ANDRITZ Capital Market Day 2017
OPP (Optimization of Process Performance)

Daniel Schuck, 12th September 2017, Graz

OPP - Optimization of Process Performance

- Increase process stability
- Reduce energy or chemical cost
- Debottleneck production, increasing total production
- Increase mill availability
- Fast response to move from area to area, or production to cost
- Keep existing savings in the long term
- Support to operation: in diagnostics, start-up, mill-balance

OPP Goals

OPP - Optimization of Process Performance

OPP - references

OPP is a **Service/Solution** offered by ANDRITZ

Regional Specialist Remote Support

Local Support

Existing DCS / ERP

Collaborative Network:

- Control Experience
- Automation Experience
- Maintenance Experience
- Best practices Database
- Continuous R&D

Metris Platform

- ANDRITZ Platform & Methodology

ANDRITZ Pulp & Paper

OPP - Optimization of Process Performance

OPP - references

Customer	1000 ton/year	Start-up
Customer A	2,330	2007
Customer B	1,758	2010
Customer C	485	2010
Customer D	1,100	2011
Customer E	1,300	2011
Customer F	1,125	2011
Customer G	1,490	2011
Customer H	455	2012
Customer I	780	2013
Customer J	1,100	2013
Customer K	420	2013
Customer L	460	2014
Customer M	610	2014
Customer N	450	2014
Customer O	1,500	2014
Customer P	500	2015
Customer Q	450	2015
Customer R	4,700	2015

Customer	1000 ton/year	Start-up
Customer S	1,950	2016
Customer T	400	2016
Customer U	700	2016
Customer V	-----	2016
Customer W	1,700	2016
ANDRITZ P&P (Capital)	-----	2016
ANDRITZ P&P (Services)	-----	2016
ANDRITZ HYDRO	-----	2016
ANDRITZ METALS	-----	2016
ANDRITZ SEPARATION	-----	2016
Customer X	730	2017
Customer Y	950	2017
Customer Z		2017
Customer AA		2017
Customer AB		2017
Customer AC		2017
Customer AD		2017

Pulp | Paper | Pulp/Paper | Steel

+5 by end of 2017
+116 by end of 2020

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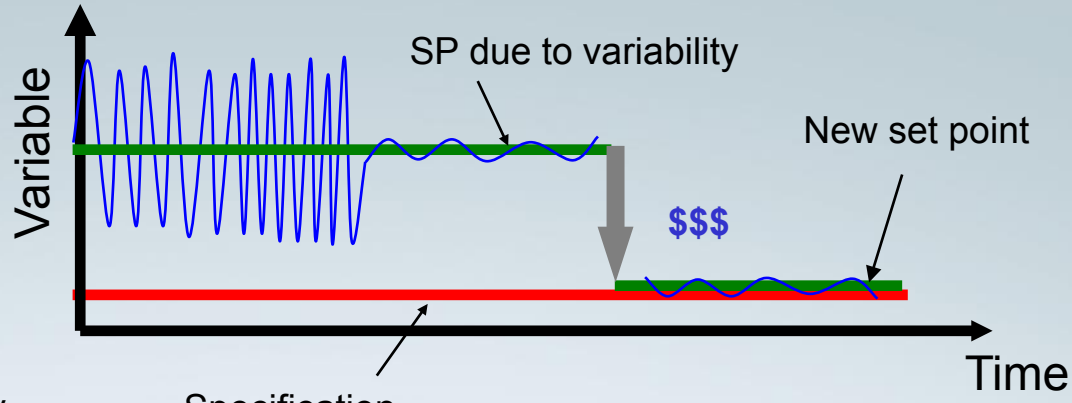
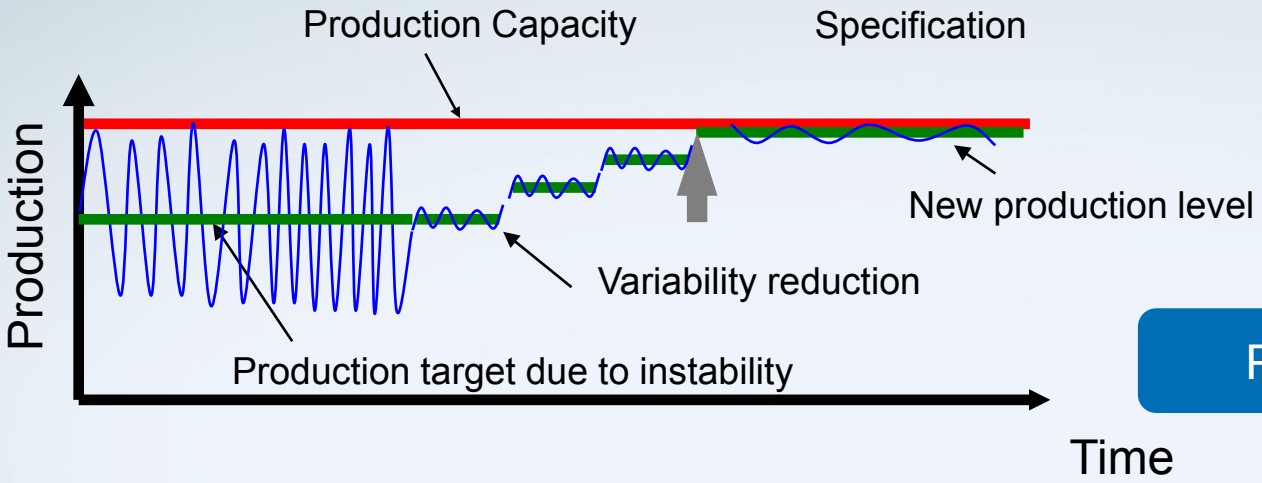
More than 150 million euros savings without capital investments

