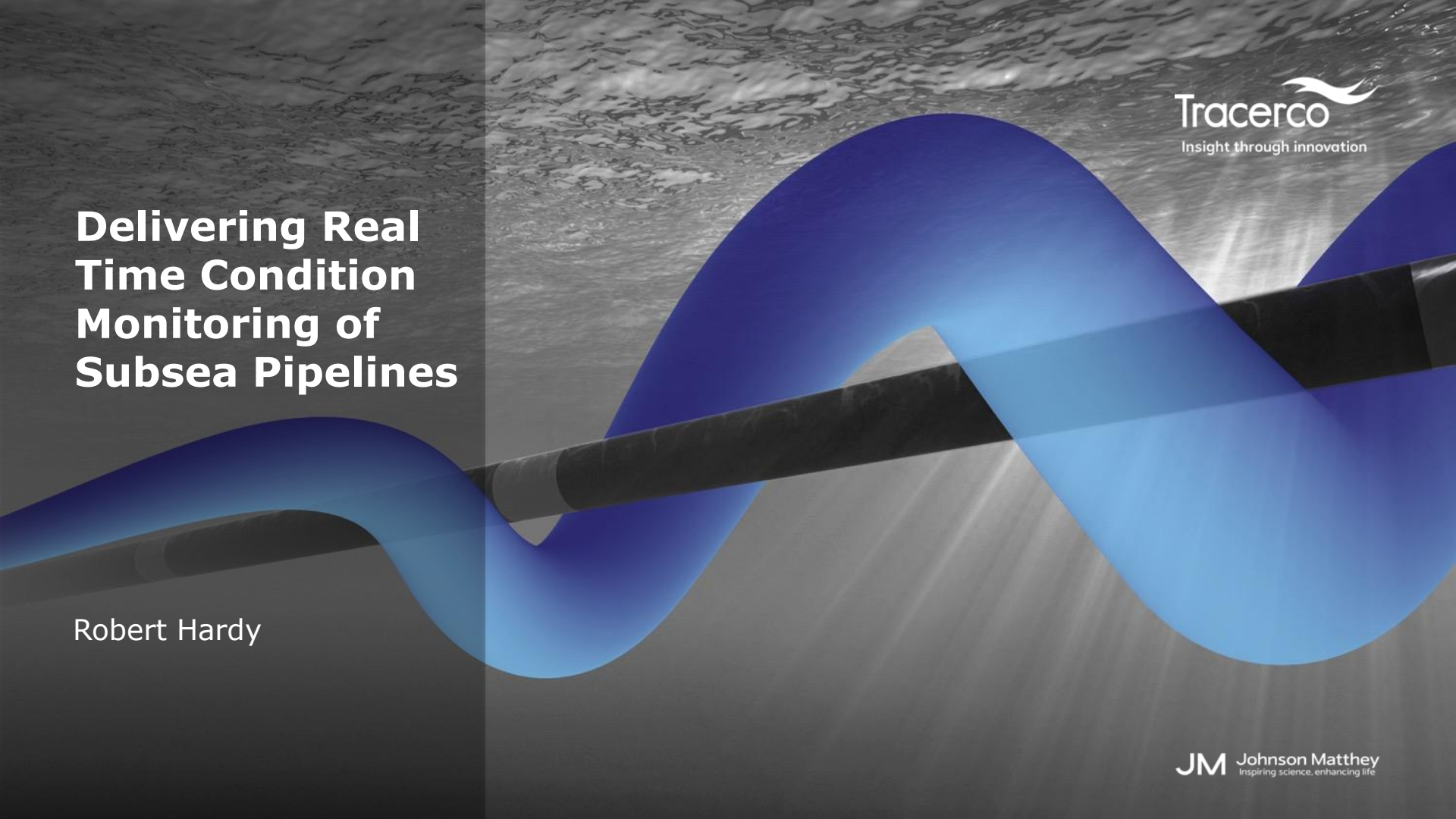
Tracerco
Insight through innovation
Delivering Real Time Condition Monitoring of Subsea Pipelines
Robert Hardy
JM Johnson Matthey
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Agenda

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Insight through innovation

01	Tracerco overview
02	Technology overview
03	Complex and coated pipelines
04	Internal corrosion
05	External corrosion
06	Internal and external corrosion
07	Recent developments
08	Overstress or fatigue
09	Flow assurance
10	Questions

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A world-leading industrial technology company that creates unique and specialised detection, diagnostics and measurement solutions to provide companies with the insight they need to make better decisions about their operations.

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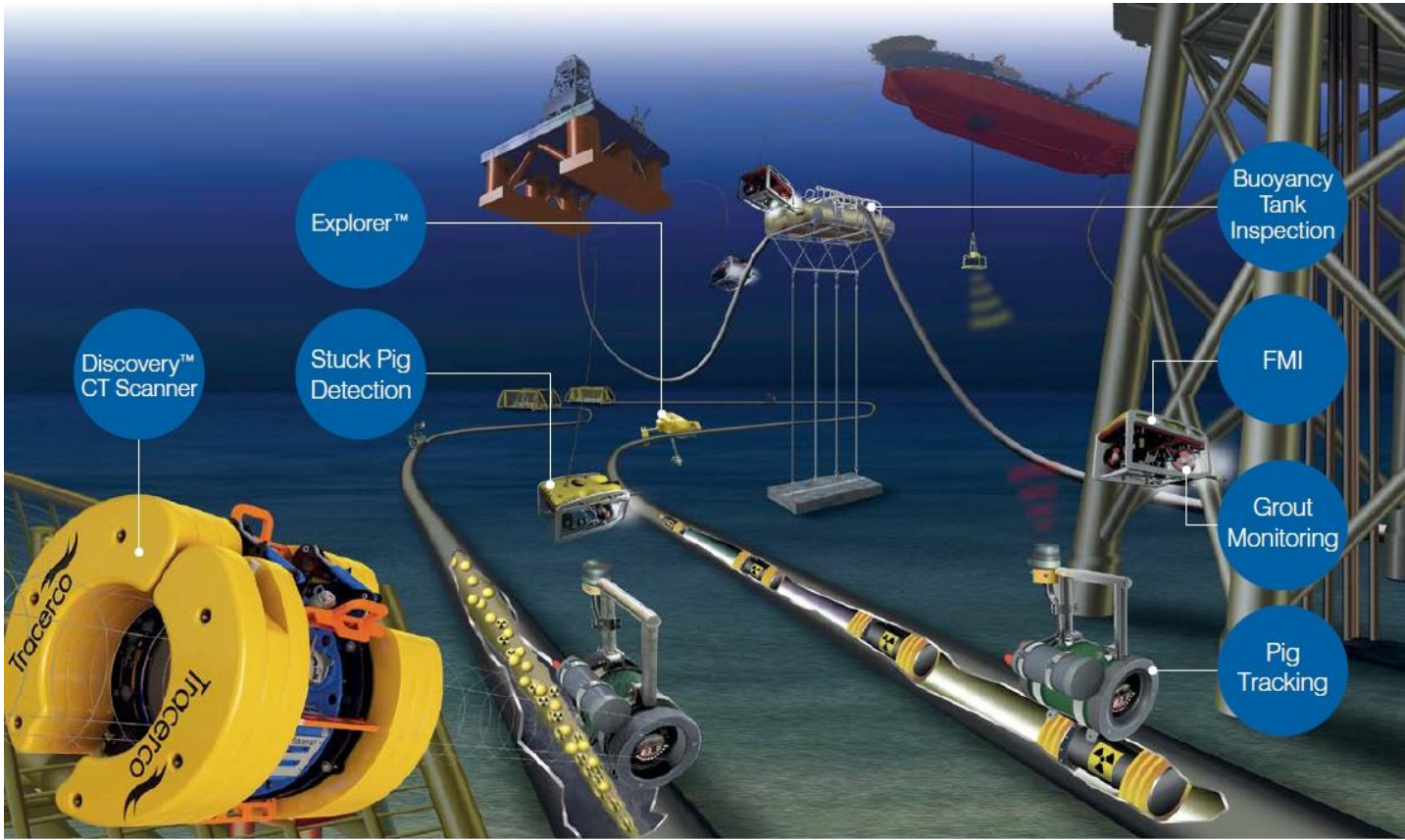
Tracerco subsea services

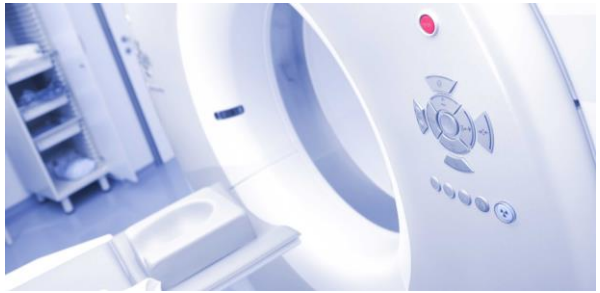
- Pig tracking and location
- Buoyancy tank inspection
- Flooded member detection
- Subsea pipeline inspection (AI and FA)
- Discovery™



