



Smart Valve

a concept that enables a new level of valve reliability

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Graduated in electronic engineering at the Polytechnic of Milan. He has been working in the valve sector for 15 years, since 2016 he has focused on embedded fluid control systems, IoT devices and ecosystems for industrial applications.

Since 2021 he is part of Advanced Technology Valve SpA, with the role of Electronic Engineering Manager where he is responsible for the R&D program relating to electronic and mechatronic products such as electric actuators and health monitoring systems for subsea and topside valves.

Lorenzo is a member of the API SC17 (Subsea Production System) commission.



Smart valve market requirements

Valve failure modes

Smart Valve:

- concept presentation
- features
- solution model

Agenda

Acoustic emission test

Development plan

The Oil&Gas plant



Operate an Oil & Gas plant means dealing with:

- Massive CAPEX and high OPEX
- Safe and continuous operation
- Minimize unplanned shutdown/maintenance
- Minimize unpredicted/uncontrolled events to prevent catastrophic scenarios



Smart Valve market requirements



The global Oil&Gas market is demanding higher safety and reliable technological systems to:

- Provide a new set for the highest assets integrity assessment
- Valve life extension based on field data
- Minimize downtime operational costs & risks
- Minimize OPEX with optimal management of maintenance
- Data sharing with the organisations
- Maximize predictability also with the use of AI



SUBSEA CONTROLS
DOWN UNDER 2024

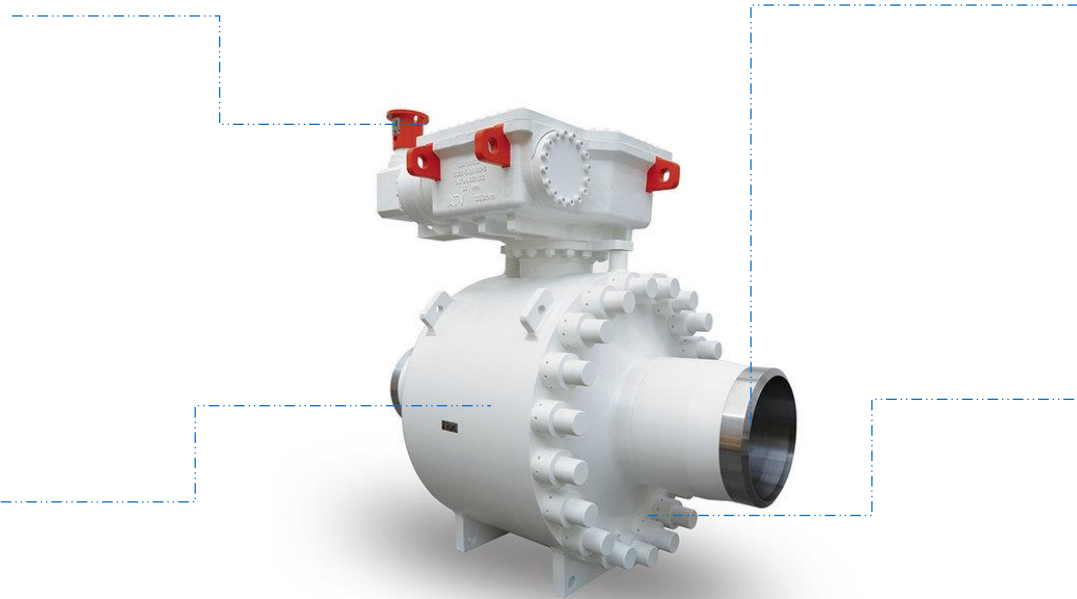
Valve failure modes



- Abnormal wear
- Fail while running
- Stuck



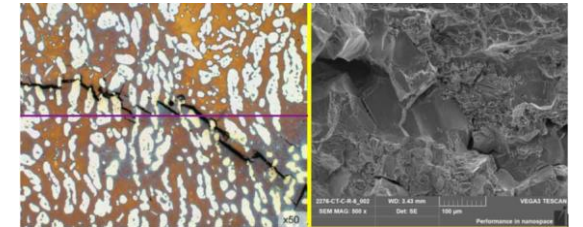
- External leakage



- Internal leakage



- Structural failure



Failure mode based on OREDA Offshore and Onshore Reliability Data.



