



QRev - Processing Moving-boat ADCP Discharge Measurements

David S Mueller

Office of Surface Water


February 27, 2017

U.S. Department of the Interior

U.S. Geological Survey

Overview

- Why QRev
- QRev Approach
- Using QRev
 - Help
 - Window details
 - Processing tidal measurements
 - Plotting transects in Google Earth
- Demo
- Dealing with warnings and errors
 - Why
 - Suggested approach
- Limitations



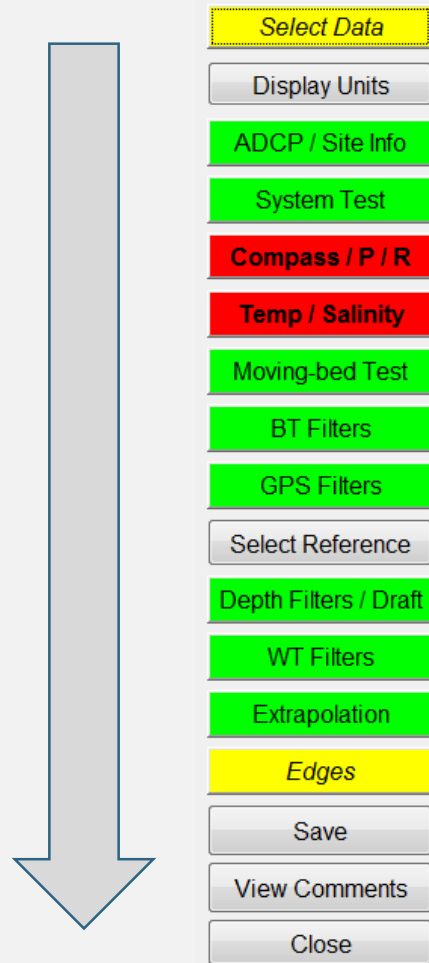
The typical ADCP user will not be an ADCP expert!

Provide HELP and GUIDANCE through **SMART SOFTWARE**

Computational Differences

Characteristic	TRDI	SonTek	Qrev 3.19
GPS based boat velocity	Nearest in time	Use last valid	Manufacturer
Edge coefficient	vertical = 0.91	vertical = f(width/depth)	Manufacturer
Edge ensembles	10 or user valid	Edge samples only	Manufacturer
Edge velocity	Simple average to get magnitude of measured	Profile averaging includes extrapolation then projects the mean vector	Manufacturer
Bottom extrapolation type	Constant not allowed	Constant is an option	Constant not allowed
Extrapolation exponent	Single	Top and Bottom	Single, Automated
Invalid water track	Increase dt	N/A	Linear interpolation
Invalid bottom track	Increase dt	Hold last valid (9)	Linear interpolation
Invalid GPS	Hold last valid	Increase dt	Linear interpolation
Invalid depth	Increase dt	Hold last valid	Linear interpolation
Invalid depth cell	Interpolate or extrapolate	N/A	Interpolate or extrapolate
Data screening / filters	Manual	None	Automatic with manual override

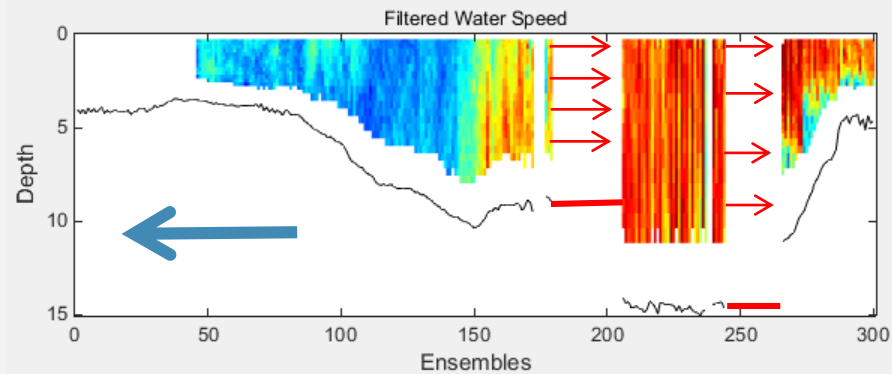
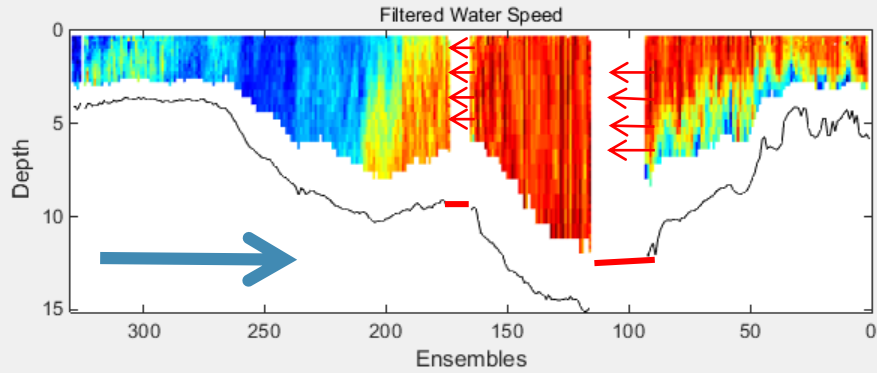
Best Available Data



- Discharge
 - Water velocity
 - Depth
 - Boat speed
- Water velocity
 - Depth
 - Boat speed
- Depth
 - dependent on boat speed for cross section shape
- Boat speed
 - Bottom track
 - GPS

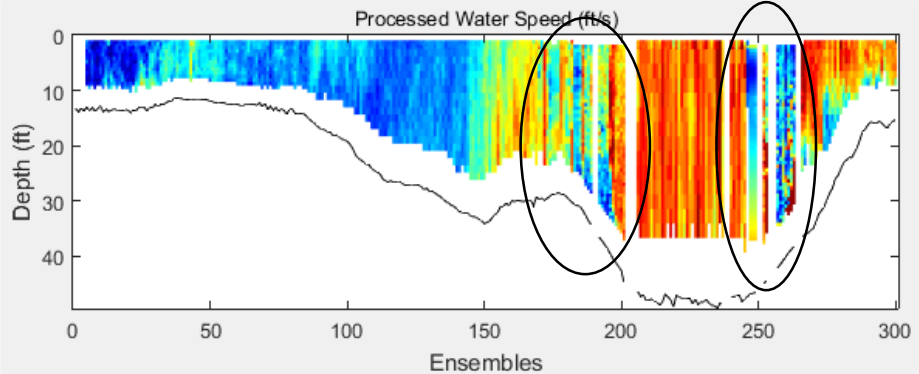
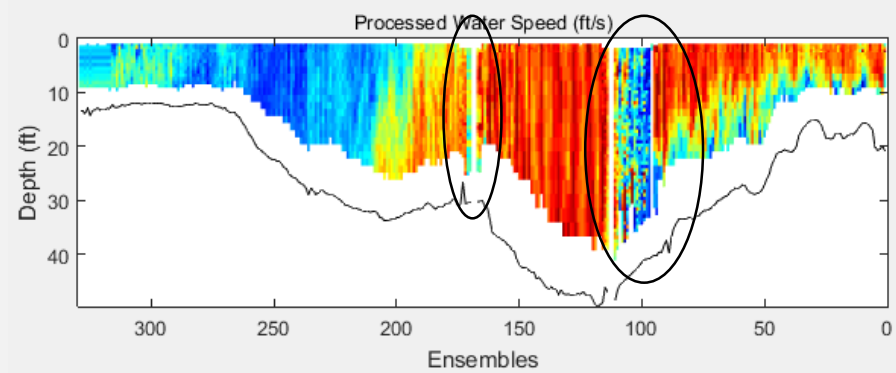
The QRev Difference

WinRiver II – Nav, ~~Depth~~, WT => ~~Ensemble~~



Q=112,400 cfs
Estimated 95% Uncertainty =40%

QRev – Nav, Depth, WT => Uses All Data



Q=95,000
Estimated 95% Uncertainty =14%

QRev – Goals & Requirements

- Process both SonTek and TRDI data
- Logical workflow
- Automated data quality review and feedback
- Consistent algorithms
- Use best available data
- Manual overrides
- Issue specific dialog windows
- Feedback to user on uncertainty
- Tablet friendly

Automated Review and Feedback

Measurement Details (Units: English)

PARAMETERS	MEASUREMENT	09-25_162227	09-25_162...	09-25_163...	09-25_16...
DISCHARGE					
Use		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Total Q (ft ³ /s)	231.501	230.398	226.926	236.587	232.093
Top Q (ft ³ /s)	47.528	48.969	46.678	46.911	47.528
Middle Q (ft ³ /s)	144.963	139.749	146.810	145.118	148.118
Bottom Q (ft ³ /s)	33.161	35.069	28.949	36.922	31.718
Left Q (ft ³ /s)	1.992	2.201	1.792	3.019	0.952
Right Q (ft ³ /s)	3.857	4.410	2.697	4.618	3.700
TIME					
Duration (s)	577.3	140.9	139.5	140.7	156.2
Start Time (09/25/2014)	16:26:18	16:26:18 L	16:29:02 R	16:31:43 L	16:34:18
End Time (09/25/2014)	16:36:54	16:28:39	16:31:22	16:34:03	16:36:55
REFERENCE					
Navigation Ref		BT	BT	BT	BT
Composite Tracks		Off	Off	Off	Off
Depth Ref		BT	BT	BT	BT
MOVING-BED					
Moving-bed	No				
Correction	No				

Measurement Quality Assessment

	COV %	Left/Right Edge:	% Q
Q:	1.73	0.86 / 1.67	
Width:	0.66	Invalid Cells:	0.52
Area:	0.64	Invalid Ens:	1.17

Parameter	Automatic	User
Random Uncertainty	2.8	
Invalid Data Uncertainty	0.3	
Edge Q Uncertainty	0.8	
Extrapolation Uncertainty	1.3	
Moving-Bed Test Uncertainty	1.0	
Systematic Uncertainty	1.5	
Estimated 95% Uncertainty	4.5	4.5

User Rating
Not Rated

Profile Extrapolation

Messages

- Transects: Duration of selected transects is less than 720 seconds;
- COMPASS: No compass calibration;
- TEMPERATURE: The difference between the average ADCP and independent temperatures is: 2.4 degrees C which is not less than 2 degrees;
- Edges: Excessive boat movement in left edge ensembles;

Web Browser - 2. Main Window

2. Main Window

Location: file:///C:/dsm/dsm_documents/MATLAB/BitBucket/QRev_Project/QRev/QRev_Help_Files/HTML/main_window.htm

QRev

User guide

Menu

- Searchable PDF File
- 1. Introduction
- 2. Main Window
- 3. Common Features
- 4. Select Data
- 5. Display Units Button
- 6. ADCP / Site Info
- 7. System Test
- 8. Compass / P / R
- 9. Temp / Salinity
- 10. Moving-bed Test
- 11. BT Filters
- 12. GPS Filters
- 13. Selected Reference
- 14. Depth Filters / Draft
- 15. WT Filters
- 16. Extrapolation
- 17. Edges
- 18. Save
- 19. View Comments
- 20. Close
- 21. EDI - Equal Discharge Ince

2. Main Window

← Previous page Next page →

Measurement Details

2

Measurement Quality Assessment

4

Buttons 1

QRev - 3.18 C:\dsm\downloads\RG600_10271_20160816...

Select Data

Display Units

ADCP / Site Info

System Test

Compass / P / R

Temp / Salinity

Moving bed Test

BT Filters

GPS Filters

Select Reference

Depth Filters / Draft

WT Filters

Extrapolation

Edges

Save

View Comments

Close

Measurement Details (Units: English)

PARAMETERS	MEASUREMENT_20160816_000	20160816_...
Use		
Top Q (ft/s)	130295.116	134229.229
Middle Q (ft/s)	21598.679	22210.802
Bottom Q (ft/s)	87216.378	89448.762
Left Q (ft/s)	17995.702	18842.579
Right Q (ft/s)	3231.617	3545.427
TIME	252.740	181.659
Duration (s)	1664.4	951.9
Start Time (08/16/2016)	14:46:33	14:46:33 L
End Time (08/16/2016)	15:15:19	15:02:25

REFERENCE

	BT	BT
Navigation Ref	BT	BT
Composite Tracks	Off	Off
Depth Ref	BT	BT

MOVING-BED

	Unknown
Moving-bed	Unknown
Correction	N/A

CHARACTERISTICS

Messages

Transacts: Uncertainty would be reduced by additional transacts.
System Test: One or more system test sets have at least one test that failed.
Temperature: No independent temperature reading.
MOVING-BED TEST: No moving bed test.

Measurement Quality Assessment

	COV %	Left/Right Edge	% Q
Q	4.27	2.48 / 0.19	
Width	0.60	Invalid Calls	0.06
Area	0.35	Invalid Ens	0.41

Parameter	Automatic	User
Random Uncertainty	14.1	
Invalid Data Uncertainty	0.1	
Edge Q Uncertainty	0.8	
Extrapolation Uncertainty	0.5	
Moving-Bed Test Uncertainty	3.0	
Systematic Uncertainty	1.5	
Estimated 95% Uncertainty	14.7	14.7

User Rating: Not Rated

Profile Extrapolation

Messages 3

7 Add Comment

8 User's Guide

9 Equal Discharge Increment

5 User Rating

6 Profile Extrapolation

The Main Window is designed to be logical and tablet friendly. The Main Window has six sections: (1) buttons down the left side, (2) Measurement Details panel, (3) Messages panel, (4) Measurement Quality Assessment panel, (5) User Rating panel, and (6) Profile Extrapolation panel. Two buttons on the right allow the user to add comments and view this user's guide. The information available from this main window provides the user an overview of the measurement quality and totals. The color highlighting and messages alert the user to any potential issues detected by the automated data quality assessment. Other modal windows to explore the data or change the processing settings are accessed from this main window using the buttons on the left.

Web Browser - 11. BT Filters

11. BT Filters

Location: file:///C:/dsm/dsm_documents/MATLAB/BitBucket/QRev_Project/QRev/QRev_Help_Files/HTML/bt_filters.htm?st=MA%3D%3D&sct=MA%3D%3D&mw=MjQw&ms=AA%3D%3D

QRev

User guide

Menu

- Searchable PDF File
- 1. Introduction
- 2. Main Window
- 3. Common Features
- 4. Select Data
- 5. Display Units Button
- 6. ADCP / Site Info
- 7. System Test
- 8. Compass / P / R
- 9. Temp / Salinity
- 10. Moving-bed Test
- 11. BT Filters**
- 12. GPS Filters
- 13. Selected Reference
- 14. Depth Filters / Draft
- 15. WT Filters
- 16. Extrapolation
- 17. Edges
- 18. Save
- 19. View Comments
- 20. Close
- 21. EDI - Equal Discharge Incr

11. BT Filters

The BT Filters button opens a window that allows the user to evaluate the bottom track data for each transect and change the filter settings. Filter settings are applied to all transects and cannot be set for individual transects.

