aspentech | Technology That Loves Complexity

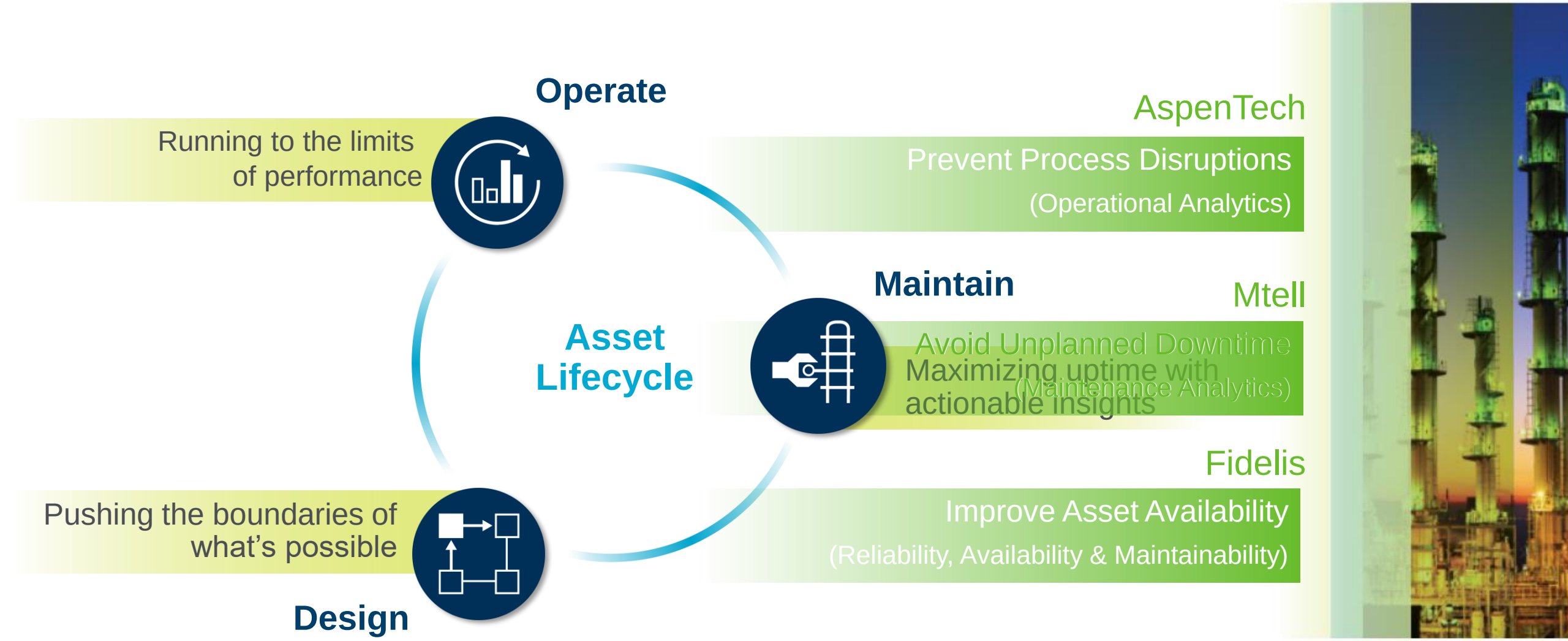
Seminario AspenTech Tampico, México

Procesos y Mantenimiento para Predecir el Comportamiento Futuro y Realizar un Mantenimiento Prescriptivo

Name: Sanzio Cunha, Business Consultant

Date: Apr 26th

APM Suite – Asset Optimization Strategy



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What's Being Challenged?

Industrial Maintenance Best Practices



Run to Failure



Calendar



Usage



Condition



RCM

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Let's Improve Maintenance

85% equipment fails in spite of calendar maintenance - *Boeing*

63% scheduled maintenance is unnecessary – *automation vendor*

The problem is here

process-induced

The spend is here

wear-and-tear

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Introducing Analytics in Maintenance

What has happened? **DESCRIPTIVE**

What will happen? **PREDICTIVE**

What should we do? **PRESCRIPTIVE**



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Prescriptive Maintenance

Symptom Analysis

Diagnosis

Consideration of Treatments

Prescription for Action



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Enlightened Approach



model machines

measure failure signatures

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Software that does the work, so you don't have to …

Prescriptive Maintenance by Aspen Mtell

Autonomous Agents capture Failure Patterns

Interpret every failure signal, every minute of the day and tells you what will happen, when and how to avoid it.



Aspen Mtell Machine learning, adaptive, big data, predictive and prescriptive action

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Aspen Mtell Agents Are Neutral

Know NOTHING about:

THE INDUSTRY YOU ARE IN
oil, chemicals, power …

THE TYPE OF ASSET
compressor, pump, heat exchanger, furnace …

THE PROCESS
batch, continuous, reforming, polyethylene, crude process, pharmaceuticals …



Agents know only the precise data patterns that reflect the actual equipment behavior

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Three Agent Types

1. Hidden Failure Agents
2. Failure Agents
3. Anomaly Agents



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Hidden Failure Agents

Run on demand for a single asset

Scan years of sensor & maintenance history

Detect probability of failure at all points in time

Remove all abnormal excursions to …

> Leave the purest pattern of normal behavior through all campaigns, start-ups/shut-downs, duty cycles, etc.

Identify periods leading to specific failures



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Failure Agents

Run live 24/7 … forever finding failures

Trained from declared work order events…
From a maintenance root cause failure event

NOT an anomaly technique

Ask – what is the exact pattern that lead to failure?

