

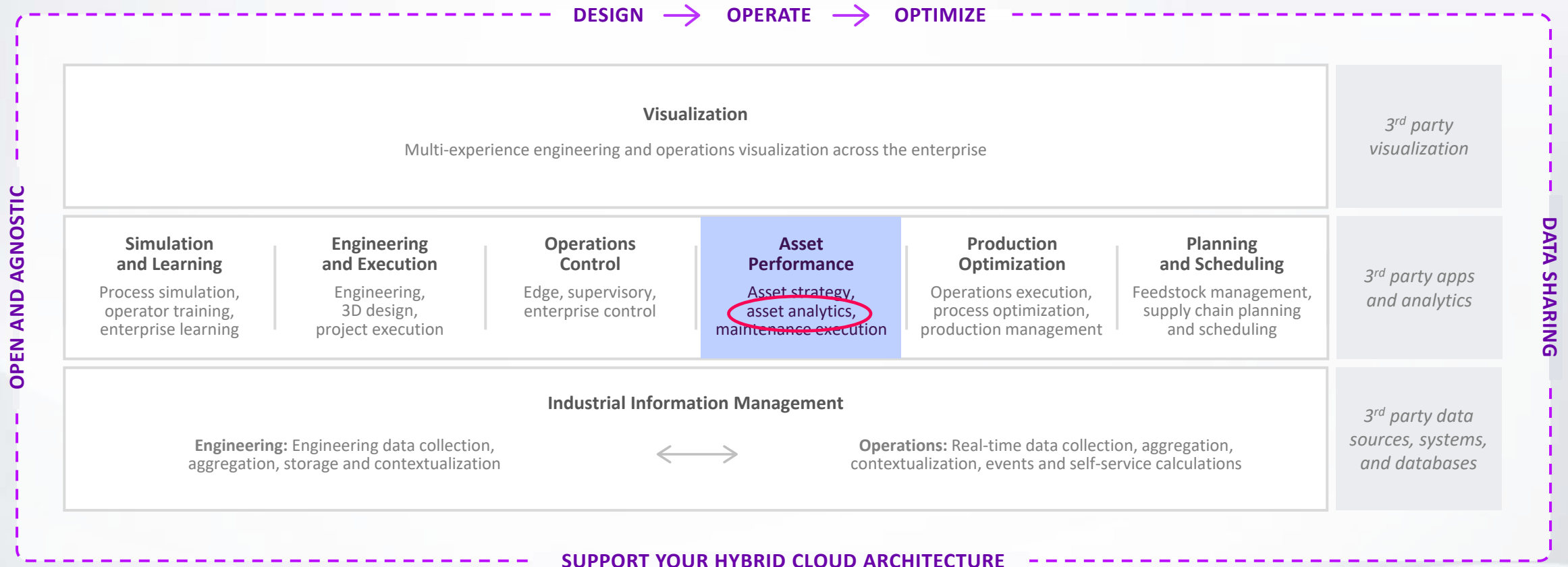


AVEVA Solutions Architecture Diagrams

AVEVA

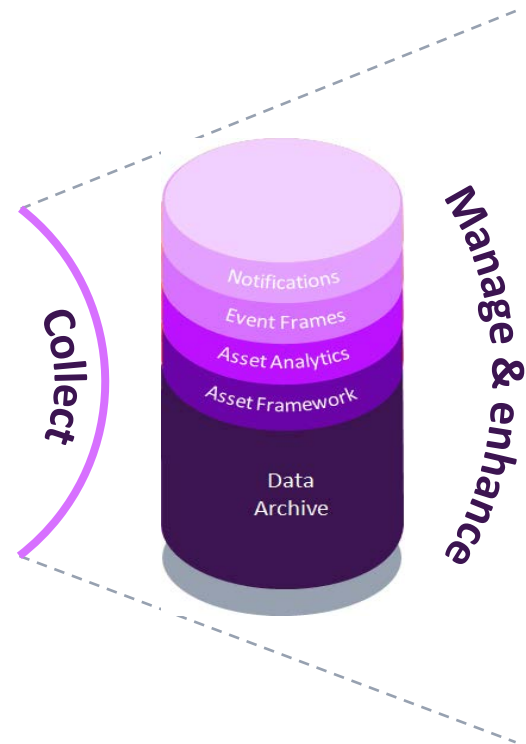
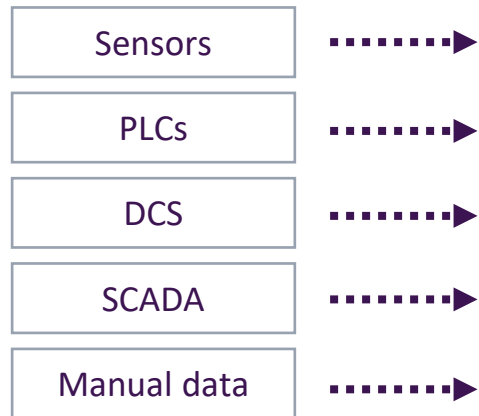
Delivering a complete digital thread, purpose-built for industry

Accelerate time to value with flexible, scalable, and trusted industrial hybrid SaaS solutions