Graphics Toolbar

11

Summary Table 1

Transect Displayed 2

Filter Graph 3

BT Speed Time Series 4

5

Ship Track Graph

12 Add Comment

13 User's Guide

6 Navigation Reference

7 Beam Filter

8 Error Velocity Filter

9 Vertical Velocity Filter


10 Other Filter

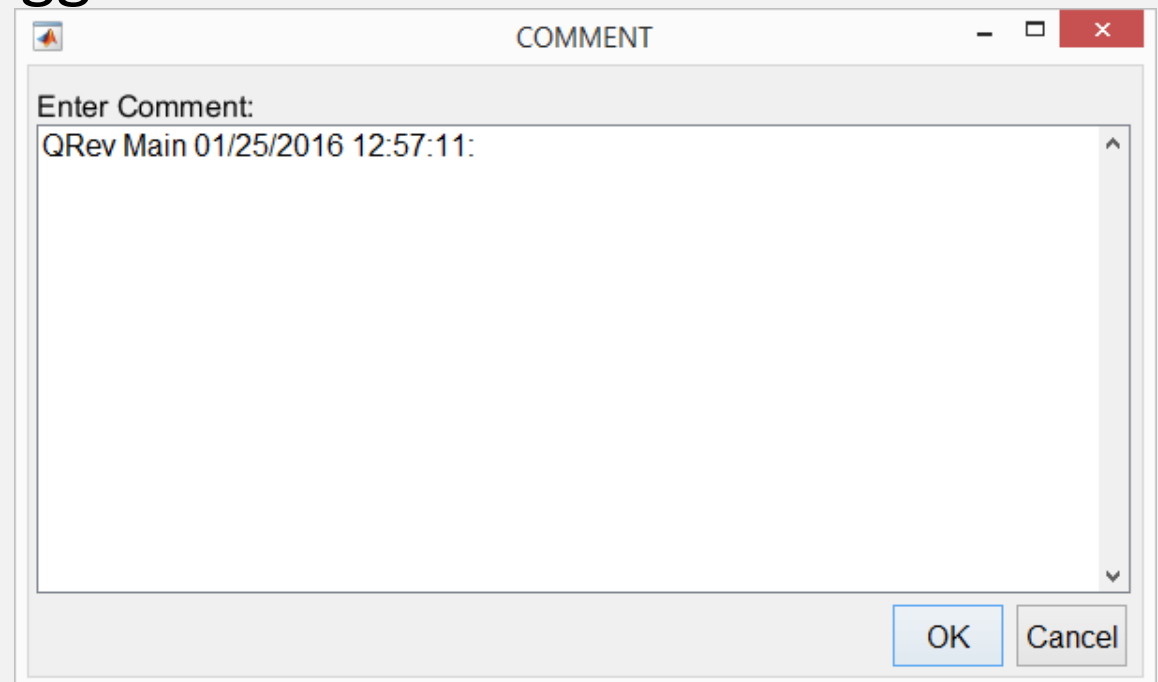
14 Close Window

Filename	# Ensembles	# <4 Beam	# Invalid Total	# Invalid Orig Data	# Invalid <4 Beam	# Invalid Error Vel	# Invalid Vert Vel	# Invalid Other	Discharge Prev. (R3/s)	Discharge Now (R3/s)	Discharge % Change
20160922153000r.mat	378	11	11	11	11	0	0	0	1442.55	1442.55	0.00
20160922153635r.mat	381	16	16	16	16	0	0	0	1535.51	1535.51	0.00

Filename	# Ensembles	# <4 Beam	# Invalid Total	# Invalid Orig Data	# Invalid <4 Beam	# Invalid Error Vel	# Invalid Vert Vel	# Invalid Other	Discharge Prev. (R3/s)	Discharge Now (R3/s)	Discharge % Change
20160922153000r.mat	378	11	11	11	11	0	0	0	1442.55	1442.55	0.00
20160922153635r.mat	381	16	16	16	16	0	0	0	1535.51	1535.51	0.00

Comment Button

- Comment button –for adding comment 
 - Located in the top right of all QRev windows. Clicking opens comment windows. User comments are tagged with name of dialog where comments were entered and time tagged.
 - All comments can be viewed by pressing the “View Comments” button on the main window
- [View Comments](#)
- Comments cannot be edited



Measurement Details – Main Window

- Table of measurement results and configuration settings
- Navigate
 - Scroll bars
 - Click in table and use keyboard arrows
 - Column width changed by click and drag of column divider
- Use check box determines if transect used in total Q and only thing that can be edited in table
- Cells related to identified issues may have a background color of yellow or red

Measurement Details (Units: English)

PARAMETERS	MEASUREMENT	60115143543r	60115143828r	60115144115r	60115144408r
DISCHARGE					
Use		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Total Q (ft3/s)	172.484	170.713	175.393	173.824	170.005
Top Q (ft3/s)	75.777	75.194	77.073	76.549	74.293
Middle Q (ft3/s)	76.817	76.085	77.363	77.336	76.485
Bottom Q (ft3/s)	16.155	16.155	16.732	16.259	15.475
Left Q (ft3/s)	1.655	1.624	1.854	1.806	1.335
Right Q (ft3/s)	2.079	1.655	2.371	1.874	2.417
TIME					
Duration (sec)	619.0	148.0	150.0	157.0	164.0
Start Time (01/15/2016)	14:35:43	14:35:43 R	14:38:28 L	14:41:15 R	14:44:08 L
End Time (01/15/2016)	14:46:52	14:38:11	14:40:58	14:43:52	14:46:52
REFERENCE					
Navigation Ref		BT	BT	BT	BT
Composite Tracks		Off	Off	Off	Off
Depth Ref		BT	BT	BT	BT
MOVING-BED					
Moving-bed	No				
Correction	No				
CHARACTERISTICS					

QRev - Measurement Quality Assessment

- Random – uses the Q COV and # transects
- Invalid – 20% of the sum % discharge for invalid cells and ensembles
- Edge - 30% of total discharge in edges
- Extrapolation – % difference in Q from selected extrap to other extrap methods and average of best 4 options
- Moving-Bed –
 - Bottom track not reference = 0%
 - bottom track used
 - valid moving bed test with no moving bed = 1%.
 - moving bed present and correction applied = 1.5%.
 - moving bed test warnings, invalid, or not done = 3%
- Systematic – 1.5% (for biases in ADCPs and beam misalignment)
- User column for adjusting Automatic computed uncertainties

Measurement Quality Assessment

	COV %		% Q
Q:	1.48	Left/Right Edge:	0.96 / 1.21
Width:	0.93	Invalid Cells:	0.11
Area:	0.75	Invalid Ens:	0.24
Parameter		Automatic	User
Random Uncertainty		2.4	
Invalid Data Uncertainty		0.1	
Edge Q Uncertainty		0.6	
Extrapolation Uncertainty		1.3	
Moving-Bed Test Uncertainty		1.0	
Systematic Uncertainty		1.5	
Estimated 95% Uncertainty		4.2	4.2

User Rating

Not Rated

Not Rated

Excellent (< 2%)

Good (2 - 5%)

Fair (5 - 8%)

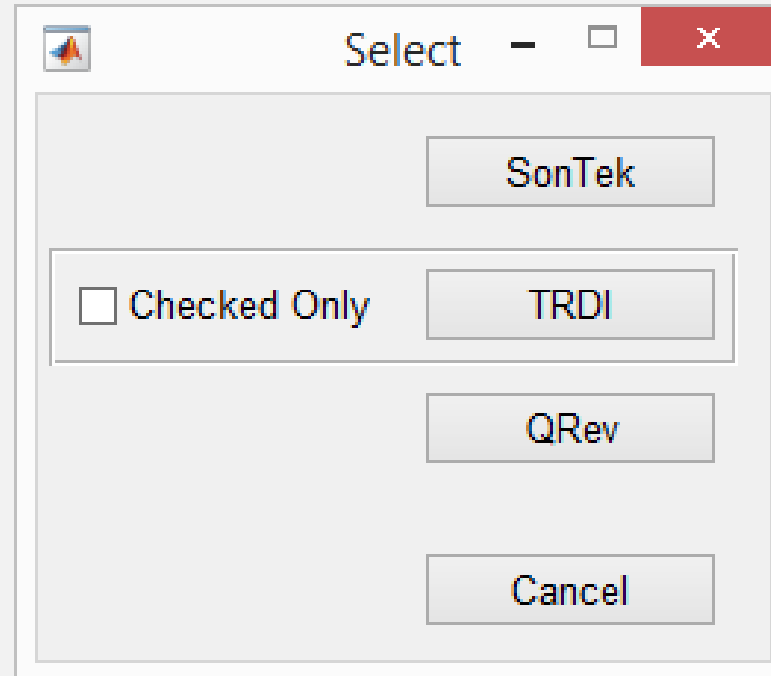
Poor (> 8%)

Selected

Selecting Data to Process

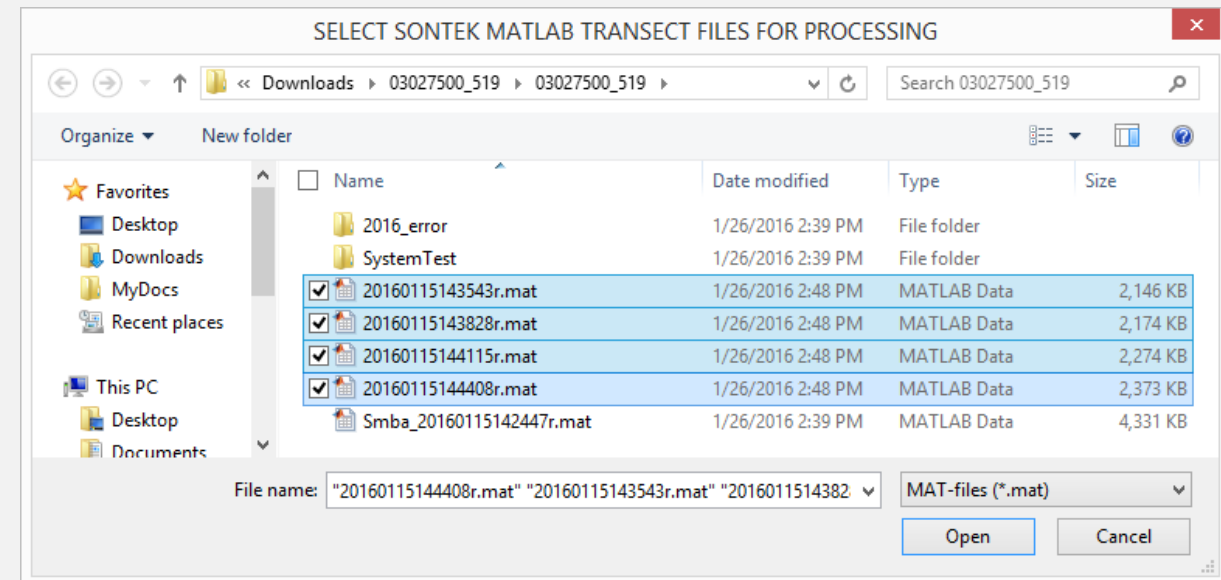
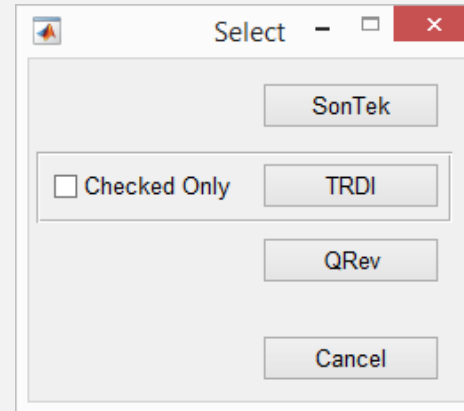
- Used to load data into Qrev
- Opens dialog box to select data
 - SonTek RS Live Matlab output
 - WinRiver II .mmt and pd0 files
 - Previously saved Qrev .mat

Select Data



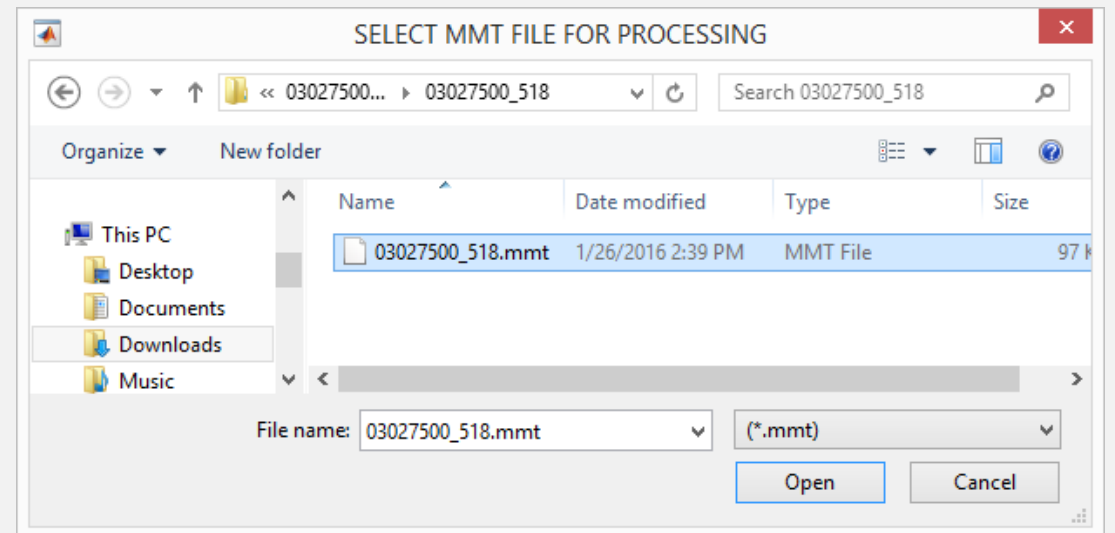
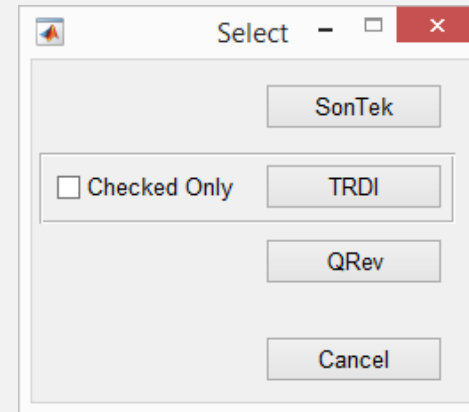
Loading RSLive Measurement Data

- Must first export all transects and moving bed test to matlab using RSLive
- Select all transects to be used
- QRev will automatically load associated moving bed tests, system tests, and compass evaluations provide they follow standard RSLive naming and file storage conventions
 - Moving bed test must be with “Smba_” or “Loop_”
 - System tests and compass calibrations must be in subfolders named “System Test” and “CompassCal”



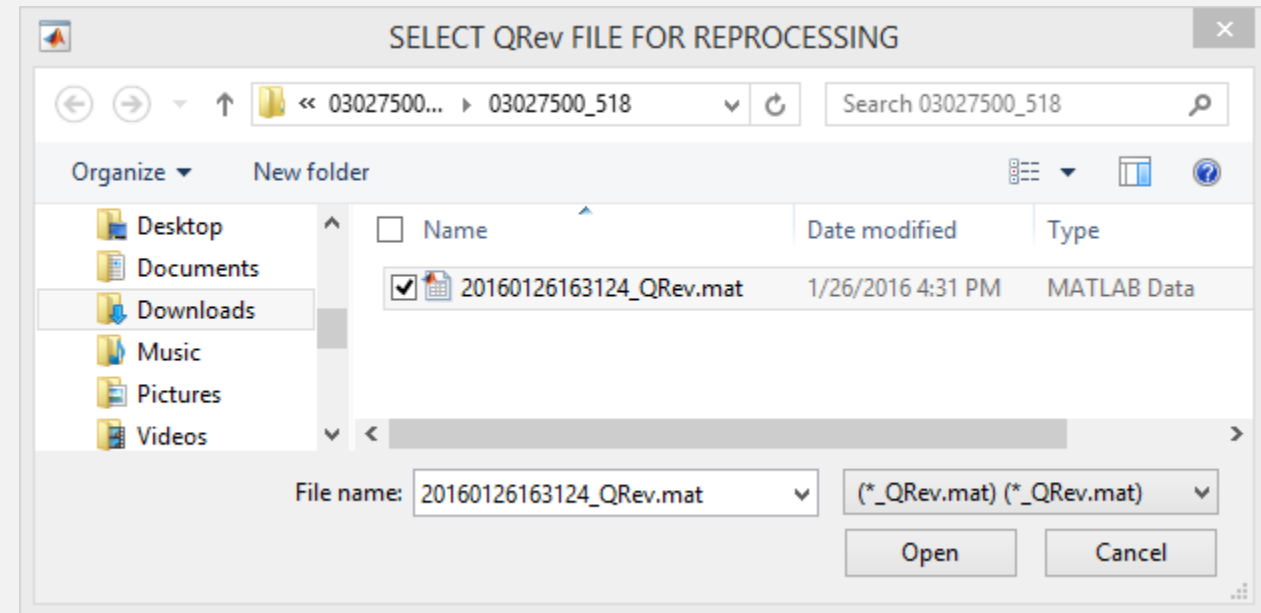
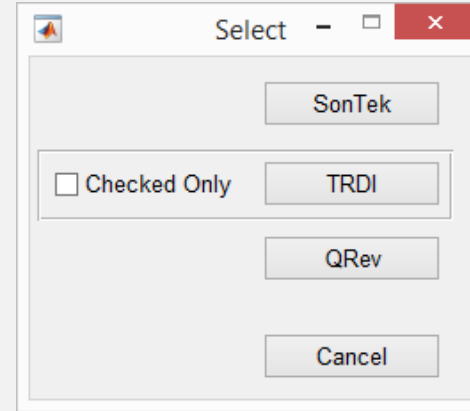
Loading WinRiver II Measurement Data

- Press TRDI button
- Select .mmt file in open dialog box and all transects and supporting data will be loaded
- If you only want to load transects that have been checked in WinRiver II, click the “checked only” box prior to pressing the TRDI button



Loading a Measurement Previously Processed in QRev

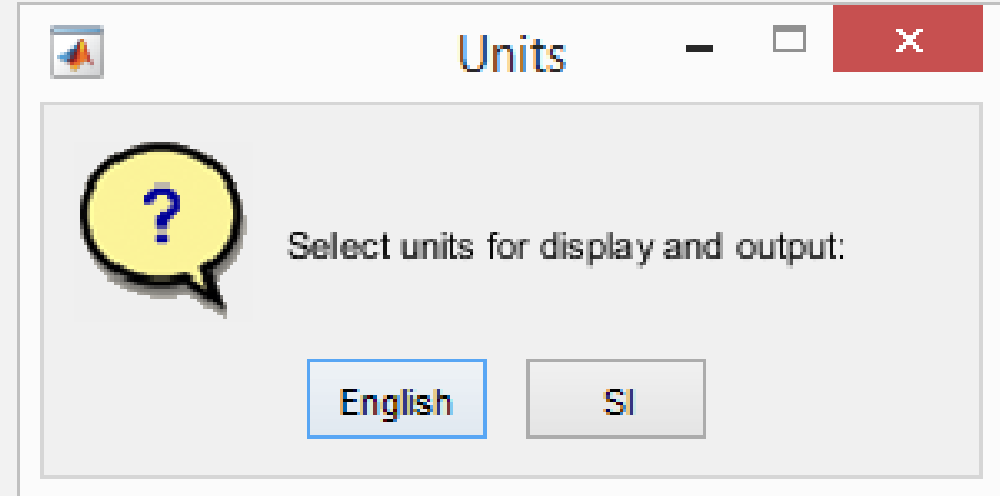
- Press the QRev button
- Select previously saved QRev file
 - Will have extension of _QRev.mat
- Note: After a measurement is processed in QRev, the QRev file should be saved and any reprocessing or reviewing of the measurement should be done by loading the QRev file NOT the original data files



