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Beyond current

Eddy Current Array for Rivet Hole Inspection

Pairing Speed, Efficiency and Reliability

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AGENDA

- Rivet hole inspection
- Our solution
- Performances
- Solution advantages

Rivet hole inspection

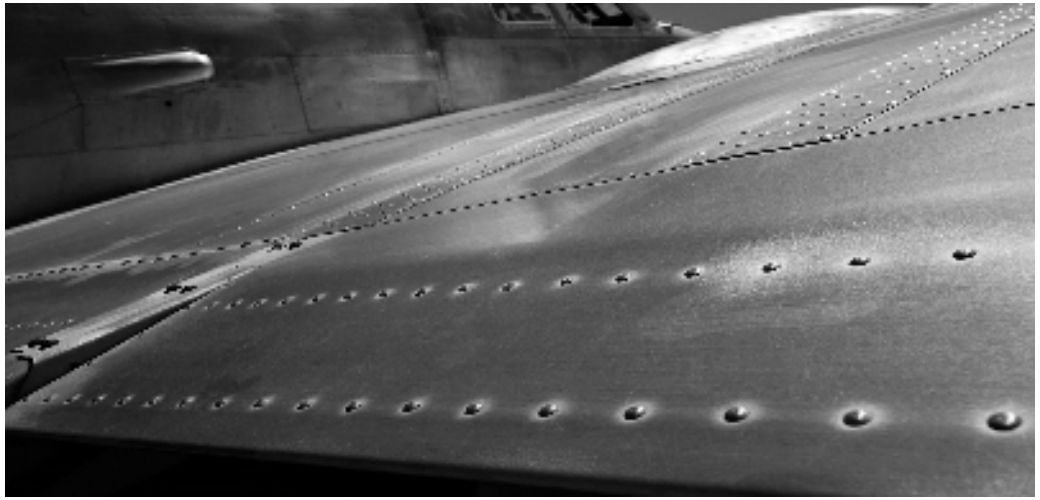
RIVET HOLE INSPECTION

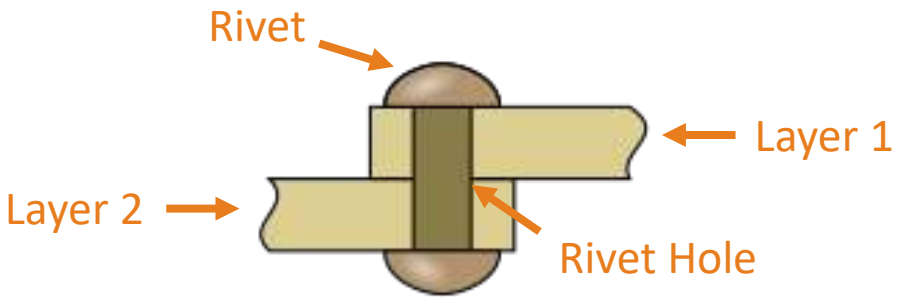
Context

- Rivet assemblies represents the main fixation system for aeronautic and aerospace structures.
- Lifetime affected by stresses leads to small cracking initiated in the rivet holes

Objective

Provide a new inspection solution using eddy current array techniques while pairing speed, efficiency and reliability





Rivet structural assembly

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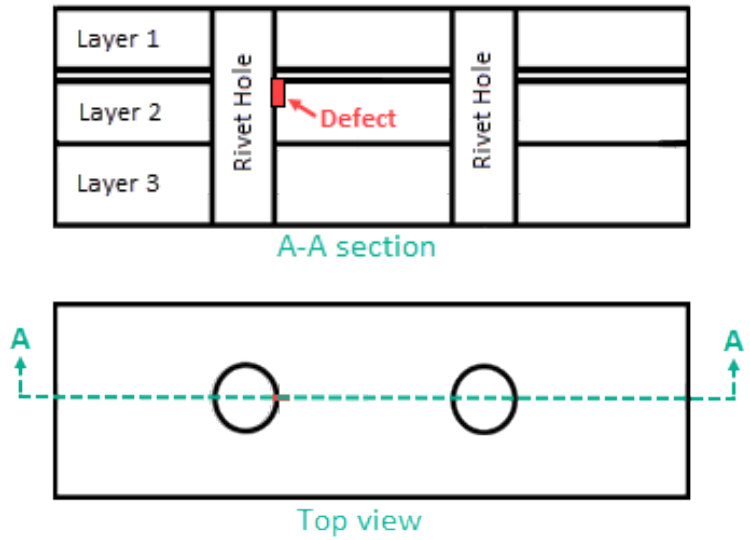
INSPECTION REQUIREMENTS