Typical Savings

Chemical or energy savings

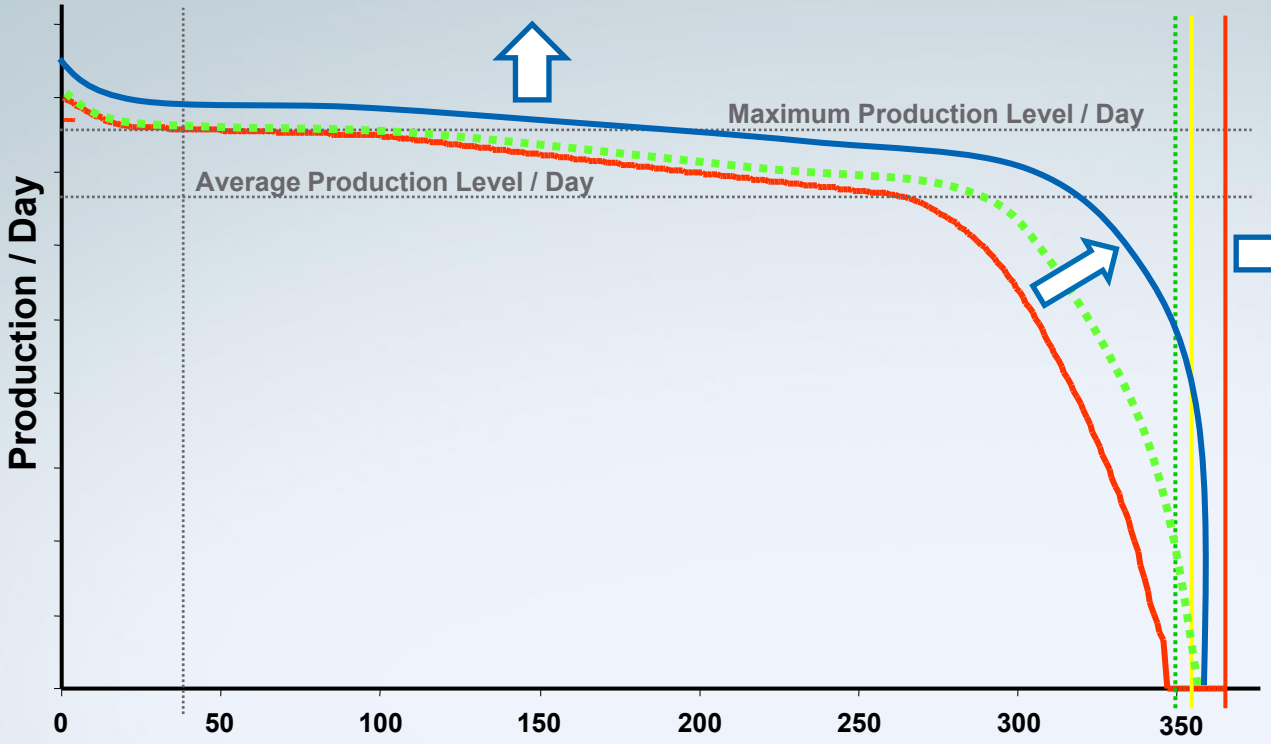




Production increase

How OPP reaches process performance

- Reduce process variability
- Debottlenecking
- Fast start-up
- Mill balance



- Avoid shutdown using automatic slowdown system
- Mill balance
- Production stability
- Equipment failure prediction

<90% (opportunity to improved) | 90-91% (acceptable) | 91-92% (target) | >92% (excellent)

