Sheet Break Analysis Report

SHEET BREAK ANALYSIS

OPTIPID completed a Paper Machine Sheet Break Analysis

RESULT OVERVIEW

The below is the fishbone diagram to show the breaks by area wise.

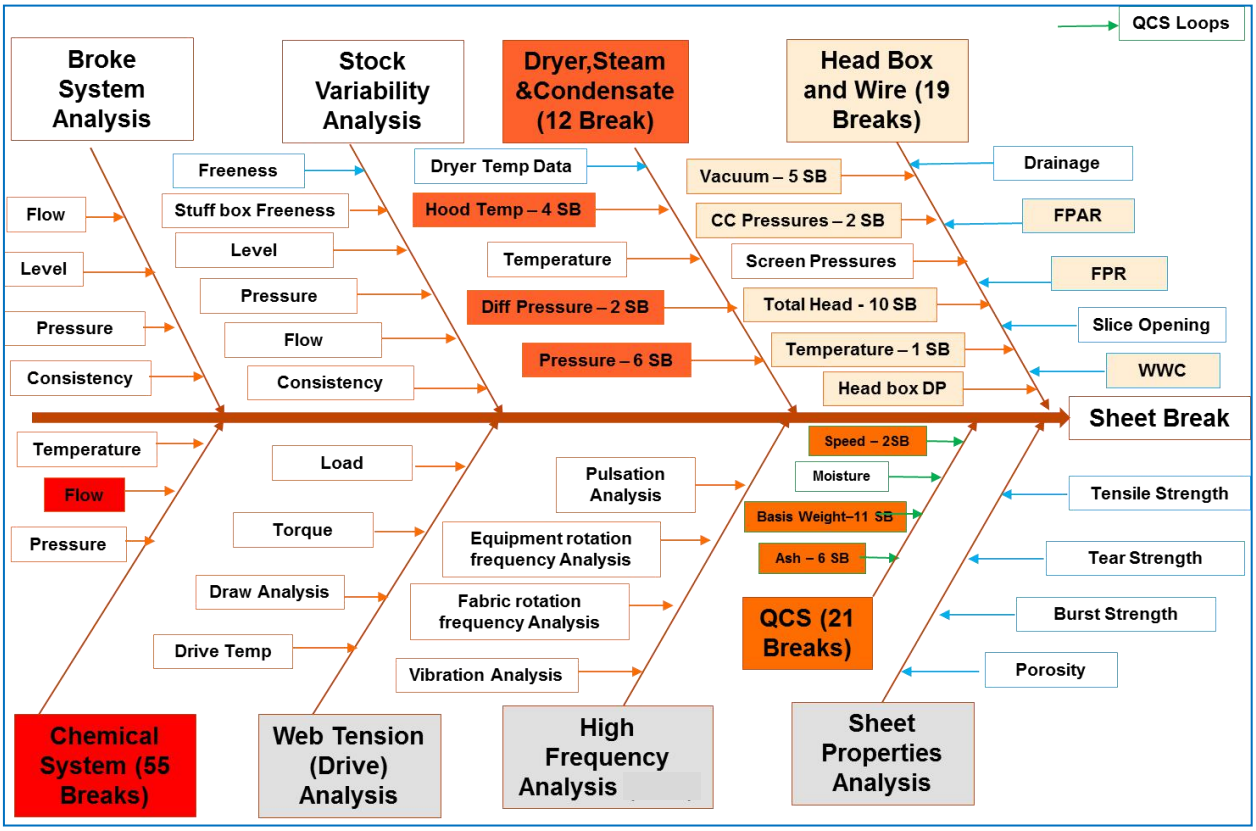


Figure: Fishbone Diagram for Sheet Break Analysis

SUMMARY OF FINDINGS

- Analysed 399 sheet break events for 6 months. This was further classified into
  - 182 Size press breaks and
  - 217 Reel breaks.
- The duration of
  - Size Press break events are 3960 mins and
  - Reel break events are 2078 mins.
- The average Size Press break is 21.7 mins and Reel Break is 9.5 mins
- It was noticed that there are 55 sheet breaks from chemical variations.
  - Micro Polymer variations
  - Retention Aid flow variations
  - Retention Aid dilution flow variations
  - Bentonite flow variations
  - OBA flow variations etc.
- It was noticed that there are 21 sheet breaks from QCS variations
  - Basis Weight
  - Moisture
  - Ash
- It was noticed that there are 19 sheet breaks from Head Box variations
  - Headbox Differential pressure variations
  - Headbox CP Dilution Flow variations
  - Total Head variations
- It was noticed that there are 12 sheet break from steam pressure variations and few breaks from Hood and Ventilation
  - IPHBFMC3240 - MOISTURE CONTROL PREDRYER EXHAUST 1
  - IPHBFMC3340 - MOISTURE CONTROL PREDRYER EXHAUST 2
  - IPHBFMC3440 - MOISTURE CONTROL PREDRYER EXHAUST 3
  - IPHBFMC3540 - MOISTURE CONTROL AFTERDRYER EXHAUST 1
- It was noticed that there are 19 sheet breaks from Vacuum variations
  - Couch Roll High/Low Vacuum
  - Forming High/Low Vacuum
  - Press Roll High/Low vacuum

RECOMMENDATION

These recommendations are a function of the analysis performed on the data collected as well as observations made during the analysis.

