

Resource efficient application technologies: Efficiency and sustainability with sensors and controls from dyeing to drying

**Hochschule Hof – University of Applied Sciences
Webtalk at 1st International Textile Online Week
on July 16th, 2021**



Dr. Jürgen Thoms
PLEVA GmbH

Since 1969 | Family business. Values. Innovation.

Development and production of sensors and controls in Germany

Focus on systems for on-line controls and monitoring of industrial processes

Family-owned company with around 60 employees

Represented in all relevant industrial countries

Worldwide service bases



Our solutions for your process.

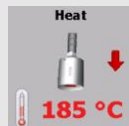


Camera systems for distortion analysis and pick/course density
Measurement, trending, analyses and control of it

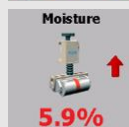


Sensors for dryers and ovens

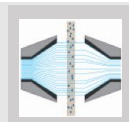
Measurement of fabric and air temperature inside of the dryer and control of machine speed



Measurement of exhaust humidity and control of exhaust volume (dryer ventilation speed)



Measurement of residual moisture and control of machine speed



Microwave measuring systems

for material moisture, coating, add-on, dye pick-up and size pick-up



Process visualization and control systems



High-tech automatic straightening in textile industry

MICROWAVE SYSTEMS FOR MOISTURE, ADD-ON AND COATING MEASUREMENT

AF 120 ONE-POINT MEASUREMENT

AF 310 THREE-POINT MEASUREMENT

MP 120 TRAVERSING MEASUREMENT

MEASUREMENT OF FABRIC TEMPERATURE, HUMIDITY AND RESIDUAL MOISTURE

FS SENSORS FOR HUMIDITY MEASUREMENT

TDS SENSORS FOR FABRIC TEMPERATURE MEASUREMENT

RR SENSORS FOR RESIDUAL MOISTURE MEASUREMENT

PROCESS OPTIMIZATION WITH PLEVATEC SYSTEMS

Microwave systems for moisture, add-on and coating measurement

Applications in textile finishing are mostly **water-based**

Minimal application processes e.g. **spraying units**, **kiss-roll devices** or **foam applicators** are very energy-efficient and save chemicals due to pick-up reduction (compared to e.g. padders from 70% to 40% or even less)

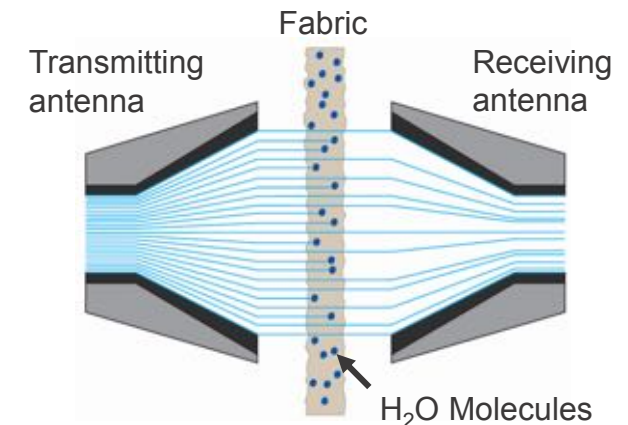
To ensure a constant, high quality it is **necessary to measure and control the minimal application**

Our solution:

Contact-free microwave moisture measurement devices with **brand-new series 700**

Measurement principle:

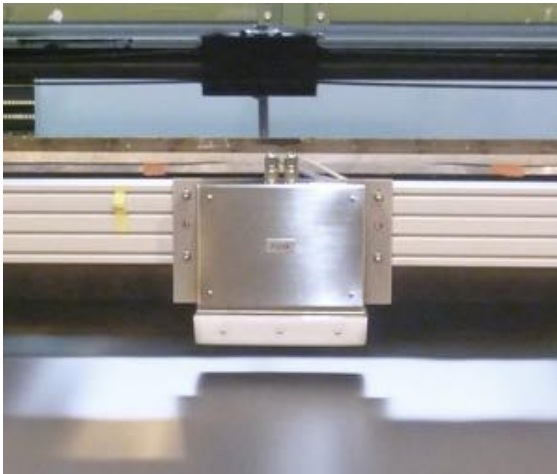
microwaves are absorbed by water content of fabric



Microwave systems for moisture, add-on and coating measurement

AF 120 / RF 120

One-point Measurement



AF 310

Three-point Measurement



MP 120

Traversing Measurement



- Wide-spread sensor heads 70mm or 250mm wide
- Large distance between sensor heads up to 110mm
- Measurement from 0-10g(H₂O)/m² up to 5000g(H₂O)/m²

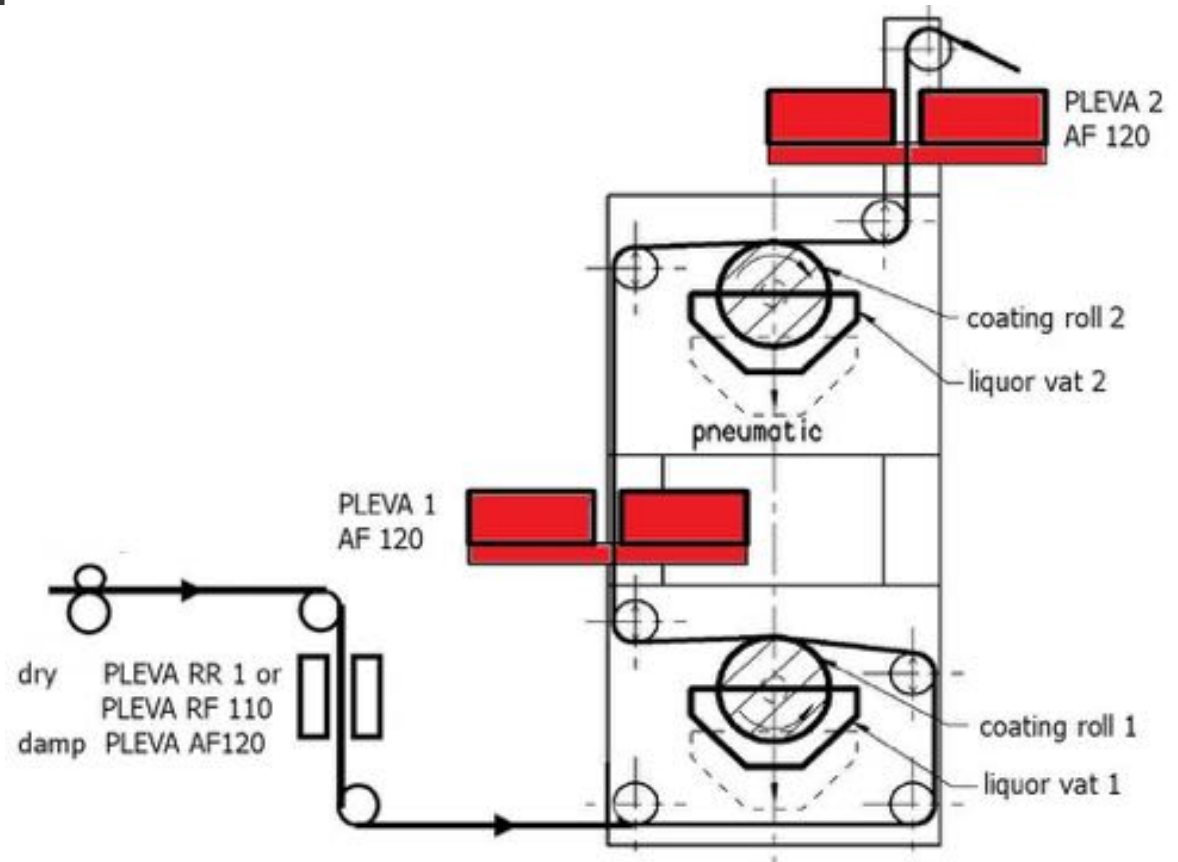
- Minimum Applications
- Continuous Dyeing
- Coating Add-On

