

Demonstration of a Fully Integrated Handheld Ultra Light ElectroMagnetic Array (ULEMA-H)

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Unexploded Ordinance Problem

- UXO littered across activate ranges and old combat fields
- These munition response sites can contain rough/rocky terrain, wooded areas, wetlands
- Remediation is necessary to reuse land
- Advanced geophysical sensors provide cost-effective remediation of UXO

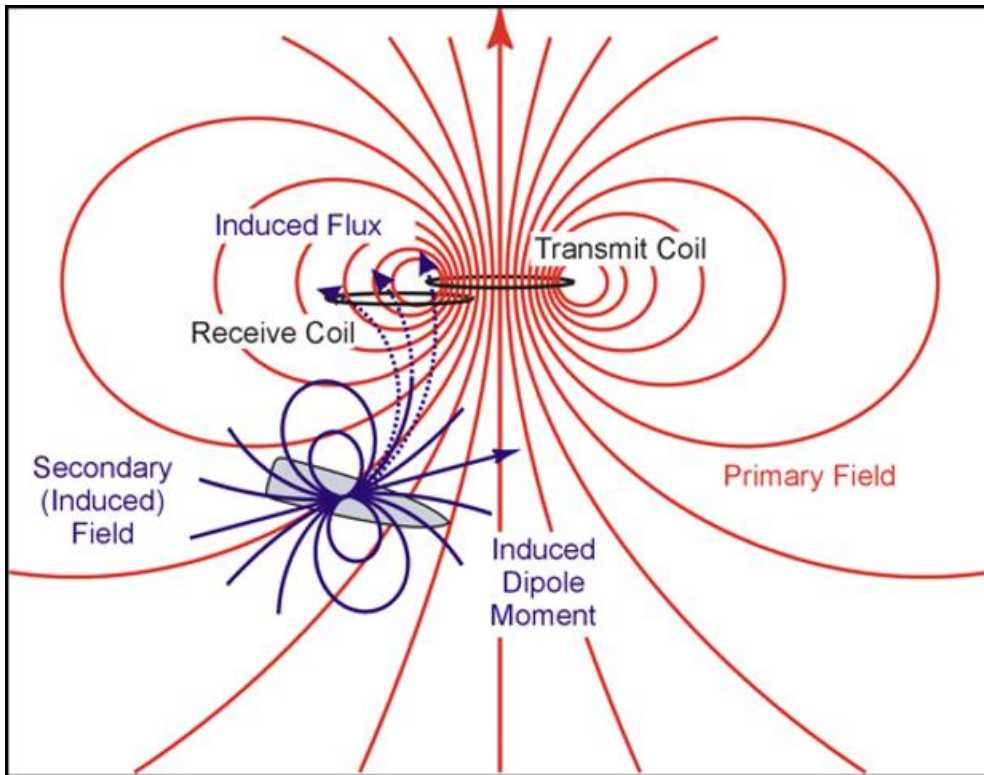


Current UXO Detection Sensors

- Capable of classification and discrimination, in static or dynamic modes
- Large form factors and heavy
 - Perform great in smooth terrain
 - Difficult to deploy in rough terrain only passable on foot



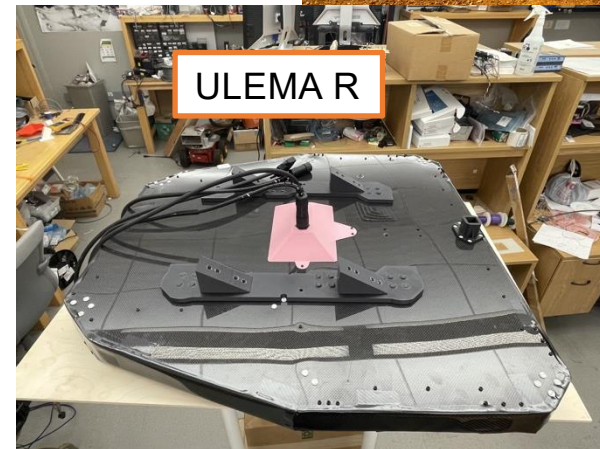
EMI Background



- Primary field generated by DC current
- While collapsing the field, eddy currents develop in conductive objects creating a secondary magnetic field
- Receivers transduce secondary magnetic field to a voltage

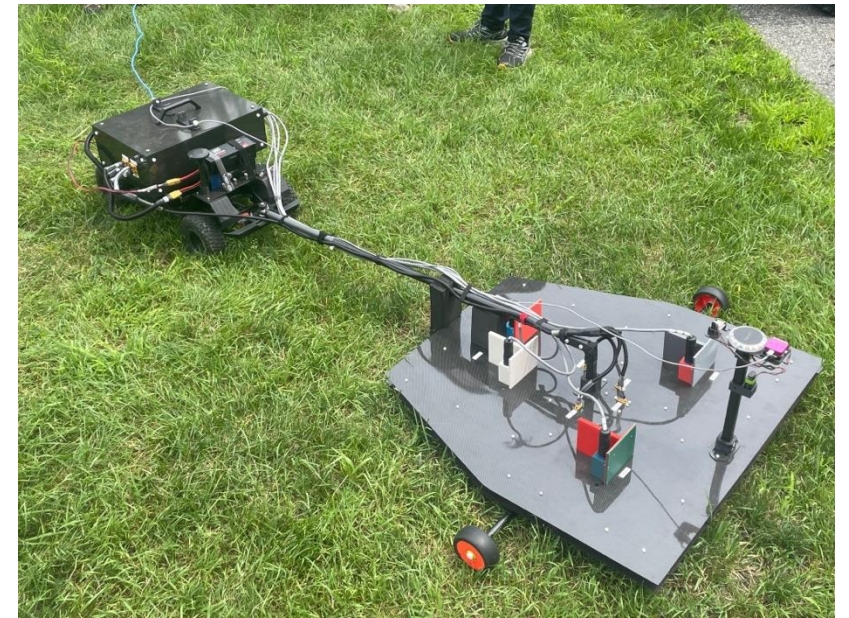
ULEMA System

- Human portable Time Domain advanced EMI
- 4 Tx sequentially pulsed with 10A current
- 4 triaxial 100 turn receivers
- 7.5 Hz data rate
- Lightweight RTK GPS (1.5 cm CEP)
- IMU for attitude measurements

