

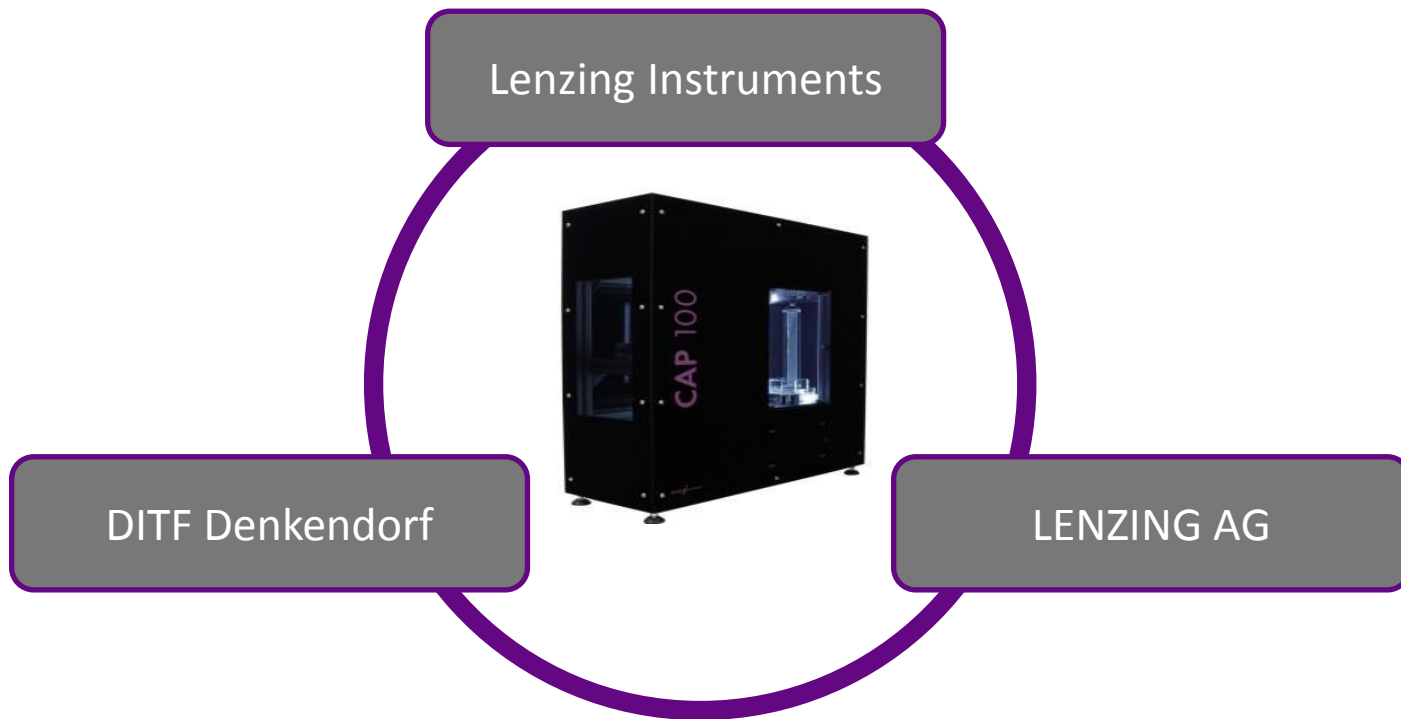
# New automated method for determination of wicking behavior in fabrics

**Ulrika Tropper<sup>1</sup>, Thomas Maier<sup>2</sup>**

**1. Lenzing Instruments GmbH & Co. KG**

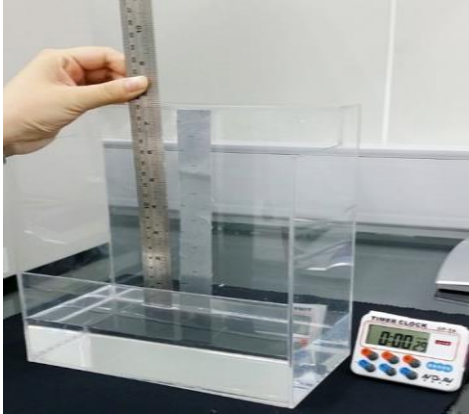
**2. LENZING AG**

# CAP 100 – CO-OPERATION



## LENZING INSTRUMENTS

- **Quality- and process control systems**
- **Staple fiber, nonwovens, synthetic filament**
- **Co-operations with industry and research institutes**
- **First products in the 60's**
- **Part of the Textechno group**



- Detailed analysis of fluid handling / capillary properties
- CAP 100 offers fully automated wicking test
- Wicking speed, Washburn constant, capillary flows
- Volume and speed of absorbed liquid
- For producers and converters of nonwoven and woven materials

