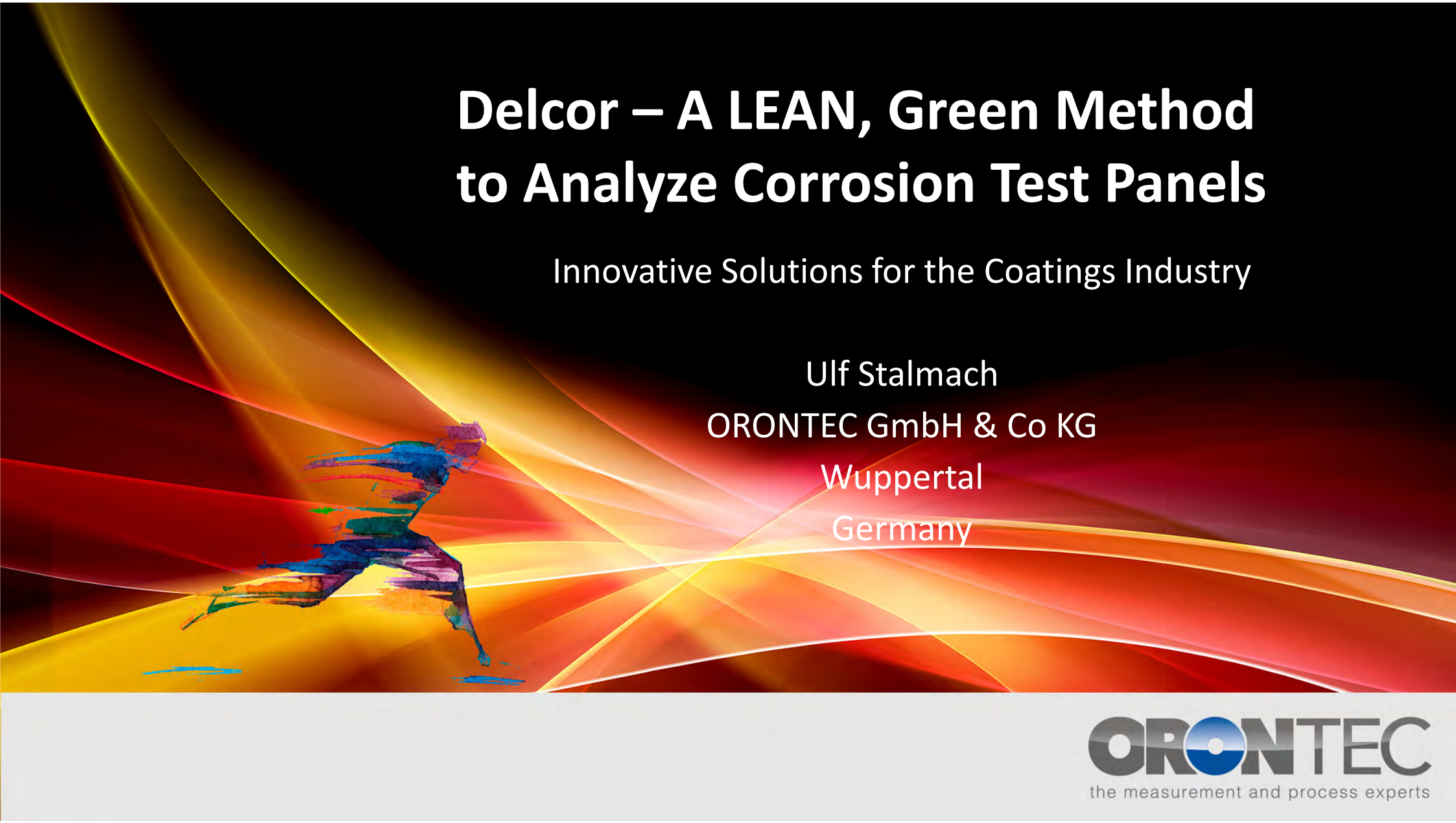
Delcor – A LEAN, Green Method to Analyze Corrosion Test Panels

Innovative Solutions for the Coatings Industry

Ulf Stalmach
ORONTEC GmbH & Co KG
Wuppertal
Germany



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Economical Volume of Corrosion Protection

Approximatelly 3 – 4 % of the gross domestic product
are losses by corrosion.

Improving the corrosion protection and the test method
has a big impact on economy.

The estimate of losses in Germany is between 100 and 150 MM$.

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Process Control a la ORONTEC




DELCOR®

R&D
formulation

Q-Chain® SuMo

Q-Chain® PolyShear

Q-Chain® SSA

QC
incoming goods

Production
semi-finished goods => finished goods => corrections

QC
outgoing goods

Client

not film-forming

film-forming

liquid sample

painted (dry) samples

MagnoMeter XRS®

Q-Chain® LCM

MagnoMeter XRS®

complexity of formulation

cost of correction

The earlier the process is controlled, the less error propagation

Control of semi-finished goods => right-first-time production

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4 LEAN and Green?

