Use Case

Heat Exchanger Predictive Maintenance

Problem Objective

1. Predicting end-of-cycle (EOC) for a heat exchanger due to fouling is a constant challenge faced by refineries. Proactively predicting when a heat exchanger needs to be cleaned enables risk-based maintenance planning and optimization of processing rates, operating costs, and maintenance costs.
2. Before using Seeq, the engineer had to manually combine data entries in a spreadsheet and spend hours/days formatting and filtering the content or removing non-relevant data when necessary (for example when equipment was out-of-service).

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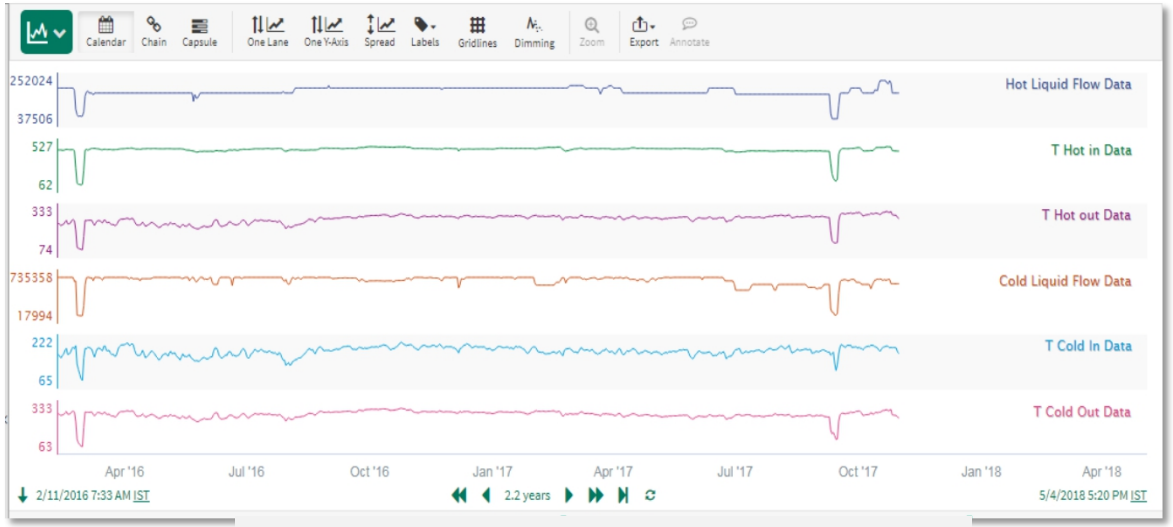
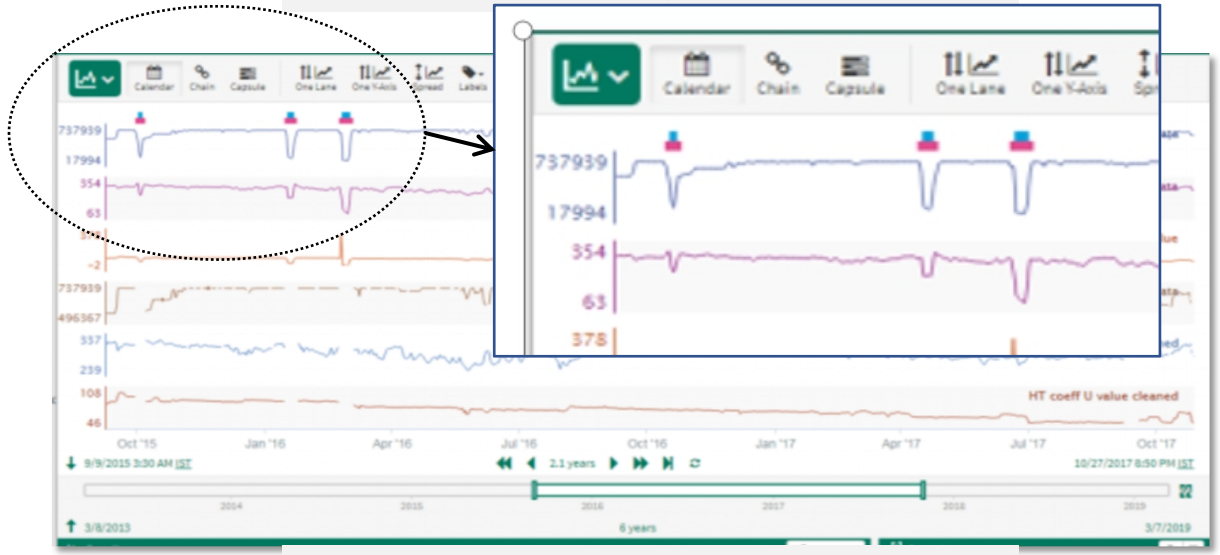
Approach & Solution

