



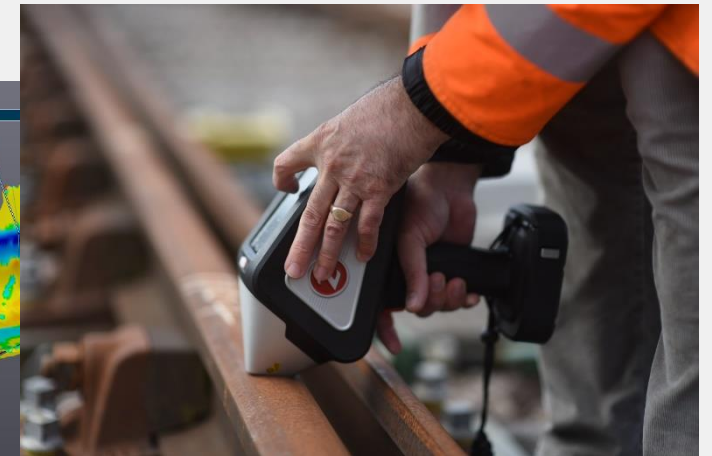
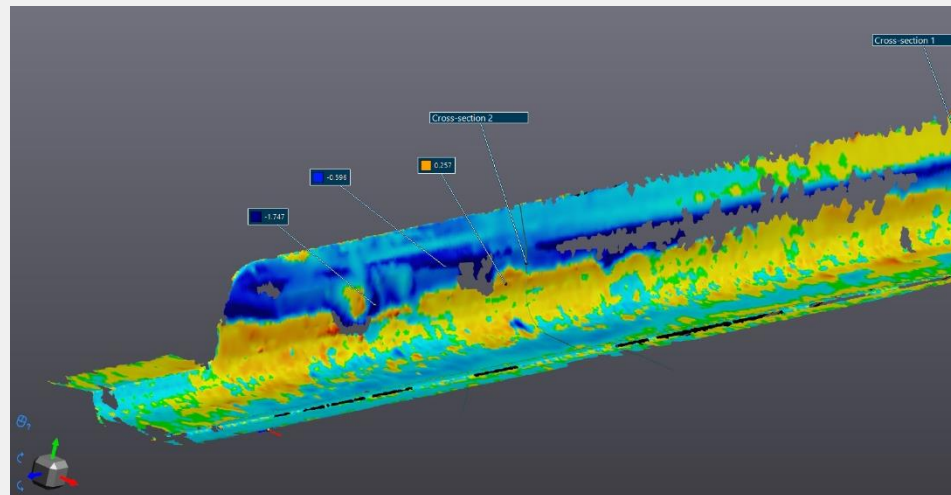
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# Field measurement and laser-clad enhancement of switch blades

Ruby  
Kempka

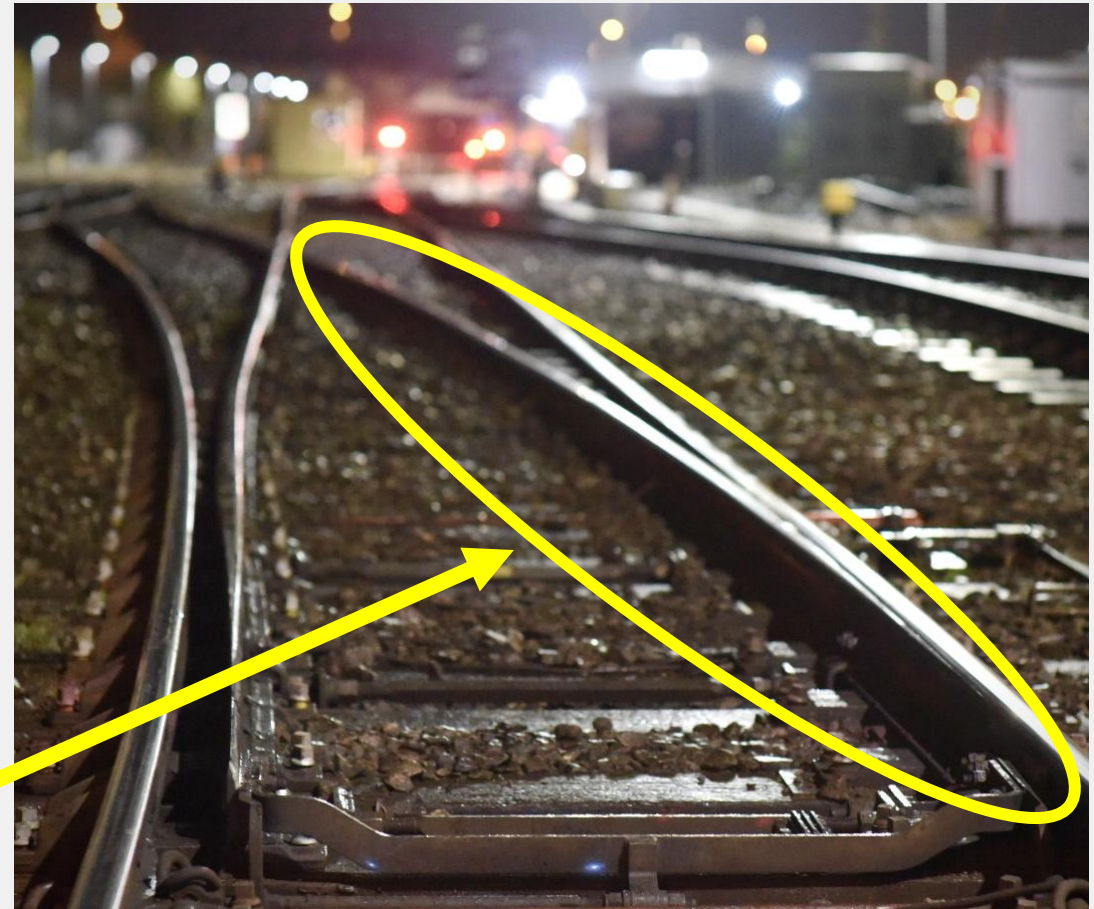
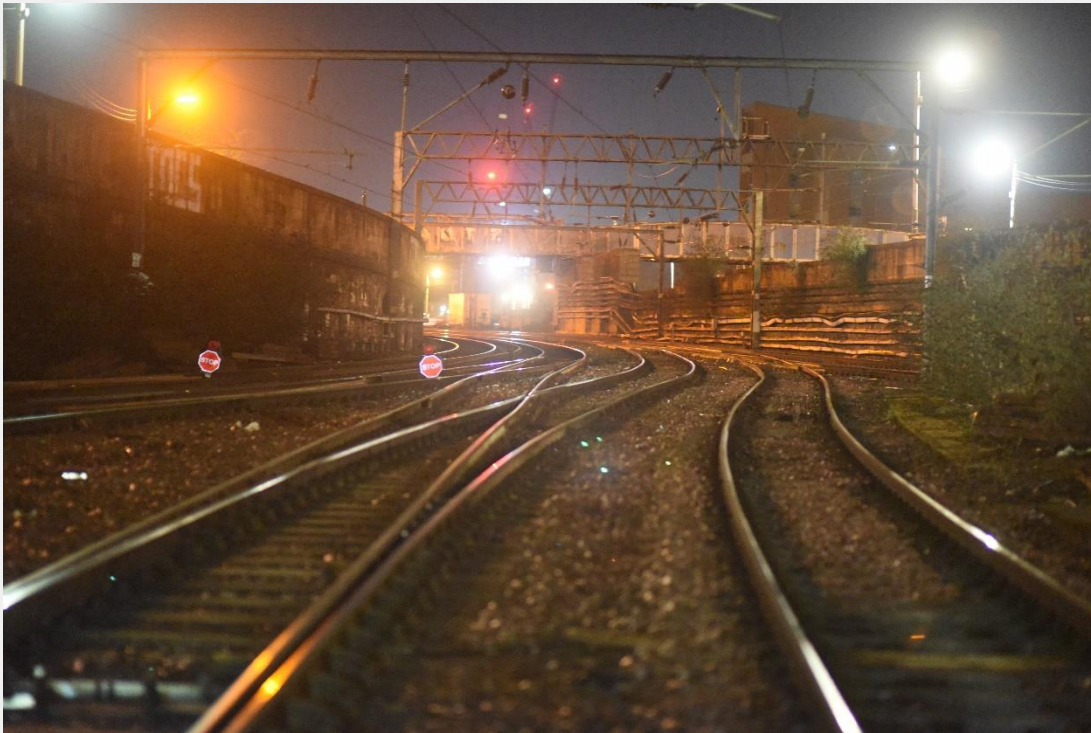
[r.Kempka@sheffield.ac.uk](mailto:r.Kempka@sheffield.ac.uk)





