coatmaster

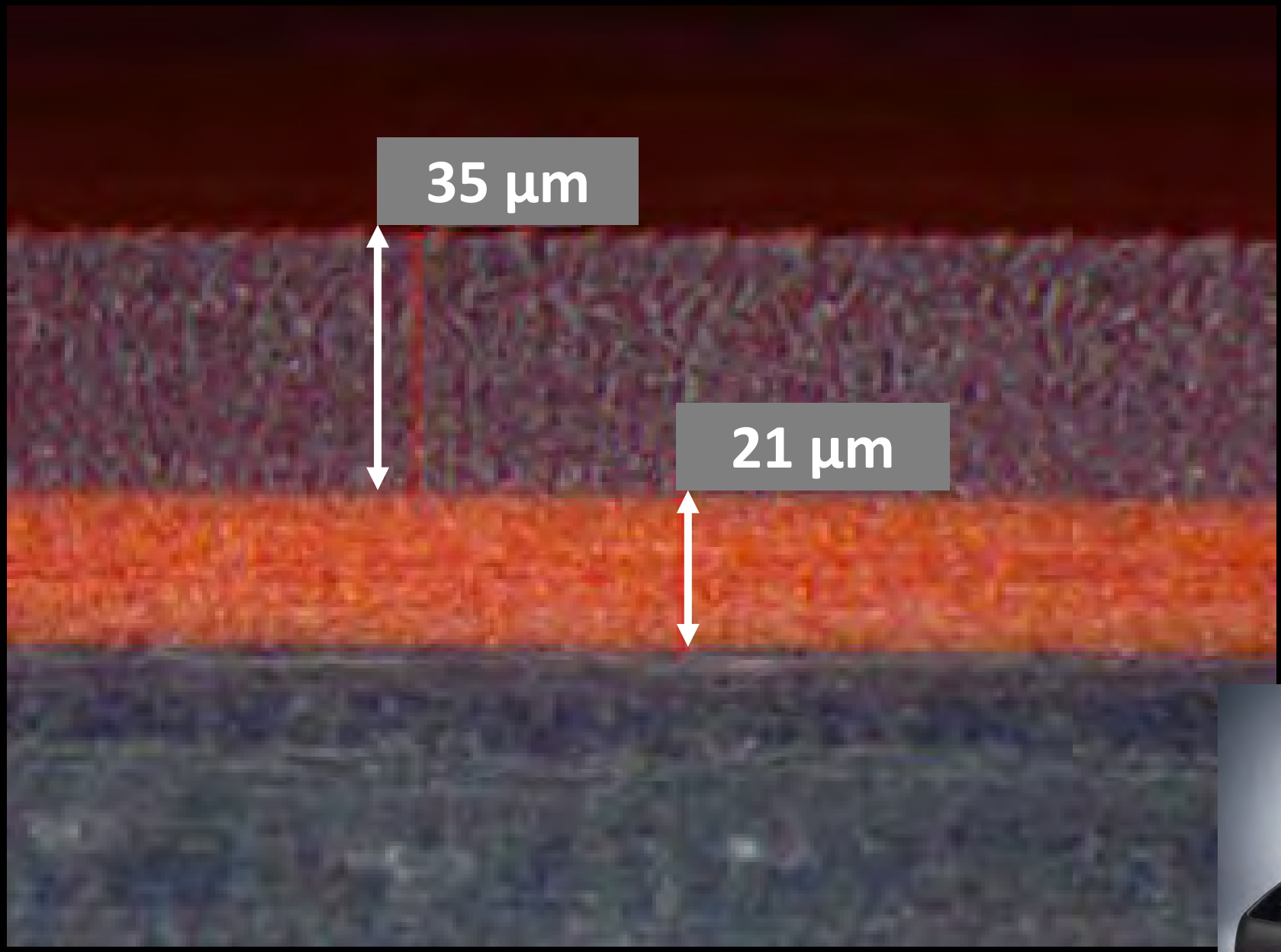
Case Studies on the Optimization of Profile Powder Coating Processes

Prof. Dr. Nils A. Reinke

Survey 1

What challenges will we have to face in surface technology within the next 5 years?

- Increasing shortage of skilled workers
- Rising raw material prices
- Growing quality requirements
- Advancing globalization
- Stricter environmental regulations

