



Advances in Data Analytics for Continuous Manufacturing

Laura Wareham, Merck
Emily Johnston, Seeq



Advances in Data Analytics for CM



Laura Wareham

- Senior Scientist at Merck & Co., Inc.
- Laura.Wareham@merck.com



Emily Johnston

- Analytics Engineer at Seeq
- Emily.Johnston@seeq.com

Agenda

- Welcome and Introductions
- Challenge – Maximize Value from Data
- Solution – Process Characterization with PI & Seeq
 - Use Case 1: Loss-in-Weight Feeder Dashboards
 - Use Case 2: Film Coating Parameter Analysis
- Results – Process Optimization & Shared Insights
- Future Opportunities

About Our Company



VISION

To make a difference in the lives of people globally through our innovative medicines, vaccines, and animal health products. We are committed to being the premier, research-intensive biopharmaceutical company and are dedicated to providing leading innovations and solutions for today and the future.



WHO WE ARE

We are a global healthcare company with a 125-year history of working to make a difference.

Our company is known as Merck in the United States and Canada. Everywhere else, we are known as MSD.



HEADQUARTERS

Kenilworth, N.J., U.S.A. and operates in more than 140 countries



MERCK & CO., INC.

is our legal name and is listed on the New York Stock Exchange under the symbol "MRK."



EMPLOYEES

approximately 69,000 worldwide (as of 12/31/17)



About Our Company



Advanced analytics: application of big data, machine learning, and other innovations to derive insights and improve outcomes



