- > select topmost match Grid Info. Click *Browse* button and select above PWAVIT50.GRD.
- click Open button and OK button to obtain Fig. 3.
- > repeat the last 3 steps with above SHWVIT50.GRD to obtain Fig. 4.

To be able to carry out Grid Math operations based on above two grids, we first need to resize and resample SHWVIT50.GRD to the size and density (row, column count and cell size) of PWAVIT50.GRD.

- ➢ in Surfer main window select File|New|Plot Document
- enter search term Extract at top and select topmost match Extract
- click Browse and select SHWVIT50.GRD and edit field "First row" to 28, as shown below. I.e. vary this field until "Minimum y" optimally fits the minimum y value of PWAVIT50.GRD amounting to -12.5.
- click on the Folder icon to the right of edit field Output Grid and enter file name SHWVCLIP.GRD.
- > click on Save, and then click on OK to generate the clipped grid file (Fig. 5)

Critetion	C:\RAY32\WAVE_SH\GRADTOMO\SHWVIT50.GRD					
Direction	# of Node	s Minimur	m Max	dimum	Spacing	_
x	420	-15	68.	В	0.2	
Y	91	-18	0		0.2	
C:\RAY32\WAVE_SH\GRADTOMO\SHWVCLIP.grd Read # of Direction First Last Every Nodes Minimum						Maximum
X	1	420 🌲	1	420	-15	68.8
Y	28	91	1	64	-12.6	1.77635683940
7 Add arid	as laver to:	[New Map	0]			

Fig. 5 : Extract S-wave grid matching size of P-wave grid.

- select File|New|Plot Document
- > enter search term Mosaic at top and select topmost match Mosaic
- select SHWVCLIP.GRD and click Open button
- edit the dialog as shown below in Fig. 6 : set Output Grid to SHWVSIZE.GRD.
- set X # of Nodes to 839, and set Y # of Nodes to 126, i.e. to the same values as for PWAVIT50.GRD. Then click on OK to generate the resampled grid file :

rid Mosaic	and a lot				? X
Input Grid					
Grid Filename		xMin	xMax	yMin	<u>A</u> dd
C:\RAY32\WAVE_S	SH\GRADTOMO\SHWVCLIF	.grd -15	68.8	-12.6	Remove
•	Ш			۱.	Down
Re <u>s</u> ample Method:	Bilinear Interpolation 🔻	O <u>v</u> erlap Me	ethod: Average	ge 🔻	Info
Output Grid Geometr	у		Grid Ext	ents	
Copy geometry from	<pre>Custom&gt;</pre>	▼ Browse			
			_		
Minimum	Maximum Spac	ing # of Nodes	3		
<u>X</u> : -15	0.09999	99999 839			
<u>Y</u> : -12.6	33940025E-15 0.1008	126			
Calculate From Ir	nut Extents				
	put Extents				
Black boxes represent selected input arid, an	the input grids, the red bo d the solid grav box is the	x represents the output extents.			
Output Grid					
C:\RAY32\WAVE_S	H\GRADTOMO\SHWVSIZE	.grd			
Add grid as layer t	o: [New Map]			-	ОК
New laver his	Contour			_	Cancel
new layer typ	e. Contour			-	Curicer

Fig. 6 : resample clipped S-wave grid to P-wave grid cell size of 0.1m using Mosaic dialog.

- select File|New|Plot Document
- > enter search term Math at top and select topmost match Math
- click button Add Grids and select PWAVIT50.GRD (Fig. 7)
- click Add Grids again and select SHWVSIZE.GRD
- set Output Grid to C:\RAY32\WAVE\_SH\GRADTOMO\RATIO.GRD
- set "Enter a function of the form f(A,B) " to A / B and click on OK. Confirm the following prompt to generate a grid containing the ratio of P-wave velocity to S-wave velocity :

