3D-Stick latest developments

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innovation for paper

ctp
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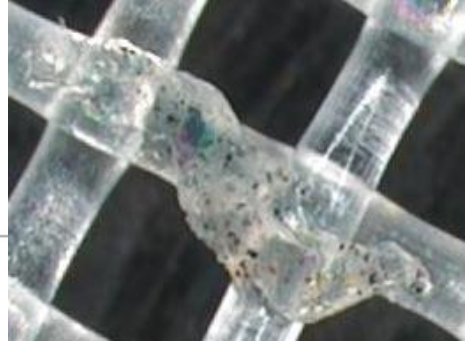
du papier

Motivations



- **Stickies are tacky particles,**
  mainly from converting adhesives in recycled pulps

- **➔disturbances in the papermaking process**
  - Paper quality reduction: holes, specks…
  - Productivity reduction: deposits, breaks…

- **Most harmful mini-stickies = mini-PSA (Pressure Sensitive Adhesive)** *(Fabry et al. 2010)*
  - Small particles (but still macro-stickies)
  - Tacky at room temperature
  - Soft and viscous (can be extruded during screening)

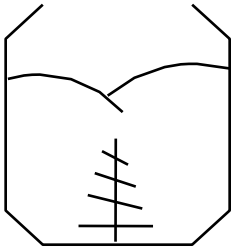
Motivations & objectives

- **According to (Doshi, 2009), a stickies measurement method should give access to**
  - quality of furnish
  - efficiency of removal processes
  - deposit control on paper machines
  - performance improvement of recycled paper products
- **A new method would be:**
  - quantitative results (mm² of stickies per kg of pulp)
  - qualitative information (chemical nature of the stickies, tackiness)
  - + *no deformation*

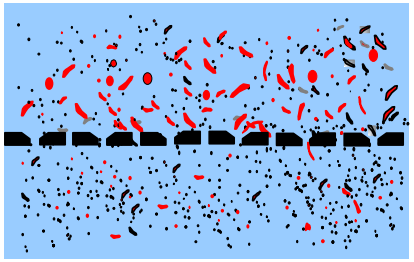
Doshi, M. R. (2009). "A review of stickies measurement methods." Progress in Paper Recycling, 18(3), 20–30.

Methods

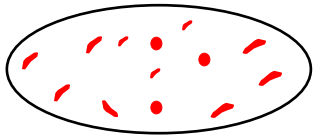
Sample preparation: 3DStick vs. INGEDE#4



contaminated pulp



screening (100 µm)

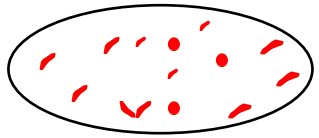


Macro-contaminants

Air drying

3DStick

3D morphology of all contaminants (incl. stickies)



