



▶ UMI SCANS OF PLATES WITH PENETRATIONS

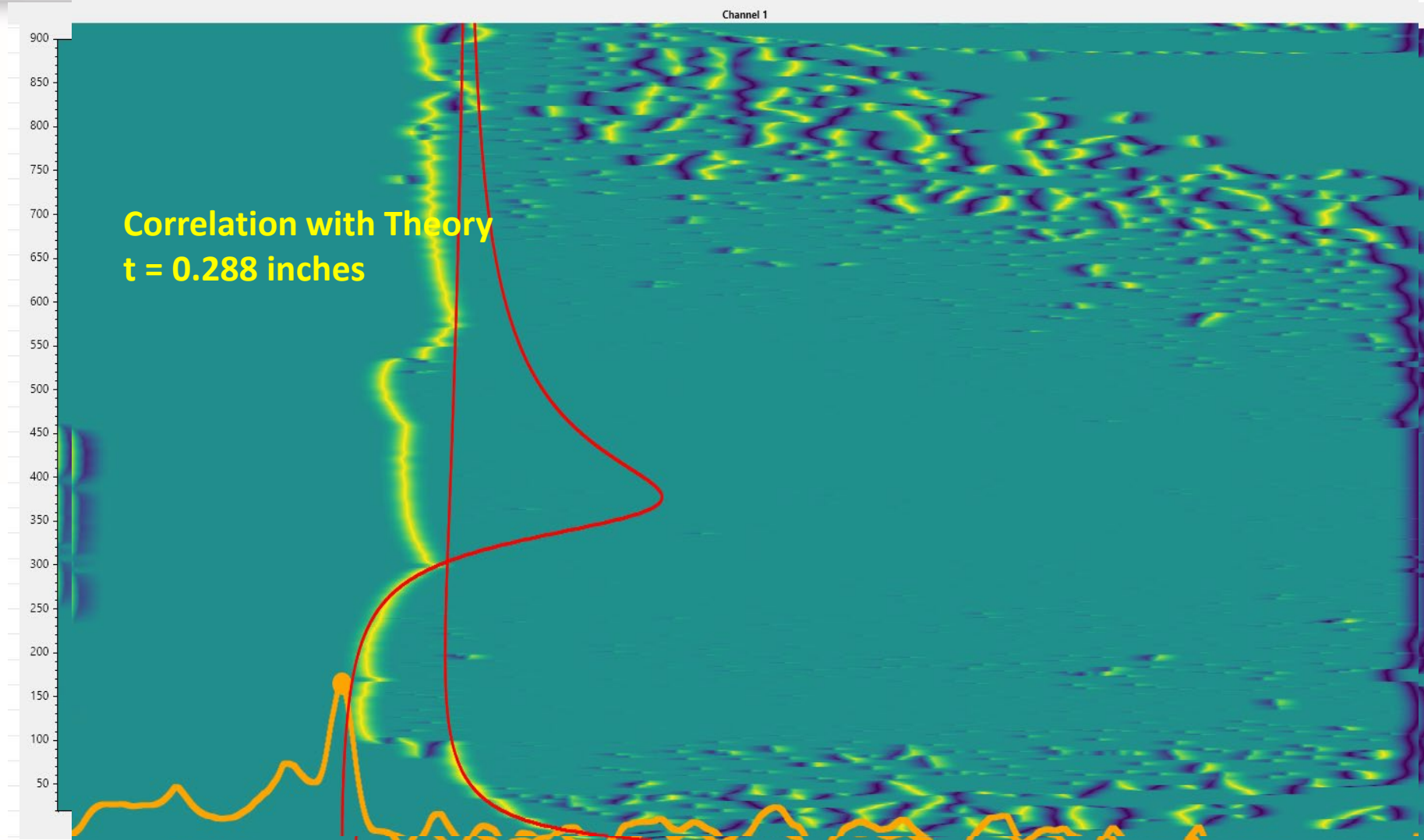
NATIONAL SHIPBUILDING RESEARCH PROGRAM (NSRP) FY25 PANEL PROJECT (PP25-29)

17 June 2026

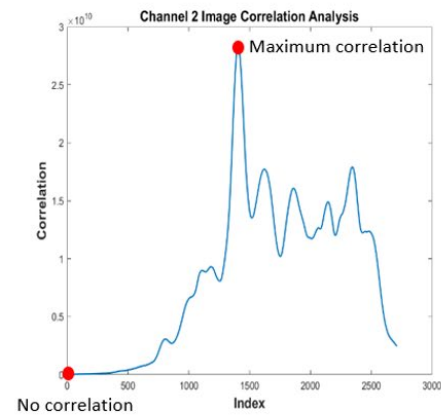
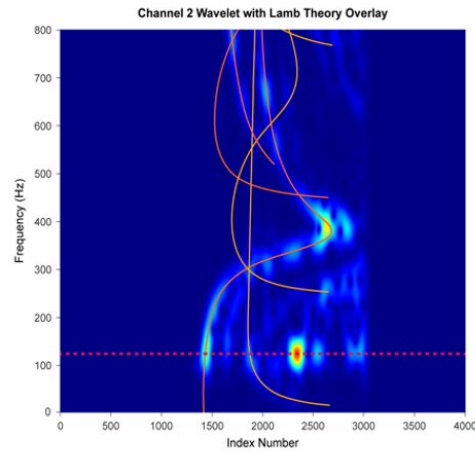
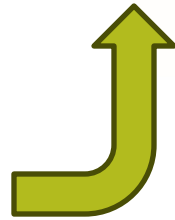
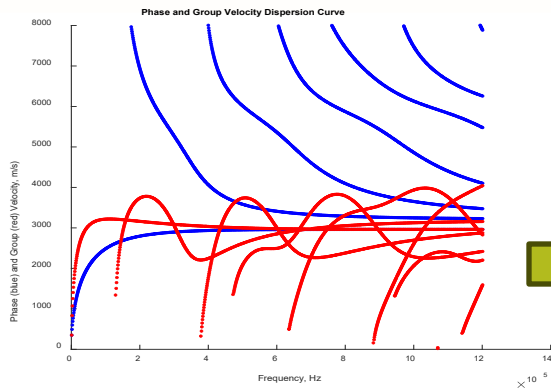
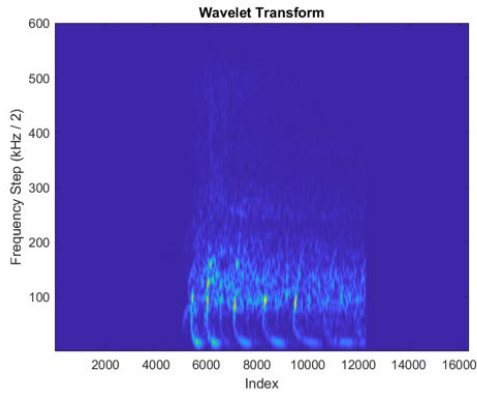
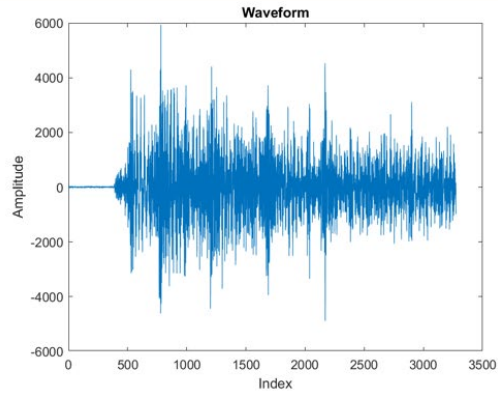
Antech Team

▶ AGENDA

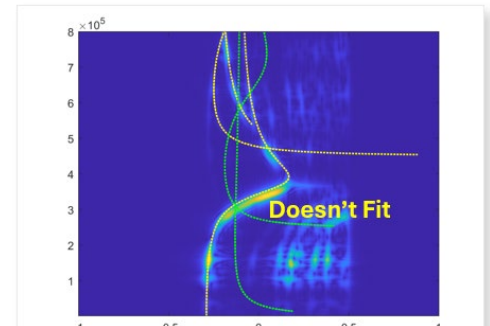
- ▣ What is UMI?
- ▣ Beam Mapping
- ▣ Lab Work
- ▣ Field Scans
- ▣ AI and Future



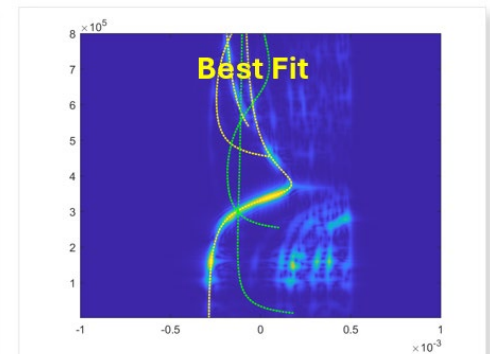
▶ WHAT IS ULTRASONIC MODE IMAGING?