Client requirements

- Multi-layer of aluminium plates with a hole length range from 0.12 to 0.7 inches
- 0.5 inches hole ID with 100 mils variation
- Detection of axial cracks with the smallest crack having 80 mils Height x 20 mils Depth

Challenges

- Rivet hole geometry and restricted access
- Flaws located mainly on the layer transition



Defect representation in a triple layer sample

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Our complete solution

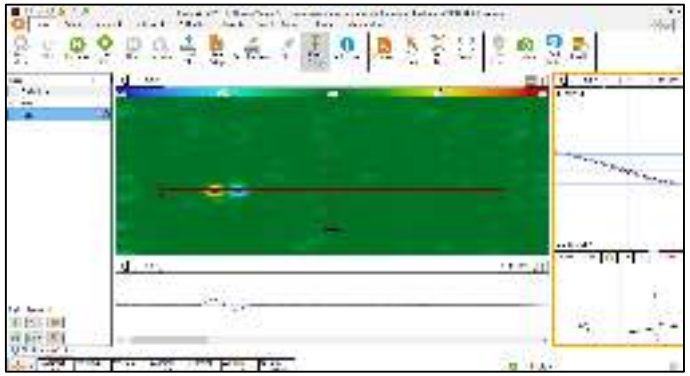
OUR SOLUTION

A complete acquisition chain (probe, instrument and software), that is rapid and simple to deploy and answers the industry's need

Probe : Rivet hole ECA probe

EC instrument : Reddy

Acquisition and analysis software: Magnifi



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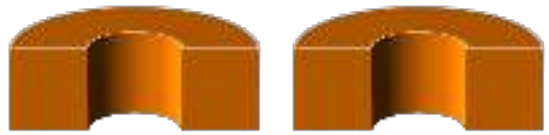
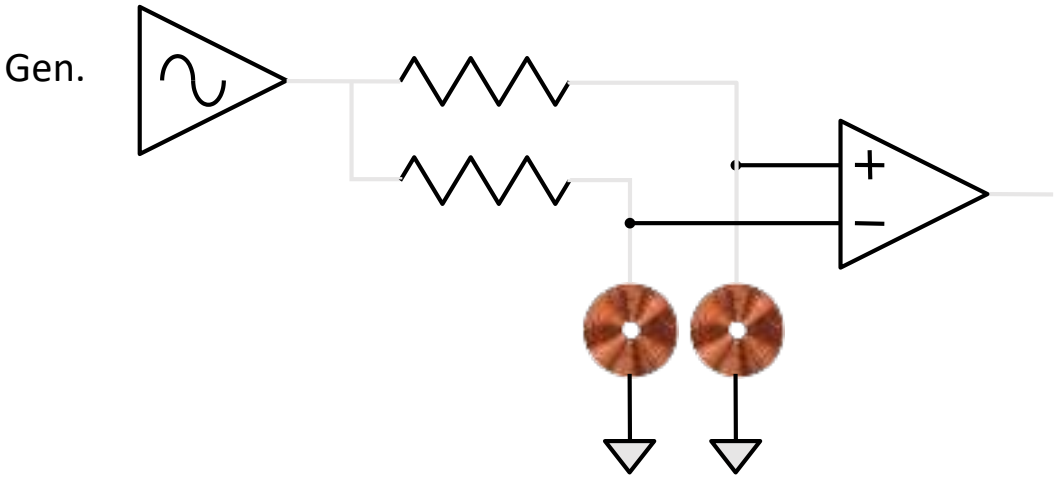
CUSTOM ECA PROBE

