Dynamic AGC Methods for Cost Effective Quality Assurance and Control

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WHITE RIVER TECHNOLOGIES

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QA vs. QC Seeding for AGC

Quality Assurance:

- Tests the system (equipment, software, personnel)
- Seeds placed at sub-maximal depths
- Verifies the Geophysical Classification Organization (GCO) is following the procedures
- Usually performed by a third-party contractor or the Government

Quality Control:

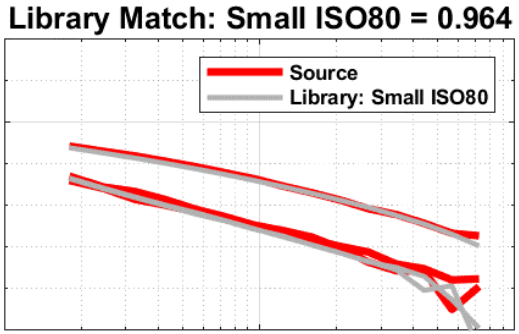
- Tests the performance
- Seeds placed at or near maximal depths
- Verifies the planned operating envelope (size, depth, density) is achieved
- Performed internally by the GCO contractor

QA Seeding: Why Use AGC?

Quality Assurance:

- Failures likely indicate improper procedures (e.g., data collection, data processing, equipment setup)
- Result in a **STOP WORK** order and notification to the Accrediting Body (AB) during RCA and prior to CA implementation
- CA's may involve modifying Standard Operating Procedures

Using AGC to verify QA seed emplacement ensures the QA program is implemented correctly.



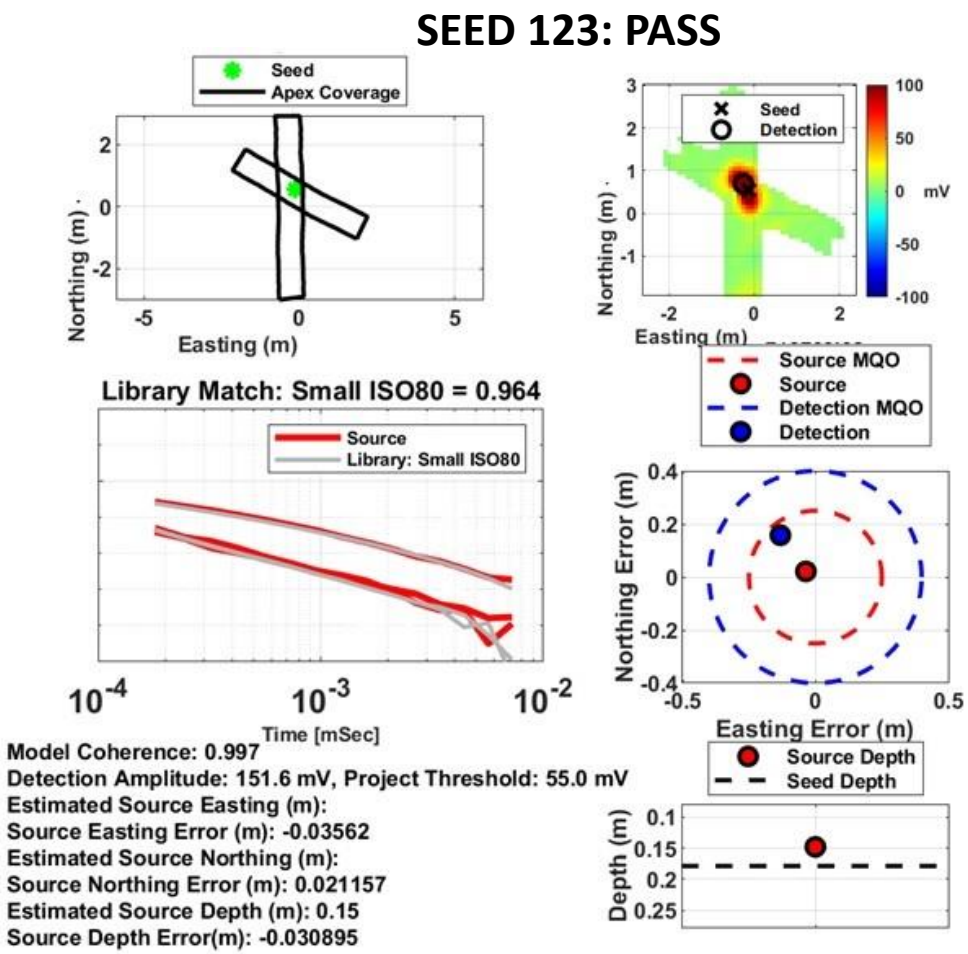
Quality Control:

- Failures also indicate unexpected site conditions (e.g., environmental noise, terrain, geology, target density etc.)
- Work can continue during RCA
- CA's may require adapting procedures for the site (e.g., data processing parameters, data collection procedures, etc.)

QA Seeding: Why Use Dynamic AGC?

Dynamic AGC for QA Seed Verification:

- It is fast (1 – 2 minutes per seed)
- No static backgrounds needed
- Samples the local background
- Provides detection metrics in addition to classification metrics
- Field team can verify Measurement Quality Objectives (MQOs) are achieved on the spot
- Clean locations can be mapped and identified by the field team
- Cost-effective: ~25%* of total project costs

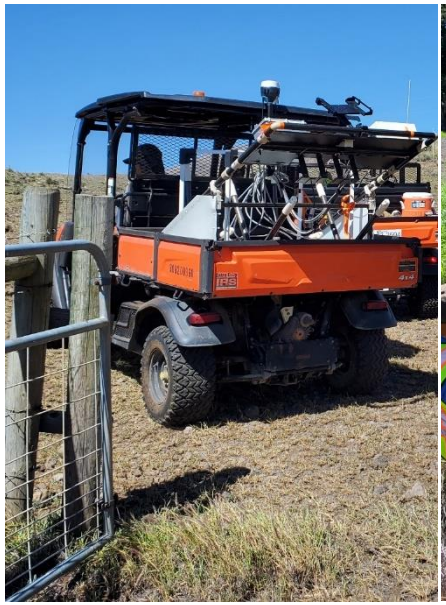


* Site dependent

In-Field Verification

Confirm MQOs on the spot:

- Seeds often emplaced in remote areas or time restricted Right of Entry (ROE)
- Vegetation removal may not be completed yet
- Need to stay in synch with Remedial Action (RA) schedule
- Avoid returning by confirming MQOs achieved in real-time

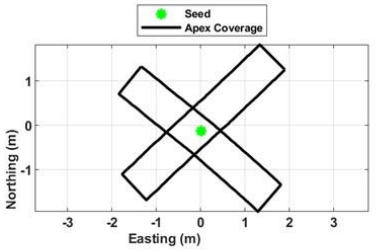


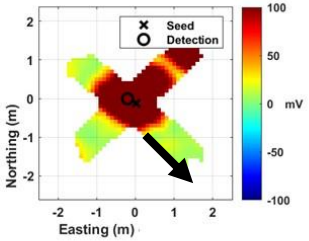

In-Field Verification

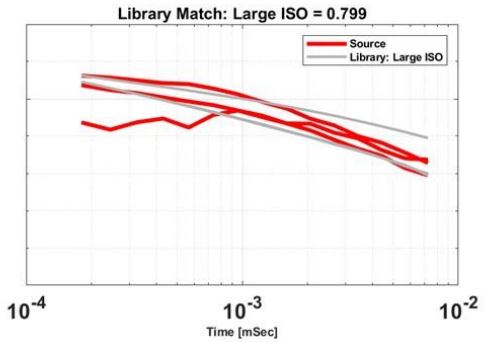
Address MQO failures on the spot:

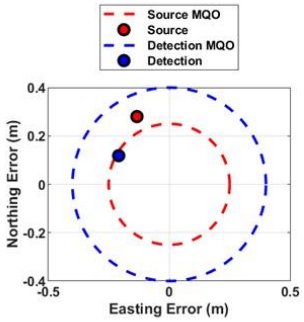
- Ground truth error – inaccurate depth or GPS measurement?
- Does the seed need to be moved – too close to another anomaly?

