

Investigation of the effect of press and paper variables on linting during the offset printing of newsprint

Afriana Sudarno¹, Warren Batchelor¹,
Paul Banham², Chamundi Gujjari¹

¹APPI, Monash University

²Norske Skog, Boyer, Tasmania



Introduction

- Offset
 - Ink transfers to paper from printing plate with separate transfer cylinder called offset or blanket cylinder
- Lithography
 - Ink and water don't mix. Image on the offset plate (hydrophobic) receives ink. Non-image area (hydrophilic) repels ink, accepts water.
- Linting
 - Removal of particles from surface of paper and accumulation on blanket, ink, fountain solution trains

Objective

Identify and quantify effect of variables on linting in offset printing

Heidelberg GTO-52 and Man-Roland Uniset

Heidelberg: Controlled Temperature and Humidity Experiment

Man Roland: Controlled Temperature



Sample Collection

■ Tape pulls

- Adhesive tape used to remove lint from printing blanket
- Weight measurement

■ Domtar Lint Collector

- 5% isopropanol used to clean lint from blanket
- Collected using domtar frame
- Filtered with glass filter
- Weight measurement to confirm tape pull result
- Image Analysis using Image Pro
 - Area and length distribution

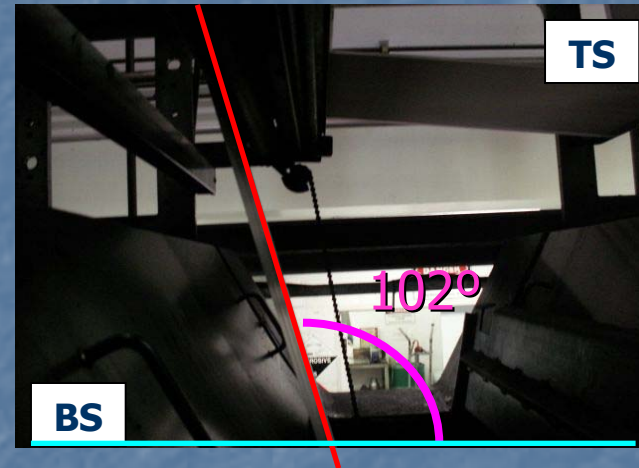


Paper: Improved brightness (ISO brightness 74), 52 gsm

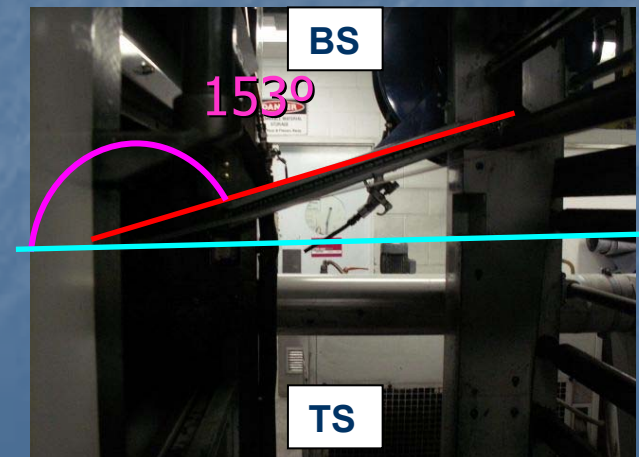
Trial	Colour	Brand	Tack
Heidelberg GTO-52 Man-Roland Uniset	Black	A	4
Heidelberg GTO-52	Black	A	6
Heidelberg GTO-52 Man-Roland Uniset	Black	A	9
Heidelberg GTO-52 Man-Roland Uniset	Black	A	13.5
Heidelberg GTO-52 Prüfbau Deltack	Black	B	13.5

Man-Roland Uniset Trial

- Printing Press Variables:
 - Ink Tack
 - Tack 4, 9, 13.5
 - Paper Side
 - T/S or B/S
 - Print Couple
 - Top unit
 - Take off angles 78° and 102°
 - Bottom unit
 - Take off angles 27° and 153°
 - Printing Screen
 - 0%, 25%, 50%, 75%, 100%



