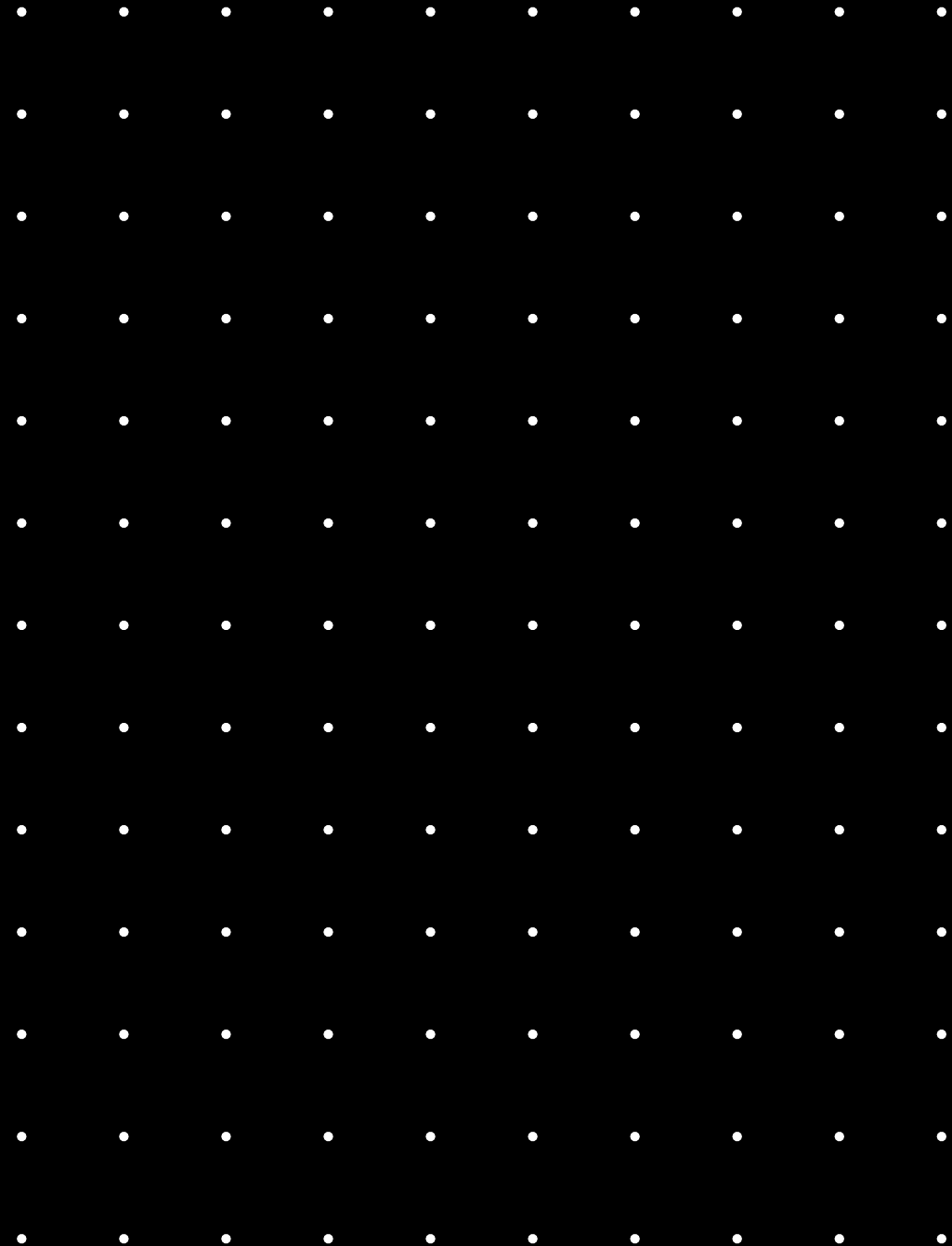




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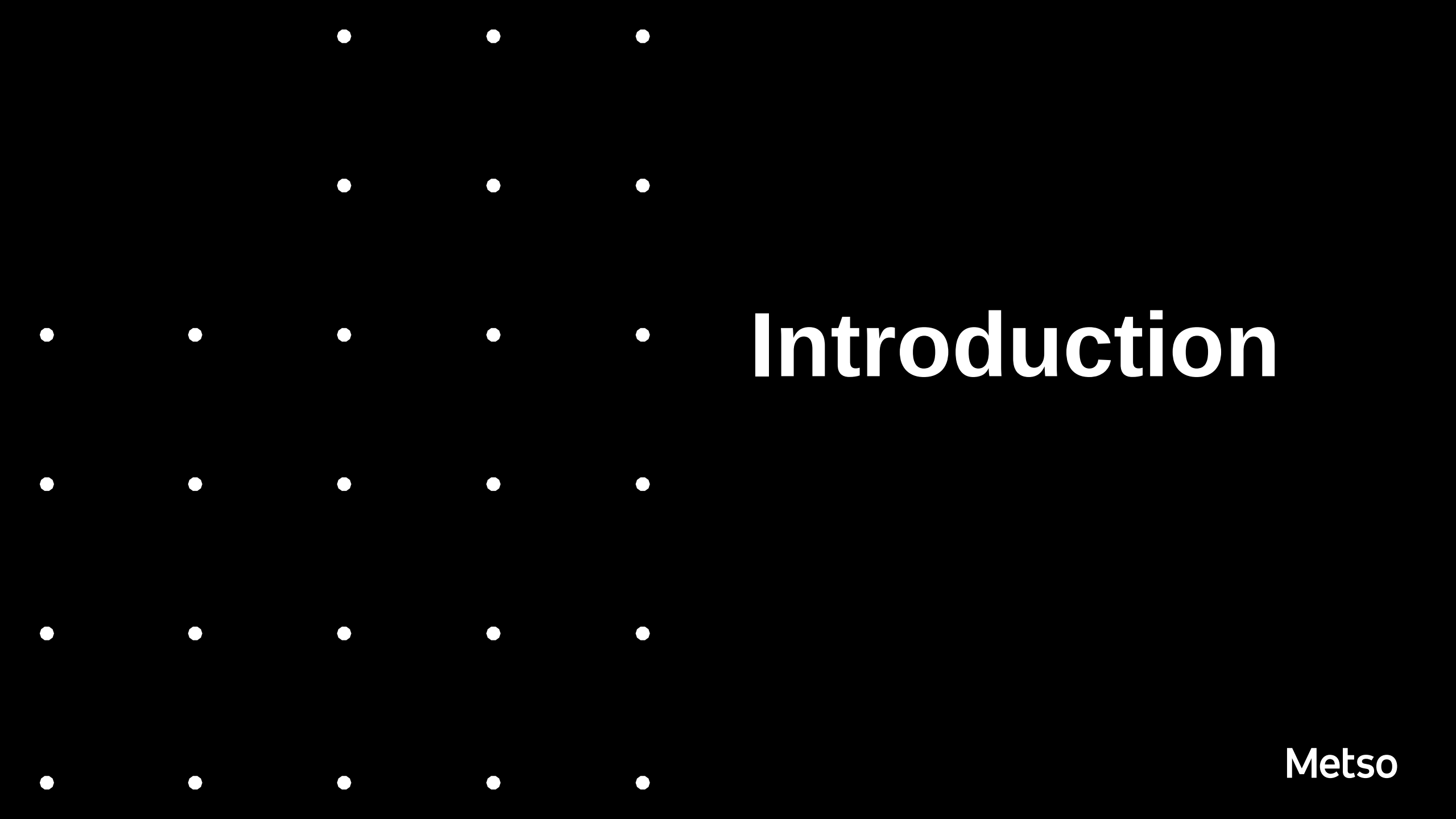
Digital solutions - gas cleaning and sulfuric acid plants

