AI-Assisted Manual PAUT

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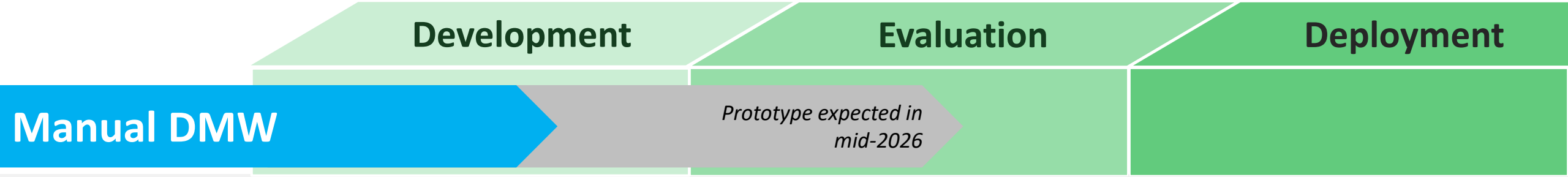
Introduction

- All efforts to date focused on AI-assisted analysis of *encoded* examinations
- Manual PAUT examinations are still common
  - More susceptible to environmental and human factors
  - No posterior review

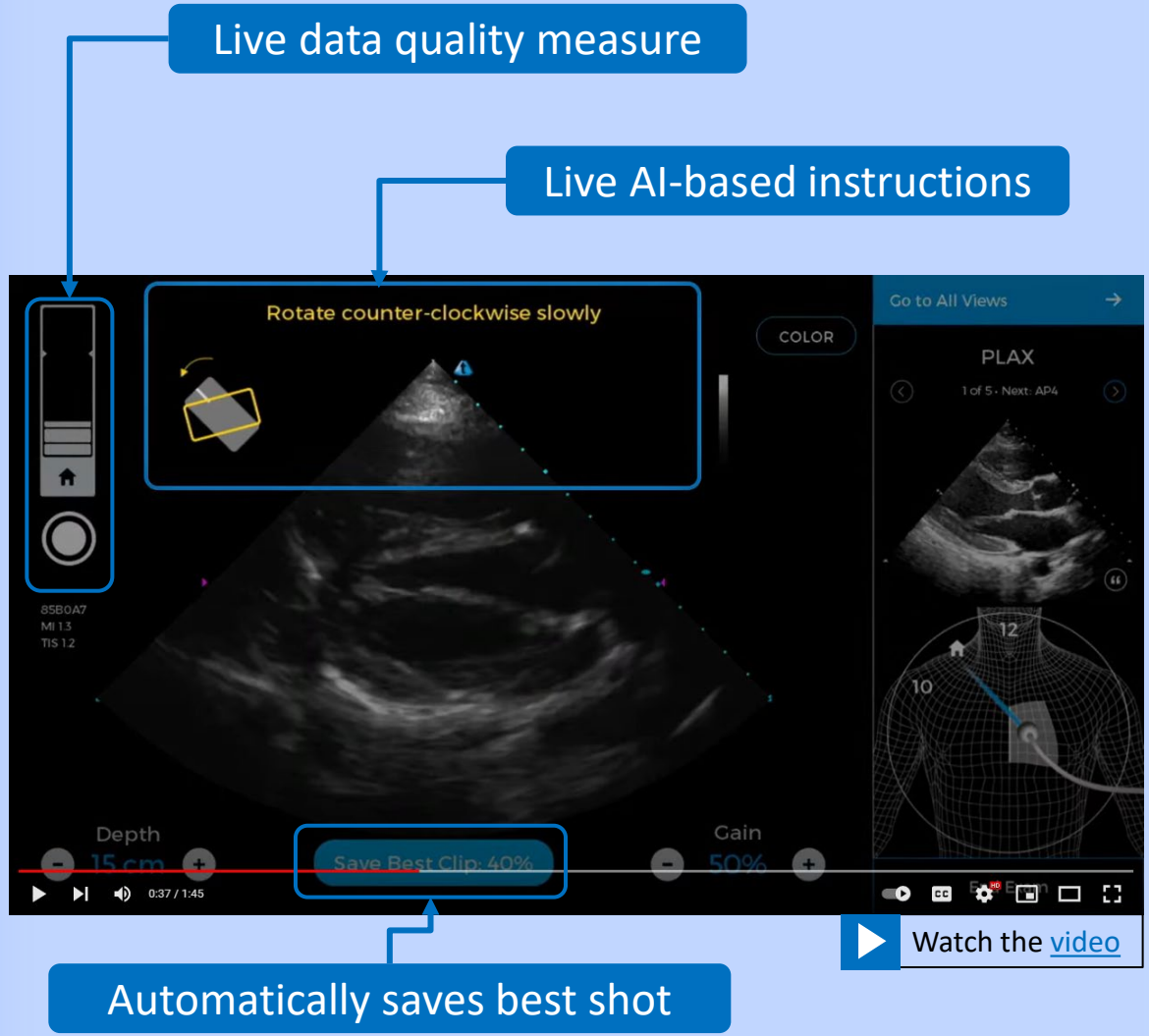
➢ High(er) value proposition in AI-assistance for manual PAUT