1. Data aggregation and cleaning

- The objectives of this Seeq Workbench Analysis are to
  - Develop calculations to monitor the heat transfer performance of a heat exchanger over time
  - Predict the date for needed maintenance based on the trend of the calculated U-value (heat transfer coefficient)
- Collect the following signals
  - Cold fluid inlet and outlet temperature
  - Hot fluid inlet and outlet temperature
- Clean the signals using agile filter to remove the noise and invalid values.



Raw Signals



Identifying Downtime

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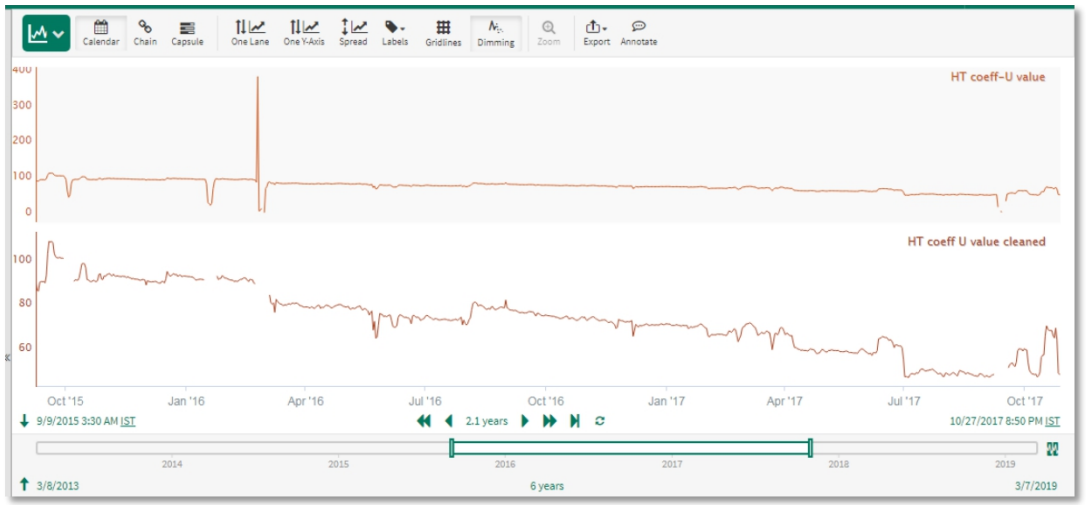
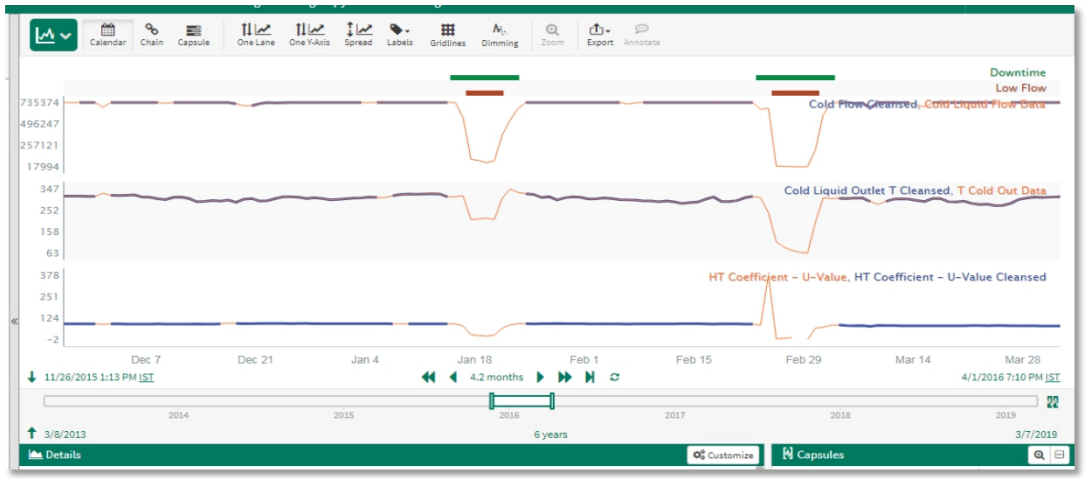
2. Soft - Sensors

