

USBL CALIBRATION

Least Squares

LEAST SQUARES DEFINITIONS

Databases

C:\Program Files (x86)\QPS\USWind

0022 - 1 - 0001	6/06/2015	15:02:45
0022 - 2 - 0001	6/06/2015	15:07:36
0024 - 3 - 0001	6/06/2015	15:14:17
0025 - 4 - 0001	6/06/2015	15:19:02
0026 - 5 - 0001	6/06/2015	15:23:50
0027 - 6 - 0001	6/06/2015	15:28:55
0028 - 2 - 0001	6/06/2015	15:37:10

Properties

USBL System	USBL	Vessel Object	Shearwater
Reference Point	USBL	Gyro System	Wavemaster Gyro
Transducer Node	USBL	VRU System	W
Transponder Node	SSS CoG	Echosounder	Manual
Computation	Wavemaster		

Statistics

Number of USBL Observations	302	100 %
Number of Used Observations	295	97 %
Number of Disabled Observations	7	2 %

LEAST SQUARES SETTINGS

USBL Observations

Alignment Corrections	No Corrections
Reference Point	Actual USBL Transducer
Sound Velocity	Calibrated Sound Velocity
Computation Parameters	Scale, Angles (Roll, Pitch, Heading)
Standard Deviations	Scaled Calibration Standard Deviations

LEAST SQUARES RESULTS

Computation Results

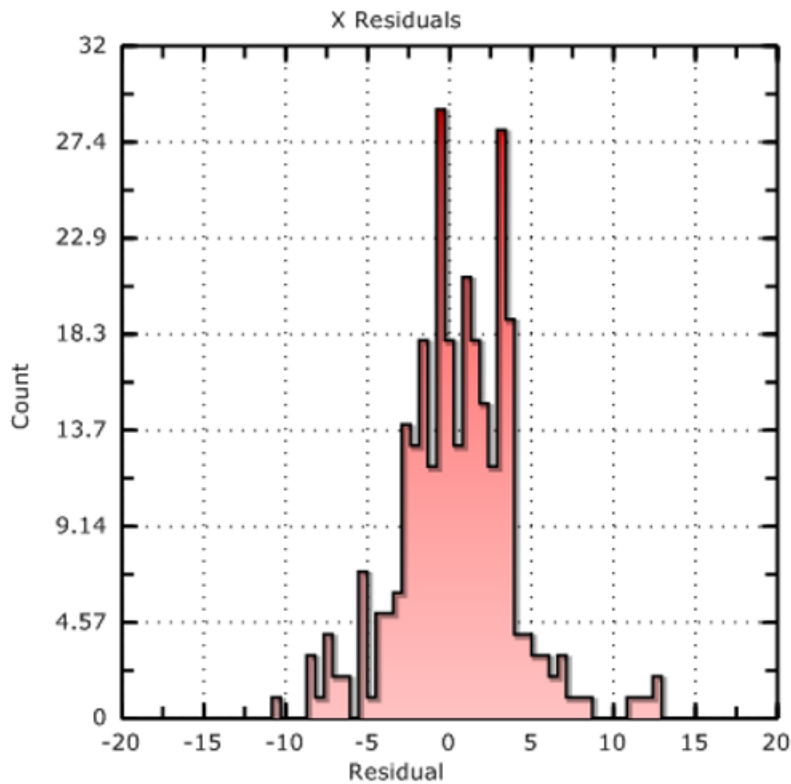
Parameter	Value	SD
Scale Factor	1.06788	0.02882
Roll Angle	-5.159 °	3.504 °
Pitch Angle	-25.394 °	1.853 °
Heading Angle	7.437 °	2.892 °