- Challenges go beyond technology development
  - ASME Code and other considerations require pro-active attention



Motivating Vision

- Live guidance
- Alarms
- Real time feedback on data quality
- Speed monitoring
- Real time coverage assessment
- Recorded data for posterior review



AI guides user in cardiac ultrasound

Next Generation of Manual UT Scans

For the inspector

- Similar to today's technique
  - Maintain familiarity
  - Fall back if something goes wrong

AI unlocks the next level of performance by leveraging previously unusable data

Manual flexibility with next level performance

For the machine

- Richer data
  - Multiple levels
  - Beyond what humans can analyze

Key feature: *Auto encoding*

3 Full 3D Reconstruction
- Save full data volume
- Potentially additional ML layer

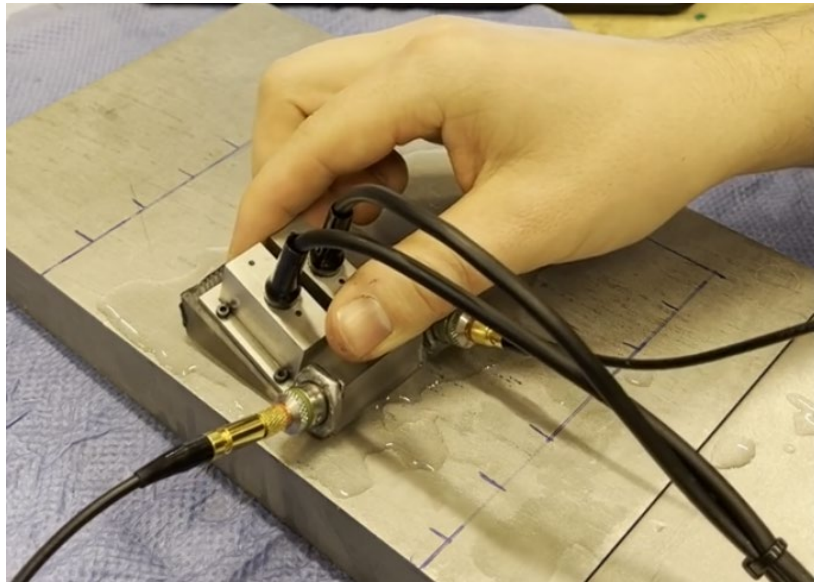
2 Live Scan Line
- More robust ML
- Live scanning guidance
- Potential to save images

