

NavView User Guide – 16 USBL Boxin and Calibration

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4D NAV

16. USBL BOXIN AND CALIBRATION

16.1 OVERVIEW

Depending on the version and modules present, NavView supports ultrashort baseline (USBL) and long baseline (LBL) acoustic systems to varying extents. This includes standard USBL positioning and USBL calibrations. This section details managing the beacons and executing USBL calibrations in NavView.

16.2 USBL CALIBRATION

USBL calibrations determine the error in the mounting of the USBL transducer relative to the vessel's local coordinate reference frame. The results are correction values for pitch, roll and heading with an option for scaling that are applied to USBL observations before they are used.

Calibrations are often carried out in the USBL system directly and the results applied in the same. With this approach all systems using the USBL system, e.g. DP and survey systems, benefit from the application of the calibration corrections at the source. However, there are instances where this is not feasible or desirable and an alternative is required. NavView provides an alternative with its USBL Calibration feature. This feature can also be used to load and process USBL calibration data collected with WinFrog and HiPAP systems.

The USBL calibration process involves the following operations.

- 1. Create an Active calibration and planning the calibration data collection with the Add USBL Cal wizard. See section 16.2.3
- 2. Review/Edit data collection setup. See section 16.2.4
- 3. Data collection. See section 16.2.5
- 4. Finalize the Active calibration so it can be processed. See section 16.2.6
- 5. Process to solve for the Boxin and USBL Calibration values. See section 16.2.7

If Roles and Privileges are enabled, the following are what is allowed for each role:

Roles	Privileges
Not Logged In/User	Cannot add or remove a calibration, can process completed calibration
Online/Supervisor/Administrator	Can add or remove a calibration, can process completed calibration

16.2.1 ACCESSING THE USBL CALIBRATION FEATURE

The USBL Calibration feature is part of the Database Services. Configure these as per the Database Services section in the User Guide ensuring that that the USBL Calibration service is enabled (Enabled check box is checked) and active (Loaded icon is green) as shown in Figure 16-1.



Setup		🗹 Enable Datal	base Services				
Data	Beacons	Server name:	(localdb)\v11	.0			
	ADCP Profiles	Authentication:	Windows Au	thenticatior	1 ×		
•	Database Services						
	DTM						
	Project Databases	┌ 🗸 Use Custom	File Location -				
	Quick Fixes	Project Fold	er Shared\Dat	a\Database			
	Tides						
	Data Recording	Name		Enabled	Custom Location	File Location	Loaded
	Configuration History	Data Archive		<		Shared\Data\Database	۲
	DVL Calibration	DVL Calibration		✓			\bigcirc
	Position Fixes	Quick Fix		✓		Shared\Data\Database	 \bigcirc
Lo	gbook	Configuration Ch	ange Watcher	✓			٢
Pip	oe Tallies	Documents		✓		Shared\Data\Database	۲
(***	Pipelines	Position Average		✓			٢
4	Survey Lines	Tide		~			 \bigcirc
P V	Vaypoints	DTM					
		DIM					
		USBL Calibration		✓		Shared\Data\Database	Ö
		Test Connection					

FIGURE 16-1 DATABASE SERVICES - USBL CALIBRATIONS ENABLED

The USBL Calibration feature is accessed from the Explorer view by selecting the USBL Calibration under the Database Services item (see Figure 16-2).

•	Setup Data)	Ac	tive Calibra	tions Finalize
	1	Beacons	Name	Description	
	Ζ	ADCP Profiles	Hume	Description	
	v 🖗	Database Services			
		DTM			
		Project Databases			
	•	Quick Fixes	Com	pleted Calib	orations
	►	Tides	Configu	re Reports	
	•	Data Recording	Name	Description	
		Configuration History			
		DVL Calibration			
	►	Position Fixes			
		USBLCalibrations			
	Lo	ogbook			
	Pi	pe Tallies			
	(***	Pipelines			
	11	Survey Lines			
		Waypoints			

FIGURE 16-2 DATABASE SERVICES - USBL CALIBRATION FEATURE

16.2.2 USBL CALIBRATION STATES: ACTIVE & COMPLETED

Active Calibration is one that the data collection has not been completed. While in this state, the data collection settings can be edited and data can be collected but it cannot be processed to determine the USBL calibration values. Once the data collection is complete, the calibration is Finalized and set to Completed. In this state, the calibration can be processed.



16.2.3 USBL DATA COLLECTION PLANNING

NavView uses a wizard to step the user through the planning stages to create an Active Calibration.

- 1. Access the **USBL Calibration** feature in the Explorer view.
- 2. In the **Active Calibration** section (see Figure 16-2) click the Dutton to launch the Add USBL Cal wizard.
- 3. **USBL Calibration Properties** page (see Figure 16-3)

🎱 Add USBL C	al	—		\times
Usbl Calibrat	ion Properties			
Name:	USBL Cal 1			
Description:	Location N 2° 24' 58.6997	/" E 4° 05'	09.8064"	
Can	cel < Back M	Next >	Finis	h

FIGURE 16-3 USBL CALIBRATION PLANNING WIZARD - CALIBRATION PROPERTIES

- **Name:** Enter a name for the calibration, recommend a brief name but providing sufficient information to identify the calibration, e.g. USBL Cal 1
- Description: Enter a description of the calibration, e.g. calibration location (optional)
- 4. Click Next
- 5. Plan Beacon References page.
 - I. Select the beacon from the dropdown menu that will be used for the box in and click the Dutton
- **Note:** The beacon being used in the calibration must be added to Beacons, see section on Configure Beacons.

Q Add USBL	Cal				_		\times
Plan Beaco	n Referenc	es					
					HPR B2	3 - 4	
Name	Address	Starting Location	σ East	σ North	Elevation	σ Eleva	ition
HPR B23	B23	E 620751.51 m N 267124.20 m Geo Grid Fix	5.00 m	5.00 m	-500.00 m 📃 Fix	5 <mark>,00 m</mark>	
					1	_	
			Cancel	< B	ack Next >	Fir	nish

FIGURE 16-4 USBL CALIBRATION PLANNING WIZARD - BEACON REFERENCES

- Name: Name of the beacon in the software (from Configure Beacons window)
- Address: Channel of the beacon in the system (from the Configure Beacons window)



- Starting Location: Enter the installed position of the beacon (Position average of beacon location if taken). If the Fix checkbox is checked, the position entered will be held and not adjusted during calibration
- σ East: Accuracies of USBL system on board vessel. If the box in is being performed in 500m of water depth and the accuracy of the USBL system is 1% of water depth, enter 5m here
- σ North: Accuracies of USBL system on board vessel. If the box in is being performed in 500m of water depth and the accuracy of the USBL system is 1% of water depth, enter 5m here
- **Elevation:** Elevation of the installed beacon. If the **Fix** box is checked, the elevation value entered will be held and not adjusted during calibration
- σ Elevation: Accuracies of USBL system on board vessel. If the box in is being performed in 500m of water depth and the accuracy of the USBL system is 1% of water depth, enter 5m here
- 6. Click Next
- 7. Plan USBL Calibration Data Collection page.