Technology overview

Computer Tomography

- Same principle as medical CT scanner
  - Reconstruct image from a series of line measurements
- One key difference
  - Target is mostly steel, not body tissue (~water)
- Therefore using gamma rays instead of X rays



Technology overview

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- Truly non-intrusive technology
  - Scan through any coating
  - No coating damage
  - No interference to production
- Integrity and flow assurance data in a single scan
- Real time data
- 0.05g/cc density resolution
- 10,000’ water depth
- 6”-26.5” Total OD capabilities
- Work class ROV

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Technology overview - calibration

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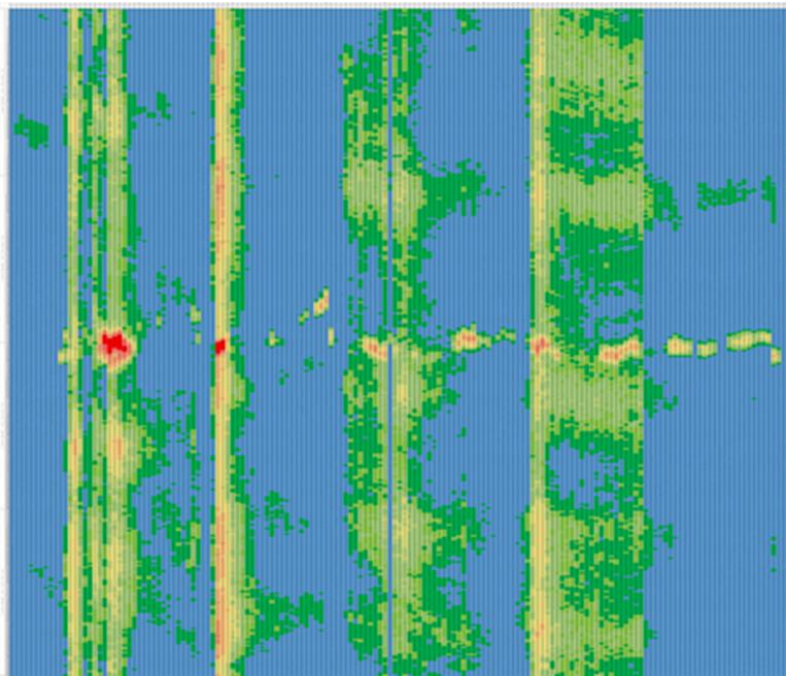
- Truly non-intrusive technology
- Pre project FAT & Calibrations possible
- Techniques comparisons & Validations
- Eg small pinhole



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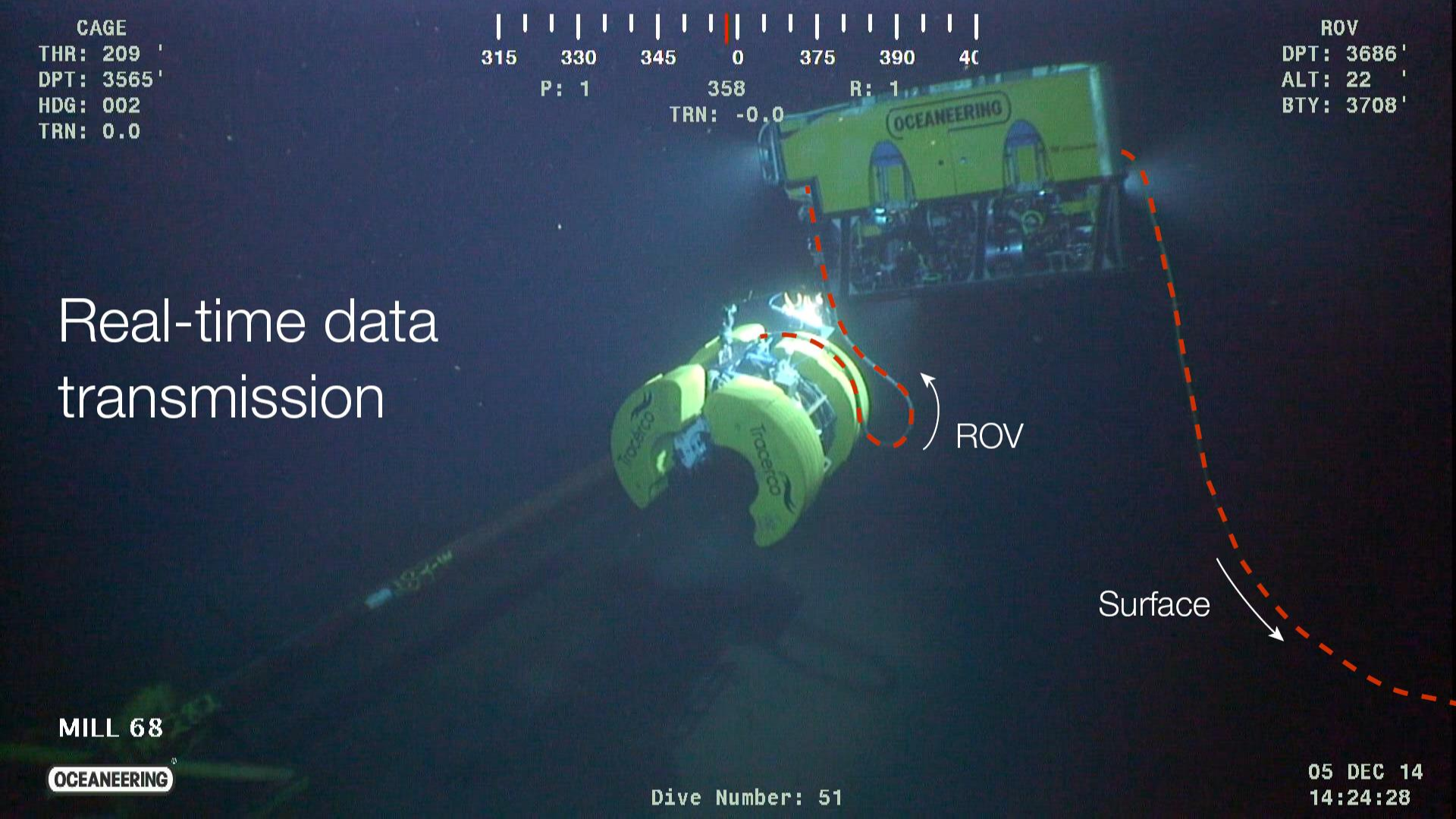
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THR: 209 '
DPT: 3565'
HDG: 002
TRN: 0.0
315 330 345 0 375 390 40
P: 1 358 R: 1
TRN: -0.0
ROV
DPT: 3686'
ALT: 22 '
BTY: 3708'
OCEANEERING
Tracerco
Real-time data transmission
ROV
Surface
MILL 68
OCEANEERING
Dive Number: 51
05 DEC 14
14:24:28

Discovery™

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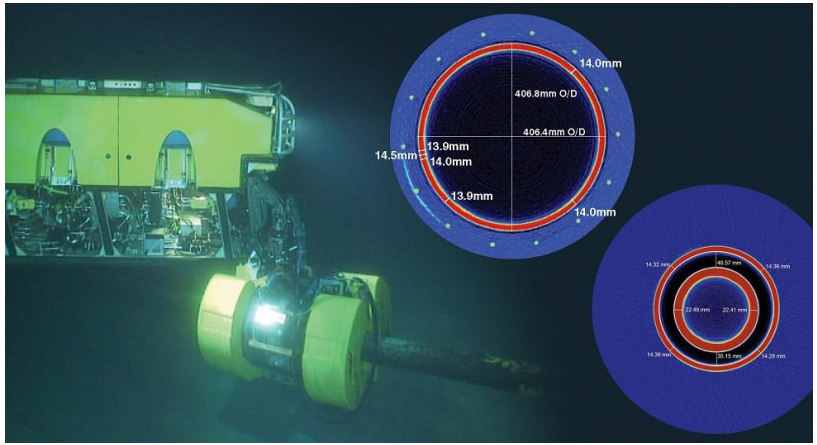
Why use Discovery™ for integrity applications:

- Save up to 1/3 on the cost of subsea pipeline inspection
- Eliminate the vast cost and risk of removing coatings subsea
- Eliminate interruption to production and normal pipeline operations – therefore no deferment of revenue
- Reduce operational intervention time so critical decisions can be made immediately by obtaining data online
- For the first time, get a complete picture of the integrity of your complex pipeline systems



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Complex pipelines – concrete coated

