

OCTOBER 25, 2023

Predictive Rotating Equipment Analytics (PROTEAN) X AVEVA™ Predictive Analytics

Ir Dr Harris Abd Rahman Sabri - Principal Engineer, PETRONAS Upstream

AVEVA



Ir Dr Harris Sabri

Principal Rotating Engineer

- Operational Excellence (OE), Development, PETRONAS Upstream
- harris_ars@petronas.com
- www.linkedin.com/in/irdrharrisarspmp

PROTEAN Increase PETRONAS Upstream Turbomachinery Unit Reliability by up to 4%

Challenge

- OEM Solution based subscription becoming uneconomically challenge in high OPEX environment
- Digital solution applied on selective critical equipment instead of masses
- The needs of digitalization is increasing, and centralization effort would benefit the company in long run

Solution

- Predictive Rotating Equipment Analytics (PROTEAN) developed by PETRONAS, is a digital solution that enables remote monitoring of rotating equipment anytime, anywhere. Developed with in-house algorithm, PROTEAN is proven highly effective in detecting anomalies in rotating equipment,.
- Utilizing PI AF and PI Vision, with AVEVA Predictive Analytics providing the multivariable analysis functions

Results

- Operational expenditure (OPEX) and unit maintenance cost (UMC) reduction
- Lower dependency on remote monitoring solutions subscription
- Higher unit reliability for rotating equipment (up to 4%)
- Capability building through digital retooling



PROTEAN Predictive Rotating Equipment Analytics

- **PROTEAN Anomalies Detection**

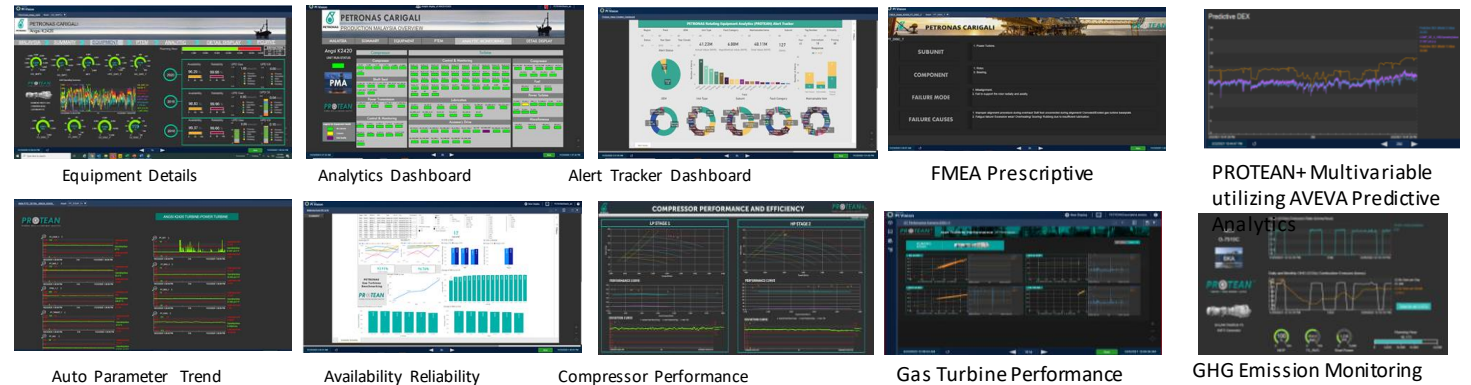
PROTEAN provides predictive alerts to user when the machine operates beyond its normal operating limit, indicating potential anomalies

- **PROTEAN+ Centrifugal Compressor Performance Benchmark**

Using digital twin of compressor performance, PROTEAN provides the expected performance of the compressor and indicates potential deterioration – not applicable for PECL

- **PROTEAN+ Gas Turbine Performance Benchmark**

Using data driven approach, PROTEAN provides the benchmark of gas turbine performance based on zero-hour unit



- **PROTEAN+ Multivariable***

PROTEAN provides the digital twin of the predicted value for critical equipment parameter and detects anomalies based on deviation between predicted and actual value under collaboration with AVEVA Predictive Analytics

- **PROTEAN+ FMEA Prescriptive Library**

PROTEAN provides automatic prescriptions of potential failures based on in-house technical library

- **PROTEAN+ Greenhouse Gas (GHG) Emission Monitoring**

PROTEAN monitors the equipment's green house gas emission based on real time performance – subjected to availability of required parameters

