ESTEP 2025 Annual Event
28-30 October 2025
Udine (ITALY)

How decarbonisation, digitisation and circular solutions forge the sustainable European steel future?

Luca Cestari
Danieli Automation SpA
Product Manager

DRIVING QUALITY INNOVATION IN STEELMAKING THROUGH DIGITAL SOLUTIONS

ESTEP
European Steel Technology Platform

DIGIMET

DANIELI AUTOMATION

UNIVERSITÀ DEGLI STUDI DI UDINE
HIC SUNT FUTURA

INDEX

Overview

ABS Quality Vision
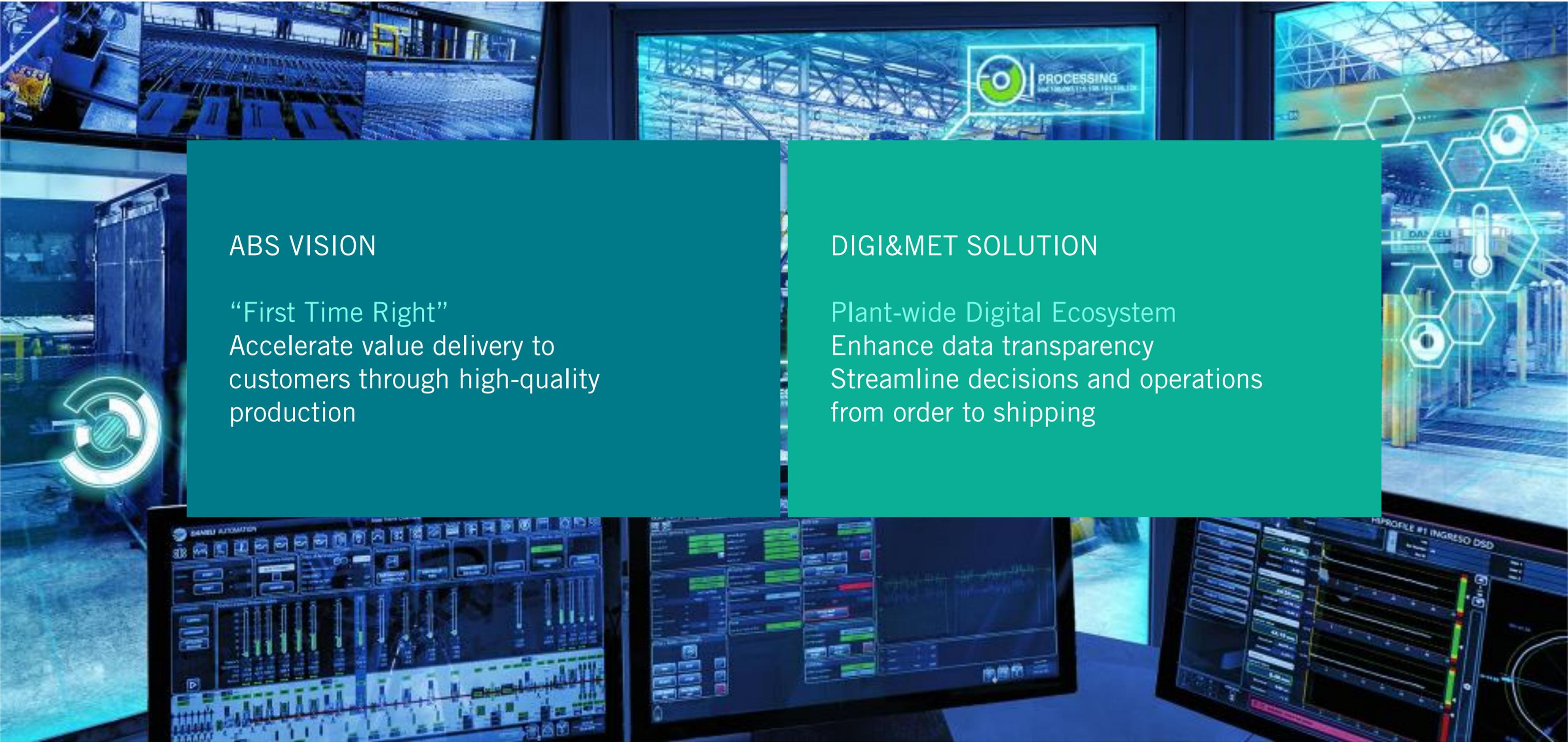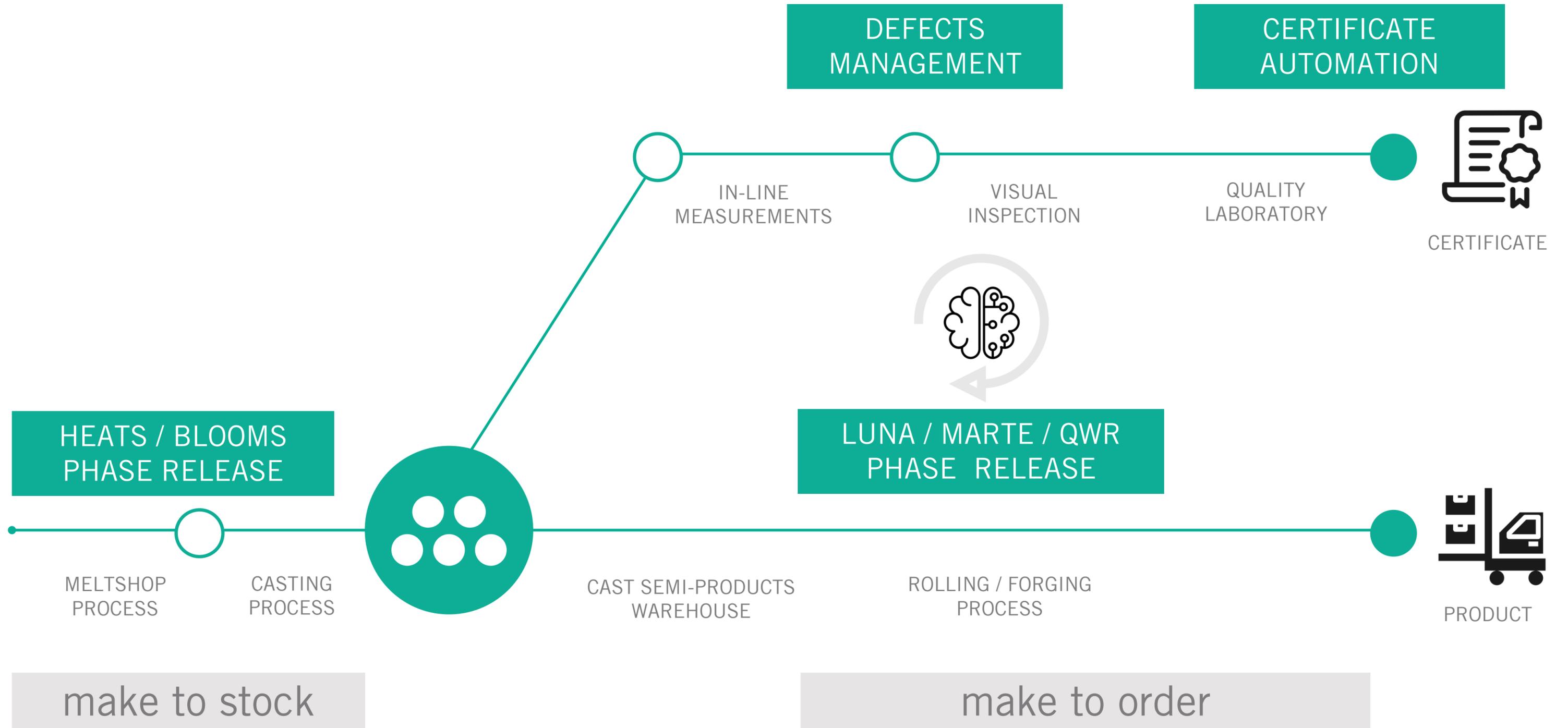
ABS VISION

