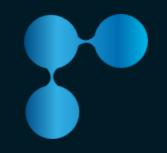




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PERFORMANCE OPTIMIZATION TRACK



Calculating OEE in Seeq and Exporting the Visualization

Mike Fialkowski

Data Analytics Specialist

3M





Background

16 years with Dow Chemical

- Superabsorbent Polymer
- Reverse Osmosis Membranes
- Process Modeling
- Process Safety

20 years with 3M

- Microreplication
- Web Processing
- Fiber Processing
- Data Analytics

Good Data Analysis Drives

- Good Business Decisions
- More Reliable Processes
- Improved Quality
- Improved Yields
- Increased Profits

How do we best get this information to those who need to use it?



Solving a 2-Level Problem

• How Seeq can be used to calculate Overall Equipment Effectiveness (OEE) to drive improvement?

• How can we make base-level analytics available to those who don't use Seeq and let them further refine the analysis for their use?

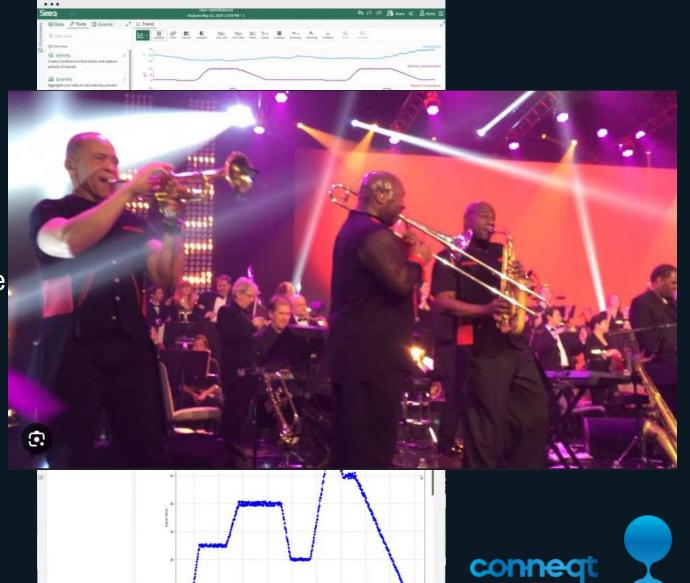


Data Visualization and Manipulation

- Why Visualize using something other than Seeq
 - Some can't or won't use Seeq –

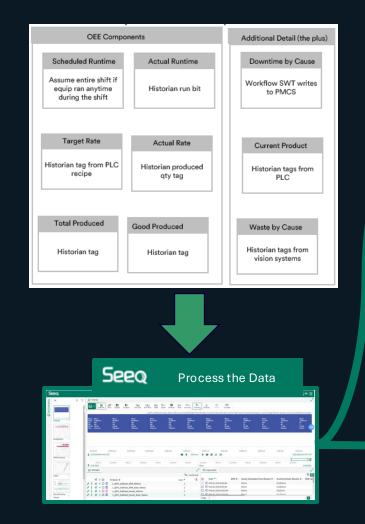
Learning curve time investment

- Seeq analyst does not know all the questions
- End data user is invested
- Builds trust in the data



Overall Equipment Effectiveness – OEE

- Common Lean Metric
- Components of OEE
 - Availability
 - Productivity
 - Quality
- Additional Waste Components
 - Waste by Cause
 - Downtime by Cause
 - Classify by Product







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OEE – Calculating Availability

• Define a "Line Running" Condition

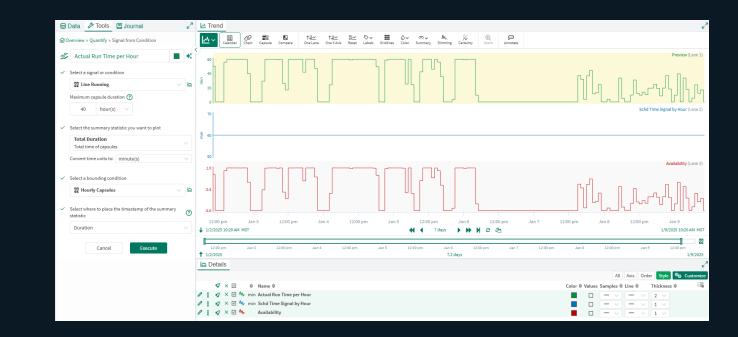
- Sensors vs. Humans
 - People get busy causing errors
- Startup & Shutdown
- Good vs. Scrap

