

INTRODUCTION

Optimization service contract with an intention to improve the QCS/DCS equipment availability and hence improve the Paper machine performance. After optimization, we have noticed significant improvement in terms of both Quality and Production.

OPTIMIZATION STRATEGY

Major Steps taken during the optimization

- Improved DCS control Utilization
- Tuning all the DCS control loops and improved the performance
- Identified and solved process intermittent issues
- Calibration or Repair done for required instruments
- Improved signal conditioning by placing proper filters in the measurements
- Identified and discussed with customer for the design issues like piping, pumps etc.
- Tuning all the QCS controls and improved the performance

BENEFITS

The paper machine performance in terms of Product Quality and Runnability has improved

- Improved DCS control utilization from 57% to 84%
- Improved loop performance index about 25%
- Improved Stock Stability Index by 67% which provided more stable stock to paper machine
- Improved the QCS Response index by 65% which provided more stable Basis weight and Moisture variability and improved recovery from upset

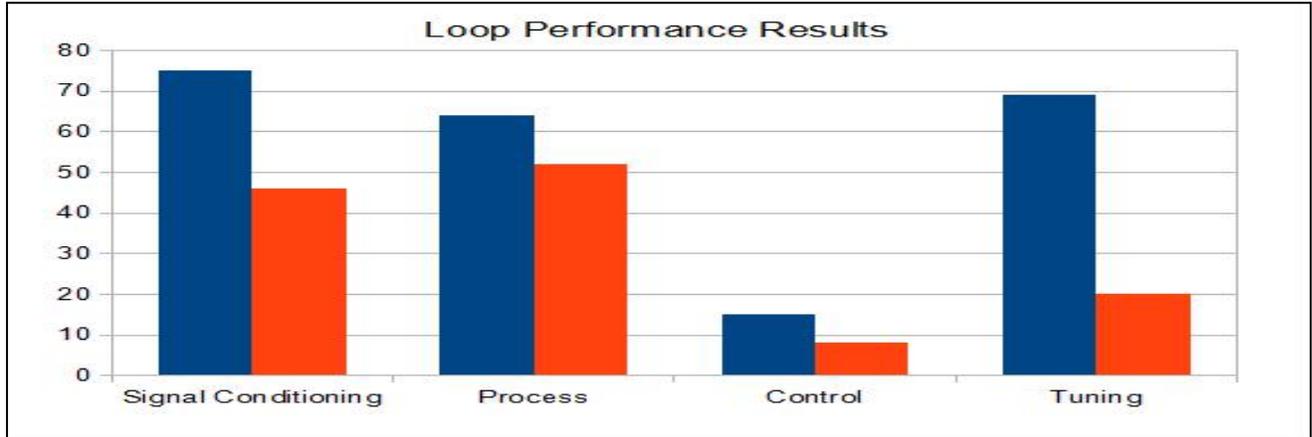
The below is the comparison table for the key performance indexes.

Description	Goal	PM3		Remarks
		Before Tuning	After Tuning	
Basis weight 2 Sigma	<0.3	>3.5	<0.5	Improved by 86%
Reel Moisture 2 Sigma	<0.2	>0.6	<0.2	Improved by 67%
Stock Stability Index	<0.6	>4.78	1.59	Improved by 67%
Stock Flow Response Index	<3.0	12.2	4.96	Improved by 59%
QCS Response Index	<4.5	12.97	4.6	Improved by 65%
Loop Tuning Index	>15	69	<20	Improved by 71%

Table: Key Performance index comparison

LOOP PERFORMANCE SUMMARY

The DCS Control loop performance improved significantly as shown in the below chart



Loop Performance	Before	After
Signal Conditioning	75	46
Process	64	52
Control	15	8
Tuning	69	20

