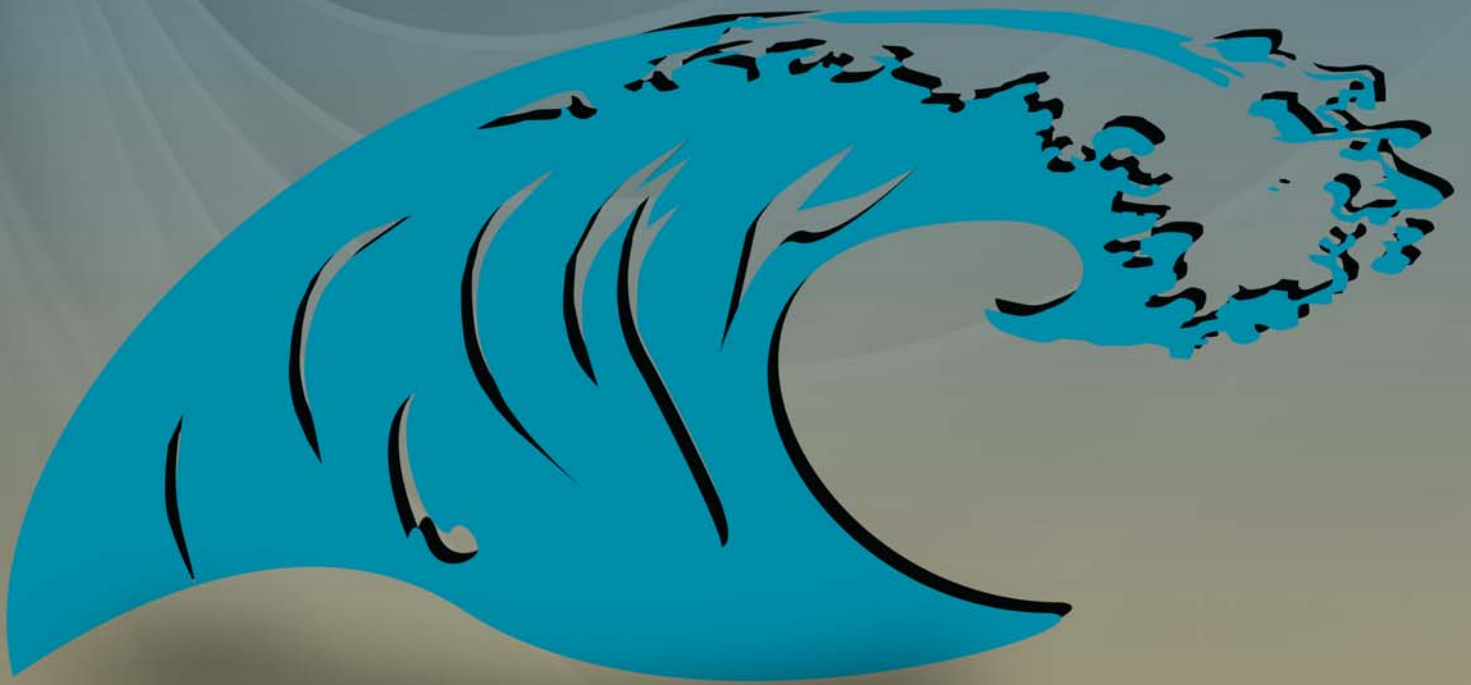


# Time Semblance



# Tsunami Development

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## INTRODUCTION

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The Semblance plug-in is used to pick velocity-time pairs and ETA-time pairs based on hyperbolic searches for coherence between multiple seismic signals in migrated gathers. The goal of this utility is to provide a robust velocity analysis to aid in further iterations of migration. In Tsunami's Semblance Builder, the user is capable of picking both RMS and ETA semblance simultaneously, with instantaneous on-screen updates of the flattened gathers. With the Semblance utility, the user can choose to output an RMS velocity model and/or an ETA model of interpolated Semblance picks.

To access this help file at any time, press F1 with an active Semblance Session.

## SETUP

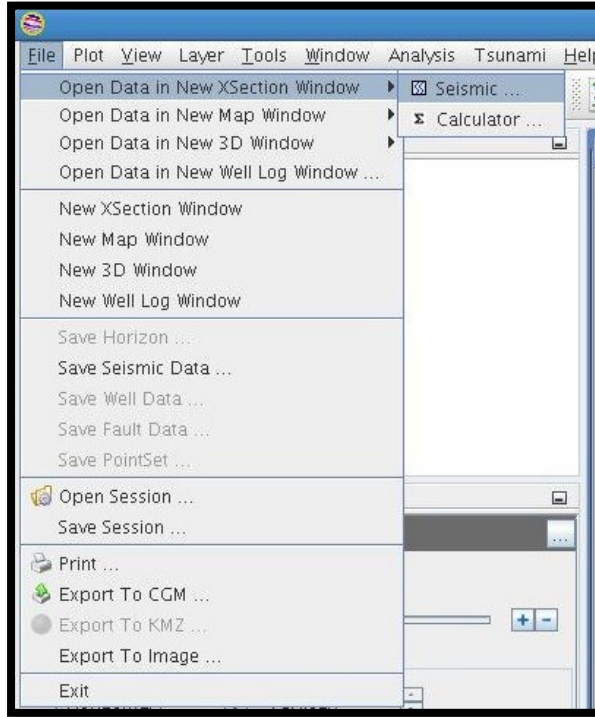
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### OPENING GATHERS

