

# Optimizing Predictive Maintenance at Barrick Gold

## Integrating Asset Data and Process Data

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# Agenda

1. Introduction to Barrick Gold
2. Push for Digital Transformation
3. Petasense Asset Reliability & Optimization
4. Pilot at Cortez Process
5. The Path Forward

# Barrick Gold

One of the world's largest gold producers

- HQ in Toronto, ON, Canada.
- Global company with a focus on the Americas
- 75%+ of our gold production comes from the Americas region
- Additional mining operations and projects in Australia, Chile, Papua New Guinea, Saudi Arabia, and Zambia
- 64.4 million ounces – Barrick gold reserves



# Barrick Nevada

## Cortez Operations

- 100 kilometers southwest of Elko, NV
- Cortez Mining District mining since 1862
- Proven and probable gold reserves at 10.0 million ounces

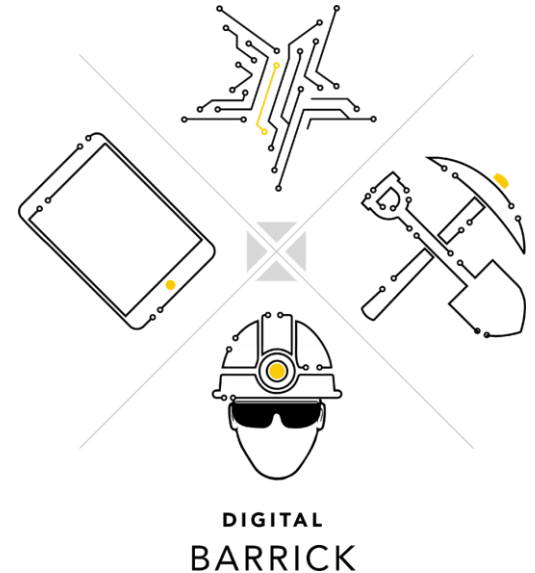


# Digital transformation journey

Barrick Gold, like many world-class companies today, has embarked on a digital transformation journey

- Harness the transformational potential of digital innovation across the whole enterprise
- Strategic intent to transform Barrick into a Digital Enterprise

*“A productive, safe, environmentally friendly, socially responsible, low cost digital enterprise that leverages technology and data as a competitive advantage.”*



# Barrick is a big user of OSIsoft PI

- Using PI across the enterprise for nearly 10 years; have an Enterprise Agreement
- Primarily used for
  - Analytics & visualization
  - Process modeling
  - Planning
  - Process monitoring
- Over 250K tags



... but limited use for predictive maintenance

# Predictive Maintenance until now



## Limitation

Infrequent data collection  
data collected every 4-5 weeks

Only taken in horizontal direction

Time-consuming data collection  
350 points = 2-3 hours each day

Tedious analysis process  
3-4 hours for each hour of sampling

## Consequence

Increased failure risk (asset condition  
may change between data collection)

Misses important signals  
in vertical and axial directions

Increased failure risk (asset condition  
may change between data collection)

