

# AI-Assisted Manual PAUT



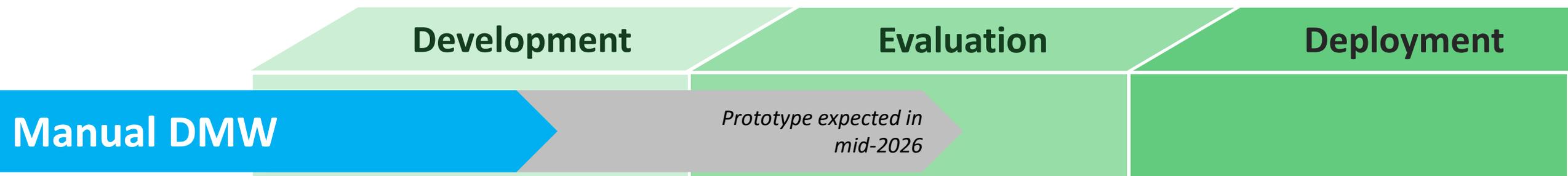
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**2026 NRC-Industry NDE Technical Information Exchange**

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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

The image shows a screenshot of a cardiac ultrasound interface. The main display area shows a grayscale ultrasound image of a heart. A yellow box highlights a specific region of the image, and a blue box with the text "Rotate counter-clockwise slowly" is overlaid on it, indicating a live AI-based instruction. A blue box labeled "Live data quality measure" points to a vertical bar on the left side of the interface. Another blue box labeled "Live AI-based instructions" points to the yellow box. At the bottom of the interface, a blue box labeled "Automatically saves best shot" points to a "Save Best Clip: 40%" button. A video player interface is visible at the bottom right, with a "Watch the video" button. The interface also includes various controls like "Depth 15 cm", "Gain 50%", and "COLOR".

Live data quality measure

Live AI-based instructions

Rotate counter-clockwise slowly

Save Best Clip: 40%

Automatically saves best shot

Watch the [video](#)