Input Grid		Variab	NoData Hand	Rem	Add Grids
C:\RAY32\WAVE_P	\GRADTOMO\PWAVIT50.GRD	A	NoData output	0	Domesia Crid
C:\RAY32\WAVE_S	H\GRADTOMO\SHWVSIZE.grd	В	NoData output	0	Remove Grid
					Grid Info
•	Ш			Þ	
lign grids XY coor	dinates 🔻 Master	grid (for ge	ometry): A	•	
Nign grids XY coor	dinates Master m f(A, B,) where A, B, are the	grid (for ge e variables i	ometry): A	•	
Nign grids XY coor	dinates   Master  m f(A, B,) where A, B, are the	grid (for ge e variables i	ometry): A	•	
Nign grids XY coor inter a function of the for A / B Nutput Grid: C:\RAY32\WAVE_SH\GR	dinates   Master  m f(A, B,) where A, B, are the ADTOMO\RATIO.grd	grid (for ge e variables i	ometry): A	•	
Nign grids     XY coor       Inter a function of the for       A / B       Dutput Grid:       C:\RAY32\WAVE_SH\GR.       Add grid as layer to:	dinates     Master       m f(A, B,) where A, B, are the       ADTOMO\RATIO.grd       [New Map]	grid (for ge e variables i	ometry): A	<ul> <li></li> &lt;</ul>	ОК

Fig 7 : determine ratio of P-wave grid o S-wave grid and save to RATIO.GRD

- > in our Grid menu select command Surfer plot Limits
- > check new option *Use data limits* and click OK button (Fig. 18)
- > in same Grid menu select new command *Image Surfer .GRD file without .PAR file*
- select C:\RAY32\WAVE\_SH\GRADTOMO\RATIO.GRD to obtain Fig. 8 showing the velocity ratio



Fig. 8 : image P-wave to S-wave velocity ratio obtained as in Fig. 7. Compare to our original tutorial <u>https://rayfract.com/tutorials/poisson.pdf</u>.

- select File|New|Plot Document
- > enter search term Math at top and select topmost match Math
- click button Add Grids and select PWAVIT50.GRD (Fig. 9)
- click Add Grids again and select SHWVSIZE.GRD
- ➢ set Output Grid to C:\RAY32\WAVE\_SH\GRADTOMO\POISSON.GRD
- > set "Enter a function of the form f(A,B) " to ( pow(A,2) 2\*pow(B,2) ) / ( 2\*(pow(A,2) pow(B,2) ) ) and click on OK
- > confirm the prompt to generate a grid containing the Dynamic Poisson's ratio (Fig. 10)

Grid Math	2 WAVE SHI	ntig	PUISSUN	-87	2 X	
Input Grid		Variab	NoData Hand	Re	Add Grids	
C:\RAY32\WAVE_P	0	Remove Grid				
Output Grid:	ADTOMO\POISSON ard			<b>1</b>		
Add grid as layer to:     [New Map]					ОК	
<u>N</u> ew layer type:	Contour			•	Cancel	

Fig 9 : determine dynamic Poisson's ratio of velocity grids and save to POISSON.GRD

- > in our Grid menu select command Image Surfer .GRD file without .PAR file
- select C:\RAY32\WAVE\_SH\GRADTOMO\POISSON.GRD to obtain Fig. 10 showing the dynamic Poisson's ratio
- > in Surfer plot / Contents tab select item Color Relief-POISSON.GRD (Fig. 11 at left)
- ➢ in Properties window / General tab click button ... at end of Colors row
- uncheck option "Use data limits". Set Minimum to 0 and Maximum to 0.7. Of course the real maximum value is 0.5, but the display looks better with 0.7.
- > move the "Color spectrum" nodes for yellow and red closer together, to obtain a display as in Fig. 10



Move the yellow and red color spectrum nodes, until the Poisson's ratio is shown with optimum contrast, in the deeper half of above plot. Note the similarity of above dynamic Poisson's ratio plot to the simple P-wave to S-wave velocity ratio plot (Fig. 8). When you are done, select File/Save As and specify file name POISSON.SRF.

The abnormally low Poisson's ratio (approaching 0) just below the topography at the right end of the section can be explained by too early picks for traces 10 & 11 of shot nr. 5 of line WAVE\_SH. The corresponding high velocity anomaly is clearly visible in the earlier S-wave velocity tomogram.



Fig. 11 : edit dynamic Poisson's ratio value range and color spectrum in Golden Software Surfer 23.

We thank Dr. Anibaldi at Methodo s.r.l. for making available in 2004 above consistently picked .ASC profiles.

