
SeeQ
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PERFORMANCE OPTIMIZATION TRACK

Calculating OEE in Seeq and Exporting the Visualization

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Data Analytics Specialist

3M

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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?

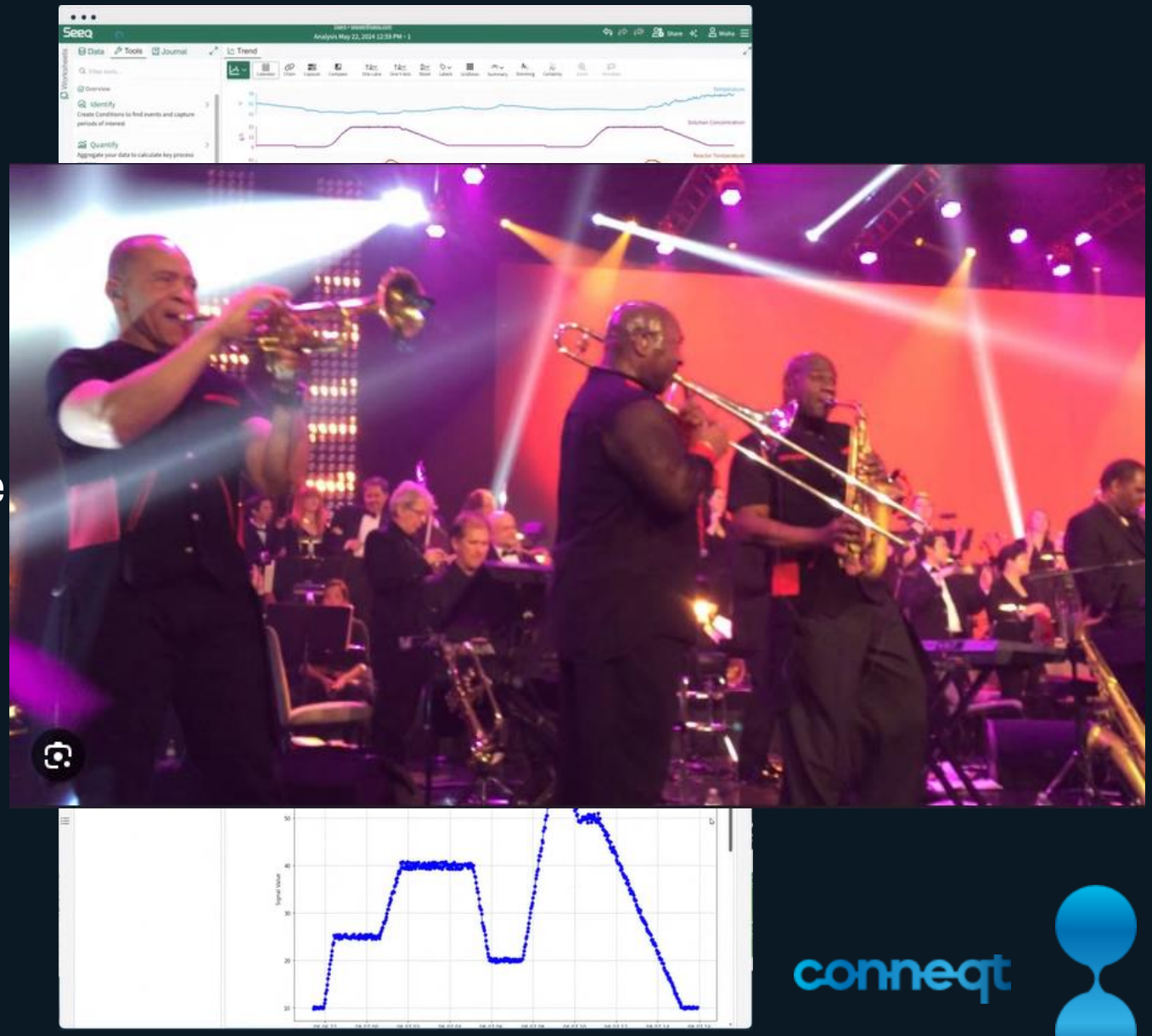
Solving a 2-Level Problem

- 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?