Relentlessly inspect incoming data to give earliest warnings of exact failure patterns recurring
Send alerts, works orders,

And, prescriptive action with full digital work-scope



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Anomaly Agents

Run live 24/7 … forever finding failures & excursions

Report any excursion – could be *failure* or new/unknown *"normal"* – needs a little human help

Automatically request inspection – enter work order directly into the maintenance system

SELECT FAILURE – automatically trains a new Failure Agent – more accurate and warns earlier

SELECT NORMAL – system automatically adds new pattern to baseline normal in the Anomaly Agent

They adapt automatically to changes in process



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No More False Alarms

Where every message is a truthful, early, accurate forecast you can trust delivering good prescriptive advice that you can rely upon and take affirmative action.



Agents Eliminate the False Positives

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Learn on One…Transfer to Many

Where every behavioral aspect you learn transfers; applying the same breakdown, safety and environmental protection to all similar equipment



Agents learn from actual sensor data and retain the knowledge…forever

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Making Machines Smart

with Autonomous Agents™

Learn



Agents learn from their surroundings

Adapt



Agents watch and warn of new danger

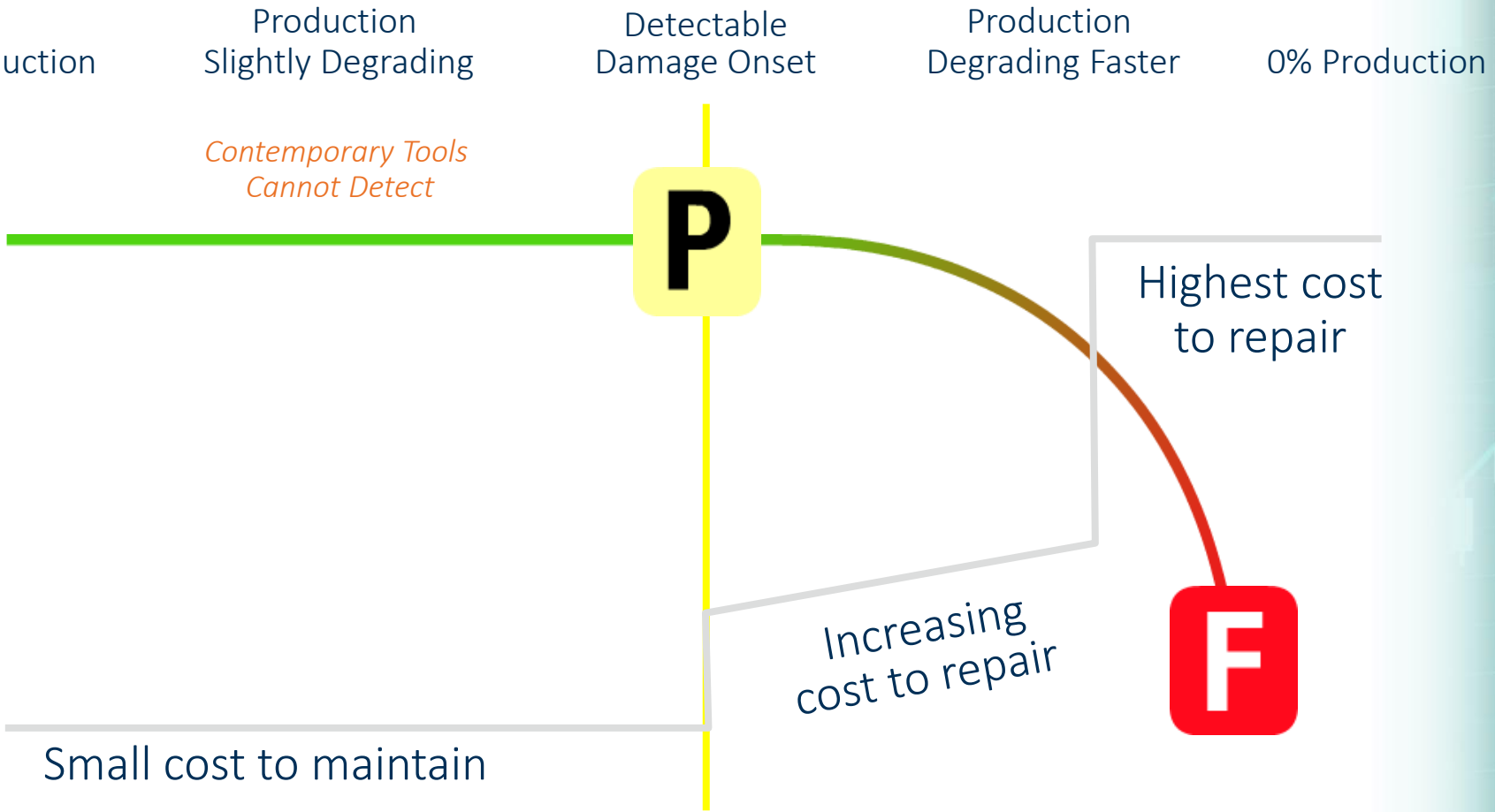
Inoculate



Agents share and increase protection

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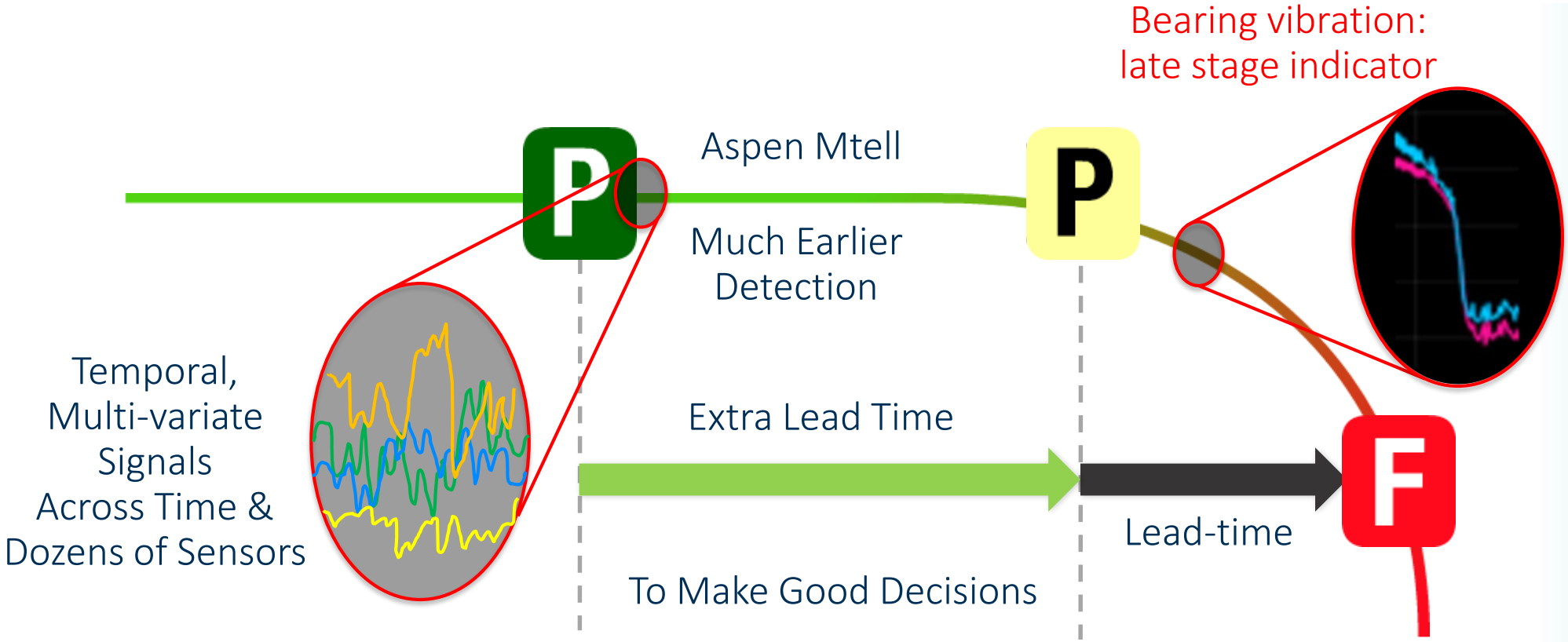
P-F Curve & Maintenance Costs





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Far Earlier Lead-Time-to-Failure

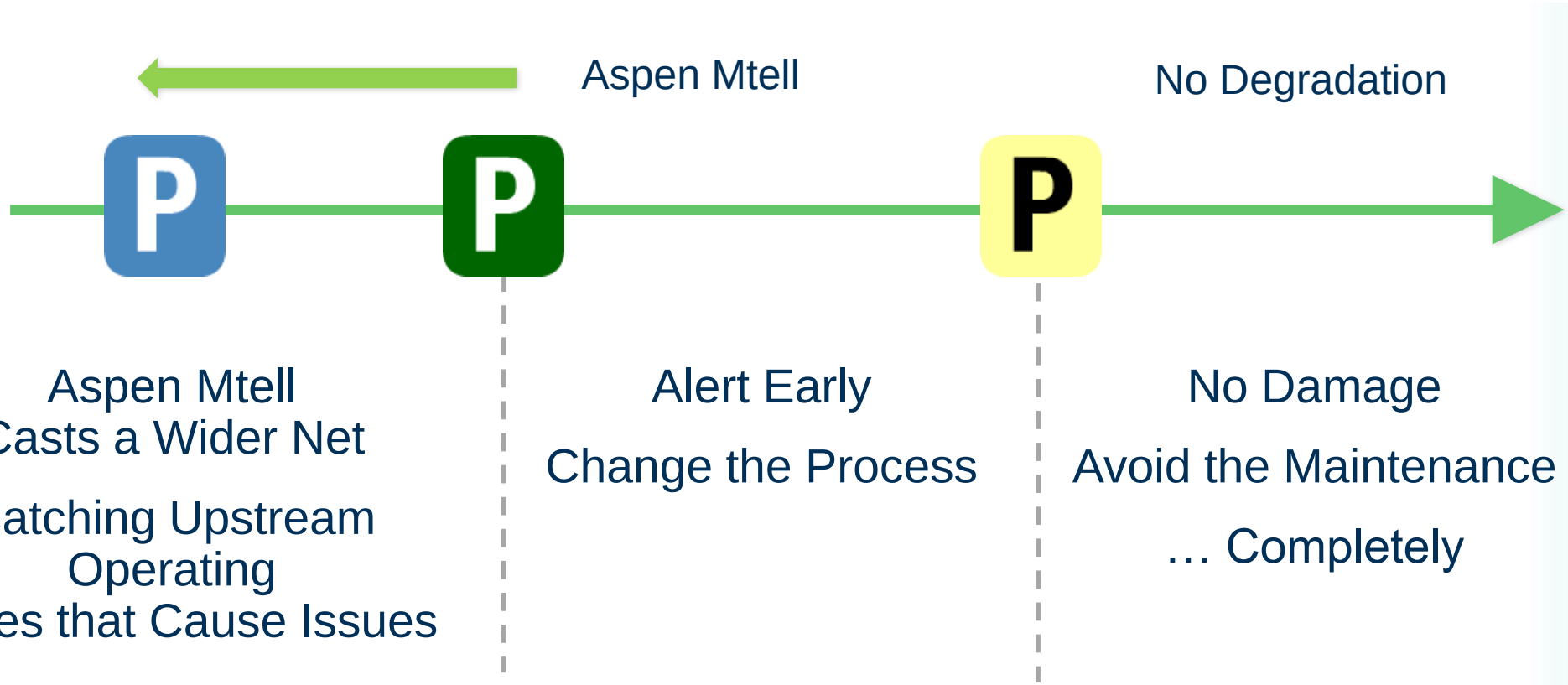




Aspen Mtell Machine Learning Sees Things That Humans & Other Technologies Cannot

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Catch More Than the 18% Mechanical Errors

