REVOLUTIONIZING
VISUAL ANALYTICS

Visual Assessment of Pipeline Cleanliness for CCUS Conversion
A New Diagnostic Approach: Liverpool Bay Case Study

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PPSA Conference - November 2025

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Carbon Capture Utilisation & Storage - Project

- The UK government is committing up to £21.7 billion to accelerate HyNet and other CCUS initiatives
- ENI led the HyNET project for CCUS in the UK (Liverpool Bay)
- Repurposing of existing infrastructure is crucial to economic viability and reduced environmental impact
- 145+ kilometres of offshore and onshore pipelines will be converted for CO_2 use, during this project

Fig1: Liverpool Bay Project

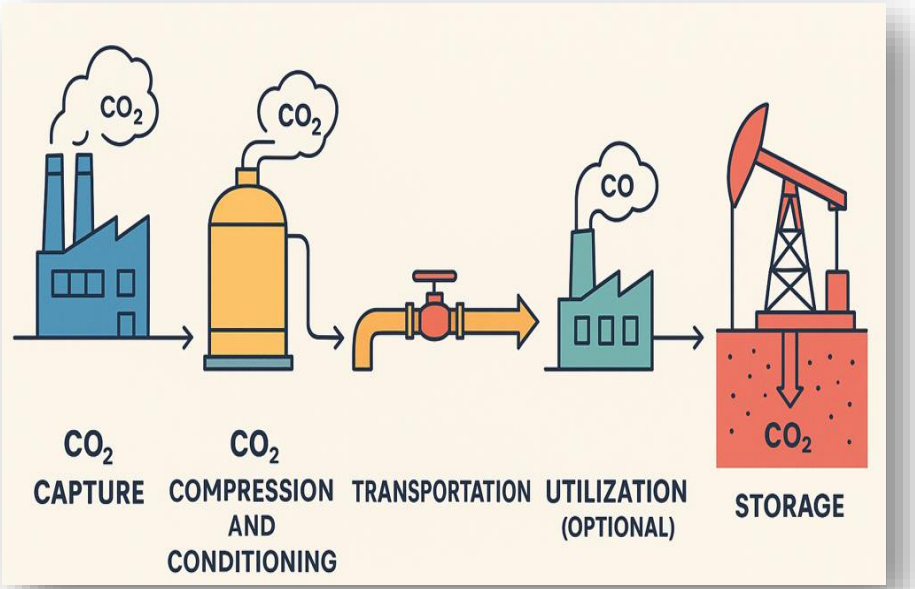


Fig2: TRACCS Project

Carbon Capture Utilisation & Storage - Transport

With the transport of CO_2 comes multiple complexities:

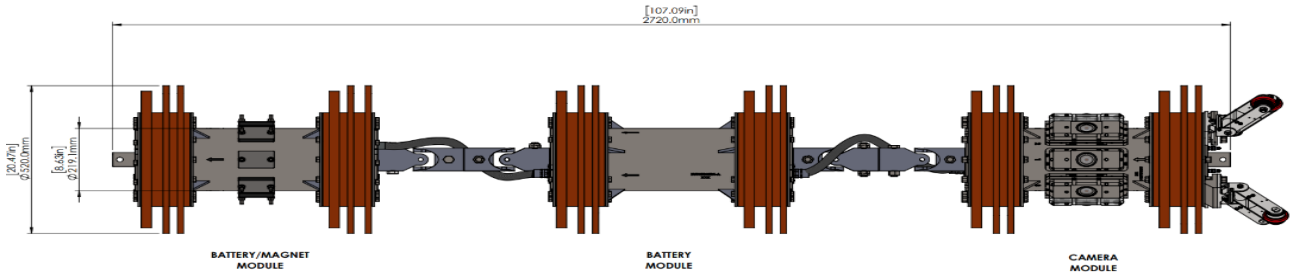
- Challenges related to utilizing existing infrastructure
- Handling impurities within the CO_2 (ie. Water, H2S, SO2)
- Corrosion & contamination management

To assure repurposing of existing infrastructure:

- Mechanical and Chemical cleaning programme
- Structural integrity assessment
  - Inline Inspection (ILI) type tools
- Ensuring surface cleanliness of ISO SA 2.5 or better
  - Video assessment tool

ISO 8501-1 Standard

Videography - Innovations



A novel visual inspection solution was needed:

- Allow detailed 360-degree inspection of the pipe walls
- Be free-swimming
- Have a long battery life & memory to store data
- Enable rapid “express report” analysis, <48hrs
- Not be limited by the poor sidewall resolution of forward-facing cameras

A multi-camera sideview array tool was deployed:

- 4 or 8 sideview array cameras to cover 360-degrees (10-36”)
- Focuses directly on the pipe wall in high-resolution
- Operates for up to 96 hours continuously (176km)
- Has internal/onboard ODOmeters, azimuth & gyro (+0.5%)

PigCAM®8

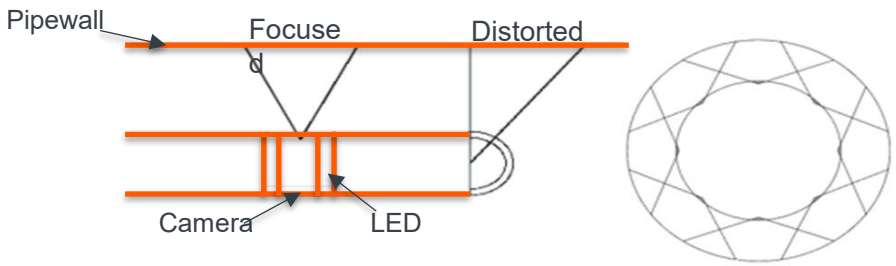
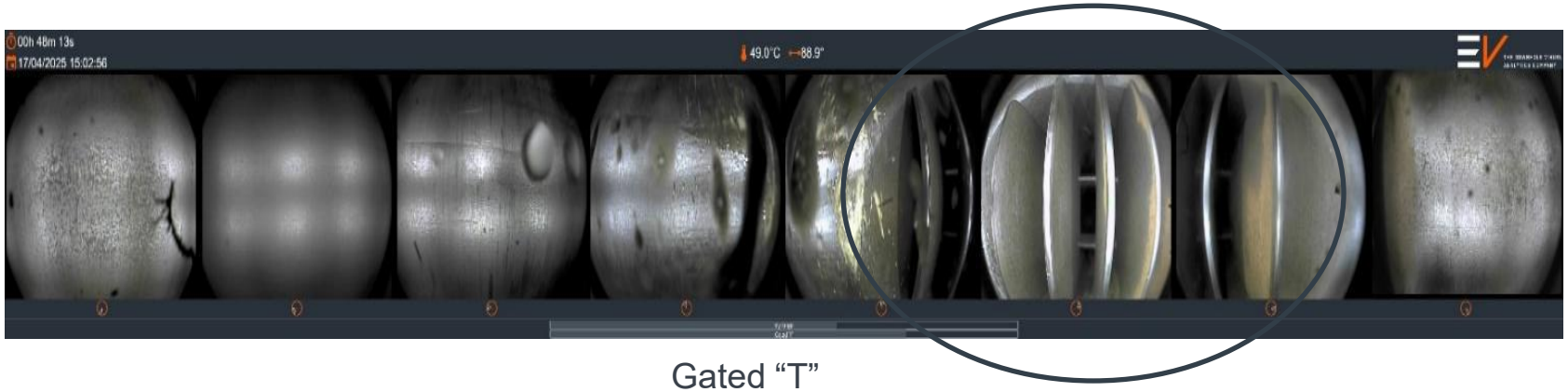


Fig5. Field of Focus

Videography - Data Collection Case History

- The 8-camera pig system was deployed to assess the internal condition and cleanliness of a 24”, 27 km pipeline
- The inspection was deemed a success, with multiple areas of interest highlighted
- A gradual build-up of debris partially contaminated the camera lenses towards the end of the operation
  - Debris & liquid pooling was identified



Gated “T”