The major issues for the instability of the Paper Machine are identified as

- Wet end variability, which was causing the product variability and also taking longer time to stabilize after sheet breaks. OPTIPID recommend to stabilize the wet end by improving loop tuning and reduce intermittent variations in the process which will definitely reduce the sheet breaks.
- Chemical variability, which was causing product chemistry and variations and also can create sheet breaks. OPTIPID recommend to stabilize by tuning the chemical flow controllers, and better preparations at the back end.
- Vacuum variability, which was causing instability in retention, drainage etc. and can create fluctuation in the sheet draw, tension which will definitely causing breaks. Recommend to improve the vacuum system by tuning vacuum controller tuning.
- Headbox variability, which was causing instability in head box stock delivery and can cause breaks. OPTIPID recommend to find out the source of Head Box CP dilution flow and DP variations.
- Steam and Condensate variability, which was causing instability in moisture variations and can cause sheet breaks. OPTIPID recommend to tune the Steam and Condensate loops.
- Hood temperature fluctuation will also cause sheet breaks due to instability in Hood balance.
- Recommend to solve the Basis weight, Ash sensor shutter issue which was causing the measurement jumps
- Recommend to change the grade using AutoGradeChange feature which can prevent breaks.
- Recommend to find out the source of size press chemical flow and temperature variations to avoid reel breaks

ECONOMIC REVIEW

The annual savings will come from: increased production, improved quality, less sheet breaks, faster sheet break recovery, better grade changes. The distribution and range of savings can be seen in Figure shown below.

Estimated Production and Cost data

Production	
Annual Production (T/Y)	432000.00
Operating Days per year	340.00
Total Monthly Production (T/M)	38117.65
Total tons per day	1270.59
Production per hour (T/H)	52.94
Production per minute (T/min)	0.88
Cost	
Sales Value ($/T)	$ 1,000.00
Profit per ton	$ 100.00
Sheet Breaks	
Avg. Sheet Breaks per month	100
Sheet Breaks Loss Time (mins)	1500
Avg. Loss Time per Sheet Break (mins)	15

Figure: Sheet Break reduction benefits (Estimated)

SHEET BREAK ANLYSIS - METHODALOGY

The main target of the paper manufacturer is to make a product with the desired material properties. To do this economically, the good runnability of paper machine is required. Paper machine runnability is often evaluated by the number of web breaks in proportion to production speed. To attain good runnability, the paper must run well (with a low number of web breaks) in each sub-process along the entire paper machine line.

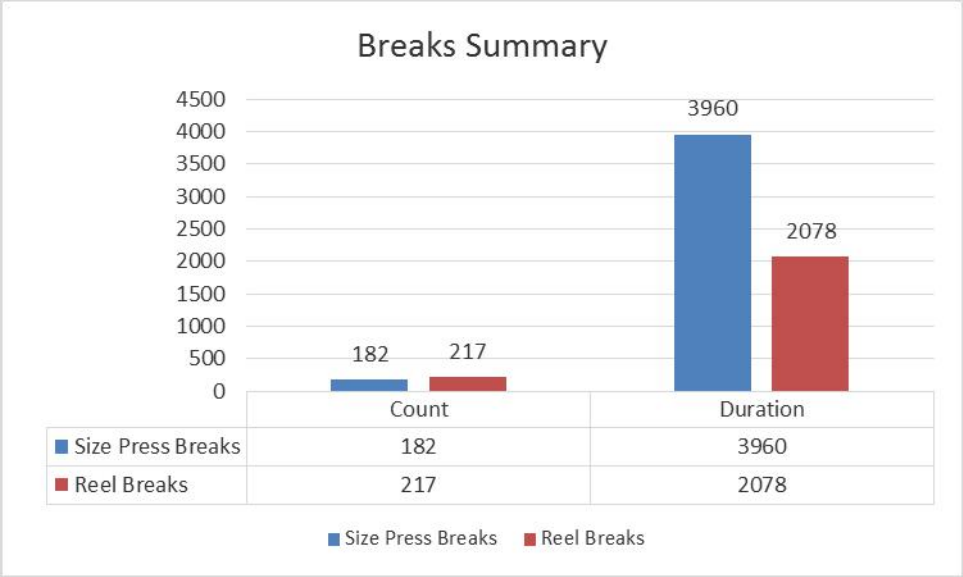
The below is the areas and measurement that we have analyzed for Sheet break analysis

1. Sheet Break due to Process variability
    a. Stock Preparation Loops
    b. Short Circulation Loops
    c. Chemical Loops
    d. Head box Loops
    e. Steam and Condensate Loops
    f. Vacuum Indications (Vacuum and water drainage indications etc.)
    g. Screen system indications (Accept, reject pressures etc.)
    h. Centri Cleaning system indications (Accept, reject pressures etc.)
    i. QCS measurements (Basis Weight, Moisture, Ash etc.)
    j. Analyzer measurements (FPR, FPAR, WWC, Slice Opening etc.)
2. Sheet Break due to Drives variability
    a. Drives load
    b. Drives torque
    c. Drives tension etc.
3. Data Collected for 6 Months
4. Data from 60 minutes before a Sheet Break were Analyzed
5. 3σ and 4σ outliers in the period preceding a Sheet Break were segregated as the likely causes
6. Segregated Tags around 840 across the 399 events were analyzed.

TECHNICAL REVIEW

SHEET BREAK SUMMARY

The data collection tool has identified and collected around 399 sheet break events for 6 months. This was further classified into 182 Size press breaks and 217 Reel breaks. The duration of Size Press break events are 3960 mins and Reel break events are 2078 mins.