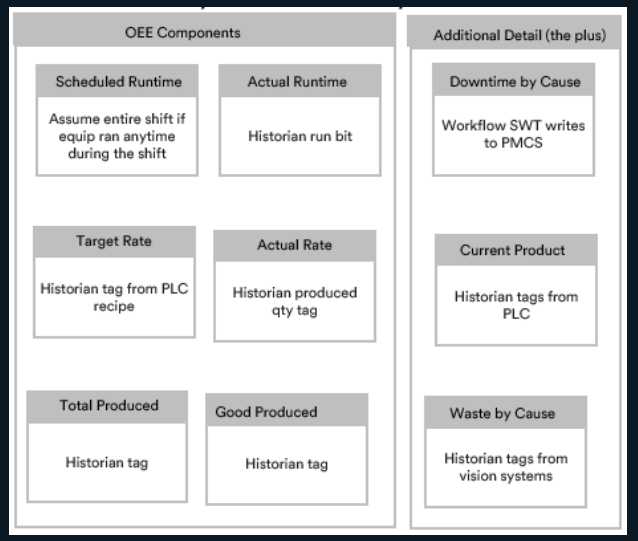
Data Visualization and Manipulation

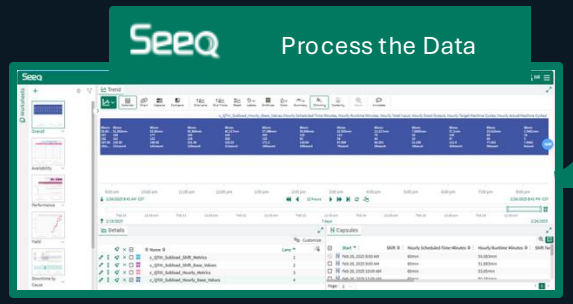
- Why Visualize using something other than Seeq
  - Some can’t or won’t use Seeq – Learning curve time investment
  - Seeq analyst does not know all the questions
  - End data user is invested
  - Builds trust in the data