SEED 123: FAIL

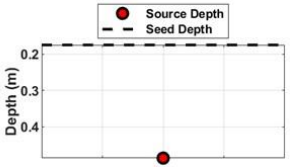




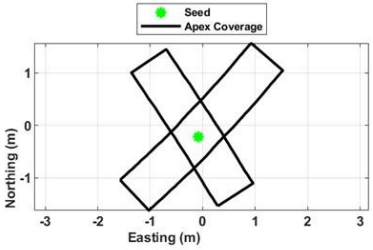


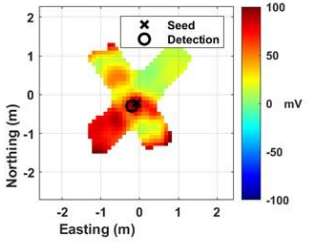


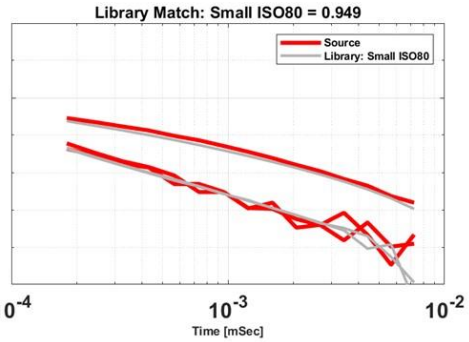
Model Coherence: 0.962
Detection Amplitude: 384.7 mV, Project Threshold: 55.0 mV
Estimated Source Easting (m):
Source Easting Error (m): -0.13336
Estimated Source Northing (m):
Source Northing Error (m): 0.28009
Estimated Source Depth (m): 0.49
Source Depth Error(m): 0.31152

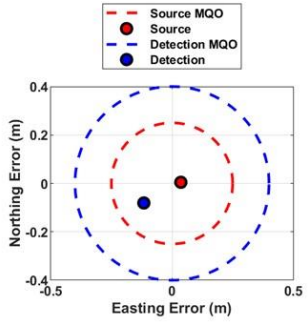


SEED 123: PASS

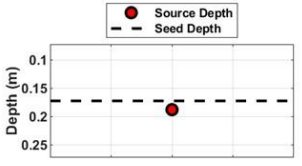








Model Coherence: 0.972
Detection Amplitude: 116.7 mV, Project Threshold: 55.0 mV
Estimated Source Easting (m):
Source Easting Error (m): 0.036396
Estimated Source Northing (m):
Source Northing Error (m): 0.0045488
Estimated Source Depth (m): 0.19
Source Depth Error(m): 0.015464

