

AVEVA WORLD 2023

AI & ML-Based Analytics Using AVEVA™ PI System™ Data

Taking the Next Step in your Digital Journey

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Agenda

“AI & ML-based analytics using
AVEVA PI System”

- “Quo Vadis?”
- Predictive + Prescriptive Maintenance
- Integration with AVEVA™ PI System™
- Next Steps in your Digital Journey – AI at AVEVA

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“Quo Vadis?”

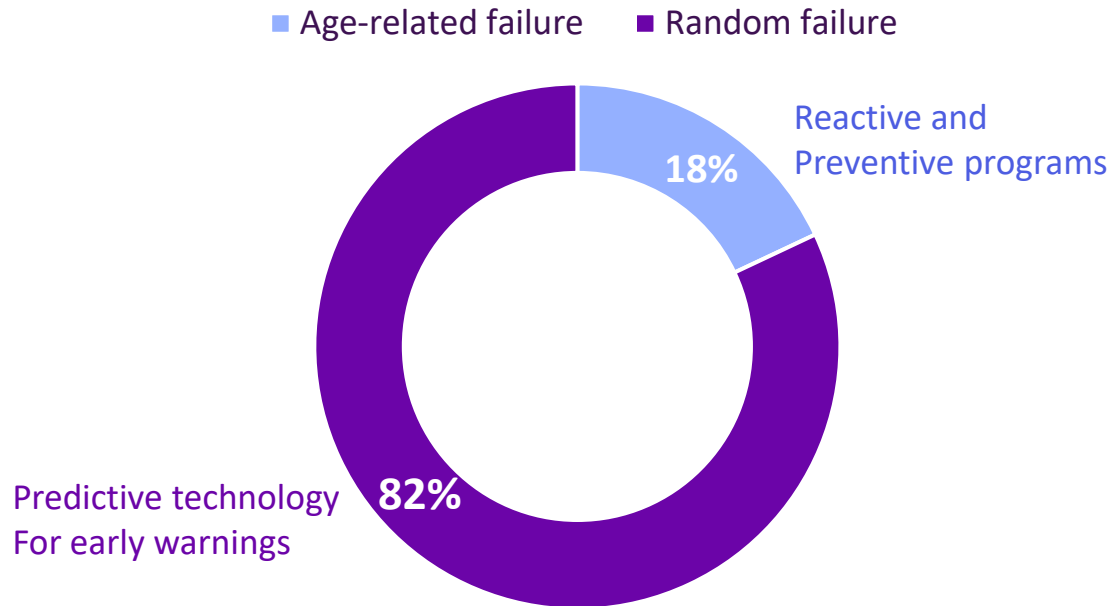
“OK, I have a great PI implementation, where do I go now?”

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Optimize your asset reliability, maintenance and performance

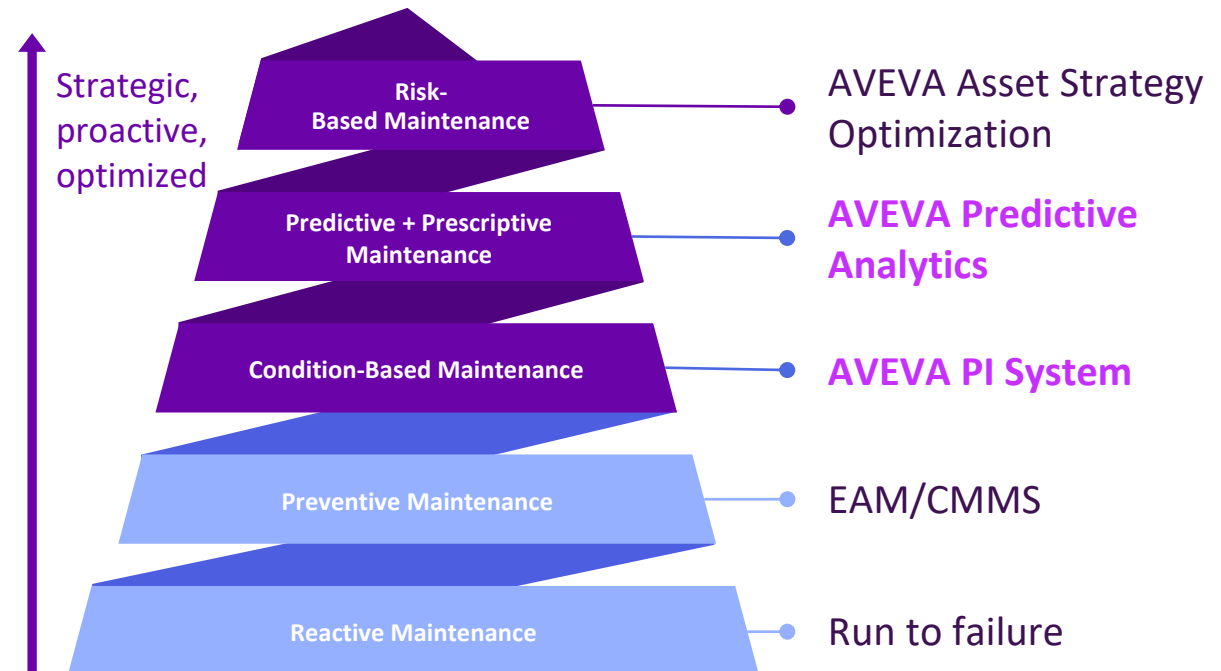
A journey in operational reliability with AVEVA PI System and AVEVA Predictive Analytics

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

It's a journey



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Predictive + Prescriptive Maintenance