OSIsoft



**Enterprise
Infrastructure**

10101
01010
00100



AUTOMATION/CONTROL SYSTEMS

1010110101
0101001010



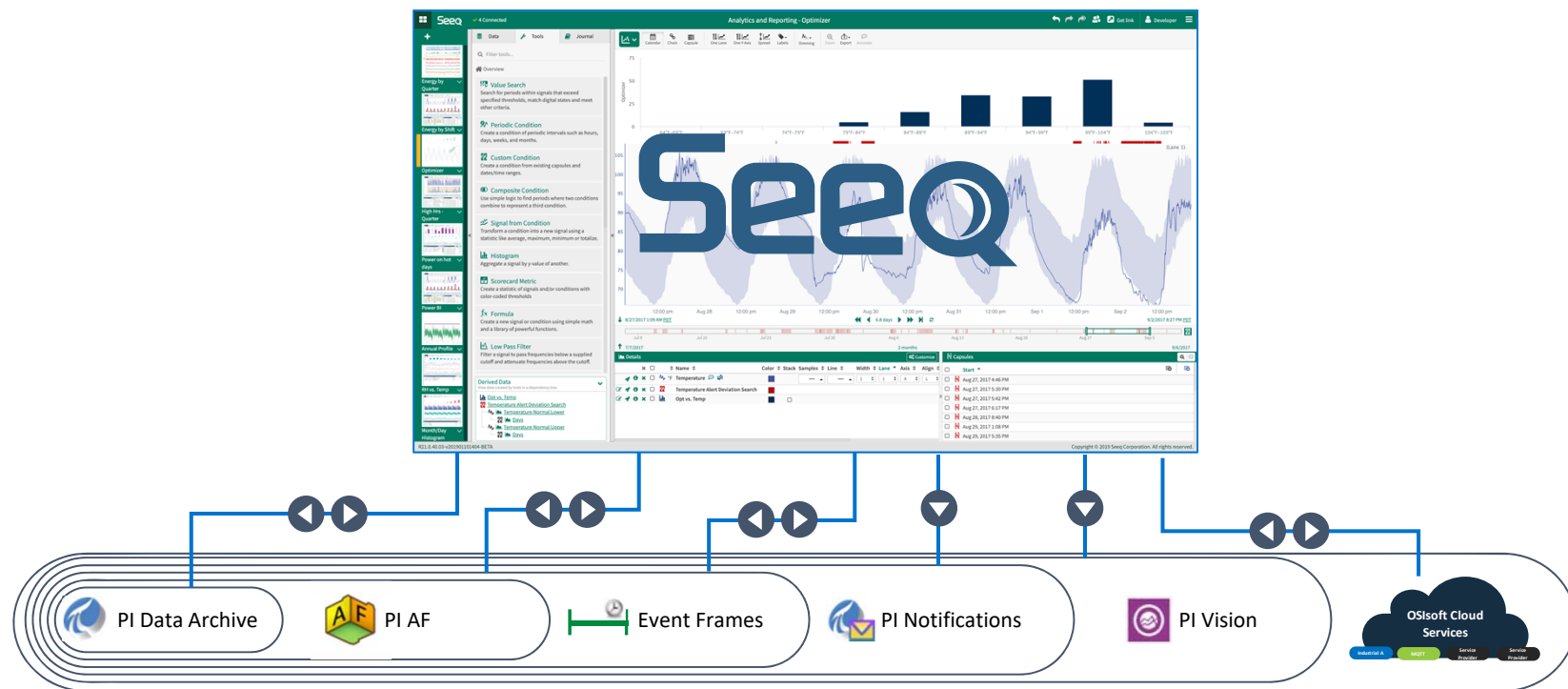
NEW SENSOR TECHNOLOGY

10101
01010

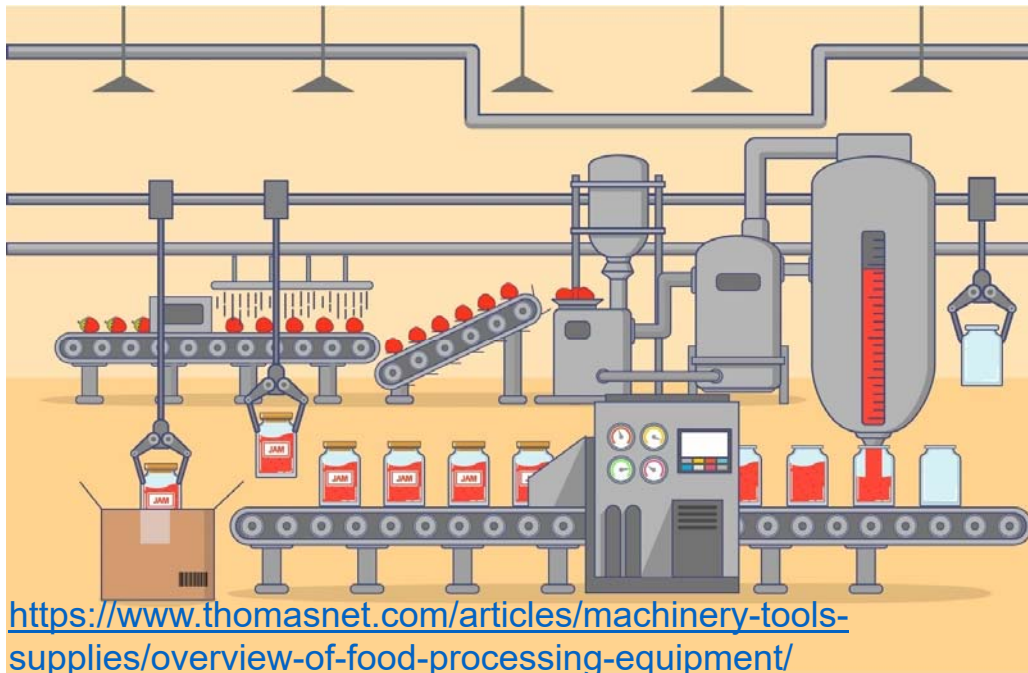


REMOTE AND MOBILE ASSETS

Advanced Analytics for OSIsoft PI System



Continuous Manufacturing



<https://www.thomasnet.com/articles/machinery-tools-supplies/overview-of-food-processing-equipment/>

“Material is fed through an assembly line of fully integrated components. This method **saves time, reduces the likelihood for human error, and can respond more nimbly to market changes.**”

Sau (Larry) Lee, Ph.D.