# NONWOVENS QUALITY CONTROL

## LISTER AC/LC

Liquid strike-through time  
INDA/EDANA  
WSP 70.3



## WETBACK

Rewet properties  
INDA/EDANA  
WSP 80.3



## GE-TE-FLOW

Water permeability  
EN ISO 11058,  
ASTM D 4491



## SLOSH BOX

Disintegration  
INDA/EDANA  
FG 502

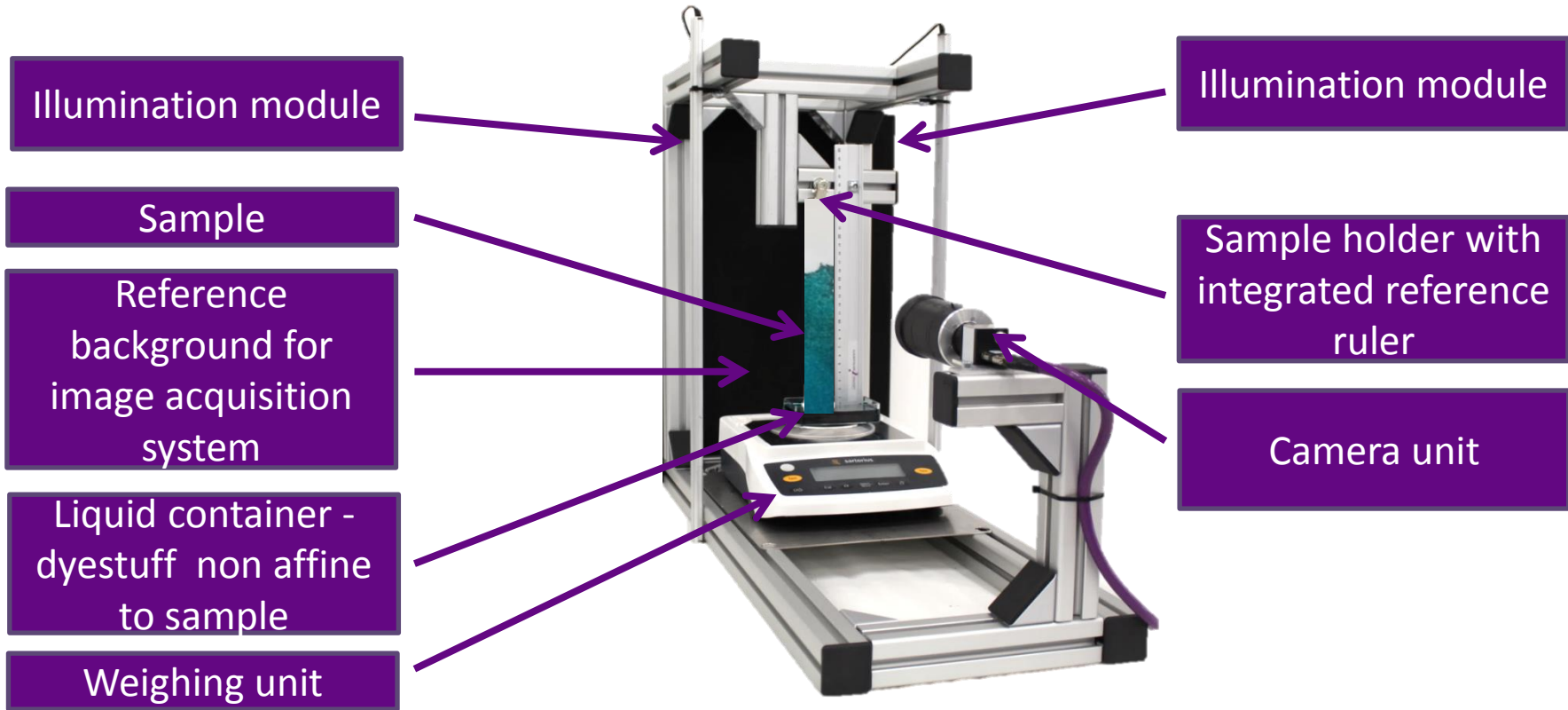


## FLUSH 100

Dissolvability  
INDA/EDANA  
FG 511.2



# CAP 100 – FUNCTIONAL PRINCIPLE



# CAP 100 – VERSIONS



## AUTOMATIC CAPILLARY RISE DETECTION AND LIQUID ABSORPTION MEASUREMENT

Model	SAMPLE HANDLING	NUMBER OF SAMPLES
ADVANCED	Automatic	1
INDUSTRIAL	Automatic	3

