Sonardyne
SOUND IN DEPTH

UM-CASIUS 6

CASIUS 6 Processing

Issue A Rev 1

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Note

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Amendment History

The amendment history records all amendments and additions made to this manual.

Issue	Revision	Date	Comments	Section	Page
A	1	20-07-2018	CASIUS 6 First Issue with MM/R2 V6.00	All	All

Section 1 – Introduction

1.1 Scope of this Manual

This manual refers to the Calibration of Attitude Sensors In USBL Systems (CASIUS 6) software, introduced with Marksman and Ranger 2 V6.00. It provides important information about the software and how to calibrate and operate it safely and effectively.

Note

Some features shown in the software screen captures may not be available in your installation, depending on the exact product and options purchased.

1.2 Purpose of this Manual

This manual contains information for anyone involved with operating and diagnosing CASIUS 6 software together with Marksman and Ranger 2 systems.

This manual may be printed in part or whole by the user but cannot be copied or changed. Copyright of this manual remains with Sonardyne International Limited at all times.

1.3 Related Publications

Table 1–1 Related Publications

Publication	Title
UM-8250	*Marksman L/USBL, Ranger 2 Pro/Survey/DP USBL V6.00 User Manual*
UM-8251	*Ranger 2 USBL V6.00 User Manual*
UM-8245	*Mini-Ranger 2 USBL User Manual*

1.4 Conventions

Table 1–2 Conventions used in this Manual

Format	Conventions
Boldface Type	User Input, Menu Options, Keys, e.g. Click **OK**
Italic Type	References to Figures, Tables, Sections and other internal/external source
Arrow (**>**)	Selection of an additional menu item e.g. **File > Save**

Section 2 – Technical Description

2.1 CASIUS 6 Overview

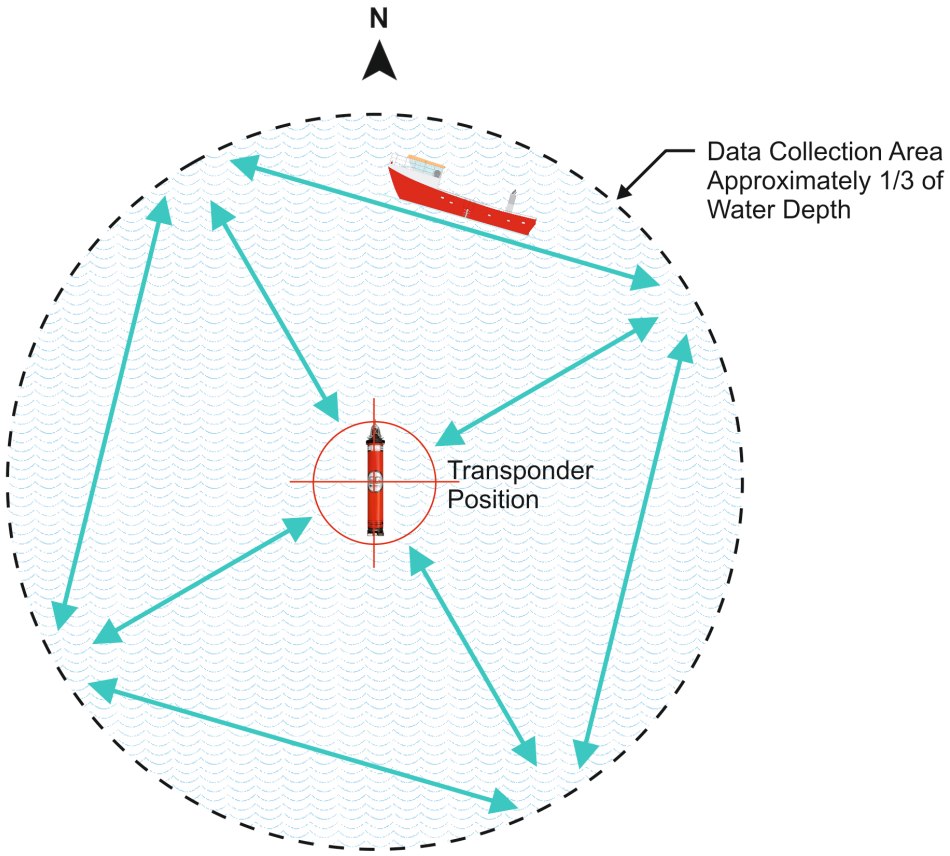
CASIUS 6 USBL calibration tool is a Microsoft Windows® based software application installed with Marksman and Ranger 2 software applications. CASIUS 6 optimises the performance and accuracy of Ultra-Short BaseLine (USBL) acoustic positioning systems by accurately calibrating a vessel's attitude sensors such as Gyros and Vertical Reference Units (VRUs).

CASIUS 6 can use the location and time that the data is collected at to model, and correct for changes in tide and refraction.

The process starts by deploying a reference acoustic transponder on the seabed. Next, the vessel sails in a pre-determined calibration pattern over and around the transponder whilst simultaneously collecting DGPS, USBL, VRU and Gyro Compass data. During this process, the data is logged by the USBL system and CASIUS application for post-processing.

The data collection area should be set to one third of the water depth, but at least 40 metres and no more than 500 metres (Sonardyne changed the data collection area from half to one third of water depth when Wideband was adopted due to the increased range accuracy and to save time).

Figure 2–1 Data Collection Example



Notes

Data collection should be turned off when the vessel is outside the data collection area.

Once the vessel has performed its calibration pattern over the seabed transponder, the DGPS and USBL acoustic range data is processed by CASIUS to compute an unbiased estimate of the reference beacon position, the grid sound velocity and the antenna offsets.

USBL data is then compared with predicted data from the DGPS/reference transponder to estimate the pitch, roll and heading errors.

2.2 Calibration Verification

The Average Fix Tool can be used to confirm that an existing USBL system calibration is still valid, and so avoid the need to spend valuable time re-calibrating the system unnecessarily. The tool allows a report of current system settings, and performance to be produced, which when compared to the result of the previous CASIUS 6 calibration can be used to decide whether a new calibration is required.

A transponder is placed on the seabed, either at an arbitrary position, or a known location co-ordinate, and the vessel carries out some basic manoeuvres, such as spins, or figures of eight above the transponder, before sailing a short distance away. The tool produces an estimate of the position of the transponder with respect to the GNSS, and the spread. A report can be generated that provides the installation settings that were used, and the achieved position performance. This report can be either used as evidence of the performance of the system following a fresh calibration, or as evidence that the existing calibration achieves the required survey performance, and so a new calibration was not necessary.

2.3 Calibration Procedure

CASIUS 6 achieves improved accuracy and precision by working directly from the Sonardyne Wideband signals, modelling tidal variation during the data collection, and compensating for refraction to estimate misalignments between the USBL transceivers and other reference sensors.

Data that may have already been collected for verifying the existing calibration can be supplemented with additional data either from fixed locations spread around a transponder that has been placed on the seabed, or by carrying out recommended manoeuvres while collecting GNSS, AHRS and USBL data. The modelling of tidal changes, means that data collected at different stages of the tide can be accurately processed.

CASIUS 6 then computes an unbiased estimate of the position of the seabed transponder, the lever arm between the USBL and the GNSS antenna, and the pitch, roll and heading misalignments between the USBL transceiver and the reference sensors. A report can be generated that summarises the performance of the system before, and after the calibration. This report is commonly included within a survey report.

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Section 3 – CASIUS 6 Calibration Processing

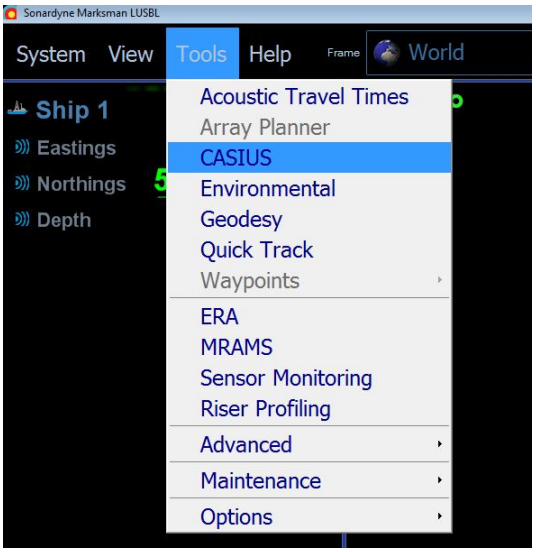
3.1 Introduction

CASIUS 6 is opened from the Marksman and Ranger 2 application.

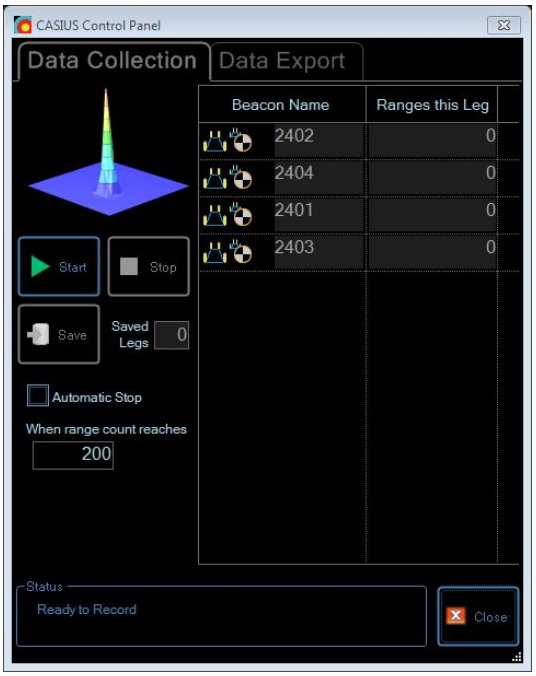
CASIUS 6 can also be manually opened from the Windows® Start menu; see *Appendix A "Manually Opening CASIUS 6"*.

3.1.1 Opening CASIUS 6 in Marksman and Ranger 2

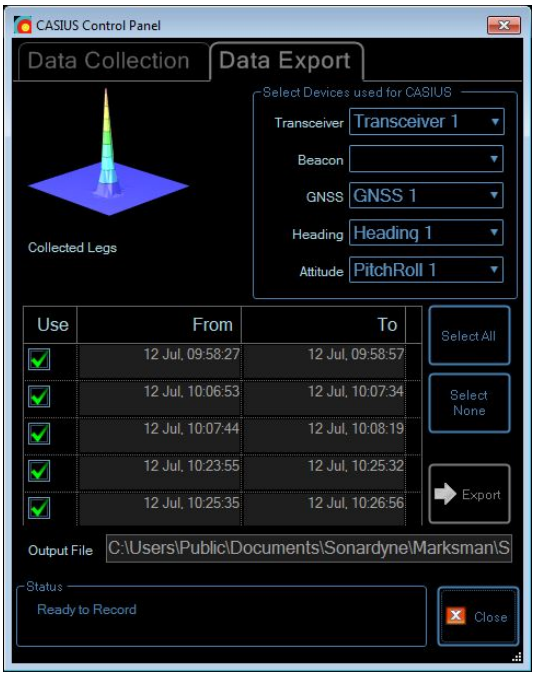
1. In Marksman/Ranger 2 select **Tools>CASIUS**.