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Agenda

- Introduction to Digitalization
- Process know-how – the basis for Digitalization
- Digital Solutions
 - Gas Cleaning
 - Sulfuric Acid
- Conclusions

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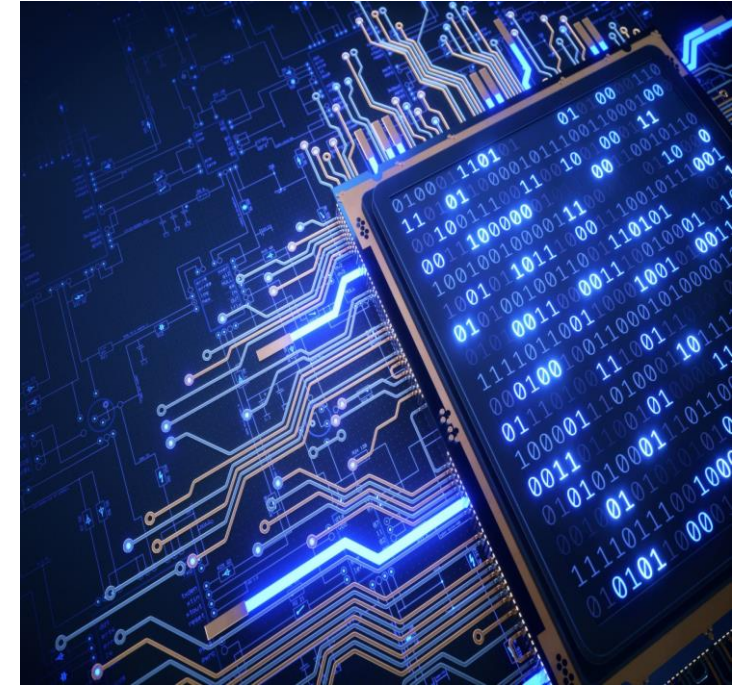
Introduction

Why digitalization matters

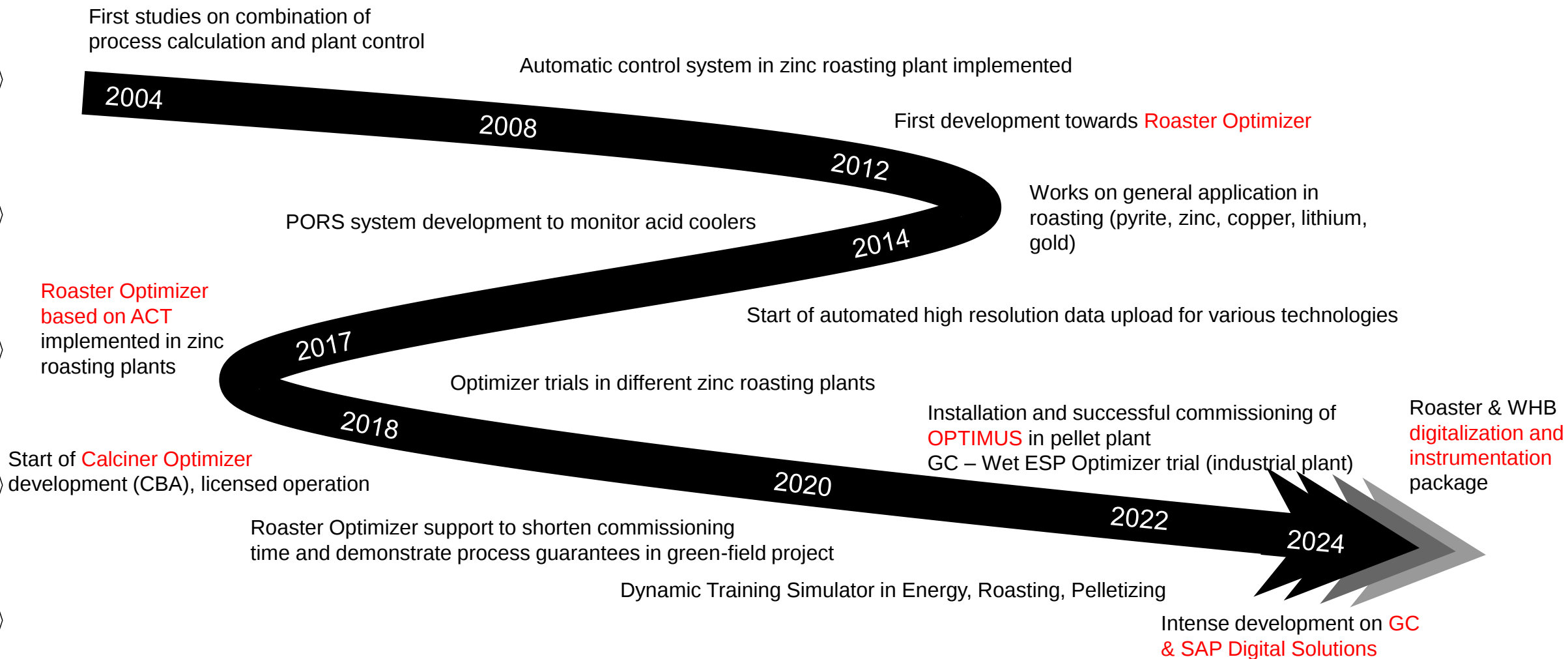
Every operation is targeting maximum plant efficiency

