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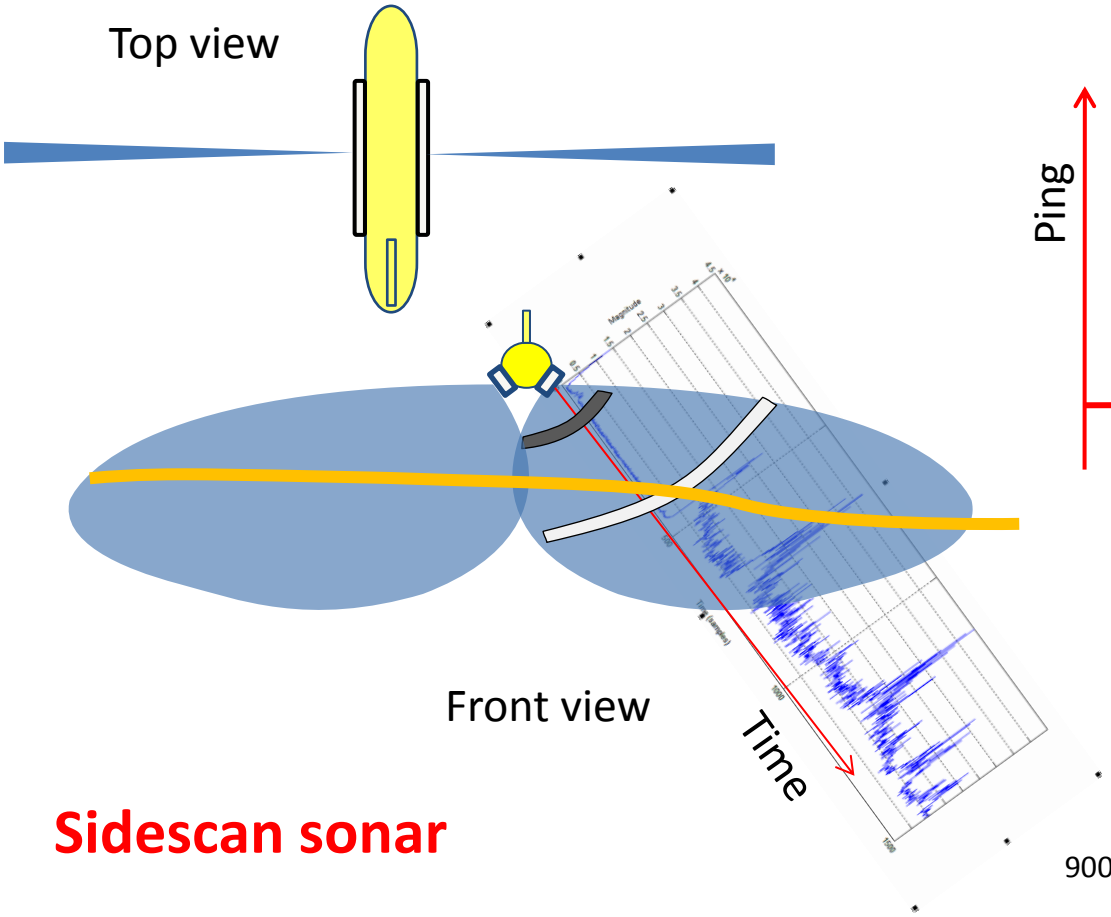
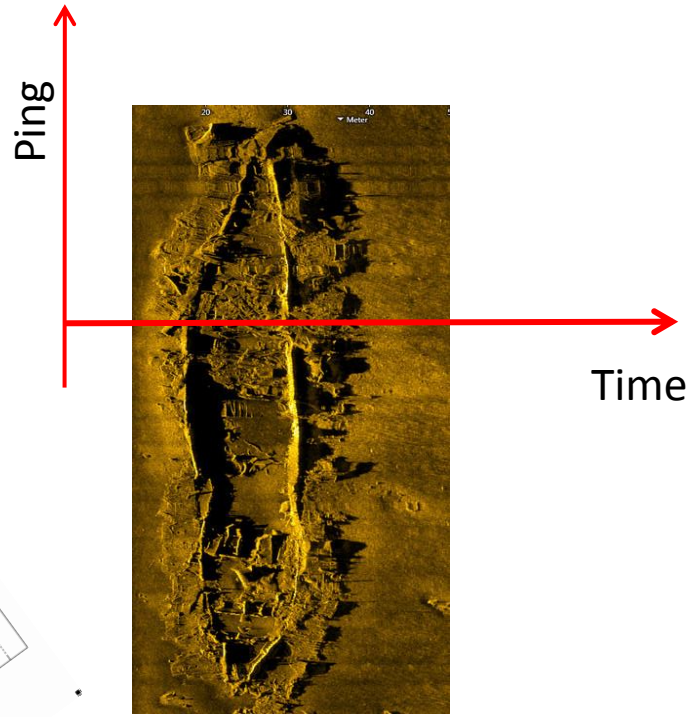
SeaBat sounders and backscatter

Eric Maillard

eric.maillard@teledyne-reson.com

Imagery formation and extraction





Sidescan sonar

900 kHz image of a shipwreck at 50m range, © Edgetech

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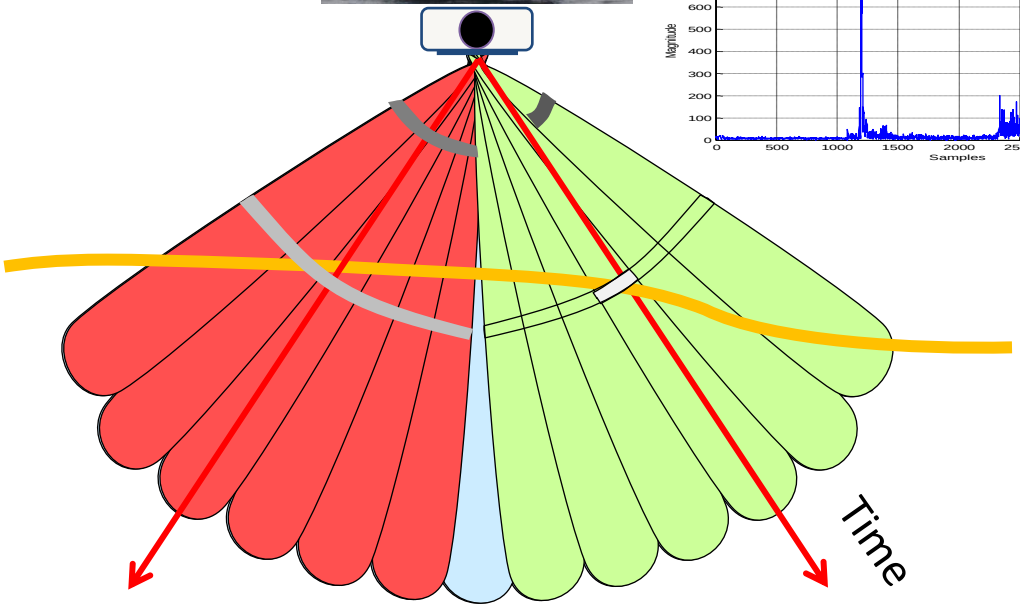
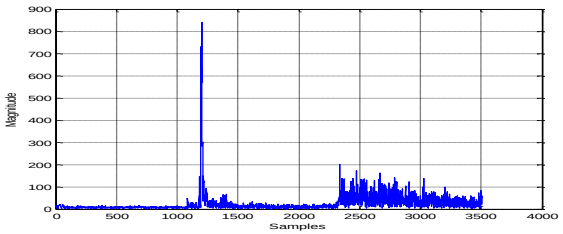
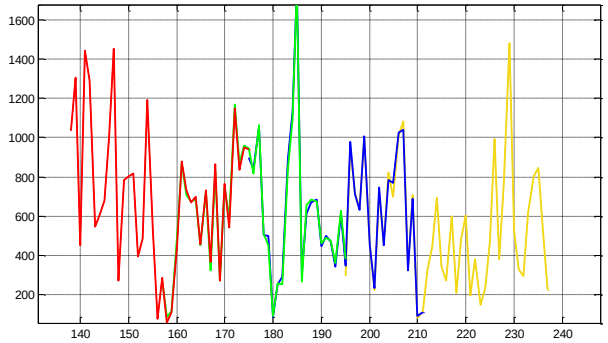
Imagery formation and extraction