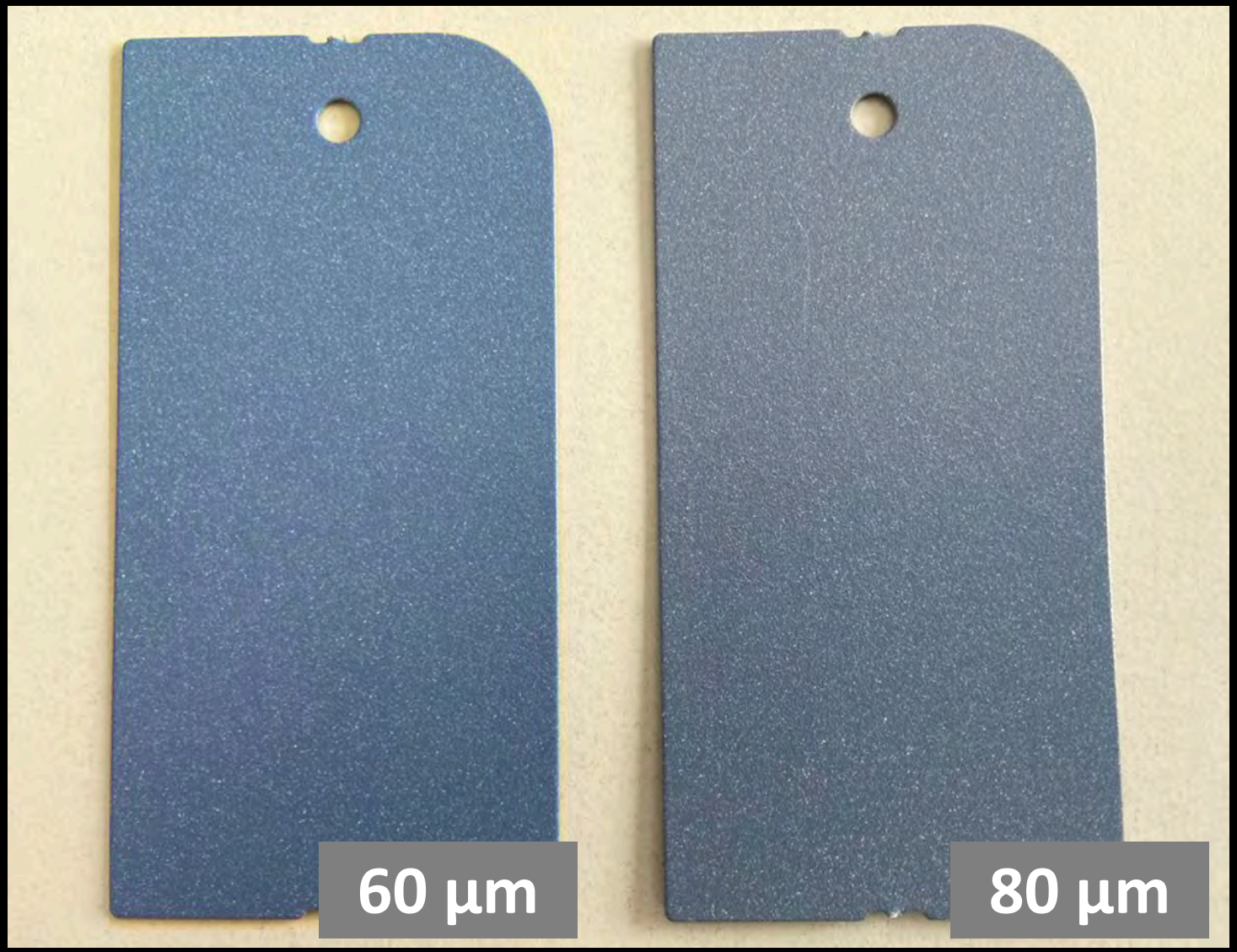

35 µm
21 µm

Survey 2

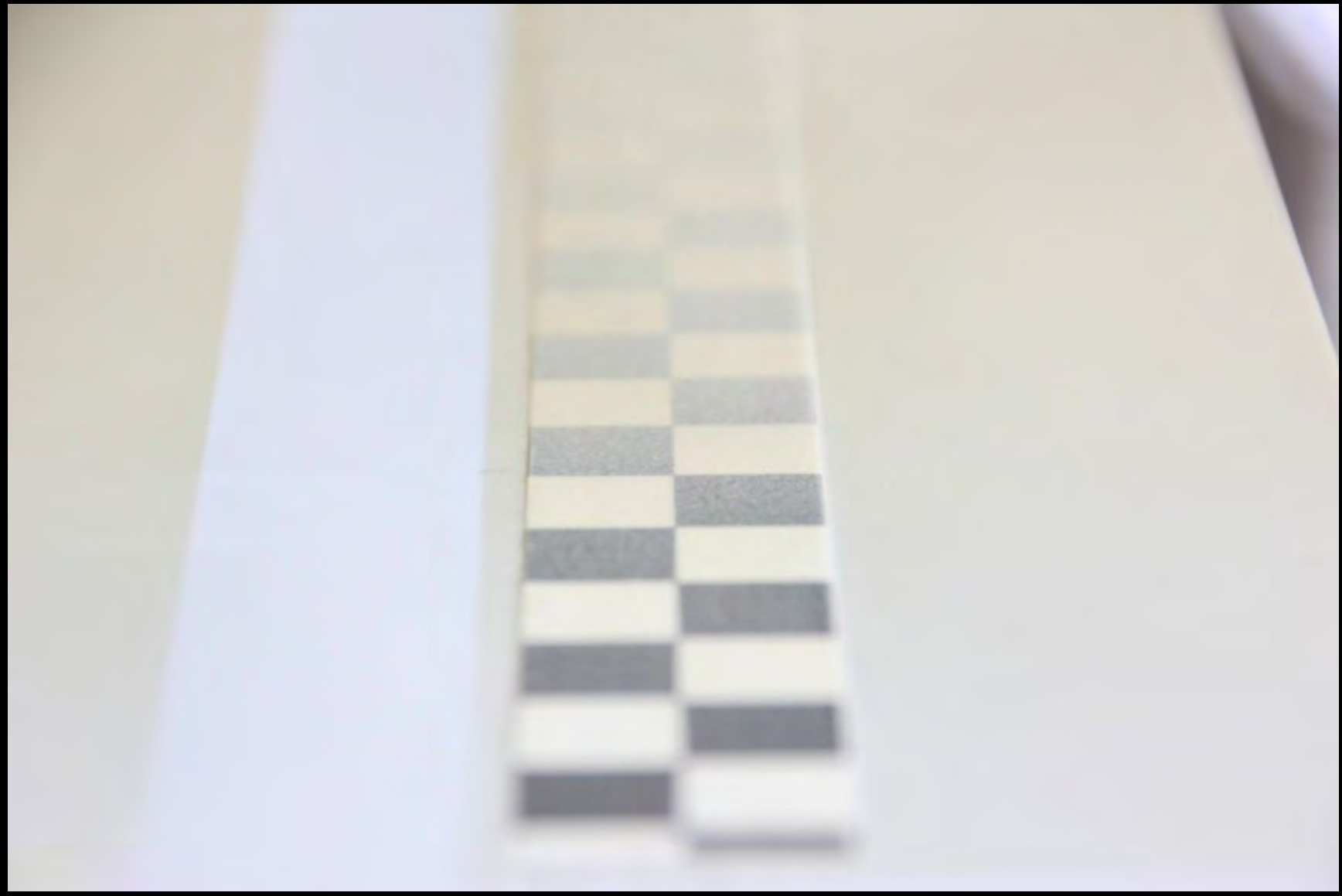
Which coating parameters are mainly influences by the coating thickness?

- Color & Gloss
- Haptics, Cool & Warm Touch
- Mechanical properties
- Chemical Resistance
- Protection Against Corrosion

Color



Opacity



Gloss level

Texture & Haptics

Mechanical Resistance

Protection Against Corrosion

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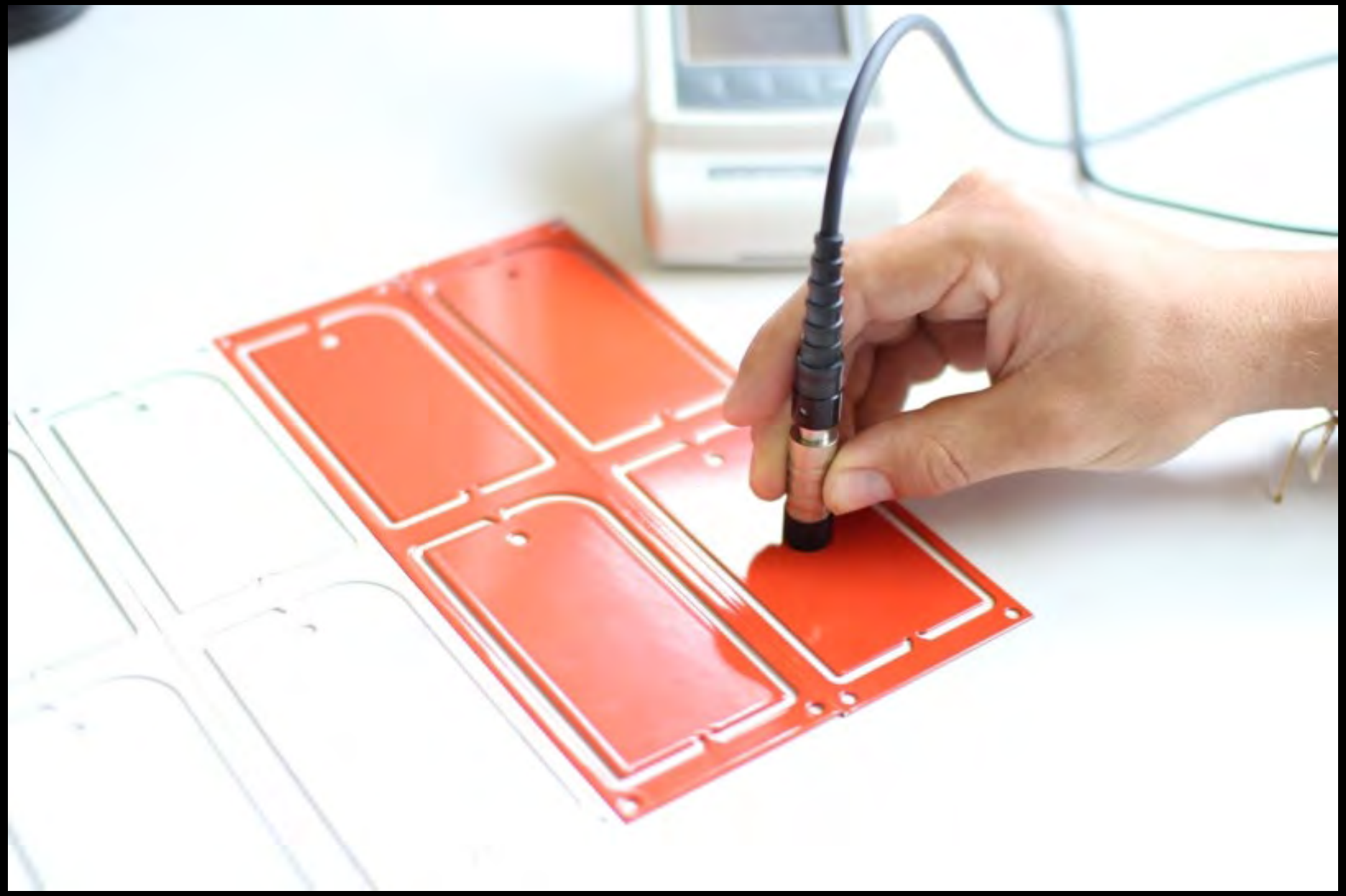
Chemical resistance



