



TRENDMINER APPLICATIONS IN CHEMICAL LIME AND DOLIME MANUFACTURING

Trend Lab Conference 2026

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The Selected Solution: TrendMiner

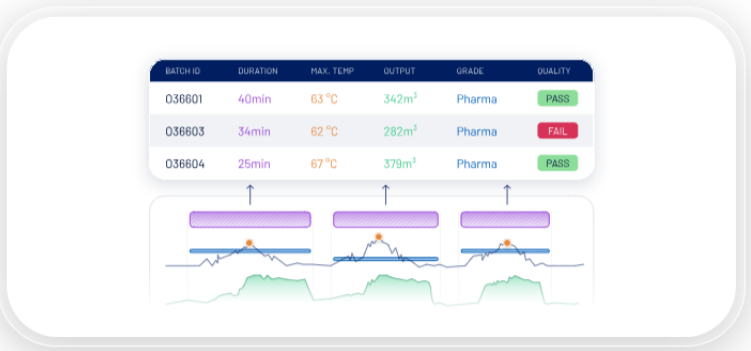
Diagnostics: Search & Correlations

Time-series analysis means being able to search through years of data and look for patterns, multi-variate conditions or relationships to find answers. If you need help, let TrendMiner search for correlations across your entire dataset.



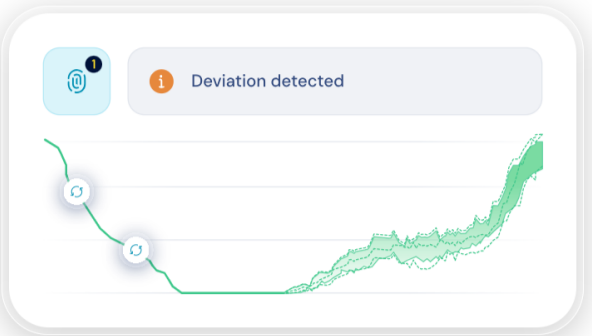
Event analytics: Calculate, aggregate & refine

Add valuable insights with calculated features on top of your data. Your enhanced data set is then ready for use in visualizations and filters.



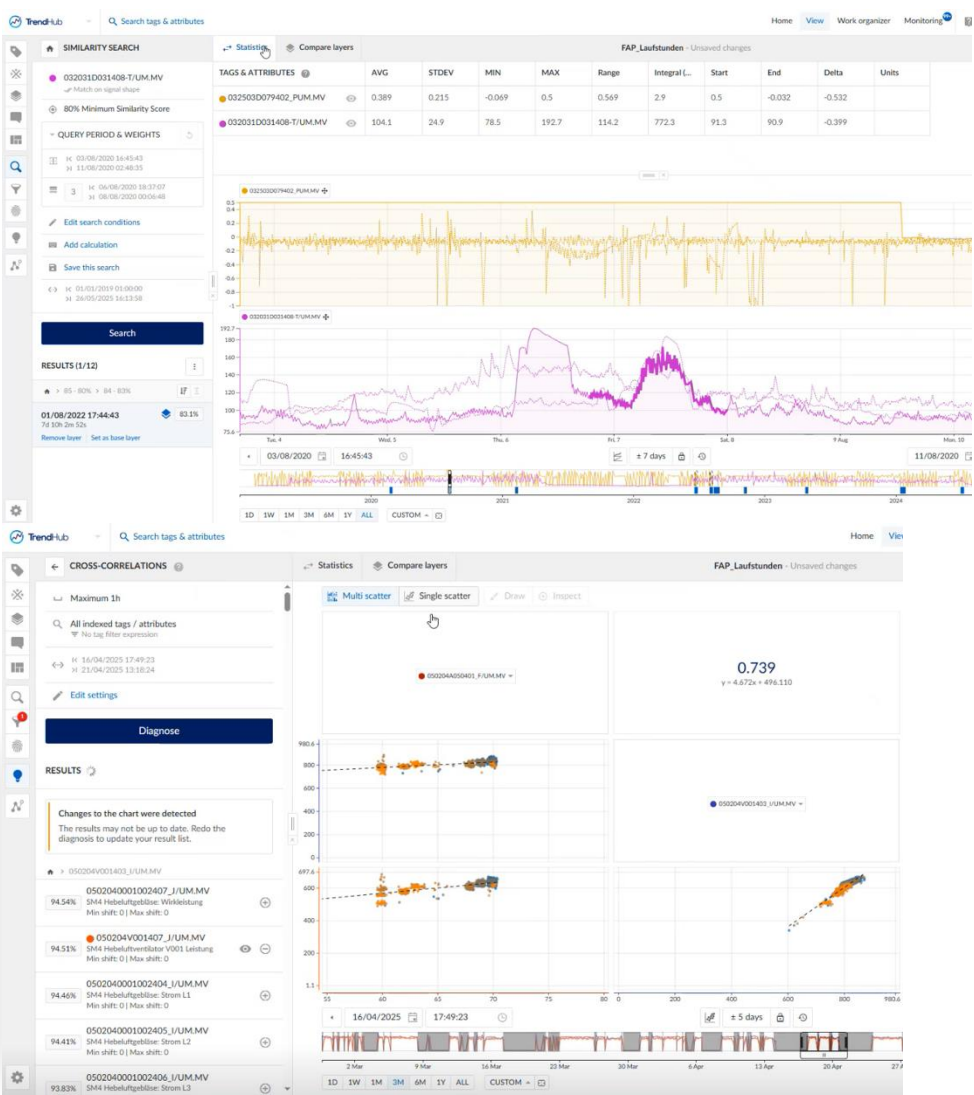
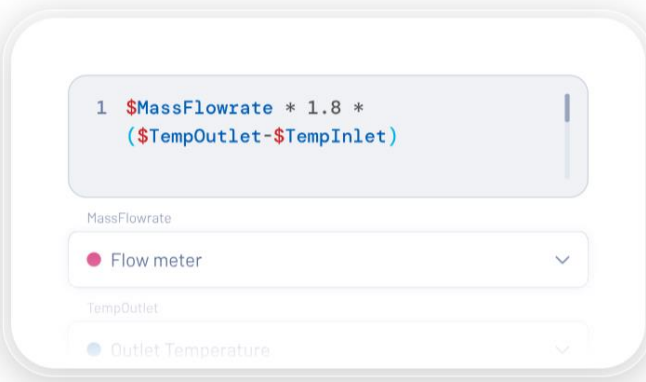
Fingerprints: Define golden scenarios

Tracking behavior from assets or processes can be difficult. Create visual fingerprints that can be visually tracked on dashboards, or run automated detections in the background 24/7.



Formula: Generate your own time-series

Creating your own formulas, aggregations or machine learning models with an easy to use interface. Usable like any other time-series signal.



TrendMiner Features – Process Monitoring

High resolution data (Could be sub-second)

Trending of time series data and transactional data

Process deviations

Performance drift

Equipment abnormalities

Production bottlenecks

Opportunities for optimization

Key Applications at Our Sites:

- Quarry and limestone handling, crushing, screening
- Rotary and PFRK Kilns
- Combustion, burner and system air temperatures
- Kiln Draft
- Fuel Consumption
- Dust collection systems
- Production Rate
- Product quality

Examples:

Coolers

- Bed Level
- Fan Dampers
- Airflow Distribution
- Temperature Profiles

Dust Collection Systems

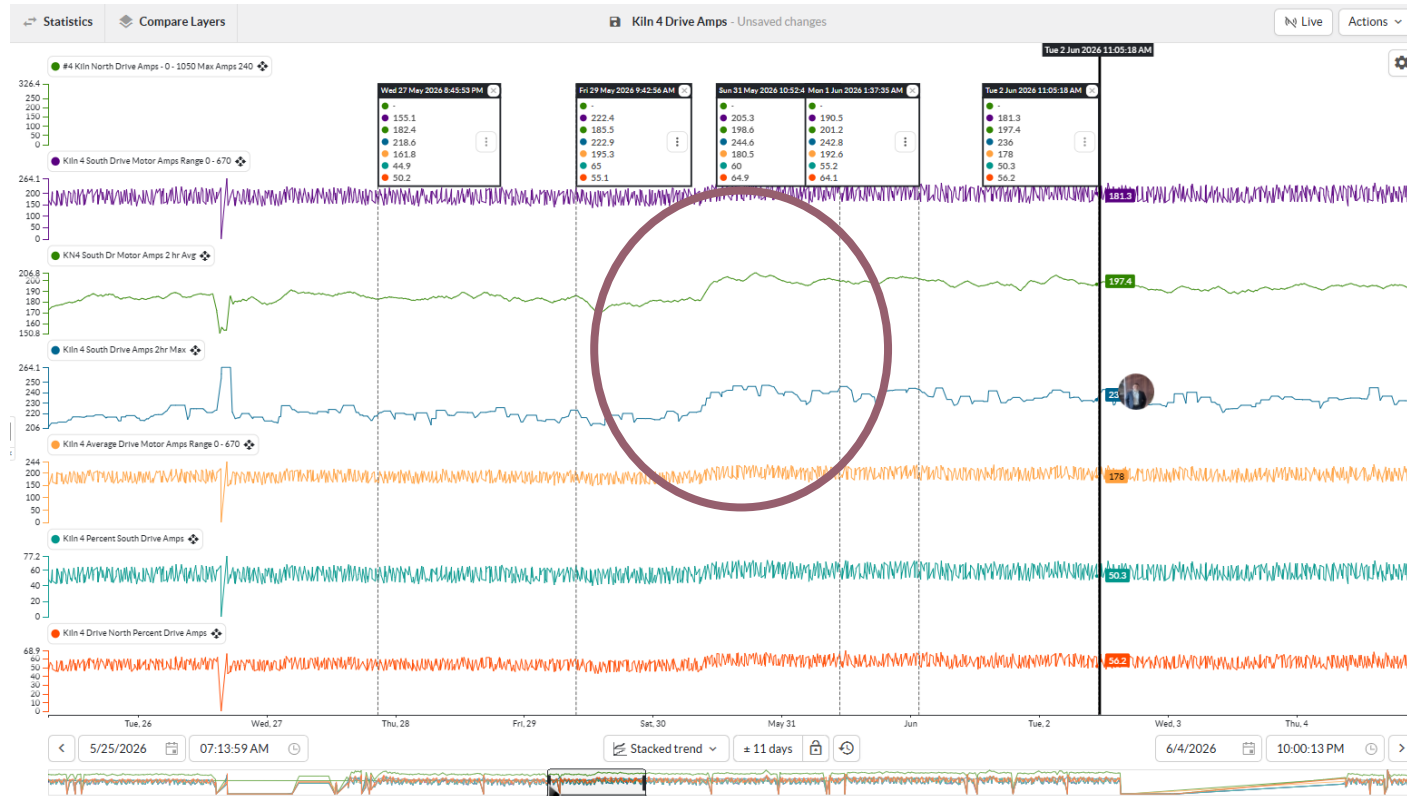
- Differential Pressure
- Fan Performance
- Airflow Stability
- Hydration & Crushing
- Throughput Monitoring
- Equipment Utilization
- Process Stability

