

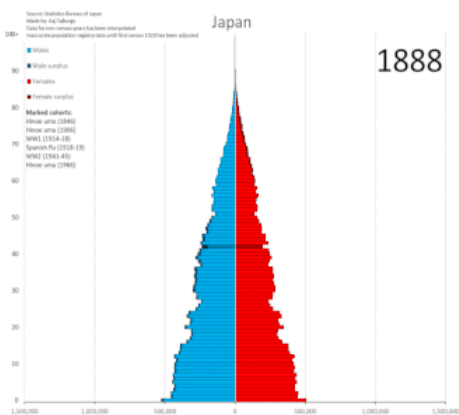


Automated Robot-Supported Rail and Switch Maintenance

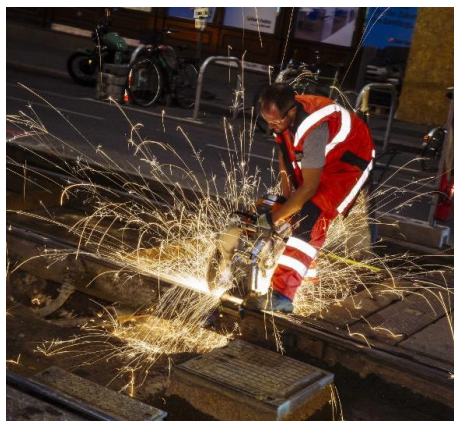
10th Railway talk, 2025-06-25

OUR PLANET NEEDS A STRONG RAILWAY

We are striving to realize the planned transport growth on railways through **robotized, automated maintenance solutions**.