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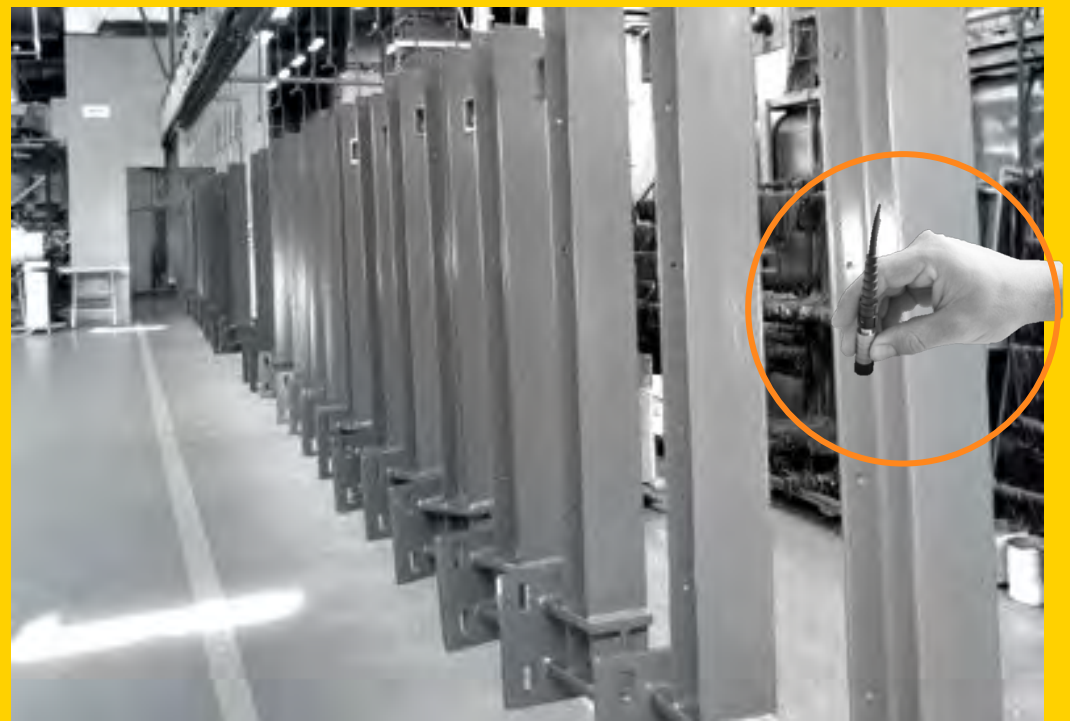
Typ. Quality Assurance

- Delayed coating thickness measurement (after 3-24h)
- Scrap and loss of quality
- High consumption of coating material



Survey 3

Which environmental parameters influence the coating thickness?

- Ambient humidity & temperature
- Environmental & pressure
- Electrical grounding
- Particle distribution & viscosity
- Wear and tear

Temperature

Humidity

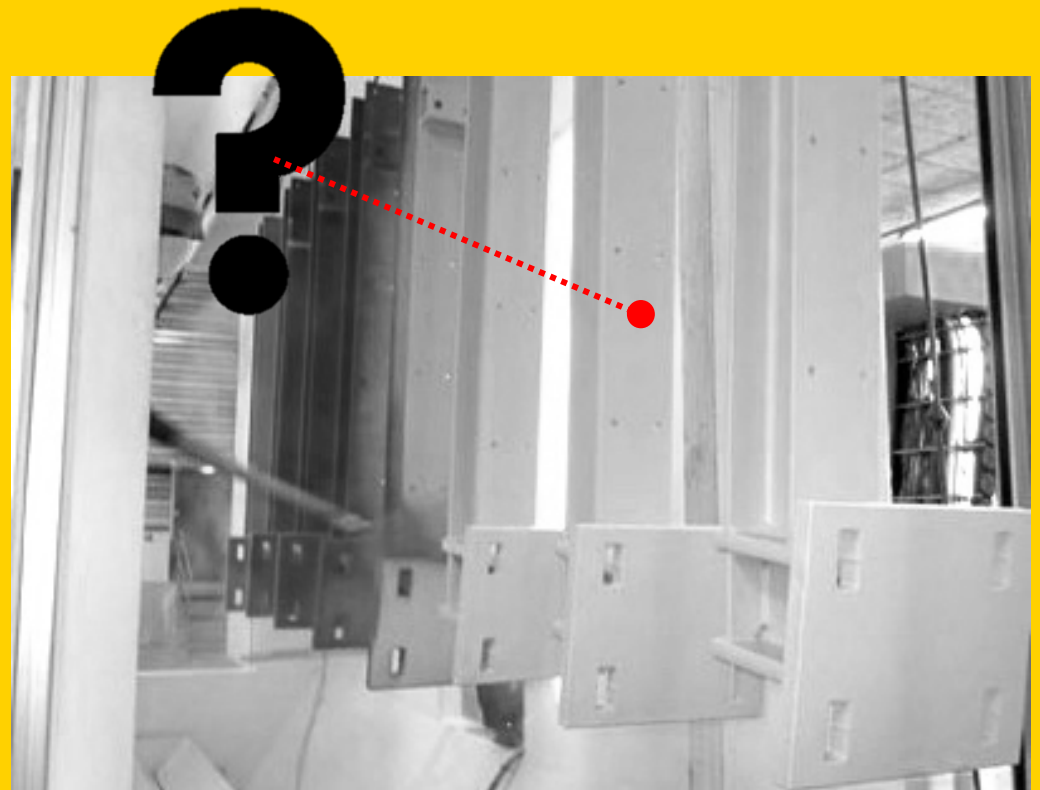
Environmental Pressure

Aging

Electrical Isolation

Early process assurance

- Non-contact coating thickness measurement after application (typ. 10s)
- Minimum scrap & best possible quality
- Saving of coating material



Survey 2

Which advantages of non-contact coating thickness measurement are relevant for you?

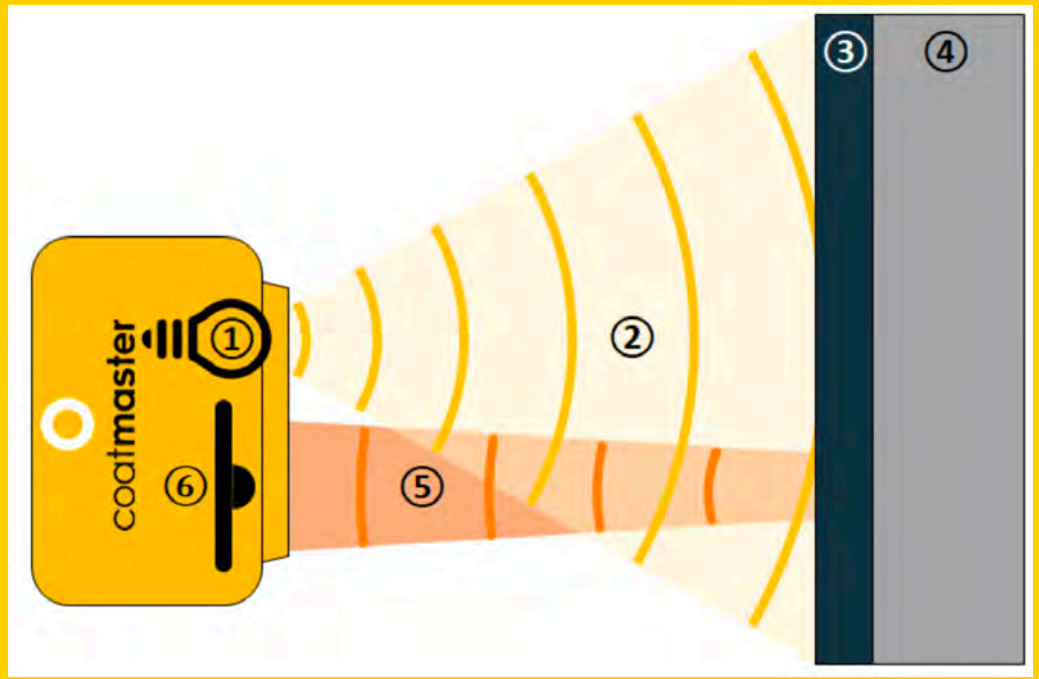
- Save material costs & avoid rejects
- Ensure quality by digitizing measuring processes
- Train new personnel faster
- Increase efficiency & reduce color change times
- Protect the environment & improve sustainability

Requirements for early coating thickness measurement

	Requirements	Airborne-Ultrasound	Photothermal
Non-contact	Yes	Yes	Yes
Working distance	> 10 cm	20 mm	30 mm
Distance tolerance	> ± 1 cm	± 1 mm	± 3 mm
Angle tolerance	> ± 45°	± 5°	± 20°
Geometry independence	Yes	Only flat parts	Yes
All colors	Yes	Yes	Non-white
Measuring area (diameter)	1-10 mm	5 mm	0.1 mm
Measuring range	1-1000 µm	10-100 µm	20-150 µm
Measuring time	< 300 ms	5s	3s
Moving parts	Yes	No	No

Underlying Magic – Advanced Thermal Optics ATO

- Large-area heating of the coating by light pulse
- Non-contact measurement of the surface temperature
- Evaluation of the data with proprietary algorithms

