

**Eddyfi Technologies**

Beyond current



# Heat Exchanger Tubing Inspection: Revolutionizing Asset Integrity Management



# SPEAKER PRESENTATION

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Eddyfi Technologies

General Manager - Africa

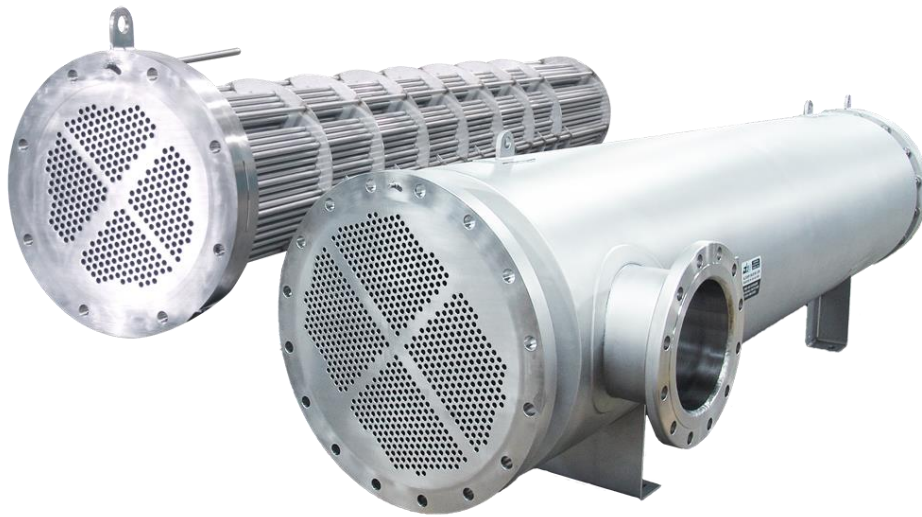
- General Manager for Eddyfi, Silverwing, TSC and Teletest products lines in Africa
- Over 20 years of experience in the NDT industry
- Eddyfi Technologies offices are located in Cape Town, South Africa

# CONTENT

1. Heat exchangers
2. Conventional tubing probes
3. Why move to an array technology?
4. Manual pulling
5. Why move to a probe pusher?
6. Manual analyst
7. Why move to the automatic data screening?
8. Innovating to combine the best of both worlds

# HEAT EXCHANGERS

- Mainly used in Oil & Gas industry, to transfer heat between fluids
- Some use cold water or large fans to dissipate the heat
- Designed with straight tubes or U-bends
- Made of ferrous and non-ferrous material



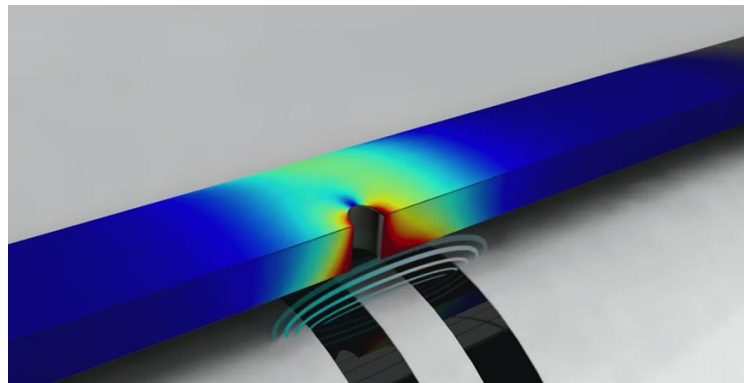
Conventional heat exchanger



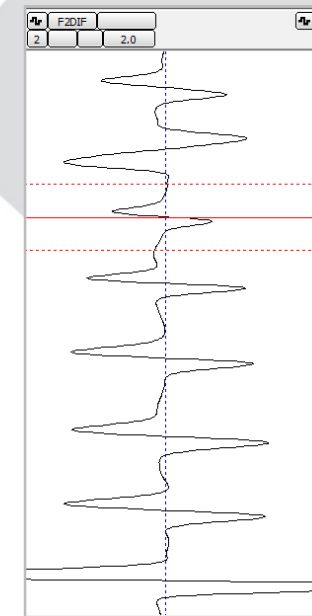
Fin fan air cooler heat exchanger

# CONVENTIONAL TUBING PROBES

- ECT for the non-ferromagnetic and the RFT & NFT for the ferrous tubes inspection
- Fast acquisition, good detection and sizing capabilities (NFT = screening tool)
- Typical flaws (pitting, fretting, erosion, general corrosion)
- Most of the time **re-scanned by IRIS**
- **Very limited on crack detection**, crucial information for the plant owner
- Strip chart analysis only – **no C-scan imaging**