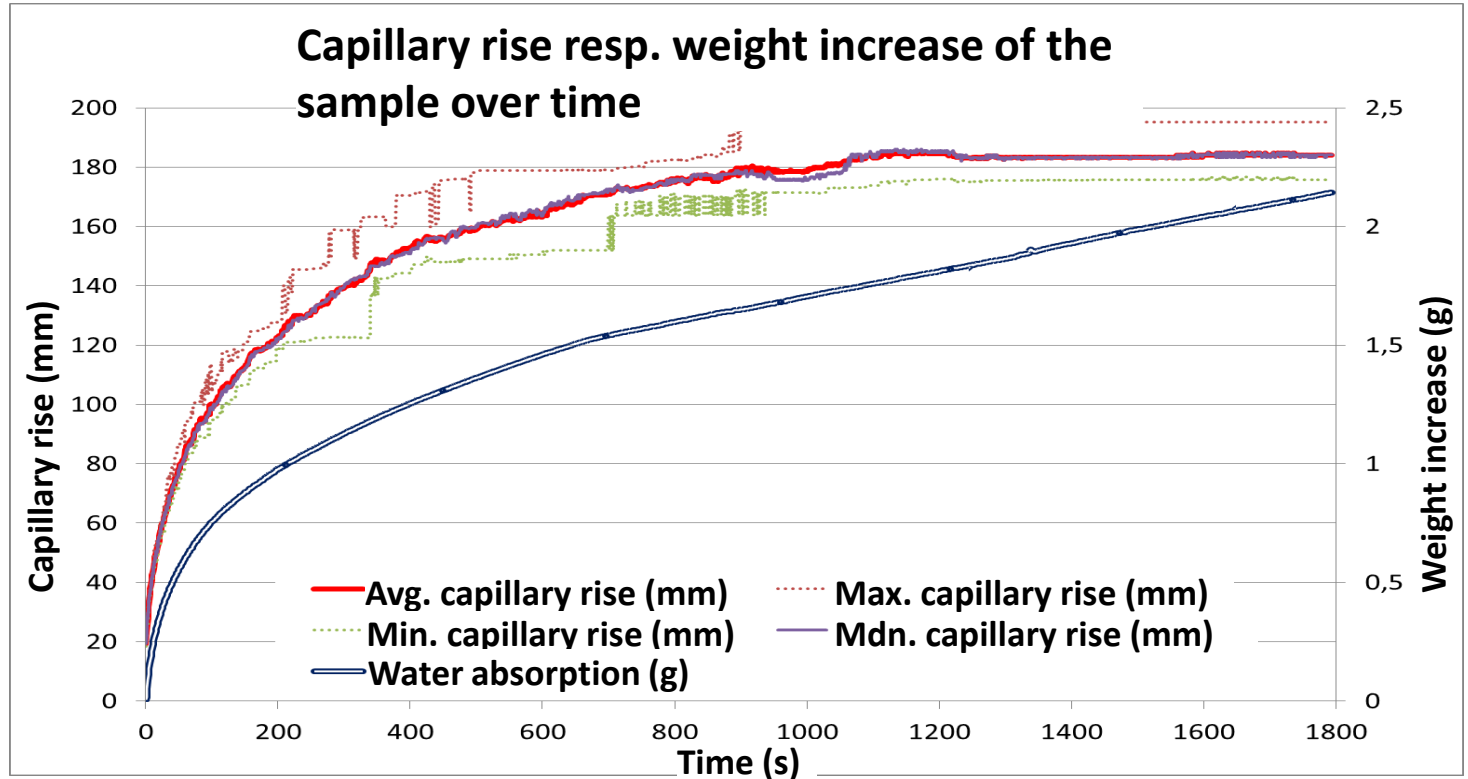
## AUTOMATIC CAPILLARY RISE DETECTION

Model	SAMPLE HANDLING	NUMBER OF SAMPLES
BASIC	Manual	1
AUTOMATIC	Automatic	1





# CAP 100 – INTERIM RESULTS



The Testing Company

# CAP 100 – MODEL BASED RESULTS

Interim results of CAP 100 with image processing

- Capillary rise over time:  $h_{\max}$ ,  $h_{\min}$ ,  $h_{\text{avg}}$ ,  $h_{\text{mdn}}$
- Absorbed liquid over time:  $m$  (g)



Identified model parameters by characterisation algorithm

- Capillary speed constant:  $v$  mm(s)
- Maximum liquid rise level:  $h_{\max}$  (mm)



Dependent parameters for product optimisation

- Absorbed liquid volume during specified time period
- Time needed for absorption of a certain liquid amount
- The Washburn capillary constant
- Time until 95% of the max. liquid rise is reached
- Wicking in the horizontal

**Thank you for your attention!**

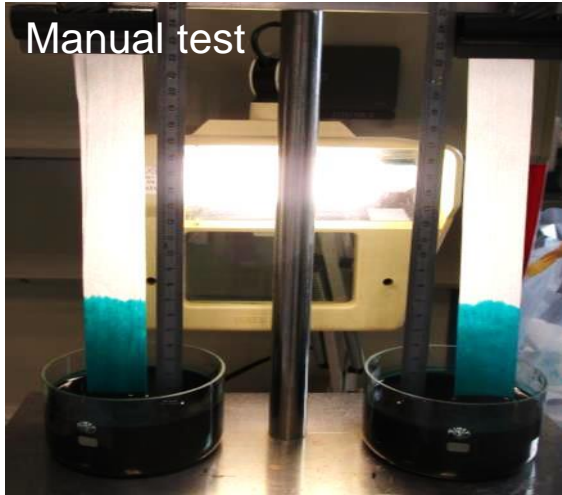
# CAP100 – First practical results

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Thomas Maier, Lukas Gaggl, Josef Innerlohinger