2. CASIUS 6 opens on the **Data Collection** tab ready to start data collection.



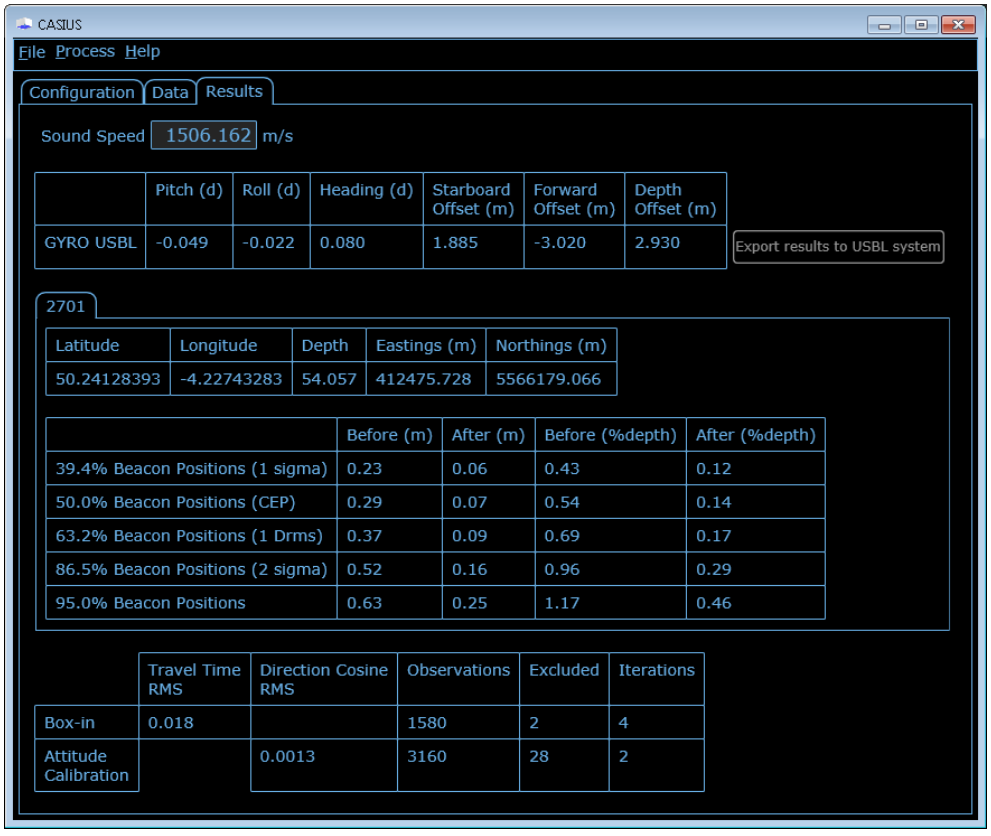
3. On the **Data Export** tab, selected Data Collection legs can be exported ready for processing.



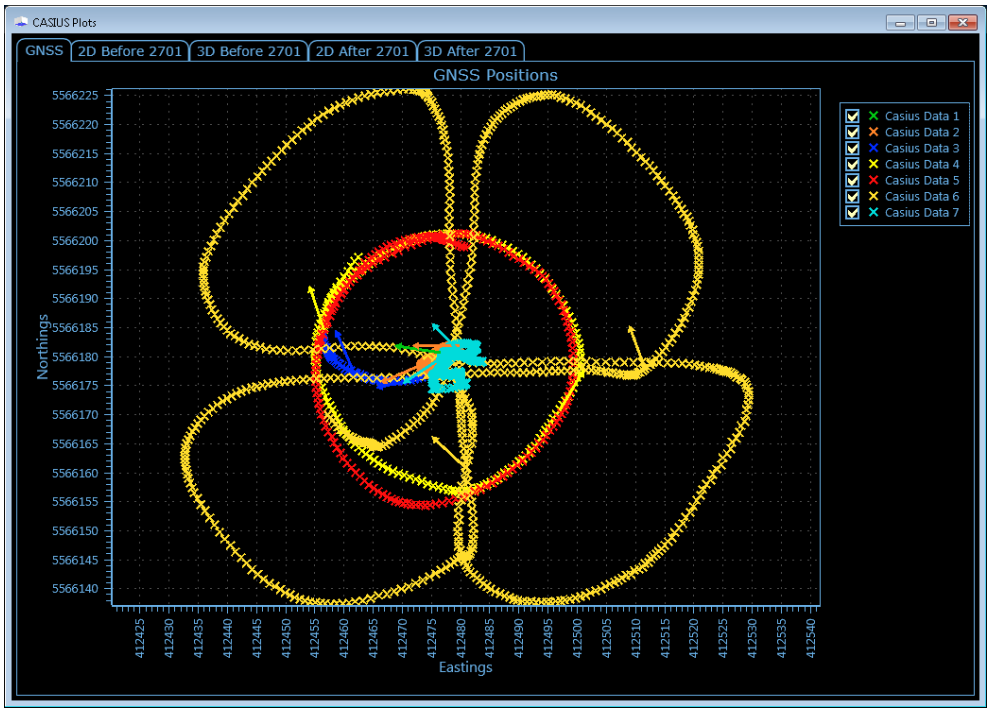
4. After the export has completed CASIUS 6 displays the the Results and Plots as shown in the examples below.

Note

A Data Collection export must first be performed before the CASIUS Process window opens (shown below).



5. The GNSS positions for each Data Collection leg are also displayed; see *Section 3.3.2*.



Note

The exported Data Collection file (.CAS2 file) can also be opened manually outside of Marksman/Ranger 2 for processing; see *Appendix A "Manually Opening CASIUS 6"*.

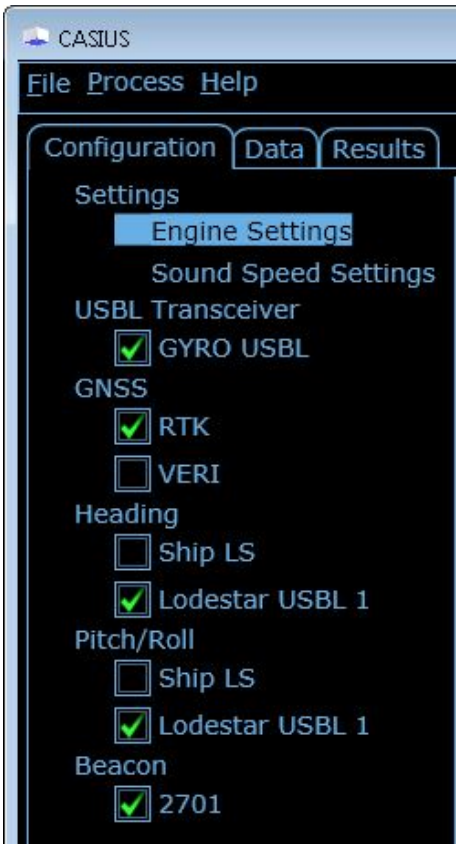
3.2 CASIUS 6 Configuration and Data

3.2.1 Configuration Settings

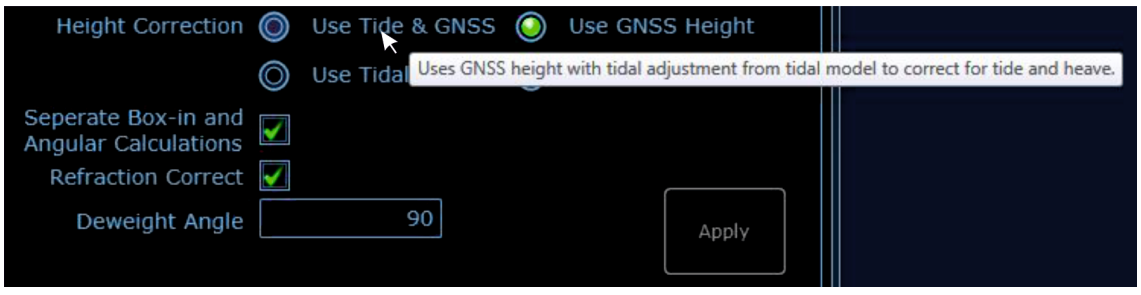
The **Configuration** tab displays **Engine** and **Sound Speed Settings** and instruments that were selected for the Data Collection.

Note

If there are multiple devices for each setting, select the devices to be used for processing. This can be useful to compare the trending performance of the system using different sensors.



Tooltips are displayed for some Engine Settings options by moving the cursor over the selection.



The **Engine Settings** are described in *Table 3–1*.

Note

After changing settings, click "Apply" to update the Engine Settings.