Microwave systems for moisture, add-on and coating measurement

Microwave minimal application measurement

Minimal application on kiss-roll coating

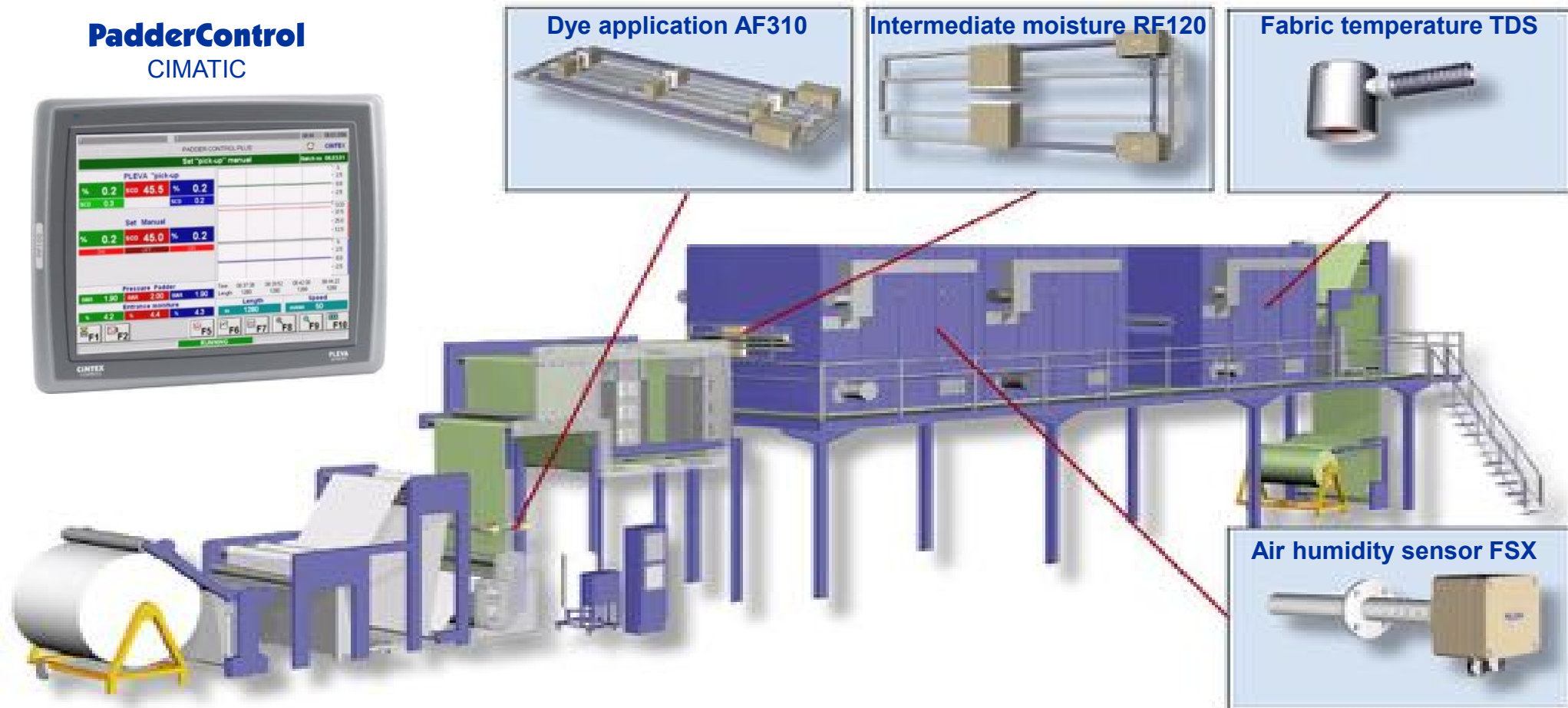
- Minimal application by controlling the speed of coating roll (kiss-roll coating)
- One or two-sided application with different add-ons:
15 g(H₂O)/m² per side
on 500 g/m² fabric (3 %)



Example: Monforts Eco Applicator

Microwave systems for moisture, add-on and coating measurement

Microwave measurement on Continuous Dyeing Process PAD-DRY / PAD-STEAM



Microwave systems for moisture, add-on and coating measurement

Microwave measurement on coating line

Permanent control of absolute amount of coating application
→ constancy & reproducibility

Permanent control of application profile side / centre / side
→ evenness

Especially for back and face coating when the visual control of application is not possible!

Direct control before drying:
→ fabric tension, fabric quality, coating knife and angle



Traversing measurement MP120 after knife coating



Coating is the essential part of functionalizing textiles, e.g. for sun protection, blackout curtains...
Thereby, chemical pastes or foams are added to the textile.