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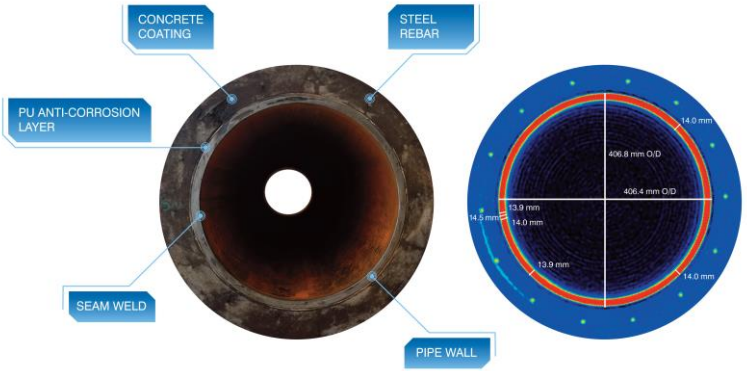
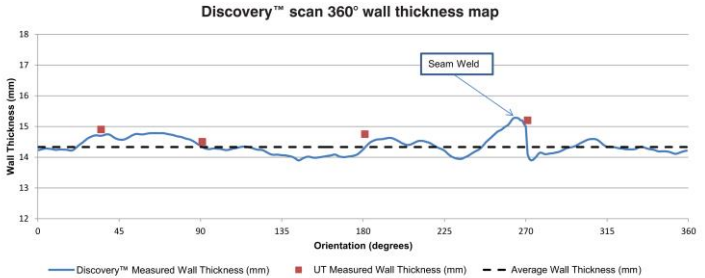
- 16” concrete weight coated pipeline (5mm polyurethane under 63mm concrete)
- Consistent wall thickness of approximately 14mm obtained
- No requirement to remove coating or rebars to obtain the data





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Complex pipelines – piggyback lines

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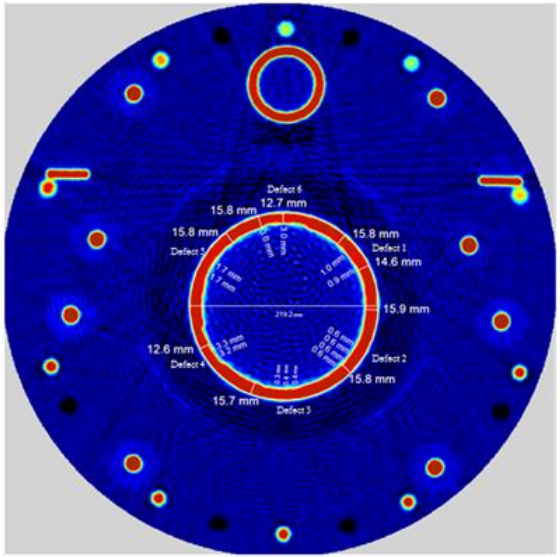

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Complex pipelines – pipe-in-pipe

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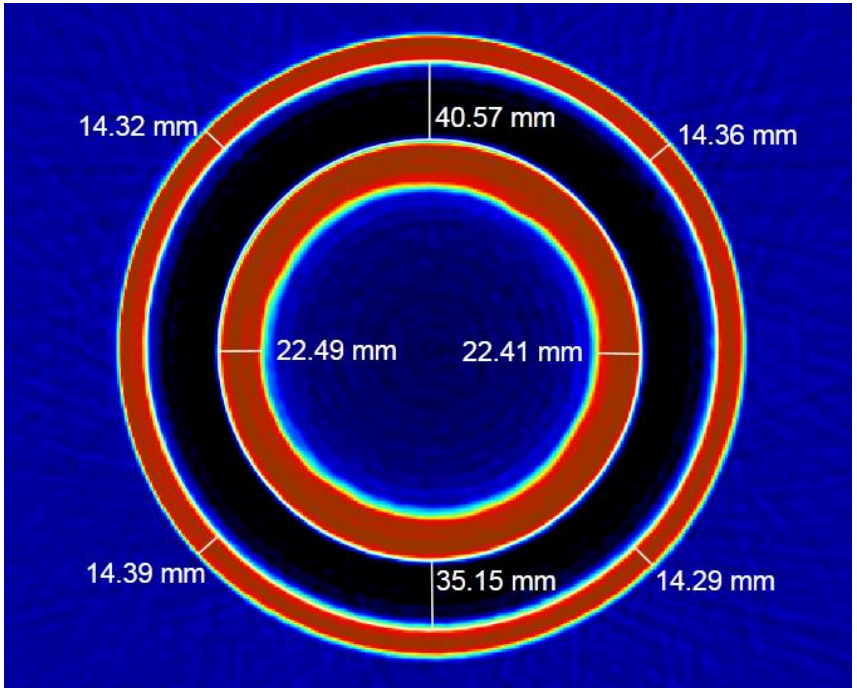

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Complex pipelines – bundles

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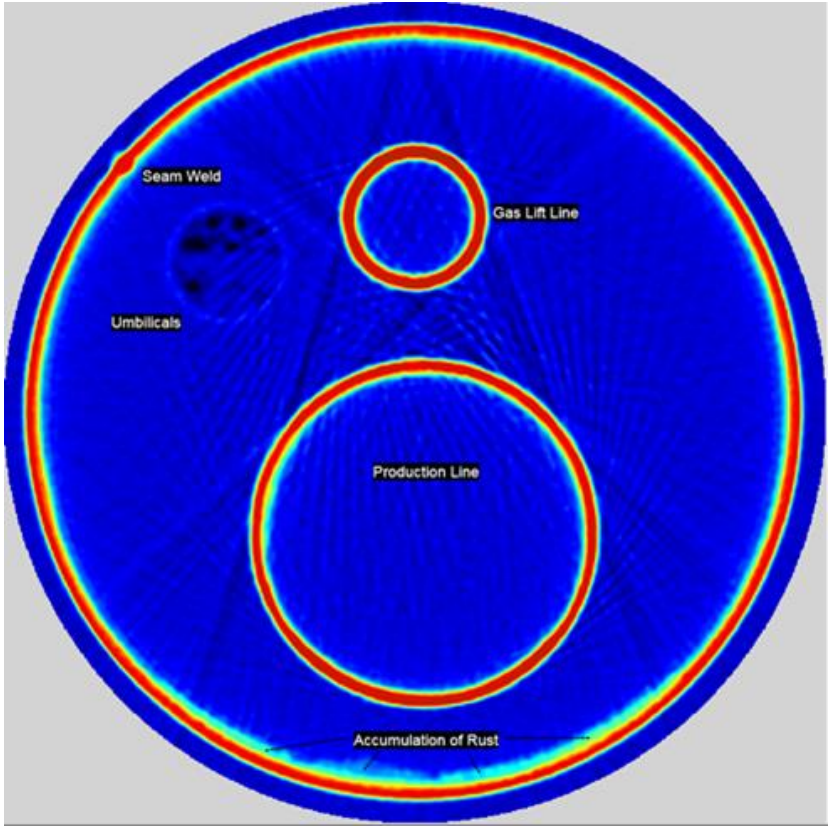

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Internal corrosion

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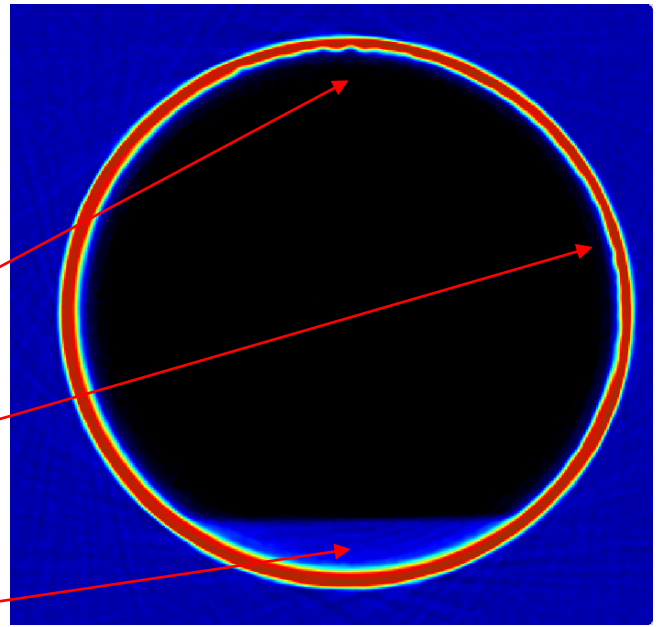
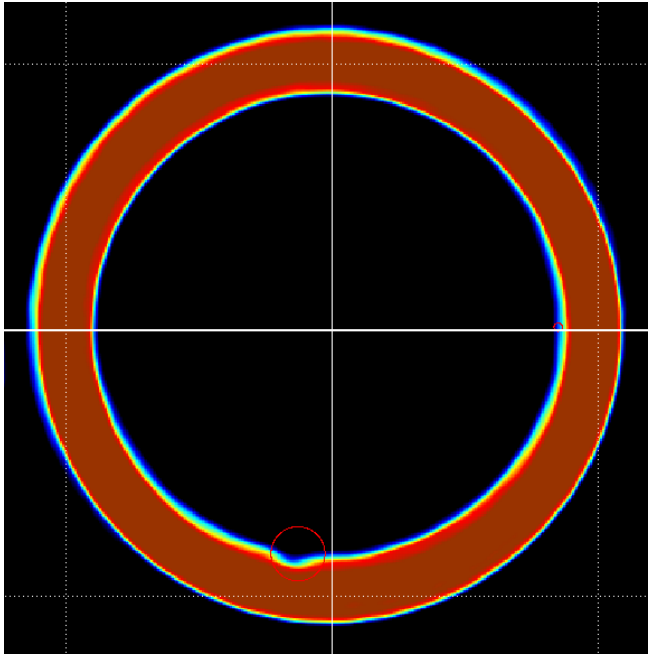
- Large diameter gas line
- Major wall loss observed in multiple locations around the pipe
- Condensate in the pipe - a possible contributing factor to internal corrosion