How OPP reaches process performance

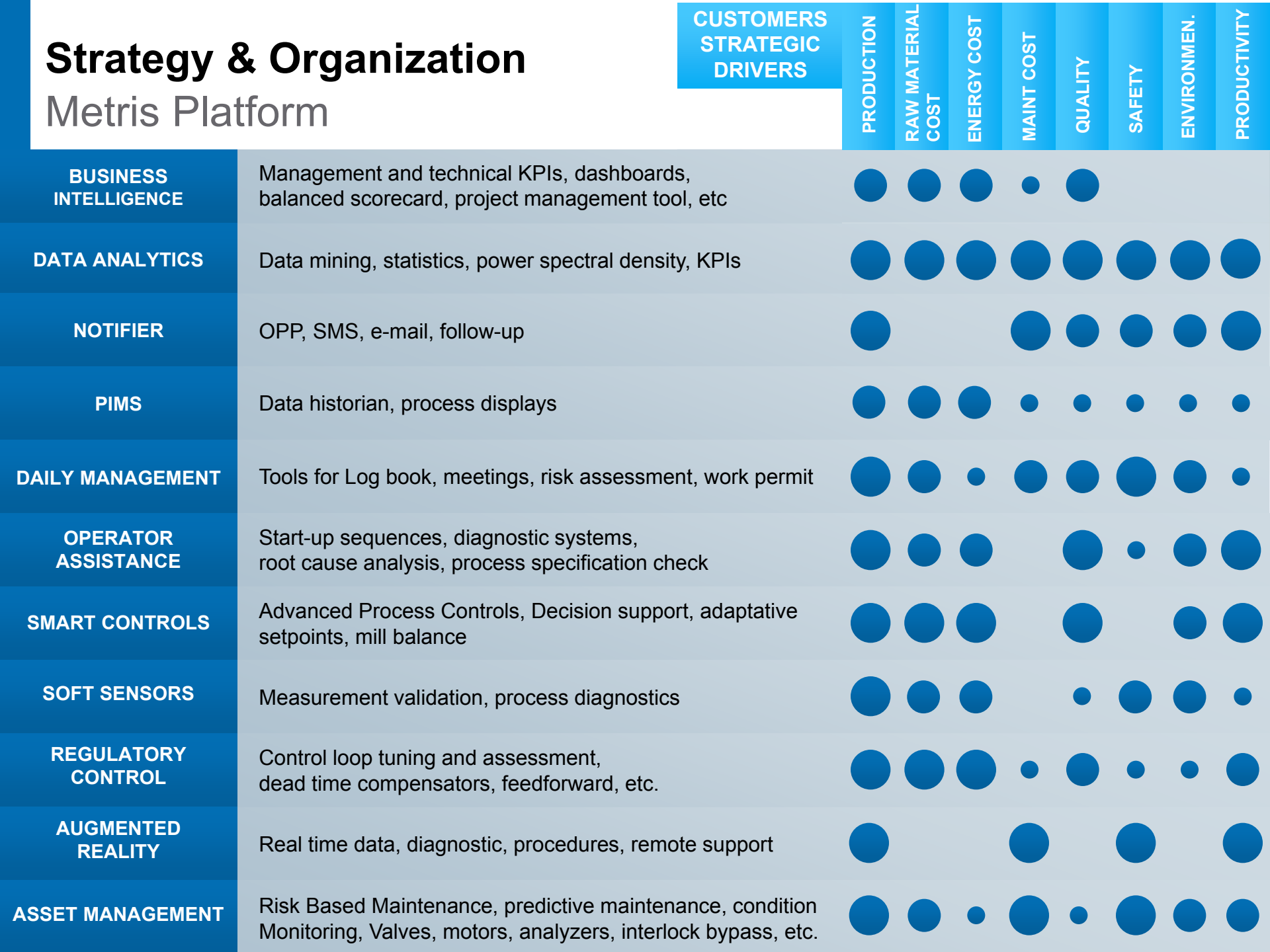
Strategy & Organization

Metris Platform

BUSINESS INTELLIGENCE	Management and technical KPIs, dashboards, balanced scorecard, project management tool, etc	**LEVEL 4: MANAGERS**
DATA ANALYTICS	Data mining, statistics, power spectral density, KPIs	**LEVEL 3: ENGINEERS (OPERATIONS AND MAINTENANCE)**
NOTIFIER	OPP, SMS, e-mail, follow-up	
PIMS	Data historian, process displays	
DAILY MANAGEMENT	Tools for Log book, meetings, risk assessment, work permit	**LEVEL 2: OPERATORS AND SHIFT SUPERVISOR / CORDINATOR**
OPERATOR ASSISTANCE	Start-up sequences, diagnostic systems, root cause analysis, process specification check	
SMART CONTROLS	Advanced Process Controls, Decision support, adaptative setpoints, mill balance	
SOFT SENSORS	Measurement validation, process diagnostics	
REGULATORY CONTROL	Control loop tuning and assessment, dead time compensators, feedforward, etc.	
AUGMENTED REALITY	Real time data, diagnostic, procedures, remote support	**LEVEL 1: FIELD OPERATORS AND MAINTENANCE TECHNICIAN**
ASSET MANAGEMENT	Risk-based maintenance, predictive maintenance, condition Monitoring, Valves, motors, analyzers, interlock bypass, etc.	

Strategy & Organization

Metris Platform



Strategy & Organization

Metris OPP Platform

AUTONOMOUS OPERATIONS

MANAGEMENT OPTIMIZATION

1. Business Intelligence
2. Quality Management
3. Augmented Reality
4. Knowledge Management
5. Data Analytics

PROCESS OPTIMIZATION

1. Process & Control Engineering
2. Production Management
3. Mill Balance
4. Smart Controls

ASSET OPTIMIZATION

1. Systems
2. Devices

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Autonomous Operations

Decision levels

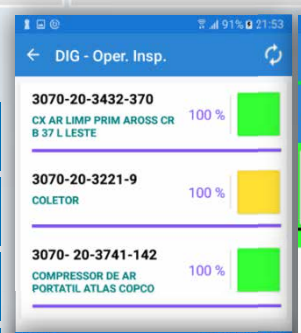
MARKET STRATEGY	**Maximize company results** Market x Budget analysis and definition of production strategy	MONTHLY
PRODUCTION STRATEGY	**Budget control** Speed, Economy, Balanced (It defines how mill balance should work)	DAILY
PRODUCTION & COST MANAGEMENT	**Mill balance control** Start-up/Stop, Speed-up/Slow-down, Recipes (35 controls)	MINUTES TO HOURS
SMART CONTROLS	**Control of complex variables** Kappa, Brightness, Moisture, Dry-solids, etc. (75-100 controls)	3 -300 SECONDS
REGULATORY CONTROLS & SAFETY	**Control of simple variables and avoid interlocks** Flow, Temperature, etc. (1000 controls + 2000+ interlocks)	0.1 -1 SECONDS
RELIABILITY	**Equipment (some assets have their own controls)** Big assets, instruments, valves, motors, etc. (15,000+ devices)	MILISECONDS

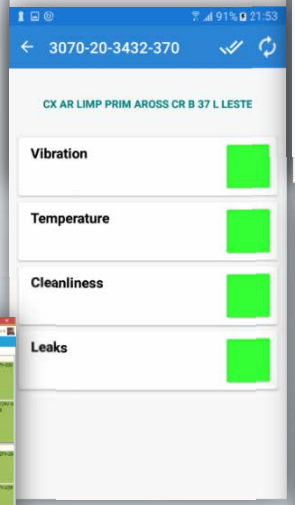
Autonomous Operations

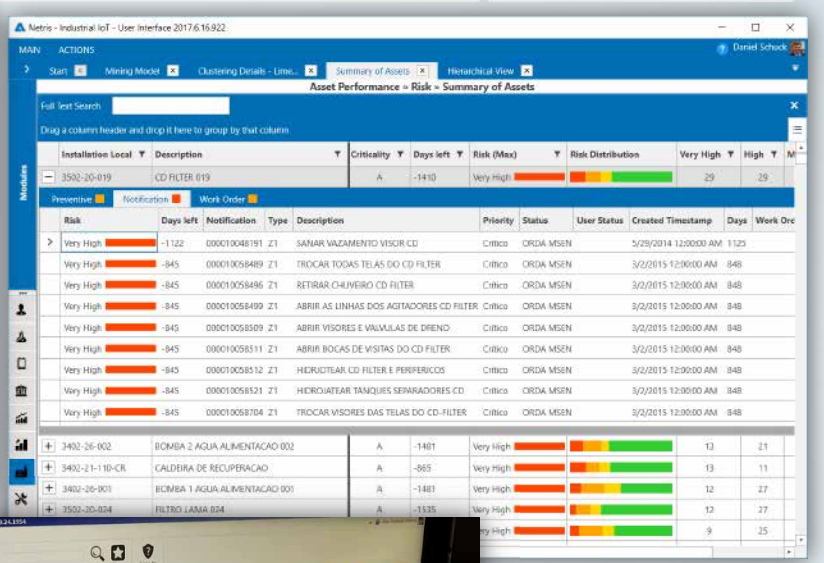
How to achieve it

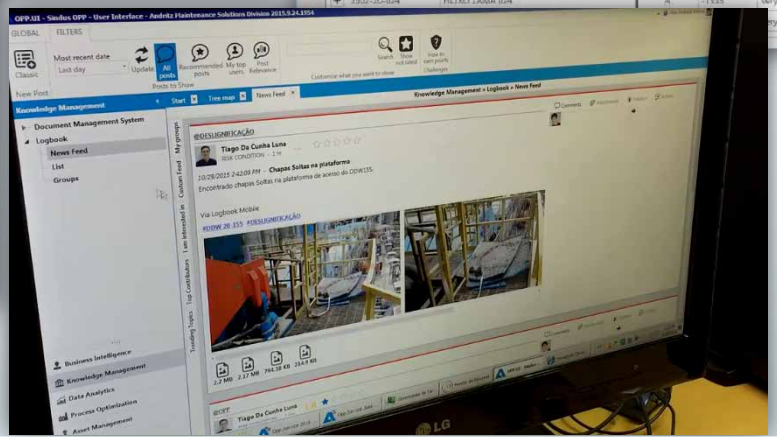
Customer need	How to improve it?		
Equipment must be reliable	Prediction of failure and automatic notification based on on-line data	Prediction of failure and automatic notification based on inpections. AR (Augmented Reality) can help.	Risk-based Maintenance (RBM) algorithm

- Instruments
- Control Valves
- On-off Valves
- Motors
- Variable Frequency Drives
- Pumps
- Smart Sensors
- Soft Sensors









