QRev - 3.27   C:\dsm\dsm_documents\MATLAB\BitBucket\QRev_Project\Testing\TRDI_Validation\Data\RG_11530500_485\

Measurement Details (Units: English)

PARAMETERS	MEASUREMENT	math_485_000	math_485_0...	math_485_0...	math_485_0...
DISCHARGE					
Use		☑	☑	☑	☑
Total Q (ft3/s)	22022.065	22195.715	21939.618	21473.655	22479.272
Top Q (ft3/s)	5094.114	4951.768	5141.481	4948.868	5334.337
Middle Q (ft3/s)	13035.632	13031.836	13067.013	12582.948	13460.731
Bottom Q (ft3/s)	2606.840	2541.944	2625.825	2517.238	2742.354
Left Q (ft3/s)	989.162	1329.934	895.158	991.220	740.335
Right Q (ft3/s)	296.317	340.232	210.141	433.382	201.515
TIME					
Duration (s)	549.9	153.4	125.1	161.3	110.1
Start Time (02/12/2008)	11:28:44	11:28:44 L	11:31:30 R	11:33:41 L	11:36:33 R
End Time (02/12/2008)	11:38:24	11:31:17	11:33:35	11:36:23	11:38:24
REFERENCE					
Navigation Ref		VTG	VTG	VTG	VTG
Composite Tracks		Off	Off	Off	Off
Depth Ref		BT	BT	BT	BT
MOVING-BED					
Moving-bed	Yes				
Correction	No				
CHARACTERISTICS					

Select Data
Options
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 Quality Assessment

	COV %			% Q
Q:	1.94	Left/Right Edge:		4.49 / 1.35
Width:	1.26	Invalid Cells:		0.00
Area:	1.14	Invalid Ens:		56.28

Parameter	Automatic	User
Random 95% Uncertainty	3.1	
Invalid Data 95% Uncertainty	11.3	
Edge Q 95% Uncertainty	1.8	
Extrapolation 95% Uncertainty	0.6	
Moving-Bed 95% Uncertainty	0.0	
Systematic 68% Uncertainty	1.5	
Estimated 95% Uncertainty	12.2	12.2

User Rating

Not Rated

Profile Extrapolation

Messages (11)

	Message
4	⚠ **GGA-DGPS: Int. Q for invalid ensembles in a transect exceeds 25%;**
5	⚠ **VTG-All: Int. Q for invalid ensembles in a transect exceeds 25%;**
6	⚠ **VTG-Original: Int. Q for invalid ensembles in a transect exceeds 25%;**
7	⚠ *Transects: Duration of selected transects is less than 720 seconds;*
8	⚠ *Moving-Bed Test: The moving-bed test(s) has warnings, please review tests to*
9	⚠ *bt-All: Int. Q for invalid ensembles in a transect exceeds 10%;*

QRev Version 3.28

User Guide
June 23, 2017

Searchable PDF File

Table of Contents

1. Introduction

The use of acoustic Doppler current profilers (ADCPs) from a moving boat is a commonly used method for measuring streamflow. These measurements have been reviewed and post-processed using manufacturer supplied software and the user's knowledge and experience to interpret the quality of the measurement, correctly configure discharge processing settings, and set appropriate thresholds to screen out erroneous data. This dependency on the software supplied by the manufacturer has created two problems for the U.S. Geological Survey (USGS).

1.   The software supplied by the different manufactures have limited automated quality assessment features, and graphics and tables for user review are inconsistent among the manufacturers. Consequently, data quality assessment is not independent of the instrument used to make the measurement but rather is dependent on the capabilities of the manufacture supplied software to review and assess the data quality. The lack of automated quality assessment features leaves the assessment to the knowledge and experience of the user and may result in inconsistent assessments of data quality.

2.   Software from different manufacturers use different algorithms for various aspects of the data processing and discharge computation. Consequently, if the same dataset could be processed by each of the manufacturers' software, the resulting discharges could be different.

Development of common and consistent computational algorithms combined with automated filtering and quality assessment of the data will provide significant improvements in quality and efficiency of streamflow measurements. This development will ensure that USGS streamflow measurements made using ADCPs are consistent, accurate, and independent of the manufacturer of the instrument used to make the measurement.

The USGS, Office of Surface Water developed a computer program, QRev. The program can be used 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 applies consistent algorithms for the computation of discharge independent of the manufacturer of the ADCP. In addition, QRev automates filtering and quality checking of the collected data and provides feedback to the user of potential quality issues with the measurement. Various statistics and characteristics of the measurement, in addition to a simple uncertainty assessment are provided to the user to assist them in properly rating the measurement. QRev saves an extensible markup language (XML) file that can be imported into databases or electronic field notes software, such as, SVMobile.

1.1. Purpose and Scope

The purpose of this guide is to describe the user interface, features, and designed workflow of QRev. The report will present all the windows and describe the function and intended use of all the interactive controls of QRev's graphical user interface (GUI). The specific algorithms used are not discussed in this report but are documented in a technical manual (Mueller, 2016).

1.2. Software Design Objectives

The general design of QRev was guided by the following criteria:

1. Process SonTek and TRDI data.
2. Use consistent algorithms.
3. Use the best available data (interpolate only what is missing or invalid).
4. Provide a logical workflow.
5. Automate data quality assessment and provide useful feedback.
6. Provide manual overrides for all automated filters.
7. Use windows with tables and graphs designed to evaluate specific problems.
8. Provide uncertainty information to the user.
9. Use a GUI and layout that is tablet friendly.

The goal is for QRev to be used for data review and processing of all moving-boat ADCP streamflow measurements. Use of QRev will ensure consistent algorithms are applied for the computation of discharge, independent of the ADCP manufacturer. QRev also provides the same automated data filters, graphs and tables, and user feedback for all data to improve consistency of data quality assessments.

1.3. Updates and Support

Versions of QRev and supporting information are available from the [USGS Hydroacoustics web page for QRev](#).

In order to provide support for QRev and to provide an efficient means to communicate with users and allow users an efficient and organized means of providing suggestions and comments, you are encouraged to register for the OSW Hydroacoustic Forum. In the forum you will find a "[QRev](#)" board under Hydroacoustics Moving-Boat Deployments. Open the QRev board and click "Notify" to automatically receive emails on any bug fixes or issues identified with QRev. This is the only way of being automatically notified if there has been an identified problem or if a new version has been released. You are also encouraged to report any problems you encounter with QRev and attach the associated files so that any identified problem can be resolved. To access the OSW Hydroacoustics Forums you must be a registered user of the forums.

[Register for access to OSW Hydroacoustics Forums](#)

[OSW Hydroacoustics Forums for Registered Users](#)

2. Main Window
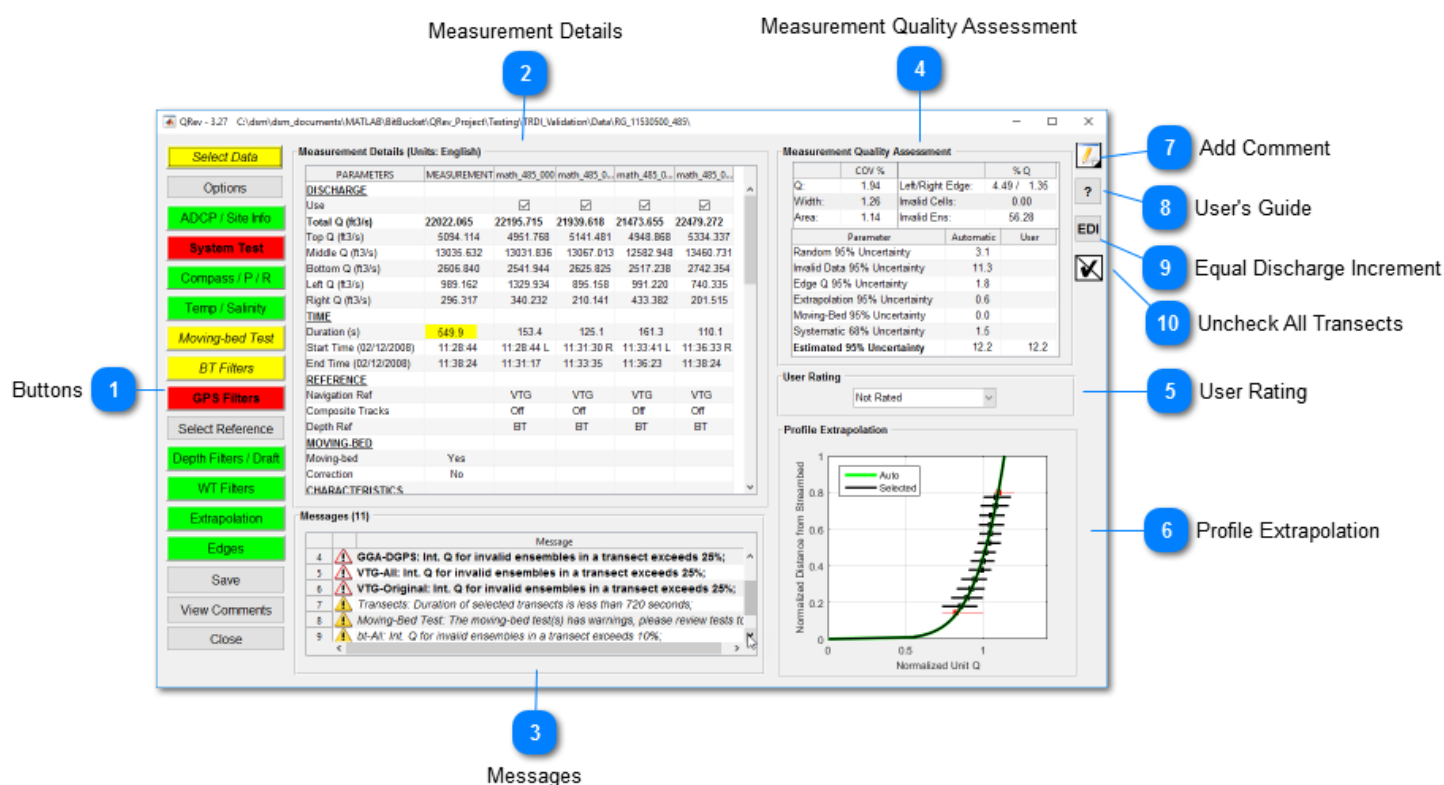
The Main Window is designed to be logical and tablet friendly.The Main Window has six sections: (1) buttons down the left side, (2) Measurement Details panel, (3) Messages panel, (4) Measurement Quality Assessment panel, (5) User Rating panel, and (6) Profile Extrapolation panel. Two buttons on the right 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.

The Main Window is designed to be logical and tablet friendly. To load and review data, the user works from top to bottom along the buttons on the left. This approach leads the user through the premeasurement steps first. Navigation reference, depth, and water data are needed to compute discharge. By working top to bottom the best navigation data are obtained, then the best depth data, and finally the best water data, which are dependent on the navigation reference and depth. Thus, the final discharge is based on the best available data.

The buttons turn green, yellow, or red based on the automated data quality assessment (ADQA). If a button is yellow or red, an associated message will be in the message box at the bottom of the main window. Buttons, check boxes, radio buttons, and pop-up menus are used in lieu of menus in an attempt to make QRev easy to use on a touch screen tablet. Each button opens a modal window that provides tables, text, options, and graphics needed to assess and process that particular aspect of the data in more detail. The modal window will not allow the user to open or work in another window until that window is closed.

QRev is designed to update the data immediately upon a changed setting. While QRev is processing, the cursor will appear with the busy shape and no other buttons or selections should be made. Once QRev has finished processing, the cursor will return to the default shape.

Select Data
Options
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
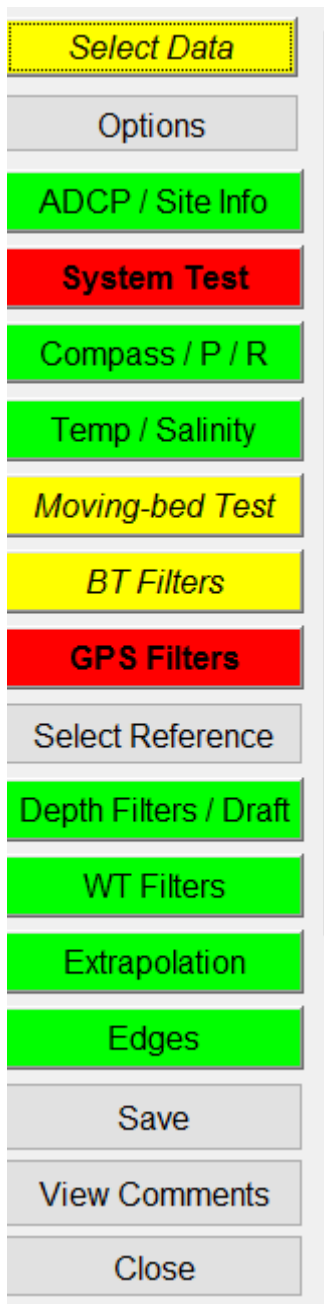
The buttons are designed to be logical and tablet friendly. To load and review data, the user works from top to bottom along the buttons on the left. This approach leads the user through the premeasurement steps first. Navigation reference, depth, and water data are needed to compute discharge. By working top to bottom the best navigation data are obtained, then the best depth data, and finally the best water data, which are dependent on the navigation reference and depth. Thus, the final discharge is based on the best available data. Details on each button can be found in sections 4 - 21 of this help file.

The buttons will display in one of four ways depending on the results of the automated data quality assessment (ADQA):
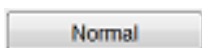
Normal A normal button color after a file has been loaded indicates that no ADQA is associated with this button, but the button provides access to other functions or windows, or both.

Inactive An inactive button indicates that the data loaded does not have data associated with that specific feature.

Good A green button with normal text indicates that this aspect of the data passed all the ADQA checks.

Caution A yellow button with italic text indicates that the ADQA has identified a potential issue, but the issue is likely not critical. An associated message will be in the Message panel. The caution message will use lowercase letters in the message identifiers.

Warning A red button with bold text indicates that the ADQA has identified an issue that could have a significant effect on the measurement or that violates USGS policy. An associated message will be in the Message panel. The message identifier will be in uppercase letters for a warning message.

The buttons are meant to draw attention to potential issues. When processing data, it may not be possible to achieve all green buttons. When a button is not green, it is good practice to add a comment about the identified condition to let a future reviewer know that you evaluated the identified issue.

② Measurement Details

Measurement Details (Units: English)

PARAMETERS	MEASUREMENT	math_485_000	math_485_0...	math_485_0...	math_485_0...
DISCHARGE					
Use		☑	☑	☑	☑
Total Q (ft3/s)	**22022.065**	**22195.715**	**21939.618**	**21473.655**	**22479.272**
Top Q (ft3/s)	5094.114	4951.768	5141.481	4948.868	5334.337
Middle Q (ft3/s)	13035.632	13031.836	13067.013	12582.948	13460.731
Bottom Q (ft3/s)	2606.840	2541.944	2625.825	2517.238	2742.354
Left Q (ft3/s)	989.162	1329.934	895.158	991.220	740.335
Right Q (ft3/s)	296.317	340.232	210.141	433.382	201.515
TIME					
Duration (s)	549.9	153.4	125.1	161.3	110.1
Start Time (02/12/2008)	11:28:44	11:28:44 L	11:31:30 R	11:33:41 L	11:36:33 R
End Time (02/12/2008)	11:38:24	11:31:17	11:33:35	11:36:23	11:38:24
REFERENCE					
Navigation Ref		VTG	VTG	VTG	VTG
Composite Tracks		Off	Off	Off	Off
Depth Ref		BT	BT	BT	BT
MOVING-BED					
Moving-bed	Yes				
Correction	No				
CHARACTERISTICS					

The Measurement Details panel provides a table of the measurement results and configuration settings. The units system used for the measurement is shown in the panel label and with each row label that has units associated with it. A scroll bar on the right allows the user to scroll up

and down through the table. Depending on the number of transects in the measurement there may be an additional scroll bar at the bottom to allow the user to scroll left and right. Clicking in the table will allow navigation of the table with the arrow keys. The width of the columns can be changed by placing the cursor in the column labels and dragging the column divider.

The only row in this table that can be edited is the row labeled "Use". This row identifies the transects that will be used to compute the final average discharge. Clicking the check box under each transect name will change whether the transect is used (checked) or not used (unchecked) in the final average discharge computation. The automated data quality assessment (ADQA) will update every time a change in the transect selection is made and will report on only the data and associated computations of the selected transect.

If the ADQA identifies specific issues, some of the cells in the Measurement Details table may have a background color of yellow or red, like the buttons. For example, if an odd number of transects are selected, the "Use" label will be red. Similarly, if the duration of the measurement is less than 720 seconds, the duration of the measurement will have a yellow background.

③ Messages

The Messages panel displays messages reported by the automated data quality assessment (ADQA). Each message is identified as a warning or a caution with warnings appearing at the top of the list. A warning has the symbol ⚠ and the text is bold and preceded by an identifier in uppercase. A caution has the symbol ⚠ and the text is italic and preceded by an identifier in title case. Warnings are associated with buttons that are red and cautions with buttons that are yellow. Clicking on the message will open the appropriate window to investigate the cause of the message, just like clicking on the associated button. The scroll bar on the right allows the user to scroll through messages if the messages exceed the panel size. The number of messages is displayed in the messages panel title.

④ Measurement Quality Assessment

Measurement Quality Assessment

	COV %		% Q
Q:	1.94	Left/Right Edge:	4.49 / 1.35
Width:	1.26	Invalid Cells:	0.00
Area:	1.14	Invalid Ens:	56.28

Parameter	Automatic	User
Random 95% Uncertainty	3.1	
Invalid Data 95% Uncertainty	11.3	
Edge Q 95% Uncertainty	1.8	
Extrapolation 95% Uncertainty	0.6	
Moving-Bed 95% Uncertainty	0.0	
Systematic 68% Uncertainty	1.5	
Estimated 95% Uncertainty	12.2	12.2

The Measurement Quality Assessment panel (fig. 1) consists of three tables with information to assist the user in rating the quality and uncertainty of the measurement. The table in the upper left provides the coefficient of variation in percent (COV %) for the total discharge, the cross-section width, and the cross-sectional area. The table in the upper right provides the percentage of total discharge (% Q) in the left and right edges (Left/Right Edge), in invalid cells (Invalid Cells), and in invalid ensembles (Invalid Ens.). Cells in the tables may be colored based on the results of the ADQA.

The table at the bottom of the panel has two columns for the uncertainty of the various aspects of the measurement. The column labeled "Automatic" contains the values generated by QRev based on assumptions and computations defined in Mueller (in review) and briefly in the following paragraphs. Because the assumptions and computations used to generate the values in the "Automatic" column are simplistic, the values may not accurately represent the uncertainty for all conditions. The column labeled "User" allows the user to override the automatic values with a user supplied value. A value entered by a user should be supported with a comment. The total estimated 95 percent uncertainty value will be recomputed each time a new "user" value is input. The uncertainty categories are defined as follows.

• **Random Uncertainty**—The random uncertainty expands the Q COV to a 95 percent level by applying a coverage factor from the Student's t-distribution based on the number or degrees of freedom and then dividing by the square root of the number of transects. When only 2 transect comprise a measurement, the theoretical Student's t approach is abandoned and the 95 percent random uncertainty is computed as Q COV * 3.3.

• *Invalid Data Uncertainty*—The 95 percent uncertainty for invalid data is assumed to be 20 percent of the sum of the percent discharge for invalid cells and ensembles.

• *Edge Q Uncertainty*—The 95 percent uncertainty for the edge discharge is assumed to be 30 percent of the total discharge in the edges. The Edge Q Uncertainty accounts for uncertainty in the edge shape, roughness, distance to shore, depth, and water velocity.

• *Extrapolation Uncertainty*— The percent extrapolation uncertainty is computed by computing the percent difference in discharge from the selected extrapolation method to other possible extrapolation methods and averaging the best four options.

• *Moving-Bed Test Uncertainty*— If bottom track is not the navigation reference, the percent moving-bed test uncertainty is assumed to be zero. If bottom track is used and a moving-bed

test is valid, the percent moving-bed test uncertainty is assumed to be 1 percent if the test indicates no moving bed is present and 1.5 percent if a moving bed is present. If the moving-bed test has warnings, is invalid, or no moving-bed test was completed, the uncertainty is set to 3 percent.

• **Systematic Uncertainty**— Systematic uncertainty, such as biases in the components of the ADCP and beam misalignment, is assumed to be 1.5 percent.

• **Estimated 95% Uncertainty**— The estimated 95 percent uncertainty uses the values for uncertainty from the discussed categories and combines them as the square root of the sum of the squares. The final value is only a guide because the algorithms for the various sources of uncertainty are only approximations and simple assumptions.

5 User Rating

The User Rating panel provides a popup menu to allow the user to rate the measurement. QRev does not automatically rate the measurement. The user should consider the information provided in the Measurement Quality Assessment panel (especially the uncertainty estimate), the quality of the stage measurement, and any other factors that might affect the overall quality of the measurement when selecting the final rating.

6 Profile Extrapolation
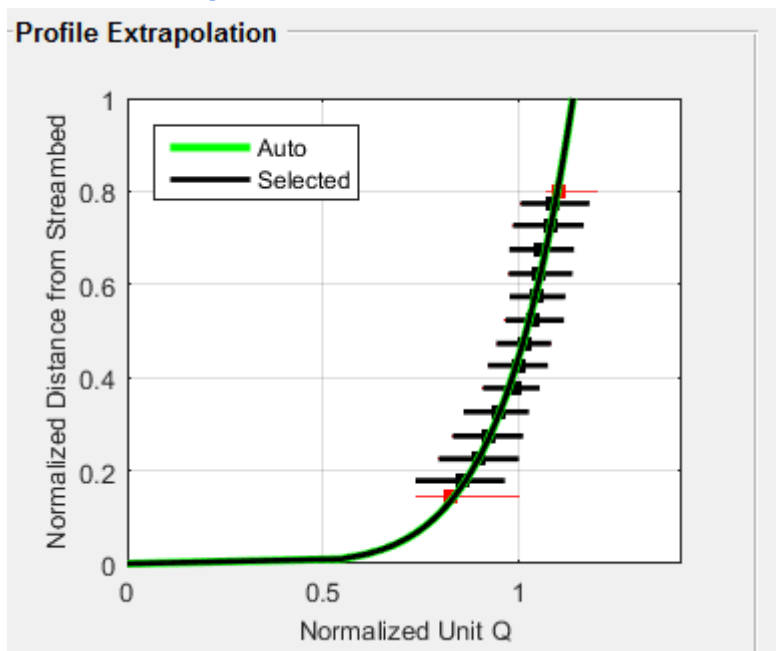
The Profile Extrapolation panel contains a graph of the normalized depth and discharge for the entire measurement (check transects only). The data are represented by median values of normalized Q at the mean normalized depth for all data within 5 percent increments of normalized depth. The whiskers on the data points show the range of 50 percent of the data in that median. The selected extrapolation methods are shown with a black line, and the extrapolation methods based on the automatic methods in QRev are shown with a wider green line. QRev defaults to the extrapolation methods based on the automatic selection algorithms; however, the user can choose to override that automatic selection.

7 Add Comment

Allows the user to add a comment. For more information see [Comment Button](#).

8 User's Guide

Allows the user to view this user's guide.

9 Equal Discharge Increment

Launches the equal discharge increment computation for water quality or sediment sampling. For more details see [Section 21 EDI - Equal Discharge Increment](#)

10 Uncheck All Transects

Unchecks all transects.

2.1. Tidal or Rapidly Varying Flow Measurements

Tidal measurement or measurement in rapidly varying flow situations often require splitting a series of transects into different measurements. This can be done more efficiently in QRev by using a couple of features that are only available through key strokes.

From the main window:

> **ALT-u** or clicking ☒ in the main window will uncheck all transects
> **ALT-s** or clicking the Options Button and then the "Only Checked Transects" option will toggle the save button to only save checked transects

The steps to split a series of transects into multiple measurements would be to
1) load tidal measurement,
2) ALT-s or use Options Button to toggle save only checked,
3) ALT-u or click ☒ to uncheck all,
4) checked first set of transects,
5) complete processing
6) click save
7) repeat 3-6 for each set of transects

3. Common Features

The windows in QRev share several features. To avoid repeating the use of these features for each window, these common features are discussed in this section and can be used in the windows where the features are present.

3.1. Comment Button

 A comment button, ⬜, is at the top right of every window in QRev. Clicking on this button will open the comment window (below). The user comment is automatically tagged with the name of the QRev modal window from which the comment button was clicked and the time and date of the comment. The user should enter comments explaining any observations associated with the data or field conditions or any changes in QRev settings. All comments can be viewed by clicking the View Comments button in the main window. Comments cannot be edited or deleted after they are entered. The Copy Comments button will copy the comments to the clipboard so that they can be pasted into any other application or document.
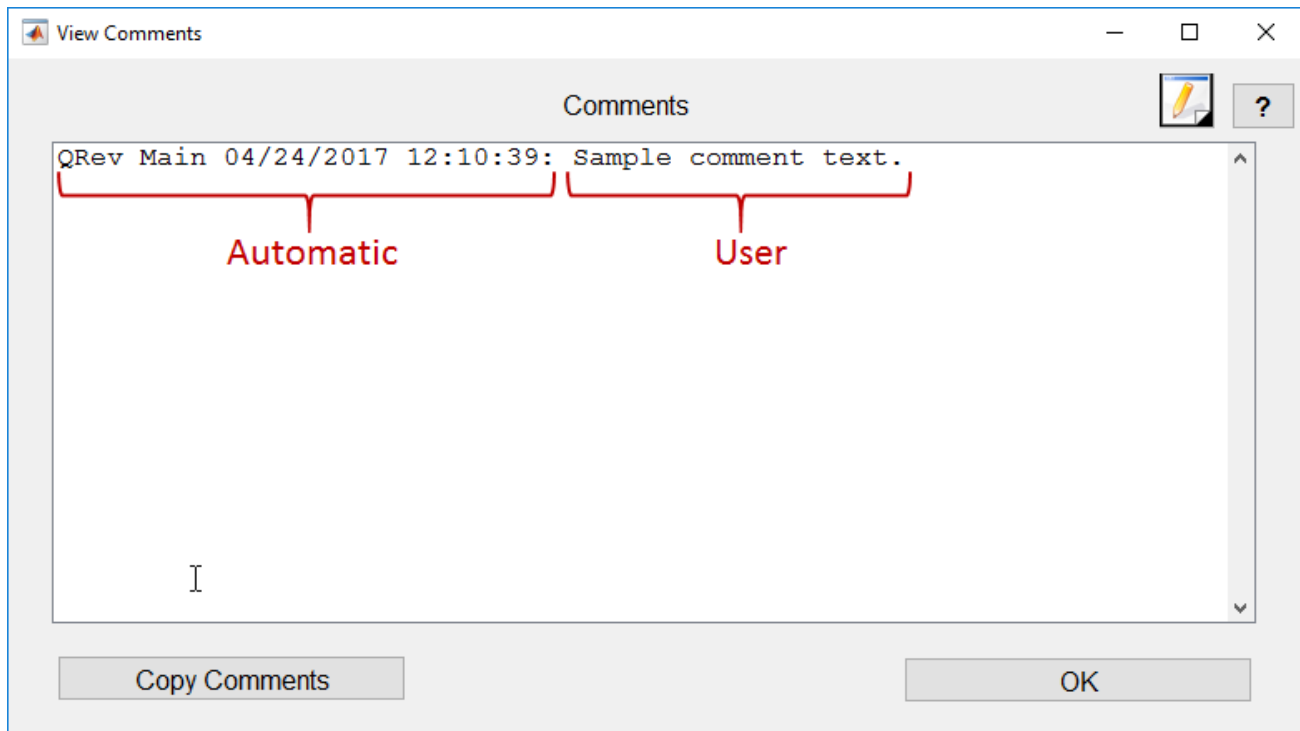
3.2. Toolbar

Each window with graphs will have a toolbar ![toolbar] at the upper left of the window. These tools can be used to zoom, pan, and query the data in the graphs.

· 🔍 Allows zooming in on data in the graph.

· 🔍 Allows zooming out on data in the graph.

· ✋ Allows panning in the graphics window.

· ⊞ Allows data values to be probed by clicking on the data points in the graphs.

3.3. Legends

Many of the graphics in QRev have a legend associated with them. Occasionally the legend may hide important parts of the graph. The legend in any graph can be moved by left clicking on the legend and dragging it to another location. The legend can be completely removed by right clicking on the legend and selecting delete. To restore the legend, the user will have to recreate the graph by changing the transect or by changing the type of data being graphed.

3.4. Tables

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	
05412500_1100_001.PD0	0.34	587	114	114	119	120			30238.05	30238.05	0.00	▲
05412500_1100_002.PD0	0.34	406	2	0	5	26			28705.46	28705.46	0.00	☰
05412500_1100_004.PD0	0.34	512	31	36	26	40			18683.06	18683.06	0.00	
05412500_1100_005.PD0	0.34	560	4	8	1	7			20108.91	20108.91	0.00	▼

Many of the dialog windows have a table displaying each transect as a row with columns of information associated with the specific measurement characteristic being evaluated. Scroll bars at the right and bottom of the tables can be used to scroll through the data in the table. In addition, after clicking in the table the cursor keys can be used to navigate through the table.

Graphs of data in QRev typically only display data from a single transect. The transect being displayed can be changed by clicking in the table on the row or filename of the desired transect. To quickly scan graphs of data from multiple transects, click in the table and change the transect graphed by using the up and down arrow keys.

Many of the tables have data with a background colored yellow or red to associate the data with a particular automated data quality assessment message.

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	
06800000_0_000.PD0	0.30	53	0	0	0	1	34		-2412.69	-2412.69	-0.00	▲
06800000_0_001.PD0	0.30	168	24	25	22	23	56		5546.72	5546.72	0.00	☐
06800000_0_002.PD0	0.30	93	4	4	2	2	33		6194.31	6194.31	0.00	
06800000_0_003.PD0	0.30	131	4	4	2	3	24		2917.31	2917.31	0.00	▼

If a value in the table can be edited, clicking on the value will open an edit dialog window (see example below). The user can change the value and then apply the change to all transects or to only the transect in the row that was clicked.

4. Select Data

The Select Data button opens the following window:
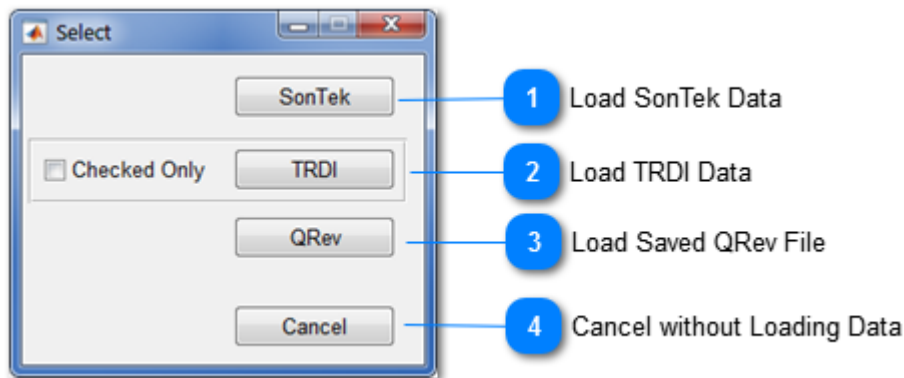
The Select Data button is used to load data into QRev. QRev can load data from the following three sources:
1. SonTek RiverSurveyor Live (RSL) Matlab output (*.mat),
2. TRDI WinRiver II (WR2) mmt (*.mmt) and pd0 (*.pd0) files, and
3. Matlab file saved from QRev (*_QRev.mat).

Clicking the appropriate data type will open a file selection dialog.
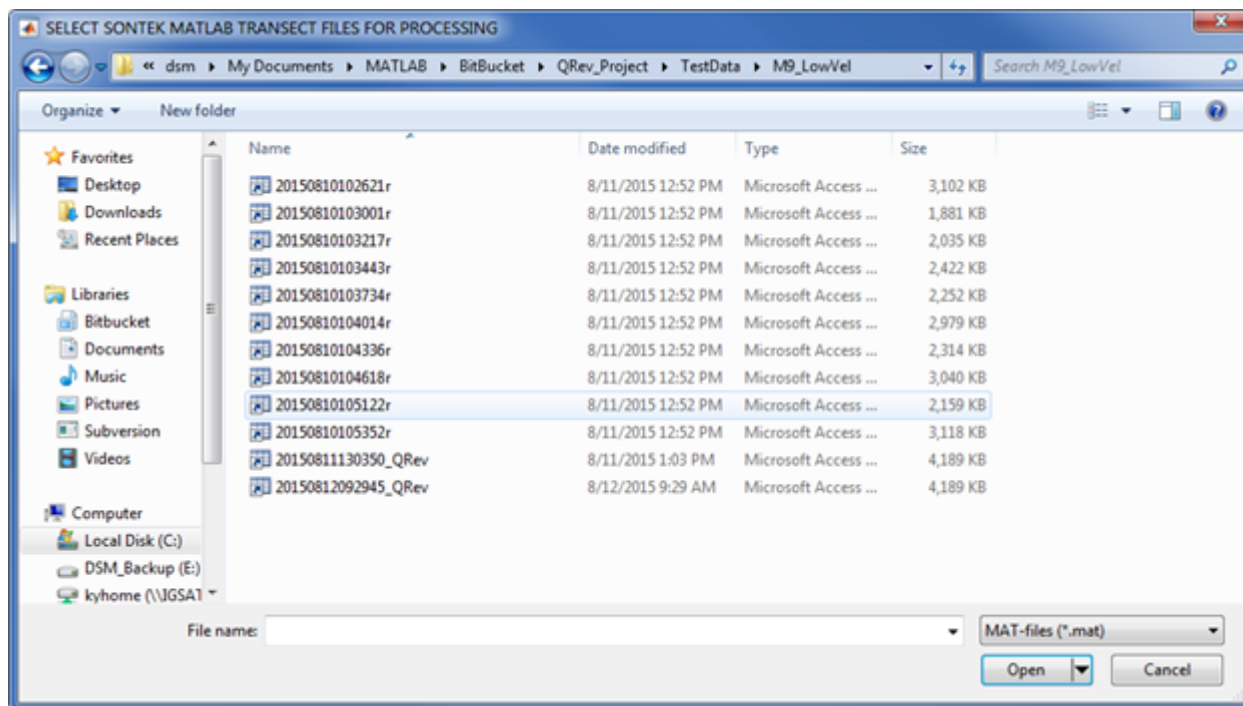
NOTE: *The user cannot add files to an existing QRev session; all files must be loaded at the same time.*

Load SonTek Data

For RSL measurements, moving-bed tests and transects must be exported from RSL using the MATLAB export feature. These files must be output using east, north, up (ENU) coordinates and BT, GGA, or VTG track reference. The files selected by the user from the Open File window shown in figure 6 should include the *.mat files for all transects in the measurement (Windows commonly does not

display the file extension and considers *.mat files to be Microsoft Access Table Shortcuts.). QRev will automatically load associated moving-bed tests, system tests, and compass evaluations provided they follow the standard RSL naming and file storage conventions. Moving-bed tests filenames must begin with "Smba_" or "Loop_" and be exported to the MATLAB format (*.mat). The system tests and compass calibration must be stored in subfolders of the measurement folder and be named System Test and CompassCal, respectively.