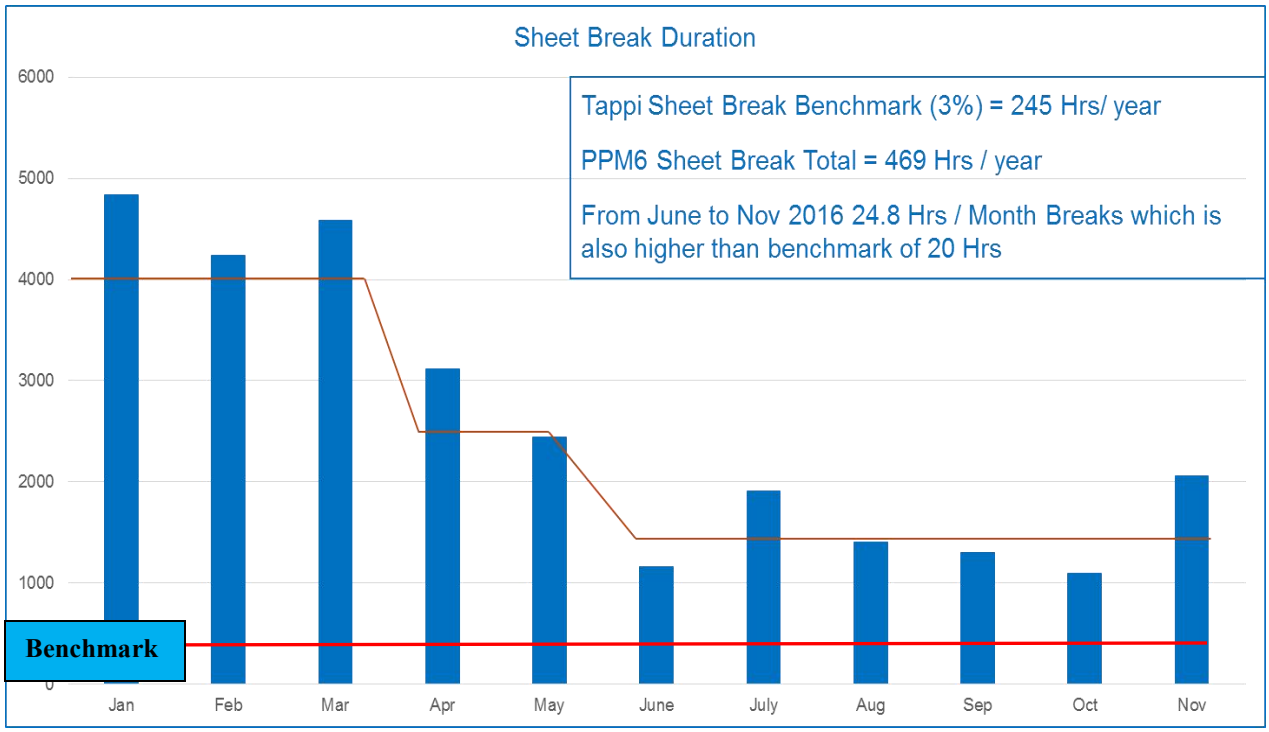
Breaks	Count	Duration (mins)	Average (mins)
Size Press Breaks	**182**	**3960**	**21.7**
Reel Breaks	**217**	**2078**	**9.5**
Total	**399**	**6038**	**15.1**

Figure: Sheet Break Summary

SHEET BREAK COUNTS MONTH WISE ANALYSIS

It was noticed that the break has been reducing over the period. The average sheet break time has come down from 3842 mins to 1488 mins after May 2016. This data has been collected from Mill personal.

It was noticed that many breaks occurred during Nov 2016 and the average break time 25 Hrs which is bit higher that the benchmark.

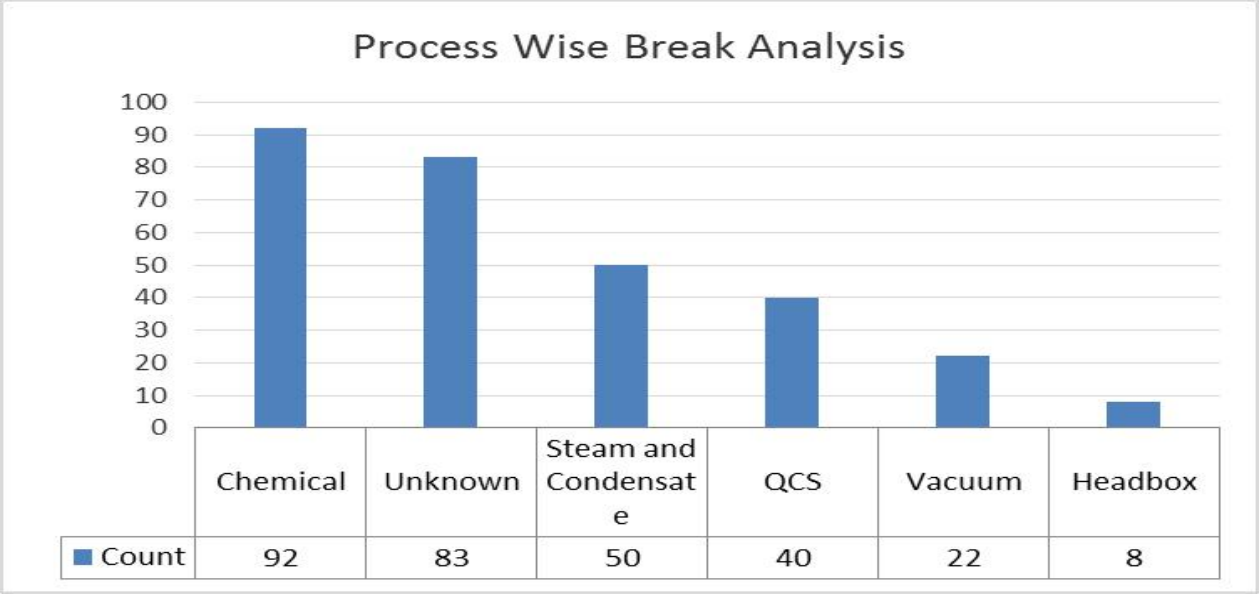


Month	Time (Mins)
Jan	4834
Feb	4239
Mar	4583
Apr	3115
May	2439
June	1162
July	1907
Aug	1402
Sep	1304
Oct	1094
Nov	2064

Figure: Sheet Break Month Wise

SUB PROCESS WISE BREAK ANALYSIS

The below is Pareto chart for the process wise sheet break



Area	Breaks Count
Chemical Related Breaks	92
Unknown	83
Steam and Condensate Related Breaks	50
QCS Related Breaks	40
Vacuum Related Breaks	22
Head Box Related Breaks	8
Drives Related Breaks	0
Mechanical Related Breaks	0

