Distillation Tower Fouling Prediction: Anomaly Detection & Causality Analysis Using Using Process Health Solution (PHS)

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Ascend Performance Materials

conneqt

Distillation Tower Fouling Prediction: Anomaly Detection & Causality Analysis Using Machine Learning

Ascend Performance Materials

Introduction

Ascend Performance Materials

- Headquartered in Houston, TX
- Global leader in integrated nylon production
- Global presence

Liberty Barney

- Data Scientist
- Artificial Intelligence, Automation, & Reporting Group

Seeq

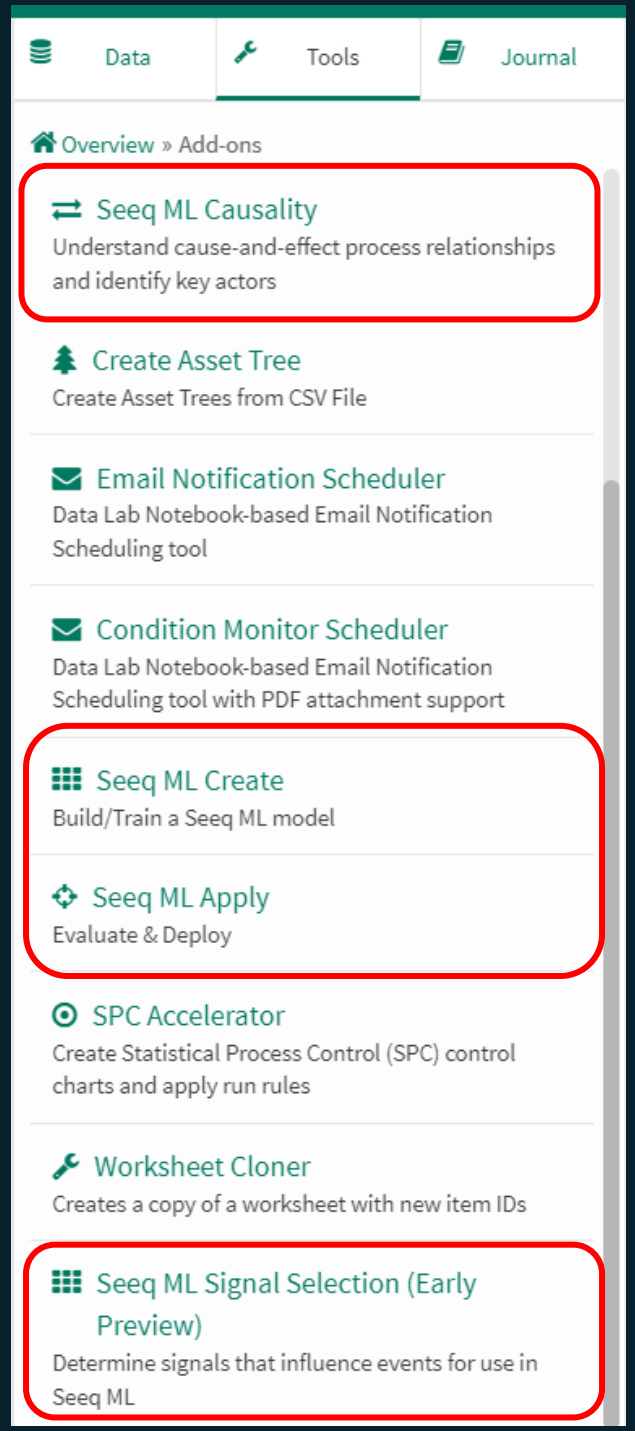
Background - Distillation Tower Fouling

Distillation Tower

- Used to recover key raw material from process
- Fouls on an 18–24-month interval
- Foulant leads to operational issues
- Leads to a 7+ day maintenance outage for cleaning