"First Time Right"
Accelerate value delivery to
customers through high-quality
production

DIGI&MET SOLUTION

Plant-wide Digital Ecosystem
Enhance data transparency
Streamline decisions and operations
from order to shipping

ABS Project Roadmap

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DEFECTS MANAGEMENT

CERTIFICATE AUTOMATION

IN-LINE MEASUREMENTS

VISUAL INSPECTION

QUALITY LABORATORY

CERTIFICATE

HEATS / BLOOMS PHASE RELEASE

LUNA / MARTE / QWR PHASE RELEASE

MELTSHOP PROCESS

CASTING PROCESS

CAST SEMI-PRODUCTS WAREHOUSE

ROLLING / FORGING PROCESS

PRODUCT

make to stock

make to order

Centralized process control
Unify operational workflows and data within a single QMS Platform

Automated production oversight
Standardize and automate phase release across production lines

Uniform operational procedures
Promote consistency in work practices across teams and sites

Consistent data flows
Ensure alignment between automation and manual operations

Seamless ecosystem integration
Connect effortlessly with existing IT/OT infrastructure

Scalable & customizable
Adapt to evolving operational needs with flexible configuration

User-friendly interfaces
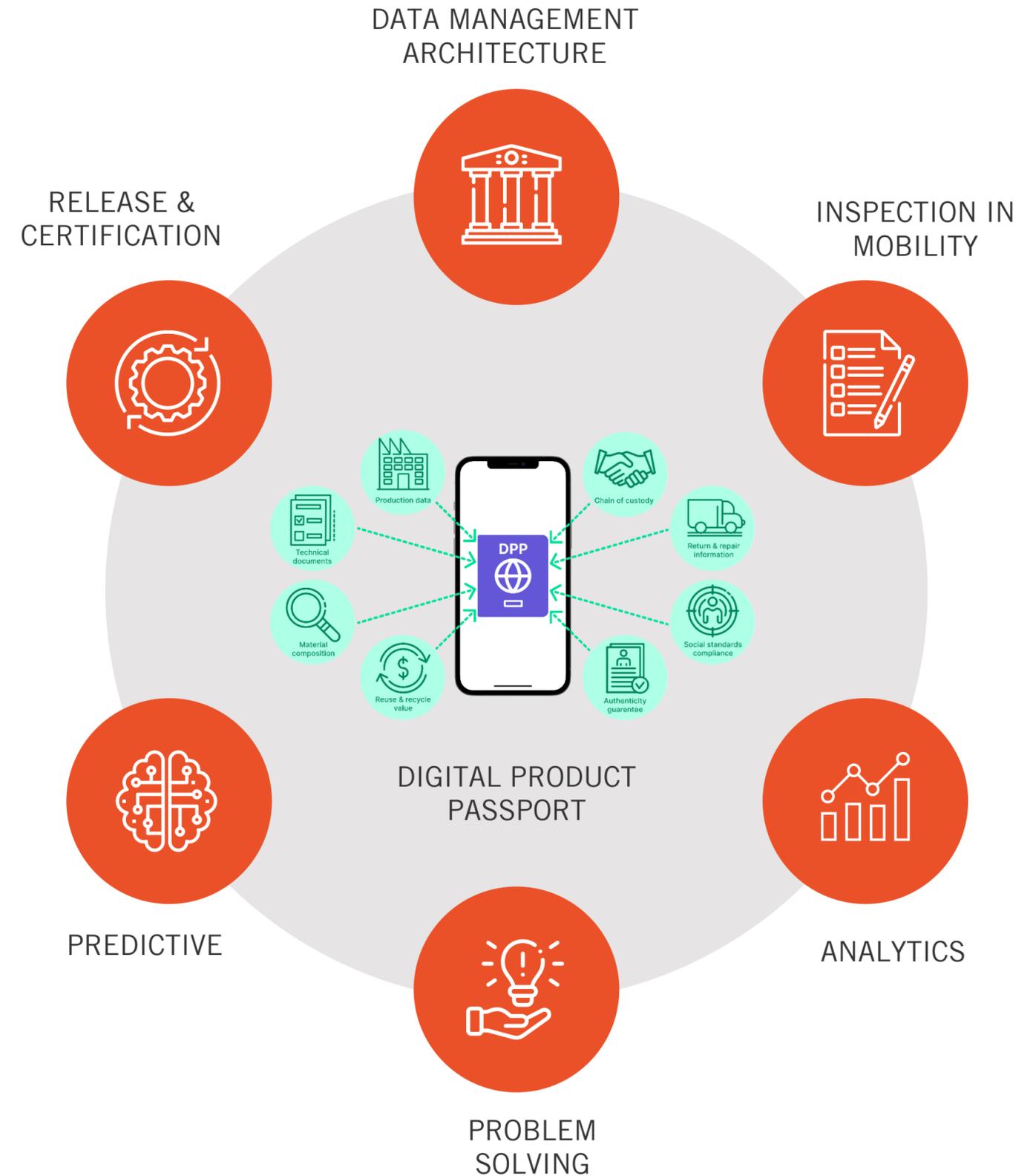Access intuitive web and mobile GUIs designed for ease of use