LEAN manufacturing is a methodology for maximizing customer value while **minimizing waste** in production. In practice, it means streamlining processes to **only use the necessary resources** and **eliminate activities that don't add value.**

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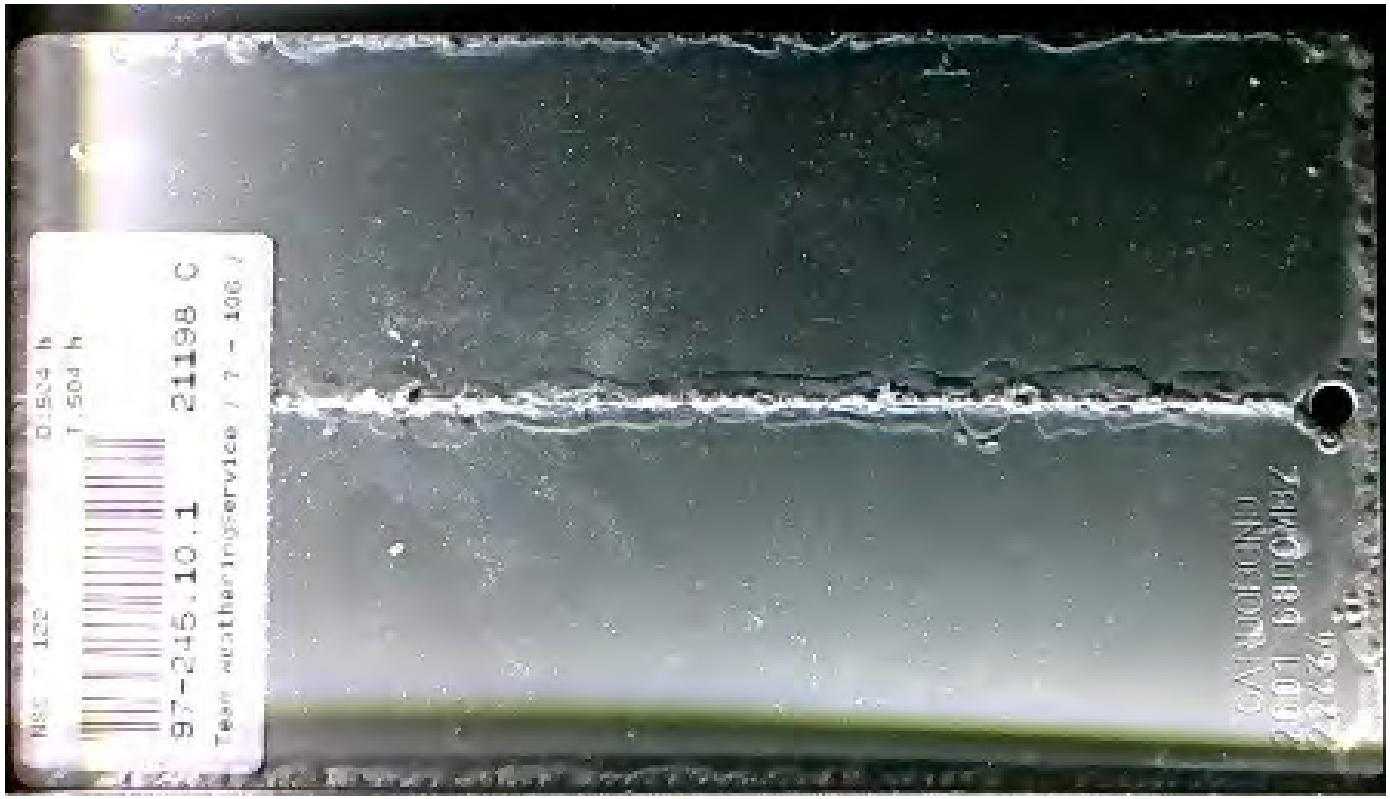
Test Panel after Exposure in Salt Spray Chamber



