Marpi Point Field
Advanced Classification Treatability Study

John Baptiste

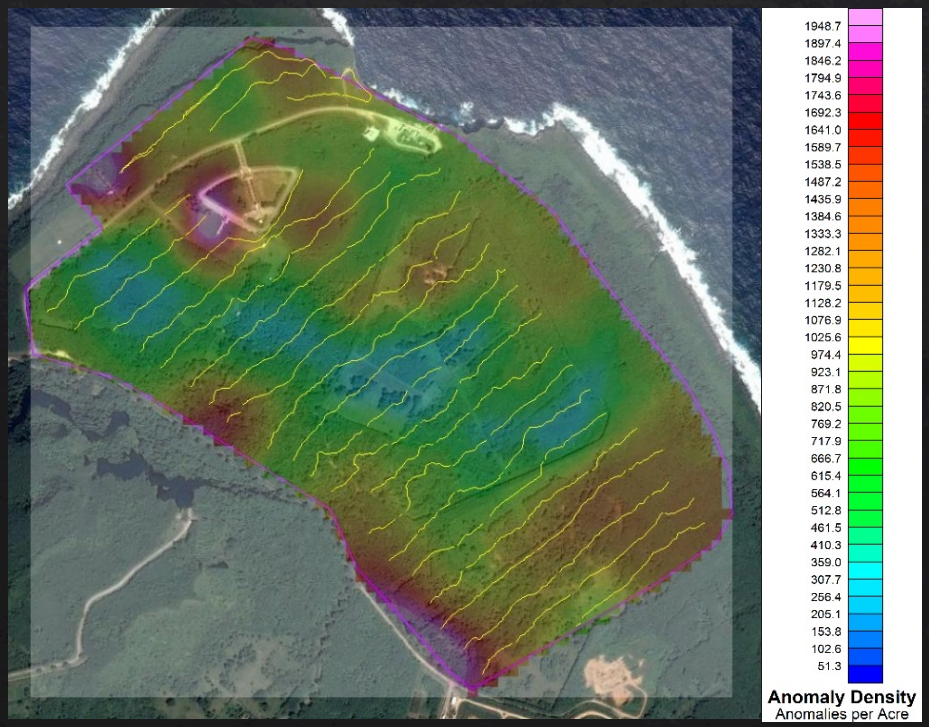
PARSONS

Marpi Point Field MRS

- 410-acre MRS
- CSM Munitions
  - Projectiles, 20-mm to 5-in
  - 81-mm mortars
- Other potential munitions
  - Hand grenades
  - Rockets
  - Mortars
  - ???

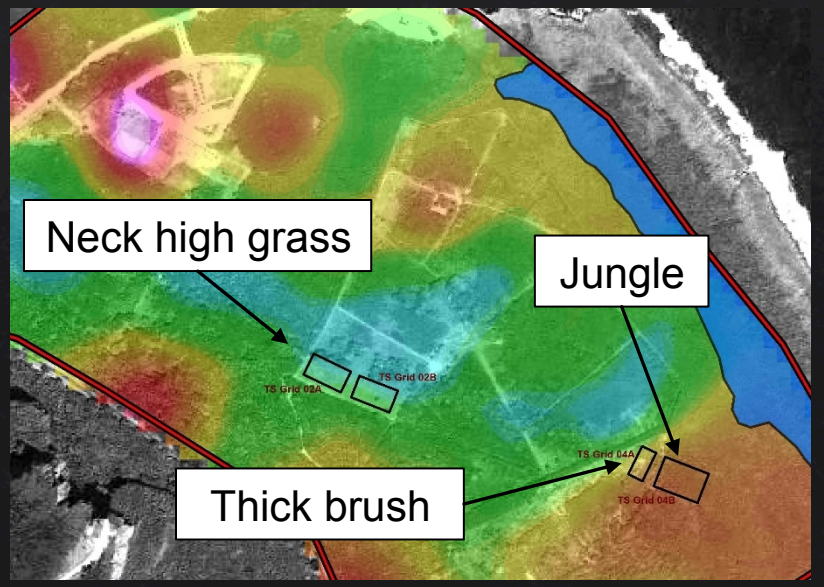
Remedial Investigation/Feasibility Study

- Full-site transect survey for anomaly density
- DGM/dig everything in low density areas
- DGM/dig for nature and extent in high density areas
- Included overlap of TEMTADS/standard sensor data