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The Smart Valve System



Electric actuator
valve fingerprint
monitoring



Actuator
pressure
monitoring



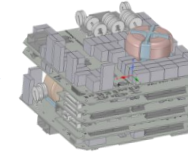
AE sensors for
flaws monitoring



AE sensors
erosion monitoring



Onboard
retrievable
electronics



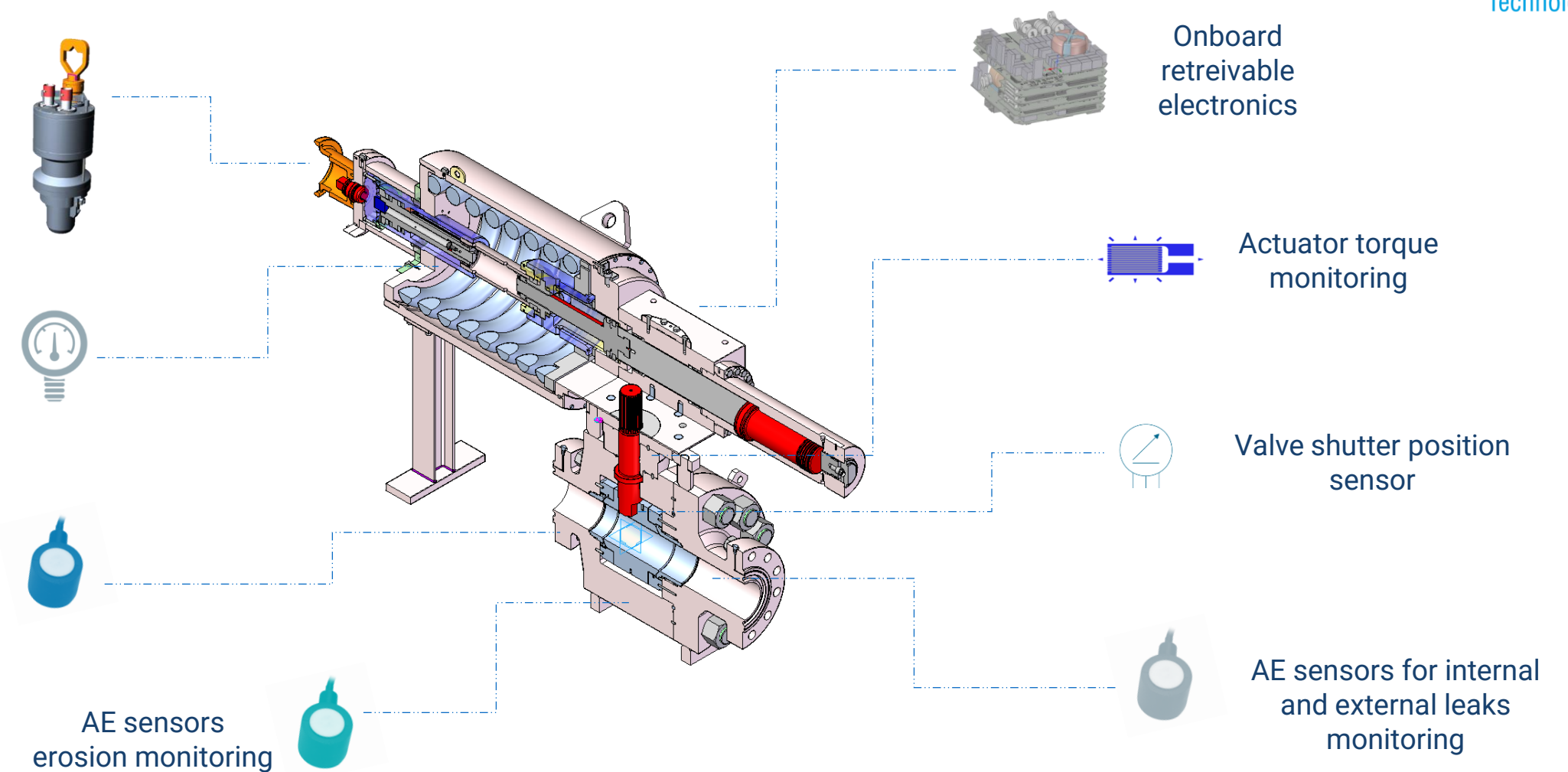
Actuator torque
monitoring



Valve shutter position
sensor



AE sensors for internal
and external leaks
monitoring



The Smart Valve features

PRODUCT FEATURES – VALVE AND SENSORS

- The sensor suite specifically optimised for each type and configuration of the valve
- Reliance where possible on not-intrusive sensors
- Sensors designed to be auto-recalibrated

PRODUCT FEATURES – ON-BOARD ELECTRONICS

