Save Energy with Splunk

Leverage Process and Energy Data to Optimize Industrial Processes

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Your 3 Key Take Aways

1 COLLECT

heterogeneous sensor data from industrial processes in one data platform

2 ENRICH

and correlate sensor data with additional data sources to create meaningful context

3 ANALYZE

various data sources to optimize processes and increase efficiency

About us

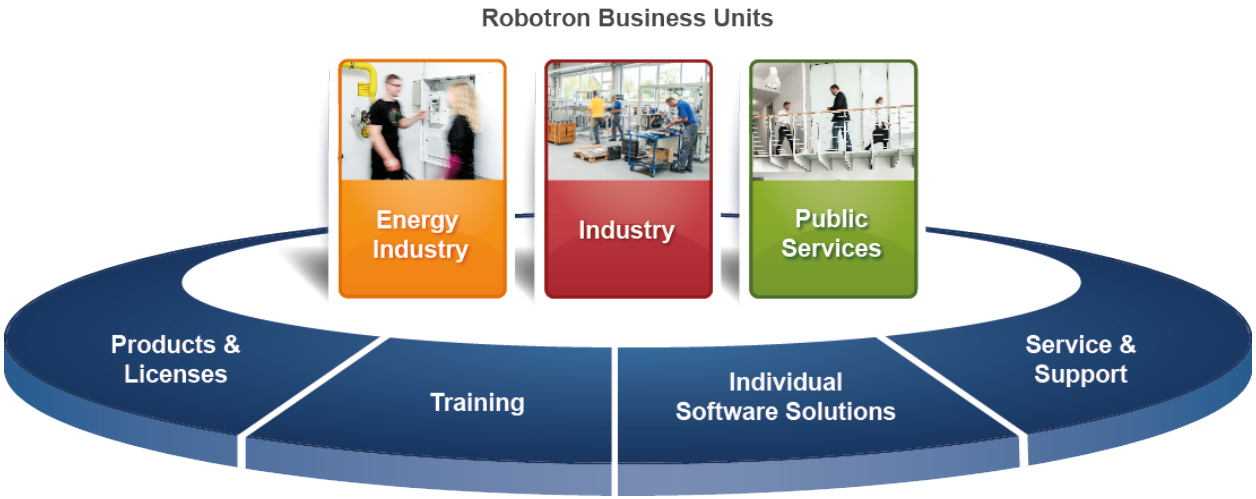
Philipp Drieger (Splunk)

- Sales Engineer at Splunk
- Background in data visualization, analytics and 3D software development
- Experience in various industry verticals such as automotive, transportation and software industries.
- Proven fast time to value with Splunk winning Deutsche Bahn hackathon

Matthias Ilgen (Robotron)

- Project manager and pre-sales engineer for business analytics
- Background in the area of information retrieval, text - and data mining
- Experience in various industry verticals such as life-science healthcare, manufacturing and automotive.
- Implementation of complex IoT solutions based on Splunk

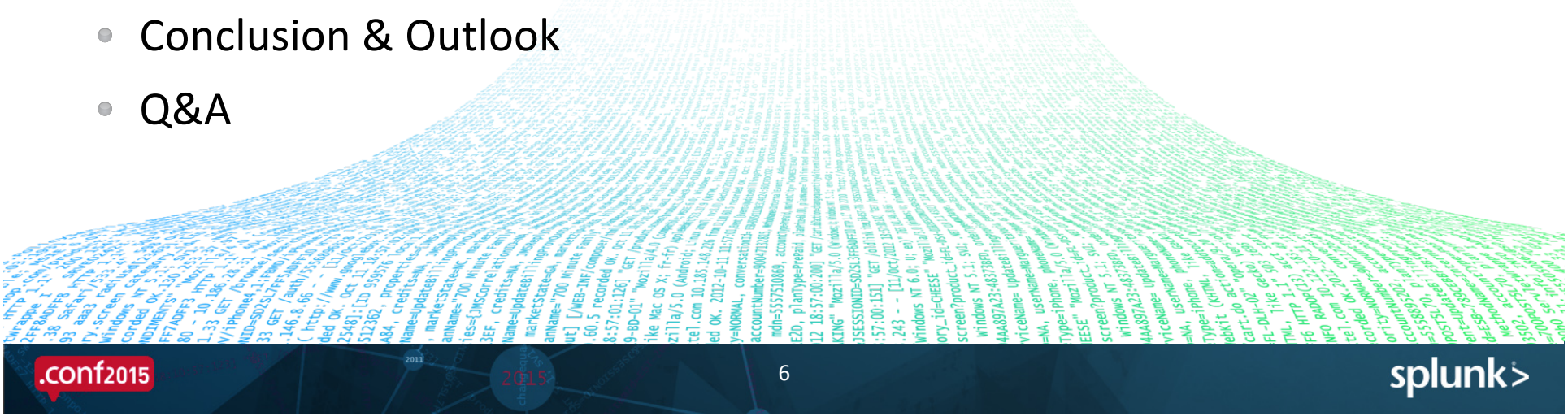
Facts about Robotron



- Methodical and technological responsibility
- Comprehensive expertise of industry-specific business processes
- Number of employees (Robotron group): 450

Agenda

- Splunk as a data platform for industrial sensor data
- Bridging the gap: Combine energy and process data
- Use Case #1: Energy efficiency monitoring and optimization
- Use Case #2: Condition monitoring and predictive maintenance
- Conclusion & Outlook
- Q&A



Splunk as platform for industrial and IoT data

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Splunk a World of Interconnected Assets

Transportation | Energy | Utilities | Building Management

Oil and Gas | Manufacturing

Sensors, Pumps, GPS, Valves, Vats, Conveyors, Pipelines, Drills, Transformers, RTUs, PLCs, HMIs, Lighting, HVAC, Traffic Management, Turbines, Windmills, Generators, Fuel Cells, UPS

