CARDING AND COMBING FINE WOOL

Gary Robinson

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	15.0/lin.metre (3m/kg)	1.32M

STAGES in ESP of WOOL

- **Greasy Wool Blending**
- **Scouring**
- **Scoured Wool Blending**
- **Carding**
- **Gilling**
- **Combing Top Finishing**

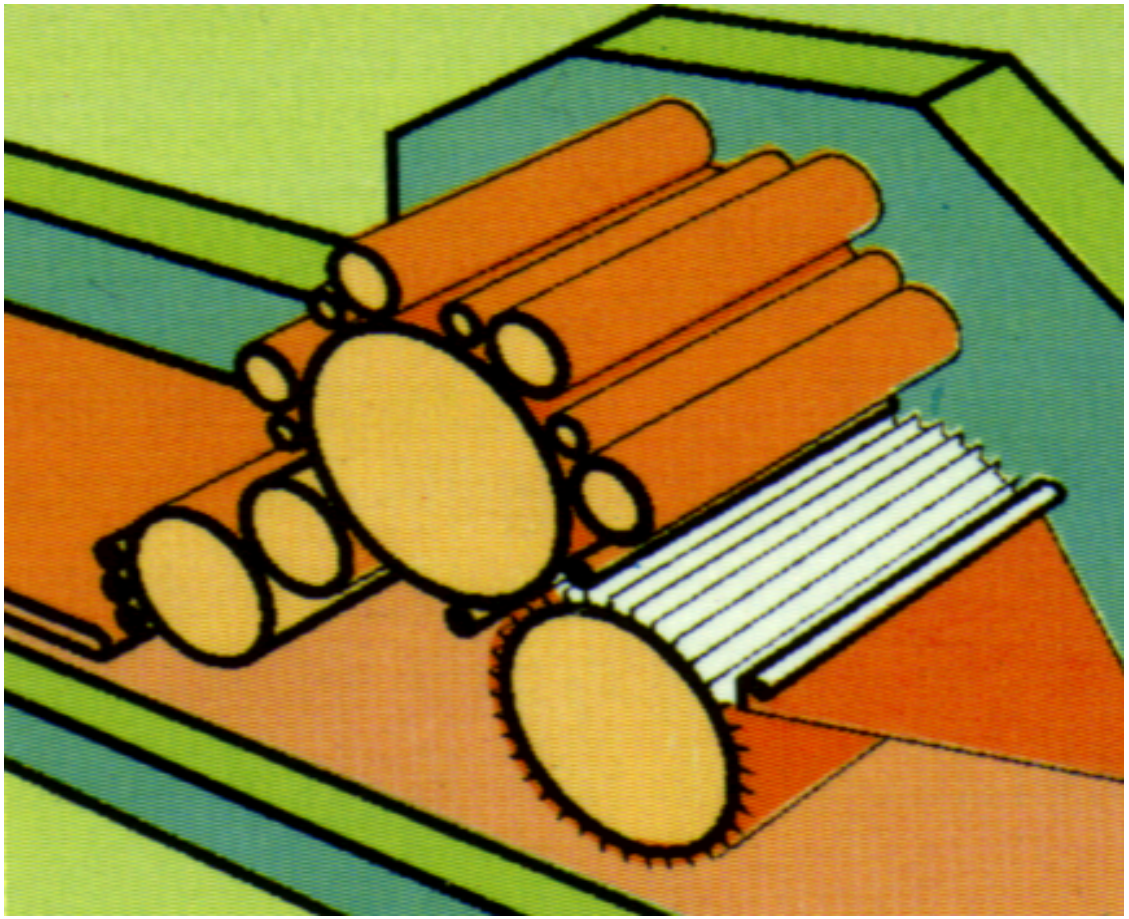
WOOL BLENDING

- ***Quality*** To meet customer requirements
- ***Price*** To meet the spinners price
- ***Profitability*** To produce the best product for the lowest price

BALING OF SCOURED WOOL

- **Storing to 12mths reduces Huateur by 2 to 3mm**
- **Bi-axial pressing worse than mono-axial pressing**
- **Packing density has little effect**
- **Regain during pressing not significant**
- **Losses erased if scoured wool relaxed >Tg**

Carding



SCOUR QUALITY CONTOL

- ***Moisture Content***

Fine Merinos (low VM)	15-17%
Fine Merinos (<3% VM)	12-14%
Fine Merinos (High VM)	<10%

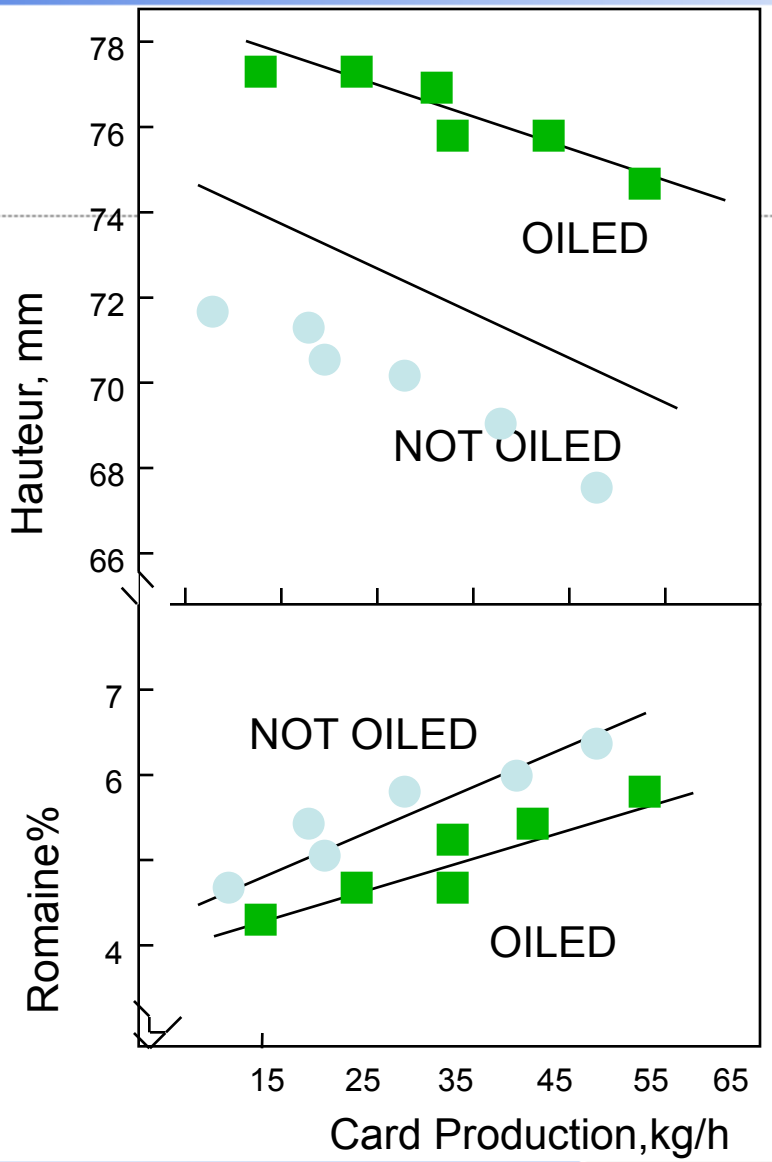
SCOUR QUALITY CONTOL

- **TFM content after scouring 0.3- 0.5%**
- **Dirt content after scouring 0.4-0.6%**