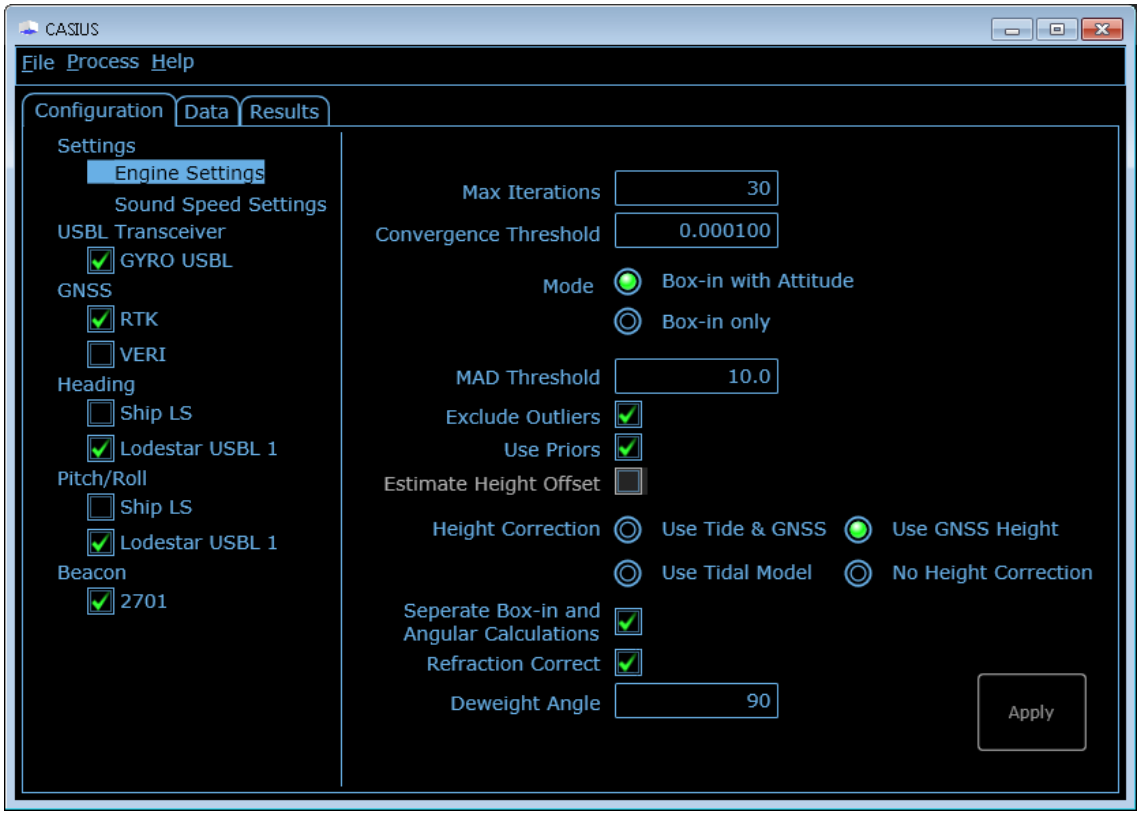


Table 3–1 Configuration - Engine Settings

Item	Description
Max Iterations	Not normally modified
Convergence Threshold	Not normally modified
Mode	Box-in of beacon only, or estimate USBL alignment + beacon
MAD Threshold	Median Absolute Deviation (lower valus cause more data to be identified as outliers; higher values cause fewer measurements to be identified as outliers)
Exclude Outliers	Exclude or weight against outliers
Use Priors	Use initial values as observations of values being computed
Estimate Height Offset	Estimate the difference in depth between USBL transceivers (only with more than one USBL)
Height Correction	Allows use of GNSS height, or a tidal model to compensate for tide during the collection
Seperate Box-in and Angular Calculations	Process box-in before estimating angular corrections, or optimise both at the same time
Refraction Correct	Estimate correction for refraction
Deweight Angle	Deweight elevation estimates above this angle (sometimes useful in shallow water)

Sound Speed Settings

The **Surface** and **Average Sound Speed** and **Error** can be manually entered or the system will calculate these if **Use Auto** is selected.

When entering Sound Speed Settings manually, it's recommended to compare the values being entered to the **Auto** values. Large discrepancies may indicate errors.

Note

After changing settings, click "Apply" to update the Sound Speed Settings.

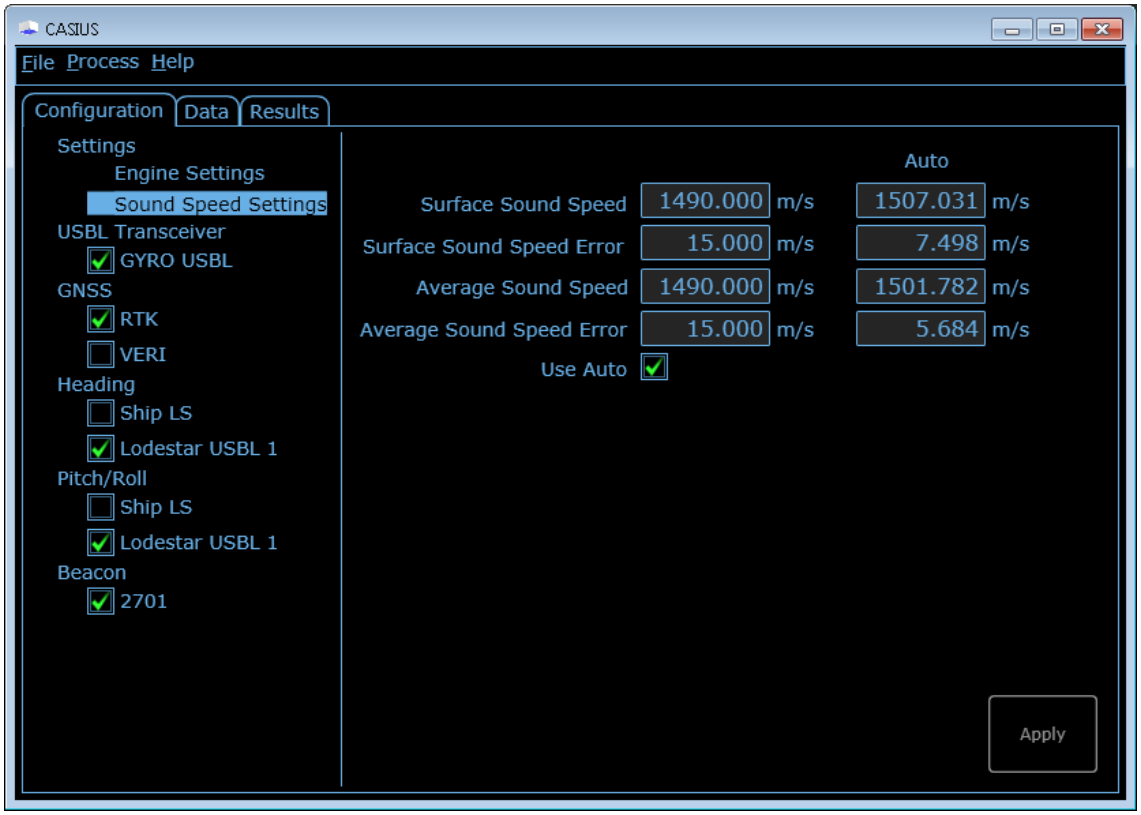


Table 3–2 Configuration - Sound Speed Settings

Item	Description
Surface Sound Speed	Sound speed at the transducer depth
Surface Sound Speed Error	Estimate of accuracy
Average Sound Speed	Average through water column
Average Sound Speed Error	Estimate of accuracy
Use Auto	No measurement is available

3.2.2 Data

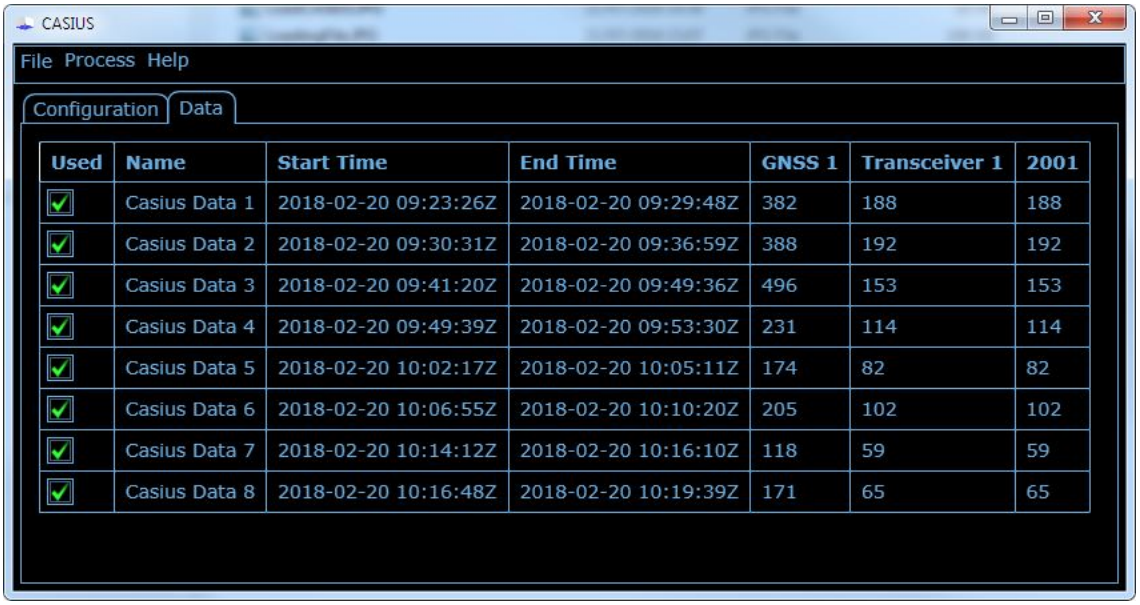
The **Data** tab displays the start and end time and how many ranges were performed by each beacon for each leg. The number of ranges in each leg should be statistically meaningful.

In the **Used** column, legs can be selected/cleared to test for bad or biased data and the Data Collection can be re-processed; see *Section 3.3*.

Note

Unselecting individual legs in the 'Data' tab (below) before clicking 'Process CASIUS' excludes them from the result.

Unselecting individual "CASIUS Data" legs  **in the chart legend does not change the result, but allows the operator to check that the none of the datasets are biased from the central solution.**



Used	Name	Start Time	End Time	GNSS 1	Transceiver 1	2001
☑	Casius Data 1	2018-02-20 09:23:26Z	2018-02-20 09:29:48Z	382	188	188
☑	Casius Data 2	2018-02-20 09:30:31Z	2018-02-20 09:36:59Z	388	192	192
☑	Casius Data 3	2018-02-20 09:41:20Z	2018-02-20 09:49:36Z	496	153	153
☑	Casius Data 4	2018-02-20 09:49:39Z	2018-02-20 09:53:30Z	231	114	114
☑	Casius Data 5	2018-02-20 10:02:17Z	2018-02-20 10:05:11Z	174	82	82
☑	Casius Data 6	2018-02-20 10:06:55Z	2018-02-20 10:10:20Z	205	102	102
☑	Casius Data 7	2018-02-20 10:14:12Z	2018-02-20 10:16:10Z	118	59	59
☑	Casius Data 8	2018-02-20 10:16:48Z	2018-02-20 10:19:39Z	171	65	65

3.3 Processing the Data Collection

Before processing, it is recommended to adjust settings (see *Section 3.2*) to optimise the Data Collection before comparing and reviewing the results.

3.3.1 Process

1. Click **Process>Process CASIUS** to start processing the Data Collection.

2. The **Results** tab displays the corrected transceiver offsets and the beacon before and after positions.

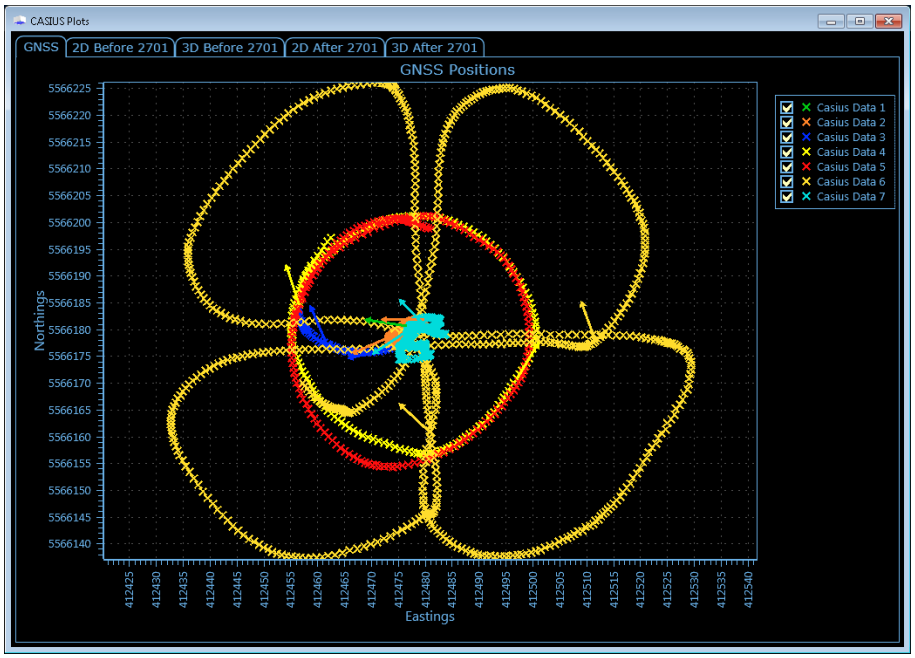
	Pitch (d)	Roll (d)	Heading (d)	Starboard Offset (m)	Forward Offset (m)	Depth Offset (m)
GYRO USBL	-0.049	-0.022	0.080	1.885	-3.020	2.930

Latitude	Longitude	Depth	Eastings (m)	Northings (m)
50.24128393	-4.22743283	54.057	412475.728	5566179.066

	Before (m)	After (m)	Before (%depth)	After (%depth)
39.4% Beacon Positions (1 sigma)	0.23	0.06	0.43	0.12
50.0% Beacon Positions (CEP)	0.29	0.07	0.54	0.14
63.2% Beacon Positions (1 Drms)	0.37	0.09	0.69	0.17
86.5% Beacon Positions (2 sigma)	0.52	0.16	0.96	0.29
95.0% Beacon Positions	0.63	0.25	1.17	0.46

	Travel Time RMS	Direction Cosine RMS	Observations	Excluded	Iterations
Box-in	0.018		1580	2	4
Attitude Calibration		0.0013	3160	28	2

3. The **CASIUS Plots** window displays the vessels GNSS position for each Data Collection leg and a set of tabs displaying backplots based on the beacons selected in the Data Collection; see *Section 3.3.2*.