Classification Treatability Study

- Dynamic and cued TEMTADS surveys
  - Amplitude response and dipole filter
  - 1,200 cued targets
- Evaluate effectiveness of both surveys
  - QAPP based on 1st draft of GCMR template
  - Used MQOs from Worksheet 22
  - Dig all cued targets
- Include results in FS

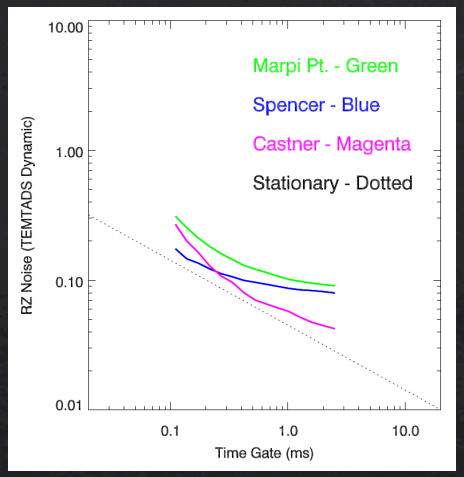


Grid Prep

- Tropical island with vegetation to match
- Limited ability to cut trees
- MEC – 41 found during brush cutting (incl. RI)
- Surface sweep and seeding

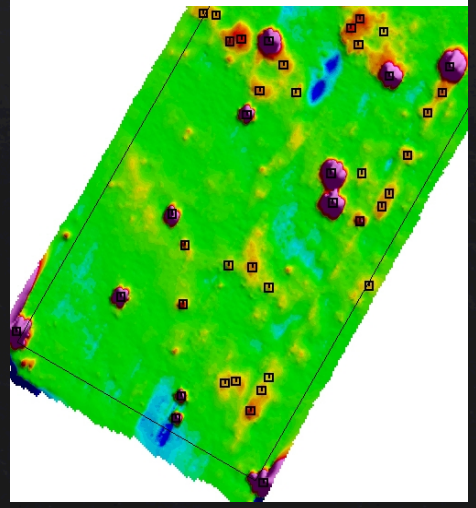
Detection Survey
Response Amplitude vs Dipole Filter

Grid	Response Amplitude	Dipole Filter				
	Within Grid Boundary	Peak Locations	Total Fits	After Filtering	After Merge	Within Grid Boundary
T06G15	510	402	2412	1218	552	523
TSGrid4A	253	245	1470	955	382	339
T07G18	165	433	2598	1177	566	541

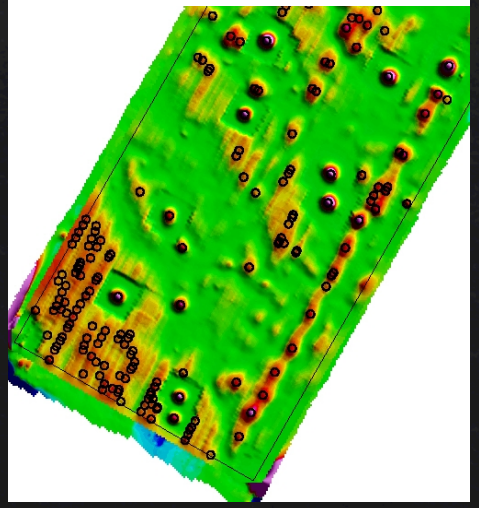


- Evaluated peaks and fits
- Peaks comparable to response amplitude except in grids with significant geologic response
- Lots of fits on geology, even in relatively quiet grids

