Optimized performance with predictive maintenance

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Content

- Valves in DCU
- Introduction to predictive maintenance
- Condition analysis services
- Case study & summary
- Questions & answers

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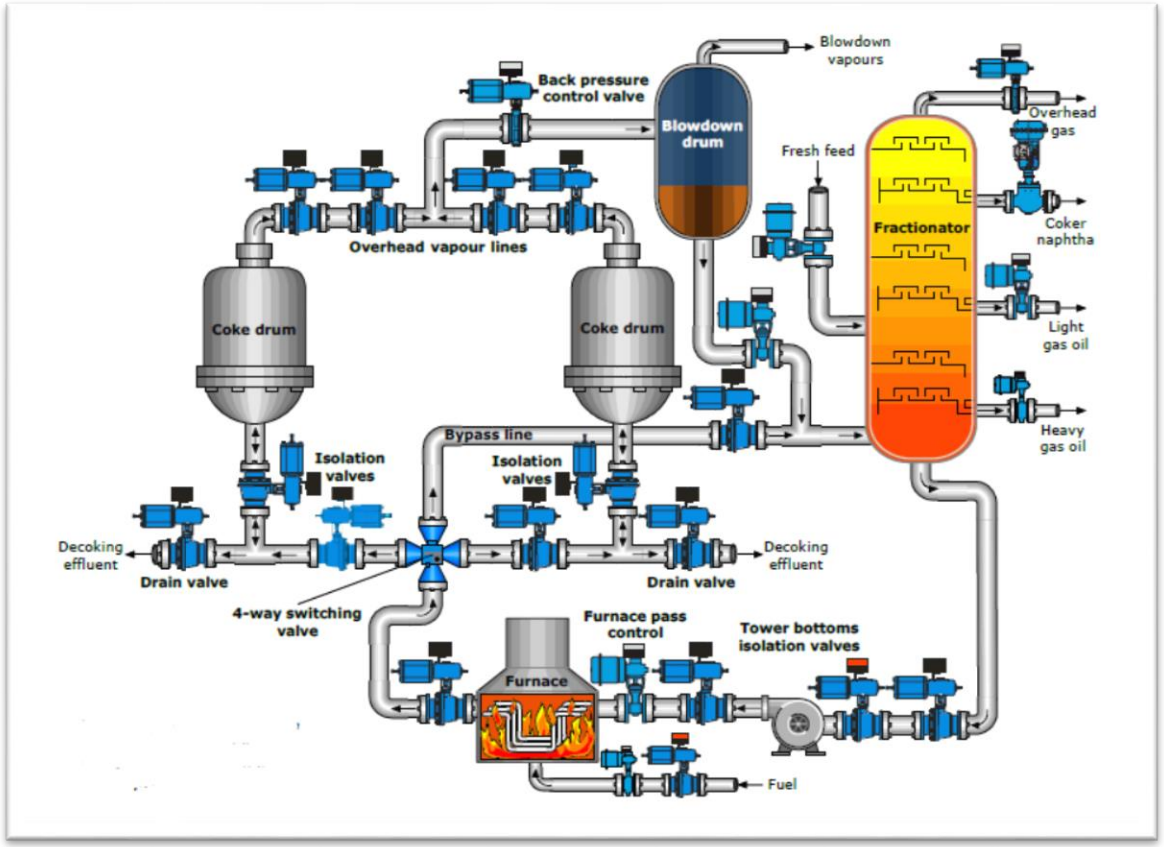
Typical valves in delayed coking

Automated on-off valves

Critical application valves

Control valves

Valve controller



Asset mnmgt & condition monitoring

ESD valves

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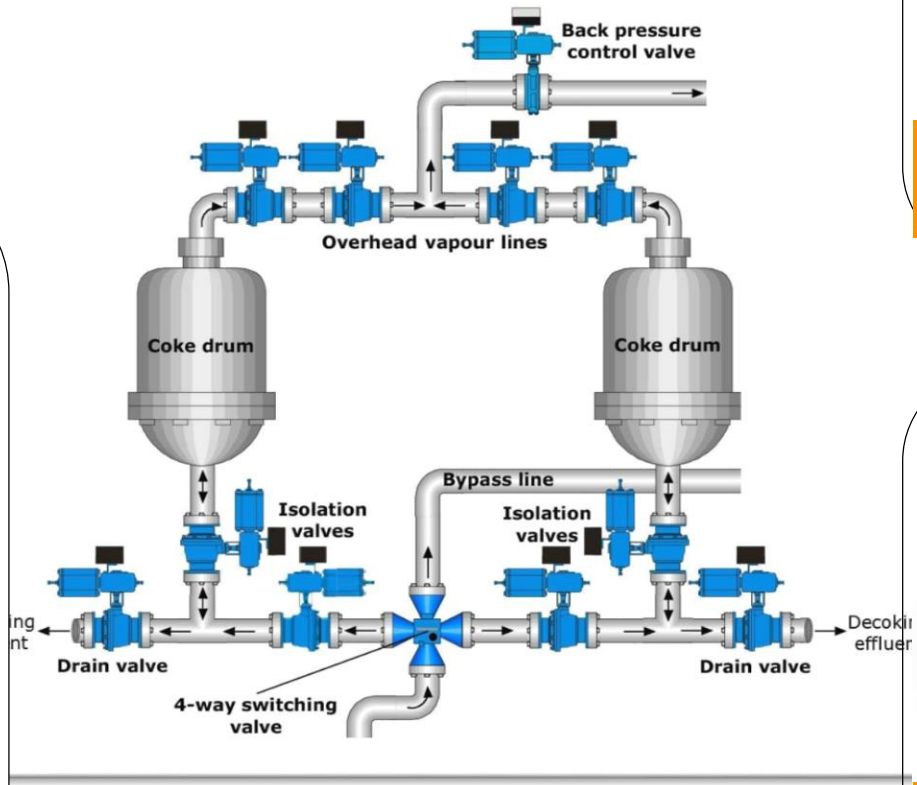
Coke drum valves

