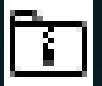


oceanillumination

Ocean Contour

Data Display and Processing

Overview Concepts

- Contour opens a **Workspace** which contains multiple **Projects**
 - Switch amongst workspaces through the File menu
- A **Project** consists of multiple folders which contain raw and processed data
- Data consists of one or more **time series** (.OCTS) files
 - A time series file can be fully loaded into memory
 - Size of file dependent upon computer (memory, CPU).
 - Controlled via Preferences : Signature Data Import: File Sizing
- A **segment file** (.OCSEG) is created for data series that are too large to fit in memory
 - Multiple time series are collated / managed by the segment file
 - Processing operations performed on the segment file result in each time series file getting processed sequentially

Overview

- Process data by transitioning through chains of processing stages
 - Separate interactive view (a “perspective”) for each stage
 - Adjust processing parameters
 - Immediately review results
 - Results stored in a separate stage folder in the project
 - Interactive view operates on a single time series file
 - Segment file processes all associated time series files when transitioning to next stage
- Chained processing stages
 - Transforms and Corrections -> Wave Processing
 - Transforms and Correction -> Data Selection -> Averaging
 - Echo Correction -> Data Selection -> Averaging
 - Processing stages accessible by buttons on top toolbar
- Data Viewing perspective (default)
 - Supports all possible data views, report generation and file playback
 - Data views accessible by buttons on left toolbar



Licensing

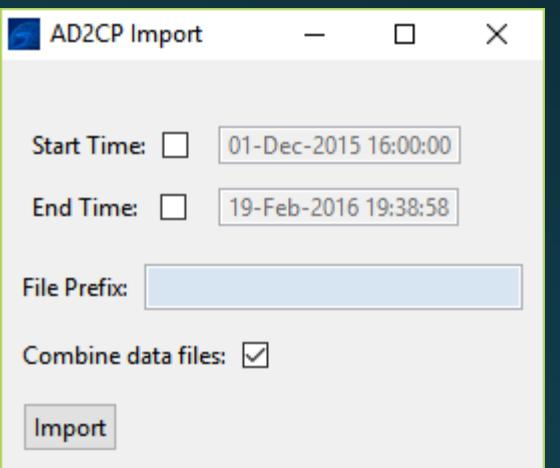
- Unlicensed
 - Imports and basic display of data (no processing, 3D etc).
- Basic license
 - Co-ordinate transforms
 - Simplified QA/QC
 - Averaging
 - Single user - operation on a single computer
- Professional license – Everything else
 - Wave processing
 - Fish Filtering
 - Processing wizard
 - Batch processing
 - Compass re-calibration
 - Bin mapping
 - Subsurface mount draw-down depth correction
 - Report generation
 - 3D data plots and 2D vector (stick line) plots
 - Single User - three activations allowed
 - E.g. field lap top and two lab computers
 - All future functionality (caveat below)
- Free upgrades for one year after purchase
 - Yearly maintenance fee must be paid to upgrade to new versions after that year is complete

Import Data

- Create new project
 - Enter project name
 - Immediately prompts for raw data file (.ad2cp or .ntk)

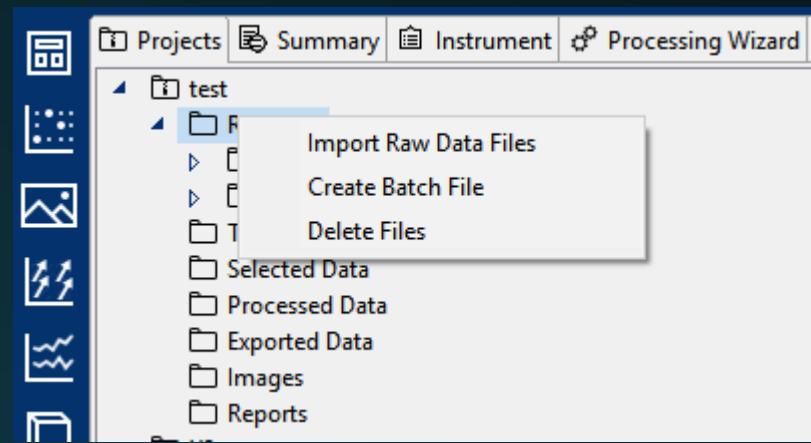


- Multiple raw files
 - Option to import a subset of the overall data file
 - File prefix added to subset if start / end time selected
 - Combine files if contiguous in time
- Press Import to start



Import Data to Existing Project

- Right click on “Raw Data” folder to bring up import selection
- Import breaks raw file up into multiple data series (OCTS / OCSEG files)
 - A series is defined as all data collected with the same time base
- Import searches for missing data if possible



Missing Data

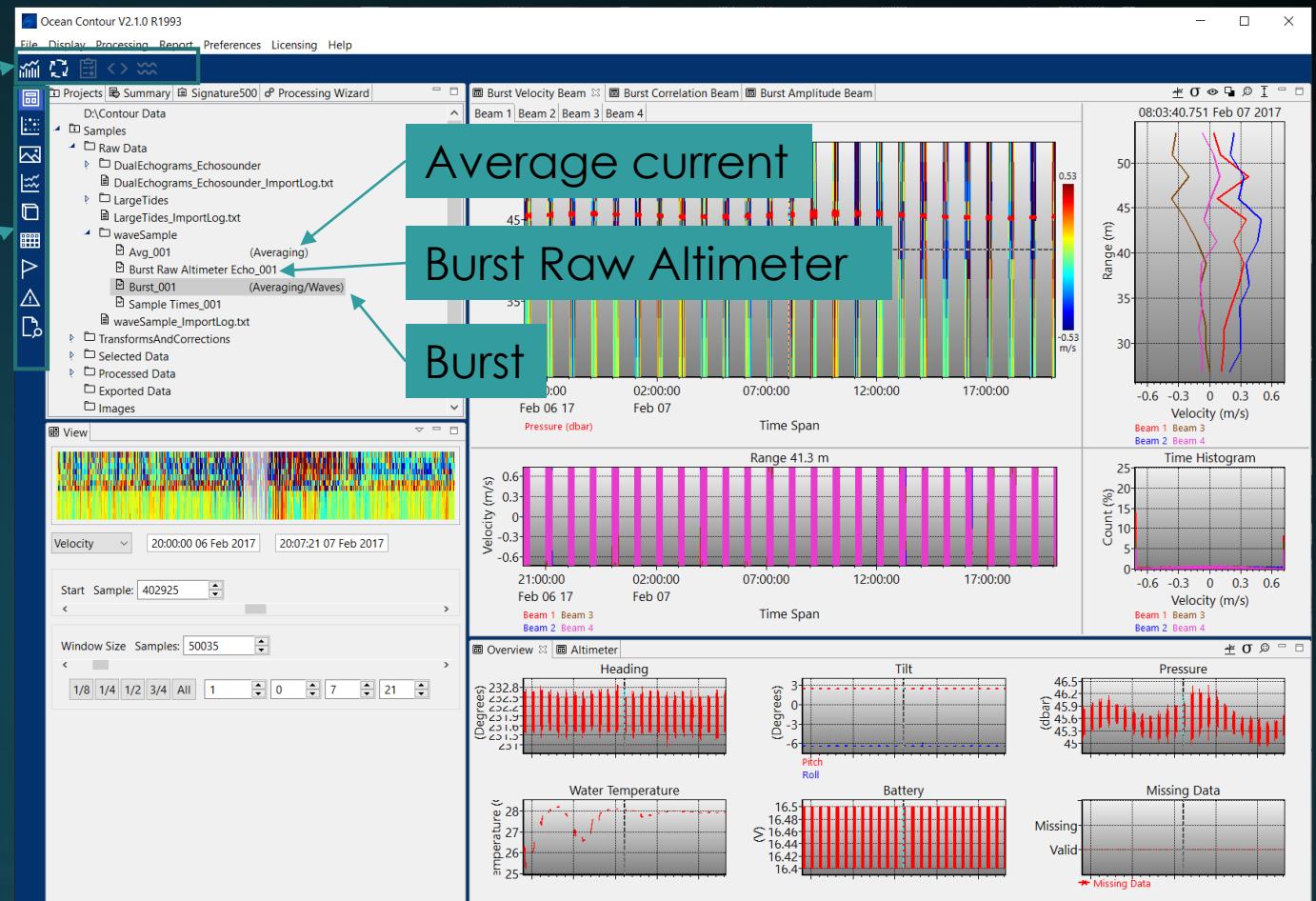
- All measurement intervals, including the first one must be complete (ensemble count)
- All measurement intervals must be present
- Missing data is flagged and “empty” samples are inserted to maintain a consistent time base
- Critical for ensuring later processing (e.g. averaging) has consistent time base to operate on
 - Missing data rejected during processing as required
- “Too much” missing data results in series being split
 - *_Cfgx time series created
 - Preferences: Signature Data Import: Split on Missing Measurement Interval Count
 - If “count” measurement intervals are missing, then the series is split
- Import log file can be examined to see where blocks of missing data were found
 - End of deployment likely not an issue (batteries depletion causes drop outs)

Project Created

- AD2CP platform allows simultaneous collection of multiple types of data
 - Each raw import has it's own folder
 - Each time series has its own data file
 - Double click on file to open
 - Right click on folder / file for drop down menu options
 - Processing options possible with file are also shown

Processing Operations

Display Operations



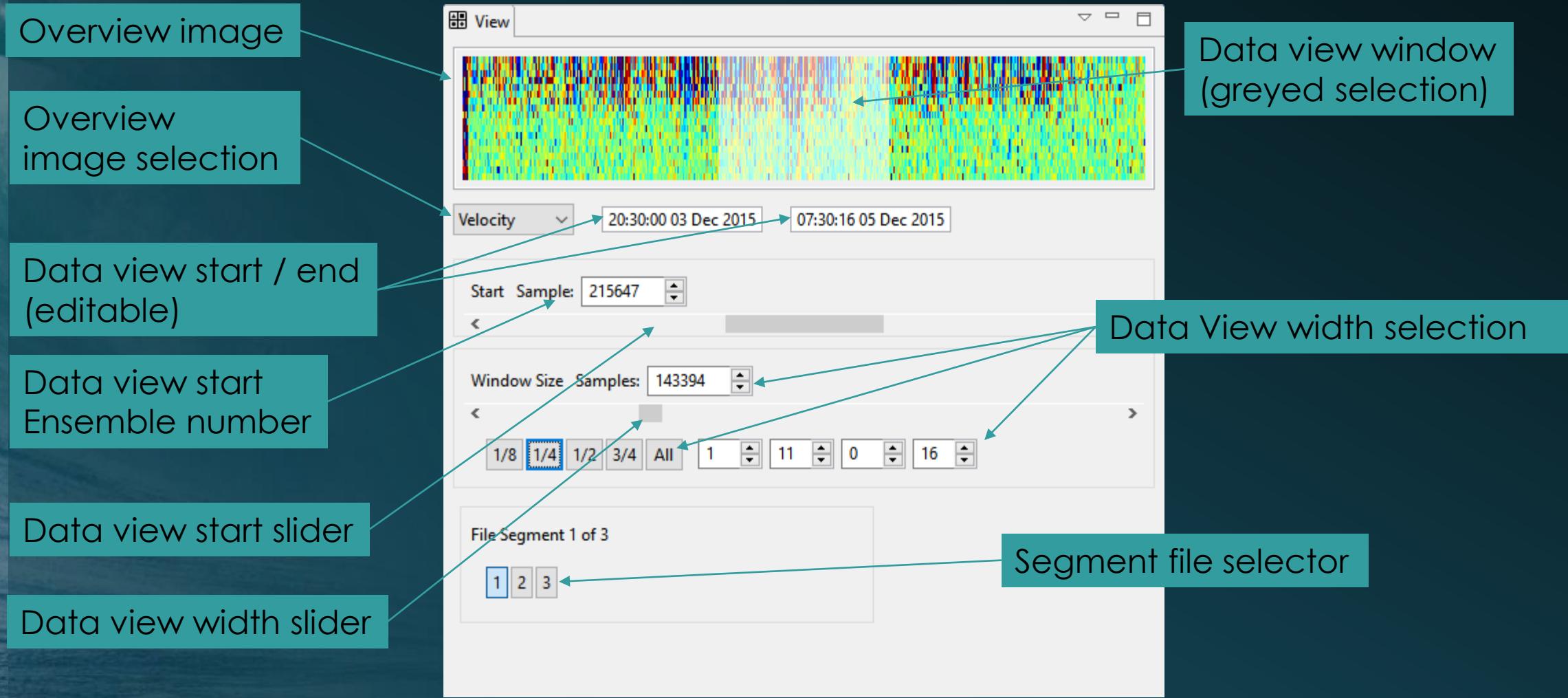
File Import

- Contour creates either a single Time Series file (OCTS) or a Segment file (OCSEG : a group of time series files)
 - Time Series File
 - Contains data and data descriptions
 - Segment File
 - Acts as an aggregator for the imported OCTS files
 - All OCTS files processed at one time and final processing will attempt to combine everything into a single output file (depending on size)
- One OCTS file is loaded into memory at a time
 - File size determines amount of data accessible at one time
 - Memory usage / quantity of data determines system responsiveness
 - Poor performance on systems with low CPU power?
 - Adjust the Preferences : Signature Data Import : File sizing factor to $\frac{1}{2}$ or $\frac{1}{4}$ (especially if a “Memory Low” or “Memory Critical” warning is shown)



View Panel

- Double click on data file to open
- Use view panel to navigate within a time series
 - All displayed data taken from the selected data view window



Data Display

Processing

Display

Transforms / Corrections,

Data Selection

Averaging

Waves

Data summary

Instrument Configuration

Processing Wizard

2D Profiling data

Image per input

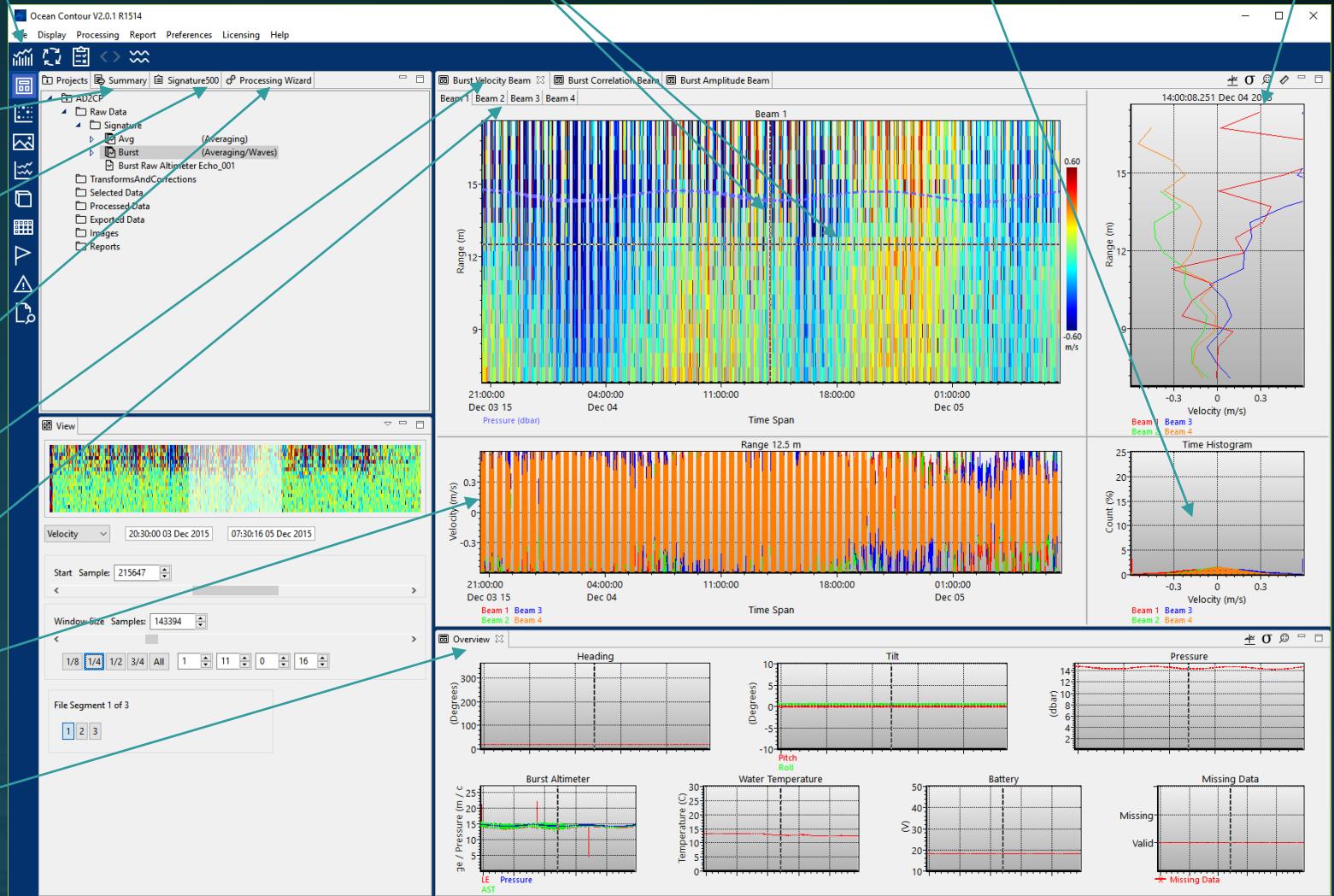
Time series for a particular cell

Overview ancillary plots

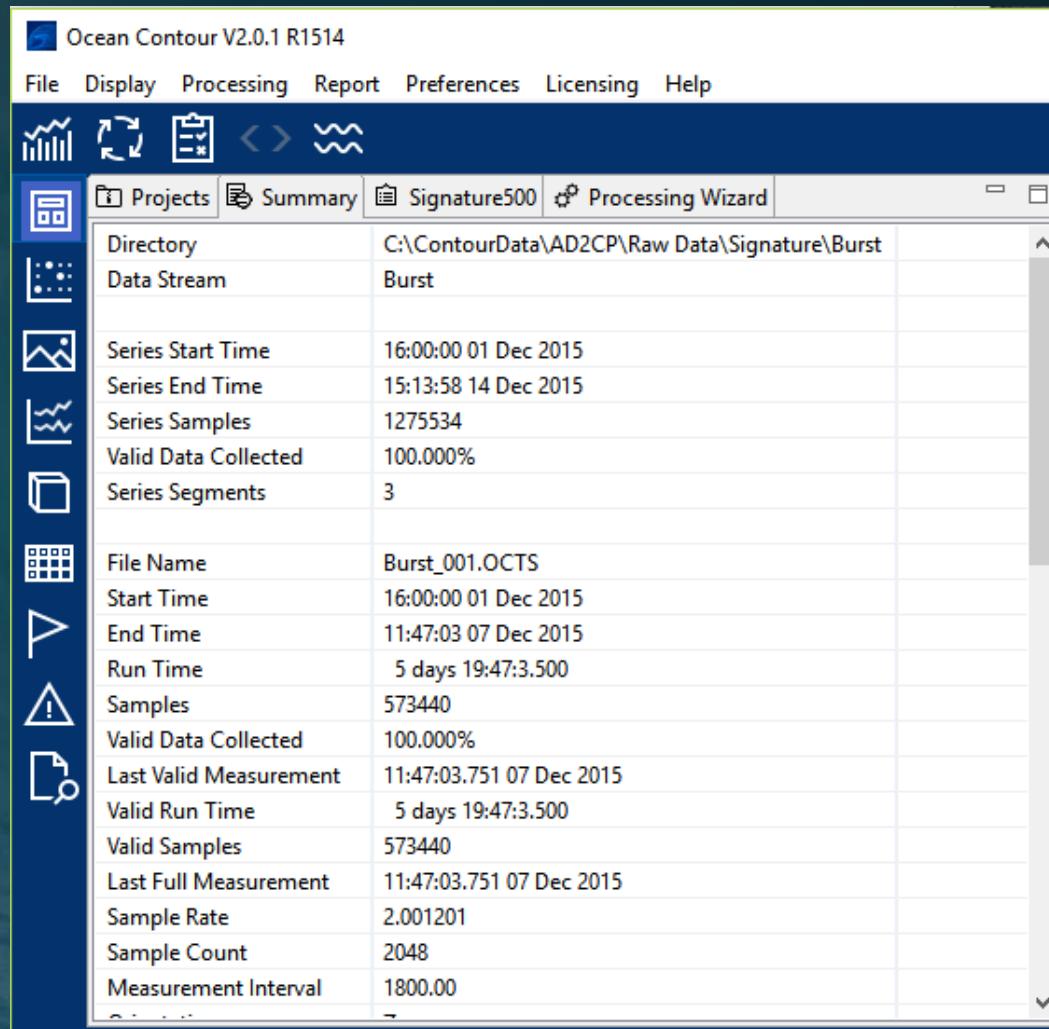
Horizontal cursor selects cell
Vertical selects time

Time series histogram

Profile view for a given time



Data Summary and Instrument Configuration

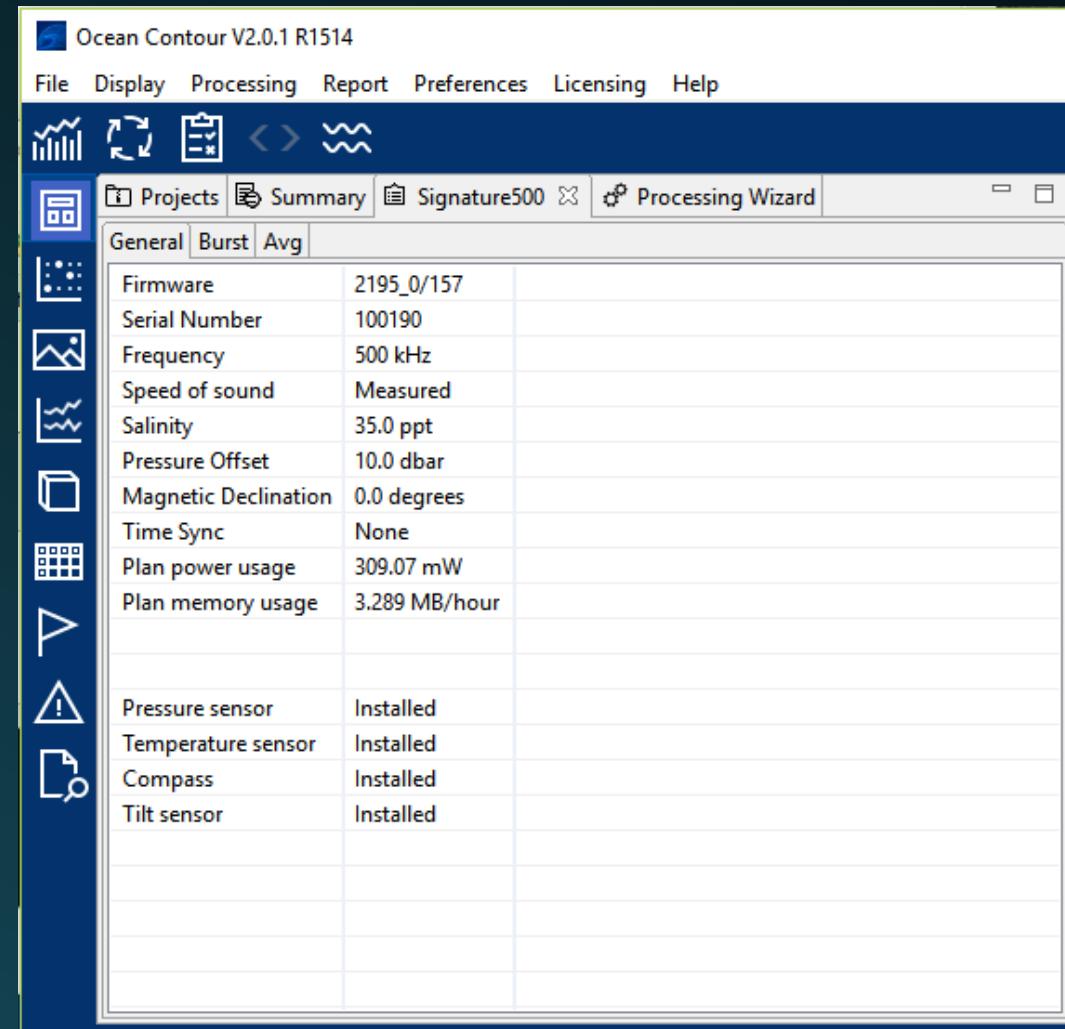


Ocean Contour V2.0.1 R1514

File Display Processing Report Preferences Licensing Help

Projects Summary Signature500 Processing Wizard

Directory	C:\ContourData\AD2CP\Raw Data\Signature\Burst
Data Stream	Burst
Series Start Time	16:00:00 01 Dec 2015
Series End Time	15:13:58 14 Dec 2015
Series Samples	1275534
Valid Data Collected	100.000%
Series Segments	3
File Name	Burst_001.OCTS
Start Time	16:00:00 01 Dec 2015
End Time	11:47:03 07 Dec 2015
Run Time	5 days 19:47:3.500
Samples	573440
Valid Data Collected	100.000%
Last Valid Measurement	11:47:03.751 07 Dec 2015
Valid Run Time	5 days 19:47:3.500
Valid Samples	573440
Last Full Measurement	11:47:03.751 07 Dec 2015
Sample Rate	2.001201
Sample Count	2048
Measurement Interval	1800.00



Ocean Contour V2.0.1 R1514

File Display Processing Report Preferences Licensing Help

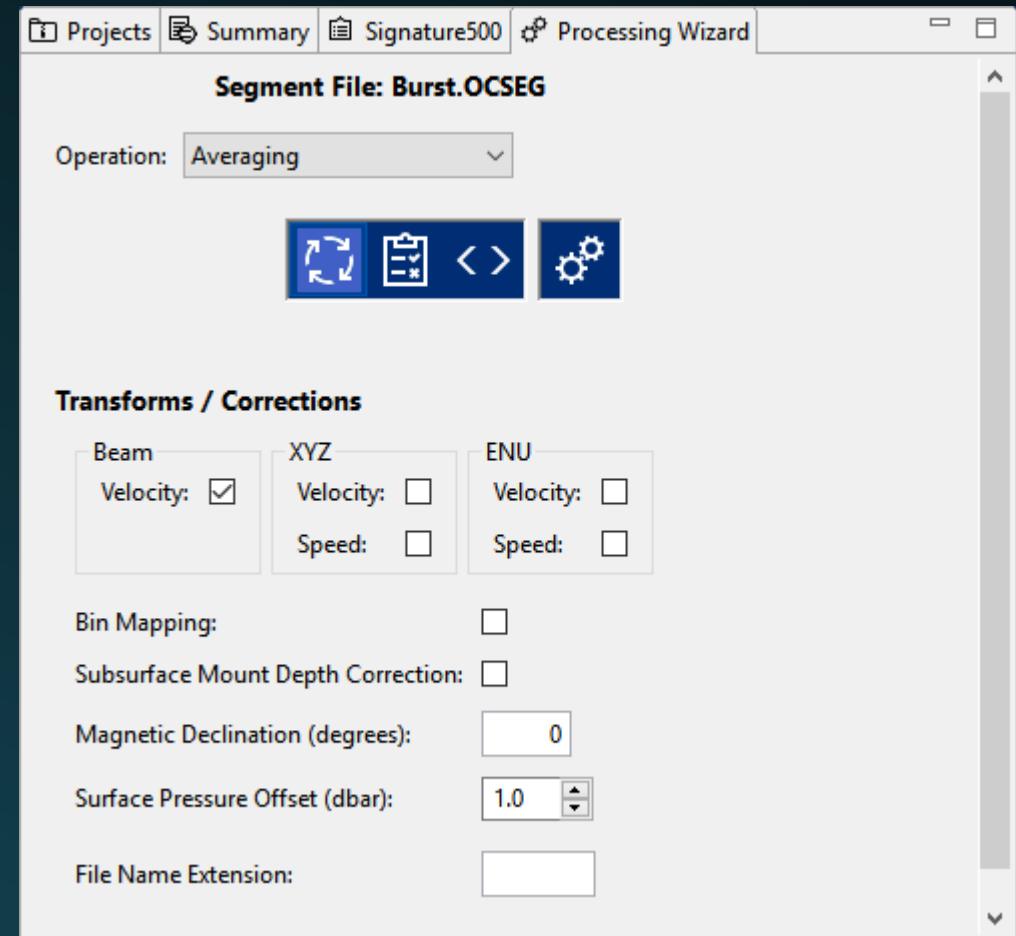
Projects Summary Signature500 Processing Wizard

General Burst Avg

Firmware	2195_0/157
Serial Number	100190
Frequency	500 kHz
Speed of sound	Measured
Salinity	35.0 ppt
Pressure Offset	10.0 dbar
Magnetic Declination	0.0 degrees
Time Sync	None
Plan power usage	309.07 mW
Plan memory usage	3.289 MB/hour
Pressure sensor	Installed
Temperature sensor	Installed
Compass	Installed
Tilt sensor	Installed

Processing Wizard

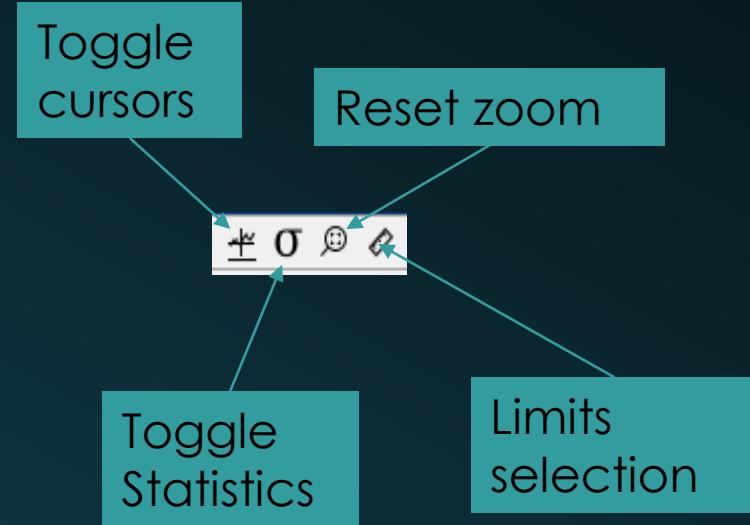
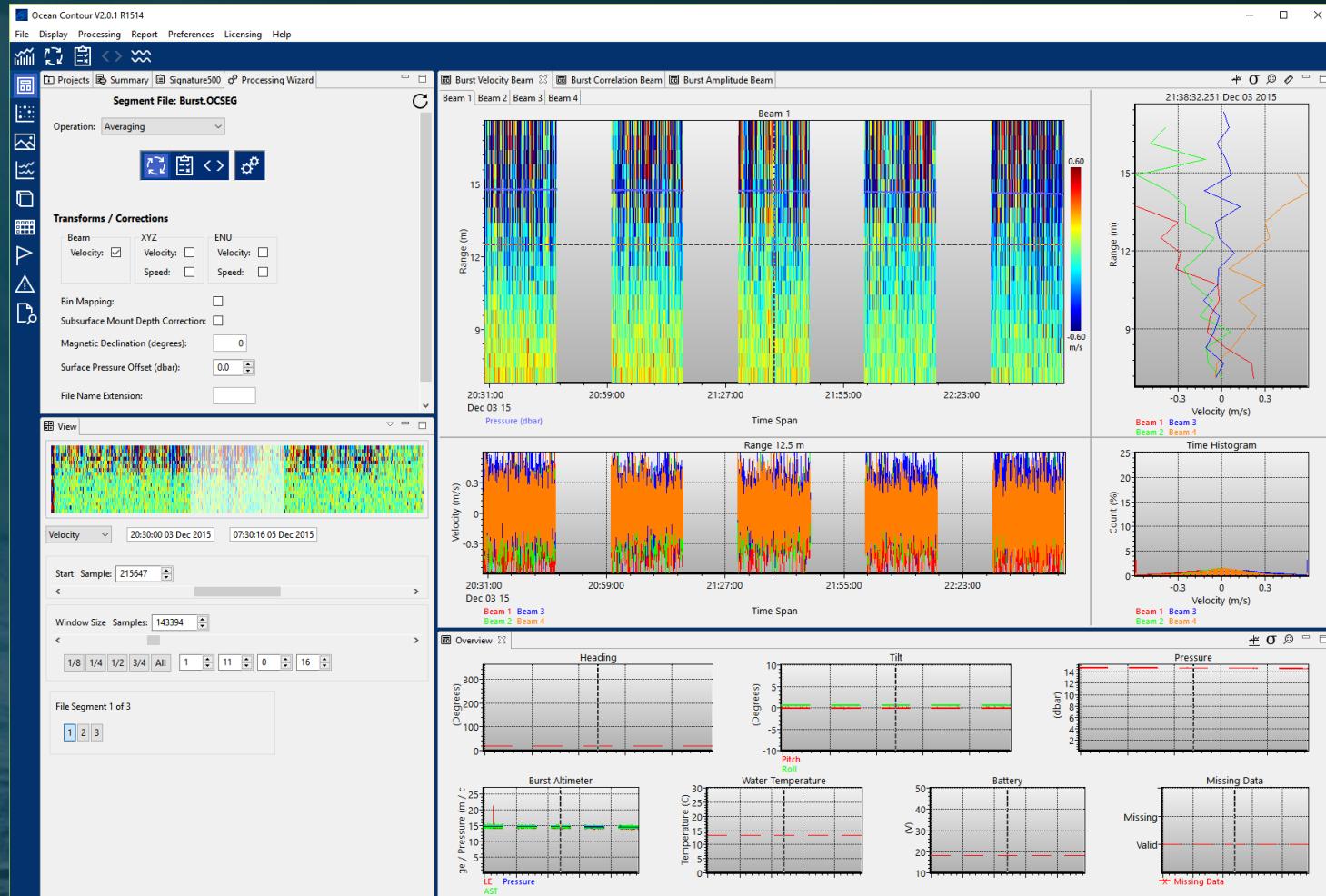
- Select overall processing operation
- Configure all stages
- Process all
- Configuration parameters already known
 - No interactive adjustment / viewing of data during processing
- Works with currently opened file (non-interactive mode)
 - Batch file
 - Single data file



Zoom in on image using mouse wheel

- Zoom with mouse over axis for time or range only

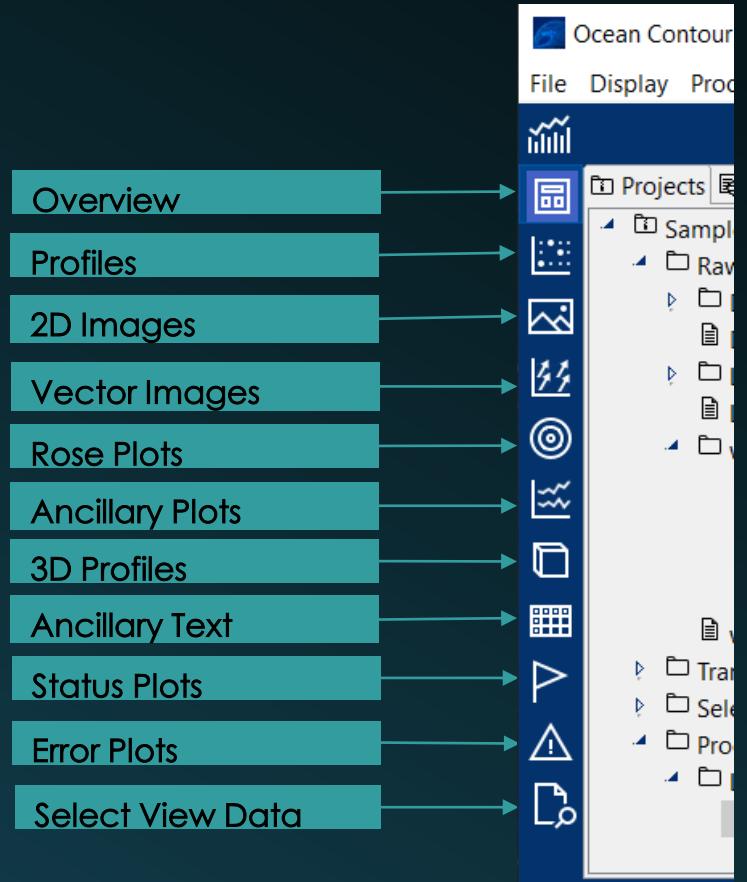
- Image / ancillary plot time axes are linked so all views show to the same data



- Histogram limits usually the best way to view data since outliers don't skew colour scale
- Limits selection are "sticky"
 - Once set, they are re-used for that data frame every time the file is opened

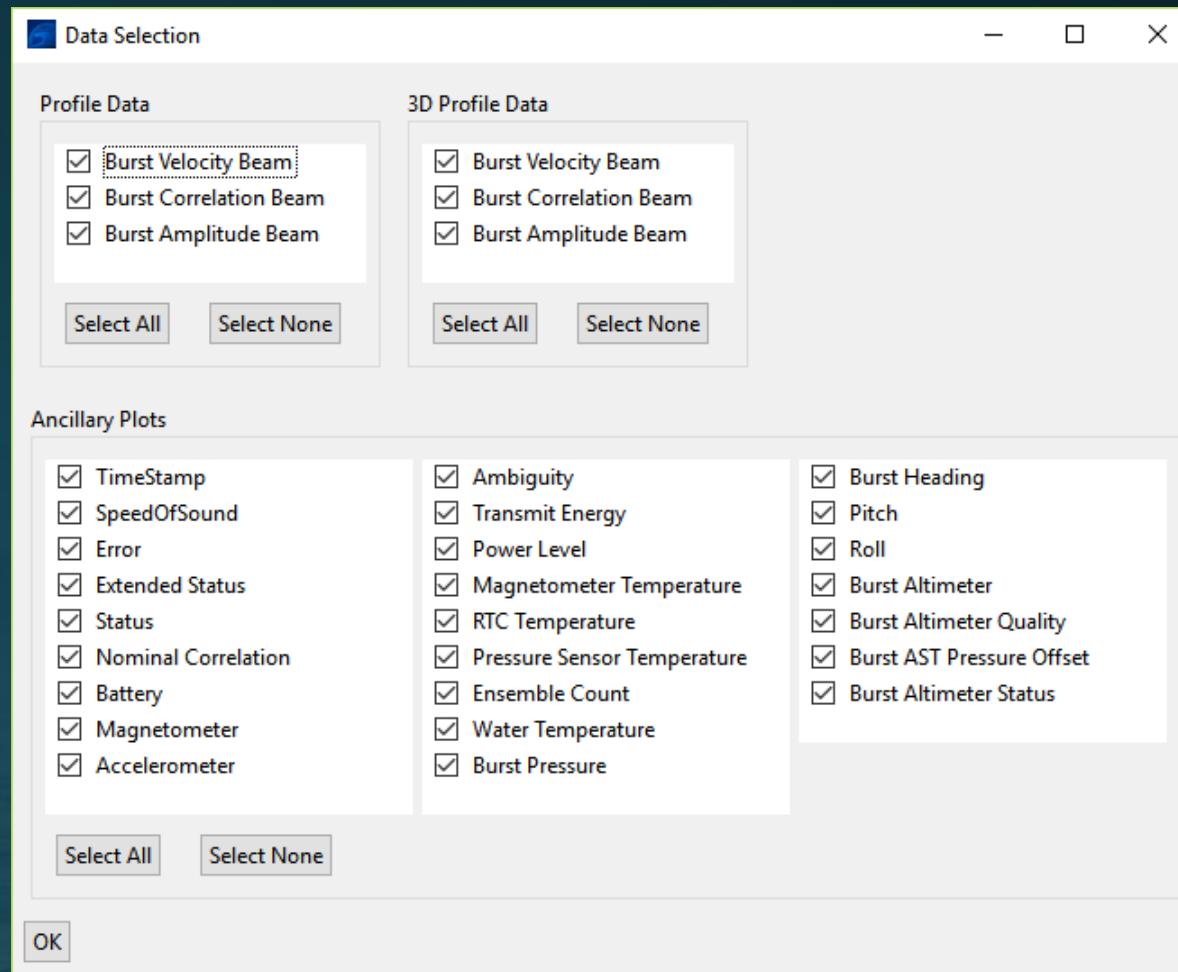
Data View

- **Overview** Default view when file is opened
- **Profile View** Contour plots & profile / time series/ histogram plots
- **2D Images** Contour plots of data
- **Rose Plots** Rose plots of continuous / processed data
- **Vectors** Stick line images only for continuous data
- **Ancillary Plots** Non profiled data (Heading, battery, pressure etc.)
- **3D Profiles** Measurement vs. Range vs. Time
- **Ancillary text** Text view of data (vertical cursor determines time slot)
- **Status** Missing data and operational events
- **Errors** Instrument errors (when applicable)
- **Select View Data** Determines which data to display



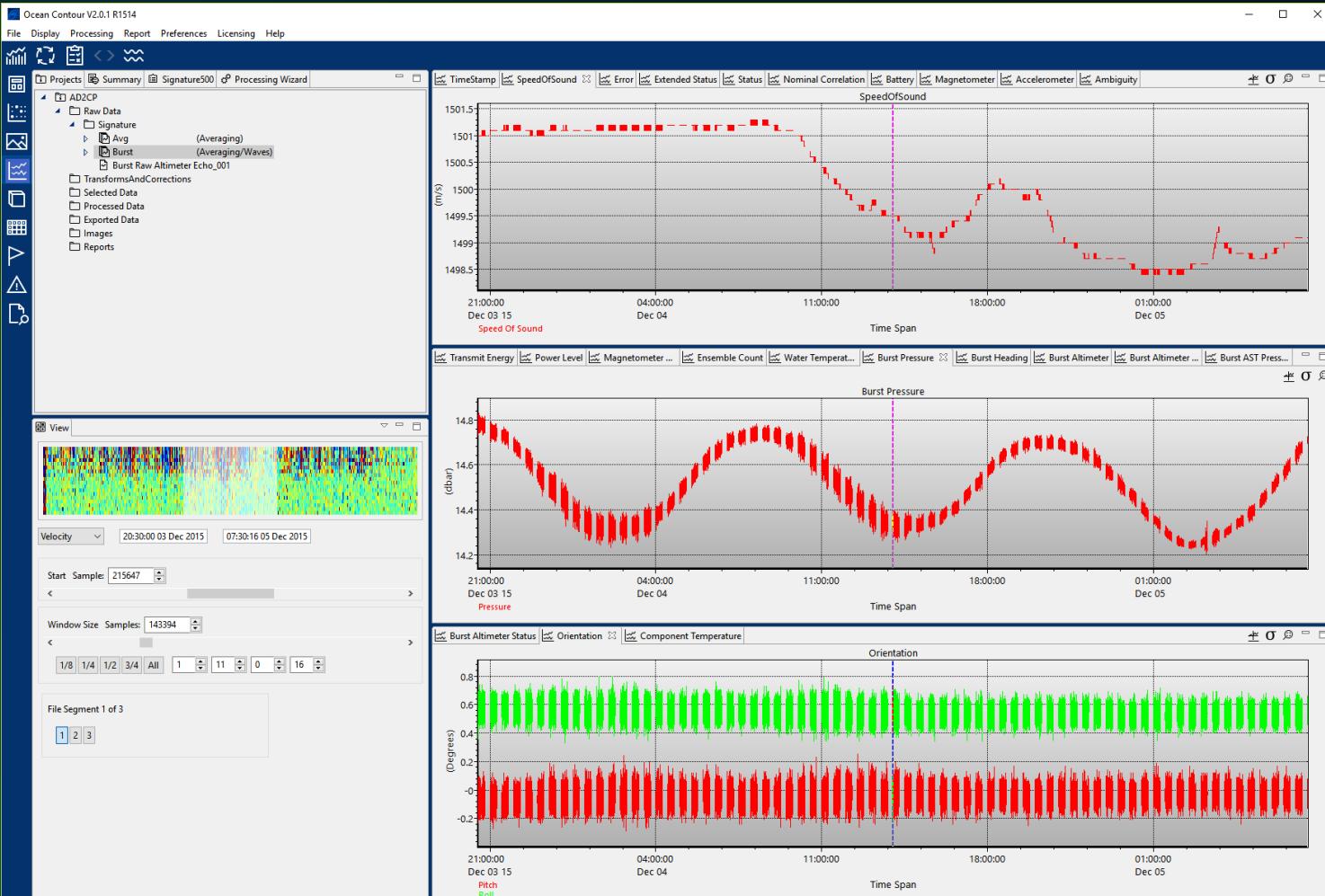
Select View Data

- Restricts data automatically displayed when file is opened
 - Settings are saved per data file and applied every time the file is opened
 - If a particular data plot isn't being shown, check here to make sure that it is selected for viewing



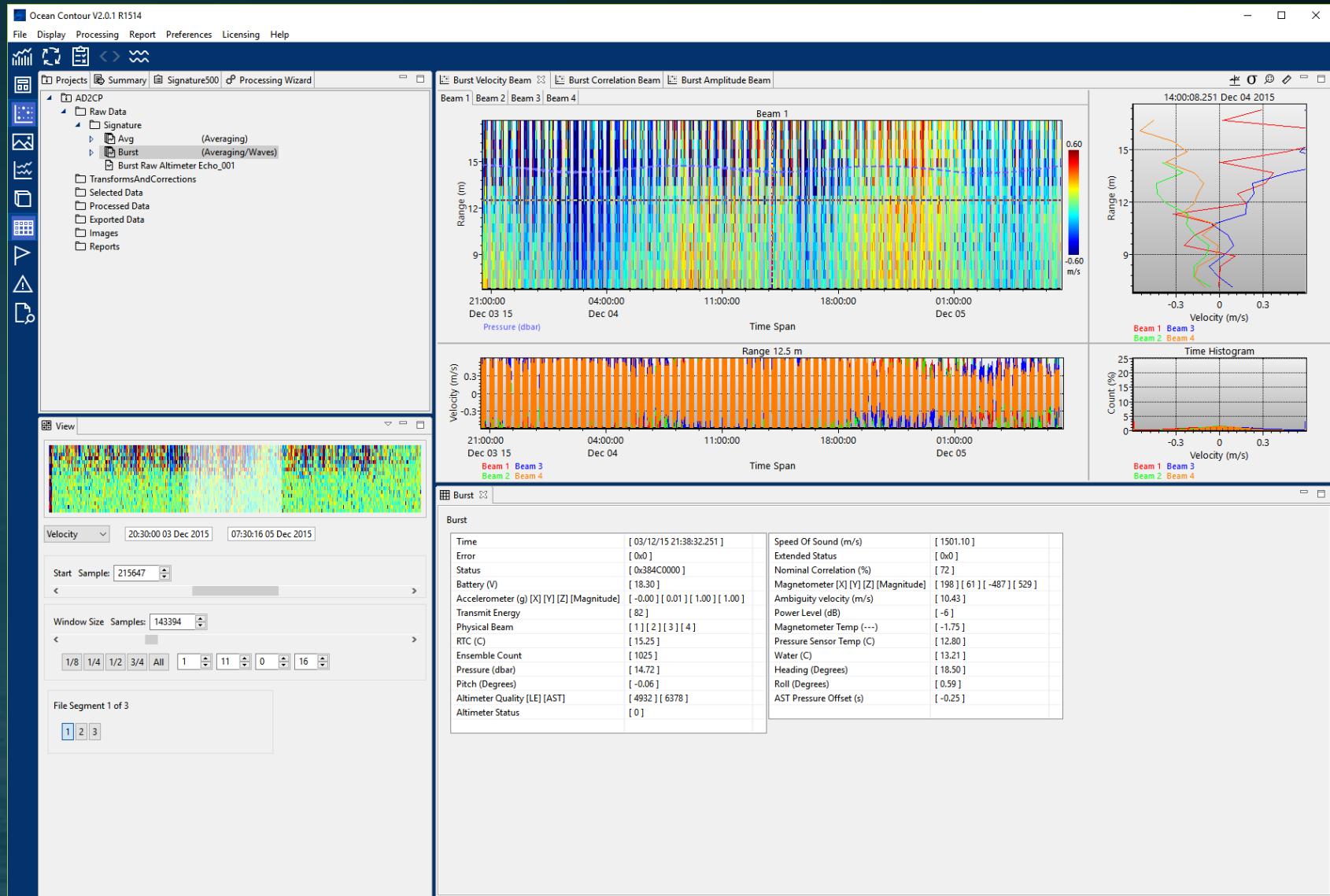
Ancillary Plots

- Right click on tab for “Close” menu
- Linked zooming
- Detach view by dragging tab off of the application window and into its own window
- The view can also be “dragged and dropped” into another view window for better real-estate usage
- Double click on tab to expand to full window



Ancillary Text

- Vertical cursor control time for text data display

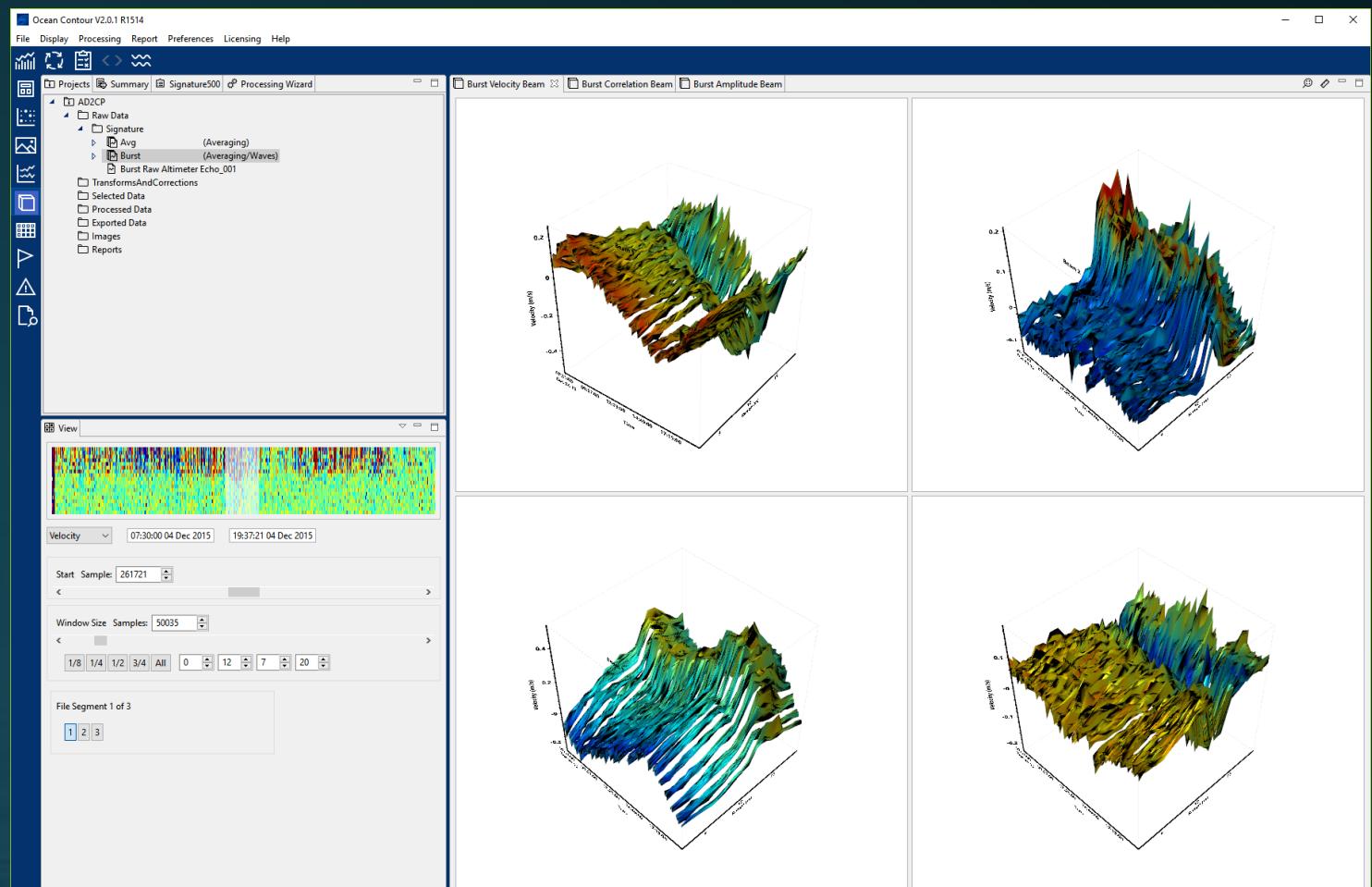


3D Display

- Rotate, zoom, shift image, data cursor
 - Click on image, press 'H' for help
- Change colour scaling
 - Right click on image

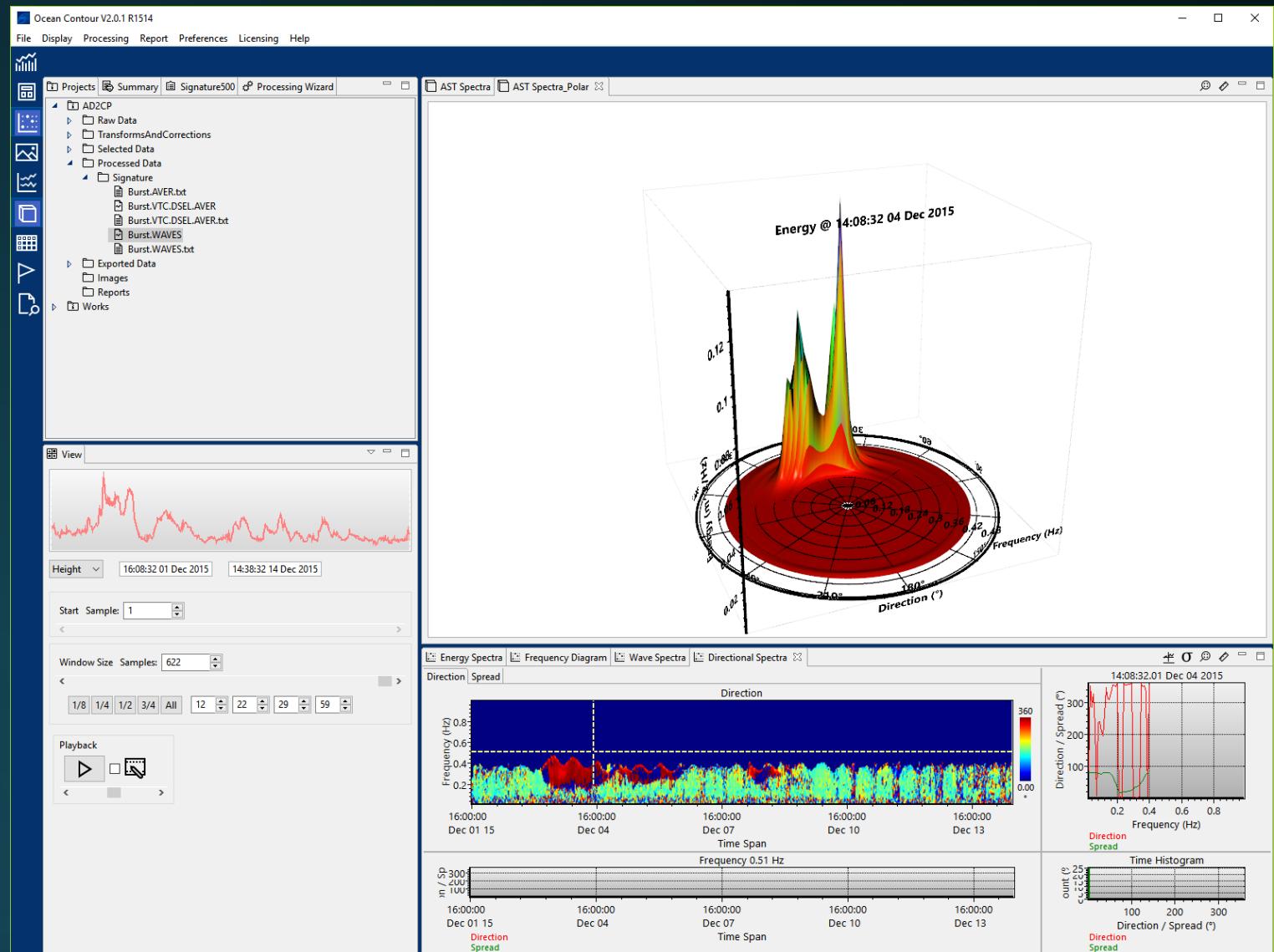
Mouse
Wheel: Zoom
Drag Horizontal: Rotate Z
Drag Vertical: Rotate X

Keys
CTRL-A: Show / hide axes
CTRL-S: Show / hide surface
ALT-C: Show / hide cursor
SHIFT-X: Move cursor to next X data point
SHIFT-Z: Move cursor to previous X data point
CTRL-X: Move cursor to previous Y data point
CTRL-Z: Move cursor to previous Y data point
CTRL-LEFT: Shift position left
CTRL-RIGHT: Shift position right
CTRL-UP: Shift position up
CTRL-DOWN: Shift position down
ALT-LEFT: Rotate counter-clockwise horizontally
ALT-RIGHT: Rotate clockwise horizontally
ALT-UP: Rotate counter-clockwise vertically
ALT-DOWN: Rotate clockwise vertically
ALT-H: Show help
CTRL-space: Reset orientation and zoom



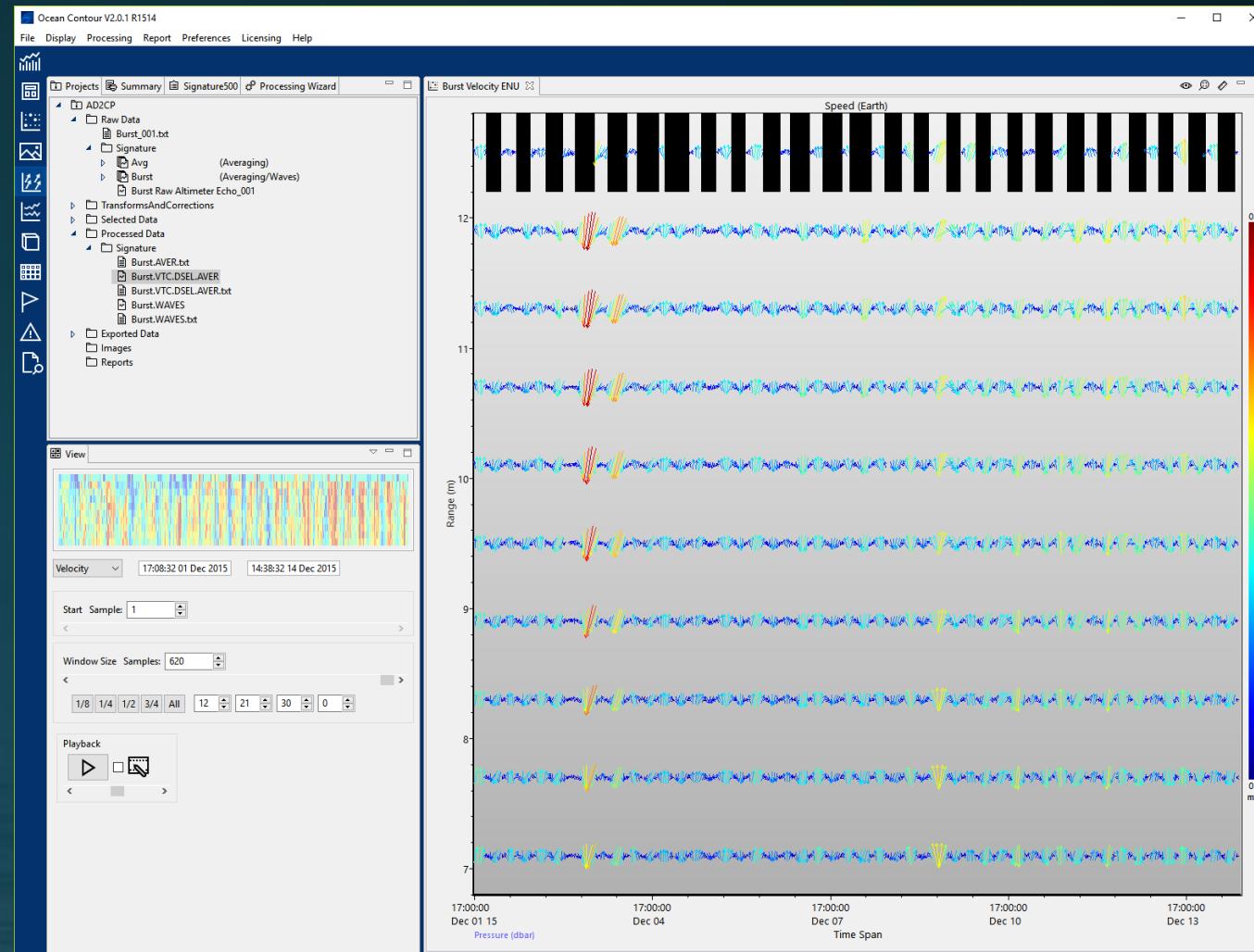
3D Wave Data

- Vertical cursor moves time
- Ctrl + mouse wheel zooms radial scale
- Right click to choose colour palette



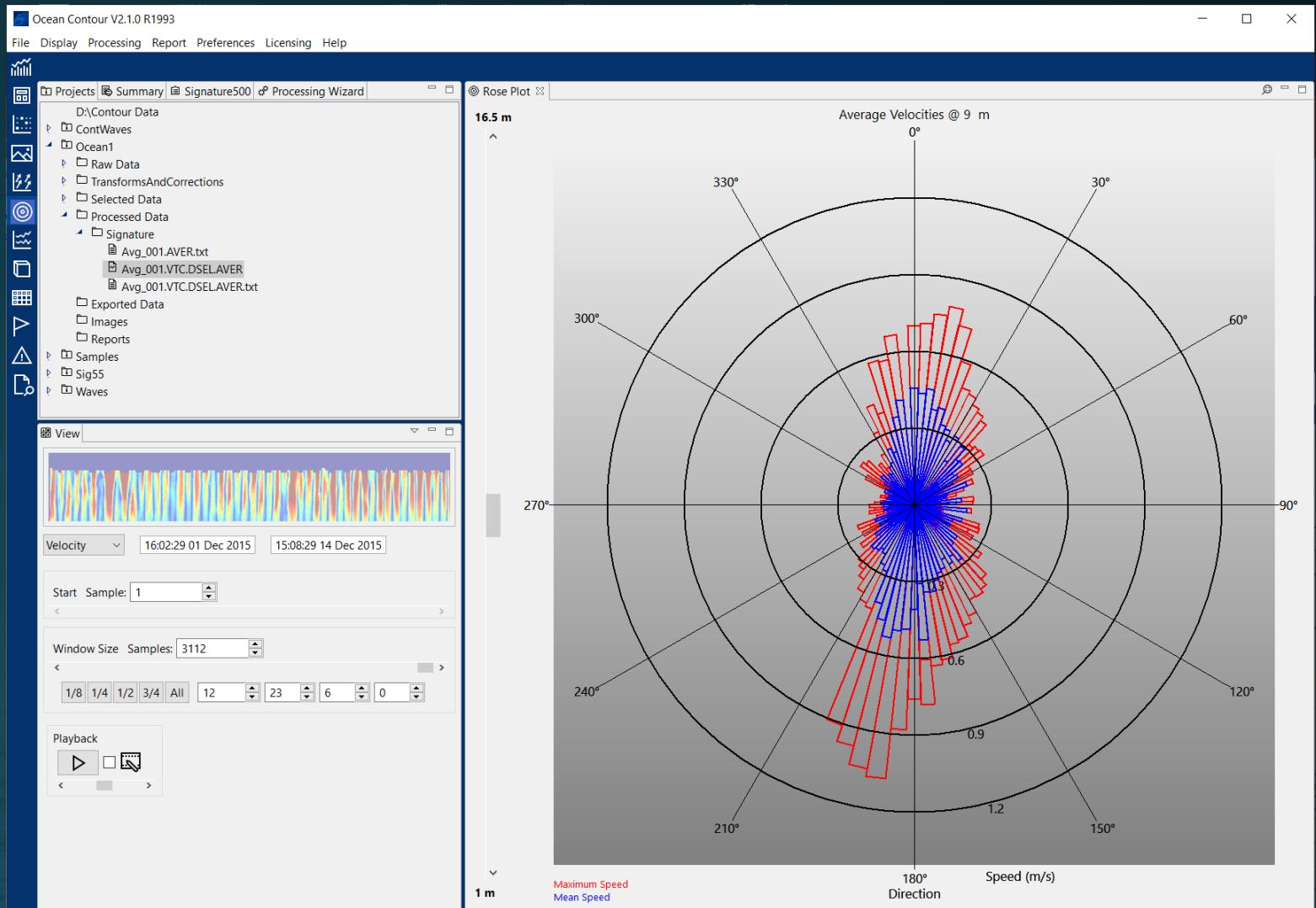
Vector Image

- Continuous, ENU data only
- Data is auto-averaged to fit display area so zoom in for more detail



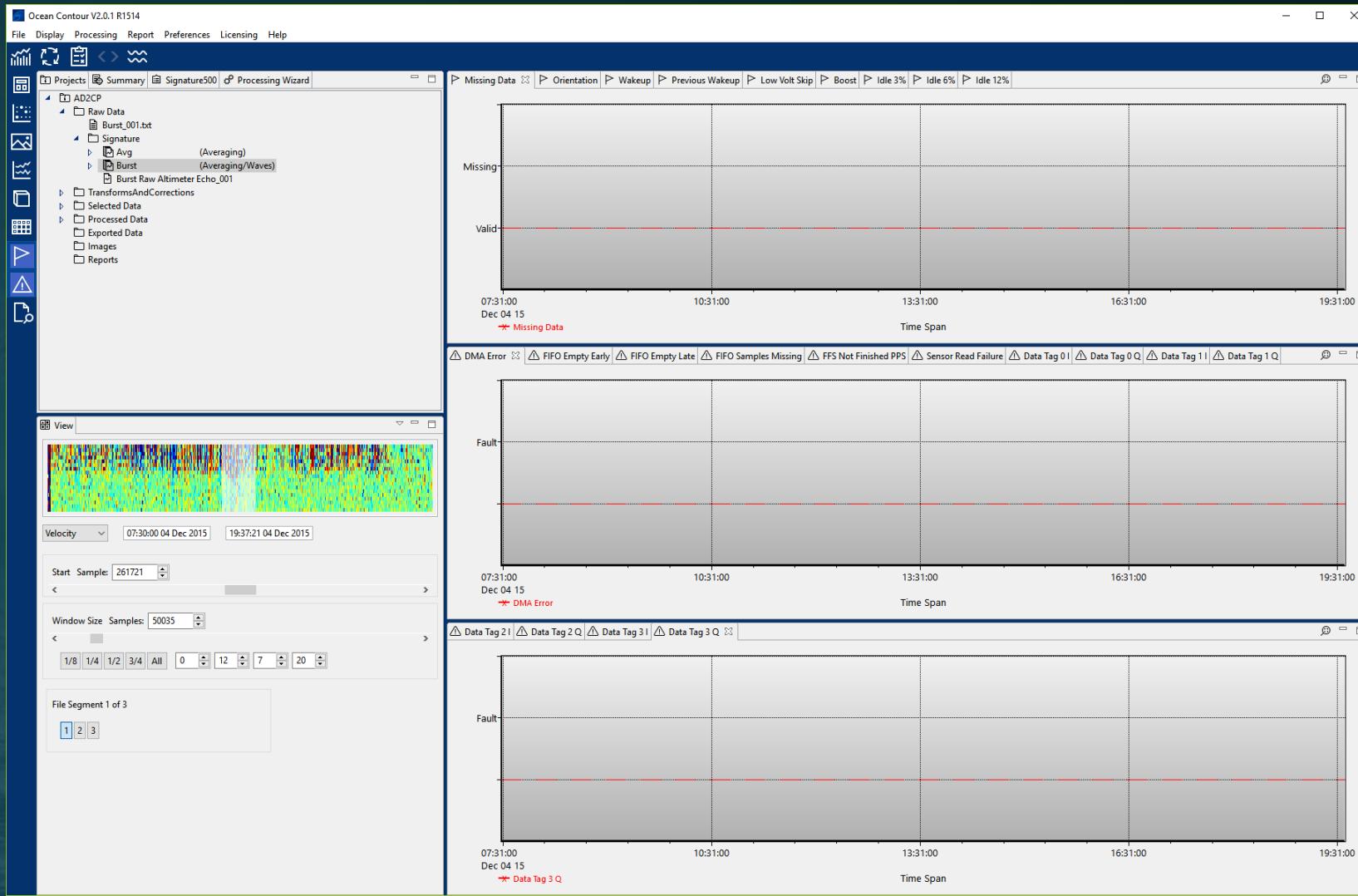
Rose Plot

- Processed ENU data
- Slider on left selects range cell used for plot



Status and Errors

- Status shows missing data and instrument operational events
- Error show instrument operational errors





Processing Stages

Interactive Step Through

- Top bar shows processing steps next processing stages

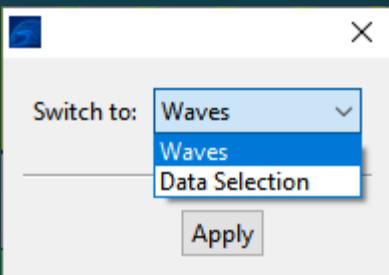


- For example, switch between raw view and data selection view
- Following stages include data selection, data averaging and wave processing

- To advance to the next stage, complete current stage by clicking on the process button



- For example, clicking process in the Data Selection stage with a file capable of both averaging and waves





Velocity Transforms and Corrections

Re-process in-memory data
with new parameters

Read parameters
from file

Process entire data set and
advance to next stage

Transform co-ordinate
system

Bin Mapping
Corrects for tilted mount

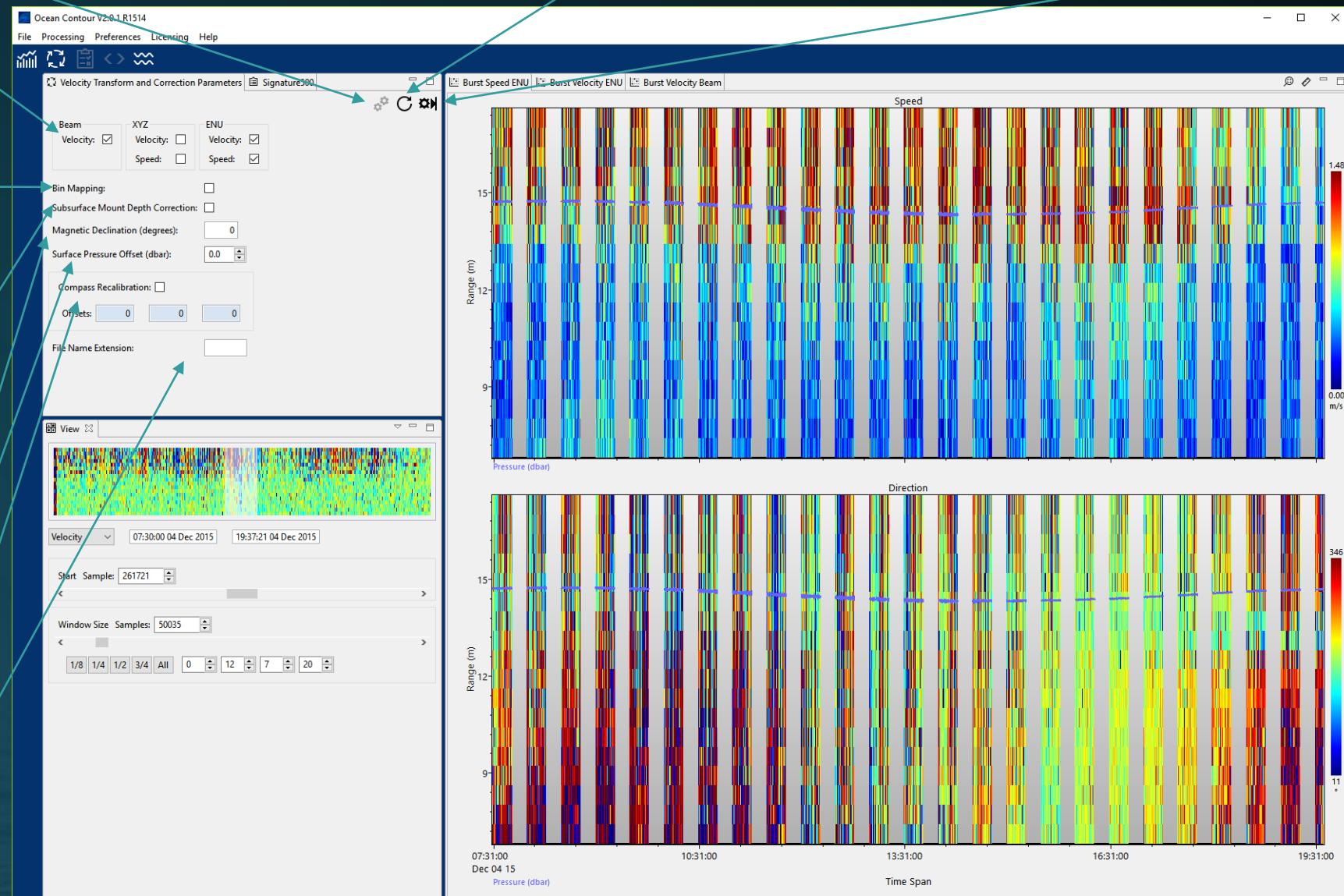
Subsurface buoy
mount
Corrects for depth
variation due to tidal flow

Magnetic Declination

Pressure Offset

Compass Re-calibration

Extension
Uniquely identify file when
using different parameters

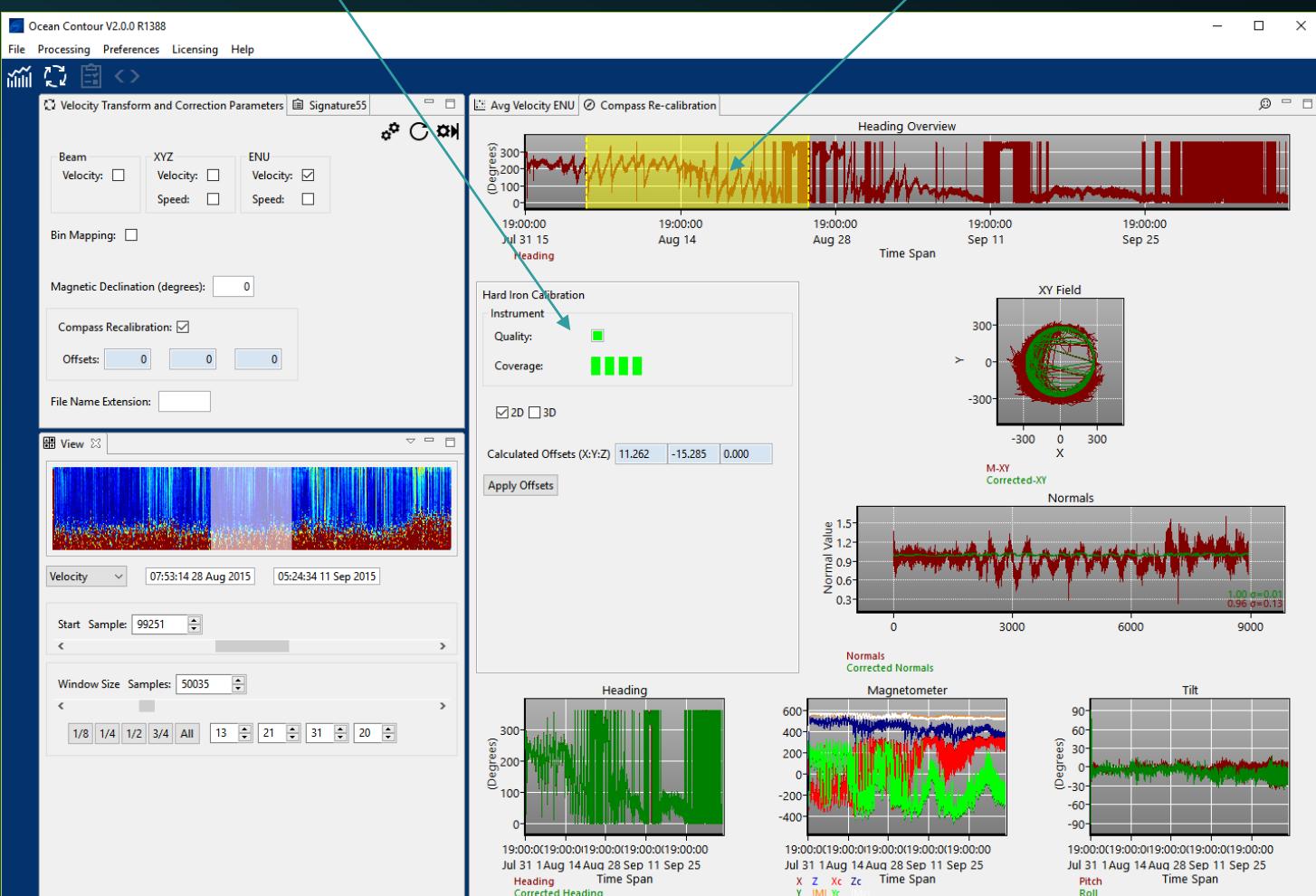


Compass Re-calibration

- Grab inside edge of selection window to expand / contract
- Grab center of window to move
- Select data to produce all green coverage / quality
- “Apply Offsets” copies offsets to Transform and Correction window for processing
- Requires sufficient rotation about axes in order to achieve good quality calibration and coverage

Re-calibration quality and coverage

Data selection window





Echo Correction (Two stages)

Subsurface buoy mount

Corrects for depth variation due to tidal flow

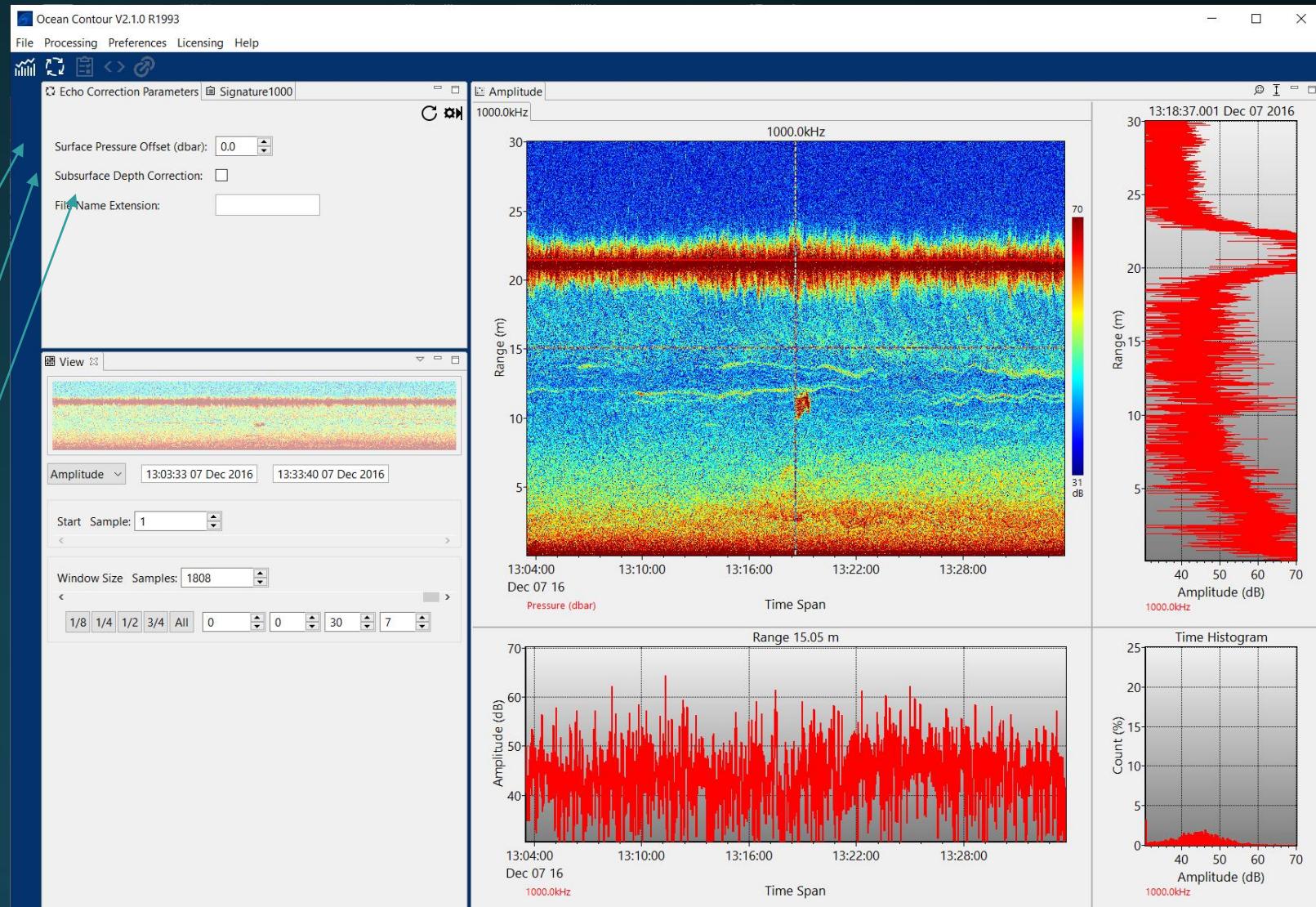
Pressure Offset

Corrects for surface pressure

Extension

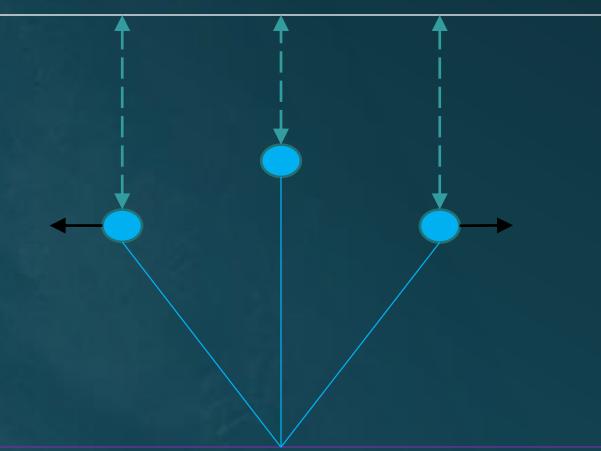
Uniquely identify processed file

- Corrects amplitude for absorption over range
- Removes user specified noise floor



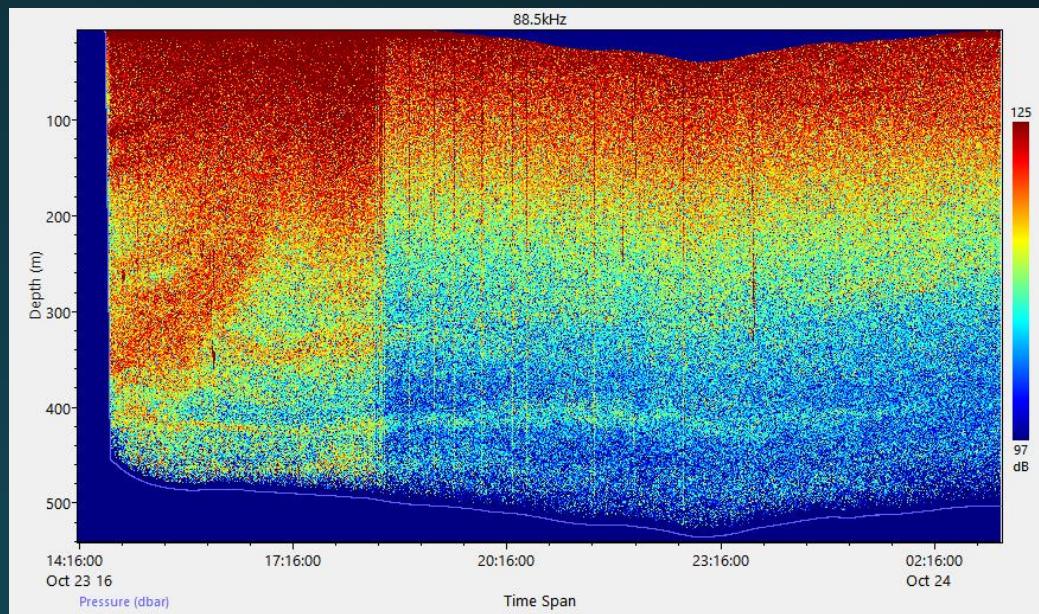
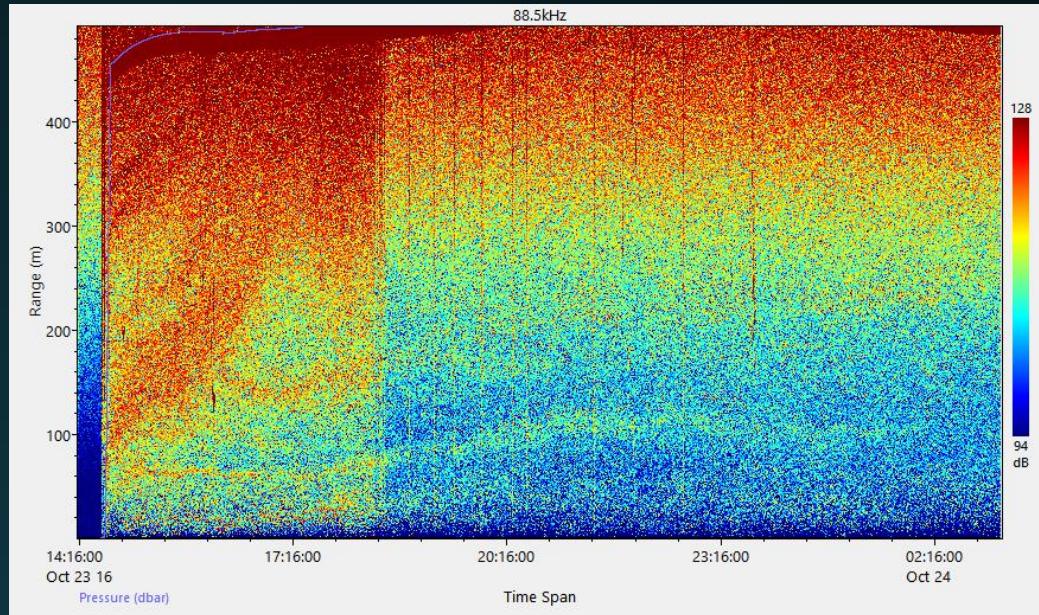
Subsurface Depth Correction

- Uses pressure to calculate profile depth offsets to account for current draw down



Depth
relative to
upwards
facing
instrument

Depth
relative to
surface



Echo Transform to TS and Sv

Salinity

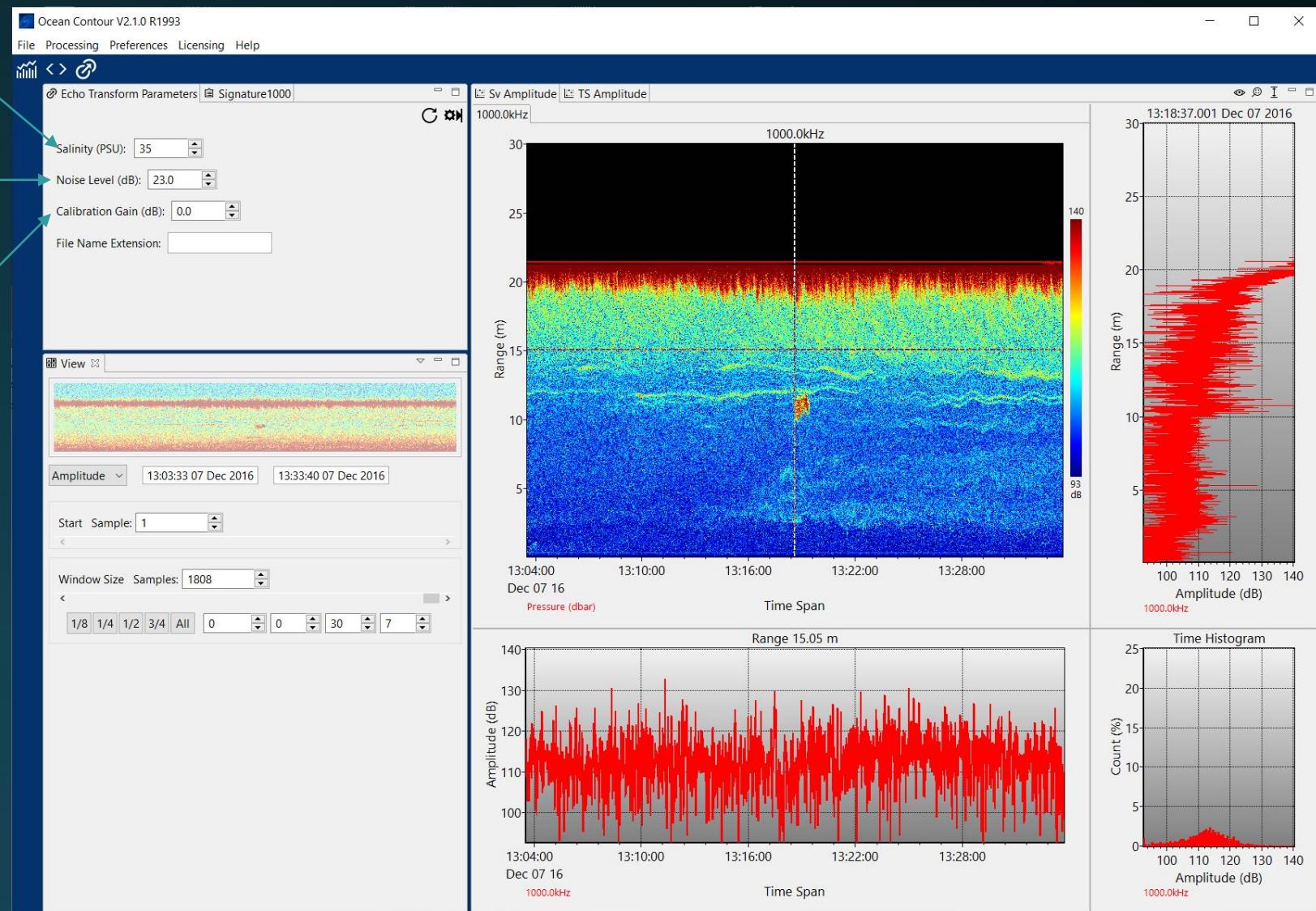
Noise Level

Removed from corrected data

Calibration Gain

Determined from calibration process

- After averaging stage
 - Averaging must be done linearly so has to be done before TS / Sv calculations
- Each instrument must be regularly calibrated to determine calibration gain



