Condition monitoring for process control

Overview of future Neles

Neles

Control valve solutions

On-off valve solutions

Intelligent safety valves

Valve Controllers, Actuators & Limit Switches

Valve services and spare parts

Leading position as flow control solution and services provider serving customers in oil & gas, petrochemicals, pulp, paper and bio industry and other process industries

Olli Isotalo
CEO

Vantaa, Finland
Headquarters

~2,900
Employees

~40
Countries present

~ 40
Service Centers

The partial demerger is targeted to be completed in the second quarter of 2020, subject to the receipt of all required regulatory and other approvals. The Extraordinary General Meetings of both Metso and Outotec approved the transaction on October 29, 2019.

The most modern valve plant footprint globally

40 service centers globally

- Existing performance
- Stable - Reliable - Optimal
- Demonstration of finding plant problems
- Results- $$ Benefits
- Benchmark – how do you rank?
- Questions and answers

Condition monitoring for optimal control performance

10%-35% of control loops are in **manual**

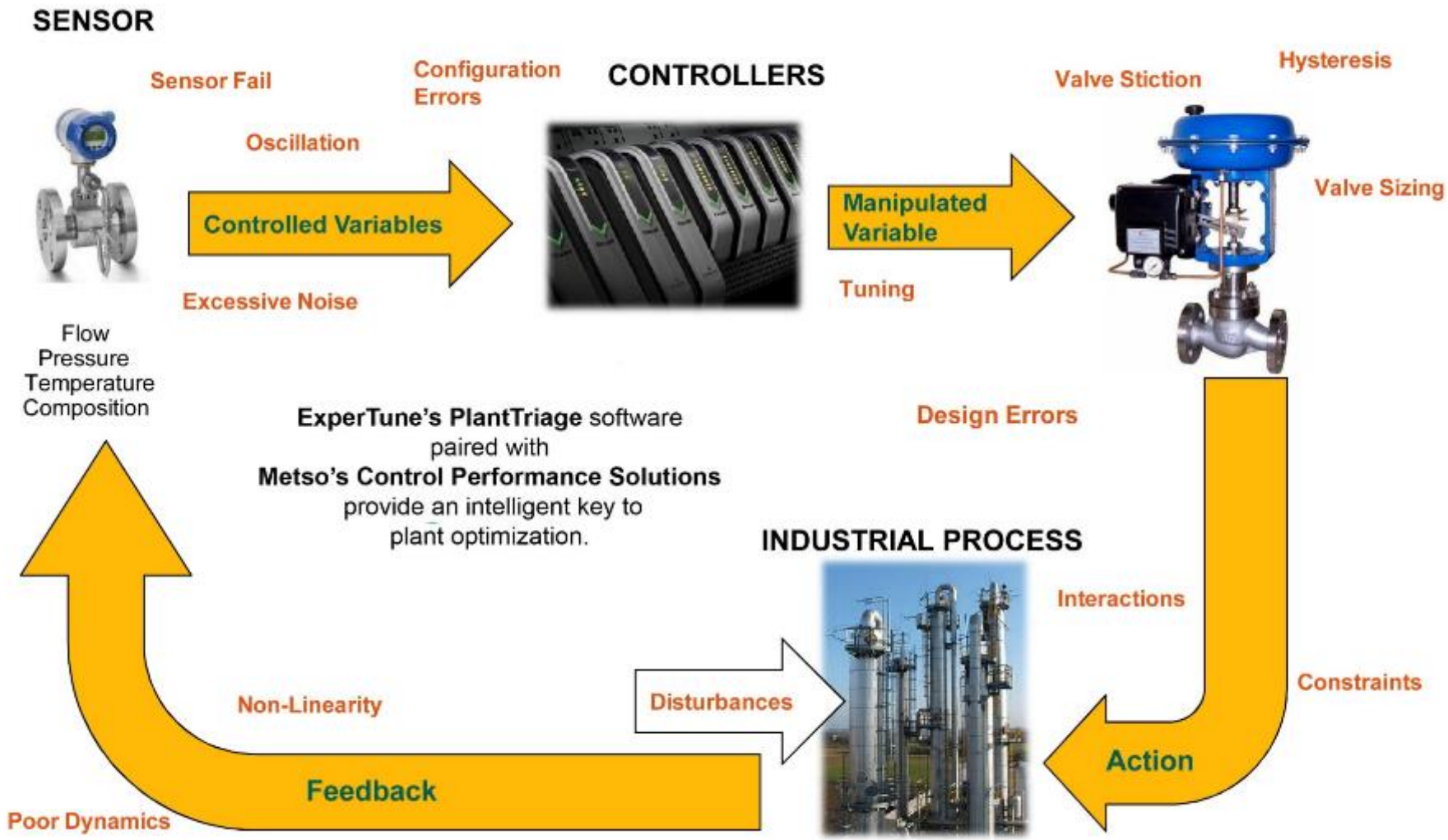
30% of control valves need maintenance

- Sites with no control performance program
  - 1.5M to 5.3M in under utilized assets by running in manual in a 1000 loop site
  - Are you repairing the correct valves?
  - 30% of control loops are tuned incorrectly, increasing variability in the process.
  - A tremendous amount of money can be saved by understanding the control loop interactions and implementing corrective action.

Detected issues

	Plant 1 – 1100 valves	Plant 2 – 390 valves	Benchmarking: Typical	Benchmarking: World class
Excessive valve travel	**4 %**	**9 %**	**5 – 15 %**	**< 5 %**
Stiction	**4 %**	**6 %**	**5 – 10 %**	**< 5 %**
Oversized	**20 %**	**12 %**	**5 – 15 %**	**< 5 %**
Undersized	**6 %**	**4 %**	**5 – 10 %**	**< 5 %**
Loops in manual mode	**21 %**	**12 %**	**10 – 25 %**	**< 10%**

Existing Control performance



Improve

Reliability

Monitor the control infrastructure

Valves & Positioners

- Valve travel & reversals
- Stiction
- Oscillation

Sensor measurements

- Noise
- Flatline
- Off scale
- Spiking

Identify performance issues before they cause an incident

Loop	Description#	Sensor health %E	Sensor - Spiking %T	Noise band %T	Noise band (%)	PV Availability %T	PV at limit %T
TC067	Hold Tank	530*	38.68	46.06	2.257E-05	0	1000
VP_TIC101	Preheat Temperature	404.2*	51.11	404.2	8.684*	0	0
35TI002	Fermenter zone 1 temp	251.3*	-	-	-	1005	-
FC122	Caustic to WWC	223.3*	32.63	80.04	5.916E-07	0	446.6
10FC026	Master Fuel Rate	153.0*	153.0	4.993	0.2256	0	0
120FC010	FO to Burners	117.9*	71.74	117.9	7.557E-05*	0	0
30LC303B	BLR B Steam Drum	100.2*	0	100.2	2.835E-07*	0	0
110PC051	Firebox Draft	86.66	86.66	28.23	3.694	0	0