Often, two challenges occur in production, which have a **high impact on sustainability** and **cost-efficiency**:

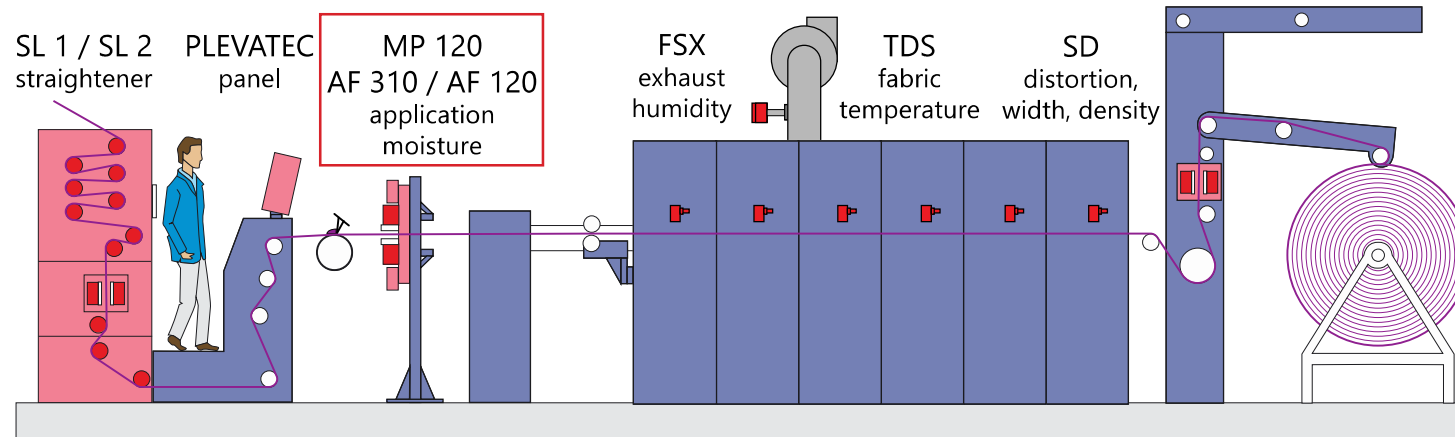
1. Too much coating is added.

This implicates **unnecessary consumption of pastes and foams**, as well as increased **energy consumption for drying**. Or in some cases it means the good is second choice or even rejected (as it is e.g. too thick).

2. Too little coating is added.

This leads to **second choice or rejects**, which in turn also means unnecessary consumption of resources.

To save valuable resources and prevent rejected goods, the contactless measurement and control of the add-on is required.



The microwave measurement systems [AF 120](#), [AF 310](#) or [MP 120](#) are placed directly after the coating knife. This enables a permanent monitoring and control of the coating application. Even the smallest changes of the coating application become visible, and the add-on chemicals can be reduced to minimum.

➡ **The result is: more constancy, reproducibility and evenness.**

Sustainable SuccessStory

Exemplary calculation of resource and cost savings

with data from one of our customers with a coating production in the Netherlands

Production data	1 500 000 m ² foam coatings per year	and	1 500 000 m ² paste coatings per year
Costs of chemicals	foam = 1.6 €/kg	and	paste = 3.5 €/kg

Exemplary, experienced saving of chemicals due to usage of microwave sensor: 5 g/m²

Savings of costs	Foam: 1 500 000m ² • 5 g/m ² • 1.6 €/kg = 12 000 €
	Paste: 1 500 000m ² • 5 g/m ² • 3.5 €/kg = 26 250 €

38 250 €



Our impact as your **HEROES FOR SUSTAINABILITY**

- Only required chemicals are used, which saves resources (up to some tons per year).
- Energy consumption for drying can be reduced to a minimum.
- Less rejected/second choice goods are produced.
- No need for cut-outs of fabrics for checking the coating.

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TDS SENSORS FOR FABRIC TEMPERATURE MEASUREMENT

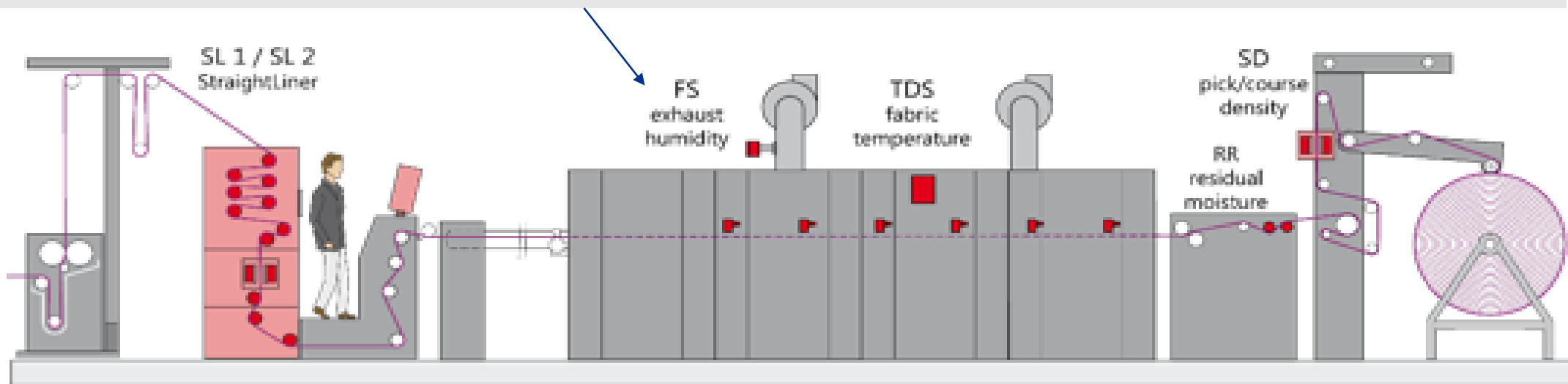
RR SENSORS FOR RESIDUAL MOISTURE MEASUREMENT

PROCESS OPTIMIZATION WITH PLEVATEC SYSTEMS

Humidity measurement with FSX sensors

- Drying processes are very energy-intensive and crucial for fabric quality
- **Main Target:** Load air optimally with water vapour (air humidity, exhaust humidity)
- The higher the air humidity is, the lower is the exhaust air volume.
 - ➔ efficient energy consumption
 - ➔ Less fresh air needs to be heated up to process temperature

A robust, precise and stable **measurement system** is elementary in tough environments with high temperatures and heavy contamination.