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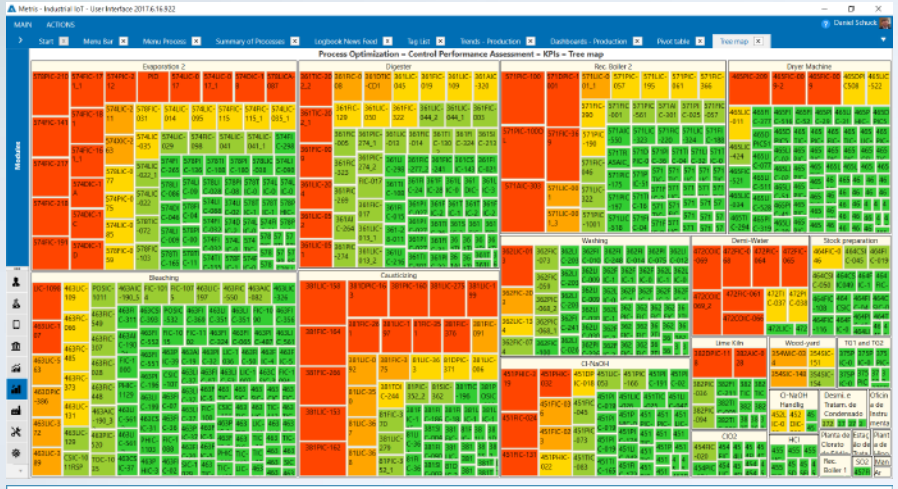
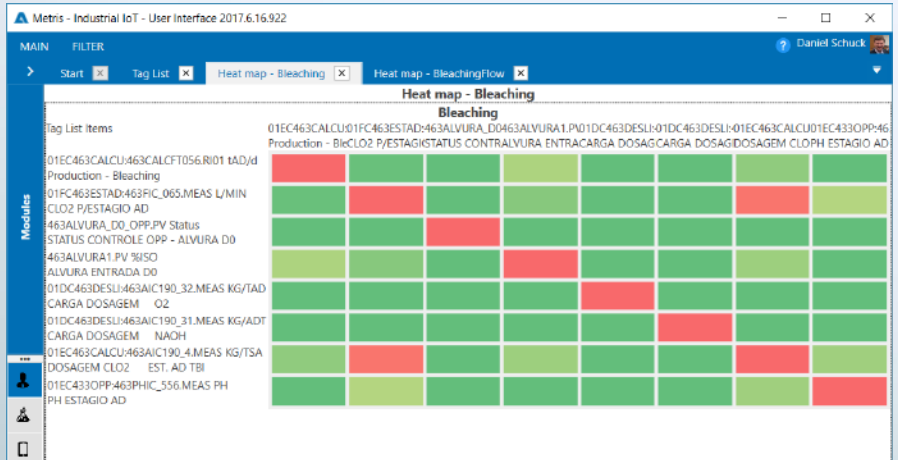
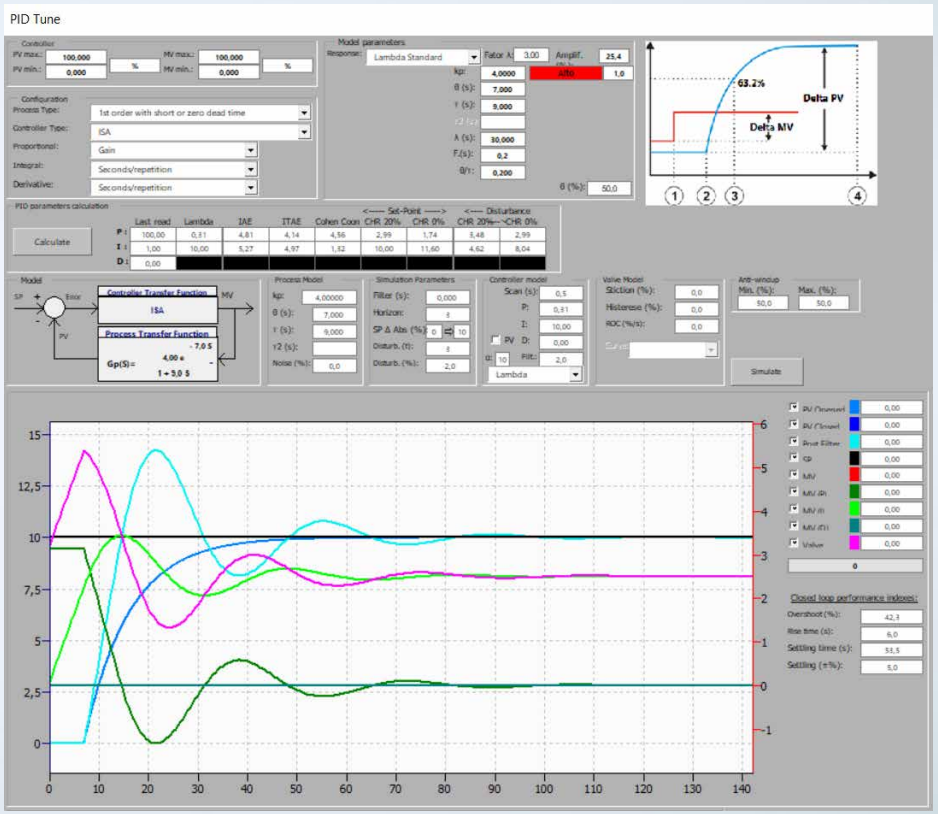
Autonomous Operations

How to achieve it

Customer need	How to improve it?		
Basic loops must work at least 95% in auto mode, with minimum IAE (Integral of Absolute Error)	Automatic diagnostics of instruments and valves	Automatic diagnostics of control loop performance	Control loop monitoring and tuning







