Data Processing Challenges in Marine AGC

Black Tusk GEOPHYSICS

Kevin Kingdon

Acquiring Marine AGC Data: One-Pass Surveys

Acres Surveyed

	AOC A	AOC B	AOC C
Shallow	32.0	3.0	29.9
Deep	28.9	14.6	62.8

Total Area Surveyed: 171.2 acres

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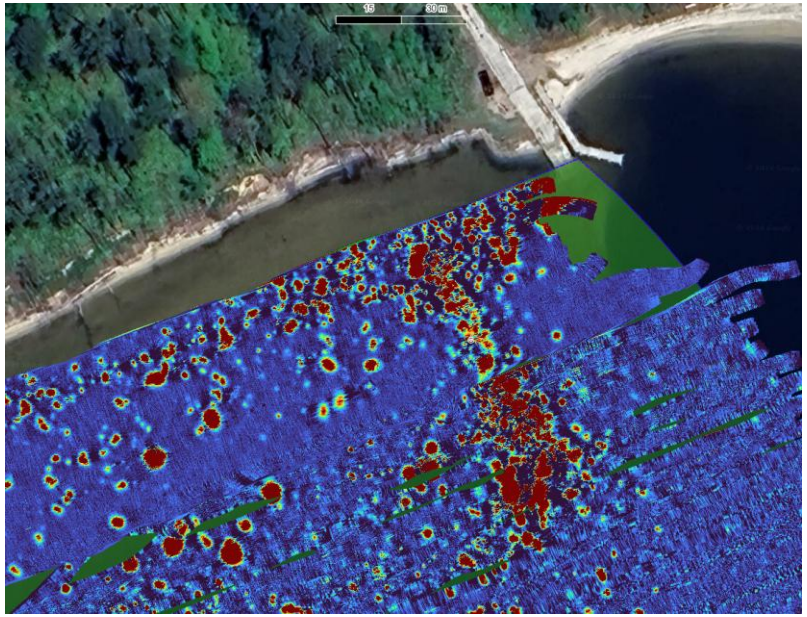
Marine AGC Challenges

1. Noise source from active thrusters
2. Positioning uncertainties
3. Cost



- Develop methods to improve characterizing system performance, such that unnecessary recollects and gap fills are minimized
- Implement methods that account for variable noise and positional uncertainties

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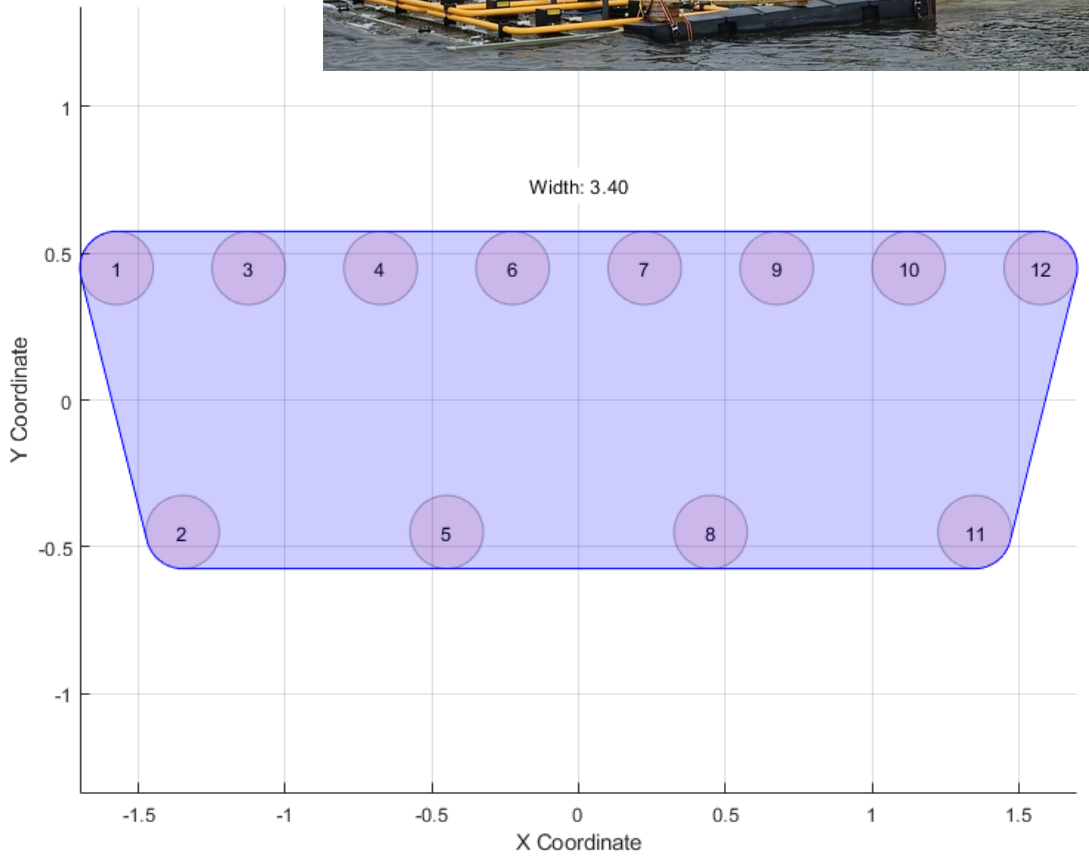
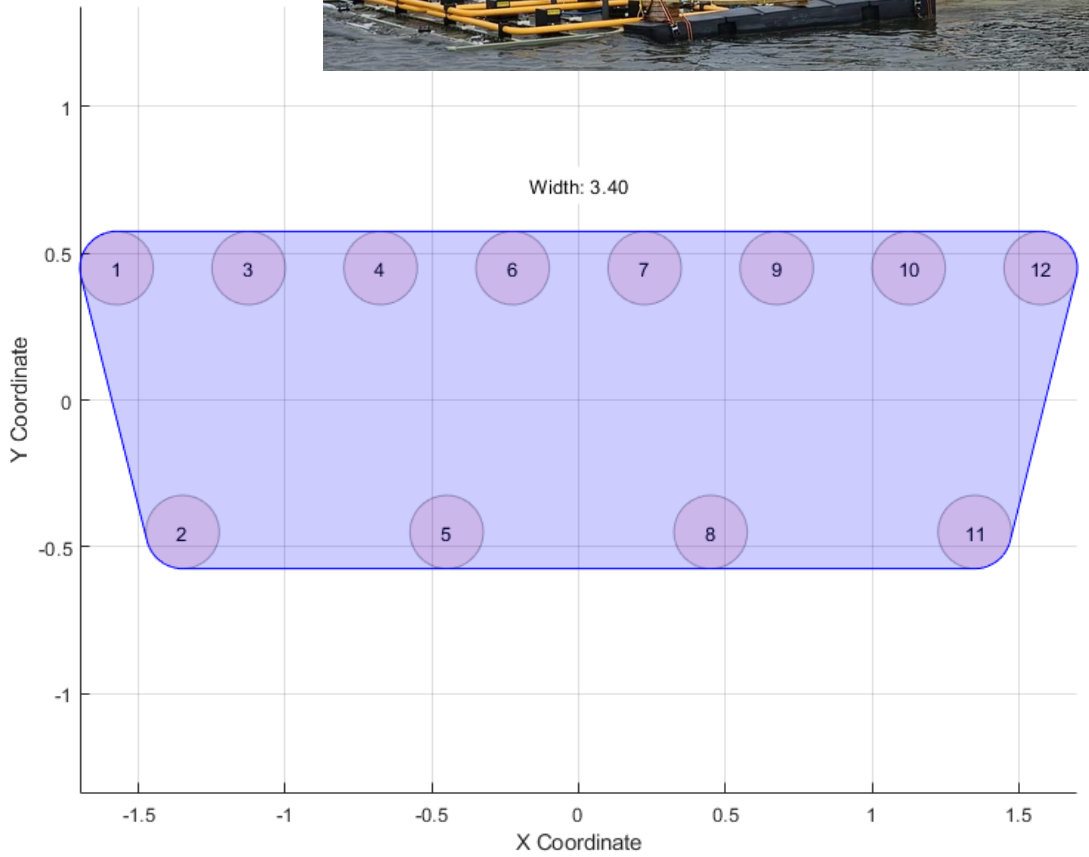
Coverage MQOs

