Digital Radiography Condition Assessment

of Valves, Fire Plugs, and Pipes.

Presenter/ Authors:

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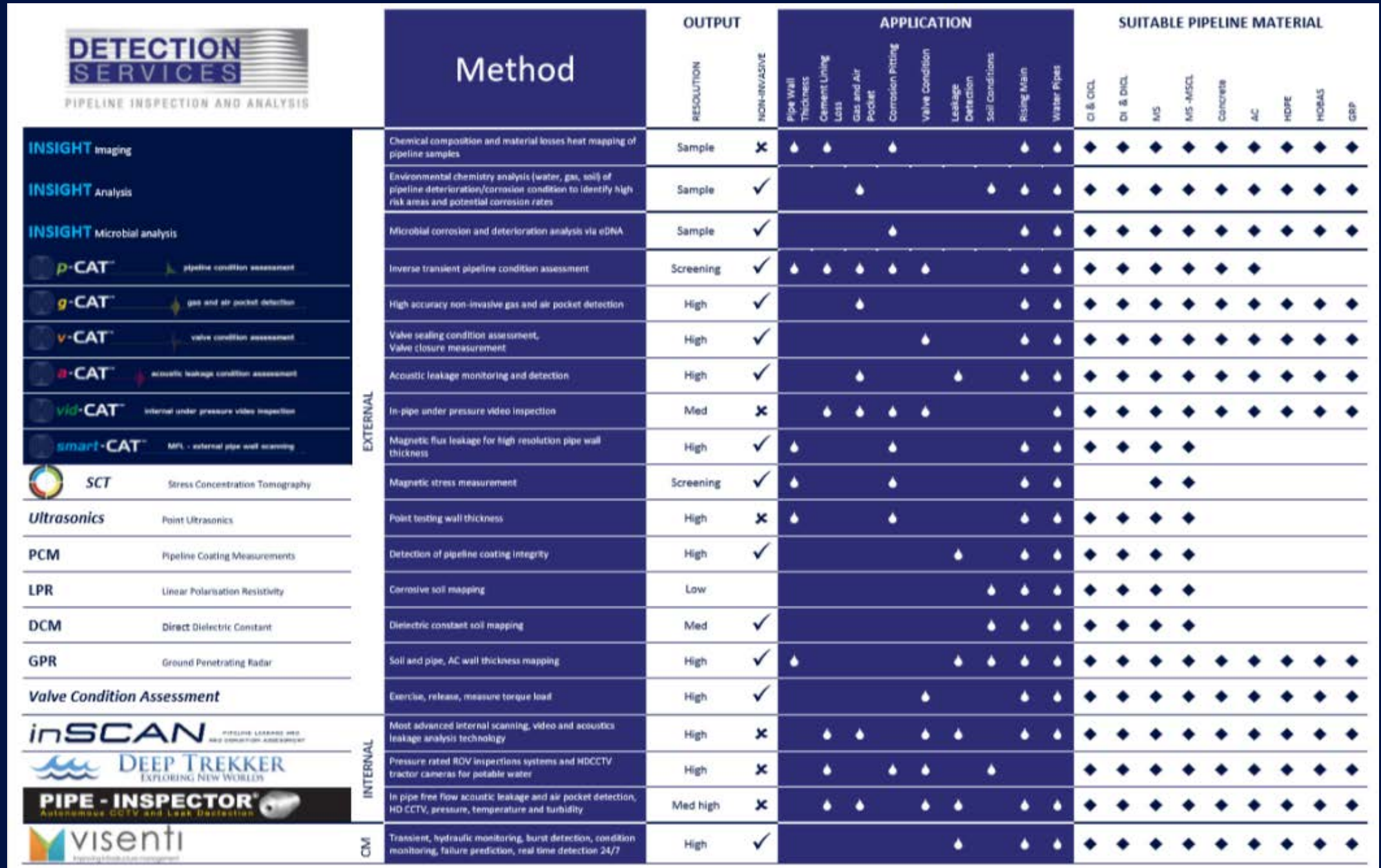
Detection Services / DS Insight

- Undertaken the longest pipeline test to date
  - 2015 150km BHP Olympic dam – PCAT
  - 2017 180km BMA
  - 2018 110km BMA
- Commonly 200+km a year of pipeline inspection
- A wide range of tools
- Located in WA, Victoria, South Australia, Sydney, Queensland, Auckland, Wellington, and Christchurch
- We mobilise worldwide to test pipelines


DETECTION SERVICES
PIPELINE INSPECTION AND ANALYSIS
Method
OUTPUT
RESOLUTION
NON-INVASIVE
APPLICATION
Pipe Wall Thickness
Cement Lining Loss
Gas and Air Pocket
Corrosion Pitting
Valve Condition
Leakage Detection
Soil Conditions
Rising Main
Water Pipes
SUITABLE PIPELINE MATERIAL
CI & DICL
DI & DICL
MS
MS -MSCL
Concrete
AC
HDPE
HOBAS
GRP
INSIGHT Imaging
Chemical composition and material losses heat mapping of pipeline samples
Sample
INSIGHT Analysis
Environmental chemistry analysis (water, gas, soil) of pipeline deterioration/corrosion condition to identify high risk areas and potential corrosion rates
Sample
INSIGHT Microbial analysis
Microbial corrosion and deterioration analysis via eDNA
Sample
p-CAT pipeline condition assessment
Inverse transient pipeline condition assessment
Screening
g-CAT gas and air pocket detection
High accuracy non-invasive gas and air pocket detection
High
v-CAT valve condition assessment
Valve sealing condition assessment, Valve closure measurement
High
a-CAT acoustic leakage condition assessment
Acoustic leakage monitoring and detection
High
vid-CAT internal under pressure video inspection
In-pipe under pressure video inspection
Med
smart-CAT MFL - external pipe wall scanning
Magnetic flux leakage for high resolution pipe wall thickness
High
EXTERNAL
SCT Stress Concentration Tomography
Magnetic stress measurement
Screening
Ultrasonics Point Ultrasonics
Point testing wall thickness
High
PCM Pipeline Coating Measurements
Detection of pipeline coating integrity
High
LPR Linear Polarisation Resistivity
Corrosive soil mapping
Low
DCM Direct Dielectric Constant
Dielectric constant soil mapping
Med
GPR Ground Penetrating Radar
Soil and pipe, AC wall thickness mapping
High
Valve Condition Assessment
Exercise, release, measure torque load
High
inSCAN
Most advanced internal scanning, video and acoustics leakage analysis technology
High
DEEP TREKKER EXPLORING NEW WORLDS
Pressure rated ROV inspections systems and HDCCTV tractor cameras for potable water
High
PIPE - INSPECTOR Autonomous CCTV and Leak Detection
In pipe free flow acoustic leakage and air pocket detection, HD CCTV, pressure, temperature and turbidity
Med high
INTERNAL
visenti
Transient, hydraulic monitoring, burst detection, condition monitoring, failure prediction, real time detection 24/7
High
CM

Pinpoint Methods

DETECTION SERVICES
PIPELINE INSPECTION AND ANALYSIS

		Method	OUTPUT: RESOLUTION	OUTPUT: NON-INVASIVE	APPLICATION: Pipe Wall Thickness	Cement Lining Loss	Gas and Air Pocket	Corrosion Pitting	Valve Condition	Leakage Detection	Soil Conditions	Rising Main	Water Pipes	SUITABLE PIPELINE MATERIAL: CI & CICL	DI & DICL	MS	MS -MSCL	Concrete	AC	HDPE	HOBAS	GRP
INSIGHT Imaging		Chemical composition and material losses heat mapping of pipeline samples	Sample	✗	♦	♦		♦				♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
INSIGHT Analysis		Environmental chemistry analysis (water, gas, soil) of pipeline deterioration/corrosion condition to identify high risk areas and potential corrosion rates	Sample	✓			♦				♦	♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
INSIGHT Microbial analysis		Microbial corrosion and deterioration analysis via eDNA	Sample	✓				♦				♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
p-CAT pipeline condition assessment	EXTERNAL	Inverse transient pipeline condition assessment	Screening	✓	♦	♦	♦	♦	♦			♦	♦	◆	◆	◆	◆	◆	◆			
g-CAT gas and air pocket detection	EXTERNAL	High accuracy non-invasive gas and air pocket detection	High	✓			♦					♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
v-CAT valve condition assessment	EXTERNAL	Valve sealing condition assessment, Valve closure measurement	High	✓					♦			♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
a-CAT acoustic leakage condition assessment	EXTERNAL	Acoustic leakage monitoring and detection	High	✓			♦				♦	♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
vid-CAT internal under pressure video inspection	EXTERNAL	In-pipe under pressure Video inspection	Med	✗		♦	♦	♦	♦				♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
smart-CAT MFL - external pipe wall scanning	EXTERNAL	Magnetic flux leakage for high resolution pipe wall thickness	High	✓	♦			♦				♦	♦	◆	◆	◆	◆					
SCT Stress Concentration Tomography	EXTERNAL	Magnetic stress measurement	Screening	✓	♦			♦				♦	♦			◆	◆					
Ultrasonics Point Ultrasonics		Point testing wall thickness	High	✗	♦			♦				♦	♦	◆	◆	◆	◆					
PCM Pipeline Coating Measurements		Detection of pipeline coating integrity	High	✓						♦		♦	♦	◆	◆	◆	◆					
LPR Linear Polarisation Resistivity		Corrosive soil mapping	Low								♦	♦	♦	◆	◆	◆	◆					
DCM Direct Dielectric Constant		Dielectric constant soil mapping	Med	✓							♦	♦	♦	◆	◆	◆	◆					
GPR Ground Penetrating Radar		Soil and pipe, AC wall thickness mapping	High	✓	♦					♦	♦	♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
Valve Condition Assessment		Exercise, release, measure torque load	High	✓					♦			♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
inSCAN	INTERNAL	Most advanced internal scanning, video and acoustics leakage analysis technology	High	✗		♦	♦		♦	♦		♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
DEEP TREKKER EXPLORING NEW WORLDS	INTERNAL	Pressure rated ROV inspections systems and NDCCTV tractor cameras for potable water	High	✗		♦		♦	♦		♦			◆	◆	◆	◆	◆	◆	◆	◆	◆
PIPE - INSPECTOR Autonomous CCTV and Leak Detection	INTERNAL	In pipe free flow acoustic leakage and air pocket detection, HD CCTV, pressure, temperature and turbidity	Med high	✗		♦	♦		♦	♦		♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆
visenti	CM	Transient, hydraulic monitoring, burst detection, condition monitoring, failure prediction, real time detection 24/7	High	✓						♦		♦	♦	◆	◆	◆	◆	◆	◆	◆	◆	◆

Screening Methods

DETECTION SERVICES
PIPELINE INSPECTION AND ANALYSIS

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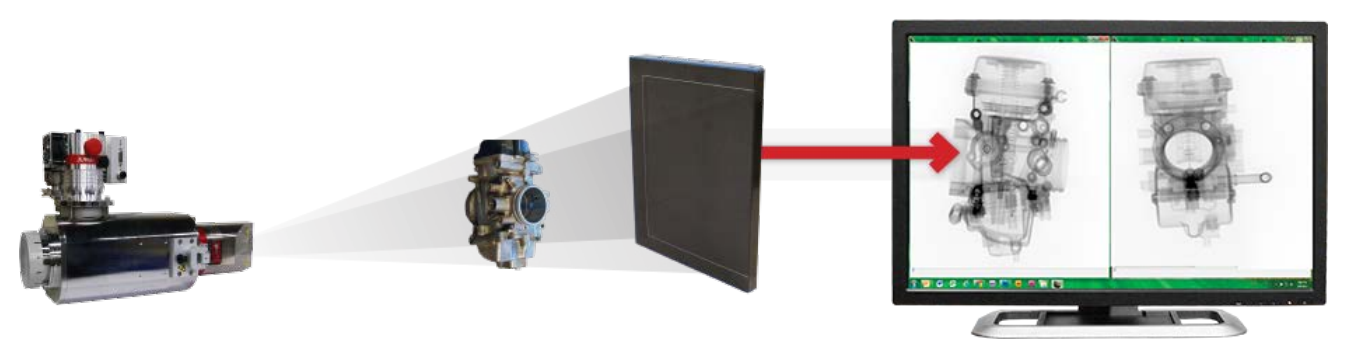
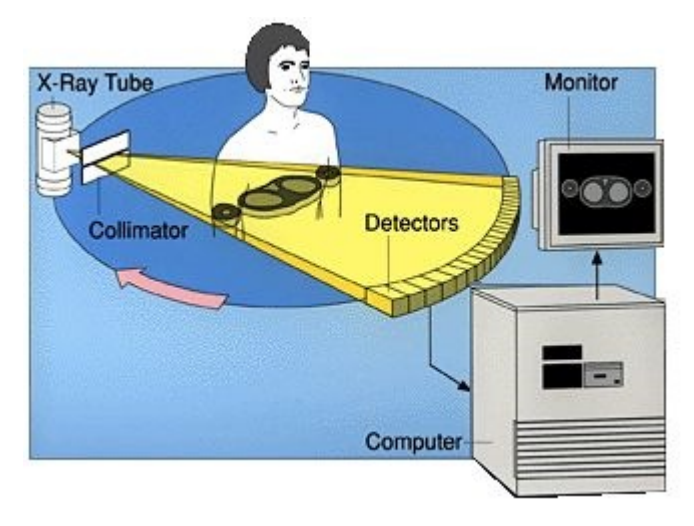
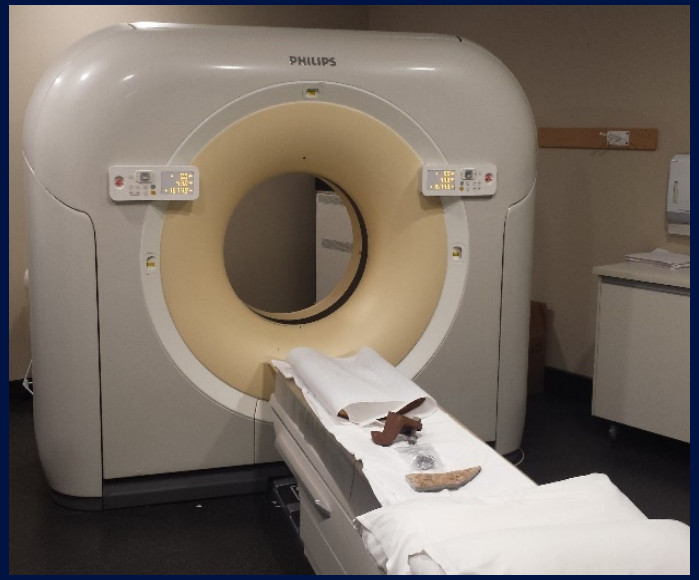
Digital Radiography