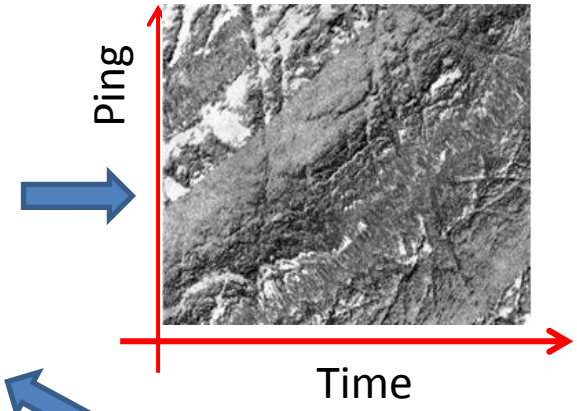


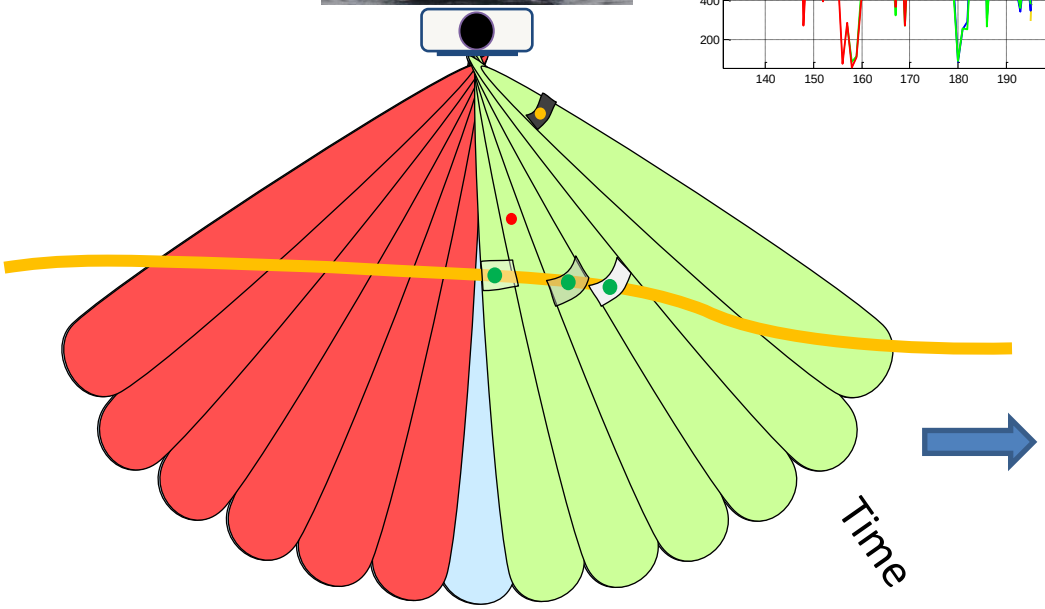


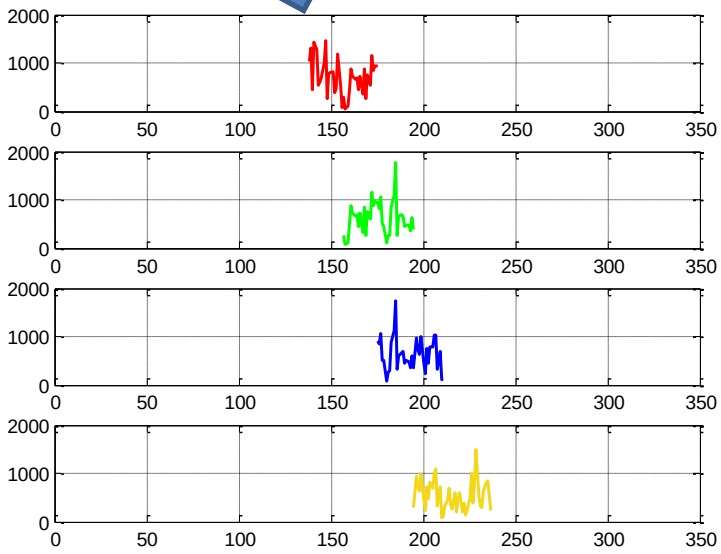
Multibeam EchoSounder as Sidescan

Imagery formation and extraction



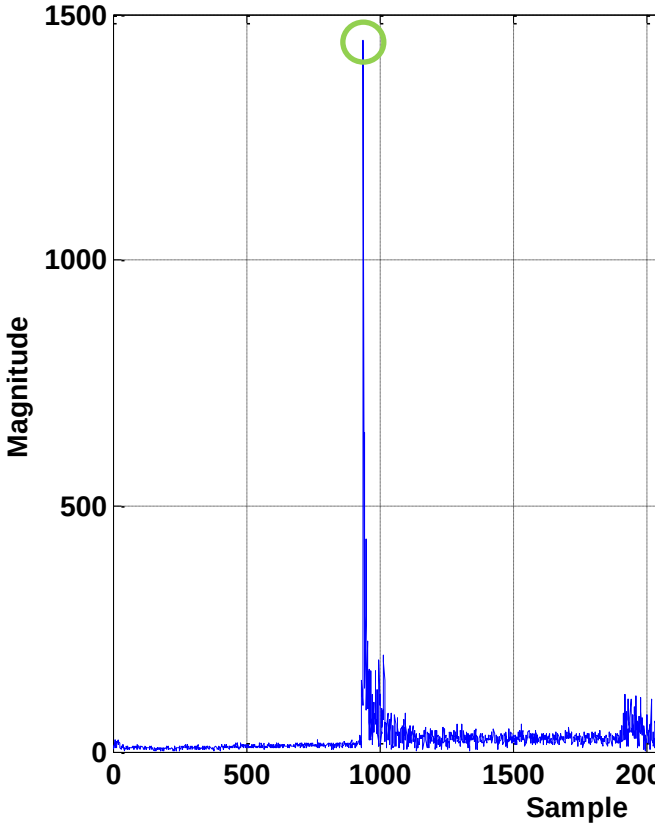


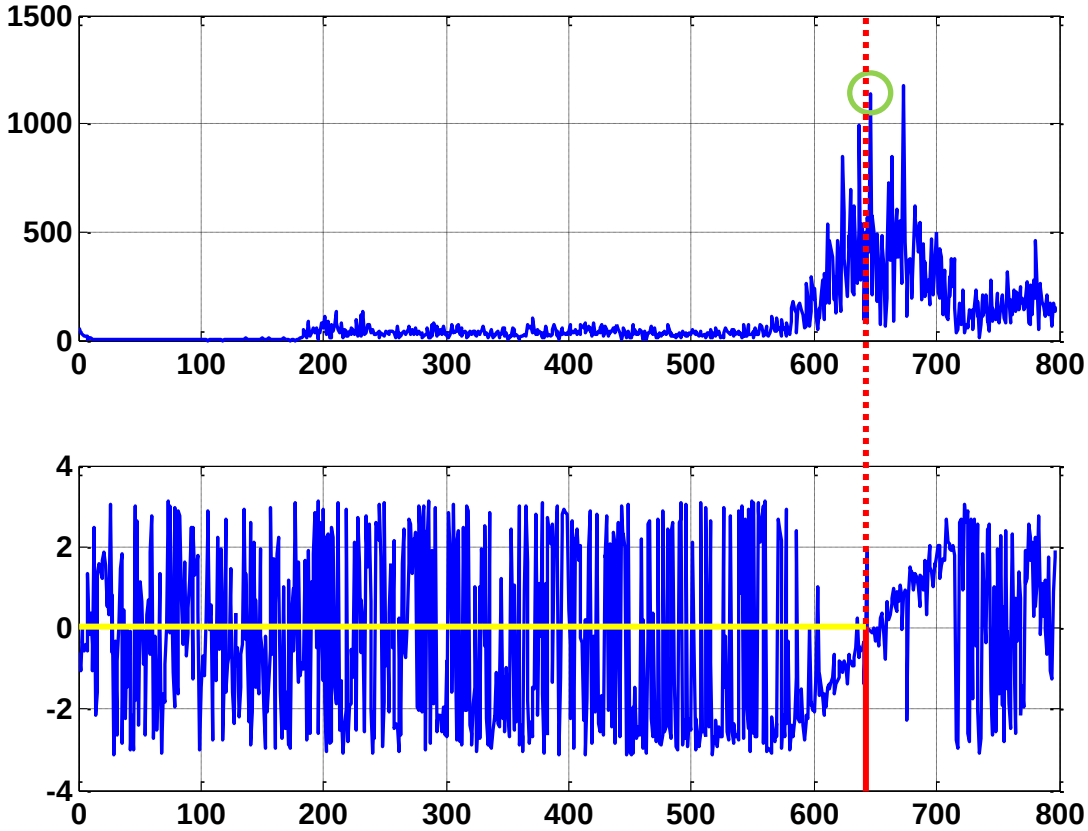




Multibeam EchoSounder Snippets

Magnitude at bottom detection sample





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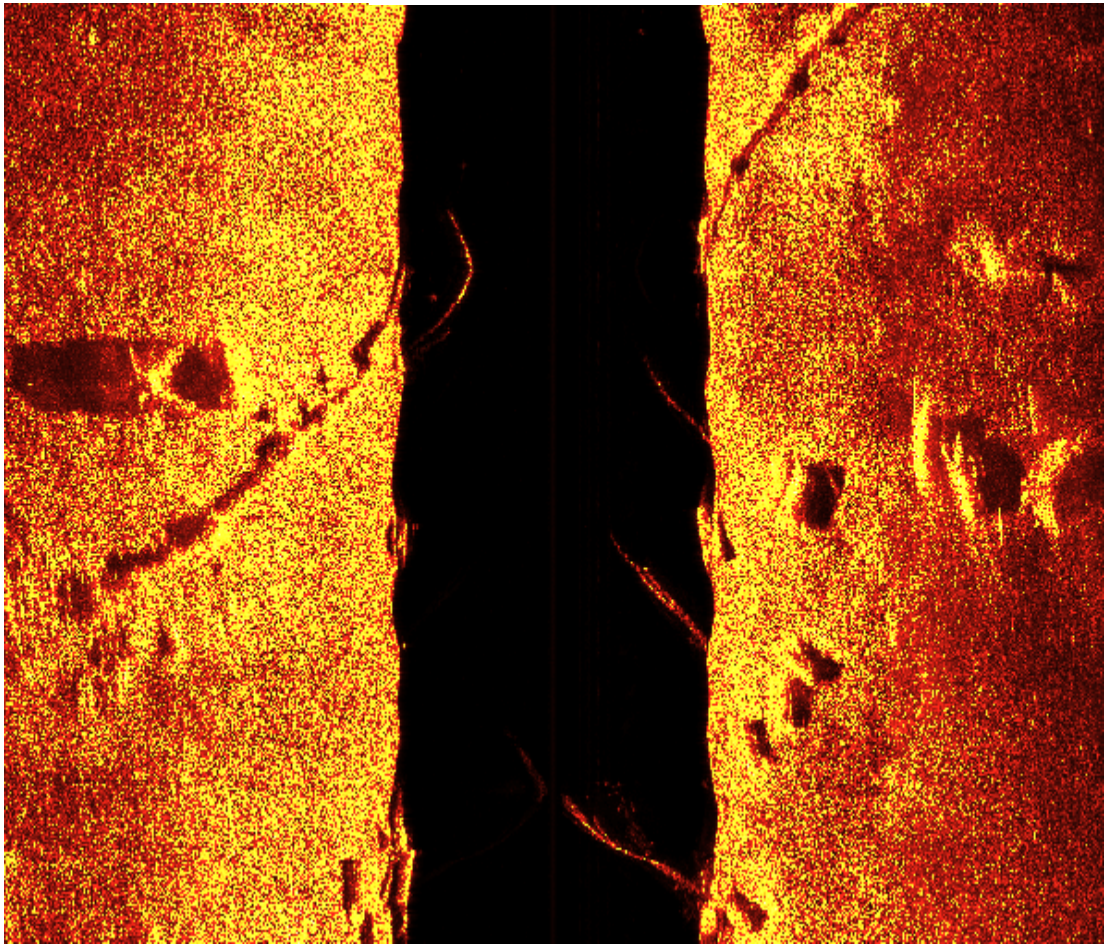
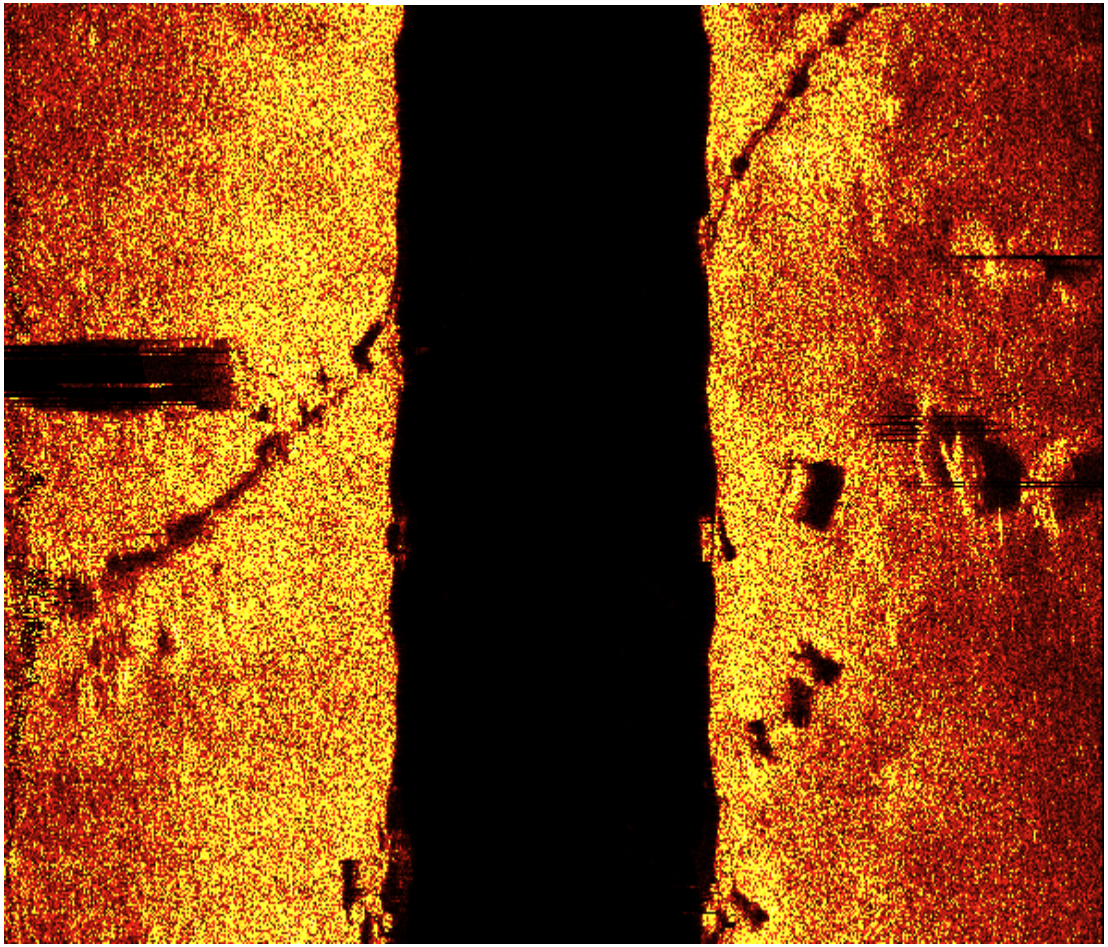
RESON sidescan