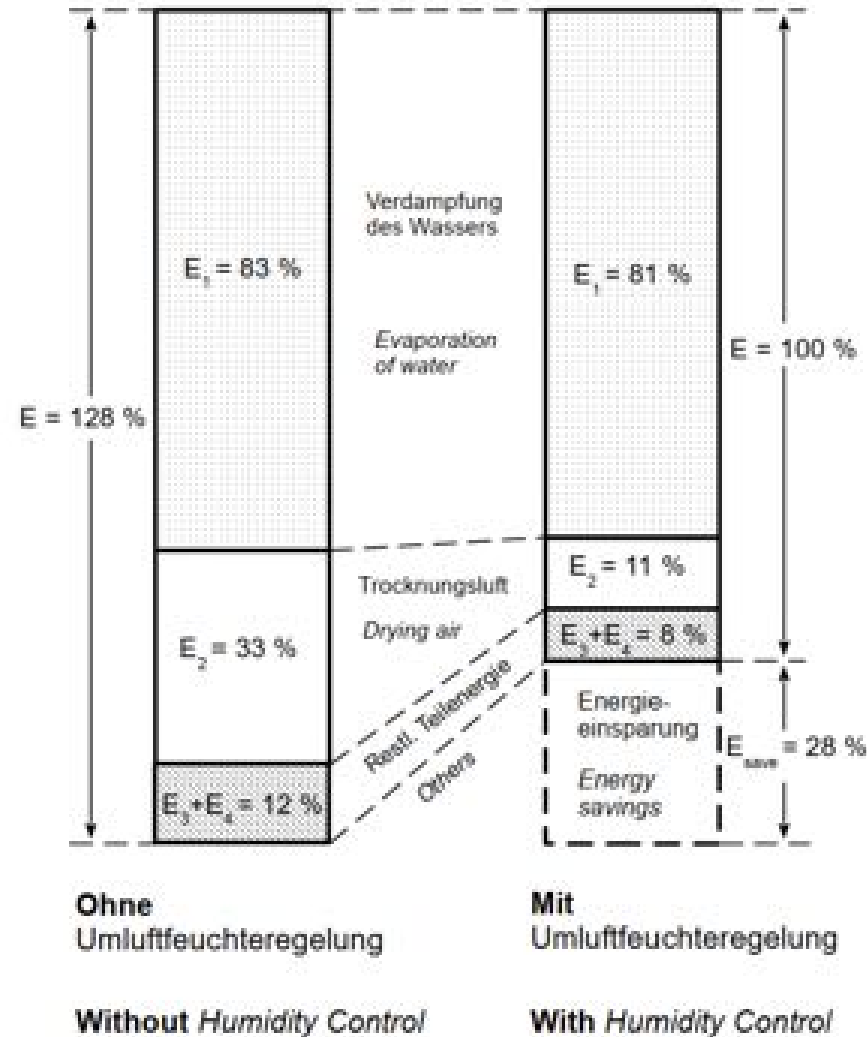
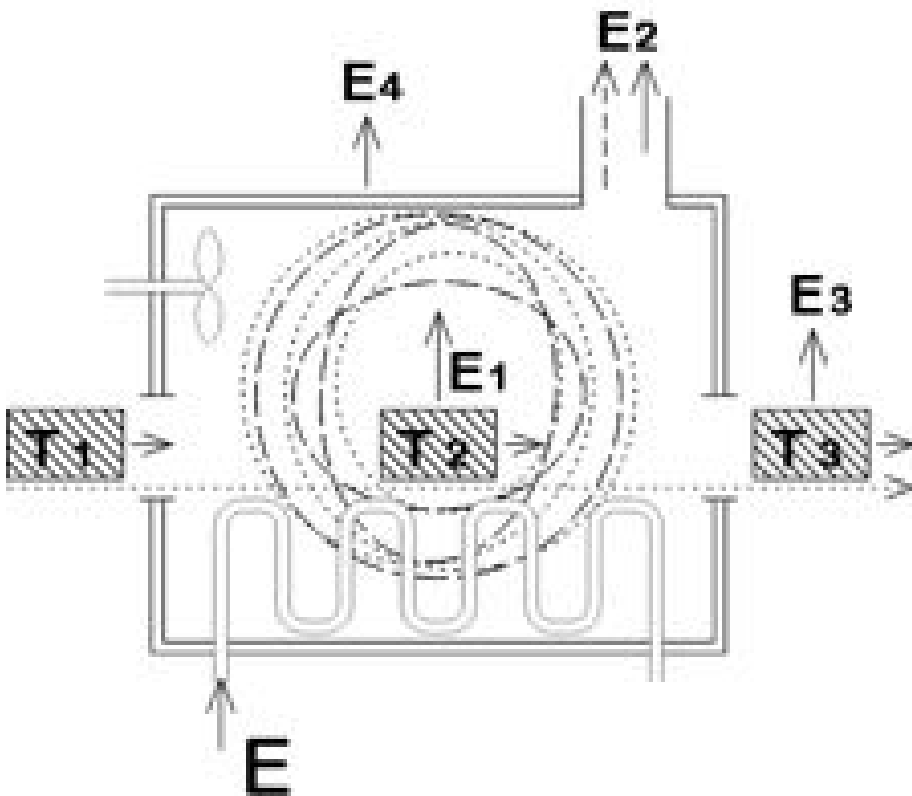
Humidity measurement with FSX sensors

- **Maintenance-free**, heated sensor
- Robust and reliable
- Can be used on very high air pollution levels
- Process temperature **up to 600 °C**
- Measurement at extremely high humidity (1000 g(H₂O)/kg)
- **Retrofitting on existing dryers possible**