Internal corrosion

- Bacteria / microbial induced corrosion
- Potential corrosion hot-spots can be identified through modelling
- Localised inspection was used to check for pitting



Internal corrosion

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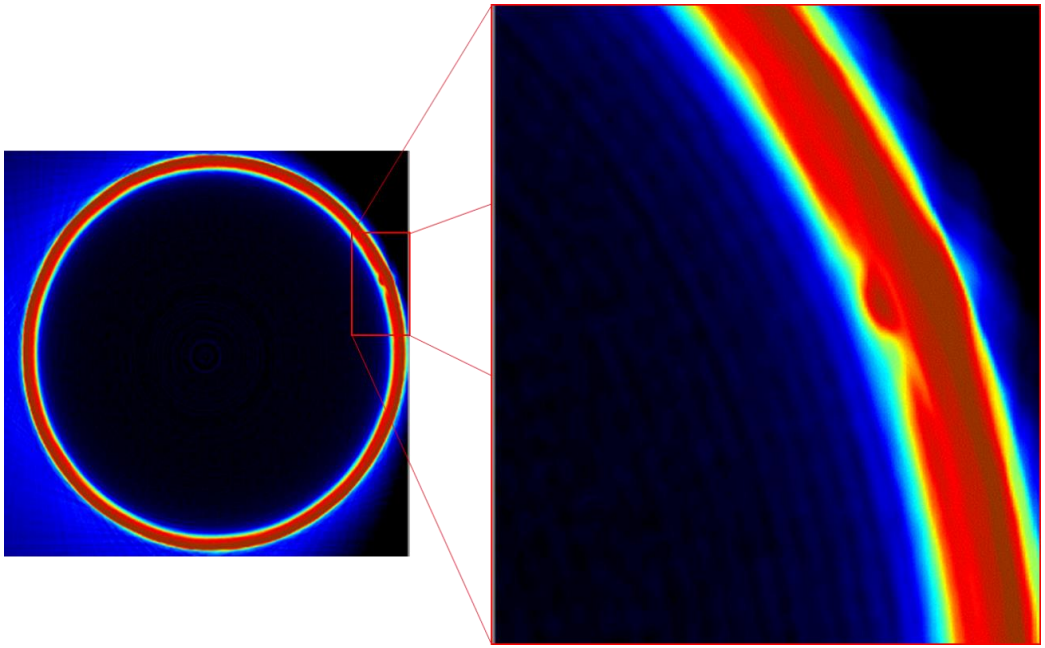
- Preferential weld corrosion (PWC) is a threat to welded joints
- Localised inspection was used to check a seam welded pipe for evidence of PWC
- Results used to determine pipeline life extension



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Disbonded Coating

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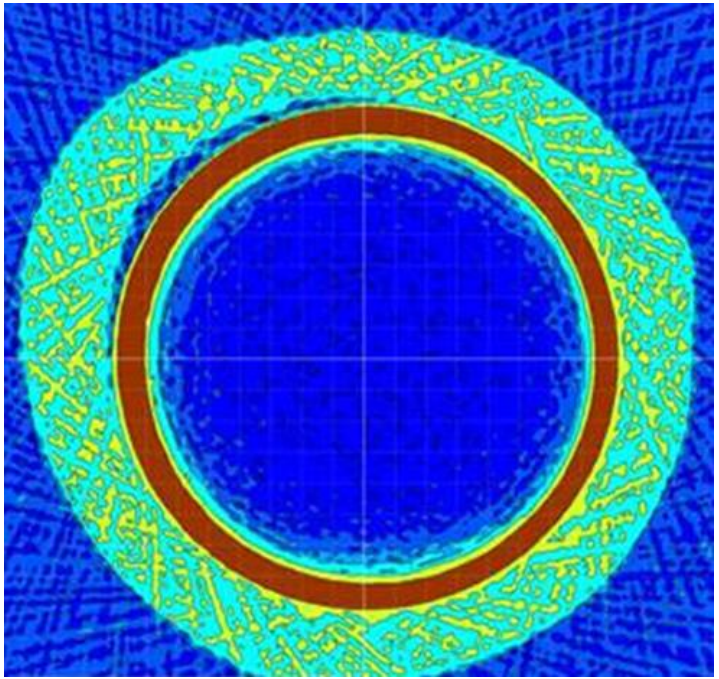
- Fusion Bonded epoxy coating
- Generally expected to be in good condition
- Discovery – Pipe wall in good condition
- Problems with coating revealed



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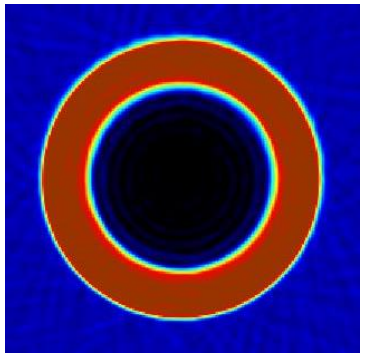
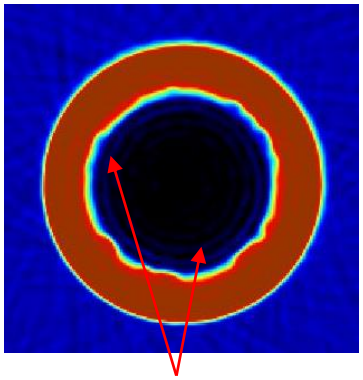
Internal corrosion

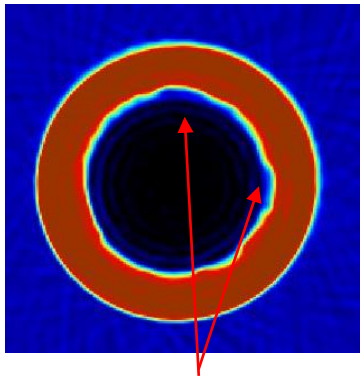
- Riser integrity – corrosion depletion
- Major wall loss observed in two sections of the riser



Good condition



Major wall loss



Major wall loss

Internal and external corrosion

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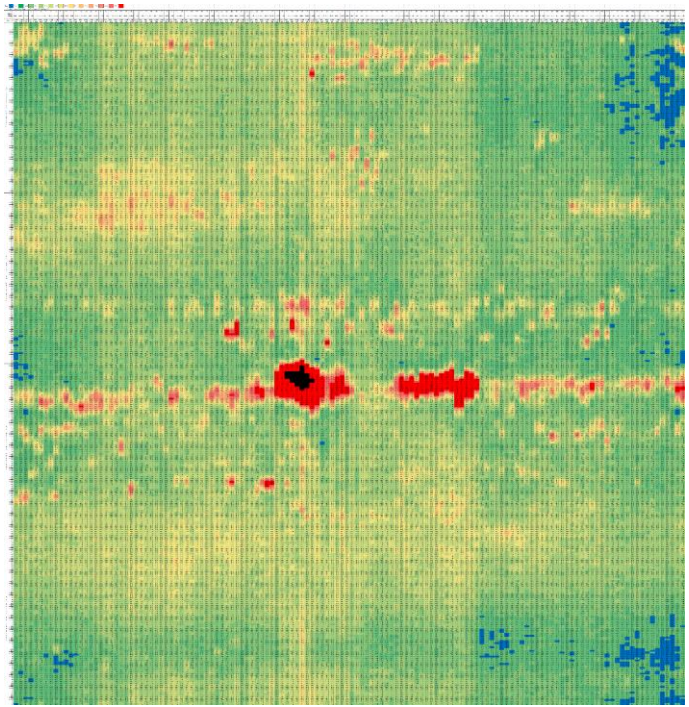