Top Unit of Man-Roland Uniset



Bottom unit of Man-Roland Uniset

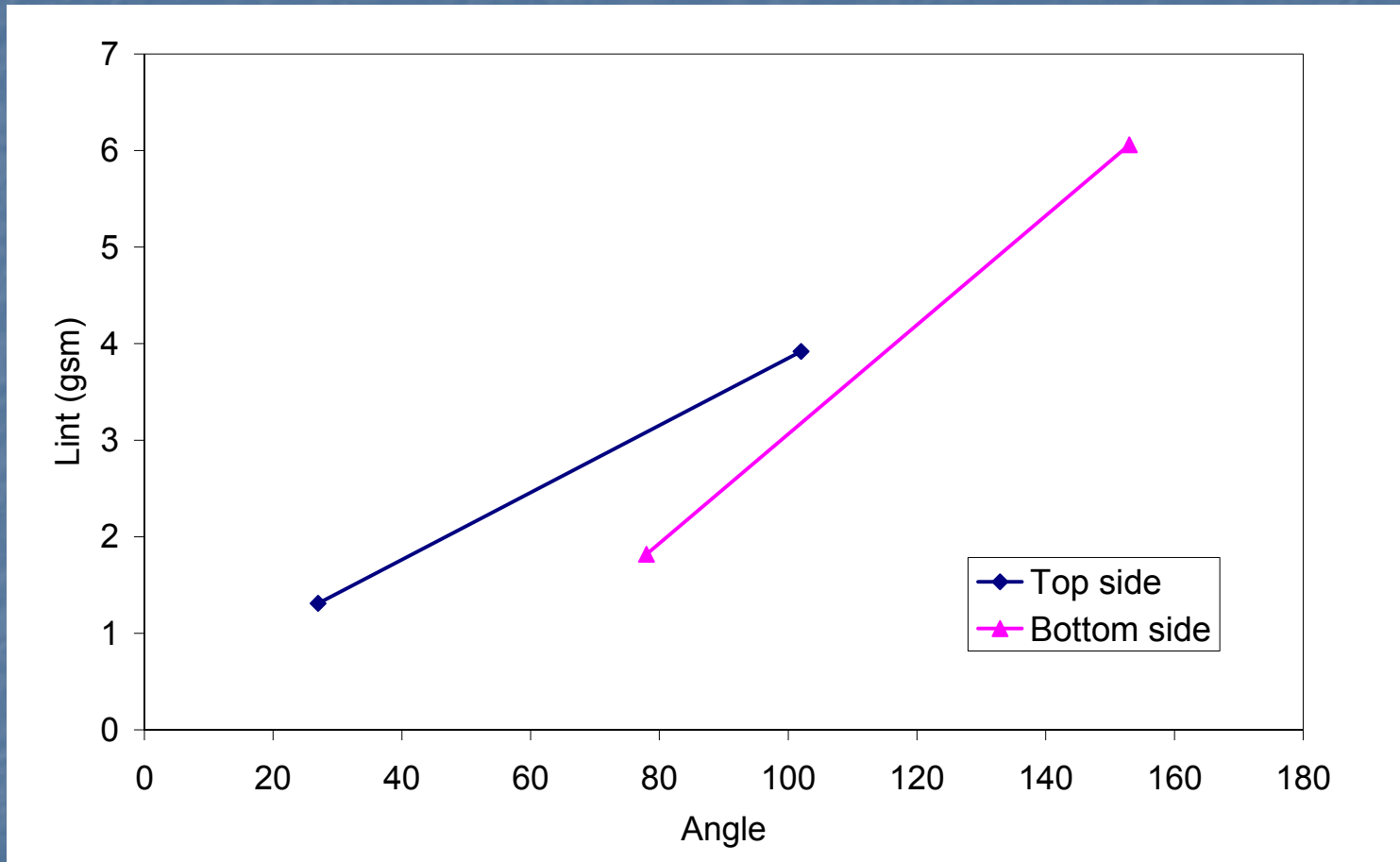
Heidelberg GTO-52 Trials



- 7000 copies printed
- Tack
 - 4, 6, 13.5
- Printing Screen
 - 0%, 25%, 50%, 75%, 100%