Industrial Data

Retail | Home | Consumer

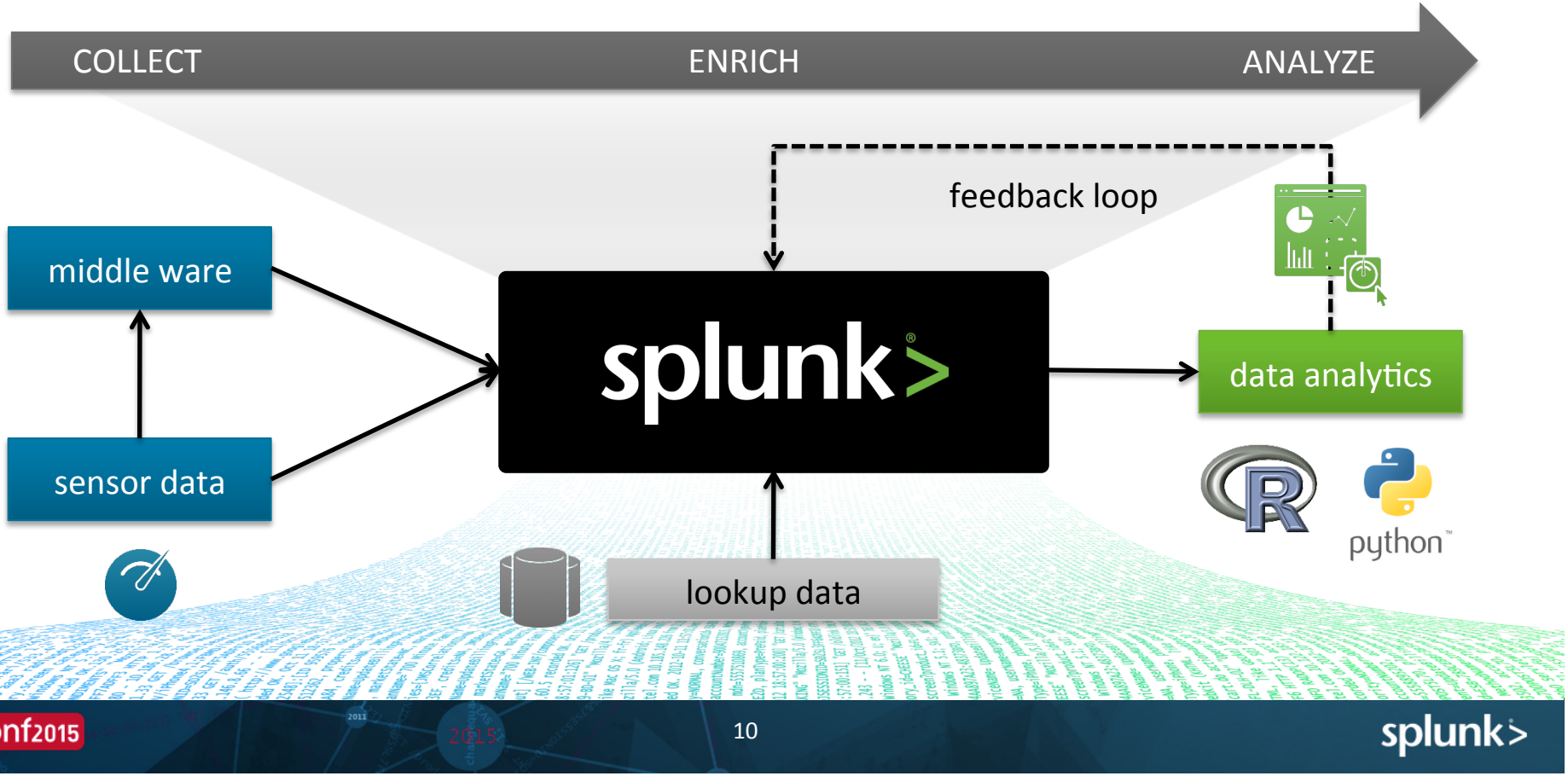
Telemedicine | Connected Cars

Wearables, Home Appliances, Consumer Electronics, Gaming Systems, Personal Security, Set-Top Boxes, Vending Machines, Mobile Point of Sale, ATMs, Personal Vehicles

Internet of Things

Splunk for 360 degree data view

Typical Workflow for Analyzing Sensor Data



3 Common Ways to Analyze Sensor Data with Splunk

1 SPL

use out of the box SPL search commands to analyze your data

stats	calculate various statistics
(time)chart	chart (time-series) events for viz
anomalies / outlier	detect unusual / outlier events
cluster / kmeans	cluster events based on similarity / given cluster #
associate / arules	identify correlations / relationships between fields
autoregress	calc autoregression (for moving average)
correlate	co-occurance between fields
contingency	calc relationship between variables
predict	prediction for time-series data