1 Live Single Shot
- No encoding needed
- Immediate feedback / alarm

UT encoding is the gatekeeper

Increasing capability

Proposed System

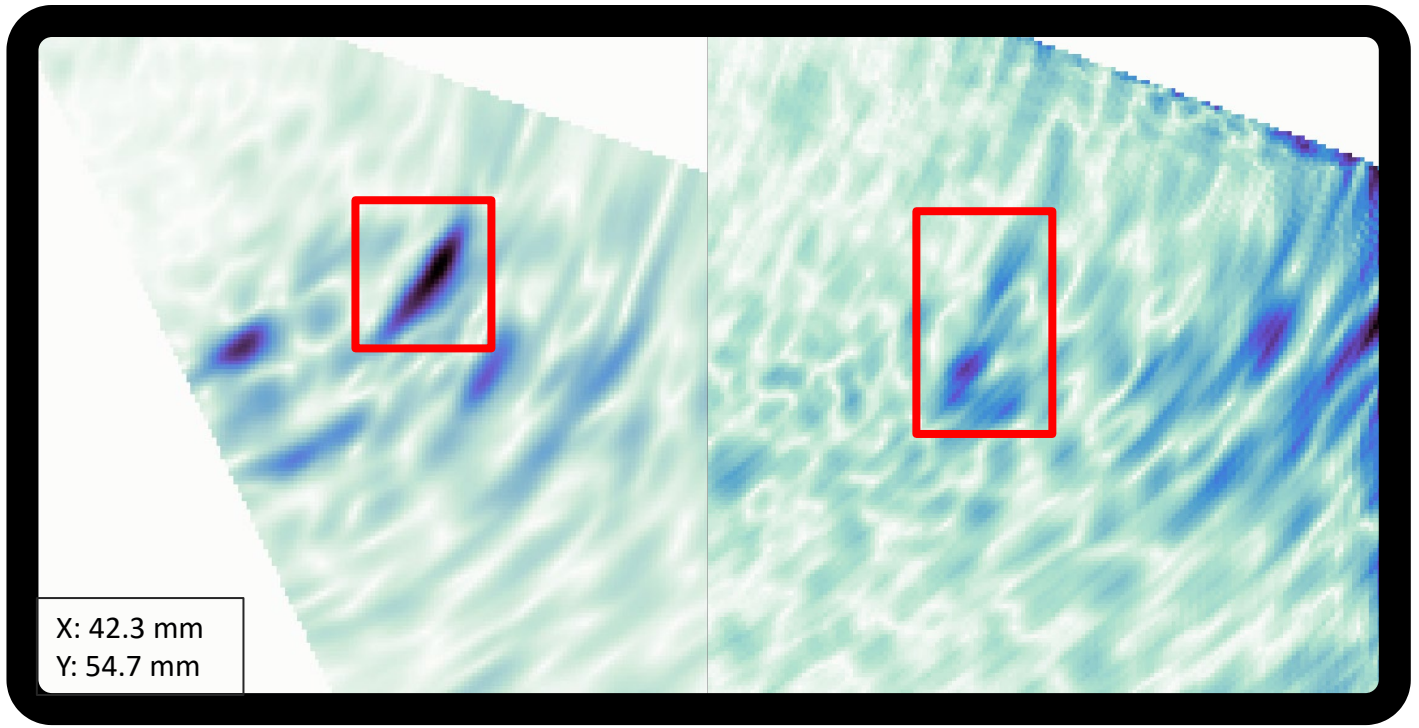


Manual scanning with UT encoder

- Two-axis encoding