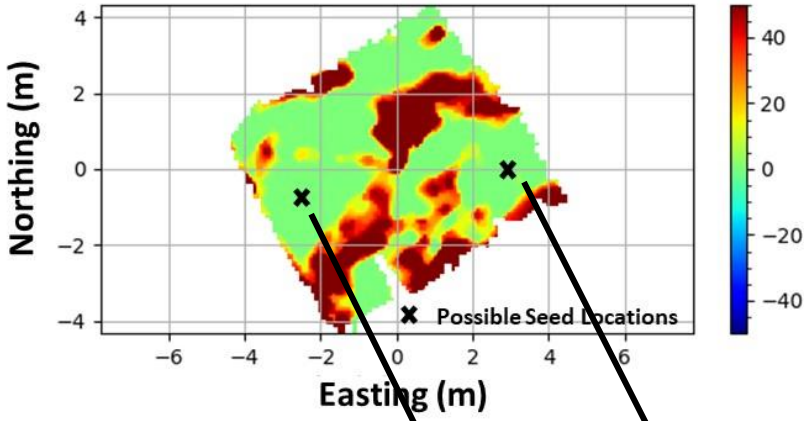


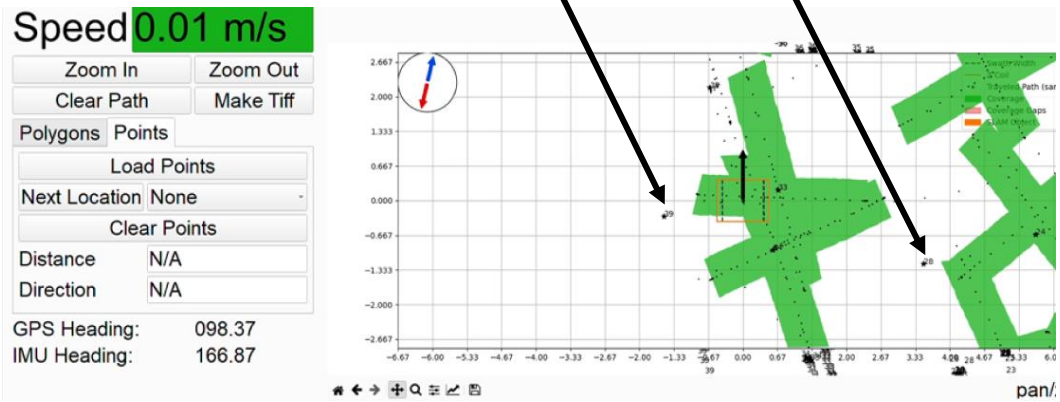
QA seeds should pass with <u>1-Target</u> Model

Location Selection

Locate clean background areas for seed location:

- Perform mini-survey to identify best location
- Identify geology or other clutter that may be difficult for analog sensors
- Find possible seed locations and load into sensor navigation display