Computer Tomography





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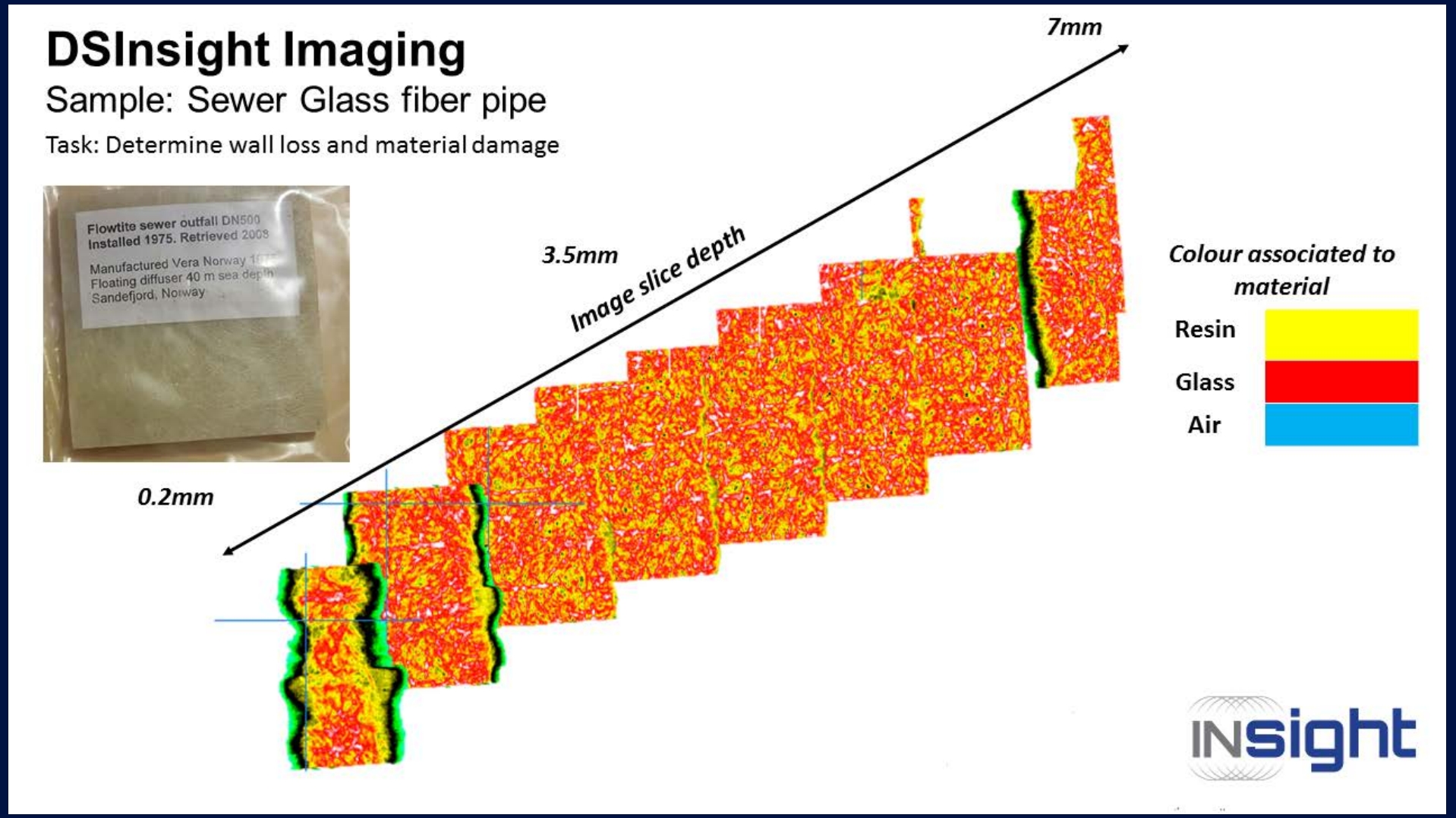

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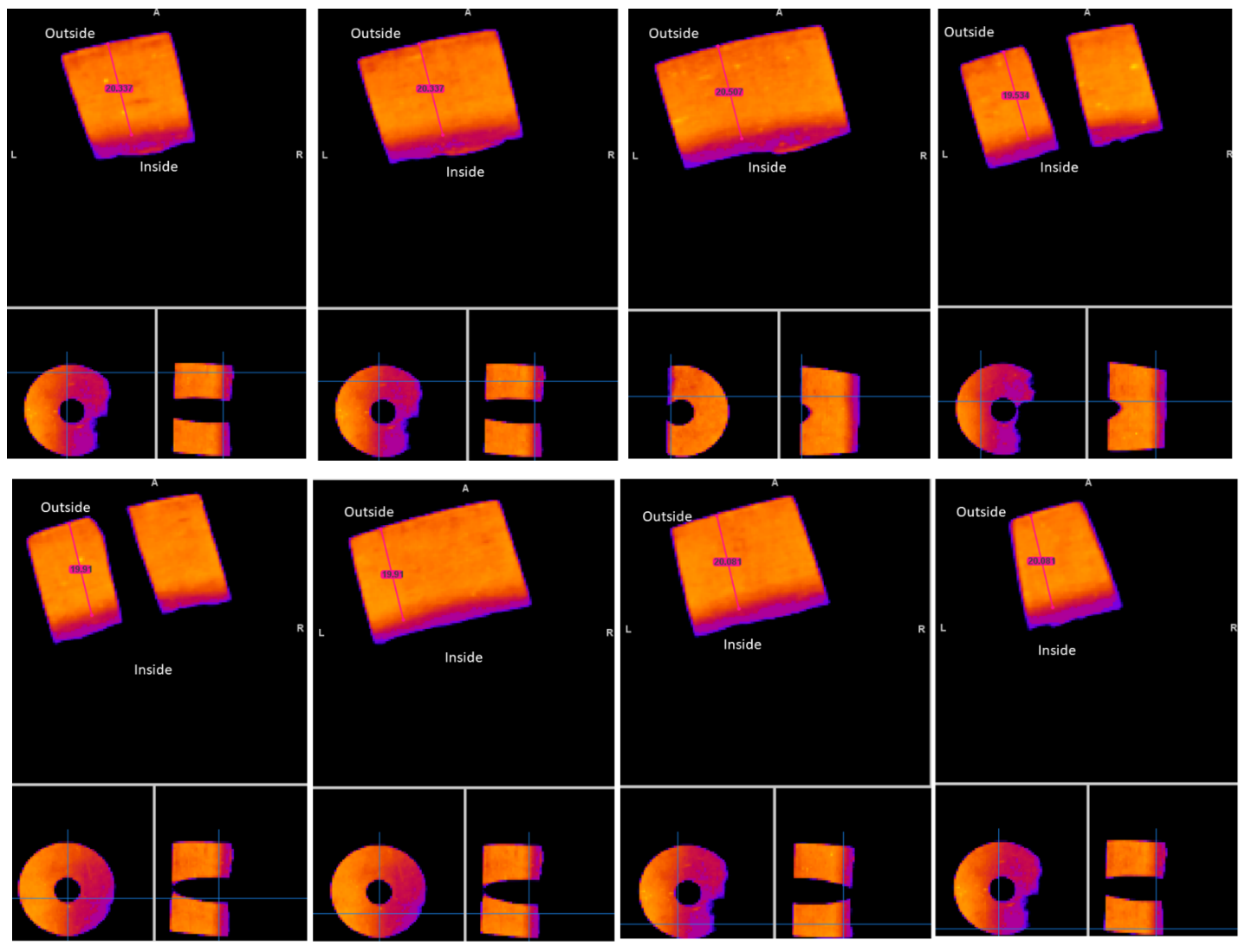
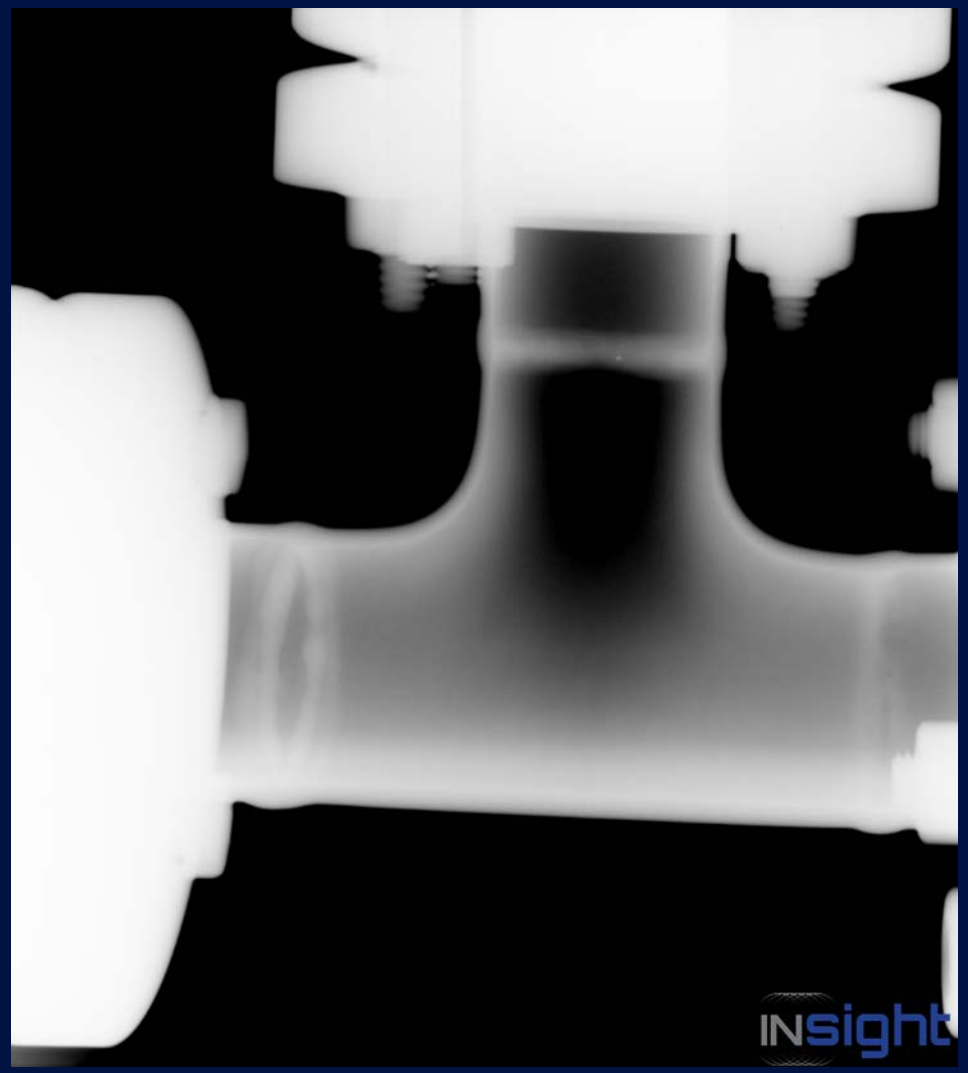


Digital Radiography of Critical Assets

- Can penetrate many different materials.
- Data obtained instantly within the field.
- Used for visual inspection and quantitative data can be collect from the images.
- Can be used to identify internal issues.