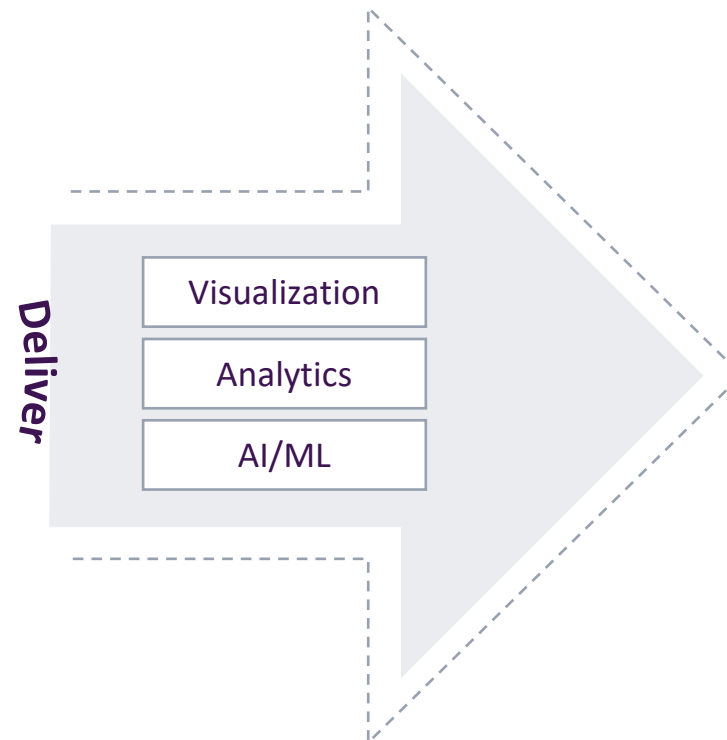


Industrial Data Infrastructure

Operations data sources



PI Server

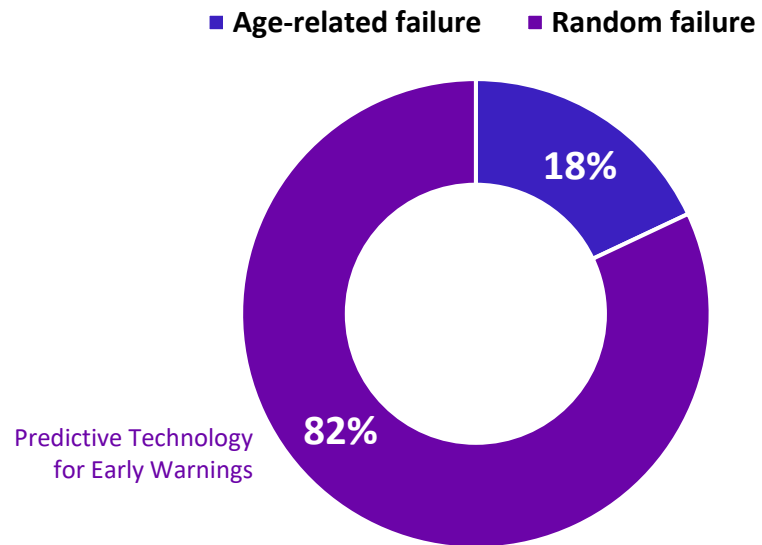


Data consumers



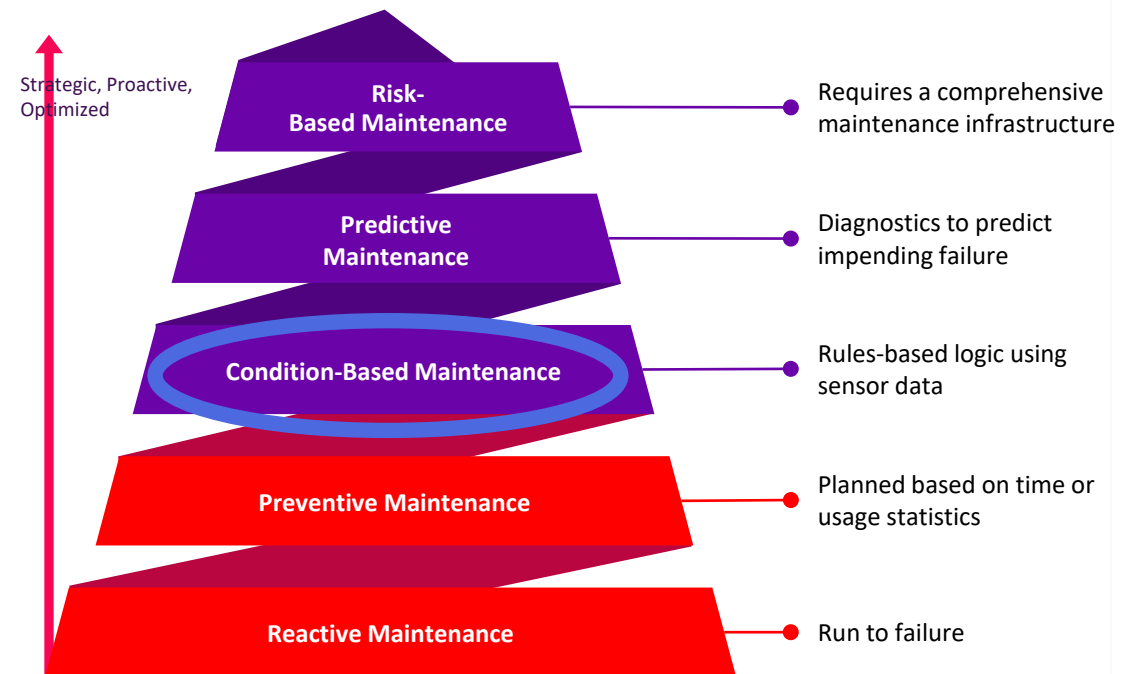
AVEVA APM connects Asset Strategy to Corporate Objectives