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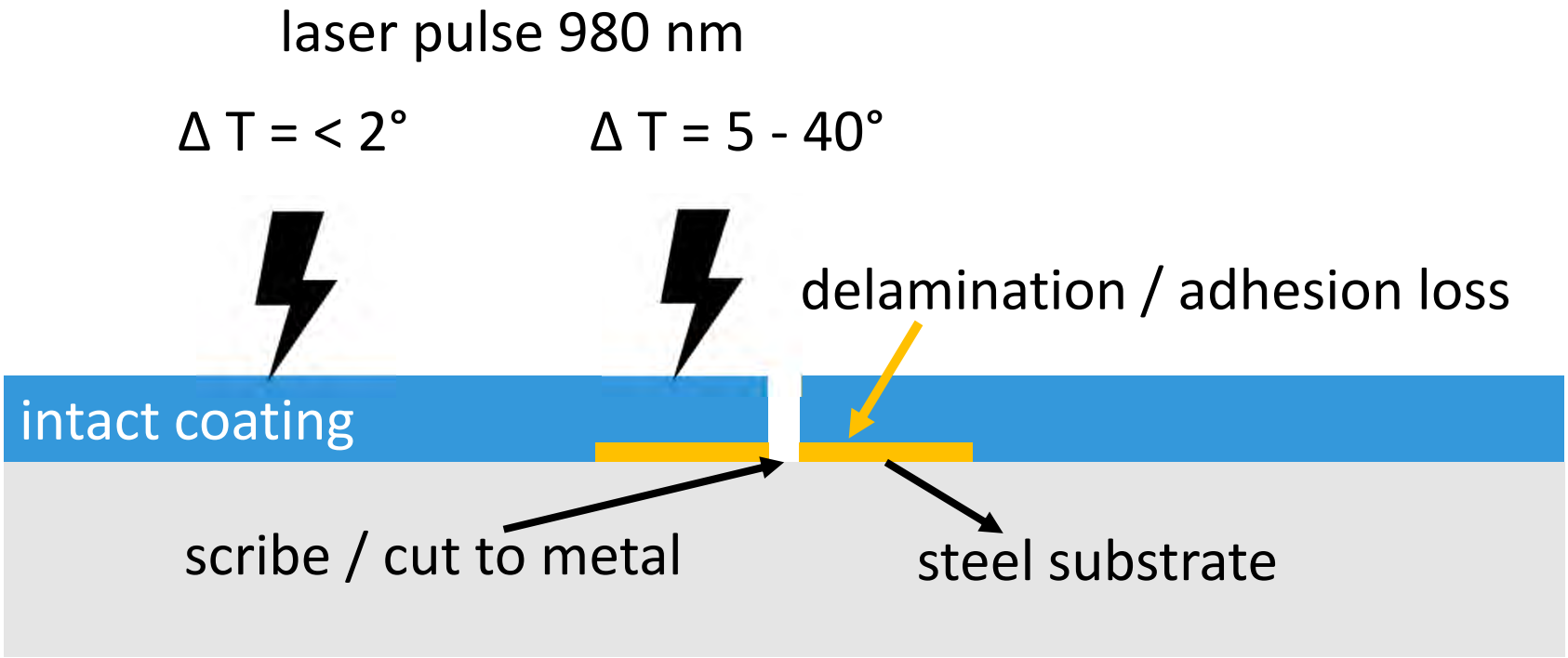
Principle of Impulse Thermography