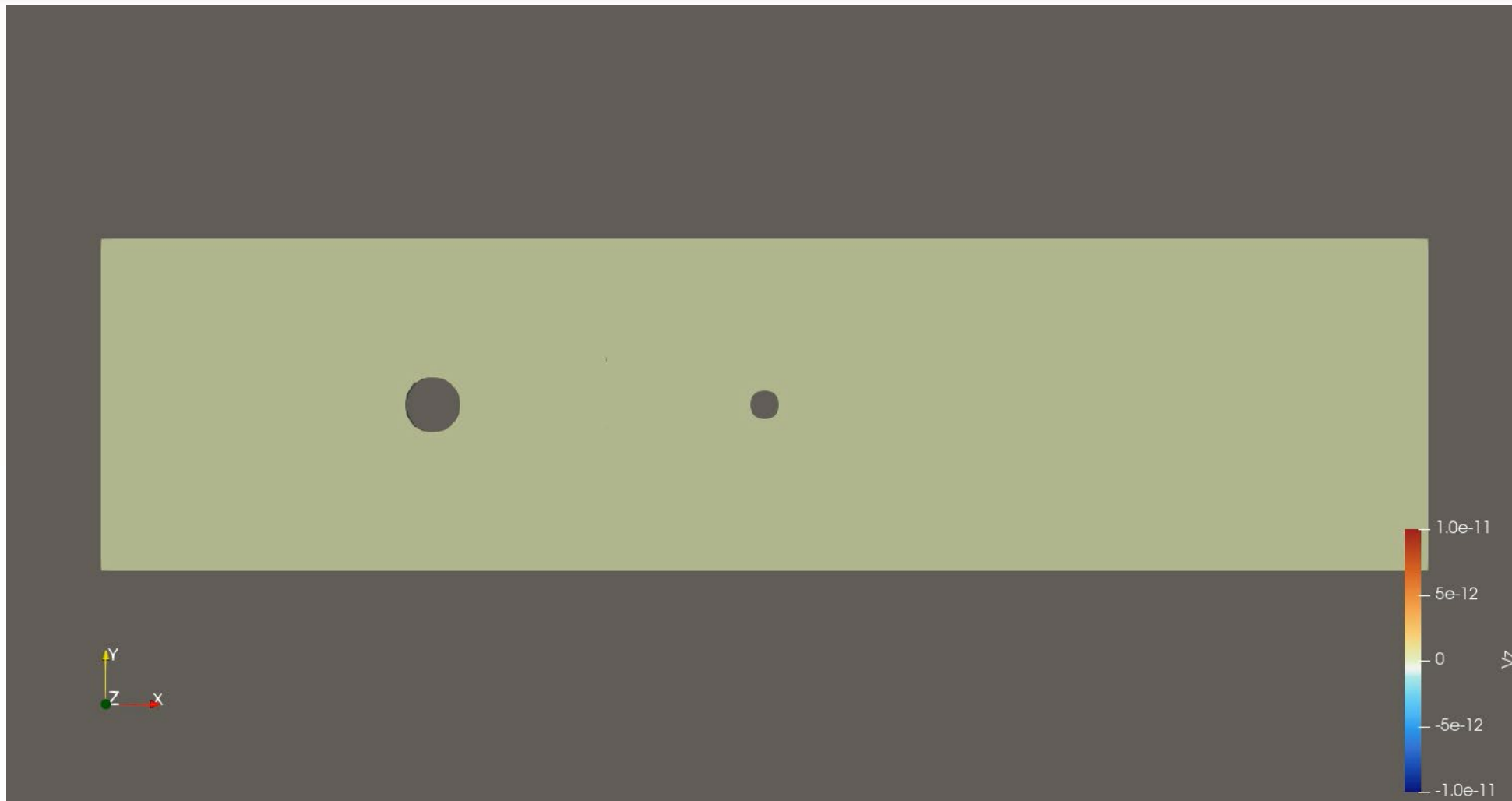
0.240" Dispersion Curves



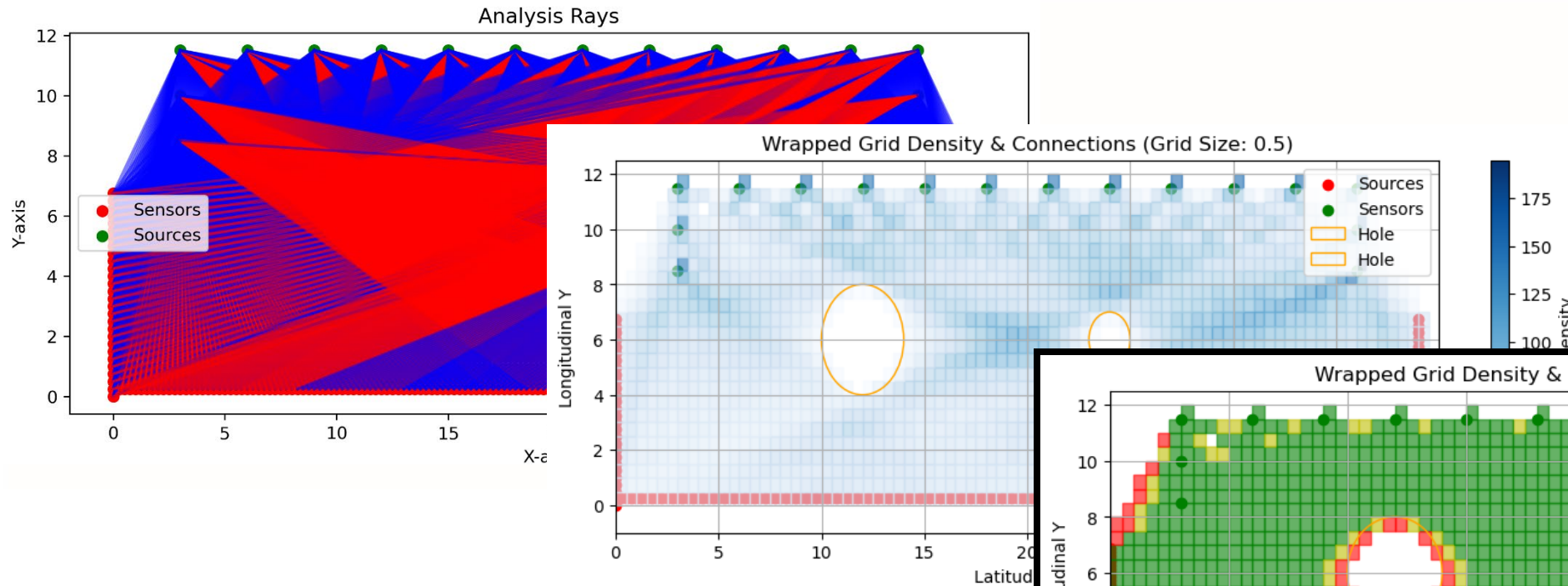
0.250" Dispersion Curves



▶ SIMULATION ANIMATION

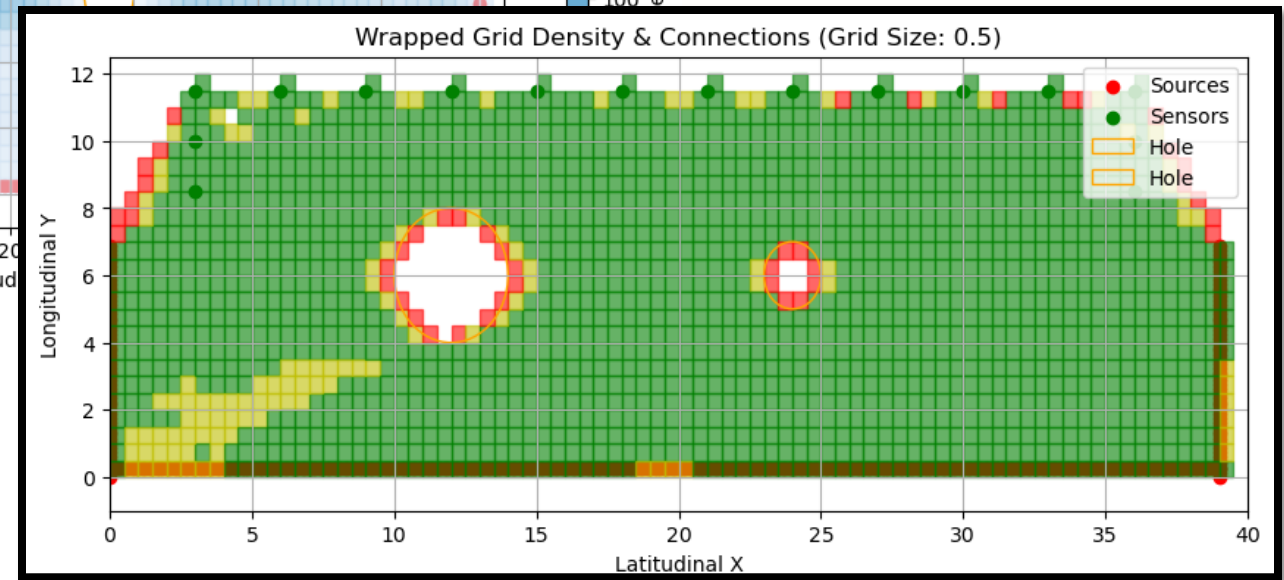


▶ BEAM MAPPING TO BEAM DENSITY



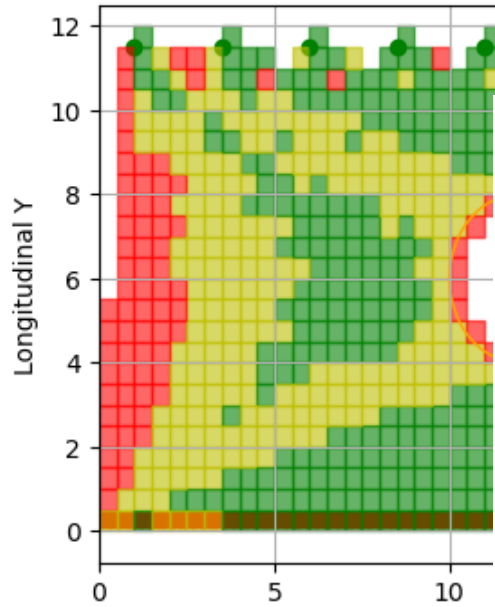
▶ Used new interface for test configurations

▶ Generated user interface concepts for conducting a UMI scan around a penetration