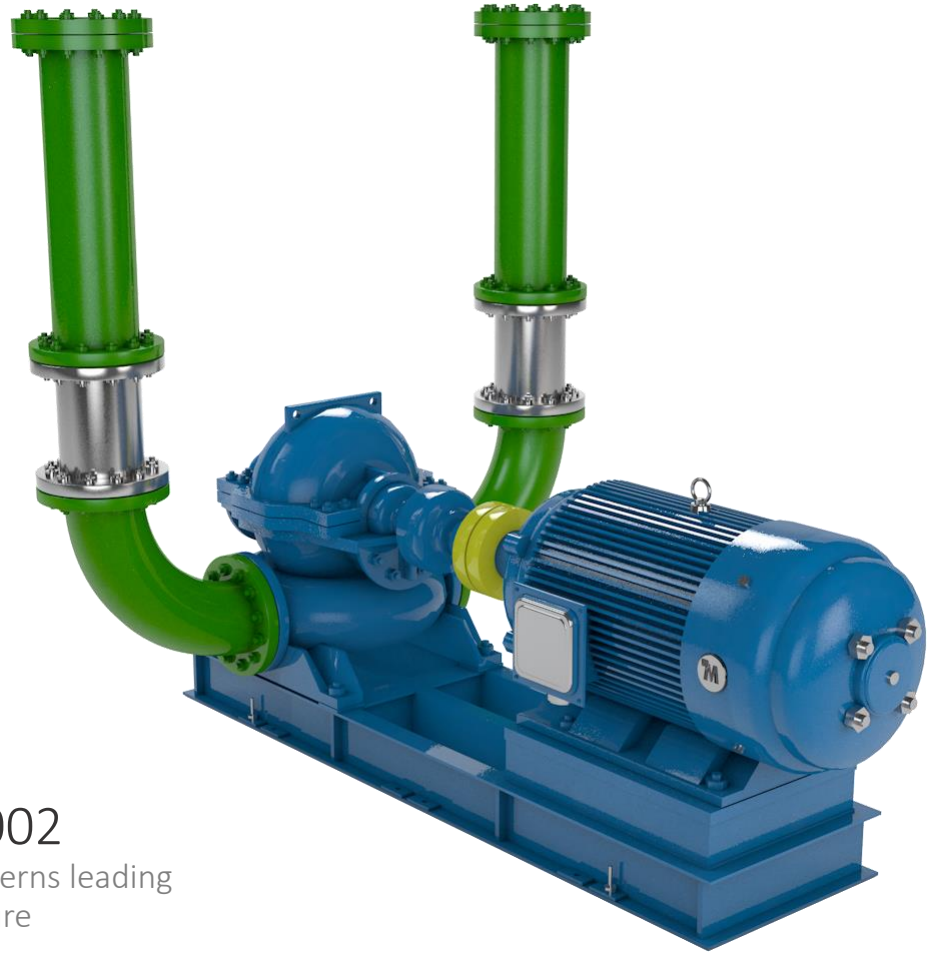




Only Aspen Mtell Steps Up to Address 100% of Failures Issues

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Many Agents per Asset





Anomaly Agent

Knows all learned patterns

matching all normal operating states



Failure Agent 002

Knows precise signature of patterns leading to drive coupling failure



Failure Agent 001

Knows precise signature of patterns leading to bearing failure



Failure Agent 003+

Many other agents assigned to detect exact failure patterns

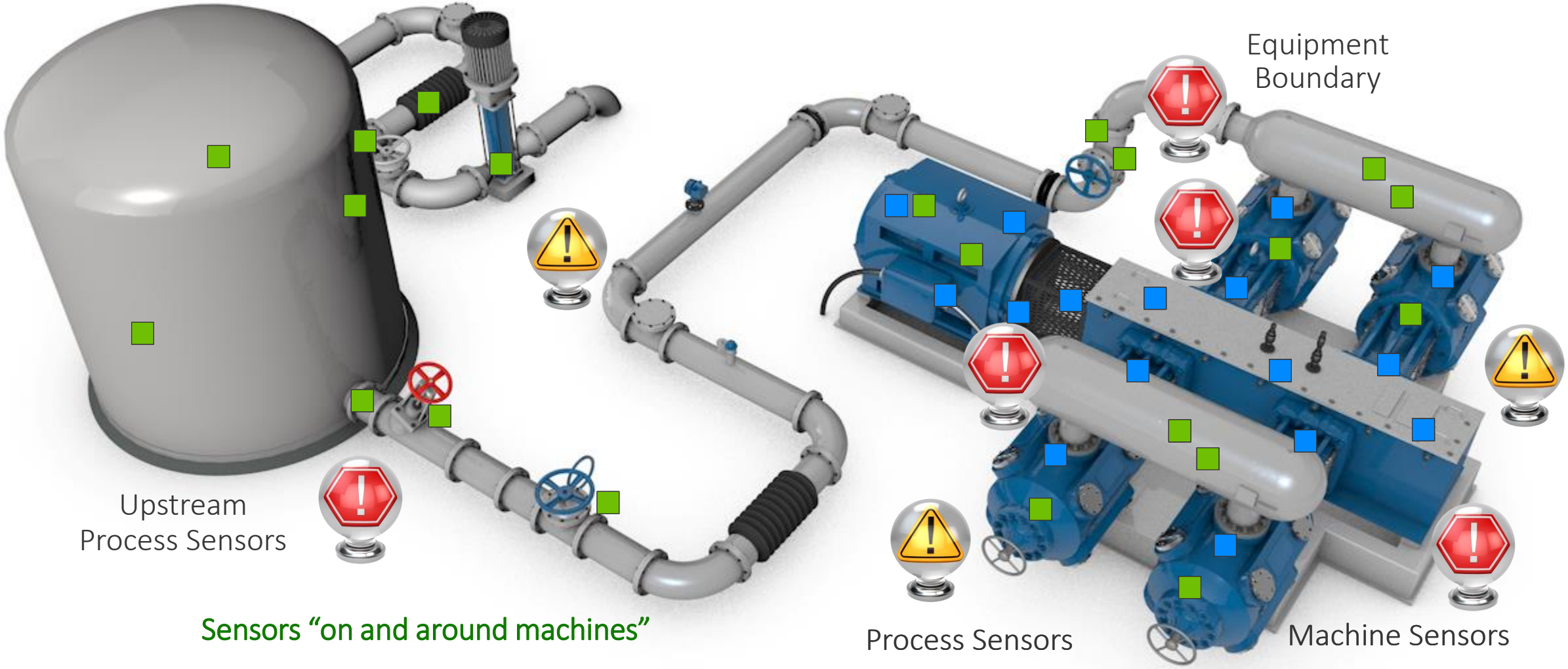
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Agents Cast a Wider Net