Edit Profile					
Line ID W Line type R Job ID I Instrument Client Company	AVE_P	d/line		Time of Date Time Time of Date Time	of Acquisition
Observer				Units	meters 💌
Note			^	Sort	As acquired 💌
			$\sim$	Const	
Station spacing	m]	5.	00000	🗌 Lef	t handed coordinates
Min. horizontal se	eparation [%]		25		
Profile start offse	t [m]	(	0.0000		
Force grid	cell size		Cell siz	ze [m]	0.1000
Force first recei	iver station nur	mber for	profile		
First receiver [st	ation number]		0	∏ Fo	rce first receiver
Extrapolate sta	ting models ar	d WET	tomogram	is	
Extrapolate [sta	tion spacings]	I	0	Ex Ex	trapolate tomograms
Add borehole li	nes for WET to	omograp	hy		
Borehole 1 line	Select				
Borehole 2 line	Select				
Borehole 3 line	Select				
Borehole 4	Select				
ОК	Cancel		Reset		

Replace gradient velocity profile	
Force limits of starting model grid	
Force grid limits Res	et limits to grid Reset top elevation
Grid bottom elevation -12.500	Grid top elevation [m] 0.000
Left limit of grid [m] -15.000	Right limit of grid [m] 68.750
Replace computed velocity gradient wit     Replace velocity active     Select velocity profile     Force velocity for constant-velocity starti	h user velocity profile
Force constant velocity	
Forced velocity	
OK Cancel R	eset

Fig. 12 : Header/Profile

Fig. 14 (above) : *Smooth invert/Custom 1D-gradient velocity profile* for profile WAVE\_P

Fig. 15 (right) : Grid/Surfer plot Limits for profile WAVE\_P

Edit WDVS (Zelt & Chen 2016)						
Edit parameters for wavelength-dependent velocity smoothing						
use WDVS for forward modeling of traveltimes						
☑ fast WDVS : less accurate mapping of scan line nodes to grid nodes						
I add nodes once only with overlapping scan lines for velocity averaging						
add all velocity nodes within WDVS area with radius of one wavelength						
F pad WDVS area border with one grid cell						
WDVS frequency 300.00 [Hz]						
Angle increment between scan lines 7 [Degree]						
Regard nth node along scan line [node]						
Parameters for Cosine-Squared weighting function (Chen and Zelt 2012)						
a : Cosine argument power 1.000 [power]						
b : Cosine-Squared power 1.000 [power]						
Modify WET smoothing mode : discard after forward modeling						
OK Cancel Reset						

### Fig. 13 : Model/WDVS Smoothing

Edit Surfer plot li	mits							
Plot Limits	e 🗆 Use	data limits	ОК					
Min. offset	-15.000	[m]	Cancel					
Max. offset	68.800	[m]	Reset					
Min. elevation	-12.500	[m]	Reset to grid					
Max. elevation	0.000	[m]	Redisplay grid					
Min. velocity	200	[m/sec.]						
Max. velocity	2500	[m/sec.]						
Plot Scale Proportional X	Y Scaling imeter. Unche	eck for inch.						
X Scale length	6.000	[inch]						
Y Scale length	3.000	[inch]						
Color Scale	Color Scale							
Adapt color sc	ale							
Scale height	3.000	[inch]						
Velocity interval	200	[m/sec.]						
Coverage	5	[paths/pixel]						
- Receiver labeling								
First station	1	[station no.]						
Station interval	1	[station no.]						
Use station ind	ex or station i	no. offset						

