Phased Array ultrasonic inspection in the Aerospace community

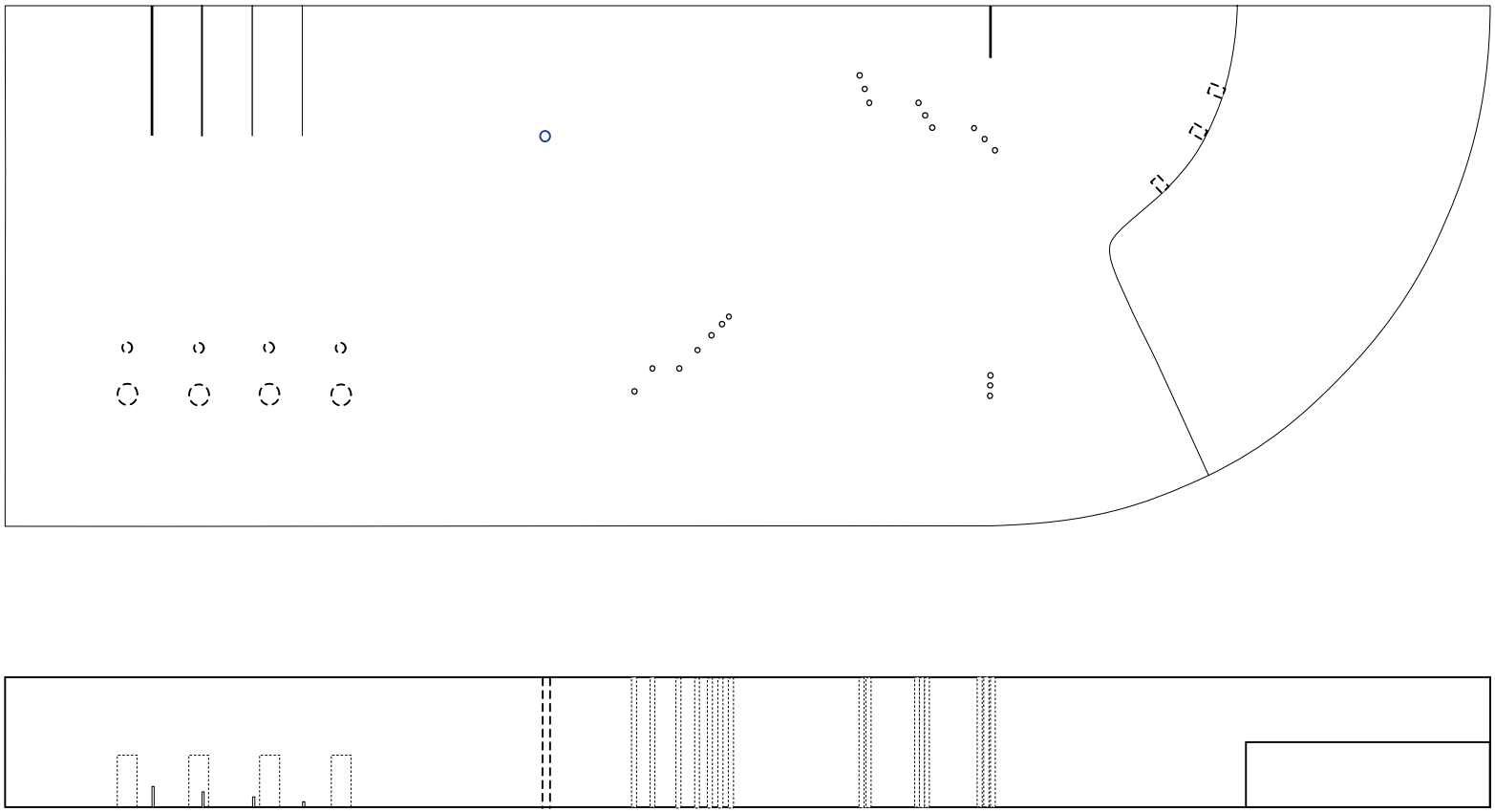
"Is there really any value to multiple angle manual ultrasonic inspection ?"

imagination at work

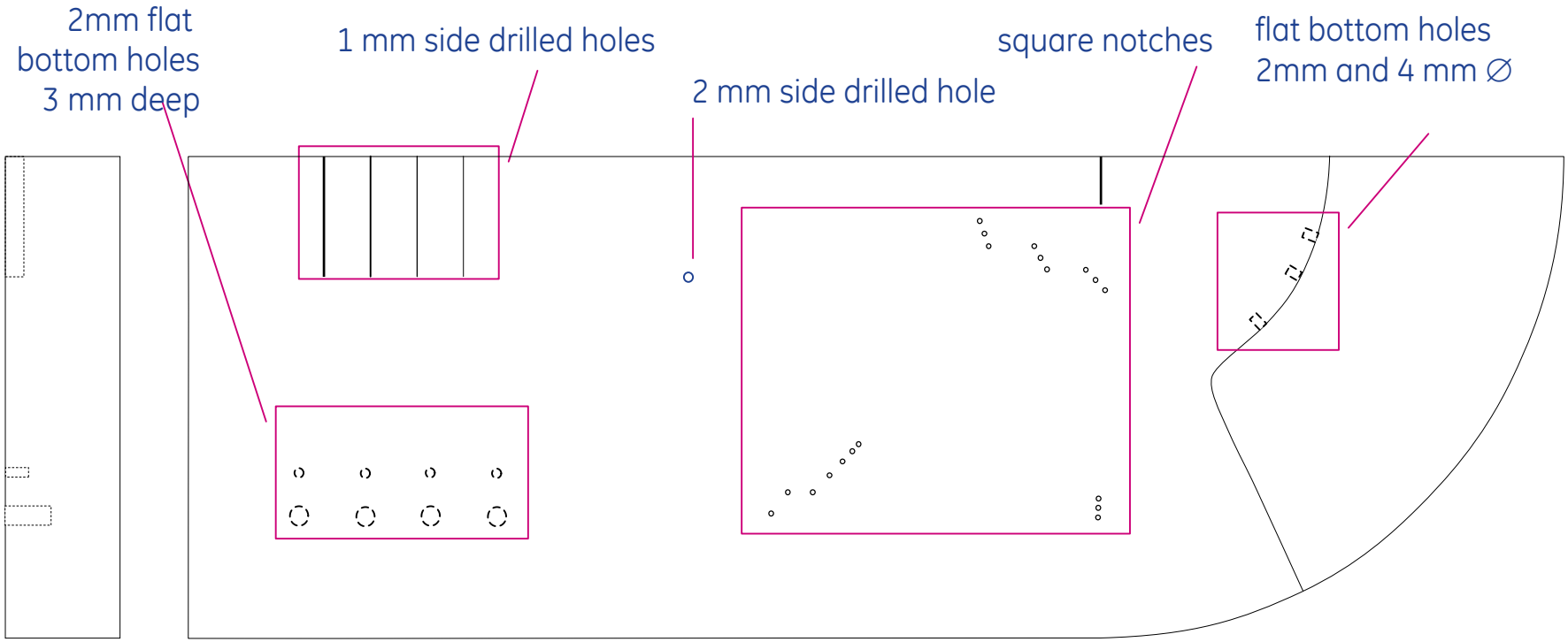
Exercise

- Create a test block depicting defects in Aluminum
  - Patterned after IIW Type II or V1
- Choose conventional and phased array probe
- Select areas of interest

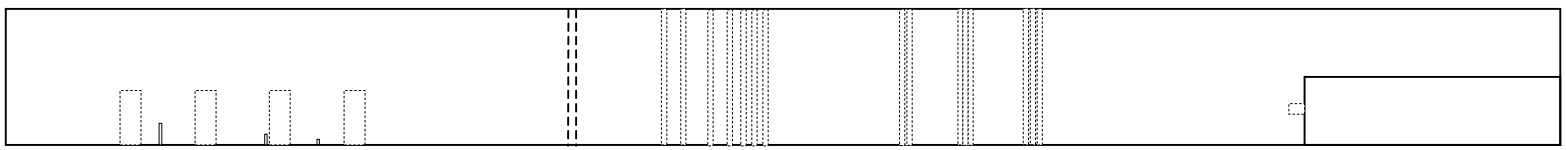
Phased Array test Block



Description



Material: Aluminium

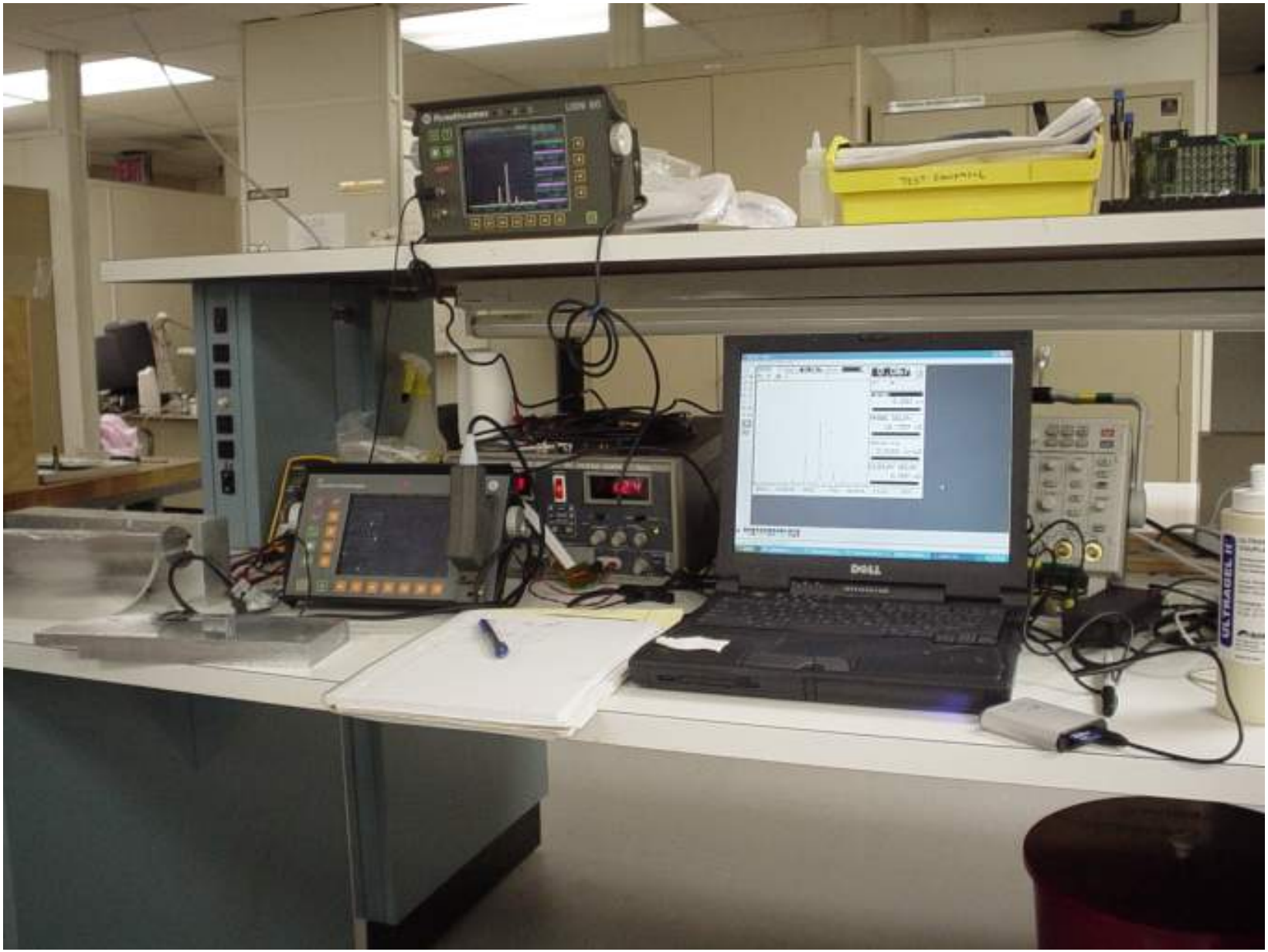


Equipment used -

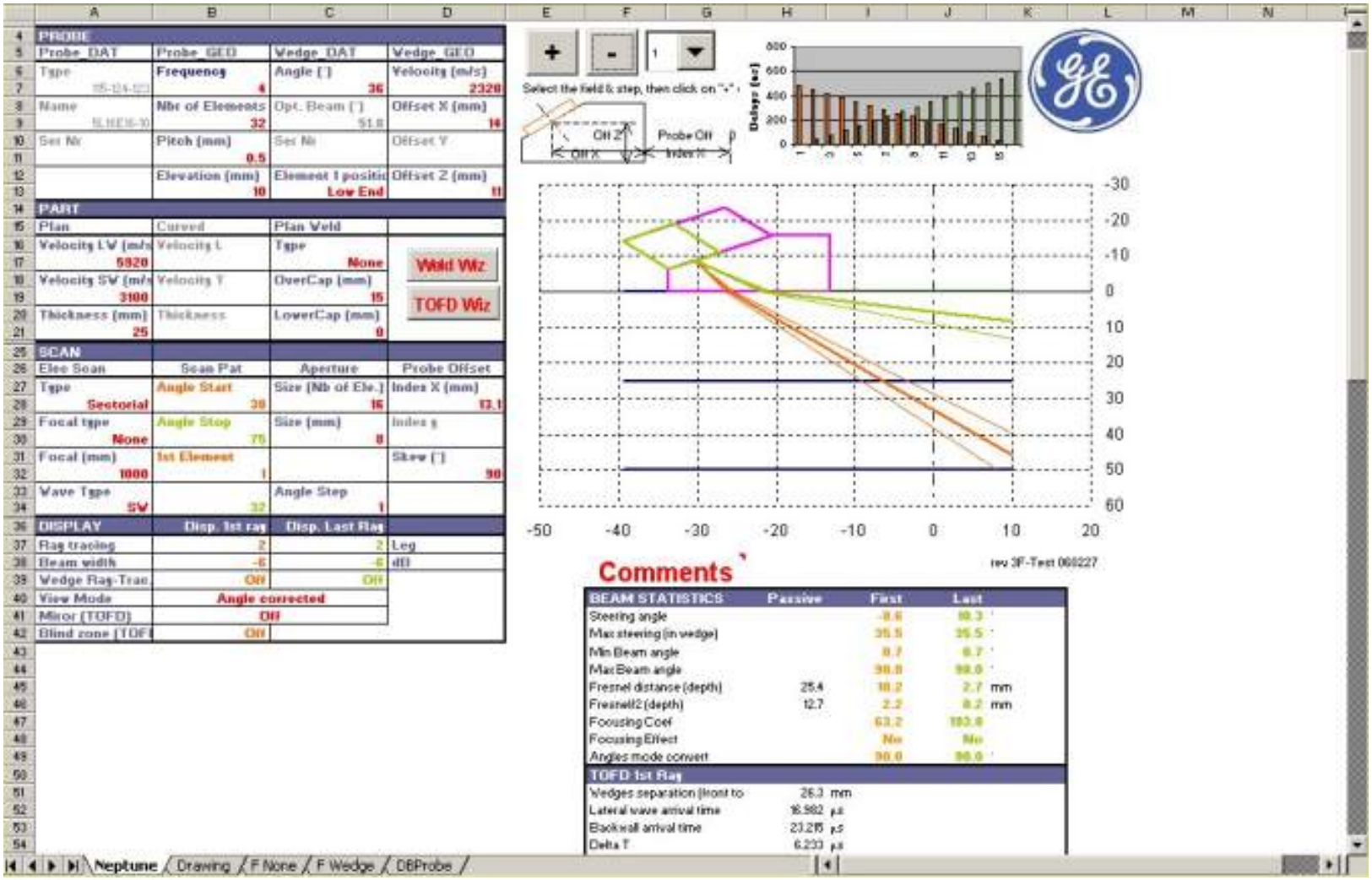
- MWB 70 – 4 – fixed wedge angle beam probe conventional shear wave probe
- MWBPA-5- detachable wedge 32 element 0.5mm, pitch 10 mm elevation – 16 element aperture phased array probe
- USN60 conventional flaw detecto
- Phasor XS Portable PA
- UltraDoc vers. 4.42 Software
- GE Modeling Excel Sheet