Quality Execution System

Digital Solution Implementation

Digital Solution Steps

1 DATA PLATFORM
Eliminate data silos to turn information into actionable knowledge

2 QUALITY OPERATIONS
Trace product value chain and support decisions to improve yield and lead time

3 AI TAILORED SOLUTIONS
Leverage AI and data science to boost plant capabilities in complex contexts

DATA MANAGEMENT
ARCHITECTURE

RELEASE &
CERTIFICATION

INSPECTION IN
MOBILITY

DIGITAL PRODUCT
PASSPORT

PREDICTIVE

ANALYTICS

PROBLEM
SOLVING

WHY

✓ Data synergy from various plant sources

✓ Knowledge sharing and transparency

✓ Unlock insights and AI solutions

WHAT

✓ Data Management Platform with IoT architecture to govern plant data lifecycle

✓ Scalable, hybrid cloud infrastructure

HOW

✓ Ingest, clean, transform, process, analyze and visualize plant data in a common portal

✓ Support unified analytics across production, process, and quality domains

✓ Govern deployment and monitoring of AI use cases with MLOps

15
Process lines

50
Data flows

**1400**
Process variables

5 GB/day
Data throughput

WHY

✓ Automated quality grading: streamline product phase release and material certification

✓ Data-informed material usage decisions: leverage data for fast decision making

✓ Integration with PCS process control systems and ERP order management workflow

WHAT

✓ Quality Operations module which combines expert metallurgical know-how with data-driven through-process rules

HOW

✓ Quality control plans based on real time process data, laboratory tests, automatic and manual inspection results
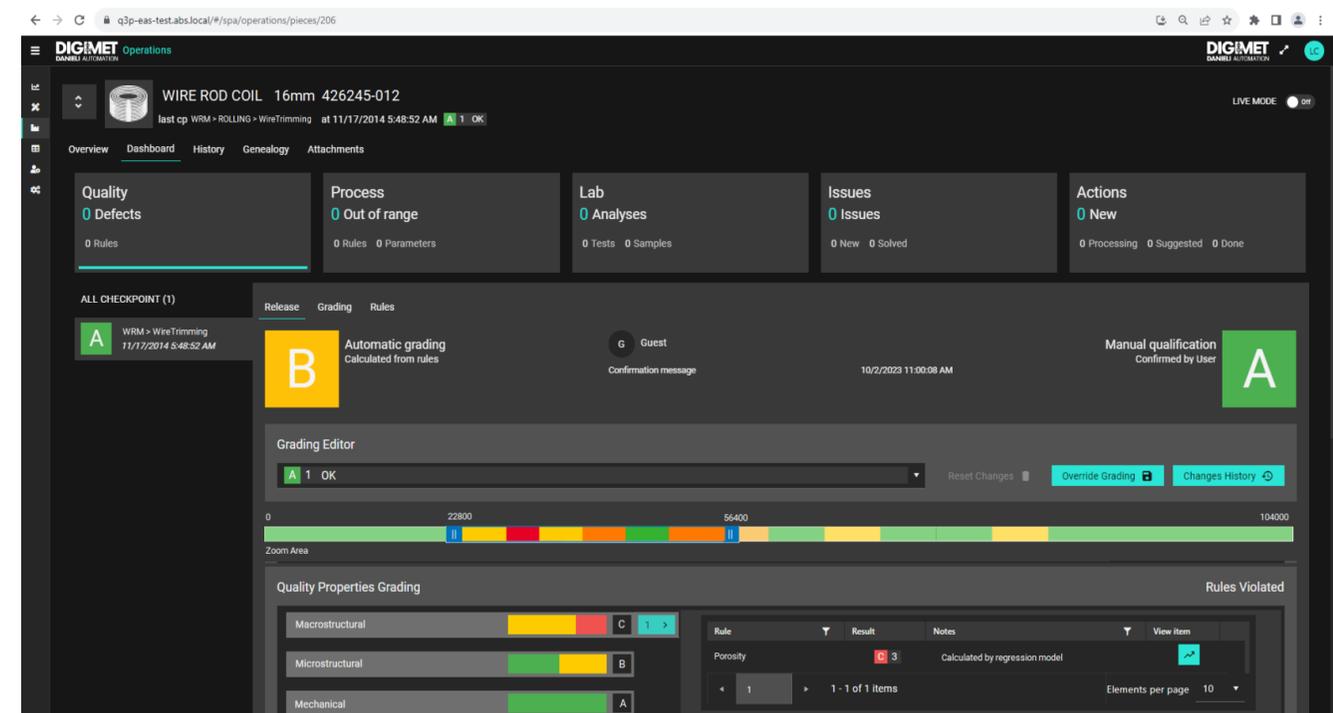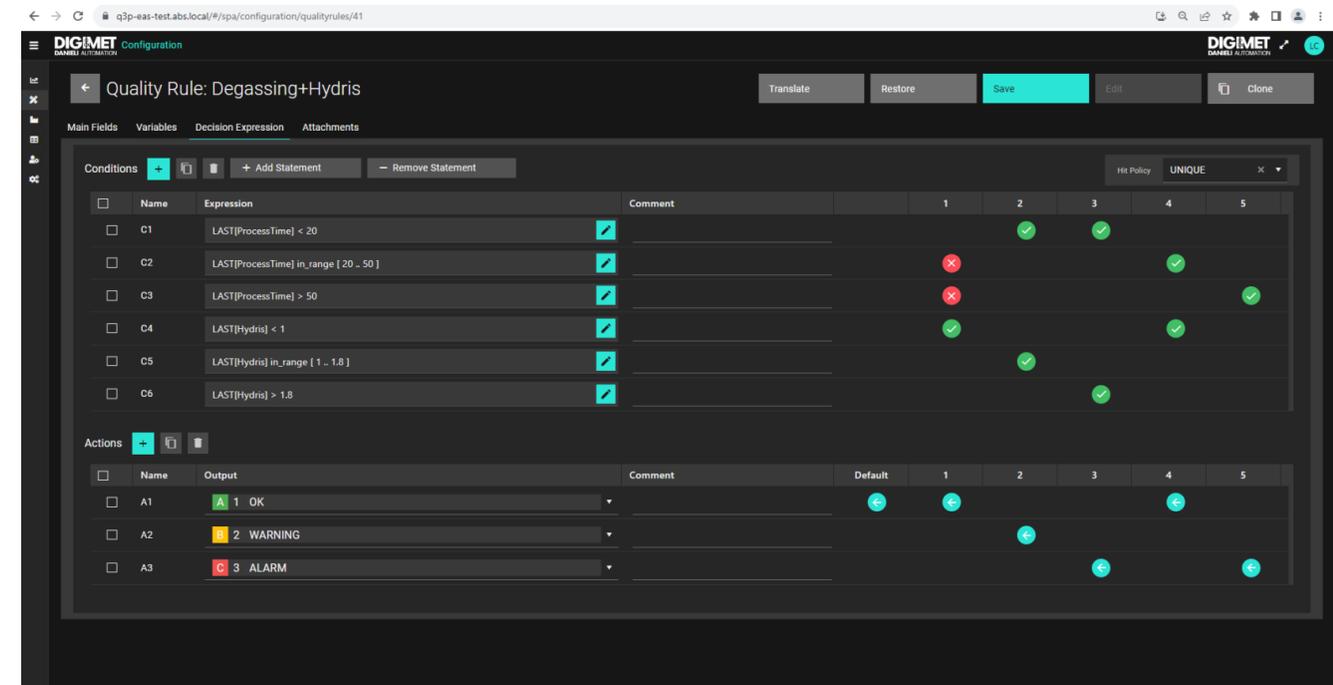
WHY