• Runtime or Uptime

• Simple Total Duration of the "Line Running" Condition

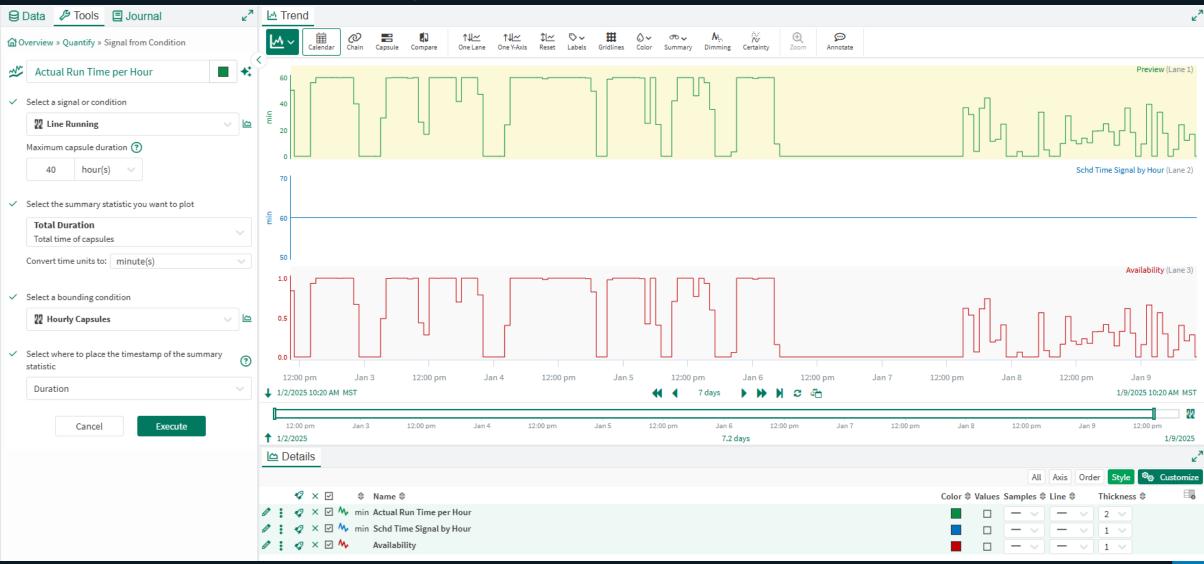
• Total Time

- Often defined by crewing
- Same time buckets as Runtime





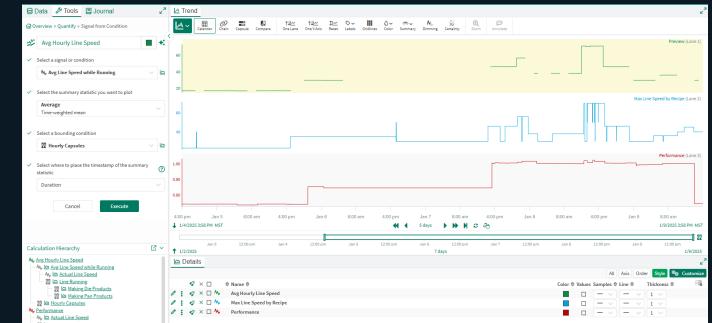
OEE – Calculating Availability



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OEE – Calculating Performance

- How do you measure Rate in your process?
 - Continuous ft/min, lbs/h?
 - Semi-batch parts/h?
 - Batch cycle time min?
- Run Rate
 - Simple integration of "Rate"
- Maximum Rate
 - Often defined by product
- Performance = Rate/Max
 - If cycle time, use Best/Rate





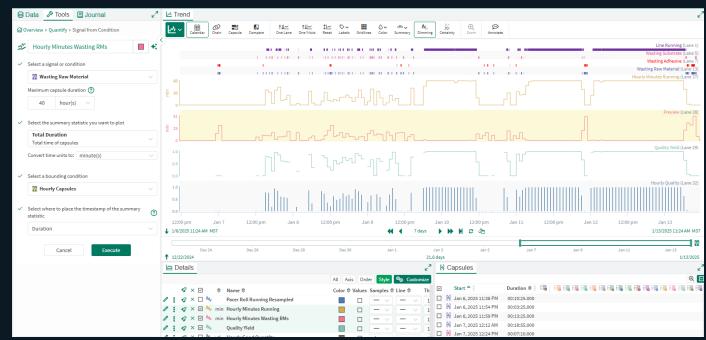
OEE – Calculating Performance

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- Making Pan Products		Avg Hourly Line Speed	
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- M. 🖻 Actual Line Speed			



OEE – Calculating Quality

- Usually the most difficult of the three to define
 - Inline vs Offline testing
 - Diversion of material
 - Relative to specified conditions
- Define Good Material
 - Simple integration of "Good"
- Define Total Material
 - Good + Bad ?
 - Is unit conversion helpful?