PROTEAN Aspiration and Journey Ahead



2017

PROTEAN Pilot @ Angsi
12 Alerts
1st Pilot under collaboration with PMA



2018

55 Trains =147 Alerts
- Move to PDCC
- Collaboration with UTP and Texas A & M University



2019

129 Trains =274 Alerts
- PFLNG1 selected PROTEAN
- IET Industry Award



2020

200 Trains =502 Alerts
- PFLNG2 selected PROTEAN
- Successfully replace all OEM Remote Monitoring Solutions for Upstream



Million for Yearly OPEX on Remote Monitoring under OEM

2021

255 Units =744 Alerts
- PROTEAN Mobile Apps
- ATPS 2021 - TRL#7
- PETRONAS IP
- IEM Industry Award



2022

~300 Units =1000 Alerts
- MLNG selected PROTEAN
- Commercialization - ATPS 2022
- PROTEAN+ GHG Emission
- Expansion to Indonesia and Canada



2023 Onwards

Agile Solution
PROTEAN supporting MFT 50.30.0

50% Improvement on Operation Cashflow
Cost Avoidance via PROTEAN Predictive Alerts

Collaboration with AVEVA Predictive Analytics

GHG emission 2024
MA COB tCO₂e
PROTEAN GHG Emission monitoring and collaboration with CMD



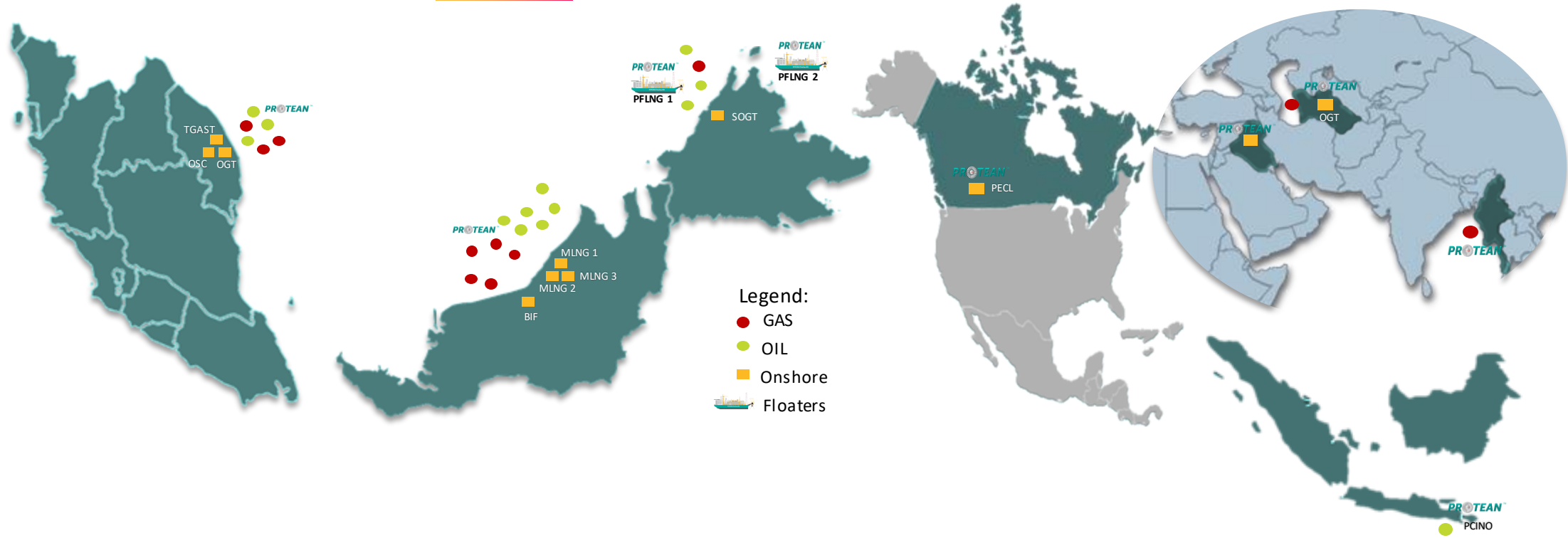
Protean Coverage And Equipment Population

