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An equipment health journey

Connecting the AVEVA™ PI System with AVEVA™ Predictive Analytics

Allen Turner – International Paper

Alex Jenkins – AVEVA

AVEVA

Allen Turner

Manager, Remote Analytics

- International Paper – Advanced Analytics Center
- Allen.Turner@ipaper.com

Alex Jenkins

Senior AI Solutions Engineer

- AVEVA
- Alex.Jenkins@aveva.com

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International Paper

Who We Are

- Founded in 1898

- 39,000 employees worldwide

- 250 facilities (35 U.S. states & 10 countries)

- 21,000 customers in 150 countries

- $21.2 billion net sales in 2022

- Our businesses – Industrial Packaging
  Global Cellulose Fibers

Core Values

It's about... **LIFE** — LIFE-CHANGING INJURY AND FATALITY ELIMINATION

COURAGE TO CARE

Recognition

2022 WORLD'S MOST ETHICAL COMPANIES® — WWW.ETHISPHERE.COM — 16-TIME HONOREE

FTSE4Good

FORTUNE — THE WORLD'S MOST ADMIRED COMPANIES

THE AMERICAN OPPORTUNITY INDEX — 2022 BEST EMPLOYERS

BEST COMPANIES TO WORK FOR WOMEN — WOMEN'S CHOICE AWARD 2023

Source: International Paper – Corporate Communications

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Pulp & paper – continuous industrial manufacturing

Typical pulp mill

- 4 main unit operations
- ~30,000 total equipment assets
  - ~5% designated critical
  - ~1% high priority critical assets
- ~1,500 control loops
- ~30,000 to 100,000 process data tags
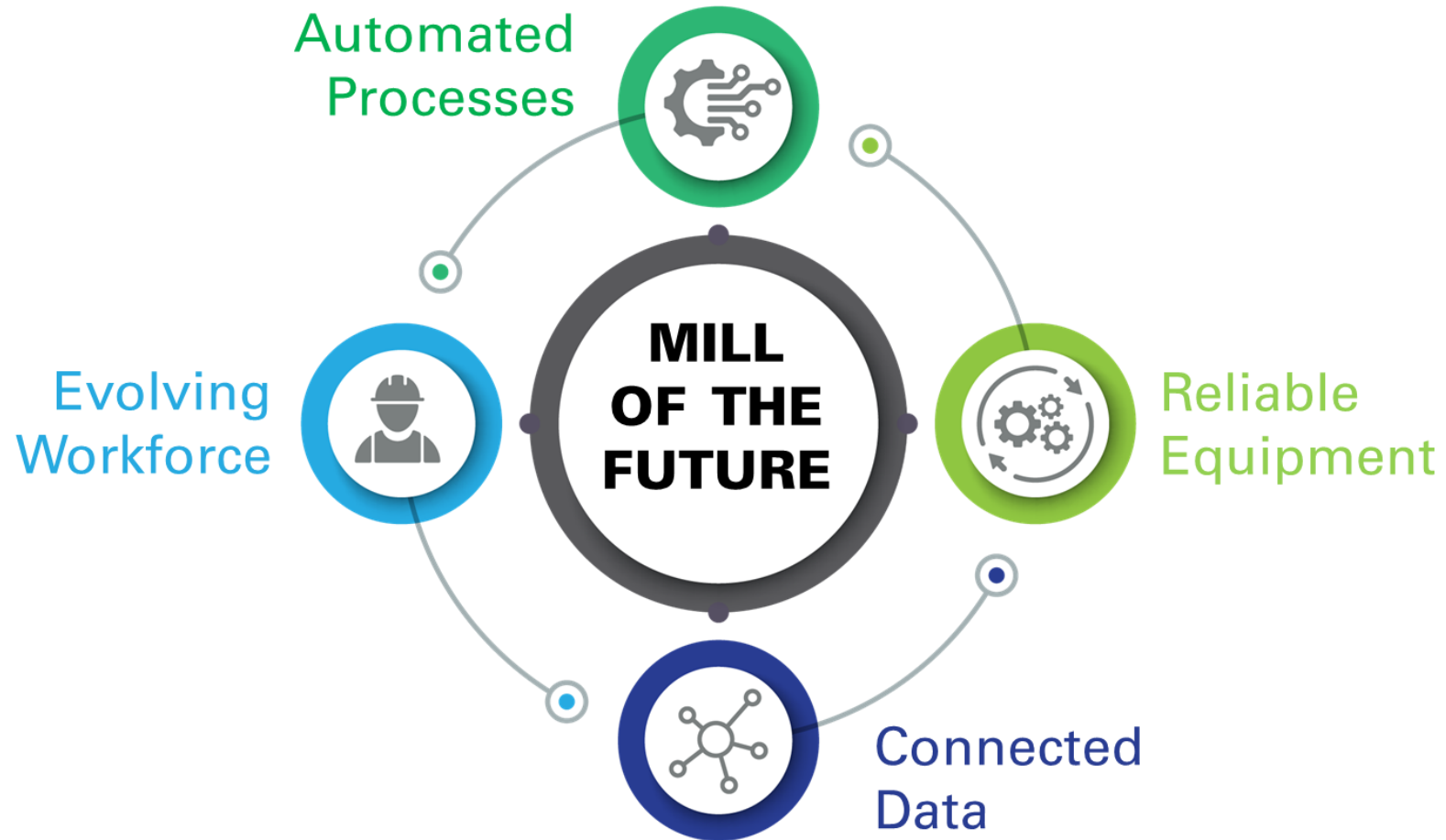
International Paper – by the numbers