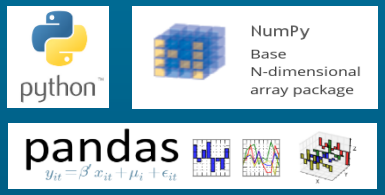
2 APPS

leverage Splunk Apps to quickly onboard data and gain insights

https://splunkbase.splunk.com/

3 SCRIPT

create scripts or code with SDKs for advanced and customized solutions



Cheat sheet: Splunk Commands for Analytics

Splunk command	What can I achieve with it?
(stream)stats	calculate various statistics
(time)chart	chart (time-series) events for viz
anomalies / outlier	detect unusual / outlier events
cluster / kmeans	cluster events based on similarity / given cluster #
associate / arules	identify correlations / relationships between fields
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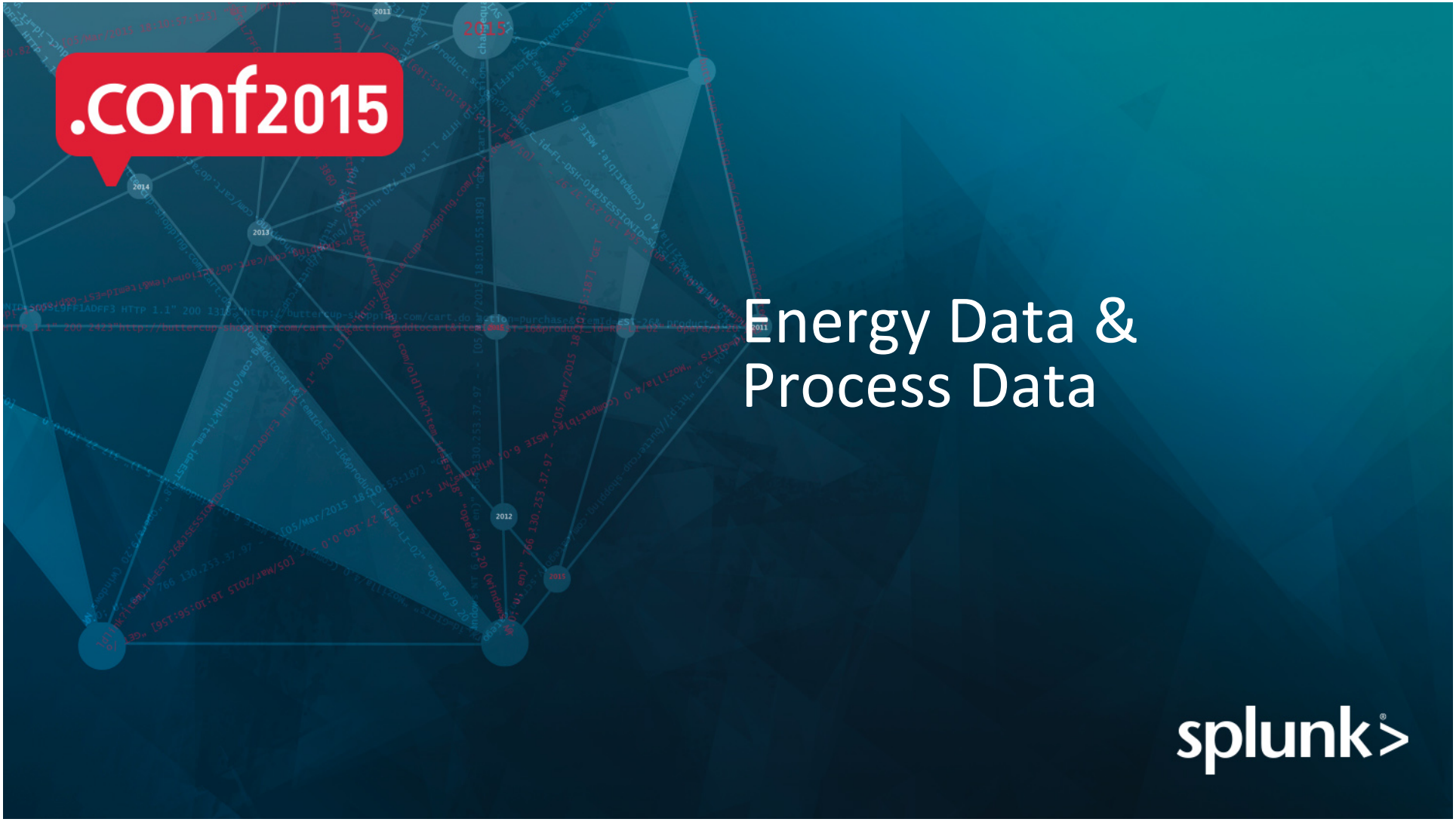
Find out more: http://docs.splunk.com/Documentation/Splunk/latest/SearchReference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Energy Data &
Process Data
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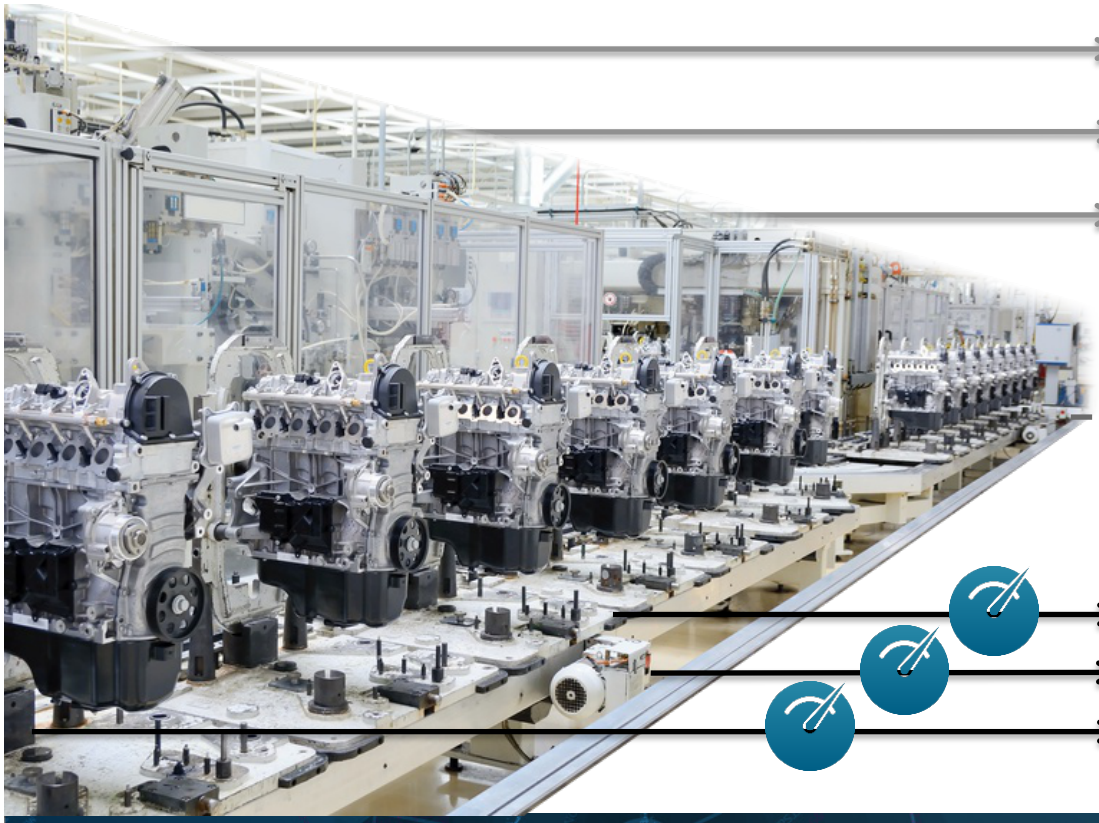
Challenge: Optimize Energy Efficiency



process data
contains information about
operational state of equipment

bridge the gap!

Σ(energy meters)
= energy consumption

What is…

Category	Energy Data	Process Data
Time	Equidistant time series	Process event based
Type	Sensor data	Control data, sensor data
Semantics	Energy metrics	Equipment behavior
Source	Energy logger, Equipment, EDM	SPS, SCADA, HMI, …
Format	Variety of formats	Variety of formats

Energy Data

Energy consumption

86348 24.03.15 23:59:59 140808,297;
140746,031;140919,500;

Process Data

Production status

24-03-2015 01:00:59 EPIP02-03-A;SB;PPR PR;
PRODUCTION;PR;aRTC: accounted transaction
(equip02_evnt_job_unit01);;;;;;;0,014;753,000

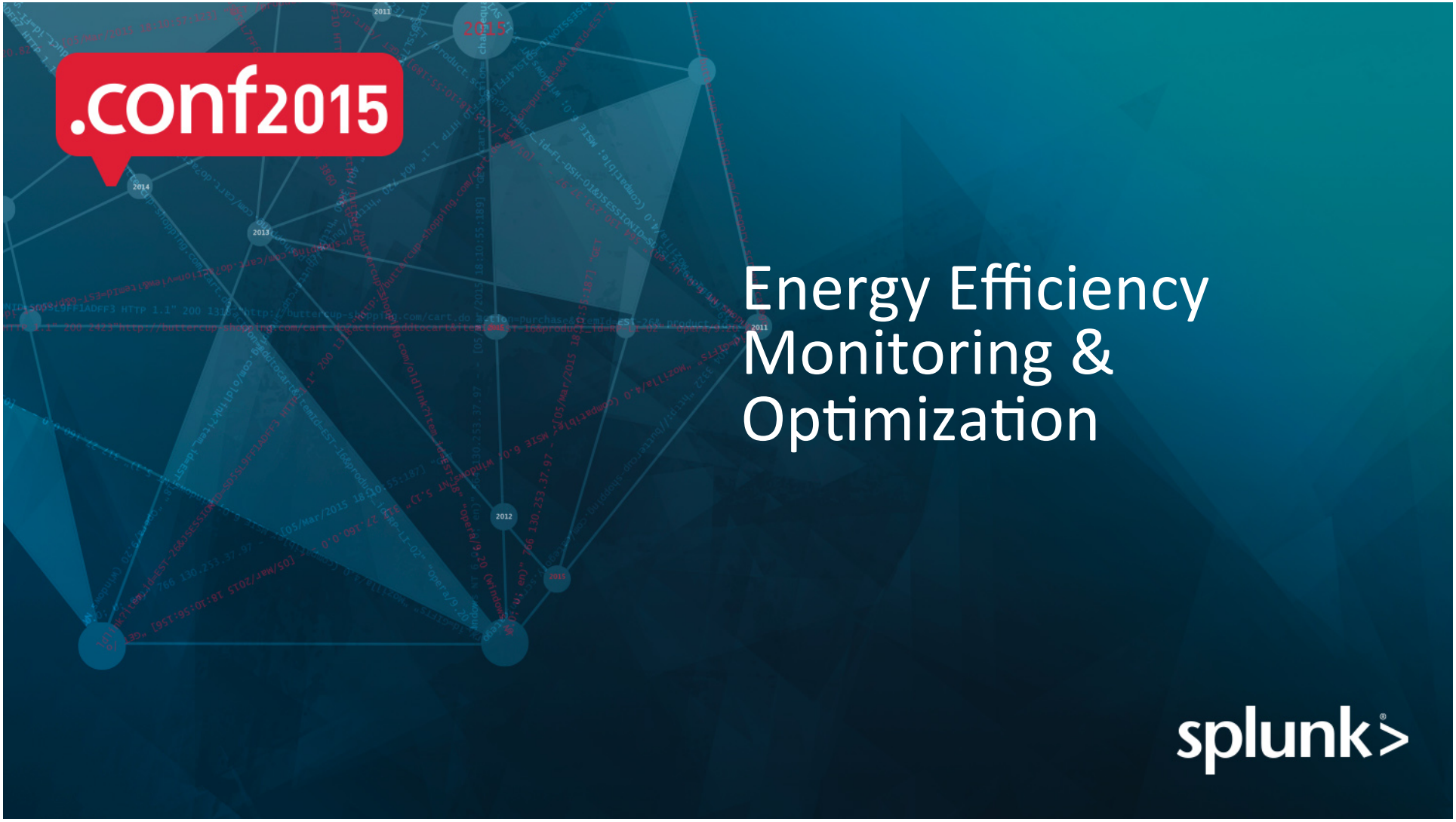
correlation over time (join)

Use cases

- Transparency of equipment on shop floor level
- Discover process weaknesses
- Condition based and predictive maintenance
- Optimization of energy efficiency of equipment
- Optimization of energy purchasing process (forecast / predictive)

… etc ….

Increased efficiency
Saved energy
Saved $$$



Energy Efficiency Monitoring & Optimization

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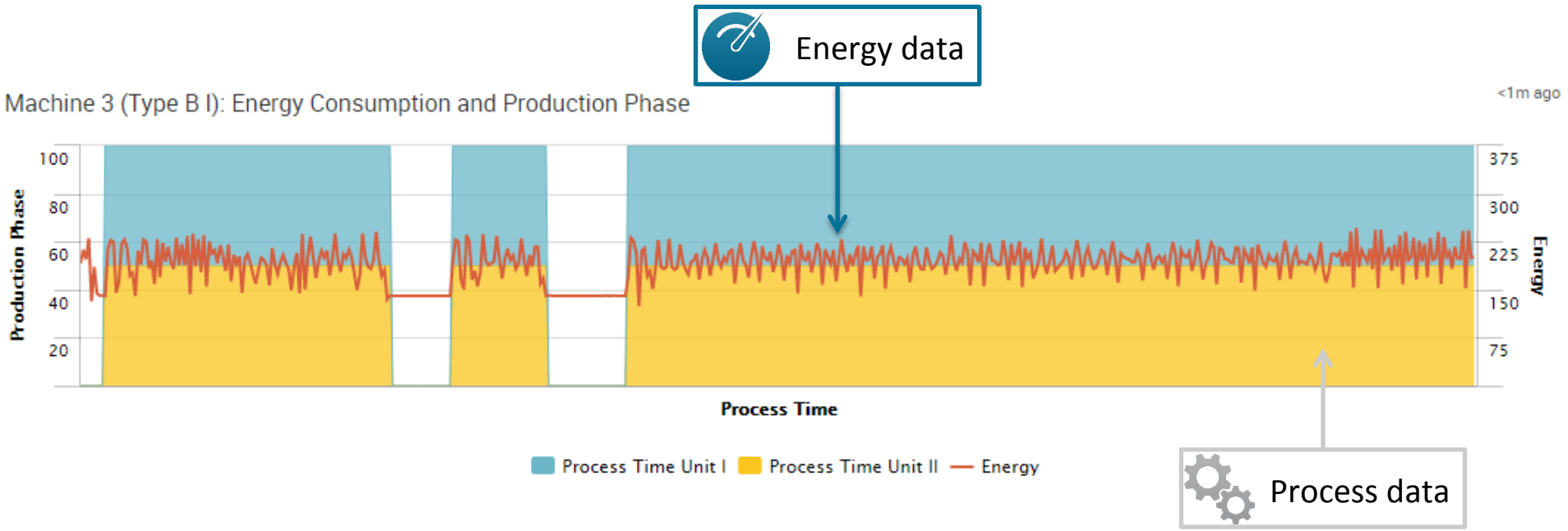
EEE Monitoring & Optimization

Correlating energy and process data



Energy Efficiency Monitoring

- Optimization of energy efficiency for production
- Reduction of energy consumption of non-value-adding activities
- Optimization of production schedule of similar equipment
- Reduction of specific energy consumption per produced item

$$\text{Energy Efficiency of Equipment (EEE)} = \frac{\Sigma(\text{value-added energy consumption})}{\Sigma(\text{total energy consumption})}$$

Energy Efficiency of Equipment (EEE)

High Level Overview: Finding efficiency issues at a glance

All Machines and Units

Machine 1 (Type A I):

Energy Efficiency:

0.403

Total Energy (kVAh):

3631.77

Machine 2 (Type A II):

Energy Efficiency:

0.62

Total Energy (kVAh):

3250.49

Machine 3 (Type B I):

Energy Efficiency:

0.842

Total Energy (kVAh):

4276.82

Machine 4 (Type B II):

Energy Efficiency:

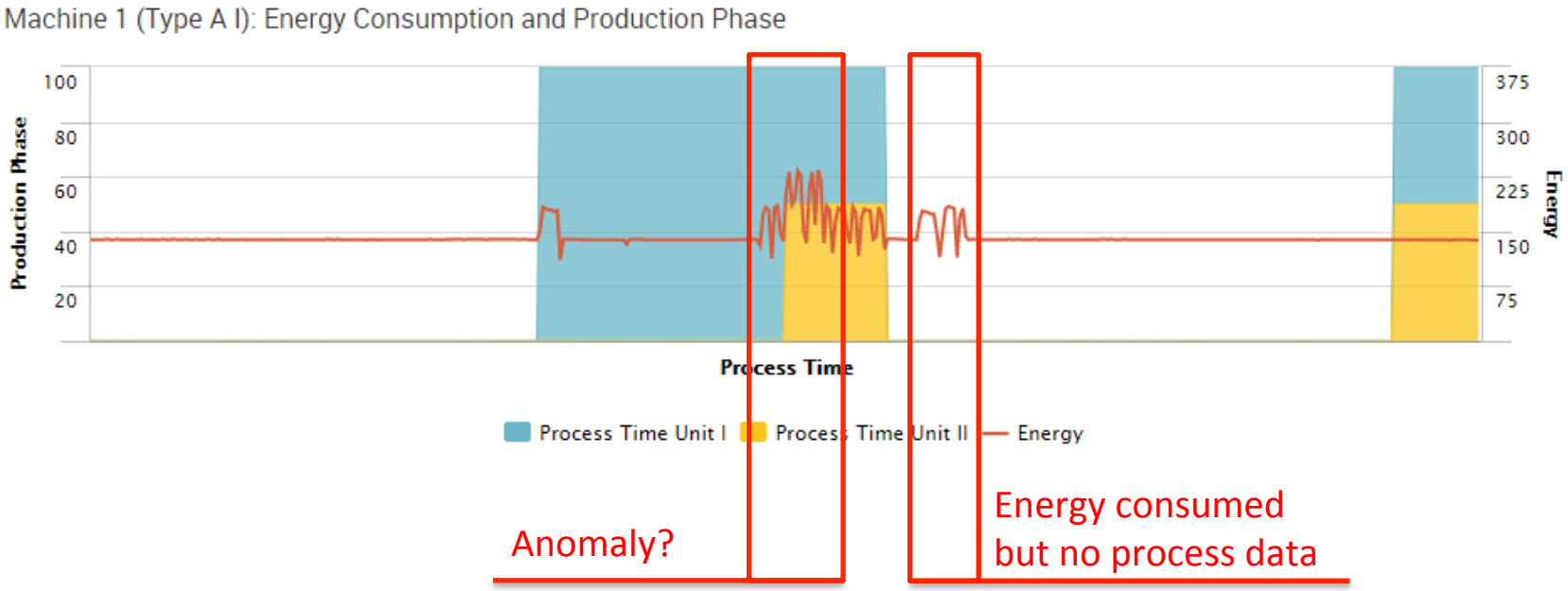
0.812

Total Energy (kVAh):