Table: Result Data

PHASE 1: EXAMPLE DATA -SHEET BREAK ANALYSIS USING PROCESS DATA

QCS RELATED BREAKS

CONDITION WIGHT VARIATION

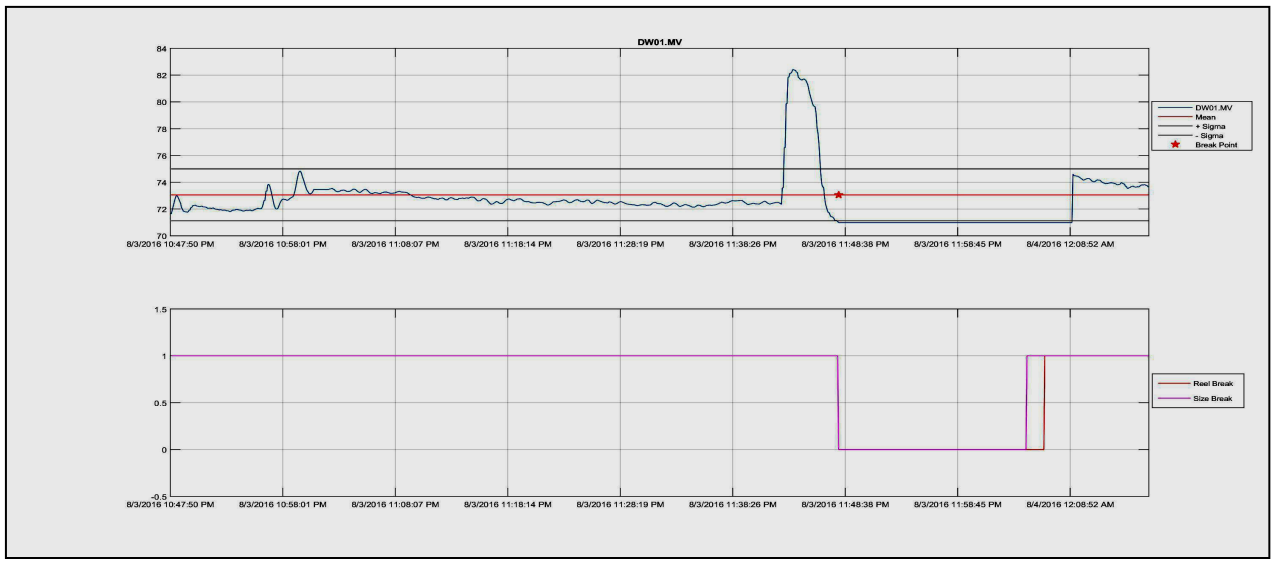


Figure: Condition Weight variations resulted Break

MOISTURE VARIATION

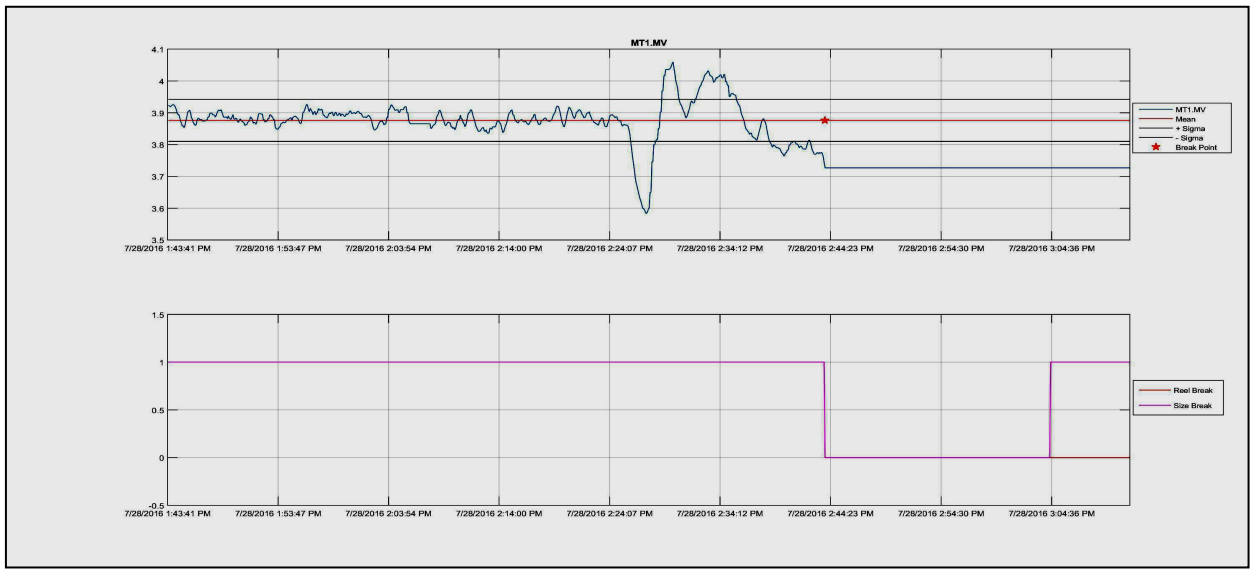


Figure: Moistur variation resulted Dryer Break

ASH VARIATION

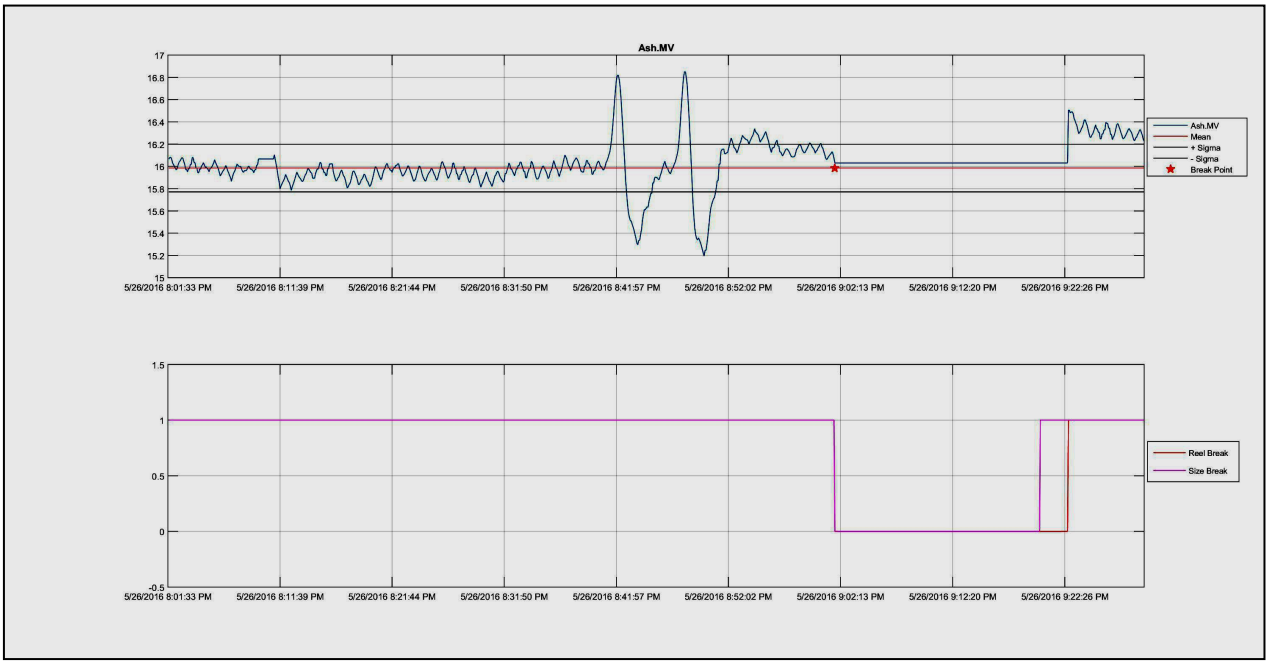


Figure: Ash variation resulted Break

SPEED VARIATION

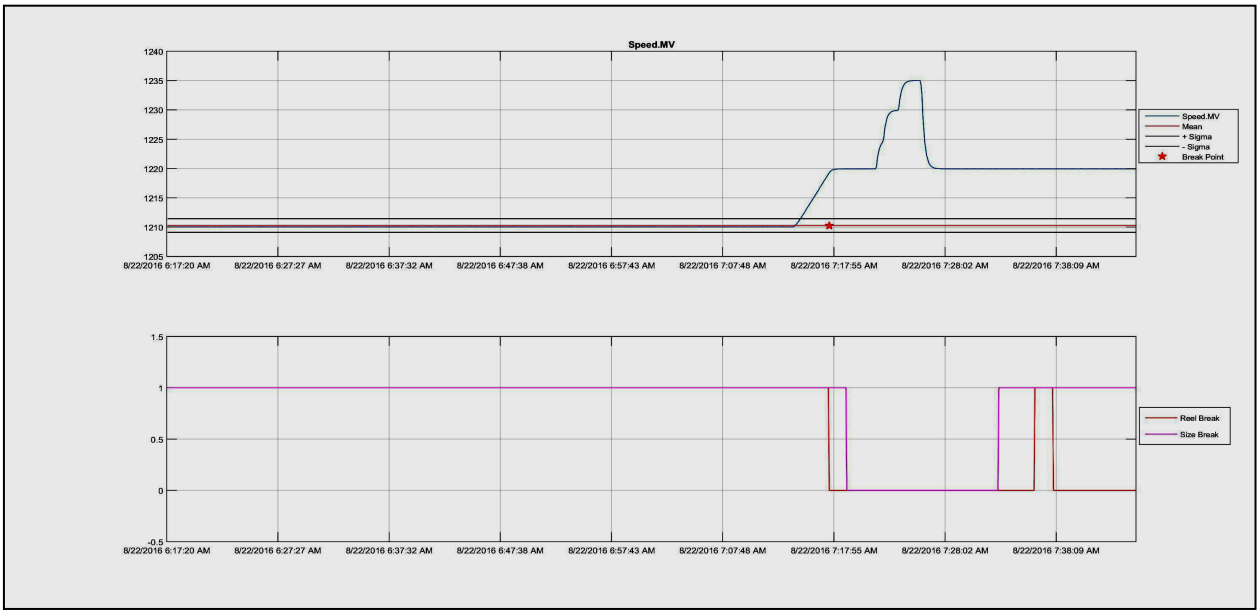