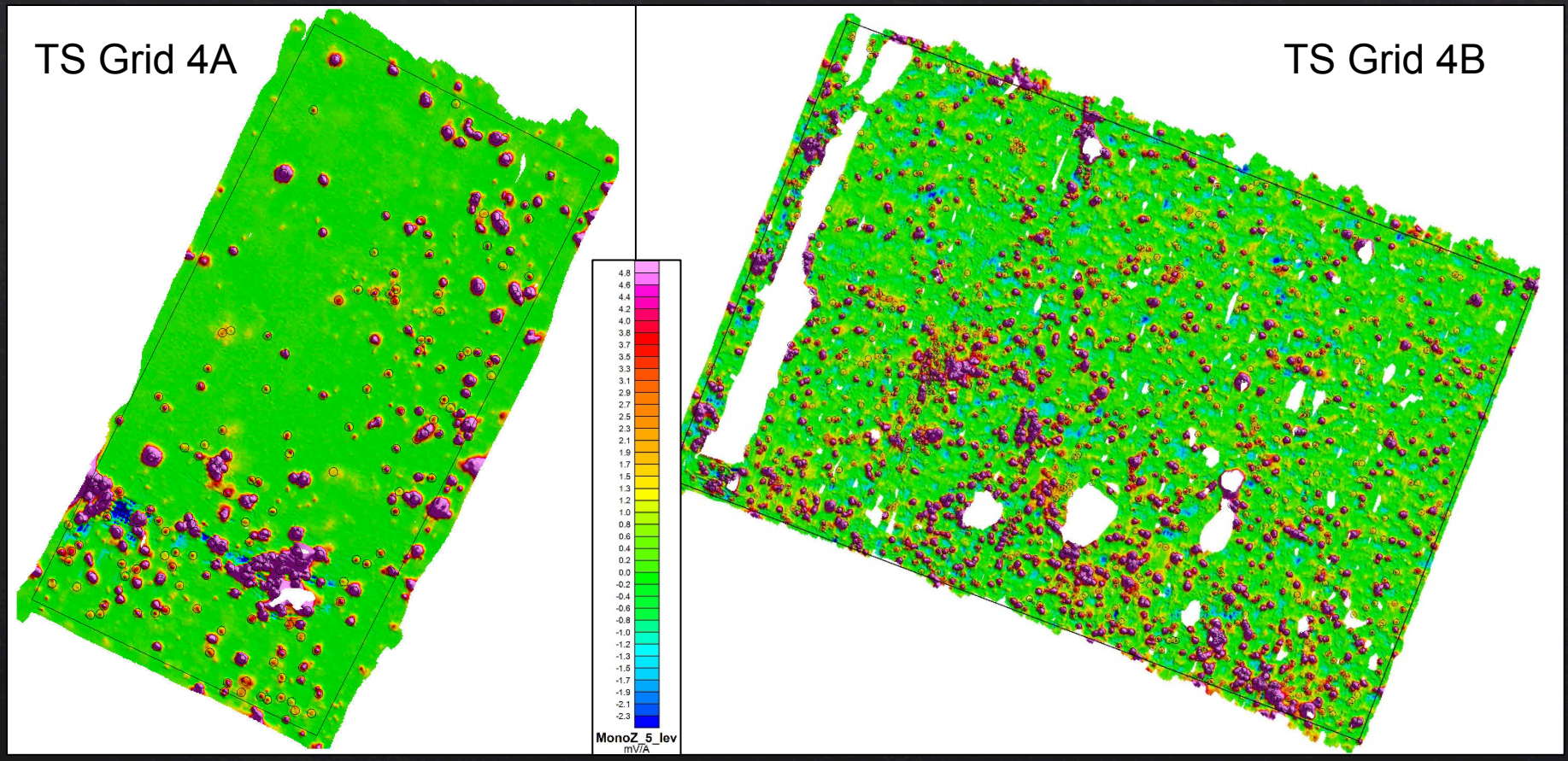
Response Amplitude



Dipole Filter Peaks



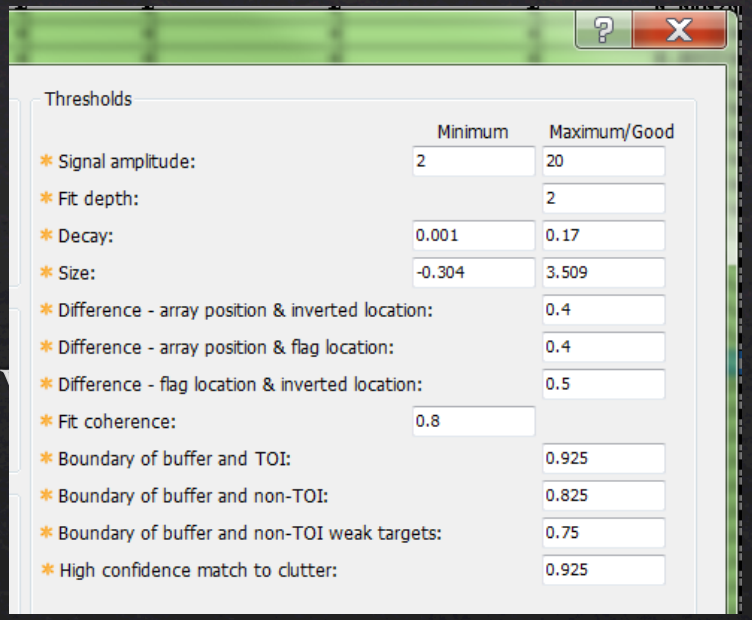
Detection Survey Results



- 3.4 acres
- 1.45 mV/A threshold
- 2,854 targets selected
- All seeds identified
- Notable geologic response changes between grids

