100%-coverage basis-weight scanning of nonwovens by M-Rays

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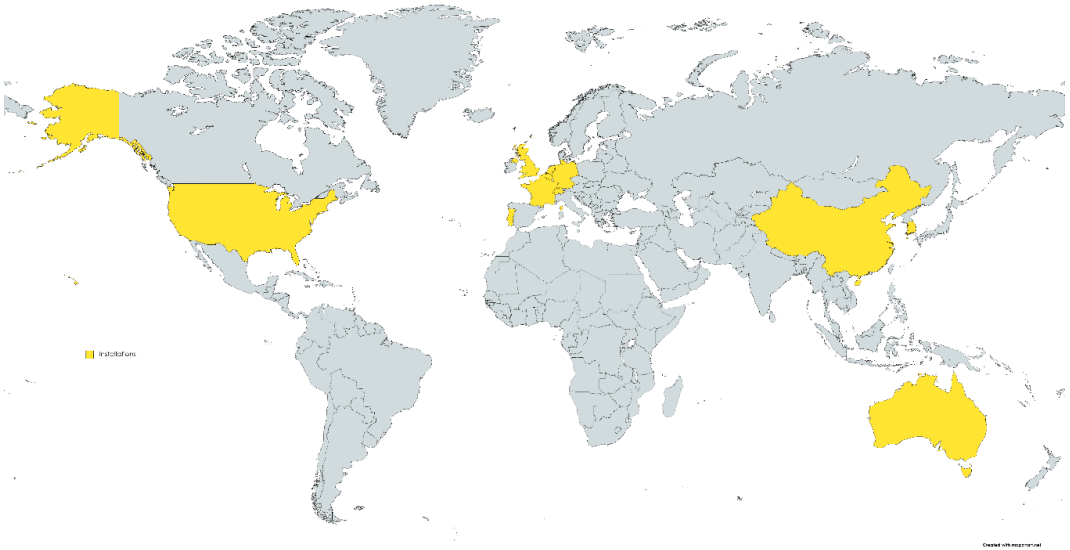
About us

- Development, installation and support for industrial quality control equipment
- Mainly for roll-to-roll processes such as textiles, nonwovens, plastics, steel and insulation
- 2016-founded spin-off of KU Leuven, now privately owned
- Applying unique technology from Faculty of Engineering Science, KU Leuven, Belgium
- HQ Located in Herk-de-Stad, Belgium
- 2020 VOKA Young Export Potential prize winner

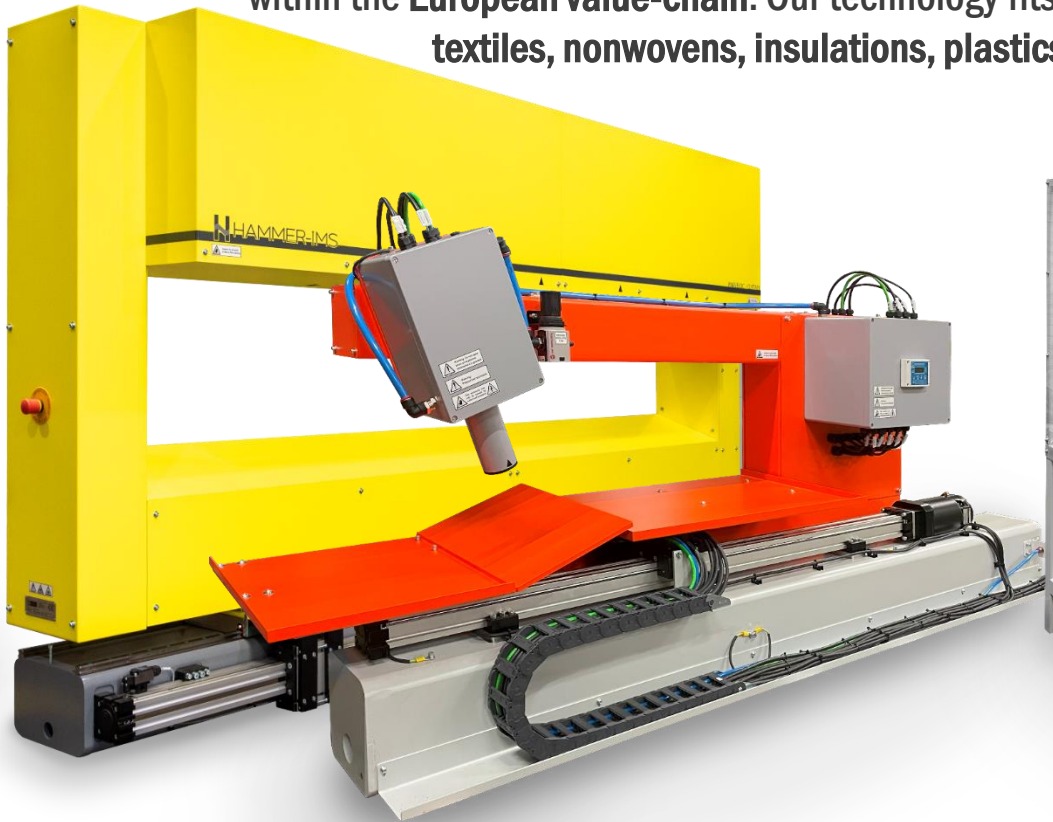
About us

- Projects in Belgium, The Netherlands, France, Germany, Switzerland, UK, China, USA, South-Korea and Australia
- Office in the USA in Duncan, SC



Products

We supply industrial material-scanners, camera-systems and lab-devices based for **industrial quality control**. The products we make are based on **sustainable** technologies (no harmful radiation!). Our main suppliers and sub-contractors are within the **European value-chain**. Our technology fits markets such as **textiles, nonwovens, insulations, plastics, batteries and metal**.



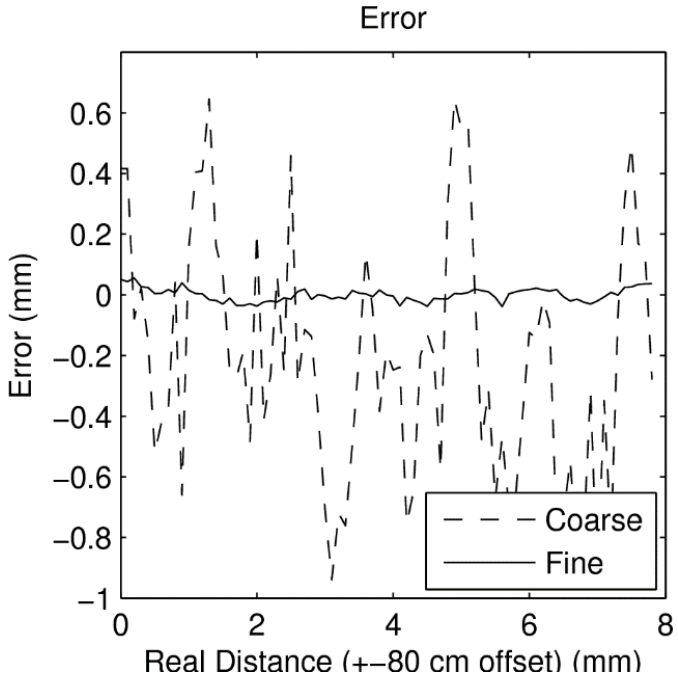
Topic

- Quality is about meeting (or even outperforming!) customer expectations
  - Every day
  - Every shipment
  - In each product
  - Year after year
- Companies target
  - Higher quality output & lower cost of quality
- Why?
  - Greater customer satisfaction
  - Higher productivity → higher revenue
  - Higher operational efficiency → higher profit
- Presentation title