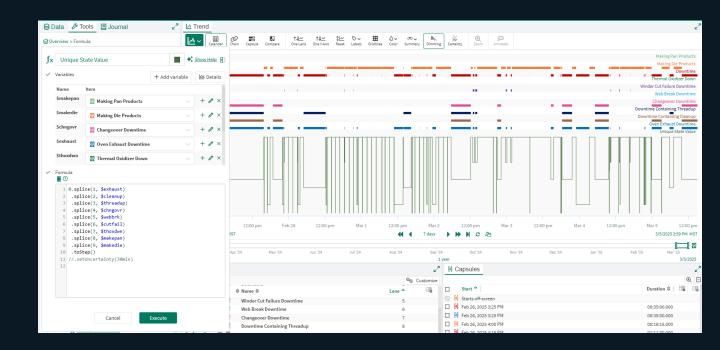
OEE – Calculating Quality

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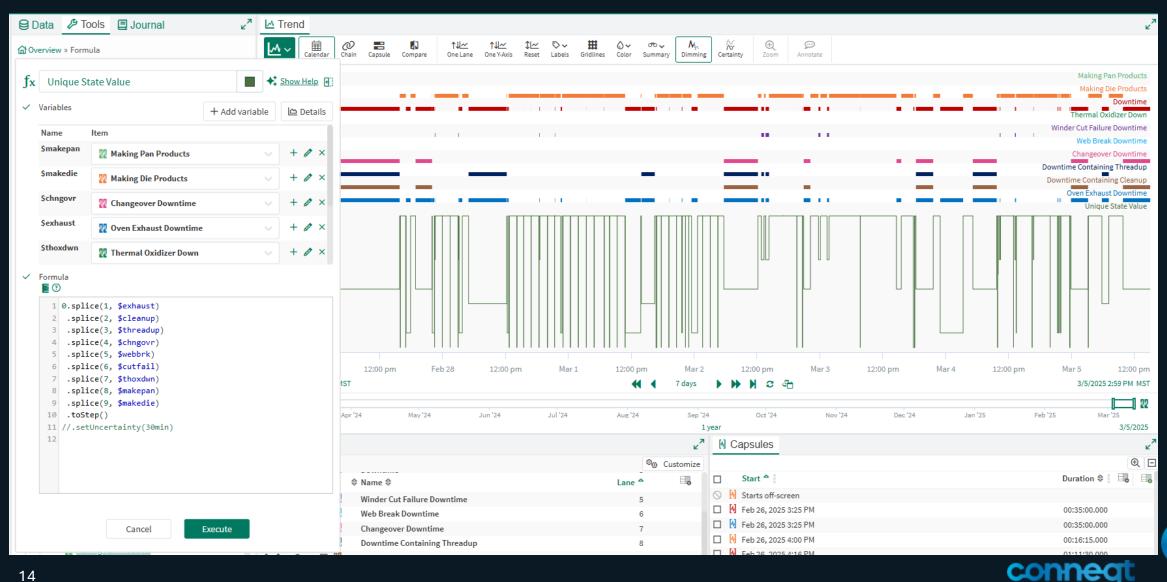
OEE – Downtime by Cause

- Some causes easier to define than others
 - Sensors vs Humans
 - Matching timestamps
 - Ambiguity often encountered
- Strategy
 - Make a list of causes
 - Assign a number to each
 - Use splice() for each cause in order from least to most important





OEE – Downtime by Cause



OEE – OData Export

- Push data to PowerBl using Export to OData
 - Create Conditions with Properties
 - Separate Conditions for OEE components, machine state, waste, and product type are helpful for future clarity

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Definitions

- Familiarity with PowerBI setup is necessary at this point
 - Receiving the data
 - Designing the look of the report

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Consumers of the Power BI Report

- Process Engineers
 - What breaks most often
- Product Owners
 - How can my product be made better or less expensive
- Management
 - Product demand vs capability
 - New machine vs improve existing
- All of these visualizations enabled with the same base analytics



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Results

- Applied the Seeq OEE method to over a dozen machines so far
 - Supplementing business level OEE with machine level
 - Improved accuracy
 - Savings and improved output over \$5,000,000 so far
- 3M is a large organization
 - \$25 billion annual revenue
 - In excess of 1,000 machines
 - Just now scratching the opportunity surface



In Conclusion

- Common Metrics, such as Overall Equipment Effectiveness can be quickly computed using Seeq
 - Can be based entirely on machine data rather than human entry
 - Accuracy with respect to time is improved over human entry
- This information can be made available to Stakeholders who don't use Seeq
 - Export to OData
 - Power BI allows users to aggregate and filter the information for their needs
- Seeq to Power BI allows you to be the musician while allowing non-users to select the songs

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Thank You!