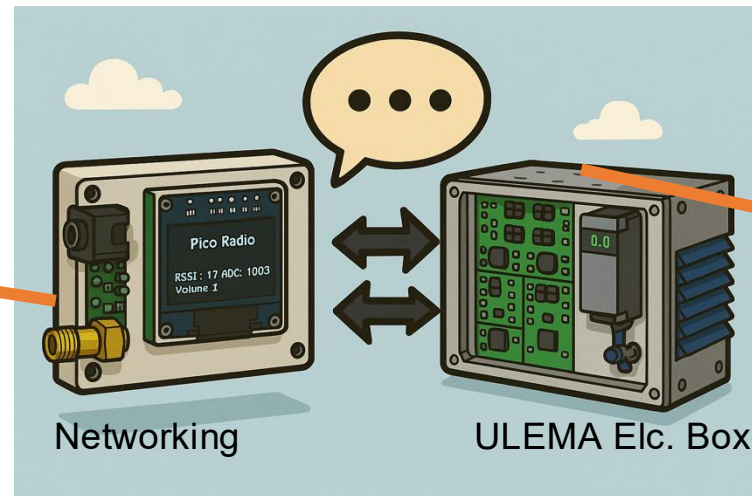


ULEMA-H data collection

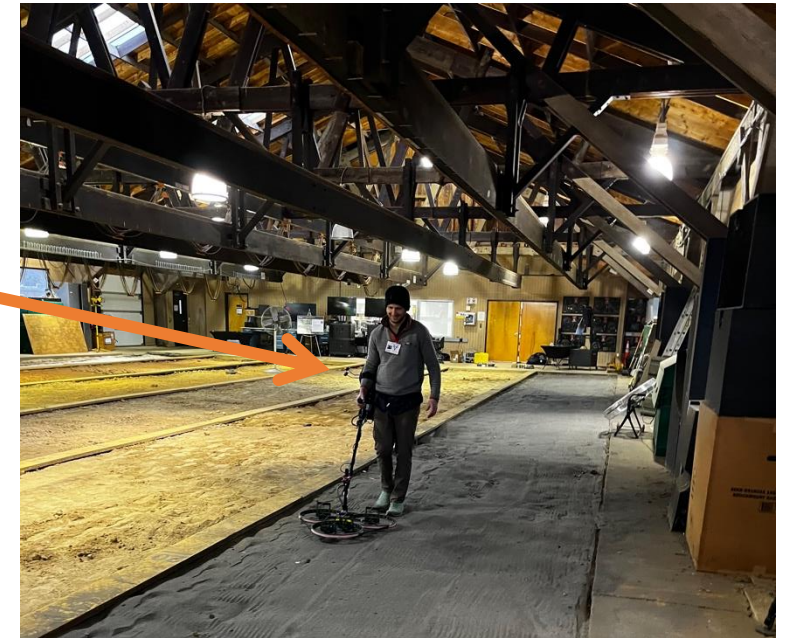
- Tethered or remote options
- Realtime display of EMI/IMU/GPS data
- Realtime coverage maps