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

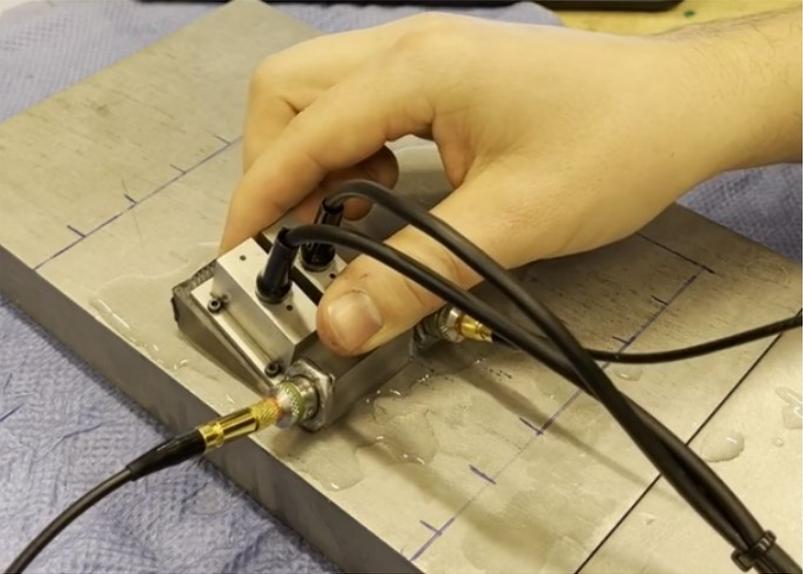
### 1 Live Single Shot

- No encoding needed
- Immediate feedback / alarm

**UT encoding is the gatekeeper**

Increasing capability

