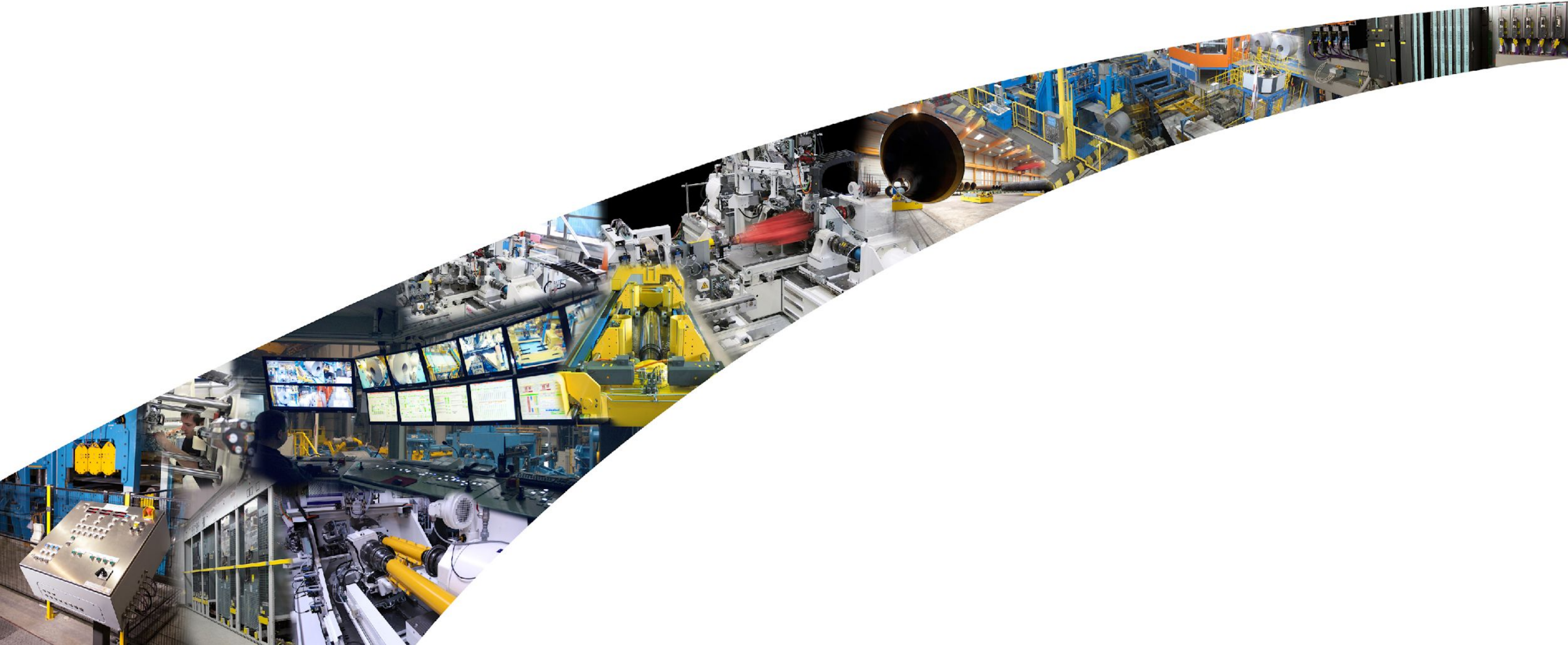


# KLEINKNECHT **KK**





## Agenda

### Electrical Discharge Texturing (EDT) Increase Of Roll Surface Quality By Use Of Linear Motors In A CRM Rollshop

- Introduction of Kleinknecht
- Electrical Discharge Texturing (EDT) in Cold Mill Roll Shop
- Application of EDT / EDT in Automotive
- Product range
- Electrode adjustment by linear Motor
- Summary
- Q&A





Solutions for the Industry

- Industrial Applications
  - Machine Tools
  - Logistics and Material Handling
- ~200 Employees at three locations

Since 1946 Your Reliable Partner for High-Tech Quality Solutions

1946: Formation as an Engineering Consultant

1948: Formation of H. Kleinknecht & Co. GmbH, Siegen

2003: Formation of H. Kleinknecht GmbH & Co. KG, Lohfelden

2006: Integration of 

2011: Combined mechanical competences at Quartier Landeskrone, Wilnsdorf

2016: Strategic Share holding by 

2018: Merger of the Kleinknecht-Entities into one Company: H. Kleinknecht & Co. GmbH





## What we can do

### Automotive Powertrain

- End Of Line – Noise / Vibration / Harshness Testing
- Gear box / engine test rigs

### Steel & Energy

- Automation and Drives Systems for Processing Lines
- EDT Machines
- Roll Grinder CNC, Modernizations and Retrofits