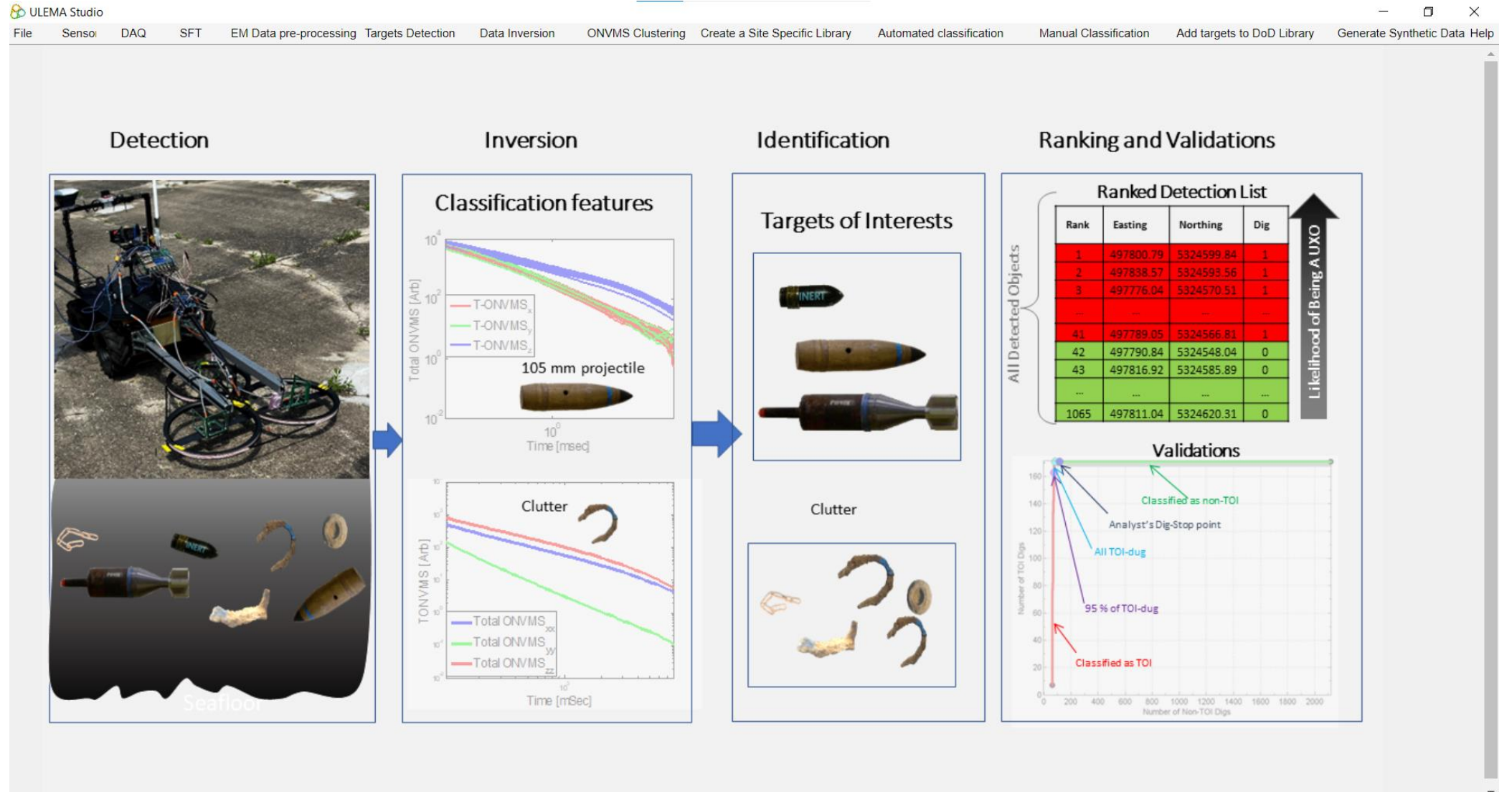
Communication



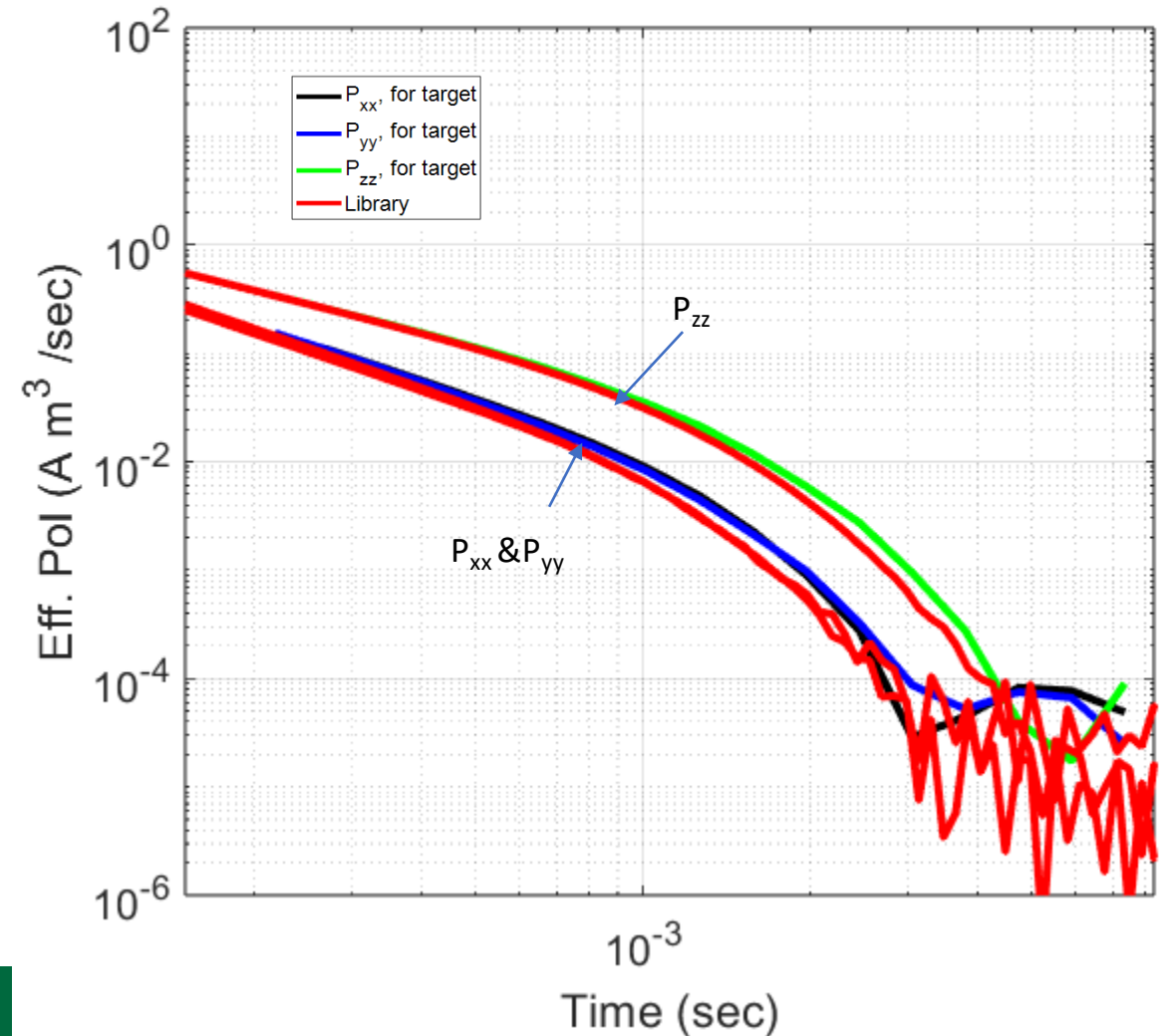
Pico radio



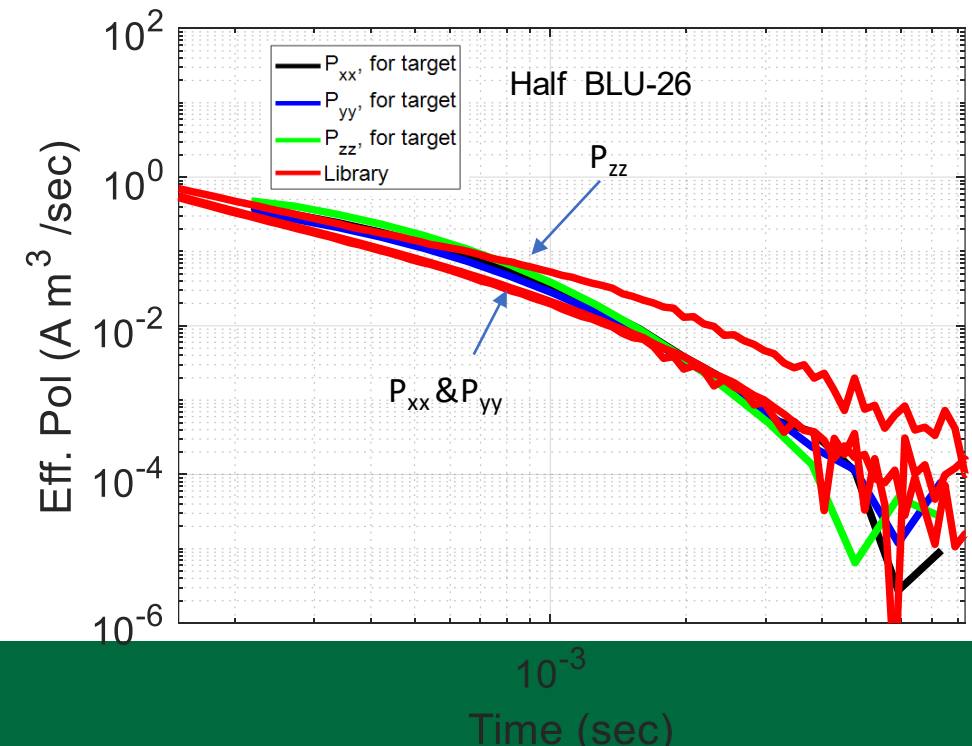
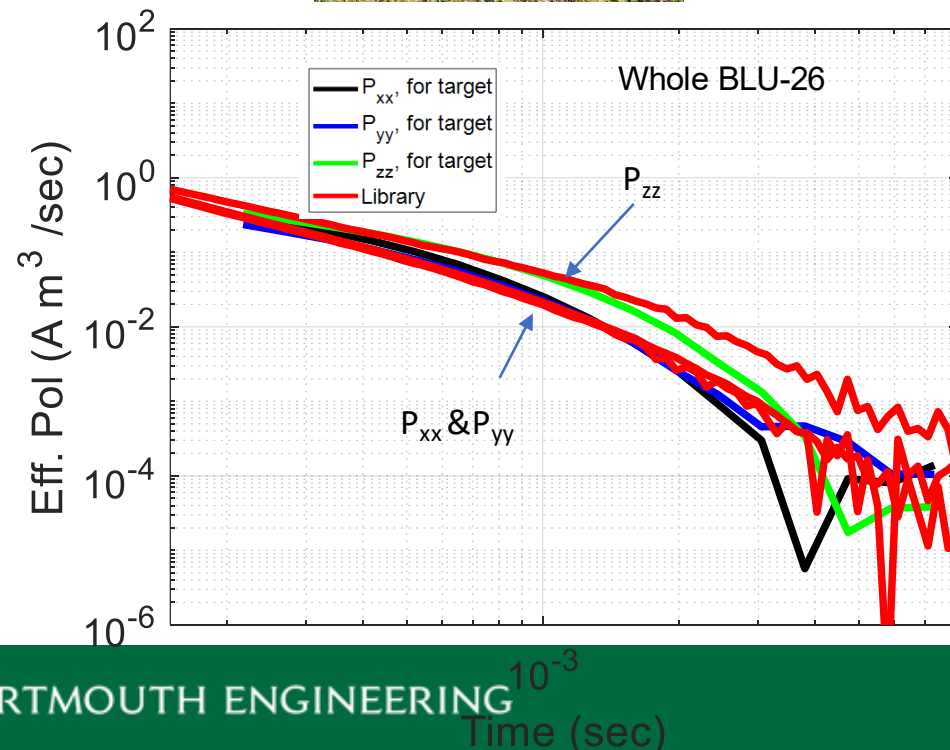
ULEMA Studio