Load TRDI Data

Checked Only | TRDI

For TRDI ADCPs, select the *.mmt file in the Open File dialog and the transects and supporting data will be loaded. To only load the transects that have been checked in WR2, first click the "Checked Only" box and then click on TRDI.

Load Saved QRev File
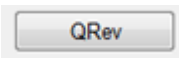
QRev

The QRev data type is for a measurement that has already been processed and saved by QRev. The file is a "*_QRev.mat" file. This file contains all the data and settings used in QRev and will present the data exactly as the file was saved. If the file was saved with an earlier version of QRev and additional features and quality checks have been updated in the current version the following dialog will be displayed giving the user the option of viewing the data as it was saved or reprocessing it. *If a change is made to the data the data will be reprocessed using the features of the current version.*

QRev - Updated

QRev has been updated since this file was saved. You can view the file as it exists by pressing View. NOTE: Any changes will reprocess the file using the QRev updates. You can reprocess the file now by pressing Reprocess.

View | Reprocess
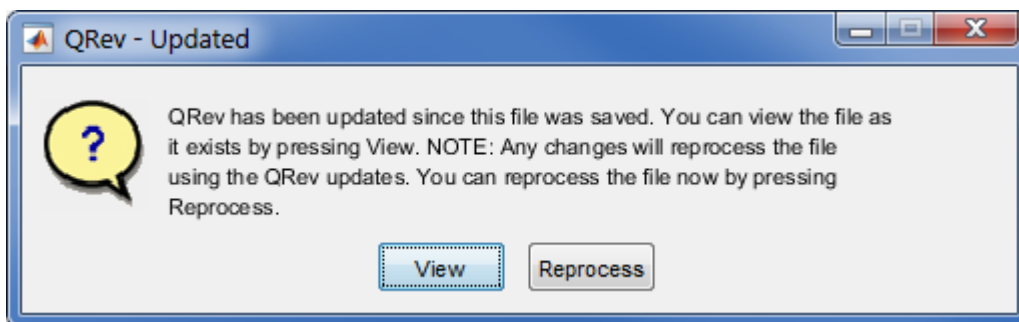
Cancel without Loading Data

Cancel
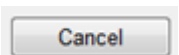
Close window without loading data.

4.1. Measurement Quality Checks

The Select Data button may be colored based on the following ADQA checks.

Good (Green)

Passed all quality ADQA checks.

Caution (Yellow)

Check—Number of transects checked for use is less than 2.
Message—Transects: Only one transect selected.

Check—Number of transects checked is 2 and COV is greater than 2.
Message—Transects: Uncertainty would be reduced by additional transects.

Check—Total duration of all checked transects is less than 720 seconds.
Message—Transects: Duration of selected transects is less than 720 seconds.

Warning (Red)

Check—Number of transects checked for use is zero.
Message—TRANSECTS: No transects selected.

Check—Number of left to right and right to left transects checked for use are not equal.
Message—TRANSECTS: Transects selected are not reciprocal transects.

Check—One or more of the transects checked for use have different signs.
Message—TRANSECTS: Sign of total discharge is not consistent. One or more start banks may be incorrect.

Check—One or more of the transects checked has a zero discharge.
Message—TRANSECTS: One or more transects have zero discharge.

5. Options

The Options button opens a window that allows the user to select the desired units (English or International System of Units [SI]) and the Save Options. A change to the units can be made at any time. This setting only affects the display of the data and does not have to be consistent with the original units of the loaded data. All data in QRev are stored internally in SI units. The Save Options can also be changed at any time and will remain in effect until changed or QRev is closed. Save All Transects is the default and will save information for all transects loaded whether they a check to be used in the discharge computation or not. Saving only the check transects will only save information from those transects that are checked to be included in the final discharge and will include all supporting information, such as, system and moving-bed tests.
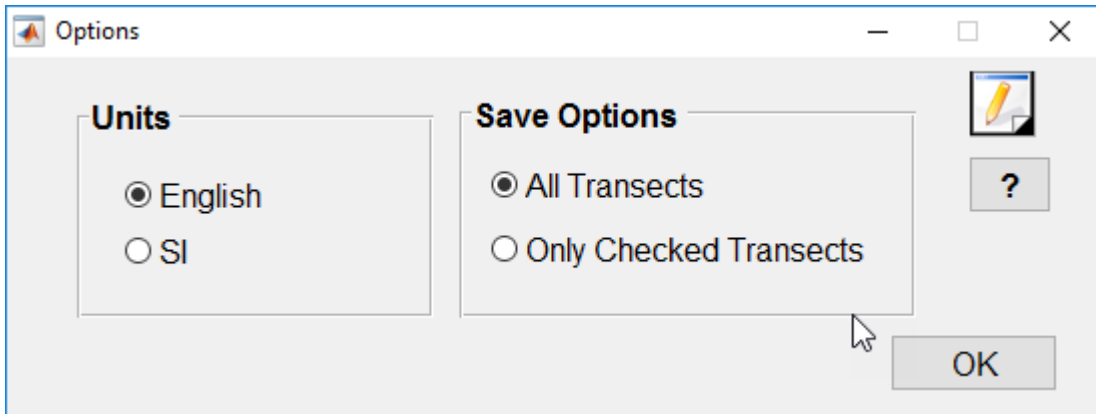
6. ADCP / Site Info

The ADCP / Site Infor Button opens the window below.
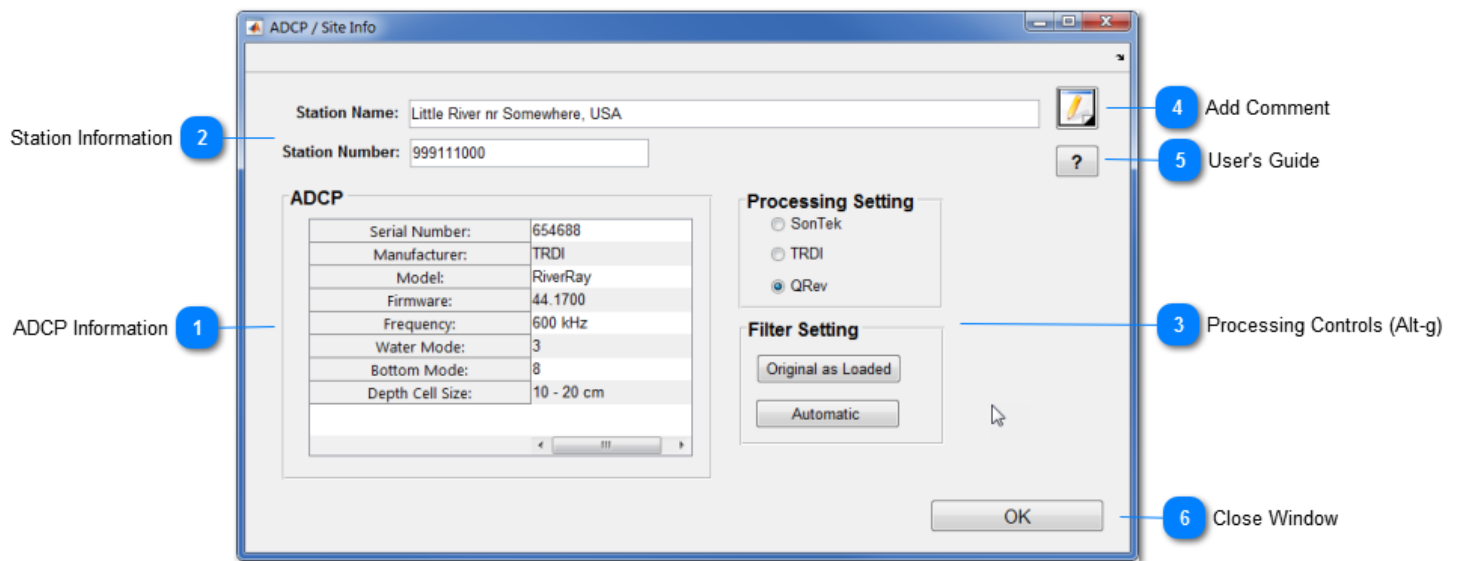
1 ADCP Information

This table provide information about the ADCP and its configuration. ADCPs with auto-adaptive water and bottom modes and frequencies may display "Variable" or a range of values representative of the data collected. The Station Name and Station Number can be edited by typing in the edit box.

2 Station Information

The Station Name and Station Number are read from the loaded data. They can be edited by typing in the box containing the name or number.

3 Processing Controls (Alt-g)

Processing Setting
- ○ SonTek
- ○ TRDI
- ● QRev

Filter Setting
- [Original as Loaded]
- [Automatic]
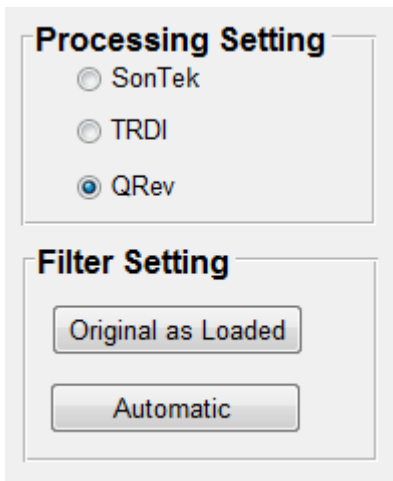
These options are seldom used and can only be accessed by opening the ADCP / Site Info window and pressing Alt-g.

The Processing Setting panel allows the user to change the processing algorithms and global filter settings used to compute discharge. The Processing Setting defaults to QRev and the filter setting defaults to Automatic for all data types. The Automatic filter setting turns most of the filters in QRev to an Auto setting, meaning these filters will be applied to the data using preset values or preset dynamic algorithms. The extrapolation is also set to the automatically selected methods. The navigation reference is set to whatever reference was set in the loaded data.

The user can switch the processing type among SonTek, TRDI, or QRev. Switching the processing type changes the way invalid data are interpolated and handled. The user can also change the filter settings to the filter settings used in the original data (Original as Loaded). If a filter is not supported by the manufacturer and does not have a setting, that filter is turn off. For QRev to process the data like RSL, the user would select SonTek, wait until QRev finishes processing that request, and then click on Original as Loaded. This combination will process the data similarly to RSL. Likewise, to process data like WR2, the user would select TRDI and then click on Original as Loaded. The user can use the Automatic button to turn all filters to Automatic if changes have been made using other windows in QRev.

4 Add Comment

Allows the user to add a comment. For more information see Comment Button.

5 User's Guide

[?]

Opens this User's Guide

6 Close Window

[OK]
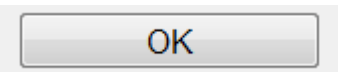
Closes this window and returns control to the main window.

6.1. Measurement Quality Checks

The ADCP / Site Info button may be colored based on the following ADQA checks.

Good (Green)

Input passed all quality checks.

Caution (Yellow)
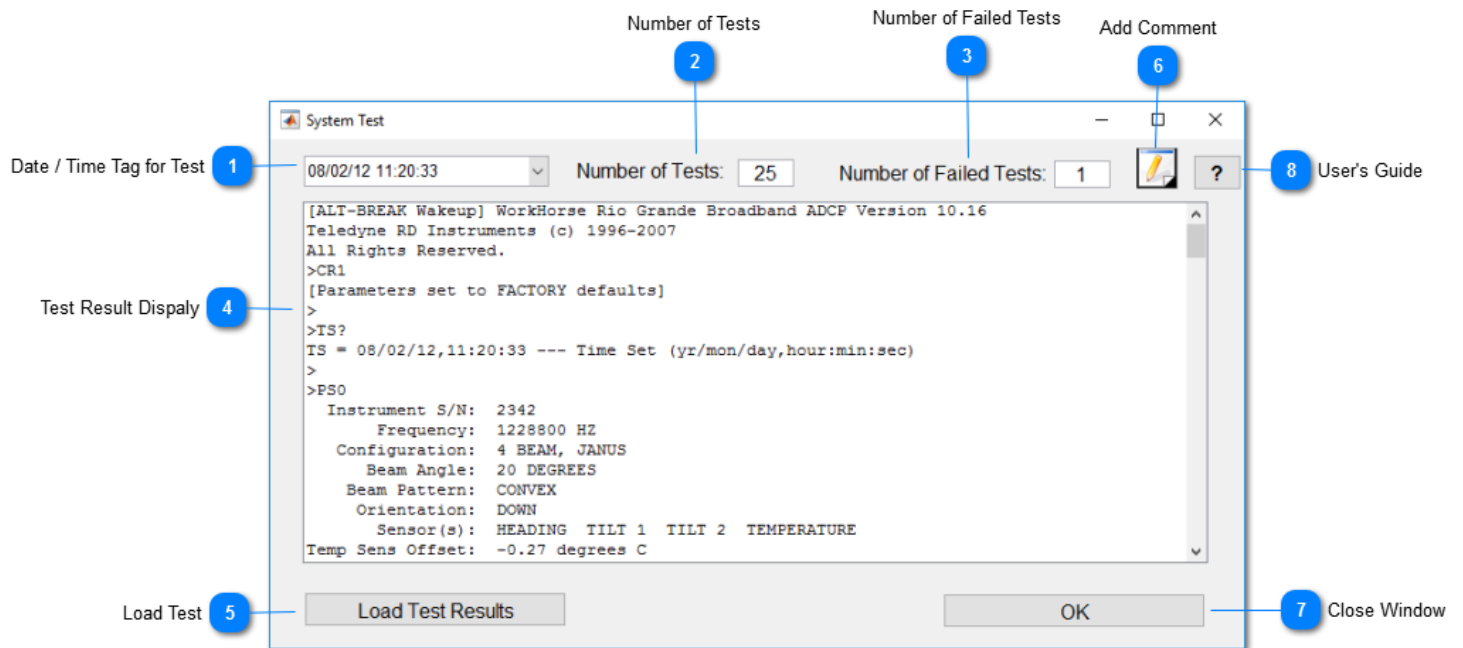
Check—A station name has not been entered.
Message—User Input: Station name not entered.

Check—A station number has not been entered.
Message—User Input: Station number not entered.

7. System Test

The System Test button opens the following window.

1. Date / Time Tag for Test

08/02/12 11:20:33

System tests stored in the *.mmt file for WR2 measurements or in the System Test folder for RSL measurements will be loaded automatically. System tests loaded automatically are identified by a date and time stamp shown in the popup menu in the upper left of the System Test window. If multiple tests were completed, each test can be reviewed by using the popup menu to select the test to display in the display text box.

2. Number of Tests

Number of Tests: 25

Shows total number of tests run within the overal test set selected.

3. Number of Failed Tests

Number of Failed Tests: 1

Shows the number of failed individual tests within the overal test set selected.

4. Test Result Dispaly

```
[ALT-BREAK Wakeup] WorkHorse Rio Grande Broadband ADCP Version 10.16
Teledyne RD Instruments (c) 1996-2007
All Rights Reserved.
>CR1
[Parameters set to FACTORY defaults]
>
>TS?
TS = 08/02/12,11:20:33 --- Time Set (yr/mon/day,hour:min:sec)
>
>PS0
   Instrument S/N:  2342
        Frequency:  1228800 HZ
    Configuration:  4 BEAM, JANUS
       Beam Angle:  20 DEGREES
     Beam Pattern:  CONVEX
      Orientation:  DOWN
        Sensor(s):  HEADING  TILT 1  TILT 2  TEMPERATURE
Temp Sens Offset:  -0.27 degrees C
```

Results of the system test selected from the Date / Time Tag drop down menu is displayed. The scroll on the right can be used to scroll through the test results. The tests cannot be edited.

5 **Load Test**

> Load Test Results

If a system test was collected outside the normal procedures and not stored in the default file and location, the user can manually load the file. Manually loaded files are identified by their filename. The manually loaded file must be an ASCII text file.

6 **Add Comment**

Allows the user to add a comment. For more information see Comment Button.

7 **Close Window**

> OK

Close this window and return control to the main window.

8 **User's Guide**

> ?

Open User's Guide

7.1. Measurement Quality Checks

The System Test button will be colored based on the following ADQA checks.

Good (Green)

A system test was completed with no failures reported.

Caution (Yellow)

Check—At least one of the system tests have one or more failures.
Message—System Test: One or more system test sets have at least one test that failed.

Check—PT3 test failed to report a lag 3 or greater correlation less than 15% of lag 0.
Message—System Test: One or more PT3 tests in the system test indicate potential EMI

Warning (Red)

Check—There is no system test.
Message—SYSTEM TEST: No system test.

Check—All system tests have at least one failure.
Message—SYSTEM TEST: All system test sets have at least one test that failed.

8. Compass / P / R

The Compass / P / R button will open the following window, which allows evaluation of the heading, pitch, and roll and adjustments to the magnetic variation and heading offset.
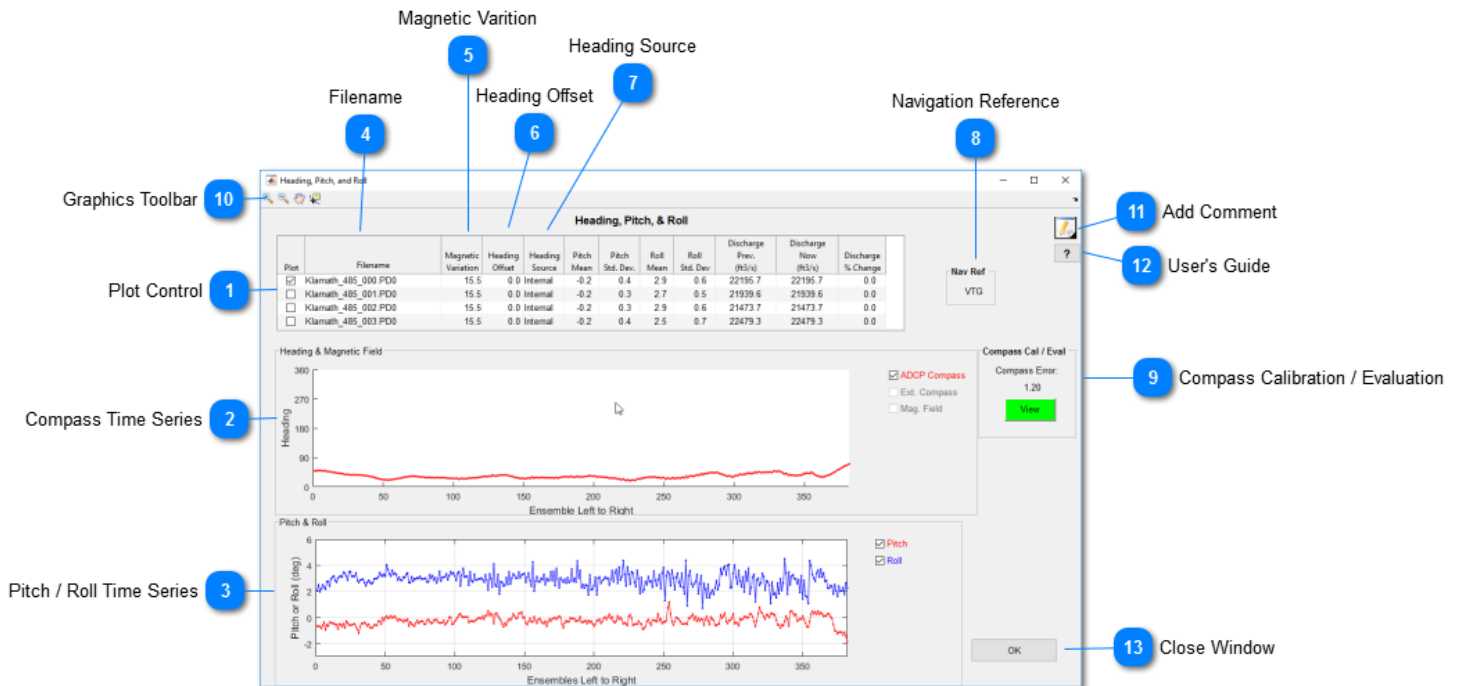
Plot Control

The time series for multiple transects can be overlayed on the compass and pitch / roll time series graphs by checking multiple transects. The transects are NOT identified by different line types or colors in the graphs as the colors are used to identify the type of data. NOTE: All data are plotted by ensemble number from left to right.
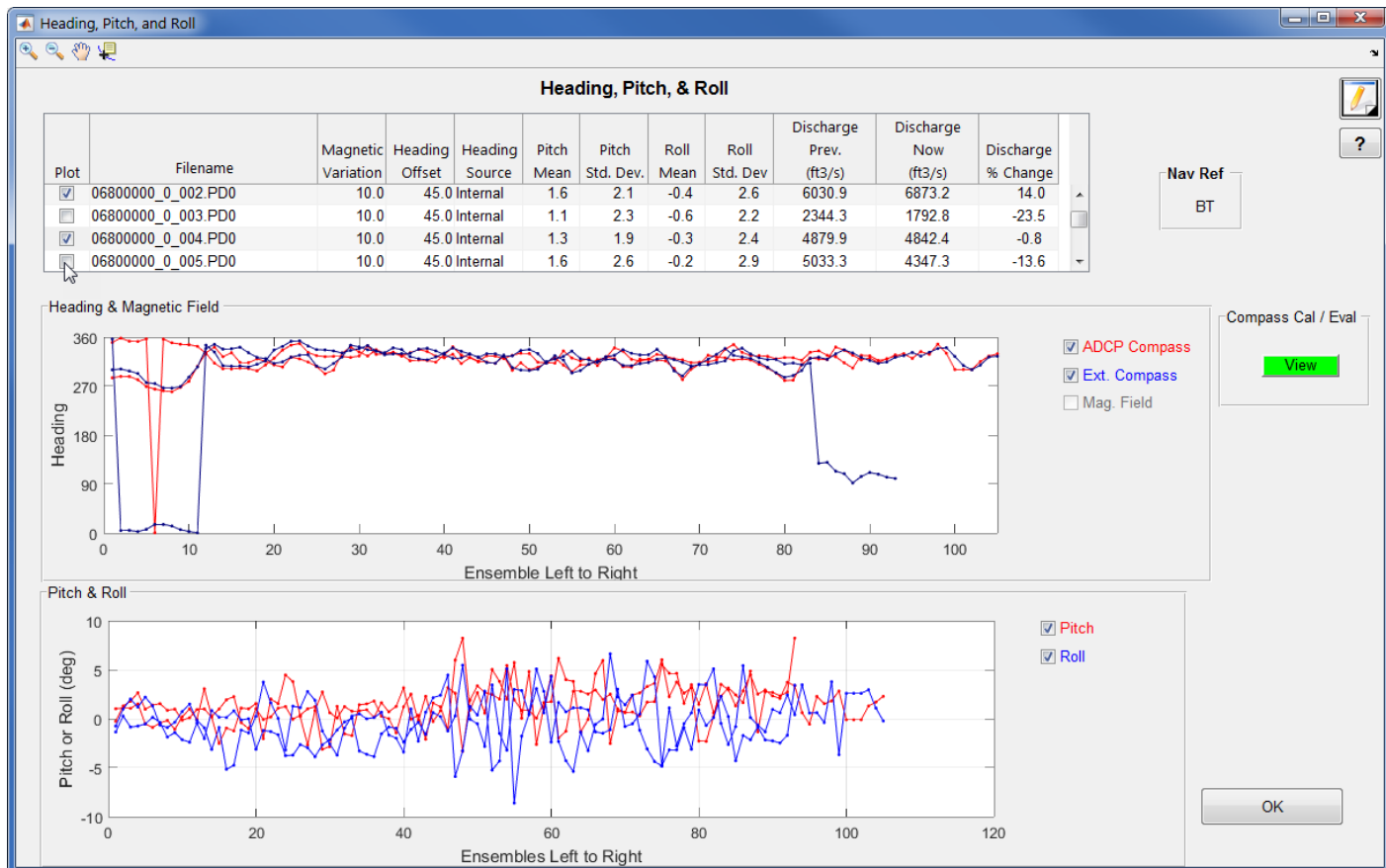
2 Compass Time Series
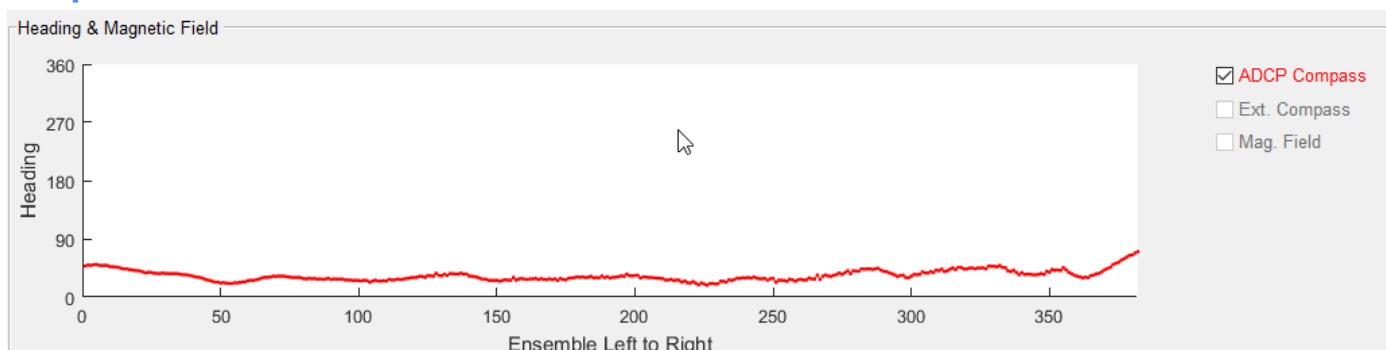
The compass time series displays the compass heading from either the internal compass or an external compass or both. For RiverSurveyors the change in magnetic field strength compared to the magnetic field strength during calibration can also be shown and will have its scale along the right axis. The dashed line is the threshold at which the effect of the change on heading should be carefully evaluated. The user can check or uncheck the data types available to change which data types are displayed. Data are always displayed by ensemble from left to right.
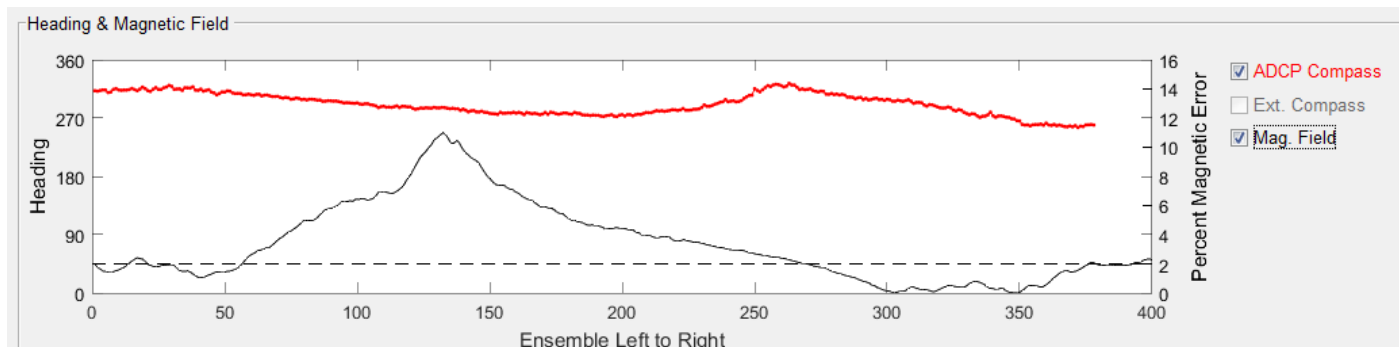
Pitch / Roll Time Series
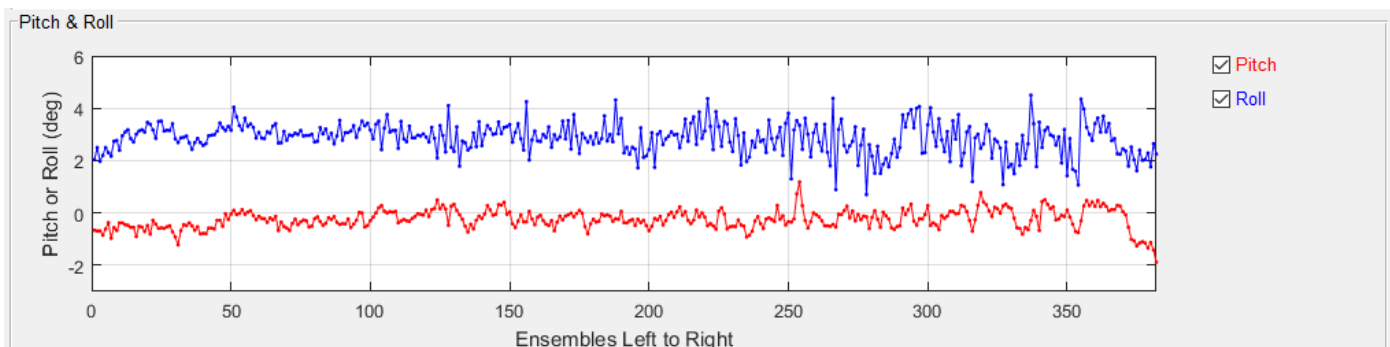
The pitch / roll time series displays the pitch and roll from the internal sensors. Data are always displayed by ensemble from left to right. If data are from a RiverSurveyor with a G3 compass the pitch and roll limits of the compass calibration will be displayed as dashed lines.
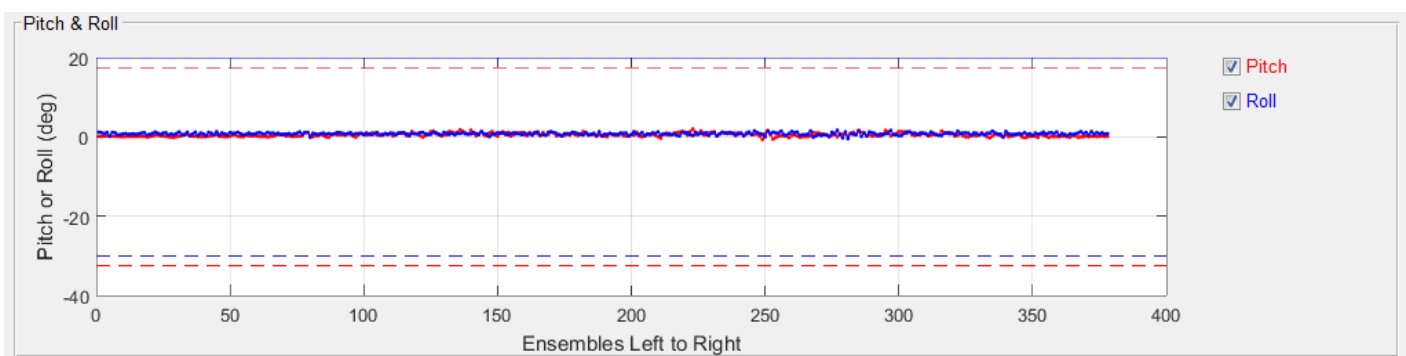
Filename

Filename
Klamath_485_000.PD0
Klamath_485_001.PD0
Klamath_485_002.PD0
Klamath_485_003.PD0

Clicking in the table on one of the filenames will clear the graphs and plot only that transect.