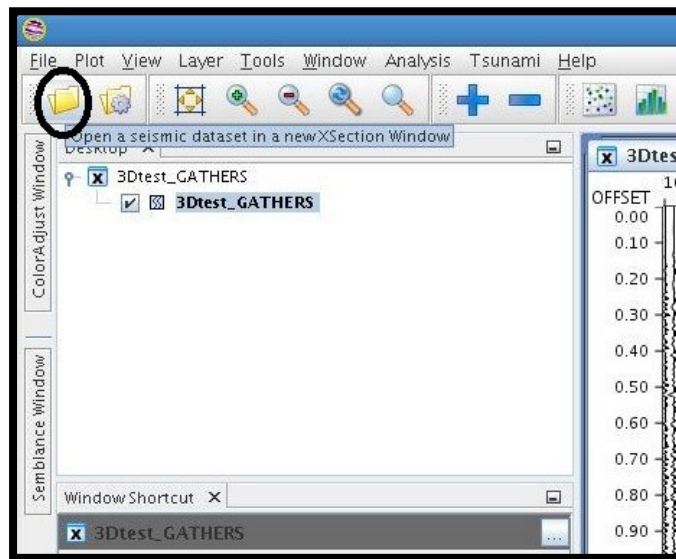
Semblance Builder requires a set a migrated gathers and an RMS velocity model. If the gathers were migrated using an ETA model, the ETA model used must also be supplied. The migrated gathers can be 3D (indexed by INLINE, XLINE, and Offset) or 2D (indexed by XLINE and Offset). The associated RMS velocity model must be rectangular (each INLINE has the same number of XLINES) and be indexed in 3D (INLINE and XLINE) or 2D(XLINE). The associated ETA model (if used) must be rectangular (each INLINE has the same number of XLINES) and must be indexed in 3D (INLINE and XLINE) or 2D(XLINE).

- See INTViewer's tutorial on indexing for more information and options.

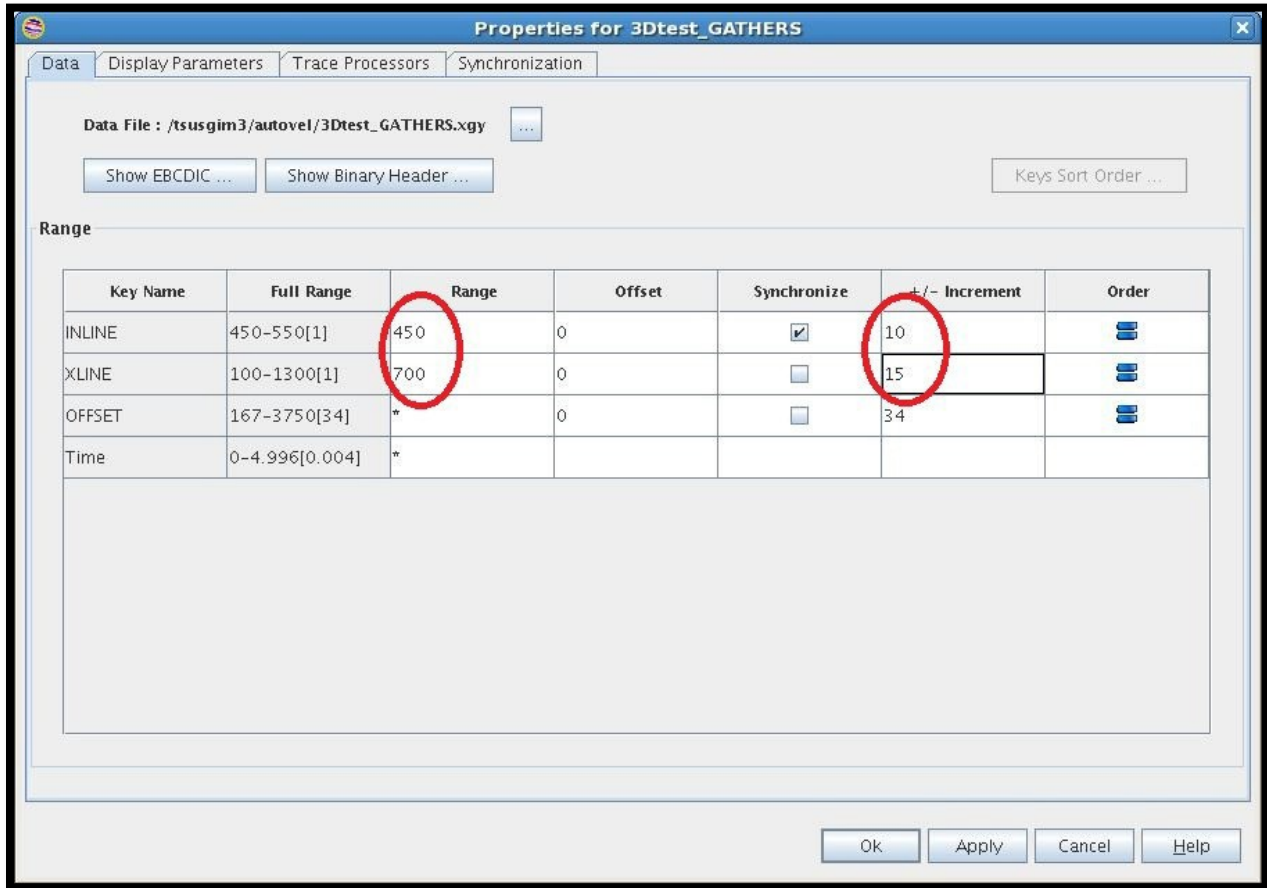
Once indexed, the gathers are loaded into the INTViewer by selecting File->Open Data in New XSection Window->Seismic...



Alternatively, the user could open the migrated gathers by clicking the Directory button below the file menu.

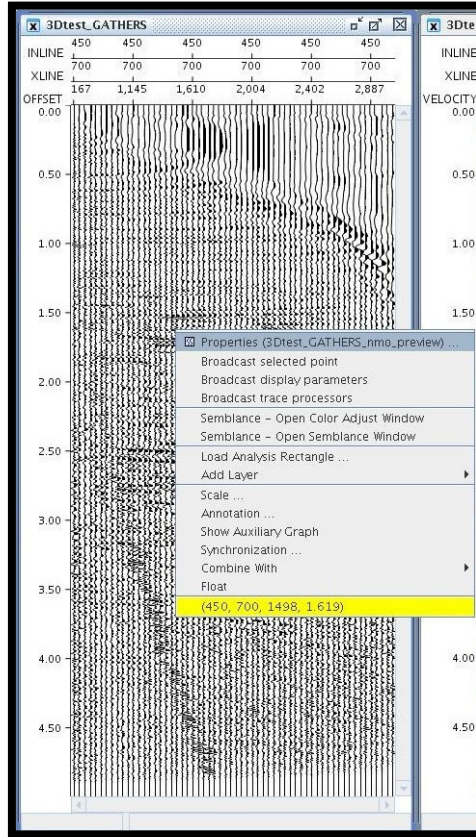


When the properties menu is displayed, select one gather to be used to build the first semblance by restricting the inline and xline range. Select the increment you wish to pick in both the INLINE and XLINE directions.