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Sensors On & Around Equipment



Sensors “on and around machines”

ensure agents alert root cause of issues

Process Sensors

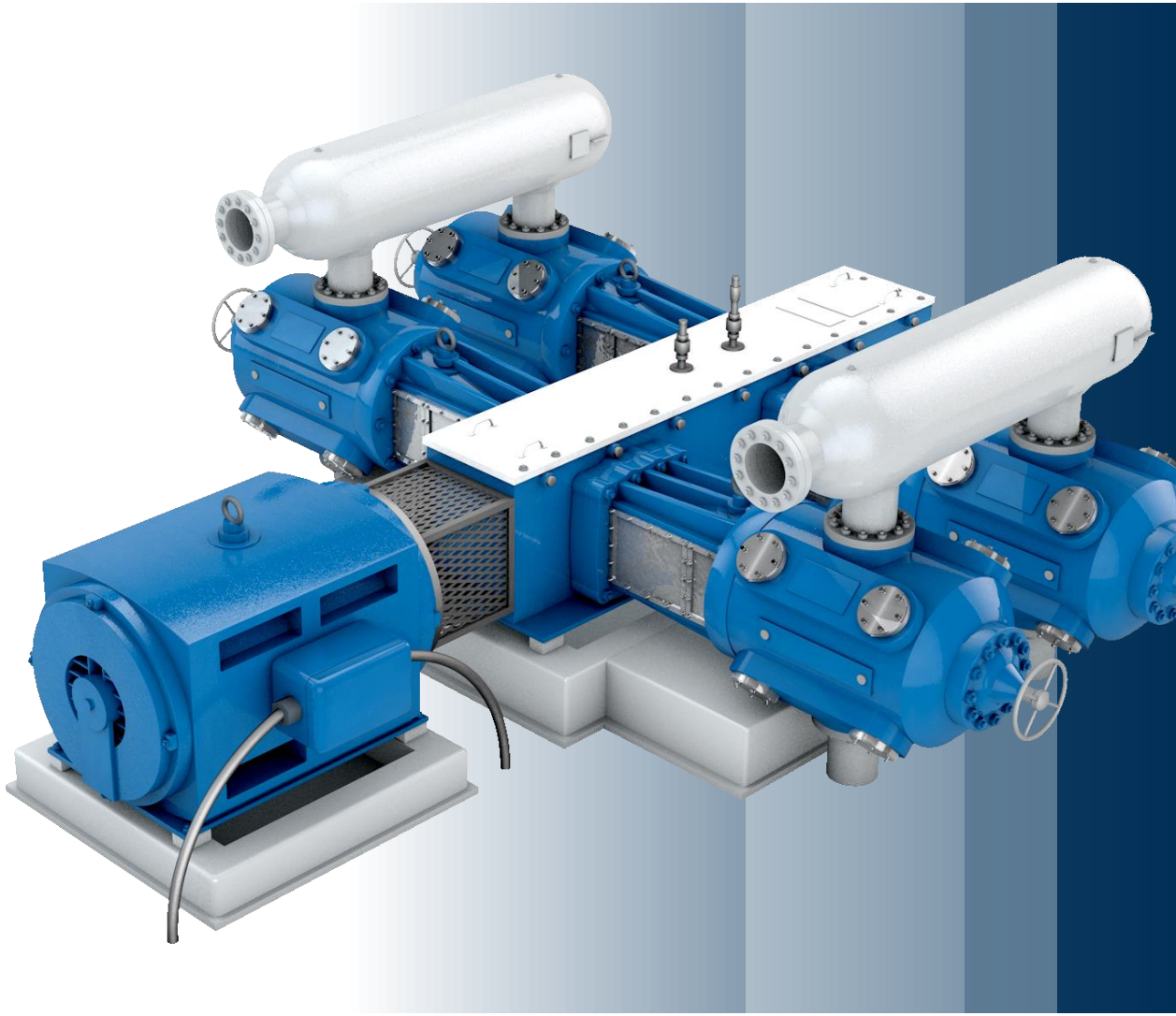
e.g. Press, Temp, Level, Flow…

Machine Sensors

e.g., Vibrations

Refining Case Study

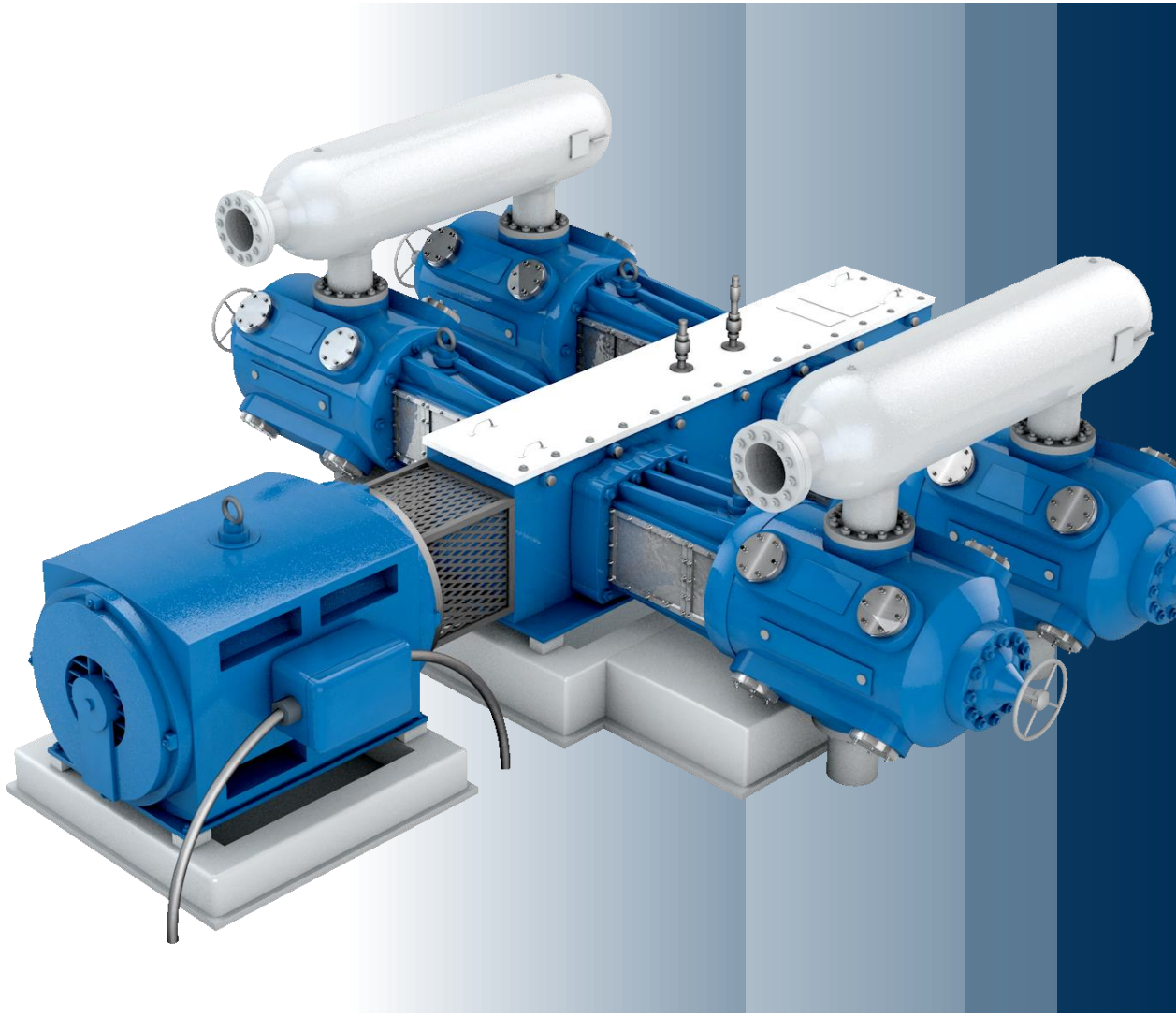
- Decades-long issues with compressors failing in spite of $millions on vibration systems & RCM
- Regular, periodic failures requiring $multi-million overhauls and production losses several times larger