100%-coverage basis-weight scanning of nonwovens by M-Rays

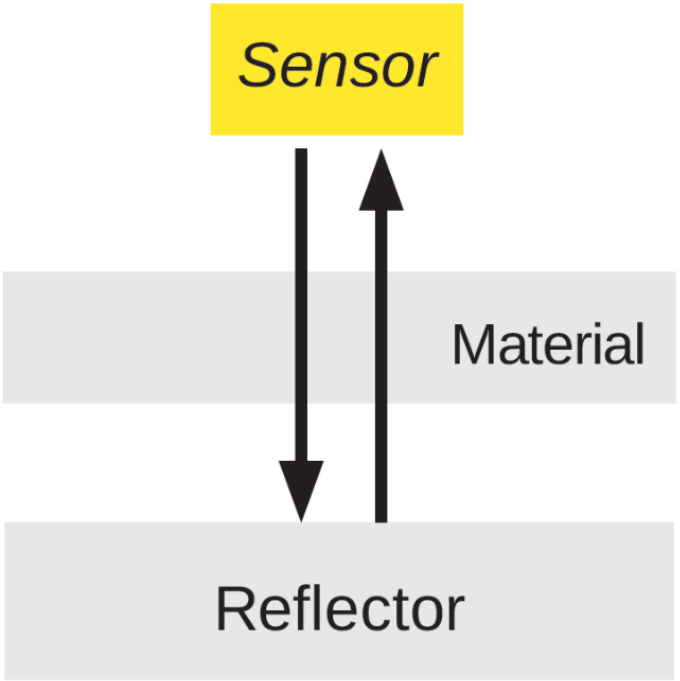
M-Rays


Startup Meeting
Ultra Fine Ranging + Built-in Imaging
Technical Insights/Feasibility/Discussion
Noël Deferm
Tom Redant
31/01/2013
mi as
ESAT
KATHOLIEKE UNIVERSITEIT
LEUVEN


Error
Error (mm)
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
0
2
4
6
8
Real Distance (+−80 cm offset) (mm)
Coarse
Fine

M-Rays

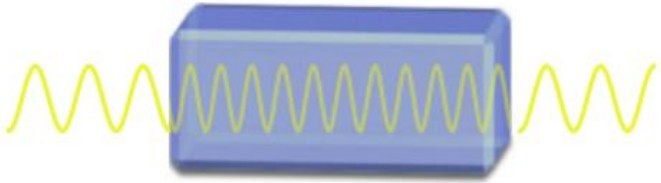
- Transmitted M-Rays go through the material
- A reflector bounces them back
- We calculate how long it takes for the waves to reach the sensor again



How does it work?

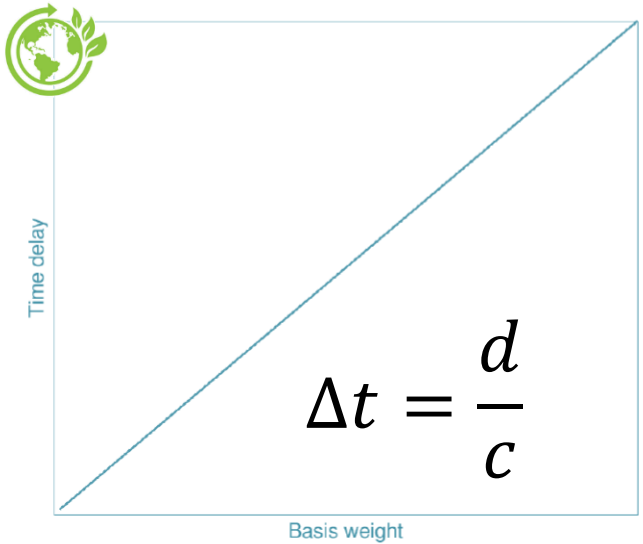
air:
v = 299.792.458 m/s

Glass fibers:
v = 142.758.313 m/s*

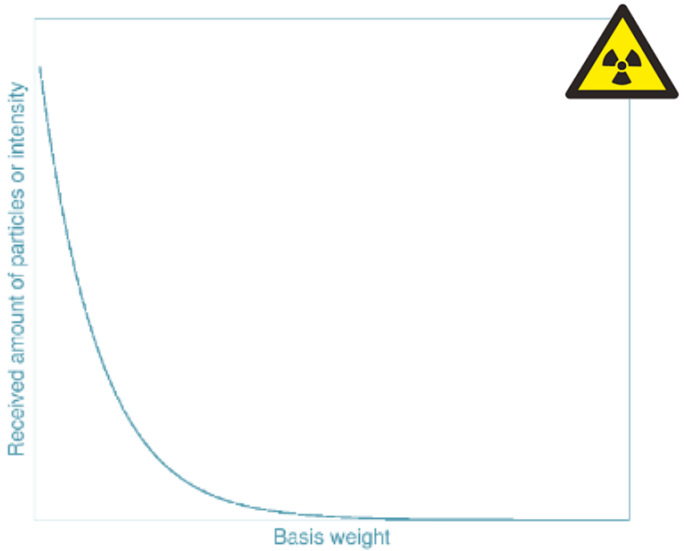


***speed** and wavelength of M-Rays are reduced – frequency unchanged*

How does it work?