Goals

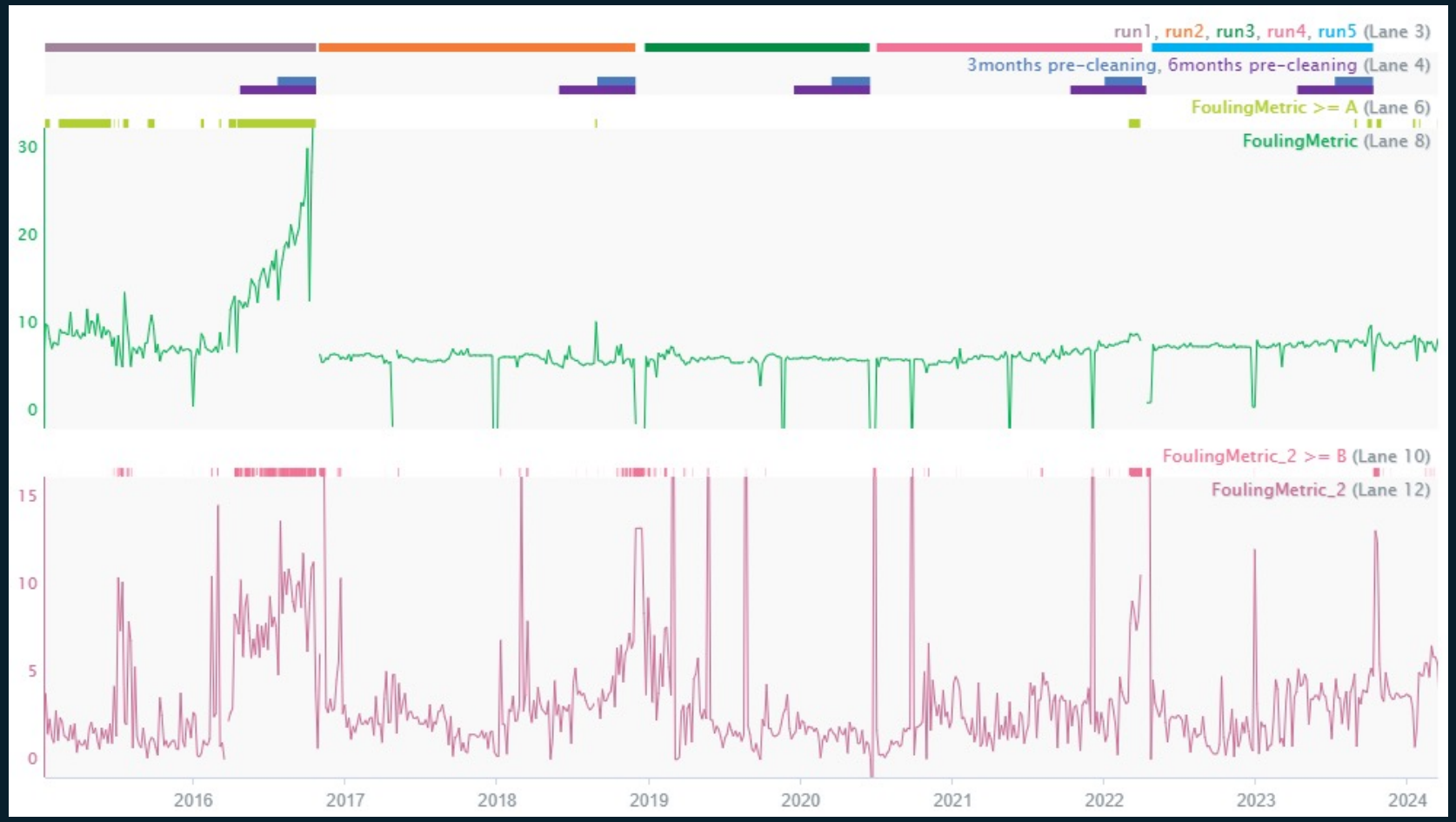
- Predict fouling 3 months in advance to enable proper planning for downtime
- Identify key contributors to fouling to extend operation time between cleanings



Approach - Seeq Process Health Solutions

- ML Causality
  - Root Cause Analysis
  - Regression Input Selection
- ML Create / ML Apply
  - Anomaly Detection
  - Signal Contributions
- ML Signal Selection
  - Identify & remove low variance signals
  - Identify & remove multicollinearity
  - Rank signal importance

