

OCEANEERING[®]



Speir Hunter Limited



FOCUSED STRESS CONCENTRATION TOMOGRAPHY (FSCT) – a CUI solution

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BACKGROUND ON EXISTING SCT TECHNOLOGY

**The VILLARI EFFECT*

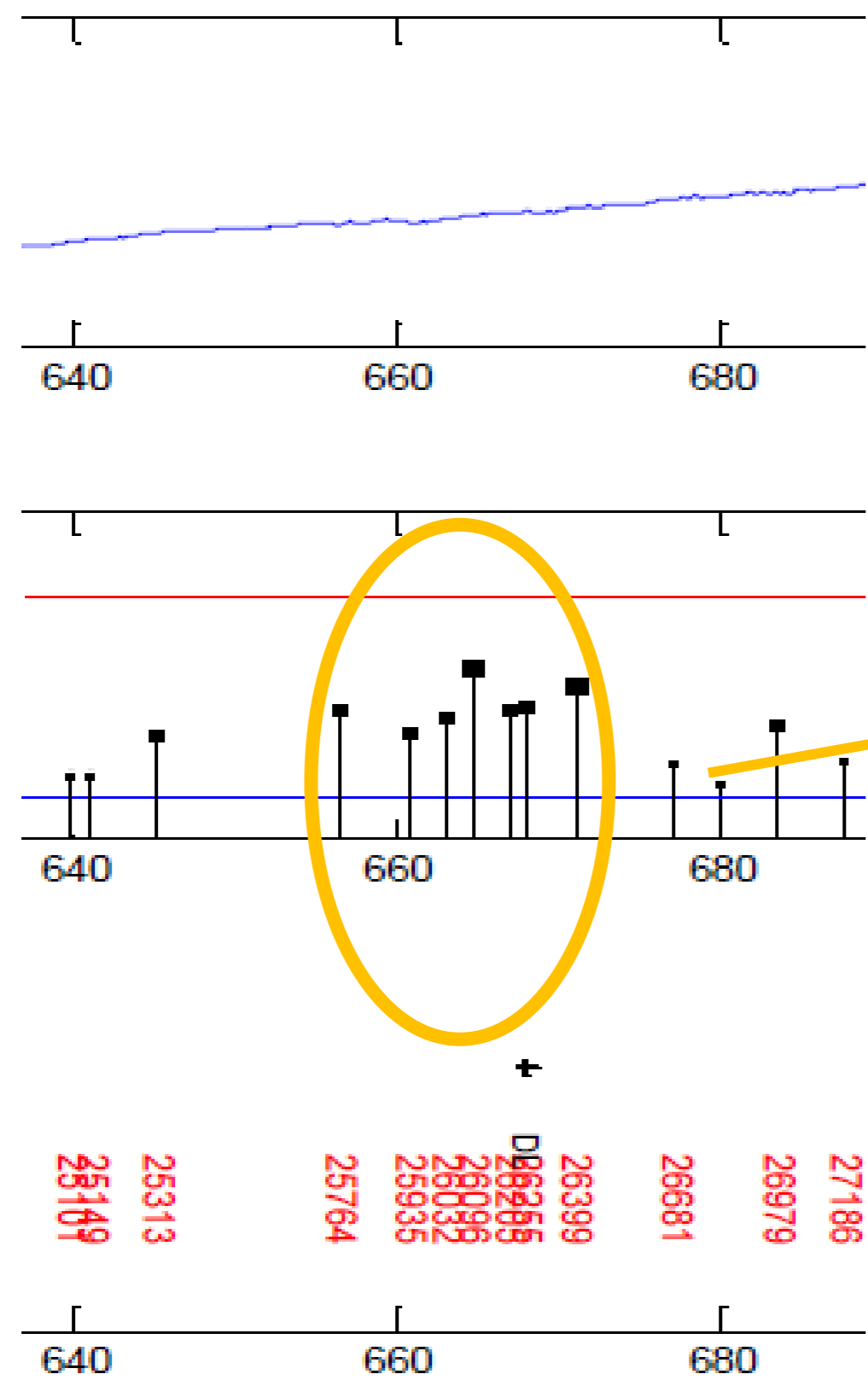
- Pipeline remains in operation – no need to shutdown
- Person wearing the inspection tool walks over the buried pipeline – desert, farmers field or inner city road
- The inspection tool with small, very sensitive magnetometers, absorbs data from the pipeline – no energy induction
- The background magnetic field changes around localised flaws in any pipe which is, or has, suffered pressure
- Magnetometers ‘listen’ to these changes, and interpret them as SCZ’s – Stress Concentration Zones - % of SMYS*
- Offline analysis of collected data delivers SCZ location, severity, pipeline route and depth of burial