imagination at work

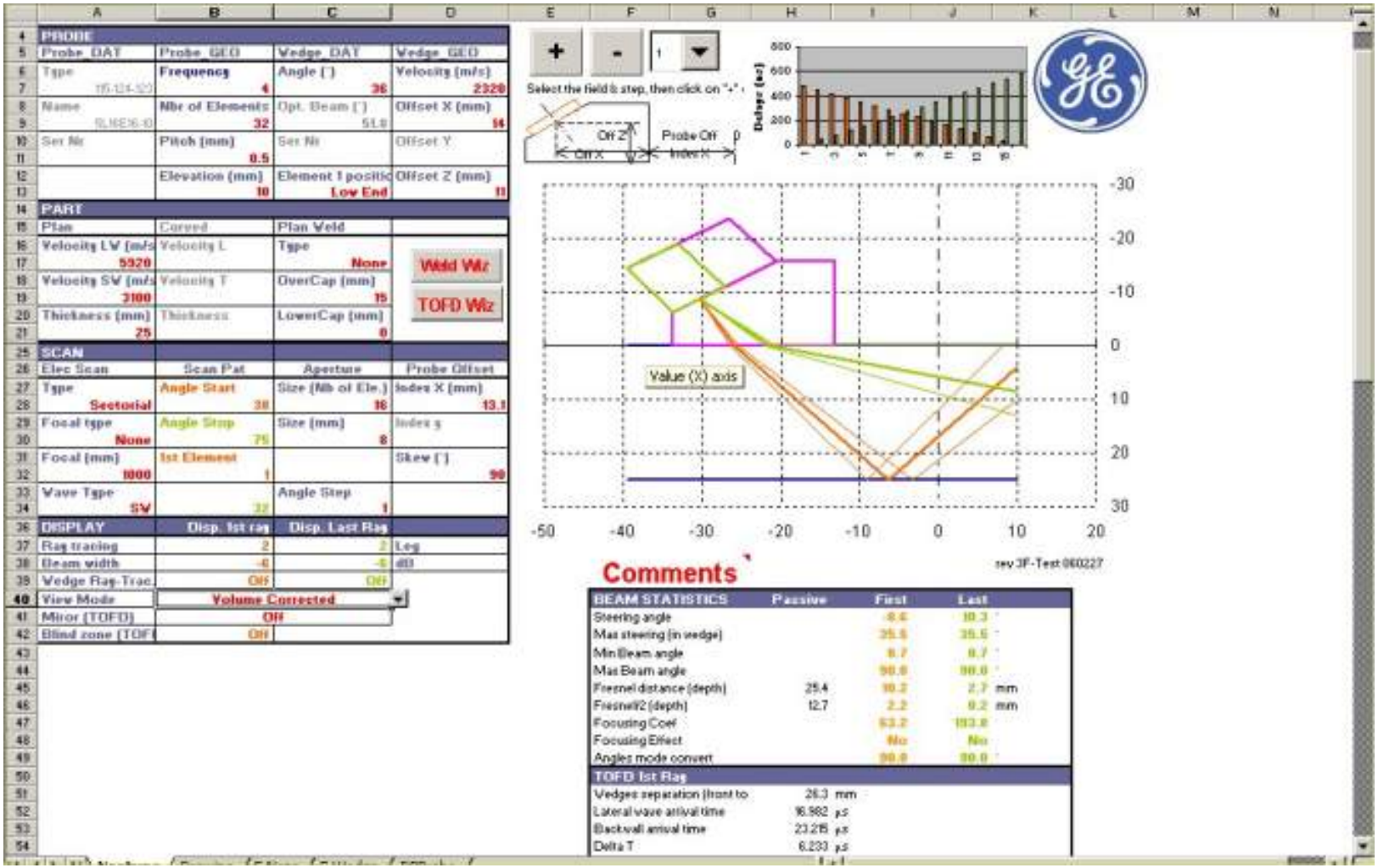
The block


DELL

GE Modeling Tool – Excel Spreadsheet
Angle Correction mode



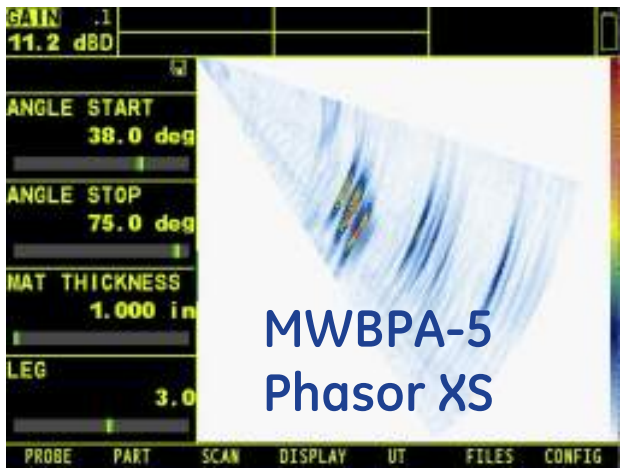
GE Modeling Tool – Excel Spreadsheet
Volume Correction Mode

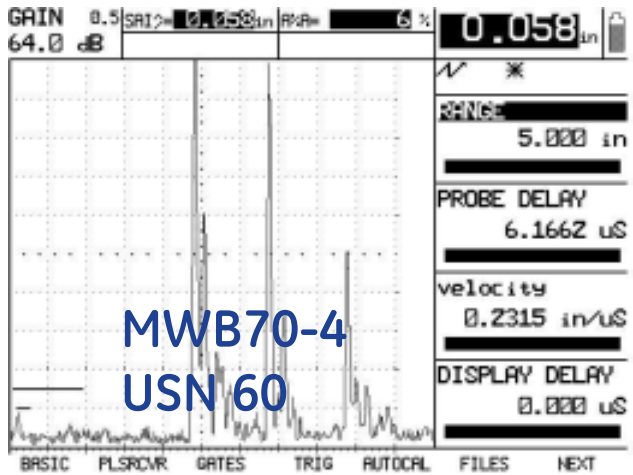


Method

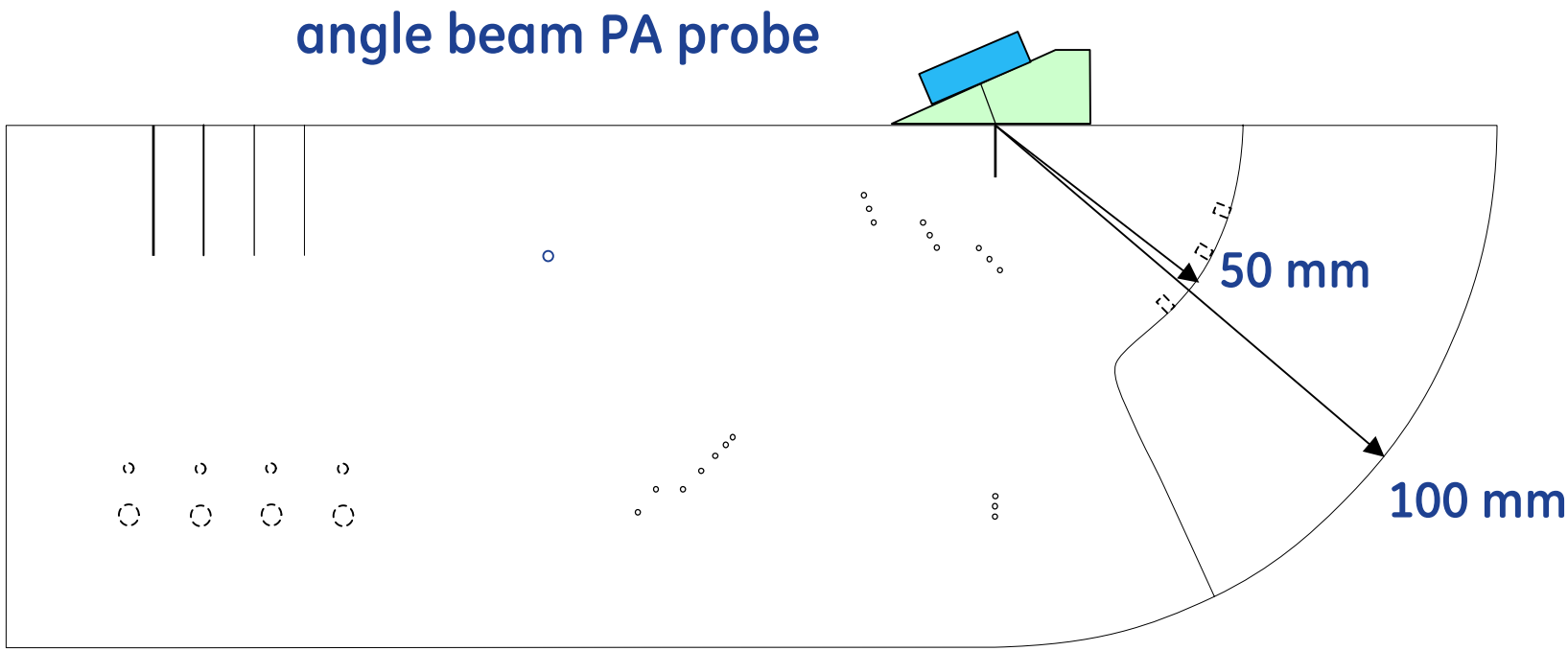
- Model the Beam from Phased array probe
- Place fixed angle conventional probe and phased array probe in same position on the block.
- Record display, compare results.

Subjective comparison and image observation

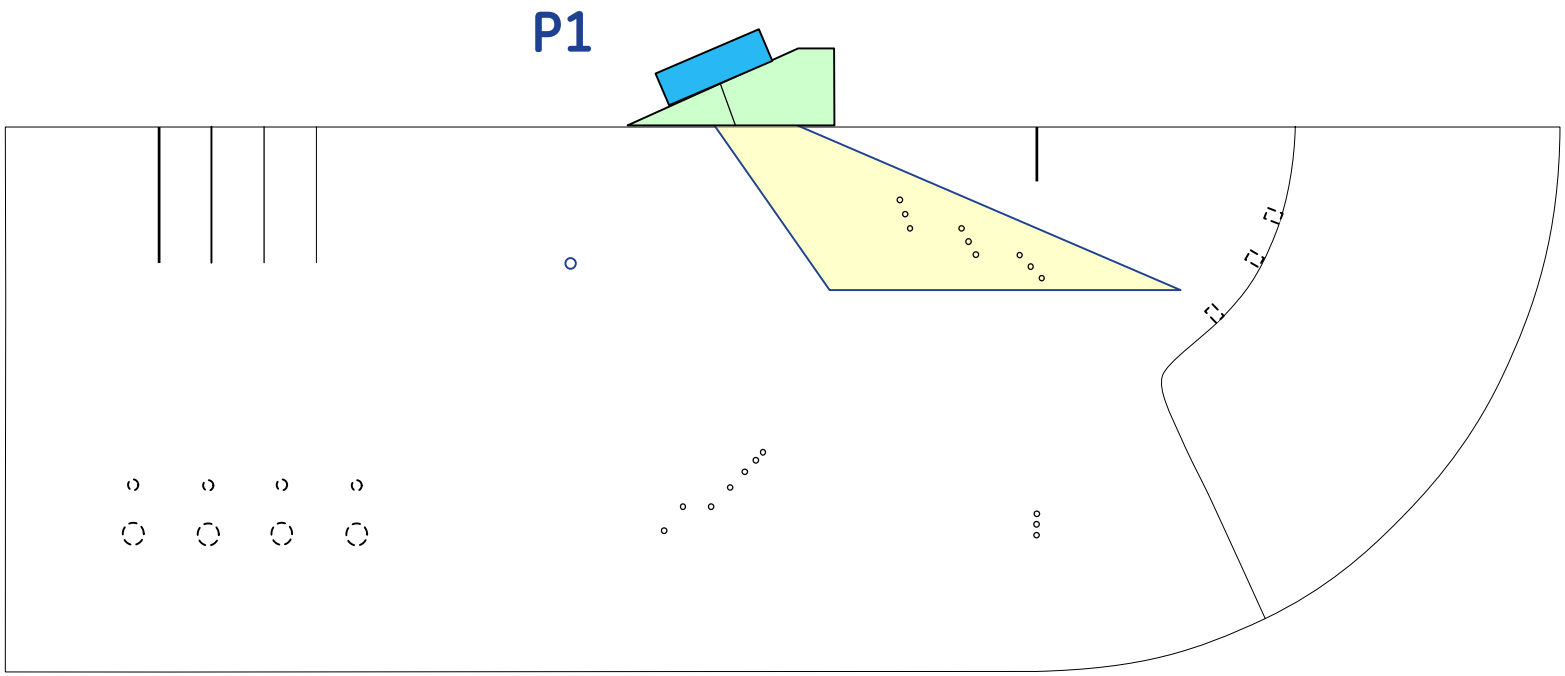




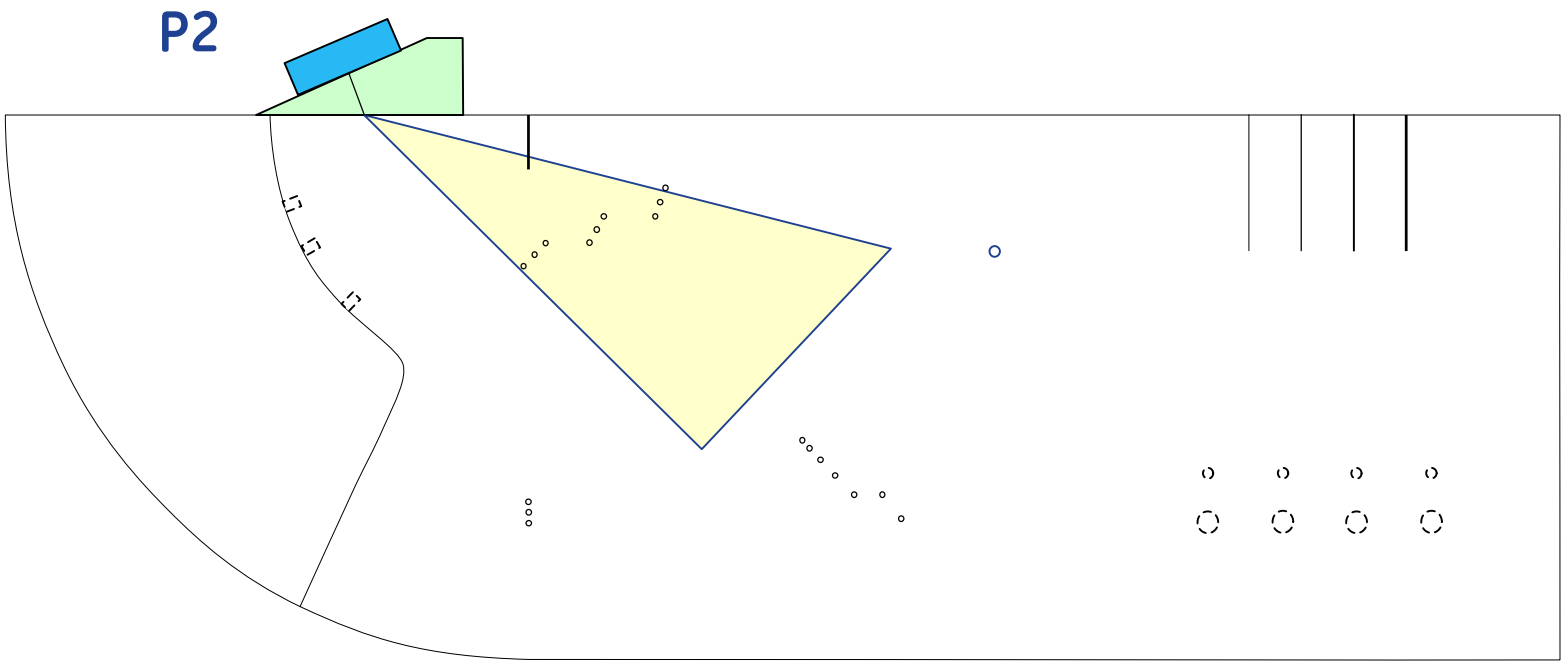
Calibration (angle)