- Current MQO uses a swath width of 3.4m or 1.7m from the center of the array to the edges.
- Advantage: Computationally easy
- Disadvantages
  - Assumes all components for each Tx firing are good quality. Ie low noise, functioning normally
  - One bad Rx cube and we should discard entire line for this coverage analysis to be valid.

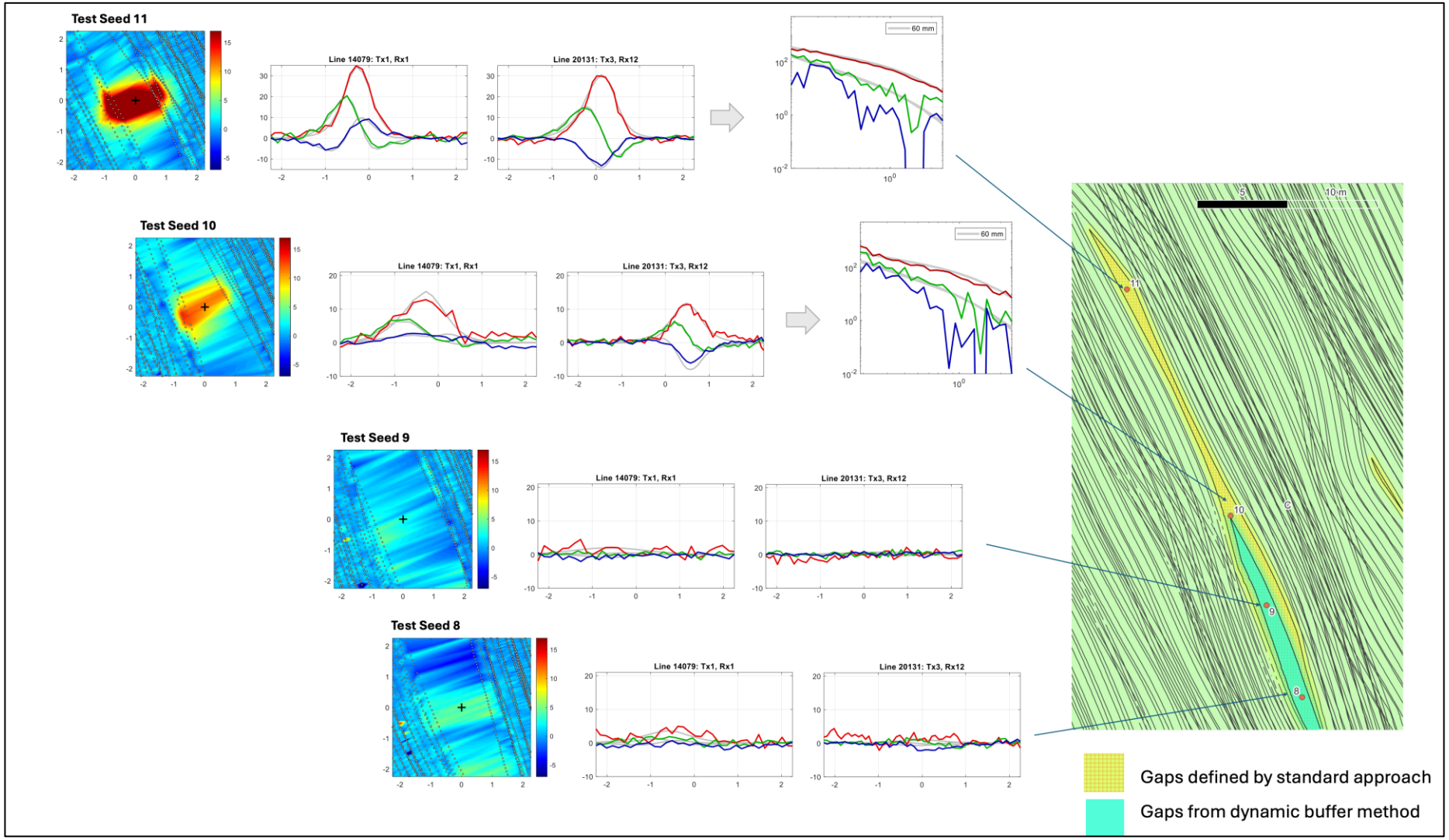


Modified MQO: Dynamic Buffer Analysis

- Use forward modelling to determine which locations in the survey do not meet the detection objective.
- Inputs:
  - Altitude
  - Noise levels
  - Detection objective (e.g. target type and depth)