Avoiding downtime and optimizing operating costs



Real AI, real results

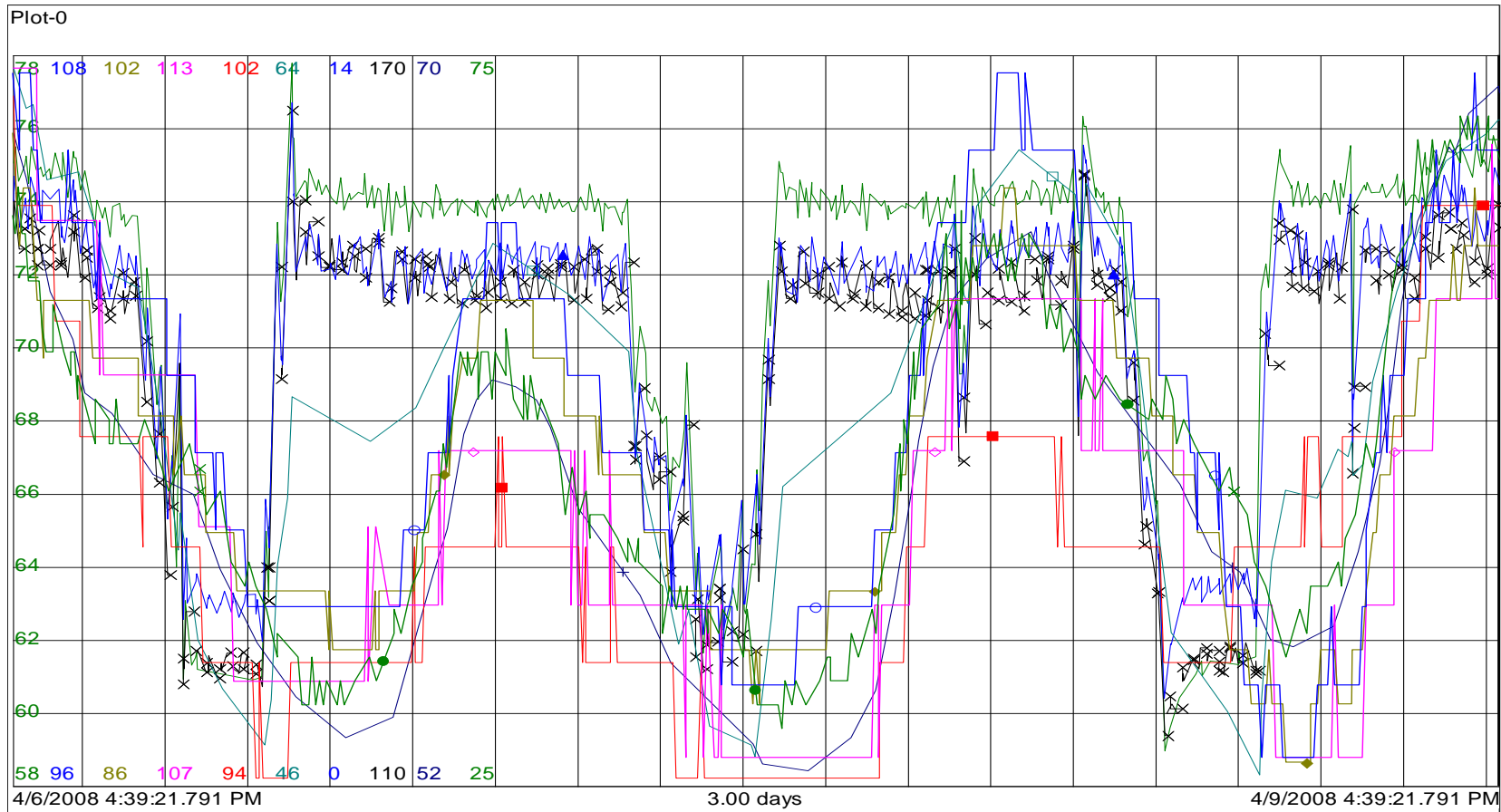
Predictive failure detection for business-critical equipment

- No code AI and machine learning
- Advanced alert and case management for knowledge capture and reporting
- Data playback capability for testing models
- Templates accelerate configuration, deployment and scale-up

