

TRACKING PERFORMANCE AFTER OPTIMIZING A DEINKED PLANT

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ABSTRACT

How do we measure the performance of a deinked plant?

A deinked plant has been optimized successfully in a pulp and paper mill in Eastern Canada. Managers, engineers and operators were getting benefits. They decided to select KPIs (Key performance indices) to track performance over time.

This paper will present how the plant was optimized, and how key performance indices were selected. Results will be presented and performance indices discussed.

INTRODUCTION

The decision to optimize the deinked plant occurred when problems at the paper machine were observed. Lab tests and ERIC measurement also showed periods where the quality was below expectations. These periods of low quality could not be linked to operation.

One key point was also the agility of this plant: how quickly we could modify the load and react to different parameters.

This paper mill recently optimized the steam plant and they have a control performance monitoring system.

Using the historical data and performance reports, they asked support from a consultant to work with them.

Two concurrent tools were used:

1. Control performance monitoring (CPM) using software and consultant expertise;
2. Process optimization using TaiJi tuning tool.

Control performance monitoring consists of analyzing incoming signals (process variables, transmitter signals, measurements, generated set points and states) and outgoing signals (controller outputs and set points) in order to determine whether the expected performance is reached. All signals are read from the control system (distributed control system, programmable logic controller,

quality control system, etc.) via digital communications. The system detects oscillations, equipments that do not behave as benchmarked, process control problems, process problems, operation problems, etc.

Process optimization consists of adjusting control systems to reach a selected goal.

The project was done in four weeks. The consultant and plant personnel worked together and their collaboration was successful.

The team that was formed to optimize the deinked plant was composed of an experienced operator, an instrument technician and a process control specialist.

PROCESS

De-inking is a chemical and physical process for removing ink fillers and minerals contained in recycled paper and simultaneously increasing the brightness of the waste paper stock. The process involves the use of various chemicals and flotation techniques.

After pulping, the pulp is sent through screens. After screening, the pulp goes into flotation cells where the air is blown and chemicals added to agglomerate ink particles. The impurities are attached to the air and the froth containing ink and minerals is removed while the pulp is collected below the surface.

The pulp is sent to screens, then washed, and finally pressed to deduce water content and eliminate fine particles.

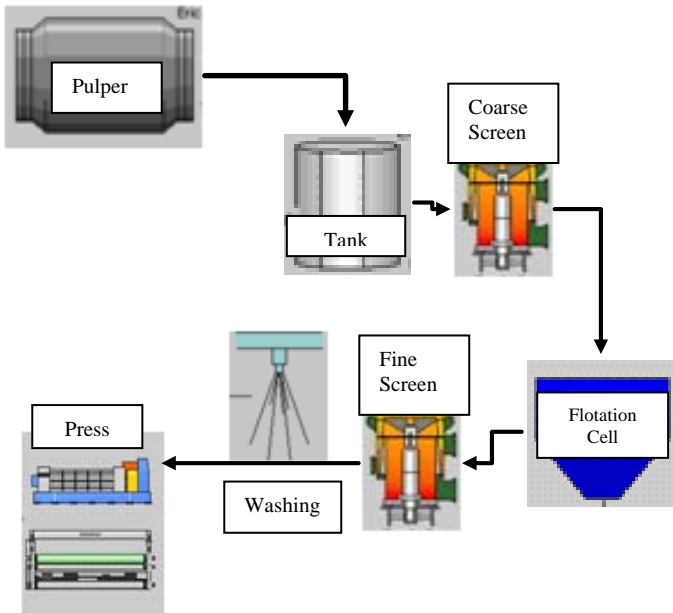


Figure 1: Deinked plant process

OPTIMIZATION

The first step in optimizing the process is to ensure that each piece of equipment is working properly and not at its limit. After confirming equipment performance, control strategies are added to limit production when a limit is reached on any piece of equipment; this will guarantee normal operation and quality.

The next step is to stabilize each unit to maintain a stable production and quality. Reviewing control strategies and optimizing them is standard practice. The last step is to optimize and tune each loop. These three steps were done using historical data and reports from CPM.

KEY PERFORMANCE INDEX

Process optimization was successful; to sustain results and monitor performance, key performance indices were needed. After discussing with plant personnel, no relevant index could be found. The operation asked for indices tied to stability at the presses and asked for an index qualifying the agility; the agility in this case corresponds to being able to quickly adapt to demand. Finally, another index was needed for the quality itself.

Stability

After analyzing the data and many performance indices, two indices were selected for stability:

- Standard deviation of consistency before the presses, $\sigma_{KIC46123}$
- Integral of absolute error for level tank feeding the presses, $IAE_{LIC46121}$

These two performance indices were closely linked to overall performance after analyzing six months of data.