🤍 Add USBL Cal		_		\times
Plan USBL Calibration				
Plan USBL Ca	libration Data C	ollection		
Enter the distance to the st orientation of the top statio The orientation will also be heading for each station.	ations and the on from the cent used as the prir	ter. mary		
Radius	500.000 m			
Orientation	0.000°			
Data Collection Setup				
🗹 Collect Data Over Top	Primary and R	eciprocal Hea	ding 👻	
Collect Data At Cardinal	Primary and R	eciprocal Hea	ding 👻	
🗸 Auto Stop:	100			
Cancel	< Back	Next >		

FIGURE 16-5 USBL CALIBRATION PLANNING WIZARD – COLLECTION PATTERN

• Collection Pattern:

- **Radius:** Enter the radius of the circle about the calibration beacon the data collection points will be located on
- **Orientation:** Enter the orientation angle (azimuth) to base the data collection pattern on, this will be the primary vessel heading at each collection point and used to calculate the **Top** collection point relative to the calibration beacon



Data Collection Setup:

- **Collect Data Over Top:** If data is to be collected directly over the calibration beacon check this box and select the heading option:
 - a. **Primary and Reciprocal Heading**: Data collected with vessel on primary heading (pattern orientation) and 180° from this heading
 - b. **Primary Heading only**: Data collected with vessel on primary heading (pattern orientation) only
 - c. **Four Quadrant Headings:** Data collection with vessel on the primary heading (pattern orientation) and primary heading plus 90°, 180° and 270°
- **Collect Data at Cardinals:** Check if data is to be collected at the cardinal points, i.e. the four data collection points generated from the calibration beacon, the radius and the orientation, orientation + 90°, orientation + 180° and orientation + 270° and select the heading option (see above)
- **Auto Stop:** Check if the data collection at each location is to stop automatically after a specified number of USBL epochs are collected and enter the number to collect
- 8. Click Next
- 9. USBL Calibration Data Sources page.

QUsbl Calibration Da	ta Sources	_) ×
Vessel Calculation:	Vessel USBL Cal			*
Geographic2D Source:	Devices/GPS/GGA/Geo2D (WGS 84	-4326	j) – T
Elevation Source:	Fixed Elevation			
Heading Source:	Devices/Gyro/HDT/Heading			*
Pitch/Roll Source:	Fixed Pitch/Roll			*
USBL Device:	Devices/USBL/PSIMSSB/USI	3L-RAW	(Calil	oration)
		OK		Cancel

FIGURE 16-6 USBL CALIBRATION PLANNING WIZARD - DATA SOURCES

- **Vessel Calculation:** Select the vehicle calculation assigned to the vessel that will be performing the box in. This will auto populate all the primary data sources assigned to the vessel: Position, Elevation, Heading and Pitch/Roll
- USBL Device: Select the USBL-Raw observation data source from the available USBL devices listed in the drop down list
- **Note:** All data source fields and USBL device must have a valid data source selected. This includes the Pitch/Roll Source. If the respective Calculation does not have a suitable Pitch/Roll device source available, it must be set to Other > Fixed.
- **Note:** The USBL system must be outputting bow referenced Cartesian XYZ data in order for the data to be valid and available for use in a USBL Calibration.
- 10. Click Finish.



The USBL calibration plan setup is now added to the list of Active Calibrations and displayed in the right panel and is ready for <u>review</u> and <u>data collection</u>.

16.2.4 EDIT AN ACTIVE CALIBRATION'S SETTINGS

Any active USBL calibration setup can be reviewed and edited, including one just completed with the USBL Planning wizard. This can be done prior to and during the data collection.

- 1. Access the **USBL Calibration** feature in the Explorer view.
- 2. In the Active Calibration section (see Figure 16-2) select the calibration to edit.
- 3. Review and edit as required.

Active Calibrations • • Finalize	-Selected A	ctive usbl Calibration			Settings	Edit Steps	Edit Data Sources	Generate Waypoint
Name	Data Stat	tus	Calibration Steps					
Name Description	Status	Name	Step Name	# Accepted	# Rejected	% Complete	Required Observ	vations
USBL Cal 1 Location N 2º 24		Calculations/Vessel USBL Cal/Input/Geographic2D/Sources/Devices-GPS-GGA-Geo2D (WGS 84-4326	USBL Cal 1: Center +0°	0		0.0%	50	
		Calculations/Vessel USBL Cal/Input/Elevation/Sources/Fixed Elevation/Raw	USBL Cal 1: Center +180°			0.0%		
		Calculations/Vessel USBL Cal/Input/Heading/Sources/Devices-Gyro-HDT-Heading/Raw	USBL Cal 1: Top +180 ⁰			0.0%	50	
Completed Calibrations		Calculations/Vessel USBL Cal/Input/Pitch-Roll/Sources/Fixed Pitch-Roll/Raw	USBL Cal 1: Top +0 ⁰			0.0%		
Configure Reports 👻 🖨	Č	Devices/LISBI /PSIMSSB/LISBI -RAW (Calibration)	USBL Cal 1: Right +0 ⁰			0.0%	50	
Name Description			USBL Cal 1: Right +180°			0.0%		
· ·			USBL Cal 1: Bottom +180°			0.0%	50	
			USBL Cal 1: Bottom +0 ⁰			0.0%		
			USBL Cal 1: Left +0°			0.0%	50	
			USBL Cal 1: Left +180°			0.0%		
		>	Start Logging Stop Logg	ng NO STE	EP SELECTED	Observat	tion Count: 0	

FIGURE 16-7 ACTIVE USBL CALIBRATION

II. Data Status: The status of the data sources is indicated by the LED, a

indicates the data source is valid and providing data, a 🕺 indicates the data source is either invalid or not receiving data and must be investigated, all must be

lefore data collection can be executed

III. Settings: Click to open USBL Calibration Control Settings dialog



FIGURE 16-8 USBL CALIBRATION CONTROL SETTINGS DIALOG

- Name: Edit as desired
- **Description:** Edit as desired
- Auto Stop: Edit as desired
- **Note:** If **Auto Stop** is enabled and data has been collected for a step but must be recollected, the Auto Stop must either be disabled and the starting and stopping to recollect at this step be done manually; or the number of observations to collect increased accordingly and the data collection started again. The Auto Stop can then be reconfigured before proceeding with the data collection at subsequent steps.



- IV. Click **OK** to accept changes
- V. Edit Steps (If required)
 - Plan Beacon References: Edit as required (see step 5 in Error! Reference source not found.)
 - Click Next
 - Plan USBL Calibration Data Collection: Review and edit as required (see step 7 in Error! Reference source not found.)
 - Click Finish
- VI. Edit Data Sources (If required)
 - USBL Calibration Data Sources: Edit as required (see step 9 in Error! Reference source not found.)
 - Click **OK** to accept changes
- VII. **Generate Waypoints:** Click to generate waypoints at the location of the data collection points
 - Review/Edit Center Point position, this being the calibration beacon initial position, see Figure 16-9

🥥 Generate Wa	ypoints —		×
Select Beacon:	HPR B23		•
Center Point:	E 620751.51 m O Geo N 267124.20 m O Grid		
	Create	Ca	ncel

FIGURE 16-9 GENERATE WAYPOINTS

 Click Create to generate the waypoints, these will be displayed on map view see Figure 16-10. These are then available to assist navigating between locations to optimize transiting. The waypoints are added to the waypoint manager which then can be edited. See Waypoints section in this User Guide



FIGURE 16-10 CALIBRATION STEPS - MAP VIEW



4. **Calibration Steps:** The calibration data collection steps are listed in the data grid and are updated as data is collected.

Step Name	# Accepted	# Rejected	% Complete	Required Observations	
USBL Cal 1: Center +0 ⁰	0		0.0%	50	
USBL Cal 1: Center +180 ⁰	0		0.0%	50	
USBL Cal 1: Top +180 ⁰	0		0.0%	50	
USBL Cal 1: Top +0 ⁰	0		0.0%	50	
USBL Cal 1: Right +0 ⁰	0		0.0%	50	
USBL Cal 1: Right +180 ⁰	0		0.0%	50	
USBL Cal 1: Bottom +180°	0		0.0%	50	
USBL Cal 1: Bottom +0 ⁰	0		0.0%	50	
USBL Cal 1: Left +0 ⁰	0		0.0%	50	
USBL Cal 1: Left +180 ⁰	0		0.0%	50	
Start Logging Stop Logging NO STEP SELECTED Observation Count:					

FIGURE 16-11 CALIBRATION STEPS – DATA COLLECTION

- Step Name: Name of the step assigned by the wizard
- **# Accepted:** Number of data epochs collected accepted
- **# Rejected:** Number of data epochs collected rejected
- **% Complete:** Percentage of Required Observations collected
- **Required Observations:** Total number of observations to collect

16.2.5 USBL CALIBRATION DATA COLLECTION

Data can be collected for any Active Calibration, whether one just created or one where the data collection has previously been started. The following details the collection process for one for which the data collection has not yet started.