3930.25

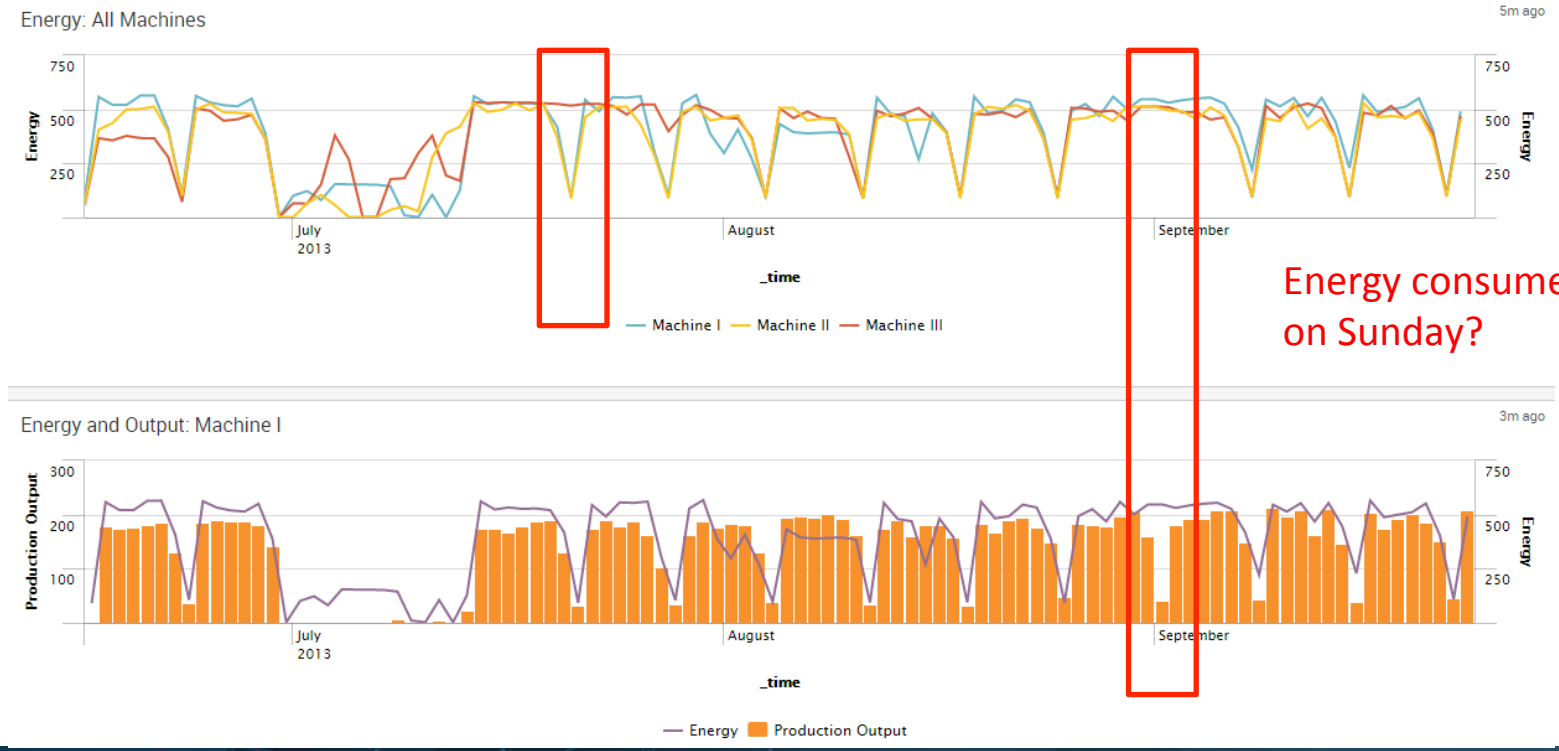
EEE Monitoring & Optimization

Detect process weaknesses: identifying anomalous patterns



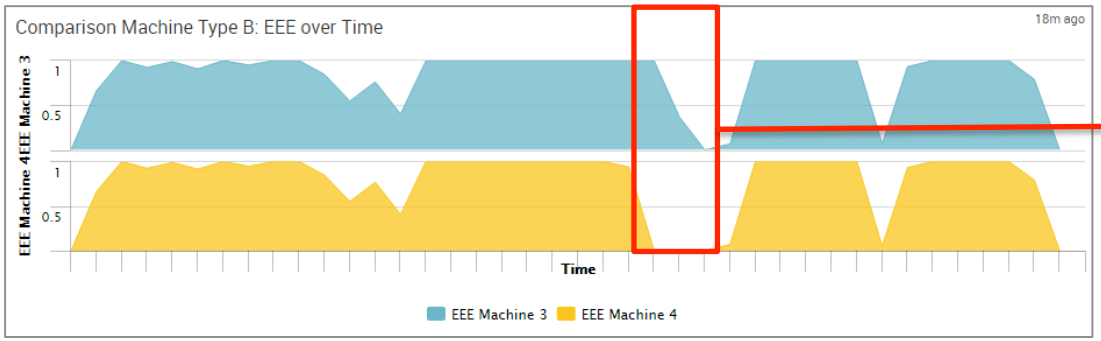
EEE Monitoring & Optimization

Detect process weaknesses: optimize stand-by times

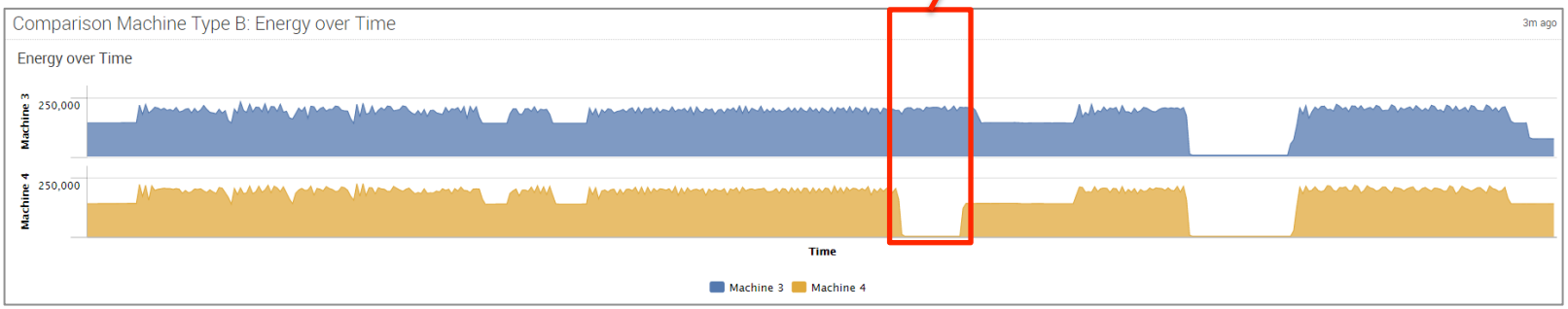


EEE Monitoring & Optimization

Energy consumption over time: benchmark different equipment of same type

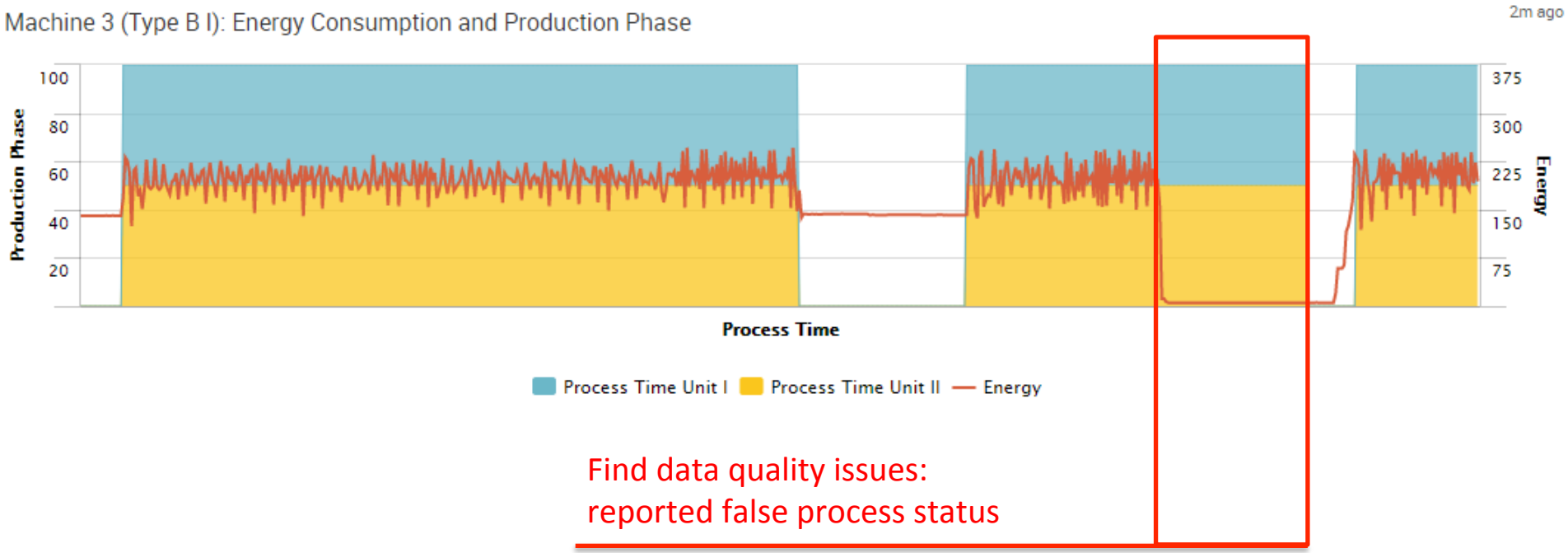


Visual correlation:
Detect differences!

