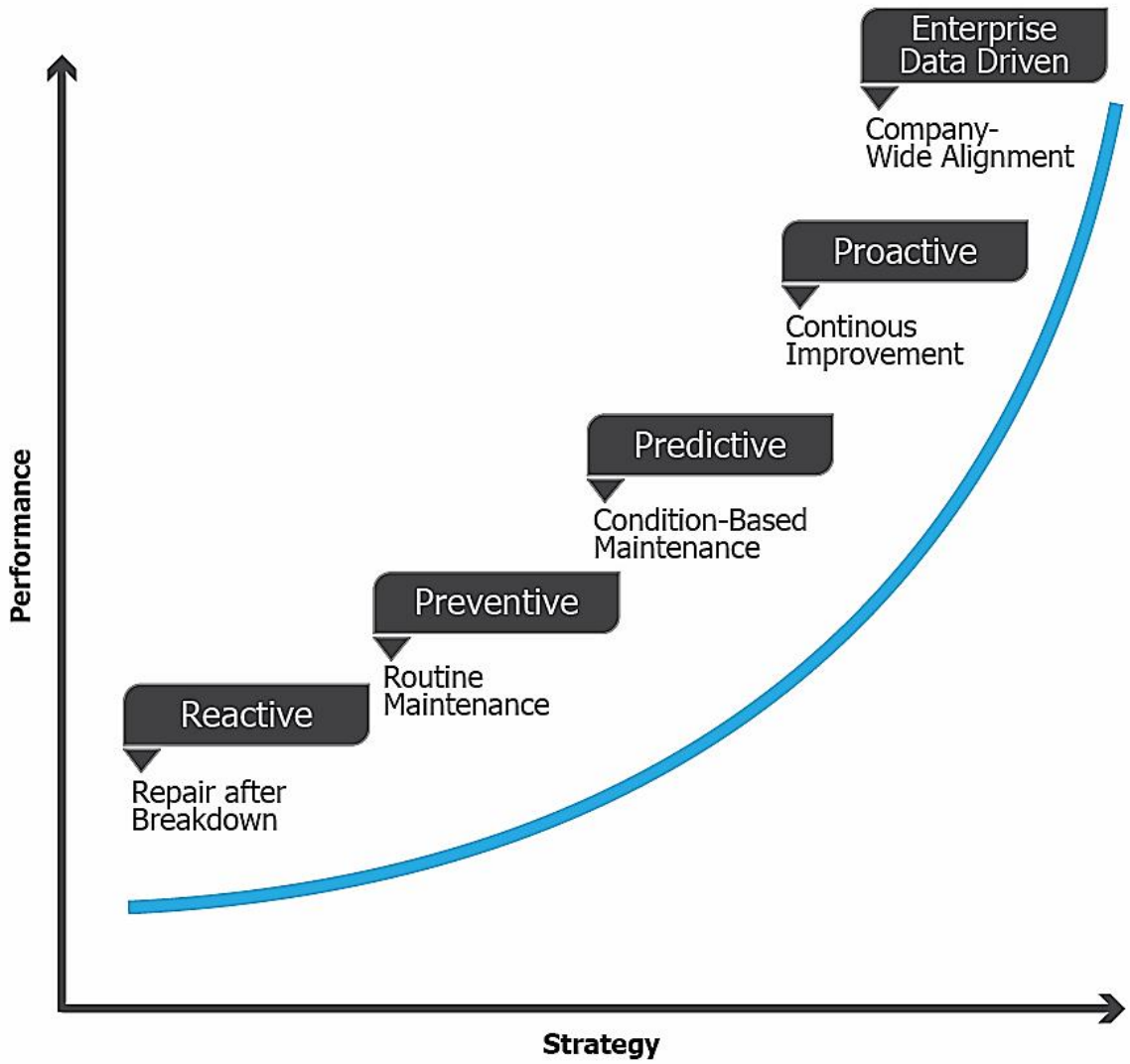
Predicting the Future – Trends for Predictive Maintenance

Dr. Dirk Woldt

DALOG®

Certified ISO 9001: 2008
With product development

DALOG® Effects of Strategies on Performance



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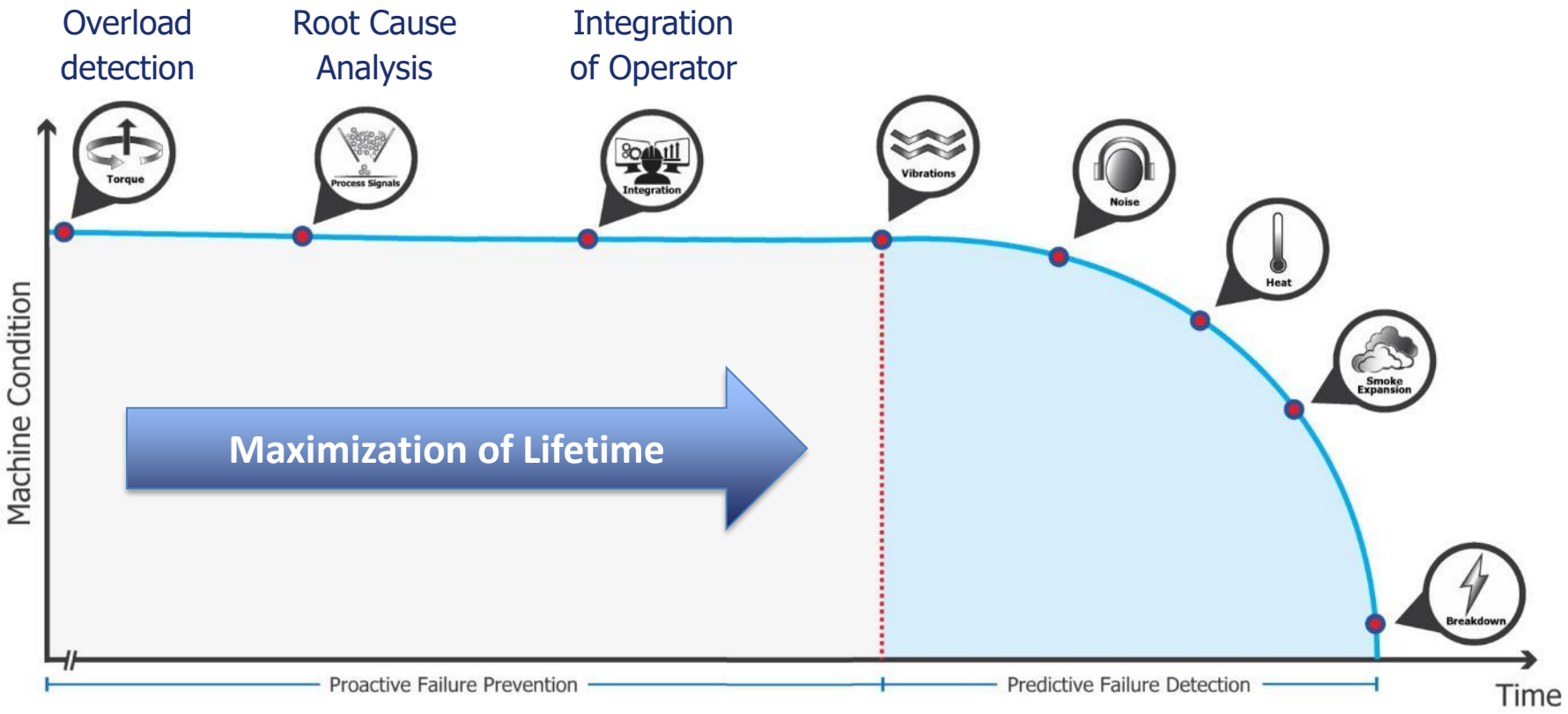
DALOG® Optimized Failure Curve