Decreasing
dependency
from
Demographic
Change



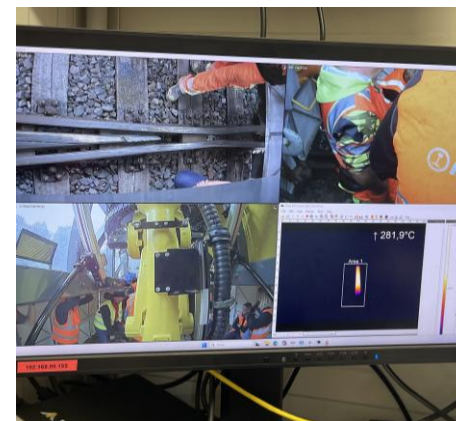
Working in
Short
Maintenance
Windows



Improving
Quality & Safety
of Work



Reducing
Emissions



Integrating
Seamless Into
Other Digital
ECO Systems

Local Rail and Switch Frog Flaws



squads



belgrospi



impression

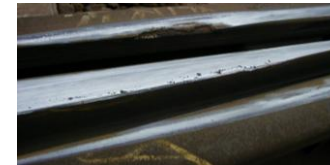
Shelling



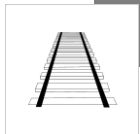
wear



breakouts

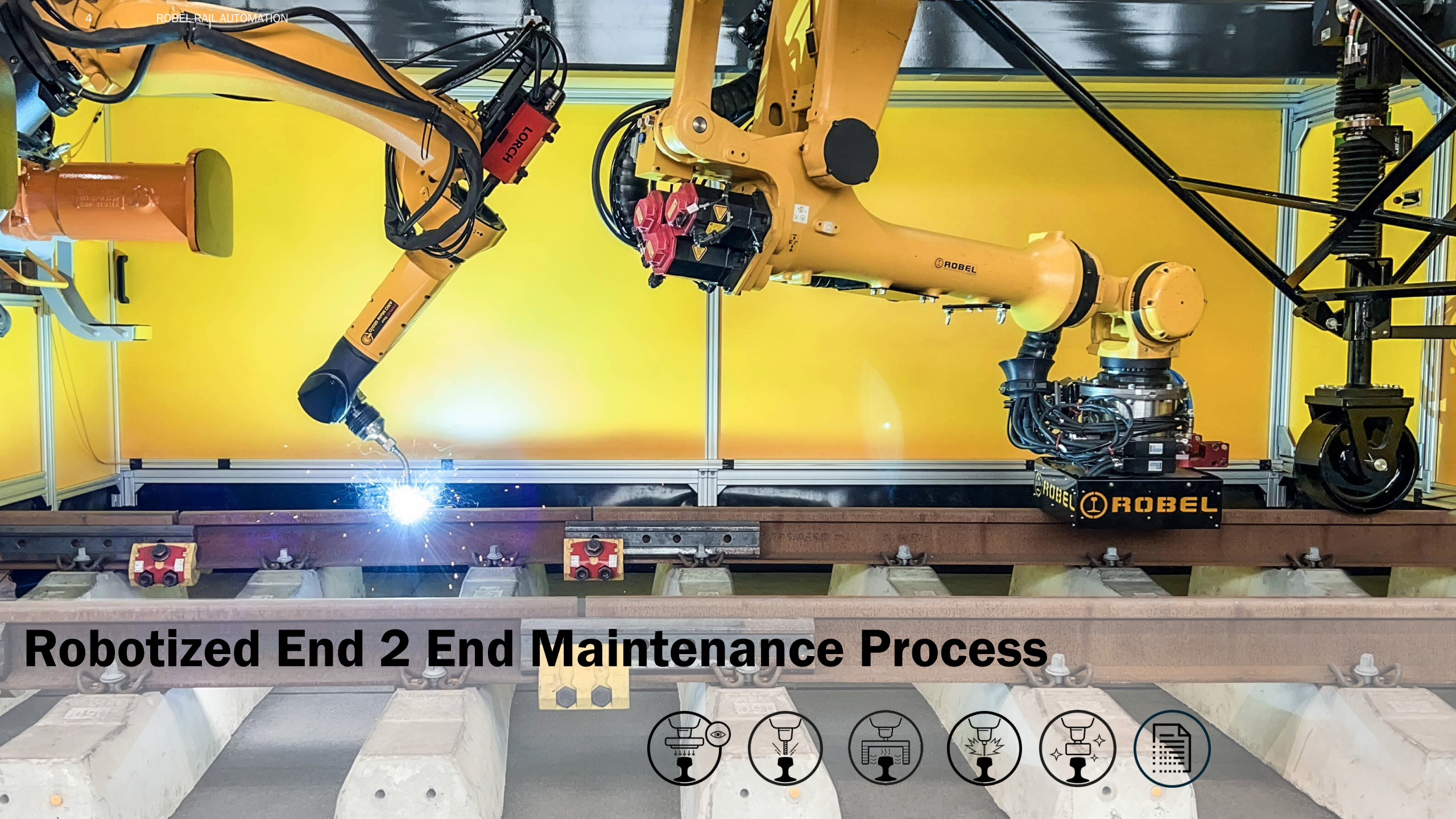


Local Defect
Repair on Rail



Switch
Maintenance and Repair

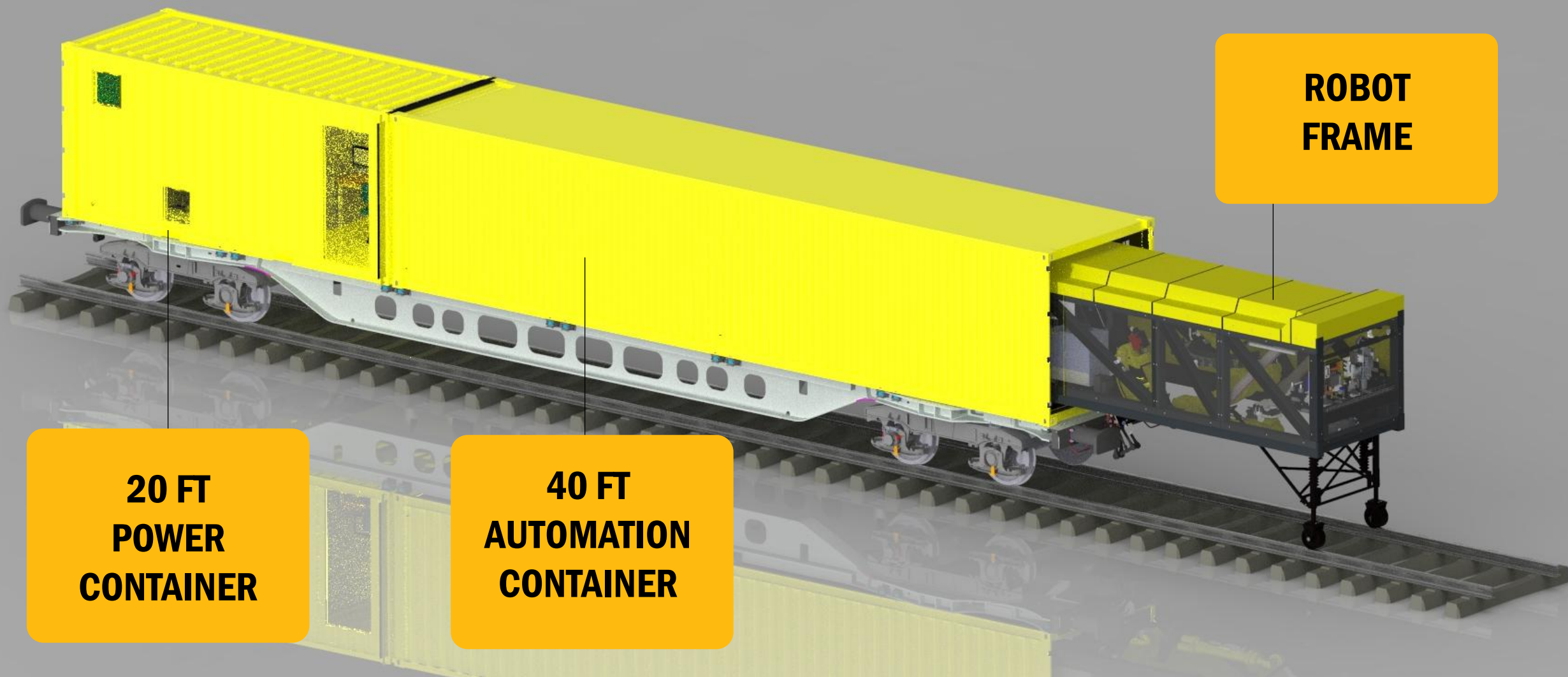




Robotized End 2 End Maintenance Process



Focus on Process not Vehicle Development





ROBOT

Local Defect Repair

Local Defect Repair



squads



belgrospi



impression

Local Defect Repair on
Rail



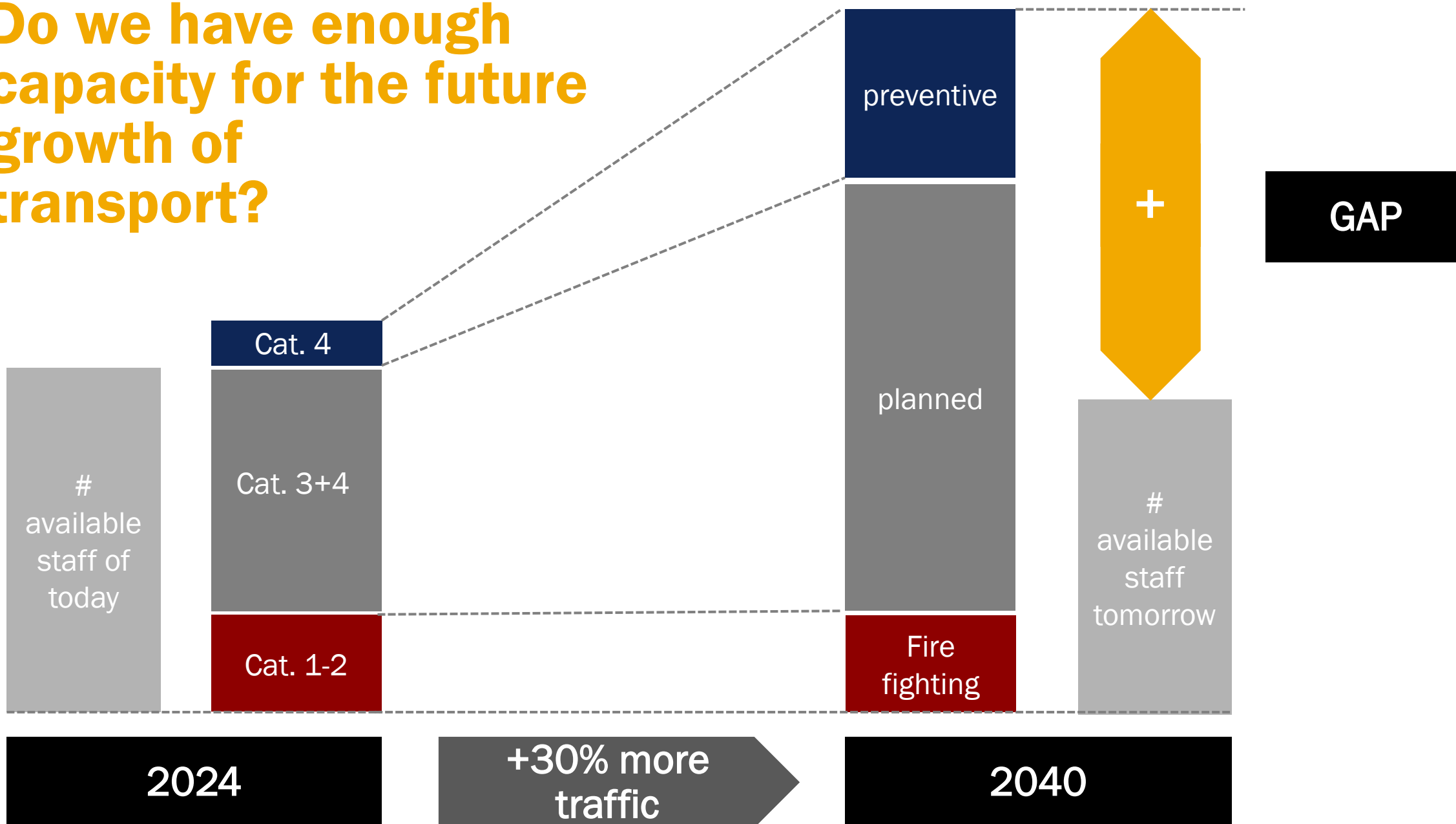
End 2 End Process

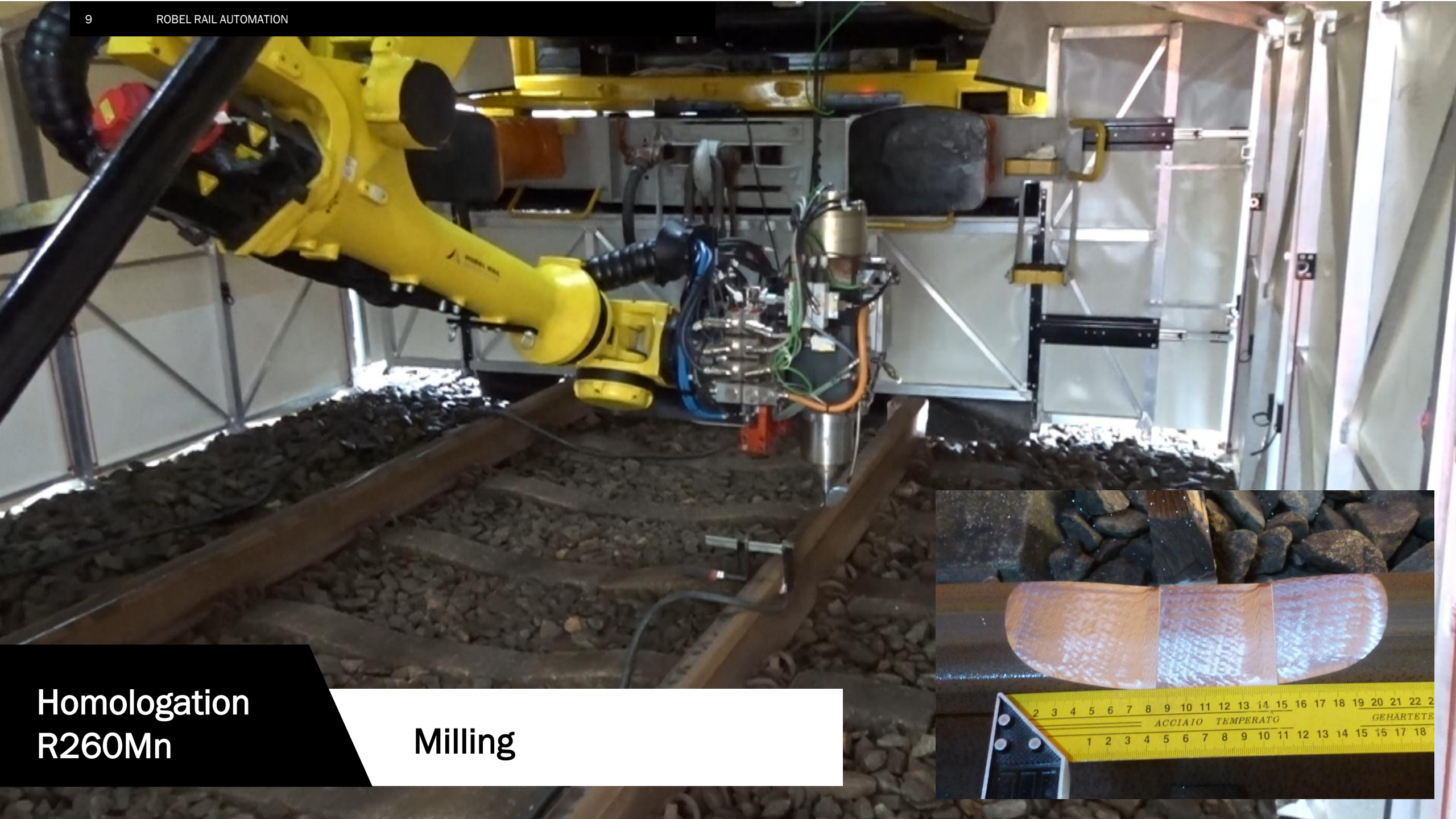


R260, R260Mn, R350HT



Do we have enough capacity for the future growth of transport?

