Case Study - Pharmaceutical Manufacturer (Equipment Health Monitoring & Reporting)

Background:

A pharmaceutical manufacturer has a mix of state-of-the-art equipment and older generation equipment on the manufacturing line for several products. The status of the equipment, including some limited health metrics, is only accessible though the computer on each individual unit. Additionally, the manufacturing engineering team does not have any analytical tools other than Excel. Individual batch records are on paper and not linked to any other data.

Problem:

Individual tools generate data that is not accessible. Batch records are on paper and not electronic. There is no culture of analytics and no way to see the overall status of all the equipment and batches. When issues occur, they are often a surprise. Root cause analysis is extremely difficult to conduct. There is no visibility into batch location.

Necessary Parts of a Solution from the Engineers/Scientists:

- Give us a system that pulls data from the equipment PLCs and saves it for analysis.
- Give us a system that captures key elements of the paper batch records.
- Link batch and equipment data.
- Create tools for us to access the data and perform both routine and special case analysis.
- Notify us when issues occur, in real time.
- Join the data with production metrics such as daily output.
- Create an overall dashboard for batch and equipment status.

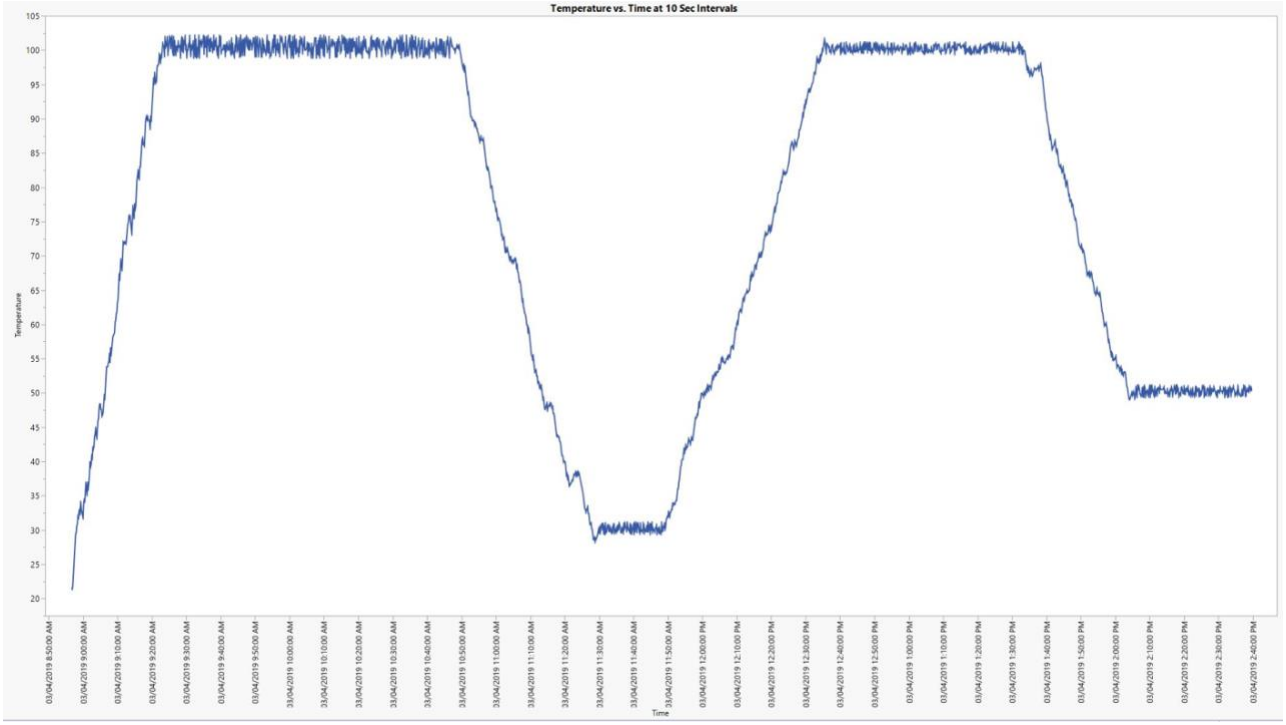
Preferred Elements of a Solution:

The Manufacturing team needs a desktop, client analytics tool to access the data and perform analytics. JMP is recommended for this key part. For data entry and server components, Python is recommended for flexibility. The operation already has SQL Server.

The Solution:

Create a JMP and Python based system for equipment and batch data. Create equipment and batch record databases in SQL server. Implement PLC monitoring software to pull and store equipment data in SQL server. Dashboards in JMP.

The diagram below shows an example of data pulled from a piece of equipment in a pharmaceutical manufacturing line. The data signal shows the batch start, ramp up and then the two sub-cycles of the batch. The signal in the example ends with the batch going into a hold mode. This type of signal data can be used to monitor equipment performance and health.

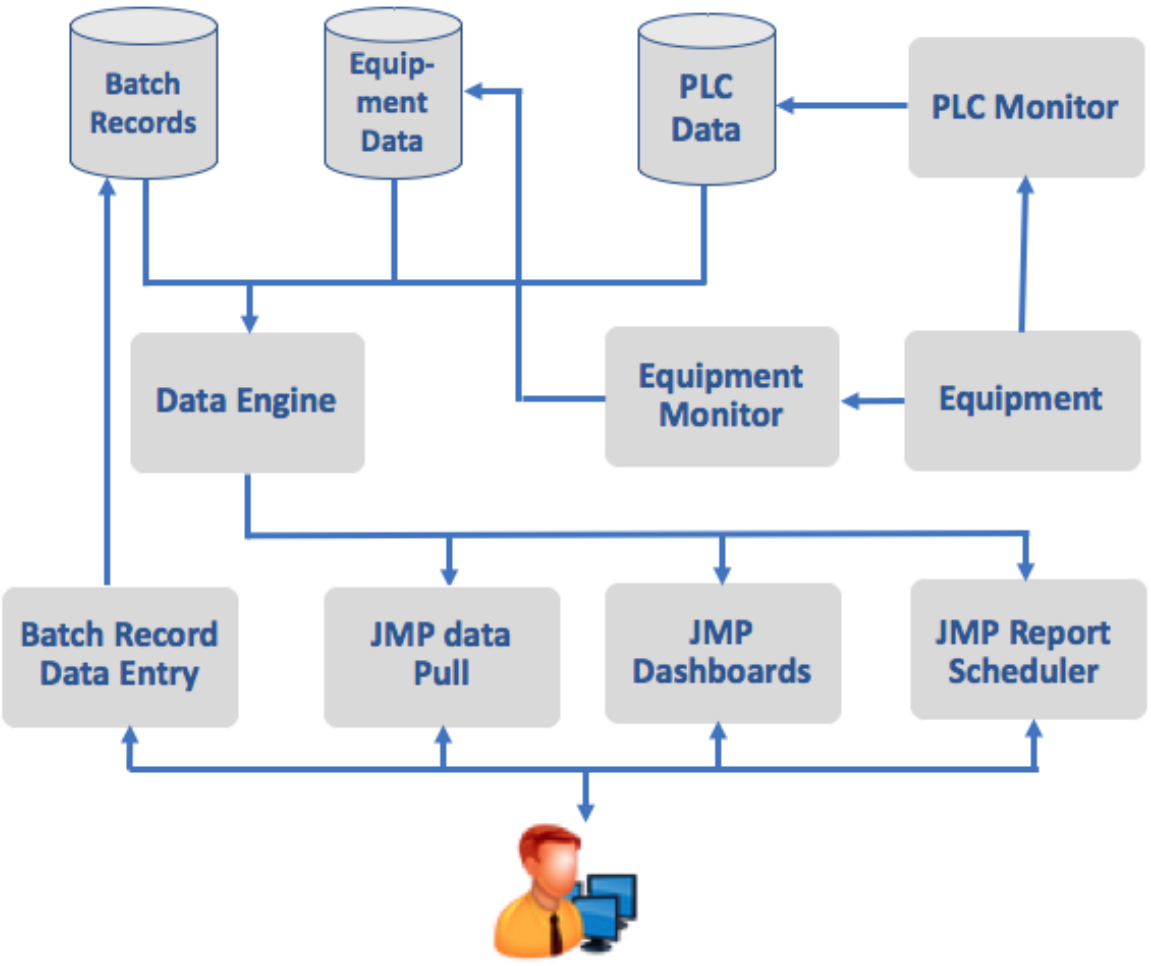


Key Elements:

Graphical User Interface in JMP for selecting equipment and batch data from the created databases.

- A data pull, join and clean engine to access the data, clean and transform it for analysis.
- SQL Server Database for Equipment Data.
- SQL Server Database for Batch Record Data.
- PLC Monitoring Software.
- An engine to create charts and graphs and populate a JMP dashboard.
- Data entry screens for Batch Record data.
- Server components to monitor non-PLC equipment data.
- A schedule to create and send out JMP reports at user defined intervals.

Pharmaceutical Manufacturer



The Impact:

- Quality excursions that force holds to be placed on valuable product are reduced dramatically.
- Problem prevention is now possible by identifying movement in parameters before they become an issue.
- Equipment can now be maintained pro-actively and as needed.

Unforeseen Benefits:

- Identified equipment with recurring, systematic problems.
- Surfaced patterns in problem occurrence where on piece of equipment was different than its companions.
- Identified parameters with overly optimistic (loose) limits.
- The uncovering of new insights and many “Ah Ha” moments.