Proactive Failure Prevention
Increase Time Between Failures
Optimize Performance

Predictive Failure Detection
Minimize Unplanned Stoppages
Avoid Secondary Damage

DALOG Machine Protection Concept: Reduction of Total Costs – Increase Profits

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DALOG® Online Condition Monitoring Solutions

DALOG® D-MPC®
Machine Protection Concept

- **Increase Operating Time**
  Avoid Stoppages
- **Optimize Process**
  Save Energy
- **Boost the Expected Life**
  Reduce Maintenance Cost

Independent and objective

Integration

Sustainable
Improvement
DALOG Integration

Process Signals

Performance
Optimization
DALOG Process Monitoring System
D-PMS

Torque

Proactive
Failure Prevention
DALOG Torque Monitoring System
D-TMS

Vibration

Predictive
Failure Detection
DALOG Condition Monitoring System
D-CMS

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DALOG® Application Fields in Heavy Industry

Cement Industry

Metal Processing Industry

Mining

Transport and Logistics

Power Plants

Petrochemical Industry

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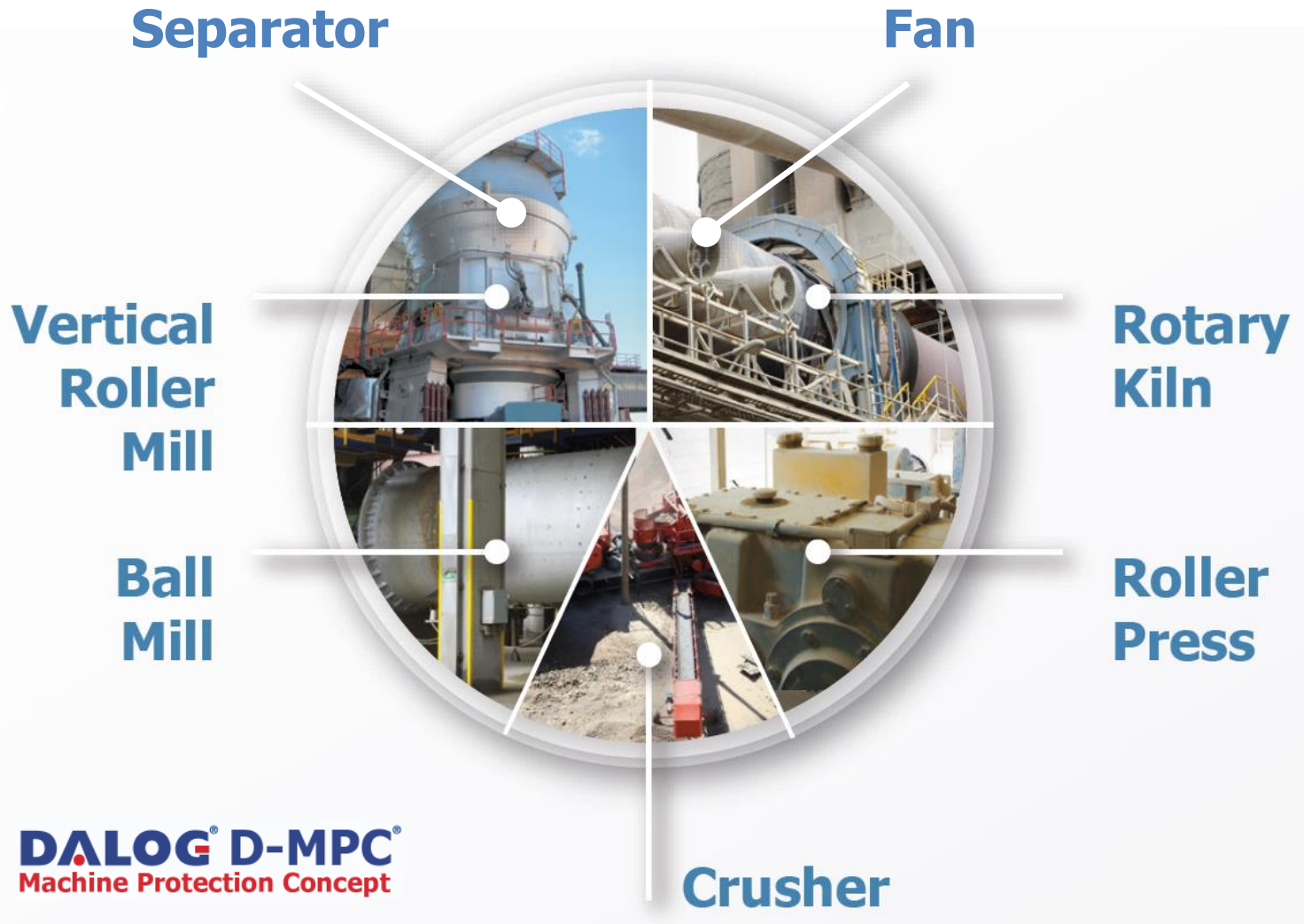
DALOG® Machine Protection Concept in Cement Industry



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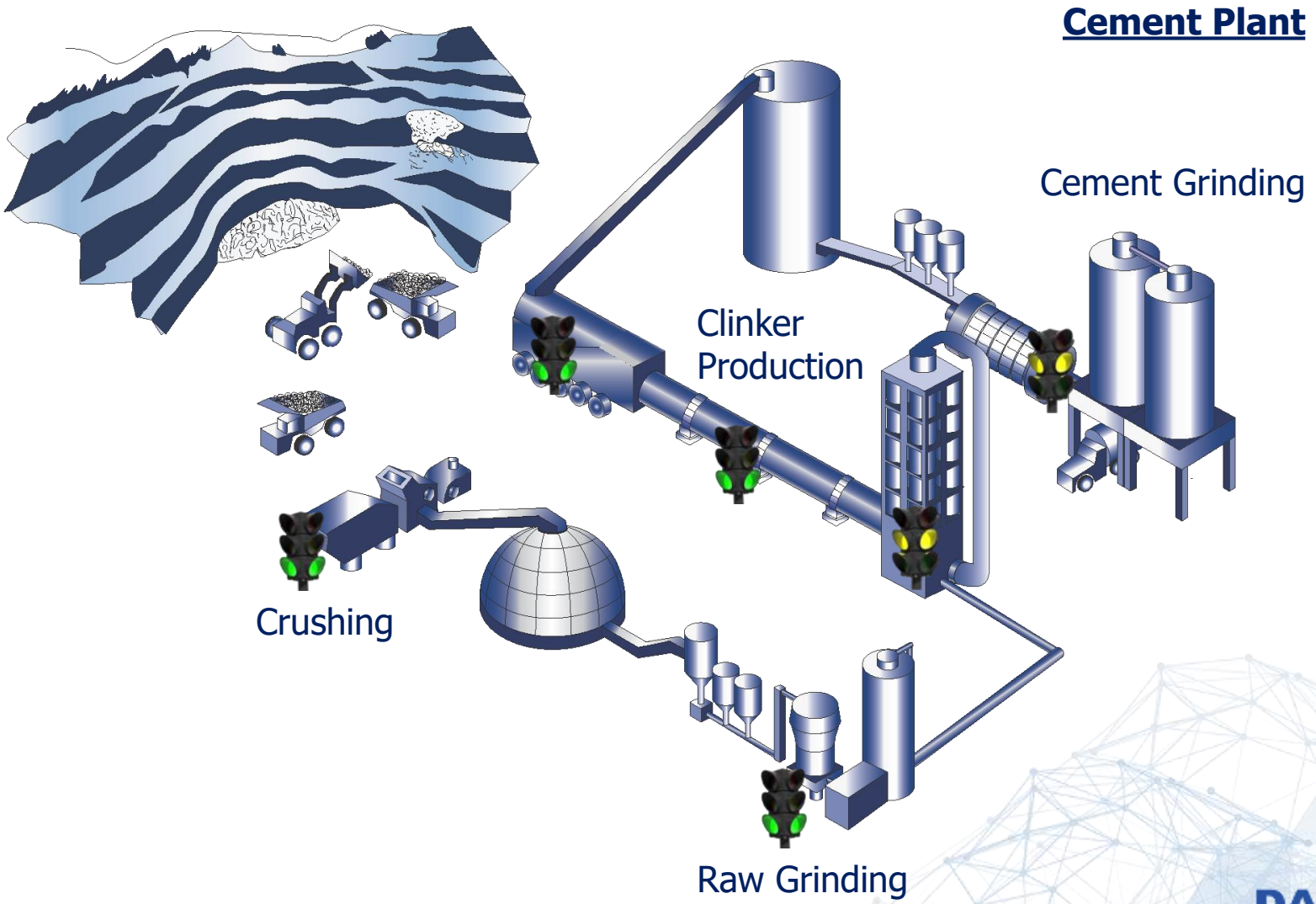
DALOG® Plant Protection Concept – A Step further

- Plant-wide monitoring of critical equipment combined in one system.