It's the way you operationalize and scale AI for industrial operations

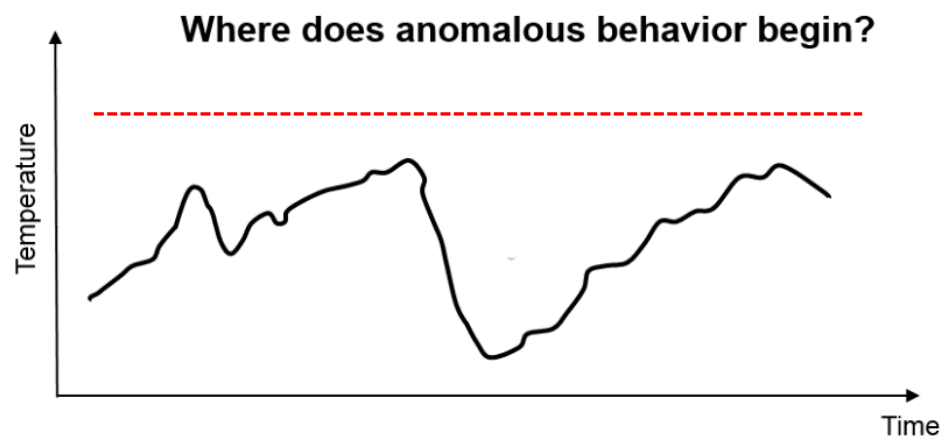


Monitoring without predictive analytics



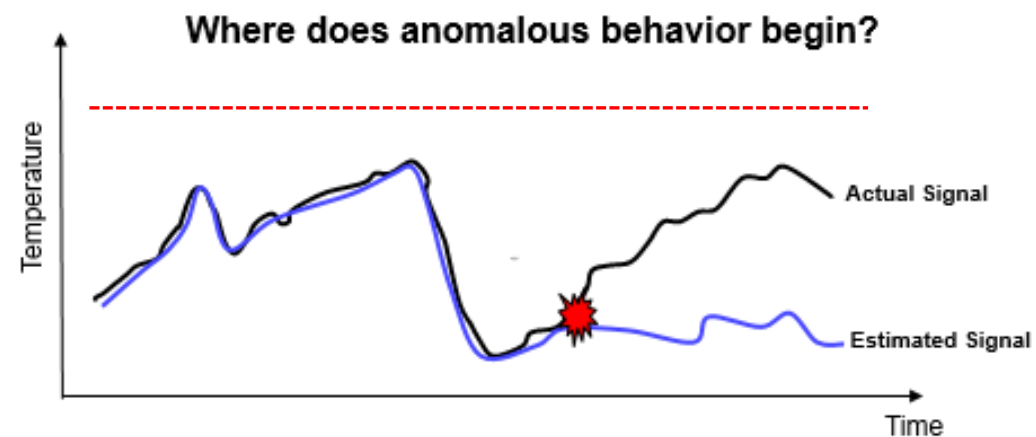
Monitoring approach

Traditional Monitoring



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

Predictive Asset Monitoring

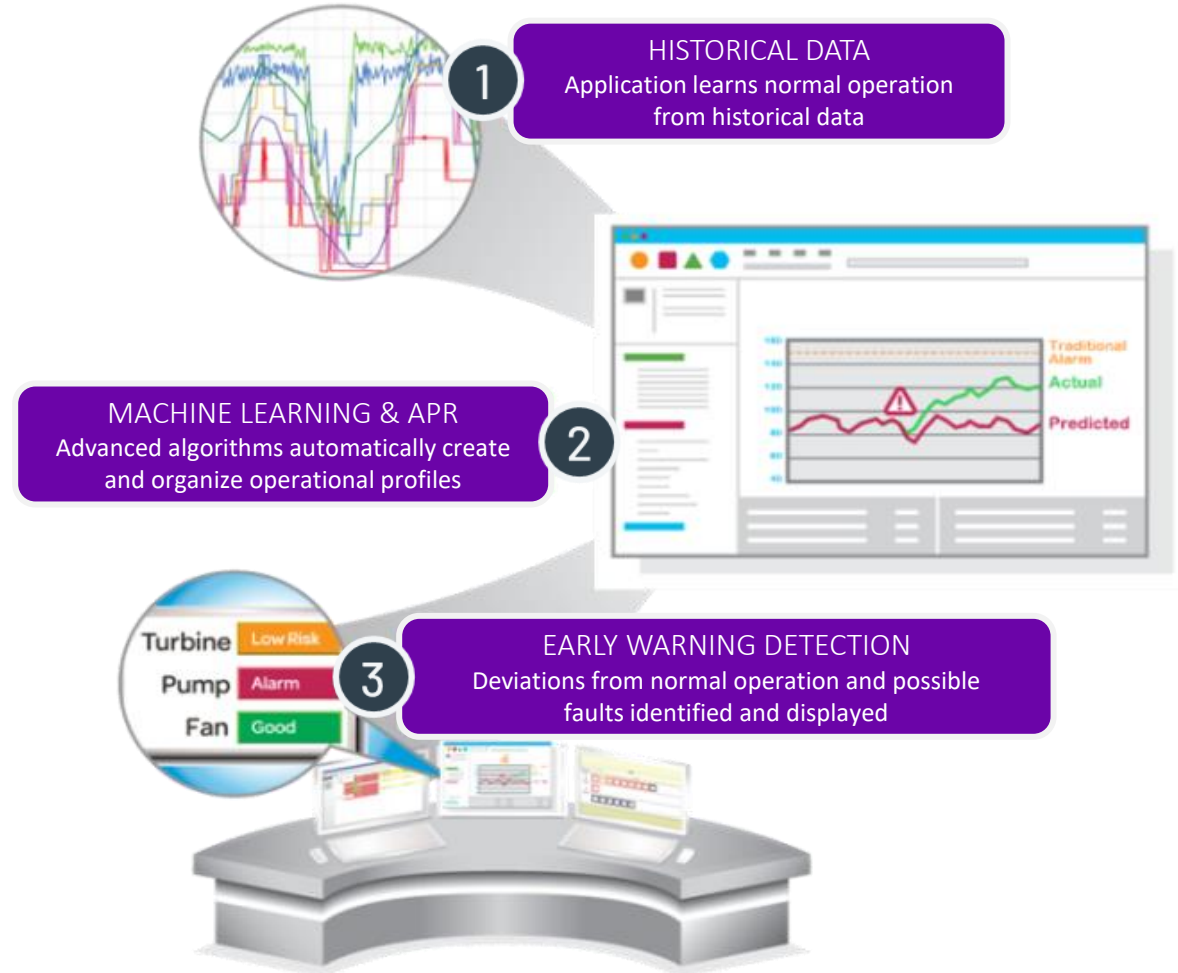


- Actual minus estimated (residual) signal detects anomaly as-soon-as-possible

Theory underlying predictive analytics

Foundation for AVEVA solutions

- Uses historical data to describe how a piece of equipment normally operates and build a model (*patented AI algorithm for optimized results*)
- 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

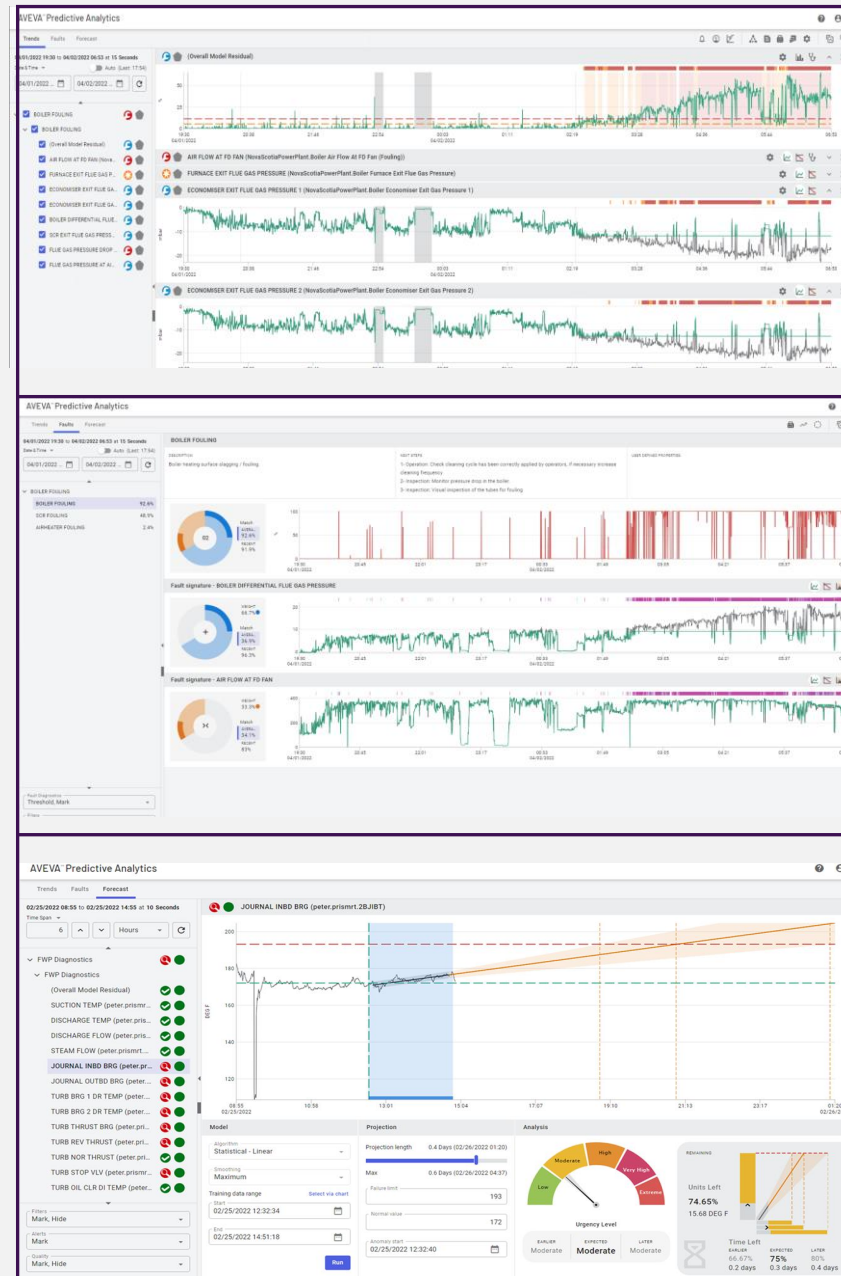


Deep and clear predictive analysis



**An anomaly was detected.
What are the next steps?**

- Overall anomaly score trending
- Individual sensor deviations trending
- Sensor contribution score to anomaly
- Diagnostics on sensor deviation signature
- Ranking of potential faults
- Fault match trending
- Prescriptive guidance for remediation
- Forecasting for time until failure
- Case tracking from alert inception until remediation