Maintenance approach

Maintenance approach	Cost impact
Reactive maintenance or repair Race to failure and repair	High operating and maintenance costs $$$$$
Preventive or time-based maintenance Service at a fixed cycle or time interval	High operating and maintenance cost and higher frequency of unplanned downtime $$$$
Condition-based monitoring with single variable Monitors process data, identifies bad trends and alerts before failure	Moderate operations and maintenance cost, high frequency of false positive diagnosis $$$
Predictive and prescriptive maintenance analysis Analysis with multivariable time series data	Minimal operations and maintenance costs and downtime approach zero $$

- Source: http://www.valvemagazine.com/web-only/categories/trends-forecasts/7283-improving-control-valve-maintenance-with-the-industrial-internet-of-things.html

Manage the improvement workflow

Select KPI's

Establish thresholds for performance

Not set at point of failure

Apply an economic weight factor per loop

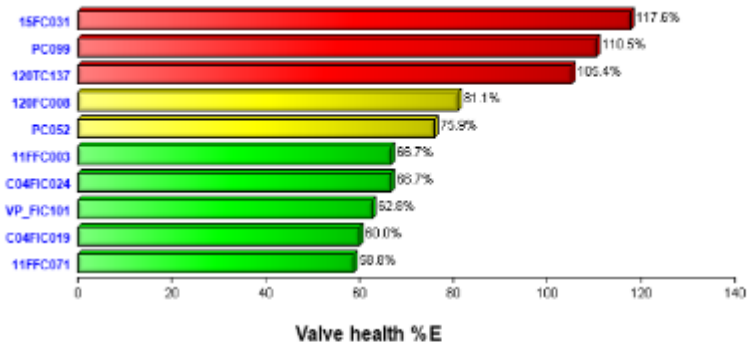
Aids in prioritizing issues

Monitor

Review reports regularly (subscribe)
Set alerts to specific conditions
Evaluate condition trend direction and change rate

Act !

Create a system or process and engage regularly

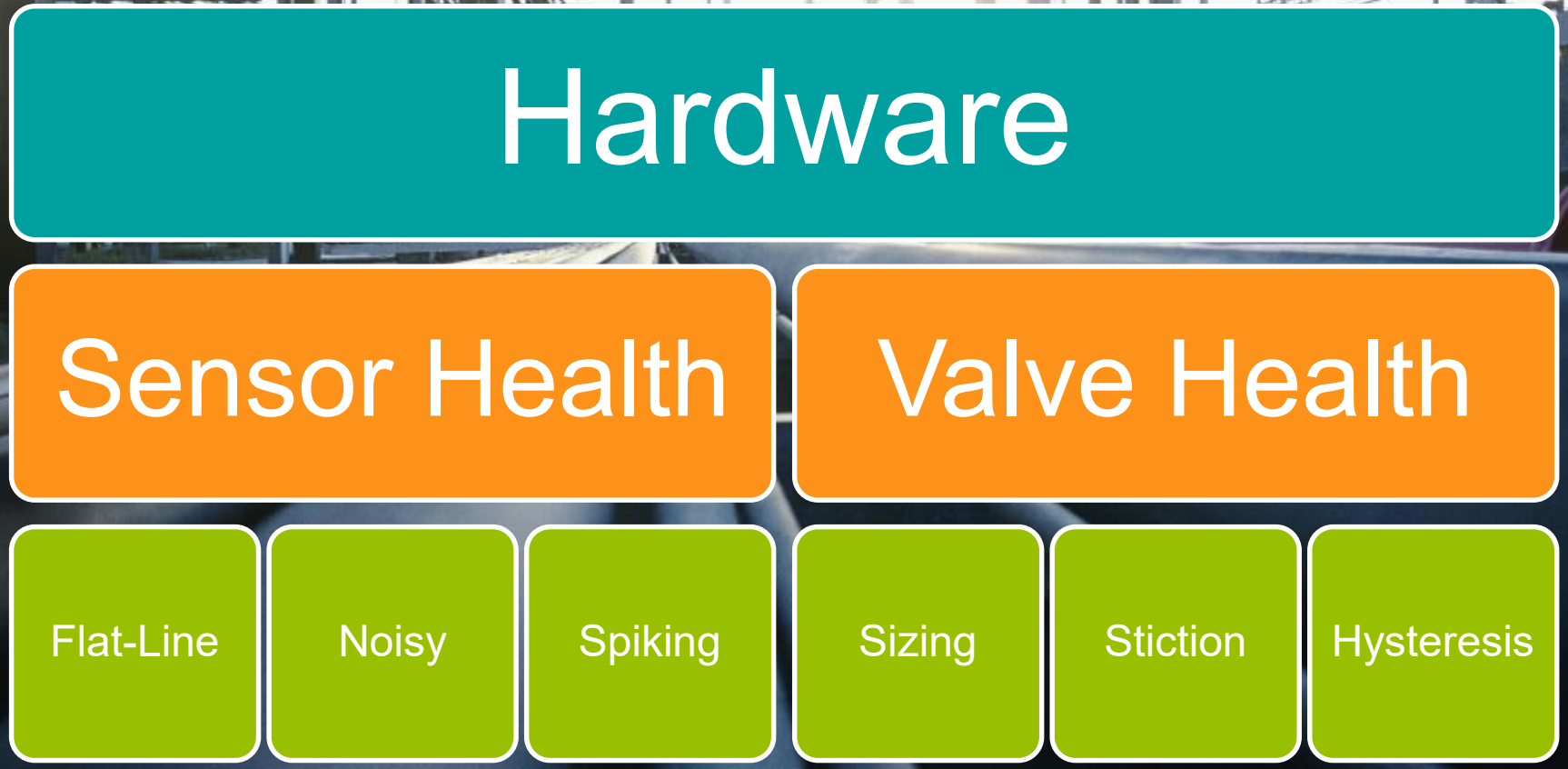


Loop	Description#	Valve health %E	Osc. Valve %T	Stiction %T	Output at limit %T
15FC031	C-7 Reflux	117.6*	117.6	86.47	0
PC099	Plant Water Supply	110.5*	23.53	221	0
120TC137	Cont. Blowdown Drum	105.4*	117.6	421.5	0

Focus on reliability

Pay attention to hardware KPIs

Is the Hardware performing?



