# “Monitoring and Analysing your Processes"

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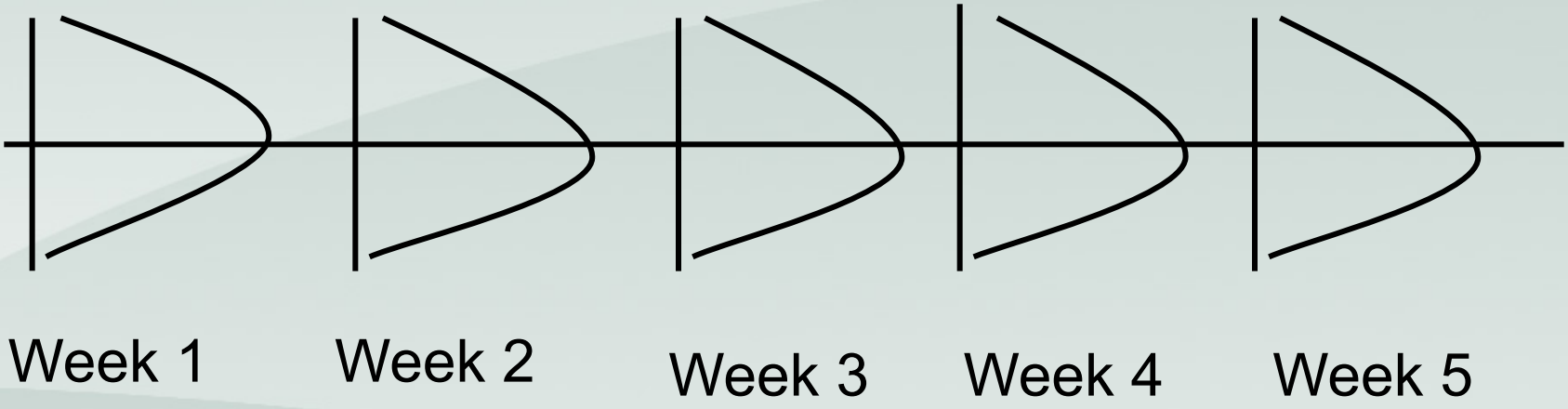
australian wool innovation limited

