FLUKE®
Reliability

THE EVOLVING LANDSCAPE OF VIBRATION ANALYSIS

Webinar 2025

Meet the Speaker

Jeff Langford

Analysis and CM Manager

- Oversee Day to Day Operations of Analysts Team
- Support Remote Vibration Services
- Support Automated Analytics

Background:

- 25 years in Predictive Maintenance
- ISO Cat III Vibration Analyst

Joined Azima in 2008:

- Field Technician
- Data Collection
- Analysis
- Balancing
- Alignment
- Infrared Surveys
- Promoted to Manager 2019

Azima DLI Service History & Milestones

1966 — Founded

1976 — Aircraft Carrier Contract

1980 — 1st Triaxial Accelerometer

1986

1990 — ExpertALERT™ — First Expert Automated Software

1995 — Online Diagnostic System

2000 — Azima DLI is formed

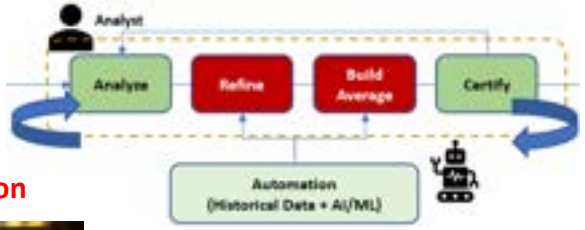
2005

2012 — TRIO® Windows Based Data Collector — WATCHMAN Reliability Portal™

2015 — Cloud-enabled complete PdM Program Solution

2017 — Strategic Business Level Metrics

2019 — First Commercial Report Automation



2023 — 2021 Treon Sensor — > 1,000,000 Annual Report Delivery

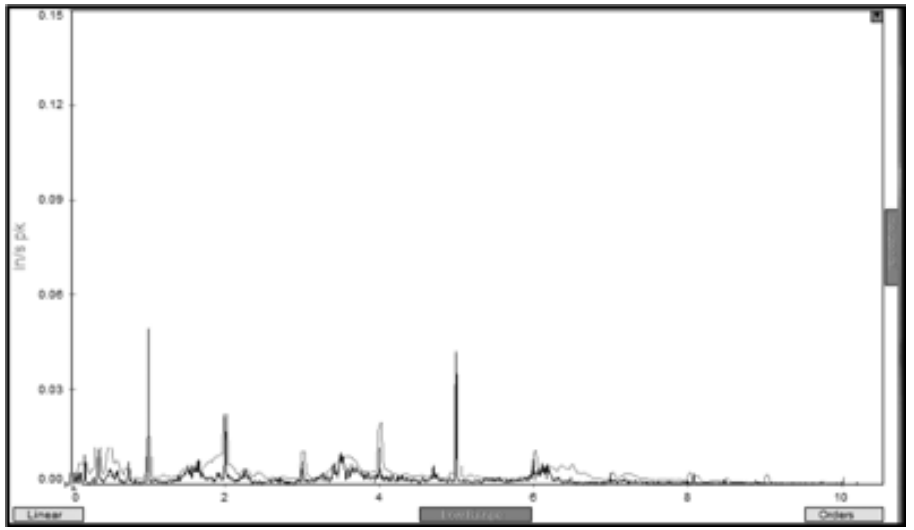
Historical Process

- **Prior to 2010 - Service Approach by Azima**
- Technicians traveled to customer sites.
- Vibration data was collected on a monthly basis; tradition walk around programs.
- Analysis and reporting were performed manually with a 1:1 ratio of data collection to analysis time.

- **After 2010 - Transition to Remote Analysis (Watchman Services)**
- Previously developed with the U.S. Navy and other clients.
- Eliminated the need for travel by enabling site personnel to collect data.
- Data was transferred via a secure portal using predefined routes.
- Utilized replication-based data transfer.
- Integrated *ExpertAlert* software for automated, rules-based data screening.

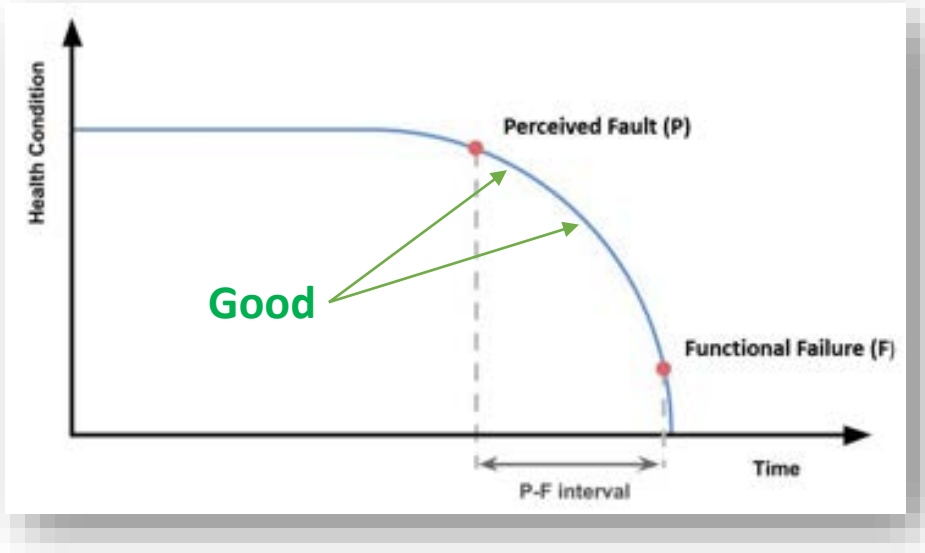
Historical Process

Diagnostic-Targeted Approach



Full Manual Analysis (All Vibration Data)

- High value - Low volume
- Good Analyst = Good Assessment
- Substantial Resource Constraints
  - ~25 Machines reviewed per-day/Analyst
  - Data collection is additional time

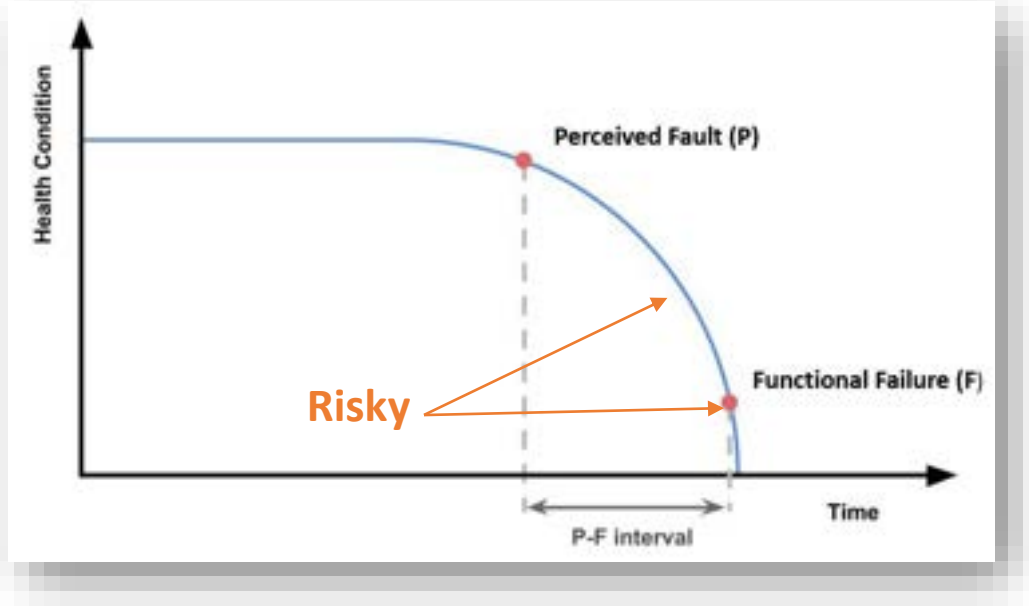


Historical Process

Alarming Approach

Overall Vibration Alarm

- Low Value - High Volume
- Not Diagnostic
  - No Actionable Results
  - Hand Raiser
- Often Late-stage/Reactive



Wireless Sensor Technology

Not all wireless sensors are created equal

- Some collect diagnostic data such as time waveform and spectrum along with other trendable parameters such as temperature
- Others only take overall values and simply act as “hand raisers” with no diagnostic recommendations

Evolution of Technology ≠ Evolution Analysis

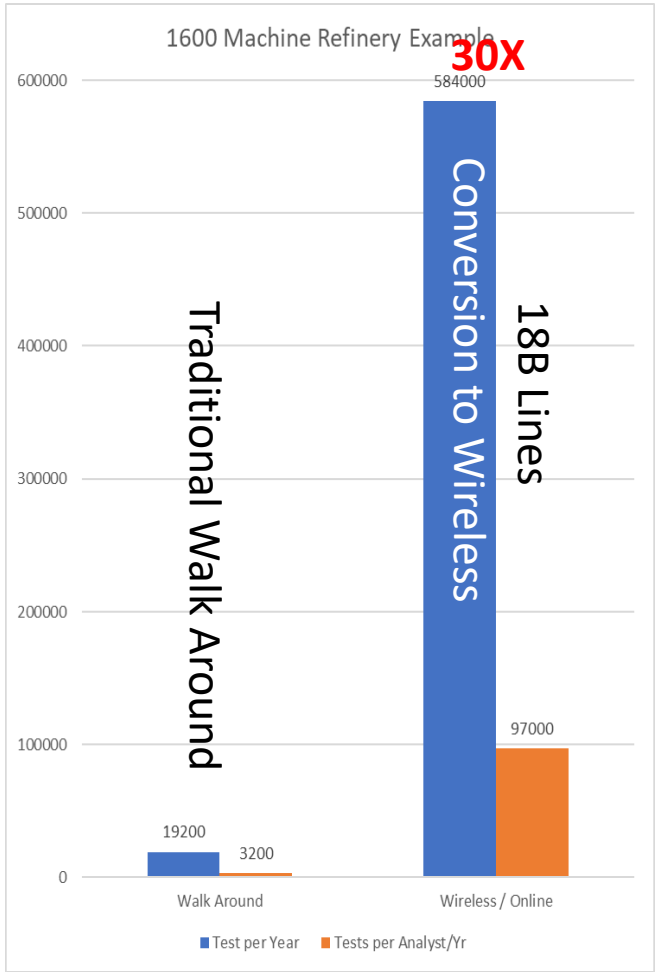
- More machines and more data means less analyst capacity
- More frequent data does not mean better analysis
- Simplification at detriment of risk
- Harder to retain experienced staff due to overload or missed failures