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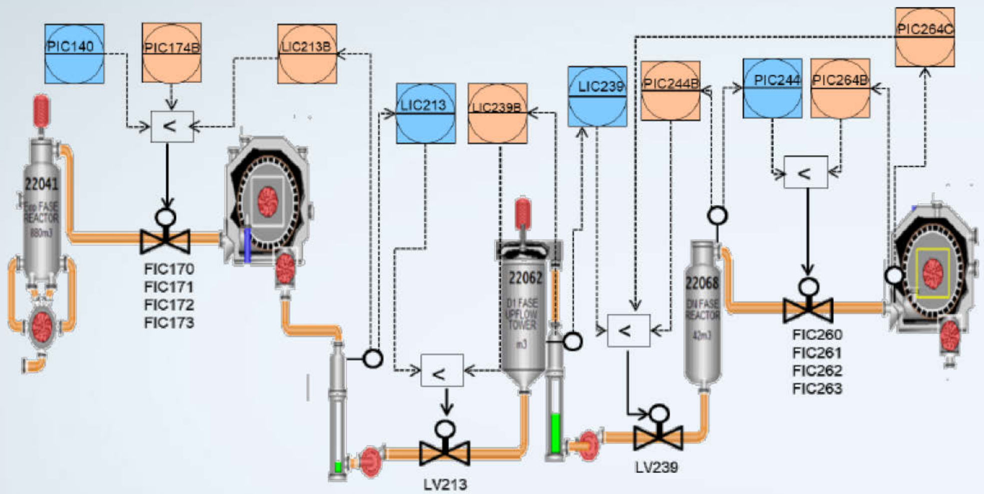
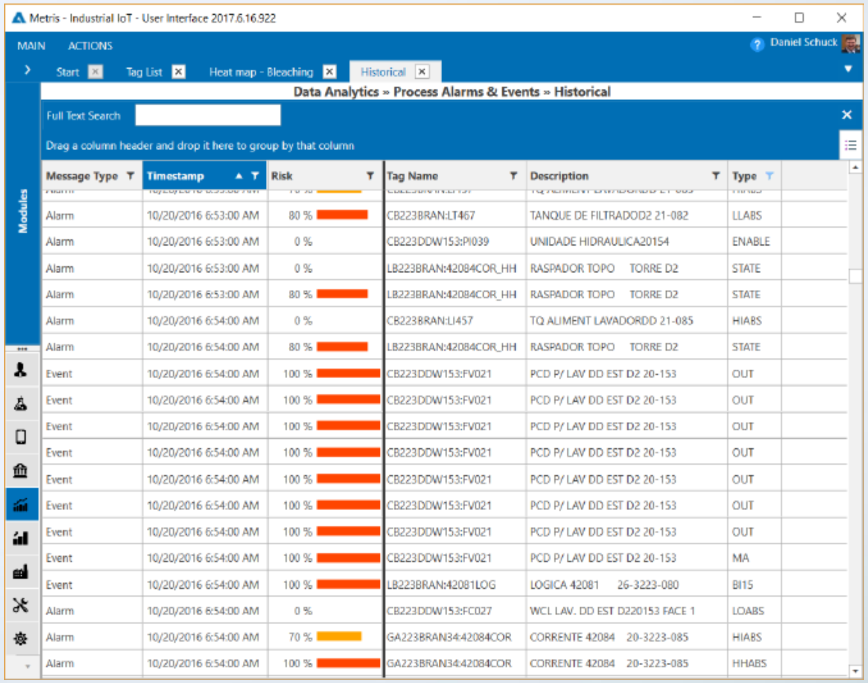
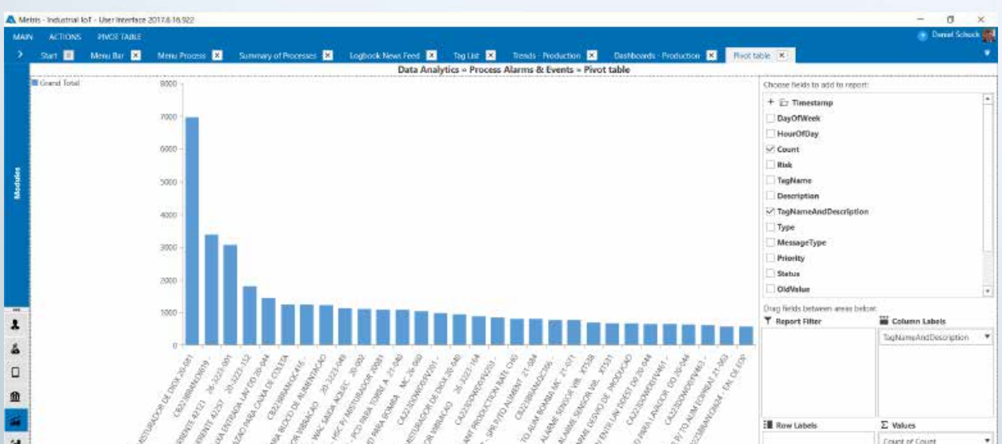
Autonomous Operations

How to achieve it

Customer need	How to improve it?				
Interlocks must be avoided	Automatic slow-down system	"Hacking" operator actions and make it automatically	Eliminate not needed interlocks	Review interlock limits	Delay interlocks when possible







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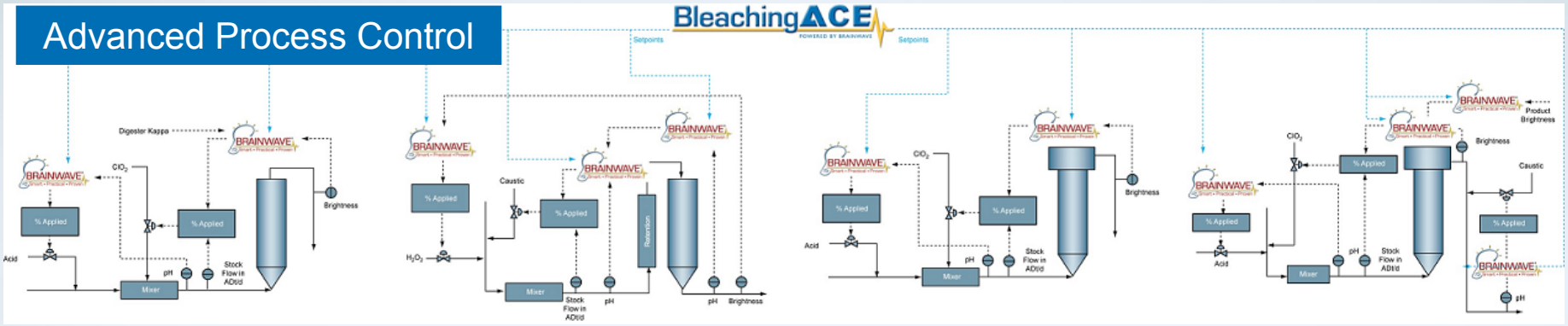
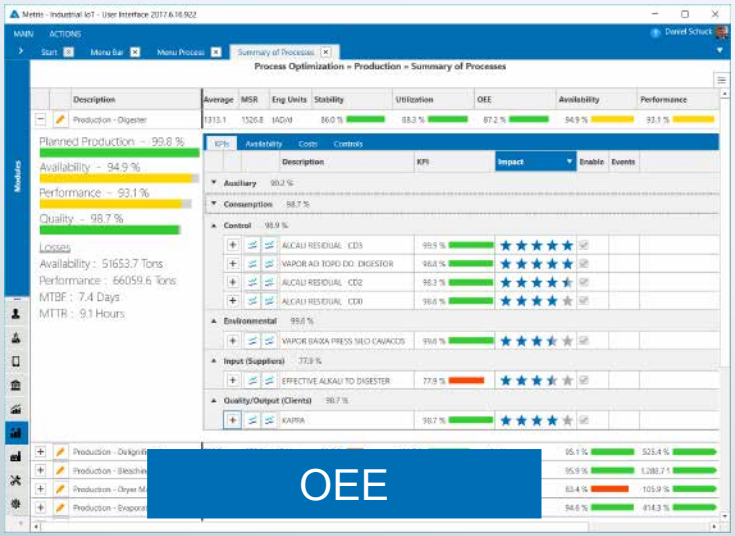
Autonomous Operations

