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Maintaining Indonesia's National Energy Security with AVEVA™ PI System™ and AVEVA™ Predictive Analytics

PERTAMINA – Indonesia National Energy Company (NEC)

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PERTAMINA at Glance

Vision and Mission

Vision

To Be a World-Class National Energy Company

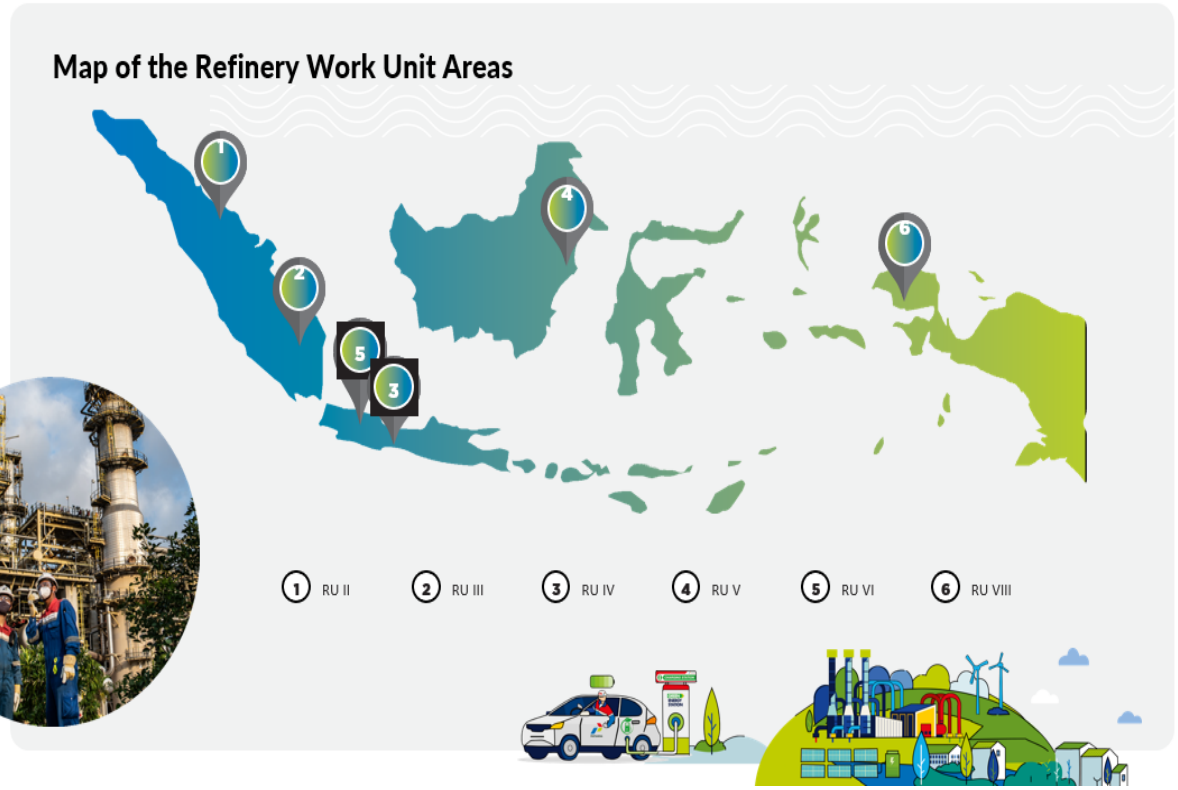
Mission

To Carry Out Integrated Core Business in Oil, Gas, New and Renewable Energy based on Strong Commercial Principles

Pertamina as the National Energy Company and one of the largest State-Owned Enterprises in Indonesia has developed **an integrated business network** that covers a range of services, from the upstream to downstream.

On 12 June 2020, **6 (six) Sub Holdings were established under Pertamina**, i.e., Subholding Upstream (SHU), Subholding Gas (Gas), Refinery and Petrochemical (R&P), New & Renewable Energy (NRE), Commercial and Trading (C&T), as well as Integrated Marine Logistics (IML).

PT Kilang Pertamina Internasional



PERTAMINA conducts business activities in refinery operations and development under Refining and Petrochemical Sub-Holding.

PT Kilang Pertamina Internasional (KPI) was appointed as the management of Refining & Petrochemical. As a Sub-Holding company, PT KPI is responsible for the investment and PERTAMINA business ventures related to the refining business, processing, and petrochemical refinery megaprojects.

PERTAMINA has **Six Refinery Units (RU)**, with a total capacity of **1,058 MBOPD :**

1. **RU-II Dumai**
2. **RU-III Plaju**
3. **RU-IV Cilacap**
4. **RU-V Balikpapan**
5. **RU-VI Balongan**
6. **RU- VII Kasim**

• Oil & Gas, Indonesia

The Journey Implementing Predictive Analytics Solution in 5 Refineries of PERTAMINA

CHALLENGES

- Managing Six Refinery Units across Different Islands and Time Zones with **Limited Connectivity and Varied Historian Systems**
- **Data Fragmentation** due to Refineries Operating in Different Locations and Time Zones
- **Addressing Data Format** and Communication Protocol Differences across Refineries' Historian Systems
- **Limited Internal Expertise** in Developing Predictive Analytics Tools
- Overcoming **Resistance to Adopting New Technology** for Existing Processes
- **Safeguarding Against** Cybersecurity Threats

SOLUTION

AVEVA PI System

- Standardizing Connections via PI OPC Data Access
- Utilizing PI Data Archive for a Unified Historical Data Platform
- Structuring Critical Equipment Data with PI Asset Framework

AVEVA Predictive Analytics

- Generating Robust Predictive Analytics for Asset Maintenance
- Real-time Monitoring Dashboard for Enhanced Oversight

Cybersecurity Measures

- Employing Operational Technology (AVEVA PI System & Predictive Analytics) as an Alternative to Internet of Things Technology

BENEFIT

Real-time Monitoring
of Approximately 90 Critical Assets across Five Major Refinery Units via Predictive Analytics

Notable Cost Savings
$2 million (2020), **$3** million (2021), and **$6** million (2022) from Mitigated Production Losses owing to Unplanned Shutdowns

Potential Annual Reduction
of Maintenance Costs by **15%**

Elevated Company Reputation through Deployment of a Leading-Edge Solution, with Emphasis on Cybersecurity Implementation

From 2012 to 2019, RU 6 Balongan Experienced Numerous Unplanned Shutdowns Caused by 10 Main Equipments

The three out of ten

MAB & WGC ARE CRITICAL EQUIPMENT IN RESIDUAL CATLYTIC CRACKER (RCC) UNIT

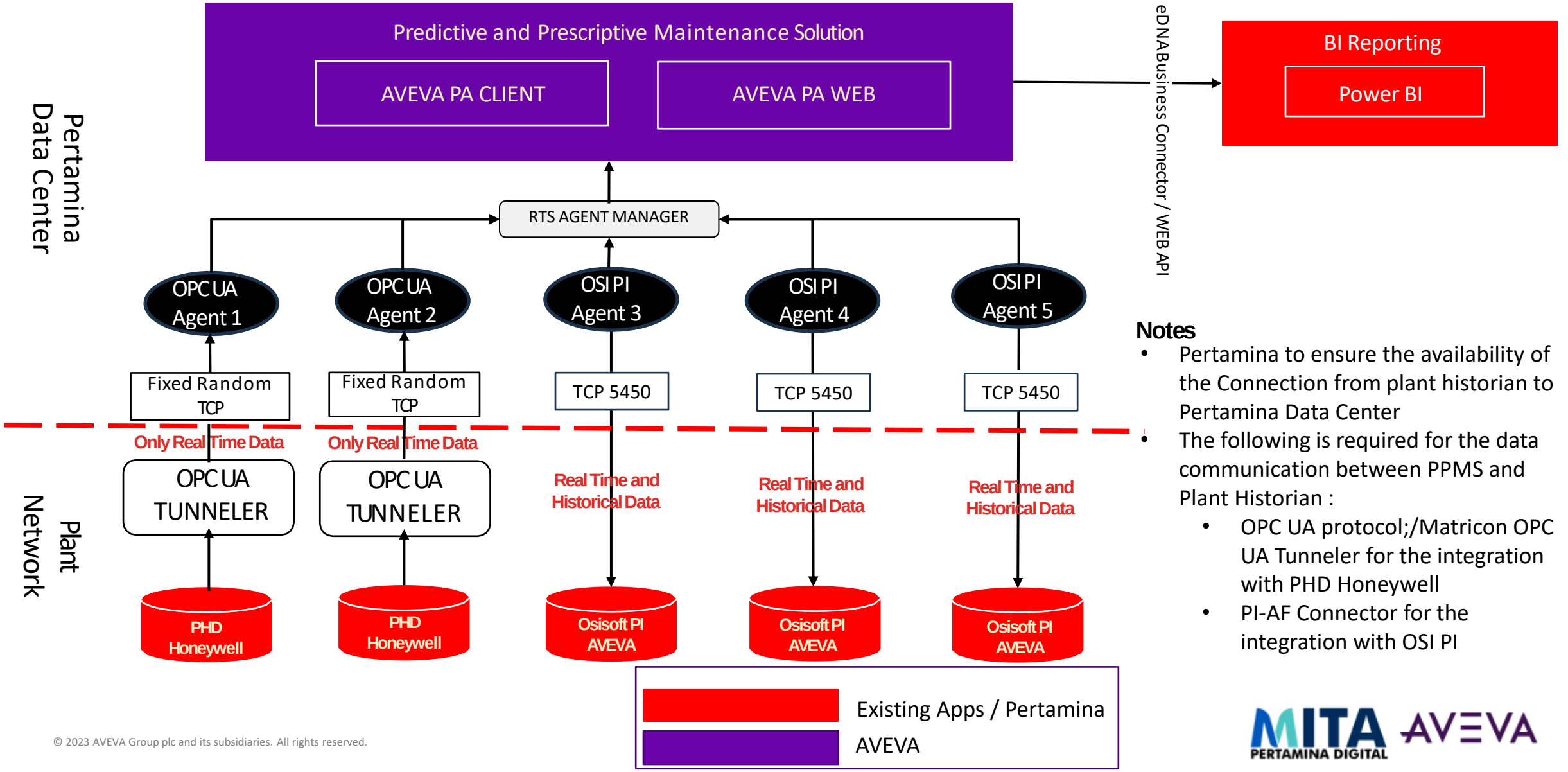
- Main Air Blower (MAB) (15-K-101)
  Experienced **4** endogenous failures in the range 2013 to 2018

RGC IS CRITICAL EQUIPMENT IN PLATFORMER (PLT) UNIT

- Wet Gas Compressor (WGC) (16-K-101)
  Experienced **3** endogenous failures in the range 2013 to 2018

- Recycle Gas Compressor (RGC) (32-K-101)
  Experienced **2** endogenous failures in the range 2012 to 2019

Solution Architecture

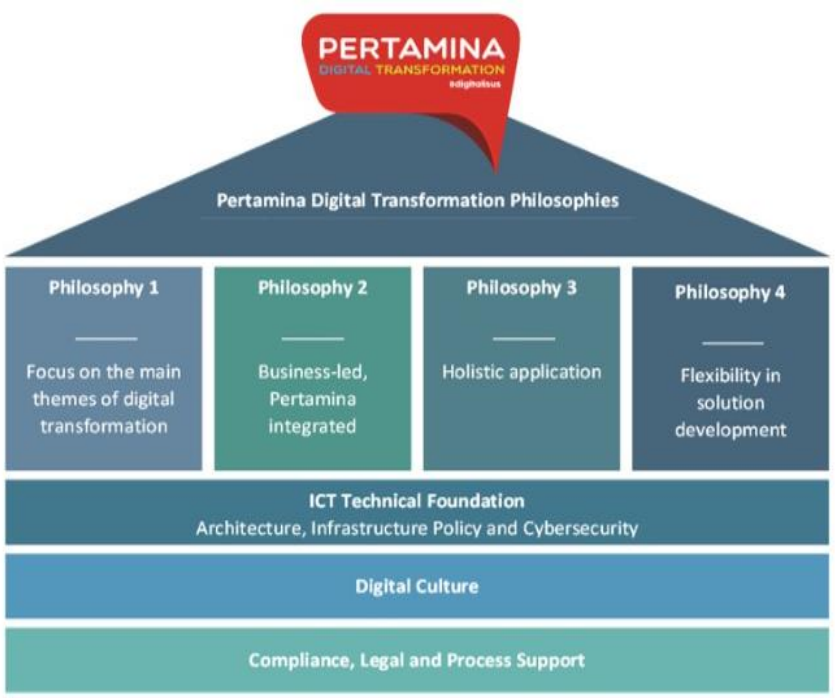


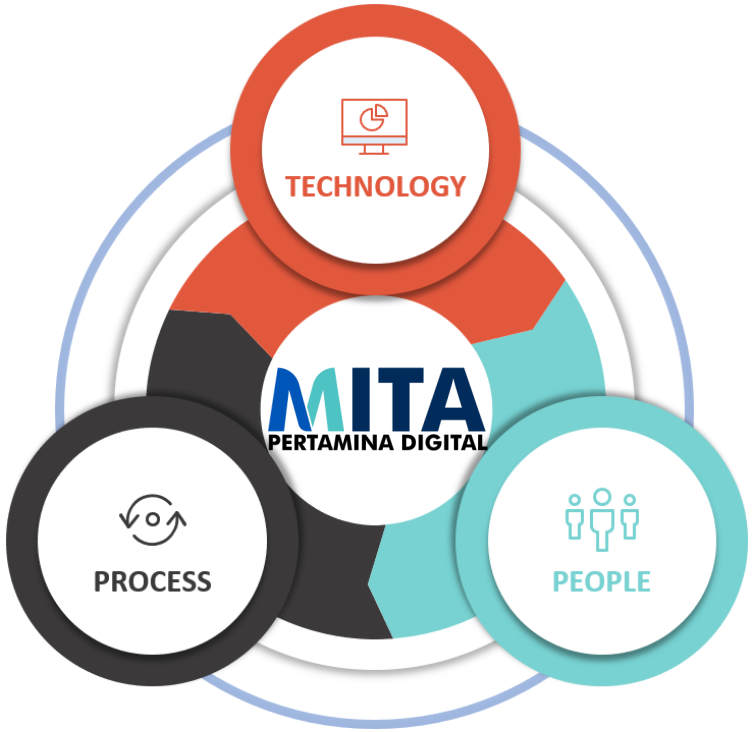
Notes

- Pertamina to ensure the availability of the Connection from plant historian to Pertamina Data Center
- The following is required for the data communication between PPMS and Plant Historian :
  - OPC UA protocol;/Matricon OPC UA Tunneler for the integration with PHD Honeywell
  - PI-AF Connector for the integration with OSI PI

Implementation Details (Solution)

PERTAMINA Digital Transformation & It's Holistic Approach





PROCESS (Business)

- Top Equipment Prioritized
- Revise Maintenance Procedure
- Roadmap to Scale-up Implementation

TECHNOLOGY

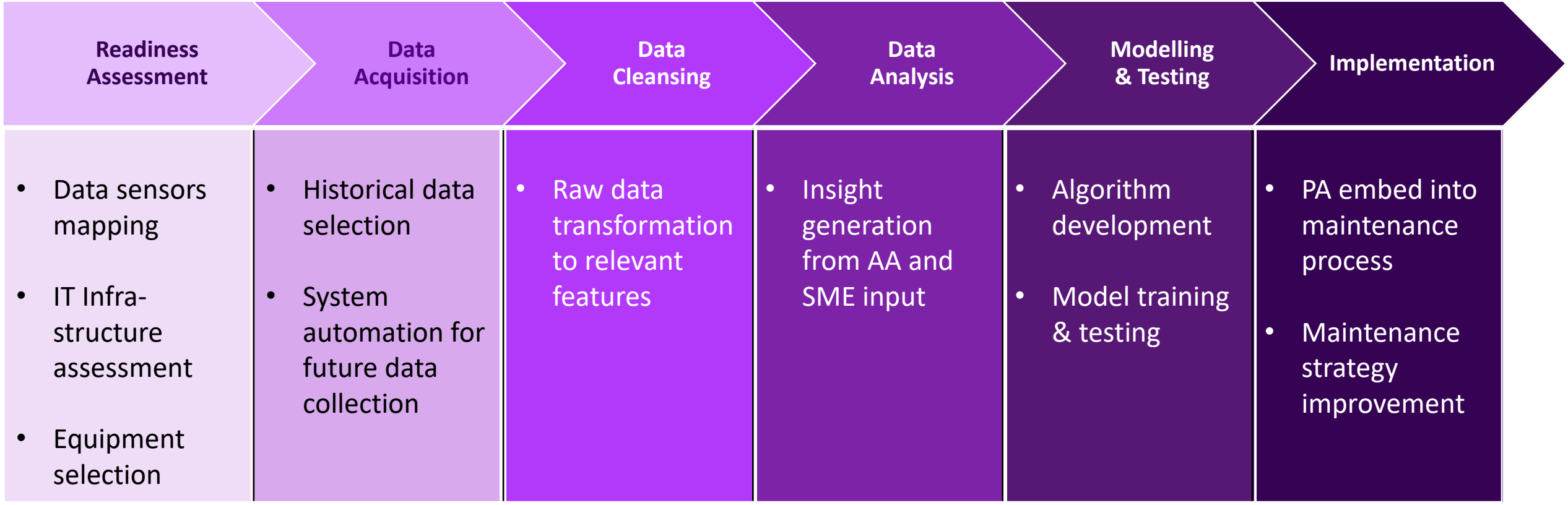
- Best-In-Class P Solution
- Reliable IT Infrastructure
- Integrated Solution

PEOPLE (Organization)

- Change Management
- Personnel Improvement
- Design Thinking

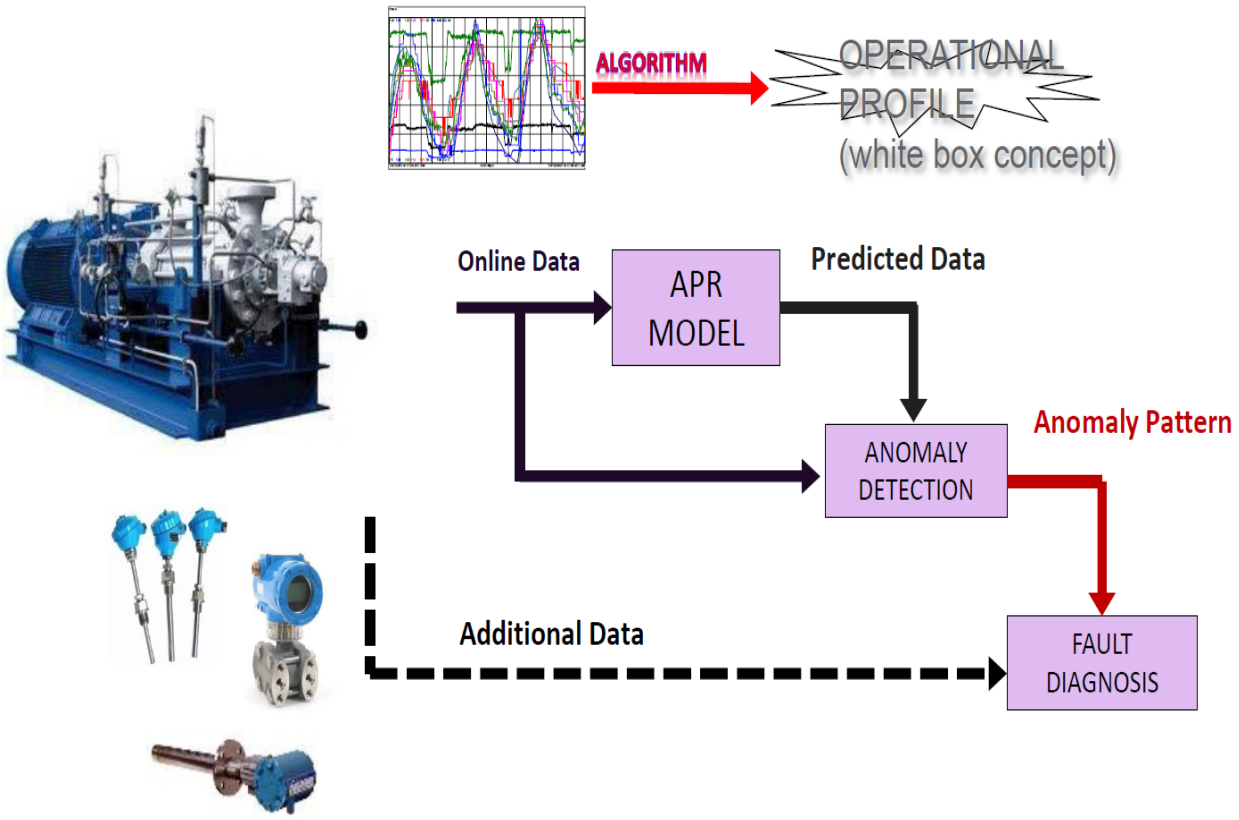
Implementation Details (Solution):

End to end Predictive Maintenance Development & Implementation

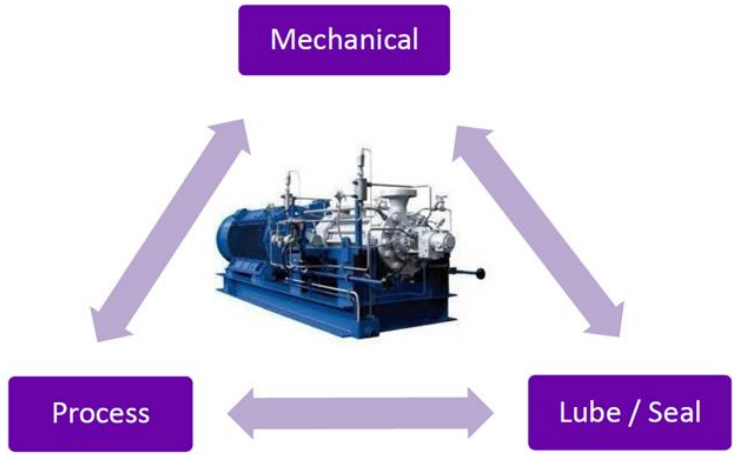


Implementation Details (Solution)

Technical Working Principle



Specific, but holistic model approach



- Dedicated models to monitor different performance areas
- Minimize noises and confusions
- Best approach to keep high model accuracy

Implementation Details (Solution)

32-K-101(Recycle Gas Compressor)

Model Parameters:

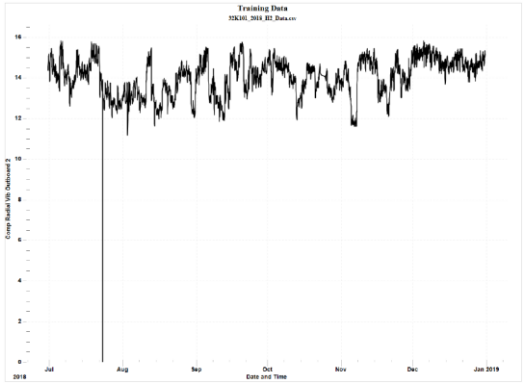
32-FI-006A	Comp Gas Flow
32-FI-006B	Comp Gas Flow
32-FI-006C	Comp Gas Flow
32-VXE201	Comp Radial Vib Outboard 1
32-VYE201	Comp Radial Vib Outboard 2
32-ZE-201	Comp Axial Disp

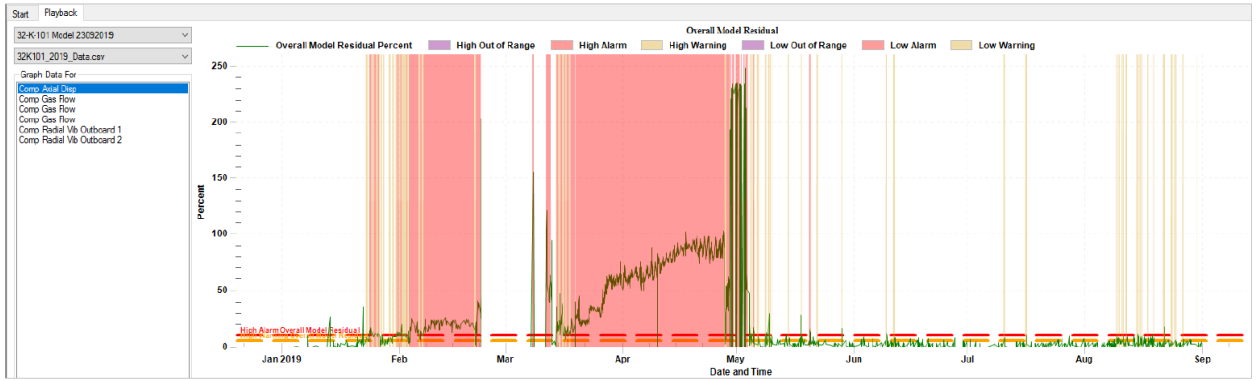
Model Objective:
Monitor compressor mechanical performance, issue early warning to users about potential problems that causes machine mechanical performance deviations.

Training dataset:
1st Jan -2018 ~ 31st Dec 2018

Validation dataset:
1st Jan 2019 ~ 31st Aug 2019

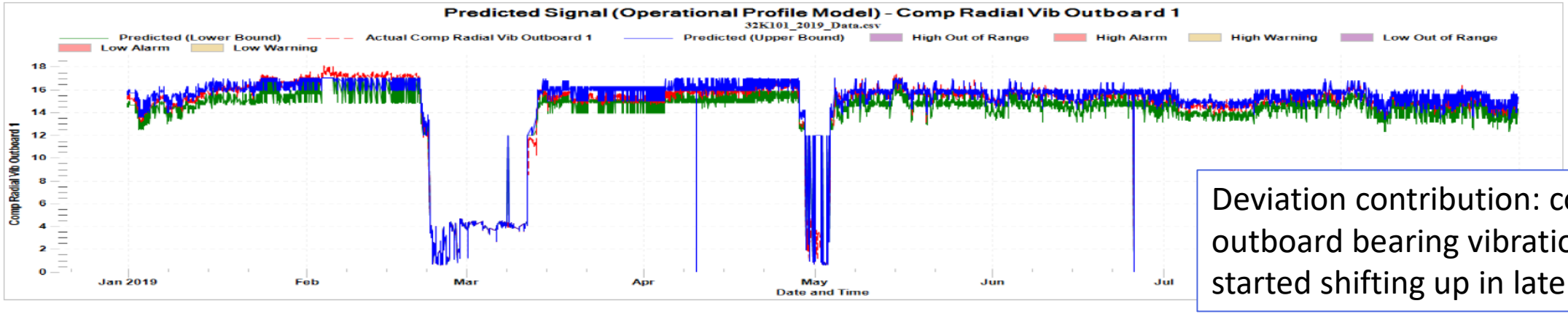
Training Data & Result



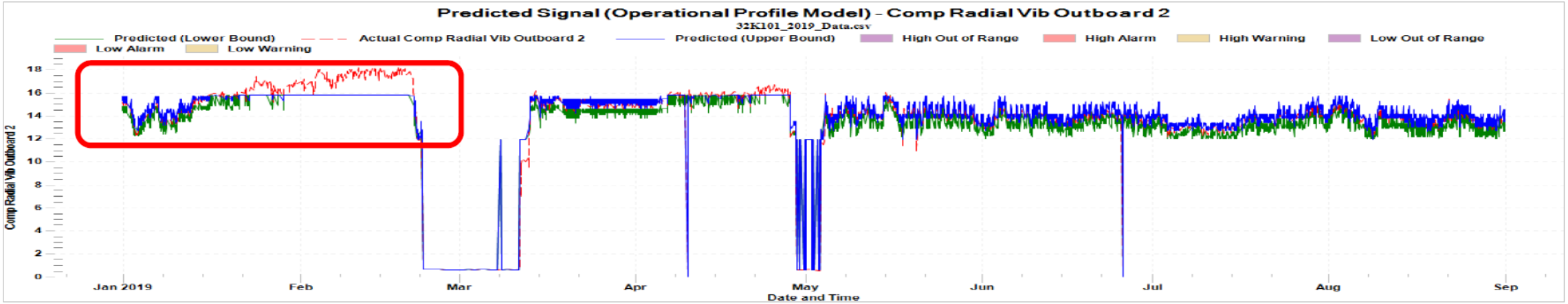


Implementation Details (Solution)

32-K-101(Recycle Gas Compressor) Model Result

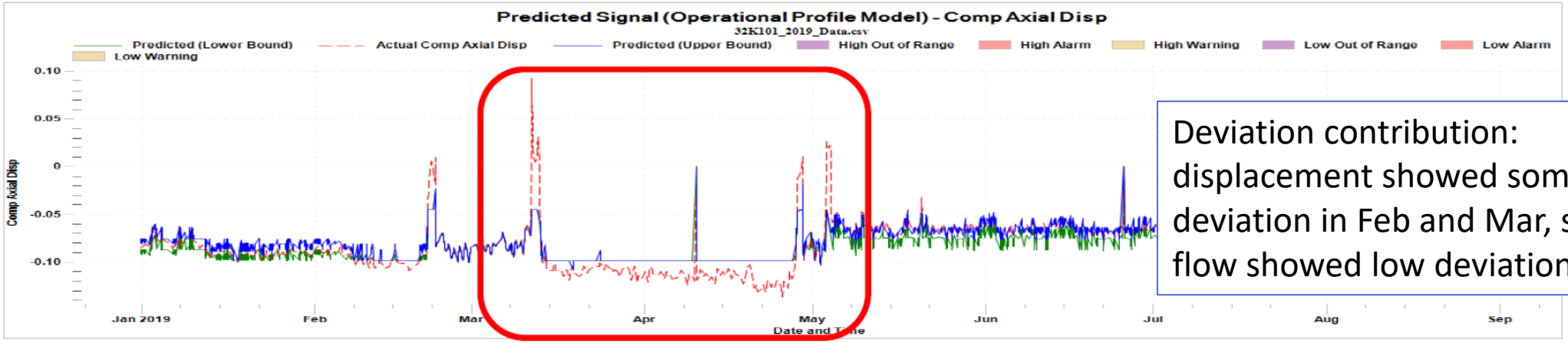


Deviation contribution: compressor outboard bearing vibration sensors started shifting up in late Jan

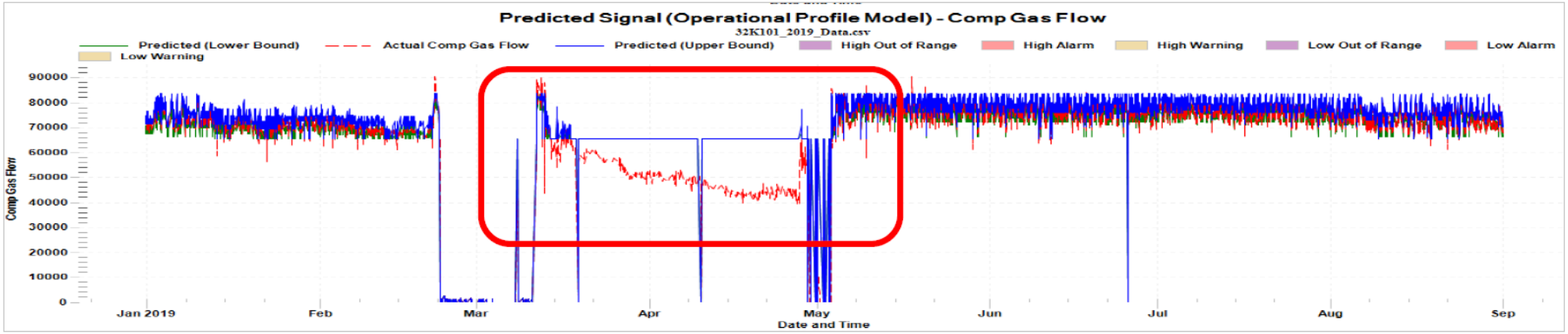


Implementation Details (Solution)