Noise, Altitude and Data Coverage: Dynamic Buffer Analysis



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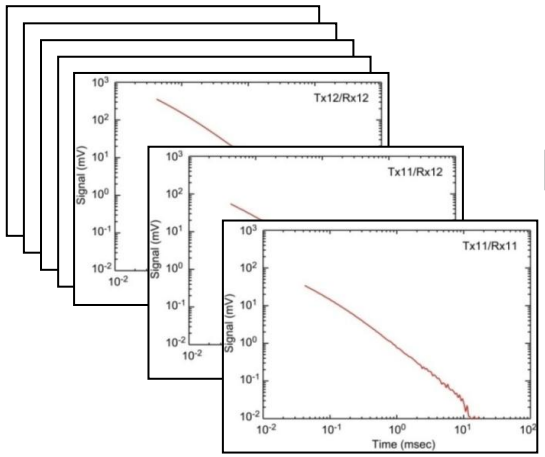
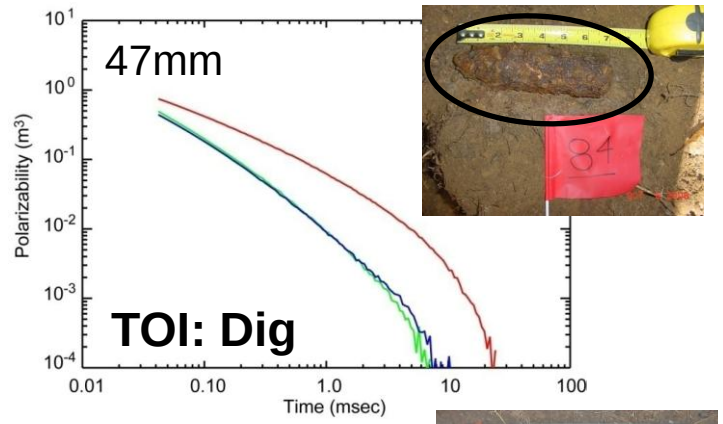
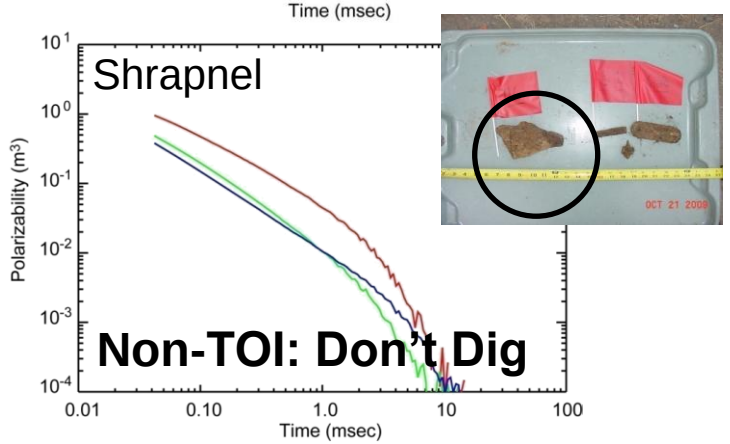
Advanced Geophysical Classification

- Use a dipole signal model and principal axis polarizabilities for distinguishing potential UXO from scrap



Inverse operation





Data from different sensor/object geometries

Principal axis polarizabilities

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Classification results based on submitted diglist

Name
100-lb Bomb
105mm
106mm
155mm
2.36-in
2.75-in
25-lb Bomb
250-lb Bomb
3.5-in
37mm
40mm
5-in
5-lb Bomb
60mm
81mm
90mm
Dual Mode HE Rocket
Fuze
Grenade
ISO Medium
ISO Small
Plate 5-lb
Rocket Motor

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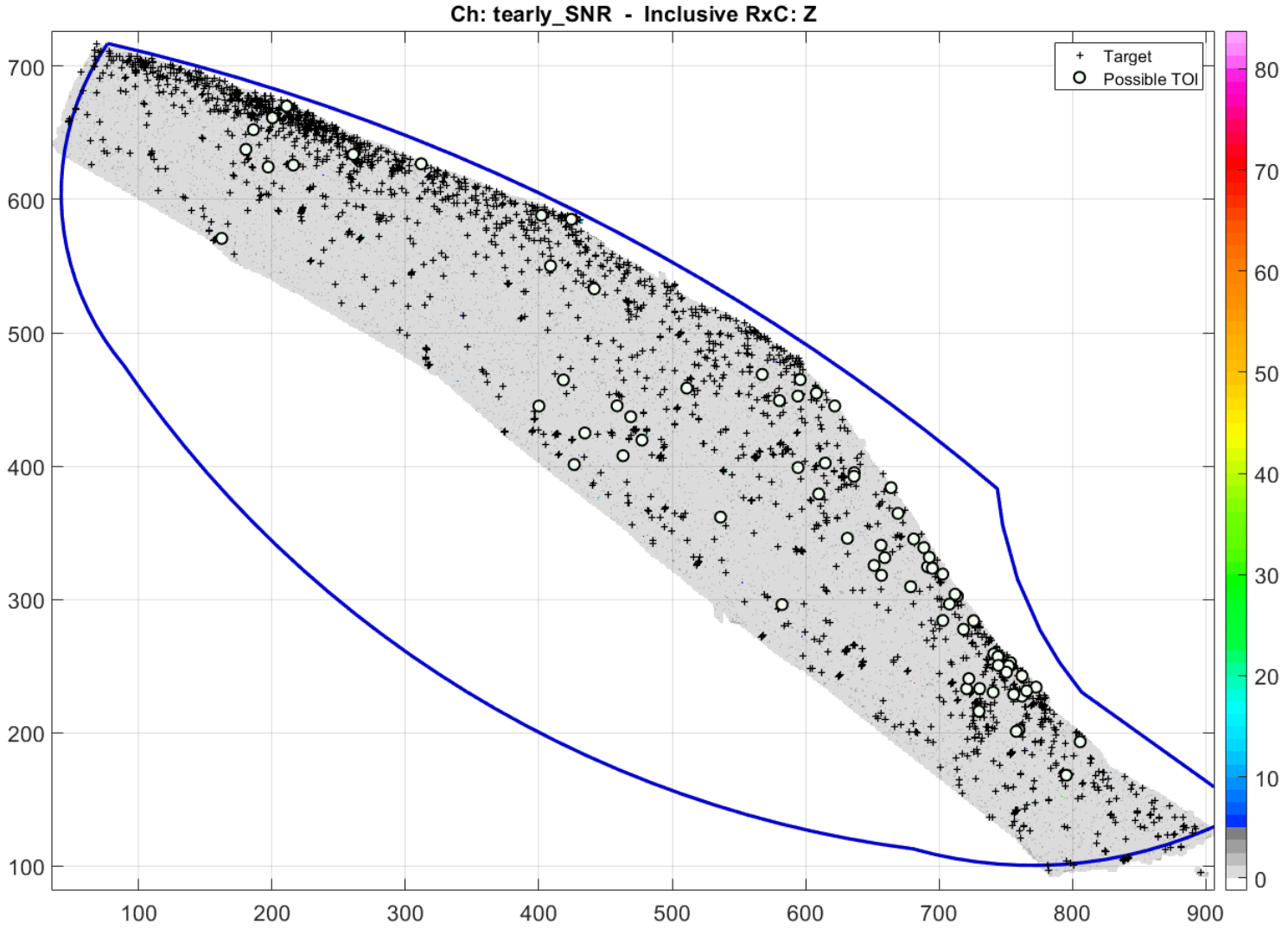
Acquiring AGC Data: One-Pass Surveys in AOC A (Shallow)