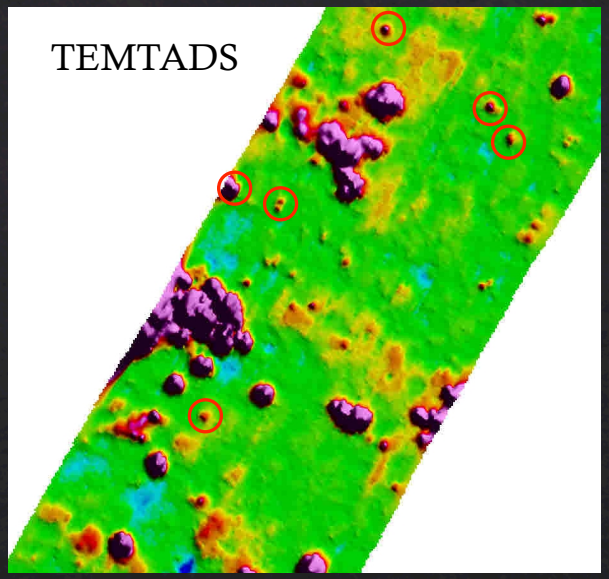
Cued Survey Summary

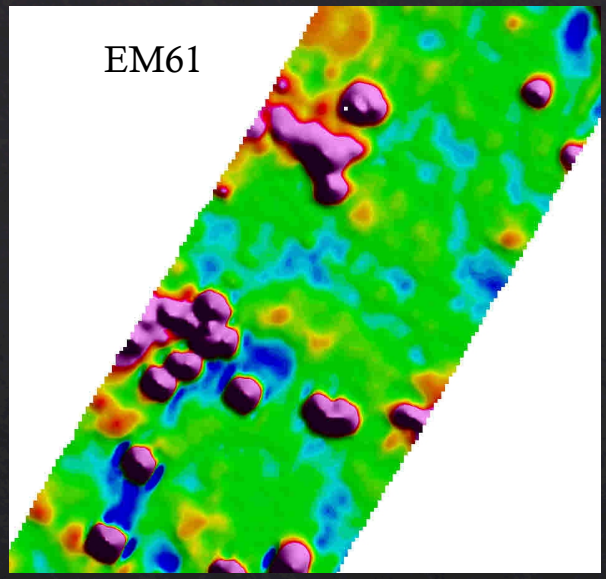
- 1,216 cued targets – selected by QC Geo
- Ranked dig lists
  - First (36.5% dig rate) missed QA seed
  - Re-classified using "classify and rank" (45 % dig rate) before intrusi
  - Despite revision, still included 1 seed classified as non-TOI (depth) and one exceeding offset MQO (vertical)
- Post-Intrusive MQO results
  - Predicted sizes: 15% incorrect
  - Correct TOI/non-TOI threshold: 2 native TOI classified as non-TOI
  - Non-TOI predictions qualitatively match sources: VERY subjective process; 1 considered incorrect