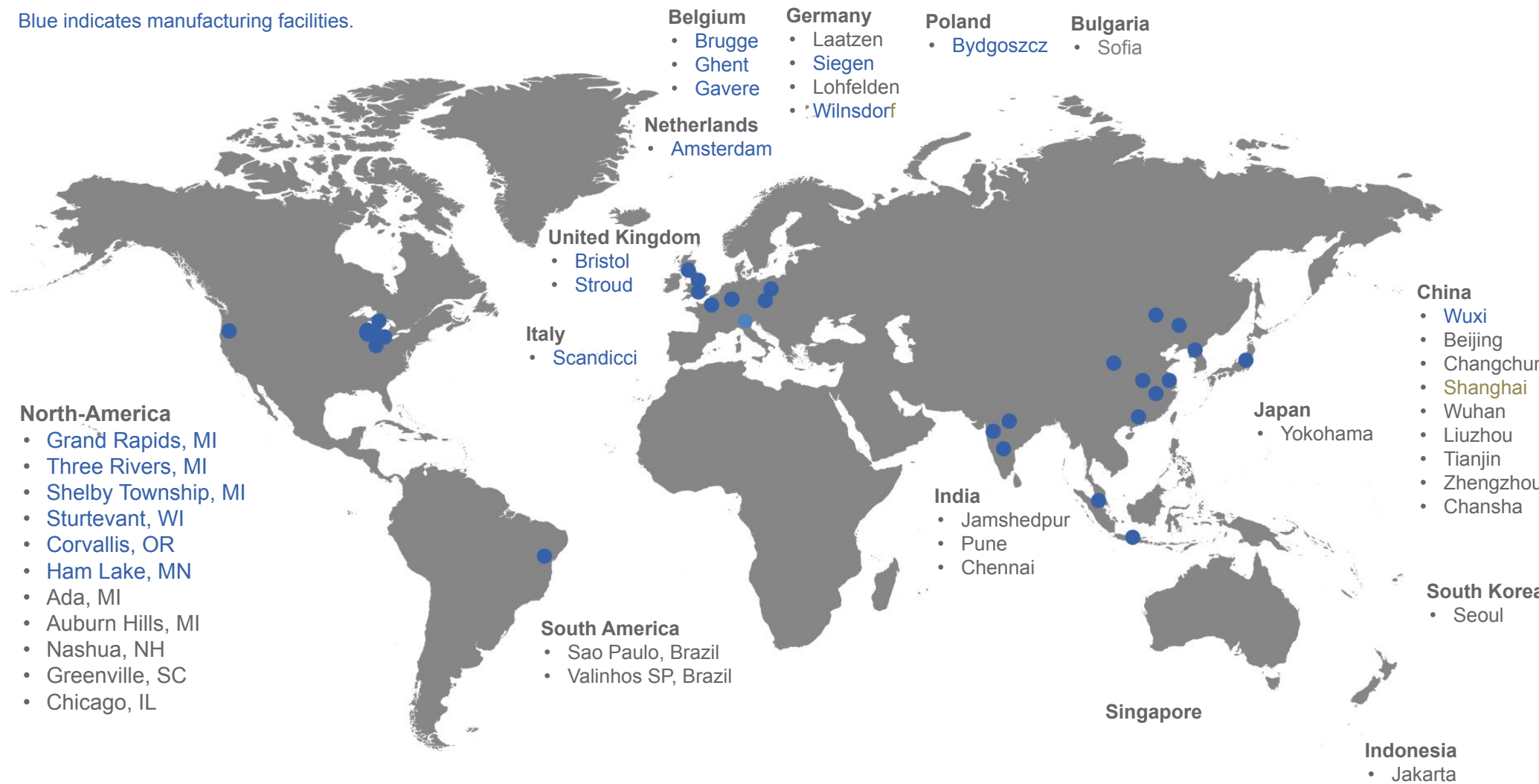
Quality Management Certification acc. to DIN EN ISO 9001:2015

Health and Safety Management Certification acc. to SCC\*\*2011

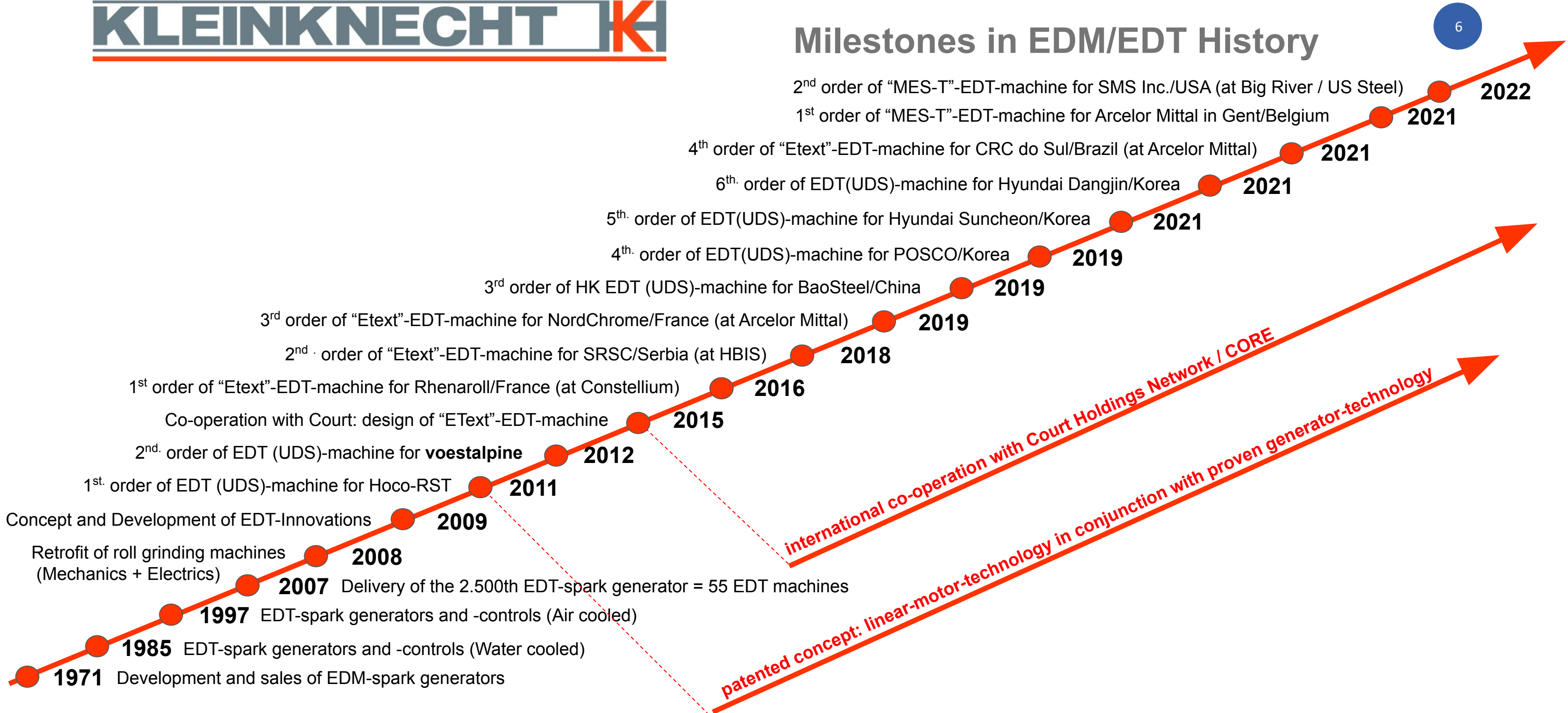




Blue indicates manufacturing facilities.