How to achieve it

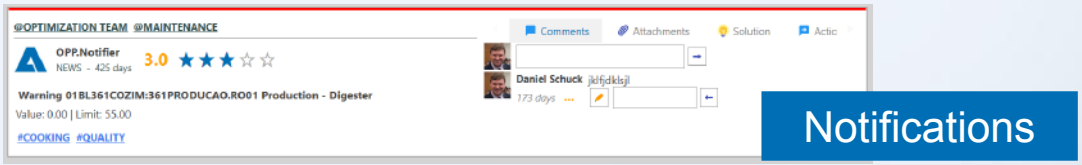
Customer need	How to improve it?		
Key process variables must be controled inside specifications	Sophisticated control algorithms must be developed and updated continuously	Specifications limits must be reviewed based on best operations days	Prediction of process problems and automatic notification

Advanced Process Control

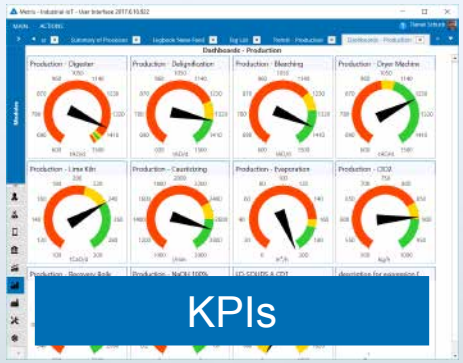




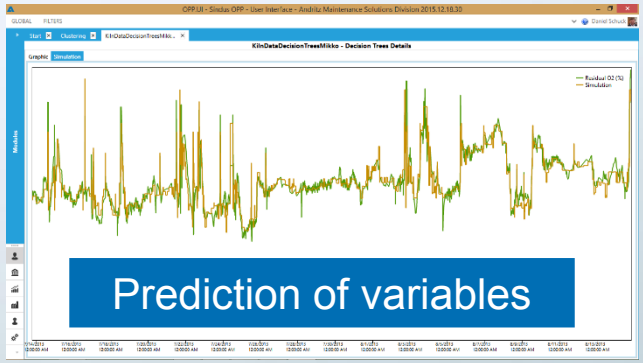
OEE



Notifications



KPIs

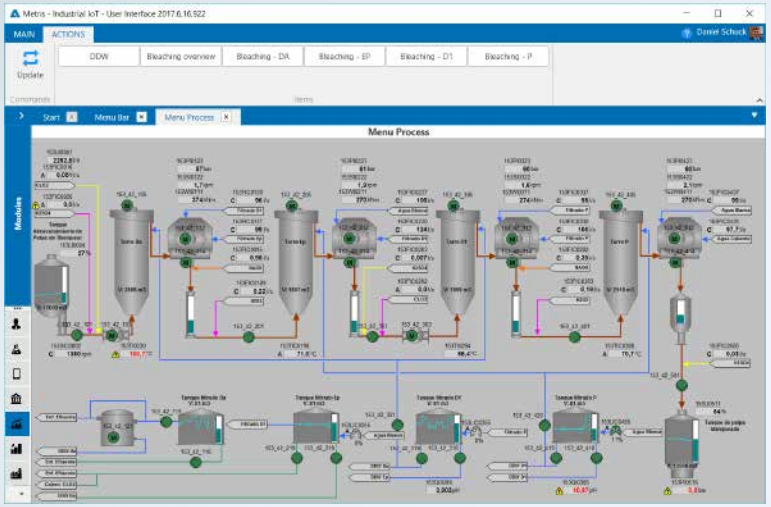


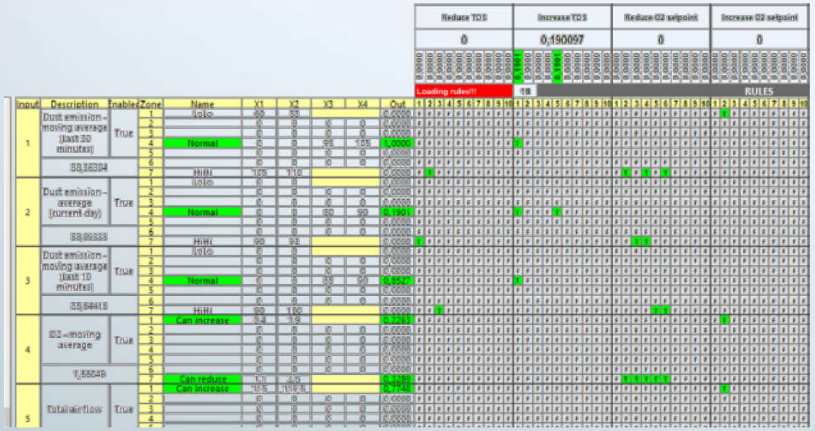
Prediction of variables