Display Units


Display Units


- Sets the units used for values displayed in Qrev
 - English (default)
 - SI
- Option chosen will continue to be used when QRev is restarted



ADCP / Site Info


ADCP / Site Info

Station Name: 

Station Number: 

ADCP

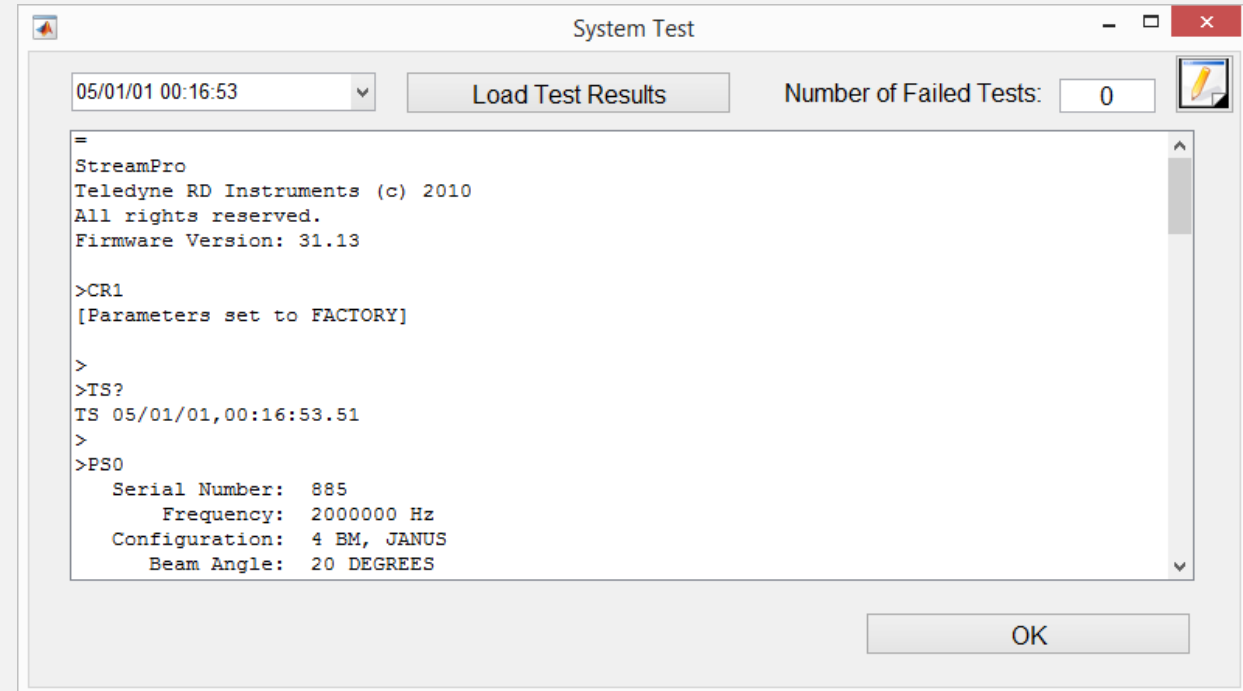
Serial Number:	3143
Manufacturer:	TRDI
Model:	Rio Grande
Firmware:	10.1600
Frequency:	600 kHz
Water Mode:	12
Bottom Mode:	5
Depth Cell Size:	50 cm



System Test

System Test

- User can review system tests collected with measurement
- Automatically loads tests from .mmt and RSLive tests found in “System Test” folder
- Test done outside normal procedures and not stored in default location or file can be loaded using the “Load Test Results Button”








Compass / P/R (Heading, Pitch, and Roll)

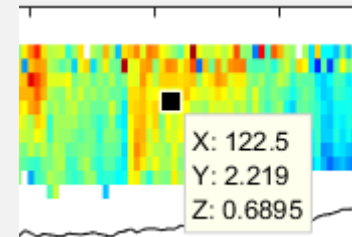
Compass / P / R

- For evaluation of the heading, pitch, and roll and adjustments to the magnetic variation and heading offset



Common Features in QRev Windows

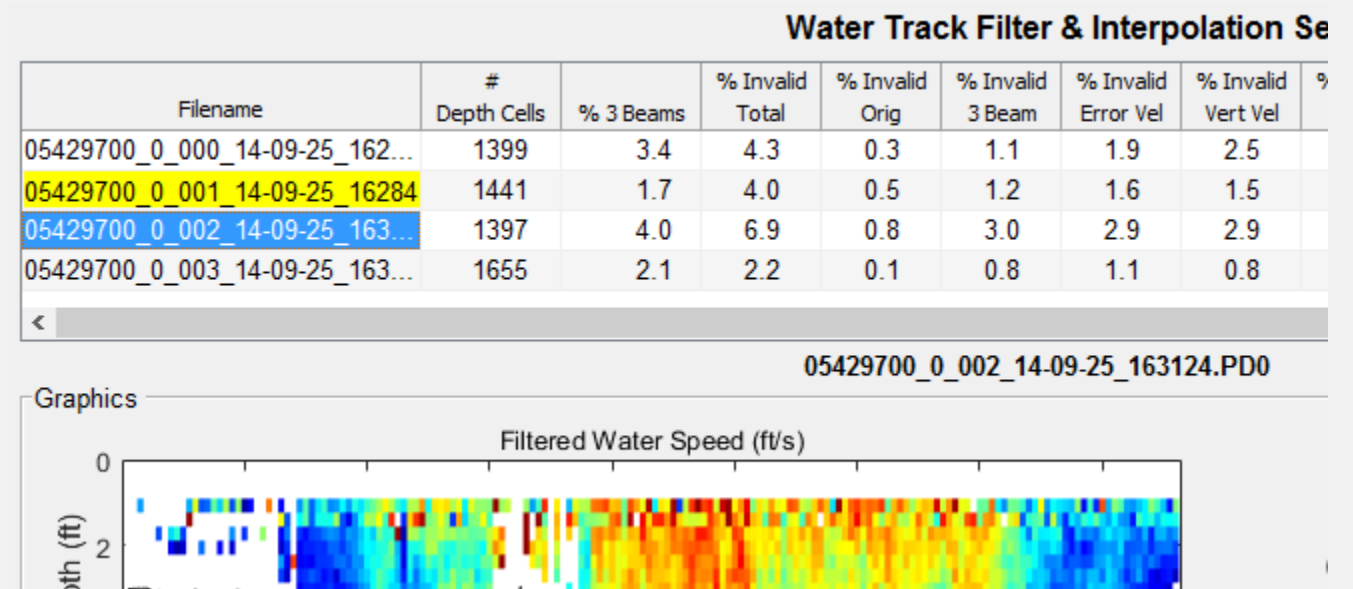
- Tool Bar 
 - Each window with graphs has a toolbar at the upper left
- Zoom In: 
- Zoom Out: 
- Pan: 
- Probe Data:  Clicking on a data point displays data values



Common Features in QRev Windows

- Tables

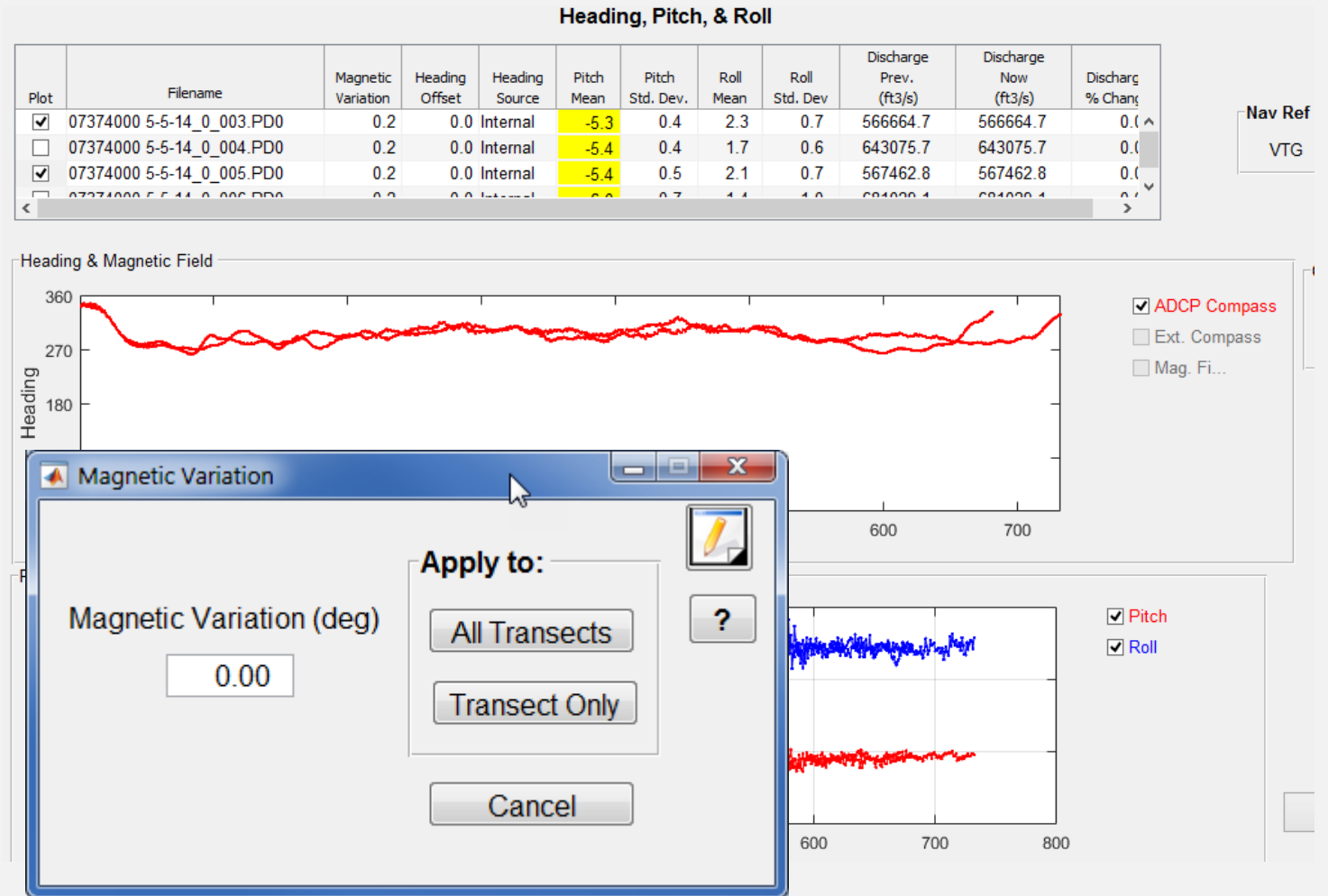
- Many windows have a table displaying transects as a row with columns of associated info
- Scrollbars located at the right and bottom can be used to move through the table
- After clicking in a table, keyboard can be used to navigate
- Graphs typically only display data from a single transect. The transect being displayed can be changed by changing the row selected in the table (up/down arrow keys)



Compass / P/R (Heading, Pitch, and Roll)

Compass / P / R

- Can plot multiple transects in graphs using the “Plot” checkbox in table
- Can adjust
 - Magnetic Variation
 - Heading Offset (only applicable if using external heading, such as GPS heading)
 - Heading source

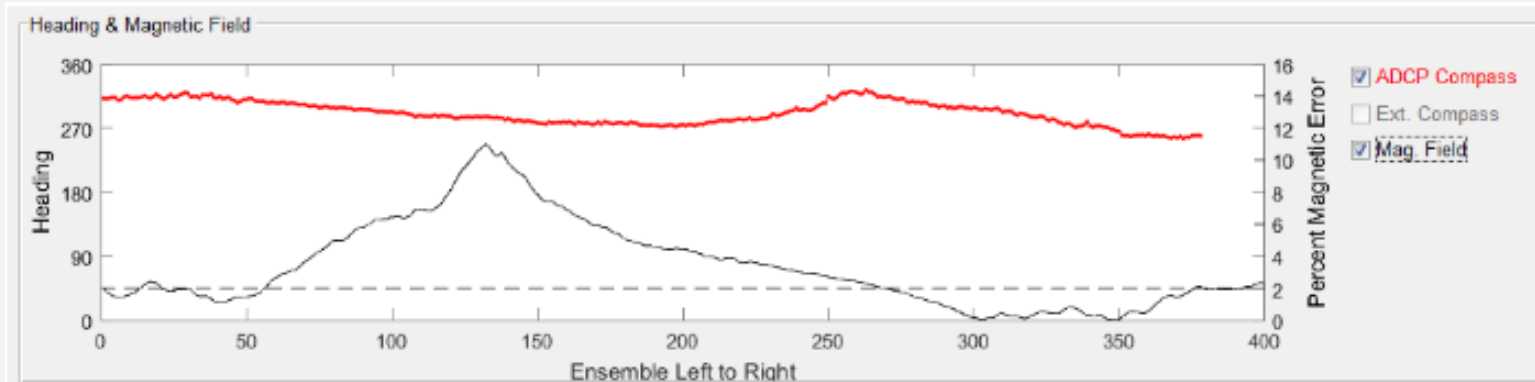
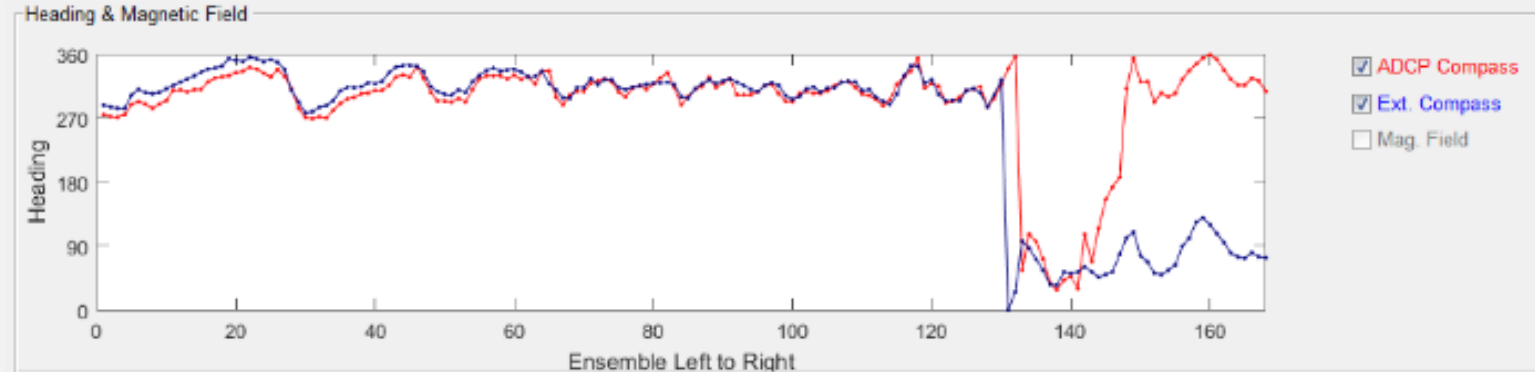


Compass / P/R (Heading, Pitch, and Roll)