# Productivity Is:

| Total Outputs | Compared with | Total Inputs |
|---|---|---|

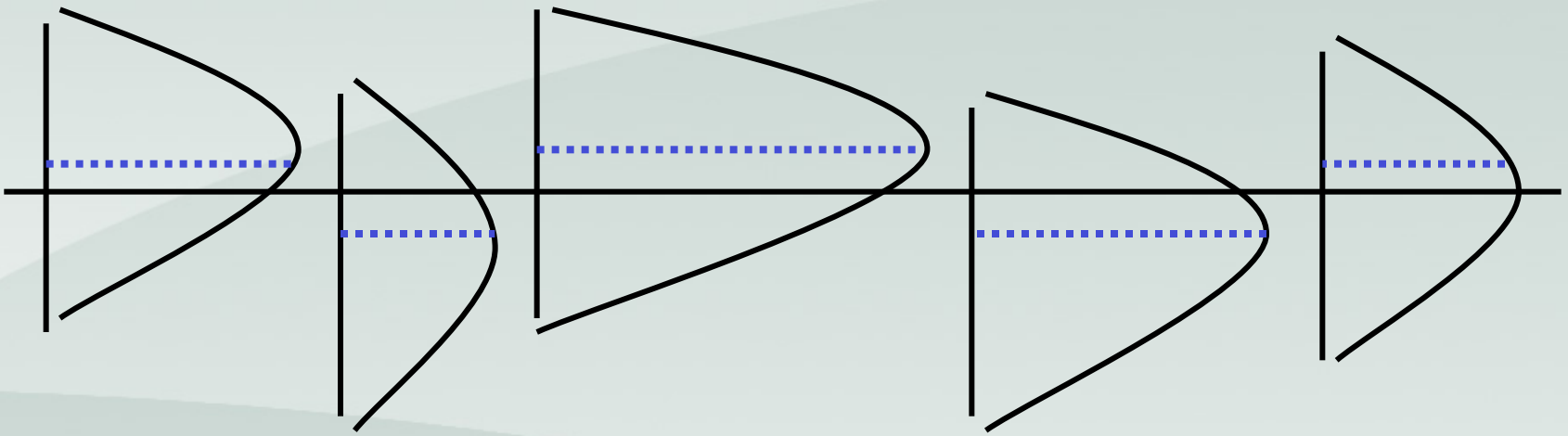
Improved Productivity = Improved Profit

# A Stable Process



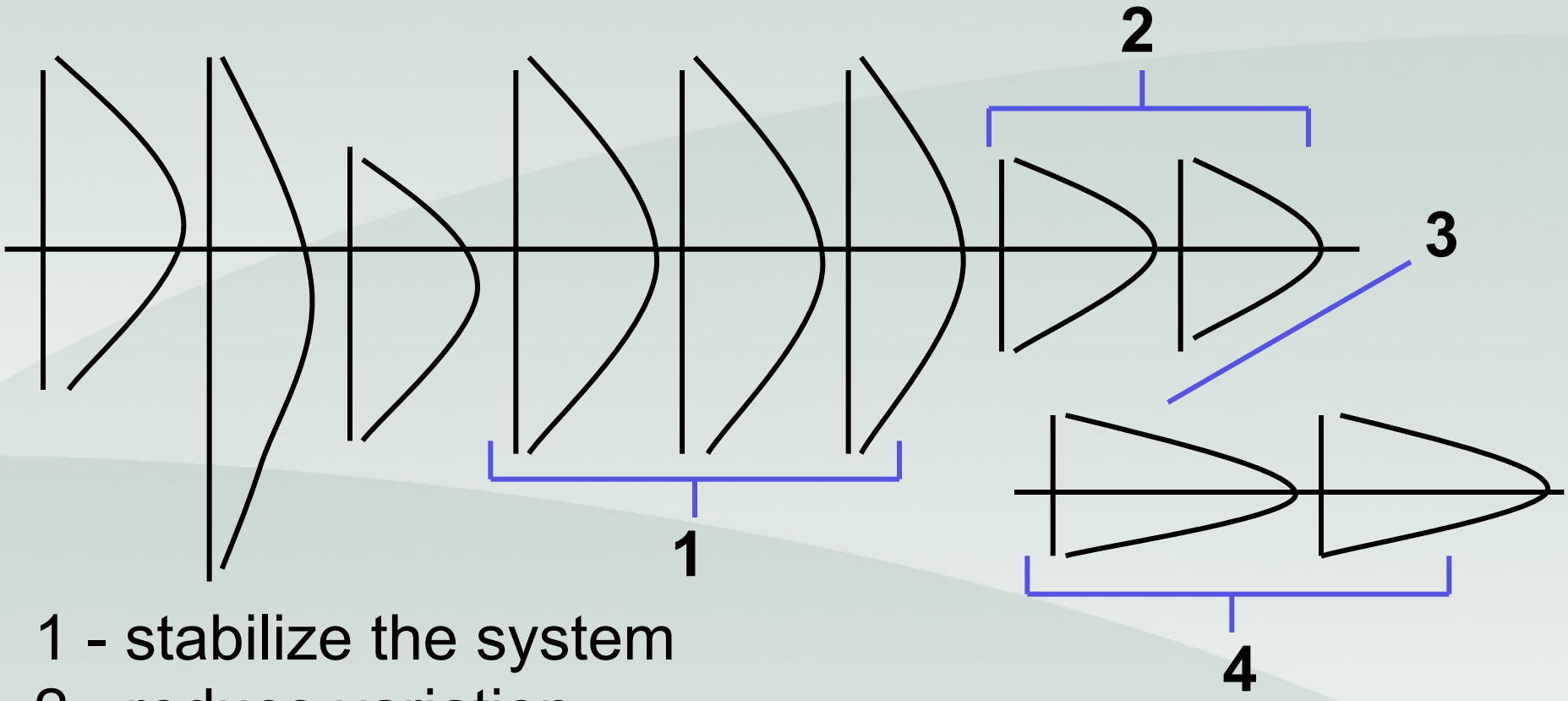

Process outcomes are predictable over time, the process is therefore deemed to be stable

# An Unstable Process



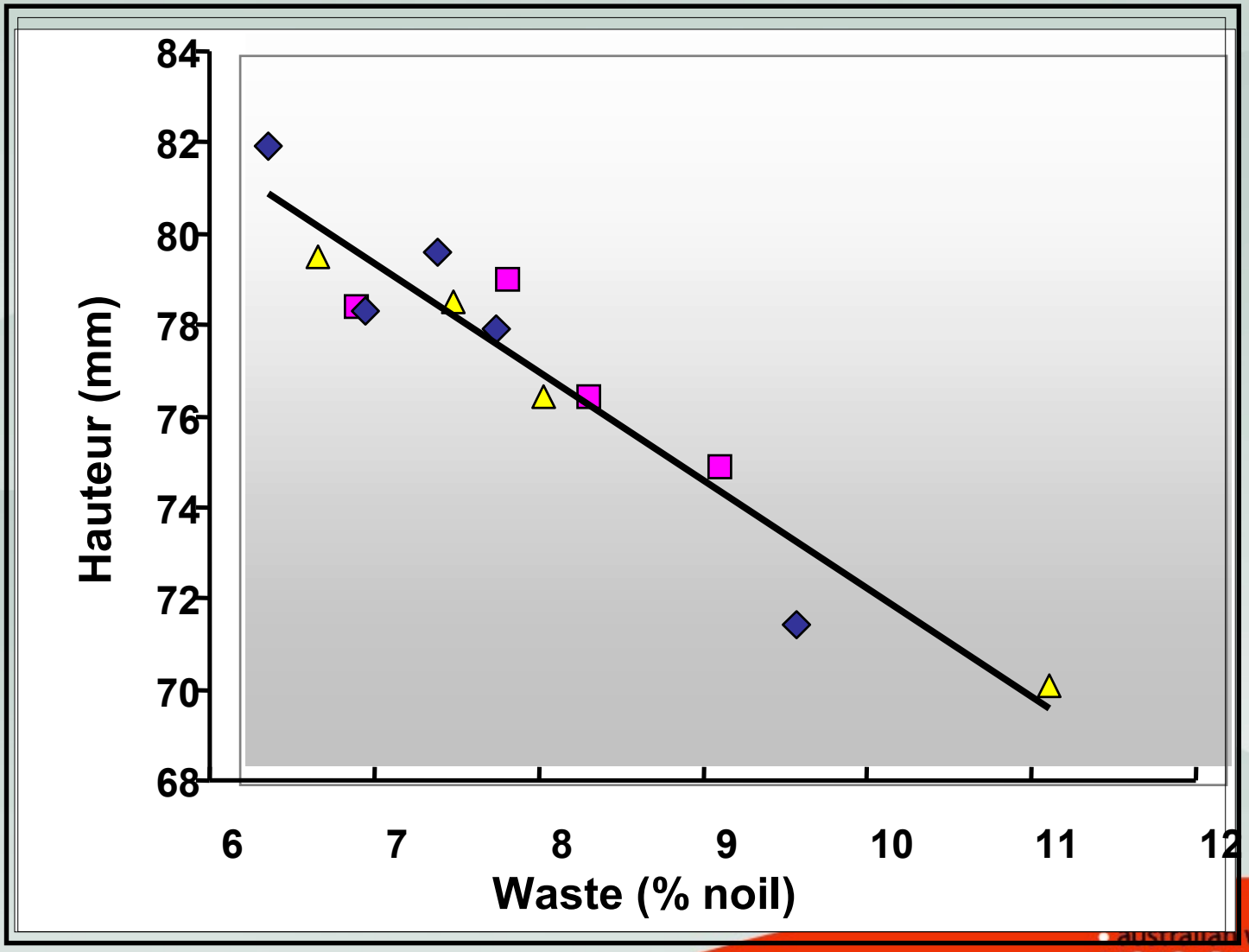
Process outcomes are unpredictable over time and therefore the process is deemed to be unstable