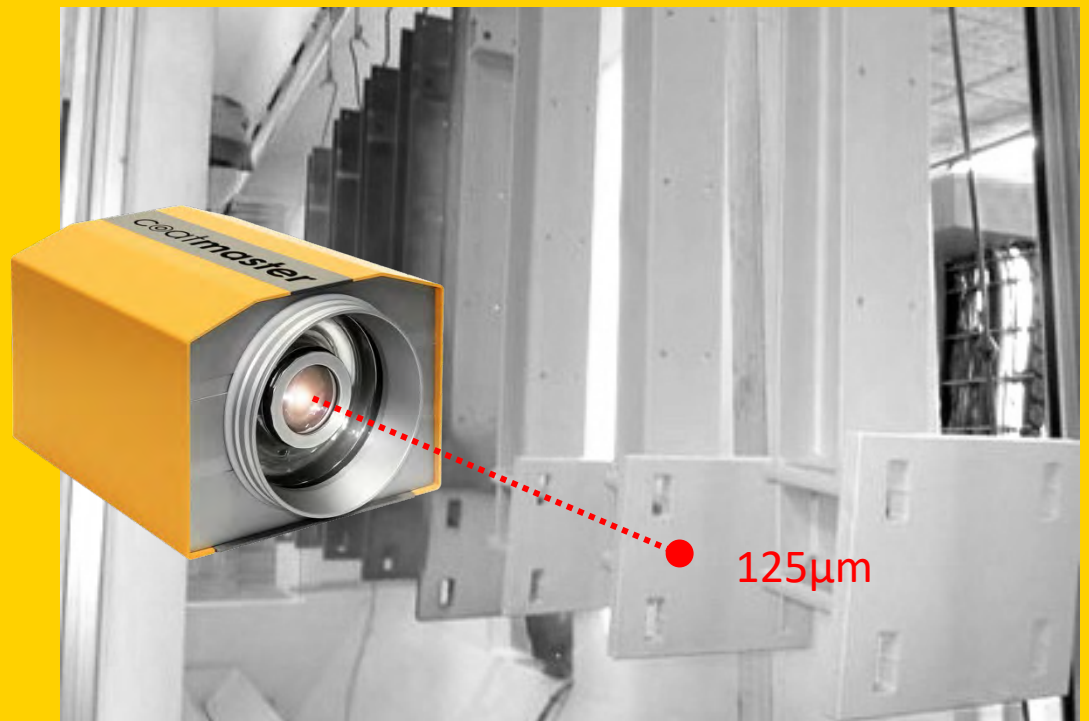


Requirements for early layer thickness measurement

	Requirements	Airborne-Ultrasound	Photothermal	ATO
Non-contact	Yes	Yes	Yes	Yes
Working distance	> 10 cm	20 mm	30 mm	10 - 100 cm
Distance tolerance	> ± 1 cm	± 1 mm	± 3 mm	± 1 - 20 cm
Angle tolerance	> ± 45°	± 5°	± 20°	± 70°
Geometry independence	Yes	Only flat parts	Yes	Yes
All colors	Yes	Yes	Non-white	Yes
Measuring area (diameter)	1-10 mm	5 mm	0.1 mm	1-10 mm
Measuring range	1-1000 µm	10-100 µm	20-150 µm	1-1000 µm
Measuring time	< 300 ms	5s	3s	50 – 300 ms
Moving parts	Yes	No	No	Yes

Measure early in your process

- Non-contact coating thickness measurement after application (typ. 10s)
- Minimum scrap & best possible quality
- Saving of coating material



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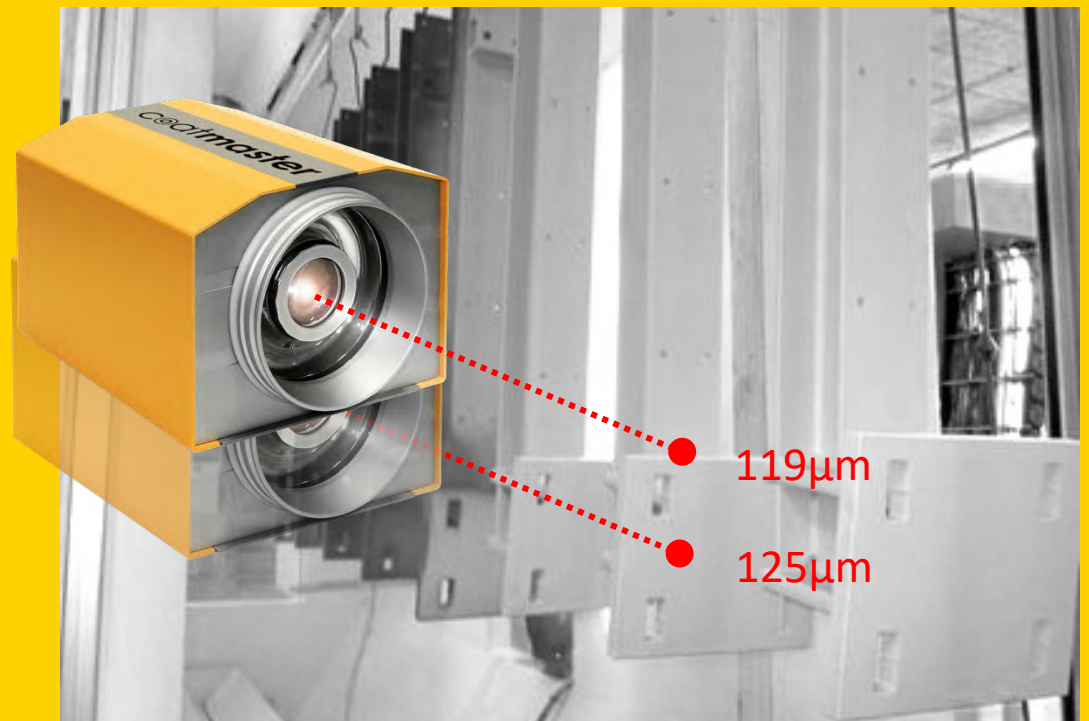

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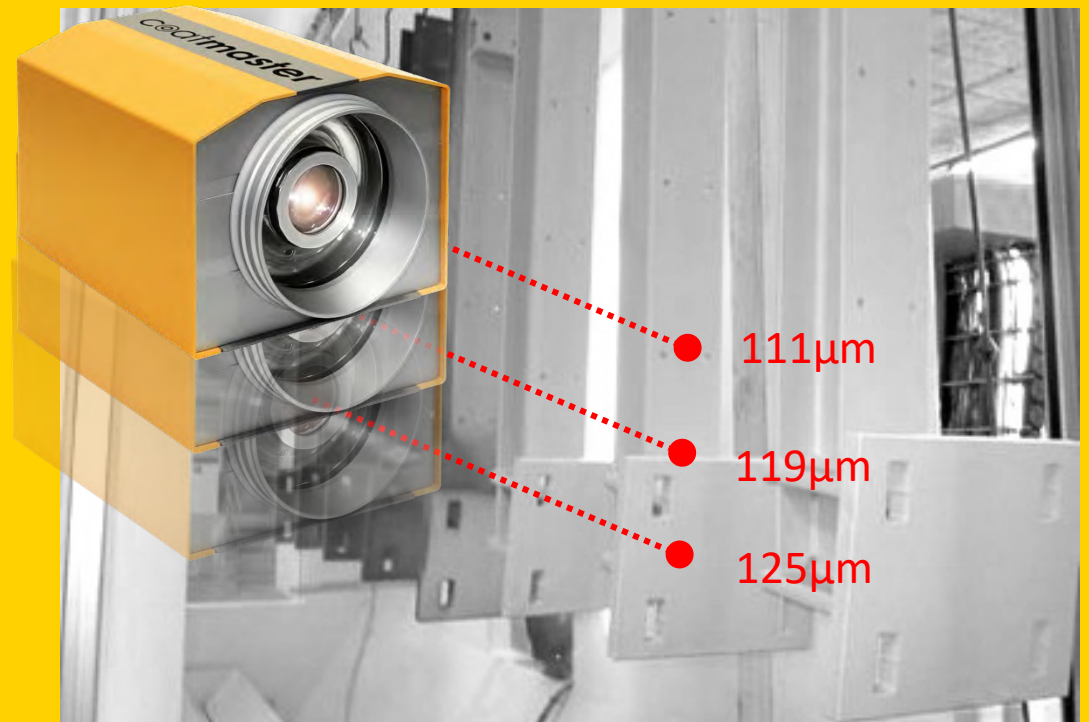