Failure Patterns

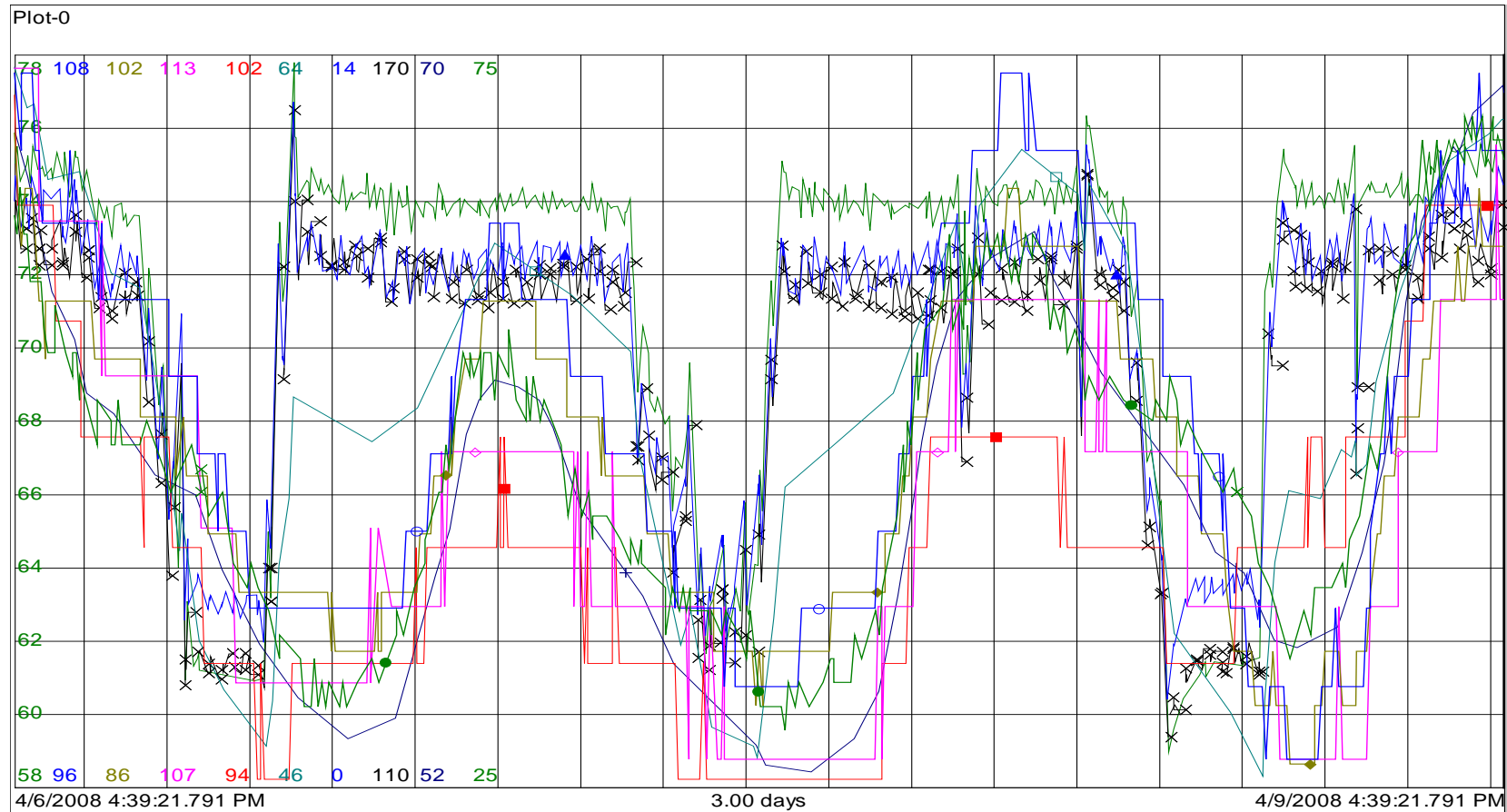


«ARC STUDIES SHOW ONLY 18% OF ASSET FAILURE IS AGE-RELATED. BASED ON THESE DATA, PREVENTIVE MAINTENANCE PROVIDES A BENEFIT FOR JUST 18 PERCENT OF ASSETS AND MONITORING FOR PREDICTIVE MAINTENANCE IS A RECOMMENDED OPTION FOR THE REST. WWW.ARCWEB.COM/LISTS/POSTS/POST.ASPX?ID=260

Maintenance strategy

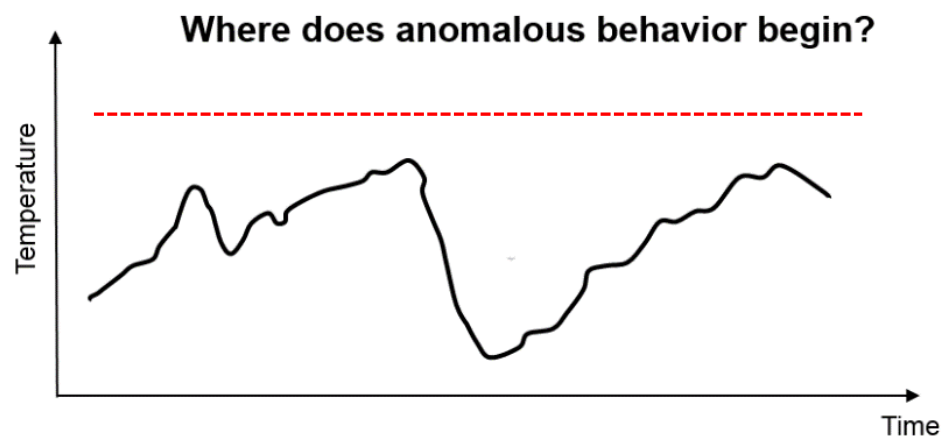


Monitoring Without Predictive Analytics



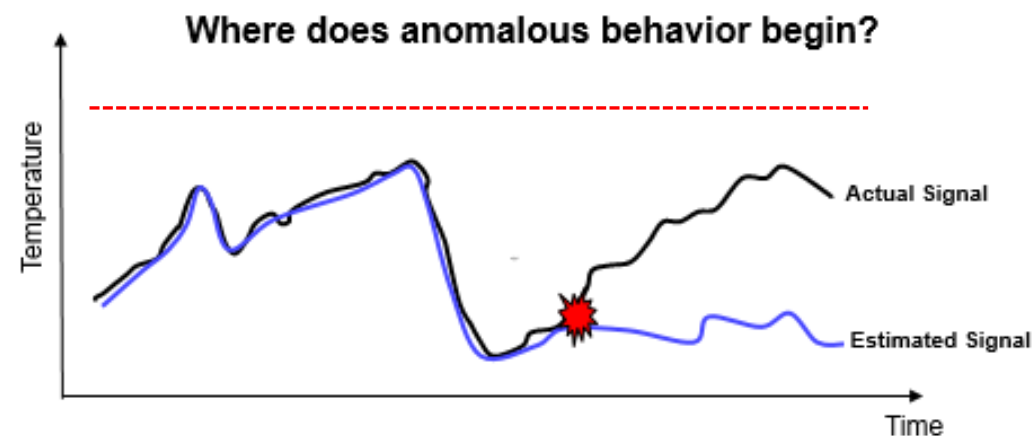
Monitoring Approach

Traditional Monitoring



- Constant alert/alarm limits are typical
- Damage accumulates prior to reaching limit