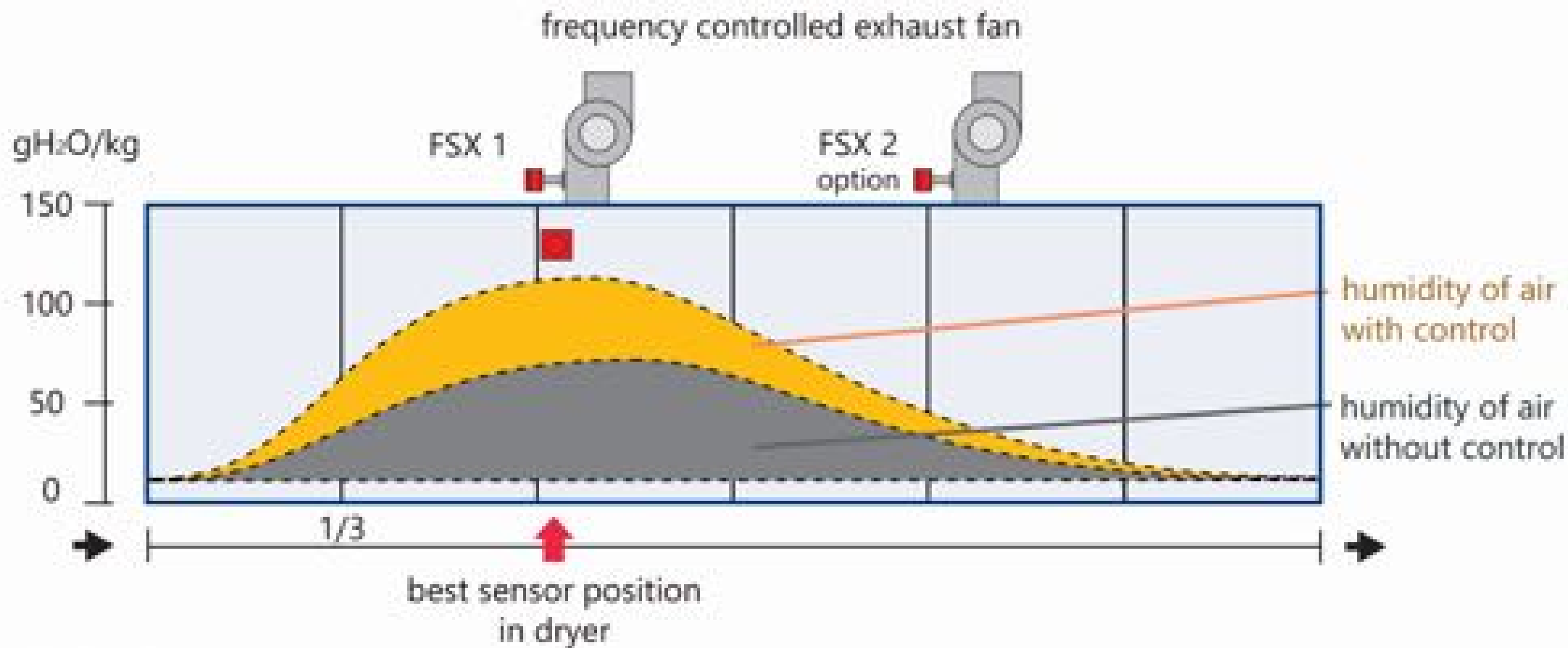
Optimizing potential: Exhaust humidity

Energieverteilung beim
Trocknungsprozess
Energy demand of the dryer



→ Saving energy
by reducing amount of
air used for drying

Humidity measurement with FSX sensors



Humidity distribution in a stenter

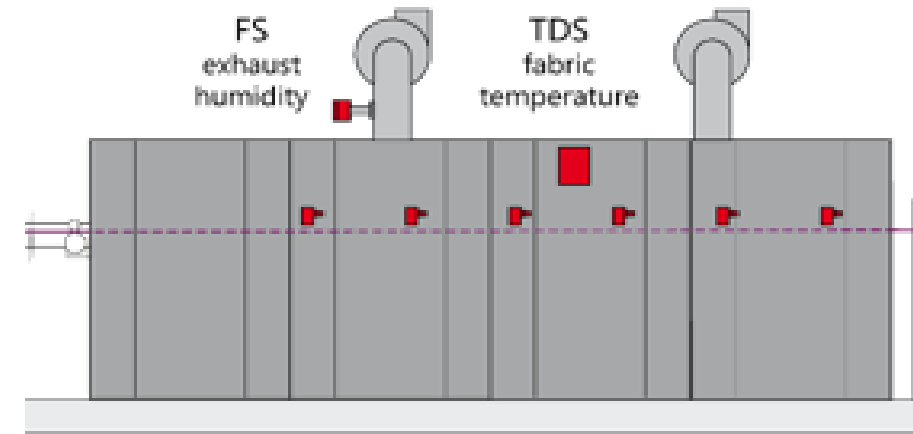
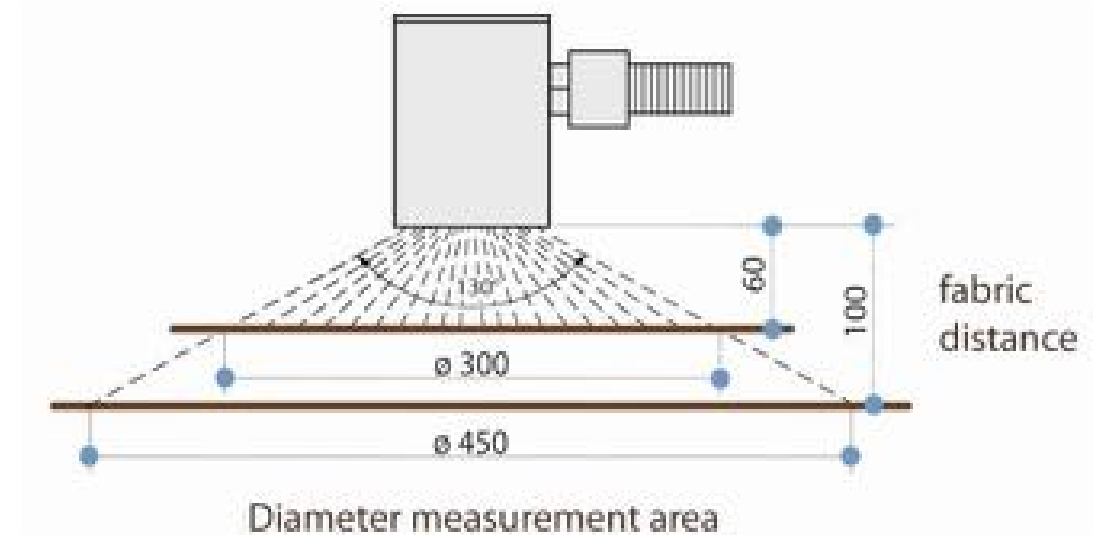
Fabric temperature measurement with TDS

- Thermo **D**ynamic **S**ensor
- Measurement of **fabric temperature** and **air temperature**
- For use inside hot environments up to 400 °C, no cooling needed
- Sensor is unrivalled robust
- Not sensitive to soiling by avoidance of condensation



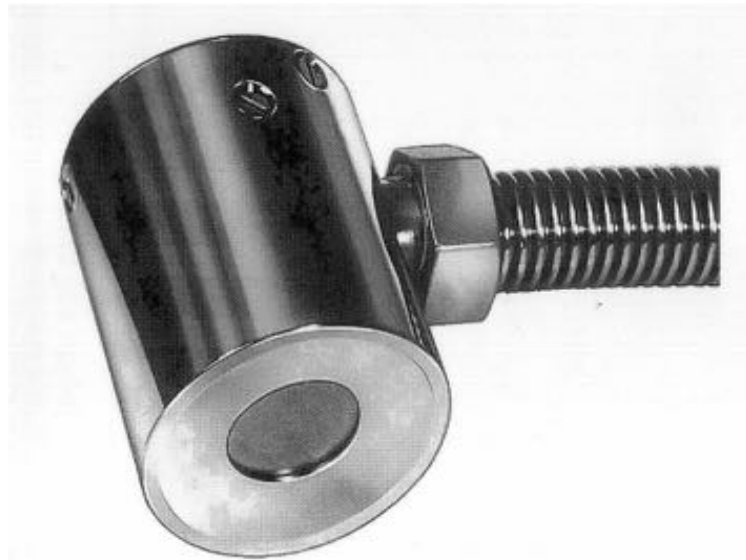
Fabric temperature measurement with TDS

- **Fast reaction time** for temperature changes
- No calibration required
- **Large measurement area**
- Very high accuracy
- Not influenced by colour, distance or flapping of fabric