Configuration – Differential mode

- Coils are physically placed side-by-side
- Coils are excited and sensed at the same time
- One coil connected to positive input and the other to negative input



Physical configuration – side-by-side



Operating mode

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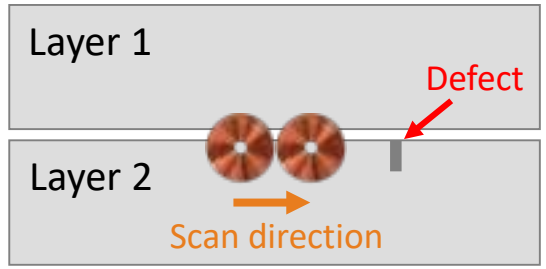
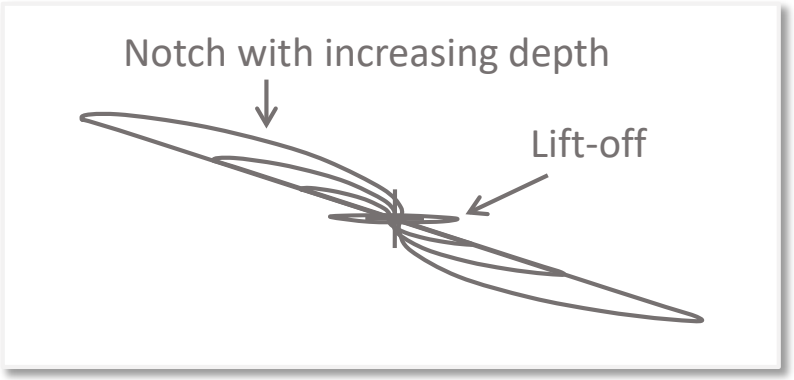
CUSTOM ECA PROBE

Signal response and advantages

- Signal from the subtraction of two sensors
- Double loop for each defect detected (8 shape)
- Very sensitive to short defects and provides a high signal-to-noise ratio
- Unaffected by gradual variations similar to lift-off, layer transition



Inspection method – Defect located between layers



Differential mode – Signal response

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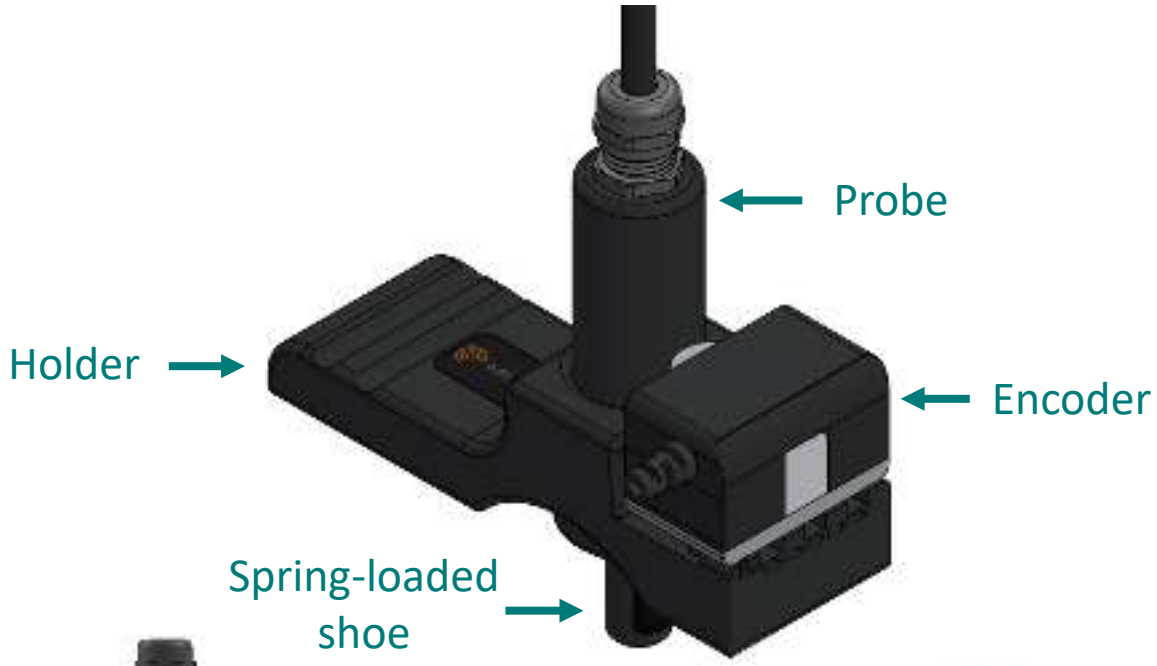
CUSTOM ECA PROBE

Mechanical solution

- Adapted spring-loaded shoe
- 360-degree probe rotation
- Custom holder for a stable scan
- Encoded scans
- Easy-to-repair probe head
- Optional ceramic shoe for better durability



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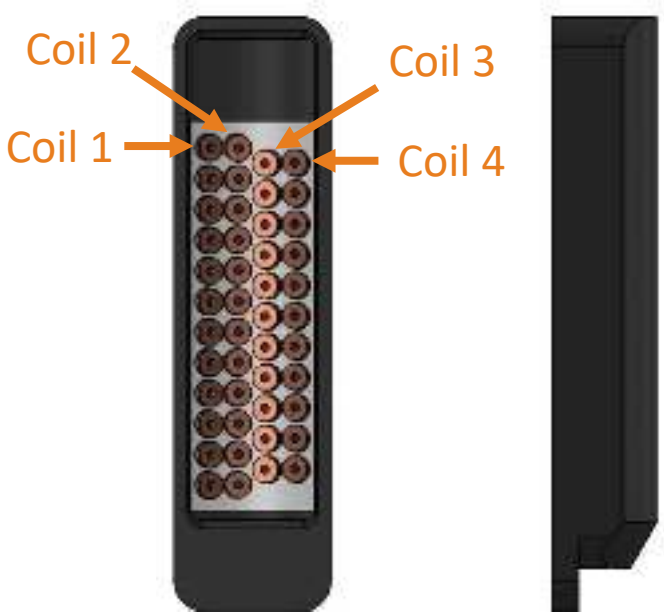
CUSTOM ECA PROBE

Coil arrangement

- Total of 46 coils generating 23 channels as for client's request
- Probe total coverage of 0.8 inches that can be increased if required
- Coil OD 60 mils centred at 1MHz with frequency range from 500 - 1500KHz