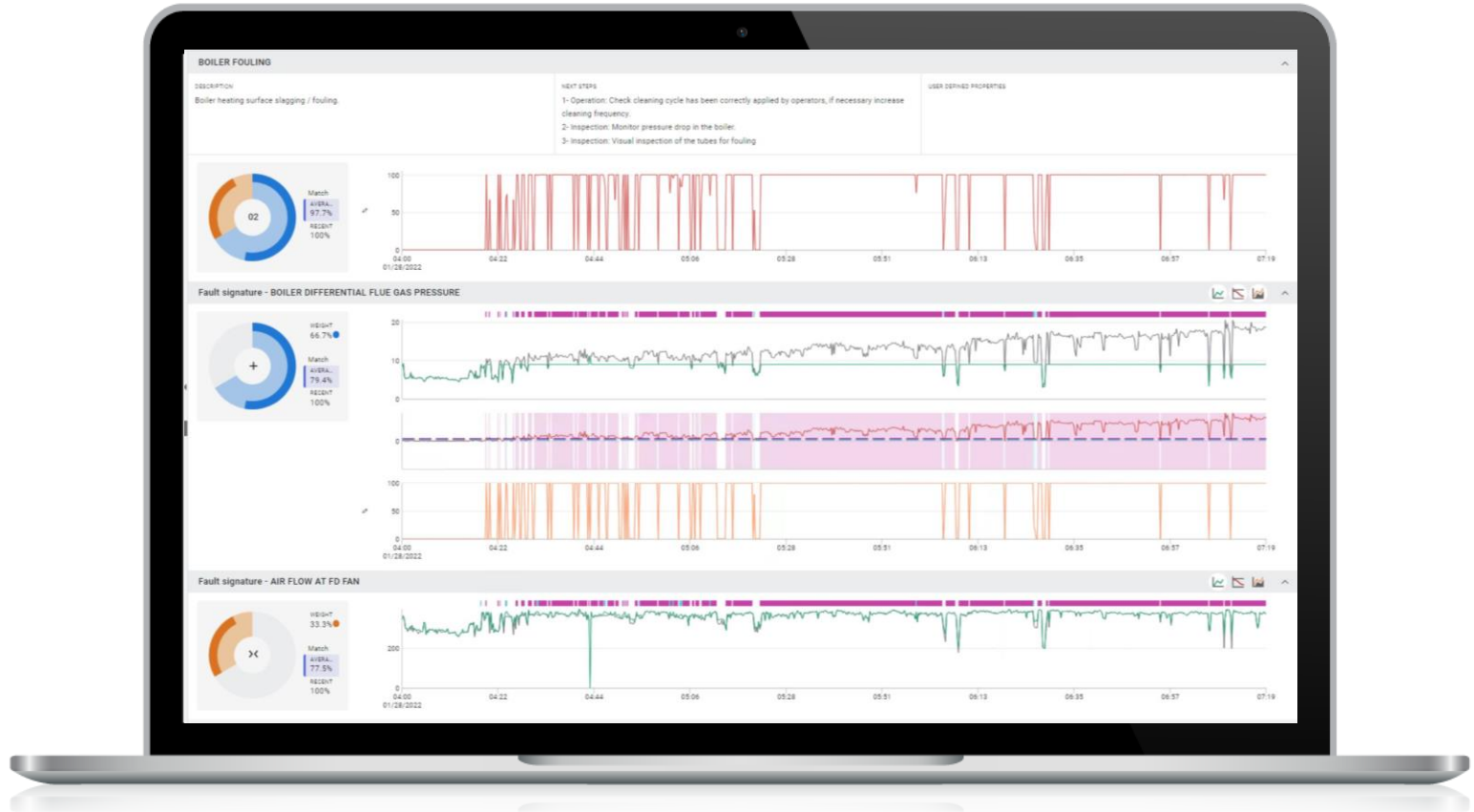
Which sensors are contributing to the anomaly?

What are the potential faults and related inspections?

What is the urgency level before breakpoint?