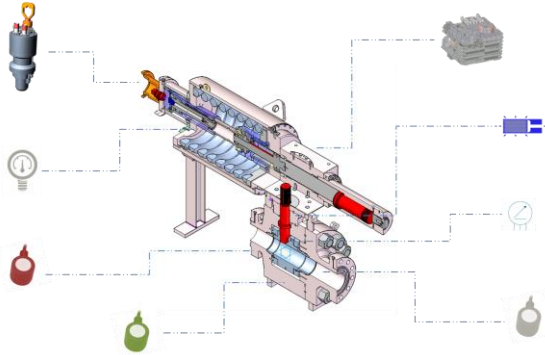
- Compact on-board data acquisition and communication electronics
- Powered with solar panels, batteries or wired
- Data acquisition with local processing, recording and basic diagnostic and predictive functions
- Communication of the valve health status
- Possibility to perform diagnostic tests



The solution model



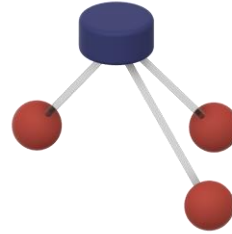
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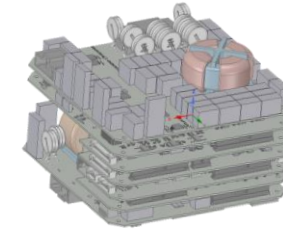
SMART VALVE

Real time
process
data
acquisition

SENSING NET



Real time data
collection & pre
conditioning



ON BOARD
EDGE COMP.

Data analysis
and control
Local warning
system

Real-time data sharing
and monitoring
Wi-Fi,
Ethernet,
etc.