- ✓ Efficient and traceable inspection process
- ✓ Structured data management
- ✓ Flexible and unified working method

WHAT

- ✓ **Quality Inspection** Mobile App for digitalization of visual inspection tasks and instrumentation measures

HOW

- ✓ Inspection Job checklist management
- ✓ Product barcode-based identification
- ✓ Measurements mobile data entry with multimedia uploads and voice notes
- ✓ Submission and approval for quality control
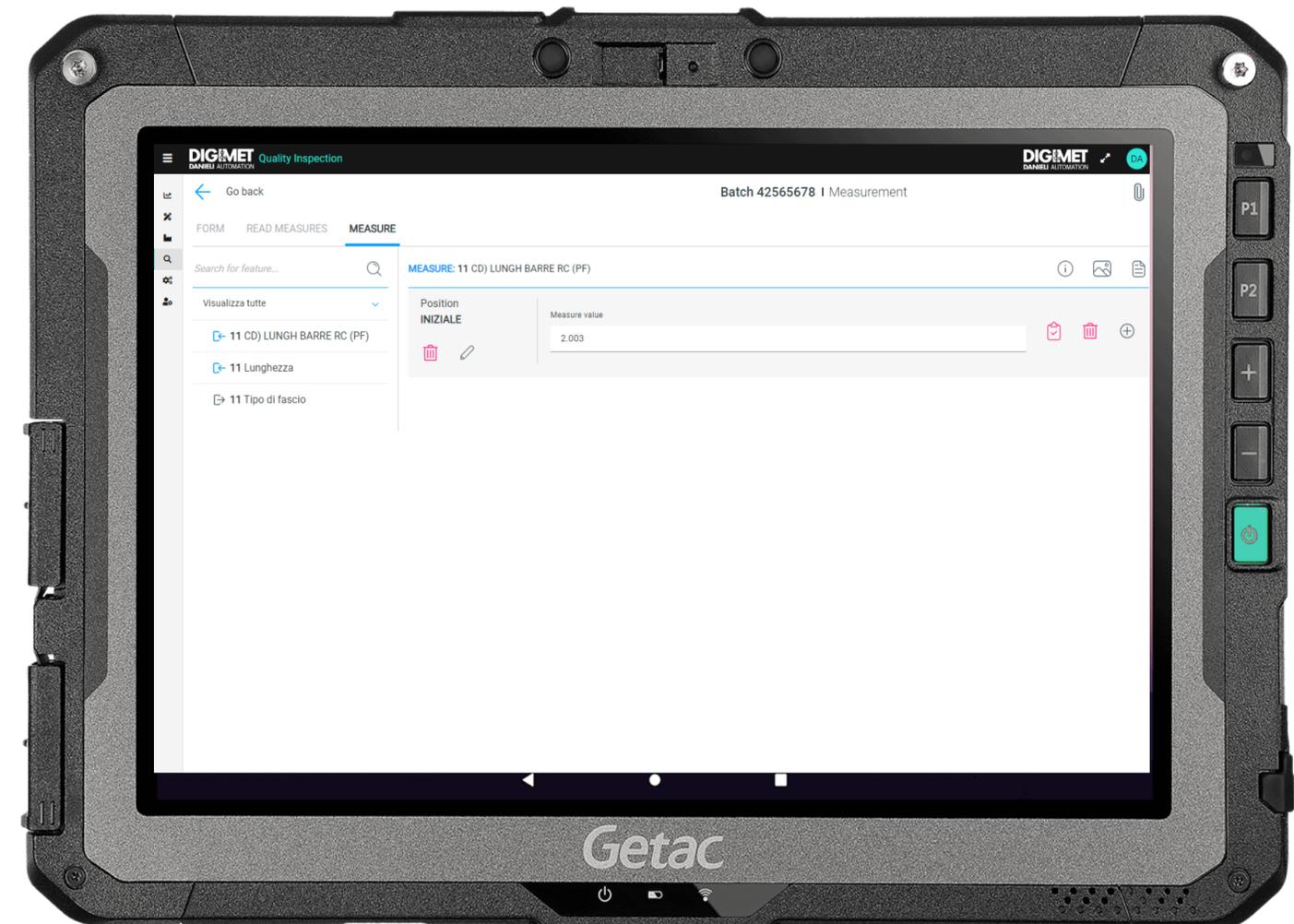
WHY