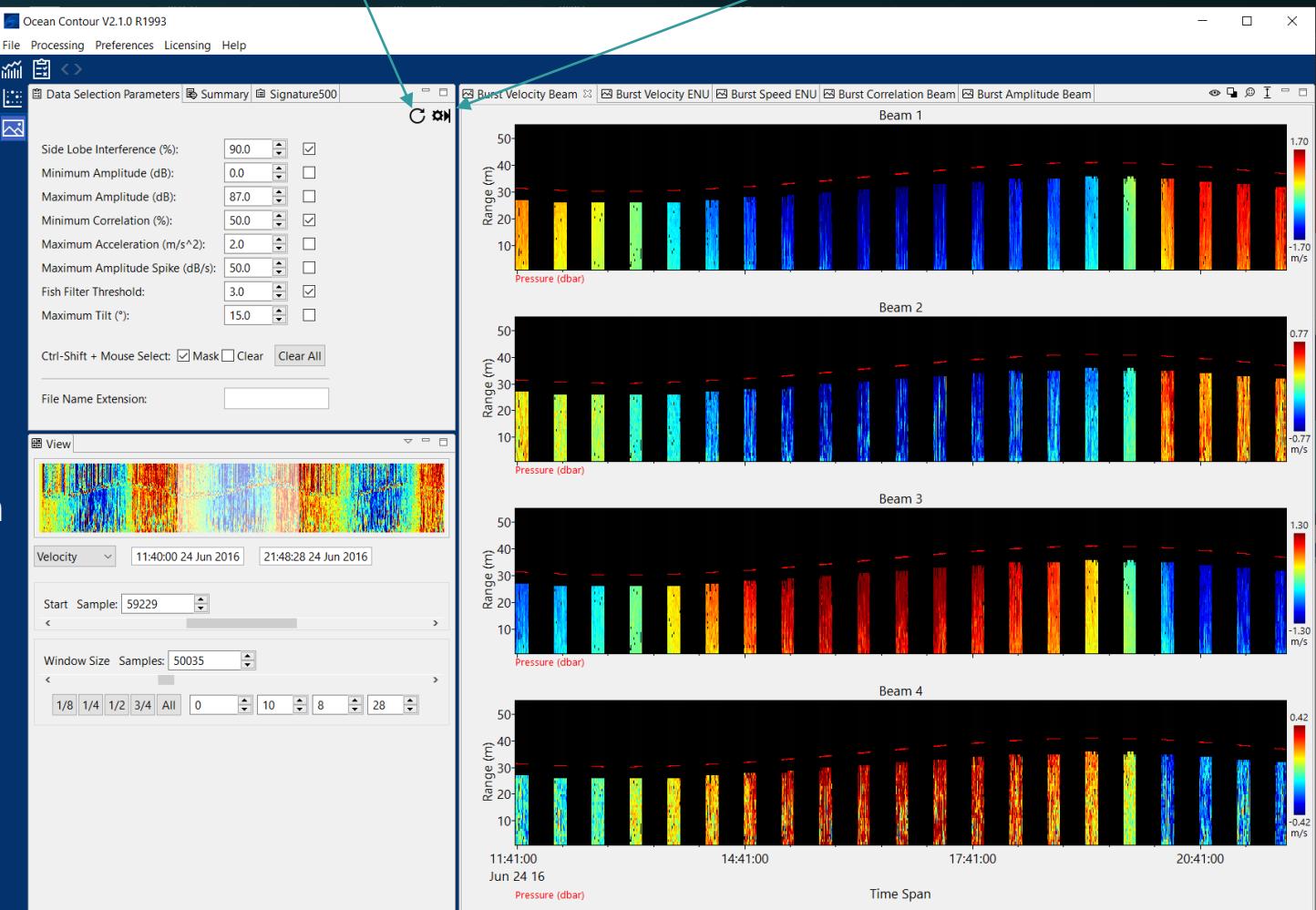


Data Selection

- Calculates “bad data” mask
- Mask calculated dynamically as parameters are enabled / updated
- Side Lobe Interference
 - Side lobe interference region calculated using pressure data
- Minimum / maximum amplitude
- Minimum Correlation
- Maximum Acceleration
 - Remove non-physical spikes from velocity data
- Fish Filter
 - Examines differences in beam amplitudes for each cell
- Maximum Tilt

Read parameters from file

Process entire data set and advance to next stage



<> Averaging

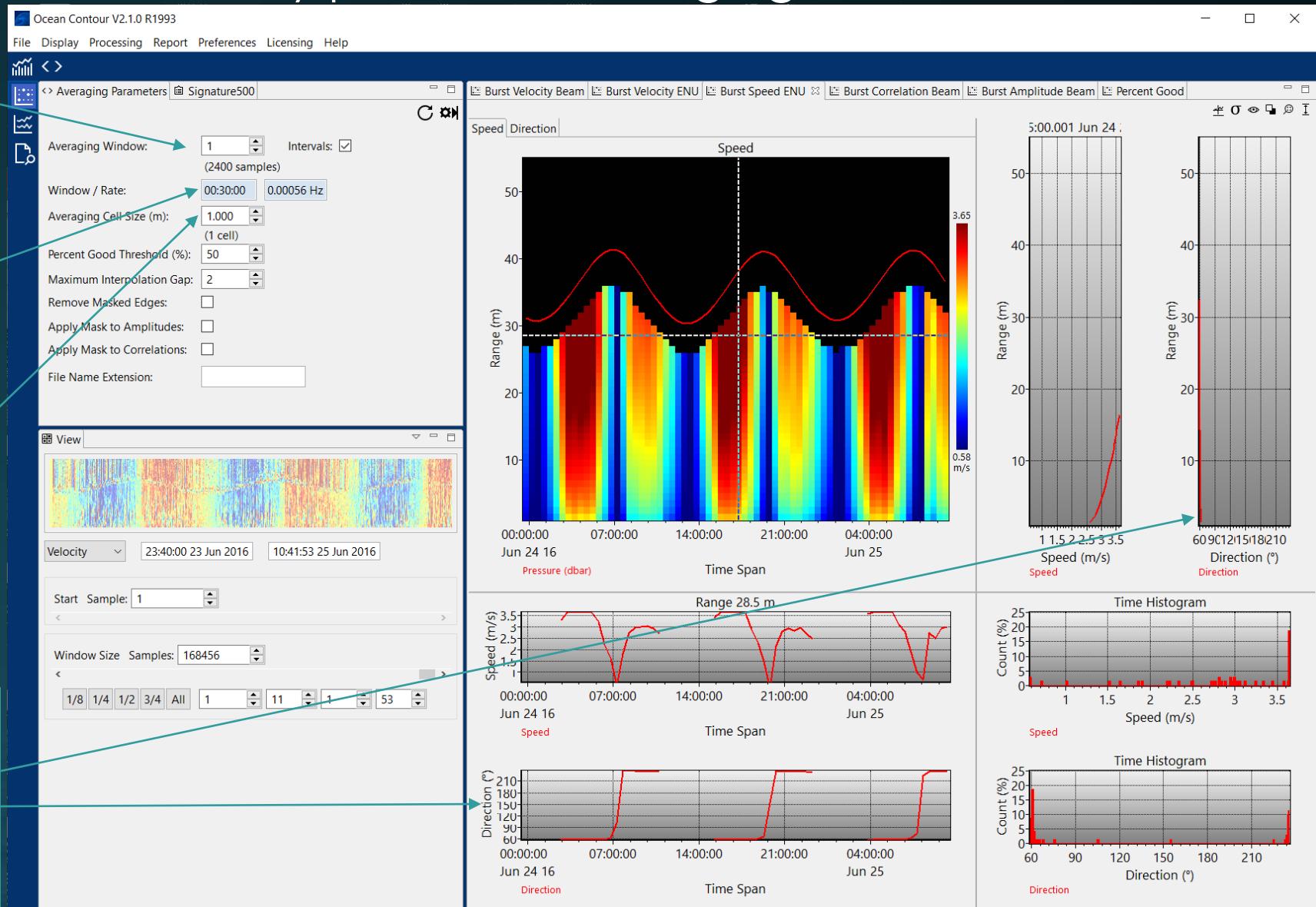
- Switching automatically performs averaging

Interval over which averaging will be done

Corresponding time window / sample rate

Average cells in range as well as time

Stick plot data (ENU only) now available (speed as length / colour and direction as angle)





Averaging

- Averaging interval
 - “Intervals” not checked - Average based on number of single pings up to maximum pings in interval
 - “Intervals” checked - Average based on number of measurement intervals ($N \times$ number of single pings in measurement interval)
 - “Intervals” not shown for continuous data
- Averaging Cell Size
 - Averages over range as well as time.
 - Shows the cell size that will be produced and number of cells averaged together
- Percent Good Threshold
 - Percentage of good data in average for data to be qualified as “good” (A percent good mask gets automatically calculated with the average)
- Maximum interpolation gap
 - Replaces bad data with data interpolated from surrounding data for at most the given number of averaged time slots.
- Remove Masked edges
 - Truncates data so that bad data at beginning / end of time series and end of profile are deleted
- Apply Mask to Amplitudes / Correlations
 - Whether or not mask will remove “bad” amplitude / correlation data from the averaging
 - May want to include bad data to get an idea of overall quality of data
- In most cases, data from multiple OCTS files will be aggregated into a single OCTS file

Display (Processed Data)

- Automatically switches back to Data Display perspective and loads averaged data file

- Each processing stage saves a data file and a corresponding text parameter file
- Playback mode available
- Stick plots displayed (ENU data)
- Vector images and rose plots available (ENU data)



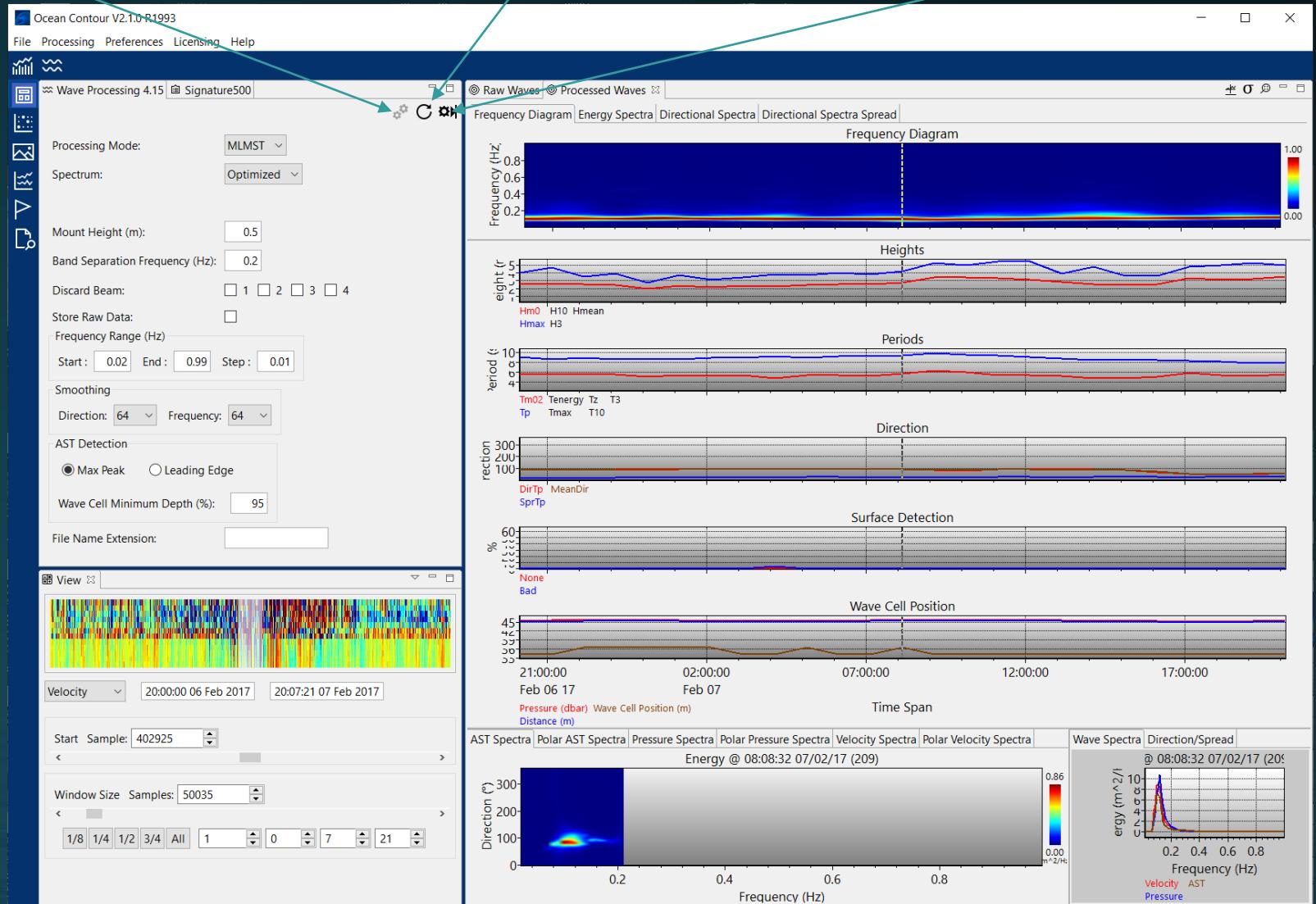
Wave Processing

Re-process in-memory data
with new parameters

Read parameters
from file

Process entire data set and
advance to next stage

- Overview
 - Time spectra
 - Height
 - Period
 - Direction spectra
 - Surface detection
 - AST / wave cell information
 - Time selected by vertical cursor on plots or time spectra
 - Wave spectra
 - Linear and polar
 - Mouse wheel to zoom data