*Chair of the Emerging Technology Team
Office of Pharmaceutical Quality, CDER*

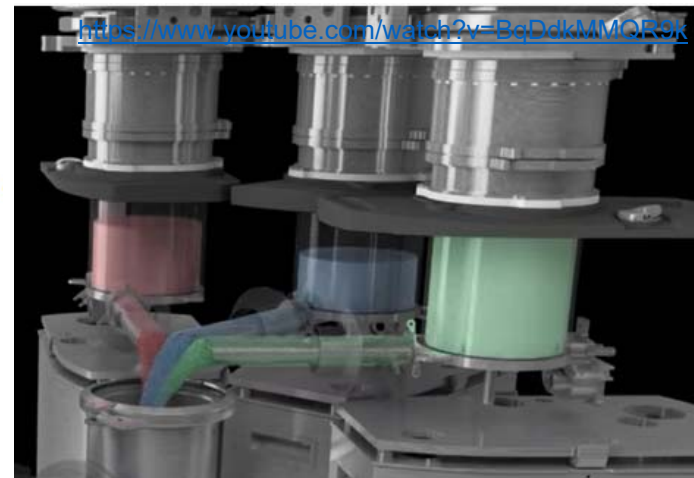
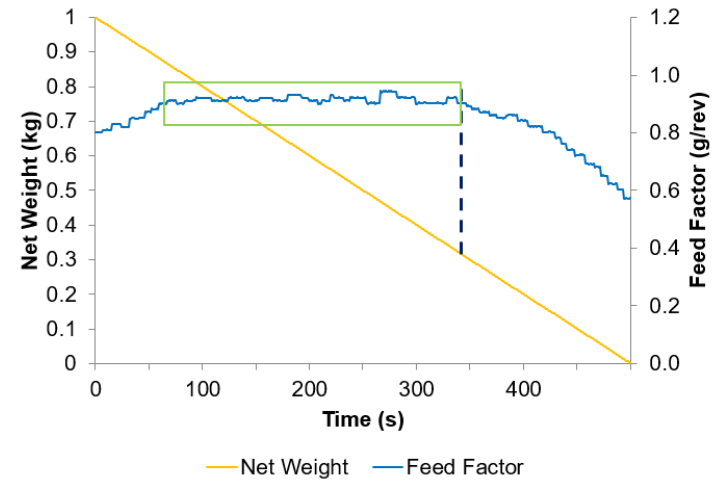
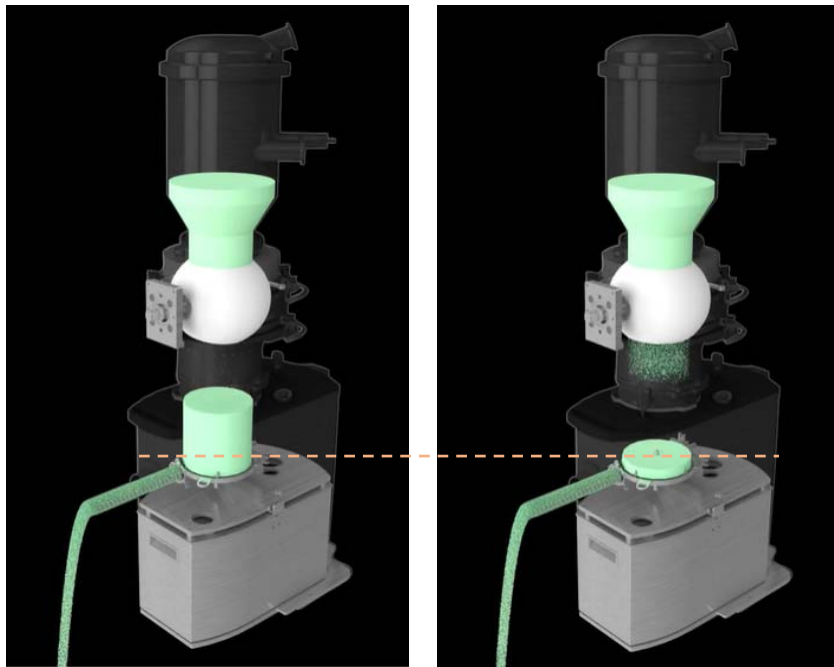


Goal: Maximize Value from Data

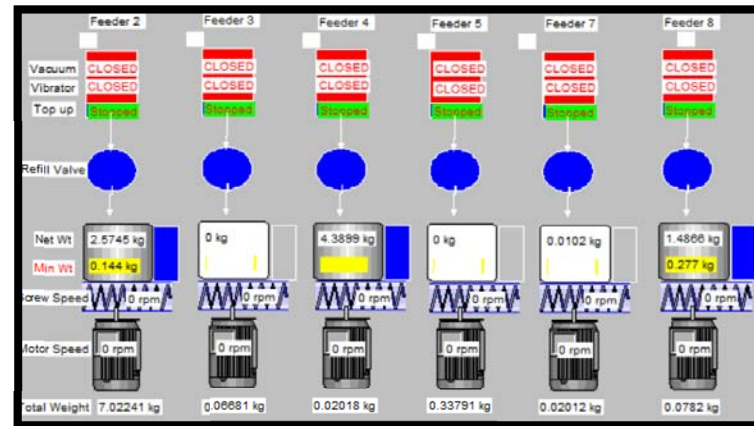
Operationalize normal production behavior to proactively identify trends or process deviations