# Process Improvement




1 - stabilize the system
2 - reduce variation
3 - shift the system (if necessary)
4 - reduce variation (and so on)

# ENTANGLEMENT OF SCOURED WOOL



# TEAM 3: Actual-Predicted Values for Different Regions

| Region | Number of Mills | Actual - Predicted | |
|---|---|---|---|
| Australia/ Europe | 14 | 6.4 | 2.7 |
| China | 11 | 5.5 | 2.0 |
| India | 5 | 4.7 | 1.6 |

# FINANCIAL IMPLICATIONS:

| PLANT | Reduction of 1%Romaine | Plant efficiency % | Product Value USD | Potential Gain USD/ann. |
|---|---|---|---|---|
| **Greasy to top 1,000kg/hr** | +10kg/hr | 80 | 8.00 (10.00 – 2.00) | 0.67M |
| **Vertical – greasy to fabric. 350kg/h** | +3.5kg/hr | 70 | 15/lin.metre (3m/kg) | 1.32M |

# How Do You Improve?

- Measure
- Collect data
- Monitor and Analyse data
- Investigate outcomes in cause & effect
- Solution applied Measure
- Complete Feedback

# How Do You Know ?

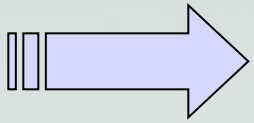
Team Formulae:

H = 0.43SL + 0.35SS + 1.38D – 0.15M -0.45VM – 0.59CVD - -0.32CVL +21.8 + MA

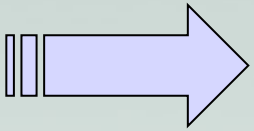
Also Noil, CVH (different formulae)

# How Do You Know?

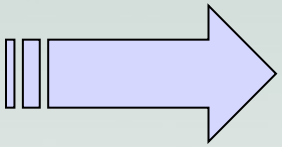
TEAM: Provides *estimated* benchmark data