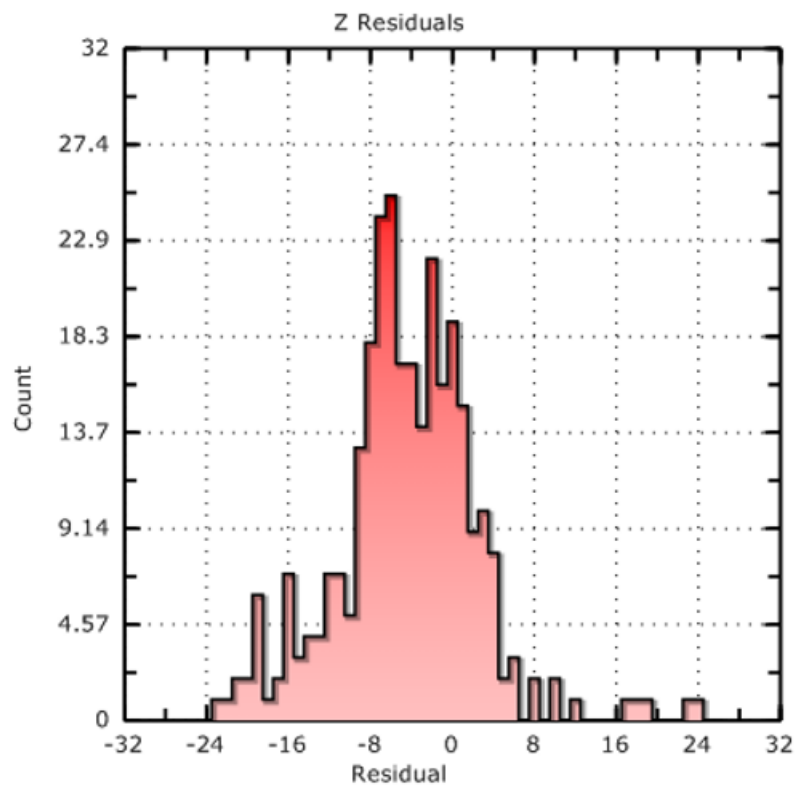
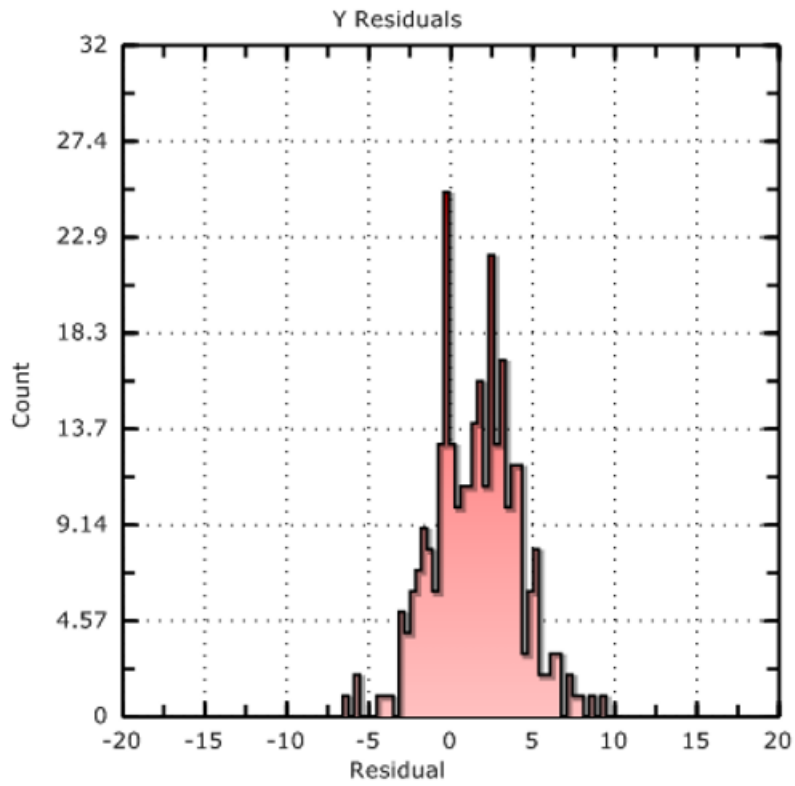
Transponder Position

Coordinate	Value	SD
Easting TP	615115.29 m	N/A m
Northing TP	4429255.53 m	N/A m
Height TP	-41.81 m	N/A m

Least Squares

LEAST SQUARES GRAPHS





Mean Position

Coordinate	Value
Easting	0.00 m
Northing	0.00 m
Height	0.00 m

Calibrated Transponder Position

USBL Observations

Alignment Corrections	No corrections
Reference Point	No reference point
Sound Velocity	No sound velocity

Computation Results

Parameter	Value	SD
Offset X	0.00 m	N/A m
Offset Y	0.00 m	N/A m
Offset Z	0.00 m	N/A m