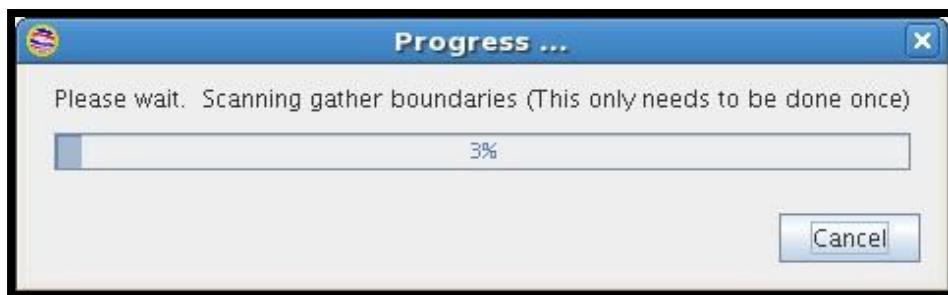


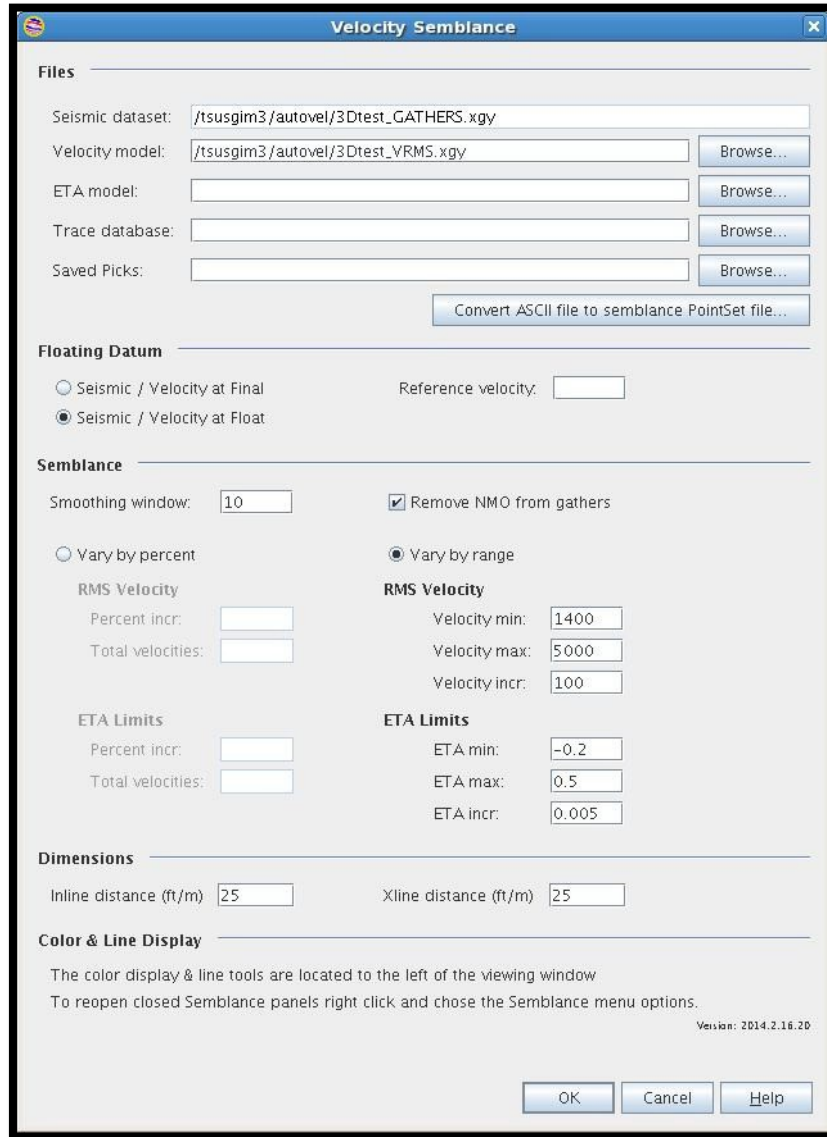
In the picture example, the first gather selected is INLINE 450, XLINE 700. When Semblance starts, it will pick on every 10<sup>th</sup> INLINE and every 15<sup>th</sup> XLINE.

The user could change the picking increment at any time during the Semblance picking session by selecting the input gathers layer, then right click to bring up the properties menu.



In order to start the plug-in, the indexed gathers must be open and made an active layer. Open the Semblance plug-in panel, by navigating to the Tsunami tool bar -> Velocity -> Semblance Builder. Upon opening data used for the first time, the “Scanning gather boundaries” dialog box will pop up. The larger the input gathers, the longer it takes to initialize the file, but generally it renders at a rate of 8000 CDPs/min. This is only done once, as long as the user has permissions on the .pec files created in the application directory (the directory that contains the input gathers).





This is the Semblance panel on start-up. Supply the relevant parameters and press OK to start the RMS and/or ETA picking session. *Opening/Saving Parameter files*

Once happy with your parameters, the user can save the parameters by right- clicking the Semblance panel and clicking Save As.

