Paper Strain influenced by Tack and Fountain Solution

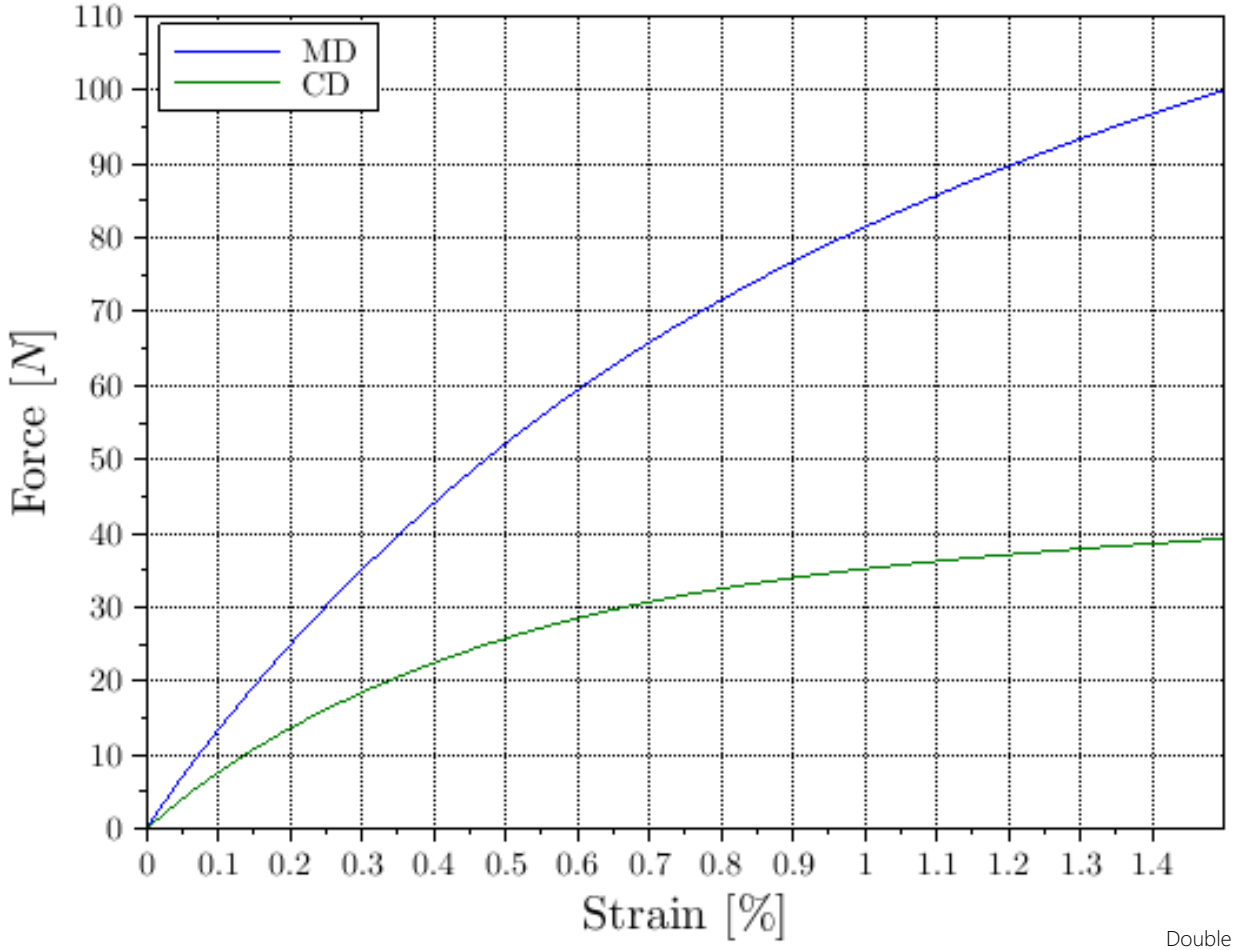
B.Eng. Dilan Cetinkaya, M.Eng. Chan Li,
Prof. Dr. Karl Schaschek

Hochschule der Medien, Stuttgart

Introduction

- Paper, card board and other fiber materials are used in packaging and graphic arts industry, they are:
  - Anisotrop: machine direction (MD) / cross direction (CD)
  - Sensitive to humidity E = f(rH), ε=f(rH)
  - Printing machines are getting bigger → absolute color register error incr.
  - ‚New process‘ waterless offset / wet offset (lithography)
- Study influence of
  - Paper (100 g/m2 uncoated, 110 g/m2 double coated)
  - Humidity (fountain solution)
  - Printing process (waterless offset / lithography)

Paper stress and strain



Double coated paper 135g/m2
25 mm

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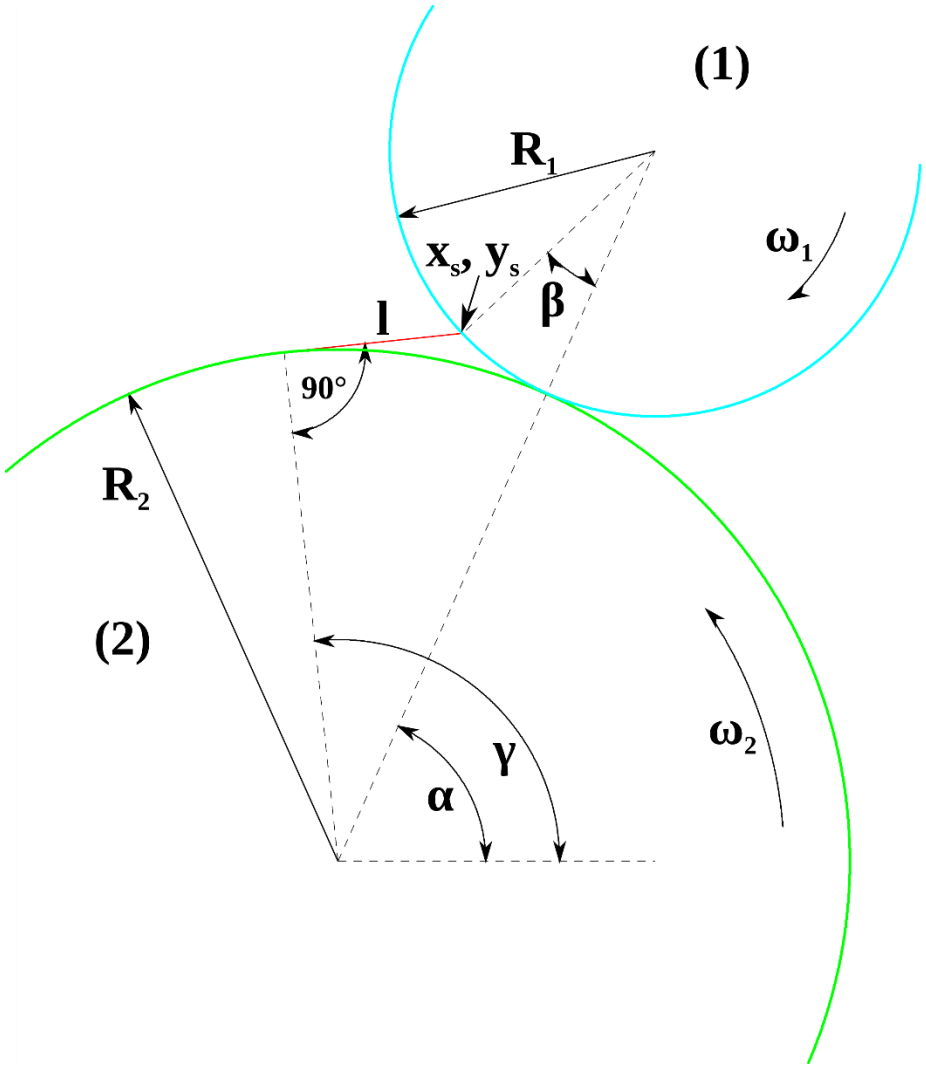
Ink tack and trailing angle (β)