The Wireless Data Tsunami

- More Data ≠ Better Insights
- Analysts Overrun
- Ineffective use of High Value Talent
- Significant Resource Constraints
- 30-100x more data
- Overall Vibration Trend NOT enough

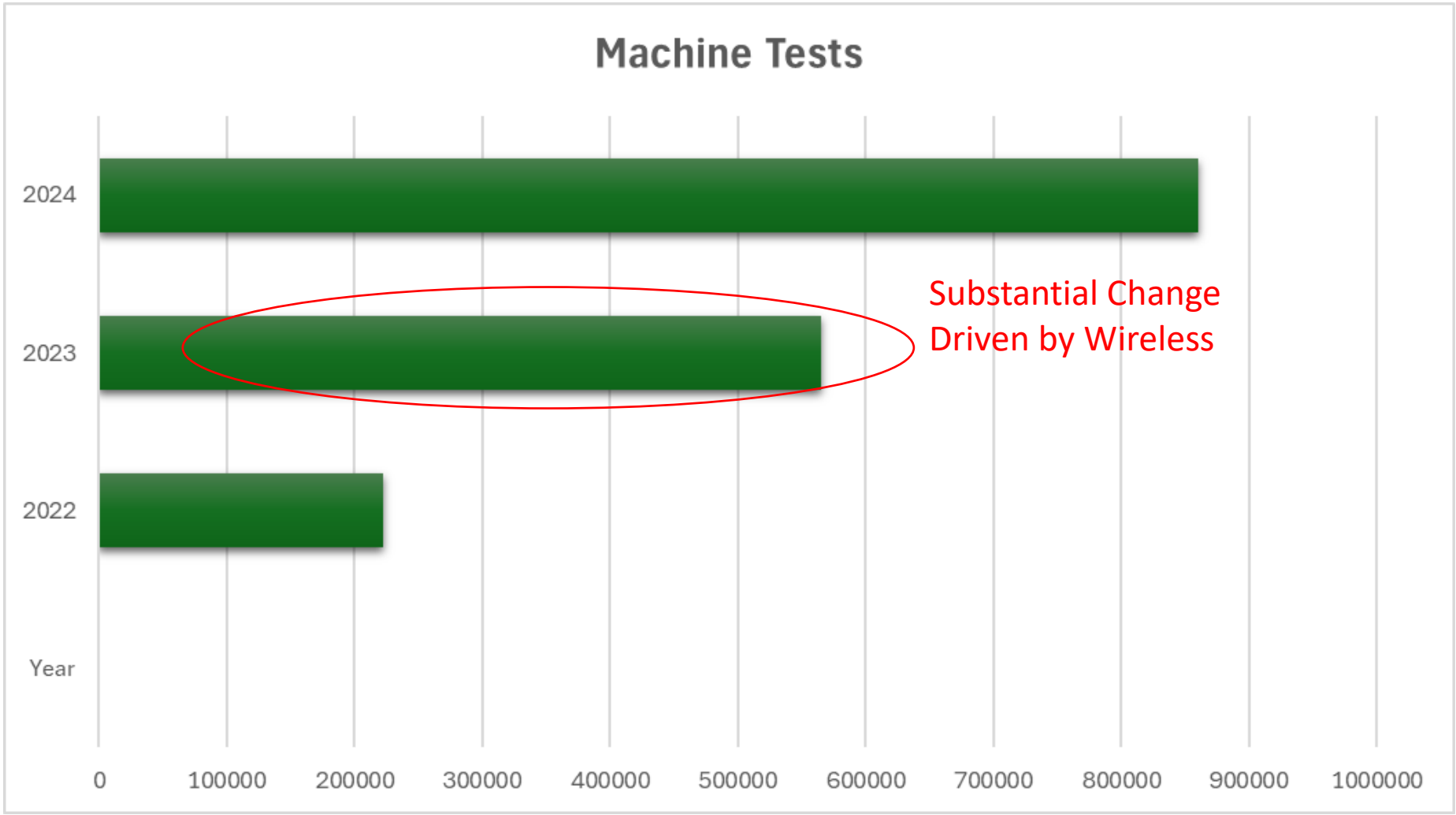
Better Approach

- Refocus Analyst on Actual Faults
- Fault Rate (Standard in industry)
  - Emergent (early) 10%
  - Serious actionable faults 3%
- Automate Low Risk Results
- Escalate High Risk Results To Analyst