Results in infrequent and rushed  
analysis

## All resulting in big risks

1. Increased risk of unplanned downtime
2. Increased cost of repairs
3. Unnecessary preventive maintenance

# Our goal is to modernize our predictive maintenance practice

We identified

PetaSense

# 4 disruptive technologies are paving the way for a digital future



Pervasive  
Wireless



Inexpensive  
Sensing

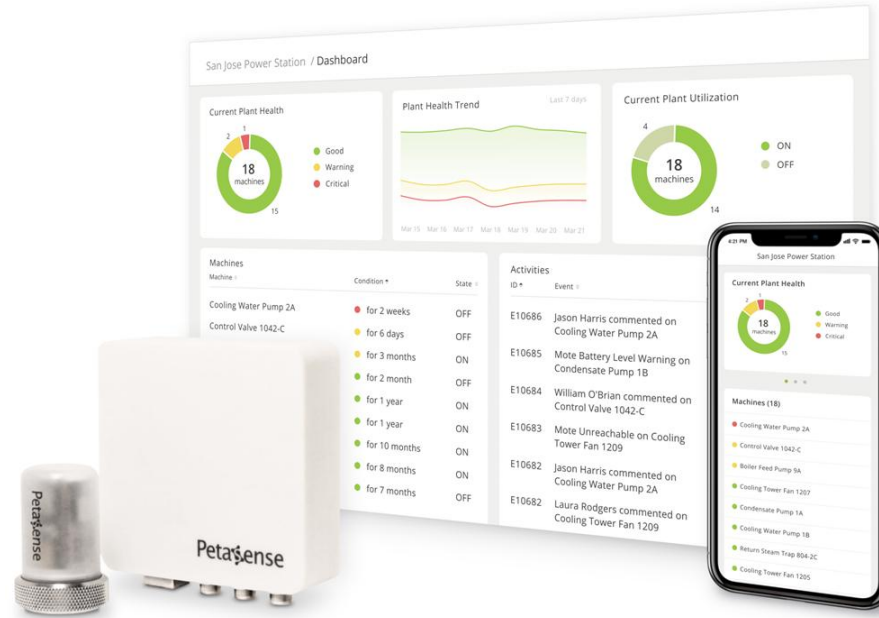


High-performance  
Cloud Computing



Data Science &  
Machine Learning

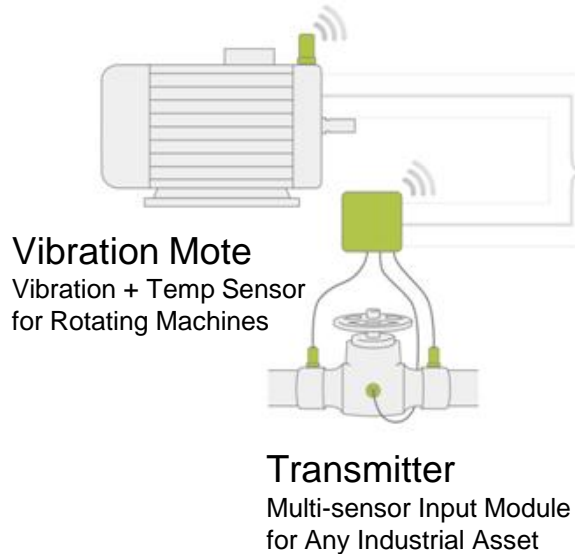
# Petasense plug-n-play tech brings it together



Asset Reliability & Optimization for the Digital Plant

# Petasense Asset Reliability & Optimization System

## 1 Wireless Sensors



## 2 ARO Cloud



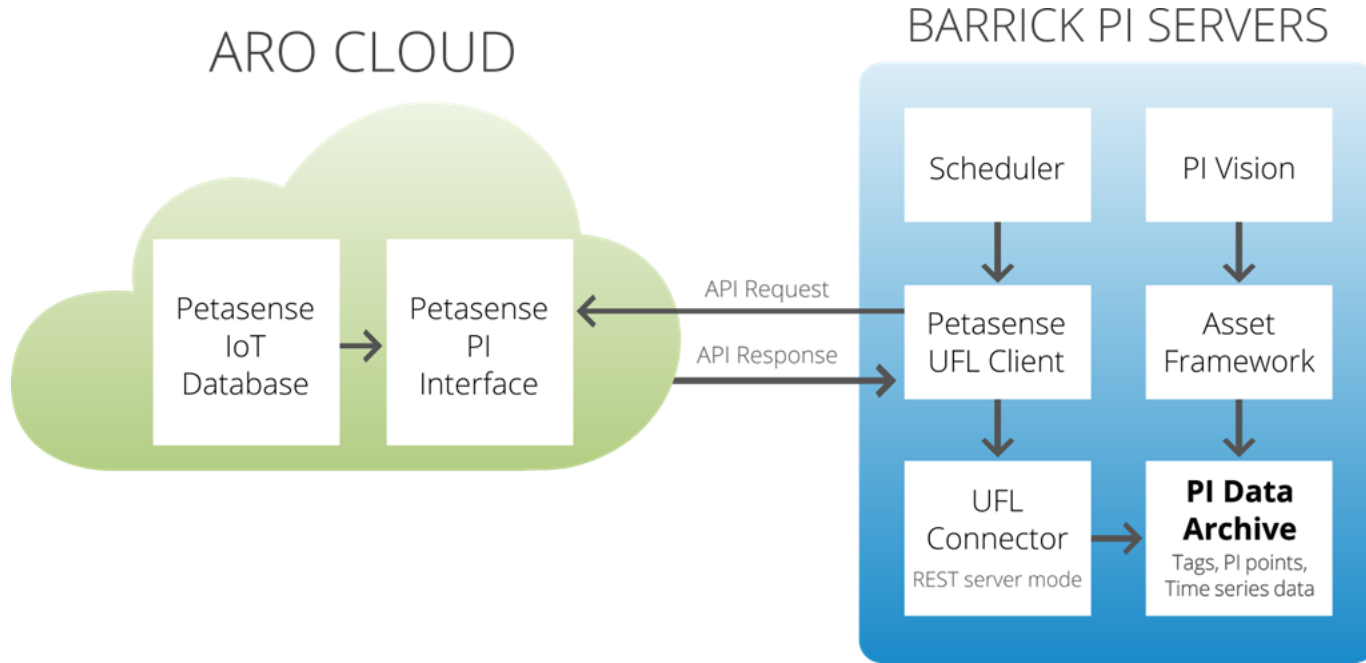
- Machine Learning Analytics
- Deep Asset Knowledge Database
- Enterprise-grade Security