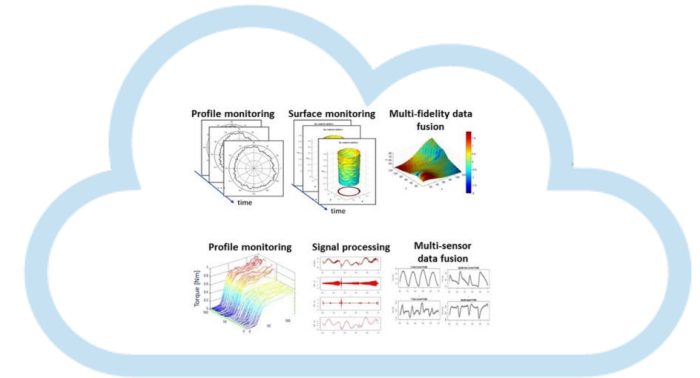
Threshold and
Limits updating
loop

Warnings and key
parameter/data
evaluation -
monitoring

Planned actions
Intervention
Process
feedbacks



CONTROL/MONITORING,
ACTION PLAN



CLOUD

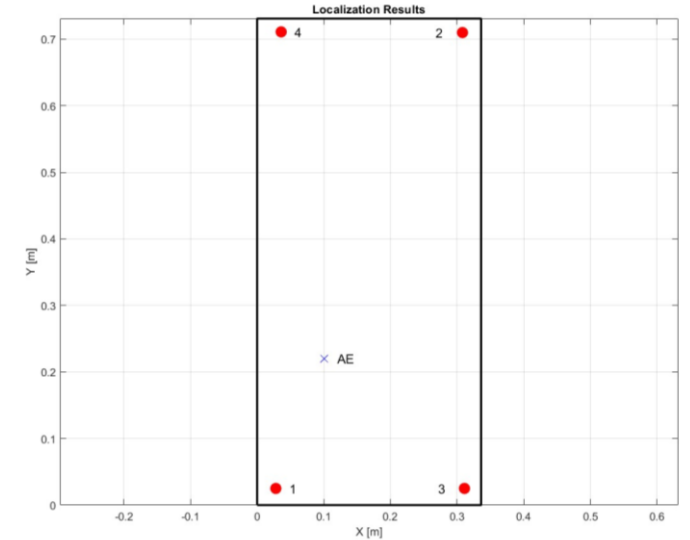
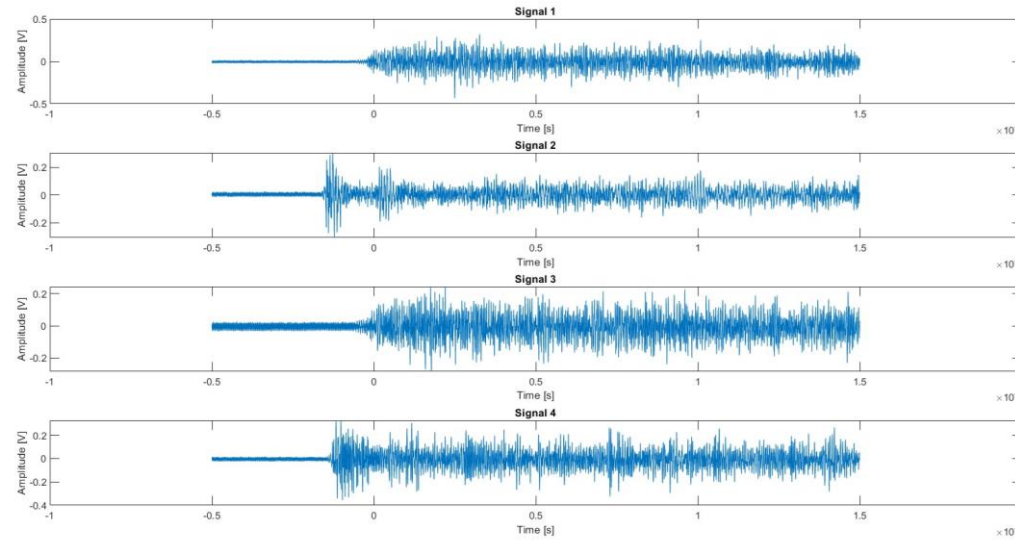
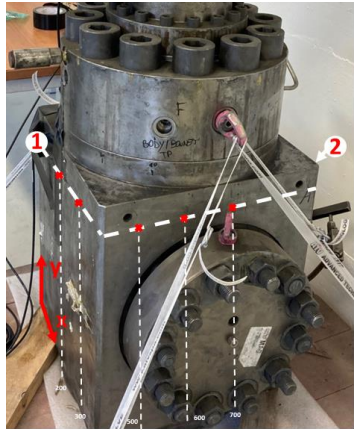