Agility

If the deinked plant can quickly adapt to a new demand, then the process is agile.

The standard deviation of feedrate error is used to estimate agility, $\sigma_{Err_{WIC21023}}$

Quality

The limit for quality is 290 ppm ERIC. This limit is used by operation to determine if quality meets the plant standards.

To quantify quality, the percentage of time above this limit is calculated, $\%time_{AI26102 > 290ppm}$.

Whisker box plot

Whisker box plots are useful to represent descriptive data. The whisker box plot represents graphically depicting groups of numerical data. Figure 1 is used to explain how the whisker box plots for a data set. The maximum and minimum are easily shown.

The box contains data between the 25th percentile and 75th percentile; finally the middle bar is the median.

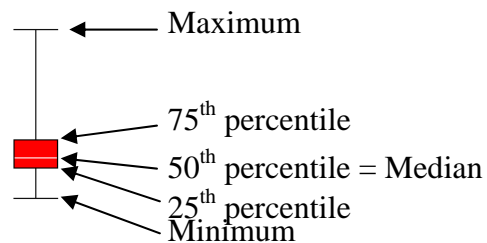


Figure 2: Whisker box plot example

RESULTS OF THE DEINKED PLANT

Stability

$\sigma_{KIC46123}$

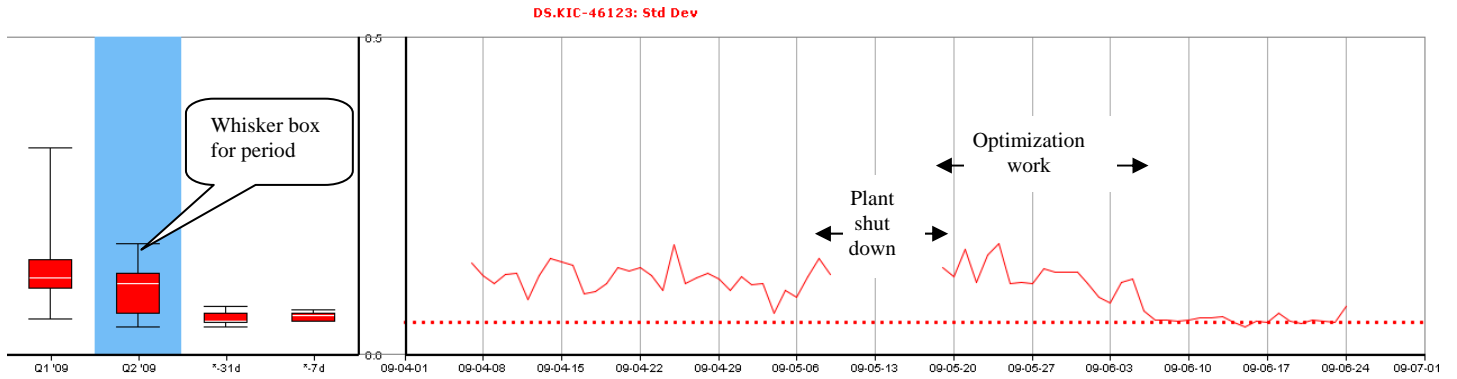


Figure 3: Consistency presses feed, standard deviation: $\sigma_{KIC46123}$

$IAE_{LIC46121}$

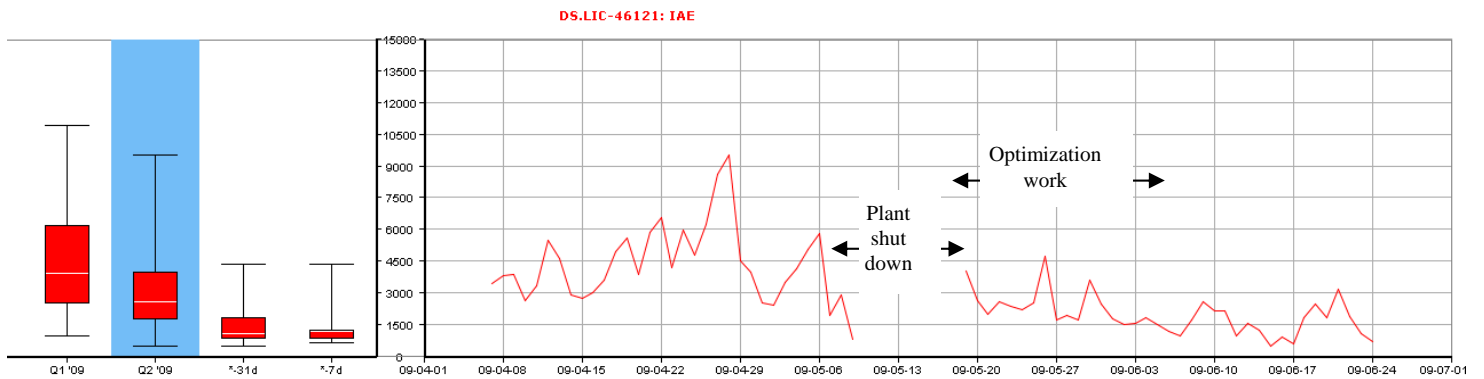


Figure 4: Level tank feeding presses, integral of absolute error, $IAE_{LIC46121}$