Approach - Identify Historical Fouling



Identified 5 fouling events

Proved historical fouling metric **not** a reliable indicator of fouling

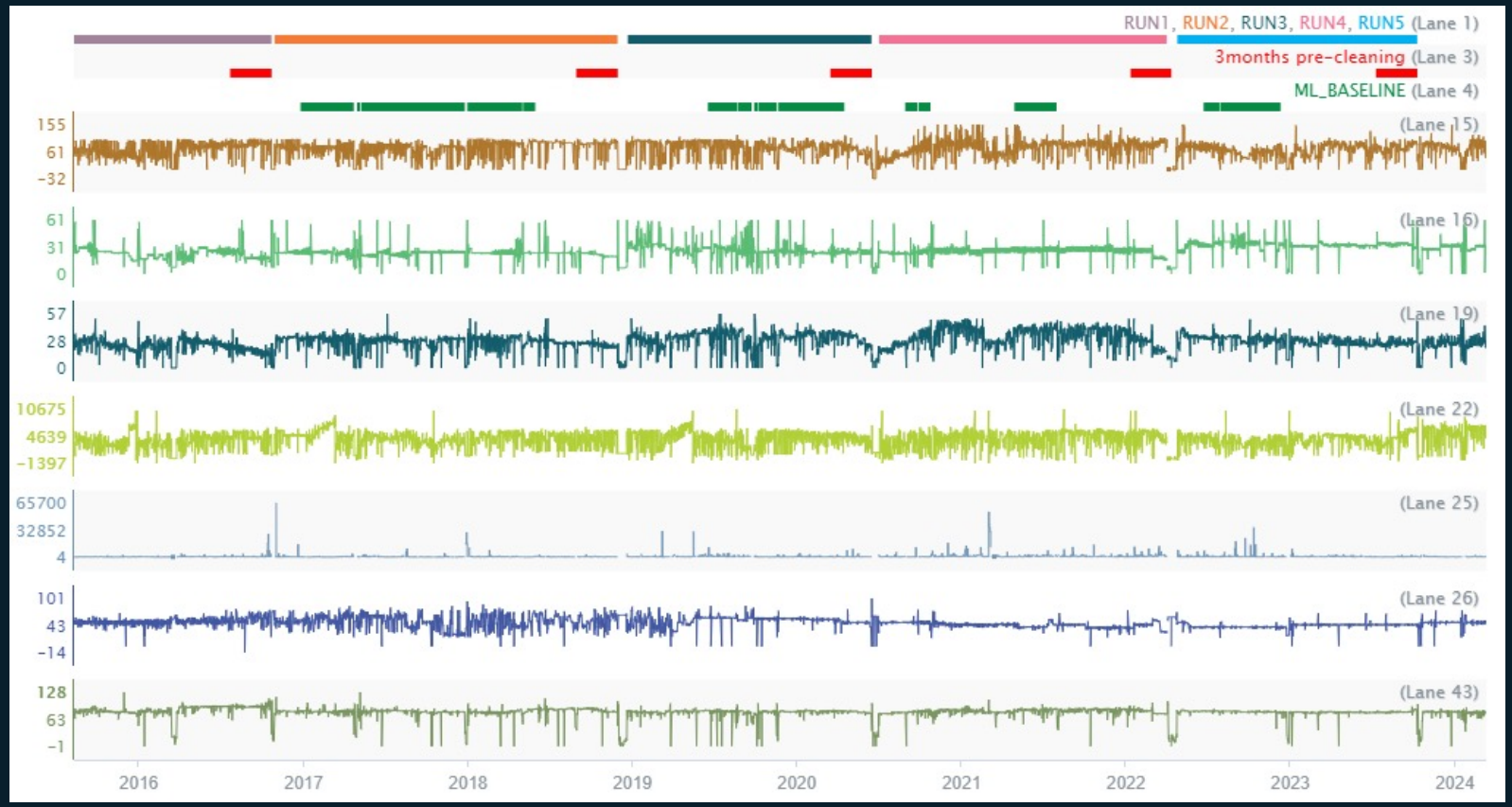
Approach - Pull & Cleanse Data for ML

Data Preparation

- Data dump- 60+ signals
- Data cleansing
- Event characterization

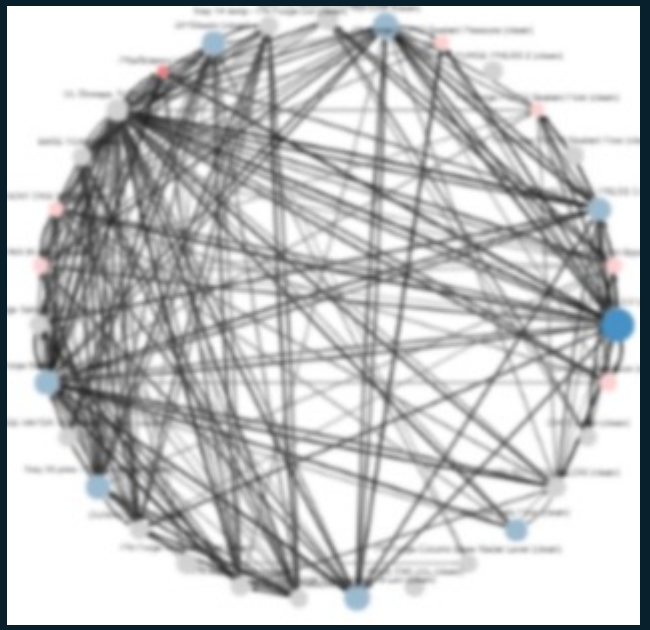
Seeq ML Prep

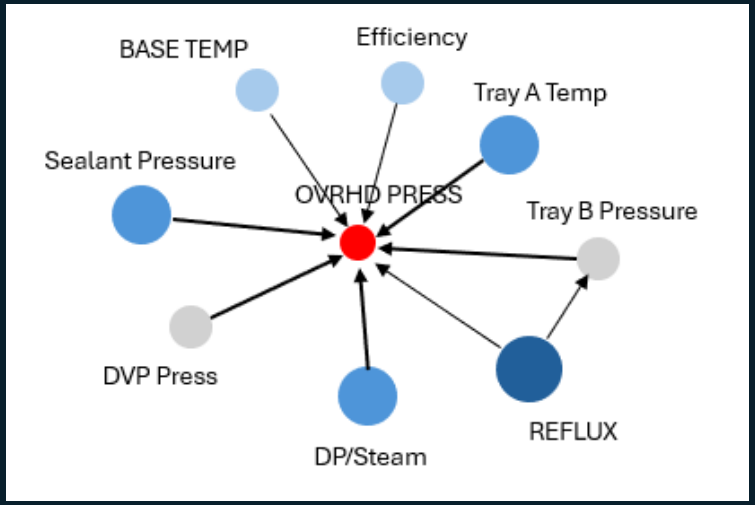
- Identify ”baseline” & “target” periods



Approach— Seeq Signal Selection & Causality

- Seeq ML Signal Selection tool
  - Remove low variance & high multicollinearity
- Seeq ML Causality analysis
  - Identify causal relationships
  - Compare dynamics before/during/after fouling event

