MINIMIZE SHEET BREAKS USING GEN-AI
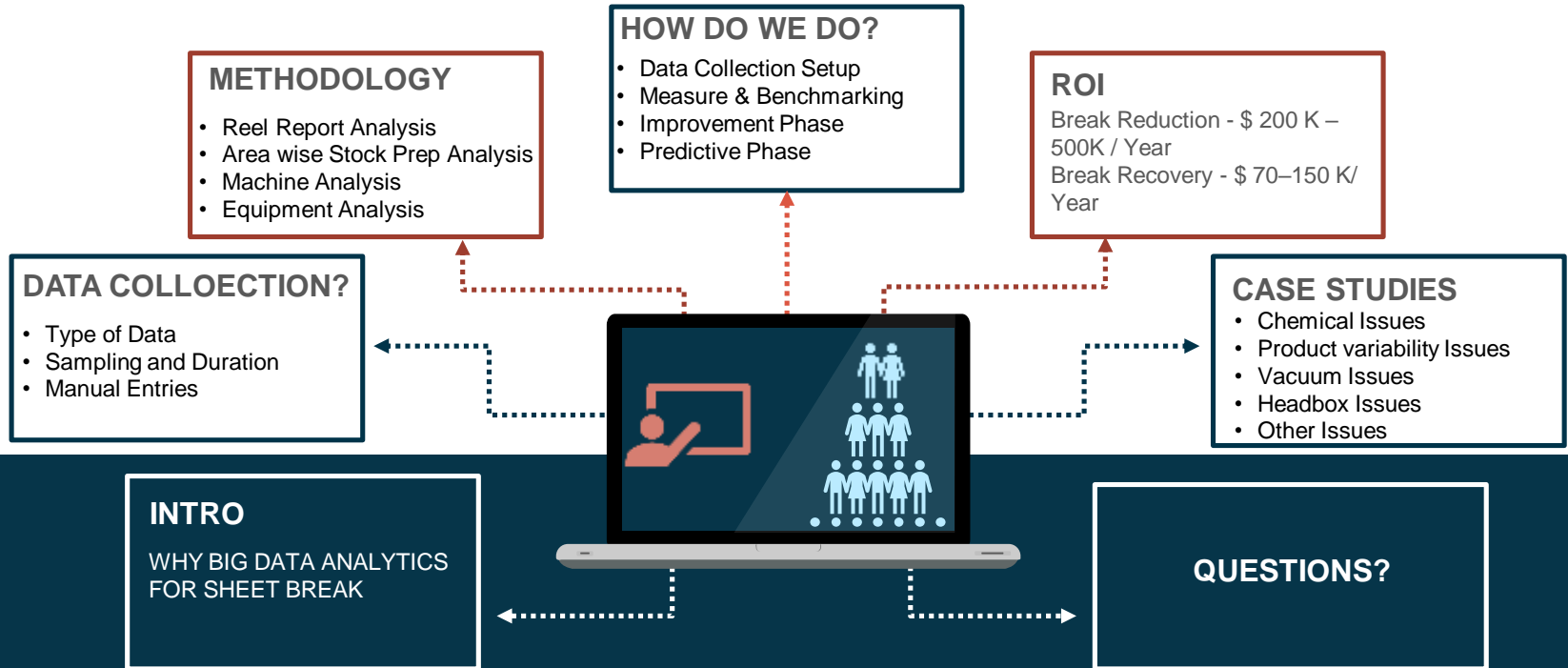
P KANNAN

26 JULY 2024

TURiLYTiX.Ai
Technology Partner

OPTIPID
CONSULTING

OUTLINE

METHODOLOGY

- Reel Report Analysis
- Area wise Stock Prep Analysis
- Machine Analysis
- Equipment Analysis

HOW DO WE DO?

- Data Collection Setup
- Measure & Benchmarking
- Improvement Phase
- Predictive Phase

ROI

Break Reduction - $ 200 K – 500K / Year
Break Recovery - $ 70–150 K/ Year

DATA COLLOECTION?

- Type of Data
- Sampling and Duration
- Manual Entries

CASE STUDIES

- Chemical Issues
- Product variability Issues
- Vacuum Issues
- Headbox Issues
- Other Issues

INTRO

WHY BIG DATA ANALYTICS FOR SHEET BREAK

QUESTIONS?

BIG DATA HELPS IN OPTIMIZING PAPER MACHINE

DATA AVAILABLE TODAY IS INCREDIBLE, USE OF THAT IS LESS IMPRESSIVE

WHY BIG – AI?