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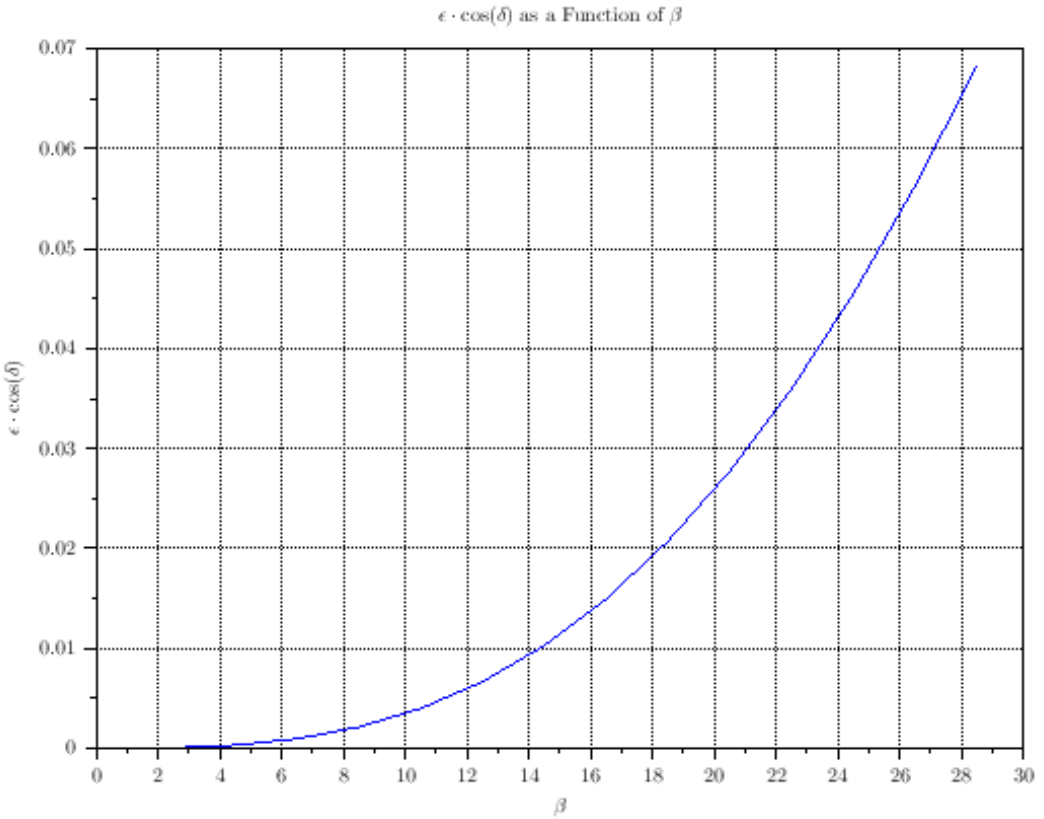
Relation tack / modulus of elasticity

- $F_{pull} = \sigma_{XD} \cdot A = \epsilon \cdot E_{XD} \cdot A$
- $F_{rest} = F_{tack} / \cos(\delta)$
- $\epsilon \cdot \cos(\delta) = \frac{F_{tack}}{E_{XD} \cdot A}$
- $\delta = \beta + \gamma - \alpha$



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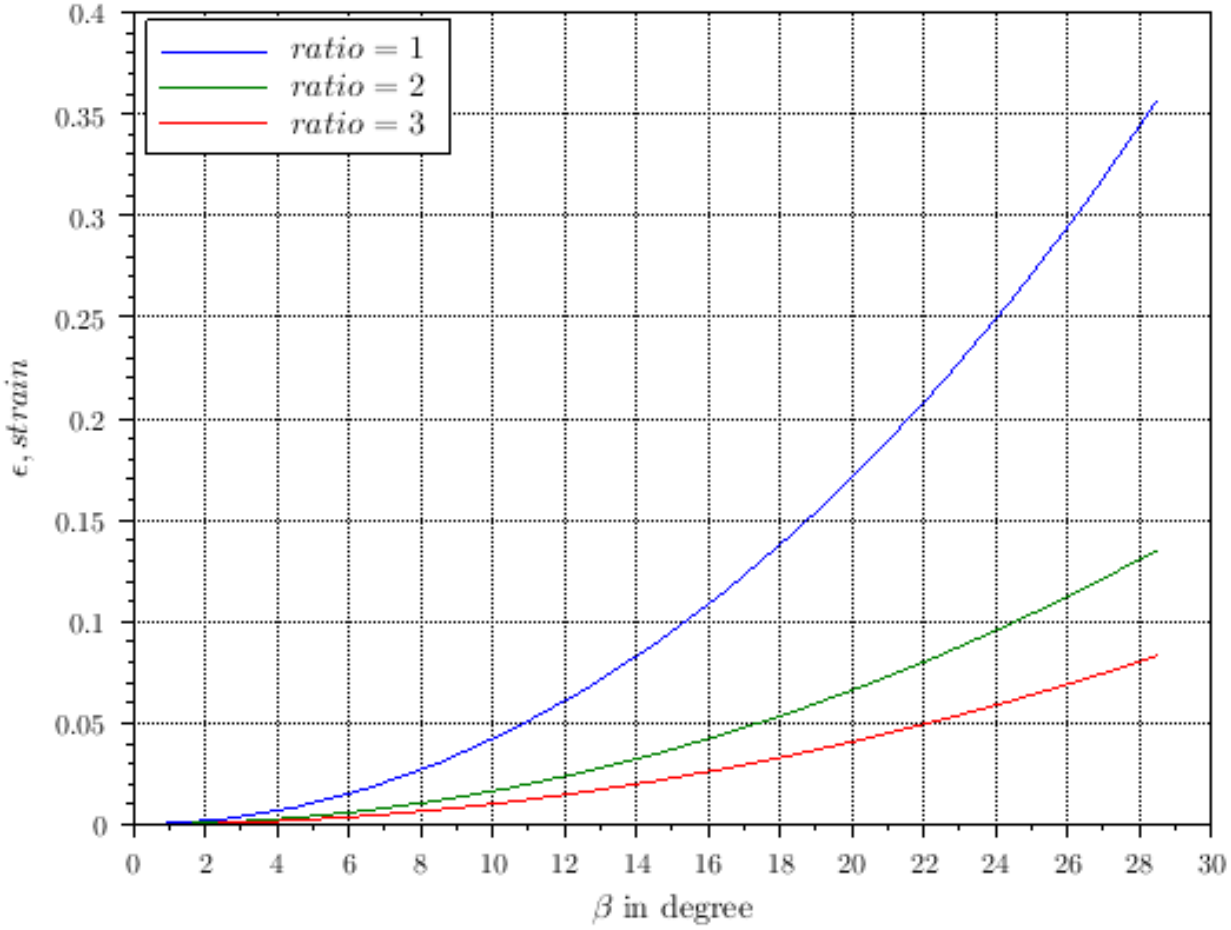
Paper Strain and trailing angle (β)



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Equilibrium moisture content