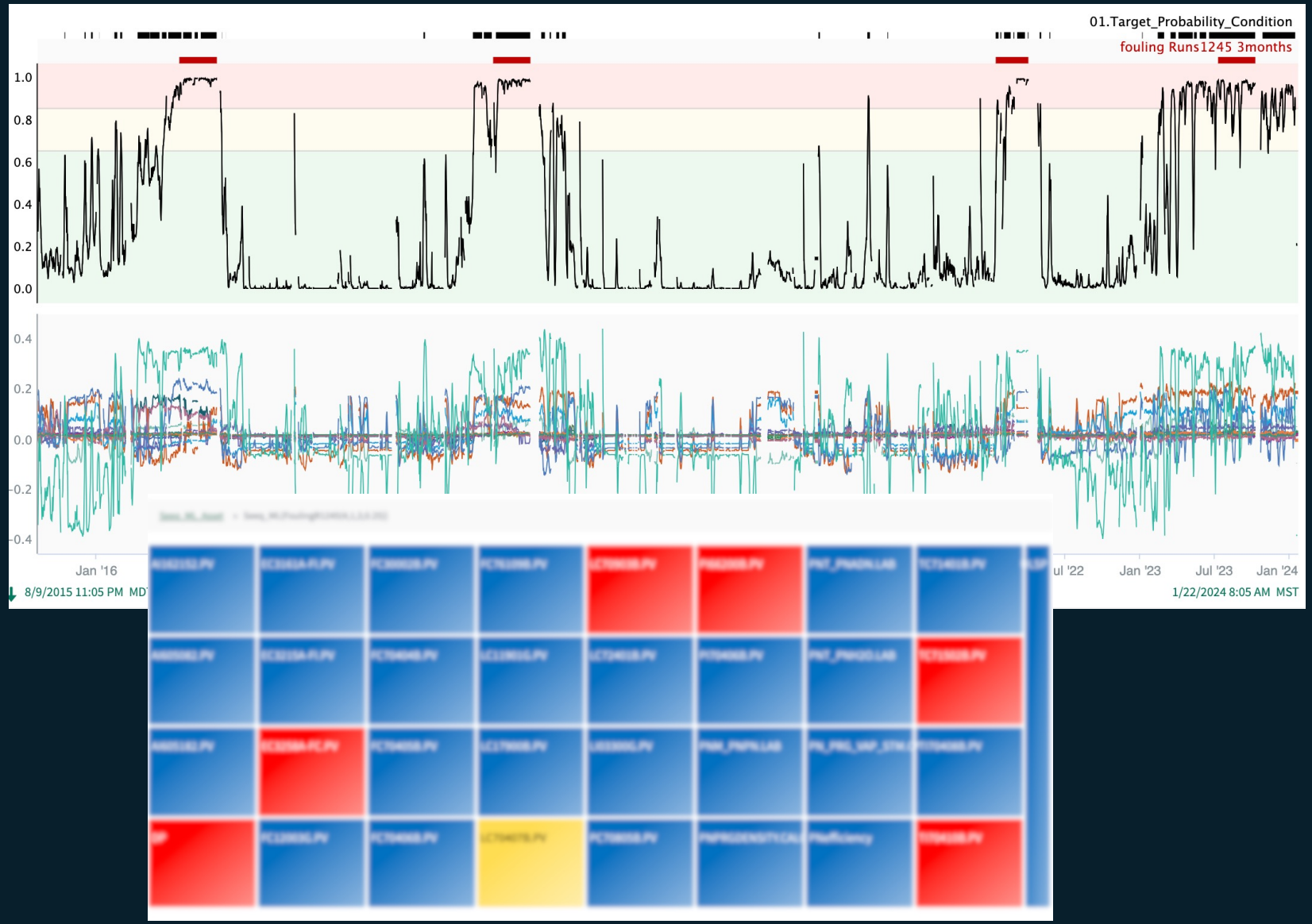




Approach - Seeq ML Anomaly Detection

Predicts need for maintenance with at least 60-day lead time

Identifies key contributors to anomalous behavior



Results

Built a model that predicts need for downtimes at least 60 days in advance

Identified key contributors to fouling;
Proposed operational changes to extend runtime between cleaning