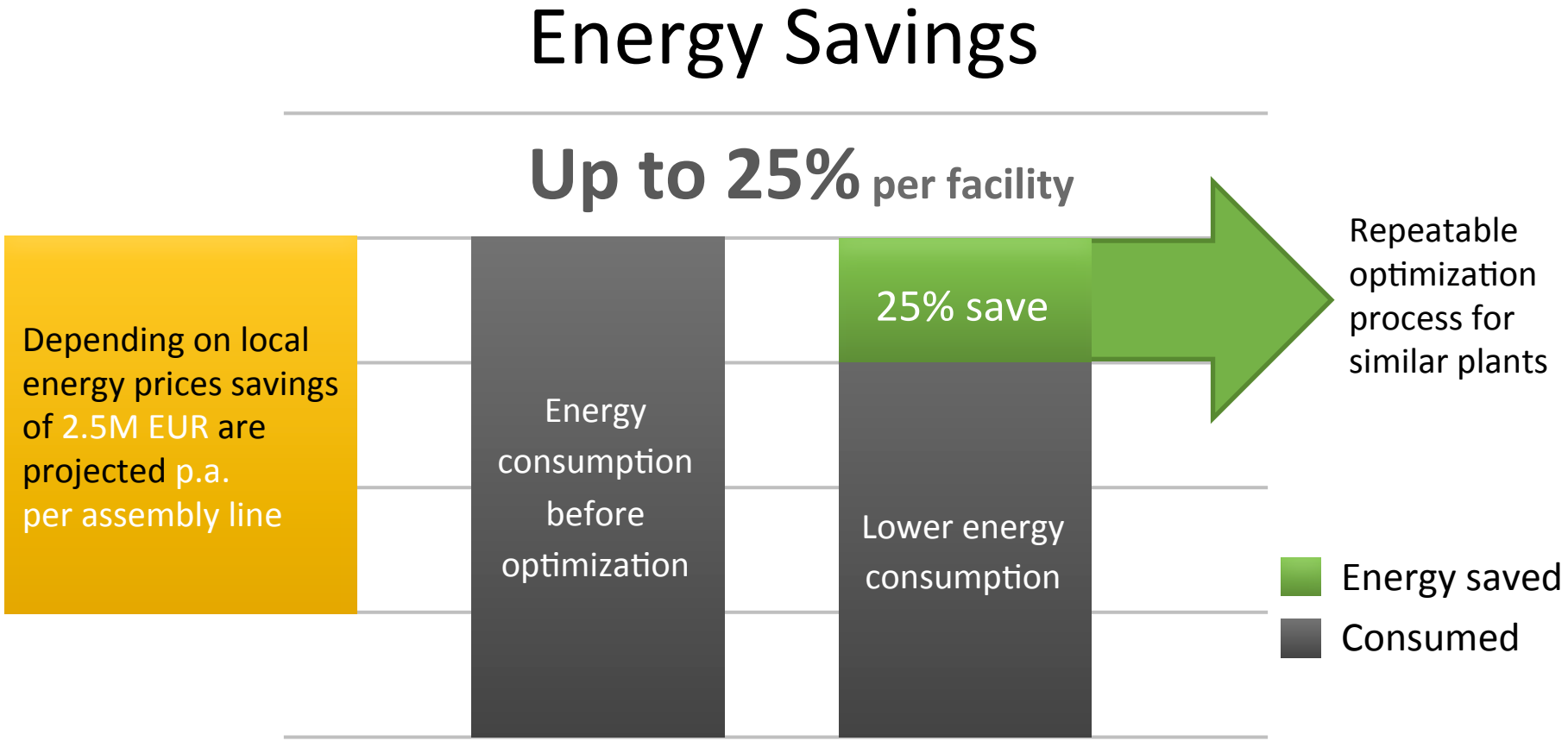


EEE Monitoring & Optimization

Further use cases: “findings by accident”



Energy Savings



Condition Monitoring & Predictive Maintenance

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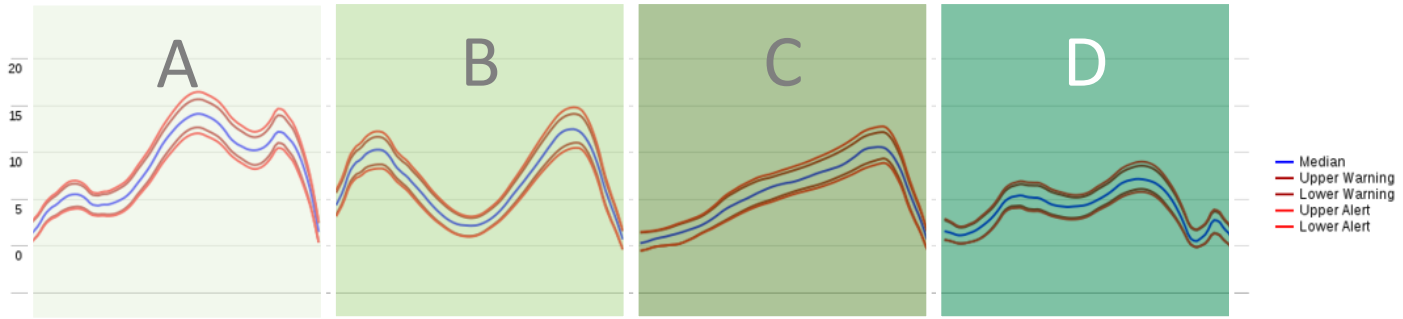
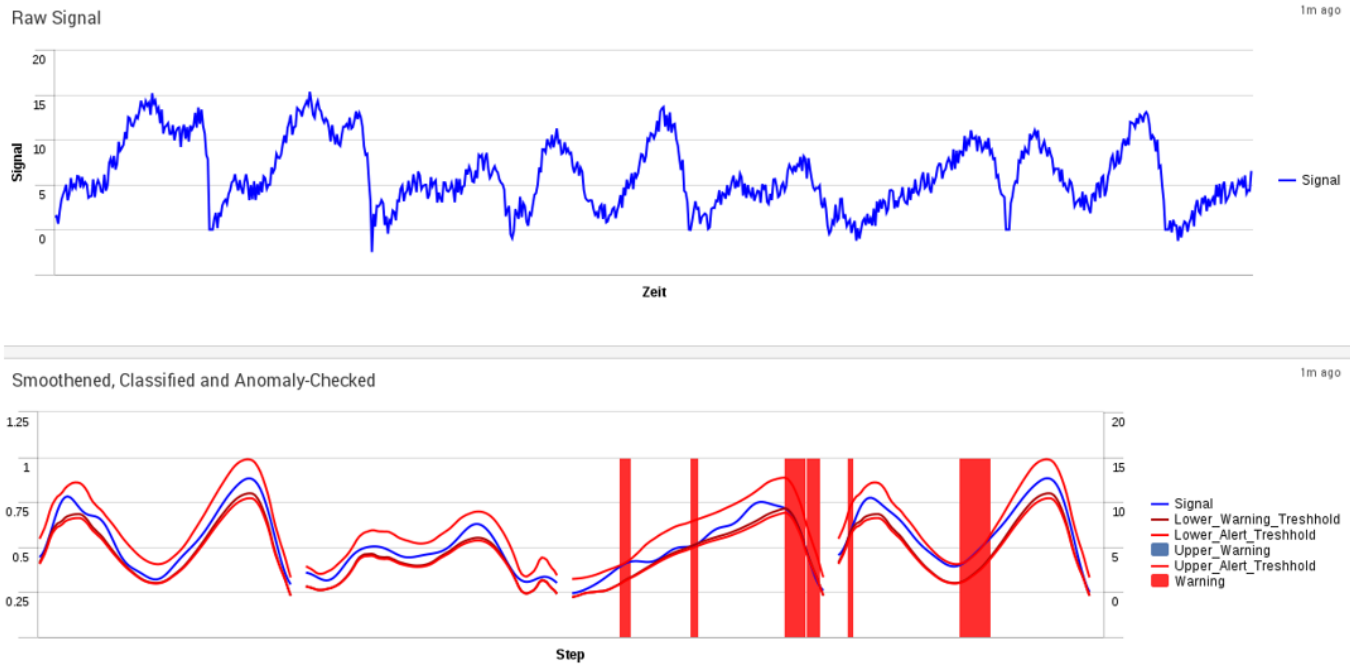
Energy and process data for maintenance