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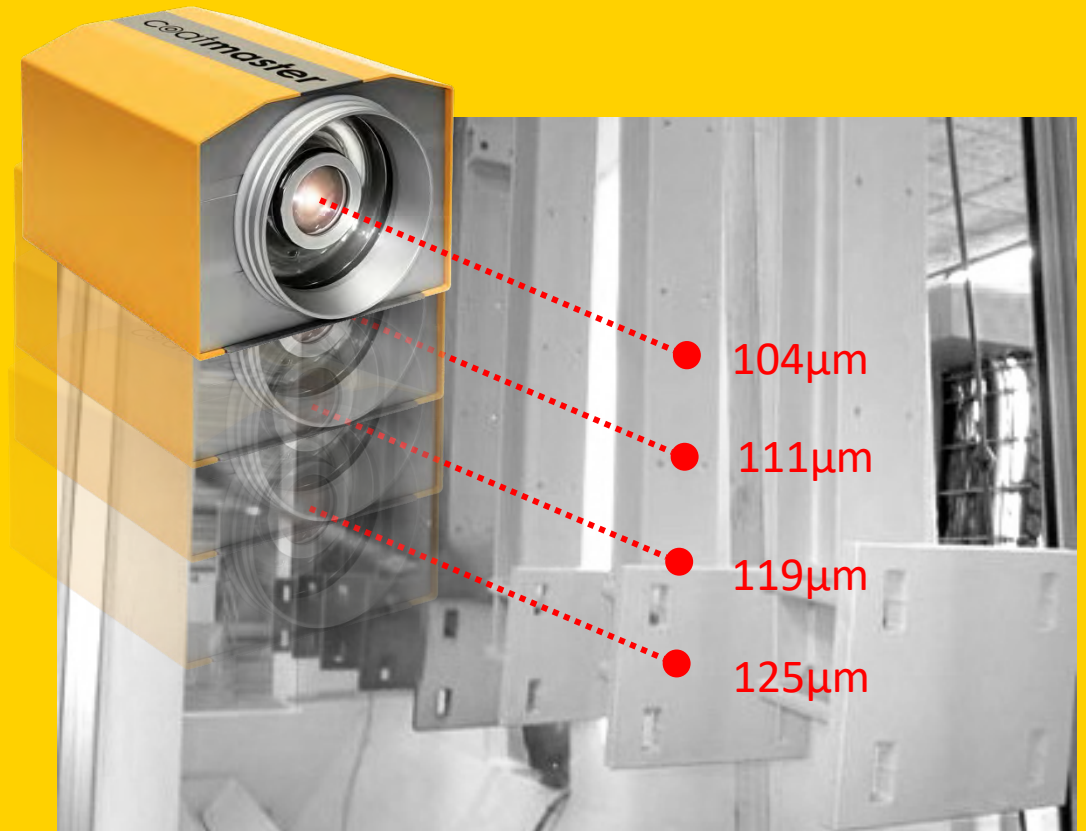
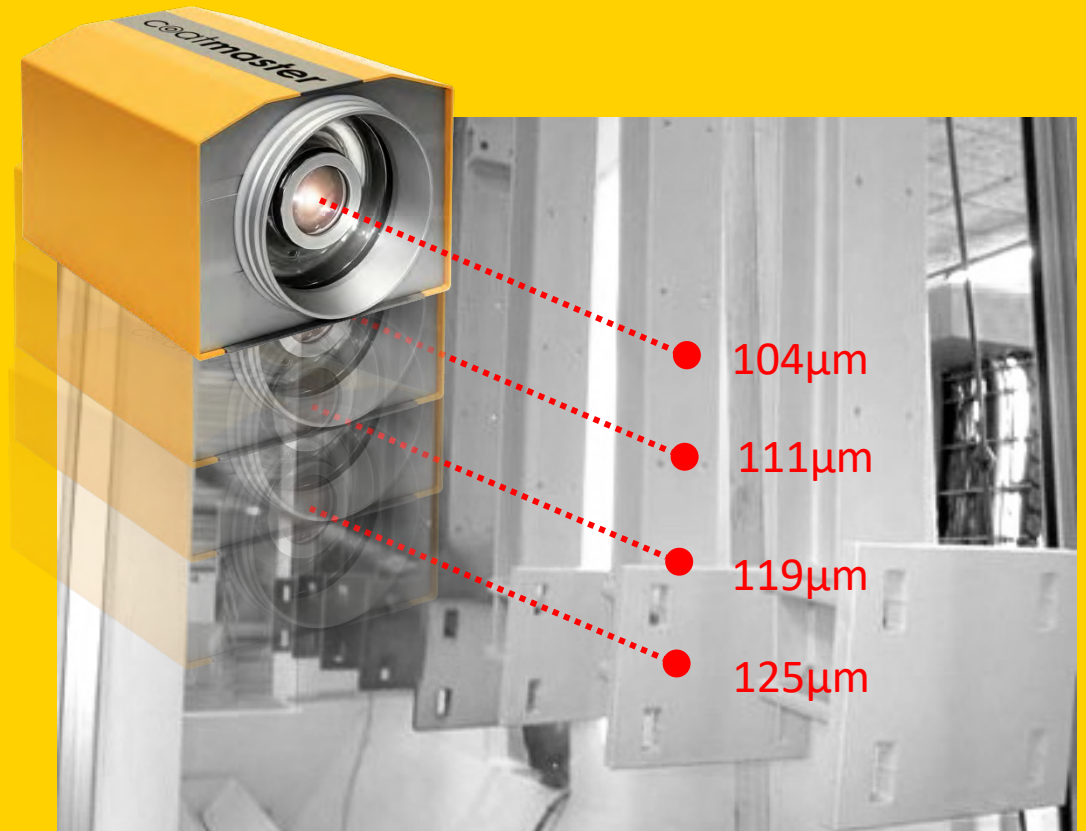


Requirements

- Image acquisition with automatic image evaluation
- Definition of measuring point for respective workpieces
- Motion technology 1D, 2D..., robots



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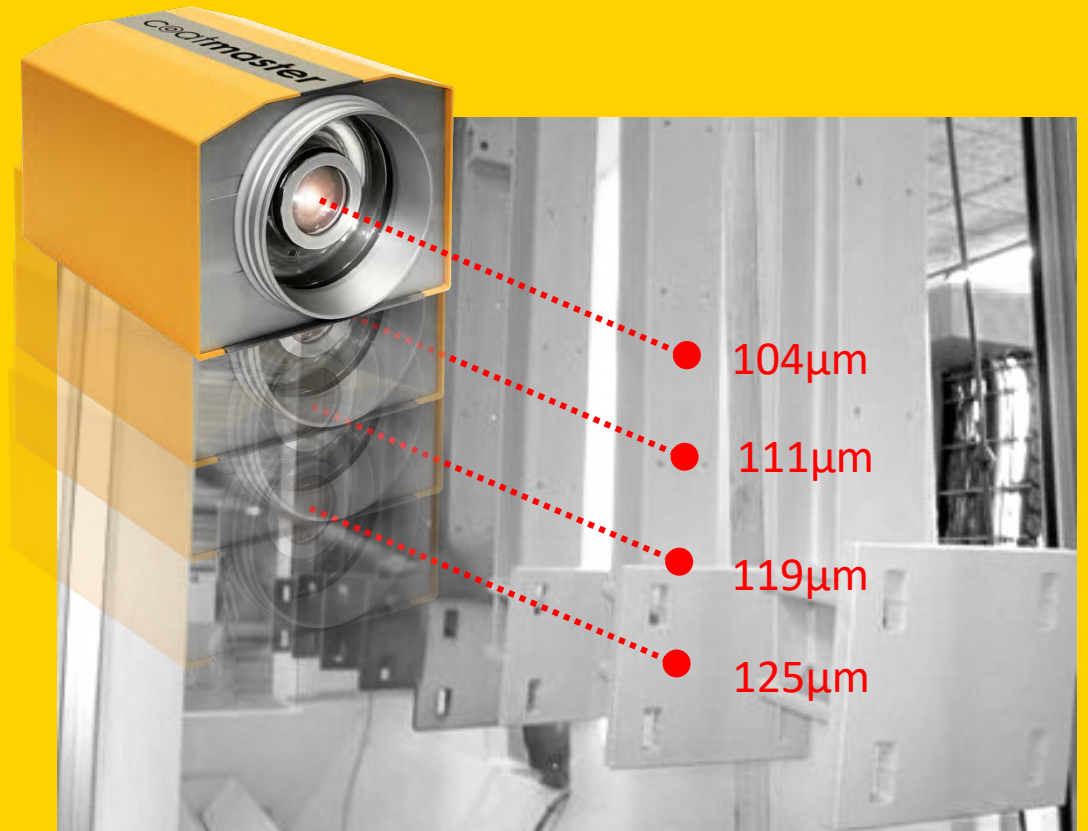
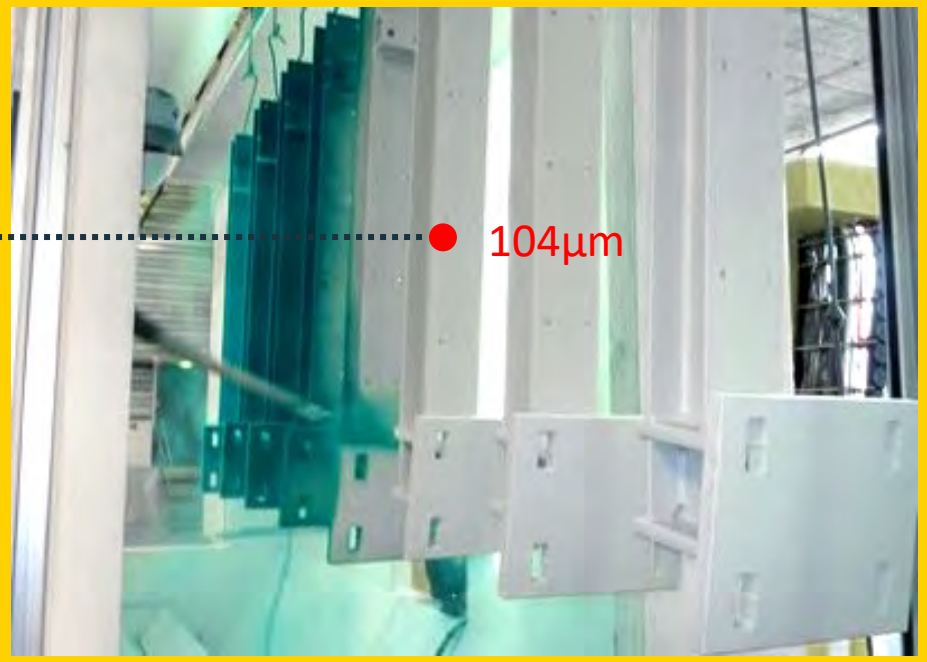