Hydration & Crushing

- Throughput Monitoring
- Equipment Utilization
- Process Stability

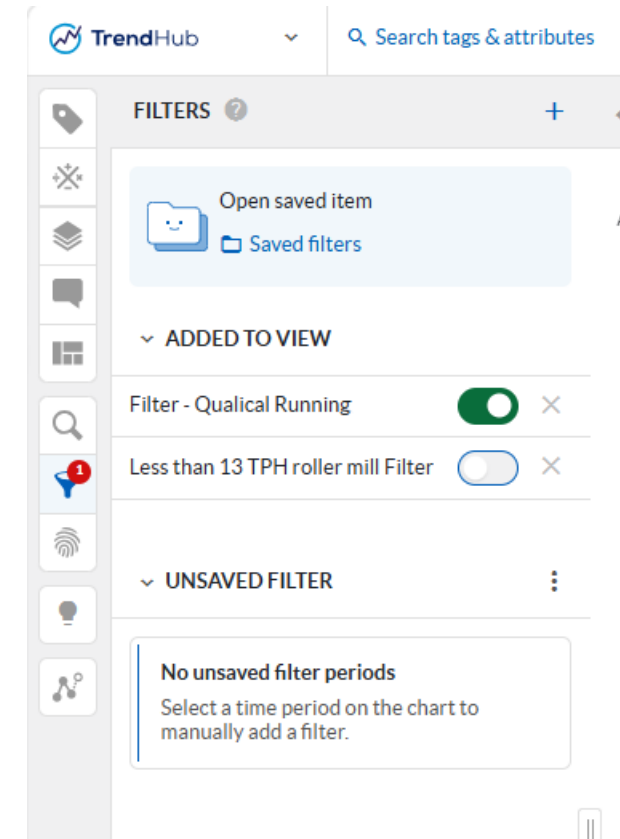
Process Trending and Troubleshooting

- Challenge: Root-cause analysis of rotary kiln tire #5 vibration/failure
- Observed load increases from 184 amps to 204 amps. Vibration and other field data gathered to find the root cause.



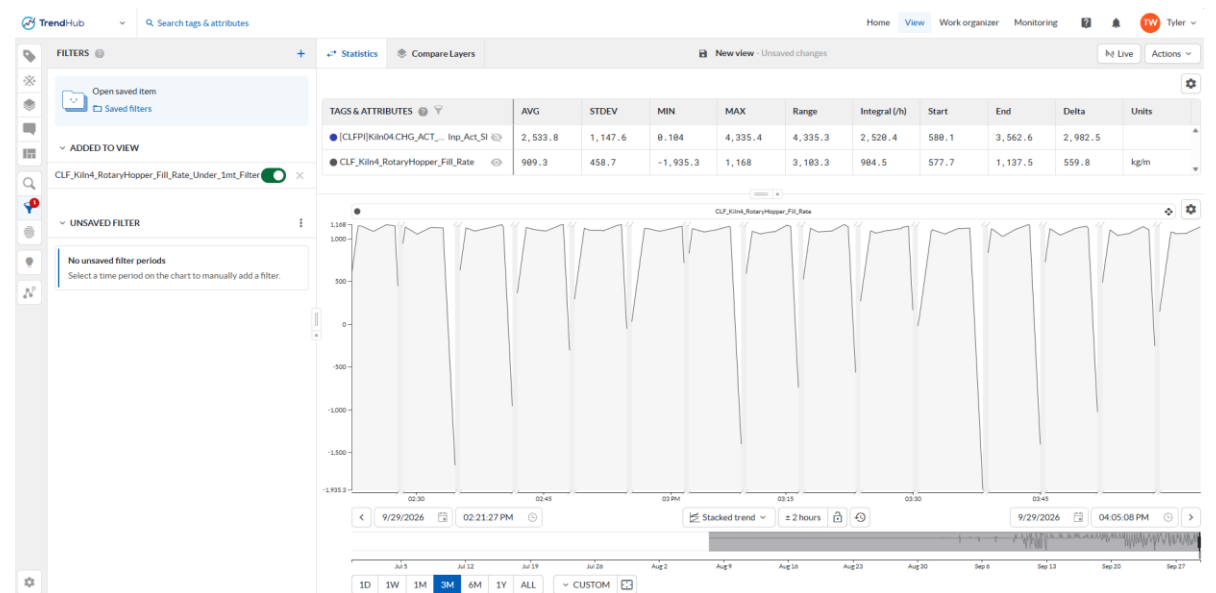
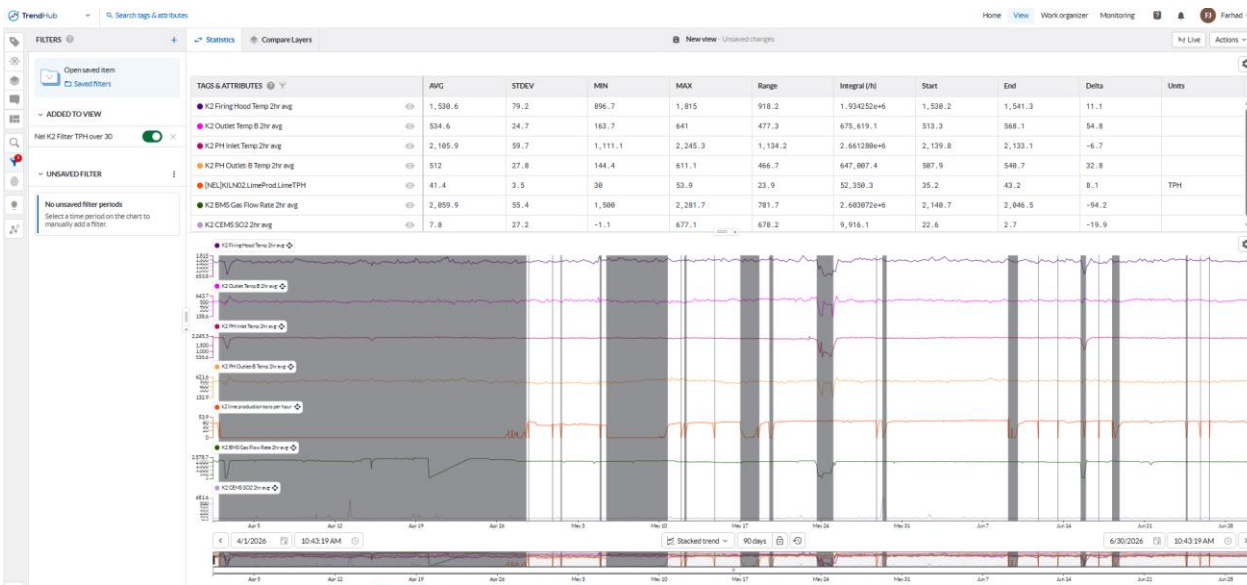
Value-Based Search and Filtering

- Finding the Right Data Before Doing the Analysis
- Industrial data contains large amounts of irrelevant operating periods.
- Startup, shutdown, maintenance, equipment trips, low production periods, unstable conditions, and upset conditions can distort analysis.
- Trend Miner filters allow users to focus only on desired operating conditions.
- Filters can be built using process variables, equipment status signals, alarms, production rates, or quality parameters.
- Analysis becomes more accurate and representative of true plant performance



Value-Based Search and Filtering

- Example: Filtering out data for when the production rate was less than typical.