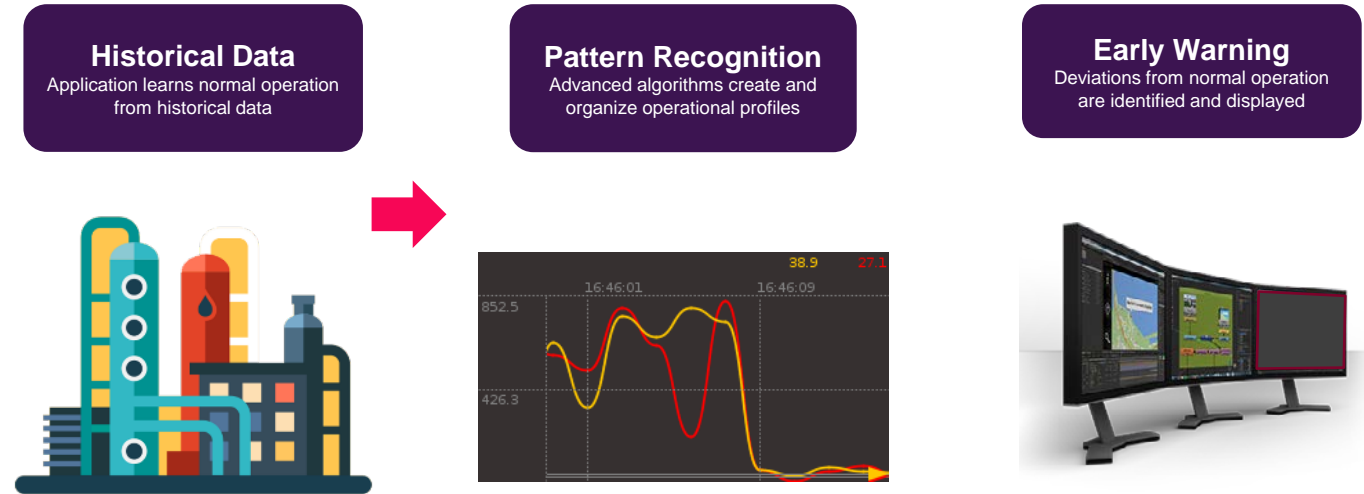
Predictive Asset Monitoring



- Actual minus estimated (residual) signal detects anomaly as-soon-as-possible

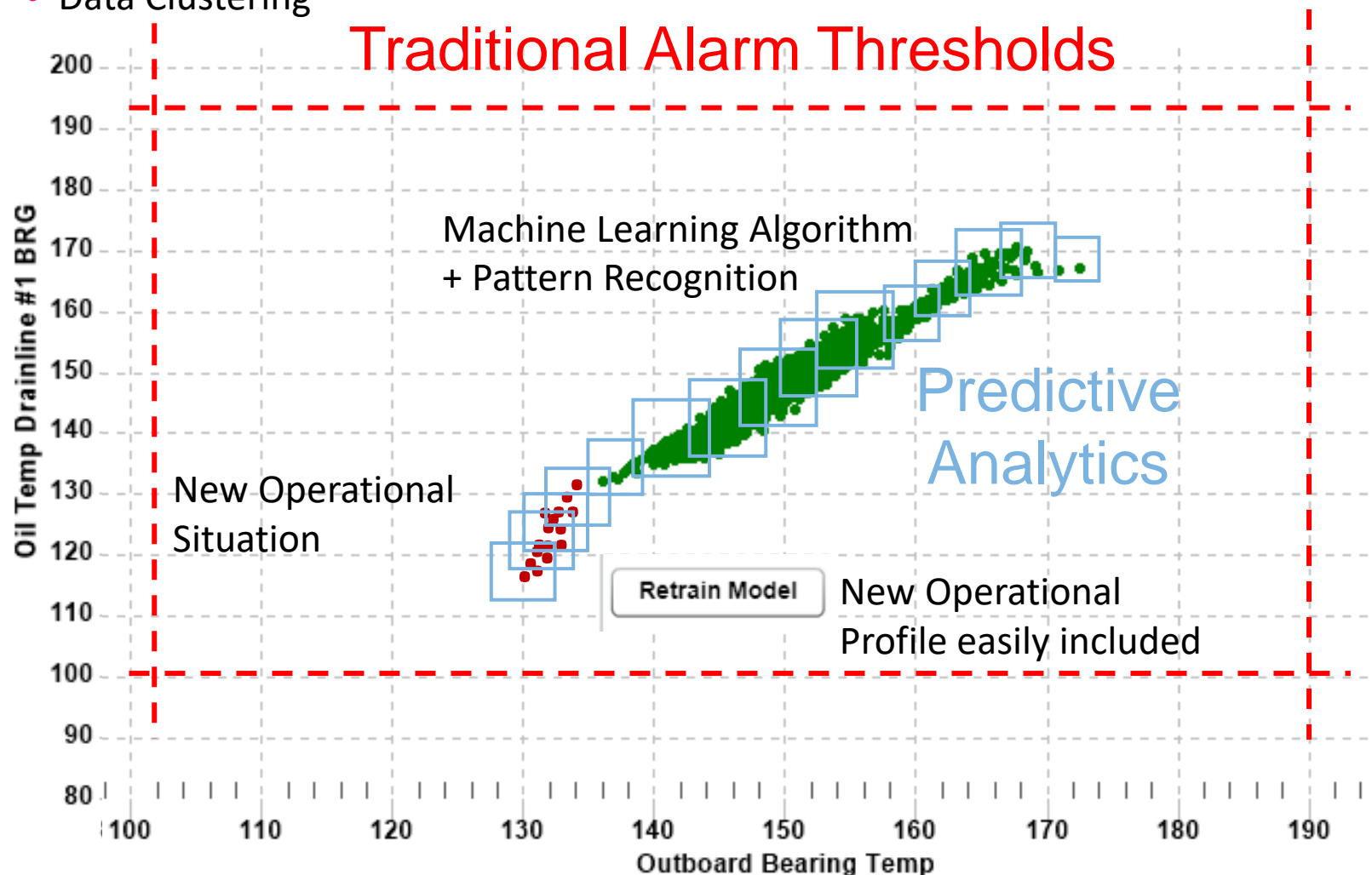
AVEVA Predictive Analytics – How Does It Work?