- Facilities: 29
- PI Servers: 46
- PI Tags: 1.5 Million
- Equipment: 120,000 Rotating Equipment

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What is a Mill of the Future?

Automated Processes

Reliable Equipment

MILL OF THE FUTURE

Evolving Workforce
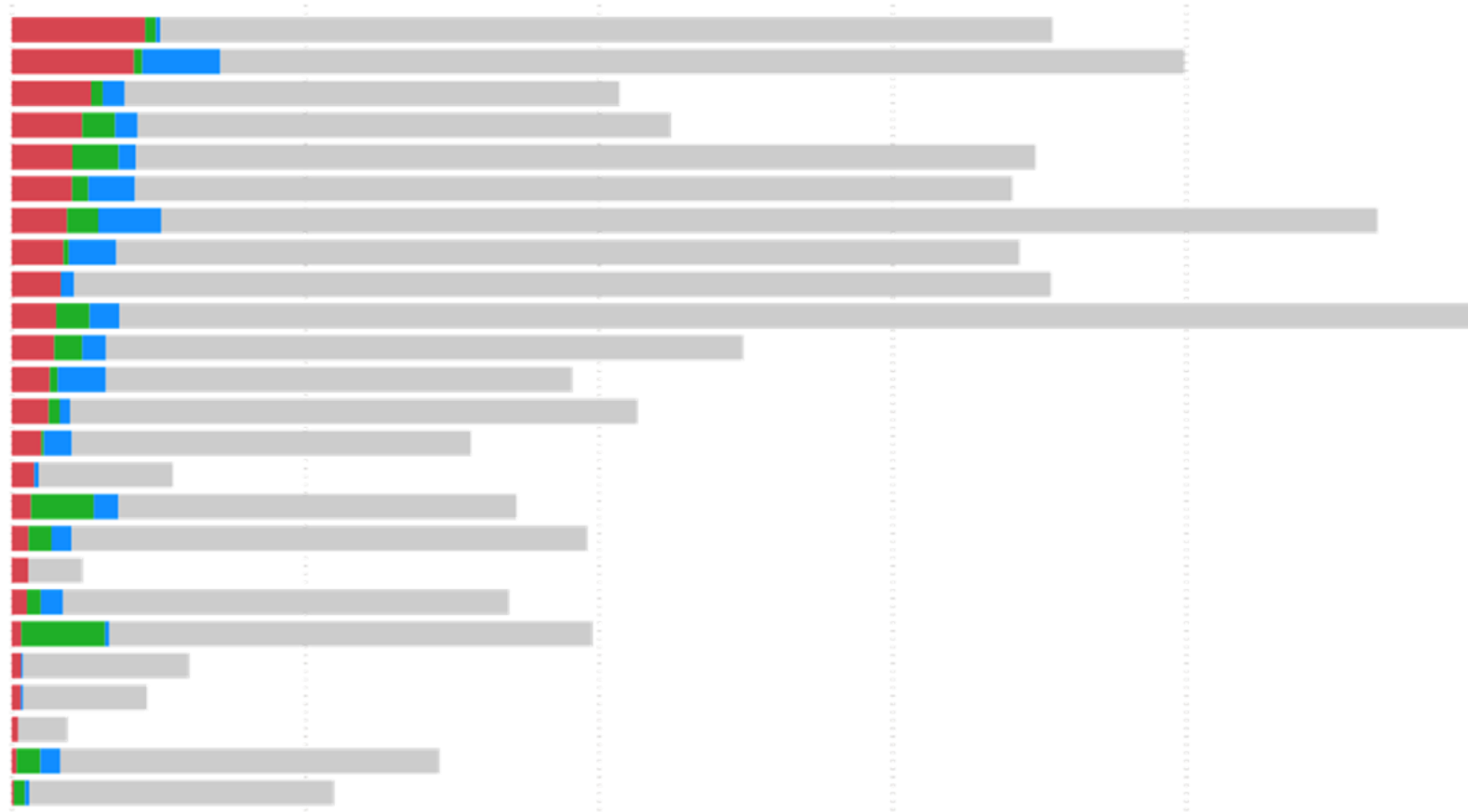
Connected Data