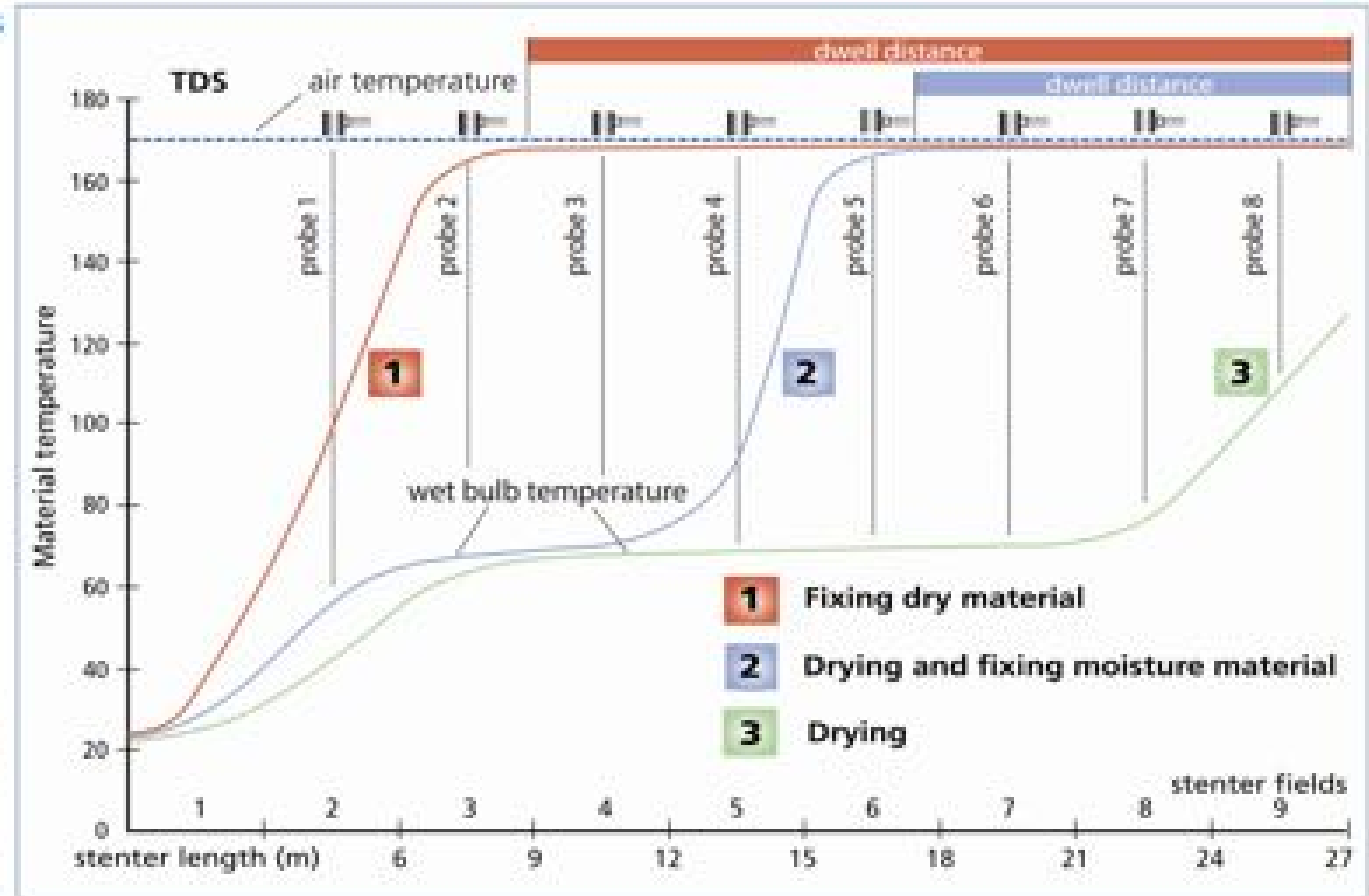


Fabric temperature measurement with TDS

Temperature patterns
in a dryer



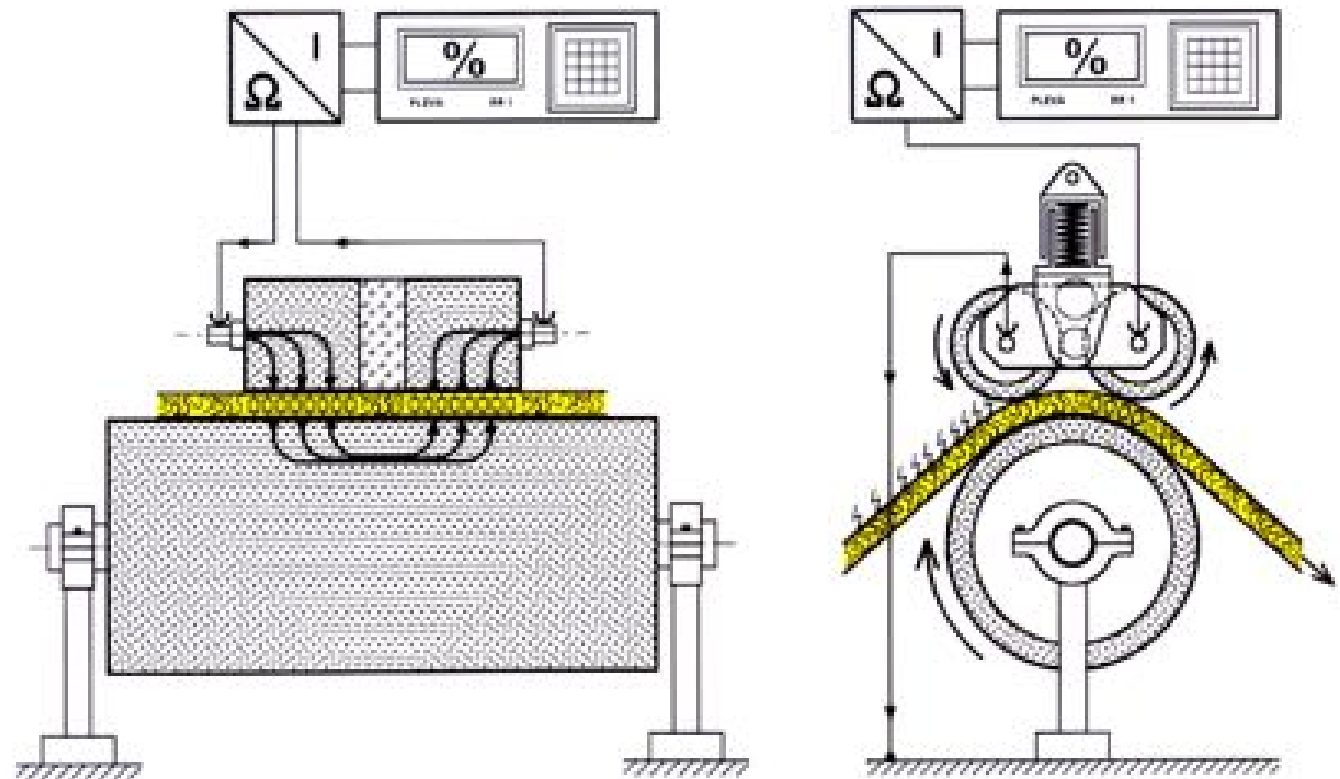
Temperature patterns
of the product heated
at different techno-
logical processes in a
continuous dryer.