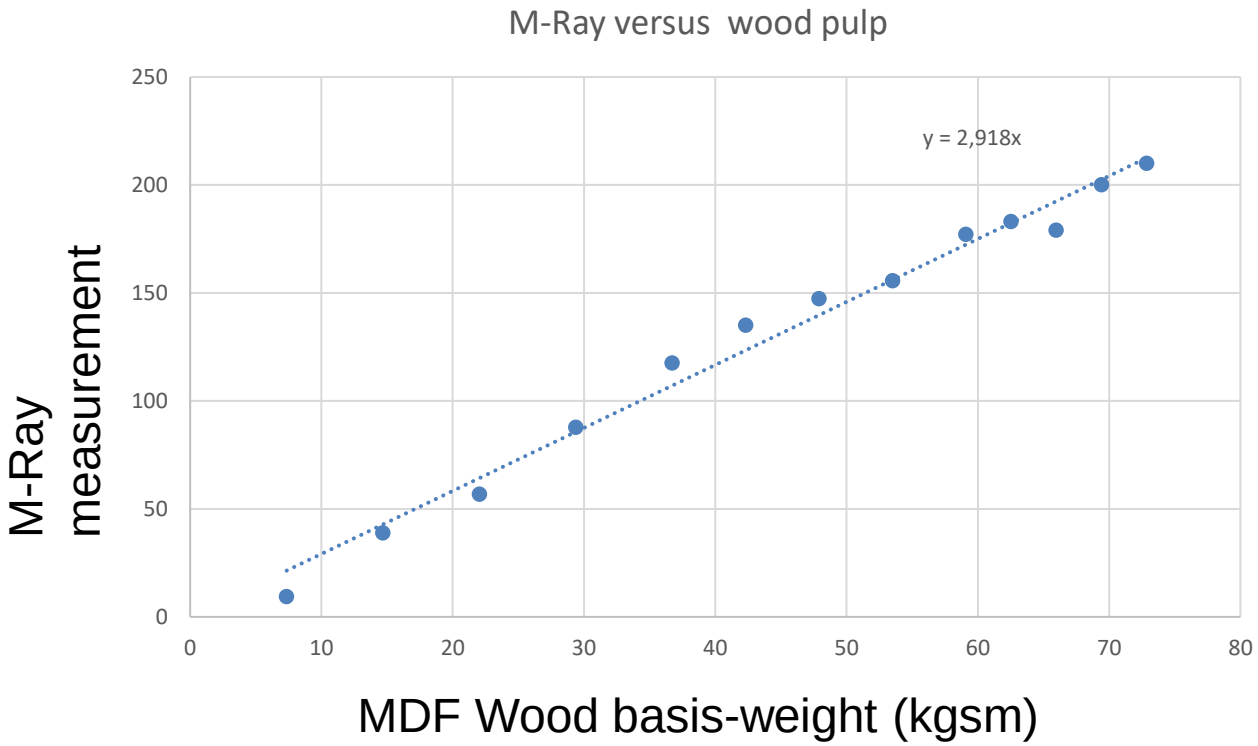


Δt: wave time delay
c: speed of electromagnetic waves
d: amount of material (g/m²)



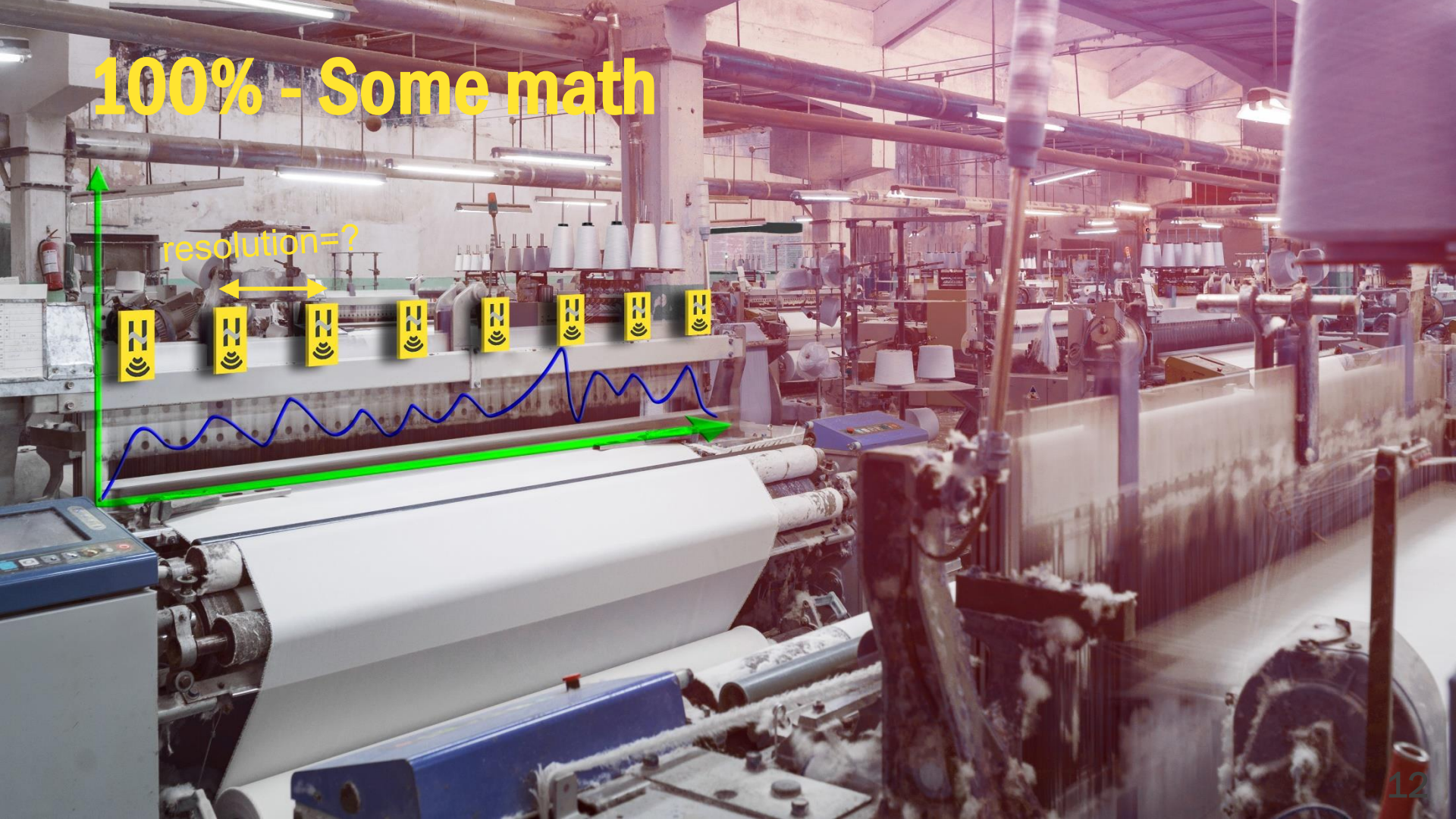
amount of particles after traveling through the material