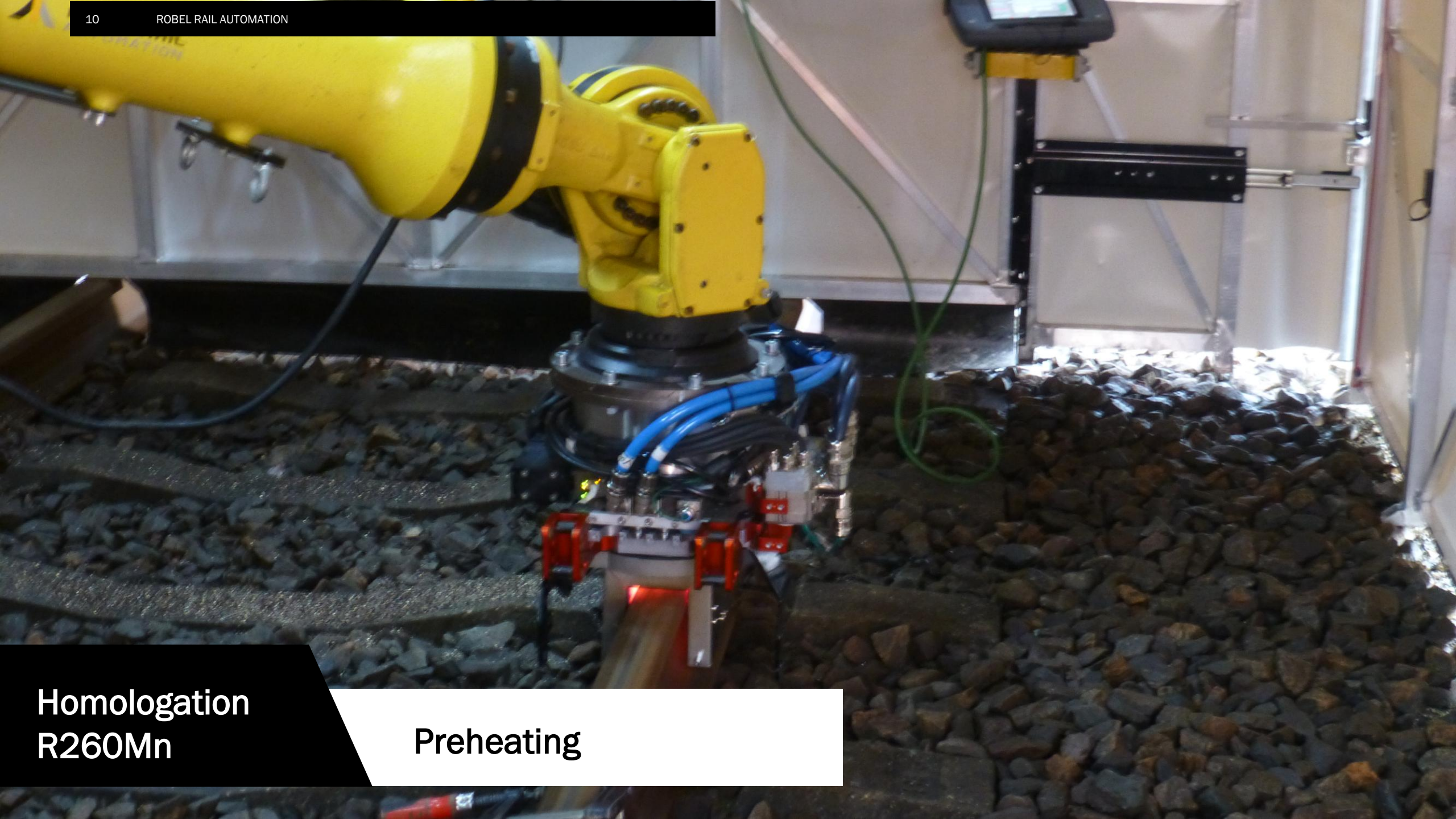




Homologation
R260Mn

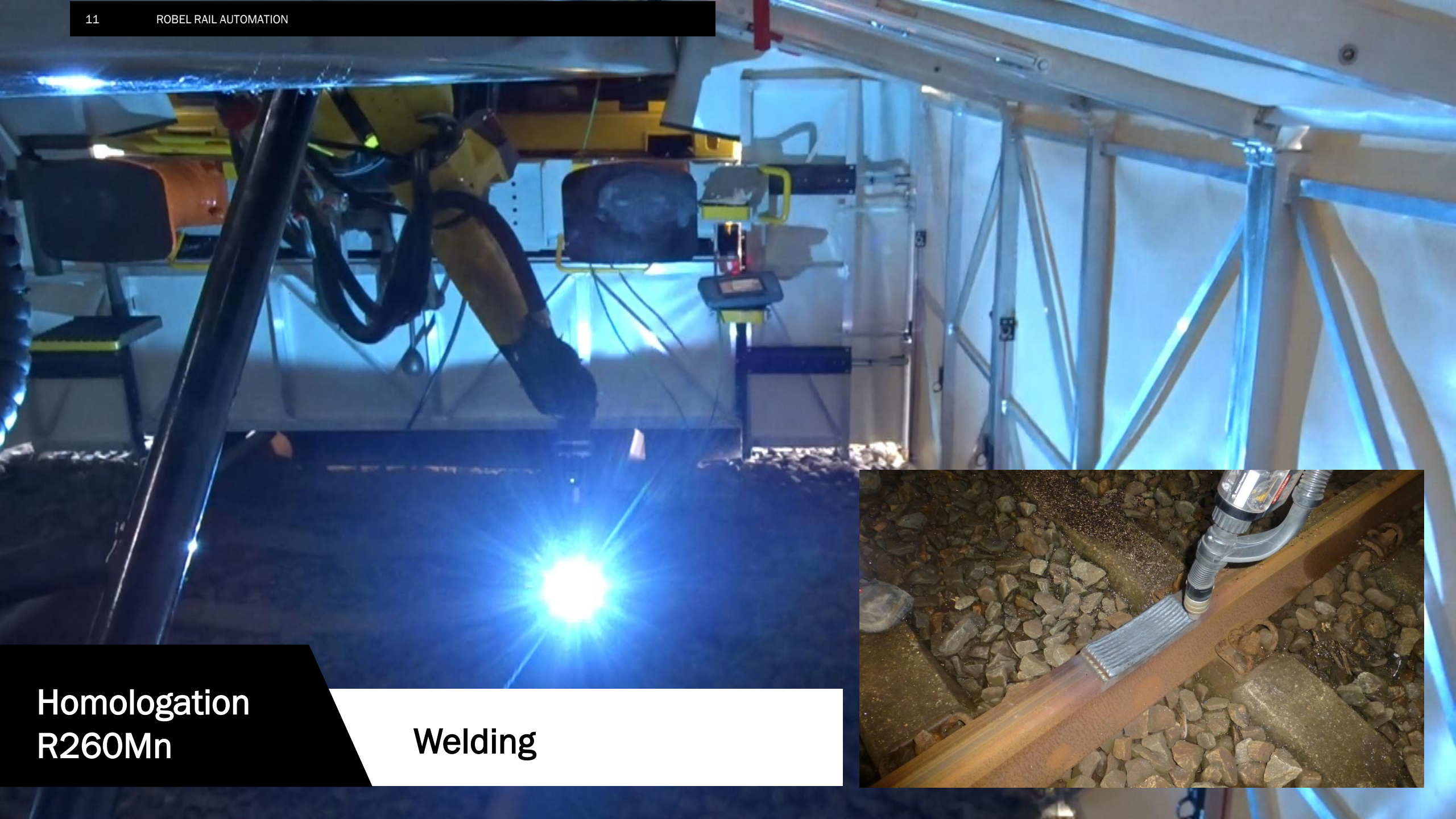
Milling





Homologation
R260Mn

Preheating



Homologation
R260Mn

Welding





Homologation
R260Mn

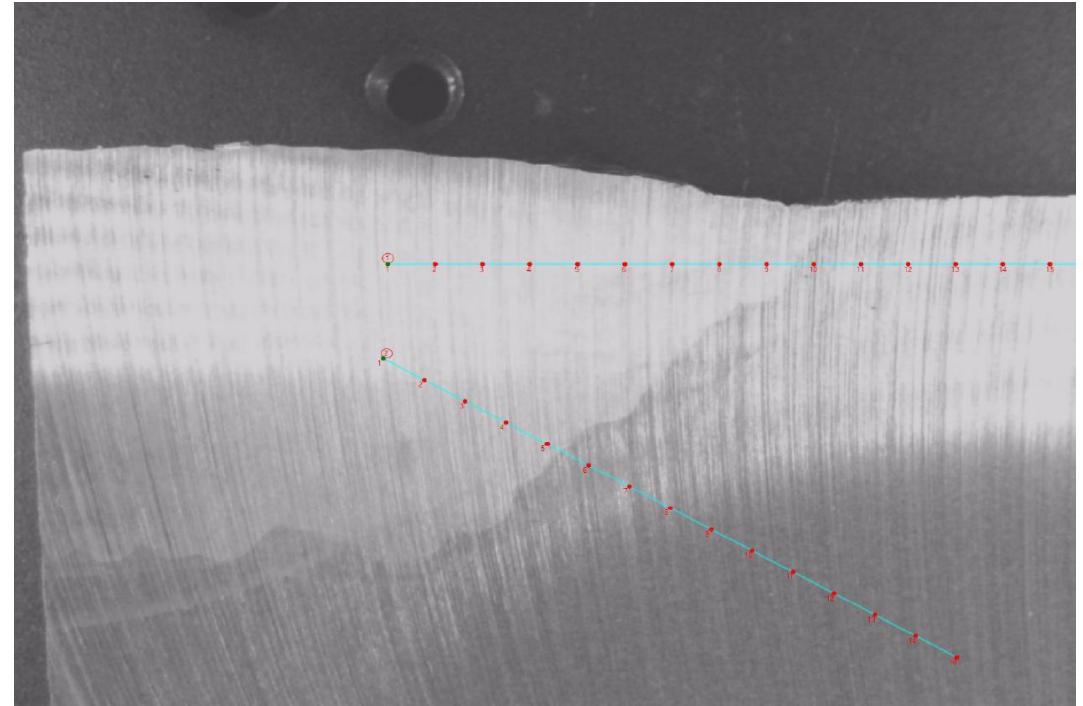
Welding



Homologation
R260Mn

Final result after grinding

Welding of 260Mn rail grade material according to ISO 15613 and RLN00451-2 approved



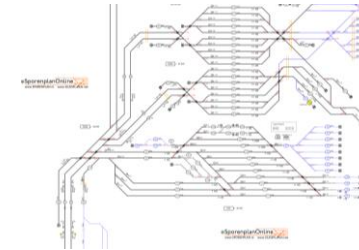
Pre-Homologation
Mn-Switch

Pre-homologation Samples

- 4x single layer and 4x multi-layer (5 layers) restoration welds are produced:

Production day	Weld number	Track number	Track category	Geo code
11-10-2024	1ML	808	6	478
11-10-2024	2SL	808	6	478
13-10-2024	3ML	RT	4	950
13-10-2024	4SL	RT	4	950
20-10-2024	5ML	RT	4	950
20-10-2024	6SL	RT	4	950
20-10-2024	7SL	RT	4	950
17-11-2024	8ML	714	6	950

- The restoration welds are tested with 0,45 - and 70 degrees US-testers and with magnetic penetrant test.
- Results of three DEKRA measurements on
17-11-2024, 11-01-2025 and 30-03-2025:
no indications found.