✓ Support hands-free bar inspection and defects confirmation

✓ Remove the need for spray painting products in rolling line

WHAT

✓ **XR Virtual Mapping** for rolled bars with defects identification

HOW

✓ Helmet with smart goggles integration

✓ Product digital twin with automatic defect localization

✓ Integration with NDT and process control system

WHY

✓ Empower process engineers with actionable insights for decision-making

✓ Drive continuous improvement with enhanced understanding of process

WHAT

✓ Quality Intelligence for advanced analytics and decision support

HOW

✓ Analyze complex datasets to assess process and corrective actions

✓ Prototype and model in a collaborative data science workspace

✓ Apply PDCA methodology to identify root causes and implement solutions

AI Use Cases

Data Science Integration

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AI USE CASES

Tailored AI solutions leveraging process know-how, data science and cutting-edge models governed through MLOps framework

Strategic Decision Support

Empower operational decisions with predictive capabilities

Process Control Reliability

Improve process control consistency across diverse production conditions

| 1	2	3	4	5
Design Thinking	**Data Collection**	**Model Development**	**Testing and Validation**	**Deployment and Monitoring**
Identify opportunities Explore the most promising solutions	Gather relevant dataset for the selected use case	Implement, train, measure and refine AI models	Test and validate the models with domain experts	Release in production and integrate

WHERE

✓ CC3 "Hercules" Continuous Casting Machine

WHY

✓ Enhance precision and consistency in bloom cutting

WHAT

✓ Data collection with 3D scan and high-speed camera

✓ Computer vision and ML for dimensional analysis and cut defects identification and classification

✓ Optimization of oxy-fuel torch flame parameters

RESULTS & BENEFITS

✓ Defect reduction through real-time monitoring

✓ AI-driven adjustments improving cutting precision

✓ Early detection of process drifts to support predictive maintenance
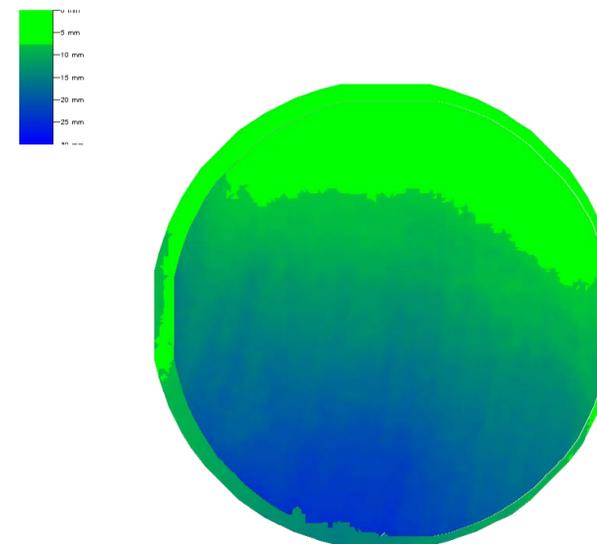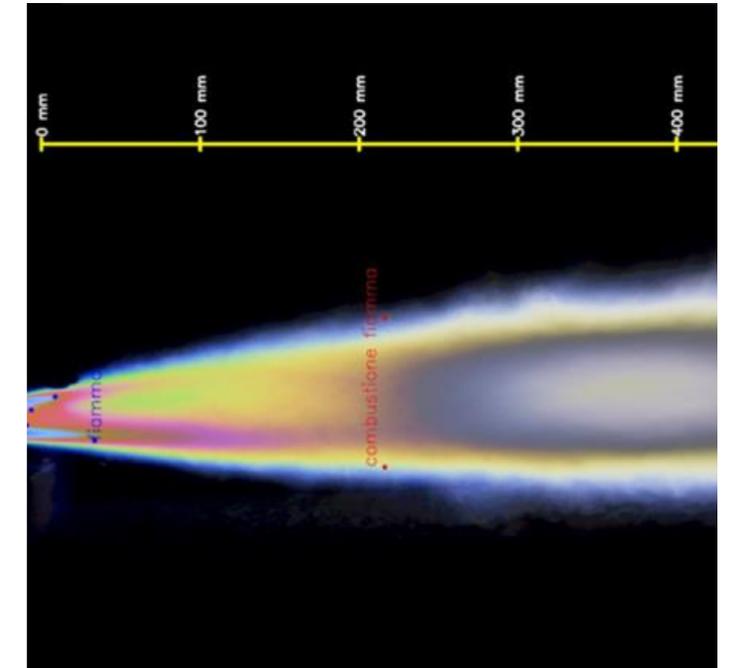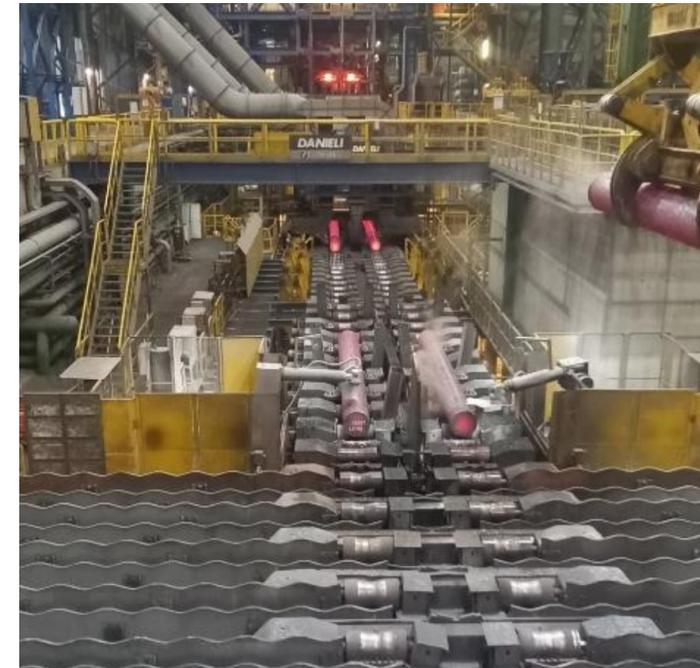