4 way switch valve



Overhead vapor line back pressure control valve

Overhead vapor & drum isolation valves

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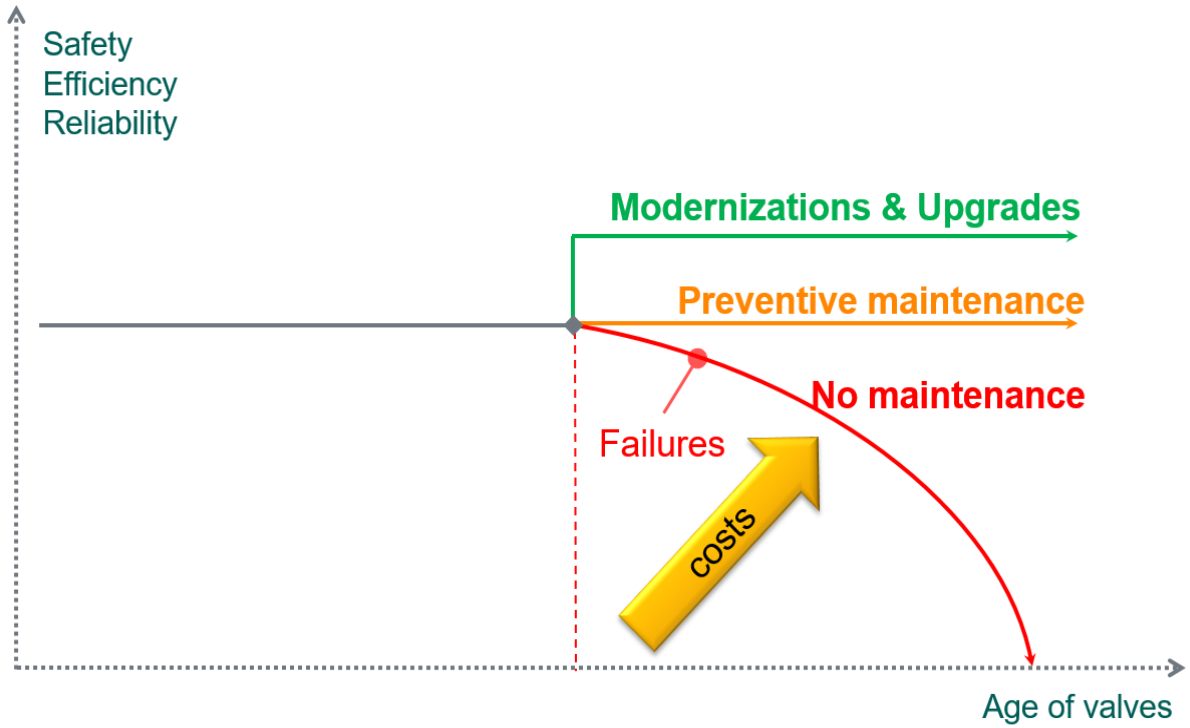
Managing valve's lifetime

Which way to reach the targets?



- Condition monitoring
- Installed base analysis
- Maintenance support
- Repairs and spare parts
- Shutdown preparation
- Process improvement
- Partnership
- Condition analysis

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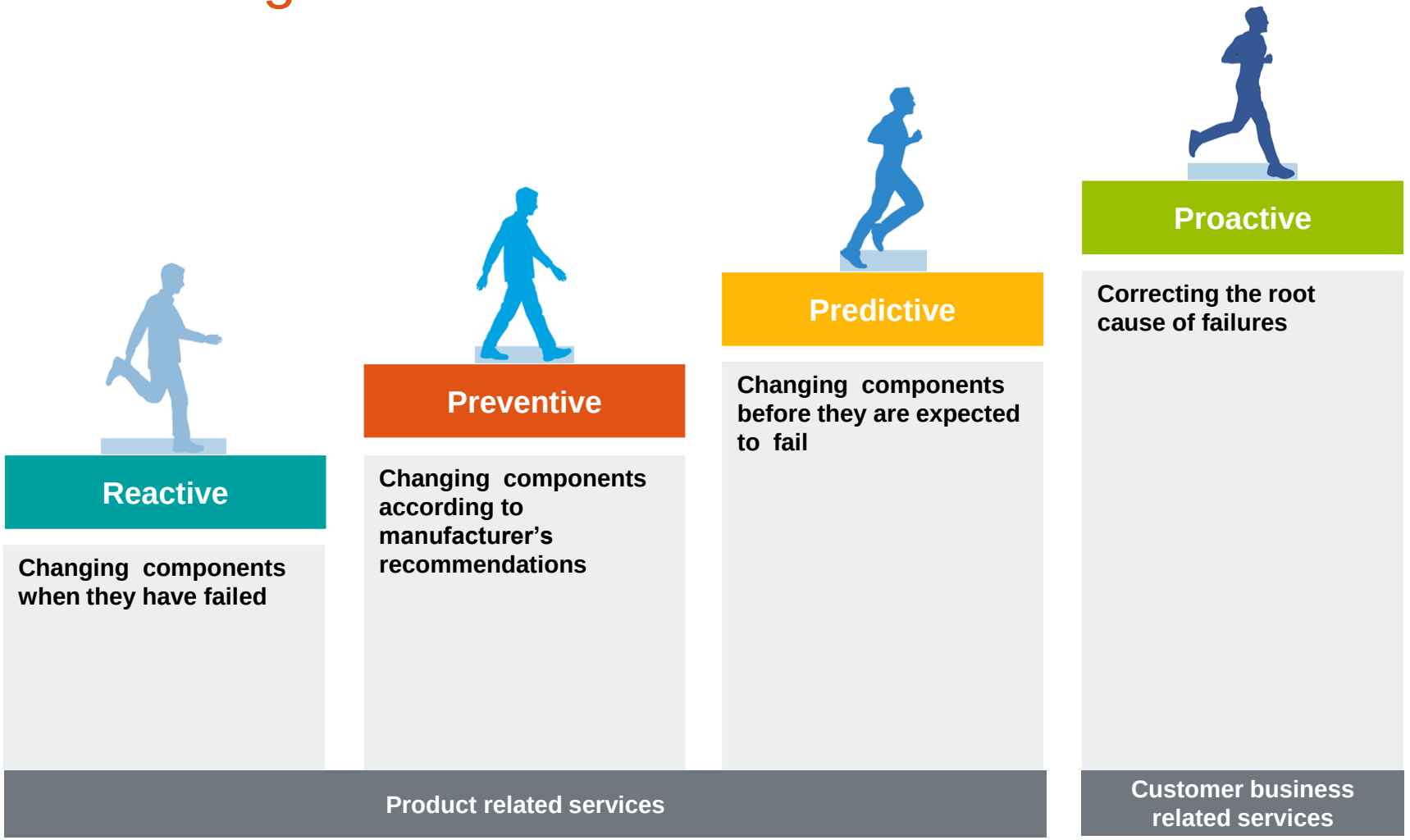
Maintenance path