Digitalization is a key to overcome day-to-day operational challenges:

- Operational consistency
- Reduce risk
- Overcome maintenance hurdles and productivity loss by process plant and equipment monitoring
- Providing the right information at the right time to take informed decisions
- Accurate, neutral, and unbiased reporting
- Remote locations and lack of skilled personnel



History

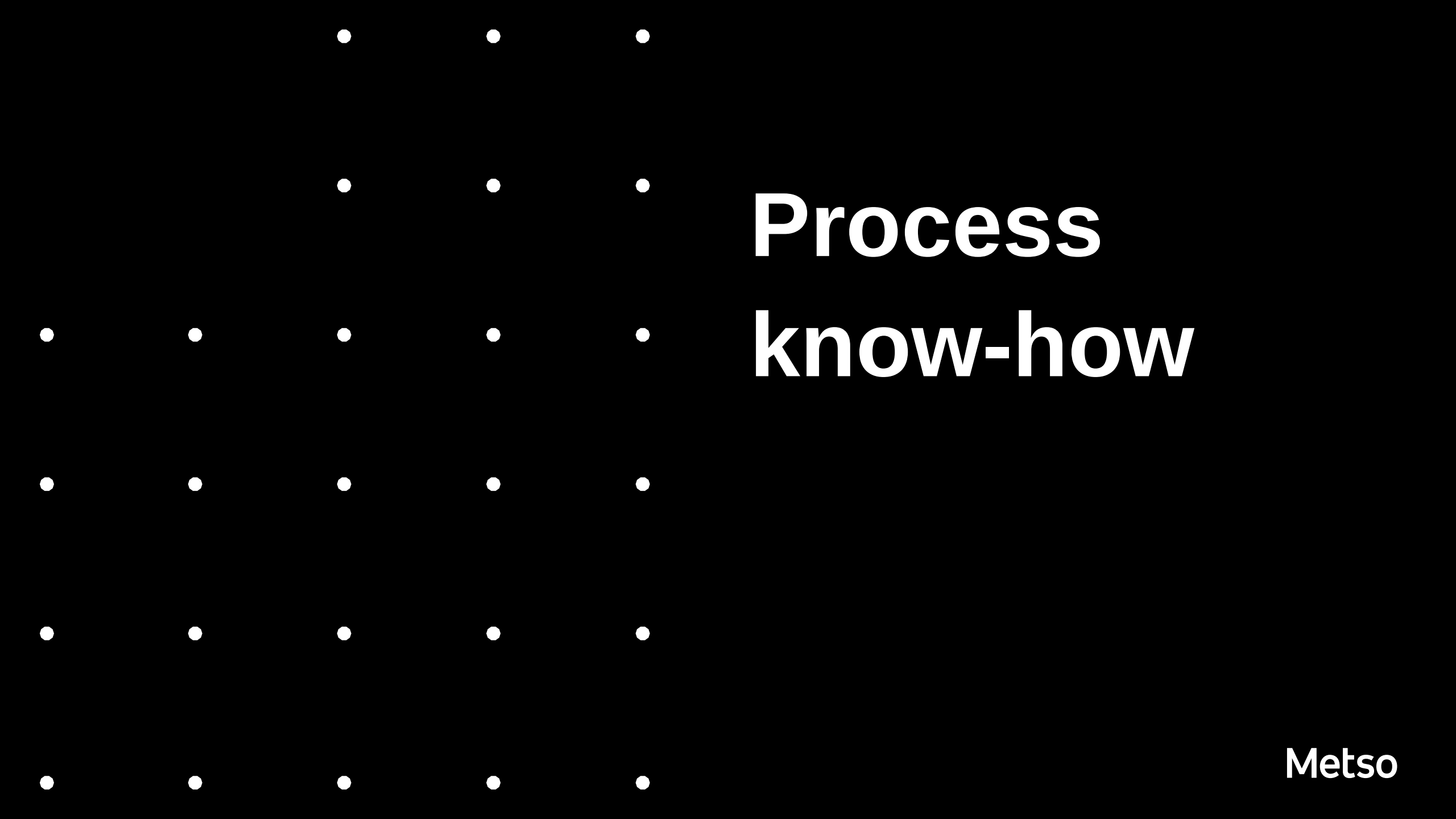


When is the right time to go digital?

The right time to go digital is NOW

- The technology is available to implement Digi in new and existing plants
- On existing plants Digi can be implemented without the need to invest in new equipment or new instrumentation
- The journey can start now - with any plant, at any location - there is no reason to wait



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Process know-how

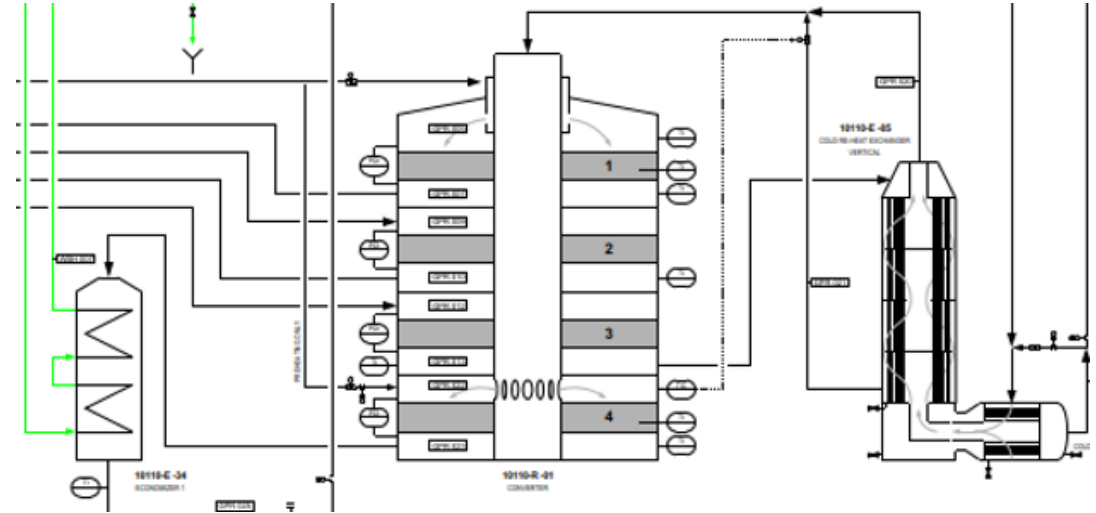
Process know-how is the basis for Digitalisation