Digital Radiography

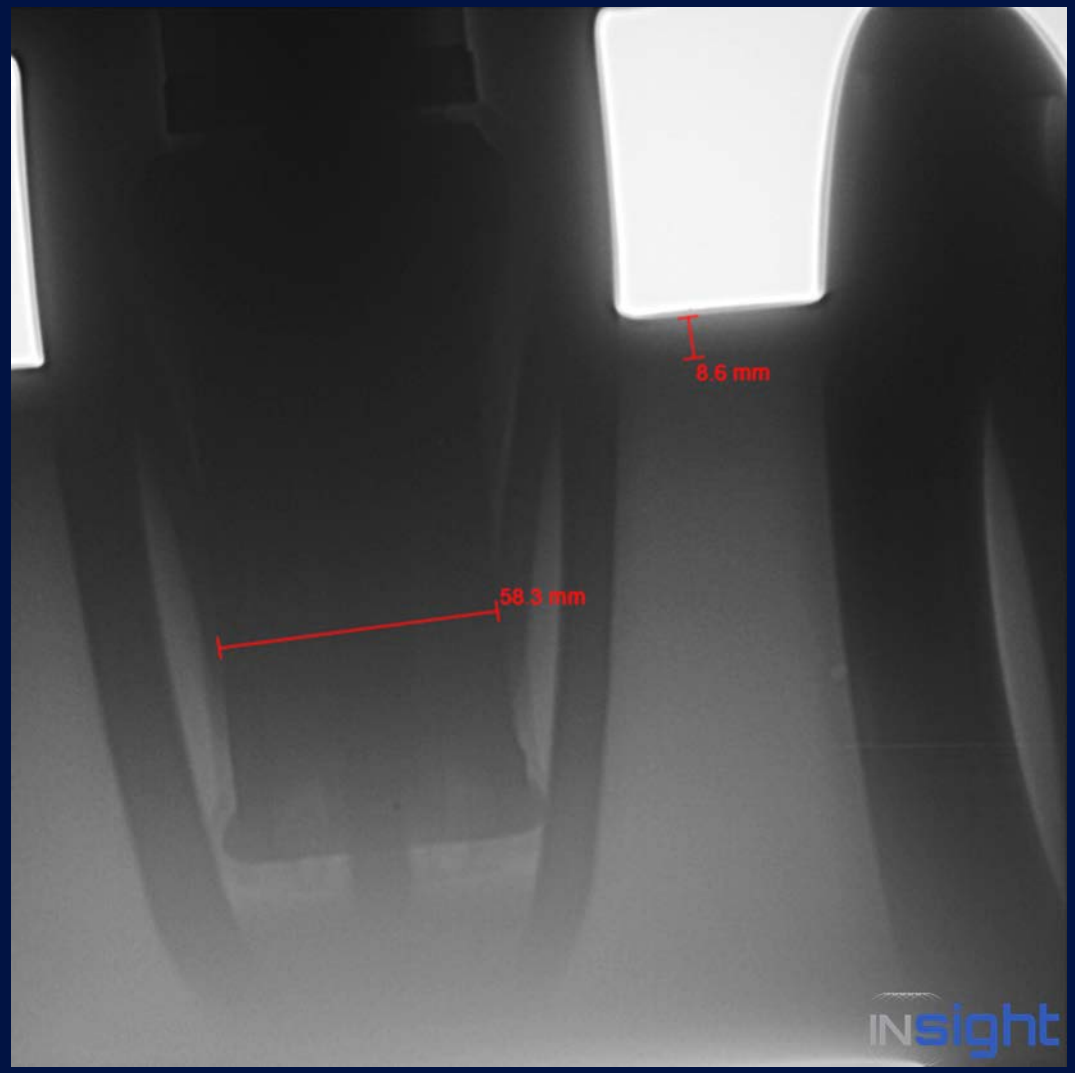
Joints



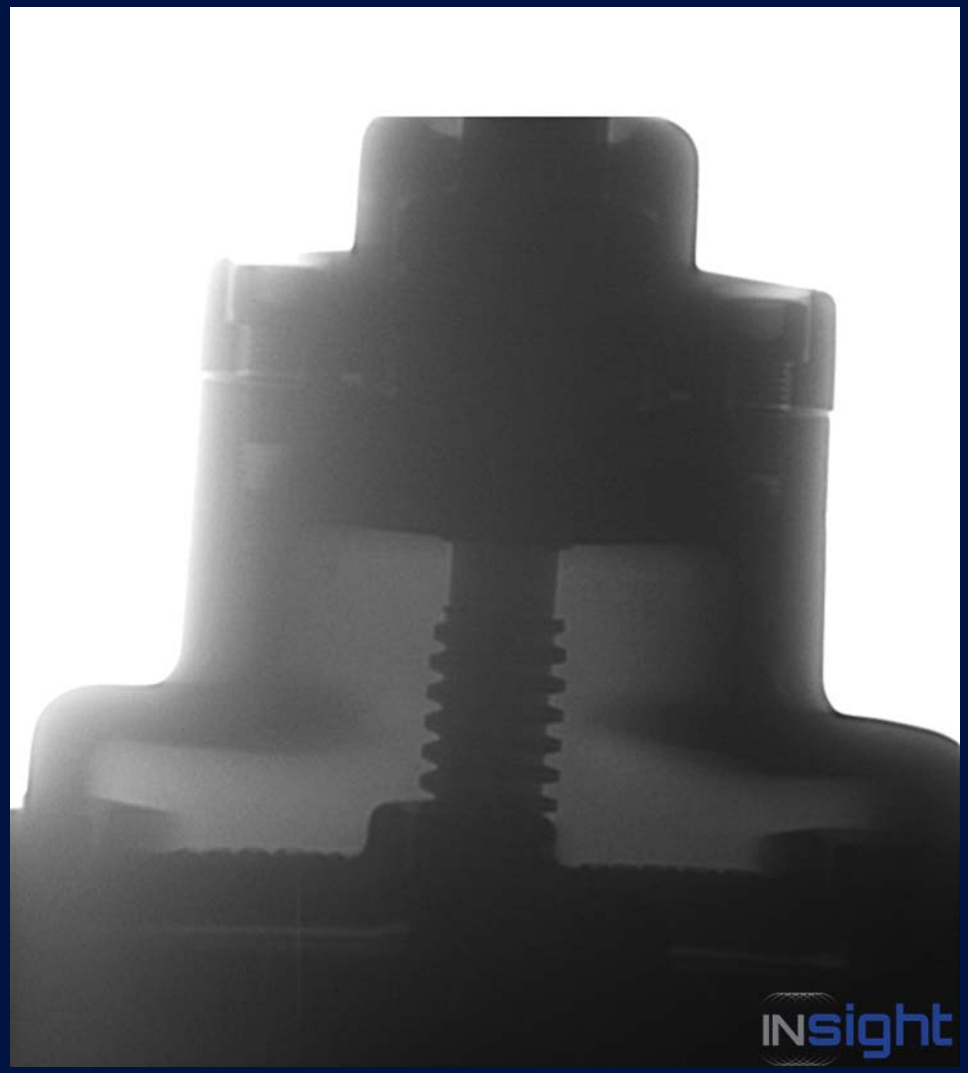
Bends

Digital Radiography

Valves



Spindles



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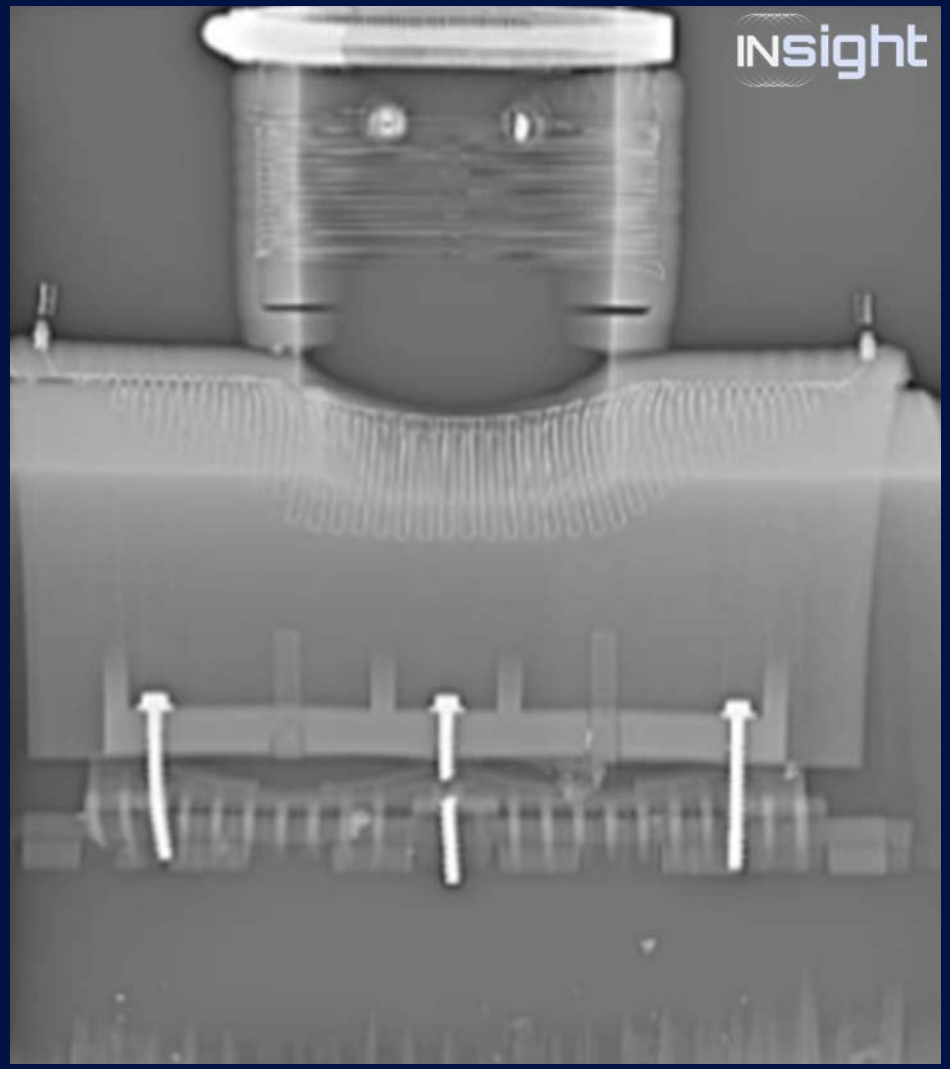