Mohammad Abu-Rous

# CAP100 versus manual test



## Manual test

### Liquid rises up

- Eye detection
- at 10, 30, 60 and 300 s

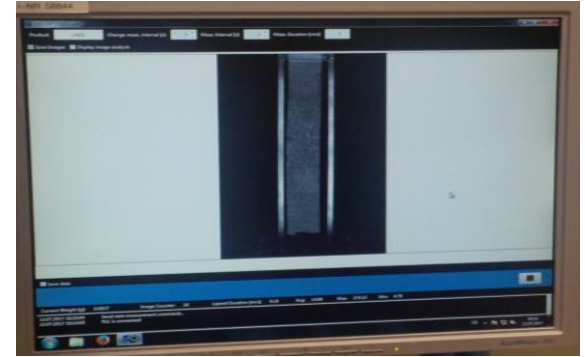


## CAP100

### Liquid rise up

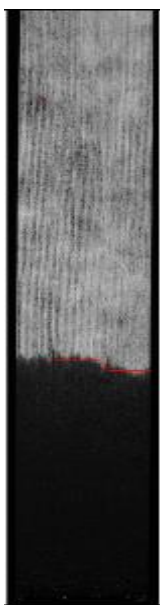
- Camera detection
- Continuous

+ **measures liquid uptake** (weight increase)

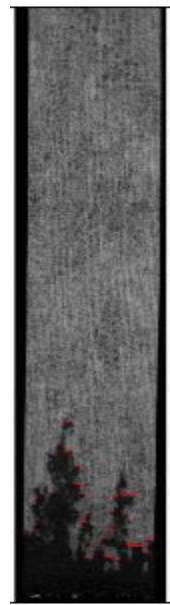


# CAP100 – camera advantages and limits

- Independent of operator
- At non-regular rise, CAP100 provides a more accurate height average
- For a very dark fabric, camera settings can be adjusted and provide a more accurate result than manual test
- Slight differences between eye and camera are due to:
  - Differences in the recognition of the start point
  - Irregularity and estimation/calculation of the mean height
  - Detection speed
  - Contrast recognition in the case of colored fabrics
- Limit: Fabrics with complex prints



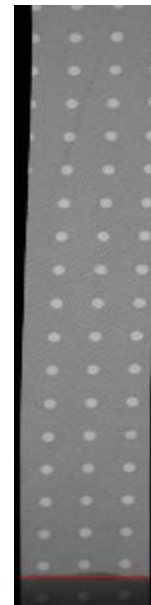
Even  
rise  
front



Uneven  
rise  
front



Black  
fabric

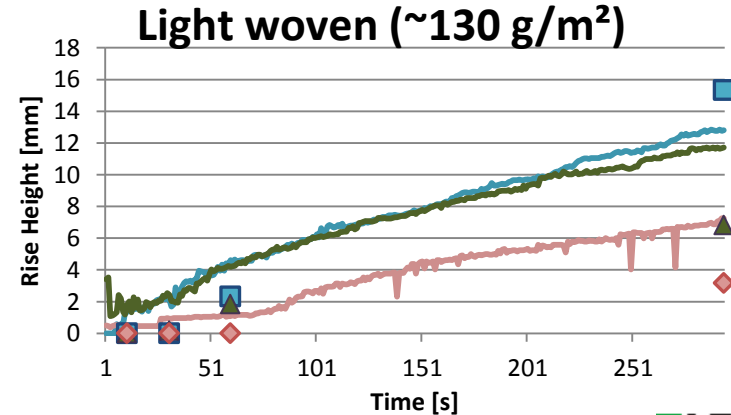
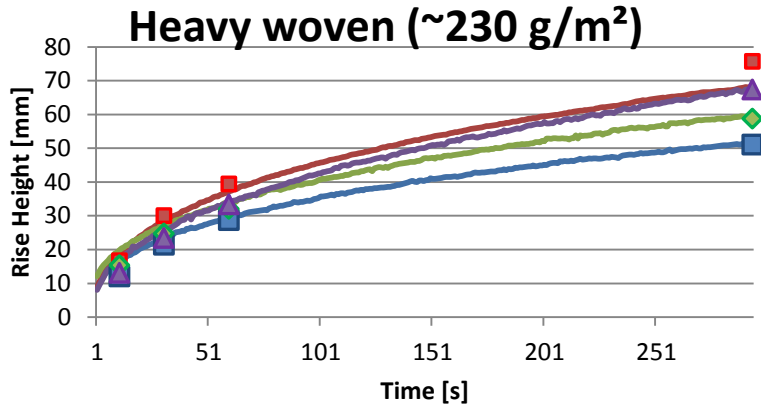
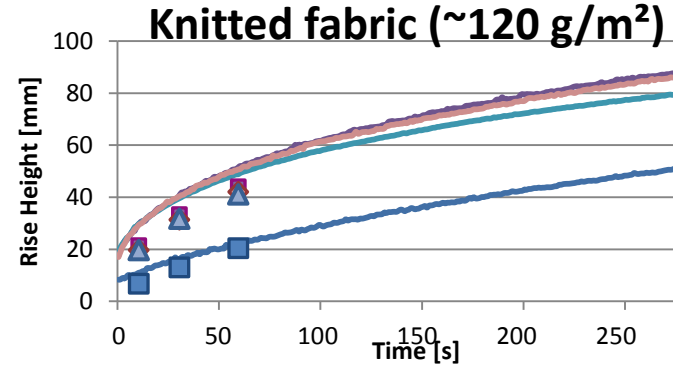
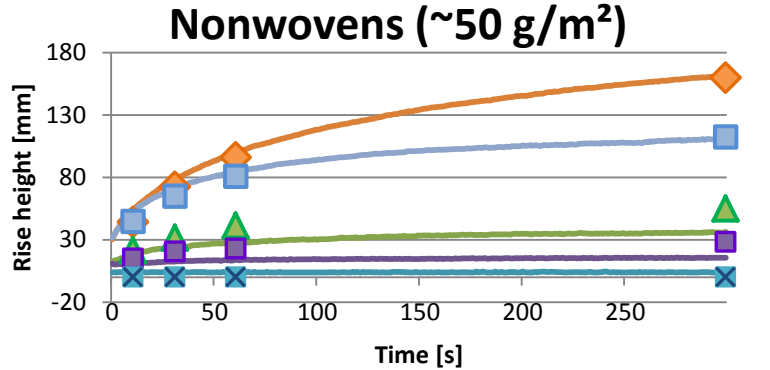