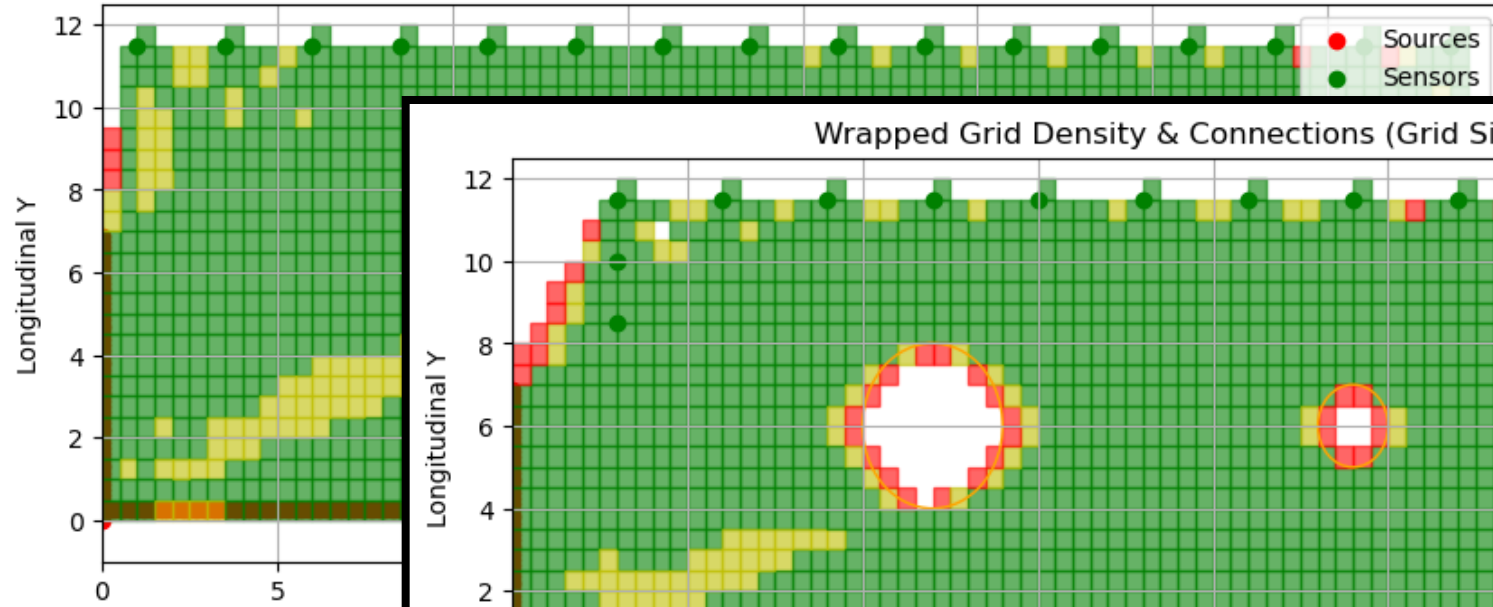


► CONFIGURATION ITERATIONS

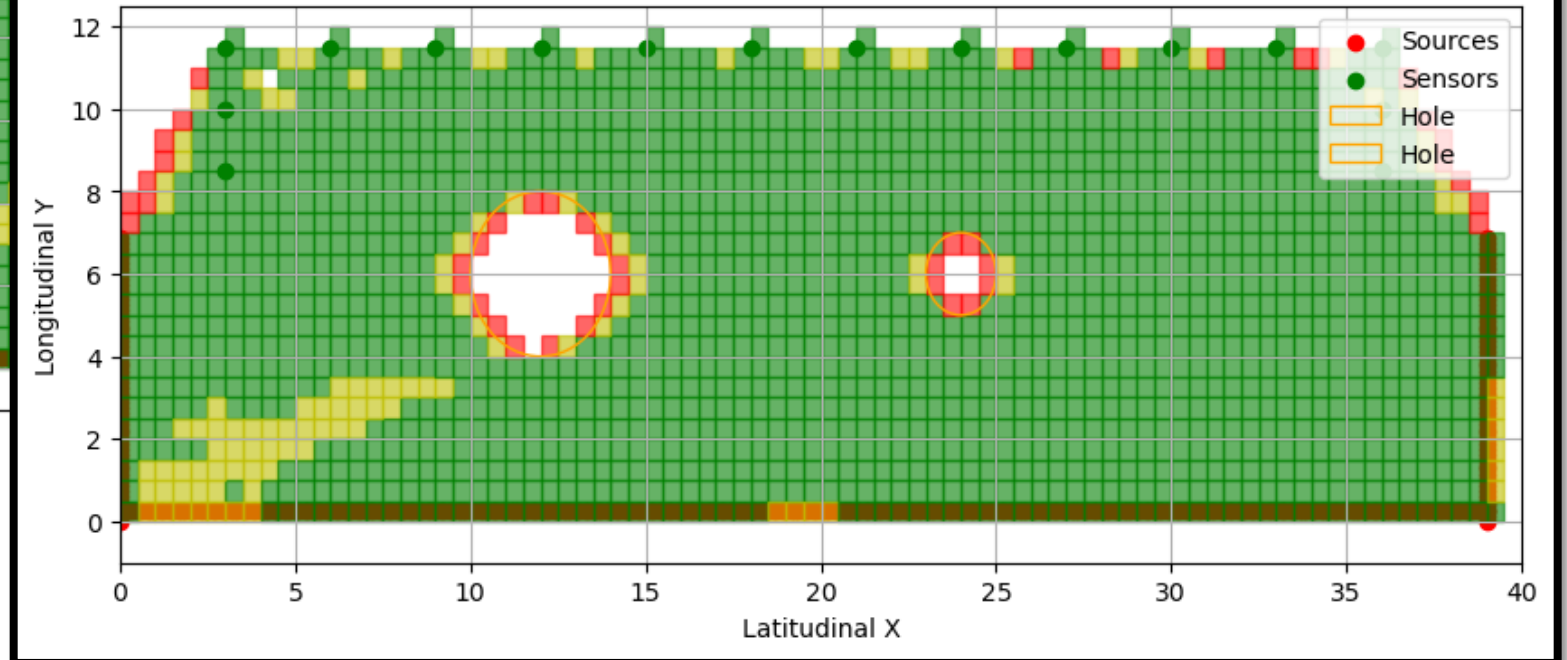
Wrapped Grid Density & Connections (Grid Size: 0.5)



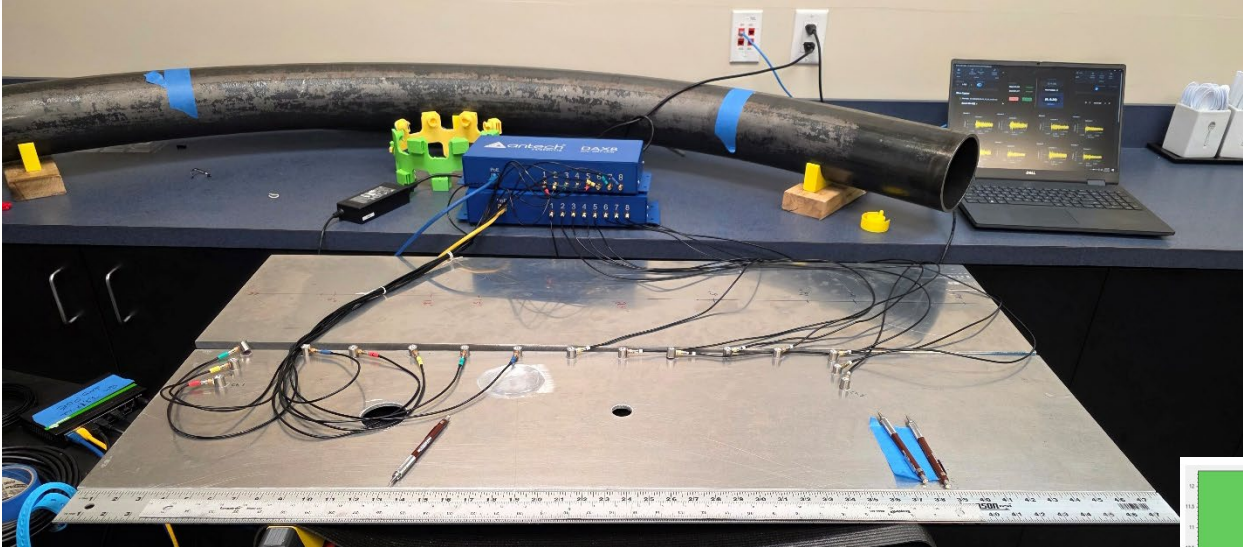
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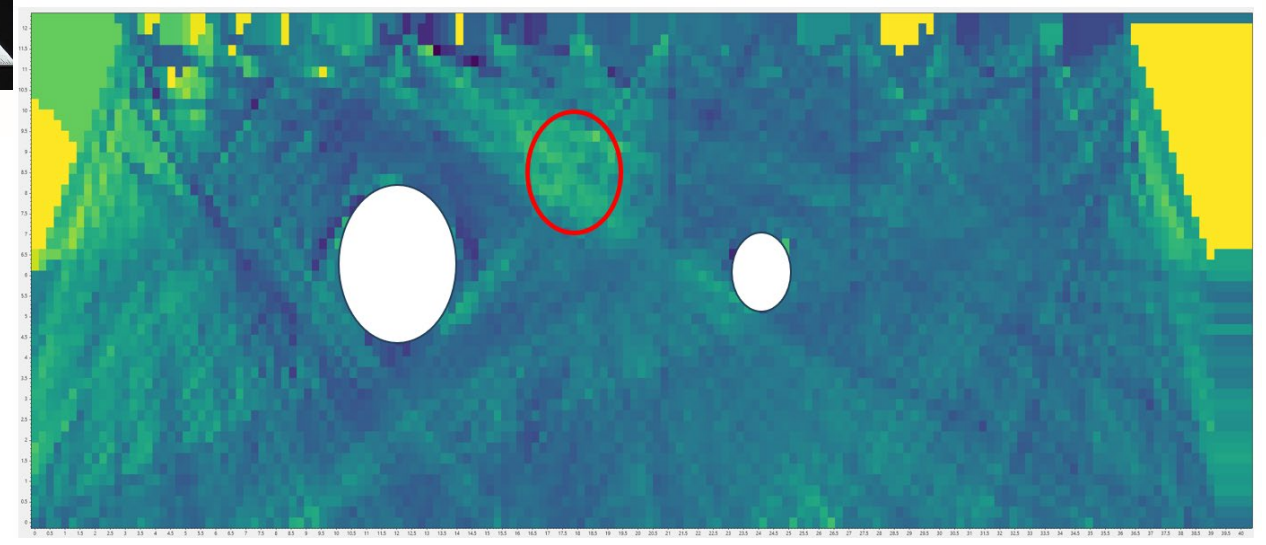
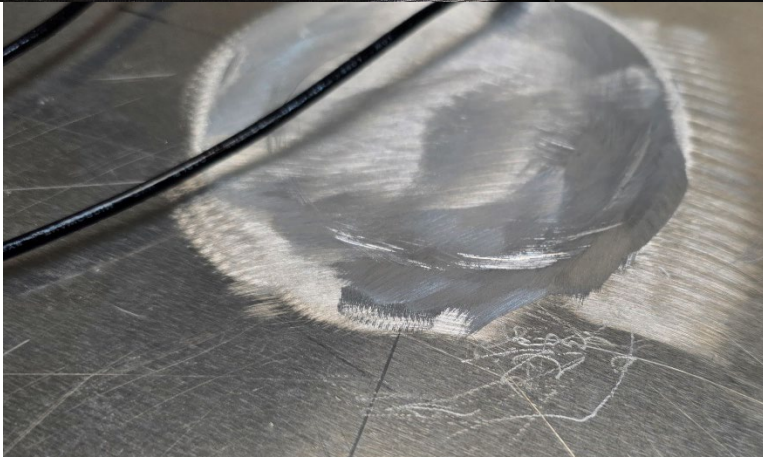
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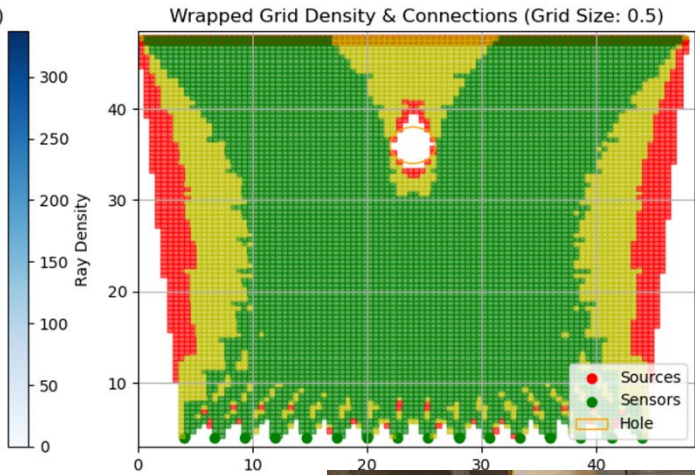
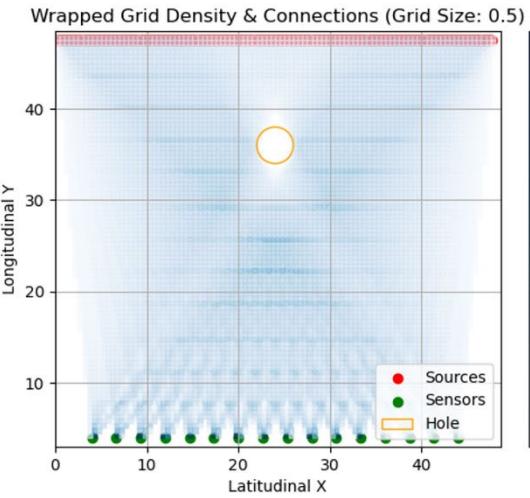
▶ LAB TESTING