BEFORE
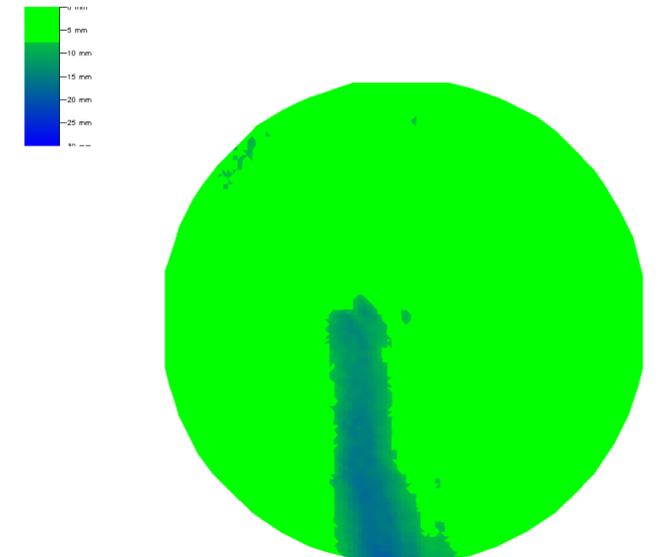
NOW

WHERE

✓ QWR Quality Wire Rod Mill

WHY

✓ Support process engineers in design and optimization of steel grades and rolling practices

WHAT

✓ Prediction of mechanical properties (Rm, A, Z)

✓ Offline What-If Analysis and Optimization module

✓ Identification of optimal chemical composition, temperature evolution and cooling strategy setup

RESULTS & BENEFITS

✓ Process Design: Reduce analysis time and resources to define steel grade and process setup

