PII Pipeline Solutions
a GE Oil & Gas and Al Shaheen joint venture

VERIFICATION OF ILI INSPECTION RESULTS WITH THE USE OF AUTO UT DATA

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A CASE STUDY OF AN OFFSHORE PIPELINE
Introduction

The Pipeline

- History, Importance
- Condition, Inspections

The Problem

- Integrity Concerns
- Verification of in-line inspection data

The Software and Assessment

- The software tools
- The assessment methodology

The Results

- The findings of the investigations following the assessment and verification

The Pipeline Background and History

Large Diameter, Offshore, Crude Oil Pipeline

- Multiple Inspections
  - MFL, USWM and Calliper
  - Most recent inspection conducted with an MFL inspection vehicle
- Multiple Integrity Studies
  - Fitness For Purpose Studies
  - Corrosion Growth Assessments
  - Remaining Life Investigations

Critical line for operations and supply.
The consequences of a leak would be severe

The Pipeline
MFL Tool Sizing Spec

	METAL LOSS CATEGORY		
	Pitting <(3tx3t)*	**General >(3tx3t)***	**Gouging**
Minimum Depth for Accurate Sizing	0.2t with surface dimension greater than: (7mm)x(7mm) or (0.4tx0.4t)**	0.1t	If w>0.5t or 7mm**=0.2t If w>3t=0.1t
Sizing Accuracy *(Depth)*	±0.1t	±0.1t	±0.1t
HAZ	±0.15t	±0.15t	±0.15t
Sizing Accuracy *(Length)*	±10mm	±20mm	±20mm
HAZ	±15mm	±25mm	±25mm

The most recent inspection was carried out using PII's MFL3 ILI tool

Corrosion Summary:

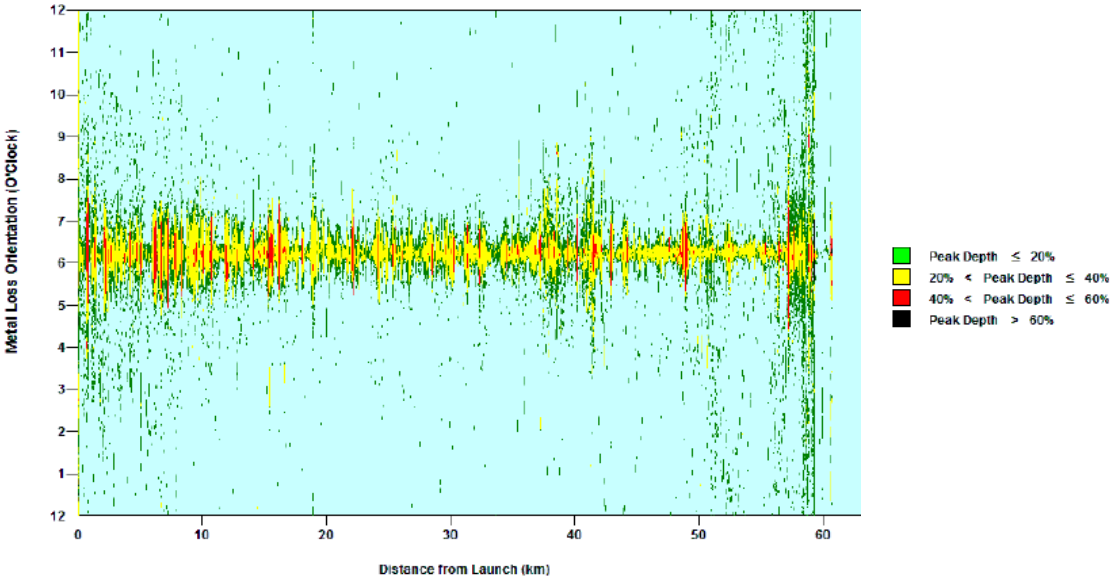
- Specification for 12" -56"
- Applicable for seam welded/ERW/spiral weld/seamless pipelines
- Specification given for pitting and general corrosion
- Smaller features are reported when visible
- Standard sizing spec therefore is ± 10% wt at the 80% confidence interval