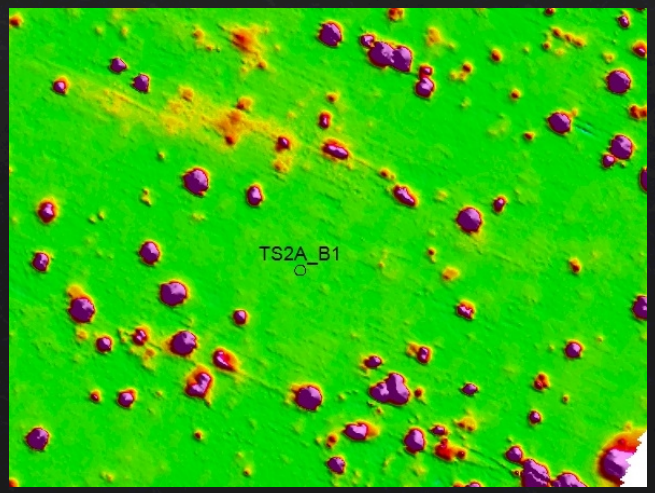
Background Comparisons

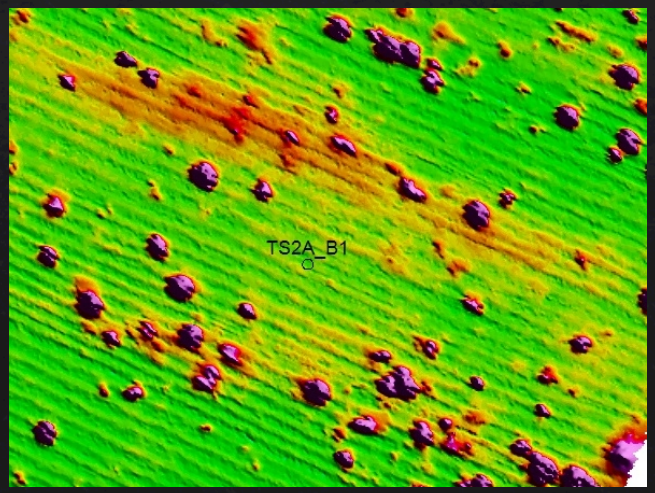
- TEMTADS vs EM61
- SNR for small ISO at 15 cm = 24.1 for TEMTADS vs 5.4 for EM61





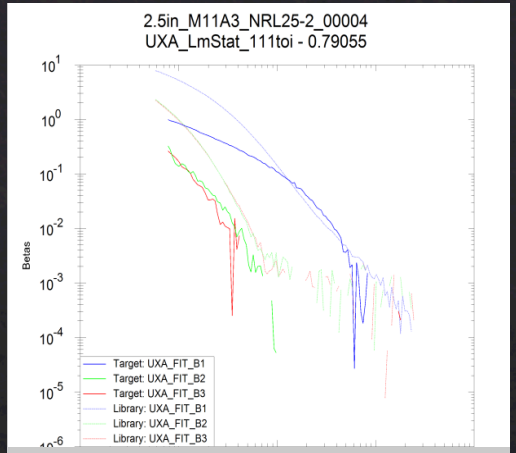
- TEMTADS rolling stats vs simple addition



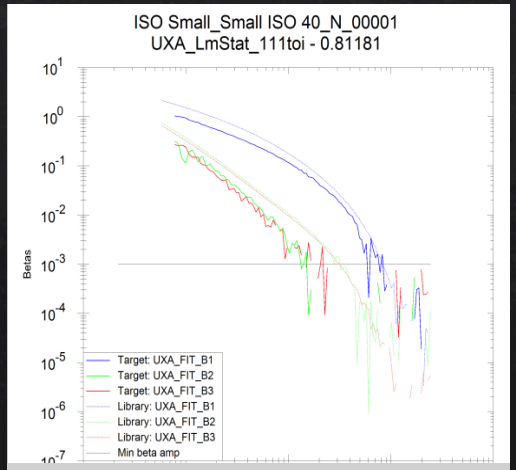


Misclassified QA Seed

- Revised dig list classified initial result as TOI
- Real issue was background correction
- Re-correcting with alternate background point resulted in much more TOI-like result
- But no identifiable problems with original background…