Spring-loaded shoe

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EC INSTRUMENT

Reddy ®

Proposed solution is compatible with the Reddy instrument

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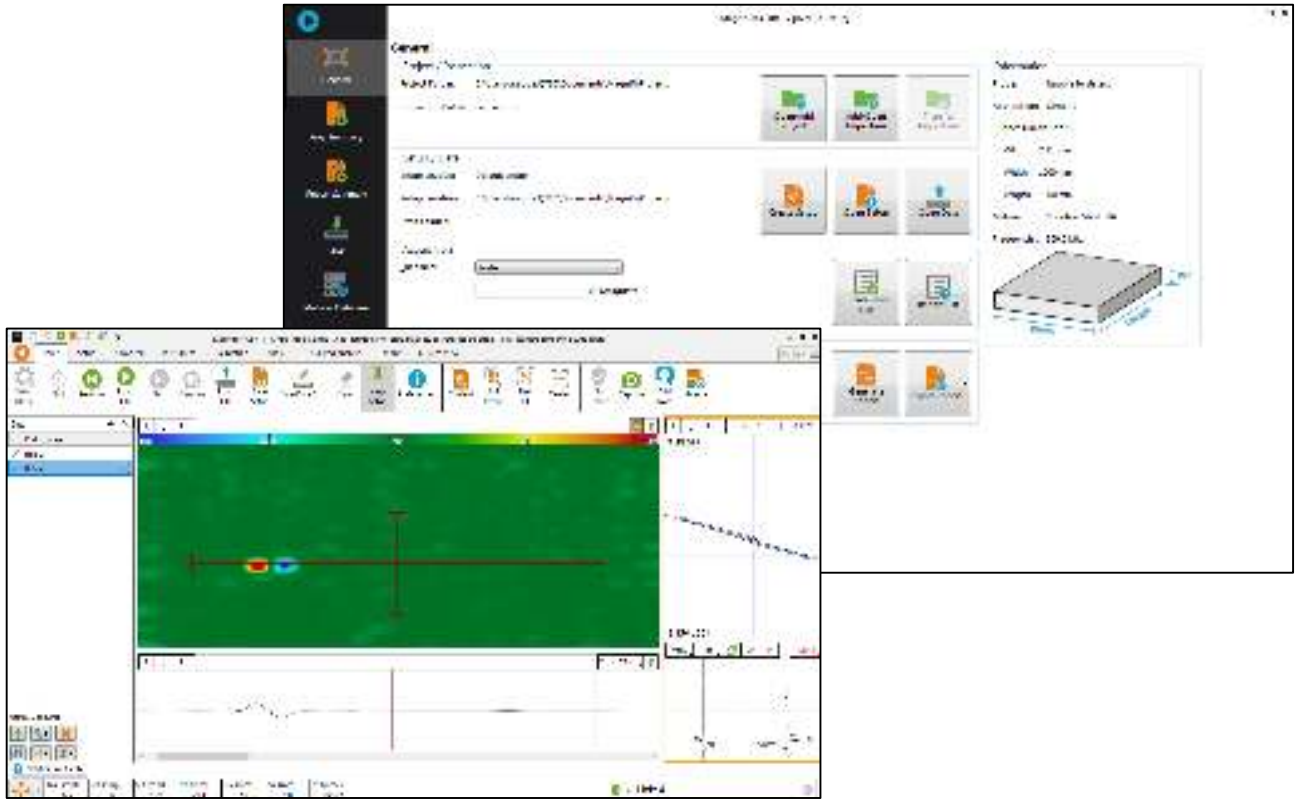
ACQUISITION AND ANALYSIS SOFTWARE

Magnifi overview

- Intuitive user interface
- Assisted analysis
- Automatic reporting
- Full data traceability



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Performances

TEST SAMPLE

Sample composed by 3 layers having 8 rivet holes

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TEST SAMPLE

Defect size
80 mils H x 40 mils D

Defect size
80 mils H x 40 mils D

Defect size
80 mils H x 20 mils D

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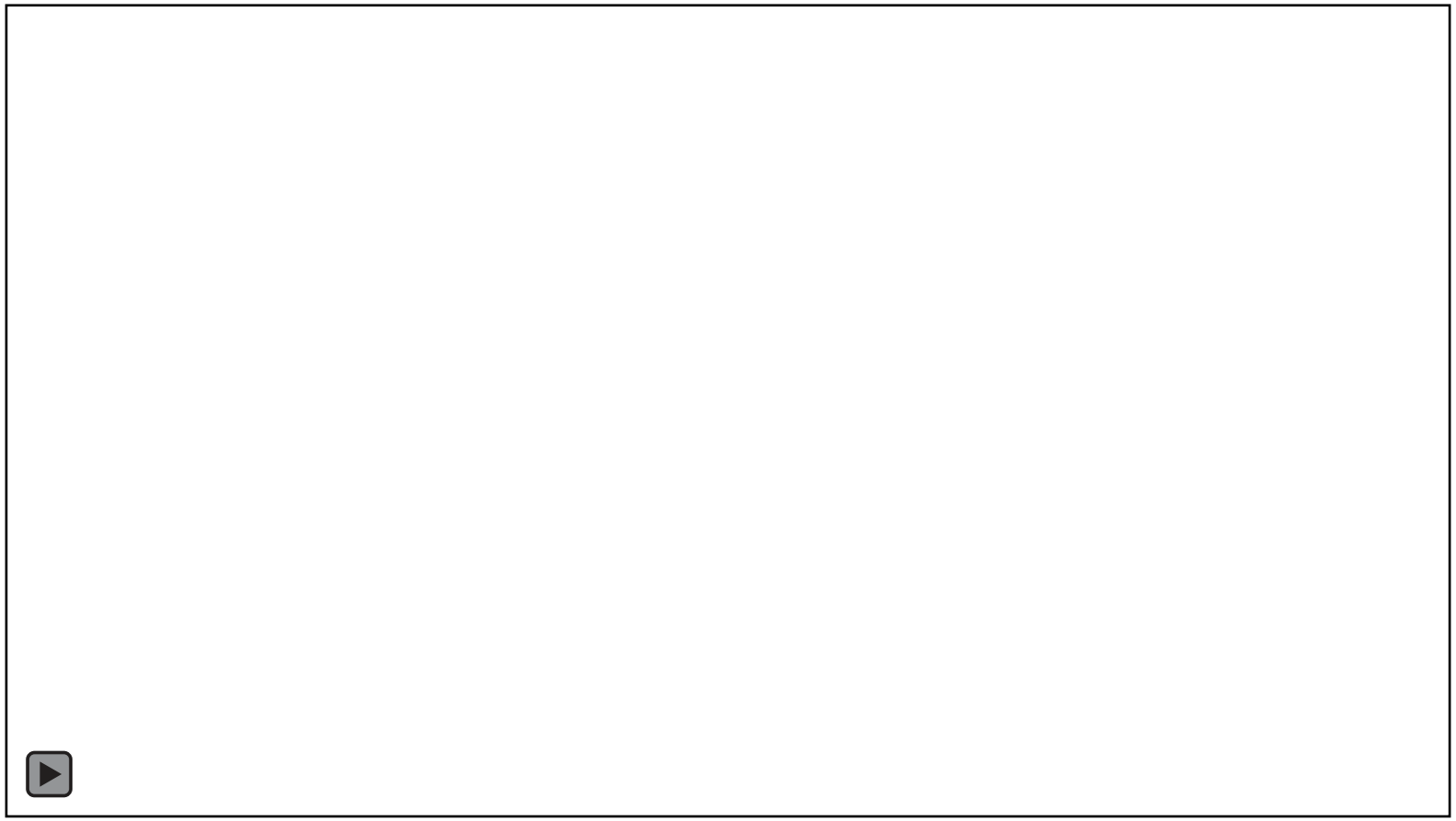
QUICK DEMO



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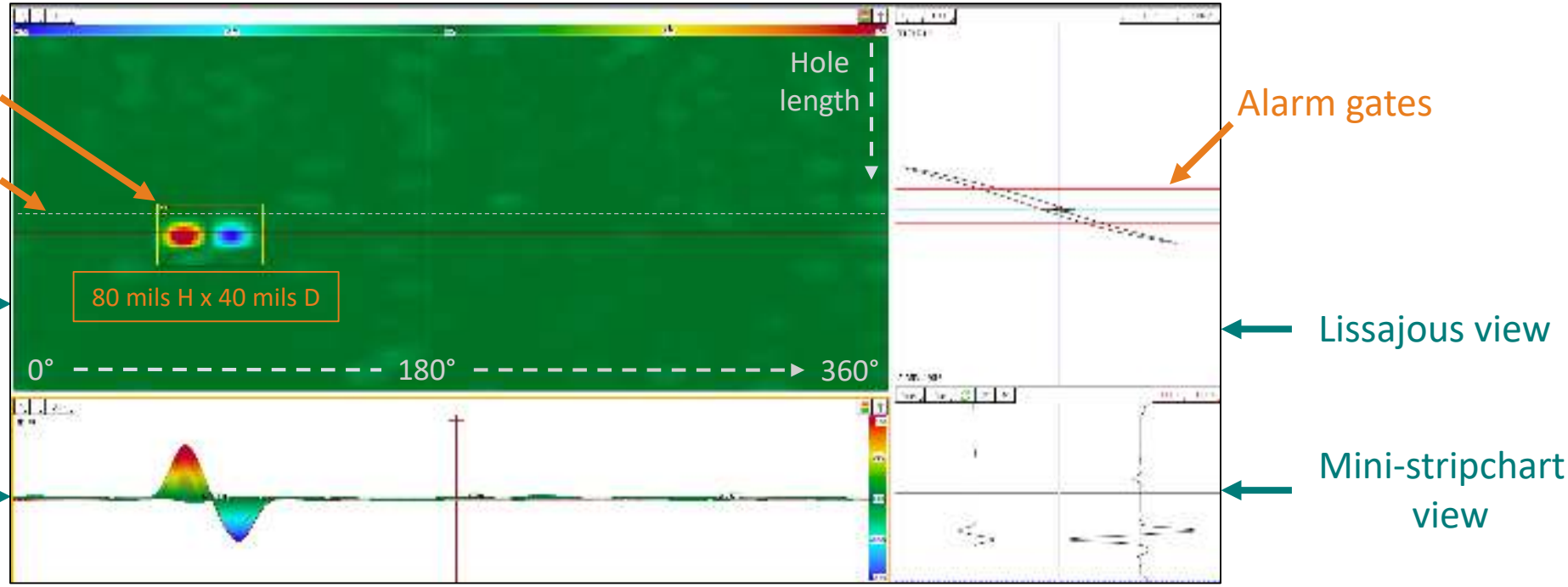
RESULTING DATA IN MAGNIFI