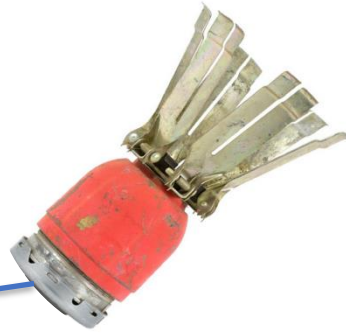
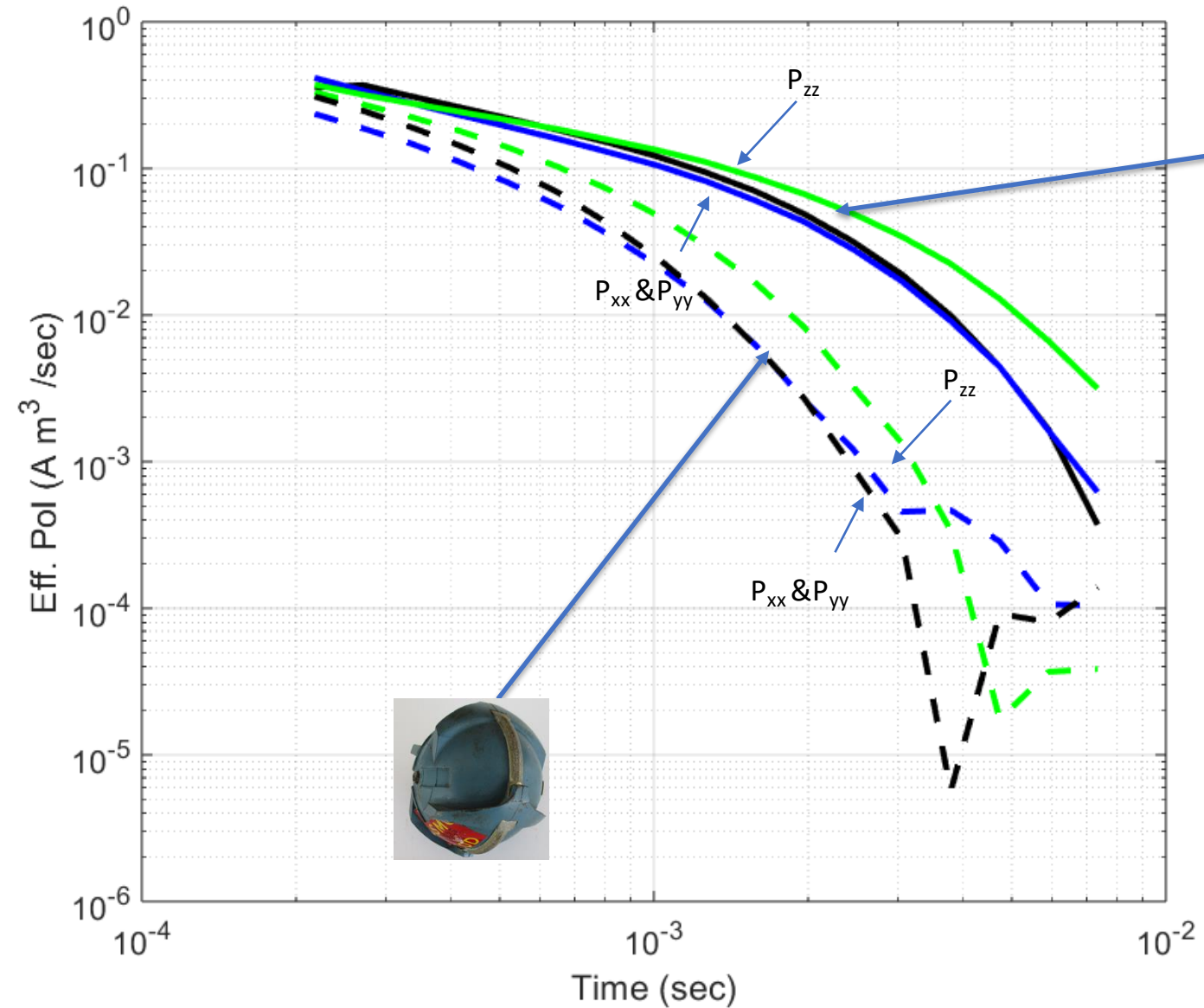
ULEMA –H classification: M42 Submunition



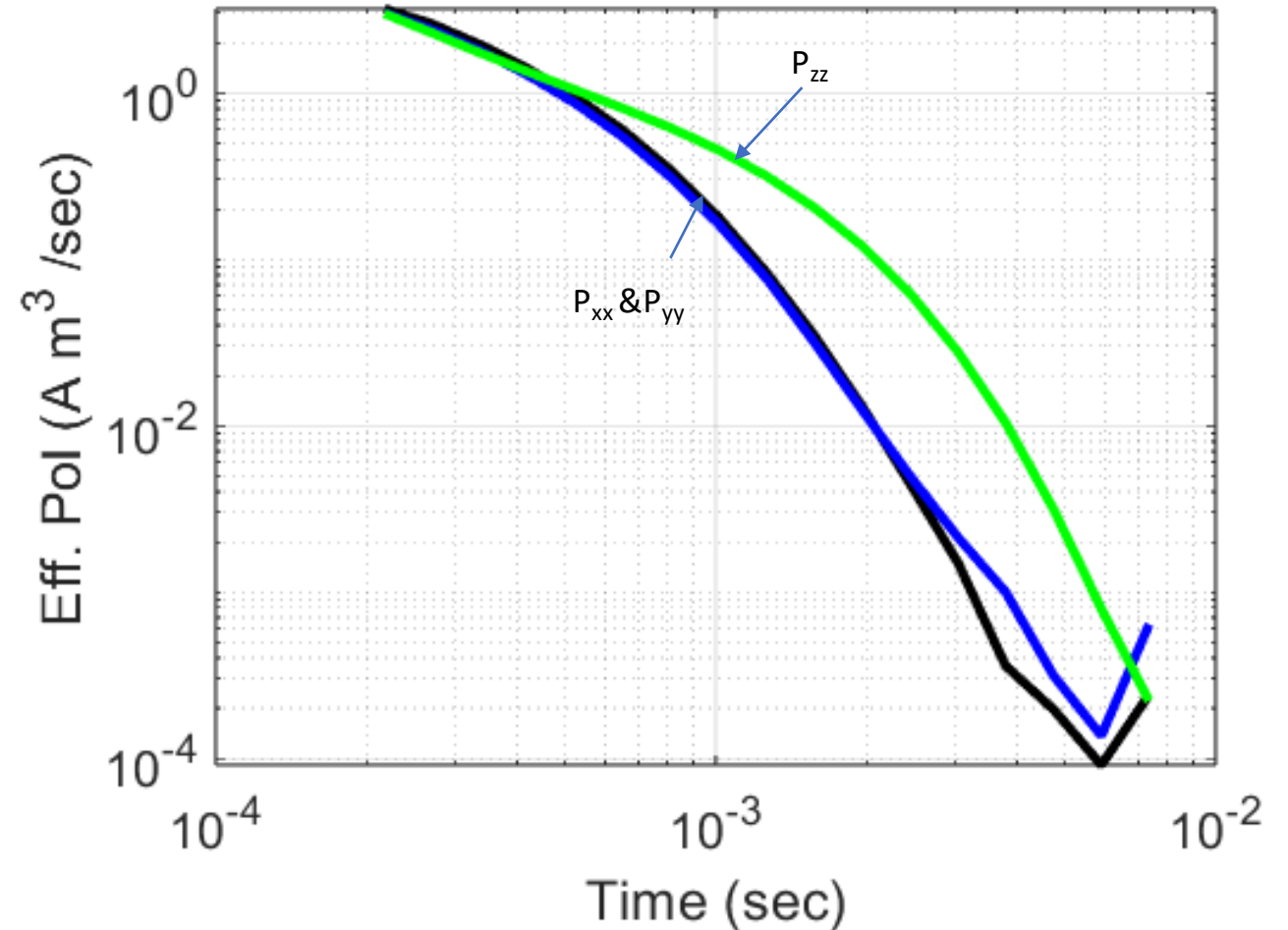
ULEMA –H classification: Whole and Half BLU-26