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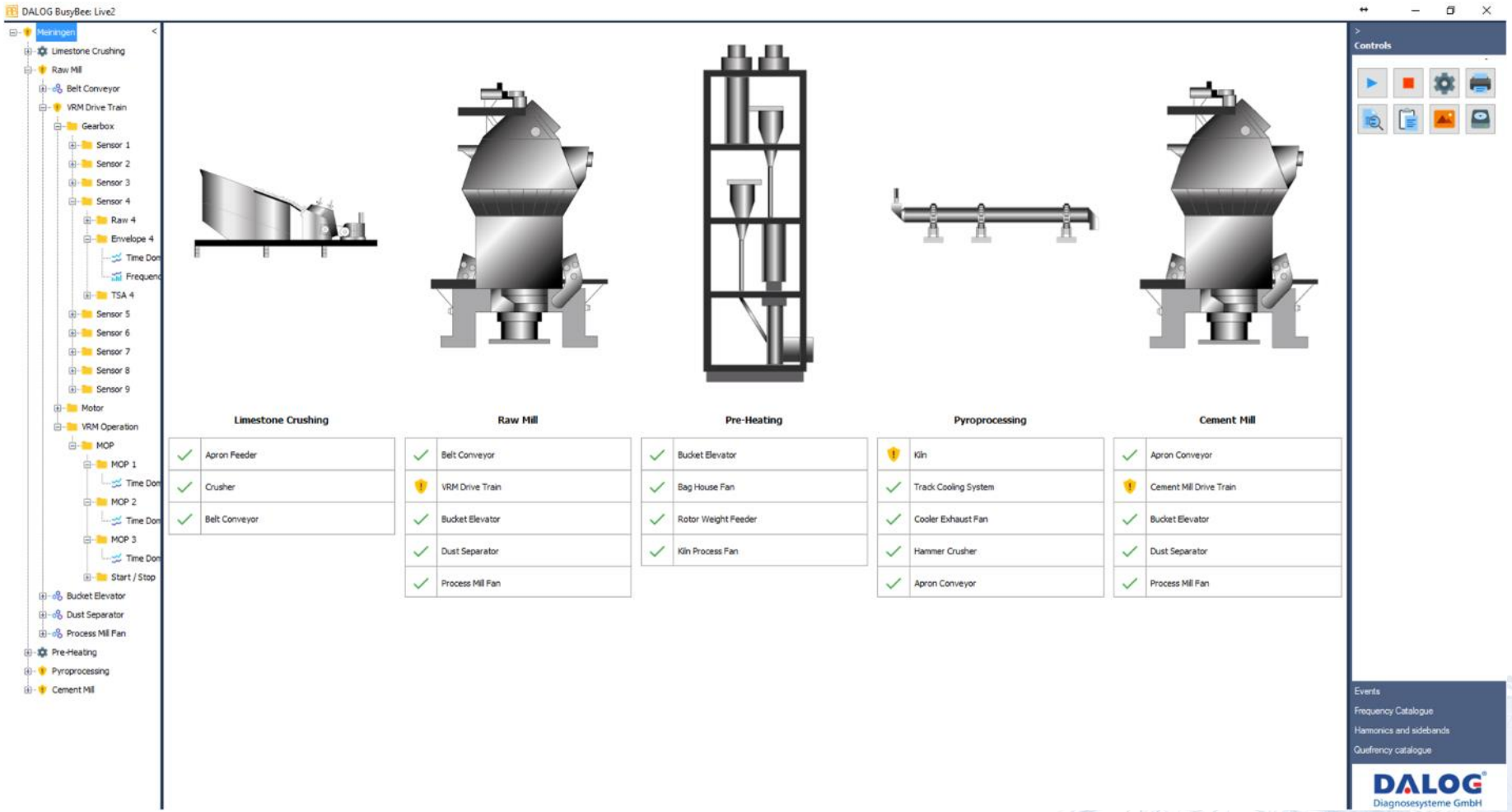
DALOG® BusyBee Condition Monitoring Software

- Status overview of equipment condition and load as well as operational stability and performance of a whole plant.



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DALOG® Data Driven Company Strategy

- BusyBee allows to compare status and performance of several plants:
  - Clear indication of mechanical and operational issues
  - Key performance indicators and statistics visualized in customizable dashboards
  - Statistics and benchmarking of equipment and plants

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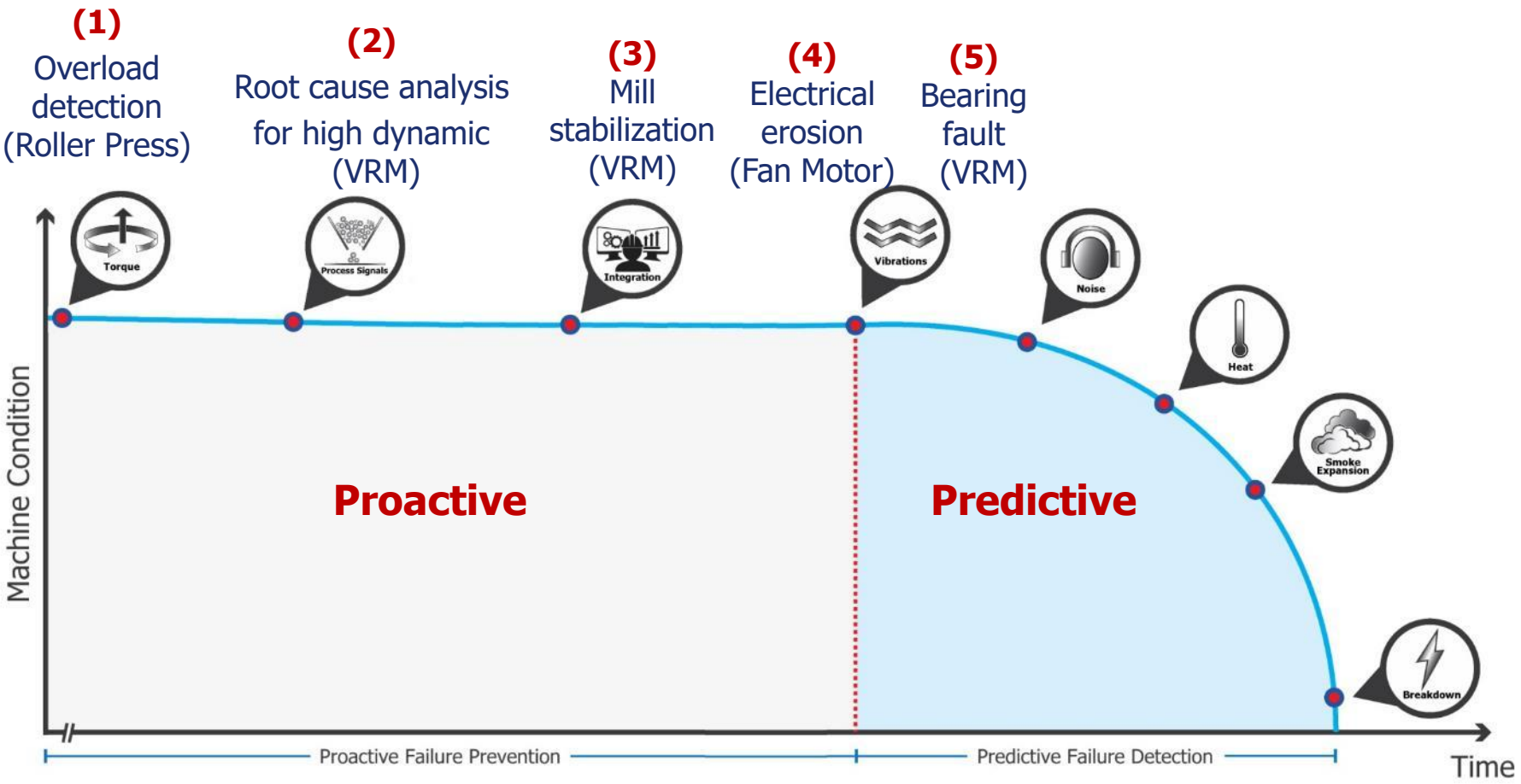
DALOG® Practical Cases