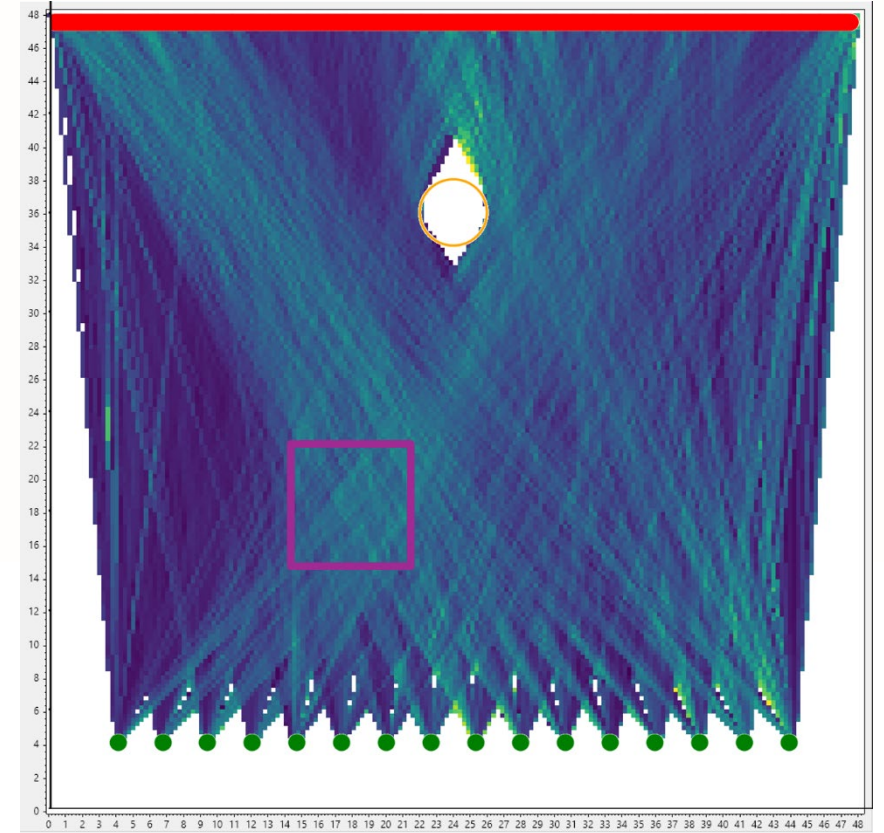
- ▶ Initial Lab test on 4' x 1' plate
- ▶ Plate has 2" and 1" holes
- ▶ Plate has a 50% flaw
- ▶ UMI Scan Successfully found flaw



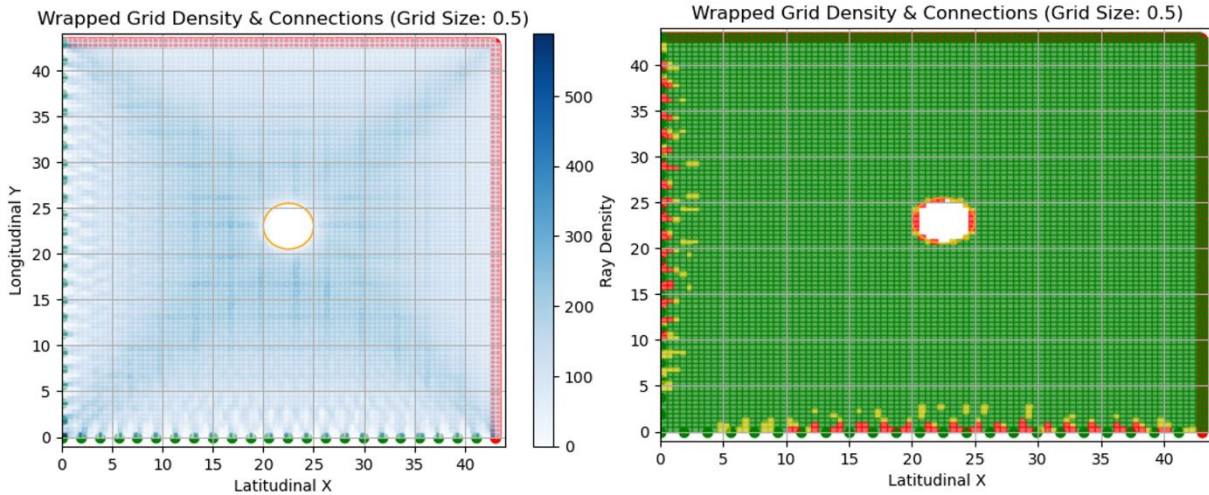
▶ SECOND ROUND LAB TESTING



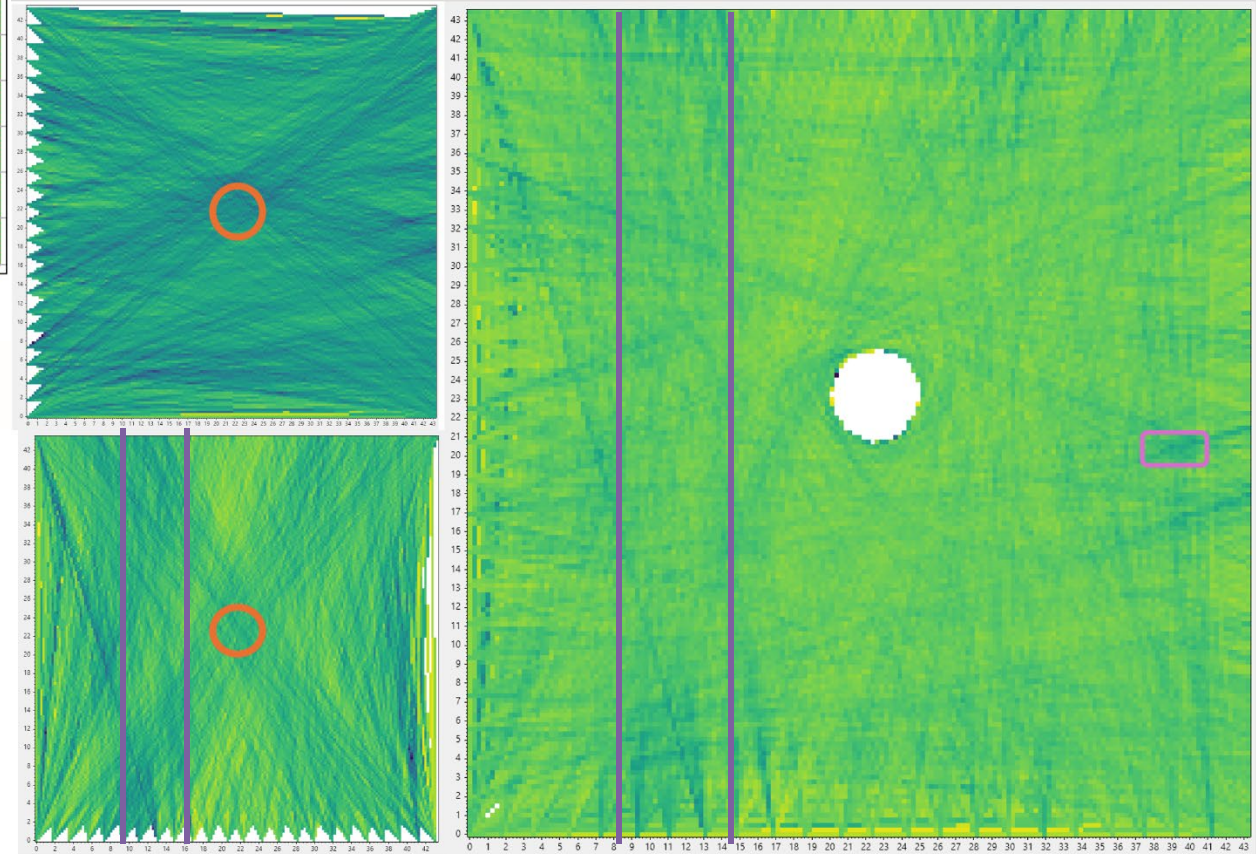
- ▶ Second Lab test on 4' x 4' plate
- ▶ Plate has 3" hole
- ▶ Plate has a 33% flaw
- ▶ UMI Scan Successfully found flaw



► FIELD TESTING AT NNSY



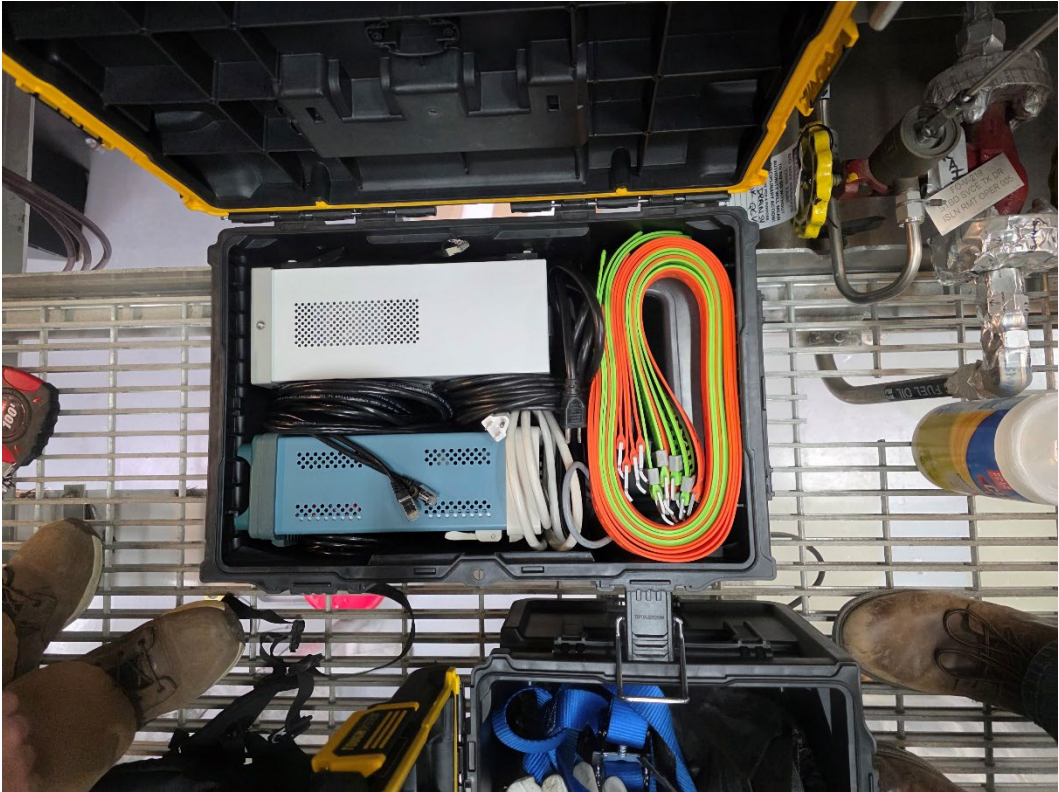
- ▣ Tested a tank at the NNSY
- ▣ Able to scan around flaw on a vertical surface
- ▣ UMI Scan successfully found thick section where pipe support is welded to under side



