SAG Italy - May 8, 2020

Sören Hams
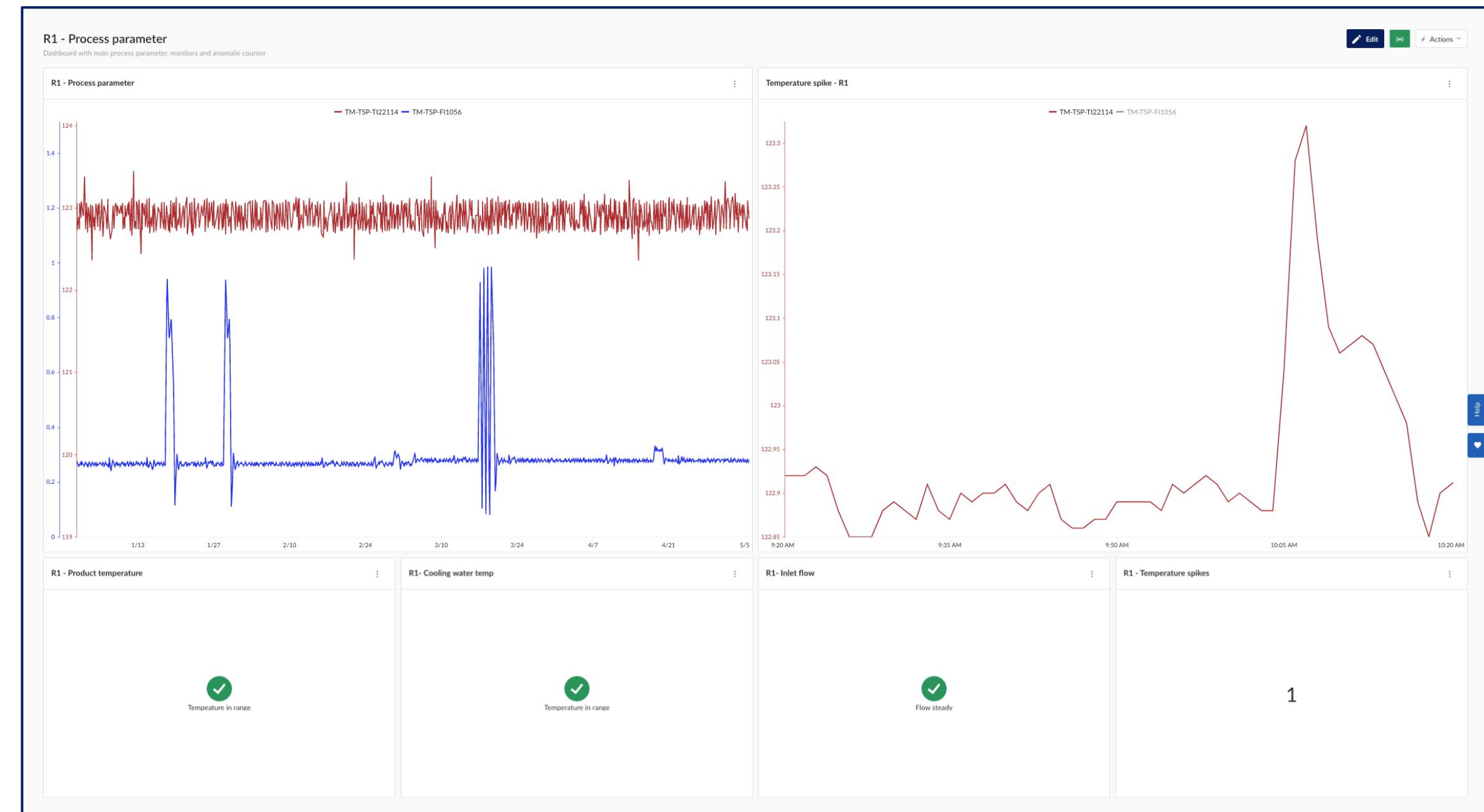
Temperature Spike in Reactor

Root cause analysis of issues in continuous reactor

TrendMiner
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Temperature Spike in Reactor

- ## Process
  - Continuous process
  - Temperature sensitive product

- ## Problem
  - Temperature spike in reactor
  - Quality loss

- ## Goal – Root cause analysis
  - What has happened?
  - When did it happen?
  - Why did it happen?