Maintenance strategies



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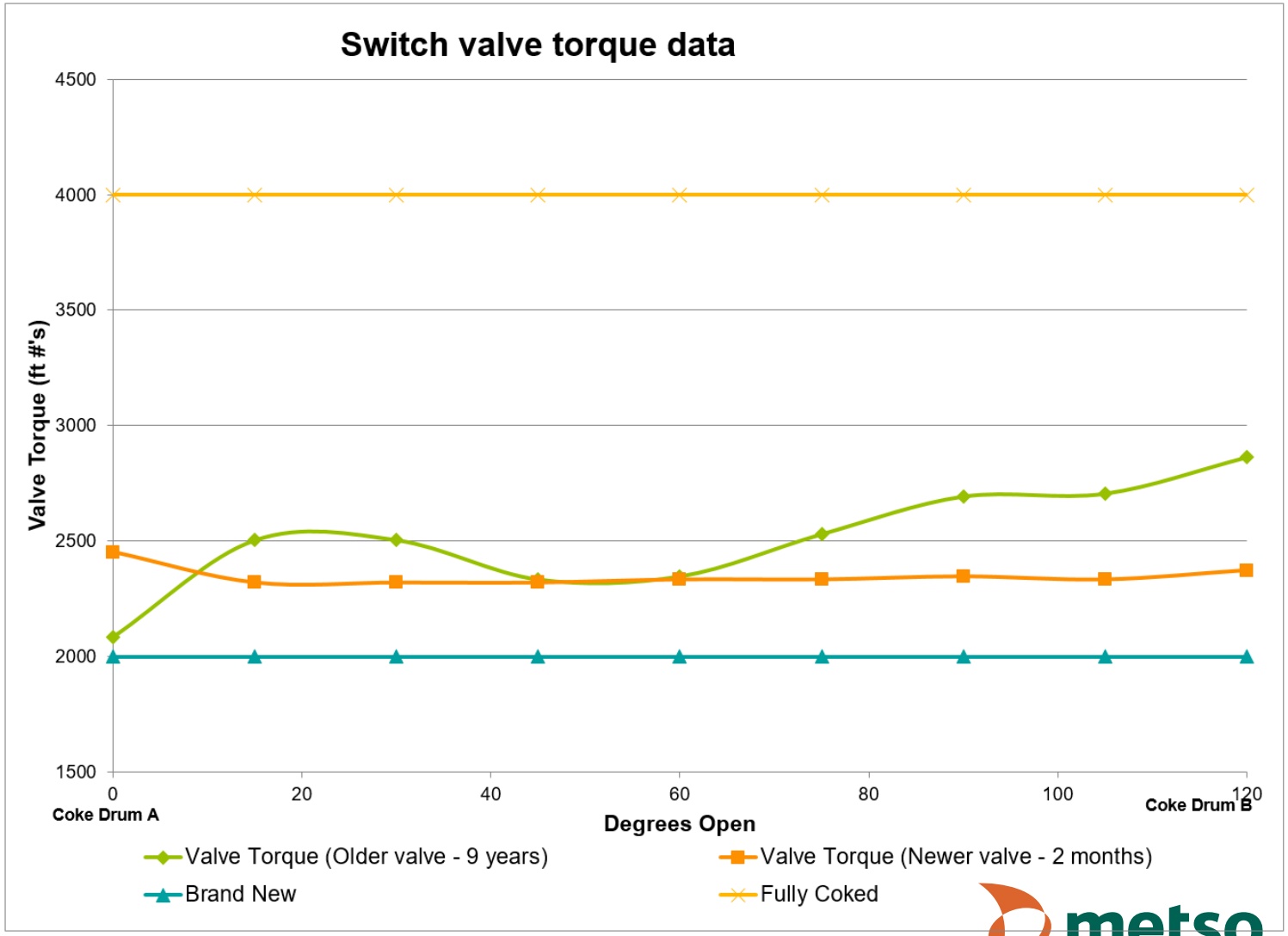
Condition analysis services

Maintenance planning for **on off valves**

- Valve testing
- Torque read out and analysis
- Service inspection
- Leakage detection
  without valve removal

4 way switch valve



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Valve condition analysis

Predictive Maintenance for **control valves**

Different approaches for condition based maintenance

Control loop analysis

+ Prioritizes according to process effect
- Only for devices under control loops

ValveTriage service

PlantTriage

Smart device analysis

+ Reveal also developing issues
- Applies only for digital positioners

Smart device monitoring

Smart device check

Online

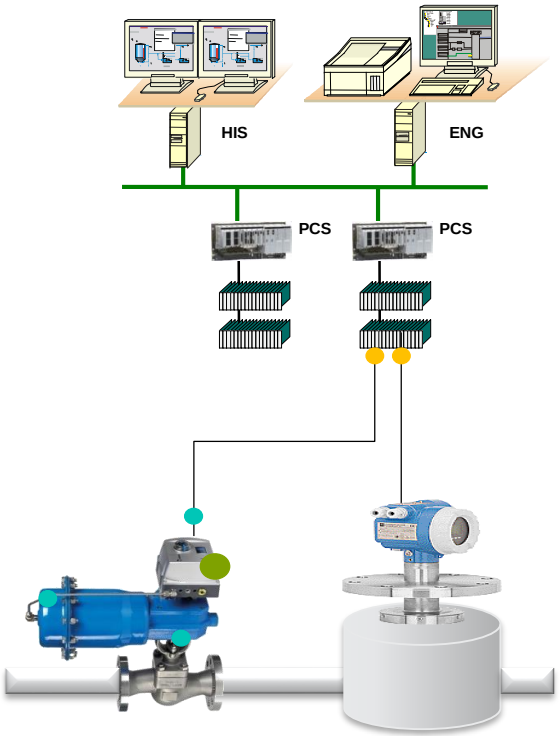
Valve testing / inspection

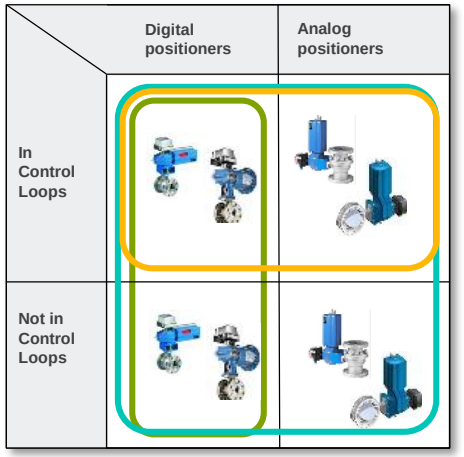
+ Includes experts visual inspection
- Testing disturbs the process

Control valve testing

Valve leak testing

Offline





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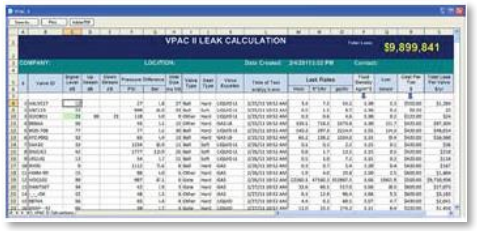
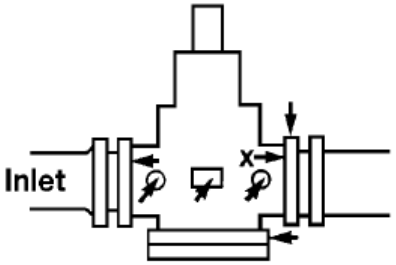
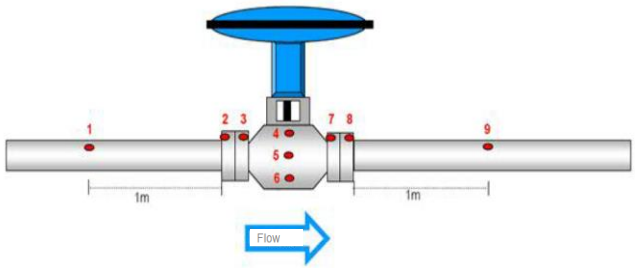
Valve leak testing