- Using seeq's formula tool, include the soft-sensor that are necessary for calculation of U-value.
  - Hot liquid specific heat
  - Cold liquid specific heat
  - Hot and cold duty
  - LMTD
  - Heat transfer U-value
- This calculated U-value will be used for predicting the next requirement for maintenance
- Clean this signal to remove the outliers and invalid values
- Identify the downtime in the heat exchanger operation



U Value Calculation



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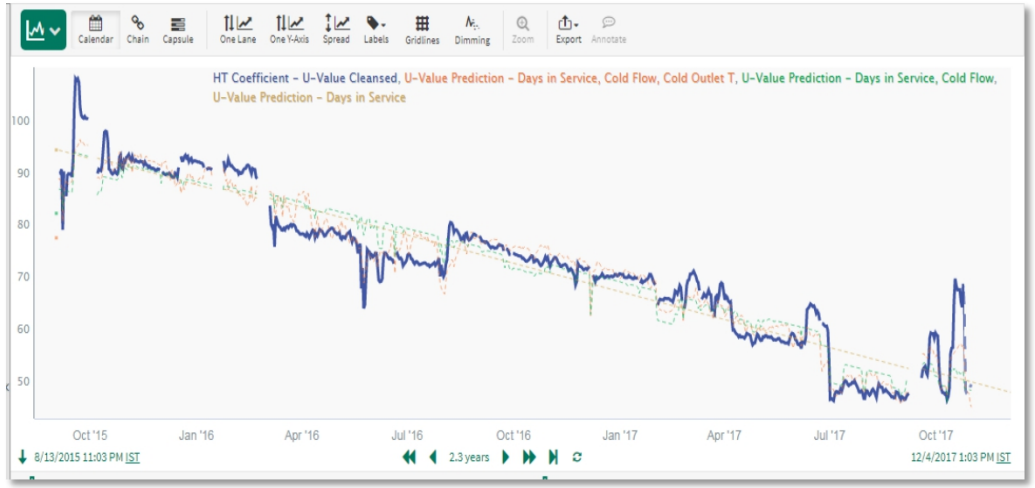
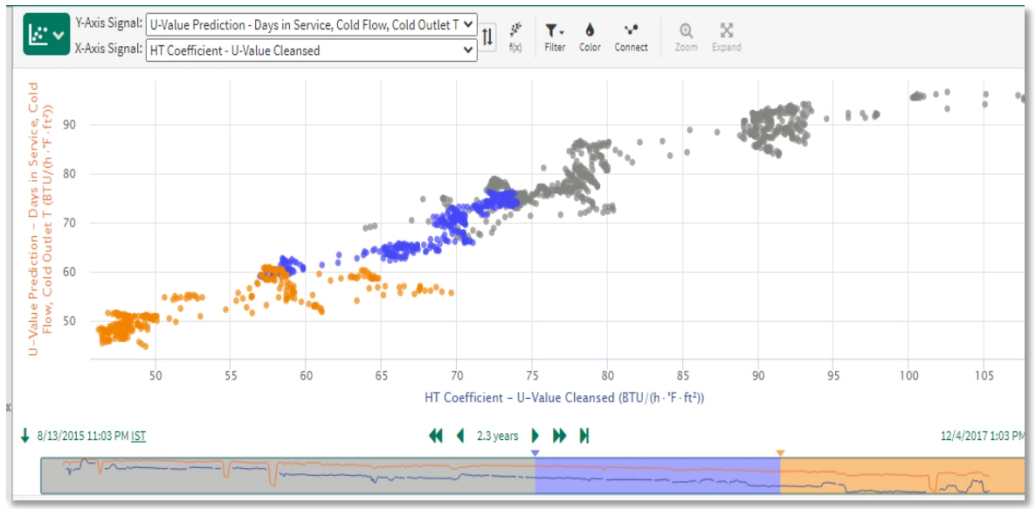
3. Regression Model