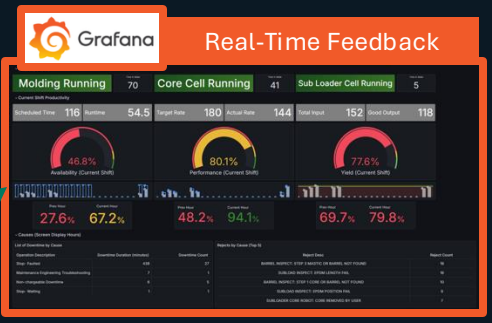


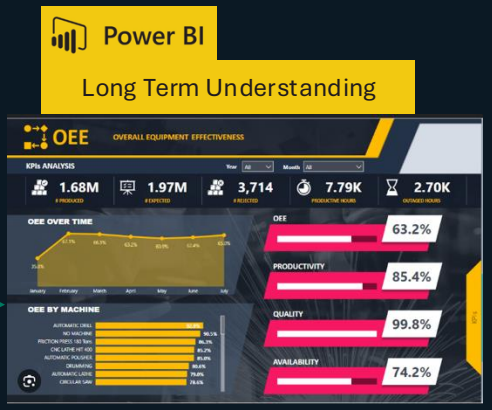
Overall Equipment Effectiveness – OEE

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



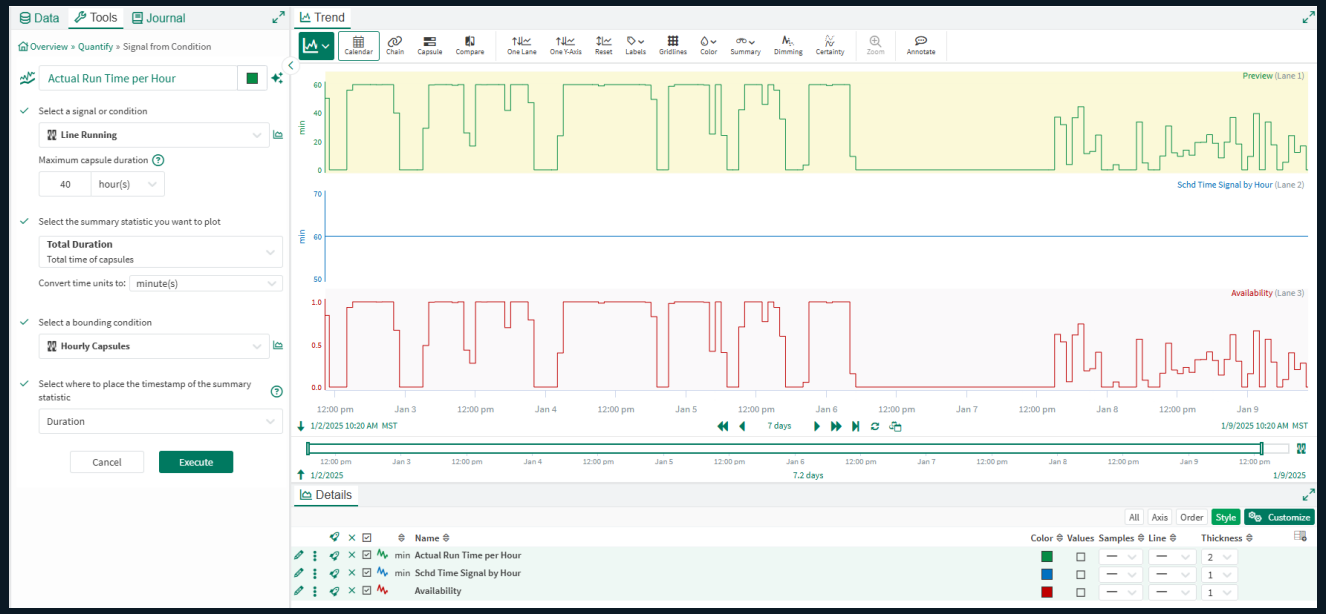




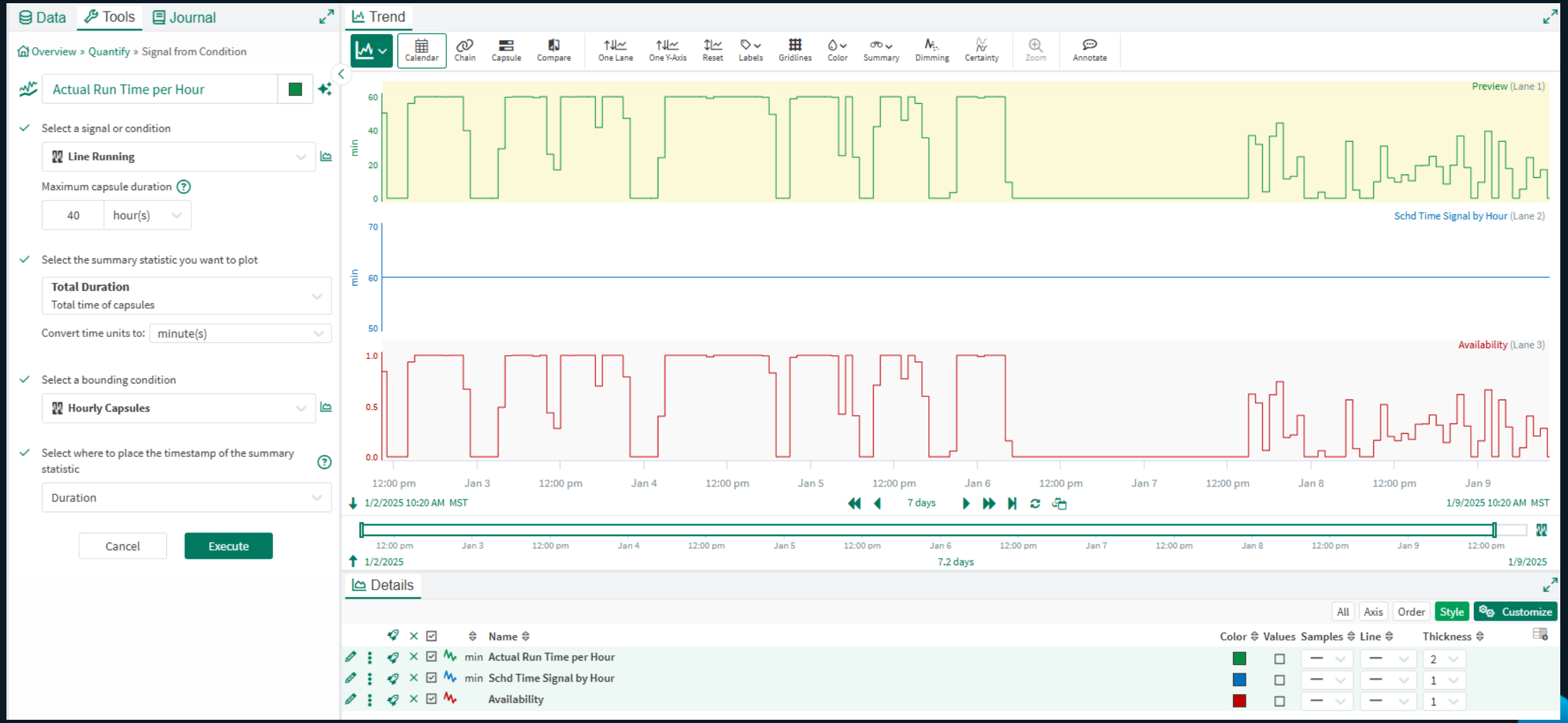


OEE – Calculating Availability

- 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

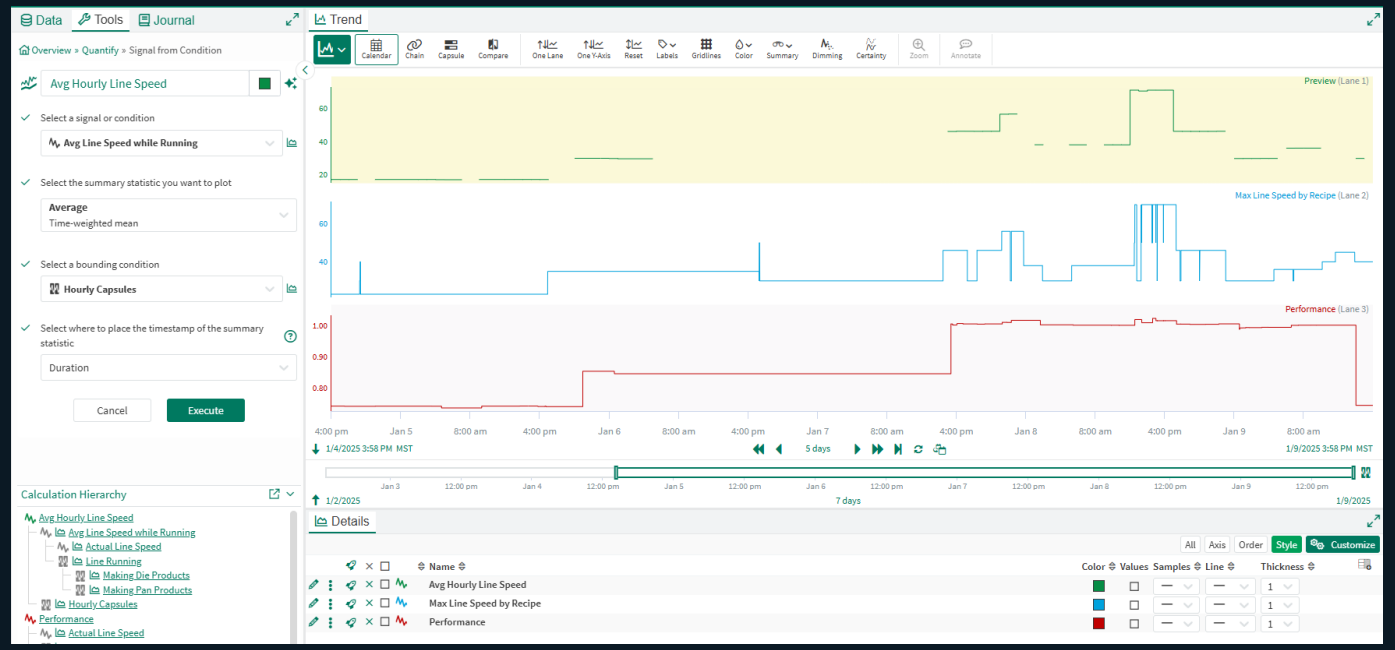