: 20 batches – fully measured

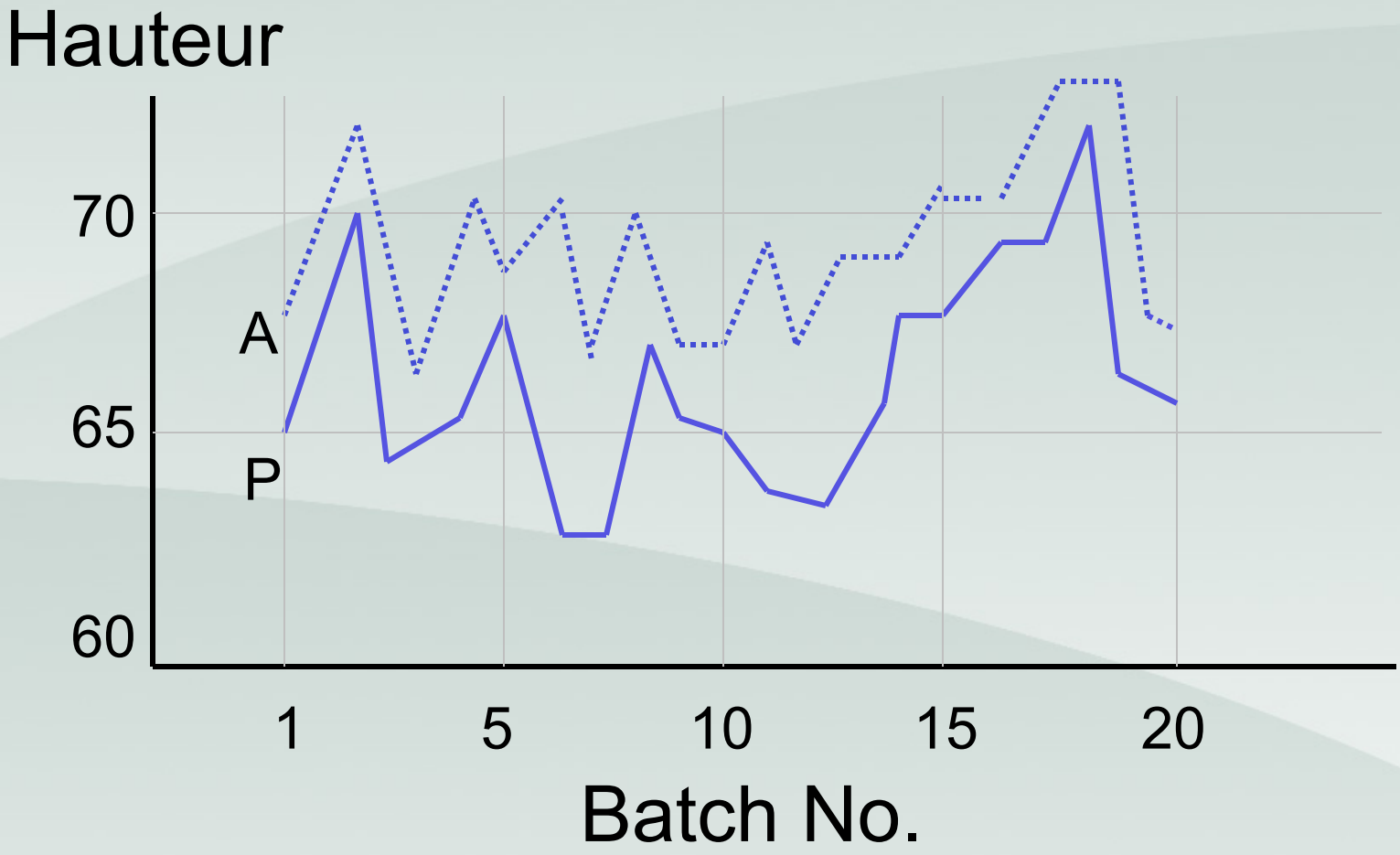


: Team Values - *P*redicted

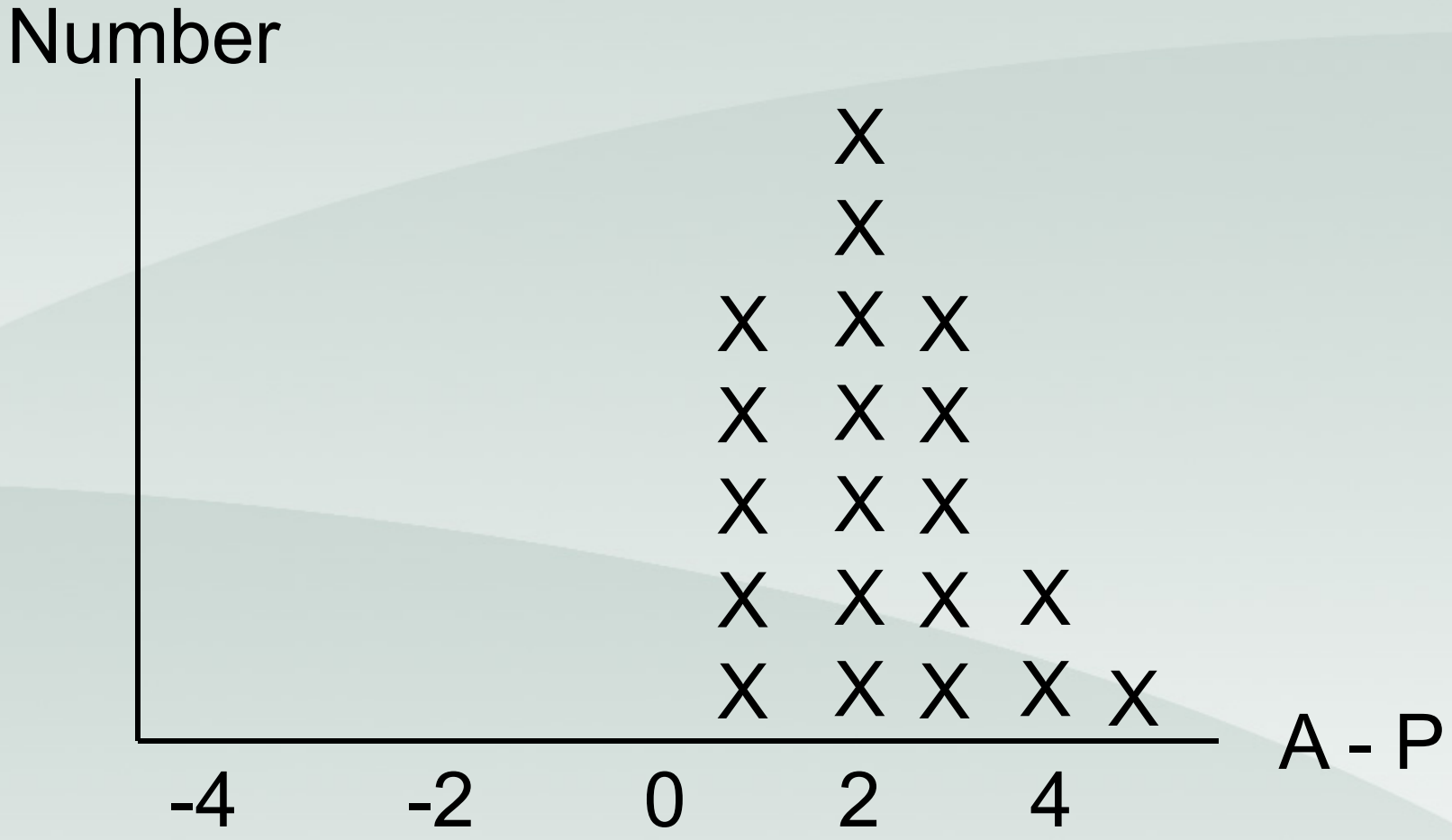