Stickies quantification

Pressing, drying, dying, white powder

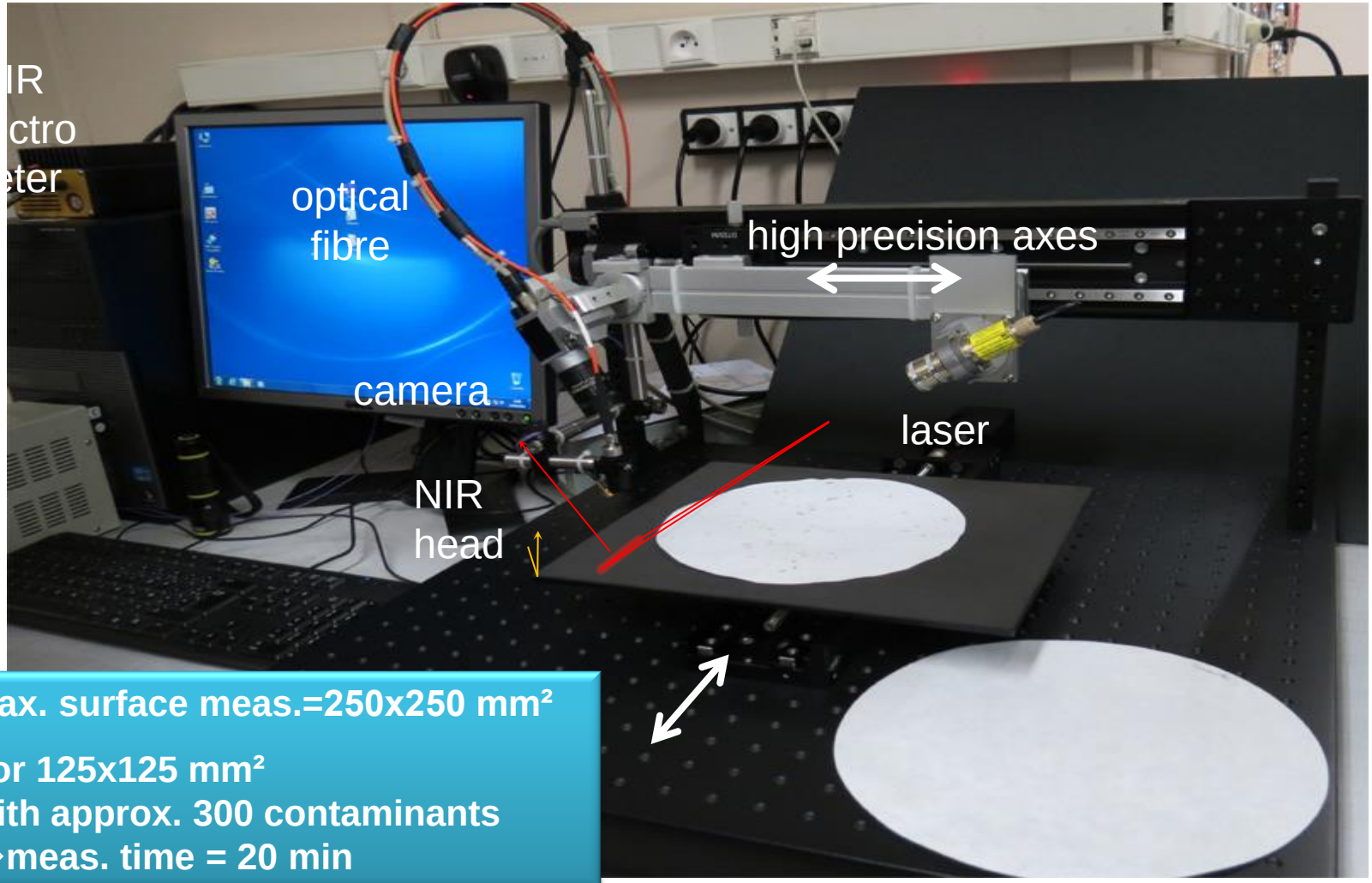
INGEDE #4

surface distribution of stickies

We analyse contaminants with a size >100µm

Methods

3DStick sensor

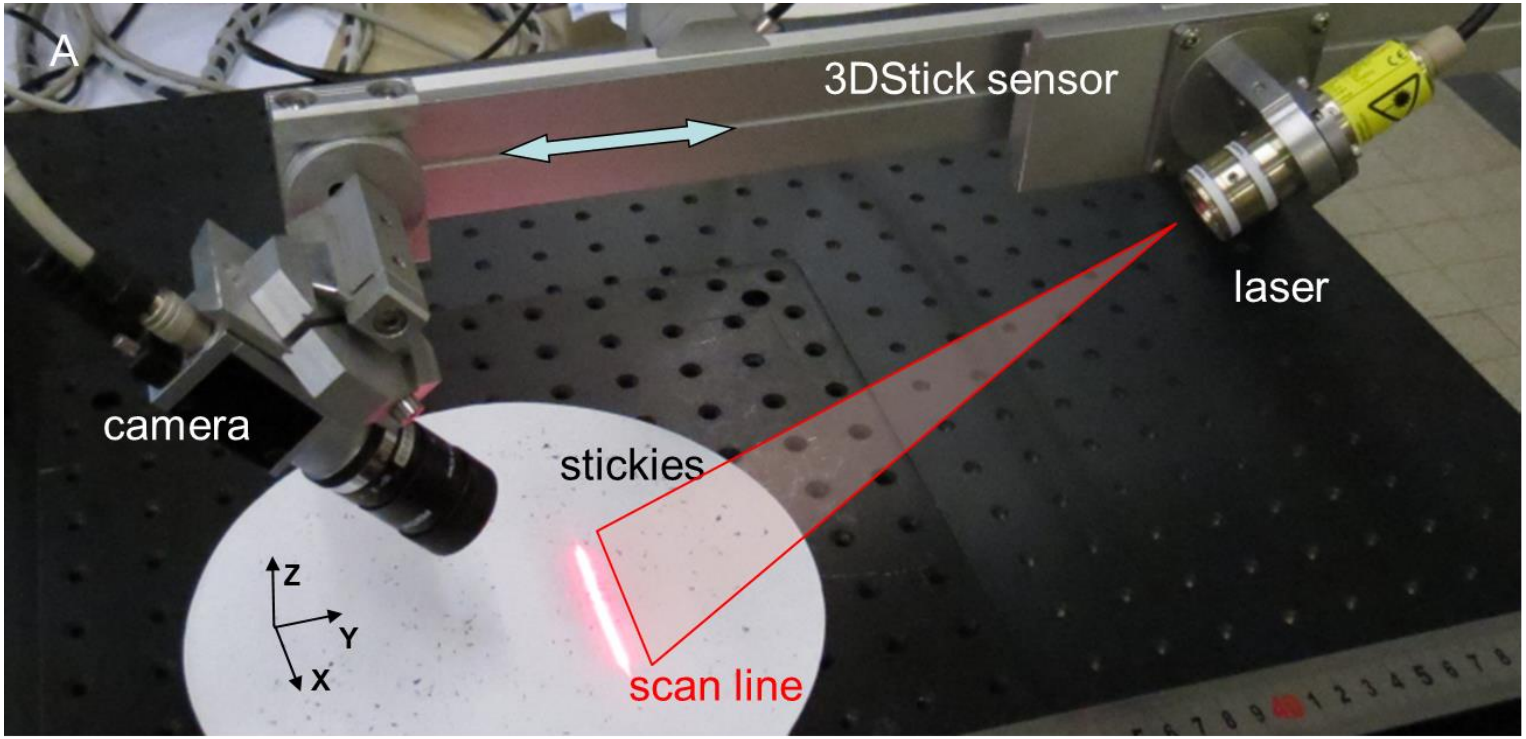


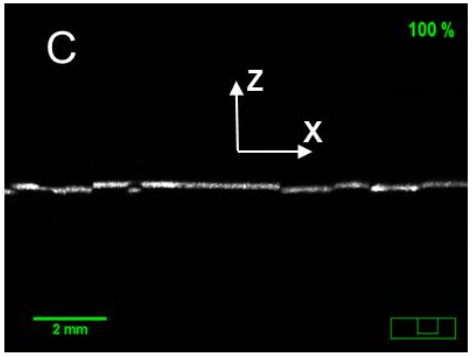
Max. surface meas.=250x250 mm²

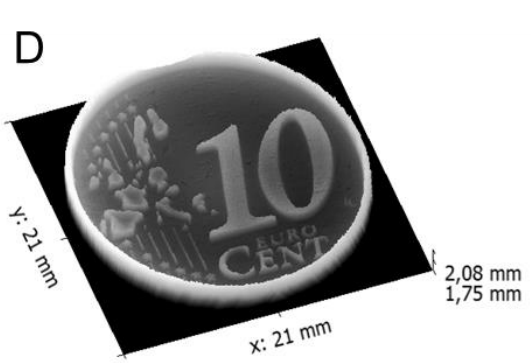