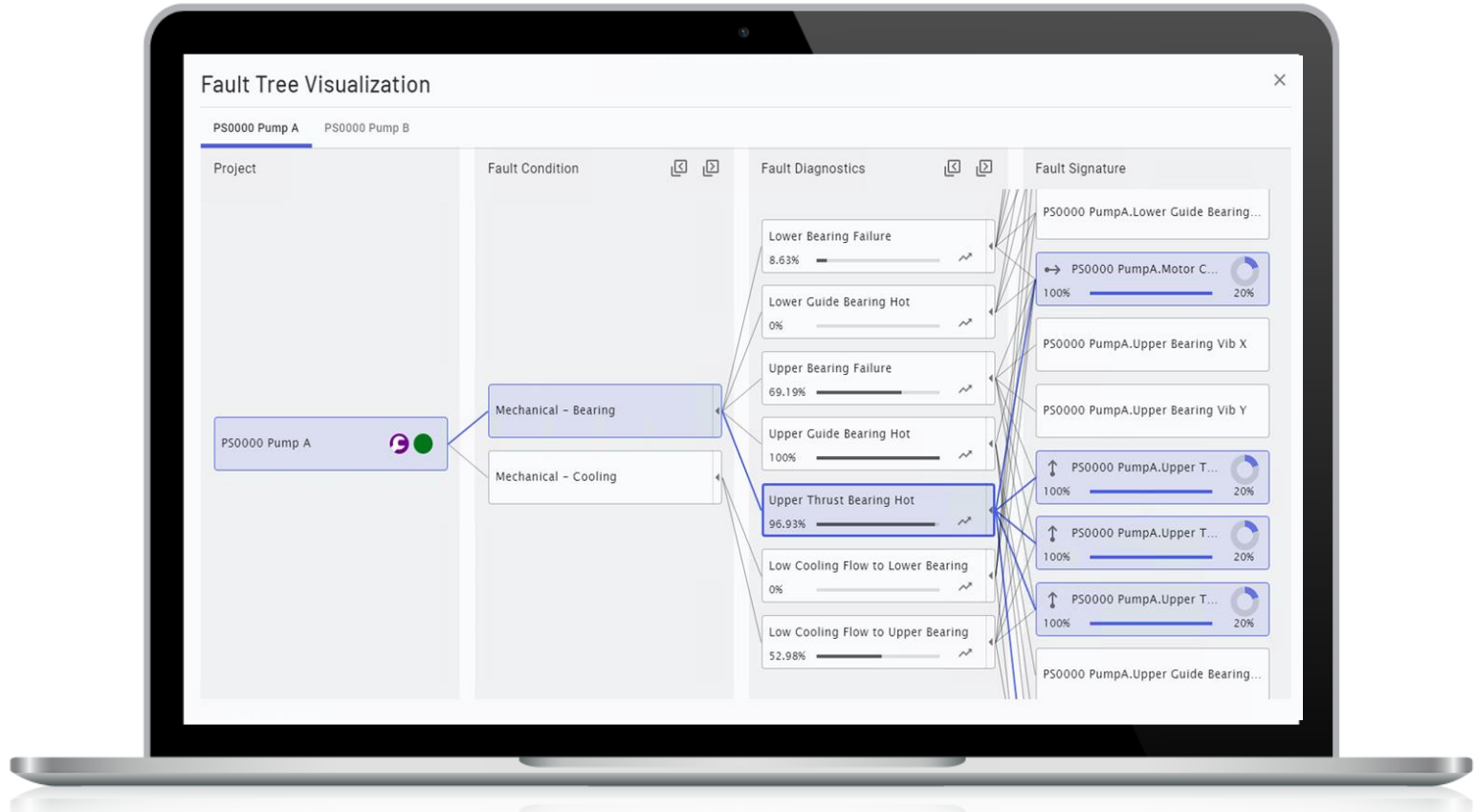
Best in class fault diagnostics

- Visualization and representation of fault diagnostics including fault trees for deeper insights
- Probability on failure modes
- Remediating actions with prescriptive analytics



Fault tree visualization

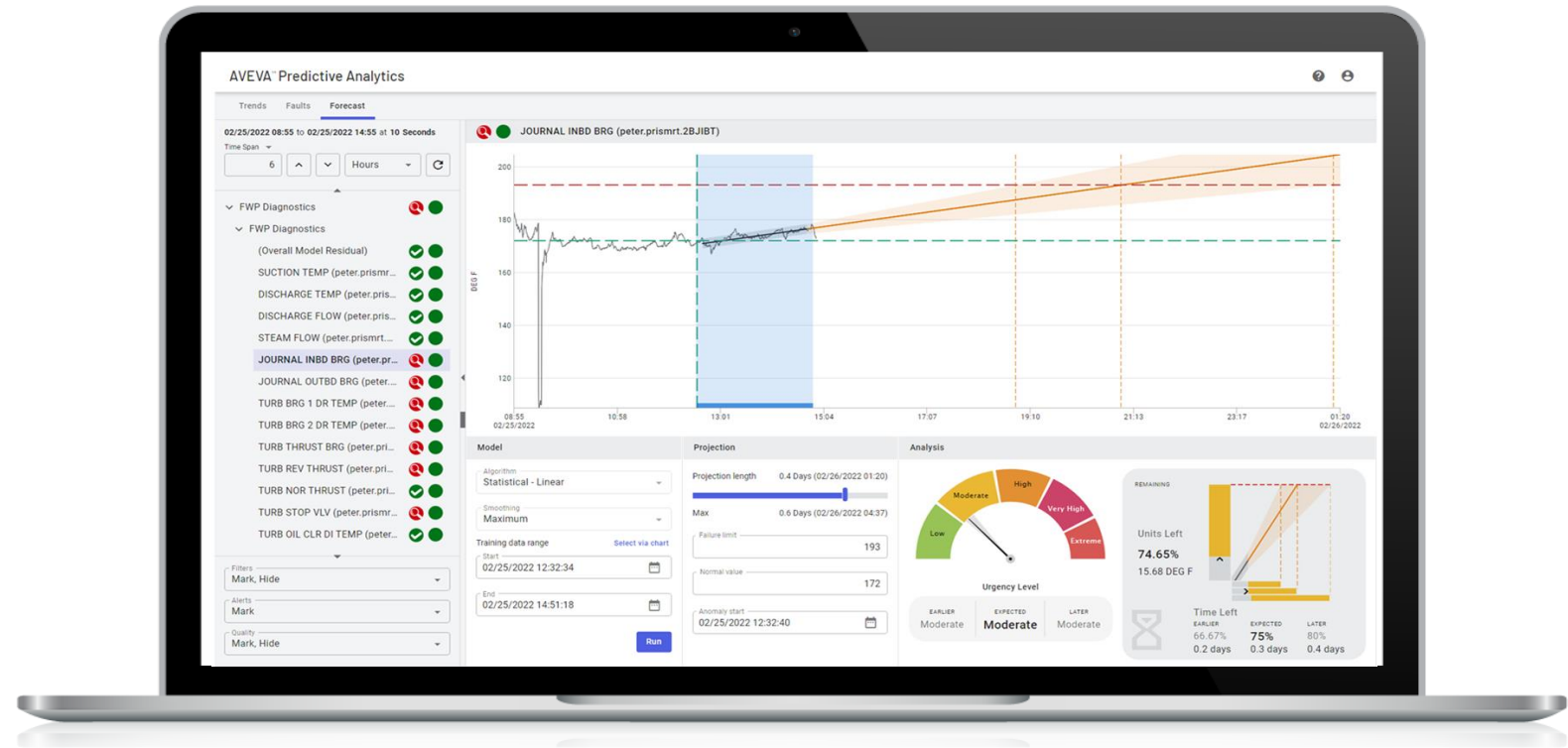
- Visualization and representation of fault diagnostics including fault trees for deeper insights
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Time to failure forecast