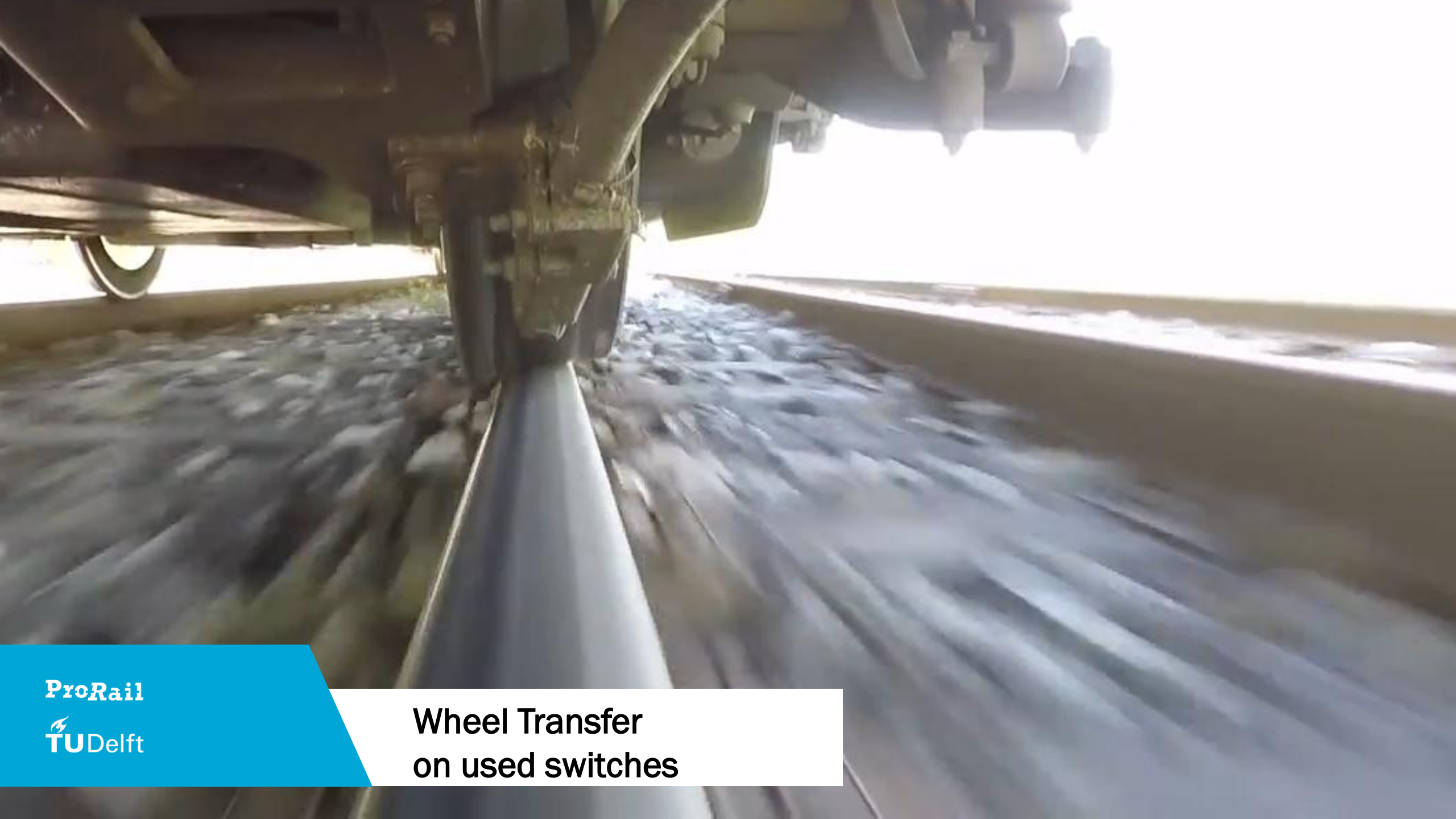
**Pre-Homologation
Mn-Switch**

Pre-homologation Samples



ROBOT

Switch Frog – Mn13 / HT350



Switch Frog Maintenance



Shelling

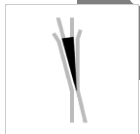


wear



breakouts

Switch Frog Maintenance



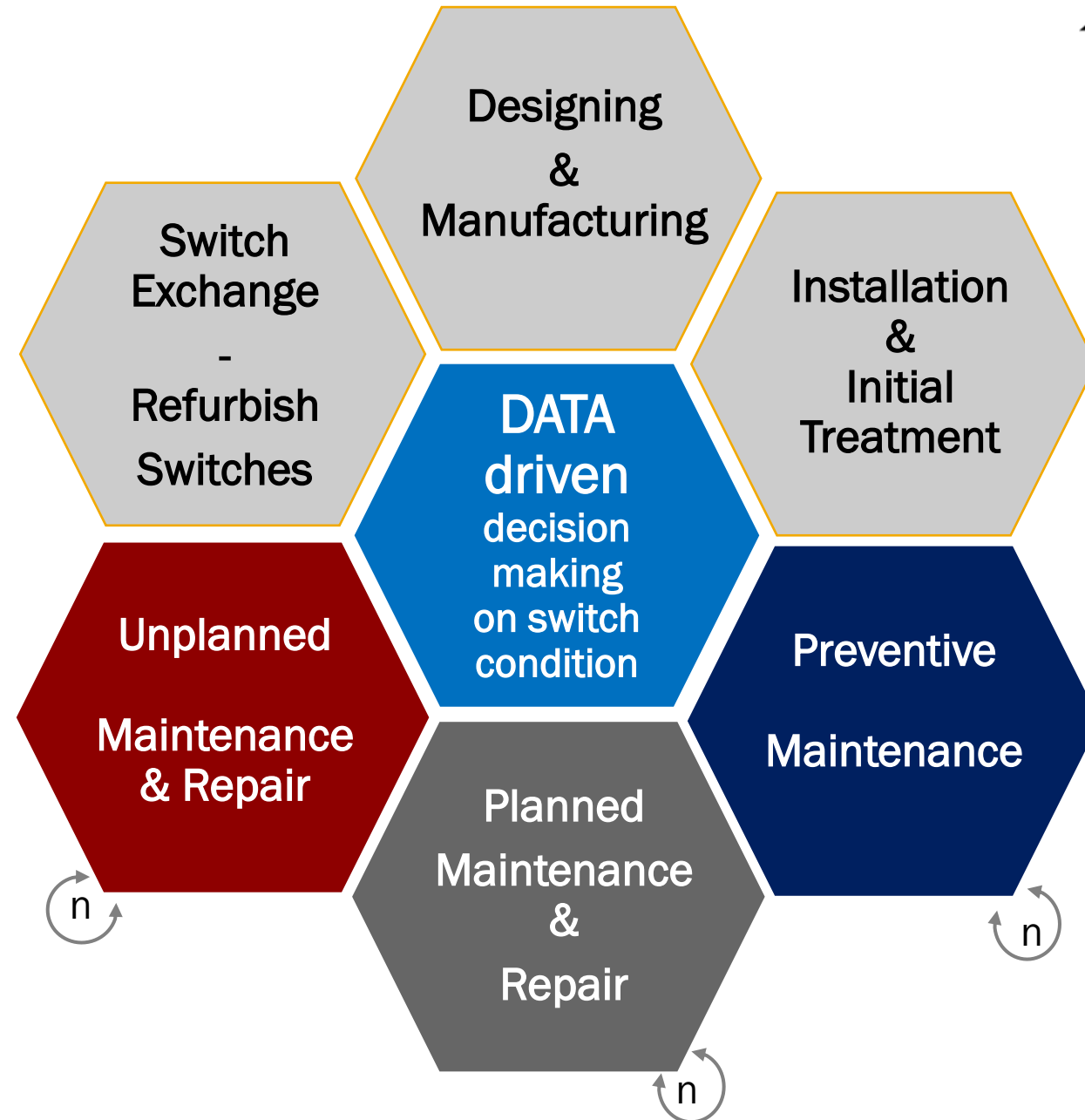
End 2 End Process



X120Mn12, R350HT



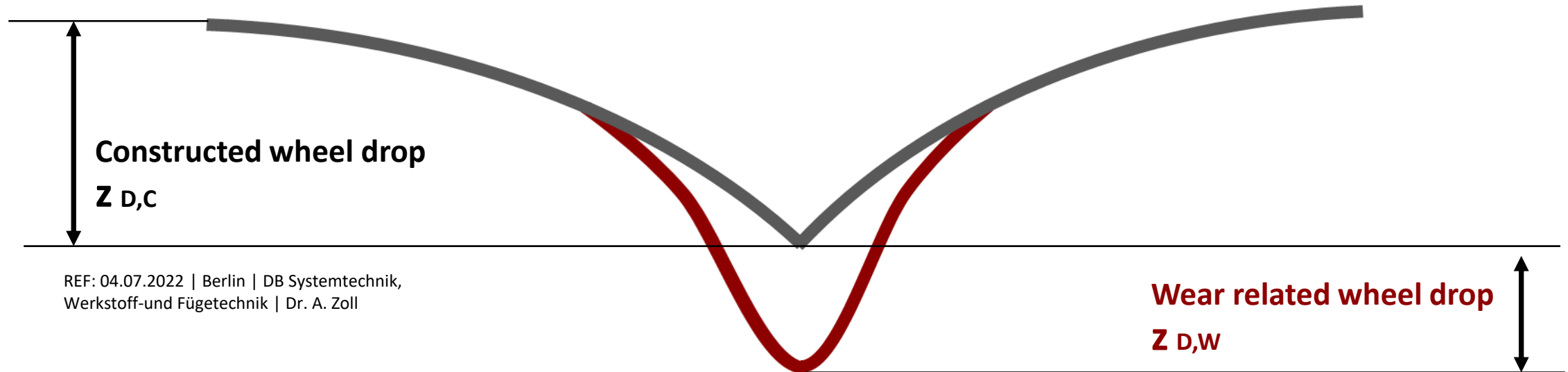
Data driven life cycle management for switches.



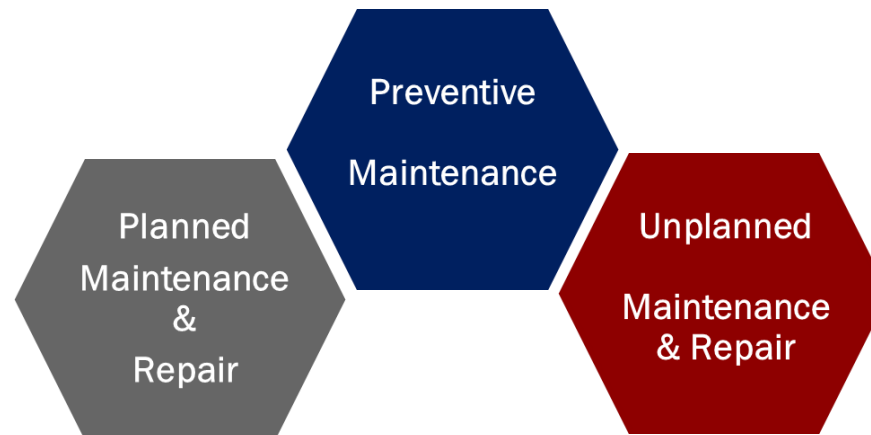
System View:

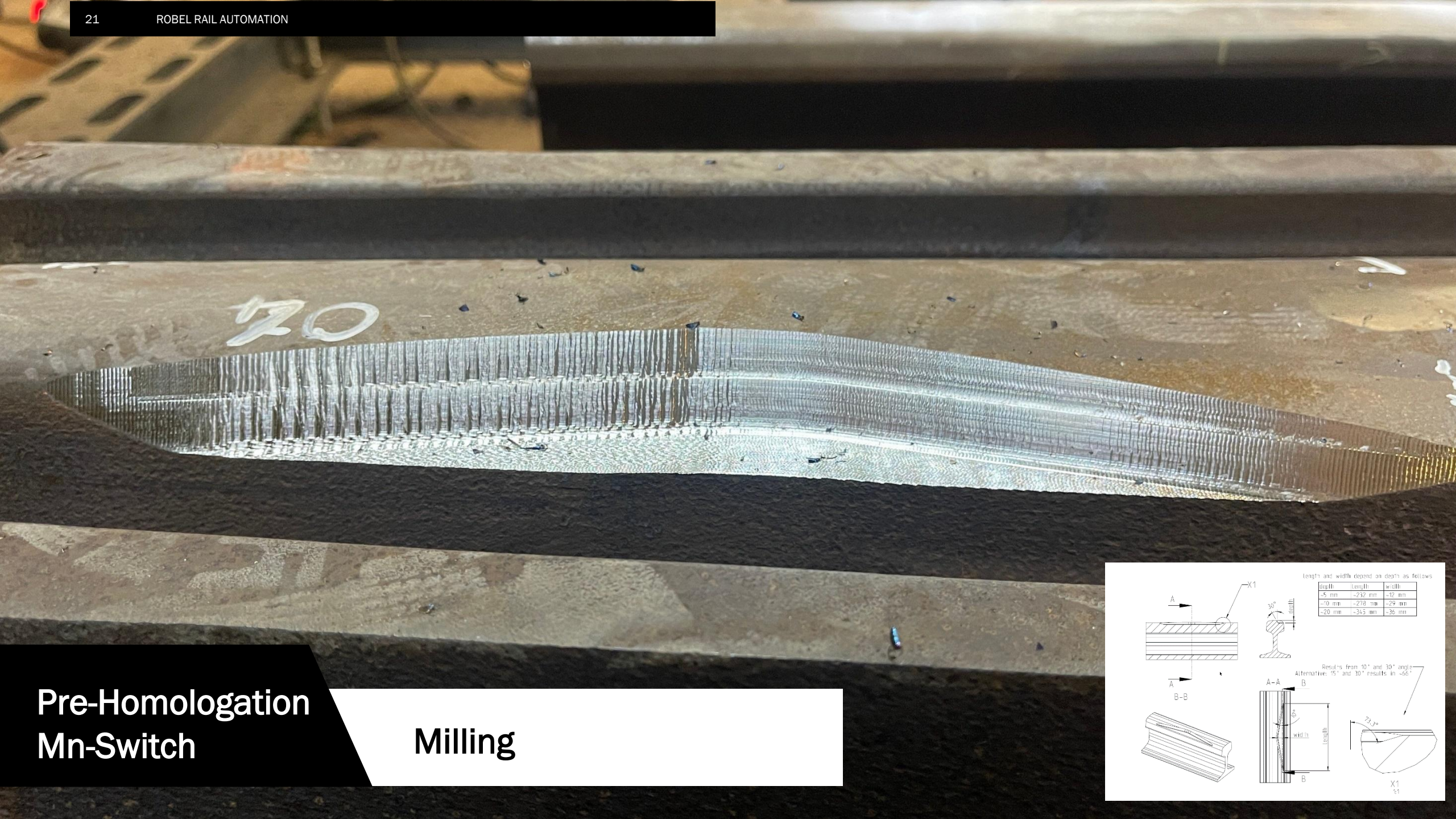
ballast, sleeper, fastening, track switches and components.