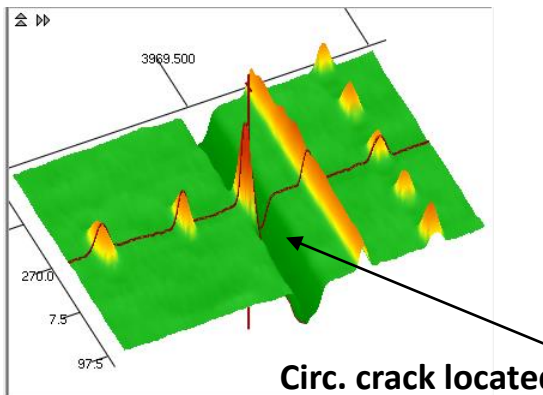
*Eddy current density simulation performed with COMSOL® Multiphysics with ECT*



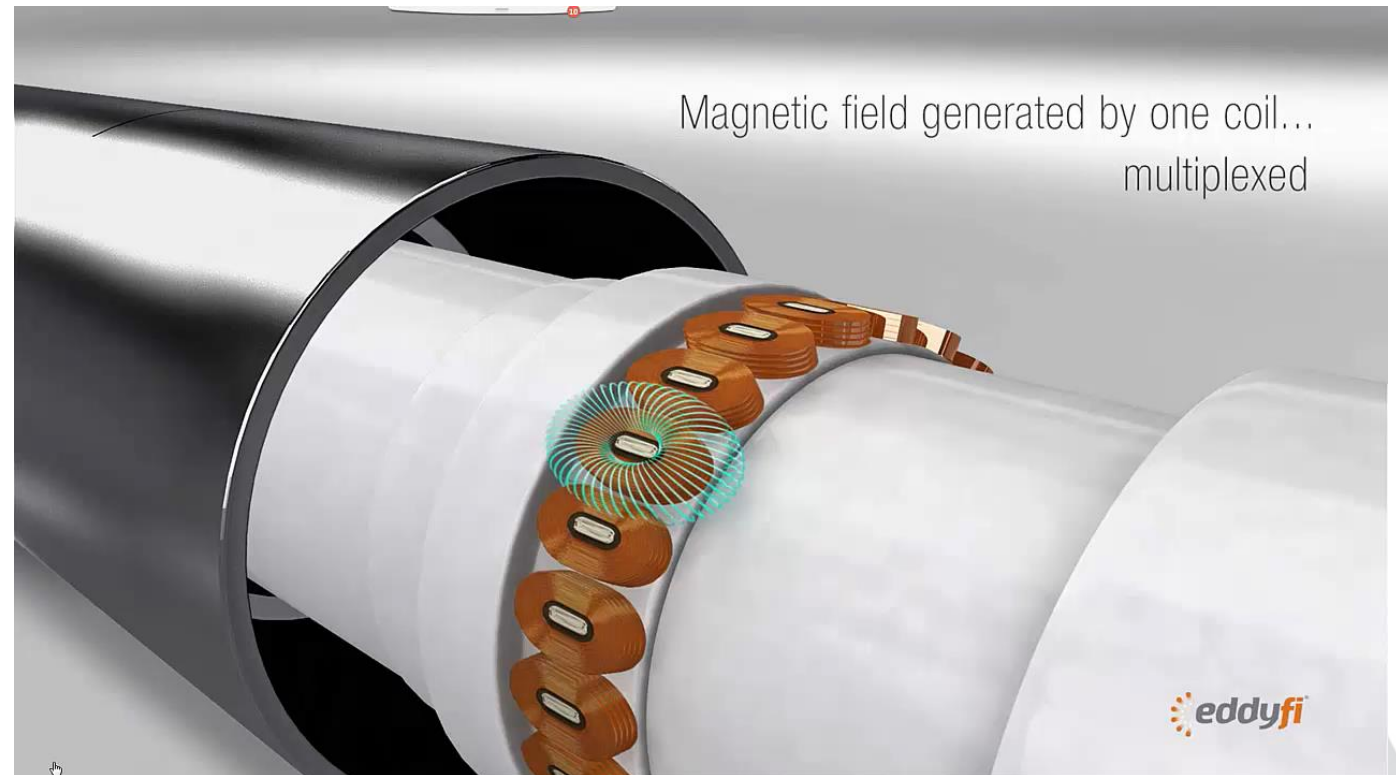
*ECT Typical strip chart display*

# WHY MOVING TO AN ARRAY TECHNOLOGY?

- Uses individuals **multiplexing** coils to “sweep” the entire interior surface
- Makes **circumferential flaws** easier to identify (length and position)
- Easily displayed by **C-scan imaging**
- **Better defect discrimination** at support plate and at tubesheet