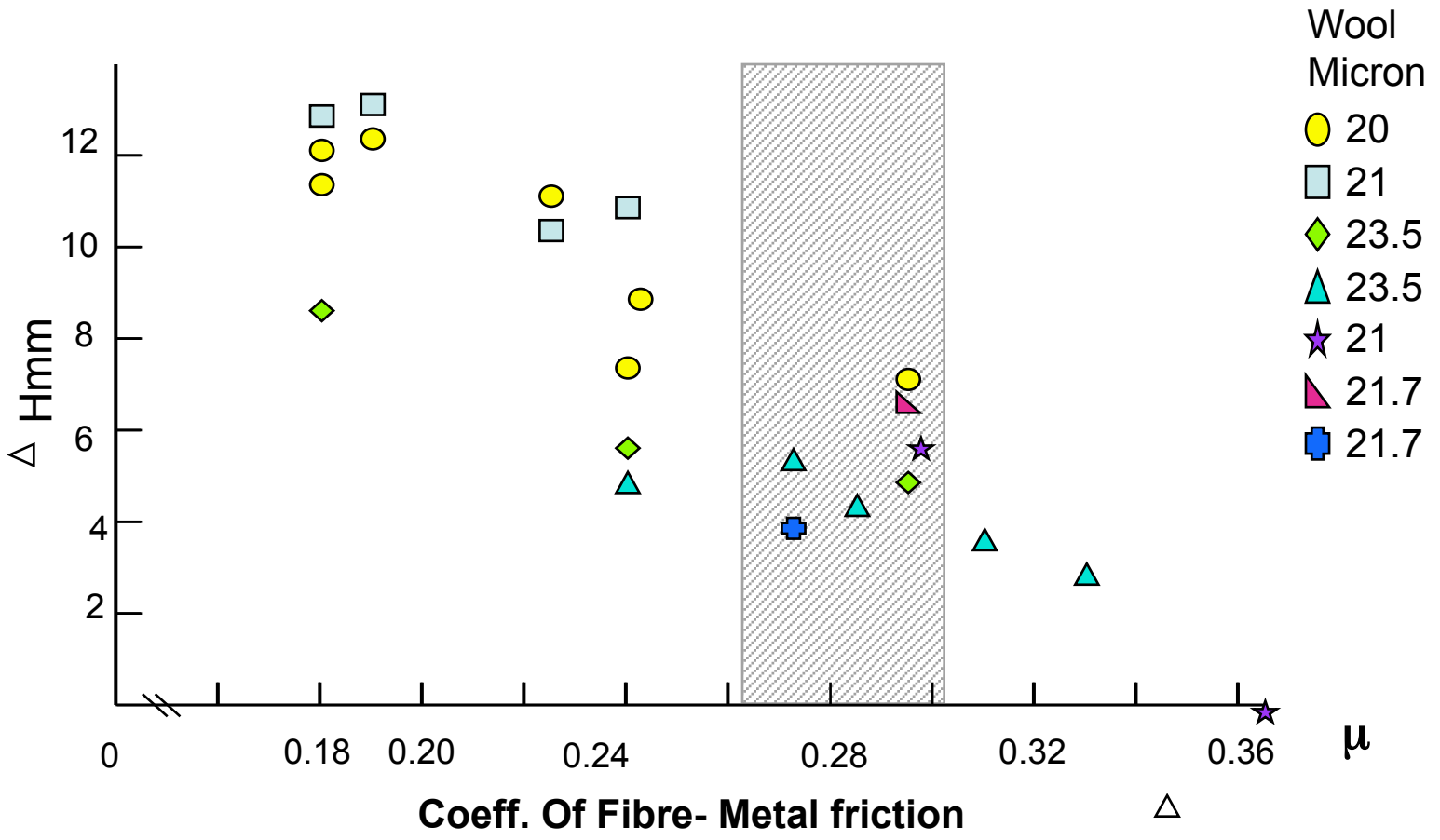
REGAIN FOR PRODUCTION

- **Increased regain reduces fibre strength**
- **Increased regain increases fibre extension**
- **At both conventional and high card speeds, feed regain does not affect fibre breakage.**
- **Regain important for fibre control – 16 to 18% optimum**
- **For high VM wools, drier is better**