- The goal is to find root cause very early before major damage occurs



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Refining Case Study

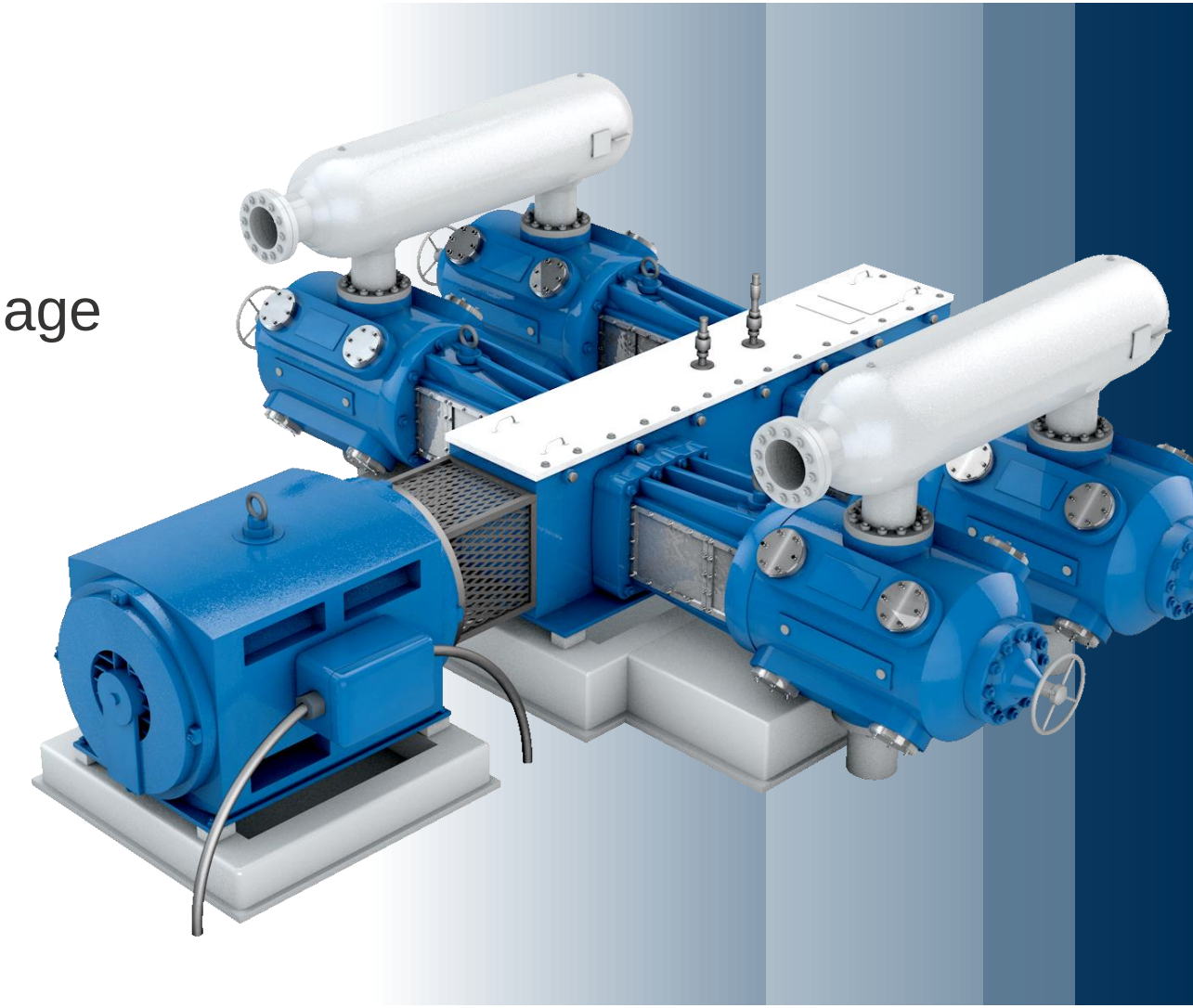
- Autonomous Agents™
  cast a “wider net” around equipment
  to cover process & machine issues
- Root cause detected =
  Liquid carry-over
- Chief rotating engineer:
  “You can do that? I cannot apply
  enough people to do that level of
  monitoring & analysis”