For 125x125 mm²
with approx. 300 contaminants
➔meas. time = 20 min

Methods

Laser triangulation



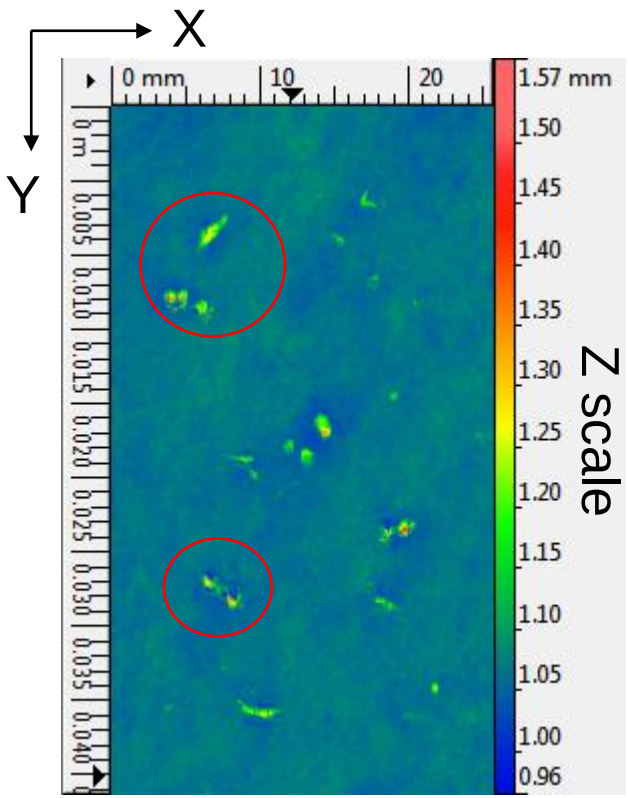




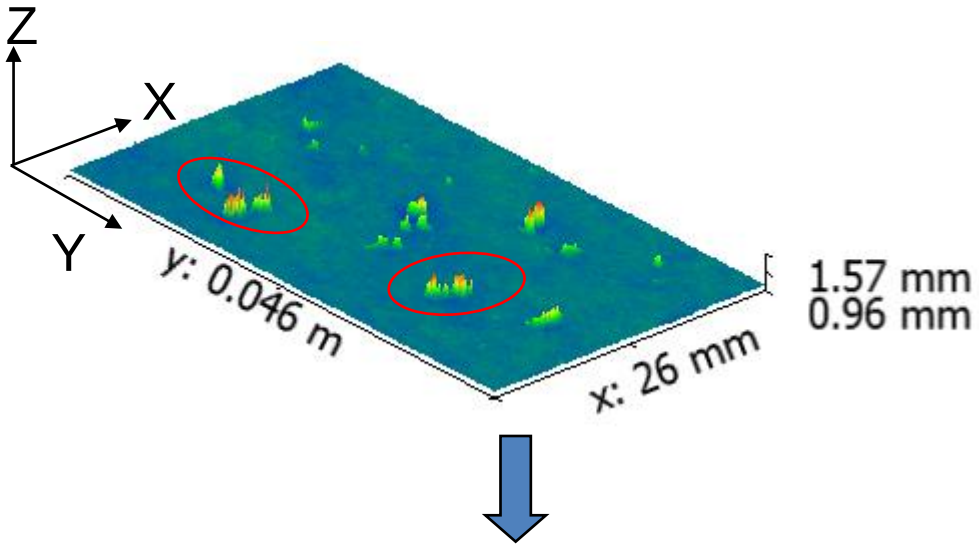
Methods

3D stickies morphology

Profile scan



Altitude map

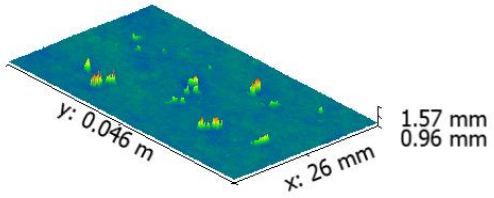


Extraction of contaminants morphology…

Resolution:

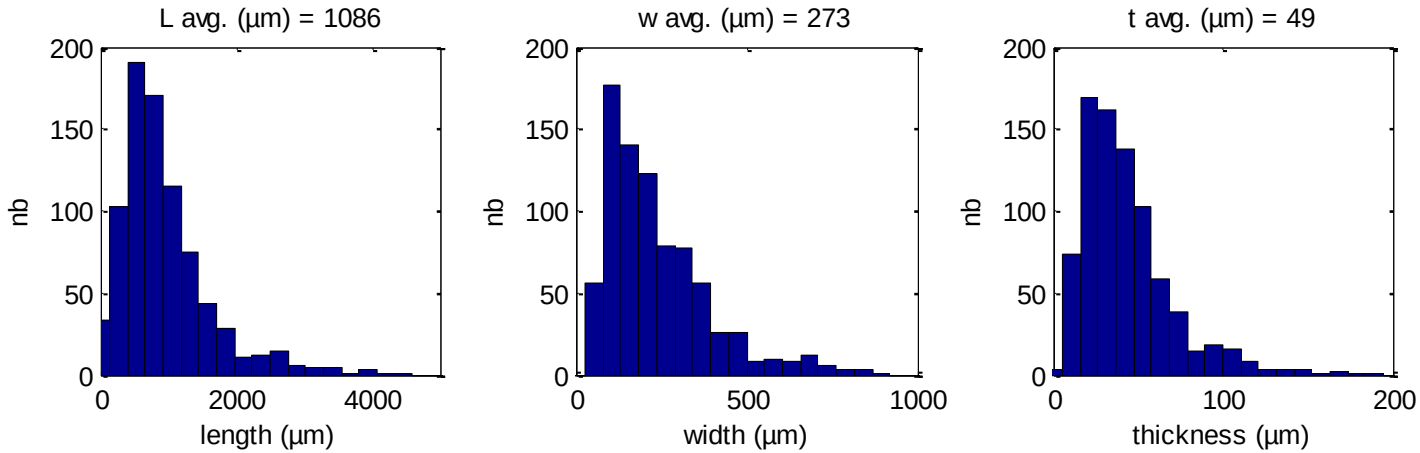
- dx= 20 µm
- dy= 20 µm
- dz= 3 µm

Results
Stickies 3D morphology

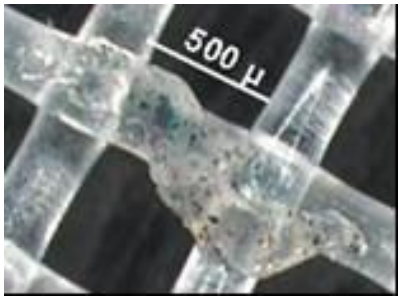


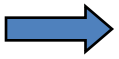
Industrial stickies ≈ 1100 x 250 x 50 µm^3