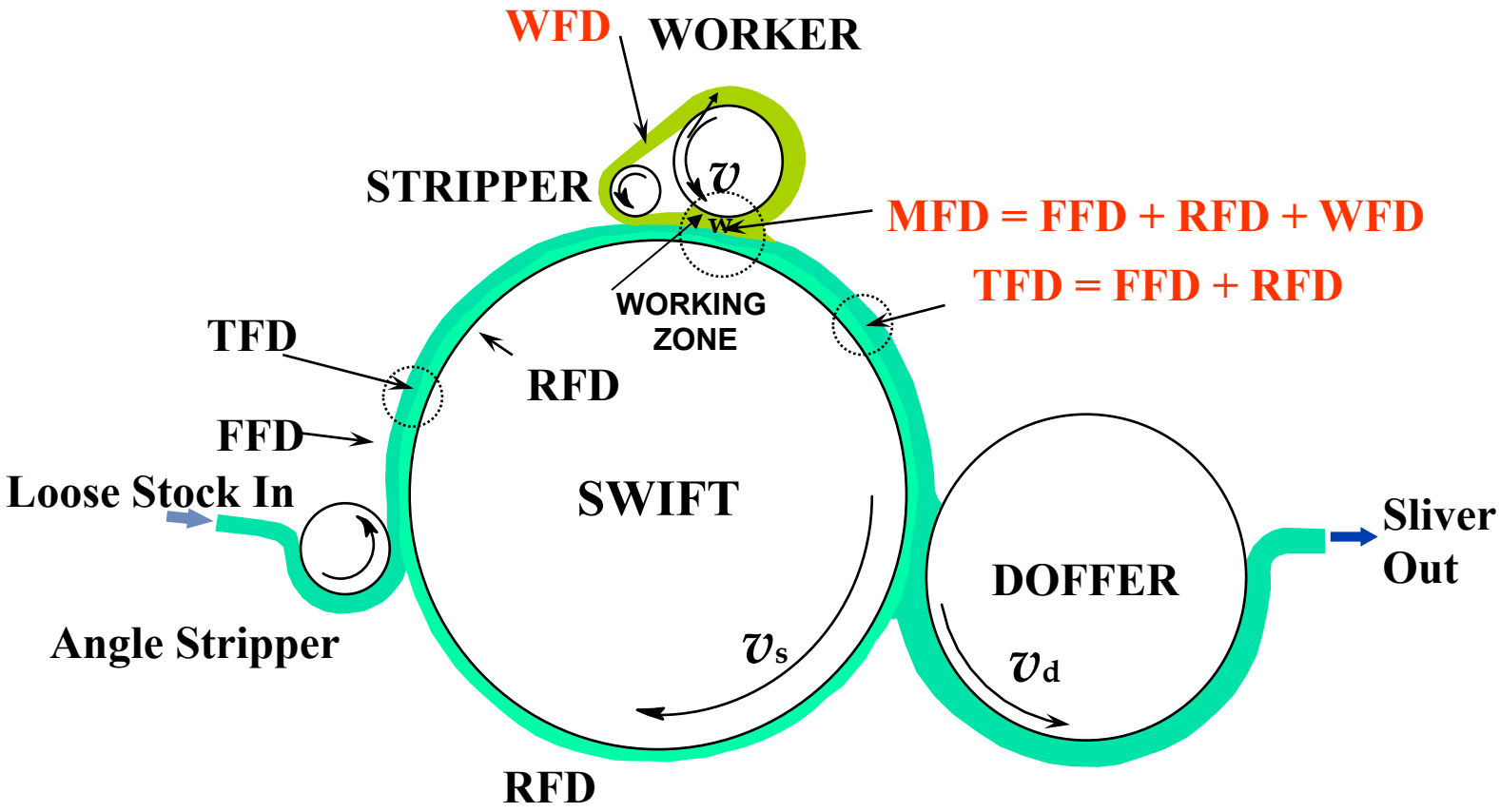
Lubricating wool



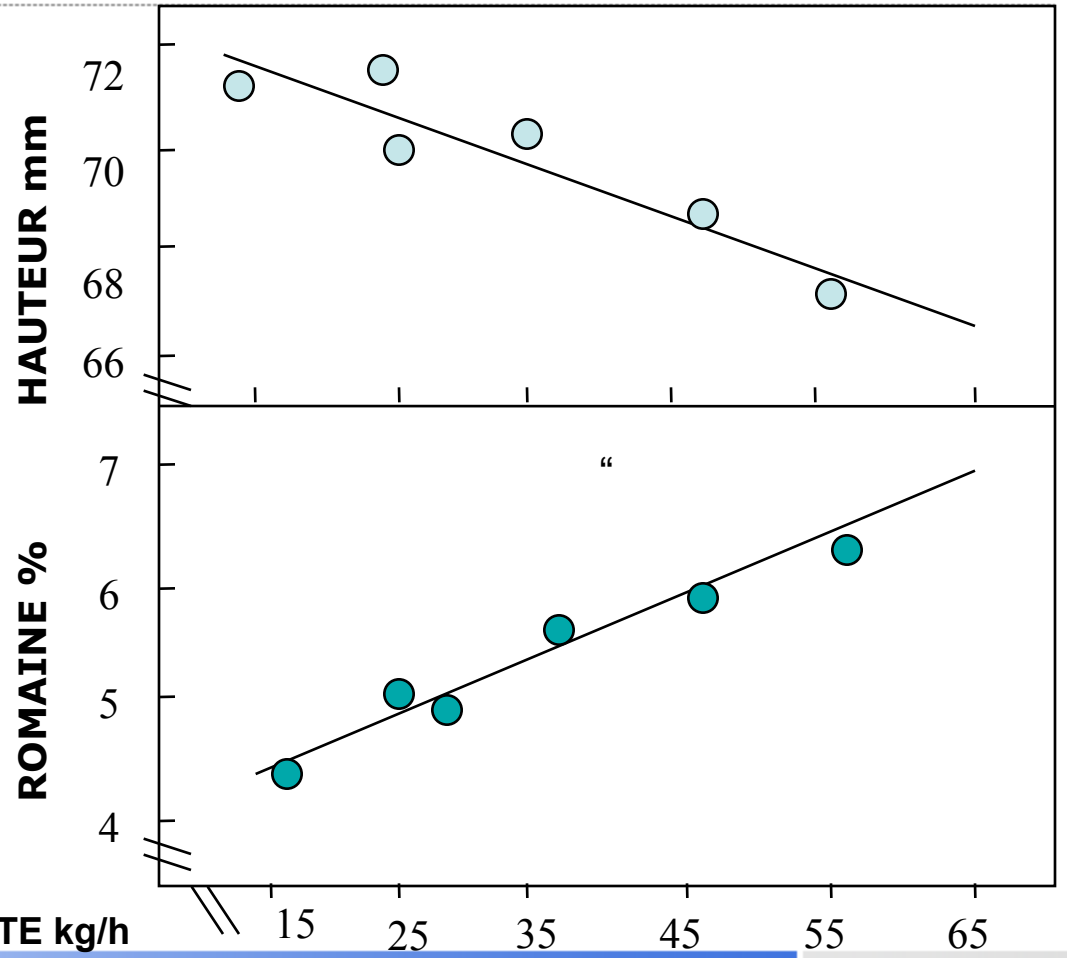
HAUTEUR AND FRICTION



THE FLOW OF FIBRES



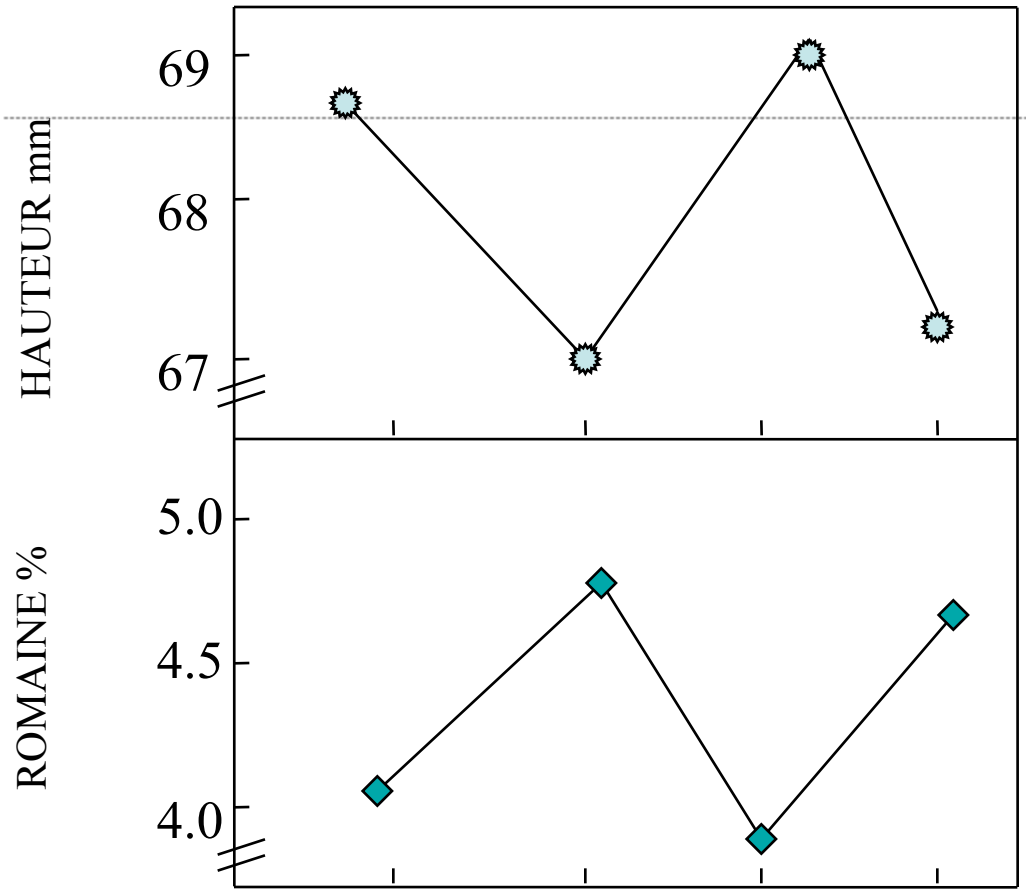
PRODUCTION RATE EFFECTS



EFFECTS OF FIBRE DENSITY AND CARD SPEED

Experimental Condition	Card Production Rate kg/m/h	Card Speed (Swift) m/min	Fresh Fibre Density g/m^2
I	17	450	0.6
II	30	450	1.1
III	30	800	0.6
IV	53	800	1.1

Effect of Fresh Fibre Density and Speed on Hauteur and Romaine



Carding Conditions

I	II	III	IV	
0.6	1.06	0.6	1.06	Fresh Fibre Density (g/m²)
30	52	52	90	Card Production Rate (kg/h)
450	450	800	800	Swift Surface Speed (m/min)

FIBRE DENSITY IN CARDING VERY FINE WOOL (17.2 µm wool)

Swift Speed (m/min)	Fibre Density (g/m²)	Combing Noil (%)	Hauteur (mm)
600	0.8	12.0	61.4
900	0.5	9.7	63.2