Library type	Count
40mm	23
Fuze	21
2.36-in	15
60mm	6
2.75-in	3
Grenade	2
25-lb Bomb	1
81mm	1
105mm	1
90mm	1
Dual Mode HE Rocket	1
3.5-in	1
37mm	1



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Acquiring AGC Data: One-Pass Surveys in AOC A (Shallow)

AOC A Shallow:
Best 30 matches

Library type	Count
40mm	23
Fuze	21
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60mm	6
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Grenade	2
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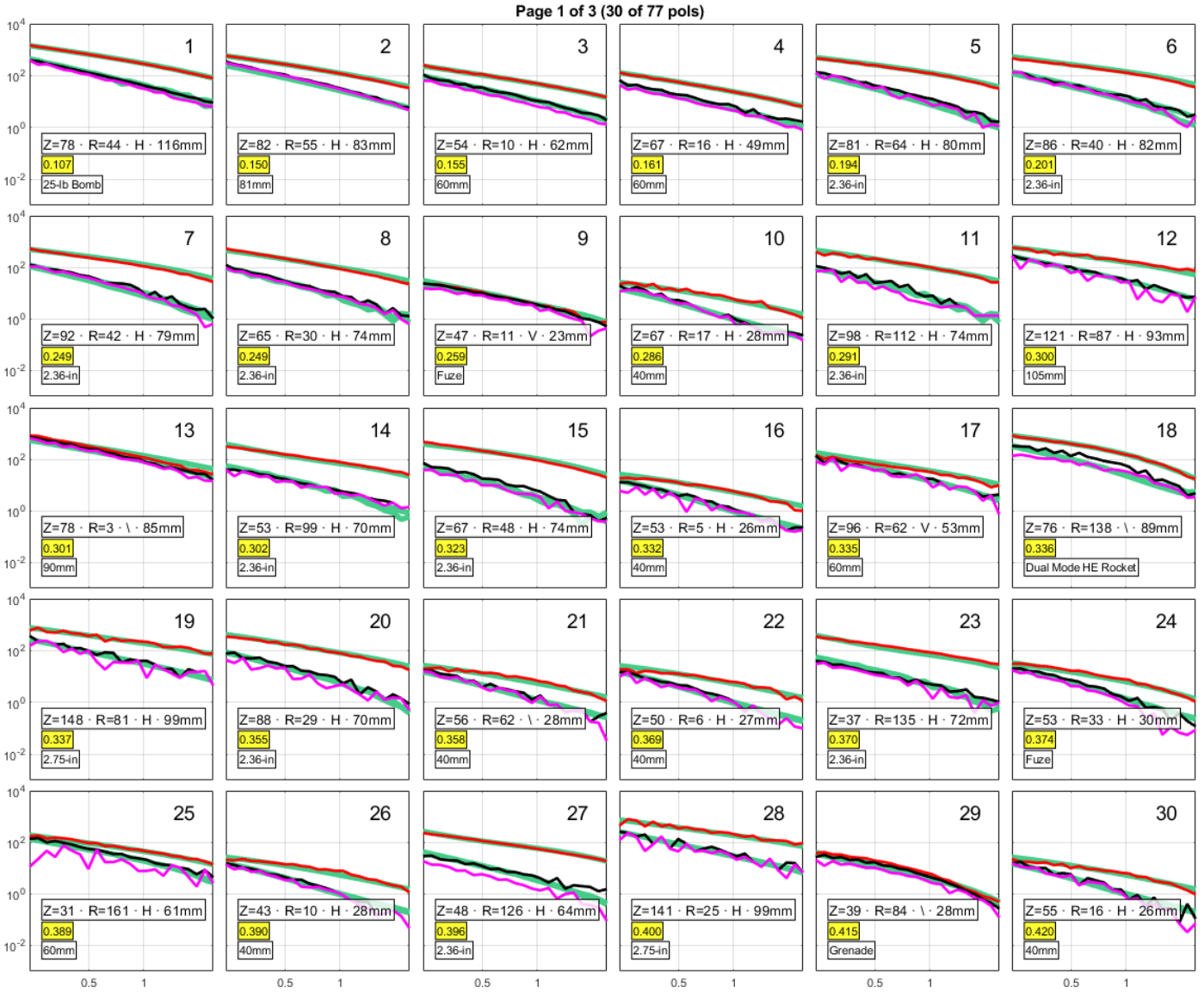

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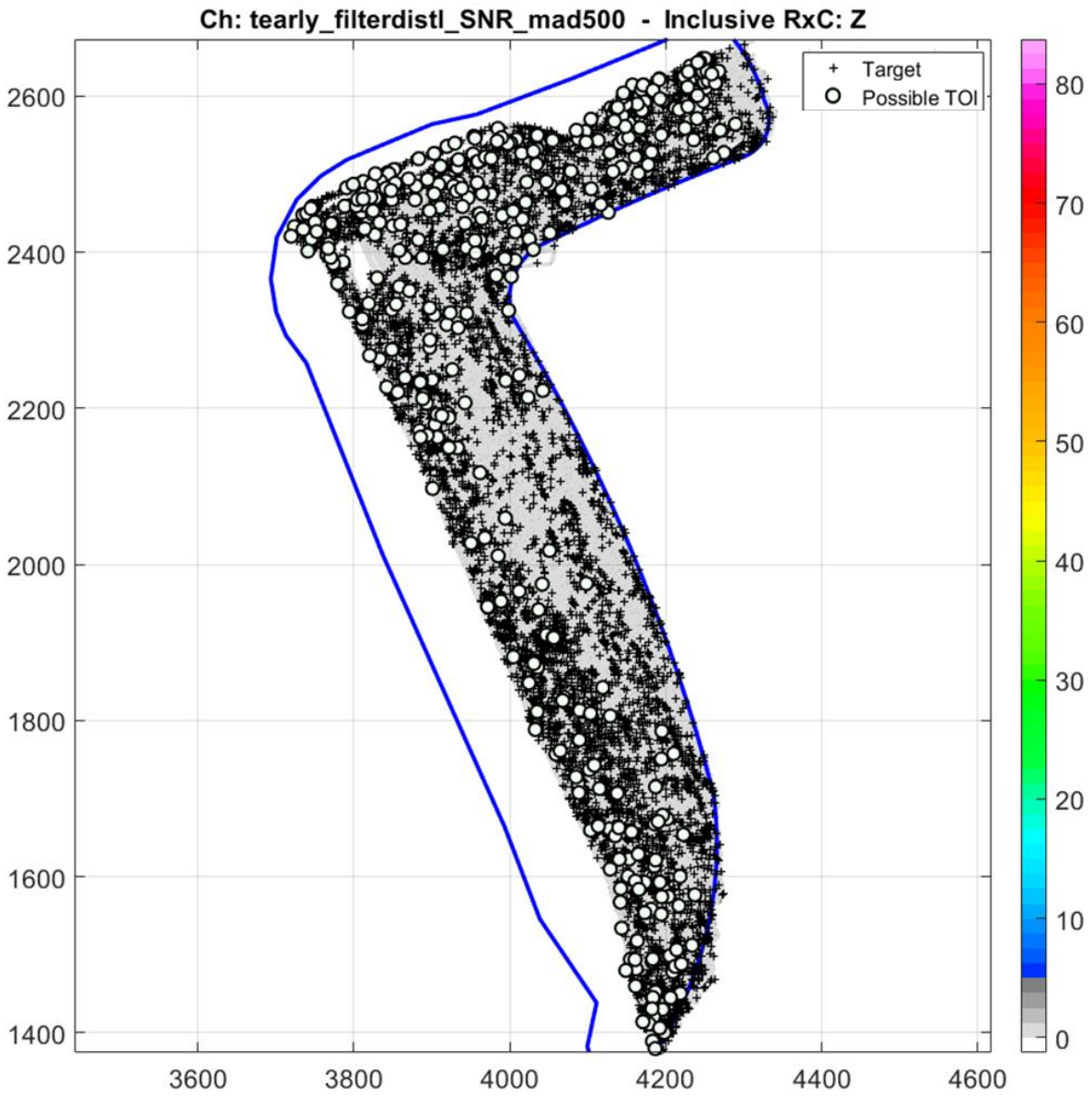
Acquiring AGC Data: One-Pass Surveys in AOC C (Deep)