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Our equipment health analytics journey

Full vision is to reach Level 4 COLM of Critical rotating equipment to reach maximum value of expected equipment life
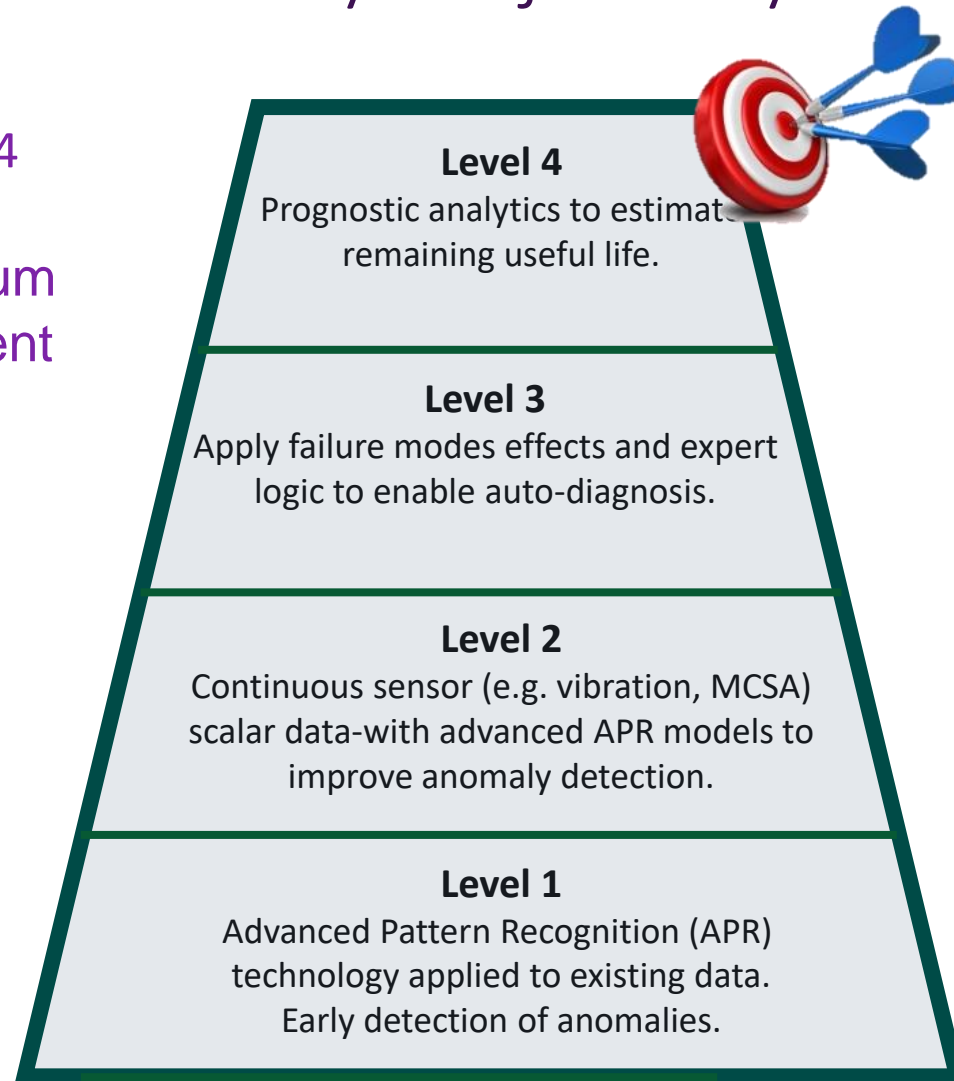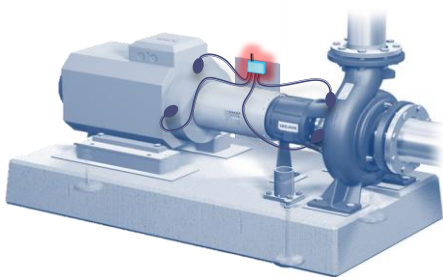
Level 4
Prognostic analytics to estimate remaining useful life.