Figure: Loop performance Benchmark Analysis

STOCK STABILITY IMPROVEMENT

Stock Stability Index has been improved

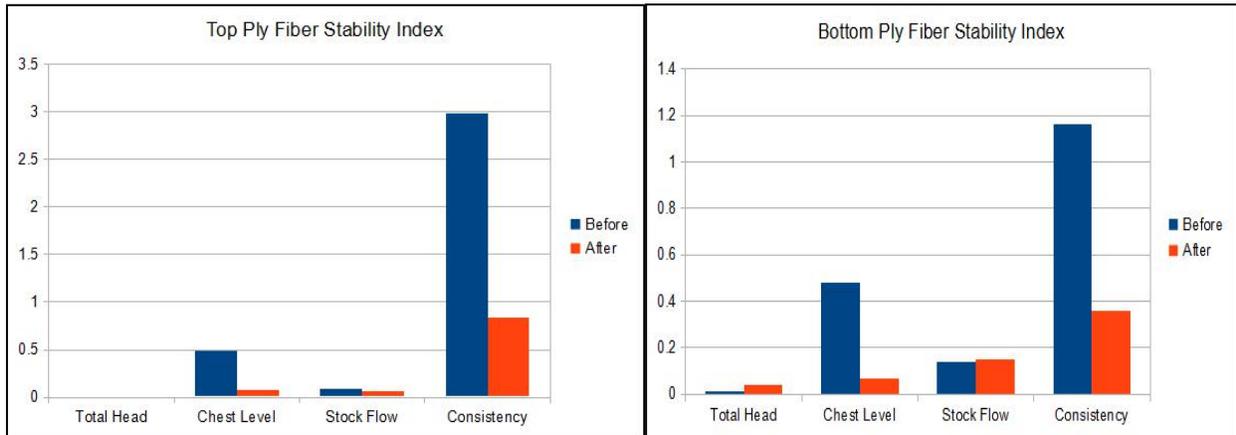


Figure: Fiber Stability Comparison

The fiber line stability index shows the stability of the stock approach system. This index is generated from the set point, measured value, and range of the following signals: Total Head, Mixing Chest Level, Thick Stock Flow, and Thick Stock Consistency. The goal of this index should be less than 0.15

- Top Total head appeared to the best control with very low index of all 0.0183.
- Top Ply Mixing Chest level Index has improved from 0.49 to 0.07 after careful tuning of this loop.
- Top ply Stock Flow index has improved from 0.084 to 0.058 and noticed that there was huge filter in DCS (255s) due to heavy noise in the measurement. After changing the flow meter, it was noticed good measurement which has no filter.
- Top ply Mixing Chest consistency has improved from 2.98 to 0.84. This high variations are coming from intermittent process disturbance.
- Bottom Total head appeared to the best control with very low index of all 0.013.
- Bottom Ply Mixing Chest level Index has improved from 0.48 to 0.068 after careful tuning of this loop.
- Bottom ply Stock Flow index was seen low index of 0.014.
- Bottom ply Mixing Chest consistency has improved from 1.16 to 0.36.