Wheel drop - constructed & wear related



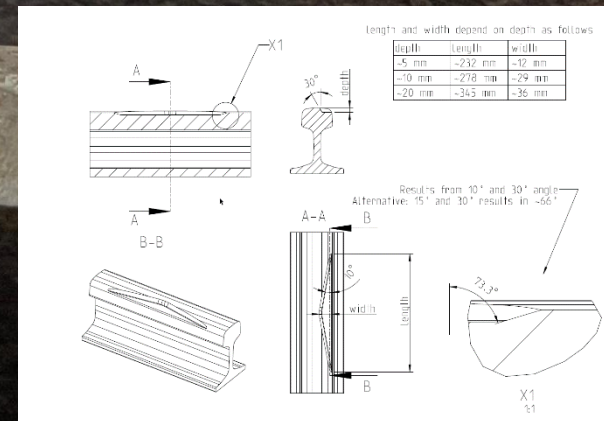
REF: 04.07.2022 | Berlin | DB Systemtechnik,
Werkstoff-und Fügetechnik | Dr. A. Zoll

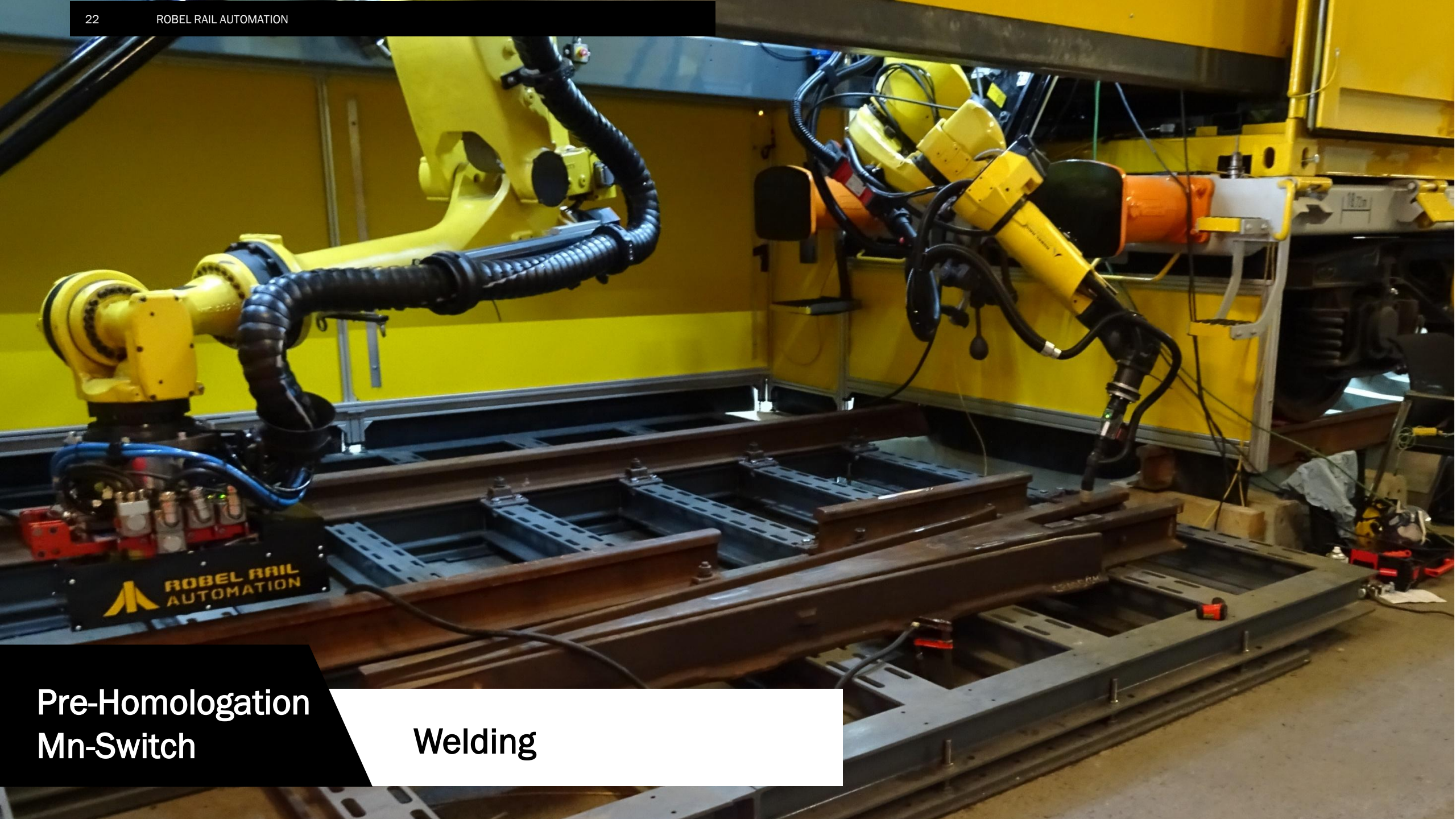




Pre-Homologation
Mn-Switch

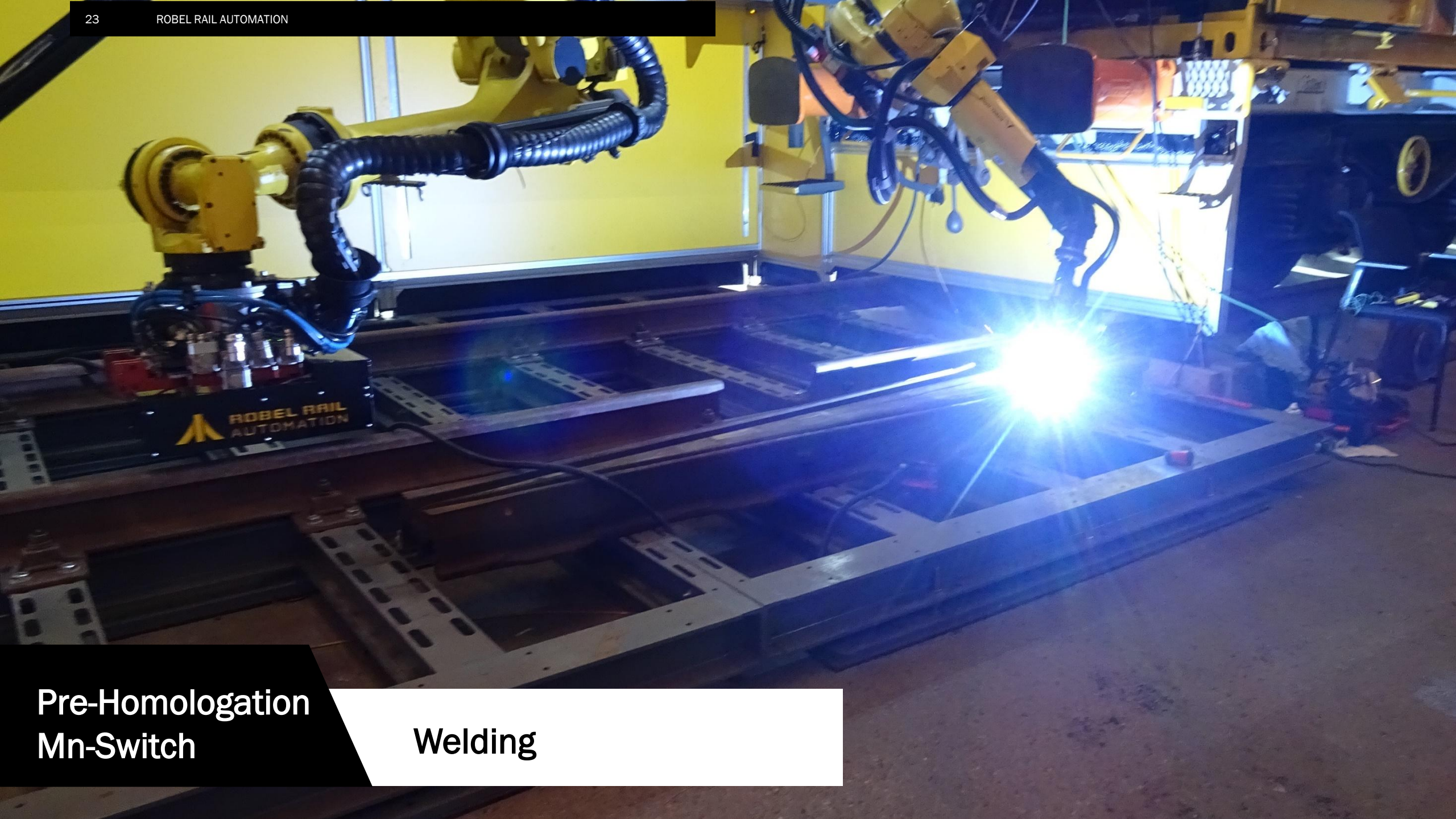
Milling





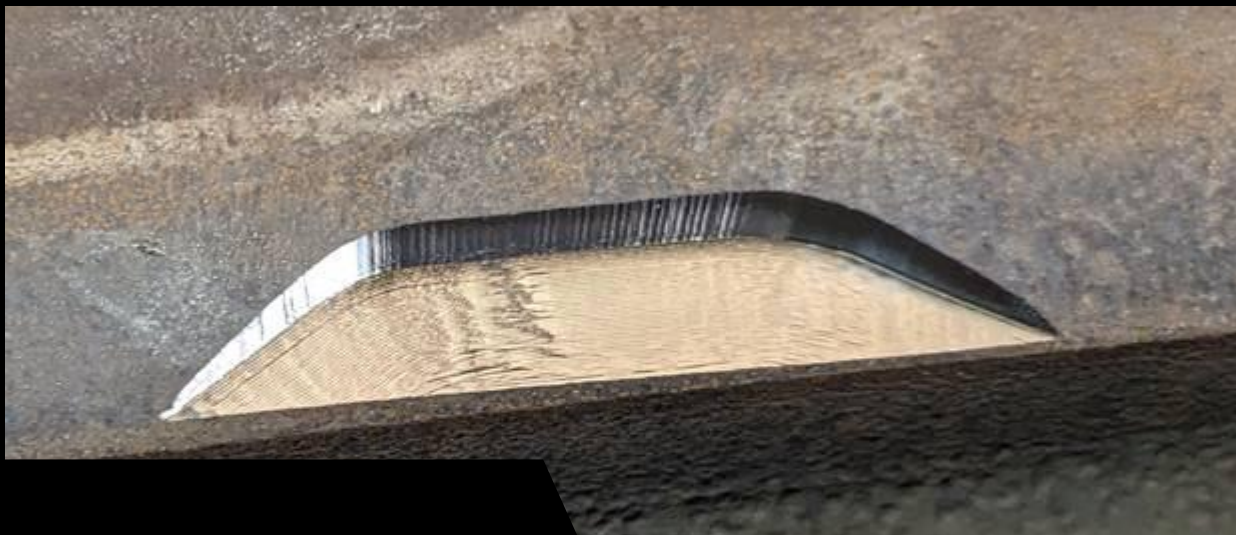
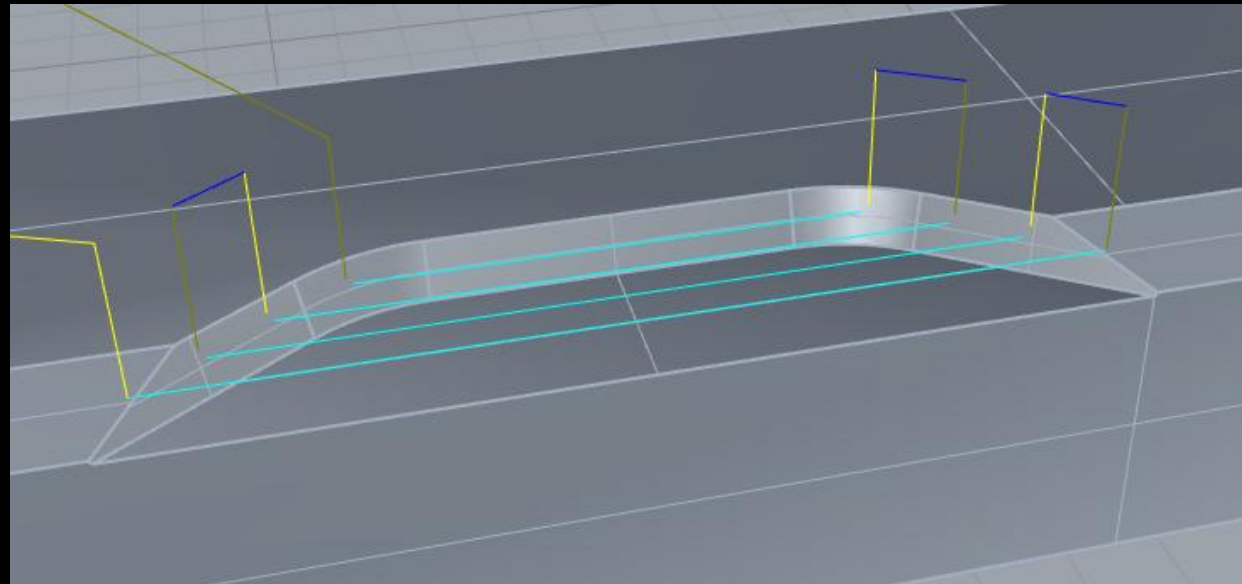