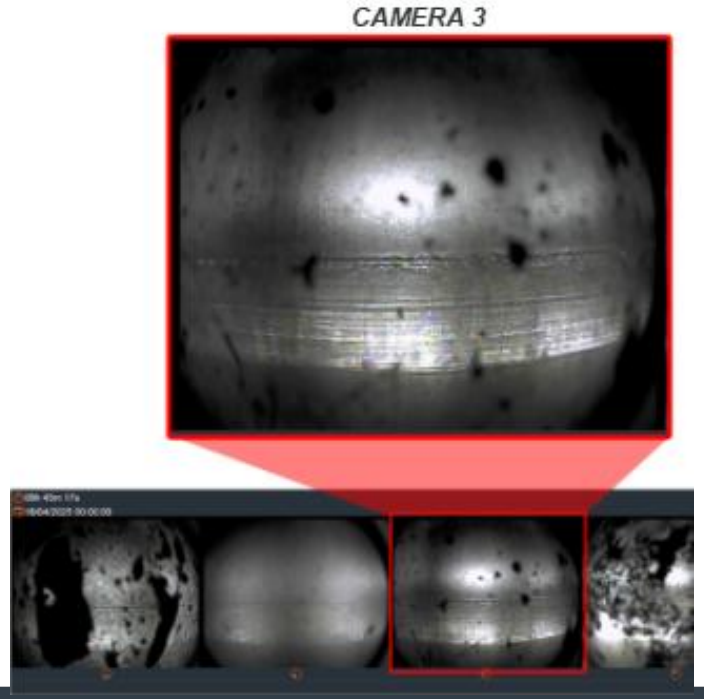
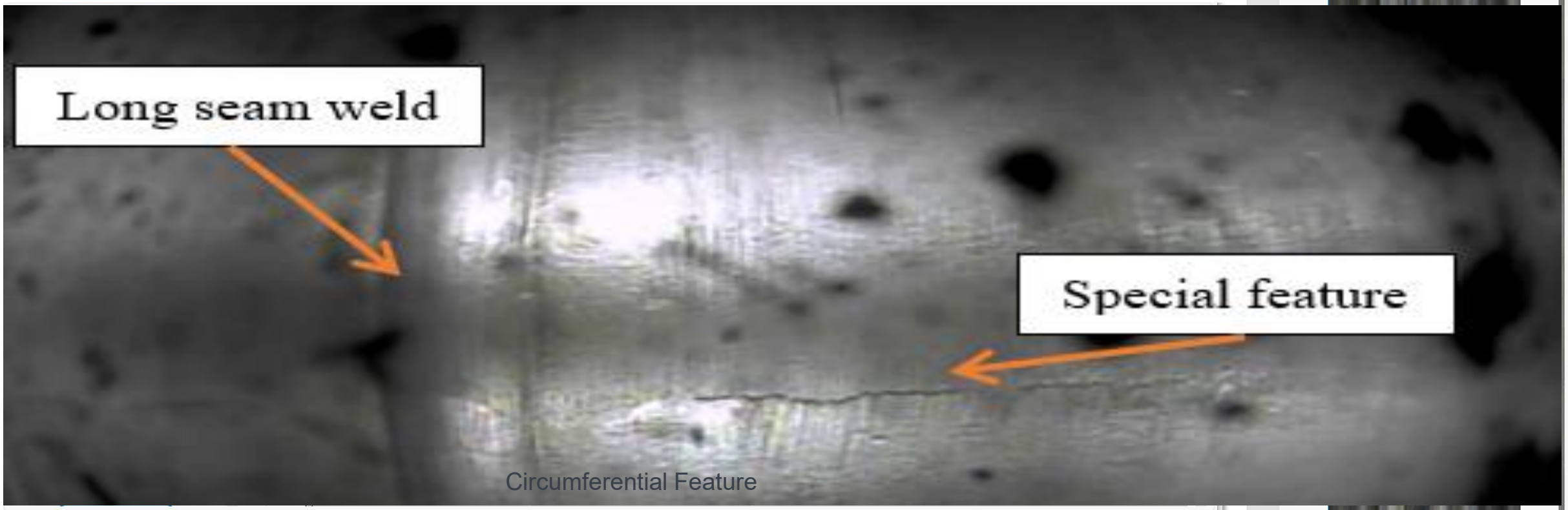