FIELD



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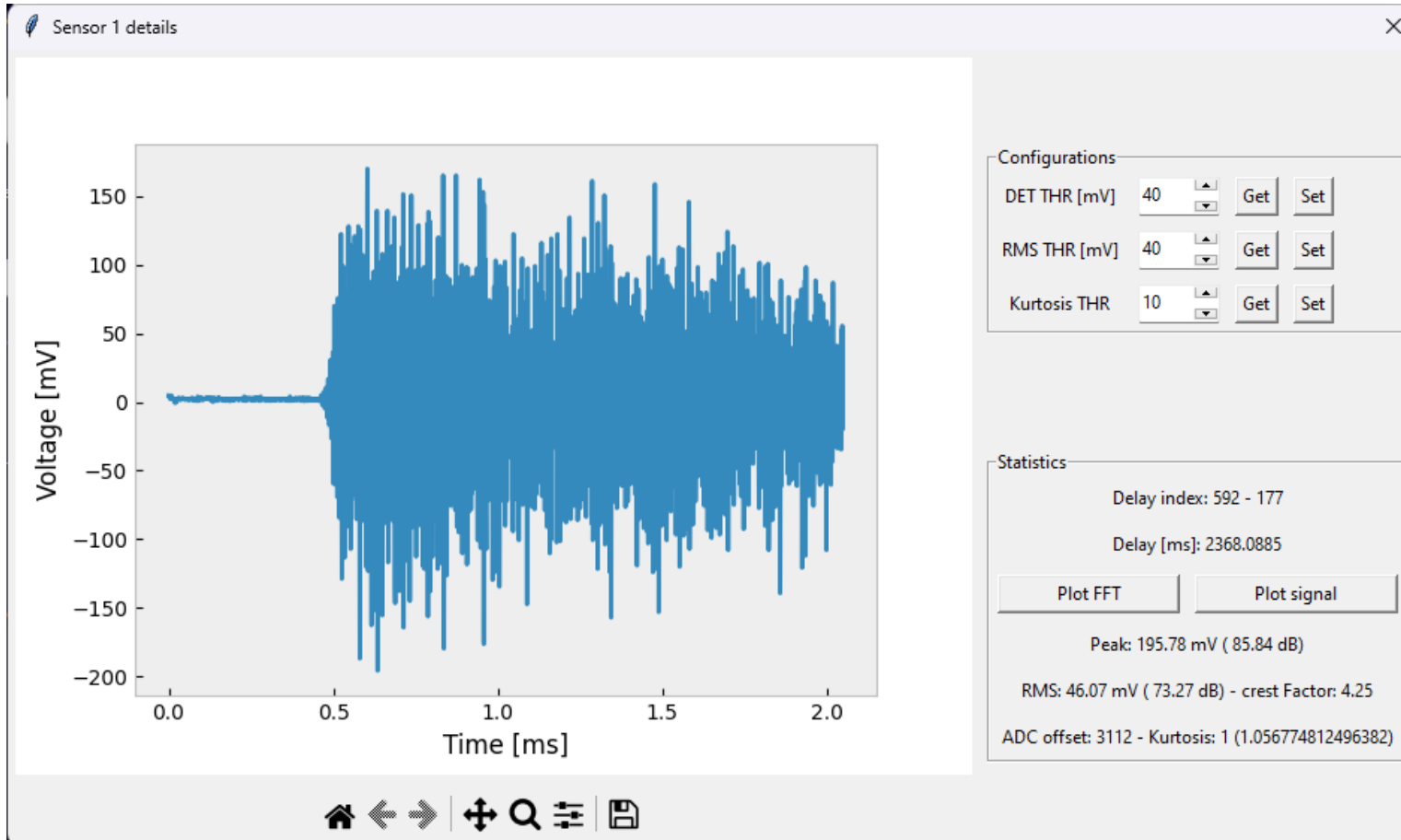
Acoustic Emission test