During the data collection process, the data can be monitored graphically in time series, histogram views and in map views.

- 1. Access the **USBL Calibration** feature in Explorer view.
- 2. In the **Active Calibrations** section (see Figure 16-2) select the calibration for data collection.
- 3. To start logging data, in **Calibration Steps**.
 - I. Select the **Calibration Step** to log data for (it is recommended that the steps be executed in the order they are listed because these have been ordered to minimize transit times, but it is not mandatory)
 - II. Click the **Start Logging** button



Active Calibrations	- Selected Active usbl Calibration		Settings Edit Steps	Edit Data Sourc	es Generate Waypoints
Name and Desidentian	Data Status	Calibration Steps			
Name - Description	Status Name	Step Name	# Accepted # Rejected	% Complete	Required Observations
USBL Cal 2023-12	Calculations/Vessel USBL Cal/Input/Geographic2D/Sources/Devices-GPS-GGA-Geo2D (WGS 84-	USBL Cal 2023-12-11: Center +0 ⁰		0.0%	100
	Calculations/Vessel USBL Cal/Input/Elevation/Sources/Devices-GPS-GGA-Elevation Working (MS	USBL Cal 2023-12-11: Center +180 ⁰		0.0%	100
	Calculations/Vessel USBL Cal/Input/Heading/Sources/Devices-Gyro-HDT-Heading/Raw	USBL Cal 2023-12-11: Top +180 ⁰		0.0%	100
Completed Calibrations	Calculations/Vessel LISBL Cal/Innut/Pitch-Roll/Sources/Fixed Pitch-Roll/Raw	USBL Cal 2023-12-11: Top +0 ⁸		0.0%	100
Configure Reports 🛛 👻 🖨	Calculation (Concern and Concern and	USBL Cal 2023-12-11: Right +0 ⁰		0.0%	100
Name Description	evices/03bc/P3ilvi53b/03bc-PAW (Calibration)	USBL Cal 2023-12-11: Right +180 ^e		0.0%	100
		USBL Cal 2023-12-11: Bottom +180 ^e		0.0%	100
		USBL Cal 2023-12-11: Bottom +0°		0.0%	100
		USBL Cal 2023-12-11: Left +0 ⁰		0.0%	100
		USBL Cal 2023-12-11: Left +180 ⁹		0.0%	100
		Start Logging Stop Logging NO	STEP SELECTED Obser	vation Count	: 0
	Name: USBL Cal 2023-12-11: Center +0 [®] Start Time: End Time: Color:				
	List Slant Range Beacon USBL XYZ				
	Count: 0				
	Time Station Code Used Obs X Obs Y Obs Z Slant Range Calculated Slant Range Bon	East Bon North Bon Elevation Ra	inge Accuracy Residual	w	

FIGURE 16-12 ACTIVE CALIBRATION - DATA COLLECTION DIALOG

a. The **Start Logging** button will be disabled and the **Stop Logging** button will be enabled (see Figure 16-13)

D-1- 0-1									Cuthandran Quan		Settir	ngs Edit	Steps Edit Da	ata Sources	Generate Wayp
Data Statu	us								Calibration Steps						
Status	Name								Step Name	# Accep	ted # Rejecte	d % Comp	lete Required	Observations	
\sim	Calculations/	Vessel USBL Cal/Input/Geo	ographica	2D/Sourc	es/Devices	-GPS-GGA-G	Geo2D (WG	S 84-4326)/Rav	USBL Cal 1: Center +0	° 50		100.0%	50		
 Image: A start of the start of	Calculations/	Vessel USBL Cal/Input/Elev	vation/So	ources/Fi	ced Elevatio	on/Raw			USBL Cal 1: Center +1	80 ⁰ 50		100.0%	50		
\checkmark	Calculations/	Vessel USBL Cal/Input/Hea	ading/So	urces/De	vices-Gyro-	-HDT-Headi	ng/Raw		USBL Cal 1: Top +180			8.0%	50		
 Ø 	Calculations/	Vessel USBL Cal/Input/Pitc	:h-Roll/So	ources/Fi	xed Pitch-R	Roll/Raw			USBL Cal 1: Top +0 ⁰	Ö		0.0%	50		
	Devices/USBL	/PSIMSSB/USBL-RAW (Cal	libration)						USBL Cal 1: Right +0 ^o	0		0.0%	50		
									USBL Cal 1: Right +18	0 0		0.0%	50		
									USBL Cal 1: Bottom +	180° 0		0.0%	50		
									USBL Cal 1: Bottom +I	۳ 0 -		0.0%	50		
									USBL Cal 1: Left +0°	0		0.0%	50		
									USBL Cal 1: Left +180	0		0.0%	50		
<									Start Logging Stop I	ogging LOC	GING Obse	rvation Co	unt: 4		
Name: U	JSBL Cal 1: Top	+180 ⁰ Start Time:	End Time	e: Co	lor:										
List S	lant Range	Beacon USBL XYZ													
Count: 3															
Time		Station	Code	Used	Obs X	Obs Y	Obs Z	Slant Range	Calculated Slant Range	Bcn East	Bcn North	Bcn Elevatio	n Range Accu	racy Residu	ual W
13-Dec-2	023 13:32:28	USBL Cal 1: Top +180 ⁰	B23	✓	-4.00 m	499.06 m	497.36 m	704.50 m	707.10 m	620755.91 m	267125.12 m	-497.34 m	5.00 m	-2.59 r	n 0.000
13-Dec-2	023 13:32:31	USBL Cal 1: Top +180 ⁰	B23	<	2.11 m	489.06 m	504.02 m	702.22 m	707.10 m	620749.80 m	267135.11 m	-504.00 m	5.00 m	-4.88 r	n 0.000
13-Dec-2	023 13:32:34	USBL Cal 1: Top +180 ⁰	B23	✓	-3.97 m	504.66 m	502.12 m	711.84 m	707.10 m	620755.89 m	267119.51 m	-502.10 m	5.00 m	4.74 m	0.000
13-Dec-2	023 13:32:37	USBL Cal 1: Top +180°	B23	1	-5.65 m	499.10 m	509.33 m	713.05 m	707.10 m	620757.57 m	267125.07 m	-509.31 m	5.00 m	5 95 m	0,000

FIGURE 16-13 ACTIVE CALIBRATION - DATA LOGGING

- b. The status will change from **NOT LOGGING** to **LOGGING**
- c. The **Observation Count** will increment as observation epochs are collected
- d. The **Calibration Steps** data grid will become inactive preventing changes to the selected step being made while data is logged
- e. The data grid columns # Accepted and % Completed will update with each observation epoch collected
- f. The data tabs (List, Slant Range, Beacon and USBL XYZ) at the bottom of the panel will populate with the collected data providing the means to monitor the data quality, see Figure 16-13
- g. The calculated beacon position based on the selected data sources will plot in any open Map views in the color indicated in Figure 16-14