Improve

Control

Can the controller do the job?

At a limit

- The control valve is 100% open/closed
- The variable-speed drive is at min/max speed
- The heater is on (or off) 100% of the time
- The control output is limited by a soft limit
- The process variable is at 0% or 100% of its span

Controller in manual *(open loop)*

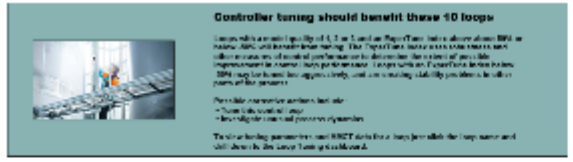
- Control element only moves with operator intervention
- No response to disturbances

Stability is affected when you cannot respond

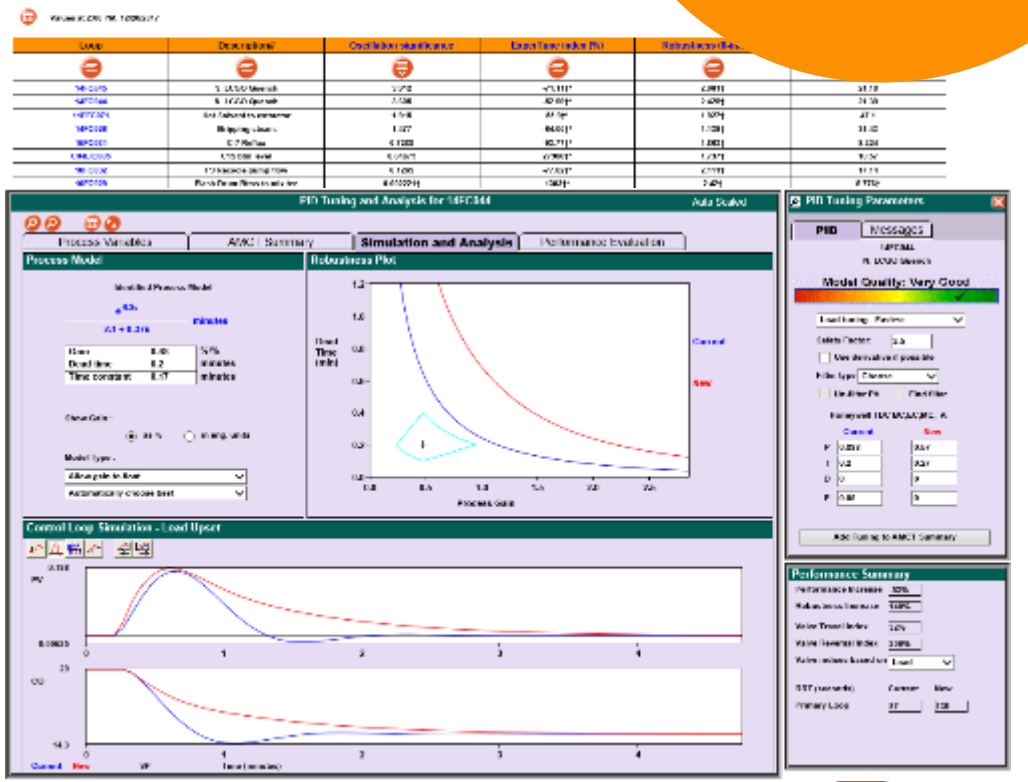
Loop	Description#	Output at limit (%)		
		Minimum	Average	Maximum
Sort	Sort	Sort	Sort	Sort
11FFC016	Raffinate to WS	100	100*	100
C05TIC020	V-17 tank temp	43.25	98.77*	100
C04FIC039	Sweep gas flow	0	87.18*	100

What to do

- Relieve the constraint
  - Valve too small/large resize / alternate trim
  - Change pumps
  - Reduce throughput
  - Repair / re-range measurement device
- Find out why controller is manual
  - Repair hardware
  - Re-design the loop

