Measuring up to reality

In the oil and gas industry, asset integrity and the related management of risk and operating cost have always been a major concern for any pipeline operator. With dropping oil prices, the accuracy of inspection results and subsequent reliability of integrity assessments have become even more important, as these are directly related to the above.

This is especially the case for older, more heavily corroded pipelines, where cost for maintenance and repair can easily skyrocket.

However, certain difficult-to-assess defect types such as pinholes (PINH) with a diameter of 1 to 2 mm, complex corrosion, bacterially induced corrosion (MIC), top-of-line corrosion (TOLC) or preferential girth weld corrosion, have been very hard to assess.

This has been due to the shortcomings of available high-resolution in-line inspection (ILI) tools, resulting in very conservative integrity assessments and thus leading to numerous costly field verifications that could have been reduced by deploying a more accurate inspection technology.

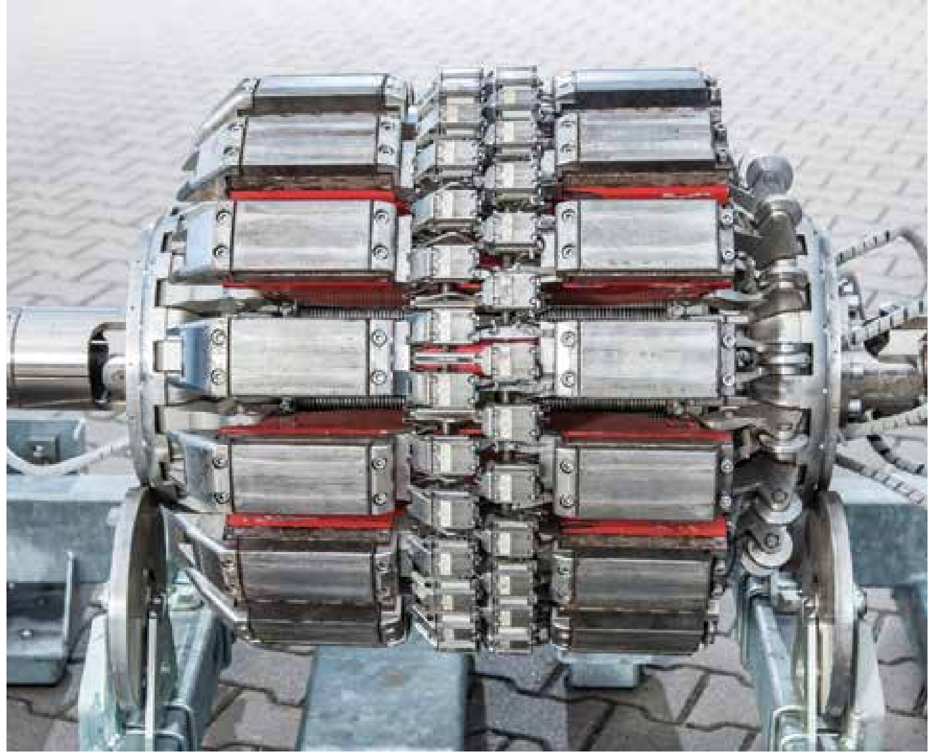

Fig. 1: A 24-inch RoCorr MFL-A Ultra ILI tool, MFL-A section.

Step change in the ILI industry

To tackle this, ROSEN started the development of a new ILI service several years ago. Three areas had to be addressed to make this possible:

- new sensors had to be developed
- the mechanical properties of the ILI tools in regards to sensor positioning, girth weld passage and axial guidance had to be improved
- new algorithms for tool calibration and data evaluation had to be developed.

The first hurdle to be taken in order to deliver laser scan-like results was the improvement of the sensor itself. Developing a new sensor carrier that would contain as many sensors as mechanically possible was the initial goal.

Going from single hall elements to highly integrated circuit (IC) modules developed solely for this purpose resulted in placing about 10 times more sensor elements into the existing sensor. The outcome was a carrier with a circumferential track pitch of 1.6 mm, leading to a resolution of about 1,500 dpi. Early tests were already showing very promising results and a capability to detect defects of approximately 1 mm in diameter.

Similar attention had to be paid to the mechanical characteristics of the ILI tools. Common MFL-A tools have their sensor carriers mounted on one ring with a minimum of about 2 mm spacing between carriers. To achieve the desired circumferential track distance across the entire inner pipe wall, this solution was not suitable. Hence, carriers had to be positioned on two rings in an offset fashion as seen in Fig. 1 to ensure full coverage.