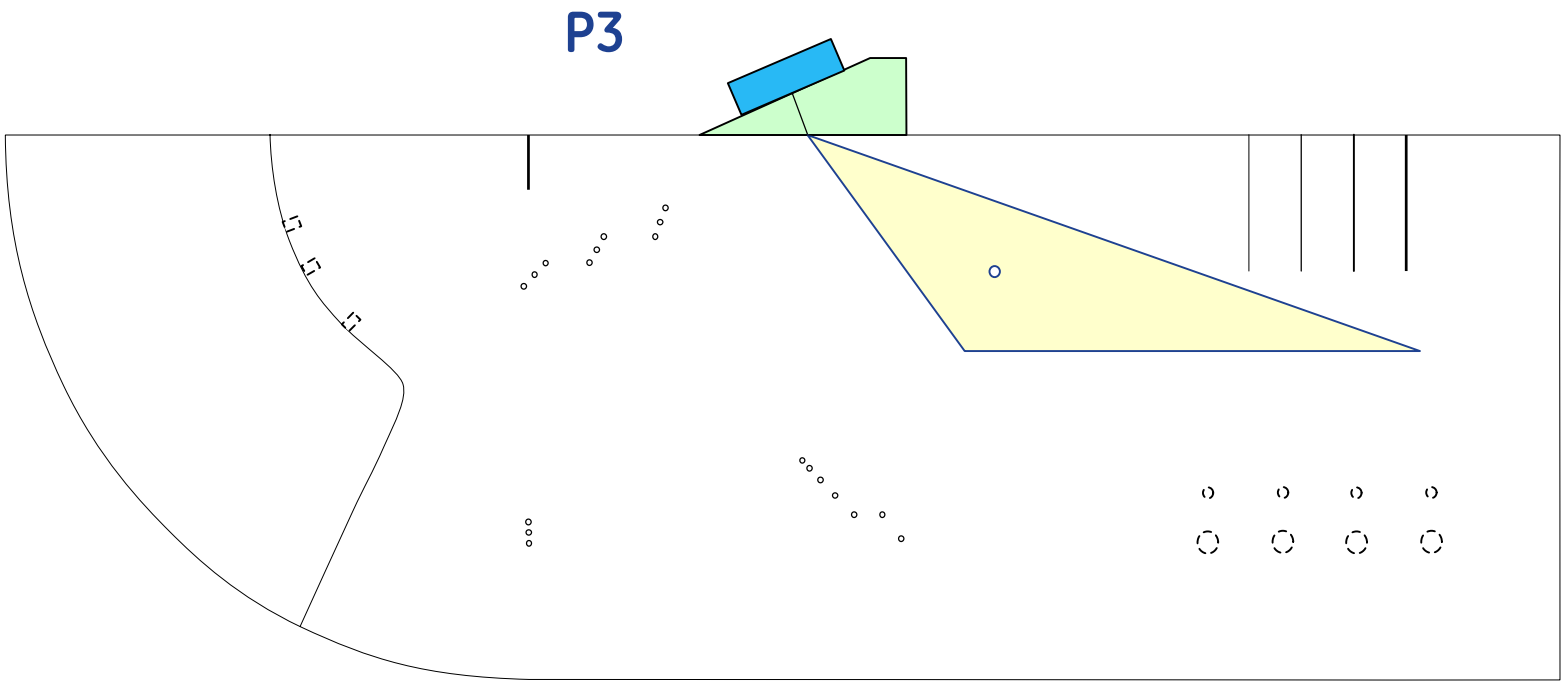
Angle scanning – 38°-75°



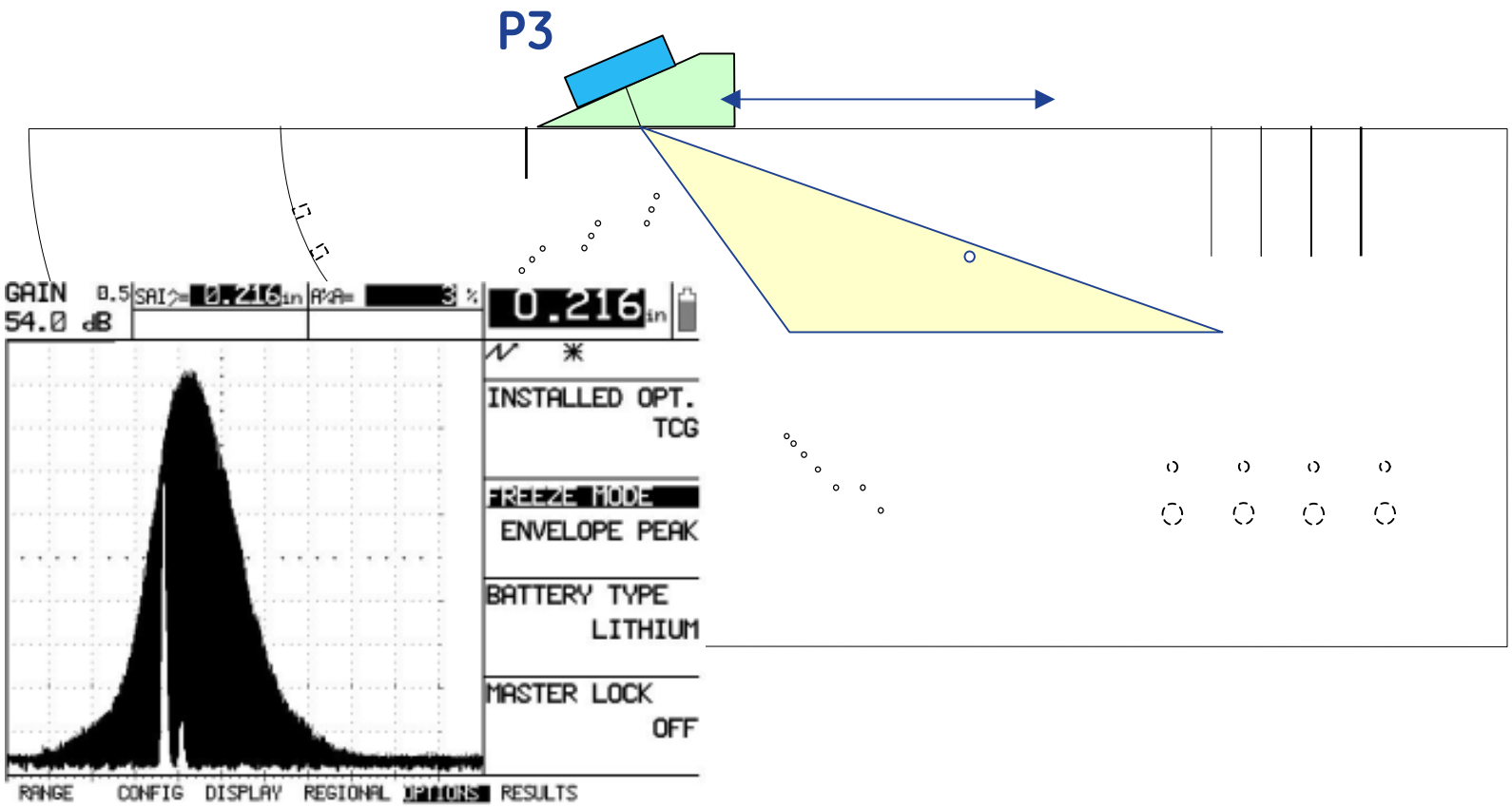
Angle scanning – 38°-75°



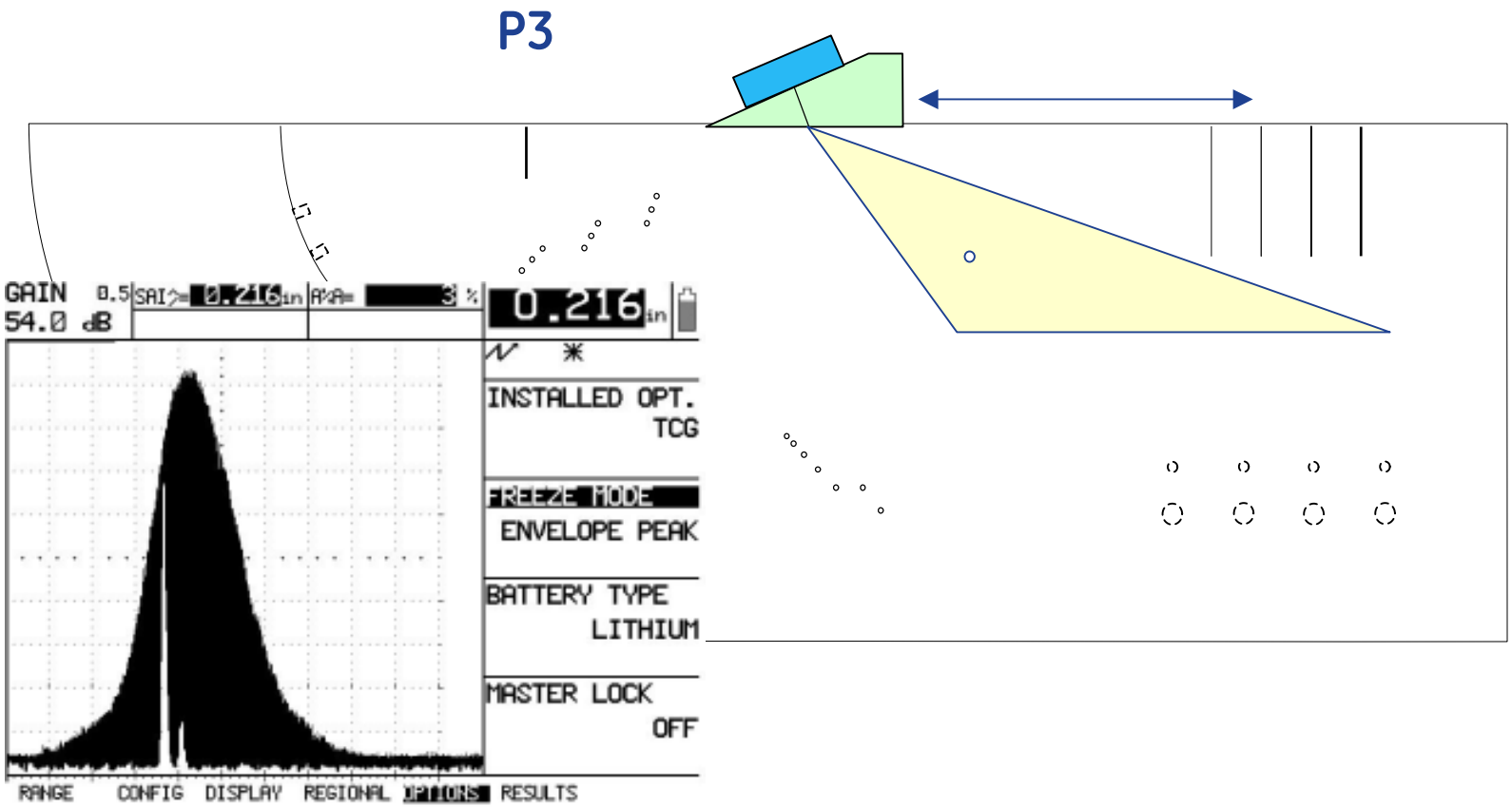
Probe at 2 mm SDH Angle scanning – 38°-75°



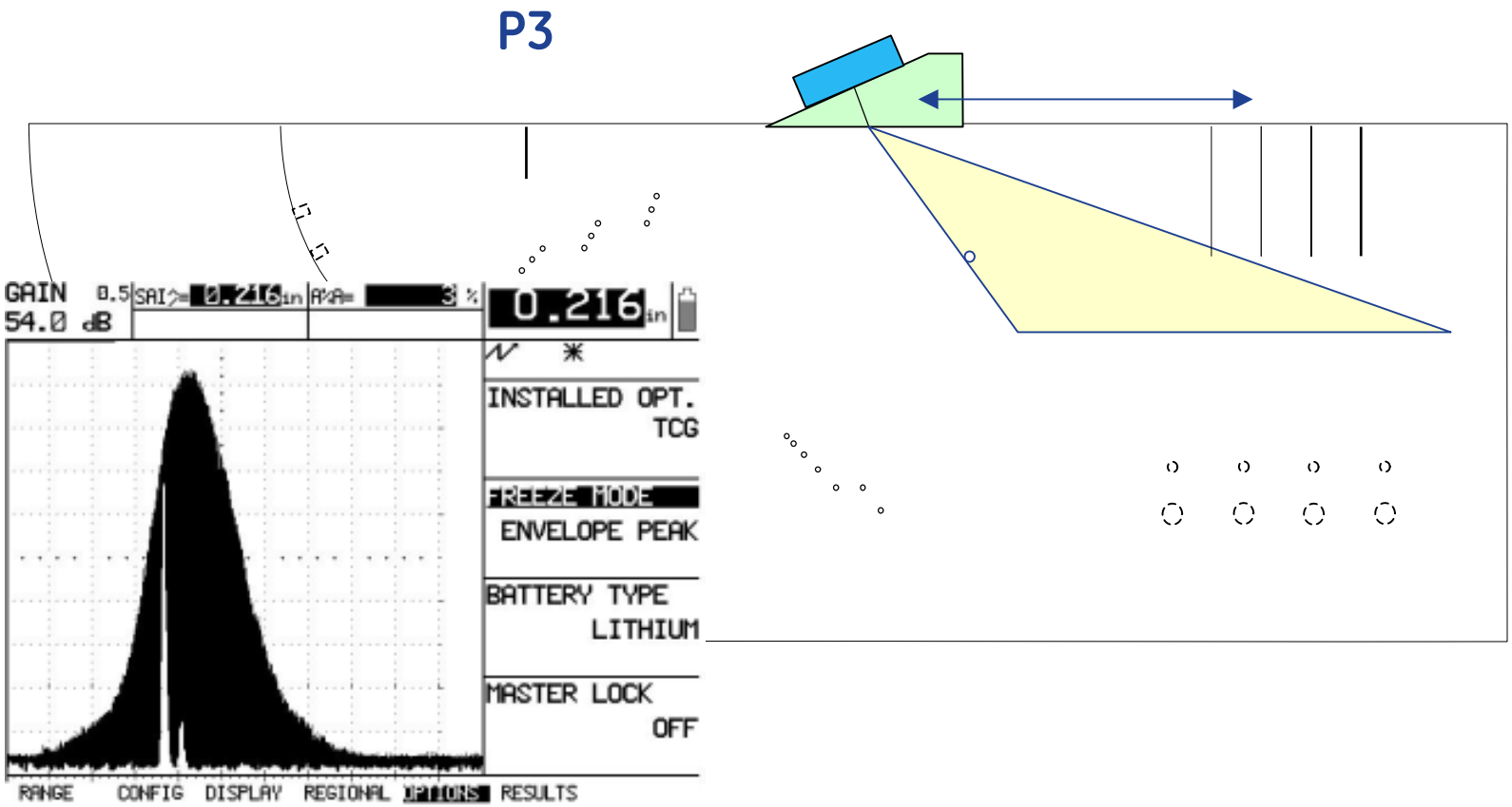
Probe at 2 mm SDH
Conventional probe was scanned forward and back



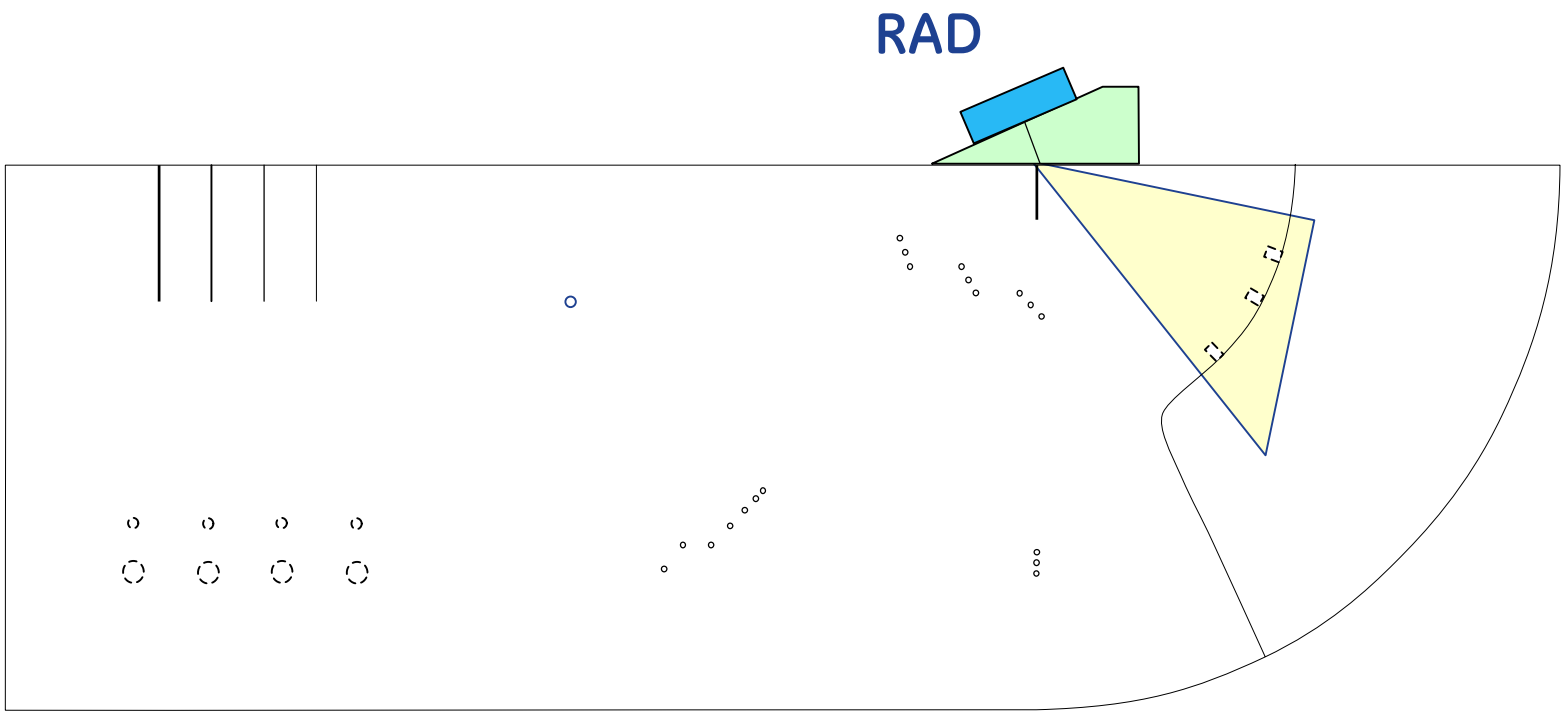
Probe at 2 mm SDH
Conventional probe was scanned forward and back



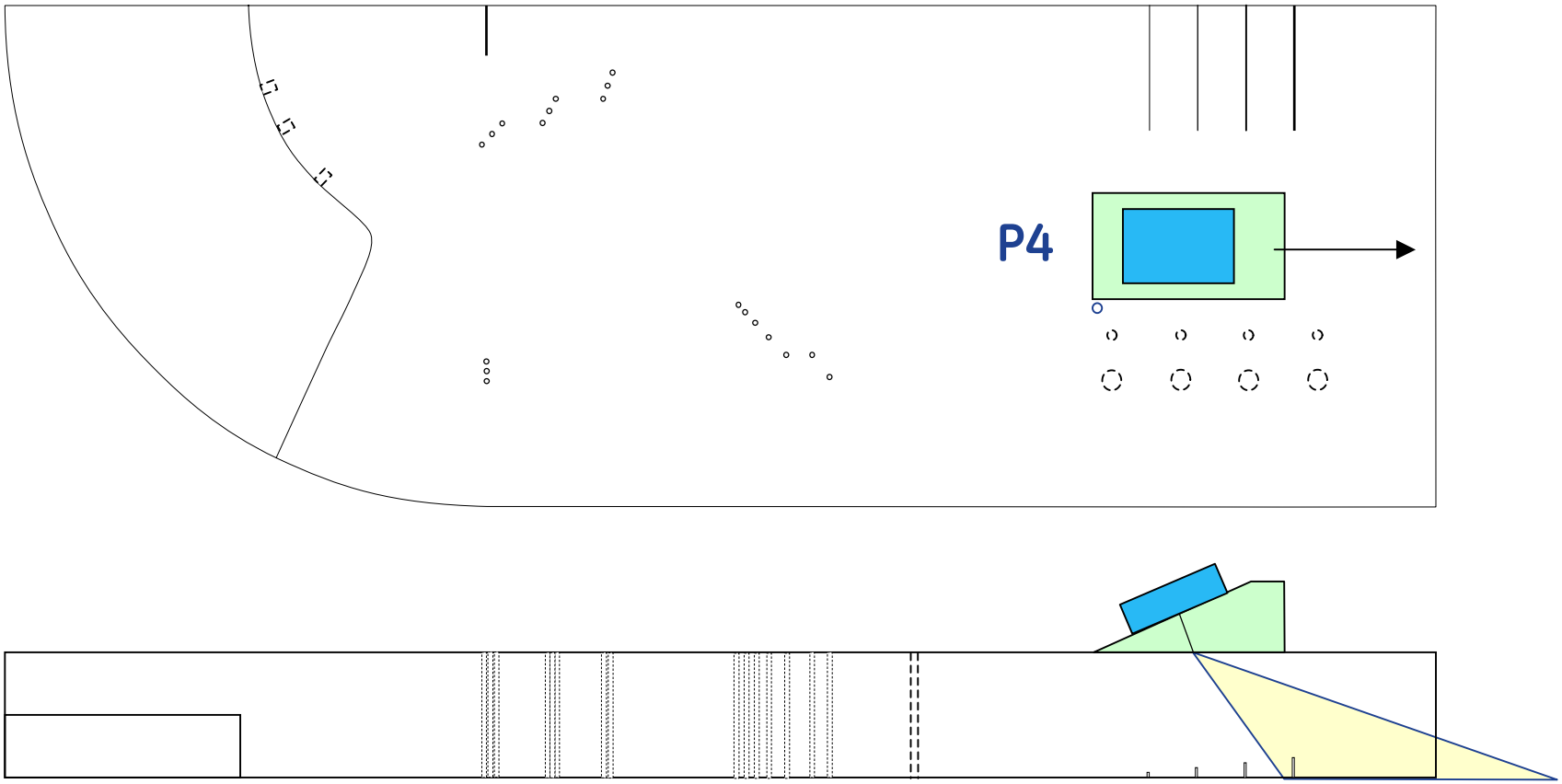
Probe at 2 mm SDH
Conventional probe was scanned forward and back



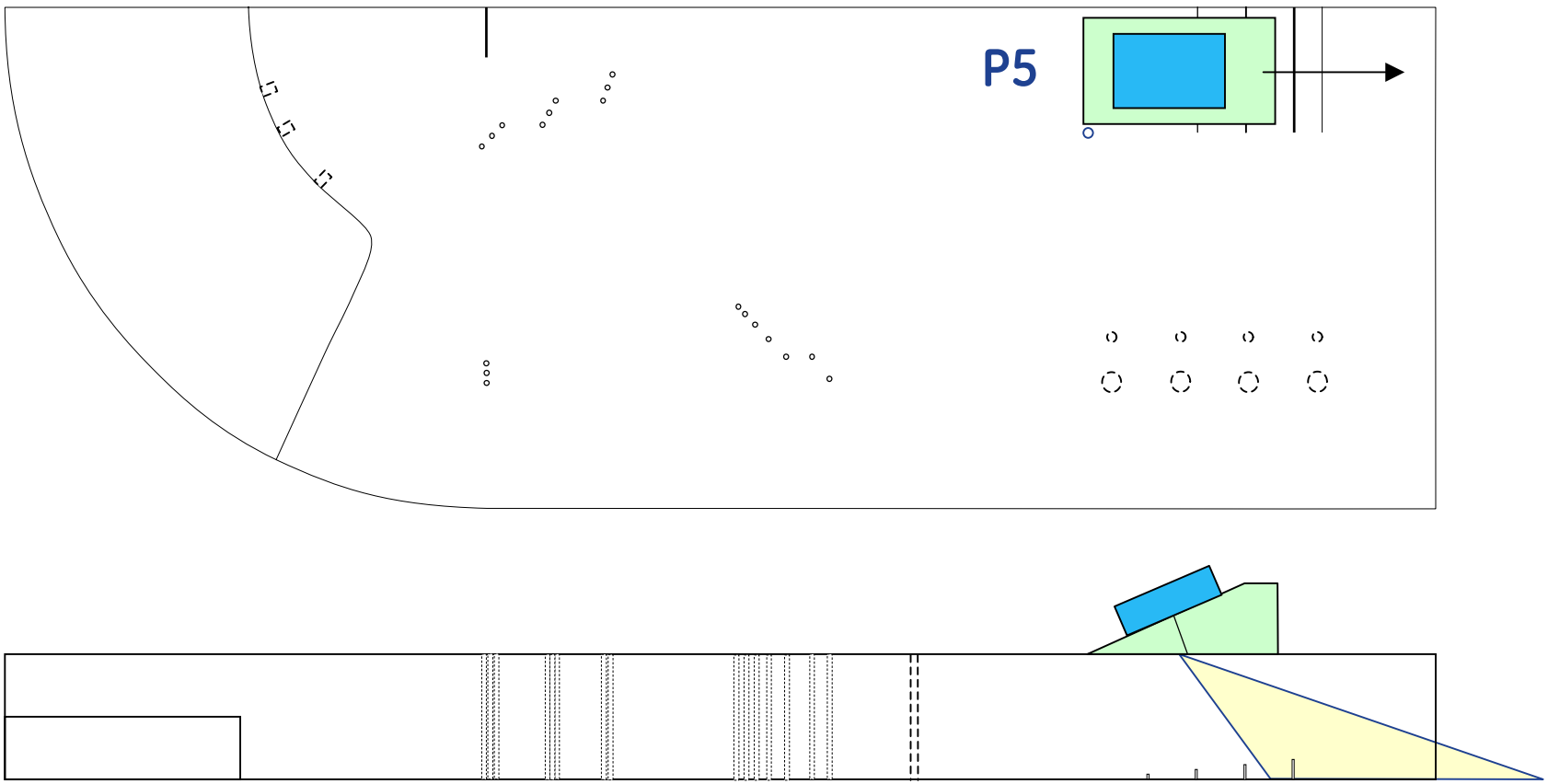
Angle scanning – 38°-75° – resolution before BW



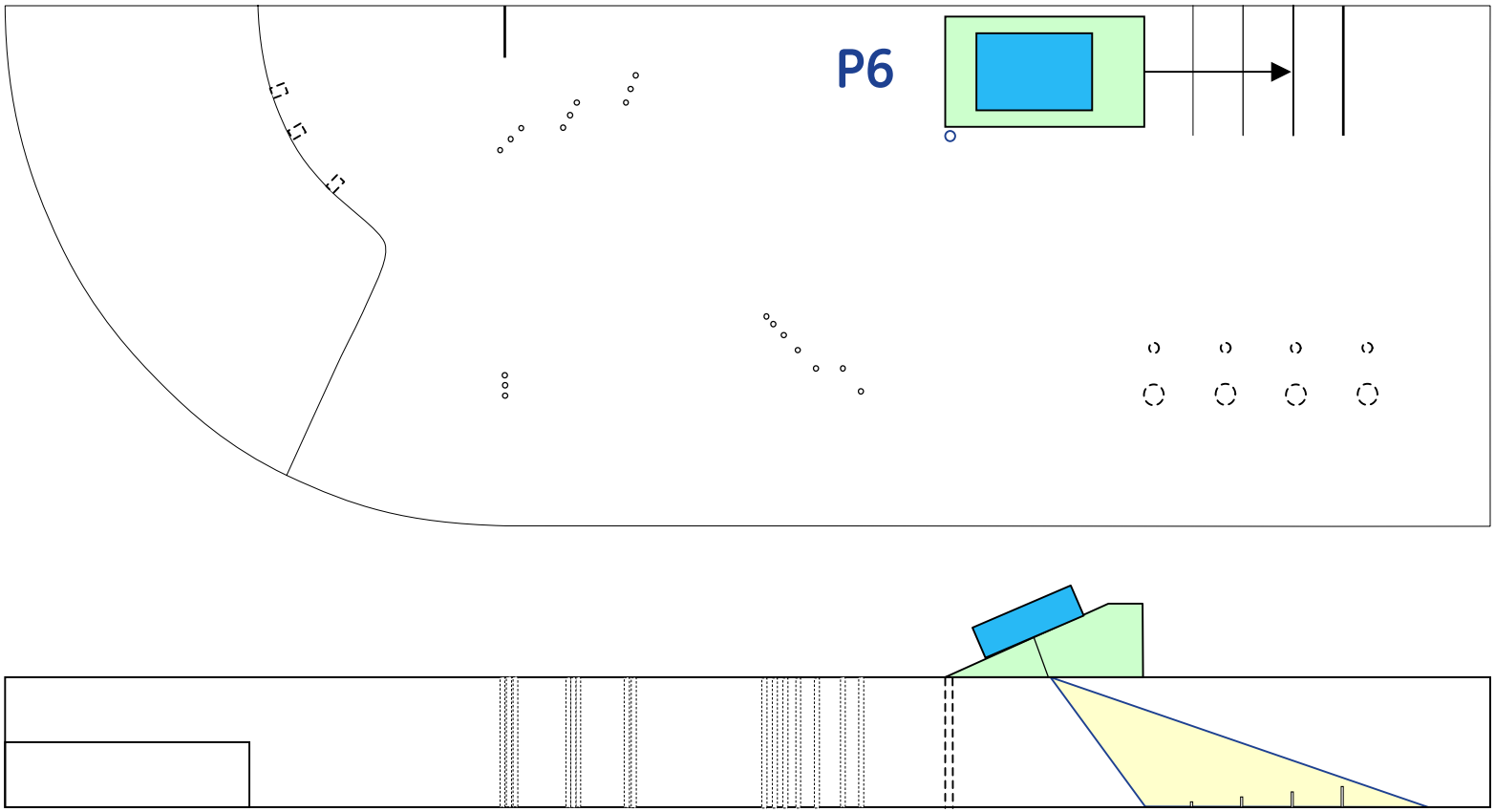
Angle scanning – Corner shot



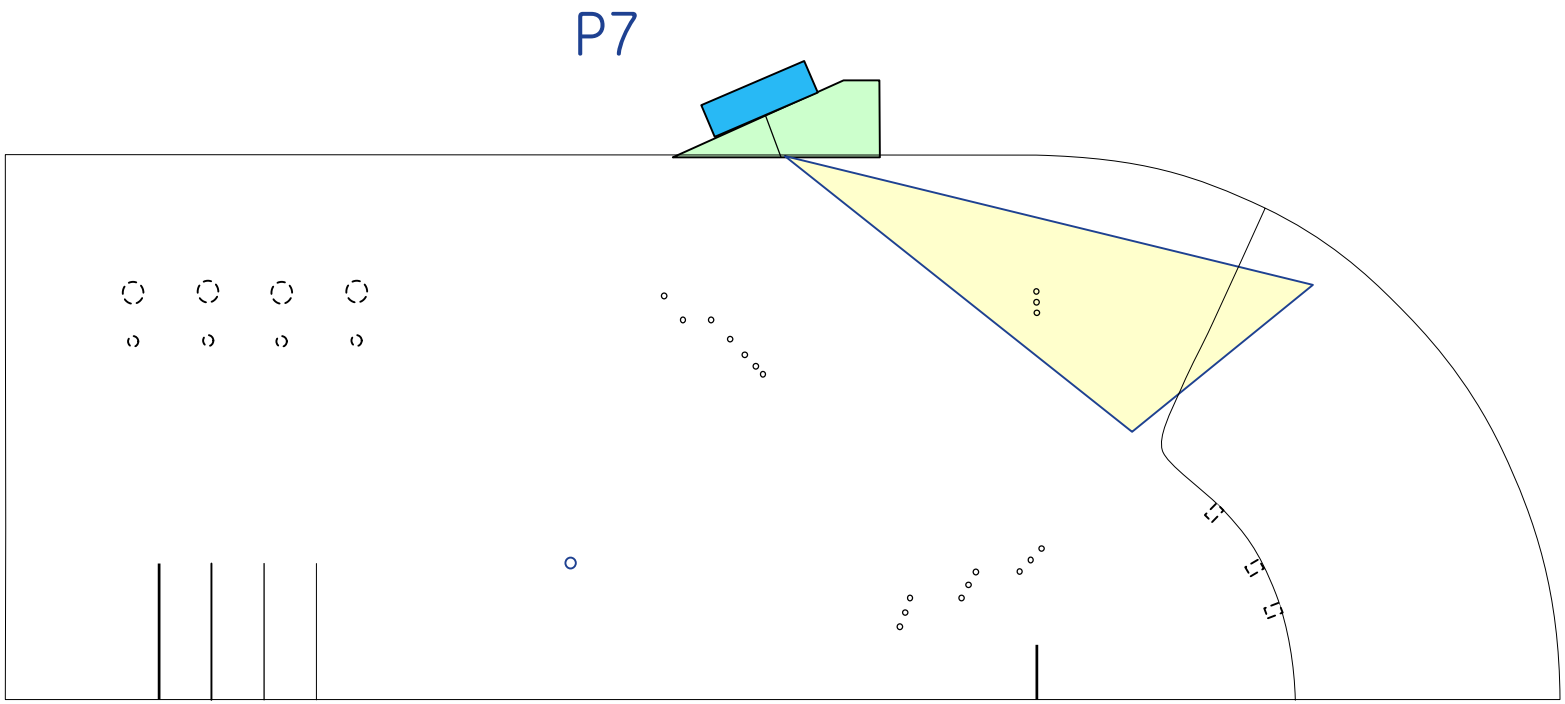
Angle scanning – crack evaluation



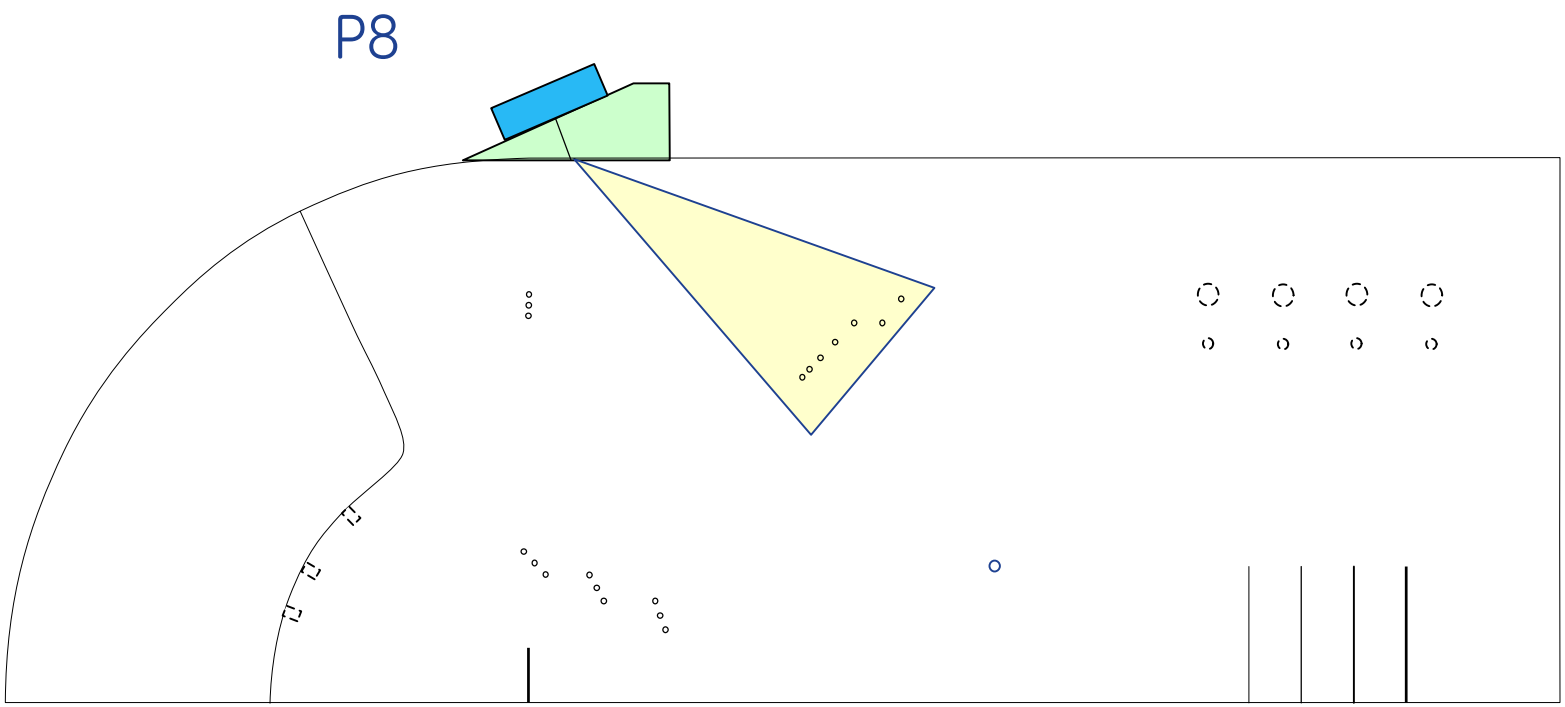
Angle scanning – crack evaluation



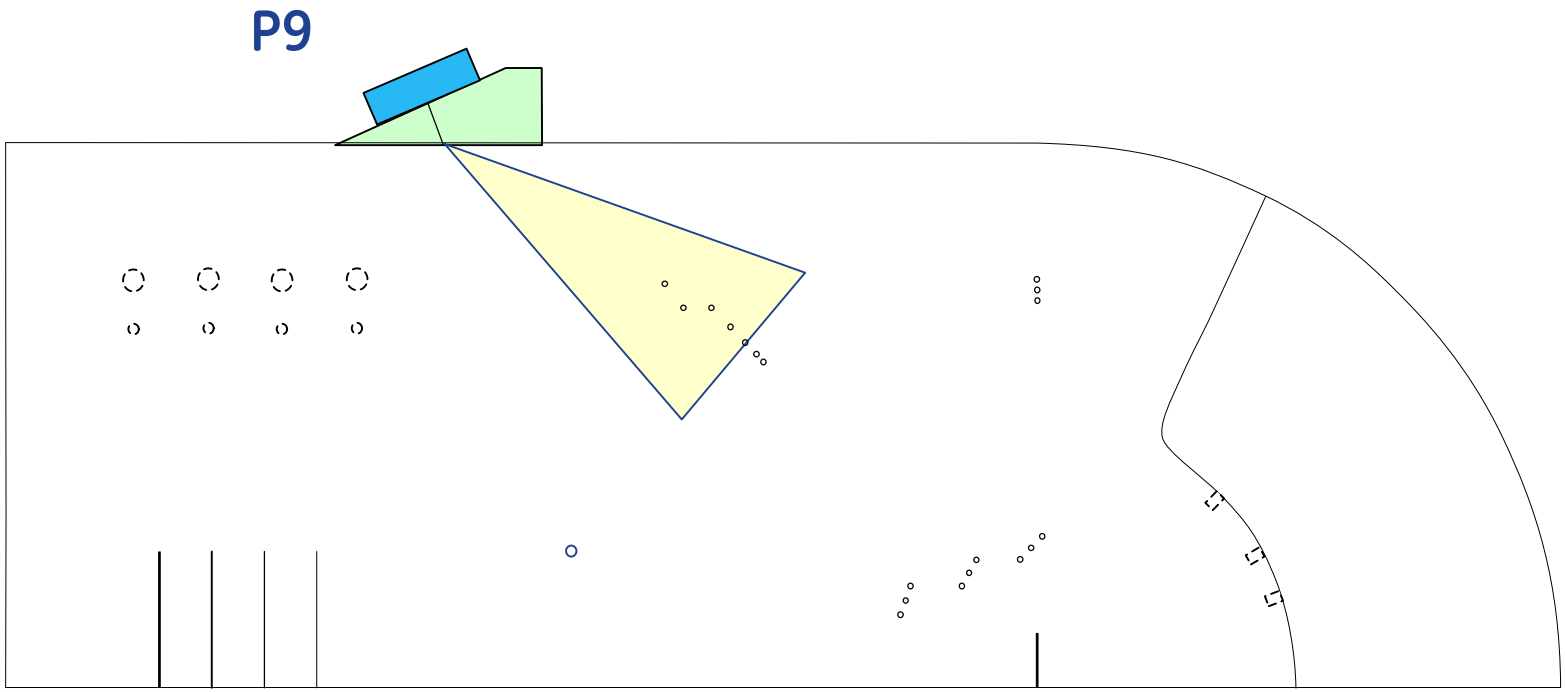
Angle scanning – resolution



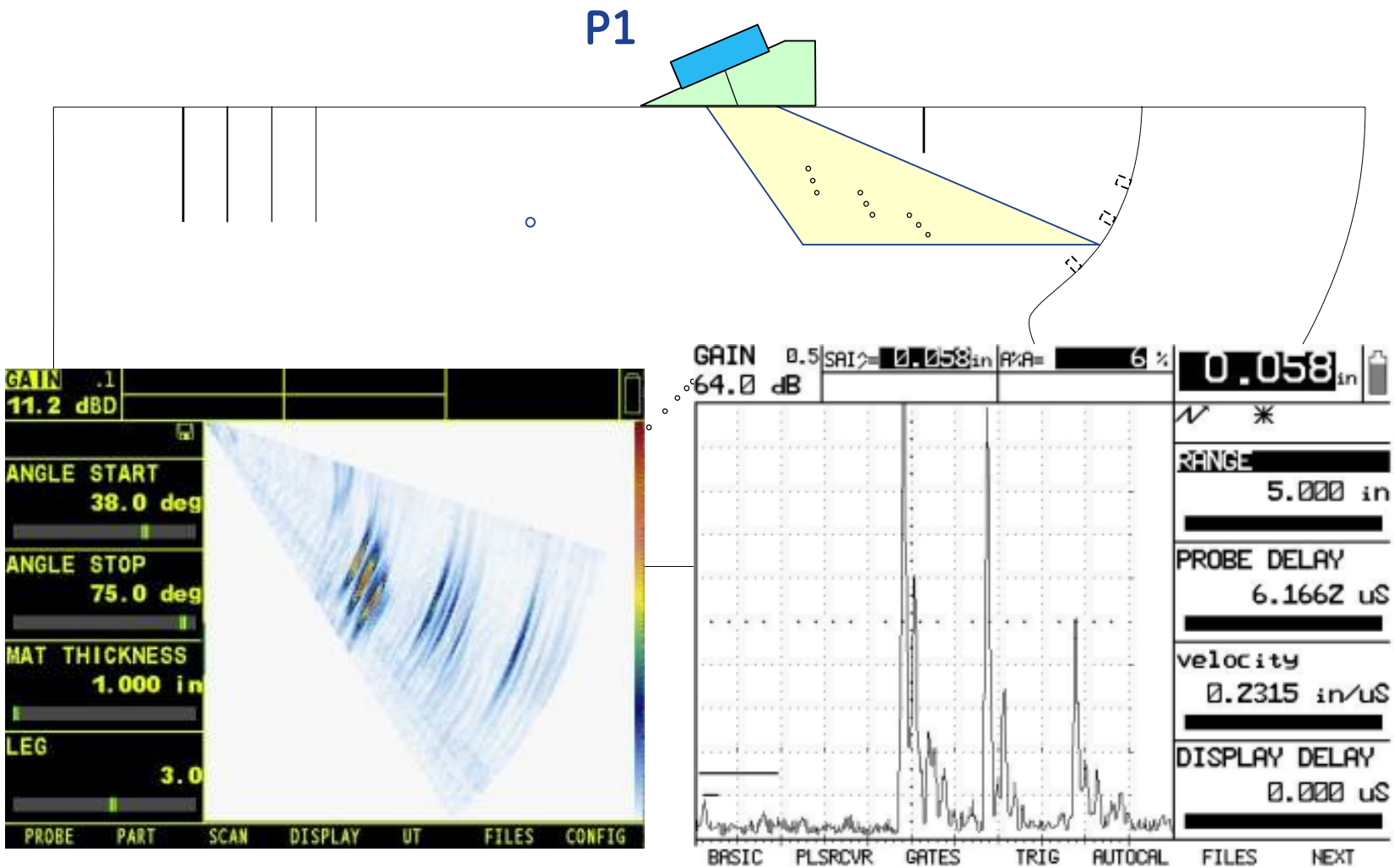
Angle scanning – resolution



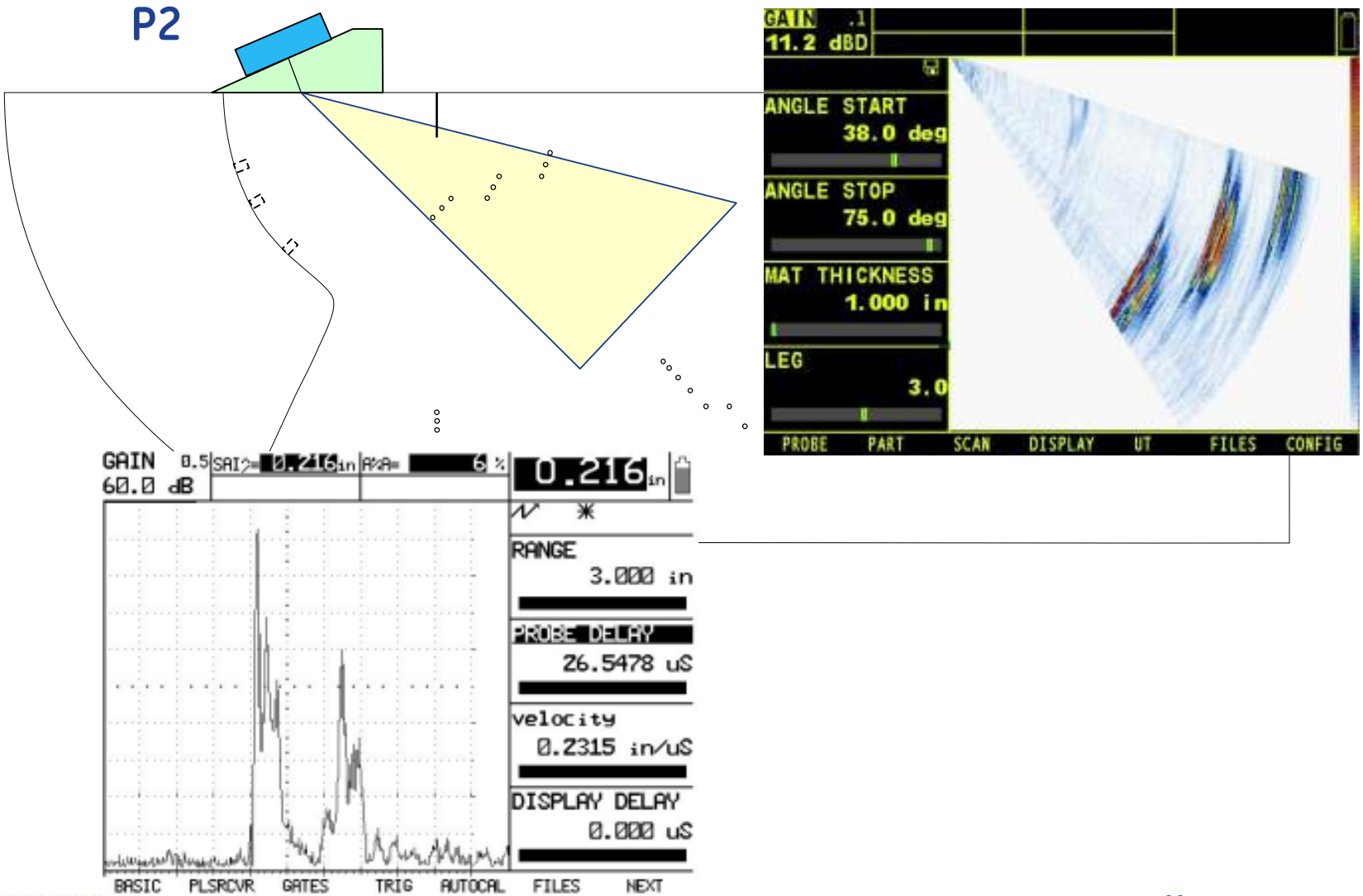
Angle scanning – resolution



P1 – No probe movement
Conventional probe peaked on near holes

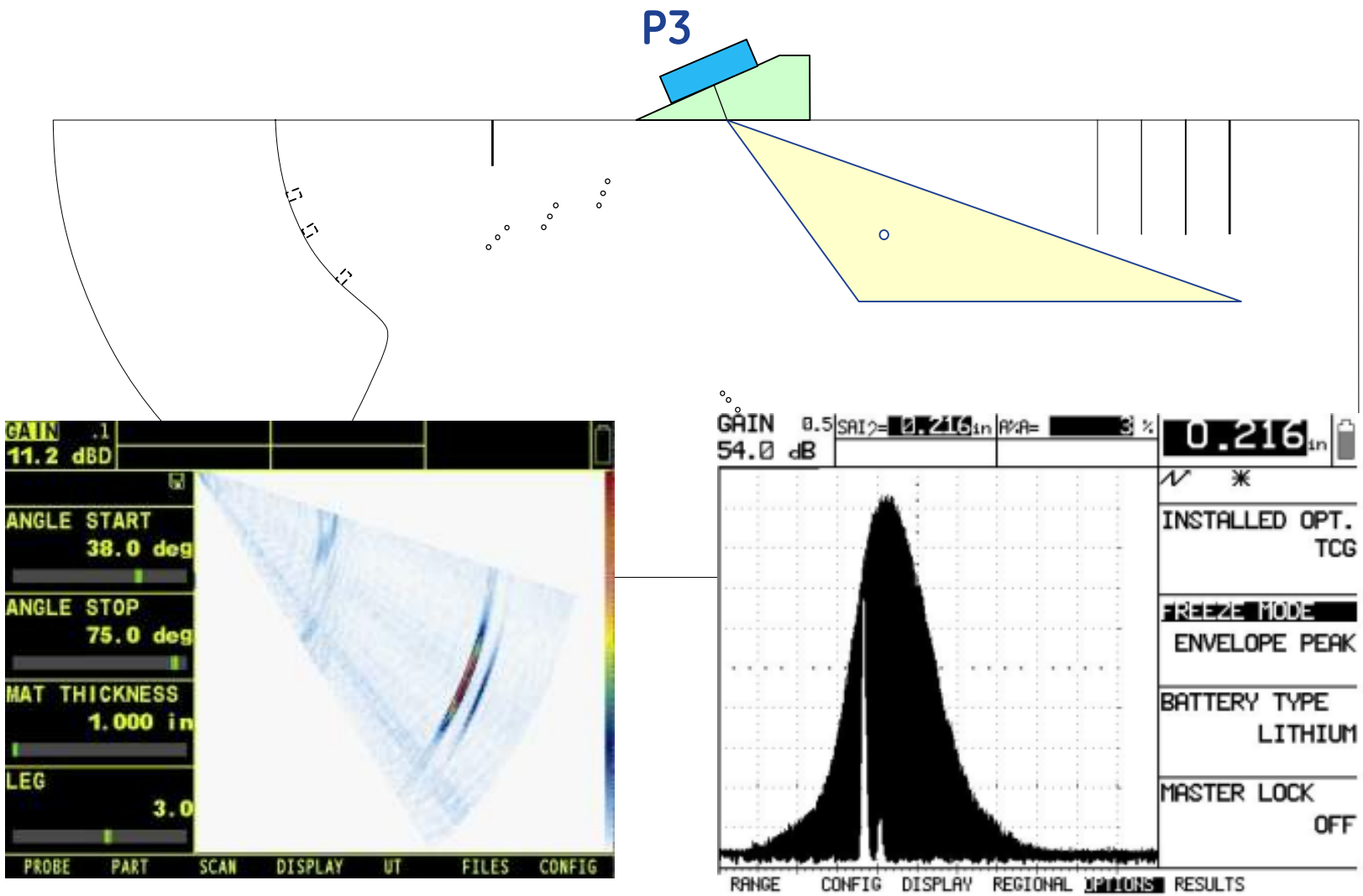


Angle scanning 1 – 38°-75° No probe movement

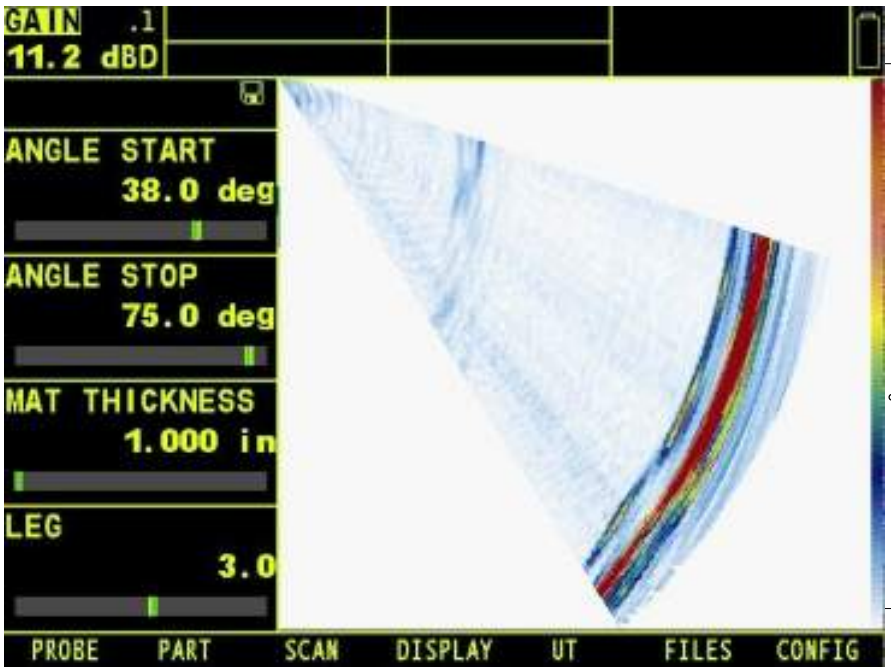


imagination at work

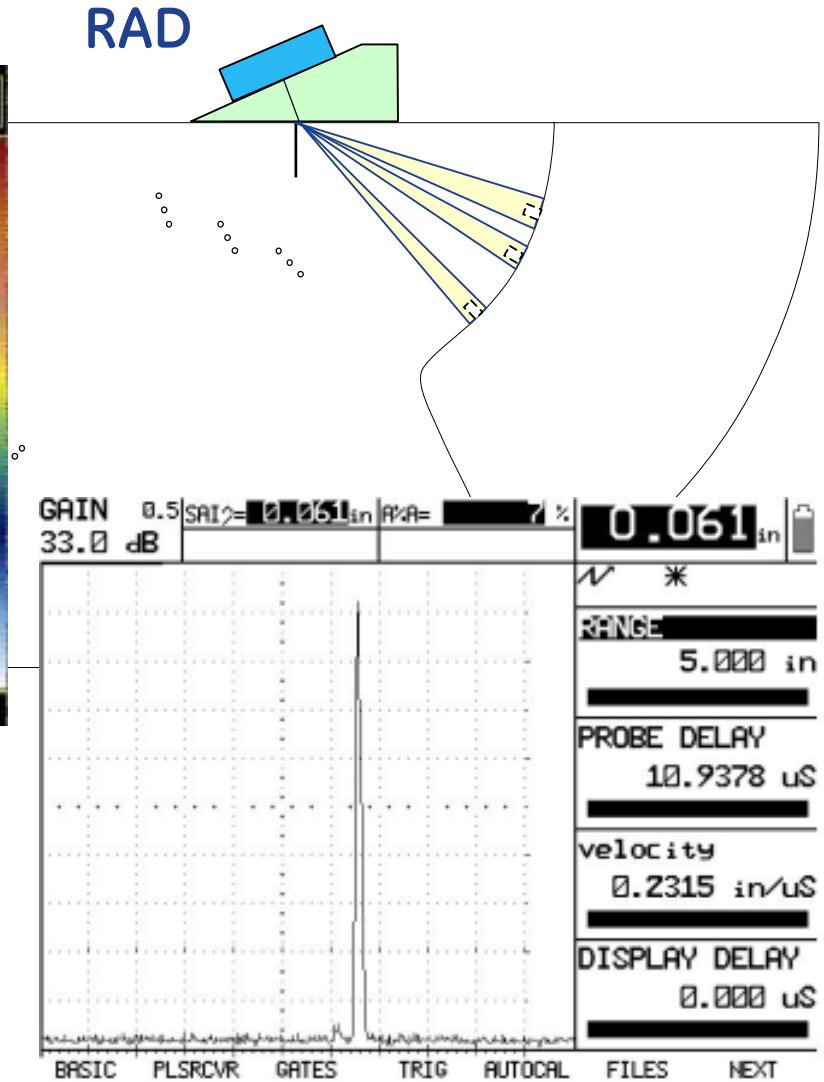
Probe normalization at 2 mm SDH - conventional probe scanned Peak envelope recorded to show beamspread



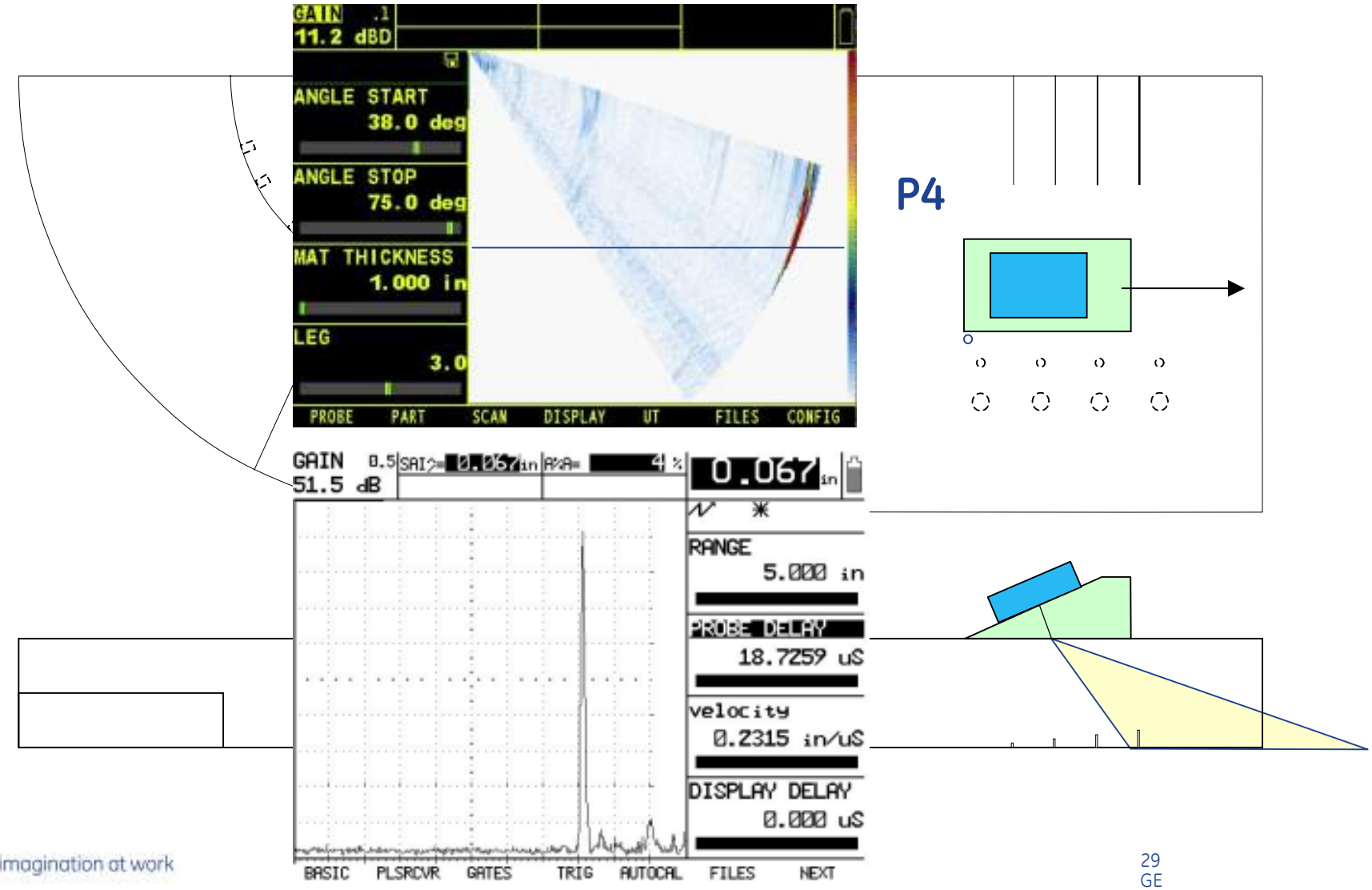
Angle scanning 5 – resolution before BackWall