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# Switches and Crossings



Switchblade



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# MEASUREMENTS OF SWITCHBLADES





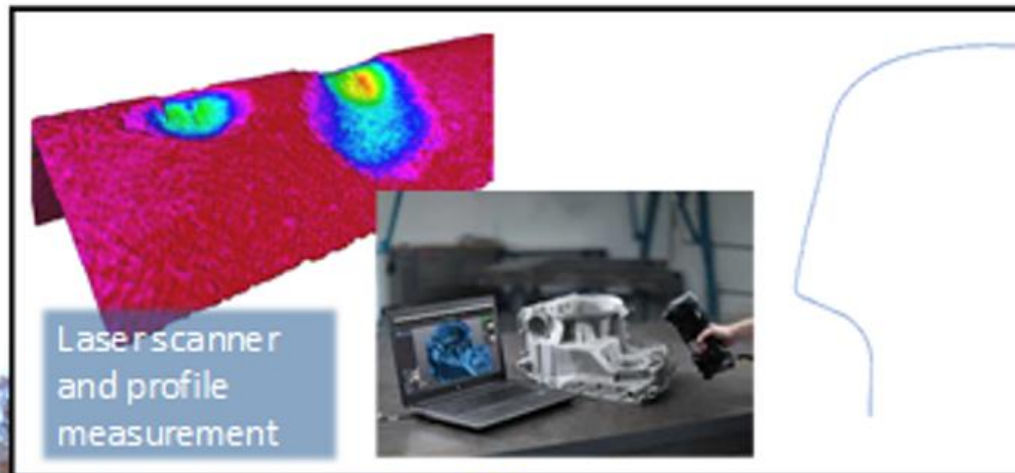
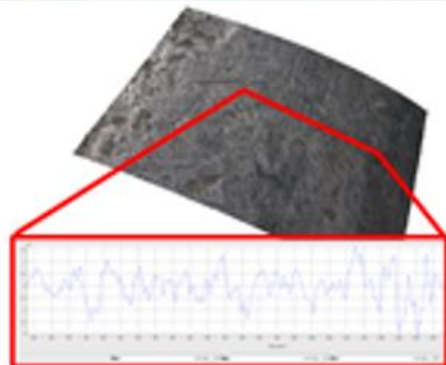
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LIBS  
Analyser

Aluminium	0.16%	0.16%	0.16%
Copper	0.01%	0.01%	0.01%
Iron	99.83%	99.83%	99.83%
Manganese	0.01%	0.01%	0.01%
Silicon	0.01%	0.01%	0.01%
Sulphur	0.01%	0.01%	0.01%
Zinc	0.01%	0.01%	0.01%

Aluminium: 0.16%, 0.16%, 0.16%  
Copper: 0.01%, 0.01%, 0.01%  
Iron: 99.83%, 99.83%, 99.83%  
Manganese: 0.01%, 0.01%, 0.01%  
Silicon: 0.01%, 0.01%, 0.01%  
Sulphur: 0.01%, 0.01%, 0.01%  
Zinc: 0.01%, 0.01%, 0.01%



Laser scanner  
and profile  
measurement



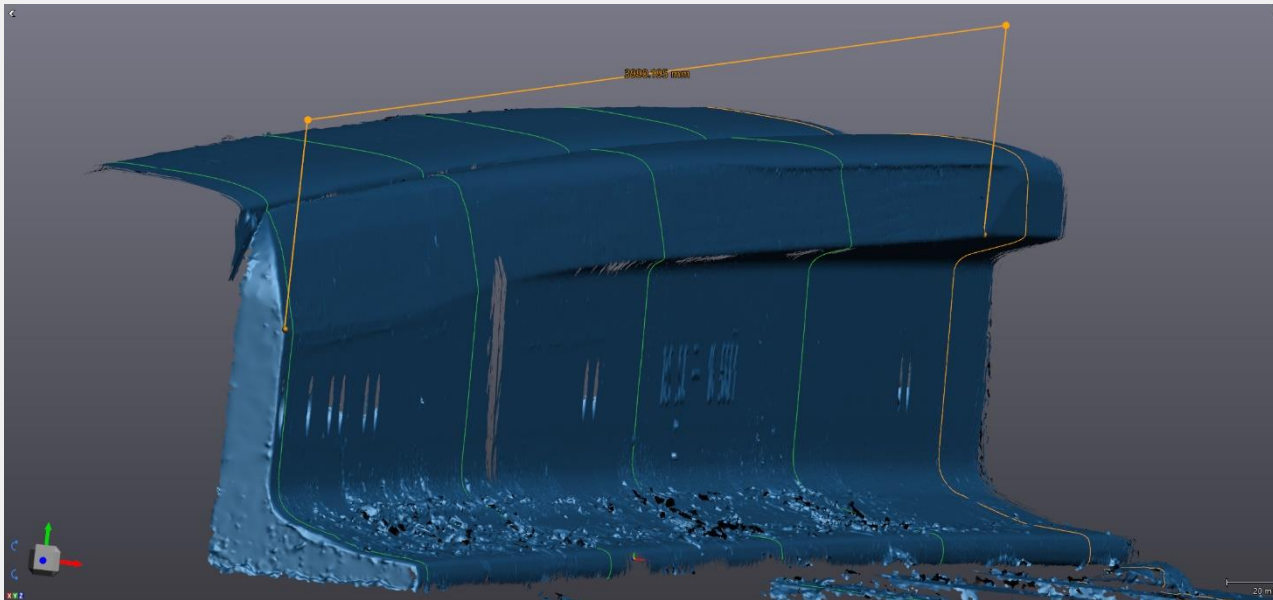
OnTrack Tribometer





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# Large scale 3D scanning





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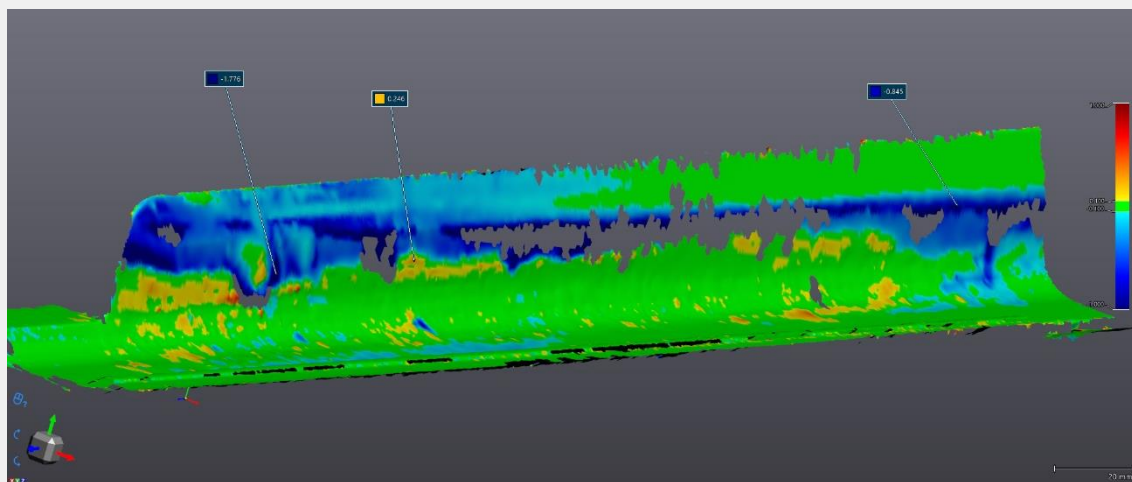
# WEAR PROFILES