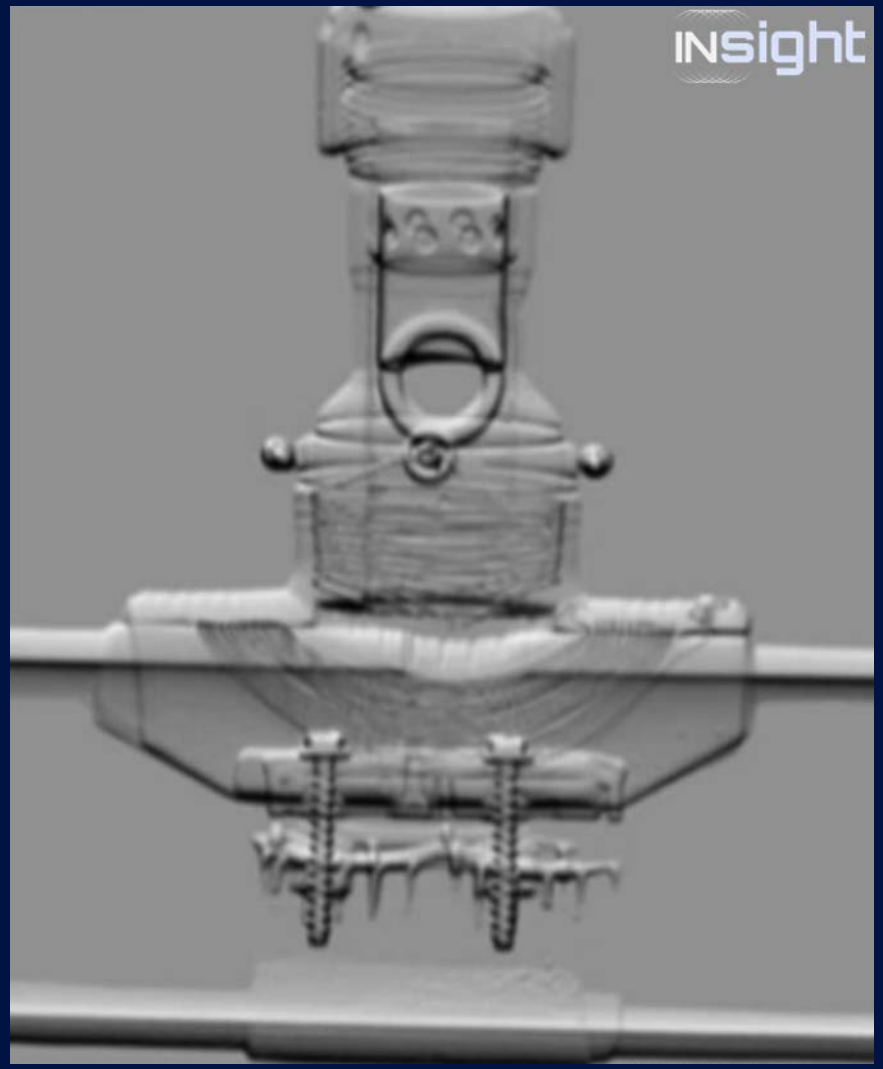

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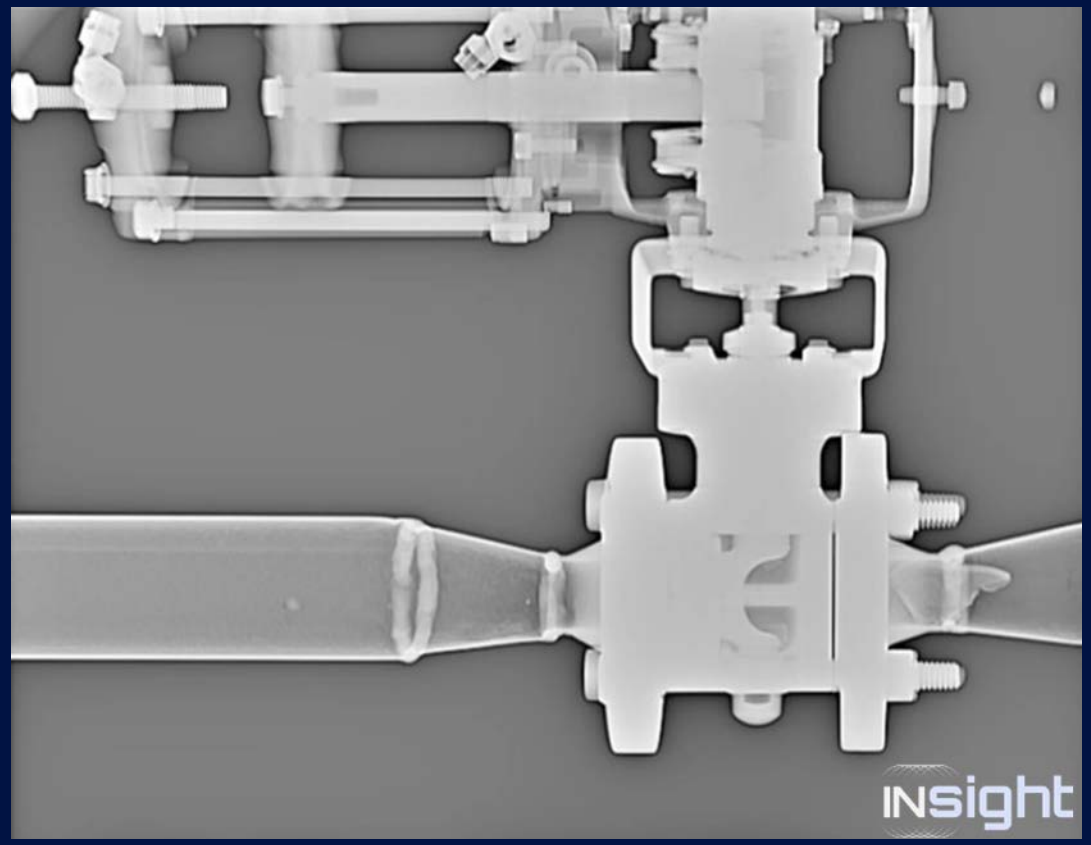
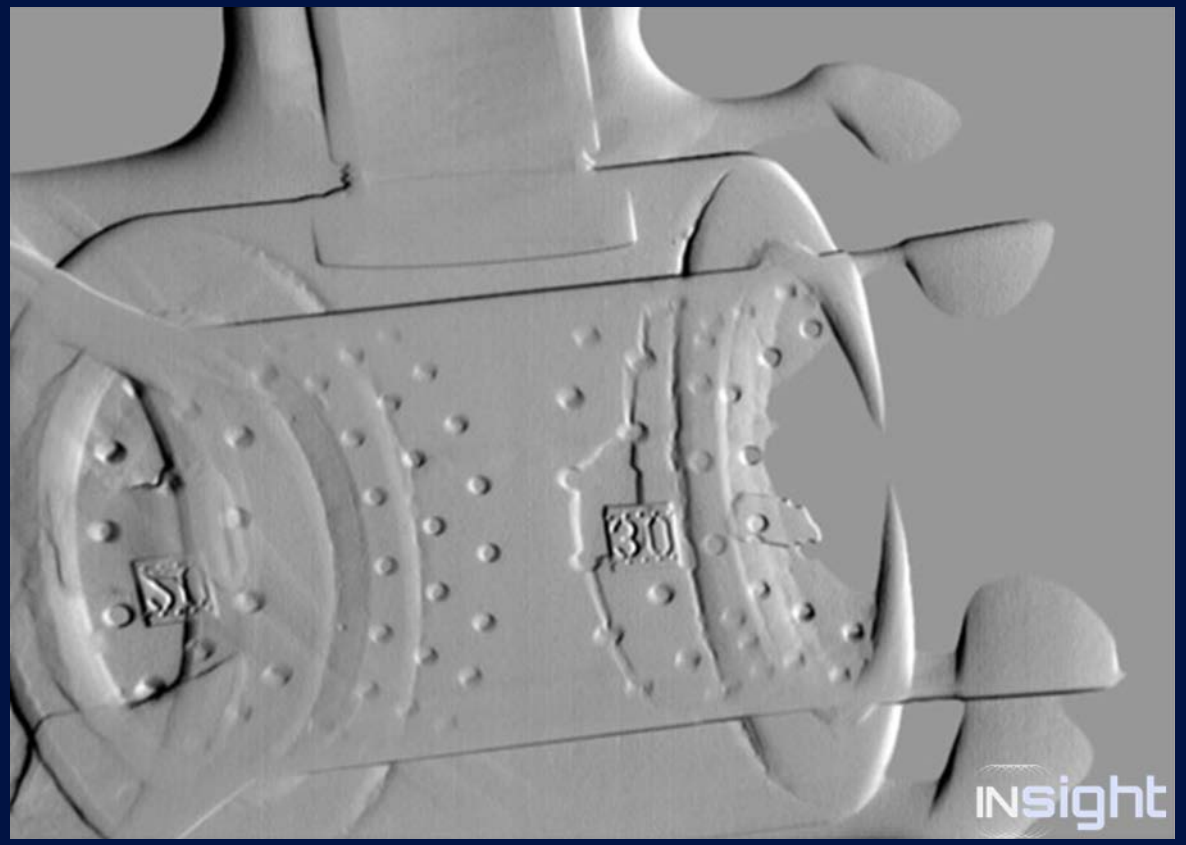
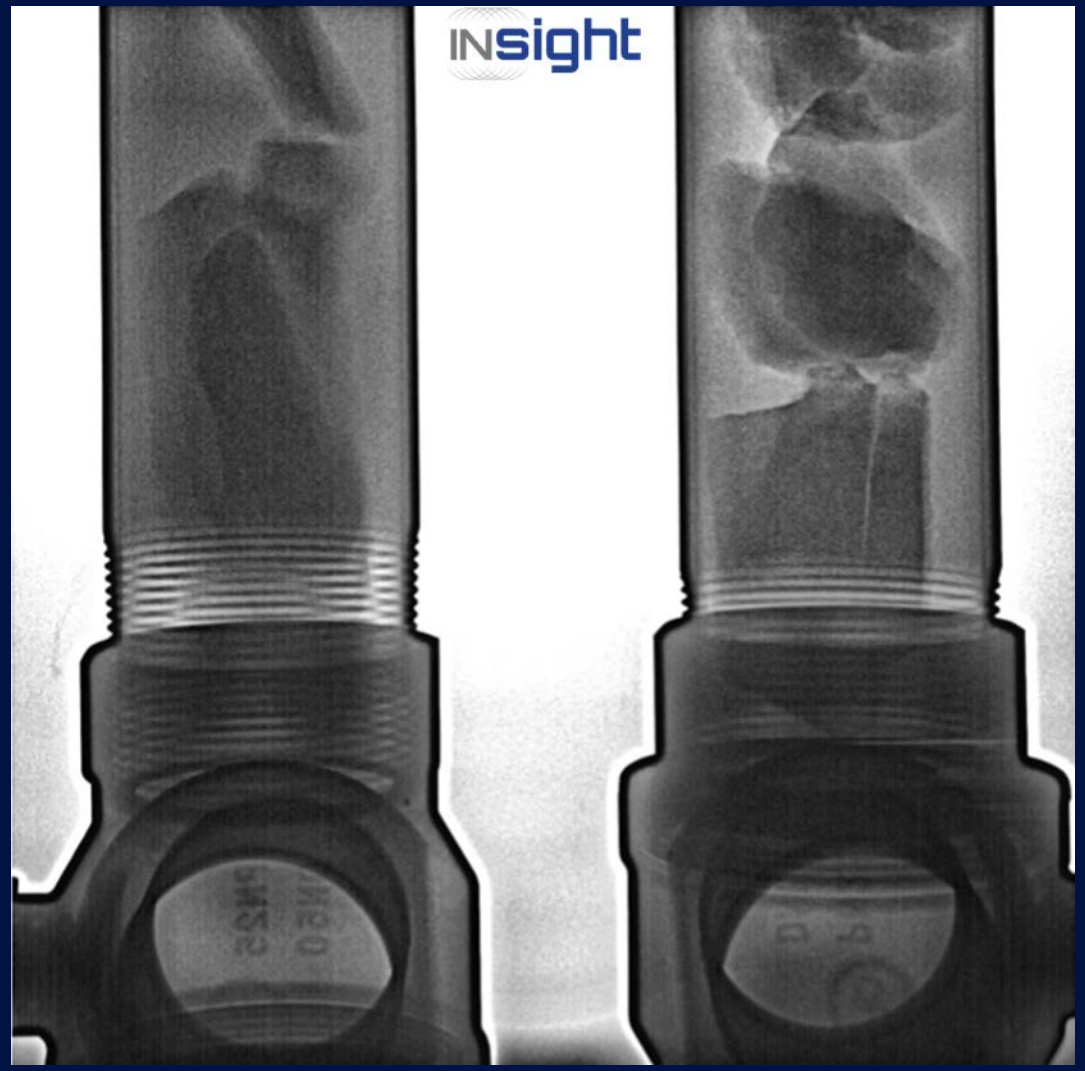
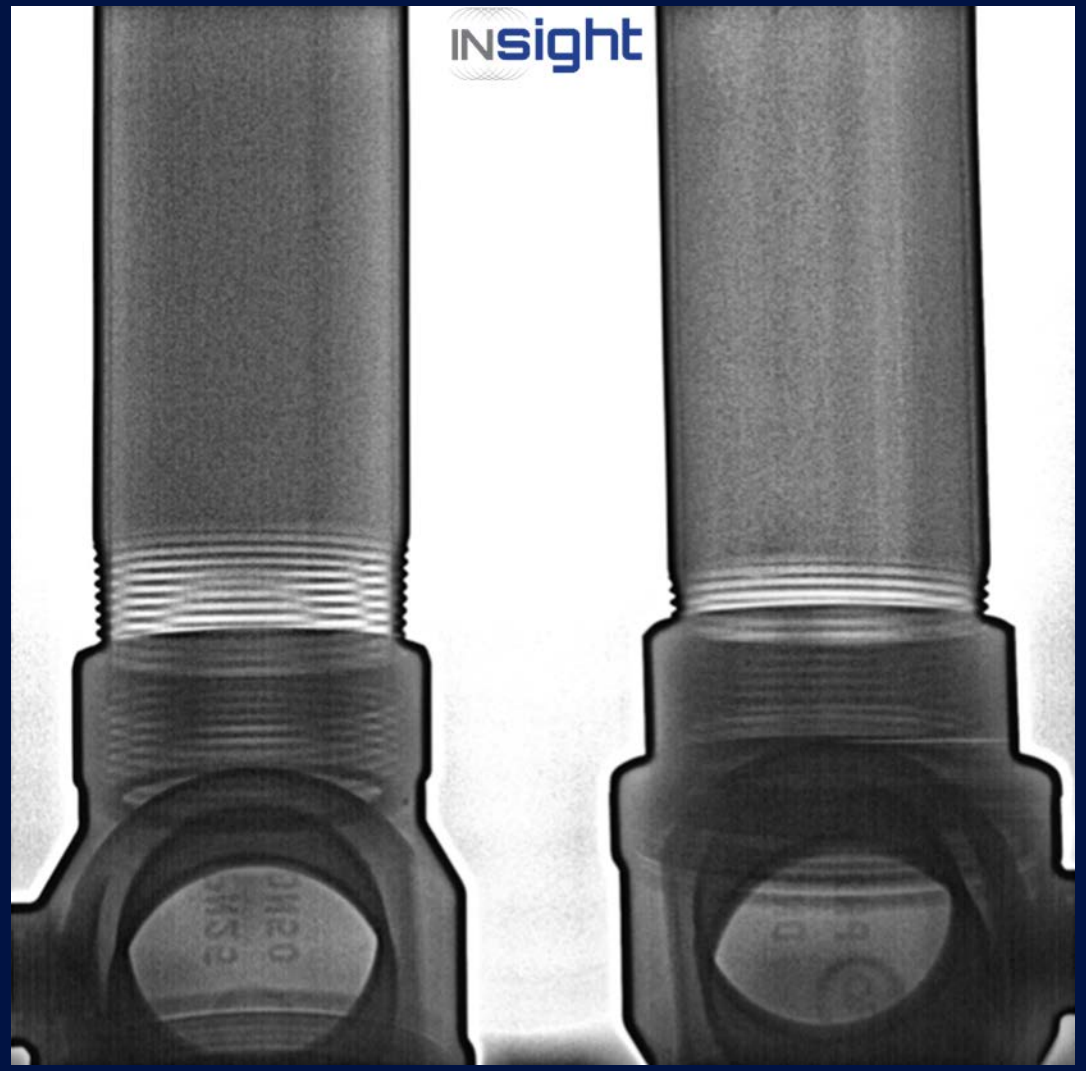




