NavView User Guide – FLOWIT Module

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1 INTRODUCTION

1.1 SCOPE

The FLOWIT module of NavView has been developed to provide the capability to easily import, analyze and process acoustic metrology data, both as a survey contractor and a client survey quality control and assurance representative. The implementation is such that any one component can be handled independently of the others and then combined in an overall metrology solution. This enables application to stand alone depth loops, attitude and baseline determinations as well as the complete metrology.

This guide is broken into sections, each addressing a component of FLOWIT.

1.2 INSTALLATION

FLOWIT is one of the modules that can be included with 4D Nav's NavView positioning and navigation package and therefore installed with NavView if it has been purchased. For assistance with the installation, refer to the **Introduction** section of the **NavView User Guide**.

1.3 LICENSING

Licensing is controlled by the NavView software security, either a KEYLOK USB dongle or a Cloud Controlled Network Floating License. In either case, the license must include the option for FLOWIT.

If using a KEYLOK USB dongle, plug this into an available USB port on your PC, if using a Cloud Controlled Network Floating License refer to the **Introduction** section of the **NavView User Guide**.

To check if your license supports FLOWIT, from the NavView Home ribbon click on About and confirm that the "**HasFlowit"** item is set to true.

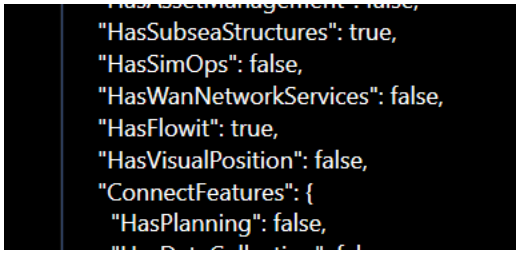


FIGURE 1 - HASFLOWIT CONFIRMATION

2 NAVVIEW AND FLOWIT

2.1 STARTING FLOWIT

To use FLOWIT the user must run NavView and create a new project or open an existing project and configure it for the work area. This includes the following configuration items:

- Geodesy
- Background drawings
- Enable Database Services

For details on these, refer to the **NavView User Guide**.

Note: The configuration for a NavView project includes the setting of Environmental Parameters. These do not affect the FLOWIT module. FLOWIT provides the option to define specific Pressure to Depth calculations with their own models and parameters.

Note: Database Services must be enabled to be able to add Infrastructure and data to FLOWIT. If Database Services are not enabled, the FLOWIT data and management panel does not display.

2.2 BASICS

FLOWIT provides the user with the means to import, analyze and process acoustic metrology data. Each data type is handled separately and supports the import, analysis and processing associated with it. These can then be combined into a metrology calculation

The data types supported are as follows:

- **Sound Velocity:** Supports SV profiles and CTD casts
- **Infrastructure:** Supports adding any object associated with a metrology survey including
  - Structures with hubs, e.g. manifolds, trees
  - Tripods with transponder buckets and porches
  - Seabed Depth Loops and Profiles observation locations
- **Baselines:** Supports acoustic baseline observations
- **Elevations:** Supports depth loops, seabed depth profiles, tides and pressure to depth calculations
- **Attitudes:** Supports inclination and heading observations

FLOWIT is presented in its own view opened by clicking on the FLOWIT icon in the View ribbon.

FIGURE 2 – FLOWIT VIEW (BASIC)

Selecting a data type from the tree displays a view in the right panel where that data type is managed.

Note: Unless otherwise noted, all references to a FLOWIT component will assume the FLOWIT view is open.

In the Basic view shown above, interim calculations are hidden. The user is presented with settings, environmental settings, infrastructure and jumper calculations. Each jumper calculation contains the data and calculation views for each data type. The advanced view is shown below which provides access to standalone attitude, elevation and range data and calculation pages, see Figure 3.

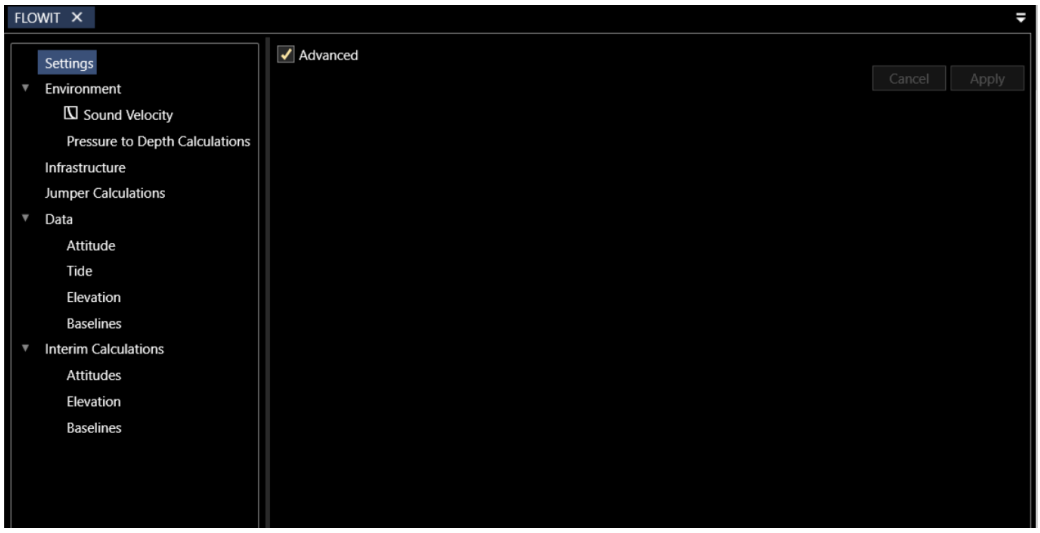


FIGURE 3 - FLOWIT VIEW (ADVANCED)

3 SOUND VELOCITY PROFILE AND CTD CAST

3.1 OVERVIEW

The requirement for the import of a Sound Velocity and/or CTD cast depends on how the depth and/or baseline data to be imported are to be processed. If Baseline data is to be reprocessed with a different sound velocity profile than was used when the data was collected and therefore imported with, at a minimum a Sound Velocity profile must be loaded. If the Dynamic model for Pressure to Depth calculations is to be used, a CTD cast must be loaded.

3.2 LOADING SOUND VELOCITY OR CTD

FLOWIT supports importing sound velocity data from a from a probe such as a Valeport SVX2 or manual entry of a Sound Velocity (SV) profile or CTD cast.

3.2.1 IMPORT SOUND VELOCITY DATA

1. Select Environment->Sound Velocity to display the Sound Velocity management view, see Figure 4.

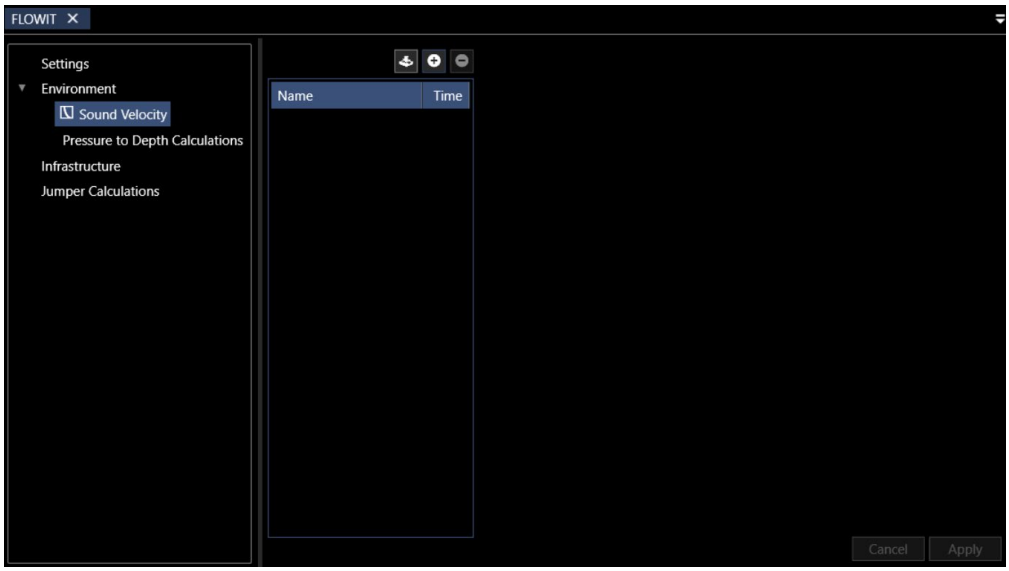


FIGURE 4 – SOUND VELOCITY MANAGEMENT

2. Click the button to launch the Import wizard.
3. Navigate to the folder where the file to import is located, select it and click Open, the **Settings** page will open.

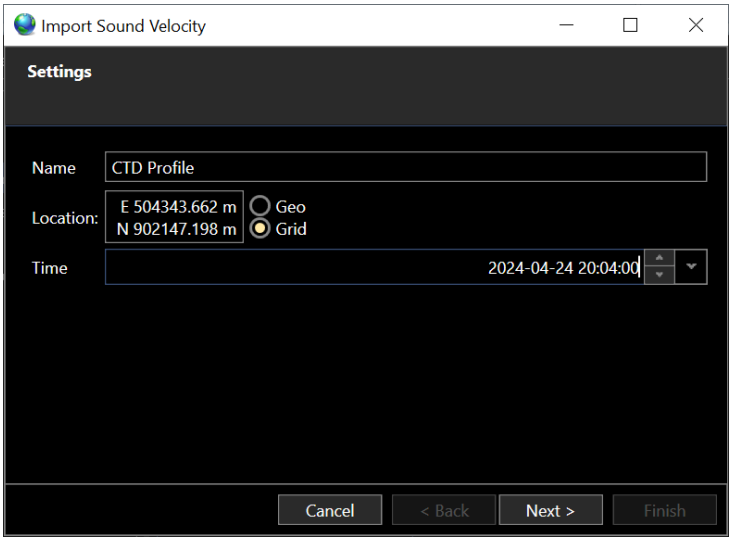


FIGURE 5 – IMPORT SOUND VELOCITY – PROFILE NAME AND LOCATION

4. Enter the information for the import data.
    - **Name:** Enter a name for the profile, default is the file name
    - **Location:** Enter the position the profile was collected (not required)
    - **Time:** Enter/set the date and time the profile was collected

5. Click Next to open **Processing Settings** page. Configure **Processing Settings**. Refer to Section 4 for details on the Pressure to Depth calculation.

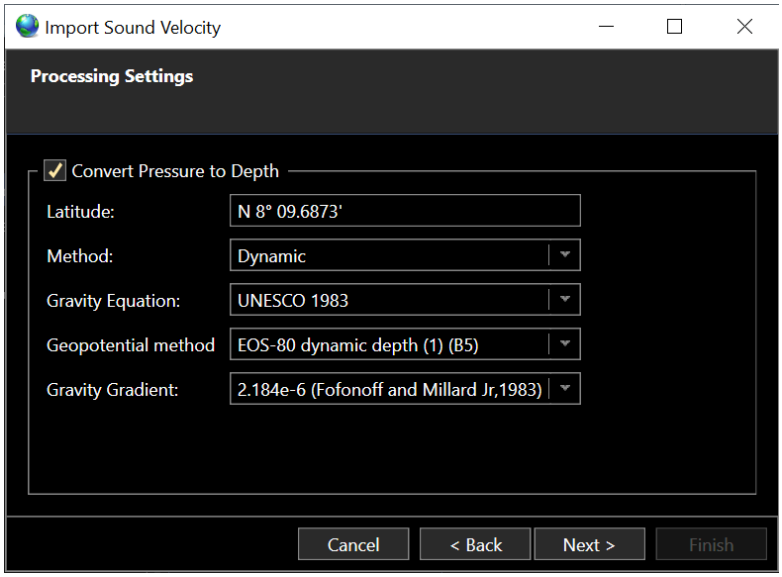


FIGURE 6 – IMPORT SOUND VELOCITY - PROCESSING SETTINGS

6. Click **Next** to open **File Settings** page.
7. Configure the Input Parser for the selected file.

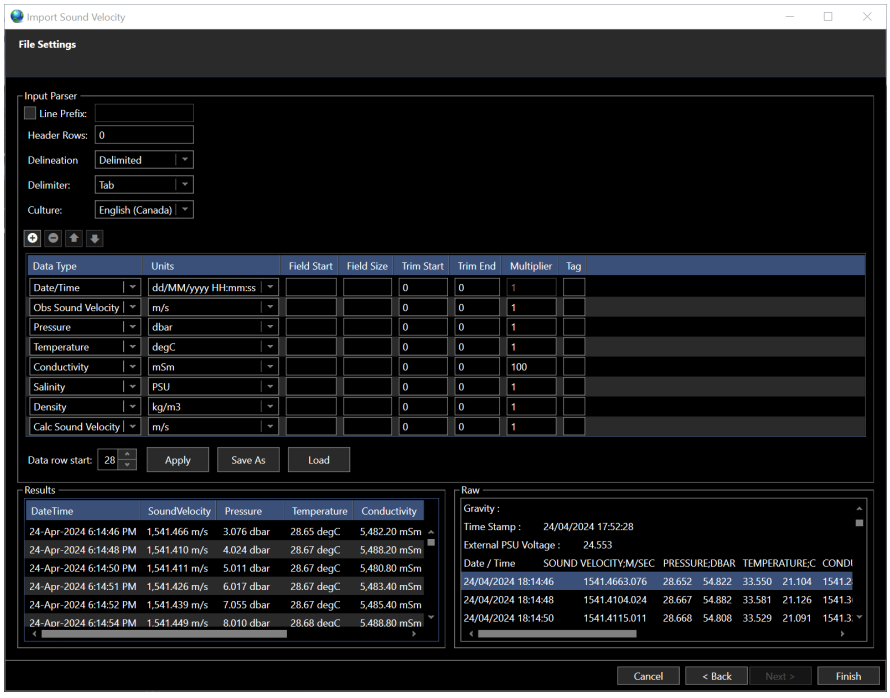


FIGURE 7 – IMPORT SOUND VELOCITY – FILE SETTINGS

- **Line Prefix:** If the file records have a prefix, check this box and enter the prefix
- **Header Rows:** Number of rows to skip at start of file
- **Delimiter/Fixed Length:** Select the record type, delimiter or fixed length
  - **Delimiter:** Select delimiter from the dropdown, if option is not listed select Custom and then enter the delimiter character in the entry space provided
  - **Fixed Length:** No additional options
- **Culture:** Select the culture type (this will define what character is used for the decimal point and thousand, millions, etc. separator), default is en-US
- **Data Fields:**
  - **Add a field:** Click the  button to add a field
  - **Remove a field:** Select the field in the list and click the  button to remove the field
  - **Shift field:** Select the field and click the up arrow to move the field up in the list, the down arrow to move it down in the list
  - **Data Type:** Select the data type from the drop-down list
  - **Units:** Select the units the data is in

Note: If the specific unit type is not listed, look for one that can then be scaled. In the example above, the 5th field is Conductivity in MS/CM, which is not available in NavView, so select mSm and enter a scale value of 100.

- **Field Start:** If Delineation is Fixed Length, enter the zero-based index of the start of the field, e.g. the index of the first character in a record is 0, the index of the 10th character is 9
- **Field Size:** If Delineation is Fixed Length, enter the length of the data in the field
- **Trim Start/End:** If the file is Delimited and there are characters at the start and/or end of a field, enter how many characters to trim in the respective column
- **Multiplier:** If the field must be scaled to convert it to a unit supported by NavView, enter the scalar in the Multiplier column
- **Tag:** Enter a Tag to make identification of the data type when listed, easy to identify (this is not required)

- **Data row start:** Enter or scroll up/down to specify the number of header rows to skip to get to the first data record (the respective row will be highlighted in the Raw panel)
- **Apply:** When file import settings are set, click the Apply button. The decoded data will display in the Results panel, confirm the parsing is correct and adjust as required and click Apply again
- **Save As:** Once the file import is correctly configured, clicking the Save As button allows the user to save the File Import settings to a 4di file which is then available for loading for subsequent imports
- **Load:** Click the Load button to navigate to and load a previously saved 4di file to set the file import configuration

8. Click **Finish** to load the file. The imported file is now available to view.

3.3 VIEWING SOUND VELOCITY PROFILE/CTD CAST

1. Select Sound Velocity to display the Sound Velocity management view.

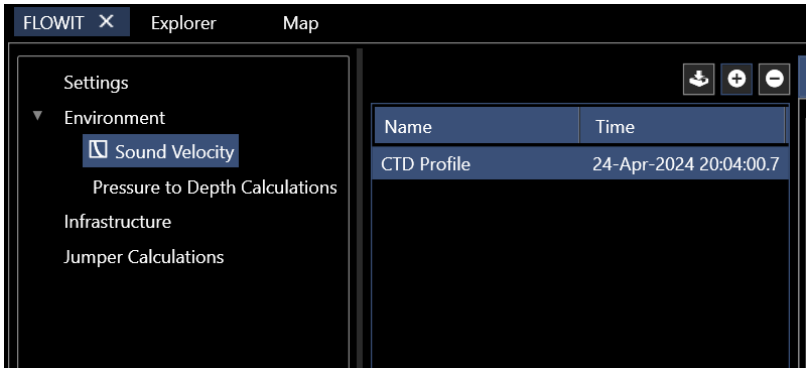


FIGURE 8 – SOUND VELOCITY MANAGEMENT

2. Select the profile to view, details of the profile will be displayed, see Figure 9.

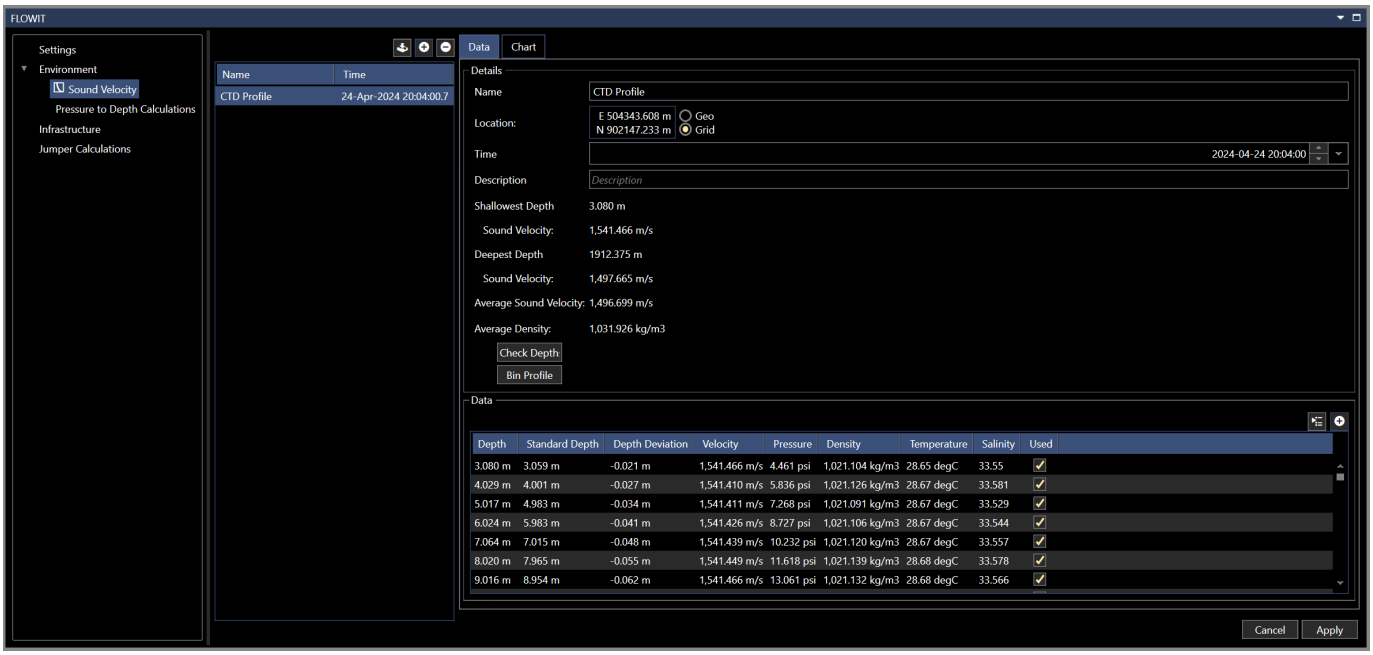


FIGURE 9 – SOUND VELEOCITY PROFILE DETAILS

3.3.1 DATA TAB

3.3.1.1 DETAILS PANEL

- **Name:** Profile name
- **Location:** Profile location
- **Time:** Recorded time of profile
- **Description:** Optional

Note: Name, Location, Time and Description can be edited. Click Apply for changes to be applied.

- **Shallowest Depth/Sound Velocity:** Shallowest record in profile with corresponding speed of sound
- **Deepest Depth/Sound Velocity:** Deepest record in profile with corresponding speed of sound
- **Average Sound Velocity:** Average sound velocity from all profile records
- **Average Density:** Average Density from all profile records
- **Check Depth:** Computes the Depth Anomaly, i.e. Depth calculated using v[S,t,p] (Dynamic Depth, also referred to as True Depth, see section 4) minus Standard Depth calculated using v[35,0,p] (UNESCO, see section 4) across all recorded pressures. This generates a Sound Velocity Deviation Report

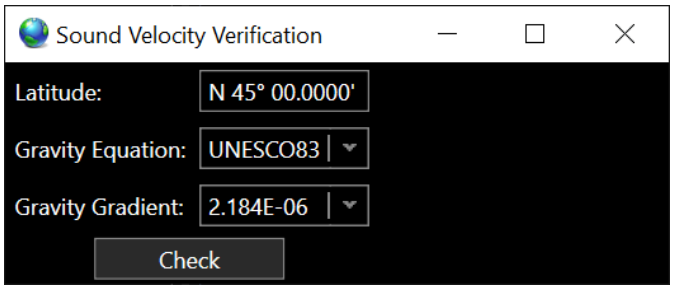


FIGURE 10 – SOUND VELOCITY VERIFICATION (CHECK DEPTH)

I. Enter latitude cast was taken
II. Select the gravity equation to use
III. Select the gravity gradient to use
IV. Click Check
V. From the Save As dialog, navigate to location to save the Sound Velocity Deviation Report, a csv file listing the UNESCO depth, True Depth and the deviation

- **Bin Profile:** Profile records are binned into specified layers using Pressure or Depth. This will generate and add to the Sound Velocity Manager a binned profile with the name of selected profile with binned appended, see Figure 12

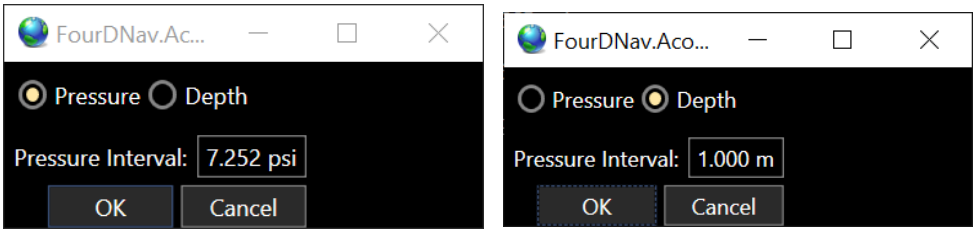


FIGURE 11 – BIN PROFILE – PRESSURE OR DEPTH

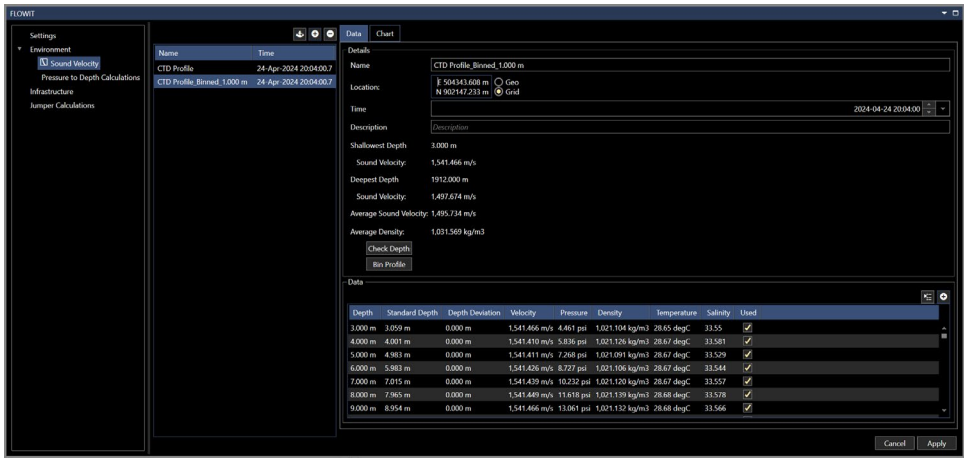


FIGURE 12 – BINNED PROFILE DETAILS

3.3.1.2 DATA PANEL

1. To edit a specific value in a record, double click in the respective cell and enter the corrected data.
2. To remove a record from use, uncheck the respective Used check box.
3. To add a record back in for use, check the respective Used check box.
4. To add a new record to the end of the profile, click the button then click in the cells of the new record to enter the desired value.

Note: Adding records at the end of a file enables the user to extend the profile if required, though care must be taken to ensure the data is not compromised.

5. To insert a record, select the record where the new record is to be inserted before and click the button then click in the cells of the new record to enter the desired value.
6. Click **OK** to apply the changes and close the view; or
7. Click **Cancel** to remove any changes made since the last time changes were applied; or
8. Click **Apply** to apply the changes and leave the view open.

3.3.2 CHART TAB

The Chart tab displays the profile data. Checkboxes are available to show/hide various data items in the chart. After selecting, click the **Update Chart** button.

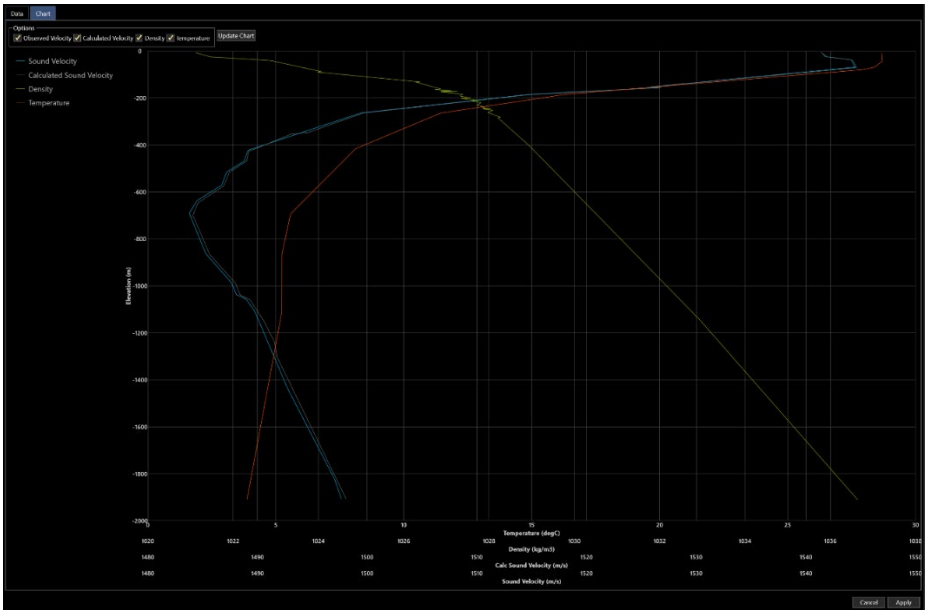


FIGURE 13 SOUND VELOCITY CHART TAB

3.3.3 PROFILE COMPARISONS

Visual comparisons can easily be made between multiple sound velocity profiles by multi selecting profiles in the list.

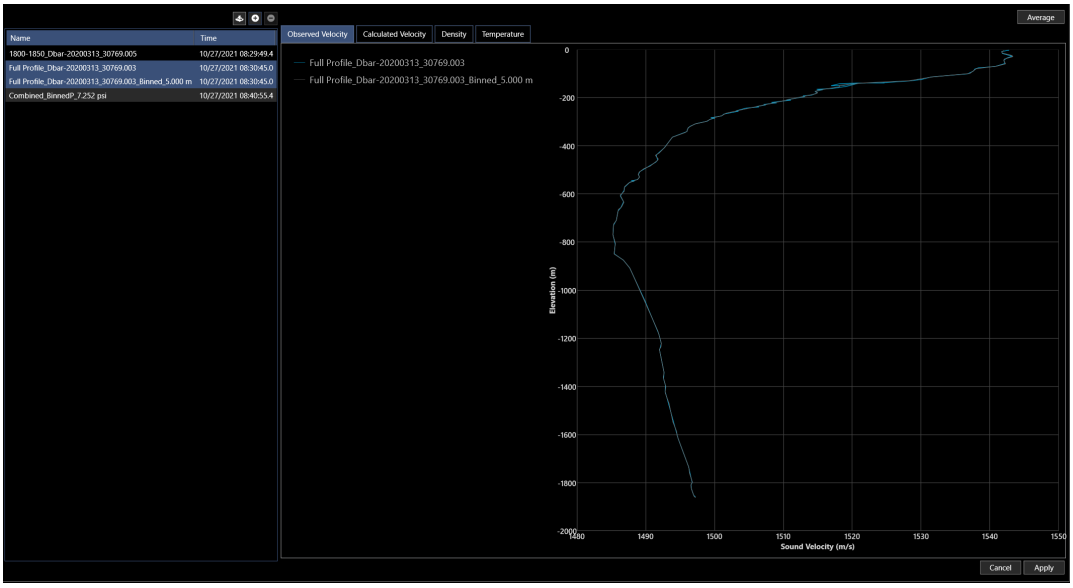


FIGURE 14 MULTI SVP COMPARISON

In Figure 14 above only the chart data is shown, and a separate chart is created for Observed Velocity, Calculated Velocity , Density, and Temperature. Data from each selected profile is added to the charts as a separate line, if available. It is possible to zoom in on the chart to make closer comparisons by using the mouse wheel.

In Figure 15 below, the blue line is the unbinned profile, and the grey line is binned. It can be seen that the binning is effective and has smoothed out the noise in the profile.

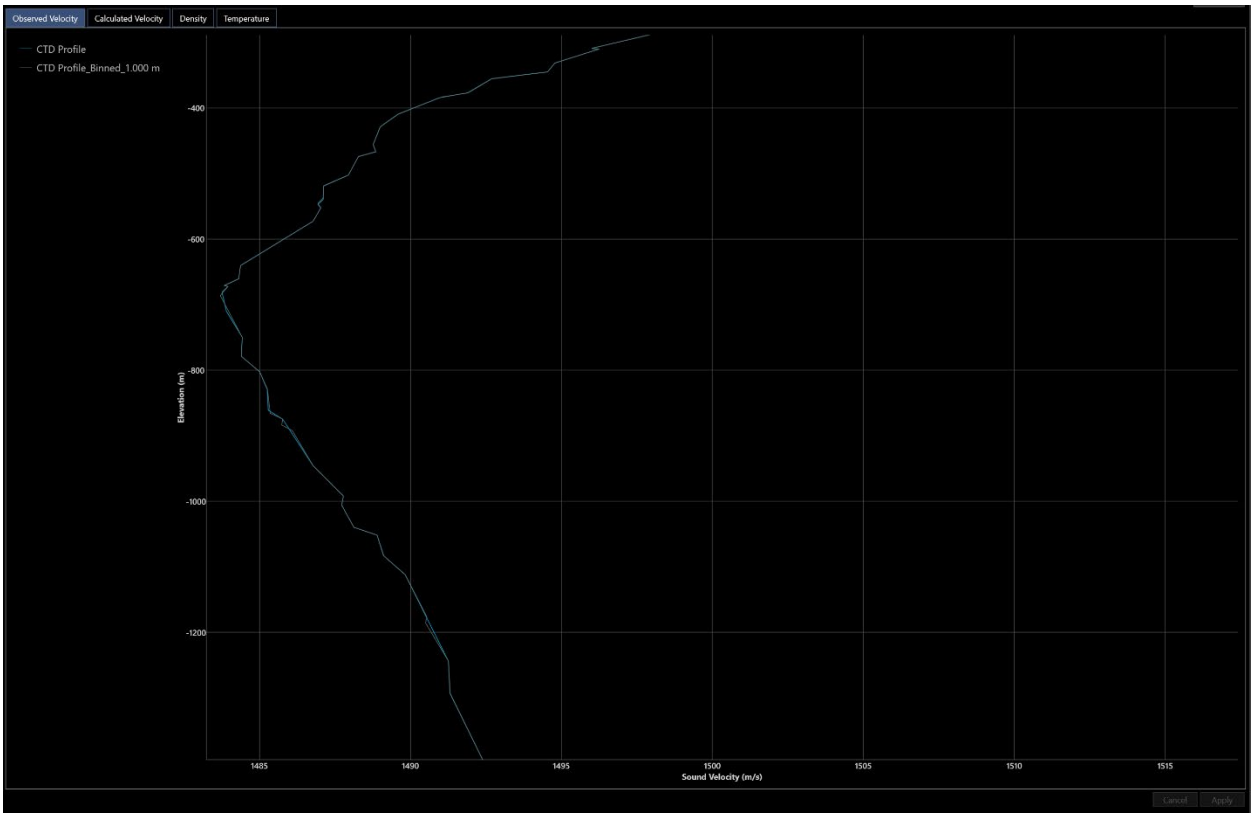


FIGURE 15 MULTI SVP COMPARISON, ZOOMED VIEW

3.3.4 COMBINING PROFILES

When multiple profiles are selected, the Average tool becomes available, as seen in Figure 14 in the top right corner. The average tool requires a pressure or depth interval as in Figure 11, as binning is part of the process. Data points from all selected profiles are combined into one list, This is then sorted based on pressure or depth, and then binned using the selected bin setting. A new profile is added to the list with the result which is labelled "Combined_Binned[interval]".

4 PRESSURE TO DEPTH CALCULATION

FLOWIT supports the creation of multiple pressure to depth calculations to be used as required for different Elevation data files. These are as follows:

a. **UNESCO:** The UNESCO equation refers to the 1980 Equations of State of Seawater, published in the UNESCO technical paper 44, referenced as UNESCO 1983. This equation uses IOGP conversion 136, EOS-80 standard ocean depth and takes input of pressure and latitude

b. **Density:** The density equation requires a mean density of the water column, which can be determined from a Conductivity Temperature Density (CTD) profile of the water column. The Density value is entered into the Density text box and used for this calculation

   The depth equation is as follows:

$$Depth = \frac{P*0.70307}{d} * \left(\frac{G_{std}}{G_{local}}\right)$$

   0.70307 = psi to meters conversion for water of standard density

   P = Pressure in PSI

   d = mean density of the water column

   G_{std} = Standard gravity 9.80665 m/sec2

   G_{local} is the local gravity from the International association of Geodesy, Special Bulletin on Geodesy (1970) ref: Anon 1970

   $G_{local} = Ge*(1+0.0053024*sin^2\phi - 0.000059*sin^2(2\phi))$

   G_e = 9.7803184 m/sec2

   ϕ = Latitude

c. **Dynamic:** Calculates depth using density from water column profile. Provides most accurate result of three options

Note: The dynamic calculation implements dynamic depth equations described in IOGP Report 649 (Seawater Pressure to depth conversion). A combination of geopotential method and gravity settings must be chosen to adhere to this setup.

4.1 ADD A PRESSURE TO DEPTH CALCULATION

1. Expand Elevations and select Pressure to Depth Calculations.
2. Click the  button open the Configure Depth Calculation dialog.

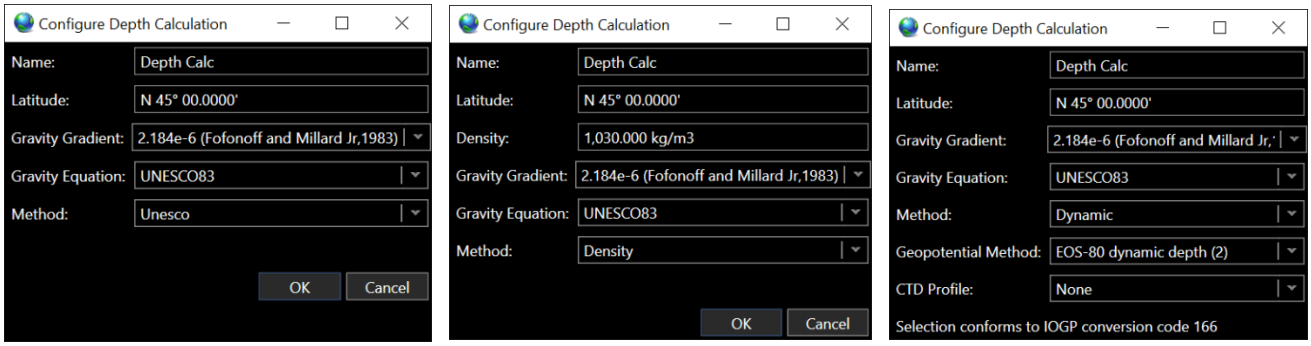


FIGURE 16 PRESSURE TO DEPTH CALCULATION METHODS

3. Configure the desired method.
    a. **UNESCO** Calculation (See Figure 16)
        - **Method:** Select UNESCO
        - **Name:** Enter the calculation name, recommend making it concise but descriptive of the calculation
        - **Latitude:** Enter the latitude for the calculation
        - **Gravity Gradient:** Select the gravity gradient to use from the drop-down list
        - **Gravity Equation:** Select the gravity equation to use from the drop-down list

    b. **Density Calculation** (see Figure 16)
        - **Method:** Select Density (default)
        - **Name:** Enter the calculation name, recommend making it concise but descriptive of the calculation
        - **Latitude:** Enter the latitude for the calculation
        - **Density:** Enter the mean density for the water column. This is captured as IOGP geopotential method B2 dynamic depth (2)
        - **Gravity Gradient:** Select the gravity gradient to use from the drop-down list
        - **Gravity Equation:** Select the gravity equation to use from the drop-down list

    c. **Dynamic Calculation** (see Figure 16)
        - **Method:** Select Dynamic
        - **Name:** Enter the calculation name, recommend making it concise but descriptive of the calculation
        - **Latitude:** Enter the latitude for the calculation
        - **Gravity Gradient:** Select the gravity gradient to use from the drop-down list
        - **Gravity Equation:** Select the gravity equation to use from the drop-down list
        - **Geopotential Method:** From the drop down, select the Geopotential method to use

- EOS-80 dynamic depth (1) – Method Code B5: Calls for an average density and are only valid for use on a processed CTD profile that has been binned into uniform pressure spacing so as not to skew the average density value

- EOS-80 dynamic depth (2) – Method Code B6: Calls for an average density and are only valid for use on a processed CTD profile that has been binned into uniform pressure spacing so as not to skew the average density value
- EOS-80 dynamic depth (3) – Method Code B7: Performs an integral and therefore can be performed on a raw CTD profile that may have non-uniform pressure spacing (recorded continuously or at some time interval). With this method it is important that the integral begin at zero seawater pressure and not at the first recorded seawater pressure

- **CTD Profile:** From the drop-down list, select the CTD cast from those loaded into FLOWIT to use for the calculation. The CTD profile must extend beyond the expected working pressure. The CTD profile must have at minimum fields for Pressure and for Density. IOGP report 649 details further requirements on the quality of the CTD profile to meet their standards

4.1.1 EDIT A PRESSURE TO DEPTH CALCULATION

1. Select Pressure to Depth Calculations.
2. Right mouse click on the depth calculation to be edited and then click on Edit; or double click on the calculation to be edited.
3. Edit the settings as required.
4. Click OK.

Note: When a change is made to a Pressure to Depth Calculation, it is automatically applied to all Elevation Calculations that calculation was selected for.

4.1.2 REMOVE A PRESSURE TO DEPTH CALCULATION

1. Select Pressure to Depth Calculations.
2. Select the calculation to remove.
3. Click the  button.
4. Answer the confirmation prompt.

5 INFRASTRUCTURE

FLOWIT supports the entry of those objects or Infrastructure involved in a metrology survey as Structures. These include, but are not limited to, manifolds, wells, tripods and those components associated with these such as hubs, pressure caps, transponders, etc. In the case of manifolds, wells etc., and transponder buckets and porches in the case of tripods. Seabed depth profile observation locations are also handled as structures.

Key points are:

1. All objects associated with a metrology must be added as a Structure before they can be used.
2. Data import can be interrupted to go back and add an object if the user realizes it is missing during the data import.
3. Any object can be edited, and the effect of the editing will immediately be applied wherever that object is used.

Structures are accessed by clicking on Infrastructure in the FLOWIT branch.

5.1 INFRASTRUCTURE COMPONENTS

The Infrastructure is made of Structures, each with their own Attributes. An Attribute can then be assigned an Occupation.

5.1.1 STRUCTURES AND ATTRIBUTES

A Structure represents the body of the Infrastructure object. Attributes are added to a Structure to represent those locations on the Structure to which data and Occupations can be assigned and can be added to Calculations. The following are typical Structures and their Attributes that can be added.

- **Manifolds**
  - Hubs
  - Survey Receptacles
  - Tools
- **Trees**
  - Hubs
  - Survey Receptacles
  - Tools
- **Tripods**
  - Transponder buckets
  - Benchmark porches
- **Seabed Depth Profile** paro observation locations other than the associated hubs

When a Structure is added, by default an Attribute called Origin is added to it.

5.1.2 OCCUPATION

An Occupation is assigned to those Attributes in which a transponder will be installed for Baseline and/or Attitude data observations, e.g. a hub or tool.

5.1.3 FILE HOOKS

File Hooks are properties of both attributes and occupations. A File Hook is an alphanumeric code associated with the infrastructure component which is used to help speed up file import for all data types in the project. When importing elevation profile data for example, one of the most time-consuming parts is manually associating each data set with its infrastructure location. When a file hook is applied to the attribute or occupation, and the same file hook is present in the file name of an imported file, the system will automatically and reliably make the correct association between the data set and its desired location.

To use file hooks effectively, make sure that they are unique, and one file hook string is not contained within another. The system finds the association by checking if the file name contains the file hook, so if hooks are too close together, there may be a wrong association.

Example: Hub 1 has a hook of “HUB1A” and a filename to associate with this data may be “YYYYMMDD_Loop1_Open_HUB1A.txt”. Because “HUB1A” is in the filename, the association will work.

If another hub in the project has a file hook of “HUB1” (missing the A), this string is also contained in the above filename, and HUB1A’s files may incorrectly end up associated with HUB1.

5.2 ADDING A STRUCTURE

1. Select Infrastructure to display the Infrastructure management view.

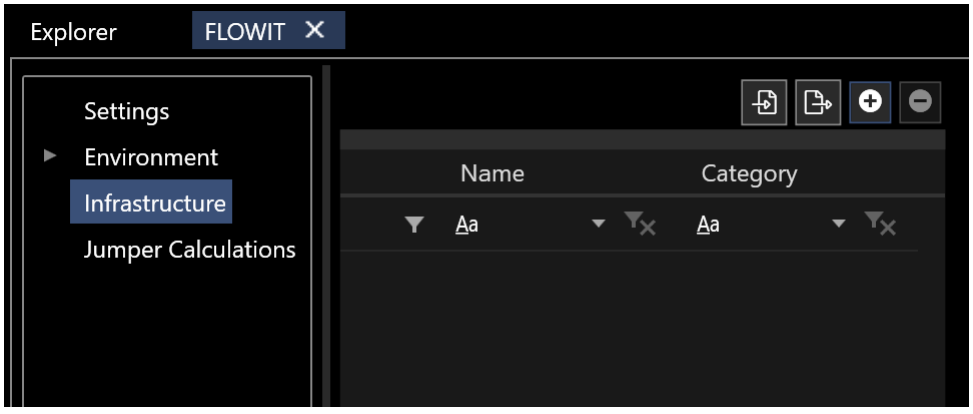


FIGURE 17 INFRASTRUCTURE MANAGEMENT VIEW

FIGURE 18 INFRASTRUCTURE MANAGEMENT VIEW – TOOLBAR

- Import a 4D Nav *.iif format file to populate infrastructure items, see Section 5.2.3
- Export Transponder locations to Remote LBL file
- Add a new structure
- Delete a selected structure

2. Click the button to open the New Structure dialog.

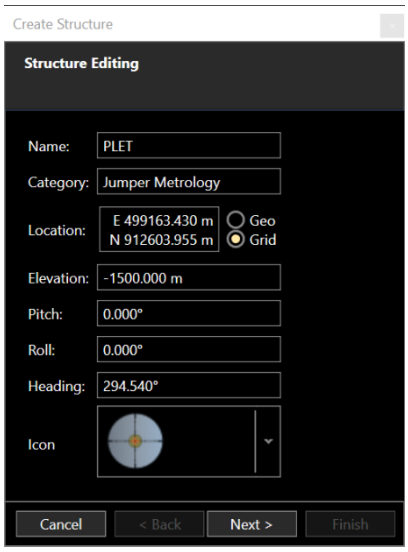


FIGURE 19 CREATE STRUCTURE – STRUCTURE EDITING

3. Enter the information for the Structure.
   - **Name:** Enter the structure's name
   - **Category:** Enter a name to group structures to a specific metrology
   - **Location:** Enter the structure's position

Note: Position can be either the structure origin or reference point where measurements will be taken such as a hub.

   - **Elevation:** If known, enter the structure's elevation, note that a depth is entered as a negative elevation
   - **Pitch:** If known, enter the structure's pitch
   - **Roll:** If known, enter the structure's roll
   - **Heading:** Enter the structure's heading, in Grid
   - **Icon:** From drop-down list, select icon to represent the structure origin or reference point where measurements will be made from

4. Click Next to open Options dialog, see Figure 20.

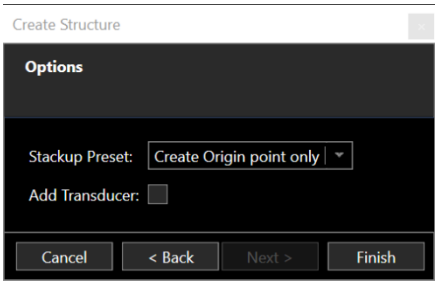


FIGURE 20 CREATE STRUCTURE – OPTIONS

5. From Stackup Preset drop-down list select the applicable stackup. Check the box Add Transducer to add to the preset stackup.
6. Click Finish. The structure will be displayed on the data table.

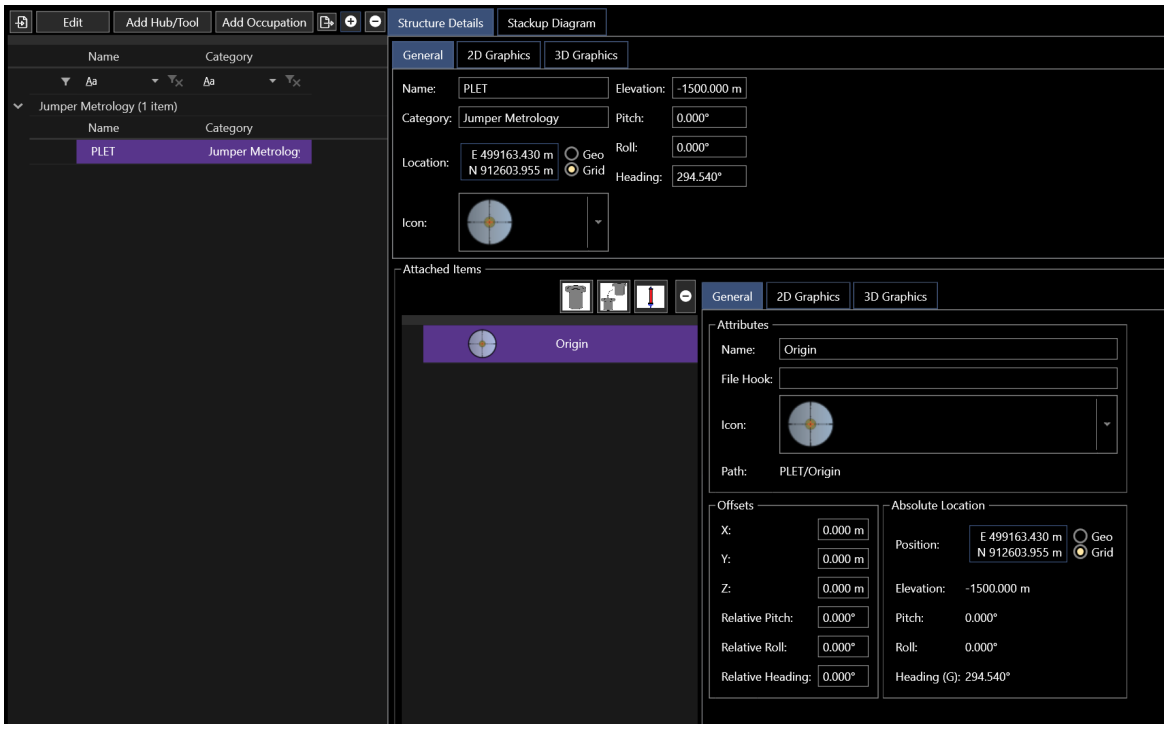


FIGURE 21 INFRASTRUTURE VIEW – STRUCTURE ADDED

5.2.1 STRUCTURE DETAILS TAB

Provides information of added structure, this contains the General tab, 2D Graphics tab an 3D Graphics tab.

5.2.1.1 GENERAL TAB

Contains the structure details and items to be added to the structure.

- **Name**
- **Category**
- **Location**
- **Icon**
- **Elevation**
- **Pitch**
- **Roll**
- **Heading**

Note: All the above can be edited if needed. Any edit will immediately be applied wherever that object is used.

5.2.1.1.1 ATTACHED ITEMS- HUB

Items representing hubs, tools, survey receptacles, transponder buckets, benchmark porches, etc. must be added to the respective structure for them to be available for assignment to imported data, Occupation and Calculations.

1. Click the New Hub on Structure button to display the Edit Tool/Hub dialog, see Figure 23.

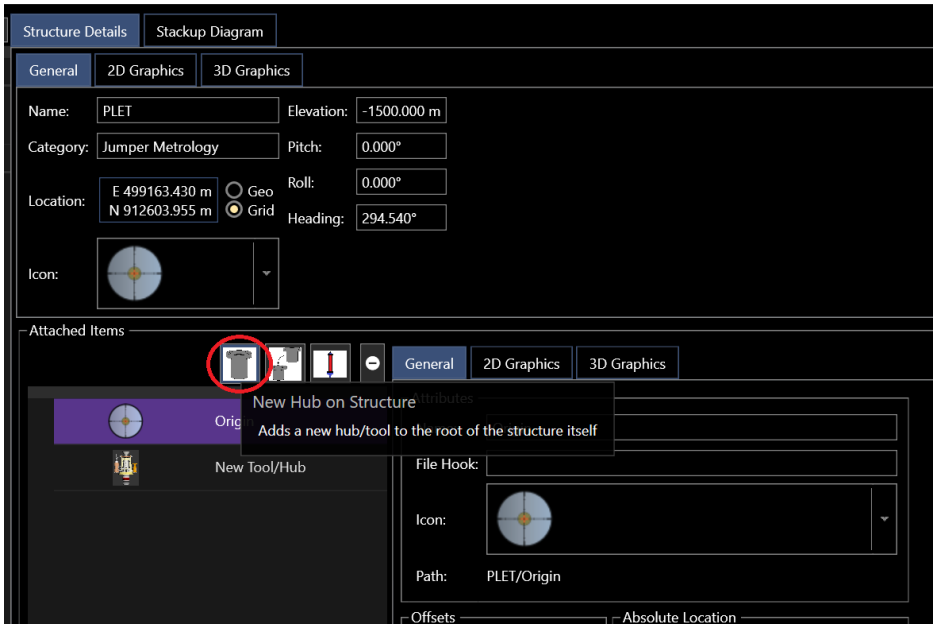


FIGURE 22 NEW HUB ON STRUCTURE

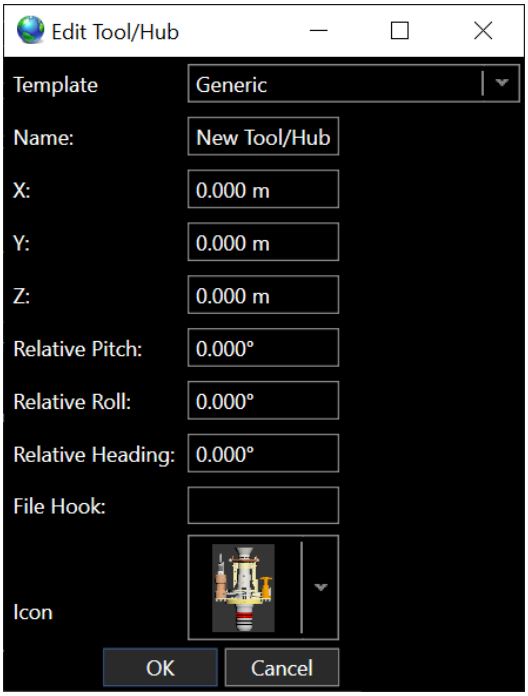


FIGURE 23 EDIT TOOL/HUB DIALOG

2. Enter the information for the Tool or Hub then enter OK to add to the structure.
    - **Template:** Choose from the list of template items. This will pre-populate the icon and the Z value of the item. For instance, if the item being added as a specific type of pressure cap this can be set up for easier data entry later
    - **Name:** Enter name for Tool/Hub item
    - **X:** Enter the X offset from the structure origin, + to starboard, - to port
    - **Y:** Enter the Y offset from the structure origin, + forward, - astern
    - **Z:** Enter the Z offset from the structure origin, + up, - down
    - **Pitch:** If known, enter the Tool/Hub pitch relative to the structure
    - **Roll:** If known, enter the Tool/Hub roll relative to the structure
    - **Heading:** Enter the Tool/Hub heading relative to the structure
    - **File Hook:** Enter the Tool/Hub file hook (optional)
    - **Icon:** Select an icon to associate with this Tool/Hub

Note: If performing a Hub-to-Hub metrology, the Hub's X, Y, Z, Pitch, Roll and Heading can be entered as 0.

Note: If a Tool or Pressure Cap is in place on a Hub, add it as a separate item and unless a Dimension Control (DC) survey has been performed on the Structure, Hub and Pressure Cap or Tool to provide the measurements, enter the same X, Y, Pitch, Roll and Heading as the Hub and enter the height from the Hub face to the Pressure Cap or Tool receptacle face.

The added Hub will be displayed in the Attached Items list.

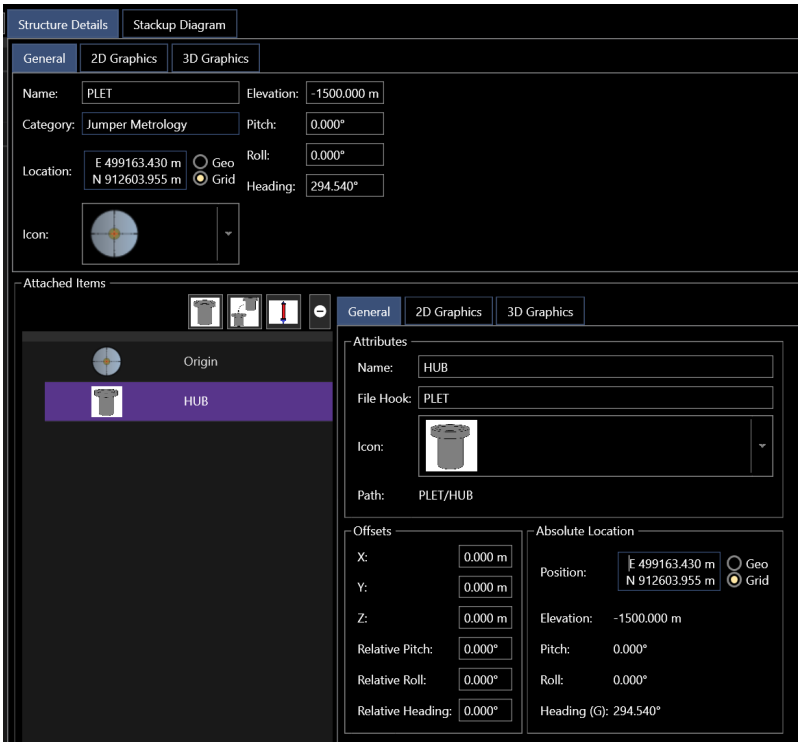


FIGURE 24 HUB ADDED TO STRUCTURE

5.2.1.1.2 ATTACHED ITEMS- TOOL

Adding a sub-item such as a pressure cap on a Hub using the New Hub on Selected Item button.

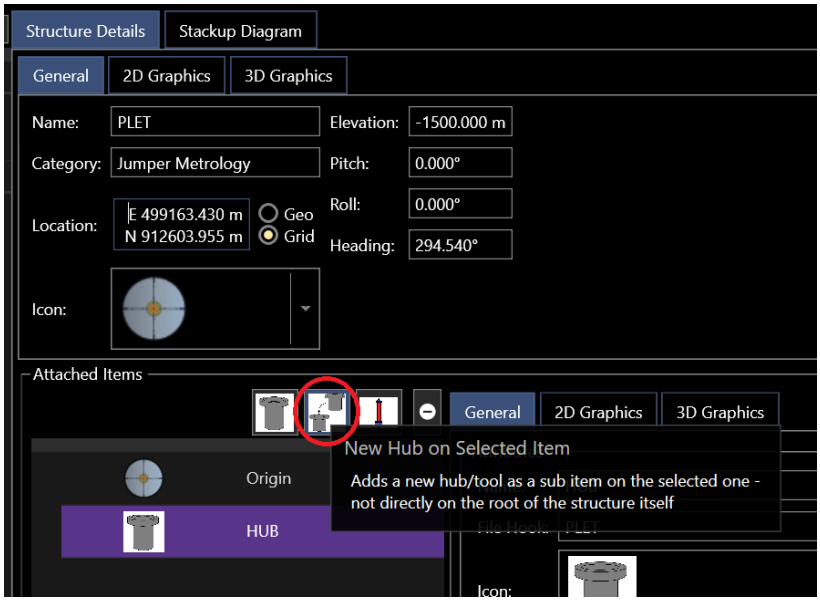


FIGURE 25 NEW HUB ON SELECTED BUTTON

1. Select the desired hub in the Attached Items list then select the New Hub on Selected Item.
2. The Edit Toll/Hub dialog will be shown as in Figure 23. Once added, the new item will be shown in the structure's Attached Items view as a sub item of the selected hub.

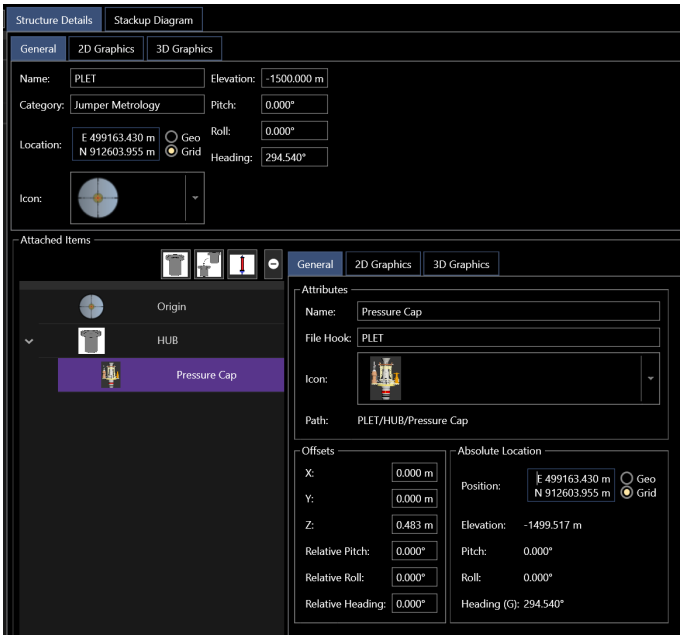


FIGURE 26 PRESSURE CAP ADDED TO HUB

5.2.1.1.3 ATTACHED ITEMS – TRANSPONDER OCCUPATION

To assign Baseline or Attitude data to an item, an Occupation must be added to it.

1. Select the item, e.g. Pressure Cap, to add the Occupation to and click the New Transponder Occupation on Selected Item button to display the Edit Occupation dialog, see Figure 28.

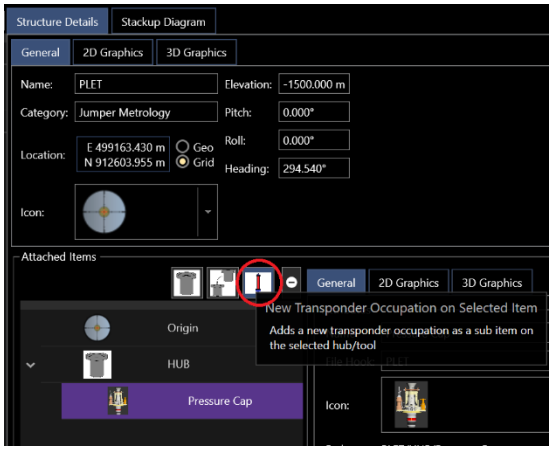


FIGURE 27 NEW TRANSPONDER OCCUPATION ON SELECTED ITEM BUTTON

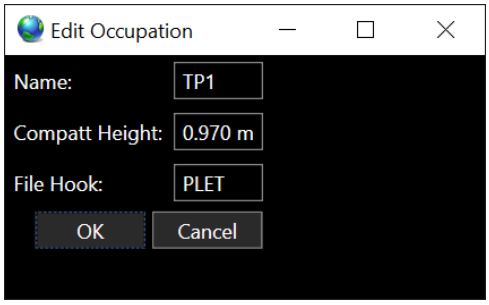


FIGURE 28 EDIT OCCUPATION DIALOG

2. Enter the information for the Occupation.
    - **Name:** Enter the Occupation's name
    - **Compatt Height:** Enter the height of the transducer above the associated item
    - **File Hook:** Enter the occupation's file hook (optional)
3. Click OK. The Occupation will be shown in the structure Attached Items tree.

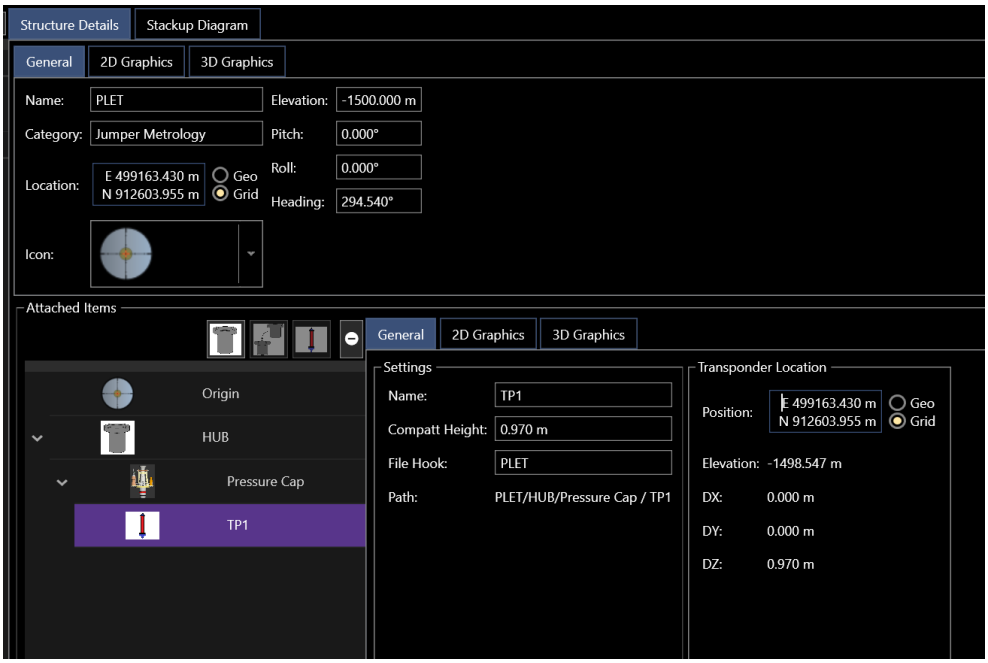


FIGURE 29 OCCUPATION ADDED (TRANSPONDER)

5.2.1.2 GRAPHICS TABS – 2D AND 3D

FLOWIT can display on the Map view and 3D Map view an outline and/or 3D model of Attached Items.

Note: Item outline file required for Map view and 3D model required for 3D Map view.

5.2.2 STACKUP DIAGRAM TAB

The Stackup Diagram is a display of the hierarchy of items on the structure. The display starts with the root structure item, and builds upwards from there, so it will be similar to how the structure is set up in the physical world – i.e., hub on structure, receptacle on top of hub, transponder on top of receptacle. Lines indicate the attachments, so it is easier to visualize and confirm that things are set up correctly.

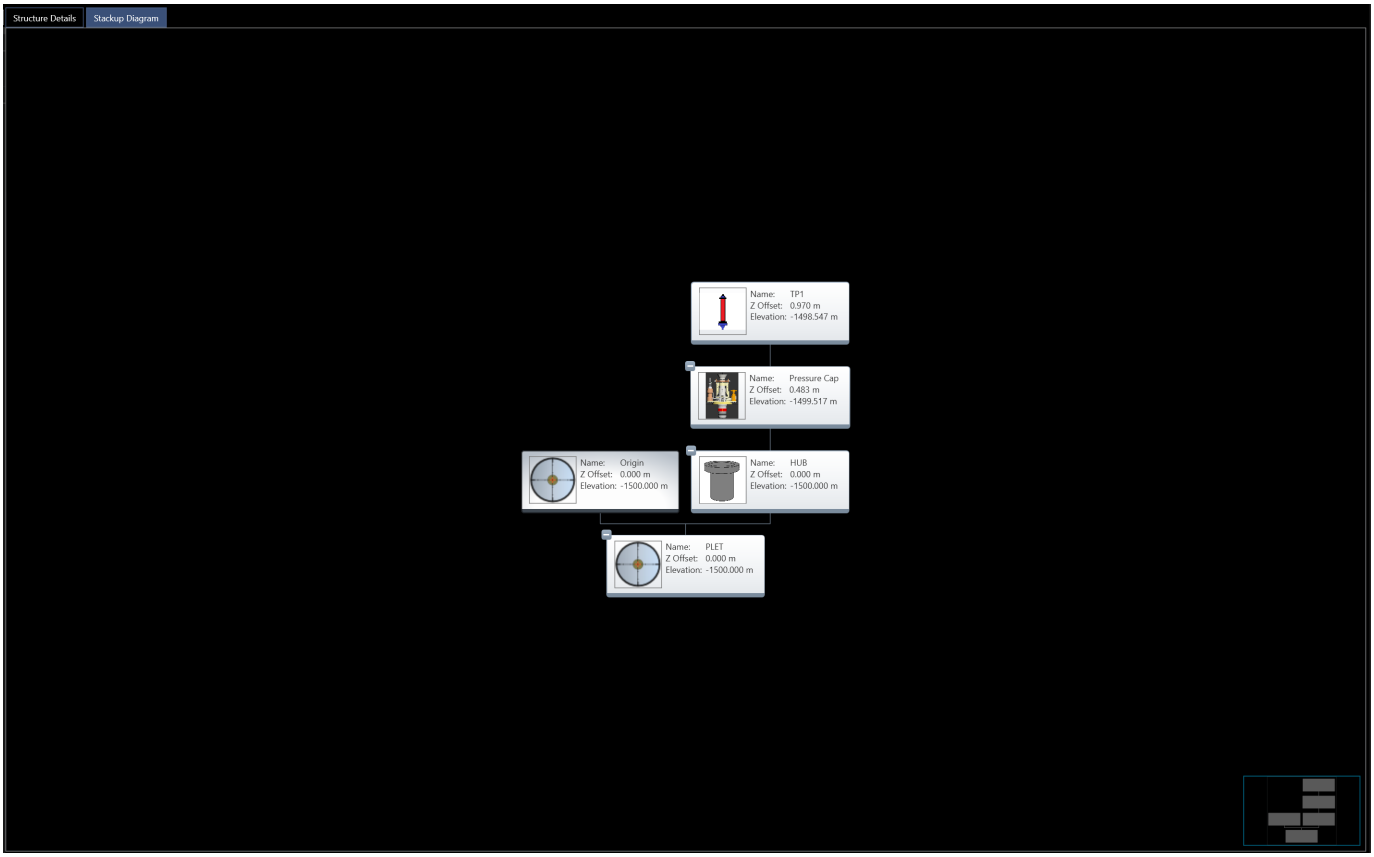


FIGURE 30 STACKUP DIAGRAM EXAMPLE

5.2.3 INFRASTRUCTURE IMPORT

Infrastructure items can be imported from a text file in the *.iif (infrastructure import format) format. An iif file consists of lines prefixed with S: for structure, H: for hub/tool and O: for occupation. The file definition is shown below.

5.2.3.1 STRUCTURE FILE FORMAT

The Structure file is a comma separated, which provides name, category, position, and orientation of a structure.

Item	Description	Data Type	Example
S:	header	n/a	S:
Name	Name of the structure	String	Structure1
Category	Category for the structure	String	CatA
Easting	Projected coordinate easting of the structure CRP, in project units	Decimal number	1234531.123
Northing	Projected coordinate northing of the structure CRP in projected units	Decimal Number	5123123.123
Elevation	Elevation of the structure in project elevation unit	Decimal Number	-101.0
Pitch	Pitch of the structure in decimal degrees	Decimal Number	0.15
Roll	Roll of the structure in decimal degrees	Decimal Number	1.0
Heading	Grid heading of the structure in decimal degrees	Decimal number	-15.0

TABLE 1 STRUCTURE FILE LINE FORMAT

Example line: S:Structure1,CatA,123541,12354,-101.0,0,0,15.0

5.2.3.2 HUB/TOOL FILE FORMAT

Item	Description	Data Type	Example
H:	header	n/a	H:
Name	Name of the attached item	String	Hub1
DX	X offset from structure origin (project working projected unit)	Decimal Number	1.0
DY	Y offset from structure origin (project working projected unit)	Decimal Number	0.5
DZ	Z offset from structure origin (projected working projected unit)	Decimal Number	-0.9
DP	Pitch offset in decimal degrees	Decimal Number	0.25
DR	Roll offset in decimal degrees	Decimal Number	1.9
DH	Heading offset in decimal degrees	Decimal Number	56.9
File Hook	File hook to associate with this hub/tool for data import purposes	string	H1234

TABLE 2 HUB/TOOL FILE LINE FORMAT

Example Line: H:Hub1,1.0,0.5,-0.9,0.25,1.9,56.9,H1234

5.2.3.3 OCCUPATION FILE FORMAT

Item	Description	Data Type	Example
O:	Header	n/a	O:
Name	Name of the occupation	string	Occ1
Height	Height of transducer relative to base (project elevation unit)	Decimal number	5.9
File Hook	File hook to associate with this occupation for data import purposes	string	O1234

TABLE 3 OCCUPATION FILE LINE FORMAT

Example line: O:Occ1,5.9,O1234

5.2.3.4 ORDER OF LINES

When importing a *.iif file, the importer will use the order of lines to create the hierarchy. For example, a structure line with two hub lines after it will result in a structure with two hubs. Any occupation lines need to follow a hub line and will be attached to that hub.

Note: If an occupation is not preceded by a hub, or if a hub/tool is not preceded by a structure, the imported will fail.

An example full infrastructure import file is shown below.

```
S:Structure1,CatA,123541,12354,-101.0,0,0,15.0
H:Hub1,2,3,4,5,6,7,H1234
H:Rec1,2,3,4,5,6,8,R1234
O:Occ1,5.9,O1234
O:Occ2,6.9,O1235
S:Structure2,CatA,5123123,513,-103,0,0,-25.0
H:Hub2,0,9,2,1,2,3,H2345
O:Occ3,11.0,O1236
```

FIGURE 31 INFRASTRUCTURE IMPORT EXAMPLE

5.2.4 INFRASTRUCTURE – 2D MAPS

Infrastructure is added to 2D Maps as a layer with each Structure and their Attached Items added as child layers. This enables the user to turn their display on and off and select them as **Move to...** objects via the 2D Map right mouse click.

5.2.4.1 ADDING STRUCTURES

The 2D Map Point Picker and Multi-Point Picker tools can also be used to create a Structure directly.

To add a single Structure:

1. Enable the Point Picker tool.
2. Click in the 2D Map where the Structure is to be added, e.g. center of a manifold that is displayed in the background drawing.
3. Right mouse click on this point to pop up the Point > Copy to... option and click on Metrology Structures to open the Configure Structure dialog with the point set as the Location.
4. Complete the Structure configuration and click OK to create a Structure at this Location or Cancel to ignore this point and not create a Structure

To add multiple structures, e.g. seabed depth profile observation locations:

1. Enable the Multi-Point Picker tool.
2. Click in the 2D Map where the observation locations are to be positioned.
3. Right mouse click on the resulting line to pop up the Multi-point > Copy to... option and click on Metrology Structures to open the Configure Structure dialog with the first of the multi-points set as the Location.
4. Complete the Structure configuration and click OK to create a Structure at this location or Cancel to ignore this point and not create a Structure.
5. The Configure Structure dialog with the next of the multi-points set as the Location will open.
6. Repeat steps 4 and 5 until all points have been either added as a Structure or ignored.

Note: Unless specific positions are provided, the use of the Multi-point tool for adding the seabed depth profile observations points is a convenient means to add these locations. Using the background drawing to view where the “mudline at the edge of the manifold” and similar and the length and azimuth of each segment to space the points out as specified in the procedures provides a simply approach to adding these. If better position determinations are obtained during the collection of the depth data, i.e. LBL positioning, the respective Structure Locations can be edited later.

6 DATA SETS

Datasets are a way to organize data in FLOWIT. When importing any batch of data, whether that is elevation, attitude, or ranges, a dataset must be selected. When a project is first created, a default dataset is created. New Datasets can be added or removed by accessing the dataset management page, by selecting the Data item in the tree view (available when advanced mode is enabled in settings).

FIGURE 32 DATA SETS – ADVANCED ENABLED

Datasets allow for data to be shared between calculation. For instance, if attitude data is collected on a manifold that is shared between different jumper calculations, the dataset of the first jumper calculation can be included with the second calculation, to access that data.

6.1 ADD A DATASET

To add a new dataset, click the  button in the datasets view. A dialog will appear as shown below where the dataset name can be edited. The new dataset will be added to the list of existing datasets, see Figure 34.

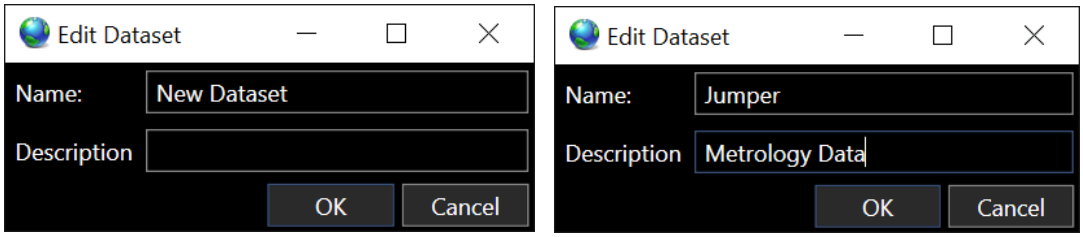


FIGURE 33 ADD A DATASET DIALOG

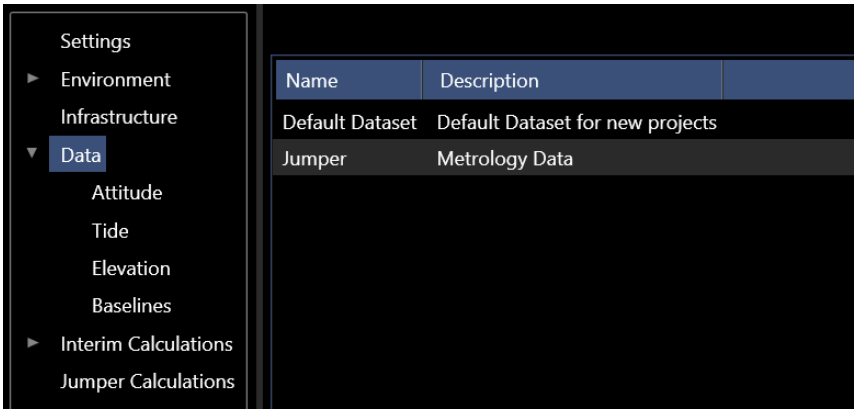


FIGURE 34 DATASET ADDED

6.2 REMOVE A DATASET

To remove a dataset, select it in the list and click the button.

Note: A dataset that has data associated with it cannot be removed.

7 ATTITUDE DATA

Attitude data refers to pitch and roll data observed at an occupation to determine the Hub/Tool attitude.

7.1 ADDING ATTITUDE DATA

Attitude data can be imported from an ascii text file or manually added.

To import from an ascii text file:

1. Click the add button to open the New Attitude Options selection window.

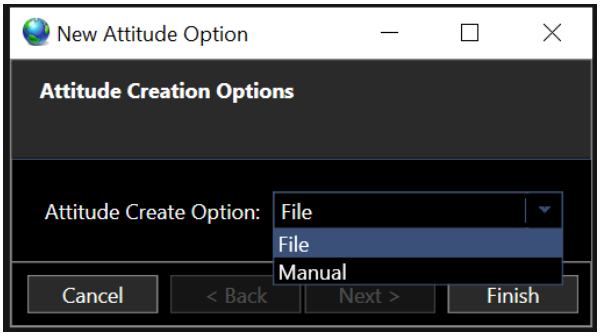


FIGURE 35 NEW ATTITUDE OPTIONS

2. Select File from drop-down list. Click Finish.
3. Select attitude file(s) to import. This will open the Import Attitudes wizard, see Figure 36.

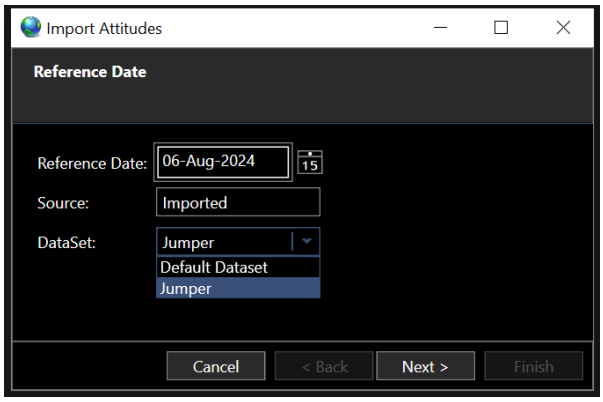


FIGURE 36 IMPORT ATTITUDES – REFERENCE DATE PAGE

- **Reference Date:** Date of data collection
- **Source:** Enter description of data source (Optional)
- **DataSet:** From drop-down list, select the dataset to add the attitude observations

4. Click Next.

Note: If multiple files are selected the File Options page will open. If a single file is selected the File Settings page will open.

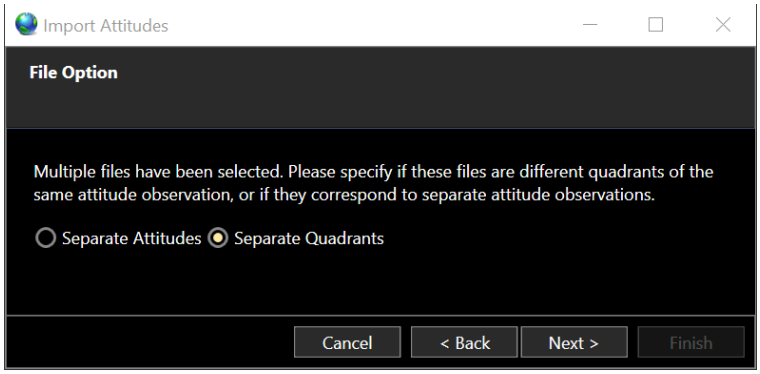


FIGURE 37 IMPORT ATTITUDES – MULTIPLE FILES - FILE OPTION PAGE

- **Separate Attitudes:** Select if attitude observations were made on different occupations
- **Separate Quadrants:** Select if attitude observations were made on a single occupation at the 4 quadrants

5. Click Next to open File Settings Page, see Figure 38.
6. Configure File Settings to import the attitude data.

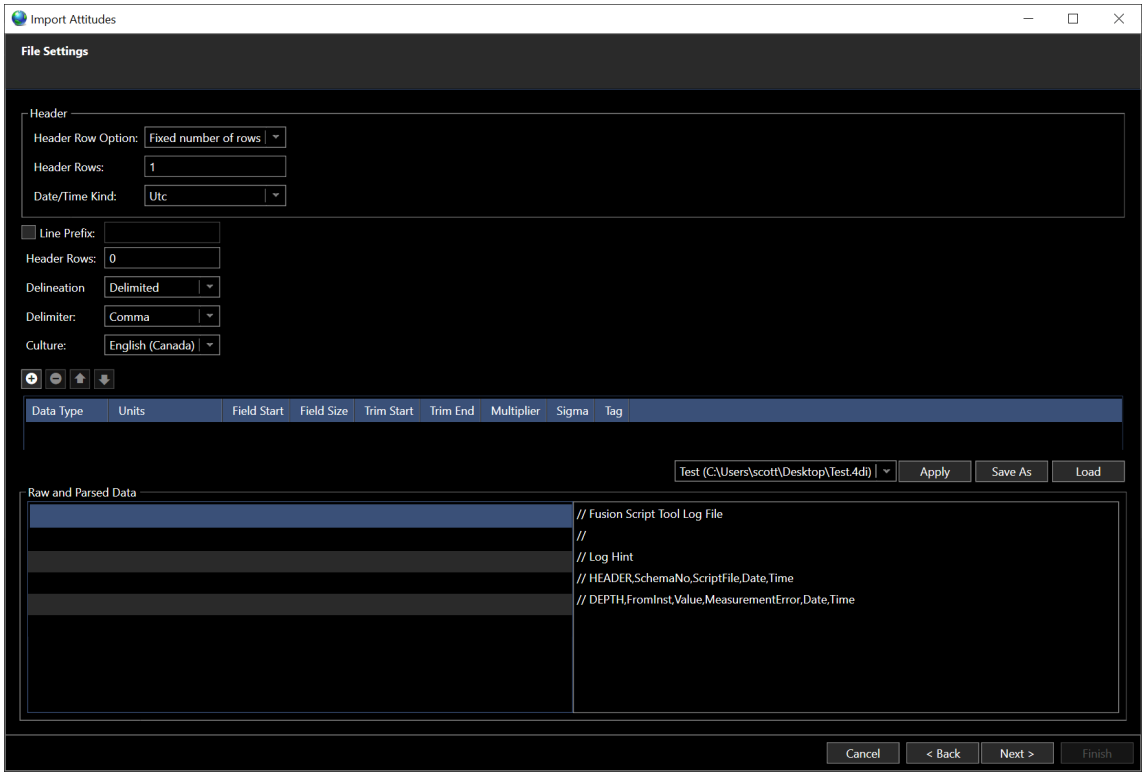


FIGURE 38 IMPORT ATTITUDES – FILE SETTINGS PAGE

- **Header Panel**
  - **Header Row Option:** From drop down list, select how header rows are to be recognized
    - If *Fixed number of rows* is selected, enter the number of header rows
    - If *Header rows have prefix* is selected, enter the prefix
  - **Date/Time Kind:** From drop-down list select the date/time zone the data was observed
    - **UTC:** Time is read in as UTC
    - **Local:** Time is read in as the Local time based on time zone setting of the PC FLOWIT is running on, not that of the PC the data was logged on
    - **Custom:** Time is read in as offset from UTC as per entered Custom Offset

Note: If the data was logged in local time in time zone A, but then imported into FLOWIT running on a PC in time zone B, the Custom option must be selected and a Custom value equal to the time offset from UTC of time zone A entered.

- **Line Prefix:** If the file records have a prefix, check this box, and enter the prefix
- **Delimited/Fixed Length:** Select the record type, delimited or fixed length
  - **Delimited:** Select delimiter from the drop-down list, if option is not listed select Custom and then enter the delimiter character in the entry space provided
  - **Fixed Length:** No additional options
- **Culture:** Select the culture type (this will define what character is used for the decimal point and thousand, millions, etc. separator), default is en-US
- **Data Fields**
  - **Add a field:** Click the add button  to add a data field
  - **Remove a field:** Select the field in the list and click the remove button  to remove the data field
  - **Shift field:** Select the field and click the up arrow to move the field up in the list, the down arrow to move it down in the list
  - **Units:** Select the units the data is in

Note: If the specific unit type is not listed, look for one that can then be scaled.

  - **Field Start/Size:** If Delineation is Fixed Length, enter the zero-based index of the start of the field, e.g. the index of the first character in a record is 0, the index of the 10th character is 9. Enter the length of the data in the field
  - **Trim Start/End:** If there are characters at the start and/or end of the data field, enter how many characters to trim in the respective column
  - **Multiplier:** If the field must be scaled to convert it to a unit supported by NavView, enter the scalar in the Multiplier column
  - **Sigma:** If known enter the data sigma
  - **Tag:** Enter a Tag to make identification of the data type when listed, easy to identify (optional)
- **Apply:** When the file import settings are set, click the Apply button. The decoded data will display in the Results panel, confirm the parsing is correct and adjust as required and click Apply again
- **Save As:** Once the file import is correctly configured, clicking the Save As button allows the user to save the File Import settings to a 4di file which is then available for loading for subsequent imports
- **Load:** Click the Load button to navigate to and load a previously saved 4di file to set the file import configuration

```
ROLLPITCH,2110_Metro,-0.310,-0.310,0.009,26 Jul 2024,22:07:00
ROLLPITCH,2110_Metro,-0.300,-0.310,0.009,26 Jul 2024,22:07:03
ROLLPITCH,2110_Metro,-0.310,-0.320,0.009,26 Jul 2024,22:07:06
ROLLPITCH,2110_Metro,-0.290,-0.320,0.009,26 Jul 2024,22:07:11
ROLLPITCH,2110_Metro,-0.300,-0.320,0.009,26 Jul 2024,22:07:14
ROLLPITCH,2110_Metro,-0.300,-0.320,0.009,26 Jul 2024,22:07:17
ROLLPITCH,2110_Metro,-0.300,-0.310,0.009,26 Jul 2024,22:07:19
ROLLPITCH,2110_Metro,-0.300,-0.310,0.009,26 Jul 2024,22:07:22
ROLLPITCH,2110_Metro,-0.300,-0.320,0.009,26 Jul 2024,22:07:25
ROLLPITCH,2110_Metro,-0.290,-0.320,0.009,26 Jul 2024,22:07:28
ROLLPITCH,2110_Metro,-0.290,-0.320,0.009,26 Jul 2024,22:07:31
ROLLPITCH,2110_Metro,-0.290,-0.320,0.009,26 Jul 2024,22:07:34
ROLLPITCH,2110_Metro,-0.290,-0.320,0.009,26 Jul 2024,22:07:37
ROLLPITCH,2110_Metro,-0.290,-0.320,0.009,26 Jul 2024,22:07:39
ROLLPITCH,2110_Metro,-0.290,-0.320,0.009,26 Jul 2024,22:07:42
```

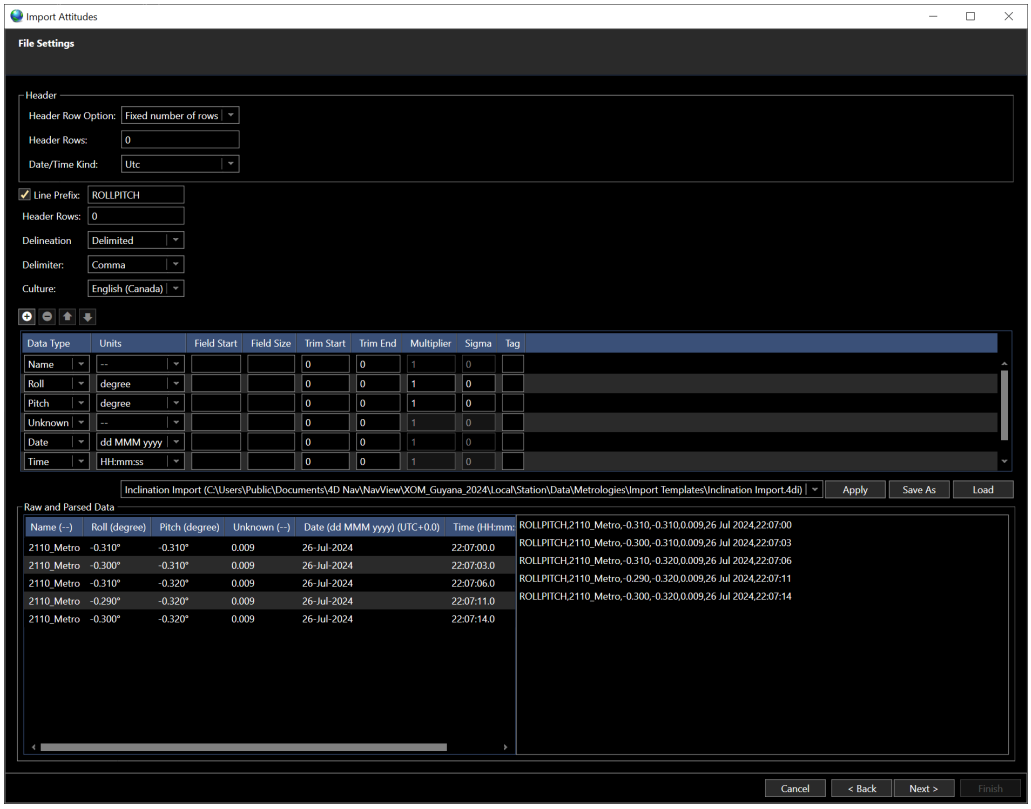


FIGURE 39 IMPORTED ATTITUDE DATA EXAMPLE

7. Click Next to open Import Settings page, see Figure 40.

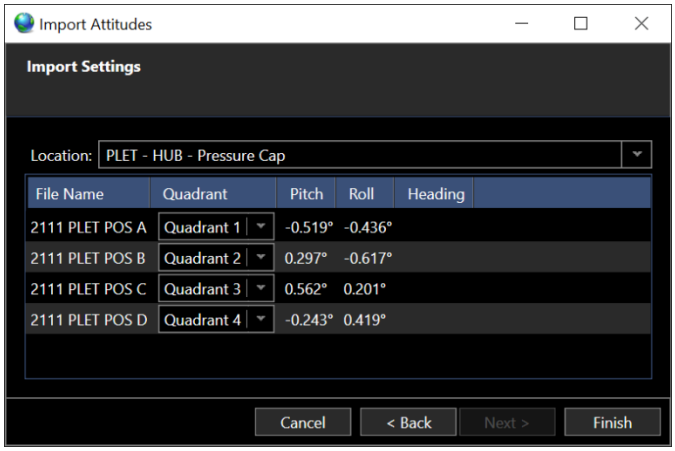
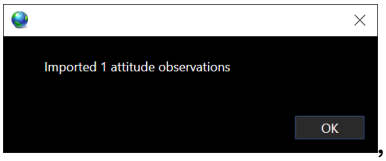


FIGURE 40 IMPORT ATTITUDES – IMPORT SETTINGS

- **Location:** From the drop-down list select occupation where observations were made
- **Quadrant:** Select corresponding Quadrant from drop-down list

8. Click Finish. Click Okay to “Imported 1 attitude observations” 

, the imported attitude will now be in the Attitude listing.

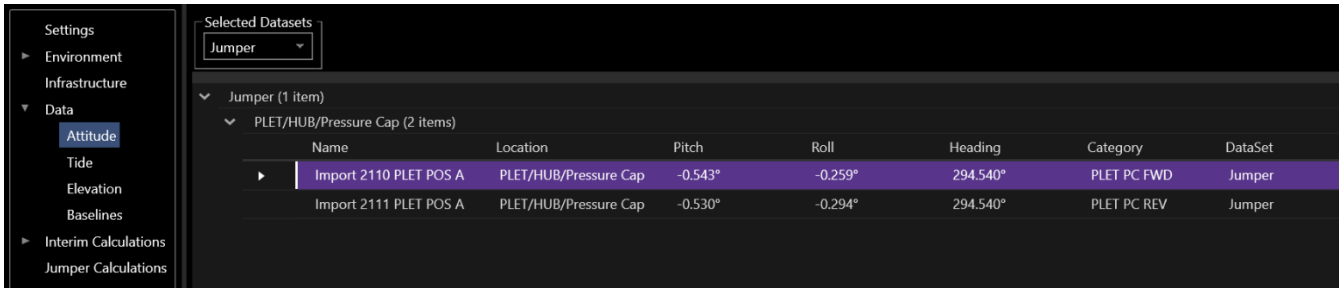


FIGURE 41 IMPORTED ATTITUDE DATA

9. Repeat Steps 1 through 7 for all Attitude data.

7.2 IMPORTED ATTITUDE DATA

The imported attitude data can be viewed by clicking on an individual import from the Attitude listing, see Figure 42.

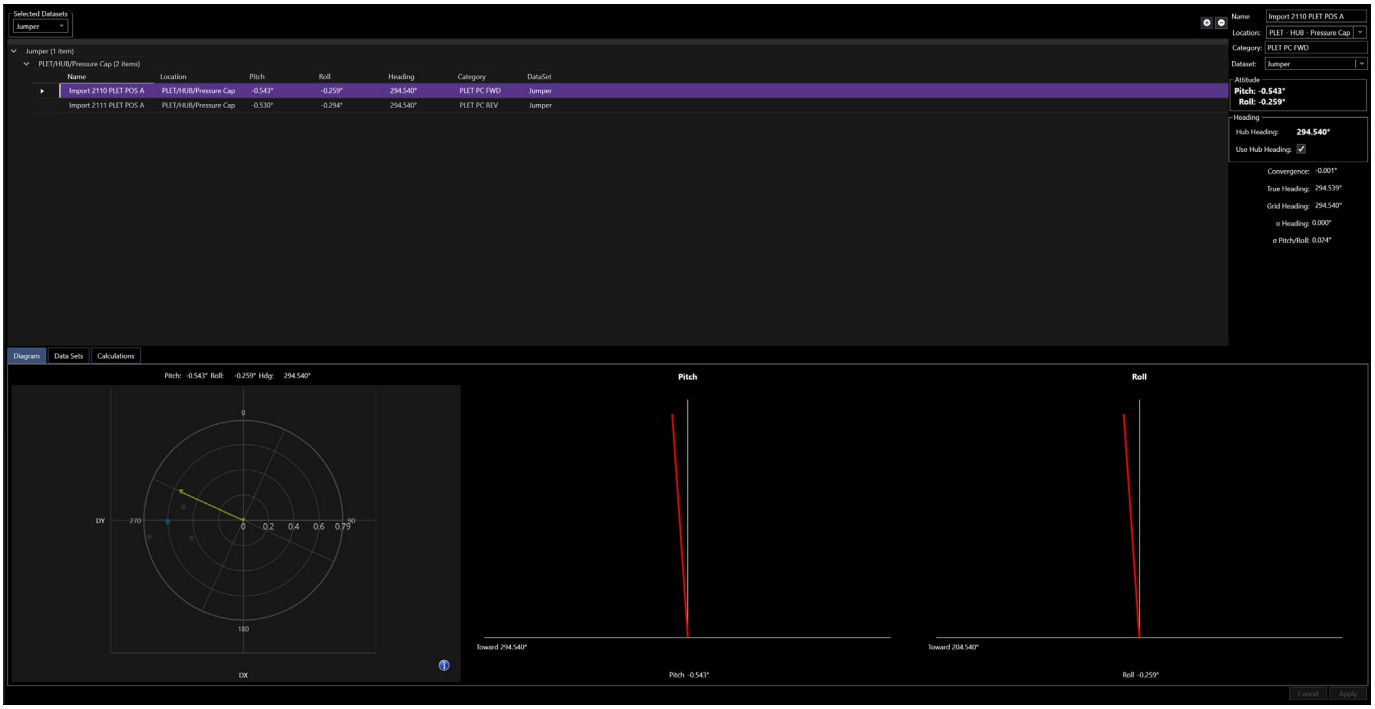


FIGURE 42 IMPORTED ATTITUDE DATA VIEW

7.2.1 DETAILS

FIGURE 43 ATTITUDE DATA DETAILS

- **Name:** By default, the name assigned is the file name. If multiple files loaded name is the first file name. This can be edited
- **Location:** Observed pitch and roll occupation. This can be changed from drop-down list
- **Dataset:** Dataset the attitude data is attached to. This can be changed from drop-down list
- **Attitude:** Calculated Pitch and Roll aligned with Tool/Hub heading
- **Heading:** If Use Hub Heading is checked, the heading is taken from the heading assigned to selected infrastructure. Un checking the box allows to enter a manual heading

Note: Heading is defined as grid.

7.2.2 DIAGRAM TAB

Polar diagram graphically showing attitude data set calculation results.

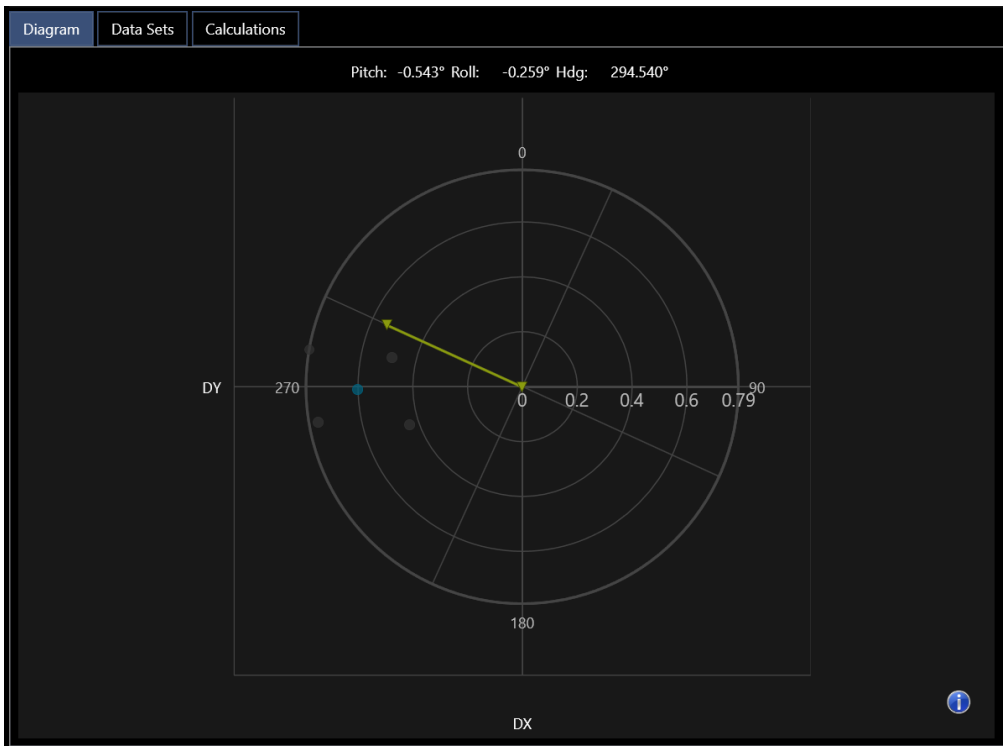


FIGURE 44 ATTITUDE DIAGRAM TAB

7.2.3 DATA SETS TAB

Displays attitude data from imported files. This can be used to check for any outliers in collected data that can be removed from solution, see Figure 45.

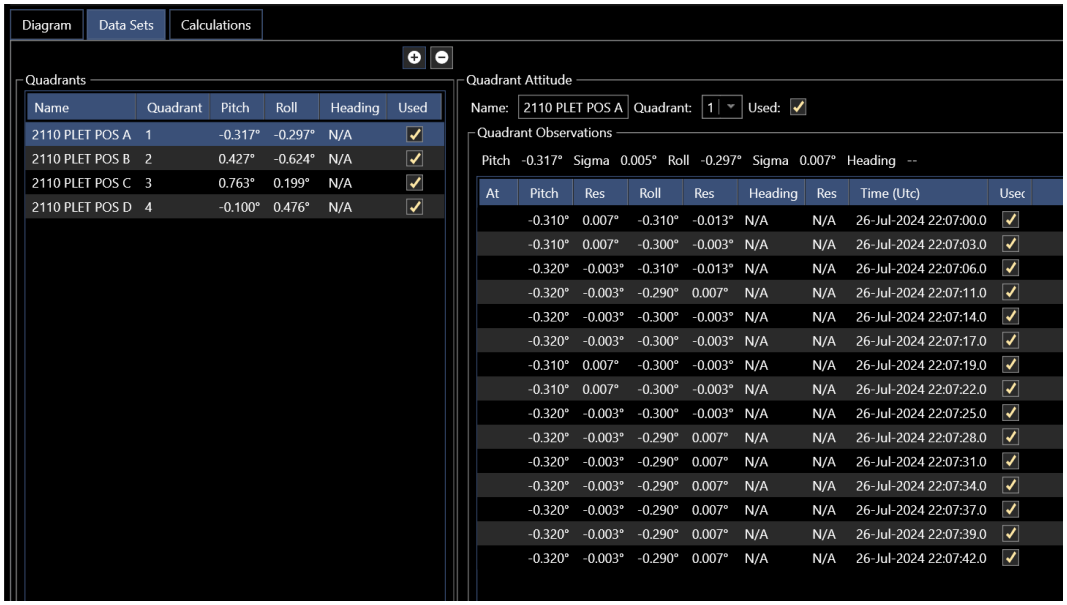


FIGURE 45 ATTITUDE DATA SETS TAB

7.2.4 CALCULATIONS TAB

Displays the pitch and roll rotated to reference heading and the resultant residuals.

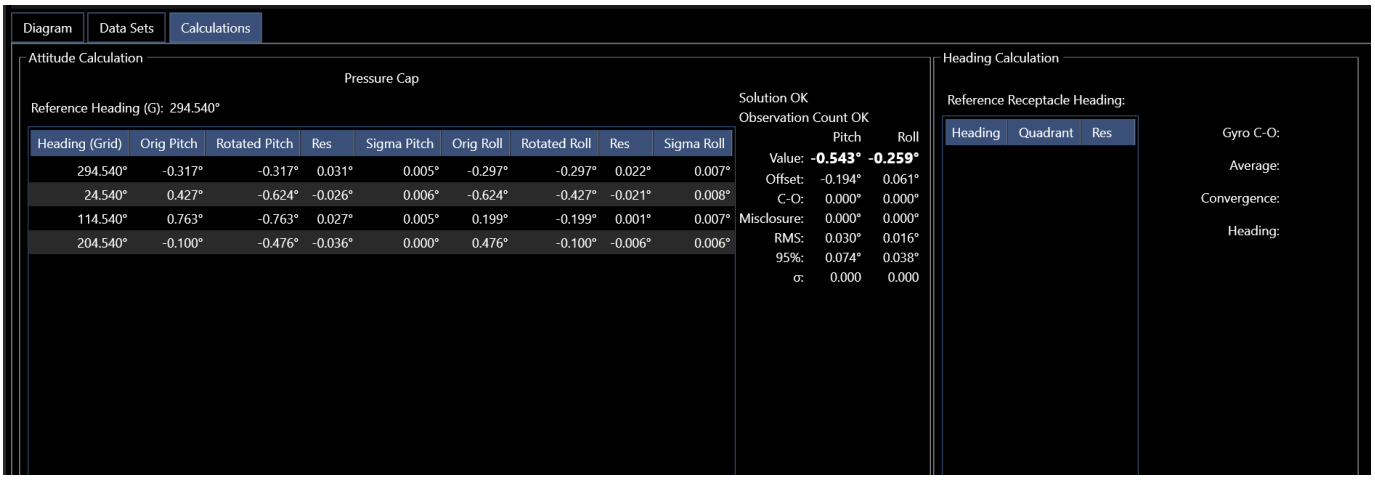


FIGURE 46 ATTITUDE DATA SETS CALCULATION TAB

8 TIDES

While not necessary for Elevation processing, FLOWIT supports the option to apply tide data to depth loops and depth profile processing. A tide value is determined for and applied to each depth observation. In the case of a depth loop or seabed depth profile that is closed out back at the starting point, the tide is applied prior to calculating and distributing the final loop misclosure.

8.1 RELATIVE TIDE

The term relative tide refers to the change in tide relative to a specific starting epoch. A transponder, configured with a depth sensor, is placed on a stable, static structure in the work area. This is interrogated for its depth during the depth loop/profile data collection. This transponder is referred to as the Tide Reference. The collected tide reference data enables the determination of the change in water depth due to tide for each depth observation. This referred to as a relative tide.

The relative tide value is determined for each depth observation and applied.

8.1.1 IMPORTING RELATIVE TIDE DATA

Relative tide data is best loaded individually for each depth loop or seabed depth profile. This makes organization of data imported to FLOWIT easier to identify and work with.

Note: It is recommended that the tide reference files and depth loop/profile observations files for a given loop/profile be copied together to the NavView project.

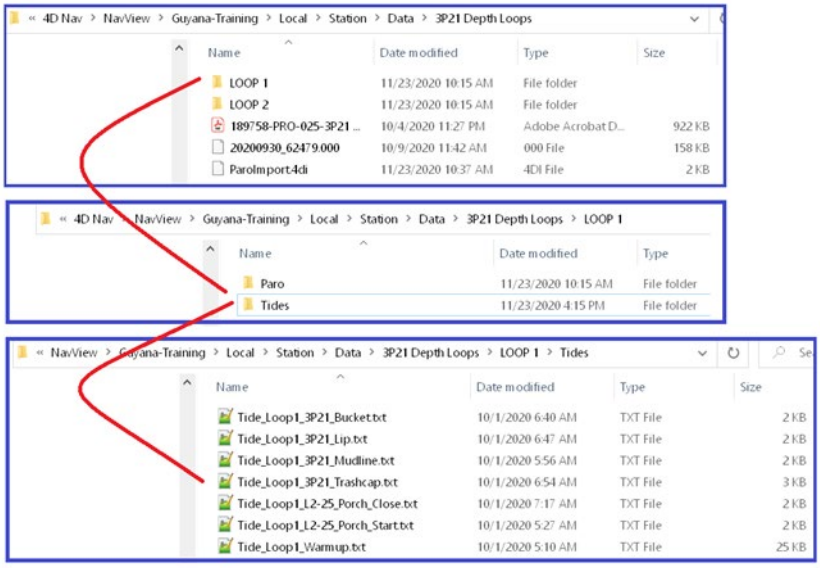


FIGURE 47 TIDE AND DEPTH DATA FILE MANAGEMENT EXAMPLE

1. Select Tide to display the Tide Data management view.

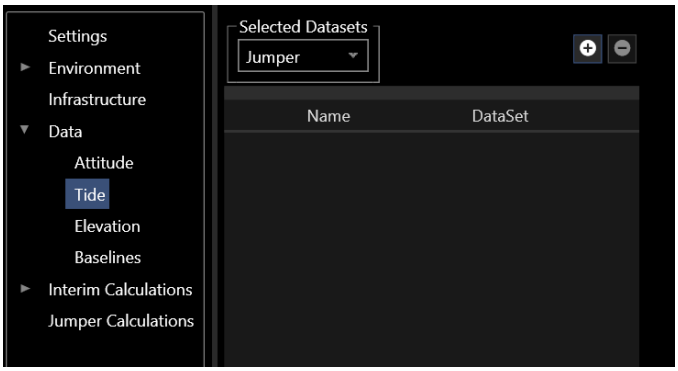


FIGURE 48 TIDE MANAGEMENT

2. From Selected Datasets drop-down list select the Dataset where the Tide data will be used.
3. Click the button to select tide files.
4. Navigate to the tide files' location and select all files that apply to a specific depth loop or profile and click Open. This will open the Create Tide Deployment – Attributes page.

Note: Tide files can be loaded one at a time or in a group. It is recommended those files associated with a specific loop/profile be loaded as a group to simplify the process.

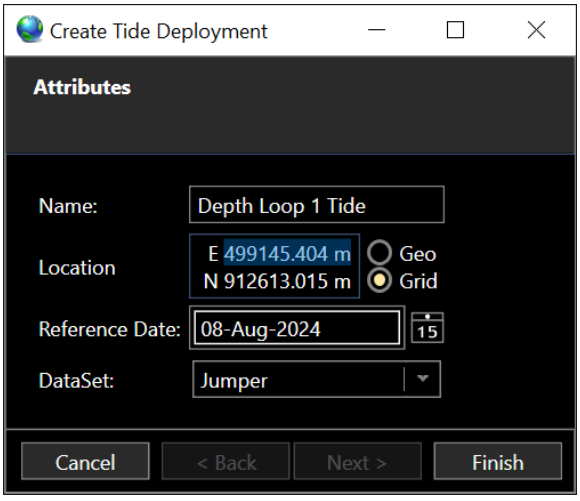


FIGURE 49 CREATE TIDE DEPLOYMENT – ATTRIBUTES PAGE

5. Enter the tide information.
   - **Name:** Enter a name that references the tide data to a specific depth loop or seabed profile
   - **Location:** Enter the position where the tide data was collected (not required)
   - **Reference Date:** Enter the date the imported tide data was observed

Note: Some Tide Reference files include a time but no date. In this case it is important to enter a Reference Date to associate the time with.

- **Dataset:** Select the Dataset where the tide data will be used

6. Click Finish. This will open the Edit/Confirm Observations page.

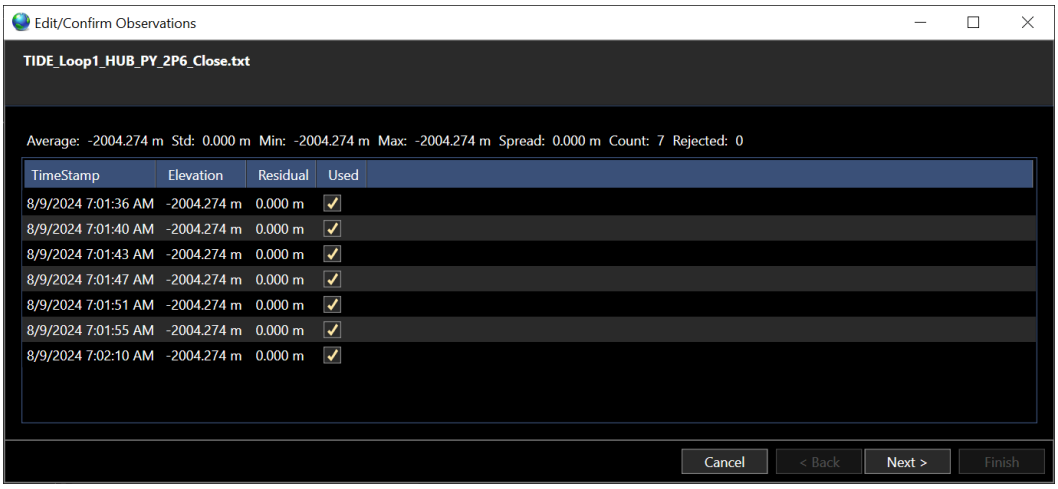


FIGURE 50 EDIT/CONFIRM OBSERVATIONS PAGE

7. The Edit/Confirm Observations page display the data from each tide file for review, editing and acceptance.
   - **Average:** Average elevation based on the observations set to Used
   - **Std:** Standard deviation of the sample of observations set to Used
   - **Min:/Max:** Minimum and maximum observations of those set to Used
   - **Spread:** Spread between the minimum and maximum observations of those set to Used
   - **Count:** Number of observations set to Used
   - **Rejected:** Number of observations not set to Used
   - **Timestamp:** Date and time of observation
   - **Elevation:** Observed elevation (depth) (observations can be sorted by elevation)
   - **Residual:** Residual of observation based on the average value (observation can be sorted by residual)
   - **Used:** Option to use or not use in application of the tide data in the file
8. As each tide file is reviewed and accepted, click Next or in the case of the final tide file, Finish.
9. The imported tide data is added to the Tide Management view list, select it to display its data and Attributes in the right panel.

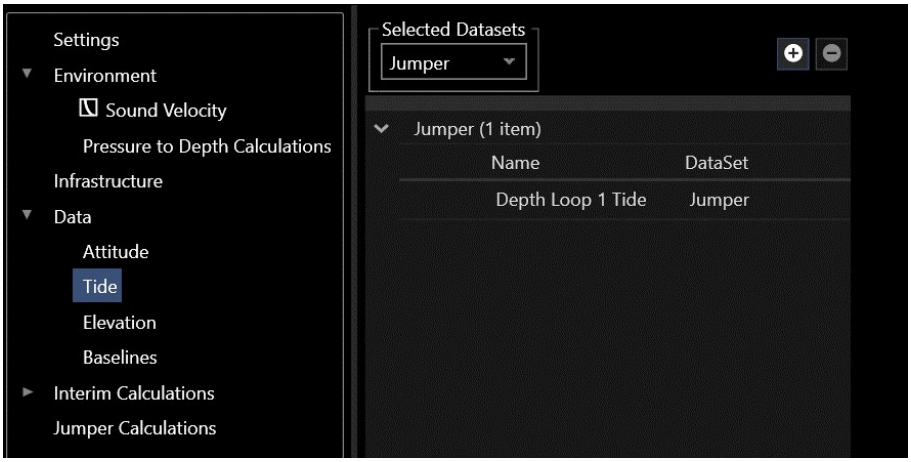


FIGURE 51 IMPORTED TIDE DATA – TIDE MANAGEMENT VIEW

8.1.2 VIEWING AND EDITING RELATIVE TIDE DATA

1. Expand the Data branch and select Tide to display the tide data groups loaded.
2. Select the tide data group to view, the details will display to the right.

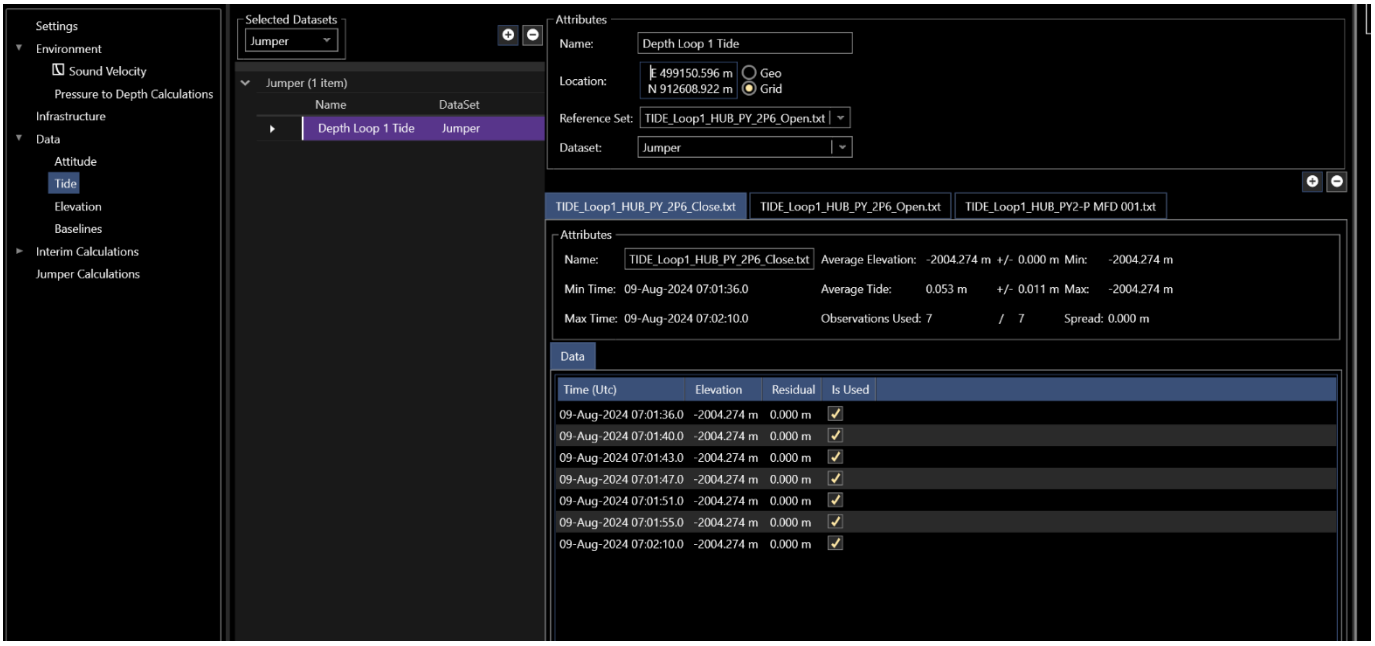


FIGURE 52 TIDE DATA DETAILS VIEW

3. Edit Attributes as required and click Apply.
    a. **Name:** Tide set name
    b. **Location:** Location of the tide data
    c. **Reference Set:** Select tide file that is to be used as the zero tide value and with which all other tide files in this set are referenced to

Note: The Reference Set is usually the tide file collected for the depth loop starting location.

d. **Dataset:** Dataset where the tide data will be used

4. Add Data: Click the button to launch a wizard to load more tide data to this group.
    a. Navigate to the tide file's location and select all files that are to be added and click Open. This will open the Add Tide Set Attributes page.

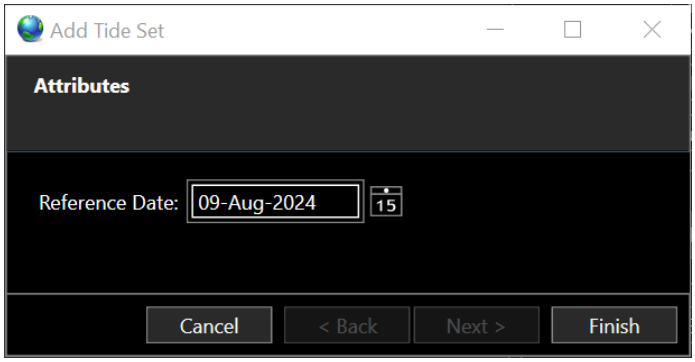


FIGURE 53 ADD TIDE SET – ATTRIBUTES PAGE

    b. Enter the reference date and click Finish
    c. Repeat Steps 7 and 8

9 ELEVATION DATA

Elevation data refers to depth loops and seabed profiles. The import is user configurable and therefore supports any ASCII text data file.

9.1 DEPTH LOOPS AND SEABED PROFILES

Depth loops involve collecting pressure data at specific structure locations such as hubs, pressure caps and vertical datum benchmarks, e.g. tripod porches. Seabed profiles involve collecting pressure data at specific structure locations plus along the seafloor at distance intervals following the proposed jumper path.

Note: It is recommended that the tide reference files and depth loop/profile observations files for a given loop/profile be copied together to the NavView project.

9.1.1 ADD A DEPTH LOOP

1. Expand Data and select Elevation.

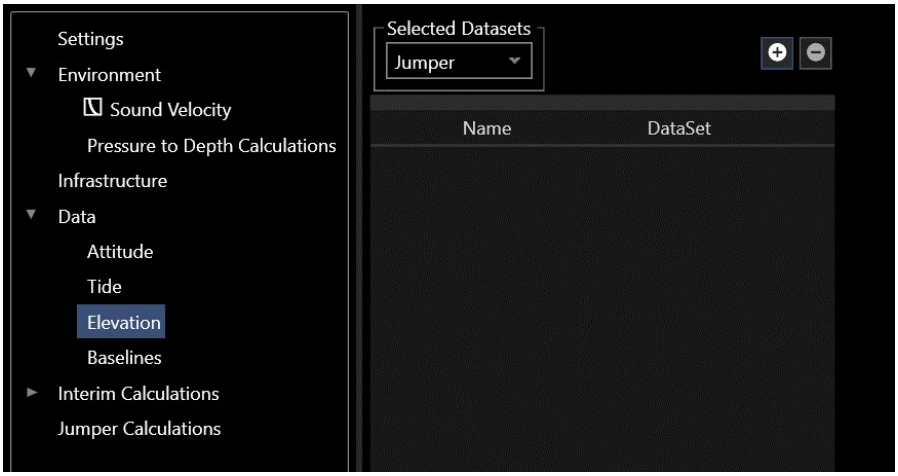


FIGURE 54 DATA – ELEVATION

2. From the Selected Datasets drop-down list select the Dataset to include the elevation data.
3. Click the  button to launch the Elevation Import wizard.
4. From the Open file dialog, navigate to the folder containing all the depth data files for one loop, select all the files and click Open. This will open the Create Elevation Loop wizard.

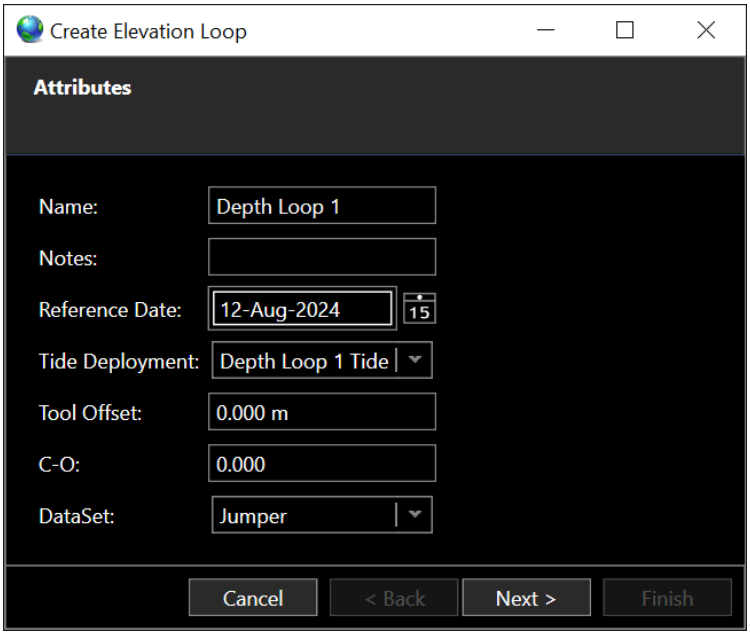


FIGURE 55 CREATE ELEVATION LOOP WIZARD – ATTRIBUTES PAGE

- **Name:** Enter a concise, descriptive name for the depth loop
- **Notes:** Enter any notes or comments associated with this depth loop
- **Reference Date:** Enter the date the depth loop data collection started

Note: Some Depth Loop pressure files include a time but no date. In this case it is important to enter a Reference Date to associate the time with.

- **Tide Deployment:** Select the tide set associated with this depth loop
- **Tool Offset:** Enter the offset from the bottom of the tool to the pressure sensor
- **C-O:** Enter the C-O of the pressure sensor
- **Dataset:** Select the Dataset to include the depth loop data

5. Click Next to open the File Settings page.

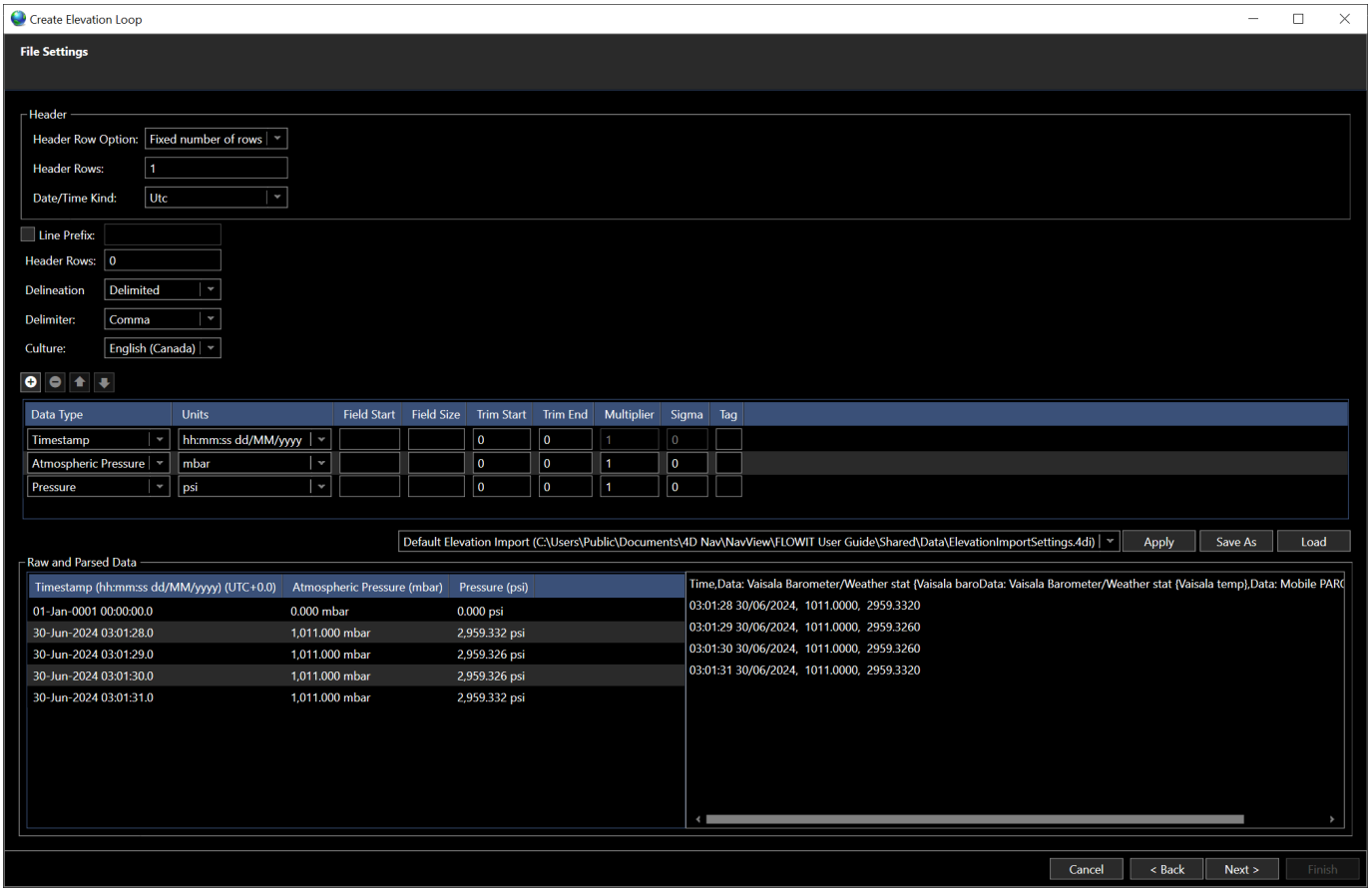


FIGURE 56 CREATE ELEVATION LOOP WIZARD – FILE SETTINGS PAGE

6. Configure File Settings to import the pressure data. See page 32 for File Settings details.
7. Click Next to open the Select Depth Calculation page, see

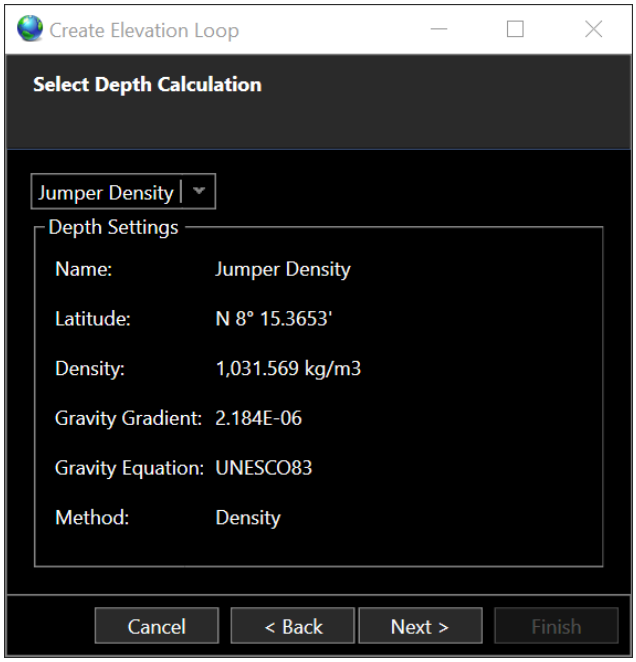


FIGURE 57 CREATE ELEVATION LOOP WIZARD – SELECT DEPTH CALCULATION PAGE

8. From the drop-down list select the pressure to depth calculation to use.

Note: Only depth calculations created in the Environment>Pressure to Depth Calculation will be available for selection.

9. Click Next to open the File Associations page.

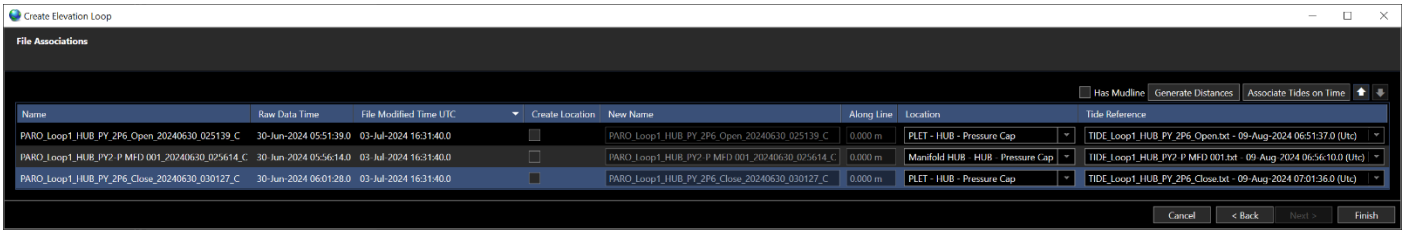


FIGURE 58 CREATE ELEVATION LOOP WIZARD – FILE ASSOCIATIONS PAGE – DEPTH LOOP

- **Name:** Name of imported file
- **Raw Data Time:** Time stamp included in file.

Note: Files are imported in the order of file name. Click on Raw Data Time to re-order by data timestamp.

- **File Modified Time:** Timestamp when file was modified, i.e. when file was copied to FLOWIT PC
- **Create Location:** Refer to Seabed Profile import, see section 9.1.2
- **New Name:** Refer to Seabed Profile import, see section 9.1.2
- **Along Line:** Refer to Seabed Profile import, see section 9.1.2

- **Location:** From drop-down list select structure occupation for each pressure file
- **Tide Reference:** From drop-down list select the tide file associated for each pressure file

10. Click Finish. This will open the Confirm Import page.

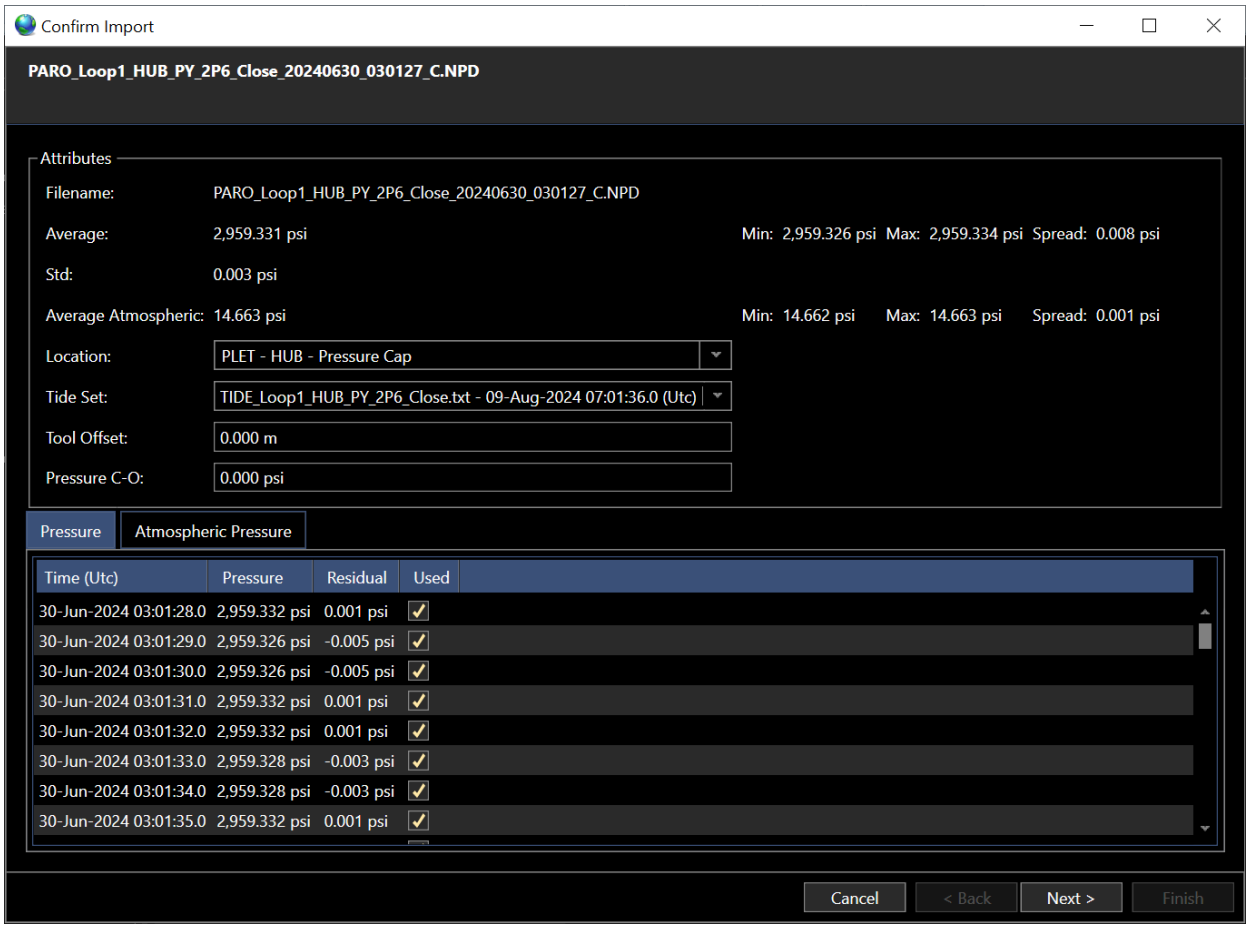


FIGURE 59 CREATE ELEVATION LOOP WIZARD – CONFIRM IMPORT PAGE

The Confirm Import page displays the data from each pressure file for reviewing, editing and acceptance.

- **Attributes**
  - **Filename:** Displays the name of the pressure file
  - **Average:** Average pressure of the values used in the solution with the Minimum and Maximum values and the Spread shown
  - **Std:** Standard deviation of the values used in the solution
  - **Average Atmospheric:** Average atmospheric pressure (if present) of the values used in the solution with the Minimum and Maximum values and the Spread shown

- **Location:** Displays the structure item the pressure observation was made on selected during import. This can be changed using the drop-down list
- **Tide Set:** Displays the Tide data file selected during import. This can be changed using the drop-down list

Note: There is a one-to-one correspondence of pressure data file to tide reference data file. Be sure to select the correct tide file. This can be edited later if necessary.

- **Tool Offset:** Displays the Tool Offset entered during import. This can be edited
- **Pressure C-O:** Displays the Pressure C-O entered during import. This can be edited

▪ **Pressure Tab and Atmospheric Tab**

- **Time:** Date and time of observation in the specified time zone
- **Pressure:** Observed pressure (observations can be sorted by pressure)
- **Residual:** Residual of observation based on average value (observation can be sorted by residual)
- **Used:** Option to use or not use the pressure or atmospheric pressure data in the calculation of the respective average

11. As each pressure file is reviewed, edited if required and accepted, click Next or in the case of the final file, Finish.

The depth loop resulting from the import is added to the Elevation list. Select it to display its Attributes and Observations in the right panel.

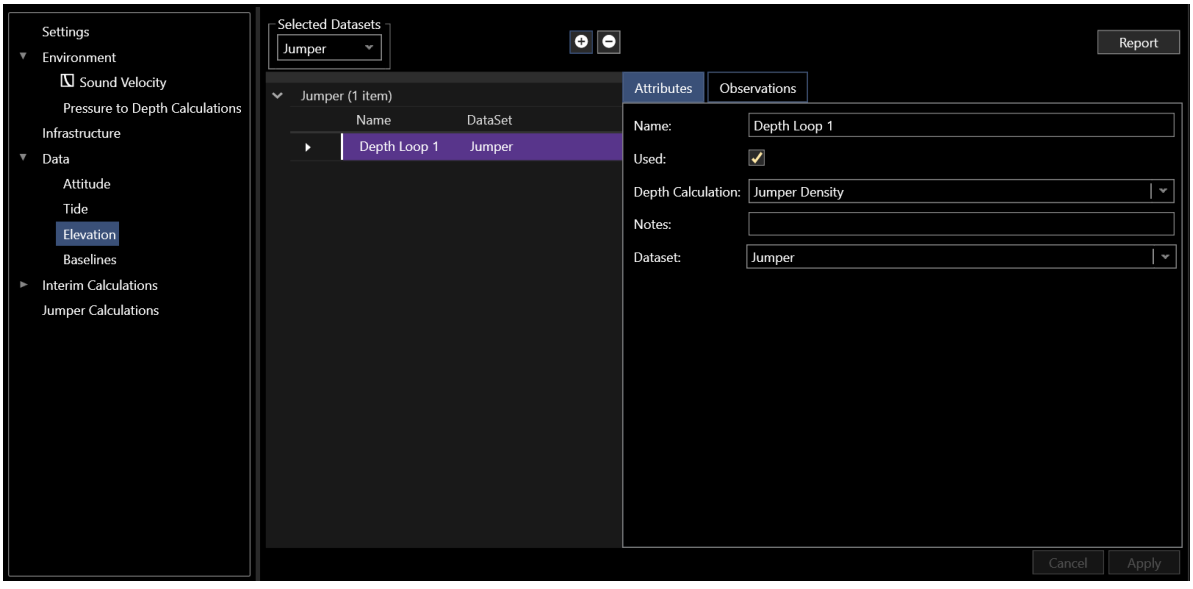


FIGURE 60 ELEVATION DATA – IMPORTED DEPTH LOOP 1 – ATTRIBUTES TAB

- **Attributes Tab**
  - **Name:** Name of imported Elevation data. Click in box to edit if required
  - **Used:** Check if data is to be used in final solution
  - **Depth Calculation:** Displays selected Pressure to Depth calculation. Edit via drop-down if required
  - **Notes:** Notes regarding Elevation data
  - **DataSet:** Displays selected DataSet group the Elevation data is assigned to. Edit via drop-down if required

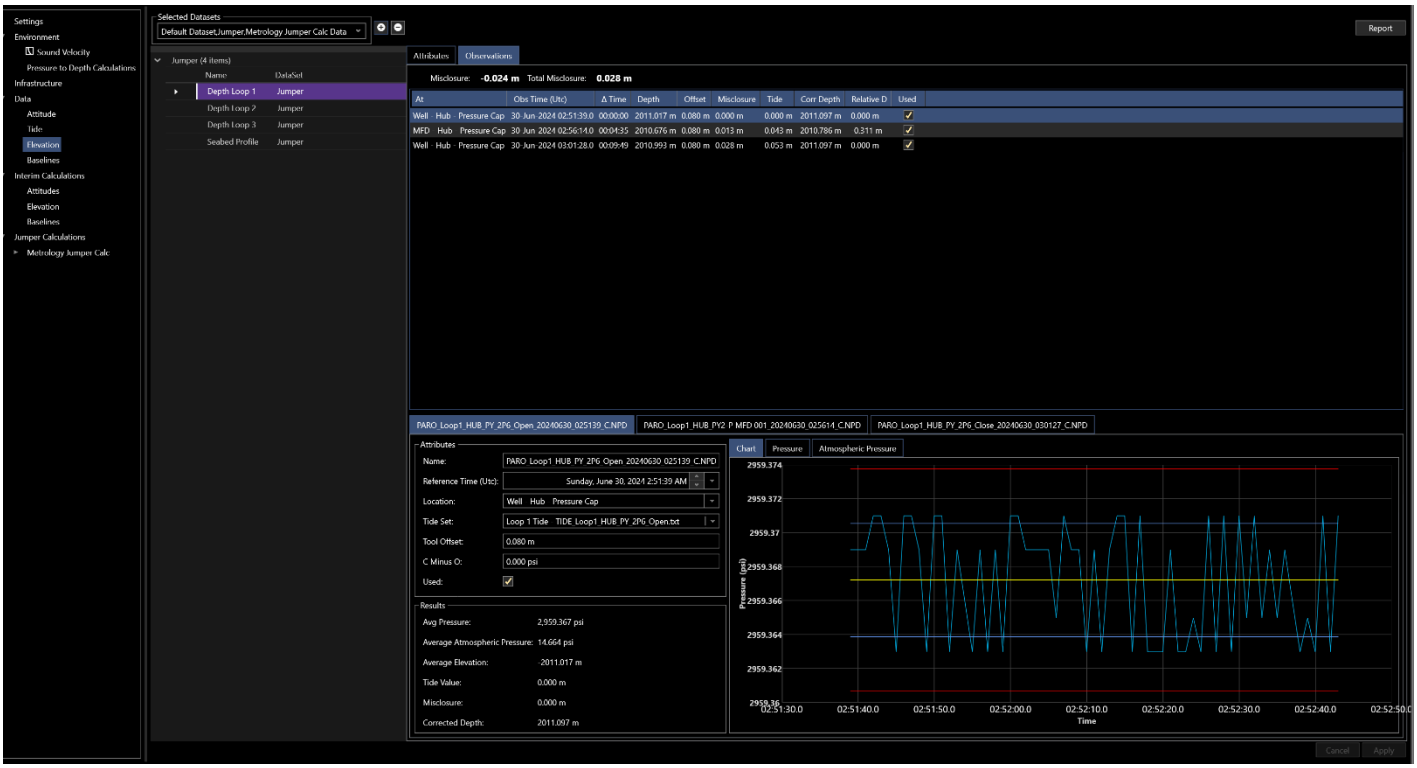


FIGURE 61 ELEVATION DATA – IMPORTED DEPTH LOOP 1 – OBSERVATIONS TAB

- **Observations Tab**
  - **Misclosure:** Misclosure of loop before applying tides
  - **Total Misclosure:** Misclosure of loop after applying tides
  - **At:** The structure item the pressure observation was made on
  - **Obs Time (UTC):** Time observation set made, time reference in brackets, e.g. UTC, Local, Custom
  - **Δ Time:** Elapsed time from first observation location
  - **Depth:** Depth calculated using selected Pressure to Depth calculation
  - **Offset:** Tool offset applied to observation
  - **Misclosure:** Amount of Total Misclosure distributed based on elapsed time

- **Tide:** Tide applied to depth
- **Corr Depth:** Depth after applying Offset, Tide and Misclosure
- **Relative D:** Depth differential relative to the starting location
- **Used:** Check if observation is to be used in final calculations
- **Report:** Click to generate an Elevation loop report

Each Elevation data file imported is presented in its own tab for review and editing.

- **Attributes**
  - **Name:** Imported elevation data file name
  - **Reference Time (UTC):** Date and time of observations in user specified time zone (UTC, Local, Custom)
  - **Location:** Displays the structure item the pressure observation was made on. This can be changed using the drop-down list
  - **Tide Set:** Tide data file selected. This can be changed using the drop-down list
  - **Tool Offset:** Offset from bottom of tool to paro sensor. This can be edited
  - **C Minus O:** Pressure C-O. This can be edited
- **Results**
  - **Average Pressure:** Average of paro pressure values used
  - **Average Atmospheric Pressure:** Average of atmospheric pressure values used
  - **Average Elevation:** Average elevation for observation before application of offset, tide and misclosure
  - **Tide Value:** Tide value from associated tide file
  - **Misclosure:** Amount of Total Misclosure distributed based on elapsed time relative to the starting location
  - **Corr Depth:** Depth after applying Offset, Tide and Misclosure
- **Chart Tab**

  Plot of observed pressure vs. time
  - **Light Blue:** Observations
  - **Yellow:** Average of used observations
  - **Dark Blue:** Standard deviation at 1 sigma (66% confidence)
  - **Red:** Standard deviation at 2 sigma (95% confidence)
- **Pressure Tab**

  Listing of observed paro pressure observations with data summary
  - **Time Stamp (UTC):** Date and time in specified time zone of observation
  - **Pressure:** Observed pressure

- **Residual:** Residual relative to average pressure
- **Used:** Check to use in average determination

- **Atmospheric Pressure**

  Listing of observed atmospheric pressure observations

  - **Time Stamp (UTC):** Date and time in specified time zone of observation
  - **Pressure:** Observed pressure
  - **Residual:** Residual relative to average pressure
  - **Used:** Check to use in average determination

- **Report Button:** Click to generate an Elevation loop report

9.1.2 ADD A SEABED PROFILE

Repeat steps 1 through 11 as in adding a depth loop, see section 9.1.1.

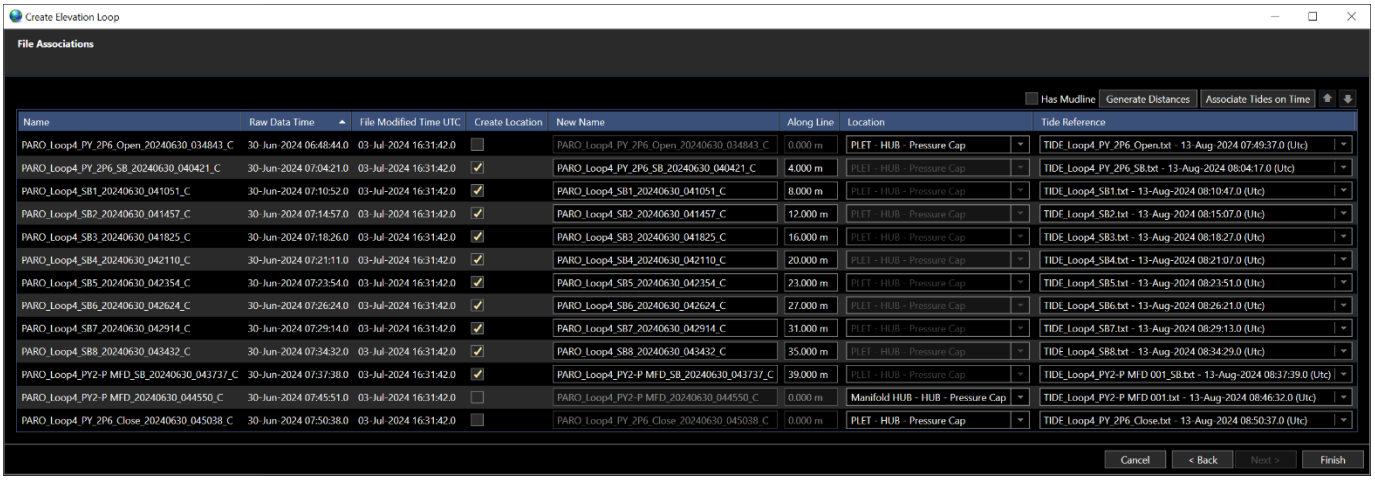


FIGURE 62 CREATE ELEVATION LOOP WIZARD – FILE ASSOCIATIONS PAGE – SEABED PROFILE

- **Has Mudline:** For generating along line distances for seabed profiles. If enabled this will create points directly at the hub locations, first point at 0 alongline and last point at the total distance. If disabled, points will be equally spaced starting at first seabed interval.
- **Generate Distances/Along Line:** For seabed profiles, this tool will calculate along line distances for use with the newly created locations along a line between the first location and the last location in the list.
- **Name:** Name of imported file
- **Raw Data Time:** Time stamp included in file

Note: Files are imported in the order of file name. Click on Raw Data Time to re-order by data timestamp.

- **File Modified Time:** Timestamp when file was modified, i.e. when file was copied to FLOWIT PC

- **Create Location/New Name:** Creates a new structure for each seabed interval and associates the file name with it. This can be used for quickly creating seabed profiles without pre-populating the seabed locations
- **Location:** From drop-down list select structure occupation for each pressure file
- **Tide Reference:** From drop-down list select the tide file associated for each pressure file

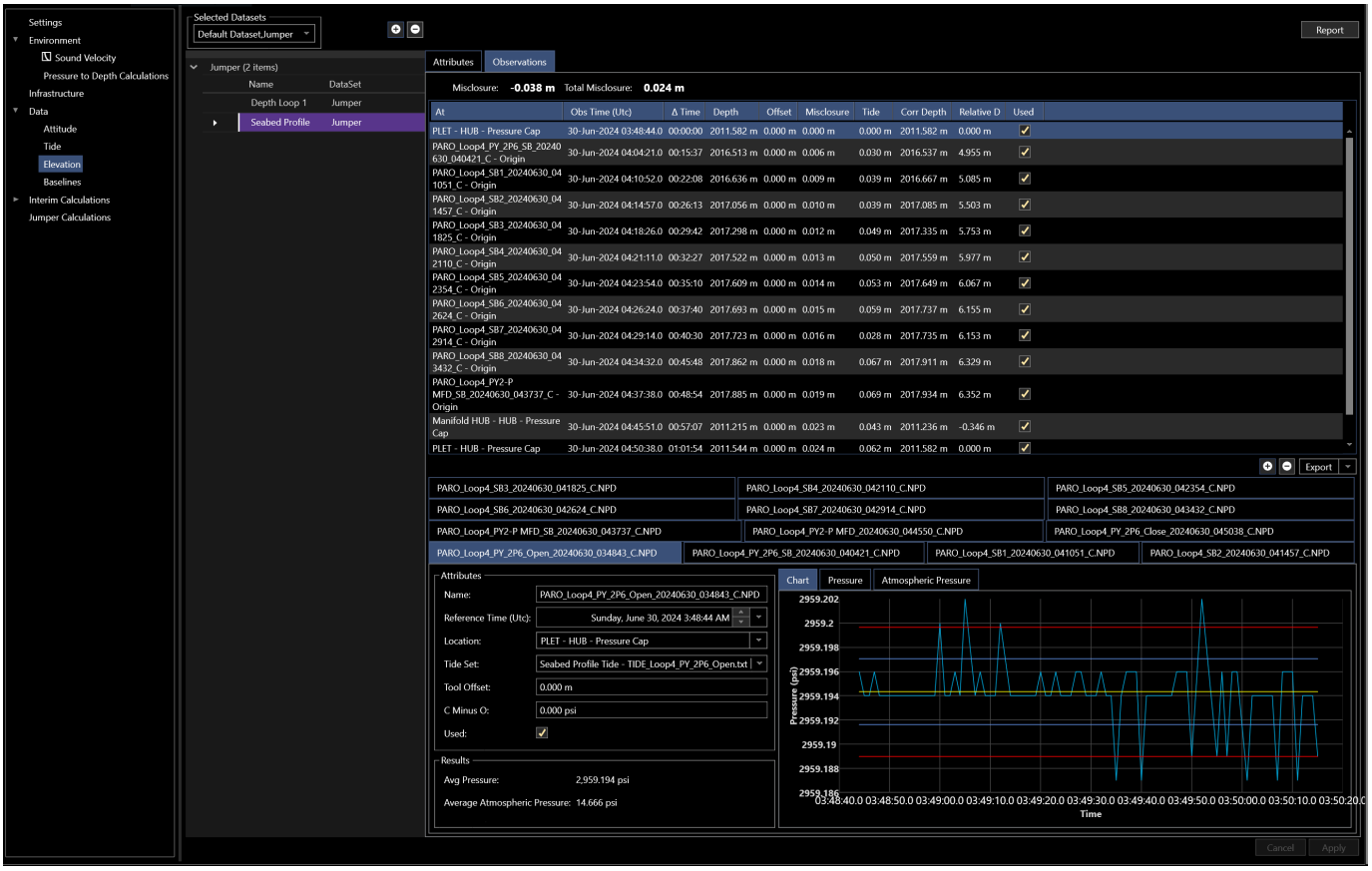


FIGURE 63 IMPORTED SEABED PROFILE – OBSERVATIONS TAB

10 BASELINES

Baseline data refers to acoustic ranges between structure locations. Baseline data can be added manually or imported from various sources.

10.1 BASELINE DATA IMPORT

1. To add or import baseline data, select the button at the top of the baseline data page. This brings up the Range Creation Options dialog, see Figure 65, where the type of data can be selected.

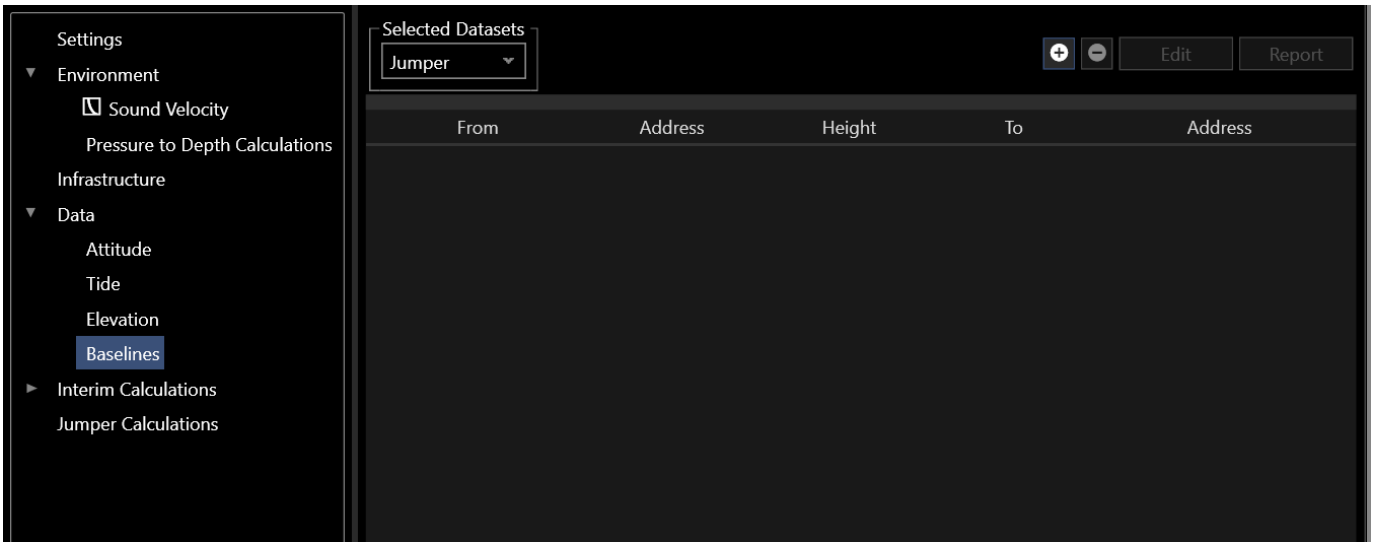


FIGURE 64 DATA – BASELINES

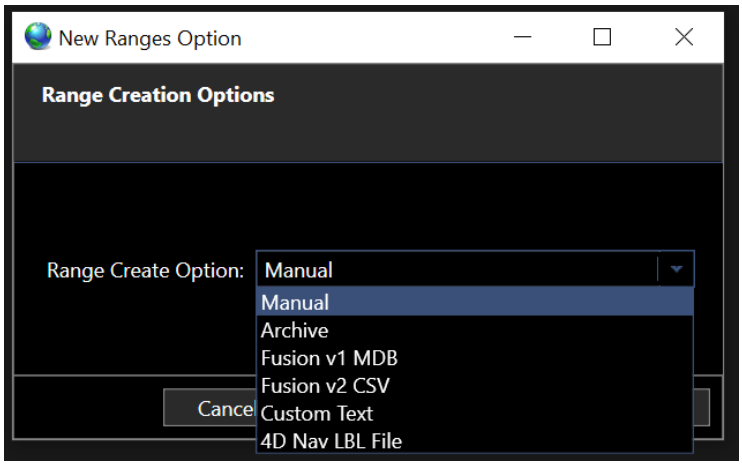


FIGURE 65 RANGE CREATION OPTIONS DIALOG

- **Manual:** Manually enter baseline range and standard deviation
- **Archive:** Loads data from a Sonardyne Connect Archive file
- **Fusion v1 MDB:** Loads an MDB file recorded using Sonardyne Fusion 1.x

- **Fusion v2 CSV:** Loads an MDB file recorded in Sonardyne Fusion, exported from Fusion v2.x or 1.x
- **Custom Text:** Loads range data using a customized import of ascii text data
- **4D Nav LBL File:** Loads range data collected in 4D Nav NavView LBL

Note: Each import option provides a wizard to guide the user through the import and data association process.

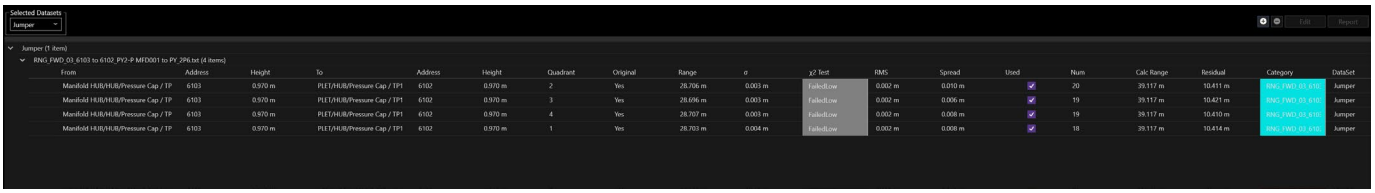


FIGURE 66 IMPORTED BASELINES EXAMPLE – DATA LIST VIEW

Each row in this view refers to a baseline. A baseline is collection or raw range observations between two locations. The summary in the list view contains the following information:

- **From:** Transponder occupation where the baseline starts
- **Address:** Transponder address for the start baseline
- **Height:** Transponder transducer height at its occupation point at the start location
- **To:** Transponder where the baseline ends
- **Address:** Address of the transponder at the end point
- **Height:** Transponder transducer height at its occupation point at the end location
- **Quadrant:** Rotational quadrant of the transponder during data collection
- **Range:** The observed range in distance units
- σ **:** The expected standard deviation of the baseline raw ranges
- **RMS:** Root mean square of the baseline raw ranges
- **Spread:** Spread between shortest and longest range in the set
- **Used:** Whether the baseline is used or not in calculations
- **Num:** Number of raw ranges in the baseline set
- **Calc Range:** Range calculated from structure coordinates
- **Residual:** Difference between the mean of the observed ranges and calculated range
- **Category:** A category is assigned to each baseline for another layer of organization. This is used to separate baselines in the list view – groups created by datasets and categories can be collapsed
- **DataSet:** Data group baselines assigned to

10.2 BASELINE DETAILS

To access and edit details of a baseline, double click on the baseline in the list view. The Baseline editing view is displayed (shown below).

FIGURE 67 RANGE OBSERVATION EDITING

From the Summary panel on the Range Observations Editing view, it is possible to modify the from and to locations and address of the baseline, select a quadrant, edit category and dataset, and set the baseline to Used or not Used.

The details panel on the right features 3 tabs to display and edit the raw data. Histogram, Time Series and List.

10.2.1 HISTOGRAM TAB

The histogram view, see Figure 68, here raw ranges are grouped together in bins and presented in a histogram. Bin sizes can be adjusted by using the Bin drop-down list. The data is color coded as either orange for forward, or blue for reverse. Reverse ranges are ranges going from the ‘To’ location to the ‘From’ location.

The histogram can be configured to show just used ranges or all ranges in the baseline set. The Gate values tool when enabled will present vertical bars which can be dragged to reject or accept data items.

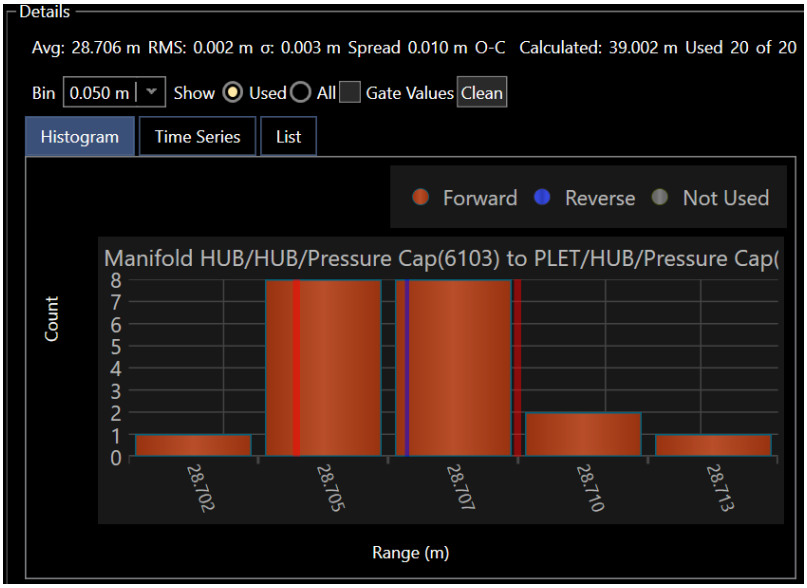


FIGURE 68 BASELINE DETAILS – HISTOGRAM TAB

10.2.2 TIME SERIES TAB

The Time Series view shows the raw ranges with the time of observation on the X axis, and the observed range on the Y axis. The data points are again colored orange (Forward) and blue (Reverse) with a square symbol.

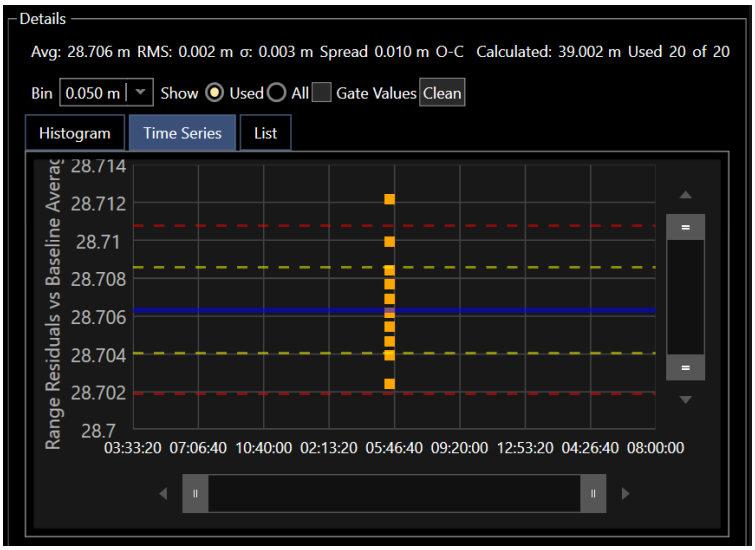


FIGURE 69 BASELINE DETAILS – TIME SERIES TAB

- **Blue Line:** Baseline average
- **Yellow Dashed Line:** Standard deviation at 1 sigma (66% confidence)
- **Red Dashed Line:** Standard deviation at 2 sigma (95% confidence)

10.2.2.1 EDITING DATA IN TIME SERIES

To Reject one data point on the time series view, left click on it. The data point will change from a square to an x, as shown below.

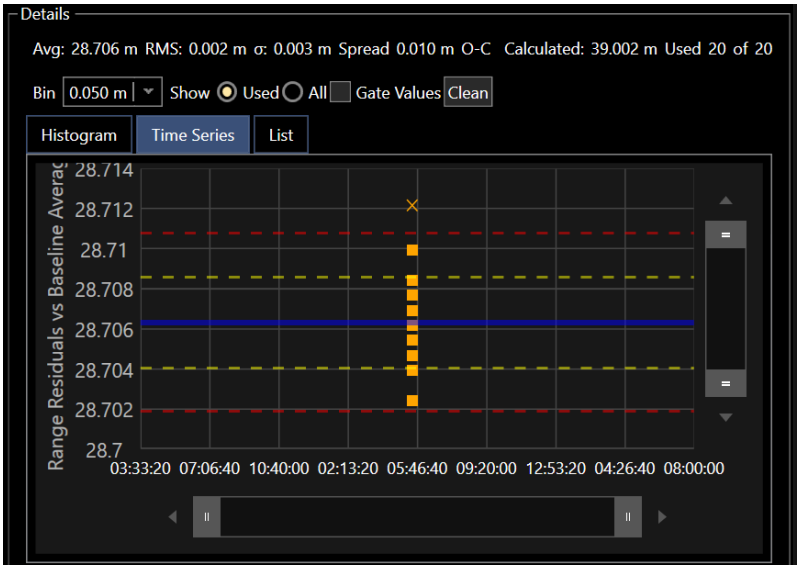


FIGURE 70 TIME SERIES – REJECTED RANGE

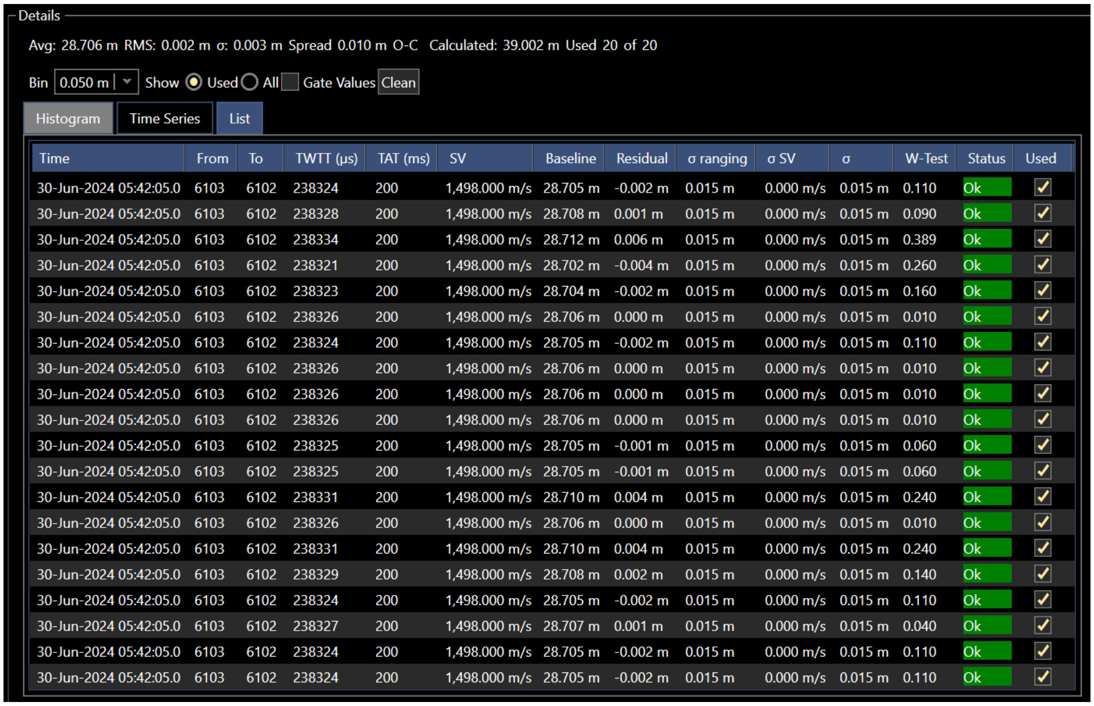
To accept a single range value, click on the x on the time series and it will be readded to the set, and turn back into a square.

To reject multiple observations, hold down the R key on the keyboard, left click, and drag a box around the desired observations.

To accept multiple observations, hold down the A key on the keyboard, left click and drag a box around the desired observations.

10.2.3 LIST TAB

The List view of ranges is shown below in Figure 71. This view shows the raw travel time, sound velocity, and other statistics of each raw range in the baseline set.


Details

Avg: 28.706 m RMS: 0.002 m σ: 0.003 m Spread 0.010 m O-C Calculated: 39.002 m Used 20 of 20

Bin 0.050 m Show Used All Gate Values Clean

Histogram Time Series List

Time	From	To	TWTT (µs)	TAT (ms)	SV	Baseline	Residual	σ ranging	σ SV	σ	W-Test	Status	Used
30-Jun-2024 05:42:05.0	6103	6102	238324	200	1,498.000 m/s	28.705 m	-0.002 m	0.015 m	0.000 m/s	0.015 m	0.110	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238328	200	1,498.000 m/s	28.708 m	0.001 m	0.015 m	0.000 m/s	0.015 m	0.090	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238334	200	1,498.000 m/s	28.712 m	0.006 m	0.015 m	0.000 m/s	0.015 m	0.389	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238321	200	1,498.000 m/s	28.702 m	-0.004 m	0.015 m	0.000 m/s	0.015 m	0.260	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238323	200	1,498.000 m/s	28.704 m	-0.002 m	0.015 m	0.000 m/s	0.015 m	0.160	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238326	200	1,498.000 m/s	28.706 m	0.000 m	0.015 m	0.000 m/s	0.015 m	0.010	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238324	200	1,498.000 m/s	28.705 m	-0.002 m	0.015 m	0.000 m/s	0.015 m	0.110	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238326	200	1,498.000 m/s	28.706 m	0.000 m	0.015 m	0.000 m/s	0.015 m	0.010	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238326	200	1,498.000 m/s	28.706 m	0.000 m	0.015 m	0.000 m/s	0.015 m	0.010	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238326	200	1,498.000 m/s	28.706 m	0.000 m	0.015 m	0.000 m/s	0.015 m	0.010	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238325	200	1,498.000 m/s	28.705 m	-0.001 m	0.015 m	0.000 m/s	0.015 m	0.060	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238325	200	1,498.000 m/s	28.705 m	-0.001 m	0.015 m	0.000 m/s	0.015 m	0.060	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238331	200	1,498.000 m/s	28.710 m	0.004 m	0.015 m	0.000 m/s	0.015 m	0.240	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238326	200	1,498.000 m/s	28.706 m	0.000 m	0.015 m	0.000 m/s	0.015 m	0.010	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238331	200	1,498.000 m/s	28.710 m	0.004 m	0.015 m	0.000 m/s	0.015 m	0.240	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238329	200	1,498.000 m/s	28.708 m	0.002 m	0.015 m	0.000 m/s	0.015 m	0.140	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238324	200	1,498.000 m/s	28.705 m	-0.002 m	0.015 m	0.000 m/s	0.015 m	0.110	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238327	200	1,498.000 m/s	28.707 m	0.001 m	0.015 m	0.000 m/s	0.015 m	0.040	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238324	200	1,498.000 m/s	28.705 m	-0.002 m	0.015 m	0.000 m/s	0.015 m	0.110	Ok	✓
30-Jun-2024 05:42:05.0	6103	6102	238324	200	1,498.000 m/s	28.705 m	-0.002 m	0.015 m	0.000 m/s	0.015 m	0.110	Ok	✓

FIGURE 71 BASELINE DETAILS – LIST TAB

Properties shown in the list view include the following:

- **Time:** Time stamp of the raw observation
- **From:** From address of this range
- **To:** To address of this range
- **TWTT:** Two-way travel time
- **TAT:** Turn around time
- **SV:** Sound Velocity
- **Baseline:** Calculated Range
- **Residual:** Difference between the average of the entire baseline set and this individual range
- **σ ranging:** The expected standard deviation of an individual range (based on manufacturer specification)
- **σ SV:** Standard deviation of the sound velocity
- **σ :** Combined ranging standard deviation and the sound velocity standard deviation. This value is used to calculate the expected standard deviation of the baseline set.
- **W-Test:** W test is the normalized residual value, the absolute value of the residual divided by the standard deviation.
- **Status:** Indicates if the W Test failed or passed
- **Used:** Indicates if the raw observation is used or not

10.2.3.1 EDITING DATA IN THE LIST TAB

In the List view, raw range observations can be toggled to used or not used, in the ‘Used’ checkbox column.

For further editing, right click on a range observation and select Properties.

Note: Multiple range observations can be selected and edited together if desired.

Figure 72 shows the Raw Ranges Properties view with a single range observation selected.

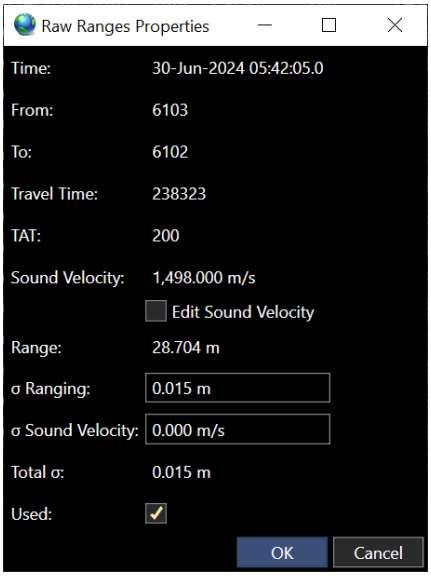


FIGURE 72 RAW RANGES PROPERTIES VIEW – SINGLE RANGE OBSERVATION SELECTED

Figure 73 shows the Raw Ranges Properties view with multiple range observations selected.

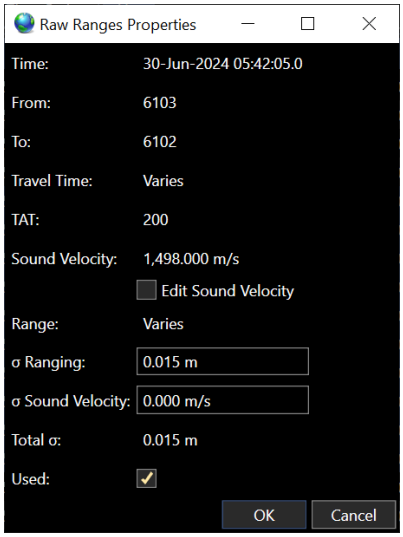


FIGURE 73 RAW RANGES PROPERTIES VIEW – MULTIPLE RANGE OBSERVATIONS SELECTED

In the case of multiple selected ranges, properties that are different across the range of items are shown as ‘Varies’.

Note: The used status, σ ranging, and σ sound velocity may be edited from this view.

10.2.3.2 SOUND VELOCITY EDITING

The current sound velocity is shown on the Raw Ranges Properties view in Figure 72 and Figure 74. To edit the sound velocity, select the Edit Sound Velocity checkbox. This will bring up the sound velocity editing panel.

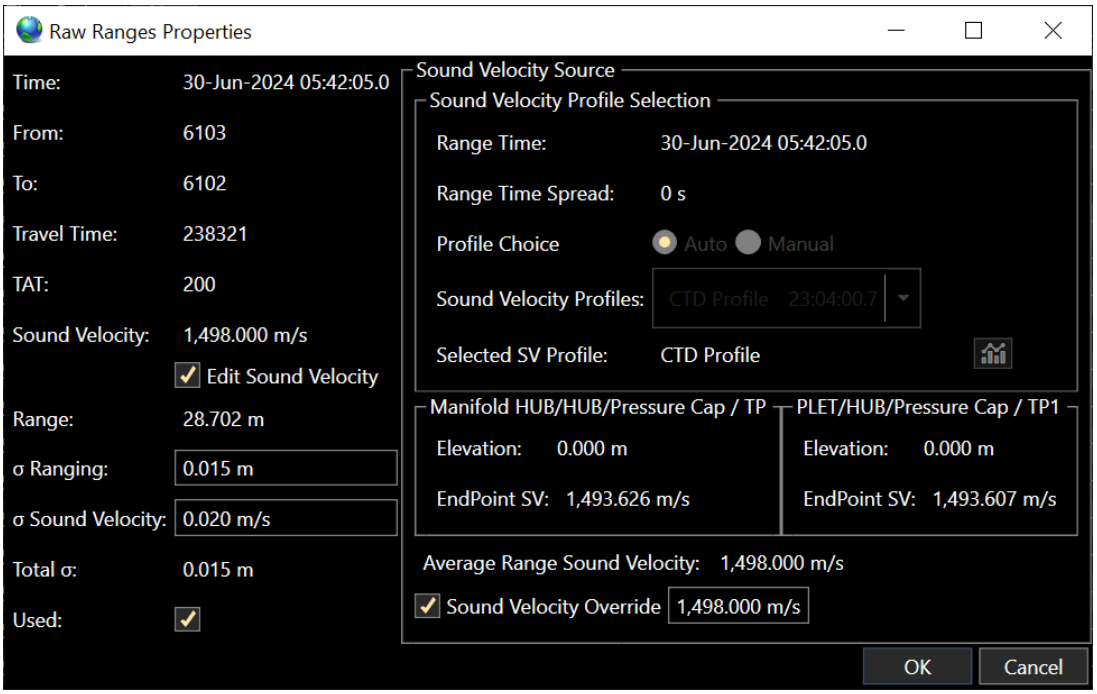


FIGURE 74 SOUND VELOCITY EDITING VIEW

In the sound velocity editing panel, it is possible to select a manual sound velocity override or have the system automatically or manually select a sound velocity profile. Sound velocity profiles must be pre-loaded for this option to be available.

- **Sound Velocity Override:** When data is imported from a source such as a Sonardyne Fusion MDB file, a single value for sound velocity is associated with it. This is shown in the Sound Velocity Override box and is selected by default. This value can be edited manually if desired. If multiple ranges are selected and they have different sound velocity values, the Sound Velocity override will be shown as varies.
- **Auto Sound Velocity Profile:** To use an automatically selected Sound Velocity Profile, uncheck the sound velocity override and leave the profile choice on “Auto”. The auto option will choose the sound velocity profile with the time closest to the range time. See Figure 75.

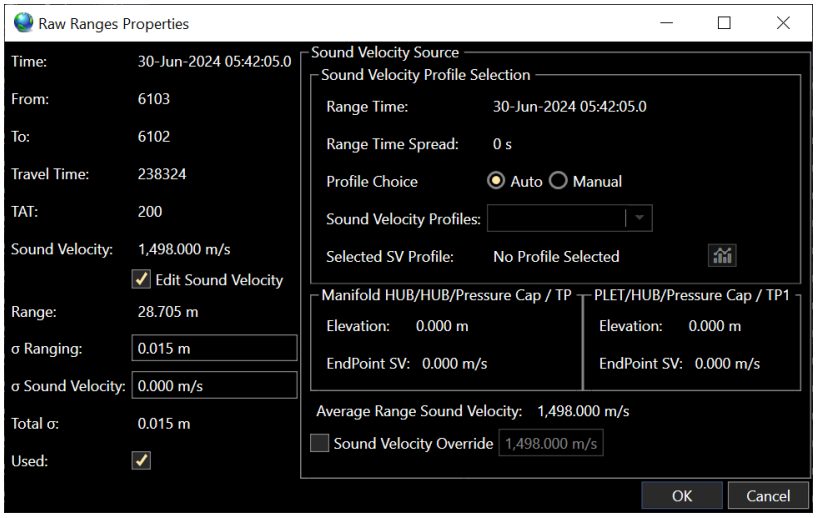


FIGURE 75 PROFILE CHOICE – AUTO

- **Manual Choose Sound Velocity Profile:** If manual is selected, a dropdown list of available sound velocity profiles is shown.

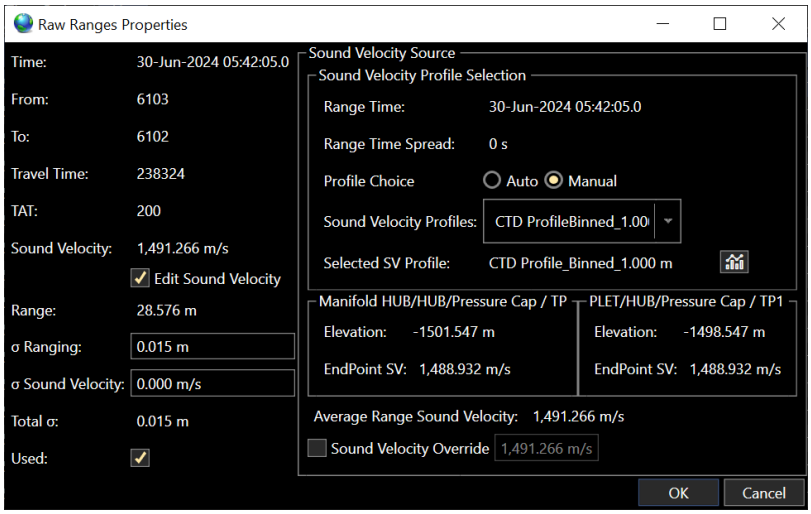


FIGURE 76 PROFILE CJOICE - MANUAL

Note: At each endpoint, sound velocity profiles are queried for the sound velocity at the depth of the transponder at that endpoint. The sound velocity values at these two locations are then average to come up with an average sound velocity for the range.

10.3 BATCH EDITING BASELINES

To edit multiple baseline sets simultaneously, select them in the list view and right click. Select the **Edit** option from the context menu.

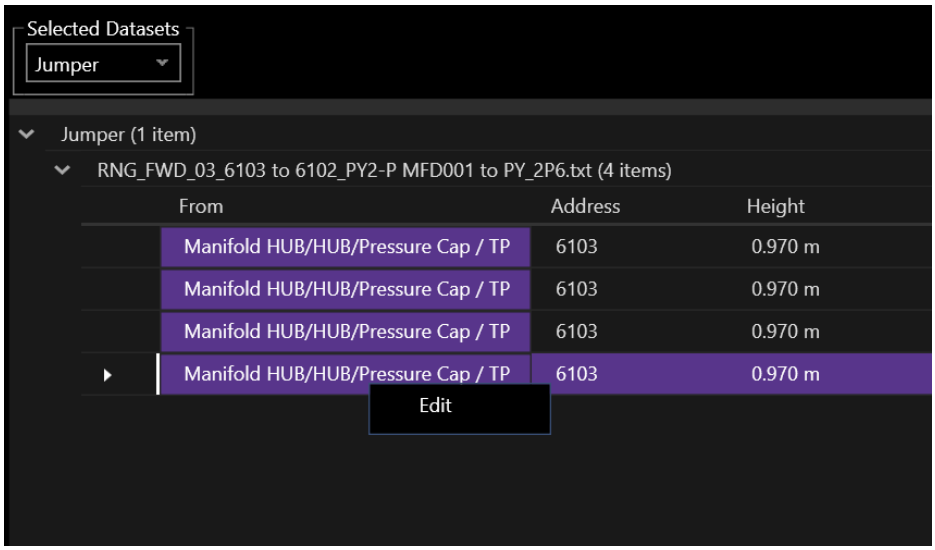


FIGURE 77 BATCH EDITING - MULTIPLE BASELINES SELECTED

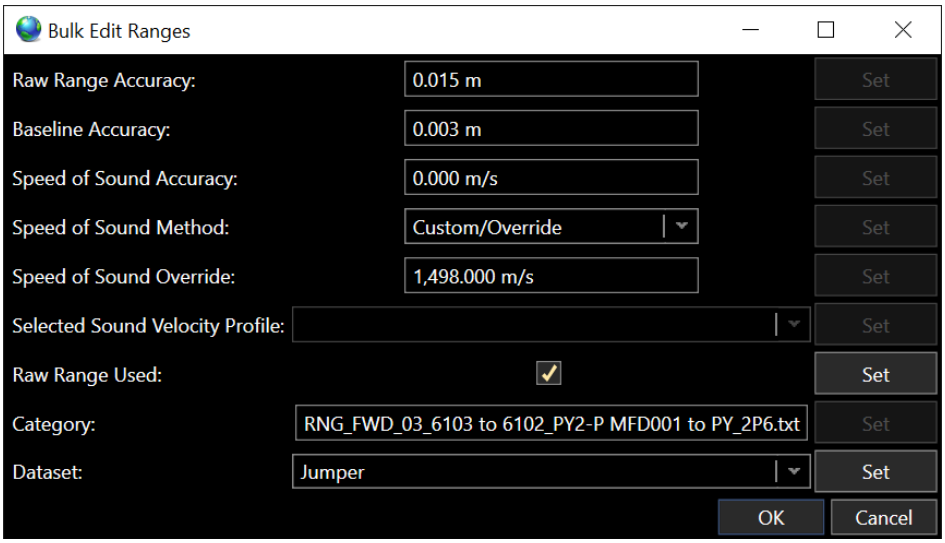


FIGURE 78 BATCH EDITING - BULK EDIT RANGES DIALOG

In batch editing mode, various values can be edited and applied to all baseline sets which have been selected. To edit a value, modify it in the line, and click the corresponding Set button. Changes are applied when the OK button is clicked. To abandon the changes, click the Cancel button.

11 DATA CALCULATIONS

Metrology Attitude, Elevation and Baseline data can be processed as an **Interim Calculation** if in Advanced Mode or in the **Jumper Calculation**.

11.1 INTERIM CALCULATIONS

Interim Calculations can be used to process Attitude, Elevation and Baseline data to obtain results that are used in the jumper calculation.

11.1.1 ATTITUDE CALCULATIONS

Inclinometer readings are reduced to a reference heading using a least squares algorithm.

1. Select Attitudes in Interim Calculation.

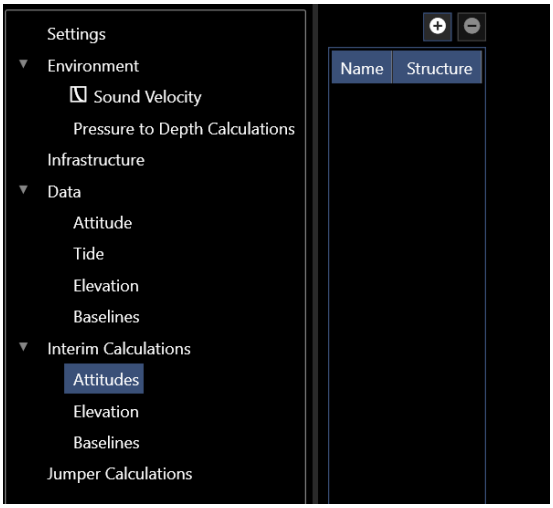


FIGURE 79 INTERIM CALCULATIONS – ATTITUDES

2. Click the button to launch the Create Attitude Calculation wizard.

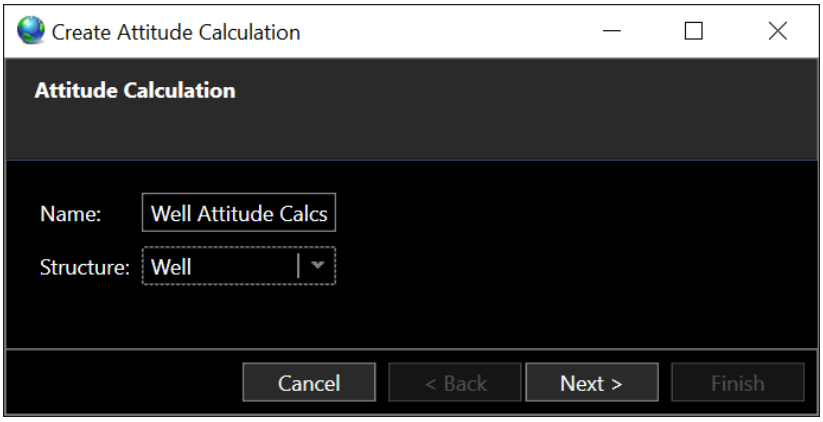


FIGURE 80 CREATE ATTITUDE CALCULATION – ATTRIBUTES PAGE

- **Name:** Enter a concise and description name for the calculation

- **Structure:** From the drop-down list select the structure where the attitude data was observed

3. Click Next to open the Dataset Selection page. Select the dataset containing the attitude data.

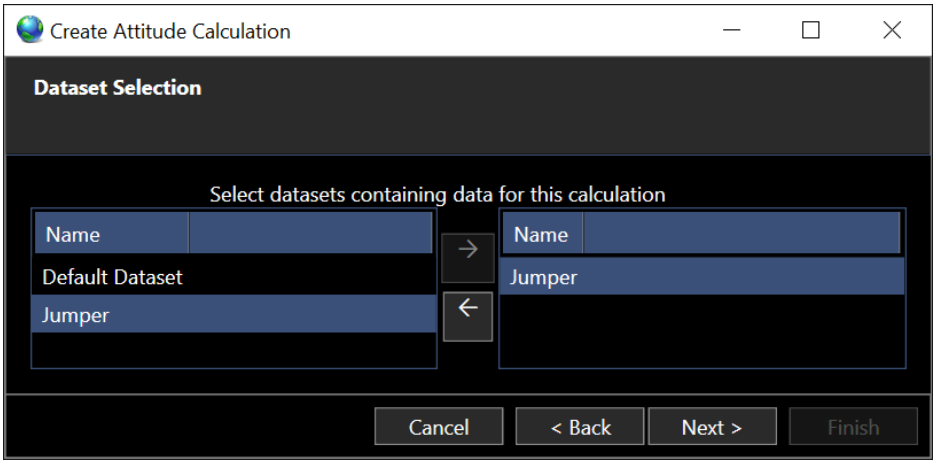


FIGURE 81 CREATE ATTITUDE CALCULATION – DATASET SELECTION PAGE

4. Click Next to open the Select Data page. Select the attitude data to be used in calculation.

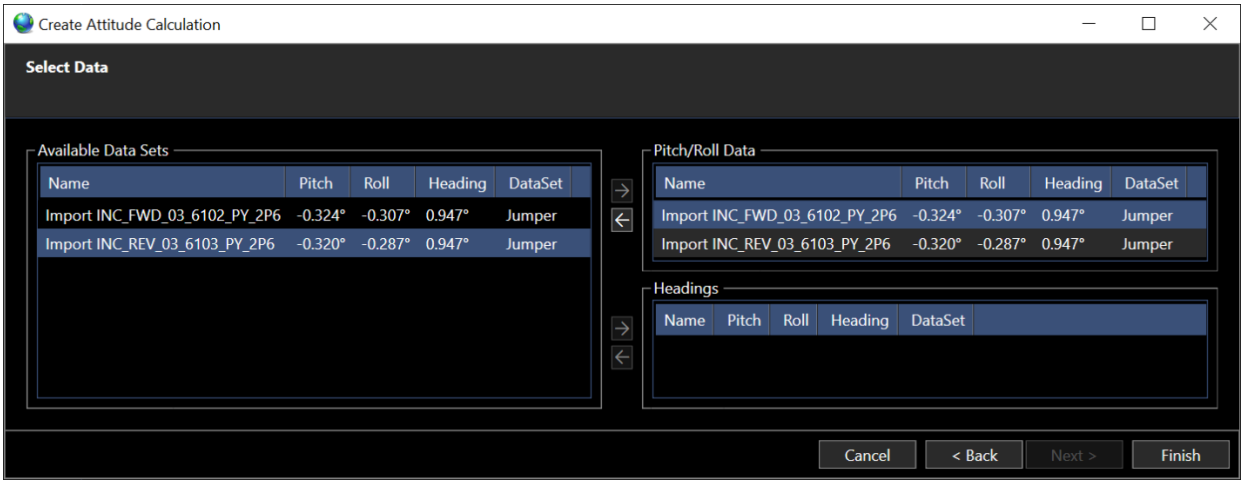


FIGURE 82 CREATE ATTITUDE CALCULATION – SELECT DATA PAGE

5. Click Finish. The Attitude Calculation is added to the list and available to display results, see Figure 83.
6. Repeat Steps 1-5 for remaining structure attitude calculations.

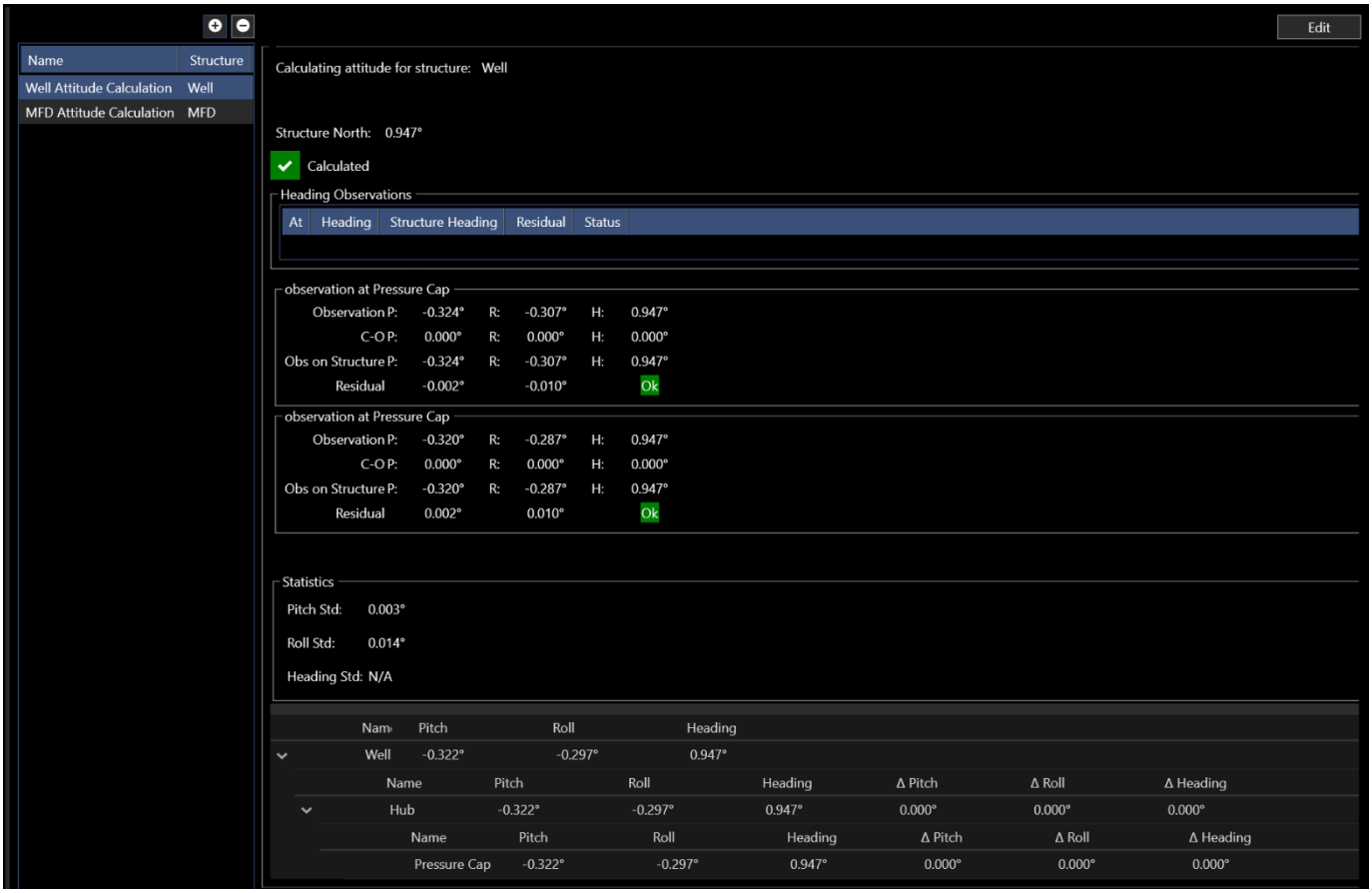


FIGURE 83 ATTITUDES CALCULATIONS – CALCULATED ATTITUDE AT STRUCTURE RESULTS

- **Edit Button:** Enables the user to access the Edit Attitude Calculation wizard to make changes

11.1.2 ELEVATION CALCULATIONS

Elevation Calculations enables the user to apply multiple Elevation Data sets (depth loops) in a single adjustment to determine the relative depths between structures and to calculate a seabed profile relative to a selected structure item.

1. Select Elevation in Interim Calculation, see Figure 84.

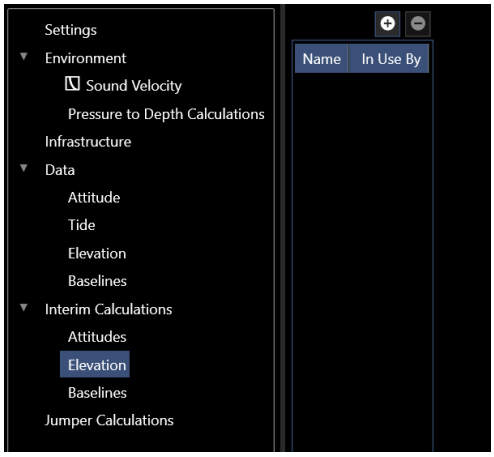


FIGURE 84 INTERIM CALCULATIONS – ELEVATION

2. Click the button to launch the Create Elevation Calculation wizard.

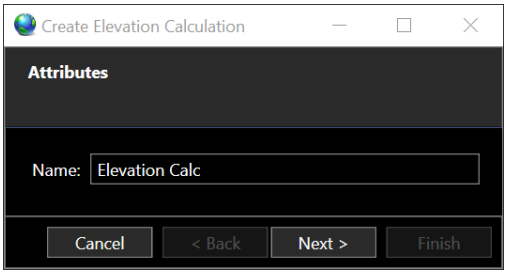


FIGURE 85 CREATE ELEVATION CALCULATION – ATTRIBUTES PAGE

3. Enter a concise and description name for the calculation.
4. Click Next to open the Dataset Selection page. Select the dataset containing the elevation data, see Figure 86.

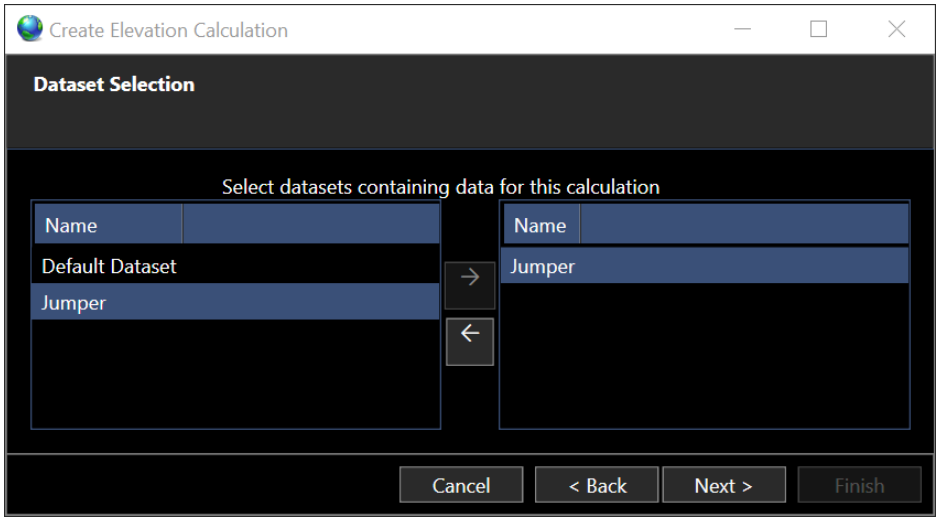


FIGURE 86 CREATE ELEVATION CALCULATION – DATASET SELECTION PAGE

5. Click Next to open the Select Data page. Select the depth loops to apply in the calculation from Available Loops panel and click the → button to add them to the Used Loops panel, to remove a depth loop from Used Loops panel, select it and click the ← button, see Figure 87.