M-Rays penetration depth

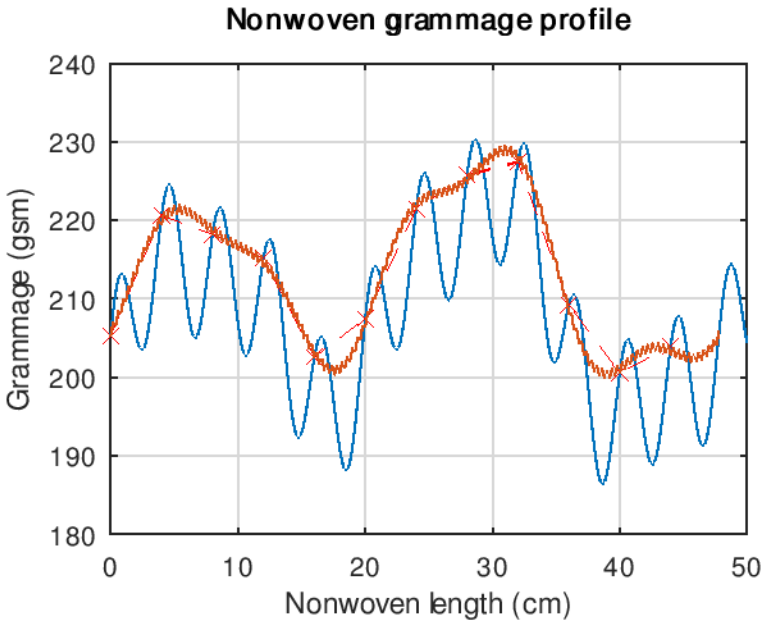



hammer

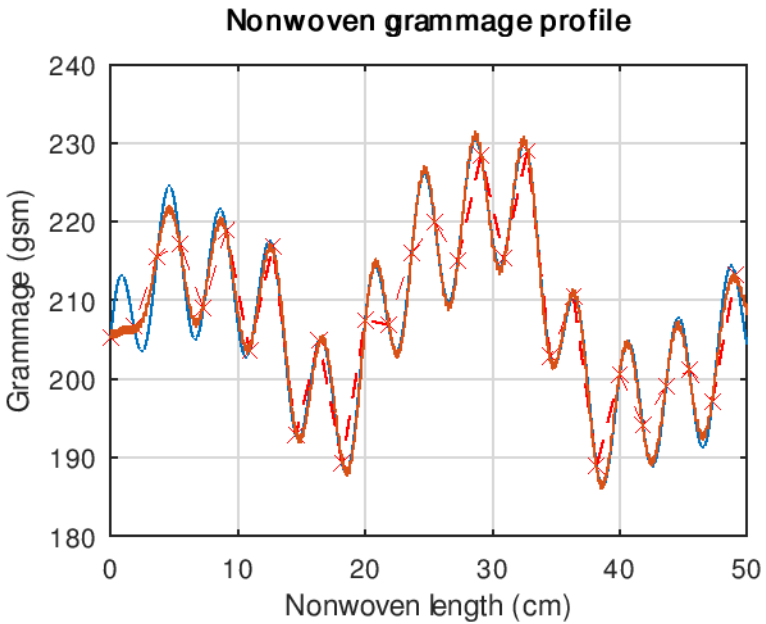
100% - Some math



100% - Some math



100% - Some math



$f_{sample} > 2 \cdot f_{max}$

Or alternatively:

resolution < Δxvariation / 2

For a Δxvariation of 10 cm, you will be fine with a resolution of 5 cm

For a web width of 1.5 m this would mean 30 measuring heads?

Choosing a resolution significantly better than the sensor's spot-size (≈ 2 cm) does not make any sense

100% - Some math and some scanning

[N · scanspeed] ≥ [webwidth · linespeed]/resolution

Numeric example:

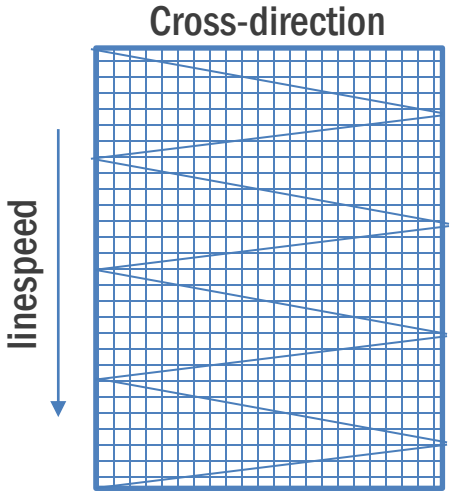
resolution = 2 cm (≈sensor's spot size)