Uniform Quality
Big data helps analyze papermaking processes and deliver consistent quality

Higher Production
Artificial intelligence helps analyze past paper production runs, data on materials being used, and environmental inputs

Reduce Energy
Big data provides deep insights into energy use

Seizing Opportunities
With the right tools that collect, analyze, synthesize, and display data, big data is a game-changer for the paper industry

BIG DATA

VOLUME

VARIETY

VELOCITY

VERACITY
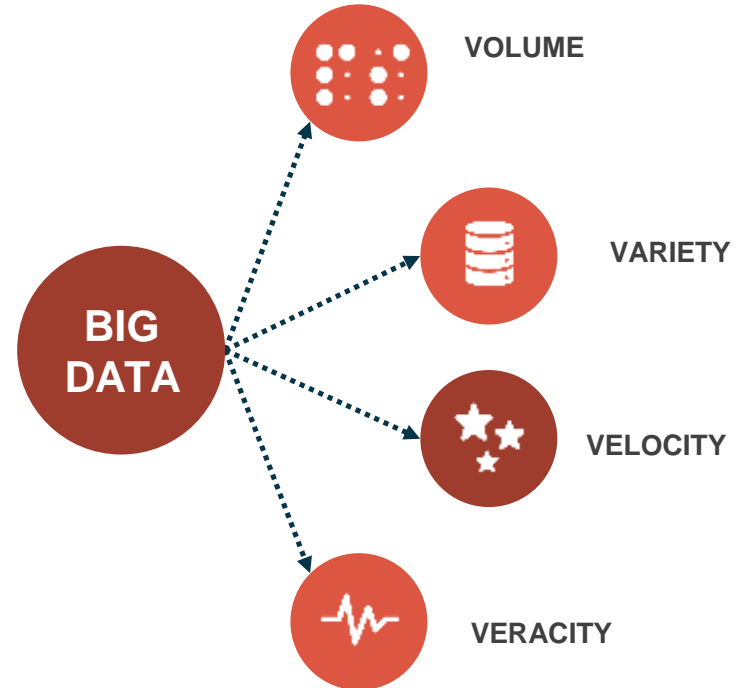
HOW DO WE DO?

DIGNOSE PHASE

- Measure Process
- Detailed Scope with defined objectives
- Forecast Performance
- Summary report

ADVANCED PHASE – BIG-AI

- Sheet Break prediction & Performance Monitoring Software
- Training for Operations and Control engineers

DATA COLLECTION PHASE

Data Acquisition with One Platform to acquire all types of data From DCS, QCS, Drives, High frequency, LAB, pulp mill, Ulma, Videos etc.

IMPROVEMENT PHASE

- Improve Performance
- Apply corrective actions

DATA COLLECTION PHASE
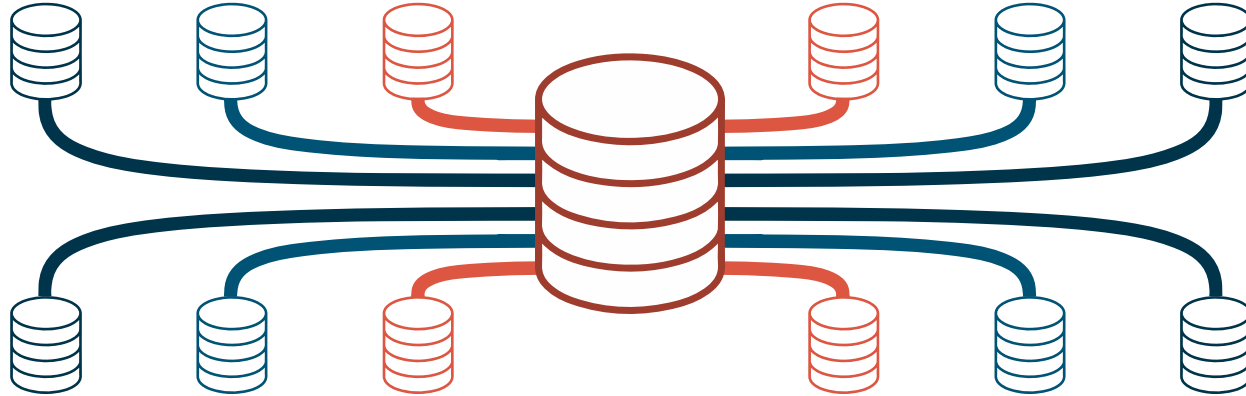

QCS
Sensors, Scanners, Product Quality data

DCS
Transmitters, Analyzers, I/O,etc

DRIVES
All Drive Speed, Load, Temp and vibration of motor etc.