3.3.2 Plots

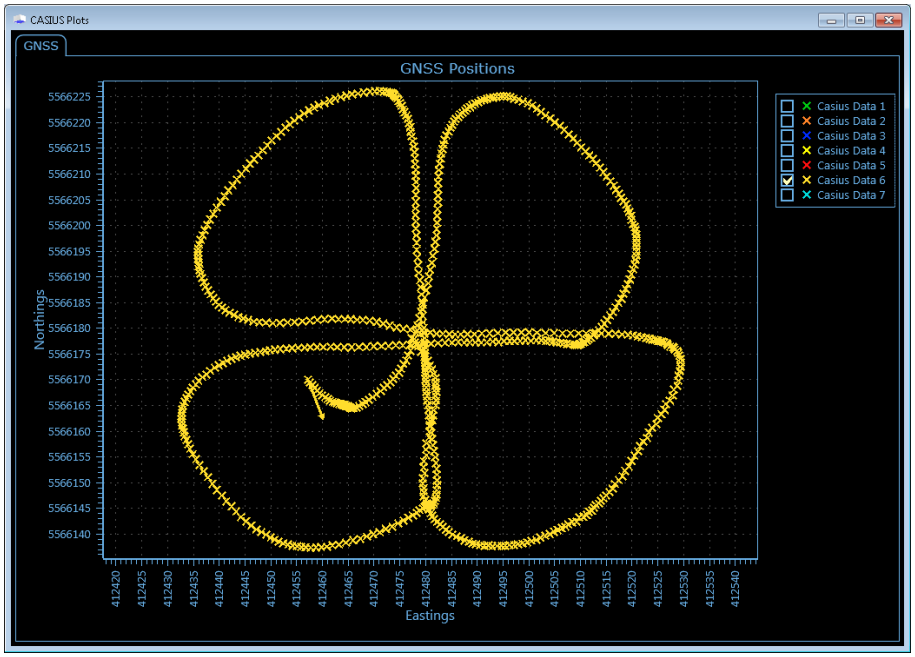
The Plots can be displayed and interacted with as follows:

- On the right side of the plot each leg can be individually selected by selecting/clearing the check box.
- Moving the cursor over a CASIUS Data leg 

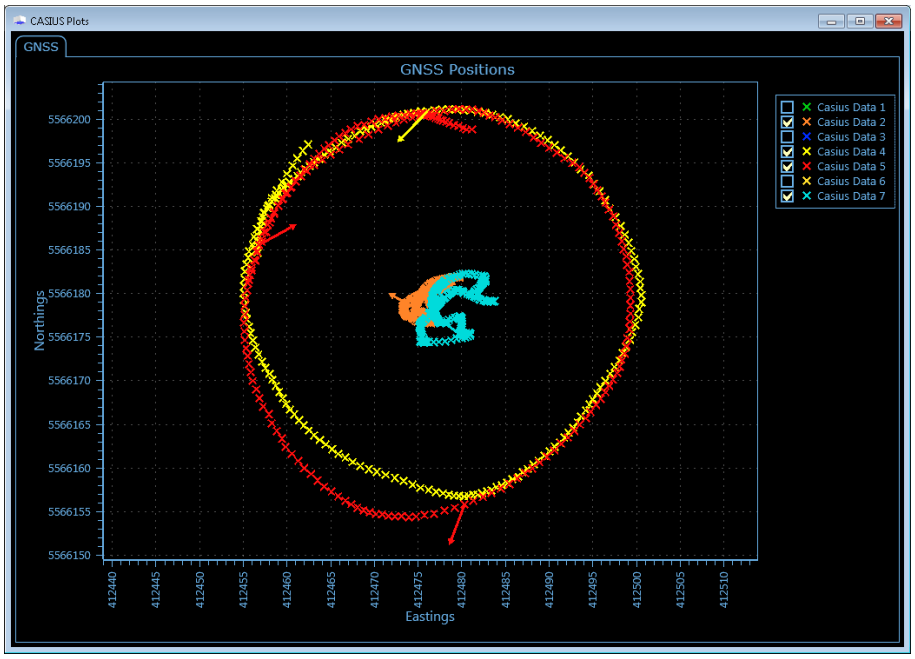
highlights that trace on the chart.
- Scrolling the mouse wheel zooms in and out of the backplot.

GNSS

CASIUS Data 6 leg selected.

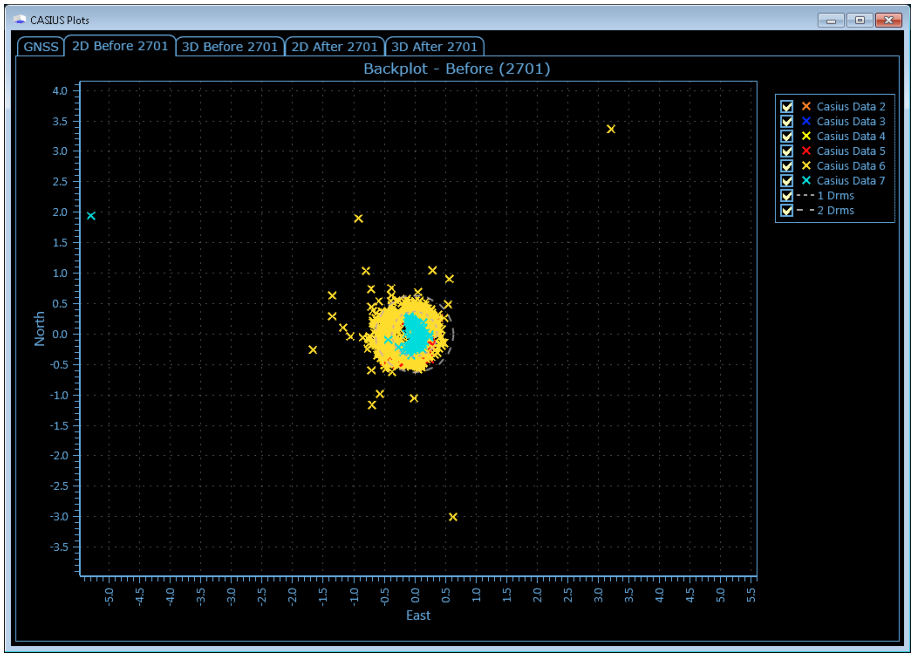


CASIUS Data 2, **4**, **5** and **7** selected.



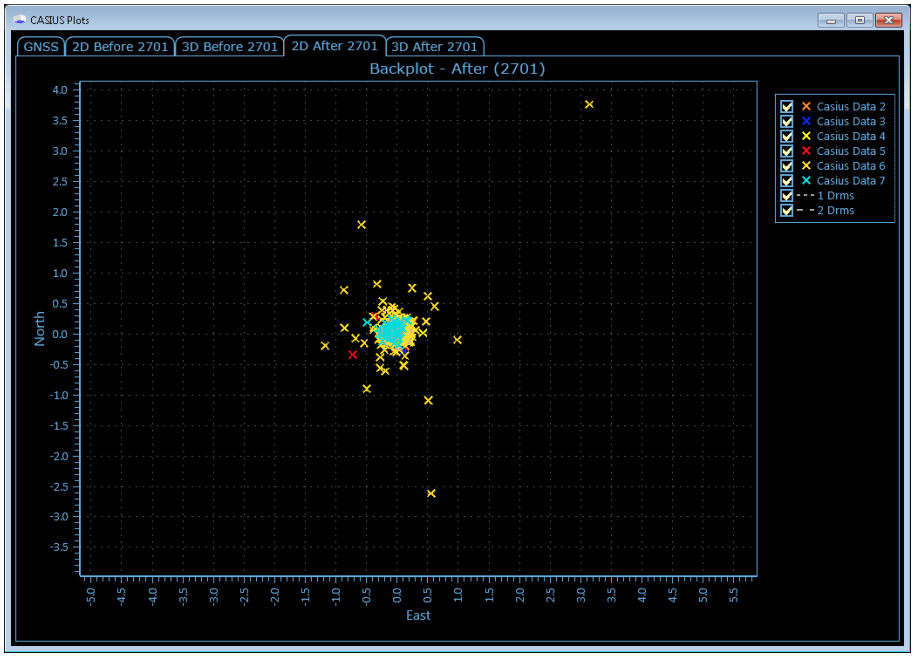
2D Before 2701

All CASIUS Data legs and Drms selected.



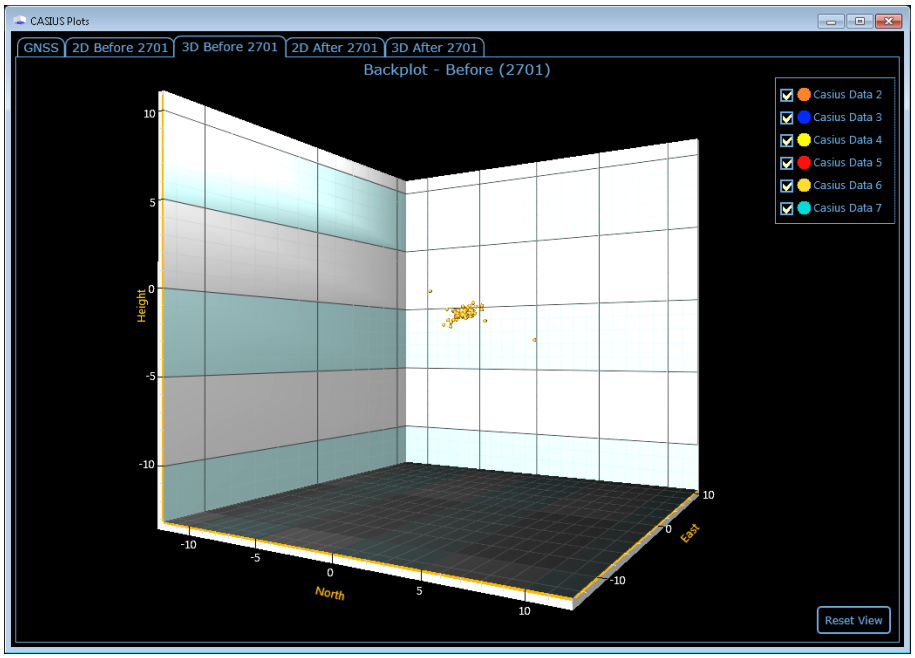
2D After 2701

It can be seen that the North and East data points are more tightly compacted after the process.