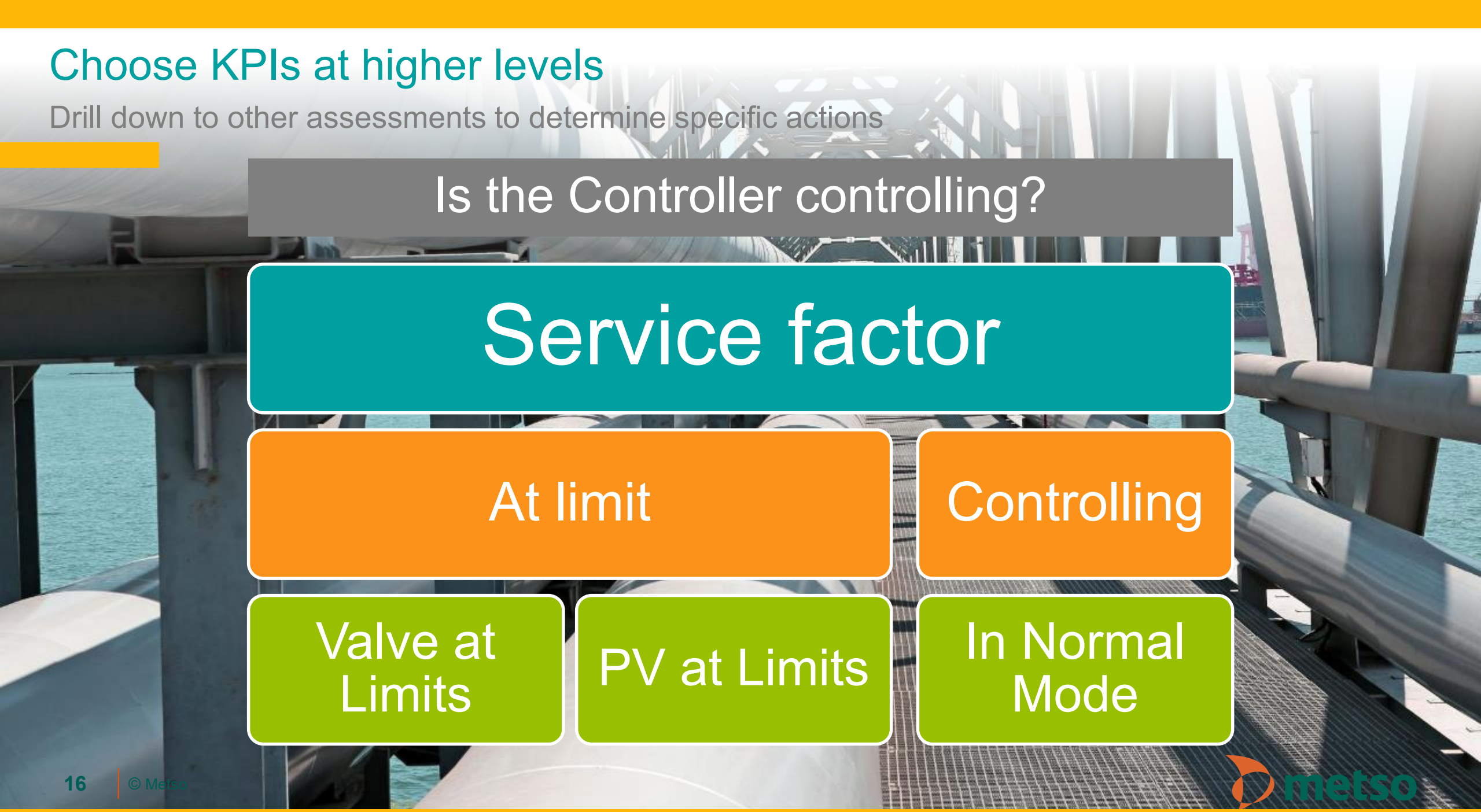


Find the cycling loops, identify new robust tuning values



Choose KPIs at higher levels

Drill down to other assessments to determine specific actions



Optimize Control

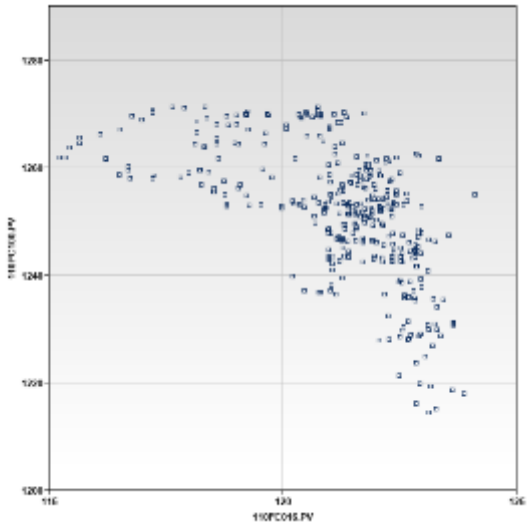
Analyze performance

Interacting Controls

- Closed control loops that disturb other loops
- Create cycles

Poor Controller Tuning

- Too aggressive, too slow
- Overshoot
- Cycling



Reduce variability through better control

Values at 7:00 AM, 12/23/2017

Loop	Description#	Ex
C04LIC005	C15 btm level	
18FC026	Master Fuel Rate	
10FC029	Flash Drum Btms to mix tee	
33FC005	Fermenter air flow	
C05LC012	T211 level	
18FC028	A18 Recycle Flow 1	
C05PIC015	Fuel Gas Hdr	
11FFC071	Hot Solvent to extractor	

metso

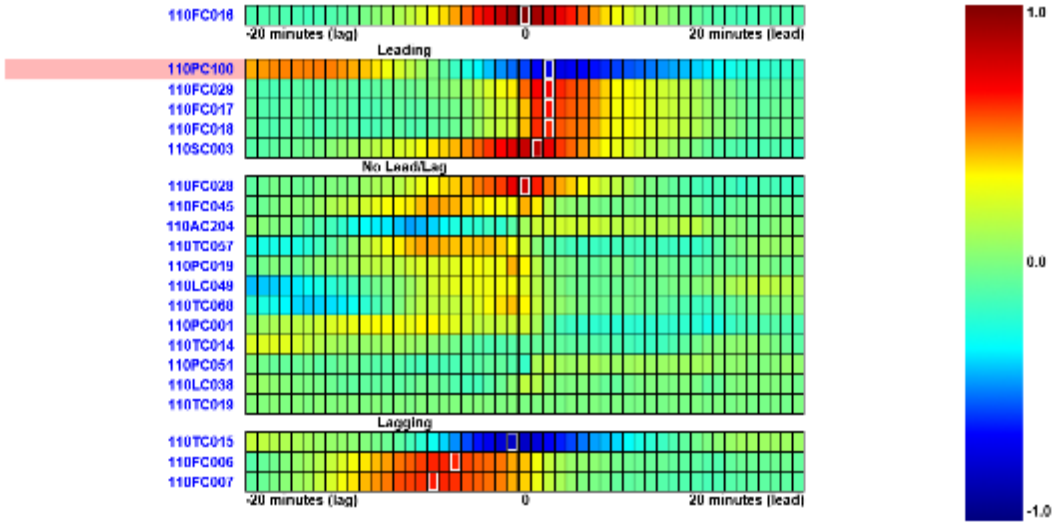
Manage performance

Find root causes

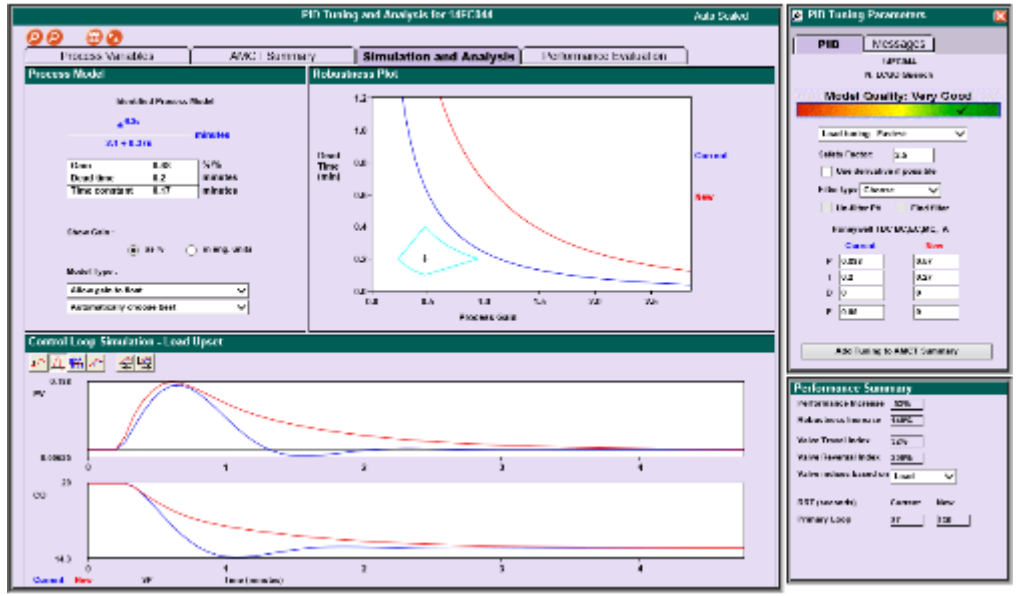
- Correlate oscilating loops
- Check interactions