OEE – Calculating Availability

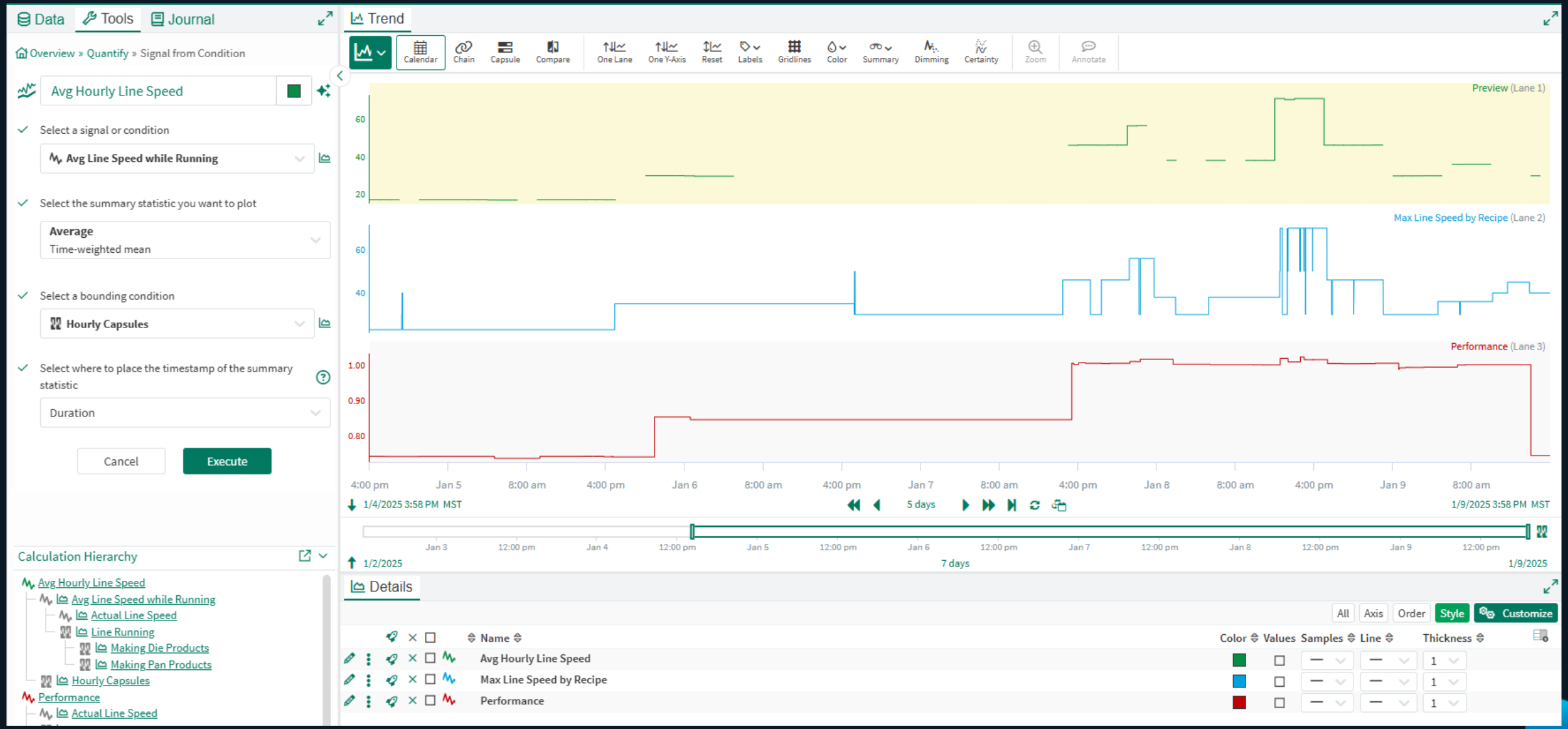


OEE – Calculating Performance

- 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