550
Total Equipment

>225k
Total daily analysis

>200k
Monitored tag

1300
Total PROTEAN alerts




121 
Gas Turbine

62 
Generator

87 
Electric Motor

10 
Steam Turbine

132 
Compressor

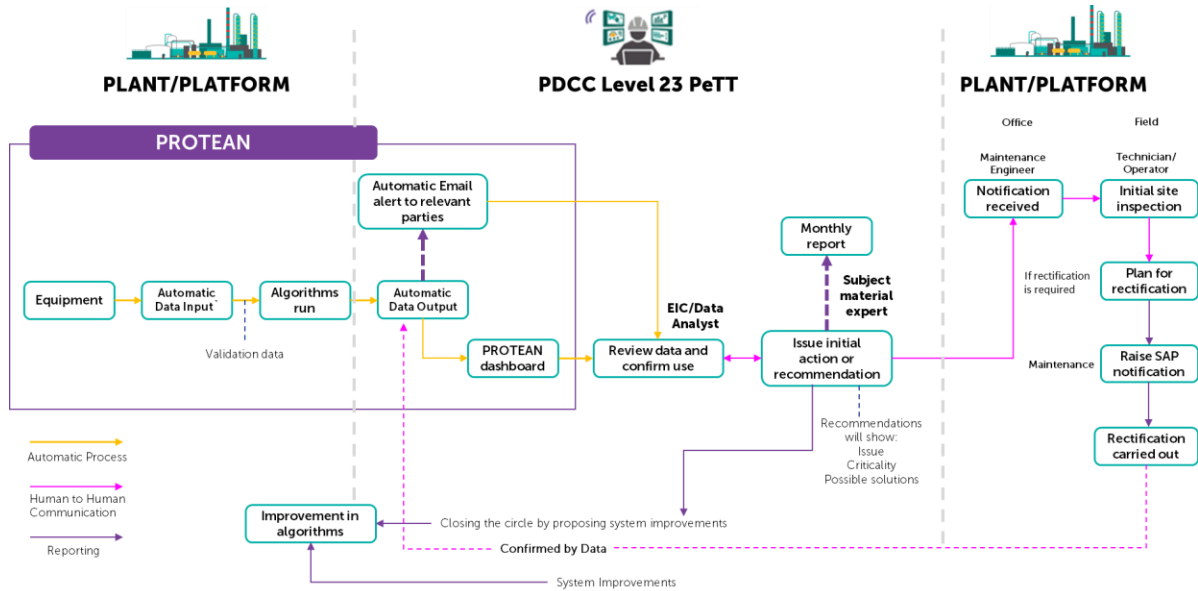
99 
Pump

16 
Turbo Expander

20 
ICE

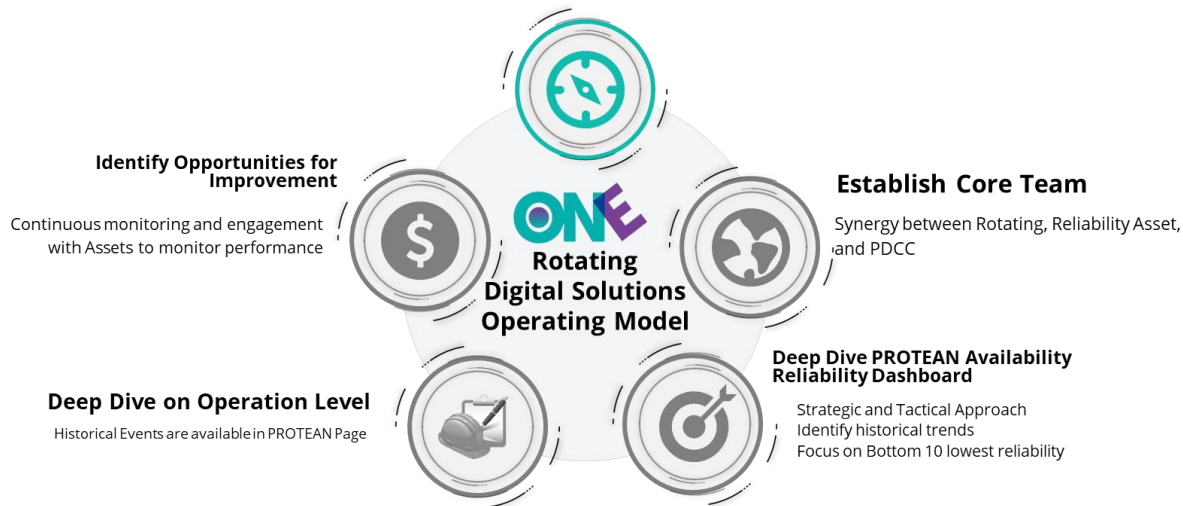
PROTEAN cover PMA | SKA | SBA | IA | PFLNG1& 2 | MLNG 1,2,3 total of 550 numbers of major rotating equipment with total asset value of more than USD500 Mill