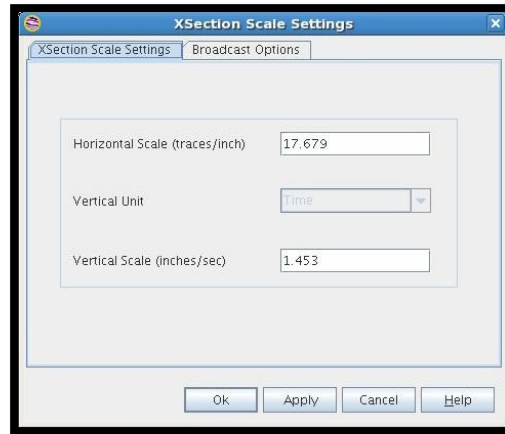
To open a saved parameter file, right-click the Semblance panel and click Open. For more information on using the parameters, see Using Semblance

For a comprehensive description of Semblance parameters see Appendix.



## SCALING

For ease of use, set the horizontal and vertical scaling parameters by going to Plot > Scale. Changing the scaling of any of the Semblance panels (gathers, RMS semblance, and/or ETA semblance) will broadcast the scaling changes to all open panels.

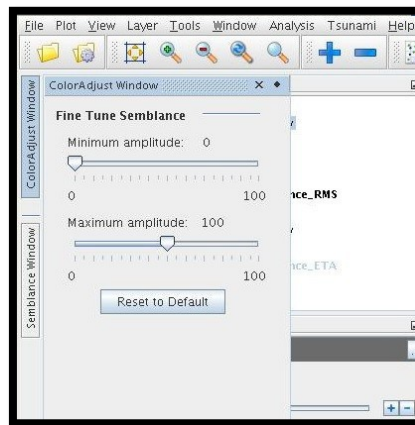


To automatically fit the scaling to the size of your open INTViewer window sessions, press F5. It will split the available room evenly between the open Semblance panels.

### *Color adjustment window*

To better focus the Semblance coherency clouds, user can change the color mapping scale.

1. Click the RMS or ETA Semblance window to make it an active layer.
2. Then click the Color Adjust Window on the side panel.
3. Change the minimum and maximum amplitude values to focus the Semblance's coherency.

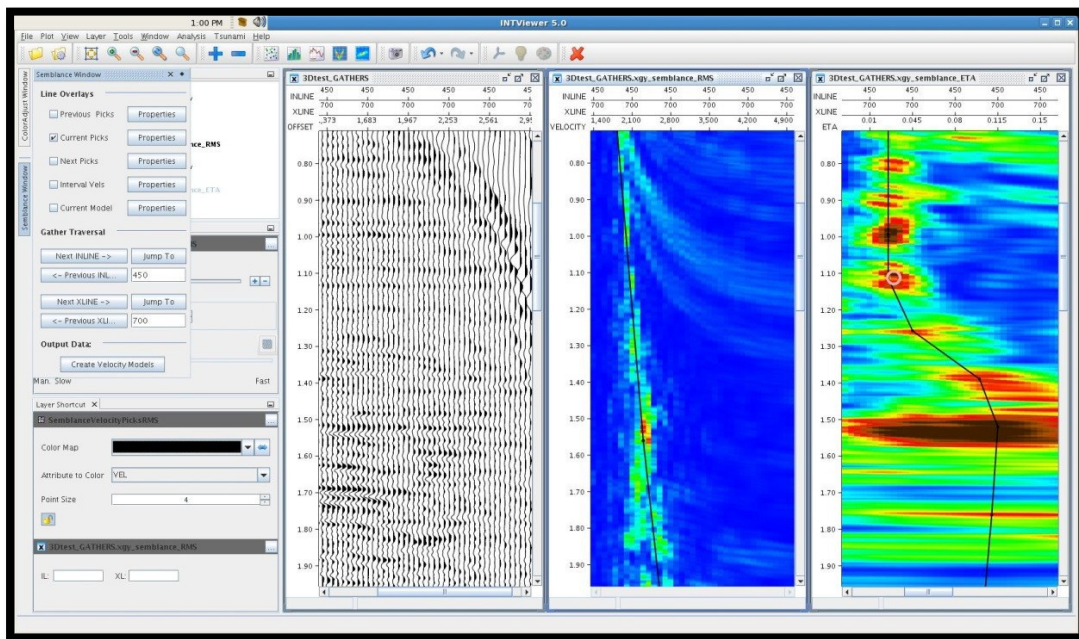


If you do not like the color mapping, press Reset to Default and continue adjusting until comfortable with the Semblance color map.

The user is now ready for Semblance picking.