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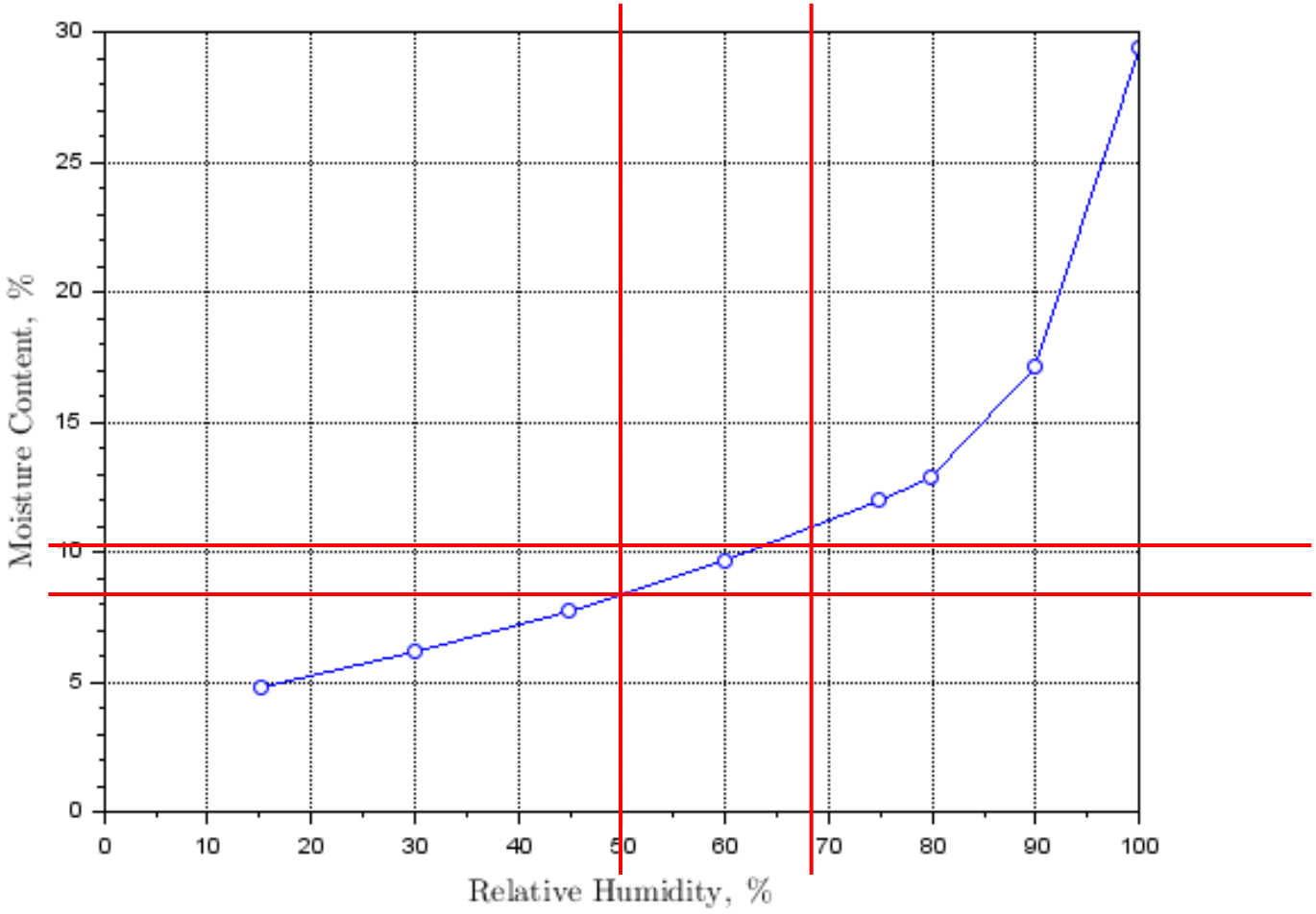
Equilibrium moisture contentof of 240g/m2 bleached Kraft paperboard as a function of relative humidity



S. G. Chatterjee et. al.
Hysteresis in vapor sorption equilibria of bleached kraft paperboard
Proceedings 3rd international Symposium 'Moisture and Creep Effects on Paper Board and Containers' 1997

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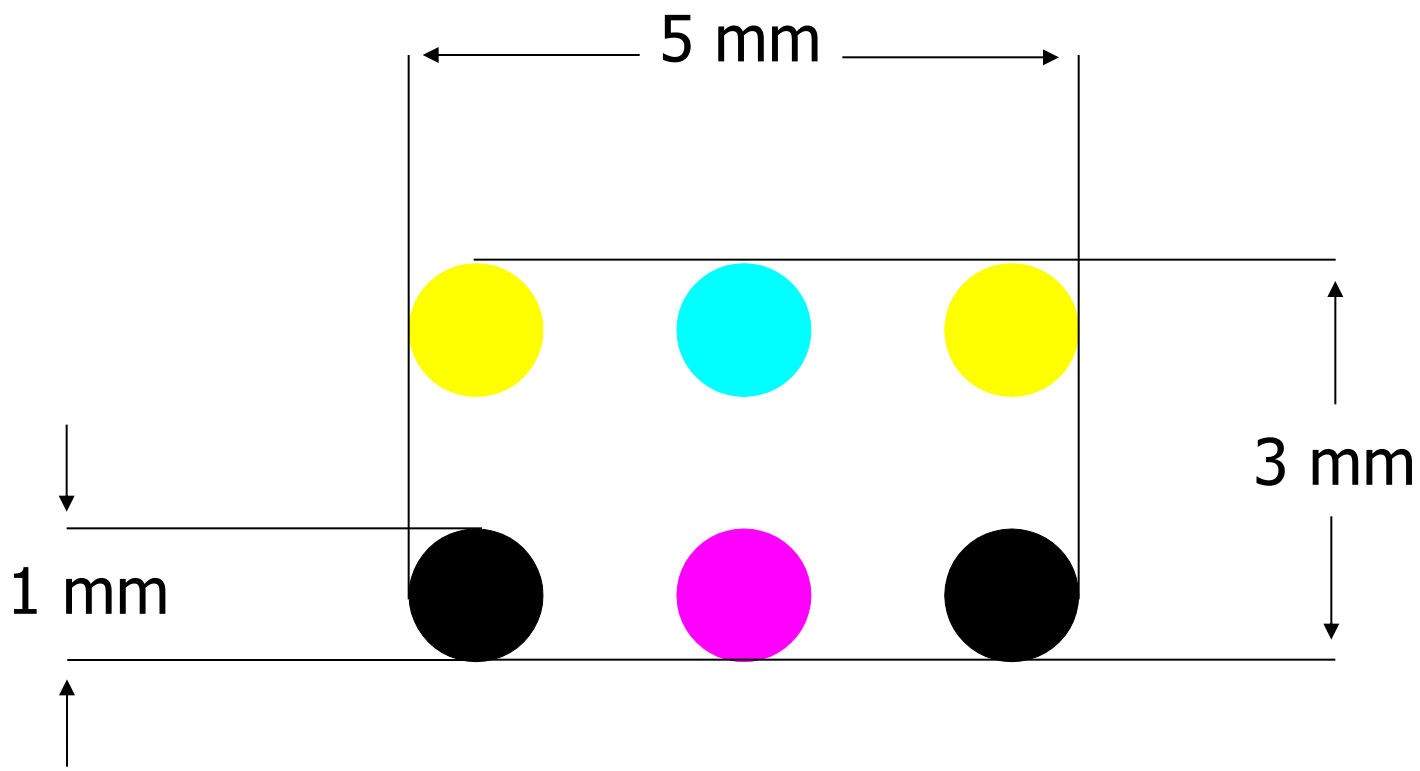
Color register mark