FIGURE 16-14 BEACON POSITIONS IN MAP WINDOW

- 4. To stop logging manually, in Calibration Steps.
 - I. Regardless of the Auto Stop setting, data collection can be stopped/paused at any time by clicking the Stop Logging button
 - The **Stop Logging** button will be disabled and the **Start Logging** button will be enabled
 - The status will change from **LOGGING** to **NOT LOGGING**
 - The steps in the data grid will become active allowing changes to the selected step to be made
 - II. To continue logging data at the same location, click the **Start Logging** button
 - III. To collect data for the next step
 - IV. Select the next step to log data for
 - V. Wait for the vessel to complete required move/rotation
 - VI. Click the **Start Logging** button
- 5. To stop logging based on **Auto Stop**, in Calibration Steps.
 - I. When the specified number of observations has been collected, logging will automatically stop
 - The **Stop Logging** button will be disabled and the **Start Logging** button will be enabled
 - The status will change from **LOGGING** to **NOT LOGGING**
 - The steps in the data grid will become active allowing changes to the selected step to be made
- 6. To continue logging data at the same location
 - I. Click the **Settings** button and either
 - II. Disable the Auto Stop feature; or
 - III. Increase the number of observations to collect
 - IV. Click **OK**
 - V. Click the Start Logging button
- **Note:** After completing the data collection for this same point, do not forget to click the Settings button and reset the Auto Stop option accordingly before proceeding with the data collection at the next step.



- 7. To collect data for the next step.
 - I. Select the next step to log data
 - II. Wait for the vessel to complete required move/rotation
 - III. Click the Start Logging button
- 8. To monitor and review data during collection
 - I. Select the step, this can be a step already completed or the step that data is currently being collected
 - II. If a step already completed is selected, the Start Time and End Time will be displayed



16.2.6 FINALIZING AN ACTIVE CALIBRATION

Once the data collection for a calibration is completed and the data considered acceptable, it must be Finalized in order to proceed with the processing.

- 1. Access the **USBL Calibration** feature in Explorer view.
- 2. In the **Active Calibrations** section select the calibration to finalize.
- 3. Click the **Finalize** button in Active Calibrations section.
- 4. The selected calibration will be moved from the Active Calibrations list then added to the **Completed Calibrations** list where it can now be processed.

16.2.7 USBL CALIBRATION PROCESSING

A completed calibration can now be processed to solve for the Boxin position and USBL calibration values. The calibration values can then be applied in NavView for the respective USBL device. The following details the steps to follow to process the data.

1. Access the **USBL Calibration** feature in Database Services.

Active Calibrations	Selected	Usbl Calibration																		
Finalize											USBL Calibrati	on								
Name Description												Load		Settings	Stations	Reset	Update	Boxin	Calibi	rate
	Data	Calibration Pa	rameters	Offsets	Beacon Info	,														
	List	Slant Range	Beacon	USBL XYZ																
Completed Calibrations	Coun	t 0																		
Configure Reports 🛛 👻 🗢	Time		Station		Code	Used	Obs X	Obs Y	Obs Z	Slant Range	Calculated S	Slant Range	Bon East	Bcn North	Bcn Elevation	Range Accuracy	Residual	w		
Name Description																				
USBL Cal 1 Location N 2º 24'																				

FIGURE 16-15 SELECTED USBL CALIBRATION

2. In the Completed Calibration section



Co	mpleted Calibra	ation	S	
Confi	gure Reports	÷	*	•
Name	Description			
USBL Cal 1	Location N 2° 24'			

FIGURE 16-16 COMPLETED CALIBRATIONS SECTION

I. Select the Completed Calibration from the list to process or import data using import button. Supported formats are Hipap File, Winfrog File, User Defined or Load from DB





II. Click the **Load** button, see Figure 16-15. This will load the logged data set for the selected calibration

-Selecte	Usbl Calibration																	
										USBL Calibration								
											Load	Unload	Settings	Stations R	eset	Update	Boxin	Calibrate
Data	Calibration Par	rameters	Offsets	Beacon Ir	nfo													
List	Clant Pango	Reason																
LISU	Siant Kange	Beacon	USBL XIZ															
Cour	t: 0																	
Tim		Station		Code	Used	Obs X	Obs Y	Obs Z	Slant Range	Calculated Slant Range	Bcn East	Bcn North	Bcn Elevation	Range Accuracy	Residual	w		
13-D	ec-2023 10:45:13	USBL Cal	1: Center +0 ⁰	B23	 Image: A set of the set of the	8.79 m	-3.85 m	497.72 m	497.81 m	500.00 m	620760.30 m	267120.36 m	-497.72 m	5.00 m	-2.19 m	0.000 ^		
13-D	ec-2023 10:45:16	USBL Cal	1: Center +0 ^o	B23	✓	1.10 m	2.43 m	502.59 m	502.60 m	500.00 m	620752.61 m	267126.63 m	-502.59 m	5.00 m	2.60 m	0.000		
13-D	ec-2023 10:45:19	USBL Cal	1: Center +0 ⁰	B23	✓	1.05 m	2.34 m	500.13 m	500.14 m	500.00 m	620752.56 m	267126.54 m	-500.13 m	5.00 m	0.14 m	0.000		
13-0	ec-2023 10:45:22	USBL Cal	1: Center +0°	B23	✓	-9.74 m	-6.31 m	498.64 m	498.77 m	500.00 m	620741.77 m	267117.89 m	-498.64 m	5.00 m	-1.23 m	0.000		
13-D	ec-2023 10:45:25	USBL Cal	1: Center +0 ⁰	B23	✓	6.19 m	3.95 m	503.15 m	503.20 m	500.00 m	620757.69 m	267128.16 m	-503.15 m	5.00 m	3.20 m	0.000		
13-D	ec-2023 10:45:28	USBL Cal	1: Center +0 ^o	B23	✓	-0.89 m	-5.29 m	500.56 m	500.59 m	500.00 m	620750.62 m	267118.91 m	-500.56 m	5.00 m	0.59 m	0.000		
13-E	ec-2023 10:45:31	USBL Cal	1: Center +0 ^o	B23	✓	8.05 m	-3.82 m	498.67 m	498.75 m	500.00 m	620759.56 m	267120.39 m	-498.67 m	5.00 m	-1.25 m	0.000		
13-0	ec-2023 10:45:34	USBL Cal	1: Center +0°	B23	✓	3.78 m	-2.74 m	505.51 m	505.53 m	500.00 m	620755.29 m	267121.46 m	-505.51 m	5.00 m	5.53 m	0.000		
13-D	ec-2023 10:45:37	USBL Cal	1: Center +0 ^o	B23	✓	1.28 m	2.24 m	505.53 m	505.53 m	500.00 m	620752.79 m	267126.44 m	-505.53 m	5.00 m	5.53 m	0.000		
13-E	ec-2023 10:45:40	USBL Cal	1: Center +0 ^o	B23	✓	0.43 m	-2.25 m	504.15 m	504.15 m	500.00 m	620751.95 m	267121.95 m	-504.14 m	5.00 m	4.15 m	0.000		
13-E	ec-2023 10:45:43	USBL Cal	1: Center +0°	B23	✓	-6.04 m	-3.65 m	501.60 m	501.65 m	500.00 m	620745.47 m	267120.55 m	-501.60 m	5.00 m	1.65 m	0.000		
13-0	ec-2023 10:45:46	USBL Cal	1: Center +0°	B23	✓	-4.73 m	-1.31 m	503.27 m	503.29 m	500.00 m	620746.78 m	267122.89 m	-503.27 m	5.00 m	3.29 m	0.000		
13-D	ec-2023 10:45:49	USBL Cal	1: Center +0 ^o	B23	✓	-3.21 m	-7.89 m	508.76 m	508.83 m	500.00 m	620748.30 m	267116.31 m	-508.76 m	5.00 m	8.83 m	0.000		
13-E	ec-2023 10:45:52	USBL Cal	1: Center +0 ^o	B23	✓	-7.72 m	-2.89 m	504.08 m	504.15 m	500.00 m	620743.80 m	267121.31 m	-504.08 m	5.00 m	4.15 m	0.000		
13-E	ec-2023 10:45:55	USBL Cal	1: Center +0°	B23	✓	-7.77 m	0.59 m	493.77 m	493.84 m	500.00 m	620743.74 m	267124.78 m	-493.77 m	5.00 m	-6.16 m	0.000		
13-0	ec-2023 10:51:16	USBL Cal	1: Center +18	0° 823	✓	-11.67 m	2.39 m	507.98 m	508.12 m	500.00 m	620763.18 m	267121.82 m	-507.98 m	5.00 m	8.12 m	0.000		
13-D	ec-2023 10:51:19	USBL Cal	1: Center +18	0 B23	✓	1.61 m	-12.51 m	506.16 m	506.31 m	500.00 m	620749.89 m	267136.71 m	-506.16 m	5.00 m	6.31 m	0.000		
13-0	ec-2023 10:51:22	USBL Cal	1: Center +18	0 ⁰ B23	 Image: A start of the start of	-3.46 m	1.87 m	499.11 m	499.13 m	500.00 m	620754.97 m	267122.34 m	-499.11 m	5.00 m	-0.87 m	0.000		
13-0	ec-2023 10:51:25	USBL Cal	1: Center +18	10 [°] B23	Image: A state of the state	8.66 m	7.45 m	500.73 m	500.86 m	500.00 m	620742.86 m	267116.74 m	-500.73 m	5.00 m	0.86 m	0.000		
13-0	ec-2023 10:51:28	USBL Cal	1: Center +18	0 [°] 823	✓	-12.59 m	5.42 m	500.45 m	500.63 m	500.00 m	620764.10 m	267118.80 m	-500.45 m	5.00 m	0.63 m	0.000		