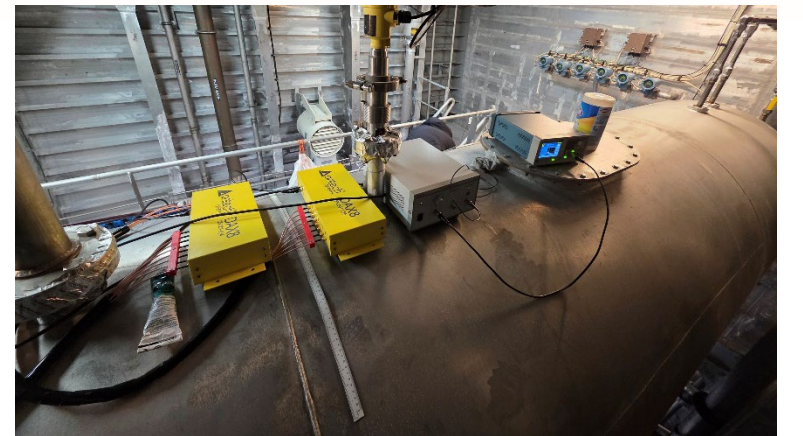
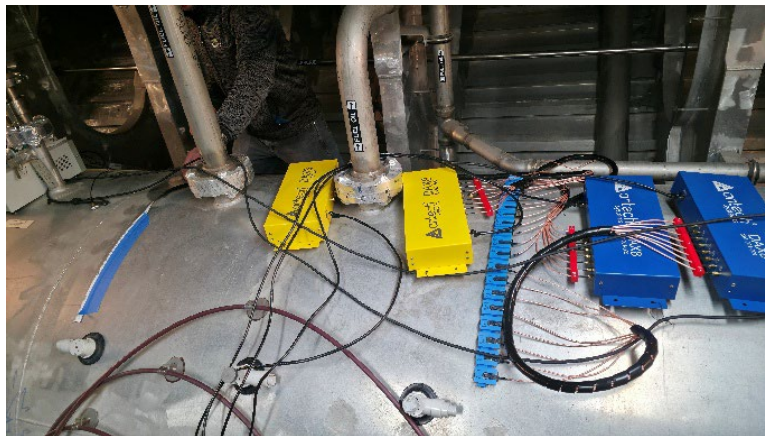
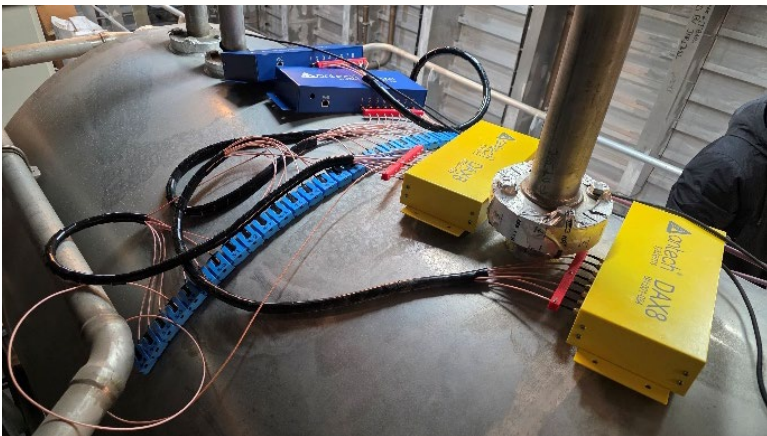
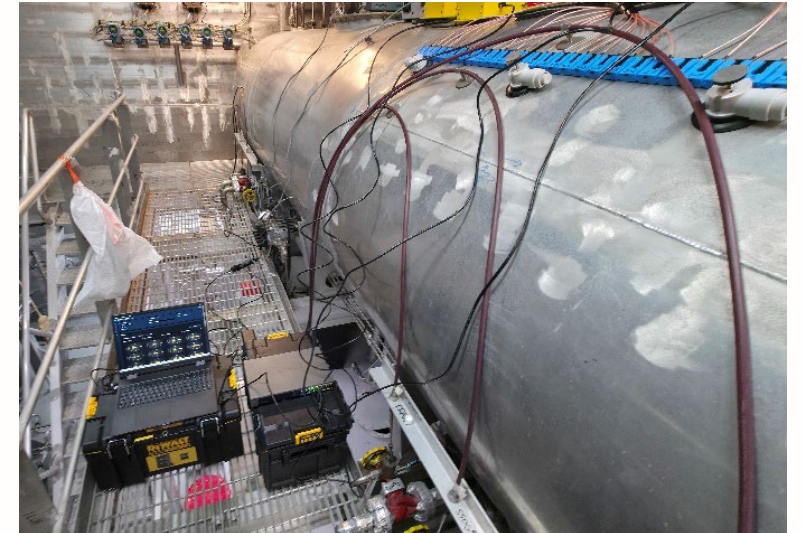
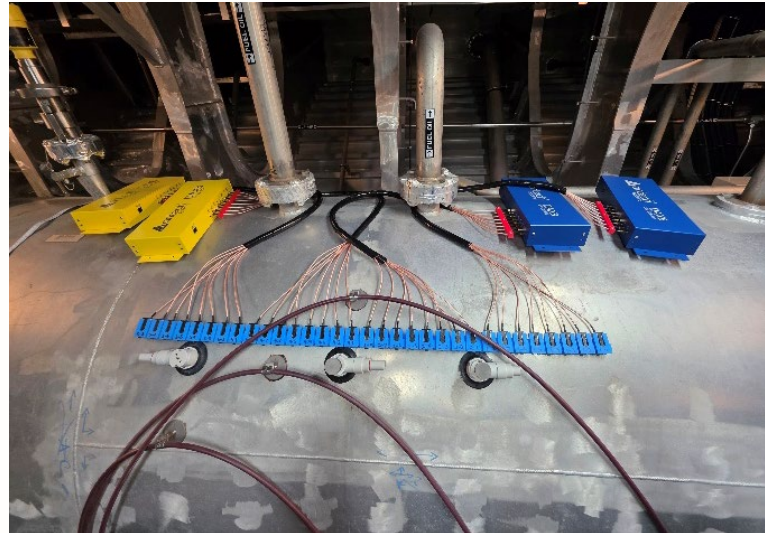
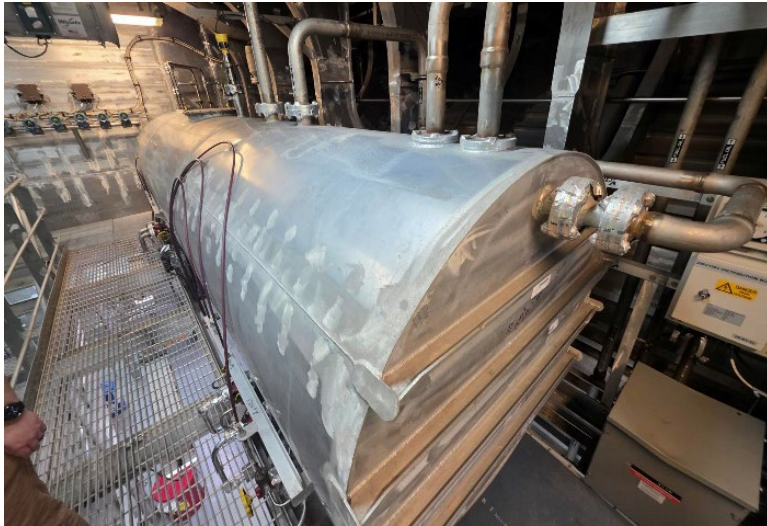
► SHIPBOARD TESTING