linespeed = 1 m/min

webwidth = 1.5 m

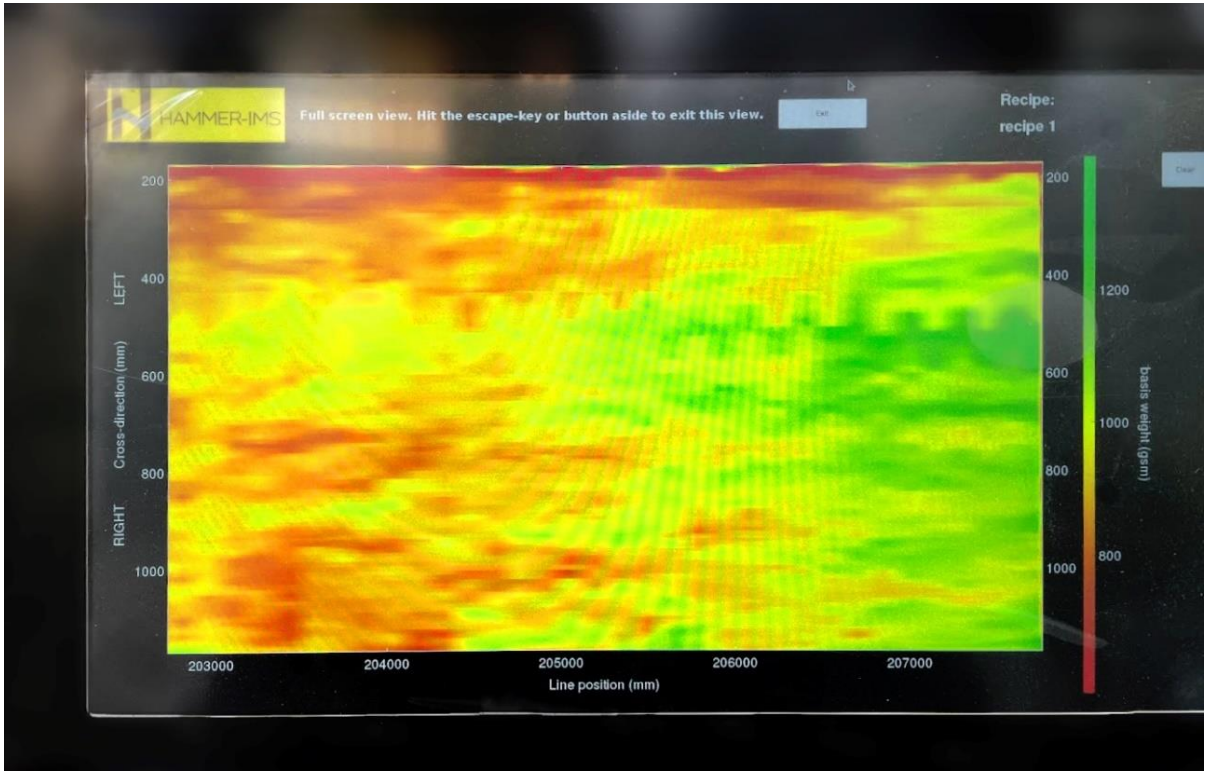
[N · scanspeed] ≥ 1250 mm/s

A 8-headed system (**N**=8) needs a **scanspeed** of 160 mm /s



Multiple sensors: N > 1

100 % visualization



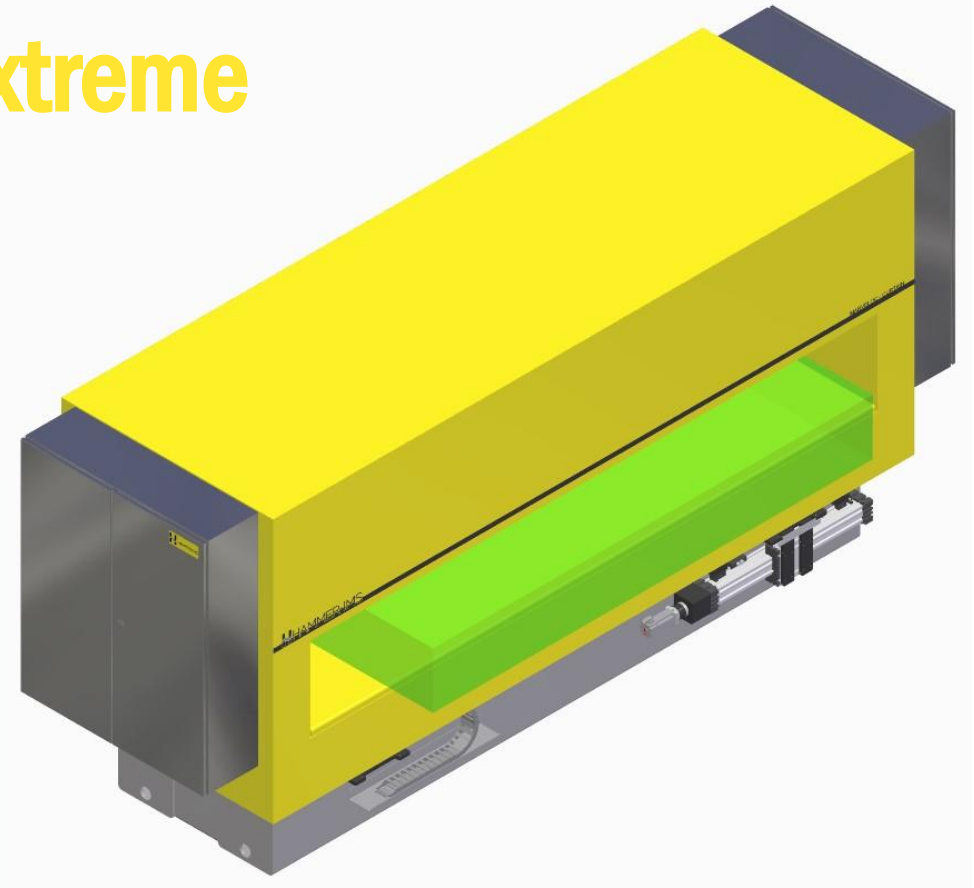
Multi-headed system in R&D center

- Technical Center Felting in Albstadt

Source: https://www.groz-beckert.com/en/news/newsletter/felting/2023/

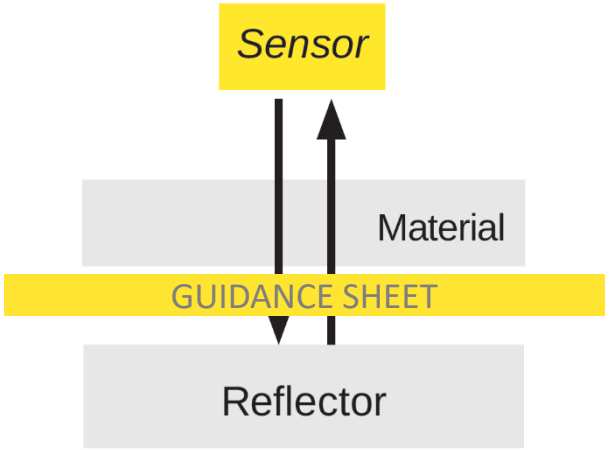
Multiple sensors - extreme

- Ongoing development

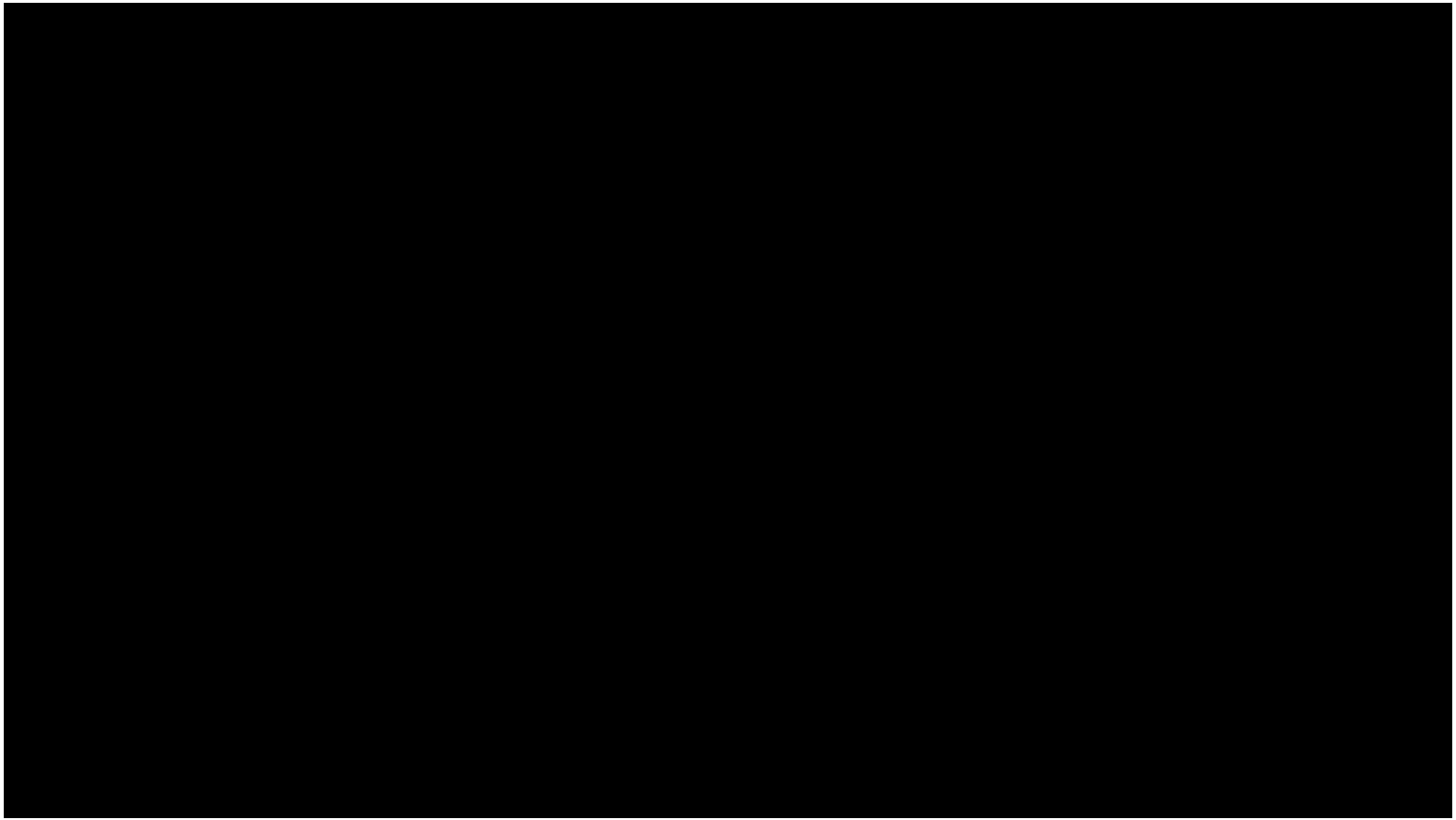


Multiple sensors - extreme

- Built-in material-handling needed
- By means of guidance sheet
- PTFE or glass fiber reinforced plastic
- Software waviness-compensation