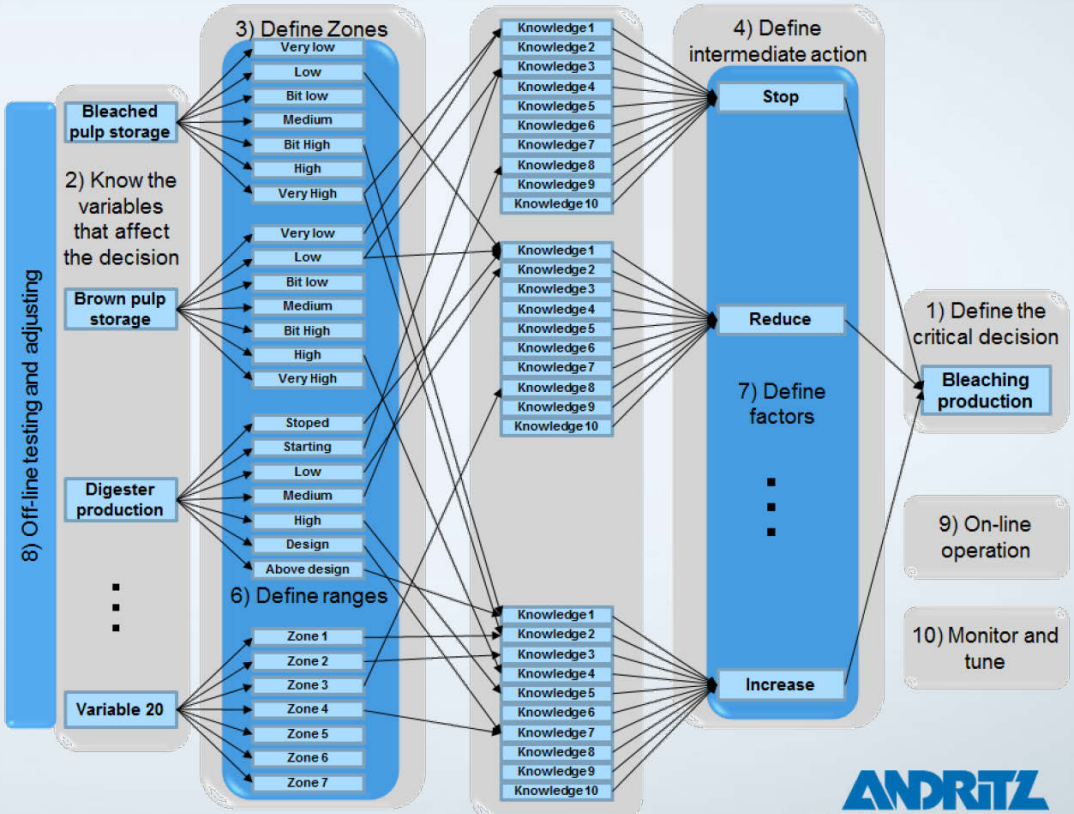
Autonomous Operations

How to achieve it

Customer need	How to improve it?		
Production rate and chemical/energy consumption must work must be always optimized	Sophisticated control algorithms must be developed and updated continuously	Create a footprint of key equipment	Benchmark with best productions days and suggest possible changes in the model automatically







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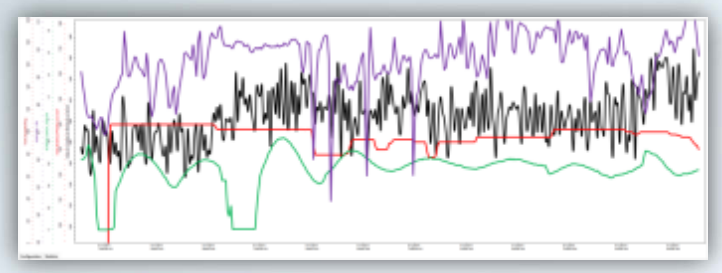
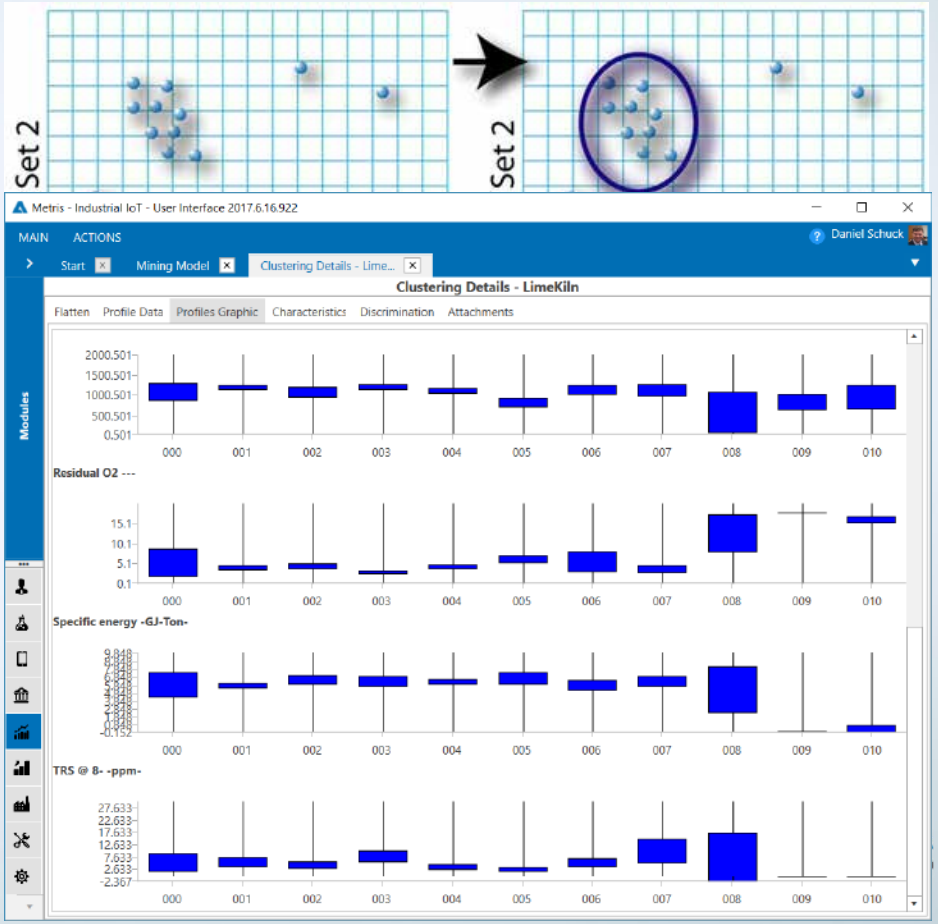
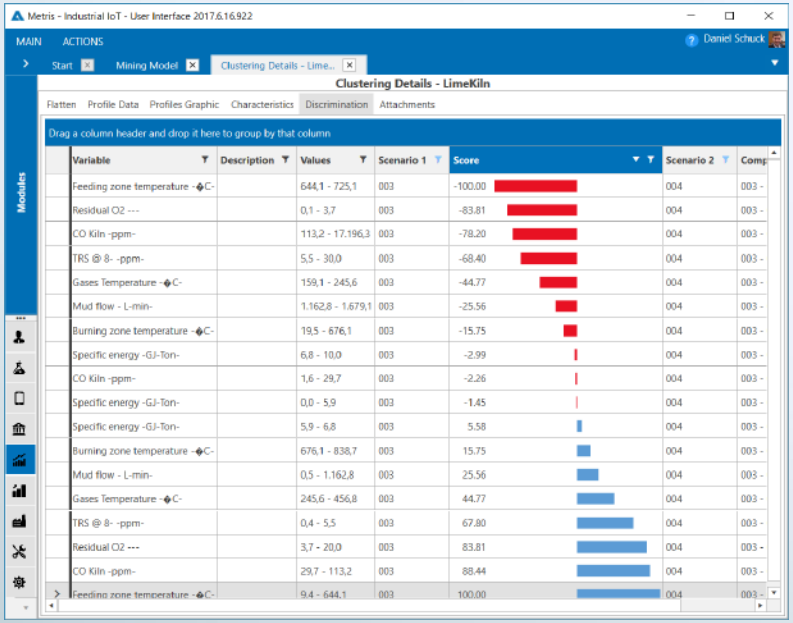
Autonomous Operations