Tune controllers to meet objectives

- Responsive and robust throughout the operating envelop.
- De-couple with appropriate parameters

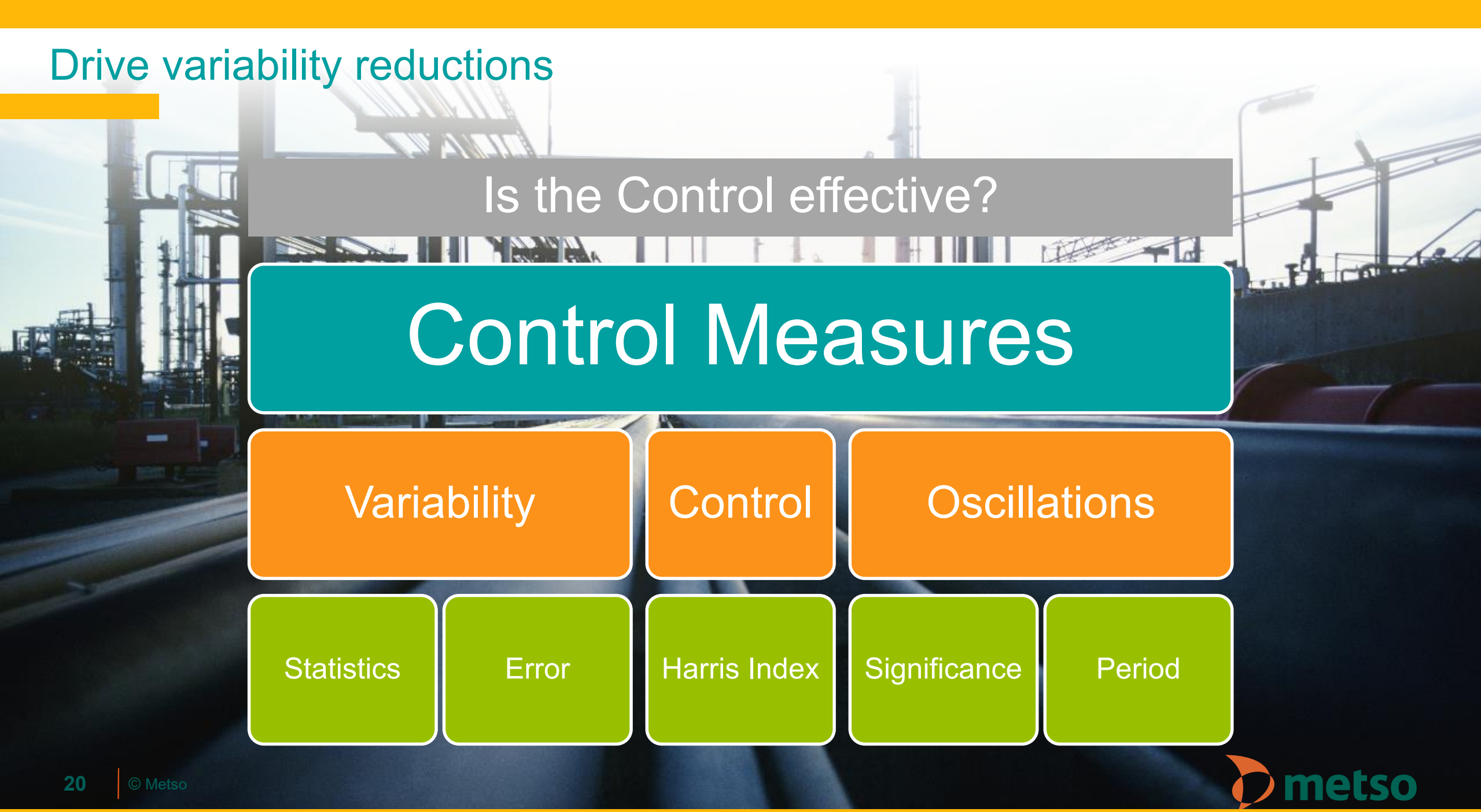


Find the cycling loops, identify new robust tuning values



metso

Drive variability reductions



Optimize

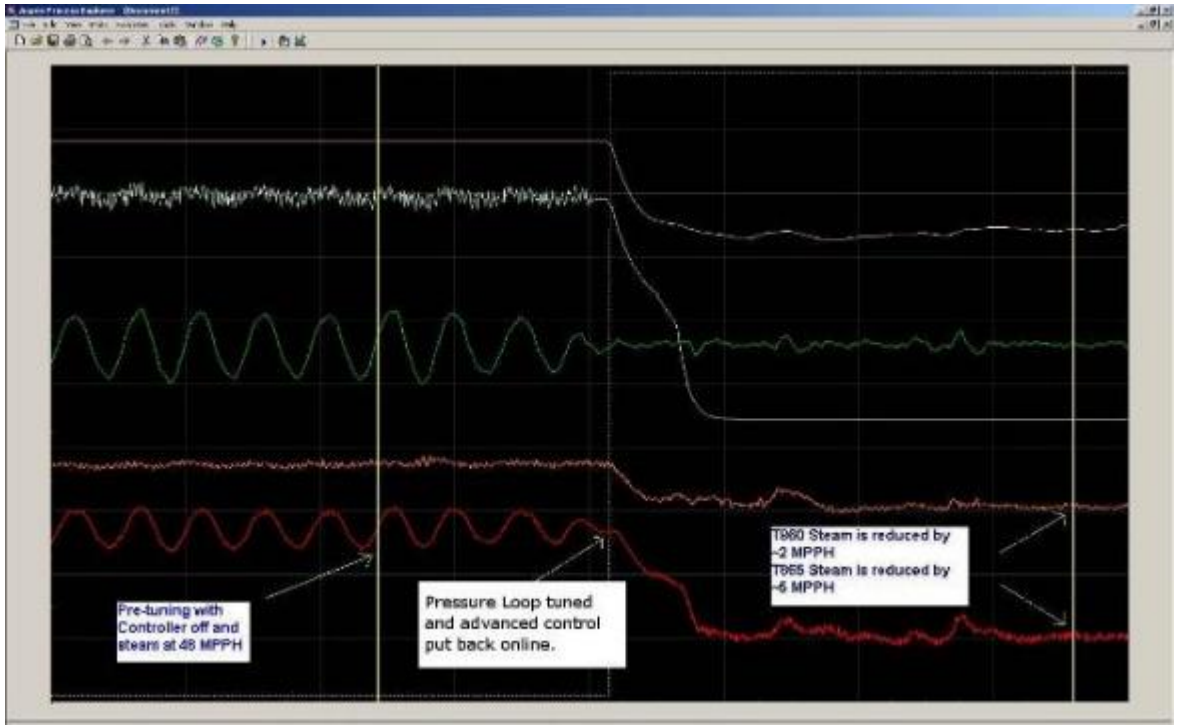
Determine best operating point(s)