Agility, $\sigma_{Err_{WIC21023}}$

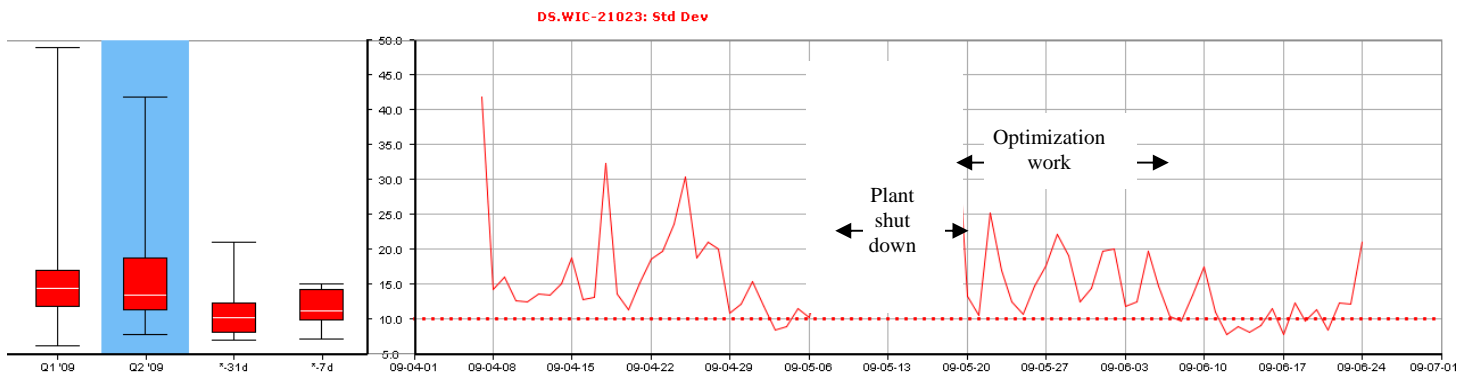


Figure 5: The standard deviation of feedrate error, $\sigma_{Err_{WIC21023}}$

%time_{AI26102>290ppm}

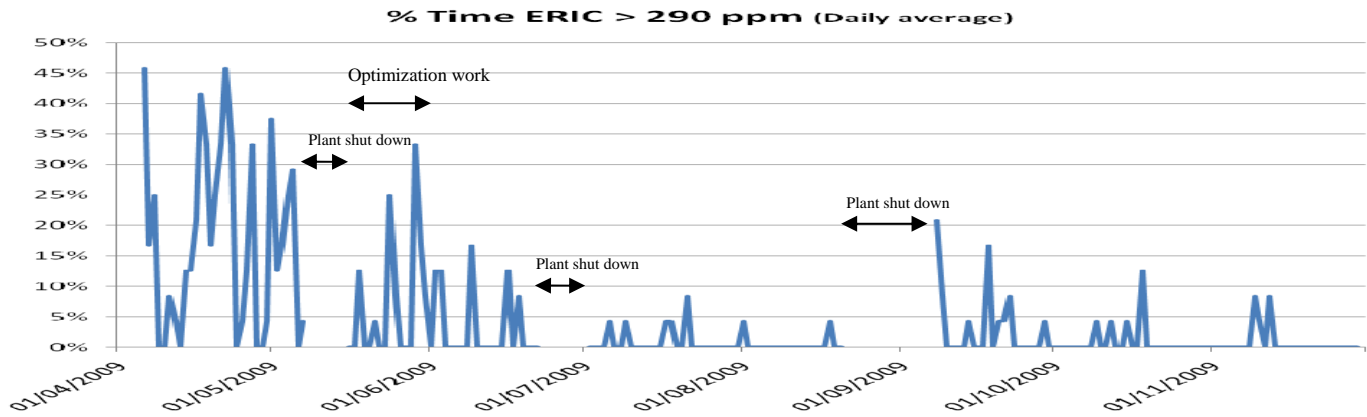


Figure 7: The percentage of time above 290 ppm from April 1, 2009 to November 30, 2009, %time_{AI26102>290ppm}

SUMMARY

Following these indices, the supervisor can now track closely the plant performance.

If these numbers deviate, plant personnel can now address the problem before quality decreases or before operation complains.

All graphics have been generated using the Matrikon Control Performance Monitoring software.

REFERENCES

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