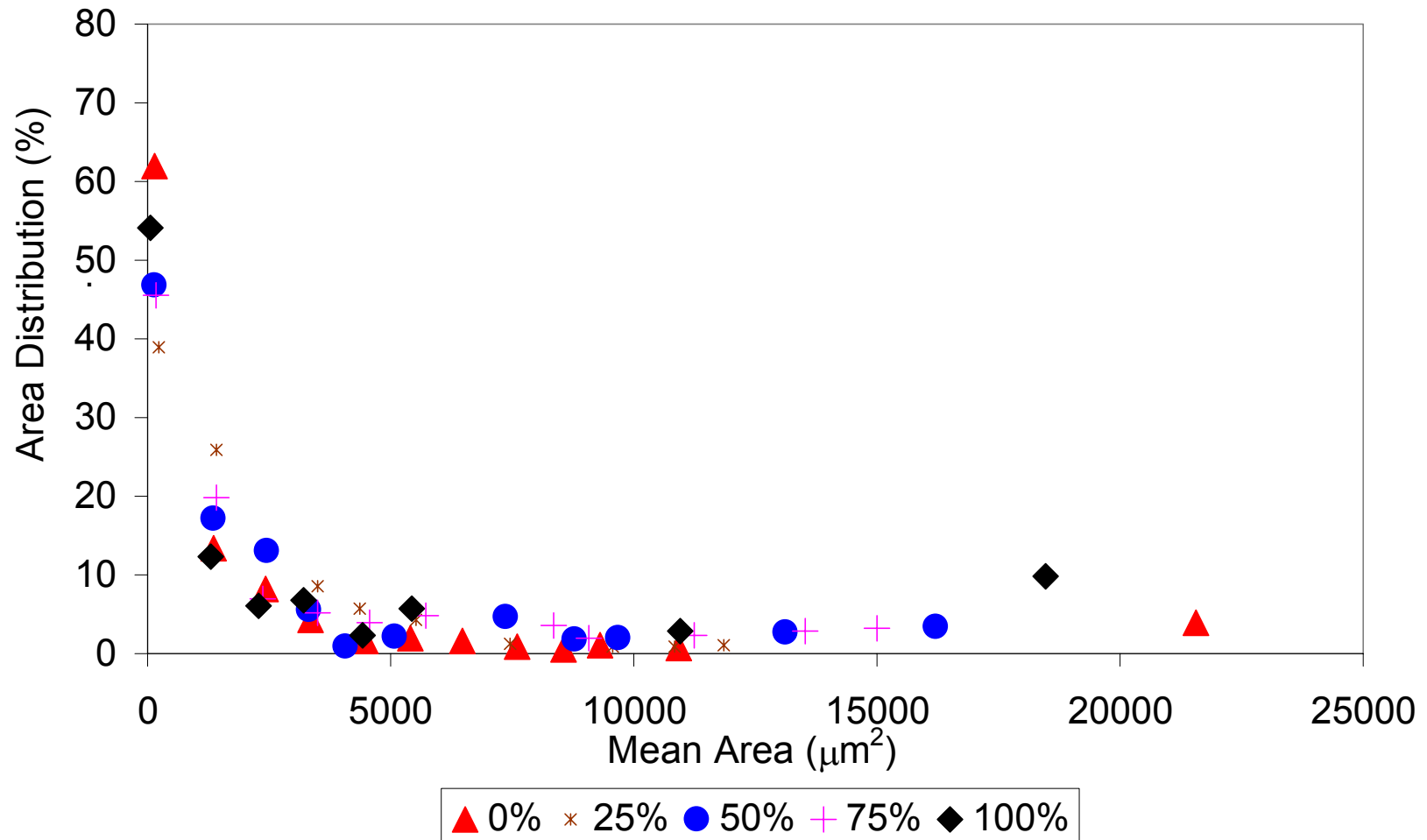
Results Part 1

Effect of Take-Off Angle and Paper Side

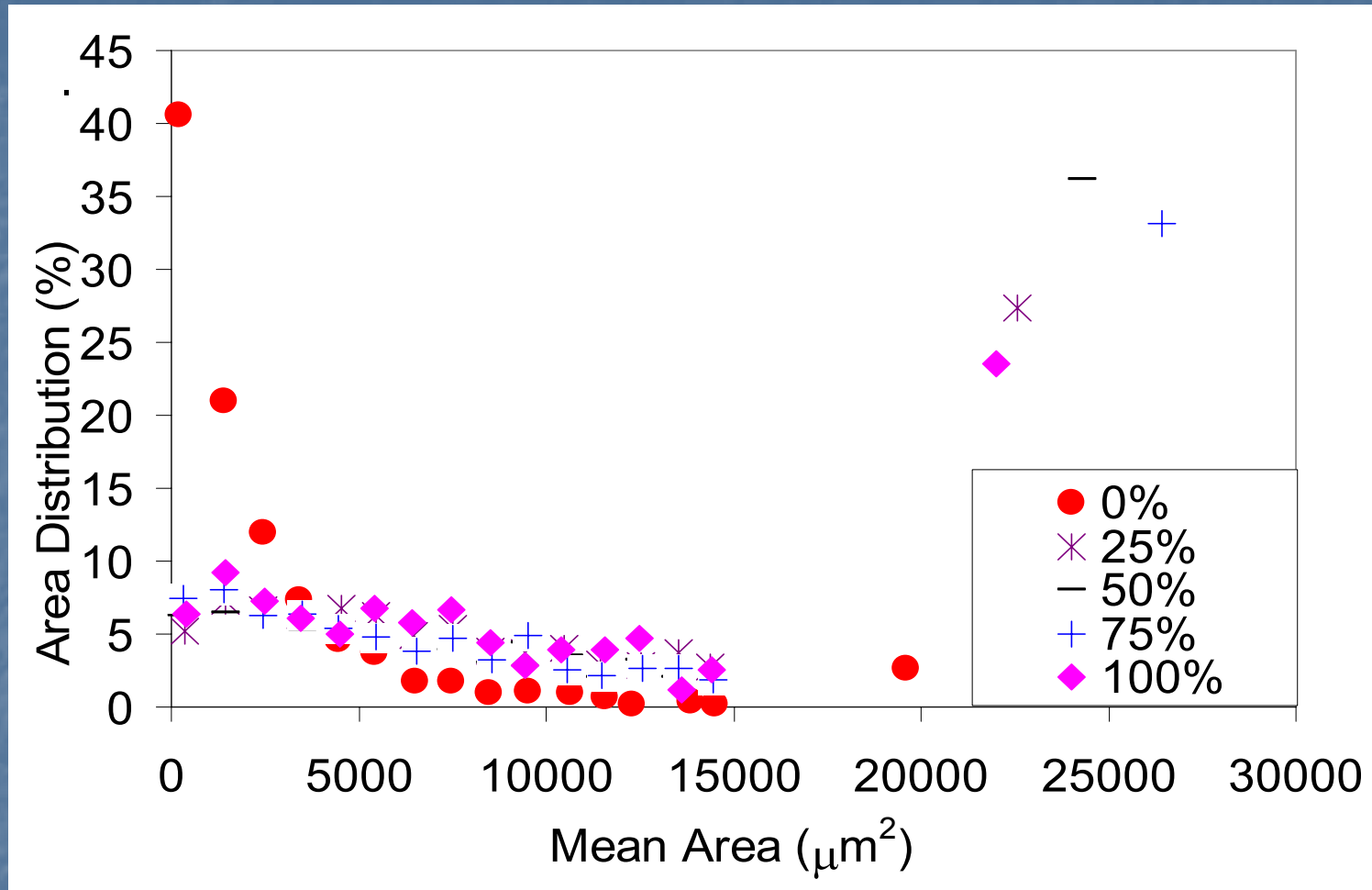


Highest average lint result (BS 153° take-off angle) is ~ 5times smallest average