QCS RESPONSE IMPROVEMENT

QCS Response Index has been improved

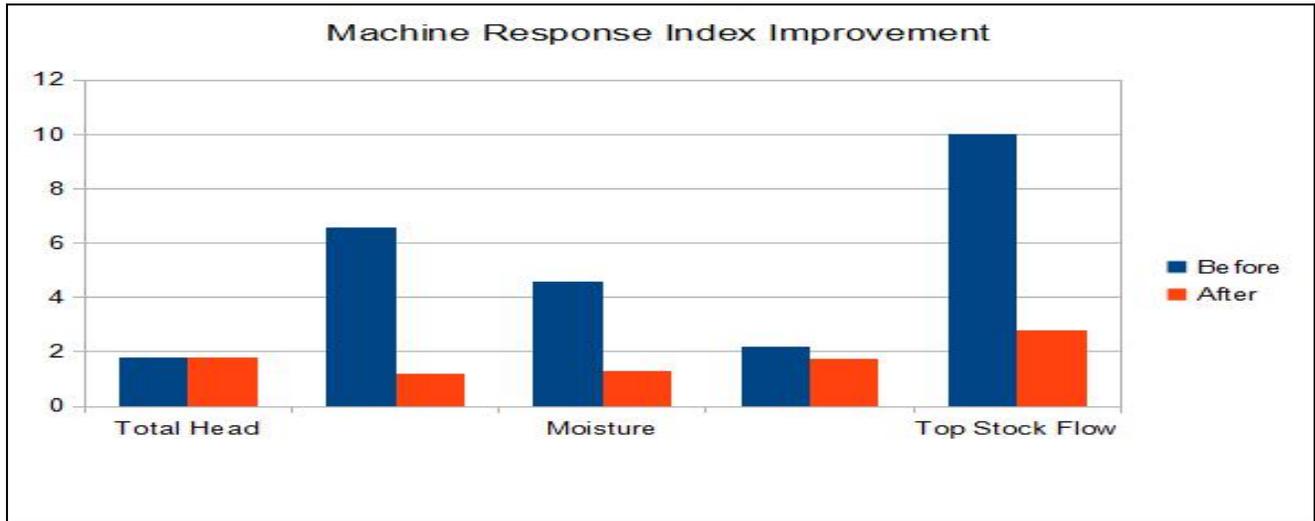


Figure: QCS Response Index Comparison

Notes:

- Basis weight long term variability (MDL) reduced by >75% in an overnight stable run.
- Reel Moisture at same grade paper long term variability (MDL) reduced by >75%
- The time to target during a basis weight set point change / disturbance rejection reduced by about 80%
- The time to target during a Reel moisture set point change / disturbance rejection reduced by about 55%.
- Sheet break recovery time was considered to be improved.