32-K-101(Recycle Gas Compressor) Model Result

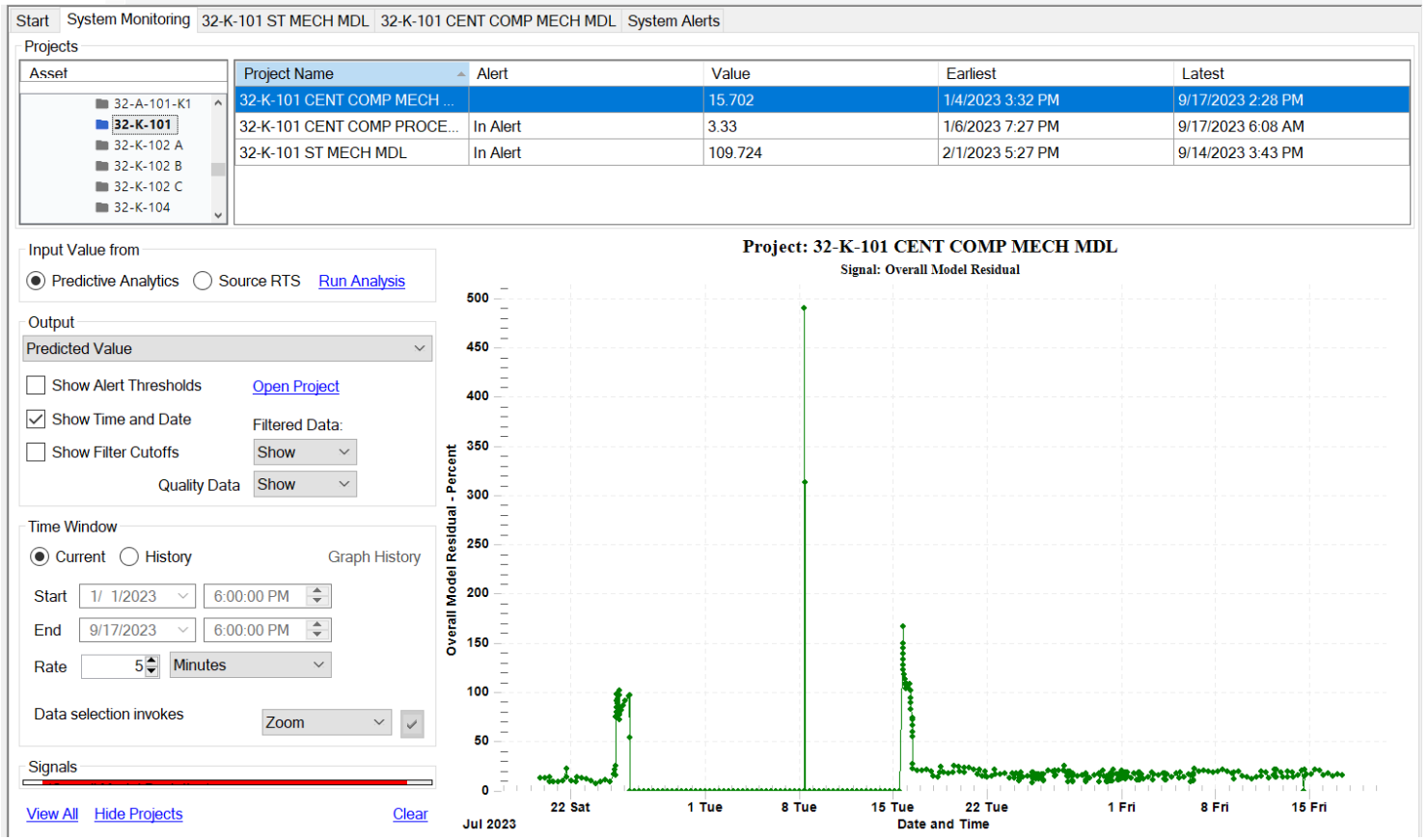


Deviation contribution: displacement showed some minor deviation in Feb and Mar, suction flow showed low deviation in Mar



Implementation Details (Solution)

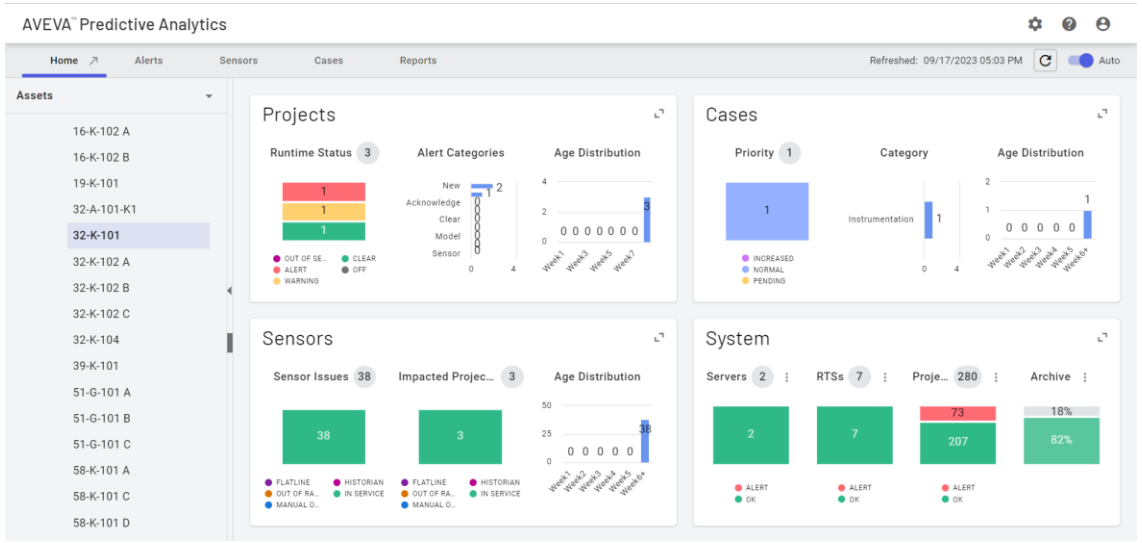
AVEVA PA System Monitoring

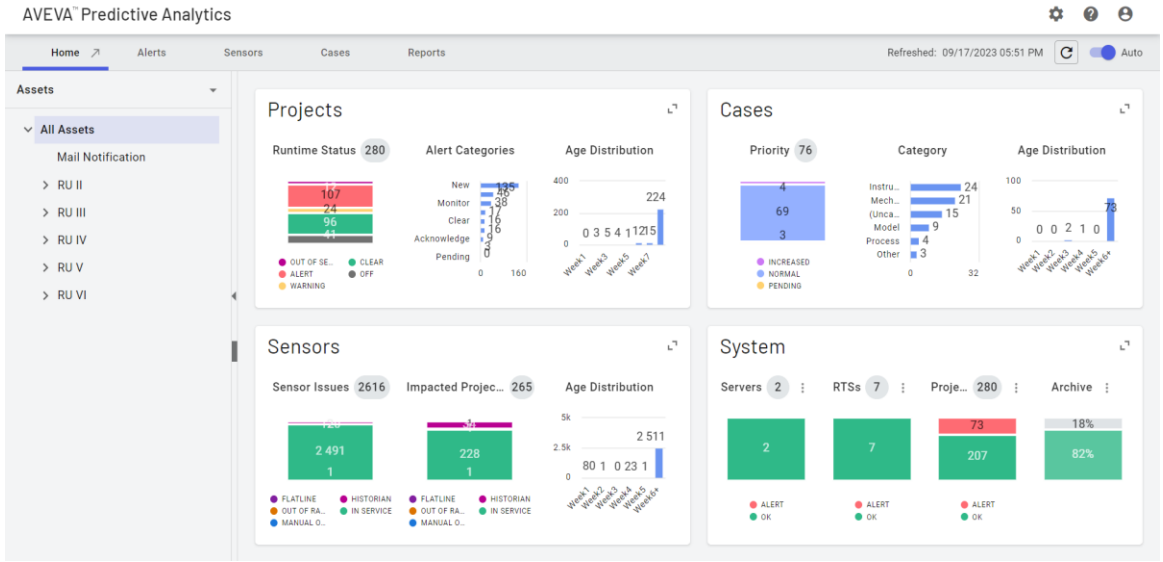


- **Hybrid GUI** with asset selection, parameters and graphical PA trends
- **Integration with AVEVA PI** infrastructure read data sensors every 5 mins
- **Configurable time window** to check data history and run PA

Implementation Details (Solution)

AVEVA PA Web Application



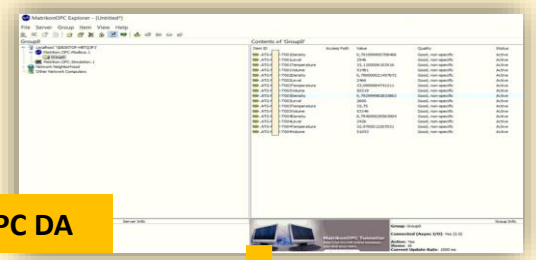


- **User friendly GUI** help personnel to monitor specific
- Personnel can **monitor** current alert and active cases
- **Integrated with AVEVA PI** Infrastructure to monitor sensor connection

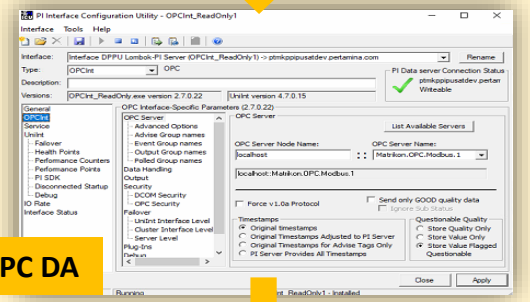
- Personnel can monitor more 90 assets in 5 Refinery Units, with active cases
- Integrated with AVEVA PI Infrastructure to monitor sensor health and connection

Benefit on Innovation Result

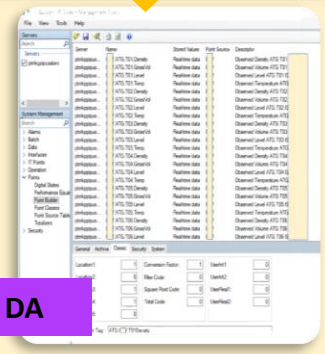
Data Source



OPC DA

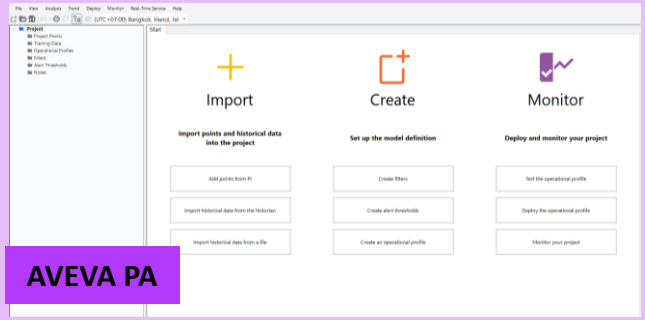


PI OPC DA

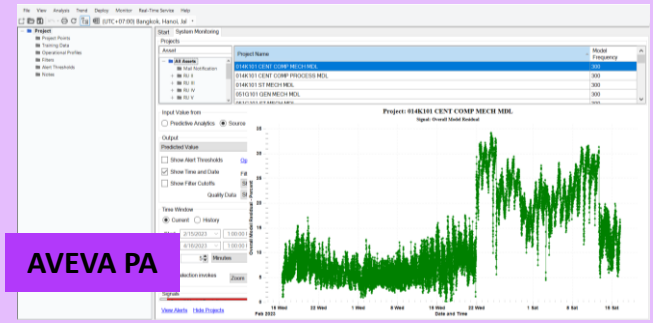


PI DA

Data Analytics

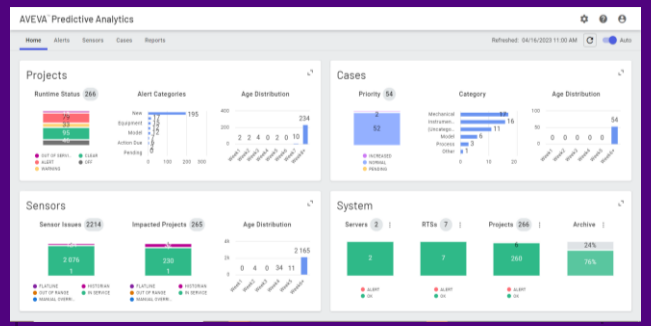


AVEVA PA

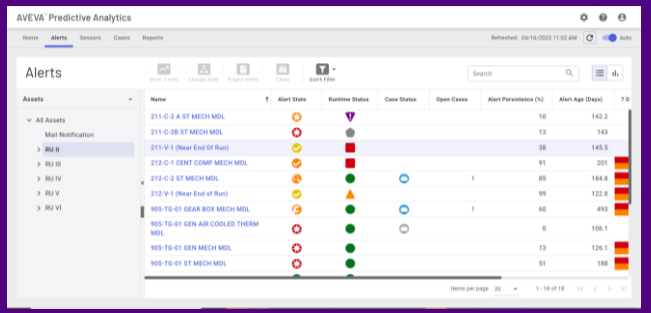


AVEVA PA

Data Visualization



DASHBOARD SUMMARY



Benefits on Cost of Avoidance

1

Jan 2022

AVEVA PA help Pertamina to avoid surging due to high air temperature discharge on a critical assets with cost of avoidance **$0.3 Million**

2

Feb 2022

AVEVA PA send an alert to repair journal bearing and winding temperature motor on three critical assets with cost of avoidance **$1.1 Million**

3

Feb 2022

AVEVA PA help Pertamina to avoid catastrophic failure due to high vibration and temperature on two critical assets with cost of avoidance **$1.3 Million**

4

Mei 2022

AVEVA PA help Pertamina to avoid catastrophic failure due to malfunction of bearing temperature sensor on a critical asset with cost of avoidance **$0.65 Million**

5

Jun 2022

AVEVA PA help Pertamina to avoid catastrophic failure due to spike vibration on a compressor with cost of avoidance **$3.2 Million**

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“You are more beautiful than you think.”

Thank You

MITA PERTAMINA DIGITAL AVEVA