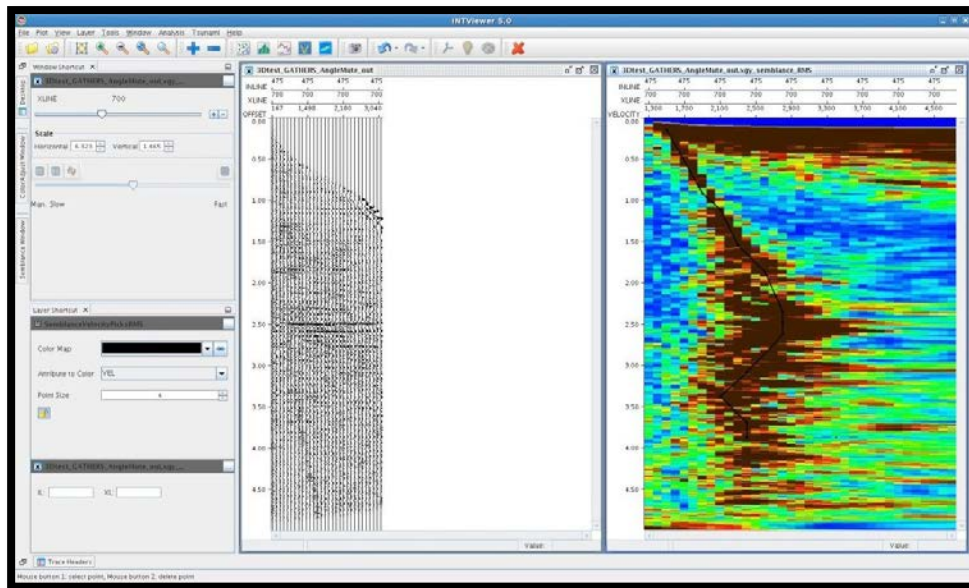
PICKING RMS & ETA SIMULTANEOUSLY

1. Supply an indexed RMS velocity model
2. If used, supply an indexed ETA model.
  - a. Note, the input gathers must have ETA applied in order to use this feature
3. If using floating datum, supply a trace.db
  - a. Specify if the Seismic and Velocity is either at Final Datum or Floating Datum
  - b. Supply a reference velocity if Seismic and Velocity is at Final Datum
  - c. If there is a mismatch between the Seismic and Velocity model datum, use Tsunami’s Floating Datum Utility to adjust the Seismic and Velocity to the same datum
4. Select “Remove NMO” from gathers
5. Select the “Vary by Range” radio button
6. Set the RMS Velocity Range. The fields will be populated with the limits of the RMS model.
  - a. Tsunami advises to make the RMS Velocity range slightly larger than the dimensions of the input RMS model
  - b. The  $[(\text{Velocity Max} - \text{Velocity Min}) / \text{Velocity Increment}] = \text{Velocity Step}$ .
    - i. The Velocity step cannot exceed 200
  - c. The smallest velocity increment that can be used is 20 [distance/time] units
7. Set the ETA Limits. The fields will be populated with the dimensions of the provided ETA model, if used.
  - a. Tsunami advises to make the ETA Limits slightly larger than the dimensions of the input ETA model
  - b. The  $[(\text{ETA max} - \text{ETA min}) / \text{ETA increment}] = \text{ETA Step}$ 
    - i. The ETA step cannot exceed 200
  - c. The smallest ETA increment that can be used is 0.001
8. Provide the INLINE and XLINE distance. This is also known as the INLINE and XLINE spacing, which will be used to interpolate the output Semblance models.
9. Press OK to start Semblance picking. Three screens will open to the screen; the input gathers with NMO preview applied, the RMS semblance panel, and the ETA semblance panel.
10. Navigate through the gathers, picking until finished with your velocity analysis.
11. It is generally advisable to make RMS picks before updating your ETA picks. Any new picks to the RMS Semblance panel will update the ETA coherency clouds.
12. To output pick files or output RMS and/or ETA models see the Output Data section



## PICKING RMS ALONE

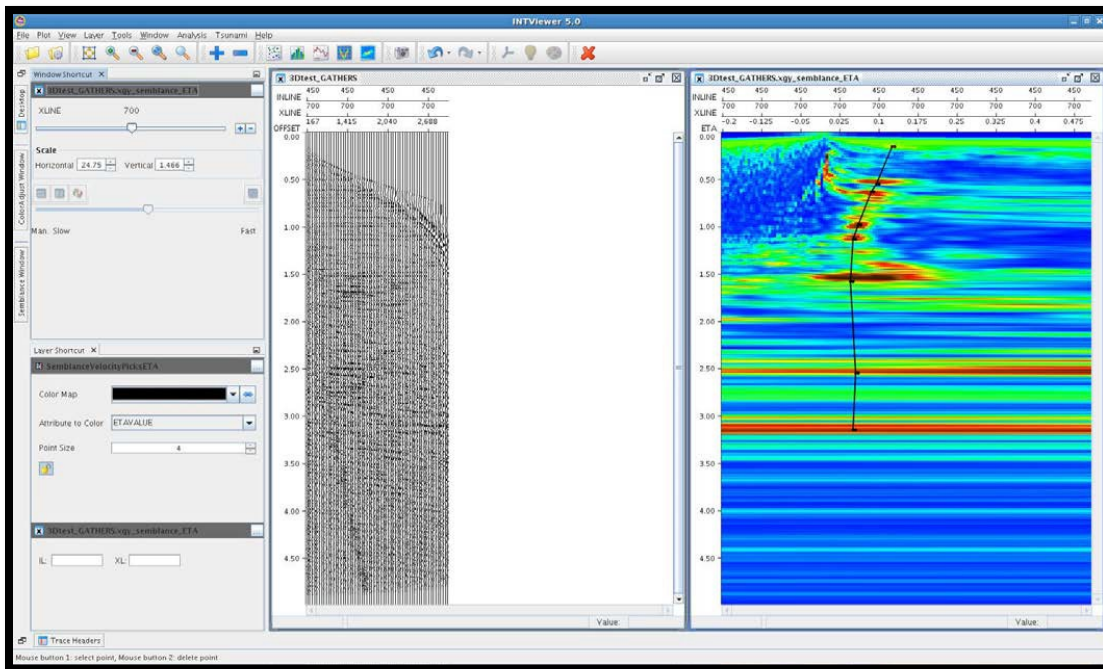
1. Supply an indexed RMS velocity model
2. If used, supply an indexed ETA model.
  - a. Note, the input gathers must have ETA applied in order to use this feature
3. If using floating datum, supply a trace.db
  - a. Specify if the Seismic and Velocity is either at Final Datum or Floating Datum
  - b. Supply a reference velocity if Seismic and Velocity is at Final Datum
  - c. If there is a mismatch between the Seismic and Velocity model's datum, use Tsunami's Floating Datum Utility to adjust the Seismic and Velocity to the same datum
4. Select "Remove NMO from gathers"
5. Select the "Vary by range" radio button
6. Set the RMS Velocity Range. The fields will be populated with the limits of the RMS model.
  - a. Tsunami advises to make the RMS Velocity range slightly larger than the dimensions of the input RMS model
  - b. The  $[(\text{Velocity Max} - \text{Velocity Min}) / \text{Velocity Increment}] = \text{Velocity Step}$ .
    - i. The Velocity step cannot exceed 200
  - c. The smallest velocity increment that can be used is 20 [distance/time]
7. Set the ETA Limits to be blank.
8. Provide the XLINE and/or INLINE distance. This is also known as the INLINE and XLINE spacing, which will be used to interpolate the output Semblance models.
9. Press OK to start Semblance picking. Two panels will open to the screen; the input gathers with NMO preview applied and the RMS semblance panel.
10. Navigate through the gathers, picking until finished with your velocity analysis.
11. To output RMS pick files or output RMS models see the Output Data section