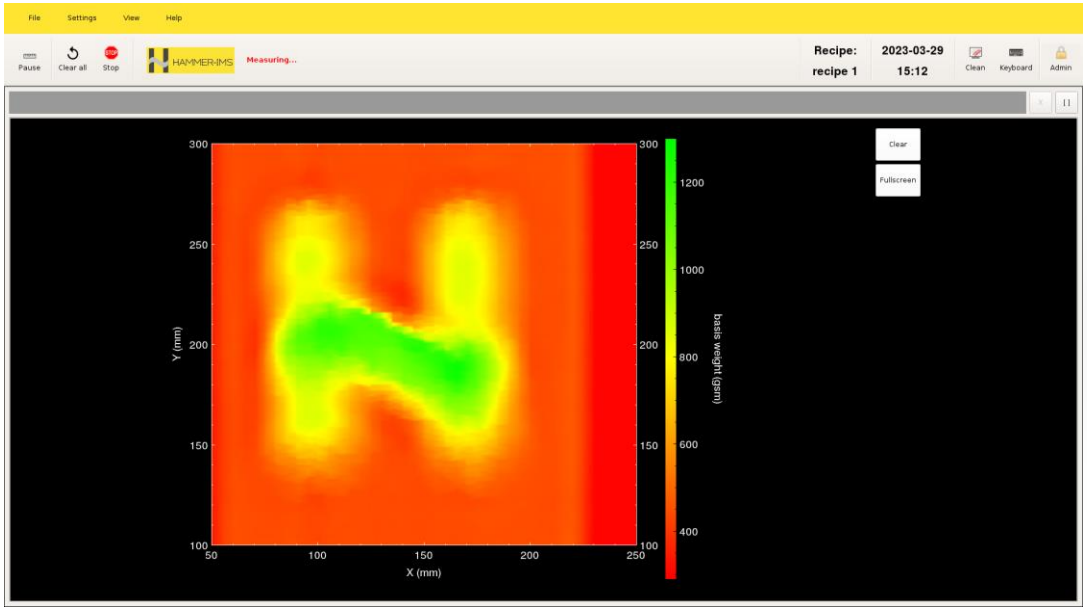


Fast-moving scanner

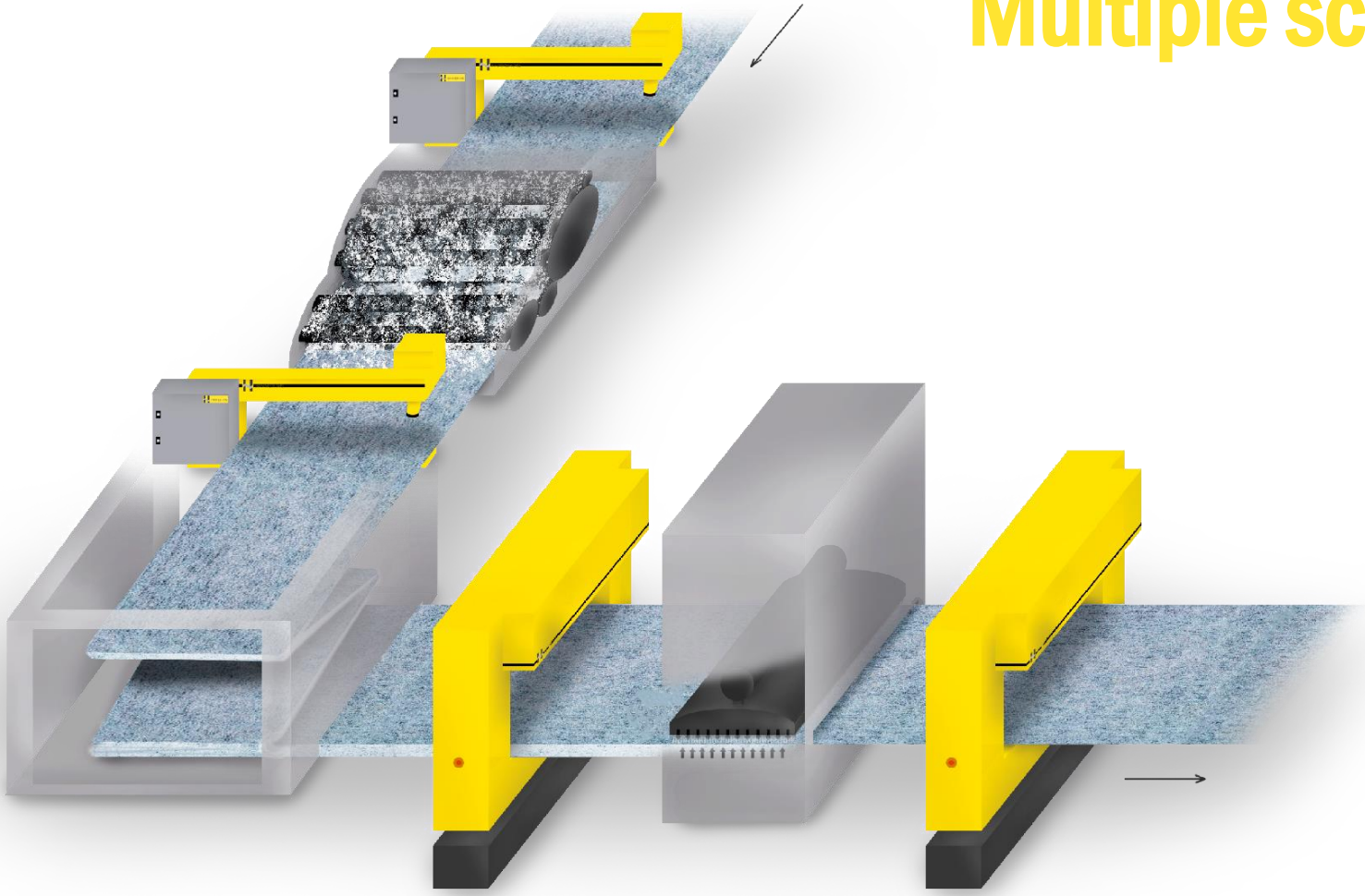


M-Ray 2D Scanner

- Slow scan
- Highly-detailed 100% view
- Demonstrated during the 2023 Hannover Messe



