Introduction to Process Optimization and Advanced Analytics with the PI System

Presented by  
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Where are we in our PI 101 Journey

01 Landscape
- My Operational Data, the PI System and the Greater Technology Landscape

02 Asset Health
- Introduction to Asset Monitoring & CBM with the PI System

03 Process Optimization
- Intro to Process Optimization & Advanced Analytics with the PI System

04 Visualization
- Introduction to Visualizing data with the PI System
Where are we in our PI 101 Journey

01. Landscape
   My Operational Data, the PI System and the Greater Technology Landscape

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04. Visualization
   Introduction to Visualizing data with the PI System
Process optimization is a journey

Issue needs a solution

Opportunity is identified

Heroic levels of optimization
Two questions to be addressed in 30 minutes

How can the process of **process optimization** be optimized?

Is there a *buzz* word that I can use to optimize a process?
Age-old questions in process optimization

How can we:

- Production by $X\%$?
- Production time by $\Upsilon$ hours?
- Operating costs by $\$Z$?
Process optimization can be streamlined with the right tool set

**Identify**

**What** components are inefficient?

- **Challenges**
  - Data silos
  - Access overhead

**Solution**

**Analyze**

**Why** is it inefficient?

- **Challenges**
  - Many “truths”
  - Comparison difficulty

**Solution**

**Implement**

**How** can we improve it?

- **Challenges**
  - Thermodynamics
  - Fluid mechanics

**Solution**

**Validate**

**Did** the process’s efficiency improve?

- **Challenges**
  - Data silos
  - Access overhead

**Solution**
How can the **PI System** help optimize a process?
• Located in Bend, OR
• Founded in 1988
• Pub opened in Portland, OR in 2007

• 2 brewhouses
• 50+ vessels
• Bottling and kegging
• 7th largest US craft brewer
Quick data access enables production increase

Challenge
“...uncharacteristic cooling behavior...”

Solution
“...PI System enabled the brewing team to quickly and efficiently implement a solution to correct this uncharacteristic behavior...”
An ideal cooling process for the *entire* tank

- Tank level
- Top, middle, and bottom zone temperatures
- Cooling duration

Identify -> Analyze -> Implement -> Validate
A deviation in cooling causes a delay in production.

Impact:
- Production
- Quality

1. Top zone separation
2. Yeast pull
3. Top zone spike
4. Additional duration

Identify → Analyze → Implement → Validate
Before we save the beer … what magic happened?
Monitor temperature at the bottom of the vessel

Identify → Analyze → Implement → Validate
Cone region response correlated with top region

1. Top & cone zone separation
2. Yeast pull
3. Top zone spike
4. Additional duration
5. Something happens in cone

Identify → Analyze → Implement → Validate
Hypothesis drives change in process

Cool the cone of the vessel as fermentation begins to cease
Process change reduces cooling time

Result

Production

Quality

Identify

Analyze

Implement

Validate
Process optimization can be streamlined with the right tool set

**Identify**

What components are inefficient?

**Analyze**

Why is it inefficient?

**Implement**

How can we improve it?

**Validate**

Did the process’s efficiency improve?

**Challenges**

Data silos

Access overhead

Solution

**Challenges**

Thermodynamics

Fluid mechanics

Solution

**Challenges**

Many “truths”

Comparison difficulty

Solution

**Challenges**

Domain expertise required

Solution
Advanced Analytics
Ways to get value from (big) data with advanced analytics

Data Warehouses
- Centralizing data from different business systems

Visual Correlations
- Visualizing data sets across multiple variables

Data Science
- Identifying patterns with statistical approaches
Need to predict transition from fermentation to free rise

**Challenge**
- Transition occurs between infrequent manual measurements

**Diagram**

- **Filling**
- **Free Rise**
- **Cooling**
- **Ready to Transfer**
- **Emptying**

**Time (hours)**
- 10 20 30 40 50 60 70

**Apparent Degree of Fermentation**
- 0.1 0.2 0.3 0.4 0.5 0.6 0.7

- Too late
- Transition
- Can this be predicted?
Spreadsheet analytics proves confidence in predictability

Bring Raw Data In

Clean it Up

Fit to a Line

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>Apparent Degree of Fermentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</table>
How to operationalize data preparation and predictions
How to operationalize data preparation and predictions

Predictions as Future Data
Refining a predictive model takes iterations and expertise.

**Benchmark:** Measure accuracy against a standard (based on historical data)

**Predict:** Use 2 early densities to estimate transition time

**Refine:** Base predictions on brand for greater accuracy
Operationalizing predictions on when the transition occurs … for all brands and vessels
In summary

Is there a *buzz* word that I can use to optimize a process?

How can the process of **process optimization** be optimized?

**PI Integrators**

- Automated data preparation for advanced analytics

**Cortana Intelligence Suite**

- Apply advanced analytics to data to gain insight

**PI System**

- Quick data access
- One version of truth
- Asset and event organization
Thank You

감사합니다

谢谢

Merci

Danke

Gracias

Спасибо

Obrigado

ありがとう
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Cone region response correlated with top region
Monitor temperature at the bottom of the vessel

Identify

Analyze

Implement

Validate
In summary

• Is there *actually* a buzz word that I can use to optimize a process?
  – Easy-to-use tools exist to automate data preparation
  – Data science can be tackled with out-of-the-box tools

• How can the process of *process optimization* be optimized?
  – Don’t let data silos prohibit quick data access
  – Have a single version of the truth
  – Organize data around common language and events