Leakage detection without valve removal (NelLeak)

- Based on high frequency noise caused by leakage in valve
- Applicable for all valve types
- Estimation of leak rate (l/min, tons/y)







Preconditions required for testing:

- Valve need to be closed
- Pressure difference over valve
- Areas on the valve's body and near surroundings without isolation
- Testing 1-2 minutes

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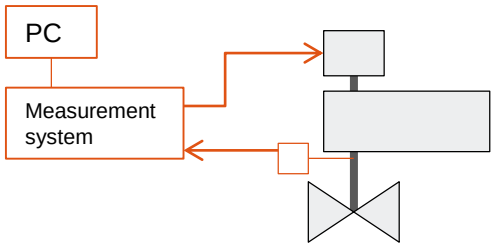
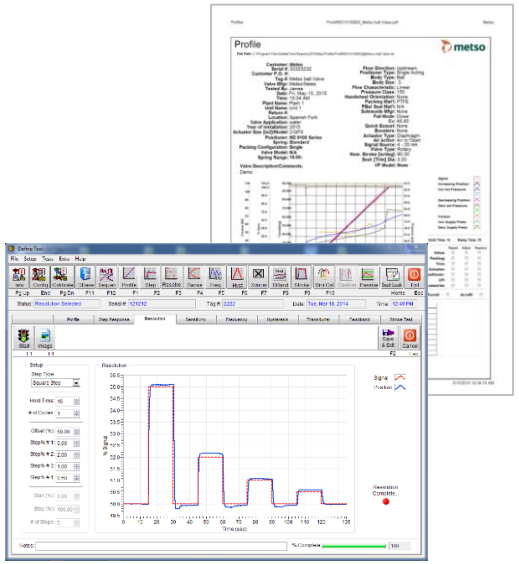
Control valve testing

Control valve's capability to follow control signal by Profiler

- Applicable for all control valve types
- Response verified by external position and pressure measurements
- Fully automated tests like:
  - step response
  - dead band
  - hysteresis





Preconditions required for testing

- Valve need to be isolated from the process
- Valve need to be disconnected from the control system
- Testing 20-60 minutes

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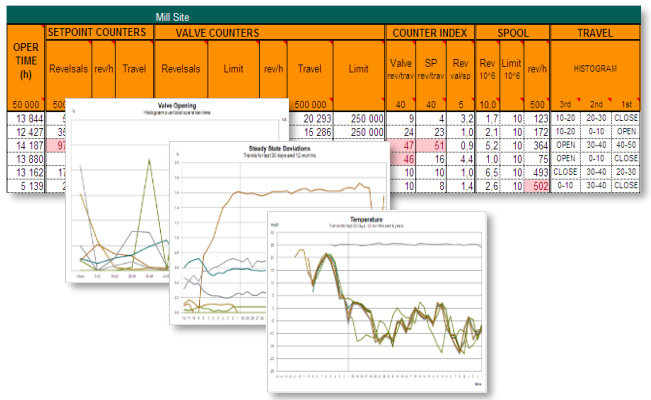
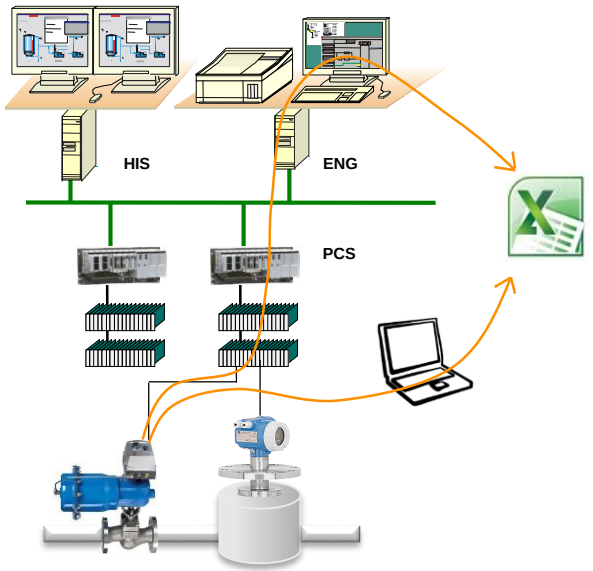
Smart device check

Valve condition analysis for valves with smart devices

- Detects under performing devices even before they are disturbing the process
- Data collection via any asset management system or with a laptop
- Reports acts as work lists for further investigations and maintenance planning





Data collection and analysis is done during normal process run

Utilizes existing asset management or point-to-point connection for data collection

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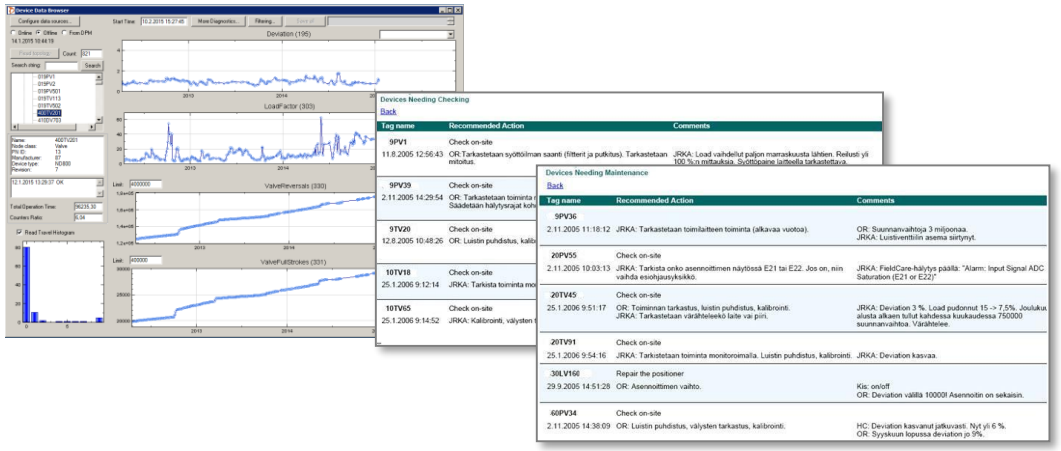
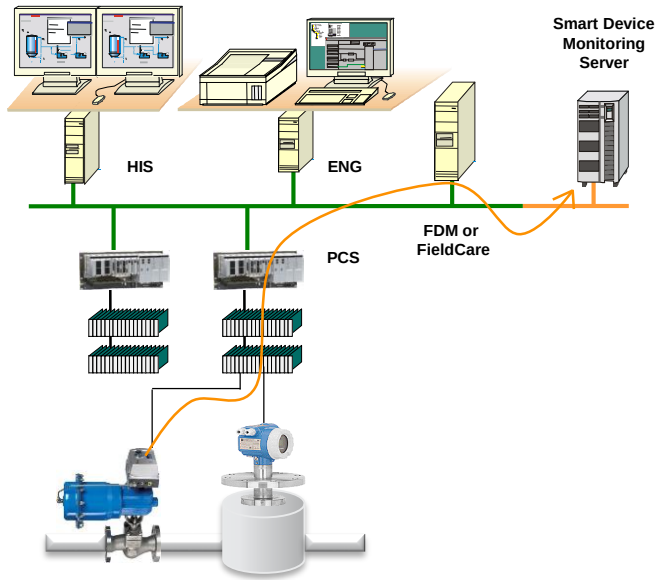
Smart device monitoring