Light  
print

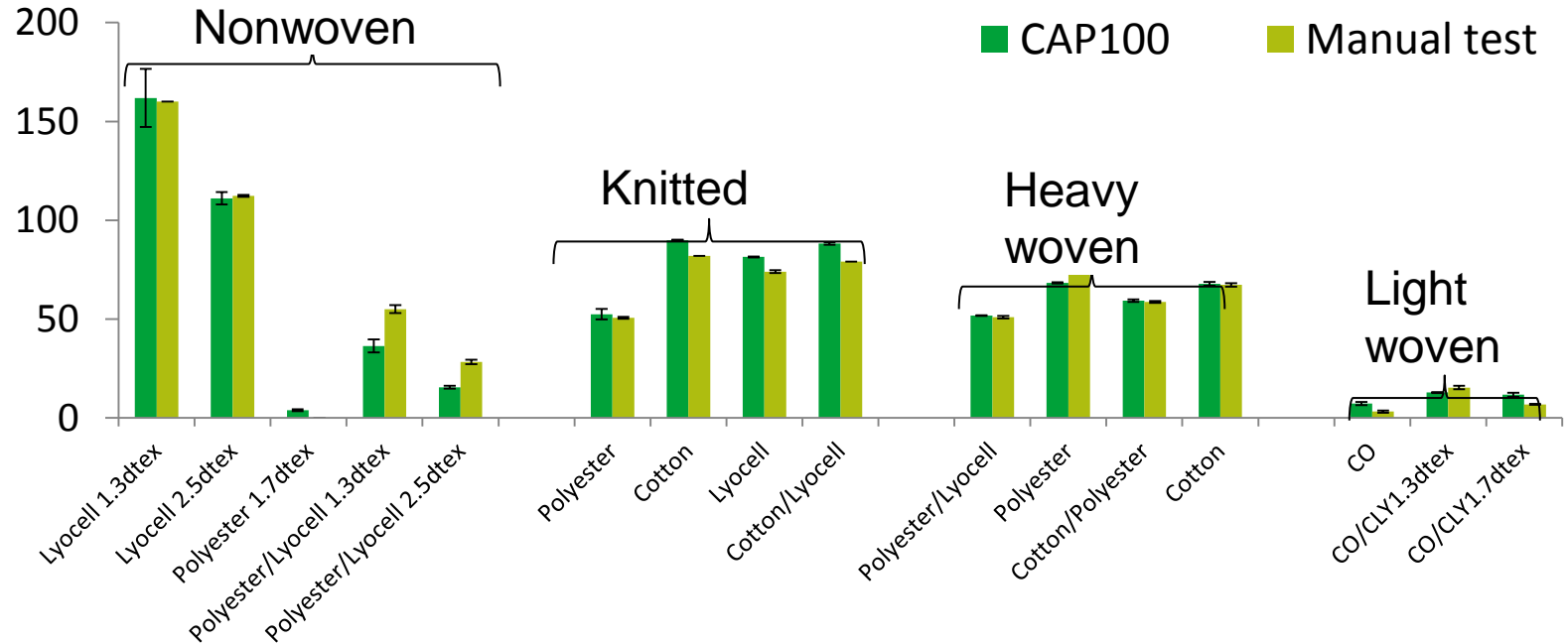


Dark  
complex  
print

# CAP100 versus manual rise height test



# Comparison of maximal height

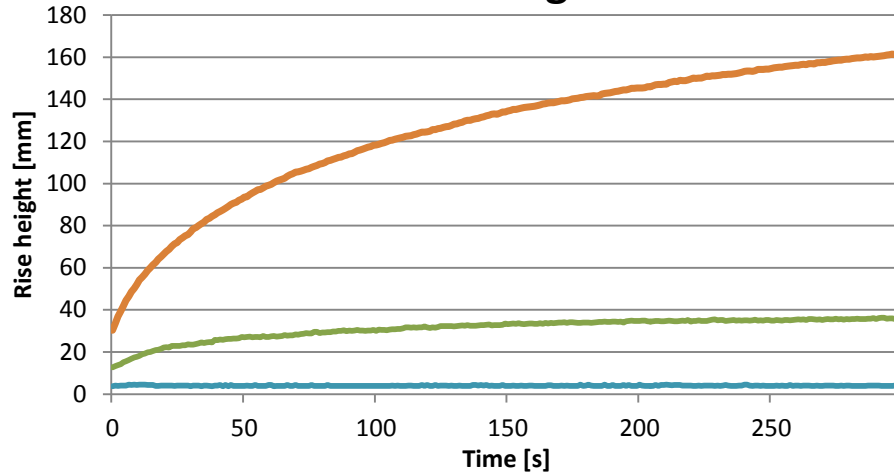


- Camera measurement provide same values as manual measurement
- Main difference between both test occurs in the first seconds => some divergence can be observed on low-absorbing fabrics