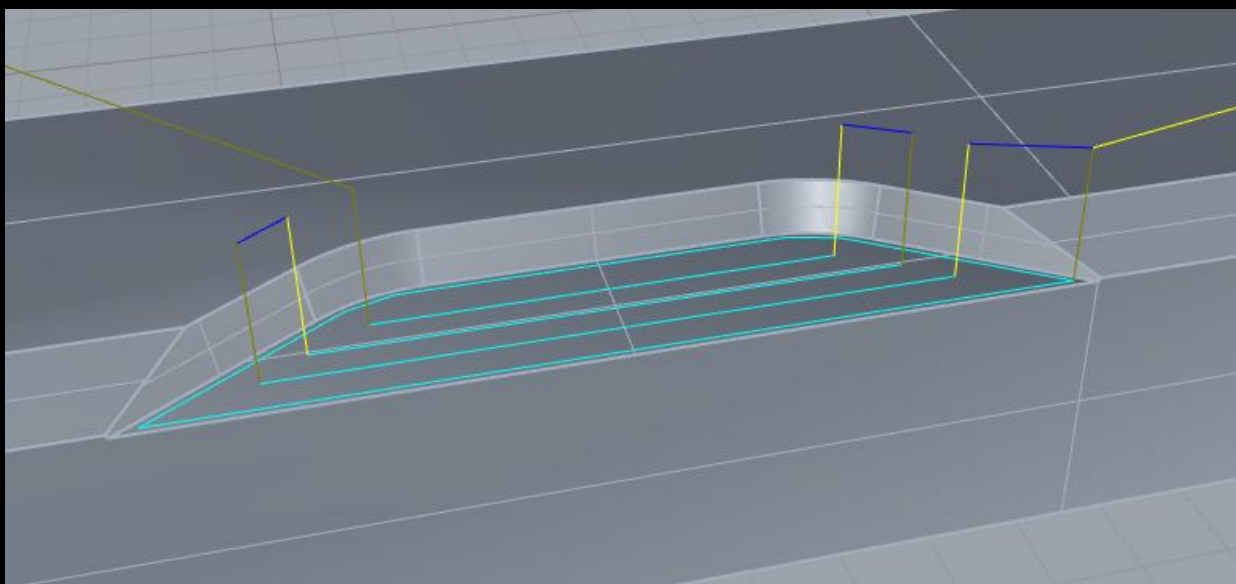
Pre-Homologation
Mn-Switch

Welding



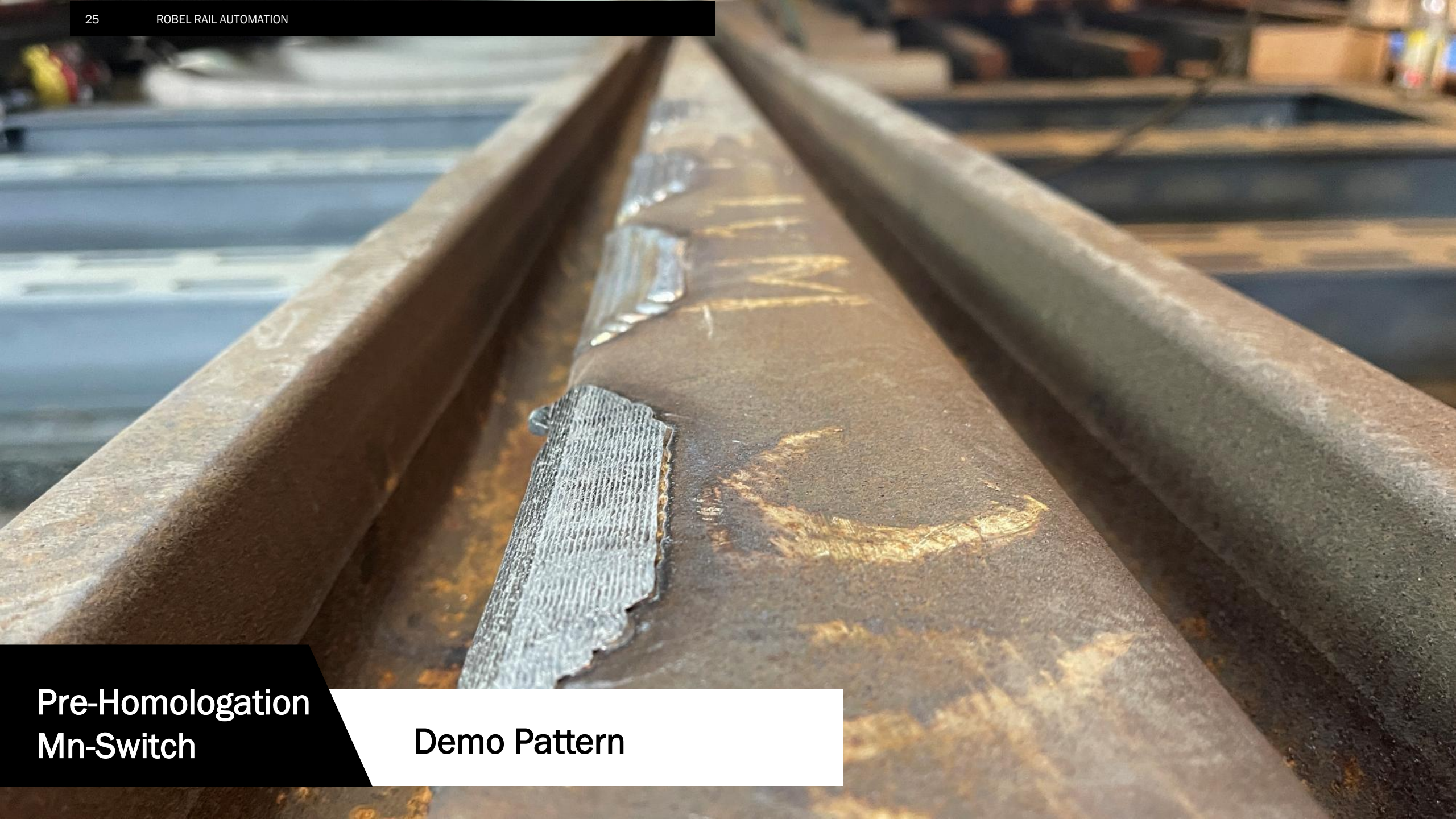
Pre-Homologation
Mn-Switch

Welding



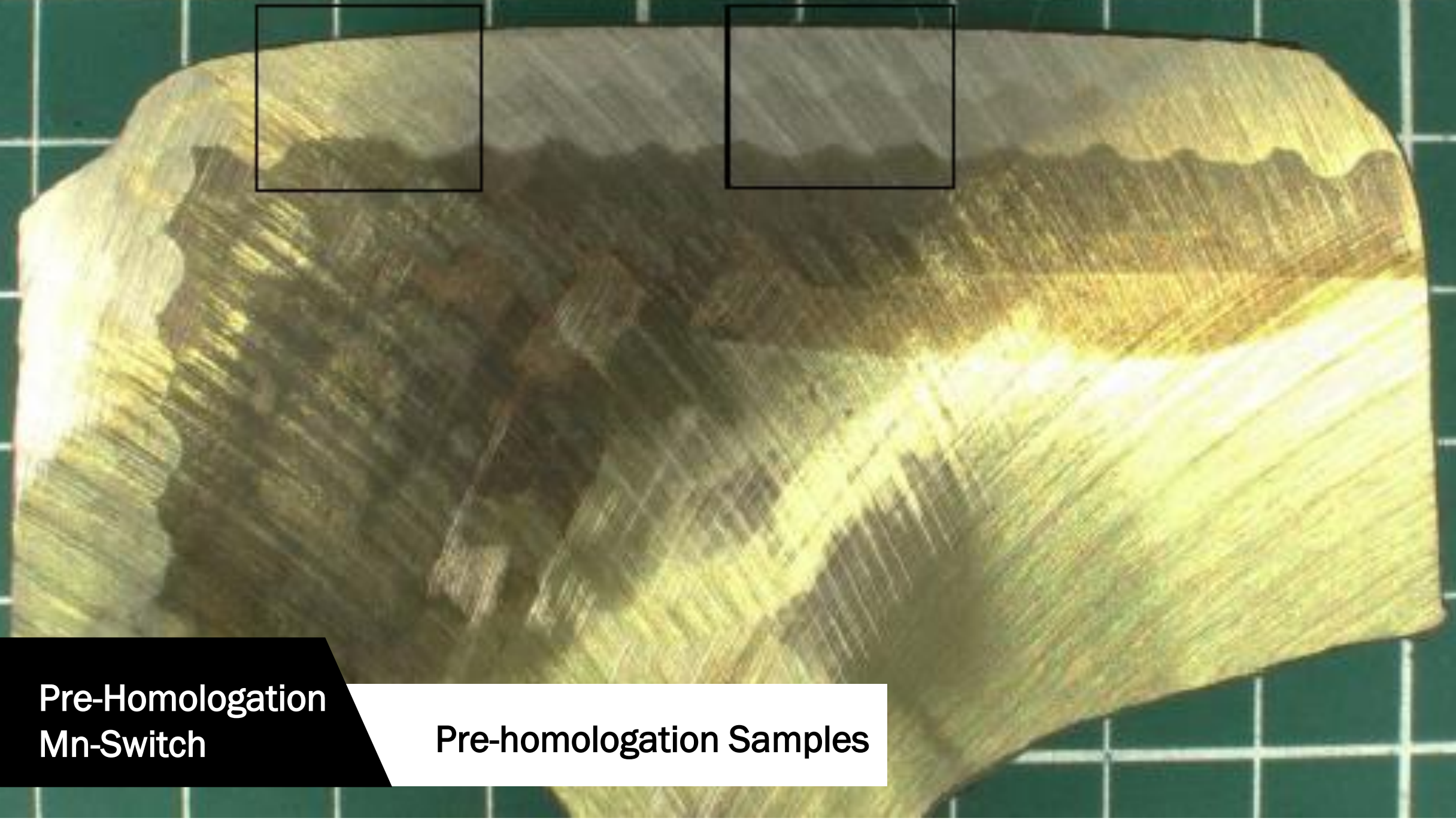
Pre-Homologation
Mn-Switch

Demo Pattern



Pre-Homologation
Mn-Switch

Demo Pattern



**Pre-Homologation
Mn-Switch**

Pre-homologation Samples



250°C of the whole
needle within 15
minutes through the
material.