Valve condition analysis for valves with smart devices

- Detects under performing devices even before they are disturbing the process
- Monitoring and analysis based on digital field devices
- Reports acts as work lists for further investigations and maintenance planning





Monitoring and analysis is done during normal process run

Utilizes FieldCare or Valmet DNA (FDM) for device communication

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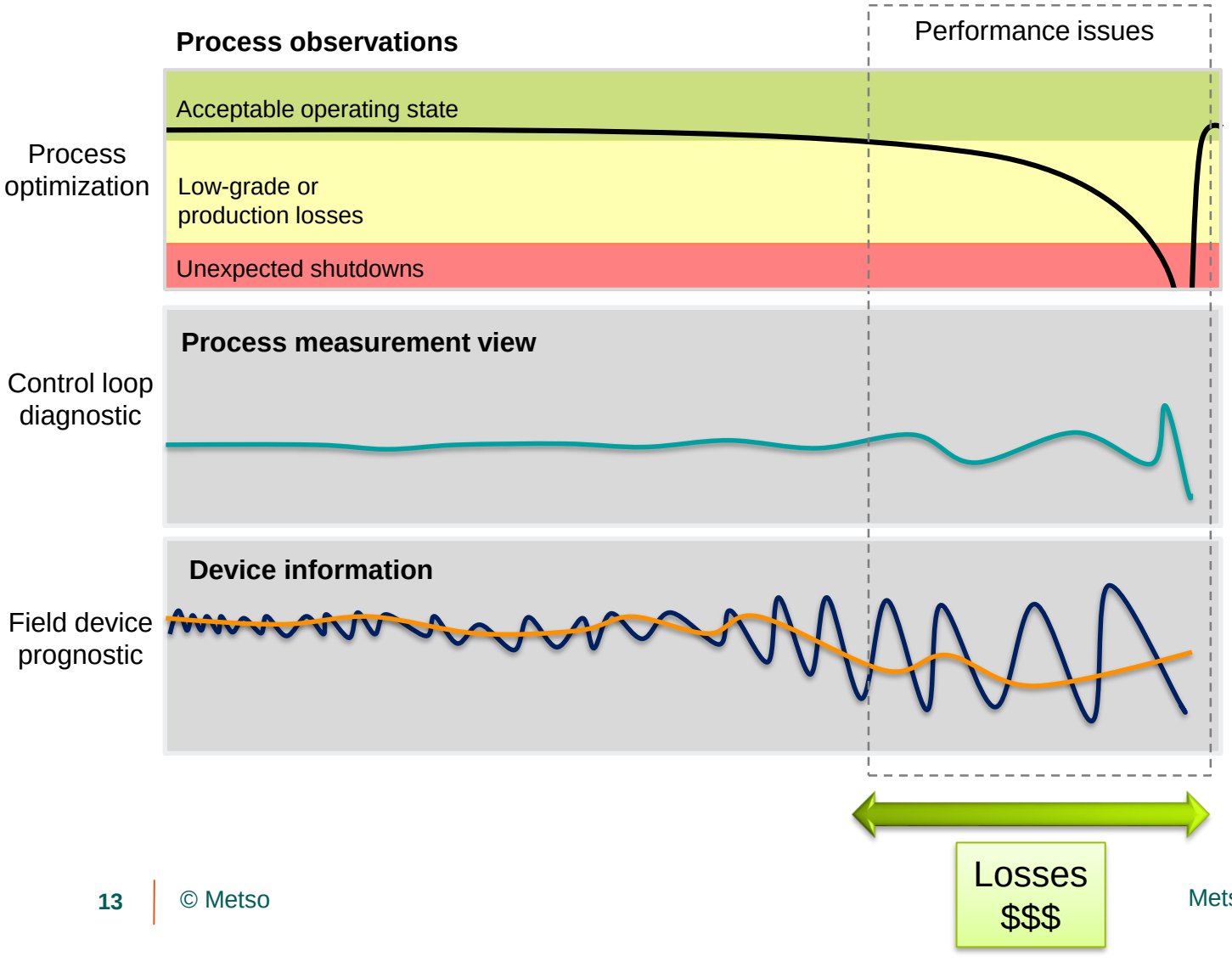
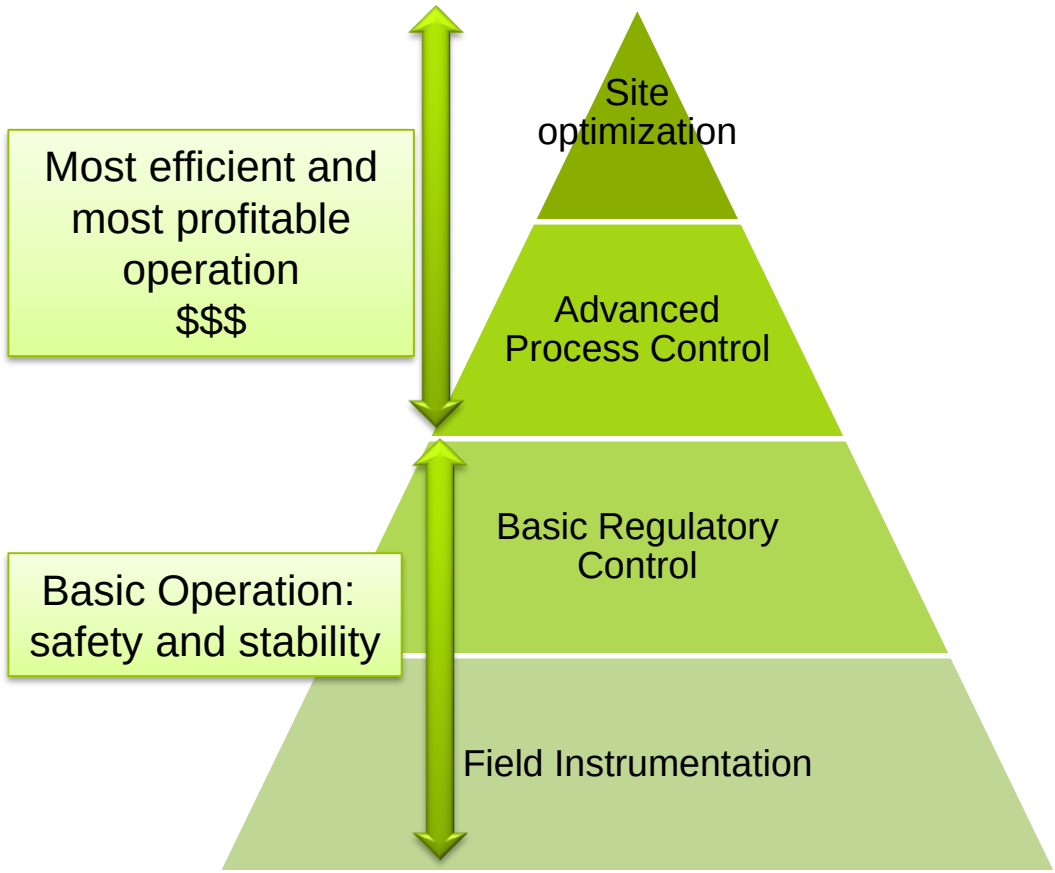
Condition based maintenance