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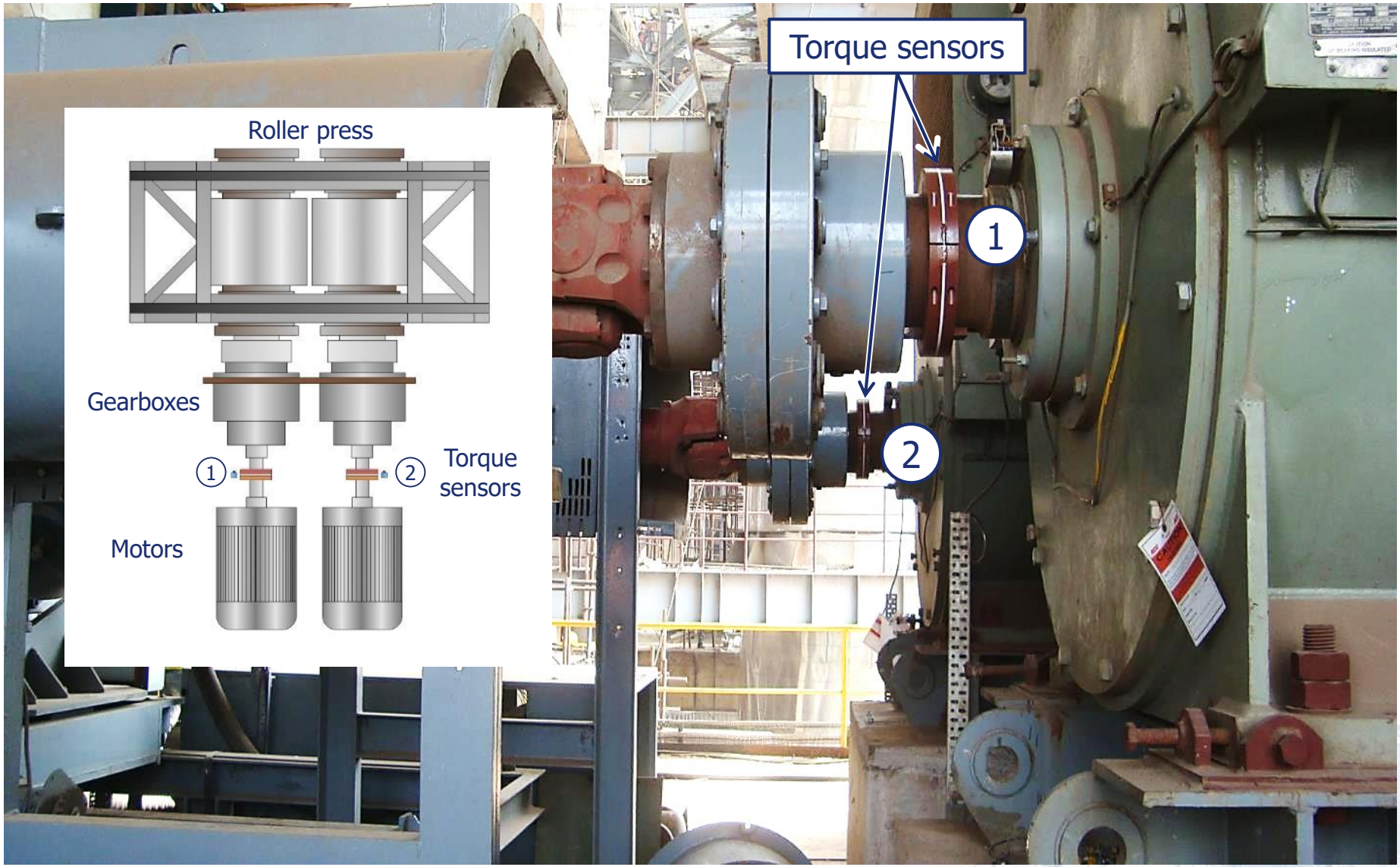
DALOG® (1) Torque Indicating Roller Wear



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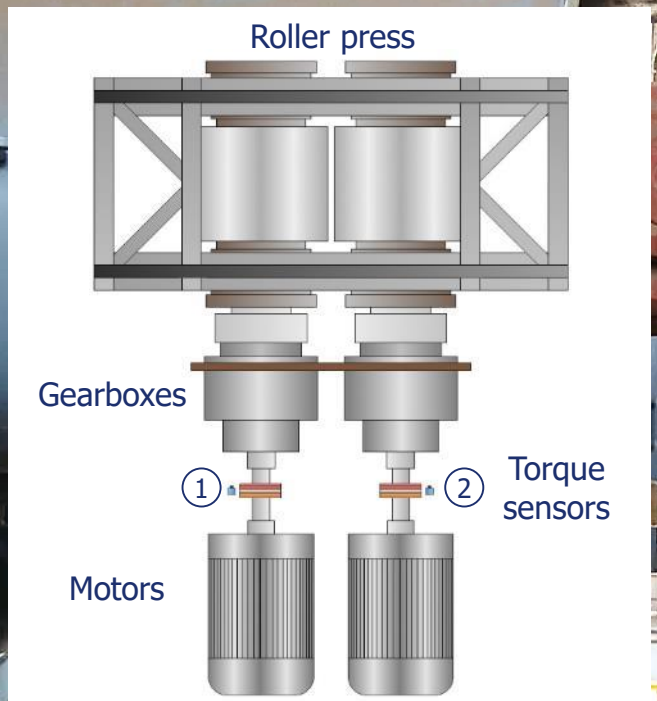
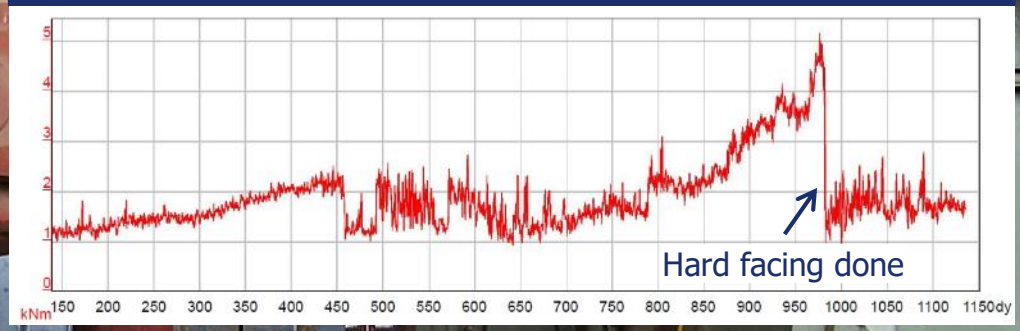
DALOG® (1) Torque Indicating Roller Wear