: Mill Data - *A*ctual

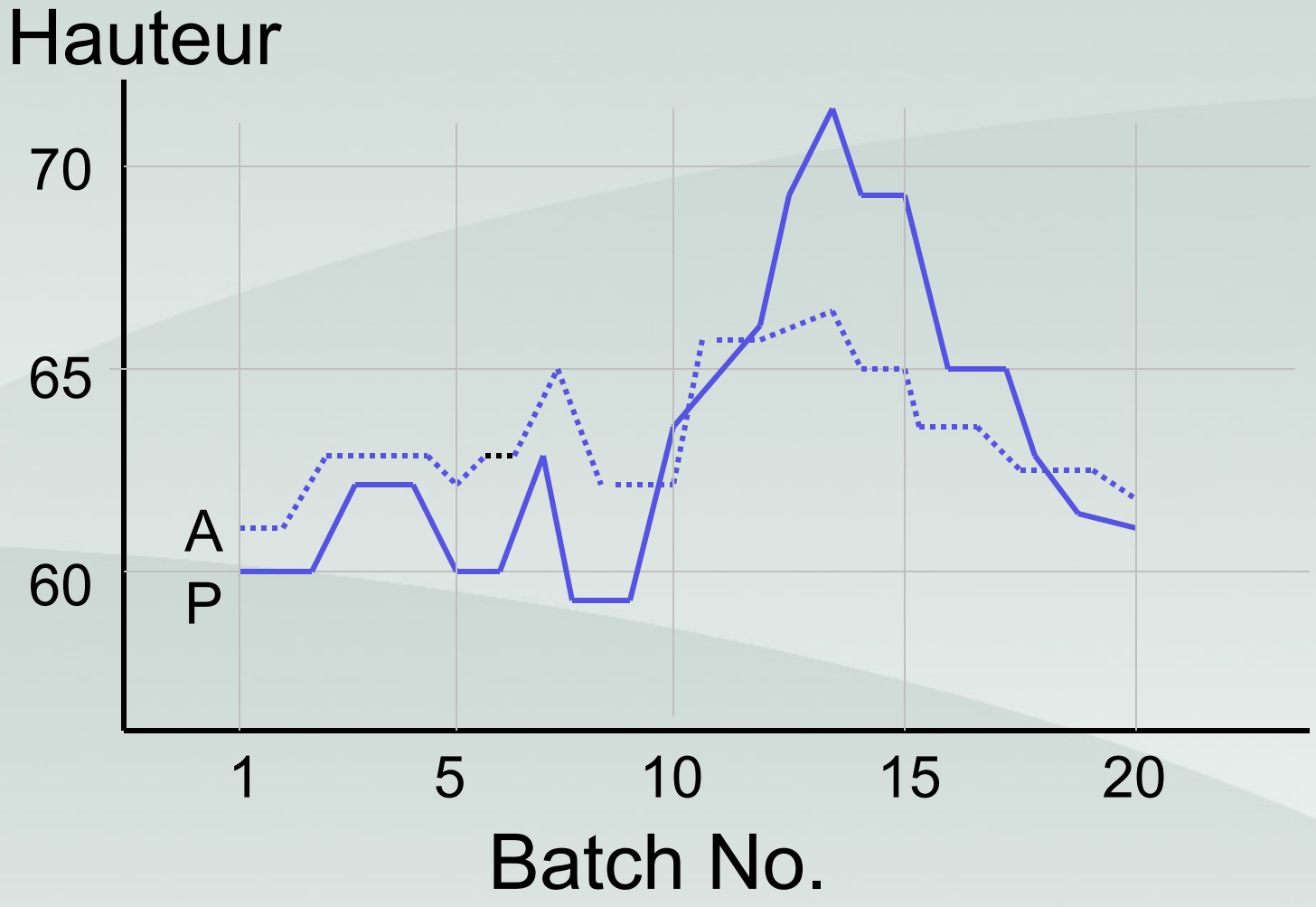
# Batch V Hauteur - (Mill 1)



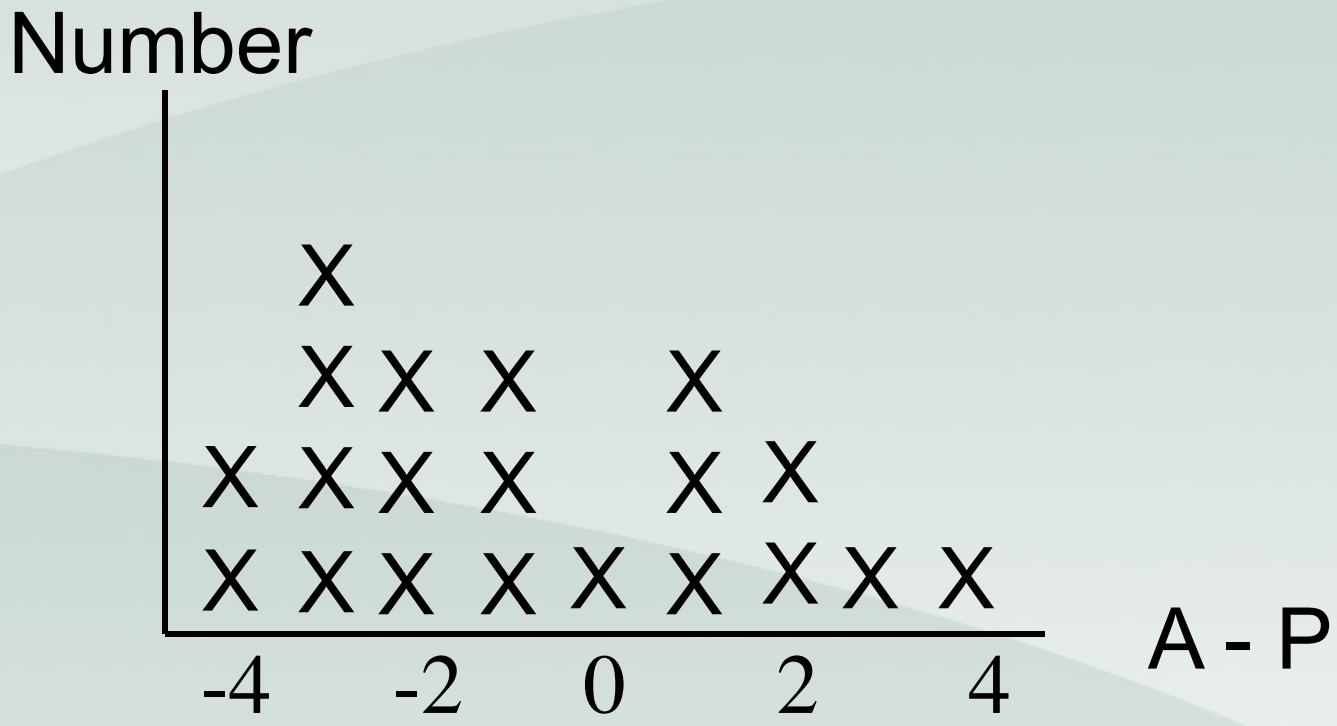
# A – P Diagram (Mill 1)