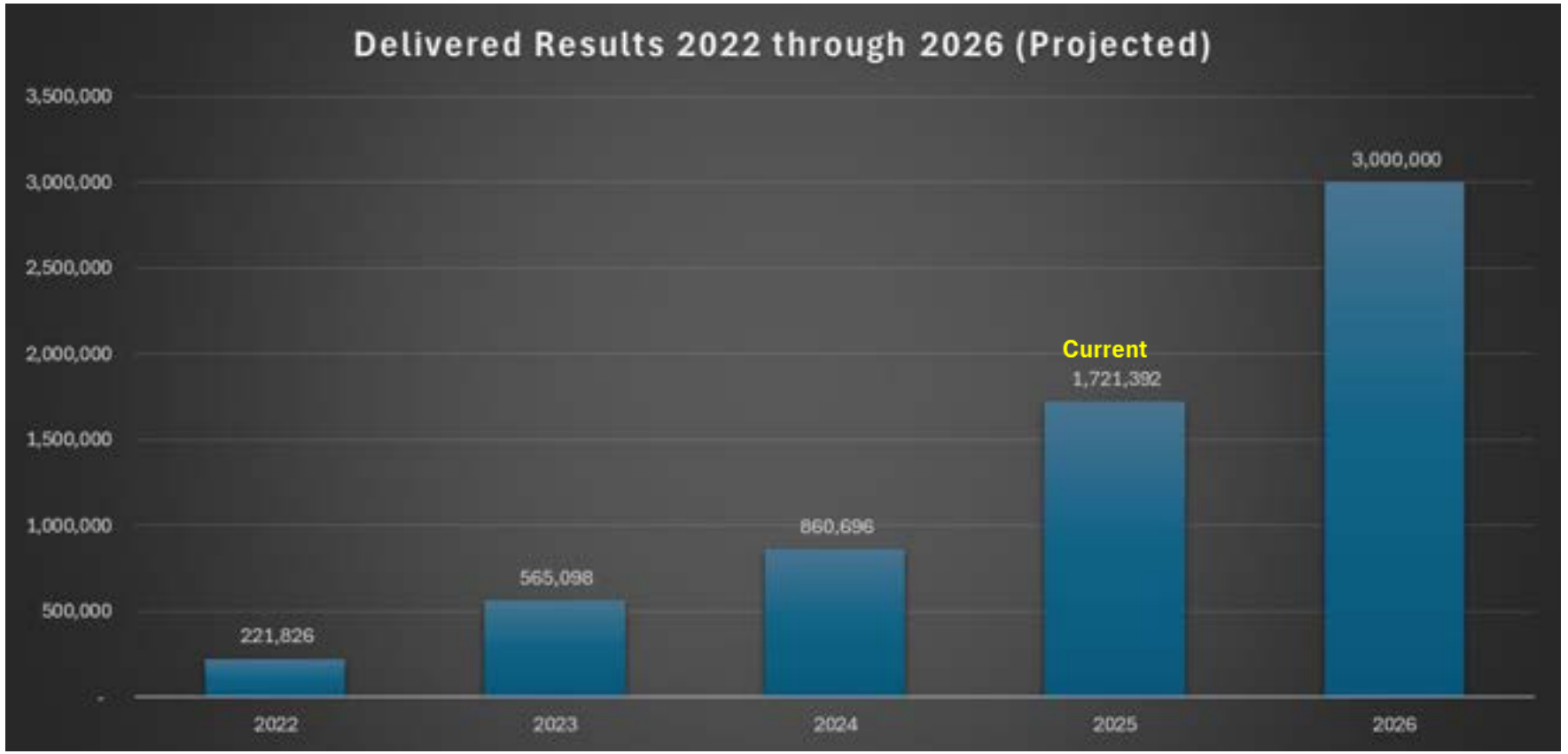


6 Analyst on-site

Azima DLI Data Increases



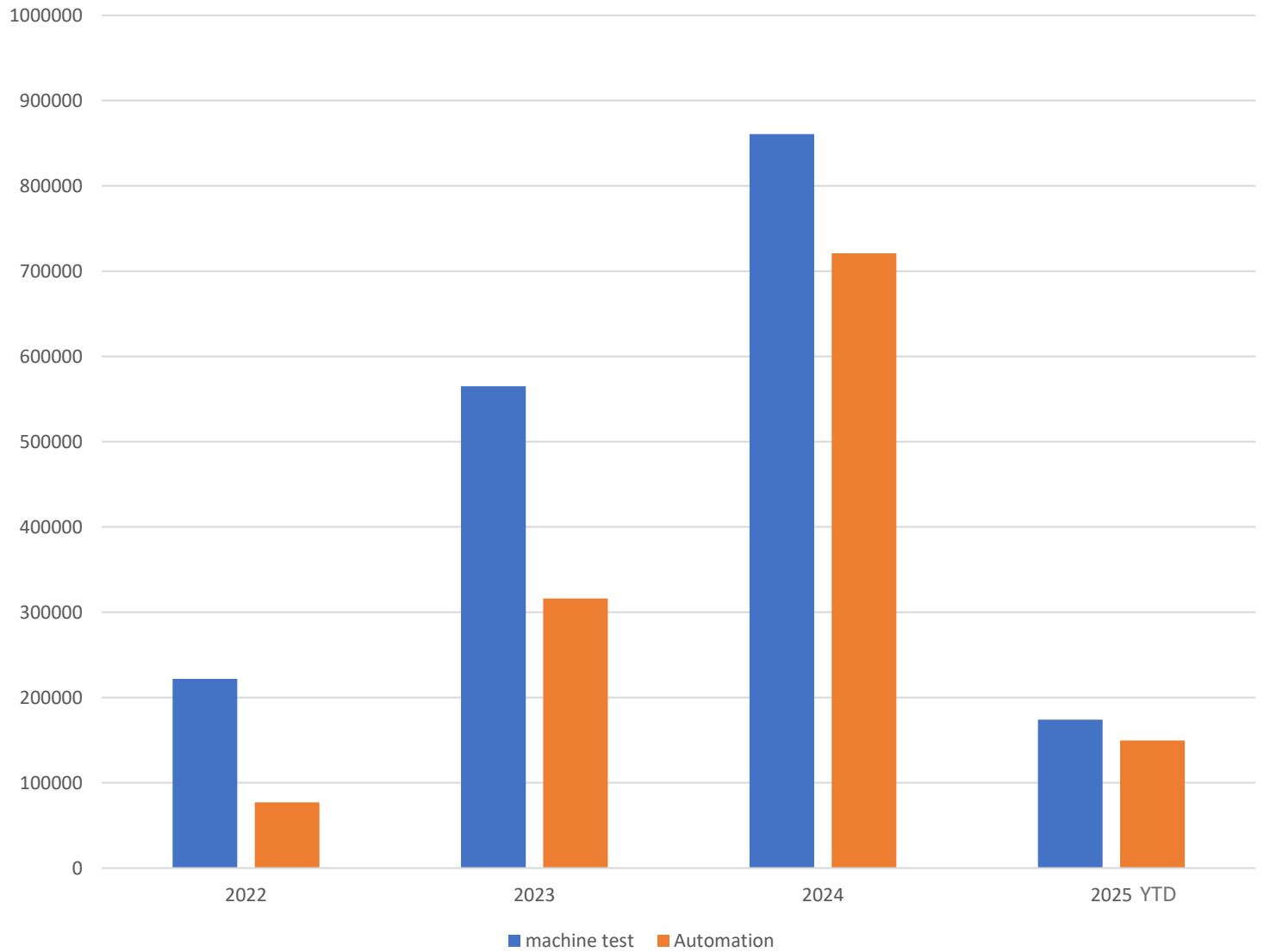
Azima History + Projections



By Year

FLUKE. Reliability

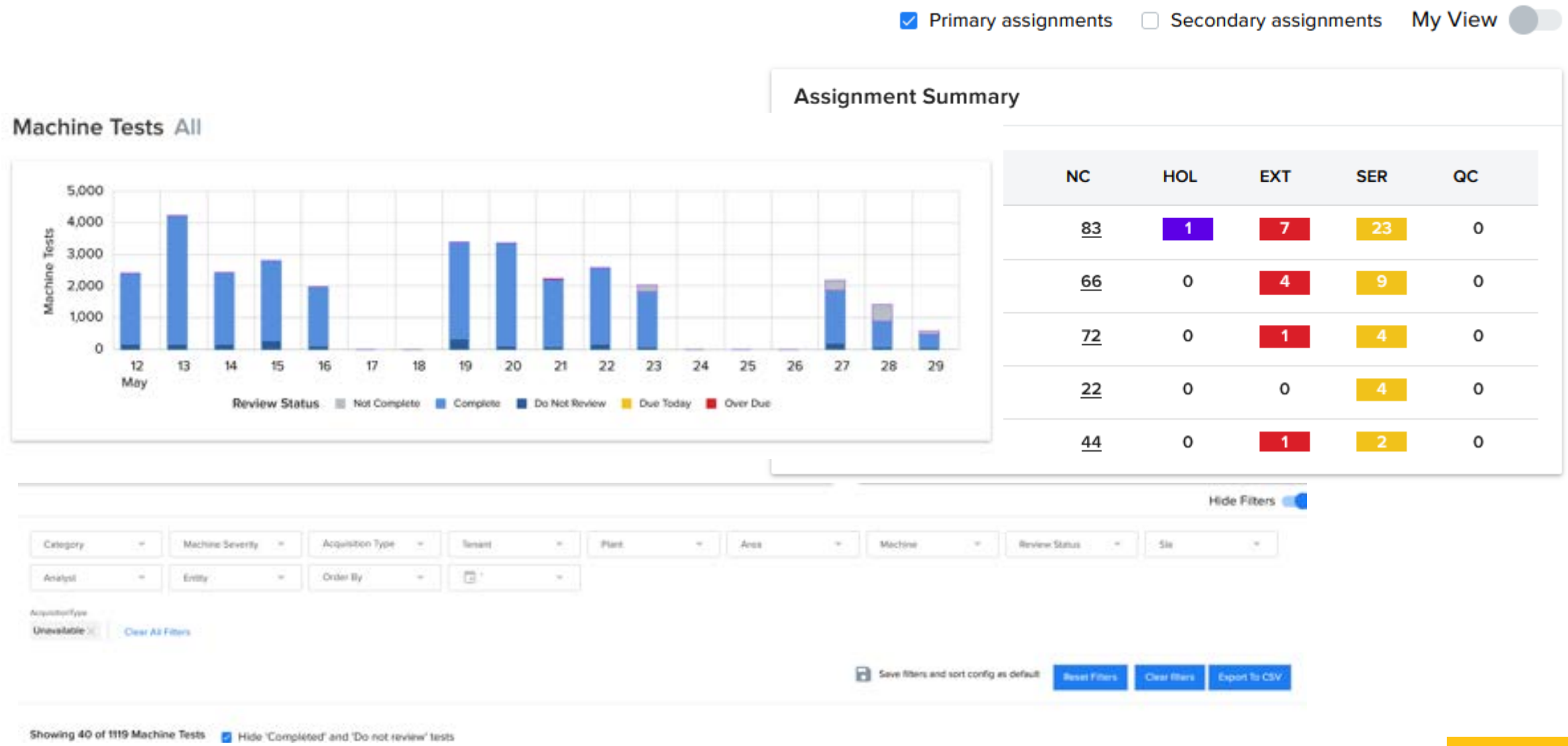
Azima DLI Automation Efforts



Workflow Management / Service Level

- **Dedicated Workflow Tool**
- **Delivery Process Driven By Severity**
  - Low Priority Results Automated
  - High Priority Results (Serious & Extreme faults)
    - Diagnostic Engine + Human Analyst

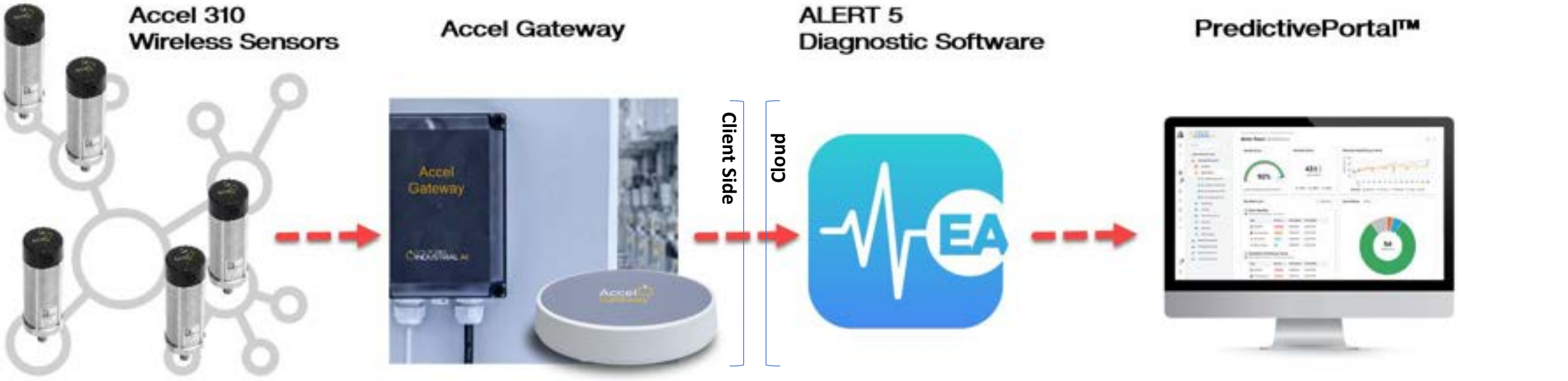
Workflow Tool



FLUKE Reliability

Wireless System Components

Watchman AIR™



Mesh Network
Self-healing and adaptive
More reliable than Wi-Fi or Bluetooth

Eureka AI Cloud-ready
Wi-Fi, LAN, Ethernet
Cellular LTE
Standard or Industrial IP-66/67

Automated Diagnostic Engine
Fully automated fault detection
6,000+ diagnostic rules
1,200+ component fault types

User Portal
Alerts & Notifications
Asset, Plant, Corporate Health Score
Cloud-based fault diagnosis, fault severity
Prioritized repair actions

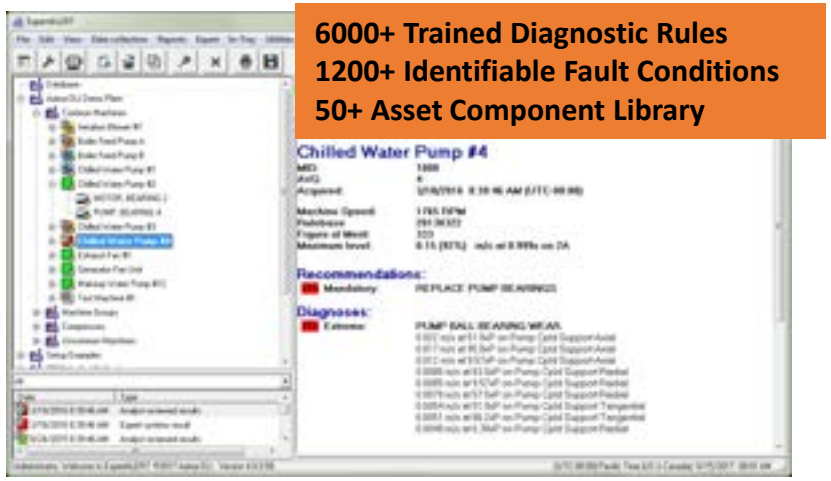
Wirepas® Mesh

WiFi, LAN Cellular

15

Watchman™ System

Expert Automated Diagnostic System



6000+ Trained Diagnostic Rules
1200+ Identifiable Fault Conditions
50+ Asset Component Library

Vibration AI

Asset Data Lake

100,000
Unique Assets

150,000
Asset Components

3,000,000
Machine Tests

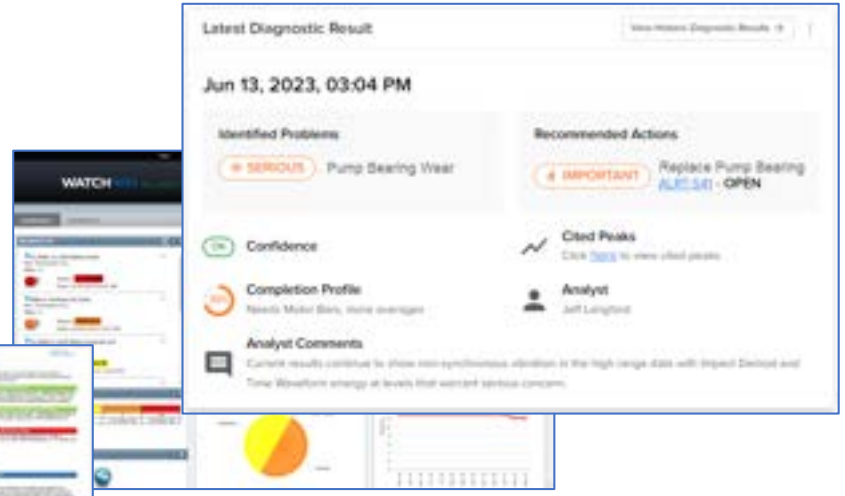
150,000
Component Specific Faults

100 Trillion
Individual Vibration Test Points

approximately

Vibration Data Sources

Program Management



Watchman Portal™

Level 2, 3, 4 ISO Certified
50k Assets Monitored
560k Annual Machine Tests

Watchman Services

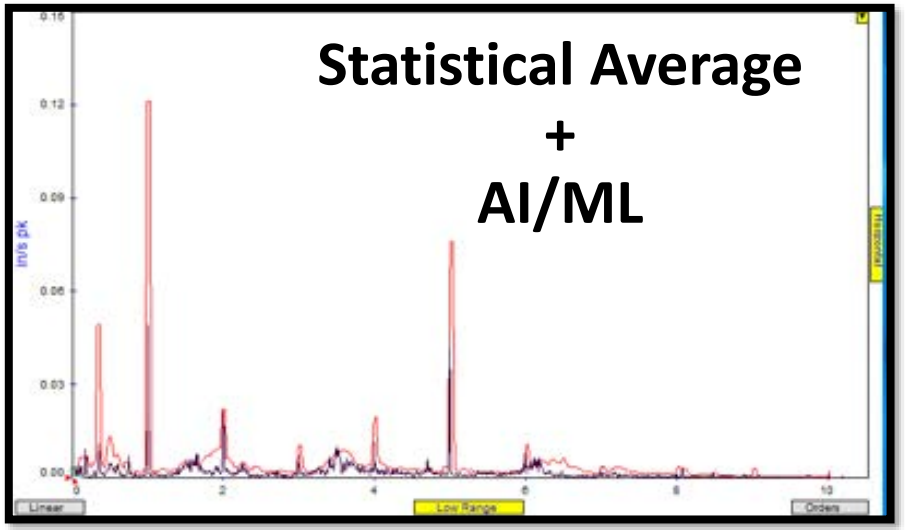
Vibration Institute

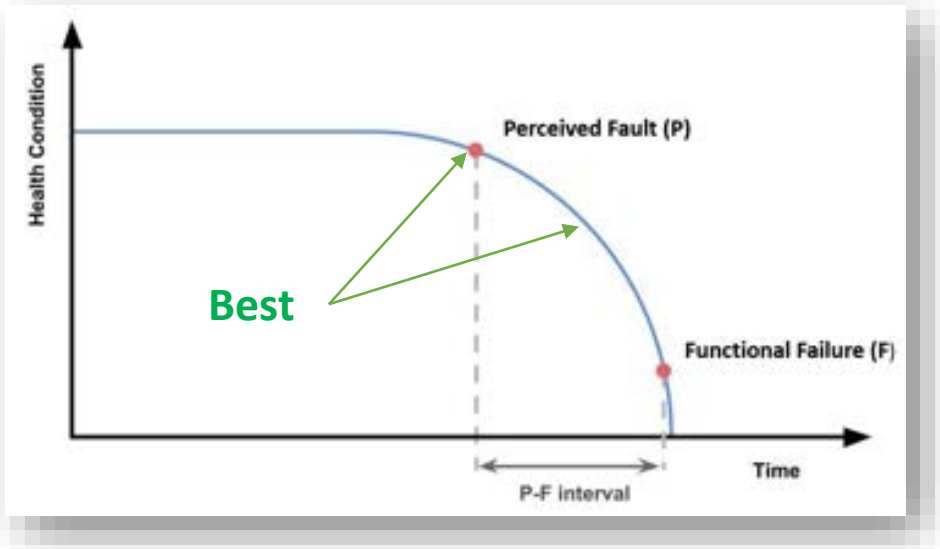
MOBIUS INSTITUTE

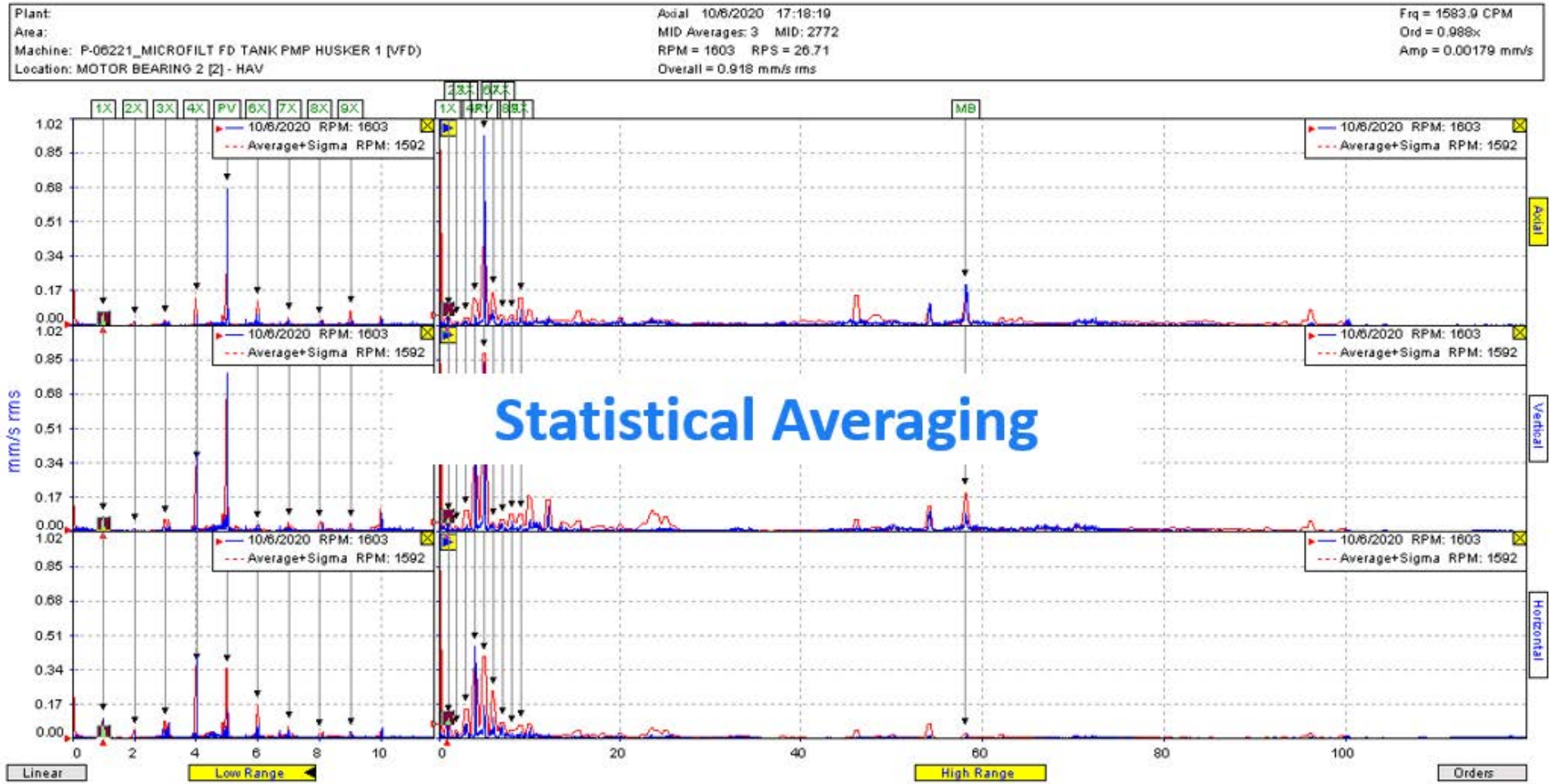
FLUKE Reliability

Azima DLI Watchman

- Empowered Vibration Data Analytics
- Diagnostic Engine + Manual Analysis
  - High value – High Volume
  - Highly Detailed Actionable Results
  - Focus Analyst on Actual Faults
  - Trusted Assessment
  - Scalable



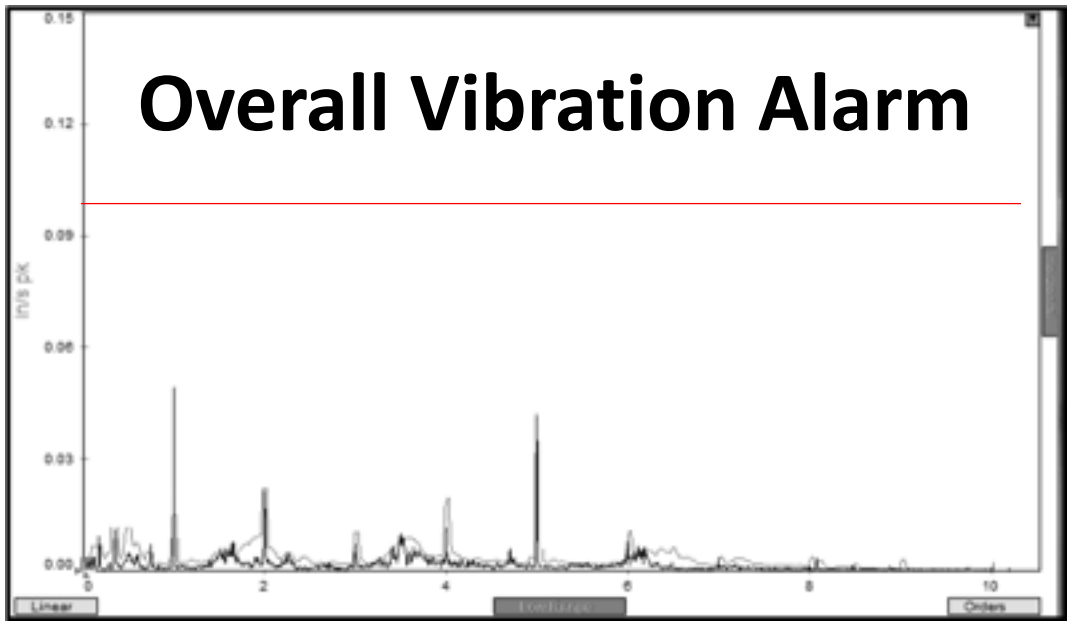




FLUKE Reliability

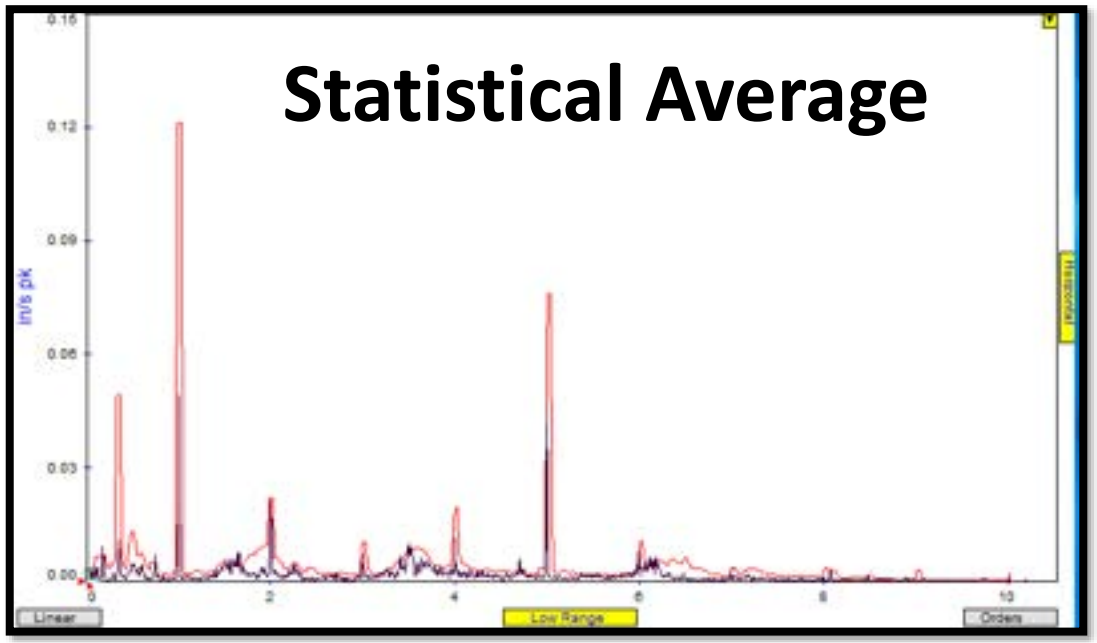
What is a Statistical Average

Others



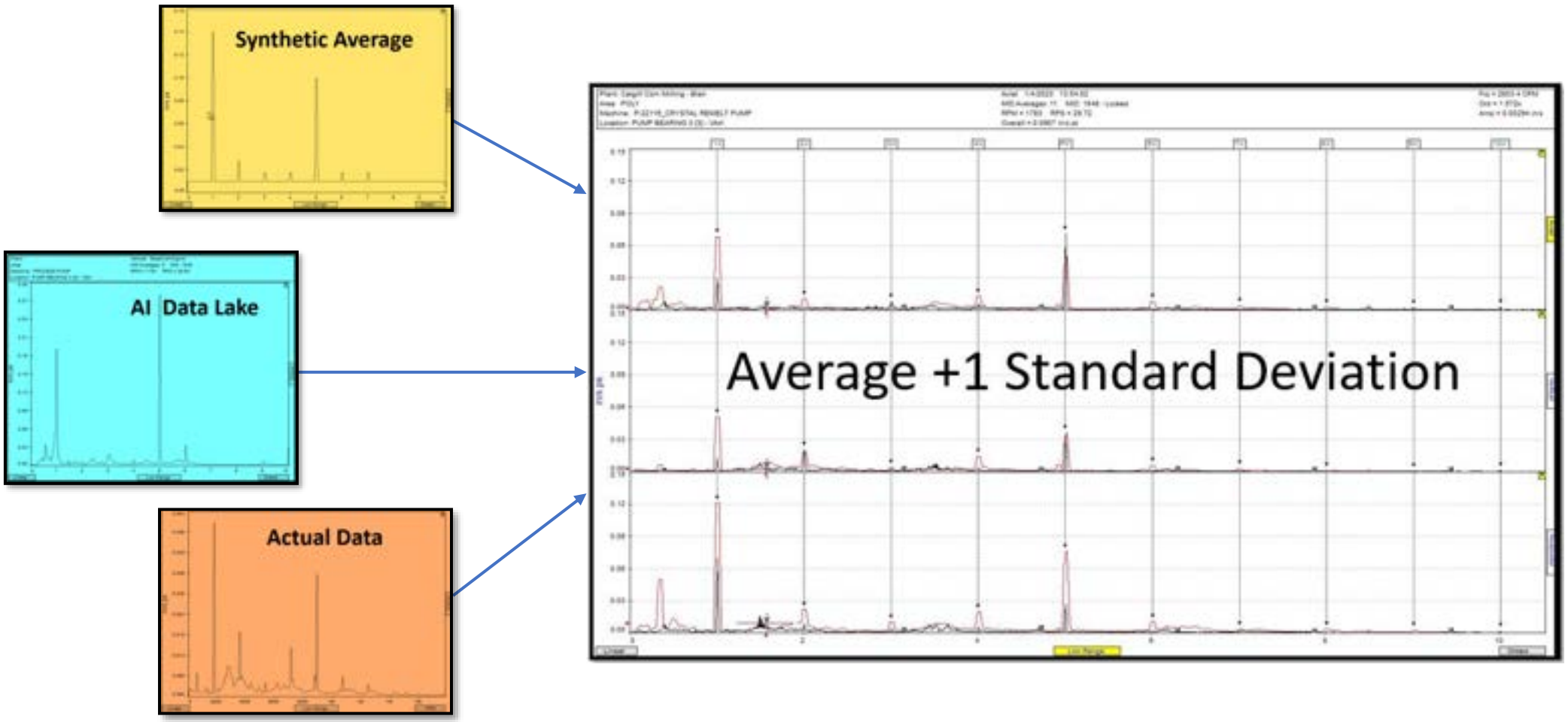
VS

AzimaDLI Screening



8000+ Line - Screening Criterion (per machine)