- Artificial Intelligence continuously monitors behavior in real-time
- Alerts when the operation differs from the historical norm
- Early warning detection of equipment problems
- Advanced analysis capabilities including problem identification and root cause analysis
- Continuously monitors for degradations 24x7



AVEVA Predictive Analytics – How Does It Work?

- Data Clustering



- Asset historical data is encoded using data clustering algorithms
- Clusters describe known relationships in data across N sensor dimension
- New data is compared against clusters to detect deviations in behavior in real-time
- Algorithm computes magnitude of deviations and which sensor(s) are contributors



Success Stories





SCG Chemicals,
Thailand

Asset Performance
infused with
Artificial Intelligence



SCG Chemicals

Thailand

Harnessing AI-infused APM to prevent unplanned downtime from shutting down value chain

Goals

- Build on integrated platform to provide integrated, real-time visibility of operations
- Leverage smart analytics and cloud to drive decision support and streamline operations
- Visualize operational information and KPIs to coordinate Asset Performance Management (APM)

Challenges

- Drive greater real-time visibility of plant performance across team
- Visualize data and track KPIs as well as leverage performance improvements from analytics-based decision support
- Build a digital operating system that would realize the vision of zero unplanned downtime

Results

- ROI of 9x achieved within six months
- Maintenance costs reduced, delivering savings of 40%
- End-to-end visibility of plant operations
- Trusted real-time data blended with analytics enables team to predict equipment health, monitor performance and drive optimizations more readily
- Better understanding and tracking of performance through visualization of data and KPIs
- Operational digital twin supports aim to dive zero unplanned downtime



Industry: Chemicals

“Our Digital Reliability Platform is an unprecedented step forward to ensure reliability for our business. AVEVA was the only company able to provide an end-to-end solution spanning engineering, operations, and maintenance. With the DRP, we have successfully brought together big data, AI, machine learning, and predictive analytics into a practical solution that will empower our workers and improve our performance. This is a great achievement and innovation for SCG Chemicals.”

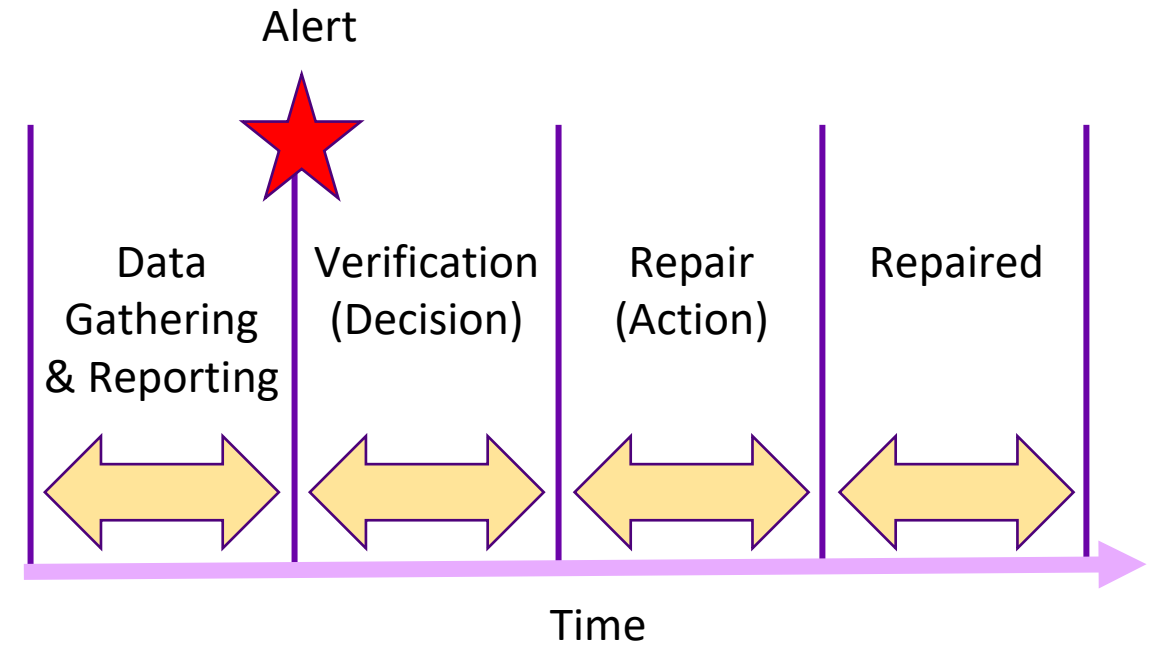
***Mr. Mongkol Hengrojanasophon, VP – Olefins Business & Operations
SCG Chemicals***

AVEVA

Enablers and Opportunities of Business Value

	Workflow	3D	KPI	Mobility
When	X	X		X
Where				X
Which	X		X	X
How	X	X	X	X

- 3D helps teams to quickly and accurately understand access to work and work at height
- Mobility minimizes field work errors and multi-shift delays
- KPIs maximizes work efficiency
- Workflow minimizes time and optimizes expert efficiency