Optimized unit operation based on valve's optimized performance





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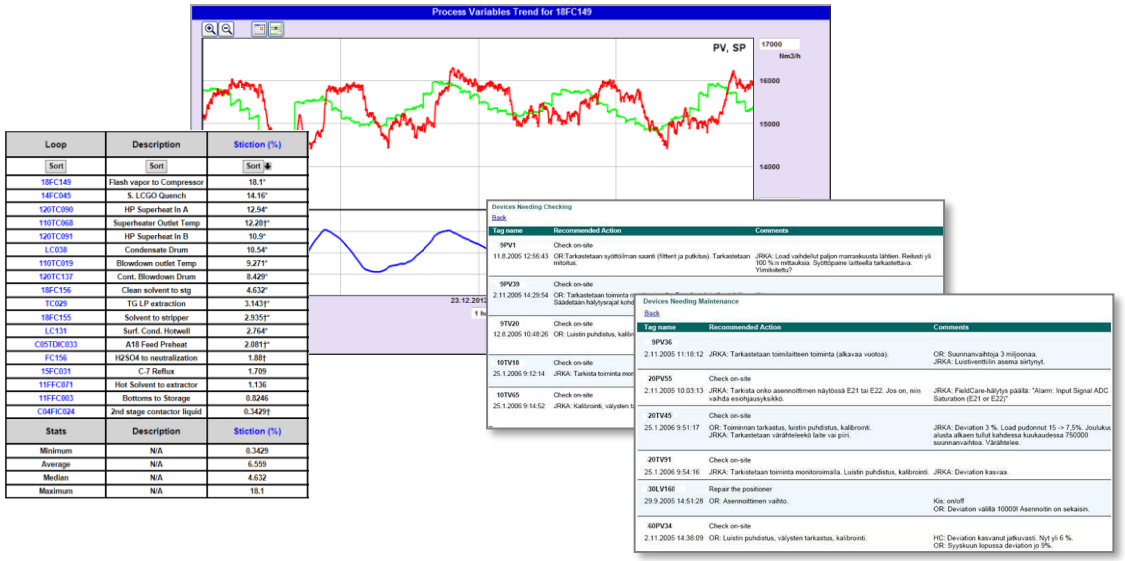
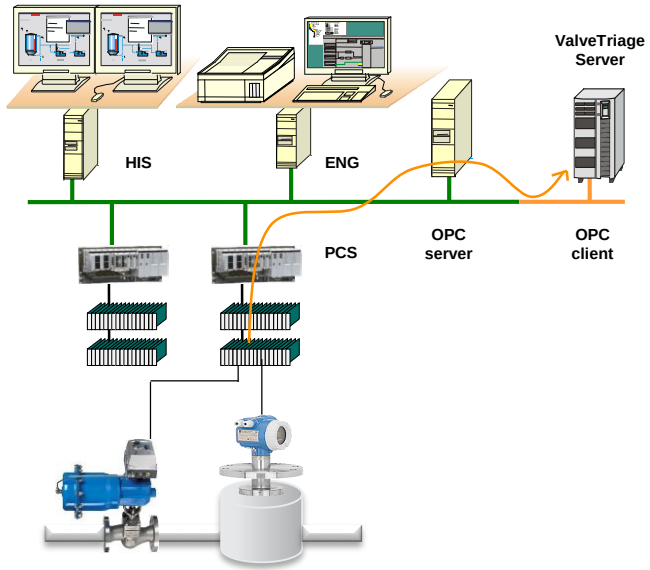
Control loop analysis

Valve condition analysis for valves under PID control

- Actions prioritized based on the process effect
- Works with both analog positioners and smart devices
- Reports acts as work lists for further investigations and maintenance planning





Monitoring and analysis is done during normal process run

Utilizes DCS data via OPC interface

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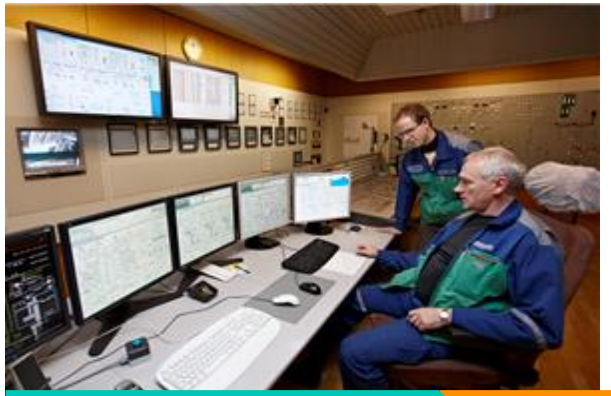
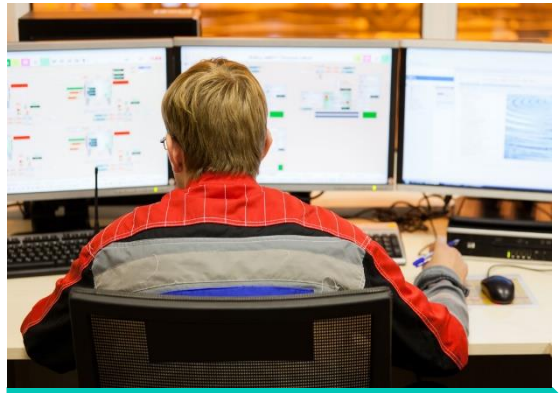
Control loop analysis





ANALYSIS

Analyze the worst performing valves in the ValveTriage service center using PlantTriage software

REPORTS

Provide reports:

>Oversized valves

>Undersized valves

>Stiction

EQUIPMENT INTEGRATION REPORTING

Evaluate smart positioners in conjunction with valve performance

RECOMMENDATIONS

Prioritize recommendations and conduct follow-up

PROCESS SOLUTION SERVICES

Analyzing and calculating direct economic impact of valve's operation on throughput, product quality & product yields