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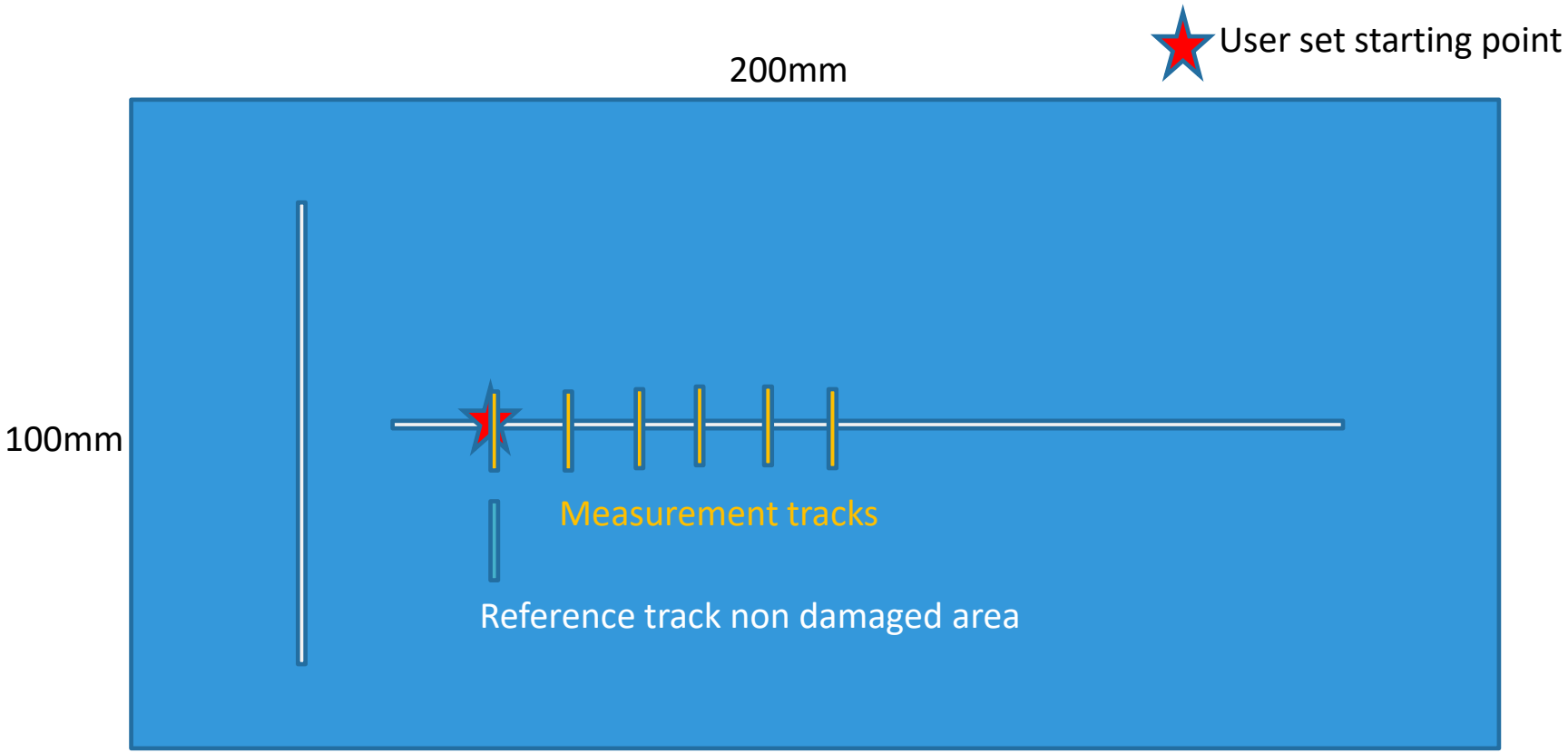
Test Method per DIN EN ISO 4628-8



Total testing time with 11 lines, 10 mm distance and 40 mm length is approx. 3 minutes