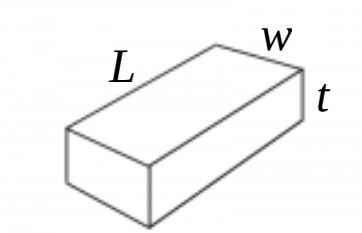
n=819 stickies



➔ stickies were characterised in their 3 dimensions

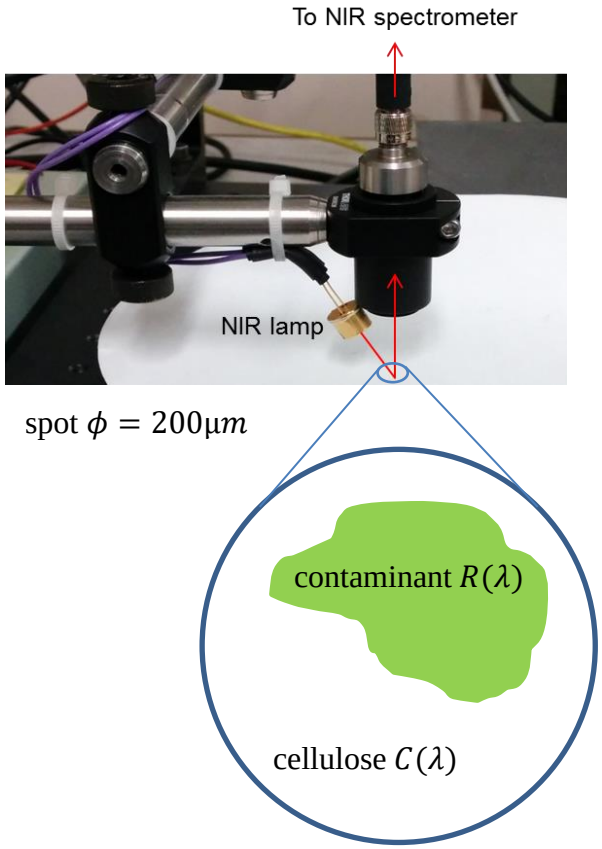






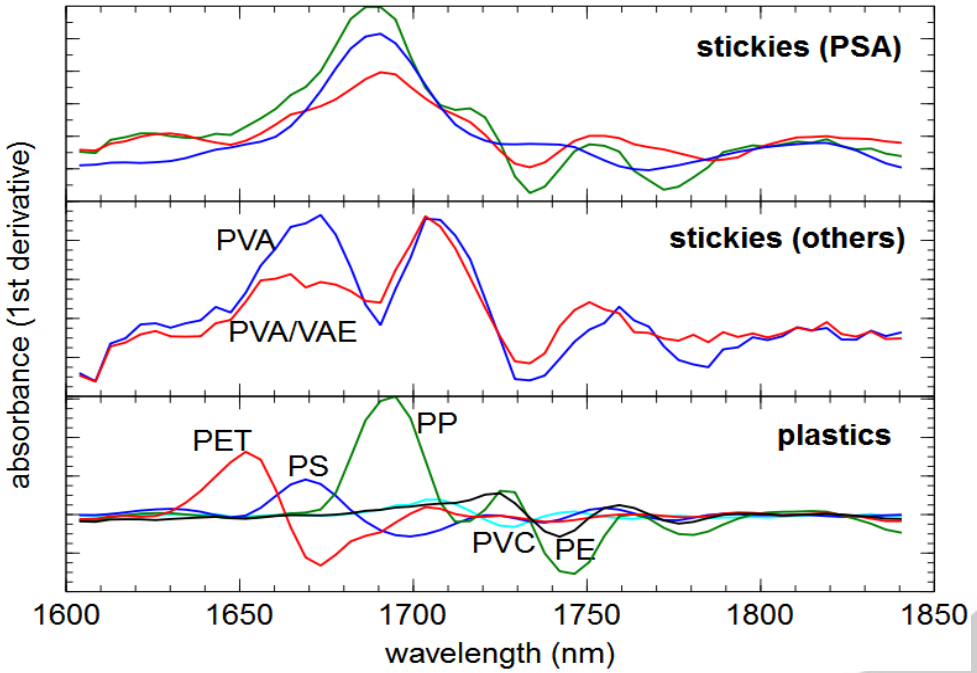
Methods
Classification of contaminants

- **Local NIRS analysis of contaminants deposited on filter paper**



$$X(\lambda) = w.R(\lambda) + (1 - w).C(\lambda)$$

Find *R* which correlates best with database references



Examples of industrial studies

centre technique du papier

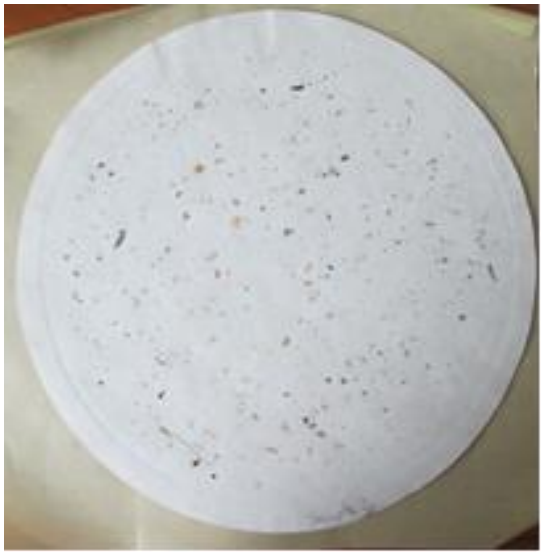
Methods
Mills A&B

- **Laboratory 3D-Stick measurements**
- **Objectives of the trials:**
  - Macro-contaminant measurements with the 3D-Stick
    - ✓Nature and morphologies of contaminants
    - ✓Quantification of the stickies contamination and comparison of raw materials
    - ✓Removal through the process
- **The mills sent us**
  - Screened contaminant of two different productions A and B
  - For production B, samples i) at the begining and ii) at the end of the process

Results
Mills A&B

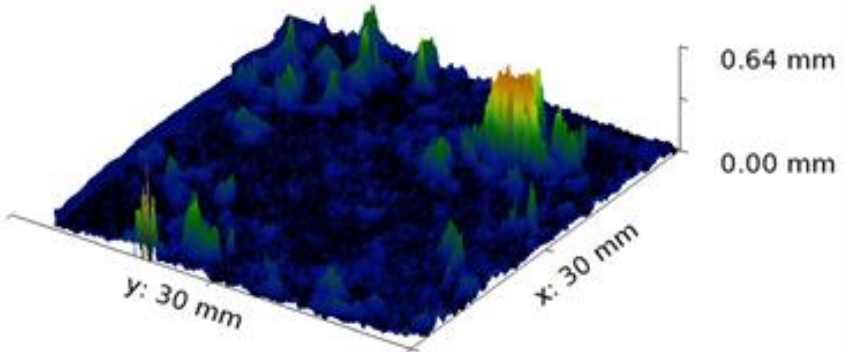
Step 1: Contaminants are deposited on a filter paper