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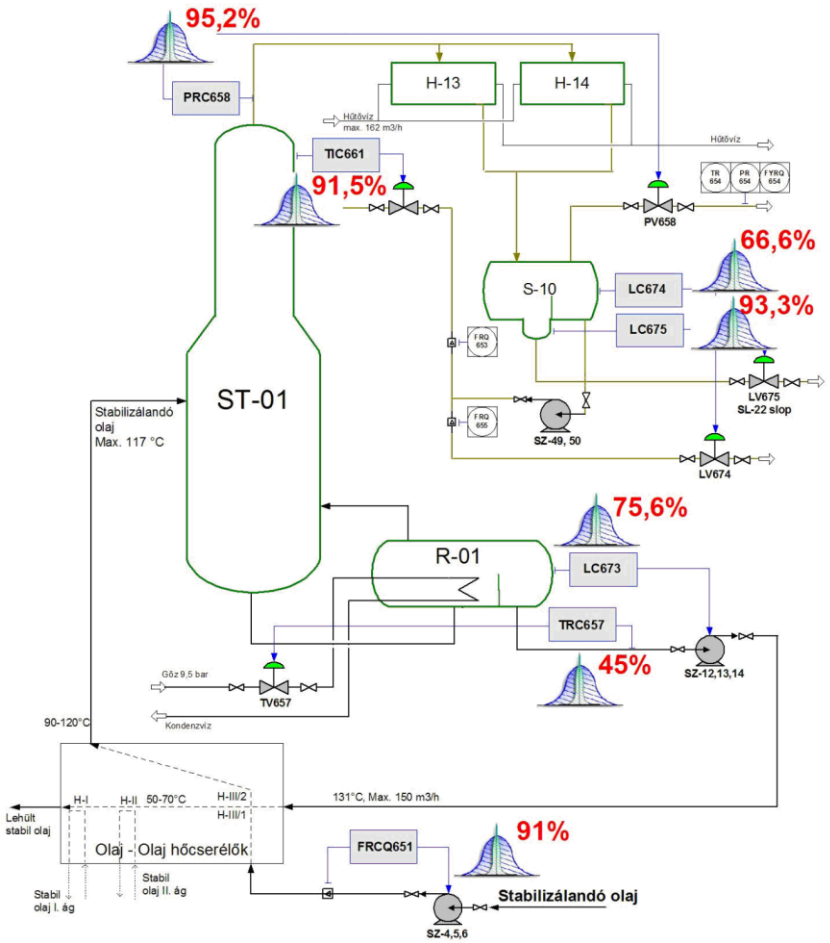
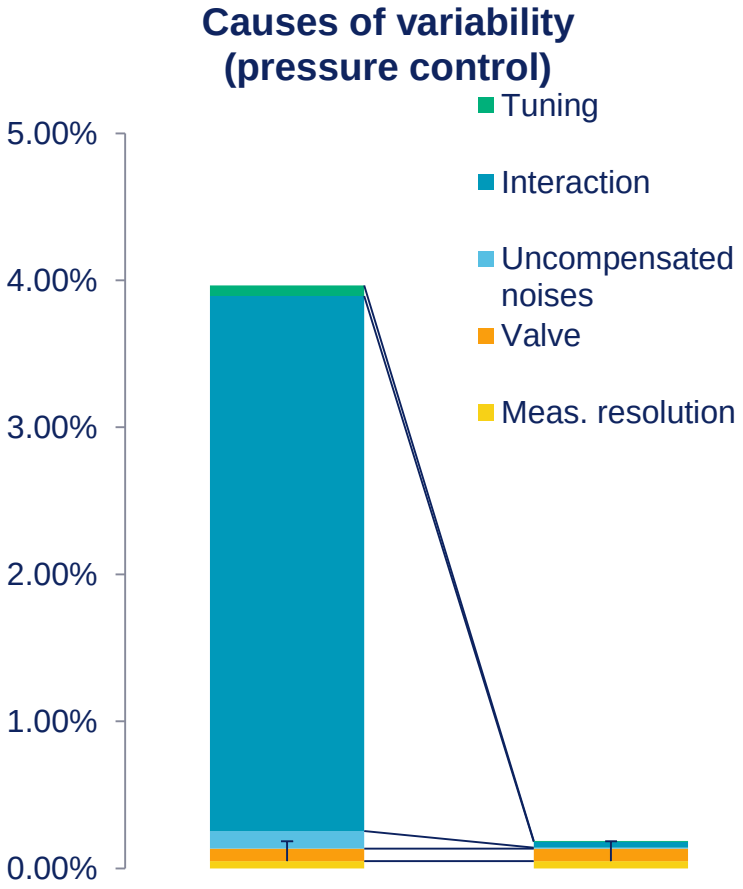
Process solution services

Loop tune benefits on a typical distillation column





Improving process stability

Average variability improvement 50 %

Financial benefit from 50 000 to 400 000 €/y

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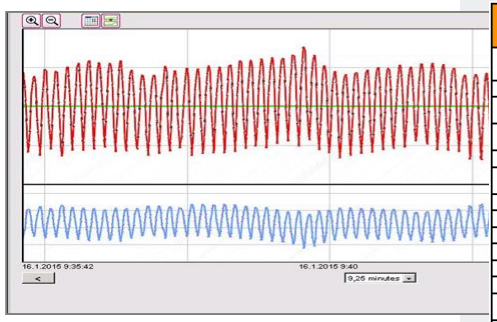
Valve performance issues

Examples

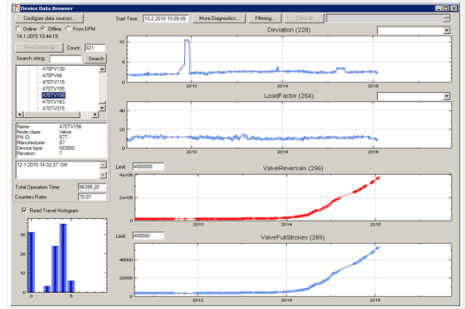
- Excessive valve travel / wear
  - Disturbs the process
  - Causes excessive valve wear



Control Loop Analysis

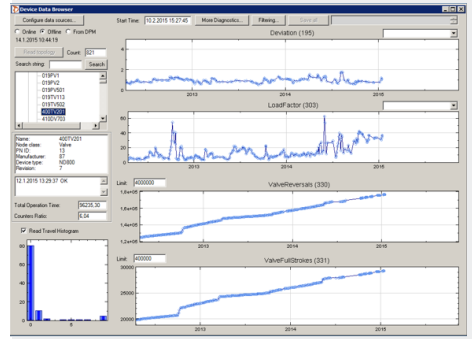
Loop	Description#	Valve travel (% per day)	Valve reversals (times/day)
32FC004	Air to Feed Tank	328700†*	29070†
PC052	HP to IP Letdown Small	26690†*	4788†
110TC019	Blowdown outlet Temp	13630†*	1494†*
30FC301C	BLR C BFW Flow	6754†	6720†
120LC049	Cont. Blowdown Drum	6481†*	5226†
110FC028	3rd Stg Air East	6288†*	1140†
14FC027	LC Cut to Exch 67	5514†	5700†
PC051	HP to IP Letdown Big	5495†	3165†
11FFC104	Steam to Exch 17-18	5062†*	960†
10FC041	A10 Inlet Feed Flow	4997†	13820†*
14FC088	NH3 injection	4730†	8388†
27FC004	Column Btms to Storage	4670	696
110FC029	3rd Stg Air West	4452†	1440†
110FC017	2nd Stg Air East	4405†	2004†
18FC149	Flash vapor to Compressor	4153†	528†