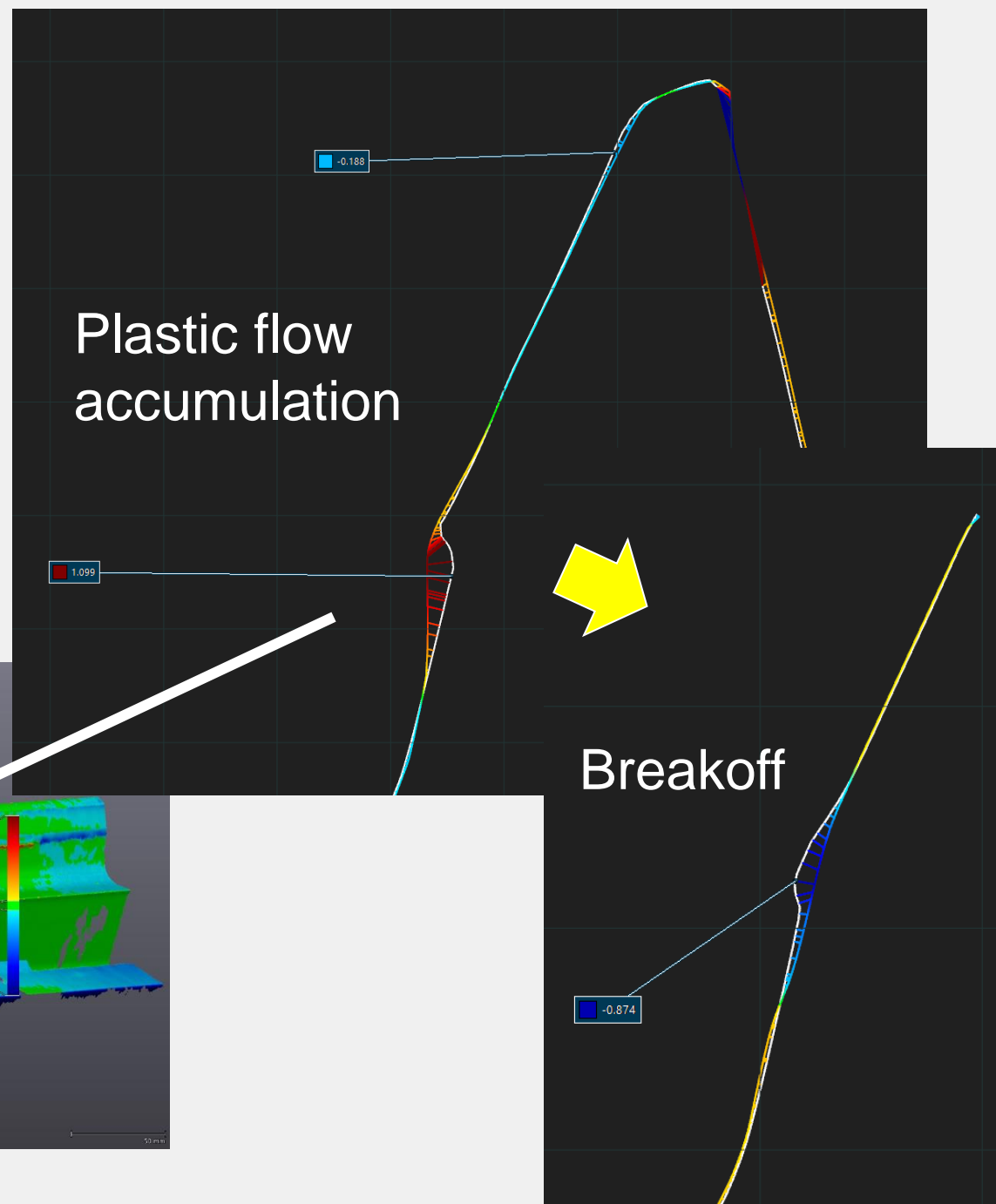
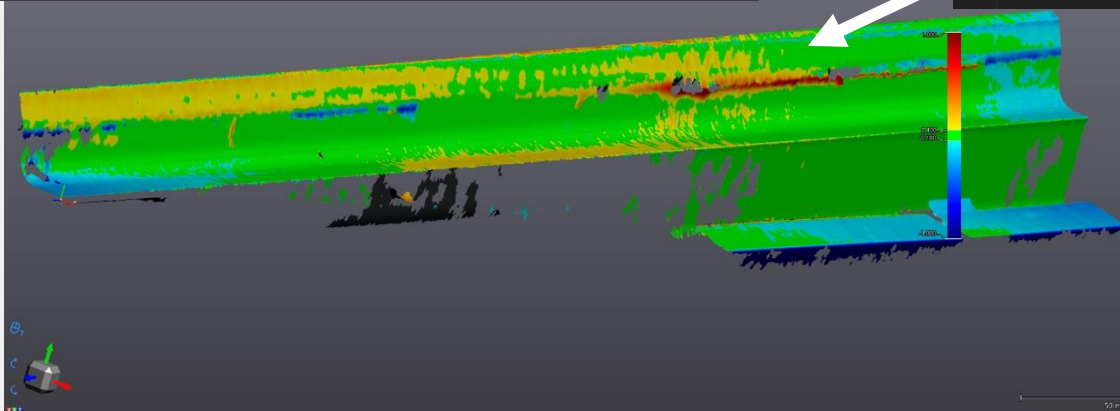