## Milestones in EDM/EDT History





Servicing and reconditioning of worn rolls

- Dechocking (disassembly of roll and chocks)
- Chock and bearing service (greasing)
- Roll grinding
- **Roll texturing (work rolls only)**
- Chrome plating (work rolls only)
- Inspection
- Chocking (reassembly of roll and chocks)
- Return to mill













Surface texture parameters,  
which can be influenced by EDT

- Ra – arithmetical mean deviation  
~0,5 to 15 $\mu$ m Ra
- RPc – standardized number of peaks  
~30 to 180 RPc

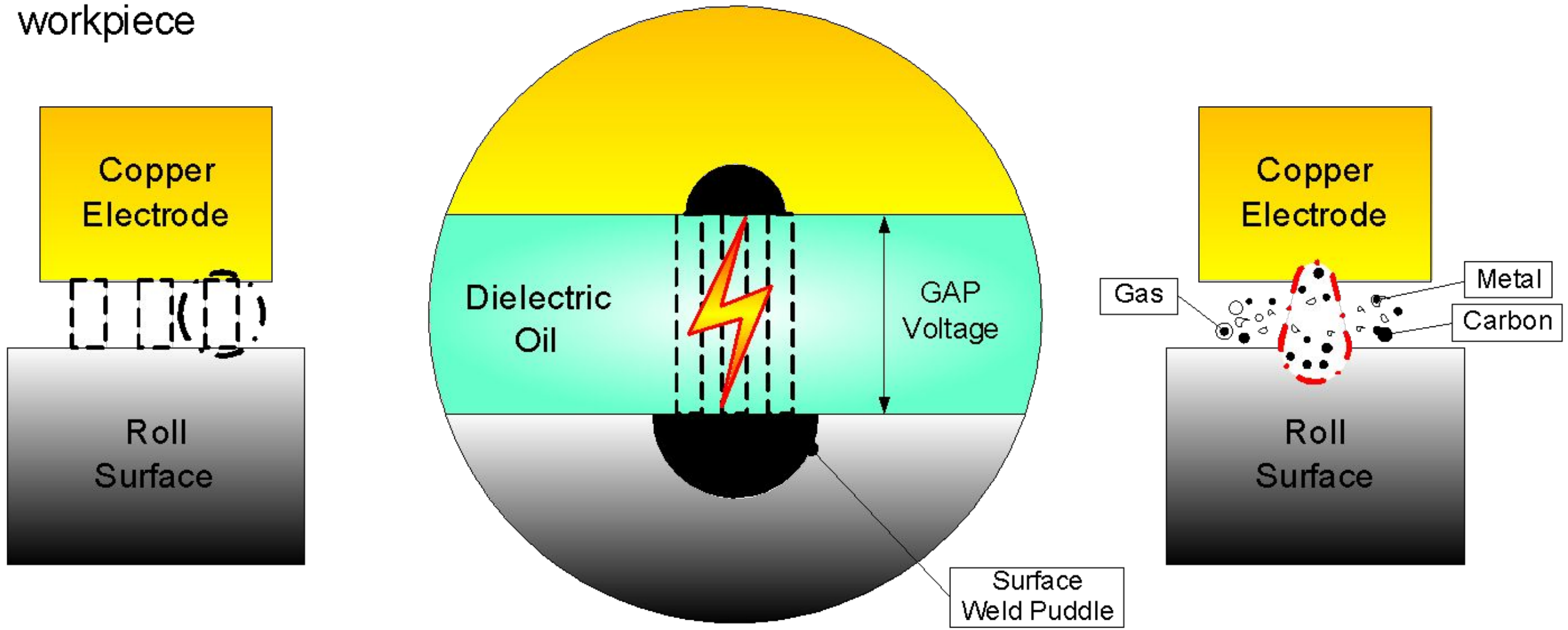


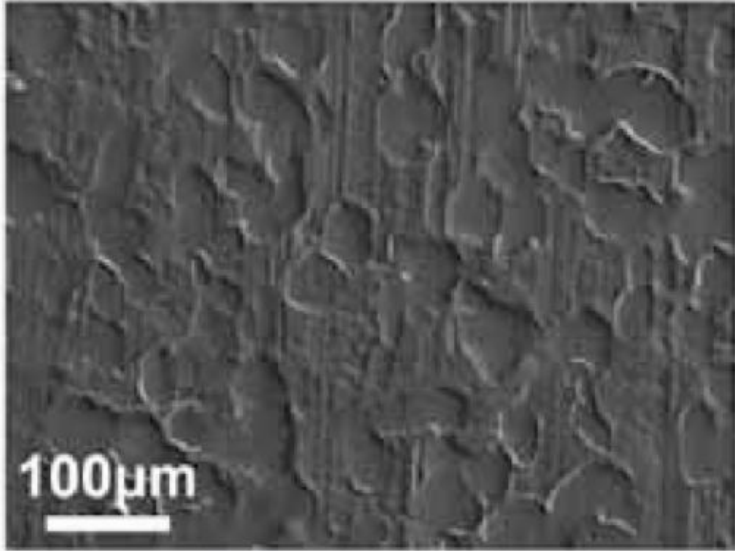
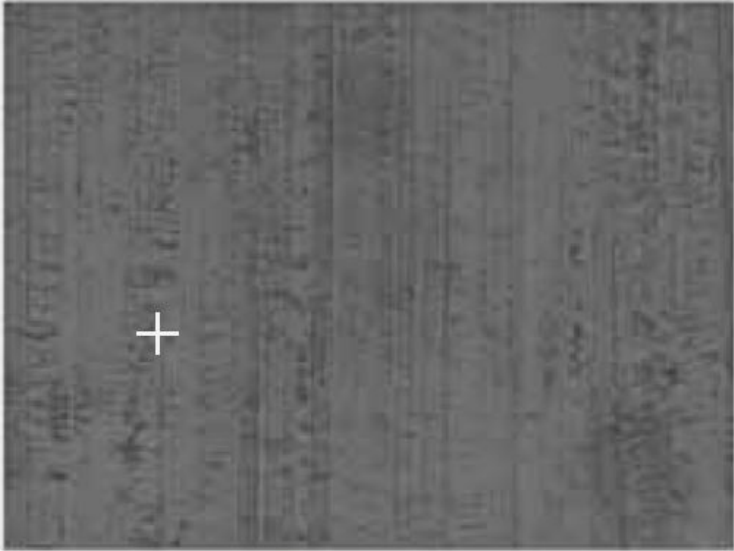
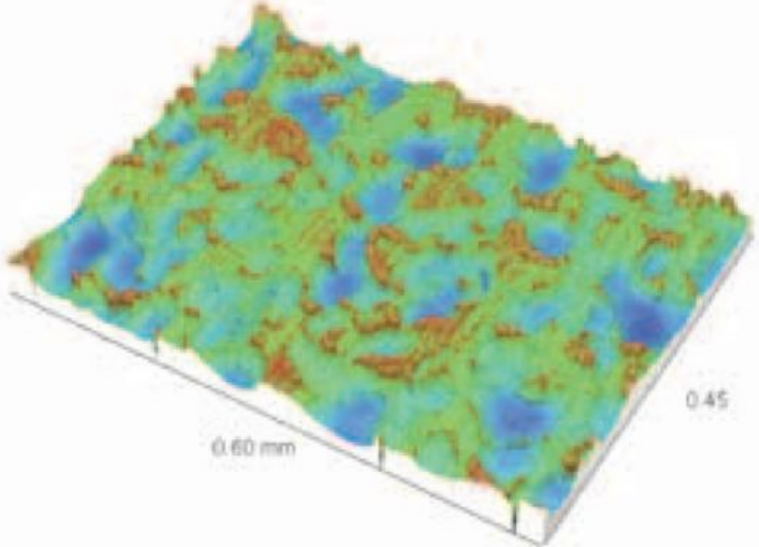
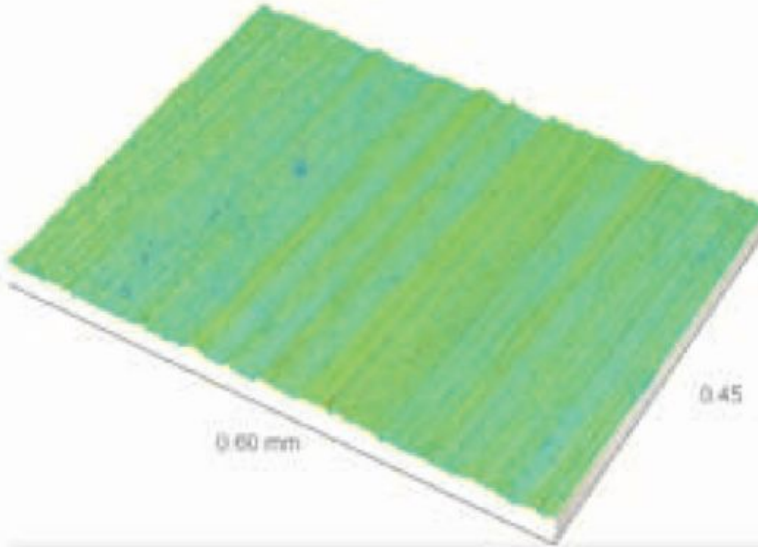
Source: worldsteel.org: Cold rolled coils in the storage yard (ID 31346), as per 16.10.2022