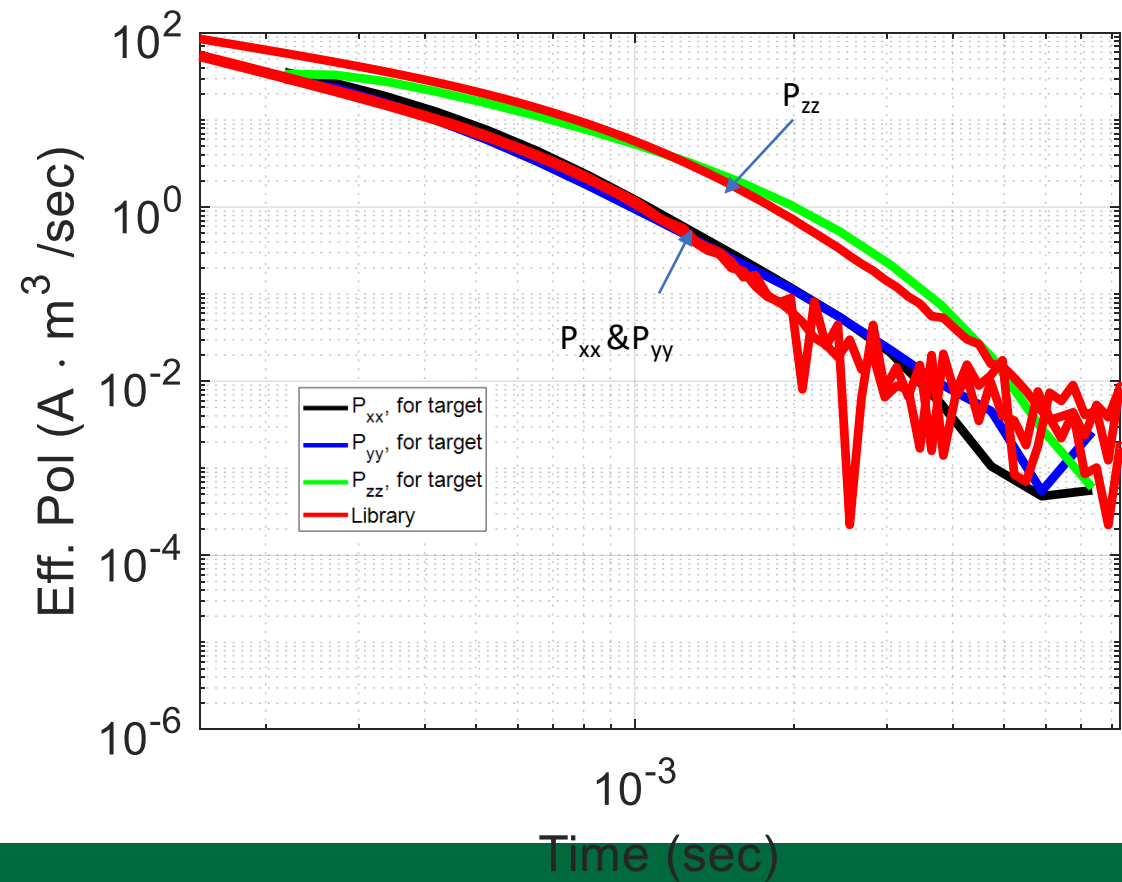
ULEMA –H classification: BLU-26 vs BDU-28