## 3 Web & Mobile Apps

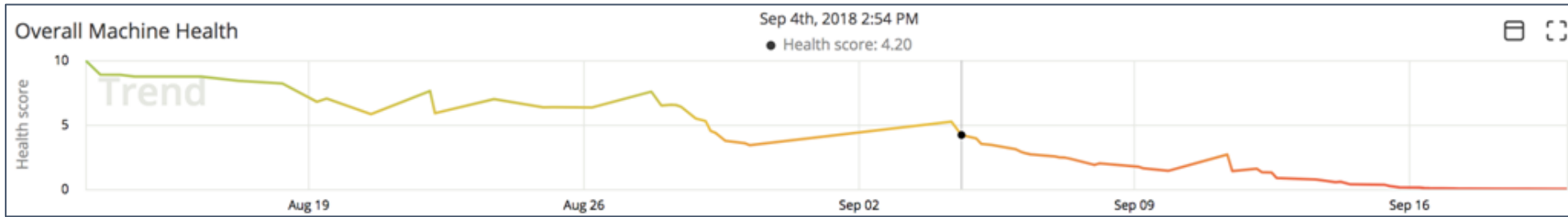


- Intuitive Dashboards and Charts
- Advanced Vibration Analysis Tools
- Real-time Event Notifications

# Integration with OSIsoft PI



# Machine Learning based Asset Health Score



- Enables reliability teams to identify defects in real-time
- Sophisticated algorithms + deep asset knowledge of rotating machines
  - 40 features from each measurement
  - Velocity, Accel, Triaxial data, RMS, P2P, Crest factor, Amplitudes of Spectrum Harmonics, etc



# Petasense Trial at Barrick Cortez

Elko, NV



# Pilot Scope



## 25 Vibration Motes & 20 Transmitters

- Wireless data collection every 3 hours (instead of every month)