Temperature Spike in Reactor

- ## Temperature spike reported
  - ### Knowledge sharing between users

- ## Identified multiple spikes in the past
  - ### Easy search functionality
  - ### Simple creation of filter

- ## Identified root cause
  - ### Correlation via Recommendation Engine
  - ### Cooling water

- ## What's next?
  - ### Set up monitor
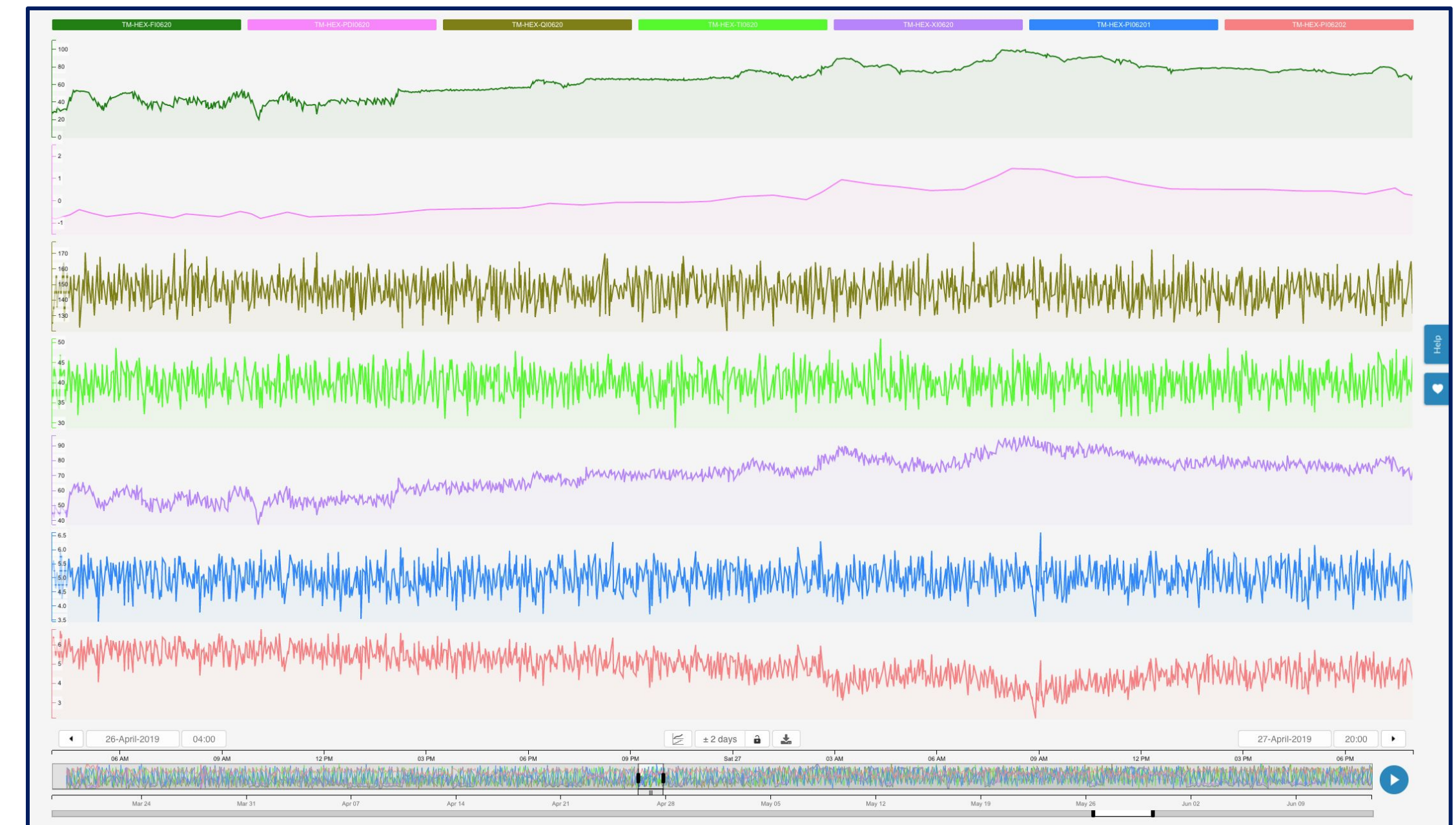 - ### Cooling water as early indicator
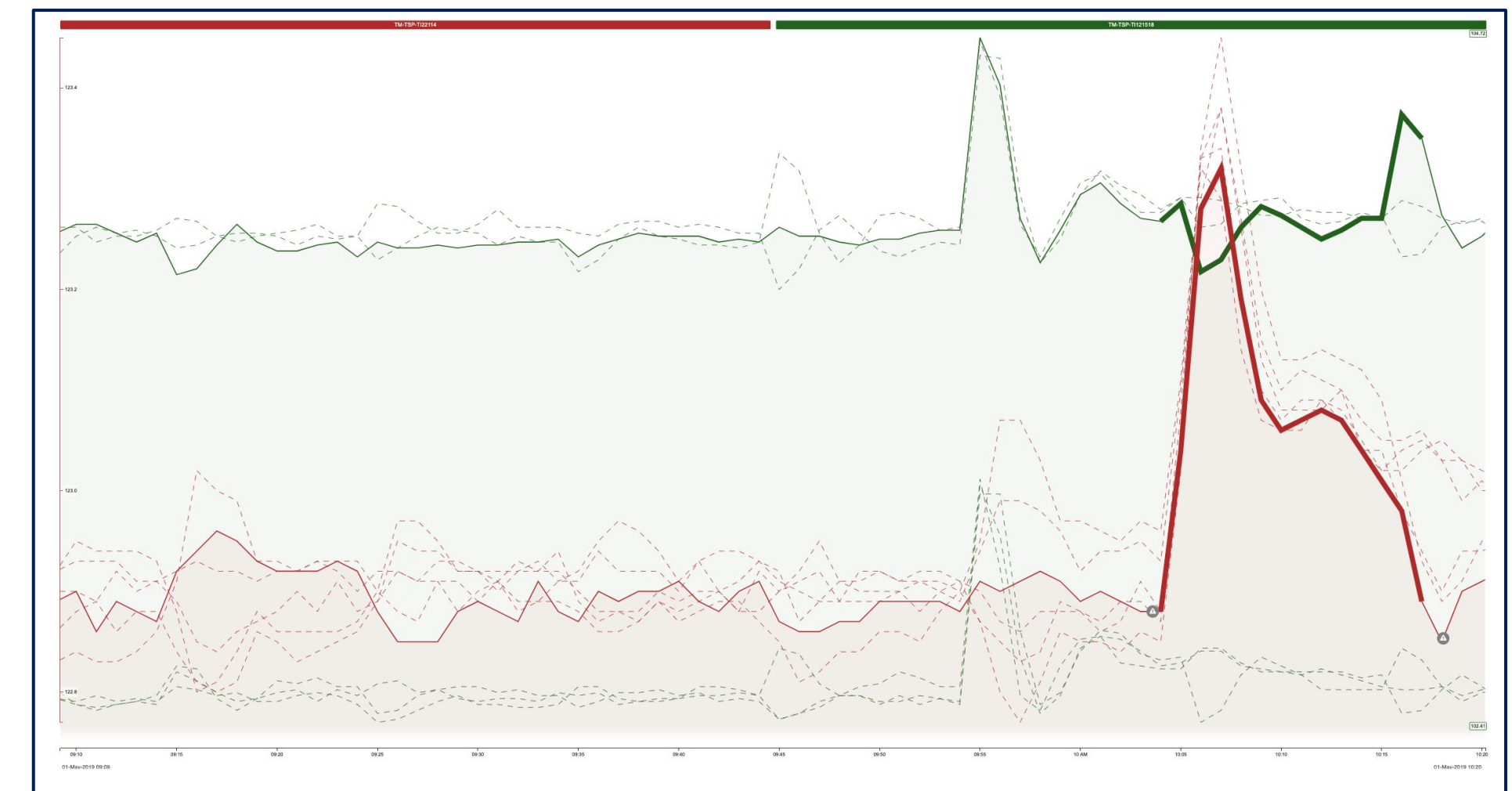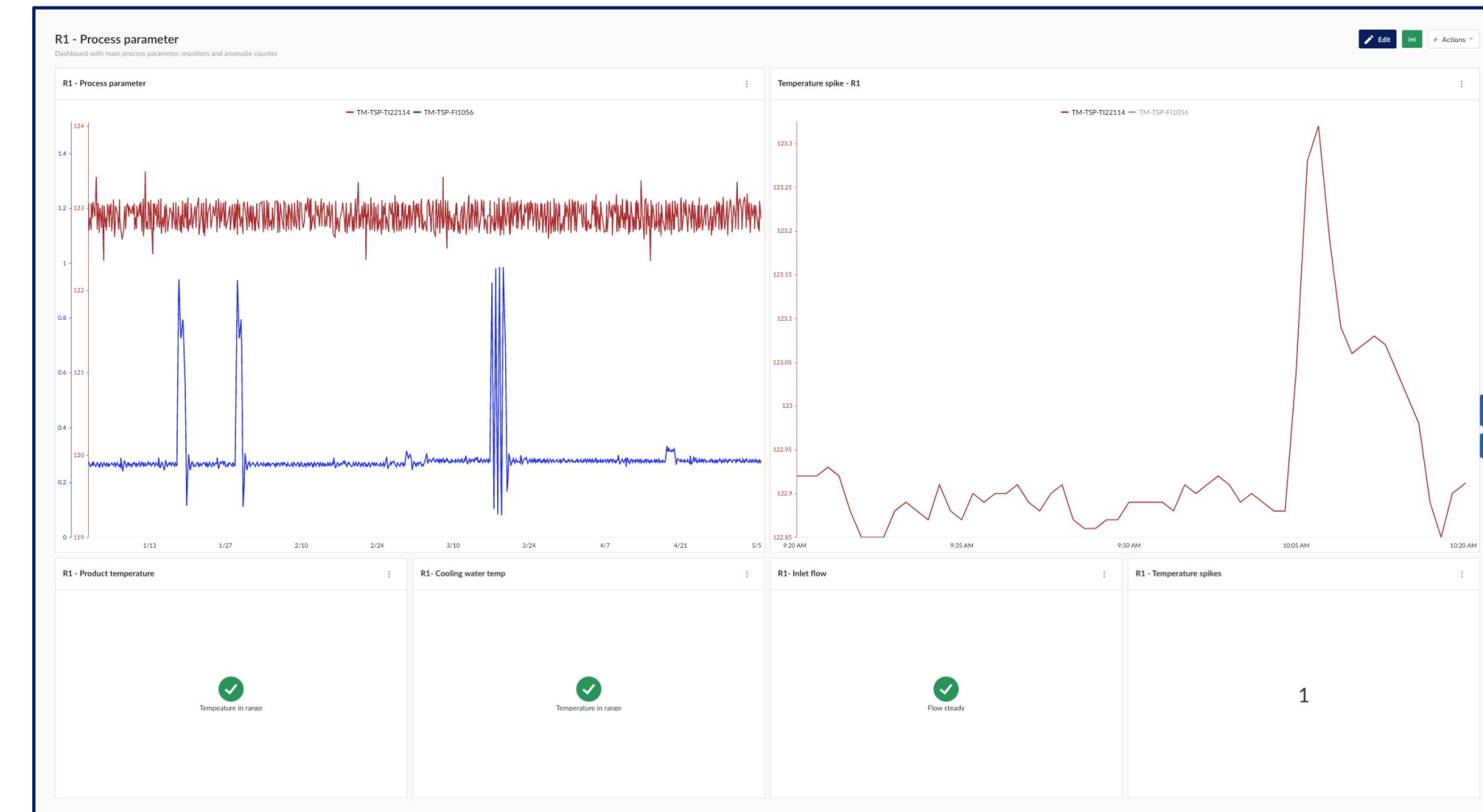
Heat Exchanger Fouling