## PICKING ETA ALONE

1. Supply an indexed RMS velocity model
2. If used, supply an indexed ETA model.
  - a. Note, the input gathers must have ETA applied in order to use this feature
3. If using floating datum, supply a trace.db
  - a. Specify if the Seismic and Velocity is either at Final Datum or Floating Datum

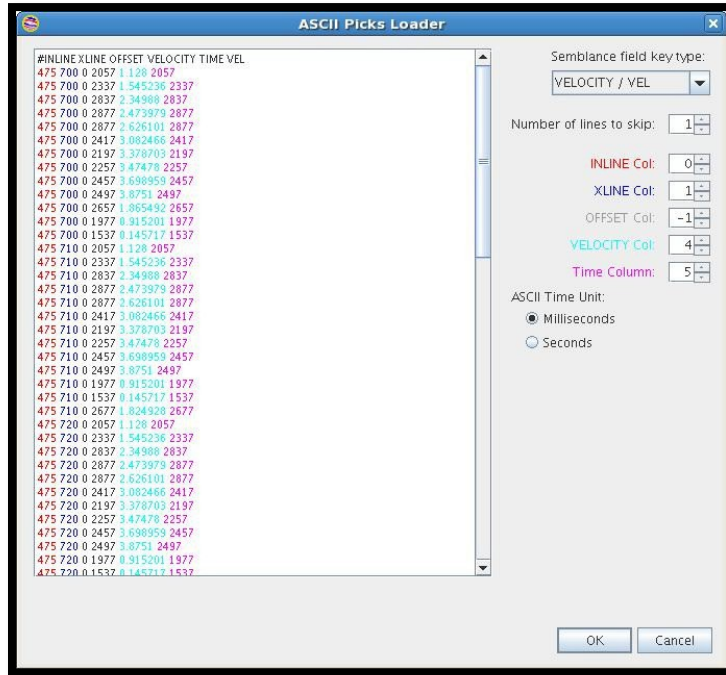
- b. Supply a reference velocity if Seismic and Velocity is at Final Datum
  - c. If there is a mismatch between the Seismic and Velocity model's datum, use Tsunami's Floating Datum Utility to adjust the Seismic and Velocity to the same datum
4. Make sure "Remove NMO from gathers" is not selected
5. Select the "Vary by range" radio button
6. Set the RMS Velocity Range to be blank.
7. Set the ETA Limits. The fields will be populated with the dimensions of the provided ETA model, if used.
  - a. Tsunami advises to make the ETA Limits slightly larger than the dimensions of the input ETA model
  - b. The  $[(\text{ETA max} - \text{ETA min}) / \text{ETA increment}] = \text{ETA Step}$ 
    - i. The ETA step cannot be less than 200
  - c. The smallest ETA increment that can be used is 0.001
8. Provide the XLINE and/or INLINE distance. This is also known as the INLINE and XLINE spacing, which will be used to interpolate the output Semblance models.
9. Press OK to start Semblance picking. Two panels will open to the screen; the input gathers with NMO preview applied and the ETA semblance panel.
10. Navigate through the gathers, picking until finished with your velocity analysis.
11. To output ETA pick files or output ETA models see the Output Data section



Continue picking with previous picks files

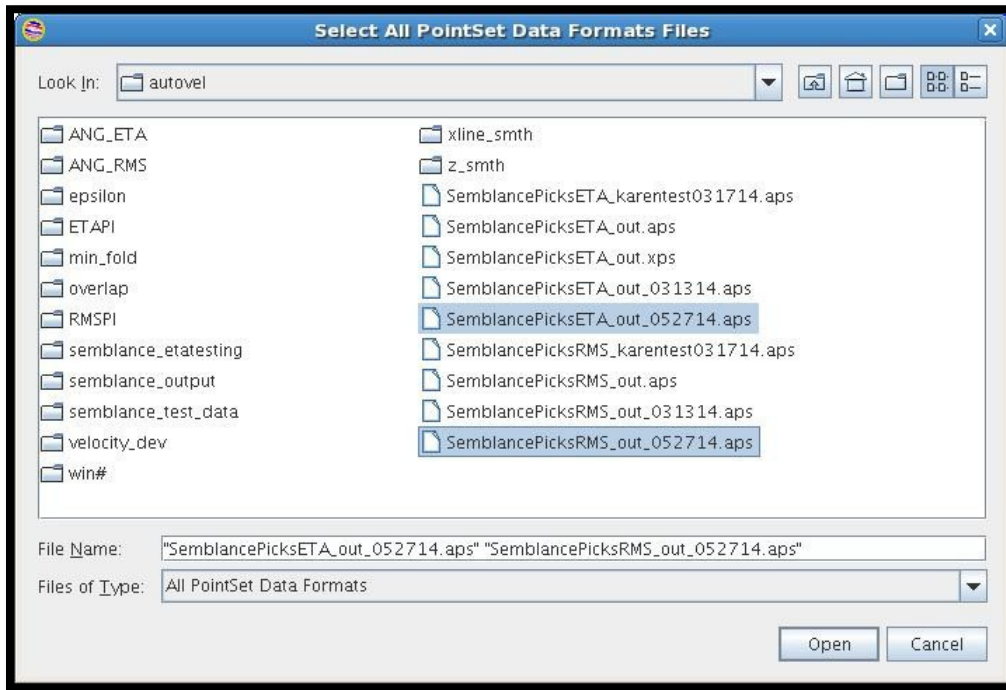
1. Supply an indexed RMS velocity model
2. If used, supply an indexed ETA model.
  - a. Note, the input gathers must have ETA applied in order to use this feature
3. If using floating datum, supply a trace.db
  - a. Specify if the Seismic and Velocity is either at Final Datum or Floating Datum
  - b. Supply a reference velocity if Seismic and Velocity is at Final Datum
  - c. If there is a mismatch between the Seismic and Velocity model's datum, use Tsunami's Floating Datum Utility to adjust the Seismic and Velocity to the same datum
4. To use pick files from 3rd Party sources
  - a. Click the "Convert ASCII file to semblance Pointset file" to convert Promax or .xml files to

- compatible pointsets.
- b. Select Semblance field key type to ETA or Velocity from the drop down menu
- c. Skip any initial lines, if necessary
- d. Select the column in which the INLINE, XLINE, offset, velocity/ETA, and time pairs are kept. The column will be highlighted by the correlating color for ease of use.
- e. Once appropriate columns are named, select the unit of time used in the pointset to be milliseconds or seconds.
- f. Select OK to name and save the pointset.