One defect identified in rivet hole #2



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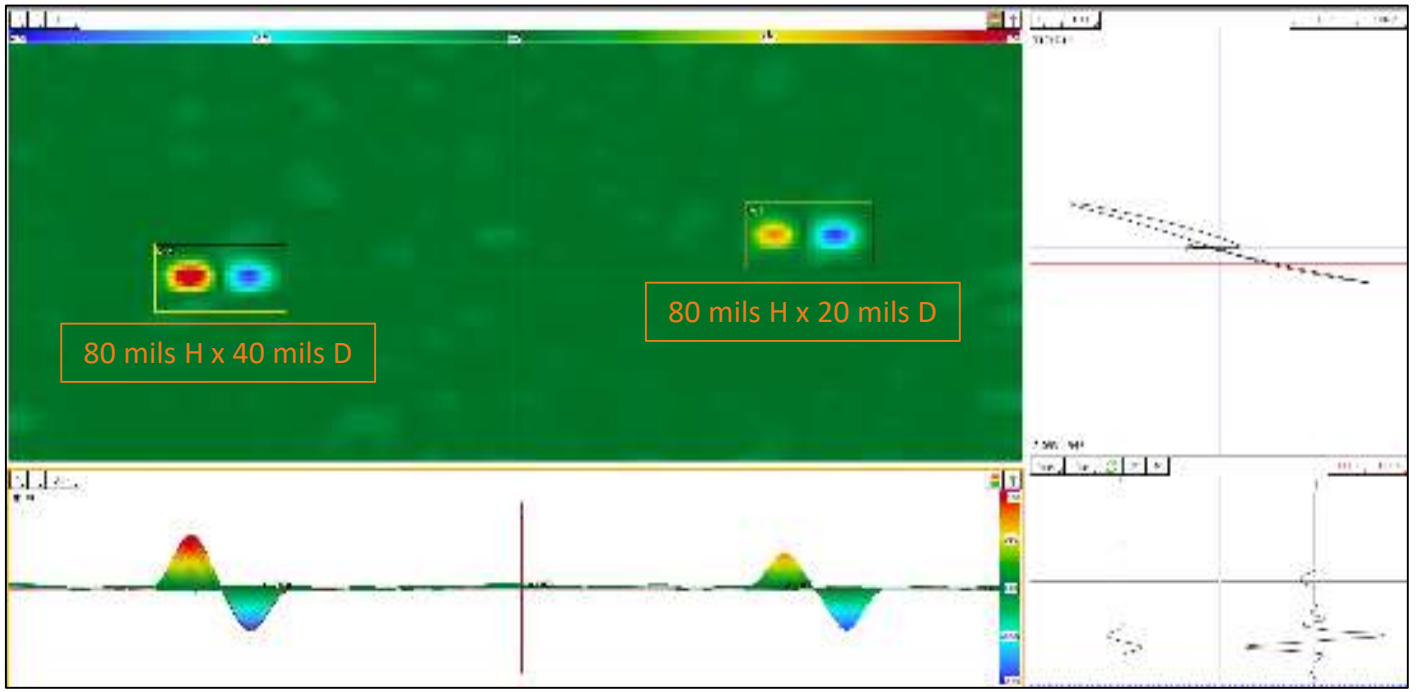
RESULTING DATA IN MAGNIFI