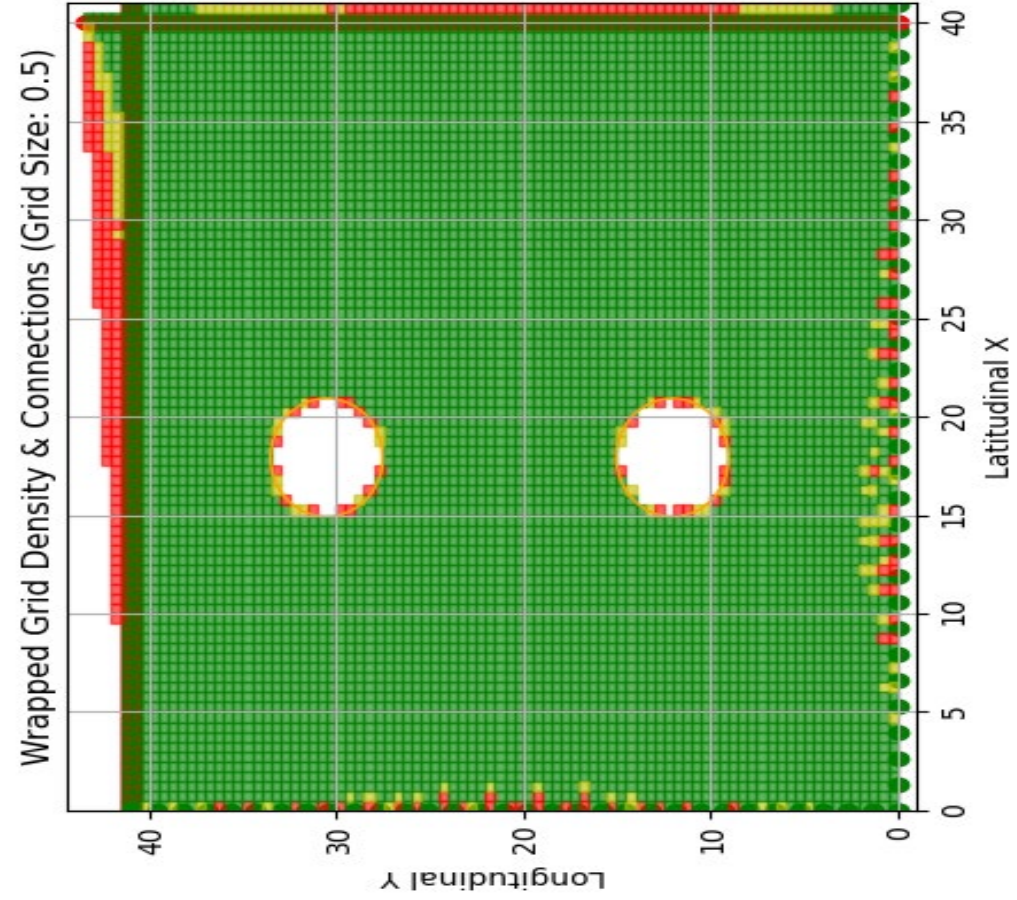
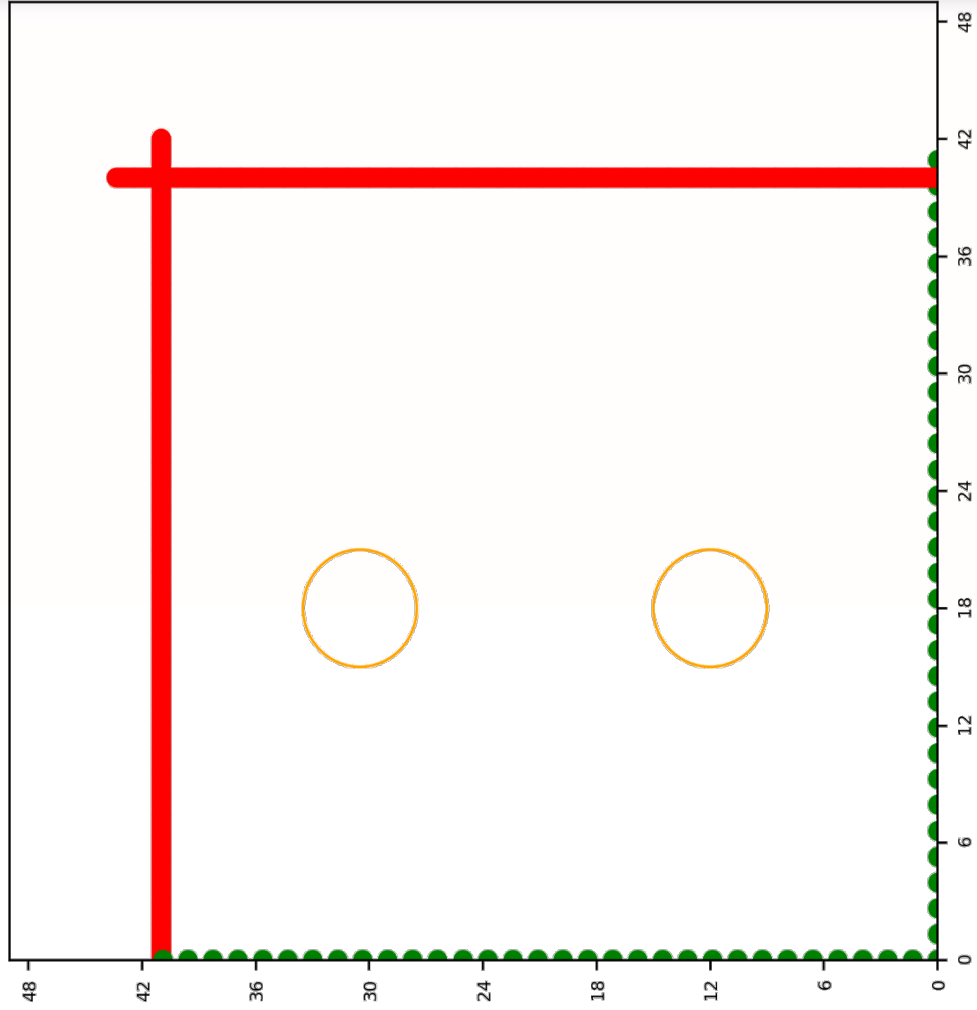
▶ TRANSPORT



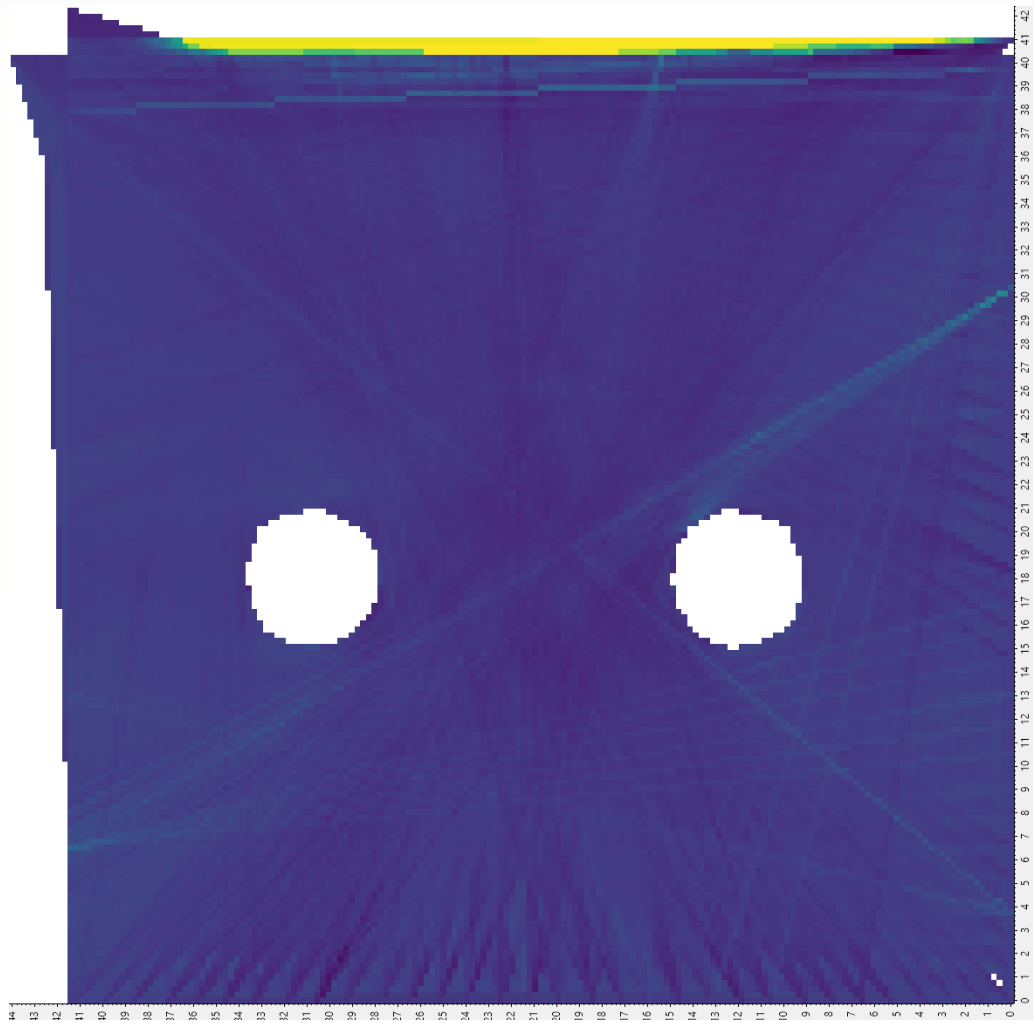
► TEST LOCATION



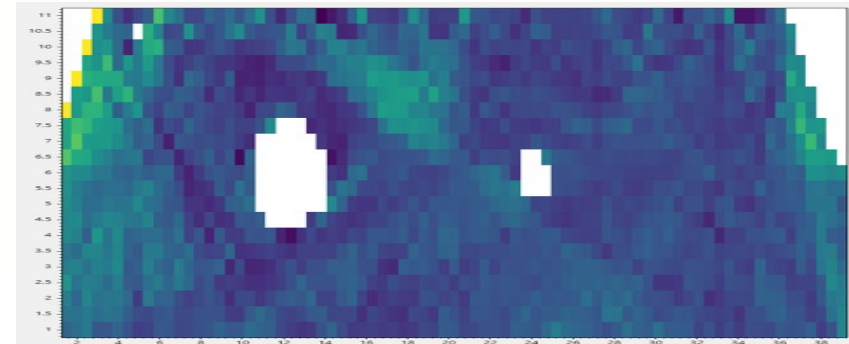
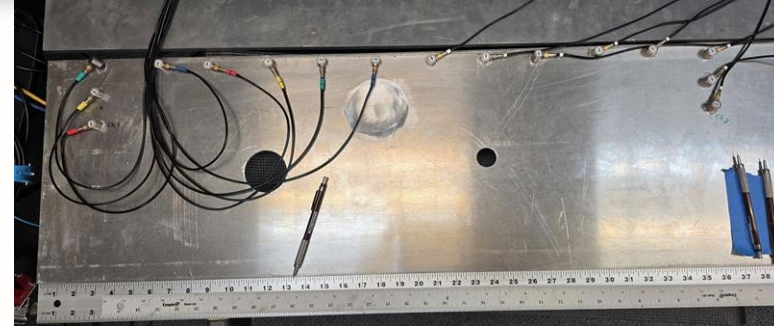
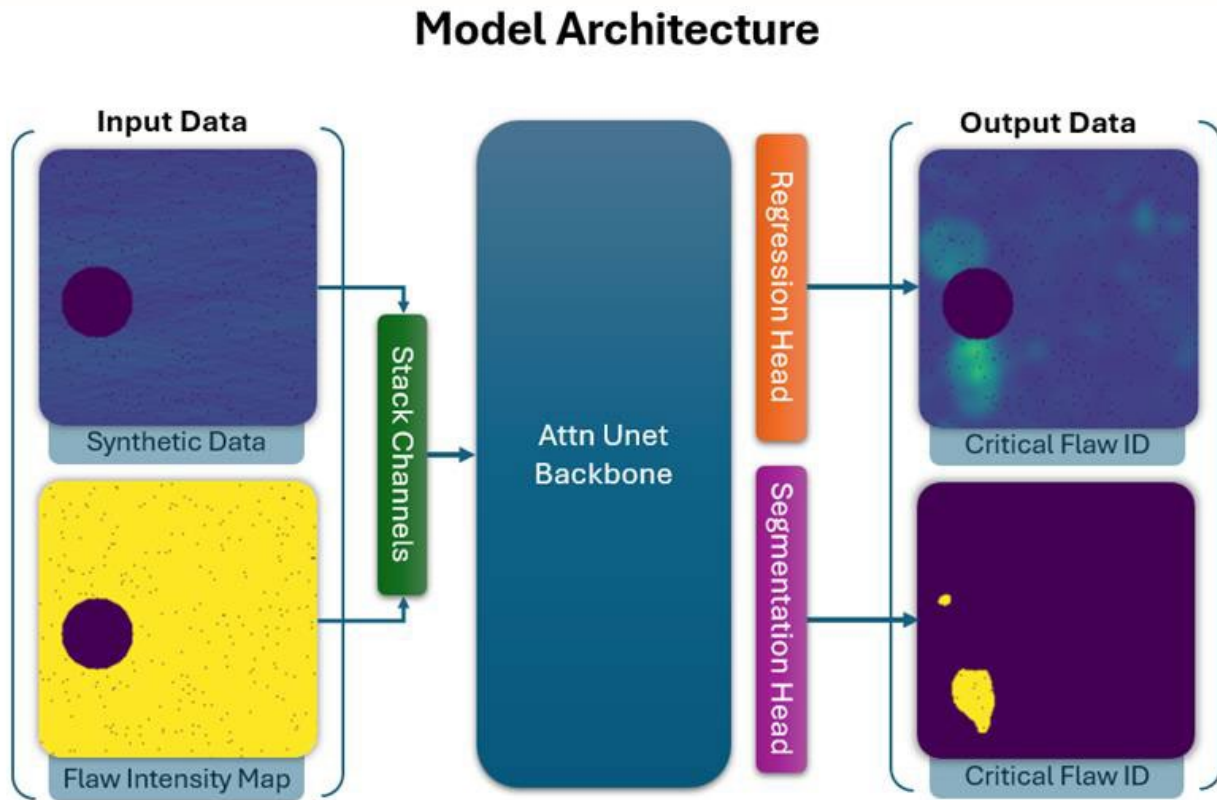
► SHIPBOARD TEST SETUP