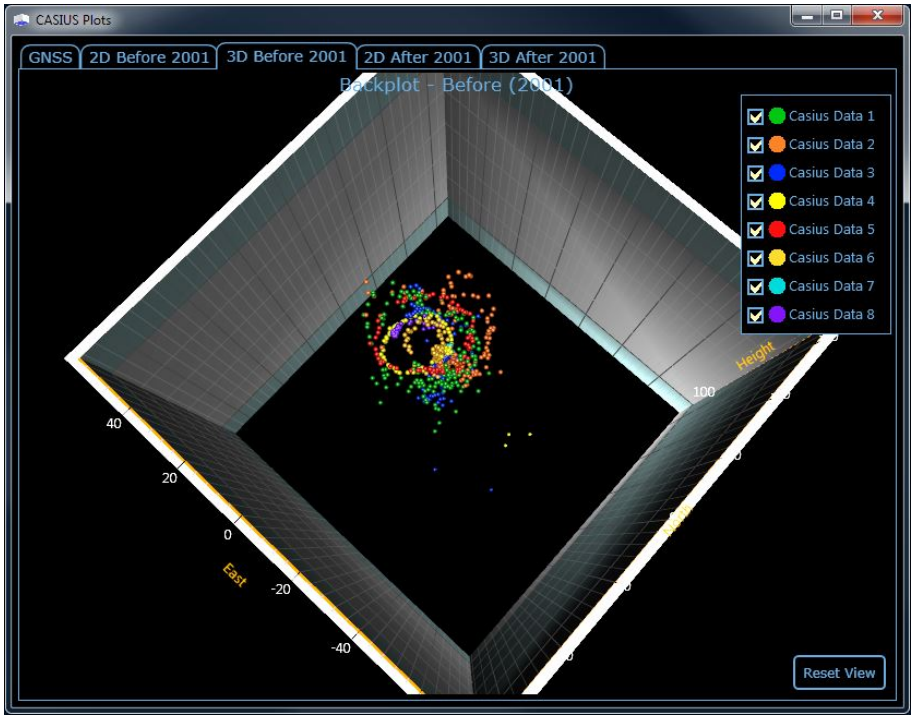


3D Before 2701

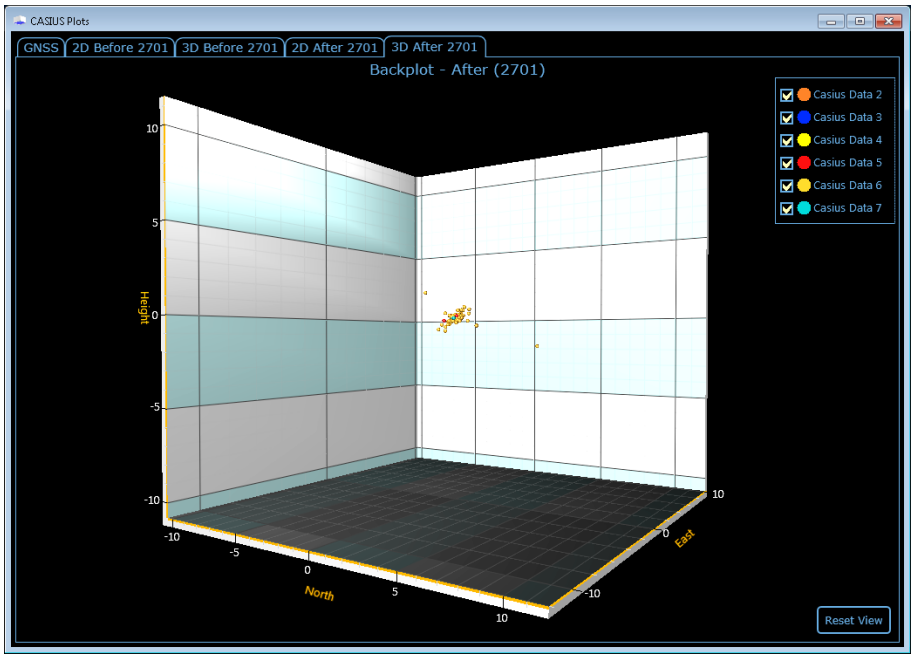
On the 3D plots the image can be rotated 360° in any direction by clicking the image, holding the left mouse button and then moving the mouse.



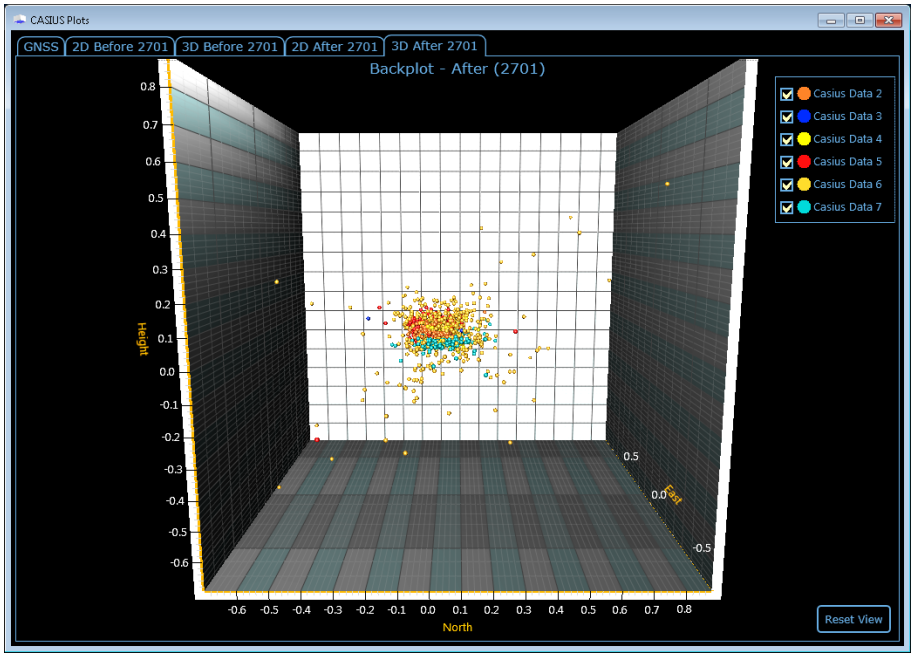
The image below has been rotated.



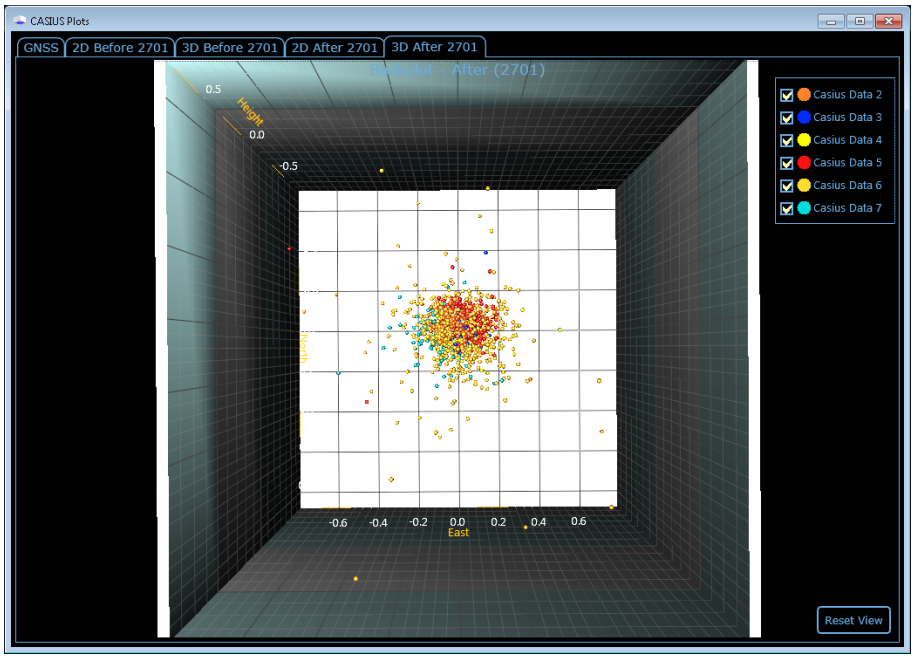
3D After 2701



The **3D After 2701** plot below has been rotated.



The **3D After 2701** plot below has been rotated.



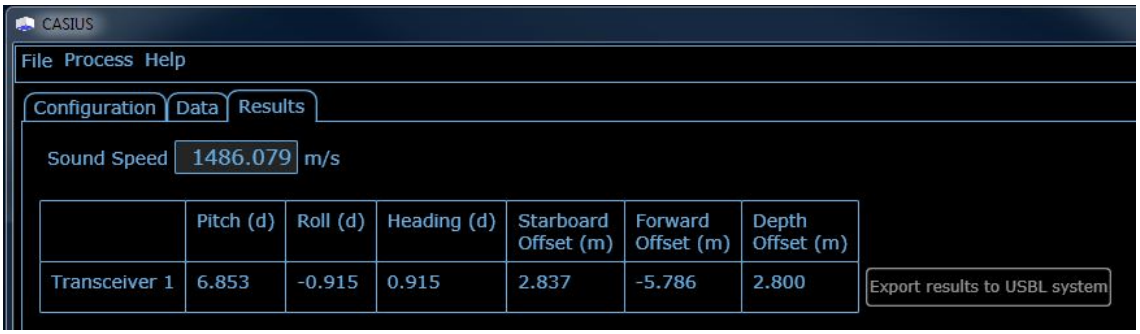
3.4 Exporting Results

The results can be exported back into to the Marksman/Ranger 2 system.

Note

Results can only be exported back to Marksman/Ranger 2 if CASIUS 6 is opened in Marksman or Ranger 2. If CASIUS 6 is opened from the Start menu (as described in *Appendix A*), the "Export results to USBL" button will be greyed out and the new transceiver offsets will have to be manually input into the Marksman/Ranger 2 system.

1. On the **Results** tab click **Export results to USBL system**.
2. The updated settings overwrite the previous transceiver settings in the Marksman/Ranger 2 system.