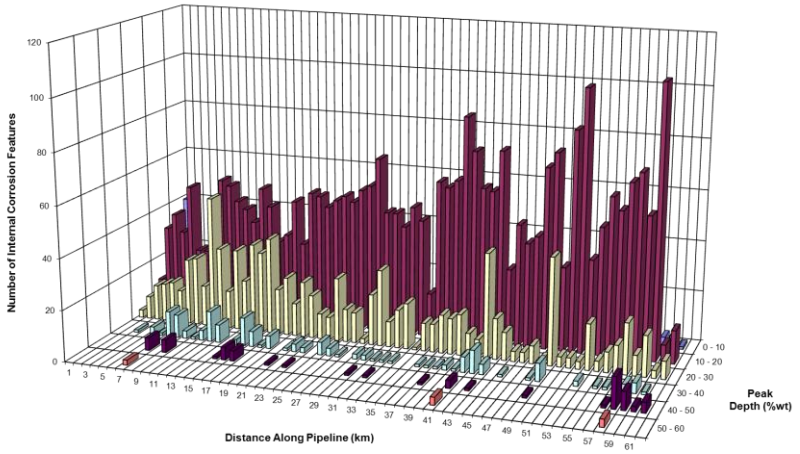
The Pipeline Condition

The pipeline has >600,000 corrosion features throughout its length

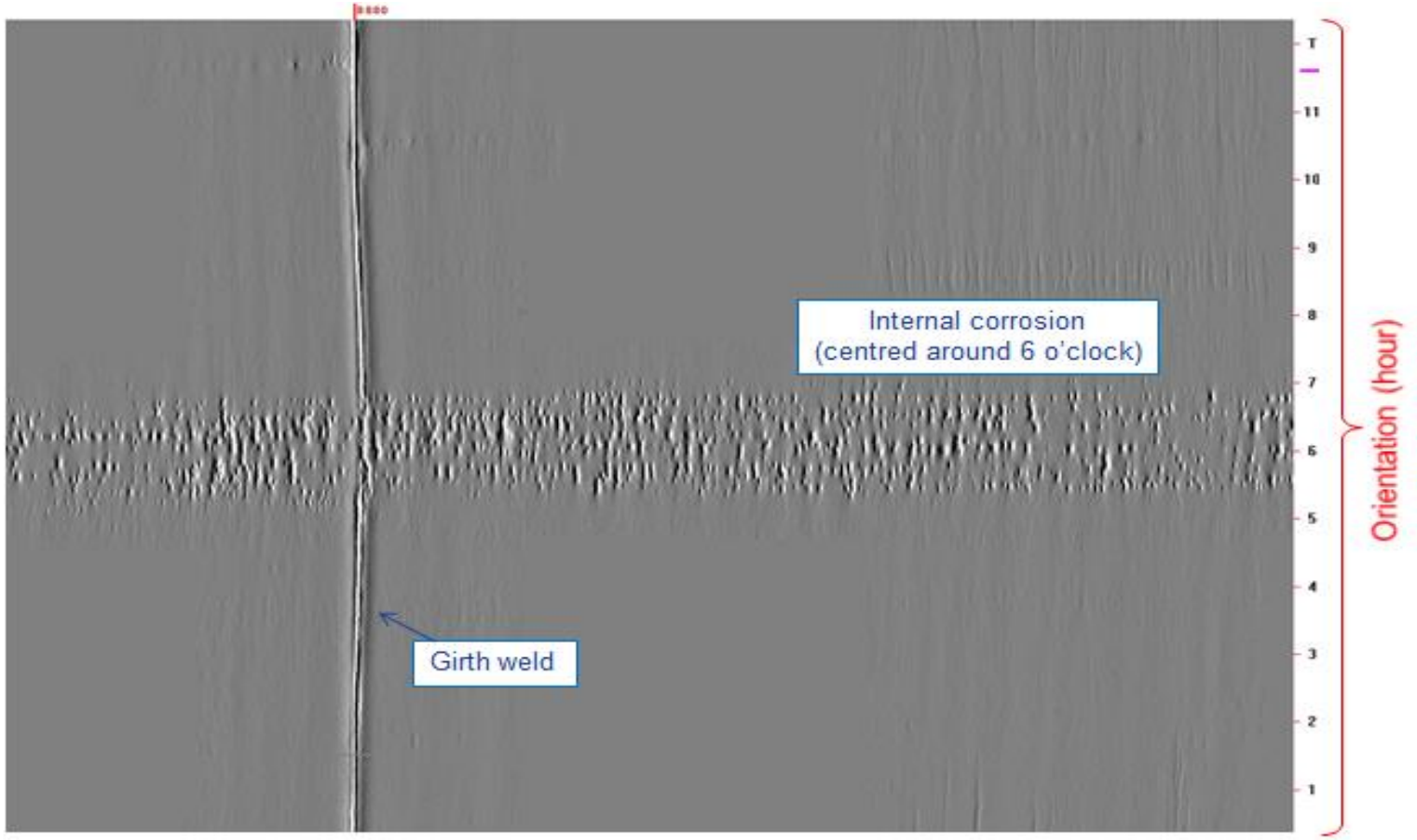
Corrosion Summary:

- Predominantly **internal** and at bottom of the line (6 o'clock)
- Previous Corrosion growth studies found Corrosion was active and **growing**
- Features typical of pitting and areas of general corrosion
- Recent studies had predicted features required repair within 5 years





The Pipeline Data Example



The Problem
Verification of ILI Results

Aims

- Verify MFL ILI results
- Confirm repair options
- Bring pipeline back into operation after mothballing

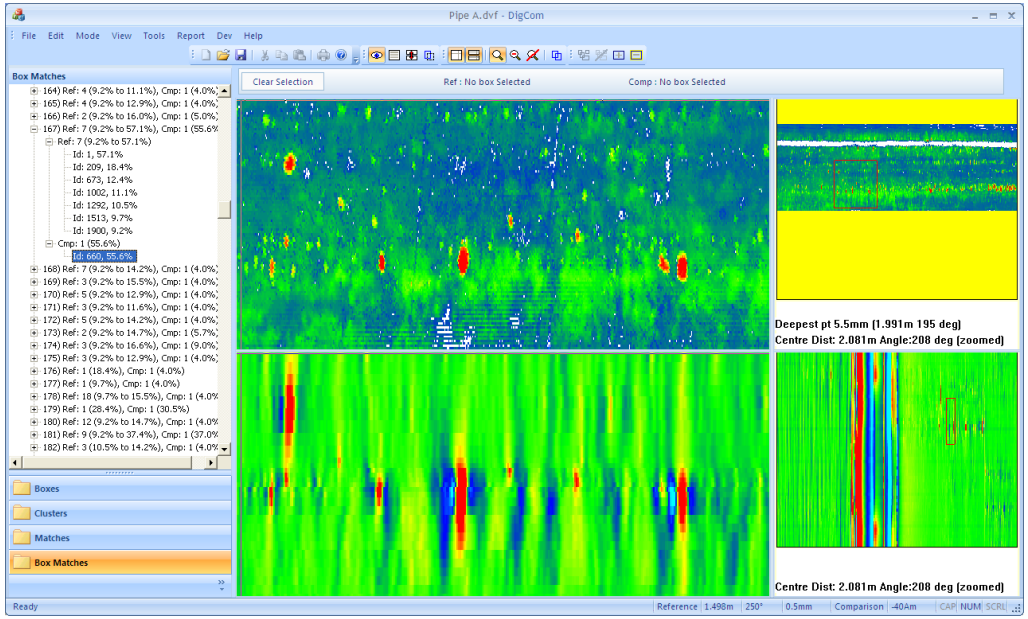
In-field Investigation

- AUT scans were performed where the MFL ILI reported significant corrosion (predicted to require repair in the near future).
- Concrete coating was removed from the pipeline and the survey was conducted by scanning the outer surface of the pipeline
- AUT scans were centred on the 6 o'clock position of the pipeline

Challenges

- Difficult to match the AUT with MFL ILI data
- Certainty AUT is scanning the same area of corrosion as reported by the MFL ILI,
  - Tolerances on: length/depth/distance/orientation
- Challenges of carrying out AUT in-field (offshore)
- Typical verification is performed on the peak depth of a small number of defects per site