Identified root causes of other non-fouling operational issues

Next Steps

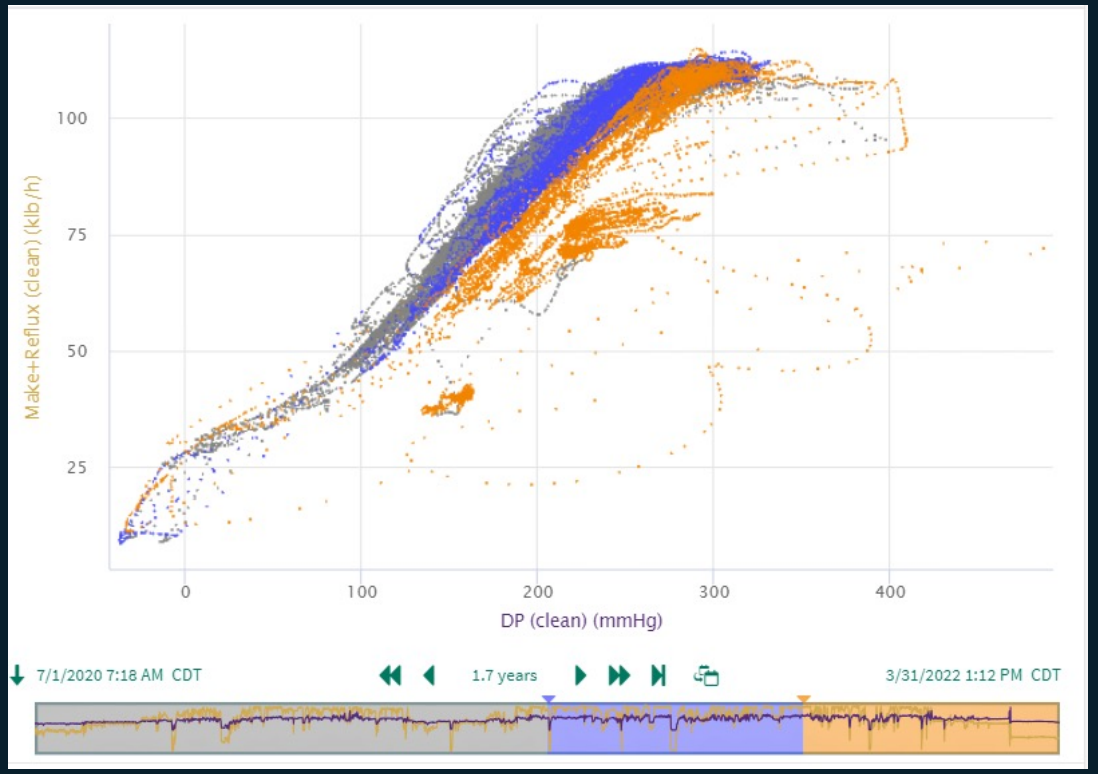
Operationalize models

Dashboard, exception notifications

Carry out trials for proposed optimization to extend runs

Enhance distillation tower monitoring &

scale to all towers across enterprise




Q & A
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Thank You!

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