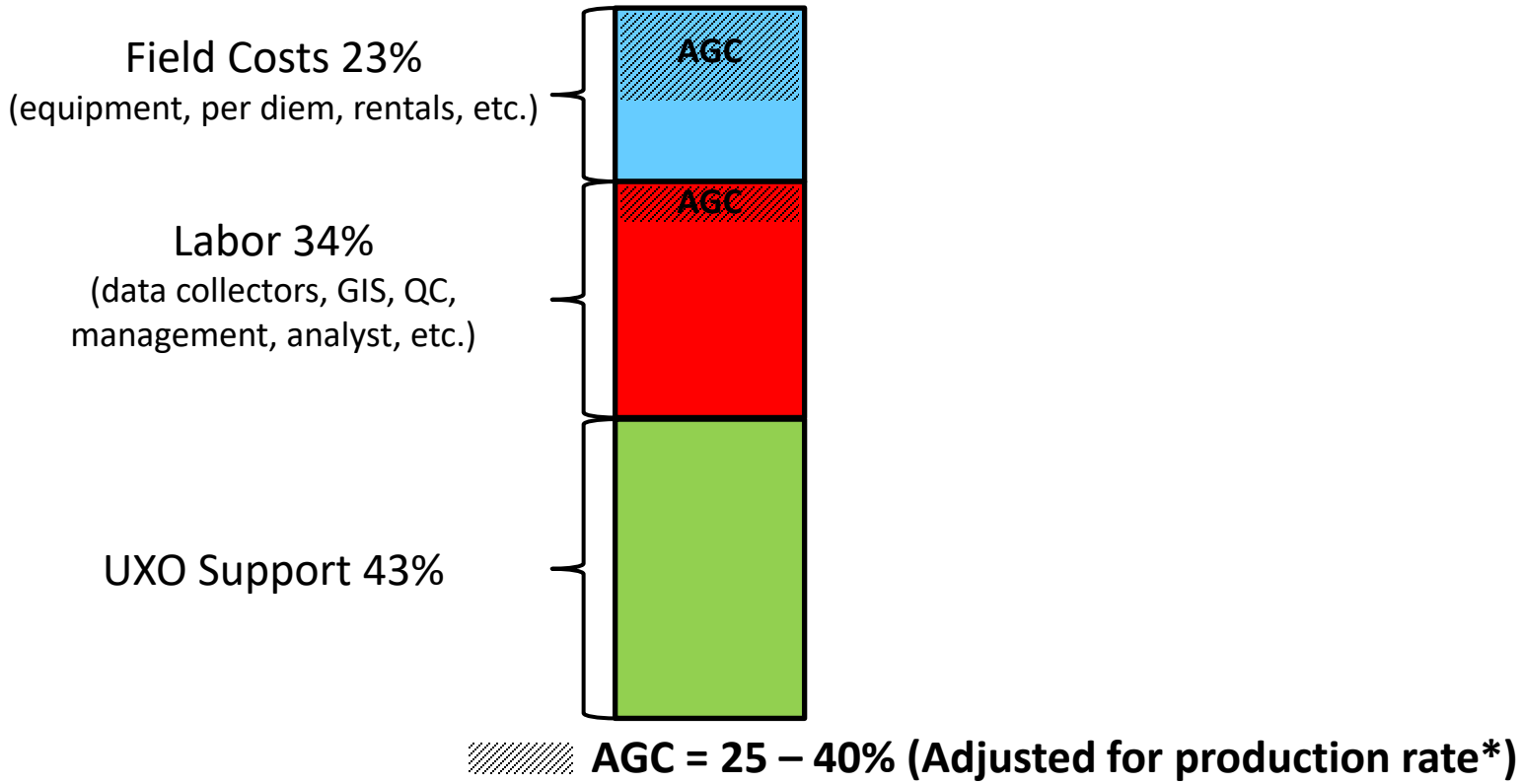


Dynamic-Cued AGC Value

Cost Benefit of AGC:

- Adding AGC to QA seeding is a relatively small percentage of overall cost
- Provides confirmation that the QA program is implemented correctly

QA Seeding Per Seed Cost Breakdown

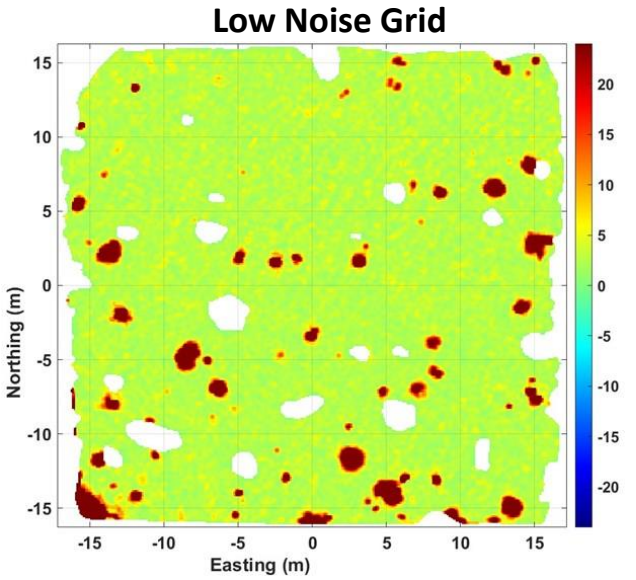


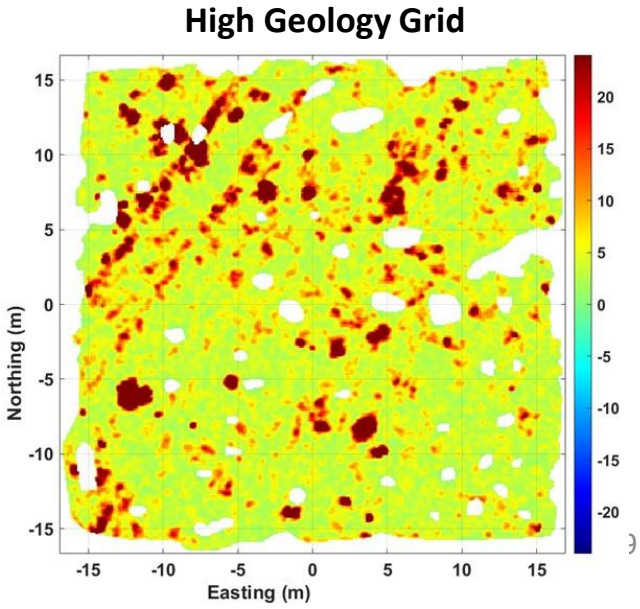
* AGC impact on QA seeding production rate is estimated to be 10 – 33% based on sample of 3rd party projects

Synthetic Seeding: Augmenting The QC Program

Benefits of Synthetic Seeding for QC:

- Implemented on real data collected on the project site
- Captures the site-specific variables: environmental noise, terrain effects, geology, operator effects
- Can be used to rapidly populate a grid with a variety of seeds without the cost of excavation and survey
- Can be distributed over a site to capture variations in target density, geology, or other site features
- Provides further verification of operating envelope and identifies any limitations or exclusions (i.e., SRA's)





Synthetic Seeding Process

Implementing synthetic seeding:

- Choose a grid
- Choose TOI
- Choose depth range
- Choose locations

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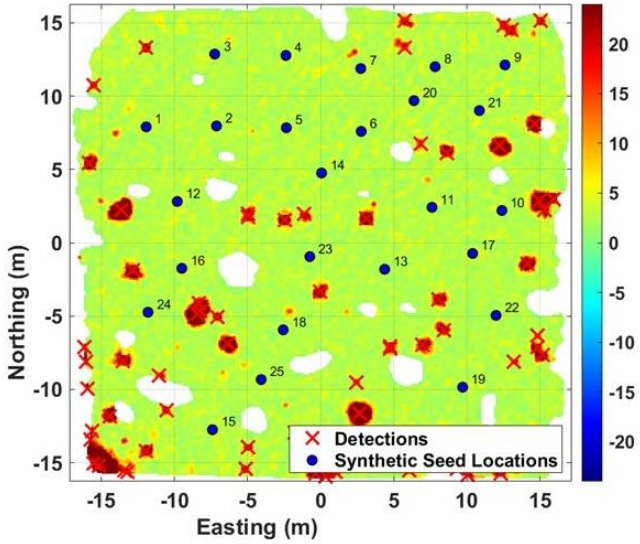

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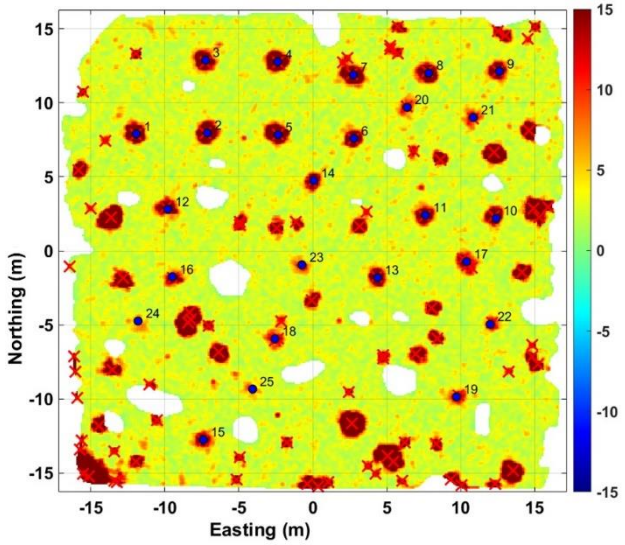
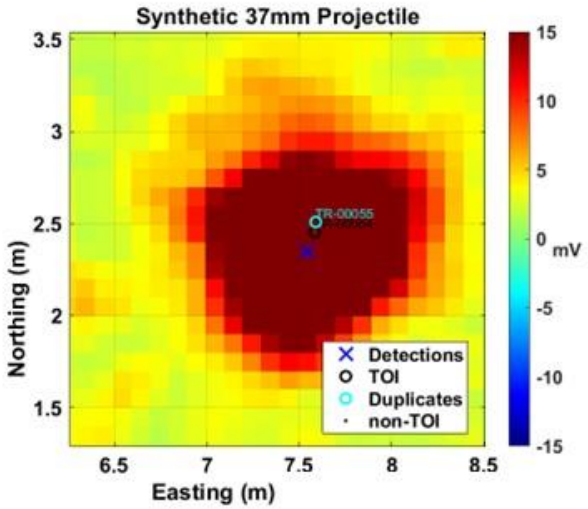
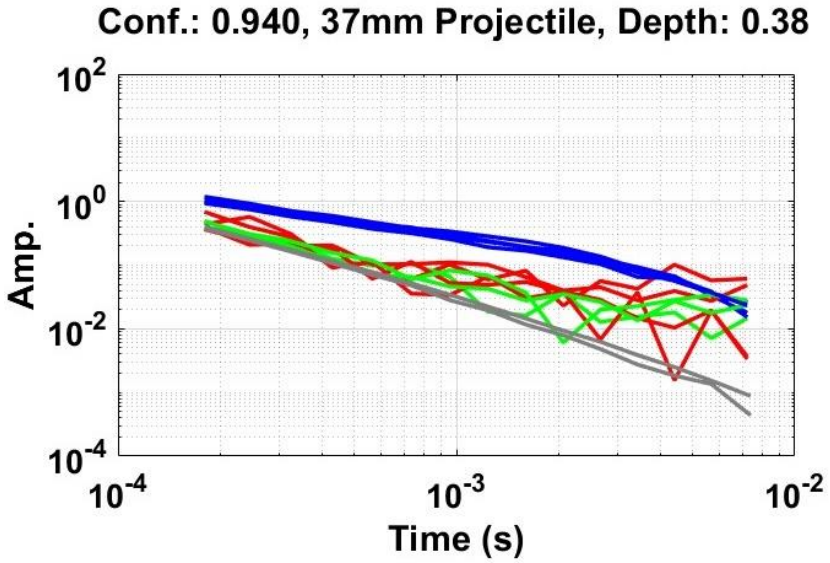