Operate closer to targets

Once stable, move the average

Keep key variables on their targets

Capture the value that was hidden by problems



metso

What to do

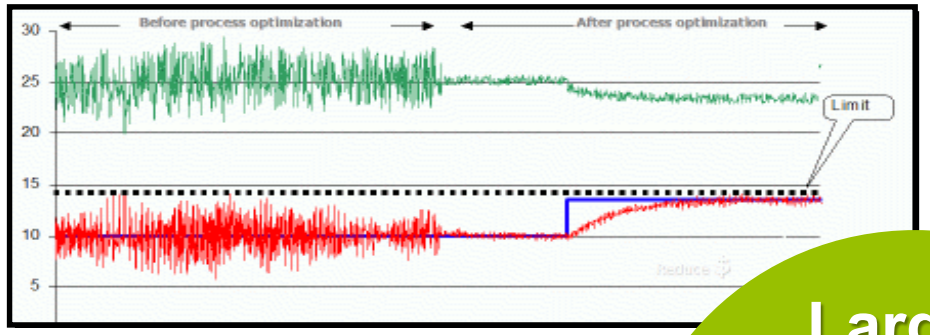
Once stable move setpoints closer to targets

Use 6-sigma to identify opportunity gaps

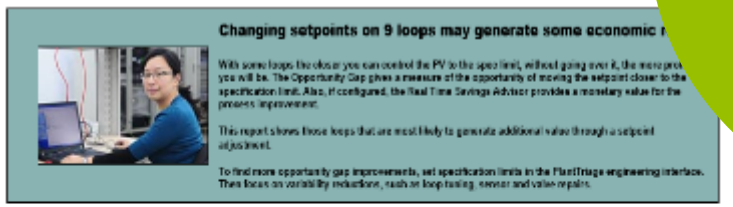
Compute and report savings associated with closing the gap