Production A after pulping



Production B after pulping

Production B at the end of process



Results
Mills A&B

Step 2	Contamination in mm2/kg		
	Production A after pulping	Production B after pulping	Production B end of process
Stickies PSA	3556	135	72
Stickies others	15227	7151	62
Plastic	101	49	9
Total stickies	18783	7286	134

- **Different contamination with the 2 raw materials**
  - Production A much more contaminated
- **Separation of contaminant by nature**
  - Here Pressure Sentitive Adhesives (PSA) and non-PSA
  - Can be separated differently according the mill issue

Results
Mills A&B

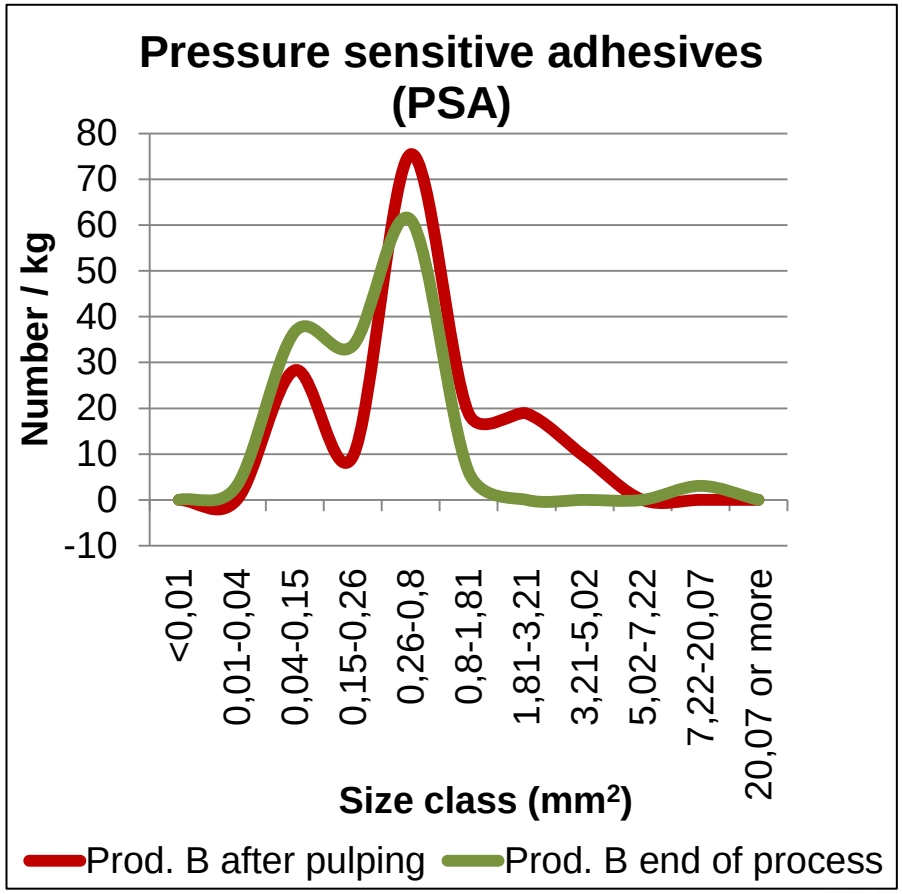
- **Removal efficiencies of stickies removal according to their type:**
  - Usually, the Pressure Sensisive Adhesives (PSA) are less efficiently removed than non–PSA glues
  - This was confirmed in the case of this production B:

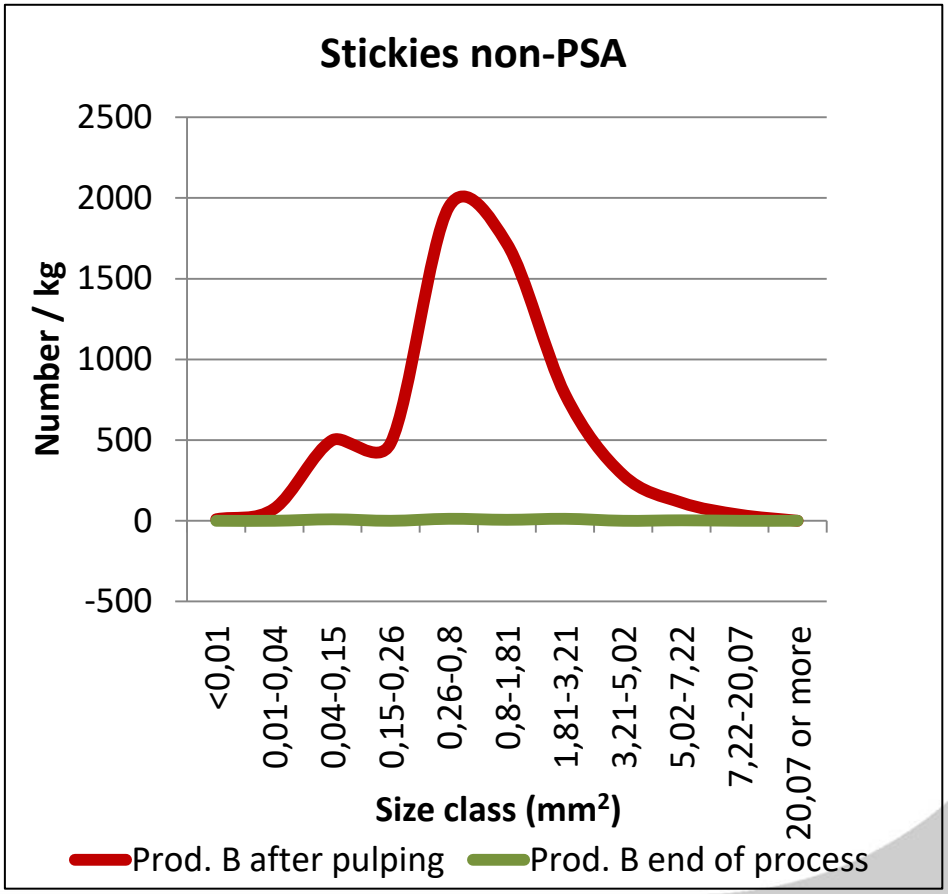
In production B grade

	Process removal efficiency (in % surf. area)
PSA	46 %
Other stickies	99 %

Results
Mills A&B

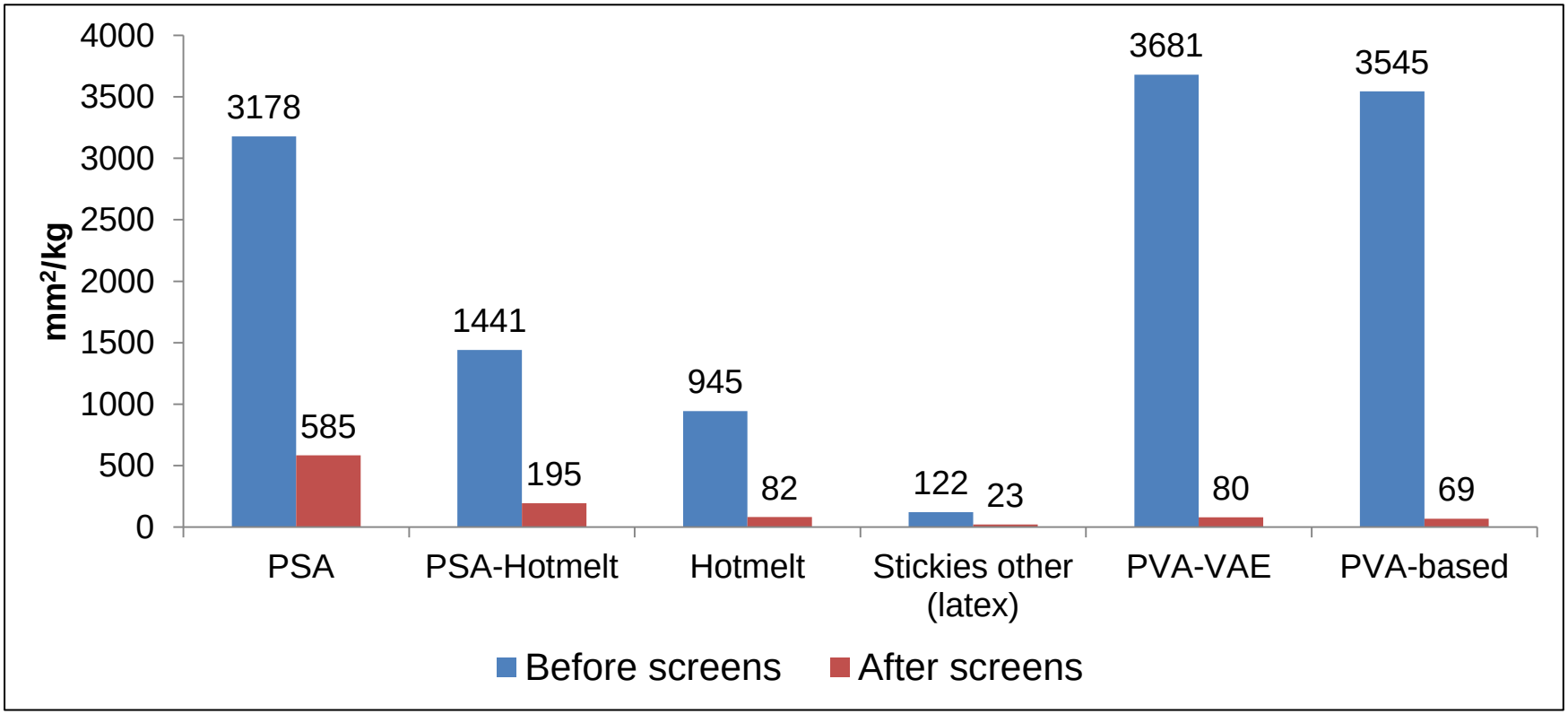
→ Stickies removal according to nature & size of contaminants. Good removal of non-PSA stickies.