### EDT Process :

Surface erosion by a controlled sparc between electrode and workpiece



	EDT	MF
SEM		
3D Optical profilometry		

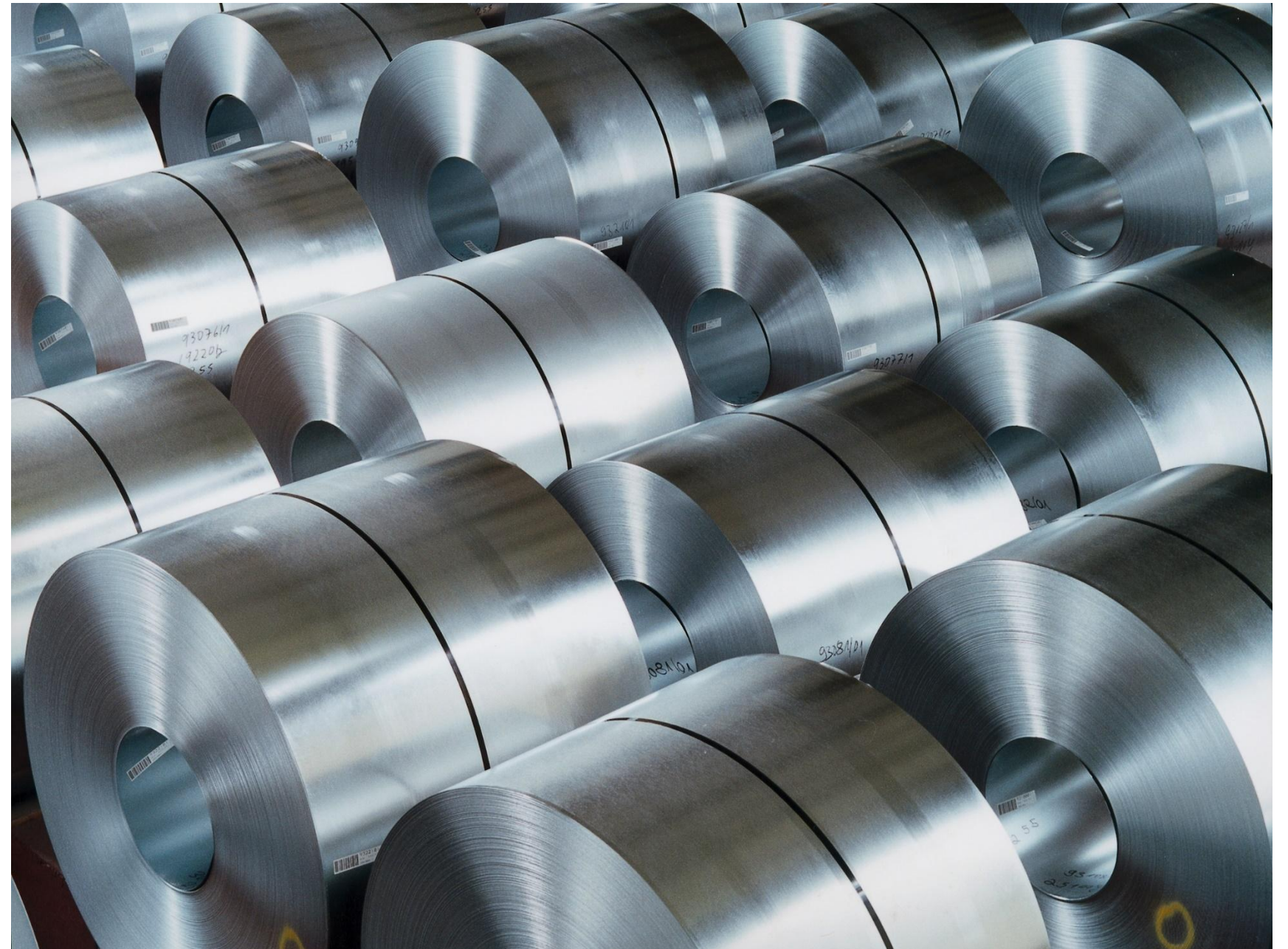


### Industry

- Automotive body (inside / outside)
- White goods (Home appliance)
- High quality products

### Material

- Carbon Steel
- Galvanized Steel
- Electro Zinc
- Tin Plate
- Color Coat
- Stainless
- Aluminum



Source: stahl.de: Galerie Umformtechnik as per 20.10.2022



Statement of SMS group:

“There are extremely high demands on material for exposed car panels. [...] Using EDT rolls ensures the required quality and durability of the color coatings on the exposed parts. [...]