Loss-in-Weight Feeders



Feeder Challenge



Modes of Operation
Process Trends
Performance Statistics

DEMO

Feeder Dashboard

1 - New Analysis - Seeq | Feeder 4 Summary - PIWorld Fee | You are controlling Laura Wareham's screen | View Options

Not secure | usctapt650110:34216/workbook/EB4E4912-BC40-41B2-BED7-AA9FC0FBF080/worksheet/DC148FDB-7EAB-47C7-AC19-493CAB4F0C7D

Seeq 4 Connected New Analysis - 1

Tools: Calendar, Chain, Capsule, One Lane, One X-Axis, Spread, Labels, Dimming, Zoom, Export, Annotations

Name contains...
Reset More filters Search

Asset Trees
Example

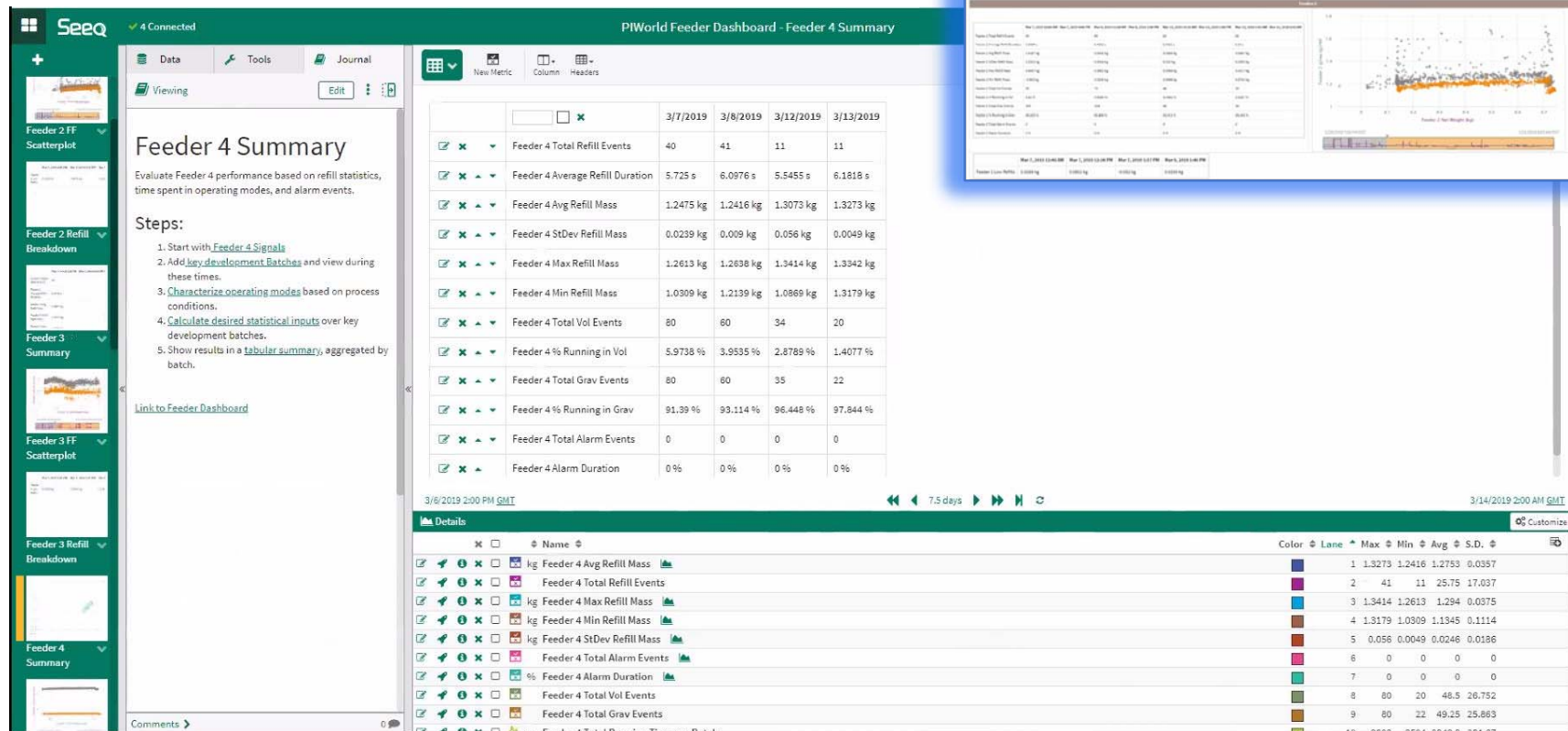
Add data to this display via the **Data** tab. You can search for signals (aka tags) directly, or you can navigate through an **Asset Tree**.