Level 3
Apply failure modes effects and expert logic to enable auto-diagnosis.

Level 2
Continuous sensor (e.g. vibration, MCSA) scalar data-with advanced APR models to improve anomaly detection.

Level 1
Advanced Pattern Recognition (APR) technology applied to existing data. Early detection of anomalies.

Pulp & paper - reliability opportunity

Reliability events over four (4) years

Annual potential **continuous on-line monitoring finds** for the enterprise

Future projects will go after other failure modes until all failures are eliminated.
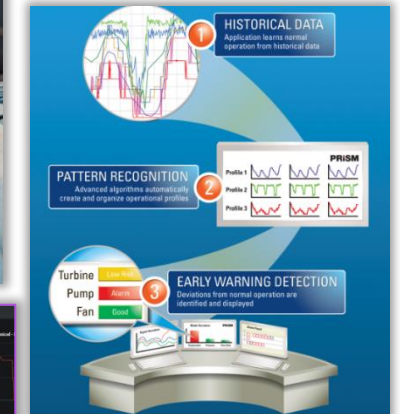
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Equipment health - continuous on-line monitoring

An investment in disruptive technology including advanced sensors and data analytics for critical rotating equipment to eliminate unplanned failures and extend equipment life.

- Advanced sensors, both wired and wireless sensors for critical rotating equipment

- Advanced pattern recognition (APR) for continuous monitoring and diagnostics – predicting failures and providing early warning of equipment issues days, weeks, or months prior to pending failure

- AVEVA™ PI System, PI Asset Framework, and AVEVA™ Predictive Analytics are foundational tools for this project.

Advanced Analytics Center

Source: International Paper – Corporate Communications
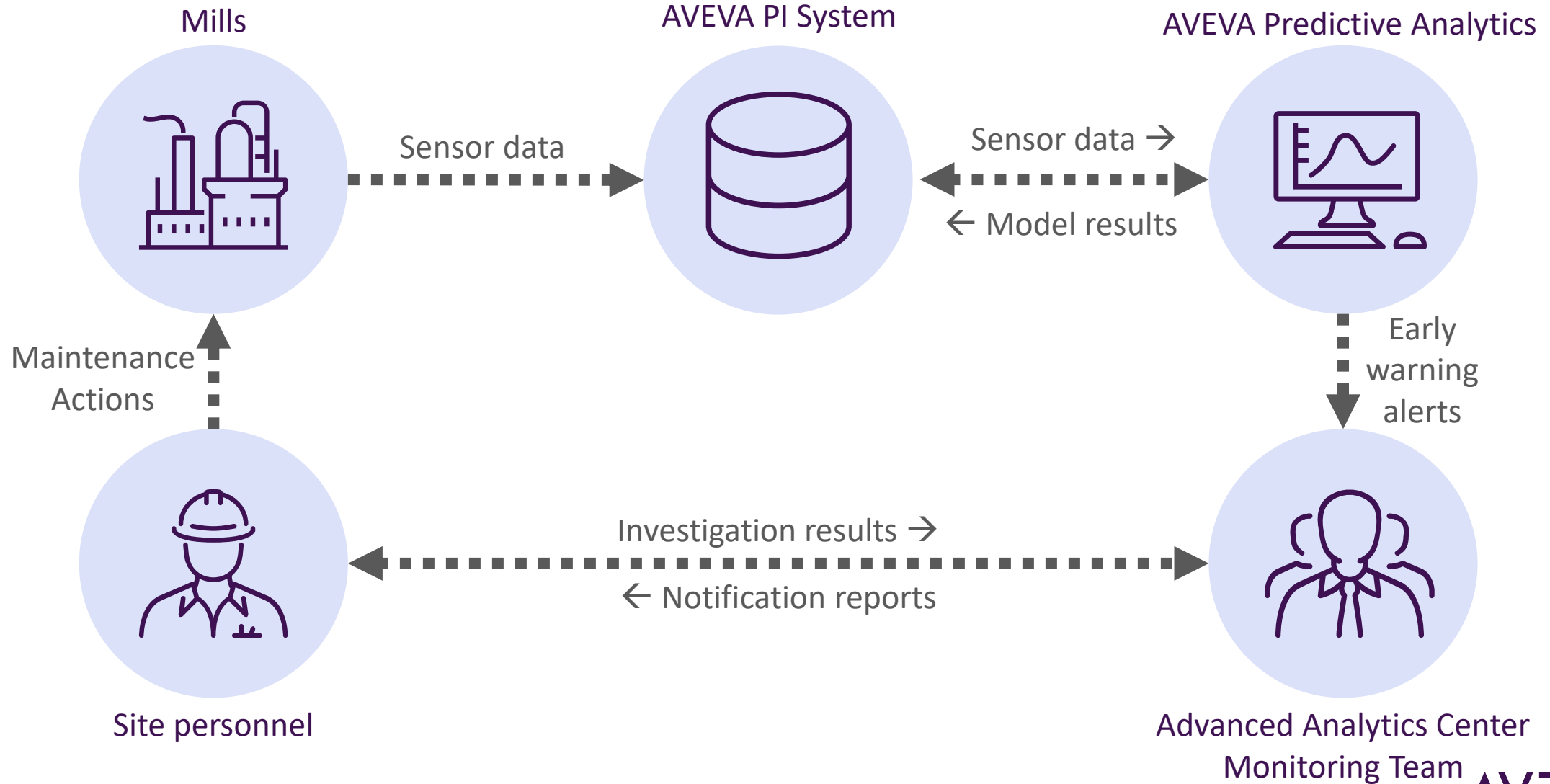
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Centralized Analytics Team – A2C

Advanced Analytics Center (A2C): An investment in a centralized cross-functional team that is strategically focused on value generation from manufacturing data

- Concept initiated March 2018

- Located in Atlanta's Technology Square

- A "flashlight" into our mill processes

- Early warning of drifts

- Continuous audit process

- Operational data and equipment status

- Delivering data to the right people at the right time

TSQ ATL

Source: International Paper – Corporate Communications

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Solution architecture

Mills

AVEVA PI System

AVEVA Predictive Analytics

Sensor data

Sensor data →

← Model results

Early warning alerts

Maintenance Actions

Investigation results →

← Notification reports

Site personnel

Advanced Analytics Center Monitoring Team

Path to success with AVEVA™ Predictive Analytics

Implementing AVEVA™ Predictive Analytics within your organization

- People – Process – Technology
  - You need all three!

- Avoid the temptation to focus only on one aspect
  - Common risk is for engineers to focus mainly on the technology
  - The world's best, most optimized, finely-tuned model will mean nothing if you don't have the people to use it or the processes to integrate it with the rest of the business

- Establishing a **monitoring center** whose focus is on detecting early signs of equipment failure, and communicating that out to individual sites, makes overall success much more likely

People

Technology

Process

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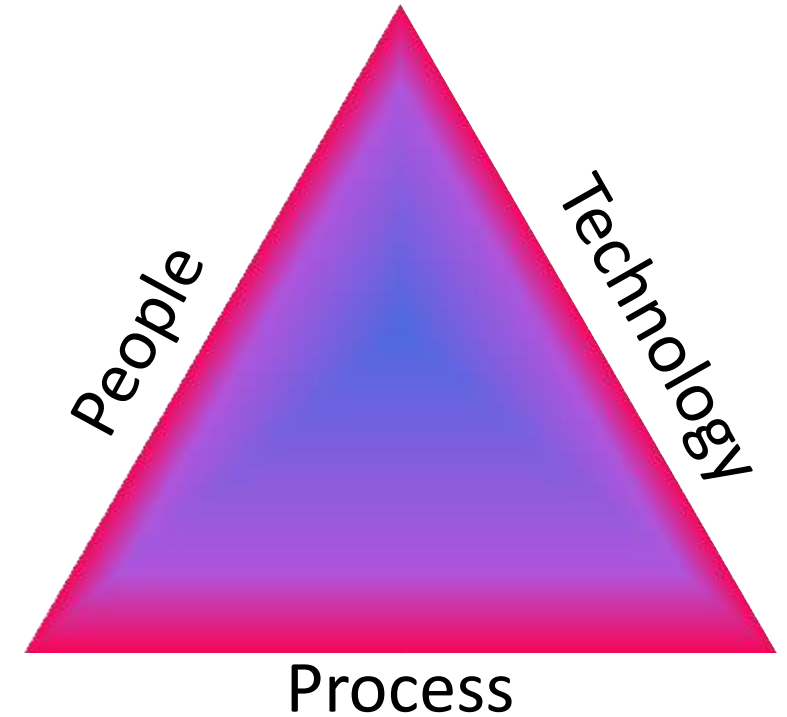
The people

Roles & responsibilities

Analyst
- Performs regular reviews of early warning alerts
- Provides initial diagnoses and create reports

Model Building Engineer
- Builds new models and templates
- Updates models based on real-world feedback

Subject Matter Expert
- Provides technical expertise to model builders and analysts
- Confers with sites

Program Champion
- Manages the monitoring team
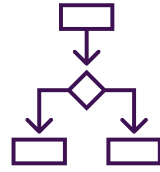- Gathers and reports on successes to the wider org

IT Admin
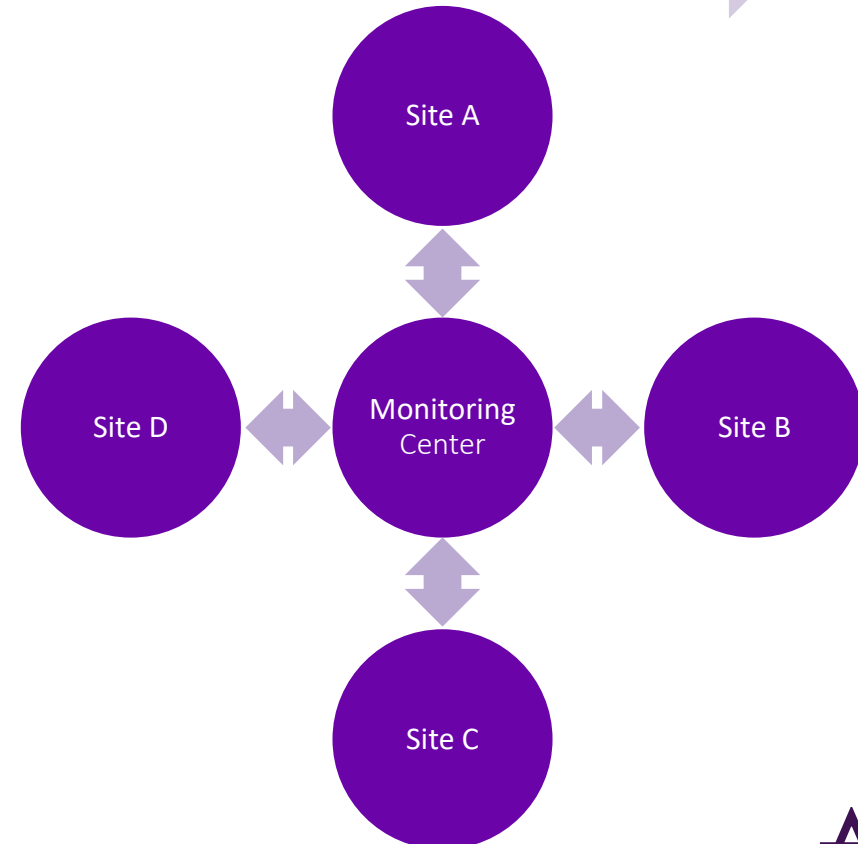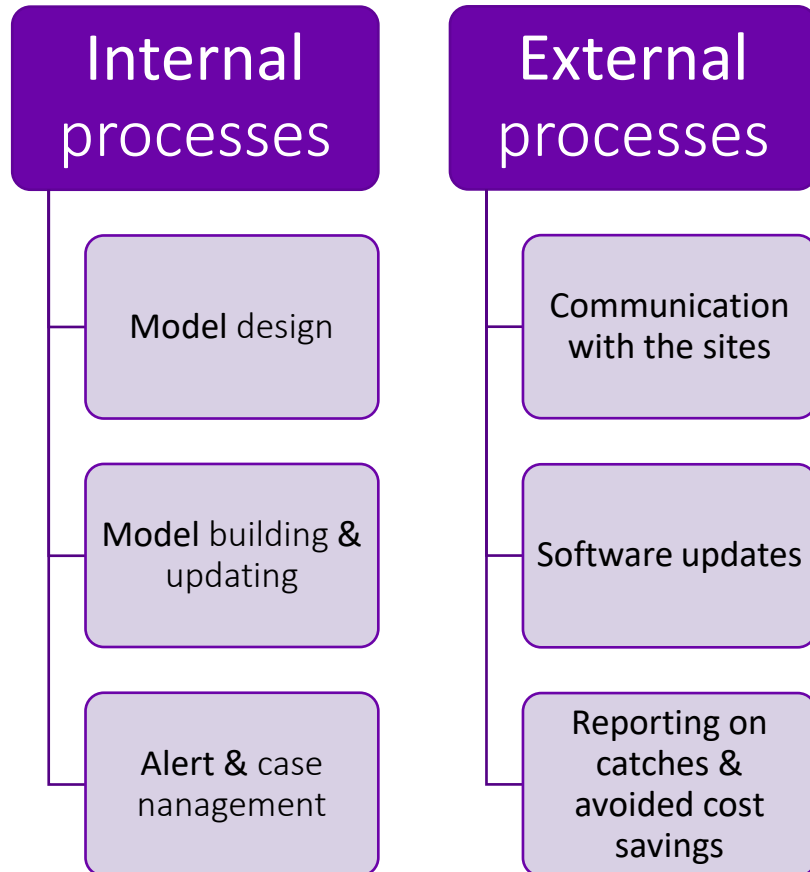- Manages data infrastructure and access rights
- Keeps software running

Site Contact
- Receives reports from monitoring center
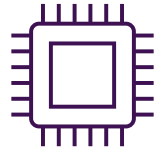- Determines appropriate action at site-level

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The process

Making it all work

| Determine scope | Create project & link to template | Import & clean historical data | Test model & refine | Deploy model |

| Internal processes | External processes |

Internal processes
- Model design
- Model building & updating
- Alert & case management

External processes
- Communication with the sites
- Software updates
- Reporting on catches & avoided cost savings

Site A

Site D — Monitoring Center — Site B

Site C

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The technology

Using the tool

- AVEVA™ Predictive Analytics is designed to enable the monitoring center to work efficiently

  - **Templates** establish consistency between models for similar equipment

  - **Bulk model building** speeds up deploying lots of models at once

  - **Alert & case management** helps keep track of which alerts have been evaluated

  - **Sensor quality management** helps identify bad sensors and dynamically removes them from the models

  - **Fault diagnostics** provide likely causes of alerts, and prescriptive actions to take

  - **Reports** provide high-level summary of the active models

  - **Forecasting** estimates urgency and time remaining of each issue

- To be effective, all of those functions require the **right people** following **good processes!**
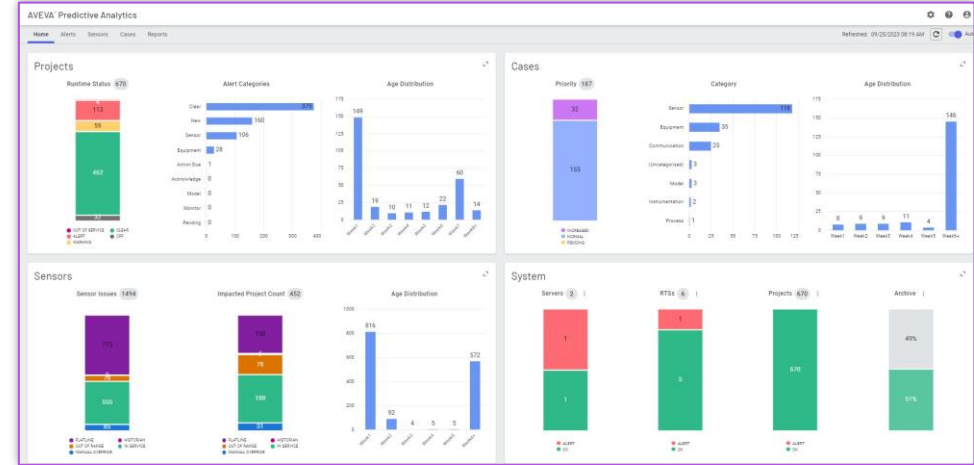
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Typical diagnostic model catch

Paper Machine roll – AVEVA™ Predictive Analytics deviation alarm

Typical diagnostic model catch

Paper Machine roll – AVEVA™ Predictive Analytics deviation alarm

Drive side fault confirmed in the field.

Continuous on-line monitoring

Challenge:

- Dramatically reduce / virtually eliminate unplanned failures of critical rotating equipment at our pulp & paper manufacturing sites.
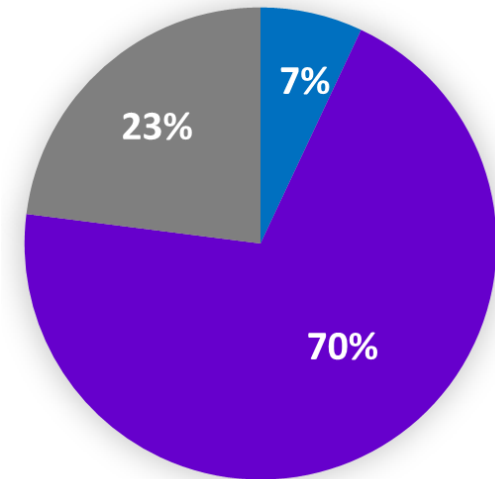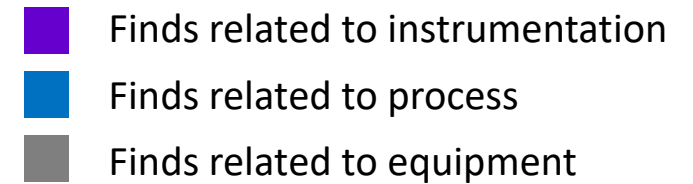
Solution:

- Our COLM project combines equipment criticality, reliability incident data, advanced sensors data, and real-time operating data using the AVEVA™ PI System archive and AVEVA™ Predictive Analytics platforms

- ## Results

  - Reliability incidents were reduced by 70%

  - Downtime hours were reduced by 77%

  For monitored equipment: (2 year baseline vs 2 year results)

Legend:
- Finds related to instrumentation
- Finds related to process
- Finds related to equipment

Pie chart: 70% (purple), 23% (gray), 7% (blue)

More information

Mill of the Future

Advanced Analytics Center

[Scan below to learn more!](#)

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