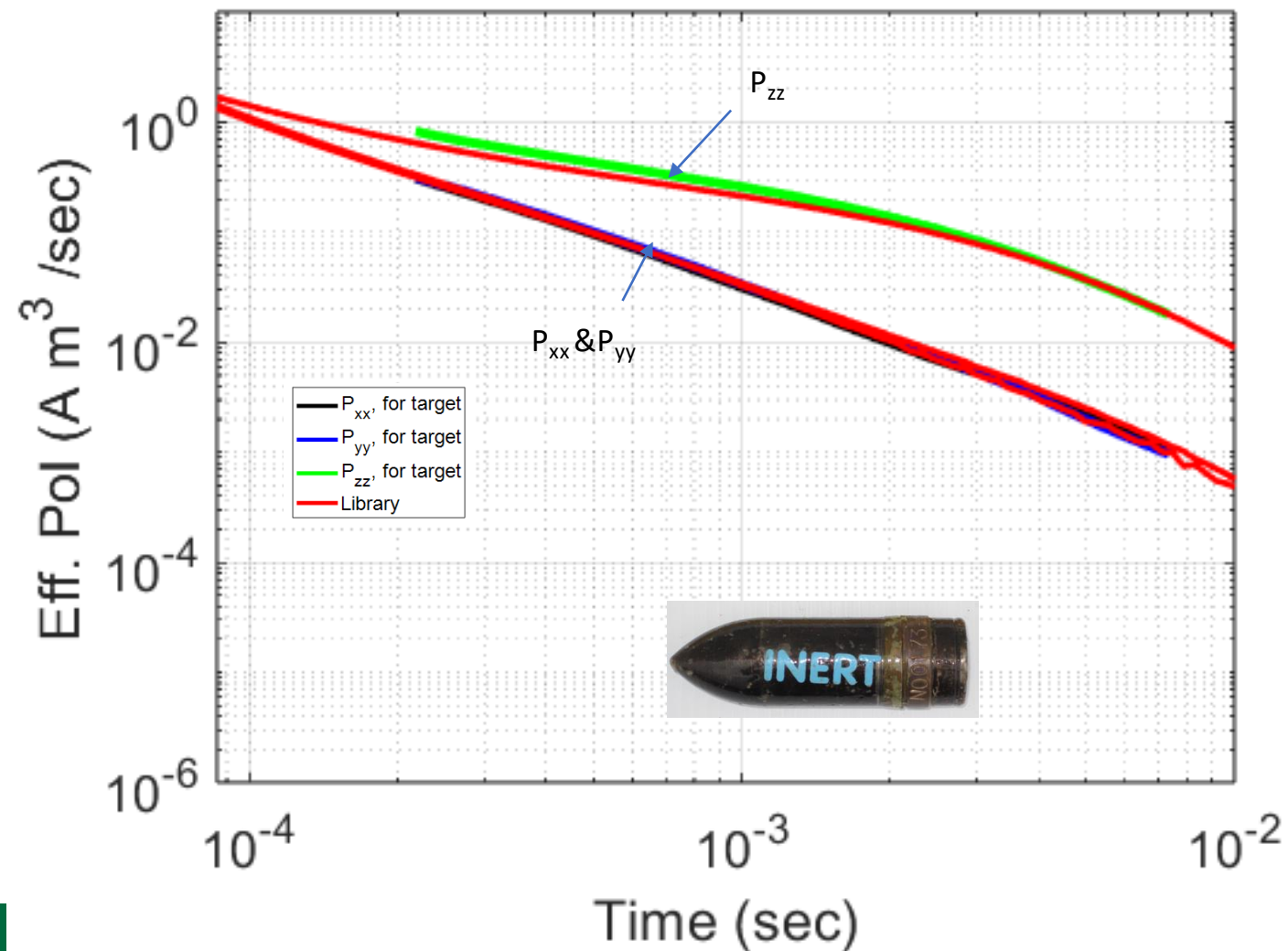
ULEMA –H classification: Anti-tank mine



ULEMA –H classification: AT62M mine



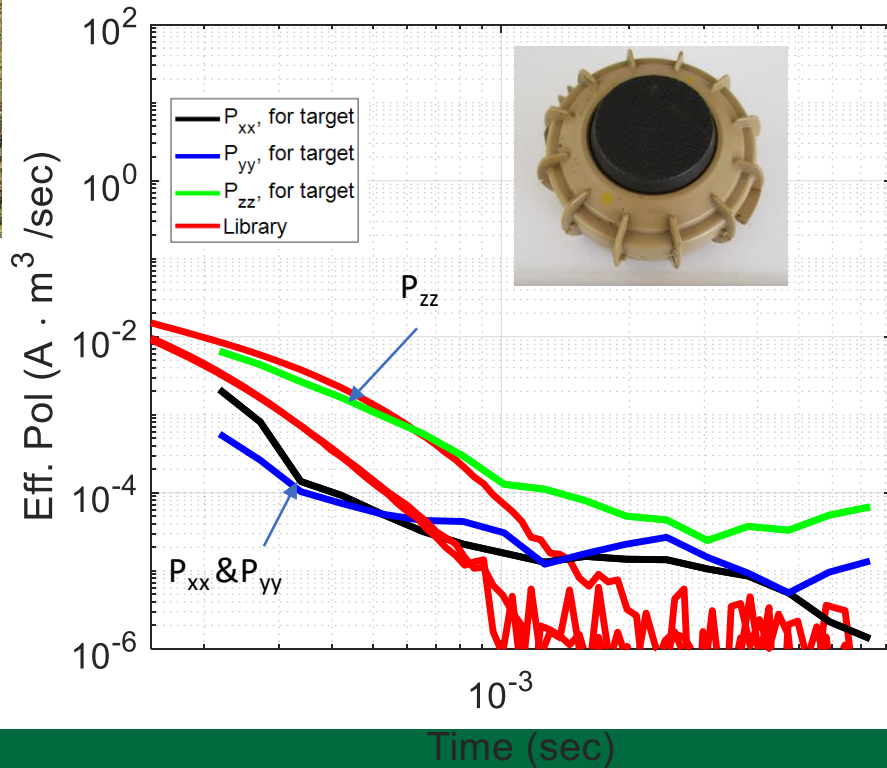
ULEMA –H classification: 37 mm projectile



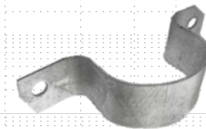
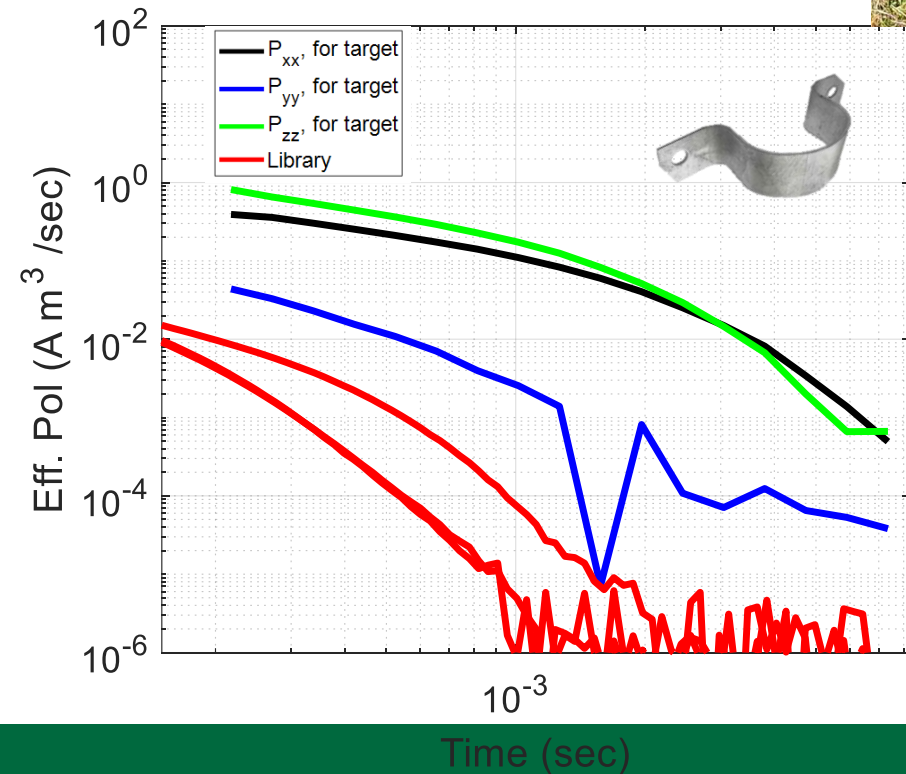
ULEMA –H classification: VS-50 mine and clutter