lint result (TS 27° take-off angle)

Area Distribution Comparison of Tack 4 Ink: Lowest Lint Result (TS, 27° Take-off Angle)

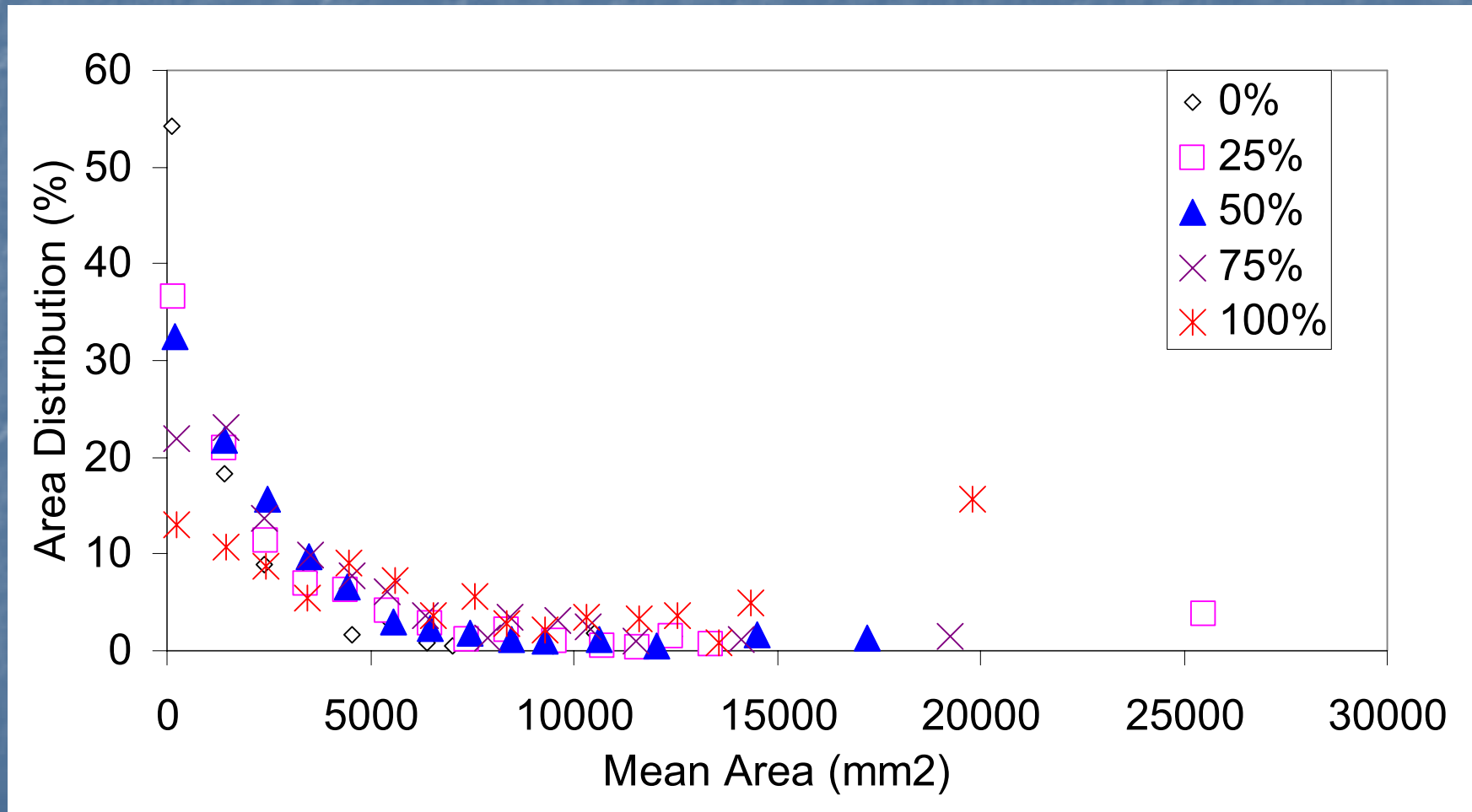


Tack 4 Highest Lint Result (BS, 153° Take-Off Angle)