ALARM DATA
Alarm management data

PULP DCS
Pulp mill data

EVENT DATA
BREAKS, GRADE CHANGE, SHADE CHANGES etc.

QMS
Quality Management system

LAB
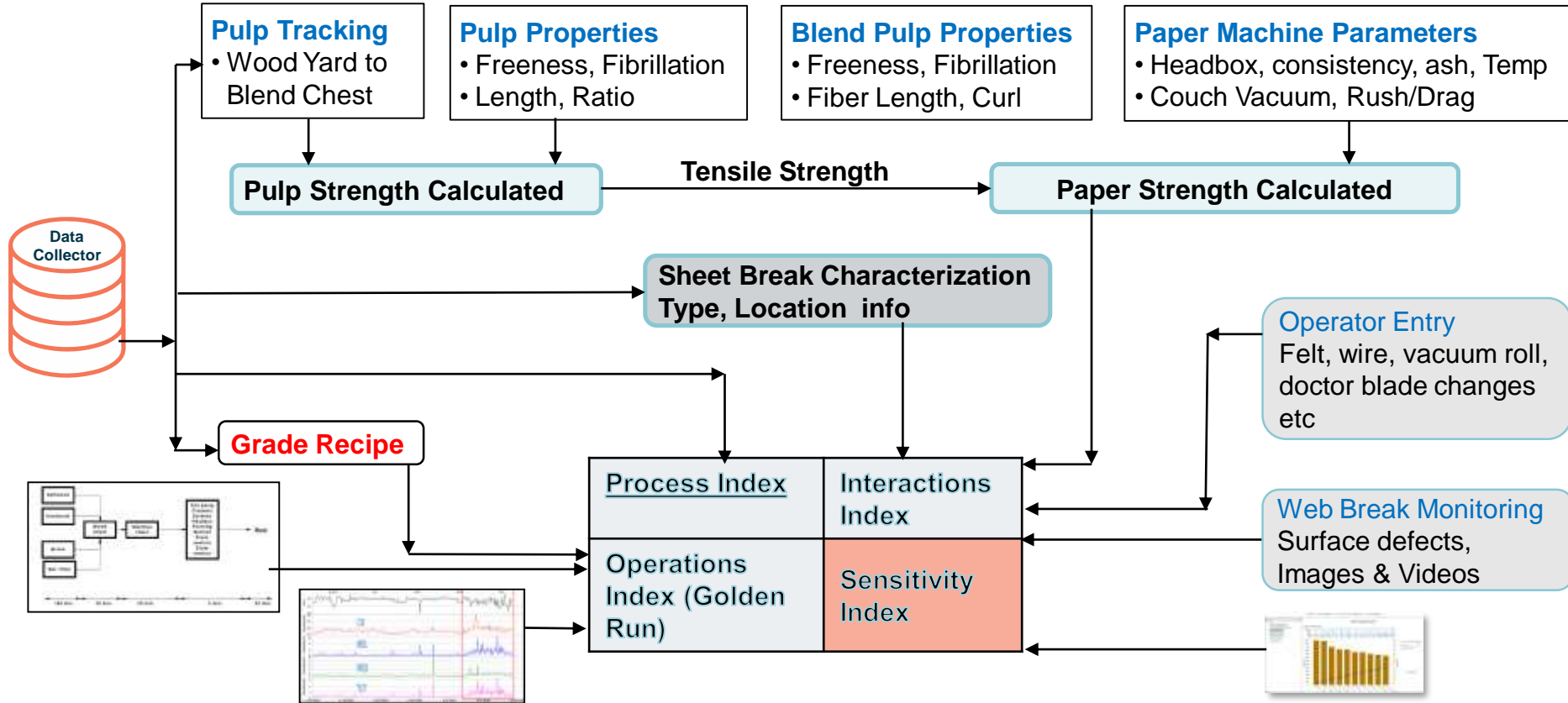Analyzer data and all the information from LAB

CONDITIONAL MONITORING
Vibration Analysis

REEL REPORT
QCS Reel report (Variation Partition Analysis).