Data driven decisions

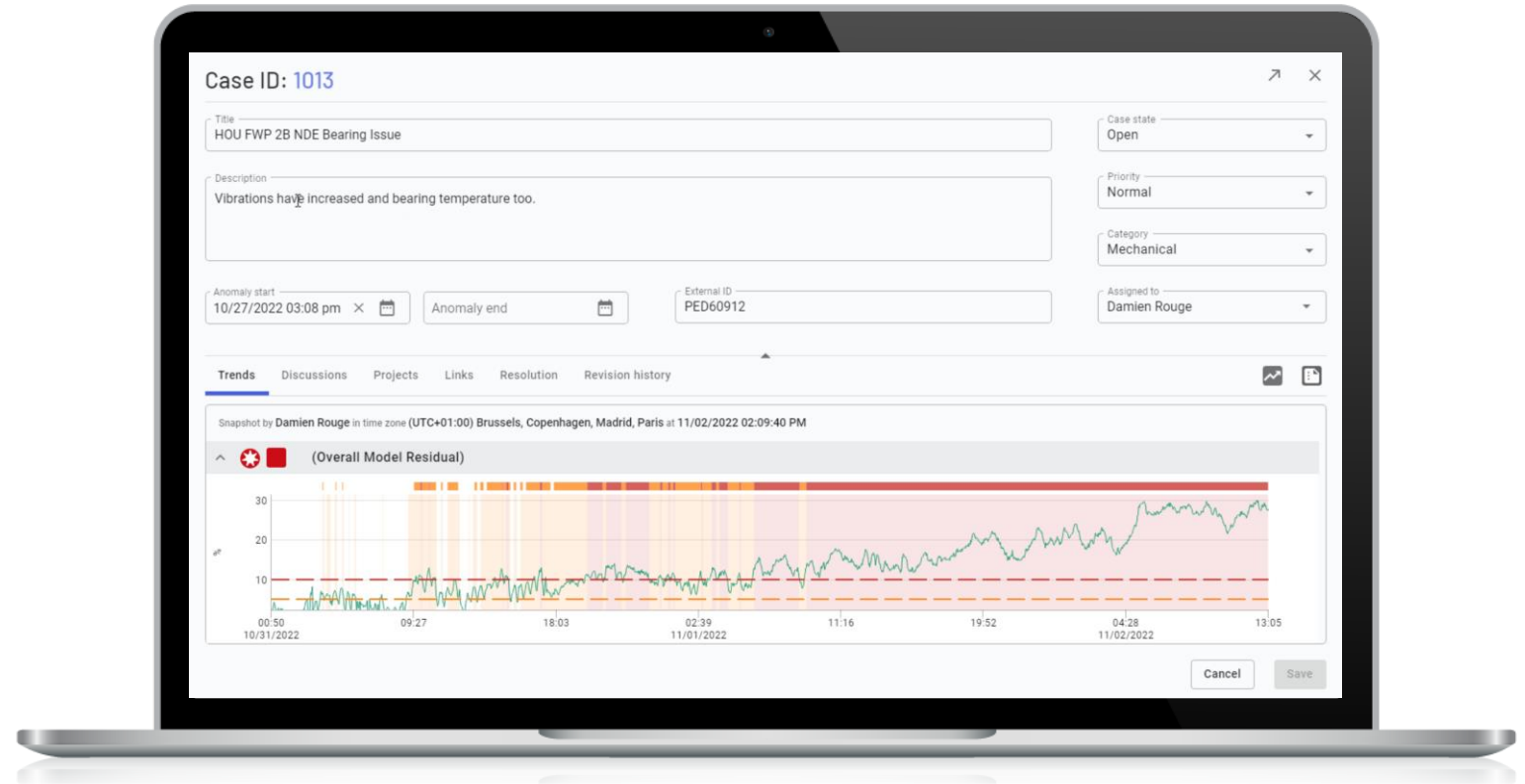
- Determine the risk level of an operating asset and urgency for actioning the predictive alerts
- Estimate time to repair or replacement under current operating conditions



Comprehensive case management

Knowledge management for continuous improvement

- See predictive trends to cases
- Make better and faster decisions with increased access to information
- Highlight relevant cases when investigating fault diagnostics
- Integrate the learnings of past anomalies with user activities
- Vizualize trends
- Capture knowledge and best practices
- Track actions (who, what, when)





Bring your own algorithm

Add value to current investments

Data scientists can create and deploy customized predictive algorithms to add value to the pre-built features of AVEVA Predictive Analytics.

- Pre-built model templates
- Automated model building
- Model back testing and validation
- Alert workflow
- Fault diagnostics
- Prescriptive actions
- Case management
- Time to failure forecasting

Operational scale matters

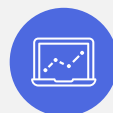
Predictive monitoring at scale



**Model Templates
and Validation**



**Fault + Prescriptive
Diagnostics**



**Performance
Monitoring**



**Case
Management**



**Alert
Management**



**Time Until Failure
Forecast**



Transient Analysis



**Asset Comparison
and Reporting**



**Integrated Alert
Workflow**



AI/Machine learning is the easy part



*Operationalizing at scale is the
difference between success or
failure*

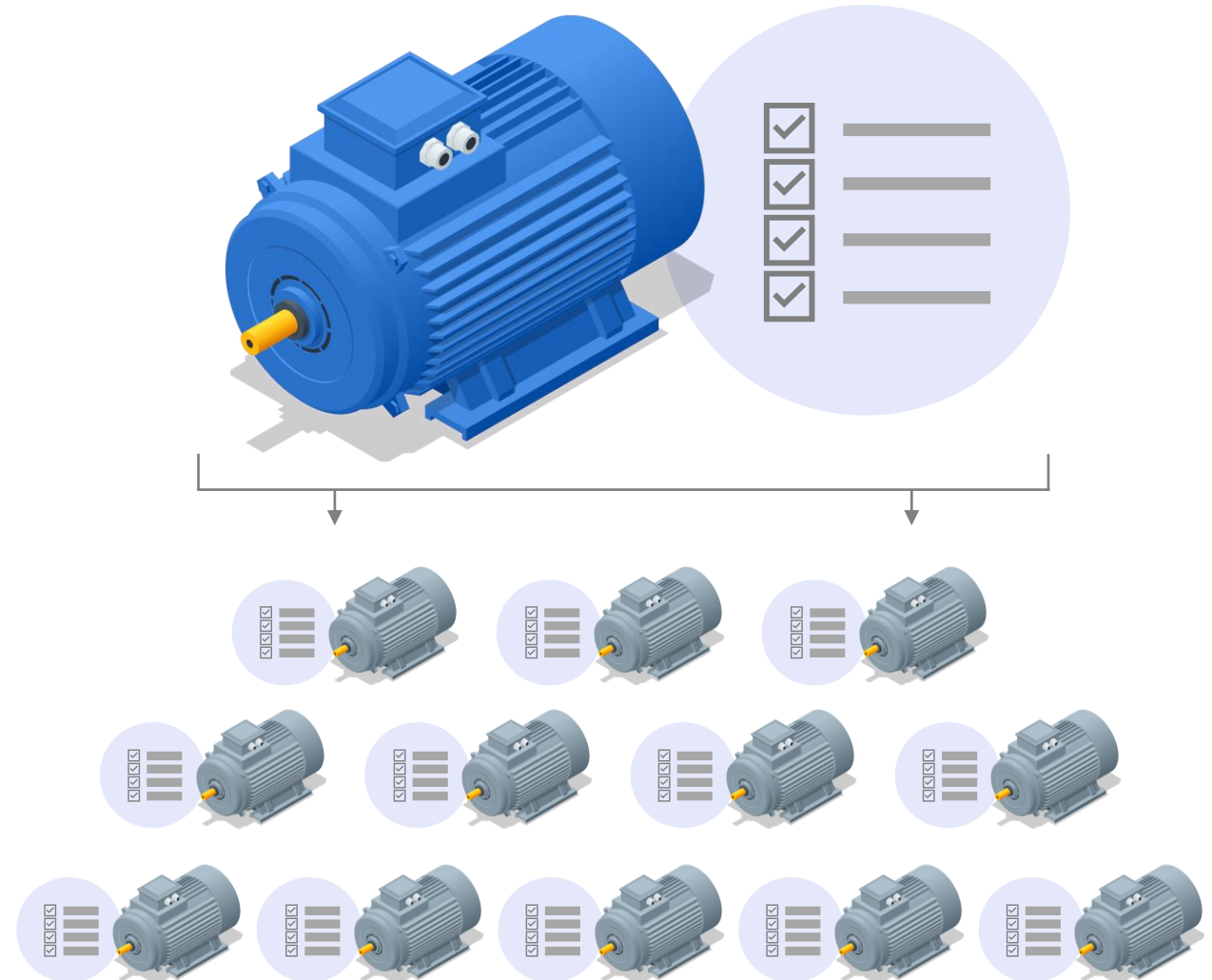
Automated model building

Deployment at scale for fast time to value

- Minimize manual work
- Model templating
- Automatic cleansing of the training data
- Automatically include filters, alert thresholds, and fault diagnostics
- Integration to PI Asset Framework or existing historian