VS-50 mine

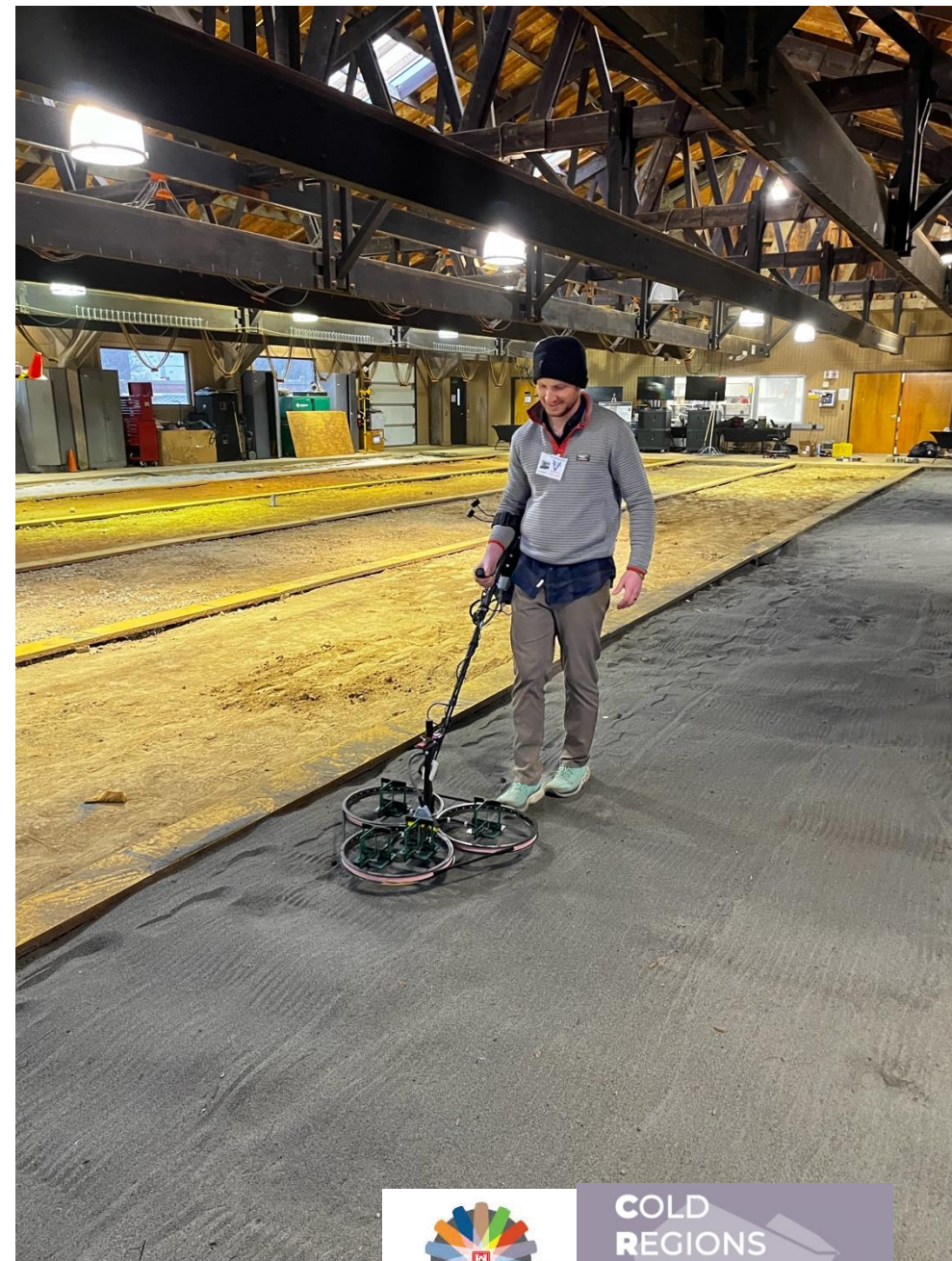


Clutter: U-clamp

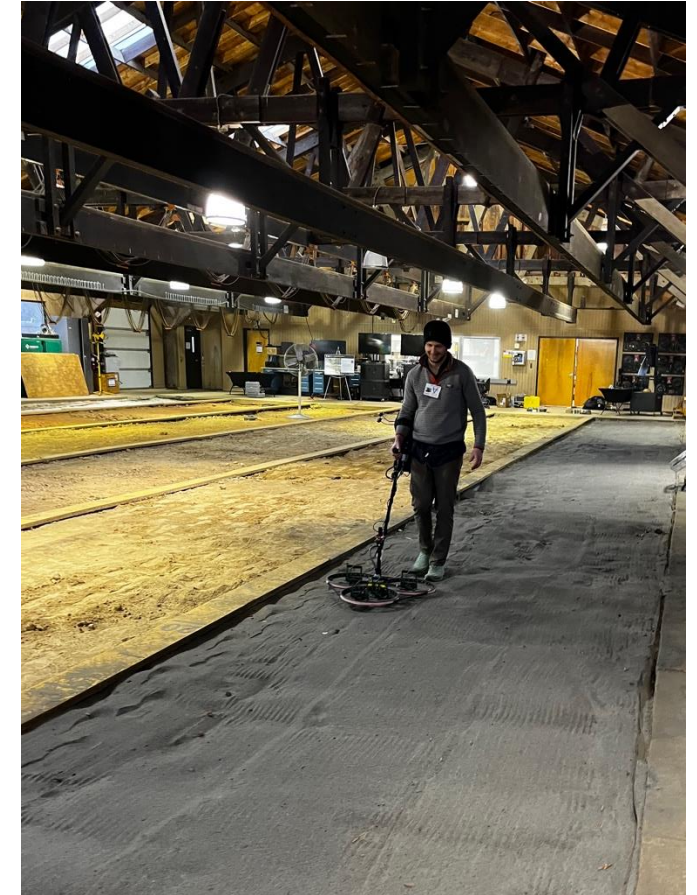
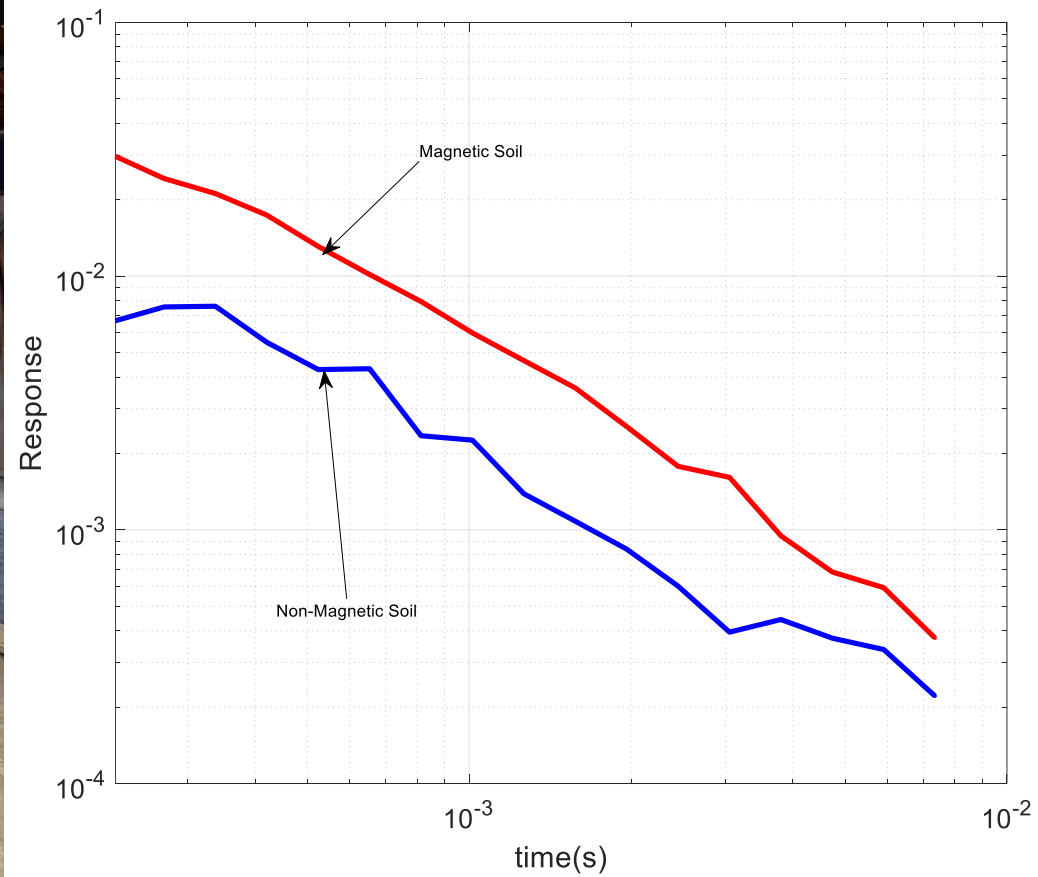
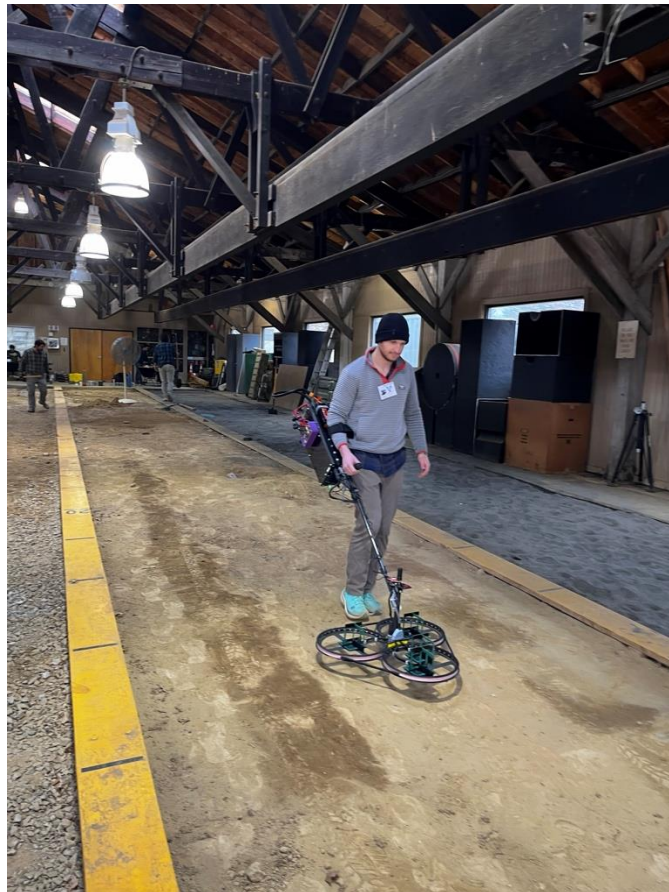