The Software and Assessment DigCom

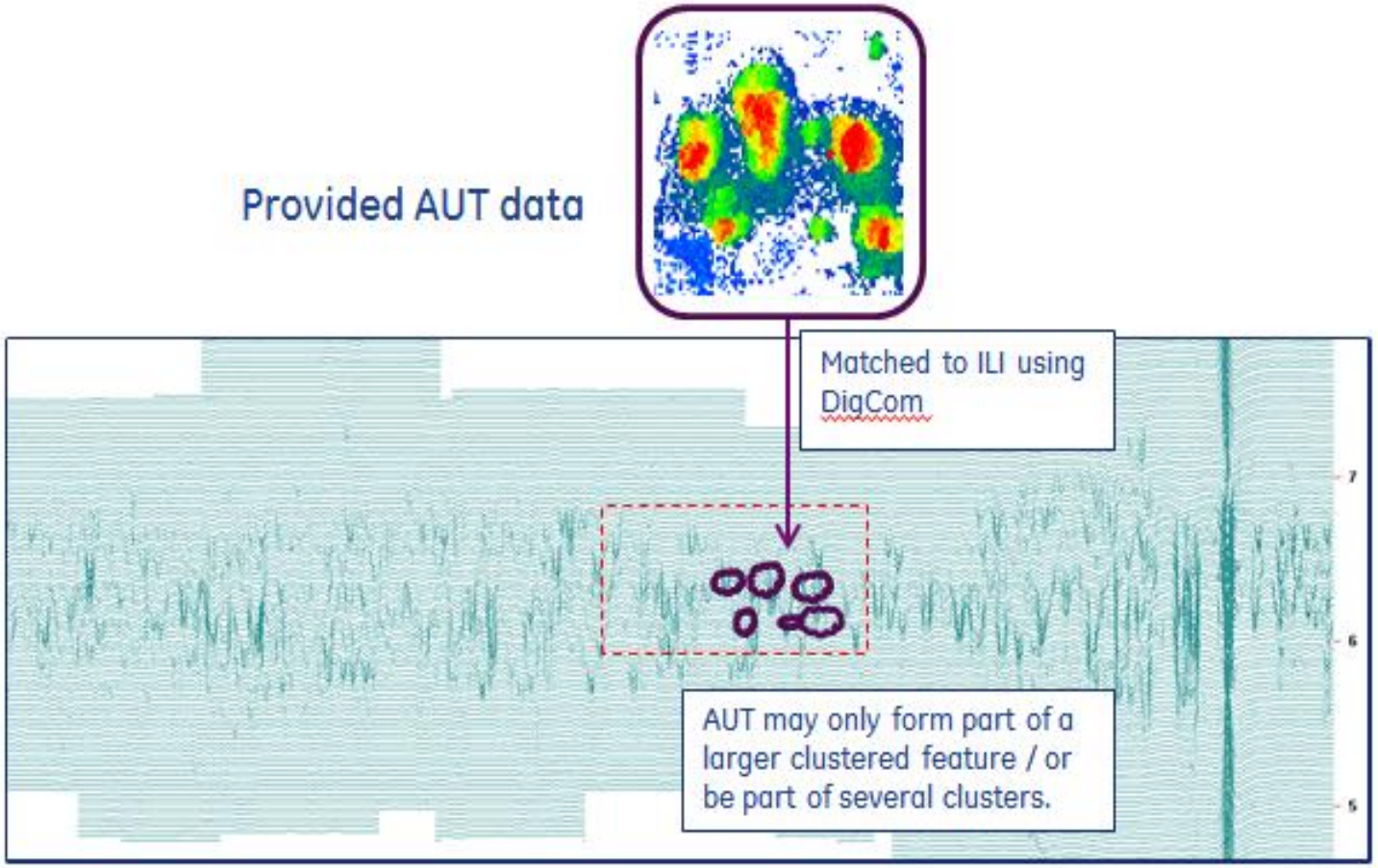


Comparison of AUT and MFL data was performed in DigCom software

Software:

- Comparison of depths and investigation of the full profile and interactions within complex corrosion features
- Maps ILI data directly onto the in-field scan using weld number and relative distance
- Visual process allows the ILI data to be aligned and scaled
- Point to point match for high degree of confidence