Robust Statistical Average



Statistical Average - Each Axis, Each Range, And Each Location of any Machine/Template

Result = 8000+ Line Screening Criterion per Machine

FLUKE Reliability

Template + Baseline Build / Certify

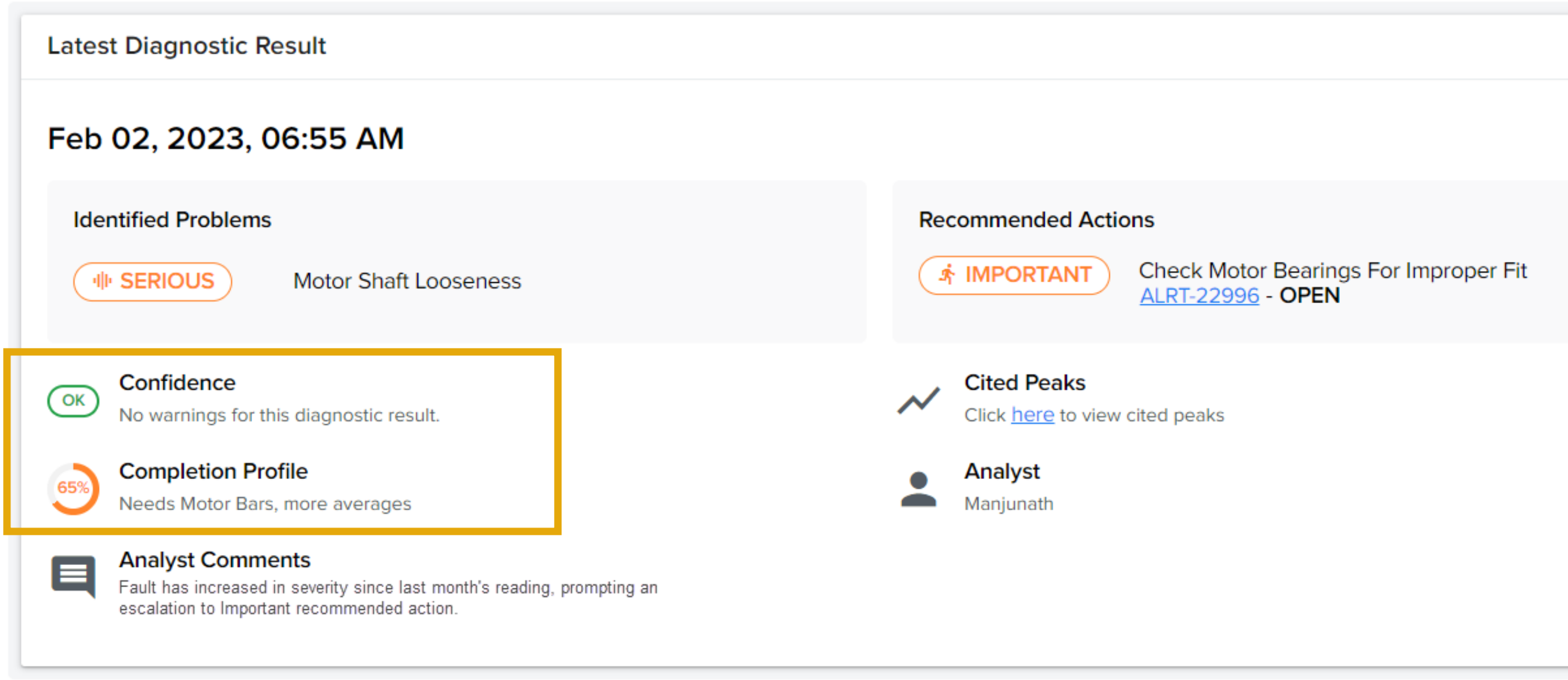
- **Diagnostic ML/AI Template Consist of:**
  - Machine Profile – Components
  - Known Fault Frequencies
  - Statistical Average Spectrum
  - Correct Machine Running Speed

- **Additional Processes**
  - MID – Completion Score
  - Certify Template
  - Secure Baseline / Management of Change MOC

Additional Process

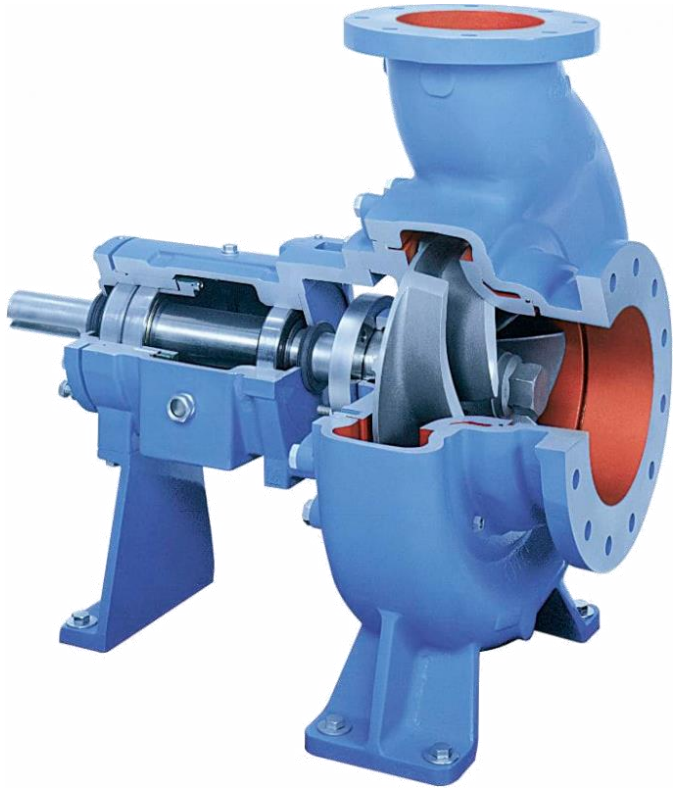
- Persistence Logic
  - Automate Persistent (Continuous) Fault Reporting
- Confidence Scoring
- Profile Completion Scoring
- Automated Fault Code finder

Confidence Level & Completion Score

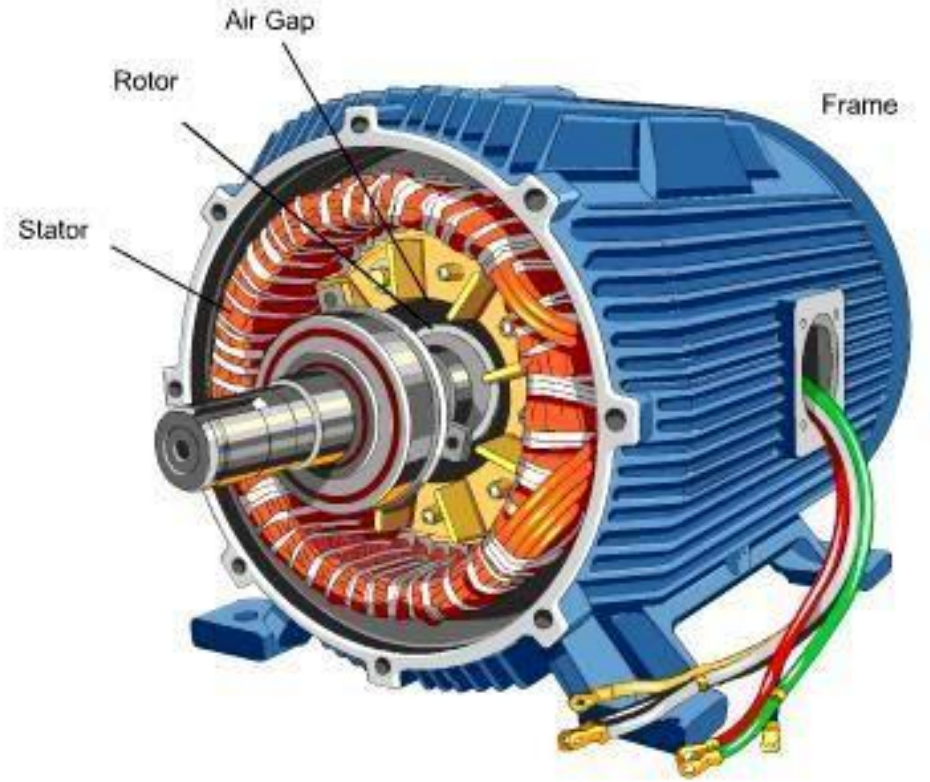


Vibration AI: Automated Fault Codes Examples

Identifies number of pump vanes



Identifies number of motor rotor bars



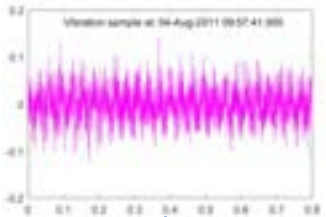
24

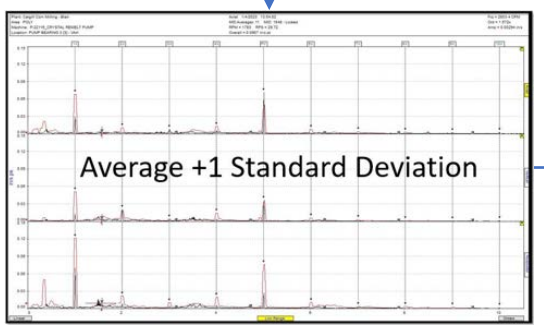
Diagnostic Recap

Diagnostic + Baseline/Grooming Process
{Analyst +AI}

- Trio: 6 – 24 Months to Mature
- Wireless 2-6 Weeks to Mature

Vibration Data





Baseline Screening

Analyst

Manual Analysis

Analyze | **Refine MID** | **Build Average** | **Certify**

Automation (Historical Data + AI/ML)