Smart Device Monitoring



- Sticky valve
  - Oscillation due to stick-slip phenomenon
  - Valve is the source of process disturbance
  - Excessive valve wear

Loop	Description#	Stiction (%)
18FC149	Flash vapor to Compressor	18,1†*
14FC045	S. LCGO Quench	14,16†*
120TC090	HP Superheat In A	12,94†*
110TC068	Superheater Outlet Temp	12,28†*
120TC091	HP Superheat In B	10,9†*
LC038	Condensate Drum	10,54†*
110TC019	Blowdown outlet Temp	9,271†*
120TC137	Cont. Blowdown Drum	8,429†*
18FC156	Clean solvent to stg	4,632†*
11FC034	Pump Around	4,231*
TC029	TG LP extraction	3,143†*
18FC155	Solvent to stripper	2,935†*
LC131	Surf. Cond. Hotwell	2,764†*
C05TDIC033	A18 Feed Preheat	2,081†*
15FC031	C-7 Reflux	1,709†
11FFC071	Hot Solvent to extractor	1,136†
11FFC003	Bottoms to Storage	0,8246†
C04FIC024	2nd stage contactor liquid	0,3429†



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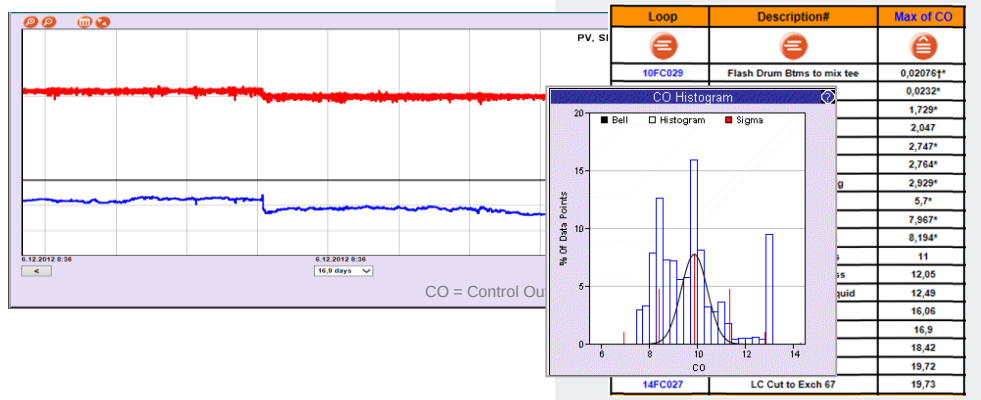
Valve performance issues

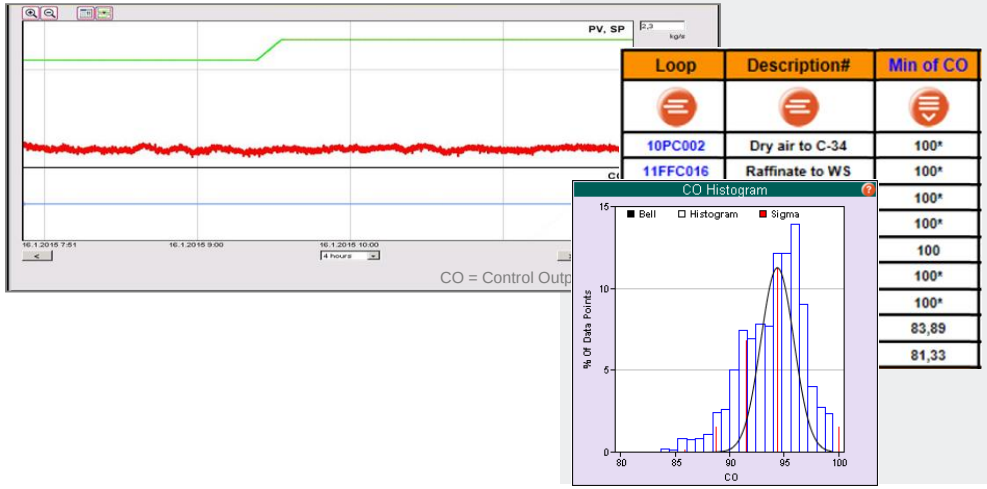
Examples

- Wasting pumping energy (oversizing)
  - Reduces control accuracy
  - Possible cause of oscillation
  - Causes internal erosion

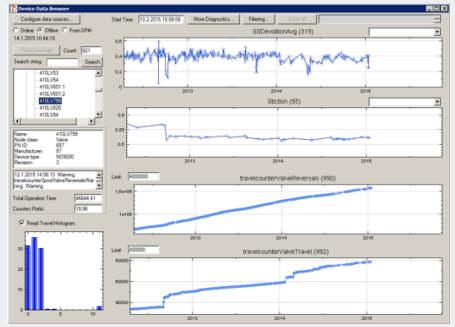
- Bottlenecks (undersizing)
  - Process variable cannot reach the setpoint even if the valve is 100 % open
  - Process not at planned operating point
  - Possible production bottlenecks

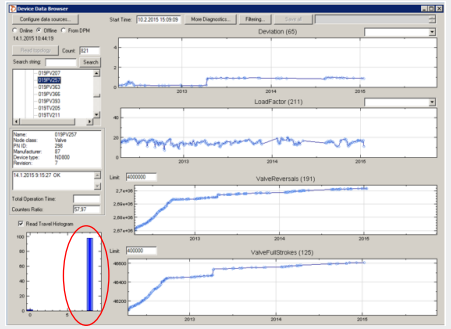
Control Loop Analysis





Smart Device Monitoring





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Measurable benefits

Focuses maintenance actions to devices needing it

- **Improved process performance**
  - Detecting valves causing process cycling
- **Reduced maintenance costs**
  - Detecting valves requiring maintenance (valves with hysteresis and stiction)
  - Preventing excessive wear (valve travel and reversals)
- **Detection of process bottlenecks**
  - Devices operating at limit
- **Prevent expensive consequences**
  - Failure and accident / release
  - Loss of production

Quantifying results

- **Directly measured results:**
  - Root cause solutions – benefits beyond the obvious
  - Crowd the specs / opportunity gap
- **Indirectly measured:**
  - Instrumentation
  - Valves
  - Tuning
  - Filters
  - Bottlenecks
  - Process & procedures

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Expect results