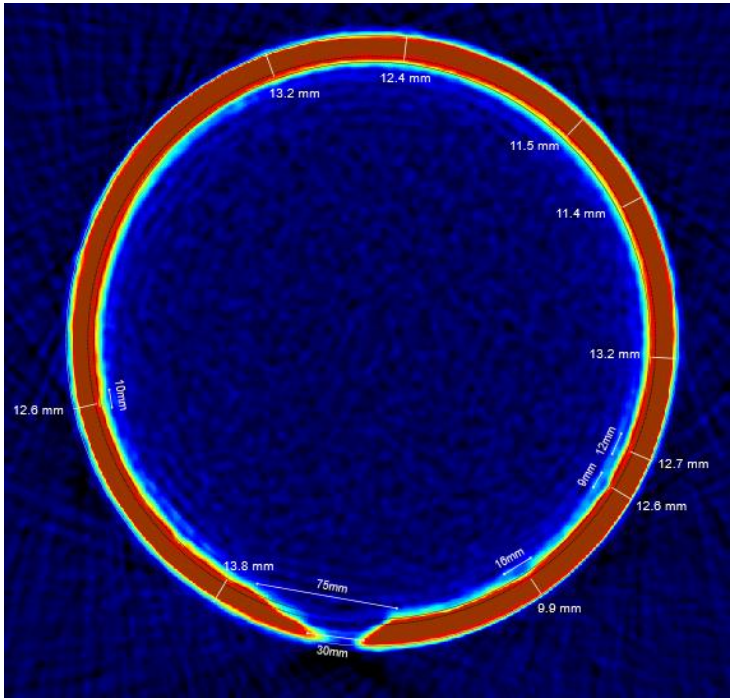

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Internal and external corrosion

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New developments – fast screening

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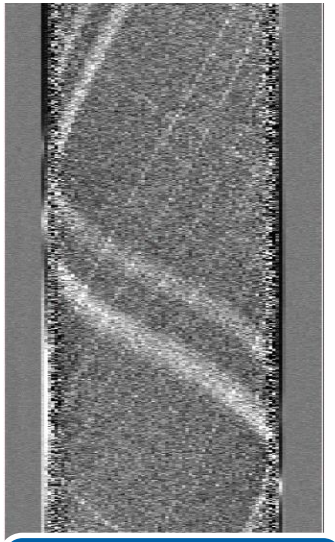
Raw data after 1 full lap



- Real time visualisation of raw projection data enables the operator to detect presence of metal loss anomalies
  - Even after just one lap!
- Where an anomaly is detected the scan continues to increase the signal-noise ratio to acceptable level to enable image reconstruction
- If no anomalies are identified the instrument quickly steps on

Raw data after >20 full laps

Anomalies detected in raw data → Continue scanning → Sufficient data acquired for image reconstruction

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Fast screening – case example

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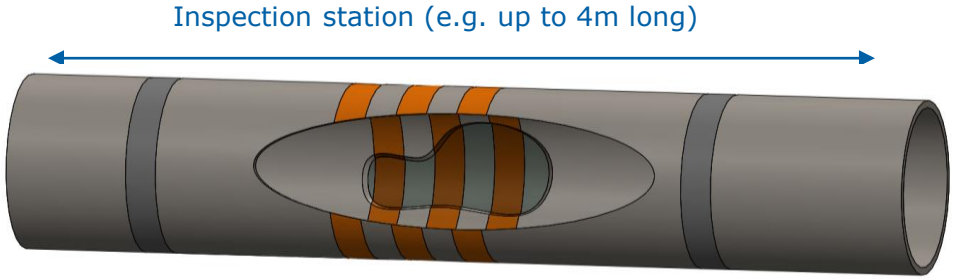
- In total, 4 locations were inspected following a typical fast screening approach as shown below:
- Minimum 1 full duration scan per 20 screening scans



Occasional full duration scans for general wall thickness measurements and deposit assessment

Full duration scans wherever an anomaly is identified

Quick screening scans; instrument quickly steps on if no anomalies are identified

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Baseline inspection

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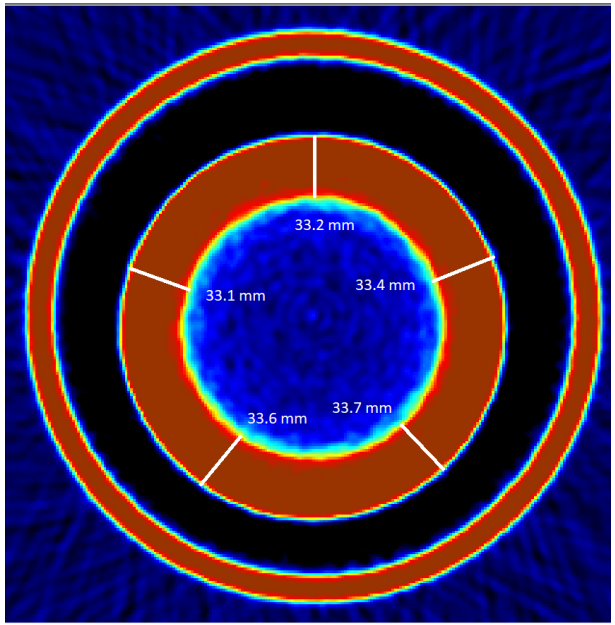
- Discovery™ deployed to obtain critical baseline data
- Accurate integrity data on areas of future potential concern, gave the operator confidence that their pipeline system meets all safety and regulatory requirements
- Discovery™ will be deployed annually to reinspect the new pipeline system to measure corrosion growth rates



Overstress or fatigue

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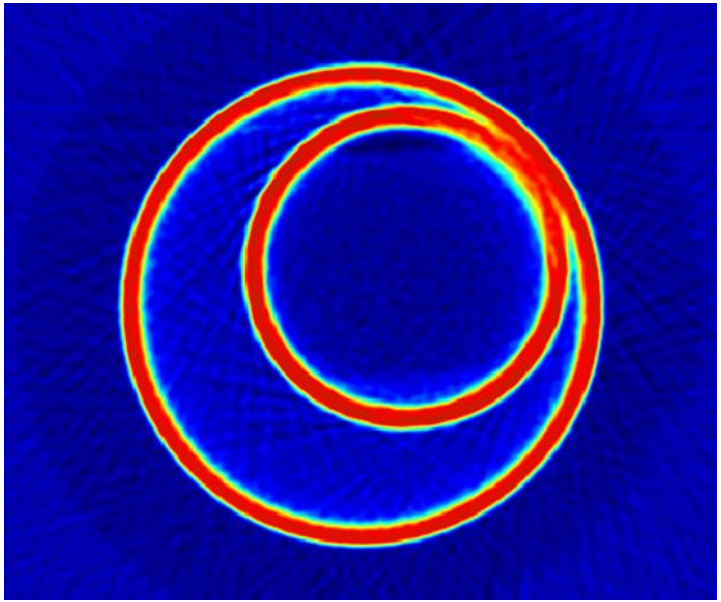
- Thermal expansion can overstress a flowline
- Ineffective thermal expansion design can also cause flow assurance issues
- In this case local inspection was used to check the effectiveness of the thermal expansion design



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Risk of fatigue damage

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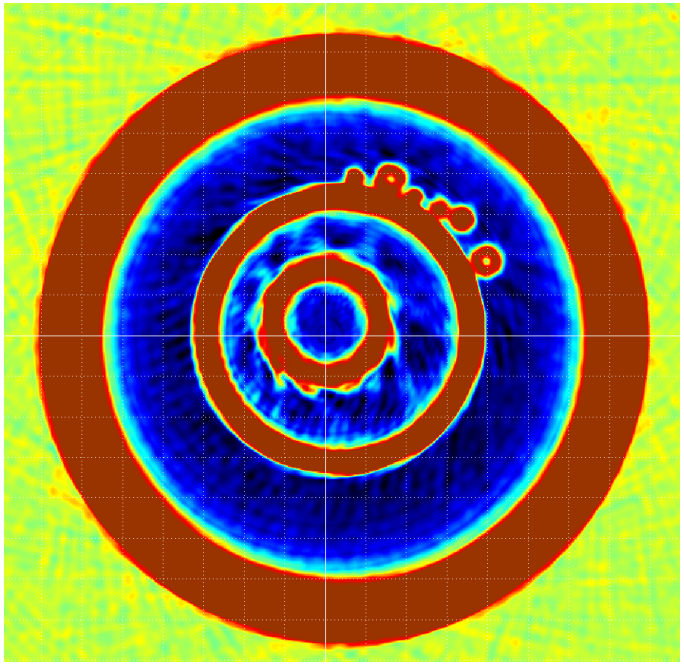
- Potential corrosive atmosphere
- Gas lift riser was observed to be moving
- Risk of fatigue damage