# Proposed System

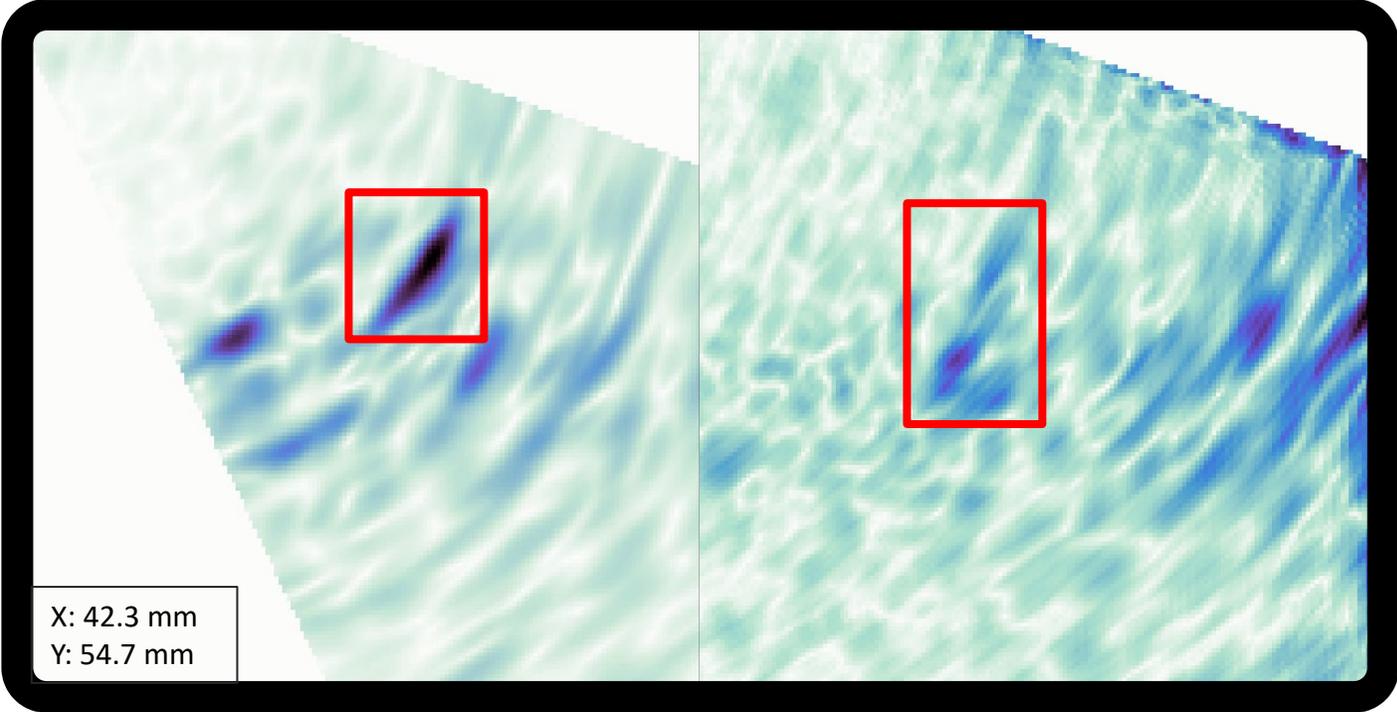


*Manual scanning with UT encoder*

- Two-axis encoding

*Partial SAFT Live View*

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



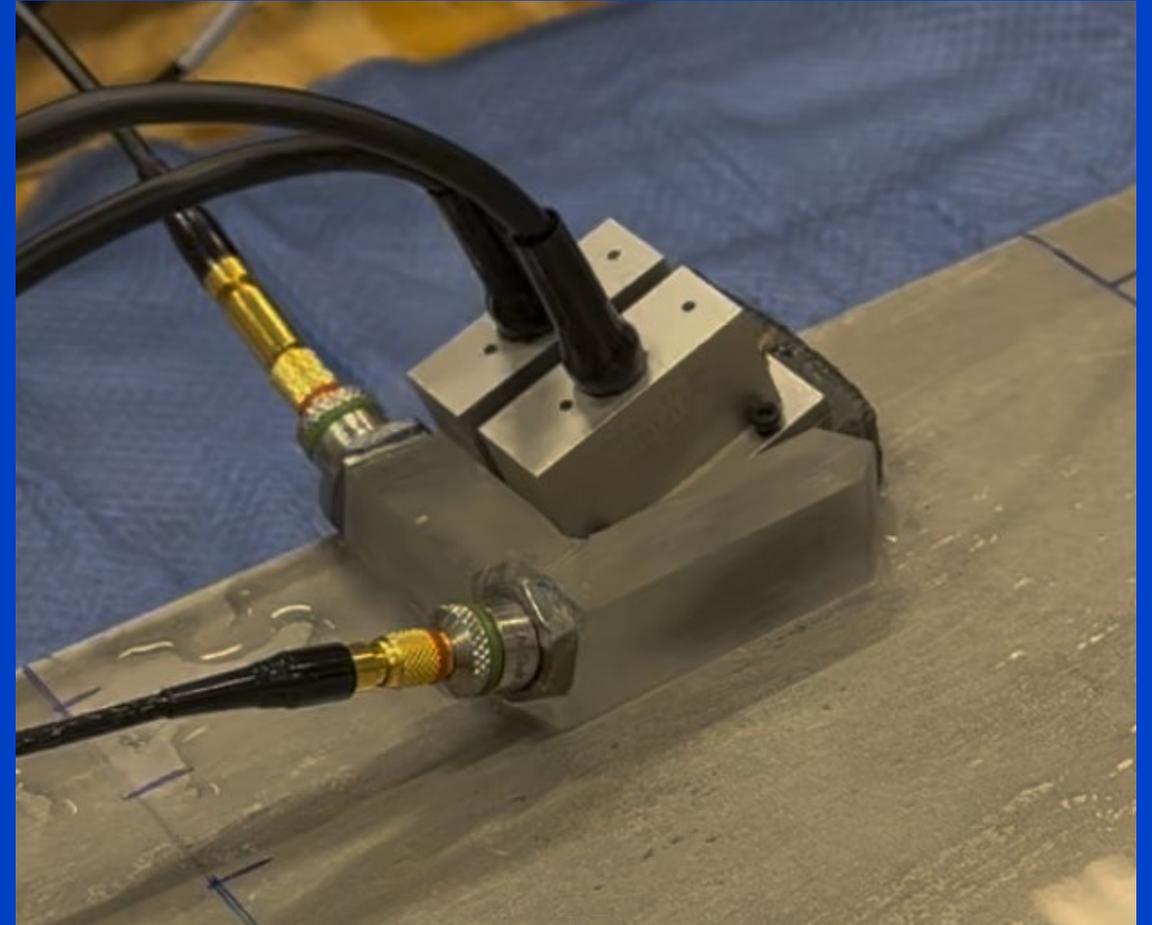
