

Aligning Data for Calculations and Correlation



ALL INDUSTRY VERTICALS

Data Sources

- Process data: AspenTech IP21, Honeywell PHD, AVEVA PI System (formerly OSIsoft)
- Quality data: Laboratory Information Management System (LIMS)

Data Cleansing

- To achieve best results, it is critical to consider preprocessing of the data set before data alignment. Preprocessing may include removing downtime data, outliers, unnecessary redundant values, etc. The user should always visually inspect the dataset closely for these needs. Seeq Formula and other tools contain the required data cleansing functionality, including smoothing functions, outlier removal functions, identification of specific periods on interest and removal of data during those periods.

Reporting & Collaboration

- Organizer Reports display aligned data values for monitoring.
- Optimally aligned signals can be created and used for modeling or other analyses, by the original user or by others.
- Frequently used alignment methods can be templated for widespread, rapid use.

Challenge

Accurately aligning data can be the most challenging step in creating process calculations, analyzing correlations, and developing prediction models. The need for data alignment often stems from time delays present in the industrial process. These time delays, also referred to as dead time or transport delay, result from industrial equipment and designs, such as conveyor belts, extrusion processes, screw conveyors, process piping, plug flow reactors, and analyzer sampling lines. Data alignment needs also arise when lab-measured values (LIMS data) are crucial to the calculations, as lab values are often reported at variable time intervals following the actual process operation.

Common scenarios that require data alignment include:

1. When correlating process signals with analytical results, work is often needed to align the signal and analytical results.
2. The time delay resulting from the transportation of material at a given speed or velocity (across some distance) can mask strong correlations between upstream and downstream signals, resulting in poor modeling results if not accounted for by a data alignment step.
3. Related to process experimentation and optimization, there may be a need to calculate and compare a process metric before and after some identified process event, such as a process additive feed being turned on, a controller setpoint being adjusted, etc

Without fully-featured analytics tools, completing these required data alignment steps can be very time consuming and tedious.

Solution

By leveraging Seeq's Value Search, Formula, Signal from Condition, and other tools in combination, engineering teams can establish a common time basis for joining and aligning data, then translate data values to earlier or later times to match up with other signal data.

In some cases, alignment may be relatively simple and involve moving a signal by a known static time delay or by a variable amount measured and stored as another process signal.

In other cases, alignment may involve joining two separate conditions using Seeq's Composite Condition tool: one for the process and one for the analytical results. When the analytical results can be reported inconsistently or out of sequence with process batches, a more advanced condition join using Seeq Formula, based on a matching id value, may be needed.

Results

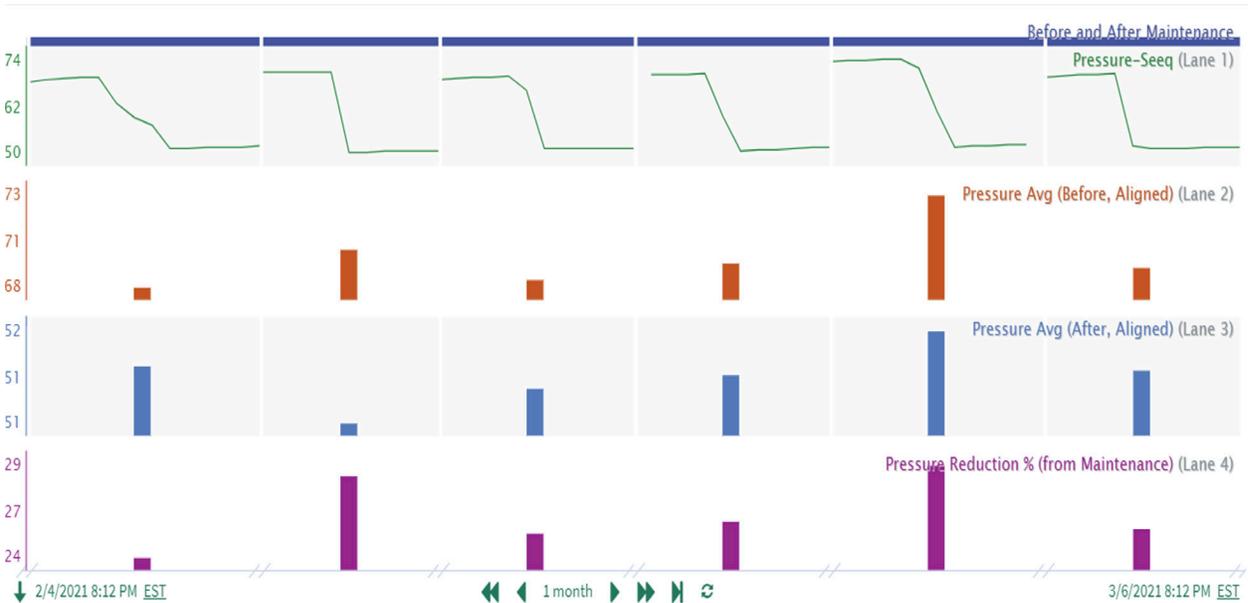
As a result, Seeq's contextualization and calculation tools can be used to efficiently align data, using virtually any alignment method, and provide:

- Correctly aligned process data values that can be used for many purposes and use cases
- Significant time savings in preparing data for calculations and modeling
- Condensed datasets that include only essential data in the final calculations
- Opportunities for better process adjustments and more optimal process performance (production and energy savings)

Calculations & Conditions

The calculations and conditions vary widely based on the alignment objectives and use case, but typically involve these tools and approaches:

- Value Search to identify a starting time basis
- Formula for translating Capsule properties into signals, joining conditions based on sequential occurrence or matching ids, retaining joined capsule properties, etc.
- Signal from Condition to quantify delay times and the move() Formula function for translating data values earlier/later in time



Seeq Chain View showing before/after process pressure averages and pressure reduction, calculated around equipment maintenance events and aligned to the midpoint of Before and After Maintenance capsules.

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