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Overstress or fatigue

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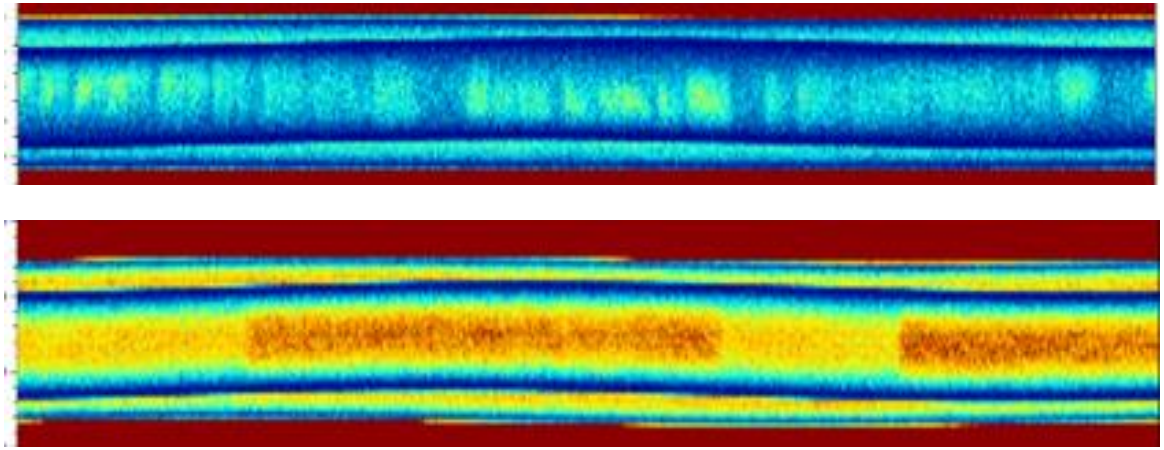
- Sensors (strain gauges) can be used to identify potential overstress situation in a riser system
- These are caused by flow regime (e.g. slugging) which was characterised in this case using local inspection



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Flow Assurance

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"Research indicates that 50-80% of remediation attempts fail first time"

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Flow assurance

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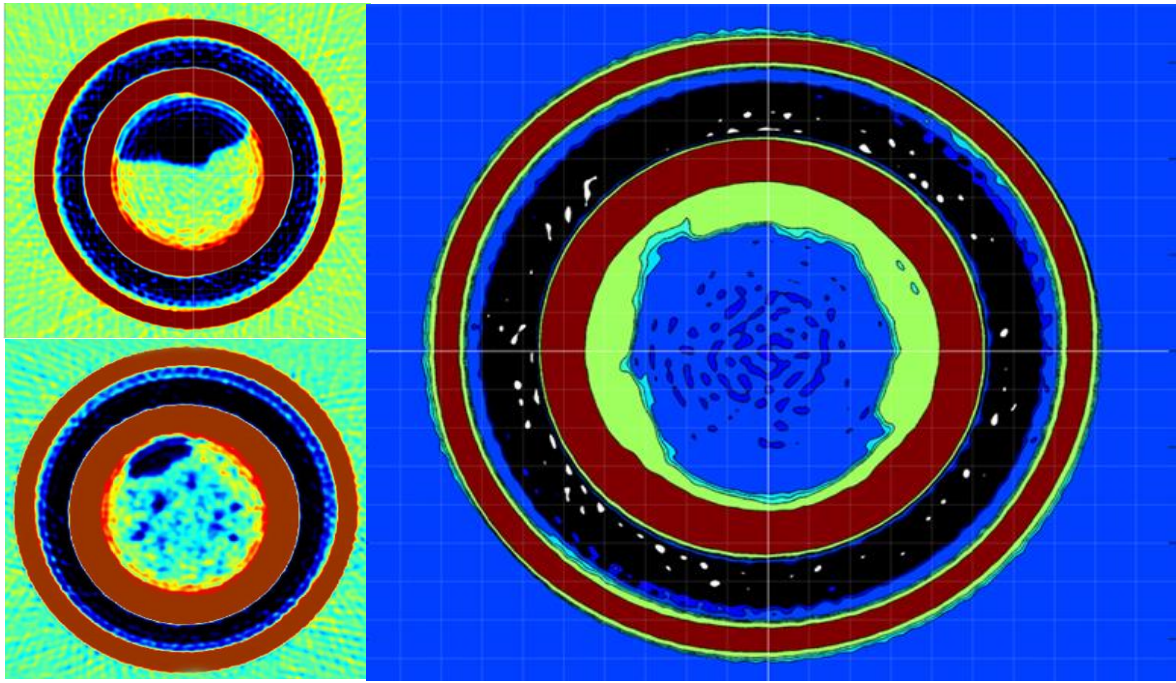
- Determine the exact location of any build-up
- Quantify and characterise deposition build up (asphaltene, sand, scale, hydrate, wax)
- Select the correct remediation approach first time



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Four steps to cost effective remediation

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1) Locate deposits/blockages: Use **Explorer™** to identify the position – know **WHERE** it is

2) Quantify and characterise: Use **Discovery™** to identify the type and nature of the deposition – know **WHAT** it is

3) Remediate efficiently and cost-effectively

Choose the correct remediation method and plan the campaign with confidence the FIRST TIME

4) Use **Discovery™** to monitor and optimise the effectiveness of your remediation

Explorer™

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- Truly non-intrusive technology
  - Scan through any coating
  - No coating damage
  - No interference to production
- Fast screening flow assurance data to locate suspect areas
- Real time data
- 0.1 g/cc density resolution
- 10,000’ water depth
- 6”- 60+” Total OD capabilities
- Most size ROV’s

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Explorer™ – step 1

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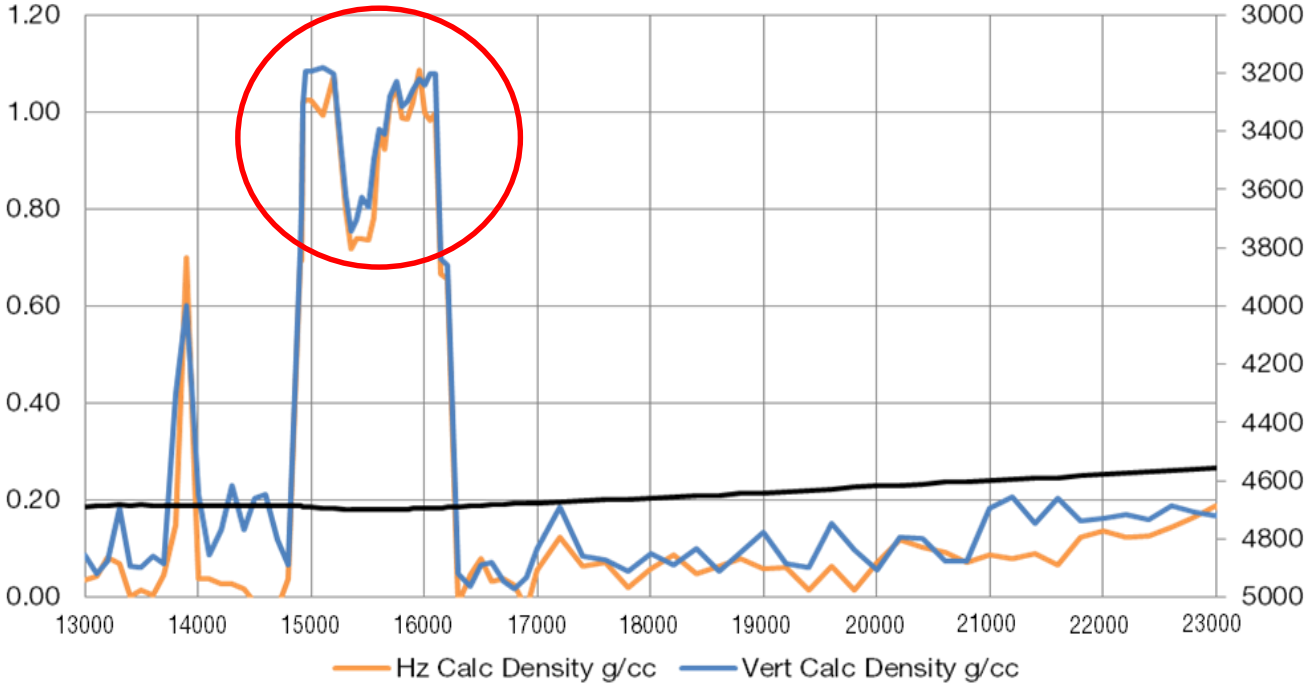