R350HT

Pre-Heating

Needle Welding

- Fully automated
- Path based
- Multi layer
- Intermediate layer temperature: 350°C
- Welding time: 60min

Wing Rail milling

- One milling tool
- 20mm depth and 800mm long
- 60 min.

R350HT

Welding



Wing Rail welding

- Fully automated
- Path based
- Multi layer
- 35 min
- Intermediate layer temperature: 150°C

R350HT

Welding



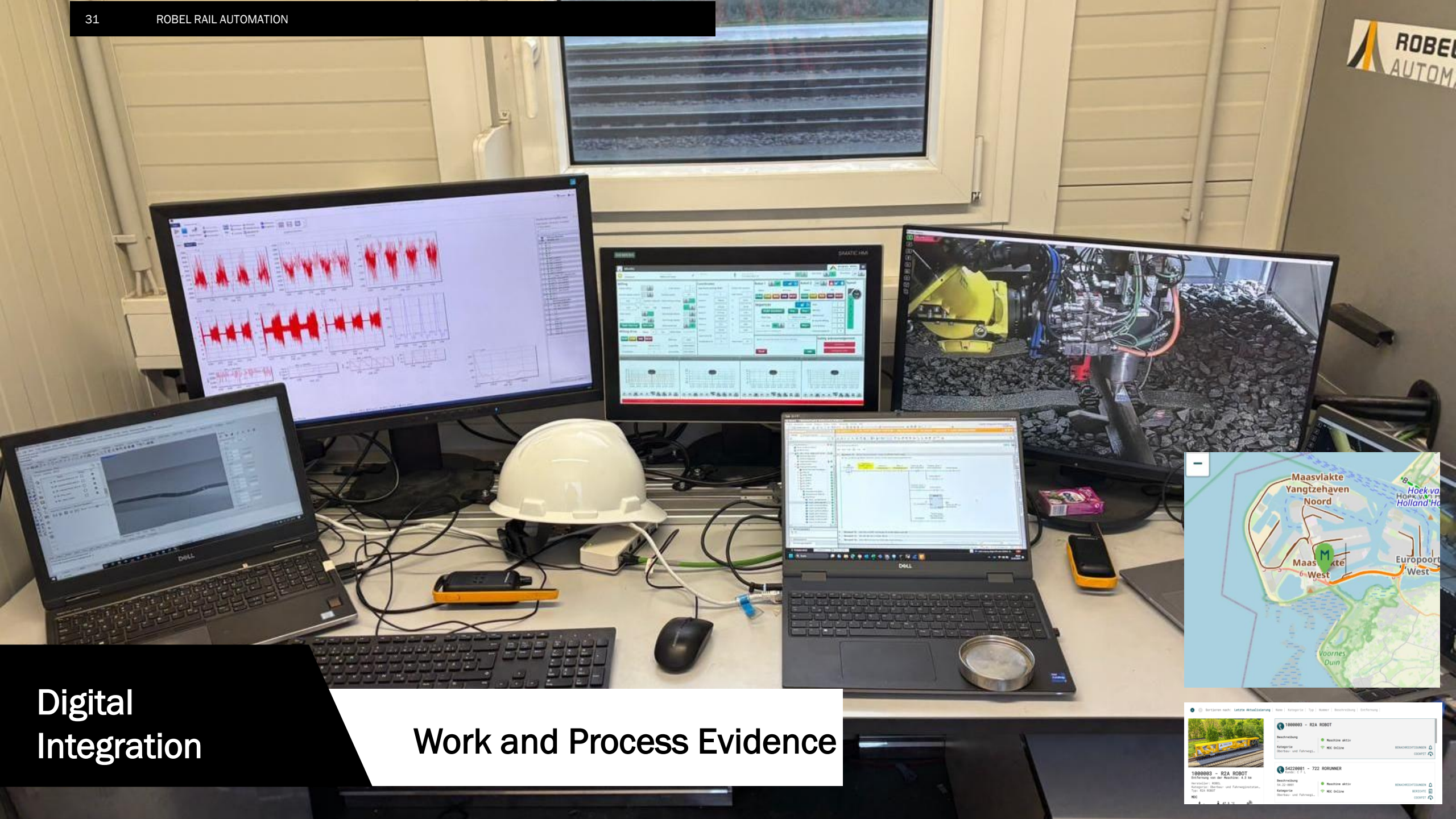
Needle and Wing Rail cladding (Mn13)

- Fully automated
- Path based
- One Layer
- 30 min for the needle and two wing rails
- Welding temperature: $<250^{\circ}\text{C}$

R350HT

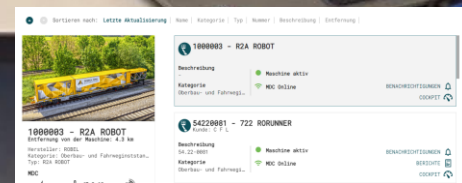
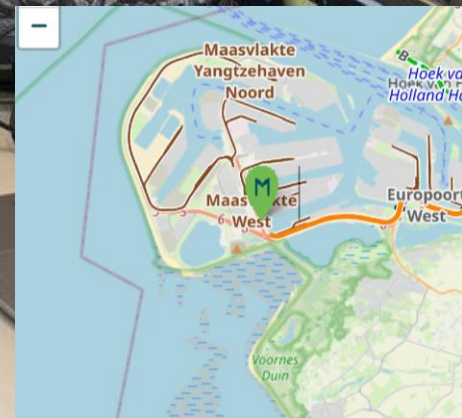
Welding

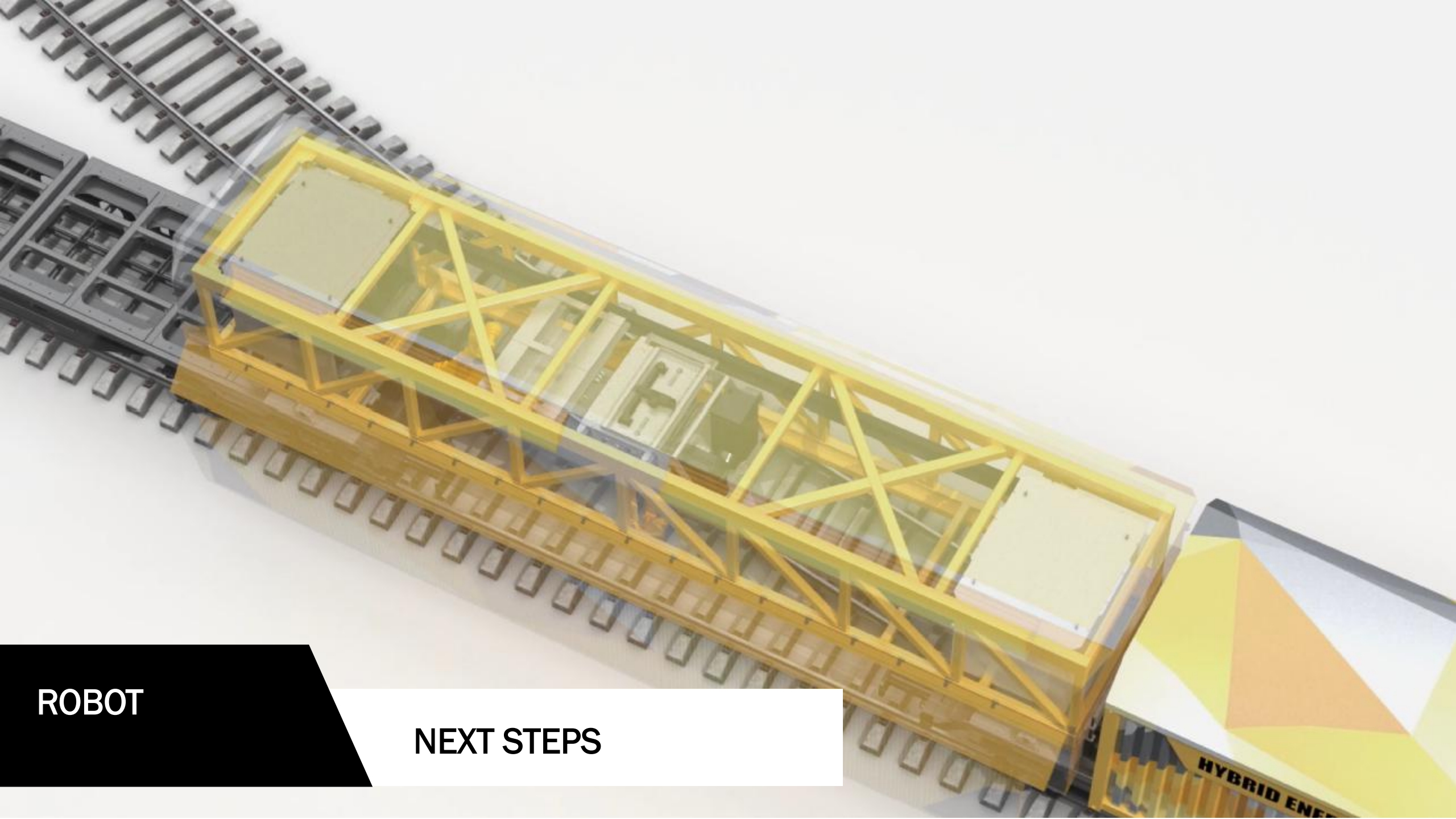




Digital
Integration

Work and Process Evidence





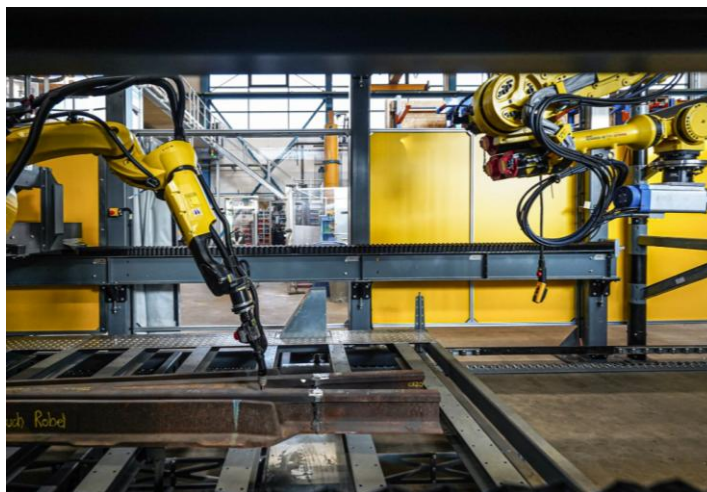
ROBOT

NEXT STEPS

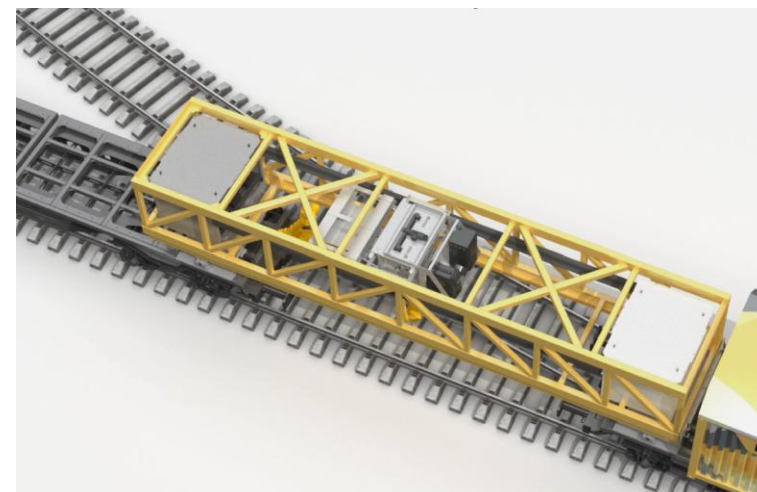
Further Homologation and Services



Switch Frog Process Development & Services



ROFACTORY Production System



Netherlands:

Rail Welding Services in ProRail's infrastructure together with VolkerRail and Strukton Rail this year in the planning.