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# Wear characteristics



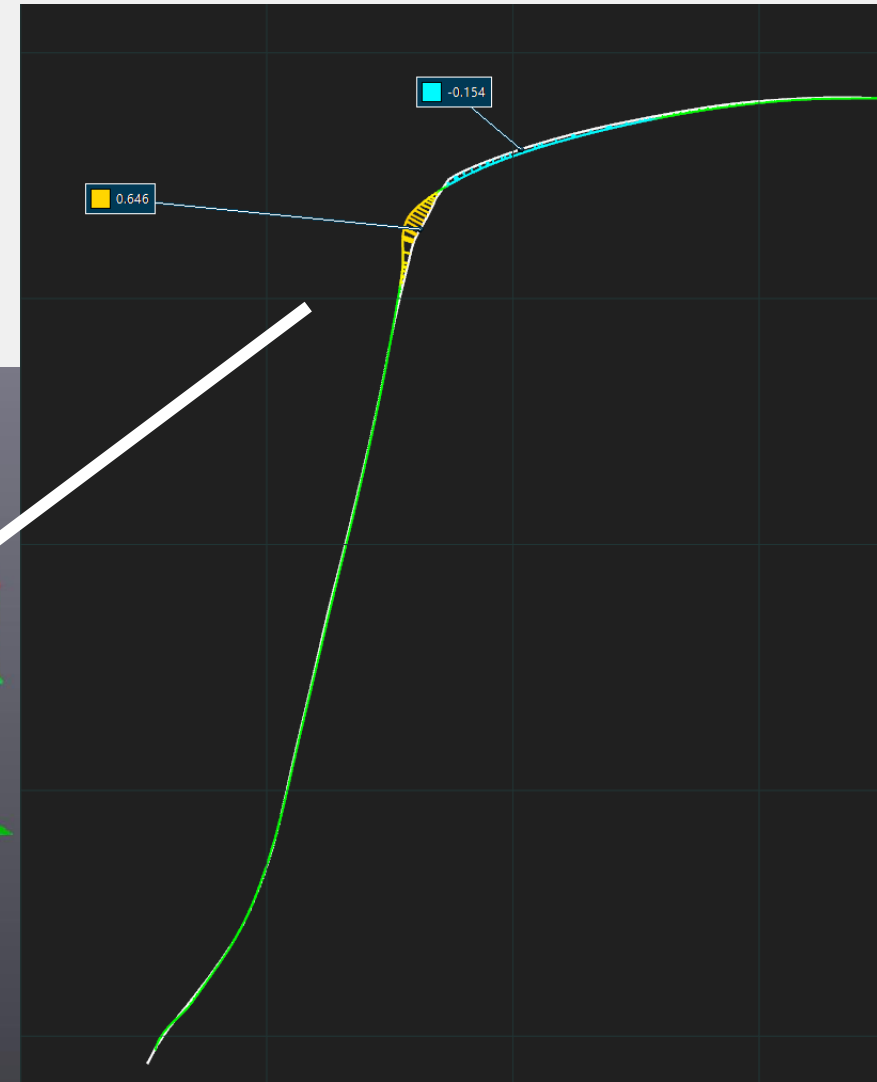
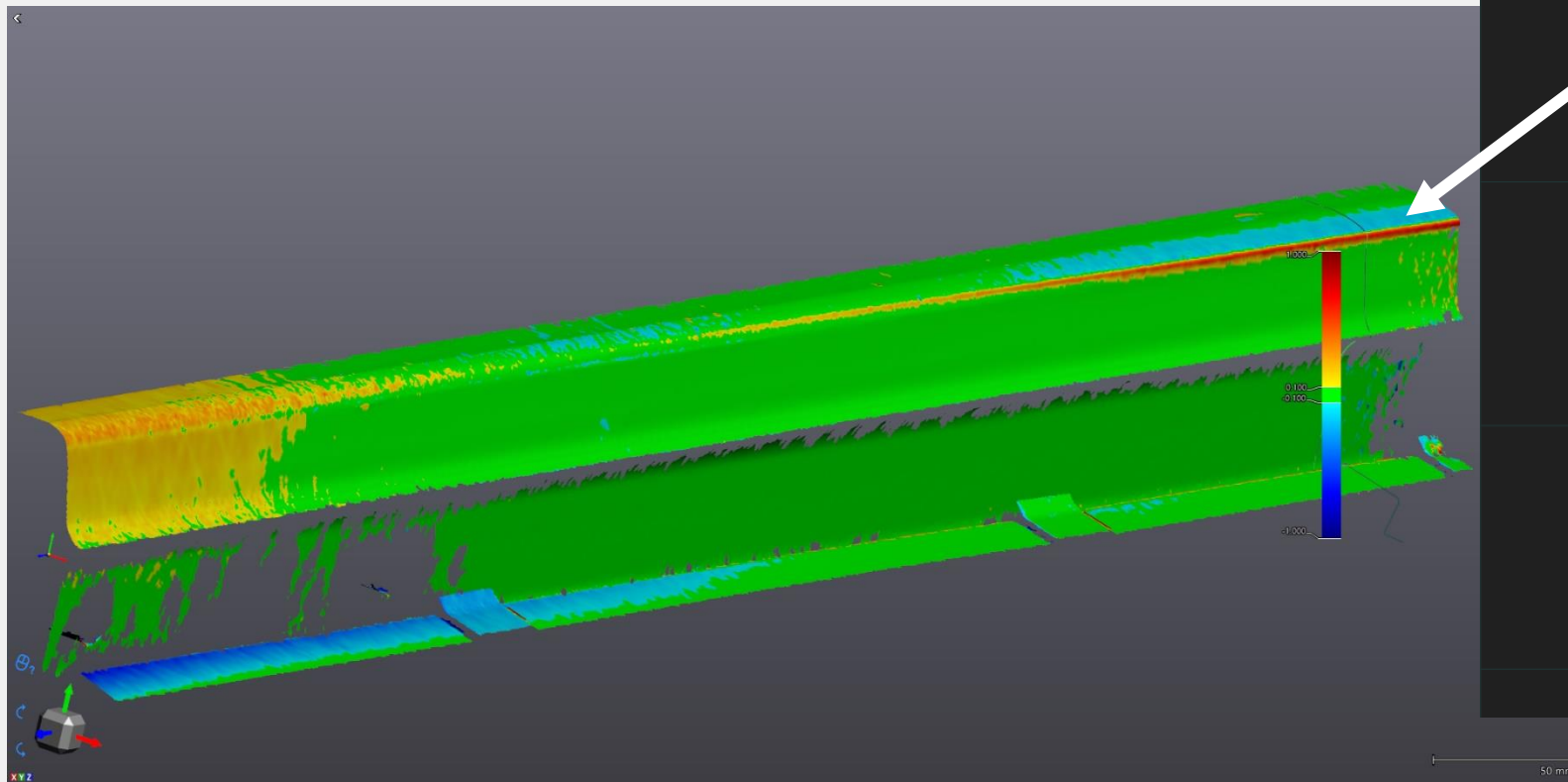
$\Delta t$ :  
10 weeks





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# Wear characteristics

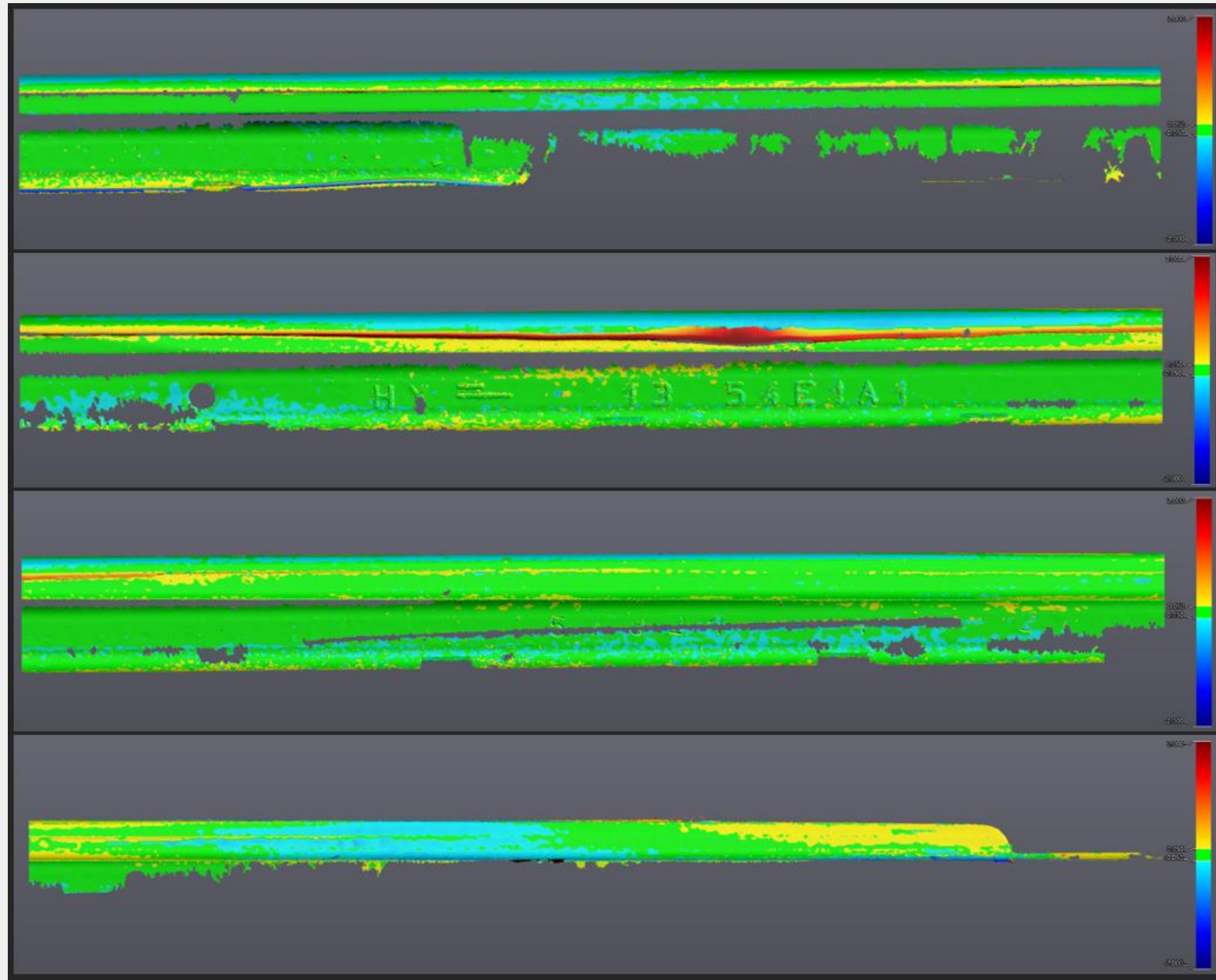






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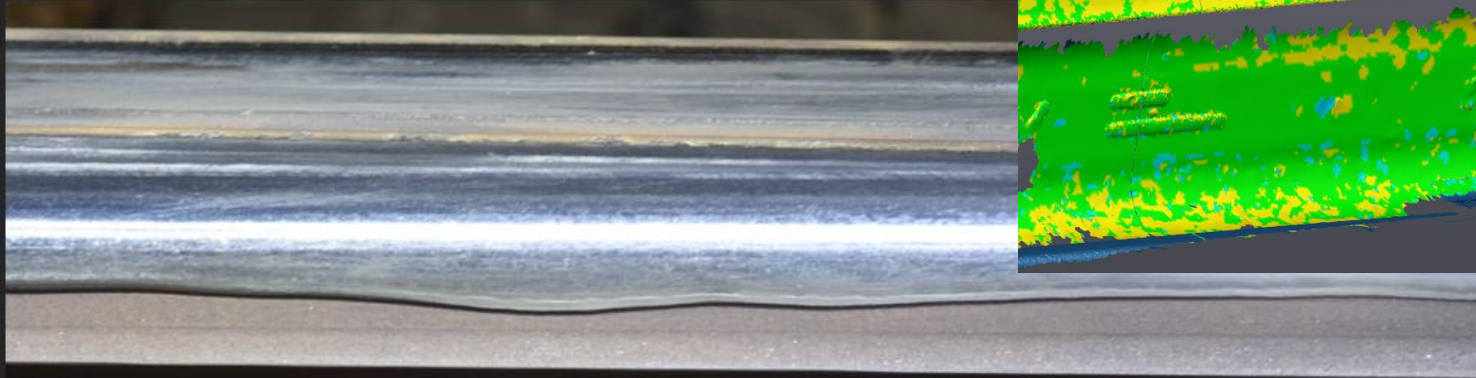
1 meter sections of  
switchblade scan  
comparisons, 10  
weeks between  
scans. Nottingham  
Station