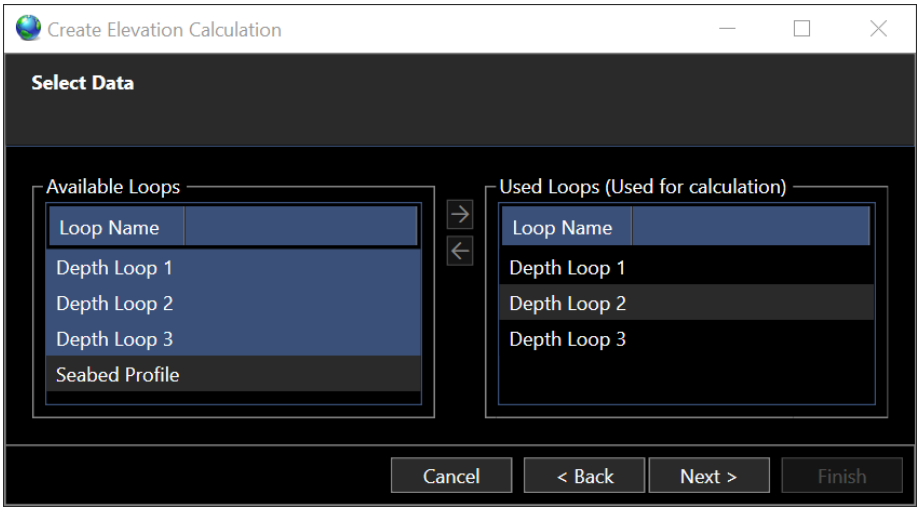


FIGURE 87 CREATE ELEVATION CALCULATION – SELECT DATA PAGE (DEPTH LOOPS)

6. Click Next to open the Structure Configuration page, see Figure 88.

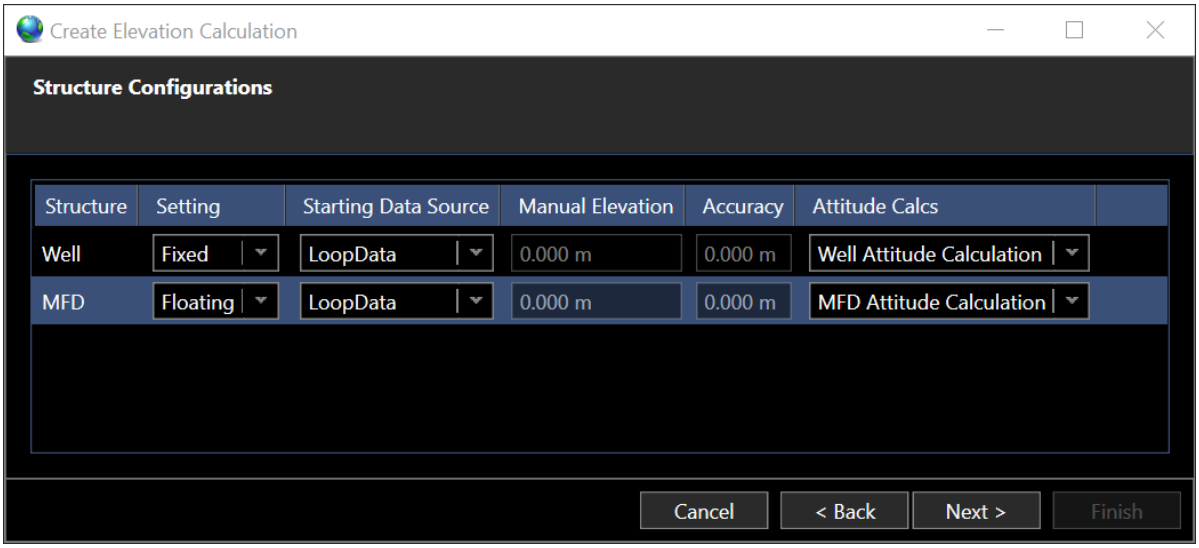


FIGURE 88 CREATE ELEVATION CALCULATION – STRUCTURE CONFIGURATION PAGE

7. Configure the structures in the selected depth loops.
    a. **Setting:** How data is used in adjustment
        I. **Floating:** Adjusted without constraints
        II. **Constrained:** Adjustment constrained based on entered accuracy
        III. **Fixed:** Held fixed in adjustment
    b. **Starting Data Source:** What starting depth is to be used for the adjustment

I. **Structure:** Elevation entered for structure used
II. **Loop Data:** Calculated from depth loop observations
III. **Manual:** Entered by user

c. **Attitude Calcs:** If Attitude Calculations have been added to FLOWIT, the respective calculation can be selected

8. Click Next to open Select Profiles page.

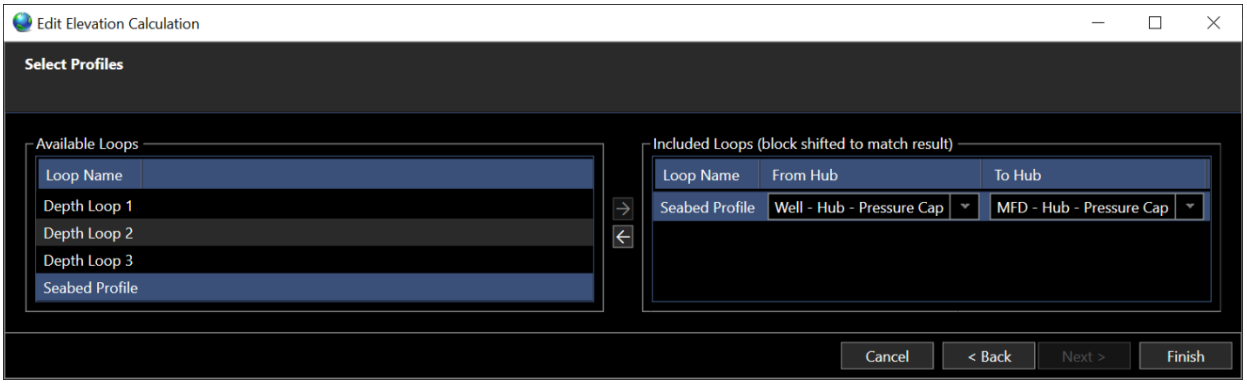


FIGURE 89 CREATE ELEVATION CALCULATION – SELECT SEABED PROFILES PAGE

9. Select the seabed depth profile(s) to apply in the calculation from Available Loops panel and click the → button to add them to the Included Loops panel, to remove a loop from Used Loops panel, select it and click the ← button.

   From the drop-down lists, select the start and end points of the profile

10. Click Finish. The Elevation Calculation is added to the list and available to display results.

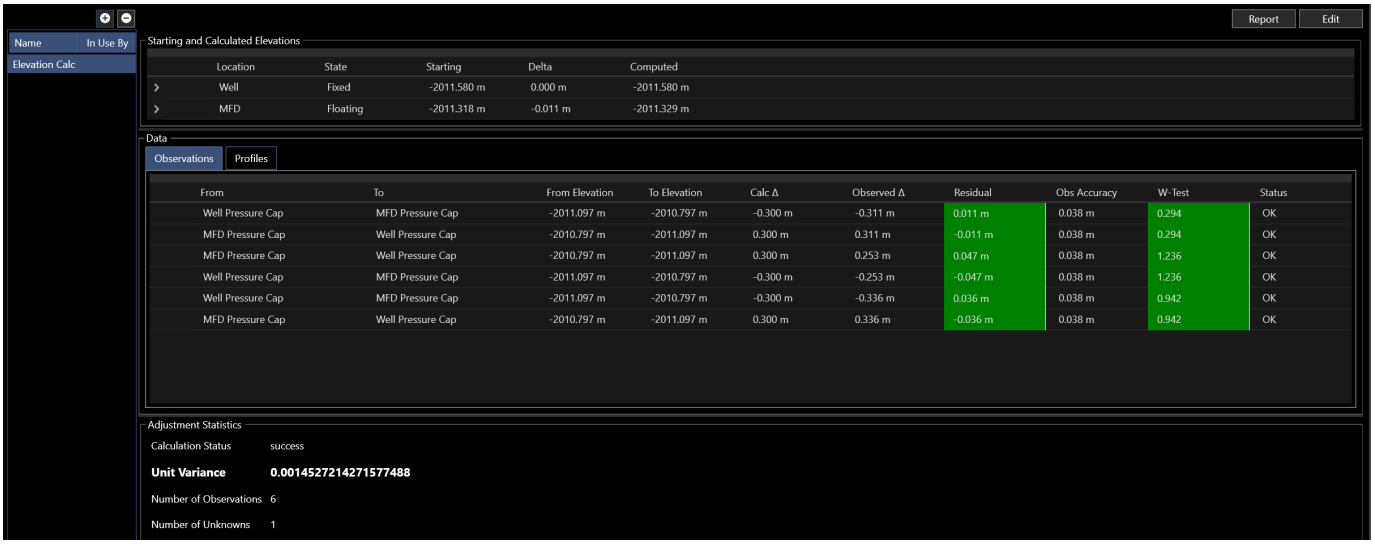


FIGURE 90 ELEVATION CALCULATIONS – OBSERVATIONS TAB - DEPTH LOOPS RESULTS

- **Report Button:** Generates a report for the Elevation Calculations
- **Edit Button:** Enables the user to access the Edit Elevation Calculation wizard to make changes

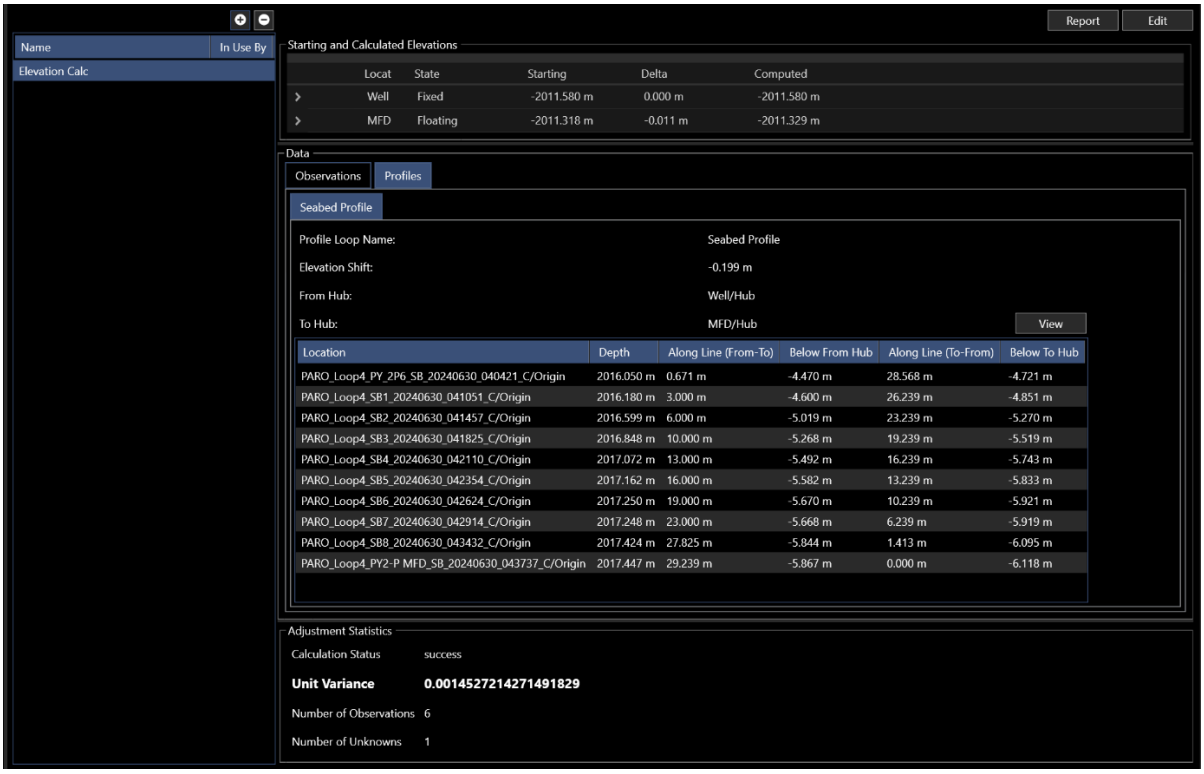


FIGURE 91 ELEVATION CALCULATIONS – PROFILES TAB – SEABED PROFILE RESULTS

- **View Button:** Generates a profile view relative to the To Hub

  Note: Once the window opens, right mouse click in the window and click Refresh to display the profile.

11.1.3 BASELINES CALCULATIONS

The Baselines Calculation is a least squares adjustment using the selected baseline data and optional results of attitude and elevation calculations.

The baseline calculation wizard described below is used both for creating new baseline calculation or editing an existing one.

1. Select Baselines in Interim Calculation.

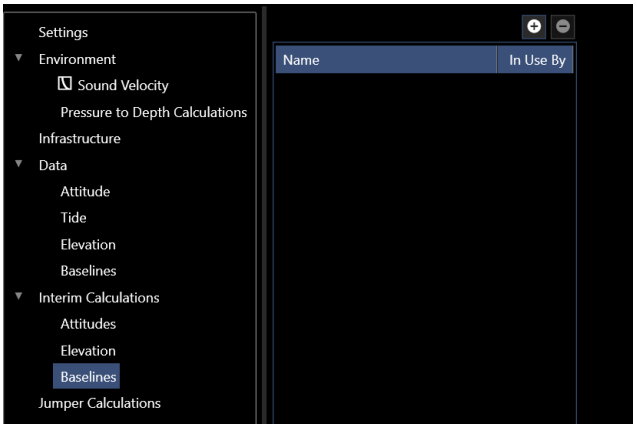


FIGURE 92 INTERIM CALCULATIONS – BASELINES

2. Click the button to launch the Create Range Calculation wizard.

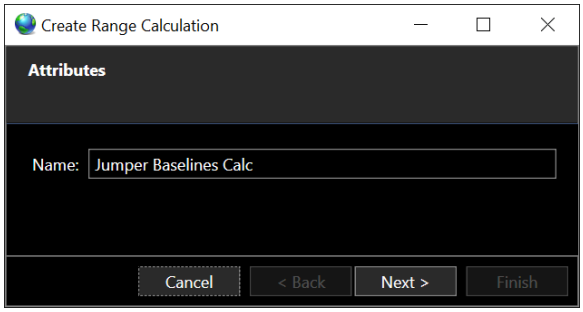


FIGURE 93 CREATE RANGE CALCULATION – ATTRIBUTES PAGE

3. In the Attributes page enter a concise and description name for the calculation.
4. Click Next to open the Dataset Selection page. Select the dataset containing the baseline data.

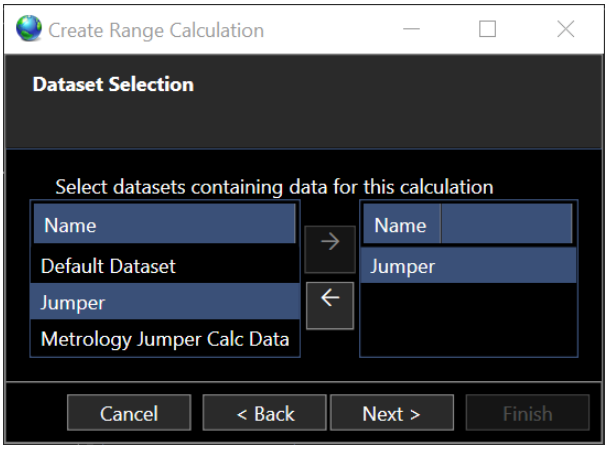


FIGURE 94 CREATE RANGE CALCULATION – DATASET SELECTION PAGE

5. Click Next to open the Select Data page, see Figure 95.

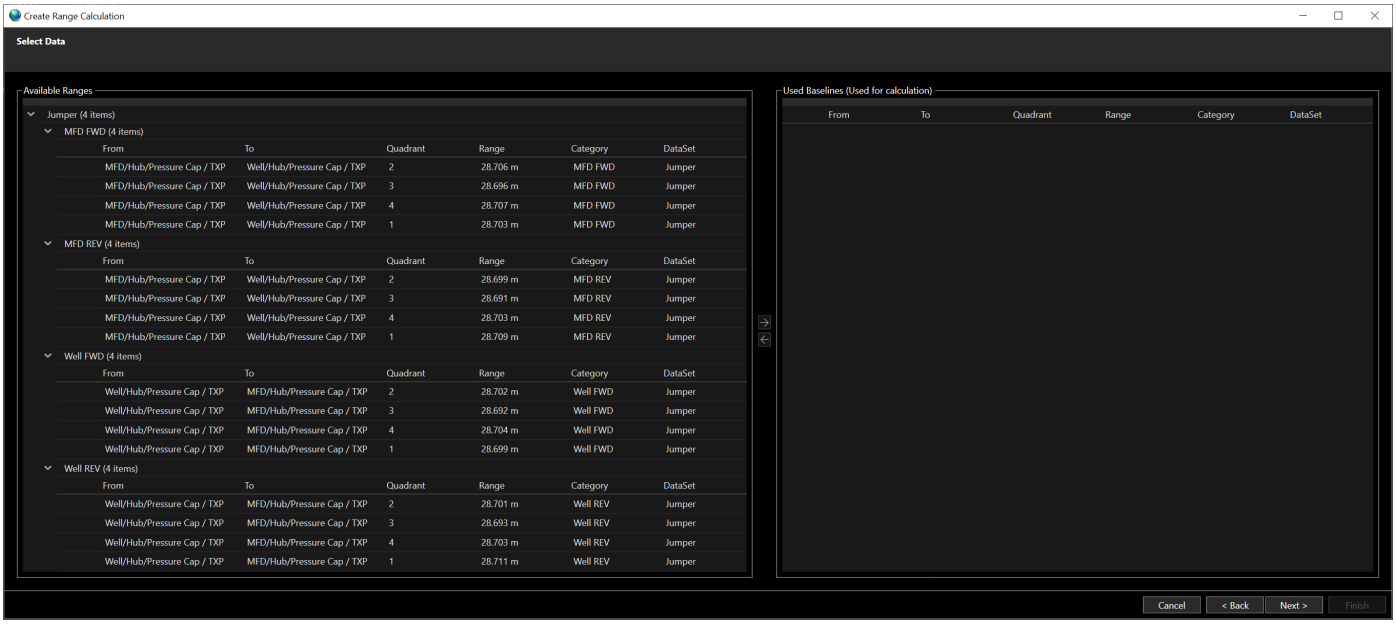


FIGURE 95 CREATE RANGE CALCULATION – SELECT DATA PAGE

6. On the data selection page select the ranges to be used in the calculation from the Available Ranges panel and click the right arrow to add them to the calculation, Used Baselines panel.

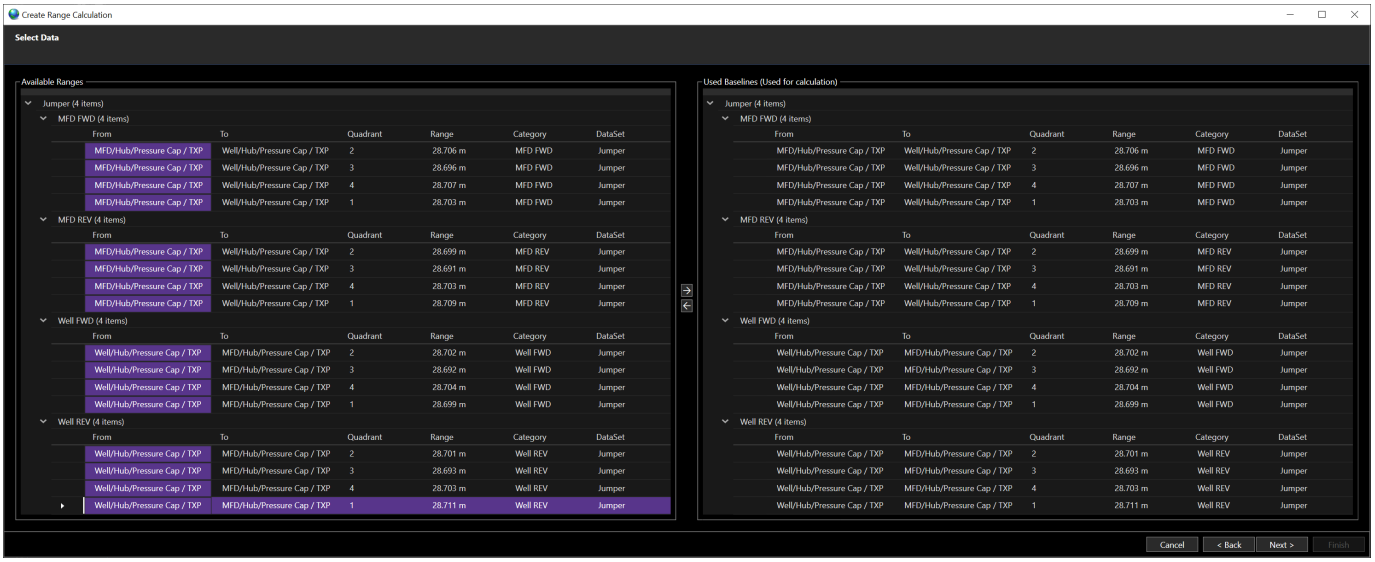


FIGURE 96 CREATE RANGE CALCULATION – BASELINES ADDED FOR CALCULATION

7. Click Next to open Bearing constraints page.

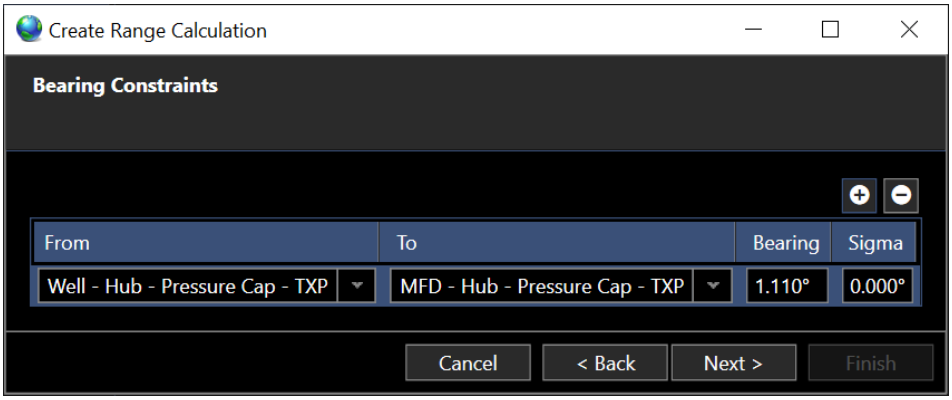


FIGURE 97 CREATE RANGE CALCULATION – BEARING CONTRAINTS PAGE

8. On the Bearing constraints page click the + button to add a new bearing constraint. Select the from and to endpoints.
    a. End points must be transponders
    b. The bearing will be calculated based on the selected endpoints but may be edited
    c. By default, the standard deviation of the bearing constraint is 0.00 making it fixed. This can be edited to any other value
9. Click Next to open Structure Configurations page.

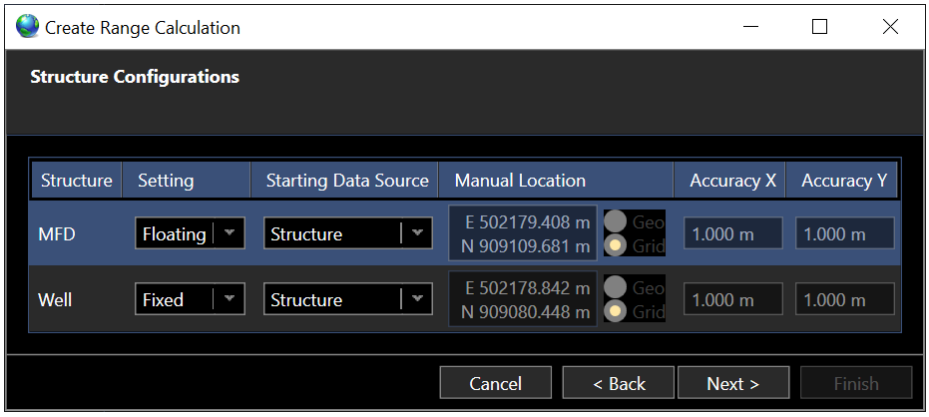


FIGURE 98 CREATE RANGE CALCULATION – STRUCTURE CONFIGURATIONS PAGE

10. On the Structure Configuration page, the base structure from all selected ranges in the calculation are extracted. Calculation parameters for these structures may be configured including:
    - **Setting:** Fixed, Floating or Constrained
        - **Fixed:** Structure will not be moved during the adjustment
        - **Floating:** Structure will move freely and does not have any position observations

- **Constrained:** Structure may move but is constrained using the Accuracy X and Accuracy Y specified. This creates additional observations in the adjustment at the specified accuracy levels

- **Starting Data Source:** Source of the starting coordinate in the adjustment. This can be set to Structure or Manual
  - **Structure:** Starting coordinate matches selected structure in the Infrastructue list
  - **Manual:** Coordinate may be entered for the structure

11. Click Next to open the Select Elevation Calcs page.

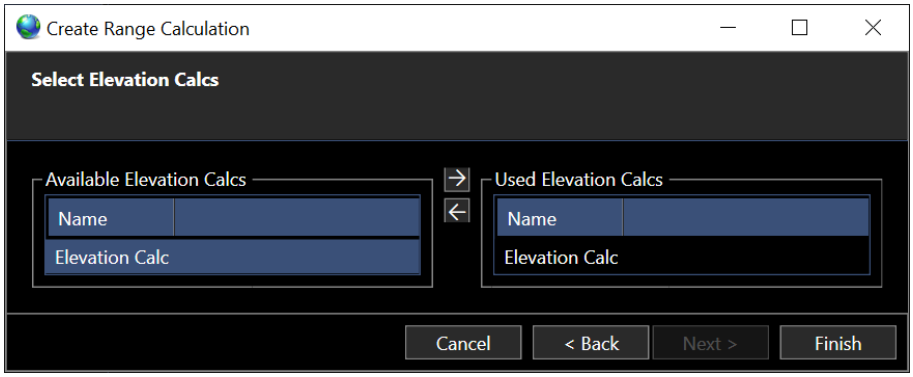


FIGURE 99 CREATE RANGE CALCULATION – SELECT ELEVATION CALCS PAGE

Any elevation calcs that are available in FLOWIT will be available for use, these can be added to the calculation. The results of these elevation calcs will be used to set the elevation of endpoints in the range calculation.

12. Clink Finish. This will add the range calculation result to list that can be viewed and edited if required, see Figure 100.

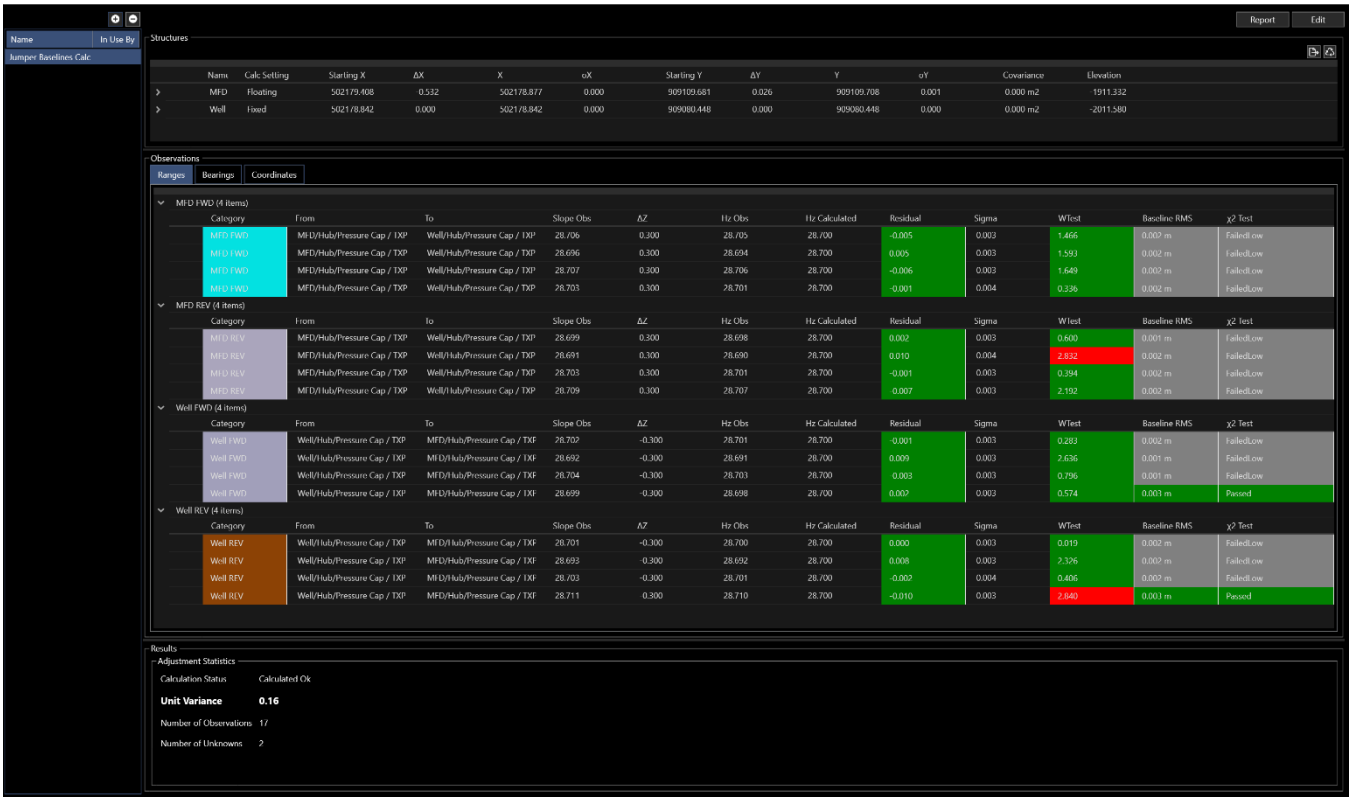


FIGURE 100 RANGE CALCULATION RESULTS VIEW – RANGES TAB

11.1.3.1 RANGE CALCULATION RESULTS

The range calc results view consists of 3 sections: Structures, Observations and Results.

- **Report Button:** Generates a report for the Range Calculation
- **Edit Button:** Enables the user to access the Edit Range Calculation wizard to make changes
- **Export Transponders:** Export transponder positions and elevation to a file
- **Update:** Forces refresh of view after editing of associated configurations

11.1.3.1.1 STRUCTURES

The structures section gives the calculation results for each structure in the calculation. The structures can be expanded to see the results at each transponder end point, see Figure 100.