Library type	Count
2.36-in	111
60mm	57
Rocket Motor	43
90mm	34
105mm	28
2.75-in	24
155mm	19
81mm	19
Fuze	19
3.5-in	16
100-lb Bomb	11
5-in	8
37mm	8
25-lb Bomb	6
250-lb Bomb	6
Dual Mode HE Rocket	6
5-lb Bomb	5
106mm	3
Grenade	1



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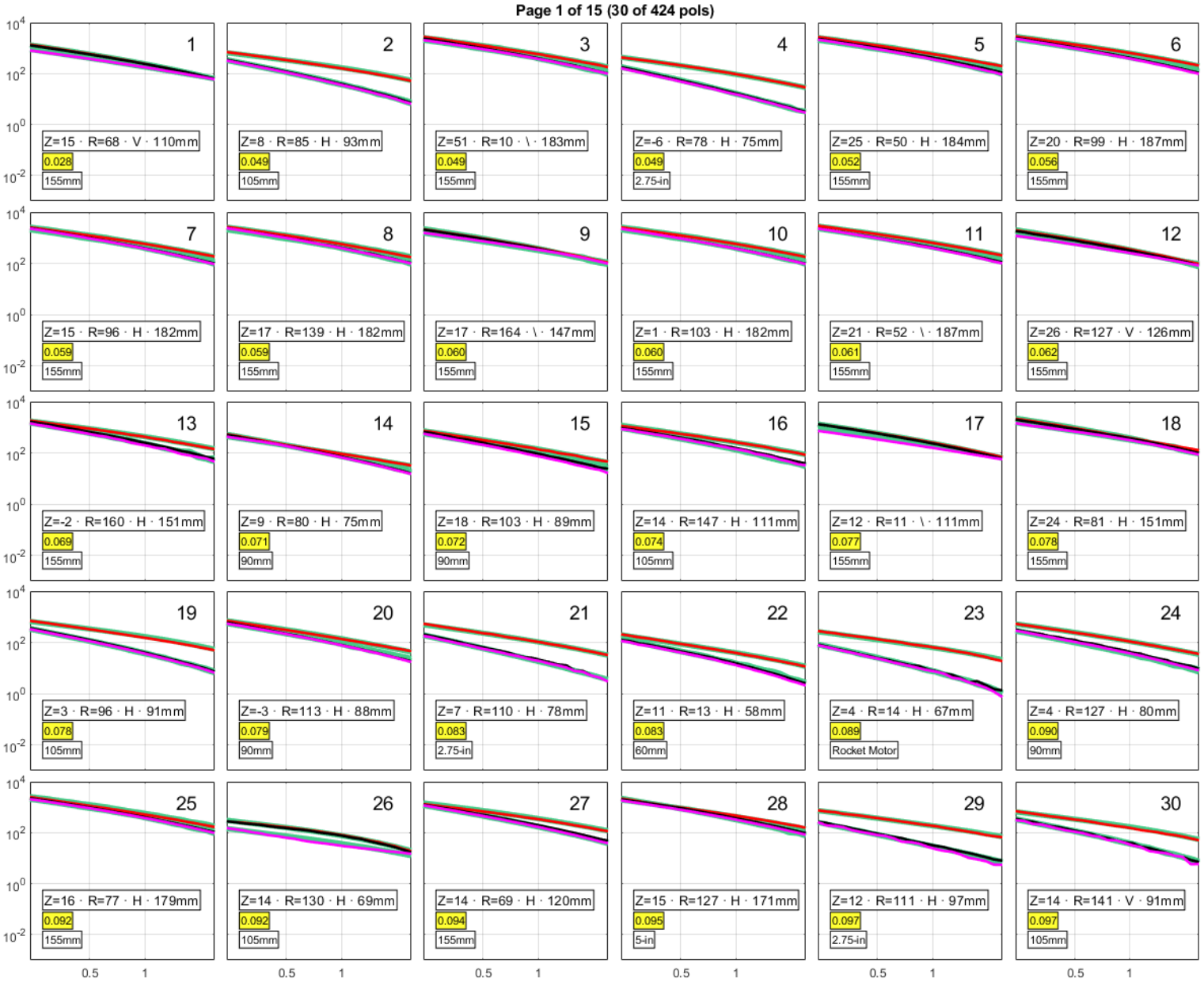
37mm	8
25-lb Bomb	6
250-lb Bomb	6
Dual Mode HE Rocket	6
5-lb Bomb	5
106mm	3
Grenade	1