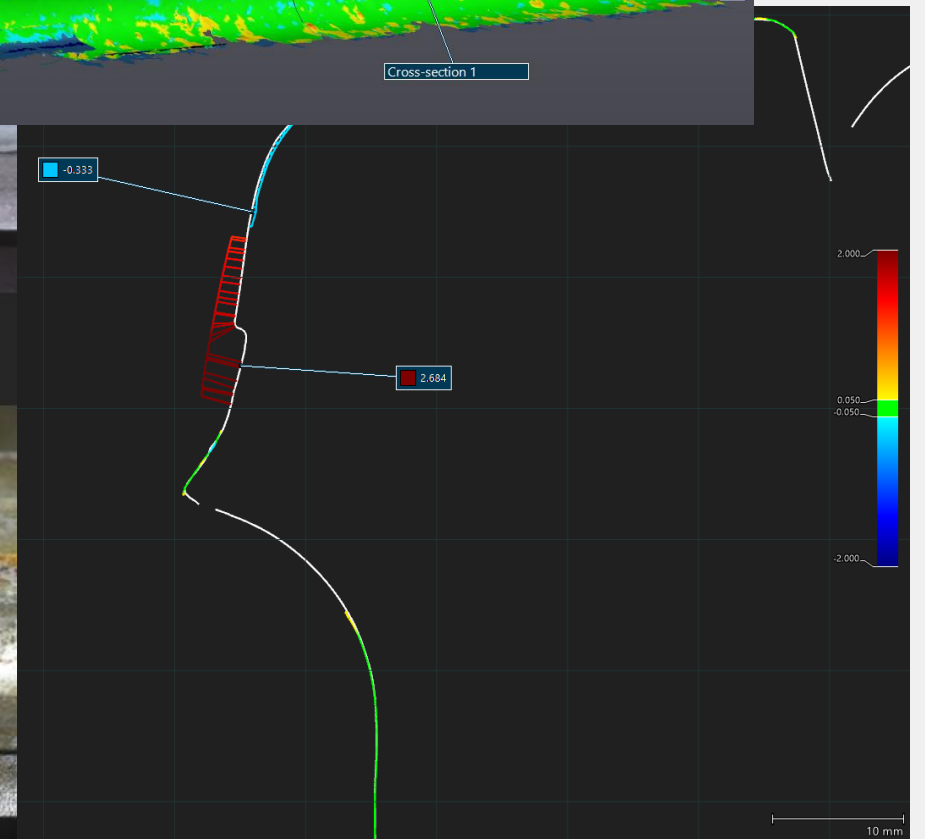
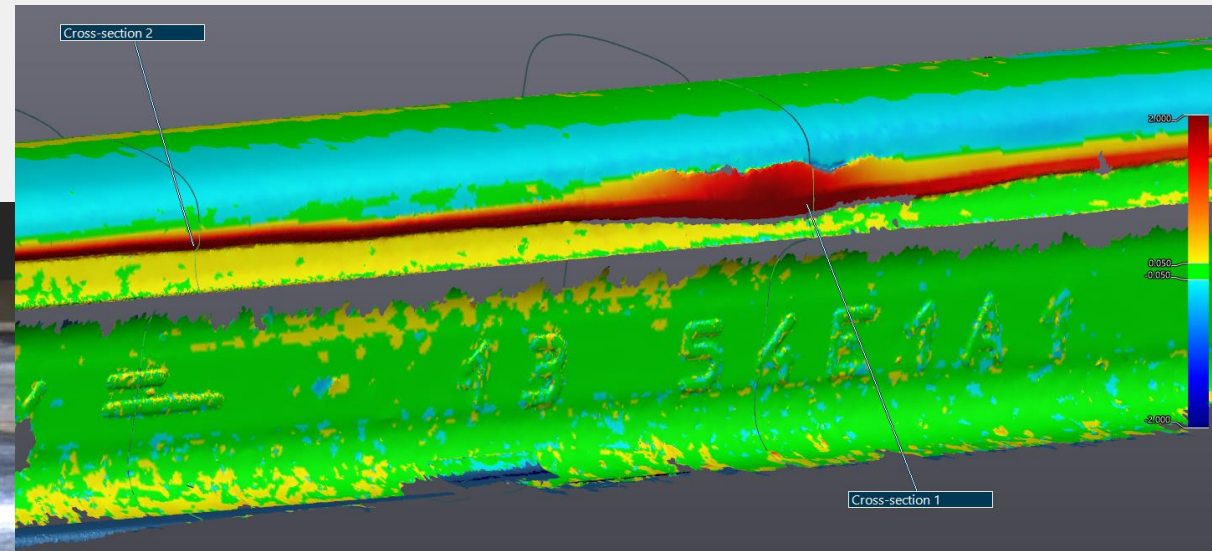
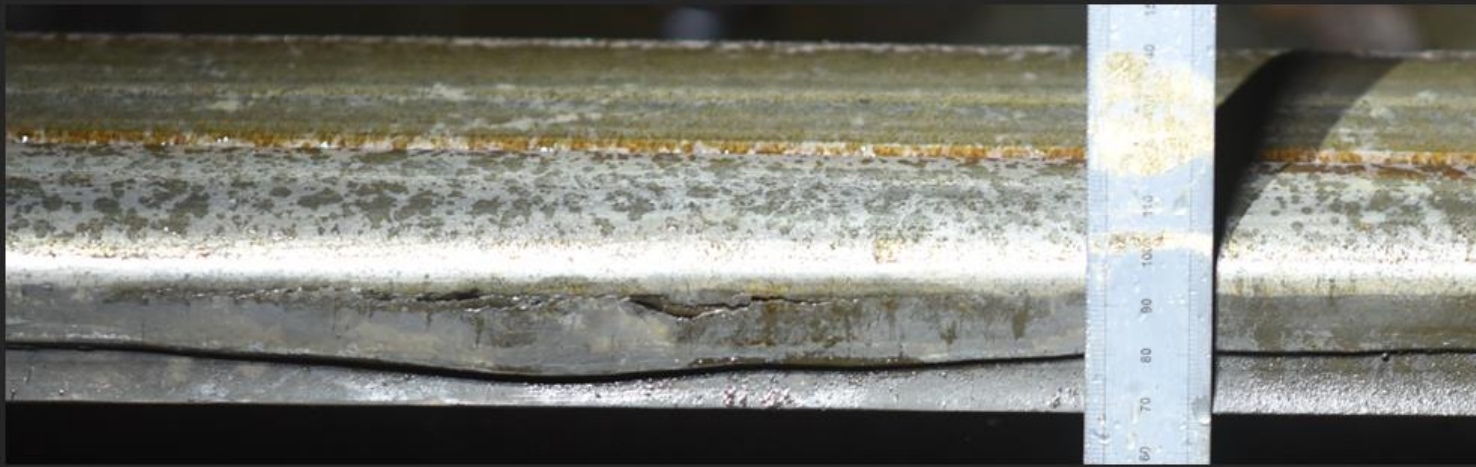
Dimensional  
change, mm



Before:



After:





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# COATING TRIALS



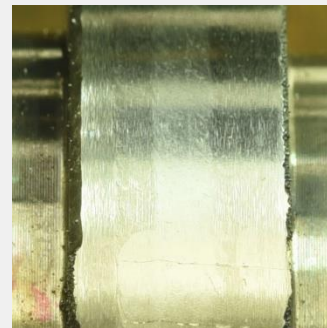


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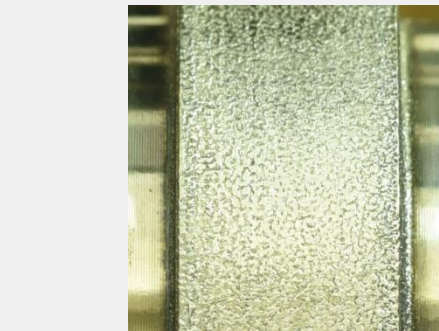
# Coating technologies



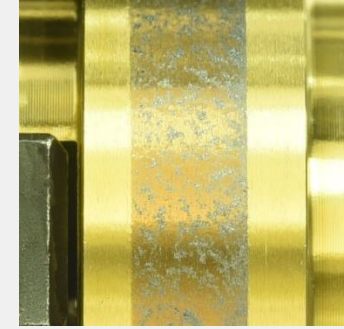
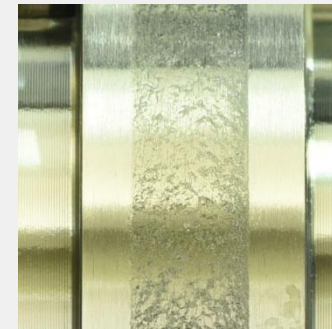
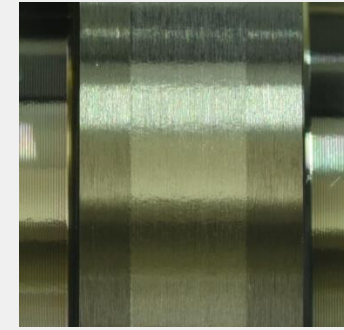
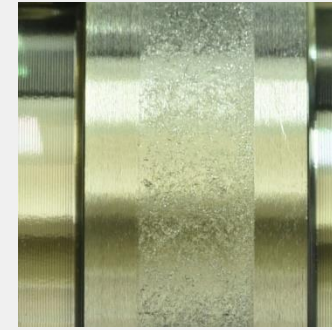
Thermal Spray  
(WCCoCr)



LMD (T400)



EHLA (T400)