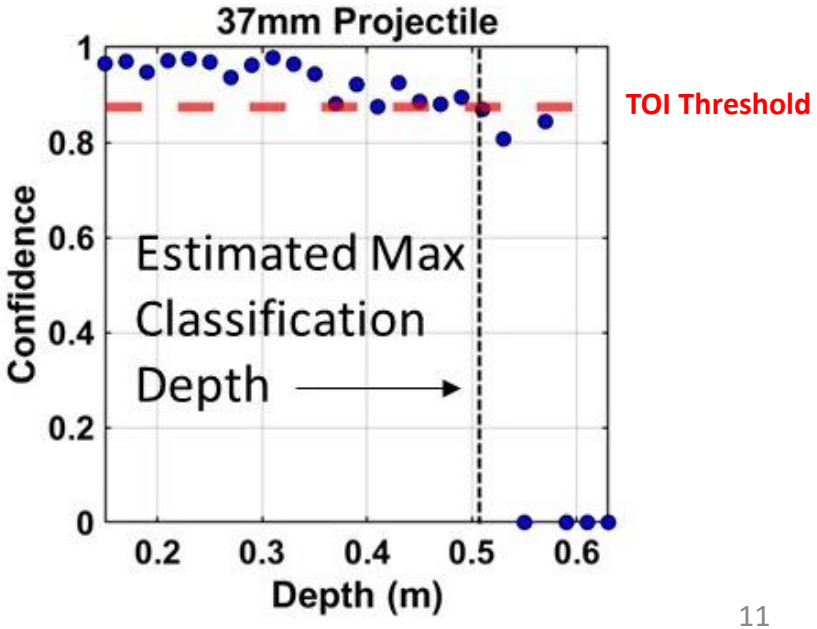
Synthetic Seeding Analysis

Analysis:

- Identify source(s)
- Evaluate TOI/non-TOI confidence
- Confirm operating envelope (max depth)
- Validate TOI threshold
- Delineate SRA's