- **Minimize errors**
- **Ensure consistency**
- **Increase labor productivity**

Automated building model



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Integration with AVEVA™ PI System™

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Deep integration with AVEVA™ PI System™

- Visibility to more people, integration of content to AVEVA PI Vision
- Predictive Analytics results integrated into AVEVA PI System for contextualized insights
- Integration with PI Server's asset framework enables more efficient model building



Predictive Analytics is integrated with Asset Framework

Effective enterprise data modelling

80-5.Net Volume DC.SJ.PUE TI-102 DC.Zero DY-108 trigger GE05_Energy C1:14AT5 AC03.Air Flow
 GE01_A_DT DC.SJ.C1.Z3.R3.PDU1.PF GE01_A_DT AC09.Power FeedBin.Cmt Boiler Cold Reheat Pressure
 GE04_OSAsset1.Problems DC.SJ.SiteReaTime Anacortes Refinery.Alkylation.Asset B737_FG117 DC.TimeLoad
 QI-122 FI-151 403511195_Wind Speed Problems B210_FG005.KPIExcursion D-110.Tank Pressure.PV
 02F102.1HRAVG BGT001 AQUA2-SI005.PV GE02_Energy 4-36.Net Volume AC04.Air Flow FI-101 bf5e1d1d-39c9- GE04_DT QI-121 GE03_V_WIN
 PI-111 facility_output 0_ENG_MODE_STS FI-141 02T1100 03LBB02CT001-2 4b5b-b3d3-c2ce05fa3a26 GE04_DT DC.RK07R
 AQUA2-TI-201.PV AlarmTest.Input.Float32.10 0 CLR_FINAL_OUT B TDC.Srv06R GE04_Energy
 AlarmTest.Input.Float32.1 364511575-AC Power WIP 339511775_Clear F506_ESS0 TI-121 FT9001
 FI-101 bf5e1d1d-39c9-4b5b-b3d3-c2ce05f GE01_DT 409510395_Wind Speed QI-109 Horiz GE01_DT FAC.OAK.Power-Kh-Val.PV
 BGE003 FI-111 02T100 Cooling Fan-711.Feed Rate DC.Srv01R Boiler-209.Fuel Gas Flow DC.Srv01R
 AF_FLOW3 02:T103 AT401 AQUA2-SI005.PV GE02_Energy 125.Fuel Gas AlarmTest.Input.Float32.1 Flow DC.Srv01R
 ACEDemo.Unit1.Output TI-178 B352_W778 0_CMP_SVLV_PCT DC.Z1R 94:GRDIDX.Tr DC.Srv01R
 02F104 CD:F161 80-13.Net 0_CMP_HDR 0_ENG_AUX_STS D-110.Tank Pressure.P Pump #1
 94:BW.R TI-101 1-13.Net Volume DY-131 DC.SJ.PUE 94:GRDIDX.ProdID % CO2
 F723_E889 Volume B045_FG978 DC.SJ.PUE QI-111 FinalProductBin.On AT401 Pump #1
 369512185-Temp Compressor-439.Feed Rate fic1001.C GE02_OT 94:GRDIDX.ProdID % CO2
 Rate FI-101 bf5e1d1d-39c9-4b5b-b3d3- Gas Flow FI-16.Net Volume GE05_ES T
 DC.CH.DCE FIC-172:210 GE01_DT c2ce05fa3a26 CB1992_MS 03LBA32CT0
 FI-121 AF_FLOW3 0 CLR_FINAL_OUT B 0_CMP_FLOW_TOTA DC.SJ.ITLoad.P 01-2
 0_ENG_MODE_STS TMP 339511775_Clear Sky F506_ESS0 FT9001 TI-145
 GE03_Q GE01_DT Global Horiz GE01_DT FT9001 FeedBin.Cmt TI-178
 DY-131:166 GE01_TD FI-101 Volume fic1001.C FR5001 fasttag FR2001
 Boiler-334.Feed Rate FI-111 02T100 FT9001 FT9001 FT9001 FT9001 FT9001
 02F102.1HR BGE003 FI-111 02T100 403511195_Wind DC.Zonet.Number GE04_OS
 AVG AF_FLOW3 02:T103 Speed DailyTrigger FrqPrbCost_ER FT9001
 BGT001 ACEDemo.Unit1.Output TI-178 B352_W778 FT9001 DC.C2Z1.Pwr.Ripp FR5001
 PI-111 facility_output 02F104 CD:F161 02F104 CD:F161 FT9001 FT9001 FT9001 FT9001 FT9001
 FI-111 02T100 02F104 CD:F161 FT9001 FT9001 FT9001 FT9001 FT9001
 FIC-144 GE04_Status FI-111 02T100 FT9001 FT9001 FT9001 FT9001 FT9001
 02F100 fasttag 02:F101.C FT9001 FT9001 FT9001 FT9001 FT9001
 AQUA2-SI005.PV GE02_Energy FT9001 FT9001 FT9001 FT9001 FT9001
 0_ENG_MODE_STS TI-178 FT9001 FT9001 FT9001 FT9001 FT9001
 DC.Z1R 0_CMP_HDR_suc_asset1_output FT9001 FT9001 FT9001 FT9001 FT9001
 FI-111 Active Meters GE01_A_DT aso FT9001 FT9001 FT9001 FT9001 FT9001
 AF_NOISE PI-115 DY-101 02T100 FT9001 FT9001 FT9001 FT9001 FT9001
 DM-05:BW.R FT9001 FT9001 FT9001 FT9001 FT9001

Weather Conditions

Relative Humidity: 34%
 Current Temp: 85 F
 High: 92
 Low: 57 F
 Wind: 8 mph/N

DAILY PRODUCTION

Planned – 112.8 kbbl
 Forecast – 119 kbbl

ALERT!