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Measurement Signal

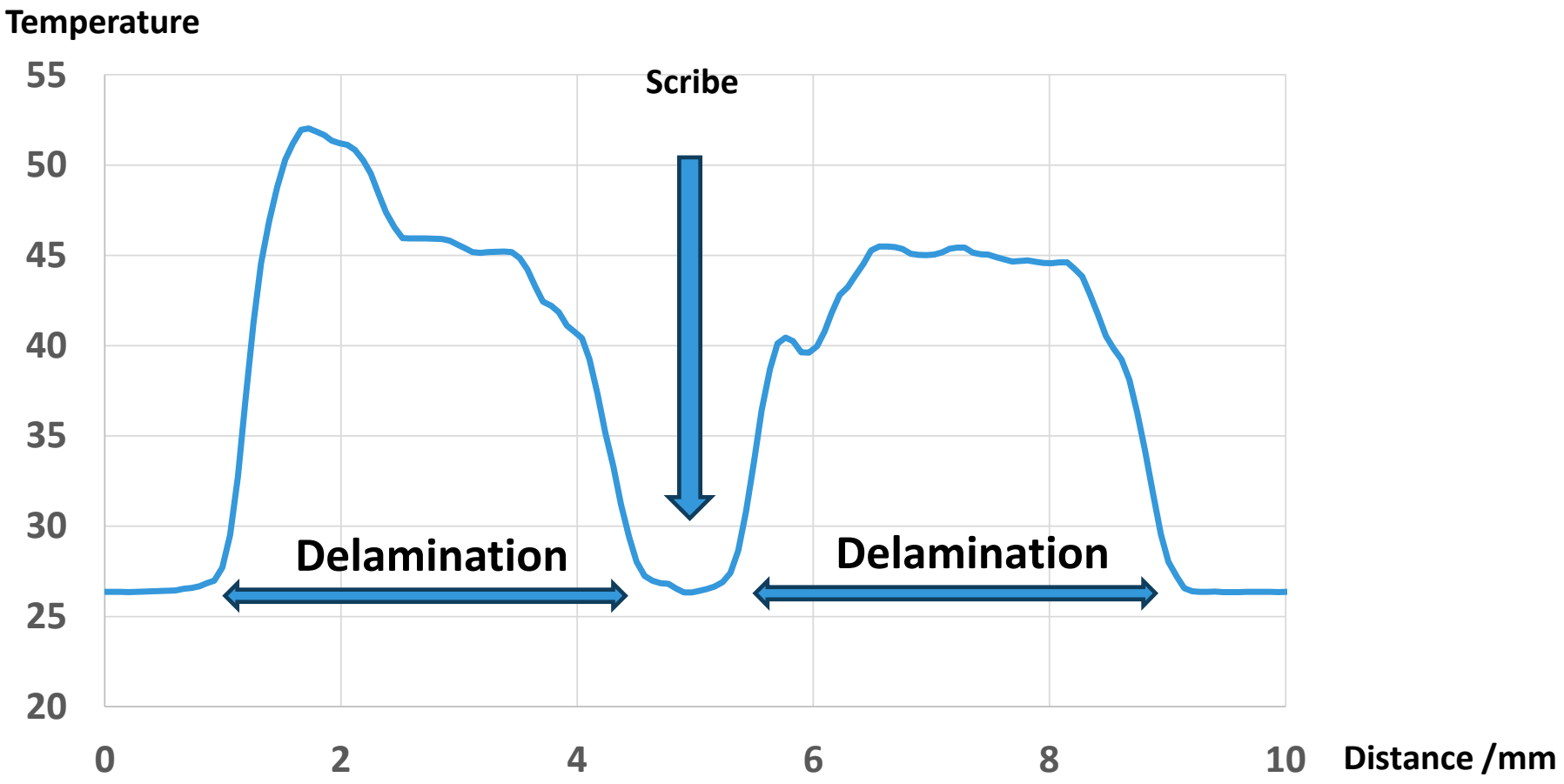
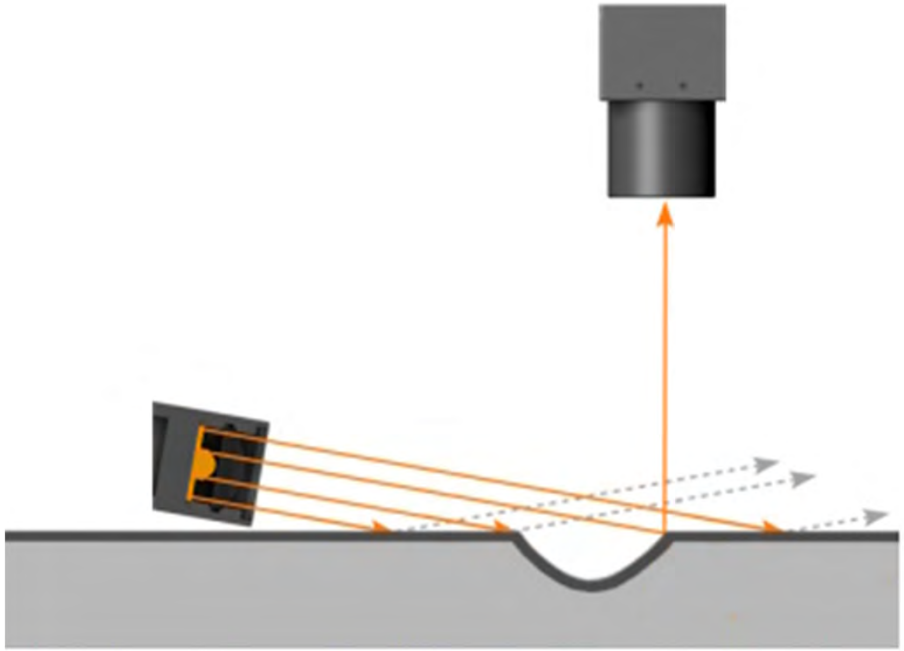


Photo Documentation

Dark field illumination – increased visibility of edges



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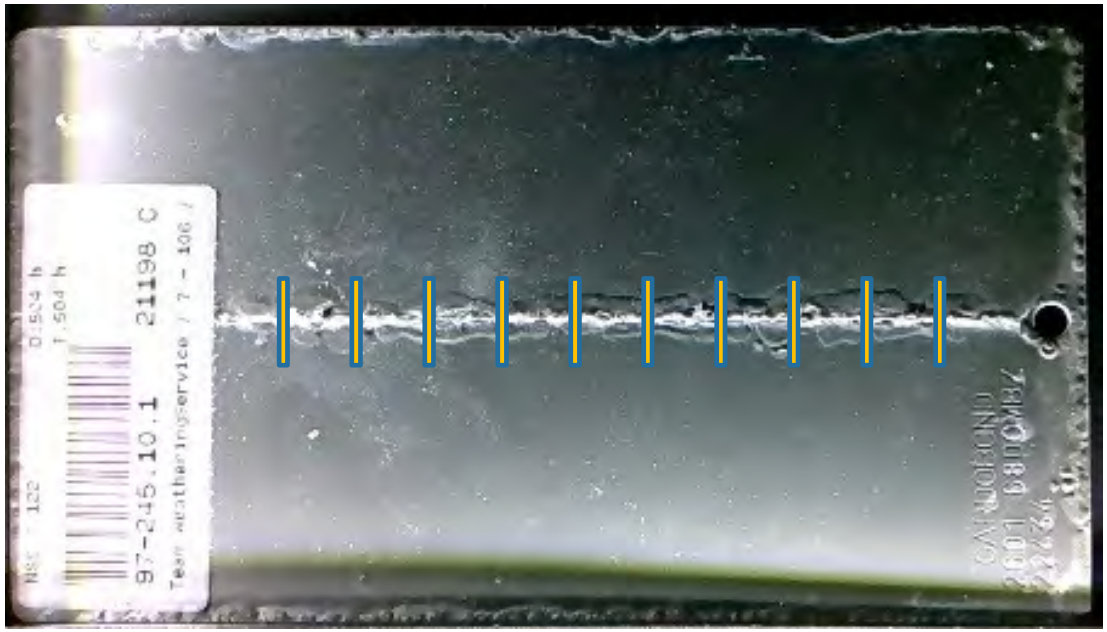
Reproducibility / Data Analysis

Line	Scan 1
1	3.78
2	7.29
3	9.14
4	6.68
5	3.64
6	8.15
7	7.22
8	9.14
9	9.00
10	4.51



Average width Scan 1 = 6.85 mm
Standard Deviation = 2.17 mm

Panel shows very irregular corrosion – how do you analyze ??

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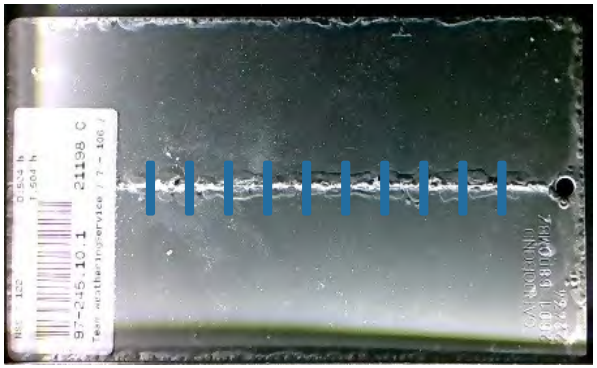
Reproducibility / Data Analysis

Line	Scan 1	Scan 2	Scan 3	Scan 4	Scan 5	average	std dev
1	3.78	2.98	3.77	3.71	3.71	3.59	0.34
2	7.29	7.29	7.29	7.35	7.35	7.31	0.04
3	9.14	9.15	9.07	9.07	9.14	9.11	0.04
4	6.68	6.76	6.76	6.76	6.75	6.74	0.03
5	3.64	3.65	3.65	3.64	3.64	3.64	0.00
6	8.15	8.14	8.21	8.21	8.21	8.19	0.04
7	7.22	7.22	7.22	7.22	7.22	7.22	0.00
8	9.14	9.14	9.14	9.20	9.20	9.17	0.03
9	9.00	9.47	9.07	9.14	9.07	9.15	0.18
10	4.51	4.51	4.51	4.50	4.64	4.53	0.06



Conclusion

Method allows to determine
Range of irregularities
Min. 2.98 mm
Max. 9.47 mm

1. Corrosion width is reproducible along each position of scan line
2. Std. deviation at each scan line is very low
3. Accuracy of method < 0.1 mm

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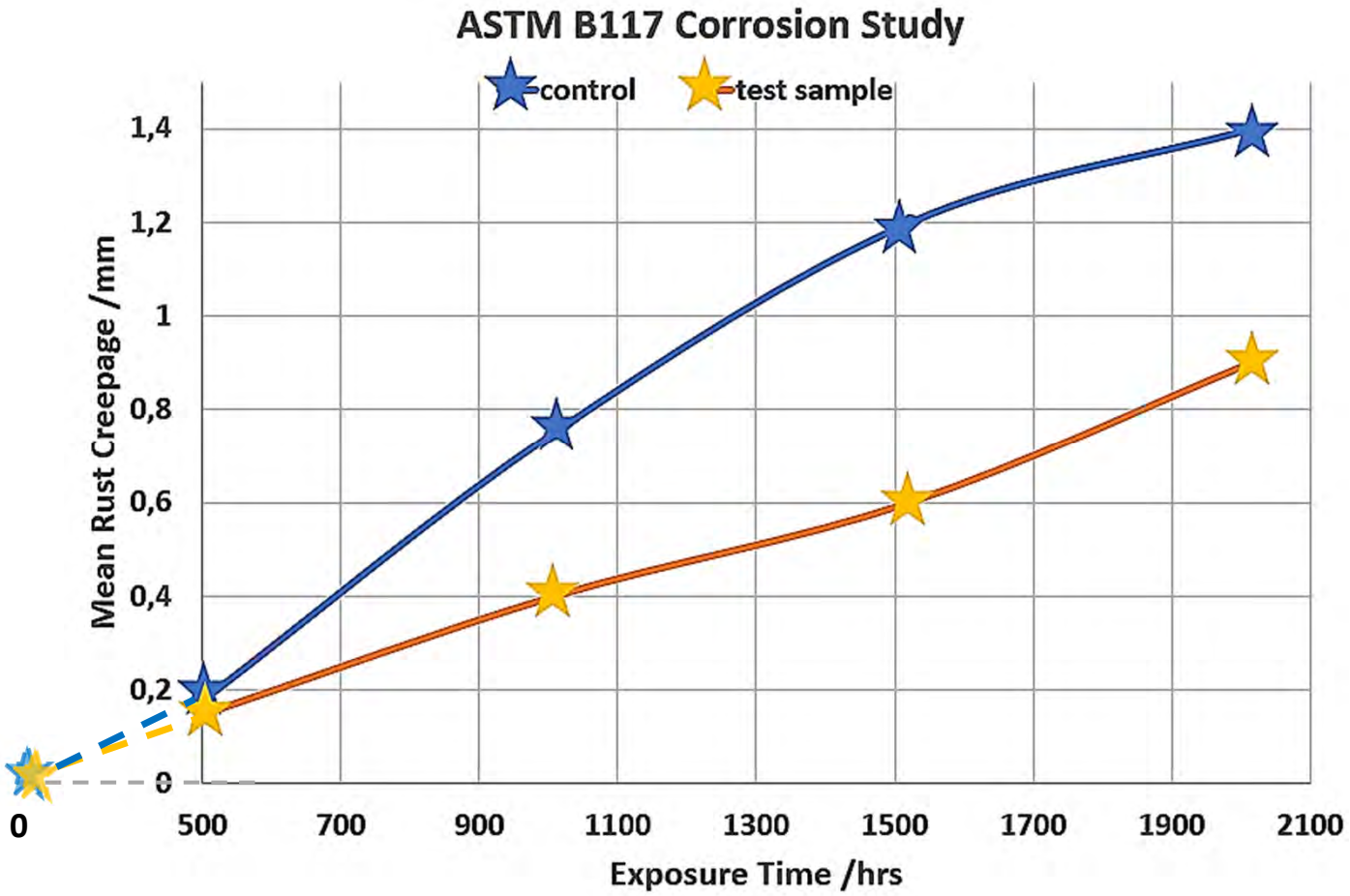
The NDT Evaluation of Test Panels



How many panels do you need for this corrosion study ?

- 8 panels per sample by standard procedure
- 2 panels per sample by using DELCOR

➢ **75% reduction in materials, energy, workload, loading of salt spray chamber**

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LEAN and Green?

Corrosion testing		in yellow: assumptions		in red: calculated			
number of products tested/year	300						
Number of panels/data point (for statistics)	3						
Number of data points	4	Number of panels/product	12				
Delcor-Factor	1	Number of panels/product	3				
				Cost per panel (EUR)	Cost per data point (EUR)	Cost per product (EUR)	Cost per product Delcor (EUR)
				17	**51**	**204**	**51**
time per panel	0,1	cost per hour (EUR)	60	6	18	72	18
kg waste per panel	0,5	cost per kg waste (EUR)	10	5	15	60	15
		materials cost per panel (EUR)	2	6	18	72	18
					Total cost	61.200	15.300
					total savings (EUR)	**-45.900**	

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LEAN and Green?

Savings

Lean:
minimizing waste,
only use the necessary resources
eliminate non-value-adding activities

Monetary:
- See excel-sheet

Sustainability:
- Less waste
- Less energy/data point
- Lower PCF
- Less manpower/data point
- Less product tests necessary

Technically:
- More reliable data:
  no operator influence
  no destroyed test panel
  re-usable test panel
- More data points w/o increase in cost
- Digitally available data
- More space in spray chamber
- Increased test productivity

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Benefits

1. **Documentation**
   - Raw/evaluation data
   - Photos of Panel

2. **(Data) Quality**
   - Traceable
   - Operator independent
   - Statistical Data

3. **Digitalisation**
   - Complete digital data set

4. **Costs**
   - one panel for the whole process
     - to prepare/spray → material/time
     - to corrode → salt spray chamber capacity
     - to scrape off (not needed) → time