2/23/2020 8:37 PM GMT 2/24/2020 8:37 PM GMT
Feb 18 12:00 pm Feb 19 12:00 pm Feb 20 12:00 pm Feb 21 12:00 pm Feb 22 12:00 pm Feb 23 12:00 pm Feb 24 12:00 pm
7 days

Details Customize

R22.0.45.02-v202001210658 Server load: 0%

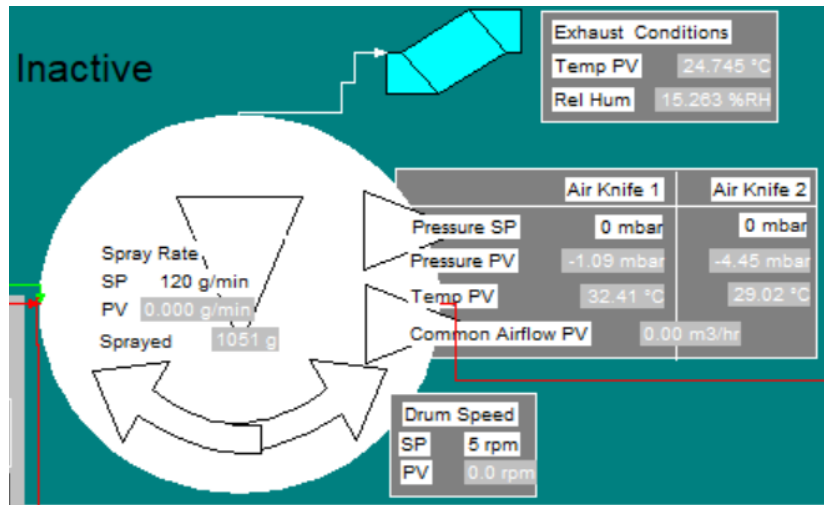
Feeder Dashboards



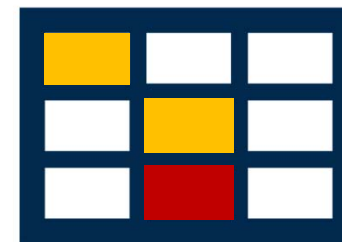
Film Coating



Coater Challenge



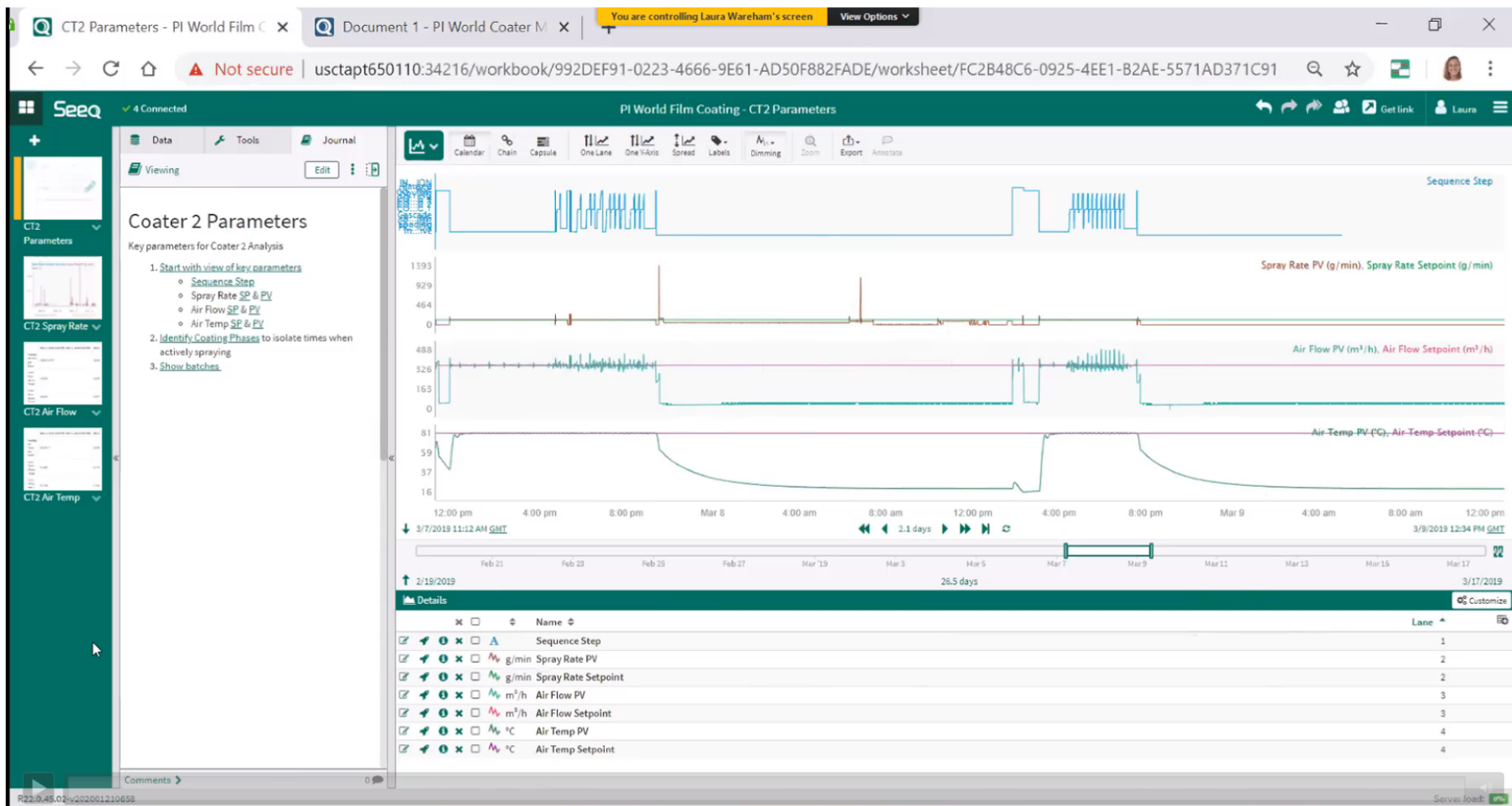
