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
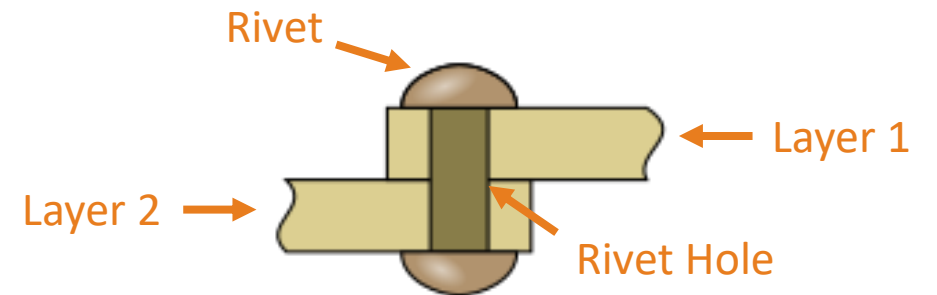

Rivet structural assembly

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INSPECTION REQUIREMENTS
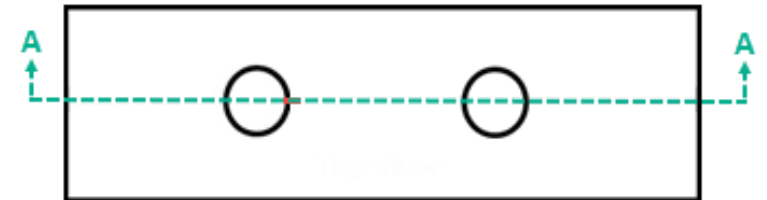
Client requirements

- 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
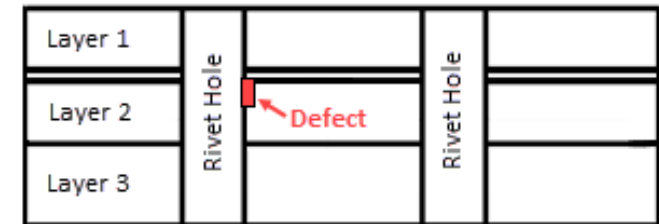
Defect representation in a triple layer sample

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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
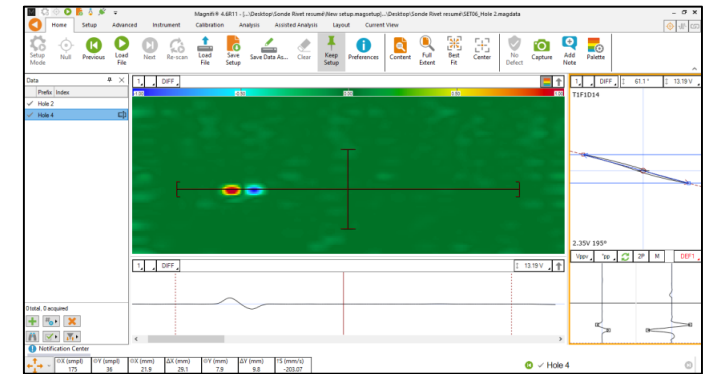
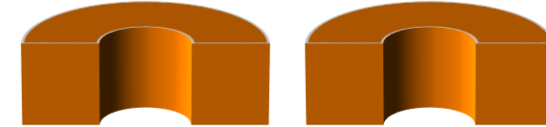Probe : Rivet hole ECA probe

EC instrument : Reddy

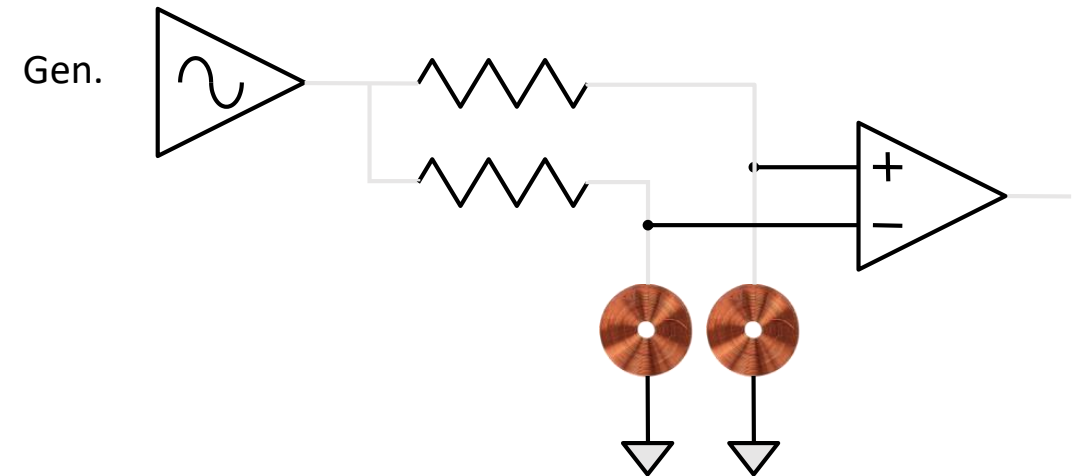Acquisition and analysis software: Magnifi

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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
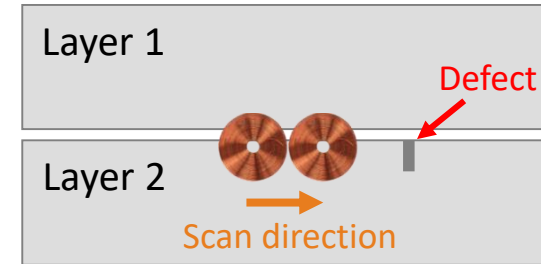
Physical configuration – side-by-side

Gen.

Operating mode

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CUSTOM ECA PROBE

Inspection method – Defect located between layers

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
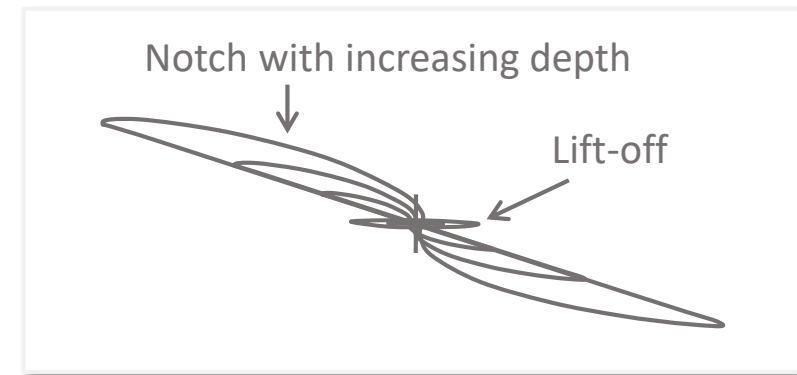
Differential mode – Signal response

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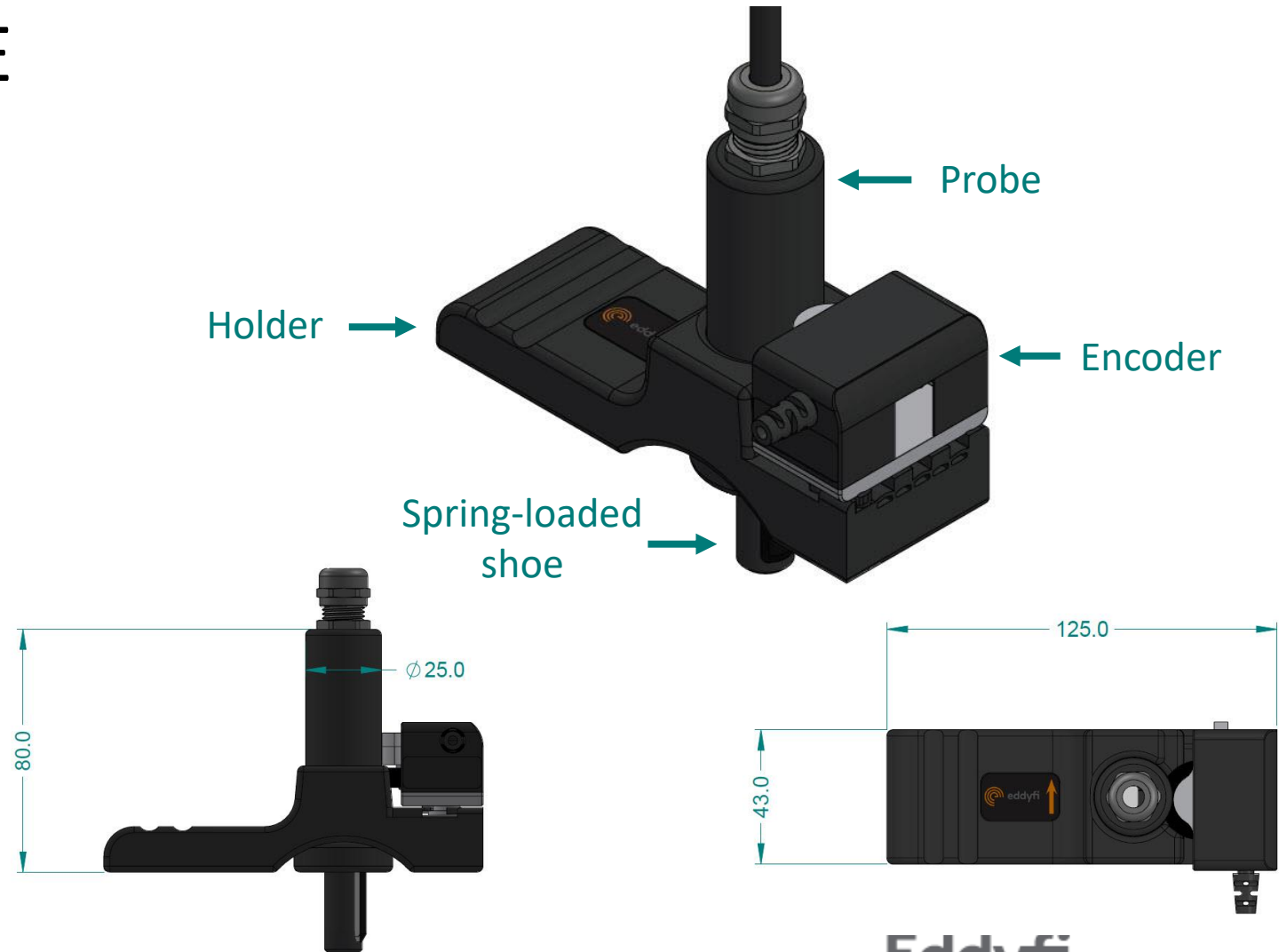
# CUSTOM ECA PROBE

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

Probe

Holder

Encoder

Spring-loaded shoe

⌀25.0

80.0

125.0

43.0

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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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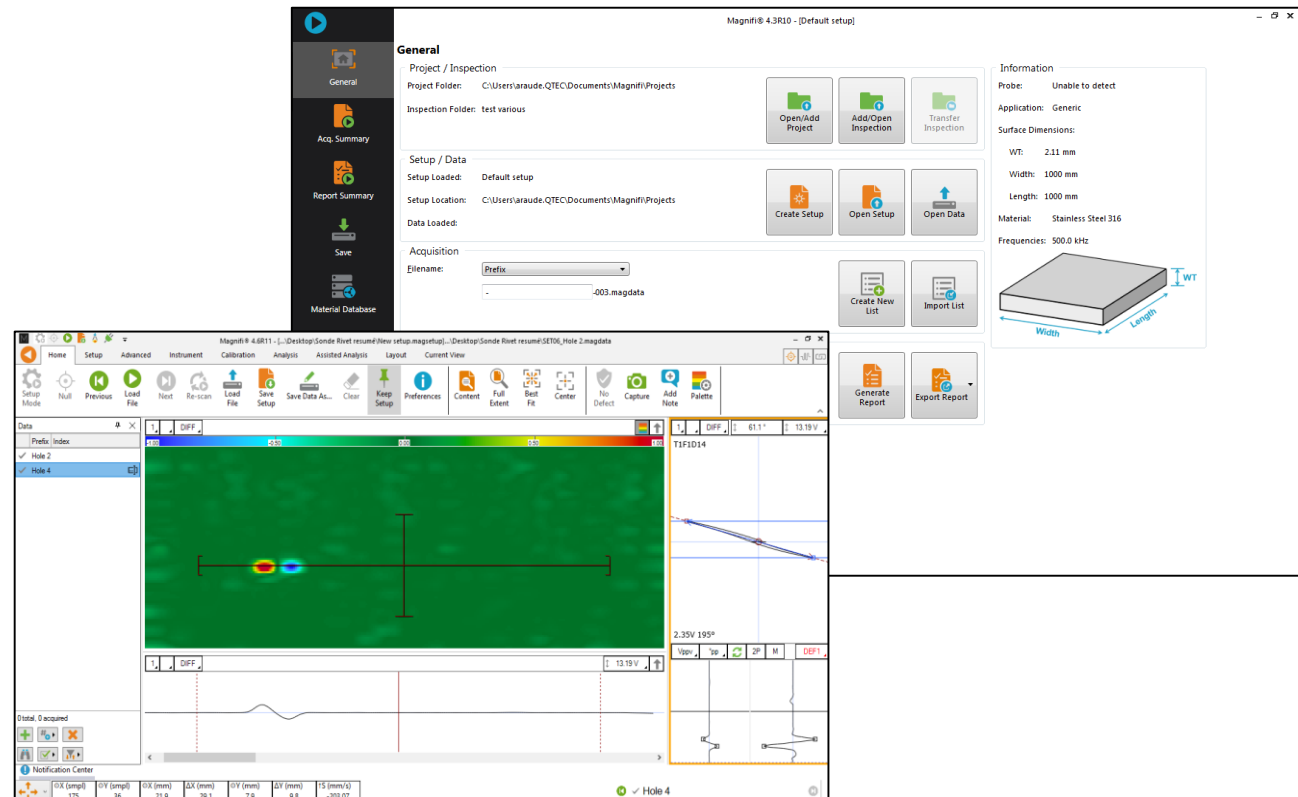
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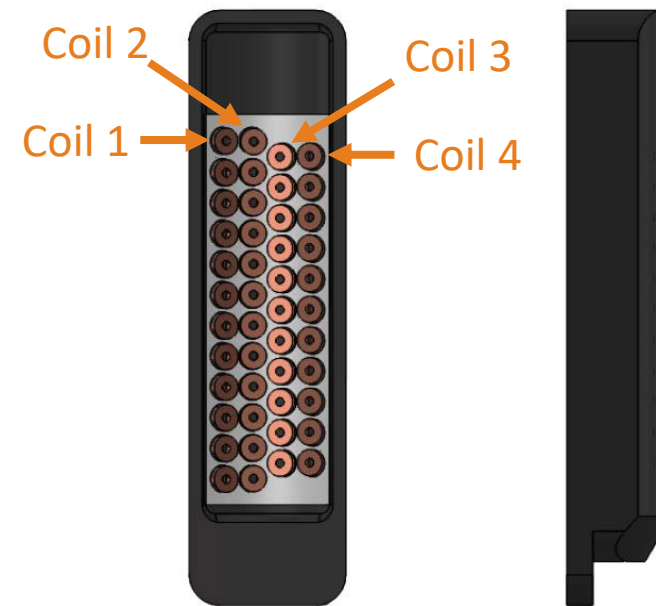
EC INSTRUMENT

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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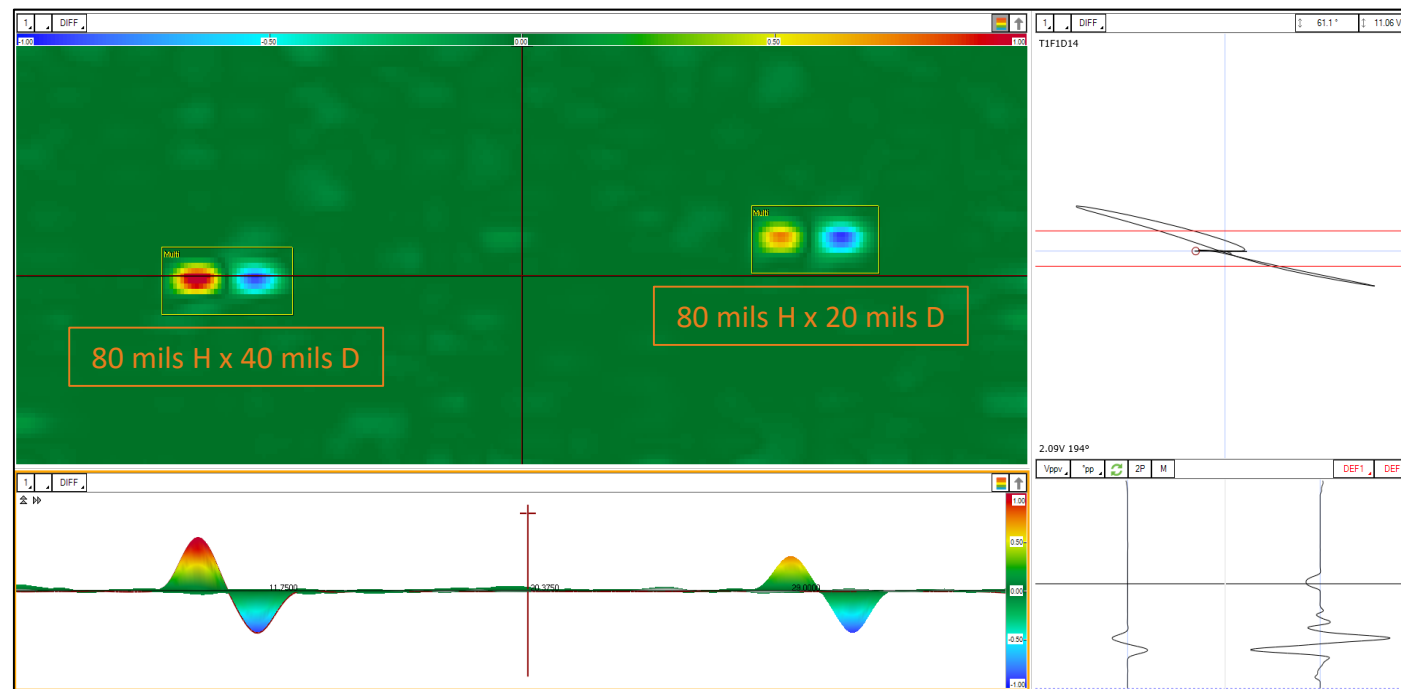# QUICK DEMO

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RESULTING DATA IN MAGNIFI

One defect identified in rivet hole #2

Indication boxes

Layer transition with C-scan grid

2D C-scan view

3D C-scan Front view

Hole length

80 mils H x 40 mils D

0°   180°   360°

Alarm gates

Lissajous view

Mini-stripchart view

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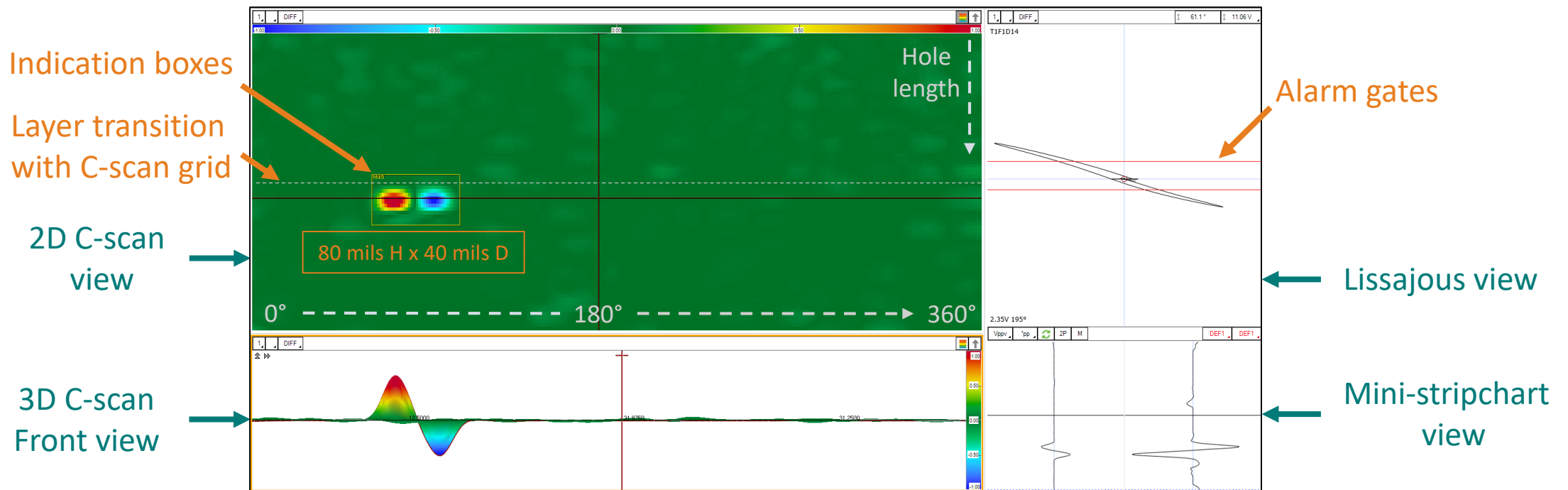
RESULTING DATA IN MAGNIFI

Two defects identified in rivet hole #4

80 mils H x 40 mils D

80 mils H x 20 mils D

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Solution advantages

FAST INSPECTION & AUTOMATIC REPORTING

Scan performed   Analysis   Automatic reporting

Rivet Hole inspection

Dedicated ECA probe

Generate Report

High speed – Single pass   *Auto defect detection with alarm gates*   *One click report generation*
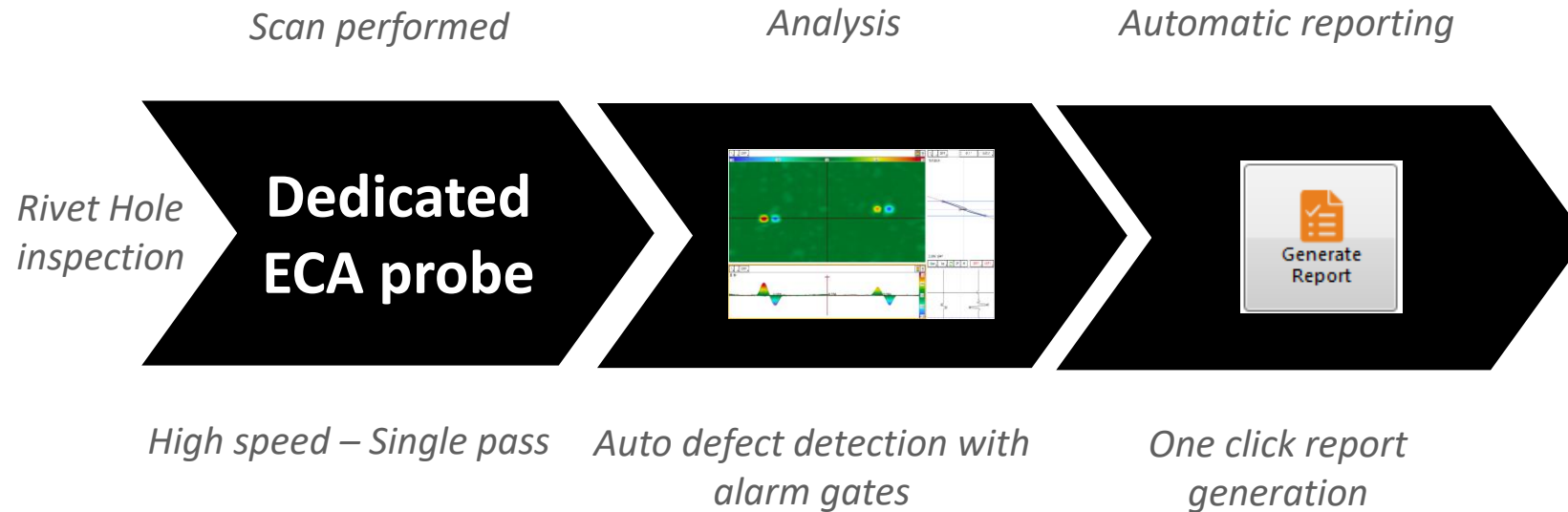
Typical inspection workflow

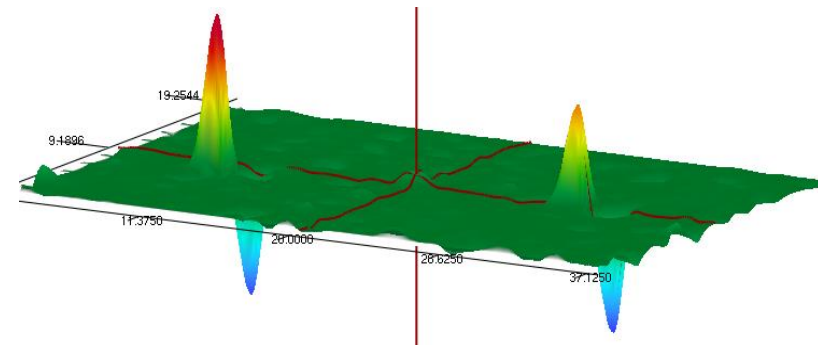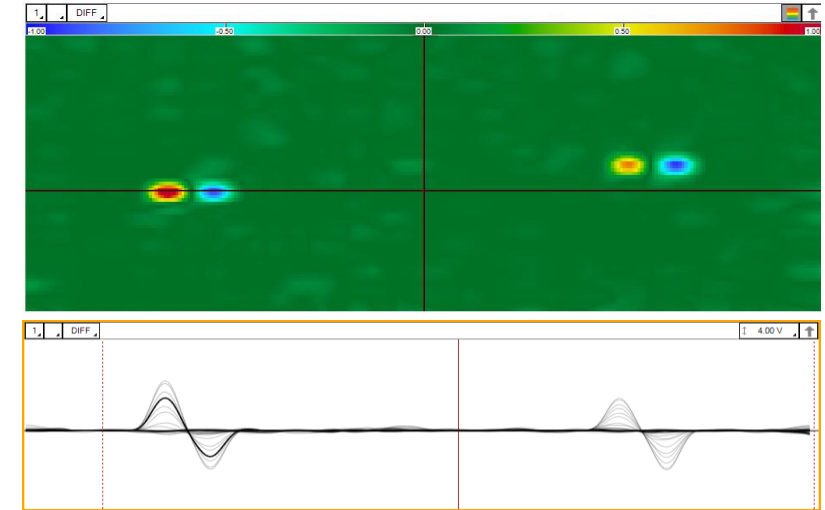**Eddyfi Technologies**
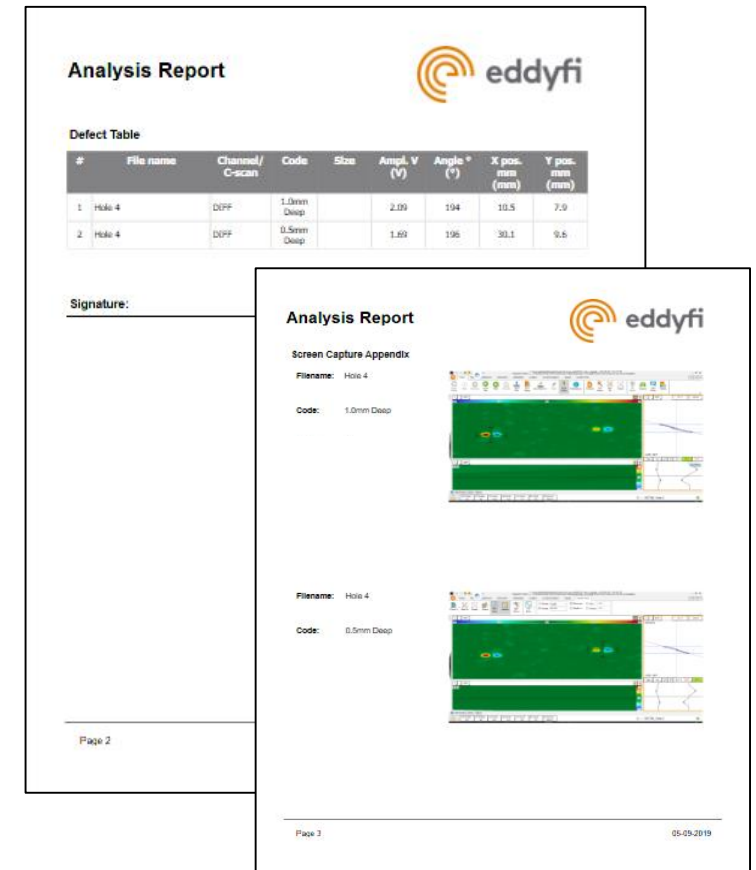
POWERFUL SOLUTION

- 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