Monitor

Review reports regularly (subscribe)
Set alerts on Time of Spec, opportunity gap

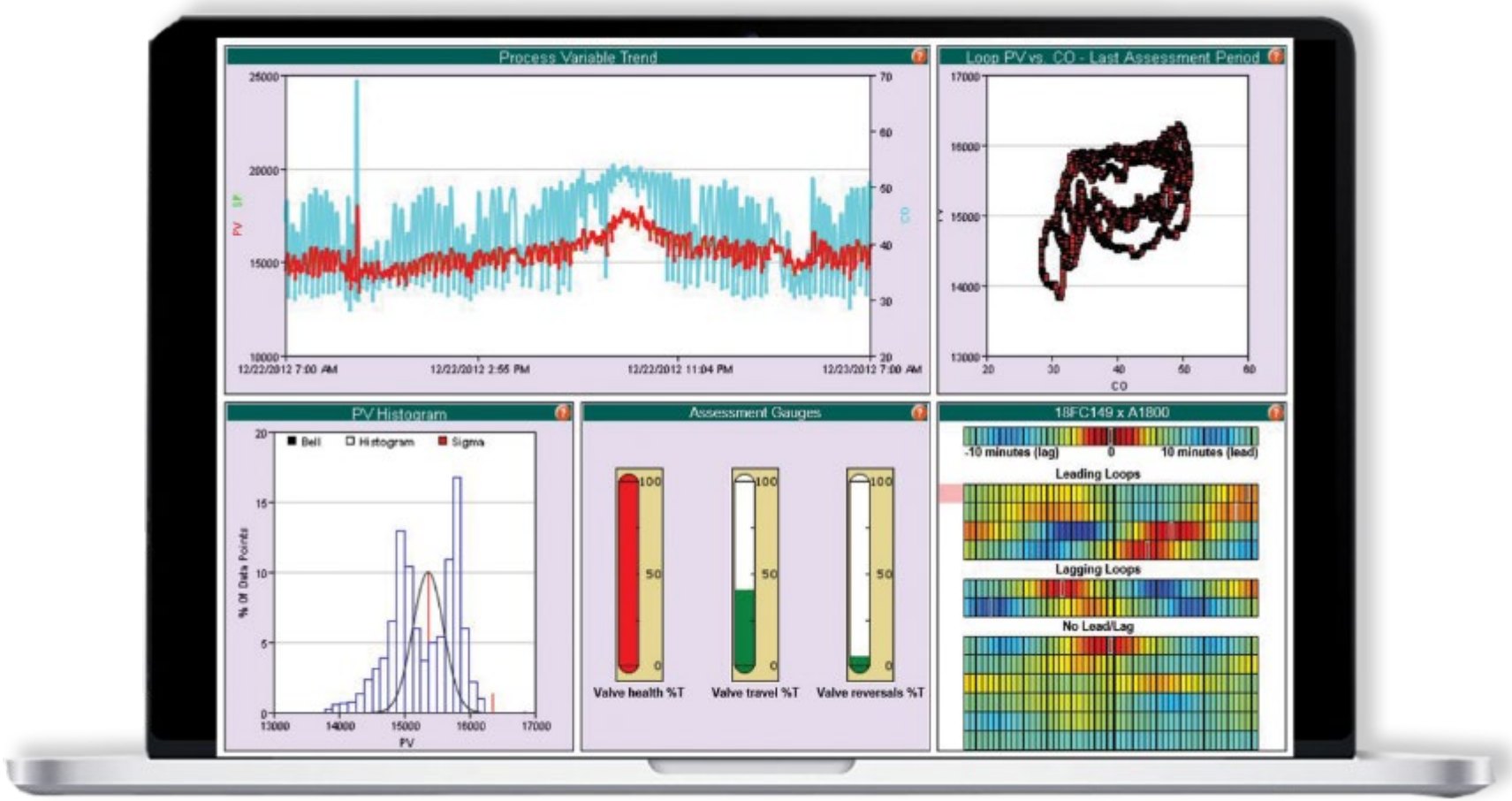


Largest benefits are obtained by moving the operating points



Expertune PlantTriage

Demonstration



European **Pulp mill**

Valve analysis

Problem

Valve oscillation detected by PlantTriage

Device demonstrated big deviation and pressure jumps

Leakage revealed in the actuator diaphragm

Solution

Automatic detection

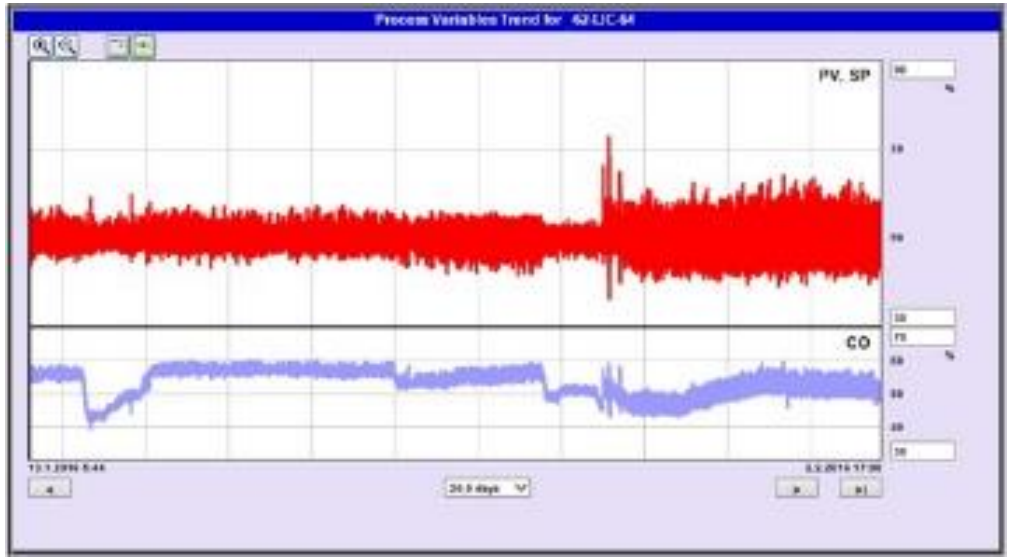
Actuator and valve were replaced in the next planned shutdown

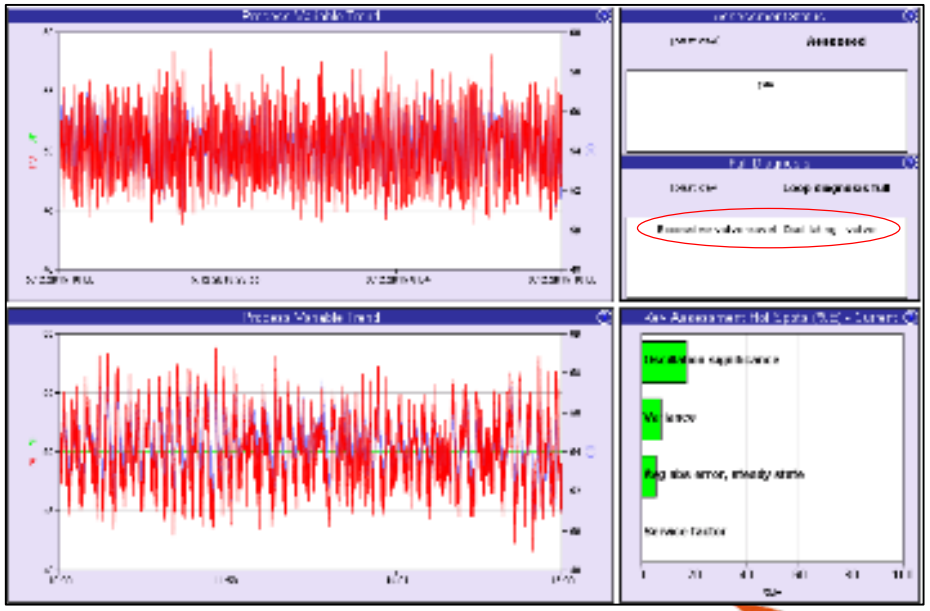
The quick flow changes disappeared

Unplanned shutdown avoidance

Valve monitoring

Problem	Solution
Excessive oscillation due to valve Field inspection revealed the actuator was barely bolted in.	Automated detection Replace and ensure all four bolts secure with an addition of an adhesive