Valve Condition Assessment

Digital Radiography





Steel Stand Pipe Blockages

Digital Radiography - Example setups

HDPE pipe

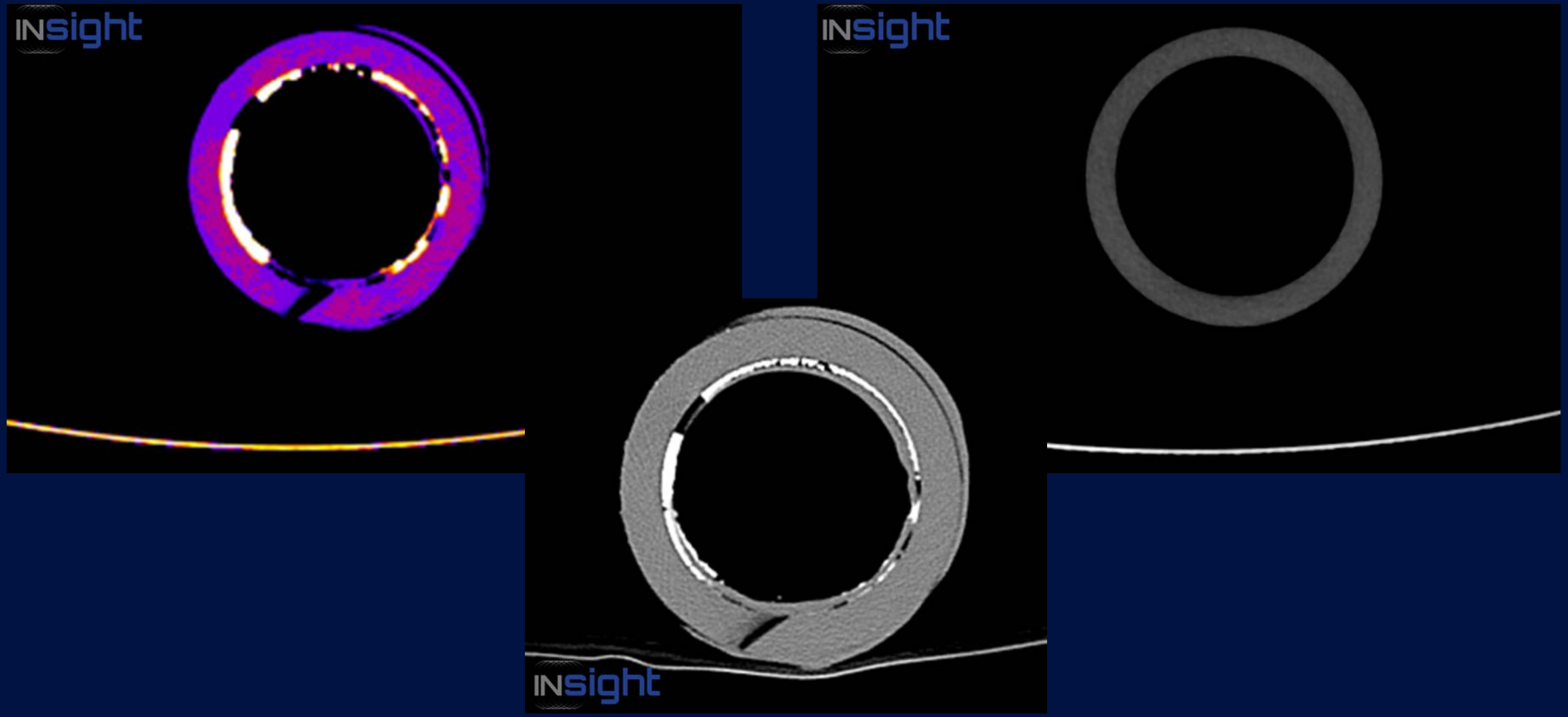
- Issues
  - Joints
  - Welds
  - Electrocoupling

Analysed

- No common method to analyse this pipe

HDPE Example

Computer Tomography



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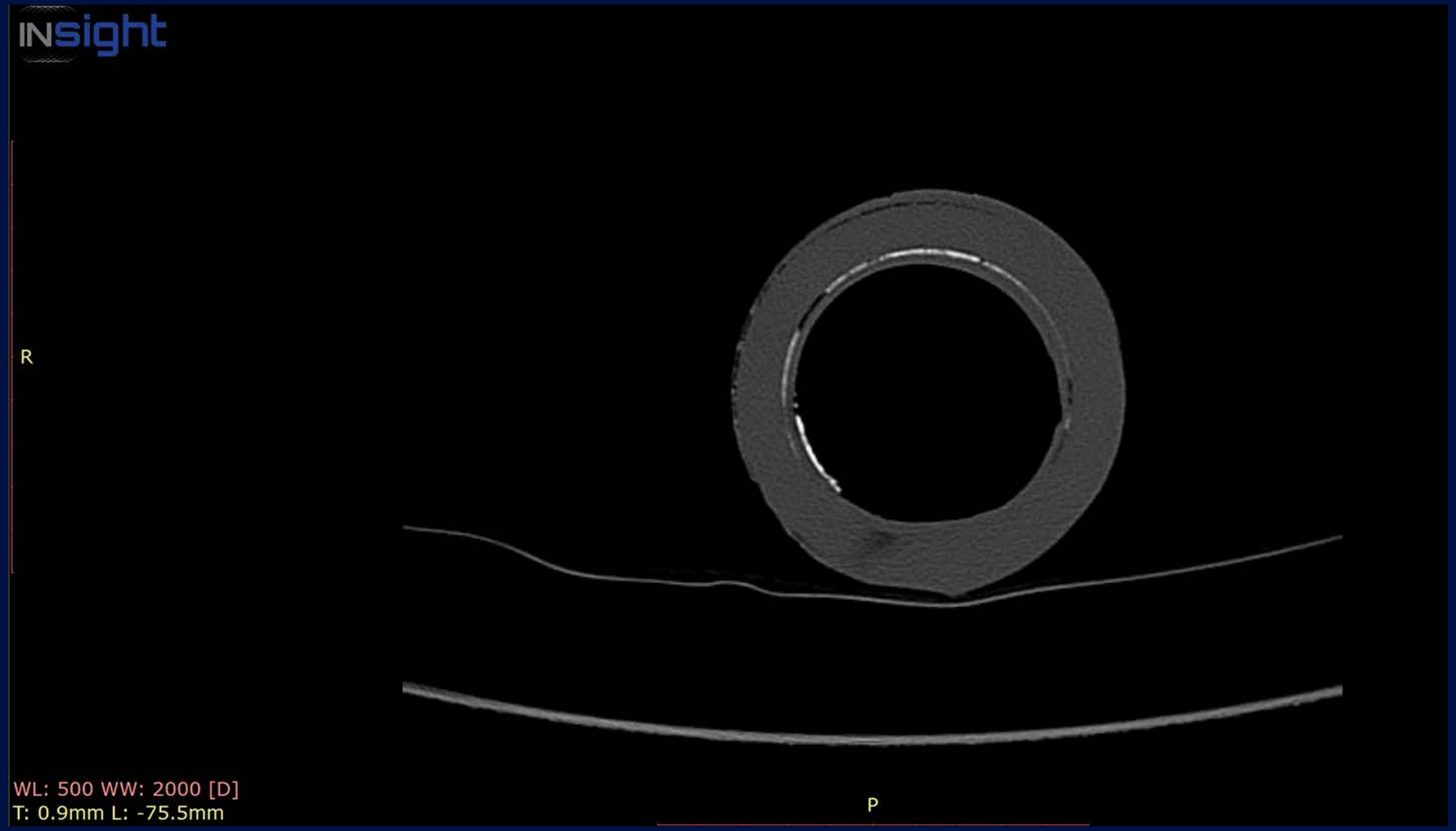

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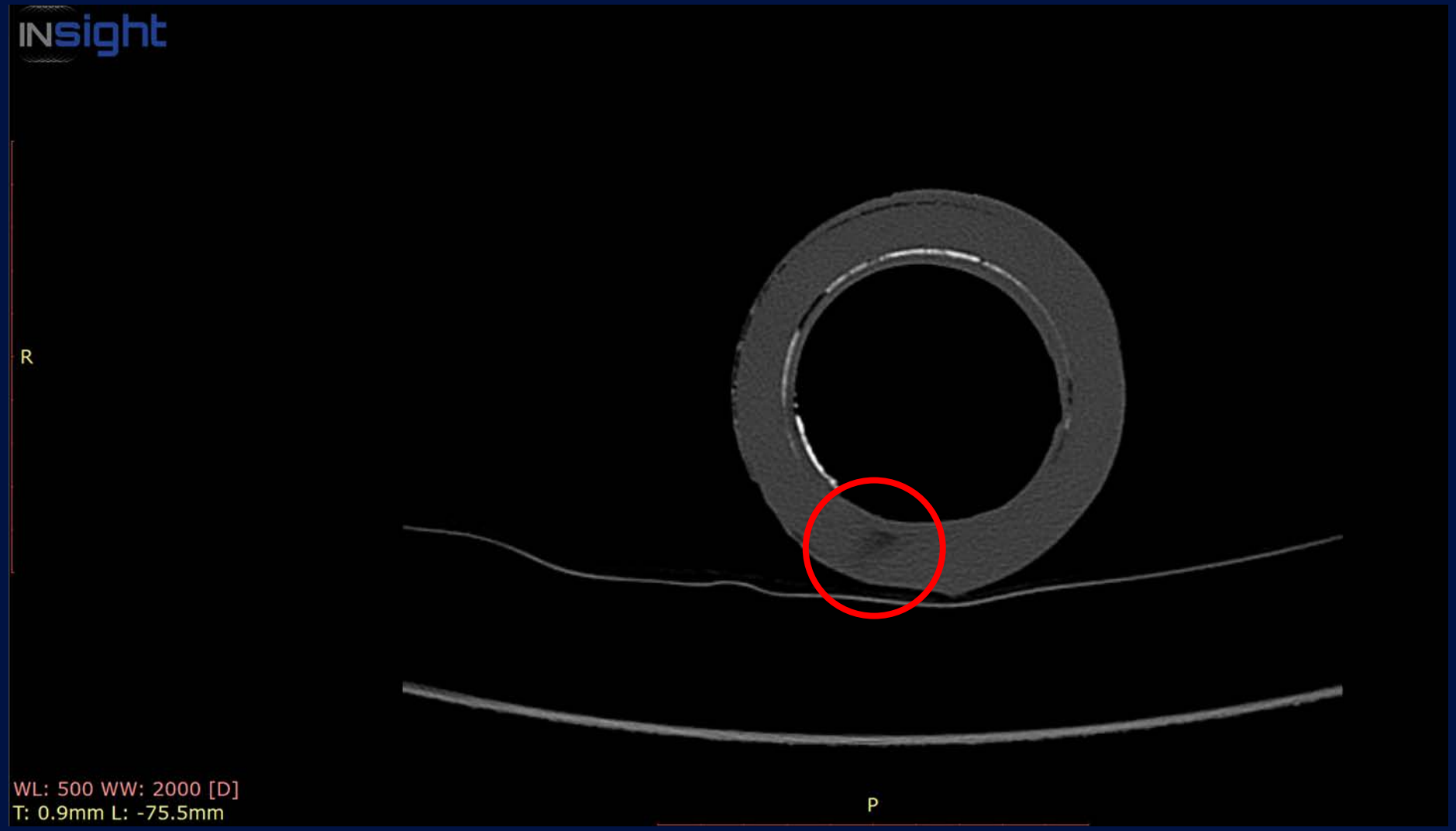