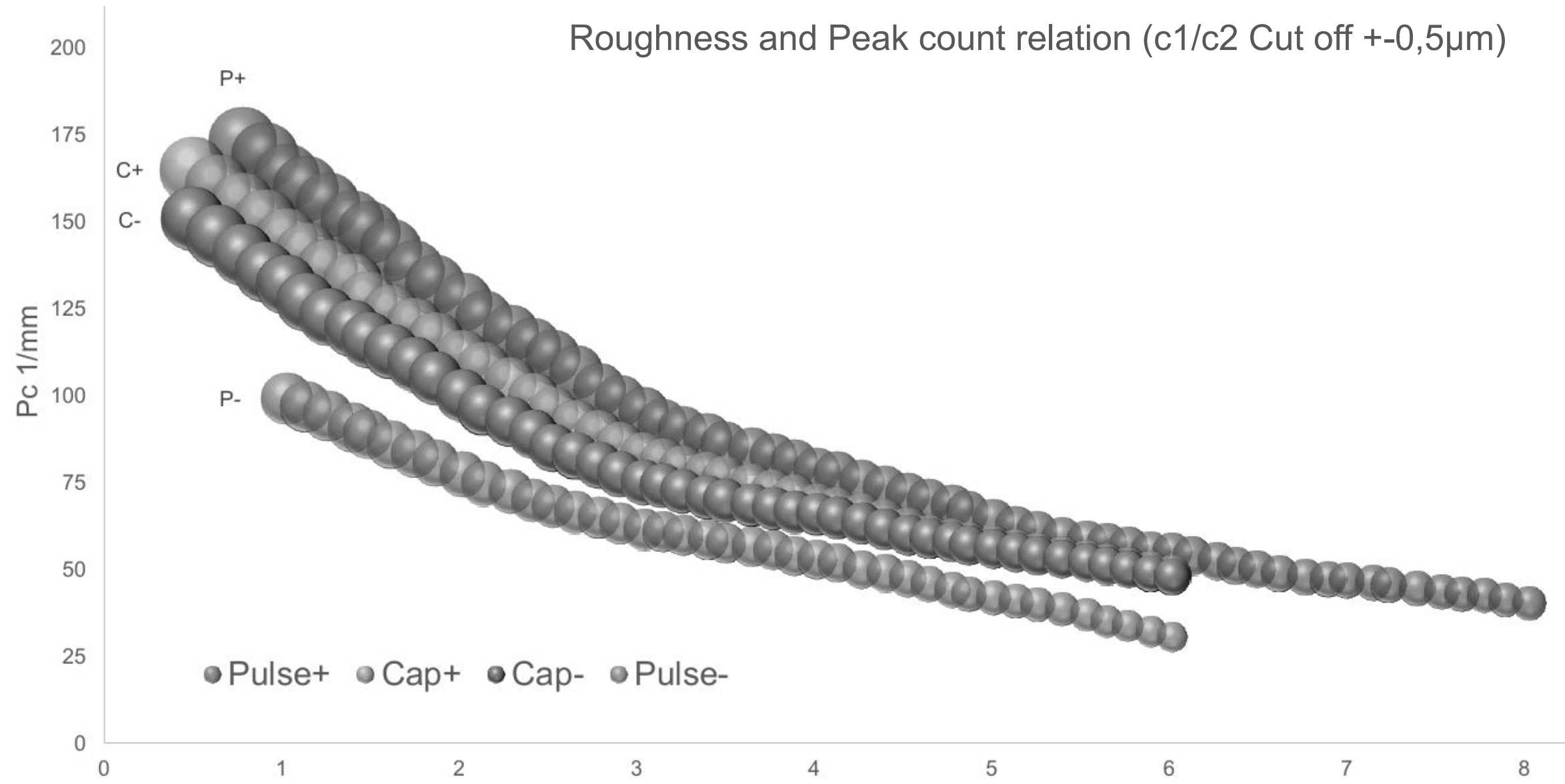
### Benefits

- Isotropic structure
- Better formability
- Better press-shop handling
- Better lacquer appearance and panel matching”

Source: <https://www.sms-group.com/plants/cold-rolling-mills-for-aluminum#c8583> as per 20.10.2022



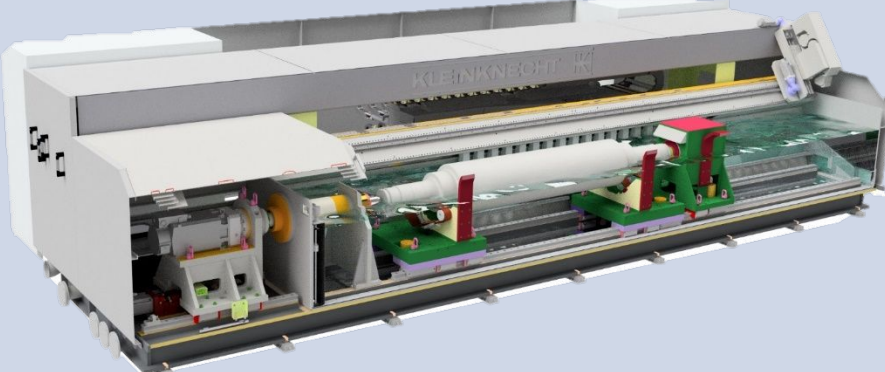
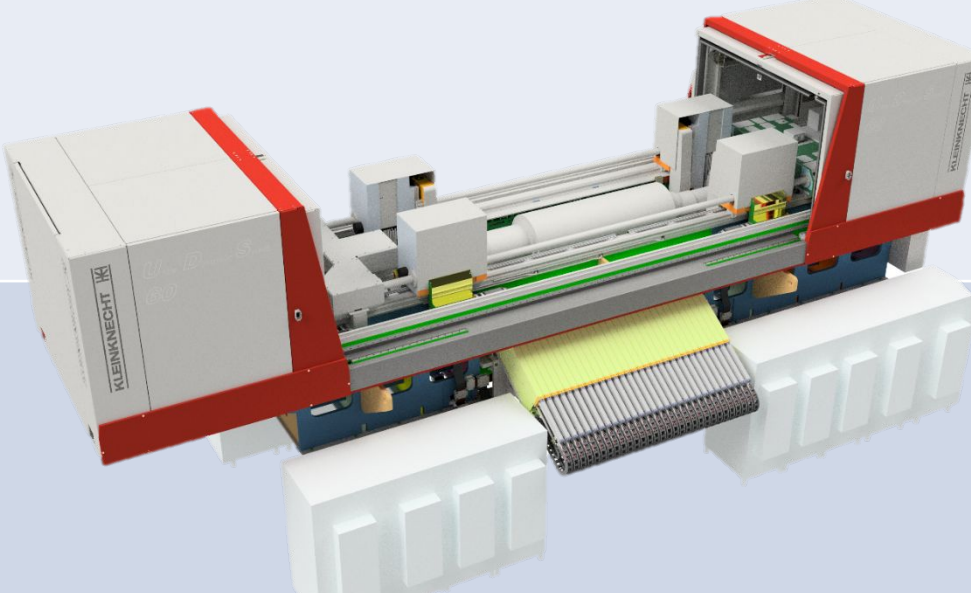