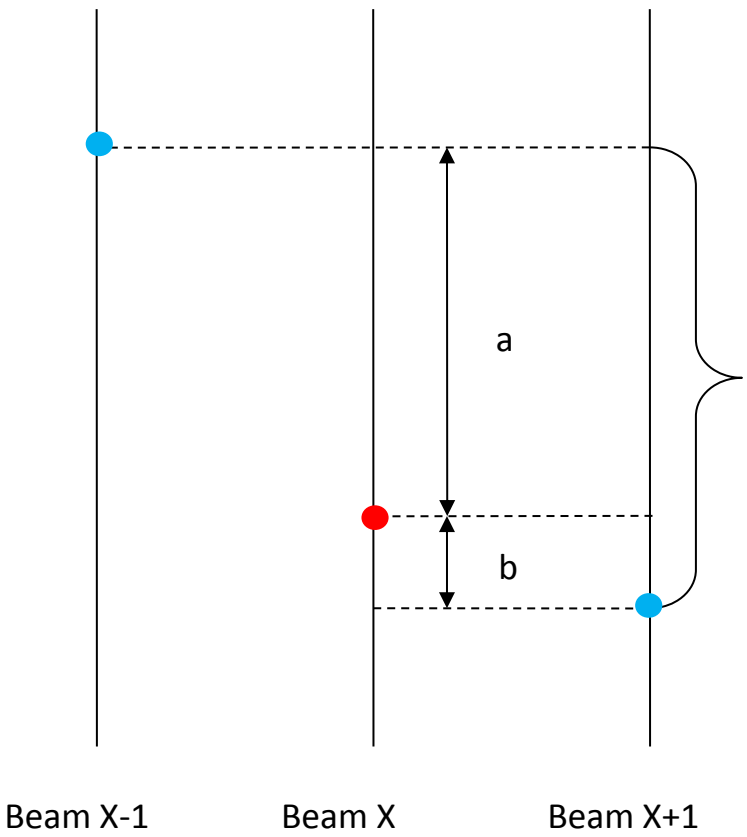


Direct comparison

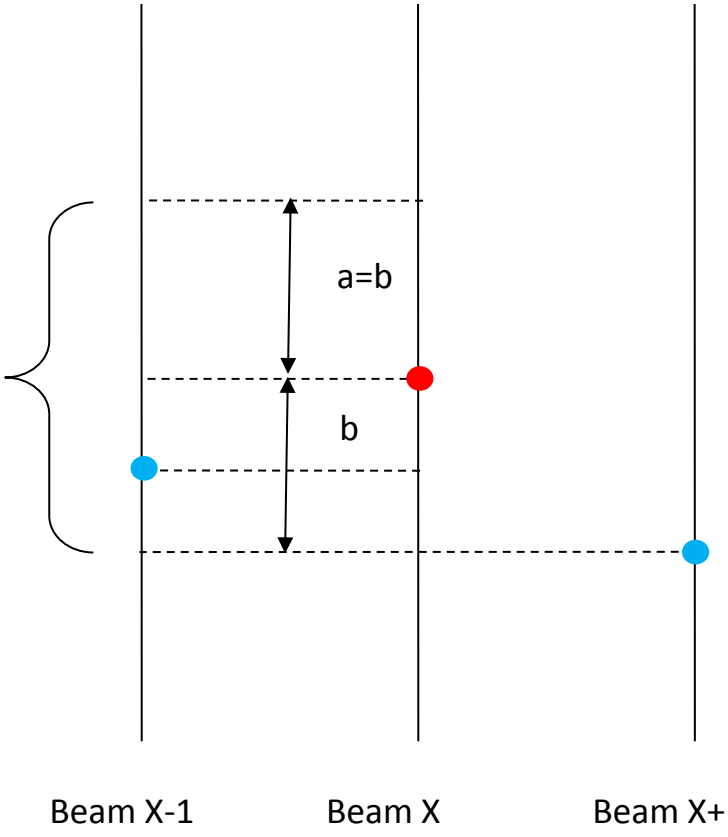
RESON snippets



Snippet size algorithm for 7K systems

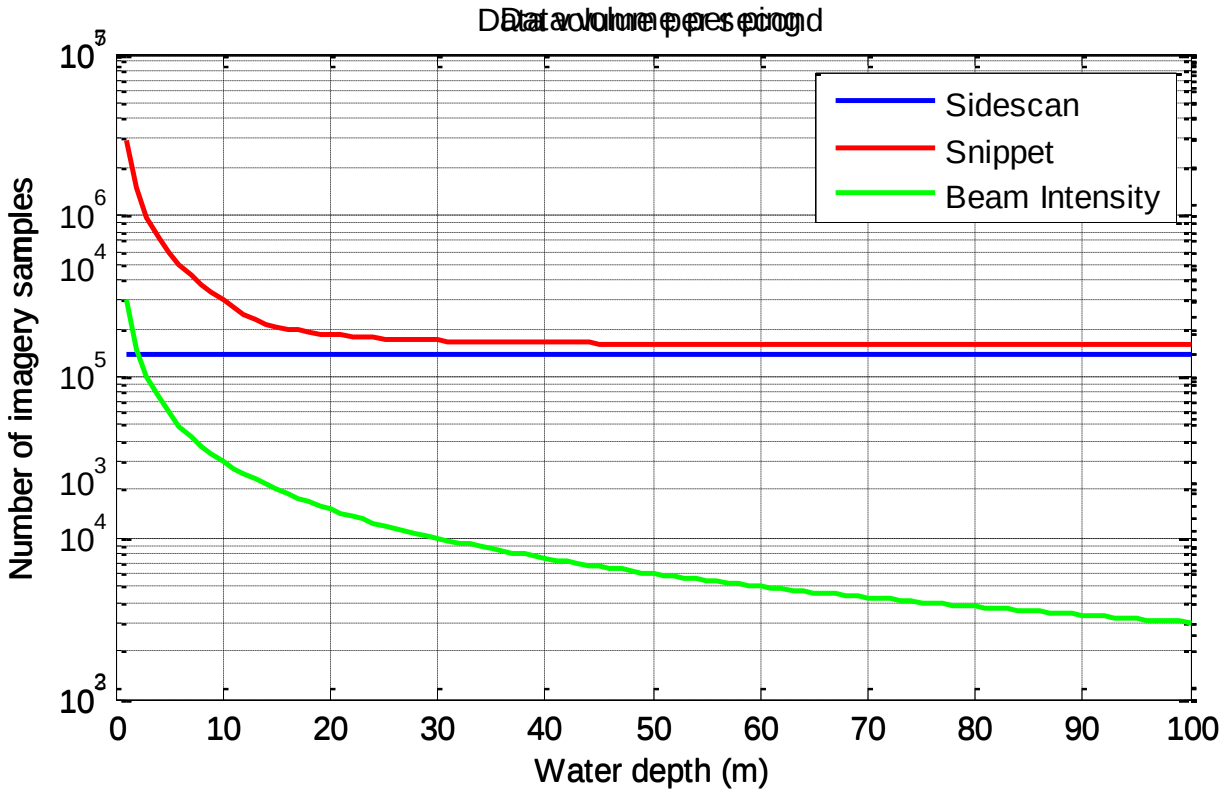


Snippet Window

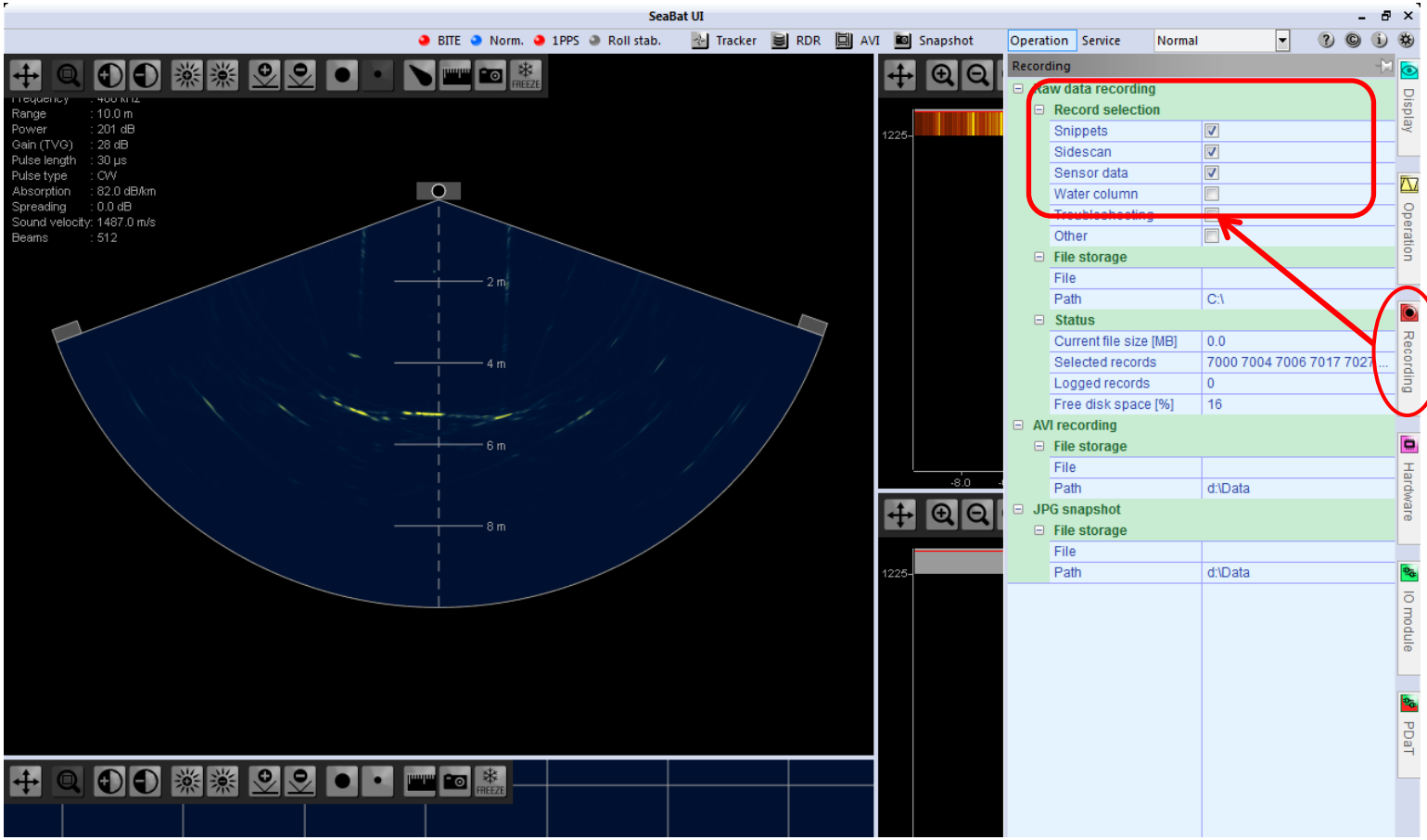


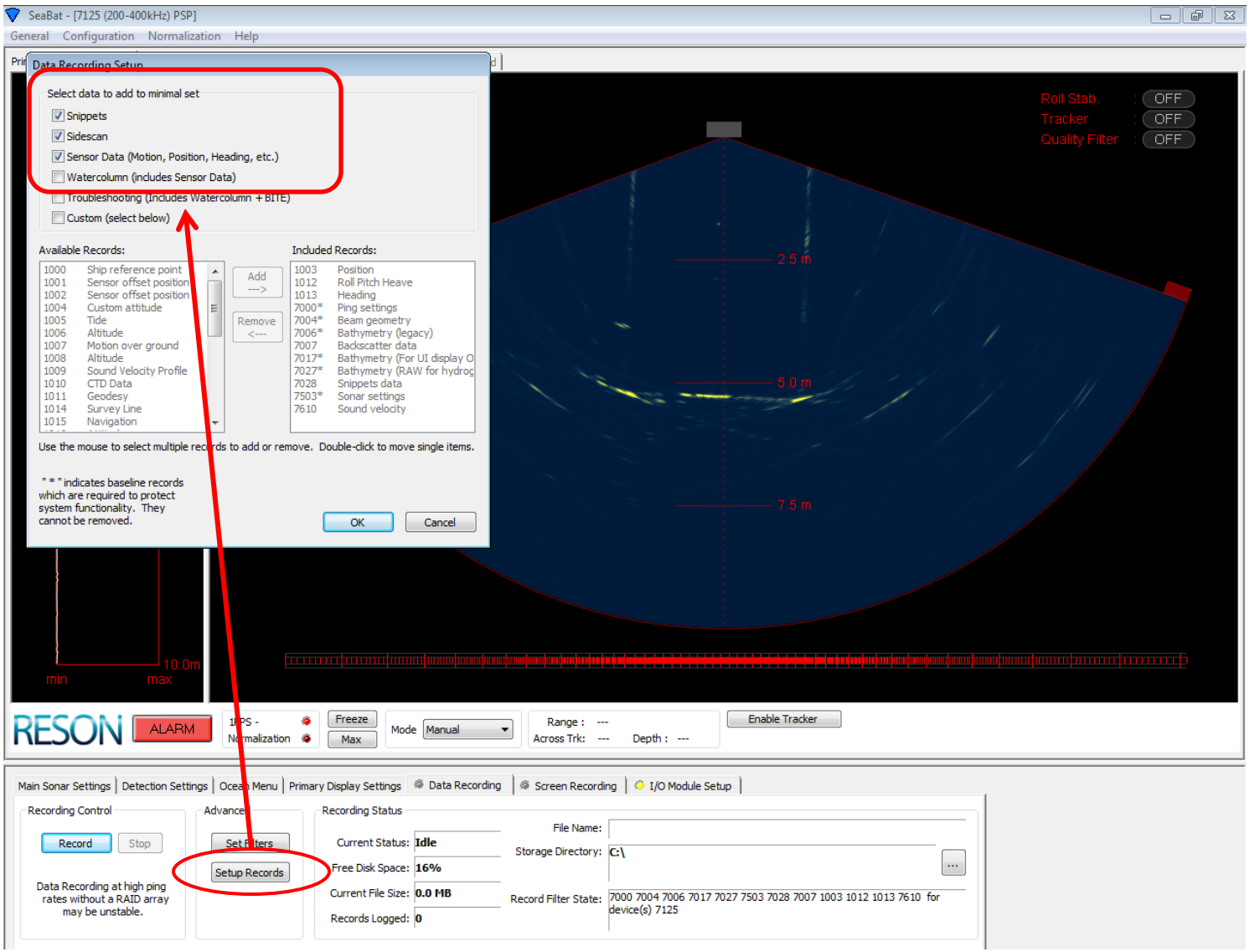
SeaBat 8K systems use a less sophisticated algorithm

Data volume comparison



How to collect data




SeaBat - [7125 (200-400kHz) PSP]
General Configuration Normalization Help
Data Recording Setup
Select data to add to minimal set
Snippets
Sidescan
Sensor Data (Motion, Position, Heading, etc.)
Watercolumn (includes Sensor Data)
Troubleshooting (Includes Watercolumn + BITE)
Custom (select below)
Available Records:
1000 Ship reference point
1001 Sensor offset position
1002 Sensor offset position
1004 Custom attitude
1005 Tide
1006 Altitude
1007 Motion over ground
1008 Altitude
1009 Sound Velocity Profile
1010 CTD Data
1011 Geodesy
1014 Survey Line
1015 Navigation
Add --->
Remove <---
Included Records:
1003 Position
1012 Roll Pitch Heave
1013 Heading
7000* Ping settings
7004* Beam geometry
7006* Bathymetry (legacy)
7007 Backscatter data
7017* Bathymetry (For UI display O
7027* Bathymetry (RAW for hydrog
7028 Snippets data
7503* Sonar settings
7610 Sound velocity
Use the mouse to select multiple records to add or remove. Double-click to move single items.
"*" indicates baseline records which are required to protect system functionality. They cannot be removed.
OK
Cancel
Roll Stab. OFF
Tracker OFF
Quality Filter OFF
2.5 m
5.0 m
7.5 m
10.0m
min
max
RESON
ALARM
Freeze
Max
Mode Manual
Range :
Across Trk:
Depth :
Enable Tracker
Main Sonar Settings
Detection Settings
Primary Display Settings
Data Recording
Screen Recording
I/O Module Setup
Recording Control
Record
Stop
Data Recording at high ping rates without a RAID array may be unstable.
Advanced
Set Filters
Setup Records
Recording Status
Current Status: Idle
Free Disk Space: 16%
Current File Size: 0.0 MB
Records Logged: 0
File Name:
Storage Directory: C:\
Record Filter State: 7000 7004 7006 7017 7027 7503 7028 7007 1003 1012 1013 7610 for device(s) 7125

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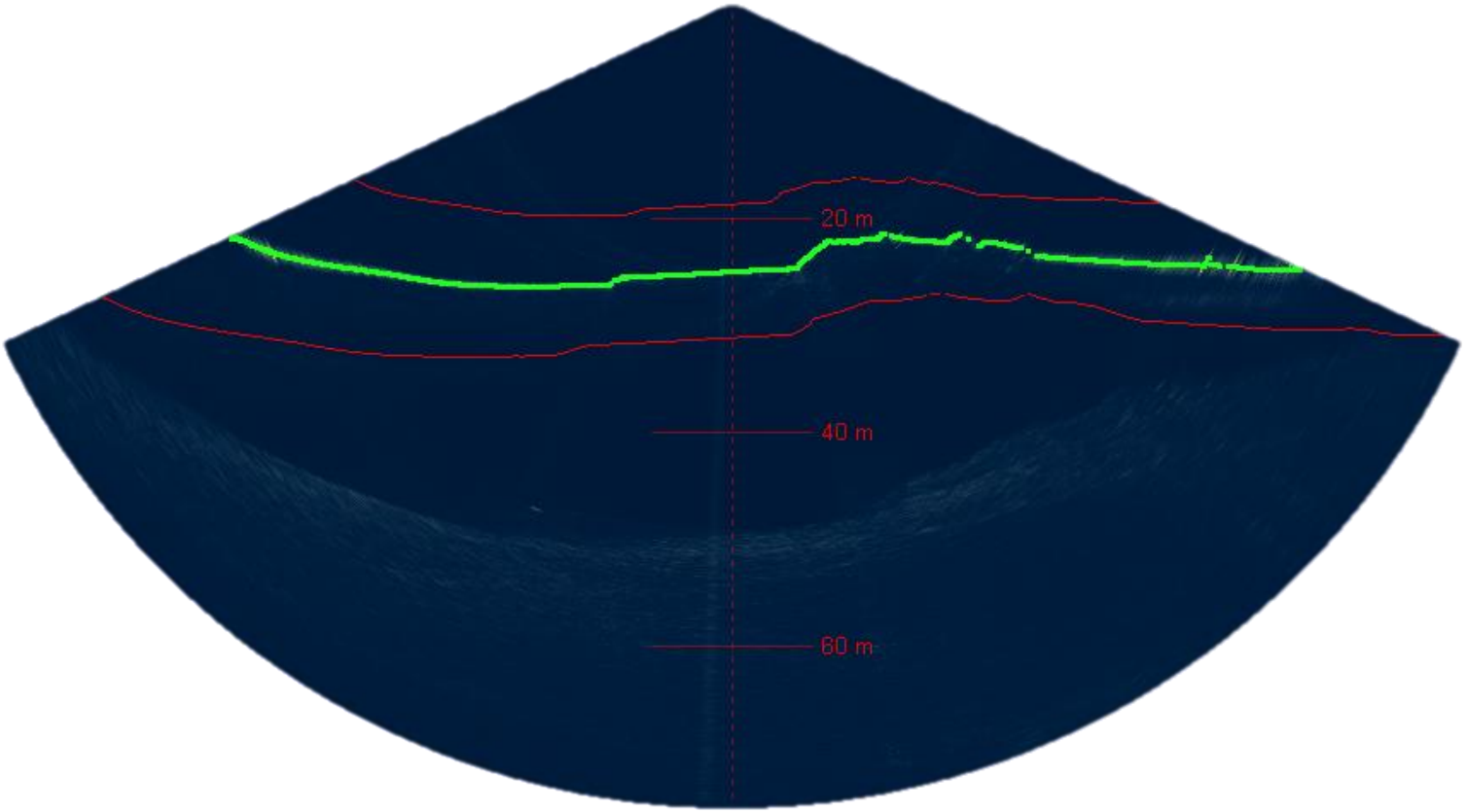
New water column record: 7041

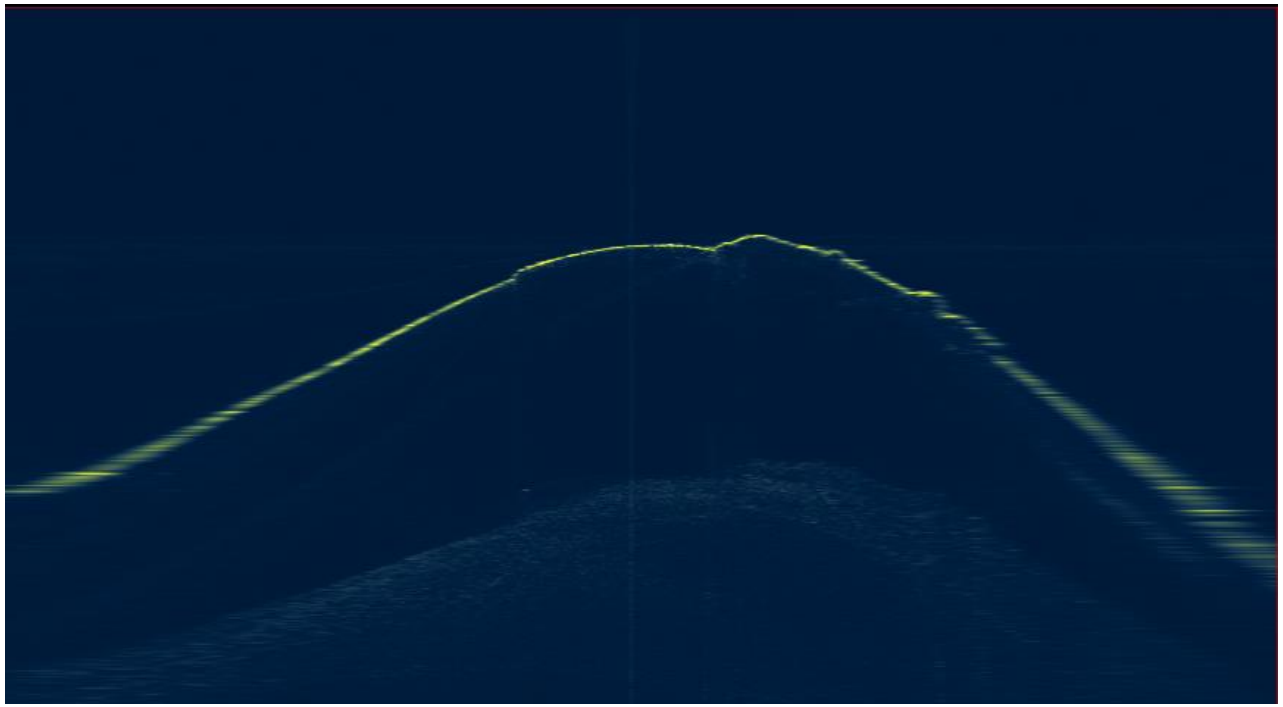
Down-sampling Method	u8	0 – No down-sampling 1 – Nearest neighbor 2 – Linear approximation 3 – Averaging 4+ – Reserved for future use
Filtering Method	u8	0 – No filtering 1+ – Reserved for future use
Flags	u32	BIT FIELD: Bit 0-3: Data Encoding 0 – 16bit magnitude 1 – 8bit magnitude 2 – 16bit magnitude & phase 3 – 8bit magnitude & phase 4 – 32bit calibrated magnitude 5 – 16bit calibrated magnitude 6 – 8bit calibrated magnitude 7 – Reserved Bit 4: Beam identification method 0 – Beam number (u16) 1 – Beam angle (f32, in radians) Bit 5-31: Reserved (always zero)
Magnitude/Calibrated Magnitude Encoding	u8	Magnitude Encoding Methods: 0 – 16 bit values 1 – 8 bit ½dB 2+ – Reserved Calibrated Magnitude Encoding Methods: 0+ – Reserved
Phase Encoding	u8	Phase Encoding Methods: 0+ – Reserved
Sample Rate	f32	Sampling rate for the data

Limiting data volumes further



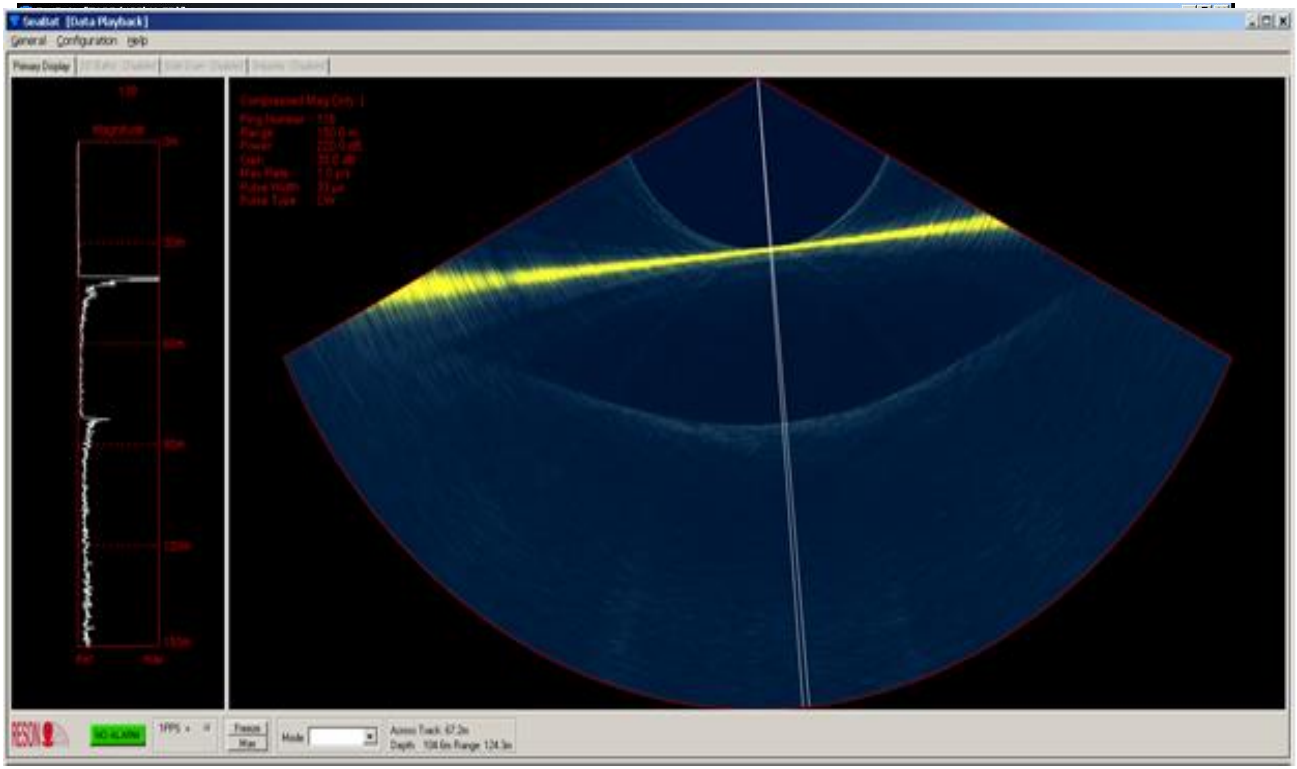
Limiting data volumes further

- For 130 degree coverage in equi-distant mode: 35% less data



SeaBat operation

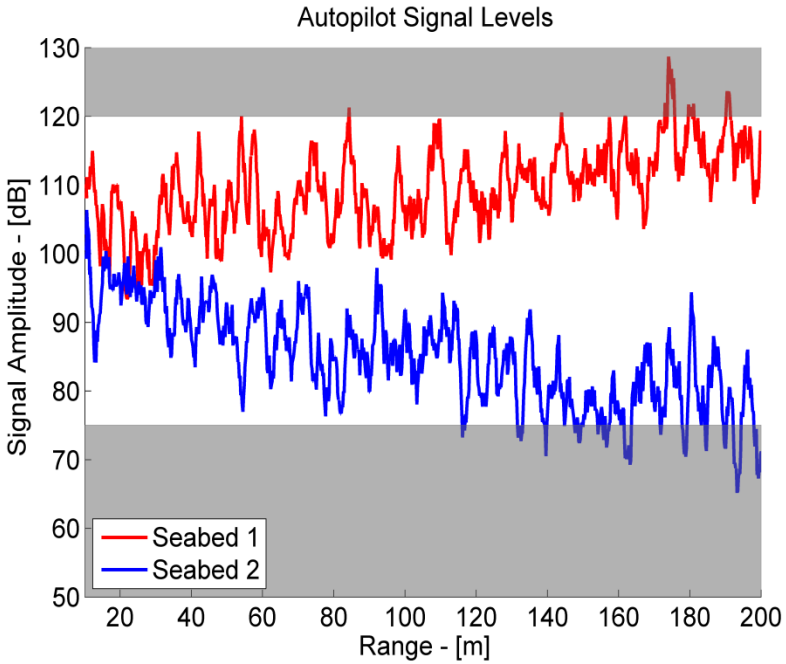
- Monitoring saturation conditions

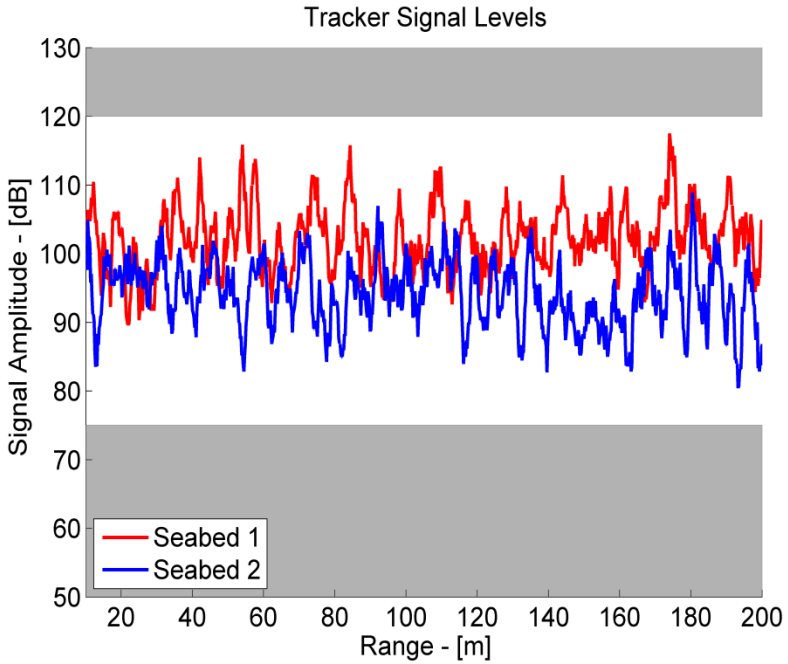


- SeaBat 7125: Avoid using FM, use CW pulses at 100µs or 200µs

New automatic control operation

- Tracker tunesTVG parameters to maintain backscatter signal levels





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GulfEx11 and TREX13

- Working with APL/UW
- Thorough study
- Repeating experiment
- Validation for high-frequency sonar
- Finalization of design
- Product to follow

Acknowledgement: Barbara Kraft & Christian de Moustier, work funded by ONR

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Keys to success

- Sonar capable of producing good raw data
- Operator choosing the multibeam echosounder operational parameters wisely
- Processing package applying the proper compensation to the raw data

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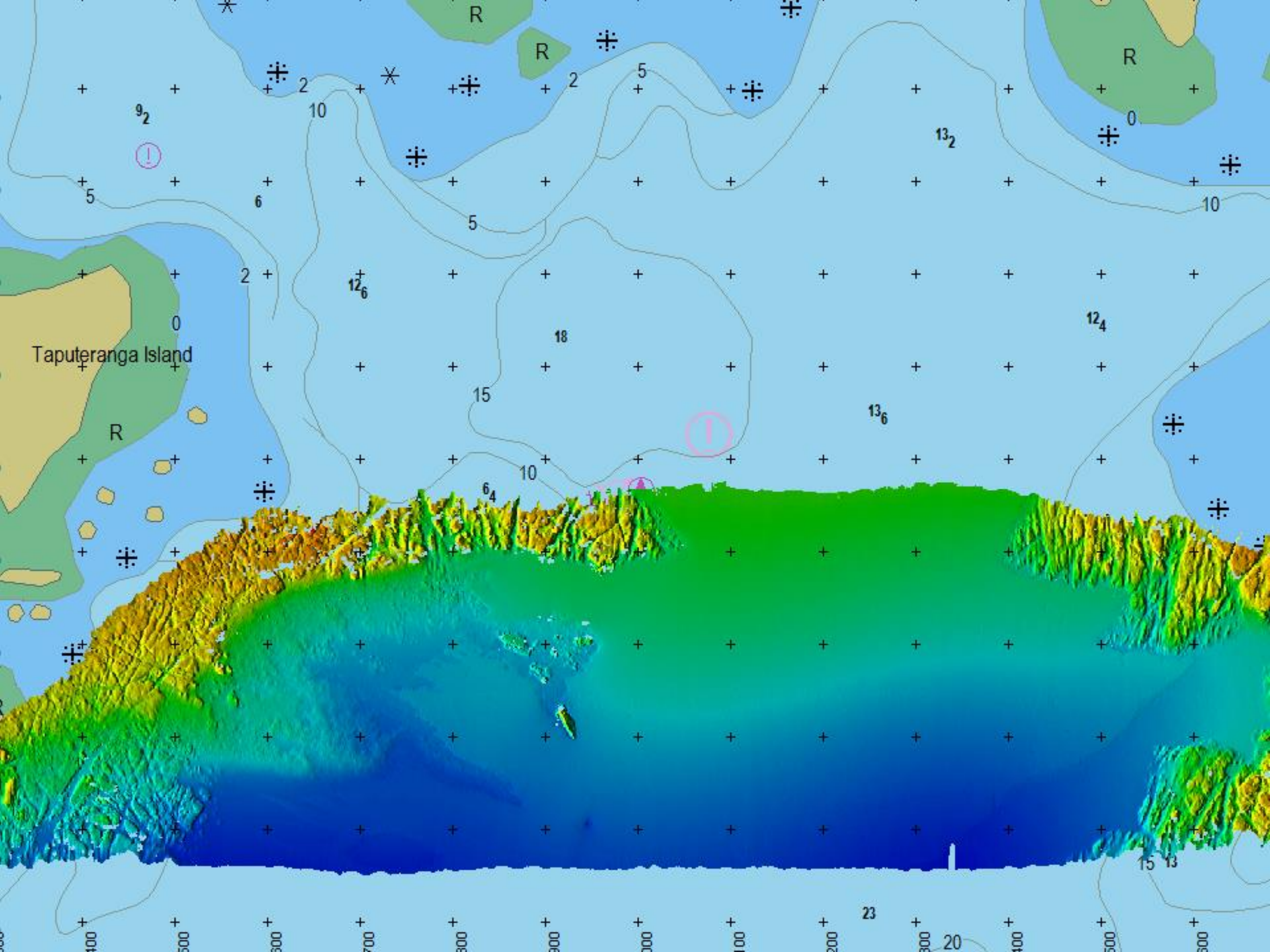
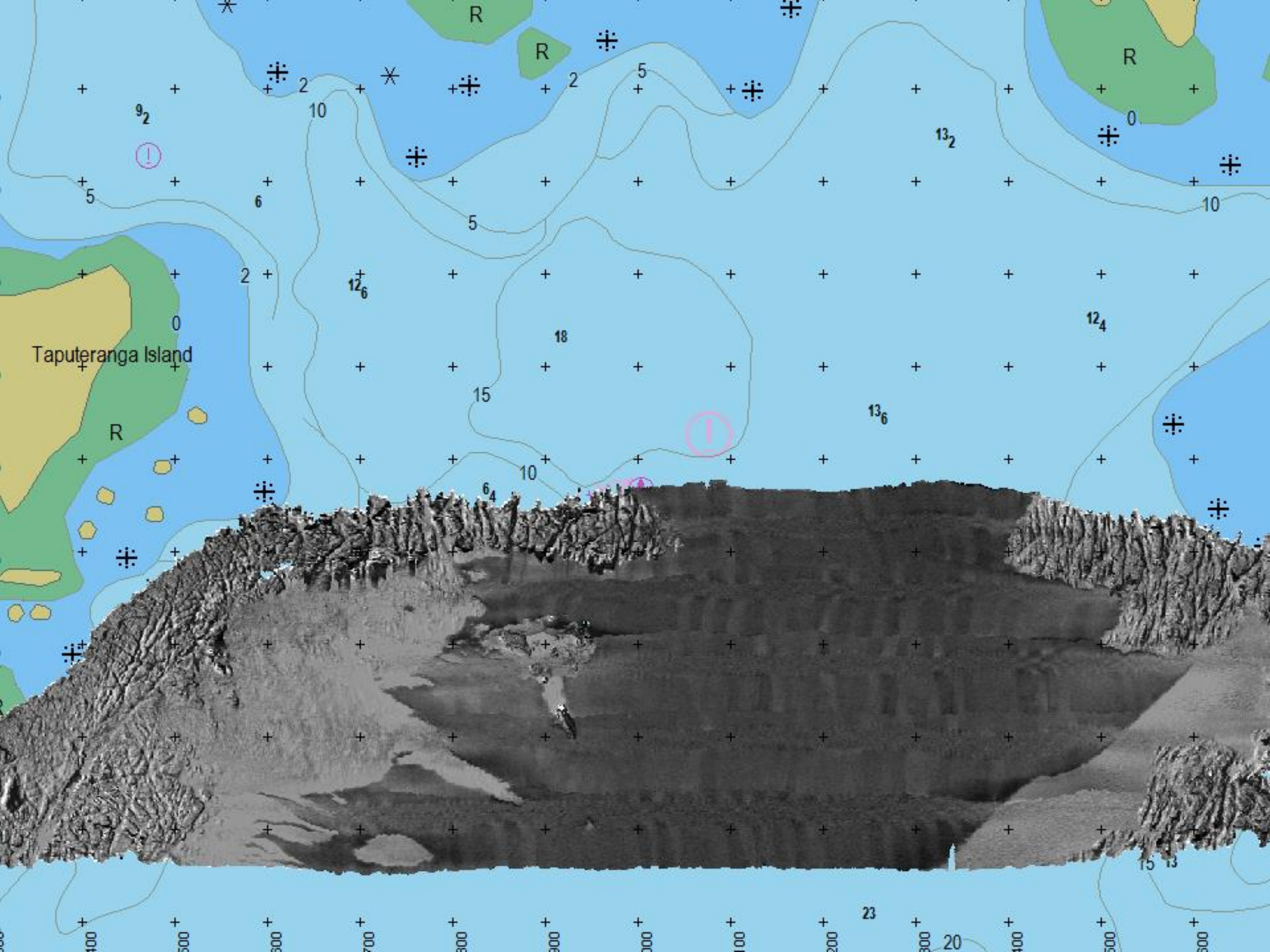
Back-Up slides

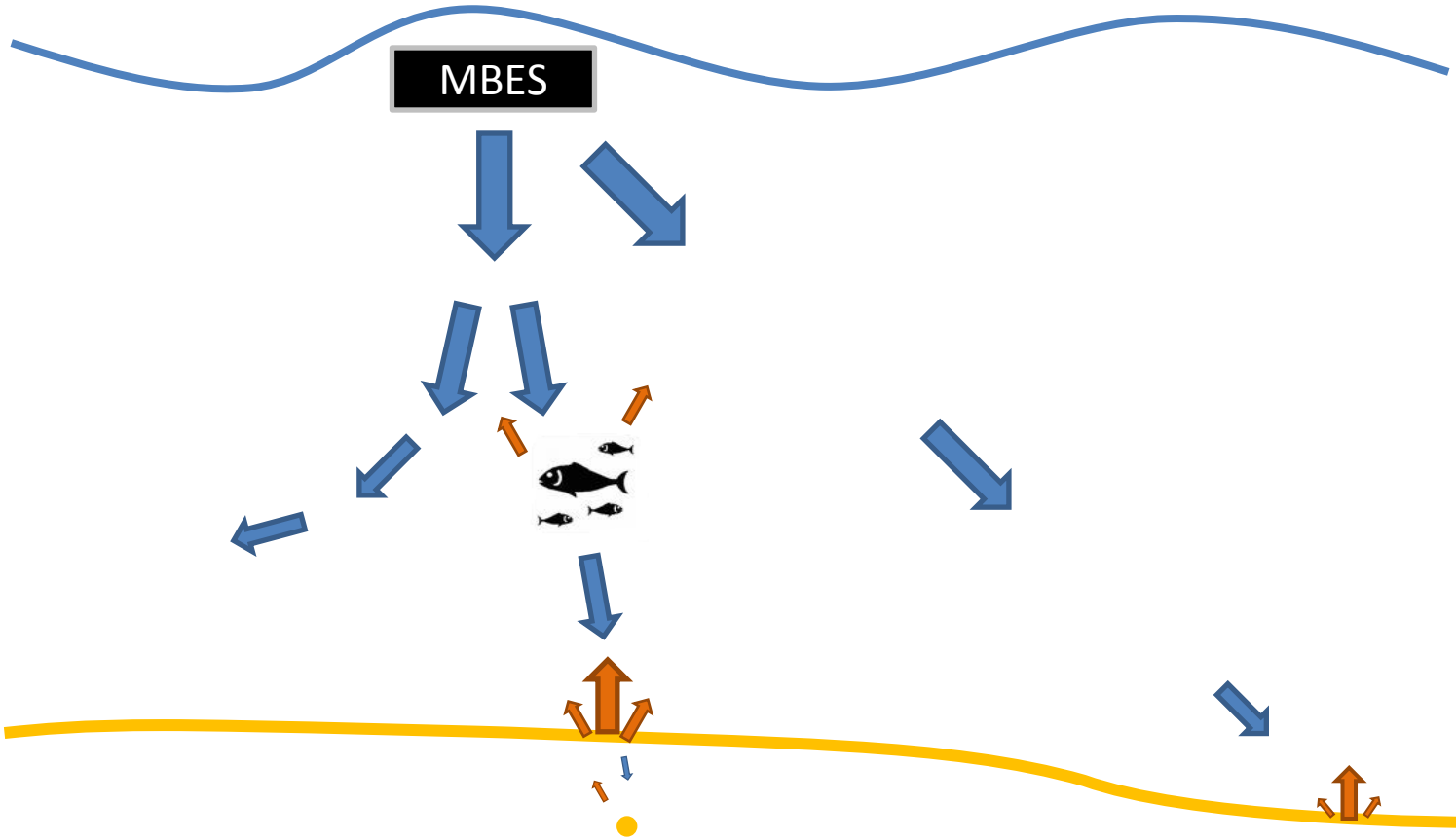


Taputeranga Island
R
R
R
R
0
0
2
2
2
5
5
5
10
10
10
15
15
20
6
18
23
13

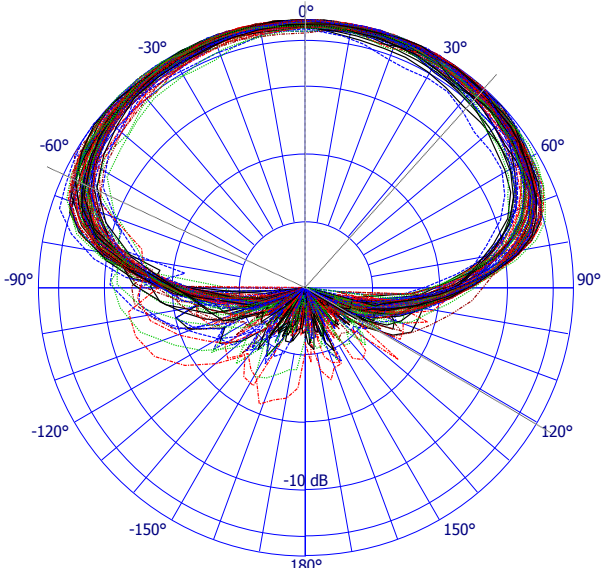


Taputeranga Island

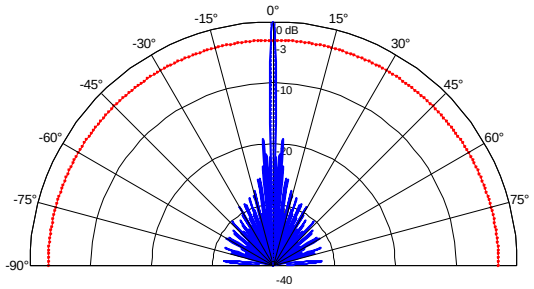
Propagation

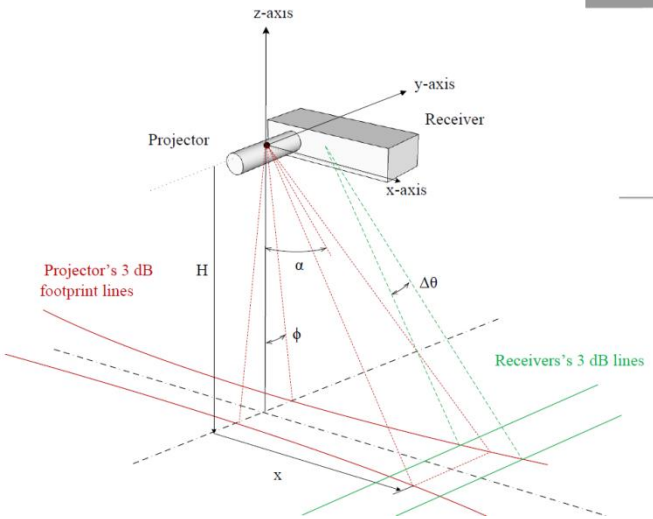


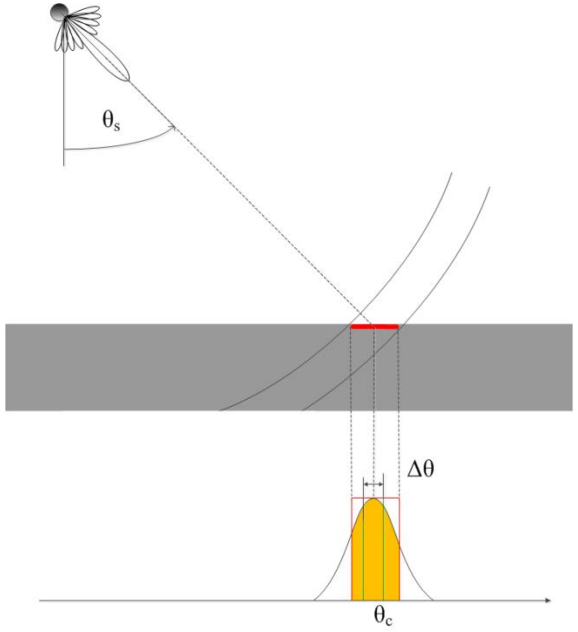
Sonar footprint



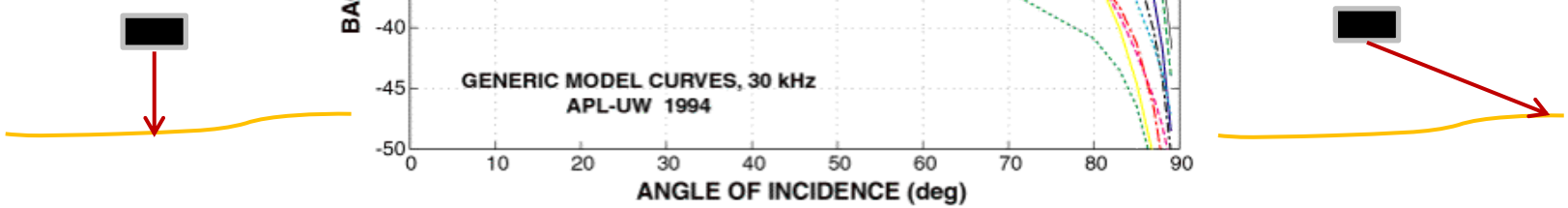
-3dB Beam width: 1.06° Side lobe level -19.2 dB
Distance: 100.00 m c=1480.0 m/s f=400.0 kHz phi=90°