Votorantim

With AVEVA Predictive Analytics, Brazil's leading mining operation cut maintenance costs by 10% and boost reliability by 6%

10% reduction in recurring maintenance costs

BRL 23 millions savings across 16 factories

Reliability boosted by 6%, achieving targets

Reduced unplanned maintenance and cut costs by 10%

Implemented successful change management strategy, improving collaboration

Improved transparency, enabling comparative analysis between plants and best practices



AVEVA

Votorantim

Votorantim Cimentos works with AVEVA to cut maintenance costs by 10%, boost reliability by 6%

Goals

- Increase operational reliability and reduce downtime using autonomous business practices

Challenges

- Need for rapid implementation and a user-friendly interface for corrective maintenance and maintenance (MRO) inventory
- Need to cut costs and increase productivity for maintenance by creating shared owners and boosting collaboration between the in-house teams
- Cut costs and drive return on investment within the first year
- Manage COVID-19 Scenario with remote deployment

Results

- 10% reduction in recurring maintenance costs
- BRL23 millions saved across 16 factories within the first year of deployment
- Reliability boosted by 6%, achieving targets of hitting 92% reliability
- Reduced unplanned maintenance and cut costs by 10%
- Implemented successful change management strategy, improving collaboration
- Improved asset transparency, enabling comparative analysis between plants and sharing of best practices



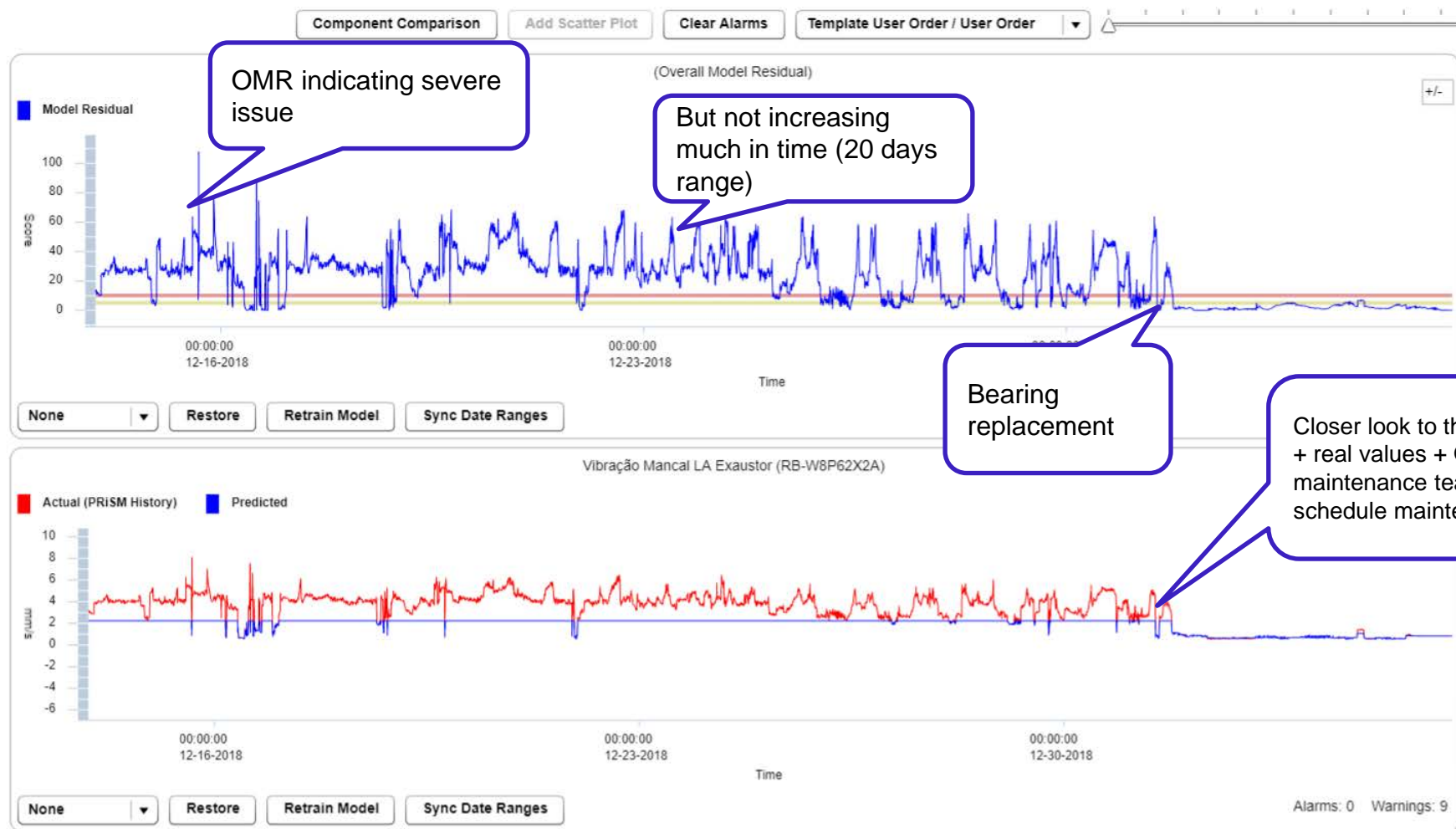
Industry: Mining

*“Using AVEVA Predictive Analytics we wanted to realize a vision of our next-generation plant operations, using data to shape our decision-making. Because AVEVA’s software is agnostic we were able to click in the systems within days, and see benefits within weeks, driving unparalleled optimizations that spanned our entire operations and our network of plants.”*Mr. Mongkol Hengrojanasophon, VP – Olefins Business & Operations