Techkon register mark → Techkon 920 Register control unit
Accuracy: 0.01 mm

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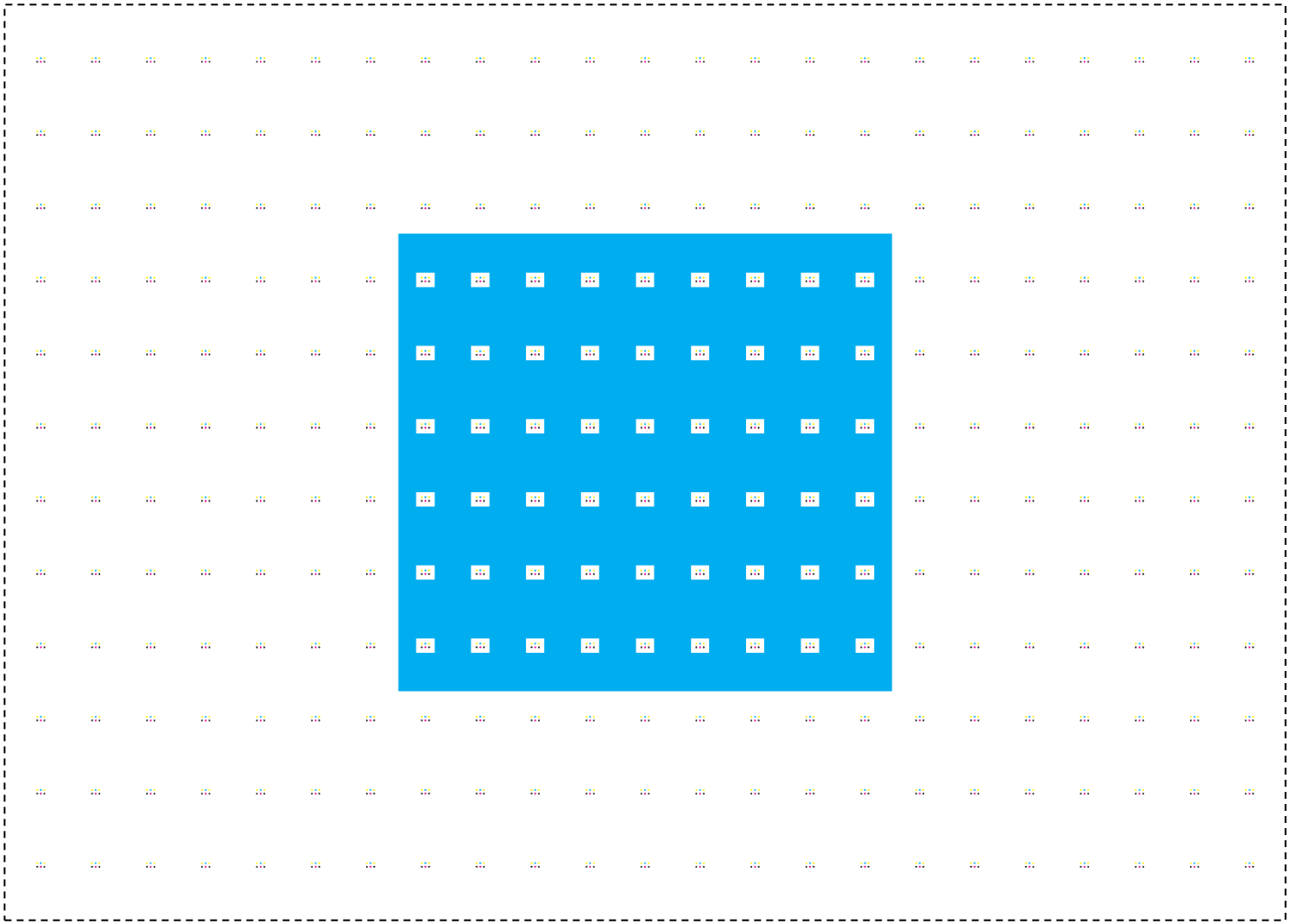
4c-Testform



23 x 12 marks

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View: Deformation of magenta separation

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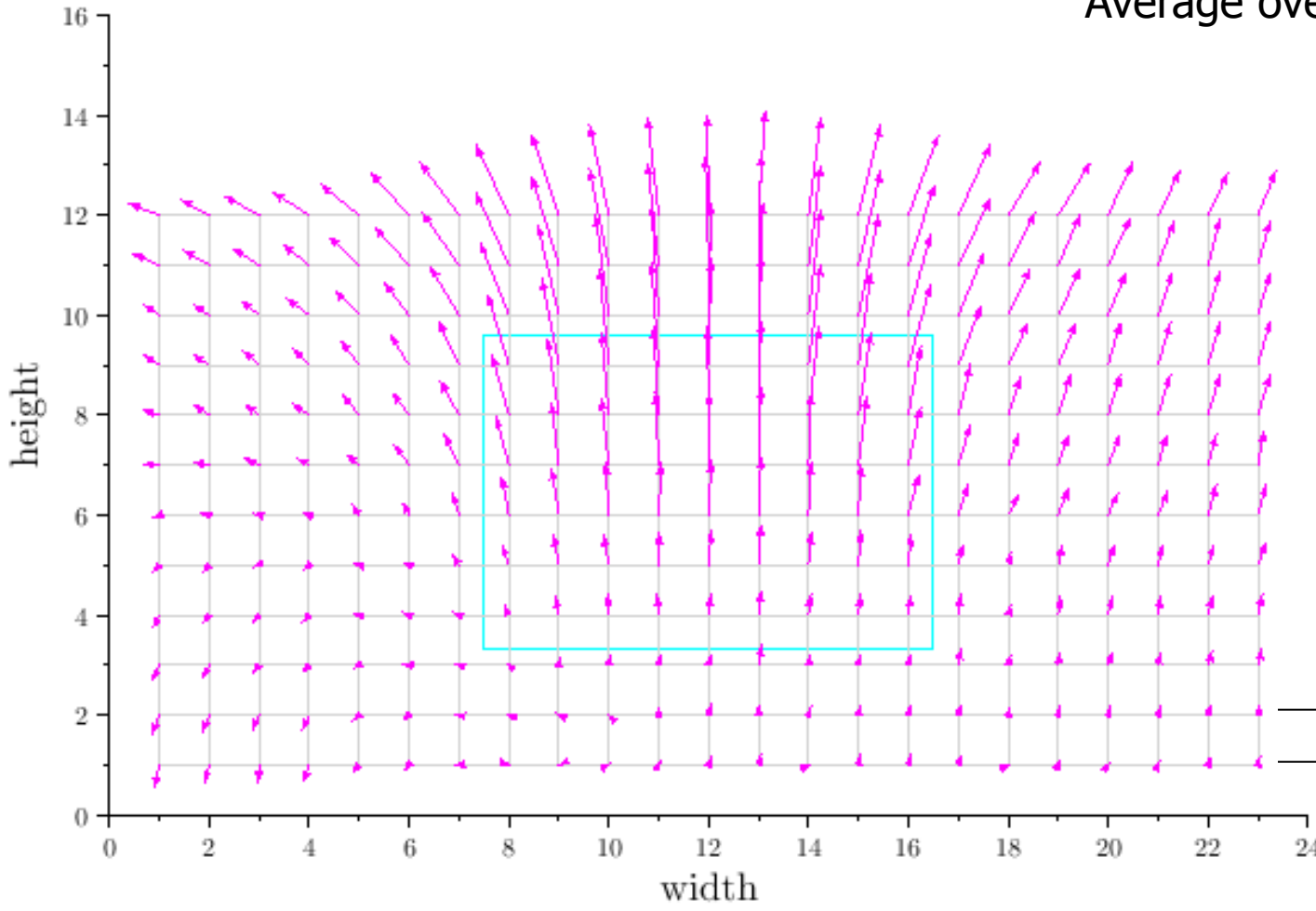
Average over 5 sheets