Moisture measurement with tandem roller sensor RR

- Measure very low residual moisture
- **Natural** fibers like cotton from 1 to 20 % and **synthetics** from 0.1 to 5 %
PA from 0.2 to 9 %
viscose from 1.7 to 30 %
- Protected against electrostatic tension
- Ideally, the fabric should be dried to the **hygroscopic equilibrium of the fiber**
- Also suitable for wet in wet processes (moisture > equilibrium condition)

Restfeuchtemessung mit Tandemrollen - Sensor
Residual moisture measurement with tandem roller sensor



Moisture measurement with tandem roller sensor RR

Sensors:

(Measuring frame with tandem roller sensor(s) and Box)

RR 1.1 Box – 1 tandem roller sensor measuring in the middle of the fabric

RR 3.1 Box – 3 tandem roller sensor measuring side/center/side output of the maximal value

RR 3.3 Box – 3 tandem roller sensor measuring side/center/side output side/center/side

➔ **Increased productivity by optimizing residual moisture and fabric temperature respectively**



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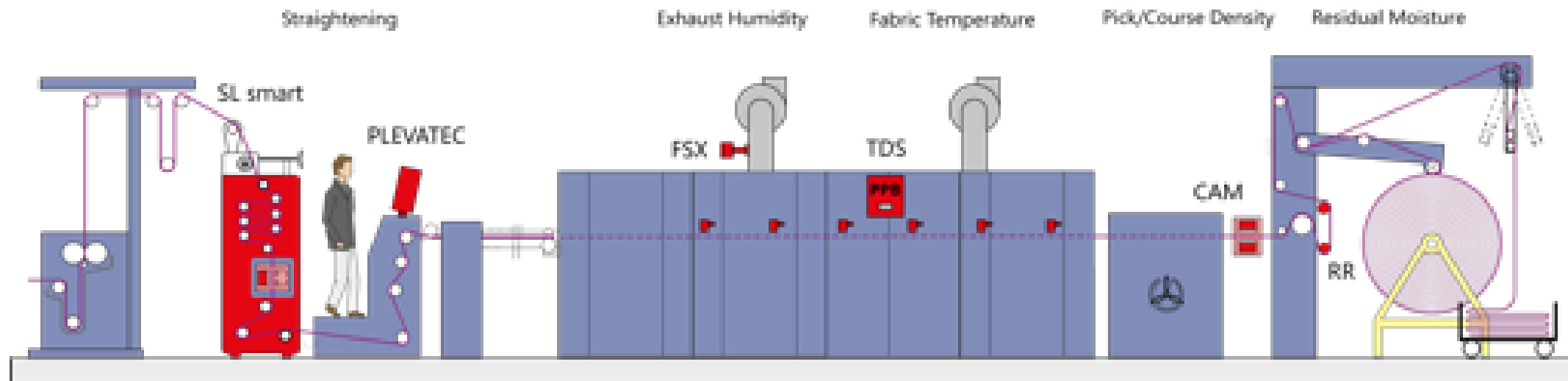
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PROCESS OPTIMIZATION WITH PLEVATEC SYSTEMS

Process optimization with PLEVATEC systems



Stenter example equipped with sensors

SL | High-tech automatic straightening machine

<https://www.youtube.com/watch?v=2Hn8f2ZbimI>

SL | High-tech automatic straightening machine



- **SL 1 / SL 2:** for Denim, technical textiles etc.
- **SL smart:** dedicated design for knits and wovens

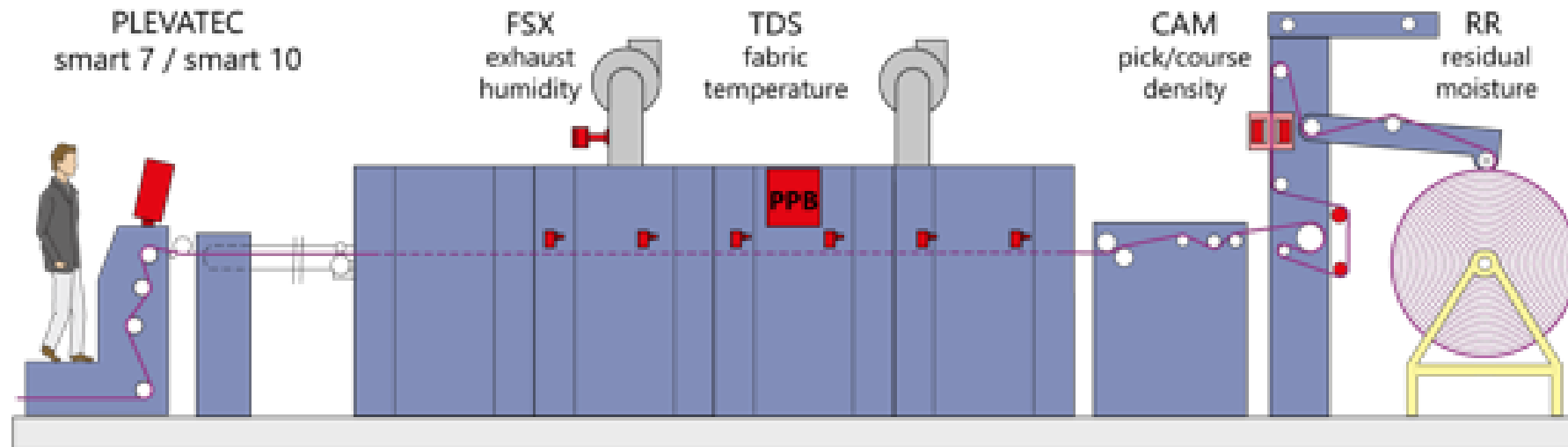
Your benefits

- Unique traversing camera technology
- Ultra-precise distortion detection
- Customizable weft-straightening machine according to individual needs

Process optimization with PLEVATEC smart

Drying processes involve a high demand of energy.