Transponder Position

Coordinate	Value	SD
Easting TP	5000000 m	N/A m
Northing TP	500000 m	N/A m
Height TP	500 m	N/A m

USBL Observations

Alignment Corrections	No corrections
Reference Point	No reference point
Sound Velocity	No sound velocity

Depth Observations

Manual Depth	N/A m
Transponder Height	0.00 m

Computation Results

Parameter	Value	SD
Average Offset Z	0.00 m	N/A m

Known Transponder Position

Coordinate	Value
Easting TP	5000000 m
Northing TP	500000 m
Height TP	500 m

Sound Velocity

USBL Observations

Sound Velocity	Calibrated Sound Velocity
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USBL Calibration Results

Parameter	Value	Factor
Calibration Results	1585.81 m/s	1.06788
Manually Set Values	N/A	

QINSy Database Settings

Parameter	Value	Factor
System-Used Velocity	1485.00 m/s	1.00000
Calibrated Velocity	1485.00 m/s	1.00000
0022 - 1 - 0001		
0023 - 2 - 0001		
0024 - 3 - 0001		
0025 - 4 - 0001		
0026 - 5 - 0001		
0027 - 6 - 0001		
0028 - 2 - 0001		

Alignments

USBL Calibration Results

Parameter	Value	SD
Scale Factor	1.06788	0.02882
Roll Angle	-5.159 °	3.504 °
Pitch Angle	-25.394 °	1.853 °
Heading Angle	7.437 °	2.892 °
Offset X	0.00 m	N/A m
Offset Y	0.00 m	N/A m
Offset Z	0.00 m	N/A m
Easting TP	0.00 m	N/A m
Northing TP	0.00 m	N/A m
Height TP	0.00 m	N/A m

USBL Transponder Positions

	95 %	SD
Error Ellipse		
Easting Center	615115.21 m	4.03 m
Northing Center	4429253.66 m	3.62 m
Semi-Major Axis	9.94 m	4.06 m
Semi-Minor Axis	8.78 m	3.59 m
Azimuth Major Axis	75.327 °	

Manually Set Values

Parameter	Value	SD
Scale Factor	1.00000	N/A
Roll Angle	0.00 °	N/A °
Pitch Angle	0.00 °	N/A °
Heading Angle	0.00 °	N/A °
Offset X	0.00 m	N/A m
Offset Y	0.00 m	N/A m
Offset Z	0.00 m	N/A m

QINSy Database Settings

Parameter	Value	SD
Scale Factor	1.00000	N/A
Roll Angle	0.000 °	0.050 °
Pitch Angle	0.000 °	0.050 °
Heading Angle	0.000 °	0.500 °
0022 - 1 - 0001		
0023 - 2 - 0001		
0024 - 3 - 0001		
0025 - 4 - 0001		
0026 - 5 - 0001		
0027 - 6 - 0001		
0028 - 2 - 0001		

MULTI-BEAM ECHO SOUNDER CALIBRATION

The Patch Test routine was performed to specific requirements on 5 June, 2015, and data were acquired using the Universal Transverse Mercator (UTM) coordinate system, Zone 18 North in meters. The Patch Test Calibration was performed in water depths of 15-18 meters.

Calibration Procedure

Navigation lines were designed to run over a debris area as well as an area of featureless seafloor.

Multiple areas were chosen from the various lines run in order to achieve an average calibration value.

Cal1 Line 501 899.26 (m), 4 248 368.40 (m) to 501 886.62 (m), 4 248 239.76 (m)

Cal2 Line 501 864.43 (m), 4 248 371.82 (m) to 501 851.78 (m), 4 248 243.18 (m)

Cal3 Line 501 829.59 (m), 4 248 375.24 (m) to 501 816.95 (m), 4 248 246.61 (m)