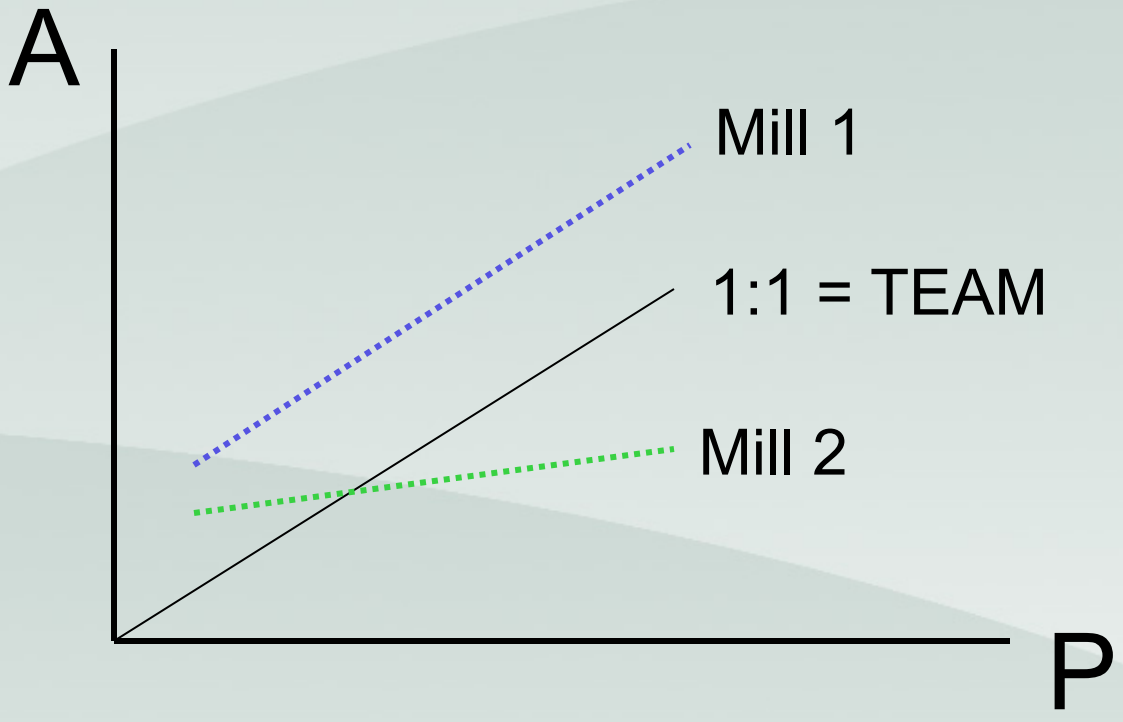
# Batch v Hauteur – Time (Mill 2)



# A – P diagram (Mill 2)



# Slope of A-P Diagram



# Team Formula – Mill 1

- Mill Correction Factor

H = Equation + 2mm

- Apply Mill Correction factor
- Re-plot residuals, (A-P)

# Team Formula – Mill 2

- Coefficients in Formula
  - New Analysis
    New Formula

$^{H}$Mill 2 = “New” Equation

# MCF & Wool Type

| Wool Type | Hauteur,mm (A-P) | Romaine,% (A-P) |
|---|---|---|
| Fleeces | +2.0 | -1.0 |
| Fleece/Pieces blend | -2.0 | +1.5 |
| Pieces | -4.0 | +2.5 |

# How to Improve?

- Extremely Valuable to Combine:
  - ✓H, CVH.%R
  - ✓Into an Overall Analysis
  - ✓Seek Explanation
  - ✓Apply ΔH/ΔR - Fibre Breakage – 10:1
    - Entanglement – 3:1

# Comments:

1. Outliers – treat separately
2. CI's – include
3. Analysis techniques – use all available techniques
4. QC methods– apply techniques
5. Seek continual improvement

# Use the Data

- Sampling plan
- Measure
- Analyse
- Target obvious/ large problems
- Monitor regularly
- Reduce variation
- Combine process knowledge and data analysis

# Monitor & Control

- **Daily Quality Control Routine**

| Test / Process | Moisture Content | Fatty Matter | Oil Addition |
|---|---|---|---|
| Carding | Once per shift | Once per shift | Check amount added once per shift |
| 1st Gill | | | As above |
| 1st Finisher | Once per shift | Once per shift | Check amount added once per shift |
| Top | Twice per shift | Twice per shift | |