Magnetic Soil

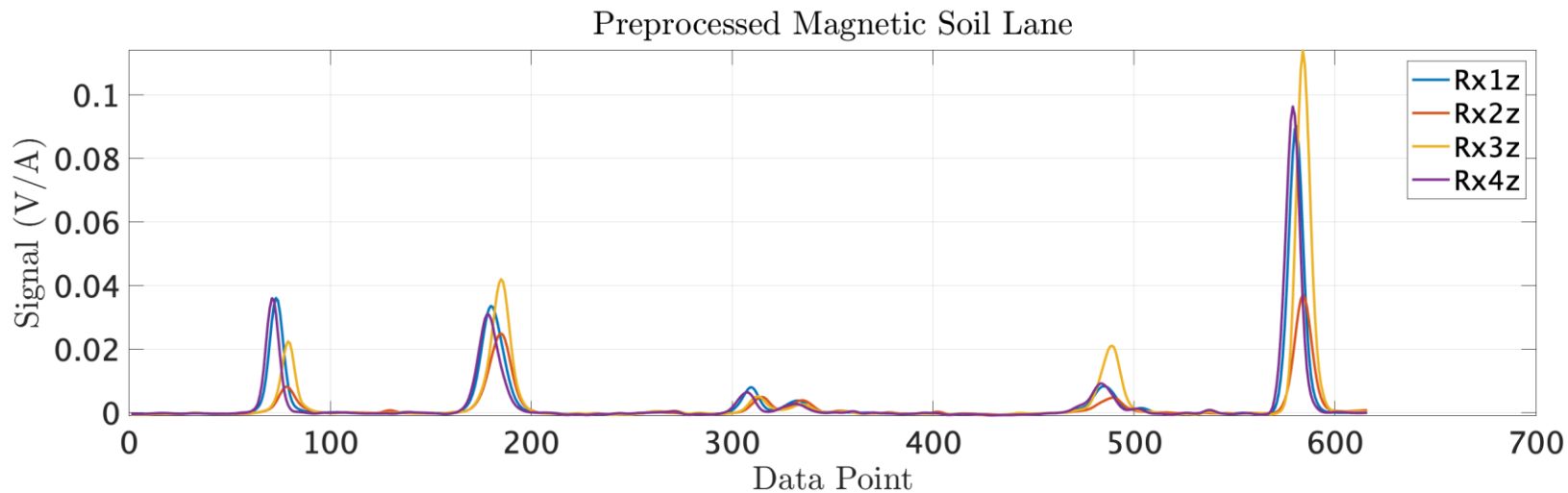
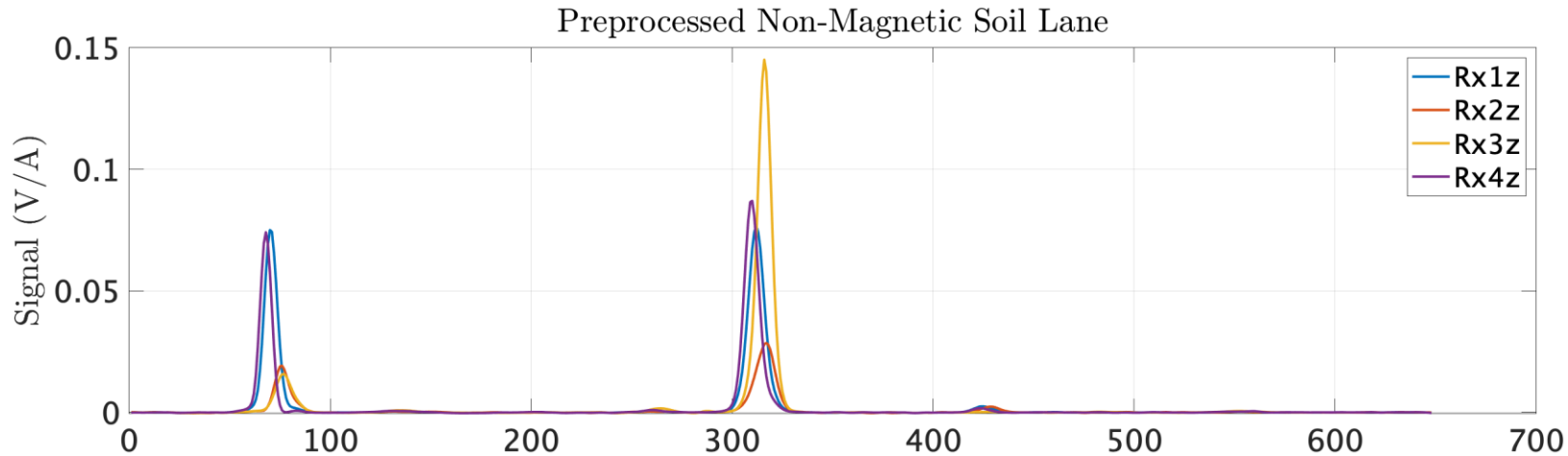
- Indoor data collected at Ft. Belvoir
- Two soil datasets: one contained magnetic soil
 - 30 m lanes
 - Variety of UXO targets: 155mm 105mm, 81mm UXO
 - Additional clutter objects: soda cans, scrap metal, ...



Soils' Responses



Magnetic Soil Noise Removal



Conclusions

- Continued development of man-portable advanced geophysical classification system
- Collected and classified data using a variety of UXO, land mine and clutter targets
- Gathered data over magnetic and non-magnetic soil
 - Applied dynamic processing to remove magnetic soil response

Questions