ROSEN
empowered by technology

Innovating tank bottom inspections with MFL Ultra sizing and machine learning

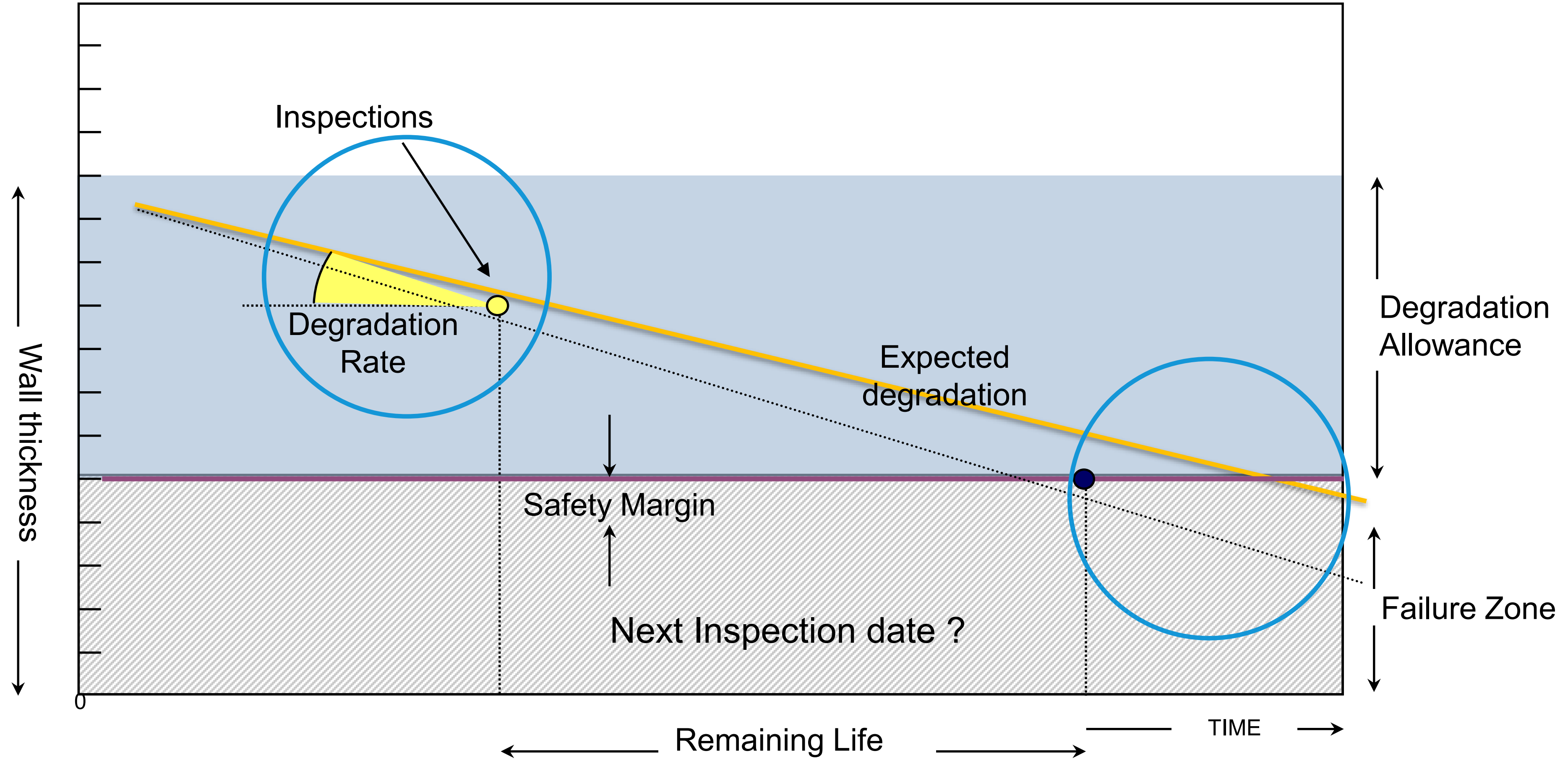
AI/ML use case

Josh Rawson | ROSEN Group | Germany | 2025

All roads lead to the bottom

- Highest corrosion risk occurs at the bottom.
- Most tank failures originate at the floor due to undetected or underestimated metal loss.
- Difficult to monitor externally.
- Primary input to API 653 calculations – remaining wall thickness and corrosion rate from the bottom drive the Next Inspection Date (NID).
- Risk-Based-Inspection (RBI) hinges on bottom data – more accurate detection and sizing allow safe extension of intervals and optimized maintenance planning.

Extending inspection intervals through RBI process



More accurate measurements lead to:

- Extended asset lifetime
- Lower probability of failure reducing risk

RBI Optimization

Industry problems & our response

ROSEN
empowered by technology

Problem #1
Early Detection of Corrosion & Degradation

Solution #1
Reporting Threshold shall be reduced from 20% to 10%.
(e.g. in pipelines – 5%).

Problem #2
Optimizing Maintenance Schedules

Solution #2
Next Inspection Interval – shifting from fixed intervals to calculated, risk-based planning.

Problem #3
Improving Safety

Solution #3
Improved POD and accuracy without the need for UT check-up's (i.e. reduce time for personnel in confined space).