- 5. To use pick files from previous Semblance sessions
  - a. The .aps or .xps files saved from INTViewer are compatible with Semblance and do not need conversion
- 6. In the “Saved Picks” field, browse to find the picks file used from a previous session. The user can select both the RMS and ETA picks files by selecting “Ctrl” and highlighting both files from the open dialog box





7. Select the “Vary by range” radio button
8. Select “Remove NMO from gathers”
9. Set the RMS Velocity Range, ETA Limits, and INLINE/XLINE distance parameters and press OK
10. Navigate to a gather picks exists on; a black line with previous Semblance picks will be drawn on the corresponding Semblance panels

## COPYING PICKS

Picks can be copied from the nearest gather by clicking the middle mouse button, also known as the scroll wheel. If picks exists on any gather, the user can copy picks to the current gather.

## ADJUSTING/DELETING PICKS

To move a pick, hover over a point until you see the highlighted target circle. Drag and drop the point to anywhere on the Semblance panels.

To delete a pick, hover over a point until you see the highlighted target circle. Click the middle mouse button, also known as the scroll wheel, to delete the pick.

## NAVIGATING THE GATHERS

The INLINE, XLINE, and offset headers will be displayed at the top of each Semblance panel.

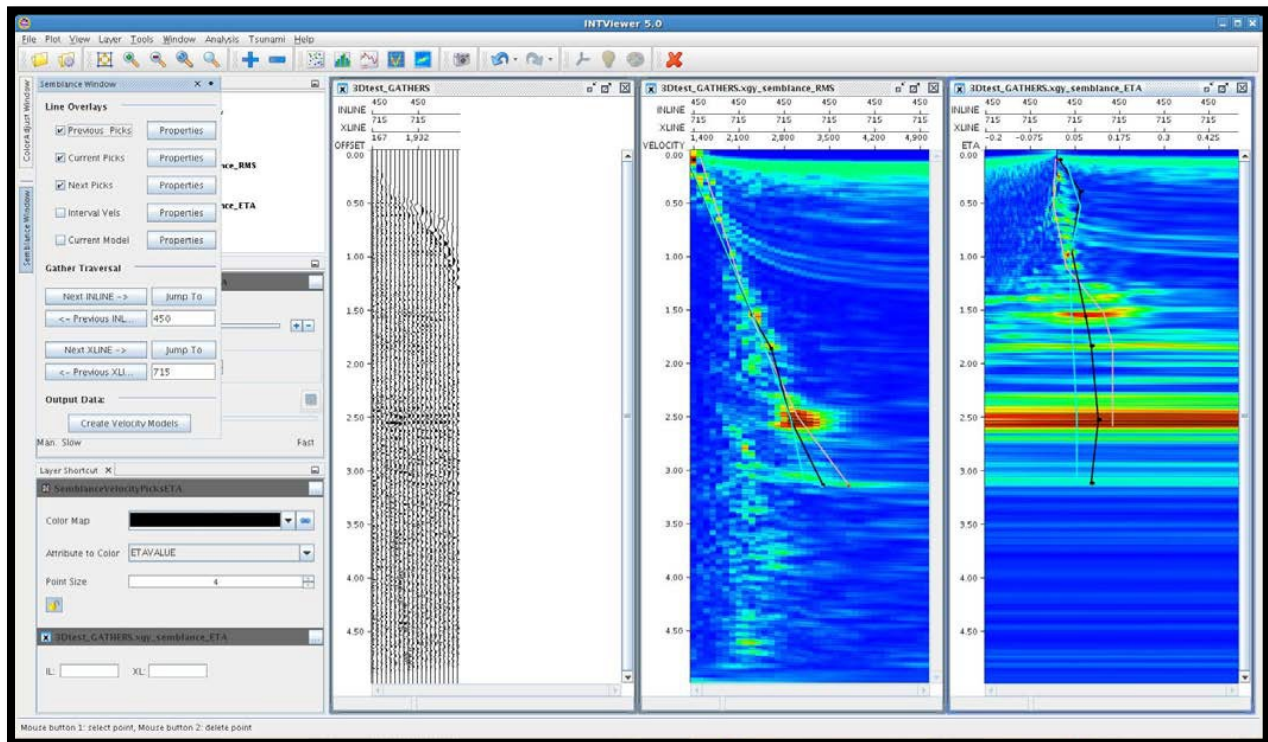
The picking increments used by Semblance are the INLINE and XLINE increments used to define the display properties at start-up. Clicking Next or Previous INLINE or XLINE will move up or down an INLINE or XLINE based on this increment. The user is free to traverse the input gathers in any direction, backwards or forwards.

Change the INLINE or XLINE picking increment at any time during the Semblance session, by clicking the gathers window to make it an active layer, right click properties, and changing the INLINE or XLINE increment.

To navigate the gathers, the user may also enter any value in the XLINE and/or INLINE “Jump to” fields, as long as it exists. If the INLINE or XLINE number used does not exist, Semblance will round to the nearest gather available. Hover over the “Jump to” fields with your mouse cursor to get the dimensions of the input dataset for easier navigation.