- Using Seeq's prediction tool fit a regression model for the Heat transfer U-value
- Create a soft-sensor signal for minimum and design U-value
- The point where the predicted U-value intersects the minimum U-value will be the time when maintenance would be required



U Value Prediction



Correlation using Scatter Plot

End of Cycle Prediction

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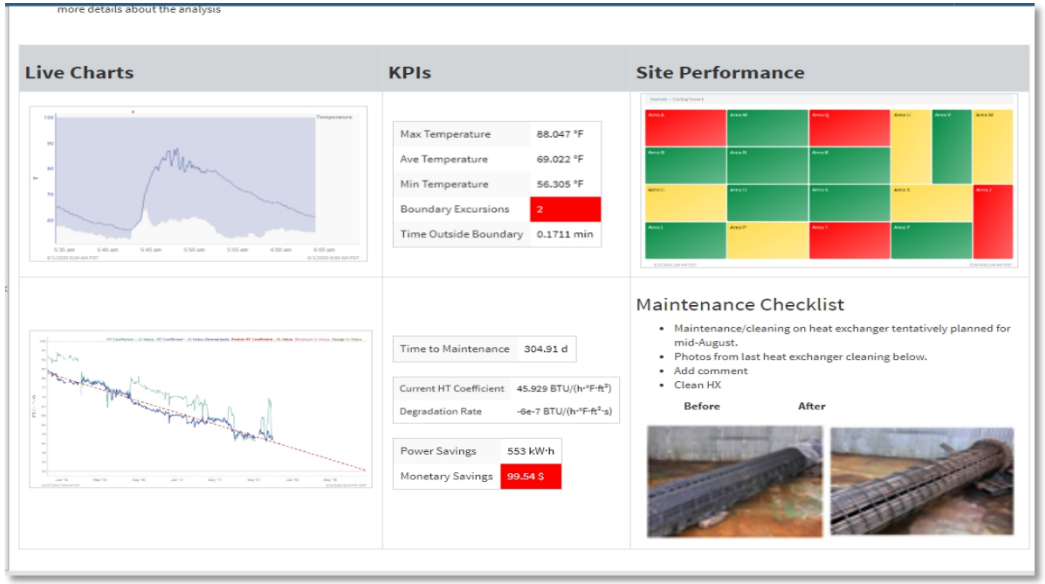
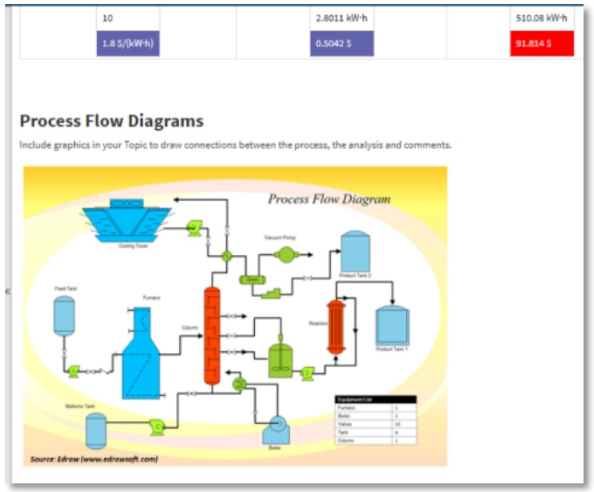
4. Organiser Dashboard

- Reporting the real-time monitoring of the performance parameters, such as calculated U-value, and forecasting it to the future
  - Reporting time to Maintenance and current value of U-value, could be helpful in understanding the insights from the process dimension
  - Predicting the date for the end of cycle could help the organization to undergo the necessary management decisions to act upon
  - Accordingly the appropriate maintenance planning could be scheduled with the reliability team
- Predictive analytics for heat exchanger in seeq can benefit the refinery to a huge economical perspective, reducing the planned maintenance costs with reduced unexpected failure events.



Real Time Monitoring Report



Contextualising Process Flow Diagram in Reports