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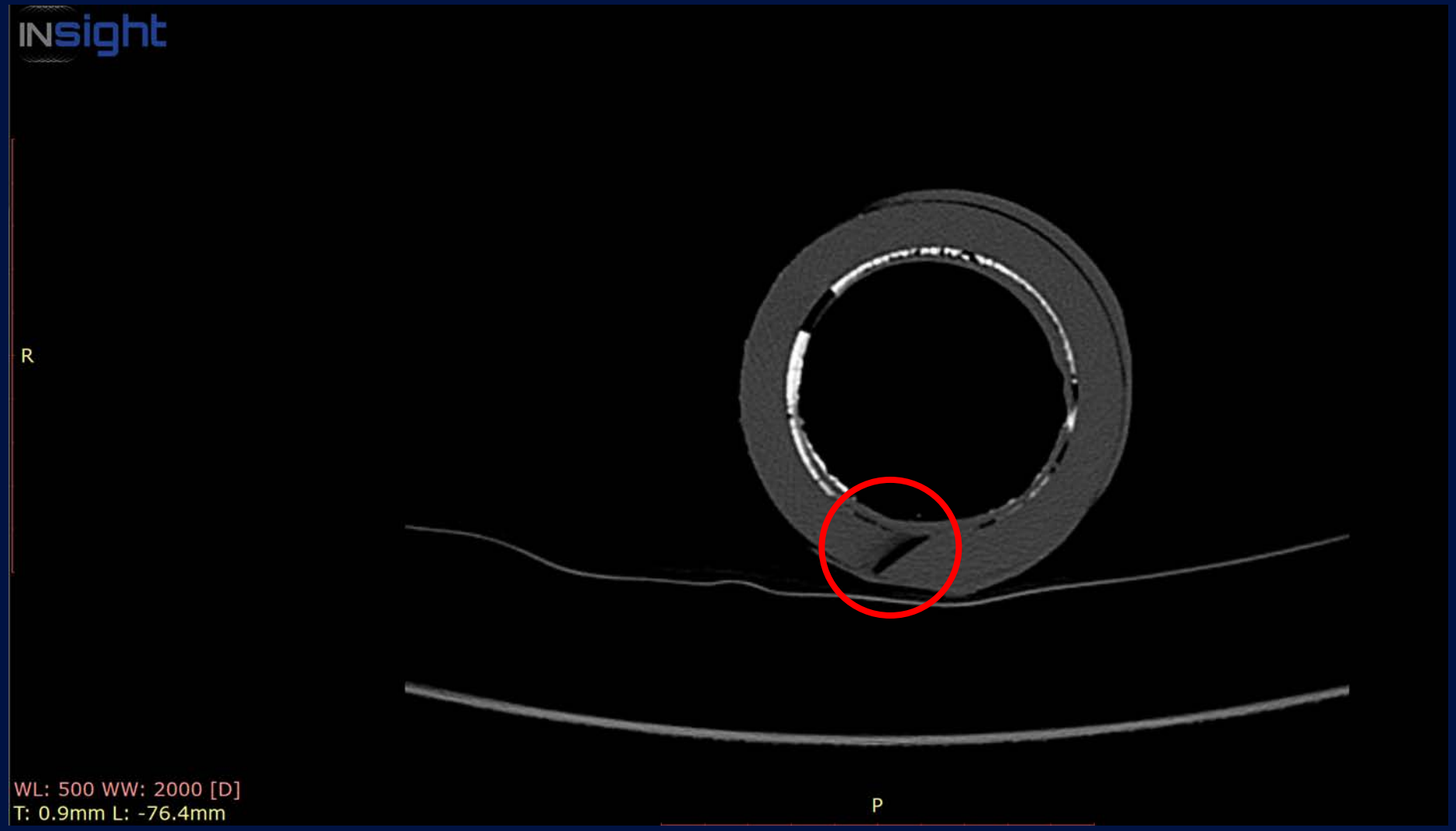

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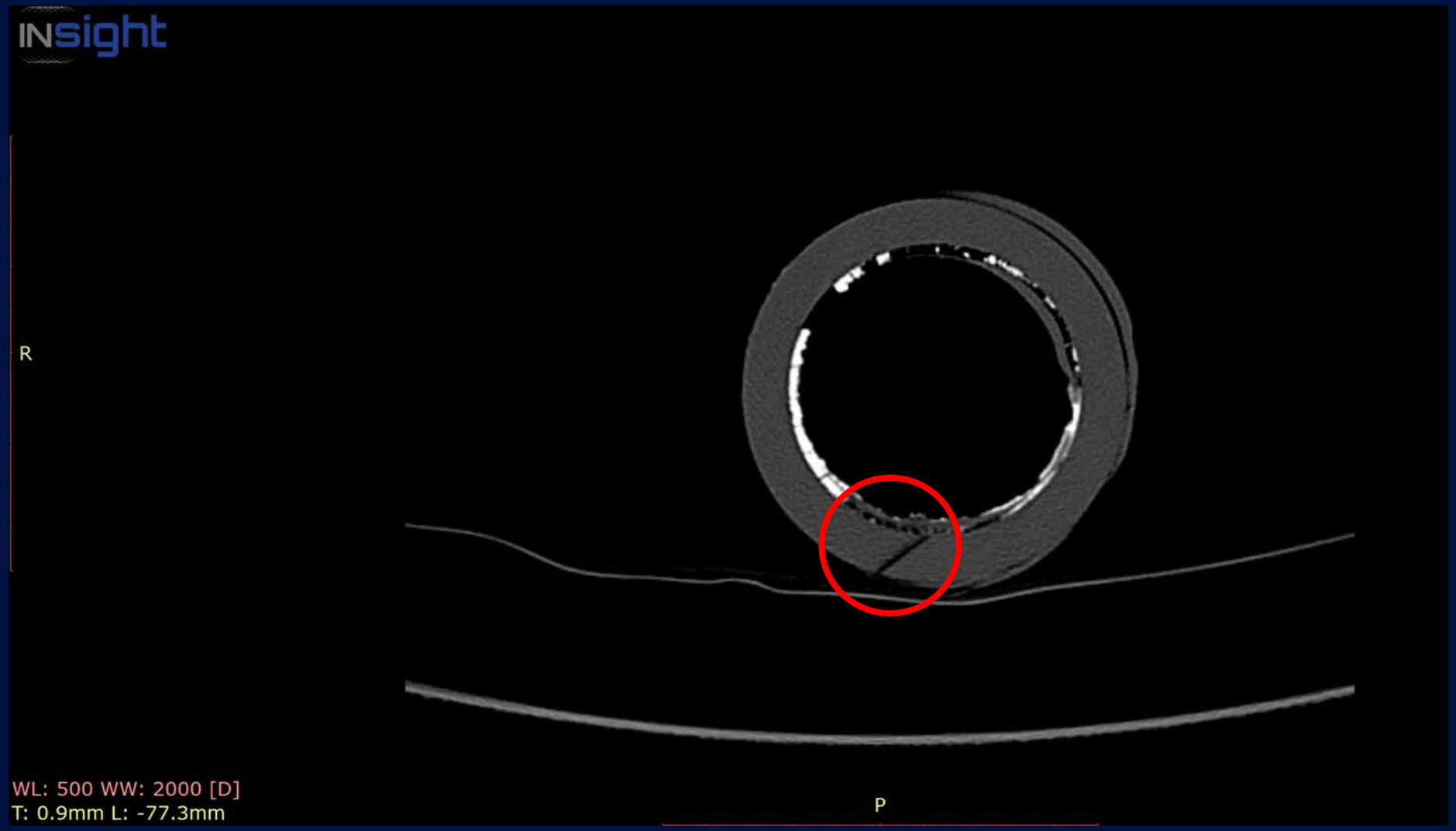

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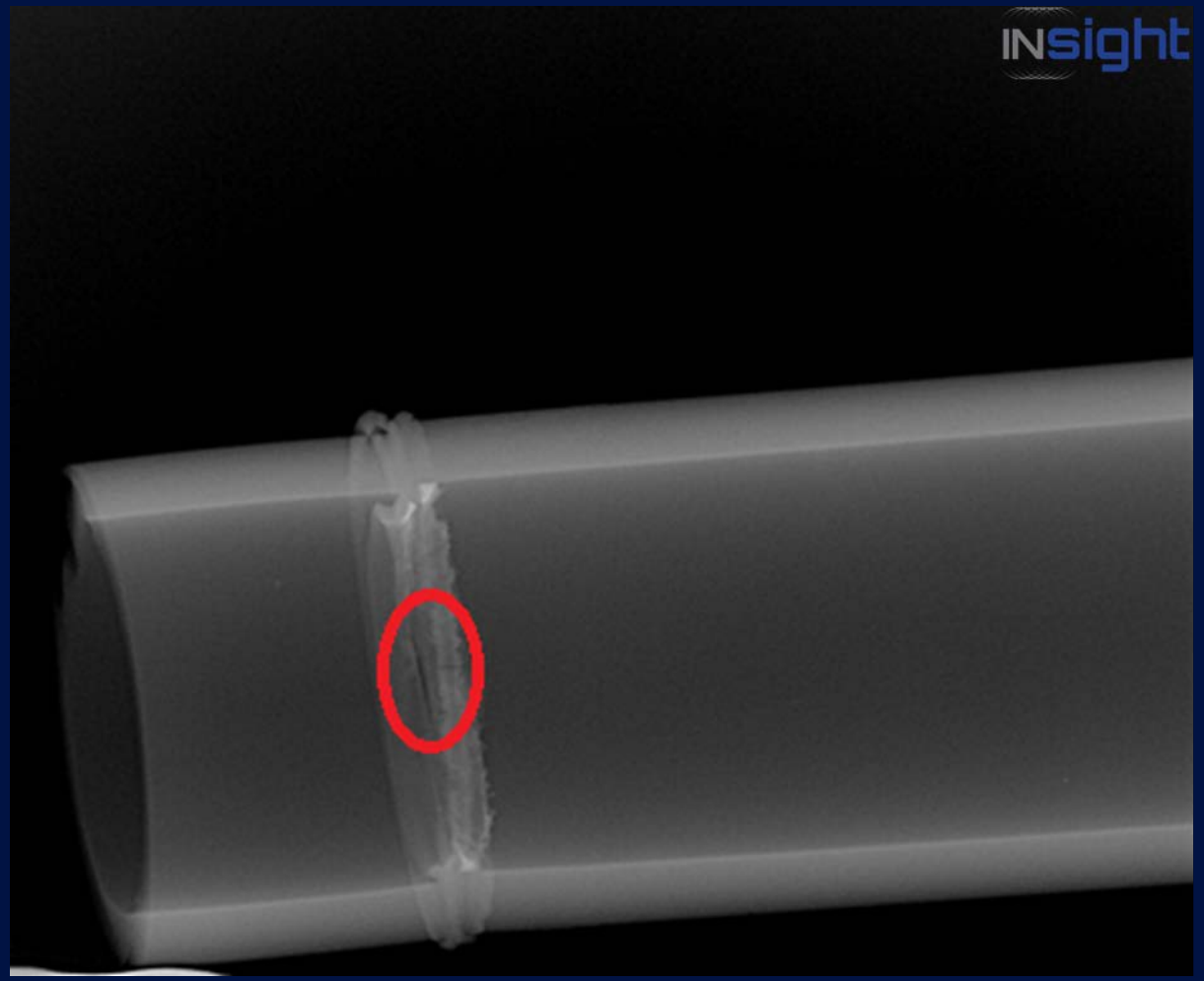
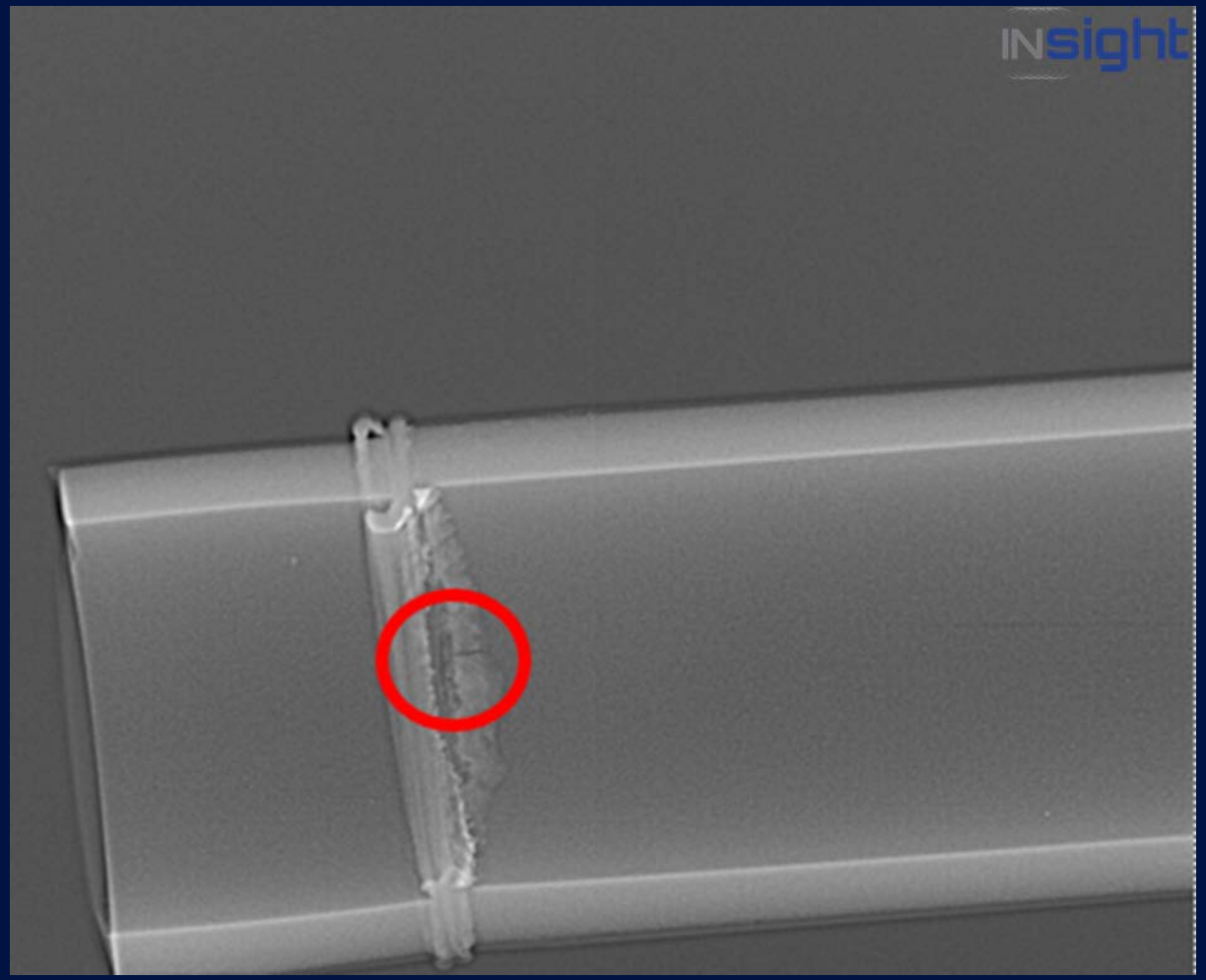