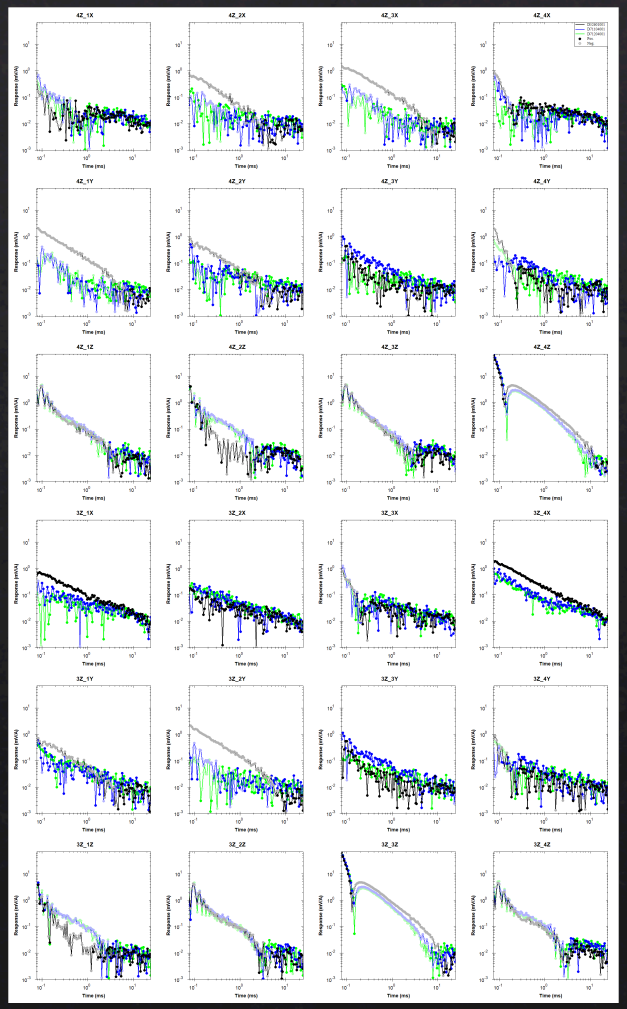


071104001 background



071204001 background

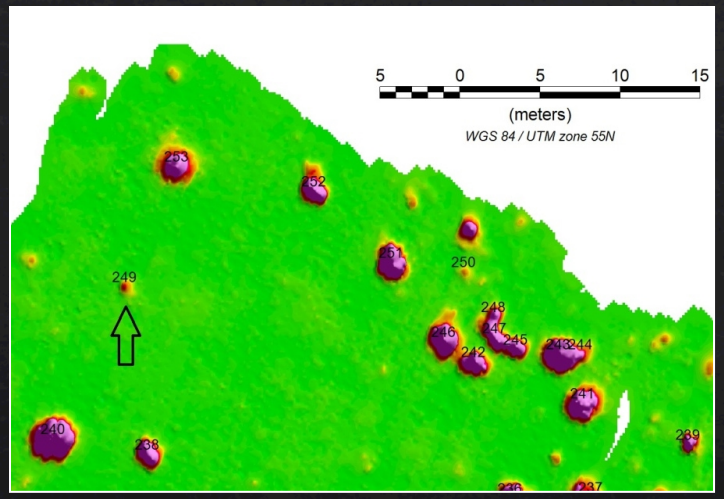
Field backgrounds vs Threshold

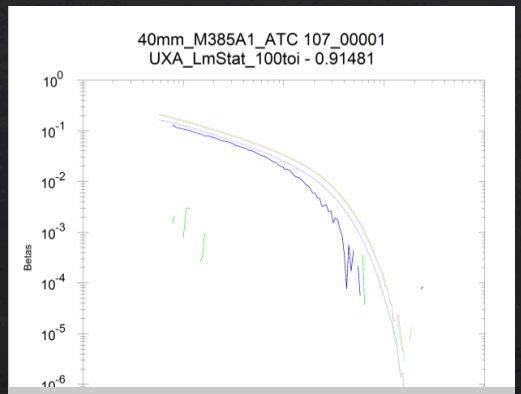


D52601001
D71104001
D71204001

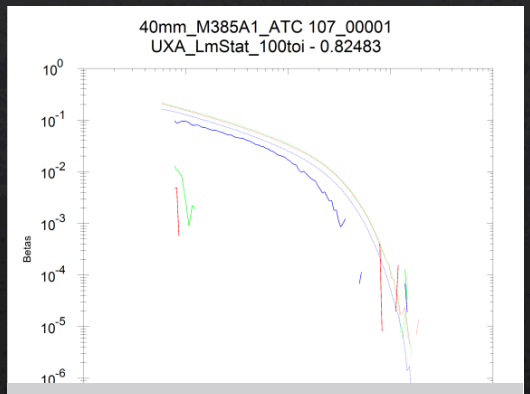
QC Seed Failures

- Inert 20-mm projectile at 15 cm (vertical)
  - Two shots collected with similar results
  - Fit coherences above 0.93 for all results
  - Another vertical 20-mm projectile seed at 15 cm was correctly classified





Original shot
100 confidence metric



Re-shot
100 confidence metric

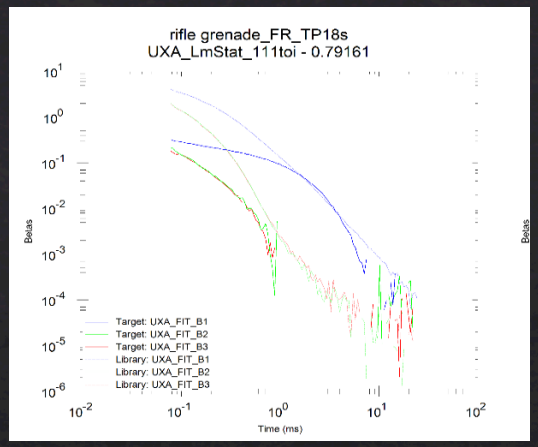
- Large ISO at 90 cm (vertical)
  - Modeled depth of 62 cm exceeded 25 cm MQO
  - Top of item was at 75 cm (13 cm offset to top)