coatmaster Flex

- no integration costs
- extremely simple operation
- immediate process reliability



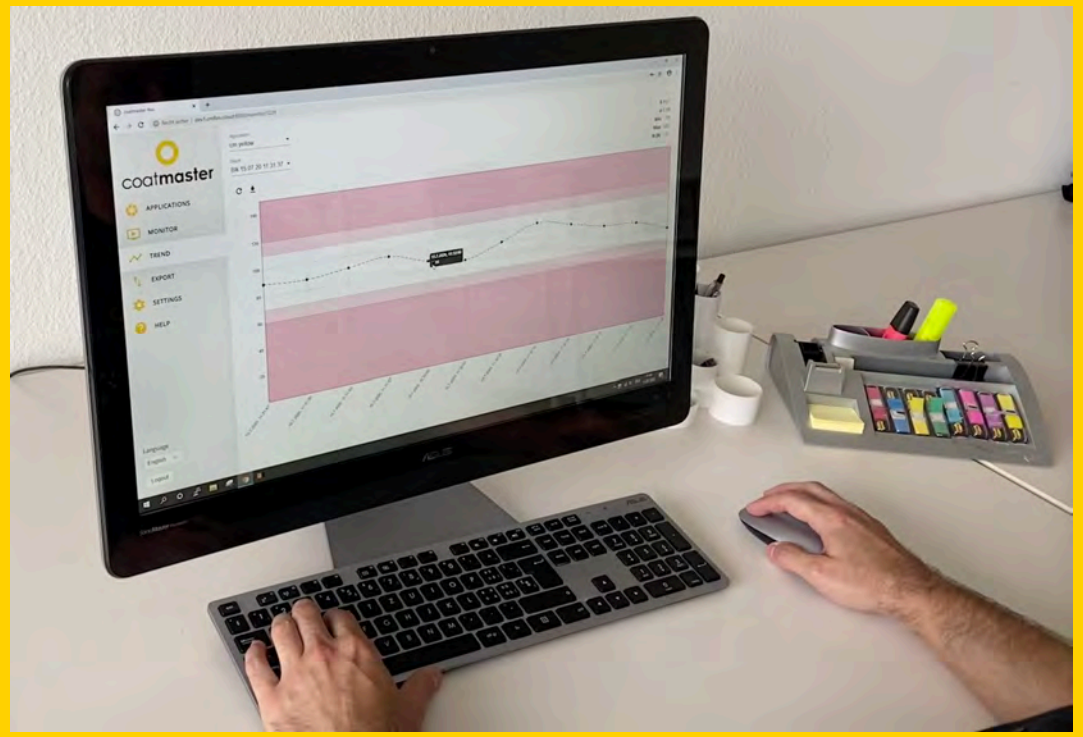
coatmaster Flex

- Accurate readings even without calibration
- Large working distance
- Extremely distance and tilt tolerant

Video 1

coatmaster Flex

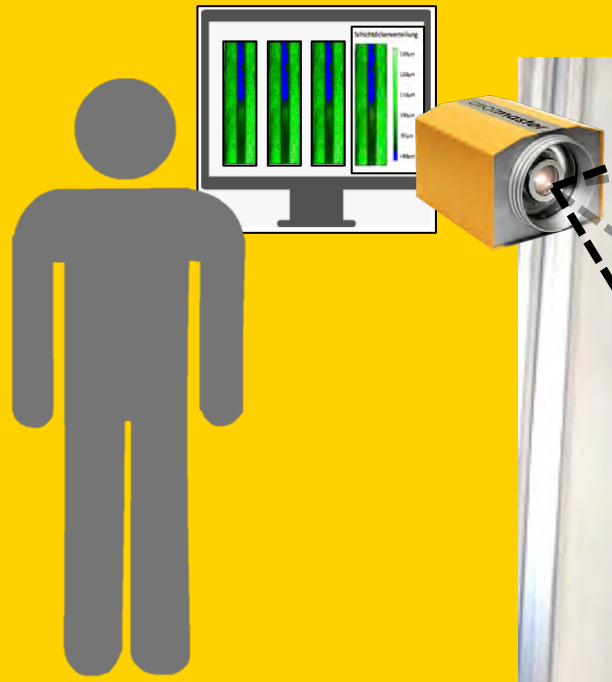
- Real-time synchronization with cloud, access via web browser
- Automated documentation of jobs
- Generate Reporting



Video 2

coatmaster 3D

- Imaging & gapless coating thickness measurement
- Simple & quasi-static setup
- cost effective solution due to standardized integration



Spatially resolved measurement with coatmaster 3D

Video 3

- For simple or complex geometries
- New quality indicator coating homogeneity
- Cost effective integration
  - Simple modular principle
  - Measuring areas of 1.5m x 1m and larger
  - no object detection
  - simple movement technique
  - no calibration necessary
  - no teaching of measuring points

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Case study 1: Powder coating in horizontal lines (manual)

- Belt speeds up to 8m/min
- Hangers of 2m height and 6m length
- Manual coating thickness measurement with coatmaster Flex
- Measurement on visible surfaces and function-critical areas
- Cost-effective entry into early process control

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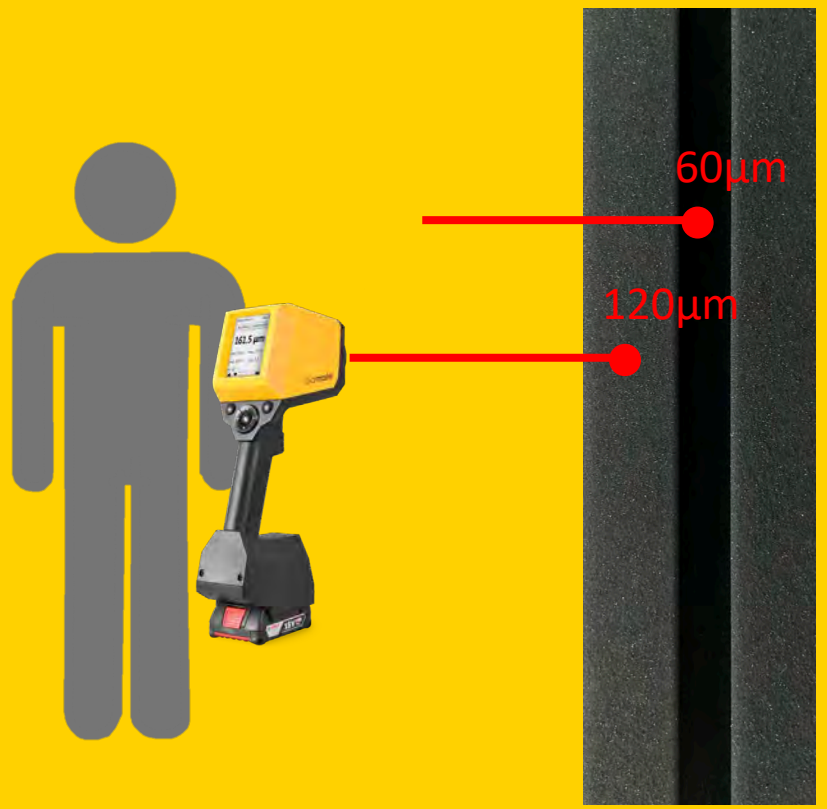
Case study 1: Powder coating in horizontal lines (manual)

Video 4

- Belt speeds up to 8m/min
- hangers of 2m height and 6m length
- Measurement at visible surfaces and function-critical points
- Cost-effective entry into early process control

Benefits: Powder savings, process reliability and documentation

Case study 2: Powder coating in vertical coating line (manual)



- Belt speeds approx. 1m/min
- Profiles up to 8m high and 0.2m wide
- Measurement at visible surfaces and function-critical points
- Cost-effective entry into early process control

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Case study 2: Powder coating in vertical coating lines (manual)

- Belt speeds approx. 1m/min
- Profiles up to 8m high and 0.2m wide

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- Belt speeds approx. 1m/min
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Case study 2: Powder coating in vertical coating lines (manual)

Only spot measurement in lower heights possible!

- Belt speeds approx. 1m/min
- Profiles up to 8m high and 0.2m wide
- Measurement at visible surfaces and function-critical points
- Cost-effective entry into early process control

Benefits: Powder savings, process reliability and documentation

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Case study 3: Powder coating in vertical coating lines (automated)

- Belt speeds up to 1m/min
- Hanger of 2m height and 5m length
- Measuring window: 0.5m x 0.5m (variable height)

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Case study 3: Powder coating in vertical coating lines (automated)

- Belt speeds up to 1m/min
- Hanger of 2m height and 5m length
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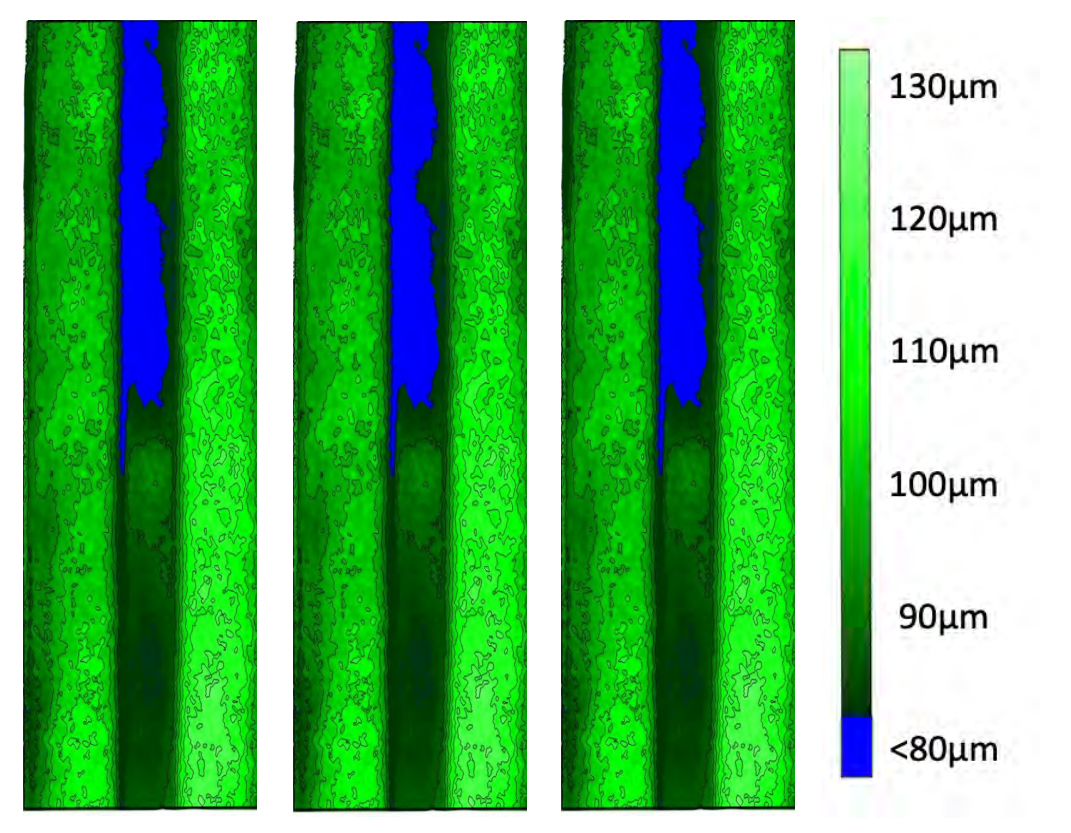
Case study 3: Powder coating in vertical coating lines (automated)



- Full information about layer thickness distribution
- 100,000 measuring points with mm resolution
- User-friendly information display

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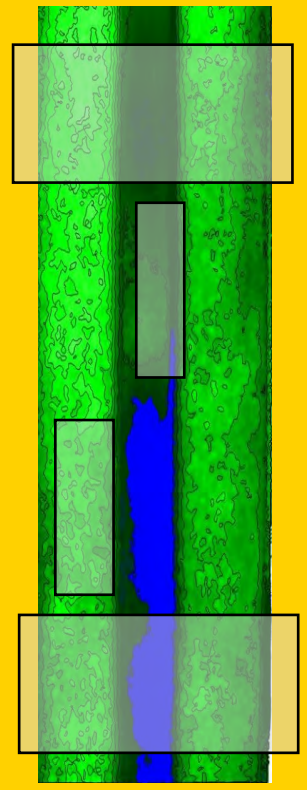
Case study 3: Powder coating in vertical coating lines (automated)



ROI 1:AVG: 90µm, STD: 28µm,
Min: 55µm, Max: 130µm

ROI 2: AVG: 60µm, STD: 3µm,
Min: 55µm, Max: 65µm

ROI 3: AVG: 110µm, STD: 6µm,
Min: 105µm, Max: 120µm

ROI 4: AVG: 100µm, STD: 16µm,
Min: 90µm, Max: 123µm

- ROI=Region of interest
- Information about:
  - AVG: Average
  - STD: Standard deviation (homogeneity)
  - MIN: Minimum layer thickness
  - MAX: Layer thickness

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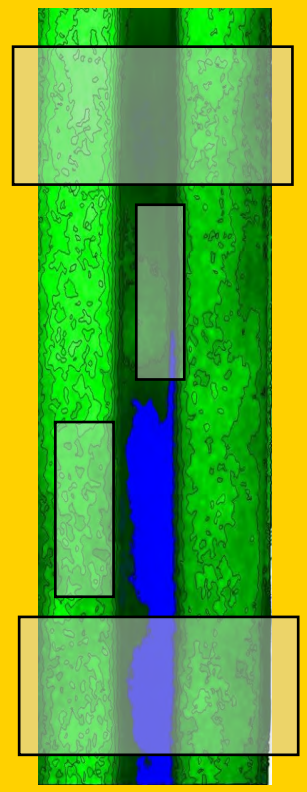
Case study 3: Powder coating in vertical coating lines (automated)



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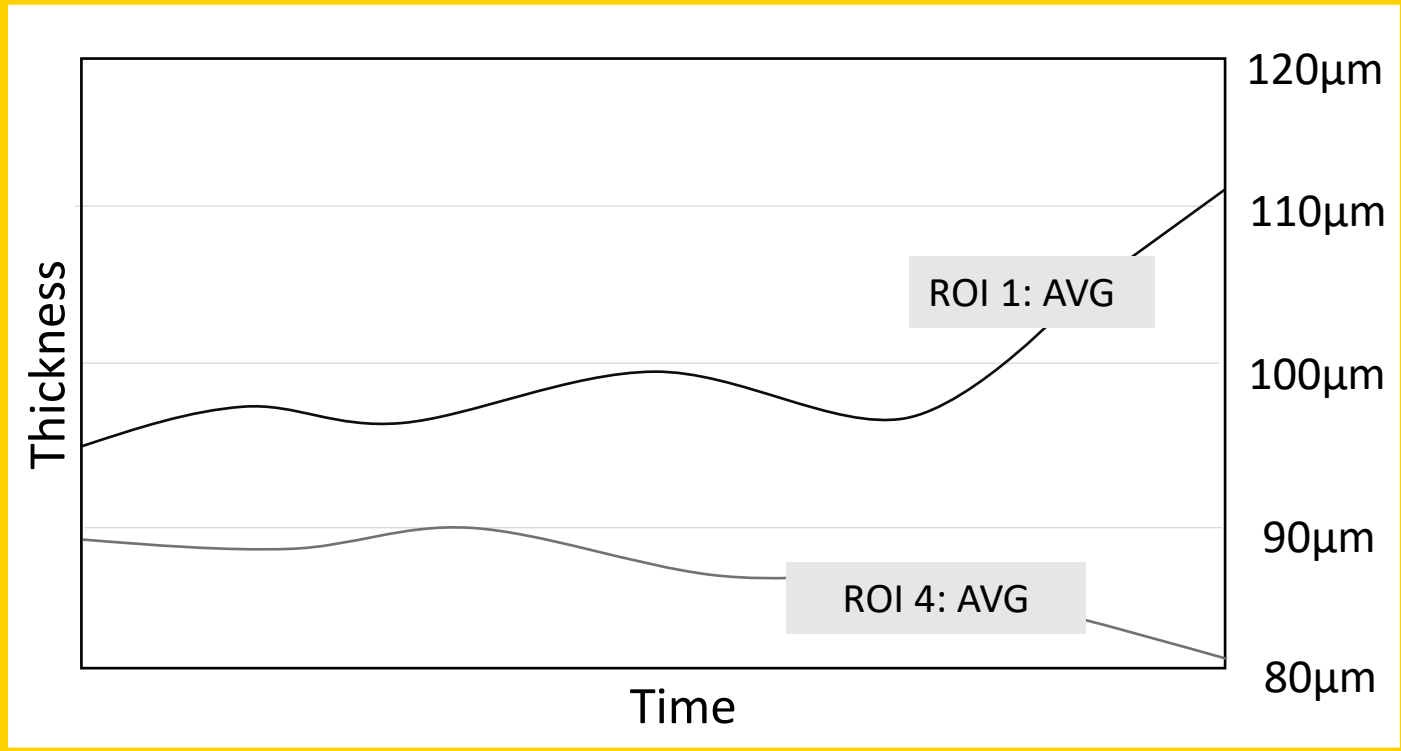