Two defects identified in rivet hole #4



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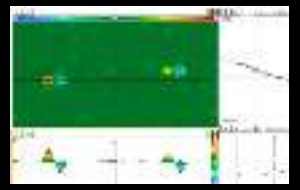
Solution advantages

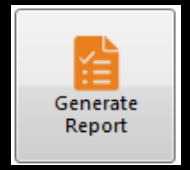
FAST INSPECTION & AUTOMATIC REPORTING

Scan performed *Analysis* *Automatic reporting*

Rivet Hole inspection

Dedicated ECA probe





High speed – Single pass

Auto defect detection with alarm gates

One click report generation

Typical inspection workflow

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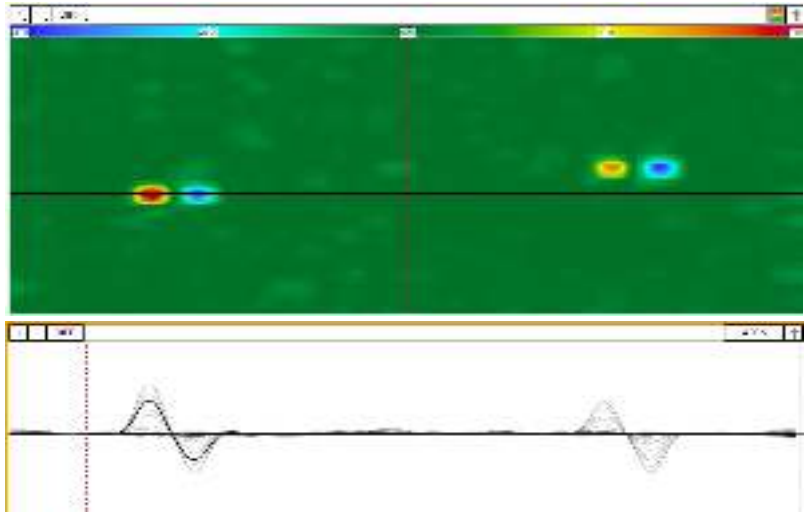
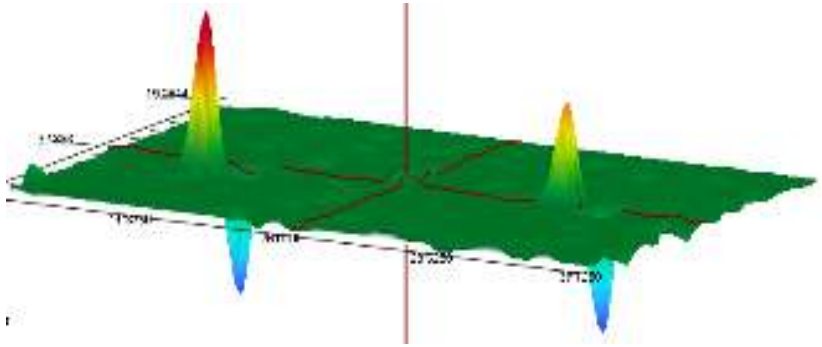
POWERFUL SOLUTION

- Human controlled factor
- Dynamic acquisition with integrated encoder for defect localization inside the hole
- Single-pass covering the full length of holes
- Unaffected by layer transition and very sensitive to small cracks initiating from this transition
- Very high signal-to-noise ratio (SNR)
- Can be adapted to a wide range of hole OD





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Thank you

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