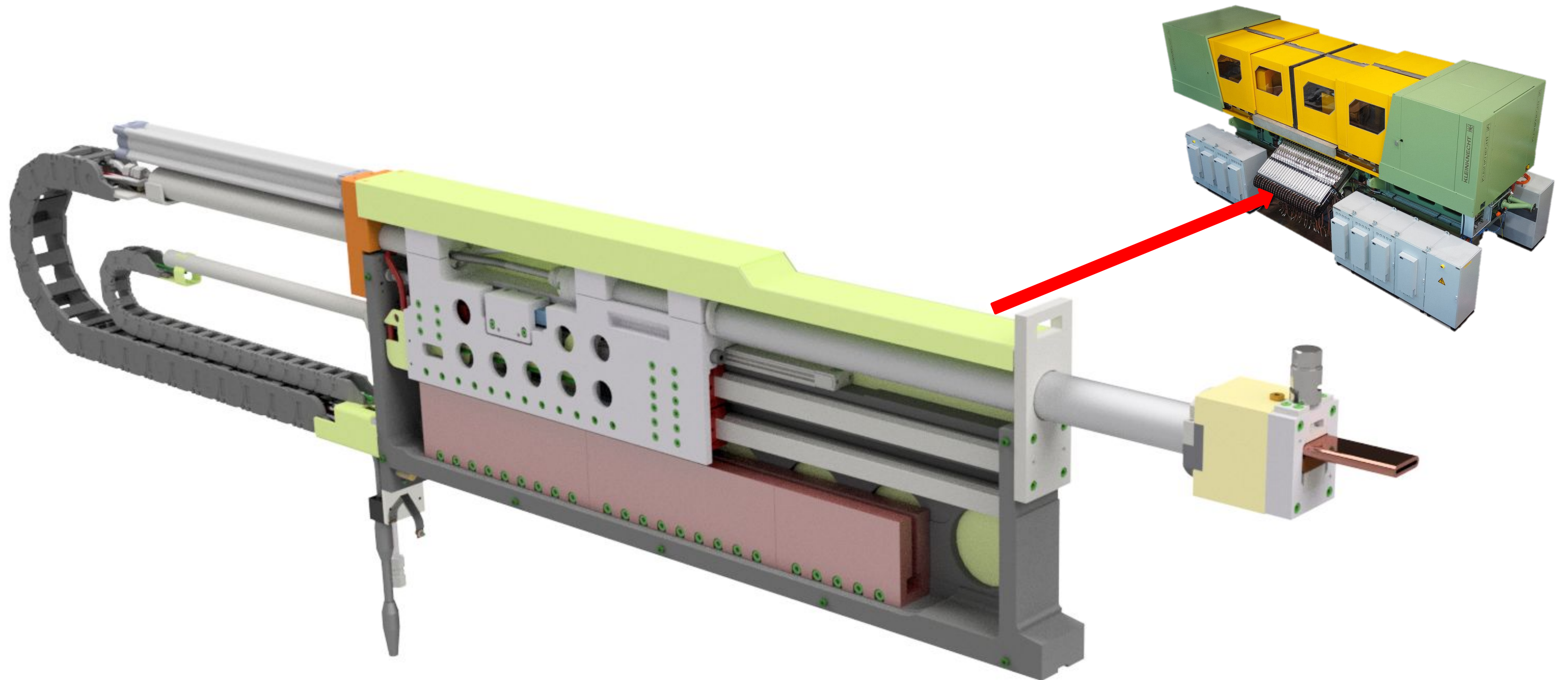


Test methods according to DIN EN ISO:  
 4287:1998 / 11562:1998  
 3274:1998 / 4288:1998

The graph above shows the Ra and Pc ratio as an example and is not a basis for machine acceptance. Pulse negative mode repeatability is limited.