Ideal operating zone

# Heat Exchanger Fouling

- ## Process
  - Heat exchanger network (HEX)
  - Pipes and pumps continuously operated

- ## Problem
  - Fouling of HEX
  - Decreasing performance requires cleaning

- ## Goal – Increase operational time
  - Define zone of ideal operation of HEX
  - Monitor for deviations such as fouling

Heat Exchanger Fouling

- ## Multivariate Scatter Plot
  - ### Correlations between tags
  - ### Define zone of ideal operation
- ## Monitor deviations and get warnings
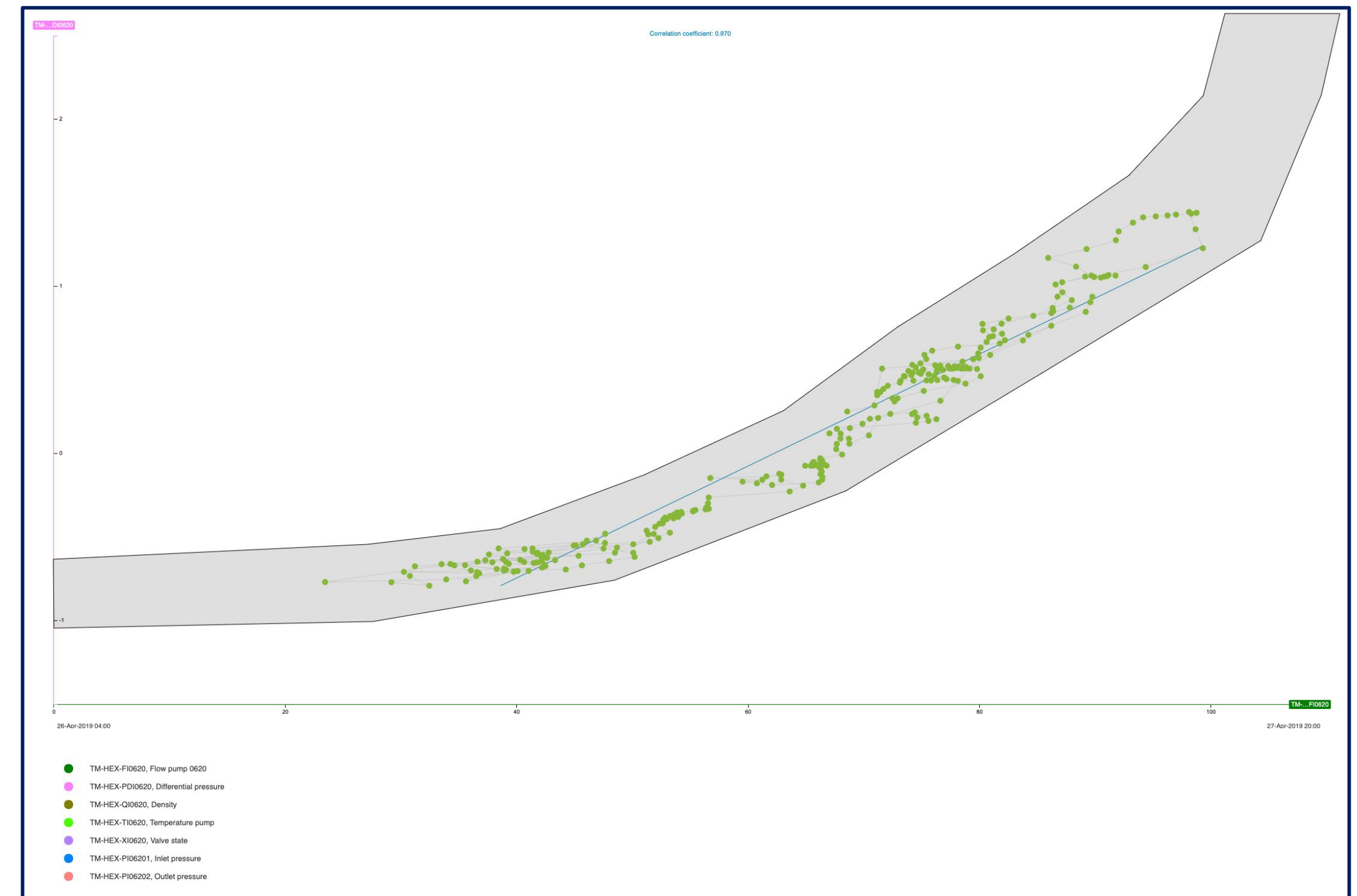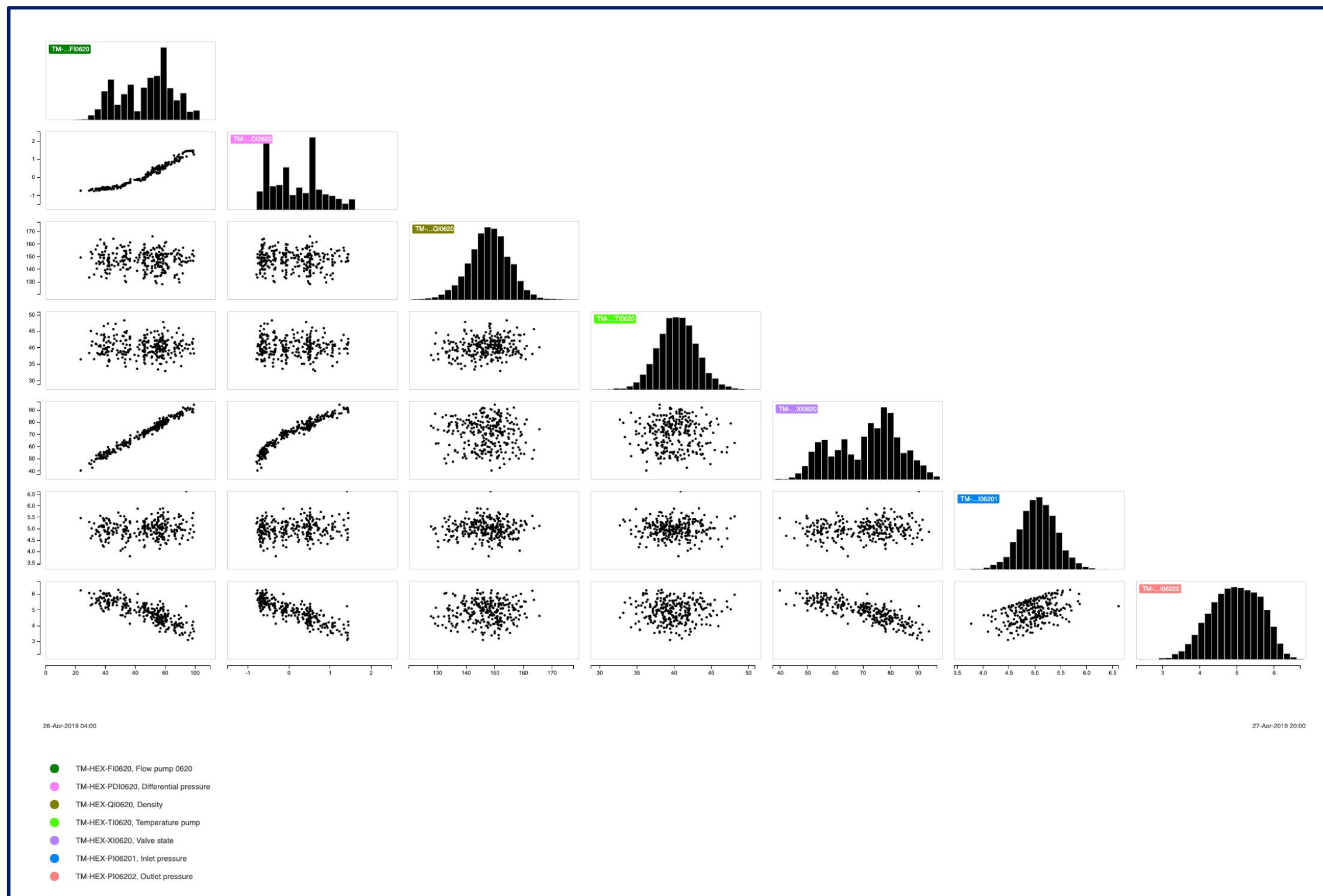
Golden Batch Production - Monitoring & Prediction

Fingerprinting of ideal batches with highest throughput

# Golden Batch Production – Monitoring & Prediction

- ## Process
  - Batch process
  - Variations in product concentration

- ## Problem
  - Is it a good batch – throughput
  - Will concentration be reached?

- ## Goal – Live monitoring
  - Current batch vs. golden batch?
  - Most likely result

Golden Batch Production – Monitoring & Prediction
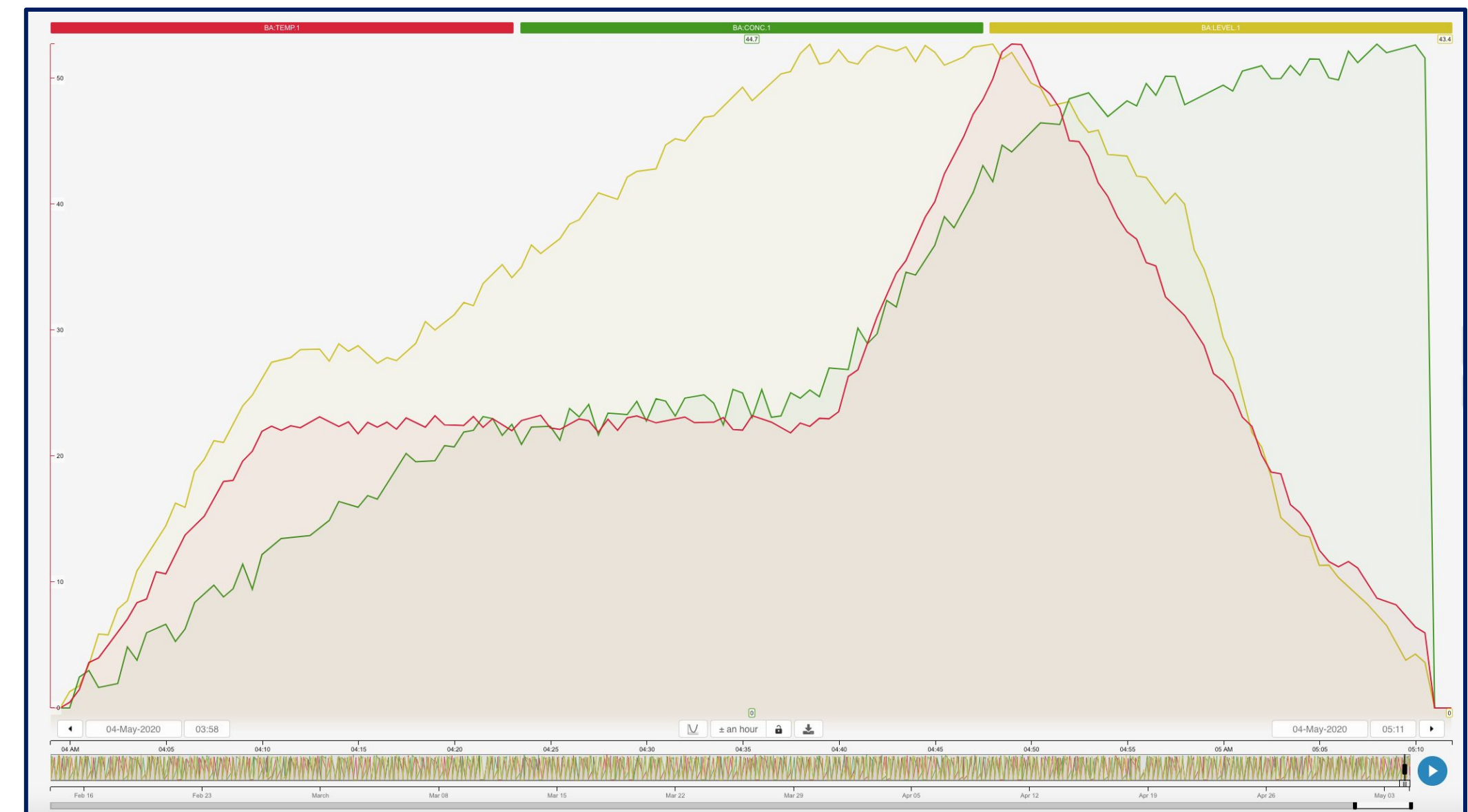
- **Find good batches**
  - High product concentration
  - Short cycle time

- **Create fingerprint**
  - Zone of optimal operation
  - Min + max of all ideal batches

- **Current batch vs fingerprint**
  - Gonna be a good batch?