RAD

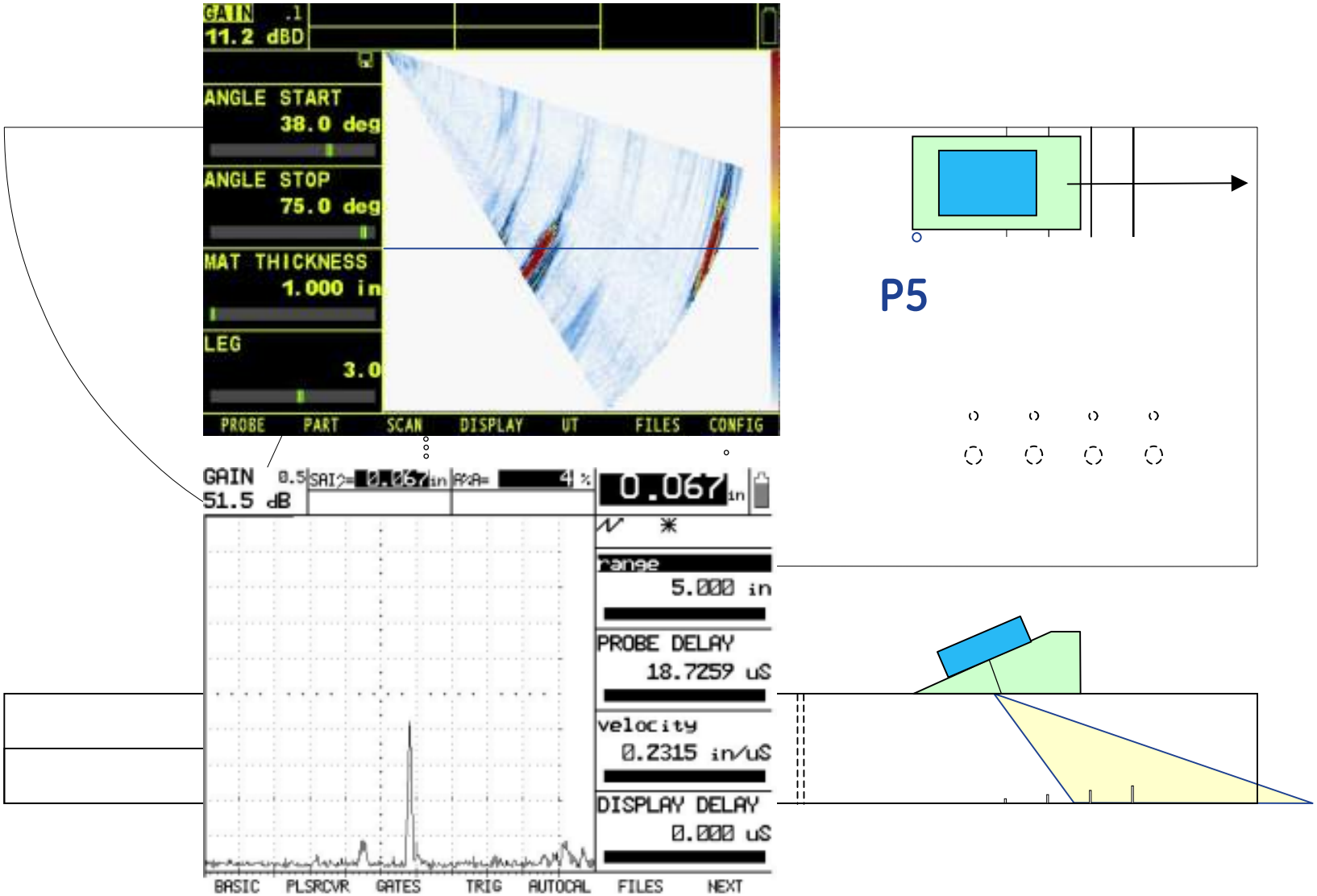


Angle scanning 5 – simulated crack evaluation

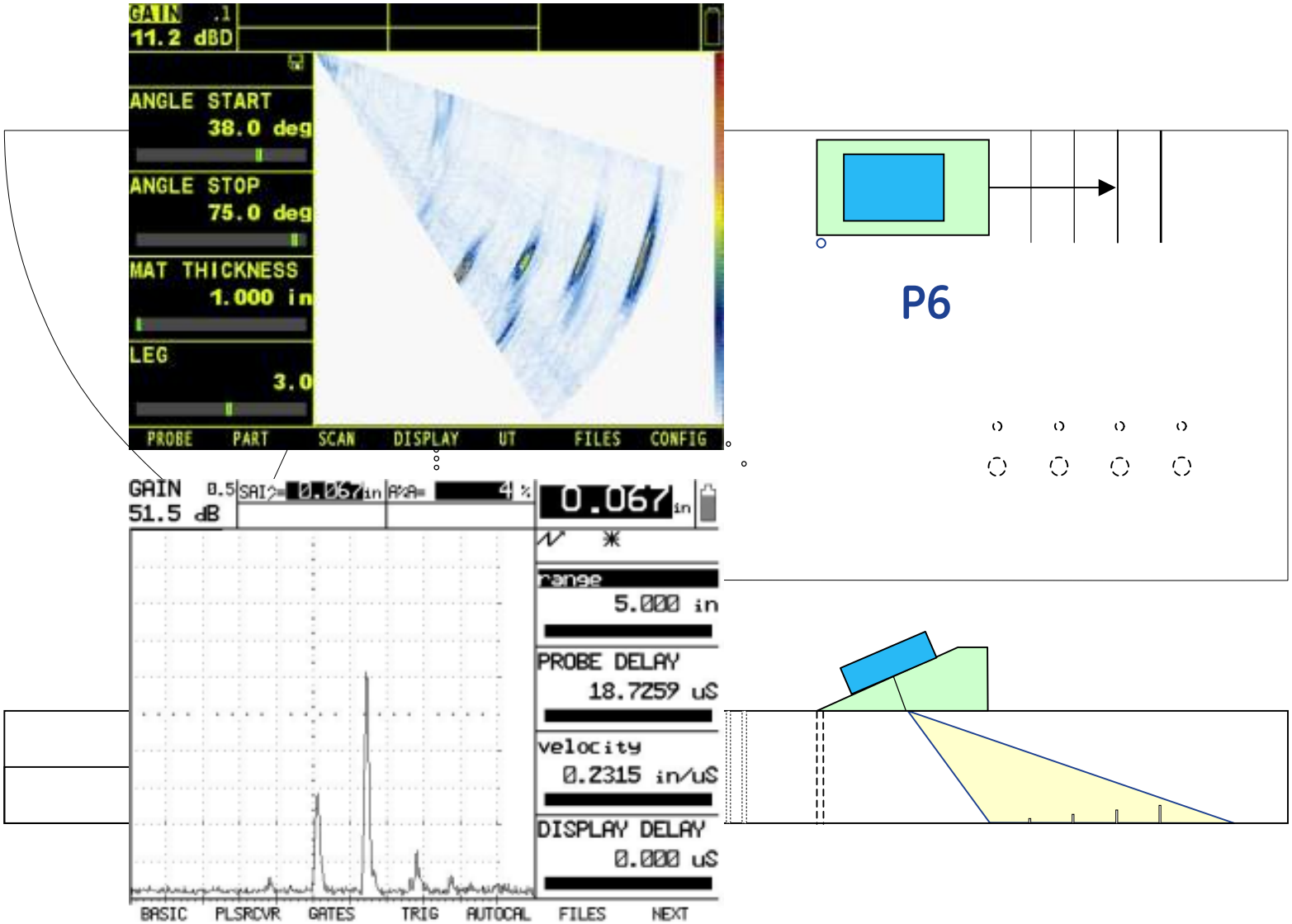


imagination at work

Angle scanning 5 – crack evaluation

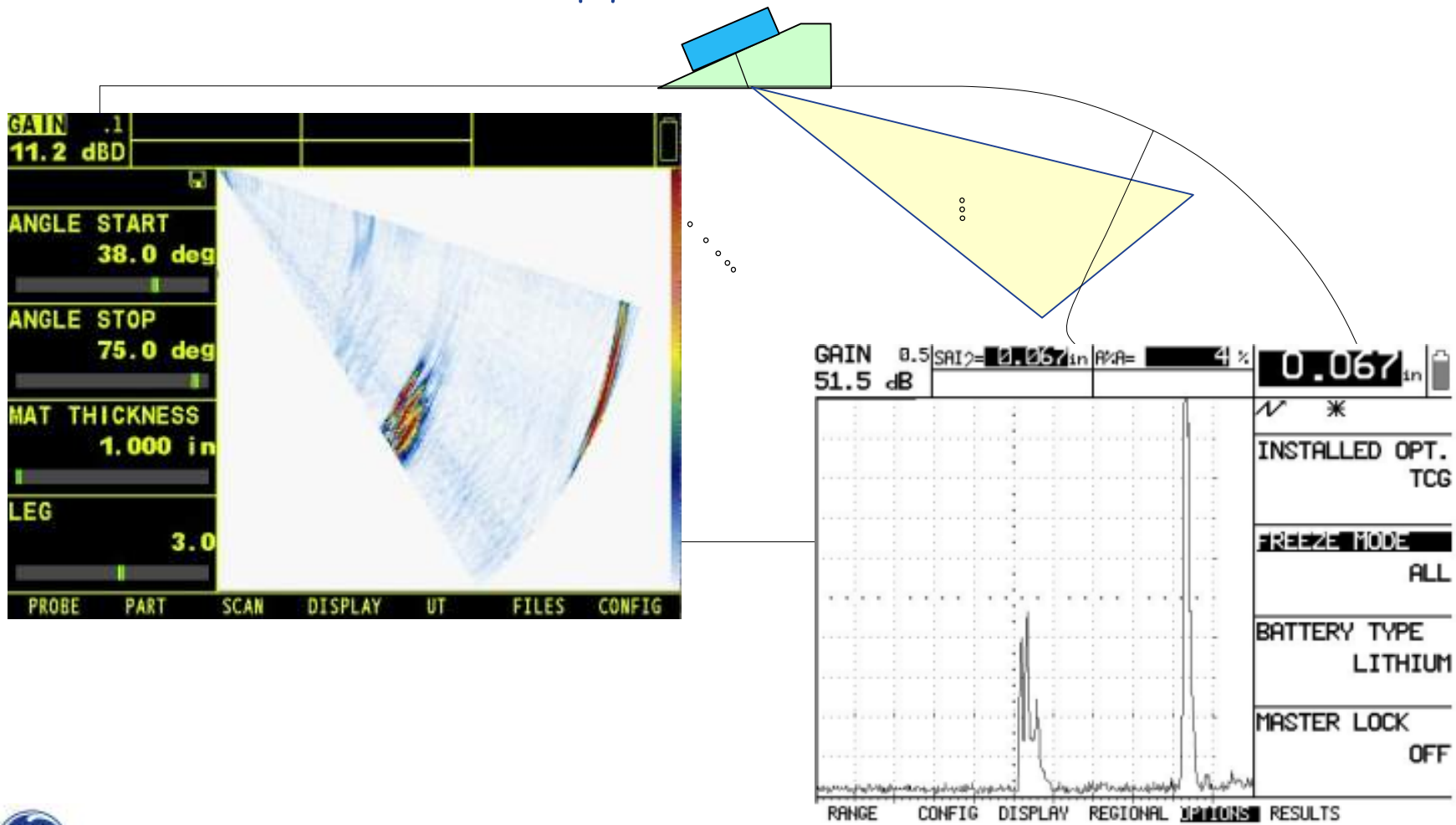


Angle scanning – simulated crack evaluation

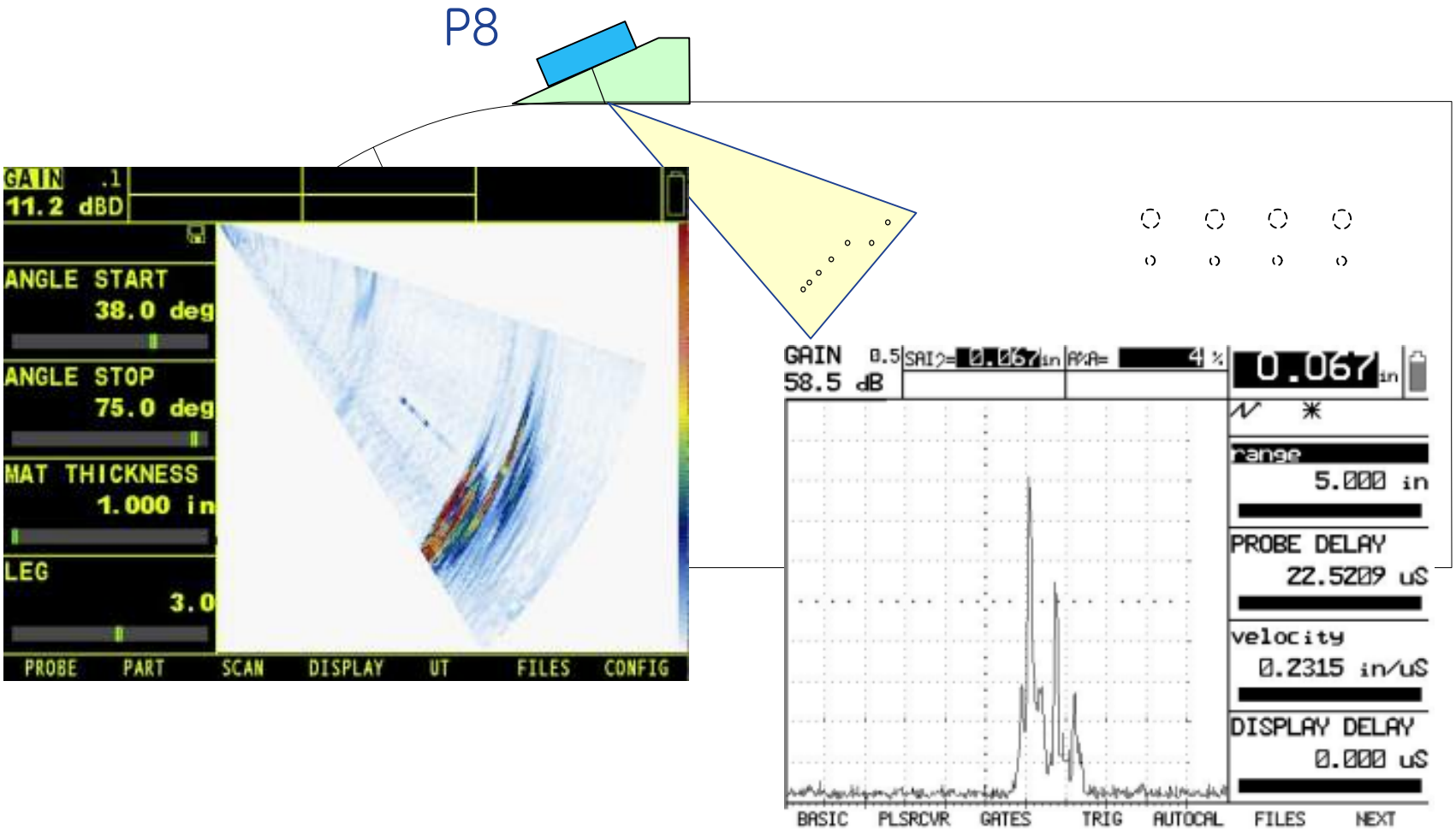


Angle scanning – 38°-75°

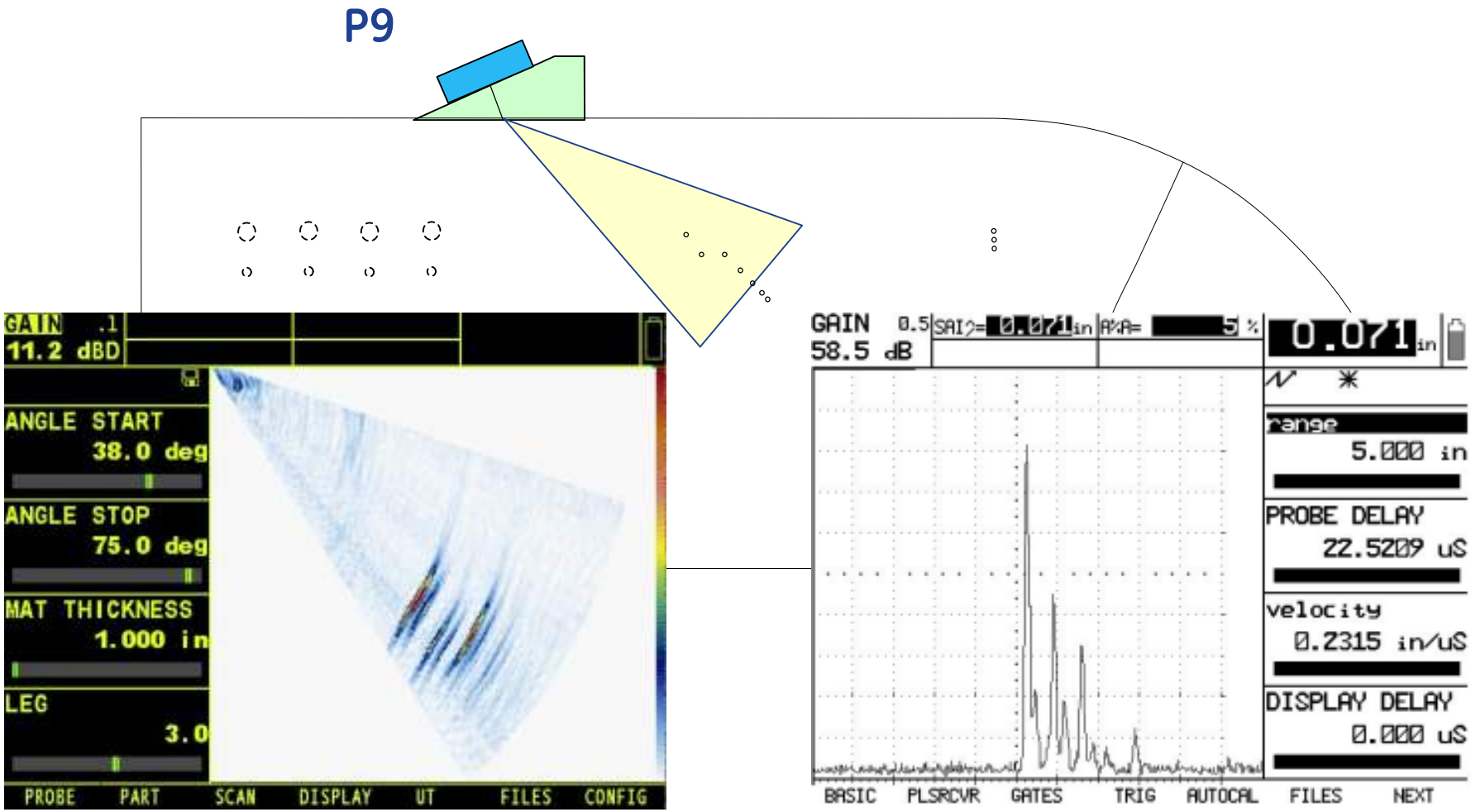
P7



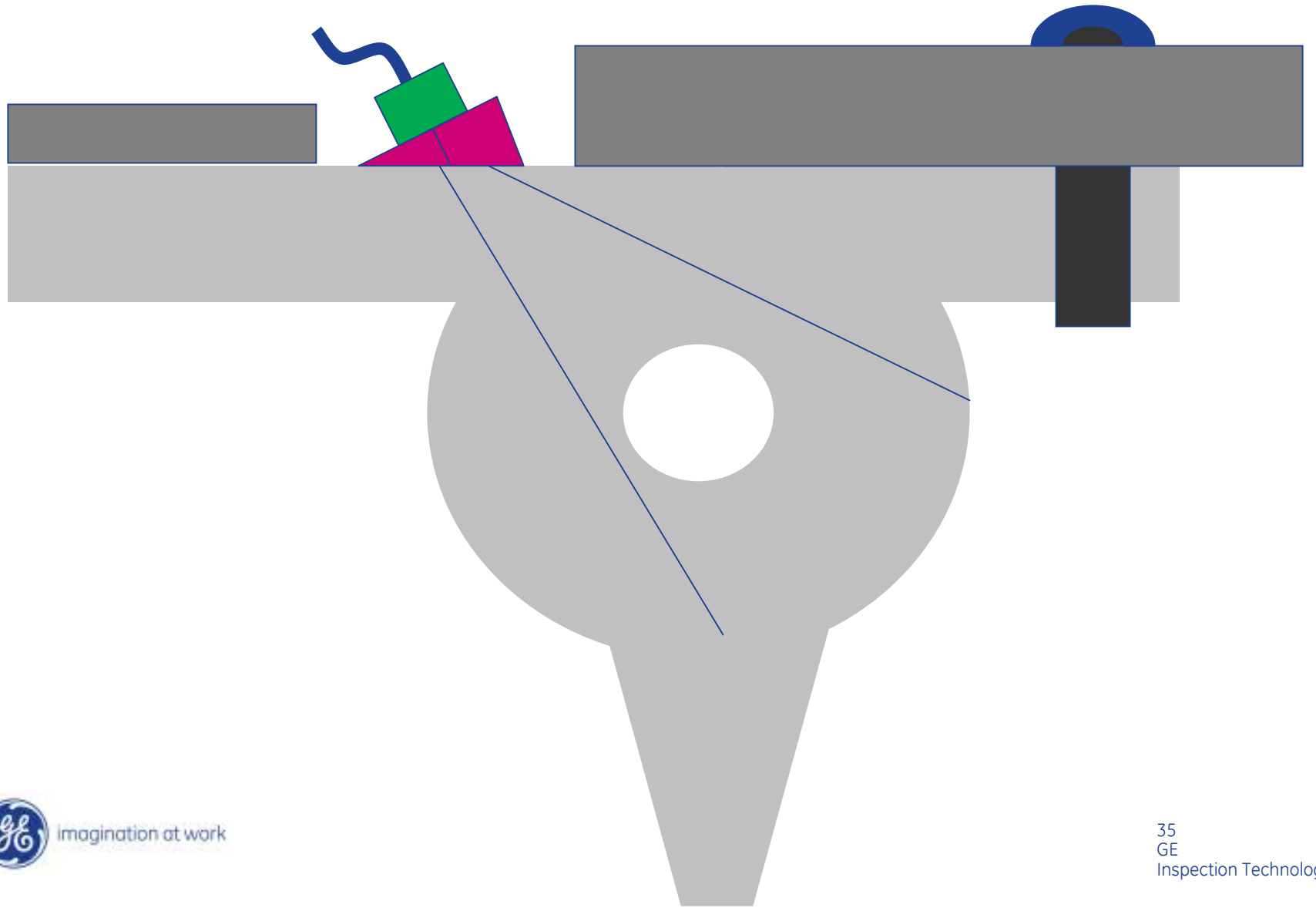
Angle scanning – 38°-75°



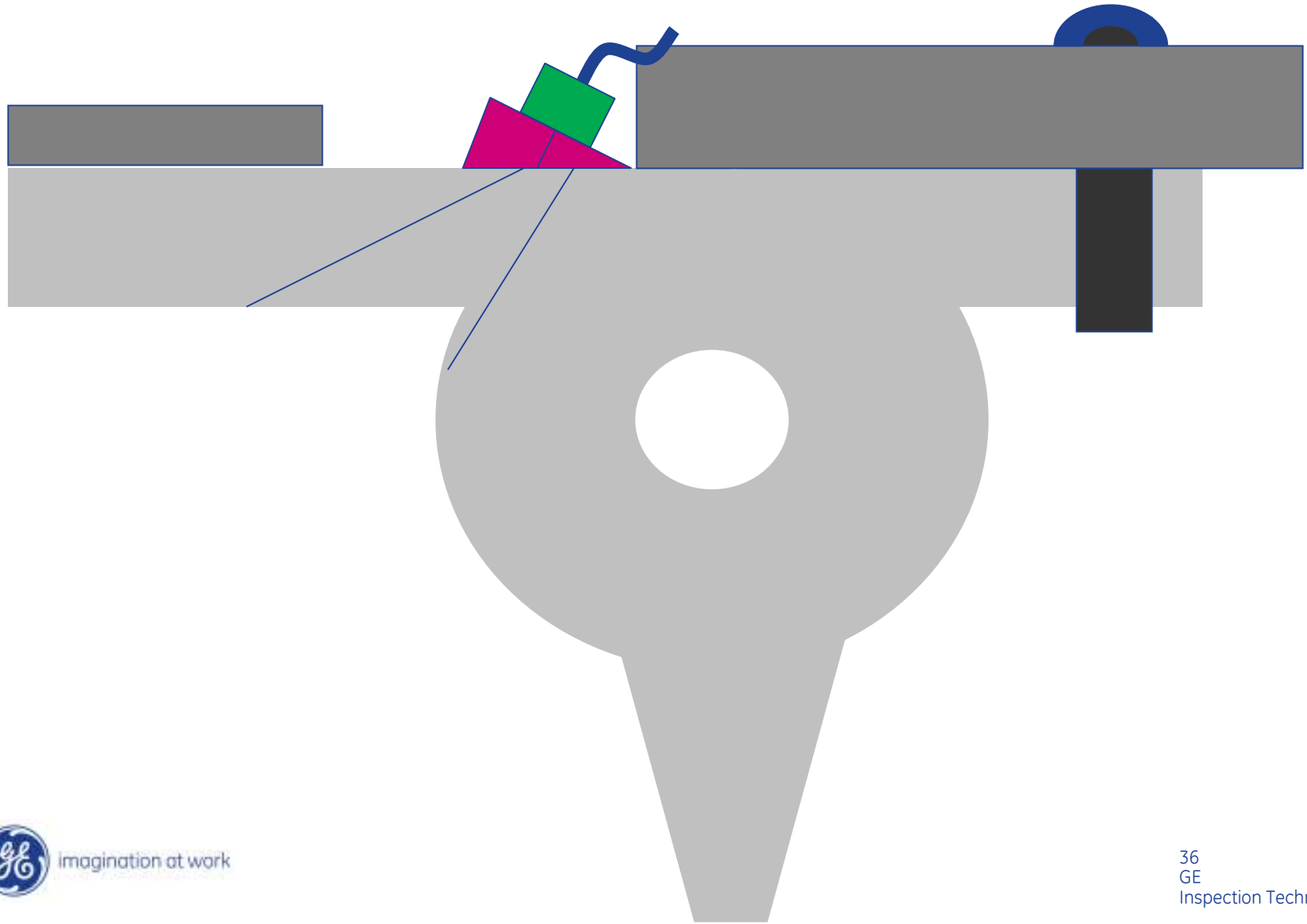
Angle scanning – 38°-75°



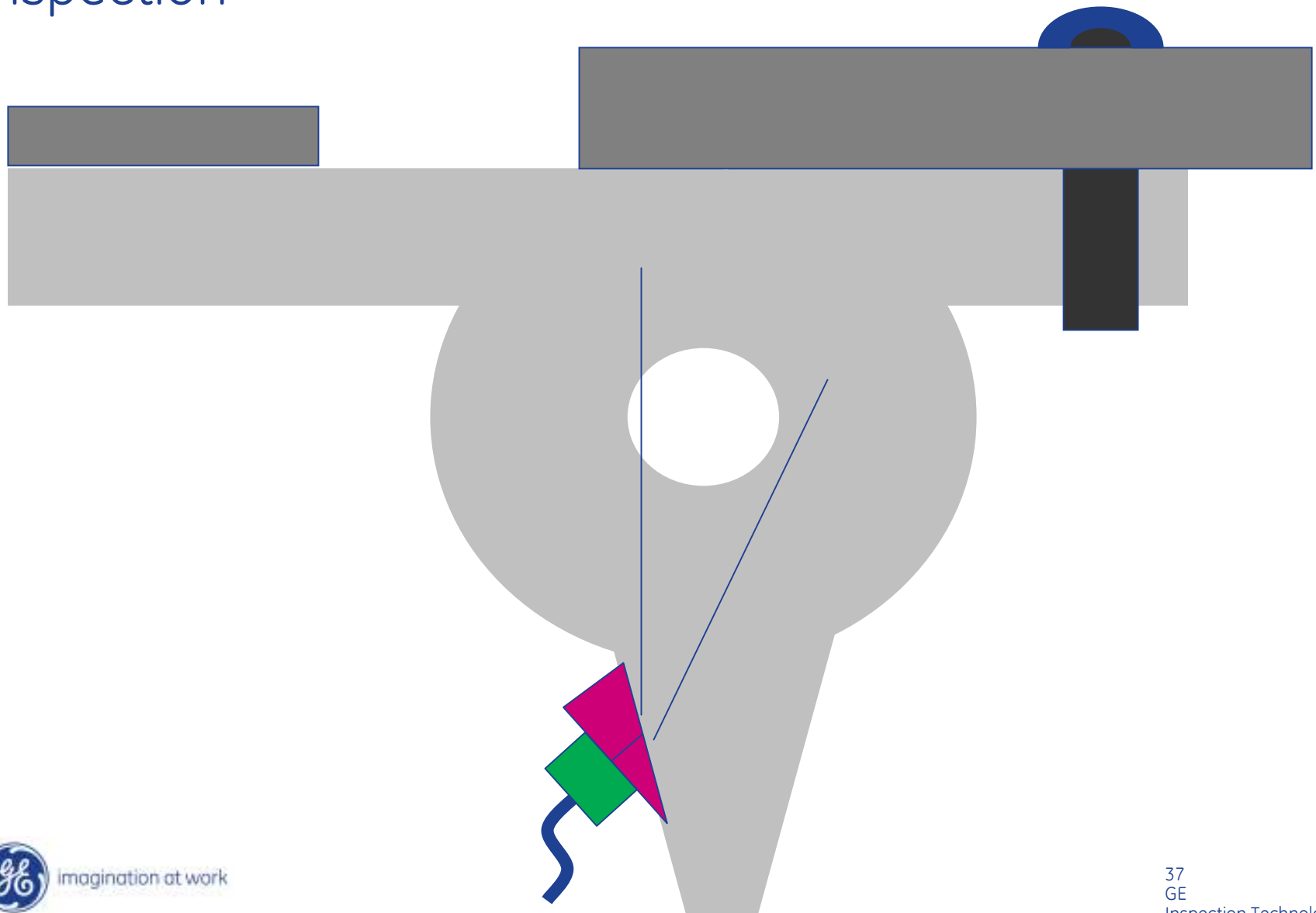
Limited access testing improved



Geometric echoes can be differentiated from defect over a broader range

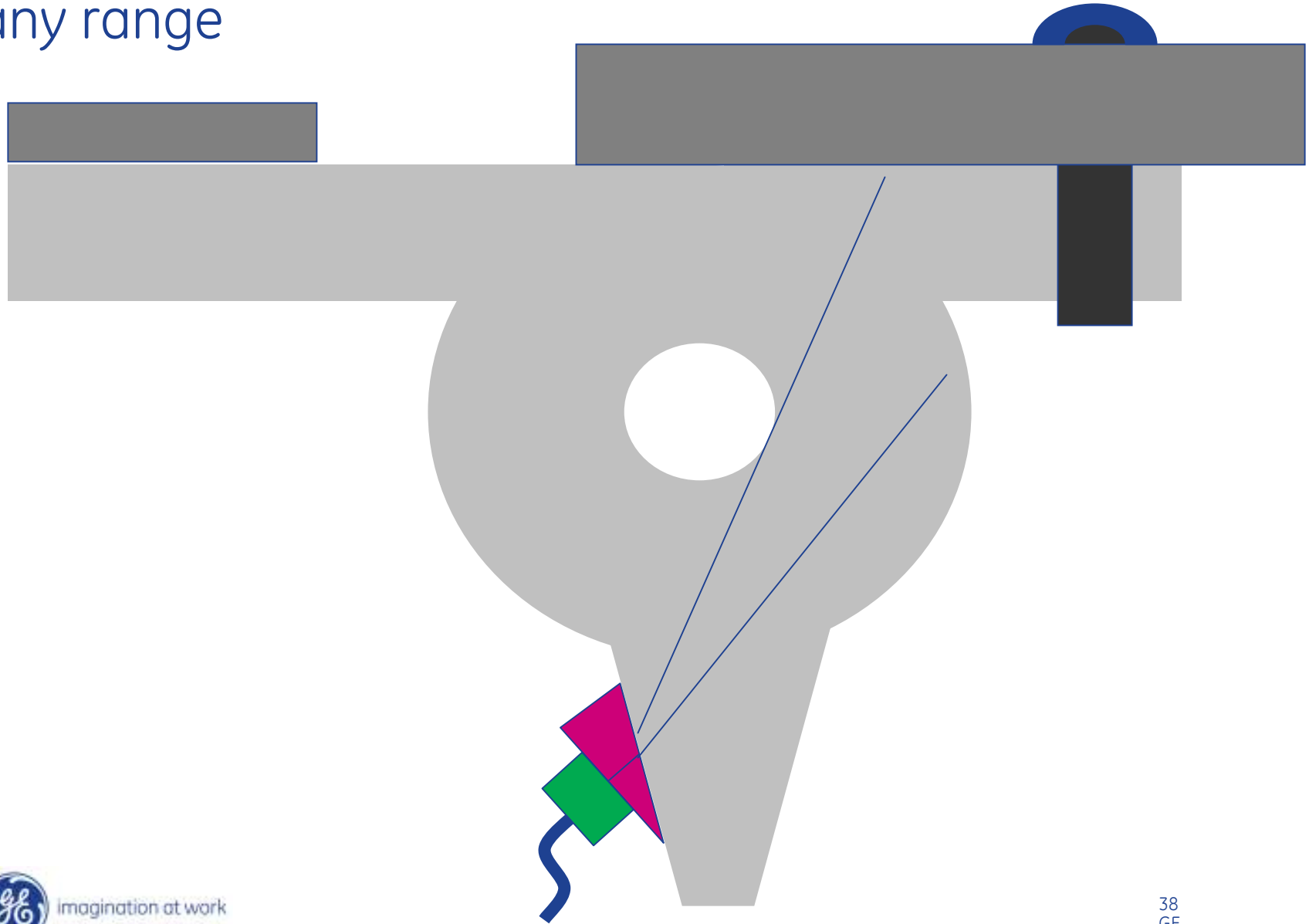


Defect orientation less critical with multiple angle inspection



imagination at work

Focus control allows ideal beam spot to be selected for any range



imagination at work

Conclusions

- True depth imaging provides spatial relationship of multiple defects when beam spread is controlled
- Multiple angle inspection improves the chance for right angle acoustic impingement on a defect.
- Multiple angle inspection improved POD when there is limited access to an inspection surface.
- Multiple angle inspection from one probe saves time and equipment expense compared to achieving the same results conventionally.
- Visualization of the ultrasound helps distinguish echoes from acceptable geometry and unacceptable reflections