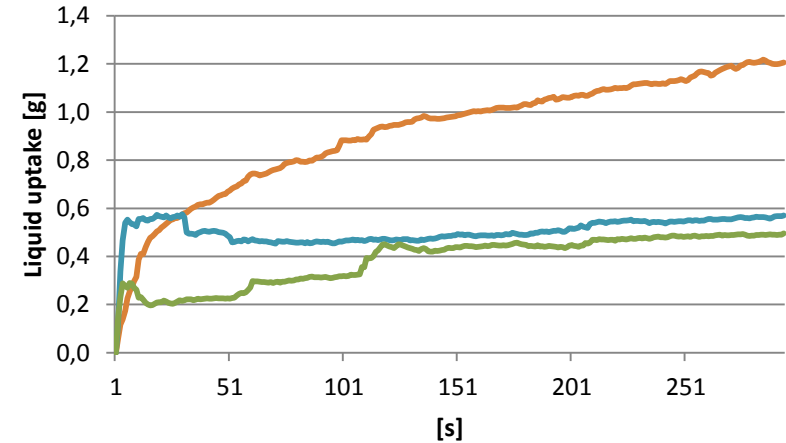


# Nonwovens - rise height versus liquid uptake

## Rise Height



## Liquid uptake

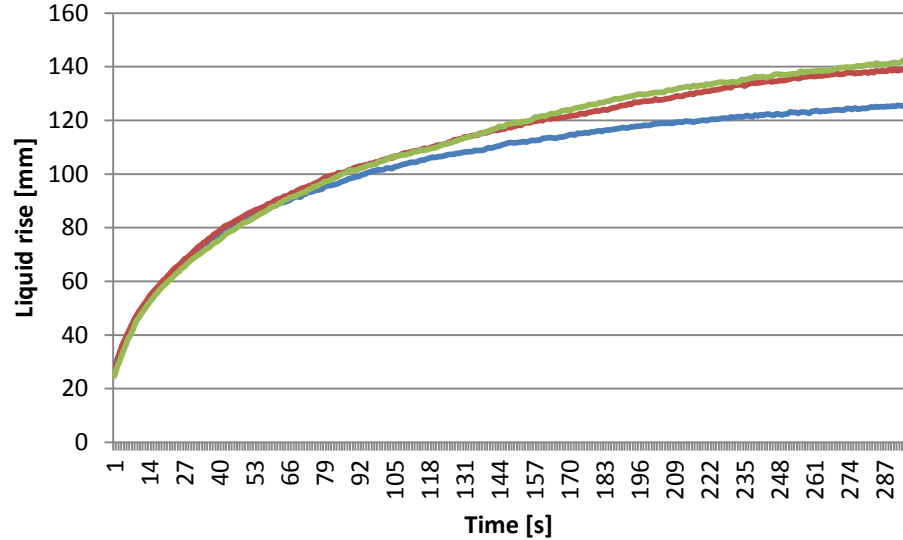


- Rise height values do not necessarily correlate with liquid up-take in the fabric
- CAP100 provides the possibility of simultaneously assessing liquid uptake and transport