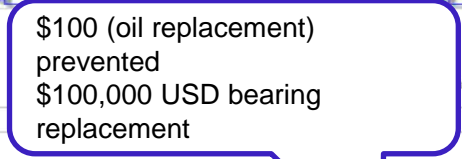
Fabio Eduardo Scarlassari
Global Maintenance General Manager
Votorantim Cimentos

AVEVA

Optimizing Kiln Maintenance



Avoided Production loss =
7000 tons (estimated)
Total Cost of maintenance = 3k
USD (bearing replacement)





Duke Energy maximizes the safety, reliability and performance of assets with AVEVA's AI technology

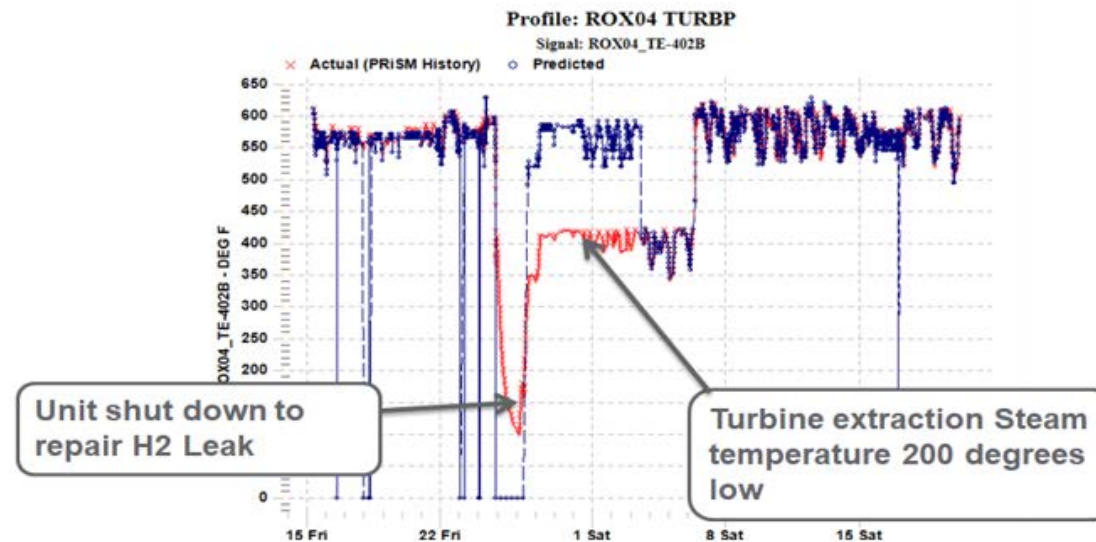
Savings of \$34.5M single early warning catch

Predictive asset analytics model, identify and resolve problems before they occur



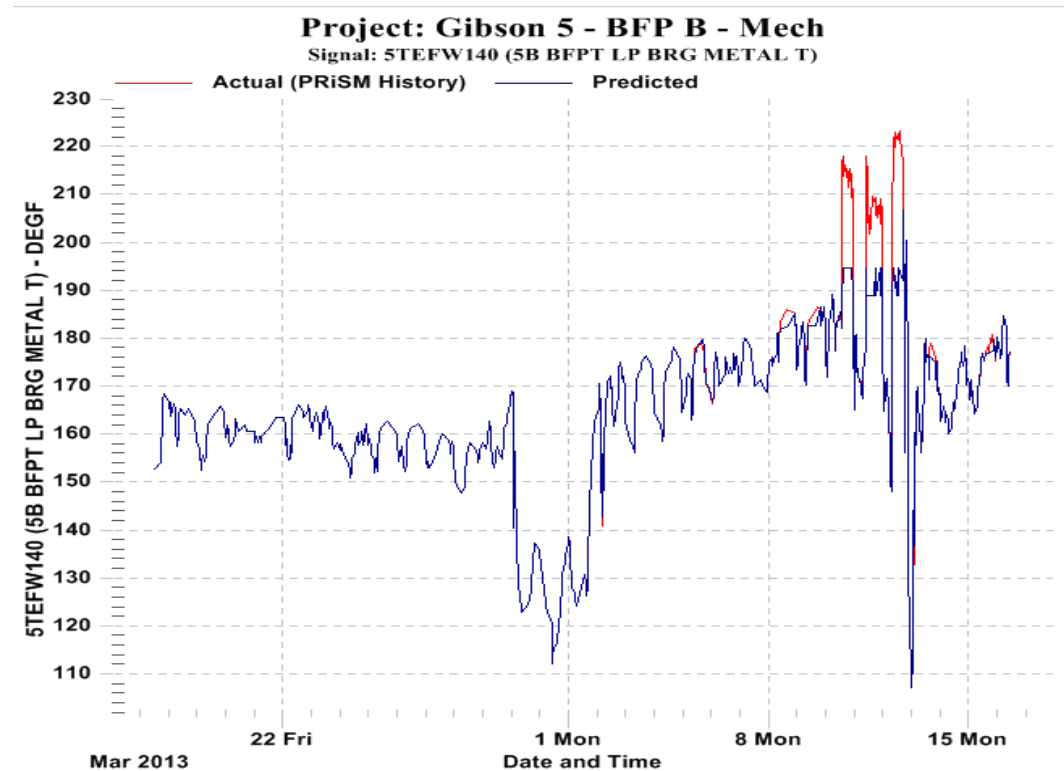
Duke Energy - Steam Turbine Efficiency Loss

- Received alarm on low extraction steam temp
- Additional fuel burned over 8 days
- Could have gone a month or more before plant found it