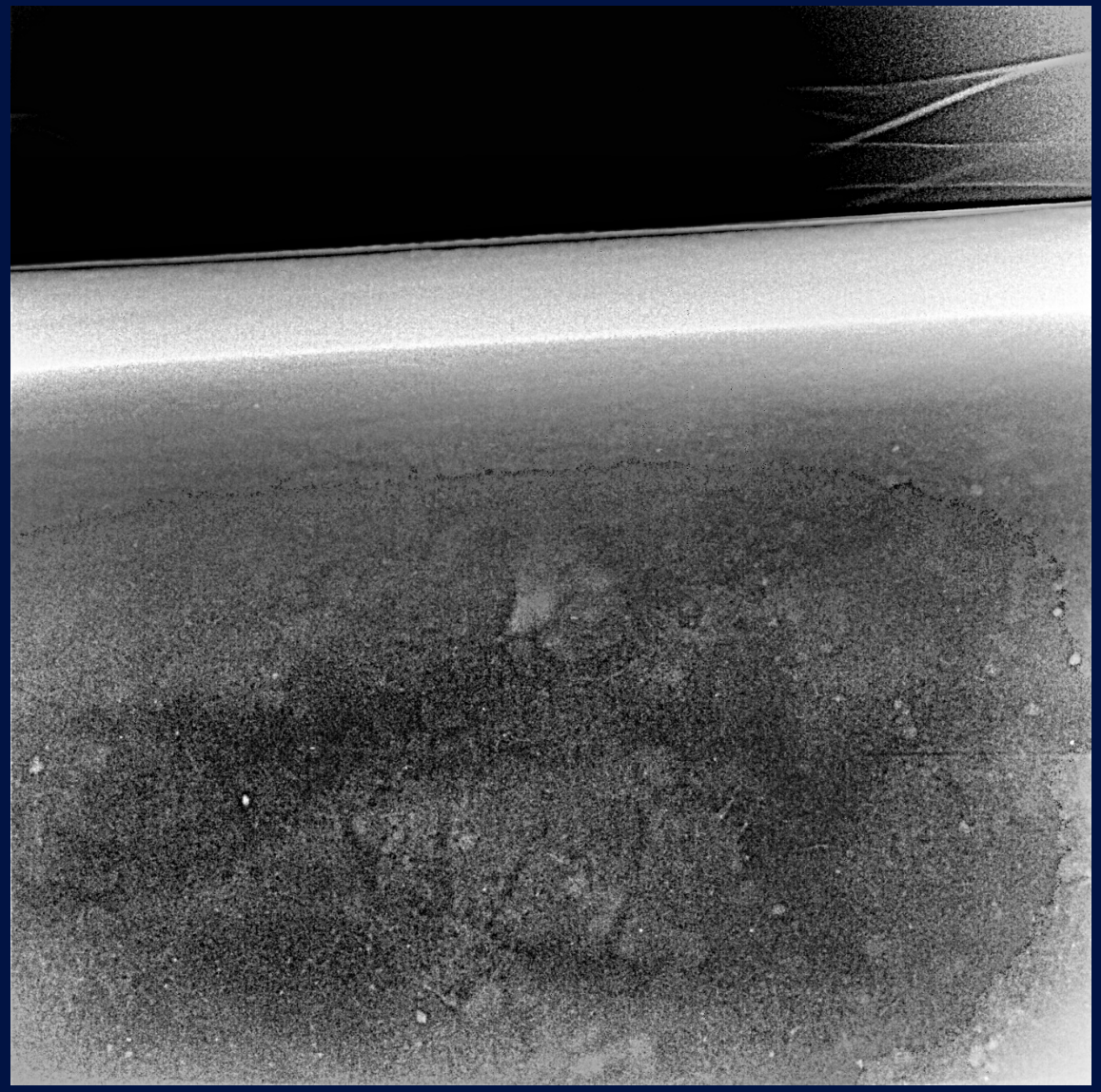
Asbestos Cement Pipe

- Issues
  - Loss of calcium matrix
  - Acid attack
  - Many pipes at the end of their working age

Analysed

- Commonly with coupons or cut pipe
- Now coupons are not required, back scatter CT can obtain the same data without the need to cut the pipe.

Digital Radiography - Asbestos Cement Pipe



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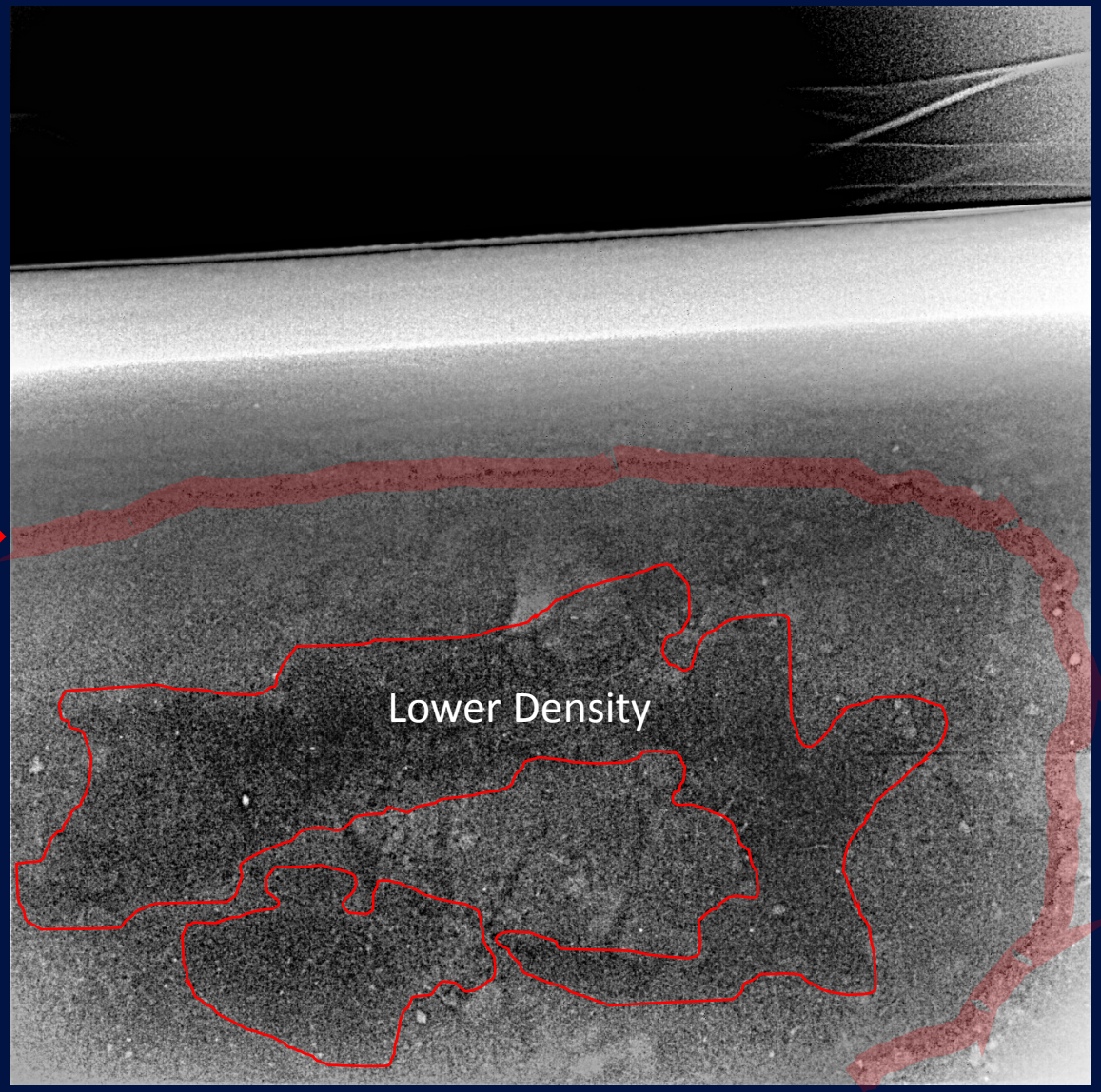