3.5 CASIUS 6 Calibration Report

A PDF report can be created and depending on the instruments in the setup typically displays:

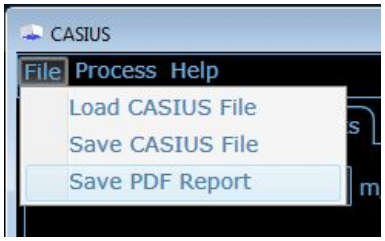
- Transceiver Settings
- GNSS Settings
- Pitch, Roll & Heading Settings
- Beacon Settings
- Sound Speed
- Beacon result
- Transceiver Result
- Summary Stats
- Engine Settings
- Data Summary
- Backplot (After)

Note

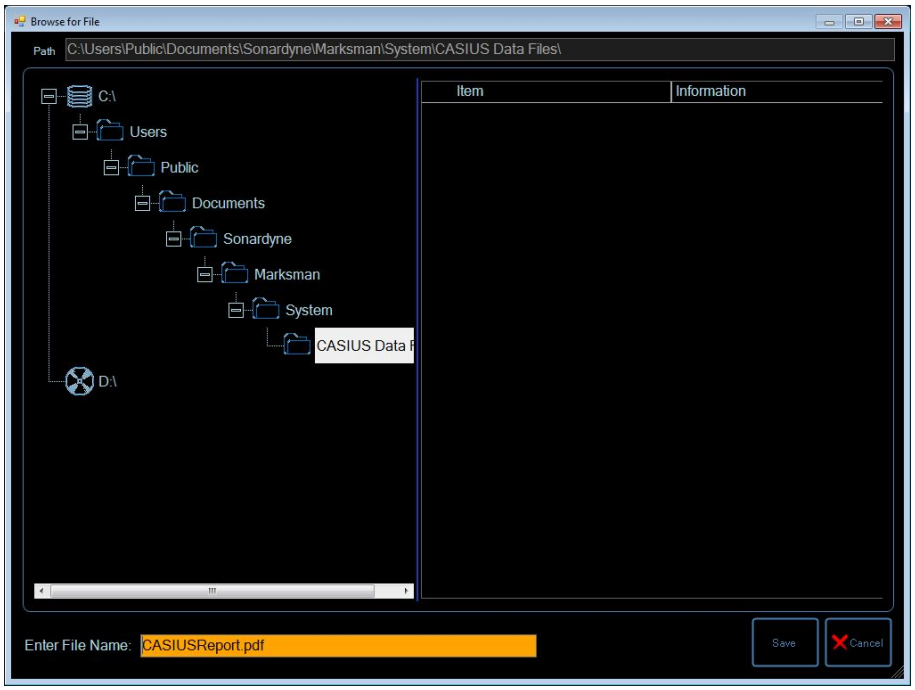
Before creating the report, zoom each plot to the required level as this is how it will appear in the pdf report.

To create a PDF report:

1. Click **File>Save PDF Report**.



2. By default the PDF report is saved in the same file location as the .CAS2 file.
3. Select a new file location if required and then click **Save**.



4. The PDF report is shown below.

Figure 3–1 CASIUS 6 Calibration Report

CASIUS Calibration Report

Sonardyne
SOUND IN DEPTH

Vessel: Ship 1 **Date/Time:** 2018 July 19 10:06:45

Transceiver Settings:

Name	Device No	X/Y Offset Error	Depth Offset Error
GYRO USBL	005472	1.0m	0.5m

GNSS Settings:

Name	Forward Offset	Starboard Offset	Height Offset
RTK	0.000m	0.000m	4.080m

Pitch, Roll & Heading Settings:

Name	Usage	Pitch Offset	Roll Offset	Heading Offset
Lodestar USBL 1	Pitch, Roll & Heading	0.00°	0.00°	0.00°

Beacon Settings:

Name	Received Signal	X/Y Error	Depth Error
2701	CRS 2700	30.0m	5.0m

Sound Speed:

	Surface	Average (Initial)	Average (Computed)
Sound Speed	1507.0m/s	1501.8m/s	1506.1m/s
Error	7.5m/s	5.7m/s	0.0m/s

Beacon 2701 Result:

	Beacon Latitude	Beacon Longitude	Beacon Depth	Beacon Eastings	Beacon Northings
Before	50.24128458°	-4.22743019°	55.015m	412475.918m	5566179.136m
Calculated	50.24128394°	-4.22743286°	54.057m	412475.726m	5566179.068m
Calculated Accuracy			0.002m	0.001m	0.001m

	Before CASIUS (distance)	After CASIUS (distance)	Before CASIUS (% depth)	After CASIUS (% depth)
39.4% Beacon Positions (1 sigma)	0.23m	0.06m	0.43	0.12
50.0% Beacon Positions (CEP)	0.29m	0.07m	0.54	0.14
63.2% Beacon Positions (1 Drms)	0.37m	0.09m	0.69	0.17
86.5% Beacon Positions (2 sigma)	0.52m	0.16m	0.96	0.29
95.0% Beacon Positions	0.63m	0.25m	1.17	0.46

Transceiver 'GYRO USBL' Result:

	Transceiver Starboard Offset	Transceiver Forward Offset	Transceiver Depth Offset	Transceiver Pitch Offset	Transceiver Roll Offset	Transceiver Heading Offset
Before	1.955m	-3.276m	2.930m	0.00°	0.00°	0.00°
Calculated	1.886m	-3.019m	2.930m	-0.05°	-0.02°	0.08°
Calculated Accuracy	0.001m	0.002m	0.000m	0.00°	0.00°	0.01°

Summary Stats:

Range RMS	Direction Cosine RMS	Observations	Excluded	Iterations
0.018m	0.0012	4740	60	5

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Engine Settings:

Mode	Max Iterations	Convergence Threshold	MAD Threshold	Deweight Angle	Height Correction
Box-in and attitude	30	0.000001	6.0	90	GNSS Height

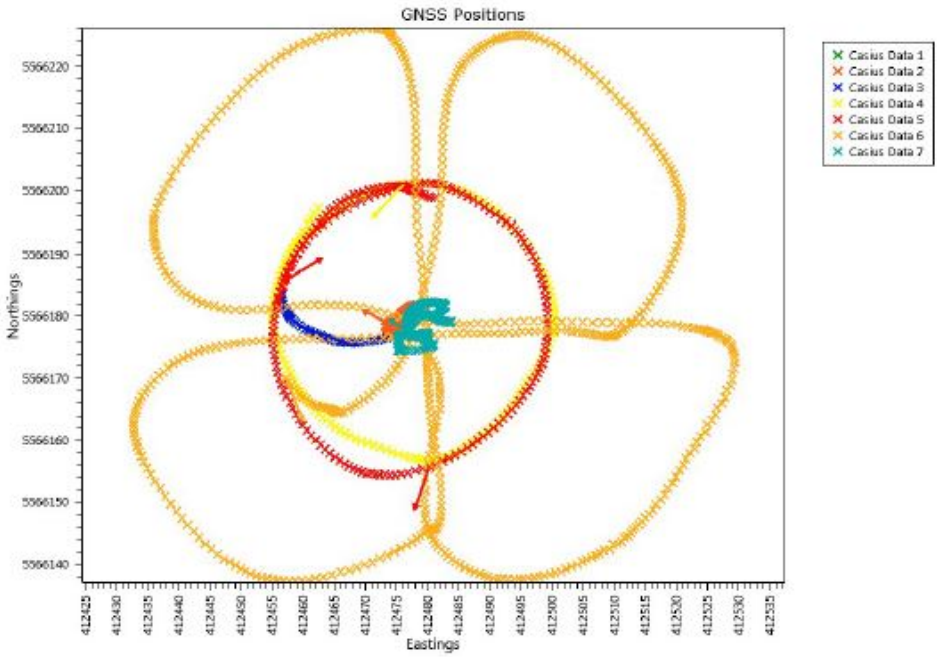
Exclude Outliers	Use Priors	Estimate Height Offset	Seperate Box-In & Attitude Calculations	Refraction Correct
Yes	Yes	No	No	No

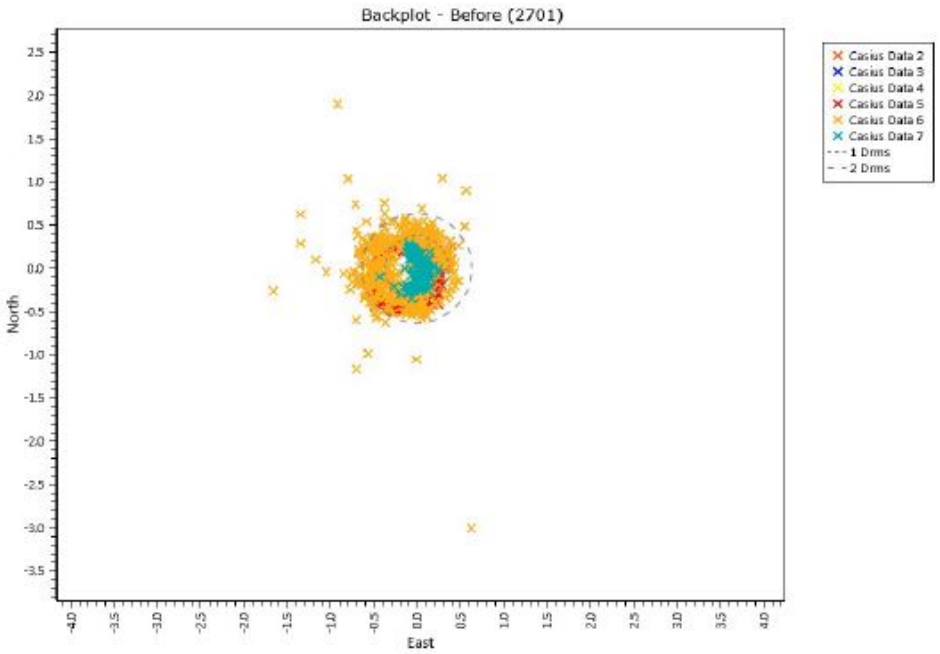
Data Summary:

Name	Start Time	End Time	VERI	RTK	GYRO USBL
Casius Data 1	2018-07-19 10:05:55Z	2018-07-19 10:05:56Z	1	1	1
Casius Data 2	2018-07-19 10:06:45Z	2018-07-19 10:10:36Z	231	231	218
Casius Data 3	2018-07-19 10:10:52Z	2018-07-19 10:11:39Z	47	47	48
Casius Data 4	2018-07-19 10:11:41Z	2018-07-19 10:14:52Z	191	191	198
Casius Data 5	2018-07-19 10:16:02Z	2018-07-19 10:19:22Z	200	200	208
Casius Data 6	2018-07-19 10:19:41Z	2018-07-19 10:30:42Z	661	661	690
Casius Data 7	2018-07-19 10:31:06Z	2018-07-19 10:34:36Z	210	210	218

Data Summary:

Name	2701
Casius Data 1	1
Casius Data 2	218
Casius Data 3	48
Casius Data 4	198
Casius Data 5	208
Casius Data 6	690
Casius Data 7	218





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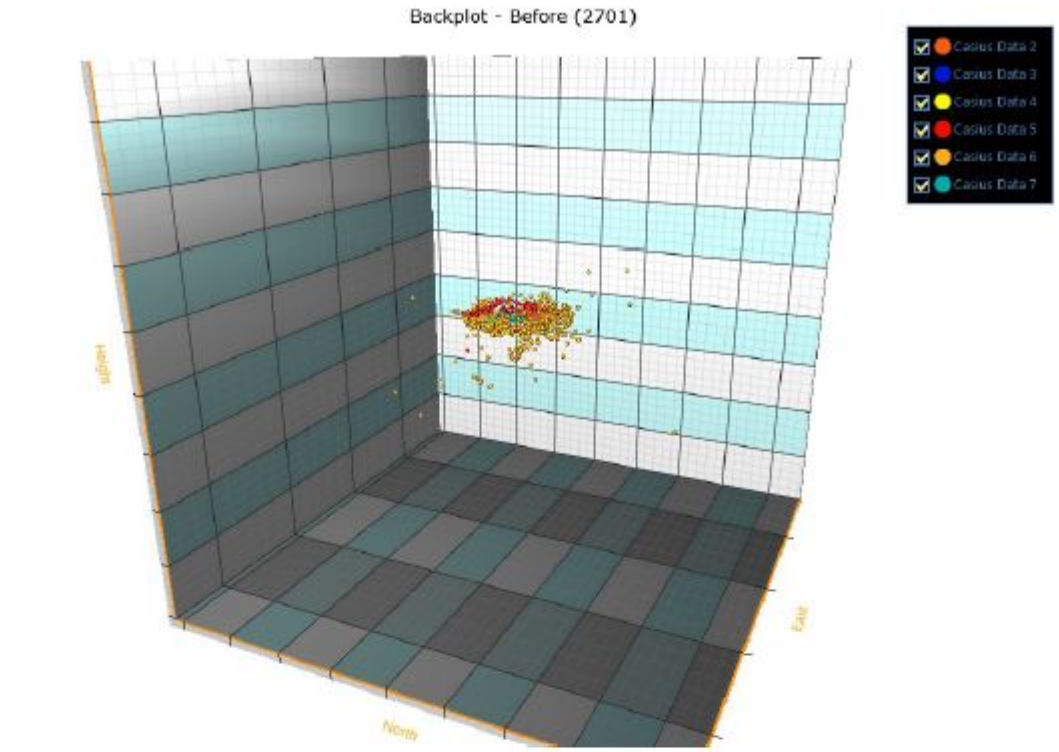

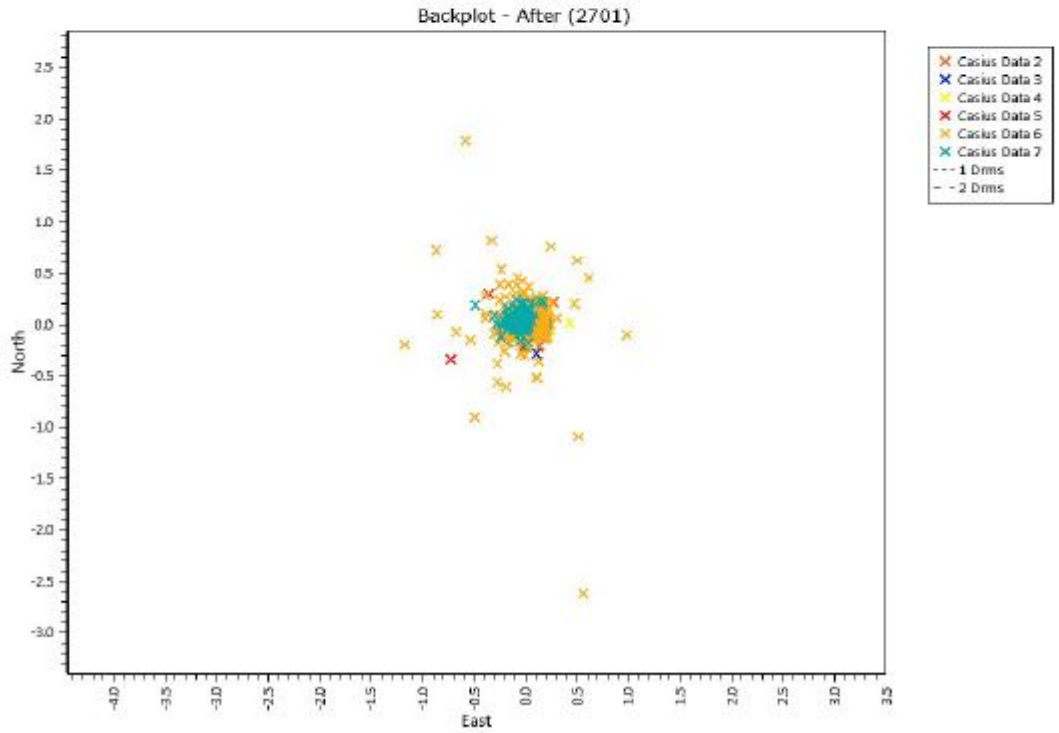

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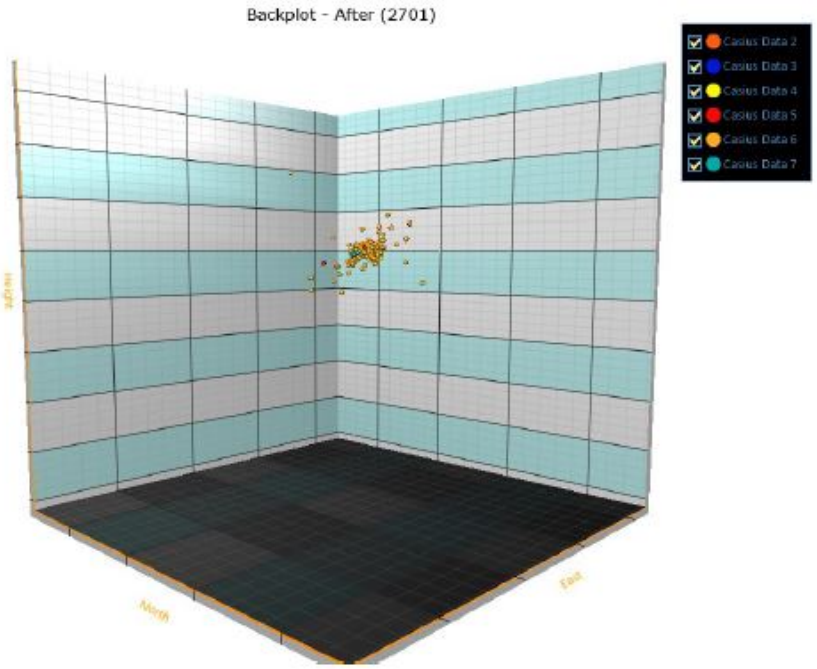

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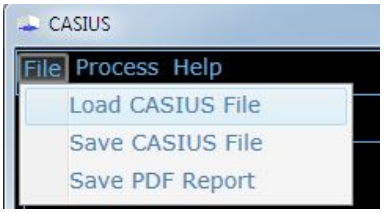
3.6 Loading and Saving CASIUS 6 Data Collection Exports

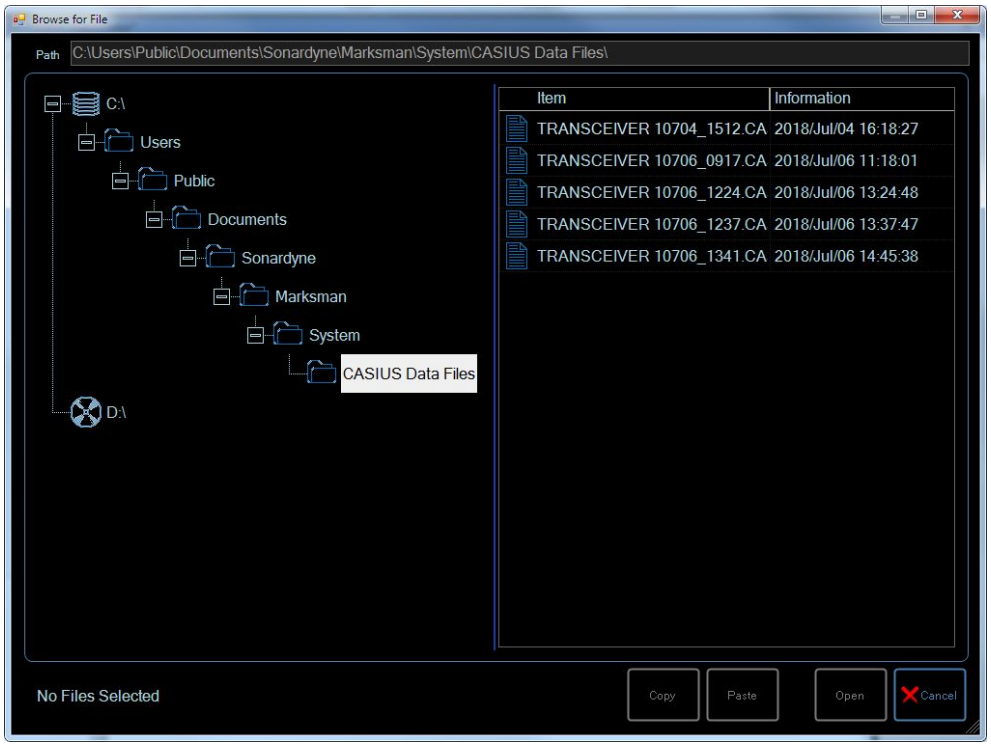
3.6.1 Loading a Data Collection Exported File

To load a CASIUS 6 Data Collection exported file:

1. Click **File>Load CASIUS File**.



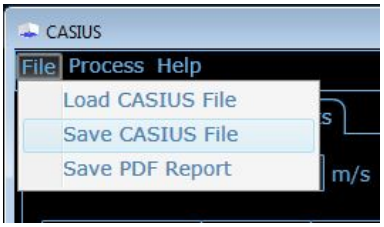
2. Browse to and select the Data Collection exported .CAS2 file and then click **Open**.