HIGH FREQUENCY DATA
1000Hz, 100Hz data for Product Variability Analysis

EQUIPMENT DATA
Pump, Screen, Rolls, Hydraulic System etc

DIGNOSE PHASE

Pulp Tracking
- Wood Yard to Blend Chest

Pulp Properties
- Freeness, Fibrillation
- Length, Ratio

Blend Pulp Properties
- Freeness, Fibrillation
- Fiber Length, Curl

Paper Machine Parameters
- Headbox, consistency, ash, Temp
- Couch Vacuum, Rush/Drag

Pulp Strength Calculated — Tensile Strength → **Paper Strength Calculated**

Data Collector

Sheet Break Characterization Type, Location info

Operator Entry
Felt, wire, vacuum roll, doctor blade changes etc

Grade Recipe

Web Break Monitoring
Surface defects, Images & Videos

Process Index	Interactions Index
Operations Index (Golden Run)	Sensitivity Index

PROBLEM BASED SOLUTION

Unstable Stock Delivery

Unstable stock preparation results in instability in paper machine which will cause poor runnability and quality

Freeness Instability

Freeness gives an estimate of what kind of fibers the pulp contains and what kind of paper can be made from it.

Control Loop Status

Are control loops solving issues or struggling with problems?

How much % of Data Utilization?

Industries use only 6% of data for data analytics to make decision

Wet End Variability

PM needs to reduce variations on headbox and WWC, Retention and sheet ash content. The ability to control chemical system will lead wet end stability

PM sluggish responds

Sluggish behavior at grade change, sheet break recovery, upset will result in high rejects, roll buildup

Event Based Analysis

Grade Change, Color Change, Alarm analysis etc.

Equipment issues

Identify problems in equipment such as pumps, rolls through the strategic collection and analysis of machine condition data.

IMPROVEMENT PHASE

Stock Preparation Stabilization

Provides information on
- Stock Preparation Area Performance
- Sources of variations
- Finding opportunity for Fiber Savings
- Control Tuning Quality

Paper Machine Response

Provides information on:
- QCS Performance
- Start up time
- Grade Change recovery
- Disturbance reduction
- Sheet break recovery

Refiner Optimization
- Energy (Kwh/DegSR/ton of Pulp)
- Freeness & properties
- Steam (tons of steam/ton of paper)
- Refiner Plate life (No of days)
.

Product Variability Analysis

Provides Information on
- Identify Controllable Energy
- Mechanical Pulsations of vibrations
- Rolls, Vacuum section problems
- Wire & Press issues
- Benchmark of machine stability

Reel Report Analysis

Provides information on
- Industry Comparisons
- Shift problems
- Felt related problems
- Maintenance problems
- Mechanical problems
- Result erosion

Transient Analysis
- Reduce Time for grade/shade changes
- Identify process limiting parameter
- Improved moisture response during and after grade change
- Reduced sheet break occurrence during and after grade change

ADVNCED PHASE — BIG-AI SHEET BREAK PREDICATION

Sheet break results showed ~85% predictions

Accurate Predictions

BIG-AI impressively forecasts sheet breaks at a rate of approximately **~85%,** leveraging available data.

Timely Alerts

The system sends instant alerts, allowing for proactive actions, and warns **30 minutes before** potential sheet breaks.

Enhanced Operations

➢ BIG-AI improves stability for the operations team.
➢ With quick alerts and accurate predictions, the team can make **informed decisions promptly**
➢ Boosting overall efficiency

ROI

Sheet Break Duration

Sheet Break Benchmark (3%) = 20 Hrs / month
Sheet Break Before = 66 Hrs / month
Sheet Break After = 20.8 Hrs / month