In past years, several ILI runs have been performed in collaboration with pipeline operators – in addition to an extensive pull and pump test program.

During these tests, it became clear that the described positioning of the carriers – one closer to the front, one closer to the back of the magnet field – had an effect on the measurement signals, due to the high sensitivity and ultra-high resolution of the sensor components. This effect needs to be taken into account during data preparation.

What do the results look like?

Noticeably, the higher resolution leads to more detailed defect images, and with the significantly improved mechanical sensor carrier suspension, the overall imagery is of unmatched clarity. This can be seen in both the pipe body (Fig. 2) and the girth weld area (Fig. 3), with the latter having been a 'blind spot' to many previous in-line inspection services.

What's to gain?

Fitness for Purpose (FFP) is a fundamental task within integrity management plans. Common applicable standards such as ASME B31G, API 579 or DNV Recommended Practice use only defect length (L) and peak depth (D) for determination of the effective area calculation.

The combination of highest resolution and improved mechanical tool design is actually a great leap forward towards a more reliable and highly accurate in-line inspection service that delivers more accurate feature boxing. This results in more reliable integrity assessments that can be used for less conservative river bottom profiles. Taking this a step even further is the use of 3D contour plots that use the actual feature shape to enhance modern integrity assessments such as Detailed RSTRENG or DNV RP 101.

MFL-A Ultra delivers highest resolution, i.e. more smaller, detailed features combined with a better differentiation of interacting features, resulting in smaller effective areas. This comes in combination with improved sizing accuracy, which results in smaller error bars that will move more features below the repair threshold.

The new MFL-A Ultra service delivers more accurate defect profiles, higher sizing accuracy and revised feature clustering, which will significantly improve reliability and reduce conservatism of integrity calculations such as FFP and Corrosion Growth Assessment (CGA), avoiding unnecessary verification dig-ups and facilitating an accurate corrosion growth behaviour assessment. **P**

For more information on ROSEN's products and services visit **www.rosen-group.com**

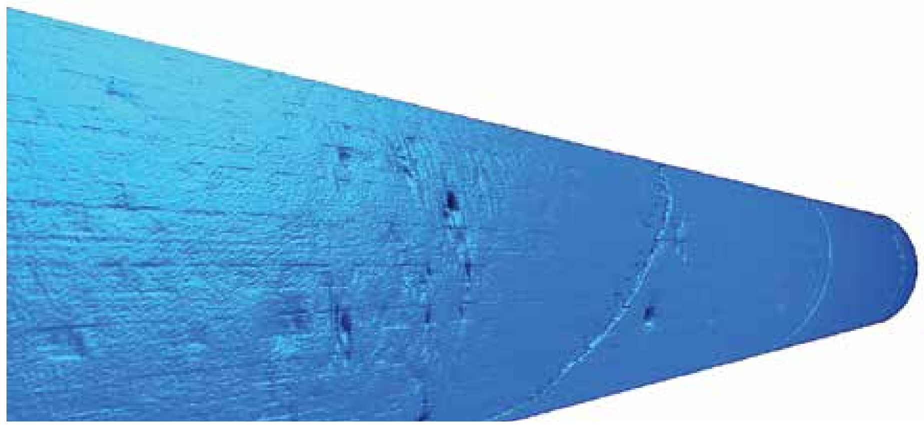

Fig. 2: example of RoCorr MFL-A Ultra data comparison between colour plot and new 3D pipeline imaging.

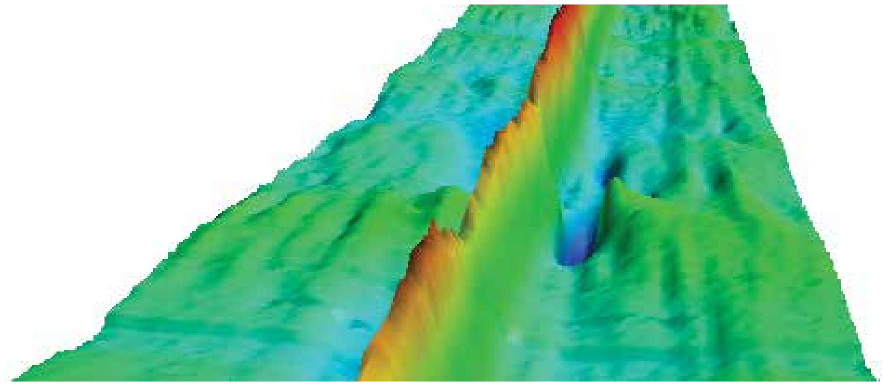

Fig. 3: MFL-A Ultra girth weld feature image.