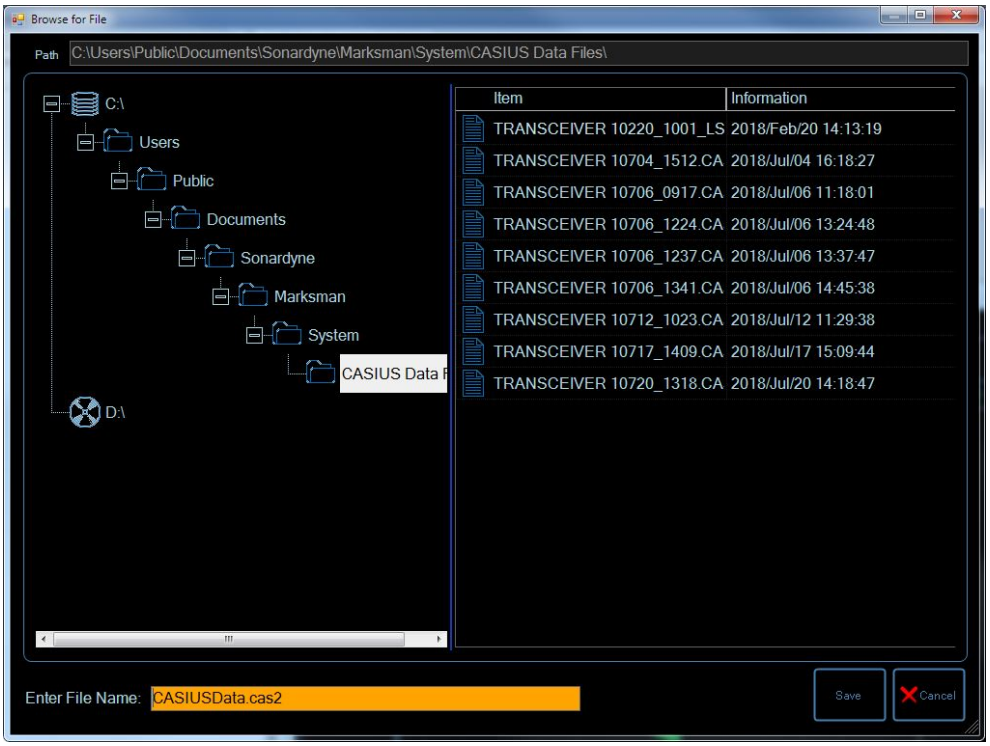
3.6.2 Saving a File Processed Data Collection

To save a CASIUS 6 processed Data Collection:

1. Click **File>Save CASIUS File**.



2. Click **Save** to save the file in the default location or browse to a new location and then click **Save**.



Section 4 – CASIUS 6 Frequently Asked Questions

Examples of frequently asked questions (FAQ) asked when collecting and processing data using CASIUS 6 are shown in *Table 4–1* below. For any questions not listed below, or further information on CASIUS 6, contact Sonardyne Support.

Table 4–1 CASIUS 6 Frequently Asked Questions

Question	Answer
What happens if I collect data beyond one third water depth away from the beacon?	Within one third water depth refraction has a very small impact on the estimate of the beacon position, and the angular corrections, and so a more precise result is produced. In shallow water, it is sometimes necessary to collect data further from the beacon. This will still produce a good result, but CASIUS 6 may need to compensate for more refraction. In this situation, using an up to date sound speed profile is recommended.
Why can't I manually exclude outliers?	CASIUS 6 includes controls that allow the operator to adjust the sensitivity of its automatic outlier identification, and to allow the operator to choose whether to fully reject, or to weight against outliers. The outlier rejection is capable of identifying whether the range, the USBL direction or both are in error, and so maximises the useable data. Manually rejecting outliers could exclude essential data and could bias the result which may mask an underlying issue.
What if I don't know the exact sound speed?	It is always best to measure the sound speed before carrying out a CASIUS 6 calibration, but if this is not possible, CASIUS 6 has an 'Auto' sound speed facility, which will use a seasonally adjusted average sound speed for the work area. It is always wise to verify that the estimated beacon depth, and the estimated sound speed in the results tab match what the operator expected. An error in sound speed would cause the estimated beacon depth to be biased. If the actual beacon depth is well known (from charts, and strop length) then enter that in the beacon properties, and set the error figure to a realistic small number. This will constrain the CASIUS algorithm to hold the depth, and estimate a sound speed that matches the depth.
Why is the data worse on certain headings?	When choosing data collection patterns, consider the direction that thruster and prop wash will be generated given the direction of the current. Changing the headings that data is collected on by +/-10 degrees can significantly improve the quality of the USBL measurements. Contact Customer Support for more information.
Can I drift while collecting data?	The acoustic signal to noise ratio is often improved while drifting, which may improve the USBL data, but there are frequent instances where the vessel drifts in a plume of aerated water reducing system performance.

Table 4–1 CASIUS 6 Frequently Asked Questions (continued)

Question	Answer
Why use Sonardyne CASIUS 6 when a survey suite has its own calibration tool?	Survey suites are excellent tools for estimating whether there is any residual bias in the USBL system after a CASIUS 6 calibration; however, they do not accurately model the true raw USBL measurements, and do not have access to the precisely time tagged raw data which is processed within CASIUS 6 which is the culmination of over 40 years of experience. CASIUS 6 is the tool that Sonardyne endorses to quantify system operation. Without undertaking this procedure there's limited ability to diagnose problems or offer support.
Why do I still see unresolved clusters in my 2D after data plot?	Data can be biased by poor line of sight in certain directions generally through thruster wash or the vessel hull configuration. Pole movement when the vessel changes heading, or refraction variations when exceeding ½ water depth can often leave data unresolvable. Contact Customer Support for more information.
My survey will be in 3 times layback to water depth should I collect my CASIUS data beyond 1/3 water depth?	When tracking more than 45 degrees elevation because surface reflection and variable refraction influence the vertical resolution.
How do I collect data with a tilted USBL head?	This is not a common occurance.Contact Customer Support to obtain the white paper on this subject.
Why am I not achieving the quoted accuracy of the USBL?	The CASIUS 6 result is a system result which amalgamates all GNSS and VRU errors and any pole movement which is very detrimental on accuracy.
Why are shallow <100 m calibrations generally worse statistics than deep water calibrations?	In less than 100 m of water the error in the GNSS can be a significant proportion of the system error, and the seabed reference beacon needs to be absolutely static – ideally the reference beacon should be deployed in a frame. Also, in shallow water acoustic noise from the vessel reflecting off the seabed can be a problem and reduce the acoustic precision. Coastal waters are prone to rapid sound speed variation which can also affect precision.
If the data is noisy are the results affected?	A good result can still be produced provided that the data is randomly distributed and the clusters can be resolved to adequate precision; however, noise could be indicative of instrument error of pole fatigue. Contact Customer Support for more information.
How can I obtain a better result?	The example data in this manual was collected using a Lodestar Gyro USBL and a precise Real-Time Kinematic (RTK) GPS over a seabed reference in a tripod in calm conditions. The pole was hydraulically clamped and surveyed offsets between the GNSS and the USBL pole were measured using a total station. Using higher specification equipment helps to obtain better results. Contact Sonardyne Sales for equipment upgrades.
Will collecting more data give a better result?	Yes, as long as it's collected overhead and evenly around the transponder. However, when collecting data over a longer period you are more likely to encounter environmental changes and this can bias the result. Two quick calibrations in agreement are better than a large erroneous one.

Table 4–1 CASIUS 6 Frequently Asked Questions (continued)

Question	Answer
Is it better to zero the previous calibration values before running a new calibration?	CASIUS 6 uses raw data so it makes no difference but using the existing results can improve navigation guidance while collecting data and help avoid biased sail patterns. It is also more intuitive to retain the previous result and confirm agreement with the new.
Why are the angular correction results different to previous CASIUS when nothing has changed?	In most cases variation is indicative of a problem such as instrument error or that something has moved like the pole, gyro, GNSS. Contact customer support for more information.
What should I do if my CASIUS 6 calibration fails to solve?	Send a CAS2 file to Customer Support. This can be reviewed against our database of 100s of known affects and may be a simple resolution.

Appendix A – Manually Opening CASIUS 6

A.1 Introduction

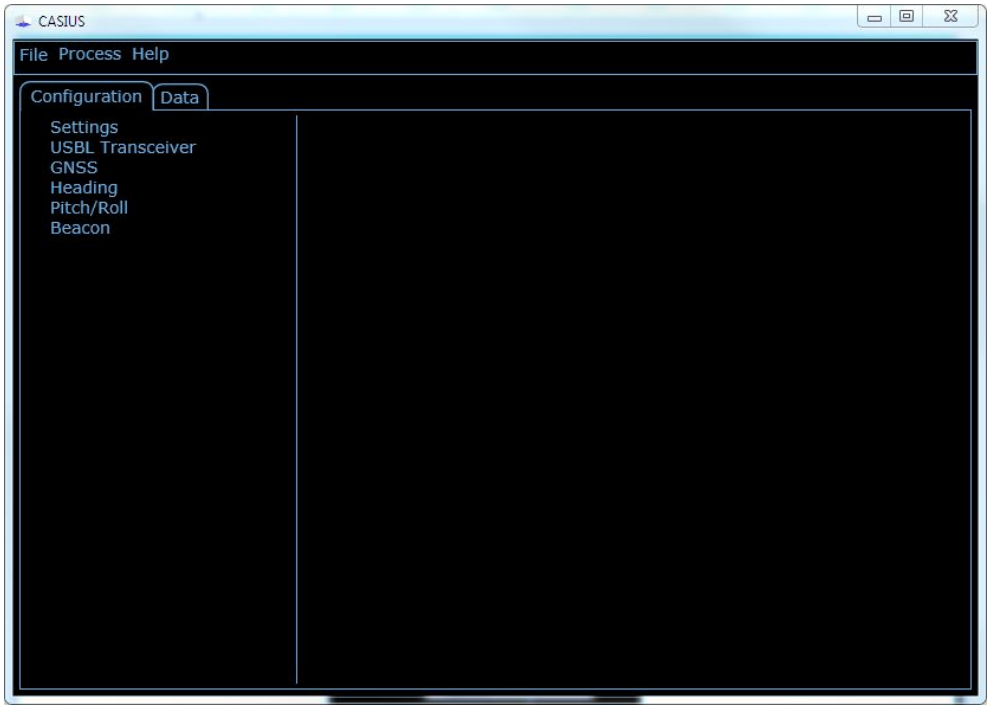
CASIUS 6 can be opened from the from the Windows® Start menu without Marksman or Ranger 2 running. CASIUS 6 data collection exports are saved as a .CAS2 file in the default location: C:\Users\Public\Documents\Sonardyne\Marksman\System\CASIUS Data Files*Filename*.CAS2

Note

Results can only be exported back to Marksman/Ranger 2 if CASIUS 6 is opened in Marksman or Ranger 2. If CASIUS 6 is opened from the Start menu (as described below), the "Export results to USBL" button will be greyed out and the new transceiver offsets will have to be manually input into the Marksman/Ranger 2 system.

A.2 Opening CASIUS 6

Click **Start>All Programs>Sonardyne>Marksman** (or Ranger 2)**>CASIUS 6**.



A.3 Loading and Saving CASIUS 6 Data Collection Exports

To load and a CASIUS 6 Data Collection exported file:

1. Load the Data Collection exported file as described in *Section 3.6 "Loading and Saving CASIUS 6 Data Collection Exports"*.
2. Configure and Process the data as described in *Section 3 "CASIUS 6 Calibration Processing"*.
3. Manually input the Results into the Marksman/Ranger 2 setup.

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