- Over 90 years experience in H_2SO_4 technology
- More than 650 acid plants built worldwide based on sulfur combustion, Smelter and Roaster off-gas
- Variety of proprietary technologies/equipment is available (HEROS, LUREC, LURO burner, SX material solutions, tail gas treatment, mercury removal, wet gas cleaning, scrubbing)
- Plant sizes from (modular) 250 tpd to 5000 tpd (S-based) implemented and in successful operation
- Industrially proven digital optimizer solutions



Integration into daily operation

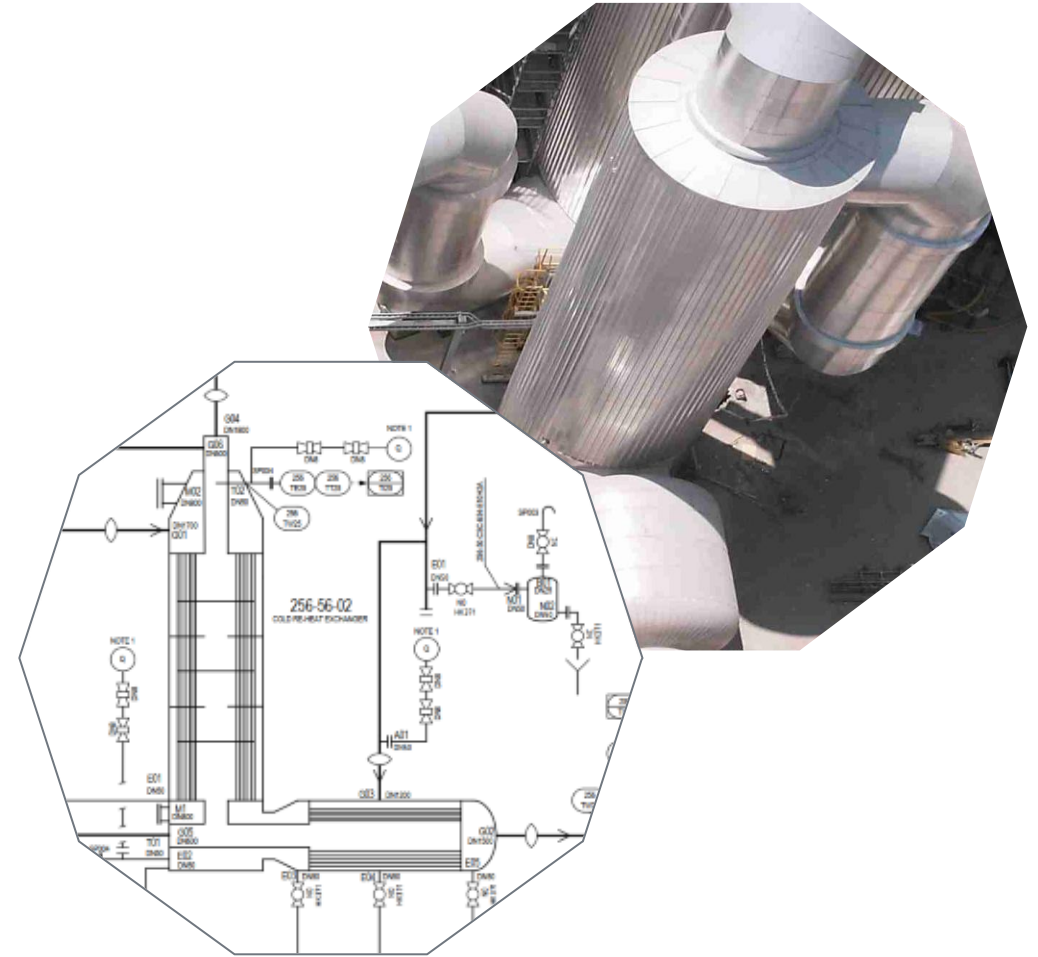
- Process simulation models are available
- Our interfaces allow us to include process models into daily operational routines
- Simulation results are available online and within short time
- Results are accessible to operating personnel as well as on-site engineers/managers



Screenshot from process simulation model around the converter section – the simulation model serves as the basis for the digital solutions

New plant instrumentation & equipment integration

- Considering Digitalization early in a project allow for optimal instrumentation selection and placement
 - Evaluate the requirement for equipment monitoring during early phase of a plant modernization project
 - Integrate digitalization in CAPEX projects at the earliest possible time
- **This will result in SMART equipment**