*TFM+PWI Live Sectorial View*

- Single shot
- Familiar view

Both levels with AI highlights

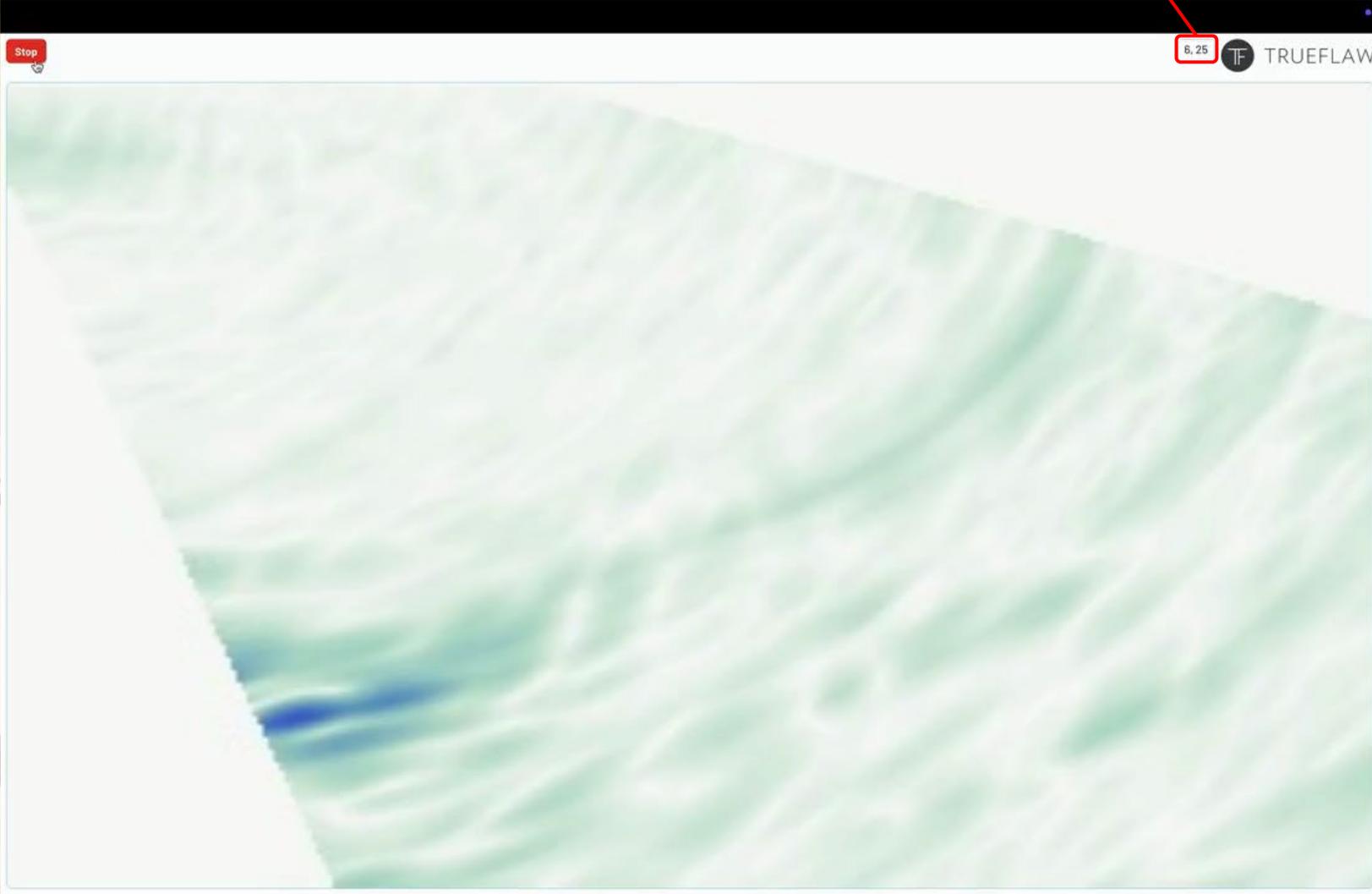
# UT Encoder

- 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