Compass / P / R

Compass Time Series

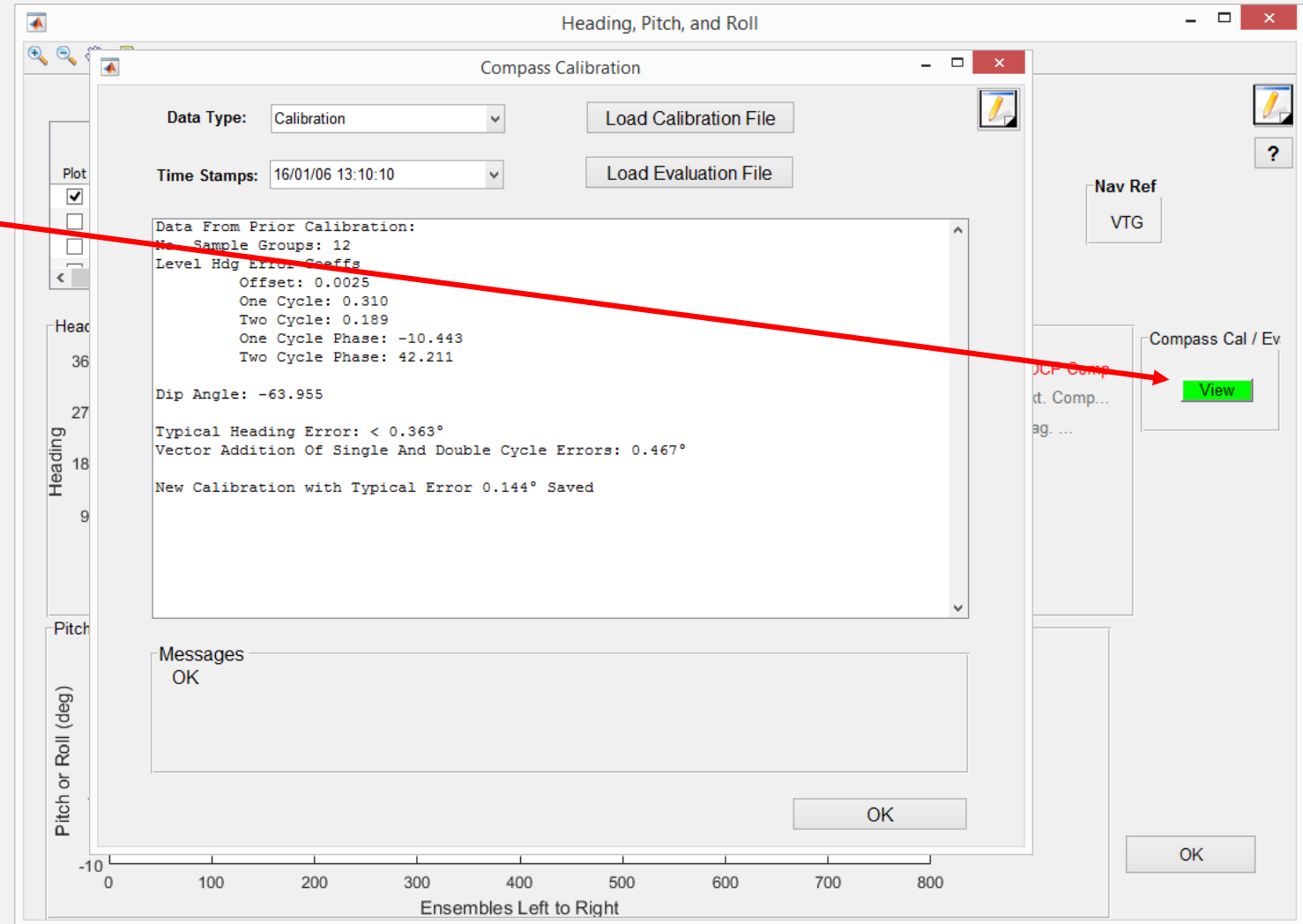
- ADCP internal compass heading
- Any External Compass heading
- Magnetic field change (for SonTek RiverSurveyor M9/S5)



Compass / P/R (Heading, Pitch, and Roll)

Compass / P / R

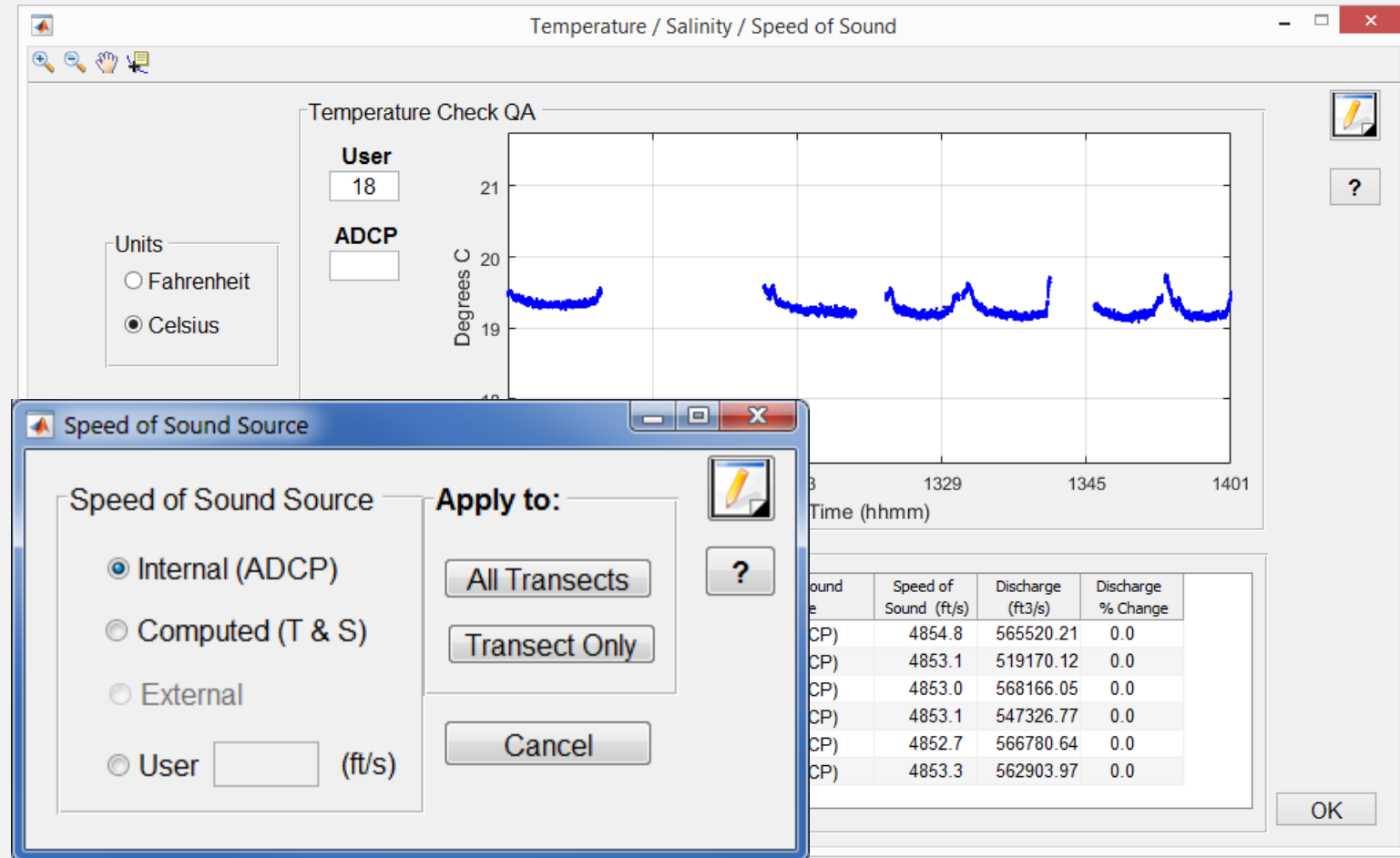
- To review compass calibration and evaluations press View button
- Automatically loads calibration and evaluations from .mmt and RSLive calibrations found in "CompassCal" folder
- Calibration done outside normal procedures and not stored in default location or file can be loaded using the "Load Test Results Button"



Temperature / Salinity / Speed of Sound

Temp / Salinity

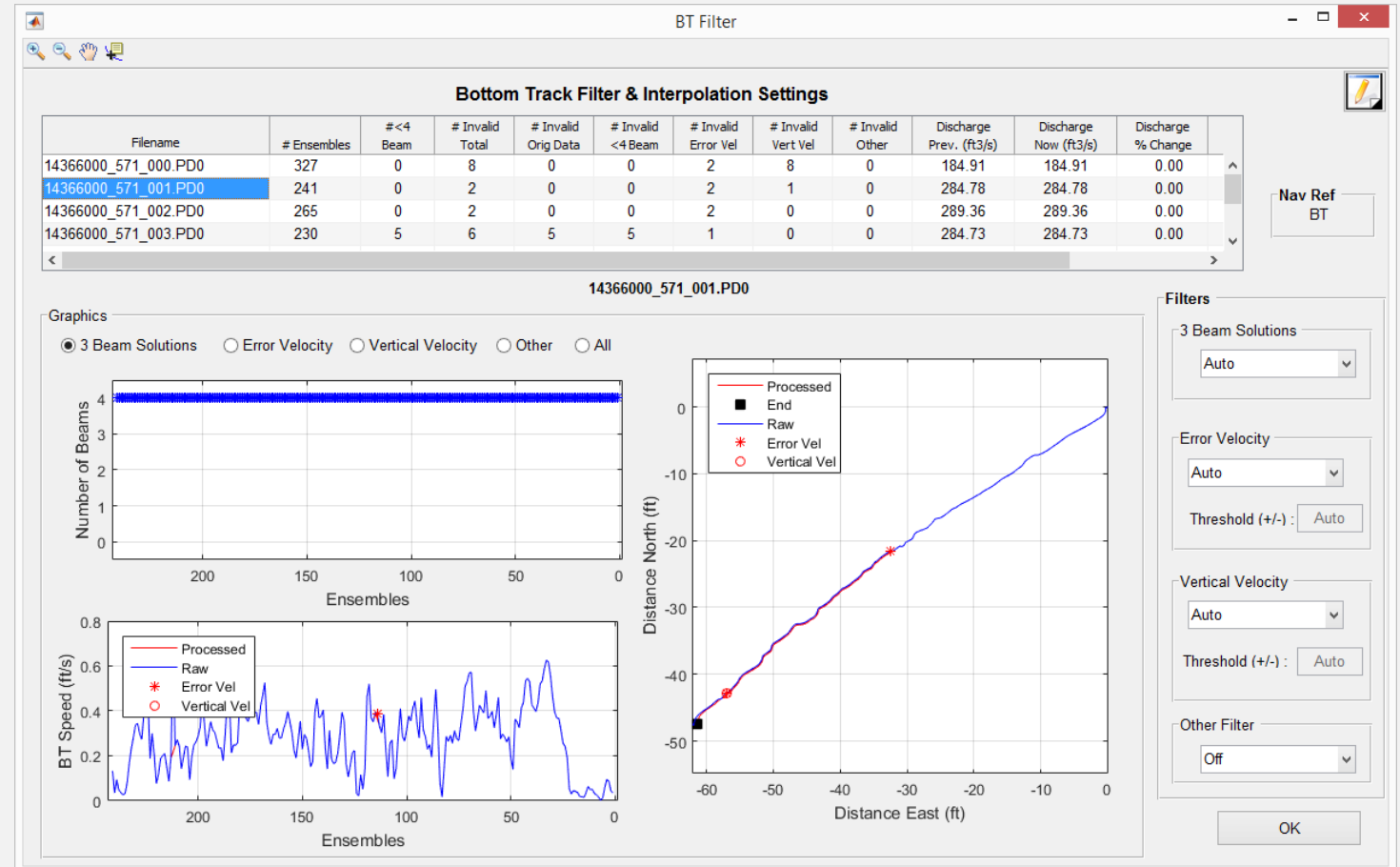
- Graph of water temperature during measurement
- Can change units
- Enter external temperature check – auto loads “Water Temp” from .mmt file in “User”
- Table for speed of sound settings



BT Filters

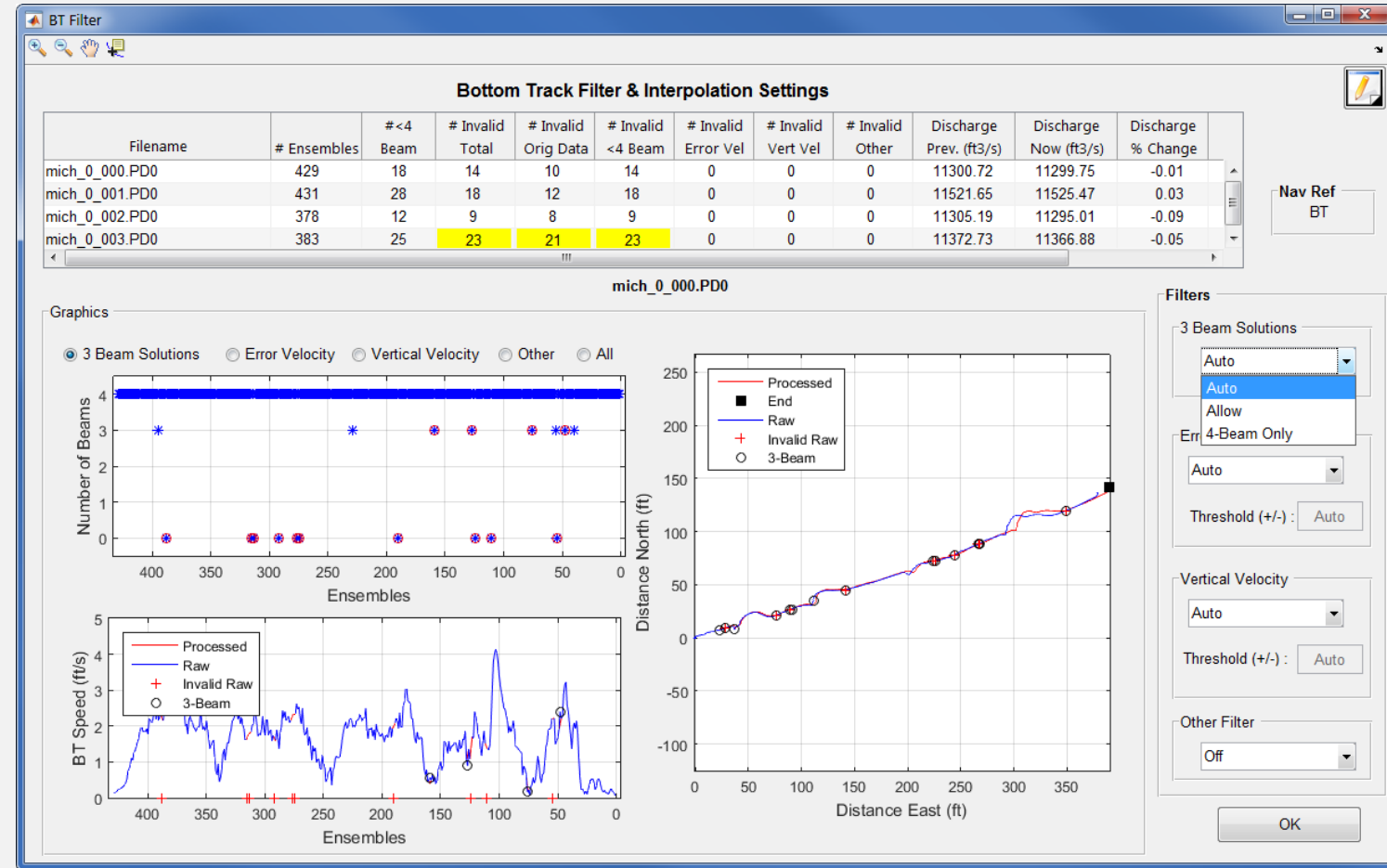
BT Filters

- Evaluate bottom track data and change filter settings
- Graphs show transect selected in to table
- Radio buttons can select the types of graphs displayed



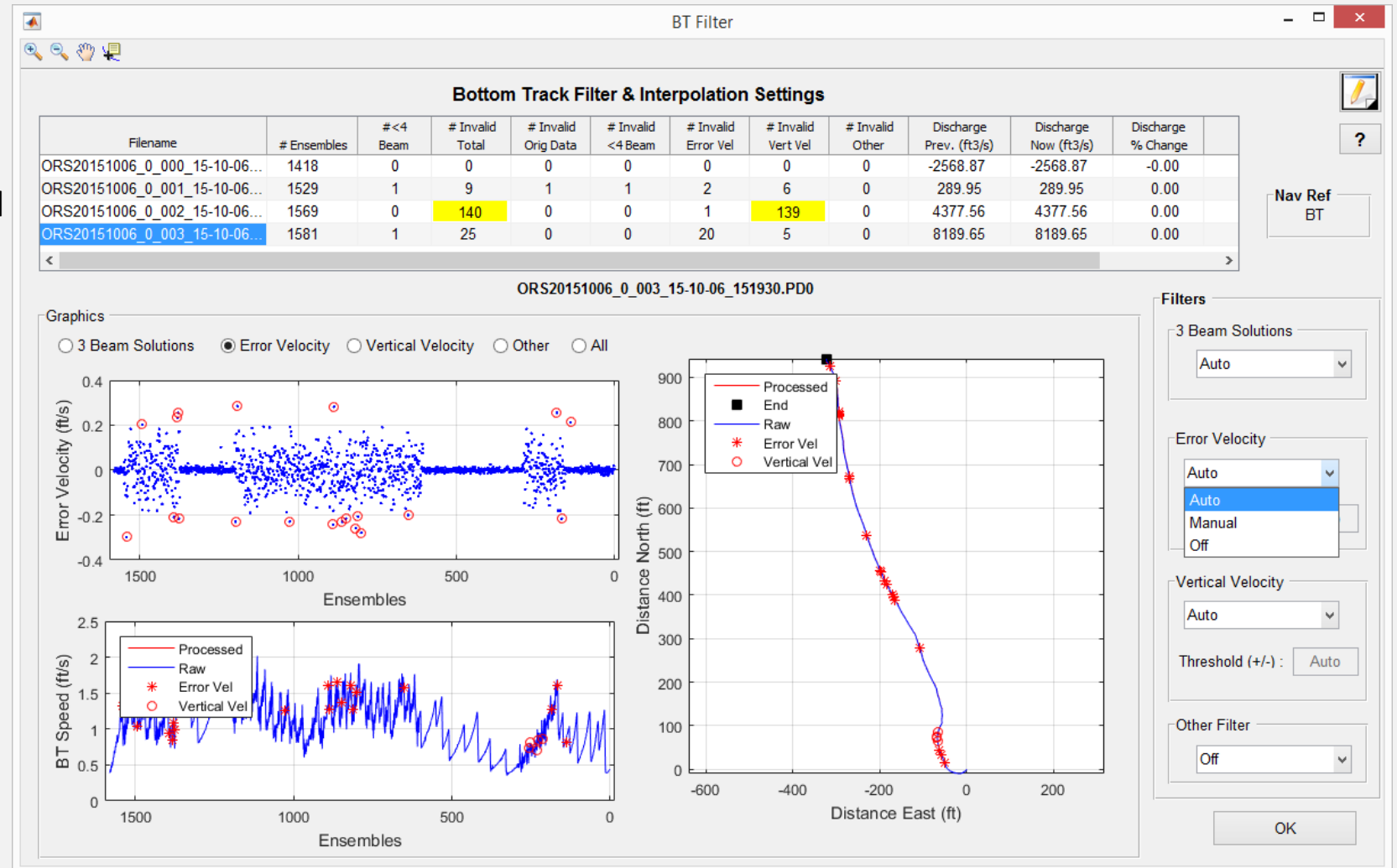
BT Filters – 3-Beam Solutions

- Auto
 - Default
 - Evaluates 3-beam solutions using neighboring data if within 50% uses as valid
- Allow - will use 3-beam solutions
- 4-Beam Only – requires all 4 beams to have valid velocity



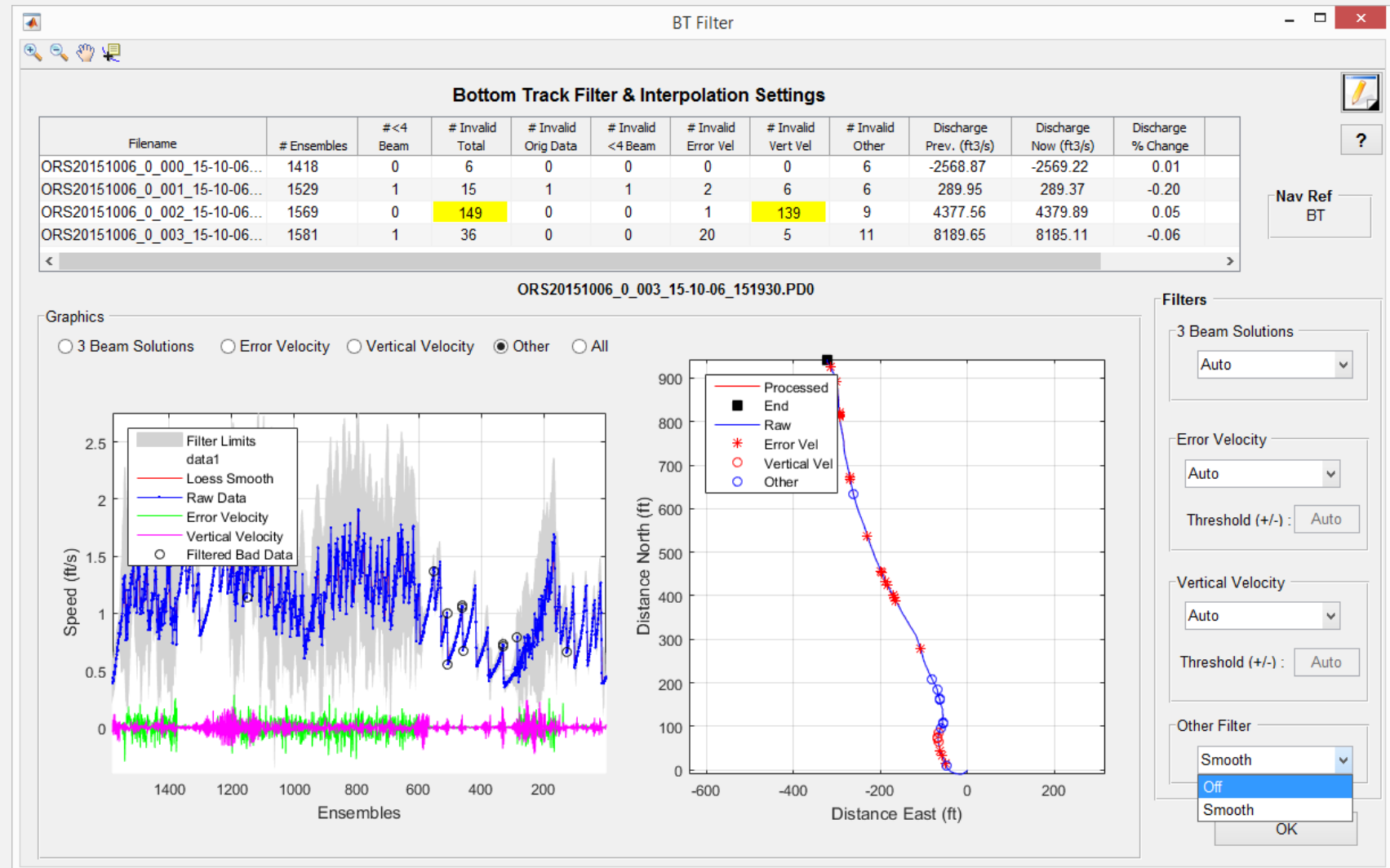
BT Filters - Error Velocity and Vertical Velocity

- Auto
 - Default
 - Use variance of error velocity data to automatically set threshold limits for each transect
- Manual
 - Users enters value that is applied to all transects
- Off
 - No error velocity filter applied



BT Filters – Other Filters

- Smooth
 - LOWESS smooth filter with dynamic moving window applied to detect and remove spikes
- Off
 - Default
 - No spike detection filter applied



GPS Filters

GPS Filters

- Evaluate VTG and GGA GPS data
- Graphs show transect selected in to table
- Filters are Auto by default be can be manually adjusted
 - Min Diff Quality (GGA)
 - Altitude Change
 - HDOP
 - Smooth

The screenshot shows the 'GPS Filter' application window. At the top, the title bar reads 'GPS Filter'. Below it is a section titled 'GPS Filter & Interpolation Settings' containing a table with the following data:

Filename	Ensembles	Invalid GGA	Invalid VTG	Unfiltered Diff Quality	Unfiltered Delta Alt.	Unfiltered Max HDOP	Unfiltered Delta HDOP	Unfiltered # Sat Chg	Discharge Prev. (ft3/s)	Discharge Now (ft3/s)	Discharge % Change
MissR_Vburg_20160113_0_...	785	1	0	2	1.67	0.8	0.0	0	1879157.12	1879157.12	0.00
MissR_Vburg_20160113_0_...	564	1	0	2	0.84	1.1	0.3	0	1942595.45	1942595.45	0.00
MissR_Vburg_20160113_0_...	717	1	0	2	1.29	1.1	0.2	0	1886910.11	1886910.11	0.00
MissR_Vburg_20160113_0_...	513	1	0	2	1.10	1.2	0.1	0	1908151.64	1908151.64	0.00

Below the table are three graphs:

- Differential Quality:** A line graph showing Differential Quality (y-axis, 1-3) vs Ensemble (x-axis, 600-0). A blue line is constant at 2.0. Legend: Dif Quality, Altitude, HDOP, # Sats.
- Boat Speed:** A line graph showing Boat Speed (ft/s) (y-axis, 0-15) vs Ensemble (x-axis, 600-0). Multiple lines in red, green, and blue show speed fluctuations. Legend: GGA, VTG, BT.
- ShipTrack:** A scatter plot showing North Distance (ft) (y-axis, -2000 to 500) vs East Distance (ft) (x-axis, 0-2500). It shows a dense cluster of black points with a red line (BT) and a blue line (GGA) overlaid. Legend: GGA, VTG, BT, Vectors, Water Vector, Invalid Raw.

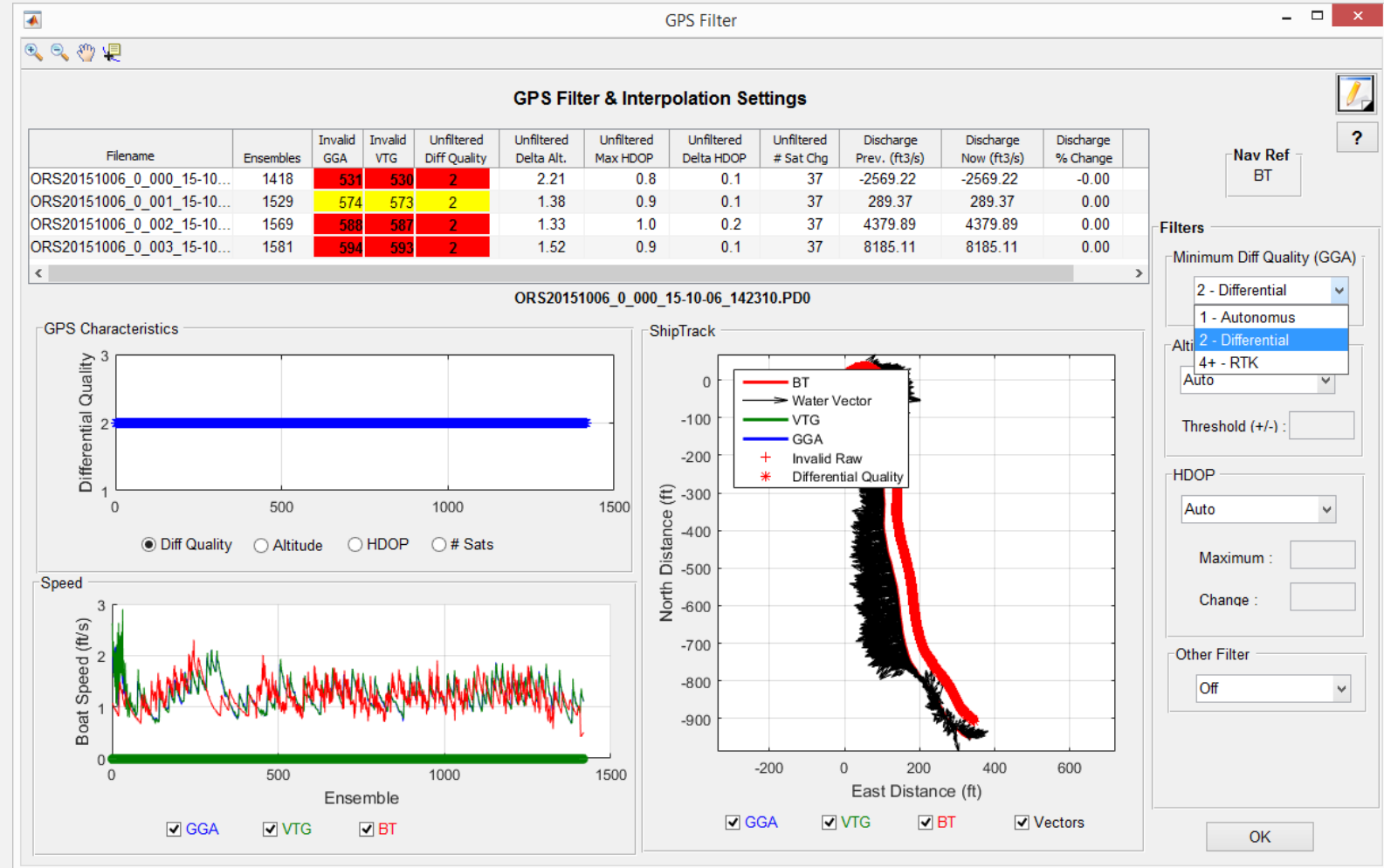
On the right side, there are filter settings:

- Nav Ref: GGA
- Filters: Minimum Diff Quality (GGA) set to '2 - Differential'.
- Altitude Change (GGA): Auto
- HDOP: Auto
- Other Filter: Off

Buttons for 'OK' and 'Cancel' are at the bottom right.

GPS - Minimum Diff Quality (GGA)

- Minimum quality of GPS GGA data required
 - 1 – Autonomous
 - 2 – Differential
 - Default
 - 4+ - RTK
- Does not affect VTG



GPS Filters – Altitude Change (GGA)

- Auto
 - Default
 - Set to 3 meters (9.84 ft)
- Manual
 - User specified
- Off
 - No Altitude Filter

GPS Filter

GPS Filter & Interpolation Settings

Filename	Ensembles	Invalid GGA	Invalid VTG	Unfiltered Diff Quality	Unfiltered Delta Alt.	Unfiltered Max HDOP	Unfiltered Delta HDOP	Unfiltered # Sat Chg	Discharge Prev. (ft3/s)	Discharge Now (ft3/s)	Discharge % Change
ORS20151006_0_000_15-10...	1418	531	530	2	2.21	0.8	0.1	37	-2569.22	-2569.22	-0.00
ORS20151006_0_001_15-10...	1529	574	573	2	1.38	0.9	0.1	37	289.37	289.37	0.00
ORS20151006_0_002_15-10...	1569	588	587	2	1.33	1.0	0.2	37	4379.89	4379.89	0.00
ORS20151006_0_003_15-10...	1581	594	593	2	1.52	0.9	0.1	37	8185.11	8185.11	0.00

ORS20151006_0_000_15-10-06_142310.PD0

GPS Characteristics

Altitude (ft)

0 500 1000 1500

Diff Quality Altitude HDOP # Sats

ShipTrack

North Distance (ft)

0 -100 -200 -300 -400 -500 -600 -700 -800 -900

-200 0 200 400 600

East Distance (ft)

BT
 Water Vector
 VTG
 GGA
 Invalid Raw
 Differential Quality

GGA VTG BT Vectors

Filters

Minimum Diff Quality (GGA)
2 - Differential

Altitude Change (GGA)
Auto

HDOP
Auto

Maximum :

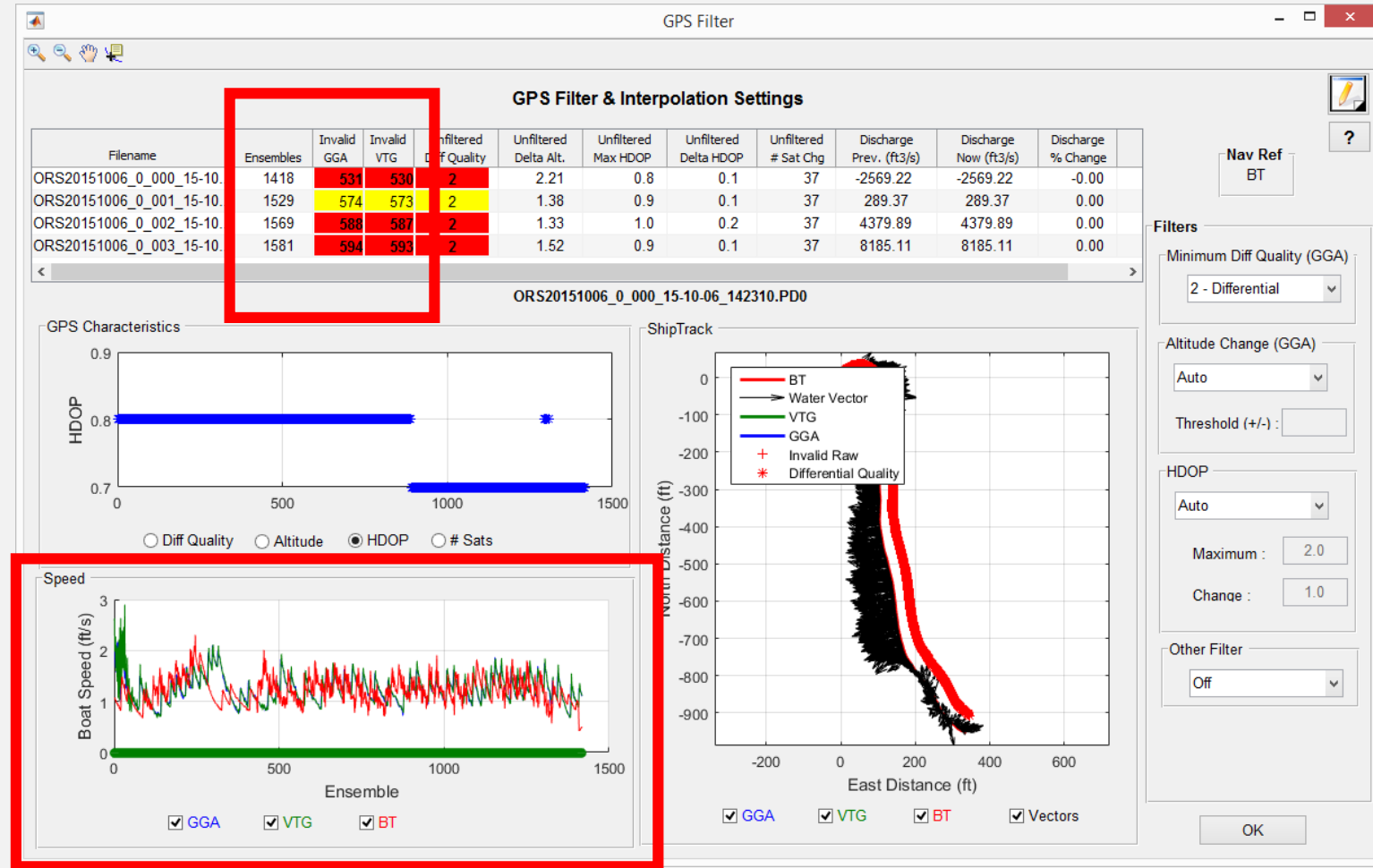
Change :

Other Filter
Off

OK

GPS Filters - HDOP

- Auto
 - Default
 - Sets maximum HDOP to 4 and maximum change to 3
- Manual
 - User selected
 - Maximum HDOP
 - Change in HDOP
- Off
 - No HDOP Filter



HDOP – Horizontal Dilution of Precision: Measure of possible error (GPS accuracy) due to the geometry of the satellites visible to the GPS receiver (lower is better, < 2 preferred)

Select Reference

Select Reference

- Select reference for navigation
 - BT
 - GGA
 - VTG
- Turn Composite Tracks on or off
 - Substitutes other valid reference is selected reference is invalid
 - Default = Off
- Button is disabled if only BT data available (no GPS)

	Filename	# Ensembles	# Ref BT	# Ref GGA	# Ref VTG	# Ref INT	Discharge Prev. (ft3/s)	Discharge Now (ft3/s)	Discharge % Change
1	20160115143543r.mat	149	149	0	0	0	170.71	170.71	0.00
2	20160115143828r.mat	151	149	0	0	2	175.39	175.39	0.00
3	20160115144115r.mat	158	158	0	0	0	173.82	173.82	0.00
4	20160115144408r.mat	165	165	0	0	0	170.01	170.01	0.00

20160115144115r.mat

Reference Used (INT=Interpolated, INV=Invalid)

Navigation Source

Speed (ft/s)

ShipTrack

Selected Reference

Composite Tracks

OK

Depth Filters / Draft

Depth Filters / Draft

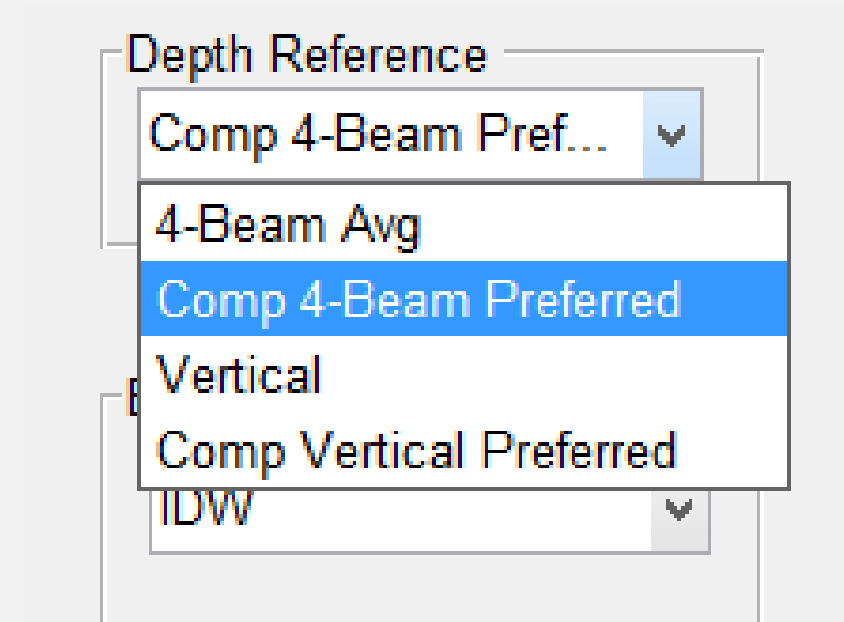
- View and update transducer draft
- Evaluate measured depths from each beam and final mean depth
- Can change primary depth reference when more than one available
- Adjust averaging and filter

The screenshot displays the 'Depth Filter' software interface. At the top, a table titled 'Depth Filter & Interpolation Settings' lists data for four files. The file '20150828100008r.mat' is highlighted in blue. Below the table is a plot titled 'Individual Beams' showing depth (ft) on the y-axis (0 to 10) and distance on the x-axis. The plot shows four colored lines representing different beams (Beam 1, 2, 3, 4) and a 'Final' line. A 'Draft' dialog box is open in the foreground, showing a draft value of 0.20 ft and options to apply settings to 'All Transects' or 'Transect Only'. The background interface also includes a 'Depth Reference' dropdown set to 'Comp 4-Beam Pref...', a 'BT Beam Averaging' dropdown set to 'IDW', and a 'Filter' dropdown set to 'Smooth'. An 'OK' button is visible at the bottom right of the main window.

Filename	Draft (ft)	# Ensembles	# Invalid Beam 1	# Invalid Beam 2	# Invalid Beam 3	# Invalid Beam 4	# Invalid Vert Beam	# Invalid External	Discharge Prev. (ft3/s)	Discharge Now (ft3/s)	Discharge % Change
20150828095239r.mat	0.20	431	0	0	0	2	1		1220.04	1220.04	0.00
20150828100008r.mat	0.20	396	3	1	1	2	0		1292.62	1292.62	0.00
20150828100701r.mat	0.20	330	0	1	0	0	0		1556.89	1556.89	0.00
20150828101251r.mat	0.20	360	1	0	0	0	0		1530.23	1530.23	0.00

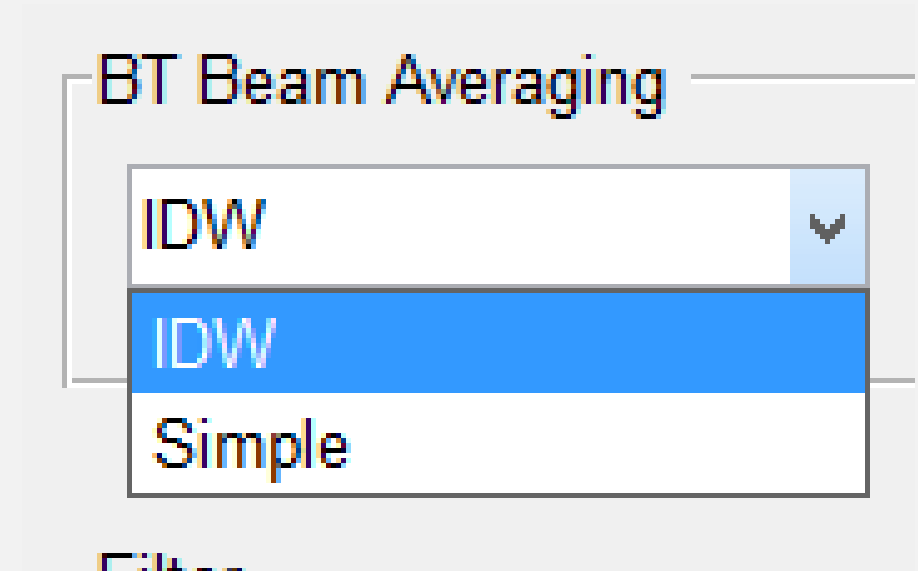
Depth Reference Options

- Comp 4-Beam Preferred
 - Default
 - Uses 4-beam average when available, if not uses depth sources
- 4-Beam Avg
 - Will only use the average of the 4-beam bottom track depths
- Vertical
 - Will only use vertical beam depths
- Comp Vertical Preferred
 - Uses vertical beam when available, if not uses other depth sources



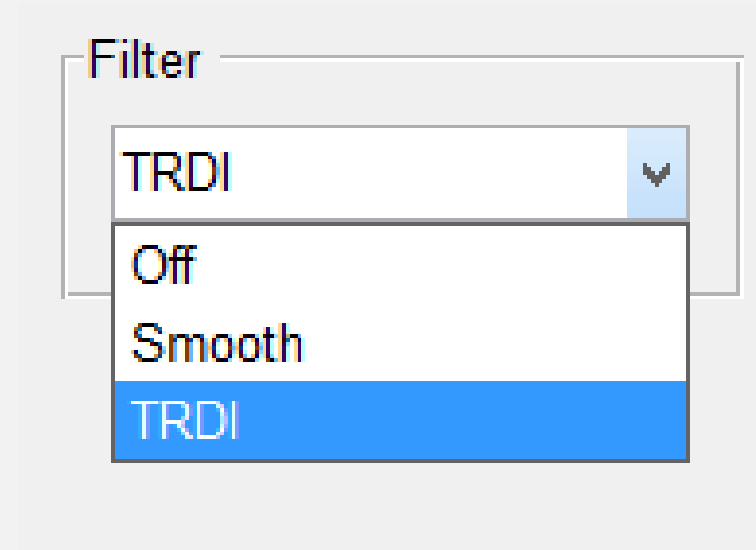
Bottom Track Depth Averaging Options

- IDW – Inverse Depth weighted Average - default
- Simple – Simple average of beam depths



Depth Options to Filter out spikes

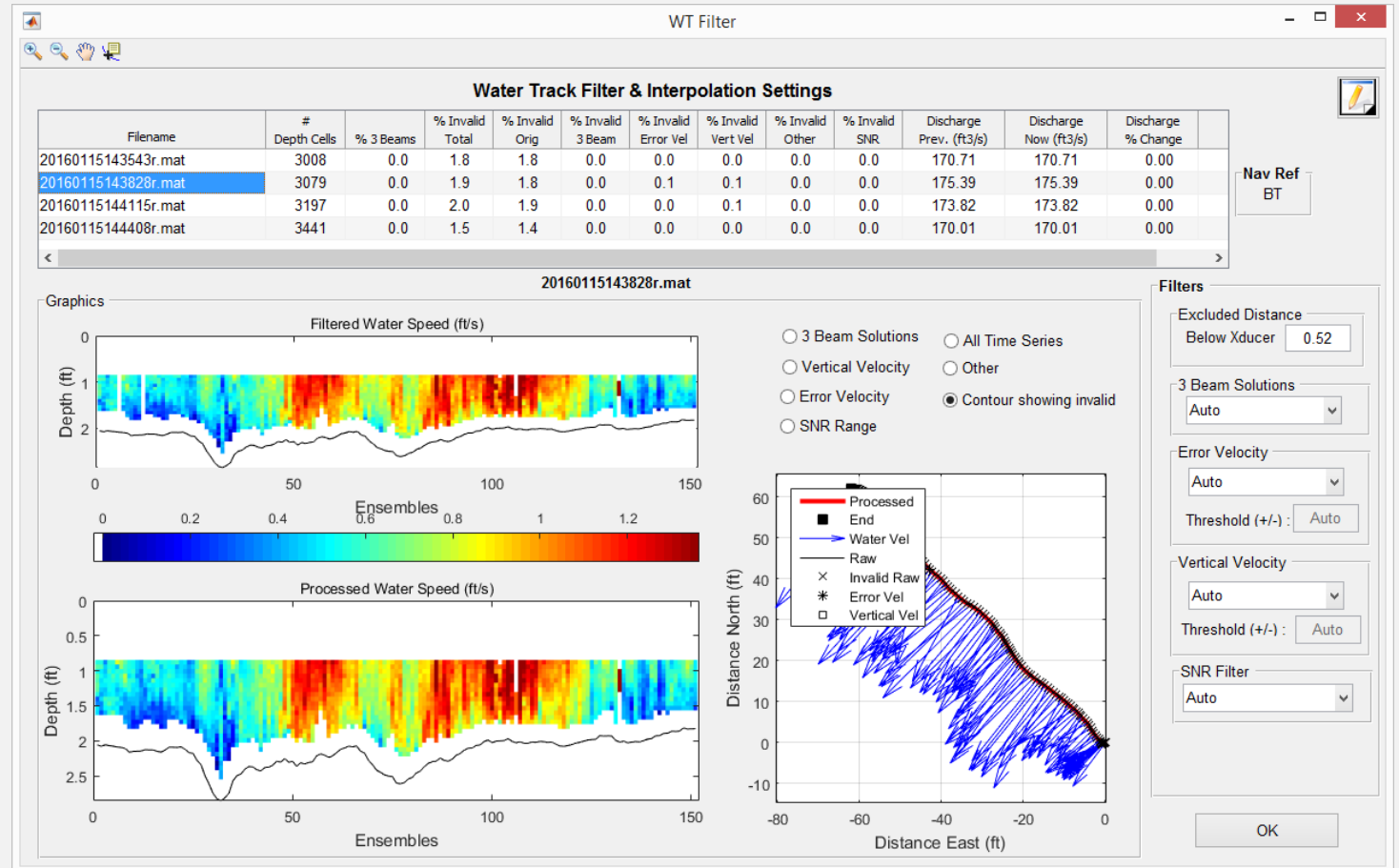
- Smooth: uses a LOWESS smooth filter
 - Default
 - Can have issues with large gaps
- TRDI – Filter out a beam depth in an ensemble if it is > 1.75 time other beam depth
- Off – No filtering of depth data



WT Filters

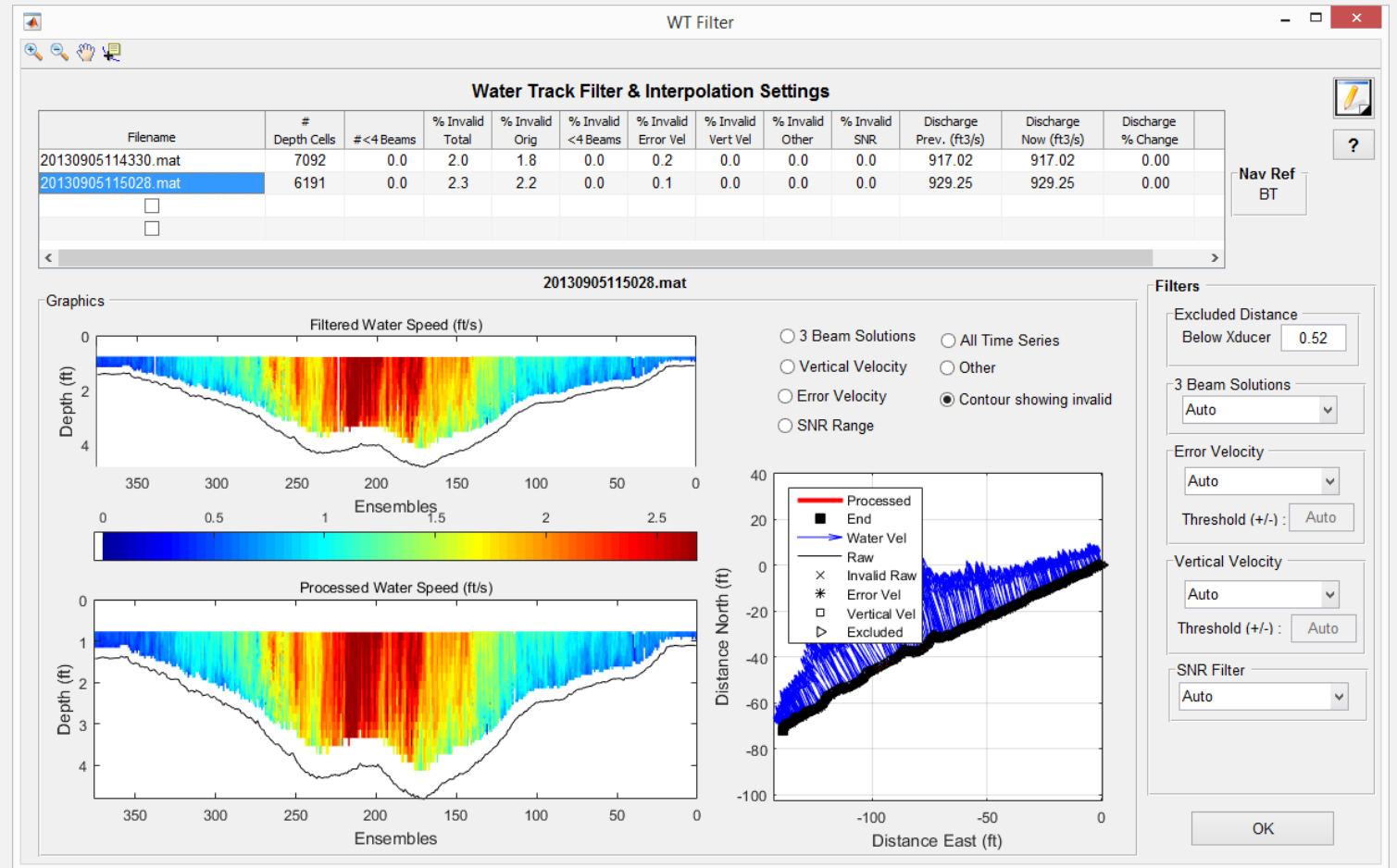
WT Filters

- Evaluate water velocities for each transect
- Graphs show transect selected in to table
- Radio buttons can select the types of graphs displayed
- Filters are Auto by default be can be manually adjusted



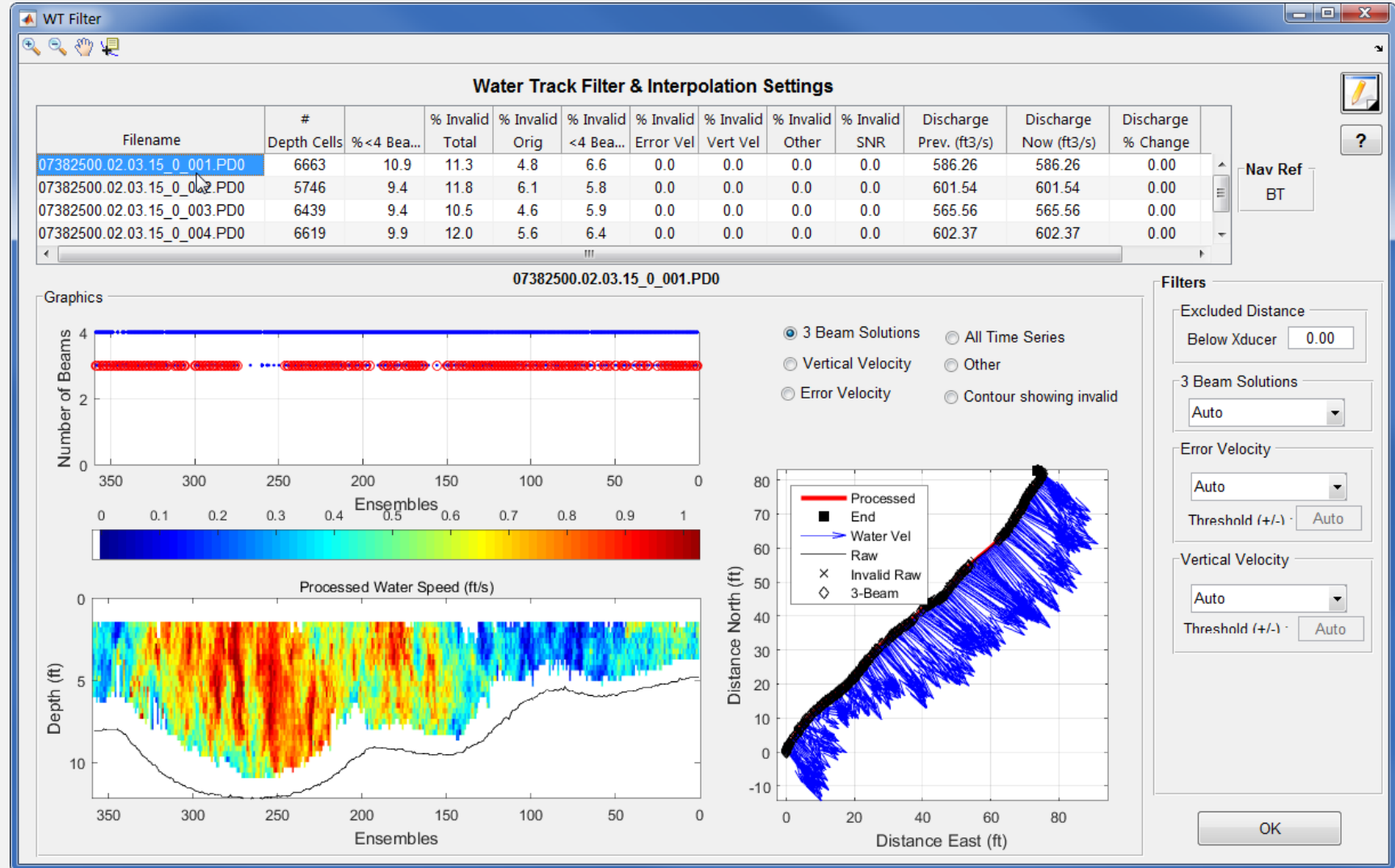
WT Filter – Excluded Distance

- Will exclude any data down to this distance below the ADCP
- For M9 defaults to .52 ft (to screen out water velocities possibly affected by flow disturbance)



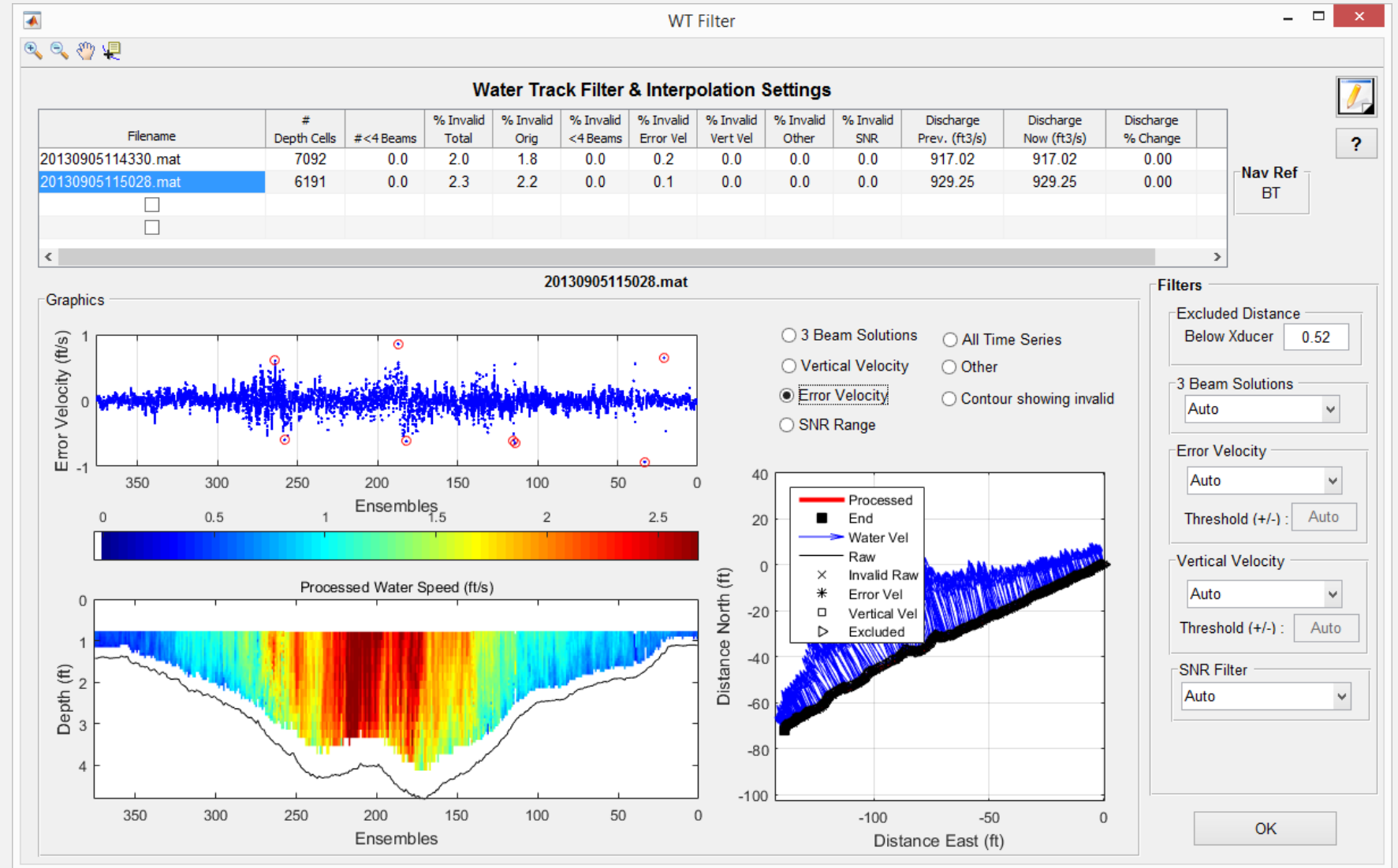
WT Filters – 3-Beam Solutions

- Auto
 - Default
 - Evaluates 3-beam solutions using neighboring data
- Allow - will use 3-beam solutions
- 4-Beam Only – requires all 4 beams to have valid velocity



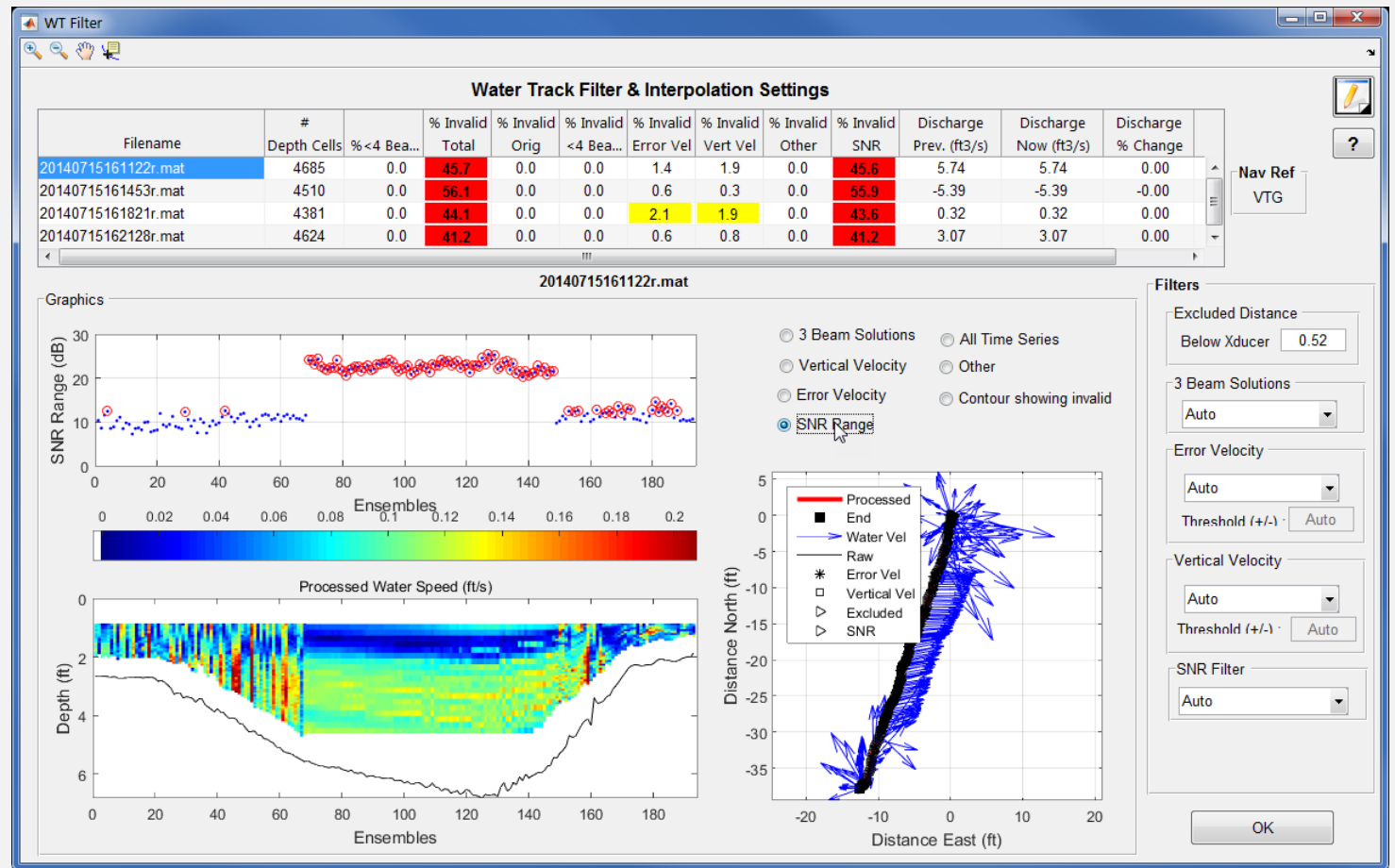
WT Filters – Error Velocity and Vertical Velocity

- Auto
 - Default
 - Use variance of error velocity data to automatically set threshold limits for each transect
- Manual
 - User enters value that is applied to all transects
- Off
 - No error velocity filter applied
- Reminder error velocity is the difference in vertical velocity between two beam pairs. For WT this is for each depth cell.



WT Filters – SNR Filter

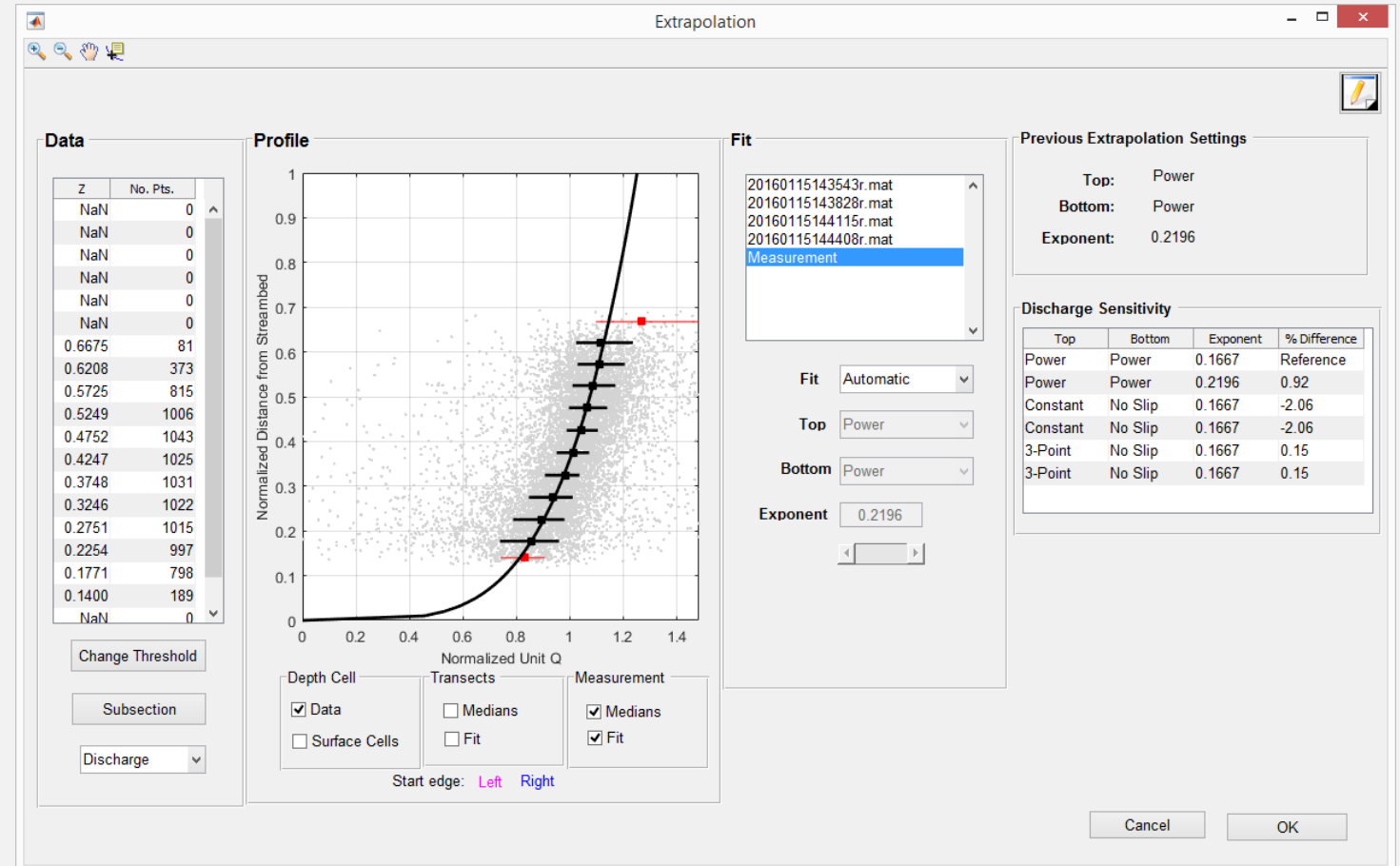
- Currently can only be applied to SonTek Data
- Looks for differences between beam SNR in an attempt to filter out data that might be affected by air/bubbles in front of transducers
- Defaults on Auto with no Manual setting (SonTek Only)



Extrapolation

Extrapolation

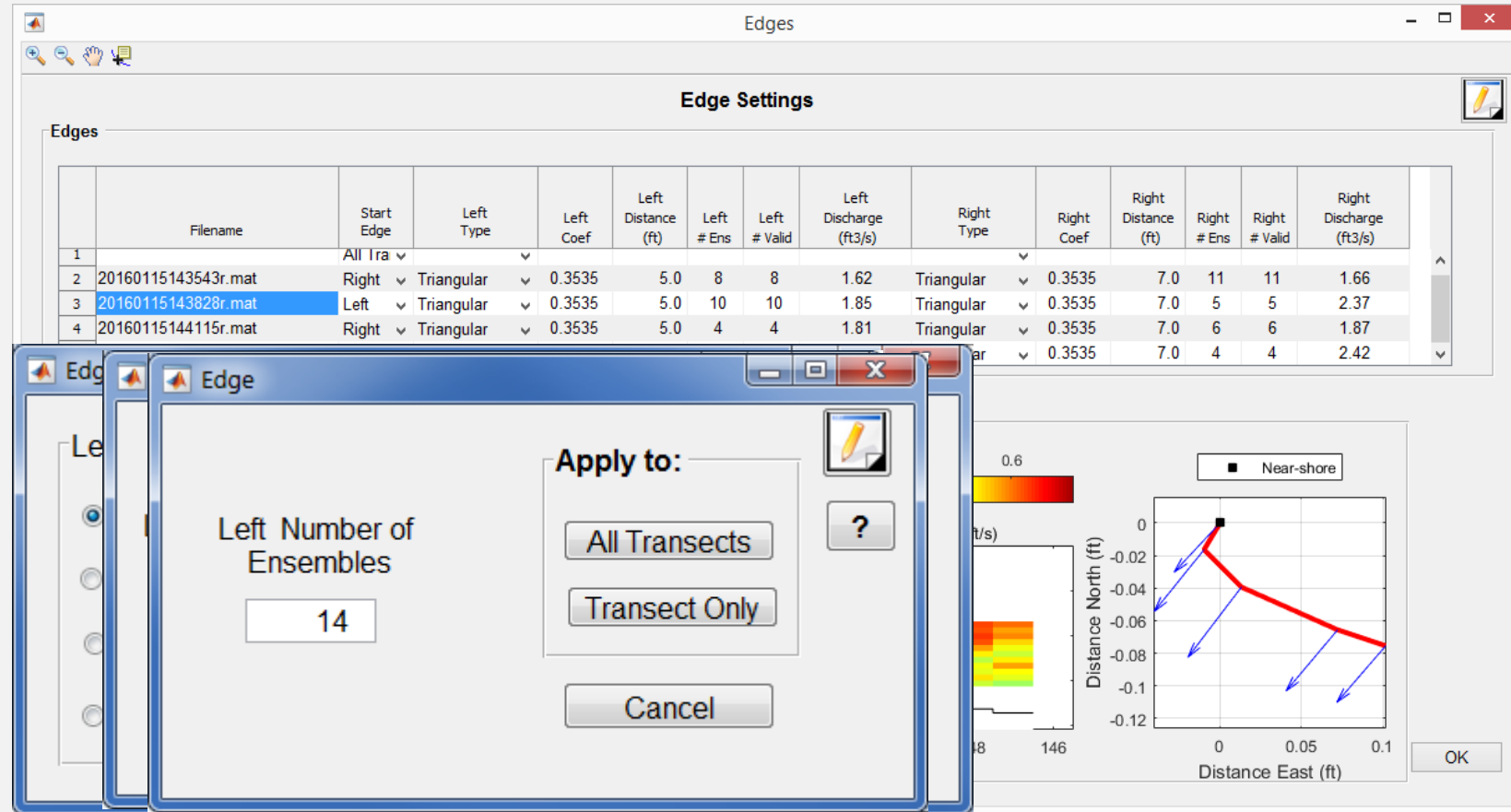
- Review and apply changes to top and bottom extrapolation methods
- Graphic display of fits to data
- Discharge sensitivity table displays % difference in discharge for various extrapolations
- “Cancel” button will revert to extrapolation set when Extrapolation window opened (listed in top right as previous extrapolation settings)
- “OK” button applies settings selected to all transects



Edges

Edges

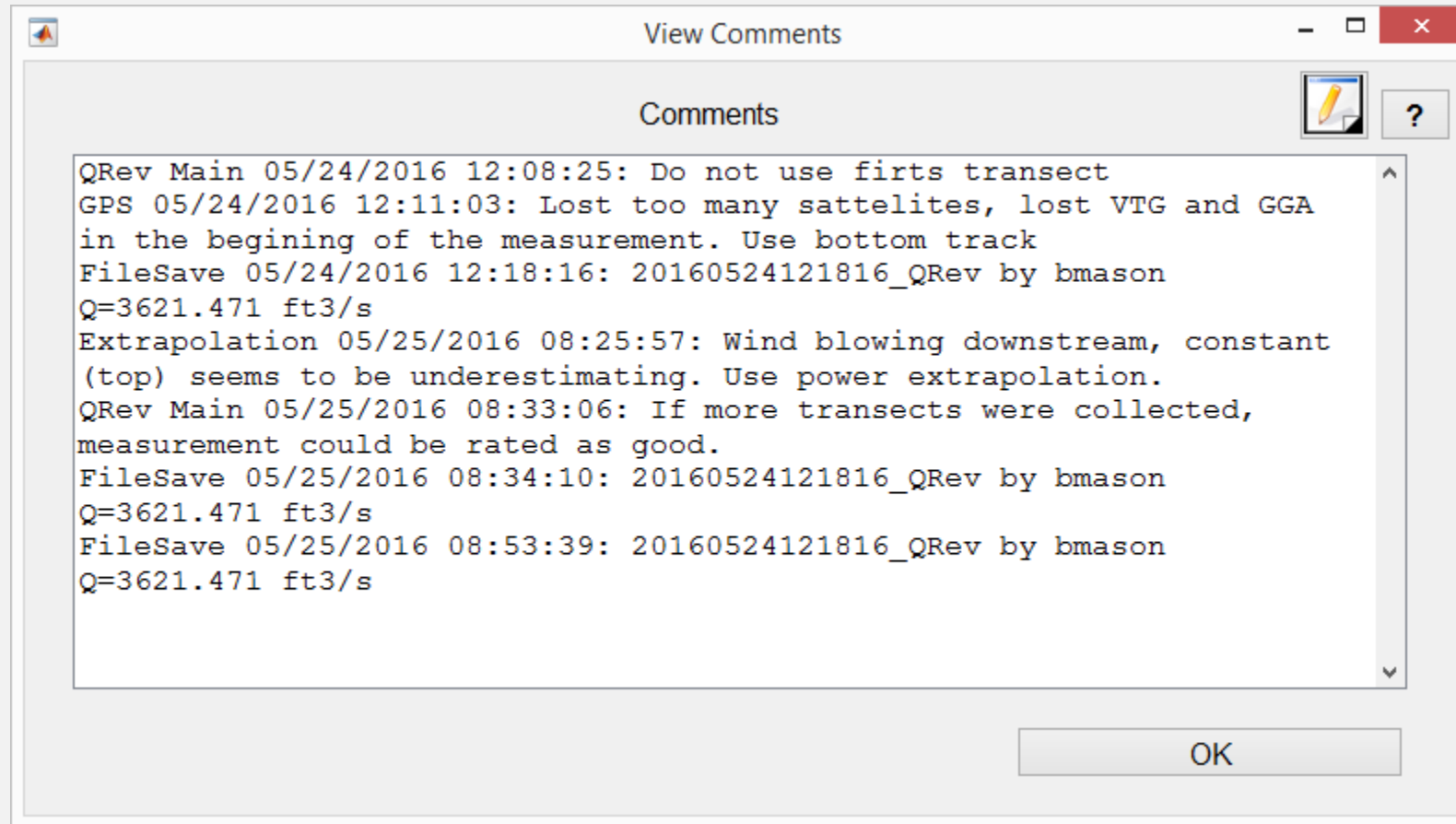
- Review and adjust settings associated with edge discharge computations
 - Start edge
 - Edge type
 - Edge distances
- Graphs show data in left and right edges for transect selected in table at top



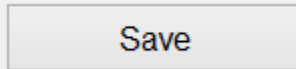
View Comments

View Comments

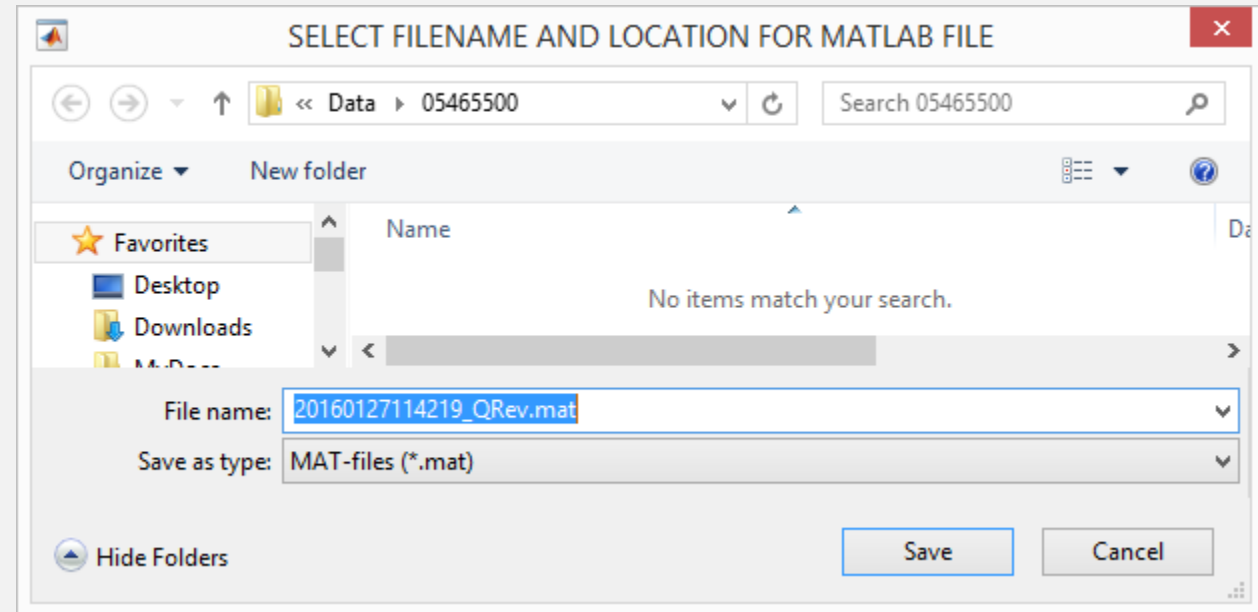
- Displays all comments
 - Imported
 - Added with QRev
- FileSave comment added when QRev file saved, includes userid



Save



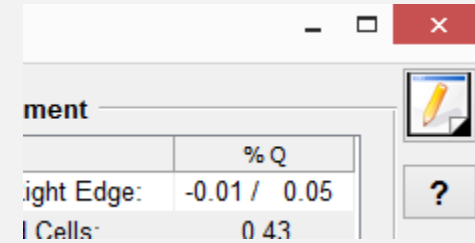
- Opens Save Dialog box for saving QRev Matlab file (*_QRev.mat)
- Defaults to folder where data was loaded
- Recommend accepting the default QRev naming format which is YYYYMMDDHHMMSS_QRev.mat where date and time is current date and time
- Also creates a .xml summary file for loading into SVMobile
- If data is later reviewed or reprocessed this is the file that should be loaded in QRev



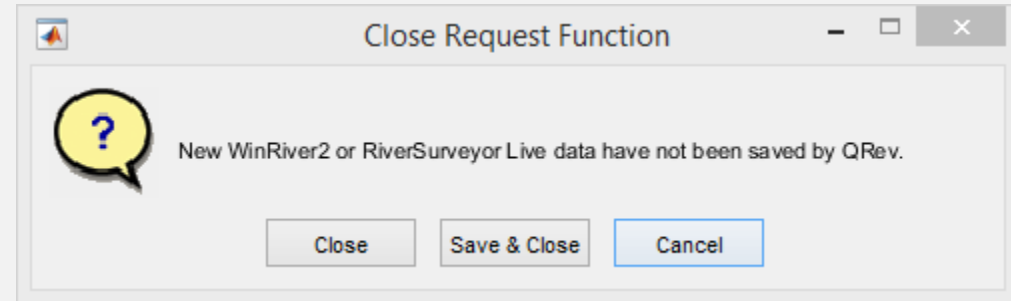
Close



- Exits QRev
- Any changes made that have not saved will be lost
- If you have imported a new measurement from WinRiver II or RSLive and not saved QRev will prompt
- No prompt while closing if
 - If you have already saved an imported Qm in QRev – even if changes made after save
 - If you open a QRev file – even if changes made without save



- Pressing the X button on the QRev main window also exits QRev



Reprocessing Large Data Sets (such as Tidal Measurements)

- Checking or unchecking a transect in the main window causes QRev to reprocess the entire measurement automatically (can be slow).
- ALT-u with uncheck all transects
- ALT-s changes the save function to save only the data from the check transects (Save button with change to Save Checked)

Suggested Procedure for Tidal (Unsteady Flow) Measurements

1. Load all data
2. ALT-s to set save to save only checked transects
3. ALT-u to uncheck all transects
4. Check the desired transects
5. Address messages and complete processing of those transects
6. Save – may desire to give a descriptive name to the saved file
7. Repeat steps 3-6 as need to process all transects

Google Earth

- If your data were collected with GPS data you can plot the transect lines in Google earth to see their location.
- Click GPS Filters button
- From the GPS Filters window press ALT-g

Demo

Warnings and Errors

- The colors and messages are to alert you to potential problems
- Evaluate the problem, make adjustments to settings is appropriate
- Add comments to support your analysis or changes
- DON'T attempt to make all buttons green

Limitations

- No ability to view intensity or correlations
- No ability to subsection data
- Invalid data at edges are not handled well by interpolation algorithms in QRev
- GPS based data with small errors in compass or magvar will inflate the Uncertainty
- Slow GPS update rate will result in a lot of invalid GPS ensembles and may inflate the Uncertainty

<https://hydroacoustics.usgs.gov/movingboat/QRev.shtml>

Training
Classes Webinars
On Demand

Memos

Hydroacoustic Forums

The HaWG

Known Hydroacoustic Issues

Moving-Boat Deployments
Instruments Guidance
Software Deployments
Tech Tips References

Index Velocity
Instruments Guidance
Software Deployments
Tech Tips References

Mid-Section Measurements
Instruments Guidance
Software Deployments
Tech Tips References

QRev

Description

QRev is a Matlab program developed by OSW to compute the discharge from a moving-boat ADCP measurement using data collected with any of the Teledyne RD Instrument (TRDI) or SonTek bottom tracking ADCPs. QRev improves the consistency and efficiency of processing streamflow measurements by providing:

- Automated data quality checks with feedback to the user
- Automated data filtering
- Automated application of extrap, LC, and SMBA algorithms
- Consistent processing algorithms independent of the ADCP used to collect the data
- Improved handling of invalid data
- An estimated uncertainty to help guide the user in rating the measurement

Because QRev uses data filters, interpolation algorithms, and computations that may be different from WinRiver II and RiverSurveyor Live, the discharge computed with QRev using default settings may be different than discharges computed by WinRiver II and RiverSurveyor Live.

[Office of Surface Water Technical Memorandum 2016.03](#) recommends and authorizes the use of QRev for processing discharge measurements made with an ADCP from a moving-boat.

QRev can be used on desktops, laptops, and tablets running either 32- or 64-bit versions¹ of the Windows operating system. QRev should be used in the field to process measurement immediately after data collection and in the office to review measurements. The graphical user interface for QRev was designed to work on tablets, so most controls are buttons, radio buttons, and check boxes that can be easily operated by tapping on the screen. QRev is written and compiled with Matlab and requires the installation of the Matlab runtime libraries.

¹NOTE: 32-bit operating systems will only be supported through about mid-2017 as Mathworks has announced that the 2015b release of Matlab is the last Matlab version that will support 32-bit operating systems.

The screenshot displays the QRev software interface. On the left is a navigation menu with categories like Training, Memos, and Moving-Boat Deployments. The main area is titled 'QRev' and contains a 'Description' section. To the right, there are three panels: 'Measurement Details (Metric: English)' with a table of parameters, 'Measurement Quality Assessment' with a table of quality metrics, and 'Profile Extrapolation' with a graph showing 'Normalized Discharge (m³/s)' vs 'Normalized Unit Q'.

PARAMETERS	MEASUREMENT	500_1100_001	500_1100_...	500_1100_...	500_1100_...
DISCHARGE					
Use					
Total Q (ft³/s)	2927.040	3028.040	20705.499	10663.062	20100.011
Top Q (ft³/s)	259.641	374.878	3086.881	3733.765	2938....
Middle Q (ft³/s)	1281.888	16296.769	15861.705	10932.696	10717.1
Bottom Q (ft³/s)	3395.888	4262.335	4223.885	2690.652	2963.3
Left Q (ft³/s)	949.696	1222.751	955.180	804.827	837.8
Right Q (ft³/s)	621.308	481.569	517.770	582.871	626.6
TIME					
Duration (s)	1312.52	234.4	763.8	205.9	226
Start Time (MM/DD/YYYY)	13/22/27	13/22/27 R	13/26/61 L	13/31/36 R	13/26 L
End Time (MM/DD/YYYY)	13/27/56	13/27/22	13/30/43	13/35/51	13/35/6
BEERBERE					
Navigation Ref	BT	BT	BT	BT	BT
Composite Tracks	Off	Off	Off	Off	Off
Depth Ref	BT	BT	BT	BT	BT
MOVING-BED					
Moving-bed	Yes				
Correction	Yes				
Extrapolation					
Edges					
Save					
View Comments					
Close					

	COV %	Left/Right Edge	% Q
Q	20.11	4.02 / 2.43	
Width	21.19	Invalid Cells	-8.20
Area	23.43	Invalid Cells	39.63
	Successes	Automatic	User
Random Uncertainty		21.1	
Invalid Data Uncertainty		7.9	
Edge Q Uncertainty		2.0	
Extrapolation Uncertainty		1.4	
Moving-Boat Test Uncertainty		1.5	
Systematic Uncertainty		1.5	
Estimated 95% Uncertainty		22.9	22.9

Links

- [Download](#)
- [Installation Instructions](#)
- [Updates and Bugs](#)
- [Integration with SV Mobile and NWIS](#)
- [Recommended Workflow](#)
- [Viewing QRev Summary without SV Mobile](#)
- [User's Manual](#) (Note: This is out of date with current software version, see User's Guide in software.)
- [Technical Manual](#)
- [Recorded Webinar](#)
- [Source Code Repository](#)

Download

[USGS Software Users Rights Notice](#)

QRev can be downloaded by clicking on the version number in the table below. *_32 is a 32-bit version. *_64 is a 64-bit version.



Questions