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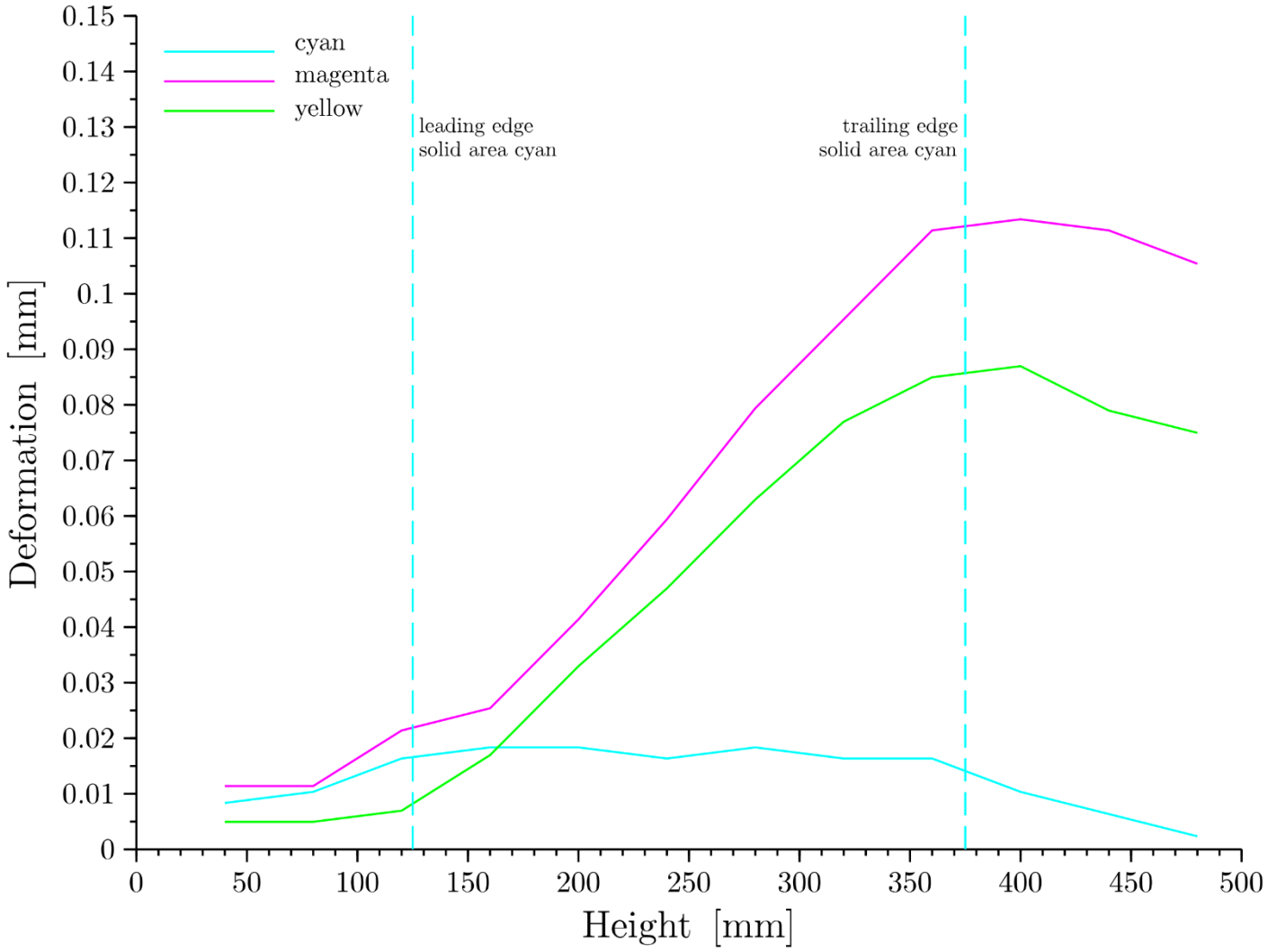
View: Paper Deformation



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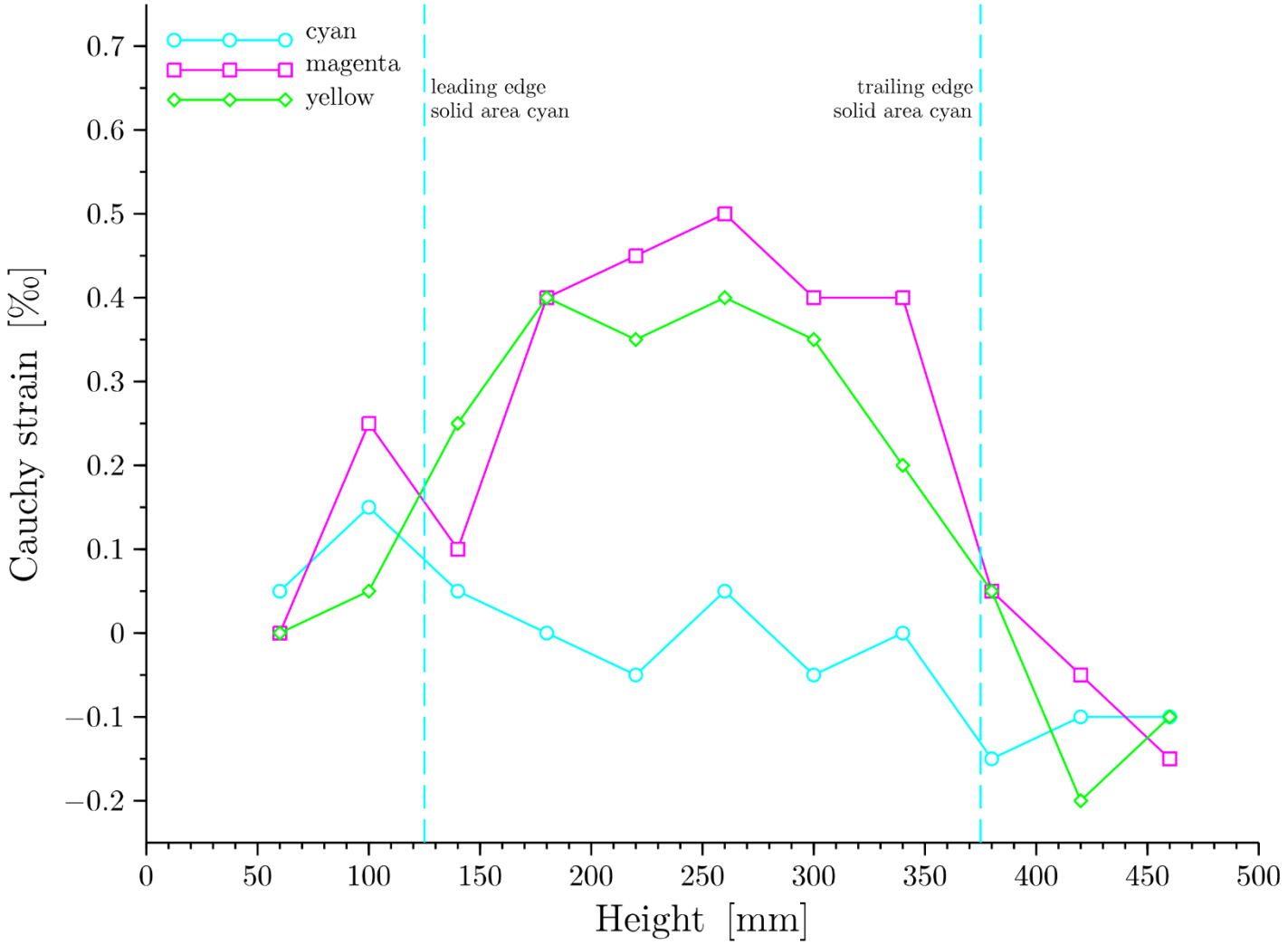
View: Cauchy Strain