SCT DELIVERABLE

CASE STUDY (excavation based on SCZ)

Diameter	10.74"
Wall thickness	0.275"
Pressure	37 Bar
SMYS	235 Mpa



- Unpiggable pipeline
- Assessed using ECDA
- DCVG indicated coating defect
- SCT indicated SCZ
- Corrosion found - extending 10m away from defective coating

OGTC funded Initiative

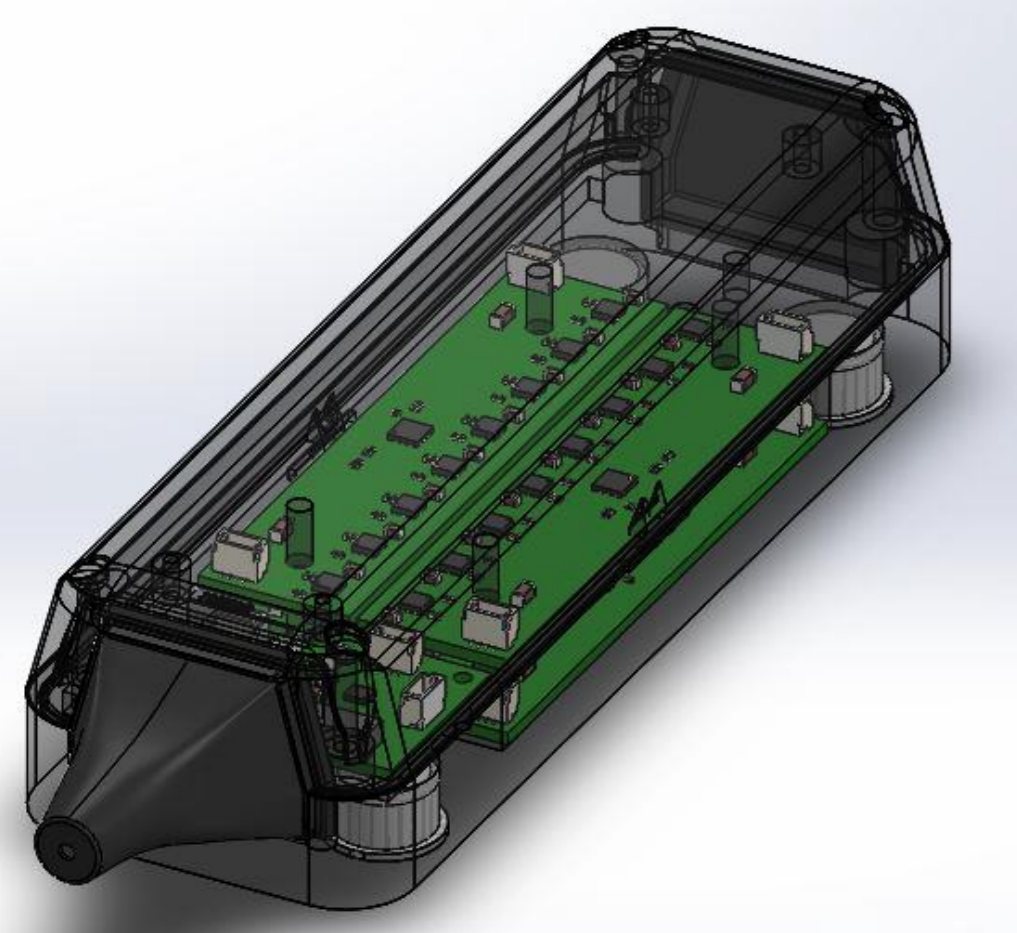
'Focused' Stress Concentration Tomography (FSCT)