— Lyocell 1.3dtex  
— Polyester 1.7dtex  
— Polyester/Lyocell 1.3dtex

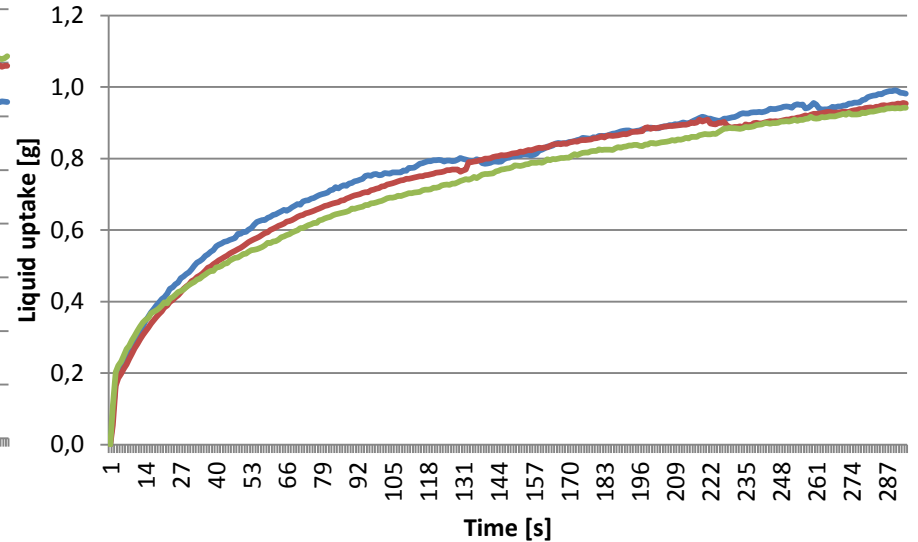
# Nonwovens: Spunlace-setting and its impact on liquid absorption behavior

## Height (CAP100)\_MD



[CLY 1,7] p1 [CLY 1,7] p2 [CLY 1,7] p3

## Weight (CAP100)\_MD

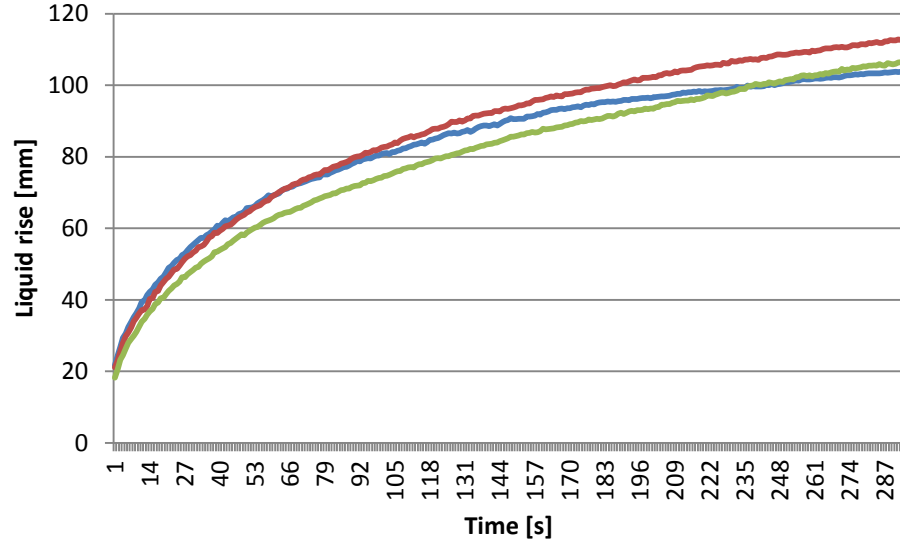


[CLY 1,7] p1 [CLY 1,7] p2 [CLY 1,7] p3

Applied water jet pressure:  $p1 < p2 < p3$

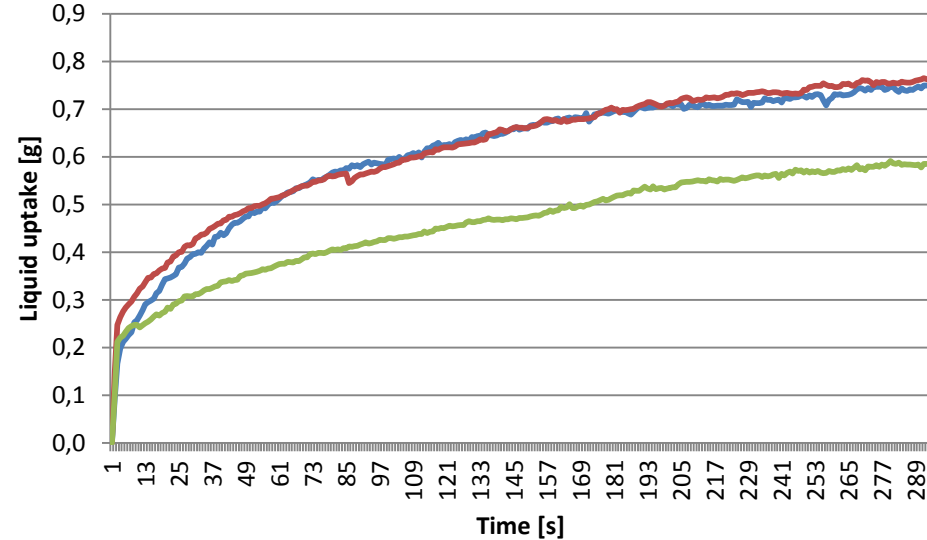
# Nonwovens: Differences in rising height and liquid uptake in nonwovens