The Software and Assessment Data Matching



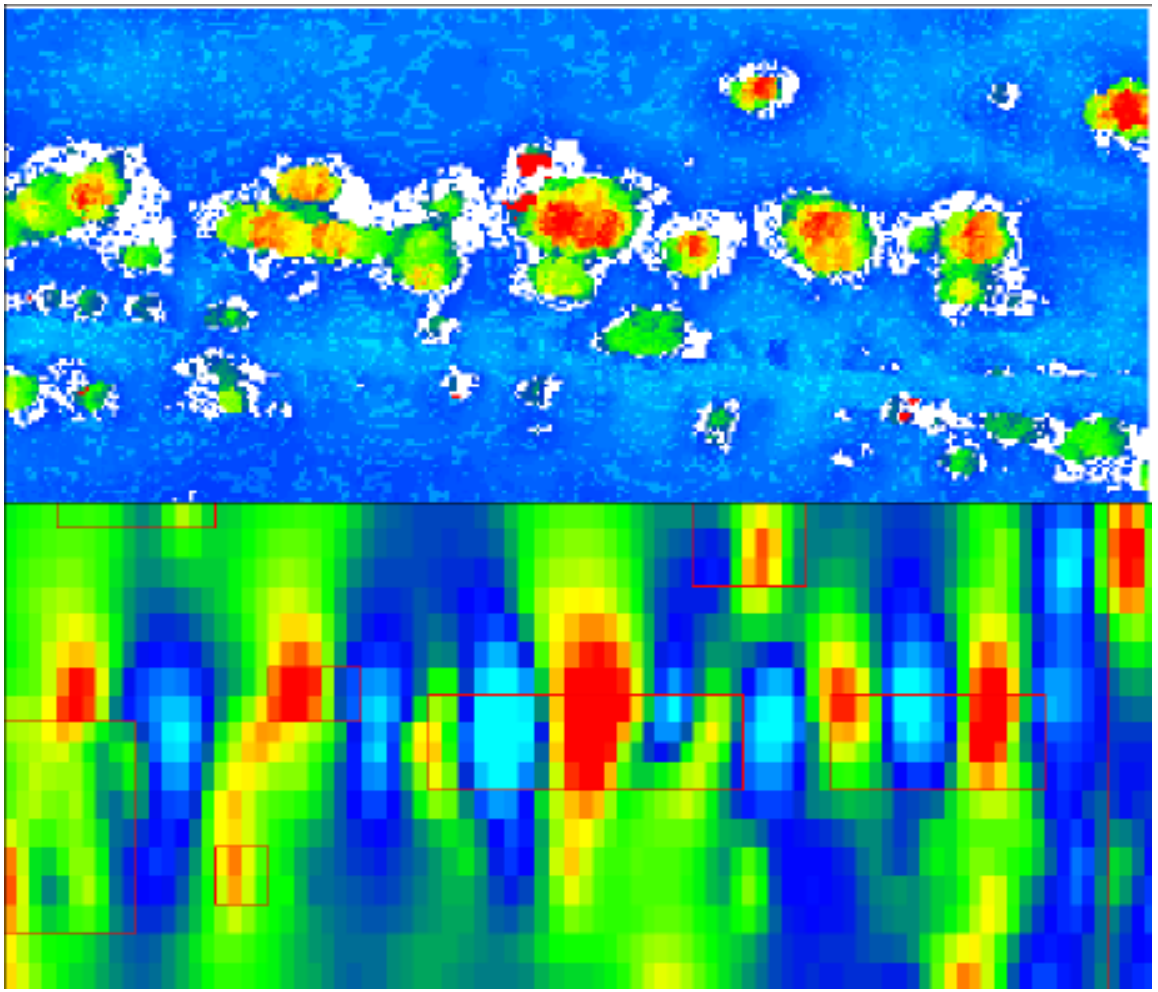
The Software and Assessment Data Matching