Magnetic Varition

Magnetic Variation
15.5
15.5
15.5
15.5

Clicking in the table on one of the values of magnetic variation will open a dialog to allow changing the magnetic variation. The change can be applied to all transects or only the selected transect.
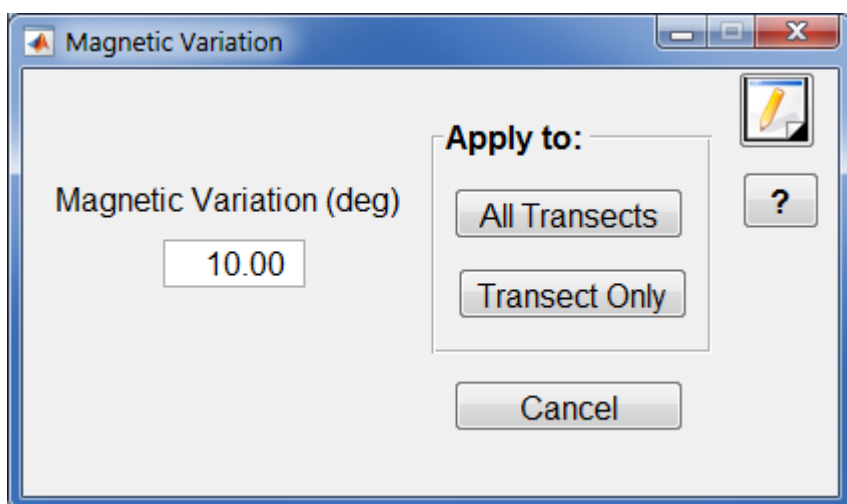
*NOTE: The magnetic variation is only applied to the internal heading.*
If the heading source is set to external and the magnetic variation dialog opened a warning will be displayed.
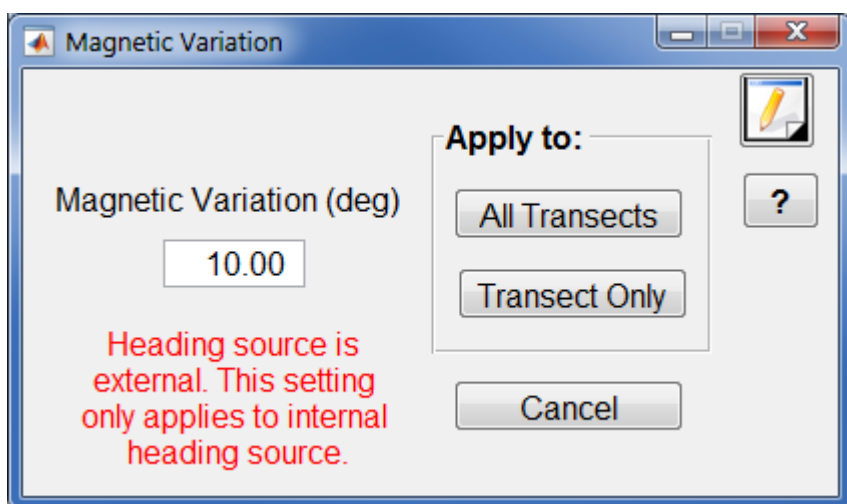

6 Heading Offset

Heading Offset
0.0
0.0
0.0
0.0

Clicking in the table on one of the values of heading offset will open a dialog to allow changing the heading offset. The change can be applied to all transects or only the selected transect.
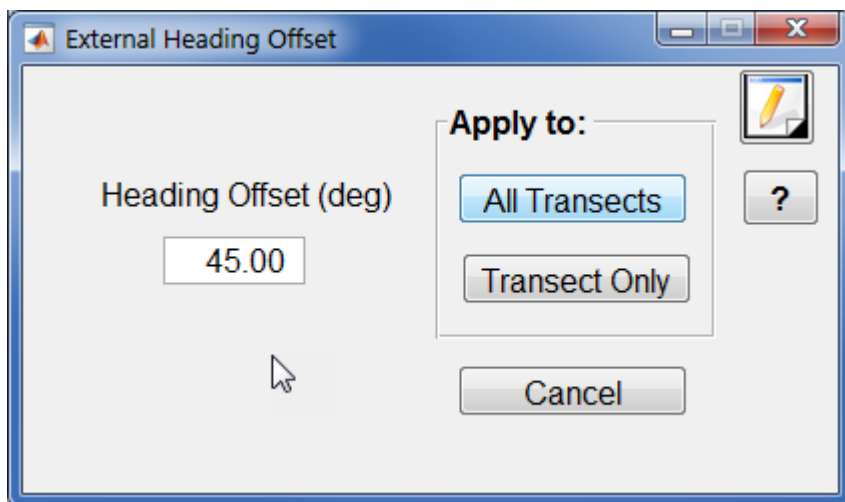
NOTE: The heading offset is only applied to the external heading.
If the heading source is set to internal and the heading offset dialog opened a warning will be displayed.
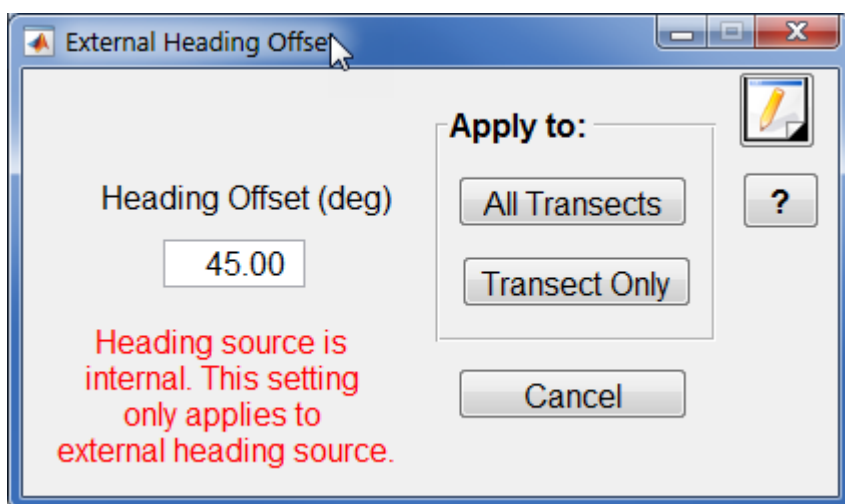
7 Heading Source

Clicking in the table on one of the rows below Heading Source will open a dialog to allow changing the heading source, if external heading data are available. The change can be applied to all transects or only the selected transect.
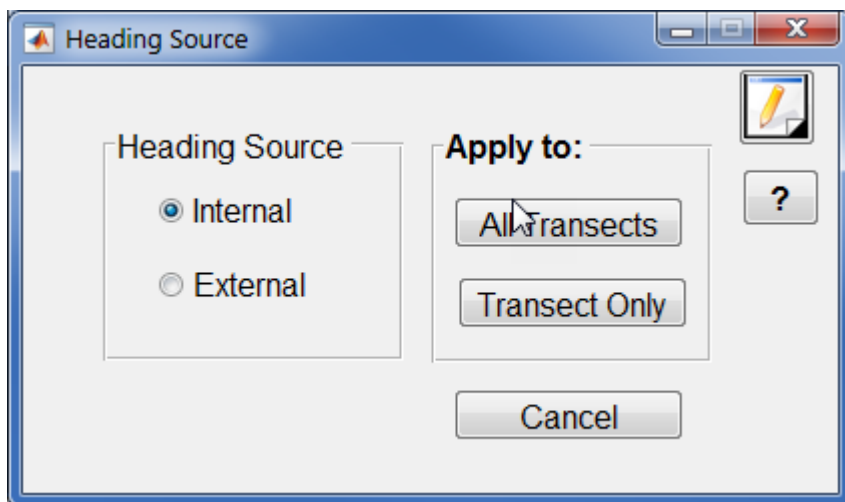
8. Navigation Reference
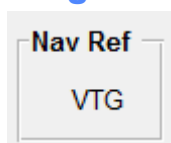
The Nav Ref panel that shows the current navigation or boat velocity reference. If this reference is not BT, then changes to the BT filters will not change the discharge.

9. Compass Calibration / Evaluation
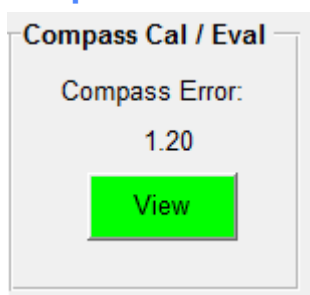
Displays the result of the compass evaluation for TRDI ADCPs and the compass calibration for SonTek ADCPs. N/A is displayed if there is no compass evaluation for TRDI ADCPs. N/A is also displayed for SonTek ADCPs if there is no calibration or the calibration is for an older G2 compass or older firmware for a G3 compass. The View button opens a window displaying the results of the compass calibration and/or evaluation. For more details see Compass Calibration / Evaluation.

10. Graphics Toolbar

Allows user to zoom, pan, and query the graphs. For more information see Toolbar.

11. Add Comment

Allows user to add a comment. For more details see Comment Button.
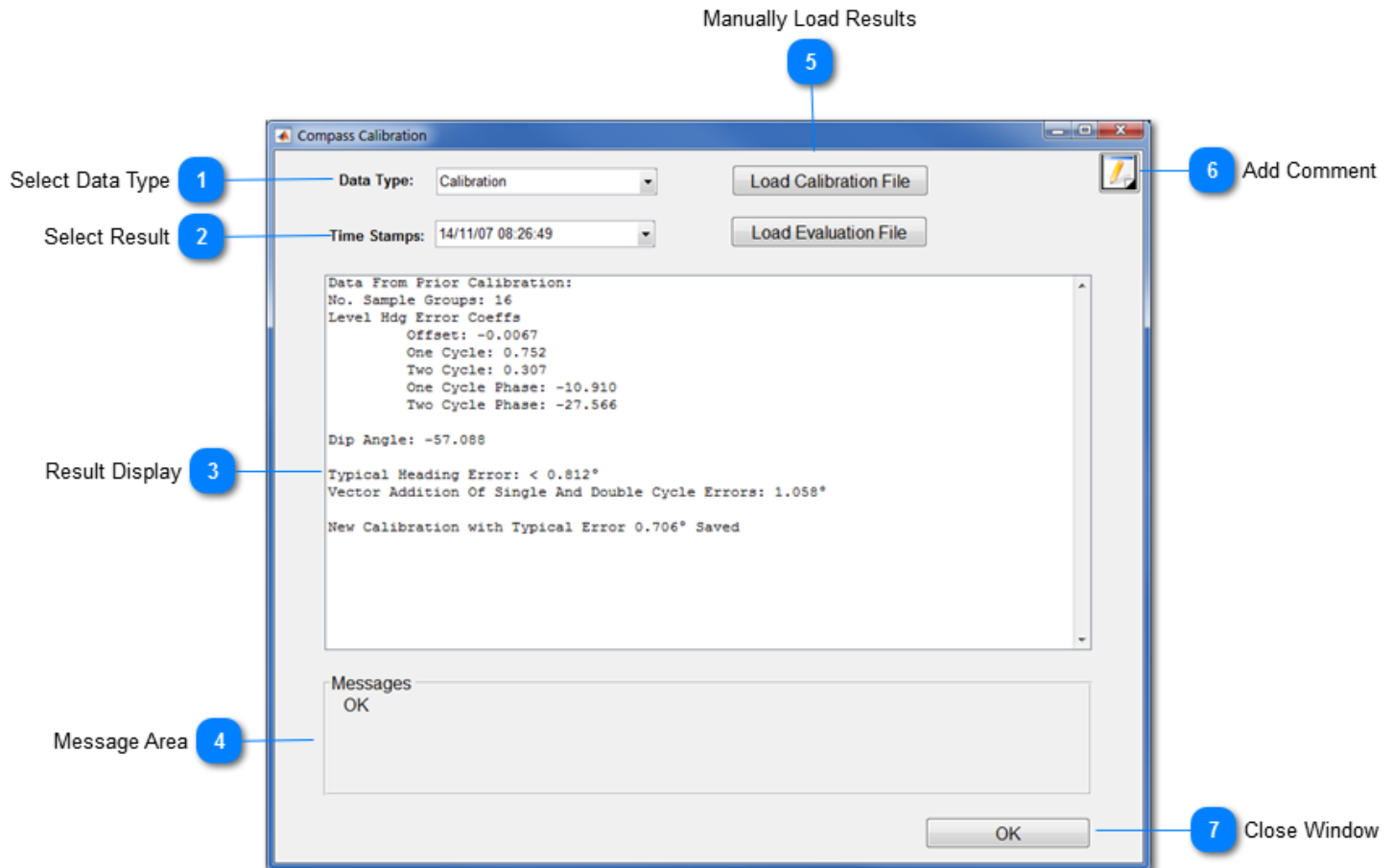
12 User's Guide

?

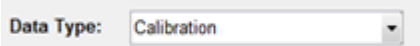Opens this user's guide.

13 Close Window

OK
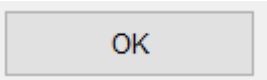
Closes the window and returns control to the main window.

8.1. Compass Calibration / Evaluation

The View button in the Compass Cal/Eval panel of the Heading, Pitch, and Roll window opens a window that allows the user to review compass calibrations and evaluations that were collected with the measurement. Compass calibrations and evaluations stored in the *.mmt file for WR2 or compass calibrations stored in the CompassCal folder for RSL measurements will be loaded automatically.
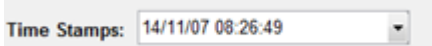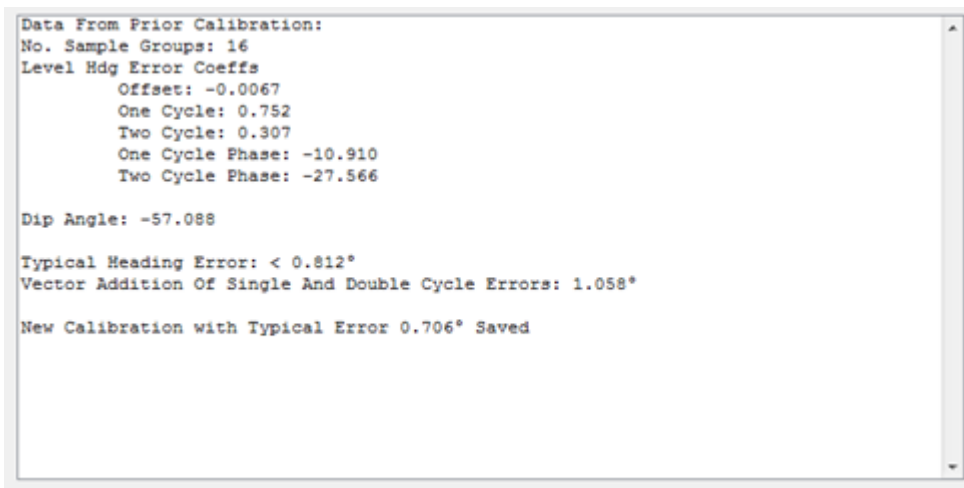
Manually Load Results

5

Select Data Type **1**

Compass Calibration

Data Type: Calibration

Load Calibration File

6 Add Comment

Select Result **2**

Time Stamps: 14/11/07 08:26:49

Load Evaluation File

```
Data From Prior Calibration:
No. Sample Groups: 16
Level Hdg Error Coeffs
        Offset: -0.0067
        One Cycle: 0.752
        Two Cycle: 0.307
        One Cycle Phase: -10.910
        Two Cycle Phase: -27.566

Dip Angle: -57.088

Typical Heading Error: < 0.812°
Vector Addition Of Single And Double Cycle Errors: 1.058°

New Calibration with Typical Error 0.706° Saved
```

Result Display **3**

Messages
  OK

Message Area **4**

OK

7 Close Window

1 **Select Data Type**

Data Type: Calibration

Drop down menu allows the user to display calibration or evaluation results.

**2** **Select Result**

Time Stamps: 14/11/07 08:26:49

Multiple calibrations and evaluations can be loaded and will be identified by date and time, if loaded automatically, or by filename, if loaded manually. This drop down allows the user to select which results to view.

3 **Result Display**

```
Data From Prior Calibration:
No. Sample Groups: 16
Level Hdg Error Coeffs
         Offset: -0.0067
         One Cycle: 0.752
         Two Cycle: 0.307
         One Cycle Phase: -10.910
         Two Cycle Phase: -27.566

Dip Angle: -57.088

Typical Heading Error: < 0.812°
Vector Addition Of Single And Double Cycle Errors: 1.058°

New Calibration with Typical Error 0.706° Saved
```

The results selected are displayed for user review. The scrollbar on the right can be used if the results are longer than the window size. QRev does not currently evaluation the quality of the calibration or evaluation.

4 Message Area

```
Messages
  OK
```
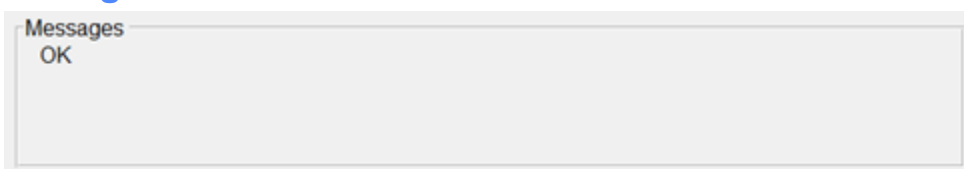
Area for future messages.

5 Manually Load Results

Load Calibration File

Load Evaluation File
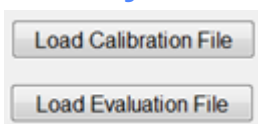
If a compass calibration or evaluation is stored in a text file in another folder, the user can manually load the file using the Load Calibration File or Load Evaluation File buttons.

6 Add Comment

Allows the user to add a comment. For more information see Comment Button.

7 Close Window

OK
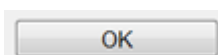
Close the window and return control to the Heading, Pitch, & Roll window.

8.2. Measurement Quality Checks

The Compass button may be colored or inactive based on the following ADQA checks.

Inactive

Check—The data loaded does not have valid heading data, such as from a StreamPro with no compass.

Good (Green)

Check—A compass calibration and evaluation were completed OR the ADCP has a compass that was not calibrated but calibration is not required because neither a loop test nor the Global Position System (GPS) are used.
Check—Pitch and Roll passed all QA thresholds.

Caution (Yellow)

Check—GPS data or the loop test is present, a compass calibration was completed but there is no compass evaluation.
Message—Compass: No compass evaluation.

Check—Magnetic variation is not consistent for all transects.
Message—Compass: Magnetic variation is not consistent among transects.

Check—Mean pitch for transect > 4 degrees.
Message—Pitch: One or more transects have a mean pitch > 4 deg

Check—Mean roll for transect > 4 degrees.
Message—Roll: One or more transects have a mean roll > 4 deg

Check—Standard deviation of pitch for transect > 5 degrees.
Message—Pitch: One or more transects have a pitch std dev > 5 deg

Check—Standard deviation of roll for transect > 5 degrees.
Message—Roll: One or more transects have a roll std dev > 5 deg

Check—Pitch within compass calibration limits (SonTek G3 compass only)
Message—Compass: One or more transects have pitch exceeding calibration limits

Check—Pitch within compass calibration limits (SonTek G3 compass only)
Message—Compass: One or more transects have pitch exceeding calibration limits

Check—Roll within compass calibration limits (SonTek G3 compass only)
Message—Compass: One or more transects have roll exceeding calibration limits

Check—Change in magnetic field strength compared to calibration exceeds 2% (SonTek G3 compass only)
Message—Compass: One or more transects have a change in magnetic field exceeding 2%

Warning (Red)

Check—GPS data or the loop test is present and there is no compass calibration.

Message—COMPASS: No compass calibration.

Check—GPS data are recorded and the magnetic variation is zero.
Message—COMPASS: Magnetic variation is zero and GPS data are present.

Check—Mean pitch for transect > 8 degrees.
Message—PITCH: One or more transects have a mean pitch > 8 deg

Check—Mean roll for transect > 8 degrees.
Message—ROLL: One or more transects have a mean roll > 8 deg

9. Temp / Salinity

The Temp / Salinity button opens a window that allows the user to evaluate the performance of the ADCP's thermister and to make changes to the temperature, salinity, and speed of sound.
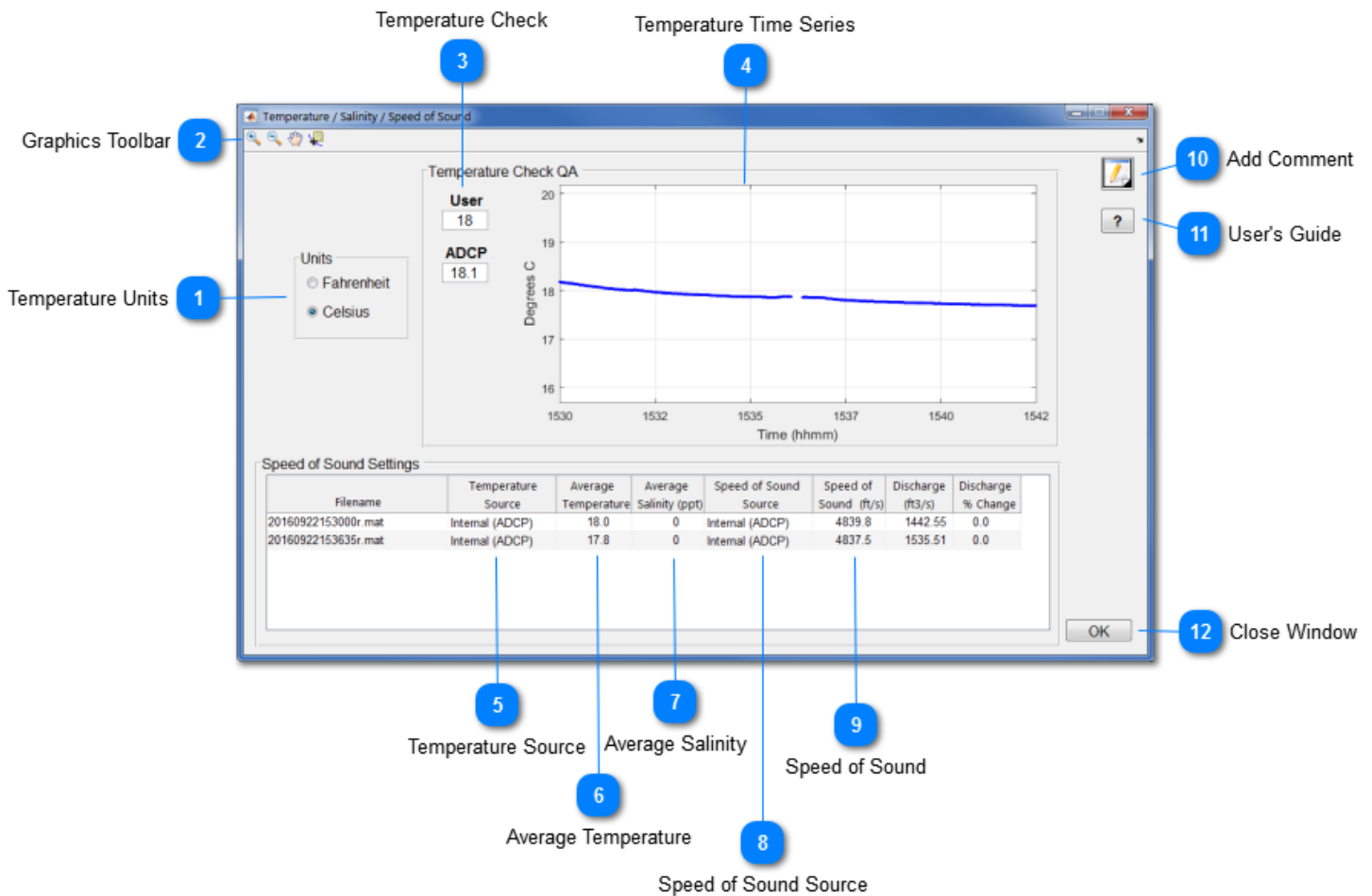
Temperature Units

The Units panel at the top left allows the user to change the temperature units. Celsius is the default.

Graphics Toolbar

Allows user to zoom, pan, and query the graphs. For more information see Toolbar.

Temperature Check

User

| 18 |

ADCP

| 18.1 |

This is where the user can enter the temperature check information collected before the measurement. The User temperature is a temperature measured using an independent temperature sensor, and the ADCP temperature is the temperature measured at the same time by the ADCP. In the absence of the ADCP temperature, the User temperature will be compared to the average temperature for the entire measurement.

4 Temperature Time Series
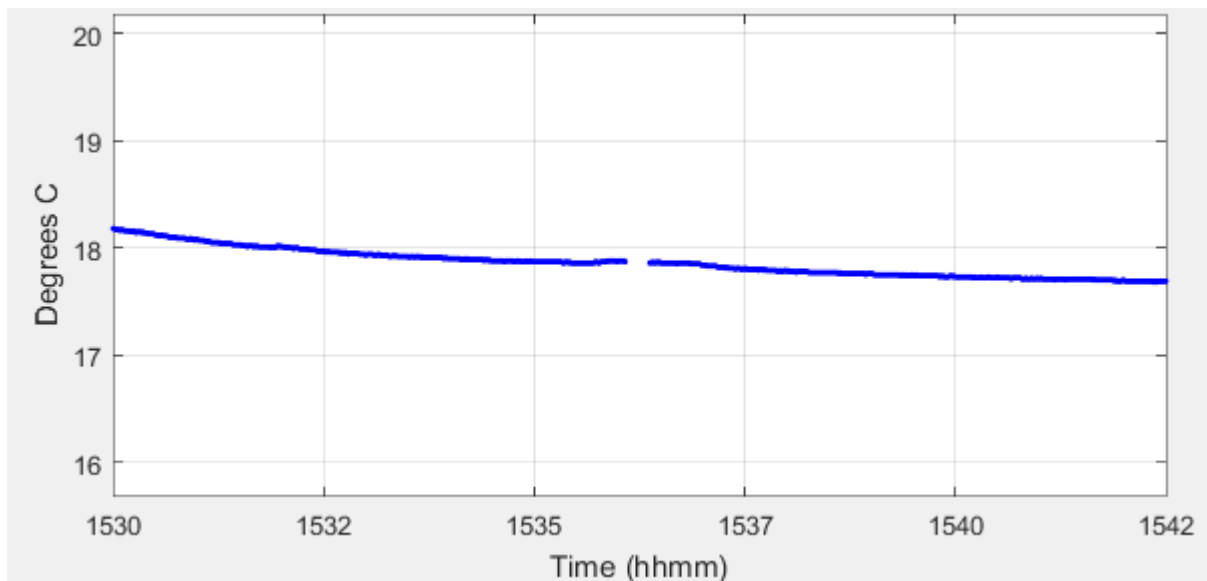
The temperature time series allows the review of a change in temperature during the measurement. A change in temperature could be due to the user failing to allow the ADCP to equilibrate to the water temperature or reflect a difference in water temperature from one side of the stream to the other.

5 Temperature Source

Temperature Source
Internal (ADCP)
Internal (ADCP)

Clicking on a row under temperature source allows the user to change the source of the tempature used to compute the speed of sound.
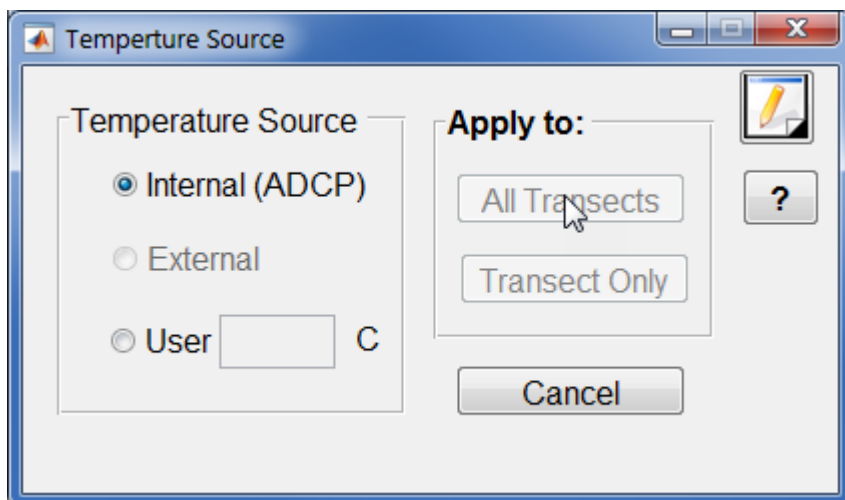
Notice that the Apply to buttons are not currently active. Since the original setting was internal no change has been made to apply. Selecting User will make the User edit box active.
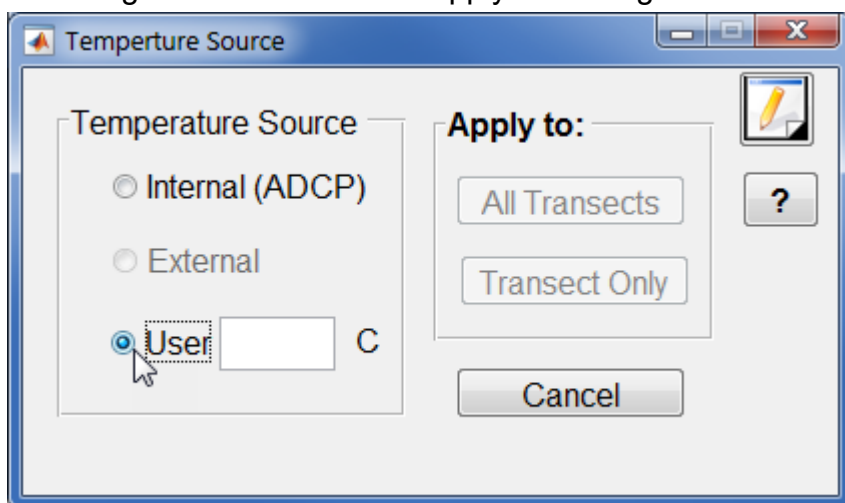
The Apply to buttons will not become active until a user temperature is entered and the enter key pressed.
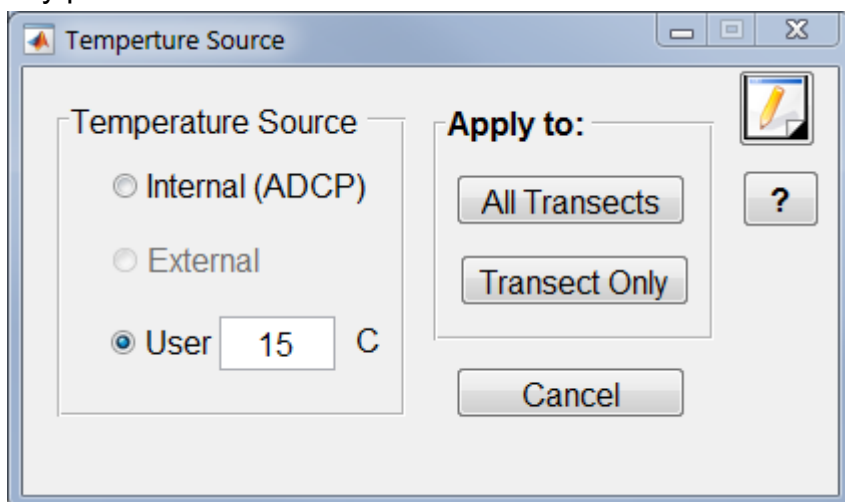

The user can then apply the change to the currently selected transect or to all transects.

## 6 Average Temperature

44

Average Temperature
18.0
17.8

The Average Temperature column displays the average temperature for the transect if the temperature source is Internal (ADCP) and clicking in a row of the column has not action. If the temperature source is User, this column displays the user entered temperature and clicking in a row of this column allows the user to change the User temperature or set the source back to Internal (ADCP).
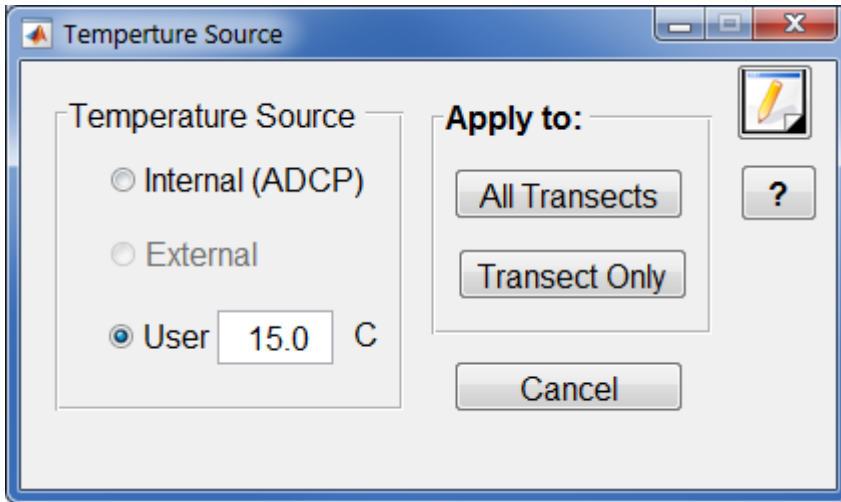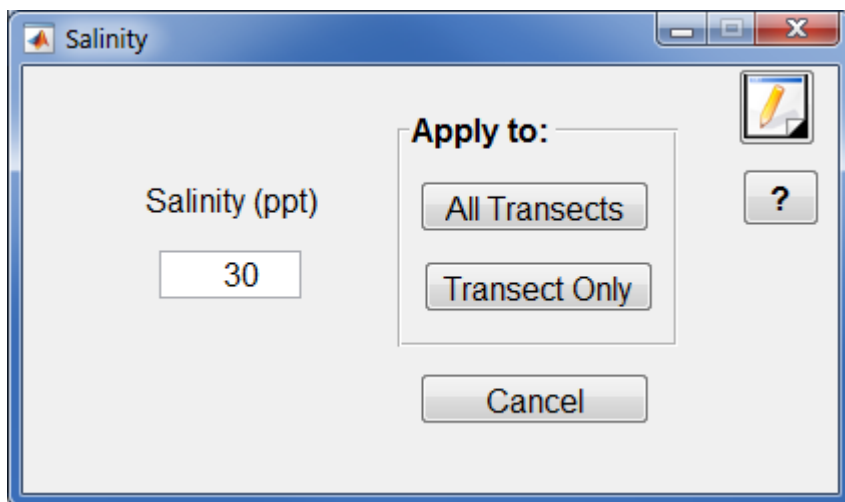

7 Average Salinity

Average Salinity (ppt)
0
0

The Average Salinity displays the user entered salinity. If this value was entered in the data collection software it is read into QRev. Clicking on a row under Average Salinity allows the user to change the salinity.
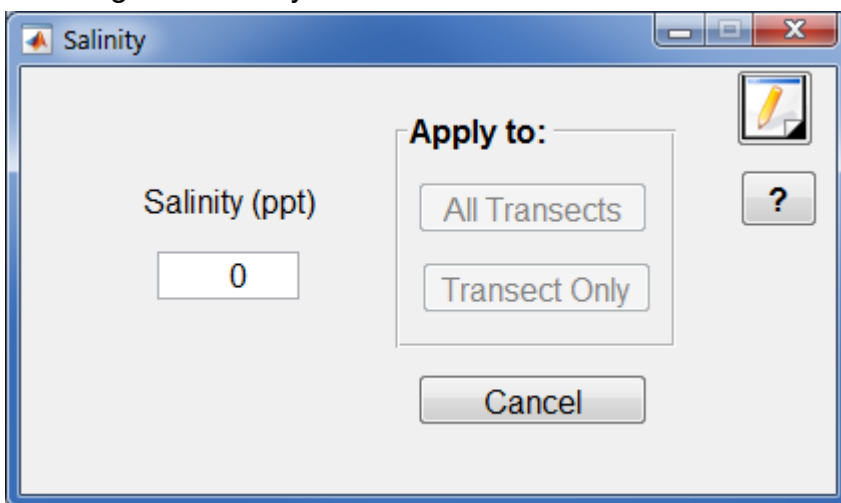
The Apply to buttons are inactive until a salinity has been entered and the enter key pressed.
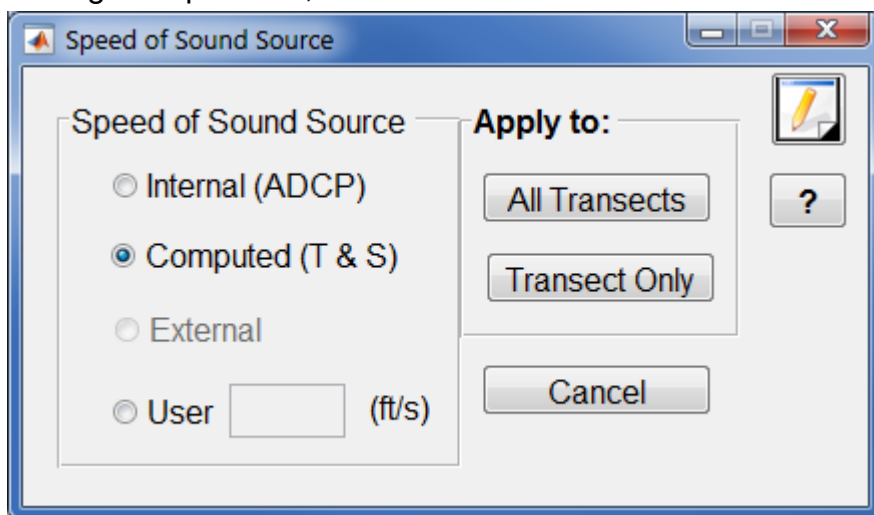
8 Speed of Sound Source

The Speed of Sound source can be changed by the User directly and is automatically changed if the user enters a temperature or salinity.