PROTEAN Operationalization and Centralization Effort to make the tool sustainable



Establish One Monthly Forum with Assets Stakeholders

Point of discussions; Rotating Bad actors, UPDs



Implementation selection criteria and consideration



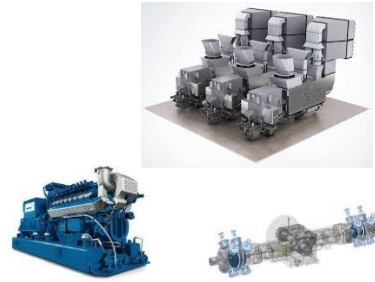
Asset Grading



Equipment Criticality



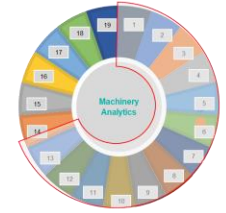
Historical Failure



Equipment Function



Data Connectivity / Readiness



Solution Features

Commercial Investment

CAPEX

OPEX

ROI

Operating Mode

Asset Based Monitoring Centre

Centralized Monitoring Centre

Capability Building

Internal

Hybrid

External / Outsource

PROTEAN has surpassed

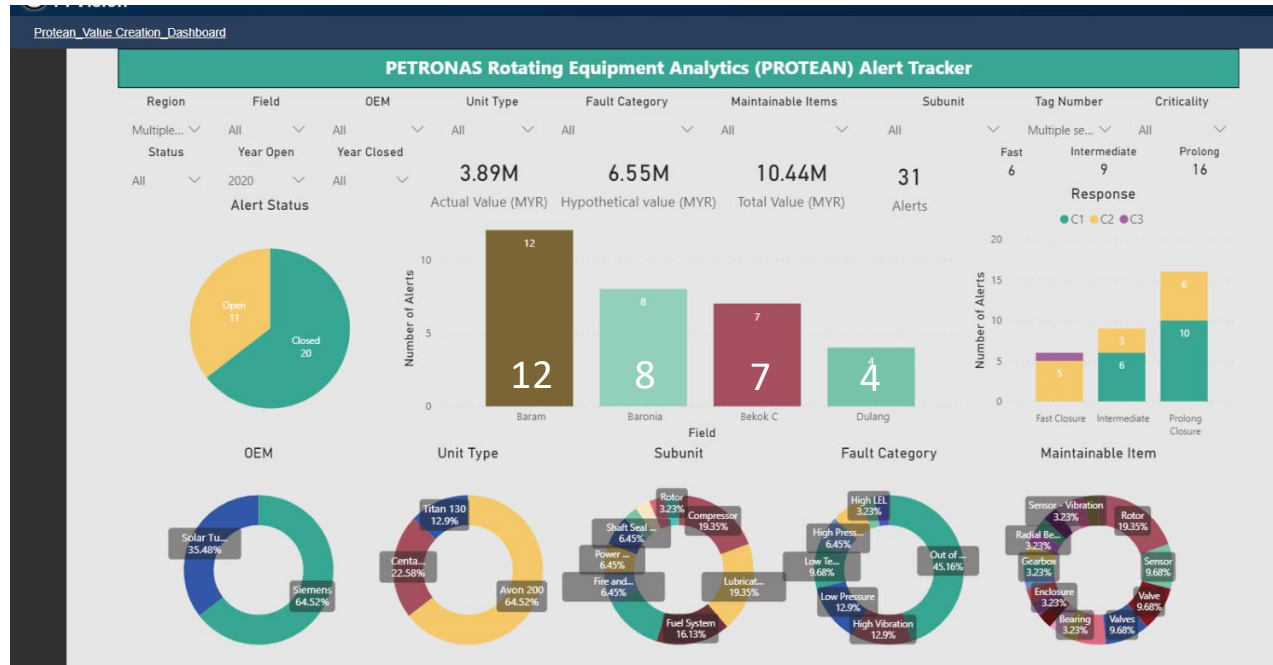
13000

Predictive Alerts

On 29th September 2023



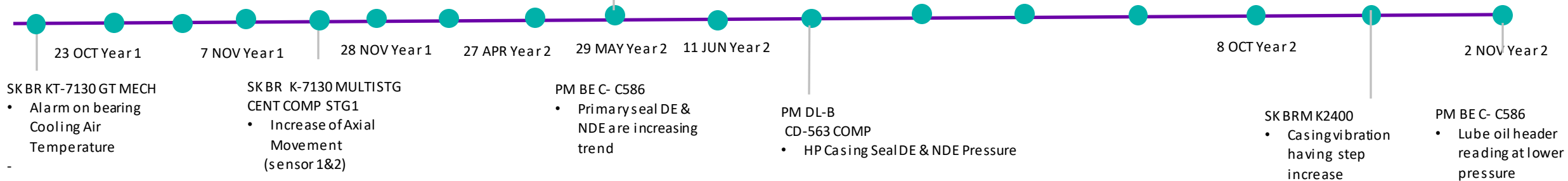
Track record of PROTEAN X AVEVA Predictive Analytics Detection



2 Years Side by Side Monitoring for 4 PETRONAS Upstream Machines (BeC C586, DL CD563, BRM K2400 and BR K7130)

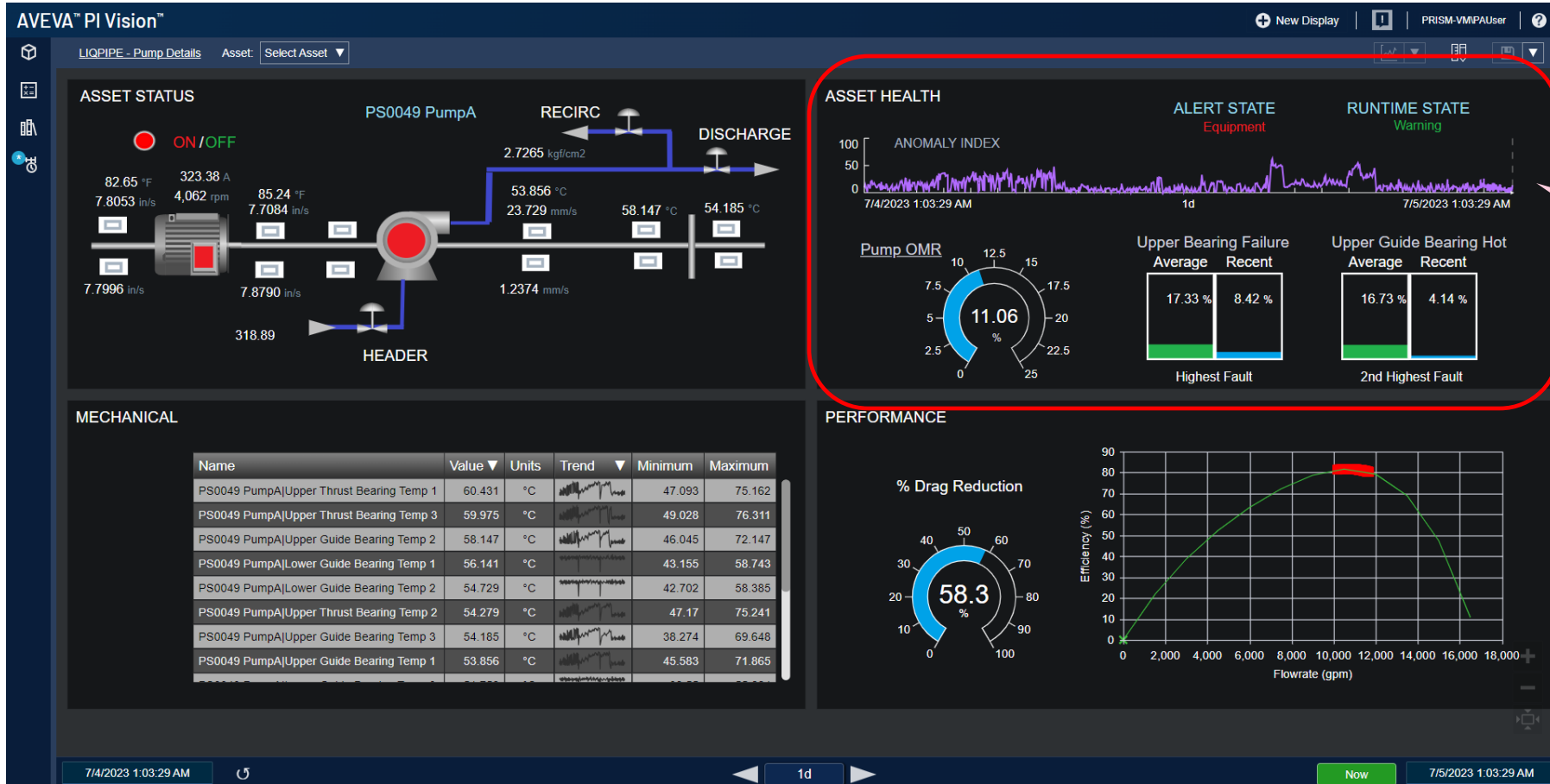
31 Genuine Alerts

6 Cases



AVEVA Predictive Analytics for PROTEAN moving forward

Adding critical insights to improve the safety, reliability, and sustainability of your operation



Results from AVEVA Predictive Analytics

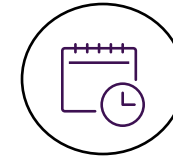


Forecast results

AVEVA Predictive Analytics for PROTEAN

Predicting Asset Failures Before They Occur

- **Leveraging and utilizing AI and machine learning to detect asset performance anomalies** ahead of potential failures, **without any coding.**
- **Visualizes sensor data** from rotating equipment and correlates it with predictions from **AVEVA Predictive Analytics.**
- Provides **monitoring, analysis, and predictive/prescriptive analytics** that enhances **diagnostic efficiency** while providing **better decision support.**