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Digital Solutions

Gas cleaning & sulfuric acid

Plant area split of Metso digital solutions



Upstream metallurgical plant

- Zinc roaster
- Pyrite roaster
- Smelter

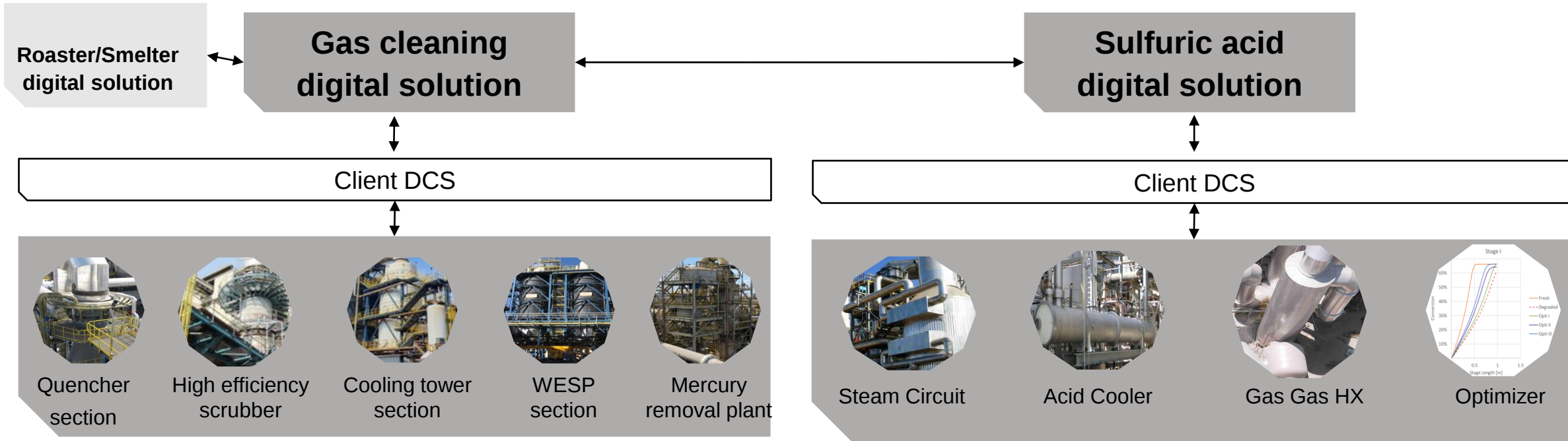
Sulfuric acid plant

- Absorption towers
- Converter
- Heat exchangers
- Acid cooler

Wet gas cleaning

- Quencher section
- High efficiency scrubber
- Wet ESP
- Mercury removal plant

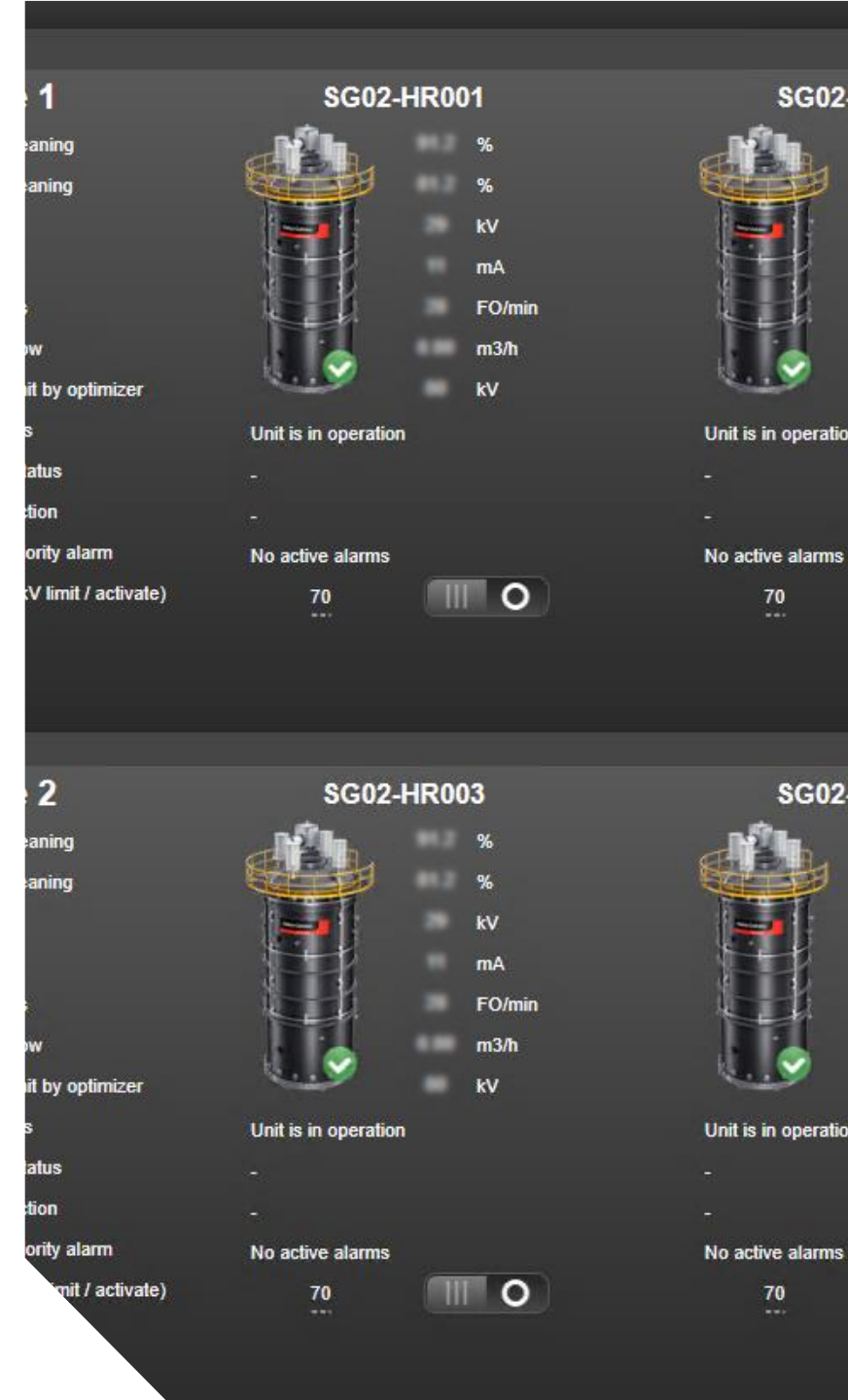
Overview



- **Gas cleaning:** WESP Optimizer, High Efficiency Scrubber Optimizer, Mercury Removal Plant Optimizer, Process Advisor
- **Sulfuric Acid:** Health monitor, Optimizer, Sequence assistant