## Monitoring 10 Machines

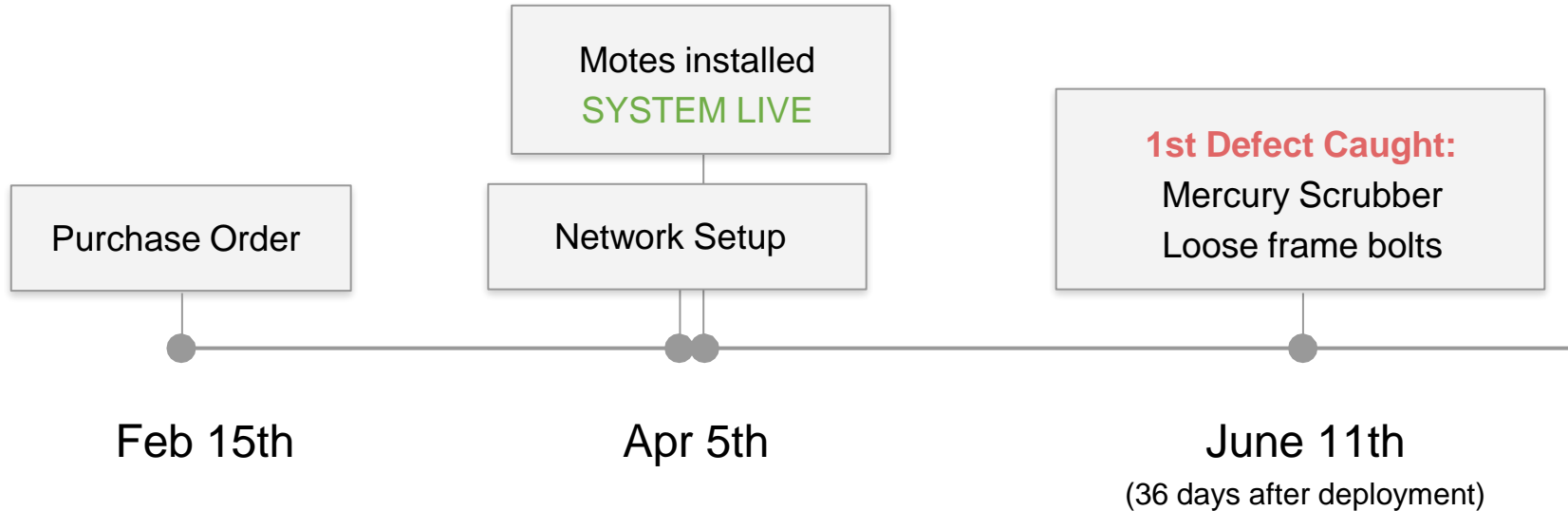
- Tails Pumps, Barren Pumps, Mercury Scrubber Fan, Cyclone Feed Pump, Electrowinning Fan, Agitator, Ball & Sag Mill