Known Issue

Chart axis (vertical): 0, 1000, 2000, 3000, 4000, 5000, 6000
Chart axis (horizontal): Jan, Feb, Mar, Apr, May, June, July, Aug, Sep, Oct, Nov
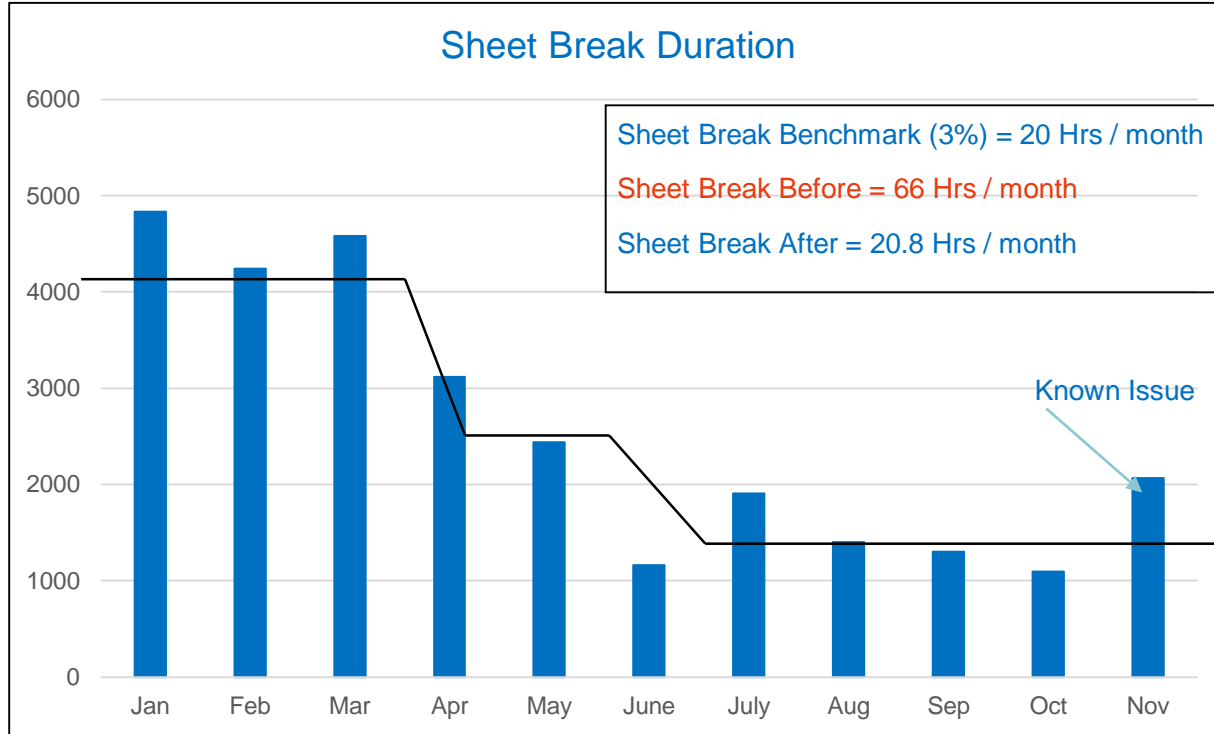
- Machine throughput = 60 Tons per hour
- Deckle = 10.6 m
- Operating Speed = 1450 mpm
- Analysed Total breaks = 399
- Source of Break Identified = 110
- Total Tags analysed = 374 tags
- After the paper machine optimization & corrective actions, the break time has been reduced by 45.8 Hr/Month which is converted to 2748 Tons per Month which is equivalent to $274,800 per Month savings

REFERENCE LIST

We will provide the
reference list on request

EXAMPLE BREAKS

ASH ISSUE – 14 TIMES IN ONE MONTH
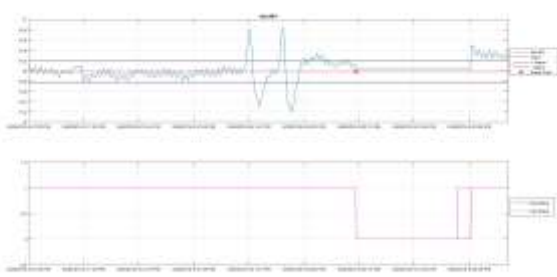
DRAW PROBLEM – 4 TIMES
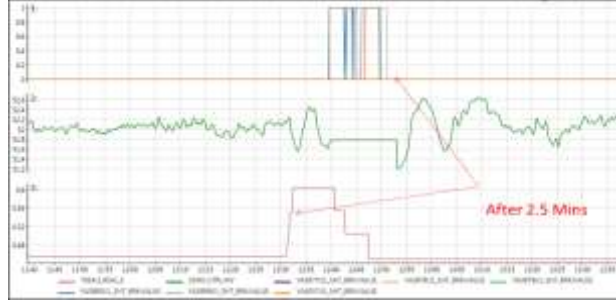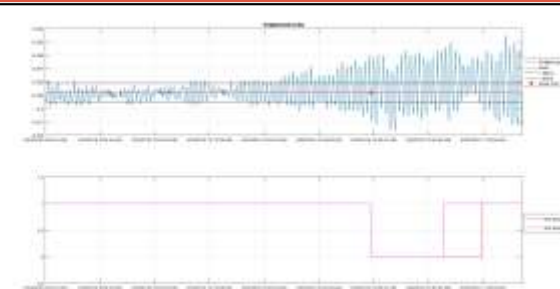
1ST DRYER DP VARITION – 17 TIMES
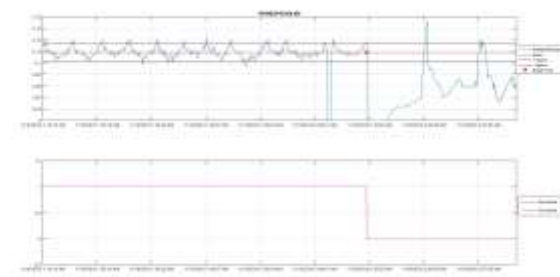
HEADBOX VARIATIONS – 16 TIMES
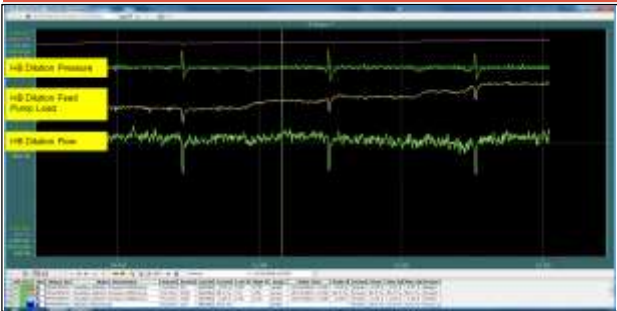
CHEMICAL VARIATION – 41 TIMES
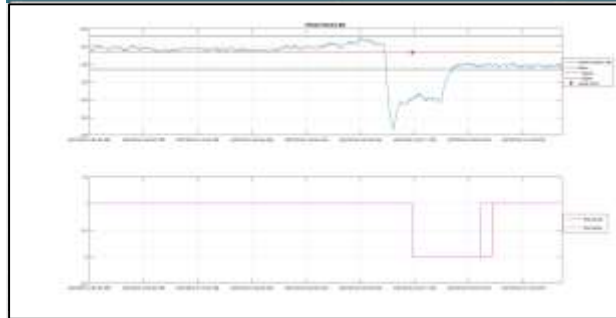
VACUUM VARIATION – 6 TIMES

REEL REPORT (VPA) ANALYSIS

CASE STUDY

INDUSTRY
Pulp & Paper

LOCATION

OVERVIEW

Comparisons industry globally
Shift problems
Fabrics related problems
Maintenance problems
Mechanical problems
Result erosion

SOURCE OF MDL

Dilution Issues
Consistency Issues
Valve, pump problems
Process Area issues (Broke, Chemical)
Speed Issues
DCS/QCS Issues

SOURCE OF MDS

Fan pump problems
Pump cavitation
Pressure Pulses
Vacuum Issues
Forming zone blades
Uneven Press Loading
Felt clean, drainage problems, etc.

REEL REPORT SUMMARY

Total Variability 2 Sigma as % of Process

Sensor	Goal	PMxx
Ash	< 4.5	7.07
Basis Weight	< 1.7	3.13
Caliper	< 1	2.64
Conditioned Weight	< 1.5	2.75
Moisture	< 10	21.99

SOURCE OF VARIATION

Total Distribution

	Sensor	Goal	Ash	BW	CA	CW	MT
PMxx	MDS	< 70	84	60.5	32.4	66.9	13.1
	MDL	< 10	8.85	8.05	64.3	6.31	14.4
	CD	< 20	7.19	31.5	3.29	26.8	72.6

REEL REPORT BAR GRAPH

Gradewise Weight Distribution — bar chart showing CD, MDL, MDS, TOT for 47 GSM, 60 GSM, 80 GSM

REEL REPORT TREND

Monthwise Weight Trend — line chart (CD, MDL, MDS, TOT)
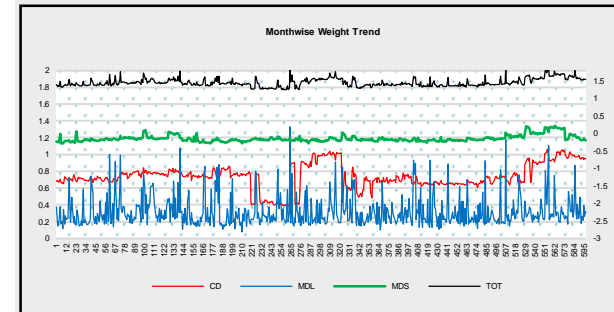
LOOP PERFORMANCE