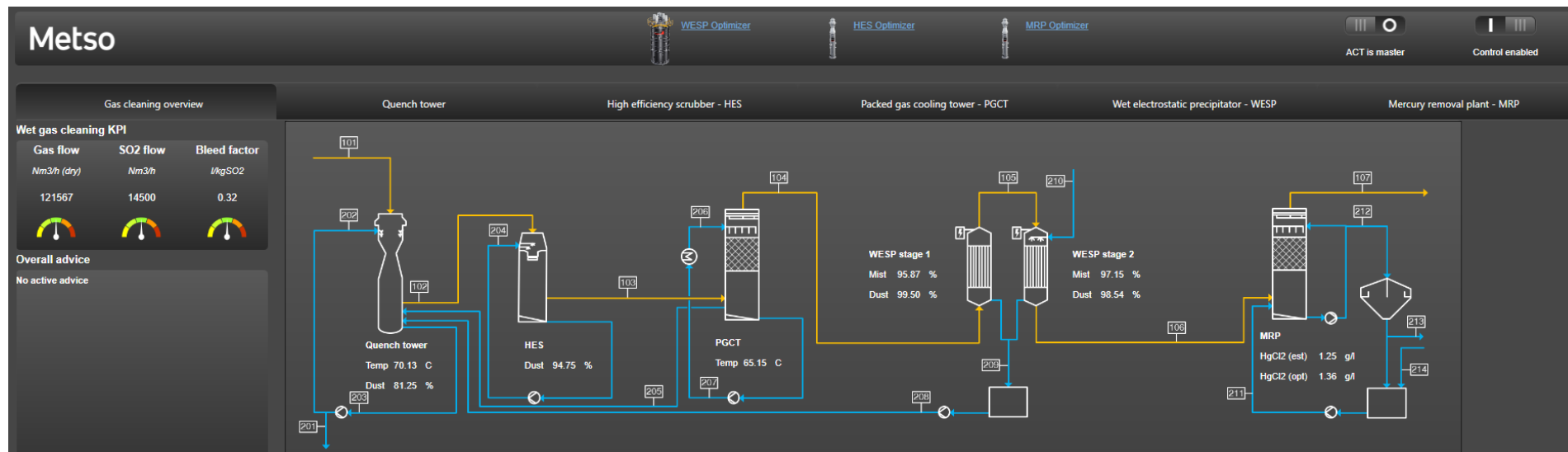
Gas cleaning – Wet ESP Optimizer

- Active control of WESP operating parameters
- Three main functional modules
 - Automated start-up
 - Optimization during stable operation
 - Health monitoring
- Estimation of cleaning efficiency
- Operationally tested 2022



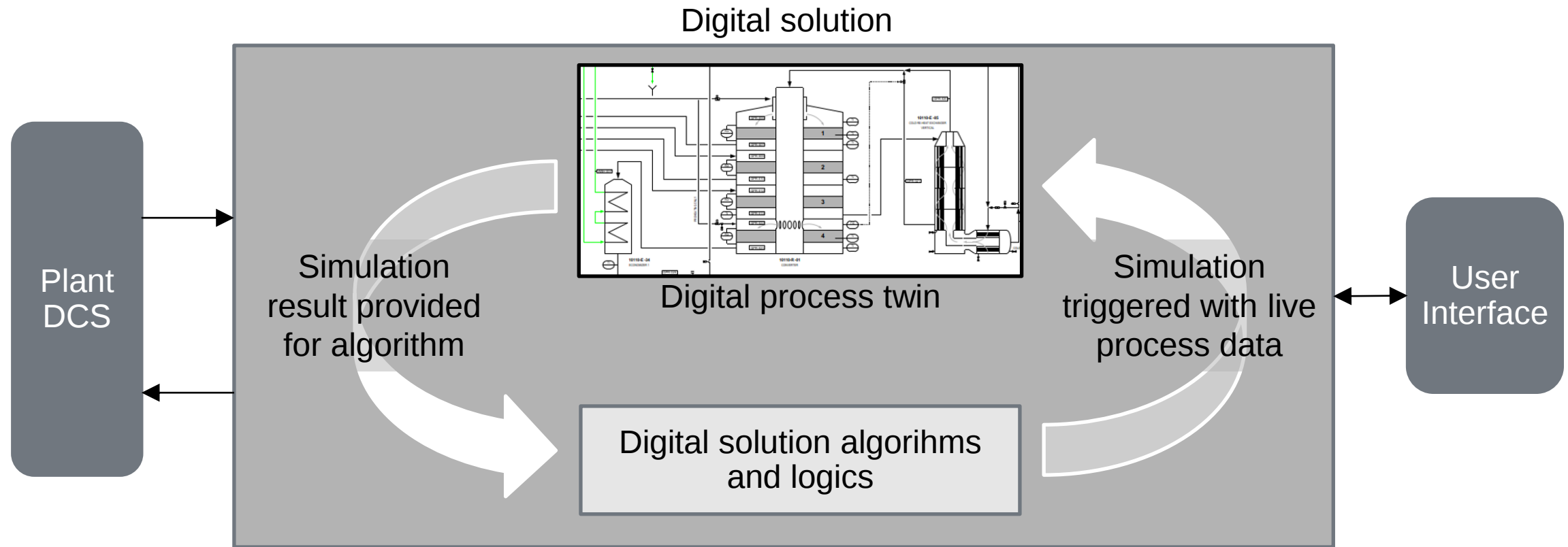
Gas cleaning – process advisor

- **Process advisor** as central part of each gas cleaning digital solution delivery
 - Tailored to plant and process flowsheet
 - Keeping multiple gas cleaning modules together
- Based on operational targets
- Provides: Process advice for operation, Health monitoring, informative user interface