P Kannan, OPTIPID Consulting

Reel Report Analysis – Reel Weight

Basis Weight Machine Direction Long term variation has been reduced by 80%

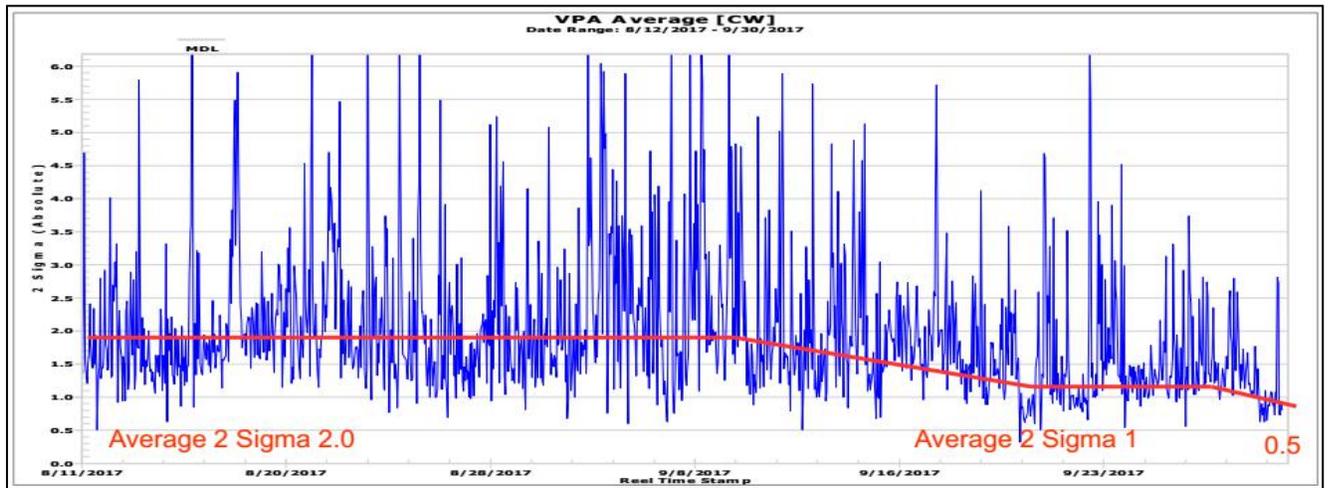
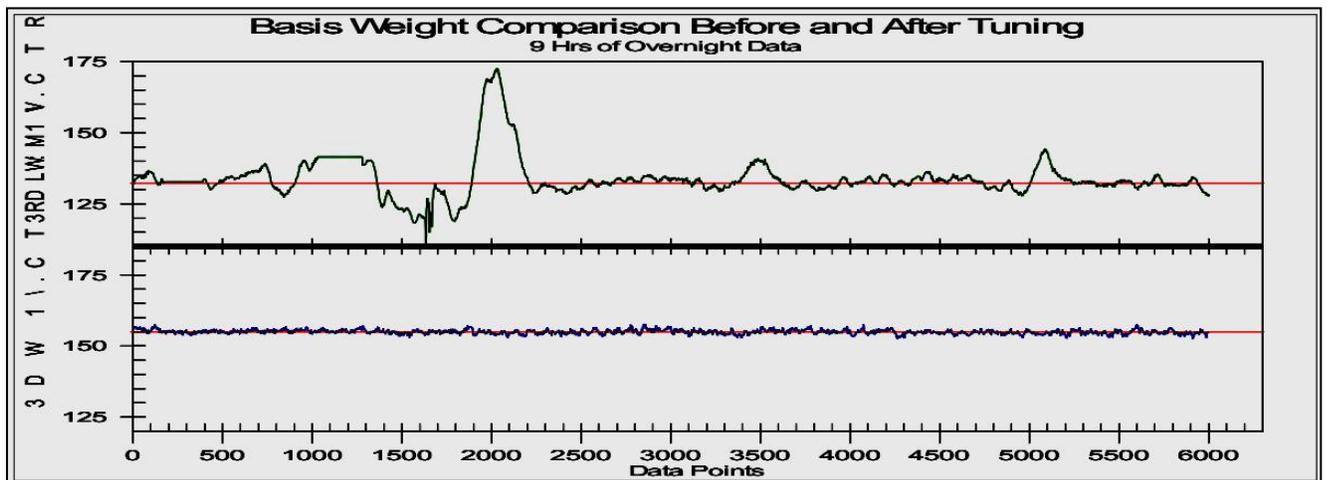


Figure: Reel Condition Weight 2 Sigma Improvement

Overnight Trend - Condition Weight



Notes:

- It was noticed that the Basis weight MDL variability has gone up from approximately 2.0 to 3.0 during 1st Sep 2017 and brought to 0.45 by tuning all the DCS loops and QCS tuning on 29th Sep 2017.
- Interestingly the MDL variability is higher in lower grammage and lower in higher grammage which may be due to Wire Drainage water to Silo. Please see detail in page no 11.