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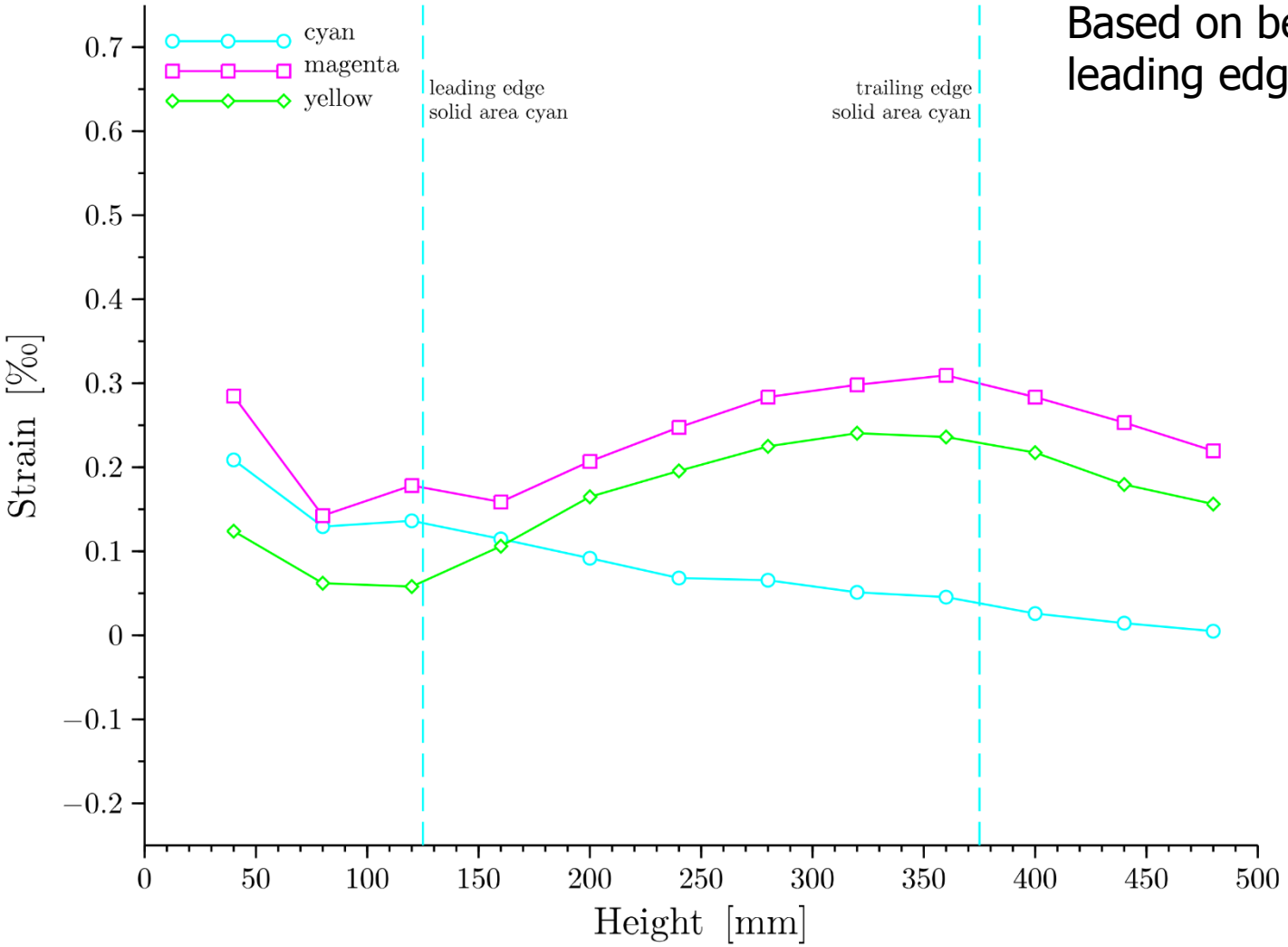
View: Paper strain



Based on begining at leading edge of sheet

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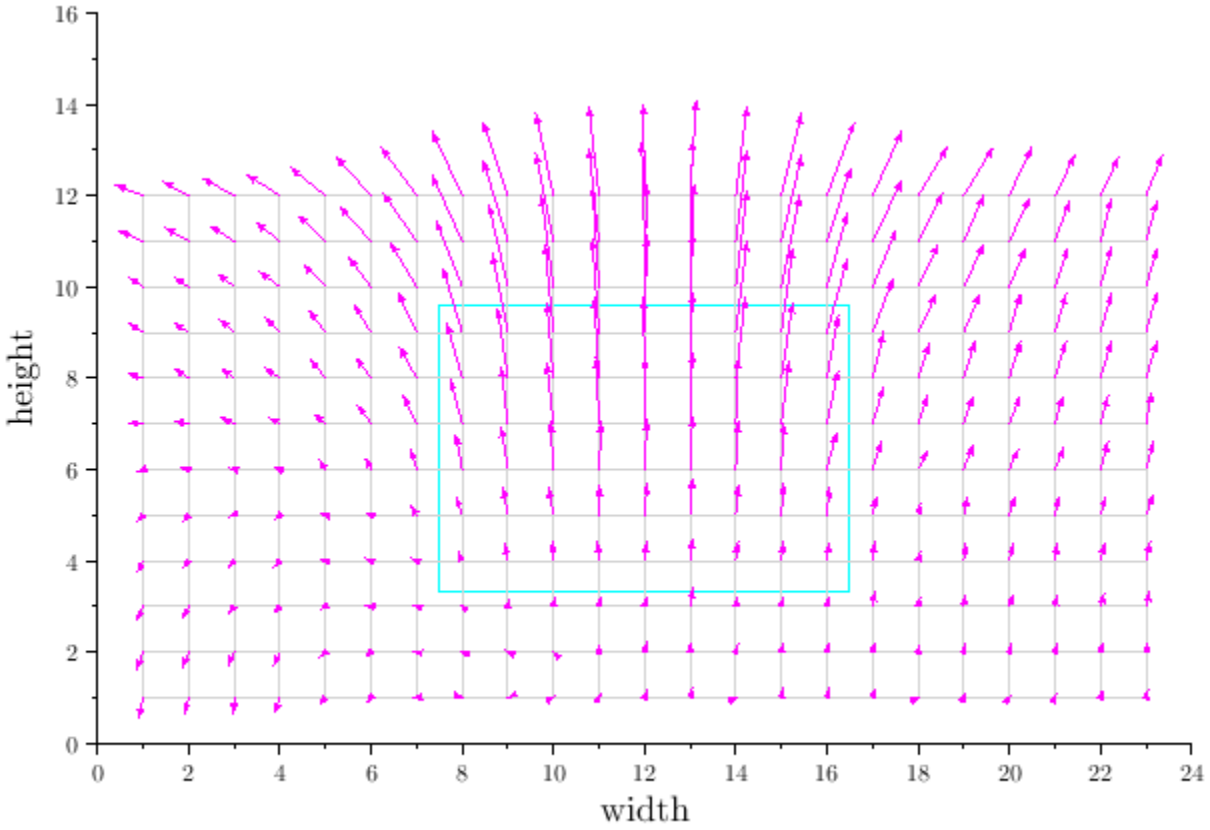
Influence Fountain setting



+/-%

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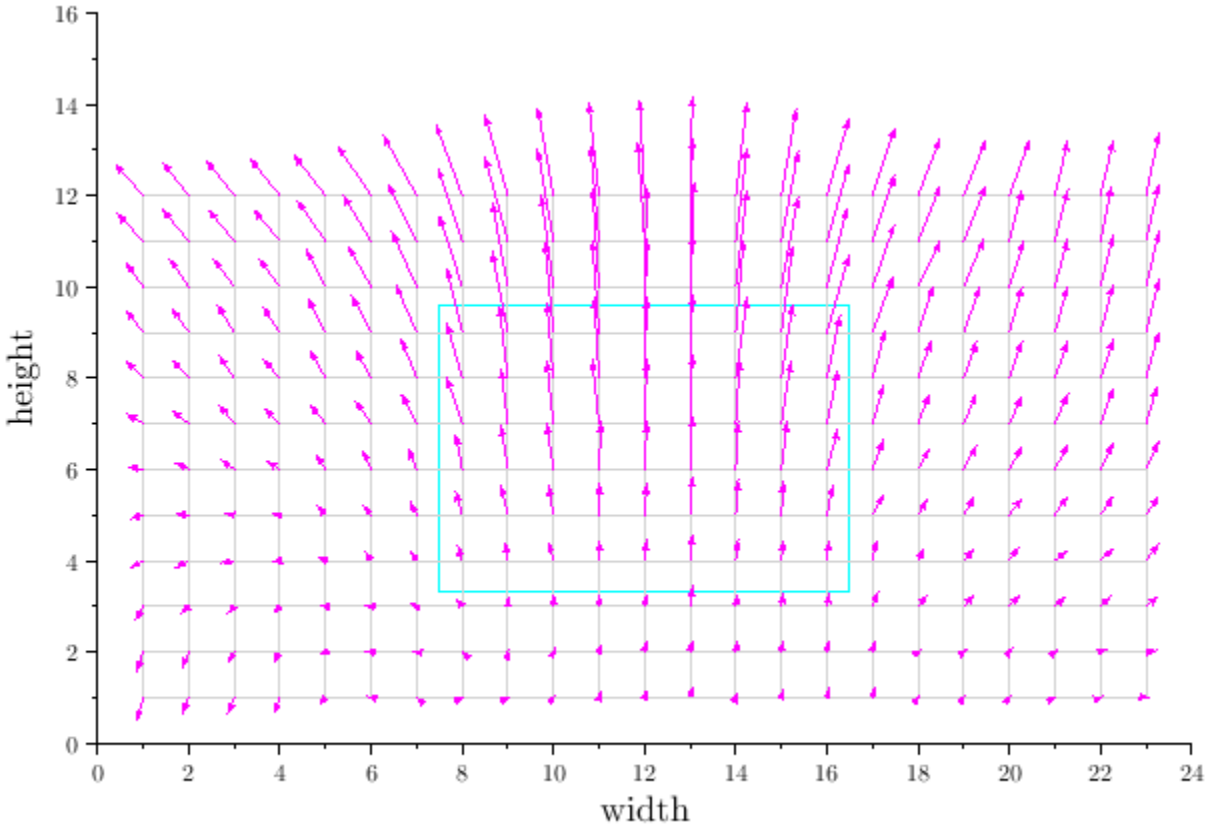
Influence Fountain setting