Torque Dynamic Trend



- Increasing machine instability due to wear
- Wear of the rollers surface is clearly seen in the torque dynamic trend
- Rollers surface hard facing resulted in clear decrease of machine load and better performance

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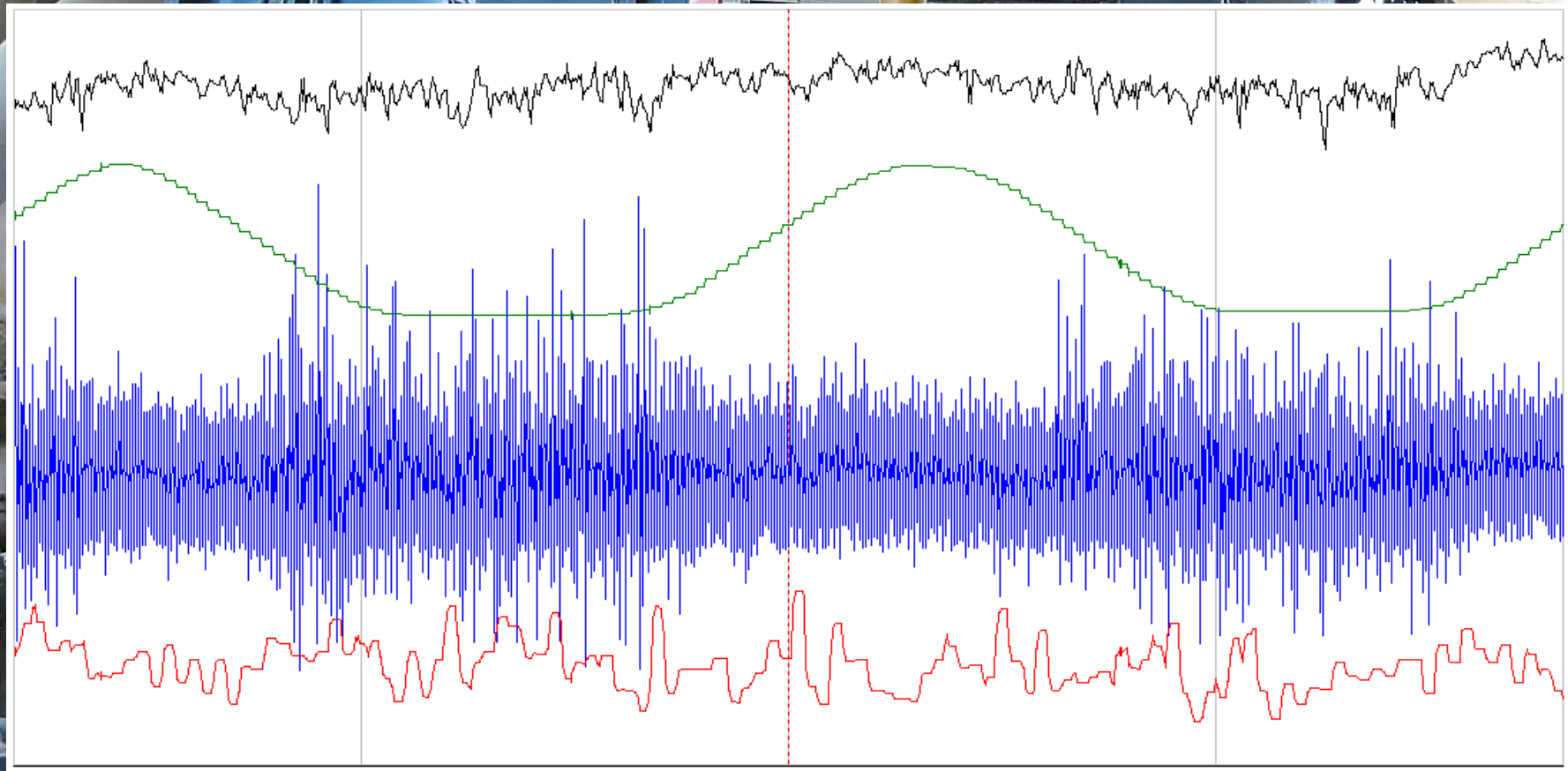
DALOG® (2) Root Cause Analysis using Process Data

- High resolution process data analyzed to find root cause for high dynamic load of the Vertical Roller Mill (high dynamic torque)
- Mill motor power and mill vibration do not show a dynamic overload situation

→ Identified root cause: Feed fluctuations caused by wrong PID parameters



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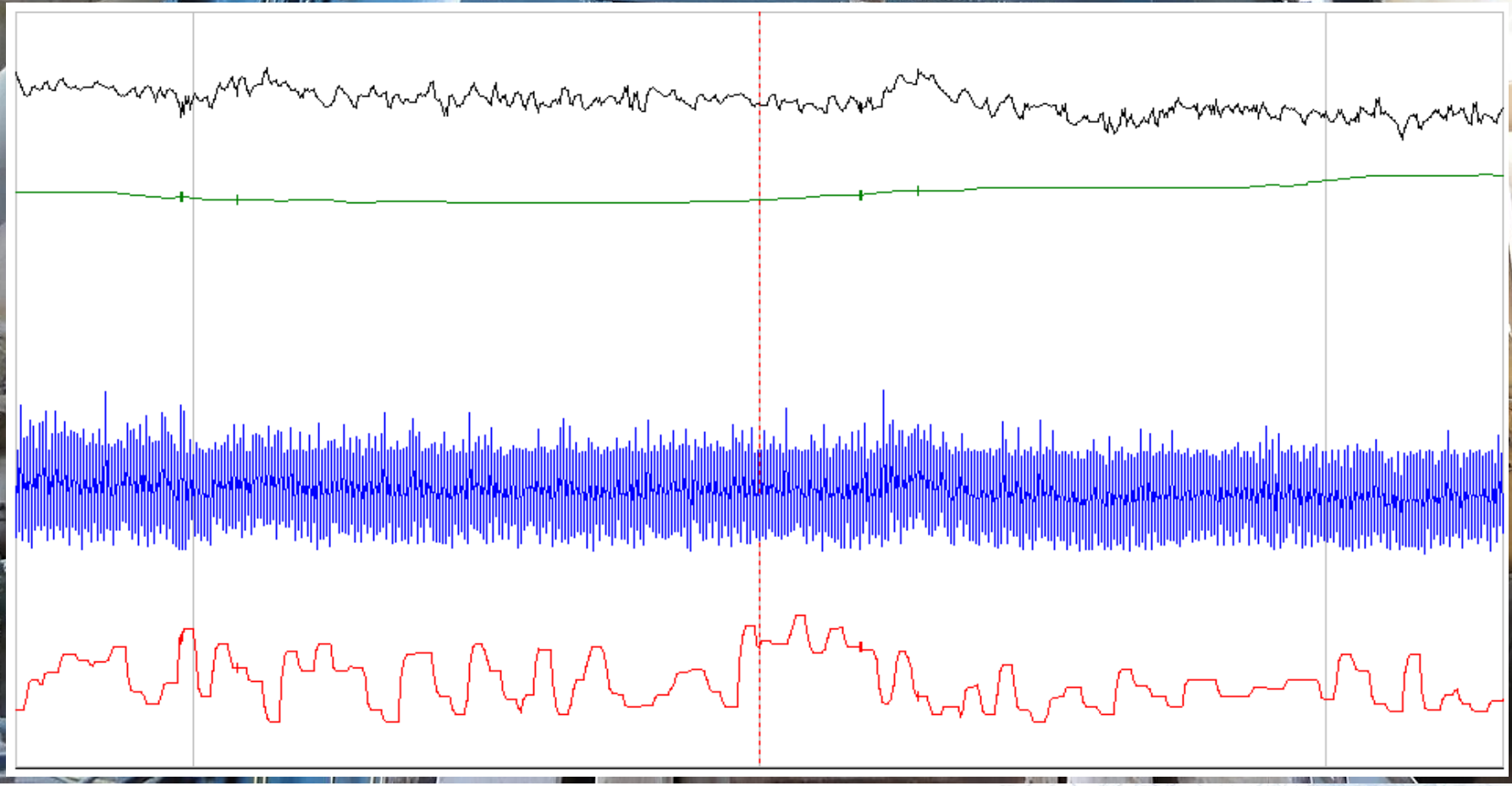
DALOG® (2) Root Cause Analysis using Process Data