- 27° : nearly half of the total area of lint is in the smallest size class, while
- 153° : the largest area class contains the most lint except for 0%

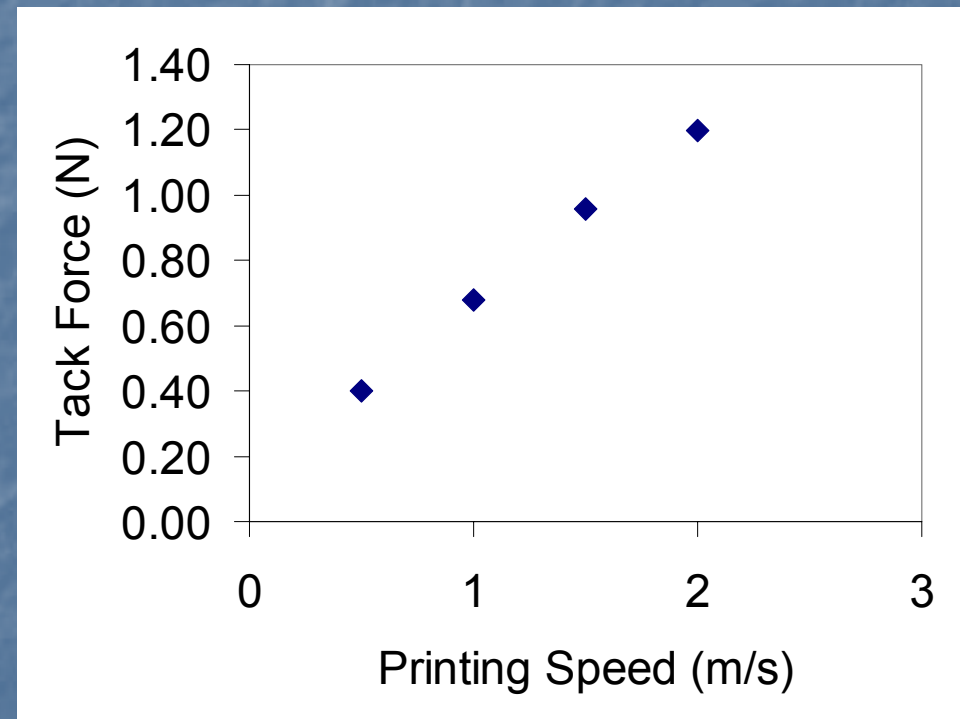
Printing Screen Area Distribution Heidelberg GTO-52 Tack 4