EU:

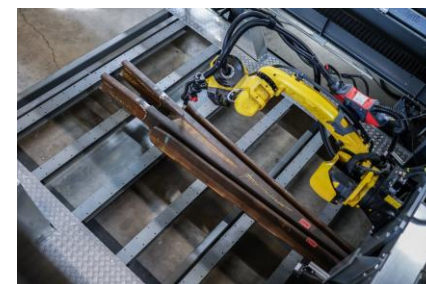
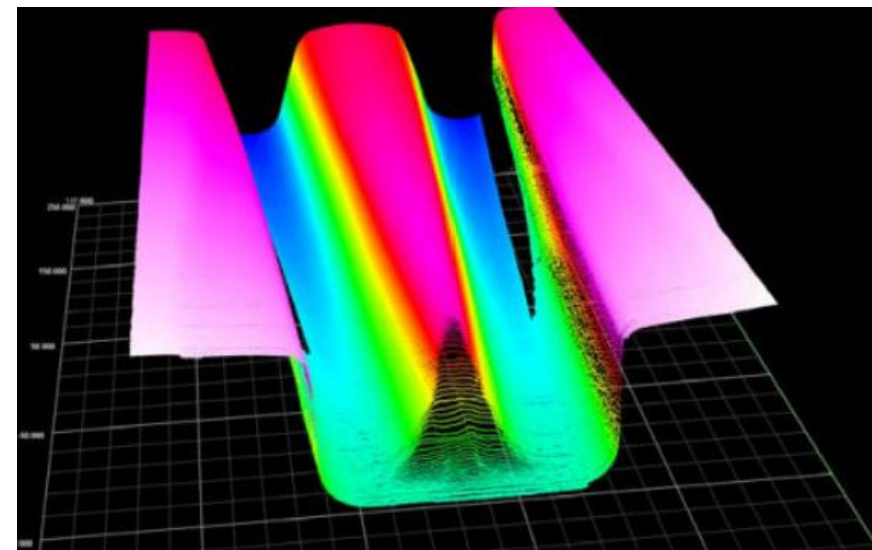
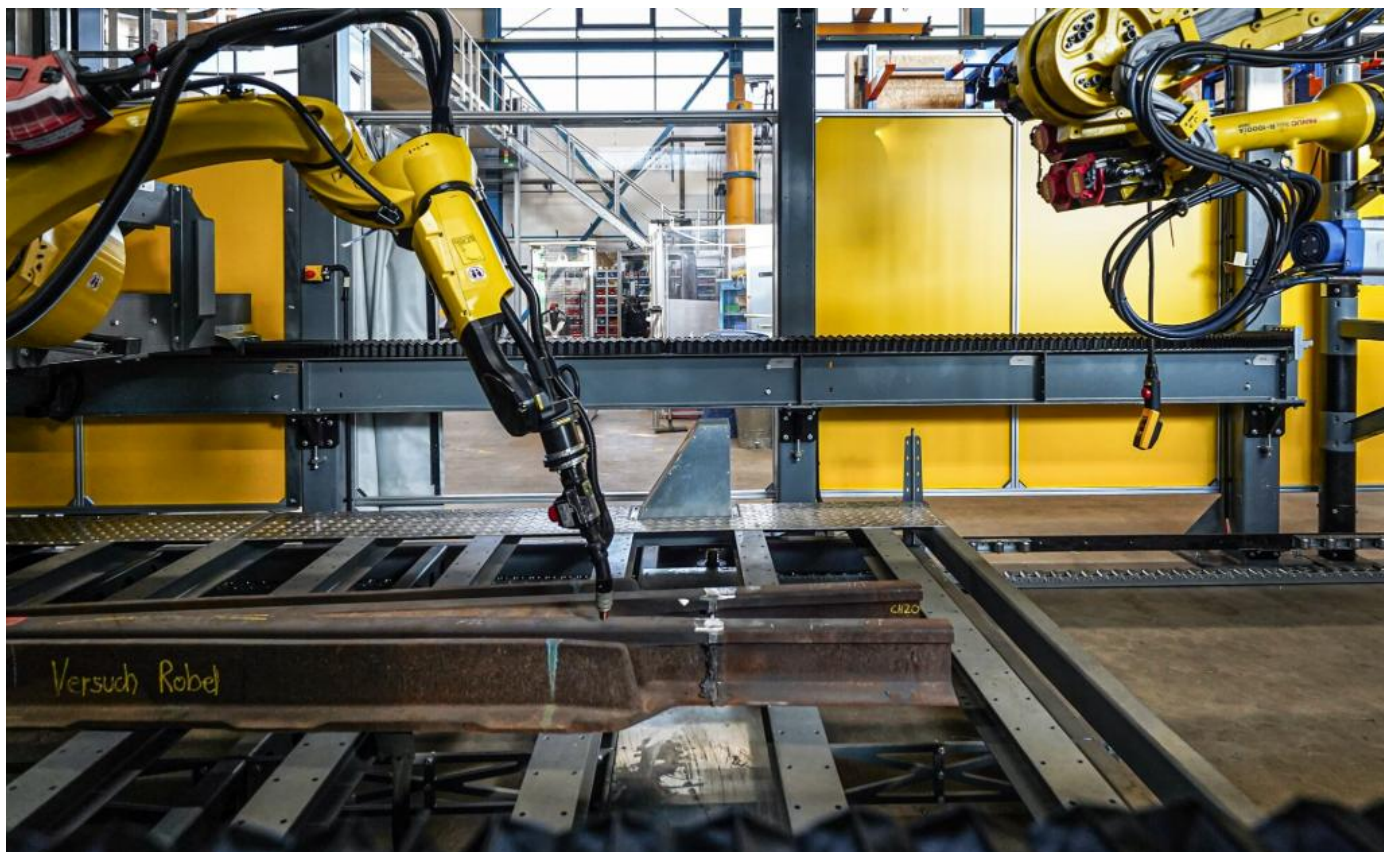
Further Infrastructure and homologation attempts in preparation with EU Infrastructure owners and construction companies.



ROBOT

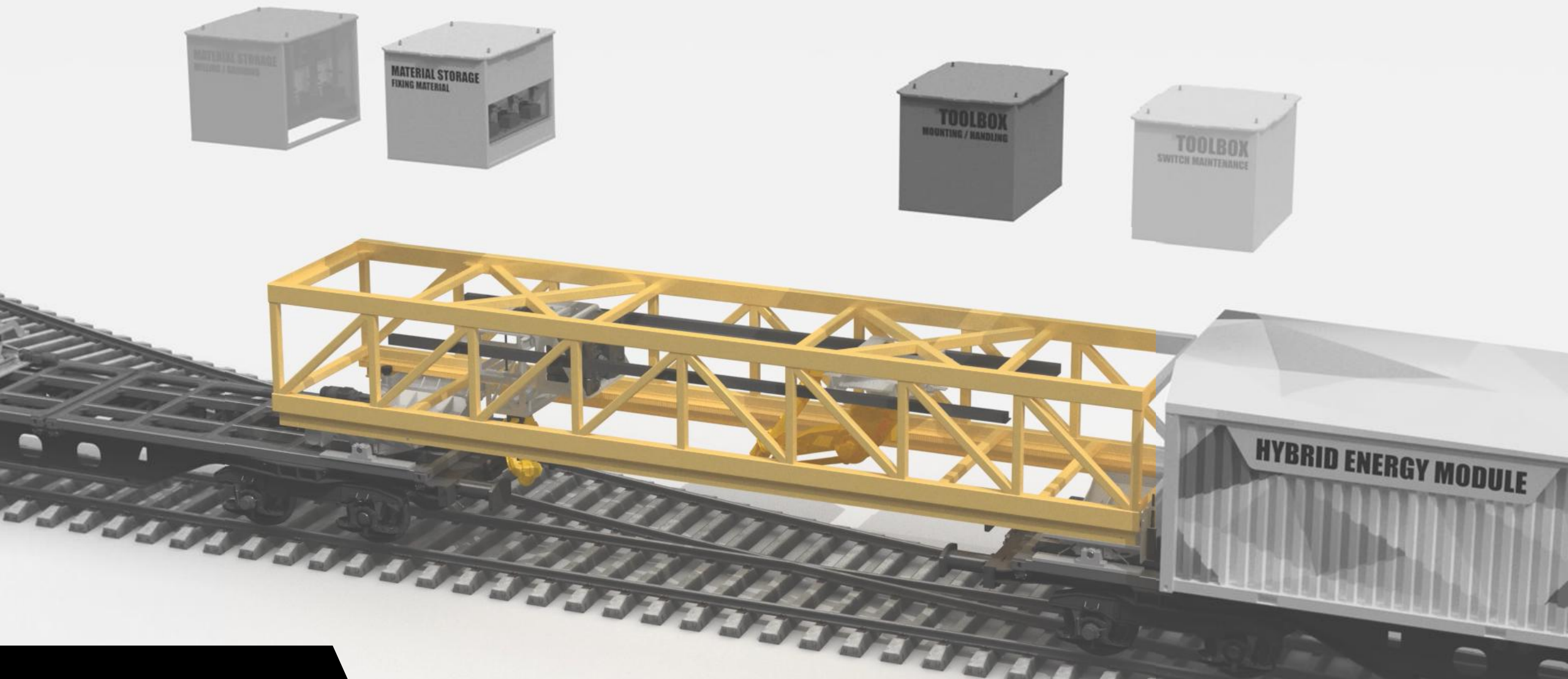
Next Homologation & Services





ROCENTER

In House Switch Services



ROFACTORY

First Productive System

- 7m of working area
- Highly configurable
- Digitally integrated
- Standard flat wagons
- TSI approved automated coupling

Safe | No boots in the ballast

Reliable | proven E2E maintenance processes

Resource Efficient | 0 emission, one operator



ROFACTORY

Highlights

RELIABLE | SAFE | RESSOURCE EFFICIENT



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