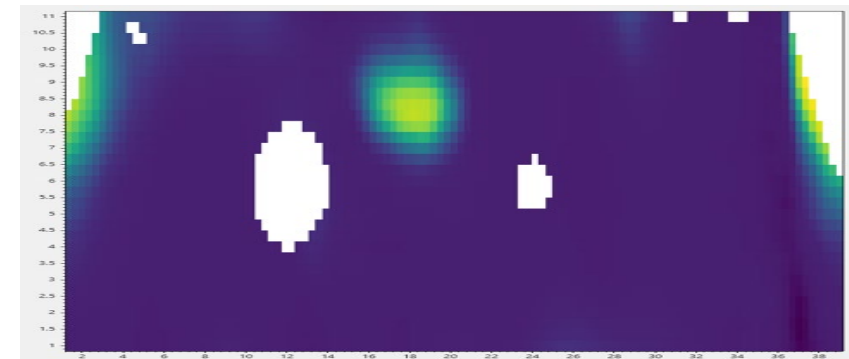
▶ SHIPBOARD TEST RESULTS



▶ AI FOR TOMOGRAPHY ENHANCEMENT

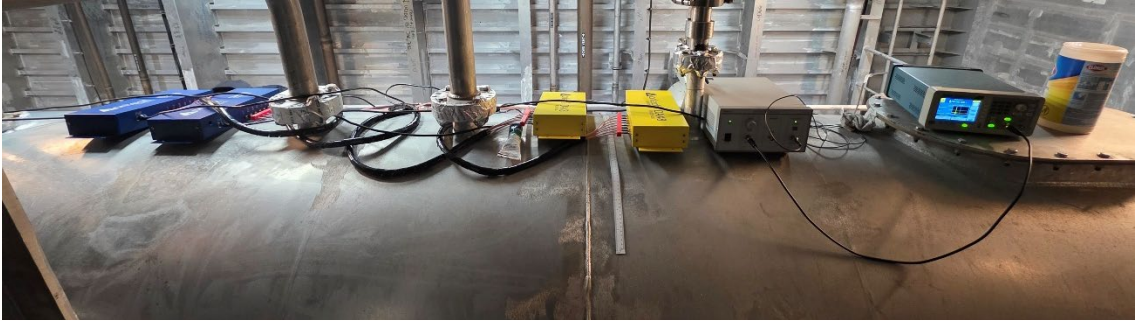


Base Tomography



AI Enhanced

► FINAL THOUGHTS



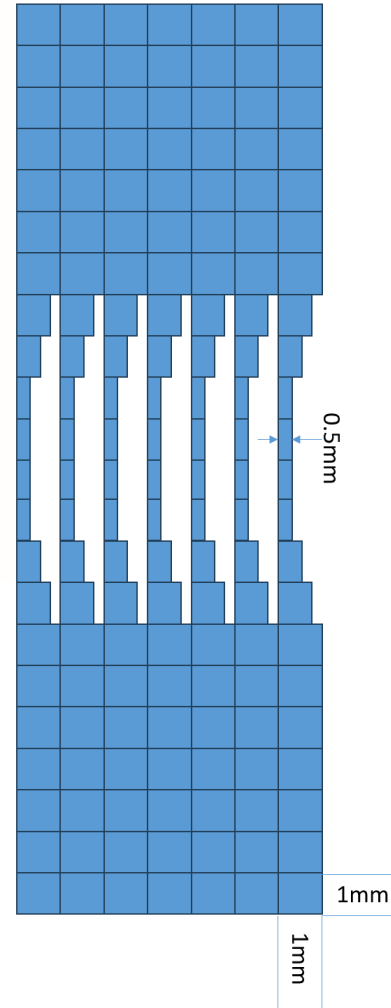
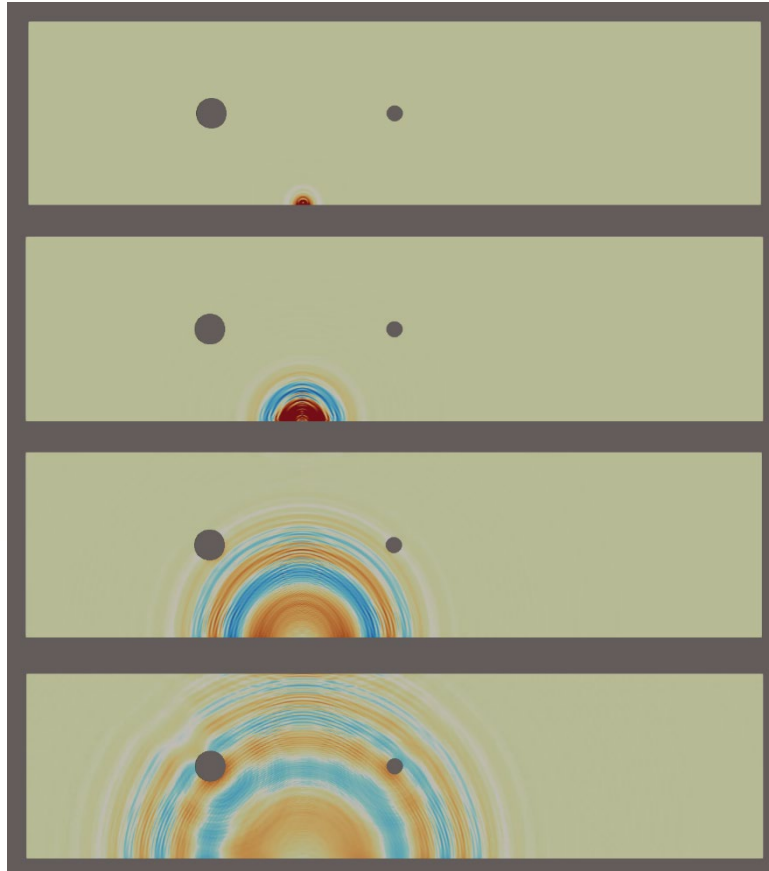
- ▣ Antech's Active UMI can scan a plate with a penetration
- ▣ UI and analysis to be incorporated into main product line
- ▣ Work continues on AI and Tomography
- ▣ Looking forward to work on bends and elbows

▶ **THANK YOU**

► PACKING LIST

- ▣ 4 Antech DAX8
- ▣ 1 Power of Ethernet 32 port high wattage switch
- ▣ 1 Ultrasonic Arbitrary Function Generator
- ▣ 1 Ultrasonic 200V amplifier
- ▣ 1 Core i9 Laptop
- ▣ 32 950Hz piezoelectric transducers and cables
- ▣ 1 255/455 kHz Piezoelectric transducer to connect to active source and cables
- ▣ 32 segments Antech custom 3D printed sensor mounts
- ▣ 3 high tension suction cups
- ▣ 1 250 WHr class battery with AC inverter
- ▣ 5 10ft CAT-6 network cables
- ▣ 1 tube of vacuum grease
- ▣ Rulers, tape measurers, levels
- ▣ Painters and Duct tape
- ▣ Paper towels and Chlorox wipes

► TASK 1: EFIT - FEA



- ▣ Developed simulation package using EFIT methodology
- ▣ Ran simulations of the plate to understand wave propagation around penetrations
- ▣ Developed methodology for showing thinning

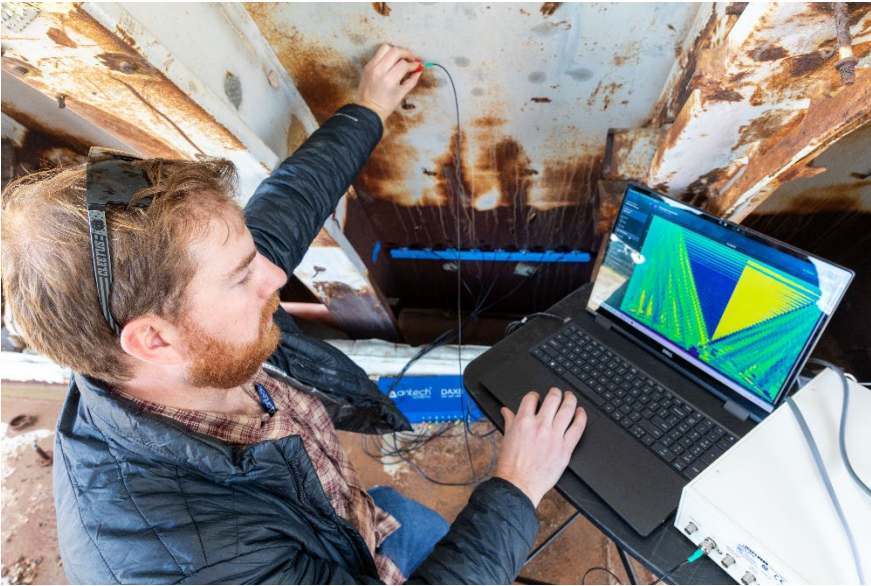
▶ LESSONS FROM SIMULATION

- ▣ Receiving transducers will get coherent Lamb signal
- ▣ Signal will have traveled different distances, and phases will interfere
 - Assume our analysis will be able to find a solution
 - Solution will be wrong
 - Location in Tomography will be wrong
- ▣ Farther from source will have interference arriving with direct shear waves
 - Will complicate other analysis
 - Require focus on initial SO Lamb mode