# Monitor & Control

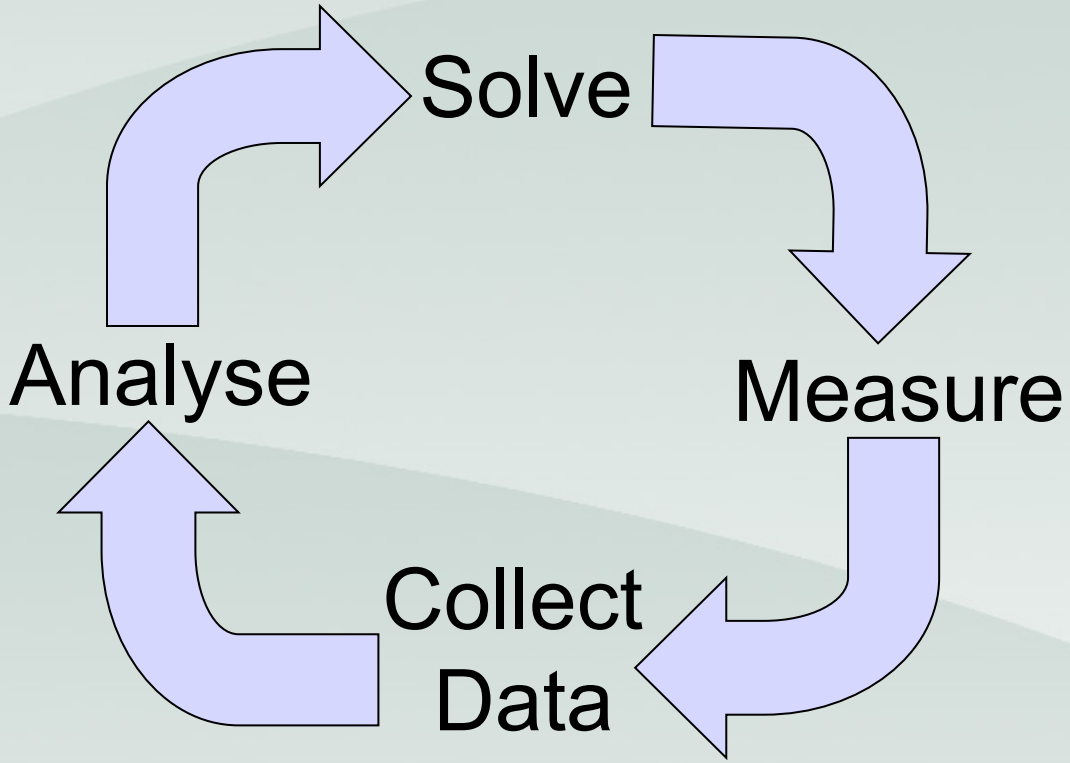
- **Faults in Processing**

| Stage | Fault | Cause | Remedy |
|---|---|---|---|
| Carding | High VM content in sliver | ➢Morel roller filled with burr<br>➢Burr rollers blunt or damaged<br>➢Burr trays blocked<br>➢Damp or wet wool | ✓Tool out<br>✓Reverse or replace<br>✓Clean regularly<br>✓Check Scour conditions |
| | Irregular sliver | ➢Lap on Rollers<br>➢Irreg. feed at hopper<br>➢Laps on hopper beaters | ✓Check & remove<br>✓Adjust feed rate<br>✓Remove & adjust |

# Monitor & Control

- **Training**
- Provide a set of Instructions
- Include
  - Objectives
  - Knowledge – both total process and specific process
  - Expectations , role, actions, key points, consequences, team work.
- Close feedback loop

# Complete Feedback = Control



# Tools for Profit

- TEAM
- TopSpec (CSIRO)
- YarnSpec (CSIRO)
- Topmaker (AST Pty Ltd)
- Pricemaker (TWC)

# Tools For Profit:

Topmaker Processing System - [Line: TRIAL, Cons: T55]

File Settings Price Model Market Value Processing Action Add-Ins About

Order | Market Value | Consignment | Optimise | Single Lot | Blend | Quality Control

| Sale Lot ID | WHS | Gsy Price | Clean Price | Value | Diam | SL | SS | CVL | PoB (M) | PoB (T) | VM | HH | Yield | Gsy Kgs | Bls | Pred Haut | Desc | AWEX ID | Bale Desc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 345 | 0 | 0 | | 21.5 | 92 | 36 | 15 | 84 | 3 | 1.2 | 0.0 | 70.0 | 158 | 10 | 65.2 | Flc | MF4 | AAM |
| 2 | 356 | 0 | 0 | | 20.3 | 87 | 36 | 18 | 65 | 9 | 1.8 | 0.3 | 68.3 | 687 | 8 | 64.8 | Flc | MF4 | AAAM |
| 3 | 445 | 0 | 0 | | 21.6 | 84 | 28 | 15 | 23 | 25 | 0.6 | 0.0 | 65.0 | 925 | 6 | 65.0 | Flc | MF5 | AAM |
| 4 | 337 | 0 | 0 | | 21.3 | 86 | 41 | 16 | 57 | 17 | 0.8 | 0.0 | 66.0 | 456 | 12 | 69.5 | Flc | MF5 | AAM |
| 5 | 28 | 0 | 0 | | 20.1 | 87 | 29 | 11 | 68 | 13 | 0.5 | 0.0 | 67.0 | 1033 | 5 | 61.3 | Flc | MF5 | AAM |
| 6 | 226 | 0 | 0 | | 19.8 | 90 | 33 | 18 | 64 | 14 | 1.2 | 0.0 | 69.4 | 879 | 9 | 64.9 | Flc | MF4 | AAAM |
| 7 | 8 | 0 | 0 | | 19.4 | 86 | 36 | 21 | 59 | 23 | 0.6 | 0.0 | 71.0 | 657 | 11 | 65.1 | Flc | MF4 | AAAM |
| 8 | 128 | 0 | 0 | | 20.3 | 88 | 37 | 19 | 47 | 2 | 1.9 | 0.6 | 66.0 | 428 | 10 | 69.2 | Flc | MF5 | AAAM |
| 9 | 311 | 0 | 0 | | 20.4 | 88 | 42 | 15 | 46 | 16 | 0.7 | 0.0 | 63.0 | 1152 | 15 | 72.3 | Flc | MF5 | AAAM |
| 10 | 325 | 0 | 0 | | 20.6 | 95 | 40 | 16 | 58 | 17 | 0.4 | 0.0 | 72.0 | 108 | 7 | 73.1 | Flc | MP4 | AAAM |
| 11 | 458 | 0 | 0 | | 20.4 | 88 | 39 | 15 | 49 | 19 | 1.7 | 0.0 | 68.9 | 943 | 6 | 69.9 | Flc | MF4 | AAAM |
| 12 | 12 | 0 | 0 | | 20.3 | 90 | 38 | 18 | 63 | 14 | 1.6 | 0.2 | 72.3 | 471 | 5 | 67.8 | Flc | MF4 | AAAM |