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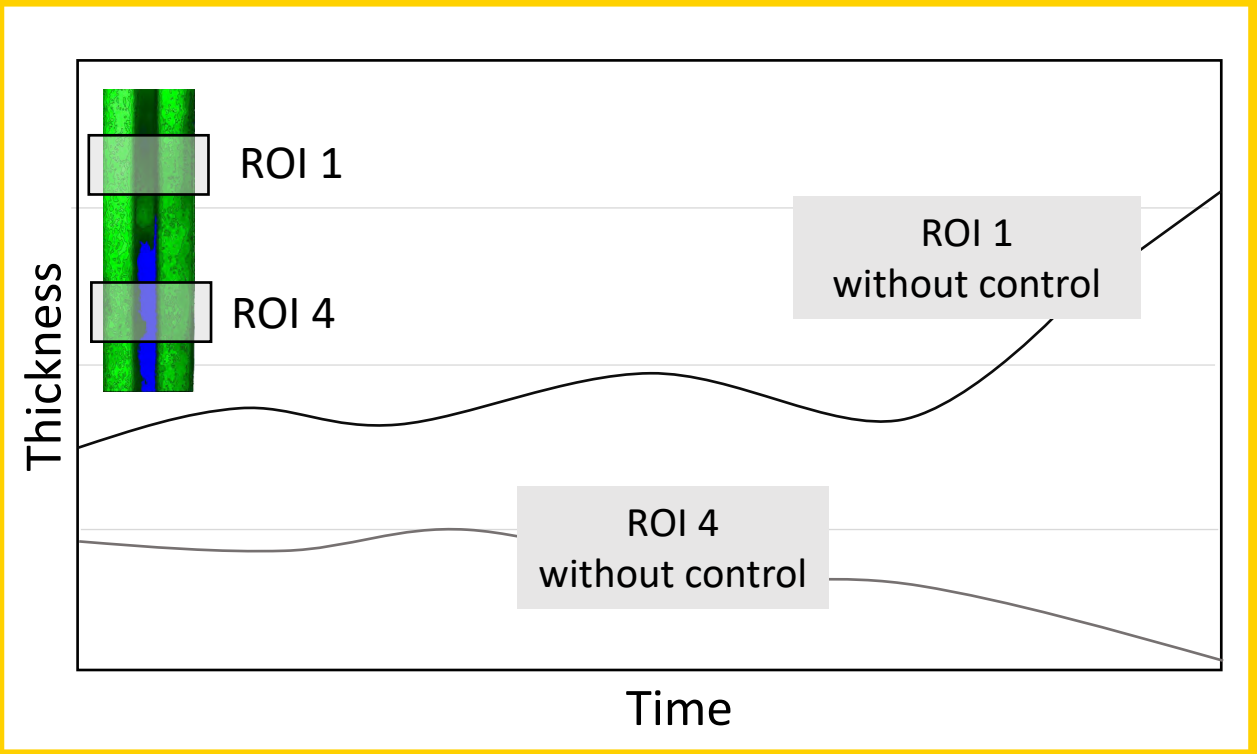

- Without control, coating thickness drifts
- Increased powder consumption or scrap

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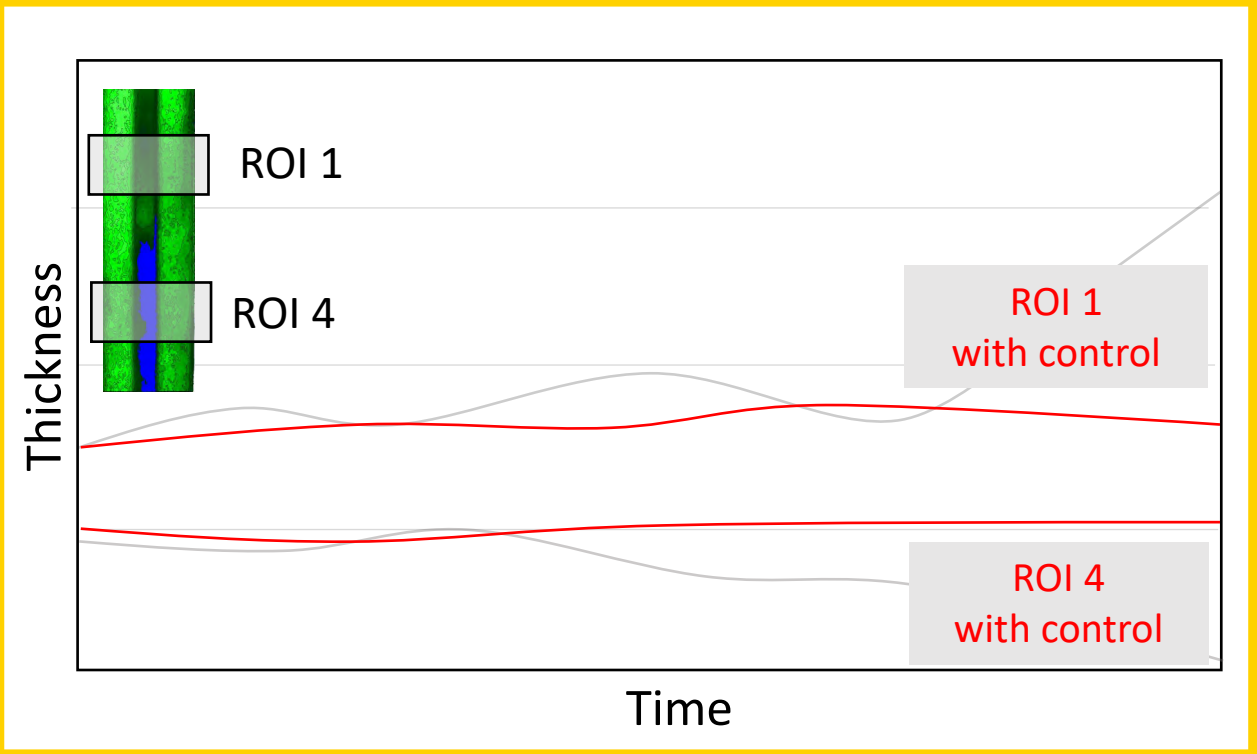
Case study 3: Powder coating in vertical coating lines (automated)



- With regulation constant layer thickness
- Minimum powder consumption
- Avoidance of rejects

Benefits: Powder savings, process reliability and automated documentation

Survey 3

Which advantages in imaging coating thickness measurement are interesting for you?

- Detect coating fluctuations and correct them
- Avoid under/over coating
- Optimize system parameters in a targeted manner
- Simplify manual rework
- Automation of testing processes

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Payback - Calculation

- Reduction of the average coating thickness from 130µm to 90µm (-30%) through process optimization with the coatmaster Flex.
- Reduction of material consumption by more than 50'000 € / year with an annual consumption of 30t
- Process assurance of the coating process
- Avoidance of incorrect coatings
- Reduction of teach-in phases

Survey 4

How can I make early process assurance work for me?

- I would like to learn more about funding opportunities.
- I want to test and personally convince myself of the benefits.
- I need individual advice or training.
- I already rely on early process safeguarding.
- My plant runs optimally even without process safeguarding.

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Already a coatmaster?

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