How to achieve it

Customer need	How to improve it?
How to deal with changes in raw material	Process model and recipes must be created for every scenario to make the process at its optimal level



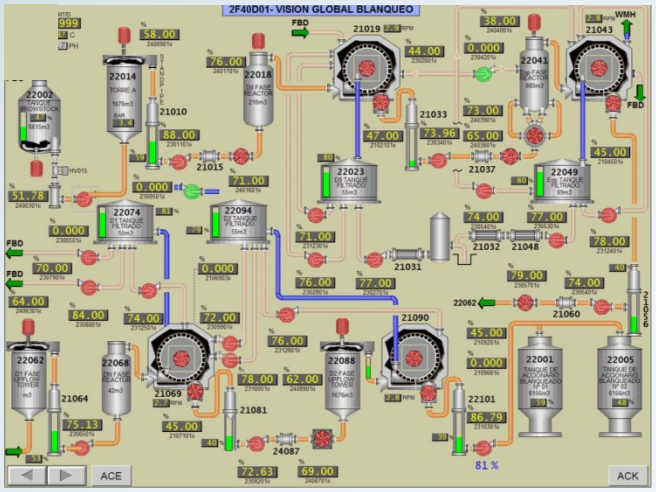


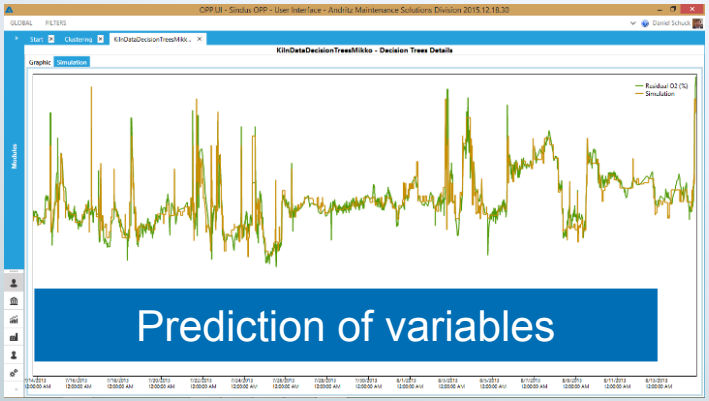


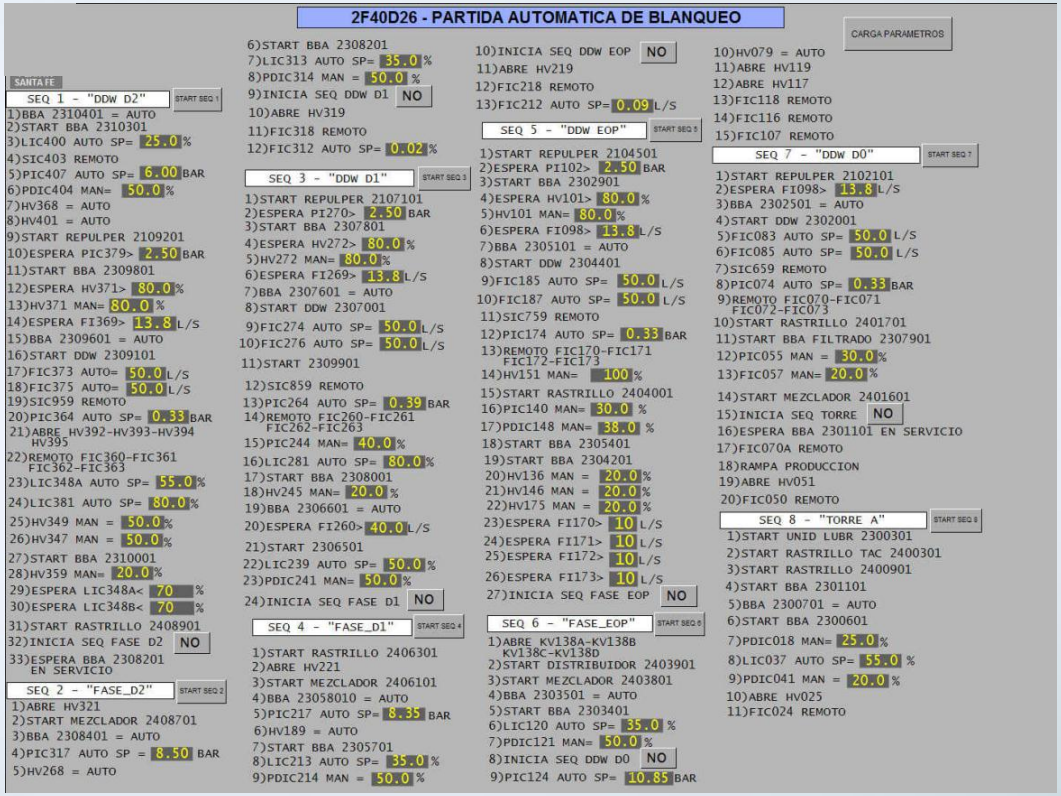
Autonomous Operations

How to achieve it

Customer need	How to improve it?	
How to deal when something goes wrong, like an instrument failure	Switch off part of the algorithm and give instructions in how to proceed	Start-up sequence to start the process quickly and in a standardized way







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Autonomous Operations

How to achieve it

Customer need	How to improve it?		
How to reduce the time to repair	Show contextual information	Have a knowledge database	Team of experts to support the mill

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Autonomous Operations

Results

Installation and tuning: Sep-Dec/16

KPI	Baseline	Goal	Jan/17	Feb/17	Mar/17	Apr/17	May/17	Jun/17
Operational Stability (average/ MSR) **hour base**	91%	94%	90.3%	94.1%	93.7%	90.5%	93.3%	95.5
Variable Costs (Consumption + Energy)	0%	-10%	-6,2%	-10,9%	-10.5%	-6.5%	-9.7%	-11%
OPP controls ON (% of Time of)	0%	90%	65,1%	90%	95%	85%	96%	97%

Production Records	Before	Q1/2017	Q2/2017	Q3/2017
Daily	5420	-	5508 (+1.6 %)	
Monthly average	4988	-	5045 (+1.1 %)	5105 (+2.3 %)
Quarter average	4694	4814 (+2.5%)	4872 (+3.8 %)	

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Thanks!

Any questions?

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