## PI Integration

# IIOT vibration sensors in action



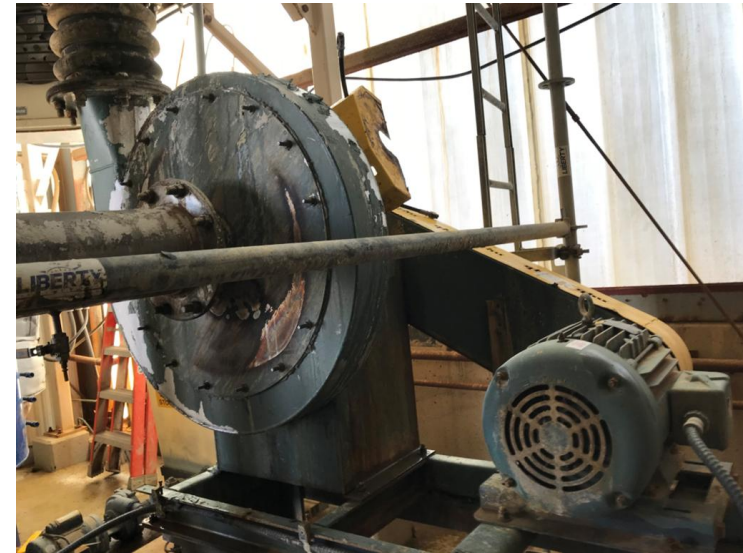
# Quick deployment, quick results



# First Defect Caught

## Mercury Scrubber Fan - Loose Frame Bolts

Avg Vib Trend - June 8 to 14

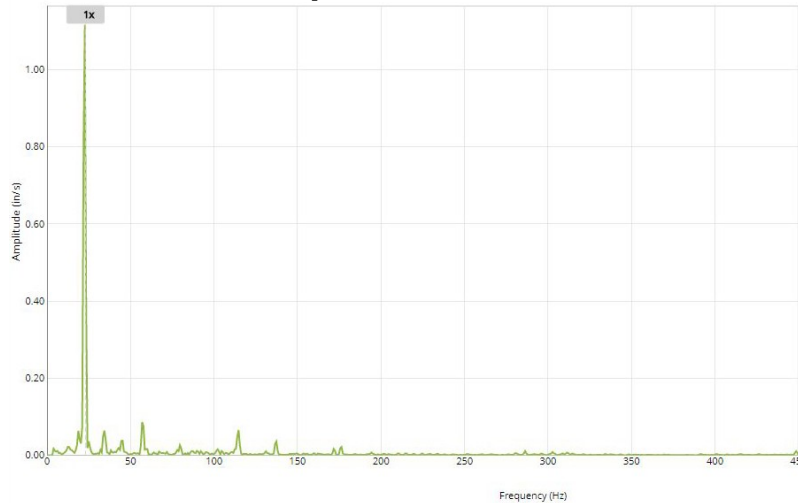


# First Defect Caught

## Mercury Scrubber Fan - Loose Frame Bolts

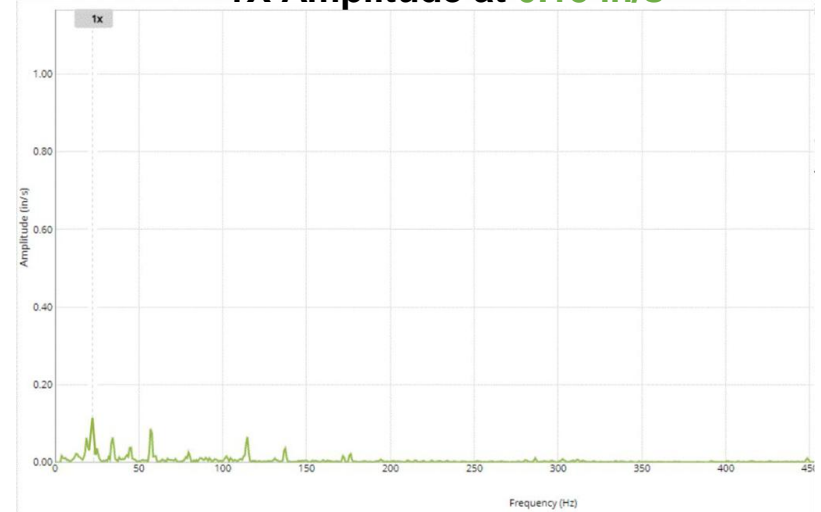
Vibration Spectrum - June 11  
(Before Repairs)

**1X Amplitude at 1.2 in/s**



Vibration Spectrum - June 13  
(After Repairs)