Results

Screening efficiencies for stickies removal in Mill C



	PSA	PSA-Hotmelt	Hotmelt	Stickies other (latex)	PVA-VAE	PVA-based	Total stickies
% Removal in screens 1	82	86	91	81	98	98	92

Conclusion

- **A new laboratory sensor available:**
  - 3D-Morphology of contaminants
  - No deformation of particles
  - First discrimination on chemical nature of contaminants
    - » PSA acrylic,
    - » PSA Hotmelt
    - » PVA-based,
    - » VAE based
    - » Hotmelt
    - » New contaminants if required
  - Fully automated
  - Fast measurement (20 min for 300 objects)
  - Non-contact method (stickies are not pressed)
  - *(no black ink on your hands anymore…)*
  - Allows to:
    - ✓**Evaluate contamination modifications due to raw material changes**
    - ✓**Assess macro-contaminant removal efficiencies of each process steps**
    - ✓**Improve process controls for optimum stickies removal**

Perspectives

- Development of an online stickies measurement machine
  - Pulp sampler
  - +Automated screen
  - +3DStick sensor

  2 meas. per hour

  ➔*under development with Techpap*

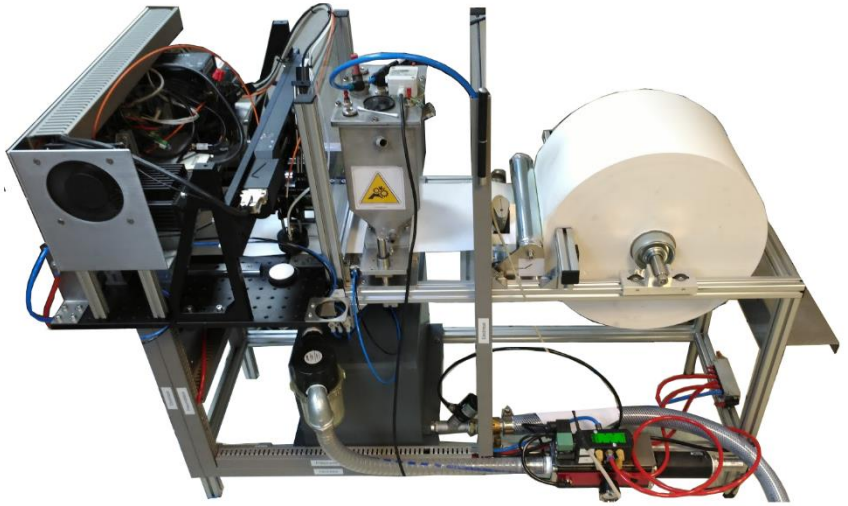
- On-line contamination follow-up
  - Identification of unacceptable raw material
  - On-line follow-up of stickies contamination at several process points
  - Toward a control/command of specific removal steps (screens reject, flotation rejects…)

General concept of the Automatic Pi-Stick Sensor

- The automatization of the 3D stick is made in 2 parts
  - Module Screening ➔*under development with CTP/Techpap*
  - Module 3DStick Auto Lab sensor

- *3DStick Auto Lab sensor* tested already in 2 mills
  - Automatic release of screen rejects on a continuous filter
  - Drying
  - Automatic 3D Scan + NIR scan

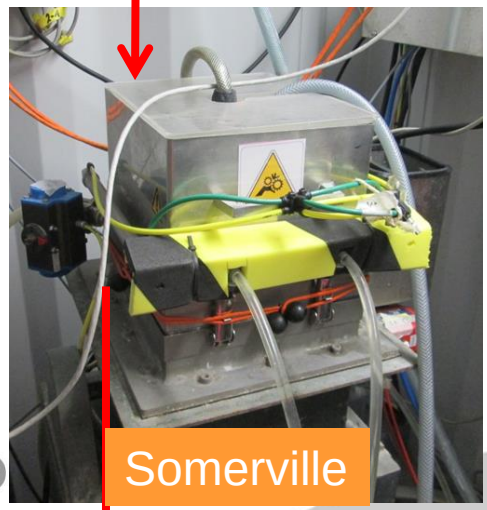
  (the module is set into a stainless steel cabinet)



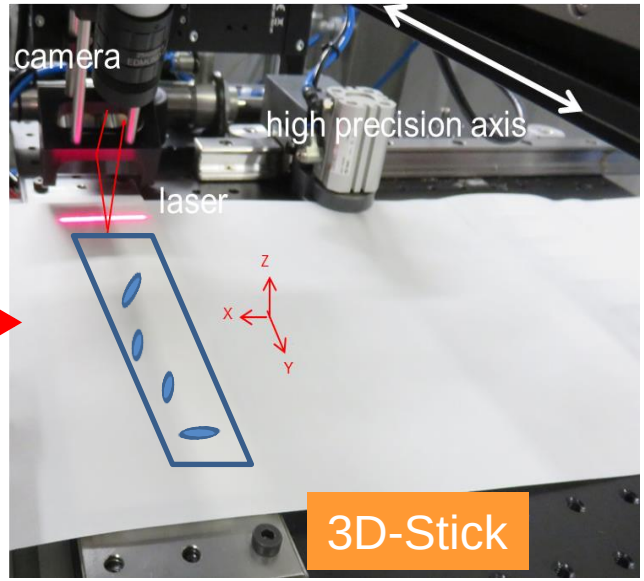
General concept of the Automatic Pi-Stick Sensor

Pulp from samplers

Consistency adjustment



Contaminants collection on filter paper



Contamination Analysis

Thank you for your attention !!

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