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Refining Case Study

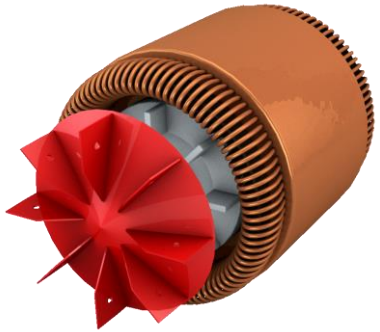
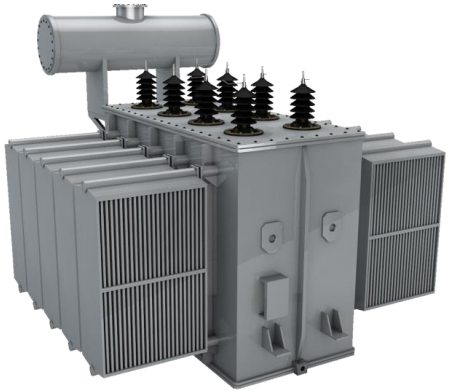
- Third-stage valve issues detected
- Alert to Cause = 8 weeks:
  7 weeks before vibration suggests damage
- Savings: $X MM Repairs
  and Loss of Product



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Types of Assets

Industrialized machine learning based prescriptive analytics
works on more than rotating equipment

Pumps & Compressors	Motors & Drives	Electrical Transformers	Vehicles	Process Equipment
				
Centrifugal Reciprocating Rotary	Centrifugal Reciprocating Rotary	Plus Other Static Equipment	Heavy Haul Trucks Locomotives	Chillers Ht. Exchangers Boilers

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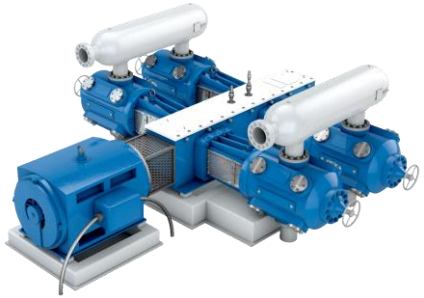
Current Industries