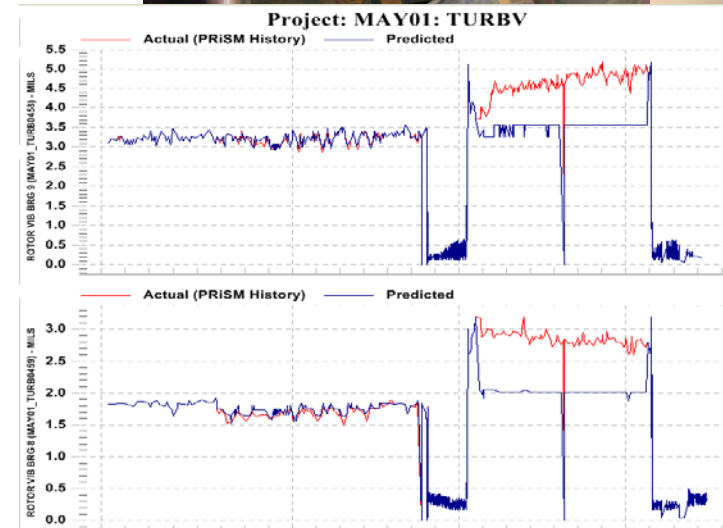
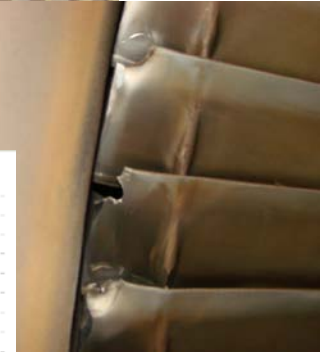
Duke Energy - Bearing Seal Problem

- Observation:
 - Bearing metal temperature spikes seen on low pressure turbine bearings
- Results:
 - Site investigation found oil reservoir filled with half water and half oil
 - Experience from site determined intricate valving was supplying too much pressure to the seals resulting in water flowing to the bearings



Duke Energy – LP Rotor - L-0 Blade Problem

- Unit was started after an outage and there was a vibration step change on one of the LP turbines (Vibration levels were well below the alarm level)
- Engineering and the plant were notified
- Vibration data was collected and unit was retired for an inspection
- Bolts on lower half of flow sleeve had broke and flow sleeve contacted L-0 blades
- Upper half of flow sleeve was no longer supported by lower half
- Although we had minor damage to the LP blades, we avoided damaging multiple stages of blades, packing, and diaphragms if we had a severe blade liberation.
- Estimated avoided cost - \$4.1M





ENEL Italy utilizes AVEVA's solutions to help them realize the fully-autonomous digital plant

Realizing the
autonomous plant
AI-infused Digital Twin



Anomaly Detection

From an accident/engineering-based to a data-driven/business approach



30 SITES
65 UNITS
1275 assets

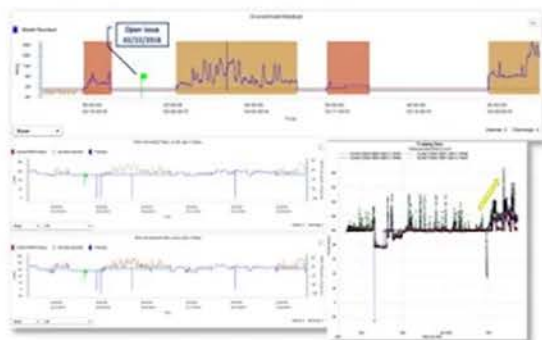


23 GW representing
80% of MARGINS

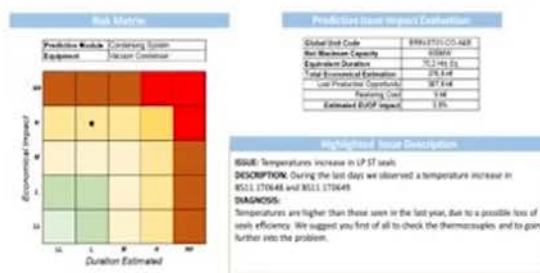


21 months of operation
>220 real events early detected

Example



Open Issue – 1° level analysis



Issue Evaluation Process

Temperatures higher than usual, due to a possible loss of seals efficiency. First of all check the thermocouples and investigate into the problem.

- Model creation based on **normal correlation among key parameters**
- Continuous monitoring of the **differences** btw **actual** and **predicted model value**
- The tool is able to identify in **advance malfunctions** and **slow performance degradation** of equipment



TOTAL uses AVEVA solutions to maximize the safety, reliability and performance of assets in the cloud

Improved reliability for refinery operations

Predictive asset analytics
monitor and diagnose equipment problems



EDF

EDF runs fleet-wide monitoring of solar, wind and energy storage using AVEVA Predictive Analytics combined with PI System operational data management. The system saved £1.5 million in a single early-warning catch.

“The PI System is designed to support our goals of operational intelligence. The idea is you build systems that take raw data and turn it into actionable information so you can make smarter decisions.”

David Rodriguez, Sr. Analytics & Intelligence Engineer, EDF Renewables



AVEVA

Ontario Power Generation

AVEVA Predictive Analytics installed across OPG's renewable and nuclear fleet enabling AI-infused condition-based maintenance

1,200 predictive maintenance operating models established

Cloud-based systems connect the monitoring and diagnostic team with operators on site enabling live collaboration

Reduced risk and increased operational efficiency – 3000 fewer annual maintenance hours

US\$400,000 saved in a single nuclear predictive analytics catch; US\$200,000 saved in a single Hydroelectric (HEP) early warning catch



Our software drives transformation for 20,000 customers



Energy



Power



Food, Bev, CPG,
Life Sciences



Chemicals



Infrastructure



Mining



Marine



EPC

ExxonMobil



ConocoPhillips



nationalgrid

enel



Xcellerex

Genentech



INEOS



Peabody



wood.


Worley




MCDERMOTT



AVEVA

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ABOUT AVEVA

AVEVA is a global leader in engineering and industrial software driving digital transformation across the entire asset and operational life cycle of capital-intensive industries.

The company's engineering, planning and operations, asset performance, and monitoring and control solutions deliver proven results to over 16,000 customers across the globe. Its customers are supported by the largest industrial software ecosystem, including 4,200 partners and 5,700 certified developers. AVEVA is headquartered in Cambridge, UK, with over 4,400 employees at 80 locations in over 40 countries.

[aveva.com](https://www.aveva.com)