+15%

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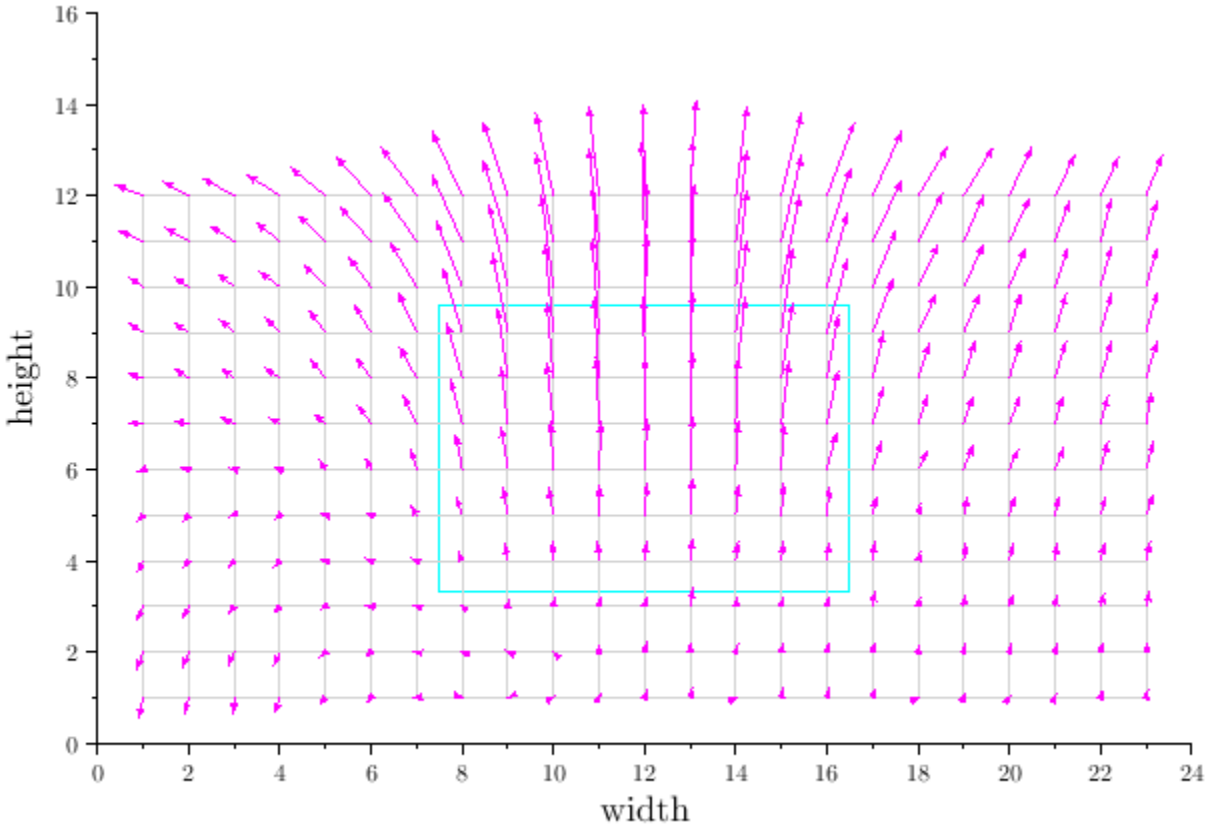
Comparison waterless Offset



+/-%

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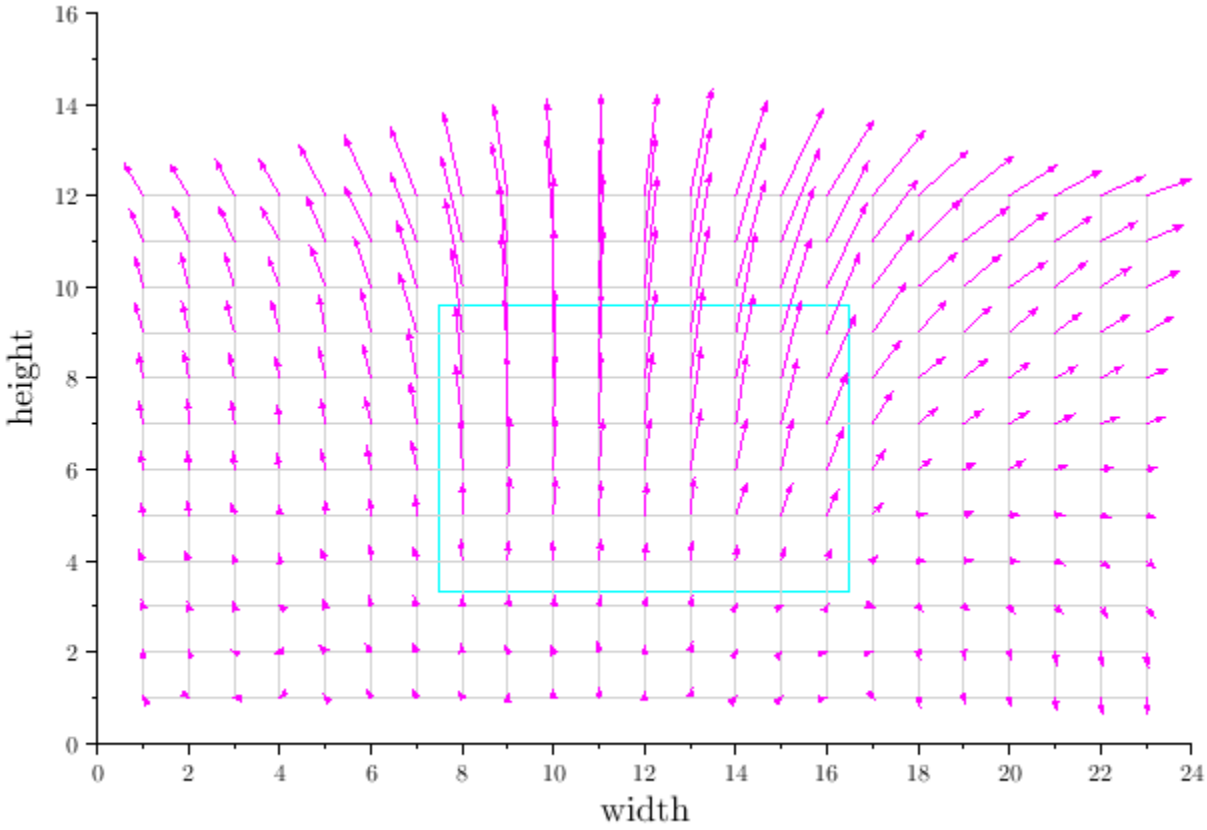
Comparison waterless Offset