- Feed rate PID control parameter adapted

→ Mill stabilized and dynamic machine load significantly reduced

→ Higher production rate and lower specific electrical energy consumption



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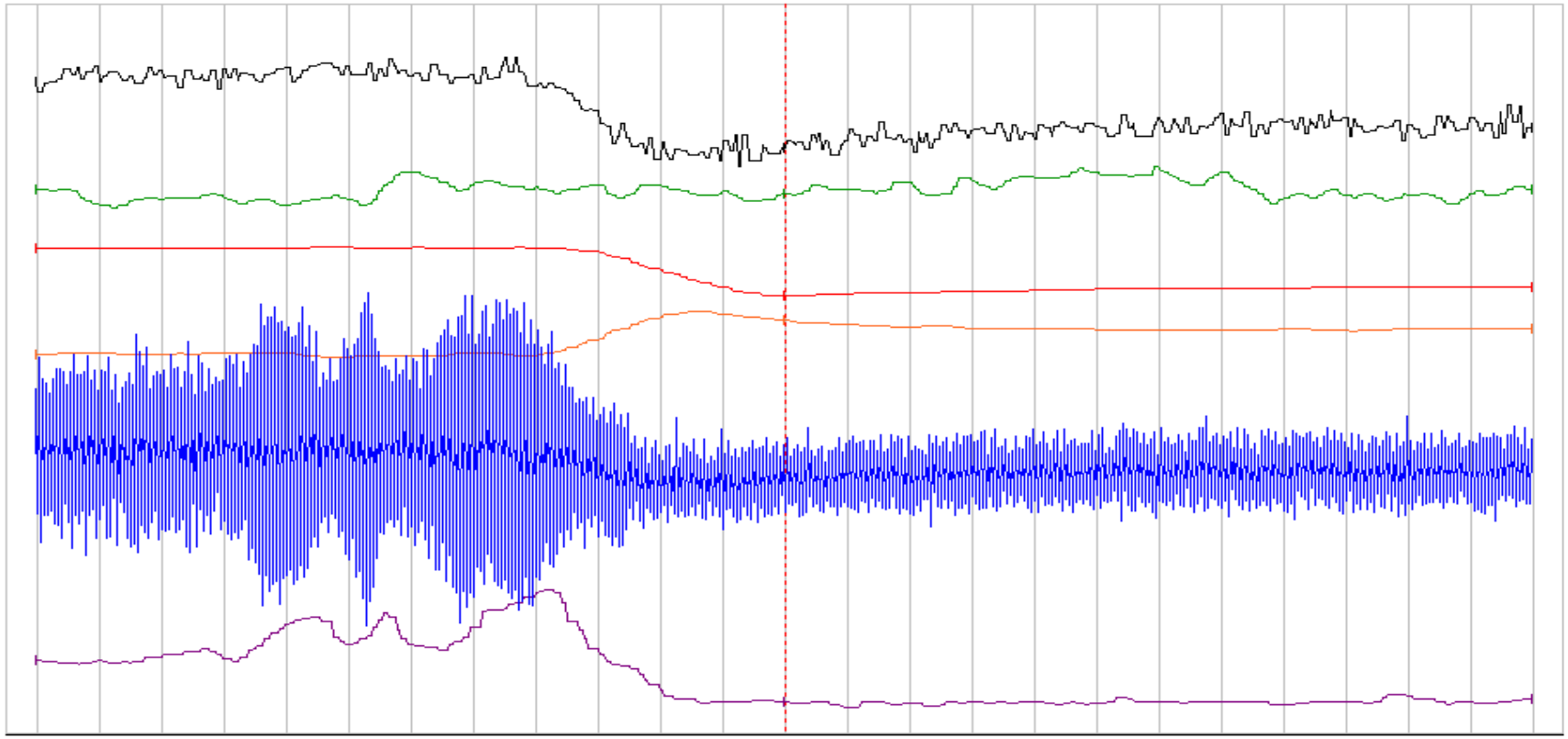
DALOG® (3) Improvement in Mill Operation

- Torque sensor detects a dynamic overload situation at the Vertical Roller Mill
- Online process data evaluation confirm instable grinding conditions
- Instant feedback to mill operator and adaptation of mill operating parameter

→ Stabilization of grinding process and significant reduction of dynamic load



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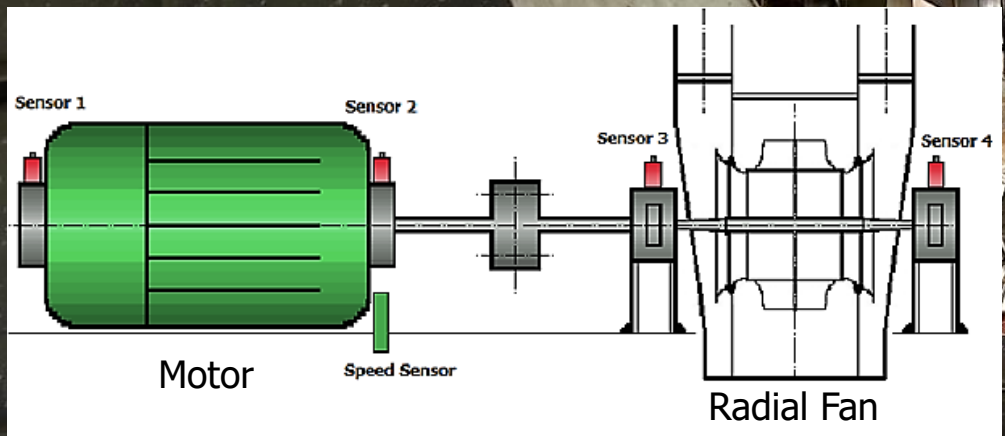
DALOG® (4) Bearing Failure Detection at Fan Motor



Point	Name	See Remark	Condition
Speed	Speed Sensor		Ok
Sensor 1	Acceleration - Motor Bearing ID NU322	page 4	ALERT
Sensor 2	Acceleration - Motor Bearing ID NU322	Page 4	ALERT
Sensor 3	Acceleration - Fan Bearing ID 22238		Ok
Sensor 4	Acceleration - Fan Bearing ID C2218		Ok
MOP	Operating Parameter		Ok