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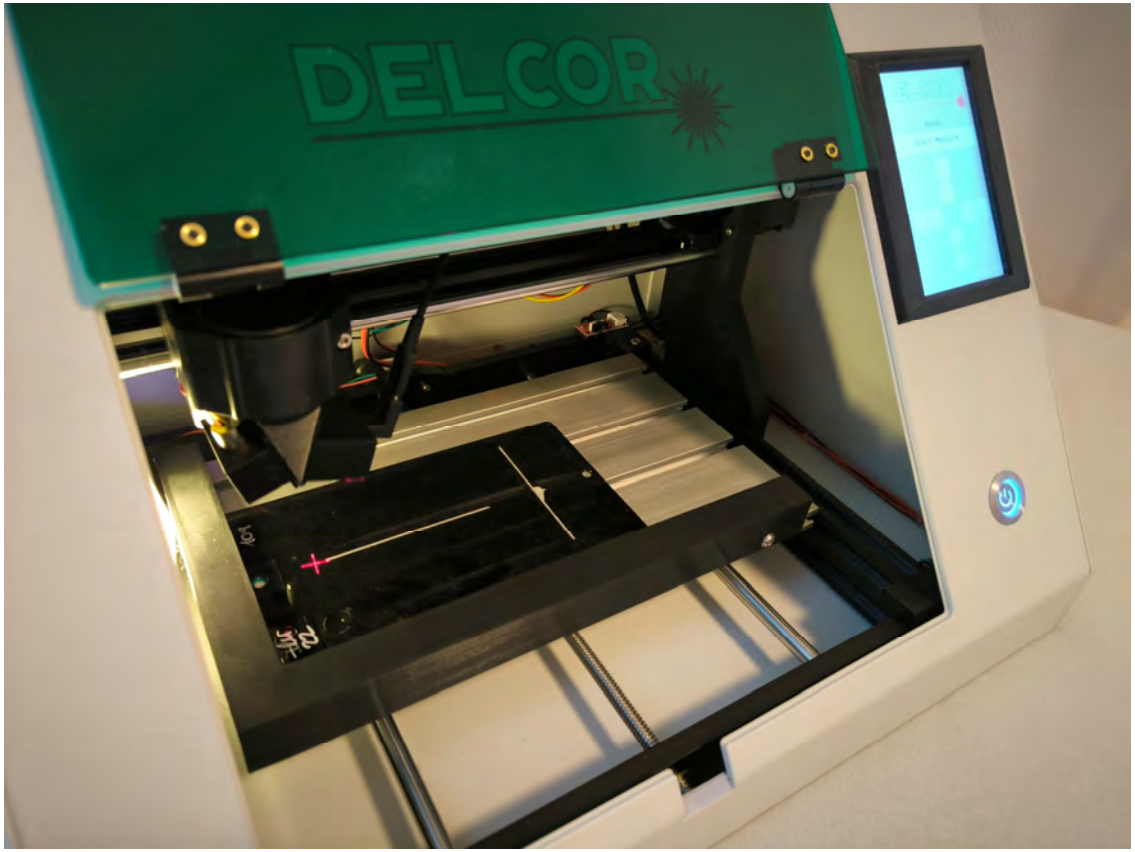
Development of Automatic Test Machine



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Market Introduction

- 5 units built
- Prototypes not programmed (yet) for filiform (Alu) corrosion
- Support to adapt to customer test requirements
- Serial production of 10 units planned for March 2026
- Scope of method will be expanded to other cases of adhesion loss
- Patents granted and pending

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Advantages at a Glance

- Small, compact and cost-effective device
- Dimensions (w/l/h): 500 x 400 x 320 mm, 8 kg
- 24 Volt power supply, Ethernet and Wifi for connection with a PC or other web device
- Autonomous measurements possible without PC
- Time for one panel < 3 minutes
- Measuring principle: thermography therefore non-destructive
- Significant load reduction of corrosion test chambers by reuse of test panels
- Panels can be tested directly after scribing before starting the test to avoid off spec sample preparation
- No scratching off of delaminated coating, no operator influence
- Significant gain of efficiency for laboratory staff by automated measurement, evaluation, and documentation

Increase of efficiency and precision

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Ulf Stalmach

ulf.stalmach@orontec.com

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More Performance for the Paint Industry

ORONTEC GmbH & Co. KG
Carlo-Schmid-Allee 3
44263 Dortmund
Tel: +49 231 477 307 770
Fax: +49 231 477 307 771
E-Mail: info@orontec.com

SmartPaintFactory.com

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Measurement Method

- Based on impulse thermography
- IR laser is scanning test panel
- Non damaged areas heat up little, as thermal conductivity to steel panel is high
- Delaminated areas heat up more, as heat dissipation to metal is interrupted
- Thermal camera is recording heat picture of panel
- Optical picture is taken for documentation
- Picture and measurement data are transferred to PC
- Mean rust creepage is automatically evaluated from thermal picture
- Automatic documentation of all data
- Measurement cycle time 1 – 5 min (depending on # scans)

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