CASE STUDY

INDUSTRY
Pulp & Paper
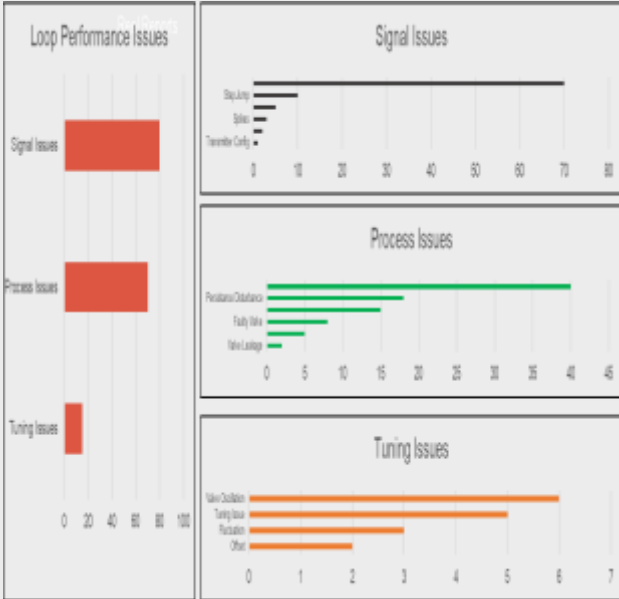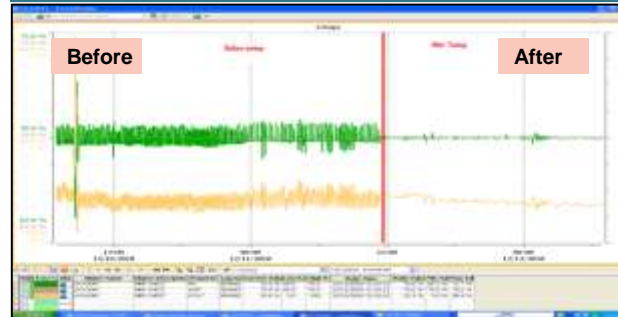
LOCATION

SIGNAL IMPROVEMENT

521FC3070

Before

After
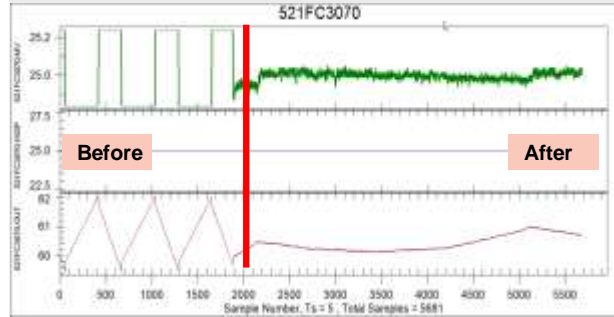
TIME TO TARGET IMPROVEMENT

Clay Before and After Tuning

250s

45s

FIC3087.MV — FIC3087.WSP
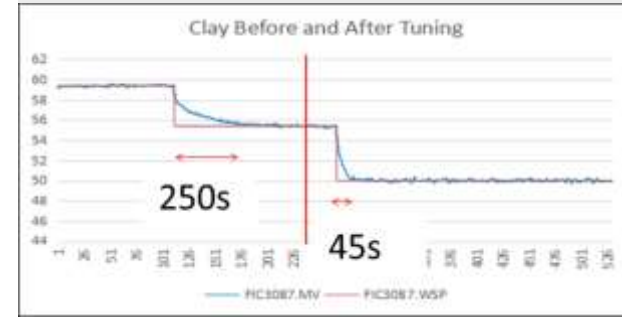
LOOP TUNING IMPROVEMENT