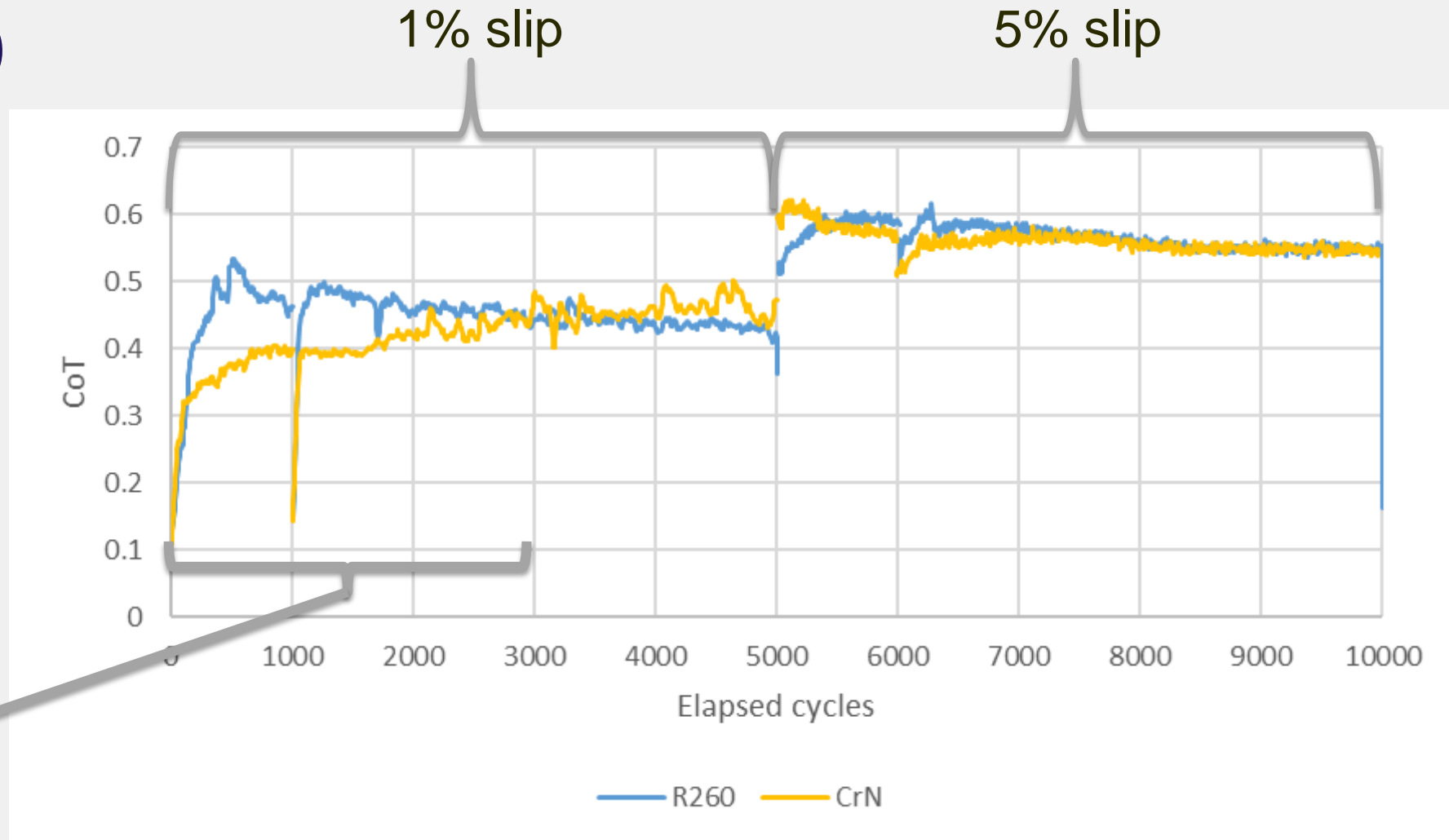


PVD



## Twin Disc tests, 1500MPa

PVD

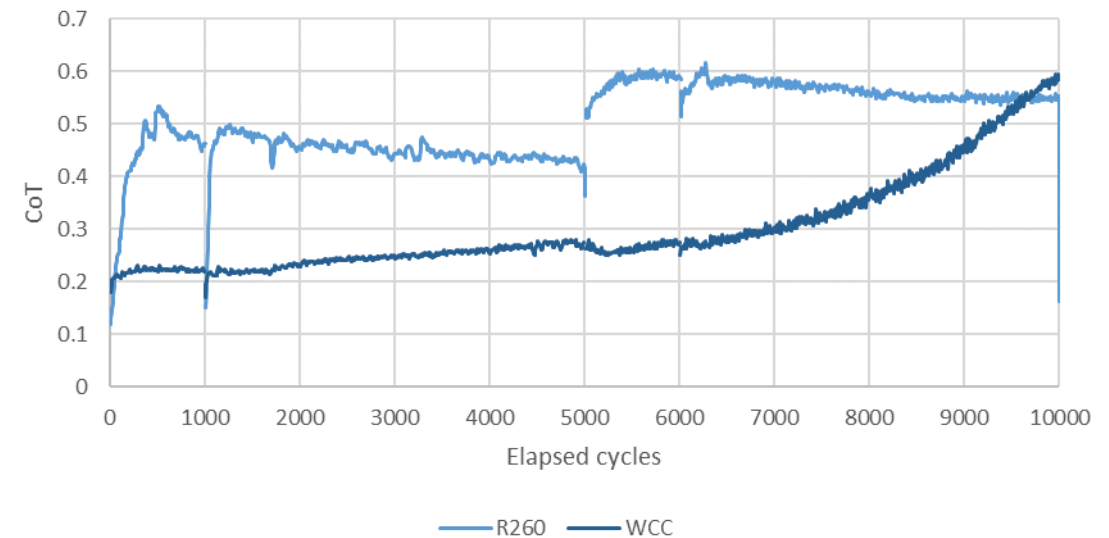
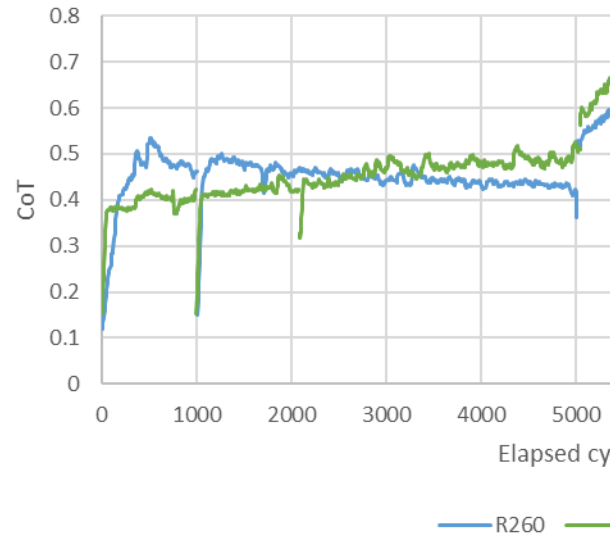
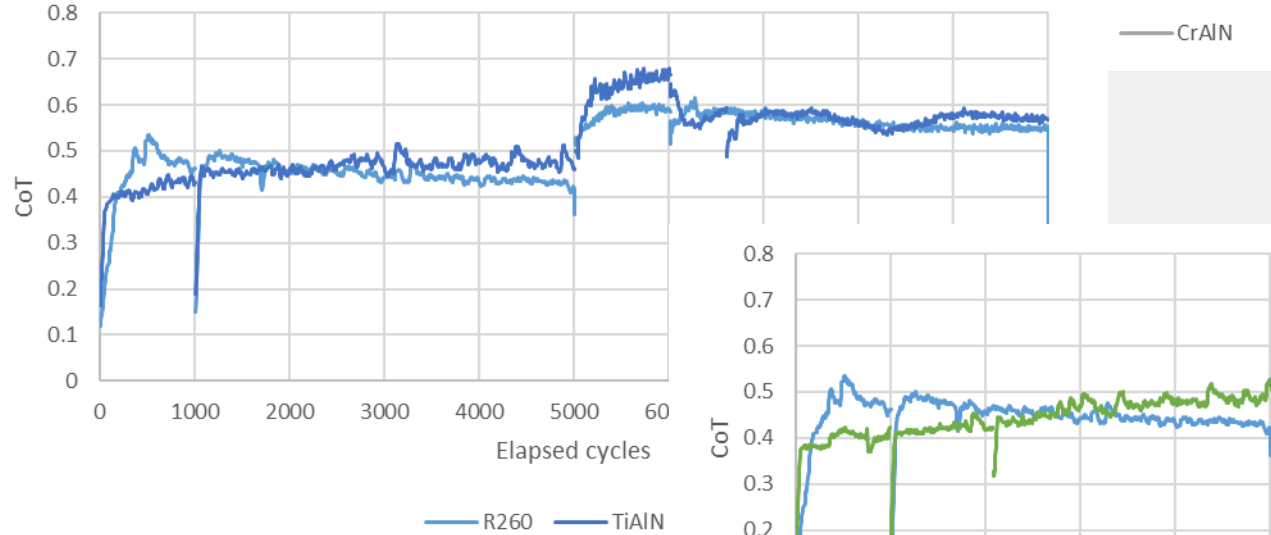
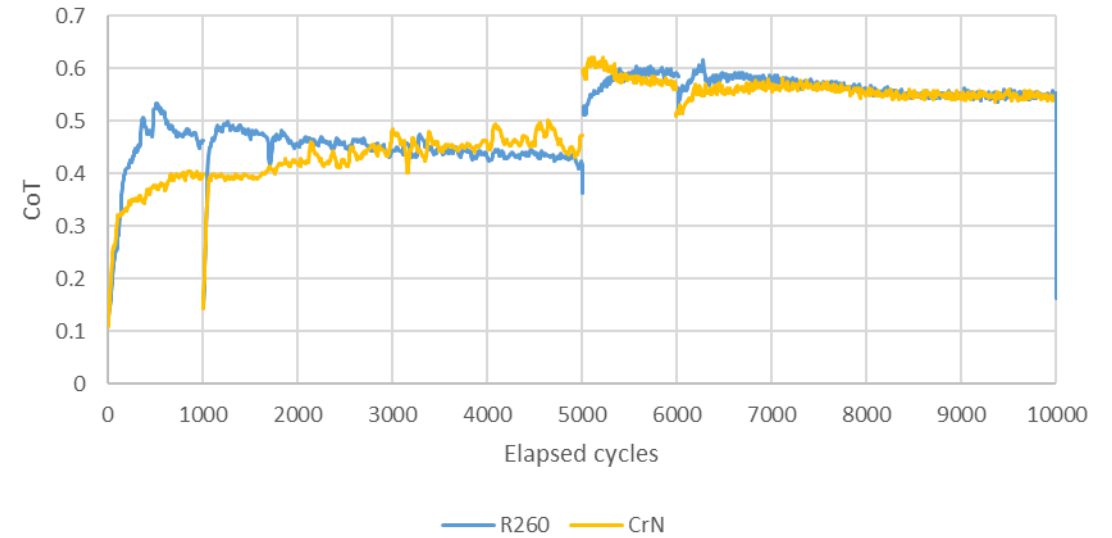
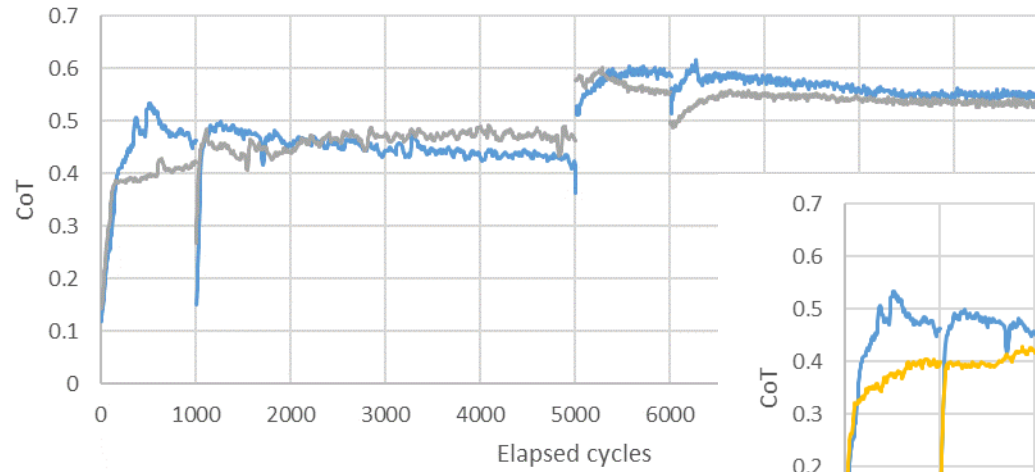