LINE OVERLAYS

If picks exists on any gather to the left or to the right of the currently selected gather on the same inline, a QC line overlay could be used to guidepicking.



In the picture example, picks exists on (il 450, xl 710) and (il 450, xl 720). Sandwiched in between is gather (il 450, xl 715). The Previous Picks (the light blue line) overlay outline picks from gather (il 450, xl710) while the Next Picks (the pink line) overlay displays picks from gather (il 450, xl 720). Both can be used to guide picking, but do not affect the current picks made on the gather.

This only works for gathers to the immediate right or left of the current gather.

Closing and restarting a Semblance session

If closing an RMS or ETA Semblance window, all other windows must close to clear the cache for future Semblance sessions. The user will be prompted with the following dialog box, to ensure closing the panels are the intended action.

### SAVING THE OUTPUT FILES

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To save the output files perform these steps:

1. Click the side Semblance Window button
2. Click the Output Data: Create Velocity Models button
3. Click to output a Semblance RMS model, an ETA model, or both
  - a. Click the radio button for the interpolation method preferred, Linear or Inverse Distance Weighting
4. Wait for the models to render, the models will output to the screen
5. Select the file and right click to go to the properties menu.
6. In the range field please put an asterisk ( \* ) in all fields to include the complete range of data. Not doing so will only save the default, selected INLINE.
7. Save the seismic by going to File--> Save Seismic Data. The segy output of the RMS and ETA volumes can be used directly into Tsunami Migration.
  - a. For further QC or gather conditioning with Tsunami tools, users can also save the indexed output by selecting index files from the drop down menu

### SAVING THE PICKS FILES

---

To save the velocity-time and/or ETA-time picks perform these steps:

1. Select the RMS or ETA Semblance window to make the window an active layer
2. Click File -> Save Pointset
3. Follow the dialog box instructions for naming of pointset files. Choose to save it as either an .aps file or an .xps file, both of which are compatible in future picking sessions of Semblance.



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## APPENDIX

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### PARAMETERS

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#### STARTING SEMBLANCE PANEL

##### FILES

- Seismic dataset: Input migrated gathers indexed in 2D (xline, offset) or 3D (inline, xline, offset)
- Velocity model: RMS velocity model used to migrate the input gathers. Must be rectangular (number of xlines must be the same for all inlines) and must be indexed in 2D (xline) or 3D (inline, xline)
- ETA model: ETA model used to migrate the input gathers. Must be rectangular (number of xlines must be the same for all inlines) and must be indexed in 2D (xline) or 3D (inline, xline)
- Trace Database: For floating datum uses only. The trace.db output from a Tsunami Migration Module that contains the floating datum statics.
- Saved picks: The picks files from a previous RMS and/or ETA picking session. Must be in .xps or .aps format. If any doubt exists, use the “Convert ASCII file to Semblance Pointset file”
- Convert ASCII file to Semblance Pointset file: Used to convert a Promax or .xml picks file to an .aps compatible format. For more information on usage, see Continue picking with previous picks files

##### FLOATING DATUM

- Seismic/ Velocity at Final: Select if the input migrated gathers and RMS velocity model are both at Final Datum
- Seismic/ Velocity at Float: Select if the input migrated gathers and RMS velocity model are both at Floating Datum
- Reference Velocity: The replacement velocity used for events repositioned to Final Datum. Only needed if “Seismic/ Velocity at Final” selected.

##### SEMBLANCE

- Smoothing window: The number of samples over which to smooth the RMS and/or ETA Semblance
- Remove NMO from gathers
- Vary by Percent: Stay tuned for future Depth Semblance properties!
- Vary by Range:
  - RMS Velocity
    - Velocity Min: The minimum velocity wanted for the RMS Semblance panel
    - Velocity Max: The maximum velocity wanted for the RMS Semblance panel
    - Velocity Increment: The velocity sampling used for the RMS Semblance panel. Cannot be less than 20 [distance/time] units
      - Note:  $(\text{Maximum velocity} - \text{Minimum velocity}) / \text{Velocity increment} = \text{RMS Step}$ . The RMS step cannot exceed 200.
  - ETA Limits
    - ETA Min: The minimum ETA wanted for the ETA Semblance panel
    - ETA Max: The maximum ETA wanted for the RMS Semblance panel
    - ETA Increment: The ETA sampling used for the RMS Semblance panel. Cannot be less than 0.001 units
      - Note:  $(\text{Maximum ETA} - \text{Minimum ETA}) / \text{ETA increment} = \text{ETA Step}$ . The ETA step cannot exceed 200.

##### DIMENSIONS

- Inline distance: The inline spacing. Used for RMS/ETA model interpolation.
- Xline distance: The xline spacing. Used for RMS/ETA model interpolation.

### **Semblance Window**

#### LINE OVERLAYS

- Previous Picks: QC guideline for picks made on an xline to the right of the current gather, on the same xline.
- Previous Picks Properties: Change the line style and color of the Previous Picks QC guideline.
- Current Picks: The line drawn to represent picks on the current gather
- Current Picks Properties: Change the line style and color of the current picks line
- Next Picks: QC guideline for picks made on an xline to the left of the current gather, on the same xline.
- Next Picks Properties: Change the line style and color of the Next Picks QC guideline.
- Interval Vels: Stay tuned for future Depth Semblance properties!
- Interval Vels Properties: Stay tuned for future Depth Semblance properties!
- Current Model: QC guideline for the RMS model trace for the current gather. Must have picks selected on the current gather to see Current Model QC guide.
- Current Model Properties: Change the line style and color of the Current Model QC guideline.

#### GATHER TRAVERSAL

- Next/Previous Inline: Using the increment set by the display properties at start up, move up or down the inline by that increment.
- Jump to Inline: Jump to a particular inline. Hover over this field to see the dimensions of the INLINE.
- Next/Previous Xline: Using the increment set by the display properties at start up, move up or down the xline by that increment.
- Jump to Xline: Jump to a particular xline. Hover over this field to see the dimensions of the XLINE.