- **Internal (ADCP)**—Speed of sound computed for each ensemble internally in the ADCP and used in the raw data.
- **Manual**—A manually entered speed of sound that will be used for all ensembles in the transect.
- **Computed**—The speed of sound is computed by QRev based on user provided salinity or average temperature, or both.

9 Speed of Sound

Speed of Sound (ft/s)
4839.8
4837.5

The Speed of Sound column displays the average speed of sound used for the transect.Clicking on a row in the Speed of Sound column will result in no action. To manually change the speed of sound click a row in the speed of sound source column.
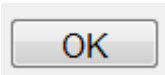
10 Add Comment

Allows the user to add a comment. For more information see Comment Button.

11 User's Guide

?

Opens this user's guide.

12 Close Window

OK

Closes the window and returns control to the main window.

Measurement Quality Checks

The Temp / Salinity button may be colored and messages provided based on the following ADQA checks.

Good (Green)

Check—Difference between the user recorded independent temperature reading and either the mean ADCP temperature for the measurement or a user recorded ADCP temperature is less than 2 degrees Celsius.

Caution (Yellow)

Check—Temperature range for the entire measurement exceeds 1 degree Celsius.
Message—Temperature: Temperature range is xx degrees Celsius, which is greater than 1 degree Celsius.

Check—There is no independent user measured temperature recorded.
Message—Temperature: No independent temperature reading.

Warning (Red)

Check—Temperature range for the entire measurement exceeds 2 degrees Celsius.
Message—TEMPERATURE: Temperature range is xx degrees Celsius, which is greater than 2 degrees Celsius.

Check—Difference between the user recorded independent temperature reading and user recorded ADCP temperature is 2 degrees Celsius or greater.
*Message*—TEMPERATURE: The difference between the ADCP and independent temperatures is: xx degrees Celsius, which is not within 2 degrees Celsius.

Check—Difference between the user recorded independent temperature reading and average ADCP temperature is 2 degrees Celsius or greater.
Message—TEMPERATURE: The difference between the ADCP and independent temperatures is: xx degrees Celsius, which is not less than 2 degrees Celsius.

10. Moving-bed Test

The Moving-bed Test button opens a window that allows the user to review moving-bed test results, mark tests invalid, and decide if any of the moving-bed tests should be used to correct the measured discharge.
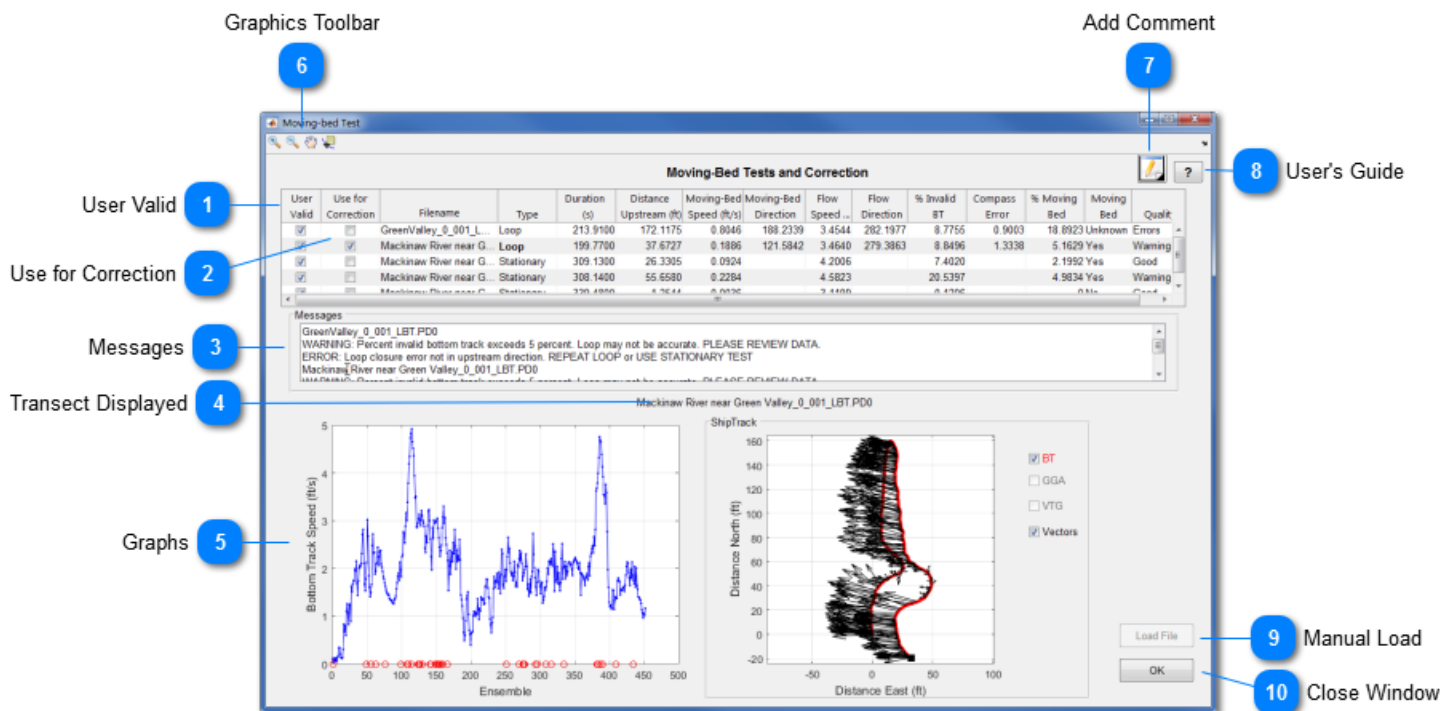
When the Moving-bed Test window is first opened, the first file automatically selected as the primary moving-bed test is the file displayed in the graphs at the bottom of the window. To display a different file, click in the table on the filename to be displayed. The filename of the moving-bed test displayed is shown immediately above the graphs. The graphs at the bottom change depending on whether the displayed test is a loop test or a stationary test.

Definition of Table Columns

• **Filename**—The filename containing the moving-bed test.
• **Type**—The type of test (Loop or Stationary). NOTE: The test automatically selected for determining if there is a moving-bed and/or correcting for it are in bold. For details see the section Automatic Test Selection.
• **Duration**—The duration of the test in seconds.
• **Distance Upstream**—The distance the test showed the boat moved upstream from its starting location. This distance is the closure error for a loop test.
• **Moving-Bed Speed**—The computed speed of the bed (Distance Upstream/Duration).
• **Moving-Bed Direction**—The direction (azimuth) the boat moved relative to its starting location. For a moving-bed condition, this value should be approximately 180 degrees from the flow direction. This value is only computed for the loop moving-bed test.
• **Flow Speed**—The magnitude of the average water velocity vector for all data in the test.
• **Flow Direction**—The direction (azimuth) of the average water velocity vector for all data in the test. This value is only computed for the loop moving-bed test.
• **% Invalid BT**—The percentage of ensembles that have invalid bottom track data.
• **Compass Error**—The difference in the flow direction between the outgoing and returning portions of the loop moving-bed test.
• **% Moving Bed**—The ratio of the moving-bed speed to flow speed expressed as a percentage.

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• **Moving Bed**—Using the criteria for a moving-bed condition documented in Mueller and others (2013), QRev determines if a moving-bed condition exists. If the quality of the moving-bed test results in errors, this field is set to Unknown because the moving-bed test is unreliable.

• **Quality**—QRev completes a quality assessment of every moving-bed test. Based on criteria documented in Mueller (2016), the quality of the measurement is set to Good if all the quality checks pass, to Warnings if some quality checks fail but are not critical failures, or to Errors if critical errors in the moving-bed test are identified.

① **User Valid**

The User Valid column lets the user identify tests that the user considers valid moving-bed tests. QRev assumes that all loaded tests are valid tests; for example, tests that were completed using proper technique. If a test is not valid because of an aborted test or because of something that happened during the test that indicates the test should not be used, the user should uncheck that test. Unchecking the User Valid column tells QRev that this test should not be used to determine if a moving-bed condition exists or to correct the discharge.

② **Use for Correction**

The Use for Correction column identifies the test or test(s) that will be used to correct the discharge for a moving-bed condition. If bottom track is the navigation reference and a moving bed exists, QRev will automatically select the moving-bed test to use to correct the final discharge; however, the user can override the selection by checking or unchecking the tests. If the user selects to use a moving-bed test that has Errors, the QRev will warn the user but allow the user to override the errors.
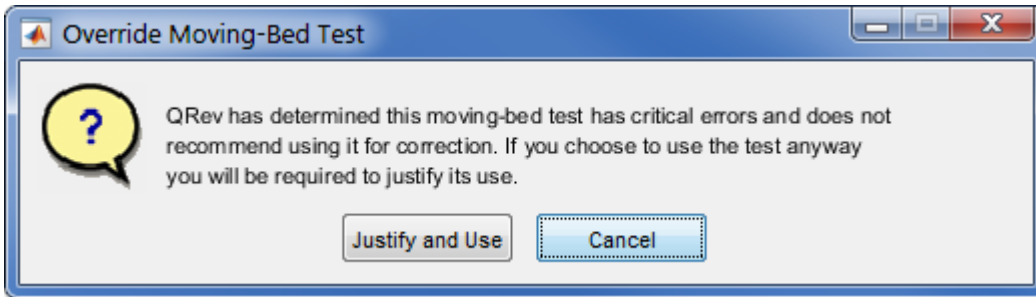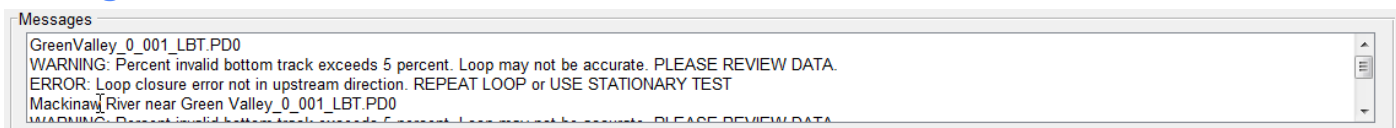
If the user chooses Justify and Use a comment must be entered.
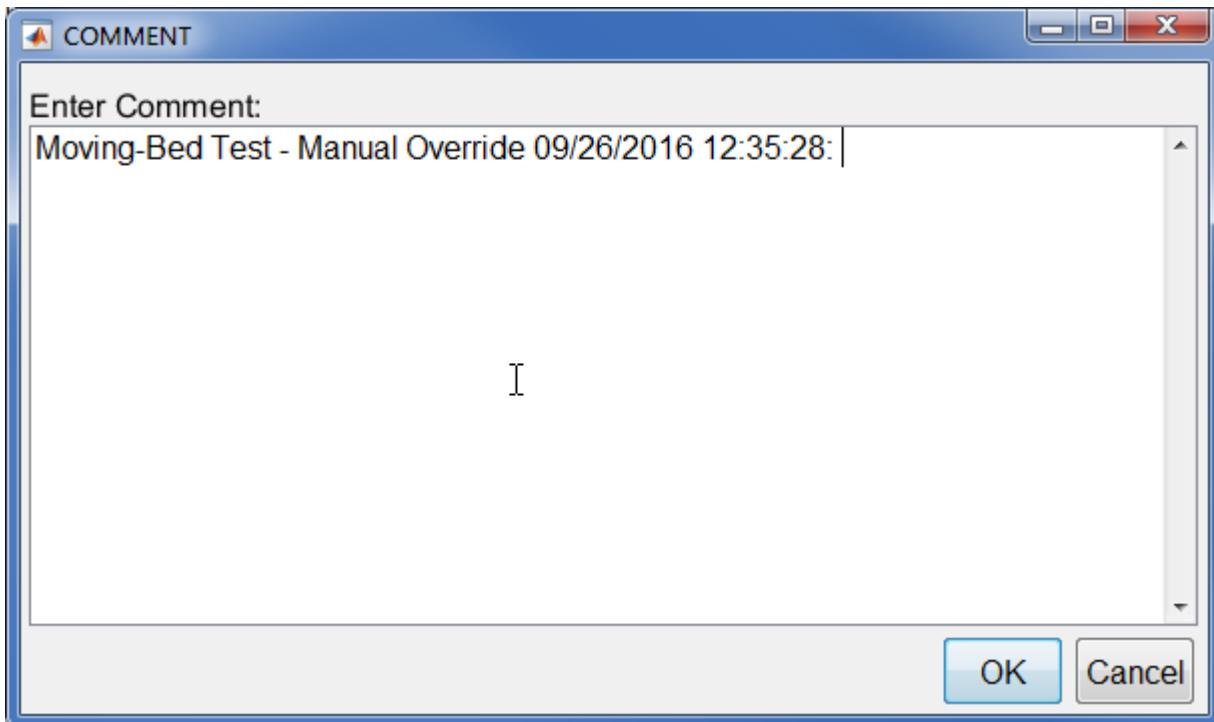
QRev does not permit the combined use of loop and stationary tests. No test can be checked or will be applied if a moving-bed condition does not exist or if GGA or VTG are the navigation reference.

③ Messages

The Messages panel lists the warning and error messages from the quality assessment for each moving-bed test. The scroll bar at the right can be used to scroll through the messages.

④ Transect Displayed

Mackinaw River near Green Valley_0_001_LBT.PD0

Identifies the transect shown in the graphic displays.

⑤ Graphs

The graphs displayed depend on whether the test displayed is a loop or stationary moving-bed test.

The two graphs for the loop moving-bed test are a time series of boat speed on the left and a ship track graph on the right. Red circles in the time series graphs identify ensembles with invalid bottom

track. Check boxes in the Ship Track panel for the loop moving-bed test can be used to control what data are displayed on the ship track.
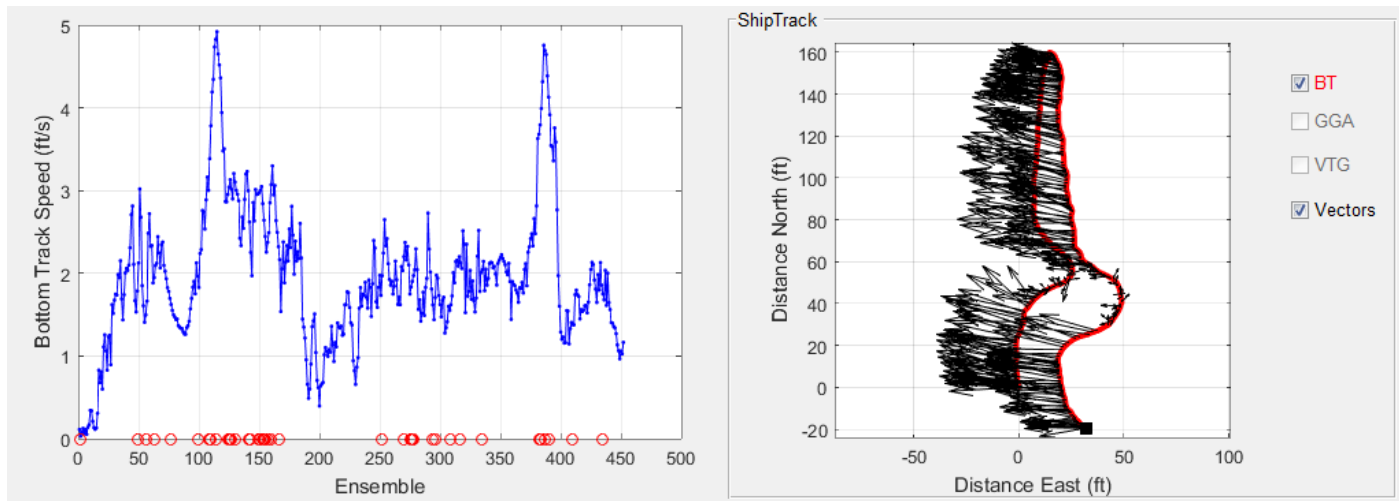
The two graphs for a stationary moving-bed test are a time series of the average moving-bed speed on the left and a ship track graph on the right. By the end of a stationary moving-bed test the average moving-bed speed should reach equilibrium, so the line in the left graph should be horizontal or oscillating slightly about a horizontal trend. Red circles in the time series graphs identify ensembles with invalid bottom track. The ship track is graphed so that the horizontal axis is the cross stream distance and the vertical axis is the upstream distance. All velocity vectors should be pointing down. A moving-bed condition would present itself as a ship track in the upstream direction.
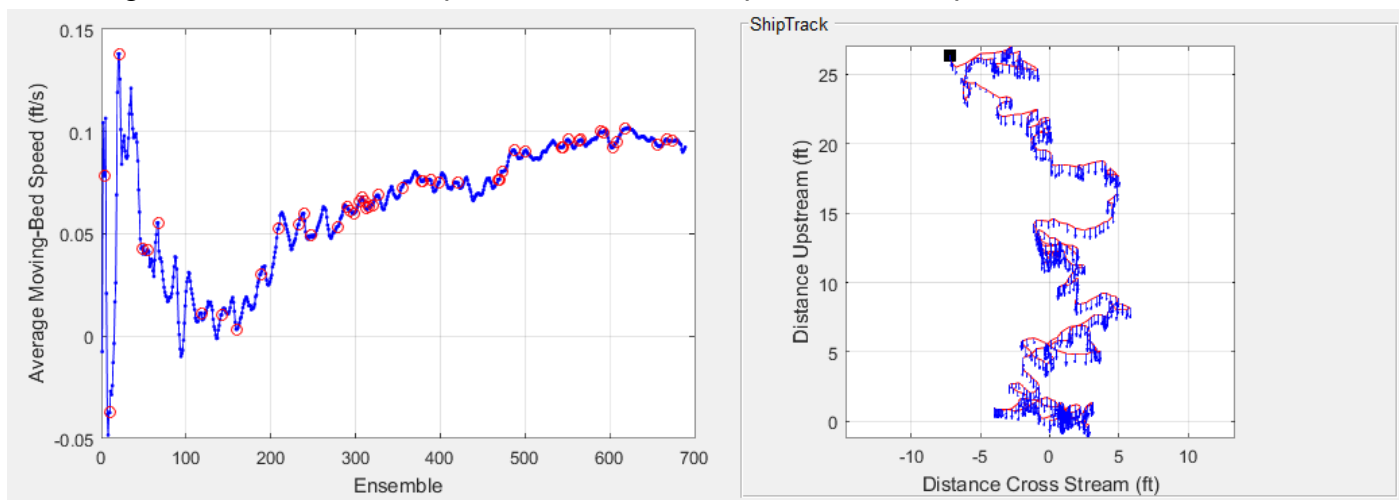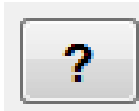

Graphics Toolbar

6

Allows user to zoom, pan, and query the graphs. For more information see Toolbar.

Add Comment

7

Allows the user to add a comment. For more information see Comment Button.
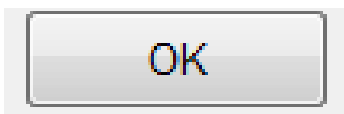
8 User's Guide

Opens this User's Guide

9 Manual Load

Currently inactive.

10 Close Window

Closes window and returns control to the main window.

10.1. Moving-Bed Test Quality Assessment

The quality assessment of moving-bed tests is completed in three steps as follows:

(1) a detailed step evaluates the actual moving-bed test based on specific criteria for loop or stationary tests;
(2) on the basis of the results of that detailed evaluation, QRev selects the moving-bed test(s) to use in determination of a moving-bed condition; and
(3) the ADQA is completed on the results of the selected moving-bed test and provides the color coded and textual feedback to the user in the main QRev window.

The detailed evaluation for loop tests uses that same criteria and algorithms used in LC (Mueller and others, 2013) and gives the loop moving-bed test a quality rating of good, warnings, or errors. The specific messages related to each loop moving-bed test are displayed in the Messages panel. For stationary tests QRev evaluates the quality of individual stationary moving-bed tests. The evaluation examines the percentage of ensembles with invalid bottom track velocities, examines the duration of the test, and determines if the test appears to have reached equilibrium (Mueller, 2016).

10.2. Automatic Test Selection

If more than one loop test or a loop test(s) and stationary test(s) are completed, QRev automatically determines which test(s) are used to determine if there is a moving-bed and to compute any required moving-bed corrections. If more than one valid loop test is present, then the last valid loop test is selected. If no valid loop tests are present, then all valid stationary tests are selected. If any of the selected tests indicate a moving bed, a moving-bed condition exists, and the selected test(s) is used to correct the bottom track referenced discharge.

10.3. Measurement Quality Checks

The ADQA uses the selected moving-bed test to set the Moving-bed Test button color and provide messages to the user.

Good (Green)

A valid moving-bed test was recorded and indicates no moving bed.

Caution (Yellow)

Check—Valid moving-bed test indicates a moving bed.
Message—Moving-Bed Test: A moving bed is present, use GPS or moving-bed correction.

Check—Moving-bed test completed but moving-bed test quality checks indicate warnings.
Message—Moving-Bed Test: The moving-bed test(s) has warnings, please check validity of tests.

Warning (Red)

Check—No moving-bed test recorded.
Message—MOVING-BED TEST: No moving-bed test.

Check—All loaded moving-bed tests have been marked invalid by the user.
Message—MOVING-BED TEST: No valid moving-bed test based on user input.

*Check*—Moving-bed test completed but moving-bed test quality check indicate the test has critical errors.
Message—MOVING-BED TEST: The moving-bed test(s) have critical errors and will not be used.

Check—A stationary moving-bed test indicates a moving bed, but GPS data are not present and less than three stationary moving-bed tests were recorded.
Message—MOVING-BED TEST: Less than 3 stationary tests available for moving-bed correction.

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.

Ship Track Graph
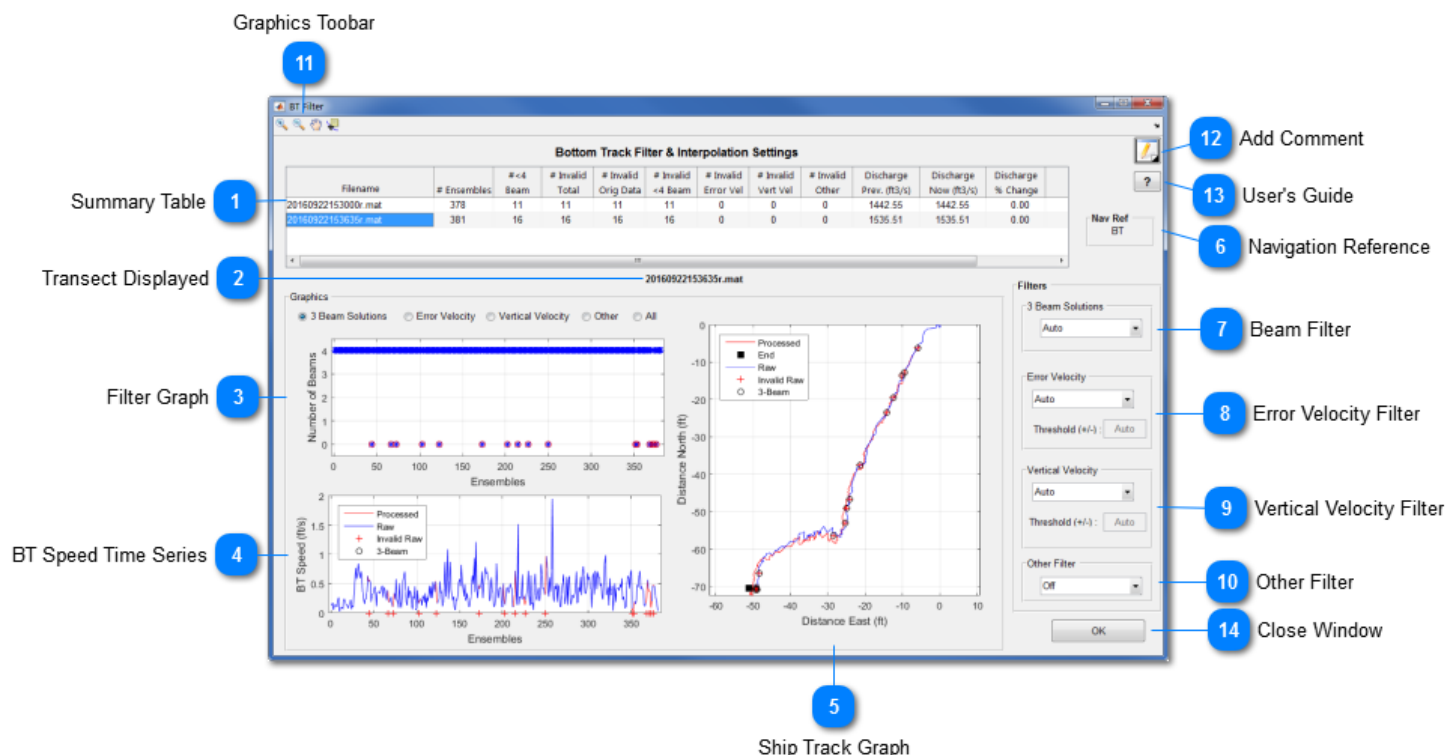
Summary Table

Filename	# Ensembles	#<4 Beam	# Invalid Total	# Invalid Orig Data	# Invalid <4 Beam	# Invalid Error Vel	# Invalid Vert Vel	# Invalid Other	Discharge Prev. (ft3/s)	Discharge Now (ft3/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

The table at the top of the window allows the user to select which transect to graph (by clicking on the desired row), provides information on the number of ensembles that have been determined to be invalid by the various filters, and shows the effect of a filter change on the computed discharge. Cells in the table contain color codes associated with cautions or warnings generated from the ADQA. This table does not have any editable cells. The columns in the table are as follows:

Filename—Filename of the transect.
 # Ensembles—Total number of ensembles in the transect.
 # <4 Beam—Number of ensembles that had valid bottom track but less than 4 valid beams.
 # Invalid Total—Number of ensembles with invalid bottom track velocity.
 # Invalid Orig Data—Number of ensembles that had invalid bottom track velocity prior to any filtering.
 # Invalid <4 Beam—Number of ensembles with valid bottom track but less than 4 beams for which the bottom track velocity has been determined to be invalid by the 3 Beam Solutions Filter.
 # Invalid Error Vel—Number of ensembles that have been determined to be invalid due to filtering based on the bottom track error velocity.
 # Invalid Vert Vel—Number of ensembles that have been determined to be invalid due to filtering based on the bottom track vertical velocity.

 # Invalid Other—Number of ensembles that have been determined to be invalid due to filtering using other filters.

Discharge Prev. —Total discharge prior to most recent filter change.

Discharge Now—Total discharge after applying the most recent filter change. If no filters have been changed, the discharge now will equal the discharge previous.

Discharge % Change—The percent difference between the discharge previous and the discharge now due to the last filter change.

2 Transect Displayed

20160922153635r.mat

Filename of transect displayed in graphs.

3 Filter Graph

The left portion of the Graphics panel is determined from the type of data graphed, which is selected by the user using the radio buttons at the top left of the Graphics panel. Invalid data are identified by red circles.
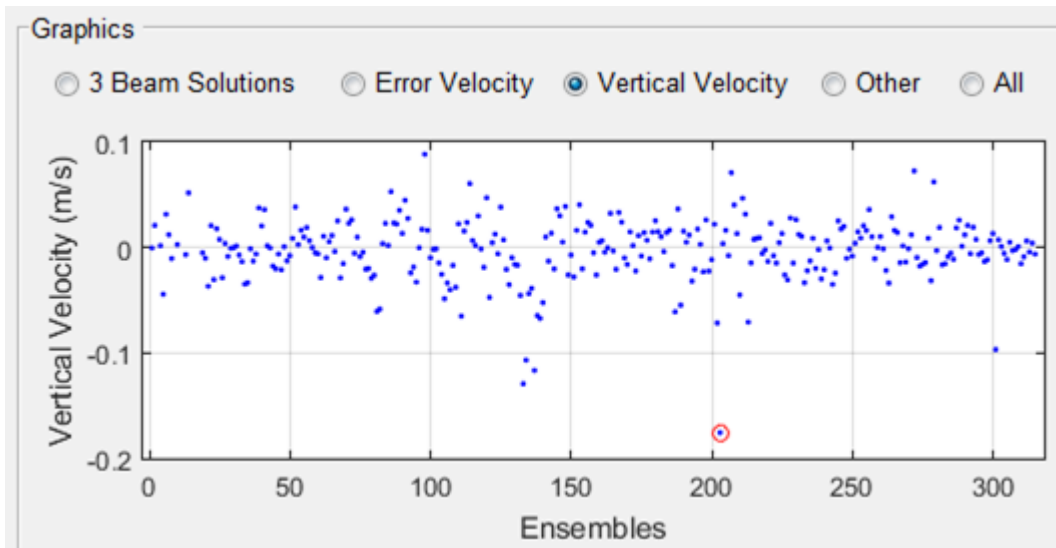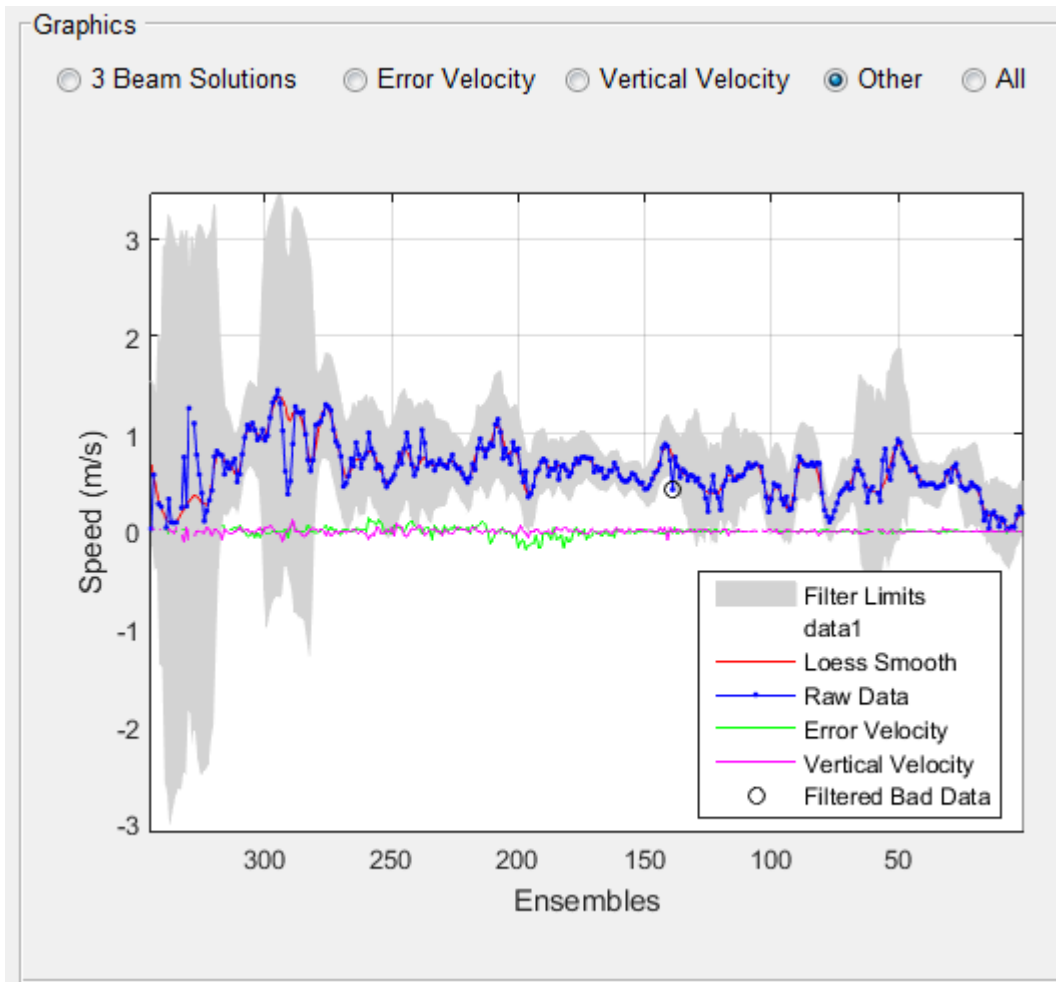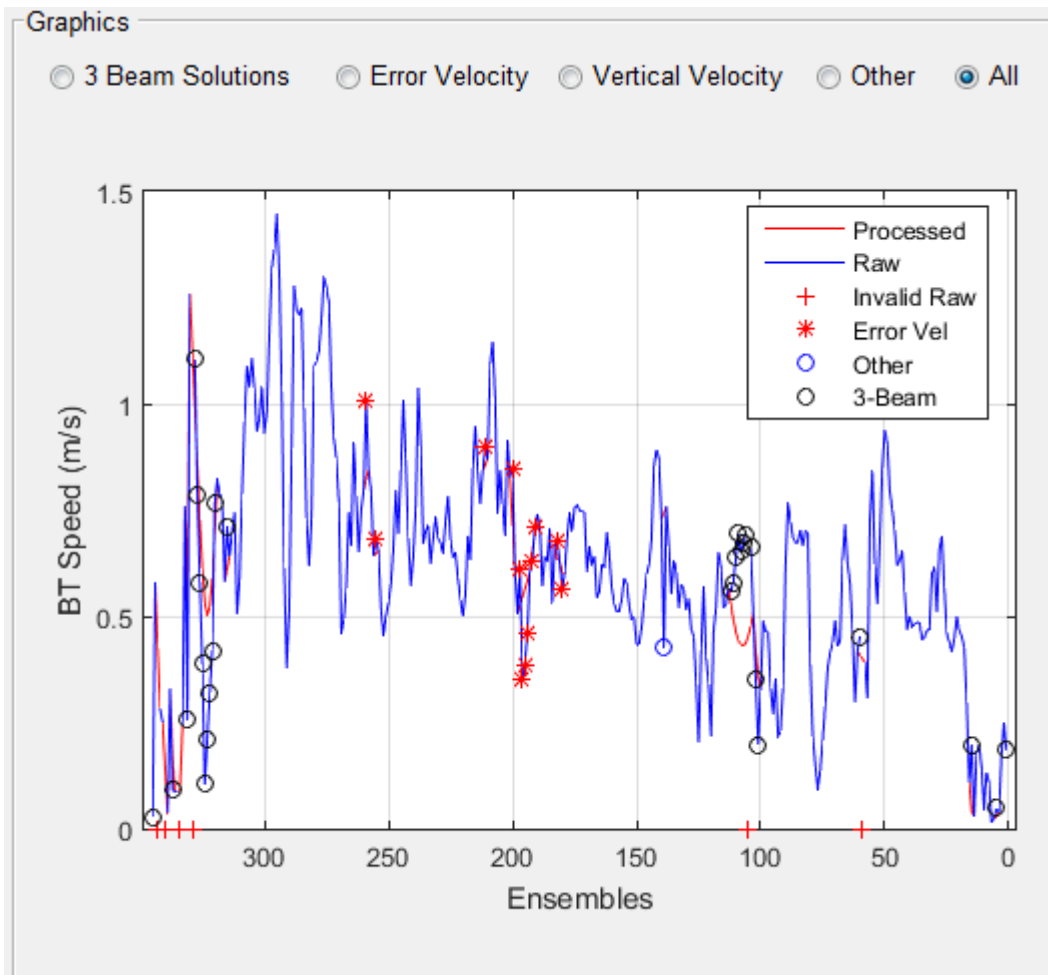
3 Beam Solutions
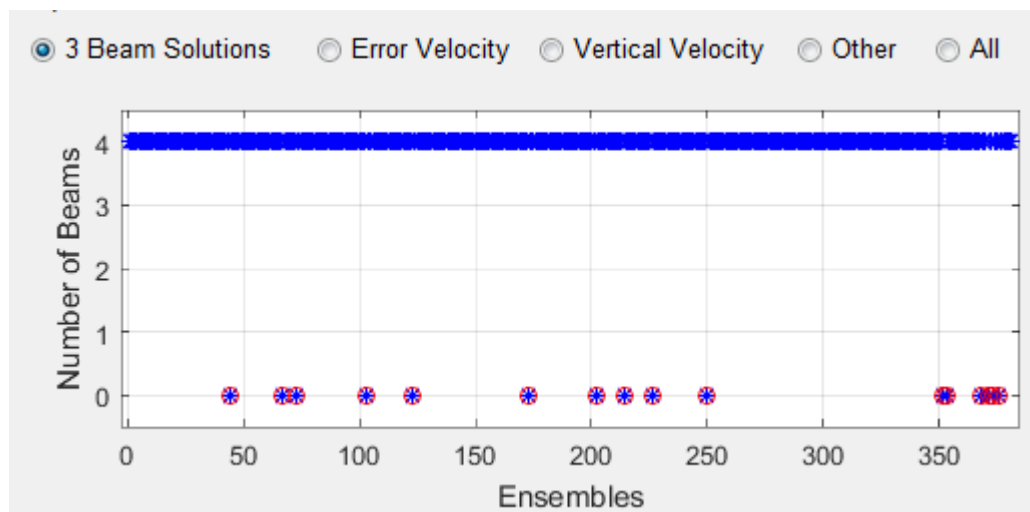
Error Velocity
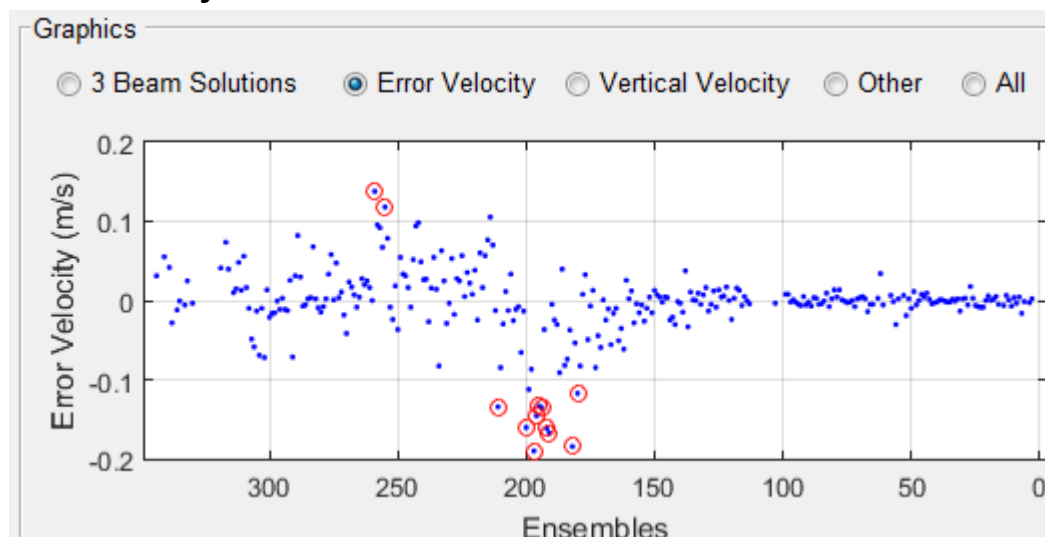
Vertical Velocity