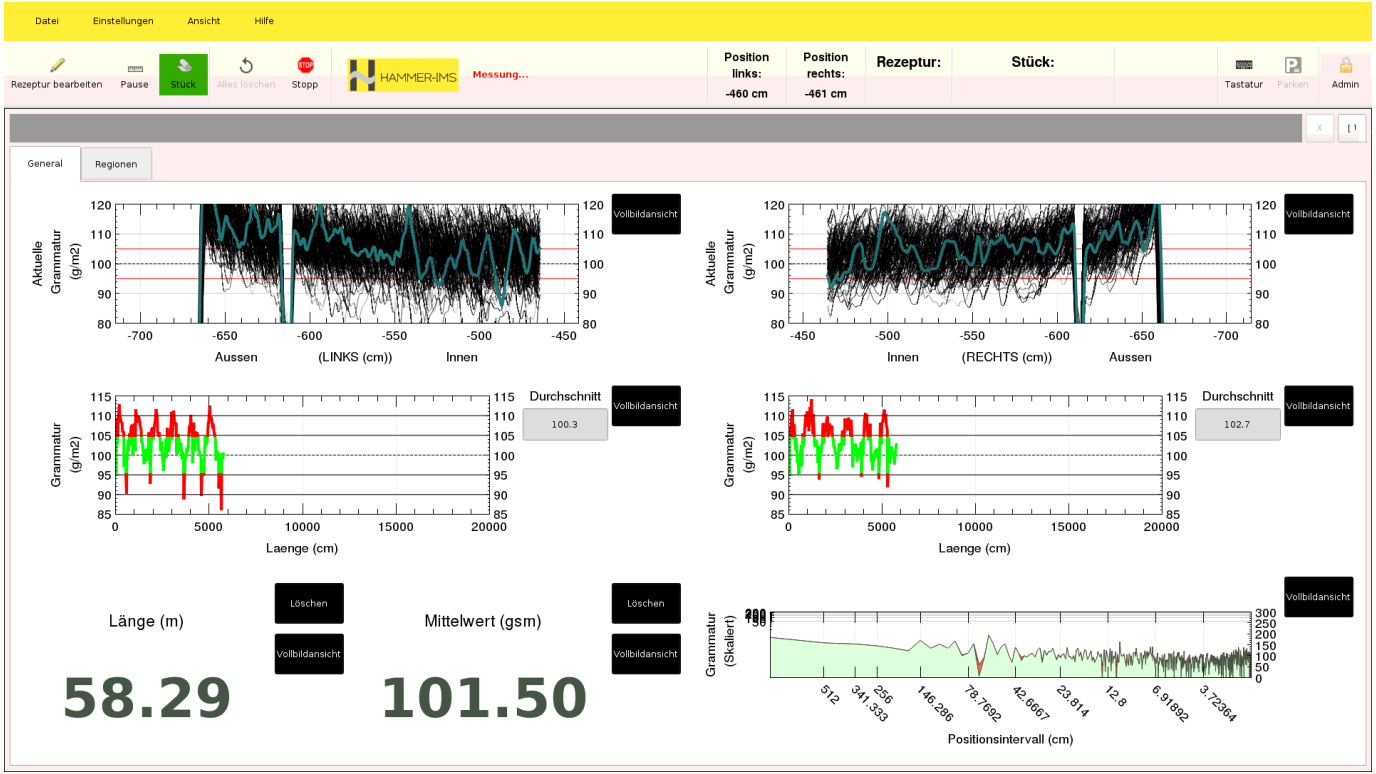
Multiple scanners



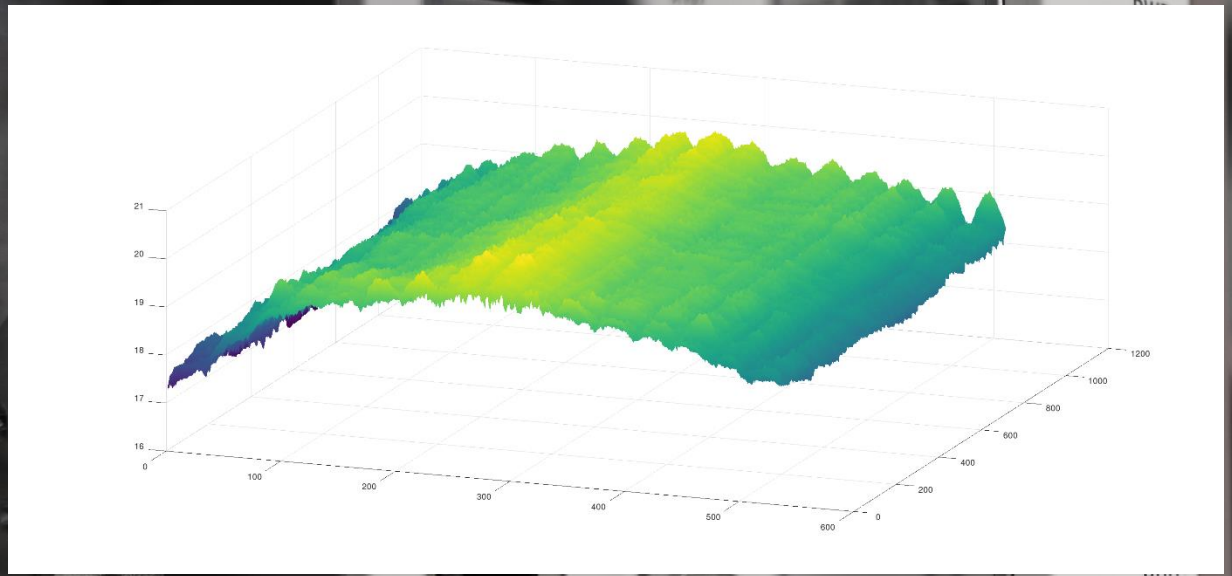
Multiple scanners in Olten, CH

Multiple scanners in Düren

Multiple scanners



Analysis: 100 % data logging and reporting



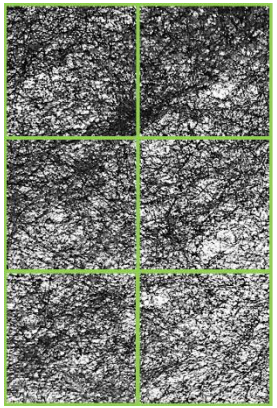
- USB data storage
- Modbus PLC integration
- PROFINET PLC integration
- OPC UA integration
- Trigger output for actuator
- FTP/SFTP file transfer for measured values and/or picture information