Explorer™ – step 1

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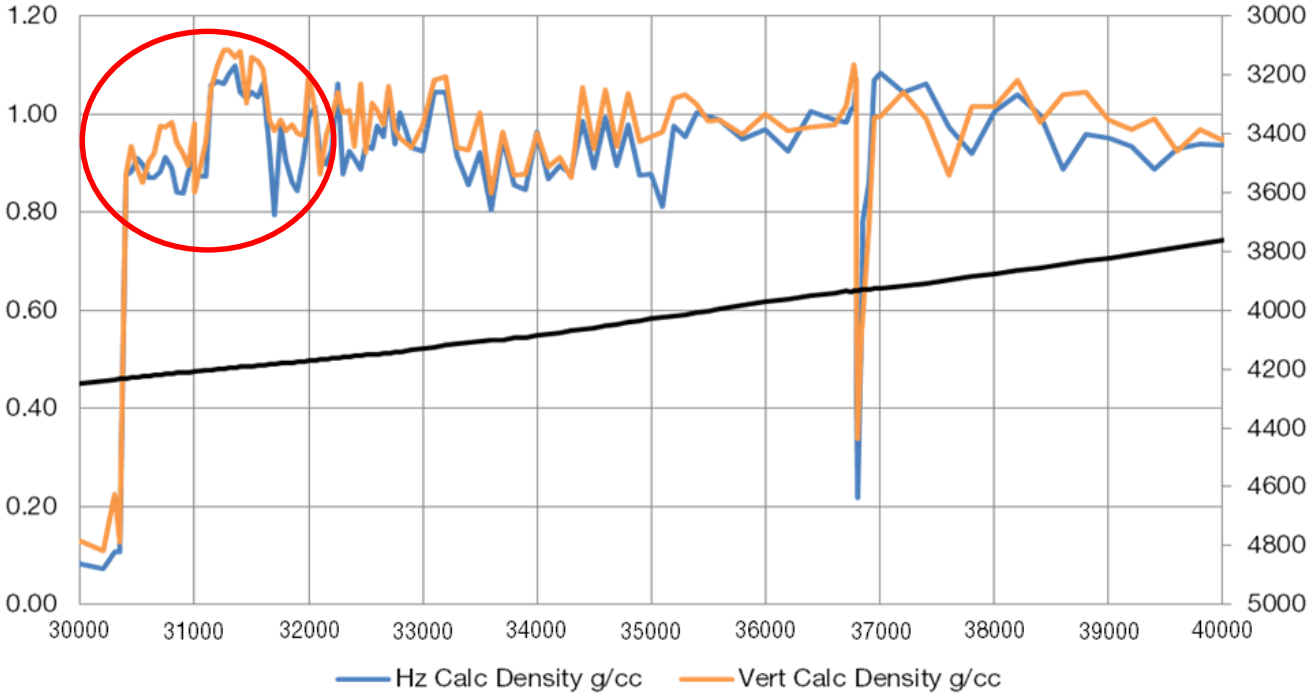

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Explorer™ – step 1

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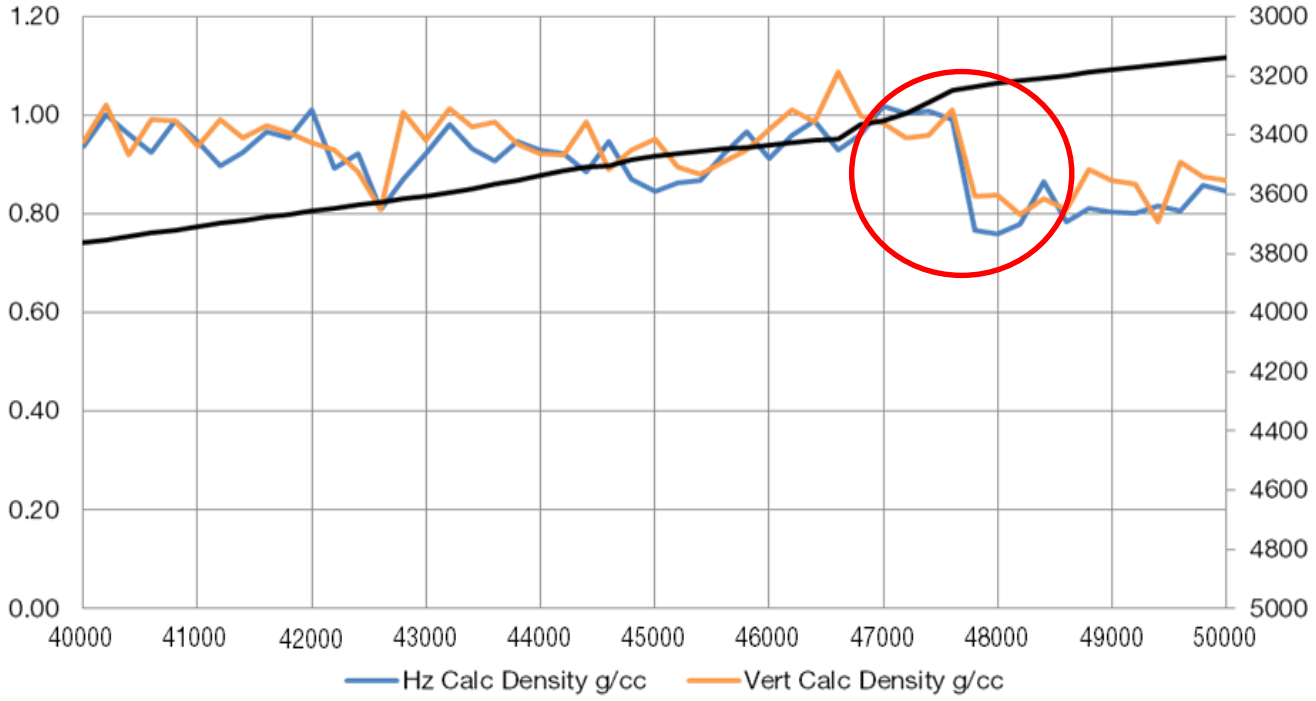

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Discovery™ – step 2

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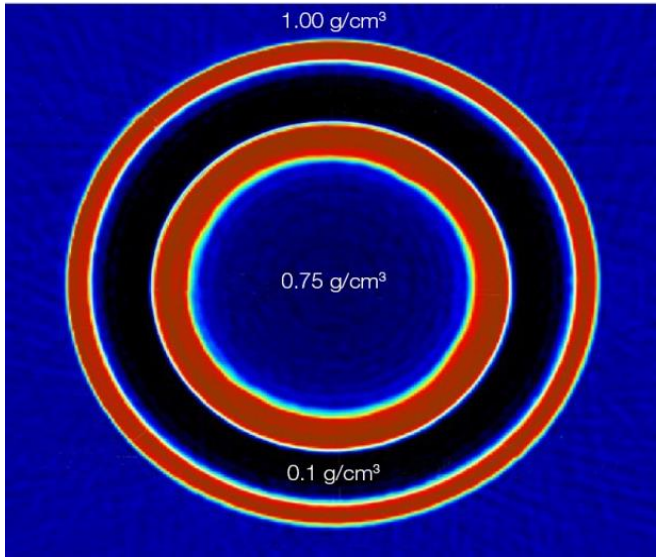
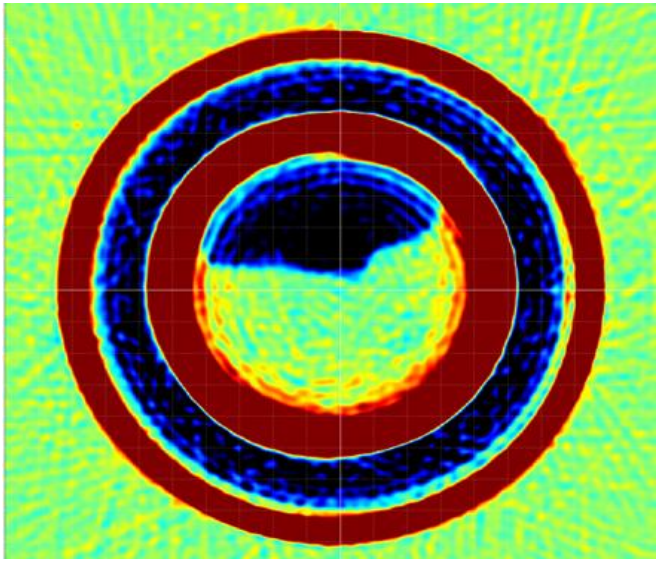
"Seeing is believing"



Clean PiP



Asphaltene @ 1.2g/cc

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Discovery™ – step 2

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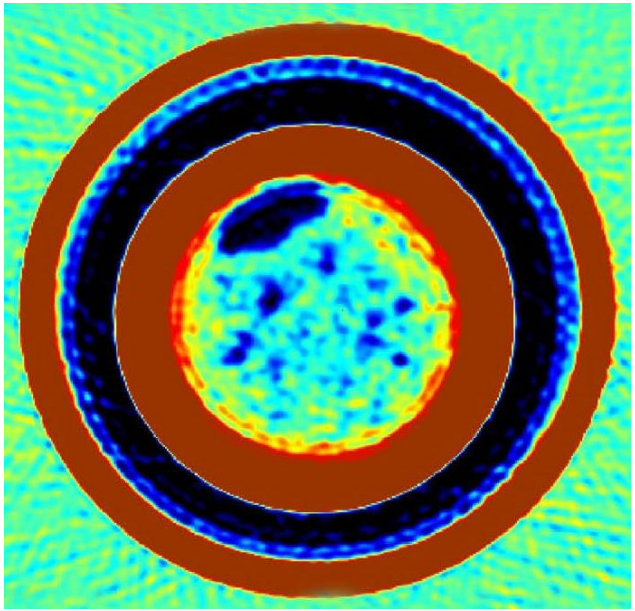
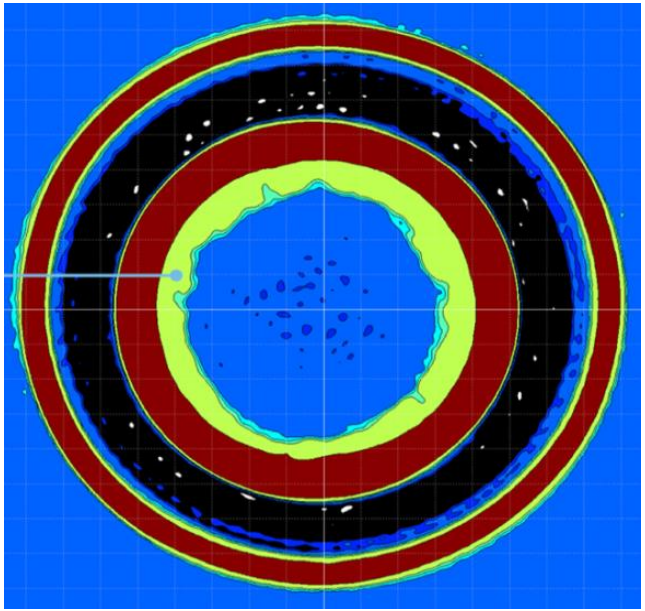
"Seeing is believing"