Specify initial velocity model	Determination of smoothing filter dimensions	
Select C:\RAY32\WAVE	<ul> <li>Full smoothing after each tomography iteration</li> </ul>	
		C Minimal smoothing after each tomography iteration
Stop WET inversion after	50	O Manual specification of smoothing filter, see below
Number of WEI tomography iterations :	50 iterations	
or RMS error gets below	2.0 percent	Smoothing filter dimensions
or RMS error does not improve for n =	20 iterations	
or WET inversion runs longer than	100 minutes	Halt smoothing filter height : 1 grid rows
WET regularization settings		Suppress artefacts below steep topography
Wavepath frequency :	50.00 Hz Iterate	Adapt shape of filter. Uncheck for better resolution.
Ricker differentiation [-1:Gaussian,-2:Cosine]	-1 times	Maximum relative velocity update after each iteration
Wavepath width [percent of one period] :	7.0 percent Iterate	Maximum velocity update : 25.00 percent
Wavepath envelope width [% of period] :	2.0 percent	Smooth after each nth iteration only
Min. velocity 10 Max. velocity	6000 m/sec.	Smooth nth iteration : n = 1 iterations
Width of Gaussian for one period [SD] :	3.0 sigma	Smoothing filter weighting
Gradient search method		Gaussian 🤨 Uniform 🗌 No smoothing
© Steepest Descent C	Conjugate Gradient	Used width of Gaussian 1.0 [SD]
Conjugate Gradient Parameters		Uniform central row weight 1.0 [1100]
CG iterations 10 Line Sea	rch iters. 2	Smooth velocity update before updating tomogram
Tolerance 0.001 Line Sea	rch tol. 0.0010	Smooth update Smooth nth 🔽 Smooth last
Initial step 0.10	Steepest Descent step	Damping of tomogram with previous iteration tomogram
Edit <u>v</u> elocity smoothing Edit	grid file generation	Damping 0.000 Damp before smoothin

Fig. 16 : WET Tomo/Interactive WET tomography main dialog for WAVE\_P (left). Edit velocity smoothing (right).

Edit WET Wavepath Eikonal Traveltime Tomography Parameters	Edit WET Tomography Velocity Smoothing Parameters
Select C:\RAY32\WAVE_SH\GRADTOMO\GRADIENT.GRD	Determination of smoothing filter dimensions Full smoothing after each tomography iteration
Stop WET inversion after Number of WET tomography iterations : 50 iterations	C Minimal smoothing after each tomography iteration C Manual specification of smoothing filter, see below
or RMS error gets below     2.0     percent       or RMS error does not improve for n =     20     iterations	Smoothing filter dimensions Half smoothing filter width : 9 columns Half smoothing filter height : 1 grid rows
Or WET inversion runs longer than     100 minutes       WET regularization settings	Suppress artefacts below steep topography Adapt shape of filter. Uncheck for better resolution.
Ricker differentiation [-1:Gaussian,-2:Cosine]	Maximum relative velocity update after each iteration Maximum velocity update : 25.00 percent
Wavepath envelope width [% of period] :         0.0         percent           Min. velocity         10         Max. velocity         6000         m/sec.	Smooth after each nth iteration only Smooth nth iteration : n = 1 iterations
Width of Gaussian for one period [SD]:     3.0     sigma       Gradient search method     0     0     0	Smoothing filter weighting C Gaussian © Uniform I No smoothing
Conjugate Gradient     Conjugate Gradient	Uniform central row weight 1.0 [50]
CG iterations         10         Line Search iters.         2           Tolerance         0.001         Line Search tol.         0.0010	Smooth velocity update before updating tomogram
Initial step 0.10 Steepest Descent step	Damping of tomogram with previous iteration tomogram Damping 0.000 Damp before smoothing
Start tomography processing         Reset         Cancel	Accept parameters Reset parameters

Fig. 17 : WET Tomo/Interactive WET tomography main dialog for WAVE\_SH (left). Edit velocity smoothing (right).

Edit Surfer plot li	mits		
Plot Limits			ОК
I Plot limits activ	e I Use	data limits	Cancel
Min. offset	-15.000	[m]	
Max. offset	68.750	[m]	Reset
Min. elevation	-12.500	[m]	Reset to grid
Max. elevation	0.000	[m]	Redisplay grid
Min. velocity	100	[m/sec.]	
Max. velocity	350	[m/sec.]	
Plot Scale			
Proportional X	Y Scaling		
🔲 Page unit cent	imeter. Unche	eck for inch.	
X Scale length	6.000	[inch]	
Y Scale length	3.000	[inch]	
Color Scale			
Adapt color sc	ale		
Scale height	3.000	[inch]	
Velocity interval	50	[m/sec.]	
Coverage	5	[paths/pixel]	
– Receiver labeling			
First station	1	[station no.]	
Station interval	1	[station no.]	
Use station ind	lex or station r	no. offset	

Fig. 18 (left) : *Grid*|*Surfer plot Limits* for line WAVE\_SH

WAVE\_P RMS error 2.6%=0.78ms 50 WET itr. 50Hz Width 7.0% initial GRADIENT.GRD v. 4.04





#### WAVE\_SH RMS error 1.3%=1.69ms 50 WET itr. 50Hz Width 21.0% initial GRADIENT.GRD v. 4.04

See also our original tutorial <u>https://rayfract.com/tutorials/poisson.pdf</u> created in 2004 and edited in 2009.