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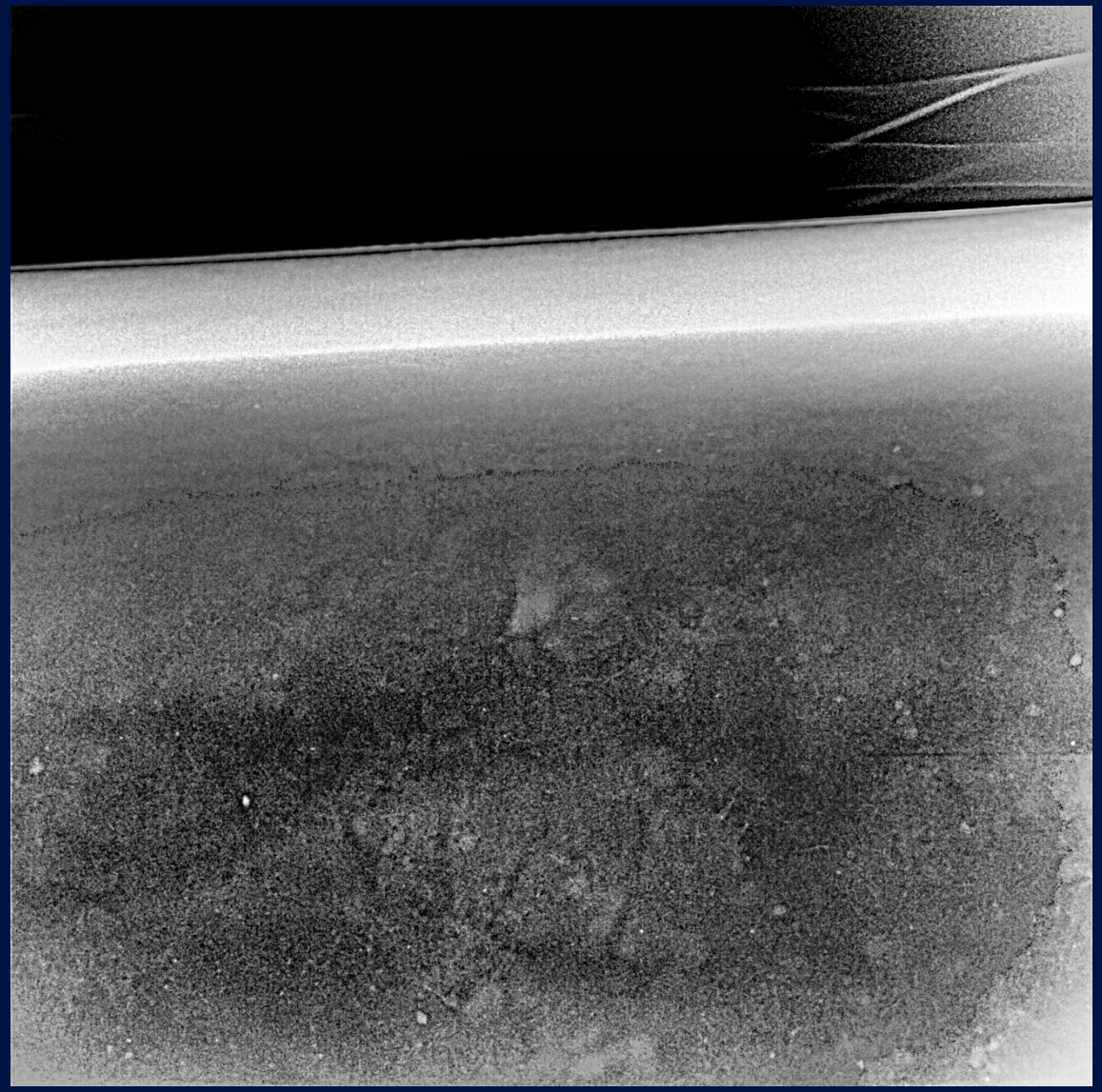
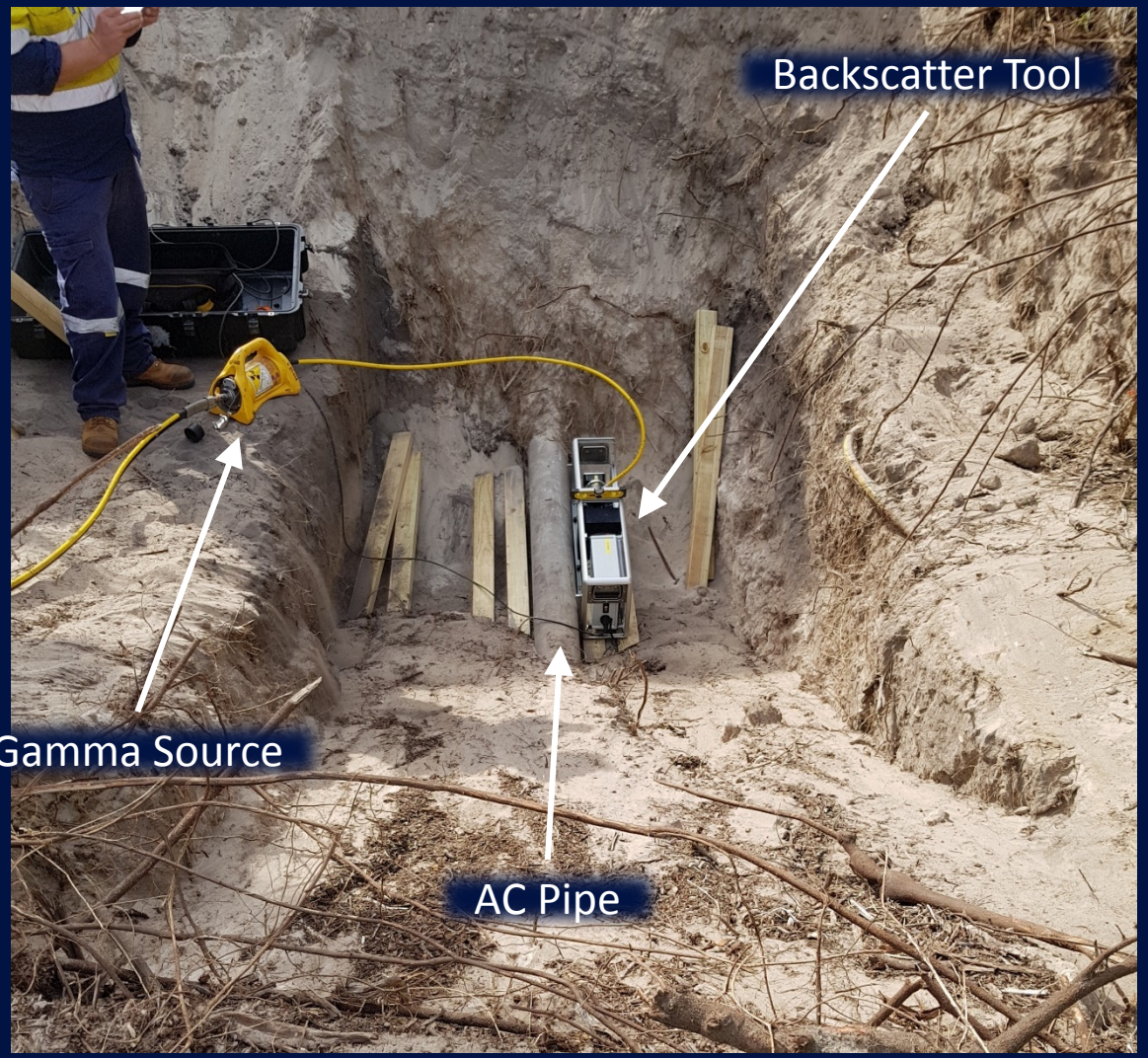


Back Scatter CT

Setup

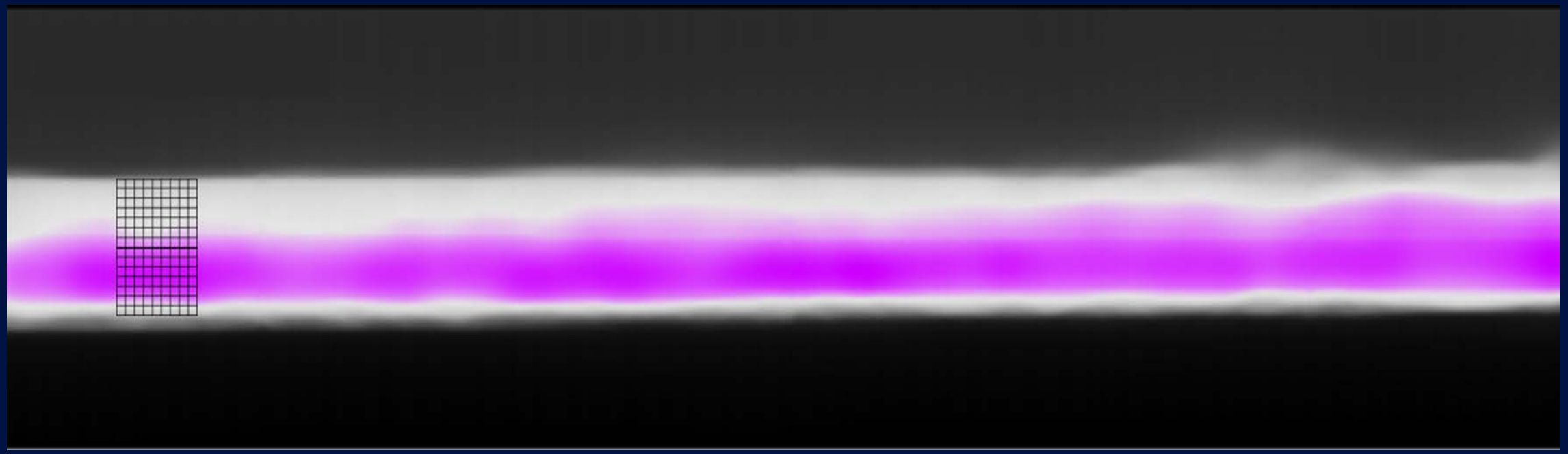
- The imager has to be place onto the pipe of interest.
- The device weighs ~20kgs
- The device is operated by a laptop with a 40m command cable.
- Wood is used to prop up the device and ensure it is square to the pipe.
- 5-10 minutes to set up
- 5-15 minutes to obtain an image

Back Scatter CT



- Safety zone, 1.5m behind, 3m in front. If in a pit, the pit edge
- Raw image can be viewed within the field to get an understanding of what it may look like.

Back Scatter CT of AC Pipe



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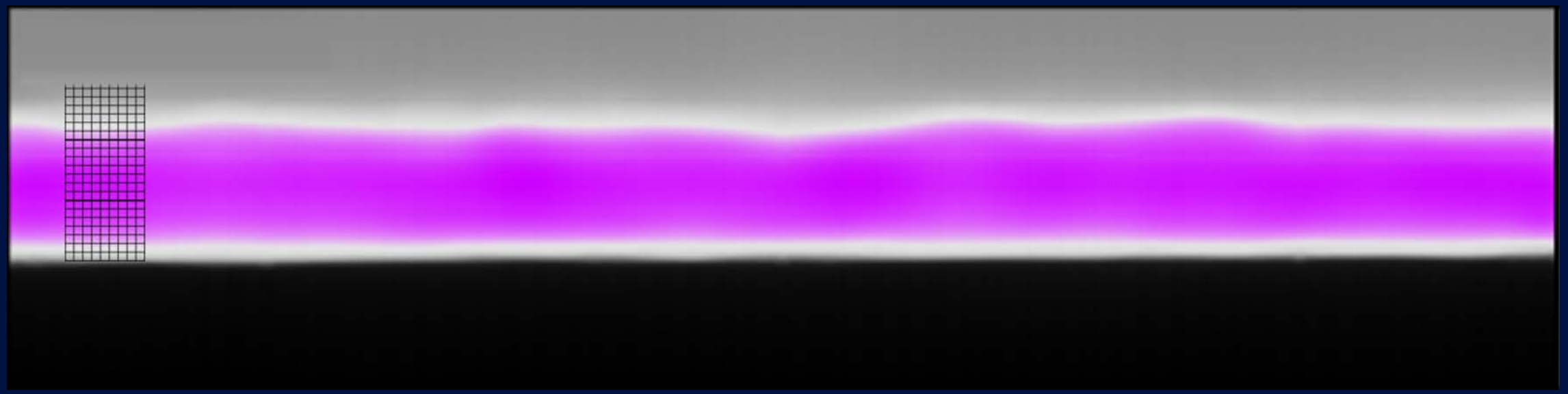

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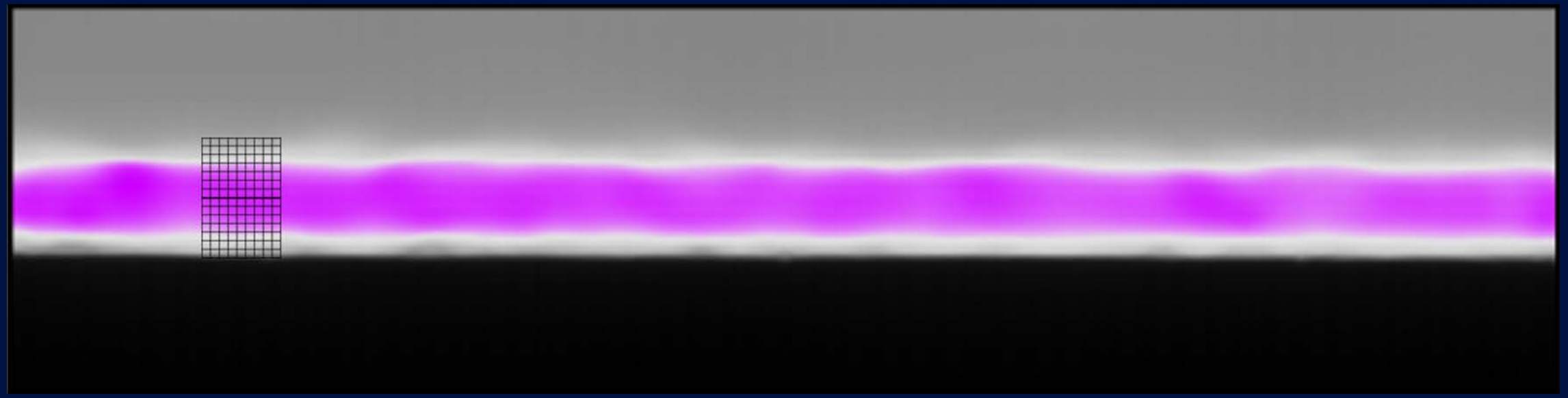
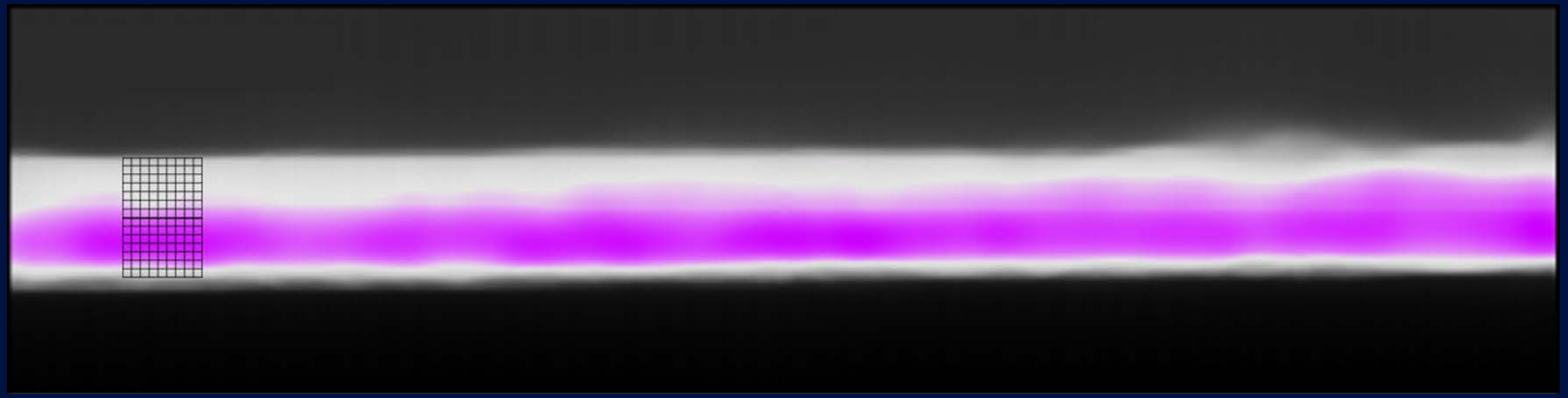


Back Scatter CT of AC Pipe



Questions

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Young-il Kim – ykim@detectionservices.com.au