| Combination | | Clean Price | | Diam | SL | SS | CVL | POB (M) | POB (T) | VM | HH | Yield | Gsy Kgs | Bls | Pred. Haut | Clean % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Combined Lots | | 0 | | 20.4 | 88 | 36 | 15 | 54 | 16 | 1.1 | 0.1 | 67.5 | 7897 | 104 | 67.8 | 0 |

| Gross Gsy $ | Target Price |
|---|---|
| 0 | 0 |

| | Diam | Ha | CVHa | Rom | % < 30 | T.W. | Tear | VM |
|---|---|---|---|---|---|---|---|---|
| Top | 20.42 | 67.8 | 48.8 | 6.9 | 14.3 | 4964 | 13.5 | |
| Order | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | 0.0 |

Version 5.6bMill | 12 lots selected.

# Tools For Profit

Topmaker Processing System - [Line: TRIAL, Cons: T55]

File Settings Price Model Market Value Processing Add-Ins About

Order | Market Value | Consignment | Optimise | Single Lot | Blend | Quality Control

| Combination | |
|---|---|
| Diameter | 20.4 |
| Length | 88 |
| Strength | 36 |
| CV Length | 15 |
| POB Mid | 54 |
| POB Tip | 16 |
| Veg Matter | 1.1 |
| Hard Heads | 0.1 |
| Yield | 67.5 |
| Greasy Weight | 7897 |
| Clean Price | 0 |
| *Cons % Pieces* | 0 |
| Req % Pieces | 0 |

Use Model Price: None

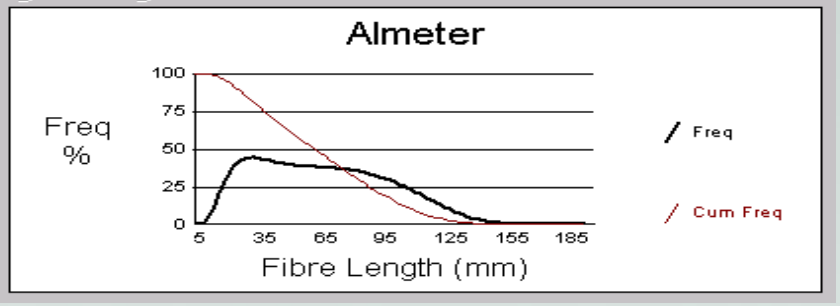
**Options:**

- (•) Almeter
- ( ) Almeter Statistics
- ( ) Mill Formulae
- ( ) Processing Value

| Ord ID: *NEW* | Top | Order |
|---|---|---|
| Diameter | 20.42 | 0.0 |
| Hauteur | 67.8 | 0 |
| CV Hauteur | 48.8 | 0 |
| Romaine | 6.9 | 0 |
| Fibres < 30mm | 14.3 | 0 |
| Top Weight | 4964 | 0 |
| Tear | 13.5 | |
| Veg Matter | | 0.0 |

| Costs | Cents |
|---|---|
| Contract Price | 0 |
| Clean Price | 0 |
| Variable Costs | 0 |
| Tariff | 0 |
| *Noil* | 420 |
| *Noil Loss* | 0 |
| Top Cost | 0.0 |
| Top Value | 0.0 |

( ) TEAM (•) Mill

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| Diameter | 20.4 |
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| Veg Matter | 1.1 |
| Hard Heads | 0.1 |
| Yield | 67.5 |
| Greasy Weight | 7897 |
| *Clean Price* | 0 |
| *Cons % Pieces* | 0 |
| Req % Pieces | 0 |

Use Model Price: None

**Options:**

- ( ) Almeter
- (•) Almeter Statistics
- ( ) Mill Formulae
- ( ) Processing Value

| Ord ID: *NEW* | Top | Order |
|---|---|---|
| Diameter | 20.42 | 0.0 |
| Hauteur | 67.8 | 0 |
| CV Hauteur | 48.8 | 0 |
| Romaine | 6.9 | 0 |
| Fibres < 30mm | 14.3 | 0 |
| Top Weight | 4964 | 0 |
| Tear | 13.5 | |
| Veg Matter | | 0.0 |

| Costs | Cents |
|---|---|
| *Contract Price* | 0 |
| Clean Price | 0 |
| Variable Costs | 0 |
| Tariff | 0 |
| *Noil* | 420 |
| *Noil Loss* | 0 |
| Top Cost | 0.0 |
| Top Value | 0.0 |

(•) TEAM ( ) Mill

| % Fibres less than | % | Length at % | mm |
|---|---|---|---|
| 10mm | 0.1 | 95% | 20.8 |
| 15mm | 1.2 | 90% | 26.0 |
| 20mm | 4.3 | 75% | 39.7 |
| 25mm | 9.0 | 50% | 64.9 |
| 30mm | 14.3 | 25% | 92.4 |
| 35mm | 19.9 | 10% | 113.6 |
| 40mm | 25.3 | 5% | 124.6 |
| 45mm | 30.5 | 2% | 135.7 |
| 50mm | 35.6 | 1% | 142.4 |

# Summary

- Productivity = Outputs – Inputs
- Measure - Benchmark
- Analyse - Change
- Solve
- Monitor
- Improve Productivity
- Improve Profit