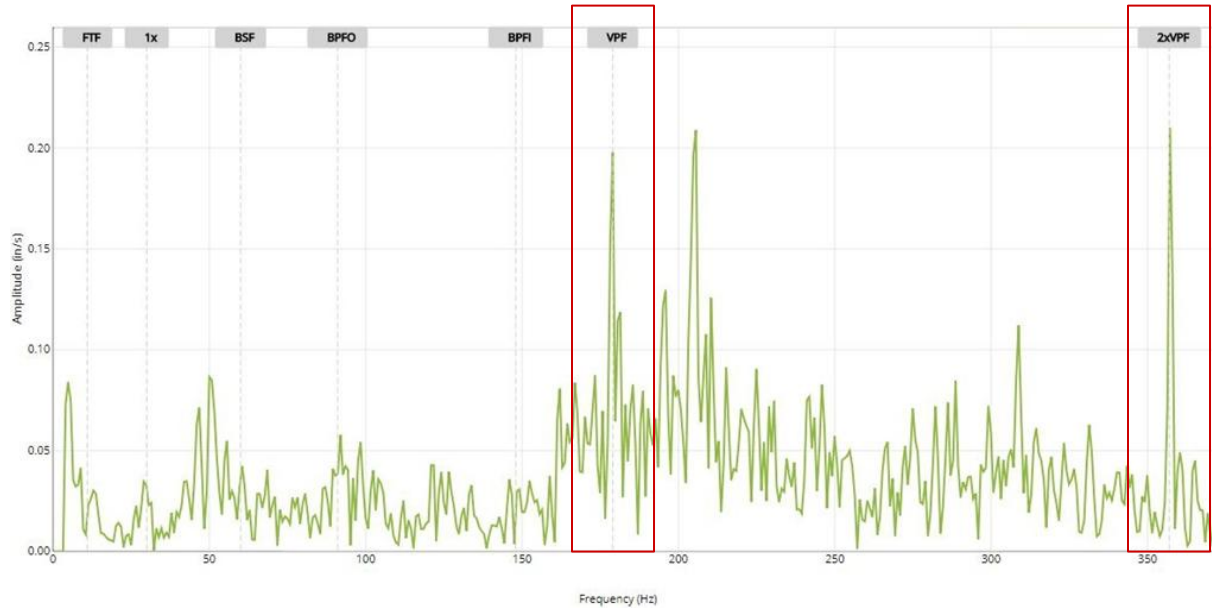
**1X Amplitude at 0.15 in/s**



# Second Defect Caught

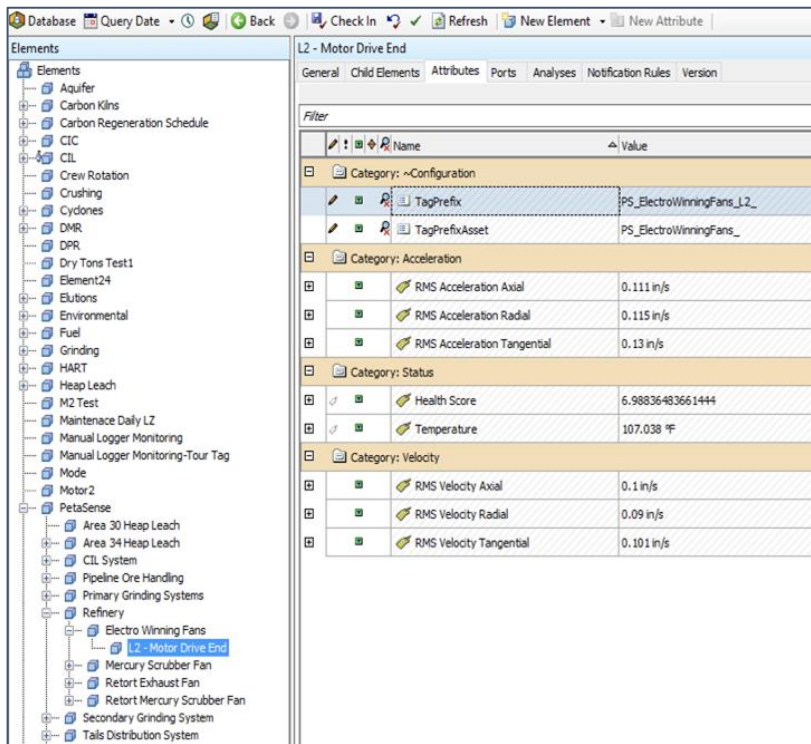
## Barren Pump - Elevated Vane Pass

Spectrum Chart - June 11



**Inspected  
Pump and  
was found to  
be cavitating**

# Integrated Petasense Vibration Tags with Pi



L2 - Motor Drive End	
General Child Elements Attributes Ports Analyses Notification Rules Version	
Filter	
Name	Value
Category: ~Configuration	
TagPrefix	PS_ElectroWinningFans_L2_
TagPrefixAsset	PS_ElectroWinningFans_
Category: Acceleration	
RMS Acceleration Axial	0.111 in/s
RMS Acceleration Radial	0.115 in/s
RMS Acceleration Tangential	0.13 in/s
Category: Status	
Health Score	6.98836483661444
Temperature	107.038 °F
Category: Velocity	
RMS Velocity Axial	0.1 in/s
RMS Velocity Radial	0.09 in/s
RMS Velocity Tangential	0.101 in/s