Sensors and process control systems help to collect all process critical data and optimize your process.



Process optimization with PLEVATEC smart



- **Modular system**
- ***DryControl smart*** includes
 - ***HeatControl smart*** with fabric/air temperature sensors TDS
 - ***MoistureControl smart*** with residual moisture sensors RR
 - ***HumidityControl smart*** with humidity sensors FSX
- ***DensityControl smart*** with up to 2 smart cameras CAM for pick/course density

PLEVATEC smart 7 / smart 10 installation at stenter frame

TDS | Sensor and HeatControl



- Measurement of fabric and air temperature inside of the dryer
- Control of machine speed
- Dwell time control or control of exit temperature
- Speed control (+/-)

Your benefits

- Contactless measurement in up to 400 °C
- Fast reaction time
- Productivity increase of up to 25%



RR | Sensors and MoistureControl



- Measurement of residual moisture
- Control of machine speed with
- **RR 3.3 / RR 3.1 or RR W** for different fibres
- **Minimum, maximum, average for control**
- **Speed control (+/-)**

Your benefits

- Contact measurement of small residual moisture
- Prevention of overdrying, maximal production speed
- Better fabric quality



FSX | Sensor and HumidityControl



- Measurement of exhaust humidity with sensor **FSX**
- Control of exhaust volume (exhaust ventilation fan)

Your benefits

- Robust and reliable sensor
- Process temperature up to 600 °C
- Measurement at extremely high humidity
- Retrofitting possible

CAM | Sensor and DensityControl



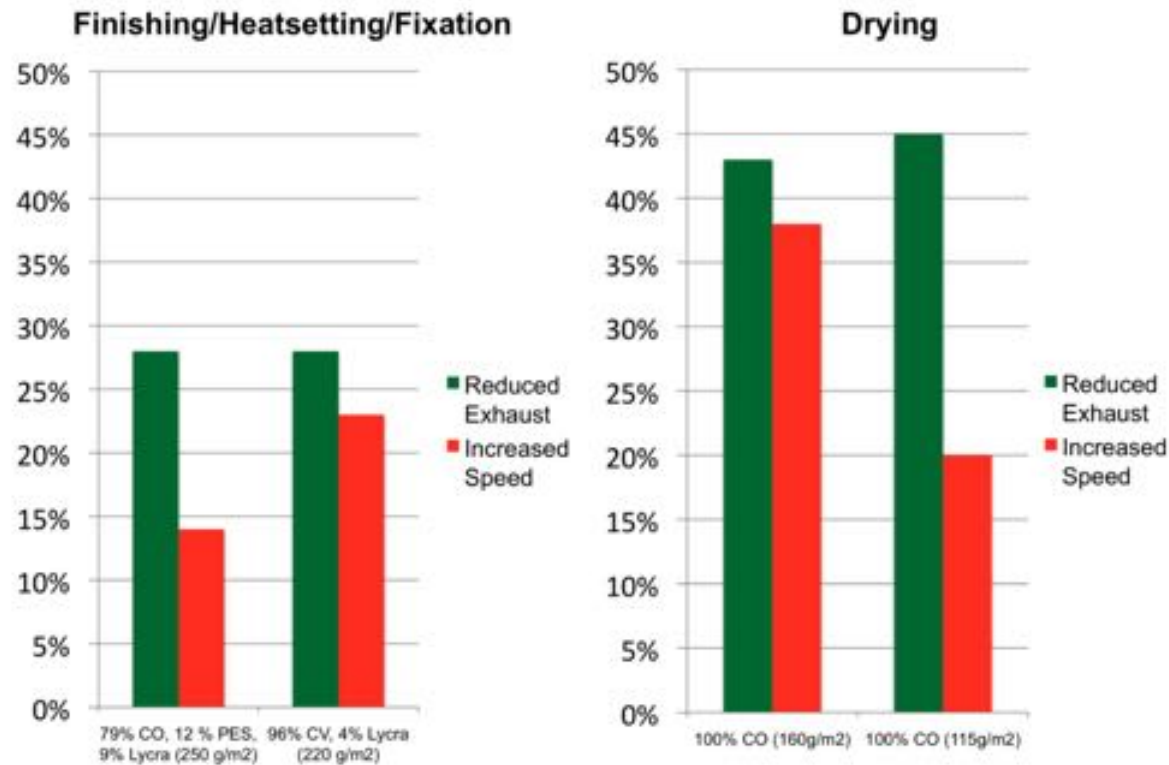
- Measurement of structure density of the fabric and control of it
- Density monitoring
- Calculation of fabric area weight
- Calculation of shrinkage
- Overfeed control at stenter or density control at shrinkage machine (+/-)

Your benefit

- Quality monitoring of final density



Process optimization with PLEVATEC smart



Source: Two customers from the knitting industry in Brazil

Excellent results on stenter frames for knitted fabrics:

- **Exhaust air volumes could be reduced by up to 45%.**
- **High energy savings** could be achieved.
- With the use of the fabric temperature sensors TDS, **production could be increased by up to 38%.**

Energy savings and CO₂-reduction by controlling the exhaust air

- **Typical reduction of exhaust air volume:**

Installed exhaust air volumes 15 000 – 40 000 m³/h at textiles and carpets

From experience: reduction of 5 000 m³/h and more possible

- With energy costs (€/MJ) of 0.35 € for 1 m³ gas and 4 000 working-hours per year

we can achieve **savings of 19 600 €/year**

and reduce CO₂ emissions by **152 t CO₂/year**

➔ Saving energy by reducing amount of air used for drying

Impact of CO₂-reduction from currently used sensors

- **Currently 5000 FS sensors in usage**

$$5000 * 152 \text{ t CO}_2/\text{year} = 760\,000 \text{ t CO}_2/\text{year}$$

- **Real-life comparison with cars:**

$$130 \text{ g CO}_2/\text{km} * 15\,000 \text{ km/year} = 2 \text{ t CO}_2/\text{year}$$

→ Measuring the exhaust air via FS sensors enables a reduction in the CO₂-emission which is **equivalent to the emission of 380 000 cars per year.**

Heroes for your textile process.

Thank you very much for your time!

Stable and controlled processes

Higher quality of final product

Energy efficiency | CO₂ reduction

Increased productivity

For more information visit our website
www.pleva.org or follow us on **LinkedIn**:

