

4D NAV

NavView User Guide – FLOWIT Module

Document:4DN_NVUG_M06_01ARelease:01Revision:AReleased:10/11/20244D Nav, LLC

REL	REV	ISSUE DESCRIPTION	PREPARED	REVIEWED	APPR OVED	DATE
01	А	Initial release	SW	GAW	GAW	October 11, 2024

© Copyright 2024 4D Nav LLC

Unless explicitly stated otherwise, all rights including those in copyright in the content of this document are owned or controlled by 4D Nav LLC (4D Nav). Except as otherwise expressly permitted under copyright law or by 4D Nav, the content of this document may not be copied, reproduced, republished, downloaded, posted, broadcast, or transmitted in any way without the written permission of 4D Nav.



Table of Contents

1	Inti	roducti	on	1
	1.1	Scope	9	1
	1.2	Instal	lation	1
	1.3	Licen	sing	1
2	Nav	/View a	and FLOWIT	2
	2.1	Starti	ng FLOWIT	2
	2.2	Basic	5	2
3	Sou	und Ve	locity Profile and CTD Cast	4
	3.1	Overv	iew	4
	3.2	Loadi	ng Sound Velocity or CTD	4
	3.2	.1 In	nport Sound Velocity Data	4
	3.3	Viewi	ng Sound Velocity Profile/CTD Cast	8
	3.3	.1 D	ata Tab	9
	3	.3.1.1	Details Panel	9
	3	.3.1.2	Data Panel	11
	3.3	.2 C	hart Tab	11
	3.3	.3 P	rofile Comparisons	12
	3.3	.4 C	ombining Profiles	13
4	Pre	ssure	to Depth Calculation	14
	4.1	Add a	Pressure to Depth Calculation	14
	4.1.	1 E	dit a Pressure to Depth Calculation	16
	4.1.	2 R	emove a Pressure to Depth Calculation	16
5	Infr	rastruc	ture	17
	5.1	Infras	tructure Components	17
	5.1.	1 Stru	uctures and Attributes	17
	5.1.	2 0	ccupation	18
	5.1.	3 F	le Hooks	18
	5.2	Addin	g a Structure	18
	5.2	.1 S ⁻	tructure Details Tab	20
	5	.2.1.1	General tab	21
		5.2.1.1	.1 Attached items- Hub	21
		5.2.1.1	.2 Attached items- Tool	23
		5.2.1.1	.3 Attached Items – transponder occupation	24



	5.2.1	1.2	Graphics Tabs – 2D and 3D	25
	5.2.2	Sta	ckup Diagram Tab	26
	5.2.3	Infr	astructure Import	26
	5.2.3	Structure File Format	26	
	5.2.3	3.2	Hub/Tool File Format	27
	5.2.3	3.3	Occupation File Format	28
	5.2.3	3.4	Order of Lines	28
	5.2.4	Infr	rastructure – 2D Maps	29
	5.2.4	4.1	Adding Structures	29
6	Data S	Sets		
6	.1 Ac	dd a D	Dataset	
6	.2 Re	emove	e a Dataset	31
7	Attitu	de Da	ta	31
7	.1 Ac	dding	Attitude Data	31
7	.2 In	nporte	ed Attitude Data	36
	7.2.1	Det	ails	
	7.2.3	Dat	a Sets Tab	
	7.2.4	Cal	culations Tab	
8	Tides.			
8	.1 Re	elative	e Tide	40
	8.1.1	Imp	porting Relative Tide Data	40
	8.1.2	Vie	wing and Editing Relative Tide Data	43
9	Elevat	ion D	ata	44
9	.1 De	epth l	_oops and Seabed Profiles	44
	9.1.1	Ado	d a Depth Loop	45
	9.1.2	Add	d a Seabed Profile	52
10	Baseli	nes		54
10	0.1 Ba	aselin	e Data Import	54
10	0.2 Ba	aselin	e Details	56
	10.2.1	His	togram Tab	56
	10.2.2	Tim	ne Series Tab	57
	10.2	.2.1	Editing Data in Time Series	58
	10.2.3	List	t Tab	58
	10.2	.3.1	Editing Data in the List Tab	60



10.2.3.2 Sound Velocity Editing61
10.3 Batch Editing Baselines63
11 Data Calculations64
11.1 Interim Calculations64
11.1.1 Attitude Calculations64
11.1.2 Elevation Calculations66
11.1.3 Baselines Calculations
11.1.3.1 Range Calculation Results
11.1.3.1.1 Structures
11.1.3.1.2 Observations
11.1.3.1.3 Results
12 Jumper Calculations
12.1 Create A Jumper Calculation79
12.2 Edit Jumper Calculation82
12.2.1 Edit Attitude Calc – From/To82
12.2.2 Edit Elevation Calc83
12.2.3 Edit Range Calc85

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.

FLOWIT ×		₹
Settings	Advanced	
▼ Environment		Apply
Sound Velocity		
Pressure to Depth Calculations		
Infrastructure		
Jumper Calculations		

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.



FLO	× TIWC		÷
	Settings	Advanced	
•	Environment		Apply
	Sound Velocity		
	Pressure to Depth Calculations		
	Infrastructure		
	Jumper Calculations		
	Data		
	Attitude		
	Tide		
	Elevation		
	Baselines		
	Interim Calculations		
	Attitudes		
	Elevation		
	Baselines		

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.



FLOWIT X		
FLOWIT × Settings Flowing Settings Sound Velocity Pressure to Depth Calculations Infrastructure Jumper Calculations	Same Time	

FIGURE 4 - SOUND VELOCITY MANAGEMENT

- 2. Click the solution 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.

🎱 Import S	ound Velocity			_		×
Settings						
Name	CTD Profile					
Location:	E 504343.662 m N 902147.198 m	Geo Grid				
Time			2	024-04-24 20:0	4:00	*
		Cancel		Next >		

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.

Import Sound Velocity			—		\times
Processing Settings					
Convert Pressure to	Depth				
Latitude:	N 8° 09.6873'				
Method:	Dynamic				
Gravity Equation:	UNESCO 1983	-			
Geopotential method	EOS-80 dynamic depth (1) (B5)	-			
Gravity Gradient:	2.184e-6 (Fofonoff and Millard Jr,1983	3) 🔍			
	Cancel < Back	Ne	ext >	Fin	ish

FIGURE 6 - IMPORT SOUND VELOCITY - PROCESSING SETTINGS

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

Import Sound Velocity										-	
File Settings											
- Input Parser											
Line Prefix:											
Header Rows: 0											
Delineation Delimited											
Delimiter Tab											
Culture: English (Ca	anada) *										
• ● ★ ₹											
Data Type	Units	Field Start	Field Size	Trim Start	Trim End	Multiplier	Tag				
Date/Time 🛛 👻	dd/MM/yyyy HH:mm:ss *			0	0						
Obs Sound Velocity	m/s 👻			0	0	1					
Pressure 👻	dbar 🗸			0	0	1					
Temperature *	degC ~			0	0	1					
Conductivity ~	mSm 👻			0	0	100					
Salinity ~	PSU *			0	0	1					
Density ~	kg/m3 ~			0	0	1					
Calc Sound Velocity	m/s *			0	0	1					
Data row start: 28 🔺	Apply Save As	Load									
Results					Raw						
DateTime	SoundVelocity Pressure	Temperatu	e Conduc	tivity	Gravity :						
24-Apr-2024 6:14:46 PM	1,541.466 m/s 3.076 dbar	28.65 degC	5,482.20	0 mSm 🔺	Time Sta	mp: 24/0	04/202	24 17:52:28			
24-Apr-2024 6:14:48 PM	1,541.410 m/s 4.024 dbar	28.67 degC	5,488.20) mSm	External	PSU Voltage :		24.553			
24-Apr-2024 6:14:50 PM	1,541.411 m/s 5.011 dbar	28.67 degC	5,480.8	0 mSm	Date / Ti	me SOL	JND V	/ELOCITY;M/SEC PRESSURE;D	DBAR TEMPERA	TURE;C	COND
24-Apr-2024 6:14:51 PM	1,541.426 m/s 6.017 dbar	28.67 degC	5,483.40) mSm	24/04/20	24 18:14:46		1541.4663.076 28.652 54.	.822 33.550 .	21.104	1541.2
24-Apr-2024 6:14:52 PM	1,541.439 m/s 7.055 dbar	28.67 degC	5,485.40) mSm	24/04/20	24 10:14:40		1541.4104.024 26.667 54 1541.4115.011 28.668 54	002 33.301 -	21.120	1541.3
24-Apr-2024 6:14:54 PM <	1.541.449 m/s 8.010 dbar	28.68 deaC	5.488.8) mSm ⇒	<	24-10-14:50		20.000 34	.000 53.329	511051	>
								Cancel < E	Back Next	>	Finish

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 D 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.

FLOWIT × Explorer Map		
Settings		\$ € ●
Environment	Name	Time
Sound Velocity	CTD Profile	24-Apr-2024 20:04:00.7
Pressure to Depth Calculations		
Infrastructure		
Jumper Calculations		

FIGURE 8 - SOUND VELOCITY MANAGEMENT

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



FLOWIT														- D
			Data Ch	art										_
Settings Environment		* • •	Data Cr	lart										
Sound Velocity	Name	Time	Namo	C	CID De-Él-									
Pressure to Depth Calculations	CTD Profile	24-Apr-2024 20:04:00.7	Nume		E 504242 609 m	Geo								
Infrastructure			Location:	1	N 902147.233 m	Grid								
Jumper Calculations			Time									2	024-04-24 20:04:00 🌐	•
			Descriptio	n D	escription									
			Shallowest	t Depth 3.0	080 m									
			Sound V	elocity: 1,5	541.466 m/s									
			Deepest D	epth 19	12.375 m									
			Sound V	elocity: 1,4	197.665 m/s									
			Average S	ound Velocity: 1,4	496.699 m/s									
			Average D	ensity: 1,0)31.926 kg/m3									
			Chec	k Depth										
			Bin	Profile										
			-Data											
													1	•
			Depth	Standard Depth	Depth Deviation	Velocity	Pressure	Density	Temperature	Salinity	Used			
			3.080 m	3.059 m	-0.021 m	1,541.466 m/s	4.461 psi	1,021.104 kg/m3	28.65 degC	33.55	✓			Ê
			4.029 m	4.001 m 4.092 m	-0.027 m	1,541.410 m/s	5.836 psi	1,021.126 kg/m3	28.67 degC	33.581	 ✓ ✓ 			
			6.024 m	5.983 m	-0.034 m	1 541 426 m/s	8 727 nsi	1,021.091 kg/m3	28.67 degC	33 544	·			
			7.064 m	7.015 m	-0.048 m	1,541,439 m/s	10.232 psi	1,021.120 kg/m3	28.67 degC	33.557	 ✓ 			
			8.020 m	7.965 m	-0.055 m	1,541.449 m/s	11.618 psi	1,021.139 kg/m3	28.68 degC	33.578				
			9.016 m	8.954 m	-0.062 m	1,541.466 m/s	13.061 psi	1,021.132 kg/m3	- 28.68 degC	33.566	✓			
													Cancel A	pply

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

FLOWIT														
Settings		400	Data C	vert										
* Environment	Nama	Time	Details	Details										
D Sound Velocity	CTD Profile	24-Apr-2024 20:04:00 7	Name		CTD Profile_Binned_1.000 m									
Pressure to Depth Calculations	CTD Profile_Binned_1.000 m	CTD Profile_Binned_1.000 m 24-Apr-2024 20:04:00.7			E 504343.608 m Q	Geo								
Intrastructure					N 902147.233 m	Grid								
Jumper Calculations			Time									2024-04-24	20104:00	· •
			Descriptio		escription									
			Shallowes	Depth 3.0	00 m									
			Sound V	elocity: 1.	541.466 m/s									
			Deenest f	ienth 19	12 000 m									
			formed	danten di	107 674 1-									
			Sound V	elocity. 12	497.074 mys									
			Average S	ound Velocity: 1,4	195.734 m/s									
			Average D	ensity: 1,0	031.569 kg/m3									
			Che	k Depth										
			Bin	Profile										
			Data											
													*5	٠
			Depth	Standard Depth	Depth Deviation			Density	Temperature	Salinity				
			3.000 m	3.059 m	0.000 m	1,541,466 m/s	4,461 psi	1,021,104 kg/m3	28.65 degC		1			
			4.000 m	4.001 m	0.000 m	1,541.410 m/s	5.836 psi	1,021.126 kg/m3	28.67 degC	33.581	✓			الک
			5.000 m	4.983 m	0.000 m	1,541,411 m/s	7.268 psi	1,021.091 kg/m3	28.67 degC	33.529	 Image: A set of the set of the			
			6.000 m	5.983 m	0.000 m	1,541,426 m/s	8.727 psi	1,021.106 kg/m3	28.67 degC	33.544	2			
			2000 m	7.015 m	0.000 m	1,541,439 m/s	10.232 psi	1,021,120 kg/m3	28.67 degt	33.557	2			
			9.000 m	8954 m	0.000 m	1.541.466 m/s	13.061 psi	1021132 kg/m3	28.68 deoC	33,566	~			
								A A A A A A A A A A A A A A A A A A A	and the second sec		-			
												G	noel Ap	pply

FIGURE 12 - BINNED PROFILE DETAILS

4D NAV

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.







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]".

4D NAV

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

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

 $G_e = 9.7803184 \text{ m/sec2}$

 $\phi = Latitude$

- 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.



Que Configure Dep	oth Calculation $ \Box$ $ imes$	Configure Dep	oth Calculation $ \Box$ $ imes$	Que Configure Depth C	alculation – \Box $ imes$
Name:	Depth Calc	Name:	Depth Calc	Name:	Depth Calc
Latitude:	N 45° 00.0000'	Latitude:	N 45° 00.0000'	Latitude:	N 45° 00.0000'
Gravity Gradient:	2.184e-6 (Fofonoff and Millard Jr,1983)	Density:	1,030.000 kg/m3	Gravity Gradient:	2.184e-6 (Fofonoff and Millard Jr, '
Gravity Equation:	UNESCO83 ×	Gravity Gradient:	2.184e-6 (Fofonoff and Millard Jr,1983)	Gravity Equation:	UNESCO83 V
Method:	Unesco 🛛 🗸 👻	Gravity Equation:	UNESCO83	Method:	Dynamic I *
		Method:	Density *	Geopotential Method:	EOS-80 dynamic depth (2)
	OK Cancel			CTD Profile:	None I *
			OK Cancel	Selection conforms to	OGP conversion code 166

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 nonuniform 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.

Create Struct	ure
Structure E	diting
Name:	PLET
Category:	Jumper Metrology
Location:	E 499163.430 m N 912603.955 m O Grid
Elevation:	-1500.000 m
Pitch:	0.000°
Roll:	0.000°
Heading:	294.540°
lcon	•
Cancel	< Back Next > Finish

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.



Create Structure				
Options				
Stackup Prese	t: Create Or	igin point only	/ -	
Add Transduc	er:			
Cancel	< Back		Finish	

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.

Structure Details	Stackup Diagram			
General 2D Gra	aphics 3D Graphics	2		
Name: PLET		Elevation: -1500.000 m		
Category: Jumper	Metrology	Pitch: 0.000°		
Location: E 499 N 912	163.430 m O Geo 603.955 m O Grid	Roll: 0.000° Heading: 294.540°		
Icon:	-			
Attached Items —				
		General	2D Graphics 3D	Graphics
	New Orig adds	Hub on Structure ^{Altribute} s a new hub/tool to the root	of the structure itself	
ŵ	New Tool/H	lub File Hoo	ok:	
		lcon:		~
		Path:	PLET/Origin	
		- Offects -		Absolute Location

FIGURE 22 NEW HUB ON STRUCTURE



🔮 Edit Tool/	Hub	_	×
Template	[Generic	•
Name:		New Tool/Hub	
Х:	[0.000 m	
Y:	[0.000 m	
Z:		0.000 m	
Relative Pitch:		0.000°	
Relative Roll:		0.000°	
Relative Head	ing: [0.000°	
File Hook:	[
lcon		-	
	OK	Cancel	

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.

Structure E	Details	Stackup	Diagram								
General	2D Gra	aphics	3D Graphi	cs							
Name:	PLET			Elevation:	-150	0.000 m					
Category:	Jumper	Metrolog	iy 🛛	Pitch:	0.000)°					
Location:	E 499 N 912	163.430 п 603.955 п	n O Geo n O Grid	Roll: Heading:	0.000)° 540°					
lcon:			*								
- Attached	ltems —										
			T 1	r 📕	•	General	2D Graphics	3D	Graphics		
			Origin			Attributes -	Pressure Can				
	-					File Hook:	PLFT				
		Ł	1100				3 				
	1	P	Pressu	ire Cap		Icon:	1 <u>4</u> 4				
						Path:	PLET/HUB/Pre	ssure	Сар		
									- Absolute Lo	cation	
						X:	0.000	m	10501010 20	F 499163 430 m	0.640
							0.000	m	Position:	N 912603.955 m	Grid Grid
							0.483	m	Elevation:	-1499.517 m	
						Relative Pi	tch: 0.000	•	Pitch:	0.000°	
						Relative Ro	oll: 0.000	•	Roll:	0.000°	
						Relative He	eading: 0.000	•	Heading (G): 294.540°	

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.

Structure [Details	Stacku	p Diagram						
General	2D G	raphics	3D Graphi	cs					
Name:	PLET			Elevation:	-1500	.000 m			
Category:	Jumpe	er Metrolo	ogy	Pitch:	0.000°				
Location:	E 49 N 91	9163.430 2603.955	m O Geo m O Grid	Roll: Heading:	0.000° 294.54	40°			
Icon:	•								
- Attached	ltems —								
			1	f II	•	General	2D Graphics	3D Graphics	
				N	ew Tra	nsponde	r Occupation of	n Selected Ite	m
	- 💎		Origin	A	dds a n	ew transp	onder occupation	as a sub item o	m
~	T		HUB		ne selec	File Hoo	ok PLET		
		4	Pressu	ure Cap		Icon:	i 🚇		
							=		

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.

	Structure D	etails Stackup	Diagram							
	General	2D Graphics	3D Graphi	cs						
	Name:	PLET		Elevation:	-1500.00	0 m				
	Category:	Jumper Metrolo	gy	Pitch:	0.000°					
	Location:	E 499163.430 n N 912603.955 n	n O Geo n O Grid	Roll: Heading:	0.000° 294.540°					
	lcon:		*							
ľ	Attached I	tems —								
			-		😑 Ge	neral 2D Gra	aphics 3D Graphics			
					S€	ettings ———		Transpond	ler Location	
		+	Origin		N	lame:	TP1	Position	E 499163.430 m 🔾 Ge	o
			HUB		c	Compatt Height:	0.970 m		N 912603.955 m 🔘 Gri	d
		iň.	D	6	F	ile Hook:	PLET	Elevation	-1498.547 m	
	Ť.		Flessu	ire Cap	P	ath:	PLET/HUB/Pressure Cap / TP1	DX:	0.000 m	
		1	TP1					DY:	0.000 m	
								DZ:	0.970 m	

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.



ltem	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

ltem	Description	Data Type	Example
Н:	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

ltem	Description	Data Type	Example
0:	Header	n/a	0:
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	01234

TABLE 3 OCCUPATION FILE LINE FORMAT

Example line: 0:0cc1,5.9,01234

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:Occ2,6.9,01235
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.
- 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.



Que Import Attitude	25	—		×
Reference Date				
Reference Date:	06-Aug-2024			
Source:	Imported			
DataSet:	Jumper			
	Default Dataset			
	Jumper			
	Cancel < Back	Next >	Fin	ish

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.

Import Attitudes	_		\times
File Option			
Multiple files have been selected. Please specify if these files are differe same attitude observation, or if they correspond to separate attitude o	ent quad bservati	rants of t ons.	he
O Separate Attitudes O Separate Quadrants			
Cancel < Back Ne	ext >	Fini	ish

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.


Import Attitudes	- 🗆 X
File Settings	
Header — Header Row Option: Fixed number of rows v Header Rows: 1 Date/Time Kind: Utc v	
Une Preitz Header Rows: 0 Delimetion Delimiter: Comma	
Culture: English (Canada) *	
Data Type Units Field Start Field Size Trim Start Trim End Multiplier Si	xigma Tag
- Pau and Burred Data	Test (C:\Users\scott\Desktop\Test.4di) v Apply Save As Load
	// Fusion Script Tool Log File
	// // Log Hint // HEADER,SchemaNo,ScriptFile,Date,Time
	// DEPTH,FromInst,Value,MeasurementError,Date,Time
	Cancel < Back Next > Finish

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 **Select** 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



	F	OLTA	TTCH.	.2110	Met	ro	0.3	10	0.	310.	0.00	9.26	Jul	202	4.22	:07:0	0		
	Ē	OLLP	ттсн	2110	Mot	ro -	0 3	<u> </u>	0	310	0 00	9 26	Jul	202	4 22	•07•0	13		
	T		ттсч	2110	Mot	ro, -	0.3	10,	.0	320	0.00	9,20	Jul	202	1 22	.07.0	16		
	T T		TTCH	2110	_Met	.10,-	0.3	10 , -	0.	220,	0.00	0,20	50UL	202	4,22	.07.1	1		
	r T	OLLP	TTCH,	,2110	_Met	10,-	0.2	90 , -	0.	320,	0.00	9,20	Jul	202	4,22	.07.1	. ⊥		
	F	OLLP	TTCH,	,2110	_Met	ro,-	0.3	00,-	•0•	320,	0.00	9,20	JUL	202	4,22	:07:1	.4		
	F	KOLTL	TTCH,	,2110	_Met	ro,-	0.3	00,-	•0.	.320,	0.00	9,26	Jul	202	4,22	:0/:1	. /		
	F	ROLLP	ITCH,	,2110	_Met	ro,-	0.3	00,-	•0.	310,	0.00	9,26	Jul	202	4,22	:07:1	.9		
	F	OLLP	ITCH,	,2110	_Met	ro,-	0.3	00 , -	0.	310,	0.00	9,26	Jul	202	4,22	:07:2	2		
	F	ROLLP	ITCH,	,2110	_Met	ro,-	0.3	00 , -	0.	320,	0.00	9,26	Jul	202	4,22	:07:2	.5		
	F	OLLP	ITCH,	,2110	Met	ro,-	0.2	90,-	0.	320,	0.00	9,26	Jul	202	4,22	:07:2	8		
	F	OLLP	ITCH,	,2110	Met	ro,-	0.2	90,-	0.	320,	0.00	9,26	Jul	202	4,22	:07:3	31		
	F	OLLP	ITCH.	2110	Met	ro,-	0.2	90. –	0.	320.	0.00	9.26	Jul	202	4,22	:07:3	34		
	F	OLLP	ттсн	2110	Met	ro	0.2	90. –	0.	320.	0.00	9.26	Jul	202	4.22	:07:3	37		
	Ē	OLLP	ттсн	2110	Mot	ro -	0 2	90, -	.0	320	0 00	9 26	Jul	202	1 22	•07•3	i a		
			TTCU	2110	_Mot	.10,	0.2	on,	0.	320,	0.00	0,20	Tul	202	1 22	.07./	2		
	F	OPPE	LICH,	,2110	_met	-10,-	0.2	90,-	.0.	320,	0.00	9,20	JUL	202	4,22	:07:4	Z		
Import Attitude	es																-		×
File Settings																			
- Header																			
Header Row O	option: F	Fixed number	of rows 👻																
Header Rows:	· _)																	
Date/Time Kin	at Li	lte																	
	. <u>.</u>	510																	
Line Prefix:	ROLLPIT	СН																	
Header Rows:	0																		
Delineation	Delimite	d 🔻																	
Delimiter:	Comma	· ·																	
Culture:	English (Canada) 👻																	
•																			
Data Type	Units		Field Start	Field Size	Trim Start	Trim End	Multipli	er Sigma	ı Ta	ig									
Name 🛛 👻		*			0	0	1	0											<u>^</u>
Roll ~	degree	e •			0	0	1	0											
Pitch *	degree	2 *			0	0	1	0											
Date *	dd MN	4Maooov 👻			0	0	1	0											
Time *	HH:mr	n:ss v			0	0	1	0											~
		nclination Im	port (CNUsers	NPublic\Docu	ments\/D N	av/Nav//iow	YOM Gu	(ana 2024)	local	\Station\Data	Matrologia	s\lmnort Ter	oplates\Inclin	ation Imp	ort 4da 🛛 🗶	Apply	Sava As	Load	
Raw and Parsed	d Data —	ncinution	pont (c. (osci.	of ablictboca	incho (40 h		(nom_ou)		teocur	(Station (Data	uncaologic	stimport ter	npiaces (incli	autori impe	Jit.Huly	прру	5446765	Loud	
Name ()	Roll (deg	gree) Pitch I	(degree) U	nknown ()	Date (dd N	ИММ уууу) (UTC+0.0)	Time (HH	l:mm:	ROLLPITCH,2	2110_Metro	,-0.310,-0.31	0,0.009,26 Ju	1 2024,22:0	7:00				
2110_Metro	-0.310°	-0.310	° 0.	009	26-Jul-2024	4		22:07:00.	0	ROLLPITCH,2	2110_Metro	,-0.300,-0.31	0,0.009,26 Ju	12024,22:0	7:03				
2110_Metro	-0.300°	-0.310	r 0.	009	26-Jul-2024	4		22:07:03.	0	ROLLPITCH,2	2110_Metro 2110_Metro	,-0.290,-0.32	0,0.009,26 Ju 0,0.009,26 Ju	1 2024,22:0	7:11				
2110_Metro -	-0.290°	-0.320	° 0.	009	26-Jul-2024	4		22:07:00.	0	ROLLPITCH,2	2110_Metro	,-0.300,-0.32	0,0.009,26 Ju	1 2024,22:0	7:14				
2110_Metro	-0.300°	-0.320	۰ م	009	26-Jul-2024	4		22:07:14.	0										
															Consul	a De al	Next		
															cancer	< Dack	INEXU >		100 C

FIGURE 39 IMPORTED ATTITUDE DATA EXAMPLE

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



Import Attitudes					_		\times
Import Settings							
Location: PLET -	HUB - Pressure Ca	ıp					*
File Name	Quadrant	Pitch	Roll	Heading			
2111 PLET POS A	Quadrant 1 👻	-0.519°	-0.436°				
2111 PLET POS B	Quadrant 2	0.297°	-0.617°				
2111 PLET POS C	Quadrant 3	0.562°	0.201°				
2111 PLET POS D	Quadrant 4	-0.243°	0.419°				
		Cancel	<	Back		Fin	iish

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.

Settings Environment	Selected Data	v v						
Infrastructure								
▼ Data	 Jumper (1 	item)						
Data	✓ PLET/	HUB/Pressure Cap (2 items)						
Attitude		Name	Location	Pitch	Roll	Heading	Category	DataSet
Tide	►	Import 2110 PLET POS A	PLET/HUB/Pressure Cap	-0.543°	-0.259°	294.540°	PLET PC FWD	Jumper
Elevation	-							
Baselines		Import 2111 PLET POS A	PLET/HUB/Pressure Cap	-0.530°	-0.294°	294.540°	PLET PC REV	Jumper
 Interim Calculations Jumper Calculations 								

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

Name	Name Import 2110 PLET POS A									
Location:	PLET - HUB - Pressure Cap 💌									
Category:	PLET PC FWD									
Dataset:	Jumper 🛛									
Attitude - Pitch: -0 Roll: -0	Attitude Pitch: -0.543° Roll: -0.259°									
– Heading –										
Hub Head	ling: 294.540°									
Use Hub	Heading: 🖌									
	Convergence: -0.001°									
	True Heading: 294.539°									
	Grid Heading: 294.540°									
	σ Heading: 0.000°									
	σ Pitch/Roll: 0.024°									

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 dropdown list
- Dataset: Dataset the attitude data is attached to. This can be changed from dropdown 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.



	Diagram	Data S	ets	Calcula	ations													
			_					÷										
I٢	Quadrants								Quad	drant .	Attitude							
	Name		Quad	rant	Pitch	Roll	Heading	Used	Nam	ne:	2110 PLE	T POS A	Quadran	t: 1 - *	Used: 🗸]		
	2110 PLE	T POS A			-0.317°	-0.297°	N/A		Qu	adran	nt Observ	vations —						
	2110 PLE	T POS B			0.427°	-0.624°	N/A		Pit	tch -	0.317°	Sigma 0.	005° Ro	l -0.297	° Sigma ().007°	Heading	
	2110 PLE	T POS C	3		0.763°	0.199°	N/A	✓	А	t	Pitch	Res	Roll	Res	Heading	Res	Time (Utc)	Usec
	2110 PLE	T POS D	4		-0.100°	0.476°	N/A	✓			-0.310°	0.007°	-0.310°	-0.013°	N/A	N/A	26-Jul-2024 22:07:00.0	1
											-0.310°	0.007°	-0.300°	-0.003°	N/A	N/A	26-Jul-2024 22:07:03.0	 Image: A set of the set of the
											-0.320°	-0.003°	-0.310°	-0.013°	N/A	N/A	26-Jul-2024 22:07:06.0	✓
											-0.320°	-0.003°	-0.290°	0.007°	N/A	N/A	26-Jul-2024 22:07:11.0	 Image: A set of the set of the
											-0.320°	-0.003°	-0.300°	-0.003°	N/A	N/A	26-Jul-2024 22:07:14.0	✓
											-0.320°	-0.003°	-0.300°	-0.003°	N/A	N/A	26-Jul-2024 22:07:17.0	✓
											-0.310°	0.007°	-0.300°	-0.003°	N/A	N/A	26-Jul-2024 22:07:19.0	✓
											-0.310°	0.007°	-0.300°	-0.003°	N/A	N/A	26-Jul-2024 22:07:22.0	✓
											-0.320°	-0.003°	-0.300°	-0.003°	N/A	N/A	26-Jul-2024 22:07:25.0	✓
											-0.320°	-0.003°	-0.290°	0.007°	N/A	N/A	26-Jul-2024 22:07:28.0	<
											-0.320°	-0.003°	-0.290°	0.007°	N/A	N/A	26-Jul-2024 22:07:31.0	✓
											-0.320°	-0.003°	-0.290°	0.007°	N/A	N/A	26-Jul-2024 22:07:34.0	<
											-0.320°	-0.003°	-0.290°	0.007°	N/A	N/A	26-Jul-2024 22:07:37.0	✓
											-0.320°	-0.003°	-0.290°	0.007°	N/A	N/A	26-Jul-2024 22:07:39.0	✓
											-0.320°	-0.003°	-0.290°	0.007°	N/A	N/A	26-Jul-2024 22:07:42.0	✓

FIGURE 45 ATTITUDE DATA SETS TAB

7.2.4 CALCULATIONS TAB

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

Dia	agram	Data S	ets Calc	ulations													
A	ttitude C	alculatio	n ———											Heading Ca	alculation —		
					Pi	essure Cap					Solution OK			Roforonco	Rocontaclo H	loading	
R	eference	Heading	g (G): 294.54	10°							Observation	Count Of	ĸ	Kererence	neceptacie il	ieaunig.	
	Heading	(Grid)	Orig Pitch	Rotated Pitch	Res	Sigma Pitch	Orig Roll	Rotated Roll	Res	Sigma Roll		Pitch	Roll	Heading	Quadrant	Res	Gyro C-O:
	2	94.540°	-0.317°	-0.317°	0.031°	0.005°	-0.297°	-0.297°	0.022°	0.007°	Offset:	-0.543°	-0.259 ⁻ 0.061°				Average:
		24.540°	0.427°	-0.624°	-0.026°	0.006°	-0.624°	-0.427°	-0.021°	0.008°	C-O:	0.000°	0.000°				Convergence:
	1	14.540°	0.763°	-0.763°	0.027°	0.005°	0.199°	-0.199°	0.001°	0.007°	Misclosure:	0.000°	0.000°				Heading:
	21	04.540°	-0.100°	-0.476°	-0.036°	0.000°	0.476°	-0.100°	-0.006°	0.006°	95%:	0.030° 0.074°	0.016° 0.038°				
												0.000	0.000				

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.







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.

Sreate Tide Dep	oloyment	_		×
Attributes				
Name:	Depth Loop 1 Ti	ide		
Location	E <mark>499145.404</mark> r N 912613.015 r	n O Ge n O Gr	eo rid	
Reference Date:	08-Aug-2024		• 15	
DataSet:	Jumper		¥	
Cancel	< Back N	ext >	Fir	nish

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.

Edit/Confirm Observation	ns								—		×
TIDE_Loop1_HUB_PY_2P6	j_Close.txt										
Average: -2004.274 m Sto	d: 0.000 m Mi	lin: -2004.27	′4 m Max	: -2004.274 m	Spread: 0.0	00 m Count: 7	Rejected: 0				
TimeStamp Eler	vation Re	esidual Use	ed								
8/9/2024 7:01:36 AM -20	04.274 m 0.0	000 m 🔽									
8/9/2024 7:01:40 AM -20	04.274 m 0.0	000 m 🗸									
8/9/2024 7:01:43 AM -20	04.274 m 0.0	000 m 🗸									
8/9/2024 7:01:47 AM -20	04.274 m 0.0	000 m 🛛 🗸									
8/9/2024 7:01:51 AM -20	04.274 m 0.0	000 m 🗸									
8/9/2024 7:01:55 AM -20	04.274 m 0.0	000 m 📝									
8/9/2024 7:02:10 AM -20	04.274 m 0.0	000 m 🔽									
							Cancel	< Back	Next >	Fin	ish

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.



•	Settings Environment I Sound Velocity	Se Ju	umper v	• 0
	Pressure to Depth Calculations		Name	DataSet
•	Infrastructure		Depth Loop 1 Tide	Jumper
	Attitude Tide Elevation Baselines			
•	Interim Calculations			
	Jumper Calculations			

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.

Add Tide Set	
Attributes	
Reference Date: 09-Aug-2024	
Cancel < Back	Finish

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.

Settings Environment	Selected Datasets	 ● ●
Sound Velocity	Name	DataSet
Infrastructure		
▼ Data		
Attitude		
Tide		
Elevation		
Baselines		
Interim Calculations		
Jumper Calculations		

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.

Create Elevation	Loop	—	\times
Attributes			
Name:	Depth Loop 1		
Notes:			
Reference Date:	12-Aug-2024		
Tide Deployment:	Depth Loop 1 Tide		
Tool Offset:	0.000 m		
C-O:	0.000		
DataSet:	Jumper v		
	Cancel < Back	Next >	ish

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.

Create Elevation Loop			- 🗆 X
File Settings			
⊢ Header			
Header Row Option: Fixed number of rows			
Honder Power			
Date/Time Kind: Utc			
Line Prefix:			
Header Rows: 0			
Delimiter: Comma 🛛 👻			
Culture: English (Canada) 👻			
Data Type Units Field Start	Field Size Trim Start Trim E	nd Multiplier Sign	na Tag
Timestamp • hh:mm:ss dd/MM/yyyy •	0 0	1 0	
Atmospheric Pressure v mbar v	0 0	1 0	
Pressure y psi y	0 0	1 0	
C	Default Elevation Import (C:\User	rs\Public\Documents\4[D Nav\NavView\FLOWIT User Guide\Shared\Data\ElevationImportSettings.4di) Y Apply Save As Load
Raw and Parsed Data			
Timestamp (hh:mm:ss dd/MM/yyyy) (UTC+0.0) Atmospheric Pressure	(mbar) Pressure (psi)		Time,Data: Vaisala Barometer/Weather stat (Vaisala baroData: Vaisala Barometer/Weather stat (Vaisala temp),Data: Mobile PAR(
01-Jan-0001 00:00:00.0 0.000 mbar	0.000 psi		U3:01:28 30/06/2024, 1011.0000, 2959.3320
30-Jun-2024 03:01:28.0 1,011.000 mbar	2,959.332 psi		03:01:29 30/06/2024, 1011:0000, 2959 3260
30-Jun-2024 03:01:29.0 1,011.000 mbar	2,959.326 psi		03:01:31 30/06/2024, 1011.0000, 2959.3320
30-Jun-2024 03:01:30.0 1,011:000 mbar	2,959,320 psi		
			4
			Cancel < Back Next > Finish

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



Create Elevation L	.oop	_	\times
Select Depth Calc	ulation		
Jumper Density	r		
Depth Settings -			
Name:	Jumper Density		
Latitude:	N 8° 15.3653'		
Density:	1,031.569 kg/m3		
Gravity Gradient	2.184E-06		
Gravity Equation	: UNESCO83		
Method:	Density		
Cancel	< Back	Next >	

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.

Create Elevation Loop							- 🗆 X
File Associations							
							Has Mudline Generate Distances Associate Tides on Time 🛨 🛡
Name		File Modified Time UTC		New Name			Tide Reference
PARO_Loop1_HUB_PY_2P6_Open_20240630_025139_C	30-Jun-2024 05:51:39.0	03-Jul-2024 16:31:40.0				PLET - HUB - Pressure Cap 🛛	TIDE_Loop1_HUB_PY_2P6_Open.txt - 09-Aug-2024 06:51:37.0 (Utc)
PARO_Loop1_HUB_PY2-P MFD 001_20240630_025614_C	30-Jun-2024 05:56:14.0	03-Jul-2024 16:31:40.0		PARO_Loop1_HUB_PY2-P_MED_001_20240630_025614_C	0.000 m	Manifold HUB - HUB - Pressure Cap 👻	TIDE_Loop1_HUB_PY2-P MED 001.bxt - 09-Aug-2024 06:56:10.0 (Utc)
PARO_Loop1_HUB_PY_2P6_Close_20240630_030127_C	30-Jun-2024 06:01:28.0	03-Jul-2024 16:31:40.0		PARO_Loop1_HUB_PY_2P6_Close_20240630_030127_C	0.000 m	PLET - HUB - Pressure Cap *	TIDE_Loop1_HUB_PY_2P6_Close.txt - 09-Aug-2024 07:01:36.0 (Utc)
							Cancel < Back Next > Finish

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.

Confirm Import		-	
PARO_Loop1_HUB_PY_2	P6_Close_20240630_030127_C.NPD		
Attributes			
Filename:	PARO_Loop1_HUB_PY_2P6_Close_20240630_030127_C.NPD		
Average:	2,959.331 psi Min: 2,959.326 psi Max: 2,959.334 psi Spre	ad: 0.008 p	osi
Std:	0.003 psi		
Average Atmospheric:	14.663 psi Min: 14.662 psi Max: 14.663 psi Spre	ad: 0.001 p	osi
Location:	PLET - HUB - Pressure Cap 🔹		
Tide Set:	TIDE_Loop1_HUB_PY_2P6_Close.txt - 09-Aug-2024 07:01:36.0 (Utc)		
Tool Offset:	0.000 m		
Pressure C-O:	0.000 psi		
Pressure Atmosphe	ric Pressure		
Time (Utc)	Pressure Residual Used		
30-Jun-2024 03:01:28.0	2,959.332 psi 0.001 psi 📝		<u>^</u>
30-Jun-2024 03:01:29.0	2,959.326 psi -0.005 psi 🖌		
30-Jun-2024 03:01:30.0	2,959.326 psi -0.005 psi 🔽		
30-Jun-2024 03:01:31.0	2,959.332 psi 0.001 psi 🔽		
30-Jun-2024 03:01:32.0	2,959.332 psi 0.001 psi 📝		
30-Jun-2024 03:01:33.0	2,959.328 psi -0.003 psi 🖌		
30-Jun-2024 03:01:34.0	2,959.328 psi -0.003 psi 🖌		
30-Jun-2024 03:01:35.0	2,959.332 psi 0.001 psi 📝		-
	Cancel < Back Ne	ext >	

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.

•	Settings Environment	S	elected Da Jumper	tasets •		9 •					Report
	Sound Velocity	~	lumpor	(1 itom)			Attributes	Obse	ervations		
	Pressure to Depth Calculations	Ť	Jumper	Name	DataSet						
	Infrastructure		•	Depth Loop 1	lumper		Name:		Depth Loop 1		
•	Data			beput boop i	Samper		Used:		✓		
	Attitude						Depth Calcul	ation:	Jumper Density		
	Tide						Notes:				
	Elevation						Dataset:	[Jumper		 •
•	Interim Calculations								· · · · · · · · · · · · · · · · · · ·		
	Jumper Calculations										
										Cancel	Apply

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.

Create Elevation Loop								- 🗆 X
File Associations								
								Has Mudline Generate Distances Associate Tides on Time 🔹 🖶
Name	Raw Data Time 🔺	File Modified Time UTC	Create Location	New Name	Along Line	Location		Tide Reference
PARO_Loop4_PY_2P6_Open_20240630_034843_C	30-Jun-2024 06:48:44.0	03-Jul-2024 16:31:42.0		PARO_Loop4_PY_2P6_Open_20240630_034843_C		PLET - HUB - Pressure Cap	*	TIDE_Loop4_PY_2P6_Open.txt - 13-Aug-2024 07:49:37.0 (Utc)
PARO_Loop4_PY_2P6_SB_20240630_040421_C	30-Jun-2024 07:04:21.0	03-Jul-2024 16:31:42.0	✓	PARO_Loop4_PY_2P6_SB_20240630_040421_C	4.000 m	PLET - HUB - Pressure Cap	~	TIDE_Loop4_PY_2P6_SB.txt - 13-Aug-2024 08:04:17.0 (Utc)
PARO_Loop4_SB1_20240630_041051_C	30-Jun-2024 07:10:52.0	03-Jul-2024 16:31:42.0	✓	PARO_Loop4_SB1_20240630_041051_C	8.000 m	PLET - HUB - Pressure Cap	×	TIDE_Loop4_SB1.txt - 13-Aug-2024 08:10:47.0 (Utc)
PARO_Loop4_SB2_20240630_041457_C	30-Jun-2024 07:14:57.0	03-Jul-2024 16:31:42.0	 Image: A set of the set of the	PARO_Loop4_SB2_20240630_041457_C	12.000 m	PLET - HUB - Pressure Cap	~	TIDE_Loop4_SB2.txt - 13-Aug-2024 08:15:07.0 (Utc)
PARO_Loop4_SB3_20240630_041825_C	30-Jun-2024 07:18:26.0	03-Jul-2024 16:31:42.0	✓	PARO_Loop4_SB3_20240630_041825_C	16.000 m		~	TIDE_Loop4_SB3.txt - 13-Aug-2024 08:18:27.0 (Utc) *
PARO_Loop4_SB4_20240630_042110_C	30-Jun-2024 07:21:11.0	03-Jul-2024 16:31:42.0	✓	PARO_Loop4_SB4_20240630_042110_C	20.000 m	PLET - HUB - Pressure Cap	~	TIDE_Loop4_SB4.txt - 13-Aug-2024 08:21:07.0 (Utc) *
PARO_Loop4_SB5_20240630_042354_C	30-Jun-2024 07:23:54.0	03-Jul-2024 16:31:42.0	1	PARO_Loop4_SB5_20240630_042354_C	23.000 m	PLET - HUB - Pressure Cap	~	TIDE_Loop4_SB5.txt - 13-Aug-2024 08:23:51.0 (Utc) *
PARO_Loop4_SB6_20240630_042624_C	30-Jun-2024 07:26:24.0	03-Jul-2024 16:31:42.0	✓	PARO_Loop4_SB6_20240630_042624_C	27.000 m	PLET - HUB - Pressure Cap	~	TIDE_Loop4_SB6.txt - 13-Aug-2024 08:26:21.0 (Utc) *
PARO_Loop4_SB7_20240630_042914_C	30-Jun-2024 07:29:14.0	03-Jul-2024 16:31:42.0	✓	PARO_Loop4_SB7_20240630_042914_C	31.000 m	PLET - HUB - Pressure Cap	~	TIDE_Loop4_SB7.txt - 13-Aug-2024 08:29:13.0 (Utc) *
PARO_Loop4_SB8_20240630_043432_C	30-Jun-2024 07:34:32.0	03-Jul-2024 16:31:42.0	√	PARO_Loop4_S88_20240630_043432_C	35.000 m	PLET - HUB - Pressure Cap	~	TIDE_Loop4_S88.txt - 13-Aug-2024 08:34:29.0 (Utc)
PARO_Loop4_PY2-P MFD_SB_20240630_043737_C	30-Jun-2024 07:37:38.0	03-Jul-2024 16:31:42.0	1	PARO_Loop4_PY2-P MFD_SB_20240630_043737_C	39.000 m	PLET - HUB - Pressure Cap	*	TIDE_Loop4_PY2-P MFD 001_SB.txt - 13-Aug-2024 08:37:39.0 (Utc) *
PARO_Loop4_PY2-P MFD_20240630_044550_C	30-Jun-2024 07:45:51.0	03-Jul-2024 16:31:42.0		PARO_Loop4_PY2-P MFD_20240630_044550_C	0.000 m	Manifold HUB - HUB - Pressure Cap	•	TIDE_Loop4_PY2-P MFD 001.txt - 13-Aug-2024 08:46:32.0 (Utc)
PARO_Loop4_PY_2P6_Close_20240630_045038_C	30-Jun-2024 07:50:38.0	03-Jul-2024 16:31:42.0		PARO_Loop4_PY_2P6_Close_20240630_045038_C		PLET - HUB - Pressure Cap	*	TIDE_Loop4_PY_2P6_Close.txt - 13-Aug-2024 08:50:37.0 (Utc)
								Cancel < Back Next > Finish

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

Settings Environment	Selected D	Datasets Dataset,Jumper 👻		•															Report
Sound Velocity	✓ Jumpe	er (2 items)			Attributes Observat	ions													
Pressure to Depth Calculations		Name	DataSet		Misclosure: -0.0	38 m -	Total Misclosure: 0.02	4 m											
■ Data		Depth Loop 1	Jumper		A+		Obe Time (Utc)	A Timo D	Jonth	Offent Micclosure	Tida Ca	r Danth Relative	D Llead						
Attitude	•	Seabed Profile	Jumper		PLFT - HUR - Pressure (an	30-lun-2024 03:48:44 0	00-00-00 20	011 582 m i	0.000 m 0.000 m	0.000 m 201	1582 m 0.000 m							
Tide					PARO_Loop4_PY_2P6_SI	_20240	30-lup-2024 04:04:21 0	00:15:37 20	016513 m	0.000 m 0.006 m	0.030 m 201	6537 m 4955 m							
Elevation					630_040421_C - Origin PARO Loop4 SB1 2024	630.04													
Baselines					1051_C - Origin		30-Jun-2024 04:10:52.0	00:22:08 20	016.636 m	0.000 m 0.009 m	0.039 m 201	6.667 m 5.085 m	~						
Interim Calculations					PARO_Loop4_SB2_2024 1457_C - Origin	1630_04	30-Jun-2024 04:14:57.0	00:26:13 20	017.056 m	0.000 m 0.010 m	0.039 m 201	7.085 m 5.503 m							
Jumper Calculations					PARO_Loop4_SB3_2024 1825_C - Origin	630_04	30-Jun-2024 04:18:26.0	00:29:42 20	017.298 m	0.000 m 0.012 m	0.049 m 201	7.335 m 5.753 m	✓						
					PARO_Loop4_SB4_2024 2110_C - Origin	630_04	30-Jun-2024 04:21:11.0	00:32:27 20	017.522 m	0.000 m 0.013 m	0.050 m 201	7.559 m 5.977 m							
					PARO_Loop4_SB5_2024 2354_C - Origin	630_04	30-Jun-2024 04:23:54.0	00:35:10 20	017.609 m	0.000 m 0.014 m	0.053 m 201	7.649 m 6.067 m	✓						
					PARO_Loop4_SB6_2024 2624_C - Origin	630_04	30-Jun-2024 04:26:24.0	00:37:40 20	017.693 m ·	0.000 m 0.015 m	0.059 m 201	7.737 m 6.155 m							
					PARO_Loop4_SB7_2024 2914 C - Origin	630_04	30-Jun-2024 04:29:14.0	00:40:30 20	017.723 m	0.000 m 0.016 m	0.028 m 201	7.735 m 6.153 m	✓						
					PARO_Loop4_SB8_2024 3432_C - Origin	630_04	30-Jun-2024 04:34:32.0	00:45:48 20	017.862 m ·	0.000 m 0.018 m	0.067 m 201	7.911 m 6.329 m							
					PARO_Loop4_PY2-P MFD_SB_20240630_043	/37_C -	30-Jun-2024 04:37:38.0	00:48:54 20	017.885 m	0.000 m 0.019 m	0.069 m 201	7.934 m 6.352 m	>						
					Manifold HUB - HUB - F	ressure	20 Jun 2024 04:45:51 0	00-57-07 20	011 015 m	0.000 m .0.022 m	0.042 m 201	1226 m 0.246 r							
					Cap PLET - HLIR - Processo C	20	20-Jun-2024 04:50:28.0	01-01-54 20	011.544 m	0.000 m 0.023 m	0.062 m 201	1592 m 0.000 m	·· ··						
					FEET - HOB - Flessure C	ap	30 301 2024 04.30.30.0	01.01.34 20	511.544 III ·	0.000 111 0.024 111	0.002 11 20	1.502 11 0.000 11						00	Export *
					PARO_Loop4_SB3_202	0630_04	1825_C.NPD		PAR	D_Loop4_SB4_20240	530_042110_C.N	PD		PARO_Loop	×4_SB5_20	240630_04235	54_C.NPD		
					PARO_Loop4_SB6_202	0630_04	12624_C.NPD		PAR	D_Loop4_SB7_20240	530_042914_C.N	PD		PARO_Loop	54_SB8_20	240630_04343	32_C.NPD		
					PARO_Loop4_PY2-P M	D_SB_20	240630_043737_C.NPD		PA	RO_Loop4_PY2-P MF	D_20240630_04	4550_C.NPD		PARO_Loop	4_PY_2P6	Close_202406	530_045038_0	C.NPD	
					PARO_Loop4_PY_2P6_0	0pen_202	240630_034843_C.NPD	PARO	_Loop4_PY_3	2P6_SB_20240630_04	0421_C.NPD	PARO_Loop4	SB1_202406	30_041051_C.N	IPD	PARO_Loop	4_SB2_20240	0630_04145	57_C.NPD
					Attributes					Chart Pres	ure Atmosp	heric Pressure							
					Name:	PARO	Loop4_PY_2P6_Open_20	240630_0348	343_C.NPD	2959.202									
					Reference Time (Utc)		Sunday, June 30, 2	024 3:48:44 /	AM 🗘 👻	2959.2									
					Location:	PLET -	HUB - Pressure Cap		•	2050 109									
					Tide Set:	Seabe	d Profile Tide - TIDE Loo	p4 PY 2P6 C	Dpen.txt ~	2555.158			<u>A</u>				A		
					Tool Offset:	0.000	- m			2959.196	\ A		Λ	$\Lambda \Lambda I$	ΝЛ	\square			
					C Minus O:	0.000	psi			52959.194 %							- MA	\square	
					Uradi	1				£ 2959.192					\rightarrow	╞═─╿			
	_									2959.19					V		VY A		
					Results		2050 101			2959.188									
					Awg Pressure:		2,959.194 psi			2959,186	0.0.02:48:50.0	02:40:00 0 02:40	10 0 02:40	0.20 0 02:40:2	0.0.02:40	40.0.02:40:1	50.0.02:50:0	0 0 02:50	10 0 03:50:2
					Average Atmospheri	Pressure	e: 14.666 psi			03:48:4	0.010314015010	05.45100.0 03:45	.10.0 03:45	.2010 03:4913 Time	0.0 03:45	40101058498	501010515010	0.0 03:50	ATOLO (05)50(2)
																		Cancel	Anote
																		Cancer	трріу

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

 To add or import baseline data, select the Dutton 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

New Ranges Option		_	\times
Range Creation Option			
Range Create Option:	Manual		
	Manual		
	Archive		
	Fusion v1 MDB		
	Fusion v2 CSV		
Cance	Custom Text		
	4D Nav LBL File		

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).

🍚 Range Obser	vation Editing									- [
Summary —		1	0etails —								
From:	Manifold HUB - HUB - Pressure Cap - TP *		Avg: 28.	706 m	RMS: 0.002 m	σ: 0.00	3 m Spread	d 0.010 m O-C	Calculated: 39	9.002 m Use	d 20 of 20
From Address:	6103 *		Bin 0.0	50 m	👻 Show 🧿 U	sed 🔿	All Gate	e Values Clean			
То:	PLET - HUB - Pressure Cap - TP1		Histog	am	Time Series	List					
To Address:	6102 *								• •	• N ·	
Computed Sur	nmary							Forward	Revers	ie 🔍 Not	Used
Range:	28.706 m			Mai	nifold HUB/H	HUB/I	Pressure	Cap(6103) to	PLET/HU	B/Pressur	e Cap(
RMS:	0.002 m		nt	8 - 7 -							
σ:	0.003 m		Coul	6 -							
χ2 Test	Failed Low			4 – 3 –							
Quadrant:	2 *			2 - 1 -							
Category:	RNG_FWD_03_6103 to 6102_PY2-P MFD001 to PY_2P6.txt			0	28.T		28.7	28.7	28.7	Ę	no 1
Dataset:	Jumper v				02		05	07	10		13
Used:							Rar	nge (m)			
									ОК	Cancel	Apply

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.



etails													
n RMS: 0.00	2 m o: 0).003 m	Spread 0.010	m O-C C	alculated: 39.00	2 m Used 2	20 of 20						
* Show	O Used		Gate Value	s Clean									
nisogram nine senes ust													
	From	То	TWTT (µs)	TAT (ms)	SV	Baseline	Residual	σ ranging	σSV	σ	W-Test	Status	Used
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	✓
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	 Image: A set of the set of the
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	\checkmark
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	✓
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	✓
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	✓
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	✓
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	✓
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	✓
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	✓
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	✓
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	✓
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	✓
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	✓
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	✓
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	✓
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	~
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	✓
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	✓
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	✓
	RMS: 0.00 ✓ Show Time Seri 05:42:05.0	RMS: 0.002 m 0 Show<	RMS: 0.002 m c: 0.003 m Show< Uset All Time Series List From To 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0 6103 6102 05:42:05.0	RMS: 0.002 r.or All Gate Value Time Server List Time Server List Time Server List Show Gate Value 05:42:05.0 G103 G102 238324 05:42:05.0 G103 G102 238326 05:42:05.0	RMS: 0.002 m or 0.003 m Spread 0.010 m O.C Q Show \bullet Ust Stand Values Clean Time Series Q OS42:05:0 G102 238324 200 OS42:05:0 G102 238326 200 OS42:05:0 G103 G102 238326 200	RMS: 0.002 m r. 0.003 m Spread 0.01 m O.C. Calculated: 39.00 Show Ust Gate Values Clean Time Server List Clean SV Show 6103 6102 238324 200 1,498.000 m/s 05:42:05.0 6103 6102 238326 200 1,498.000 m/s 0	RMS: 0.002 m or 0.003 m Spread 0.010 m Or C Calculated: 39.02 m Used 2 Show \bullet U = 0 Clean Time Series Time Series Show \bullet Series Time Series Time Series Show \bullet Series Show \bullet Series Show \bullet Sort Time Series Show \bullet Series Show \bullet Series Show \bullet Sort Show \bullet Sort Show \bullet Sort Show \bullet Sort Show \bullet Sort Show \bullet Sort Show \bullet Sort Show Onlys Sort Show Onlys So	RMS: 0.02 m or 0.03 m s view of 200 m or 0.03 m re 100 m or 0.000 m re 100 m re	RMS: 0.02 m or 0.03 m Spread 0.01 m O. Calculated: 39.002 m Used 2.0 of 20 Show Used All Gate Values Clean Time Serve List Clean State Values Clean Show Tom To TVTT (µs) TAT (ms) SV Baseline Residual or anging 05:42:05.0 6103 6102 238324 200 1,498.000 m/s 28.705 m 0.002 m 0.015 m 05:42:05.0 6103 6102 238324 200 1,498.000 m/s 28.708 m 0.001 m 0.015 m 05:42:05.0 6103 6102 238324 200 1,498.000 m/s 28.702 m 0.004 m 0.15 m 05:42:05.0 6103 6102 238324 200 1,498.000 m/s 28.704 m 0.002 m 0.015 m 05:42:05.0 6103 6102 238324 200 1,498.000 m/s 28.706 m 0.000 m 0.015 m 05:42:05.0 6103 6102 238326 200 <th1,498.000 m="" s<="" th=""> 28.706 m</th1,498.000>	RMS: 0.02 m or 0.03 m Spread 0.01 m Or O Clean Show O Used O All Gate Values Clean Inter State S	RMS: 0.002 m or 0.003 m Spread 0.010 m O. Calculated: 39.002 m Used 2 of 20 Show O Used All Gate Values Clean Time Serve List Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4" Tom To TVTT (µs) TAT (ms) SV Baseline Residual or anging o SV o 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 05:42:05.0 6103 6102 238324 200 1,498.000 m/s 28.702 m 0.001 m 0.015 m 0.000 m/s 0.015 m 05:42:05.0 6103 6102 238324 200 1,498.000 m/s 28.702 m -0.004 m 0.015 m 0.000 m/s 0.015 m 05:42:05.0 6103 6102 238324 200 1,498.000 m/s 28.704 m -0.002 m 0.015 m 0.000 m/s 0.015 m 05:42:05.0 6103 6102 238326 200 1,498.000 m/s 28.706 m 0.000 m 0.015 m <td>RMS: 0.02 r r r r r r r r r r r r r r r r r r r</td> <td>RMS: 0.002 m or 0.003 m Spread 0.010 m Operation of 0.000 m or 0.0000 m or 0.0000 m or 0.000 m or 0.000 m or 0.000 m or 0.000 m or</td>	RMS: 0.02 r r r r r r r r r r r r r r r r r r r	RMS: 0.002 m or 0.003 m Spread 0.010 m Operation of 0.000 m or 0.0000 m or 0.0000 m or 0.000 m or 0.000 m or 0.000 m or 0.000 m or

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.

🌏 Raw Ranges P	🧶 Raw Ranges Properties 🦳 🗌								
Time:	30-Jun-202	4 05:42:05	.0						
From:	6103								
To:	6102								
Travel Time:	Varies								
TAT:	200								
Sound Velocity:	1,498.000 n	n/s							
	Edit Sour	nd Velocity							
Range:	Varies								
σ Ranging:	0.015 m								
σ Sound Velocity:	0.000 m/s								
Total σ:	0.015 m								
Used:	✓								
		OK		Cancel					

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.

ම Raw Ranges F	Properties			_) ×
		- Sound Velocity Source				
lime:	30-Jun-2024 05:42:05.0	- Sound Velocity Profile Se	lection ——			
From:	6103	Range Time:	30-Jun-2024 (05:42:05.0		
То:	6102	Range Time Spread:	0 s			
Travel Time:	238321	Profile Choice	🗿 Auto 🌑 M			
TAT:	200	Sound Velocity Profiles:				
Sound Velocity:	1,498.000 m/s					
	Edit Sound Velocity	Selected SV Profile:	CTD Profile			
Range:	28.702 m	- Manifold HUB/HUB/Pres	sure Cap / TP -	PLET/HUB/Pr	essure	Cap / TP1 -
σ Ranging:	0.015 m	Elevation: 0.000 m		Elevation:	0.000	m
σ Sound Velocity:	0.020 m/s	EndPoint SV: 1,493.626	m/s	EndPoint SV:	: 1,493	.607 m/s
Total σ:	0.015 m	Average Range Sound Ve	locity: 1,498.0	00 m/s		
Used:		Sound Velocity Overrid	le 1,498.000 m	/s		
				C)K	Cancel

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.



🥥 Raw Ranges F	Properties		- 🗆 X
Time:	30-Jun-2024 05:42:05.0	Sound Velocity Source — Sound Velocity Profile Selection — Sound Velocity Profile	
From:	6103	Range Time: 30-Jun-2024	05:42:05.0
То:	6102	Range Time Spread: 0 s	
Travel Time:	238324	Profile Choice 💿 Auto 🔿 M	lanual
TAT:	200	Sound Velocity Profiles:	
Sound Velocity:	1,498.000 m/s	Selected SV Profile: No Profile Sel	ected
	Edit Sound Velocity		
Range:	28.705 m	Elevation: 0.000 m	Elevation: 0.000 m
σ Ranging:	0.015 m	EndPoint SV: 0.000 m/s	EndPoint SV: 0.000 m/s
σ Sound Velocity:	0.000 m/s		
Total σ:	0.015 m	Average Range Sound Velocity: 1,498.0	00 m/s
Used:	✓	Sound velocity Overnae 1,498.000 m	175
			OK Cancel

FIGURE 75 PROFILE CHOICE - AUTO

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

Raw Ranges I	Properties	- 🗆 X
Time:	30-Jun-2024 05:42:05.0	Sound Velocity Source
From:	6103	Range Time: 30-Jun-2024 05:42:05.0
То:	6102	Range Time Spread: 0 s
Travel Time:	238324	Profile Choice O Auto O Manual
TAT:	200	Sound Velocity Profiles: CTD ProfileBinned_1.00 👻
Sound Velocity:	1,491.266 m/s	Selected SV Profile: CTD Profile Binned 1.000 m
	Edit Sound Velocity	
Range:	28.576 m	Manifold HUB/HUB/Pressure Cap / TP PLET/HUB/Pressure Cap / TP1
σ Ranging:	0.015 m	Elevation: -1501.54/ m Elevation: -1498.54/ m
σ Sound Velocity:	0.000 m/s	EndPoint SV: 1,488.932 m/s EndPoint SV: 1,488.932 m/s
Total σ:	0.015 m	Average Range Sound Velocity: 1,491.266 m/s
Used:	 Image: A start of the start of	Sound Velocity Override 1,491.266 m/s
		OK Cancel

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.

Selected Datase	Selected Datasets							
✓ Jumper (1 i	tem)							
✓ RNG_F	WD_03_6103 to 6102_PY2-P N	/FD001 to PY_	2P6.txt (4 items)					
	From	Address	Height					
	Manifold HUB/HUB/Pressu	ıre Cap / TP	6103	0.970 m				
	Manifold HUB/HUB/Pressu	ıre Cap / TP	6103	0.970 m				
	Manifold HUB/HUB/Pressu	ıre Cap / TP	6103	0.970 m				
•	Manifold HUB/HUB/Pressu	ıre Cap / TP	6103	0.970 m				
		Edit						

FIGURE 77 BATCH EDITING - MULTIPLE BASELINES SELECTED

🥥 Bulk Edit Ranges			_	×
Raw Range Accuracy:		0.015 m		
Baseline Accuracy:		0.003 m		
Speed of Sound Accuracy:		0.000 m/s		
Speed of Sound Method:		Custom/Override *		
Speed of Sound Override:		1,498.000 m/s		
Selected Sound Velocity Profile:			v	
Raw Range Used:		\checkmark		Set
Category:	RNG_FWD_	03_6103 to 6102_PY2-P MFD001 to	PY_2P6.txt	
Dataset:	Jumper		•	Set
			OK	Cancel

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.

QUE Create At	titude Calculation	_		\times
Attitude C	alculation			
Name:	Well Attitude Calcs			
Structure:	Well			
	Cancel < Back	Next >	Finish	

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.

Create Attitude Calculation				_		\times
Dataset Selection						
Select datasets contain	ning data	for this calcu	ulation			
Name	\rightarrow	Name				
Default Dataset	Ĺ	Jumper				
Jumper	÷					
	Cancel	< Back		Next >	Fin	ish

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.

٢	Create Attitude Calculation									—		\times
s	elect Data											
Г	Available Data Sets					1	Pitch/Roll Data					
	Name	Pitch	Roll	Heading	DataSet	\rightarrow	Name	Pitch	Roll	Heading	DataSet	
	Import INC_FWD_03_6102_PY_2P6	-0.324°	-0.307°	0.947°	Jumper	÷	Import INC_FWD_03_6102_PY_2P6	-0.324°	-0.307°	0.947°	Jumper	
	Import INC_REV_03_6103_PY_2P6	-0.320°	-0.287°	0.947°	Jumper		Import INC_REV_03_6103_PY_2P6	-0.320°	-0.287°	0.947°	Jumper	
							Headings					
							Name Pitch Roll Heading	DataSet				
						7						
Ľ												
							Cancel		Back		Finis	sh
							Cancer		Dack	Next >	Finis	511

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.



	•									Edit	
Name	Structure	Calculating attitud	le for structure:	Well							
Well Attitude Calculation	Well										
MFD Attitude Calculation	MFD										
		Structure North:	0.947°								
		 Calculated 									
		Heading Observa	tions ———								_
		At Heading	Structure Head	ling Residual	Status						
		⊂observation at P	ressure Cap —								_
		Observation	P: -0.324°	R: -0.307	'H:	0.947°					
		C-C	P: 0.000°	R: 0.000°	H:	0.000°					
		Obs on Structure	eP: -0.324°	R: -0.307	H:	0.947°					
		Residua	-0.002°	-0.010		Ok					
		observation at P	ressure Cap —								_
		Observation	P: -0.320°	R: -0.287	'H:	0.947°					
		C-C	P: 0.000°	R: 0.000°	H:	0.000°					
		Obs on Structure	P: -0.320°	R: -0.287	'H:	0.947°					
		Residua	0.002°	0.010°		Ok					_
		☐ Statistics ———									-
		Pitch Std: 0.0	003°								
		Roll Std: 0.0)14°								
		Hoading Std: N/	·^								
			^								_
		Nar	n: Pitch	Ro	əll	Heading					
		✓ We	ell -0.322°	-().297°	0.947°					
			Name	Pitch	F	Roll	Heading	∆ Pitch	∆ Roll	∆ Heading	
		~	Hub	-0.322°		-0.297°	0.947°	0.000°	0.000°	0.000°	
			Name	Pitch		Roll	Heading	∆ Pitch	∆ Roll	Δ Heading	
			Pressure Ca	ap -0.322°		-0.297°	0.947°	0.000°	0.000°	0.000°	

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.



	Settings		•	
•	Environment	Name	In Use By	
	Sound Velocity			
	Pressure to Depth Calculations			
	Infrastructure			
•	Data			
	Attitude			
	Tide			
	Elevation			
	Baselines			
•	Interim Calculations			
	Attitudes			
	Elevation			
	Baselines			
	Jumper Calculations			



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

Create	Elevation (Calculation		\times
Attribut	es			
Name:	Elevation	Calc		
Ca	ancel	< Back	Next >	h

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.

Create Elevation Calculation		—		\times
Dataset Selection				
Select datasets conta	ining data for this calculati	on		
Name	Name			
Default Dataset	Jumper			
Jumper				
	~			
[Cancel < Back	Next >	Fin	ish

FIGURE 86 CREATE ELEVATION CALCULATION - DATASET SELECTION PAGE



 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.

Create Elevation Calculation			_		\times
Select Data					
Available Loops Loop Name Depth Loop 1 Depth Loop 2 Depth Loop 3 Seabed Profile	→	Used Loops (Used Loop Name Depth Loop 1 Depth Loop 2 Depth Loop 3	for calculatic	on)	
	Cancel	< Back	Next >	Fin	iish

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

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

Create Elevation Calculation											
Structure Configurations											
Structure	Setting	Starting Data Source	Manual Elevation	Accuracy	Attitude Calcs						
Well	Fixed 🛛 👻	LoopData 🛛 👻	0.000 m	0.000 m	Well Attitude Calculation						
MFD	Floating -	LoopData 🛛 👻	0.000 m	0.000 m	MFD Attitude Calculation]					
			C	Cancel	< Back Next >						

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.

Edit Elevation Calculation						_		\times
Select Profiles								
- Available Loops		Included Loops ((block shifted to match resu	t) —				
Loop Name		Loop Name	From Hub		To Hub			
Depth Loop 1	\rightarrow	Seabed Profile	Well - Hub - Pressure Cap	•	MFD - Hub	- Pressur	e Cap	~
Depth Loop 2	←							
Depth Loop 3								
Seabed Profile								
			Cancel	<	Back		Fini	ish
								_

FIGURE 89 CREATE ELEVATION CALCULATION - SELECT SEABED PROFILES PAGE

 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.

	0 0												Report Edit
Name	In Use By	Starting and C	Calculated Elevations —										
Elevation Calc			Location	State	Starting	Delta	Computed						
			Well	Fixed	-2011.580 m	0.000 m	-2011.580 m						
			MFD	Floating	-2011.318 m	-0.011 m	-2011.329 m						
		Dete											
		Observation	s Profiles										
		Fr	om			From Elevation	To Elevation	Calc ∆	Observed A	Residual	Obs Accuracy	W-Test	Status
		W	Vell Pressure Cap	MFD P	ressure Cap	-2011.097 m	-2010.797 m	-0.300 m		0.011 m	0.038 m	0.294	ОК
		M	1FD Pressure Cap	Well P	essure Cap	-2010.797 m	-2011.097 m	0.300 m		-0.011 m	0.038 m	0.294	ОК
		M	1FD Pressure Cap	Well P	essure Cap	-2010.797 m	-2011.097 m	0.300 m		0.047 m	0.038 m	1.236	ок
		W	lell Pressure Cap	MFD P	ressure Cap	-2011.097 m	-2010.797 m	-0.300 m		-0.047 m	0.038 m	1.236	ОК
		W	Vell Pressure Cap	MFD P	ressure Cap	-2011.097 m	-2010.797 m	-0.300 m	-0.336 m	0.036 m	0.038 m	0.942	ОК
		N	1FD Pressure Cap	Well P	essure Cap	-2010.797 m	-2011.097 m	0.300 m	0.336 m		0.038 m		ок
		Adjustment St	tatistics										
		Calculation S	tatus success										
		Unit Variar	nce 0.00145	2721427157748	3								
		Number of O	bservations 6										
		Number of U	nknowns 1										

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



	• •									Repo	rt Edit
Name	In Use By	Starting and C	alculated	Elevations							
levation Calc			Locat	State	Starting	De	ta Co	nputed			
			Well	Fixed	-2011.580 n	n 0.0	100 m -2)11.580 m			
			MED	Floating	-2011 318 n	n -0	011 m -2)11 329 m			
		-Data		_							
		Observation	s Profi	les							
		Seabed Pro	file								
		Profile Loop	Name:				Seabed Prof	le			
		Elevation Sł	nift:				-0.199 m				
		From Hub:					Well/Hub				
		To Hub:					MFD/Hub			View	
		Location				Depth	Along Line (From-To) Below From Hub	Along Line (To-From)	Below To Hub	
		PARO_Loop	4_PY_2P6	SB_20240630_040421	C/Origin	2016.050 m	0.671 m	-4.470 m	28.568 m	-4.721 m	
		PARO_Loop	4_SB1_202	240630_041051_C/Orig	in	2016.180 m	3.000 m	-4.600 m	26.239 m	-4.851 m	
		PARO_Loop	4_SB2_202	240630_041457_C/Orig	in	2016.599 m	6.000 m	-5.019 m	23.239 m	-5.270 m	
		PARO_Loop	4_SB3_202	240630_041825_C/Orig	in	2016.848 m	10.000 m	-5.268 m	19.239 m	-5.519 m	
		PARO_Loop	4_SB4_202	240630_042110_C/Orig	in	2017.072 m	13.000 m	-5.492 m	16.239 m	-5.743 m	
		PARO_Loop	4_SB5_202	240630_042354_C/Orig	in	2017.162 m	16.000 m	-5.582 m	13.239 m	-5.833 m	
		PARO_Loop	4_SB6_202	240630_042624_C/Orig	in	2017.250 m	19.000 m	-5.670 m	10.239 m	-5.921 m	
		PARO_Loop	4_SB7_202	240630_042914_C/Orig	in	2017.248 m	23.000 m	-5.668 m	6.239 m	-5.919 m	
		PARO_Loop	4_SB8_202	240630_043432_C/Orig	in	2017.424 m	27.825 m	-5.844 m	1.413 m	-6.095 m	
		PARO_Loop	14_PY2-P N	MFD_SB_20240630_043	737_C/Origin	2017.447 m	29.239 m	-5.867 m	0.000 m	-6.118 m	
		Adjustment St	atistics —								
		Calculation S	tatus	success							
		Unit Variar	ıce	0.00145272142	71491829						
		Number of O	bservation	is 6							
		Number of U	nknowns								

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.

Create Range Calculation	_		×
Attributes			
Name: Jumper Baselines Calc			
Cancel < Back	Next >	Fin	ish

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.



Create Ra	ange Calculation													-	
elect Dat	a														
Available	Ranges							-Used Baselines (Us	sed for calc	culation) ———					
✓ Jun	nper (4 items)							From			Quadrant	Range	Category	DataSet	
	MFD FWD (4 items)														
			Quadrant	Range	Category	DataSet									
	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.706 m	MFD FWD	Jumper									
	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.696 m	MFD FWD	Jumper									
	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD FWD	Jumper									
	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD FWD	Jumper									
	MFD REV (4 items)														
	From		Quadrant	Range	Category	DataSet									
	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.699 m	MFD REV	Jumper									
	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.691 m	MFD REV	Jumper									
	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD REV	Jumper	\rightarrow								
	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.709 m	MFD REV	Jumper	÷								
	Well FWD (4 items)														
	From		Quadrant	Range	Category	DataSet									
	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP			Well FWD	Jumper									
	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.692 m	Well FWD	Jumper									
	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.704 m	Well FWD	Jumper									
	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.699 m	Well FWD	Jumper									
	Well REV (4 items)														
	From		Quadrant	Range	Category	DataSet									
	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP			Well REV	Jumper									
	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.693 m	Well REV	Jumper									
	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.703 m	Well REV	Jumper									
	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP			Well REV	Jumper									
													ancel < Back	Next >	Finish

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.

Que Cres	Create Range Calculation -													- 🗆 X	
Selec	t Data														
- 400	lable Rang							_	I lead Racelines (trad for calculation)					
	latic hong								Osed basenness	Used for calculation					
~	Jumper (items)							 Jumper (4 	items)					
	✓ MFD	FWD (4 items)		0			Durch		✓ MFD F	WD (4 items)		Quality			Dutert
		MCD // hit //herenue Com / TVD	IO	Quadrant	Range	Category	Dataset			From	IO	Quadrant	Nange	Category MED DVD	Dataset
		MED/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.706 m	MED EWD	Jumper			MED/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.706 m	MED EWD	Jumper
		MED/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.696 m	MED FWD	Jumper			MED/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.696 m	MED FWD	Jumper
		MED/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.707 m	MED FWD	Jumper			MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.707 m	MED FWD	Jumper
		MED/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.703 m	MED EWD	Jumper			MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.703 m	MED FWD	Jumper
	✓ MFD	REV (4 items)		0			Durch		✓ MFD F	EV (4 items)		Quality			Duterat
		MED // hit /0-results Core (TVD	10	Quadrant	nange	Category	Dataset			MCD 0 bib /Drawner Car / TVD	No. 10	Quadrant	20 COD	Category	bataset
		MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.099 m	MED DO/	Jumper			MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.099 m	MED REV	Jumper
		MPD/Hub/Pressure Cap / TXP	Weil/Hub/Pressure Cap / TXP		28.091 m	MED DEV	Jumper			MrD/Hub/Pressure Cap / TXP	Weil/Hub/Pressure Cap / TXP		28.091 m	MFD REV	Jumper
		MFD/Hub/Pressure Cap / TXP	Weil/Hub/Pressure Cap / TXP		28.703 m	MED REV	Jumper	\rightarrow		MFD/Hub/Pressure Cap / TXP	Weil/Hub/Pressure Cap / TXP		28.703 m	MFD REV	Jumper
		MED/Hub/Pressure Cap / TAP	Weil/Hub/Pressure Cap / TXP		28.709 m	MED REV	Jumper	<i>←</i>		MED/Hub/Pressure Cap / TAP	weil/Hub/Pressure Cap / TXP		28.709 m	MED REV	Jumper
	✓ Well	WD (4 items)					Durch		✓ Well F	WD (4 items)					Duterat
		Well & Leb (Deservers Core / TVD)	IO MED & Lab /Description Core / TMD	Quadrant	ange	Category	Dataset			Hold Lik Deserves Care (TVD	NED #1-1- December Core (TVD	Quadrant	20.702	Category	bataset
		Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.702 m	Well FWD	Jumper			Weil/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.702 m	Well PWD	Jumper
		Weil/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TAP		28.092 m	Well FWD	Jumper			weit/Hub/Pressure Cap / TXP	MPD/Hub/Plessure Cap / TXP		28.092 11	WeilFWD	Jumper
		Weil/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.704 m	Well FWD	Jumper			Weil/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.704 m	Well FWD	Jumper
		weil/Hub/Pressure Cap / TAP	MED/Hub/Pressure Cap / TAP		28.699 m	Well FWD	Jumper			weil/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.099 m	well FWD	Jumper
	✓ Well	(EV (4 items)		Quadrant	Papaa	Catagoni	DataSat		Well N	EV (4 items)		Quadrant	Panas	Catagoos	DataCat
		Well/Hub/Pressure Can / TXP	MED/Hub/Pressure Can / TXP	2	28 701 m	Well REV	lumper			Well/Huh/Pressure Can / TXP	MED/Hub/Pressure Can / TXP	2	28.701 m	Wall REV	lumper
		Well/Hub/Pressure Cap / TXP	MED/Hub/Pressure Cap / TXP		28.693 m	Well REV	lumper			Well/Hub/Pressure Cap / TXP	MED/Hub/Pressure Cap / TXP		28.693 m	Well REV	lumper
		Well/Hub/Prersure Cap / TXP	MED/Hub/Programe Cap / TXP		28 703 m	Wall REV	lumpar			Well/Hub/Pressure Cap / TXP	MED/Hub/Programe Cap / TXP		28 703 m	Wall REV	lumpar
		Well/Hub/Program Cap / TXP	MED/Hub/Prosture Cap / TXP	1	29.711 m	Wall REV	lumper			Well/Hub/Pressure Cap / TXP	MED/Hub/Pressure Cap / TXP		29.711 m	Wall REV	lumpar
	_	wei(Plub/Plessure Cap / TXP	mrb/nub/ritesure.cap7.txr	I	28.71110	VIGH KEV	Jumper			weightub/Hessure Cap / TAP	mrb/hub/riessure.cap7.txr		20.71110	VVEII NEV	Jumpa
													Cancel	< Back	Next > Finish

FIGURE 96 CREATE RANGE CALCULATION - BASELINES ADDED FOR CALCULATION



7. Click Next to open Bearing constraints page.

Create Range Calculation		— C) X
Bearing Constraints			
			+
From	То	Bearing	Sigma
Well - Hub - Pressure Cap - TXP	MFD - Hub - Pressure Cap - TXP 🛛 💌	1.110°	0.000°
	Cancel < Back Nex	ct >	Finish

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.

🌏 Create Rai	nge Calculation			_	
Structure C	onfigurations				
Structure	Setting	Starting Data Source	Manual Location	Accuracy X	Accuracy Y
MFD	Floating *	Structure *	E 502179.408 m N 909109.681 m O Grid	1.000 m	1.000 m
Well	Fixed *	Structure *	E 502178.842 m Geo N 909080.448 m Grid	1.000 m	1.000 m
			Cancel < Back	Next >	Finish

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.

Create Range Calculation	—		\times
Select Elevation Calcs			
Available Elevation Calcs			
Cancel < Back No	ext >	Fin	ish

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.



	0 0															Report	Edit
	In Use By	Structures -															
r Baselines Calc																	B ⇔
			Name	Calc Setting	Starting X	ΔХ Х			Starting Y				Covariance	Elevation			
		>	MFD	Floating	502179.408		02178.877	0.000	909109.68	1 0.026	909109.708	0.001	0.000 m2	-1911.332			
		>	Well	Fixed	502178.842	0.000	02178.842	0.000	909080.44	8 0.000	909080.448	0.000	0.000 m2				
		Observations	0	Constanton													
		Ranges	bearings	Coordinates													
			WD (4 item														
			Categor	y From				Slope Obs		Hz Obs	Hz Calculated	Residual	Sigma	WTest	Baseline RMS	χ2 Test	
			MED FW	D MEU	/Hub/Pressure Cap / TXP	Well/Hub/Pressure C	ap / TXP	28.706	0.300	28.705	28.700		0.003	1,466	0.002 m		
			MED FW	ID MED	/Hub/Pressure Cap / TXP	Well/Hub/Pressure C	ap / TXP	28.696	0.300	28.694	28.700		0.003		0.002 m		
			MED FW	ID MED	/Hub/Pressure Cap / TXP	Well/Hub/Pressure C	ap / TXP	28.707		28.706	28.700		0.003		0.002 m		
			MED FW	MFD MFD	/Hub/Pressure Cap / TXP	Well/Hub/Pressure C	Cap / TXP	28.703		28.701	28.700	-0.001	0.084	0.336	0.002 m	FailedLow	
		V MED R	EV (4 items														
			Categor	y From				Slope Obs	ΔZ	Hz Obs	Hz Calculated	Residual	Sigma	Wlest	Baseline RMS	χ2 lest	
			MED RE	V MED	/Hub/Pressure Cap / TXP	Well/Hub/Pressure C	ap / TXP	28.699	0.300	28.698	28.700		0.003		0.001 m		
			MFD RE	V MED	/Hub/Pressure Cap / TXP	Well/Hub/Pressure C	ap / DXP	28.691	0.300	28.690	28.700		0.084		0.002 m		
			MED RE	MED	/Hub/Pressure Cap / TXP	Well/Hub/Pressure C	ар / ТхР	28.703	0.300	28.701	28.700		0.003		0.002 m		
			MFD RE	V MID	/Hub/Pressure Cap / TXP	Well/Hub/Pressure C	ар / Тхр	28.709	0.300	28.707	28.700	-0.007	0.003	2.192	0.002 m	FailedLow	
		✓ Well F	WD (4 item							U- Oh-				Millert	Paraline DMC		
			Langer	y From	Hub/Pressure Can / TVP	MED/Hub/Prozeura (Tao / TYP	28 702	-0.300	28 701	28 700	-0.001	51gma	0.292	d co2 m	Lailed our	
			Mell FM	5 Mill	(Lub/Dummer Carry TXP	MCD/Ltd./Domment		20,502	-0.202	20.604	20.700	0.000	0.002		0.002 m		
			Mall SMr	D 4460	Hub/Pressure Cap / TXP	MED/Hub/Prossure	Cap / TXP	28.704	-0.300	28.703	28.700		0.003		0.001 m		
			Mell FM	5 Well	Nuk Demour Cap (170	MED/Glob // Document	Case (TVE	78.600	-0.500	70.000	28.700		0.003		0.007 m	Deced	
		V MAILE	EV 64 iterest)	Hub/Fressure Cap / TXF	mrc/hdb/riessure	cap / TAP	20.055	-0.500	20.050		0.002	0.003	0.574	0.003 m	Passed	
			Categor	y From				Slope Obs	٨Z	Hz Obs	Hz Calculated	Residual	Sigma	WTest	Baseline RMS	y2 Test	
			Well REV	/ Well	/Hub/Pressure Cap / TXP	MFD/Hub/Pressure	Cap / TXP	28.701		28,700	28.700	0.000	0.003	0.019	0.002 m	FailedLow	
			Well REV	/ Well	Hub/Pressure Cap / TXP	MFD/Hub/Pressure	Cap / TXF	28.693		28.692	28.700		0.003		0.002 m		
			Well RFA	/ Well	Hub/Pressure Cap / TXP	MFD/Hub/Pressure I	Cap / TXF	28.703	-0.300	28.701	28.700		0.004		0.002 m		
			Well REV	/ Well	Hub/Pressure Cap / TXP	MED/Hub/Pressure (Cap / TXP		-0.300		28.700		0.003		0.003 m	Passed	
			Their fue									0.010	0.005	2.040	0.000 11	10000	
		Results															
		Adjustment	Statistics -														
		Calculation	n Status	Calculated Ok													
		Unit Vari	iance	0.16													
		Number of	f Observatio	ans 17													
		Number of	flloknown														
		Number of	r canachiciwing														

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
- Dpdate: 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
- Δ**X:** 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