AOC C Deep:
Best 30 matches



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37mm	8
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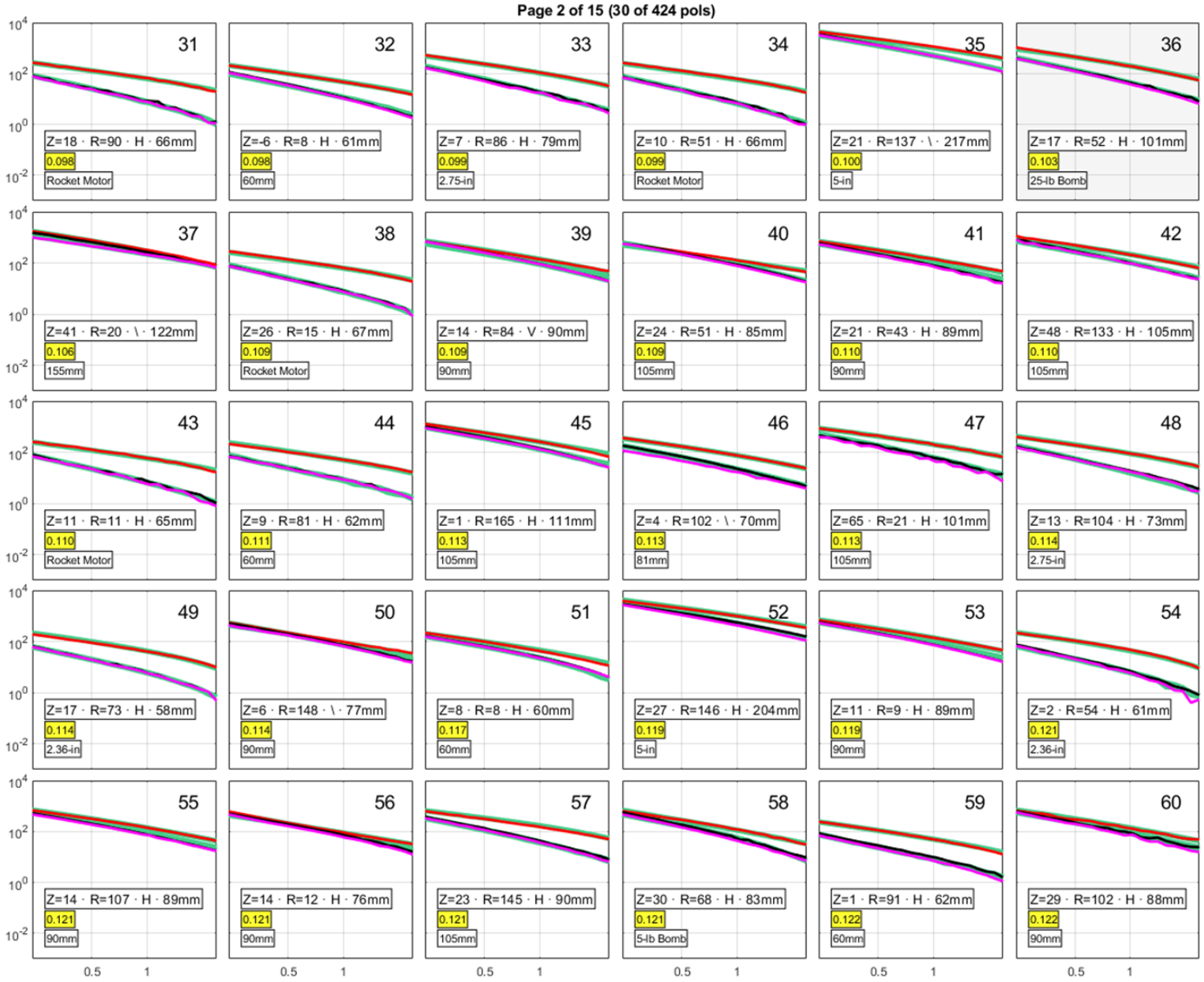
250-lb Bomb	6
Dual Mode HE Rocket	6
5-lb Bomb	5
106mm	3
Grenade	1

AOC C Deep:
Matches 31-60



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5-in	8
37mm	8
25-lb Bomb	6
250-lb Bomb	6
Dual Mode HE Rocket	6
5-lb Bomb	5
106mm	3
Grenade	1

AOC C Deep:
Matches 61-90

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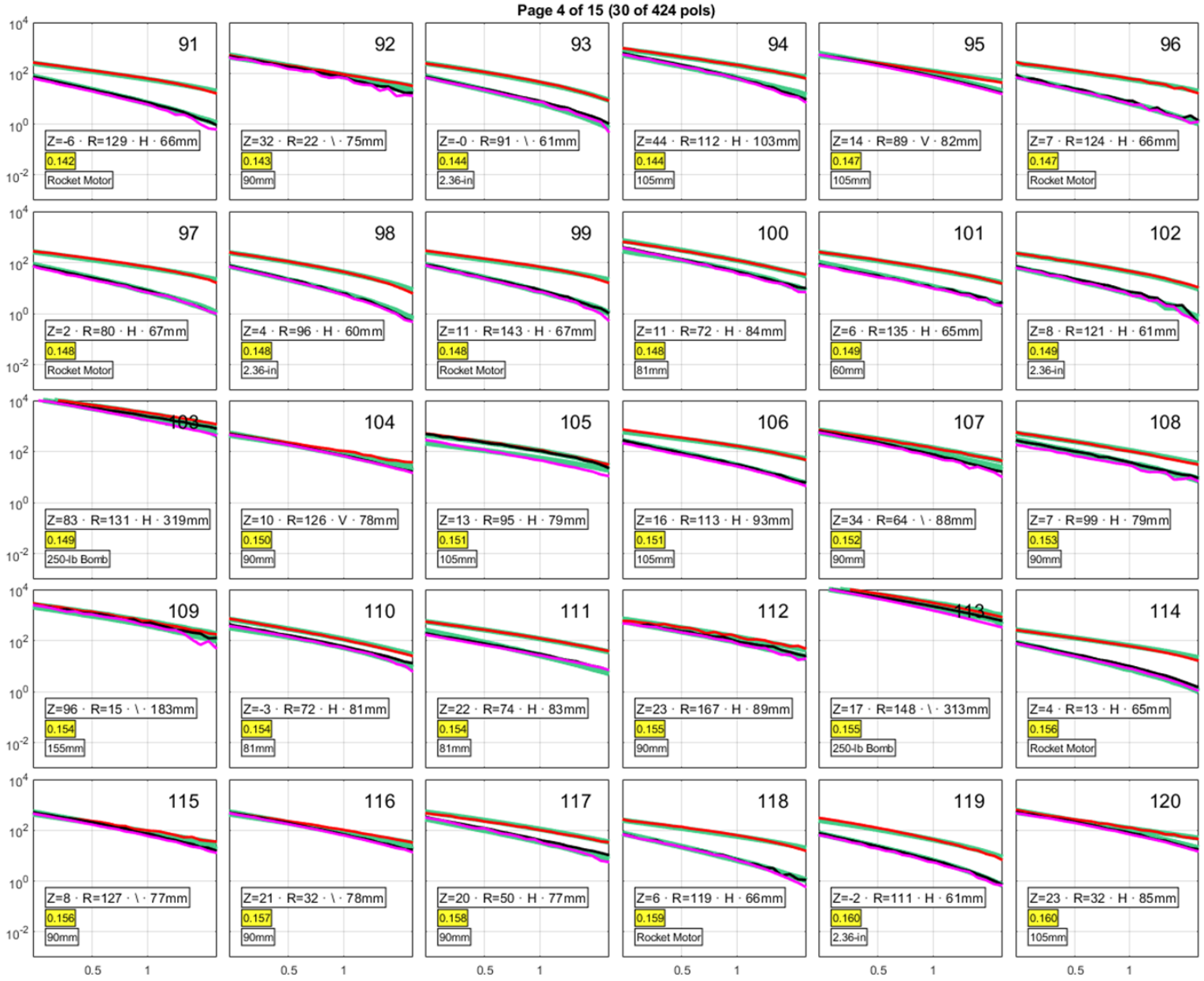
37mm	8
25-lb Bomb	6
250-lb Bomb	6
Dual Mode HE Rocket	6
5-lb Bomb	5
106mm	3
Grenade	1