Problem #4
Improving Cost Efficiency

Solution #3
Repair Criteria – calculated, based on actual degradation rates.
Fast turnaround – feature list available when leaving the tank after scanning.

The evolution of MFL in tank bottom inspection

ROSEN
empowered by technology

1990s

1st use of MFL technology.

Focus on detection of metal loss. Analog sensor, manual readout.

2000s

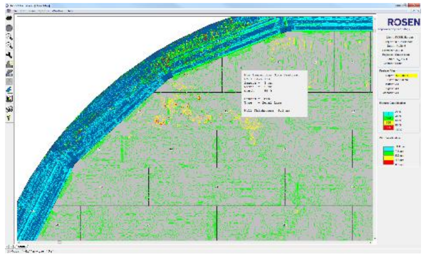
Sensing technology advancements.

Improved MFL sensors and digital data analysis.

2010s

Improvement of detection capabilities.

Integrated multi-channel analysis.



2015

Automatic feature detection and sizing.

First algorithms for automization of evaluation process.

Now

Ultra High Resolution MFL.

AI/ML approaches for fully automated & consistent data evaluation.

Predictive Maintenance

Ultra high resolution MFL Data
What is the smallest defect we could find?

- **Data Quality** - Reliability of results by far exceeding conventional MFL or EC scanners
- Indications **Ø >2mm** are detected
- Indications **as small as 10% ML (0.1t)** are detected (e.g. for a plate of 6.35 mm -> 0.6mm or .25” -> .023”)
- Sizing **accuracy is +/-4%**
  (e.g. for a plate of 6.35 mm -> +/- 0.3mm or 0.25” -> +/- .011”)
- **Inspection turnaround time** is faster due to automated feature detection and sizing
- Coatings up to **6 mm/0.24” do not need to be removed**

Extending inspection intervals
Maximizing inspection intervals through best-in-class sensitivity

ROSEN
empowered by technology

- New tank bottoms are commonly inspected 10 years after commissioning
- Normally **only limited corrosion is present**
- **Next Inspection Dates (NID)** derived from the inspection **often do not reach the allowable limits** given by the regulator (new tanks as well as older tanks)
- **Extremely low detection & repair thresholds** are needed in order to actually achieve a calculated inspection interval of 20 years or greater (according API 653):

Example: **Floorscanner “A”**

- Tank bottom constructed 2010
- Bottom plates thickness : 0.250 in. / 6.35mm
- Inspection in 2020 (10 years after commissioning)
- Detection: 20%-100% features

- Repair threshold: **>20%**
- Next Inspection: **10 years**

Example: **Floorscanner “B”**

- Tank bottom constructed 2010
- Bottom plates thickness : 0.250 in. / 6.35mm
- Inspection in 2020 (10 years after commissioning)
- Detection threshold: 10%-100%

- Repair threshold: **>10%**
- Next Inspection: **25 years** (maximized to 20 according API 653)

Complexities in Ultra High-Resolution MFL-technology

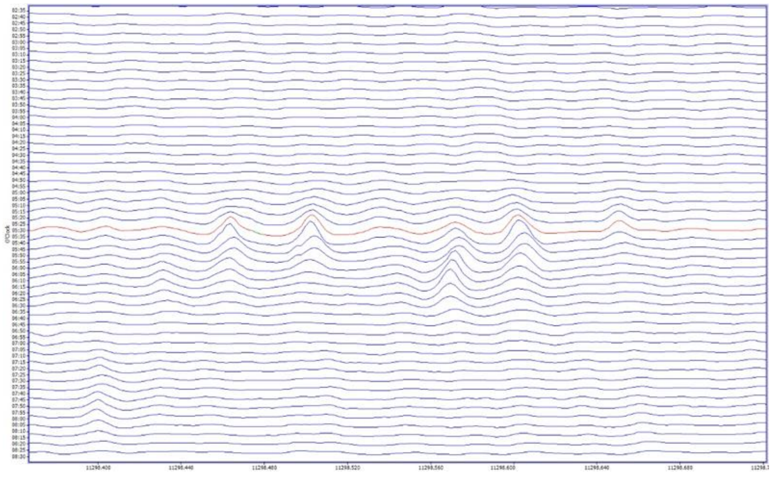
Highlighting the complexities that arise alongside our ultra high-resolution inspection advancements.