Transportation



Water / Wastewater



Refining



Pharma



Upstream



Mining



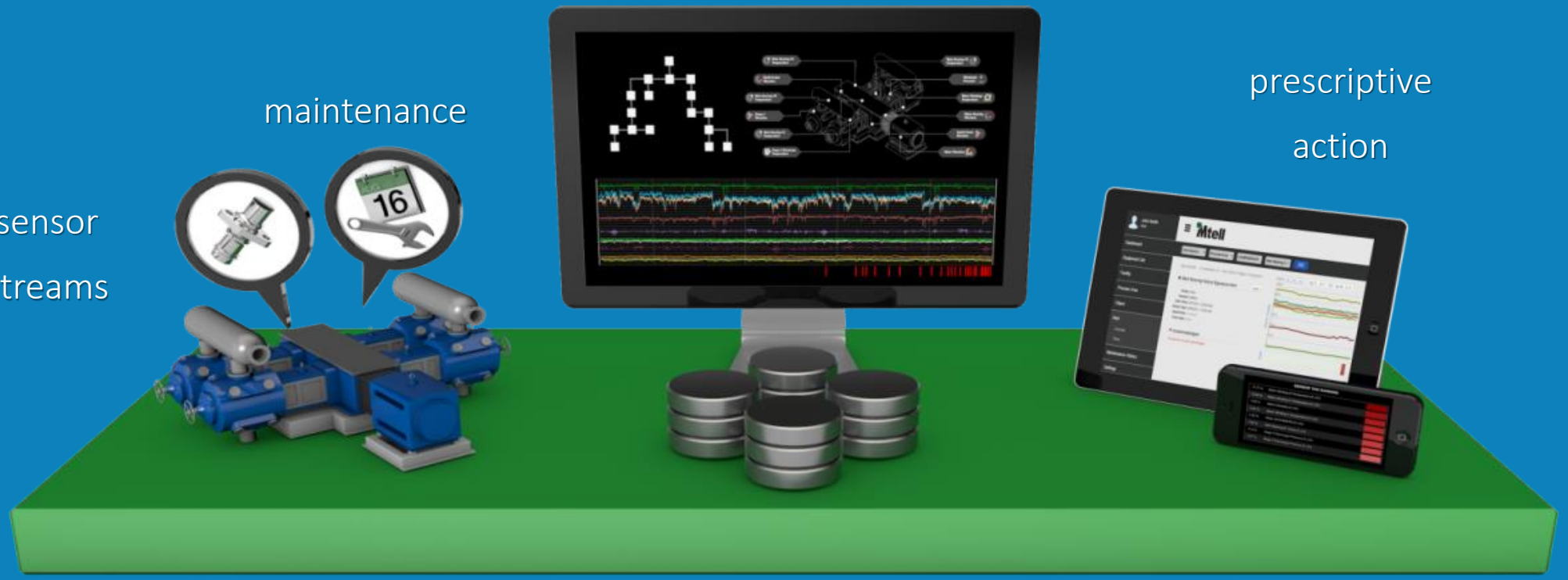
Pulp & Paper



Chemicals

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Information Flow

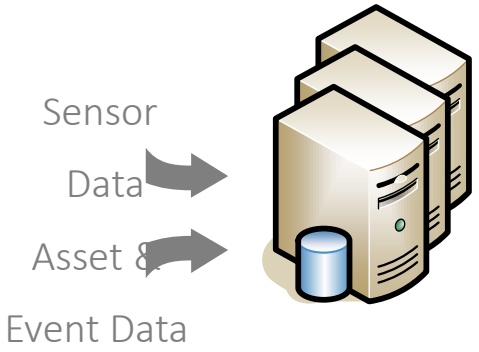


connect → import → combine → analyze → present

leverages existing infrastructure: plant historian sensor data streams, and EAM system

Scaling

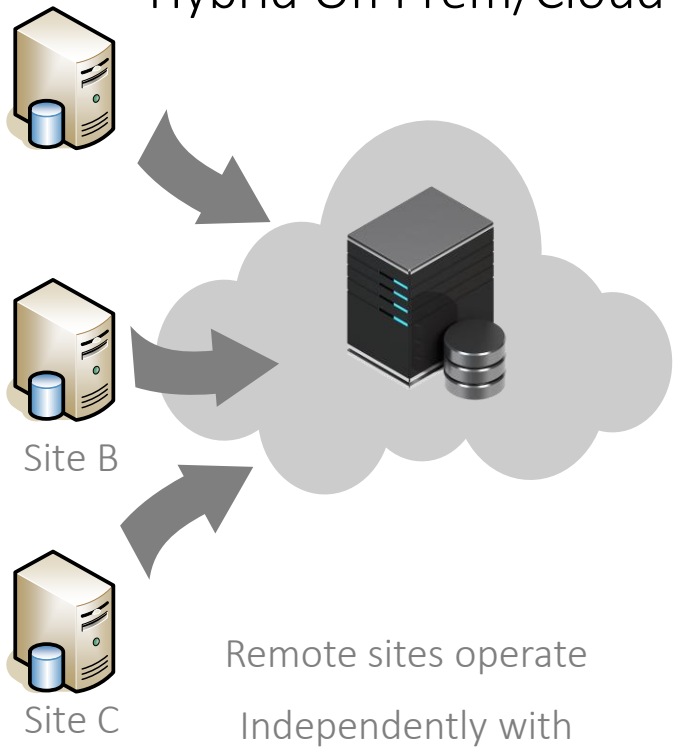
On Premise



Single Windows Server scales

to multiples for increasing # of Agents deployed, data collection, web server requirements, etc.

Hybrid On Prem/Cloud

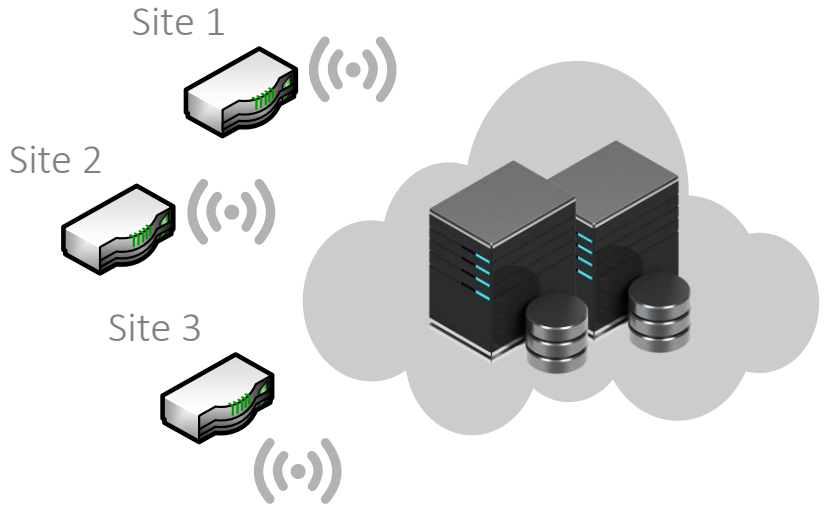


Remote sites operate

Independently with

Full connection enabling remote SME's

Private (Public) Cloud



Edge data gateway devices move data to/from Cloud. Very large computers do all processing and ML training. Enables SME's over multiple sites/customers

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Methodology

1. Install & configure Mtell Previse
2. Import sensor & failure history
3. Denominate™ algorithm: align, validate, focus, & bind



4. Apply safe operating limits
5. Automatically Analyze & build All Agents
6. Automatically Tune & Select Best Agents
7. One Button: Deploy Agents
8. Monitor with live Anomaly & Failure Agents
9. Failure Agent detects degradation
10. Send W.O. with full digital workscope
11. Anomaly Agent detects new excursion
12. Send request for inspection
13. Classify: new normal, or unseen failure
14. Auto adapt & implement changes

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Smart Machine Results



Machines stop breaking down



Machines last longer



Net output increases dramatically



Maintenance costs decrease dramatically

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Mtell Prescriptive Maintenance

The only solution that…



Tells you WHEN and HOW an asset will fail and WHAT to do to prevent it



Does not require you to know more than you already know



Uses Agents to do what experts cannot do



Converts anomaly alerts into more accurate failure alerts



Inoculates similar assets with the same safety and breakdown protection



Approaches 100% of issues: mechanical & process degradation

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Gracias por Participar!