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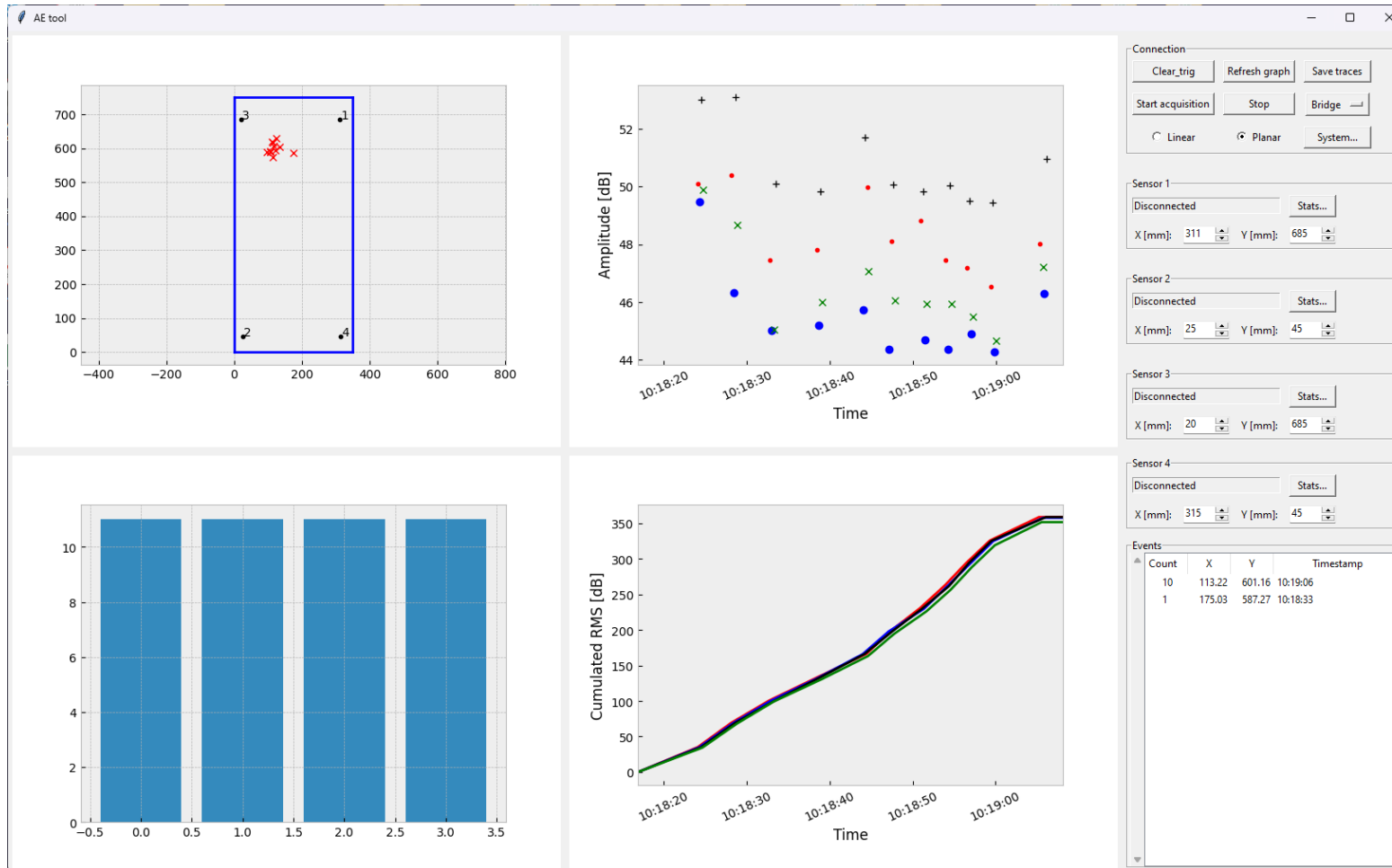
Acoustic Emission test





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Acoustic Emission test





The solution benefits



VALVE BENEFITS

- Functionality & working life confirmation and extension
- Enhanced planning of maintenance

PROCESS BENEFITS

- Real-time assets health status monitoring
- parameters acquisition
- Unpredicted and uncontrolled events prevention
- Extended production time in safe conditions



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Development Plan



SMART VALVE
program start

Created a model
for
flaw detection

AE test for flaw
detection

SMART VALVE
Final prototype

2024

2025

Studying a model
for leakage
detection

Realised an
electronic
system for AE

Valve prototypes
engineering and
production

SMART VALVE
Proof of concept



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