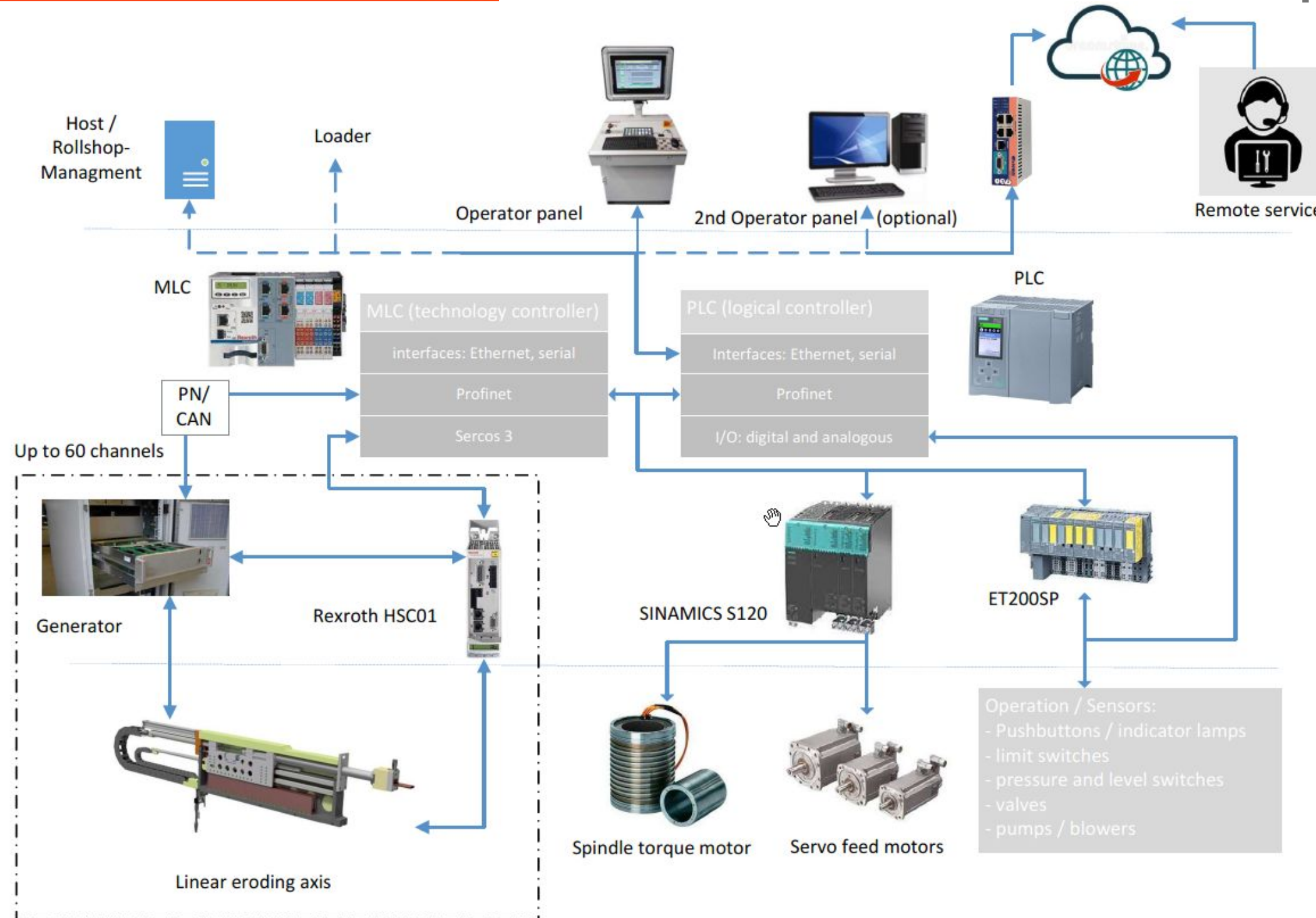


No	Name	Type	Row	Channels (Generators)	Capacity (Roll / Month)	
1	Modular Economic Spark - Tank	MES-T	1	up to 30	450	
2	Ultra Dynamic Spark	UDS 30	1 (2)	up to 30 (upgradable to 60)	500	
3	Ultra Dynamic Spark	UDS 60	2	up to 60	1000	





## Linear Motor: Control Concept





- No influence between the linear motors (neighboring motor and/or its designated measuring system are not influenced by another drive)
- 100% free of any negative influence and disturbance from outside (e.g. temperature)
- Extremely fast to high accuracy  $\pm 1\mu\text{m}$ , keeps gap constant, even at rolls with bad roundness
- Enables compact machine design, up to 30 linear motor units in one row
- Linear motor works contact-less and maintenance free



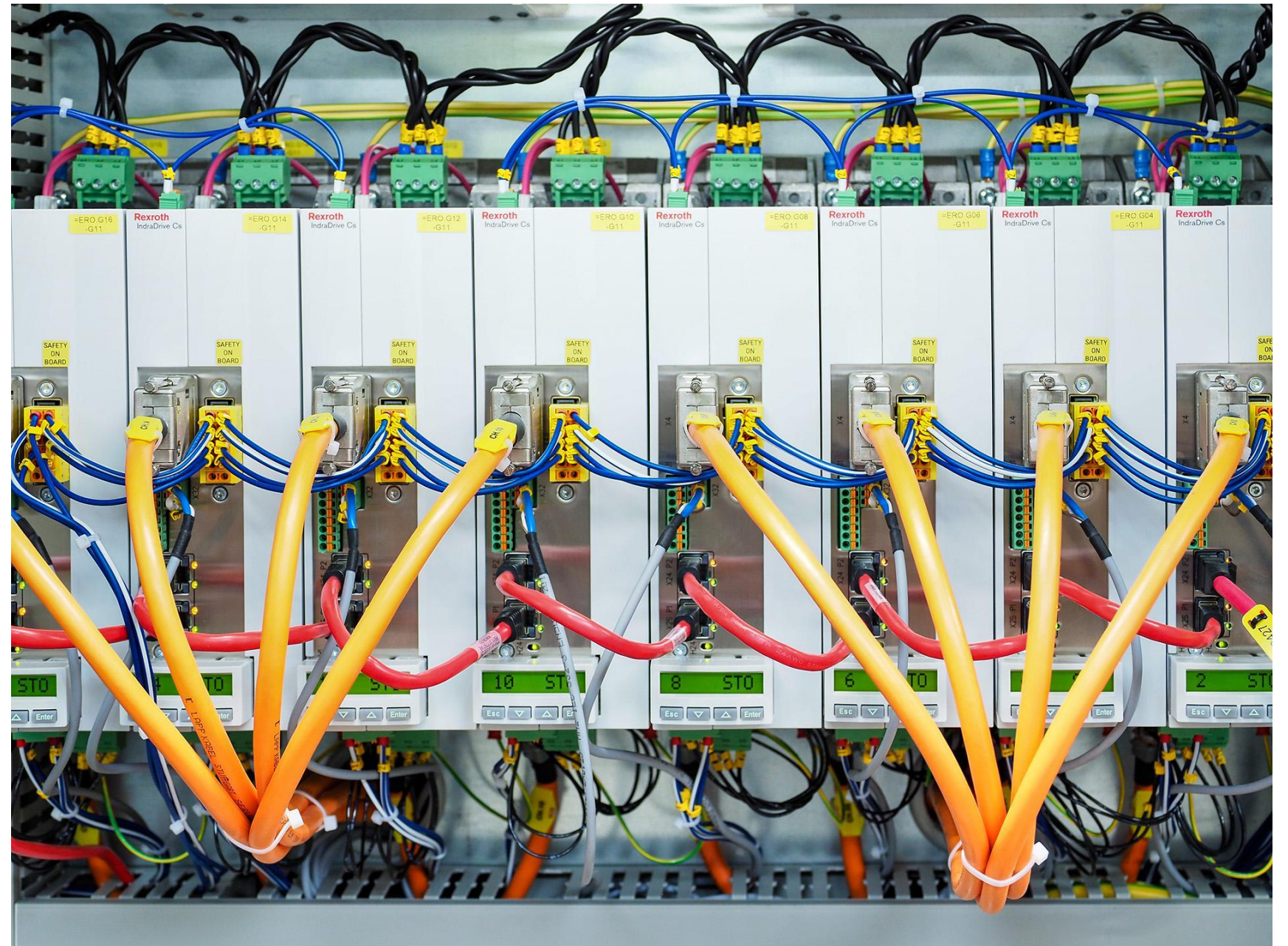


### Bosch Rexroth L75 (Controller)

- communication to the EDT-generators
- control of the linear motors
- processing of feedback data of each electrode