Generation of Ultra High Resolution MFL data

ROSEN
empowered by technology

154

sensor channels



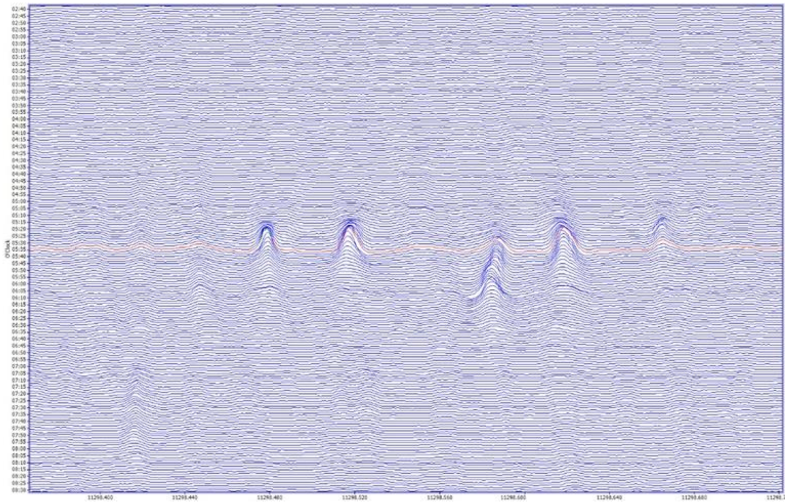
Traditional MFL resolution

6.7× higher resolution

Increased **sensitivity & precision**

1029

sensor channels

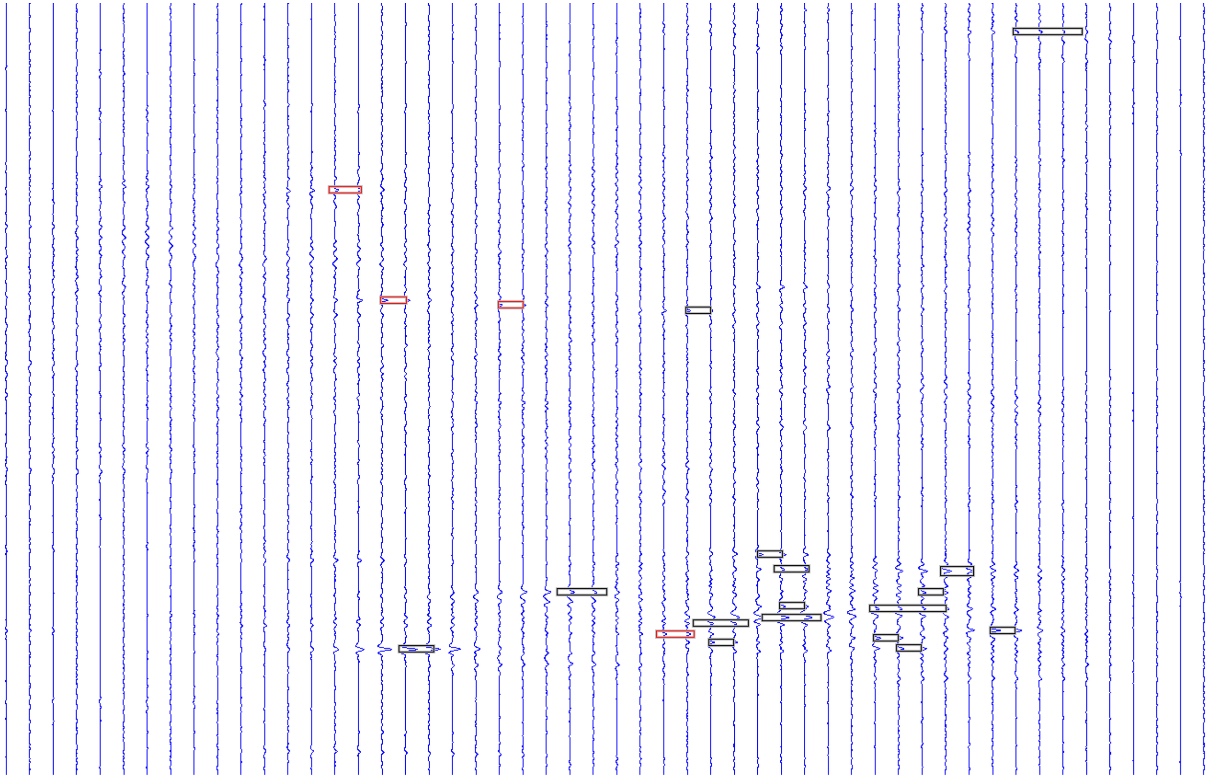


Ultra High Resolution

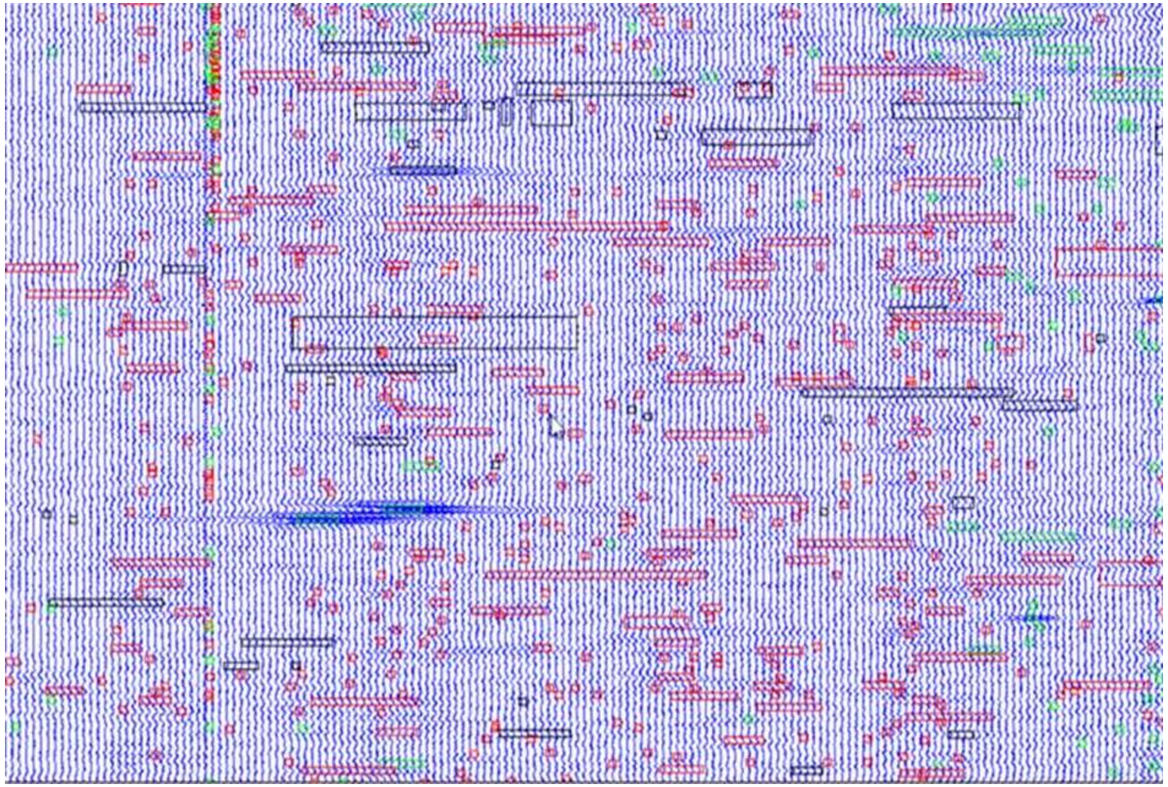
Complexities introduced by Ultra High Resolution