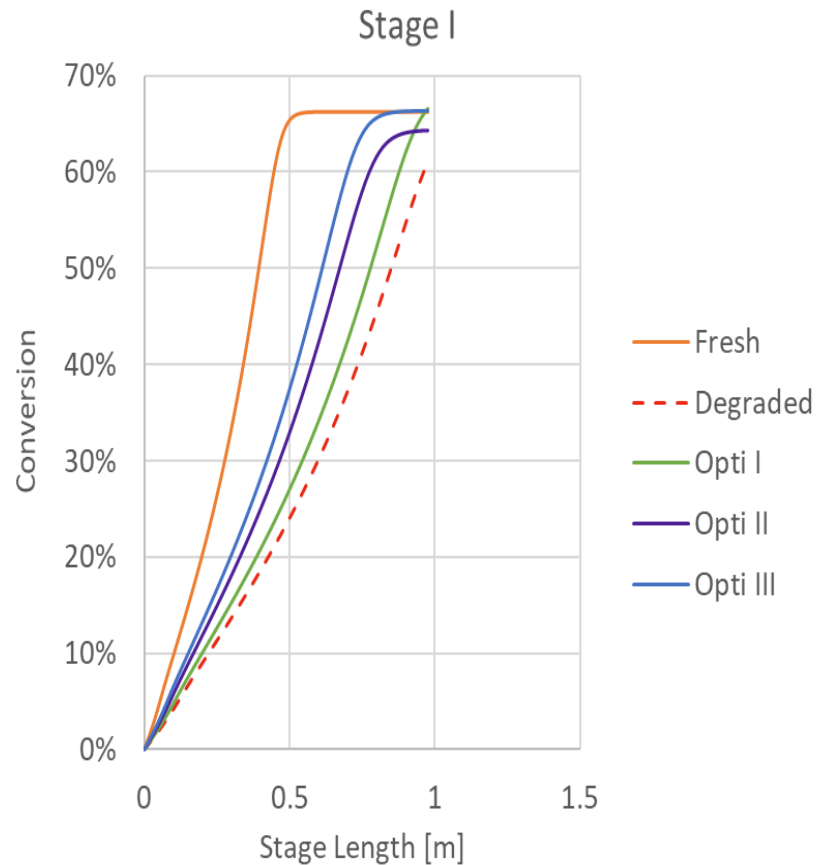


Picture: screenshot from gas cleaning process advisor

Sulfuric acid plant – simulation (Digi twin)



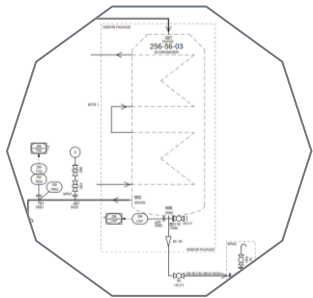
Sulfuric acid plant – converter optimizer



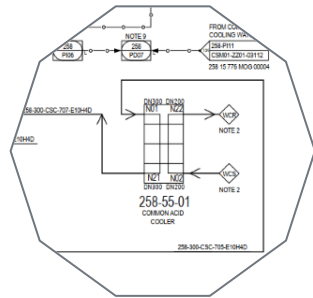
- Optimization
 - Active set point adjustment based on plant data to improve control
 - Process parameter adjustment, based on simulation feedback
- Result in simplified operation, especially in case of aged/degraded catalyst state

- Sulfuric acid plant – health monitor

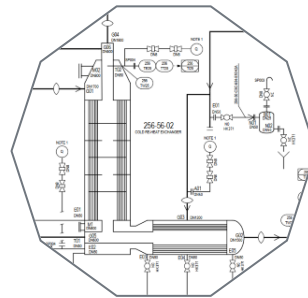
- Process simulation done based on current operating conditions
- On existing plants the Simulation tailored to match existing plant instrumentation
- Monitoring of full process operational range, instead of monitoring single instrument parameters



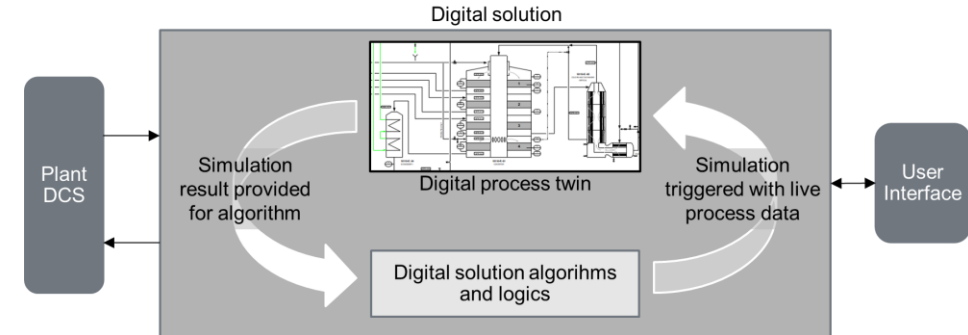
Steam Circuit
Leak Detection



Acid Cooler
Performance
Monitoring

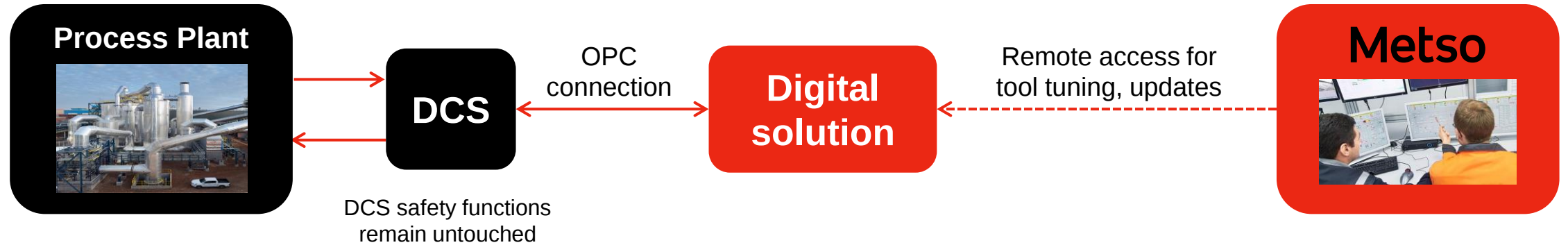


Gas/gas HX
Performance
Monitoring



- Several modules available
- Provide advice and warnings to operating personnel
- KPI monitoring and recording

Integration & architecture (How does it fit together)



- The digital solution connects to the plant DCS
 - In-built **plant safety remains untouched**, thus simple and safe integration in existing site-infrastructure
 - Operations remain in control
 - The digital solution is an expert system separate from the DCS
- Allows remote access for monitoring, evaluation and feedback for optimisation and ensure shortened response-time

Benefits of Digitalization



Utility saving

- Reduced energy consumption (gas cleaning and blower power)
- Reduced consumables



Improved operation

- Ease of operation
 - During upset conditions
 - For stable and highly efficient production
- Increased plant efficiency
 - Mercury removal
 - Converter operation
- Less frequent manual sampling of hazardous liquid
- Improved availability (several sections)