- **Predictive mode**
  - Most likely outcome
  - Based on historical data
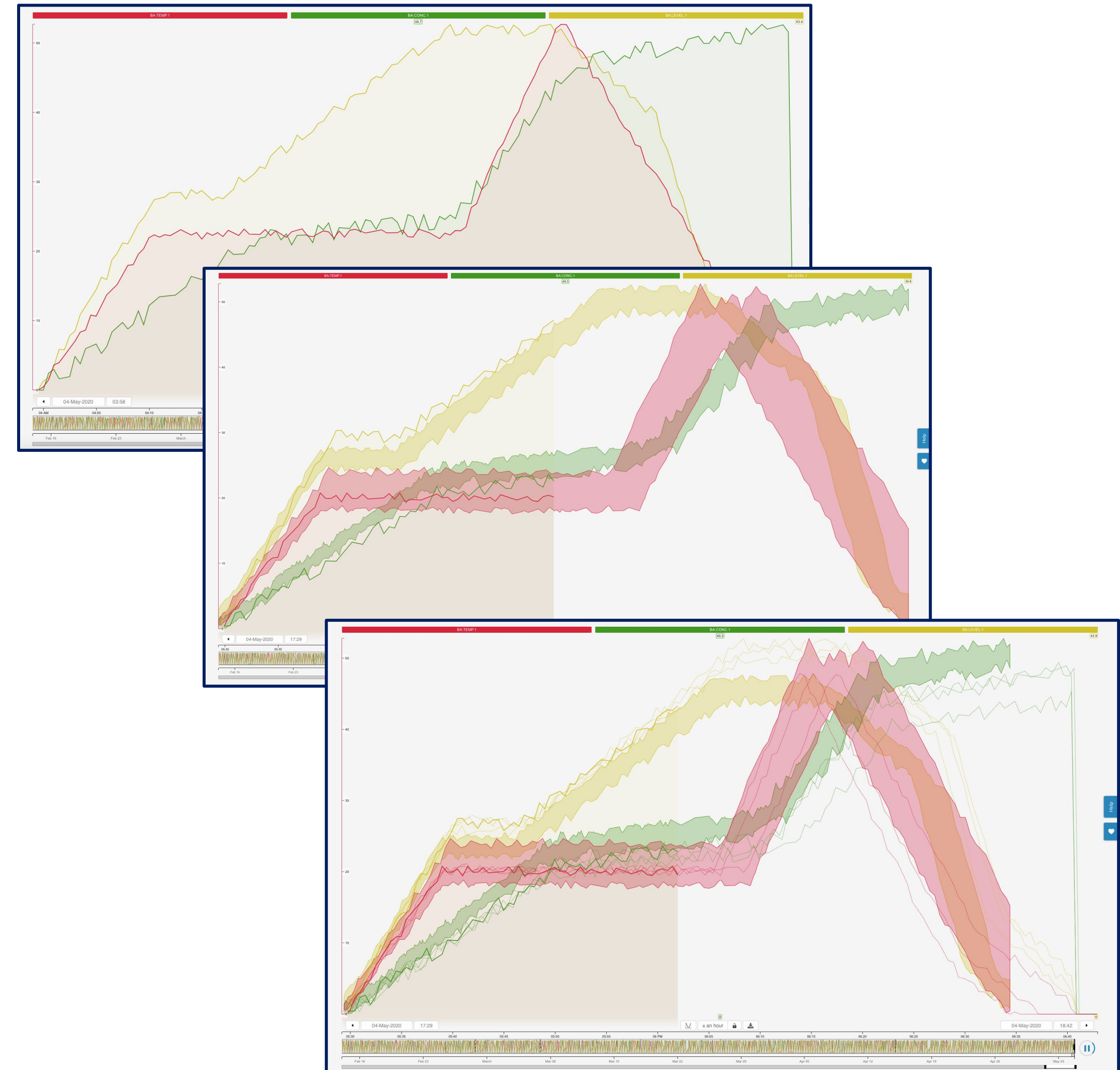
Powder Pro – Failed pharma grade batches

Quality issues in reactor

Connect quality measurements with process data

Powder Pro – Failed pharma grade batches

- ## Process
  - Batch process
  - Polymer in pharma, food, technical grade
  - KPIs:
    - #batches produced
    - #batches failed

- ## Problem
  - Failed cycles for pharma grade
  - Quality measurements in LIMS

- ## Goal – RCA by fingerprinting
  - Integration with batch quality data
  - Good vs bad batch profiles
  - Hypothesis generation and testing

Powder Pro - Failed pharma grade batches

- **Steps taken**
  - Identification of good and bad batches
  - Fingerprint of ideal batches
  - Deviation of failed batches in profiles

- **Vacuum pressure is root cause**
  - Clear deviation
  - Remaining monomer → low viscosity

- **Actions taken**
  - Fix sealing of reactor
  - Monitoring for deviations
  - Notification