Increased number of false calls

ROSEN
empowered by technology



Traditional MFL resolution



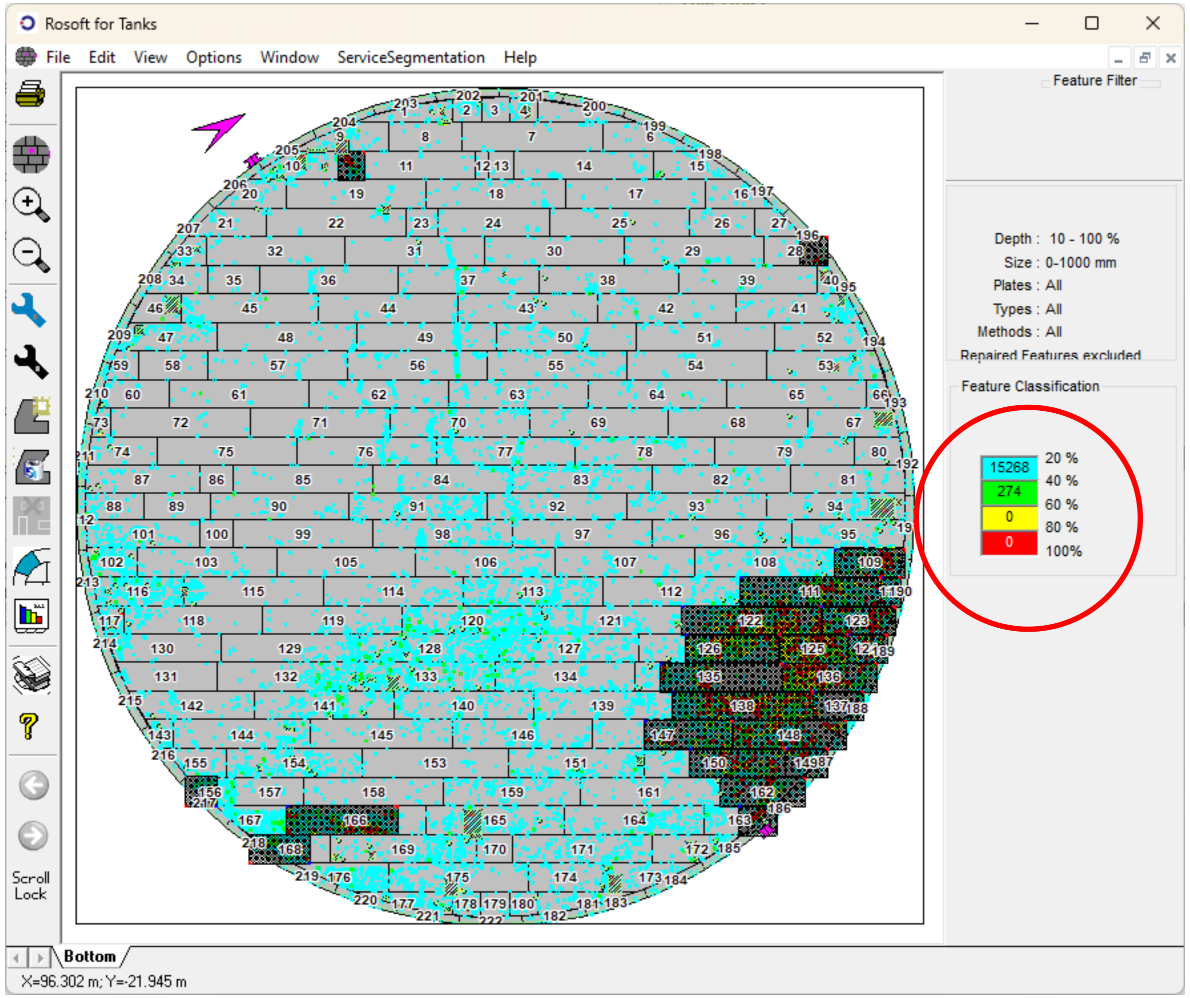
Ultra High Resolution

Complexities introduced by Ultra High Resolution