FIGURE 16-18 LOADED CALIBRATION DATA SET

USBL Calibration							
	Unload	Settings	Stations	Reset	Update	Boxin	Calibrate

FIGURE 16-19 USBL CALIBRATION TOOLBAR



Load	Click to load logged data set for selected calibration
Unload	Click to unload logged data set for selected calibration
Settings	Click to open Calibration Settings dialog to edit the Calibration name and/or description
Stations	Click to open Stations window which displays the logged steps. The name and color for each step can be edited also the data can be used or not used in the calibration by checking or unchecking the Used box at each step
Reset	Click to set calibration parameters to zero
Update	Click to apply the current calibration parameters to the data and then updates the results on screen
Boxin	Click to open the Boxin Setup dialog to run the boxin calculation
Calibrate	Click to run the calibration

16.2.7.1 USBL CALIBRATION DATA VIEW

The Data view presents the data collected for a calibration for review and editing. This view is available for both Active and Completed calibrations. In the case of an Active calibration only the data for the selected step is displayed which can be edited even while the data is being collected. When viewing a Completed calibration, the Data view contains all recorded calibration data that can be viewed and edited.

Note: Collected data can be edited in the List view or graphically in Slant Range, Beacon and USBL XYZ tabs. Data can be edited out graphically by clicking on the individual epoch. Data edited out graphically will be reflected in the Data List tab.



										USBL Calibration								
												Unload	Settings	Stations R	leset	Update	Baxin	Calibrate
Data	Calibration Par	ameters	Offsets	Beacon In	fo.													
List	Slant Range	Beacon	USBL XYZ															
Count	0																	
		Station		Code	Used				Slant Range	Calculated Slant Range	Bcn East	Bcn North	Bcn Elevation	Range Accuracy	Residual	w		
13-Der	c-2023 10:45:13	USBL Cal 1	1: Center +0 ^e	823	1		-3.85 m	497.72 m	497.81 m	500.00 m	620760.30 m	267120.36 m	-497.72 m	5.00 m		0.000 ~		
13-Dee	c-2023 10:45:16	USBL Cal 1	: Center +0 ⁰	823	1	1.10 m	2.43 m	502.59 m	502.60 m	500.00 m	620752.61 m	267126.63 m	-502.59 m	5.00 m	2.60 m	0.000		
13-Der	c-2023 10:45:19	USBL Cal 1	1: Center +0 ^e	823	1		2.34 m	500.13 m	500.14 m	500.00 m	620752.56 m	267126.54 m	-500.13 m	5.00 m	0.14 m	0.000		
13-De	c-2023 10:45:22	USBL Cal 1	1: Center +0 ⁰	823	1	-9.74 m	-6.31 m	498.64 m	498.77 m	500.00 m	620741.77 m	267117.89 m	-498.64 m	5.00 m	-1.23 m	0.000		
13-Der	c-2023 10:45:25	USBL Cal 1	1: Center +0 ⁴			6.19 m	3.95 m		503.20 m	500.00 m	620757.69 m	267128.16 m	-503.15 m	5.00 m	3.20 m	0.000		
13-Der	c-2023 10:45:28	USBL Cal 1	1: Center +0 ⁰	823	1	-0.89 m	-5.29 m	500.56 m	500.59 m	500.00 m	620750.62 m	267118.91 m	-500.56 m	5.00 m	0.59 m	0.000		
13-Der	c-2023 10:45:31	USBL Cal 1	1: Center +0 ^e		1	8.05 m	-3.82 m	498.67 m	498.75 m	500.00 m	620759.56 m	267120.39 m	-498.67 m	5.00 m	-1.25 m	0.000		
13-Dee	c 2023 10:45:34	USBL Cal 1	1: Center +0 ⁴	823	1	3.78 m	-2.74 m	505.51 m	505.53 m	500.00 m	620755.29 m	267121.46 m	-505.51 m	5.00 m	5.53 m	0.000		
13-De	c-2023 10:45:37	USBL Cal 1	1: Center +0 ^a	823	1	1.28 m	2.24 m	505.53 m	505.53 m	500.00 m	620752.79 m	267126.44 m	-505.53 m	5.00 m	5.53 m	0.000		
13-Der	c-2023 10:45:40	USBL Cal 1	1: Center +0 ⁰	823	1	0.43 m	-2.25 m	504.15 m	504.15 m	500.00 m	620751.95 m	267121.95 m	-504,14 m	5.00 m	4.15 m	0.000		
13-Der	c-2023 10:45:43	USBL Cal 1	1: Center +0 ^e	823	1	-6.04 m	-3.65 m	501.60 m	501.65 m	500.00 m	620745.47 m	267120.55 m	-501.60 m	5.00 m	1.65 m	0.000		
13-De	c-2023 10:45:46	USBL Cal 1	1: Center +0 ^o	823	1	-4.73 m	-1.31 m	503.27 m	503.29 m	500.00 m	620746.78 m	267122.89 m	-503.27 m	5.00 m	3.29 m	0.000		
13-Der	c-2023 10:45:49	USBL Cal 1	1: Center +0 ⁴	823	1	-3.21 m	-7.89 m	508.76 m	508.83 m	500.00 m	620748.30 m	267116.31 m	-508.76 m	5.00 m	8.83 m	0.000		
13-De	c-2023 10:45:52	USBL Cal 1	1: Center +0 ⁴	823	1	-7.72 m	-2.89 m	504.08 m	504.15 m	500.00 m	620743.80 m	267121.31 m	-504.08 m	5.00 m	4.15 m	0.000		
13-Der	c-2023 10:45:55	USBL Cal 1	1: Center +0 ⁸	823	1	-7.77 m	0.59 m	493.77 m	493.84 m	500.00 m	620743.74 m	267124.78 m	~493.77 m	5.00 m	-6.16 m	0.000		
13-De	c-2023 10:51:16	USBL Cal 1	1: Center +18	823	1	-11.67 m	2.39 m	507.98 m	508.12 m	500.00 m	620763.18 m	267121.82 m	-507.98 m	5.00 m	8.12 m	0.000		
13-De	c-2023 10:51:19	USBL Cal 1	1: Center +18	B23	1	1.61 m	-12.51 m	506.16 m	506.31 m	500.00 m	620749.89 m	267136.71 m	-506.16 m	5.00 m	6.31 m	0.000		
13-De	c-2023 10:51:22	USBL Cal 1	1: Center +18	B23	1	-3.46 m	1.87 m	499.11 m	499.13 m	500.00 m	620754.97 m	267122.34 m	-499.11 m	5.00 m	-0.87 m	0.000		
13-De	c-2023 10:51:25	USBL Cal 1	: Center +18	B23	1	8.66 m	7.45 m	500.73 m	500.86 m	500.00 m	620742.86 m	267116.74 m	-500.73 m	5.00 m	0.86 m	0.000		
13-Dei	c-2023 10:51:28	USBL Cal 1	: Center +18	B23	1	-12.59 m	5.42 m	500.45 m	500.63 m	500.00 m	620764.10 m	267118.80 m	-500.45 m	5.00 m	0.63 m	0.000		