Figure: Speed Variation resulted Break

HEAD BOX RELATED BREAKS

HB DILUTION FLOW VARIATION

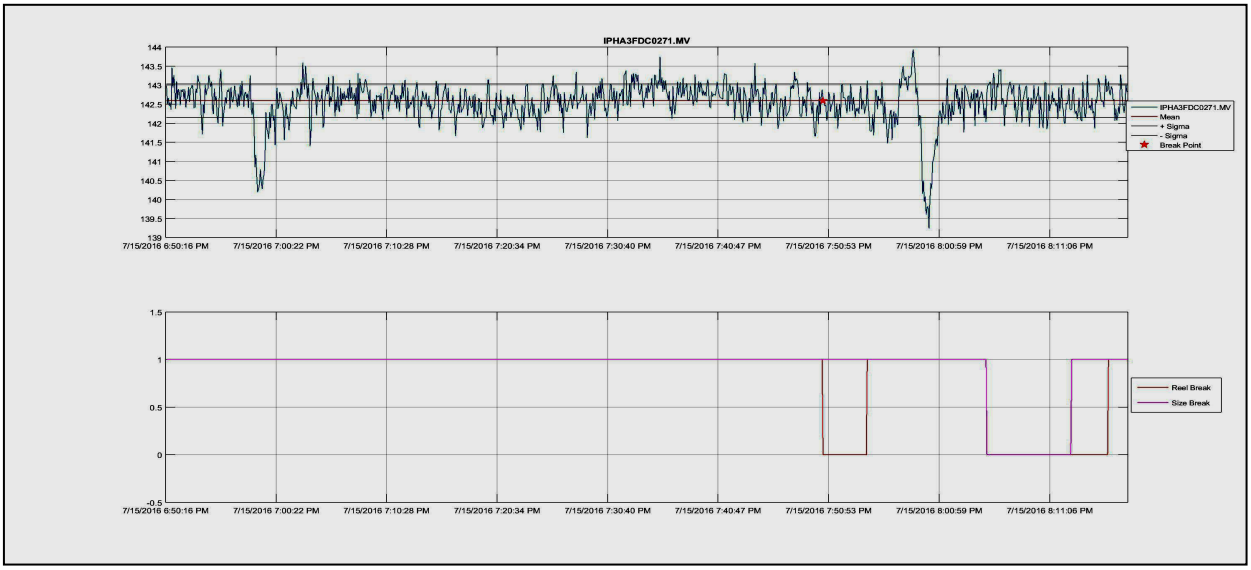


Figure: Headbox Dilution flow variation observed before break

HB DP VARIATION

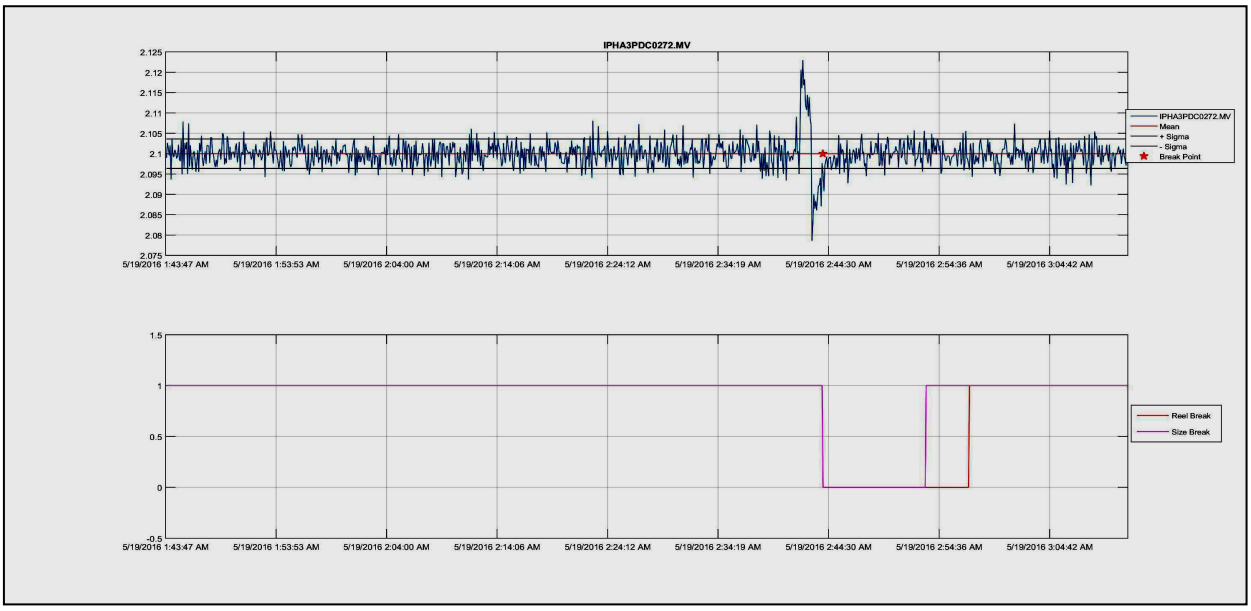


Figure: Headbox DP variation observed before break

CHEMICAL RELATED BREAKS

RET AID ADDING DILUTION FLOW

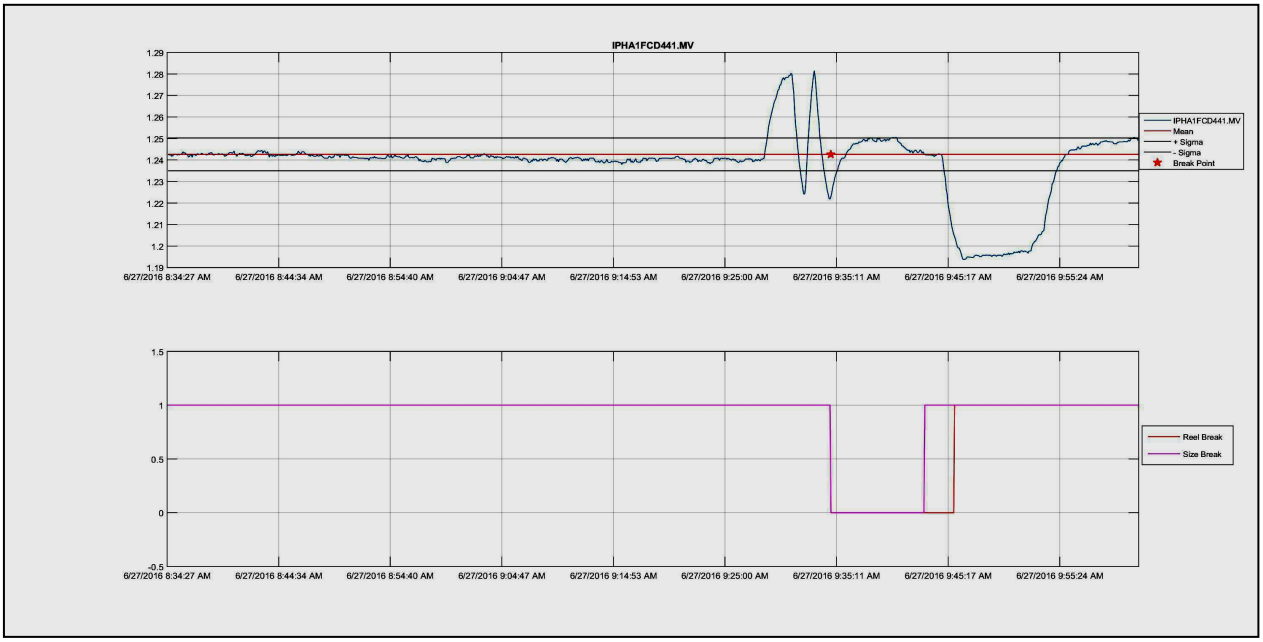


Figure: Retention Aid dilution flow variation observed before break

