Leveraging Process Data Historians: Data Analytics for Mechanical and Process Monitoring

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Data historians capture data from DCS and PLC systems, saving it for periods of years.

How many in the audience have a data historian such as PI, IP.21, ParcView, etc?
Reliability

Reliability suffers when maintenance issues that should have been identified are not

Reliability suffers when process issues that should have been identified are not

Examples:
• Motors or bearings fail
  • Temperatures, amps, and vibration monitors typically increase before the failure
• Flows suddenly become insufficient
  • Valves start to slowly open or close and eventually cause issues
• Mixers, pumps and blowers fail but don’t go undetected because the motor is running
  • Belts or couplings on pumps/agitators/blowers shear but don’t set off an alarm
Most data historian users are still using them the same way they did in the early 1990s:

- Looking at hundreds of trends
- Dumping data into Excel

The result?

You miss things.

What if you could identify variables that are out of limits instantly, without resorting to trends and spreadsheets?
Operational Efficiency Essentials

Reliability: What issues need focus now?

Metrics: What drives KPIs?

Sustainability: How do we preserve benefits?

Benchmarking: Are we operating within limits?
Data Collection Considerations

- Data must be collected continuously
- Data must be aggregated only when the process is running
  - Further processing must be done by grade/product and/or production rate
- Limits can then be calculated:
  - Defined moving time frame (3 or 6 months)
  - Fixed time period (period where the process was understood to have ran well)
  - Best in class query (days or product runs that meet defined criteria)
Data Collection

Server Side

- Envoy.DC
  Data Collection Service

- dbEnvoy
  Microsoft SQL Database

- Hourly Aggregations
- Daily Aggregations
- Limits and Targets calculations
- Per Work Shift Aggregations
- Support Backfilling

AF SDK or PI SDK

PI System

Other Implementations

Example of data collection topology
When did costs change?

Defining when a Key Performance Indicator (KPI) changed is not as easy as one might think...
A CUSUM Chart Tells Us…

Costs actually changed twice, but most significantly on Jul 23.

When the line is going down, the variable is below average; the steeper the slope, the more negative the value.

When the line is going up, the variable is above average.

Points where the line goes from a negative to a positive slope (or vice-versa) are called inflection points.

If we calculate and index the CUSUM inflection points for historian variables, we can identify what else changed when costs changed.
We detected web breaks increased substantially on May 18.

Remember, when the CUSUM line has a negative slope, the value is below the long term average; for web breaks, low is good.

On May 18 the line suddenly moved positive.

What changed?
If we look at tags that were different in a statistically different manner (high web breaks vs low) we have over 700 variables.

When we filter by CUSUM inflection we have less than 40 variables.
Web Breaks Finding

This customer removed an additive to try and save money

Once we identified this, they put it back on and web breaks declined
Case Study: Chemical Mixer

- **D/C Mixer Residual:** BPRESDL.L
  - Two Sigma Limit: -0.2 to 1.09
  - Current Value: 2.81

- **CLO2 MIXER CURRENT:** 999-II-999
  - Two Sigma Limit: 50.04 to 81.29
  - Current Value: 35.85

The key takeaway from this case study:
If you don’t recognize what is going on, don’t be afraid to contact the equipment manufacturer.

A keyway corroded away and caused costs to increase $4,140/day

Costs skyrocketed when these two events occurred

Customer Comment: Good find on the mixer, I spoke with GL&V this morning and they are pretty sure the mixer came off the shaft, we have a spare in house and plan on changing it out this Wednesday
Case Study: Sheet Caliper

We detected that caliper increased

There are two distinct periods of high caliper

What caused this process deviation?
A roll in a stack had been taken out of service; since it was behind a door, it went unnoticed.
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