AOC C Deep:
Matches 91-120



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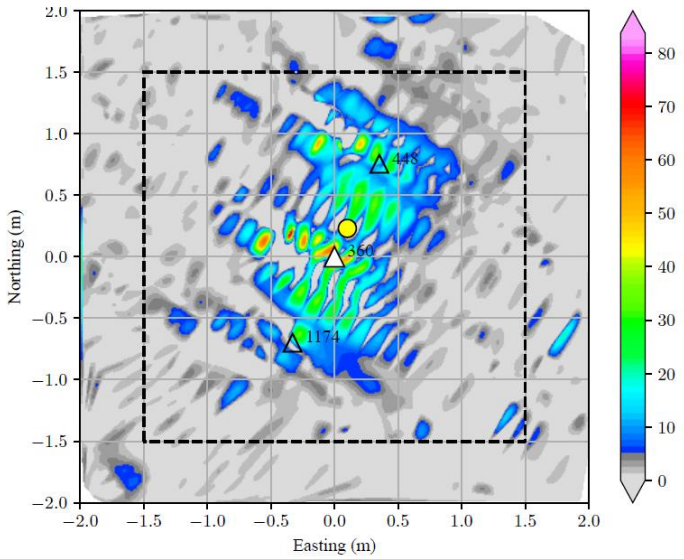
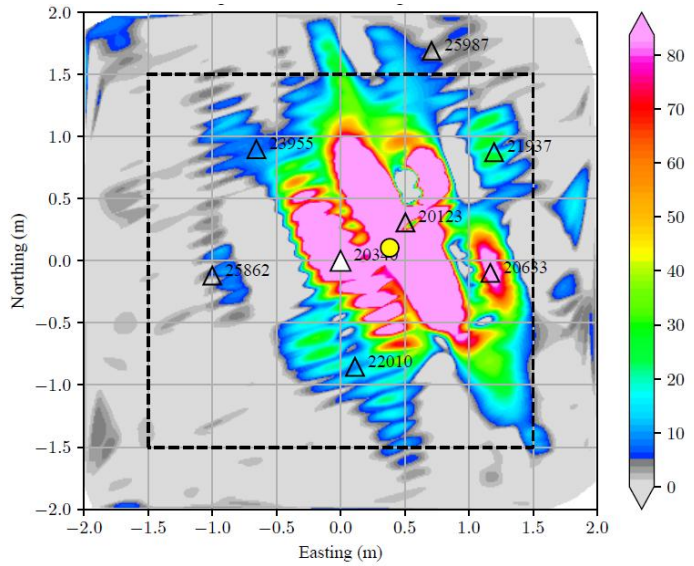
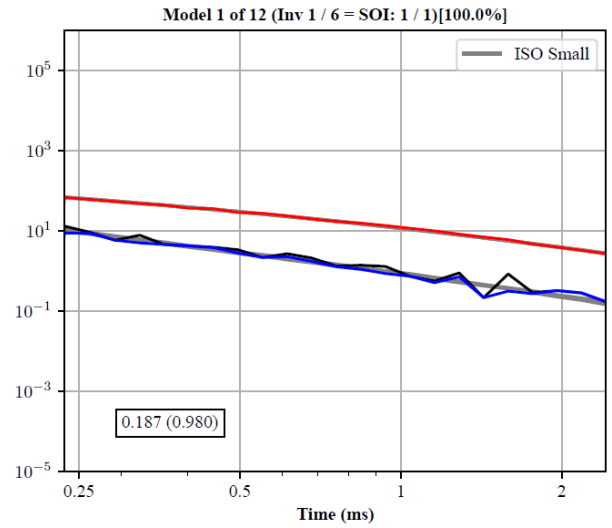
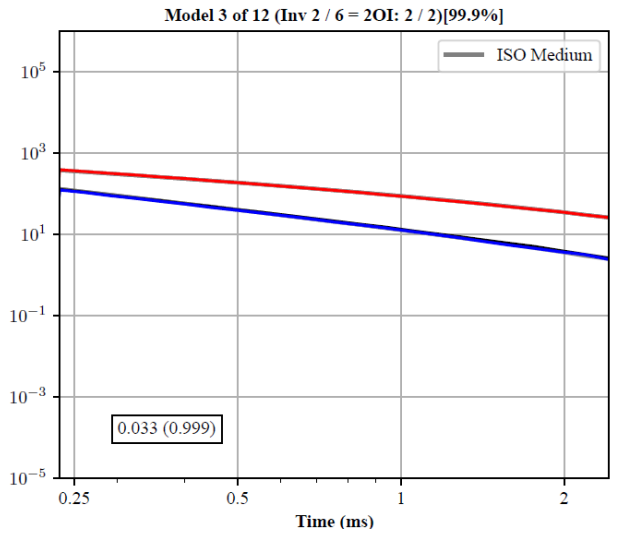
QC Seed Performance









QC Seed Horizontal Offsets (cm)