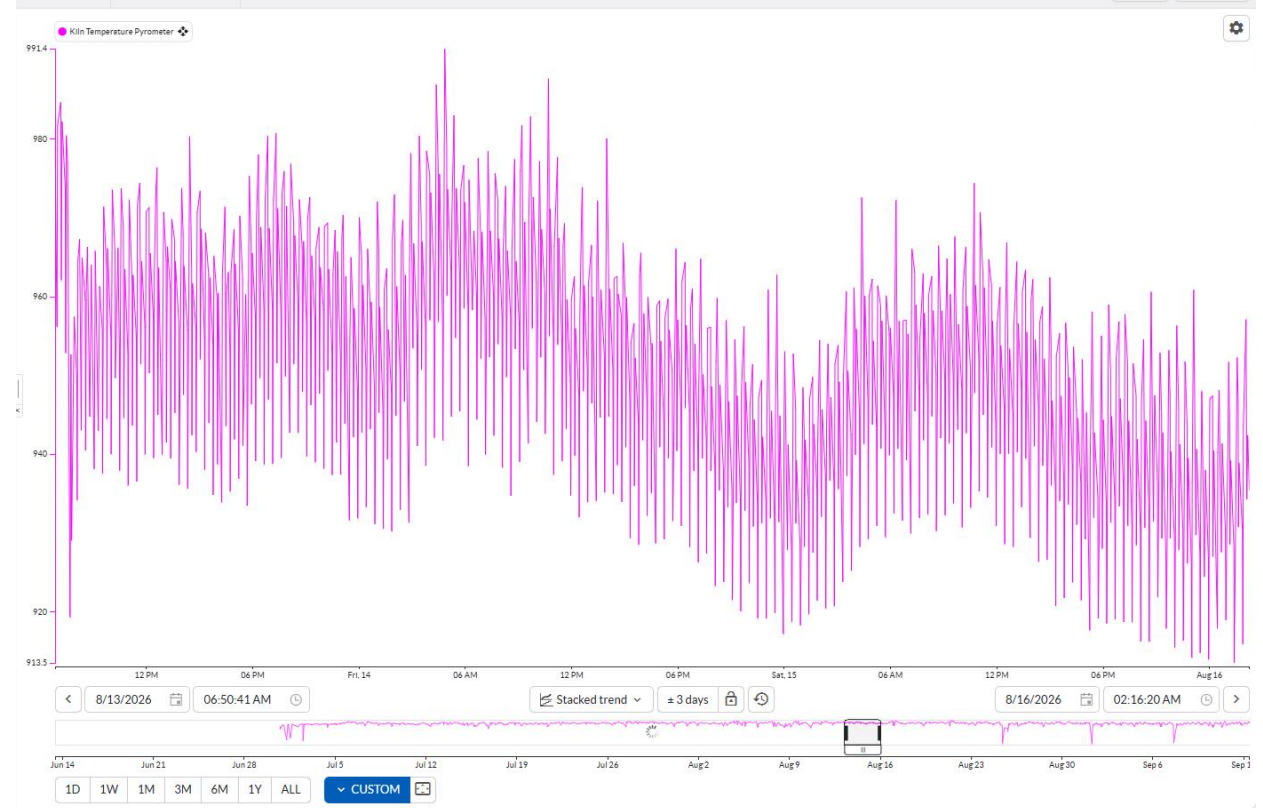
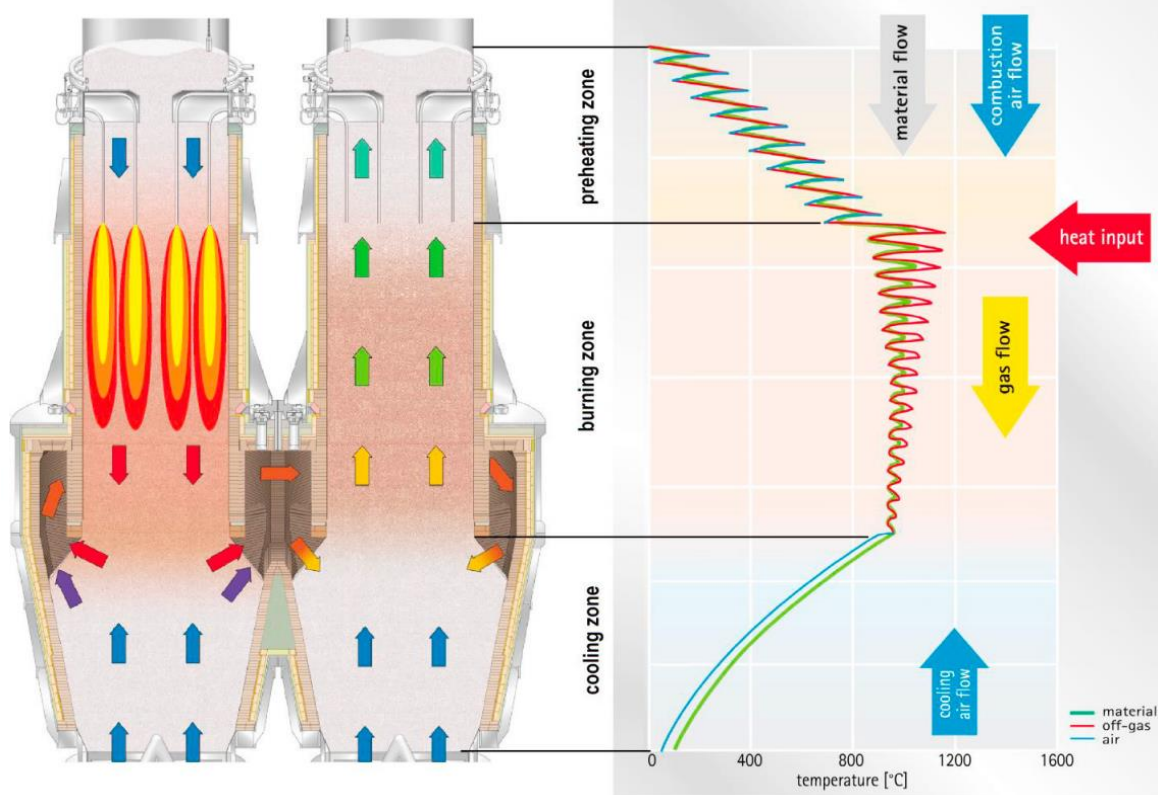
Value-Based Search and Filtering

- Example: Statistical comparison (St Dev, Avg, Range, delta, etc.) between APC (Advance Process Control) performance vs regular/manual control.



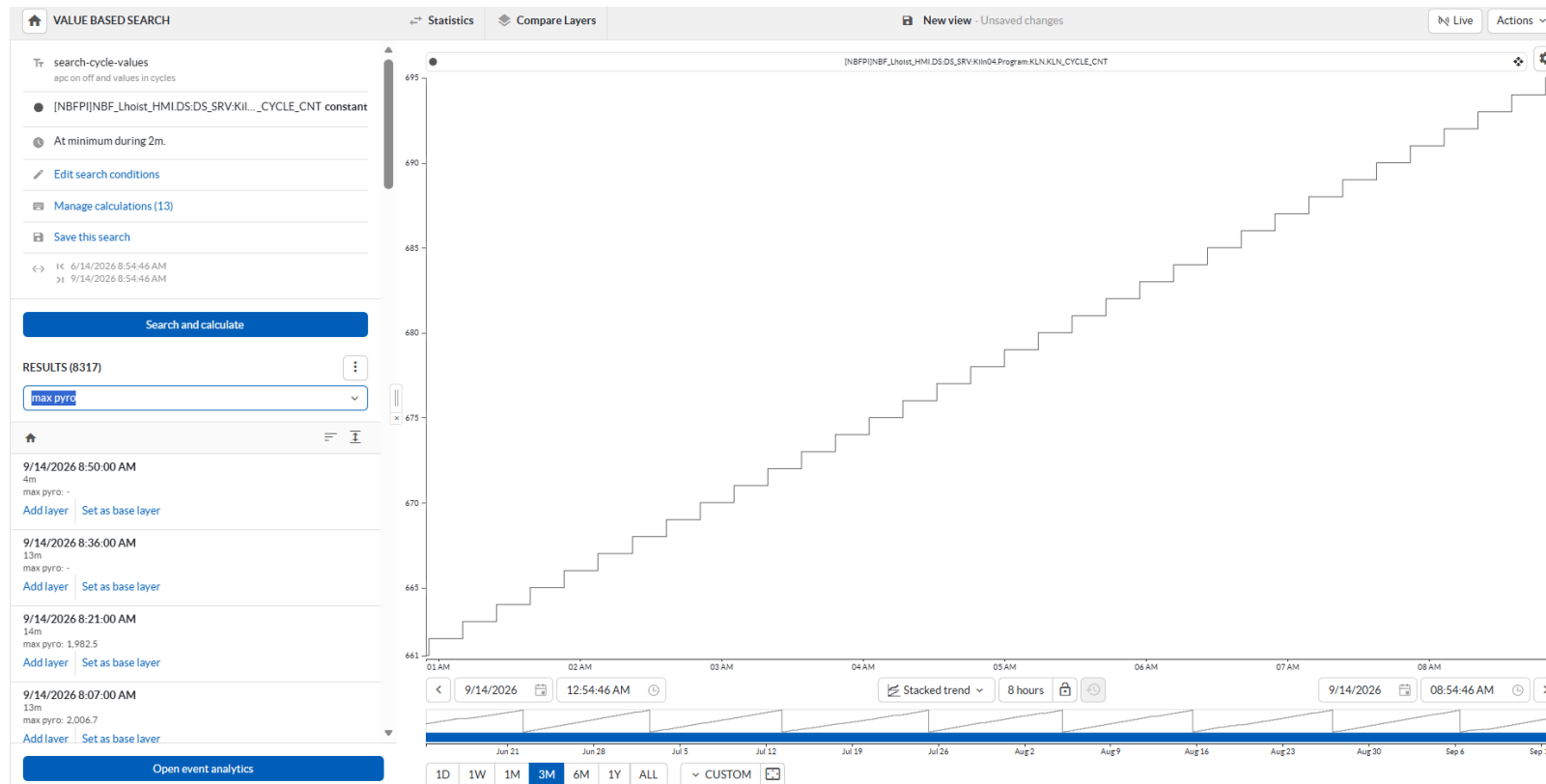
Filtering; Parallel-Flow-Regenerative Kiln Process

- Challenge: Parallel Flow Regenerative (PFR) kilns operate in alternating cycles.
 - Burning Shaft: Fuel firing active, Heat generation, Calcination occurring
 - Reversal Period: Flow switching, Process transition
 - Regenerative Shaft: Heat recovery, No fuel firing
- As a result, process variables can have significantly different behavior depending on the cycle.



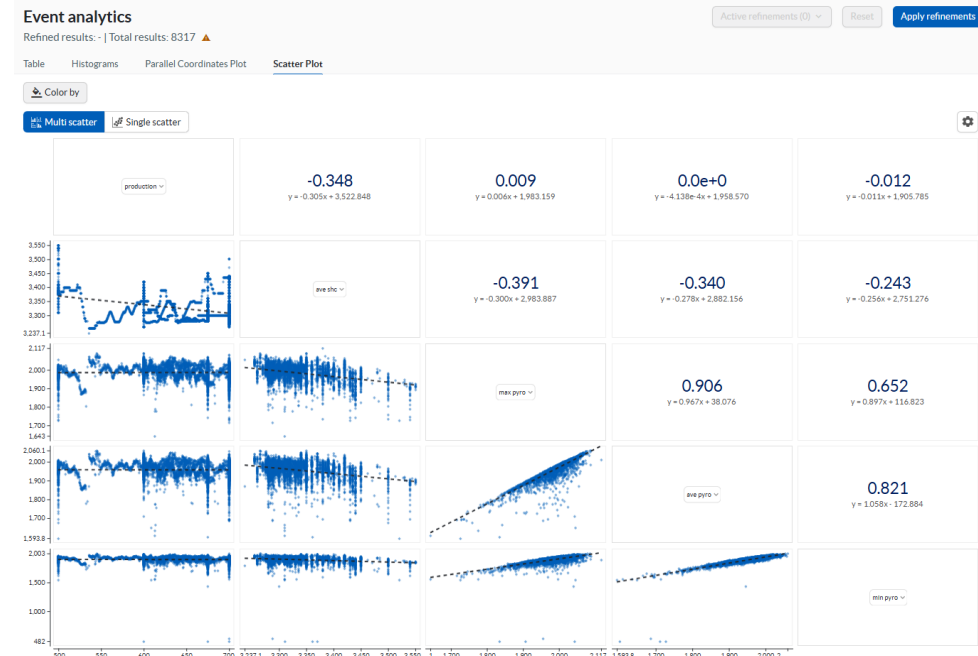
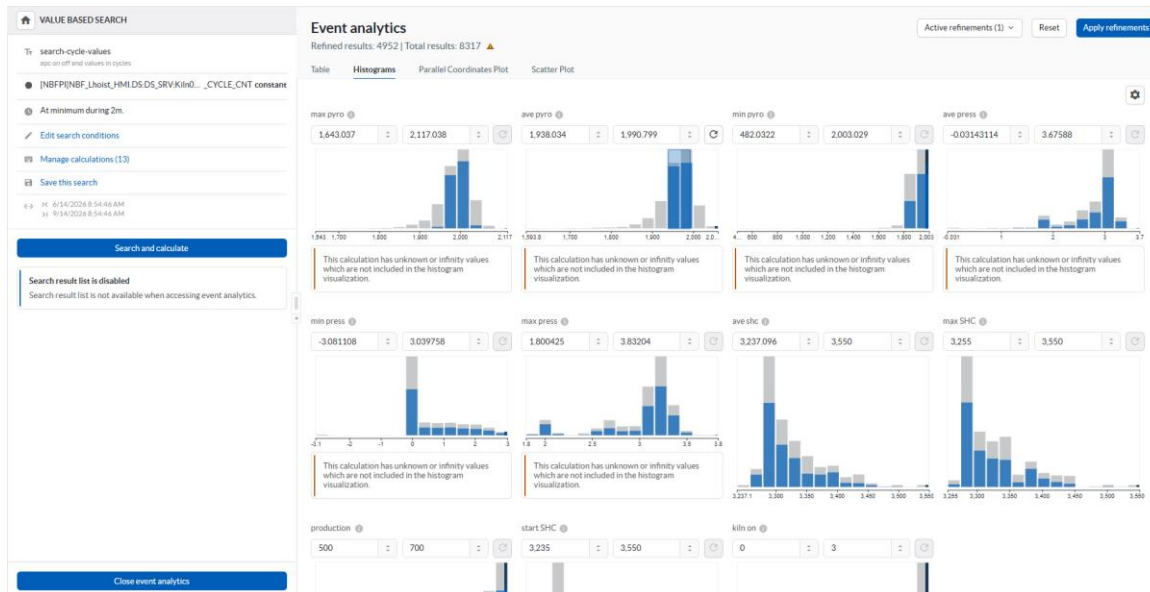
Filtering; Parallel-Flow-Regenerative Kiln Process

- Use Value-Based Search and Filtering
- Isolate burning or non-burning periods only



Filtering; Parallel-Flow-Regenerative Kiln Process

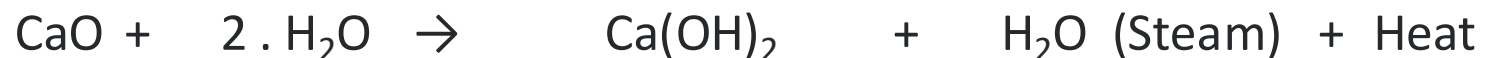
- Before Filtering:
 - Burning + Non-Burning + Reversal
 - Mixed operating conditions
 - Difficult interpretation
- After Filtering:
 - Burning Cycles Only
 - Consistent process conditions
 - Meaningful comparisons



Cross-Correlation / Statistics

Hydration Process Optimization

Lime hydration reaction (Exothermic):



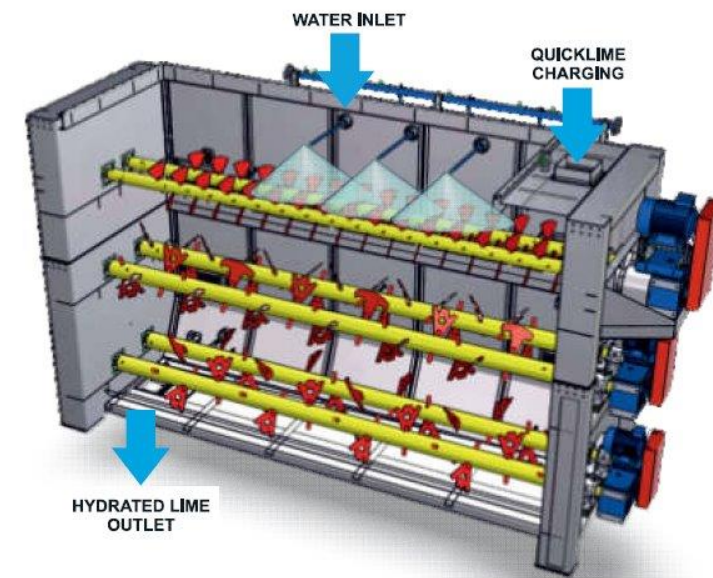
Quick Lime (CaO)
Water
Air



1. Pre-mixing
2. Hydration (Seasoning)
3. Stabilization



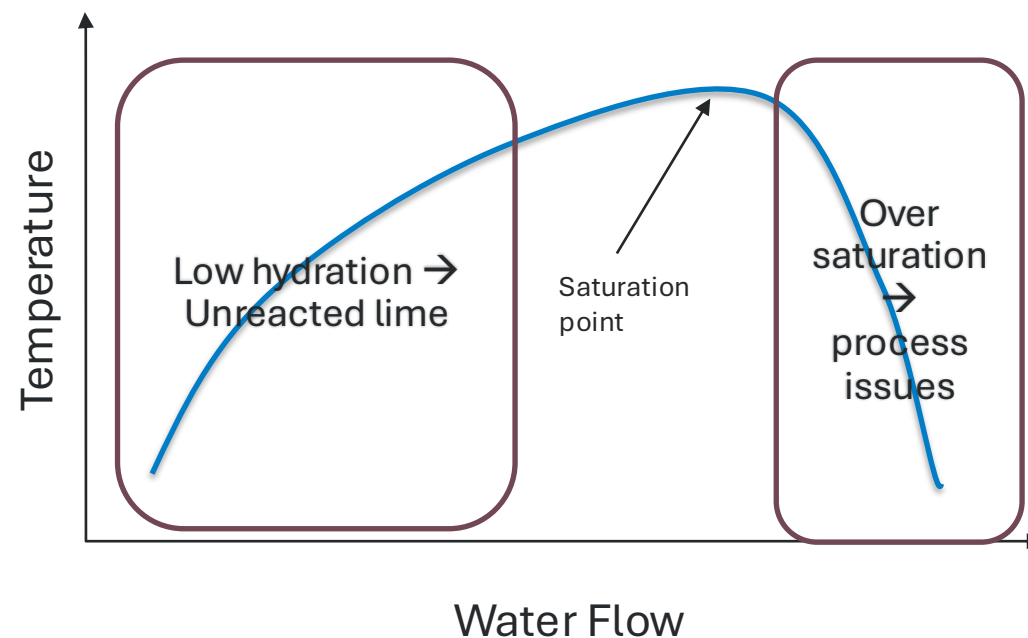
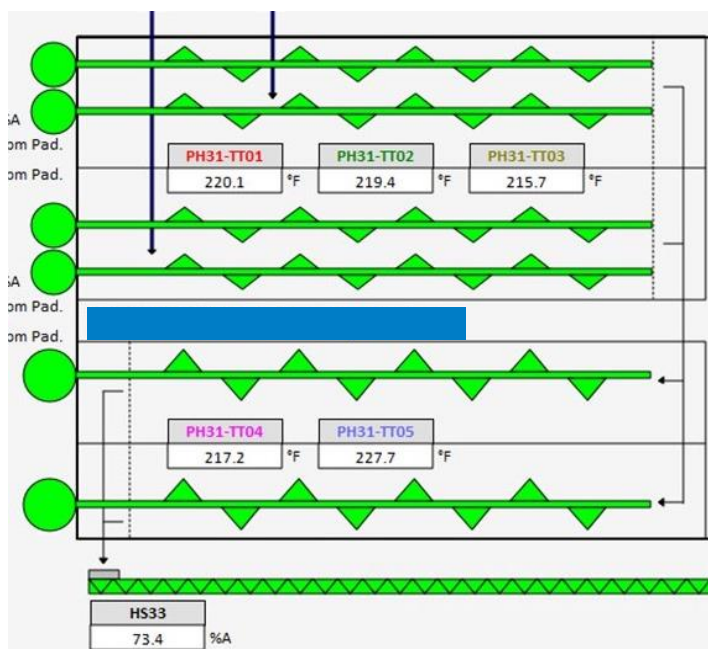
Ca(OH)₂
Steam and Air
Grits
Lime dust
Heat



Cross-Correlation / Statistics

Hydration Process Optimization

- Challenge: Hydration temperature changes lag water addition.
- Hydration process involves exothermic reaction of lime and water in an agitated chamber, where the hydration temperature is key indicator for final product quality (Free moisture).
- Due to increase in temperature during the reaction, and lag time in temperature increase water addition can be difficult to control
- The heat generates steam from water. The heat helps to speed up the reaction.



Cross-Correlation / Statistics Hydration Process Optimization

- Creating a new tag, ability to shift a relevant measurement by the retention time
- Value based search criteria for production rate range of interest

FORMULA

Name
Qualical_Temp2_30min_Shift

Units
Qualical_Temp2_30min_Shifted

Formula
1 Qualical_Temp2_30min_Shift

VARIABLE MAPPING

Qualical_Temp2_30min_Shift

✓ » [NBFPI]NBF_Lhoist_HMI.Qualical_...D_LOG.078.
Shift: 30m

Edit formula

Save formula

Remove from view

TrendHub

VALUE BASED SEARCH

Qualical Hydrate Production > 25

At minimum during 10m.

Edit search conditions

Manage calculations (8)

Save this search

1/18/2026 9:18:28 AM
9/15/2026 9:18:28 AM

Search and calculate

Search result list is disabled
Search result list is not available when accessing event analytics.

Close event analytics

Manage calculations

Calculations used 8/30

Temp1_Avg
Qualical_Temp1_30min_Shifted Average

Temp2_Avg
Qualical_Temp2_30min_Shift Average

Temp3_Avg
Qualical_Temp3_30min_Shift Average

Temp4_Avg
Qualical_Temp4_30min_Shift Average

Temp5_Avg
Qualical_Temp5_30min_Shift Average

Moisture_Avg
[NEL]HYDMOIST_LAST Average

Water_Flow_Avg

+ Add calculation

Cross-Correlation / Statistics

Hydration Process Optimization

- Event Analytics. Option of sorting the search results by calculation/duration/date.
- Can Export the results from here or continue to Open Event Analytics features within Trend Miner

Search and calculate

RESULTS (753)

Temp1_Avg

Home

September

August

July

June

Open event

SORTING

Sort by date

Sort by duration

Sort by calculation

ACTIONS

Keep results

Exclude results

Add as context item

Export

Event analytics

Active refinements (1) Reset Apply refinements

Refined results: 37 | Total results: 753

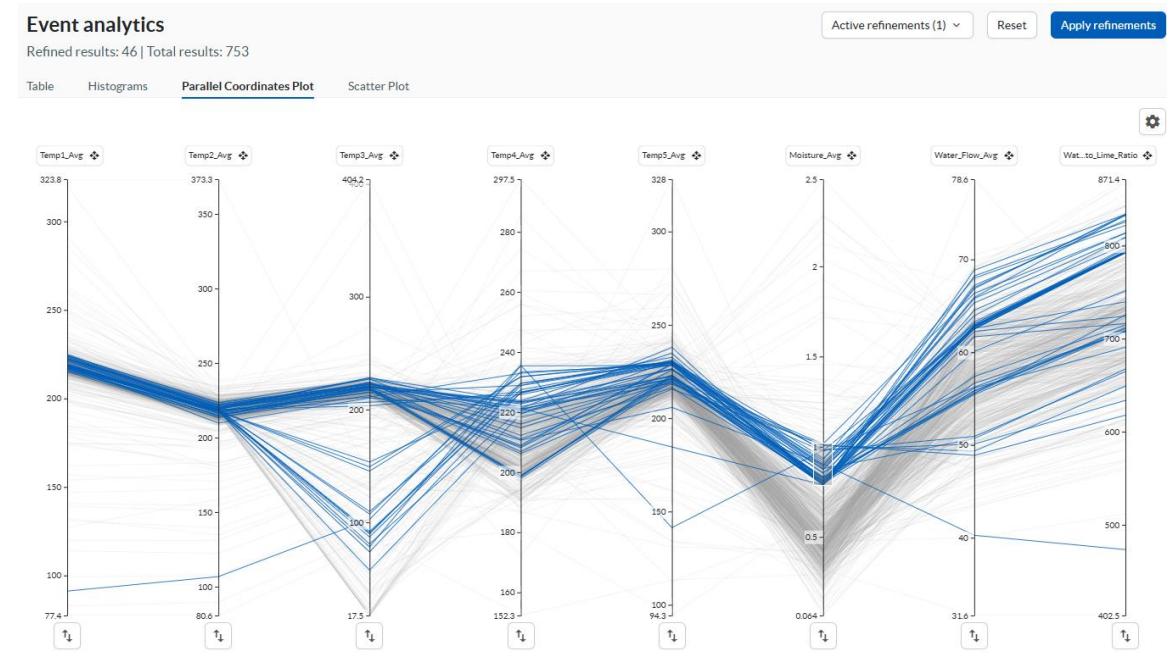
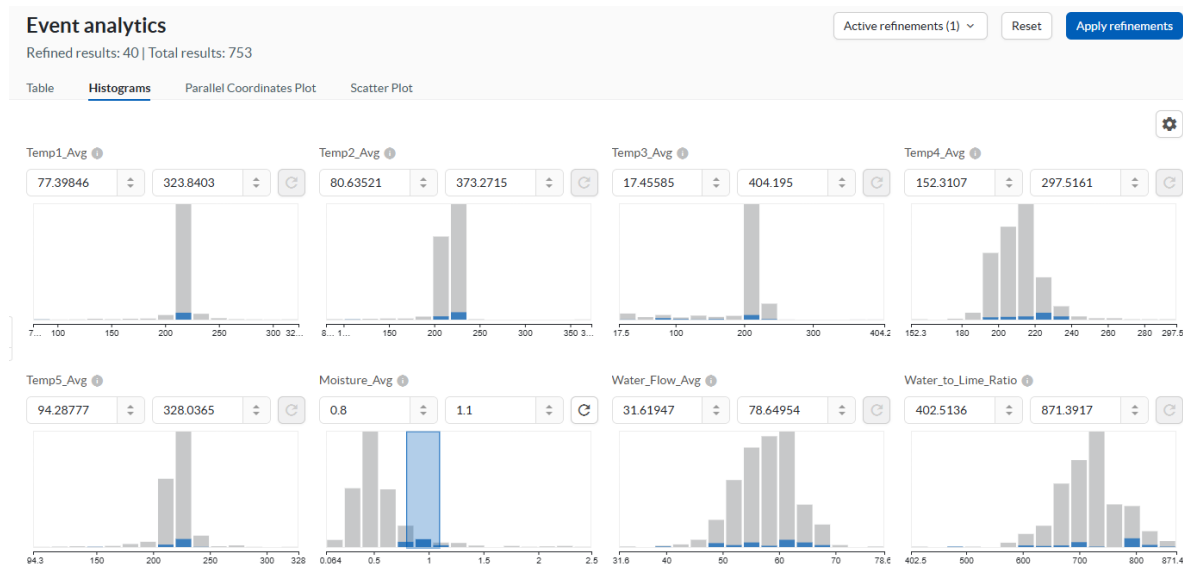
Table Histograms Parallel Coordinates Plot Scatter Plot

	Start date	Duration	Temp1...	Temp2...	Temp3...	Temp4...	Temp5...	Moistu...	Water_...	Water_...		
☐	9/13/2026 1:53:00...	9m 00s	222.2	220	221.2	214.8	219.4	0.833	65.9	833	B	+
☐	9/11/2026 5:59:00...	17m 00s	222	219.9	221.4	216.8	218.3	1	69.1	842.8	B	+
☐	9/11/2026 1:32:00...	10m 00s	221.2	220.4	220.7	223.5	221	1	66.3	813.6	B	+
☐	9/11/2026 12:43:0...	14m 00s	222.7	221.2	223.6	220.6	226.3	0.926	68	821.7	B	+
☐	9/8/2026 12:35:00...	20m 00s	222.6	220.2	227.1	210.9	218.3	0.974	56.2	708.1	B	+
☐	8/11/2026 2:01:00...	10m 00s	219.6	219.8	217	209.1	228.8	0.874	63.9	808.7	B	+

Cross-Correlation / Statistics

Hydration Process Optimization

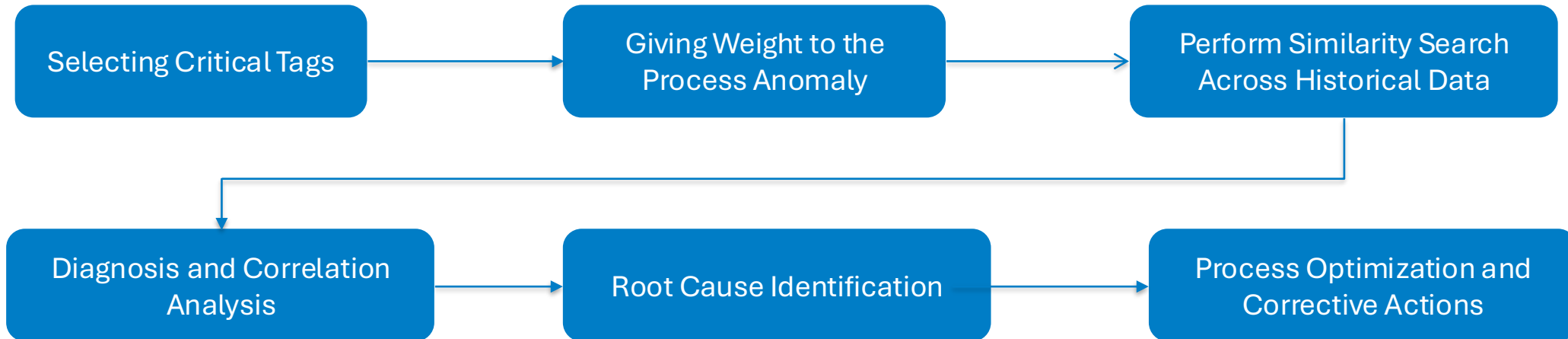
- Finding the range of process parameters where the hydrate product quality was on target



Process Optimization – Rotary Kiln Temperature Profile

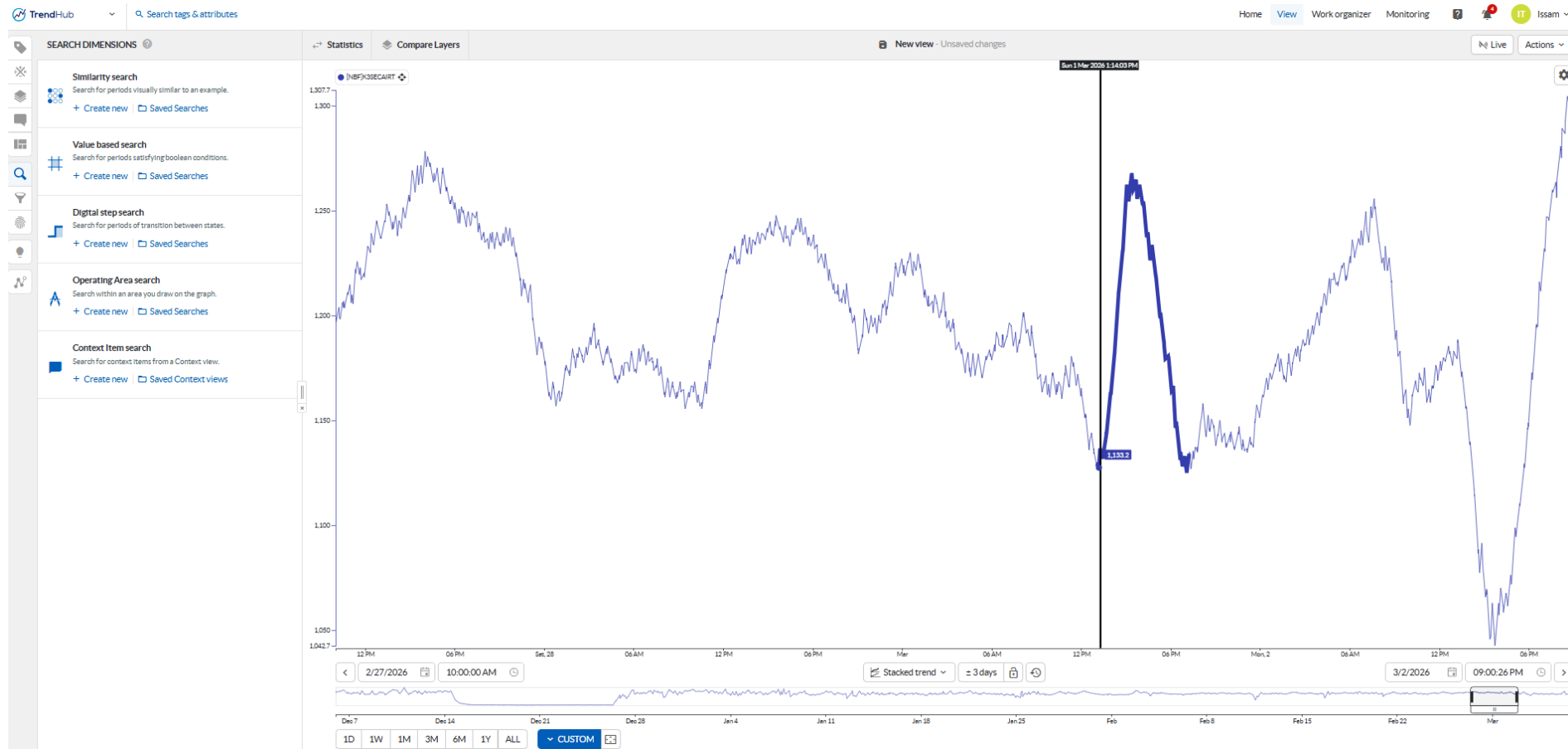
Challenge: The rotary kiln experienced periodic spikes and instability in Secondary Air Temperature (SAT), resulting in:

- Reduced process stability
- Fluctuating combustion conditions
- Increased operator intervention
- Negative impact on the consistent kiln performance

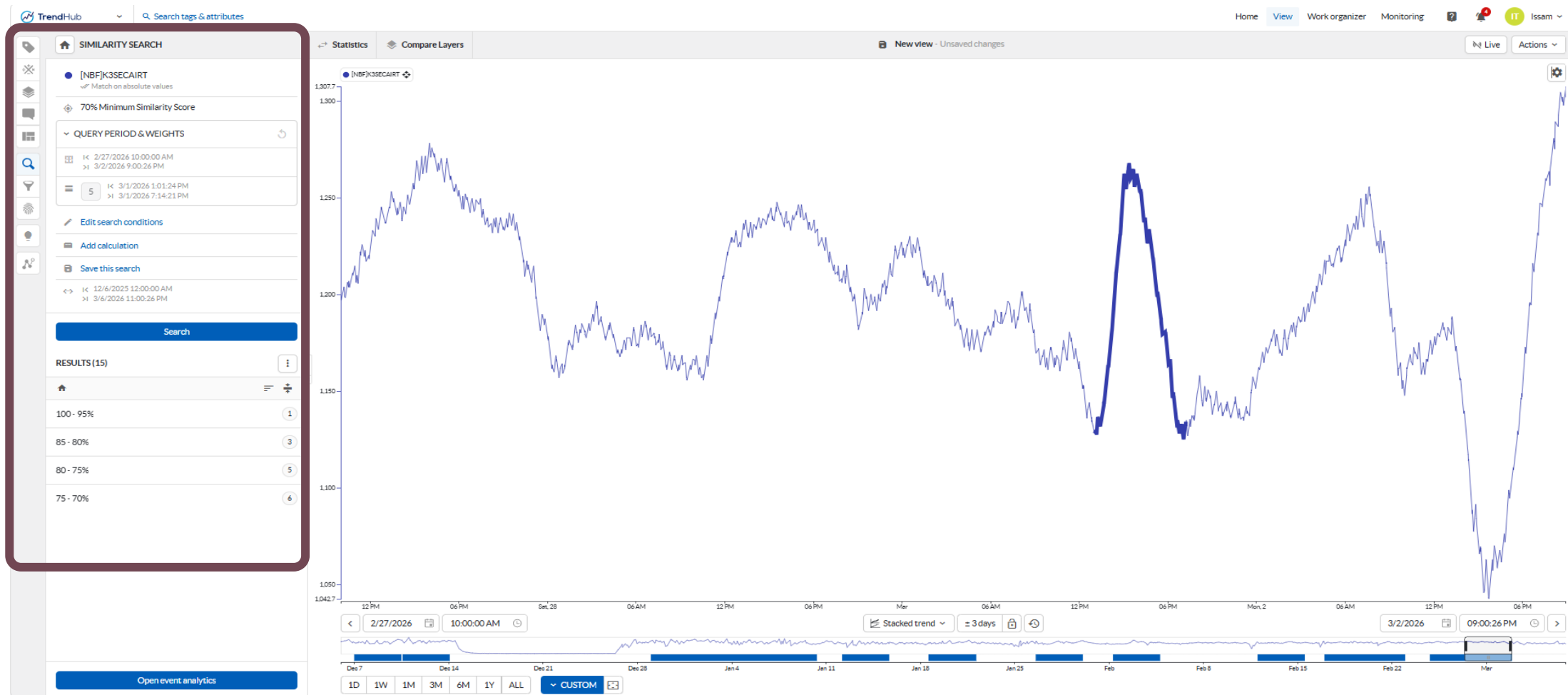


Process Optimization – Rotary Kiln Temperature Profile

- Challenge: Finding root cause of a process variation (Secondary Air Temperature).
 - Feature used: Similarity Search

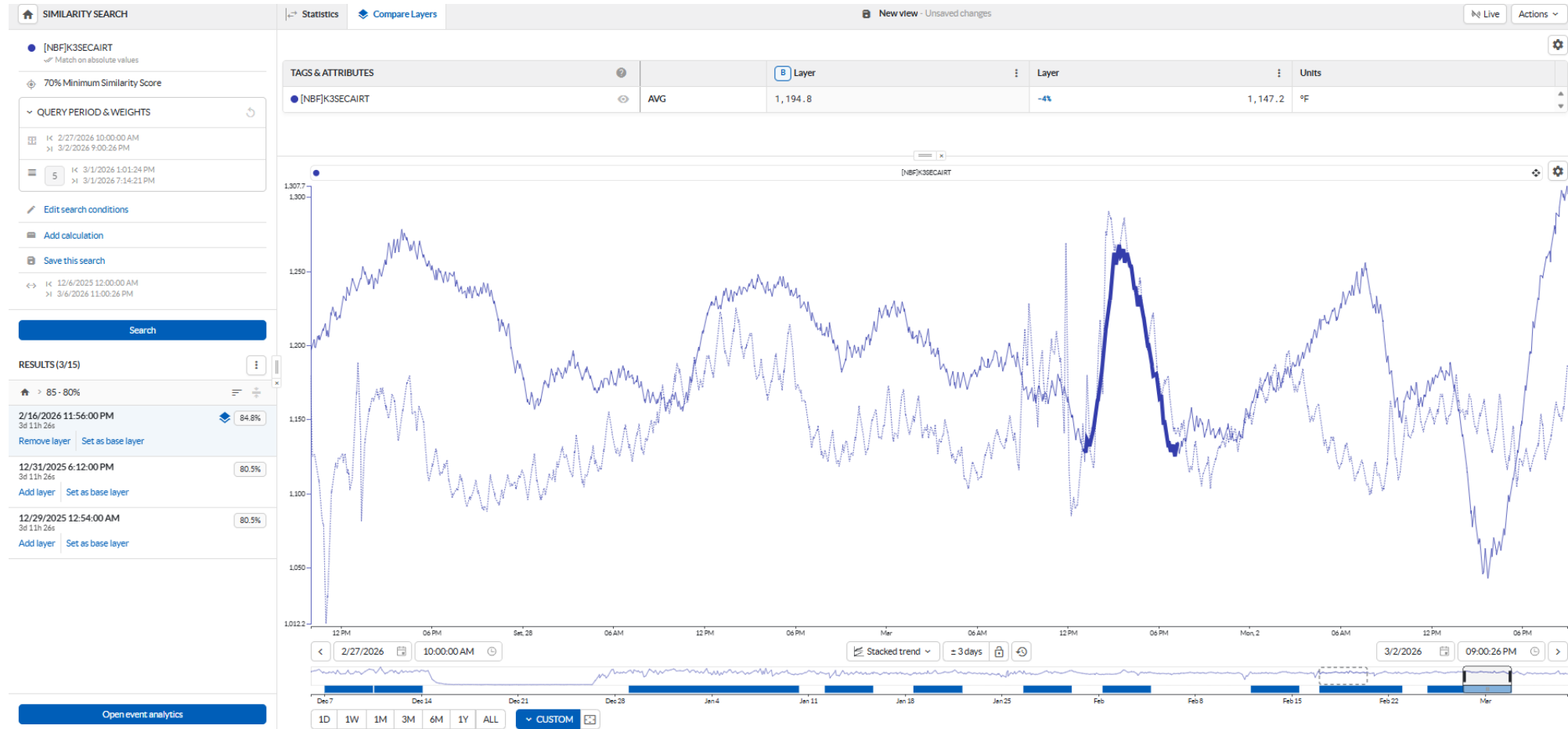


Process Optimization – Rotary Kiln Temperature Profile



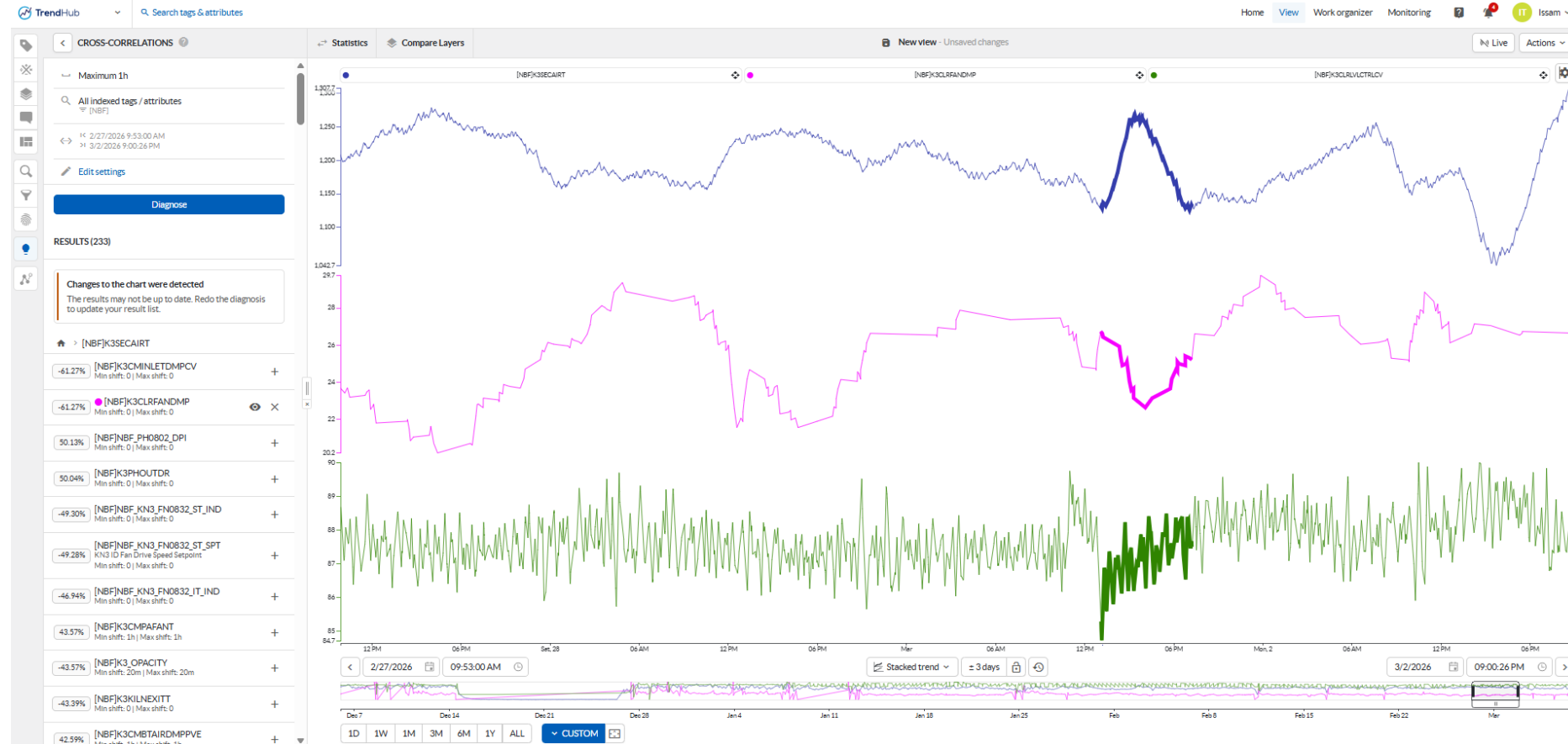
Process Optimization – Rotary Kiln Temperature Profile

- Similar instances can be found to strengthen the analysis.
 - Highest similarity scores were added as layers.



Process Optimization – Rotary Kiln Temperature Profile

- Objective: Finding process tags that could be correlated or the root cause of the secondary air T variation
 - Feature used: Diagnosis



Process Optimization – Rotary Kiln Temperature Profile

	Before	After	% change
Level- Average	87.5	87.5	0
Temperature -Average	1105	1139	3
Level- St dev	2.6	0.582	-78
Temperature- St dev	39	28.4	-27



- Collaboration between process and automation teams to improve operational efficiency.
 - Use of Trend miner to identify the problem.
 - Loop tuning software to implement the solution.
 - Data → Information → Insight → Action

Detect, Monitor, and Track Events

- A context Item is a block of information linked to a data point or a period of data

Detect and Monitor

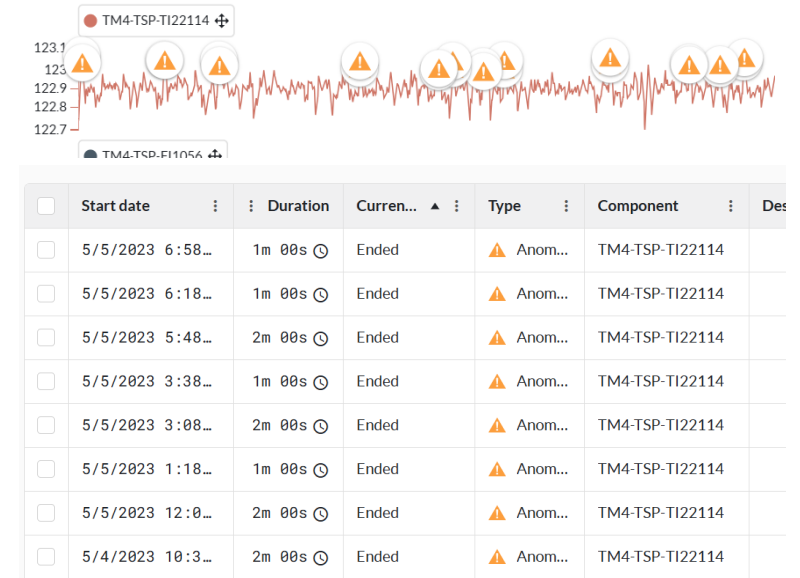
Monitor and warn about anomalies:
Capture any process event
and create context items

Track Events

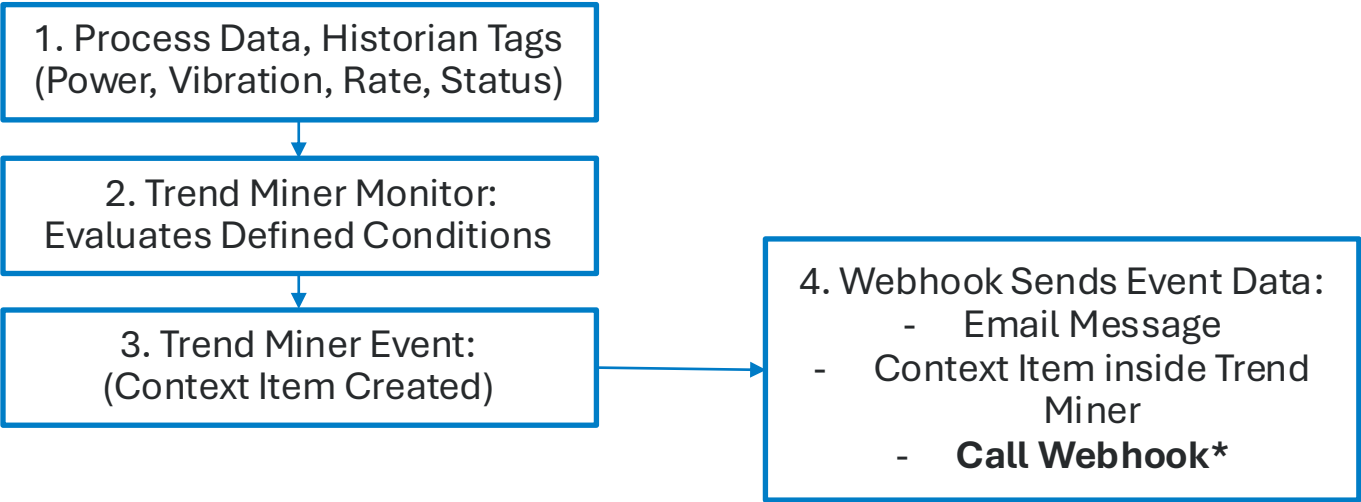
Automatically track anomalies: Store any event along with additional needed info for further analysis

Detect, Monitor, and Track Events

- Using TrendMiner to continuously evaluate certain anomalies or specific conditions:
- Detect events, Tracks occurrence frequency
 - Supports root cause analysis, Preserves operational knowledge
- Searching/ filtering information
- ContextHub Views: Visualization: Table, Gantt or Scatter
- Visualize or count Context Items in dashboards
- Visualize timeframes in TrendHub to drive your analysis
- Easily share with and searched by others
- Compare with other context information
- Graphical representation of your data in TrendHub, or viewed within ContextHub



Detect, Monitor, and Track Events



Monitor Condition	Event Generated	Team Notification
Ball Mill Down >10 min	Downtime Event	"Ball Mill #2 Down"
Vibration > Threshold	Reliability Alert	"High Vibration Detected"
Feed Rate Low	Process Alert	"Production Rate Below Target"
Equipment Running Again	Recovery Event	"Asset Returned to Service"

Crawford Plant 2 is off

MONITOR DETAILS

Crawford Plant 2 is off

The selected search contains conditions based on digital or discrete tags. TrendMiner will extend the last known value of these tags up until a new data point is received from the source. Untimely received data points might lead to inaccurate monitor results.

ACTIONS (OPTIONAL)

☐ Send email message

☐ Create context item

☒ Call webhook

WEBHOOK DETAILS

URL

https://default978e71569db745bfa7cd01df044...

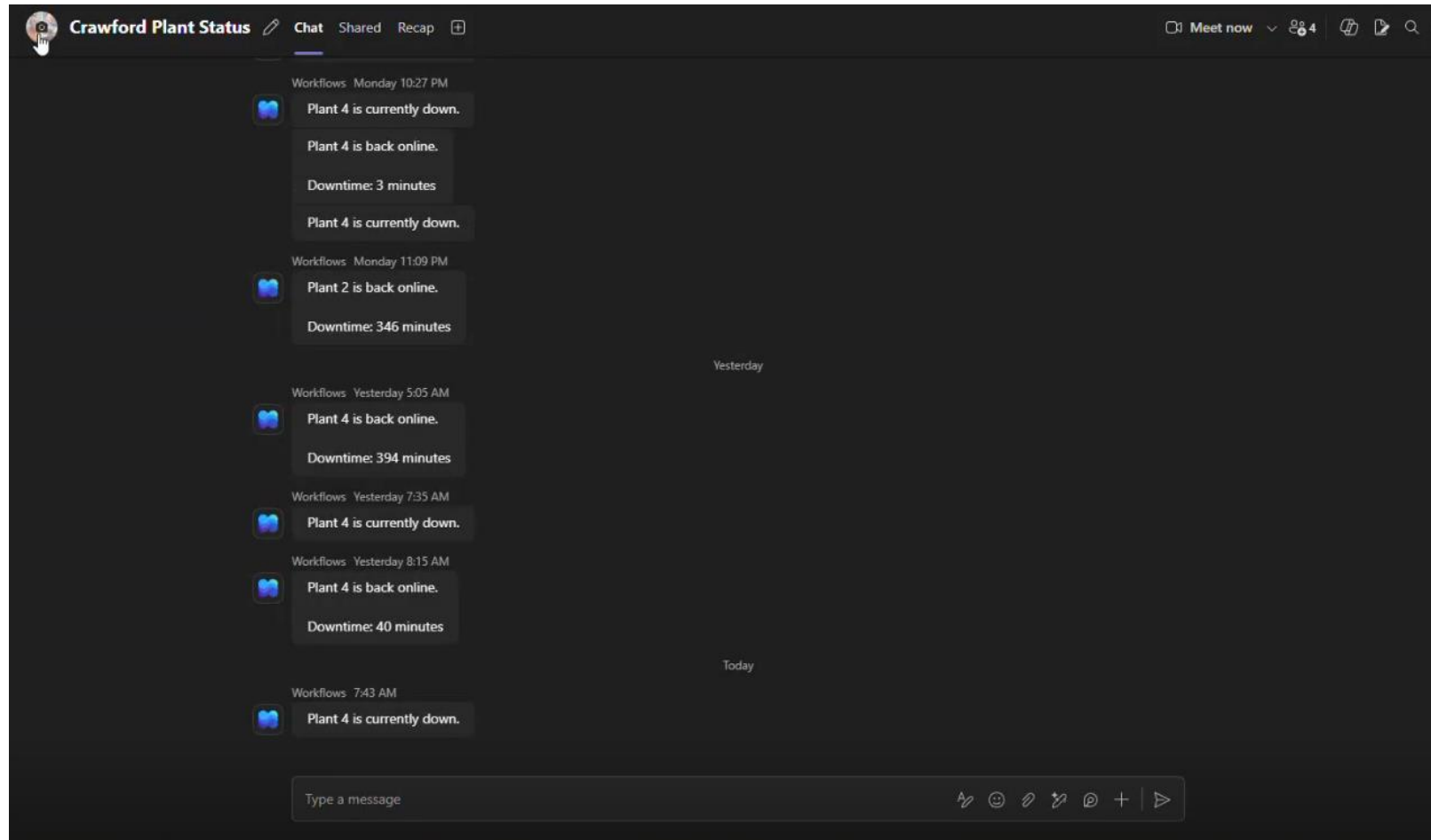
Test URL

Cancel

Save monitor

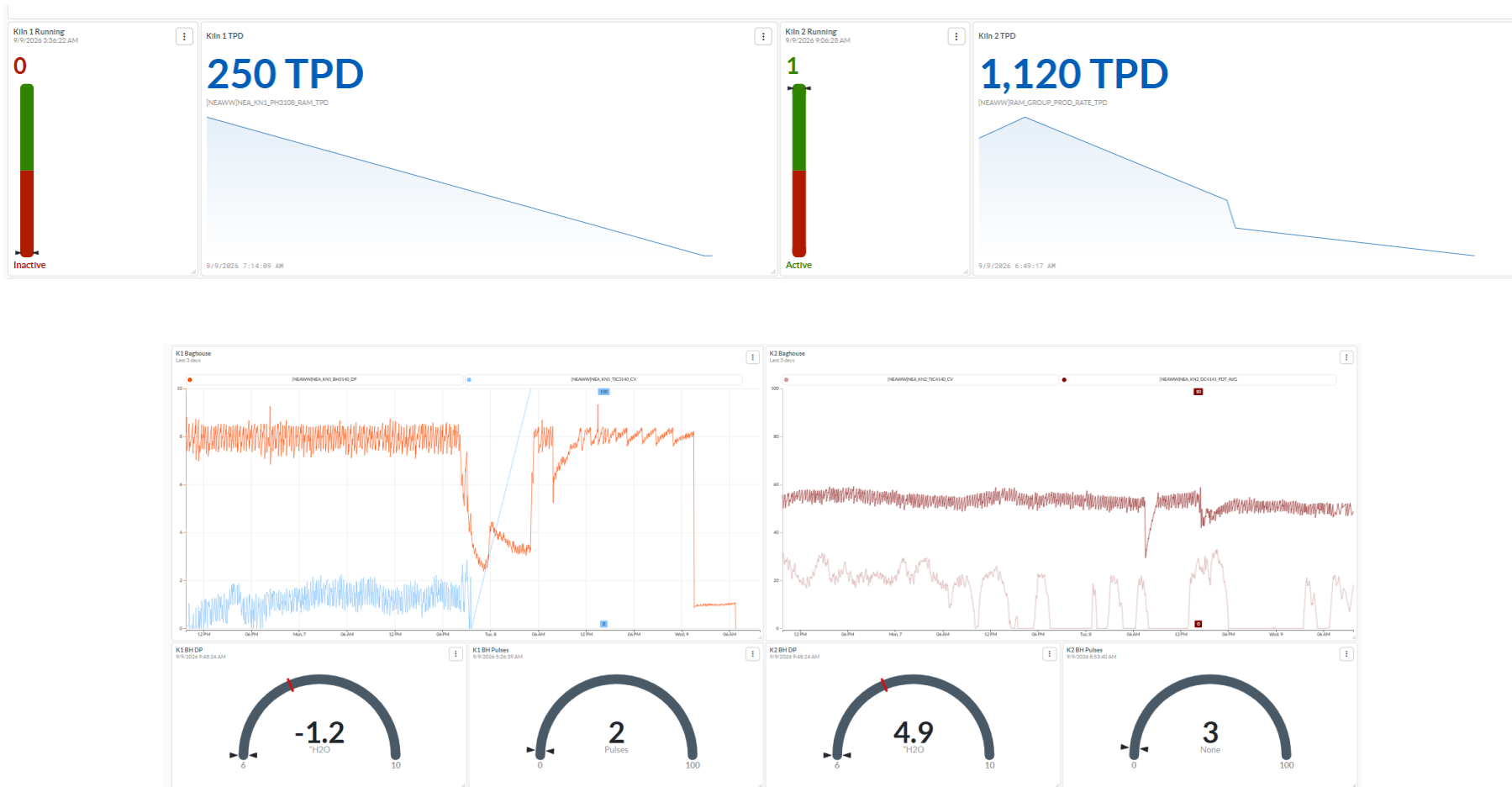
Detect, Monitor, and Track Events

- Example: Implementation of plant down/run time for a mineral processing system.



Dashboards

- Historian Data → Analysis → Insights → DashHub → Operational Visibility

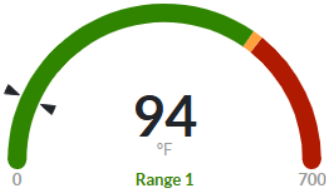


Dashboards

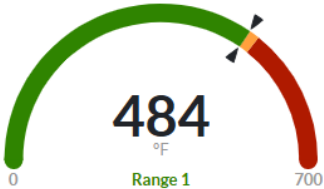
Temperatures

Baghouse Temperatures

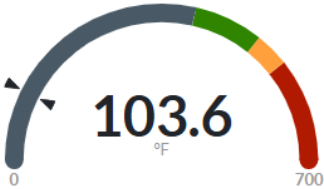
K1 BH Inlet Temp
9/9/2026 9:54:35 AM



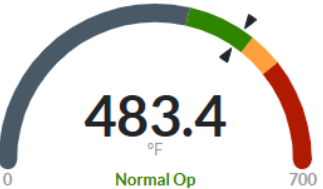
K2 BH Inlet Temp
9/9/2026 9:54:47 AM



K2 PH Exit Temp
9/9/2026 9:54:48 AM



K2 PH Exit Temp
9/9/2026 9:54:48 AM



K1 Bleed Damper %
9/9/2026 5:27:12 AM



K2 Bleed Damper %
9/9/2026 9:54:48 AM

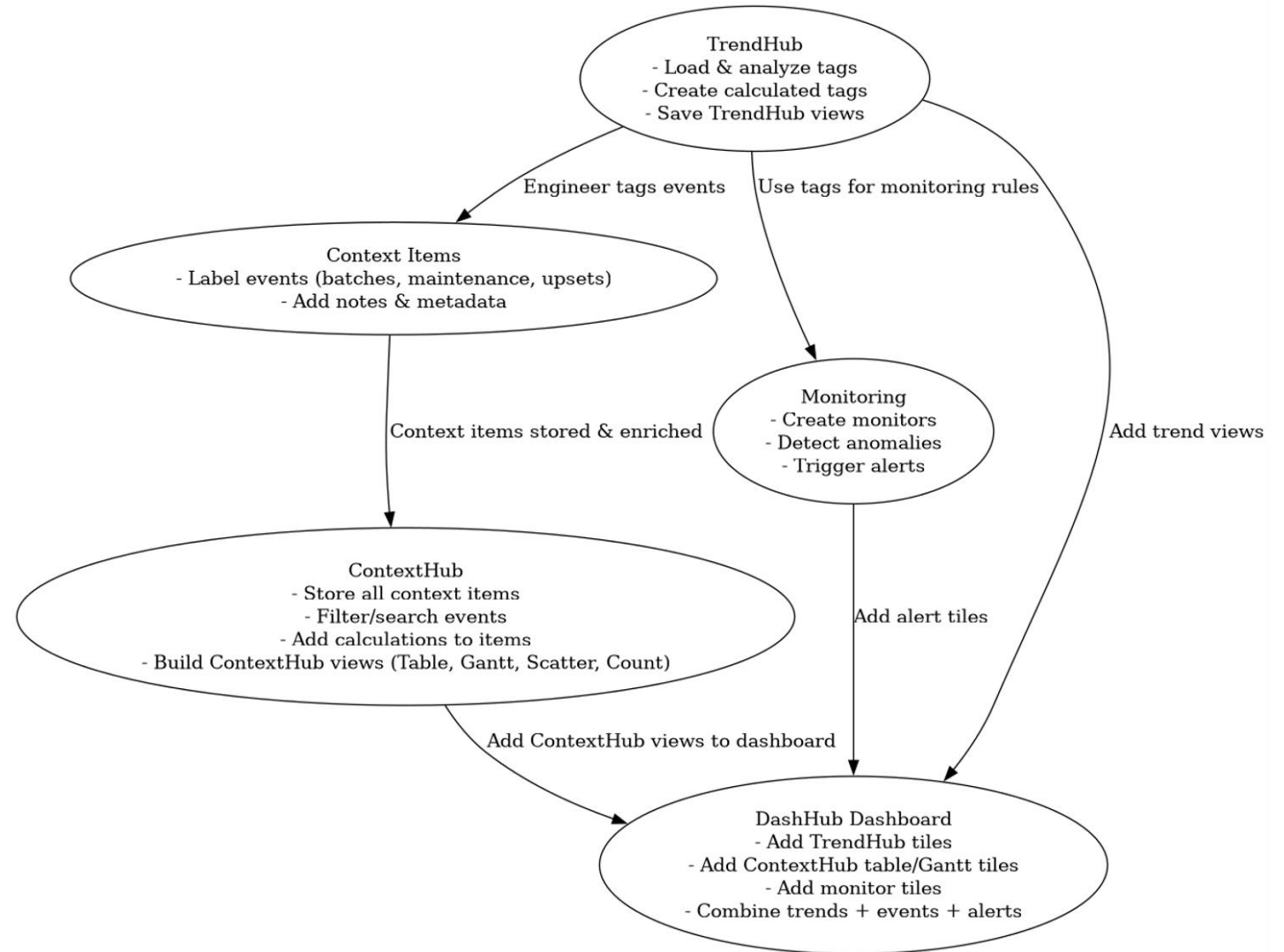


Dashboards



Summary

- Key Applications of TrendMiner in Lime:
- Data Discovery:
 - Process Monitoring
 - Value Based Search
 - Filtering
- Process Optimization:
 - Statistical Analysis
 - Similarity Search
 - Diagnosis
 - Root Cause Analysis
- Operational Intelligence:
 - Monitors
 - Context Capture
 - Notifications
 - Dashboards



Faster troubleshooting, improved process stability, and data-driven operational decisions.



Thank you for your attention!



Appendix