Reduce
Downtime



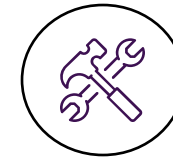
Prevent Asset
Failures



Reduce
Maintenance
Costs



Improve
Safety



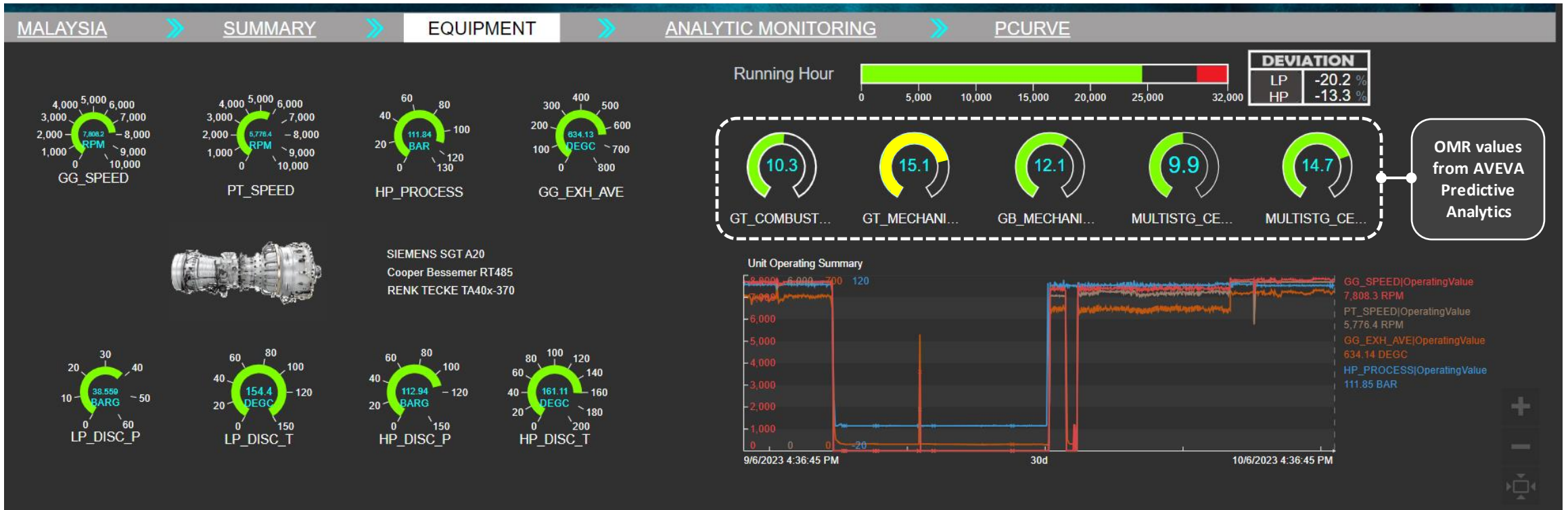
Extend
Equipment Life



Optimize
Maintenance
Planning

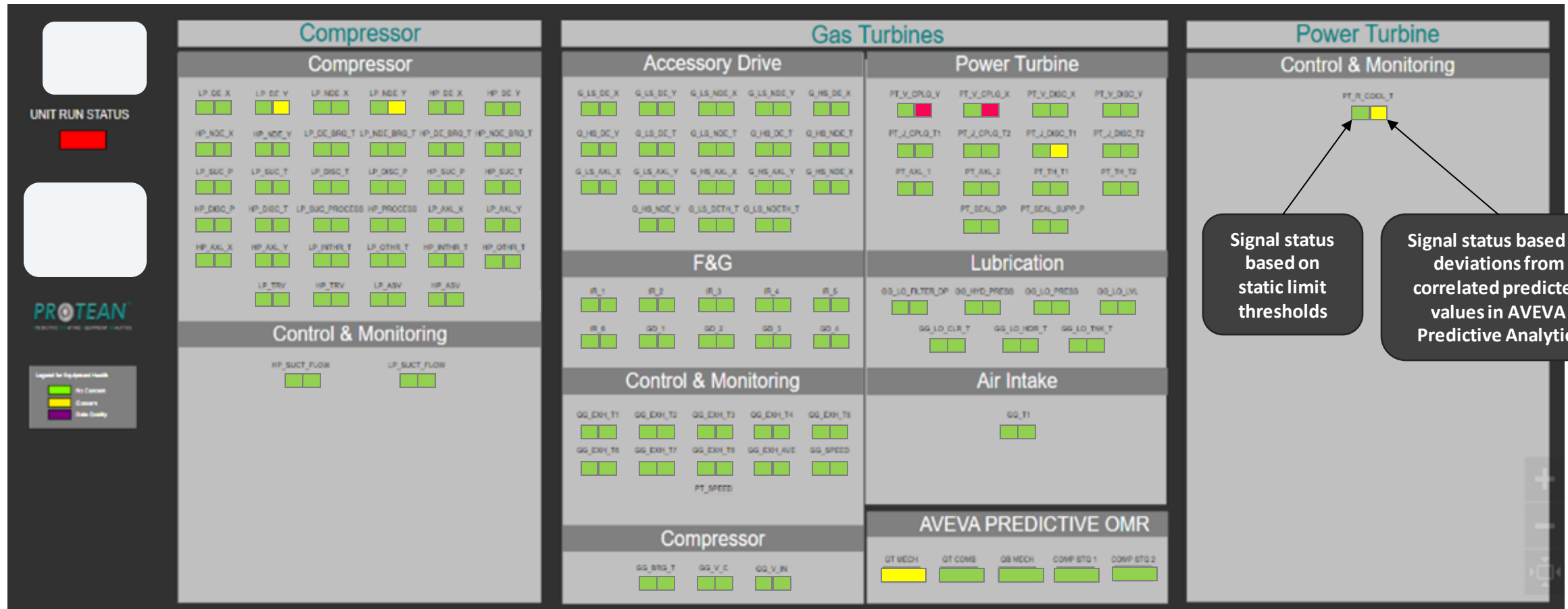
AVEVA Predictive Analytics for PROTEAN

Utilizing AI and machine learning to detect asset performance anomalies ahead of potential failures, **without any coding.**



AVEVA Predictive Analytics for PROTEAN

Visualizes sensor data from rotating equipment and correlates it with results from AVEVA Predictive Analytics.



AVEVA Predictive Analytics for PROTEAN

Provides monitoring, analysis, and predictive/prescriptive analytics that enhances diagnostic efficiency while providing better decision support.



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!

This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

The Company shall not be obliged to disclose any revision to these forward-looking statements to reflect events or circumstances occurring after the date on which they are made or to reflect the occurrence of future events.

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

 [@avevagroup](https://twitter.com/avevagroup)

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.

Learn more at www.aveva.com