Figure Girth Weld

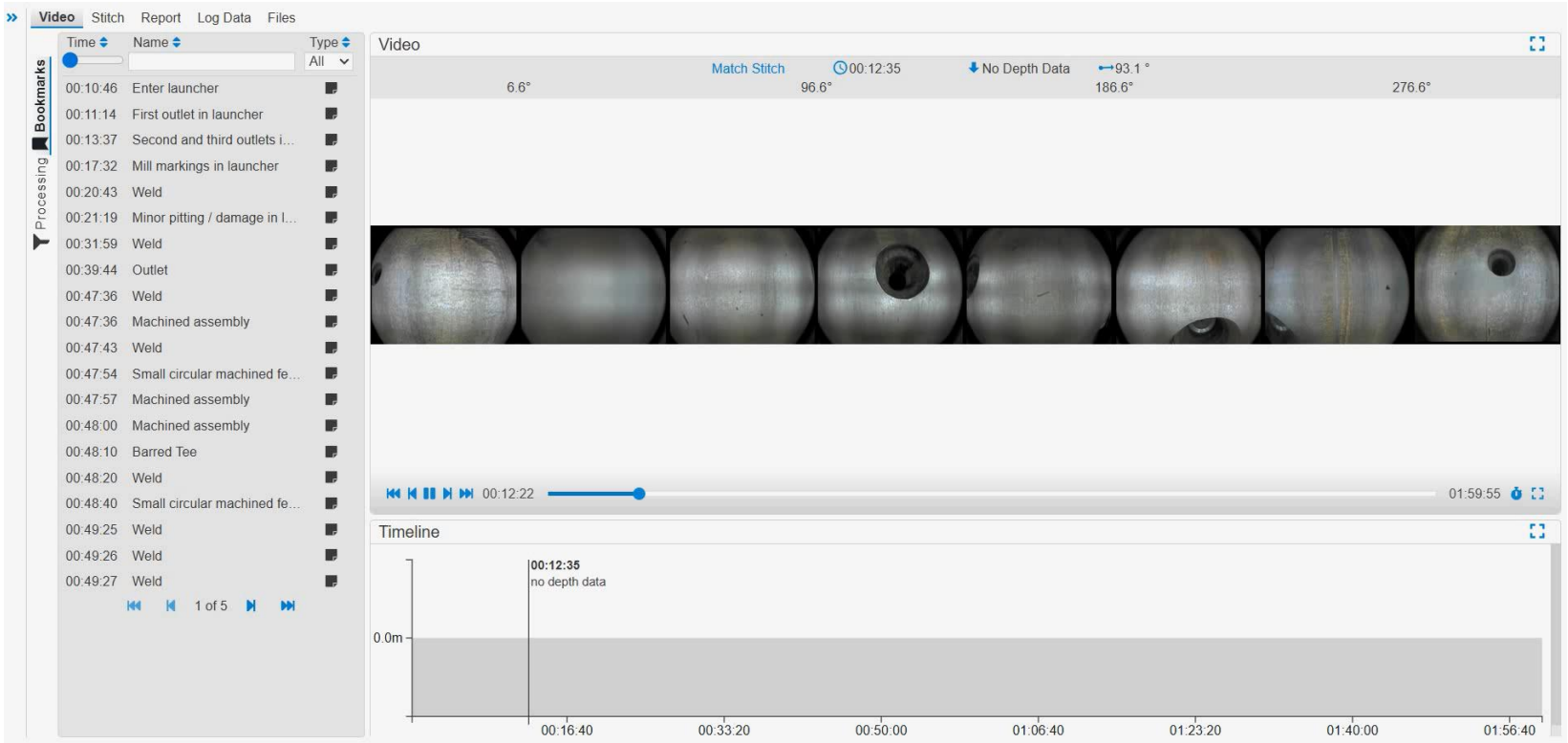
Videography - Data Collection & Analysis