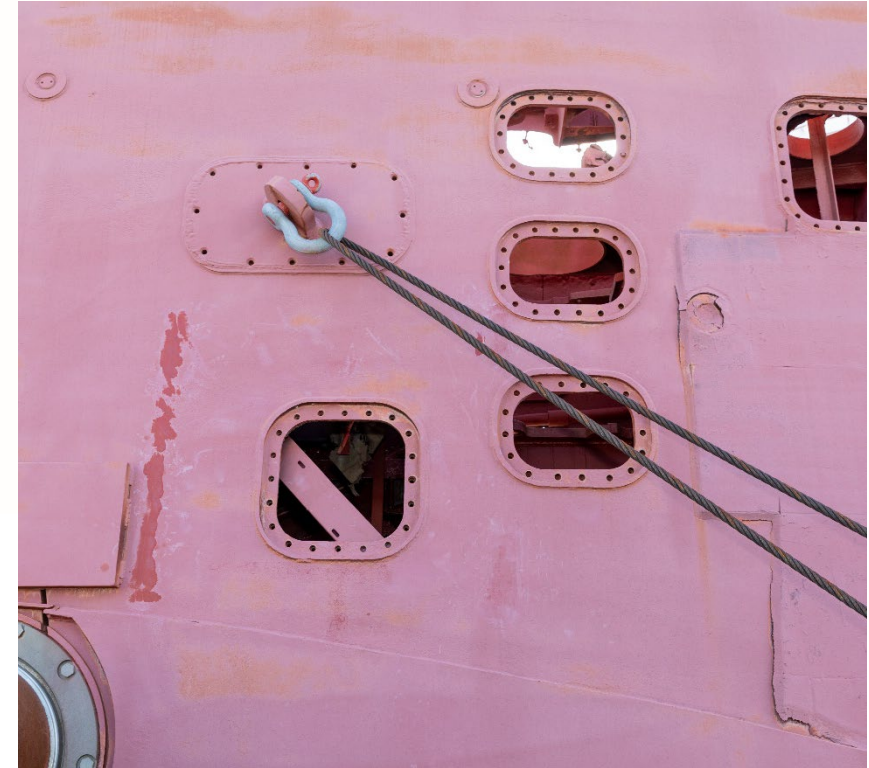
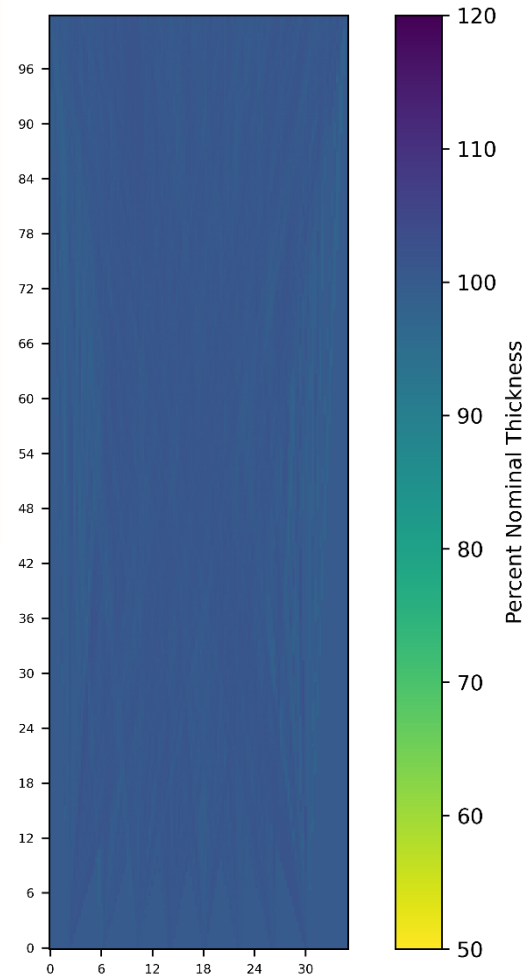
▶ LESSONS FROM UI PROTOTYPING

- ▣ Having density maps helps planning
- ▣ Keep it simple for fielding
- ▣ Can optimize time, sensor count, and layout for specific scan

► FIELD TESTING AT NNSY



- Went to test parts of a decommissioned sub hull and sail
- Able to test wall plates, but unable to find testable location of a penetration

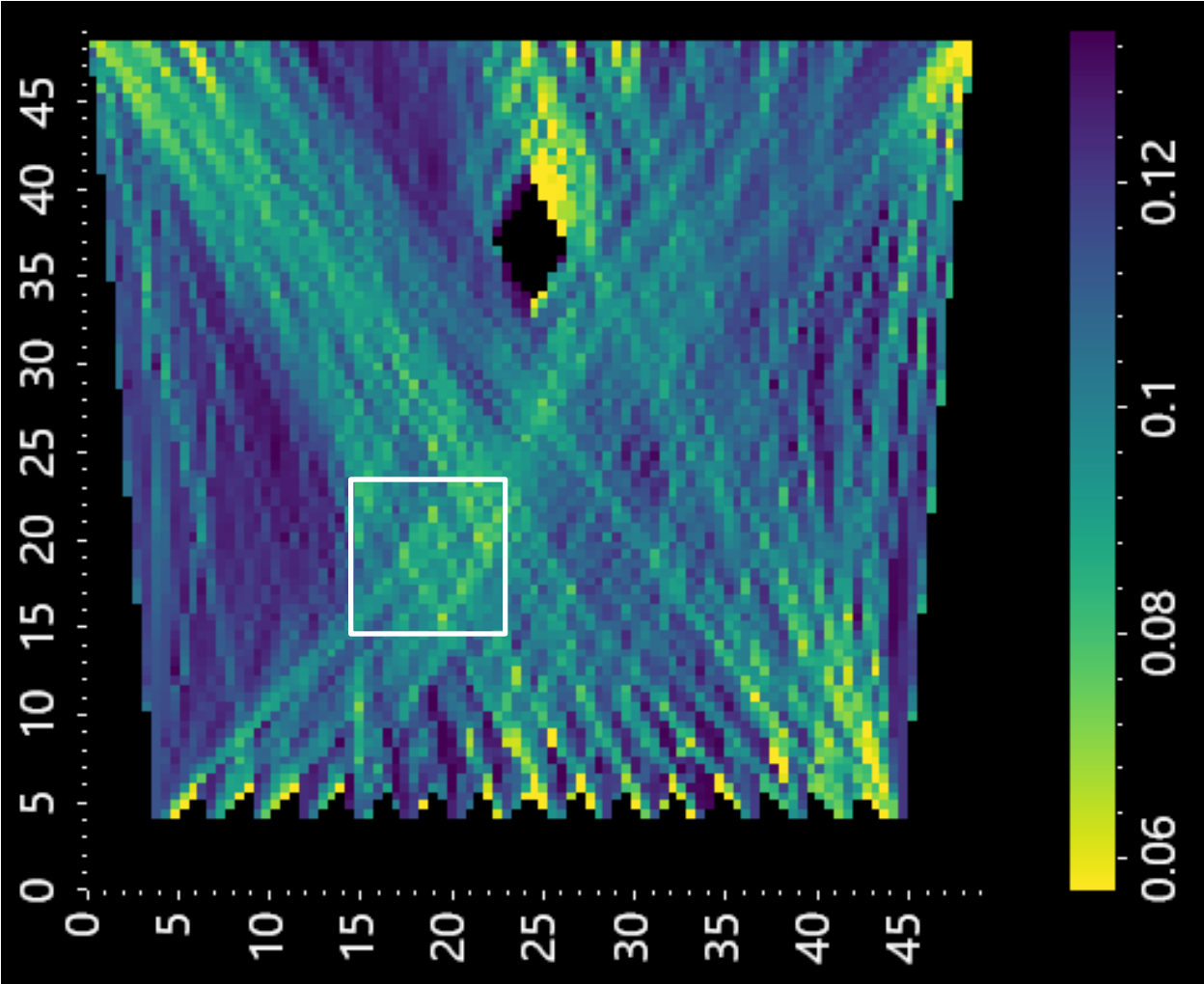


▶ TESTING LESSONS LEARNED

- ▣ System worked in Lab, Field, and Shipboard
- ▣ System worked on steel and aluminum plates and tanks
- ▣ New tasks added for our software development team
- ▣ Hardware for 32 sensors, active sources, can fit through small hatches

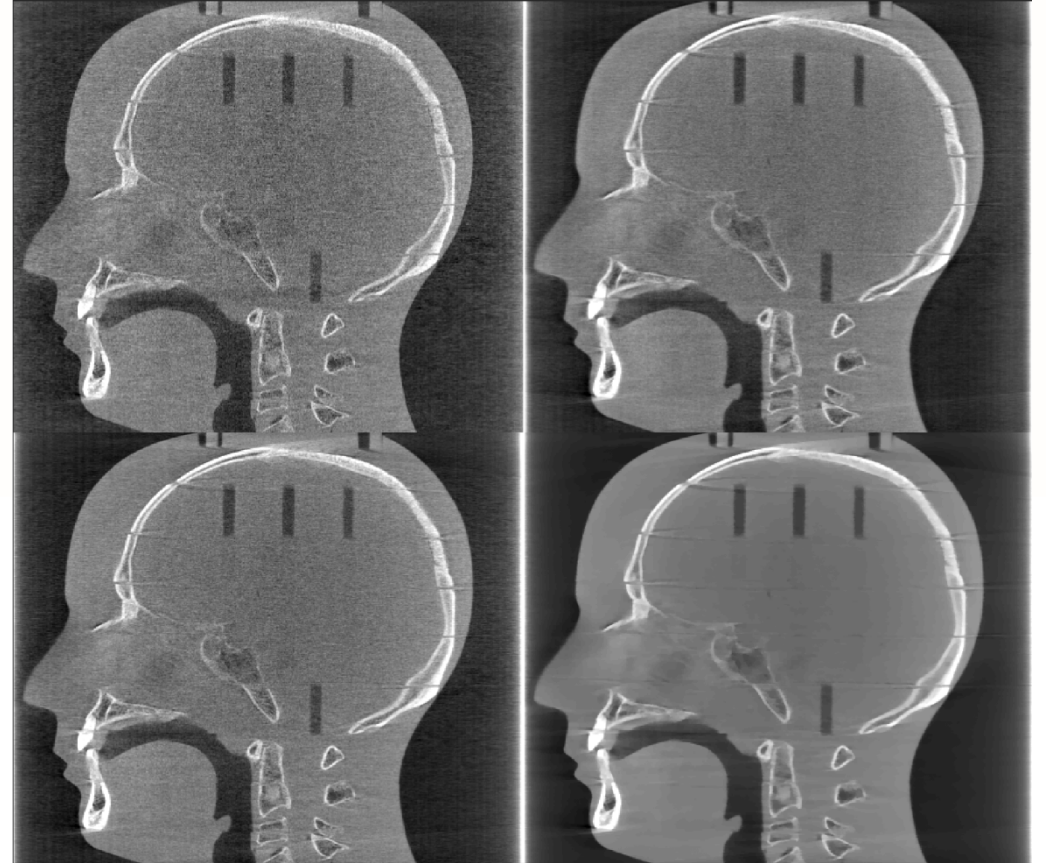
- ▣ Need ability to change trigger sensor on a board to non-obstructed sensor

▶ ADDITIONAL TASK: TOMOGRAPHY



► UMI TOMOGRAPHY – TIGRE INTEGRATION

- Tomographic Iterative GPU-based REconstruction Toolbox
- TIGRE's creation was supported by CERN
- Enables many reconstruction techniques
- **Free and open source, actively maintained**



► UMI TOMOGRAPHY & TIGRE INTERFACE

- Many new tomographic reconstruction algorithms are now possible
- Enhancement can be tailored to data

The screenshot displays the UMI Helical Tomography with TIGRE Integration software interface. The 'Algorithm' dropdown menu is open, showing a list of algorithms including Ossart, Sart, and Fdk. A red arrow points to the 'Ossart' option. The interface also shows a 'Preview' window displaying a 2D tomographic reconstruction of a cylindrical object, with a color scale ranging from 0.45 to 1.3. The software title bar reads 'UMI Helical Tomography with TIGRE Integration'.