Maintenance prediction

- Cleaning of plate heat exchanger and gas HX
- Replacement of nozzles, packings and demisters
- Identifying abnormal behavior
- More data available, more informed decisions
- Potential to identify faulty equipment



Operational benefits

- Overall wet gas cleaning and acid plant performance indication
- WESP and Scrubber removal efficiency calculated and displayed
- HX efficiency and performance indication
- WESP status indication



Remote support and assistance

Faster and more accurate remote troubleshooting and support with gas cleaning digital solution installed



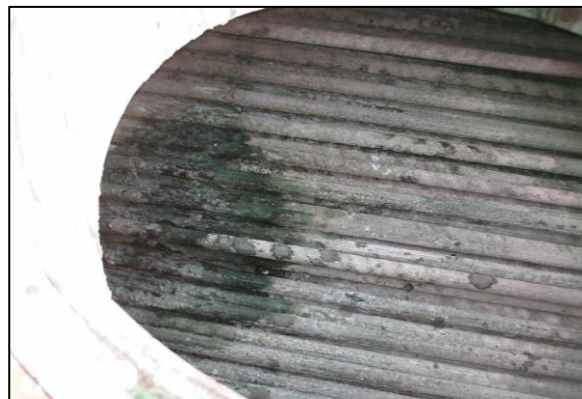
Economizer



Boiler



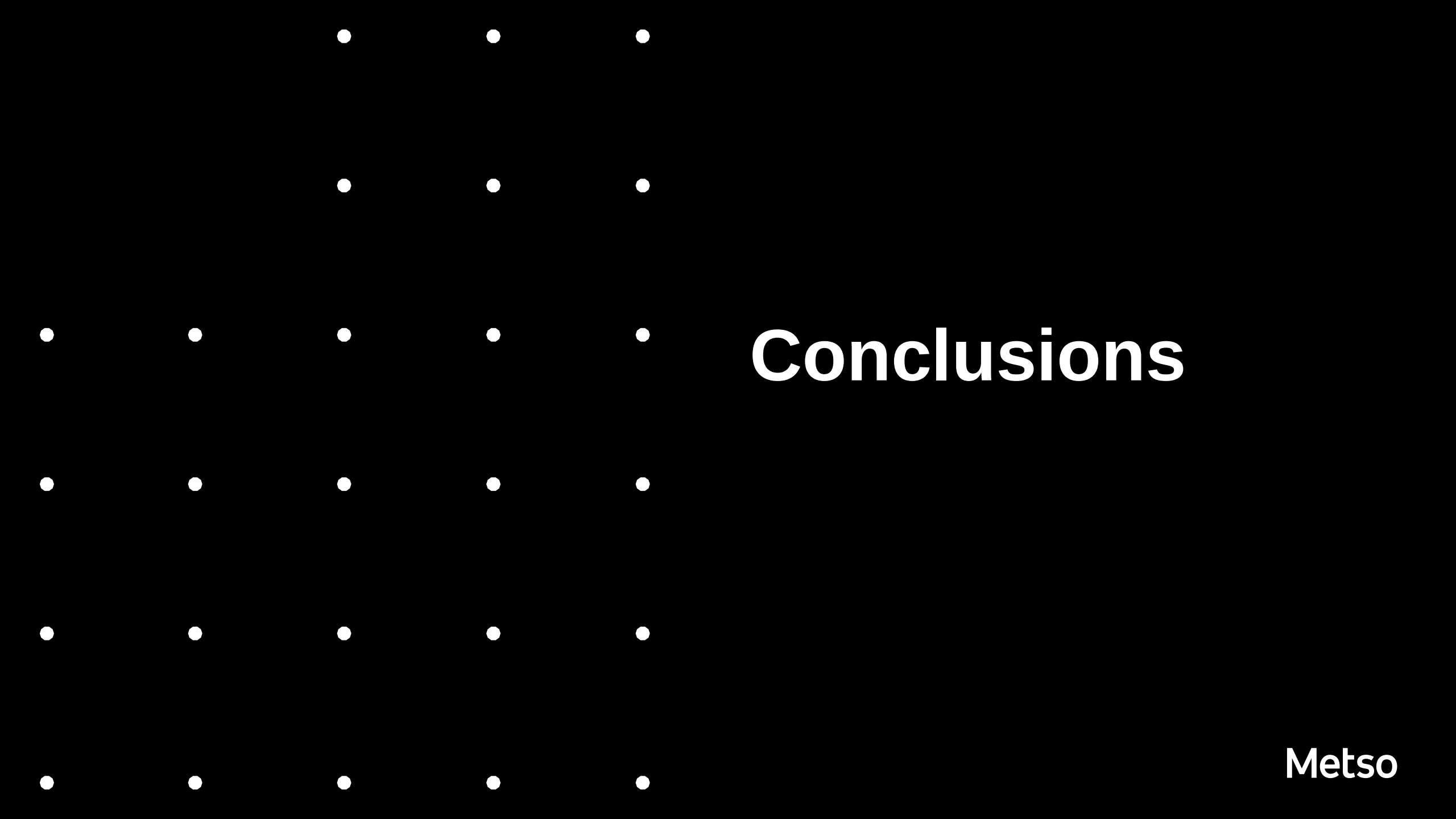
Condensate drain



Acid Cooler



Secondary Damage

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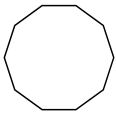
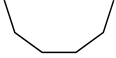
Conclusions

Recommendations

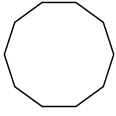
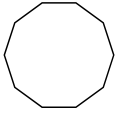
- All role players must agree on:
 - Cybersecurity requirements
 - Quality of connectivity required
 - Information required on equipment/processes during operation
 - OEM supplied information on equipment/processes

Summary

- **Process know-how** and simulation based/digital twin solutions are available
- A digital journey cannot be solved by one organization alone or one discipline, it requires **teamwork**
- Can be implemented on GC and SAP both on process and equipment level
- Customer benefits
 - Simplified operation
 - Higher plant efficiencies
 - Enhanced process monitoring
 - Cost reduction
 - Predictive maintenance planning
 - Neutral and objective KPI reporting



Finally



Digitalization is a key to overcome day-to-day operational challenges:

