CLEANING & ILI OF HEAVY WALL SUBSEA PIPELINE WITH IMPROVED DIFFERENTIATION BETWEEN DEBRIS AND CORROSION

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AGENDA

1. Executive Summary
2. Challenges
3. 3P´s Solution
4. Results

1.0 EXECUTIVE SUMMARY

- The project scope comprises of an in-line inspection of an 18inch, 286km long, 27.3mm nominal wall thickness, offshore wet gas flowline.

- Previously, the pipeline was inspected in 2020 by another ILI services company. However, the interpretation was compromised due to sensor lift-off assumed due to remaining debris in the pipeline.

- To counter the known POI challenge, 3P Services developed a combo ILI tool comprising of MFL, GEO, wall-guided, and stand-off magnetic sensors.

2.0 CHALLENGES

1. Pipeline length

- Impacts wear on tool components. Potential consequences include asymmetrical tool position, tool sagging, restricted data quality, and data loss.
- battery life – run time: 3 days. Sufficient battery power to record four times the pipeline length, one for each data set. Additional tool segments to accommodate the battery housings. Transportation and handling challenges.

2.0 CHALLENGES

2. Pipeline cleanliness

- leading to vibrations, stand-off problems ultimately degrading data quality.

2.0 CHALLENGES

3. Pipeline wall thickness

- Pipeline is classified as “heavy wall”.
- The nominal wall thicknesses of 25.4mm and 27.3mm are a measurement challenge for MFL.
- UT was not considered a viable option. History of unsuccessful UT inspection.

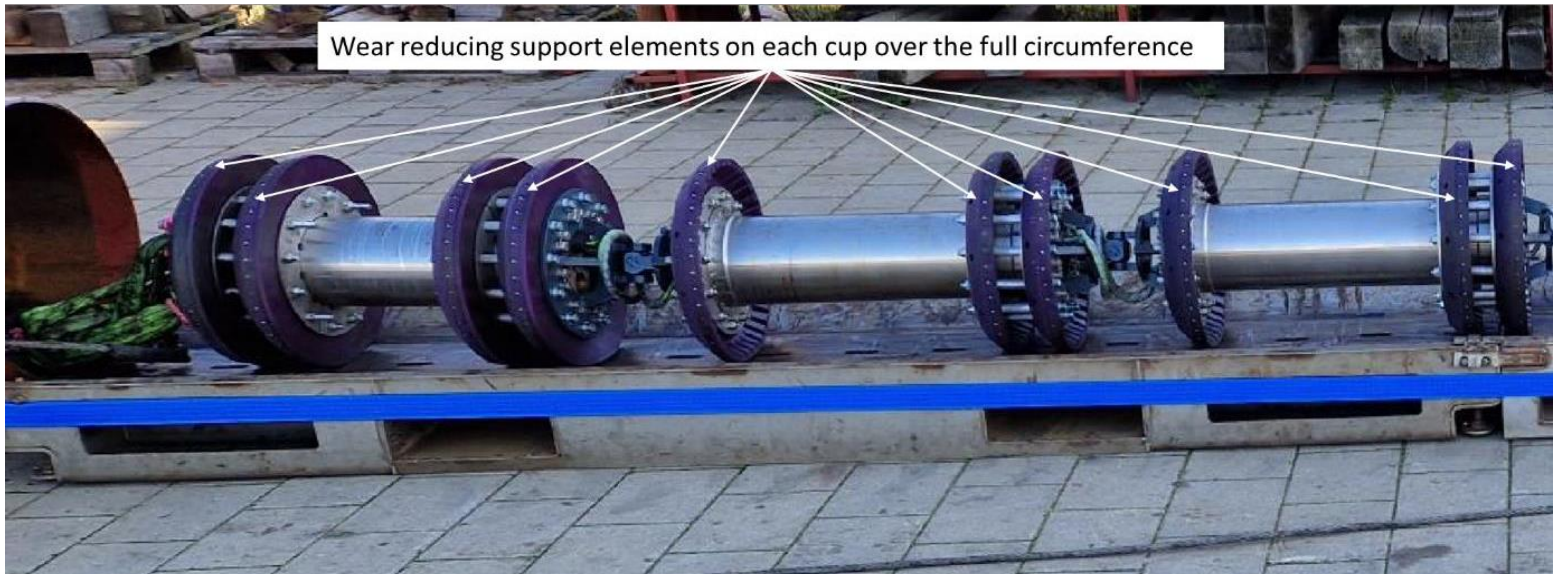
2.0 CHALLENGES

4. Project schedule

- a very challenging timeline.
- limited inspection window.
- 3P Services project team worked on project preparation, tool design, assembly, testing, shipment, project execution and reporting under elevated levels of time pressure.

3.0 3P´S SOLUTION

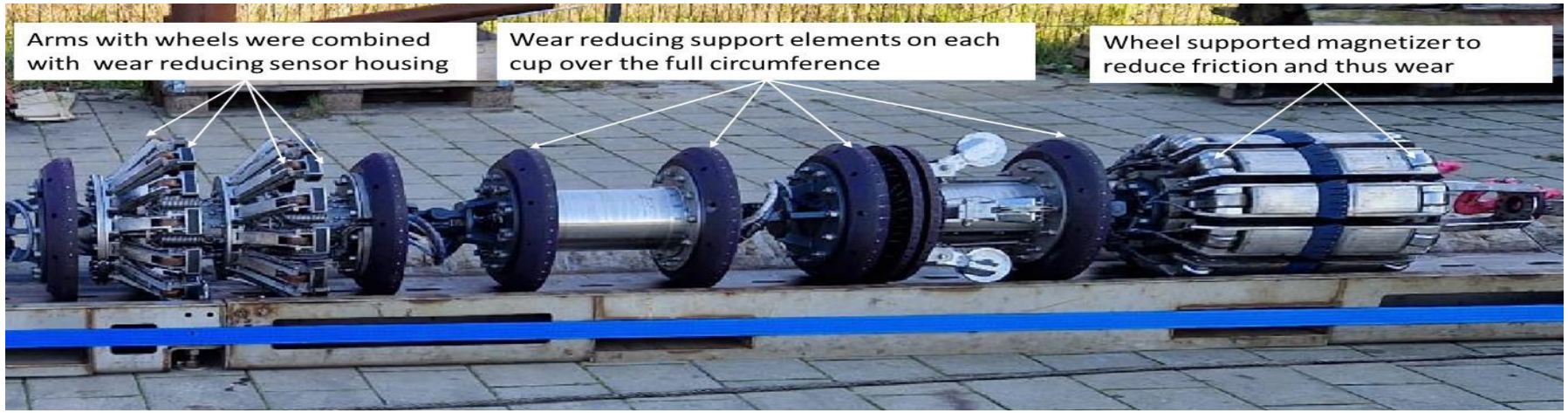
1. **Low friction and extended run components**
   - Essential to have a detailed assessment of wear reduction for each ILI tool segment.
   - Efficient design of individual segment weight, optimum number of polyurethane cups, their position and dimensions were ensured.
   - Use of several ceramic pins on each cup.



3.0 3P´S SOLUTION

2. Intelligent Sensor Carrier Design

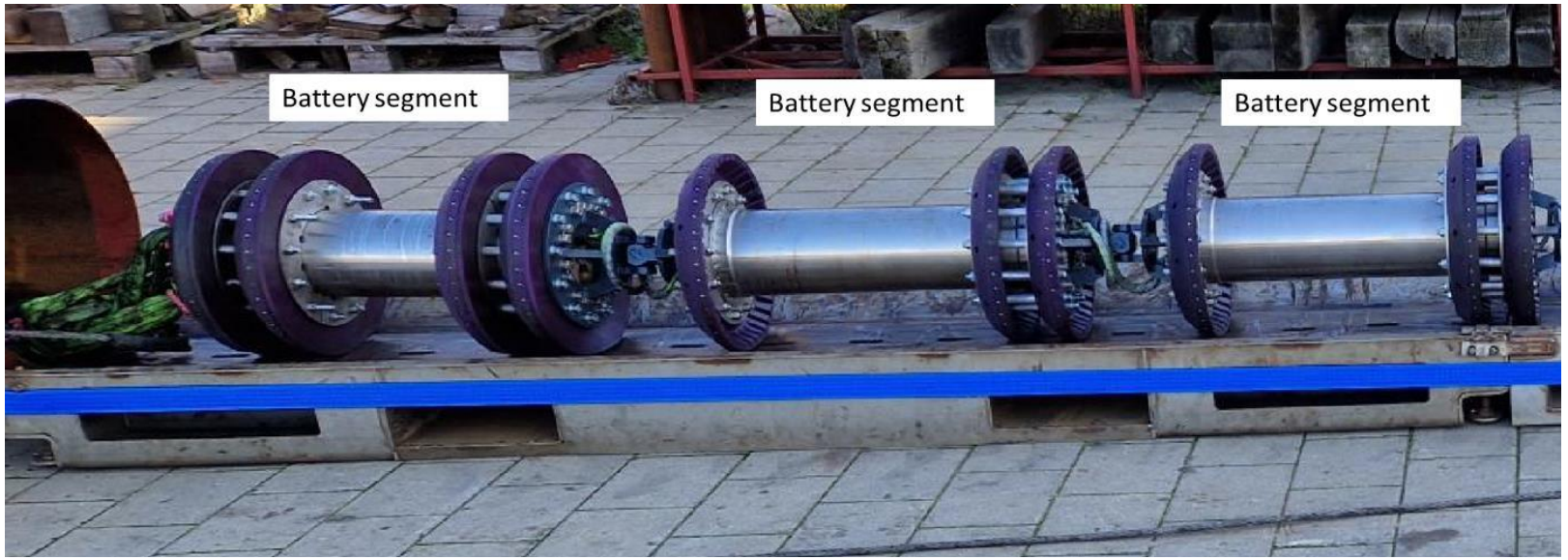
- The sensor arms were equipped with wheels which guided the arms. This design allows rolling friction instead of sliding friction.
- A combination of bespoke yoke design and exceptionally strong magnets solved the challenge of magnetizing the heavy wall.
- 3P Services has a long history of heavy wall MFL inspection in the past. These experiences were used to find the ideal balance between wear limitation, yoke volume, magnetic strength, and pipeline magnetization.



3.0 3P´S SOLUTION

3. Efficient utilization of tool segments

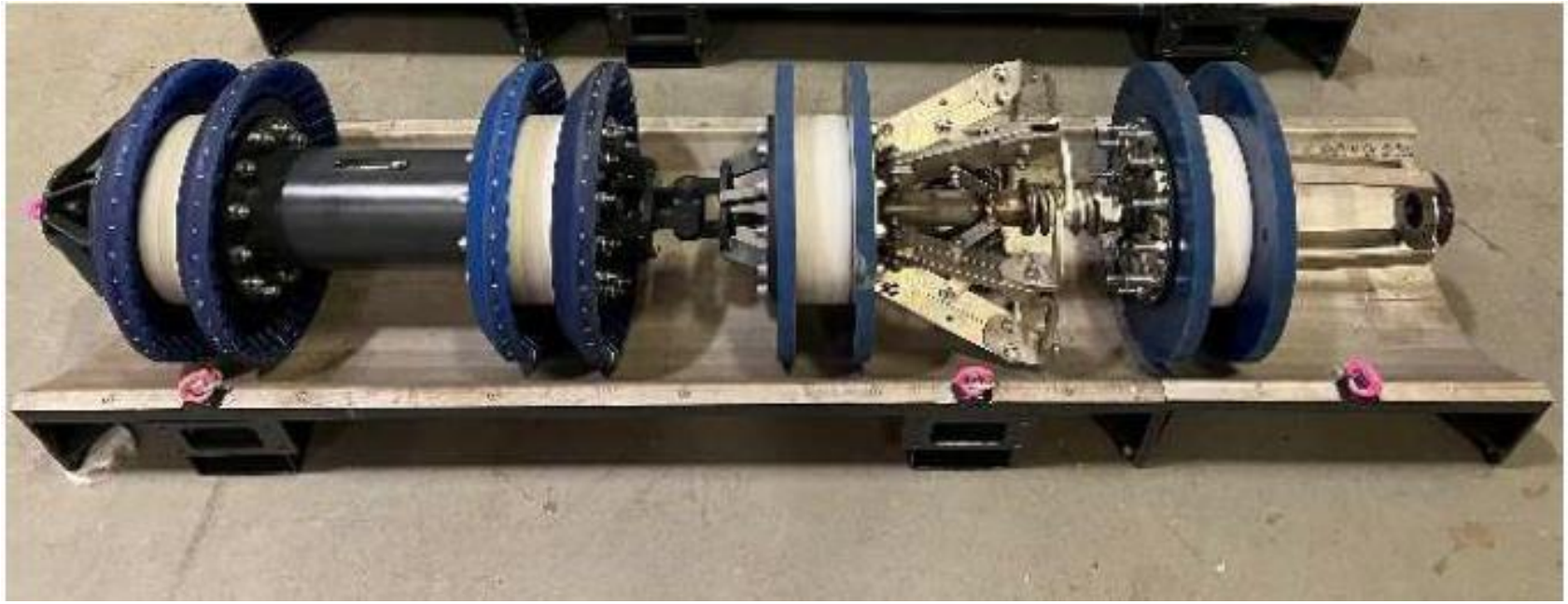
- The battery segments were used as pulling segments to limit the tool lengths and combine two functions.



3.0 3P´S SOLUTION

4. Pre ILI cleaning including 3P Services´ aggressive cleaning tool

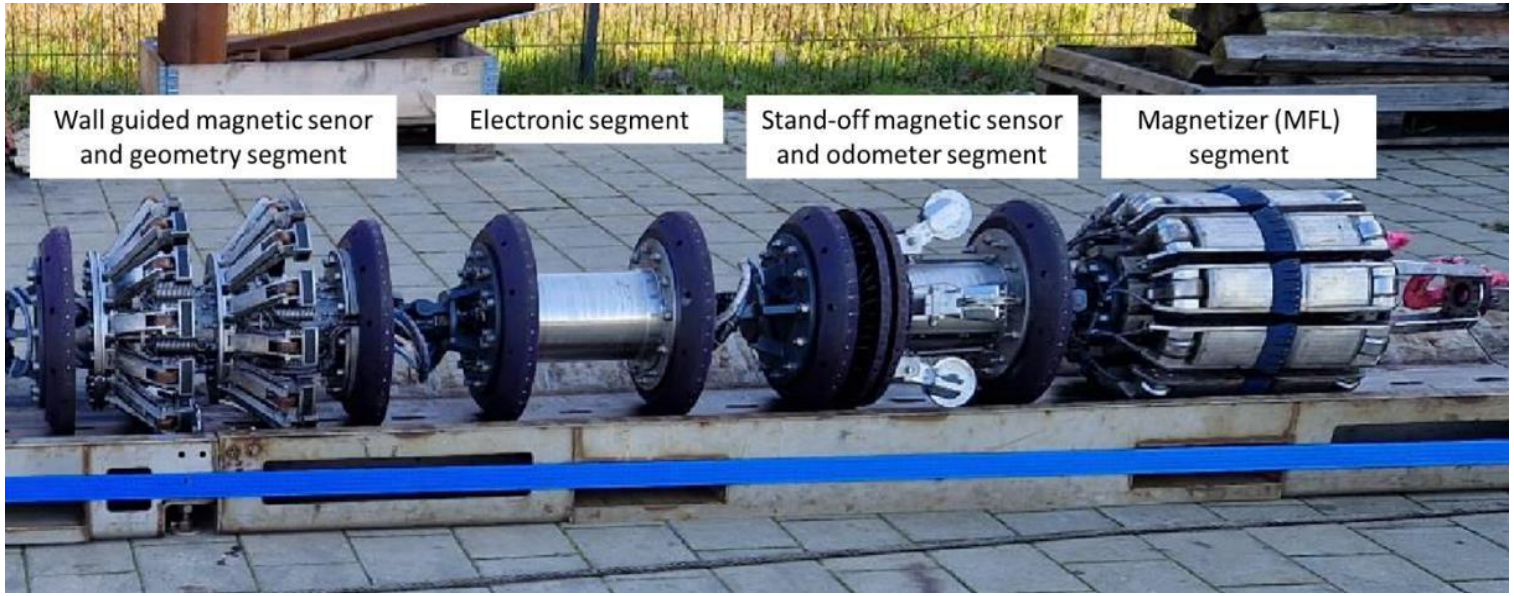
- Close collaboration with the client to enhance the overall cleaning program.



3.0 3P´S SOLUTION

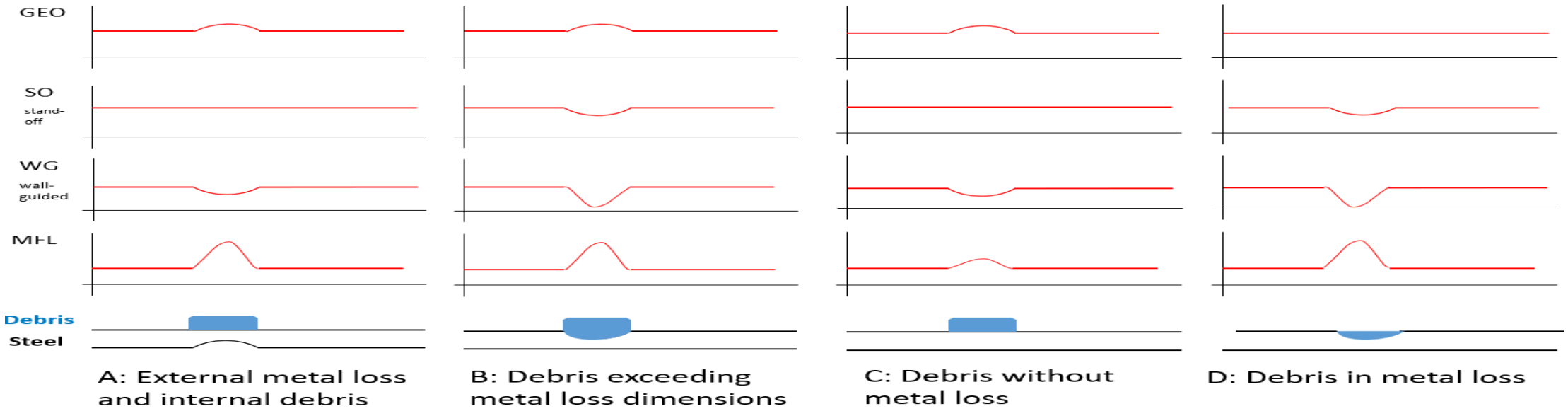
5. Inception of a 4-technology combo tool

- The following measurement technologies were combined: Magnetic flux leakage (MFL), Geometry (caliper), wall guided magnetic sensors, and stand-off magnetic sensors.
- The combination of four (4) different measurement technologies or sensor arrays, respectively, allowed a differentiation of various debris/metal loss situations based on the collected ILI data.



3.0 3P´S SOLUTION

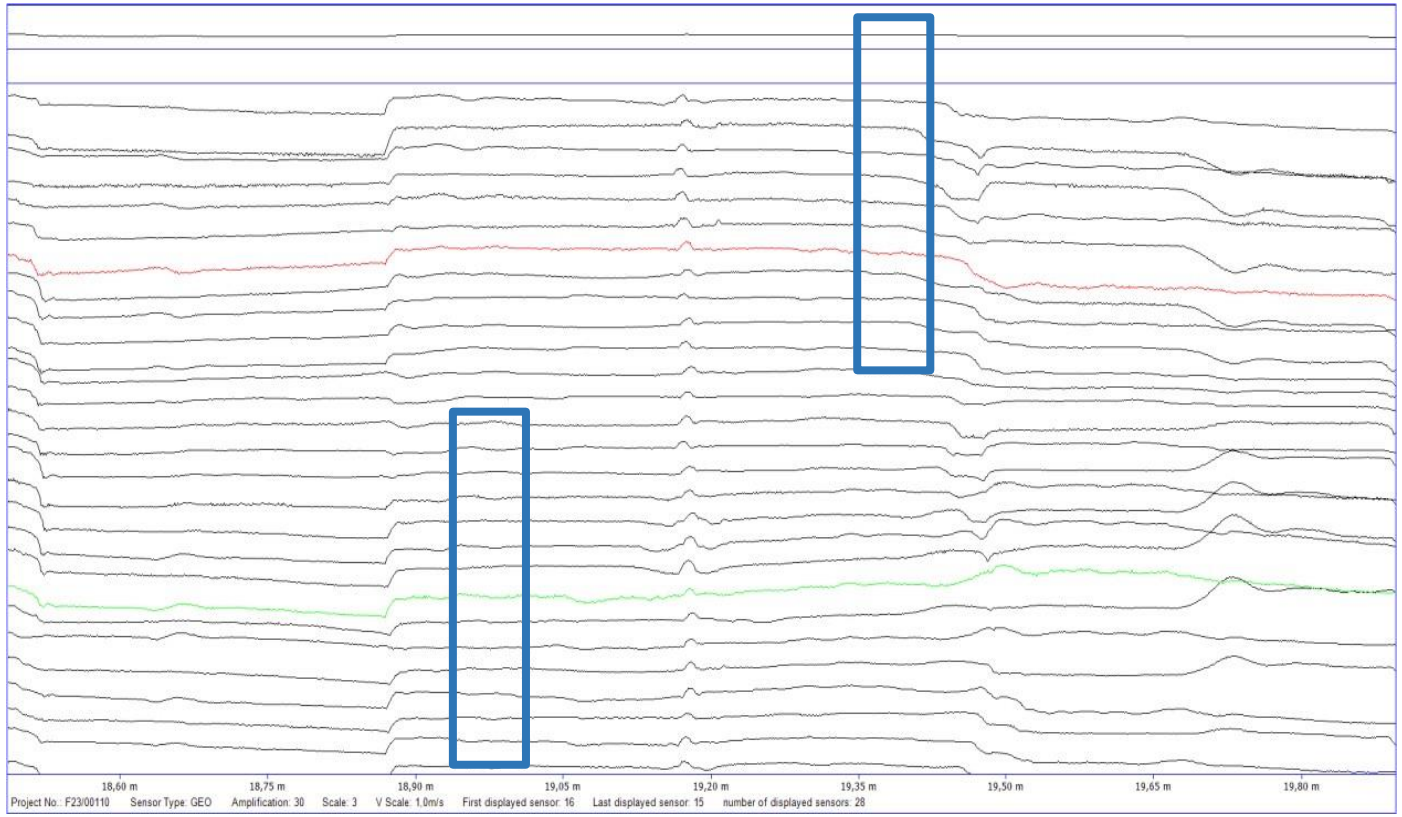
4. Inception of a 4-technology combo tool