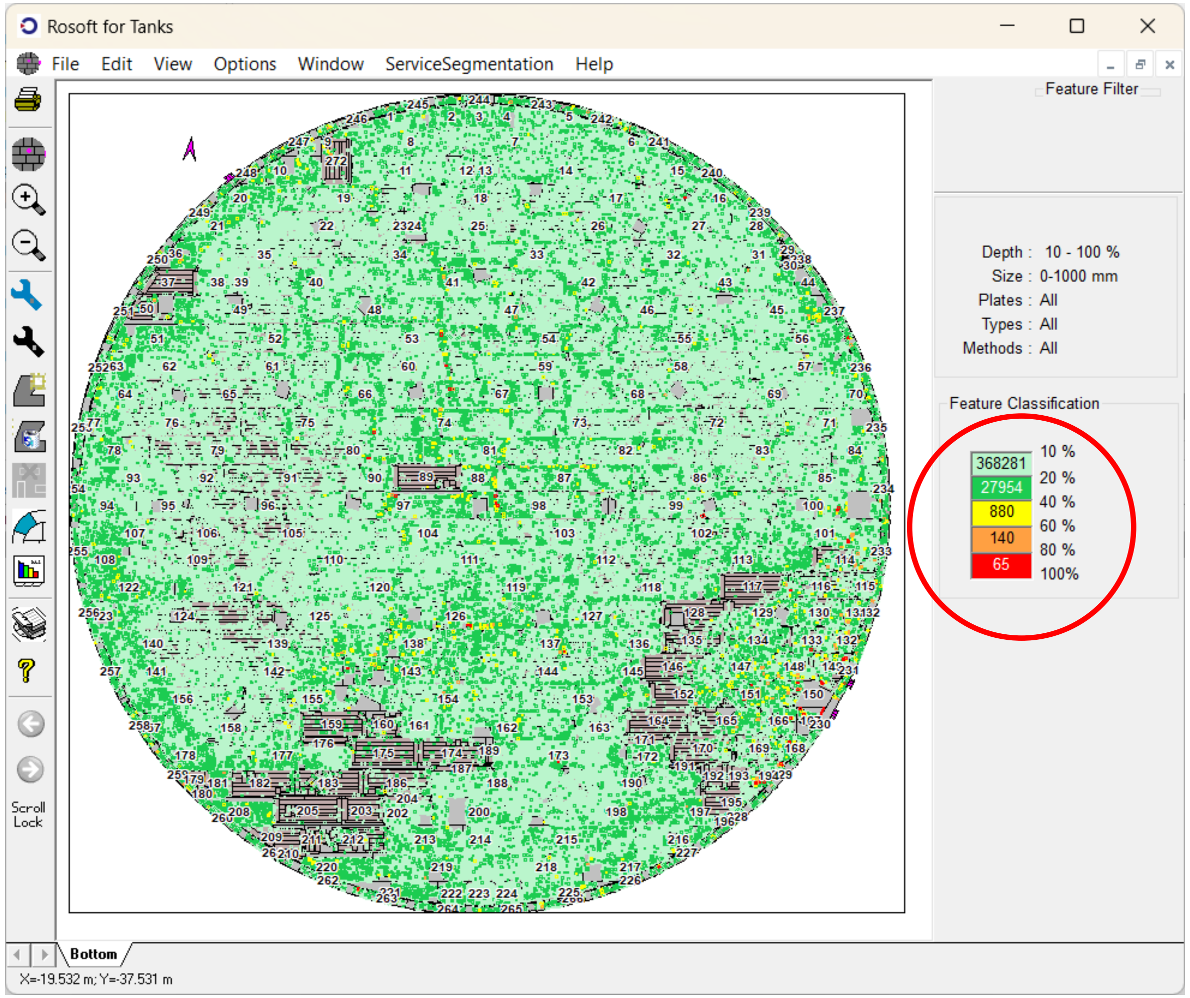
Increased number of indications to be assessed

ROSEN
empowered by technology

Inspection results with **traditional** resolution (2019)