Identify Operating Mode



Create KPIs

DEMO

Coater Dashboard

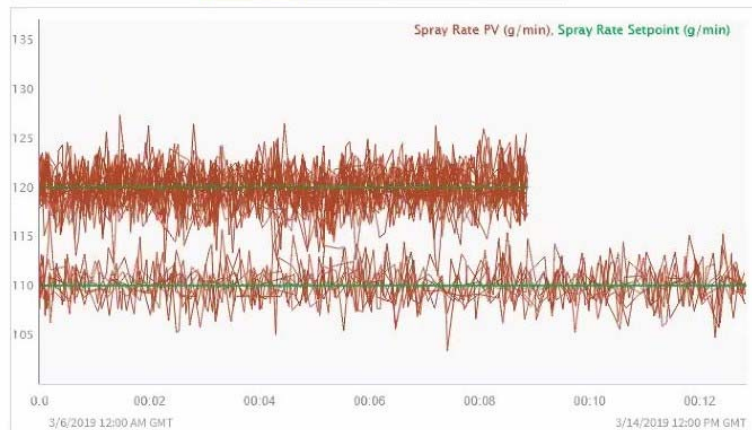


Coater Analyses

Breakdown Analysis

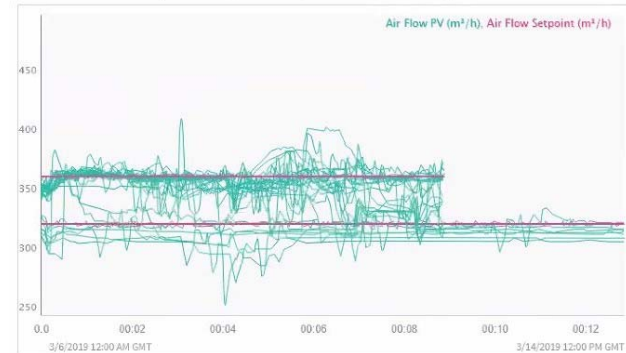
Spray Rate

	3/7/2019	3/8/2019	3/12/2019	3/13/2019
Average Spray Rate per Batch	119.83 g/min	119.92 g/min	110.06 g/min	110.1 g/min
% Spray Rate Above Target	3.9994	6.0943	6.8456	4.7892
% Spray Rate Below Target	7.5174	6.4078	6.0471	4.3502



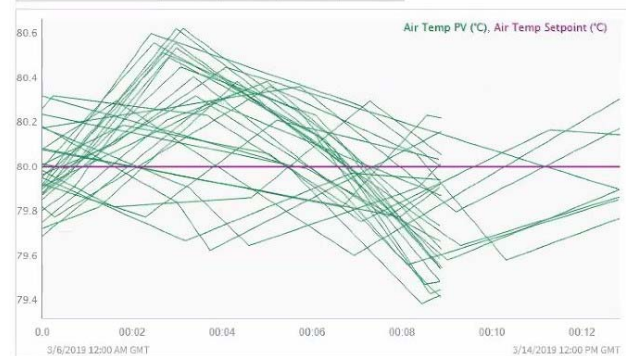
Air Flow

	3/7/2019	3/8/2019	3/12/2019	3/13/2019
Average Air Flow per Batch	356.27 m³/h	352.28 m³/h	315.96 m³/h	311.39 m³/h
% Air Flow Above Target	10.126	11.535	27.779	15.852
% Air Flow Below Target	15.637	15.974	21.439	15.465



Air Temp

	3/7/2019	3/8/2019	3/12/2019	3/13/2019
Average Air Temp per Batch	80.007 °C	80.099 °C	80.005 °C	80.026 °C
% Air Temp Above Target	0.7487	0.7758	0.5046	0.5588
% Air Temp Below Target	0.7704	0.7181	0.5534	0.5263



Results: Analytics Strategy

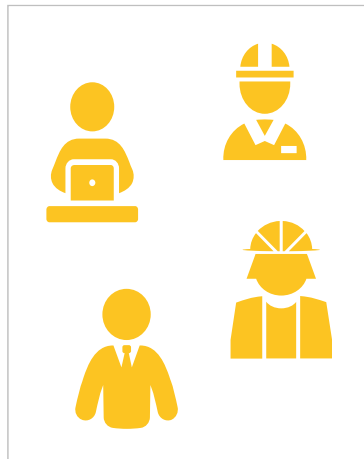
**Leverage
Historical Data**



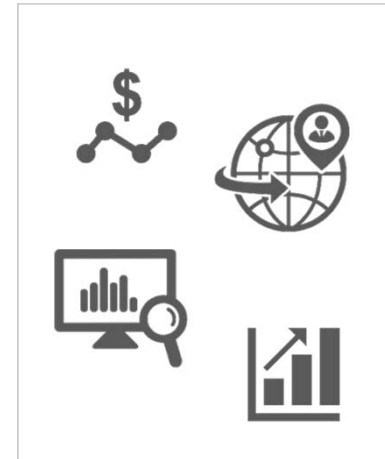
**Apply
Advanced
Analytics**



**Enable
Personnel**



**Optimize
Business**



Looking Ahead

Integrate with PI System Features



Asset Framework



Event Frames

“With enough information and quality content, these technologies can transform data into knowledge that supports critical activities, including process optimization, continuous improvement, operational excellence, and even real-time release.”

Pharmaceutical Engineering, Sep/Oct 2018

Expand Analyses Statistical Process Control Condition Based Maintenance



CHALLENGES

- Accessing large CM data sets for rapid process analysis
- Sharing analysis and insights across the broader team
- Applying learnings and analysis proactively to future lots

SOLUTION

- Utilize PI DataLink, PI ProcessBook, and Seeq to characterize the process
- Calculate statistics to understand normal process variability
- Generate reports for process visualization and performance analysis

BENEFITS

- Greater insight into real-time process performance
- Visual feedback during operation using monitoring dashboards
- Rapid analysis summarized in performance reports for broader team distribution

Feeder Report



“Modern data analysis tools like SEEQ enable new ways for SMEs to interact with their data including rapid insights into process performance.”

Justin Moser, Merck, Advanced Manufacturing Technology



Advances in Data Analytics for CM



Laura Wareham

- Senior Scientist at Merck & Co., Inc.
- Laura.Wareham@merck.com



Emily Johnston

- Analytics Engineer at Seeq
- Emily.Johnston@seeq.com

Questions?

Please wait for
the **microphone**

State your
name & company



Save the Date...



REGISTER YOUR INTEREST

AMSTERDAM
October 26-29, 2020