Asphaltene @ 1.2g/cc & Gas Pockets



Scale @2.3g/cc

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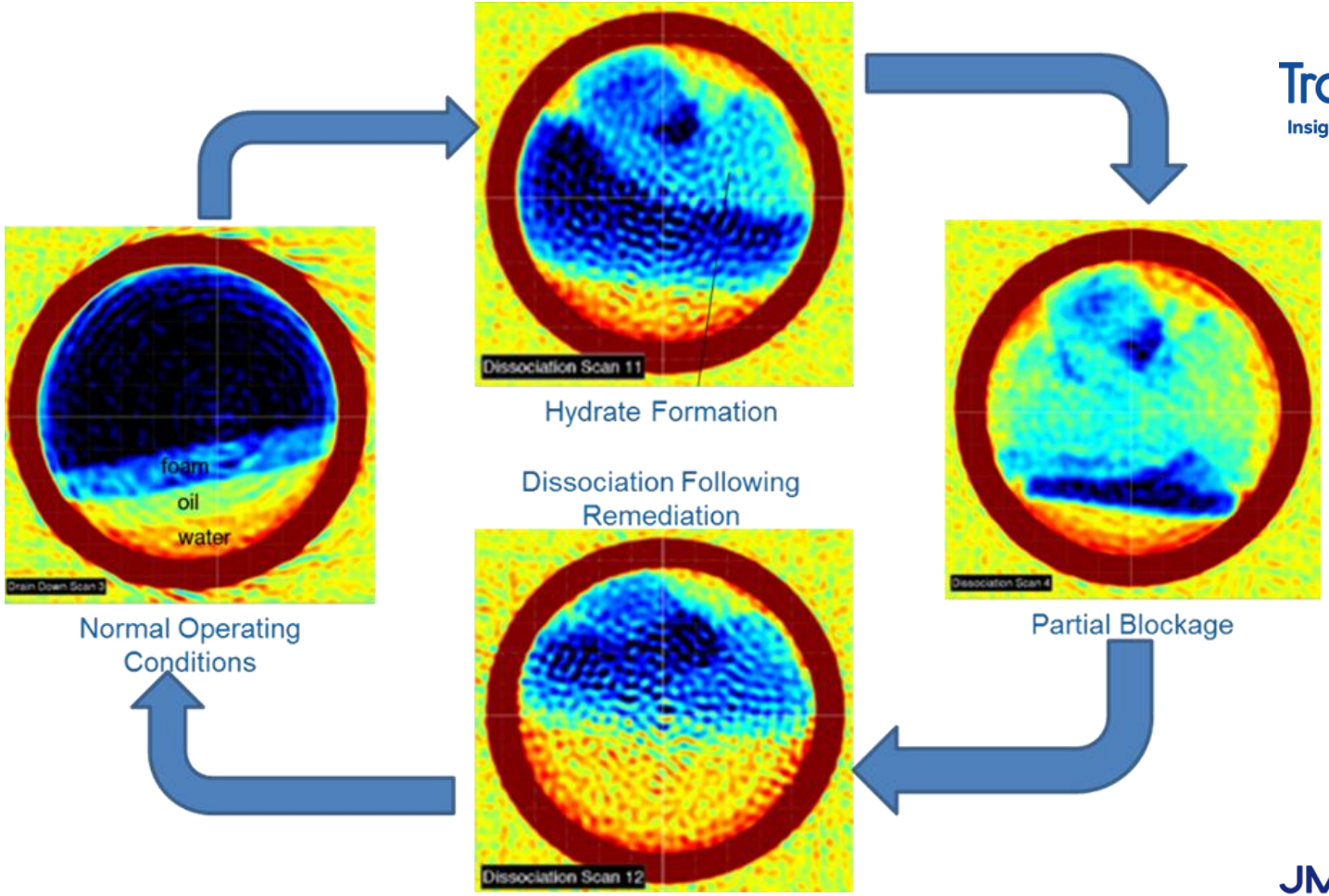
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Dissociation Scan 11
Hydrate Formation
Dissociation Scan 4
Partial Blockage
Dissociation Following Remediation
Dissociation Scan 12
Drain Down Scan 3
foam
oil
water
Normal Operating Conditions
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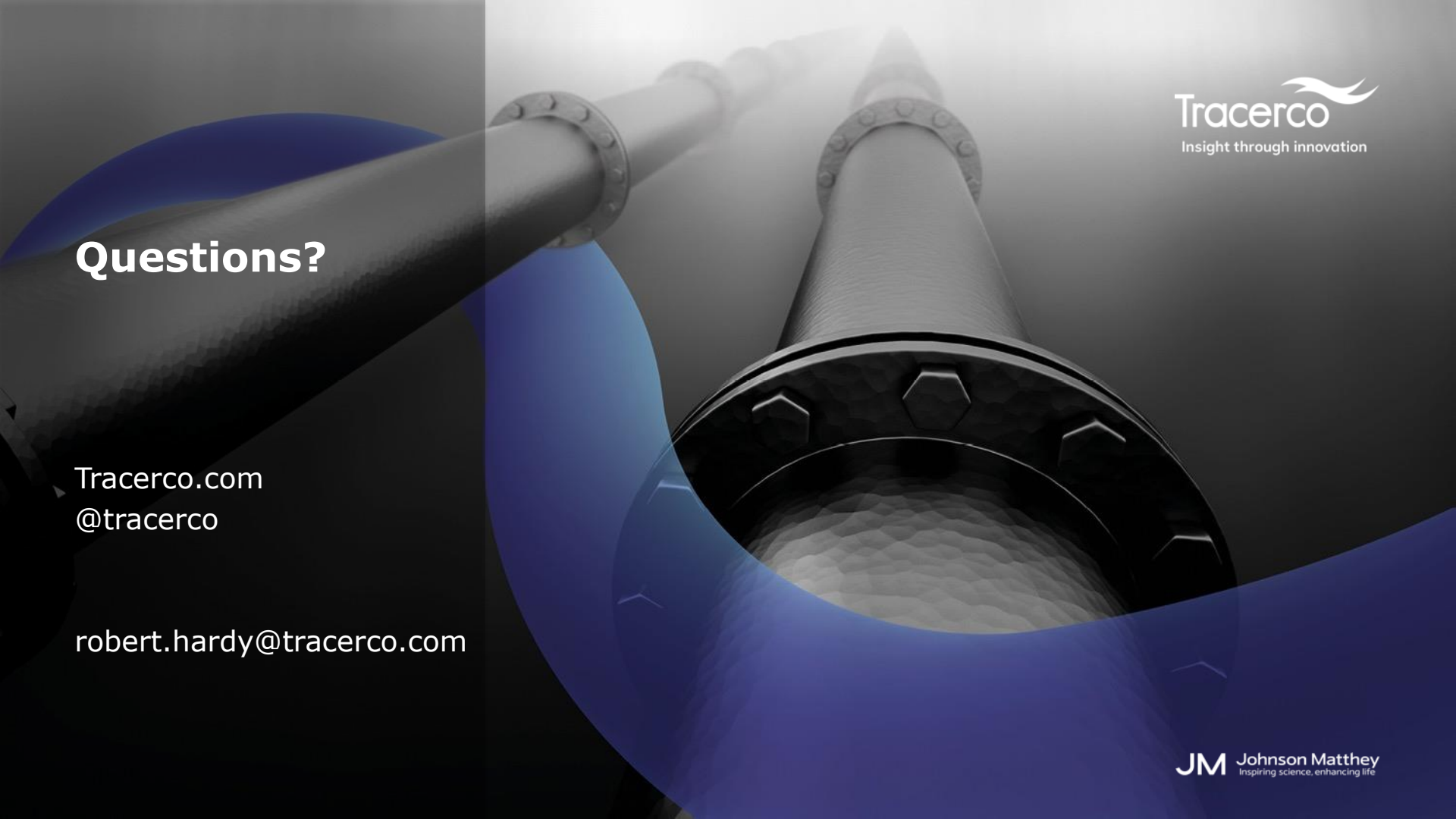
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