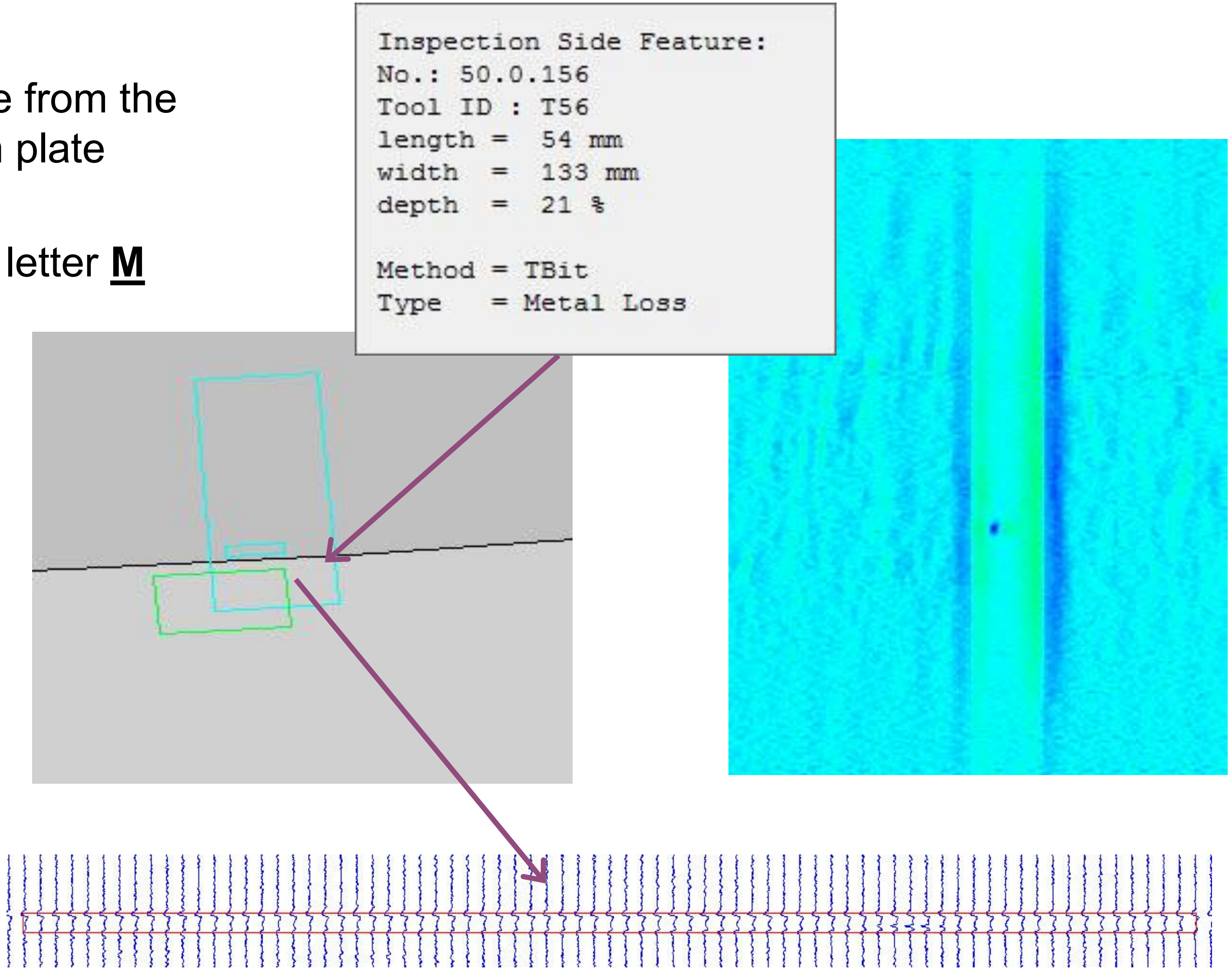
Inspection results with **Ultra** resolution (2024)



Complexities introduced by Ultra High Resolution
False call example - Tack welds

Tack weld, often left over by welders protrude from the bottom plate usually found near other bottom plate welds.

Tack welds in line plot usually resembles the letter **M**



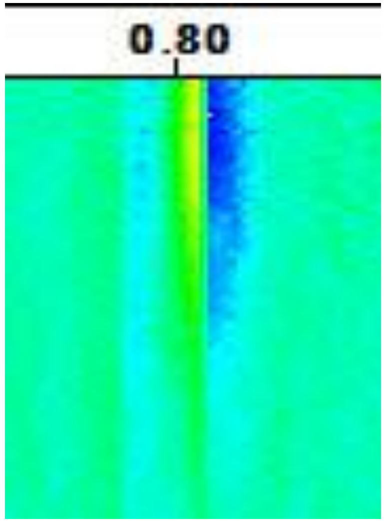
Complexities introduced by Ultra High Resolution

False call example - Settlement

ROSEN
empowered by technology

Settlement indication usually appears as a straight line that runs along the width of the line plot.

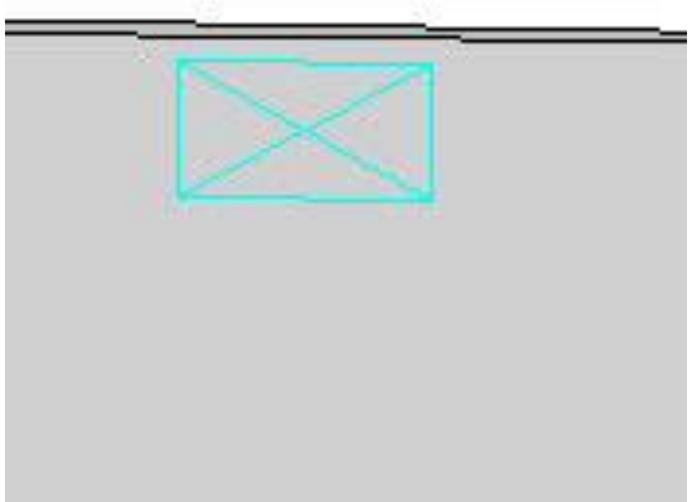
C-Scan



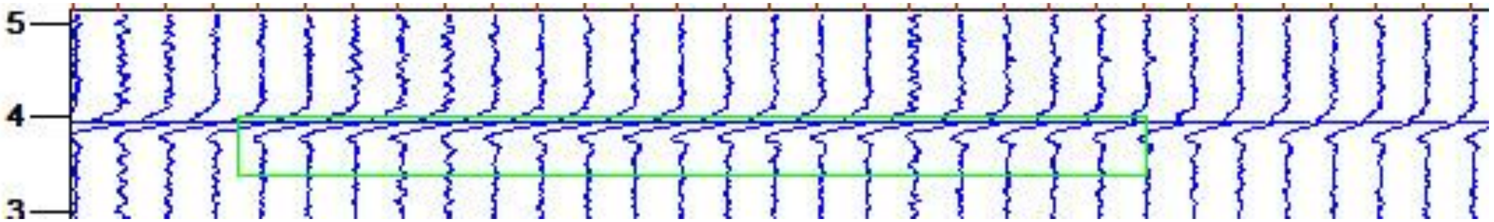
Inspection Side Feature: (disabled)
No.: 51.0.58
Tool ID : T56
length = 65 mm
width = 35 mm
depth = 27 %

Method = TBit
Type = Metal Loss

Plate View



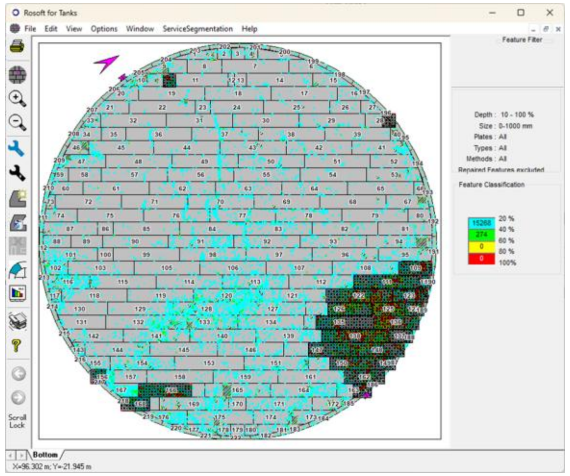
Line plot

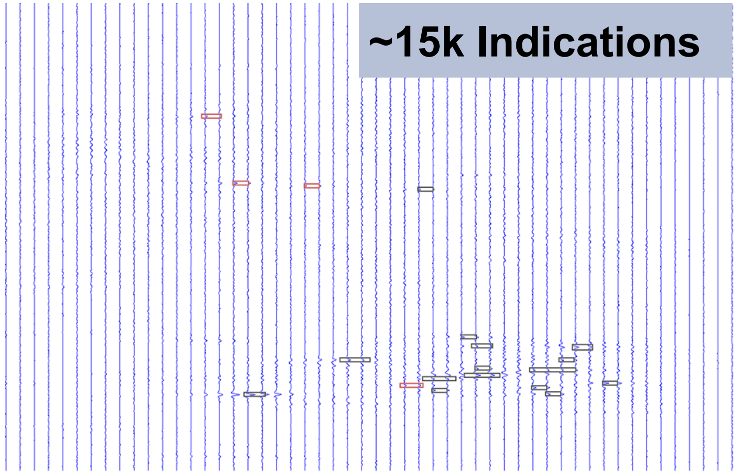


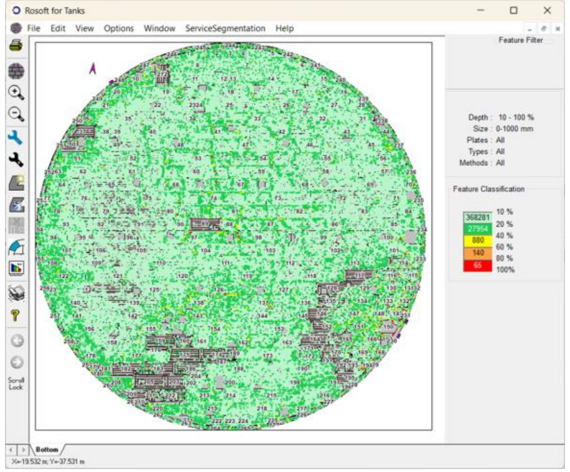
The solution - AI/ML supported automation

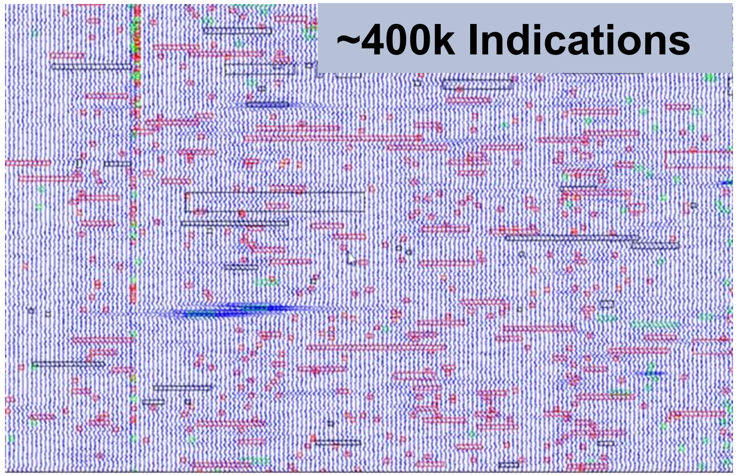
Huge amounts of detected indications cannot be assessed manually anymore. That's why AI and ML approaches need to support and efficient and effective data evaluation process.