Here is the Dropbox link <u>https://www.dropbox.com/s/q986gnnda4927hn/WAVE\_P.rar?dl=0</u> to profile folder for line WAVE\_P.

Here is the Dropbox link <u>https://www.dropbox.com/s/vb4t8cgnh3wavlx/WAVE\_SH.rar?dl=0</u> to profile folder for line WAVE\_SH.

Next we show how to plot your reciprocal traveltime picks on shot-sorted trace gathers. This lets you qualitycontrol your first break picks and check the validity of your recording geometry specification (shot station numbers and receiver station numbers). See (Whiteley J. et al. 2020) : Landslide monitoring using seismic refraction tomography – The importance of incorporating topographic variations at https://www.researchgate.net/publication/339280163 :

- > select Trace Export reciprocal traveltime picks and update database
- click button Select error file and click Save button (Fig. 23)
- click button Export to .ERR
- > optionally check new option *TracelOpen RefractorlShot CMP breaks with Shot gather*
- select Trace|Shot gather
- > check new version 4.04 option *Display*|Show reciprocal picks on Shot Gather
- browse and zoom trace gathers with function keys F7/F8, F1/F2 etc. as usual
- > navigate traces for current shot gather with arrow-left and arrow-right keys
- > if a reciprocal pick was matched to the current trace then this is plotted as a green dot on the trace
- also we show *Reciprocal Shot/Channel* and *Reciprocal offset[m]/CMP* in status bar at bottom of window if a reciprocal pick is available in the .ERR file for the current trace

Fig. 21 shows reciprocal traveltime picks for profile WAVE\_P. Fig. 22 shows reciprocal traveltime picks for profile WAVE\_SH.

The Shot CM breaks display was described by (Brueckl 1987) : The Interpretation of Traveltime Fields in Refraction Seismology at <u>https://dx.doi.org/10.1111/j.1365-2478.1987.tb00855.x</u> . First breaks for shot-sorted traveltime curves are displayed at CMP station positions instead of receiver station positions.



Fig. 21 : *Trace/Shot gather* (left). Red crosses are your traveltime picks. Green dots are your reciprocal picks matched to traces via *Trace/Export reciprocal errors and update database*. *Refractor/Shot CMP breaks* (right).



Fig. 22 : *Trace/Shot gather* (left). Red crosses are your traveltime picks. Green dots are your reciprocal picks matched to traces via *Trace/Export reciprocal errors and update database*. *Refractor/Shot CMP breaks* (right).

Select error file	C:\RAY32\WAVE_P\RECIPROCALER
Sort lines in .ERR file by decr	easing reciprocal error
C Sort ERR lines by relativ	ve reciprocal error
C Sort ERR lines by absol	ute reciprocal error in ms
Sort.ERR lines by offset	and CMP (as in Trace Offset gather display)
CMP interval for mapping cor	nmon-offset sorted traces to same midpoint
Designed al OMD internel	0.5 [station on ], to accord for regime call traces

## Fig. 23 : Trace/Export reciprocal errors and update database .

Increase parameter *Reciprocal CMP interval* for wide shot spacing to 1.0 or 2.0 station numbers so approximately reciprocal trace pairs can still be determined. This may not work in case of strong topography or with strongly undulating refractors.



Fig. 24 : click Yes button to force profile start / first receiver station number at station no. 1.

For compatibility with older profiles and tutorials and old COORDS.COR files which assume first profile receiver at station no. 0 click No button.

Alternatively force the first receiver station in Header|Profile dialog. Do this before importing any shots via File|Import Data dialog.

We thank Dr. Anibaldi at Methodo s.r.l. for making available in 2004 above consistently picked .ASC profiles.

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