✓ Reduce uncertainty of estimations thanks to statistics Bayesian modeling approach
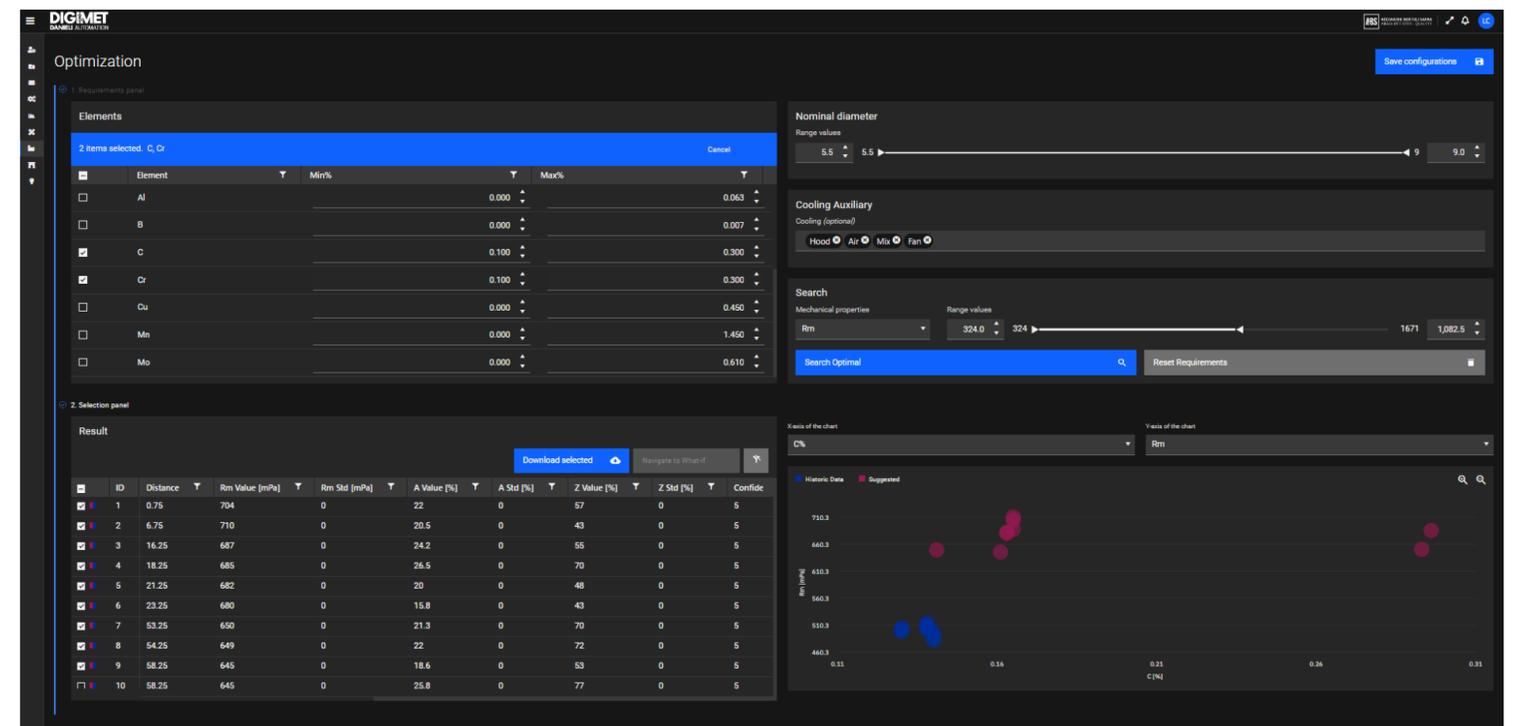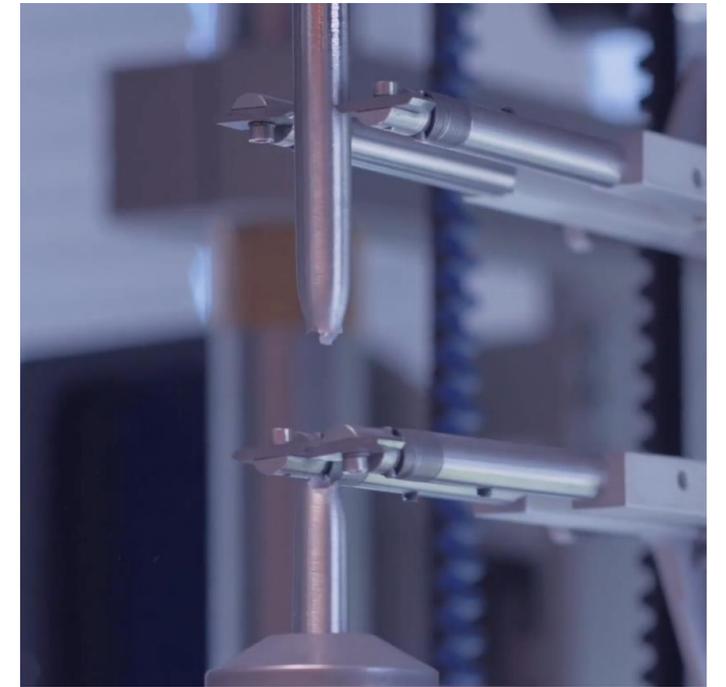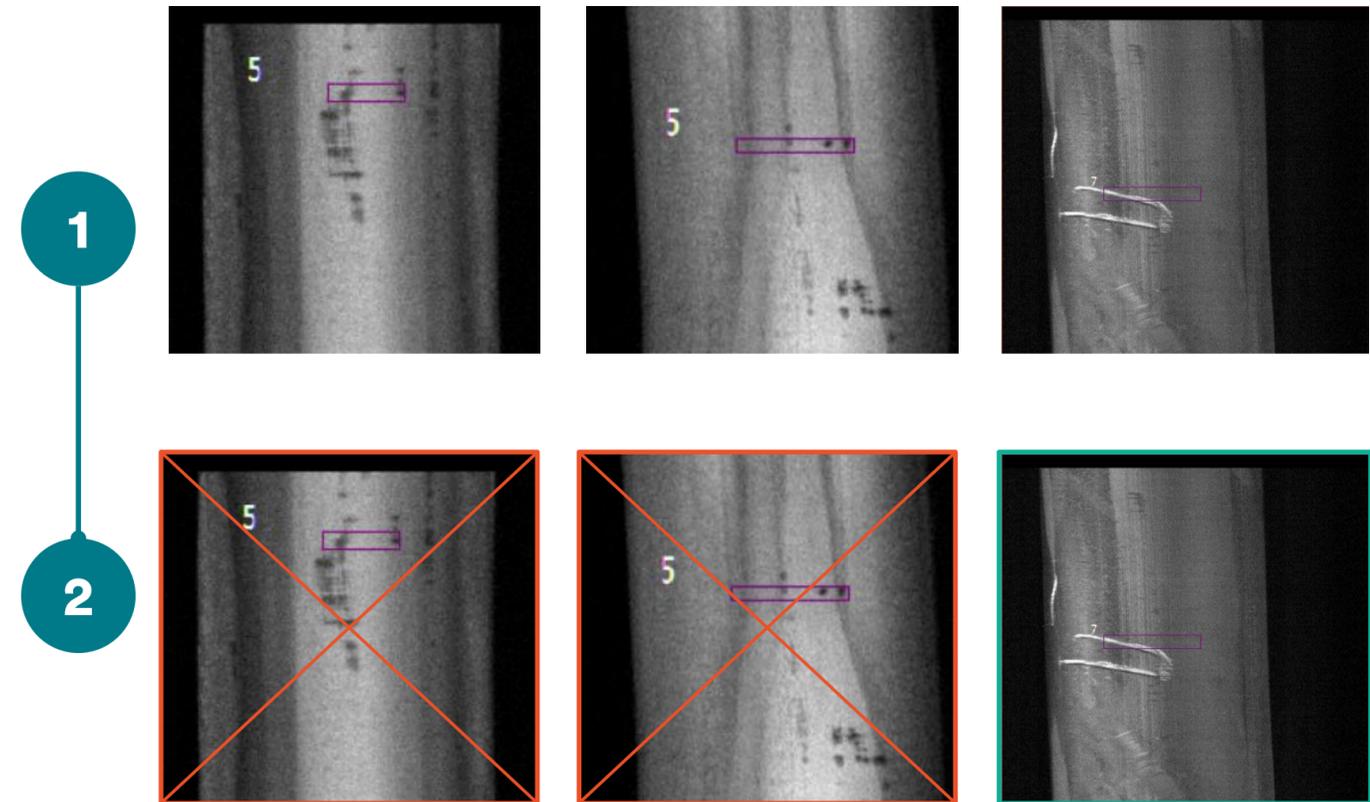
WHERE
✓ QWR Quality Wire Rod Mill