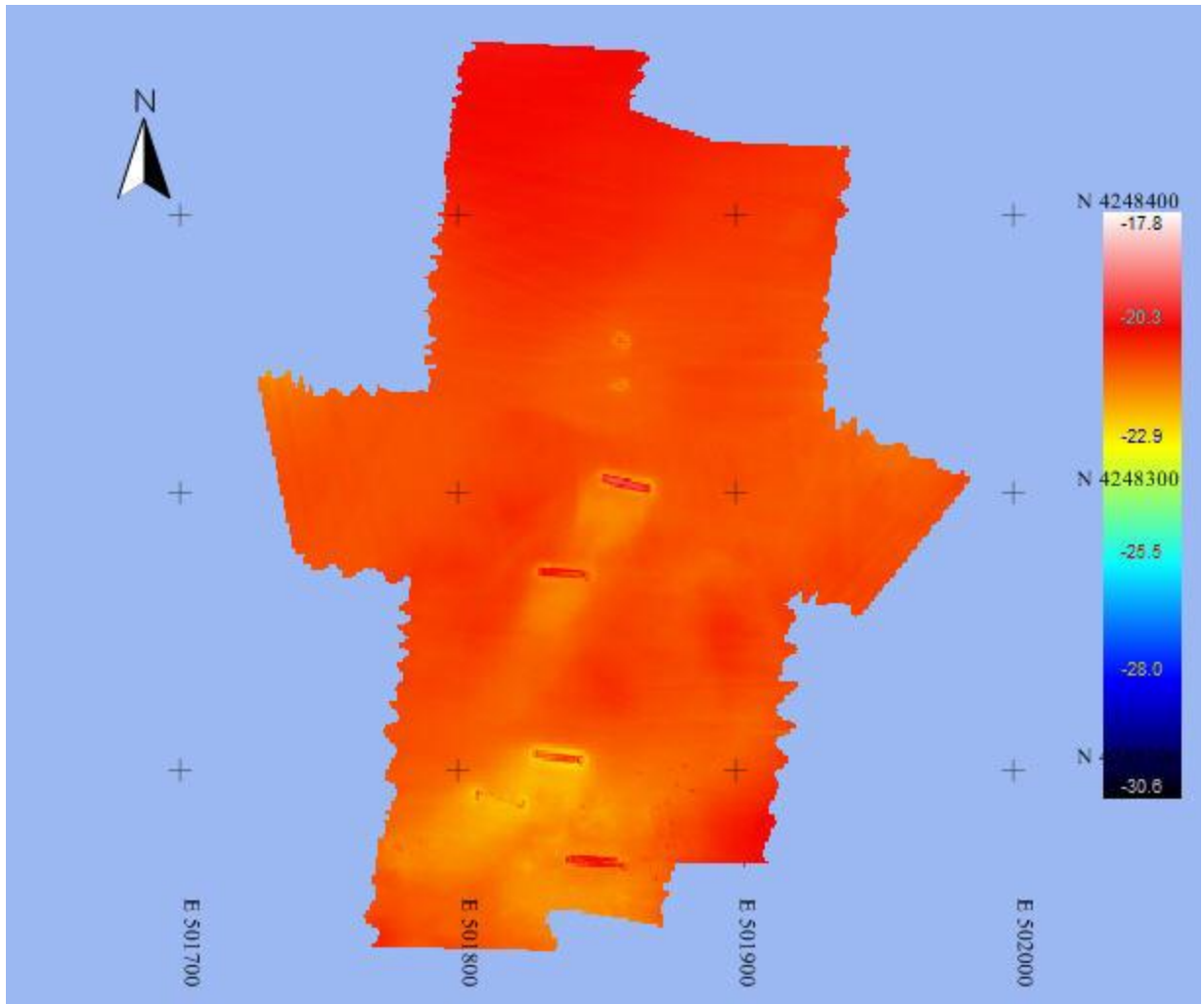
CalCross Line 501 790.47 (m), 4 248 309.41 (m) to 501 940.76 (m), 4 248 296.60 (m)

Survey Line Name	Speed	Heading
0012-Cal1-0001	4kn	005.63°
0013-Cal1-0001	4kn	185.60°
0014-Cal2-0001	4kn	005.63°
0015-Cal2-0001	4kn	185.60°
0016-Cal3-0001	4kn	005.63°
0017-Cal3-0001	4kn	185.60°
0019-CalCross-0001	4kn	274.88°
0020-CalCross-0001	4kn	094.88°

Sound Velocity

Prior to the Patch Test survey lines, a full column sound velocity profile was taken down to approximately 16m water depth at 38° 22' 24.46" N, 074° 58' 46.80" W.





Summary of Results

Summaries of the calibration results are:

Latency	Roll	Pitch	Yaw
N/A due to PPS	2.13°	-3.35°	1.00°