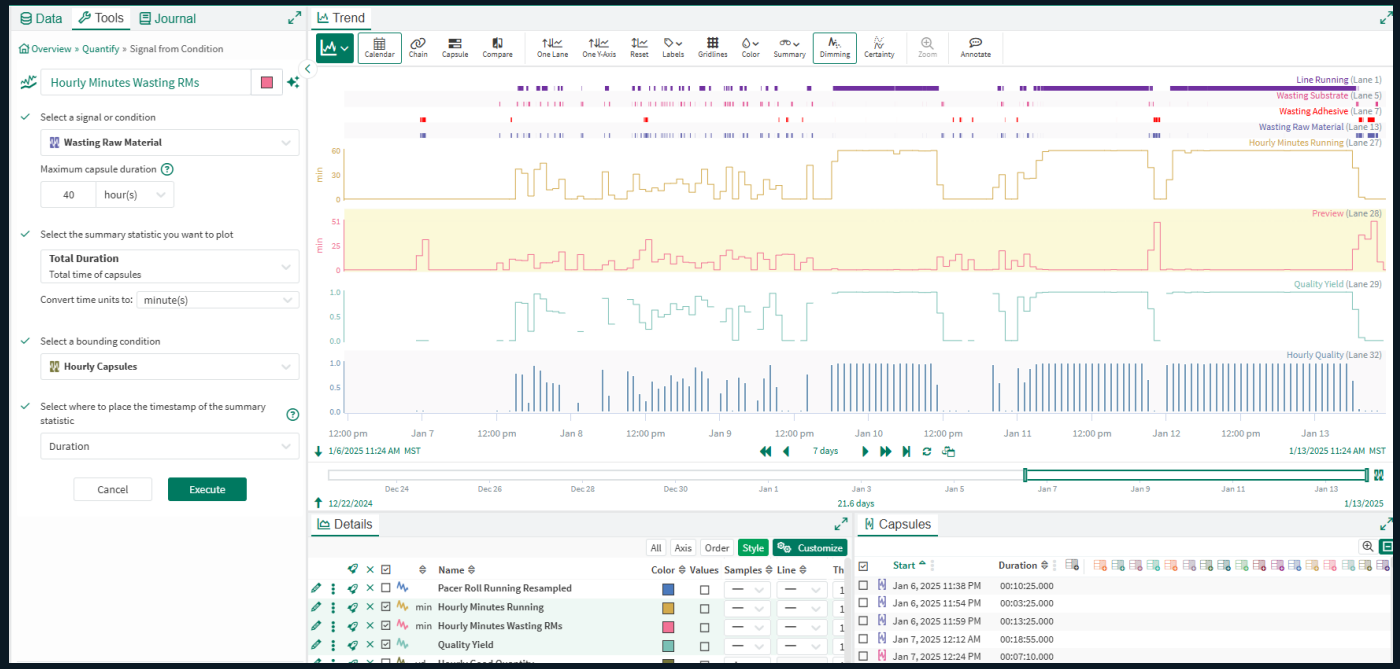


OEE – Calculating Performance

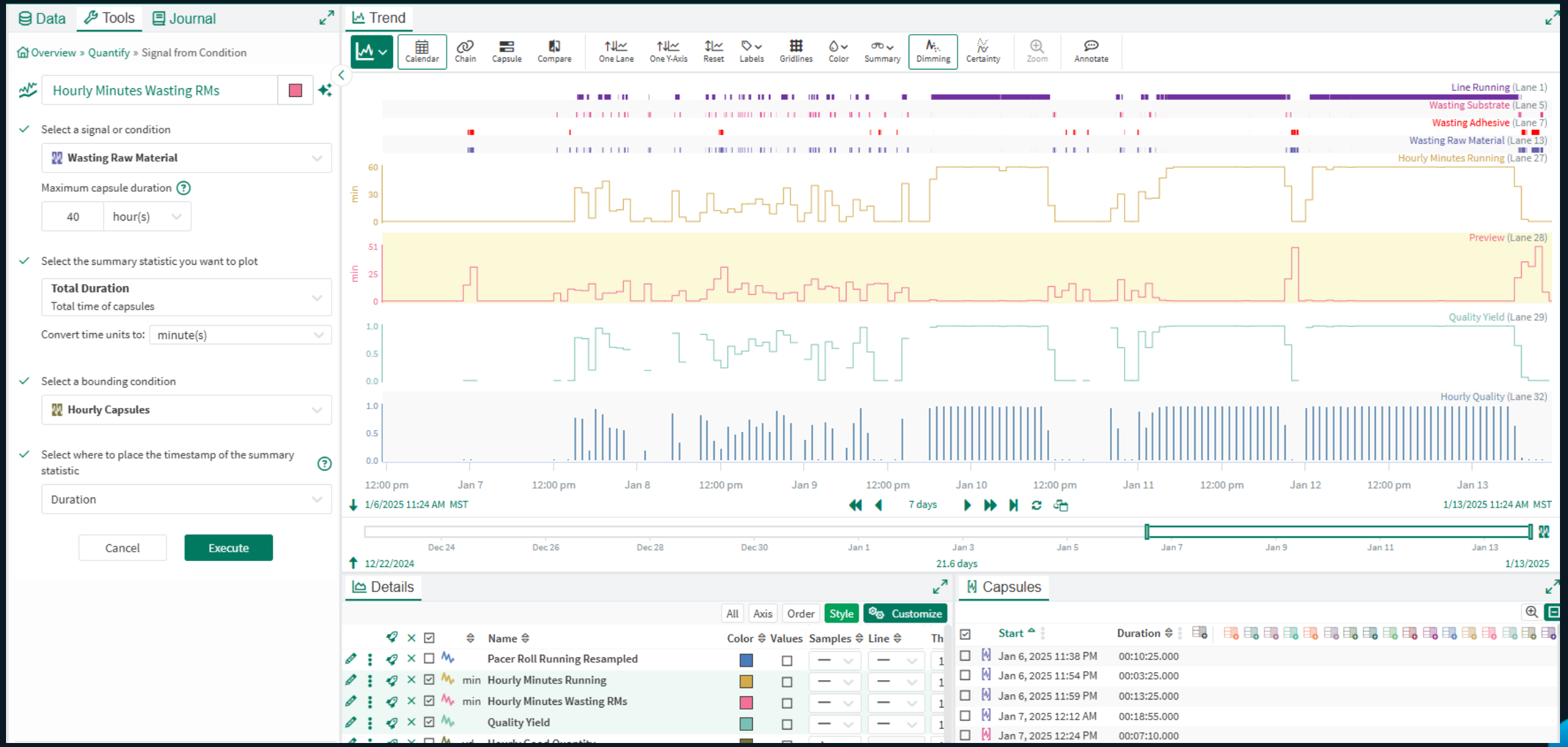


OEE – Calculating Quality

- 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 ?