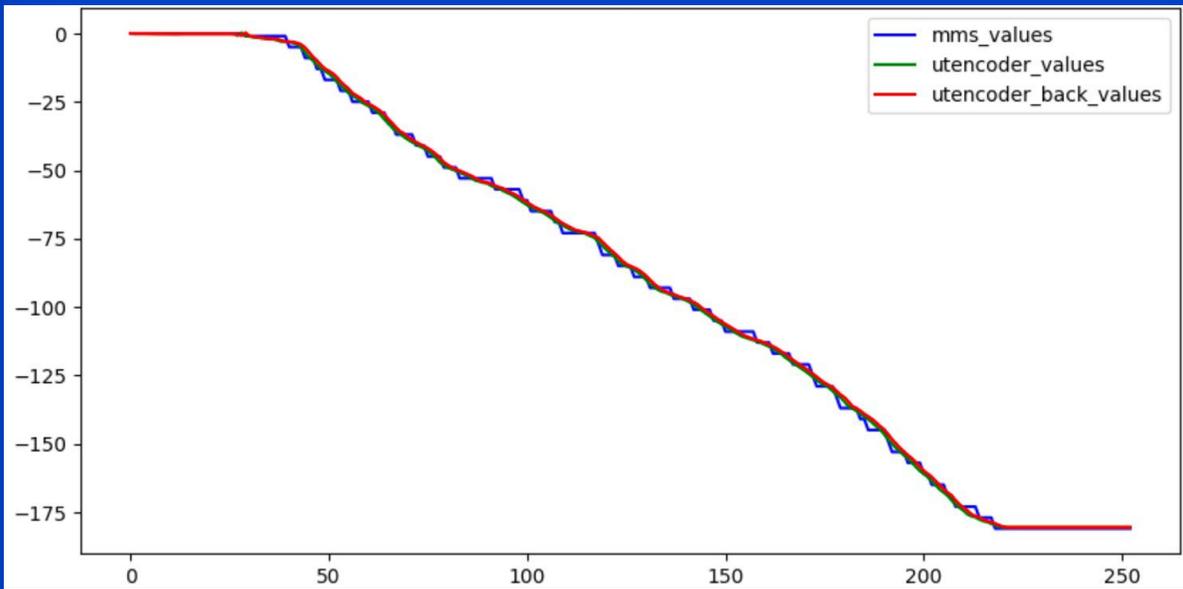


# UT Encoder in Action

6, 25



# Preliminary Performance



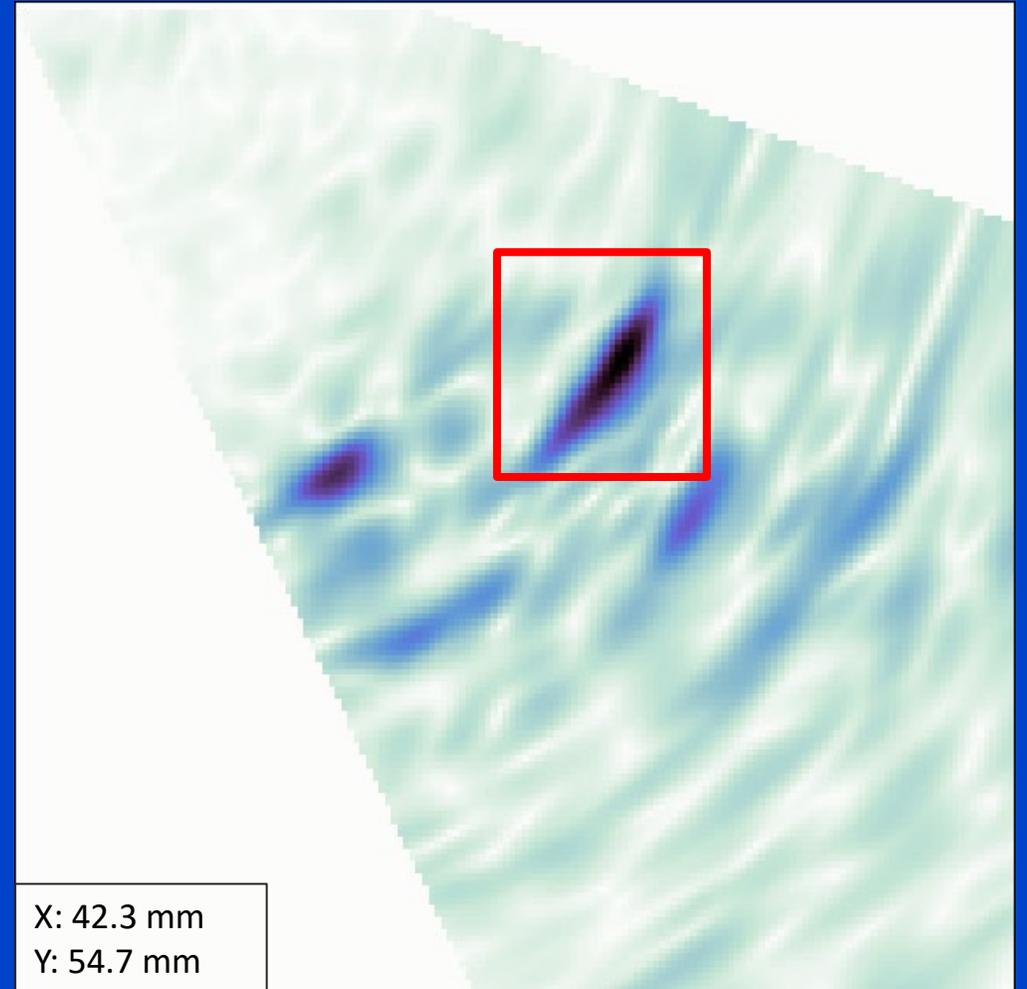
	Scan 1	Scan 2	Scan 3	Measured
Start (mm)	48	50	49	49
Stop (mm)	74	75	73	74
Length (mm)	26	25	24	25