- Energy not just a optimization target – but also an influencing factor for maintenance scenarios (rapid impact factor)
- Map low level process status to particular energy consumption profiles and learn normal states and boundaries from raw signal



Condition Monitoring & Alerting

Anomaly detection and proactive monitoring

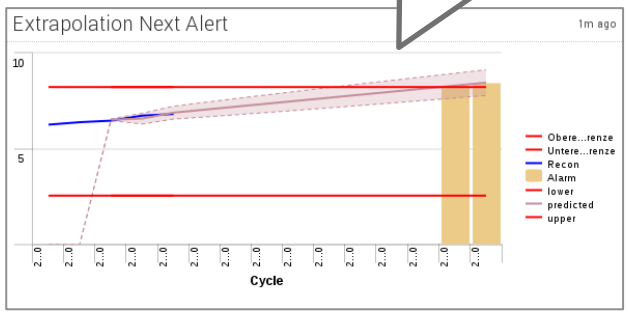


Predictive Maintenance

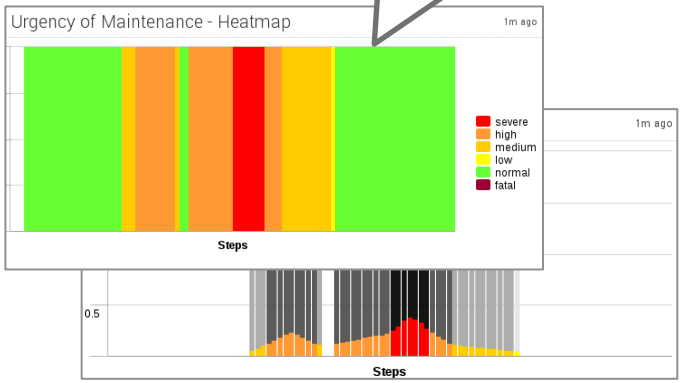
Predict anomalies for a particular process step

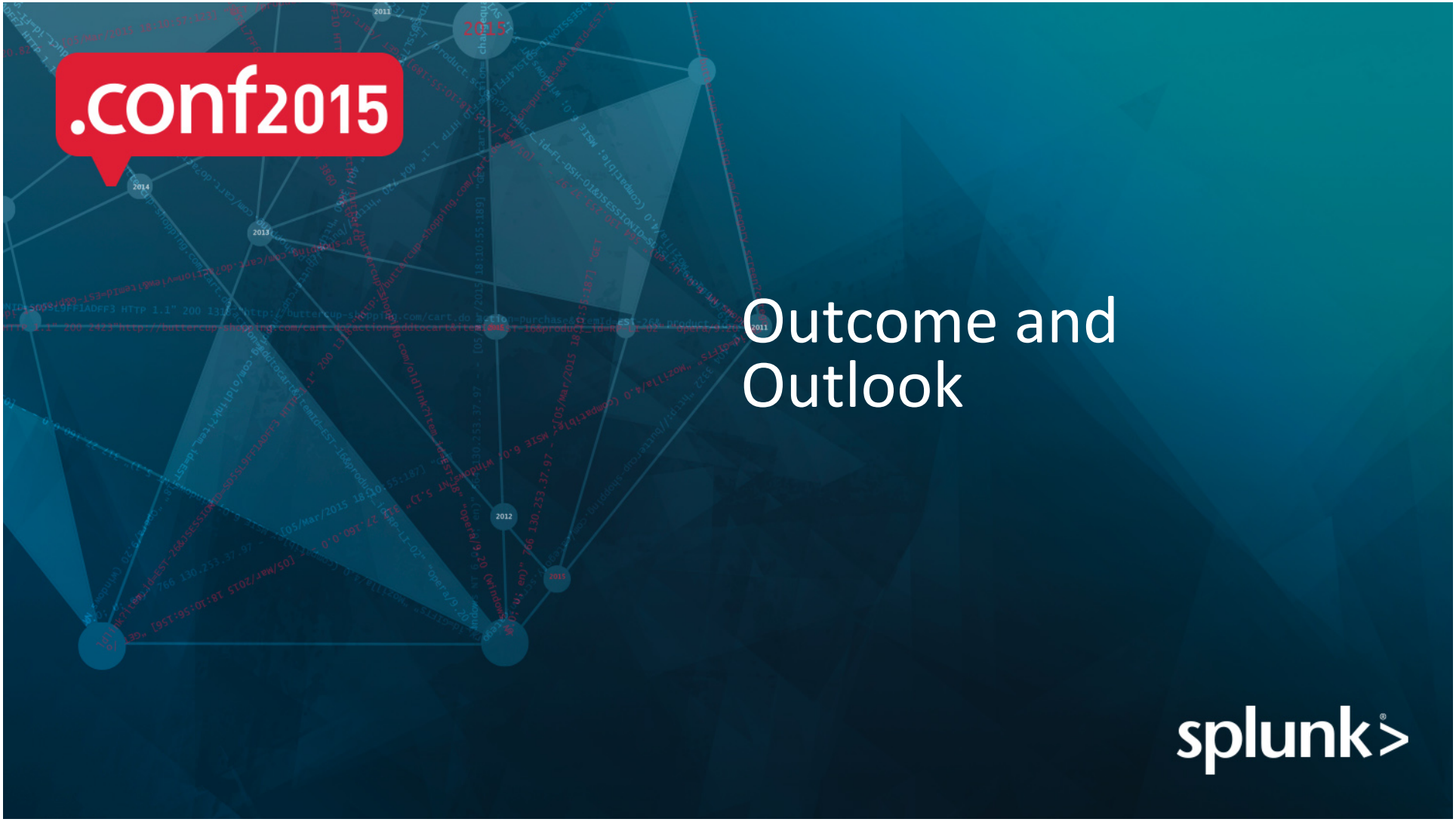
Predict process steps
In which an error might happen

Extrapolation of process steps with integrated predict function or other regressions models



Heatmap shows (recommend) time span in which an error might happen





Outcome and Outlook

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Summary & Outlook

- Generic and equipment-independent approach
- No data transformation and model mapping in advance
- Applicable for “old” equipment (without particular sensor installation)
- Out-of-the-Box Splunk data models for energy and process data
- 360° view - several kinds of visualizations
- Own Splunk commands for numeric operations and machine learning
- Enhanced time series forecasting for optimization of energy purchasing

Robotron Architecture for Industrial Data Analysis

THANK YOU

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