Incorrect TOI Sizes

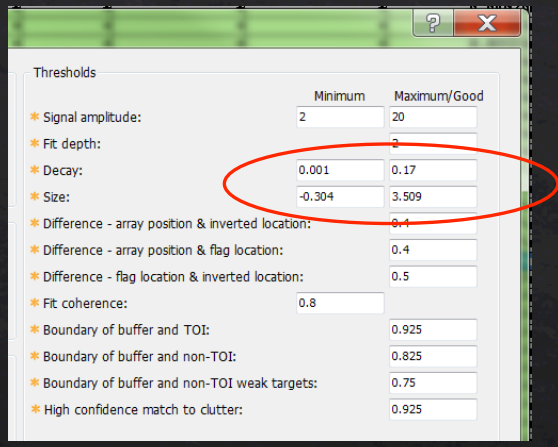
Small: ≤ 40-mm Medium: 57-mm to 81-mm Large: > 81-mm		Predicted Size		
		Small	Medium	Large
Actual Size	Small	51	3	0
	Medium	8	12	0
	Large	0	1	3

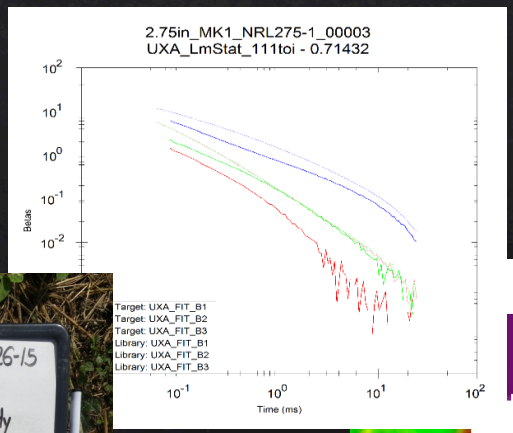
- 78 TOI (52 Seed Items, 26 native)
- 12 sizes (15%) predicted incorrectly
- 9 of 12 predicted as smaller than ground truth, including 6 MEC (2.36-in rocket and 5 60-mm mortars)
- Re-correction using alternate background ineffective