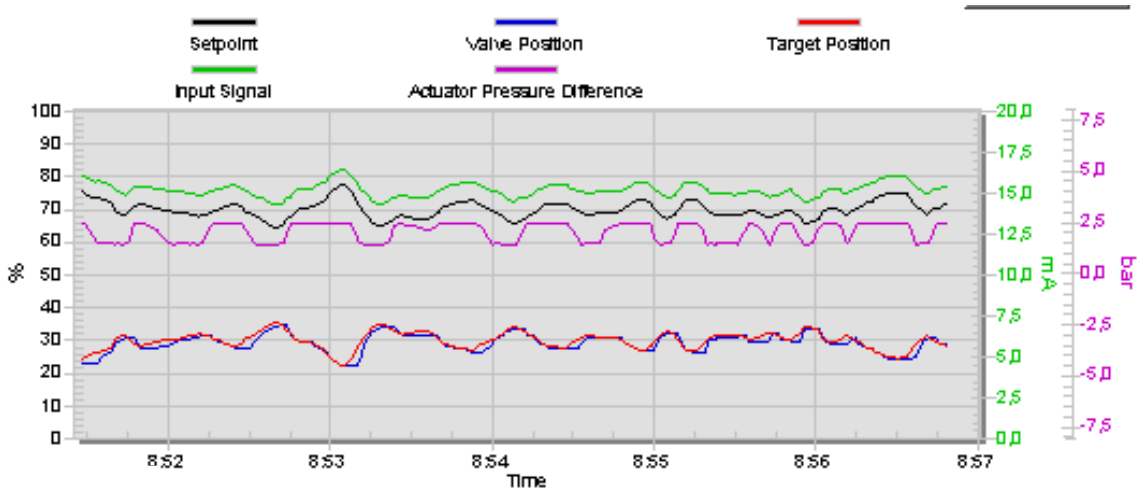


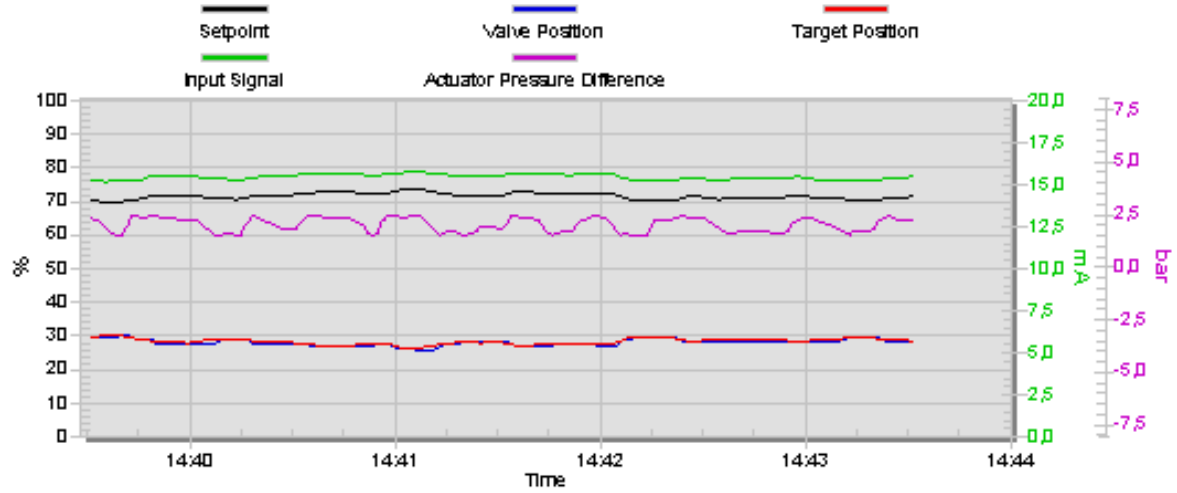
metso

European **Oil refinery**

Control loop analysis

Problem	Solution
Valve has known to have previous issues Valve demonstrating a lot of movement Valve monitored and found to operate well	Adjustment to the positioner performance level Control loop was retuned No additional repair to the valve package Valve lifetime extended





Case studies

Bleaching plant in Russia

Saves 400 KEUR a year

BP's refineries

Estimate $1-5 million per refinery, per year.

European refinery

Saves 7 MEUR per year

Vale Brazil

A 100% Return on Investment in 4 months

SABIC

Saves $1 million per year

Ras Gas

Saves $1 million per year

Summary

Utilize condition monitoring:

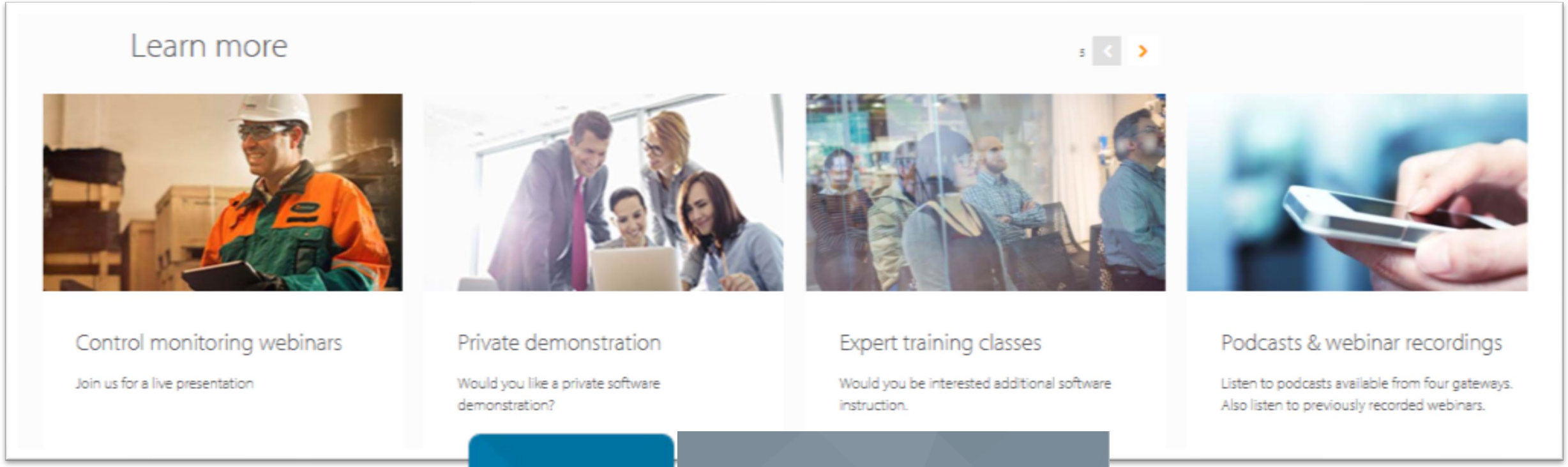
01 Implement **predictive maintenance**

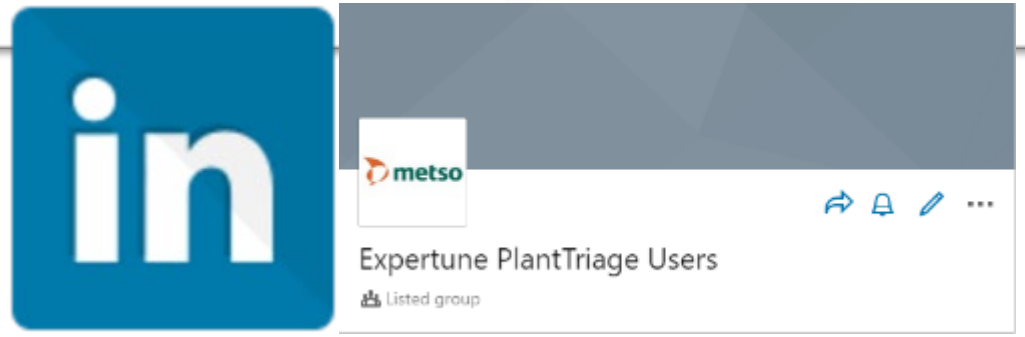
02 **Activate** existing controllers

03 **Optimize** performance

Resources and examples

Visit Metso.com, search for Expertune to discover more





Questions

For further information

Cristian Moraes
Global Sales Manager

Cristian.Moraes@metso.com
BZL: +55 15 9 9605 9154
EU: +351 914 65 6998

Boris Volavicius
EU Sales Manager

Boris.Volavicius@metso.com
+34 671 445 973

Devin Cole
Global Service Manager

Devin.Cole@metso.com
+1 208.301.0036

metso

Expect results

www.metso.com

company/metso

metsoworld

metsogroup

metsoworld

metsogroup