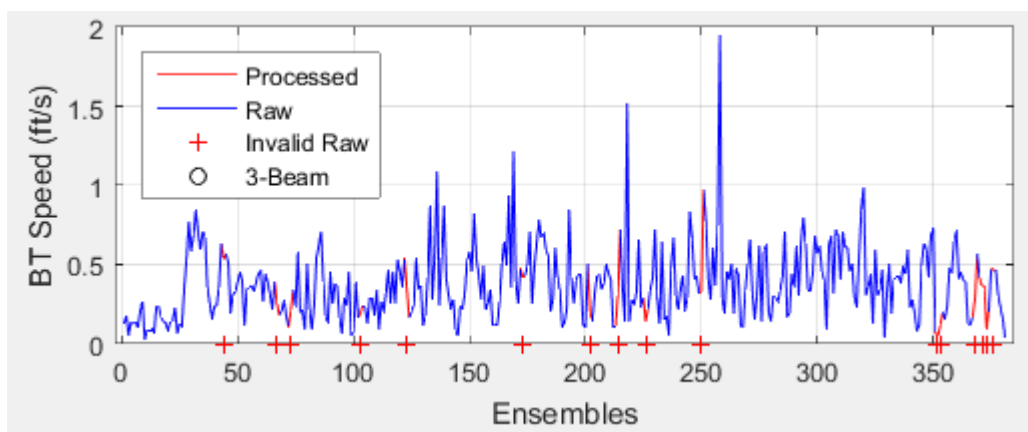**Other (only valid if the Other Filter is set to Smooth)**

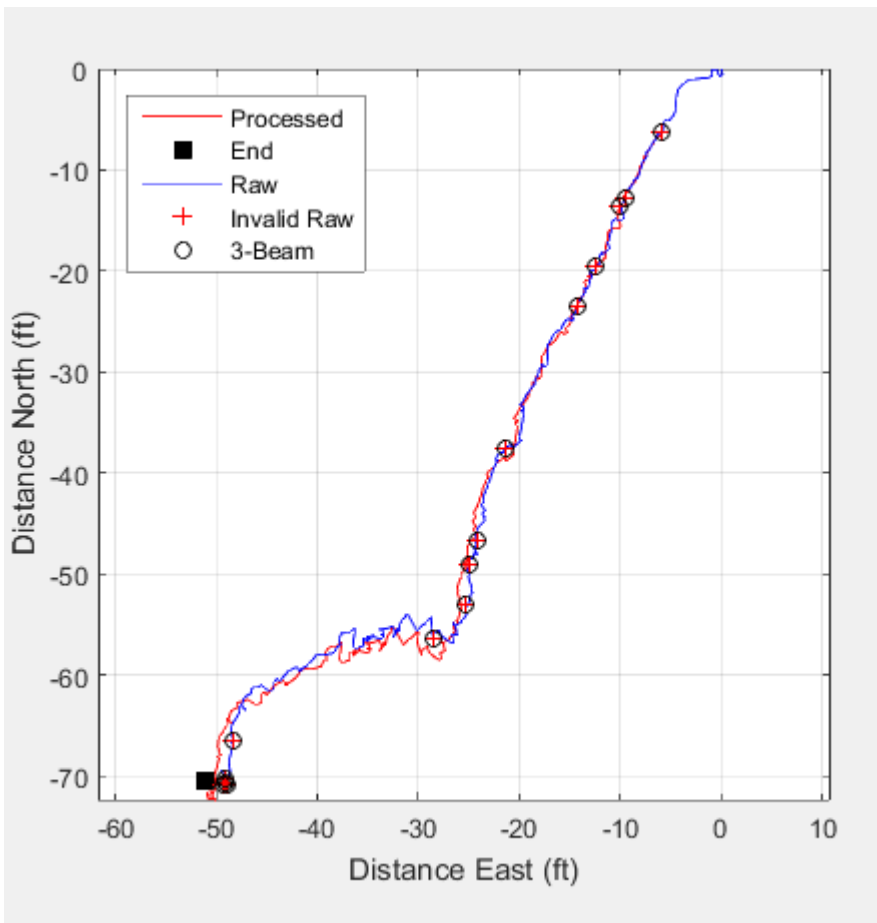

All

Instructions on moving the Legend.

BT Speed Time Series

4

The bottom track time series plot is shown except when Other and All are selected above.
Instructions on moving the Legend.
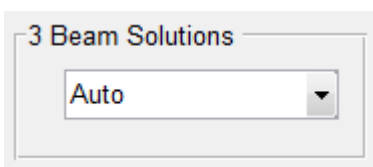
Ship Track Graph

5

The ship track graph displays the raw (unfiltered and without interpolation) ship track and the processed (filtered and interpolated) ship track. The location and source of invalid data are indicated by symbols shown in the graph legend. The end of the transect is indicated by a black square so the user can determine the direction of boat travel. Instructions on moving the Legend.

6 Navigation Reference
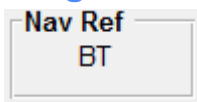
Nav Ref
BT

The Nav Ref panel that shows the current navigation or boat velocity reference. If this reference is not BT, then changes to the BT filters will not change the discharge.
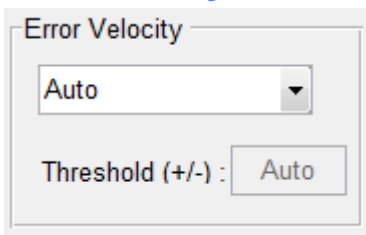
7 Beam Filter

3 Beam Solutions
Auto ▼

The Beam Filter panel shows the current setting and allows the user to change the filters as necessary from the following options:

Auto—(Default) Evaluates 3 beams solutions using neighboring data to determine the validity of the 3 beam solution. Details are documented in Mueller (2016).
Allow—Allows 3 beam solutions
4 Beam—Allows only 4 beam solutions

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8 Error Velocity Filter

```
┌─ Error Velocity ──────────────────┐
│                                   │
│  Auto                    ▼        │
│                                   │
│  Threshold (+/-) :    Auto        │
│                                   │
└───────────────────────────────────┘
```

The Error Velocity Filter panel shows the current setting and allows the user to change the filters as necessary from the following options:
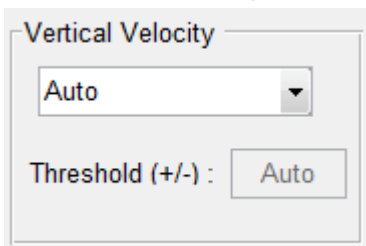
Auto—(Default) Use the variance of the error velocity data to automatically set threshold limits for each transect. Details are documented in Mueller (2016).
Manual—Allows the user to enter a threshold value that will be applied to all transects in the measurement.
Off—No error velocity filter is applied.

9 Vertical Velocity Filter

```
┌─ Vertical Velocity ───────────────┐
│                                   │
│  Auto                    ▼        │
│                                   │
│  Threshold (+/-) :    Auto        │
│                                   │
└───────────────────────────────────┘
```

The Vertical Velocity Filter panel shows the current setting and allows the user to change the filters as necessary from the following options:
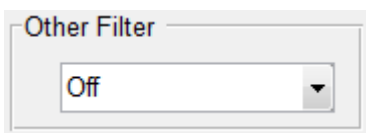
Auto—(Default) Use the variance of the vertical velocity data to automatically set threshold limits for each transect. Details are documented in Mueller (2016).
Manual—Allows the user to enter a threshold value that will be applied to all transects in the measurement.
Off—No error velocity filter is applied.

10 Other Filter

```
┌─ Other Filter ────────────────────┐
│                                   │
│  Off                     ▼        │
│                                   │
└───────────────────────────────────┘
```

The Other Filter panel shows the current setting and allows the user to change the filters as necessary from the following options:

Off—(Default) No spike detection type filter is applied.
Smooth—A locally weighted scatterplot smoothing (LOWESS) filter with a dynamic moving window is applied. Details are documented in Mueller (2016).

11 Graphics Toobar

Allows user to zoom, pan, and query the graphs. For more information see [Toolbar](#).

12 **Add Comment**

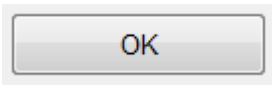Allows the user to add a comment. For more information see [Comment Button](#).

13 **User's Guide**

Opens this User's Guide.

14 **Close Window**

Close window and return control to the main window.

11.1. Measurement Quality Checks

The effect of the data marked invalid by the BT filters on the computed discharge is evaluated using thethe total discharge estimated for all invalid ensembles and the discharge estimated in consecutive invalid ensembles. The resulting messages are preceded by BT- and the filter resulting in the warning message and by bt- and the filter resulting in the caution message. For example, All (BT-All), Original (BT-Original), Difference Velocity (BT-ErrorVel), Vertical Velocity (BT-VertVel), Other (BT-Other), and 3 Beams (BT-3Beams).

Good (Green)

Check—No filters exceeded prescribed thresholds.

Caution (Yellow)

Check—More than 10 percent of discharge is interpolated for ensembles with an invalid BT velocity due to specified filter.
*Message*—bt-filter: Interpolated discharge for invalid ensembles in a transect exceeds 10 percent.

Check—More than 3 percent of the discharge is interpolated for consecutive ensembles with an invalid BT velocity due to specified filter.
Message—bt-filter: Interpolated discharge for consecutive invalid ensembles exceeds 3 percent.

Warning (Red)

Check—More than 25 percent of the discharge is interpolated for ensembles with an invalid BT velocity due to specified filter.
Message—BT-filter: Interpolated discharge for invalid ensembles in a transect exceeds 25 percent.

Check—More than 5 percent of the discharge is interpolated for consecutive ensembles with an invalid BT velocity due to specified filter.
Message—BT-filter: Interpolated discharge for consecutive invalid ensembles exceeds 5 percent.

12. GPS Filters

The GPS Filters button opens a window that allows the user to evaluate the GGA and VTG data for each transect and change the filter settings. Filter settings are applied to all transects and cannot be set for individual transects.
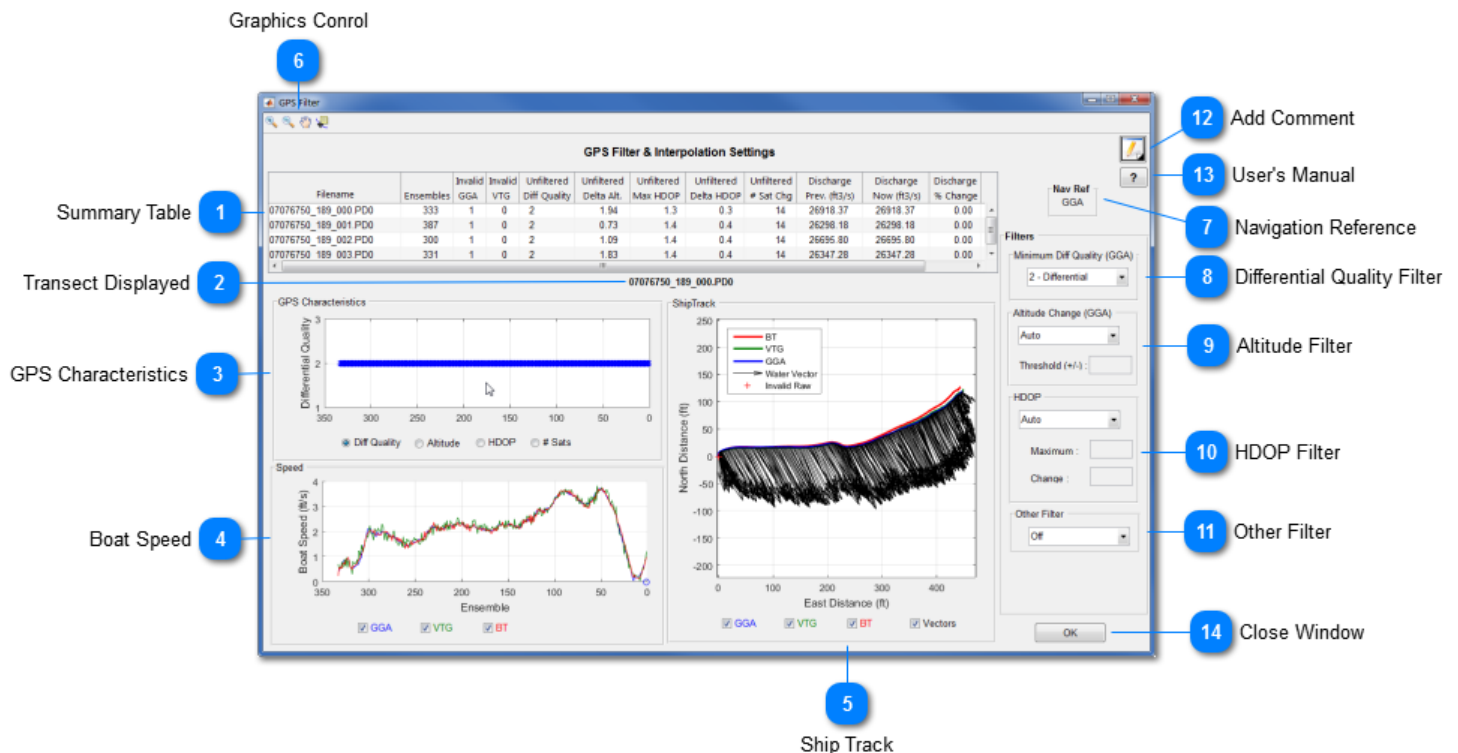
Summary Table

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
07076750_189_000.PD0	333	1	0	2	1.94	1.3	0.3	14	26918.37	26918.37	0.00
07076750_189_001.PD0	387	1	0	2	0.73	1.4	0.4	14	26298.18	26298.18	0.00
07076750_189_002.PD0	300	1	0	2	1.09	1.4	0.4	14	26695.80	26695.80	0.00
07076750 189 003.PD0	331	1	0	2	1.83	1.4	0.4	14	26347.28	26347.28	0.00

The summary table allows the user to select the transect to be graphed (by clicking on the desired row) and provides information about the quality of the GPS data. Because setting the thresholds for the GPS filters is based on best assumptions rather than statistical analysis of the data, the table lists the information about GPS quality indicators rather than the number of invalid ensembles based on each indicator. This table has no editable cells. The columns in the table are defined as follows:

Filename—Filename of the transect.
Ensembles—Total number of ensembles in the transect.
Invalid GGA—Total number of ensembles with invalid GGA data.
Invalid VTG—Total number of ensembles with invalid VTG data.
Unfiltered Diff Quality—A list of all unique differential quality values for unfiltered data.
        0—no position fix
        1—autonomous
        2—differential correction (DGPS)
        4—real-time kinematic (RTK)
        5—float RTK
Unfiltered Delta Alt. —The maximum difference in altitude for an individual ensemble and the mean altitude of all ensembles using unfiltered data.

Unfiltered Max HDOP—The maximum horizontal dilution of precision (HDOP) value for all ensembles using unfiltered data.
Unfiltered Delta HDOP—The difference between the maximum and mean HDOP for all ensembles using unfiltered data.
Unfiltered # Sat Chg—The number of times the number of satellites used in the position fix changed.
Discharge Prev. —Total discharge prior to most recent filter change.
Discharge Now—Total discharge after applying the most recent filter change. If no filters have been changed, the discharge now will equal the discharge previous.
Discharge % Change—The percent difference between the discharge previous and the discharge now due to the last filter change.

2 Transect Displayed

07076750_189_000.PD0

Filename of transect displayed in graphs.

3 GPS Characteristics

The GPS Characteristics panel below the table on the left provides a time series graph of the GPS characteristics provided in the table above the panel (fig. 20). Radio buttons below the graph are used to determine what data are graphed (figs. 20–23). Data determined to be invalid by the filters are marked with a red circle.
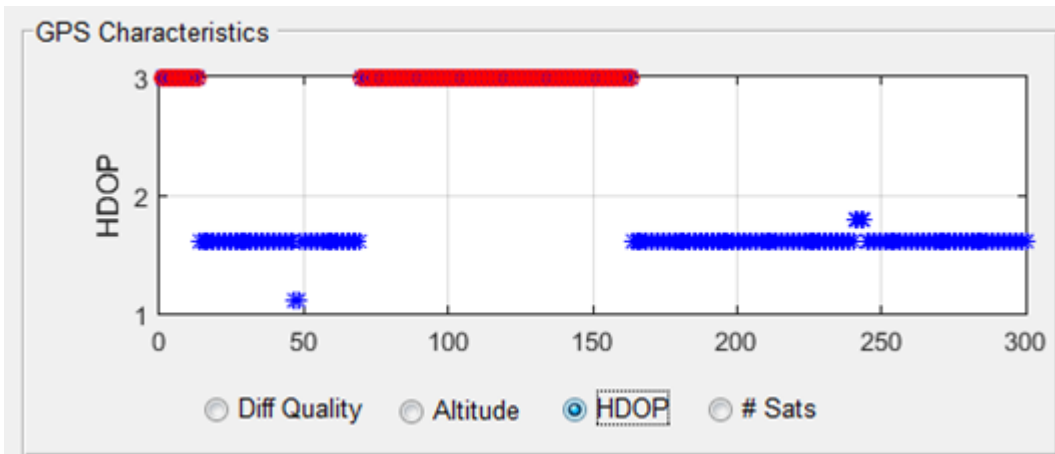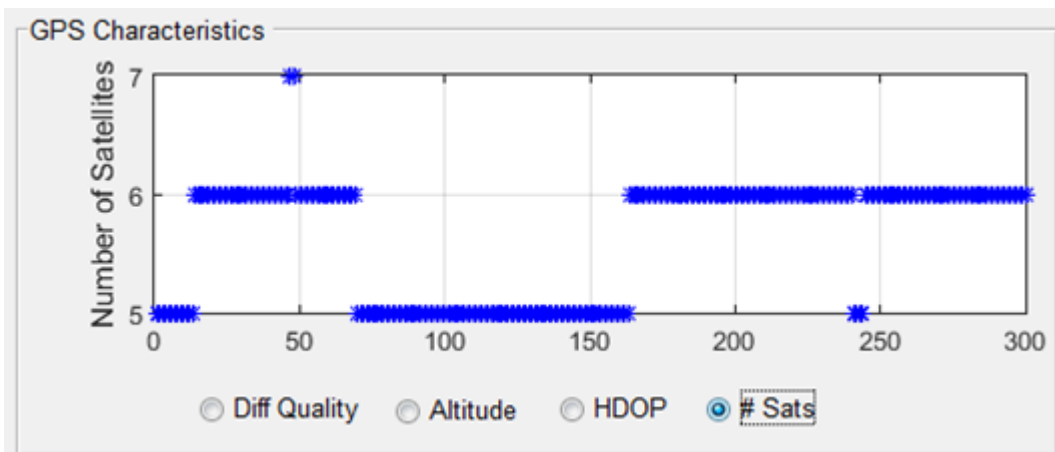
Differential Quality
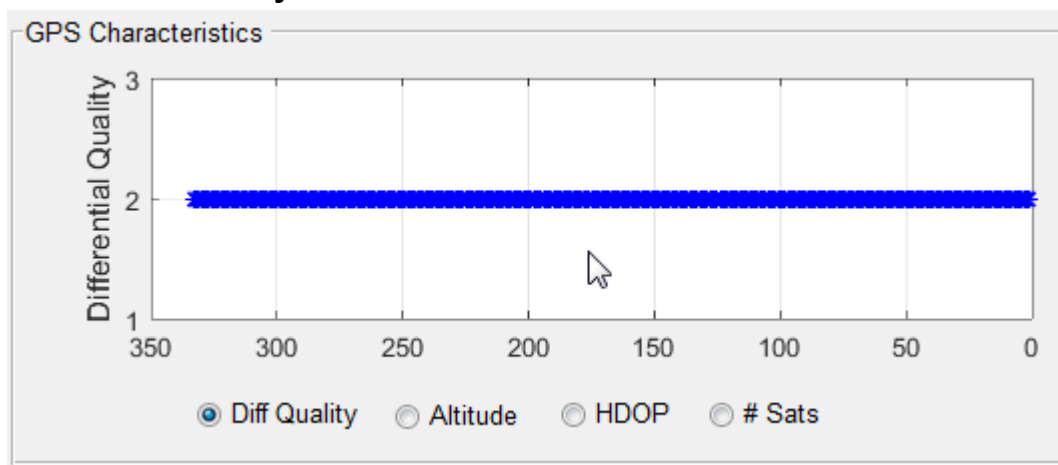
Altitude Change
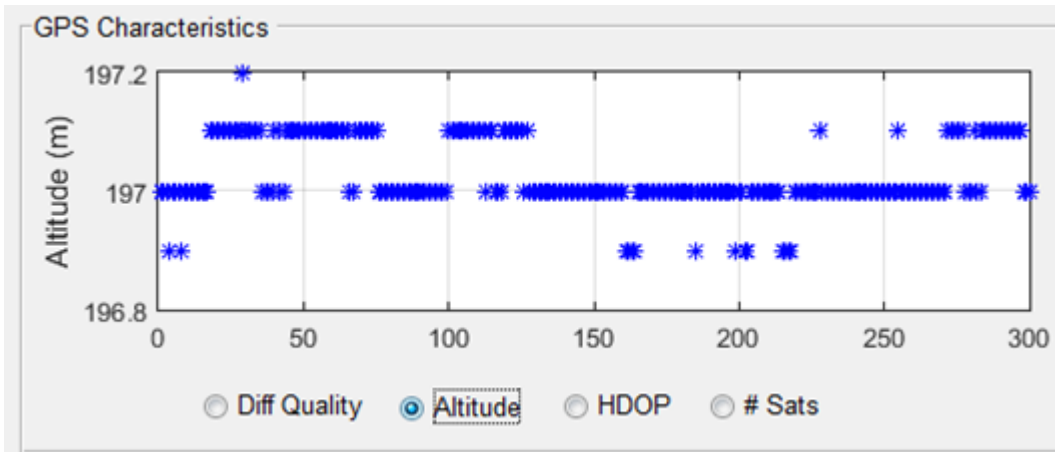
Horizontal Dilution of Precision (HDOP)
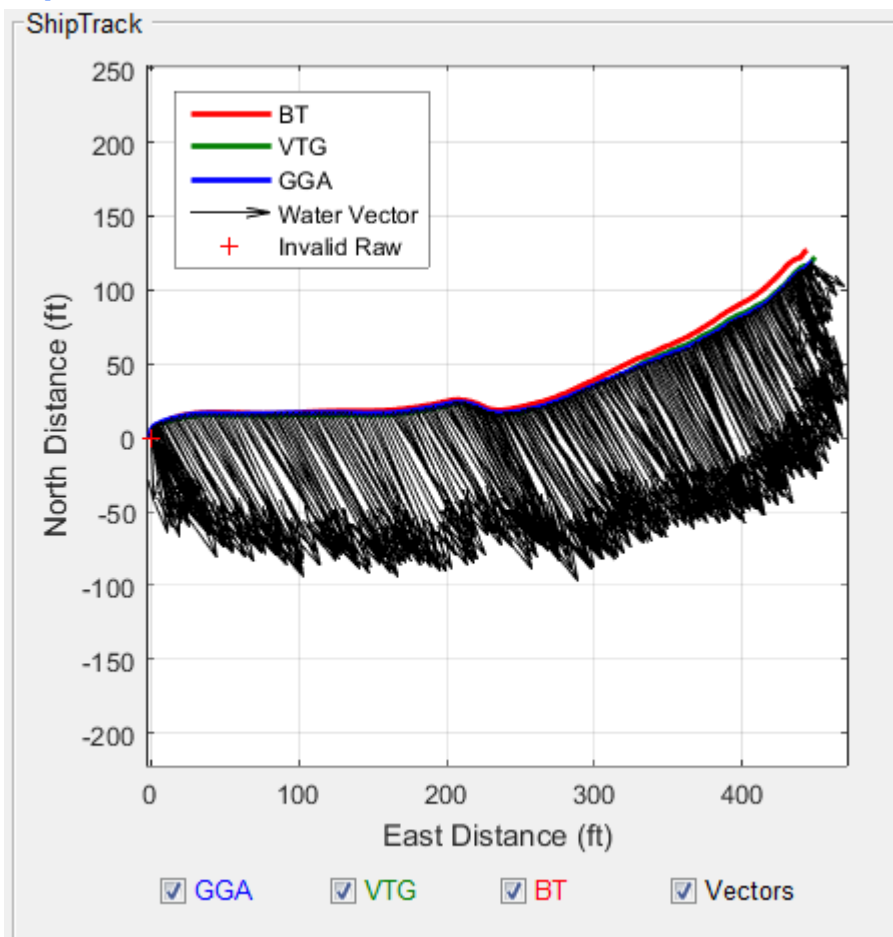

Number of Satellites

4 **Boat Speed**

The Speed panel provides a time series graph of the boat speed based on GGA, VTG, and BT data. The data displayed on the graph are controlled by the three check boxes at the bottom of the panel. Processed data (used to compute discharge) are shown in the graph as a solid line and raw data as dashed lines.

Ship Track

5

The ShipTrack panel allows the GGA, VTG, and BT ship tracks to be compared. Invalid data are identified with a symbol, which is defined in the legend. The water vectors are only graphed on the navigation reference currently selected for discharge computation. The data shown in the graph are controlled by check boxes at the bottom of the panel.

6　Graphics Conrol

Allows user to zoom, pan, and query the graphs. For more information see Toolbar.

7　Navigation Reference
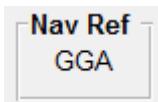
Nav Ref
GGA

The Nav Ref panel that shows the current navigation or boat velocity reference. If this reference is not GGA or VTG, then changes to these filters will not change the discharge.
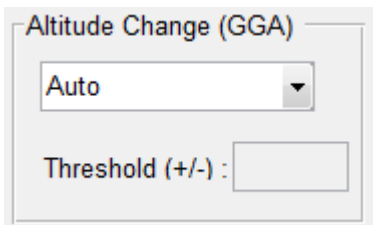
8　Differential Quality Filter

Minimum Diff Quality (GGA)
2 - Differential ▼
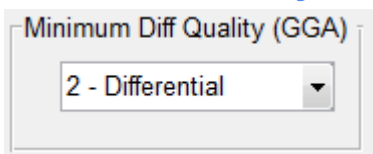
Applies to GGA data only and allows the user to set the minimum allowable differential correction quality.

       1 - Autonomous
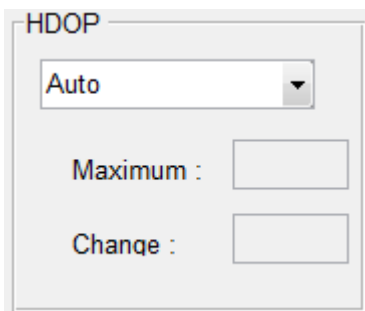   **2** - (Default) Differential
       4+ - RTK

9　Altitude Filter

Altitude Change (GGA)
Auto ▼

Threshold (+/-) :

Applies to GGA data only.

       Auto—(Default) The threshold for altitude change is set to 3 meters.
       Manual—The user can enter a user specified threshold.
       Off—No altitude filter is applied.

10　HDOP Filter

HDOP
Auto ▼

Maximum :

Change :

Applies to GGA and VTG data if GGA data are available.

Auto—(Default) Sets the maximum allowable HDOP to 4.0 and the maximum allowable change in HDOP to 3.0.
Manual—Allows the user to specify the maximum allowable HDOP and the maximum allowable change in HDOP.
Off—No HDOP filter is applied.

11 Other Filter

```
┌─Other Filter──────────────┐
│  ┌──────────────────┬───┐  │
│  │ Off              │ ▼ │  │
│  └──────────────────┴───┘  │
└───────────────────────────┘
```

Sets the smooth filter to on or off.
Off—(Default) No other filter is applied.
Smooth—A smooth filter is applied to identify spikes in the boat speed.
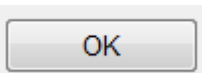
12 Add Comment

Allows the user to add a comment. For more information see Comment Button.

13 User's Manual

Opens this User's Manual

14 Close Window

```
┌──────────────────┐
│        OK        │
└──────────────────┘
```

Closes window and returns control to the main window.

12.1. Measurement Quality Checks

The ADQA evaluates the effect of the data marked invalid on the computed discharge using the total discharge estimated for all invalid ensembles and the discharge estimated in consecutive invalid ensembles. The resulting messages are preceded by GGA- or VTG- and the filter resulting in the warning message and by gga- or vtg- and the filter resulting in the caution message. For example, GGA All (GGA-All), GGA Original (GGA-Original), GGA Differential Correction Quality (GGA-DGPS), GGA Altitude (GGA-Altitude), GGA Other (GGA-Other), GGA HDOP (GGA-HDOP), VTG All (VTG-All), and VTG Original (VTG-Original).

Good (Green)

Check—No filters exceeded prescribed thresholds.

Caution (Yellow)

Check—More than 10 percent of the discharge is interpolated for ensembles with an invalid GGA or VTG velocity due to specified filter.
Message—gga- or vtg-filter: Interpolated discharge for invalid ensembles in a transect exceeds 10 percent.

Check—More than 3 percent of the discharge is interpolated for consecutive ensembles with an invalid gga or vtg velocity due to specified filter.
Message—gga- or vtg-filter: Interpolated discharge for consecutive invalid ensembles exceeds 3 percent.

Warning (Red)

Check—More than 25 percent of the discharge is interpolated for ensembles with an invalid GGA or VTG velocity due to specified filter.
Message—GGA- or VTG-filter: Interpolated discharge for invalid ensembles in a transect exceeds 25 percent.

Check—More than 5 percent of the discharge is interpolated for consecutive ensembles with an invalid gga or vtg velocity due to specified filter.
Message—GGA- or VTG-filter: Interpolated discharge for consecutive invalid ensembles exceeds 5 percent.

13. Selected Reference

The Select Reference button will only be active if GPS data are available. Clicking the Select Reference button opens a window that allows the user to change the navigation reference and to turn composite tracks on or off.

Summary Table

The summary table allows the user to select which transect is displayed in the graphs (by clicking on the desired row) and provides information on the number of ensembles referenced to each navigation reference.

Filename—Filename of the transect.
 # Ensembles—Total number of ensembles in the transect.
 # Ref BT—Number of ensembles referenced to bottom track.
 # Ref GGA—Number of ensembles referenced to GGA.
 # Ref VTG—Number of ensembles referenced to VTG.
 # Ref INT—Number of ensembles for which the boat velocity has been interpolated.
Discharge Prev. —Total discharge prior to most recent filter change.
Discharge Now—Total discharge after applying the most recent filter change. If no filters have been changed, the discharge now will equal the discharge previous.
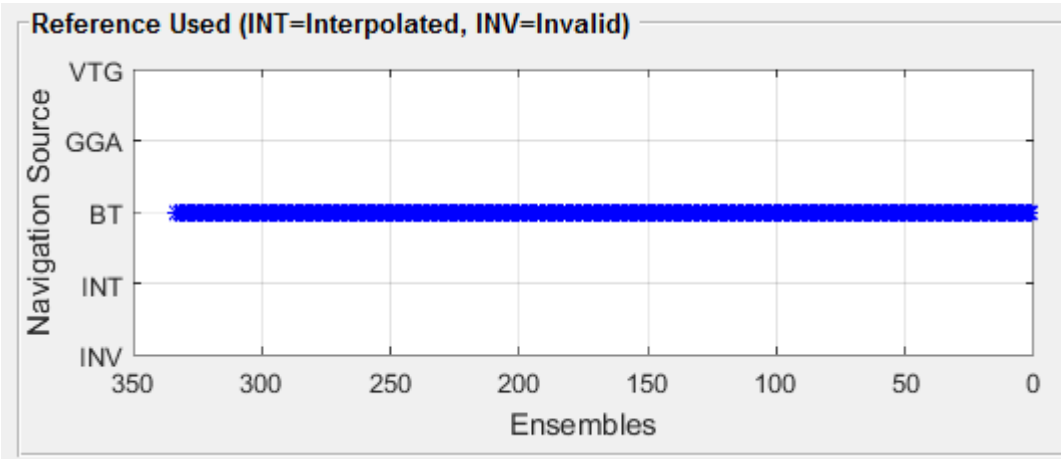**Discharge % Change**—The percent difference between the discharge previous and the discharge now due to the last filter change.

Transect Displayed

07076750_189_000.PD0

Filename of the transect displayed in the graphs.

Referenced Used

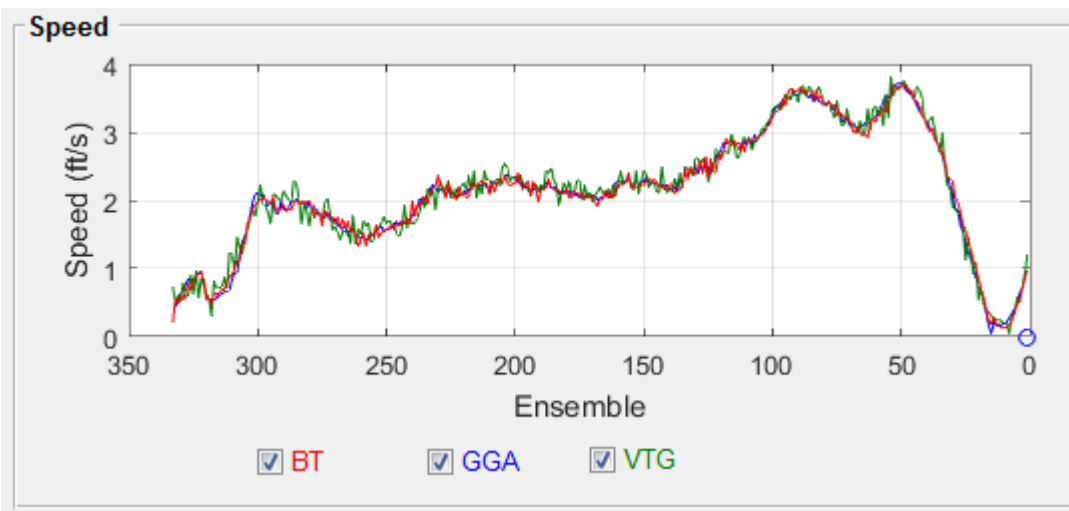The Reference Used time series displays the reference used for each ensemble of the selected transect.

VTG--GPS using VTG data type
GGA--GPS using GGA data type
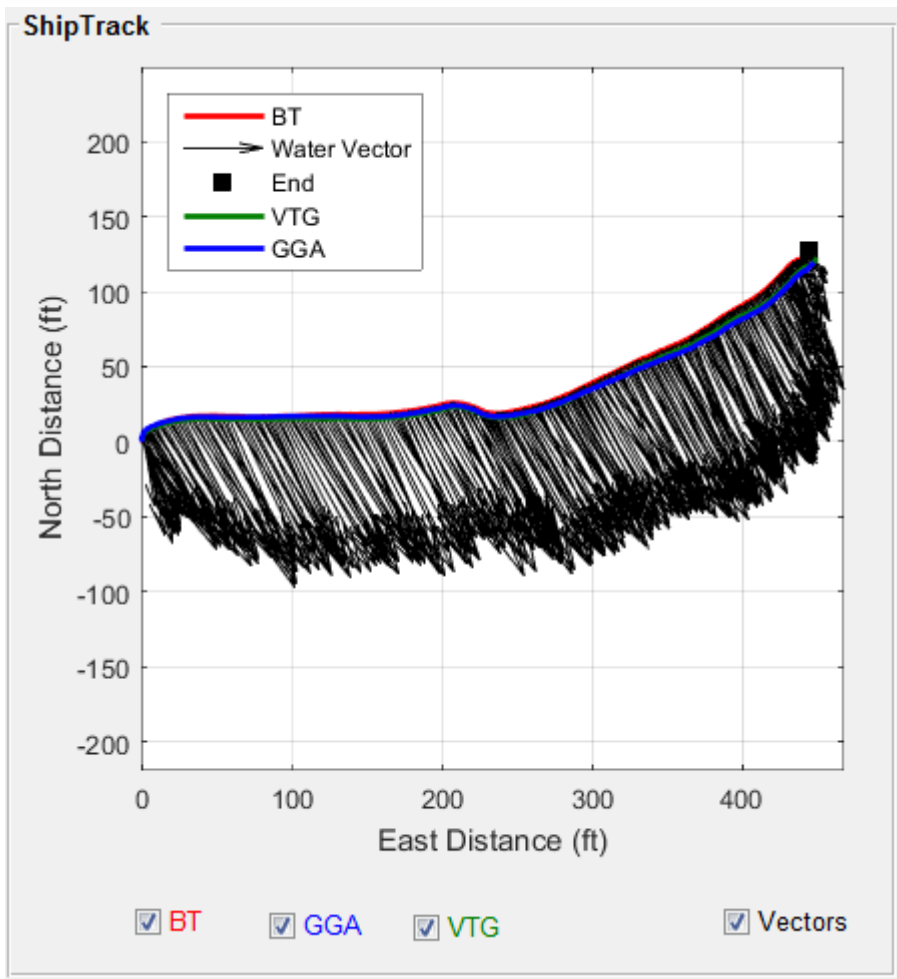**BT**--Bottom track; INT--Interpolated by QRev
INV--Invalid (no data and no interpolation)

Boat Speed

The Boat Speed time series shows the boat speed for each of the references. The user can display or hide specific references by clicking on the check boxes (this only effects the display not the reference used).

Ship Track

The ShipTrack panel allows the GGA, VTG, and BT ship tracks to be compared. Invalid data are identified with a symbol, which is defined in the legend. The water vectors are only graphed on the navigation reference currently selected for discharge computation. The data shown in the graph are controlled by check boxes at the bottom of the panel.

6 Select Reference

The Selected Reference panel shows the currently selected reference and allows the user to change the reference by clicking on the radio buttons.

7 Composite Tracks

Composite tracks is a feature that will automatically substitute one of the other valid navigation references for the selected navigation reference if the selected reference is invalid. The approach used for composite tracks in QRev is summarized in the table below. These settings apply to all transects and cannot be set differently for individual transects. QRev defaults the navigation reference to that used in the raw data. Composite tracks defaults to off.

Reference Quality	Reference Used
Bottom **Track (BT) Selected**	
BT valid	BT
BT invalid	VTG
BT invalid, VTG invalid	GGA
BT invalid, VTG invalid, GGA invalid	Interpolate from BT data
GGA Selected	
GGA valid	GGA
GGA invalid	VTG
GGA invalid, VTG invalid	BT
GGA invalid, VTG invalid, BT invalid	Interpolate from GGA data
VTG Selected	
VTG valid	VTG
VTG invalid	GGA
VTG invalid, GGA invalid	BT
VTG invalid, GGA invalid, BT invalid	Interpolate from VTG data

8 Graphics Toolbar

Allows user to zoom, pan, and query the graphs. For more information see Toolbar.
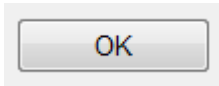
9 Add Comment

Allows the user to add a comment. For more information see Comment Button.

10 User's Guide

Opens this User's Guide.

11 Close Window

OK

Closes window and returns control to the main window.

14. Depth Filters / Draft

The Depth Filters / Draft button opens a window that allows the user to review the measured depths from each beam and the final processed cross section . The user can also change the primary depth reference and indicate whether or not to use composite depths. QRev defaults to using inverse depth weighting to compute the mean depth when the 4 slant beams are used. The user can also change the filter type to try and eliminate unreasonable and erroneous spikes in the data.
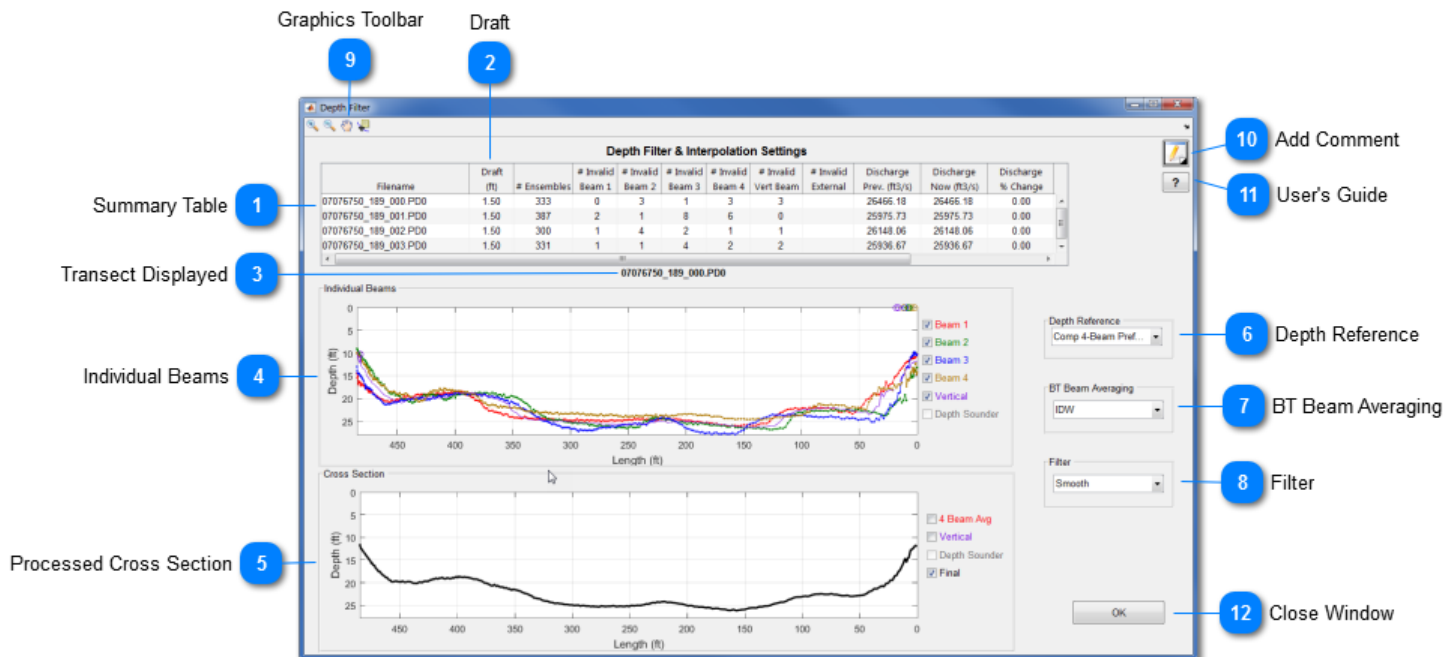
Summary Table

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
07076750_189_000.PD0	1.50	333	0	3	1	3	3		26466.18	26466.18	0.00
07076750_189_001.PD0	1.50	387	2	1	8	6	0		25975.73	25975.73	0.00
07076750_189_002.PD0	1.50	300	1	4	2	1	1		26148.06	26148.06	0.00
07076750_189_003.PD0	1.50	331	1	1	4	2	2		25936.67	25936.67	0.00

The summary table allows the user to select which transect is displayed in the graphs (by clicking on the desired row), provides information on beams with invalid depths, and allows the user to change the draft.

Filename—Filename of the transect.
Draft—Distance from the water surface to the transducers.
 # Ensembles—Number of ensembles in the transect.
 # Invalid Beam 1—Number of ensembles where the depth in beam 1 is invalid.
 # Invalid Beam 2—Number of ensembles where the depth in beam 2 is invalid.
 # Invalid Beam 3—Number of ensembles where the depth in beam 3 is invalid.
 # Invalid Beam 4—Number of ensembles where the depth in beam 4 is invalid.
 # Invalid Vert Beam—Number of ensembles where the depth in the vertical beam is invalid.
 # Invalid External—Number of ensembles where the depth from the external depth sensor is invalid.
**Discharge Prev.** —Total discharge prior to most recent filter change.
Discharge Now—Total discharge after applying the most recent filter change. If no filters have been changed, the discharge now will equal the discharge previous.
Discharge % Change—The percent difference between the discharge previous and the discharge now due to the last filter change.

2 Draft

Draft (ft)
1.50
1.50
1.50
1.50

The user can change the draft by click on any row in the Draft column. When a row in the draft column is clicked the following dialog will open.
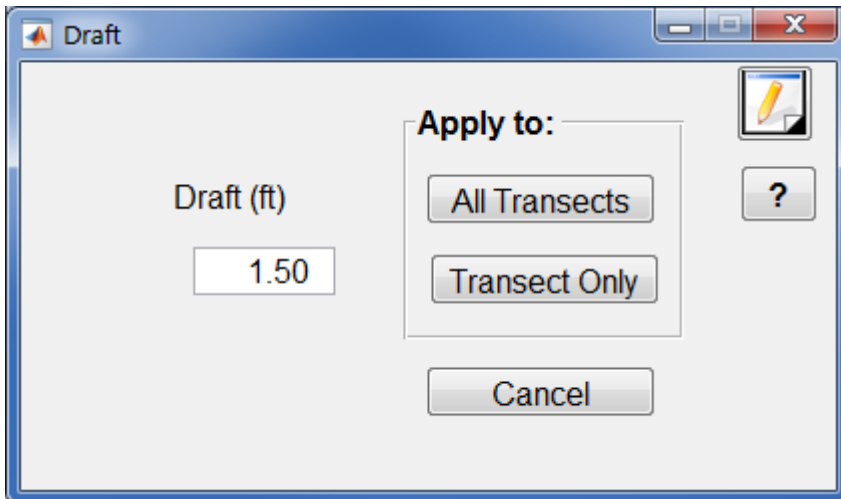
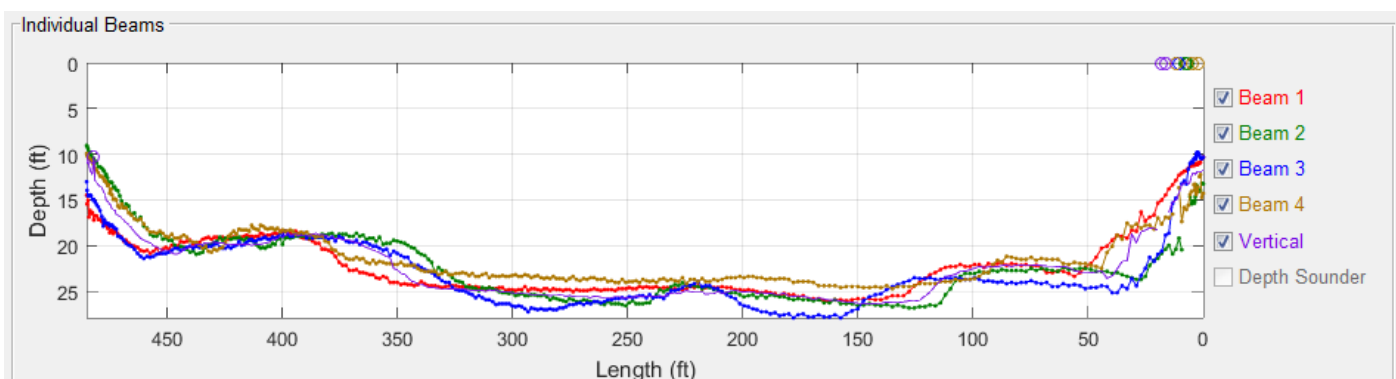
The user can enter a new draft and apply it to all transects by clicking All Transects or to only the selected transect by clicking Transect Only.

3 Transect Displayed

07076750_189_000.PD0

Filename of the transect displayed in the graphs.

4 Individual Beams

The Individual Beams cross section graph displays the cross section as measured by each individual beam. All available beams or depth sources are active in the graphs. The user can check or uncheck the check box associated with each beam to display or hide that beam; this action does not affect the computations. The circles at the top of the graph identify ensembles that have no depth. Circles on the lines of the individual beams indicate a depth that has been determined to be invalid based on the selected filters. The color of the line or circle corresponds to the beam or depth source.

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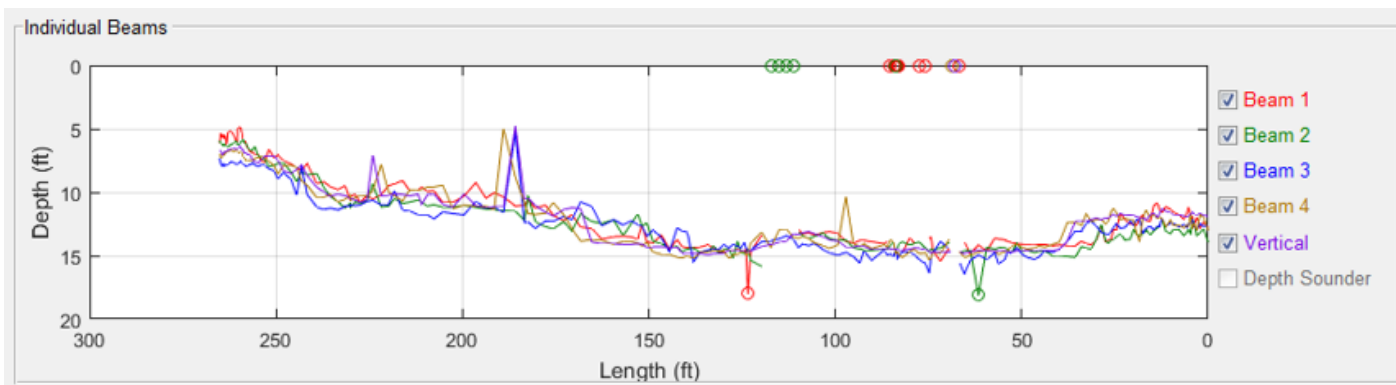
Processed Cross Section
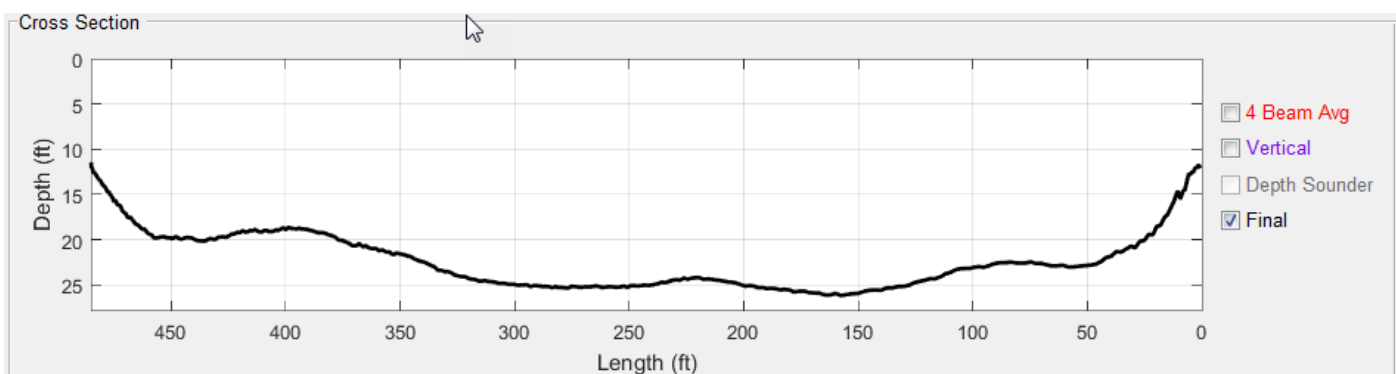
The Processed Cross Section displays the final cross section. The final cross section is based on the selected depth reference and the results of the filters and interpolation. The check boxes to the right can be used to compare the final cross section to other alternatives.

Depth Reference

The Depth Reference is a popup menu that allows the user to select from all available depth sources.

> **4 Beam Avg**—(Default) The ensemble depth is computed as the average of the 4 slant beams.
> **Comp 4 Beam Preferred**—The ensemble depth is computed as the average of the 4 slant beams, but if that results in an invalid depth, other available valid depth sources will be substituted according to the priority defined in the table below.
> **Vertical**—The depth from the vertical beam is used as the ensemble depth.
> **Comp Vertical Preferred**—The ensemble depth is the vertical beam depth, but if the vertical beam depth is invalid, other available valid depth sources will be substituted according to the priority defined in the table below.
> **Depth Sounder**—The depth from an external depth sounder is used as the ensemble depth.
> **Comp DS Preferred**—The ensemble depth is the external depth sounder depth, but if the depth from the external depth sounder is invalid, other available valid depth sources will be substituted according to the priority defined in the table below

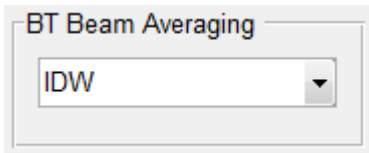| Primary	BT	VB	DS

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1st option	DS	DS	VB
2nd option	VB	BT	BT
3rd option	Interpolated BT	Interpolated VB	Interpolated DS

BT--average depth from four slant beams
DS--depth from external depth sounder
VB--depth from vertical beam

BT Beam Averaging

7

BT Beam Averaging determines if the average depth from the 4 slant beams is computed using a simple average or an inverse depth-weighted method (IDW). The inverse depth-weighted method is preferred and the QRev default. However, to allow duplication of RSL computations, the simple average option is available.

Filter

8
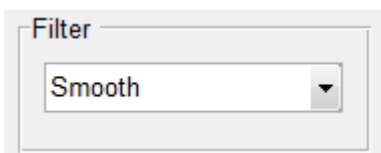
The two options available to filter out spikes in the depths are the method used in WR2 and a method based on a LOWESS smooth. The method used in WR2 will tend to filter out the lowest (deepest) data because the method was designed to filter out multiple reflections. The LOWESS smooth filter only works well with continuous data. Gaps in the data can cause the LOWESS smooth filter to miss what appear to be obvious spikes. The filter defaults to Smooth but can also be turned off.

Graphics Toolbar

9

Allows user to zoom, pan, and query the graphs. For more information see Toolbar.
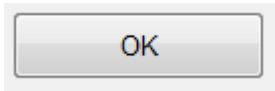
Add Comment

10

Allows the user to add a comment. For more information see Comment Button.

User's Guide

11

Opens this User's Guide

Close Window

12

OK

Closes window and returns control to the main window.

14.1. Measurement Quality Checks

The ADQA evaluates the effect of the data marked invalid on the computed discharge using the total discharge estimated for all invalid ensembles and the discharge estimated in consecutive invalid ensembles.

Good (Green)

Check—No filters exceeded prescribed thresholds.

Caution (Yellow)

Check—Transducer depth (draft) is not consistent for all transects.
Message—Depth: Transducer depth is not consistent among transects.

Check—More than 10 percent of the discharge is interpolated for ensembles with an invalid average depth.
Message—Depth: Interpolated discharge for invalid ensembles in a transect exceeds 10 percent.

Check—More than 3 percent of the discharge is interpolated for consecutive ensembles with an invalid average depth.
Message—Depth: Interpolated discharge for consecutive invalid ensembles exceeds 3 percent.

Warning (Red)

Check—Transducer depth (draft) is less than 0.01 meter.
Message—DEPTH: Transducer depth is too shallow, likely zero.

Check—More than 25 percent of the discharge is interpolated for ensembles with an invalid average depth.
*Message*—DEPTH: Interpolated discharge for invalid ensembles in a transect exceeds 25 percent.

Check—More than 5 percent of the discharge is interpolated for consecutive ensembles with an invalid average depth.
Message—DEPTH: Interpolated discharge for consecutive invalid ensembles exceeds 5 percent.

15. WT Filters

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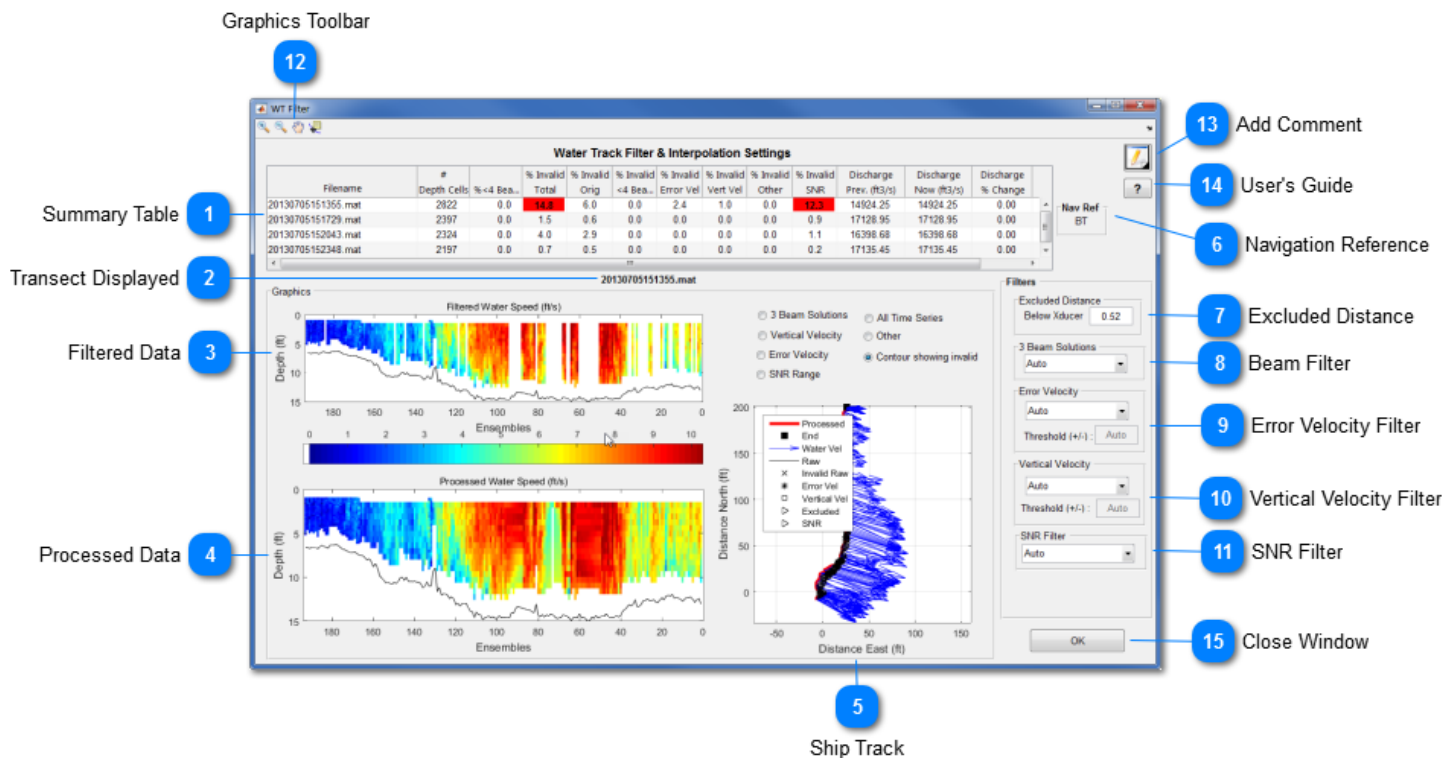
Summary Table

Filename	# Depth Cells	% <4 Bea...	% Invalid Total	% Invalid Orig	% Invalid <4 Bea...	% Invalid Error Vel	% Invalid Vert Vel	% Invalid Other	% Invalid SNR	Discharge Prev. (ft3/s)	Discharge Now (ft3/s)	Discharge % Change
20130705151355.mat	2822	0.0	14.8	6.0	0.0	2.4	1.0	0.0	12.3	14924.25	14924.25	0.00
20130705151729.mat	2397	0.0	1.5	0.6	0.0	0.0	0.0	0.0	0.9	17128.95	17128.95	0.00
20130705152043.mat	2324	0.0	4.0	2.9	0.0	0.0	0.0	0.0	1.1	16398.68	16398.68	0.00
20130705152348.mat	2197	0.0	0.7	0.5	0.0	0.0	0.0	0.0	0.2	17135.45	17135.45	0.00

The Summary Table allows the user to select which transect to graph (by clicking on the desired row), provides information on the number of depth cells that have been determined to be invalid by the various filters, and shows the effect of a filter change on the computed discharge. Cells in the table contain color codes associated with cautions or warnings generated from the ADQA. No editable cells are in this table. The columns in the table are:

Filename—Filename of the transect.
 # Depth Cells—Total number of depth cells in the transect.
% <4 Beams—Number of ensembles that had valid water track in less than 4 beams.
% Invalid Total—Number of ensembles with invalid water track velocity.
% Invalid Orig—Number of ensembles that had invalid water track velocity prior to any filtering.
% Invalid <4 Beams—Number of ensembles with valid water track in less than 4 beams for which the water track velocity has been determined to be invalid.
% Invalid Error Vel—Number of ensembles that have been determined to be invalid due to filtering based on the water track error velocity.
% Invalid Vert Vel—Number of ensembles that have been determined to be invalid due to filtering based on the water track vertical velocity.

% Invalid Other—Number of ensembles that have been determined to be invalid due to filtering using other filters. Currently (2015) other filters are not implemented.
% Invalid SNR—Number of ensembles that have been determined to be invalid due to filtering of the signal to noise ratio (SNR) range. This filter applies to SonTek data only.
Discharge Prev. —Total discharge prior to most recent filter change.
Discharge Now—Total discharge after applying the most recent filter change. If no filters have been changed, the discharge now will equal the discharge previous.
Discharge % Change—The percent difference between the discharge previous and the discharge now due to the last filter change.

Transect Displayed

20130705151355.mat

Filename of the transect displayed in the graphs.
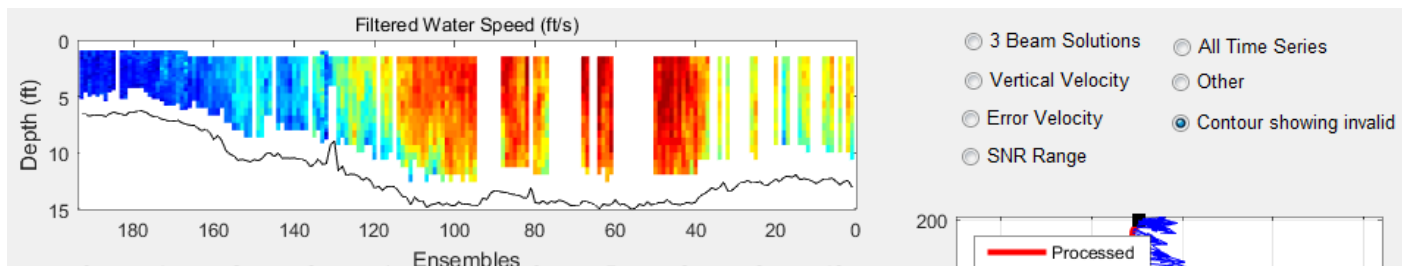
Filtered Data

The Filtered Data graph is determined from the type of data graphed, which is selected by the user using the radio buttons on the right. For 3 Beam Solutions, Error Velocity, Vertical Velocity, SNR Range (only for SonTek RiverSurveyor ADCPs), and Contour showing invalid, the left portion of the Graphics panel will display two graphs. The default is to display a color contour graph showing only valid data without interpolation. The top graph will display a time series graph for the other types of data selected:
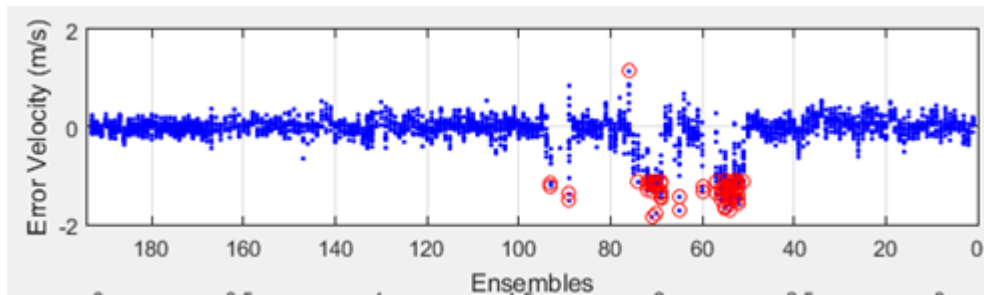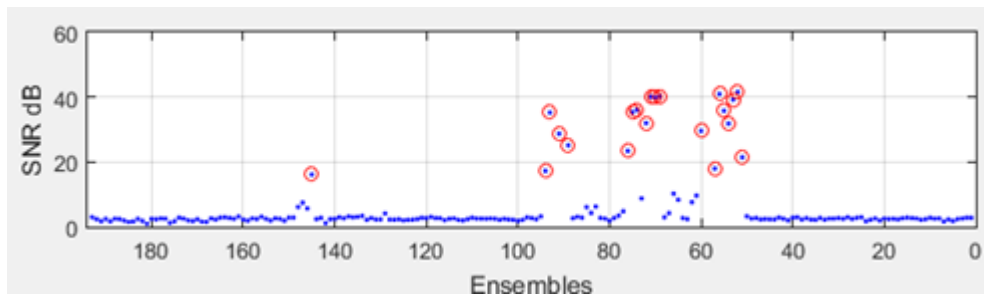
3-Beam Solutions



Vertical Velocity

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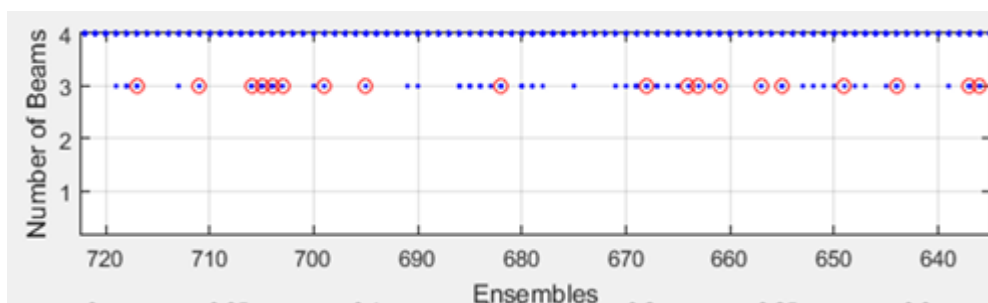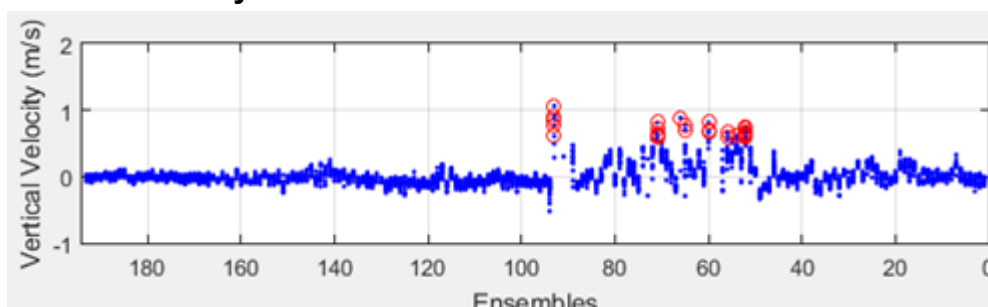
Error Velocity


SNR Range (only for SonTek RiverSurveyor ADCPs)

With the exception of 3 Beam Solutions, the time series shows every valid depth cell. Showing every depth cell allows the user to visually evaluate the magnitude and variance of the data. Invalid data are identified by red circles.

If All Time Series or Other are selected from the radio buttons, the left graph is a single time series graph.
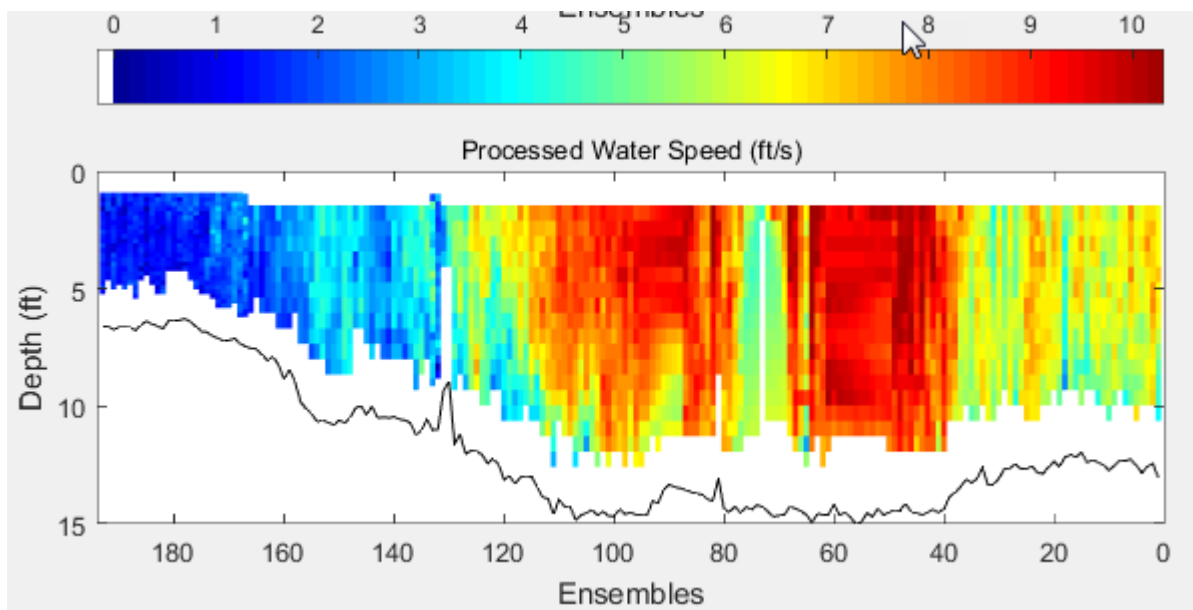
All Time Series
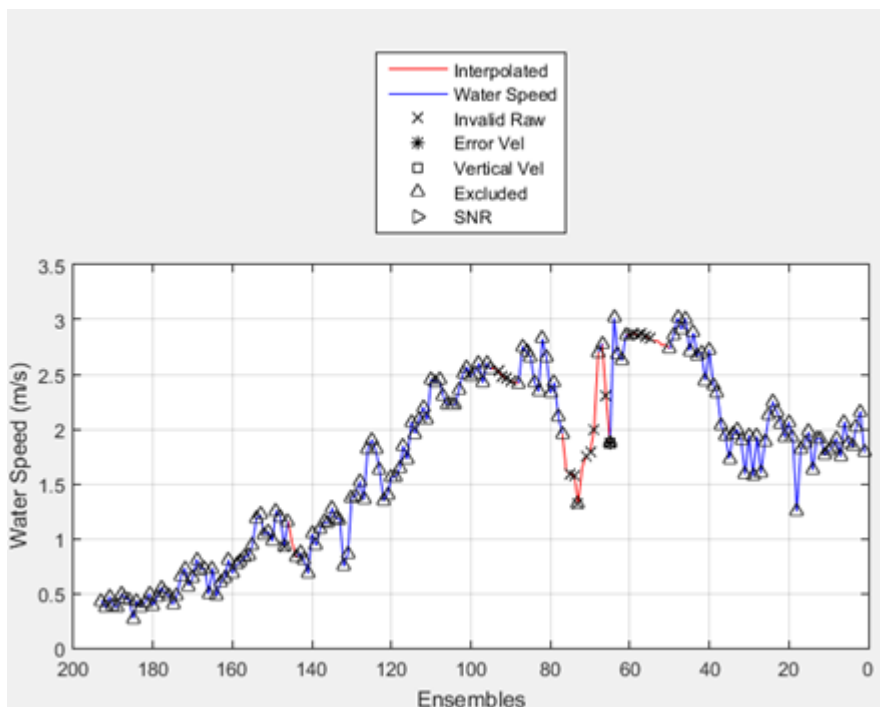
Other
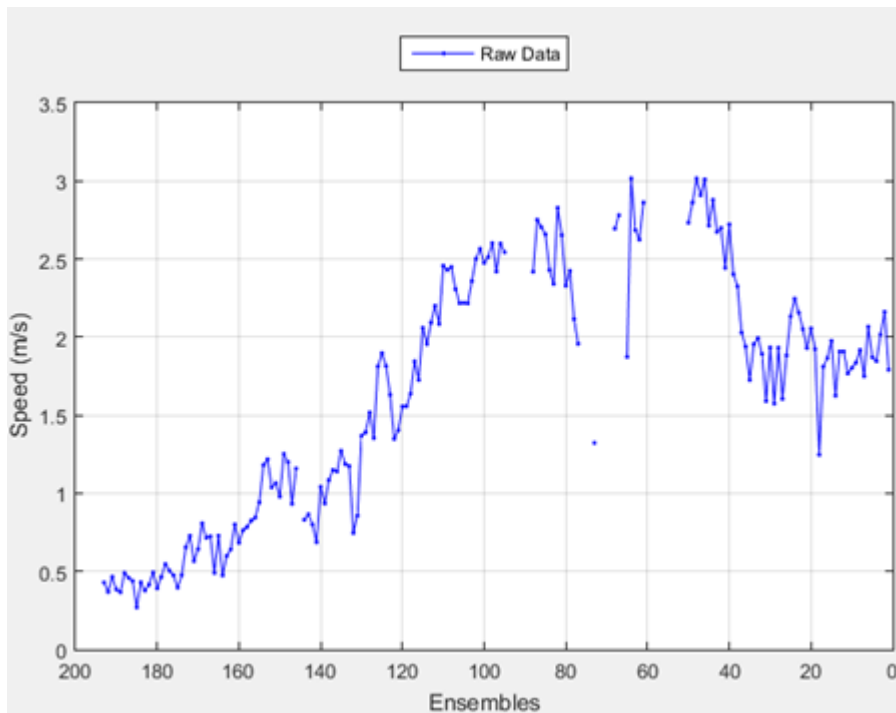
Currently, other filters have not been implemented; therefore, the other graph is a times series of the average water speed for each ensemble.
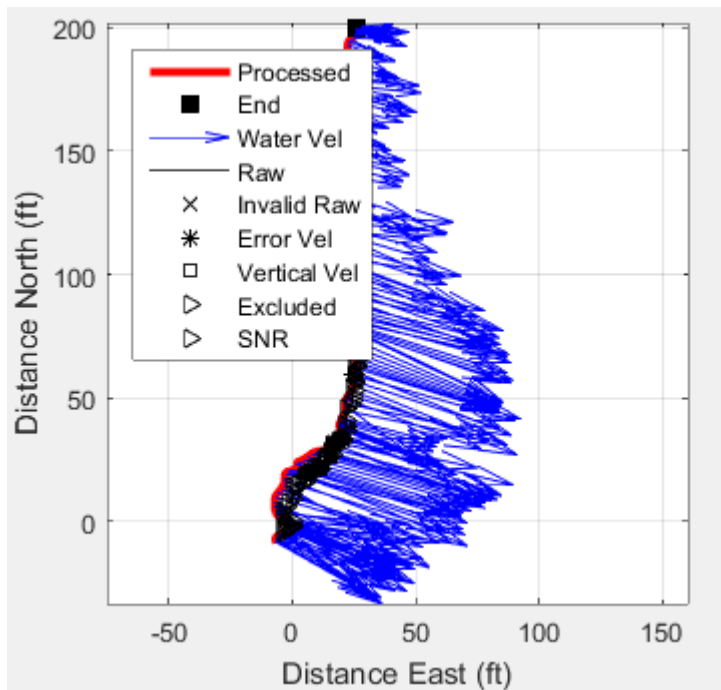
4 Processed Data

The Processed Data graph is a color contour graph showing full processed data including interpolation. These are the dat athat will be used to compute discharge.
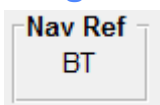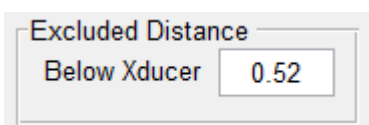
5 Ship Track

The Ship Track graph shows the ship track using the processed navigation reference. Locations of invalid water data and the cause of the data being marked invalid are shown with symbols indicated in the legend.

6 Navigation Reference

Nav Ref
BT

Identifies the selected navigation reference.

7 Excluded Distance
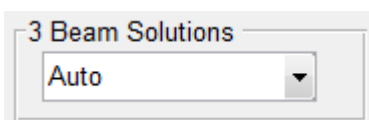
Excluded Distance
Below Xducer   0.52

The Excluded Distance is the distance below the transducer for which measured WT data will not be used. This value defaults to zero except for:
RiverSurveyor M9: default = 16 cm (U.S. Geological Survey, 2014)
TRDI RioPro: default = 25 cm

8 Beam Filter

3 Beam Solutions
Auto

The Beam Filter panel shows the current setting and allows the user to change the filters as necessary from the following options:
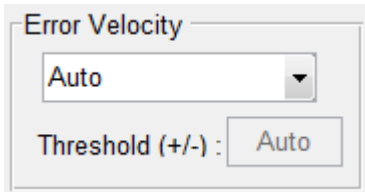
Auto—(Default) Evaluates 3 beams solutions using neighboring data to determine the validity of the 3 beam solution. Details are documented in Mueller (2016).
Allow—Allows 3 beam solutions
4 Beam—Allows only 4 beam solutions

⑨ Error Velocity Filter

Error Velocity
Auto ▼
Threshold (+/-) : Auto

The Error Velocity Filter panel shows the current setting and allows the user to change the filters as necessary from the following options:

Auto—(Default) Use the variance of the error velocity data to automatically set threshold limits for each transect. Details are documented in Mueller (2016).
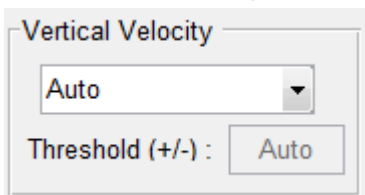**Manual**—Allows the user to enter a threshold value that will be applied to all transects in the measurement.
Off—No error velocity filter is applied.

NOTE: The error velocity filter does not always perform well on data from ADCPs with auto adaptive modes (S5, M9, RiverRay, RiverPro, RioPro) due to the change in error velocity distribution for the different modes.

⑩ Vertical Velocity Filter

Vertical Velocity
Auto ▼
Threshold (+/-) : Auto

The Vertical Velocity Filter panel shows the current setting and allows the user to change the filters as necessary from the following options:

Auto—(Default) Use the variance of the vertical velocity data to automatically set threshold limits for each transect. Details are documented in Mueller (2016).
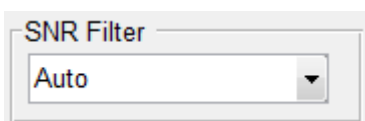**Manual**—Allows the user to enter a threshold value that will be applied to all transects in the measurement.
Off—No error velocity filter is applied.

NOTE: The vertical velocity filter does not always perform well on data from ADCPs with auto adaptive modes (S5, M9, RiverRay, RiverPro, RioPro) due to the change in error velocity distribution for the different modes.

⑪ SNR Filter

SNR Filter
Auto ▼

The SNR Filter panel shows the current setting and allows the user to change the filter as necessary from the following options:

Auto—(Default) The SNR filter is applied with predetermined thresholds to RSL data only. Details are documented in Mueller (2016).
Off—No SNR filter is applied.

12 Graphics Toolbar
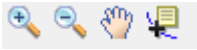
Allows user to zoom, pan, and query the graphs. For more information see [Toolbar](#).

13 Add Comment

Allows the user to add a comment. For more information see [Comment Button](#).

14 User's Guide

Opens this User's Guide

15 Close Window

Close window and return control to the main window.

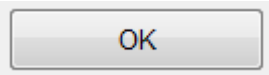# 15.1. Measurement Quality Checks

The ADQA evaluates the effect of the data marked invalid on the computed discharge using the total discharge estimated for all invalid ensembles and the discharge estimated in consecutive invalid ensembles. The resulting messages are preceded by WT- and the filter resulting in the warning message and by wt- and the filter resulting in the caution message. For example, All (WT-All), Original (WT-Original), Error Velocity (WT-ErrorVel), Vertical Velocity (WT-VertVel), Other (WT-Other), and 3 Beams (WT-3Beams).

Good (Green)

Check—No filters exceeded prescribed thresholds.

Caution (Yellow)

Check—More than 10 percent of the discharge is interpolated for ensembles and cells with an invalid WT velocity due to specified filter.
Message—wt-filter: Interpolated discharge for invalid cells and ensembles in a transect exceeds 10 percent.

Check—More than 3 percent of the discharge is interpolated for consecutive ensembles with an invalid WT velocity due to specified filter.
Message—wt-filter: Interpolated discharge for consecutive invalid ensembles exceeds 3 percent.

Warning (Red)

Check—More than 25 percent of the discharge is interpolated for ensembles with an invalid WT velocity due to specified filter.
*Message*—WT-filter: Interpolated discharge for invalid ensembles in a transect exceeds 25 percent.

Check—More than 5 percent of the discharge is interpolated for consecutive ensembles with an invalid WT velocity due to specified filter.
Message—WT-filter: Interpolated discharge for consecutive invalid ensembles exceeds 5 percent.

16. Extrapolation

The Extrapolation button opens a window that is similar to the extrap program ([Mueller, 2013](#)), except the extrapolation window has been redesigned with buttons instead of menus. QRev defaults to the extrapolation settings determined automatically from the extrap algorithms. The user can use the Extrapolation window to switch to or explore other extrapolation settings, apply manually selected extrapolation settings, and evaluate the sensitivity of the discharge to the extrapolation settings. The user can explore different extrapolation settings without applying them to the measurement if "Cancel" is selected to close the window.
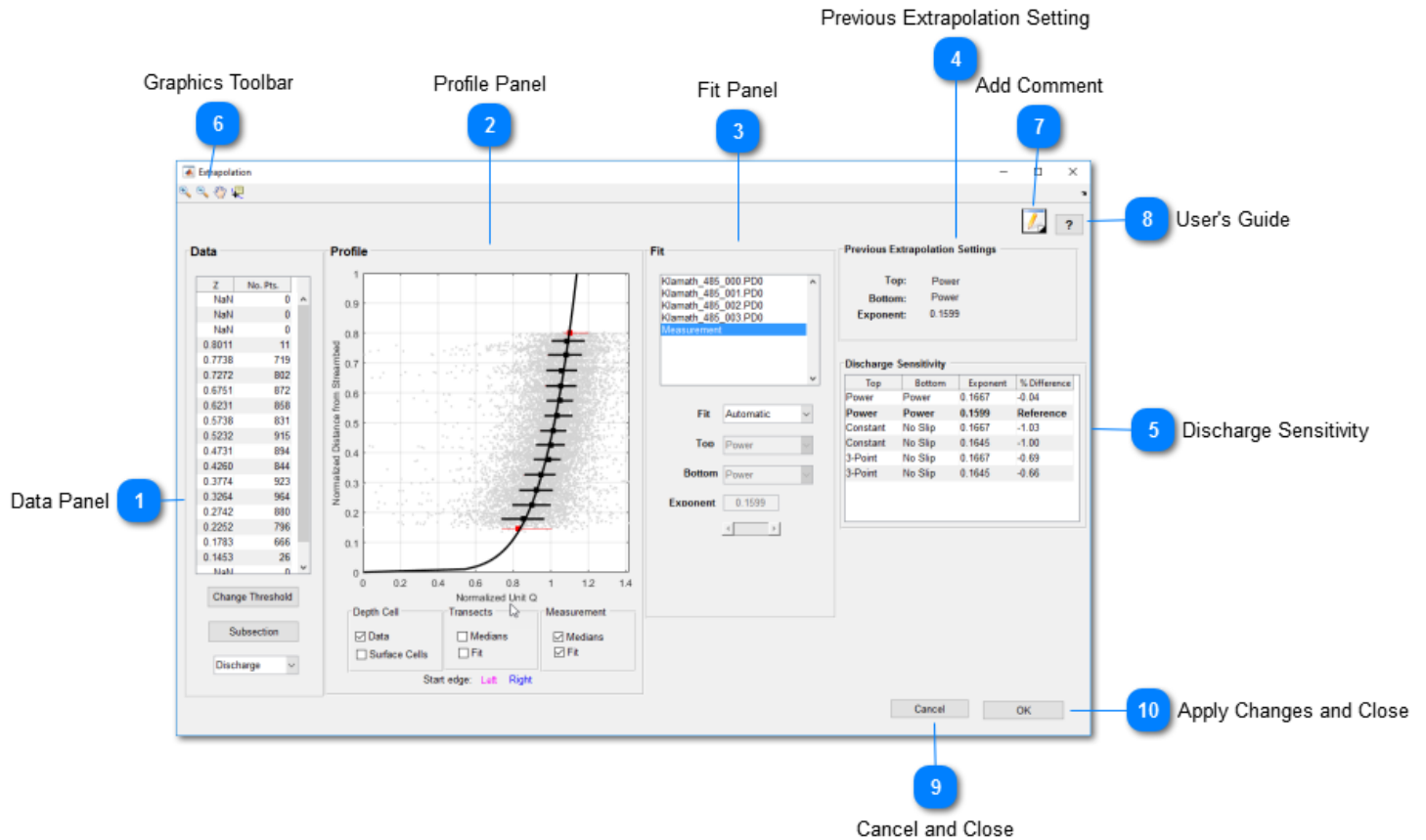
Data Panel

Data

Z	No. Pts.
NaN	0
NaN	0
NaN	0
0.8011	11
0.7738	719
0.7272	802
0.6751	872
0.6231	858
0.5738	831
0.5232	915
0.4731	894
0.4260	844
0.3774	923
0.3264	964
0.2742	880
0.2252	796
0.1783	666
0.1453	26
NaN	0

Change Threshold

Subsection

Discharge

The normalized distance from the streambed is divided into 5 percent segments (0.05; from 0 to 1). A median value of the normalized unit discharge is then computed for each segment, and the result is assigned to the average normalized depth of the data in that segment. The location of the mean normalized depth for each segment and number of points used in each segment are reported in the Data Panel. To help ensure that the median profile is representative of the data and not overly influenced by a few points in the top or bottom segments, only median values with sufficient points to exceed a specified threshold are used in the computation of the extrapolation. The default threshold is set to 20 percent of the median number of points for all segments. The threshold can be changed by the user using the Change Threshold button in the Data panel. The median points for an individual transect are colored blue if the number of points in the segment exceeds the threshold amd red if they do not..

Change Threshold button allows the user to change the cutoff threshold from the default value of 20 percent of the median number of points in all the segments to a user defined value.

Subsection button allows the user to look only at a subsection of the data by entering a lower and upper discharge range. The range is applied from the beginning of the transect independent of the starting bank. This range is only applied to the profile evaluation and does not affect the

discharge sensitivity analysis. For example, if the user wanted to look at the profile for the center 50 percent of the discharge, 25 should be entered for the lower limit and 75 for the upper limit.

The drop down menu at the bottom allows the user to select discharge or velocity data. Discharge is the default and is recommended for all moving-boat measurements.

2 Profile Panel
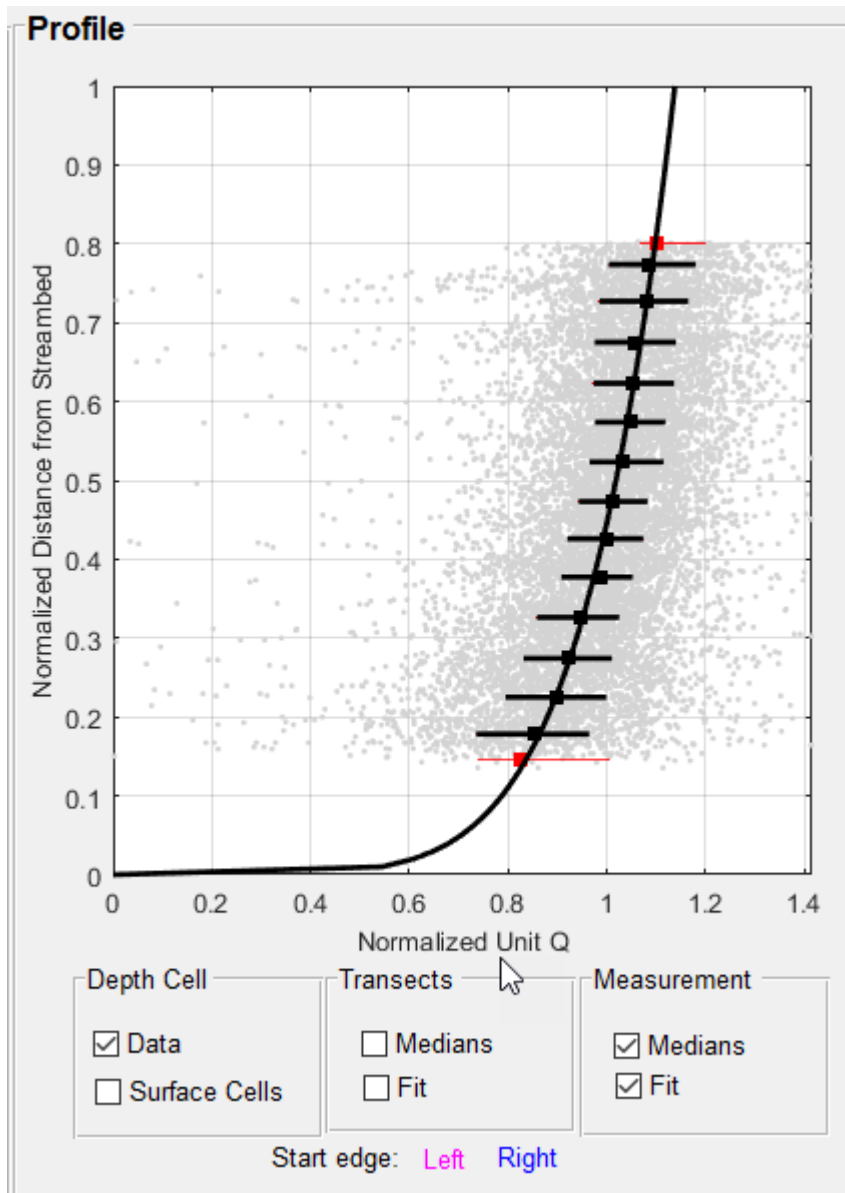
The primary panel in the extrapolation dialog window is the Profile panel. The graph in the profile panel displays the following data depending on the selections made in the check boxes below the graph.

> **Data (Gray Dots)**—The raw data represent the normalized discharge or velocity in each depth cell for all transects selected in the Fit panel.
> **Surface Cells (Green circles)**—Cells that are the top cell for each ensemble.
> **Median Points (Blue/Red/Black Squares)**—If the number of points in a segment does not exceed the threshold value, the median point is colored red and is not used in the computation of the extrapolation. Solid black squares represent the median values of the composite of all transects in the measurement.
> **Whiskers (Horizontal Blue/Red/Black Lines)**—The whiskers on each median value represent the 25th and 75th percentile of all the data in that 5 percent increment. Thus,

50 percent of the data for that increment fall within the limits of the whiskers. Colors are representative of the type of median value.

Extrapolation (Solid Blue/Magenta/Black Line)—The extrapolation fits are color coded such that magenta lines represent transects collected in the left to right direction, blue lines represent transects collected in the right to left direction, and the black line represents the composite of all transects in the measurement.

The controls at the bottom of the graph are described below:

Depth Cell

Data—Turns on and off the display of the cell data (gray dots).
Surface Cells—Highlights the cells that are the top cell for each ensemble.

Transects

Medians—Turns on and off the display of the median points for each transect.
*Fit*—Turns on and off the display of the extrapolation fit for each transect.

Measurement

Median—Turns on and off the display of the median points for the composite measurement.
Fit—Turns on and off the display of the extrapolation fit for the composite measurement.

If the transect data are shown the data for transects moving from left to right are shown in magenta and those moving from right to left in blue.

3 **Fit Panel**
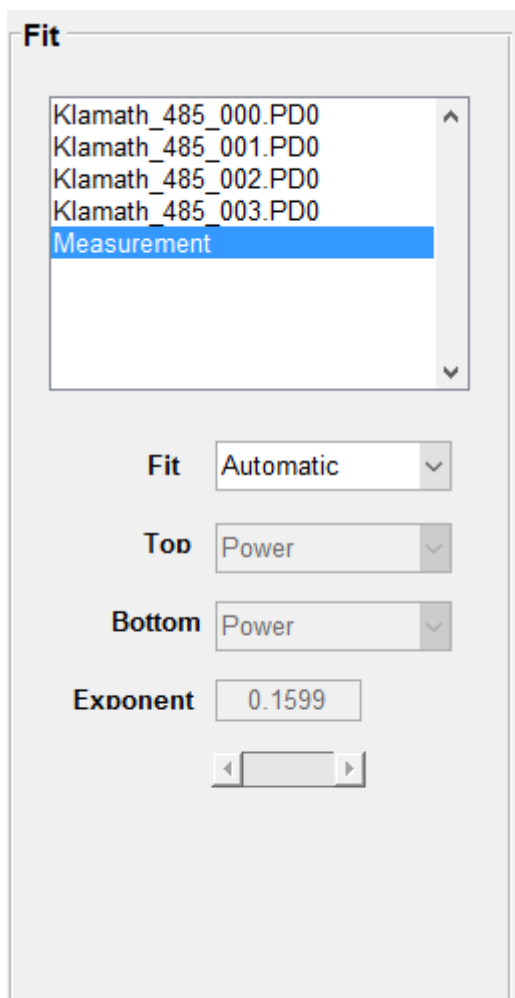
The Fit panel provides the user the ability to control what data are shown in the Profile and Data panels and change the fit type, extrapolation methods, and exponent. The transect selection list shows the filename of the transects loaded and the composite for the measurement ("Measurement"). The default is for the composite measurement to be shown. To view a specific transect, click on the transect filename, and the graph and fit characteristics for that transect selected in the Profile Panel will be shown. The fit characteristics of an individual transect can be changed; however, because QRev uses only one set of fit characteristics for the measurement, only the settings for "Measurement" are used in the discharge computation.

> **Fit**—The fit popup menu allows the user to change the fit type from the default automatic algorithms to Manual. If Manual is selected, the Top, Bottom, Exponent, and slider will become active.
> **Top**—The Top popup menu displays the top extrapolation method. This popup menu cannot be changed unless Fit is changed to Manual. The options are Power and Constant.
> **Bottom**—The Bottom popup menu displays the bottom extrapolation method. This popup menu cannot be changed unless Fit is changed to Manual. The options are Power and No Slip.
> **Exponent**—The Exponent edit box displays the exponent for the power or no slip extrapolations. The exponent cannot be changed unless Fit is changed to Manual. If fit is changed to manual, the exponent can be changed by manually typing a value in the edit box or by using the slider below the box to incrementally change the value.

4 Previous Extrapolation Setting

Previous Extrapolation Settings

Top:	Power
Bottom:	Power
Exponent:	0.1599

The Previous Extrapolation Settings are the extrapolation settings that will be used when exiting with Cancel.

5 Discharge Sensitivity

Discharge Sensitivity

Top	Bottom	Exponent	% Difference
Power	Power	0.1667	-0.04
Power	**Power**	**0.1599**	**Reference**
Constant	No Slip	0.1667	-1.03
Constant	No Slip	0.1645	-1.00
3-Point	No Slip	0.1667	-0.69
3-Point	No Slip	0.1645	-0.66

The sensitivity of the extrapolation method for the top and bottom extrapolation is evaluated by computing the discharge for each combination of top and bottom extrapolation methods with a default and with least squares fit exponents and reporting the percent difference from the selected fit (from the Fit panel). If a manual fit is used for the composite measurement, then an additional line will be added to the table that represents the manual fit. This table can be used to help determine the effect of extrapolation choices on the final discharge. The user can also click in the table to quickly evaluate other fits. Clicking a row in the table to set and display those fit parameters.

6 Graphics Toolbar

Allows user to zoom, pan, and query the graphs. For more information see Toolbar.

7 Add Comment

Allows the user to add a comment. For more information see Comment Button.

8 User's Guide

Display this User's Guide.

9 Cancel and Close

[Cancel]

Cancels any changes so the extrapolation remains as displayed in Previous Extrapolation Setting. Closes the window and returns control to the main window.

10 Apply Changes and Close

[OK]

Applys the extrapolation settings from the Fit Panel to the data. Closes the window and returns control to the main window.

16.1. Measurement Quality Check

Good (Green)

Check—Selected extrapolation methods results in a mean discharge with an uncertainty due to extrapolation of less than 2 percent.

Caution (Yellow)

Check—Selected extrapolation methods results in an uncertainty in discharge due to extrapolation methods of greater than 2 percent.
Message—Extrapolation: The extrapolation uncertainty is more than 2 percent. Carefully review the extrapolation.

17. Edges

The Edges button opens a window that allows the user to review and change settings associated with the discharge computations. This window has a table containing the edge setting and graphs to evaluate The Edges window displays a table that lists the edge settings and graphs that show the data used to compute the left and right edge discharges. Edge settings can be edited by clicking the appropriate row and column in the table.
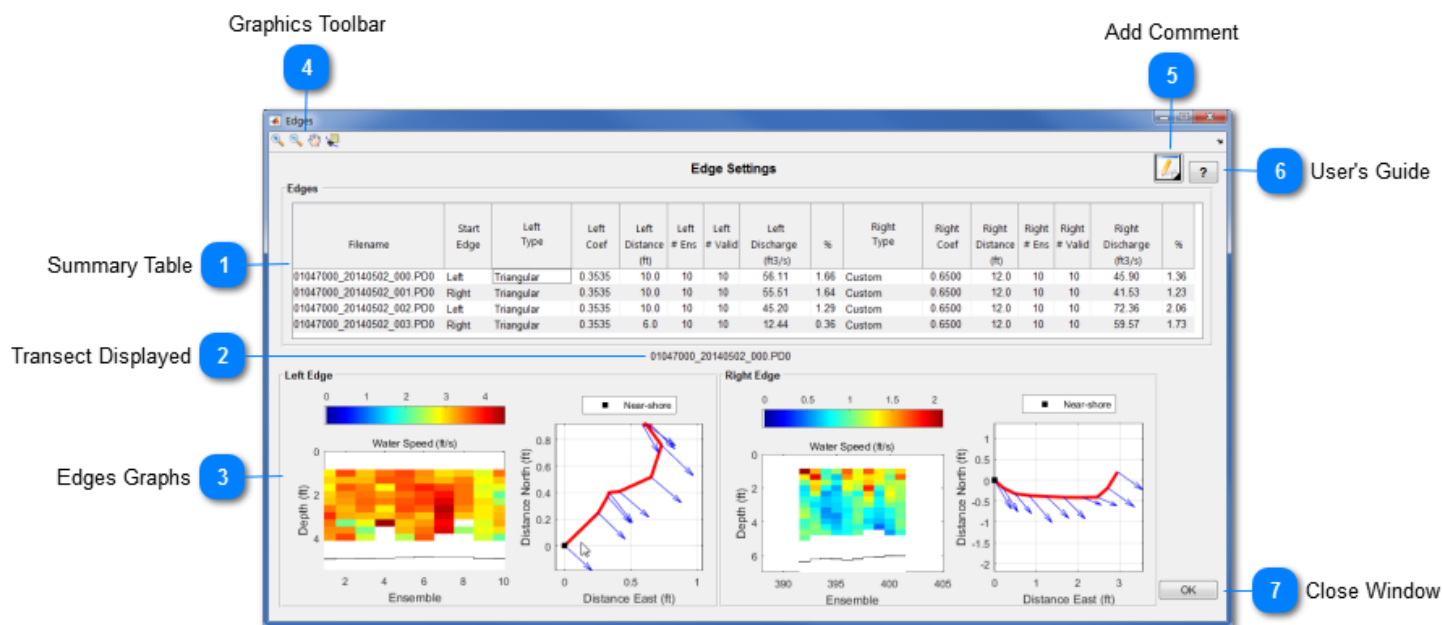
1 Summary Table

Filename	Start Edge	Left Type	Left Coef	Left Distance (ft)	Left # Ens	Left # Valid	Left Discharge (ft3/s)	%	Right Type	Right Coef	Right Distance (ft)	Right # Ens	Right # Valid	Right Discharge (ft3/s)	%
01047000_20140502_000.PD0	Left	Triangular	0.3535	10.0	10	10	56.11	1.66	Custom	0.6500	12.0	10	10	45.90	1.36
01047000_20140502_001.PD0	Right	Triangular	0.3535	10.0	10	10	55.51	1.64	Custom	0.6500	12.0	10	10	41.53	1.23
01047000_20140502_002.PD0	Left	Triangular	0.3535	10.0	10	10	45.20	1.29	Custom	0.6500	12.0	10	10	72.36	2.06
01047000_20140502_003.PD0	Right	Triangular	0.3535	6.0	10	10	12.44	0.36	Custom	0.6500	12.0	10	10	59.57	1.73

The Summary Table shows the edge settings and resulting discharge. Edge settings can be changed by clicking the appropriate column in the table. For details on editng the edge setting see Edit Edges.

Filename—Filename of transect.
Start Edge—Specifies at what edge the transect was started (Left or Right).
Left Type—Specifies the type of edge for the left bank.

Triangular—Sets the left coefficient to 0.3535.
Rectangular—For TRDI and QRev processing (WR2 and RSL data), sets the left coefficient to 0.91. For SonTek processing, an equation is used to set the coefficient (Mueller, in review).
Custom—Allows the user to type a custom coefficient in the Left Coef column.
User Q—Allows the user to not specify a coefficient but rather to specify the discharge in the left edge by entering the discharge in the Left Discharge column.

Left Coef—Coefficient, C, in the equation ($Q_{edge} = C*L*D*V$) for computing the left edge discharge.
Left Distance—The user measured distance (L) from the end of the transect to the water's edge on the left bank.

99

Left # Ens—The number of ensembles specified to determine the water velocity (V) and depth (D) for the edge discharge equation.

Left # Valid—The number of left edge ensembles that contain valid data that is used to determine the water velocity (V) and depth (D) for the edge discharge equation.

Left Discharge—The discharge computed or entered (User Q) for the left unmeasured edge.

%—Percent of total discharge in the left edge.

Right Type—Specifies the type of edge for the right bank.

> *Triangular*—Sets the right coefficient to 0.3535.
>
> *Rectangular*—For TRDI and QRev processing (WR2 and RSL data), sets the right coefficient to 0.91. For SonTek processing, an equation is used to set the coefficient (Mueller, in review).
>
> *Custom*—Allows the user to type a custom coefficient in the Right Coef column.
>
> *User Q*—Allows the user to not specify a coefficient but rather to specify the discharge in the right edge by entering the discharge in the Right Discharge column.

Right Coef—Coefficient, C, in the equation ($Q_{edge} = C * L * D * V$) for computing the right edge discharge.

Right Distance—The user measured distance (L) from the end of the transect to the water's edge on the right bank.

Right # Ens—The number of ensembles specified to determine the water velocity (V) and depth (D) for the edge discharge equation.

Right # Valid—The number of right edge ensembles that contain valid data that is actually used to determine the water velocity (V) and depth (D) for the edge discharge equation..

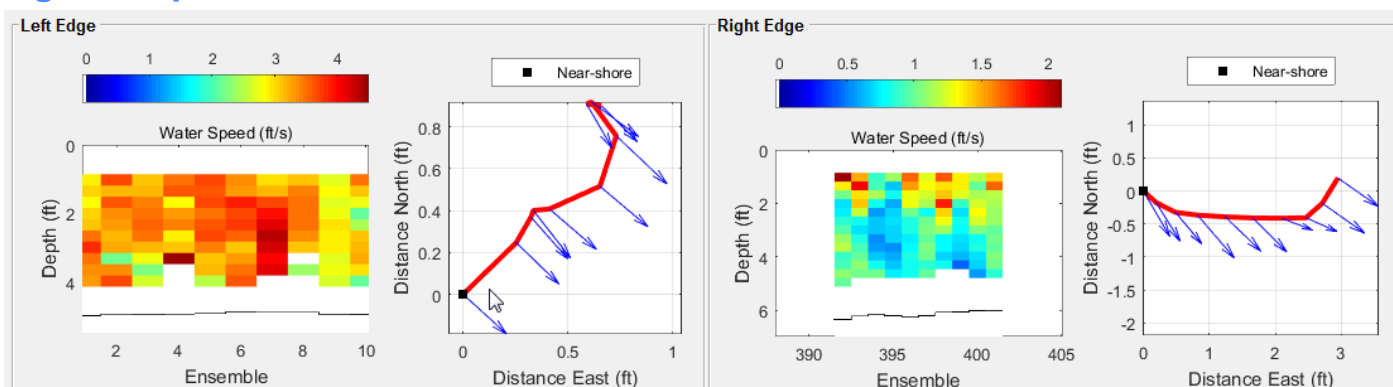**Right Discharge**—The discharge computed or entered (User Q) for the right unmeasured edge.

%—Percent of total discharge in the right edge.

2 Transect Displayed

01047000_20140502_000.PD0

Filename of transect displayed in left and right edge graphs.

3 Edges Graphs

The data used in the computation of the left and right edge discharges are displayed in the Left Edge and Right Edge panels. The transect data displayed are selected by clicking on the filename in the table. The filename of the transect being displayed is below the table and just above the left and right edge panels. Each edge panel contains a color contour graph of the water speed and a ship track graph. These graphs only contain data from the edge ensembles. The color contour graph should be used to evaluate the consistency of the depth and water speed. The ship track graph should be used to evaluate boat movement during the collection of the edge ensembles. The black square also

indicates the end of the transect closest to shore. The blue arrows represent the depth averaged velocity vectors.

4 Graphics Toolbar

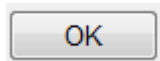Allows user to zoom, pan, and query the graphs. For more information see [Toolbar](#).

5 Add Comment

Allows the user to add a comment. For more information see [Comment Button](#).

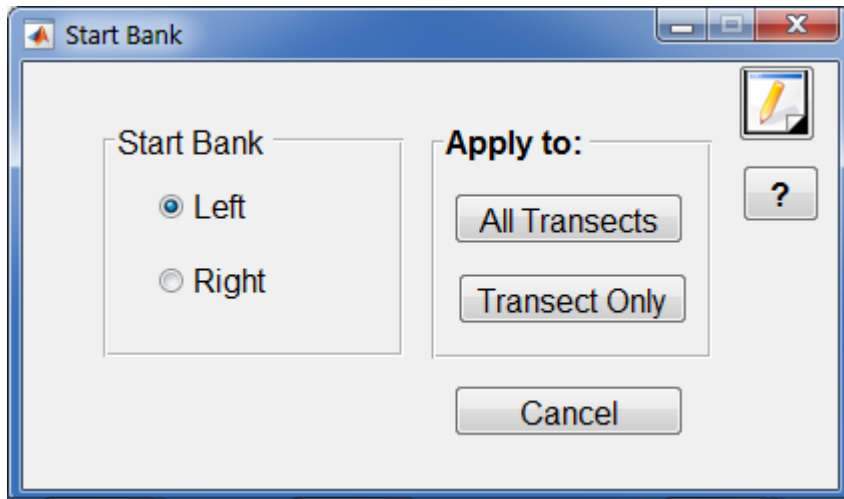## 6 User's Guide

?

Opens this User's Guide

7 Close Window

OK

Close window and return control to the main window.

17.1. Edit Edges

Edge settings can be changed by clicking on the appropriate column and making the change in the displayed dialog.

Start Bank

Clicking on a row under the start bank will display the following dialog.

The start bank can be set by selecting the appropriate bank. The change can be applied to All Transects (not likely for a start edge setting) or to only the selected transect (Transect Only).
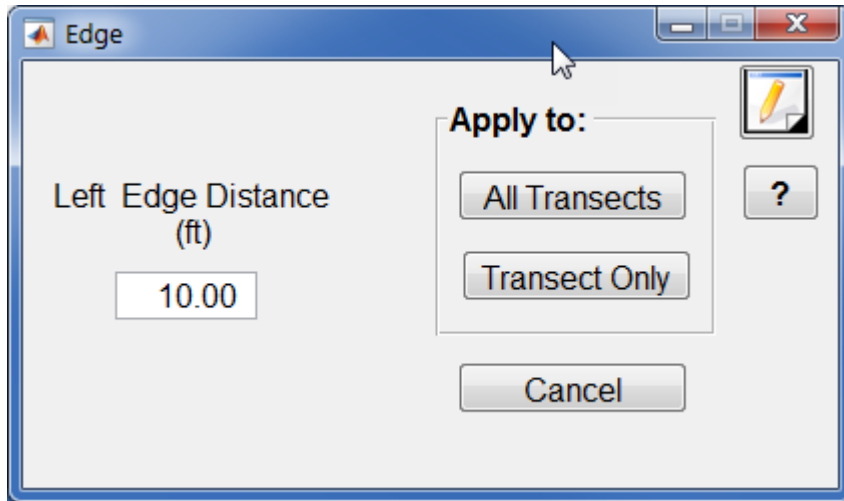
Left Edge Type, Left Coef, Left Discharge

Clicking on a row under the Left Edge Type, Left Coef, or Left Discharge will display the following dialog.
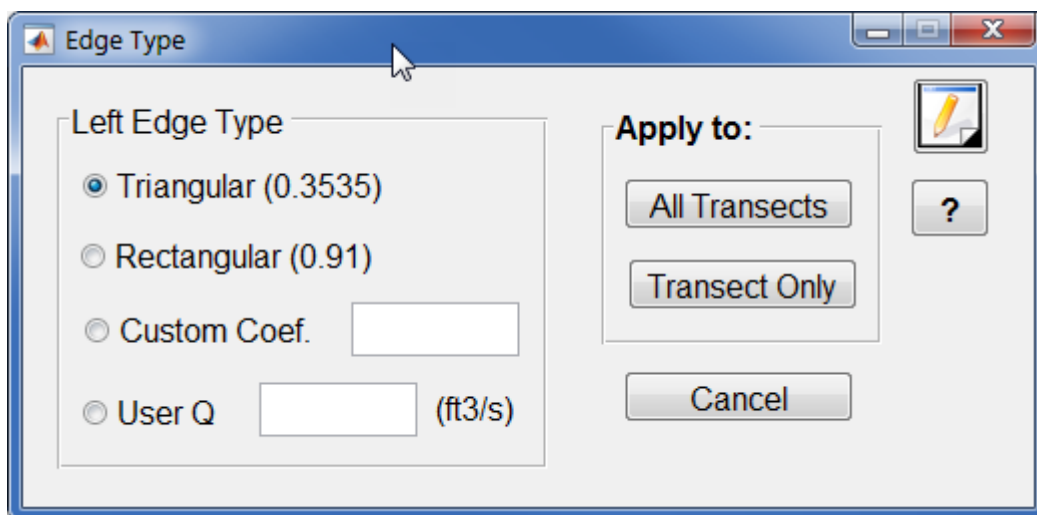
The left edge type and associated custom coefficient or user specified discharge can be set using this dialog. The setting can be applied to All Transects or only to the selected transect (Transect Only).
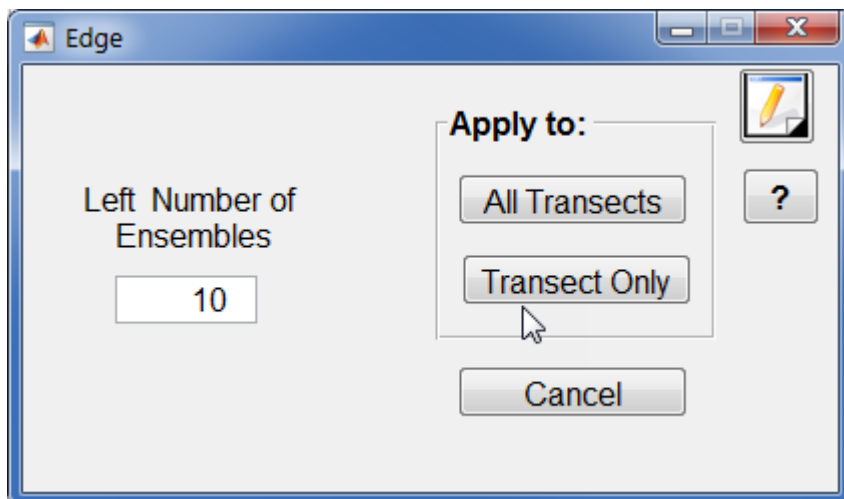
Left Distance

Clicking on a row under the Left Distance will display the following dialog.

The left distance can be edited and applied to All Transects or only to the selected transect (Transect Only).
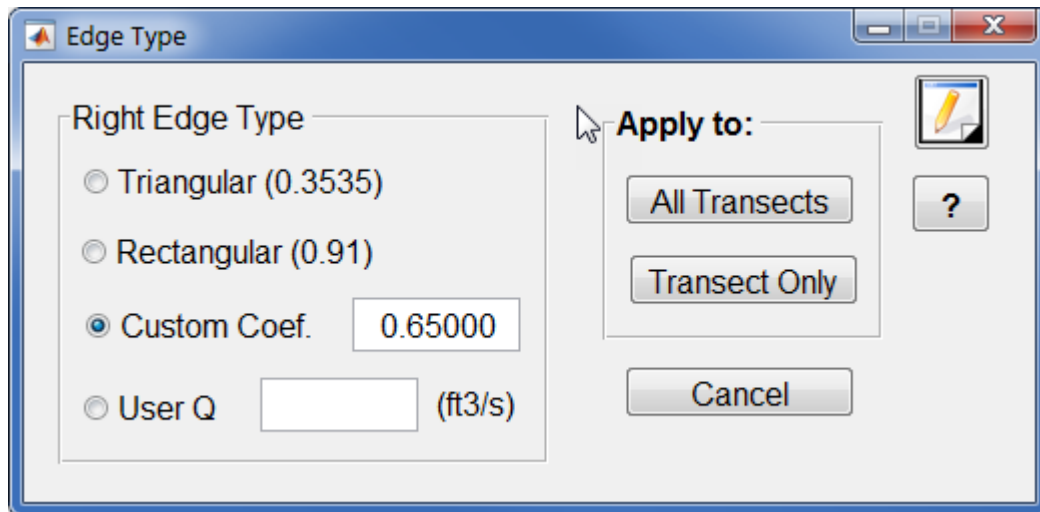
Left # Ens

The number of ensembles used to compute the mean velocity and depth can be changed by clicking a row under Left # Ens. The following dialog will be displayed.

The number of ensembles used for the left edge can be edited and applied to All Transects or only to the selected transect (Transect Only).

**Right Edge Type, Right Coef, Right Discharge**

Clicking on a row under the Right Edge Type, Right Coef, or Right Discharge will display the following dialog.

The right edge type and associated custom coefficient or user specified discharge can be set using this dialog. The setting can be applied to All Transects or only to the selected transect (Transect Only).

Right Distance

Clicking on a row under the Right Distance will display the following dialog.
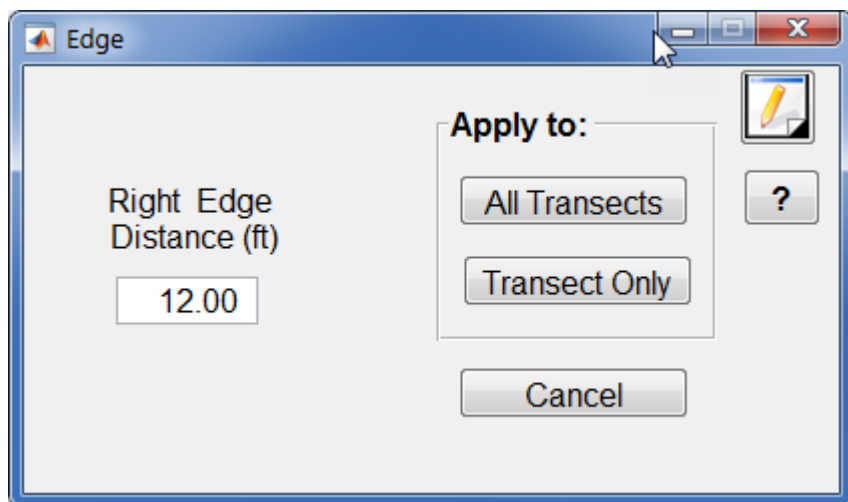
The right distance can be edited and applied to All Transects or only to the selected transect (Transect Only).

Right # Ens

The number of ensembles used to compute the mean velocity and depth can be changed by clicking a row under Right # Ens. The following dialog will be displayed.
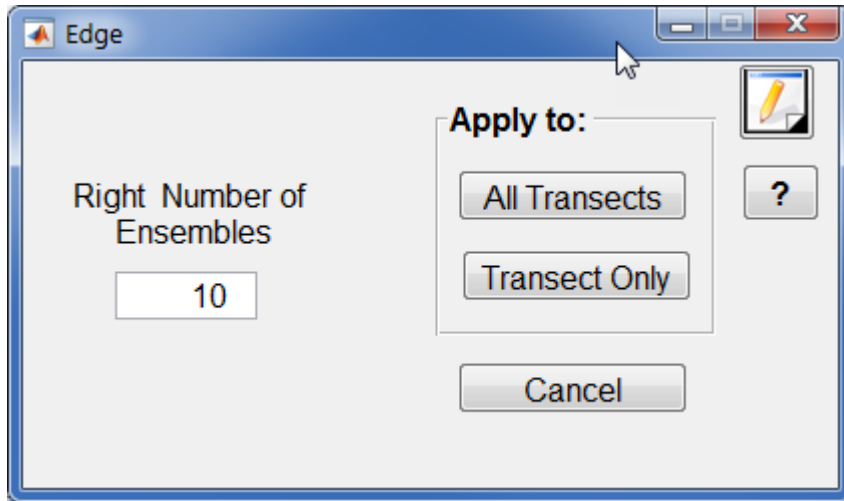
The number of ensembles used for the right edge can be edited and applied to All Transects or only to the selected transect (Transect Only).

17.2. Measurement Quality Checks

The Edges button may be colored and messages provided based on the following ADQA checks.

Good (Green)

Edges pass all quality checks.

Caution (Yellow)

Check—Edge discharges have inconsistent signs.
Message—Edges: Sign of edge discharge is not consistent.

Check—Distance the boat moved during right edge data collection is less than 5% of the distance made good of the transect and less than the average edge distance for the measurement.
Message—Edges: Excessive boat movement in right edge ensembles.

Check—Distance the boat moved during left edge data collection is less than 5% of the distance made good of the transect and less than the average edge distance for the measurement.
Message—Edges: Excessive boat movement in left edge ensembles.

Warning (Red)

Check—Discharge in each edge is nonzero.
Message—EDGES: An edge has zero discharge.

*Check*—Edge type is inconsistent for the left edge.
Message—EDGES: Left edge type is not consistent.

Check—Edge type is inconsistent for the right edge.
*Message*—EDGES: Right edge type is not consistent.

18. Save

The Save button allows the user to save a MATLAB file of the measurement as processed in QRev and an XML file that can be loaded into other software, such as SV Mobile. A save file dialog window provides a default name for the MATLAB file, which can be changed by the user prior to saving . The same name with an xml suffix will be used for the XML file. The default filename is based on the date and time of the save (yyyymmddHHMMSS_QRev.mat or yyyymmddHHMMSS_QRev.xml). If the user attempts to overwrite an existing file, a dialog is displayed indicating a file with the same name exits and asking the user if they wish to overwrite the existing file.
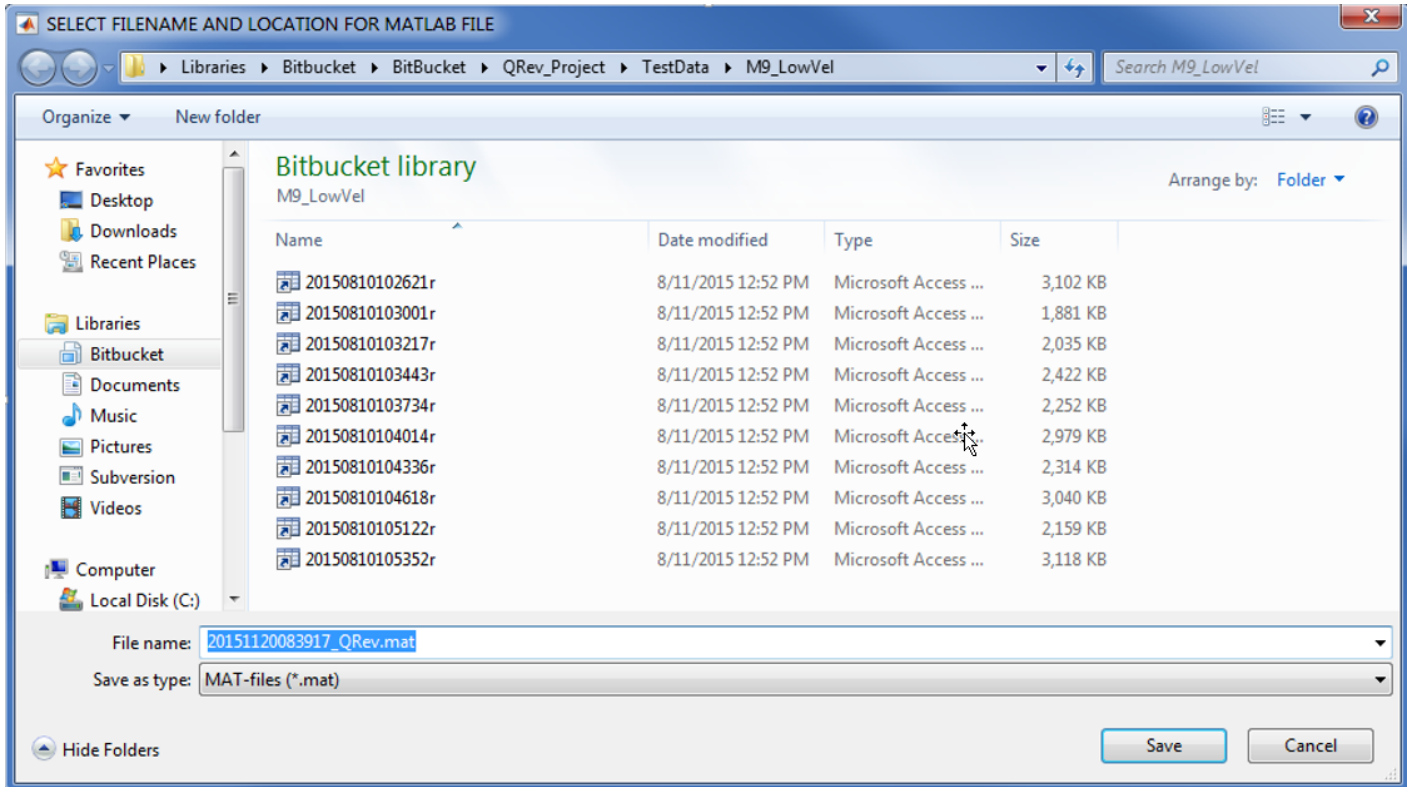
18.1. Save Checked

By default QRev saves the data for all transect loaded, even those that were unchecked to not use in the discharge computation. However, if the user desires to only save the checked or used transects they can implement this option by pressing ALT-s. This will toggle the save button to be
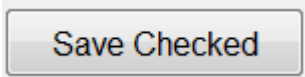
Save Checked and the QRev file will only contain data from the checked or used transects. This option is helpful when splitting a measurement into multiple measurements such as a tidal measurement or data from a rapidly varying flow situation.

19. View Comments

The View Comments button opens a window that allows the user to see comments that were either imported from the data files or have been added in QRev. Remarks made in WR2 are prefaced by "MMT Remarks". Notes associated with transects in WR2 are prefaced by the file number, the date, and the time. QRev comments are prefaced by the dialog or window name, date, and time. Comments cannot be edited or deleted and are considered original data. To change a comment, add an additional comment to correct an earlier comment.

20. Close

The close button closes QRev. If the data were loaded from a WR2 or RSL file and the data have not been saved in QRev, clicking the close button will display a dialog warning the user that the loaded data have not been saved and giving them an opportunity to save the data. This dialog will not appear if the data were loaded from a previously saved *_QRev.mat file.
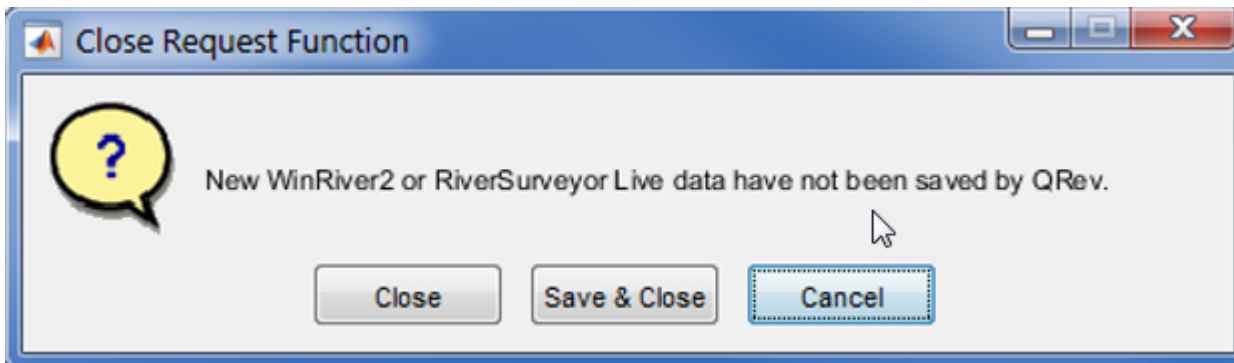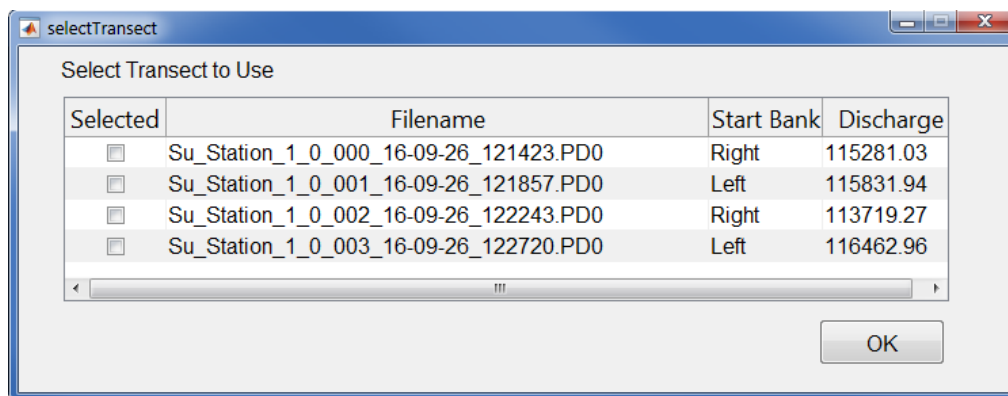
21. EDI - Equal Discharge Increment

Equal-discharge-increment method (EDI) samples are obtained from the centroids of equal-discharge increments across the cross section. This method requires some knowledge of the distribution of streamflow in the cross section, based on a long period of discharge record or on a discharge measurement made immediately prior to selecting sampling verticals. If this information can be obtained (such as with an ADCP), the EDI method can save time and labor; compared to the equal-width increment method. This is especially true on the larger streams, because fewer verticals are required (Hubbell and others, 1956) (Edwards and Glysson,1999).

A discharge measurement made with an ADCP immediately prior to the collection of EDI samples can be used to identify the location, depth, and mean velocity for each EDI sample. To improve the accuracy and efficiency of using ADCP discharge measurements for EDI sampling this function was written in Matlab to use the discharge measurements processed in QRev and perform the necessary computations.

Clicking on the EDI button opens the following window.

The user must select the transect that will be used to compute the equal discharge increments. It is important to select a transect that starts on the desired bank, as the computations will be relative to that bank. After selecting the desired transect, click OK. The following window will open.

Equal Discharge Increment Calculator

Zero Distance Offset: 0 ☐ Create TopoQuad File

Percent Q	Target Q (cfs)	Actual Q (cfs)	Distance (ft)	Depth (ft)	Velocity (ft/s)	Latitude (D M.M)	Longitude (D M.M)
10							
30							
50							
70							
90							

Su_Station_1_0_001_16-09-26_121857.PD0

Compute Stations   Close

The EDI program interface allows the user to change the default increments of 10, 30, 50, 70, and 90 percent of the discharge to any desired flow percentage between 0 and 100. The distance displayed in the user interface is from the starting bank of the selected transect and is computed as the Distance Made Good (a straight-line distance from the starting location) to the target ensemble location plus the starting edge distance and a user provided zero distance offset. Therefore, it is important that the transect traverse the channel in a straight line.

 If GPS data are available in the ADCP files, the longitude and latitude in degrees, minutes, and decimal minutes are displayed for each target sample-location. These data may be used with navigation software and devices to assist in navigating to and holding the boat on the desired locations. In addition, there is an option (checkbox Create TopoQuad File) to create a file compatible with Delorme TopoQuad software. The file is named "tqlatlon.txt", is stored in the same folder as the ADCP data, and contains the information to plot a yellow dot for each sampling location in the TopoQuad display.

When the user is satisfied with the Percent Q, Zero Distance Offset, and Create TopoQuad File settings clicking "Compute Stations" will complete the compuations and display the results.

Equal Discharge Increment Calculator

Zero Distance Offset: 0   ☐ Create TopoQuad File

Percent Q	Target Q (cfs)	Actual Q (cfs)	Distance (ft)	Depth (ft)	Velocity (ft/s)	Latitude (D M.M)	Longitude (D M.M)
10	9750.5	10136.9	215.6	23.1	5.1	61 32.9165	-151 29.8937
30	29251.5	29796.9	354.1	26.1	6.1	61 32.9303	-151 29.8554
50	48752.5	49079.7	485.0	26.5	6.8	61 32.9439	-151 29.8208
70	68253.5	68354.3	622.8	25.0	5.0	61 32.9582	-151 29.7832
90	87754.5	87802.9	841.8	17.9	4.0	61 32.9812	-151 29.7230

Su_Station_1_0_001_16-09-26_121857.PD0

Compute Stations   Close

The location of the sample is determined by finding the first ensemble (referred to as the target ensemble) with a cumulative discharge that exceeds the target discharge. The target discharge is computed as the Target Percentage multiplied by the Total Discharge obtained from the selected transect. Both the target discharge and measured cumulative discharge to the target ensemble will be displayed in the user interface. If GPS data are available in the ADCP files, the longitude and latitude in degrees, minutes, and decimal minutes are displayed for each target sample-location.

The computations used in this QRev implementation of EDI uses averaging to determine the depth and velocity which is different form standalone versions of EDI prior to EDI version 3.4. The depth and velocity displayed are an average of 1 percent of the total ensembles before and after the target ensemble. The depth used to compute the average is the final depth for each ensemble as computed by QRev. The velocity displayed is the magnitude of the mean velocity of the measured part of the velocity profile for the ensembles used in the average. The average is computed as the average of the u and v velocity components in each depth layer to form a mean profile with mean u and v components. Mean u and v components of the profile are then computed by vertically averaging the u and v profile components. Finally the magnitude of the mean u and v components is computed. No accounting for the unmeasured part of the velocity profile is included.