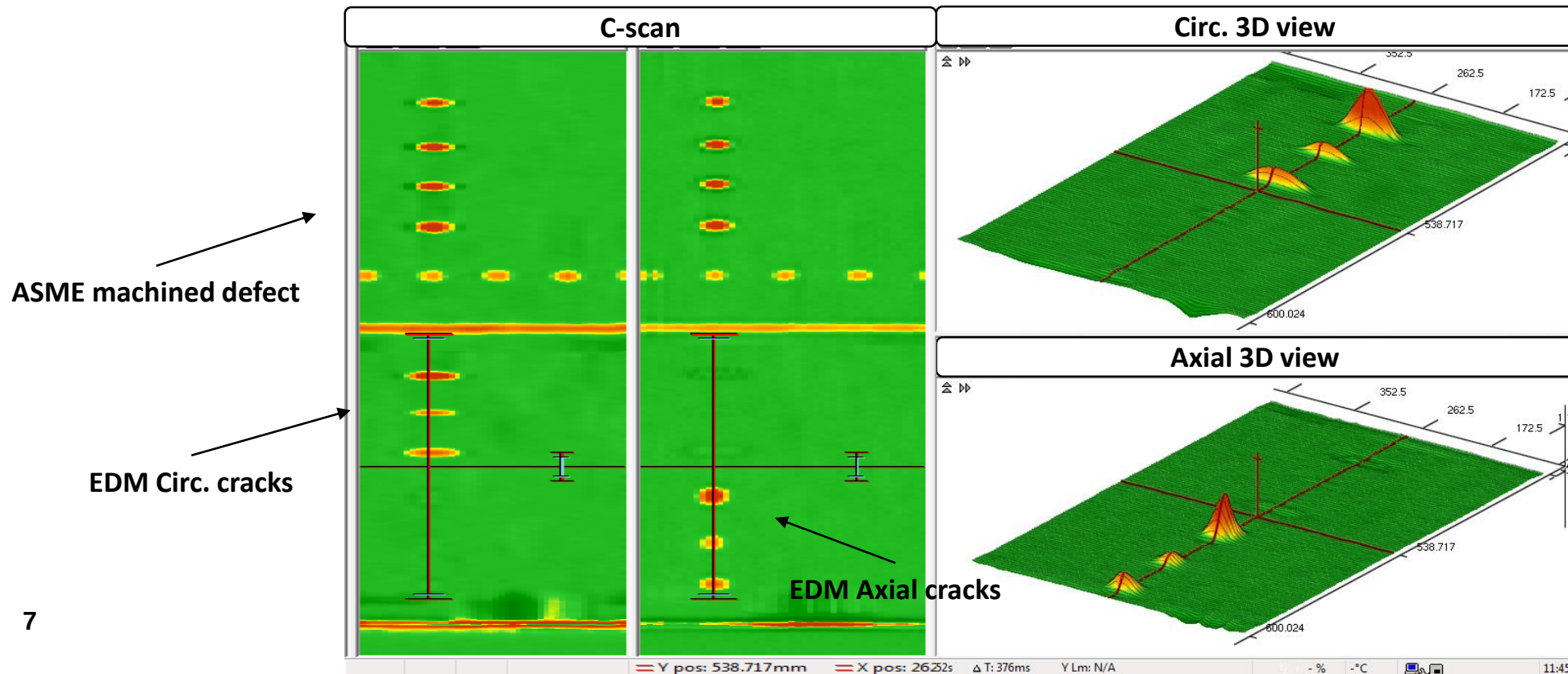


Circ. crack located under support



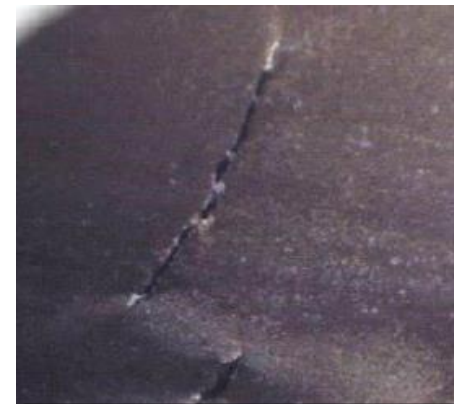
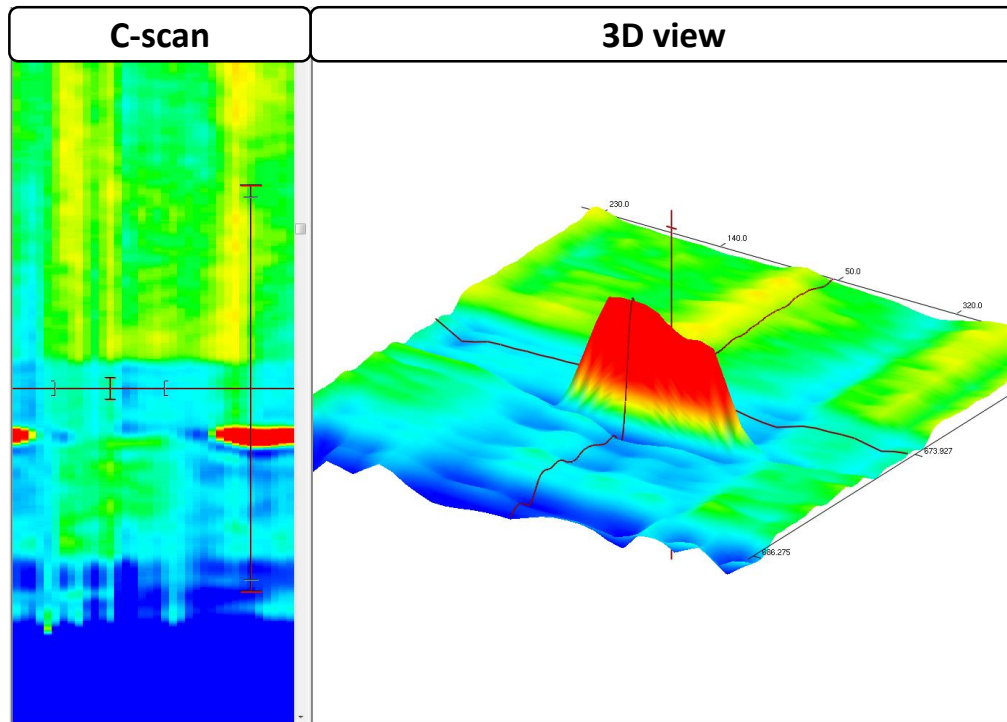
# WHY MOVE TO AN ARRAY TECHNOLOGY?

- ASME calibration tube with additional axial & circ. cracks simulator with ECA

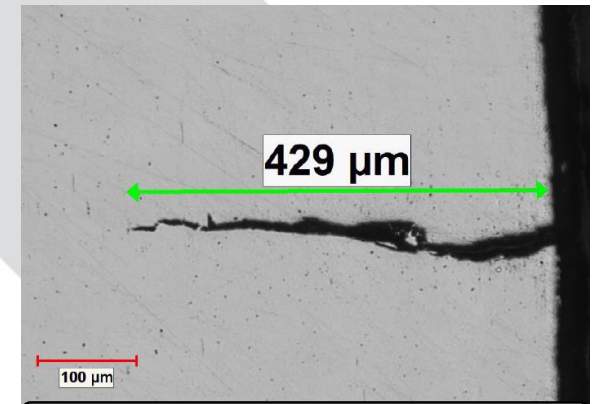


# WHY MOVE TO AN ARRAY TECHNOLOGY?

- **Significant circumferential cracking** detected with an ECA probe and then **confirmed by borescope and X-ray**.



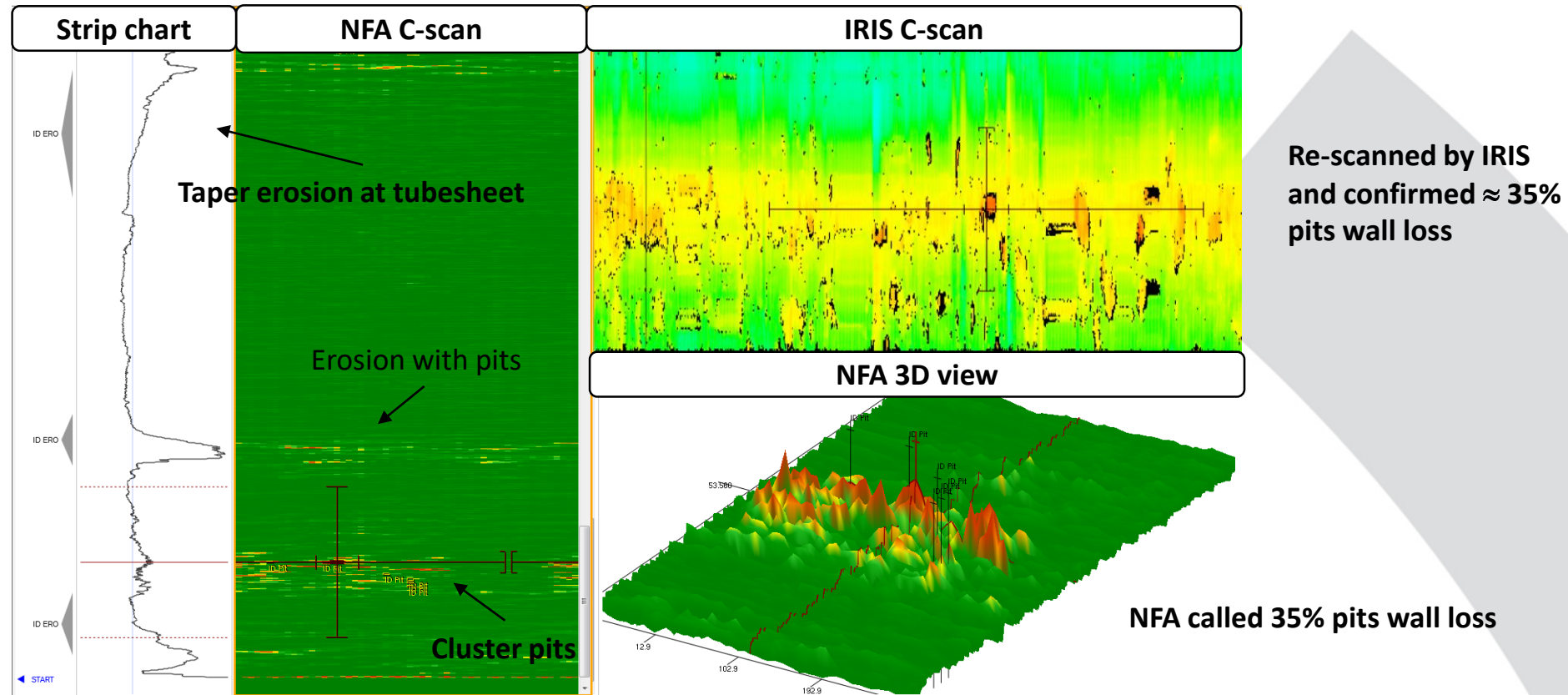
Borescope picture



X-Ray measurement

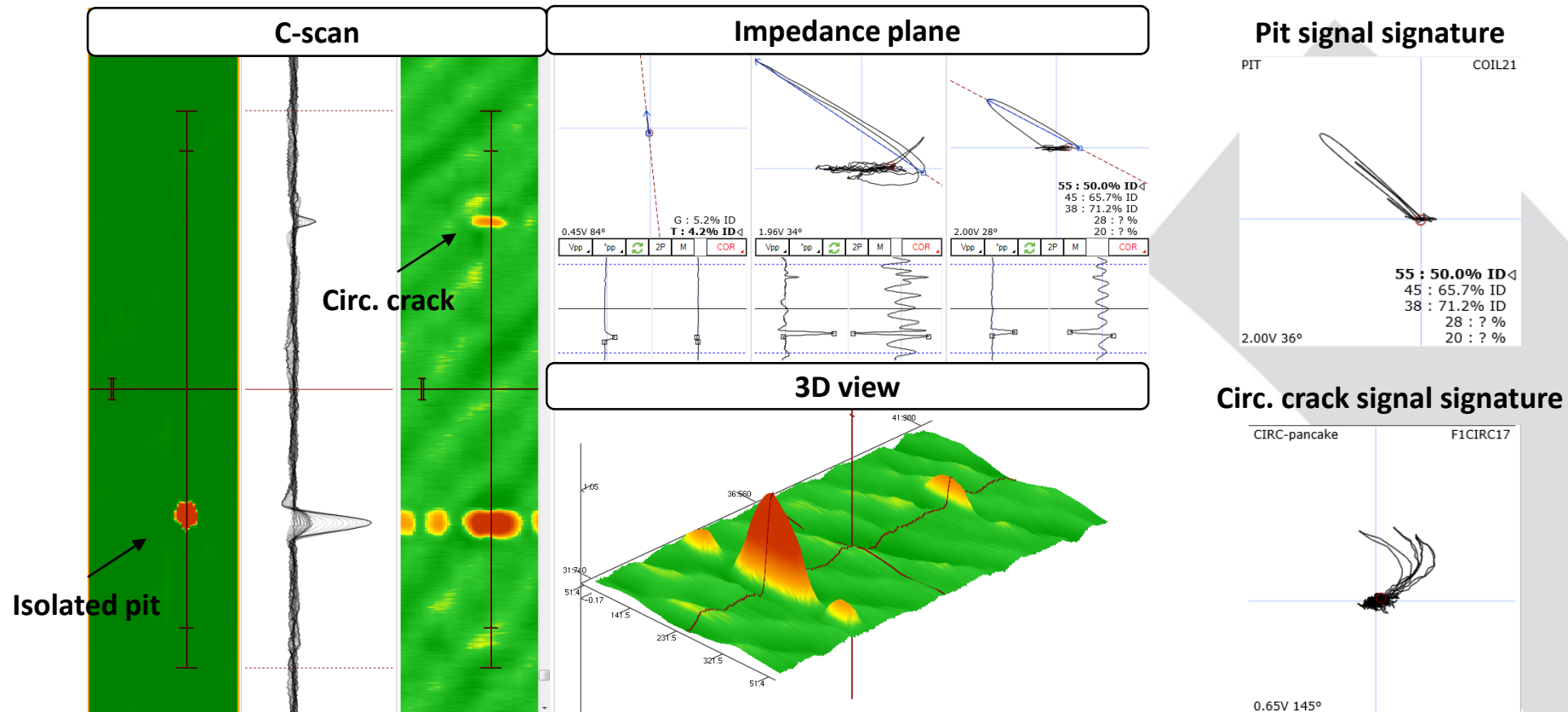
# WHY MOVE TO AN ARRAY TECHNOLOGY?

- 28 years-old fin fan air cooler tube inspected with Near Field array technology (NFA)



# WHY MOVE TO AN ARRAY TECHNOLOGY?

- NFA can both **detect and differentiate** a located **pit** and a **circumferential crack**



# MANUAL PULLING

- Hand-pulling is widely used in the industry
- This technique is easy to deploy with reasonable cost
- However, it remains:
  - Less repeatable
  - Time consuming
  - Higher risk of error
  - Human factor not controlled – worker fatigue
  - No encoded data – with limited sizing capabilities



# WHY MOVE TO A PROBE-PUSHER?

- What the probe pusher **values** are?
  - **Efficiency** – saving time / money
  - **Encoded** data
  - Higher **precision** & **accurate** data
  - Higher **sizing** capabilities
  - **Controls** human factor
  - Allows **historic** / **correlated** data
  - **Accuracy** on the bundle life cycle
- Some work needs to be done to convince the **service providers and asset owners** to integrate a probe pusher in the industry
  - Cost / ROI



Remote Field inspection using the Probot

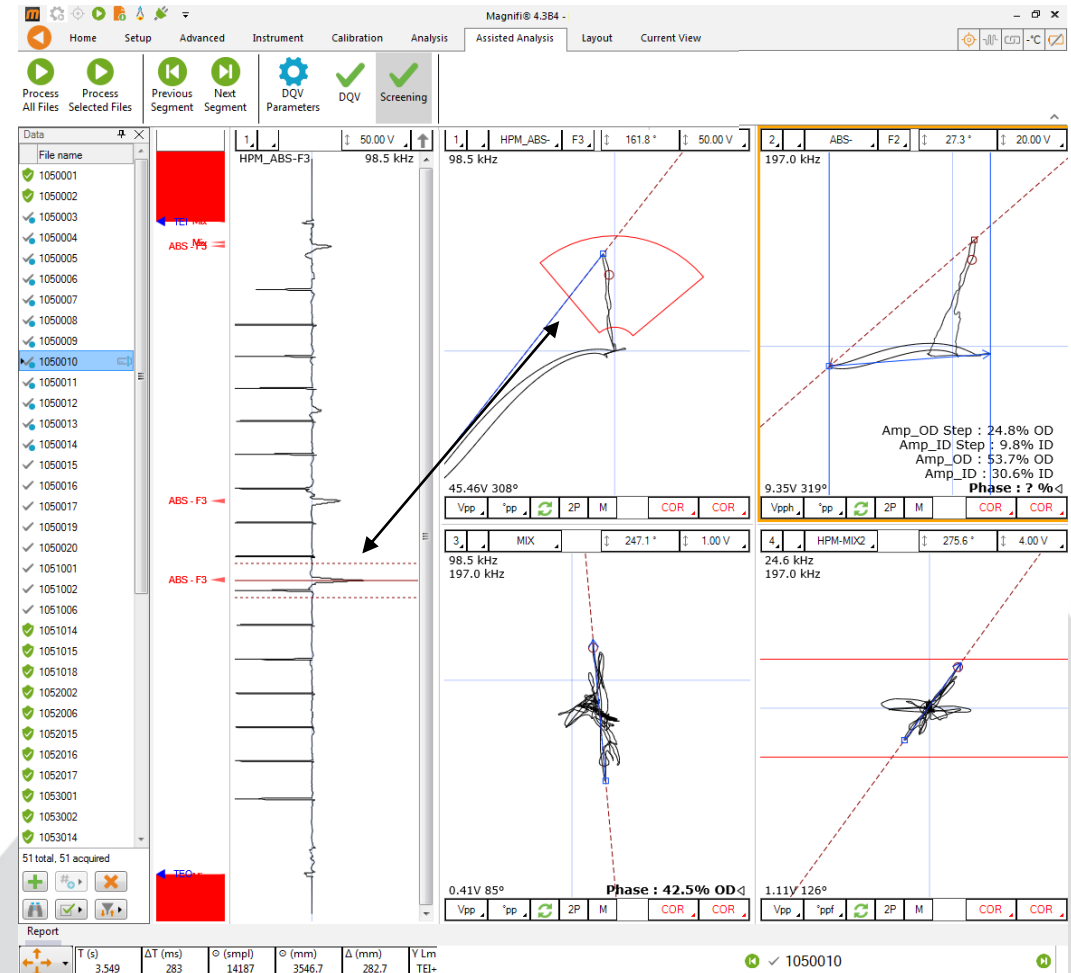
# MANUAL ANALYSIS

- Inspection crews are normally composed of :
  - 1 probe hand-pulling operator
  - 1 acquisition PC operator
  - 1 data analyst / crew supervisor
- Depending on the site requirements or the crew structure:
  - 1 analyst can be used for several acquisition crews
  - Also good analysts are rare in the industry
  - Sometimes, they can work on day and night shifts !
  - Where they cannot keep the pace – analysis delay!
- Final report can be released several weeks after the last pulled tube
- Experts charge extra hours to reduce that gap – who will pay for that?
- The asset owner has to wait or to take critical decision based on partial information