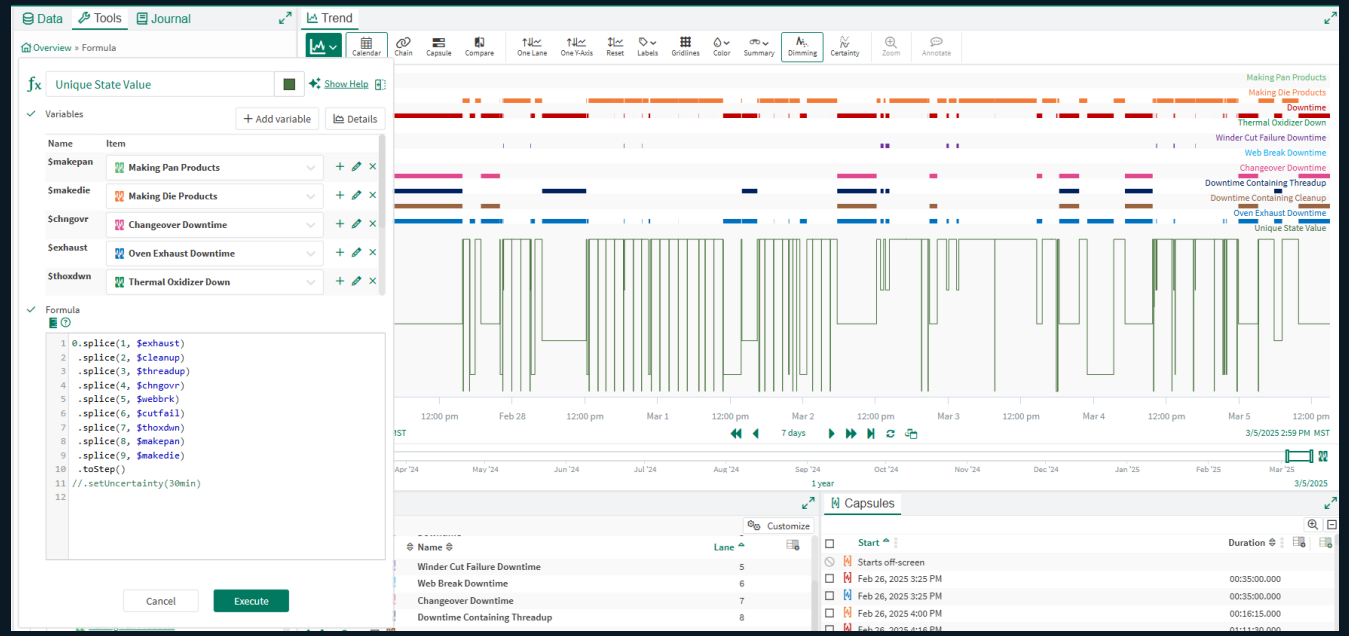


OEE – Calculating Quality



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



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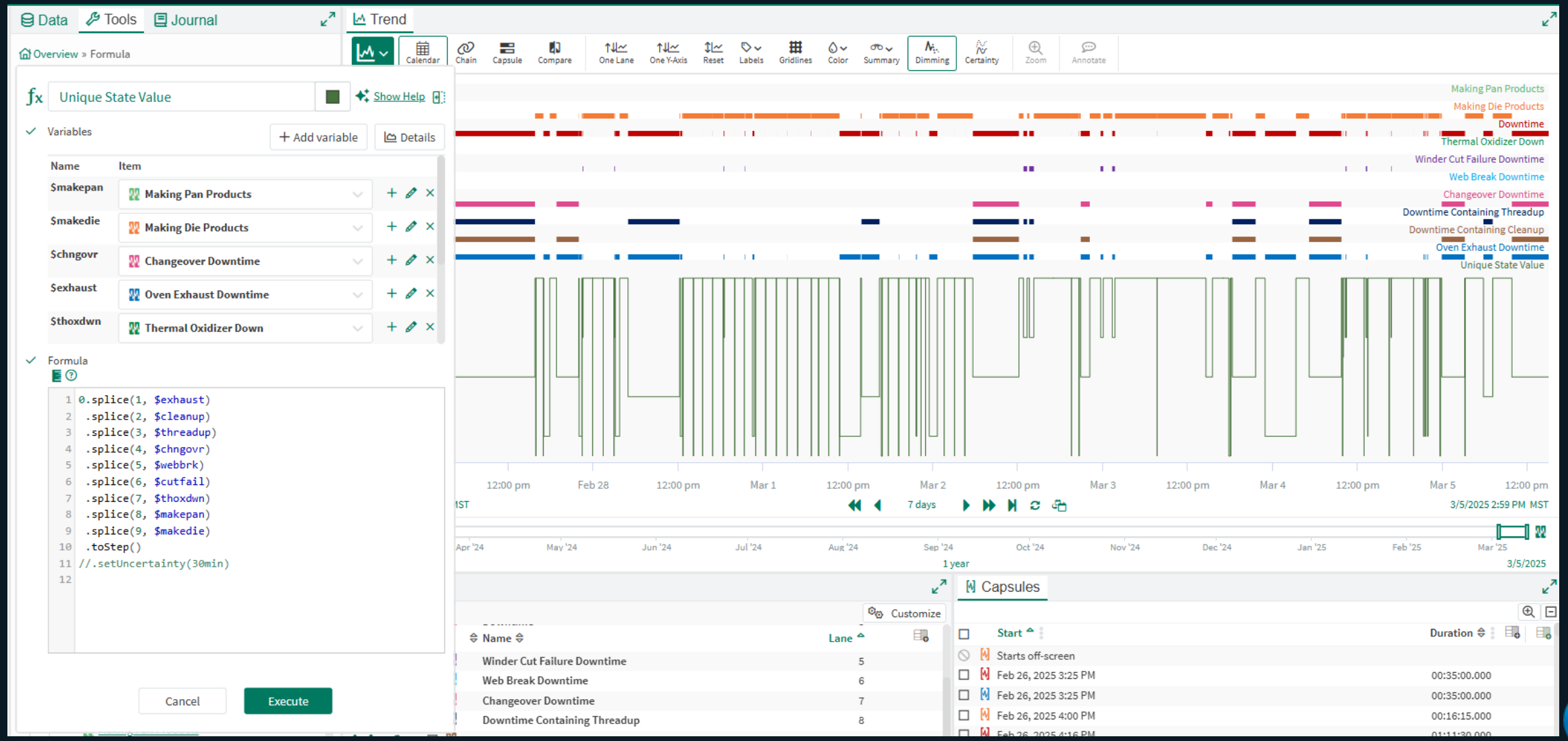
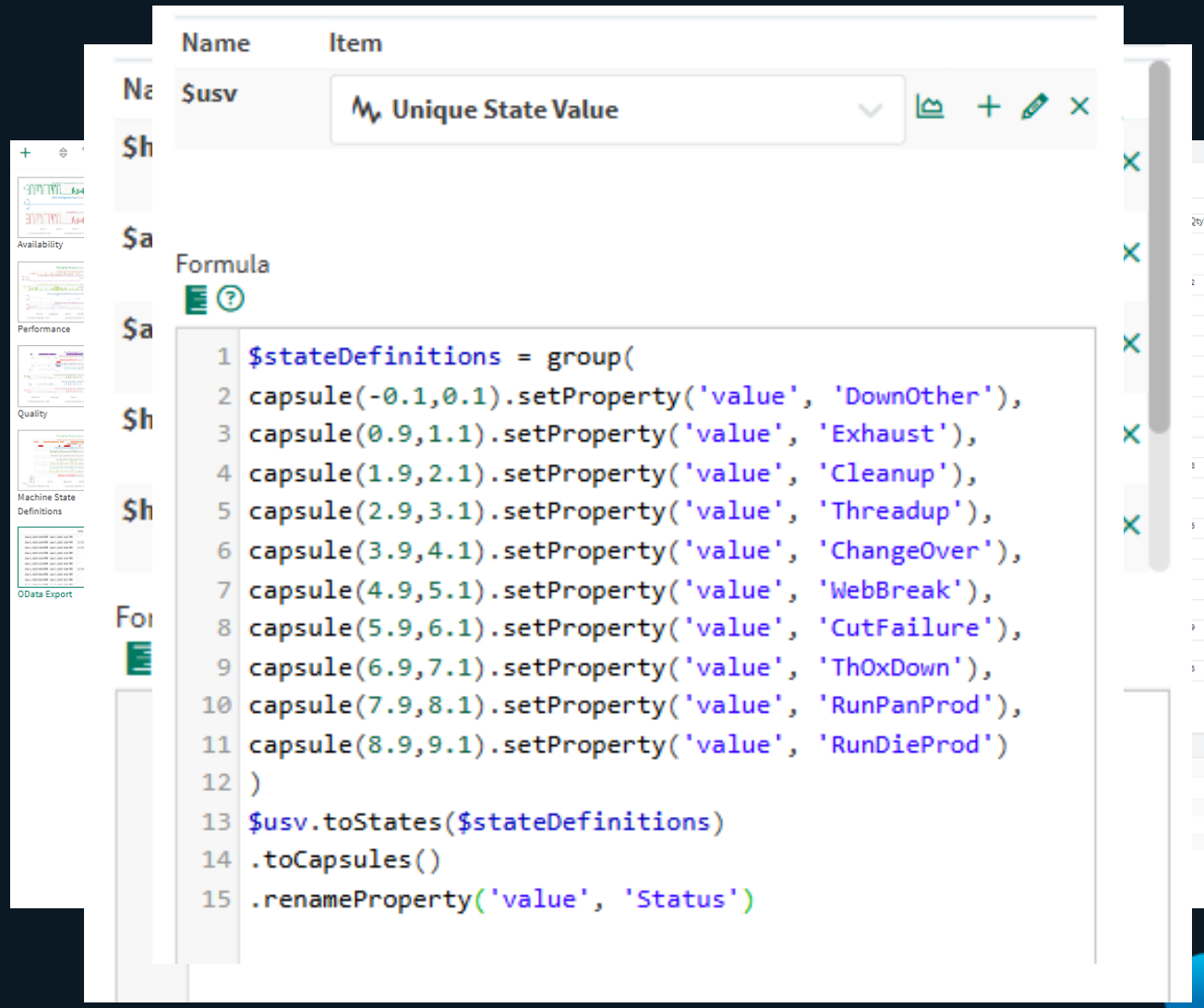


OEE – OData Export

- Push data to PowerBI using Export to OData
  - Create Conditions with Properties
  - Separate Conditions for OEE components, machine state, waste, and product type are helpful for future clarity
- Familiarity with PowerBI setup is necessary at this point
  - Receiving the data
  - Designing the look of the report



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!