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

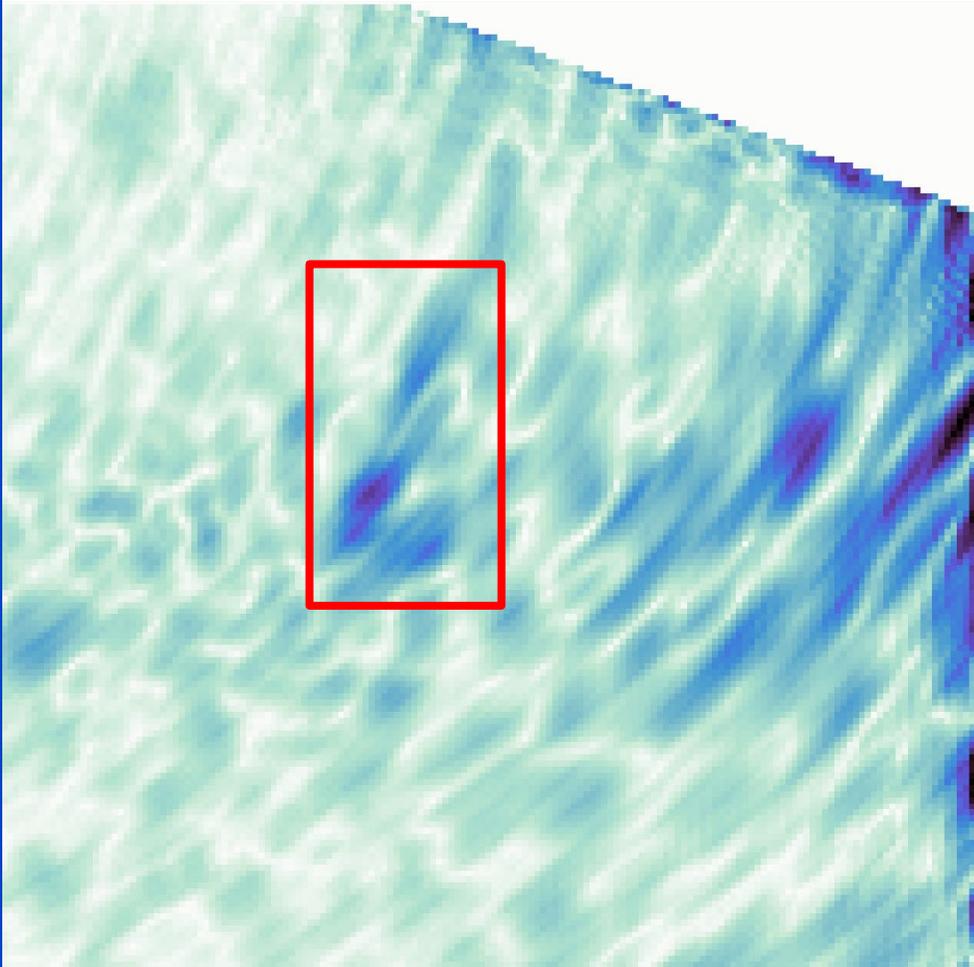
# 1<sup>st</sup> Level: Live Single Shot