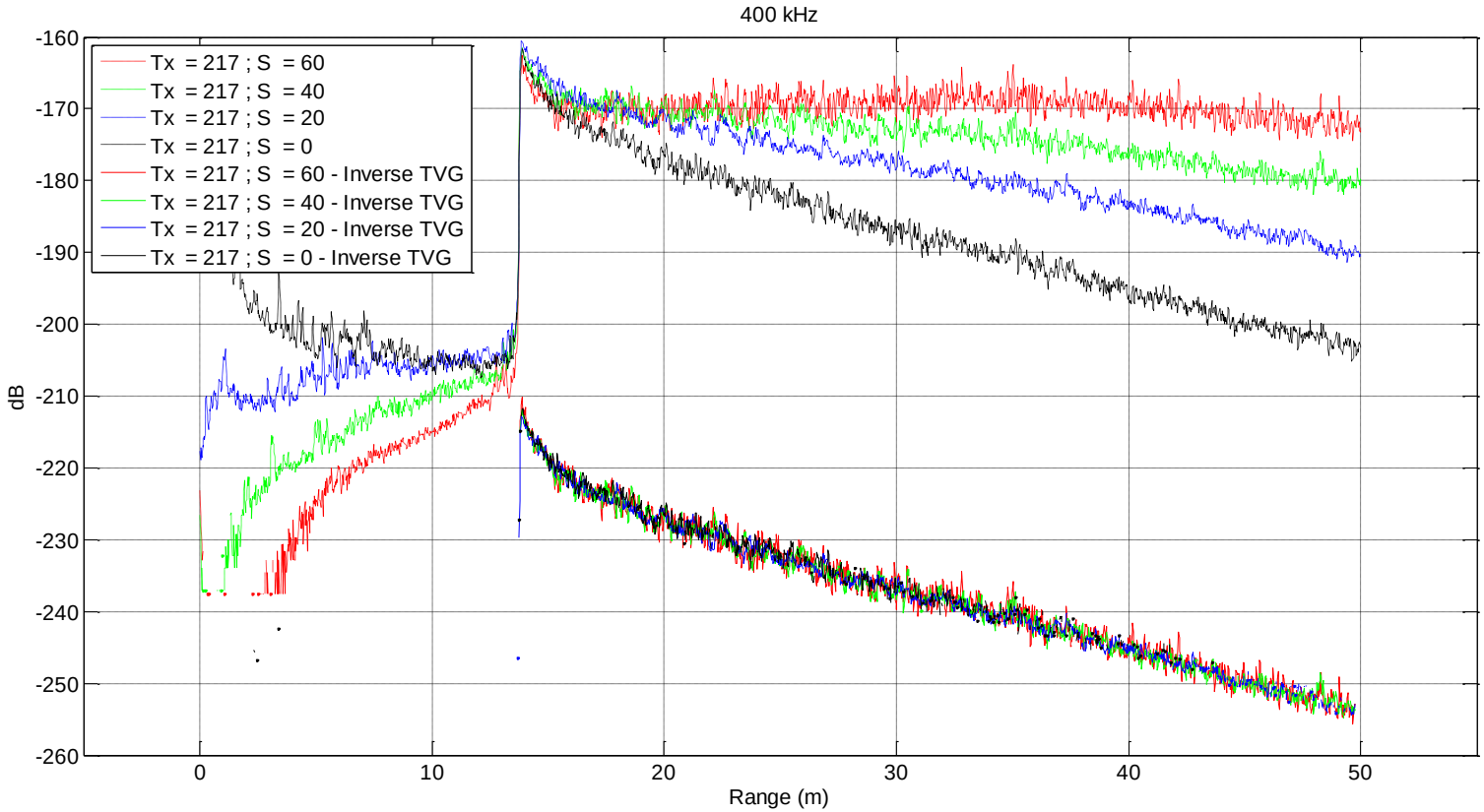




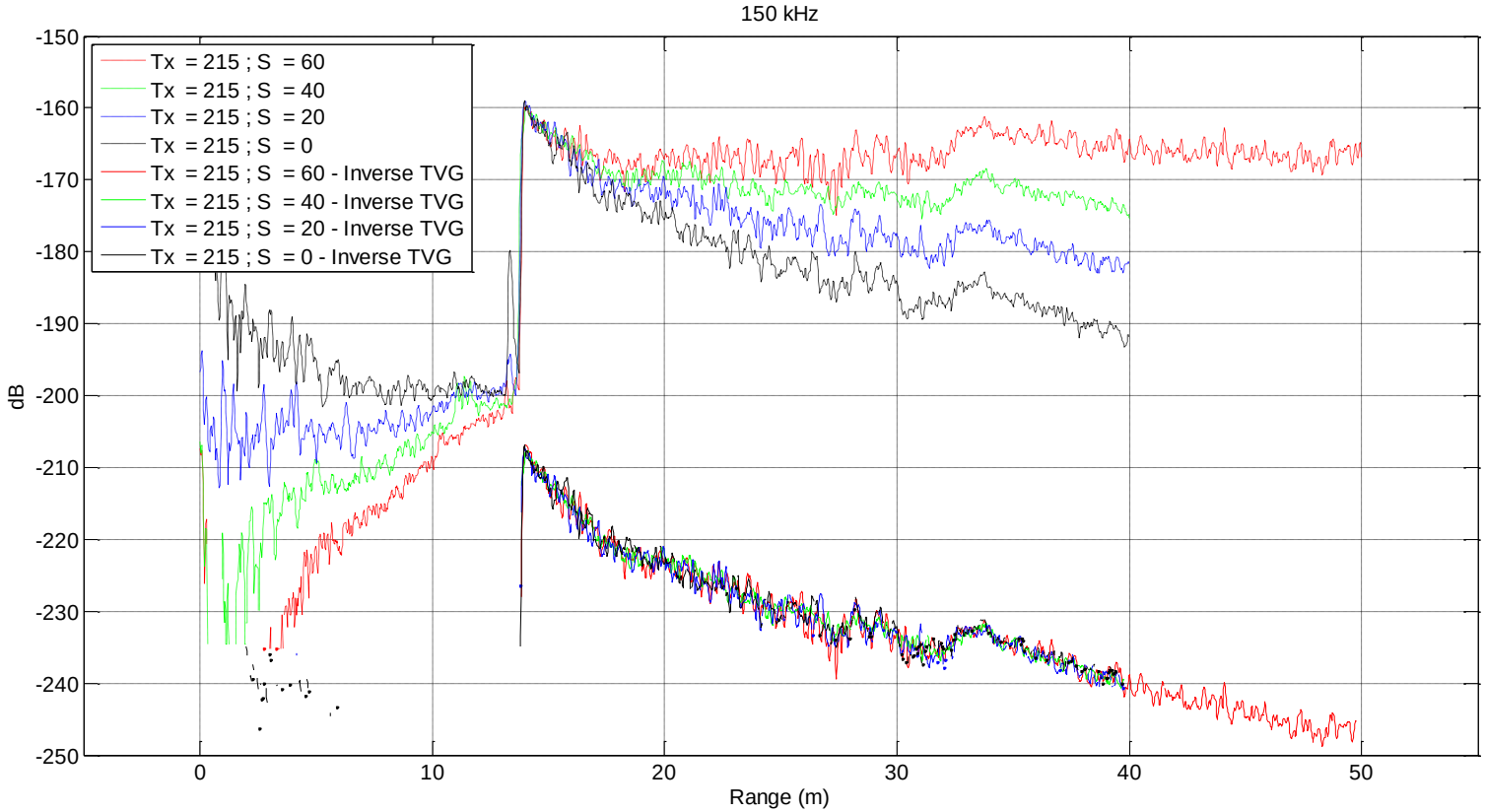
Sediment backscattering strength



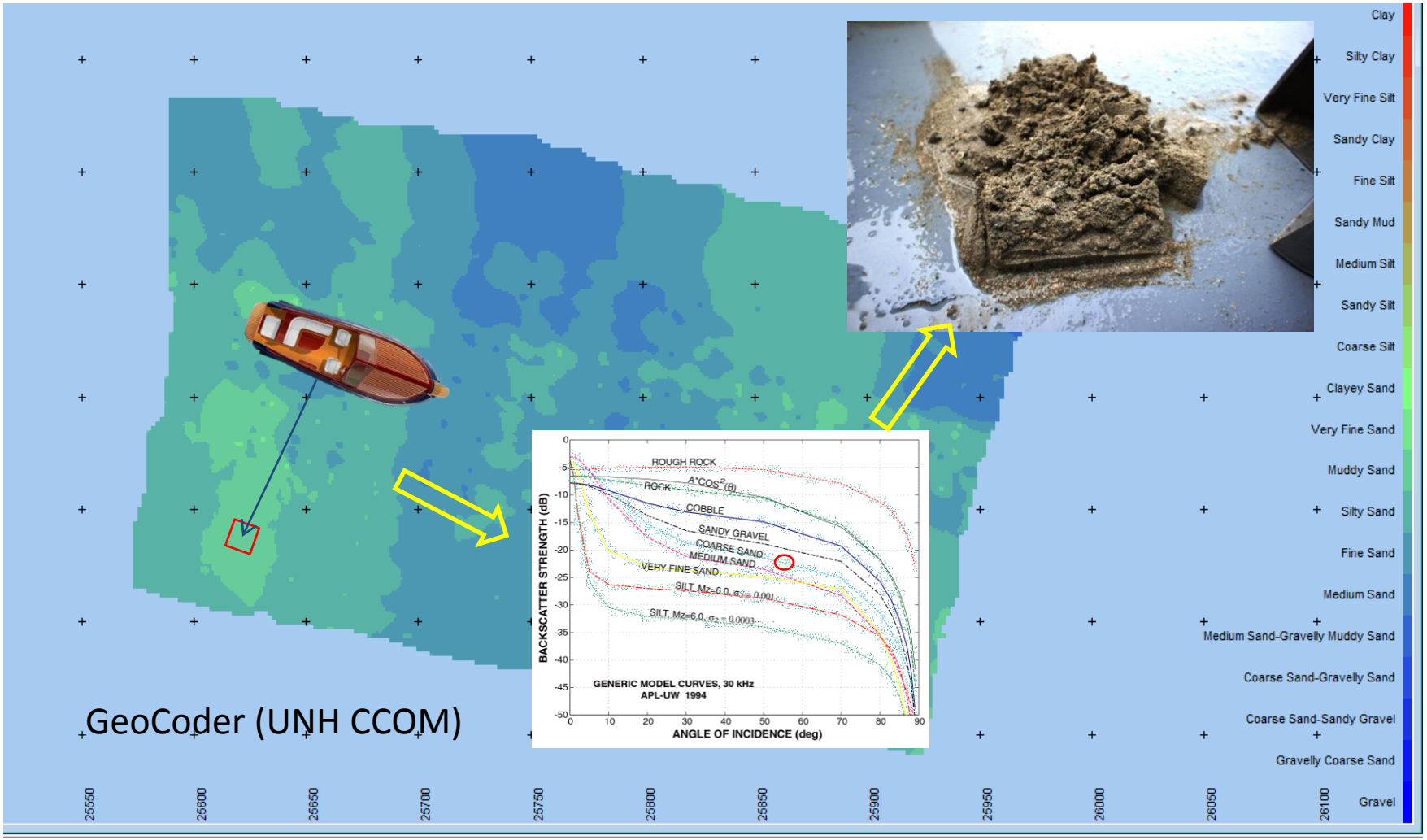
Frequency dependence



Frequency dependence



Sediment classification



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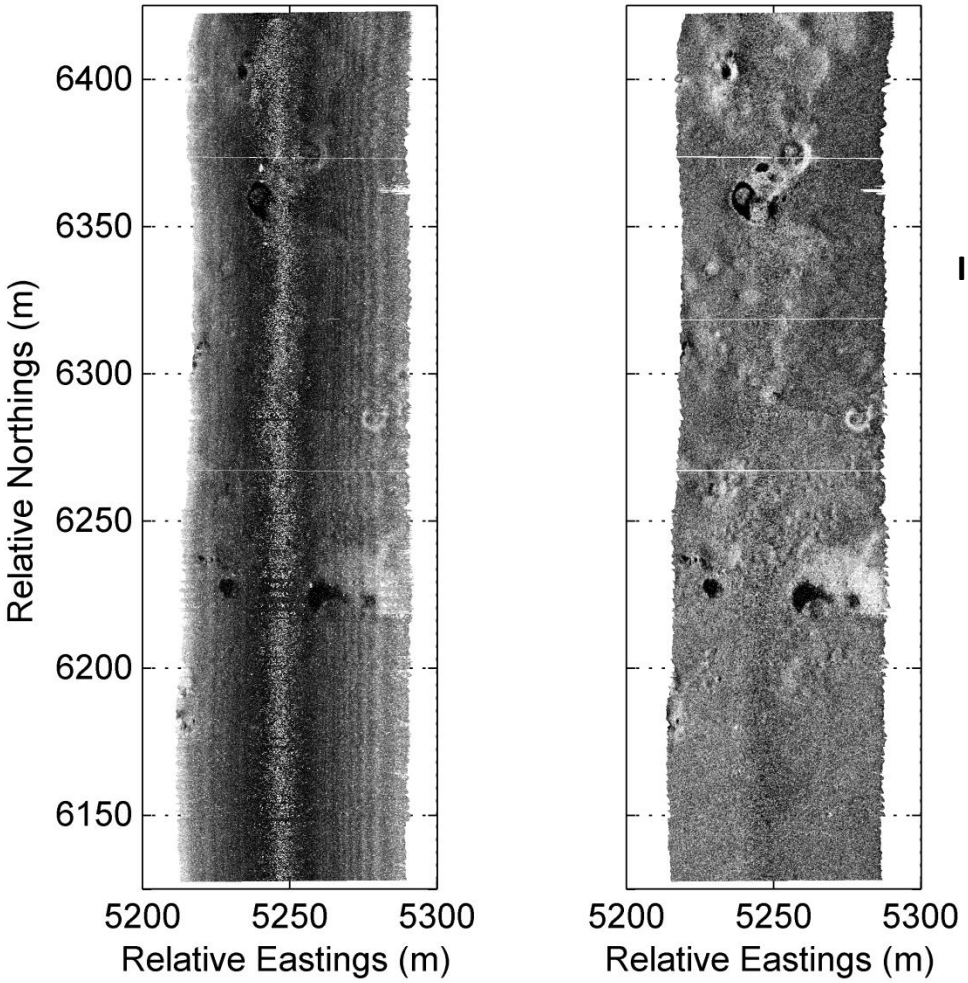
Not all processing algorithms are equal



In situ beam pattern estimation from seafloor acoustic backscatter measured with swath mapping sonars

Christian de Moustier and Barbara J. Kraft
HLS Research, Inc., La Jolla, CA, USA

To be presented at:
ICA2013, Montreal, Canada, June 2-7, 2013

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Sonar design

- Quiet system → larger Signal-to-Noise Ratio
- Accurate beamforming → low sidelobes, easier beampattern compensation
- Reliable bottom detection → Sediment, not fish, reflectivity