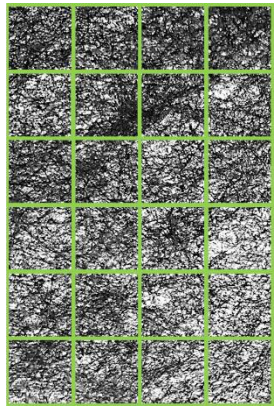
Analysis: frequency

- Interesting tool for analysis of recurring errors/deviations

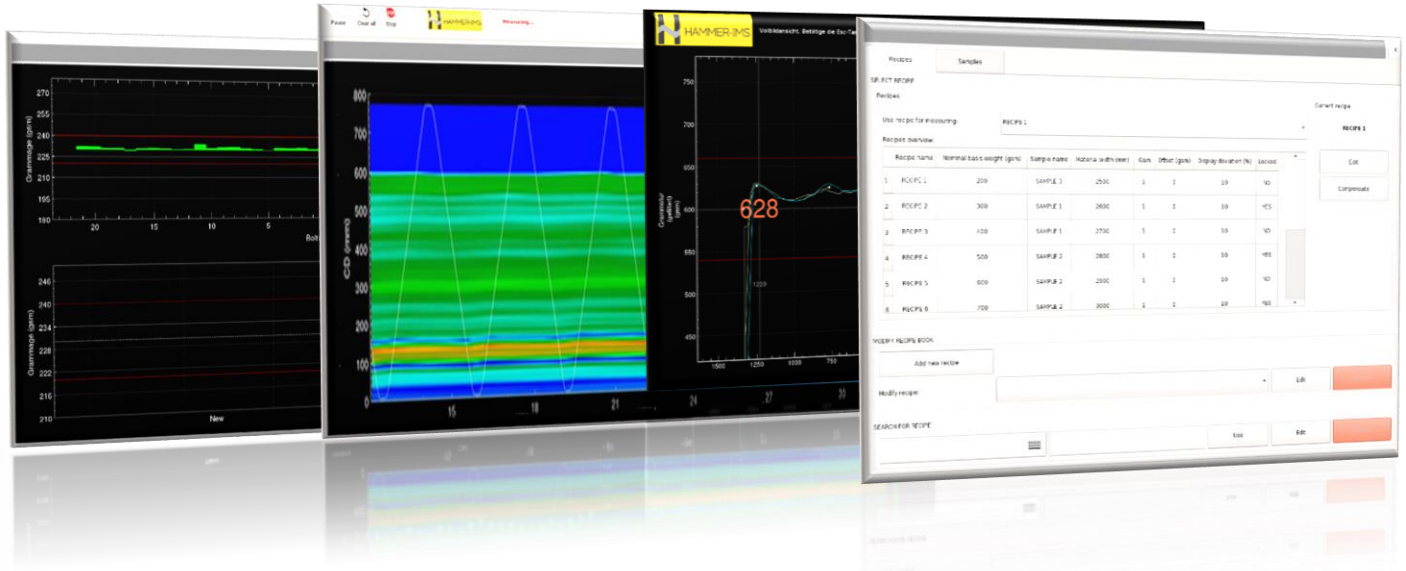
Analysis: quantitative uniformity metric

- Trying to push an industry standard for material uniformity based on scanner data
- Technique developed together with customer Autins Group (www.autins.com)
- Tests results obtained on the Autins Group's production line (polyester and polypropylene lofty nonwovens)
- To be published in Technical Textiles December 2023: "*Autins Group and Hammer-IMS Collaborate to Introduce a Novel Material Uniformity Assessment Technique Into The Nonwovens And Automotive Industries*" by dr. A. Memari et al.





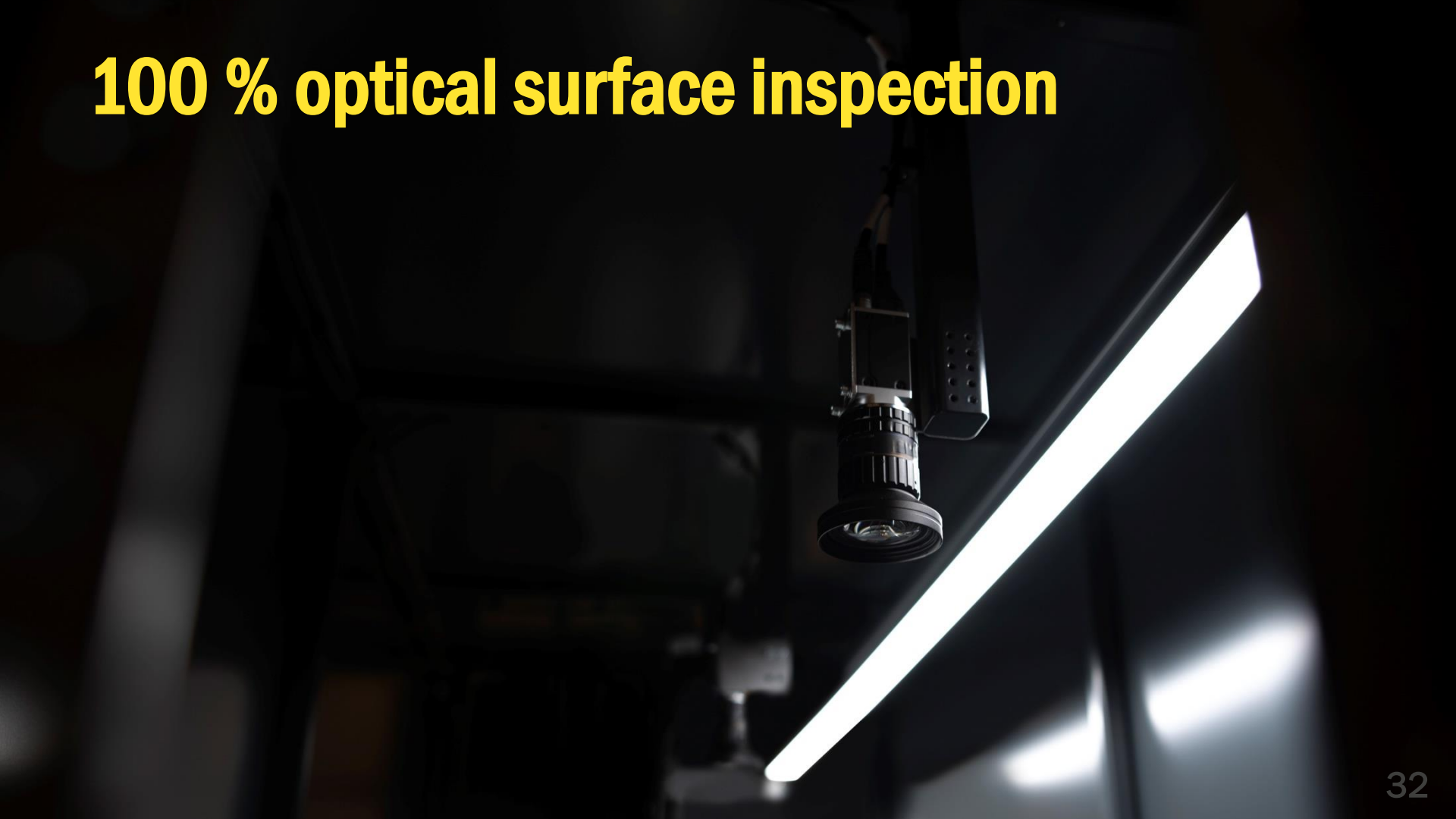
Software technology



100 % optical surface inspection

Edge-Vision-4.0-CURTAIN

100 % optical surface inspection



Conclusions

- 100% quality control by means of a sustainable technology
- Applying multiple sensor heads
- Applying fast-moving scanners
- Or a good optimum between those two
- Multiple scanners can be combined in a single software
- Color maps for intuitive visualization
- 100 % data storage
- Analysis tools available

Thanks for your attention. Now Q&A...

HAMMER-IMS