Partial SAFT Live View

- Last N (*64?*) shots
- “Line scan” view



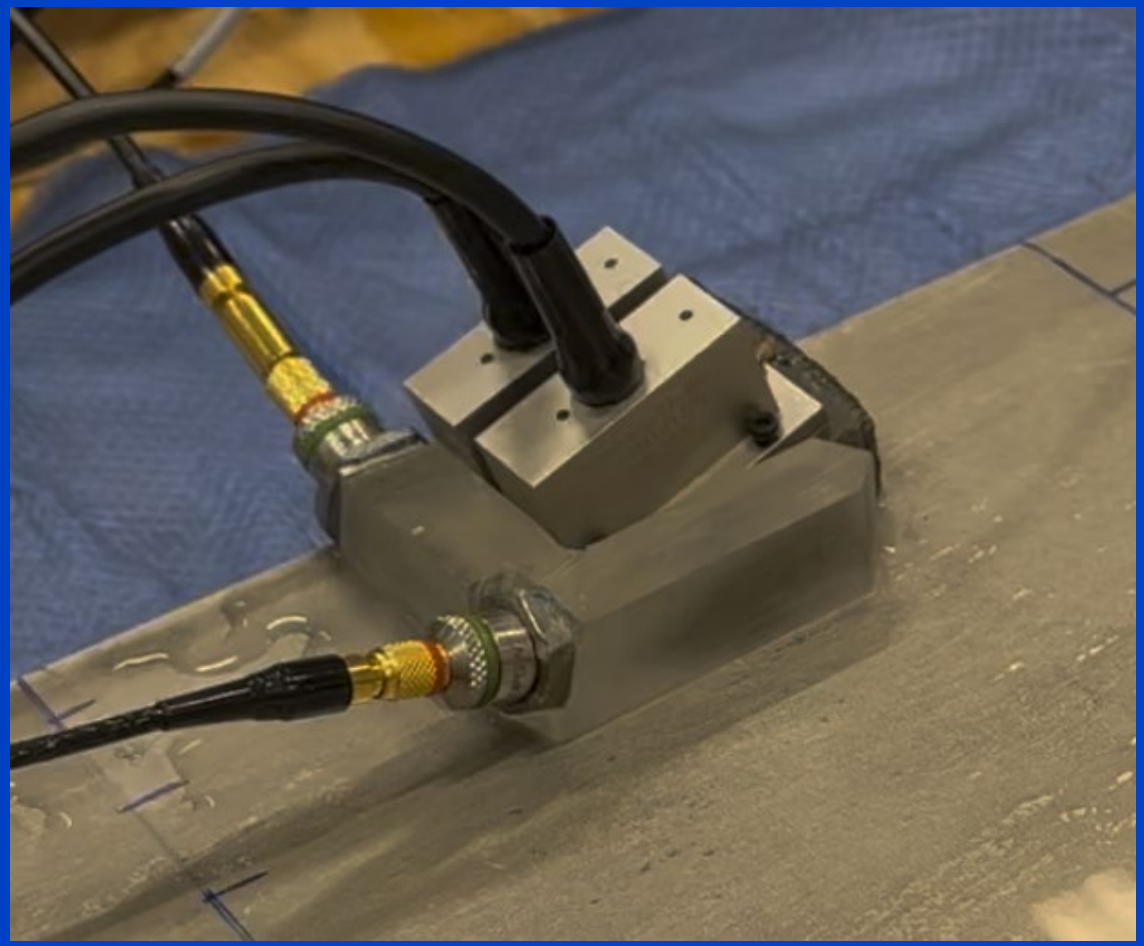
TFM+PWI Live Sectorial View

- Single shot
- Familiar view

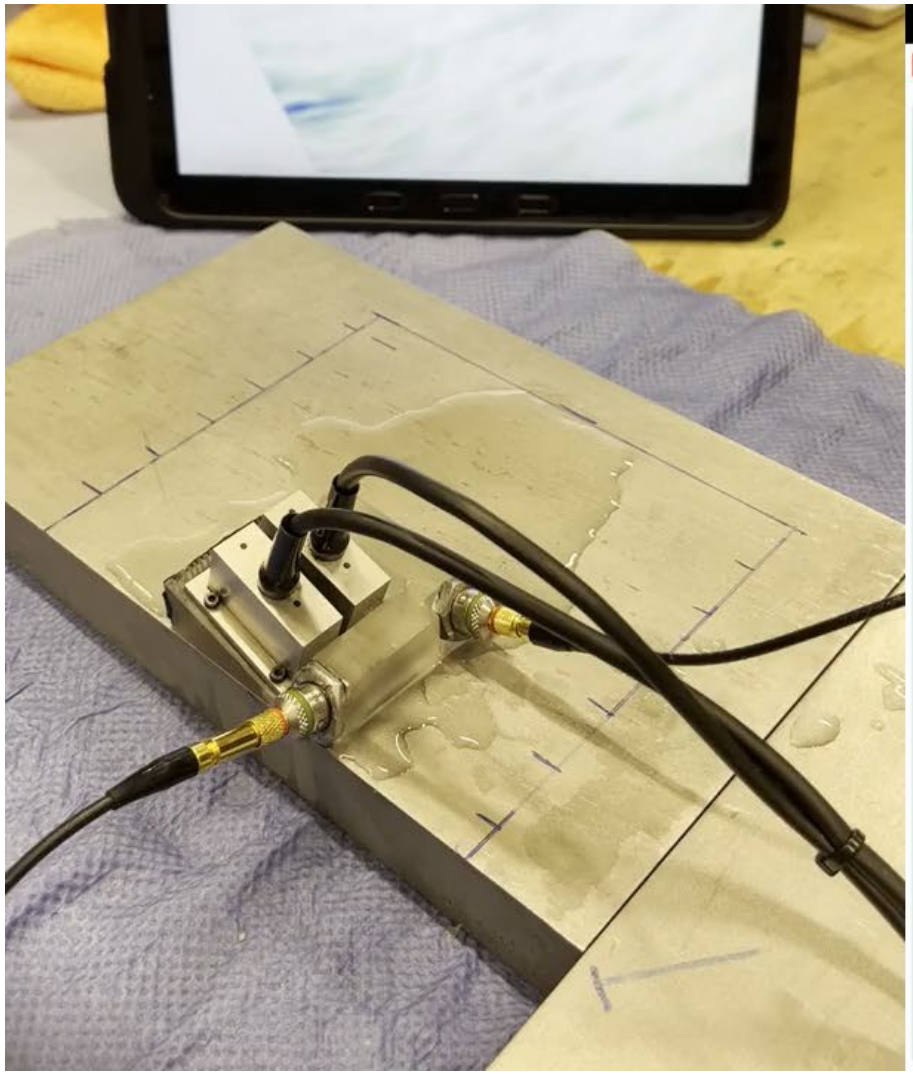
Both levels with AI highlights

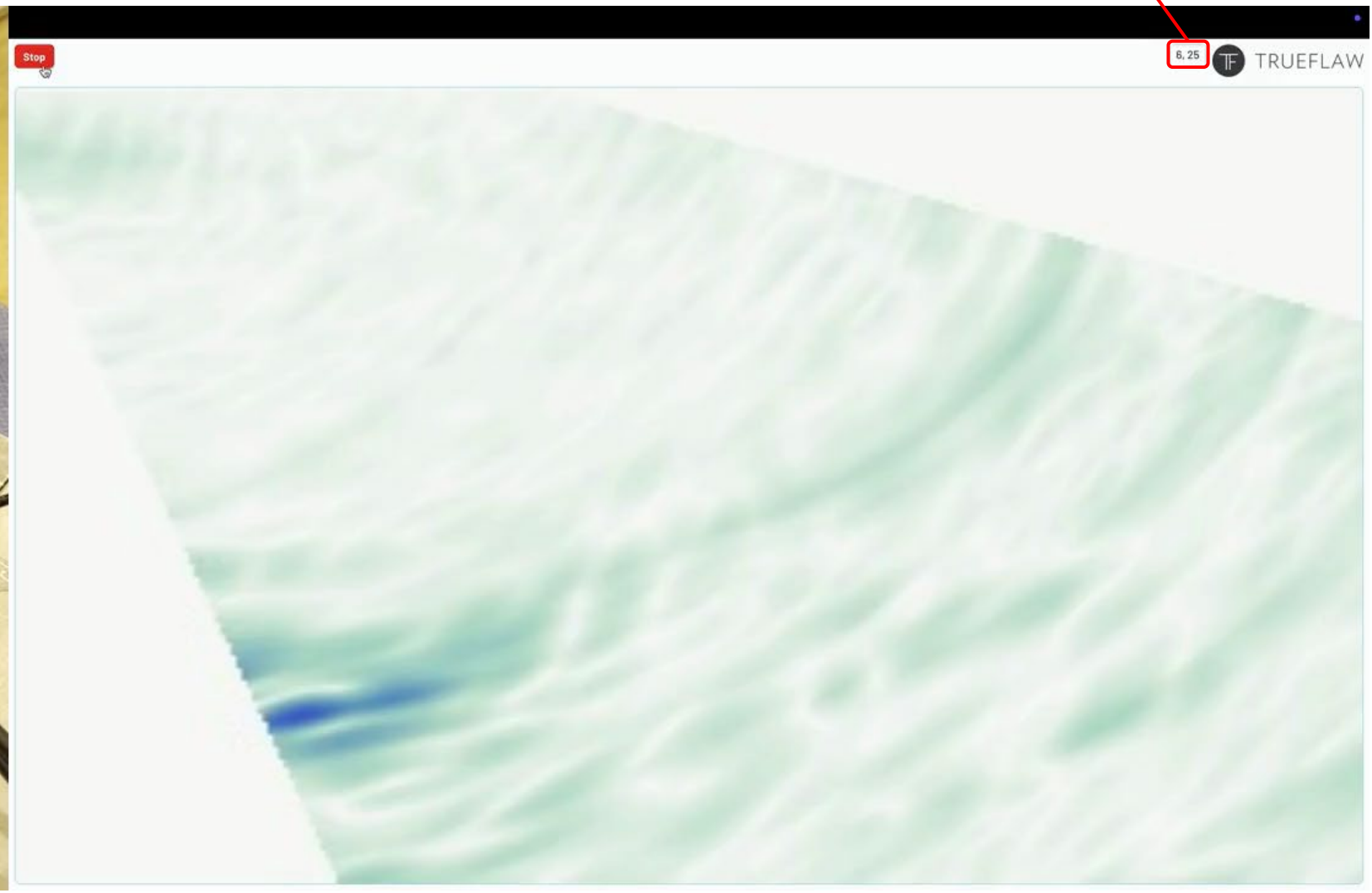
UT Encoder

- Two-axis encoding
- Two conventional probes for surface waves
- Track structural noise under the wedge
  - Not geometric features
- Still under development
- ➢ Valuable even apart from AI