WHY
✓ Improve HiNSPECT accuracy for inline detection of surface defects during rolling
✓ Reduce false positive rate of the existing system

WHAT
✓ Deep learning add-on to filter out false alarms
✓ Seamless integration with automated post-processing

STEPS
1. Real-Time Detection: base system identifies candidate defects with high speed
2. False Detection Filtering: AI module classifies defects as True or False within seconds

96%
False positive defect reduction

< 1 sec
AI Post-Processing computing time

WHERE

- ✓ QWR Quality Wire Rod Mill

WHY

- ✓ Support maintenance operators to collect quickly key information and recommend appropriate actions

WHAT

- ✓ Virtual assistant specifically designed for plant maintenance operations
- ✓ Fine-tuned LLM with RAG on equipment manuals, maintenance reports and CMMS SQL database
- ✓ Chatbot with text and voice-based interactions

RESULTS & BENEFITS

- ✓ Improved efficiency with faster access to records
- ✓ Reduced downtime with AI-driven insights
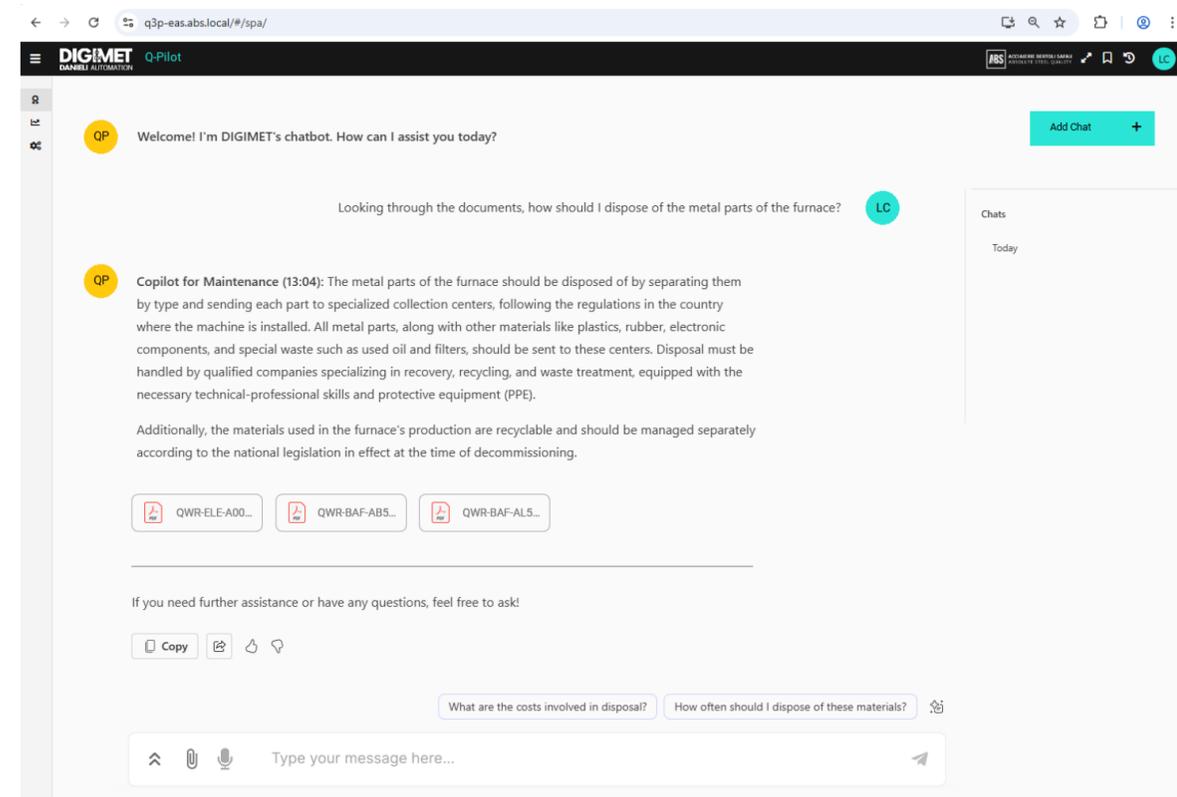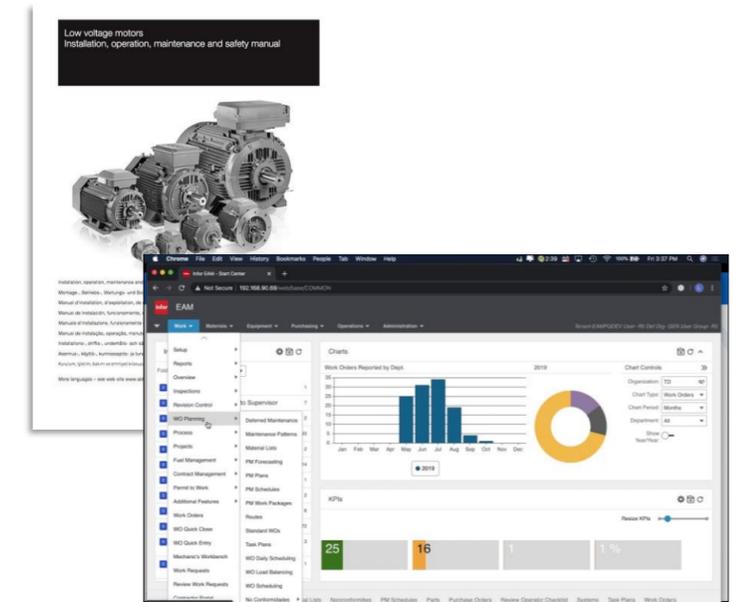
Conclusions

> Unified Workflow: Improved operational efficiency for quality control and root cause analysis

> Timely and Accurate Assessments: Streamlined approach reducing potential for human error

> Reduced Process Variability: Alignment with technical specifications through correlation of critical parameters

> Enhanced Data Analysis: Analytics supports process optimization and continuous improvement with AI

Roland Berger

QUESTIONS
& ANSWERS