FIGURE 16-20 USBL CALIBRATION DATA VIEW - LIST TAB

16.2.7.1.1 LIST TAB

Select the List Tab to Display the data in a data grid (see Figure 16-20)

- **Time:** Observation epoch
- Station: Data collection point, color coded
- Code: Calibration beacon code/channel
- **Used:** Checked if used in calibration, unchecked to not be used in calibration
- **Obs X/Obs Y/Obs Z:** Observed USBL XYZ values
- Slant Range: Slant range calculated from USBL observations
- **Calculated Slant Range:** Slant range calculated from initial entered calibration beacon position and transducer position (on vessel)
- Bcn East/North/Elevation: Calculated beacon position
- Range Accuracy: Standard deviation of USBL range data, taken from USBL device settings
- Residual: Slant range minus Calculated Slant Range
- W: Normalized residual for W test
- **Note:** In the case of an Active calibration, if the calibration beacon depth has not been entered and the transducer position does not incorporate sensor offsets, the calculated slant range, beacon position and residual values are not valid.

If a single epoch is selected, a summary of that epoch's data is displayed to the right (see Figure 16-21)



- Selecte	d Usbl Calibration																	
										USBL Calibration								
											Load	Unload	Settings	Station	s Reset	Update	Boxin	Calibrate
Data	Calibration Par	ameters	Offsets	Beacon In	fo													
Liet	Slant Pango	Reason																
List	Stant Range	beacon	USBC ATZ	هم														
Cou	nt: 0																	
Tim	ne	Station		Code	Used	Obs X	Obs Y	Obs Z	Slant Range	Calculated Slant Range	Bcn East	Bcn North	Bcn Elevation	n R	Time:			
13-	Dec-2023 10:45:13	USBL Cal 1	1: Center +0	B23		8.79 m	-3.85 m	497.72 m	497.81 m	500.00 m	620760.30 m	267120.36 m	-497.72 m	5. 🔺	Station:	U	SBL Cal 1: Center	+0°
13-	Dec-2023 10:45:16	USBL Cal 1	1: Center +0 ^e	B23	1	1.10 m	2.43 m	502.59 m	502.60 m	500.00 m	620752.61 m	267126.63 m	-502.59 m	5.	C	-	(2007F4.F4 NU	26742420
13-	Dec-2023 10:45:19	USBL Cal 1	1: Center +0°	B23				500.13 m	500.14 m	500.00 m	620752.56 m	267126.54 m	-500.13 m	5.	Source Geo2D:		520751.51 m, N 2	26/124.20 m
13-	Dec-2023 10:45:22	USBL Cal 1	1: Center +0 ⁰	B23	\checkmark	-9.74 m	-6.31 m	498.64 m	498.77 m	500.00 m	620741.77 m	267117.89 m	-498.64 m	5.	Source Elevation:	0.0	00 m	
13-1	Dec-2023 10:45:25	USBL Cal 1	1: Center +0 ⁰	B23		6.19 m	3.95 m	503.15 m	503.20 m	500.00 m	620757.69 m	267128.16 m	-503.15 m	5.	CRP Geo2D:	E	620751.51 m, N 2	267124.20 m
13-1	Dec-2023 10:45:28	USBL Cal 1	1: Center +0 ⁰	B23	~	-0.89 m	-5.29 m	500.56 m	500.59 m	500.00 m	620750.62 m	267118.91 m	-500.56 m	5.	CDD Flauations	0	00	
13-1	Dec-2023 10:45:31	USBL Cal 1	1: Center +0 ⁰	B23		8.05 m	-3.82 m	498.67 m	498.75 m	500.00 m	620759.56 m	267120.39 m	-498.67 m	5.	CRP Elevation:	0.1	JU m	
13-1	Dec-2023 10:45:34	USBL Cal 1	l: Center +0 ⁰	B23	✓	3.78 m	-2.74 m	505.51 m	505.53 m	500.00 m	620755.29 m	267121.46 m	-505.51 m	5.	Hydrophone Geo2	2D: E (620751.51 m, N 2	267124.20 m
13-1	Dec-2023 10:45:37	USBL Cal 1	l: Center +0°	B23	Image: A start of the start	1.28 m	2.24 m	505.53 m	505.53 m	500.00 m	620752.79 m	267126.44 m	-505.53 m	5.	Hydrophone Eleva	ation: 0.6	00 m	
13-1	Dec-2023 10:45:40	USBL Cal 1	1: Center +0 ⁰	B23	✓	0.43 m	-2.25 m	504.15 m	504.15 m	500.00 m	620751.95 m	267121.95 m	-504.14 m	5.	Line dia m	0	008	
13-1	Dec-2023 10:45:43	USBL Cal 1	l: Center +0 ^o	B23	Image: A start of the start	-6.04 m	-3.65 m	501.60 m	501.65 m	500.00 m	620745.47 m	267120.55 m	-501.60 m	5.	Heading:	0.1	00*	
13-1	Dec-2023 10:45:46	USBL Cal 1	I: Center +0°	B23	~	-4.73 m	-1.31 m	503.27 m	503.29 m	500.00 m	620746.78 m	267122.89 m	-503.27 m	5.	Pitch:	0.0	00°	
13-	Dec-2023 10:45:49	USBL Cal 1	l: Center +0 ⁰	B23		-3.21 m	-7.89 m	508.76 m	508.83 m	500.00 m	620748.30 m	267116.31 m	-508.76 m	5	Roll:	0.6	00"	
13-1	Dec-2023 10:45:52	USBL Cal 1	I: Center +0 ^o	B23	~	-7.72 m	-2.89 m	504.08 m	504.15 m	500.00 m	620743.80 m	267121.31 m	-504.08 m	5.		~	0.70 14- 2.05	7.407.70
13-0	Dec-2023 10:45:55	USBL Cal 1	I: Center +0°	B23	 Image: A set of the set of the	-7.77 m	0.59 m	493.77 m	493.84 m	500.00 m	620743.74 m	267124.78 m	-493.77 m	5	Raw Usbr.	X3	8.79 m, Y:-3.85 m	i, 2:497.72 m
13-1	Dec-2023 10:51:16	USBL Cal 1	i: Center +18	30° B23	~	-11.67 m	2.39 m	507.98 m	508.12 m	500.00 m	620763.18 m	267121.82 m	-507.98 m	5.	Hydrophone Adju	sted USBL: X:	8.79 m, Y:-3.85 m	n, Z:497.72 m
13-1	Dec-2023 10:51:19	USBL Cal 1	I: Center +18	30° B23	 Image: A set of the set of the	1.61 m	-12.51 m	506.16 m	506.31 m	500.00 m	620749.89 m	267136.71 m	-506.16 m	5.	Slant Range:	49	97.81 m	
13-1	Dec-2023 10:51:22	USBL Cal 1	i: Center +18	80° B23	~	-3.46 m	1.87 m	499.11 m	499.13 m	500.00 m	620754.97 m	267122.34 m	-499.11 m	5.				
13-1	Dec-2023 10:51:25	USBL Cal 1	i: Center +18	30 [°] B23	 Image: A set of the set of the	8.66 m	7.45 m	500.73 m	500.86 m	500.00 m	620742.86 m	267116.74 m	-500.73 m	5	Calculated Slant R	ange: 50	0.00 m	
13-1	Dec-2023 10:51:28	USBL Cal 1		80° B23	 Image: A set of the set of the	-12.59 m	5.42 m	500.45 m	500.63 m	500.00 m	620764.10 m	267118.80 m	-500.45 m					