- **Name:** Name of the structure
- **Calc Setting:** Fixed, Floating or Constrained
- **Starting X:** X Coordinate input into the calculation for this structure
- **ΔX:** Change in X from the calculation
- **σX:** Calculated Standard Deviation of the X coordinate
- **Starting Y:** Y Coordinate input into the calculation for this structure

- **ΔY:** Change in Y from the calculation
- **σY:** Calculated Standard Deviation of the Y coordinate
- **Covariance:** Calculated covariance of the X and Y
- **Elevation:** Elevation of the structure – this value does not change in the calculation but is included here for reference

11.1.3.1.2 OBSERVATIONS

The observations page is divided into three tabs: Ranges, Bearings, and Coordinates**.**

- **Ranges Tab:** Each Range Observation is shown with the following details

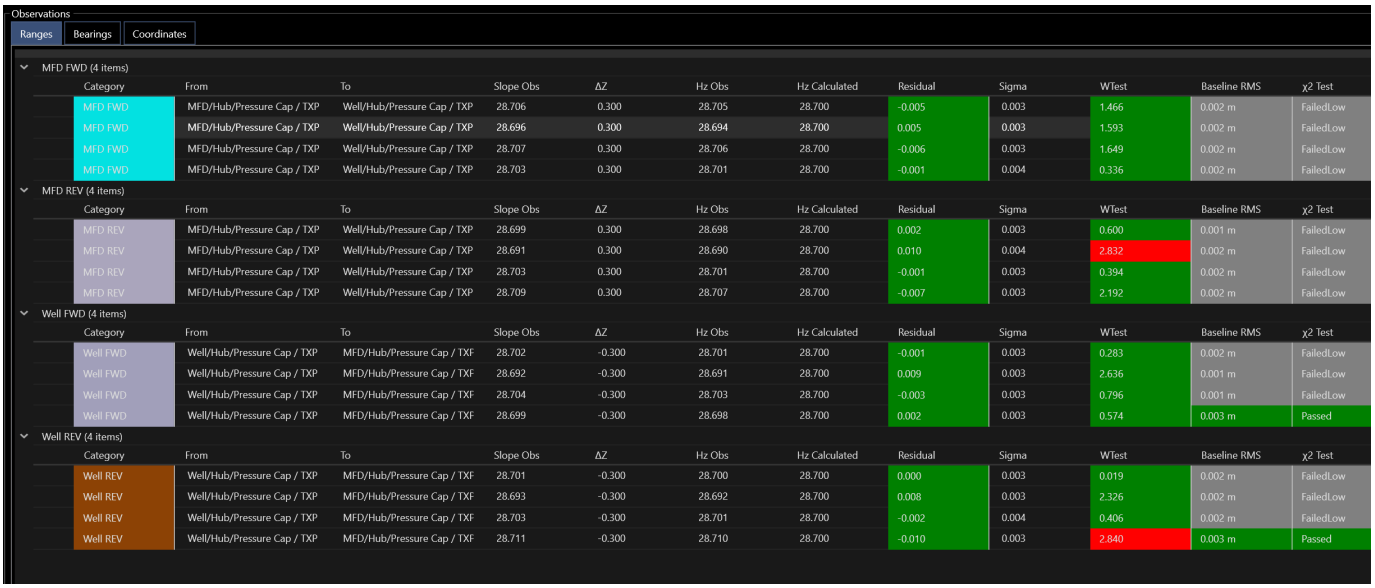


FIGURE 101 RANGE CALCULATION RESULTS VIEW – RANGES TAB

- **From:** Starting Point (Transponder)
- **To:** Ending Point (Transponder)
- **Slope Obs:** The observed range in distance units
- **ΔZ:** The difference in Z between the start and end transponders
- **Hz Obs:** The observed range reduced to a horizontal plane by the ΔZ value with the equation: $Obs_{hz} = \sqrt{Obs_{slope}^2 - \Delta Z^2}$
- **Hz Calculated:** The Adjusted range, result of the calculation
- **Residual:** Hz Calculated range vs the observed horizontal range
- **Sigma:** Accuracy of the range observation
- **WTest:** Standardized residual, residual divided by standard deviation

- **Bearings Tab:** Bearing constraints added to the calculation are shown with the following details

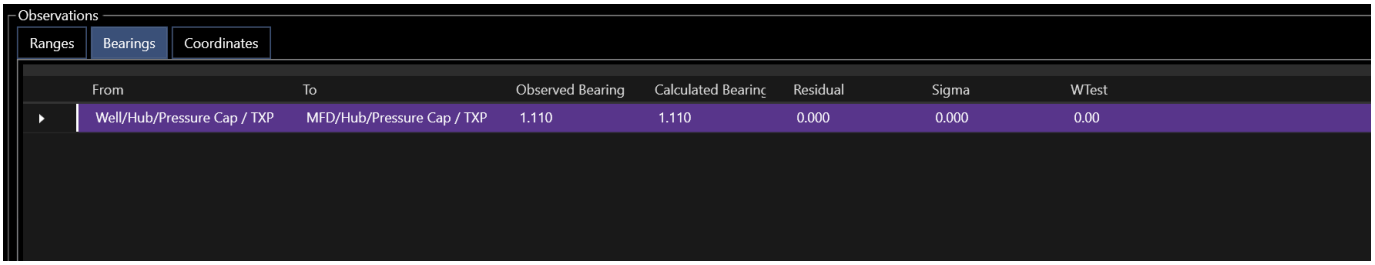


FIGURE 102 RANGE CALCULATION RESULTS VIEW – BEARINGS TAB

  - **From:** Starting Point (Transponder)
  - **To:** Ending Point (Transponder)
  - **Observed Bearing:** Entered bearing value
  - **Calculated Bearing:** Bearing Calculated after the adjustment
  - **Residual:** Calculated vs observed Bearing
  - **Sigma:** Accuracy of the bearing calculation
  - **WTest:** Standardized residual, residual divided by standard deviation
- **Coordinates Tab:** Coordinate observations created by constrained structures are added and displayed with the following details

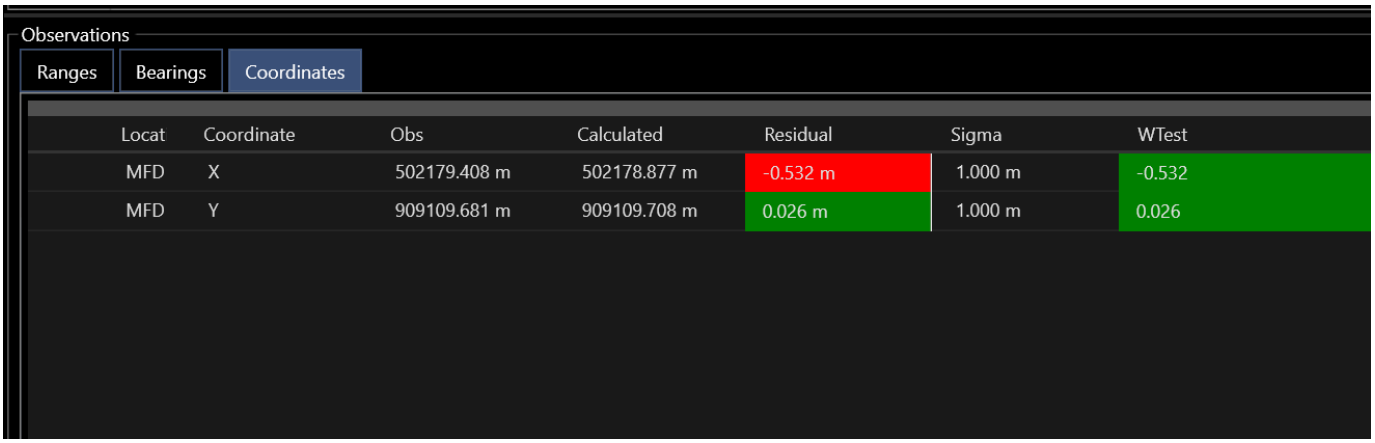


FIGURE 103 RANGE CALCULATION RESULTS VIEW – COORDINATES TAB

  - **Location:** Transponder attached to structure
  - **Coordinate:** X and Y
  - **Obs:** The actual coordinate in projected units
  - **Calculated:** Value of the coordinate after calculation has run
  - **Residual:** Calculated vs observed coordinate
  - **Sigma:** Input accuracy of this coordinate
  - **WTest:** Standardized residual

11.1.3.1.3 RESULTS

The results section gives the following information:

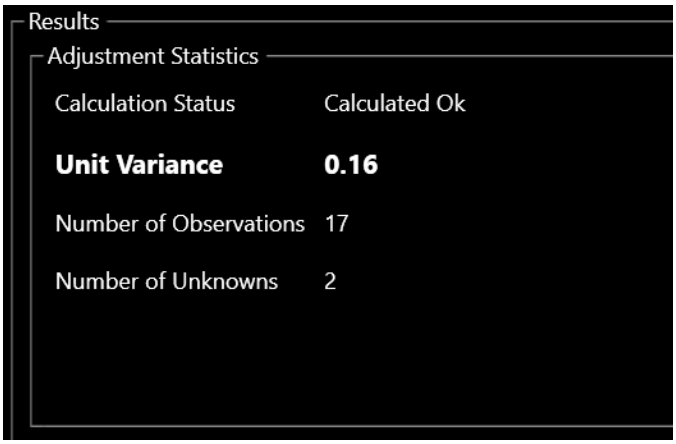


FIGURE 104 RANGE CALCULATION RESULTS VIEW – RESULTS (ADJUSTMENT STATISTICS)

- **Calculation Status:** Indicates if the calculation succeeded or failed and gives some information on reasoning if it failed
- **Unit Variance:** Indicator of the quality of the adjustment
- **Number of Observations:** Count of baseline, bearing and coordinate observations used in the adjustment
- **Number of Unknowns:** Count of unknowns calculated

12 JUMPER CALCULATIONS

The Jumper Calculations uses Attitude, Elevation and Baseline data to solve for the following

- Hub to hub horizontal range
- Jumper heading
- Pitch and roll of hubs calculated to the jumper heading
- Hub to hub depth differentials
- Seabed Profile

12.1 CREATE A JUMPER CALCULATION

1. Select Jumper Calculations.

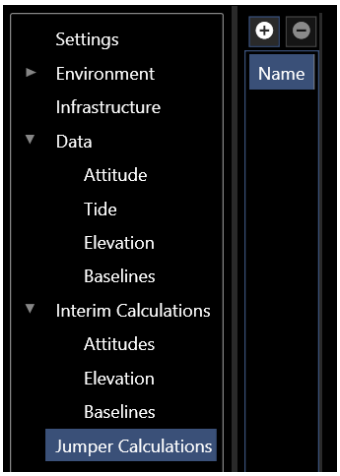


FIGURE 105 JUMPER CALCULATIONS

2. Click the add button  to open the Create Jumper Calculation wizard.
3. The Attributes page is to define the jumper calculation.
   - **Name:** Enter name to identify jumper calculation
   - **From:** Select the from hub in the drop-down listing, check box if hub is vertical
   - **To:** Select the to hub in the drop-down listing, check box if hub is vertical

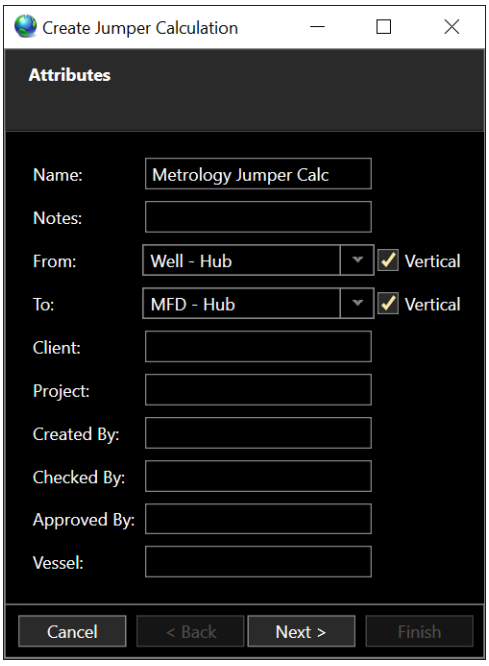


FIGURE 106 CREATE RANGE CALCULATION – ATTRIBUTES PAGE

4. Click Next to open the Dataset Selection page.

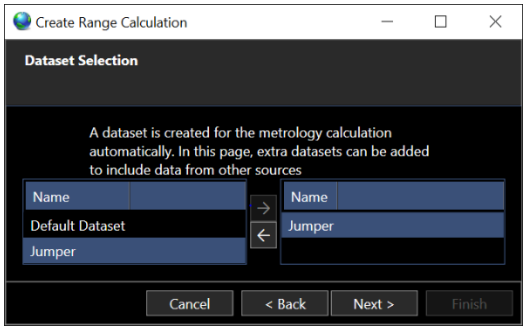


FIGURE 107 CREATE RANGE CALCULATION – DATASET SELECTION PAGE

Note: Select from the Name panel datasets containing data to be used in the calculation.

Note: A dataset is automatically created for the jumper calculation when Next is clicked. The dataset name is name entered on the Attributes page.

5. Click Next to open the Attitudes page.

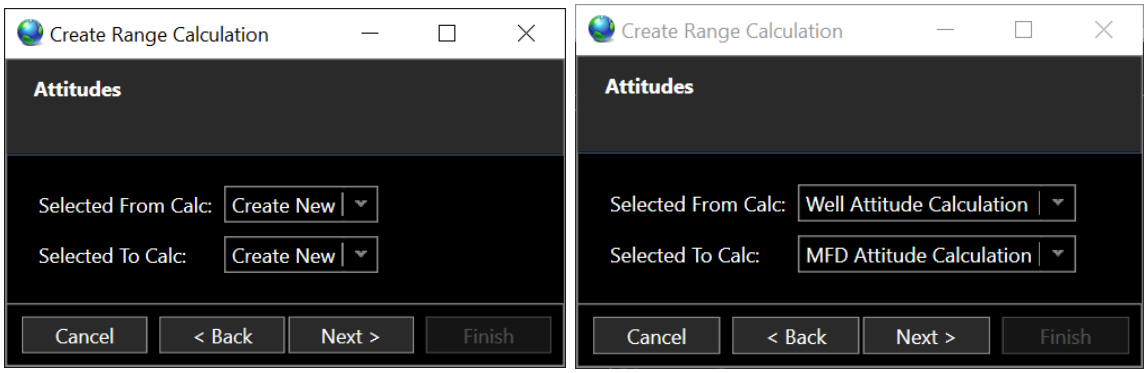


FIGURE 108 CREATE RANGE CALCULATION – ATTITUDES PAGE

6. If an attitude calculation was created in Interim Calculations, then from the drop-down listing, select the From and To attitude calculation to be used in the jumper calculation. If an attitude calculation was not created in Interim Calculations, then select Create New.
7. Click Next to open the Elevation/Range Calculations page, see Figure 109.

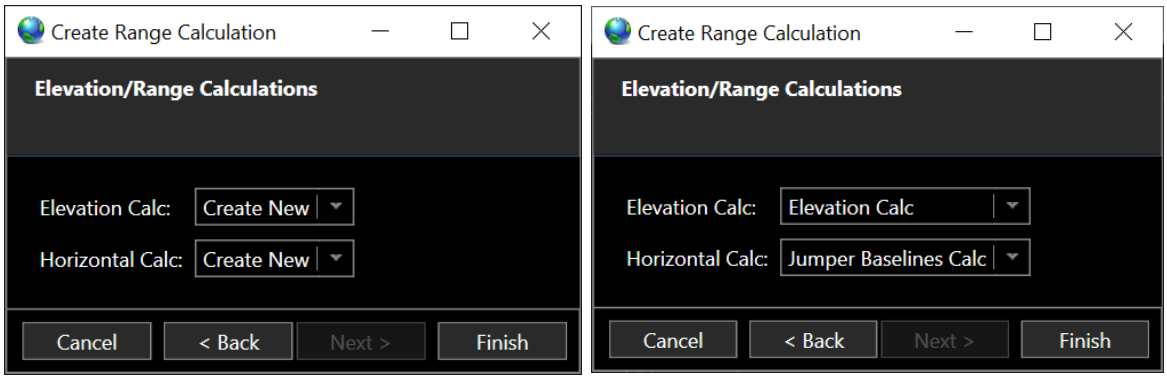


FIGURE 109 CREATE RANGE CALCULATION – ELEVATION/RANGE CALCULATIONS PAGE

8. If an elevation calculation and baseline calculation was created in Interim Calculations then from the drop-down listing, select the calculations to be used in the jumper calculation. If calculations were not created in Interim Calculations, then select Create New.
9. Click Finish. The jumper calculation is now created and listed under Jumper Calculations and the calculation result is available for display and editing if required.

Note: If Interim Calculations were selected when creating the jumper calculation, the results are available, see Figure 110.

FIGURE 110 JUMPER CALCULATION RESULTS – USING INTERIM CALCULATIONS

Note: If Create New was selected when creating the jumper calculation then the Attitude, Elevation and Baseline calculations require to be configured to solve for the jumper results, see Figure 111.

FIGURE 111 JUMPER CALCULATION RESULTS – CREATE NEW CALCULATIONS

12.2 EDIT JUMPER CALCULATION

Attitude, Elevation and Range calculations can be edited from the Calc Status panel.

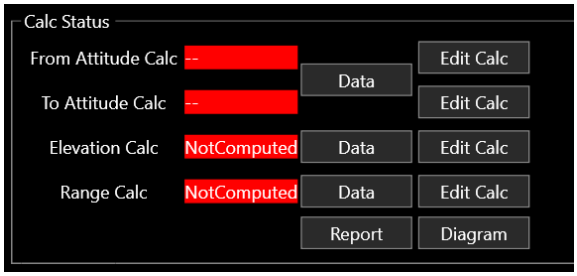


FIGURE 112 JUMPER CALCULATION – CALC STATUS PANEL

12.2.1 EDIT ATTITUDE CALC – FROM/TO

1. Click the Edit Calc button to open Edit Attitude Calculation.
2. In the Attributes page enter a name for the calculation and select the associated structure.

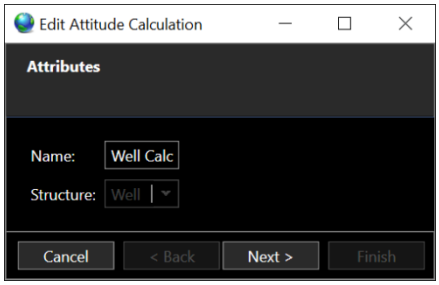


FIGURE 113 EDIT ATTITUDE CALCULATION – ATTRIBUTES PAGE

3. Click Next to open the Select Data page. Select the attitude data to apply in the calculation from Available Data Sets panel and click the → button to add them to the Pitch/Roll Data panel, to remove attitude data from Pitch/Roll Data panel, select it and click the ← button.

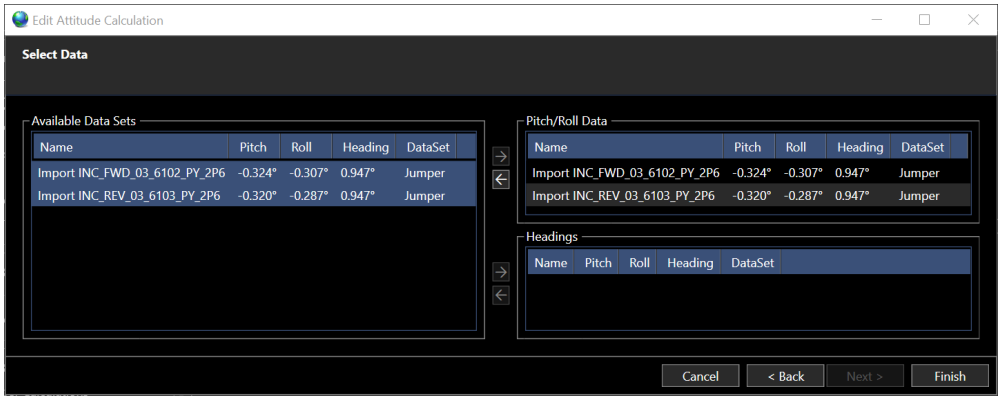


FIGURE 114 EDIT ATTITUDE CALCULATION – SELECT DATA PAGE

4. Click Finish. Refer to Calc Status, see

12.2.2 EDIT ELEVATION CALC

1. Click the Edit Calc button to open Edit Elevation Calculation.
2. In the Attributes page enter a name for the elevation calculation.

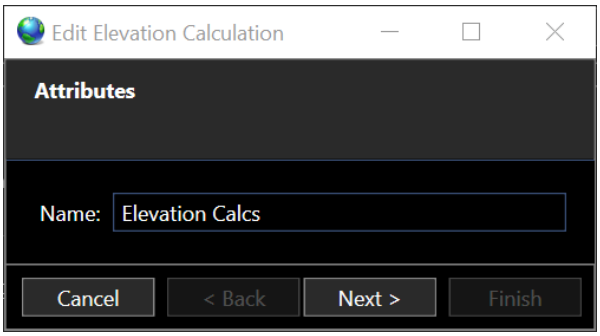


FIGURE 115 EDIT ELEVATION CALCULATION – ATTRIBUTES PAGE

3. Click Next to open Select Data page. Select the depth loops to apply in the calculation from Available Loops panel and click the → button to add them to the Used Loops panel, to remove a depth loop from Used Loops panel, select it and click the ← button, see Figure 116.

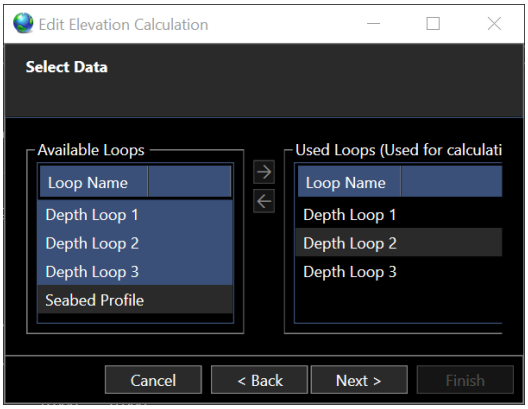


FIGURE 116 EDIT ELEVATION CALCULATION – SELECT DATA PAGE

4. Click Next to open Structure Configurations page.

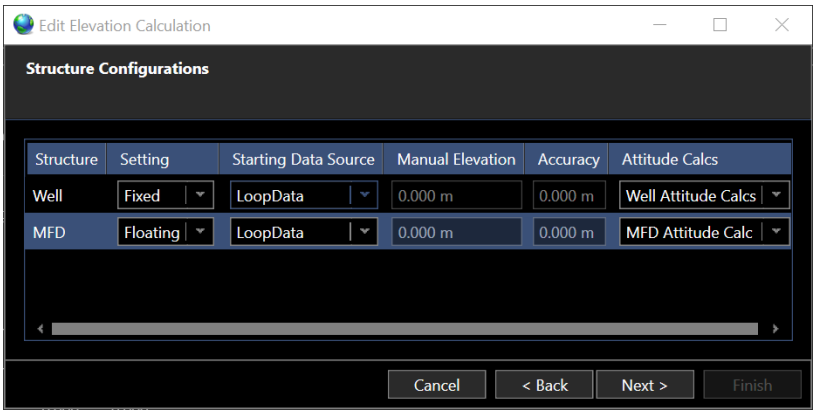


FIGURE 117 EDIT ELEVATION CALCULATION – STRUCTURE CONFIGURATIONS PAGE

5. Configure the structures in the selected depth loops.
    a. **Setting:** How data is used in adjustment
        I. **Floating:** Adjusted without constraints
        II. **Constrained:** Adjustment constrained based on entered accuracy
        III. **Fixed:** Held fixed in adjustment
    b. **Starting Data Source:** What starting depth is to be used for the adjustment
        I. **Structure:** Elevation entered for structure used
        II. **Loop Data:** Calculated from depth loop observations
        III. **Manual:** Entered by user
    c. **Attitude Calcs:** If Attitude Calculations have been added to FLOWIT, the respective calculation can be selected

6. Click Next to open Select Profiles page.

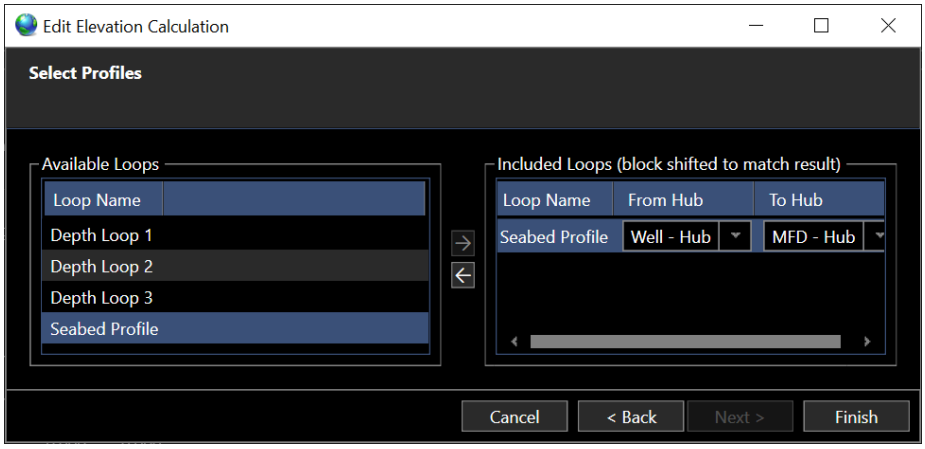


FIGURE 118 EDIT ELEVATION CALCULATION – SELECT PROFILES PAGE

7. Select the seabed depth profile(s) to apply in the calculation from Available Loops panel and click the → button to add them to the Included Loops panel, to remove a loop from Used Loops panel, select it and click the ← button. From the drop-down lists, select the start and end points of the profile.
8. Click Finish. Refer to Calc Status, see

12.2.3 EDIT RANGE CALC

1. Click the Edit Calc button to open Edit Range Calculation.

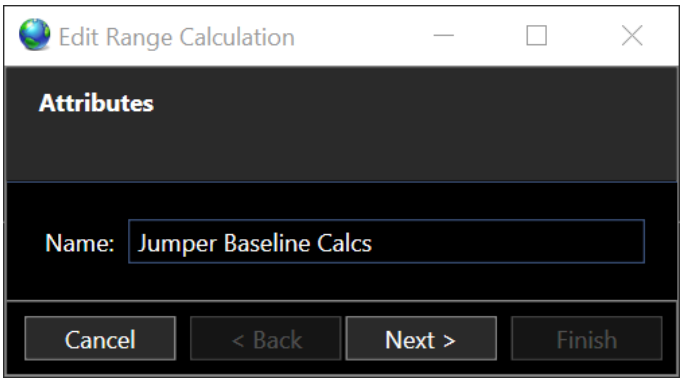


FIGURE 119 EDIT RANGE CALCULATION – ATTRIBUTES PAGE

2. In the Attributes page enter a concise and description name for the calculation.
3. Click Next to open the Select Data page, see

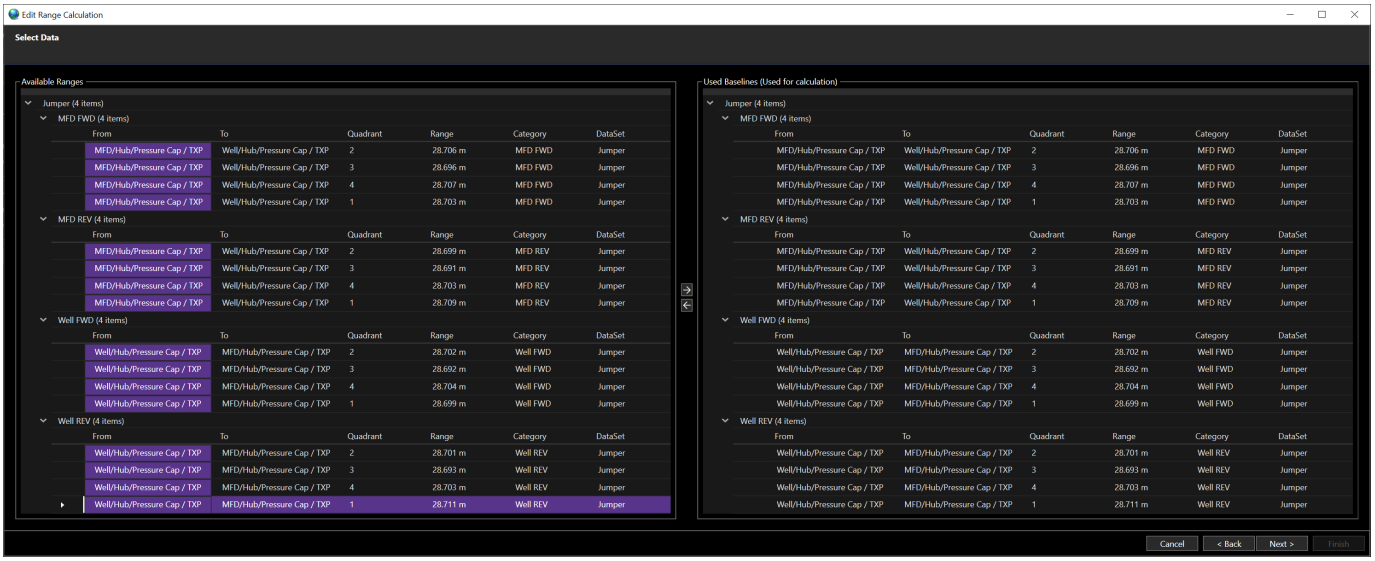


FIGURE 120 EDIT RANGE CALCULATION – SELECT DATA PAGE

4. On the data selection page select the ranges to be used in the calculation from the Available Ranges panel and click the right arrow to add them to the calculation, Used Baselines panel.
5. Click Next to open Bearing constraints page.

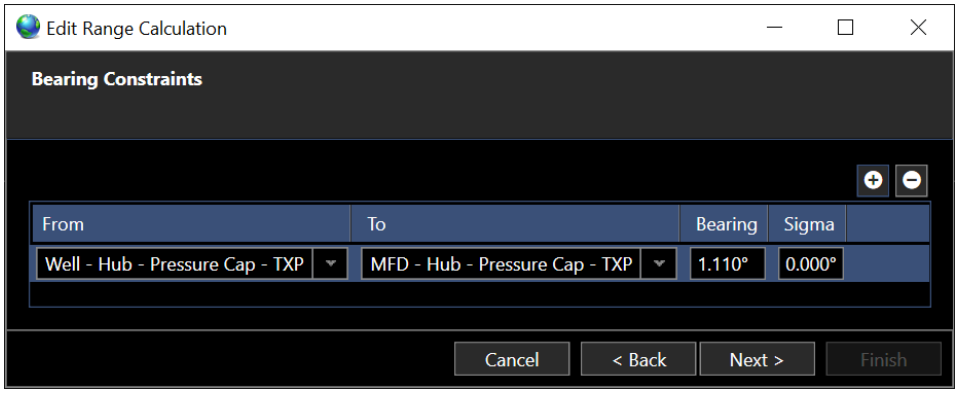


FIGURE 121 EDIT RANGE CALCULATION – BEARING CONSTRAINTS PAGE

6. On the Bearing constraints page click the + button to add a new bearing constraint. Select the from and to endpoints.
    a. End points must be transponders
    b. The bearing will be calculated based on the selected endpoints but may be edited
    c. By default, the standard deviation of the bearing constraint is 0.00 making it fixed. This can be edited to any other value

7. Click Next to open Structure Configurations page.

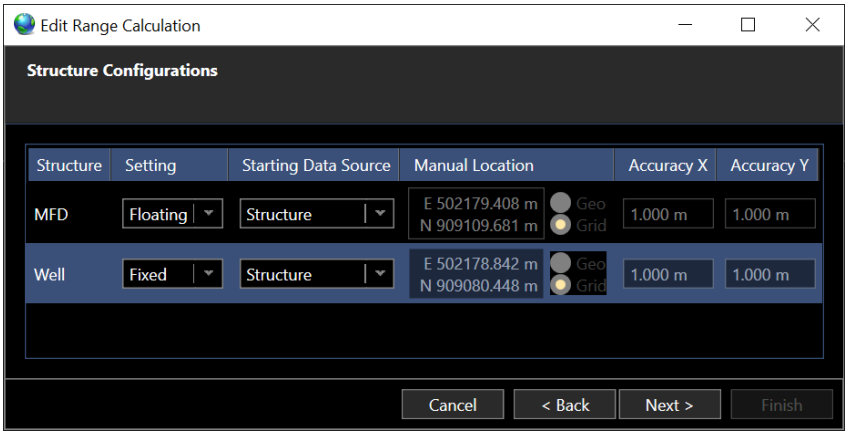


FIGURE 122 EDIT RANGE CALCULATION – STRUCTURE CONFIGURATIONS PAGE

8. On the Structure Configuration page, the base structure from all selected ranges in the calculation are extracted. Calculation parameters for these structures may be configured including:
    - **Setting:** Fixed, Floating or Constrained
        - **Fixed:** Structure will not be moved during the adjustment
        - **Floating:** Structure will move freely and does not have any position observations
        - **Constrained:** Structure may move but is constrained using the Accuracy X and Accuracy Y specified. This creates additional observations in the adjustment at the specified accuracy levels
    - **Starting Data Source:** Source of the starting coordinate in the adjustment. This can be set to Structure or Manual
        - **Structure:** Starting coordinate matches selected structure in the Infrastructue list
        - **Manual:** Coordinate may be entered for the structure
9. Click Next to open the Select Elevation Calcs page.

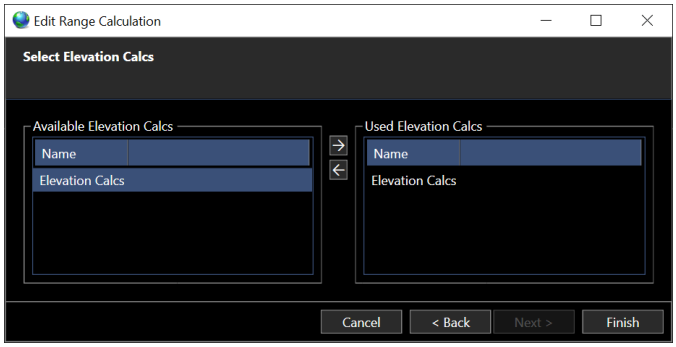


FIGURE 123 EDIT RANGE CALCULATION – SELECT ELEVATIONS CALCS PAGE

10. Click Finish for results.

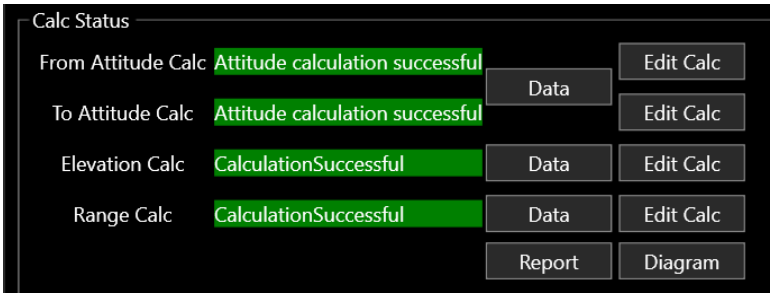


FIGURE 124 JUMPER CALCULATION – CALC STATUS

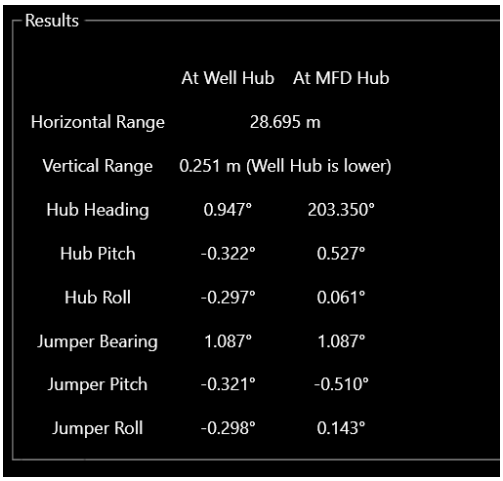


FIGURE 125 JUMPER CALCULATIONS – RESULTS

- **Report Button:** Produces a jumper calculation report
- **Diagram Button:** Produces a diagram showing relevant jumper information