Higher Carding Speeds can be used in Two Ways

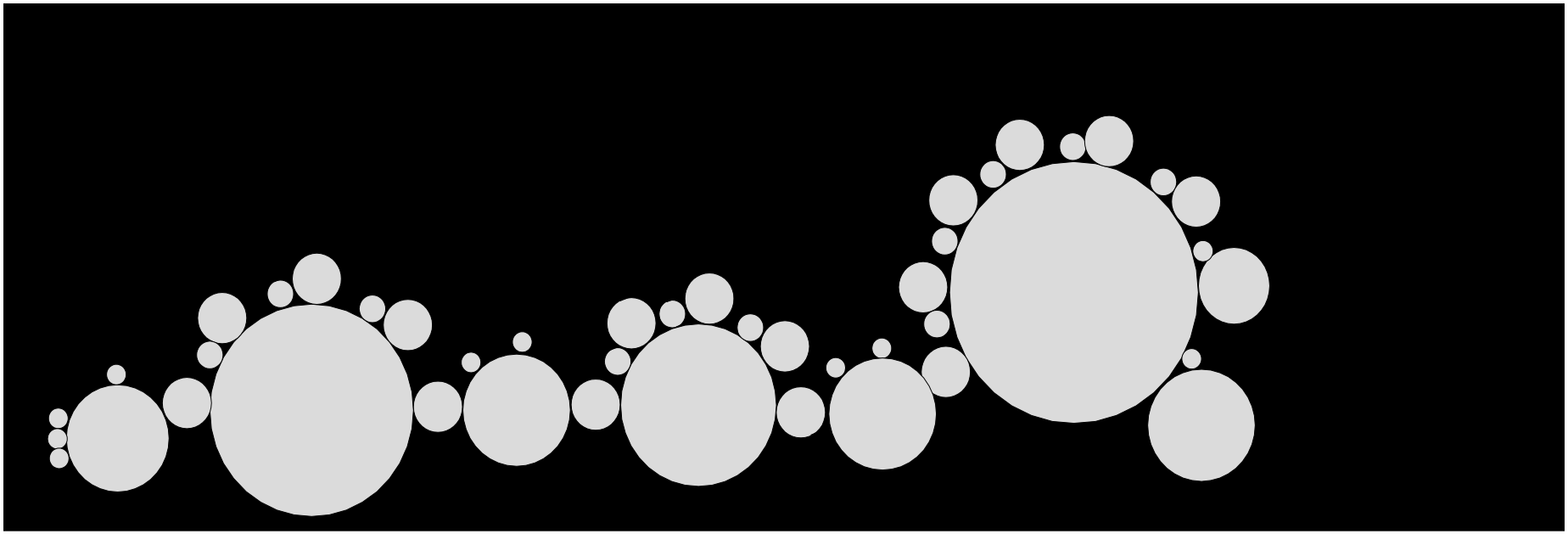
- **Condition II to condition III,**

  - there has been a gain in product quality and waste control at constant production rate.

- **Condition II to condition IV,**

  - a large gain in production rate has been achieved without any deterioration in top length or increase in noil.

THIBEAU CA7 CARD



CARDING (NEP FORMATION)

It is generally accepted that nep formation is affected by…..

- **The degree of entanglement from scouring**
- **The stripper settings**
- **The doffer settings**
- **The swift speed – fibre density**
- **SDSR**
- **The type of card clothing and its condition**
- **Moisture content**

CARDING (NEP FORMATION)

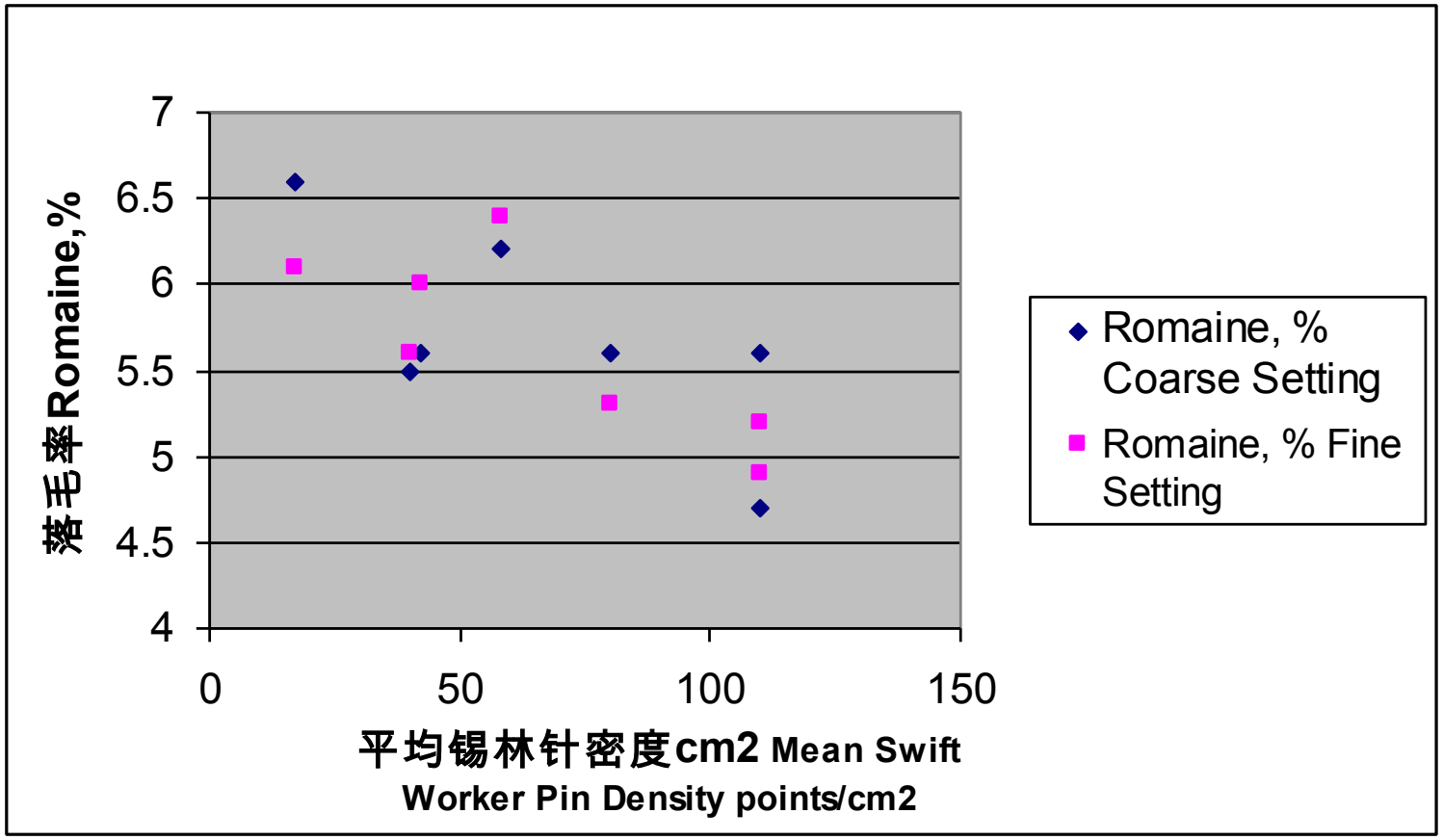
Between any two rollers, there are four influencing factors….

- **Geometry (diameter, direction of rotation)**
- **Speed (individual, differential)**
- **Gauge**
- **Clothing (type, condition)**

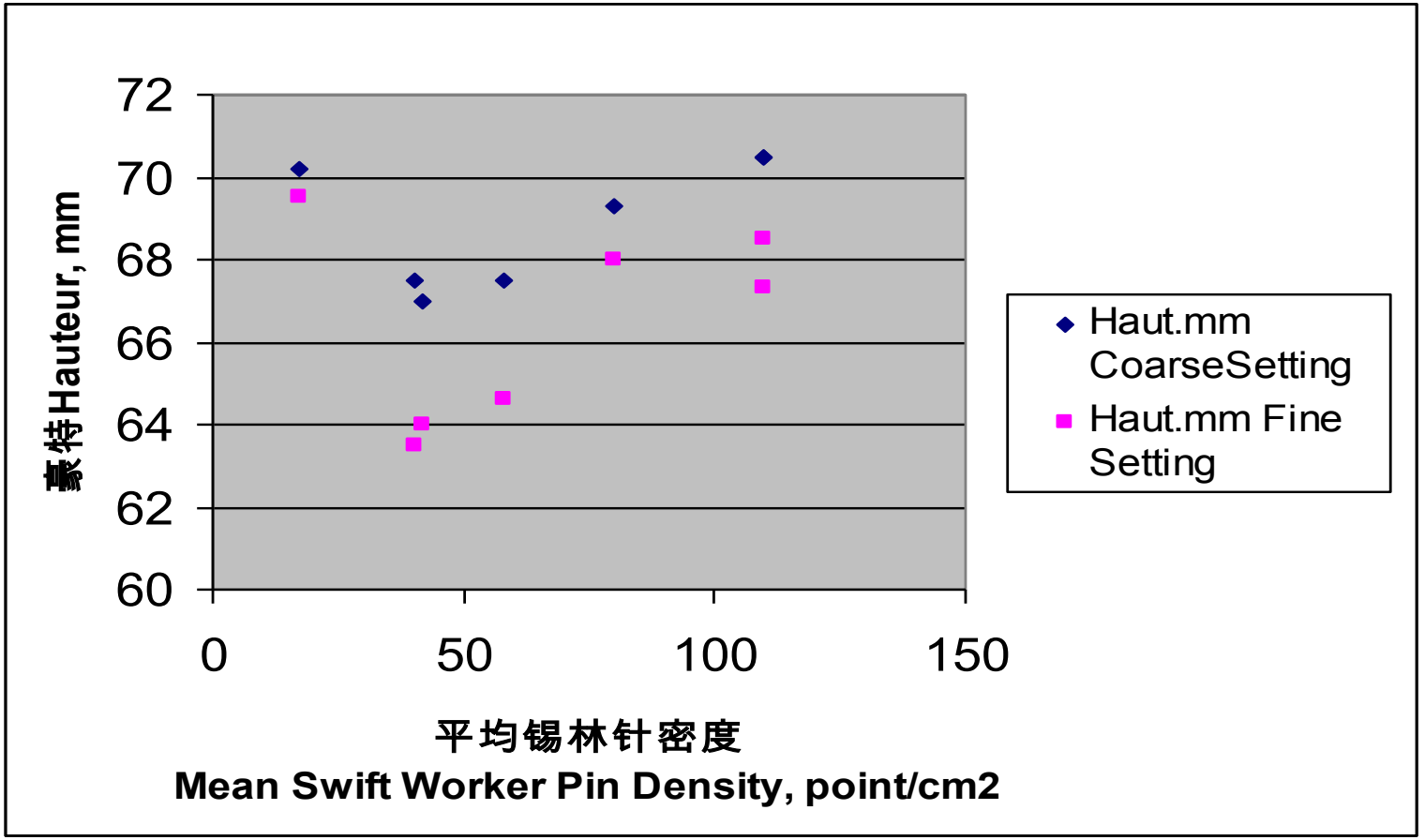
CARD SETTINGS

- **Final Setting (both worker and doffer) are major determinant**
- **More open settings gives small gain in H, but a lot more romaine**
- **Altering setting on forepart has little effect**

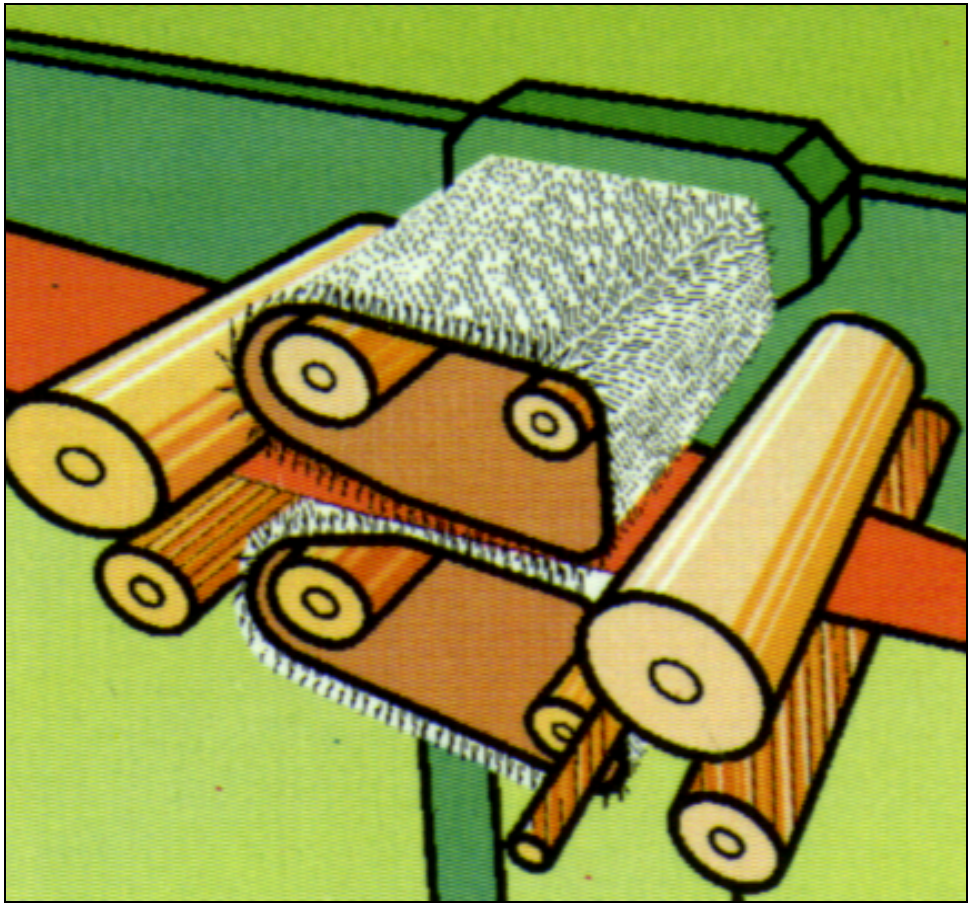
Romaine & Mean Pin Density on Swift Workers



豪特与锡林针布上平均针密度的关系
Hauteur & Mean Pin Density on Swift Workers



GILLING



PREPARATION

The objectives of preparation are to…..

- **Align the fibres into a parallel form**
- **Produce a sliver with a uniform weight / unit length**
- **Increase fibre blending**
- **Minimize neps**

GILLING

The setting of all gills is critical to quality

- **Ratch (nip distance)** **wool specific**
- **Draft** **wool specific**
- **Speed** **fibre condition**
- **Feed load** **wool specific**

The amount of draft (& doublings) is critical to the proper bending of fibres – higher draft is better.

PREPARATION

Draft is vital for.....

- **Blending**
- **Fibre distribution**
- **Removal of fibre hooks**
- **Drawing fibres parallel**
- **Nep Minimization**

DRAFT LEVEL in PREPARATION

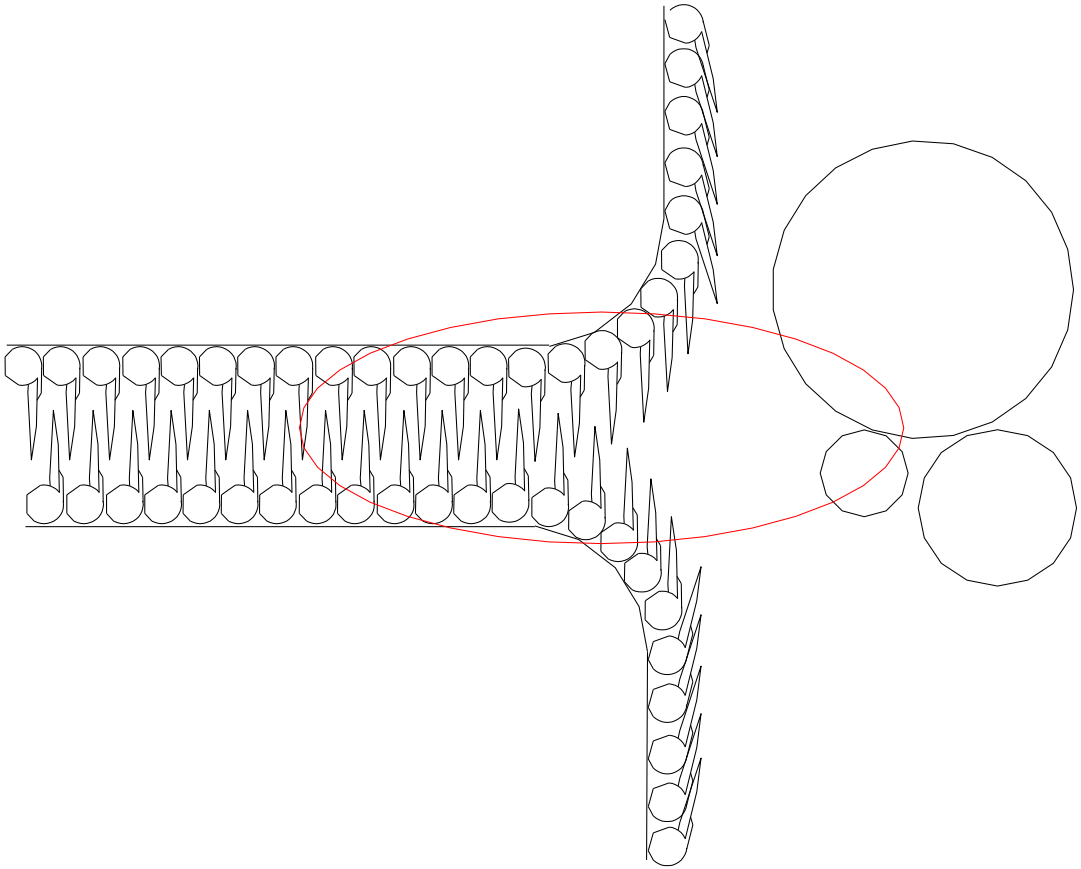
Experimental Condition	Hauteur, mm		Romaine,%	
	Wool 1	Wool 2	Wool 1	Wool 2
Control, 3 gills with total draft=200	67.2	67.0	5.3	5.9
High draft, 3 gills, total draft= 1350	70.6	69.7	4.7	4.9

GILLING

Machine speed affects…..

- **Productivity**
- **Sliver evenness**
- **Machine wear**
- **Fibre breakage**

GILLING (Draft Zone)



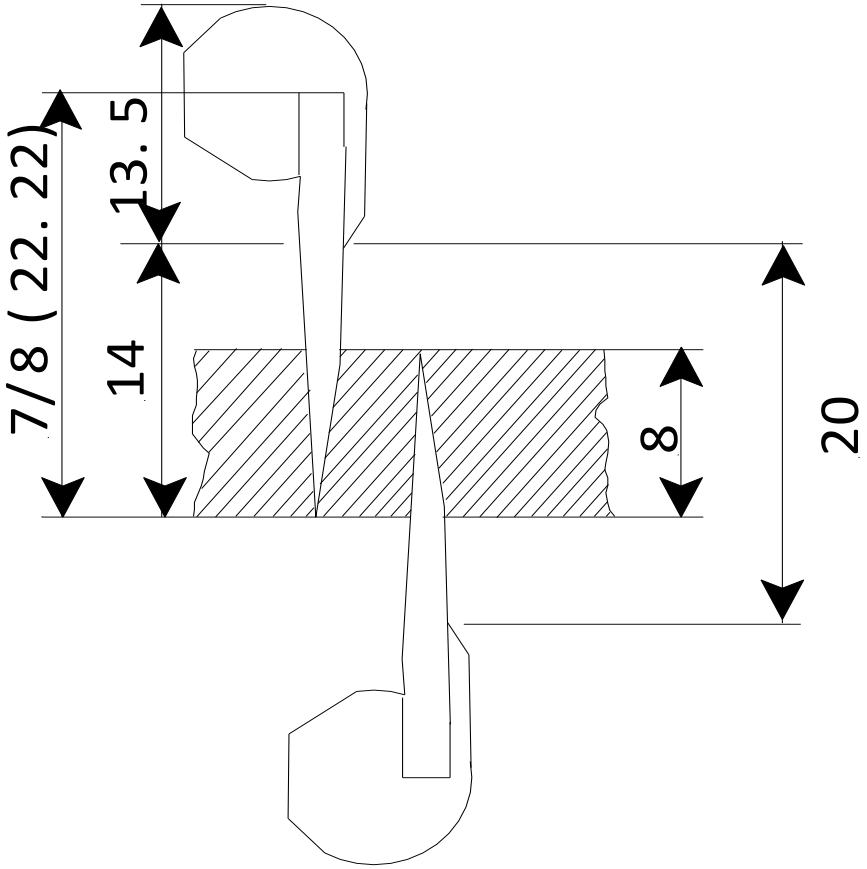
GILLING (Ratch settings)

The front ratch settings can be calculated with the following formula….

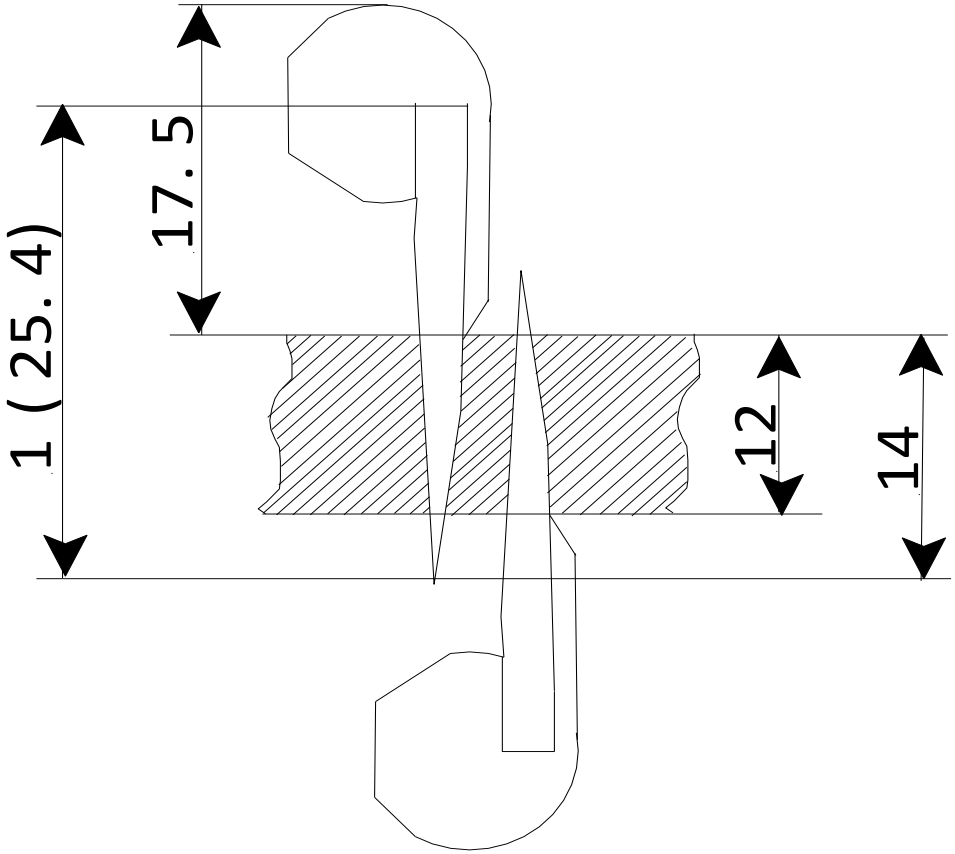
$$\left[\frac{\text{Hauteur}}{2}\right] + 5 \quad \text{(mm)}$$

e.g. $\left[\frac{70}{2}\right] + 5 = 40\text{mm}$

GILLING (1/3 Pin projection)



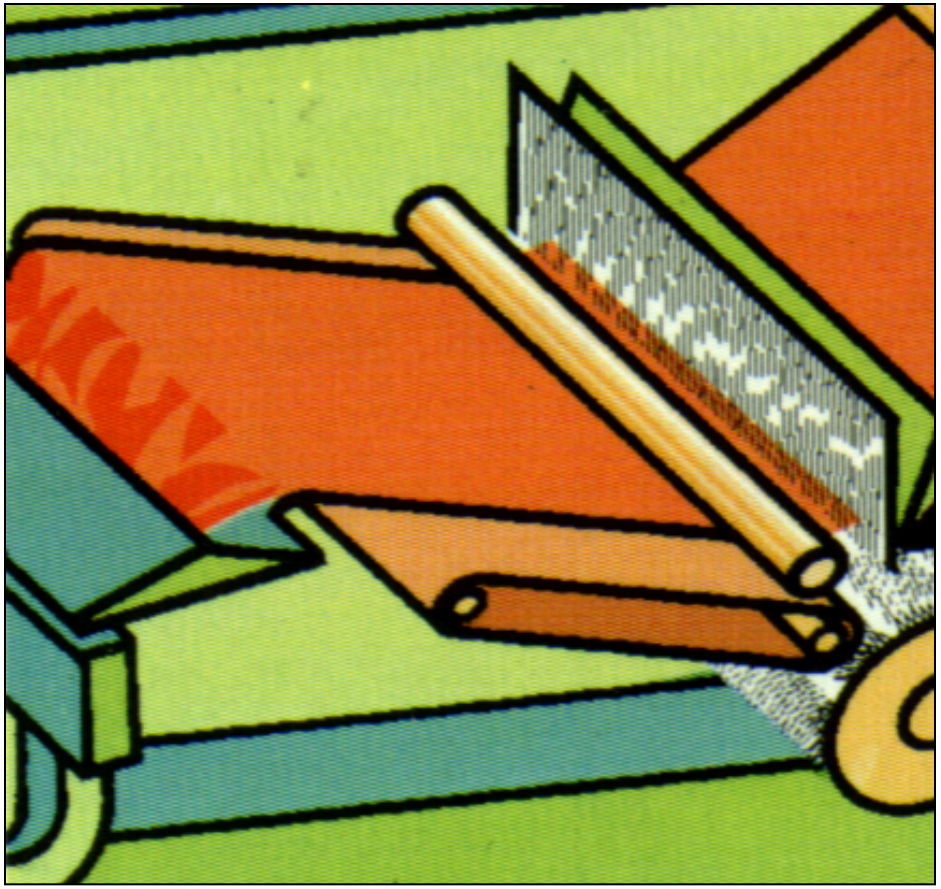
GILLING (1/1 Pin projection)



EFFECT of MULTIPLE GILLINGS

No. of Gillings	0	1	2	3	4	5	6	7
Combing Noil, （%）	14.6	12.1	10.8	10.1	9.6	9.3	9.0	8.8
Total Neps in top/100g	12	19	21	20	18	22	27	29

COMBING



COMBING

The functions of combing are to….

- **Remove the short fibres**
- **Remove neps, slubs & remaining VM**
- **Arrange fibres into a parallel state & form a sliver**

COMBING

Before combing it is important to understand…..

- The specifications of the input blend
- The condition of the wool as input material
- The top specifications required
- The settings required
- The operating conditions for the process
- The historical ability of the combs to produce to requirements

COMBING

All comb settings are CRITICAL.

Settings will affect…..

- **Production rate**
- **QUALITY**
- **Romaine**
- **Machine wear**

FEED to COMB

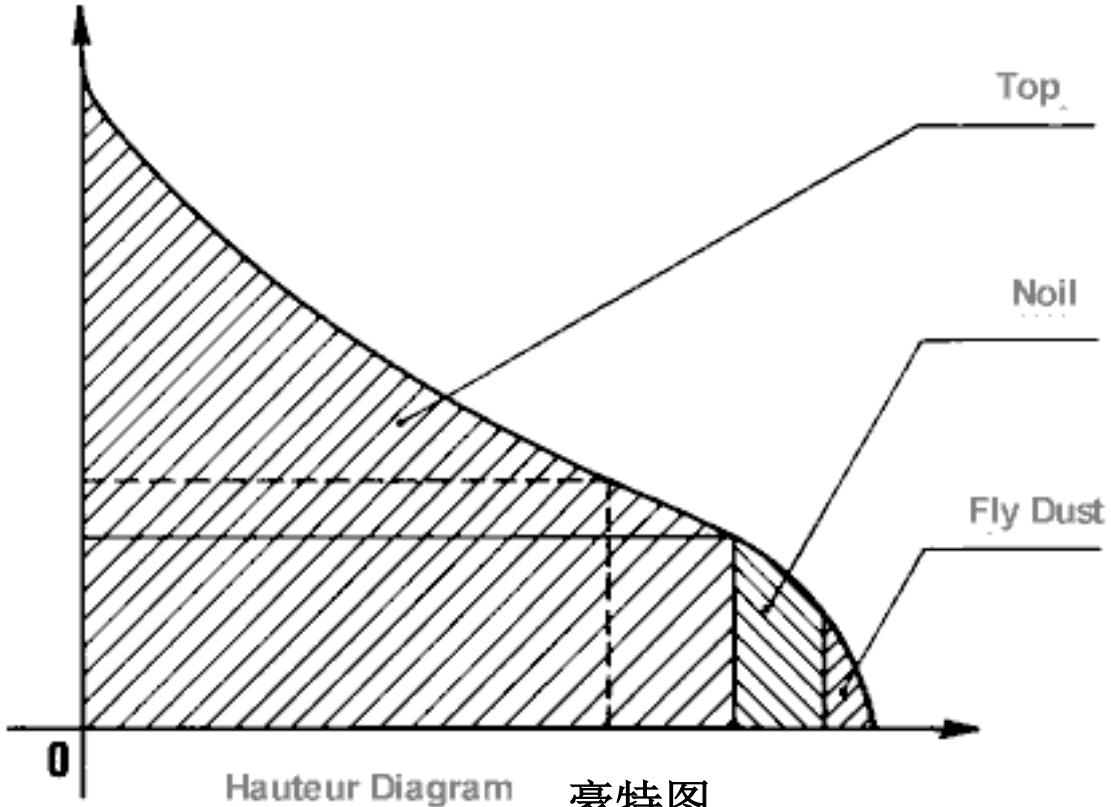
- **Fine Wools (hi – crimp) → ball feed NOT can feed**
- **%Romaine savings of 0.5 to 1.0%**

COMBING

The comb is very complex both in it's settings and it's operation

Settings should only be done by skilled technicians

COMBING (hauteur diagram)



Hauteur Diagram 豪特图

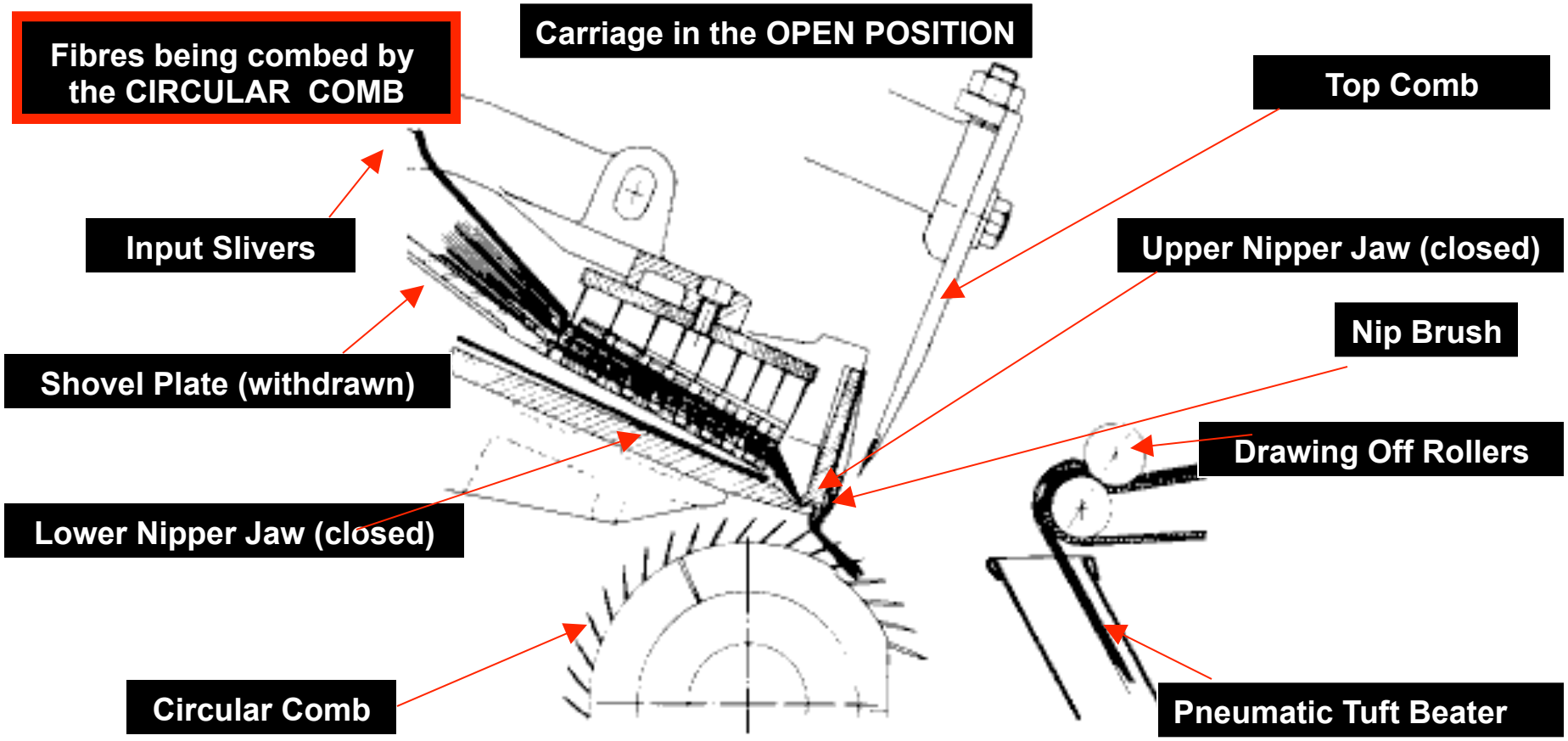
COMBING

There are two separate combing actions…..

- **Combing of the "heads" (Circular comb) and**

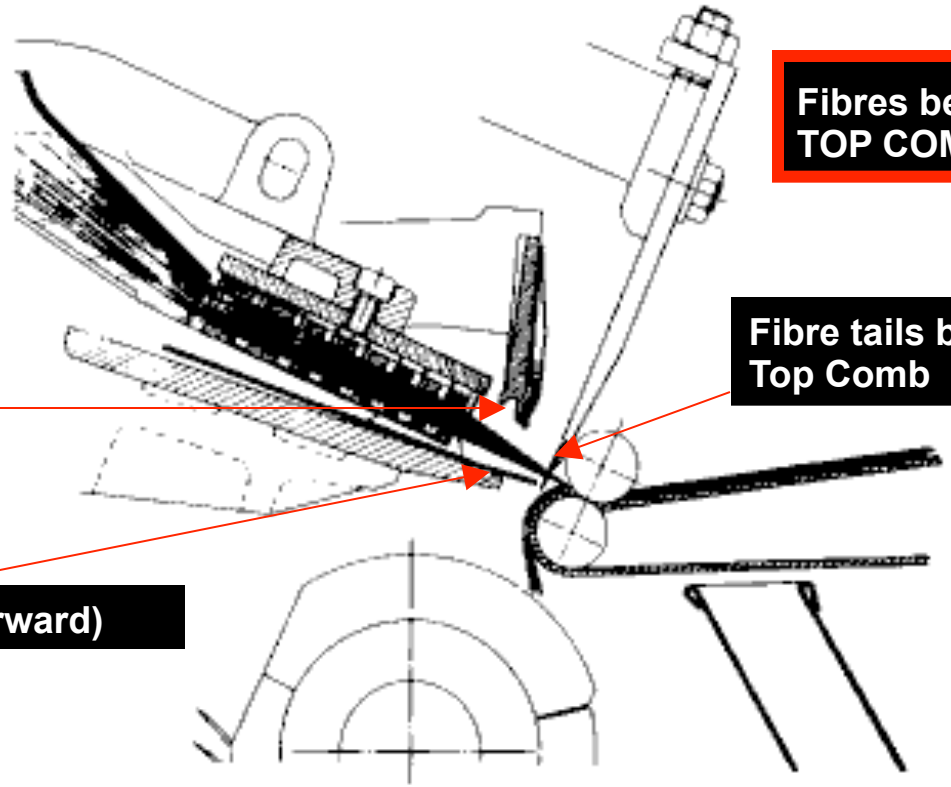
- **Combing of the "tails" (Top comb)**

COMBING (Combing the Heads)



COMBING (Combing the Tails)

Carriage in the CLOSED POSITION



Fibres being combed by the TOP COMB

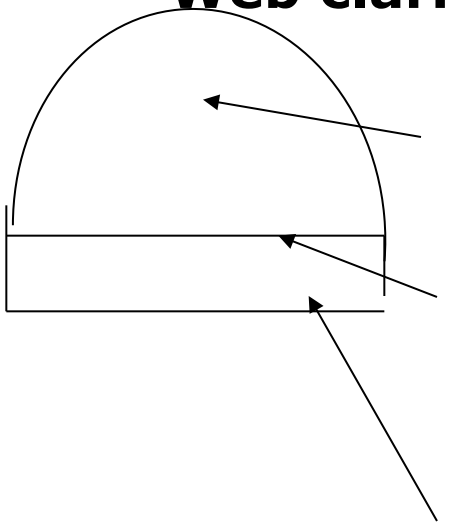
Fibre tails being pulled through Top Comb

Nipper Jaws open

Shovel Plate (forward)

FAULTS in COMBING

- **Web clarity**



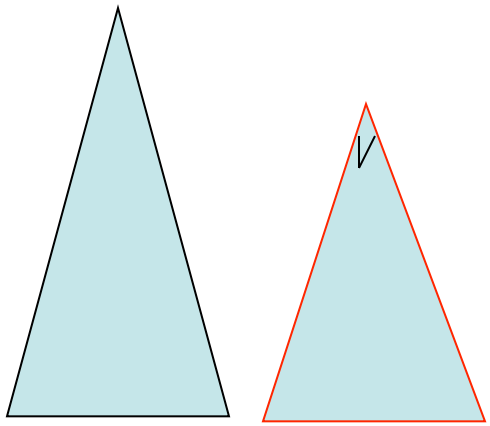
1. Dirty Circ. Comb.

2. Nip setting too short
   - TC to DO cyl. Too great

3. TC too coarse and/or dirty/damaged teeth

FAULTS in COMBING

- **Pin Life/Wear – Vario Combs**



  - **Normal life 6months (24/7)**
  - **New tooth 8%R**
  - **Worn tooth 12%R**

FAULTS in COMBING

- **Top Comb – Pin Wear/Life**
  - **Replace after five weeks (24/7) for fine wools and re-combing**
  - **Six weeks for > 21 micron**

FAULTS in COMBING

- **Circular Comb – turn brush every 48hrs**
- **Check TC brush setting every 48hrs**

To IMPROVE SLIVER QUALITY at COMB

- **Check Nep & VM levels on Apron**
- **Decrease input load**
- **Increase feed length**
- **Consider Finer TC**
- **Maintains production rate constant**

TOP FINISHING

The objectives of finishing are to…..

- **Ensures adequate blending of fibres**
- **Produce a sliver with an even & uniform weight / unit length**
- **Produces a top of uniform size, weight & density**
- **Final correction for moisture & oil content**
- **The final product for the customer**

TOP FINISHING (1st Finisher)

The 1st finisher normally…..

- **Has a moisture application for final adjustments to "conditioning"**
- **Has a can delivery for economics & sliver reversal**

TOP FINISHING

The 2nd finisher normally…..

- ***Has an autoleveler (mechanical or electronic)***
- ***Can be bobbin or bump***
- ***Has automatic delivery***

SAMPLING AND TESTING

It is vital that the Sampling & Testing Plan is reflective of the volume produced

Quality control table (sampling and testing)

SAMPLING & TESTING PLAN

PROCESS	Test	Frequency	TOLERANCE
SCOUR	Moisture Control	Every 4 hours	+/-
	RG content	Every 4 hours	+/-
BLENDING	Moisture content	Every 8 hours	+/-
	TFM	Every 8 hours	+/-
CARDING	moisture content	Every 4 hours	+/-
	VM content (vis)	Every 4 hours	+/-
	Nep content (vis)	Every 4 hours	+/-
	Sliverweight	Every 4 hours	+/-
PREPARTION	Sliverweight	Every 4 hours	+/-
	moisture control	Every 4 hours	+/-
COMBING	Production/romaine control	xx combs / shift	+/- +/-
	VM content (vis)	xx combs / shift	+/-
	Nep content (vis)	xx combs / shift	+/-
FINISHING	Micron	Every 2500 kg	+/-
	hauteur	Every 2500 kg	+/-
	VM content (vis)	Every 2500 kg	+/-
	Nep content (vis)	Every 2500 kg	+/-
	Colour	Every 2500 kg	+/-
	Sliverweight	Every 2500 kg	+/-
	Top weight	Every 2 hours	+/-
	Top size	Every 2 hours	+/-

Note *The above plan represents an example only of how such a system may*
and operated.
The tollerances have not been filled in as the client mill must decide on

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