FIGURE 16-21 USBL CALIBRATION DATA VIEW -LIST TAB - SINGLE EPOCH SELECTED

The application of the data can be edited by selecting a single or group of epochs in the data grid, right mouse clicking and clicking on Properties to open the Edit USBL Range Epochs dialog (see Figure 16-22). Any changes made are applied to all selected epochs. The options are detailed below.

Sedit USB	L Range Epochs	_	\times
X Accuracy:	2.00 m		
Y Accuracy:	2.00 m		
Z Accuracy:	0.00 m		
Range Accur	acy: 5.00 m		
🖌 Use obser	vation		
Count:	1		
ОК	Cancel Apply		

FIGURE 16-22 EDIT USBL RANGE EPOCHS DIALOG

- X Accuracy: Standard deviation of the reference position data X (Easting)
- Y Accuracy: Standard deviation of the reference position data Y (Northing)
- **Z Accuracy:** Standard deviation of the reference elevation data Z
- **Range Accuracy:** Standard deviation of the USBL slant range
- **Note:** The initial standard deviation values originate from the respective data source either entered manually or decoded from the input.
 - **Use observation:** Controls if the epochs are used in the calibration adjustments: checked they are used; unchecked they are not



16.2.7.1.2 SLANT RANGE TAB

The Slant Range Tab displays the slant range observations or slant range residuals in a time series view (see Figure 16-23 and Figure 16-24) or the Histogram Tab shows slant range residuals in a histogram (see Figure 16-25).

The Time Series Tab presentation and editing options are the same for both the observations and the residuals.



FIGURE 16-23 USBL CALIBRATION - DATA VIEW - SLANT RANGE TIME SERIES



FIGURE 16-24 USBL CALIBRATION - DATA VIEW - SLANT RANGE RESIDUALS TIME SERIES

4D Nav, LLC NavView User Guide – 16 USBL Boxin and Calibration Document: 4DN_NVUG_S16_01A Release: 01 Revision: A



The components that are common to both the observation and residual time series displays are as follows:

- **Points:** Data Used in the calibration is displayed as a square
- Data not Used in the calibration is displayed as an X
- **Observation:** Select this option to display the slant range
- **Residual:** Select this option to display the slant range residuals
- Slider Control: Vertical and horizontal slider controls can be used to set the vertical and horizontal viewing window
- Mouse Control
- Zoom: Use the scroll wheel to zoom in and out
- **Rectangle Zoom:** Left mouse click and drag to create a rectangle to zoom to
- Mouse Over: Mouse over a point to display the collection step the data is associated with
- Edit Data: Single left click on a point to toggle it enabled/disabled in the calibration
- Apply: Click to apply editing changes
- **Cancel:** Click to abort editing changes

The additional data presented on the residual time series display are:

- **– –** 95% confidence error
- _ _ _
- Standard deviation (1₀)
 - Average residual

The histogram view displays the slant range residuals only (see Figure 16-25). The histogram view includes the following text and graphical information:



FIGURE 16-25 USBL CALIBRATION - DATA VIEW - SLANT RANGE HISTOGRAM

Average residual and 1 sigma standard deviation

1 sigma standard deviation Normal distribution curve

4D Nav, LLC NavView User Guide – 16 USBL Boxin and Calibration Document: 4DN_NVUG_S16_01A Release: 01 Revision: A



Average residual

Note: The histogram display does not support editing of the data.

16.2.7.1.3 BEACON TAB

The Beacon tab displays the calculated beacon X/Y (Easting/Northing) and Z (Elevation) in time series (see Figure 16-26) and histogram (see Figure 16-27) views. The data displayed is selected using the radio buttons labelled X/Y and Z.

The display features and edit options are the same as those detailed for the Slant Range Tab.



FIGURE 16-26 USBL CALIBRATION - DATA VIEW TAB - BEACON XY TIME SERIES

The additional data presented on the Beacon X/Y and Z time series displays are:

- – 95% confidence error
- **- - -** Standard deviation (1σ)
 - Average Beacon East/North/Elevation
 - Starting Beacon Location East/North/Elevation





FIGURE 16-27 USBL CALIBRATION - DATA VIEW - BEACON XY HISTOGRAM

Average Beacon East/North/Depth and 1 sigma standard deviation



- 1 sigma standard deviation
- Normal distribution curve
- Average Beacon East/North/Depth

16.2.7.1.4 USBL XYZ TAB

The USBL XYZ tab displays the USBL observations and residuals in time series views (see Figure 16-28 and Figure 16-29) and the residuals in a histogram view (see Figure 16-30). The data displayed is selected using the radio buttons labelled X, Y and Z.

The display features and edit options are the same as those detailed for the slant range for the Slant Range Tab.



FIGURE 16-28 USBL CALIBRATION – DATA VIEW – USBL X TIME SERIES





FIGURE 16-29 USBL CALIBRATION - DATA VIEW - USBL X RESIDUALS

The additional data presented on the USBL/ X/Y/Z Residual time series displays are:

- 95% confidence error
- Standard deviation (1σ) Average X/Y/Z Residuals



FIGURE 16-30 USBL CALIBRATION - DATA VIEW - USBL X HISTOGRAM

USBL XYZ Residuals and 1 sigma standard deviation

- 1 sigma standard deviation
- Normal distribution curve
 - Average USBL XYZ Residual

4D Nav, LLC NavView User Guide – 16 USBL Boxin and Calibration Document: 4DN_NVUG_S16_01A Release: 01 Revision: A



16.2.7.2 CALIBRATION PARAMETERS TAB

Verify the Calibration Parameter Values by clicking the **Calibration Parameters** tab.

г	Selected	Usbl Calibratio	n ———			Selected Usbl Calibration											
	Data	Calibration P	arameters	;	Offsets	Beacon Info]										
	Calibra	ation Parameter	Values –			-											
	Pitch	0.00°] ±	0.00°													
	Roll C	Correction	0.00°] ±	0.00°												
	Heading Correction		0.00°] ±	0.00°												
	Scalar	r Correction	1] ±	0												
	Ca																
	Used 50	0 of 500 observ	vations.														
	Slant Ra	nge RMS:		07	m												
	Usbl Ob	5.	32	m													
	Usbl Ob	s RMS Y:	4.	75	m												
	Usbl Ob	s RMS Z:	5.	04	m												

FIGURE 16-31 USBL CALIBRATION - CALIBRATION PARAMETERS TAB

- Calibration Parameter Values
 - I. Confirm the USBL calibration parameters are at the initial values, i.e. pitch, roll and heading correction are 0.000°
 - II. If they are not, click the Reset button
 - III. Calculate Scale: Check if the USBL calibration adjustment is to solve for scale errors
- **Note:** Calculate Scale generally not done because the scale correction determined will only be applicable to the current SVP in use.