Wave Processing

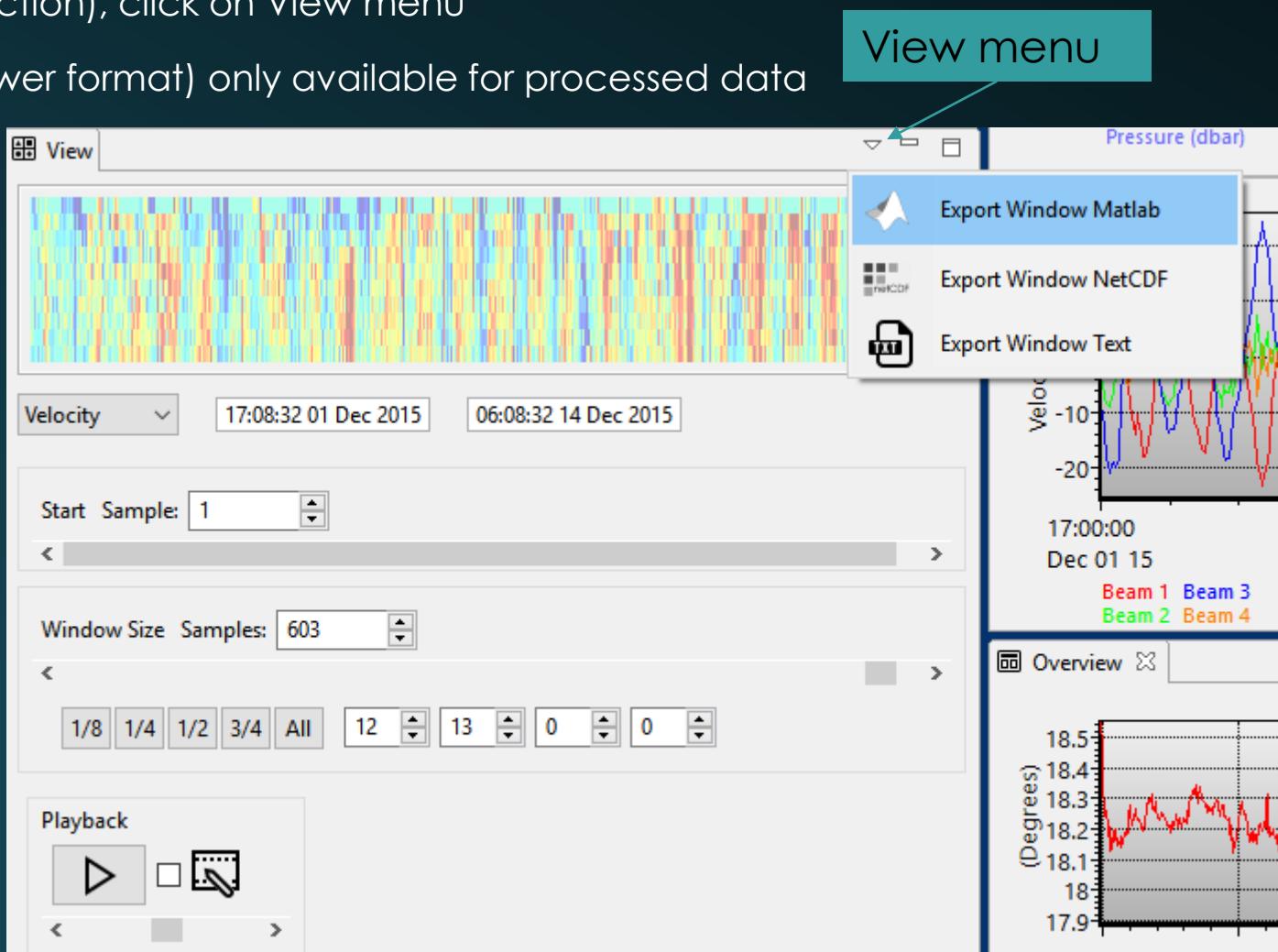
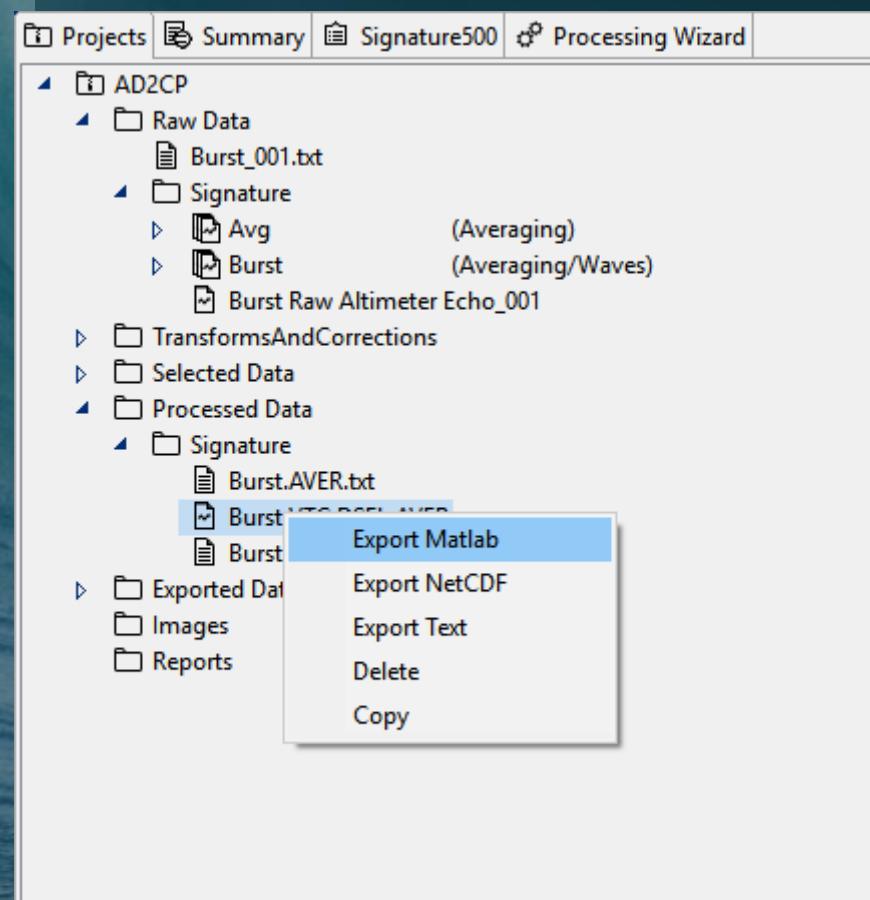
- Processing Mode:
 - MLMST - Maximum Likelihood Method with Surface Tracking (default)
 - MLM – Maximum Likelihood Method without surface tracking
 - PUV – Compares pressure and velocity to determine wave direction and assumes that waves at a given frequency come from one primary direction
 - SUV – Hybrid method between PUV and acoustic surface tracking (AST)
- Mount Height
 - Distance that the instrument head (where the pressure sensor location) is above the sea floor
- Band Separation Frequency
 - Band separation frequency distinguishes sea and swell estimates that are reported in the wave band data
 - Different between oceans. The Mediterranean waves typically separate around 3 seconds, while the Pacific around 7 seconds
- Discard Beam
 - Allows data from a “bad beam” to be removed from the process
- Store Raw Data
 - Stores raw data used to calculate wave data
 - Useful for diagnostic purposes
- Frequency Range
 - Frequency range of the non-directional (energy) spectra
 - Also the limit for the directional spectra
- Smoothing
 - How much averaging is used at each of the discrete frequencies of the spectra
- AST Detection (Acoustic Surface Tracking)
 - Use Maximum peak or leading edge
- Magnetic declination *must* be done in the Transforms and Corrections stage

Report Generation

- Available only in Display perspective
- Produces report based on data currently shown in display view
- PowerPoint, Word or images
 - Word report includes complete instrument configuration and all processing information
 - Can add information to existing file
 - Lets a user defined template be applied
- Report saved in Reports folder (click on arrow next to folder in Projects view to open folder, double click on file to open)

Exporting Data

- Export to Matlab or NetCDF formats
 - Data saved in Exported Data folder
- For full file export, right click on file in Projects view
- For partial file (based on view selection), click on View menu
- Text export (Signature waves / viewer format) only available for processed data



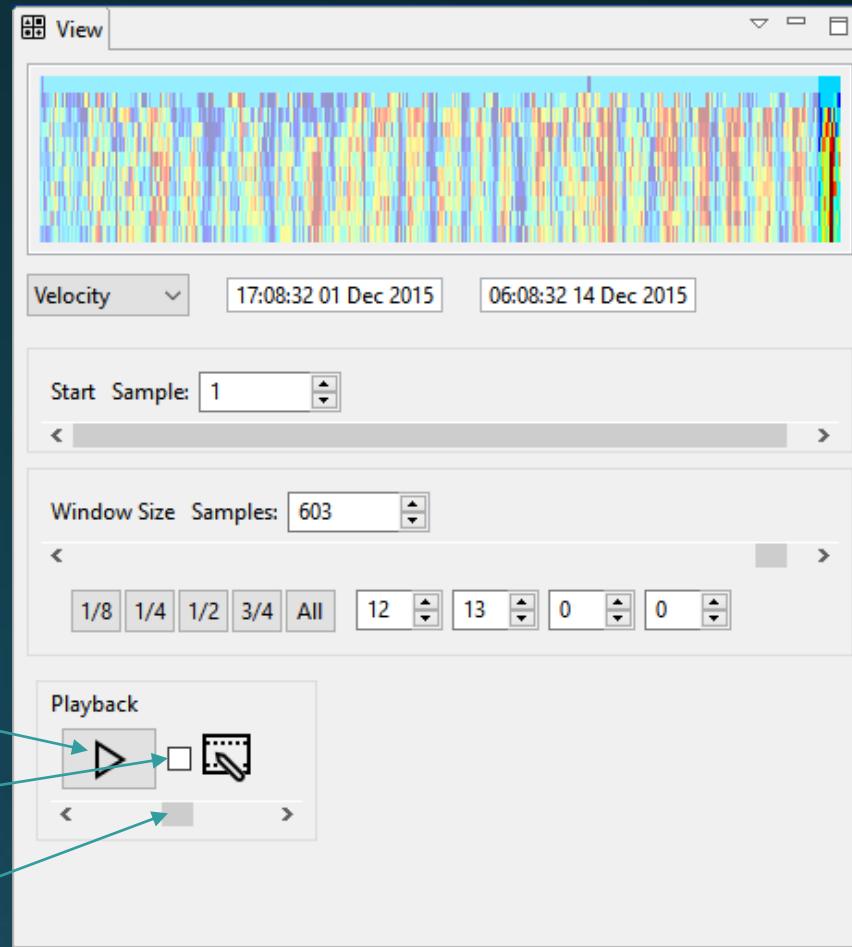
Data Playback

- Select 1/8 window
- Move playback speed slider to minimum
- Enable recording
- Press start button

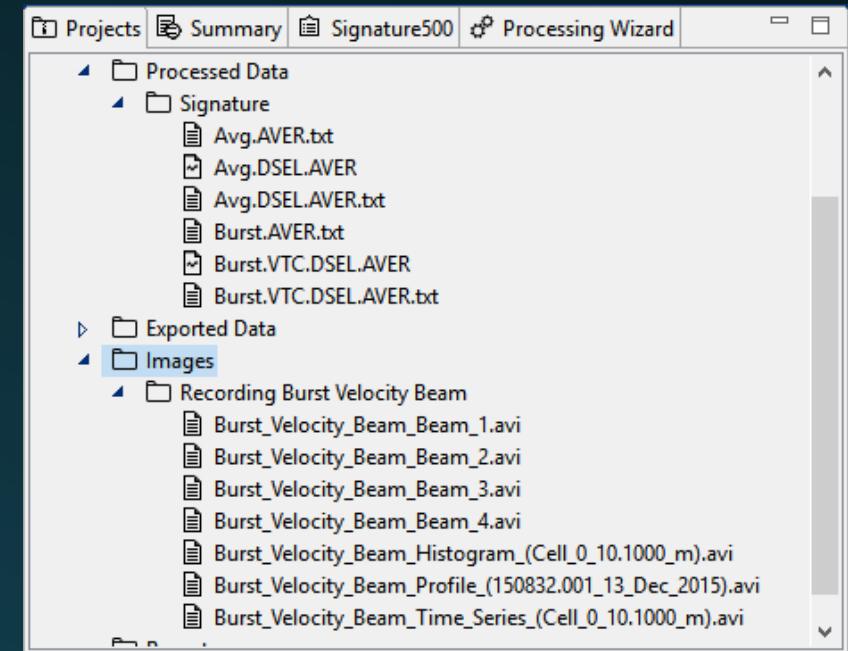
Start button

Enable recording

Speed slider

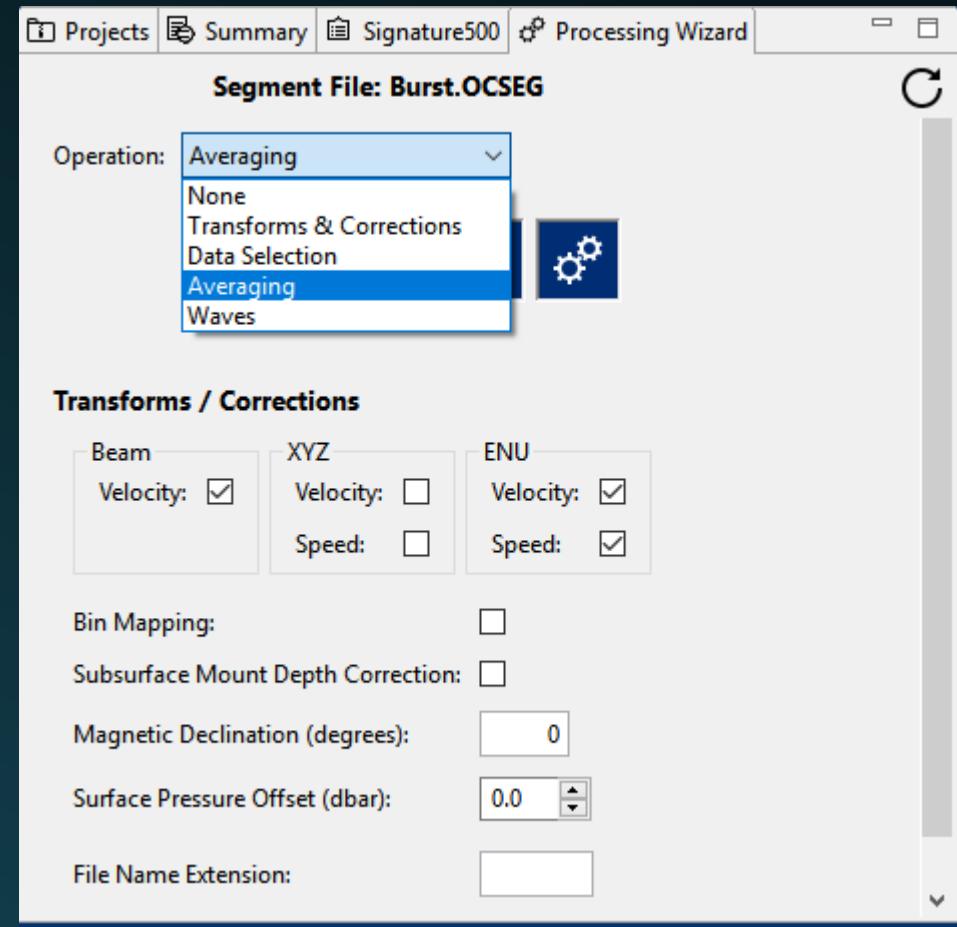


- AVI files saved in Images folder
- Double click to open

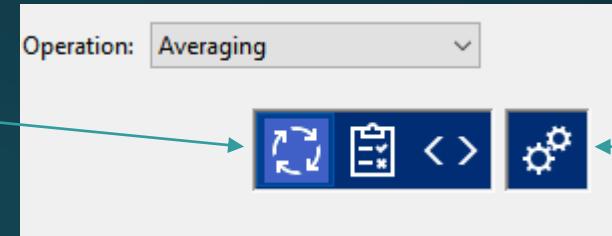


Processing Wizard

- Non-interactive processing mode
- Assumes that all configuration parameters are known
- Select end processing stage
- Set configuration parameters for each stage
- Press the process button to automatically run through all processing steps



Parameter
selection



Process
button

Batch Processing

- Process a collection of files in the same manner
- Right click on Raw Data folder : Create Batch File
- Select files to be processed
 - Available files will be base on data properties of first file selected
- Opening batch file automatically switches to Processing Wizard