	Mean	Max
Shallow	14.7	36.1
Deep	16.3	43.8

Horizontal Offset MQO: 50 cm

Processor seed examples

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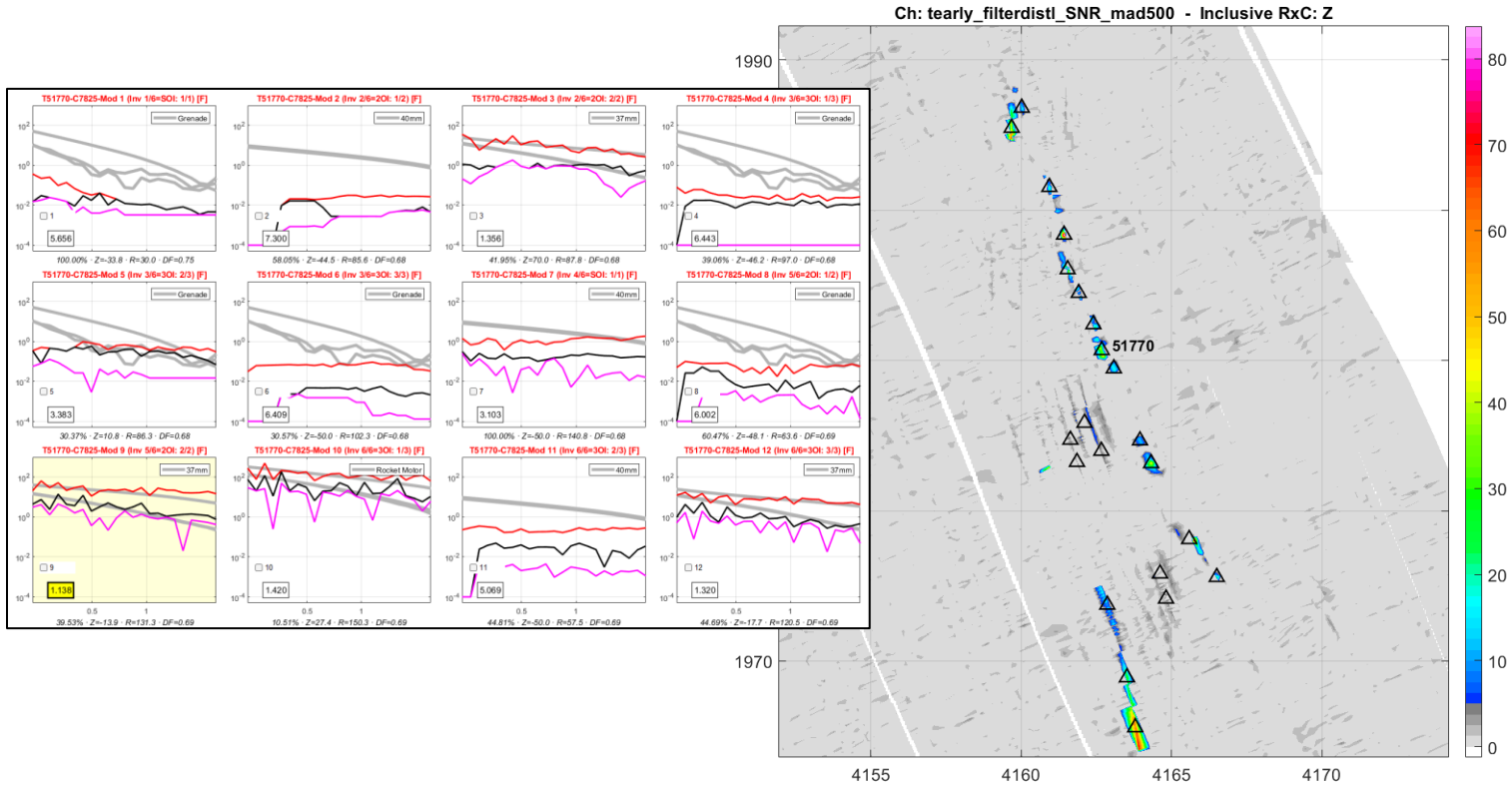
Spurious Picks, Inconclusive Sources and Suspected Empty TOI



Deep Water Diglist

- 1,989 TOI digs
- 2,085 inconclusive digs
  - 98.5% flagged as empty

Shallow Water Diglist

- 1,507 TOI digs
- 121 inconclusive digs

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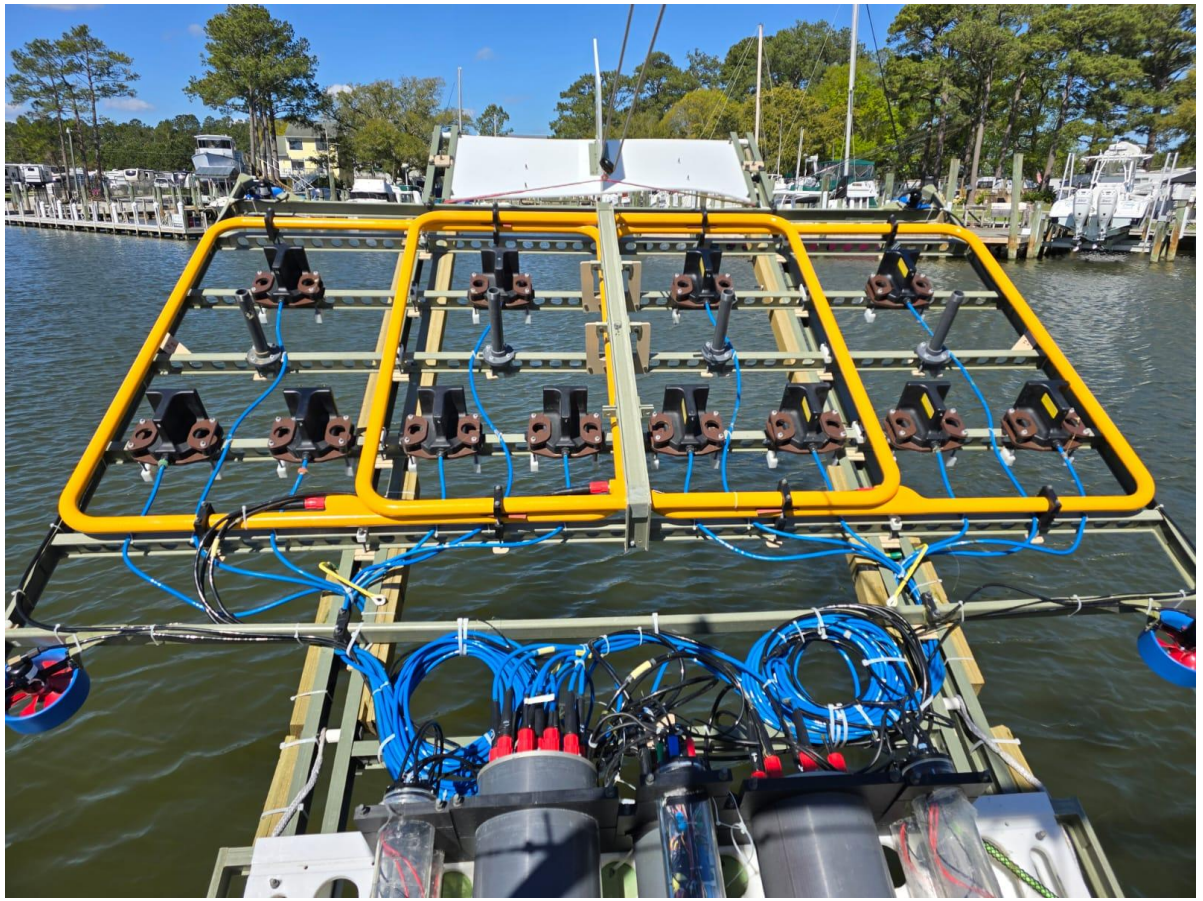
Conclusions

- UltraTEM marine data collected at this site supports AGC.
- Active thrusters introduce noise into EM data that impacts classification performance.
- Marine specific MQOs were developed to ensure project objectives were being met and recollects and gap fills were only applied to regions where project objectives could not be achieved.



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