Machine Configuration

MID – Machine Internal Design

MID

Feature Extraction

Automated Analysis (Once Certified)

Rules Engine

Report Generation

- 6,000 Diagnostic Rules
- 1,200 Fault Conditions
- 150,000+ Component specific faults
- 2 Million+ Historical Machine Tests

FLUKE Reliability

Types of Equipment (Partial List)

Individual or Coupled Combinations of Individual Components with or without transmissions

- AC Motor
- DC Motor
- VFD Motor
- Closed-coupled Motor
- Closed-coupled Turbine
- Gas Turbine
- Steam Turbine
- Two Stroke Diesel Engine
- Four Stroke Diesel Engine
- Flexible Coupling
- Magnetic Coupling
- Fluid Coupling
- Belts Drives
- Chain Drives
- Single-stage Gearbox
- Multi-stage Gearbox
- Marine Main Reduction Gear
- Gearbox Oil-pump / Aux Gear
- Machine Tool Spindle
- Turbo Charger
- Centrifugal Pump
- Propeller Pump
- Rotary Thread Pump
- Rotary Gear Pump
- Rotary Screw Pump
- Rotary Sliding Vane Pump
- Piston Pump
- Lobed Blower
- Single Stage Centrifugal Compressor
- Multi-stage Centrifugal Compressor
- Piston Compressor
- Screw Compressor
- Generator
- Generator With Exciter
- Single-stage Fan
- Multi-stage Fan
- Decanter
- Purifier With Clutch
- Purifier With Belt
- Shaft, Proximity Probes
- Horizontal / Vertical Shafting

EADS Capabilities

Automated Diagnostic Rules:

- **6000+**

Individual Fault Conditions:

- **1200+**

Industrial Machine Types:

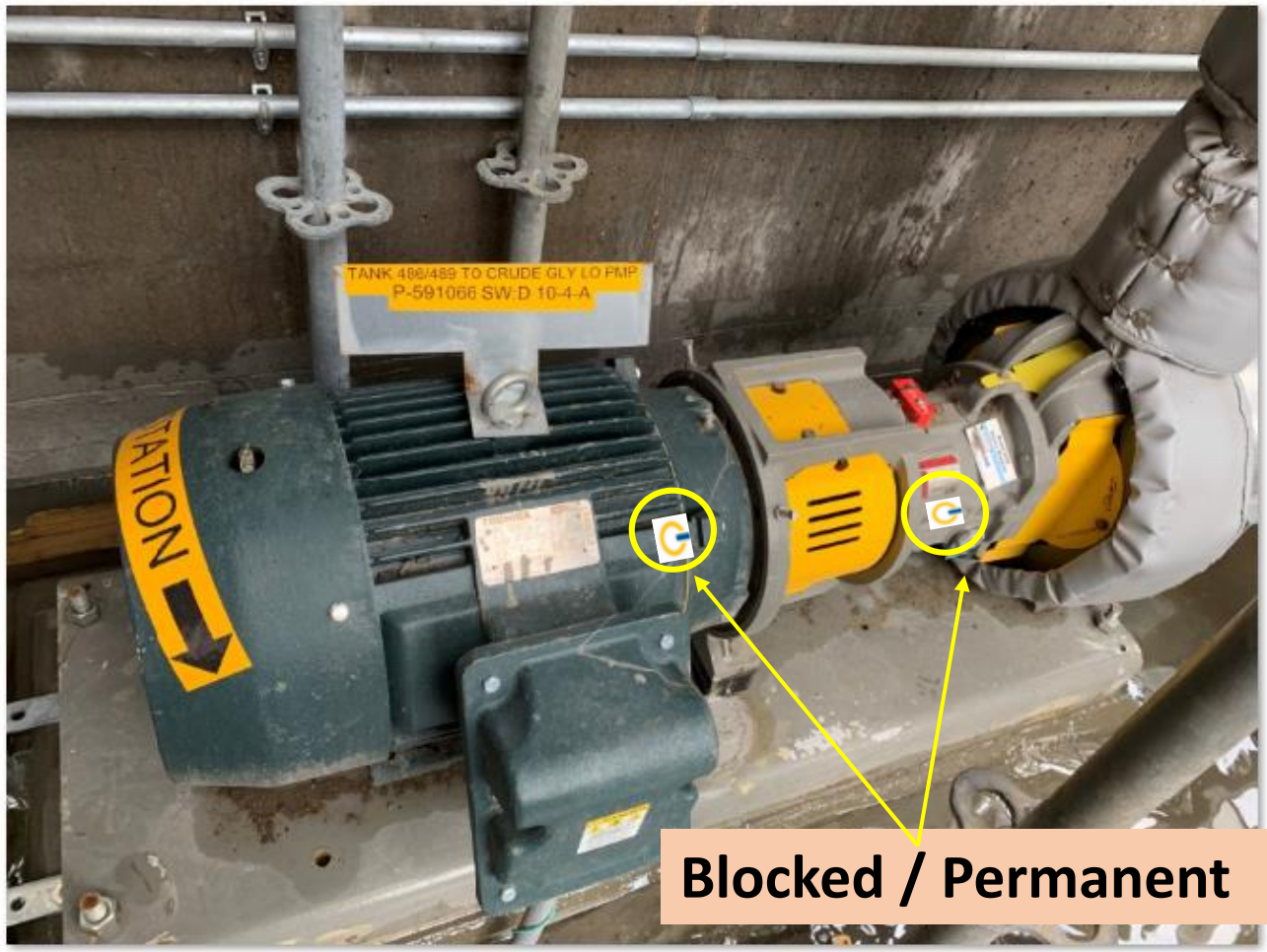
- **~50 (all common)**

Precise Application / Implementation

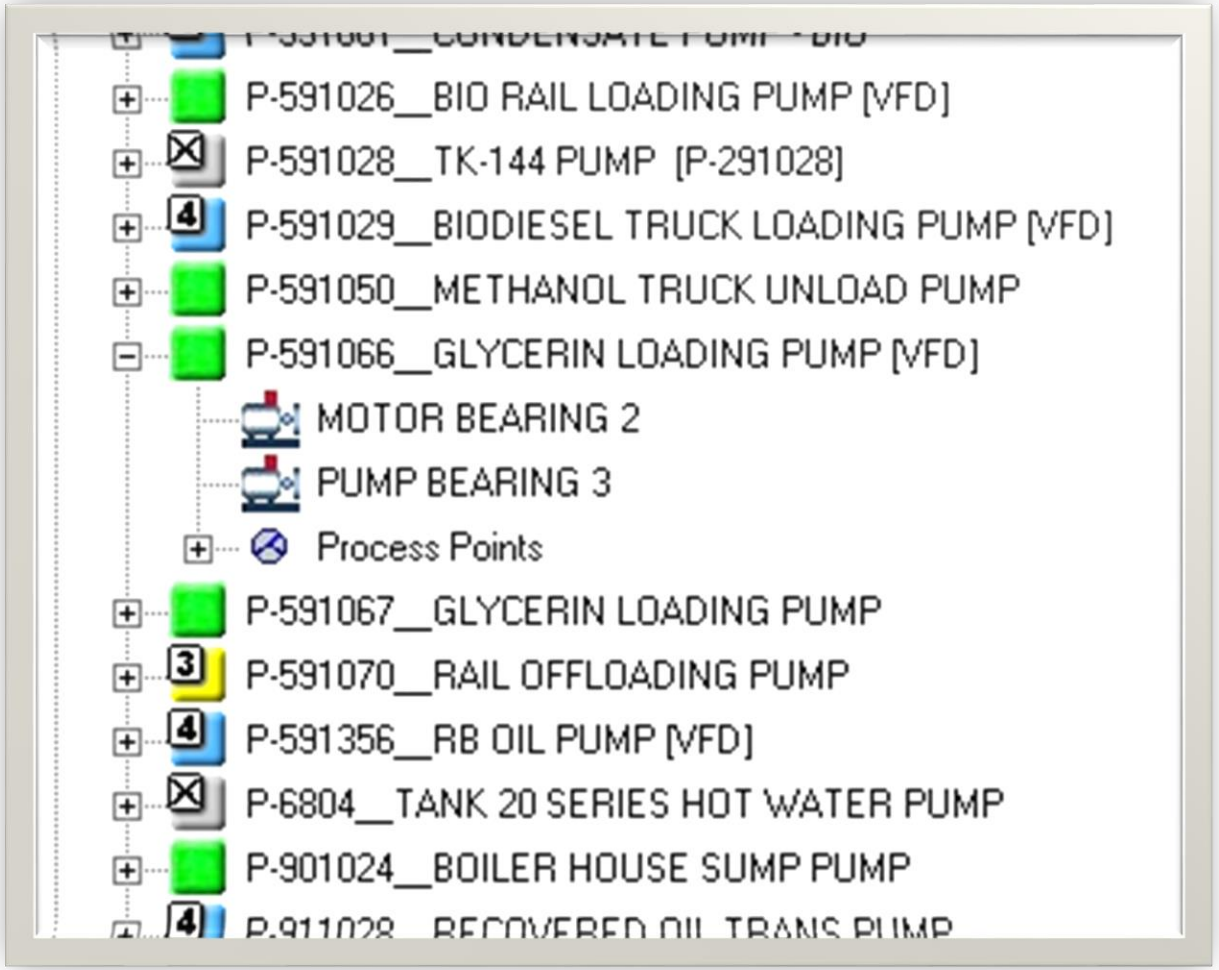
- Plant Walk Down
- Review Machine List
- Ensure Machine Application Fit
  - Verify Operating Conditions
    - Example: Intermittent Operation (Stop/Start)
  - Speed Range
    - Consistent Speed During Collection
    - Speed Within 30% Variance Between Collections
    - Slow Speed Limits
- Record Machine Profile
- Photos when possible

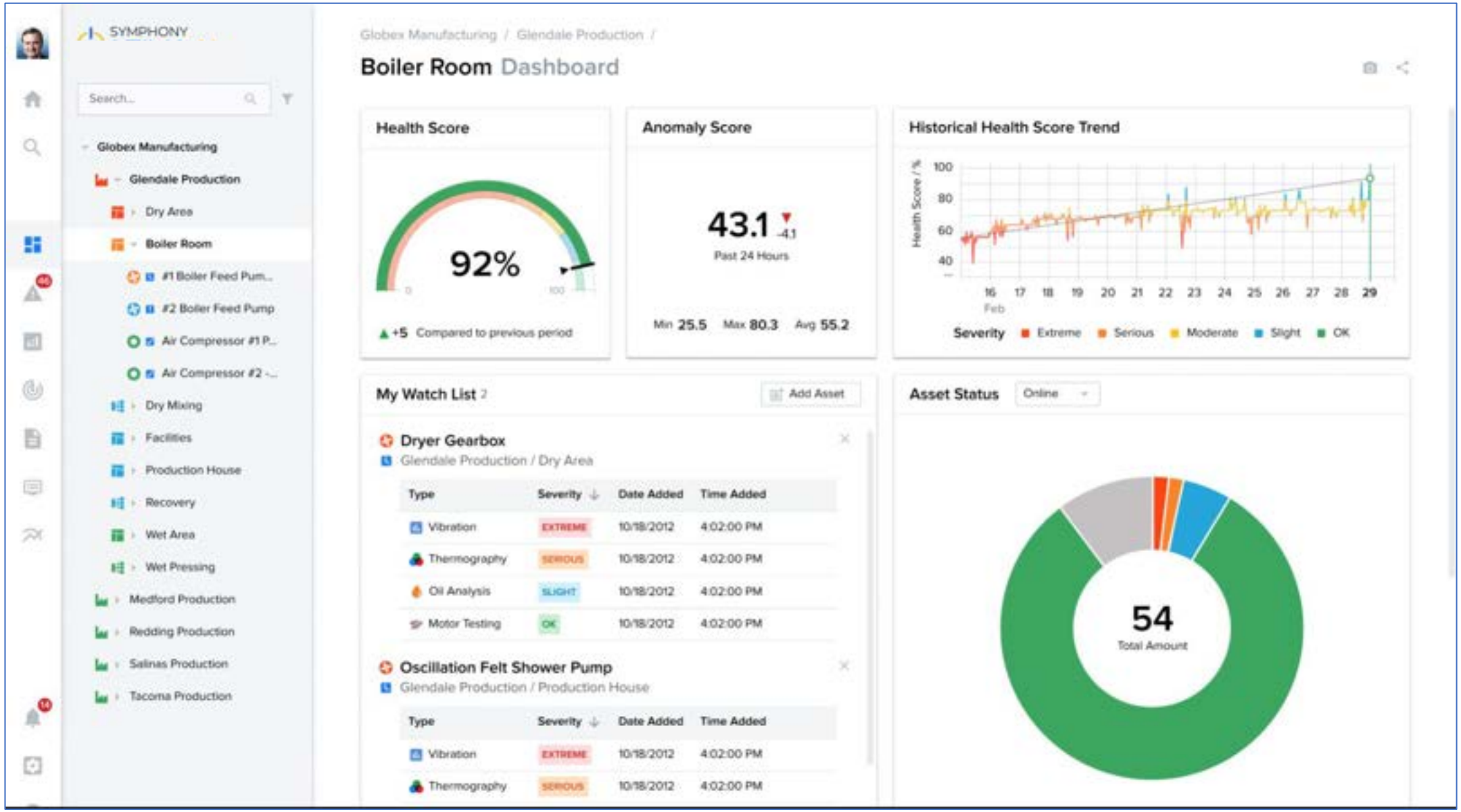
Implementation Walkdown. Photos, Vtags

Example Machine Setup

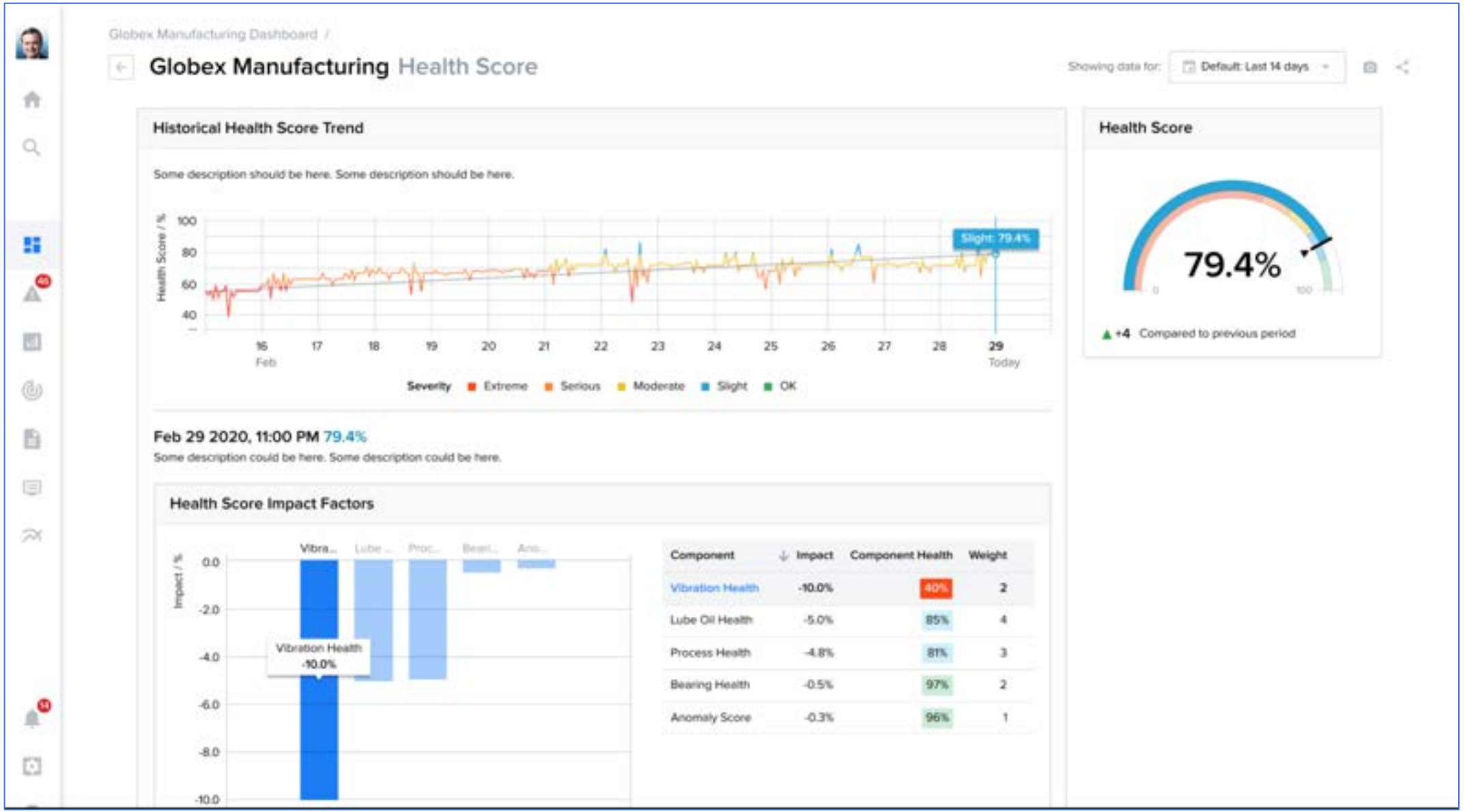


Centrifugal Pump





FLUKE Reliability



FLUKE®
Reliability

THANK YOU!

Abstract

Ensuring the success of your reliability program is a top priority for any management team. Today, many organizations are experiencing vibration data overload—where the volume of data surpasses their capacity to analyze it effectively.
In an era dominated by wireless sensors, Azima DLI manages over 1-Million machine tests annually by leveraging advanced algorithms, key performance metrics, and proven processes to maintain robust reliability programs.
This webinar will explore the evolving landscape of vibration analysis, highlighting the roles of artificial intelligence, machine learning, streamlined workflows, and organizational culture in achieving long-term success.