P Kannan, OPTIPID Consulting

Reel Report Analysis – Reel Moisture

Reel Moisture Machine Direction long term variation is being maintained

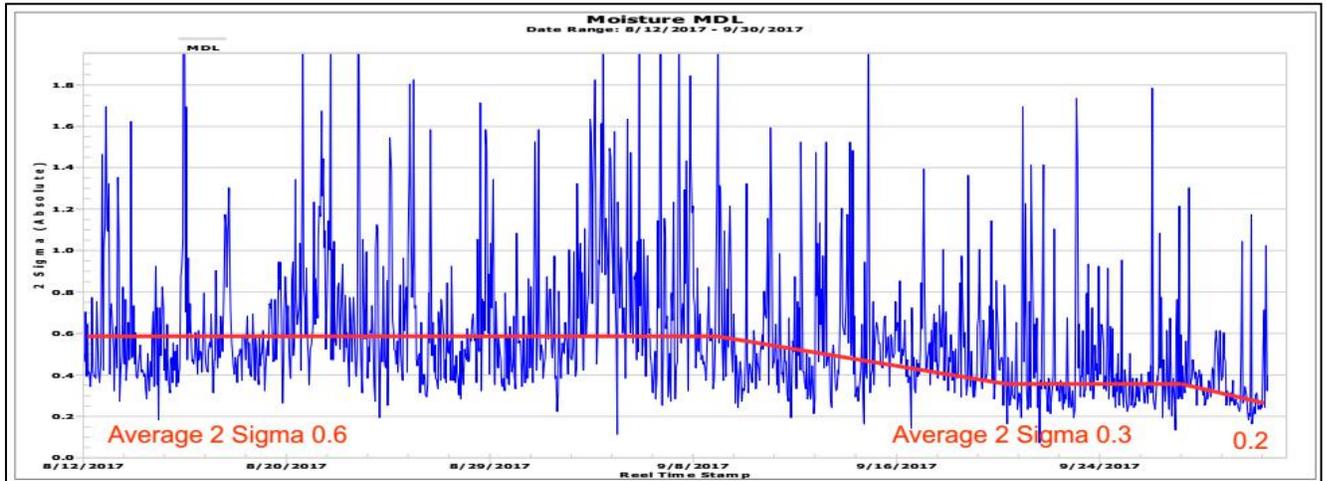
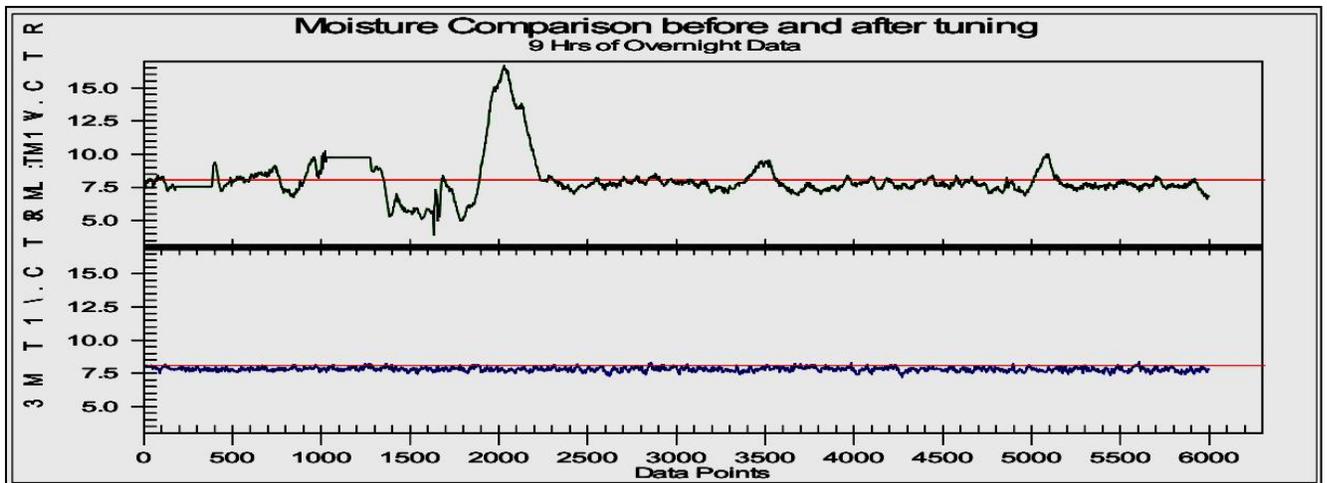


Figure: Reel Moisture 2 Sigma Improvement

Overnight Trend - Moisture



Notes:

- It was noticed that the Reel Moisture MDL variability also has gone up from 0.6 to 1.0 during 1st Sep 2017 and brought to 0.15 by tuning all the DCS loops and QCS tuning on 29th Sep 2017.