### Bosch Rexroth IndraDrive (Converter)

- feed the linear drives of the eroding units
- connection to the converters is realized by an Ethernet based SERCOS III bus

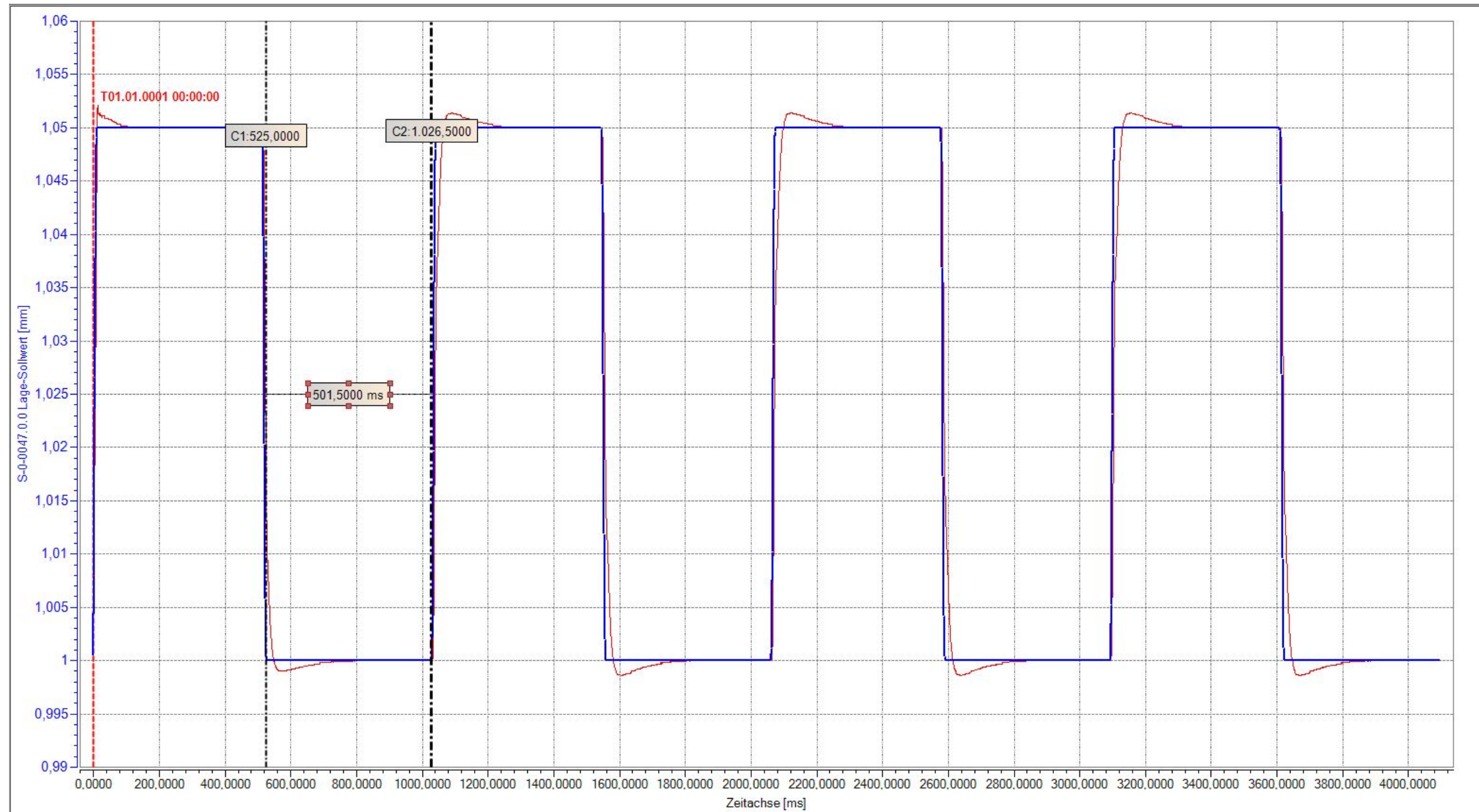




- Eight (8) modes of operation incl. CAP-mode
- Efficiency of 92.5% has been measured
- Water or air-cooling possible
- Generator R&D by Kleinknecht 'Made in Germany'
- 100% intellectual property of Kleinknecht)







The advantages of our linear motor design are

- most accurate and highly dynamic gap control
- extremely fast to high accuracy  $\pm 1\mu\text{m}$
- Wear-free and backlash-free (contradictory to other designs, like preloaded ball screw spindle)
- independent to temperature deviation (no expand and contract of any spindle).
- high-precision feedback via absolute linear scale (electrode wear can be measured)

□ **A linear motors will increase the roll surface quality and reduce the machining time**





Unit	Detail	Advantage
<b>Dielectric Oil</b>	Houghton Macron EDM 110	<ul style="list-style-type: none"> <li>• free of both, chlorine and heavy metals</li> <li>• no lifetime limitation</li> <li>• no need for complete exchange</li> </ul>
<b>Element Filter</b>	MANN+HUMMEL	<ul style="list-style-type: none"> <li>• Housing is 100% made of environmentally friendly plastic</li> <li>• The loaded filter elements can be completely thermally disposed</li> </ul>
<b>Air Ex-hauster</b>	Fuchs	<ul style="list-style-type: none"> <li>• As a cycle product, activated carbon does not have to be disposed of, but can be regenerated and used again as an adsorption medium.</li> </ul>
<b>Electrics</b>	Generator	<ul style="list-style-type: none"> <li>• On an Kleinknecht EDT generator, an efficiency of 92.5% has been measured</li> </ul>
<b>Electrics</b>	Power Consumption	<ul style="list-style-type: none"> <li>• Low power consumption (connected load is between 120kVA (single-row EDT) and 180kVA (double-row EDT))</li> </ul>



- Consultation
- Engineering
- Installation
- Commissioning
- Application
- Training
- Operation
- Service
- Spare Parts
- Revamps
- Upgrades
- Modernization



Metals

Metals

Contractors

Anlagenbau

Pipe

Rohr

Automotive

Automotive

Machine Tools

Werkzeugmaschinen

Other

Sonstige