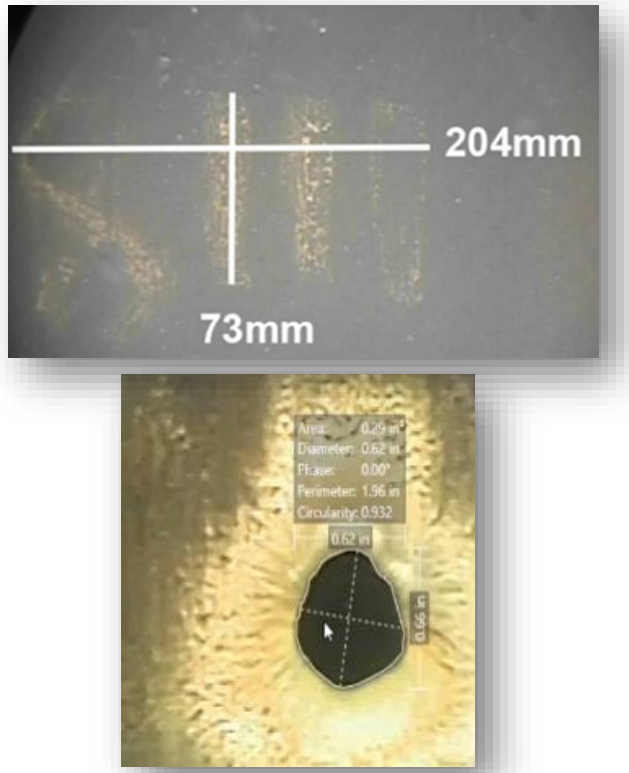
8-camera video data collected and displayed

- Multiple areas of interest seen including long seam welds and additional features
- The operation was deemed successful as full data was collected along the 27km length
- The pipeline was deemed as needing additional cleaning & drying prior to use for transporting CO_2
- A re-run will be required once full cleaning, dewatering and drying has been completed

Videography - Data Analysis



Video of visual inspection and MFL analysis



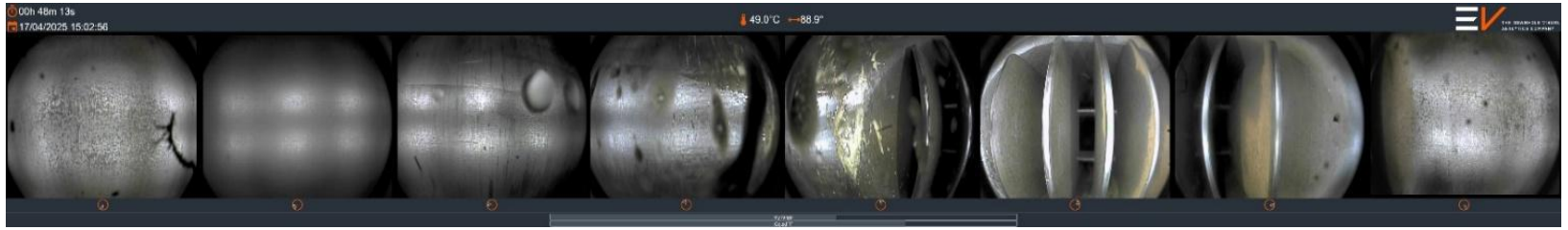
Quantitative Measurement

- Support the combination of other 3rd party datasets, such as MFC or MFL
- AI/ML interpretation to identify anomalies and quantify: ISO8501-1 SA1-3 cleanliness & readiness for CO_2
- X & Y measurement of features
- 2D & 3D visualisation of the pipeline

Conclusion & Summary

Videography can quantify cleanliness of pipelines, confirming readiness for CO_2 transportation

- **SEEING** the pipewall with this novel videography system can support repurposing existing infrastructure
- **ASSESSING** the data with Engineers & AI can accelerate the turnaround time
- **ACTING** upon the findings allows operators to make informed decisions



8 Camera Raw Output

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Special Thanks;

- Edward Bartlett – ENI
- Shaun Peck CTO – EVTC
- Chris Scott CIO - EVTC