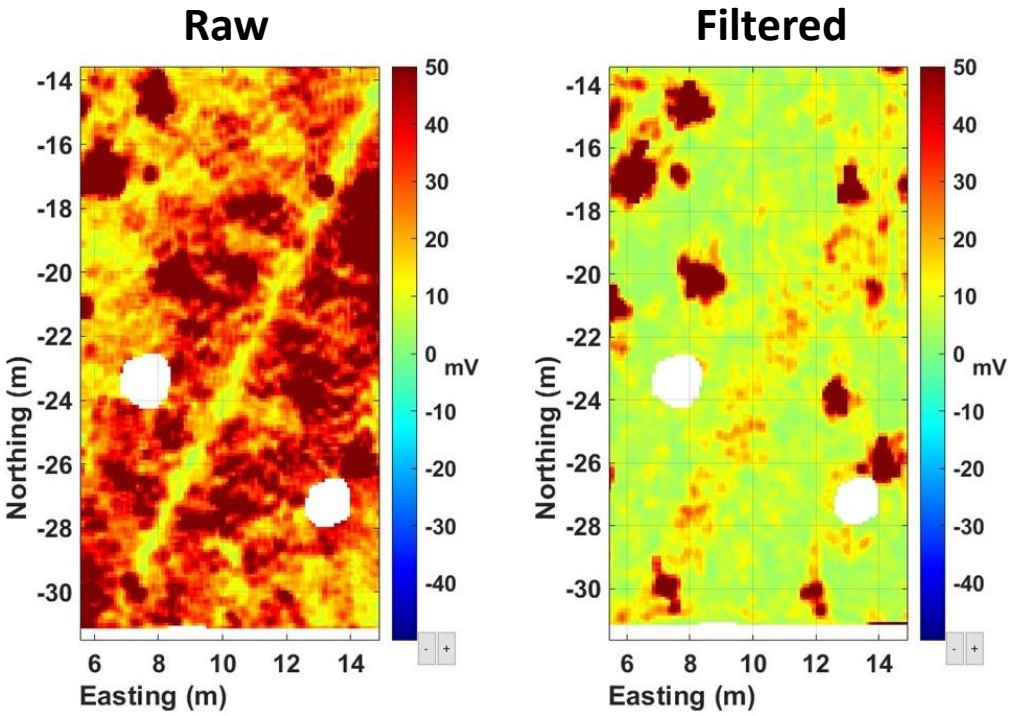


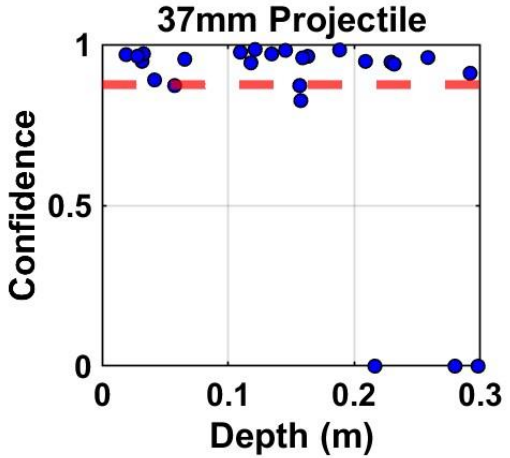
Synthetic Seeding Test Cases

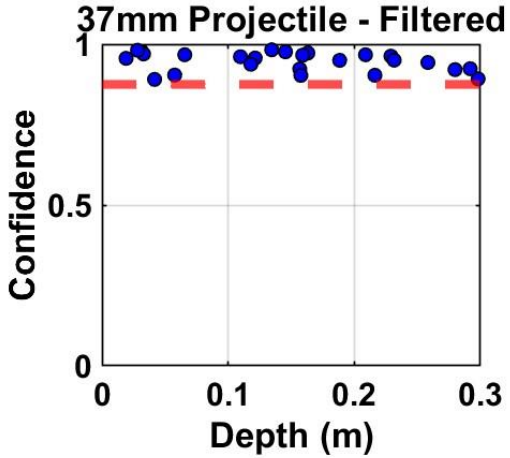
Validate Site-Specific Parameter Settings:

- Environmental noise filters
- Geology filters
- Target picking criteria (high density areas)

Power Line Noise Example







Summary

Dynamic AGC for QA Seeding:

- Dynamic AGC is a worthwhile investment for QA projects
- Increases costs 25% - 40%, but ensures the QA program is implemented effectively
- Limits future unnecessary QA seed failures, which benefits the RA contractor, the Government, and the stakeholders

Dynamic AGC for QC Synthetic Seeding:

- Cost effective way to significantly increase sample size
- Verifies operating envelope (depth, density, etc.)
- Validates changes in processing parameters (filters, target selection, etc.)

Acknowledgments

3rd Party AGC QA Seeding Supported By:

- USACE Albuquerque
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- USACE Honolulu

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- Tetra Tech
- Weston