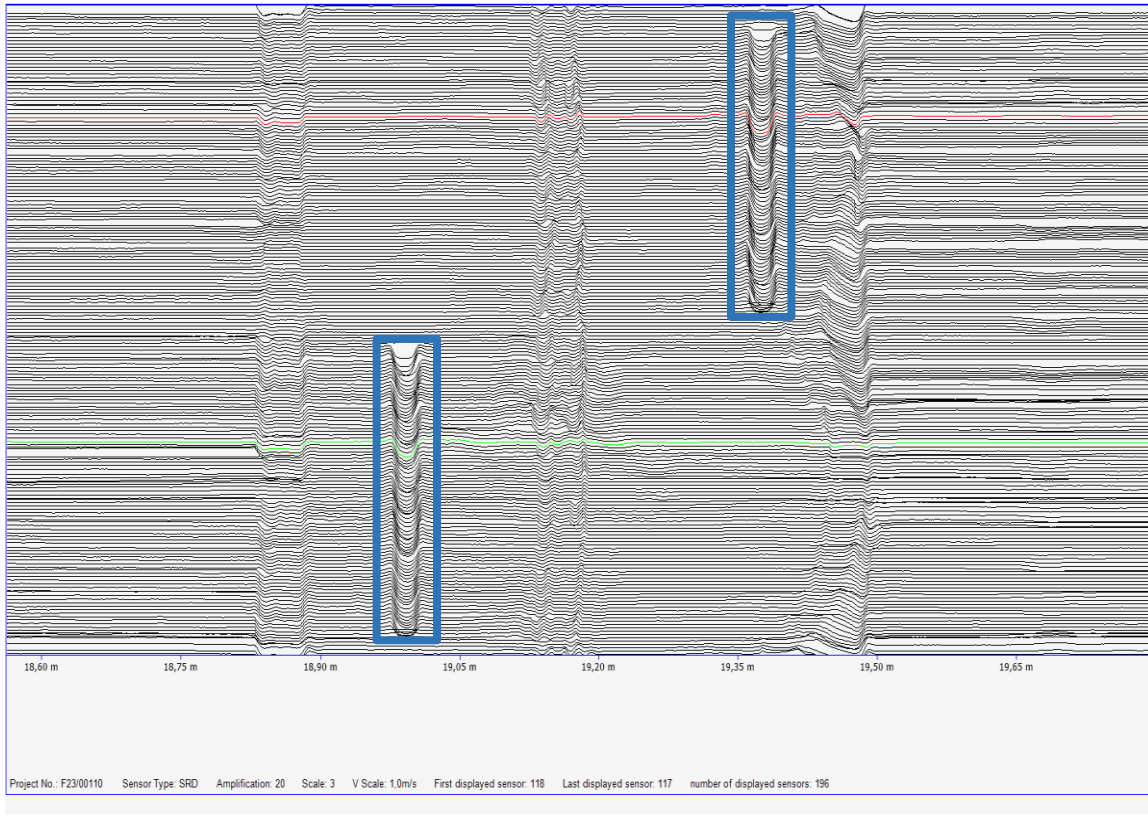
Effect of different Situation (A-D) on multiple measurement technologies