Pump needs servicing in next 72 hours

Crude Furnace

Draft Pressure: -0.5 WC
 Stack Temp: 316 F
 Oxygen: 2.5%
 Outlet Temp: 840 F
 Cold Oil Velocity: 6 ft/sec

AVEVA™ PI System™ + AVEVA™ Predictive Analytics

Air Liquide

Air Liquide uses AVEVA for SIO Predict digital transformation program

Artificial Intelligence based predictive analytics for early warning notification and diagnosis of equipment and process problems



Total

Total uses AVEVA for centralized predictive asset health and performance monitoring of assets

Artificial Intelligence based predictive analytics for early warning notification and diagnosis of equipment and process problems



BASF

BASF uses AVEVA for digital transformation initiative

Artificial Intelligence based predictive analytics for early warning notification and diagnosis of equipment and process problems and augmented reality



International Paper

The Mill of the Future

Putting data governance to work

Streamline and improve performance, and accelerate sound and real-time decision making



Duke Energy

Duke Energy uses AVEVA for predictive fleet asset health and performance monitoring

Enabling \$100's millions saving

Early warning identification and diagnosis of equipment problems – improved reliability and performance



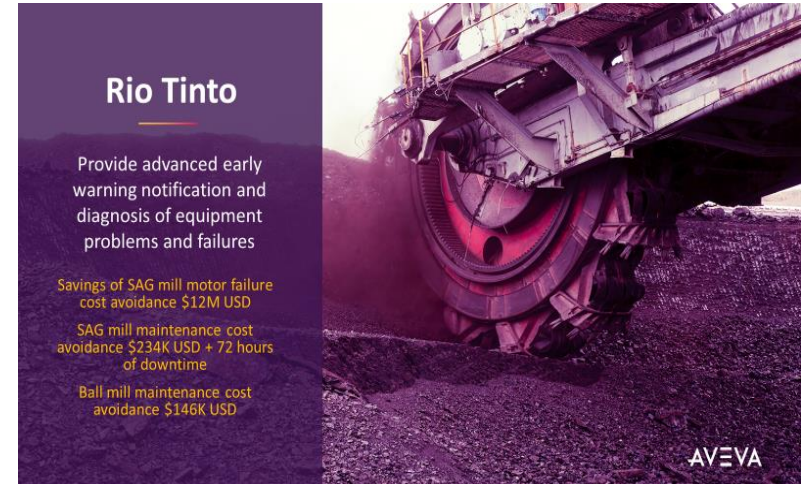
Rio Tinto

Provide advanced early warning notification and diagnosis of equipment problems and failures

Savings of SAG mill motor failure cost avoidance \$12M USD

SAG mill maintenance cost avoidance \$234K USD + 72 hours of downtime

Ball mill maintenance cost avoidance \$146K USD



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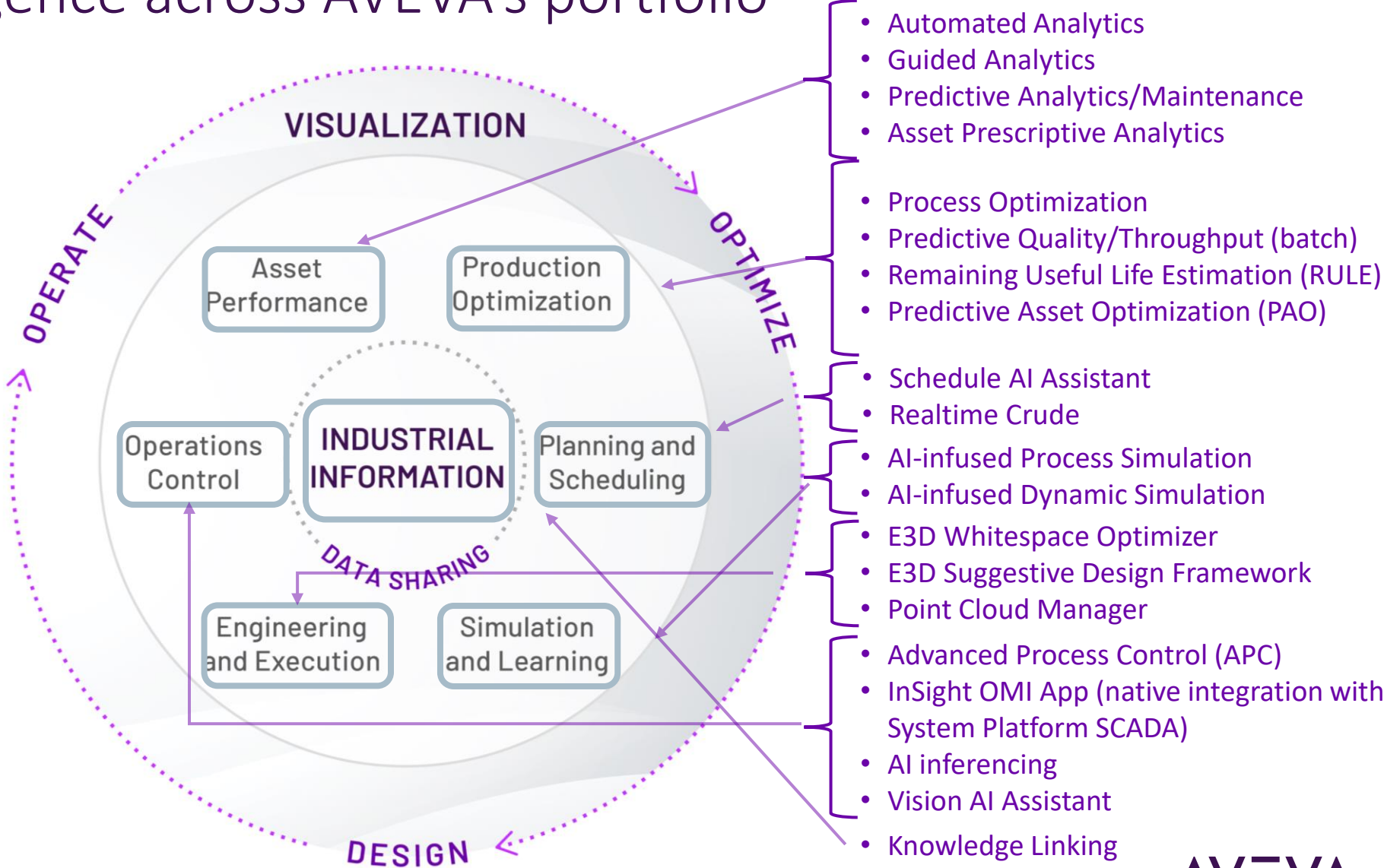
Next Steps in your Digital Journey – AI at AVEVA

AVEVA

Artificial intelligence across AVEVA's portfolio

Predictive
Performance
Prescriptive
Prognostic
Perceptive

17 commercially released AI products





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Questions?

Please wait for the microphone.
State your name and company.



Please remember to...

Navigate to this session in the mobile app to complete the survey.



Thank you!

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ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

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