Before

After

CHEMICAL PROCESS IMPROVEMENT

Stock Flow Comparison

Before Tuning_7th Apr 2014

Before

After tuning the Chemical and
Stock Prep Area

After Tuning_22nd Apr 2014

After
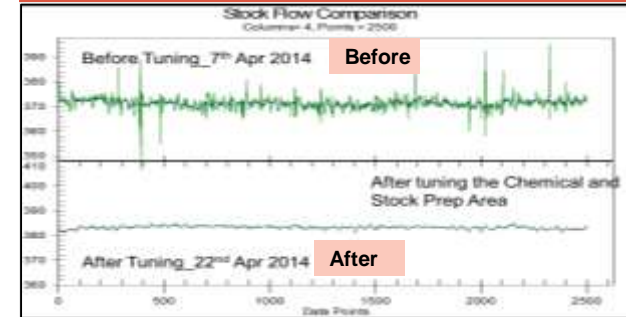
VARIABILITY (MDL) REDUCTION

CASE STUDY

INDUSTRY
Pulp & Paper

LOCATION

CUSTOMER NEED
Reduction in rejects
Less breaks
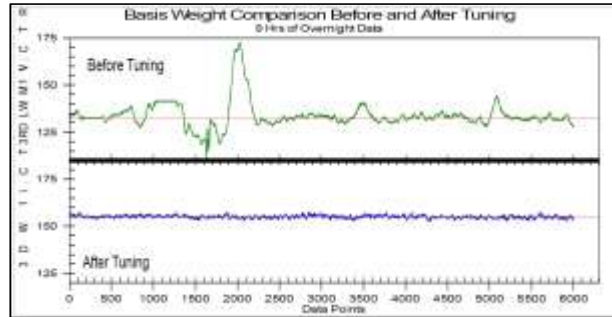Improvement in paper quality

IMPROVEMNT
Improved Paper Quality
Reduced Rejects

CUSTOMER BENEFITS
Overall Paper machine performance improved by 75%
Reduced off-spec production 4%
Sheet Break reduction by 1%
Potential issues identified faster with the help of Operator and Engineers training

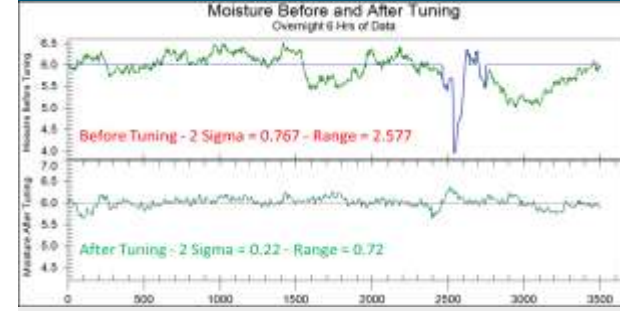## WEIGHT VARIATION REDUCTION – 70%

SAVINGS – 0.5 MUSD

STOCK CONDITIONS

WEIGHT VARIATION REDUCTION – 70%

VARIABILITY (MDL) REDUCTION

CASE STUDY

INDUSTRY
Pulp & Paper

LOCATION

CUSTOMER NEED
Sheet Breaks Reduction
Less Rejects
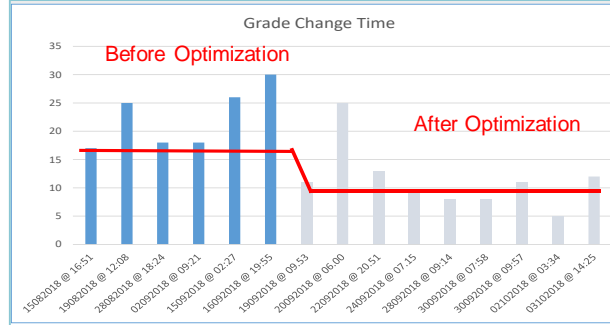Improvement in Paper Quality

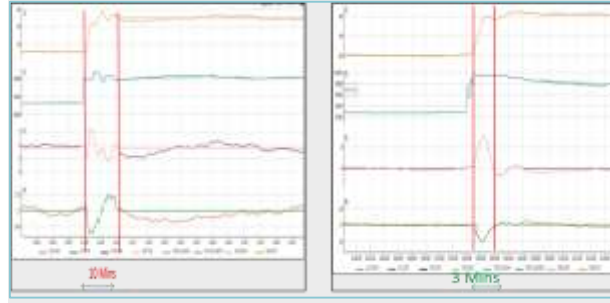**IMPROVEMNT**
Reduced Sheet Breaks
Reduced Rejects

CUSTOMER BENEFITS
Sheet Break reduced From 469 to 297 in one year
Reduced off-spec production by 0.8%
Improved sheet break recovery time by approx.50%

GRADE CHANGE TIME REDUCED

Grade Change Time

Before Optimization

After Optimization

GRADE CHANGE BEFORE

GRADE CHANGE BEFORE AND AFTER

GRADE CHANGE AFTER