- Same base SCT technology
- Specific design to 'focus' the magnetometers to shield or 'blinker' from external magnetic influences
- Objectives
 - ✓ **Quick screening**
 - ✓ **Non-intrusive**
 - ✓ **Passive**
 - ✓ **No insulation removal**
 - ✓ **Realtime result – category; severe / moderate / minor**
 - ✓ **High PoD**
- Project began – July 2019, complete by February 2021

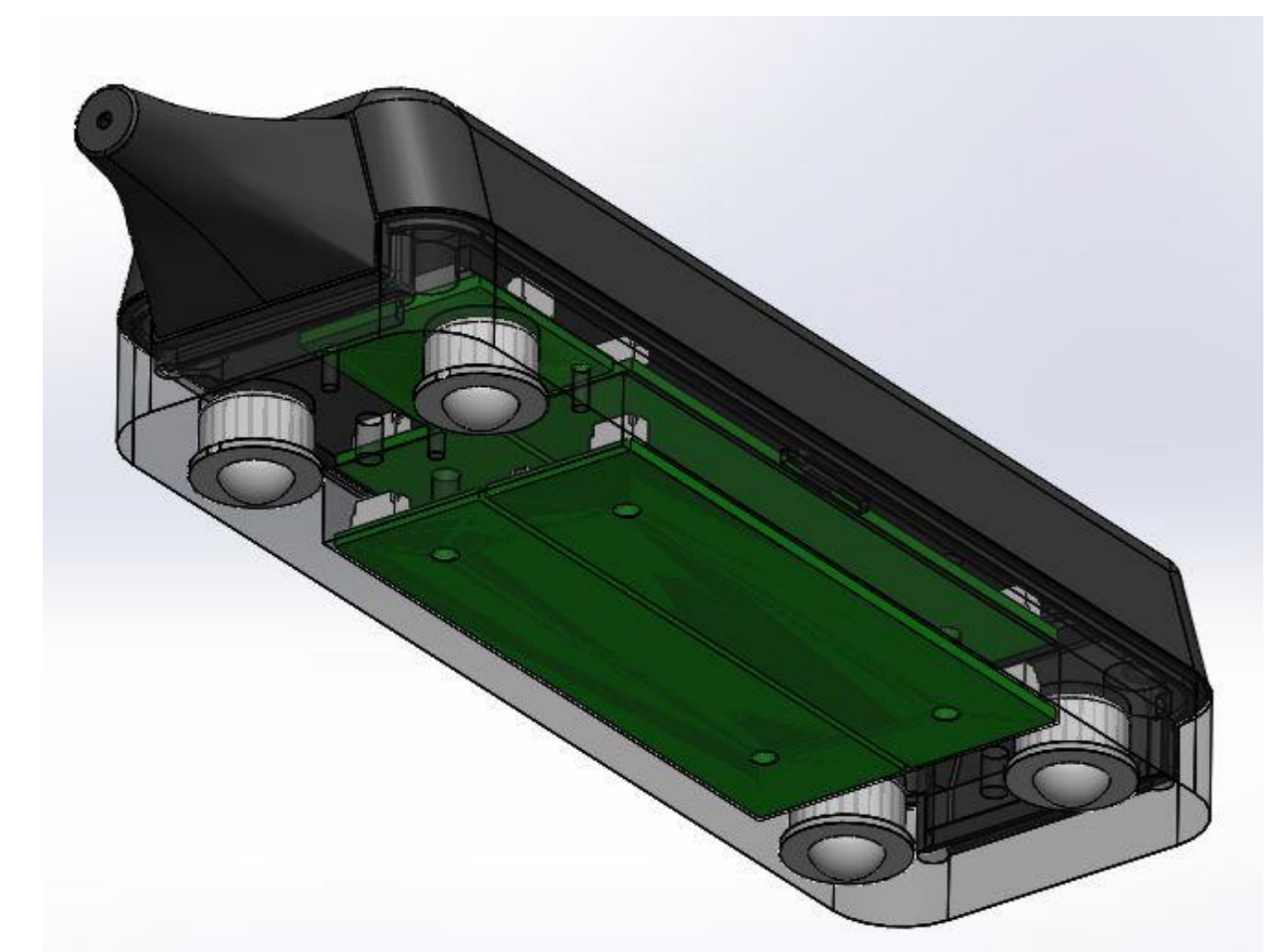


Developments to Date

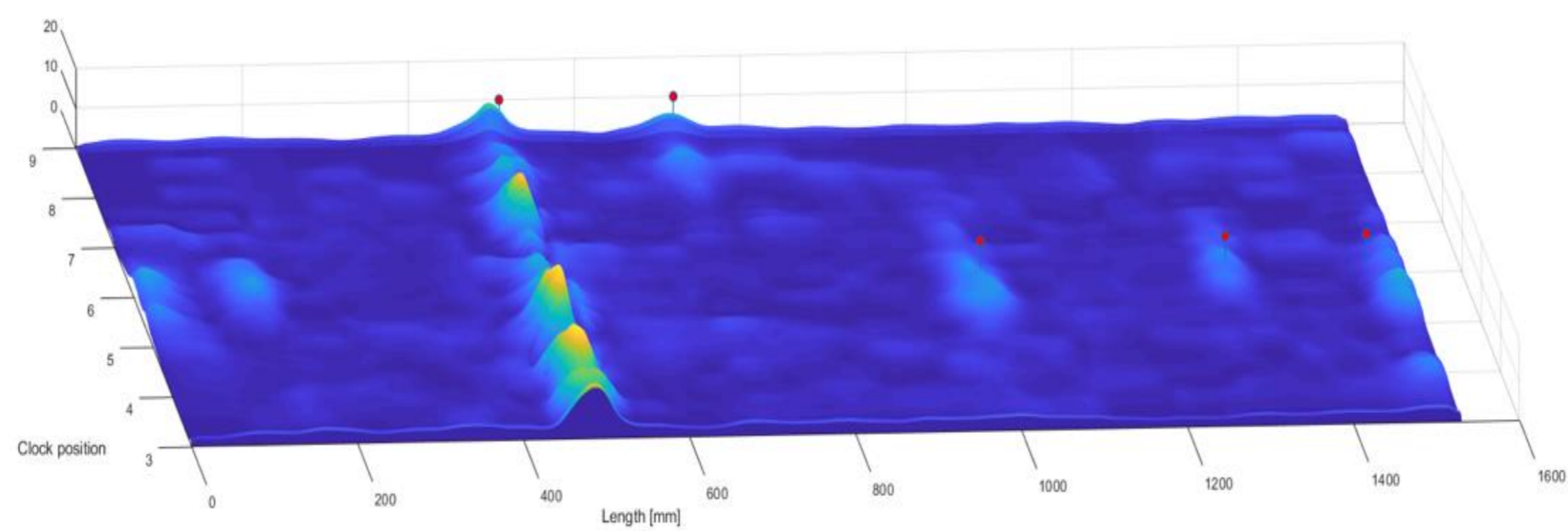
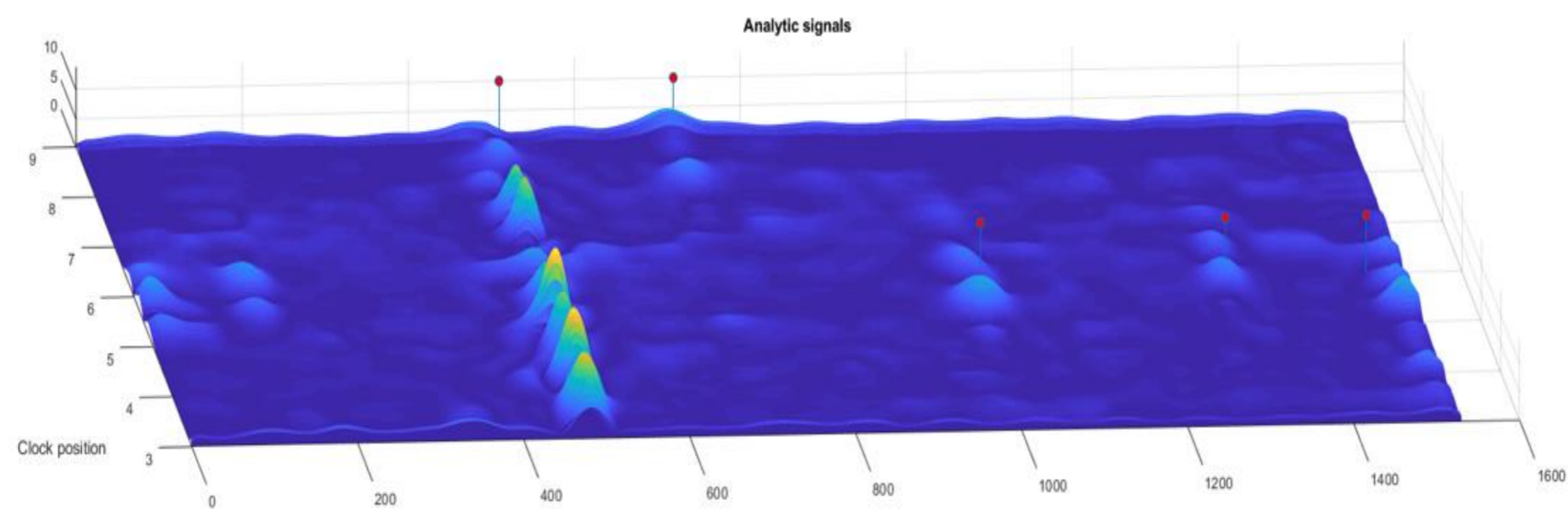
FSCT Probe