In-Field AUT Scan Data

- Converted from scan grid data
- Warmer colours signify deeper pits

ILI MFL Data

- Colour scale on ILI to match AUT data
- Warmer colours signify deeper pits

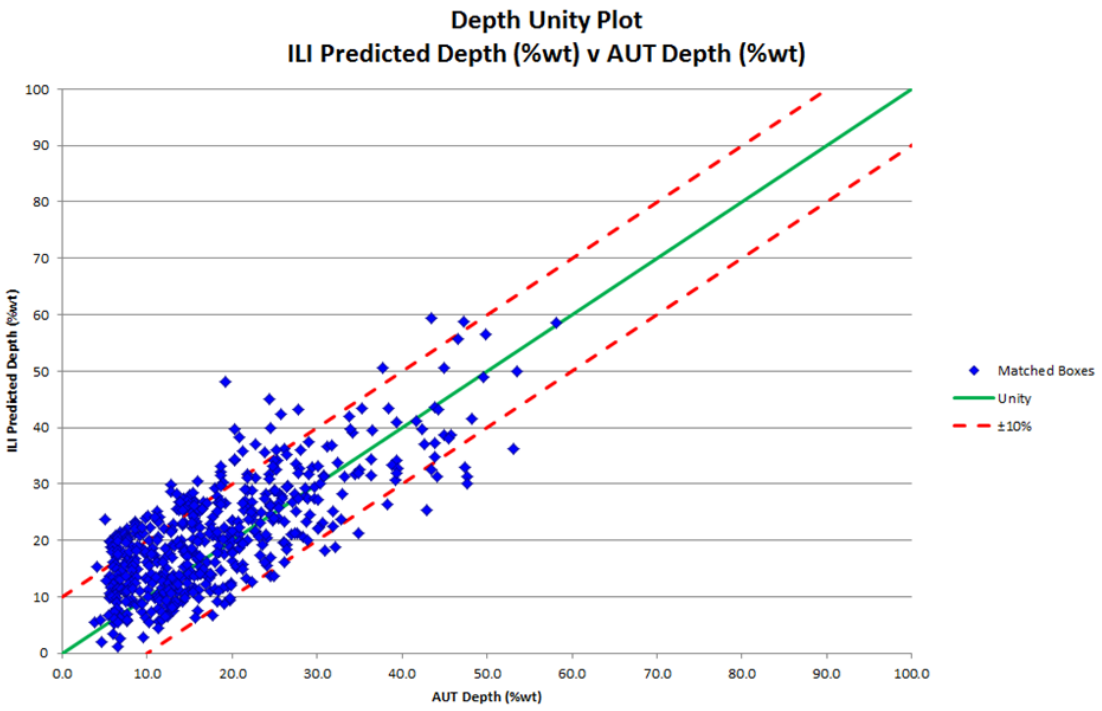


The Results
MFL ILI vs Auto UT

Excellent agreement between MFL and AUT

Results Summary:

- >500 defects matched
- Sample taken from 9 spools throughout the line
- Sample included a range of feature depths
- Sample is considered representative
- 80% confidence interval is ± 5.96% wt , therefore the ILI contractual sizing specification was exceeded

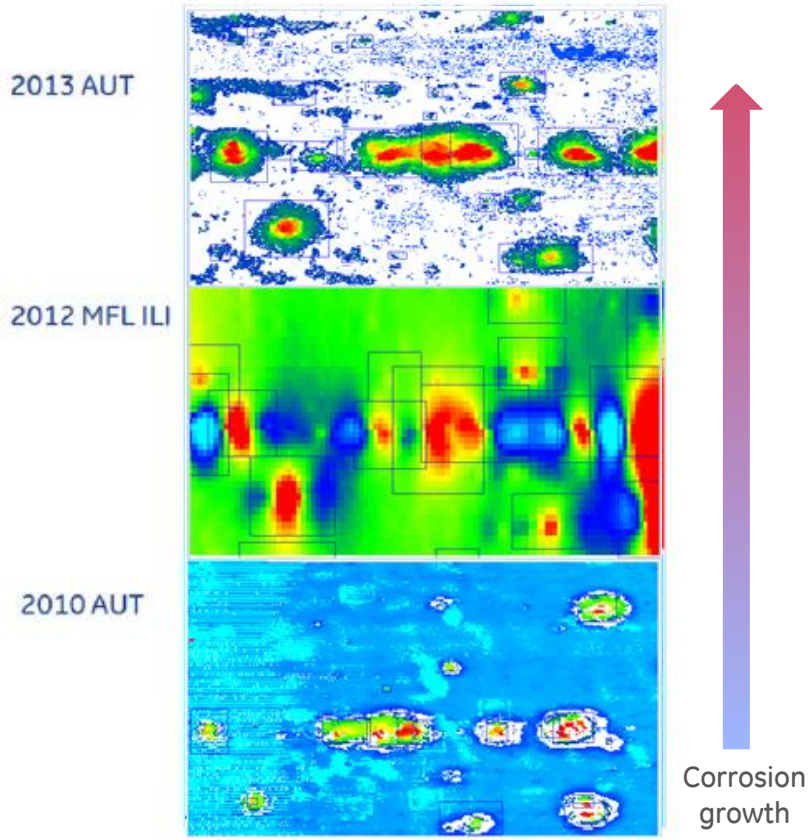


The Results
Auto UT Corrosion Rates

Several sites had been scanned using Auto UT previously

Results Summary:

- Corrosion Growth rates were determined by matching and comparing the depths
- This was carried out using the DigCom software using the MFL ILI data as a reference to enable defect matching
- Sample is considered representative
- In order to complete the integrity assessment on these defects a combination of the measured defect morphology was used (MFL ILI and AUT)



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Conclusions

Automated Ultrasonic scan data was successfully matched and aligned with Magnetic Flux Leakage in-line inspection data

Corrosion growth rates were successfully determined from comparison between Automated Ultrasonic scans

The MFL ILI tool exceeded stated specification at the 80% confidence interval (± 5.96% wt compared to ± 10% wt for general corrosion and pitting within the pipe body)

Defect morphology was successfully combined between technologies to determine improved feature sizing in investigated areas


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