16.2.7.3 OFFSETS TAB

Verify the offsets by clicking the **Offsets** tab.

Selected	Usbl Calibration													
							USBL Calibration				- ·			
Dete	Callbardian Descentary	0//	0					Unload	Settings	Stations	Reset	Update	Boxin	Calibrate
Data	Calibration Parameters	Offsets	Beacon Info											
-USBL												– Systen	n Offsets קר	.ever Arm —
												X: 0	.00 m	X: 0.00 m
Device	s/USBL/PSIMSSB/USBL-RAV	W (Calibratio	n)									Y: 0	.00 m	Y: 0.00 m
												Z: 0	.00 m	Z: 0.00 m
Elevan	ion source													X. 0.00 m
Fived	Elevation													Y: 0.00 m
														7: 0.00 m
Device	ng C-O												c-0 00	10 I
Devic	sydyro/mon/medding												0.00	,
Pitch	C-0										mut c o la	000		10
Fixed	Pitch/Koli													
Positi	on Systems													0.0
Nag	10		V Offert V	Offeret	7 Offeret									
Dev	ces/GPS/GGA/Geo2D (WGS	5 84-4326)	0.00 m 0	00 m	0.00 m		 	 						





Note: All vessel offsets are automatically populated into the USBL calibration during initial setup. Verify all offsets are correct. If vessel offsets were edited after the calibration was already setup, they will have to be updated in the calibration offsets tab.

16.2.7.4 BEACON INFO TAB

Verify the Initial Beacon Position values by clicking the **Beacon Info** tab.

USBL Calibration												
	oad Un	load Settings	: Reset	Updat	e Boxin	Calibrat						
Data	Calibration Para	meters Offsets	Beacon Infe	o								
Selected (Calibration Beac	on: HPR B23 *			•							
Name	- Beacon Info -				Boxin Status -							
HPR B23	Name:	HPR B23			Boxin Calculated: No							
	Address:	B23			Boxin Unit Variance: 0.000							
	Description:				Passed Chi Squared Test: No							
	– Starting –				-Computed —							
	Coordinate:	E 620751.51 m N 267124.20 m	O Geo O Grid		Coordinate:	E 620751.51 m N 267124.20 m	n 🔾 Geo n 🧿 Grid					
	Elevation:	-500.00 m			Elevation:	-500.00 m						
	σ East:	5.00 m			σ East:	N/A						
	σ North:	5.00 m		ix Position	σ North:	N/A						
	σ Elevation:	5.00 m	F	ix Elevation	σ Elevation:	N/A						

FIGURE 16-33 USBL CALIBRATION PROCESSING - BEACON INFORMATION TAB

- Selected Calibration Beacon: Confirm this is set to the beacon used for the data collection
- Beacon Info:
 - I. Name: Edit if required
 - II. Address: Edit if required
 - III. Description: Edit if required
- Starting
 - I. **Coordinate:** Edit if a better approximate position for the beacon than that entered during the planning process is known
 - II. **Elevation:** Enter the best approximate for the beacon elevation
 - III. σ East: Edit the initial beacon Easting standard deviation as required
 - IV. σ North: Edit the initial beacon Northing standard deviation as required
 - V. σ Elevation: Edit the initial beacon Elevation standard deviation as required
 - VI. **Fix Position:** Check only if the beacon is at a known position, installed in a previously surveyed tripod or survey receptacle on a seafloor asset
 - VII. **Fix Elevation:** Check only if the beacon is at a known elevation, installed in a previously surveyed tripod or survey receptacle on a seafloor asset



16.2.7.5 BOXIN ONLY

To calculate a Boxin position only for a beacon click the Boxin button.

🔮 Boxin Setup)	Fix Elevati	on	ElevatX:
Boxin Setup				
Coordinate	Selected Calib E 620751.51	oration Beacor 1 m Q Geo	n:	IPR B23 ▼
coordinater	N 267124.20) m 💽 Grid		
Elevation:	-500.00 m			
σ East:	5.00 m			Fix Position
σ North:	5.00 m			
σ Elevation:	5.00 m			Fix Elevation
				Estimate
Cancel	< Back	Next >		Finish

FIGURE 16-34 USBL CALIBRATION – BOXIN SETUP

1. Review beacon initial information. Edit if required.

Note: The Estimate button generates an initial estimate of the boxin position.

2. To calculate the final Boxin position click Finish.

Calibration	n Results			_		\times
	•	libration Comp	lete			
Beacon Info -			Boxin Status -			
Name:	HPR B23		Boxin Calcula	ited:	Yes	
Address:	B23		Boxin Unit Va	ariance:	1.023	
Description:			Passed Chi S			
Starting			Computed -			
Coordinate:	E 620751.51 m O Geo N 267124.20 m O Grid		Coordinate:	E <mark>62075</mark> N 26712	51.04 m 24.01 m	O Geo O Grid
Elevation:	-500.00 m]	Elevation:	-499.90 m	1	
σ East:	5.00 m		σ East:	0.50 m		
σ North:	5.00 m	Fix Position	σ North:	0.50 m		
σ Elevation:	5.00 m	Fix Elevation	σ Elevation:	0.29 m		
			Report	Oł	(Cancel

FIGURE 16-35 USBL CALIBRATION - BOXIN RESULTS

To generate a Boxin report, click Report, the resulting PDF document will be displayed and can then be exported as a PDF, XPS or an Excel document. The contents of the report will contain the items selected in **Configure Reports.** See Figure 16-36





FIGURE 16-36 CONFIGURE REPORTS

16.2.7.6 SOLVE FOR USBL CALIBRATION VALUES

To solve for the USBL calibration values that can then be applied in NavView for the respective USBL device.

1. Click the Calibrate button. The Computed Boxin and Calibration Parameter Values are calculated.



A C PL P	D II									_	7	~
Calibration	Results								_	L		~
Beacon Info Boxin Status												
Namo		0				Doxin Coloriate de Maria						
indiffe.	НРК В23							165				
Address:	B23					B	oxin Unit Va	iriano	:e:	1.02	3	
Description:						P	assed Chi S	quare	ed Test	: Yes		
Starting —						C	omputed —					
Coordinate:	E 620 N 26	0751.51 m 7124.20 m	n O Ge n O Gr	eo id		c	oordinate:	E N	62075 26712	1.04 n 4.01 n		Geo Grid
Elevation:	-500.00 m					E	levation:	-499.90 m				
σ East:						o	East:	0.50 m				
σ North:	5.00 m				Fix Position		North:	0.50 m				
σ Elevation:	σ Elevation: 5.00 m				Fix Elevation	σ Elevation: 0.29 m						
∟ ⊂ Calibration Pa	arameter	Values –				L						
Pitch Correct	tion	-0.01°	± 0.02	2°								
Roll Correction	on	0.04°	± 0.02	<u>2</u> °								
Heading Cor	rection	0.05°	± 0.03	3°								
Scalar Correc	ction	1] ± 0									
L Used 500 of 50	0 observ	ations.										
Slant Range RMS:		5.	06 m									
Usbl Obs RMS X:		5.	5.27 m									
Usbl Obs RMS Y:		4.	77 m									
Usbl Obs RMS	Z:	5.	03 m									
							Report		Ok	;	Car	ncel

FIGURE 16-37 USBL CALIBRATION - CALIBRATION COMPLETE RESULTS

- 2. To generate a Calibration report, click Report, the resulting PDF document will be displayed and can then be exported as a PDF, XPS or an Excel document. The contents of the report will contain the items selected in **Configure Reports.** See Figure 16-36
- **Note:** The beacon positions scatter plot after calibration can also be viewed in Map as a QC tool.



FIGURE 16-38 USBL CALIBRATION - CALIBRATION COMPLETE - MAP VIEW