Quality and time is key
The importance of automation in data evaluation









Example TBIT Ultra inspection:

Tank Ø: **60m**
Inspection duration: **3 days**
Defects found in Standard mode: **15.542**
Defects found in Extended mode: **397.320**
Full auto online feature sizing: **0 seconds**

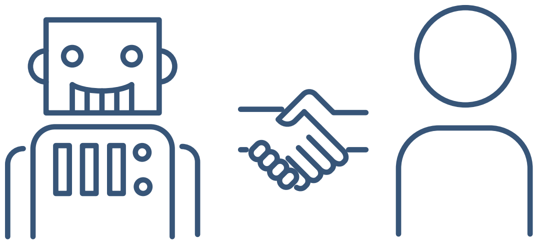
Other systems:
Detection + marking: ? days
Stop on defect. Additional time: 15.000 × 3 minutes =
750 hours additional = **75 man-days**

Is this time (cost) taken?
What if it isn't?

The solution
Combination of automatic & manual data evaluation

Higher sensitivity → Higher false call rate → **How to filter between true and false call?**

Two stage data evaluation:



1. Computer (Algorithms)

2. Evaluator (Human)

- Fast
- Quality fixed and equal across the globe
- No human error effect on the majority of data
- Can cope with unusual data

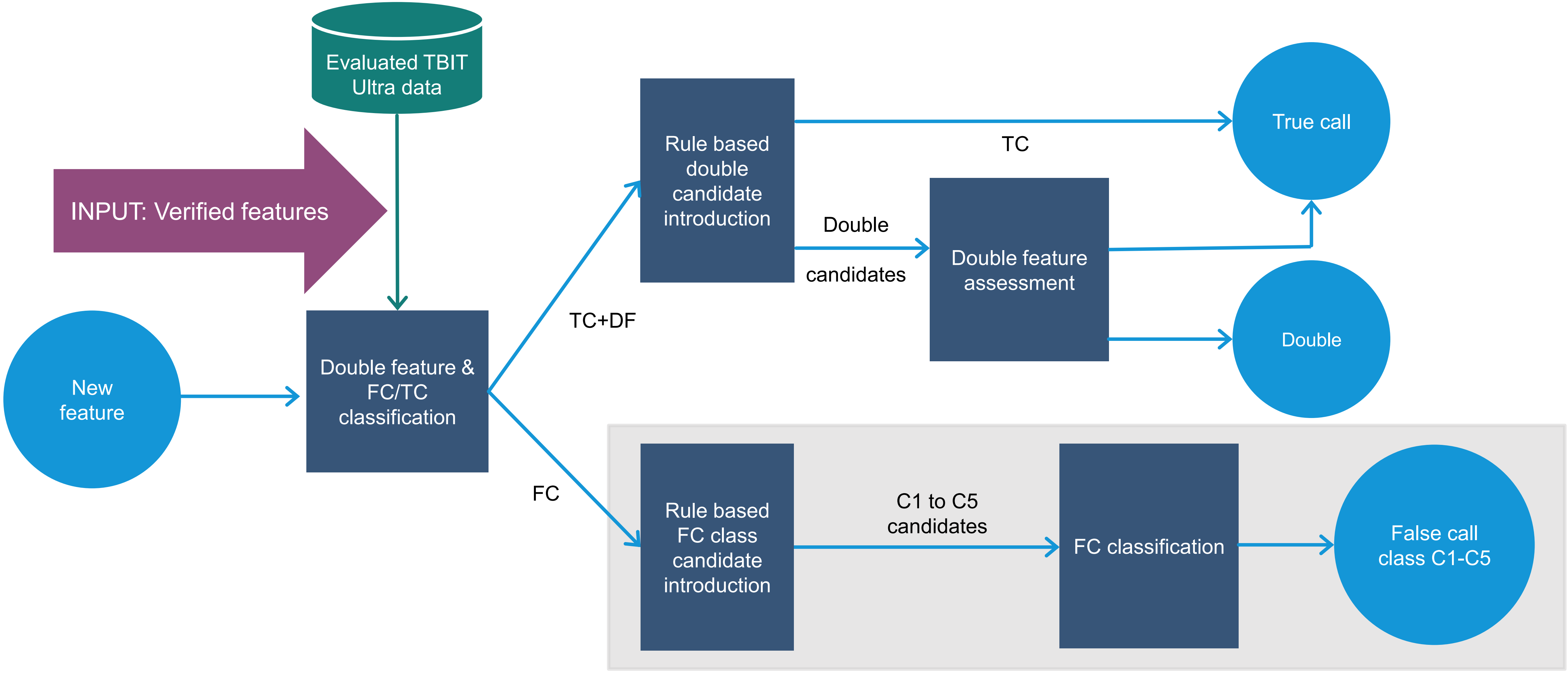
85% of the evaluation work is taken over by the algorithm

3% of the evaluation work is still performed by the Evaluator

12% true indications

The solution

Algorithm for automatic double feature & false call elimination



Conclusion

How is Ultra High resolution MFL data revolutionizing the tank bottom inspection approach

Summary - Benefits of Ultra High Resolution MFL data

ROSEN
empowered by technology

Sensitivity	Confidence	Time	RBI	AI/ML
Highest sensitivity allows for early detection of small features	Confidence and reliability in MFL data analysis	Reduction of hours due to automated feature detection and sizing	Results support RBI assessments, optimizing inspection intervals and NID determination	Enabler for AI-powered predictions

"The Big Data revolution is less about collecting more and more data. It is about collecting **the right data**."

— Seth Stephens-Davidowitz, American data scientist & economist

ROSEN

empowered by technology