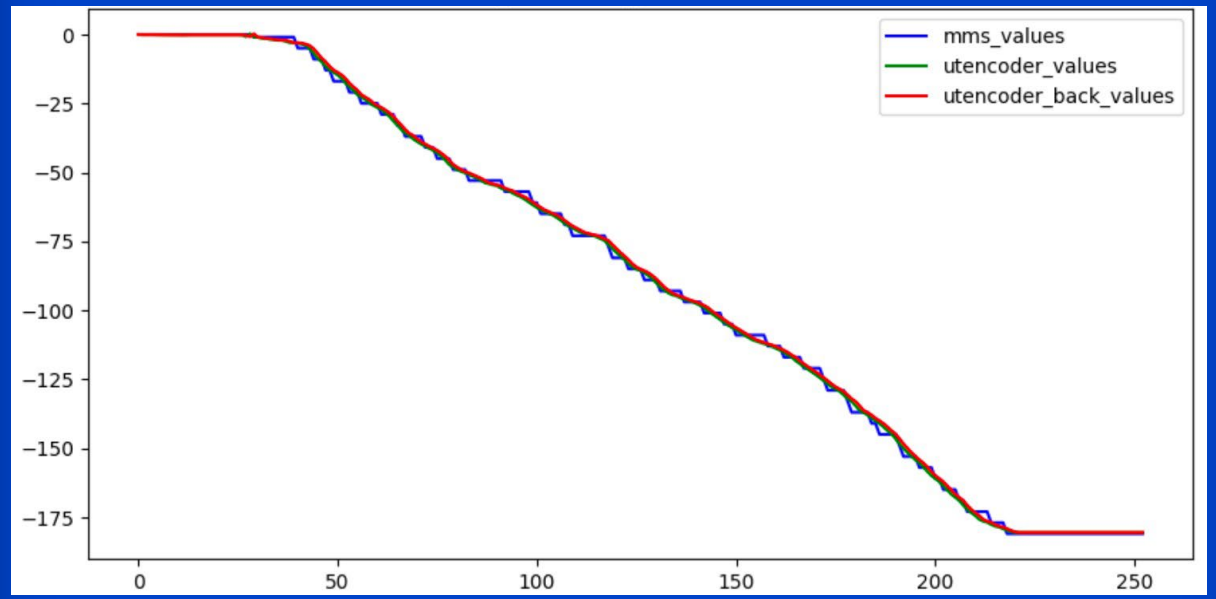


UT Encoder in Action





Preliminary Performance



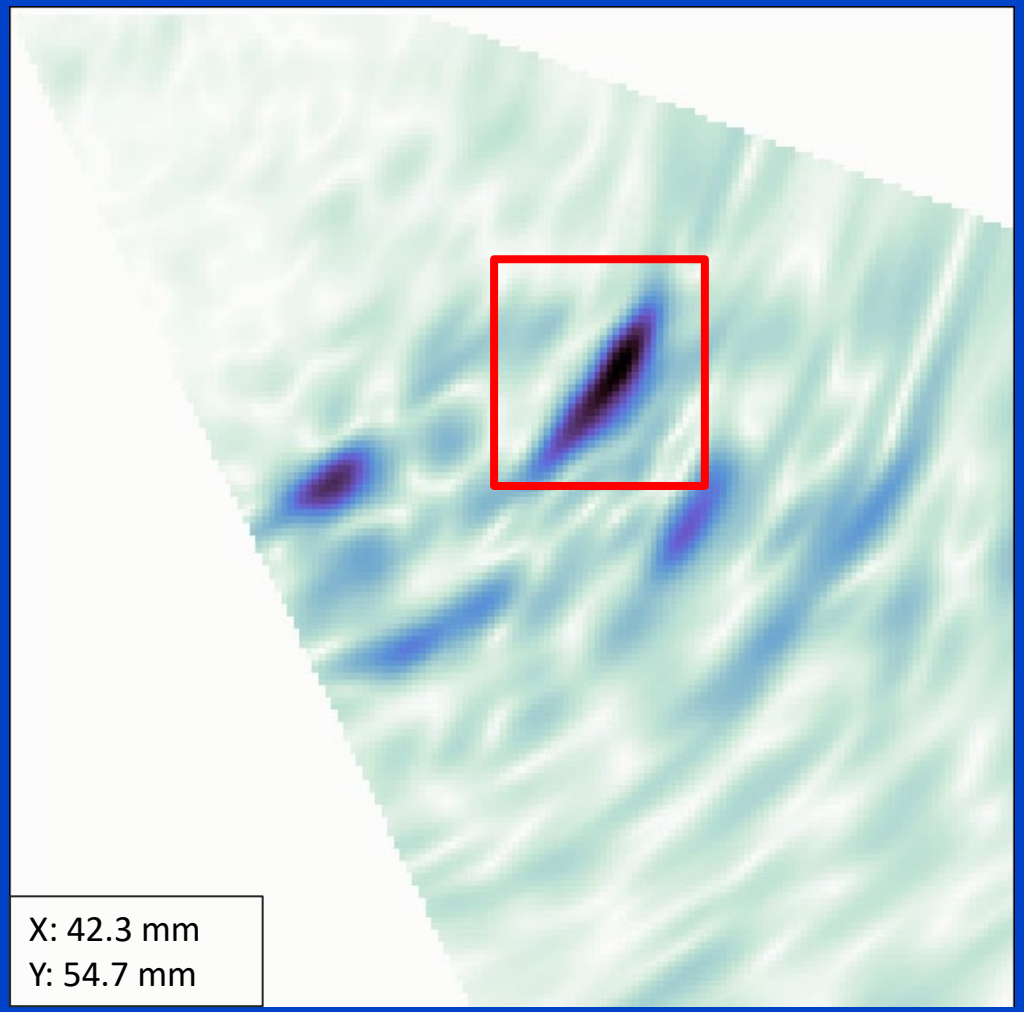
	Scan 1	Scan 2	Scan 3	Measured
Start (mm)	48	50	49	49
Stop (mm)	74	75	73	74
Length (mm)	26	25	24	25

- Sensitivity to
  - Coupling
  - Scanning speed
  - Smoothness of motion

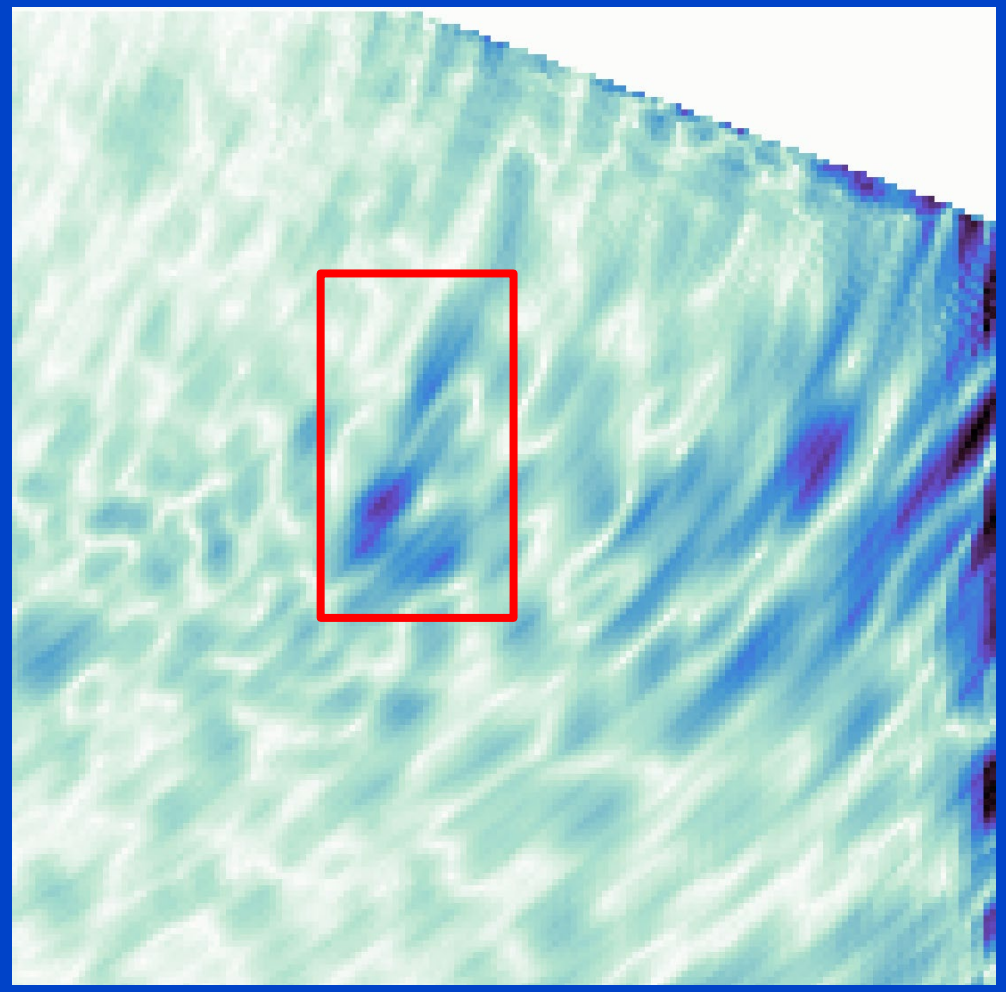
1st Level: Live Single Shot

- Familiar view
  - Richer background content
- “Backwards” compatibility
- Requires no UT encoding
- AI enables:
  - Highlights/cues/alarms
  - Basic feedback on data quality

1	Live Single Shot
	• No encoding needed • Immediate feedback / alarm



2nd Level: Live Line Scan



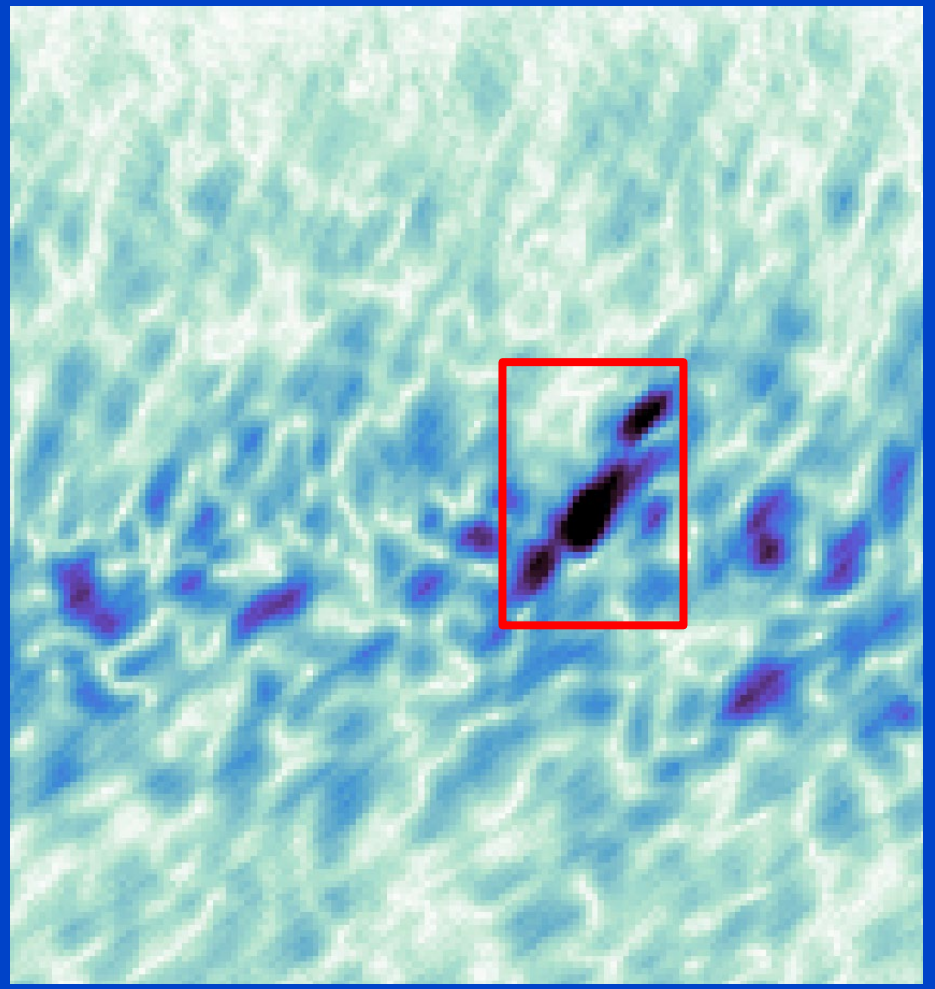
- Composition of last N shots
- Requires single-axis UT encoding
- Enables:
  - Live guidance
  - Speed monitoring

2	Live Scan Line
	• More robust ML • Live scanning guidance • Potential to save images

3rd Level: Full Reconstruction

- Full line or volumetric reconstruction once scan is complete
  - Akin to encoded examination
  - Information from all channels in a smaller file size
- Requires UT encoding (1 or 2-axis)
- Enables:
  - Recorded data for posterior review
    - B-scans, with 1-axis encoding
    - Volumetric, with 2-axis encoding
  - Real time coverage assessment (2-axis)
  - Additional independent analysis layer

3	Full 3D Reconstruction
	• Save full data volume • Potentially additional ML layer



Preparing the Way

- Value proposition for **reliability**
- Not there yet, but close
  - Prototype planned to be displayed at 2026 NDE Technology Week
- While technical challenges remain, it is time to proactively discuss:
  - Regulatory acceptance
  - Human factors or other concerns

➢ Enable safe deployment

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