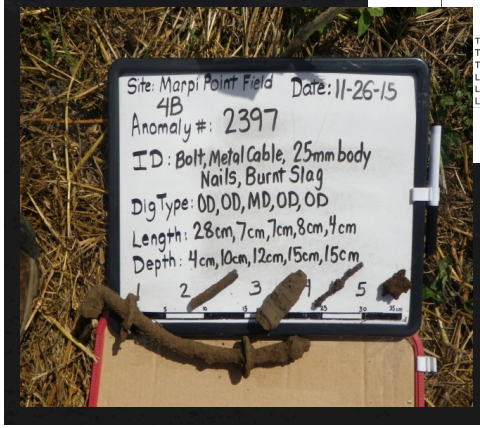
Misclassified Native TOI

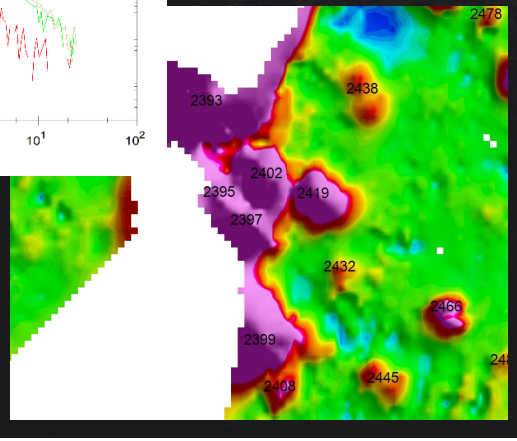


- Low-order deformation
- Size threshold in UXA



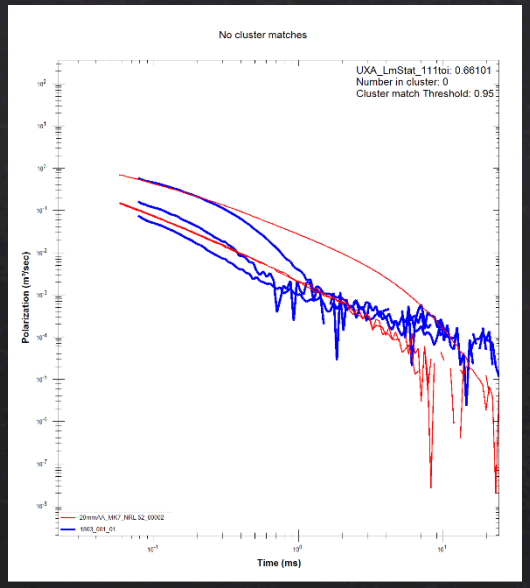




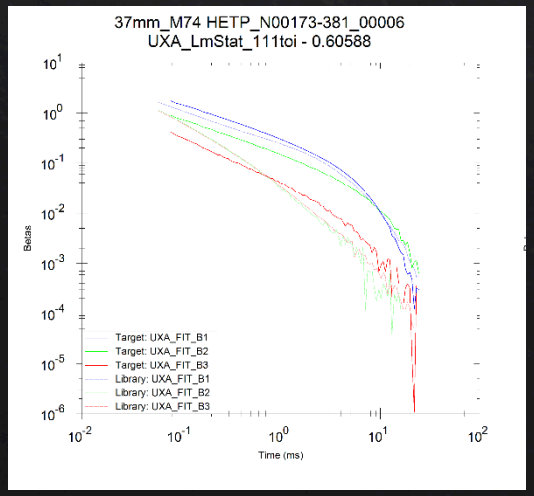


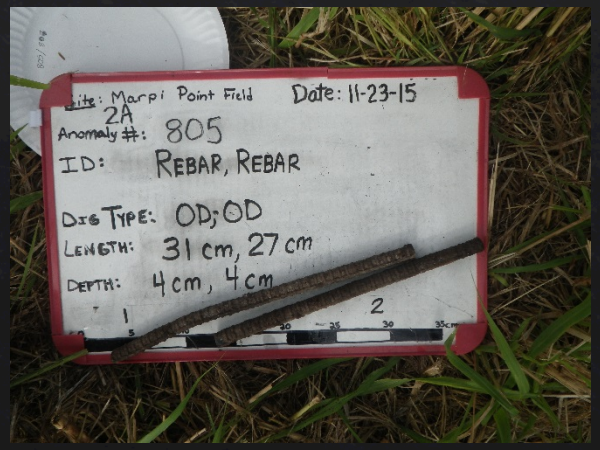
- Likely classified bolt
- Munition deteriorated
- Debris pit
- Significant geologic variability in TS-4B

Validation Targets



- "Too small" prediction
- "Decays too quickly" probably more appropriate
- Failed





- "Asymmetric/plate-like" prediction
- Neither is asymmetric or plate-like, but orientation in ground unknown
- Passed

Geophysical Results Summary

- Dynamic
  - 2,854 targets selected in 3.4 acres = 839/acre
  - All seed items selected as cued targets
  - Significantly more targets than EM61 data, but probably should be to find MEC present
- Cued
  - Dig list revisions required for missed seed and native TOI
  - Dig rate for final list was 46.5% and still incorrectly classified an inert 20-mm seed at 15 cm
  - No practical solution for incorrect size predictions
  - Validation justifications less straightforward than anticipated

Cost Summary

Cost Element	Element Summary	Costs
DGM Costs		
Standard sensor detection survey and processing costs	Detection survey data collection, processing, and ODCs (including sensor rental costs): Cost per acre for detection survey:	**Estimated** **$9,920**
TEMTADS detection survey and processing costs	Detection survey data collection, processing, and non-sensor ODCs TEMTADS rental costs: Cost per acre for detection survey:	**$53,782** **$12,000** **$19,348/acre**
TEMTADS cued survey and processing costs	Detection survey target reacquisition, cued data collection, target inversion and initial classification, non-equipment direct costs, non-TEMTADS equipment rental costs: TEMTADS rental costs: Costs per target to collect and analyze cued data:	**$67,340** **$13,500** **$59.89/target**
Intrusive Costs		
Detailed intrusive investigation	All costs related to the intrusive investigation Cost per anomaly to intrusively investigate	**$101,067** **$167.05/target**
Standard intrusive investigation	All costs related to the intrusive investigation Cost per anomaly to intrusively investigate	**Estimated** **$125.54/target**

- Detection survey choice possibly based on effectiveness rather than cost
- Cost to cue and dig 10,000 targets
  - $59.89 x 10,000 = $598,00
  - 54% reduction
  - 167.05 x 4,600 = $768,430
  - Total = $1,367,330
- Cost to dig 10,000 anomalies
  - $125.54 x 10,000 = $1,255,400

Treatability Study Conclusions

- TEMTADS DGM Surveys
  - Probable superior MEC detection performance over EM61
  - Cost would be significantly higher than EM61
    - Rental/Purchase
    - Slower production (ergonomics, RTS)
    - Maintenance
- Cued Survey
  - Missed QC seed picked in detection survey
  - More expensive than just digging everything
    - Large frag of similar size/shape to 20-mm projectiles
    - Variable geologic response, sometimes quite high
    - High native TOI rate
    - Deformed and deteriorated TOI

Questions/Explosion