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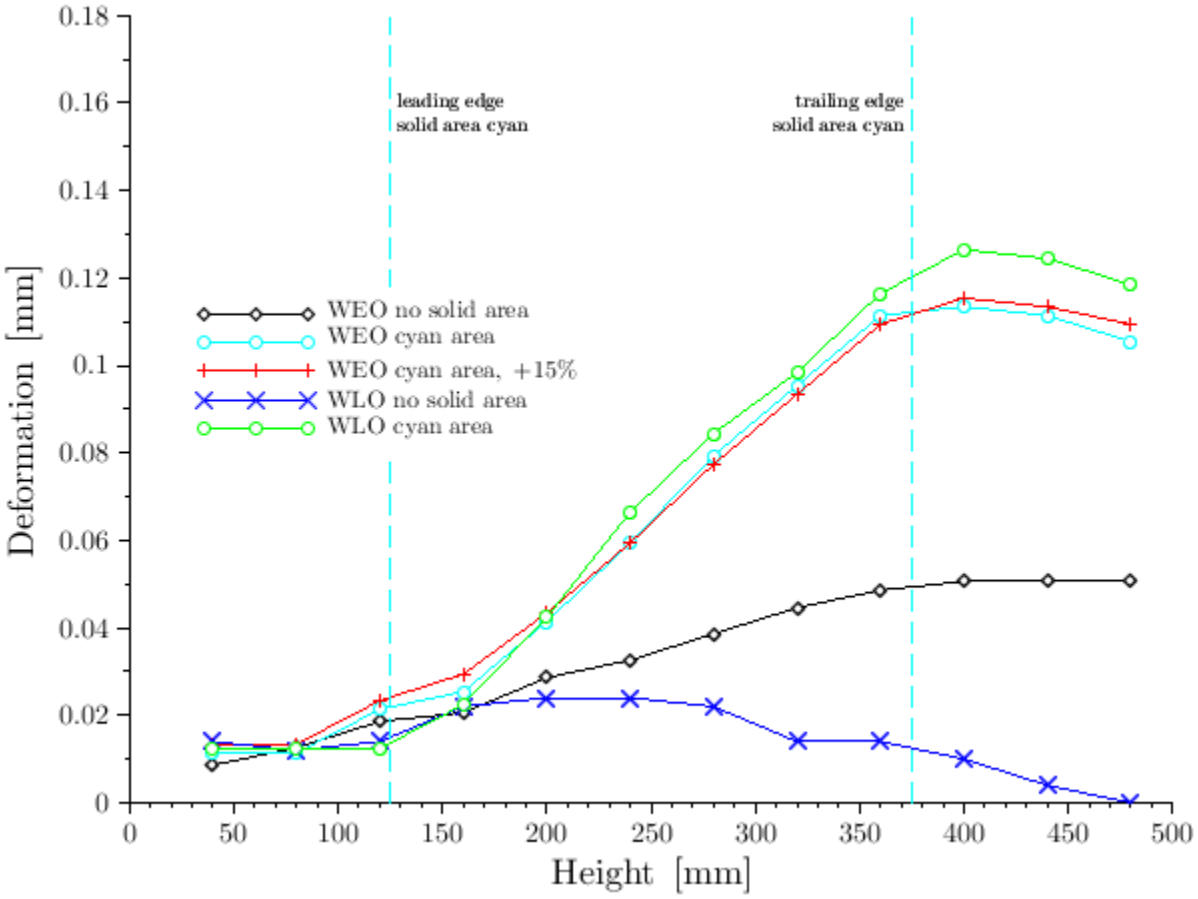
Comparison of Deformation



Double coated 115g /m2

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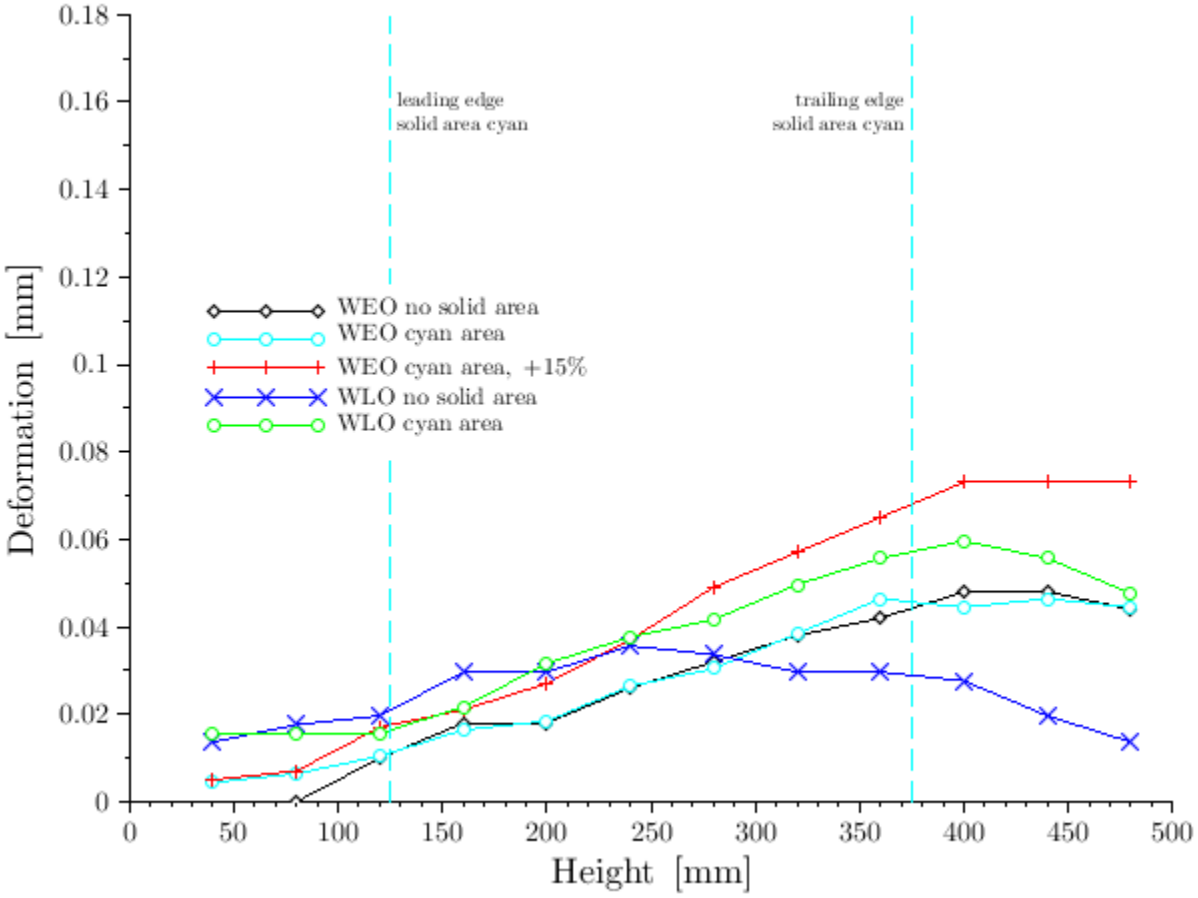
Comparison of Deformation



Uncoated 100 g/m2

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Conclusion

- The analyzed sample show:
  - Double coated paper
    - Regular print and increased fountain setting (+15%) are similar
    - Influence of solid area strongly noticeable
    - Waterless offset samples show higher deformation
  - Uncoated paper
    - Regular print and increased fountain setting (+15%) are similar
    - Influence of solid area hardly noticeable
    - Waterless offset samples show slightly higher deformation
- Indications for
  - Relaxation of deformation → speed dependency

Acknowlegment

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  - Deutsche Forschungsgesellschaft (DFG), Hochschule der Medien (HdM), Stuttgart for providing the printing machine and other infrastructure
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Prof. Dr. Karl Schaschek
Hochschule der Medien

Nobelstraße 10
70569 Stuttgart

Tel. 0711 8923 2046
Fax 0711 8923 2185
schaschek@hdm-stuttgart.de
www.hdm-stuttgart.de