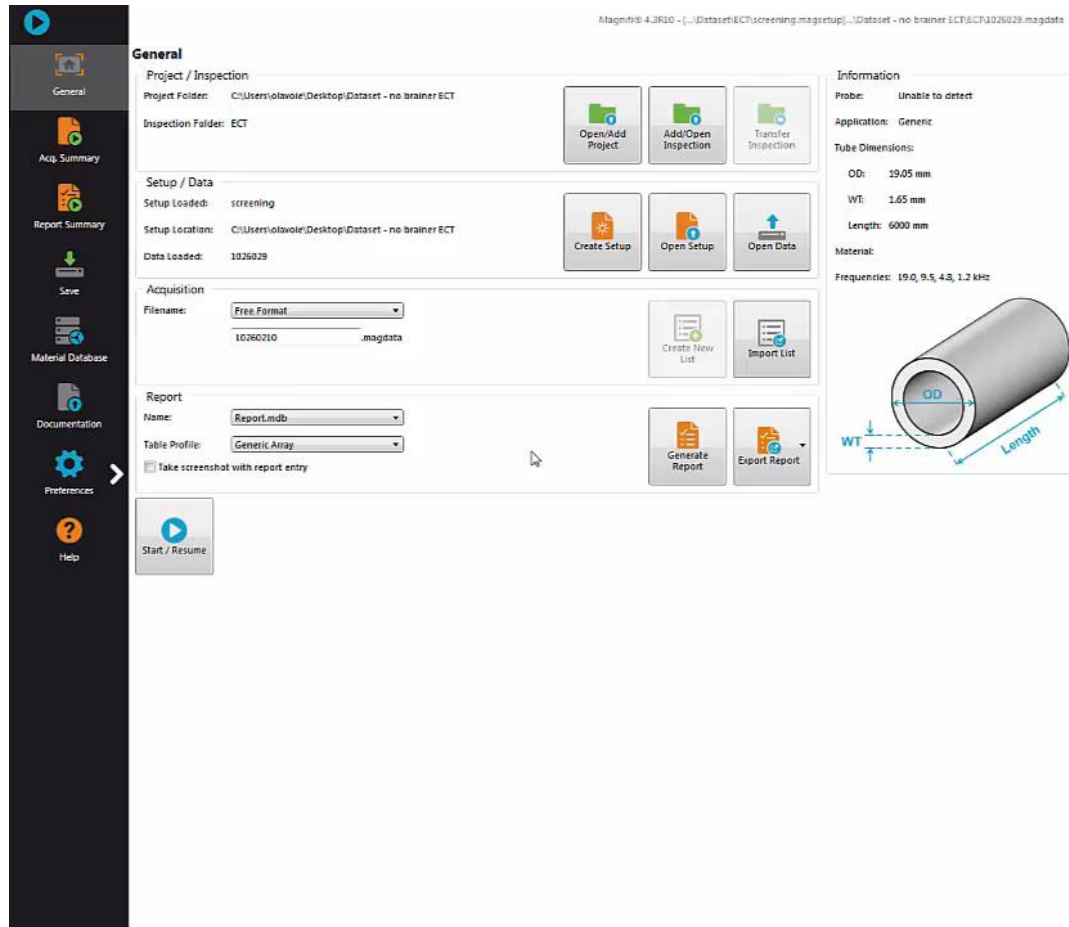


# WHY MOVE TO THE AUTO DATA SCREENING?

- Auto data screening requires additional setup time compared to manual analysis (setting detection thresholds, etc.)
- Manual analysis takes on average about 30 sec/tube for experienced data analyst
- Using the auto screening, it will take about **1 sec/tube** and all files will **automatically be tagged as “NDD” or “to review”**
- This way, the analyst will concentrate his efforts on the tagged files to review
- Doing so,
  - The **analyst time** will be **drastically reduced**
  - **Optimization of the “re-scan” tube list**
  - **Faster** generation of **final report**
  - **Number of analysts** required for the same job is significantly **reduced**



# WHY MOVE TO THE AUTO DATA SCREENING?



# INNOVATING TO COMBINE THE BEST OF BOTH WORLDS

## Array technology

- Increases the quality data (c-scan imaging)
- Increases the productivity
- Increases the sizing capabilities

## Acquisition with Probe Pusher

- Efficiency, higher productivity / saving time and money (Controls the human factor)
- Encoded data, higher precision / accurate data
- Moreover, it allows data history by correlating the data, year after year

# INNOVATING TO COMBINE THE BEST OF BOTH WORLDS

## Auto data screening

- Drastically reduces analyst time
- Optimizes the re-scan tube list
- Faster final report generation
- Reduces the number of analysts required for the same job

This solution optimizes the **acquisition and analyst time**, with the **highest** possible **data resolution** and **defect position, monitored through time** to yield optimal asset integrity management!



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Thank you!