## Types of tags integrated

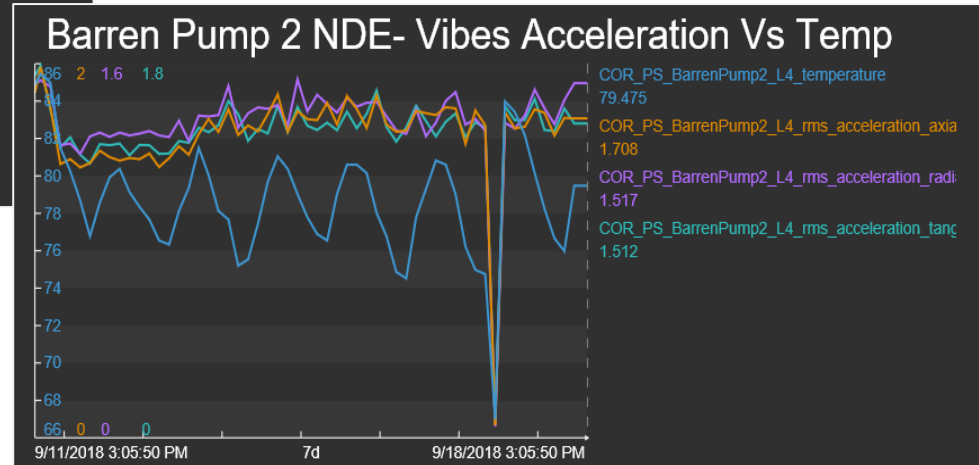
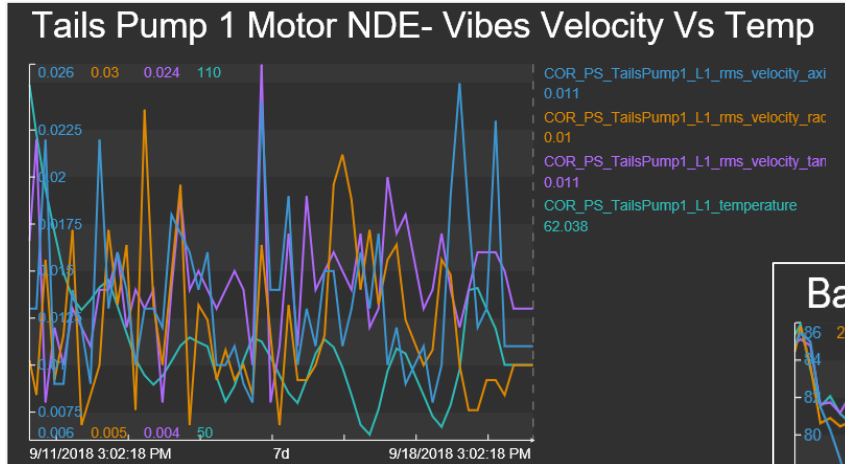
RMS Acceleration in all axes

RMS Velocity in all axes

Surface temperature

Machine Learning based Asset Health Score

# Asset and process data together tell a better story



# Benefits gained by using Petasense

1. Reduced manual rounds & associated costs
2. Reduced unplanned downtime = Increased production
3. Reduced repair costs due to early detection
4. Ability to integrate with PI
5. Upgrade from Rockwell eMonitor to modern IIoT & Cloud based technology

# Path Forward

# Implement across Barrick Nevada and beyond

## 1. Implement Petasense System across Cortez Process

- 100 Machines
- 300-500 Vibration Motes
- Several Transmitter Applications
- Leverage Asset Reliability & Optimization System

## 2. Deeper integration with PI

- Pull in all tags - sensor data and machine learning based tags
- Analyze process data alongside predictive maintenance data

## 3. Expansion to other Barrick sites

- Cortez Open Pit (Surface) & Underground, Goldstrike, Turquoise Ridge

# BARRICK GOLD

## Optimizing Predictive Maintenance at Barrick Gold: Integrating Asset Data and Process Data



# BARRICK

### CHALLENGE

#### Leveraging PI to optimize Predictive Maintenance

- Increased Risk of Unplanned Downtime
- Increased Cost of Repairs
- Unnecessary Preventive Maintenance

### SOLUTION

#### Implement an IoT-based Predictive Maintenance system

- Petasense Asset Reliability and Optimization (ARO) System
- Industrial IoT Sensors and Machine Learning Software
- Ability to Integrate with PI

### RESULTS

#### Successful POC with Petasense's PdM System including Integration to PI

- Several machine defects identified within just 2 months
- REST APIs enabled easy integration into PI Vision
- Plans to deploy the system across more assets and other sites

# Questions?

Please wait for  
the **microphone**

State your  
**name & company**



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