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

<b>1</b>	<b>Live Single Shot</b>
	<ul style="list-style-type: none"><li>• No encoding needed</li><li>• Immediate feedback / alarm</li></ul>



## 2<sup>nd</sup> Level: Live Line Scan



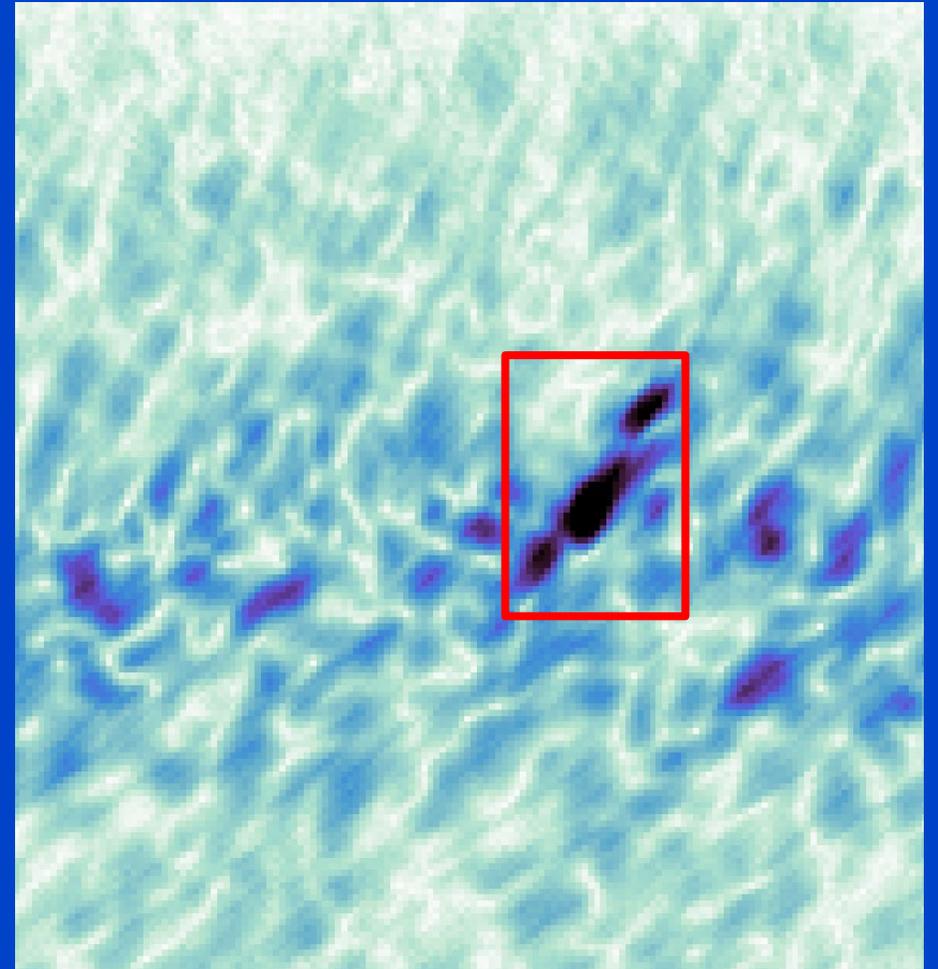
- Composition of last N shots
- Requires single-axis UT encoding
- Enables:
  - Live guidance
  - Speed monitoring

2	Live Scan Line
	<ul style="list-style-type: none"><li>• More robust ML</li><li>• Live scanning guidance</li><li>• Potential to save images</li></ul>

# 3<sup>rd</sup> 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

<b>3</b>	<b>Full 3D Reconstruction</b>
	<ul style="list-style-type: none"><li>• Save full data volume</li><li>• Potentially additional ML layer</li></ul>



# 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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