Observa	bservations												
Range	es Bearings	Coordinates											
~ 1	VFD FWD (4 items	6											
	Category	From		Slope Obs		Hz Obs	Hz Calculated	Residual	Sigma	WTest	Baseline RMS	χ2 Test	
	MFD FWE	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP	28.706	0.300	28.705	28.700		0.003		0.002 m	FailedLow	
	MFD FWE	D MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP	28.696	0.300	28.694	28.700		0.003				
	MFD FWE	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP	28.707	0.300	28.706	28.700		0.003	1.649			
	MFD FWE	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP	28.703	0.300	28.701	28.700		0.004				
~ 1	vIFD REV (4 items)												
	Category	From		Slope Obs	ΔZ	Hz Obs	Hz Calculated	Residual	Sigma	WTest	Baseline RMS	χ2 Test	
	MFD REV	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP	28.699	0.300	28.698	28.700		0.003				
	MFD REV	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP	28.691	0.300	28.690	28.700		0.004				
	MFD REV	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP	28.703	0.300	28.701	28.700		0.003				
	MFD REV	MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP	28.709	0.300	28.707	28.700		0.003				
~ \	Vell FWD (4 items))											
	Category	From		Slope Obs	ΔZ	Hz Obs	Hz Calculated	Residual	Sigma	WTest	Baseline RMS	χ2 Test	
	Well FWD	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXF	28.702	-0.300	28.701	28.700		0.003				
	Well FWE	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXF	28.692	-0.300	28.691	28.700		0.003				
	Well FWD	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXF	28.704	-0.300	28.703	28.700		0.003				
	Well FWD	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXF	28.699	-0.300	28.698	28.700		0.003			Passed	
~ \	Nell REV (4 items)												
	Category	From		Slope Obs	ΔZ	Hz Obs	Hz Calculated	Residual	Sigma	WTest	Baseline RMS	χ2 Test	
	Well REV	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXF	28.701	-0.300	28.700	28.700		0.003				
	Well REV	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXF	28.693	-0.300	28.692	28.700		0.003				
	Well REV	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXF	28.703	-0.300	28.701	28.700		0.004				
	Well REV	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXF		-0.300	28.710	28.700		0.003		0.003 m	Passed	

FIGURE 101 RANGE CALCULATION RESULTS VIEW - RANGES TAB

- **From:** Starting Point (Transponder)
- **To:** Ending Point (Transponder)
- Slope Obs: The observed range in distance units
- \circ **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

_ Observations													
	Ranges	Bearings	Coordinates										
		From		То	Observed Bearing	Calculated Bearing	Residual	Sigma	WTest				
	•	Well/Hub/Pr	essure Cap / TXP	MFD/Hub/Pressure Cap / TXP	1.110	1.110	0.000	0.000	0.00				

FIGURE 102 RANGE CALCULATION RESULTS VIEW - BEARINGS TAB

- From: Starting Point (Transponder)
- **To:** Ending Point (Transponder)
- o **Observed Bearing:** Entered bearing value
- Calculated Bearing: Bearing Calculated after the adjustment
- o 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

-0	Observations Ranges Bearings Coordinates									
		Locat	Coordinata	Obc	Calculated	Pasidual	Sigma	WTast		
		LUCAL	Coordinate	ODS	Calculated	Residual	sigina	WIESL		
		MFD	Х	502179.408 m	502178.877 m	-0.532 m	1.000 m	-0.532		
		MFD	Y	909109.681 m	909109.708 m	0.026 m	1.000 m	0.026		

FIGURE 103 RANGE CALCULATION RESULTS VIEW - COORDINATES TAB

- Location: Transponder attached to structure
- Coordinate: X and Y
- o Obs: The actual coordinate in projected units
- Calculated: Value of the coordinate after calculation has run
- o 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:

Γ	Results ——— _ Adjustment Statistics ——	
	Calculation Status	Calculated Ok
	Unit Variance	0.16
	Number of Observations	17
	Number of Unknowns	2

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

🎱 Create Jumpe) ×		
Attributes				
Name:	Metrology Jump	er Calc		
Notes:				
From:	Well - Hub		•	Vertical
To:	MFD - Hub		•	Vertical
Client:				
Project:				
Created By:				
Checked By:				
Approved By:				
Vessel:				
Cancel	< Back	Vext >		Finish

FIGURE 106 CREATE RANGE CALCULATION - ATTRIBUTES PAGE

4. Click Next to open the Dataset Selection page.



Que Create Range Ca	culation		_		\times			
Dataset Selection								
A dataset is created for the metrology calculation automatically. In this page, extra datasets can be added to include data from other sources								
Name		Name						
Default Dataset		Jumpe						
Jumper								
	Cancel	< Back	Next >	Fin				

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.

Que Create Range Calculation − □ ×	€ Create Range Calculation — □ ×
Attitudes	Attitudes
Selected From Calc: Create New 💌	Selected From Calc: Well Attitude Calculation
Selected To Calc: Create New 💌	Selected To Calc: MFD Attitude Calculation
Cancel < Back Next > Finish	Cancel < Back Next > Finish

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.

🔮 Create Range Calculation — 🗆 🗙	€ Create Range Calculation — □ ×
Elevation/Range Calculations	Elevation/Range Calculations
Elevation Calc: Create New 💌 Horizontal Calc: Create New 💌	Elevation Calc: Elevation Calc 🔍 Horizontal Calc: Jumper Baselines Calc 💌
Cancel < Back Next > Finish	Cancel < Back Next > Finish

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.



	Settings		Calc Status						
.	Environm	ent	From Attitude Calc				Edit Calc		
	So So	und Velocity	To Attitude Calc			Data	Edit Calc		
	Press	ure to Depth Calculations]	
	Infrastruc	ture	Elevation Calc	NotComp	uted	Data	Edit Calc		
	Data		Range Calc	NotComp	uted	Data	Edit Calc		
	Attitu	de				Report	Diagram		
	Tide							1	
	Eleva	tion	- Results						
	Basel	ines							
▼	Interim C	alculations	Horizontal Range	0.000	m				
	Attitu	des	Vertical Range	0.000 m (i	s low	er)			
	Eleva	tion	Hub Heading	0.000°	0.000	٥			
	Basel	ines	nub neuding	0.000	0.000	,			
•	Jumper C	Calculations	Hub Pitch	0.000°	0.000)°			
	Metro	ology Jumper Calc	Hub Roll	0.000°	0.000)°			
	A	ttitude	Jumper Bearing	0.000°	0.000)°			
	El	evation	luma an Ditak	0.0008	0.000	10			
	Ra	anges	Jumper Pitch	0.000-	0.000)			
			Jumper Roll	0.000°	0.000)°			

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.

- Calc Status			
From Attitude Calc			Edit Calc
		Data	
To Attitude Calc			Edit Calc
Elevation Calc	NotComputed	Data	Edit Calc
Range Calc	NotComputed	Data	Edit Calc
		Report	Diagram

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.

Edit Attitude Calculation	_		\times
Attributes			
Name: Well Calc Structure: Well ~			
Cancel < Back	Next >	Fini	ish

FIGURE 113 EDIT ATTITUDE CALCULATION – ATTRIBUTES PAGE



 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.

🧶 Edit Ele	evation Calculation	—		\times					
Attributes									
Name:	Elevation Calcs								
Cance	< Back	Next >	Finis	h					

 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 115 EDIT ELEVATION CALCULATION - ATTRIBUTES PAGE







4. Click Next to open Structure Configurations page.

🧶 Edit Elevat	tion Calculation				- 🗆 >			
Structure Configurations								
Structure	Setting	Starting Data Source	Manual Elevation	Accuracy	Attitude Calcs			
Well	Fixed -	LoopData 🛛 👻	0.000 m	0.000 m	Well Attitude Calcs			
MFD	Floating 👻	LoopData 🛛 👻	0.000 m	0.000 m	MFD Attitude Calc			
*					→			
			Cancel	< Back	Next > Finish			

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.

Edit Elevation Calculation				- 🗆	\times
Select Profiles					
Available Loops		Included Loops	(block shifted to n	natch result)	
Loop Name		Loop Name	From Hub	To Hub	
Depth Loop 1	\rightarrow	Seabed Profile	Well - Hub 👻	MFD - Hu	v dı
Depth Loop 2	4				
Depth Loop 3					
Seabed Profile					
					-
		Cancel <	Back Next	>	inish

FIGURE 118 EDIT ELEVATION CALCULATION - SELECT PROFILES PAGE

- 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



🔮 Edit Ra	nge Calcula	ation													- 0	×
Select D	ata															
Availab	le Ranges ·								Used Baselines (L	sed for calculation)						
~ J	umper (4 it	ems)							✓ Jumper (4 i	ems)						
	MFD FWD (4 items)						✓ MFD FWD (4 items)									
				Quadrant	Range	Category	DataSet					Quadrant	Range	Category	DataSet	
			Well/Hub/Pressure Cap / TXP			MFD FWD	Jumper			MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD FWD	Jumper	
		MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.696 m	MFD FWD	Jumper			MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.696 m	MFD FWD	Jumper	
		MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD FWD	Jumper			MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD FWD	Jumper	
		MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD FWD	Jumper			MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD FWD	Jumper	
	MFD RE	V (4 items)							Y MED R	V (4 items)						
				Quadrant	Range	Category	DataSet					Quadrant	Range	Category	DataSet	
			Well/Hub/Pressure Cap / TXP		28.699 m	MFD REV	Jumper			MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.699 m	MFD REV	Jumper	
		MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.691 m	MFD REV	Jumper			MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP		28.691 m	MFD REV	Jumper	
		MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD REV	Jumper	→		MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD REV	Jumper	
		MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD REV	Jumper	€		MFD/Hub/Pressure Cap / TXP	Well/Hub/Pressure Cap / TXP			MFD REV	Jumper	
	Well FW	/D (4 items)							✓ Well FV	/D (4 items)						
		From		Quadrant	Range	Category	DataSet					Quadrant	Range	Category	DataSet	
		Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP			Well FWD	Jumper			Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP			Well FWD	Jumper	
		Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.692 m	Well FWD	Jumper			Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.692 m	Well FWD	Jumper	
			MFD/Hub/Pressure Cap / TXP		28.704 m	Well FWD	Jumper			Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.704 m	Well FWD	Jumper	
		Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.699 m	Well FWD	Jumper			Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.699 m	Well FWD	Jumper	
	Well RE	V (4 items)							✓ Well RE	V (4 items)						
		From		Quadrant	Range	Category	DataSet					Quadrant	Range	Category	DataSet	
		Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP			Well REV	Jumper			Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP			Well REV	Jumper	
		Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.693 m	Well REV	Jumper			Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP		28.693 m	Well REV	Jumper	
		Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP	4	28.703 m	Well REV	Jumper			Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP			Well REV	Jumper	
	•	Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP	1	28.711 m	Well REV	Jumper			Well/Hub/Pressure Cap / TXP	MFD/Hub/Pressure Cap / TXP			Well REV	Jumper	

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.

Edit Range Calculation			- C	X
Bearing Constraints				
				⊕ ●
From	То	Bearing	Sigma	
Well - Hub - Pressure Cap - TXP 🛛 👻	MFD - Hub - Pressure Cap - TXP	1.110°	0.000°	
	Cancel < Back	Next	>	Finish

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.

Sedit Range	e Calculation			_	
Structure C	onfigurations				
Structure	Setting	Starting Data Source	Manual Location	Accuracy X	Accuracy Y
MFD	Floating *	Structure 🛛 💌	E 502179.408 m 🕘 Geo N 909109.681 m 💽 Grid	1.000 m	1.000 m
Well	Fixed *	Structure 🛛 💌	E 502178.842 m Geo N 909080.448 m Grid	1.000 m	1.000 m
			Cancel < Back	Next >	Finish

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.

Edit Range Calculation			-		\times
Select Elevation Calcs					
Available Elevation Calcs	→ Used Nar Elev	Elevation Calcs - ne ation Calcs			
	Cancel	< Back	Next >	Fin	ish

FIGURE 123 EDIT RANGE CALCULATION - SELECT ELEVATIONS CALCS PAGE



10. Click Finish for results.

Calc Status		
From Attitude Calc Attitude calculation successful		Edit Calc
To Attitude Calc Attitude calculation successful	Data	Edit Calc
Elevation Calc CalculationSuccessful	Data	Edit Calc
Range Calc CalculationSuccessful	Data	Edit Calc
	Report	Diagram

FIGURE 124 JUMPER CALCULATION – CALC STATUS

– Results ––––––			
	At Well Hub	At MFD Hub	
Horizontal Range	28.6	95 m	
Vertical Range	0.251 m (Wel	l Hub is lower)	
Hub Heading	0.947°	203.350°	
Hub Pitch	-0.322°	0.527°	
Hub Roll	-0.297°	0.061°	
Jumper Bearing	1.087°	1.087°	
Jumper Pitch	-0.321°	-0.510°	
Jumper Roll	-0.298°	0.143°	
L			

FIGURE 125 JUMPER CALCULATIONS - RESULTS

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