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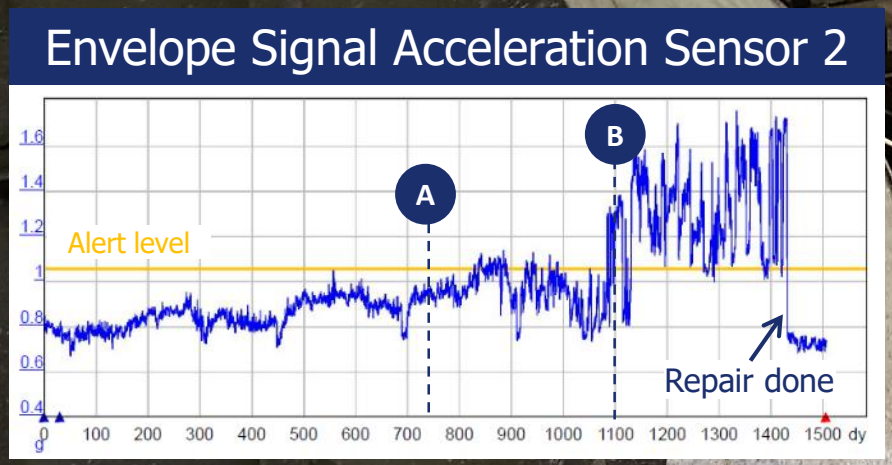
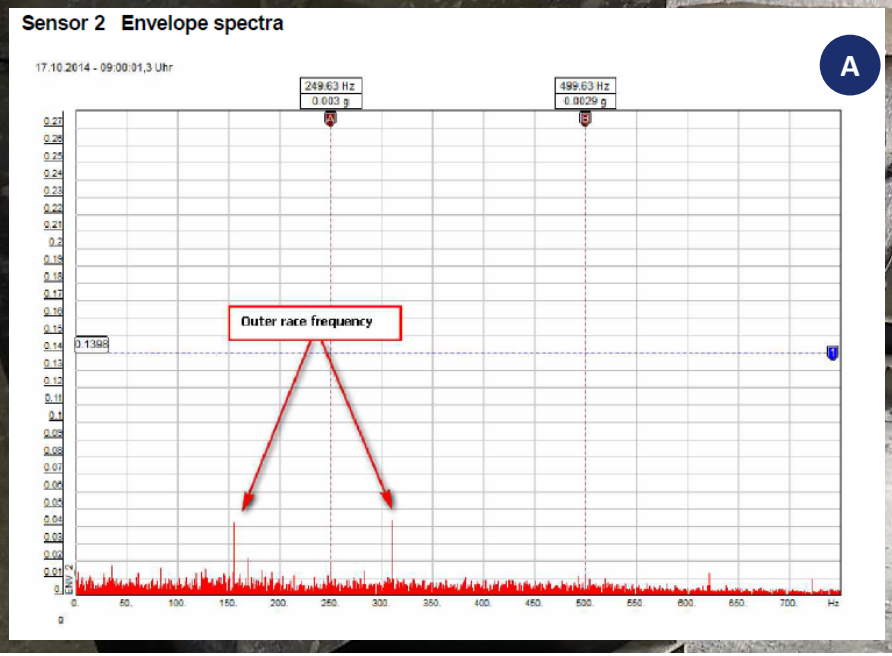
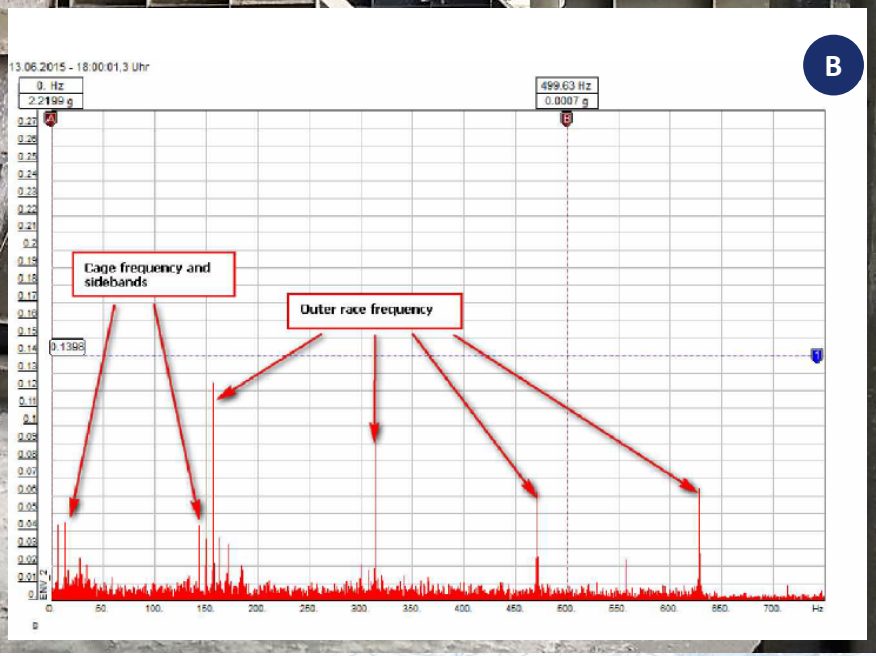
DALOG® (4) Bearing Failure Detection at Fan Motor

Envelope Signal Acceleration Sensor 2







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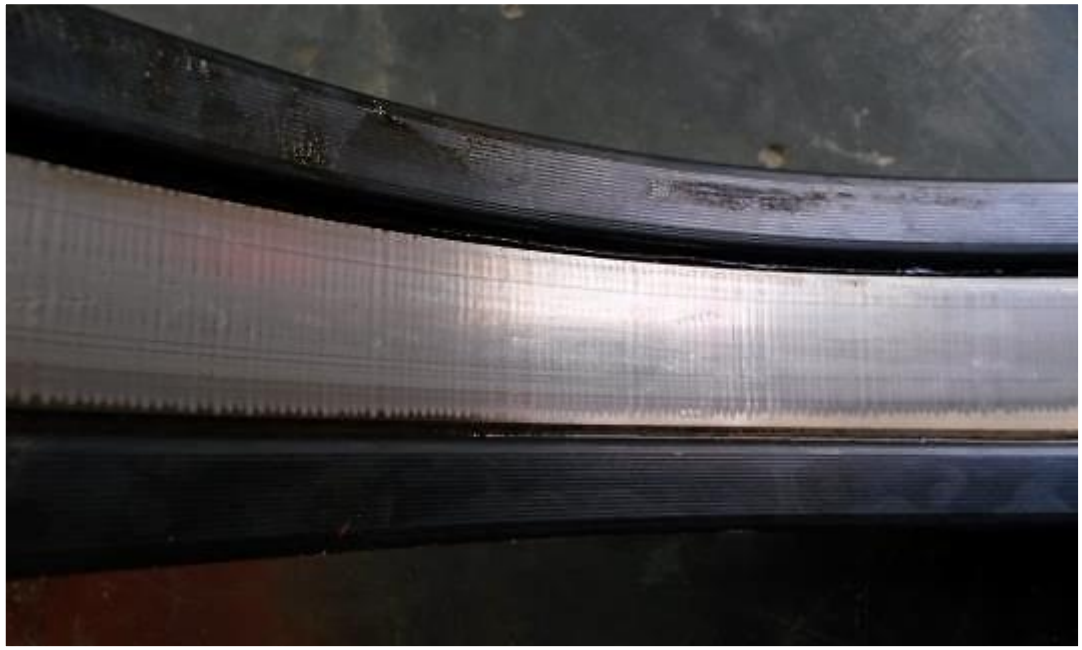
(4) Bearing Failure Detection at Fan Motor

Outer Race Failure



Results of the D-MPC:

- Failure in bearing caused by electrical erosion detected with acceleration sensors.
- Bearing exchange during annual shutdown.

No production loss nor secondary damages.