## Height (CAP100)\_CD



— [CLY 1,7] p1    — [CLY 1,7] p2    — [CLY 1,7] p3

## Weight (CAP100)\_CD

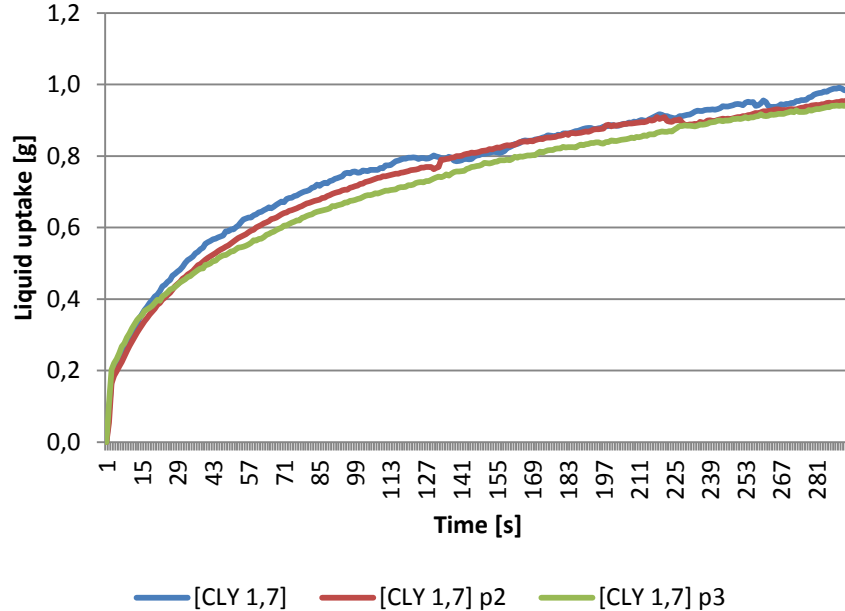


— [CLY 1,7] p1    — [CLY 1,7] p2    — [CLY 1,7] p3

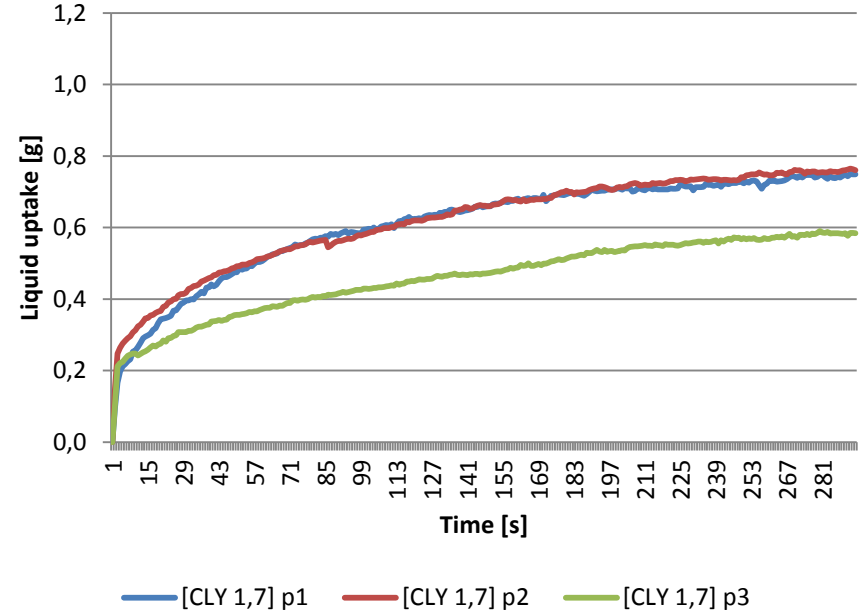
Applied water jet pressure:  $p1 < p2 < p3$

# Nonwovens: Differences in liquid uptake between MD and CD

## Weight (CAP100)\_MD



## Weight (CAP100)\_CD



Applied water jet pressure:  $p1 < p2 < p3$

# Conclusions

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- CAP100 rise height values reproduce the values from manual test.
- Possibility of contrast enhancement provides more accuracy than eye detection
- Camera detection can be irritated by color and pattern variation on the sample (printed fabrics, patterned NWs..)
- Uneven liquid uptake will be exactly averaged
- CAP 100 gives new insight in wicking behavior of Nonwovens
  - The spunlace setting has an impact on the ability of liquid absorption and influences the absorption in MD and CD which now can be seen.
  - Rise height and quantitative liquid uptake can show different trends and are complementary in assessing fabric wicking behavior.
  - First comparison on NW fabrics show a good correlation of calculated and measured wicking curve.

# Acknowledgement

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DITF

DEUTSCHE INSTITUTE FÜR  
TEXTIL+FASERFORSCHUNG

LENZING *i* NSTRUMENTS

**LENZING**

LEADING FIBER INNOVATION



Europäische Union Investitionen in Wachstum & Beschäftigung, Österreich.

# Thank you for your attention!

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