Results is between 27° and 153° Man-Roland Uniset Distributions

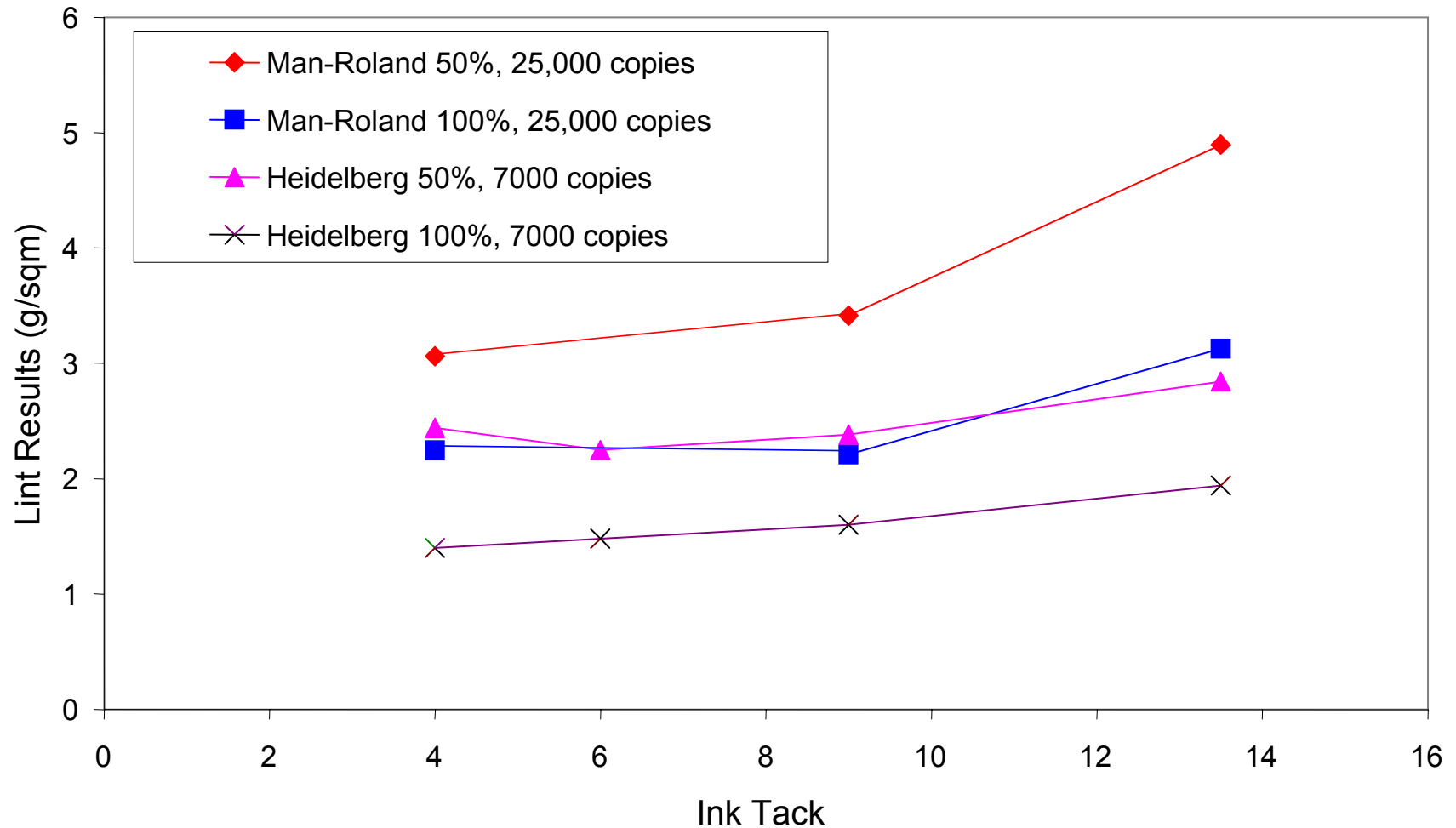
Hypothesis

- Higher take off angle, higher force, larger and more lint
- Use Prufbau Deltack to test
 - Ink film splitting force
 - Varied printing speeds
 - 0.1 mL black tack 13.5



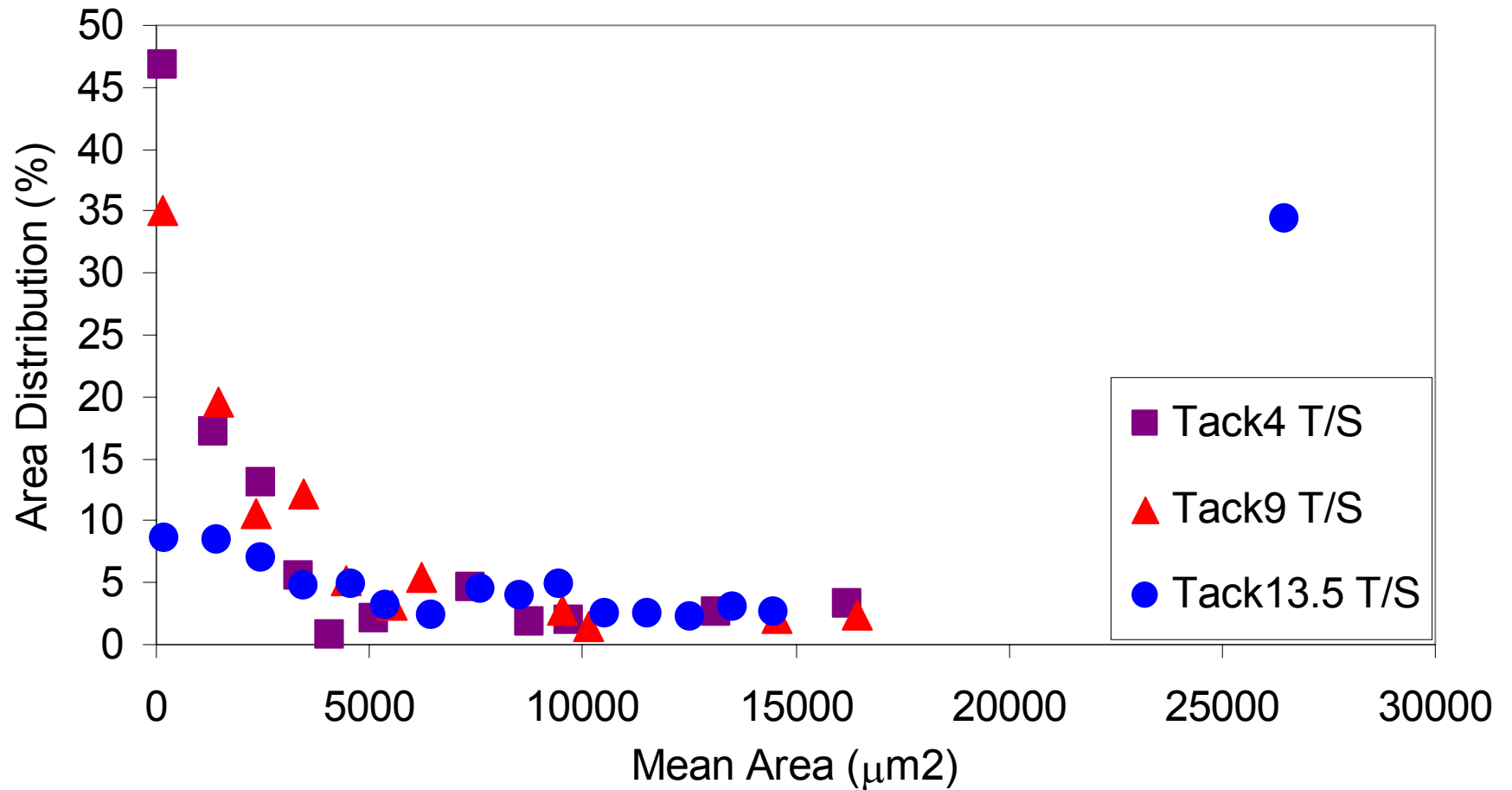
Results Part 2

Effect of Ink Tack : B/S

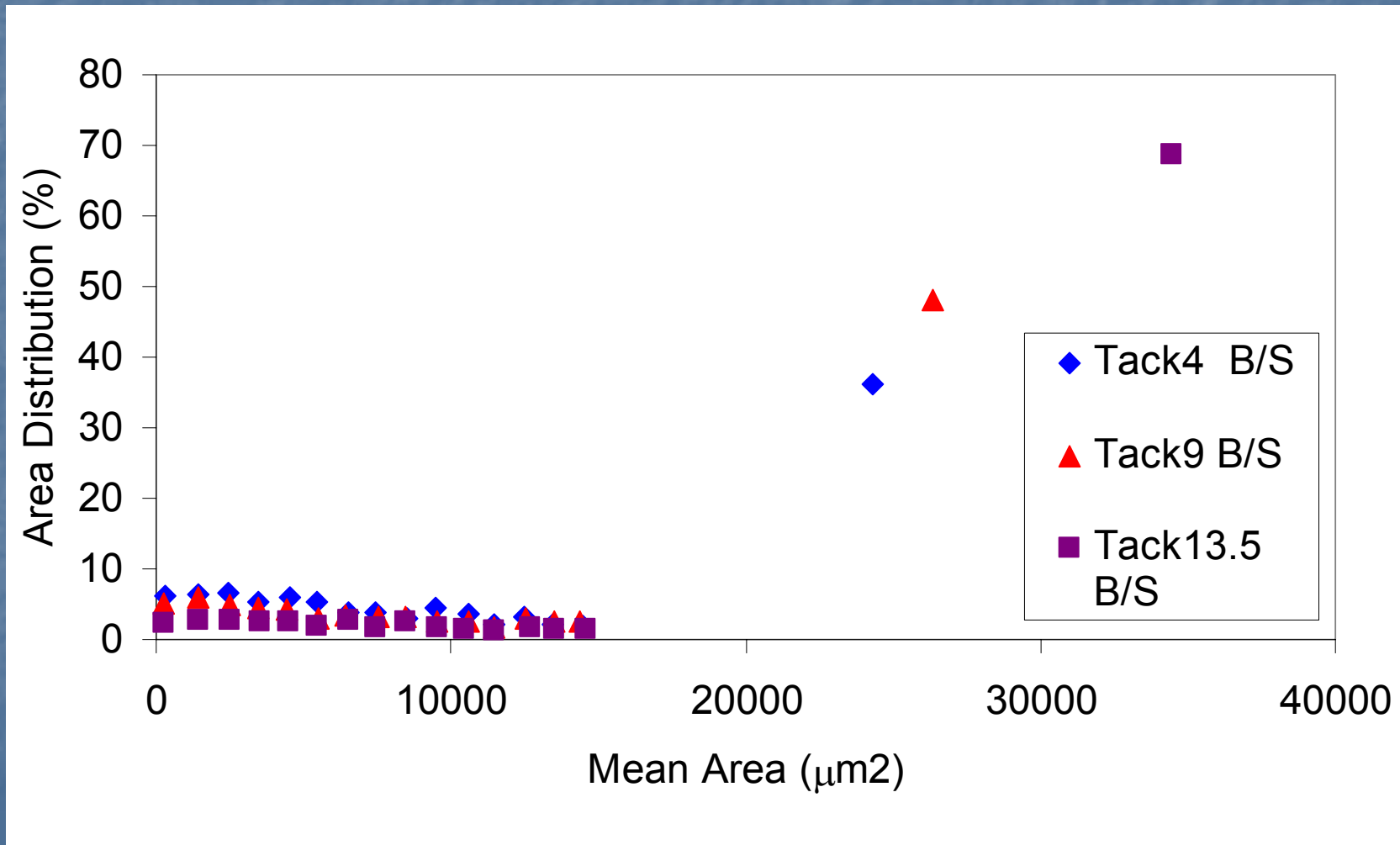


Effect of Tack

Lint Area Distribution of 50%, 27° Take-Off Angle



Lint Area Distribution of 50% Screen and 153° Take-off Angle



Ink Tack and Lint

- Tack : Measured using Inkometer
 - 800 rpm
 - Ink weight: 1.67 grams
- Printing
 - Ink Thickness 1-2 μm
- Assuming ink film splits in the middle

	Diameter	Speed	Shear Rate
	cm	m/s	s^{-1}
Inkometer	7.9	3.3	3×10^5
Heidelberg	30	1	$\sim 10^6$
Man-Roland	40	10	$\sim 10^7$

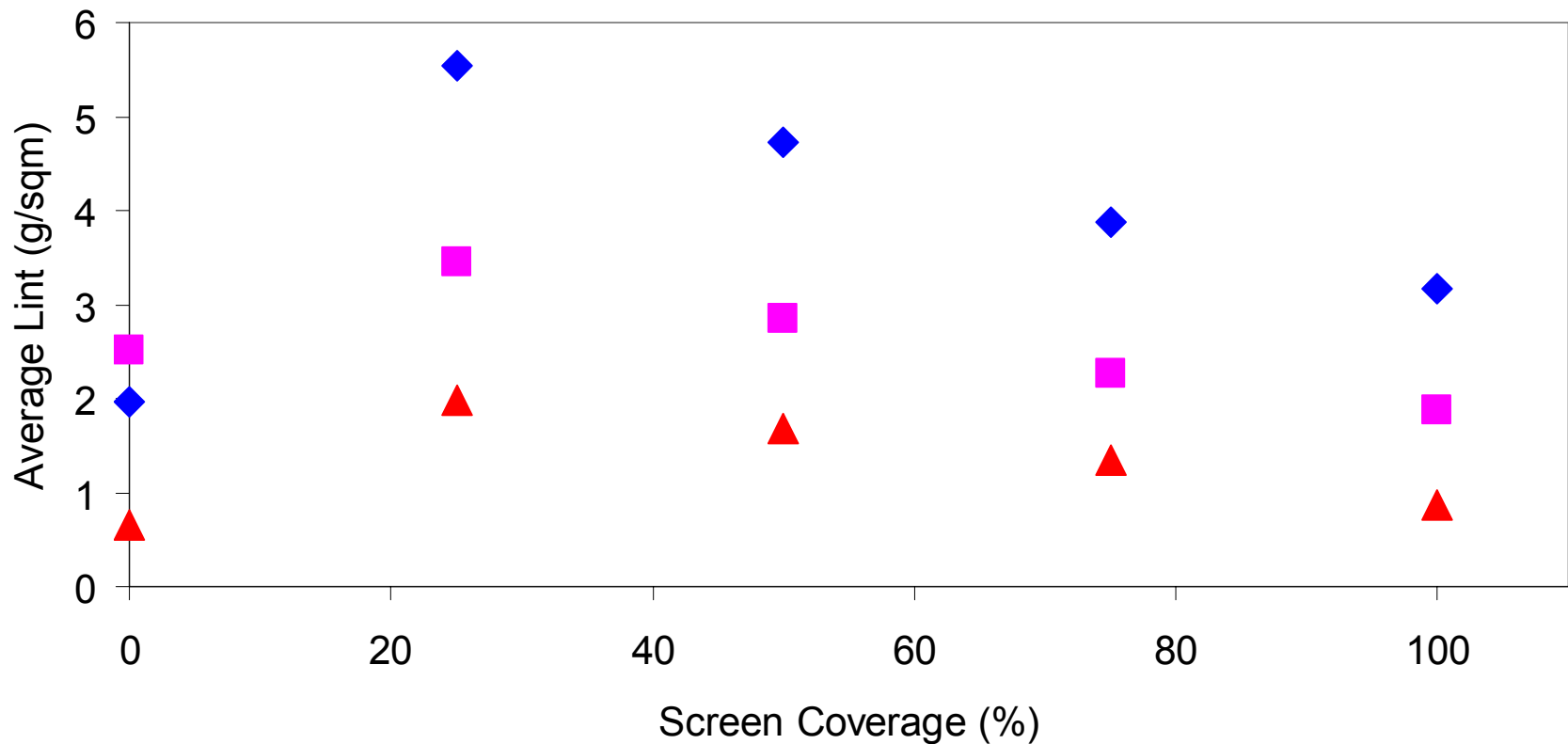
- Inks
 - Shear thinning
 - Apparent viscosity falls with apparent shear rate
- Measurements need to be performed at shear rate relevant to press under investigation
- Inkometer tack not a good predictor of linting

Results Part 3

Effect of Printing Screen

Man-Roland: Average of Tack 4, 9, 13.5

Heidelberg: Tack4



◆ B/S Average Lint Man-Roland ■ T/S Average Lint Man-Roland ▲ B/S Lint Heidelberg

Conclusions

Significant printing parameters related to lint:

- Take-off angle
 - Lint Increased greatly with take-off angle
 - Higher take off angle, higher force, larger and more lint
- Printing screen
 - Maximum at 25% screen tone

Conclusions Cont.

- Ink Tack
 - No large difference in tack 4,6, and 9
 - Tack 13.5 gave somewhat higher result
- Inkometer measures tack at a much lower shear rates compared to the shear rate in commercial printing press

Acknowledgements

- Dr Wei Shen
- John Pollard, Grant Brennan
- Shaun Jenkins, Elaine Filliponi, Herman Mulyadi, Robert Vukasinovic
- The financial support of the MGS, Smartprint CRC, Norske Skog and the Australian Research Council, through the SPIRT grant scheme, are gratefully acknowledged