BENTONITE ADDING FLOW

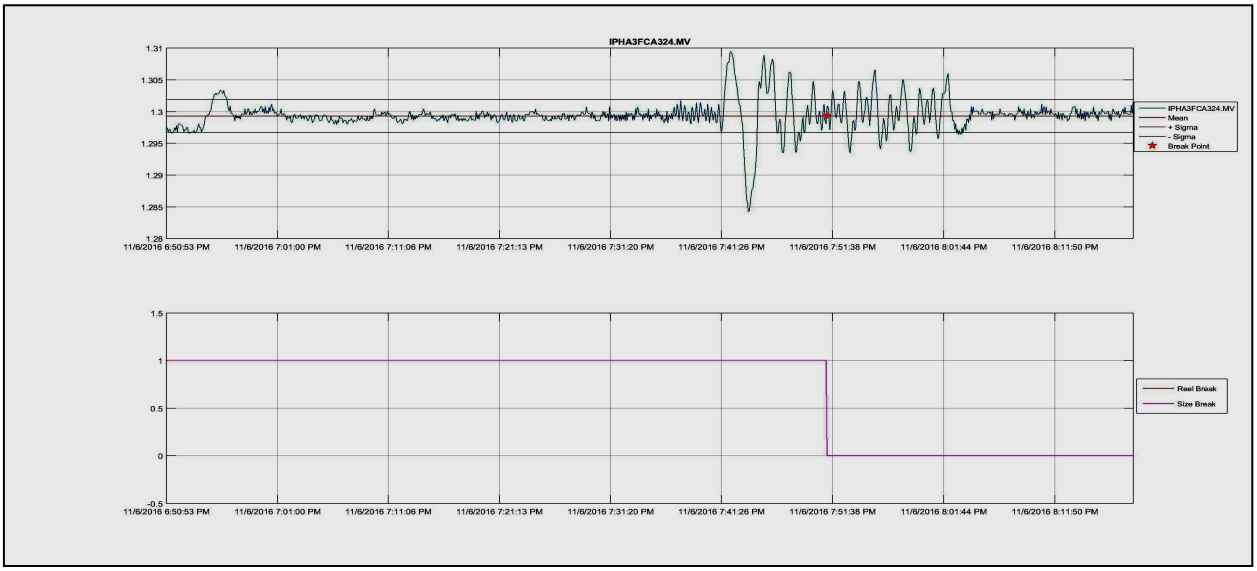


Figure: Bentonite flow variation observed before break

VACUUM RELATED BREAKS

PRESS OF LOW PRESS ROLL VACUUM

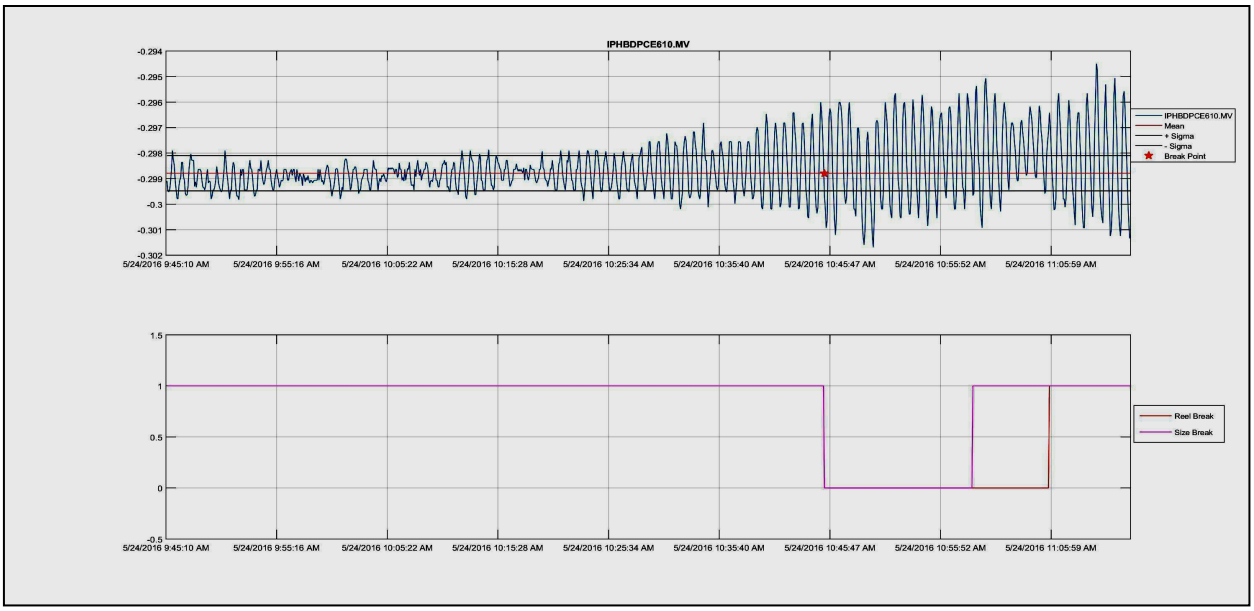


Figure: Press Vacuum variation amplified before Break

STEAM AND CONDENSATE RELATED BREAKS

DP CONTROL CYL 2

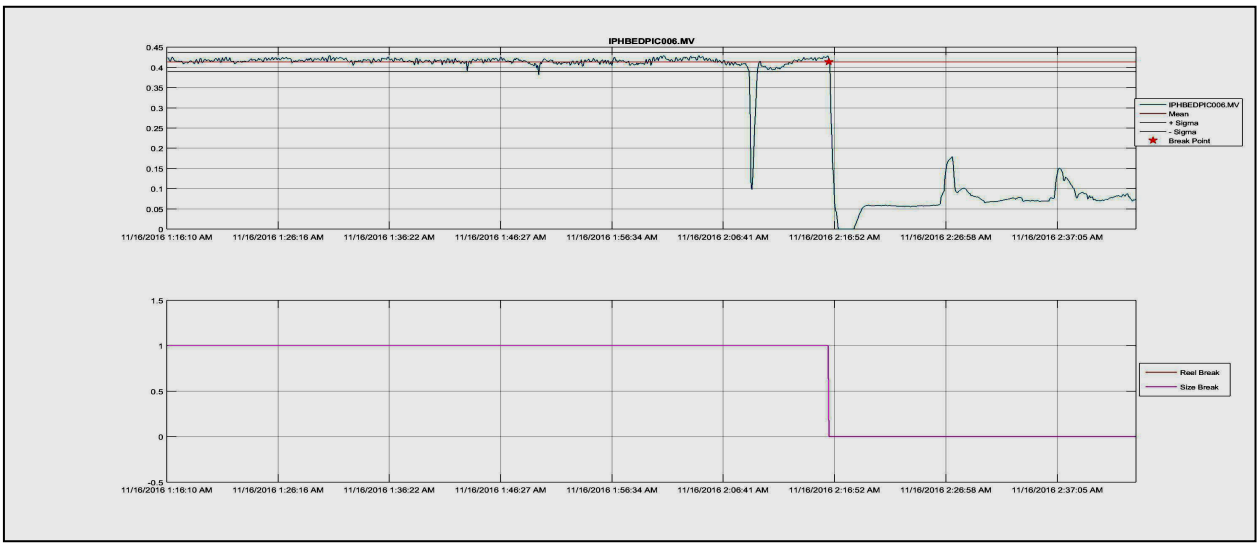


Figure: Steam DP variation observed before Break

PRE DRYER CONDENSATE VACUUM

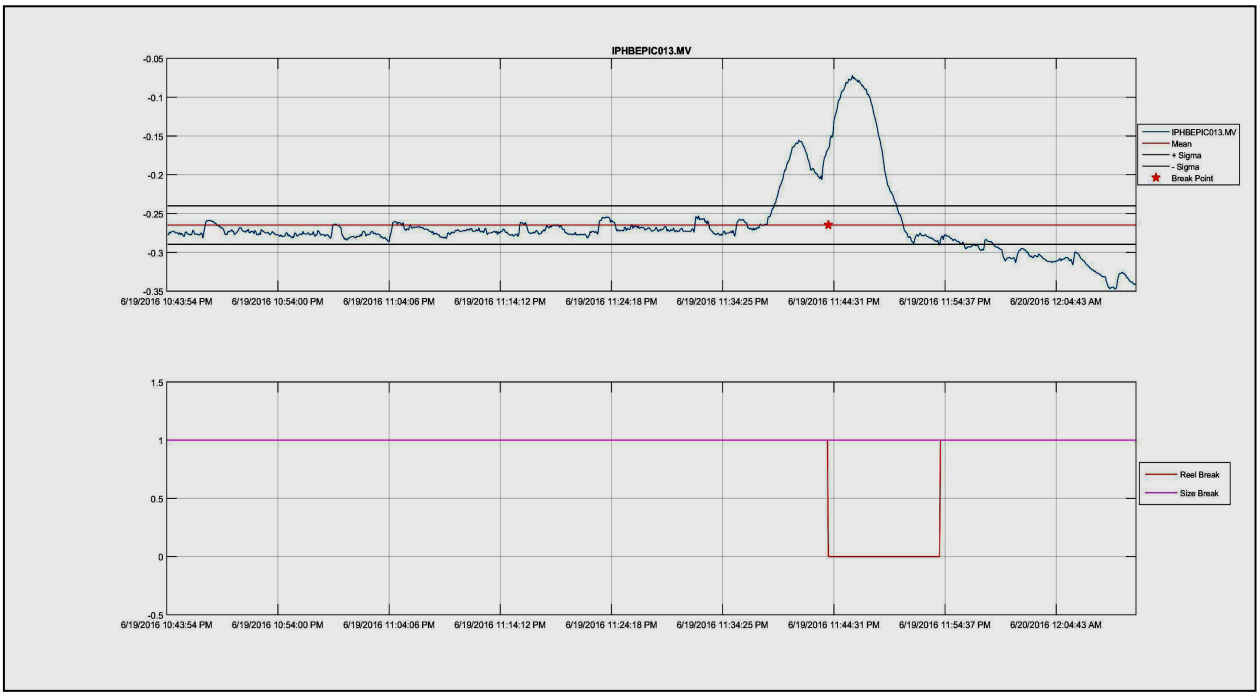


Figure: Steam and Condensate Vacuum variation observed before Break

CONCLUSION

The major issues for the instability of the Paper Machine are identified as Wet end variability, which was causing the sheet breaks and also taking longer time to stabilize after sheet breaks. OPTIPID has completed Wet end loops tuning and resulting in significant improvement in level 1 loops and also Basis weight and moisture. This improvement in Stock preparation and Steam & Condensate area will definitely reduce the sheet breaks and faster basis weight control will reduce the off grade after the sheet break.

The reduction in sheet break will result in an annual savings of $158,000 (10% Sheet break reduction) with best case of annual savings of up to $476,000 (can be targeted).

The implementation of this solution plan will result in:

- Increased production
- Improved sheet quality
- Reduced sheet breaks
- Reduced grade change times.
- Faster sheet break recovery times