3.0 3P´S SOLUTION

5. Thorough testing and client-approved factory acceptance test



GEO data – blue rectangle shows anomaly location (red/green sensors = 12h/6h)



wall-guided magnetic sensors data – blue rectangle shows anomaly location (red/green sensors = 12h/6h)

3.0 3P´S SOLUTION

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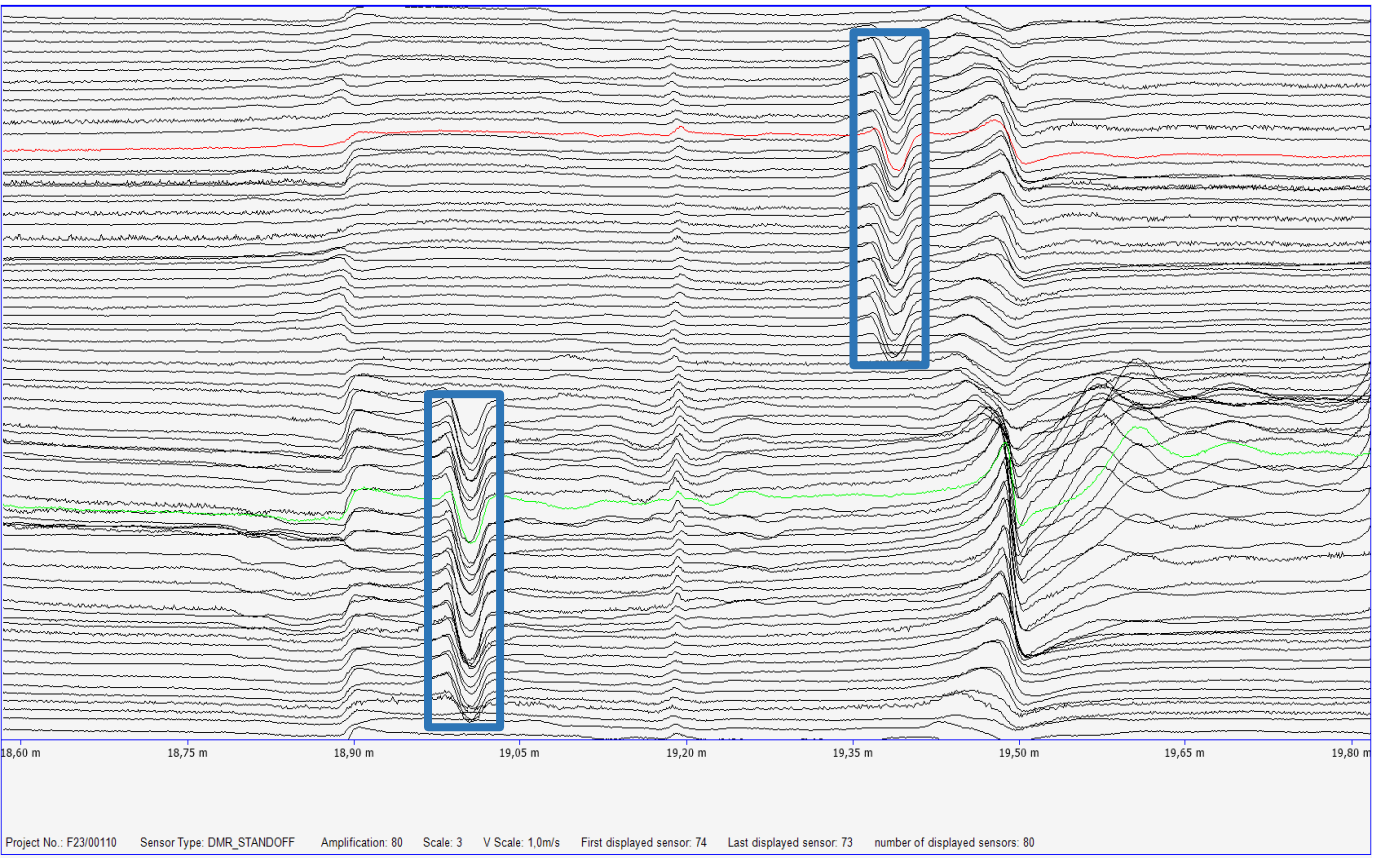
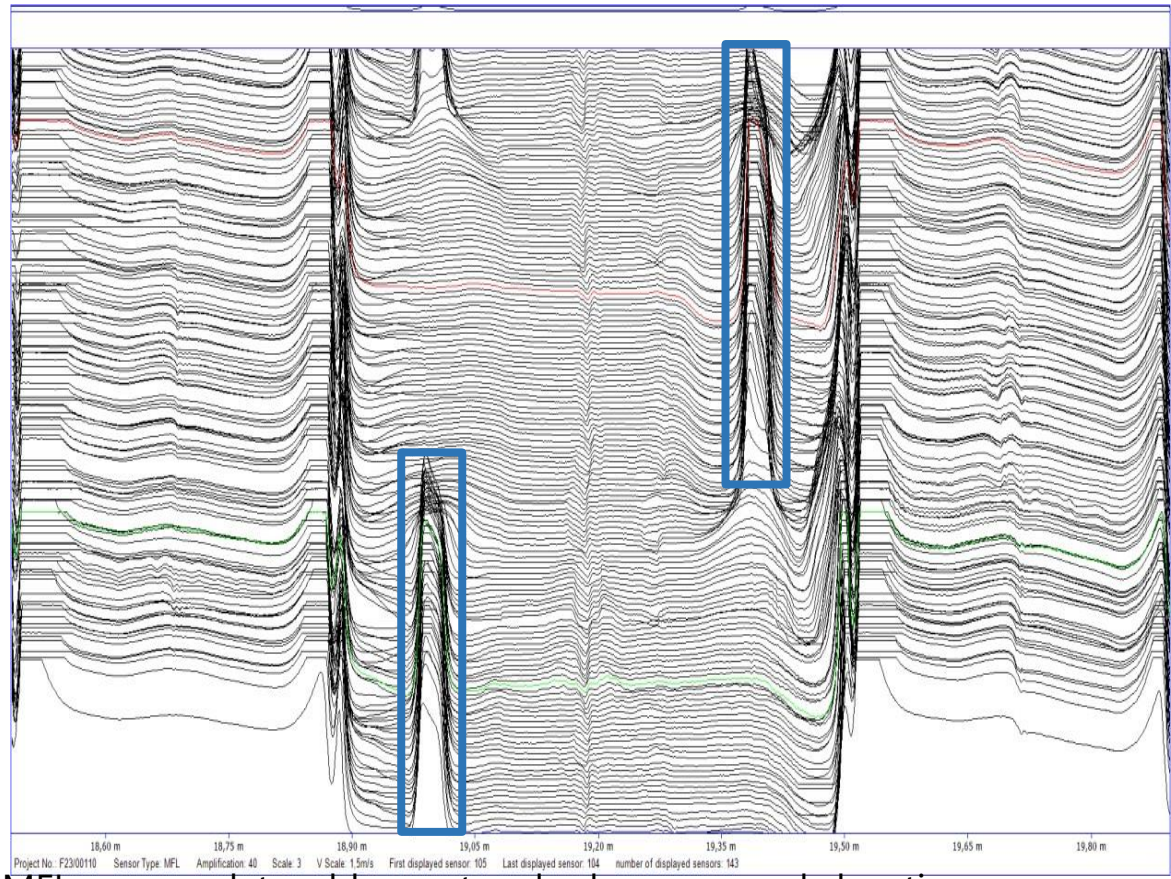


stand-off magnetic sensors data – blue rectangle shows anomaly location (red/green sensors = 12h/6h



MFL sensors data – blue rectangle shows anomaly location (red/green sensors = 12h/6h)

4.0 RESULTS

- The project was a success. The entire pipeline length was recorded.
- Total tool travel time was 62 hours with an average tool speed of 1.3m/s.
- No indications of debris influence on the data was confirmed.
- 3P services approach to challenging pipeline inspections was vital to the success of this project.
- The solutions proposed by 3P allowed an enhanced level of probability of identification (POI) enabling the client to efficiently design their pipeline integrity program.

THANK YOU

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