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DALOG® (5) Bearing Failure Detection at VRM Gearbox

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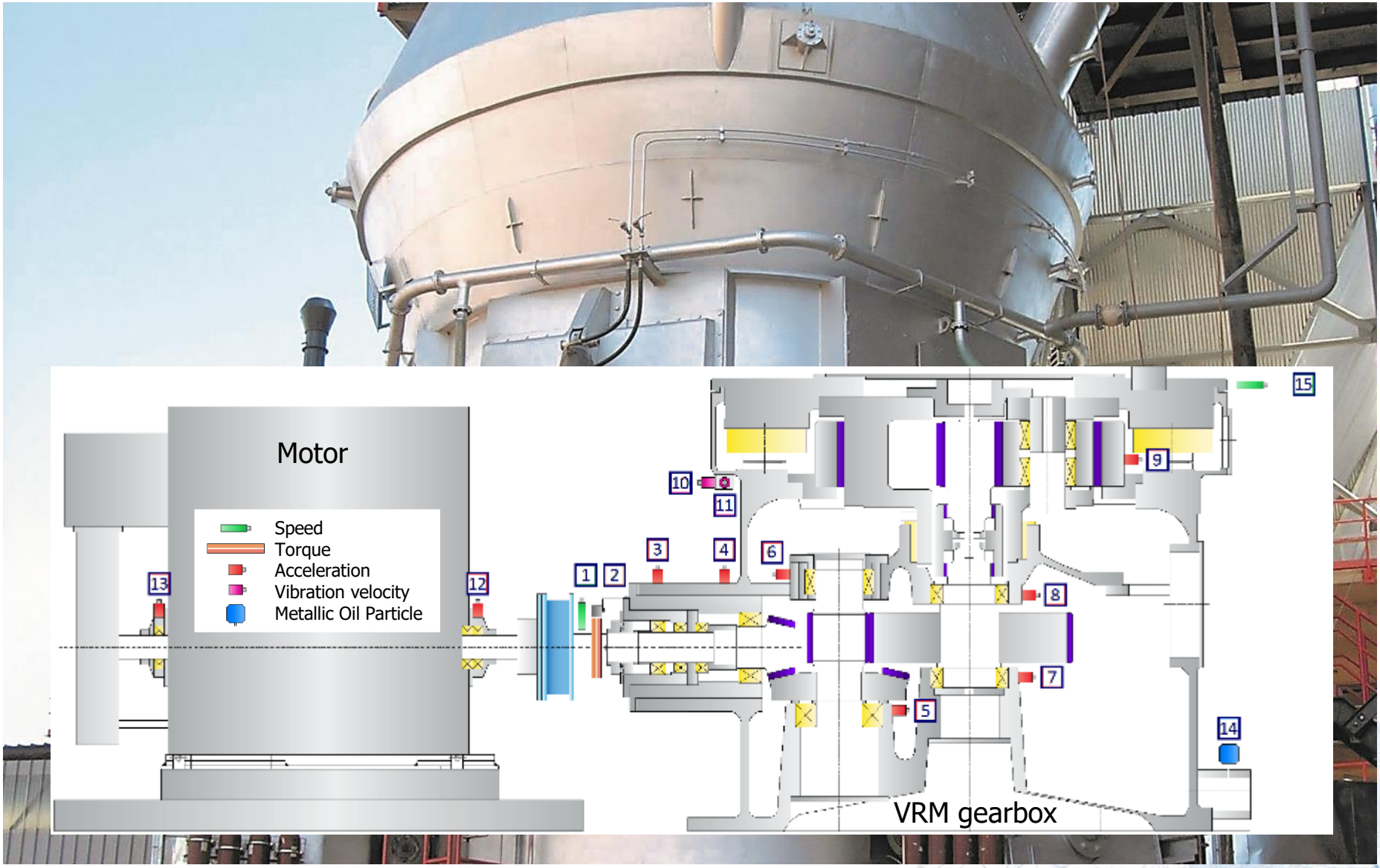
DALOG® (5) Bearing Failure Detection at VRM Gearbox



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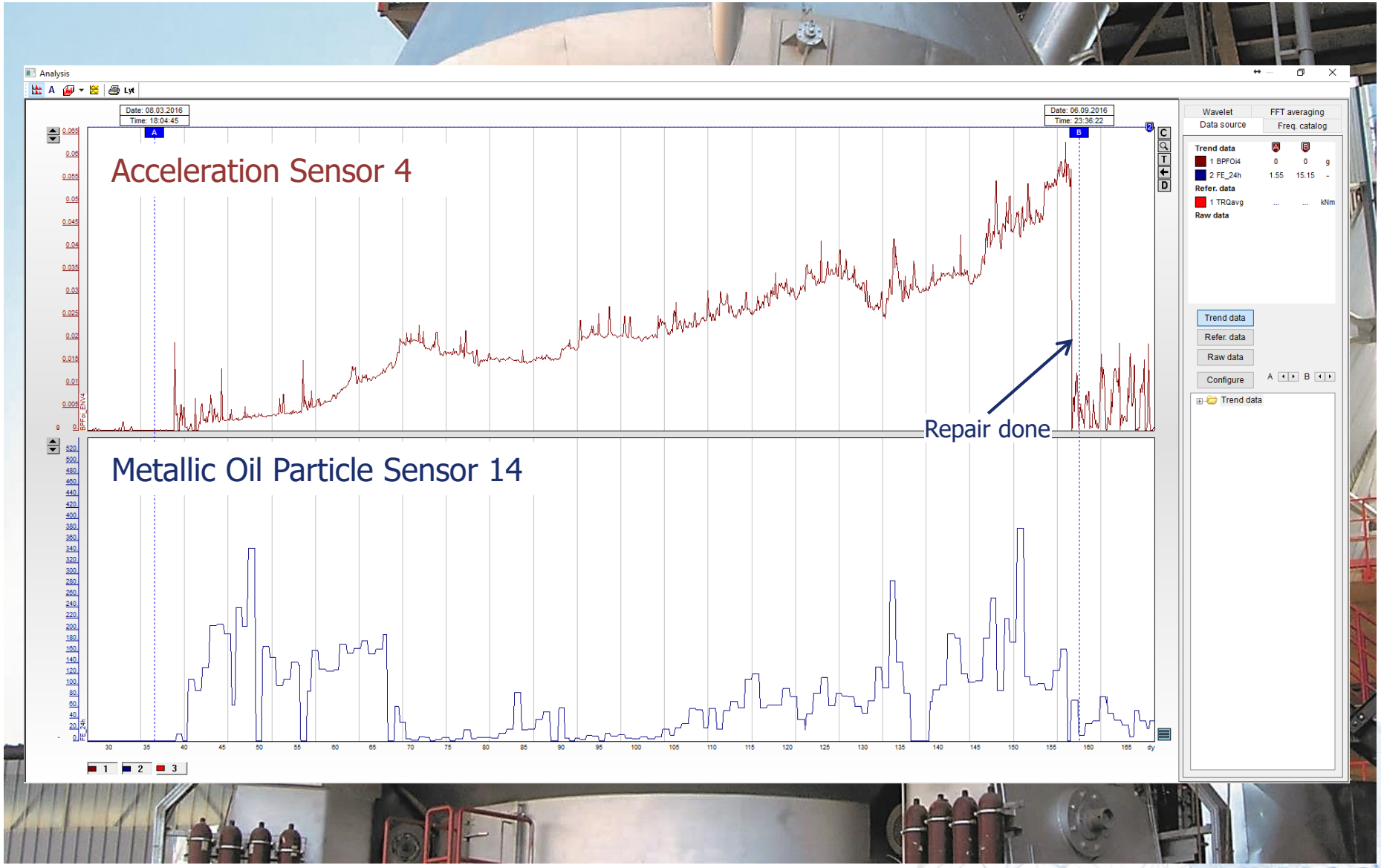
DALOG® (5) Bearing Failure Detection at VRM Gearbox



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DALOG® (5) Bearing Failure Detection at VRM Gearbox

Inner Race Failure

Results of the D-MPC:

- Damage on bearing detected with acceleration sensors and confirmed by the oil particle counter.
- Bearing exchange at an early stage of the damage during maintenance of mill rollers.

No production loss nor secondary damages.

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DALOG® Summary

- **Failure prediction** by means of online condition monitoring systems is the **standard for critical machines** in heavy industry.

- The **new trends in the heavy industry** are:
  - Proactive failure prevention to extent lifetime
  - Interconnection with plant operation
  - Plant-wide monitoring of equipment to optimize performance
  - Company-wide connection and benchmarking of plants

- With it there are also new challenges for an online condition monitoring system.

Visit us in Hall 24, Stand B34.

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Thank You!

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