- Fast scanning
- Ruggedised
- Realtime data interpretation



FSCT Results



- Faster, full coverage
- Circular Scanner
- Modular – multiple sensors
- Realtime data interpretation

FSCT Probe Array

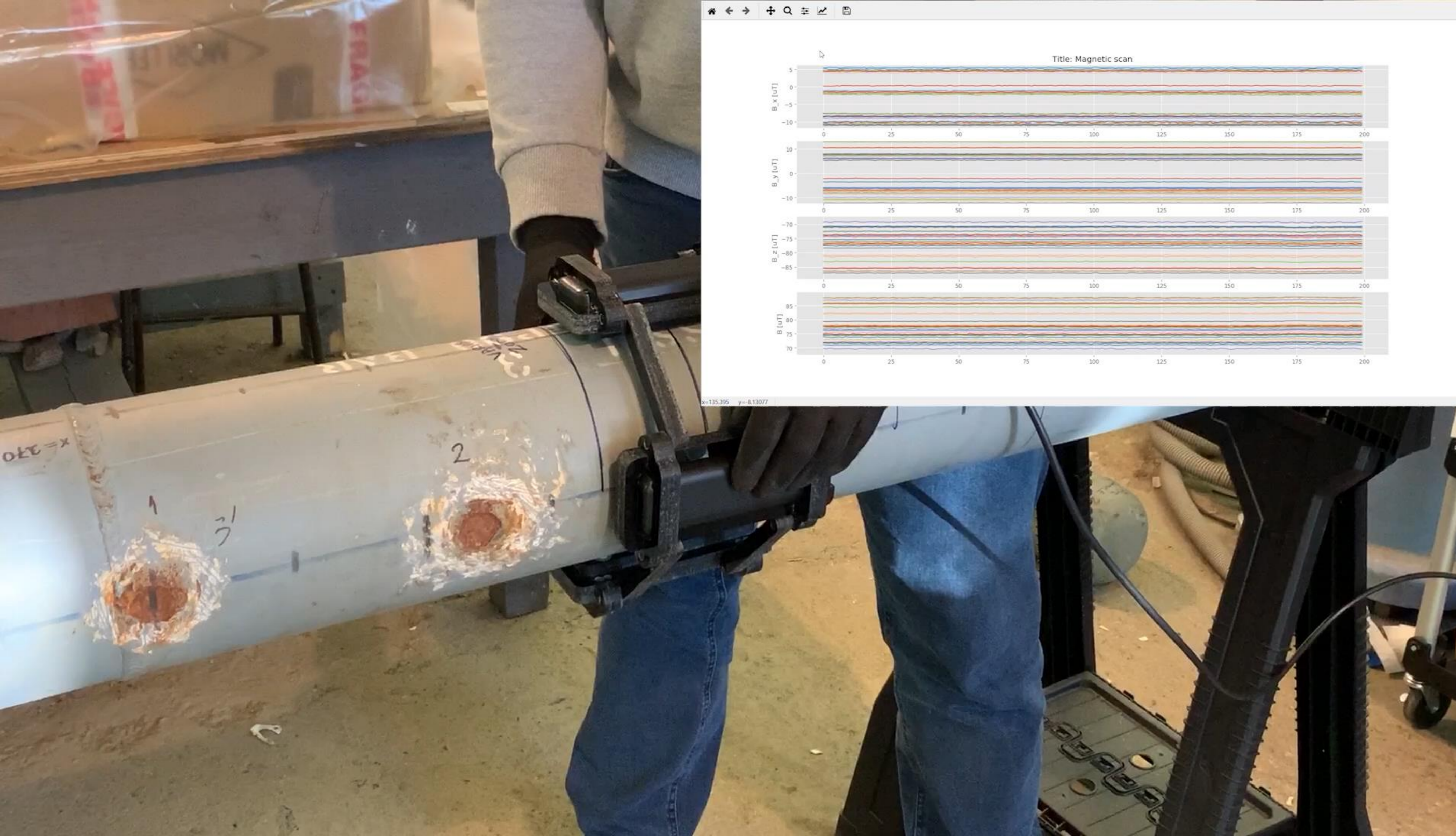


FSCT PROBE

- Ruggedised – IP65
- Collects 20 samples per second, 8cm² to 16cm²/sec coverage
- Data collected in circumferential and/or axial direction
- Currently tested on 4", 6", 8", 10" and 20" diameter samples
- Tested on 5m diameter pressure vessel
- Currently tested up to 65mm insulation thickness
- Tested in operational environment x 2 (Flotta, St Fergus)

REQUIRES EXTENDED DATA GATHERING AND ANALYSIS





FSCT PROBE ARRAY

- Circular frame fitted to pipe – wireless – rope accessible
- Manually or robotic operated circumferential movement
- No operator risk of error
- Collects 20 samples per second, 8cm² to 16cm²/sec coverage
- Potential to connect up to 4 probes or more at a time
- Quick and smooth data collection; full coverage assured
- Real-time CUI result – “severe, moderate, minor”

REQUIRES EXTENDED DATA GATHERING AND ANALYSIS

WHERE OPERATORS AND OWNERS CAN HELP

We need as much data as possible from operational environments to improve both hardware and software – all about training algorithms !

We need to test:

- Variety of diameters (3" to vessel / tank size) → Determine pipe size and thickness limitations of the technology
- Variety of insulation thicknesses → Determine maximum insulation thickness for technology – stand-off
- Variety of insulation types → Determine whether any insulation and jacket types affect results
- 'Focused' limitations wrt supports, parallel pipes etc → How close can we be to a support or another pipe ?

Bottom line – the technology sees corrosion – but we need to 'train' it as to what is severe and what's ok

VALUE

Avoids unnecessary insulation removal

Locates and categorises CUI, quickly

- CUI incurs 40 – 60% of the process plant maintenance costs within the UK Continental Shelf (UKCS)*
- CUI costs the UK £28 billion every year rising to an estimated £4 trillion globally*
- CUI is one of the major causes of accidents in the oil and gas industry*
- Since 1984, out of 137 major oil and gas accidents reported within the EU, over 20% have been associated with CUI*



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