Coating degradation



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# PVD



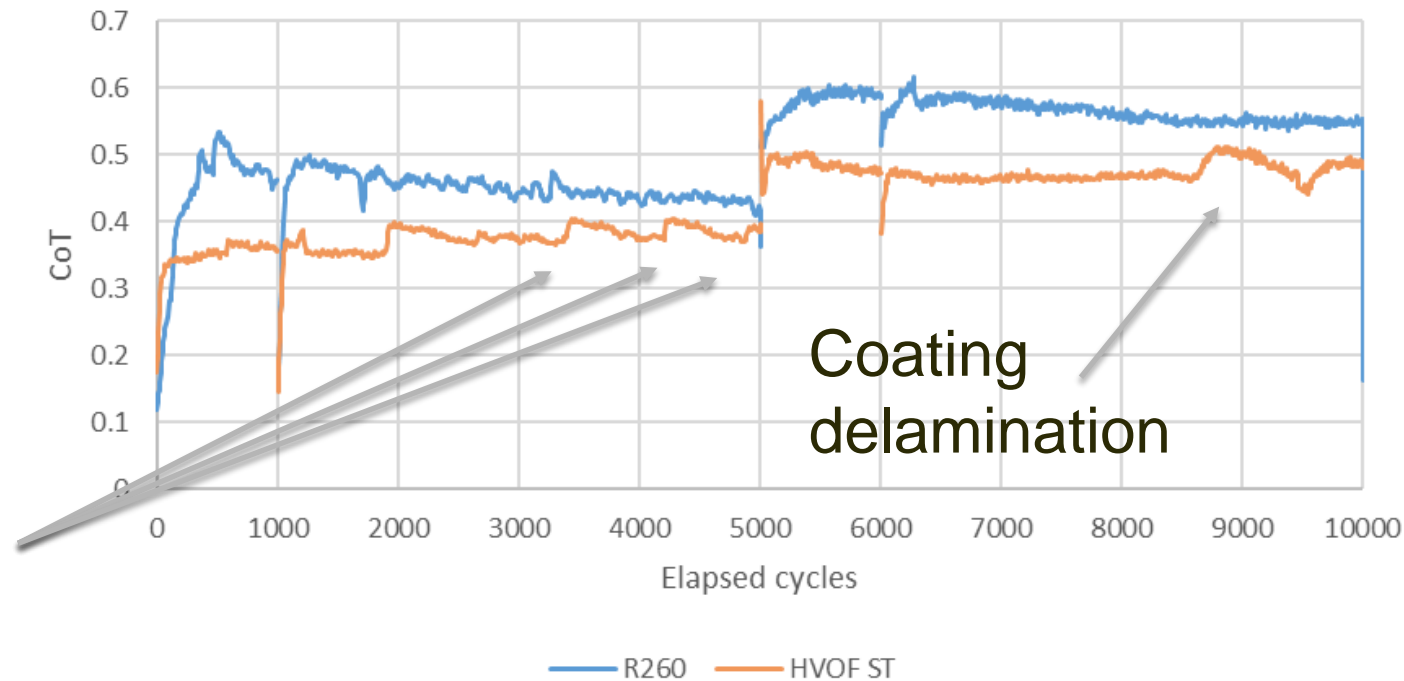




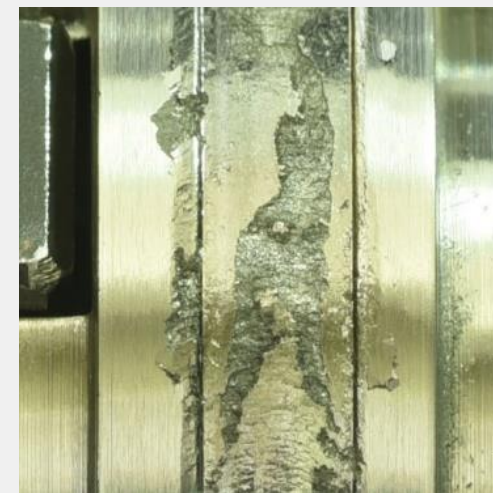
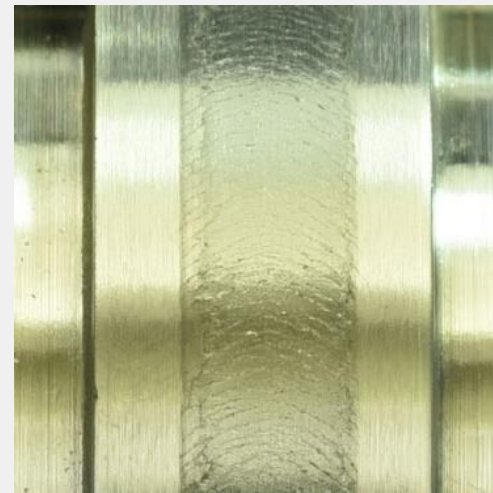
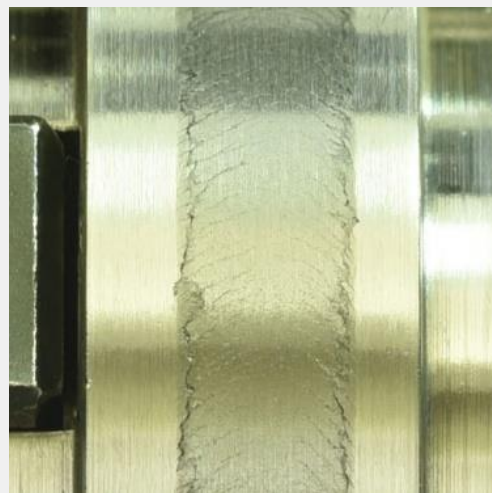
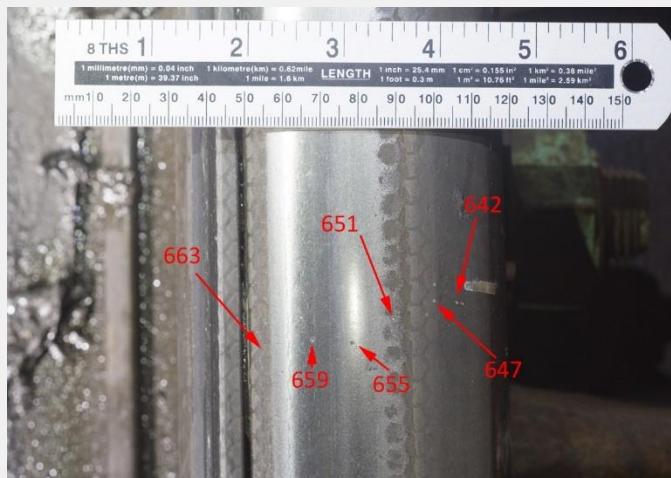
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WCCoCr

# Thermal Spray



Coating flaking off



5000 cycles, 1% slip

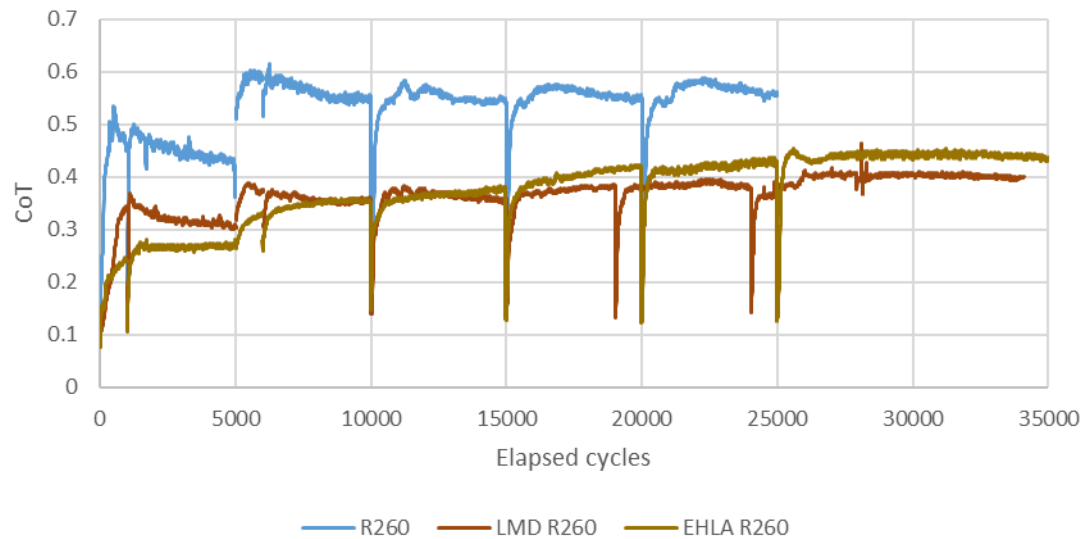
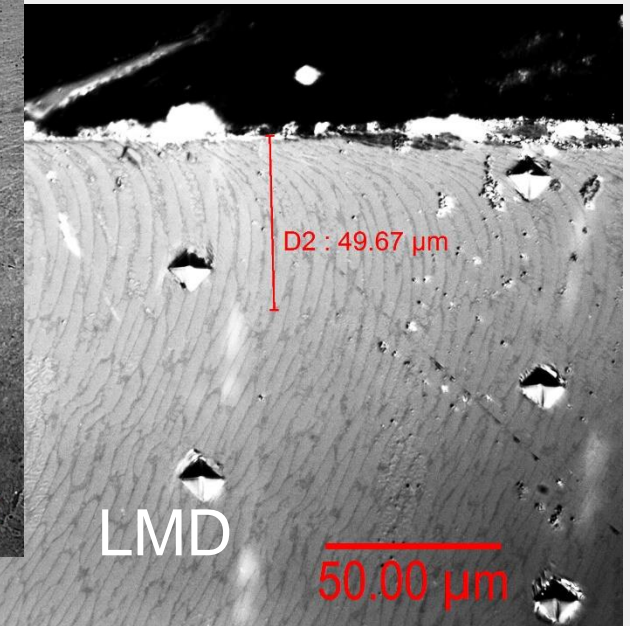
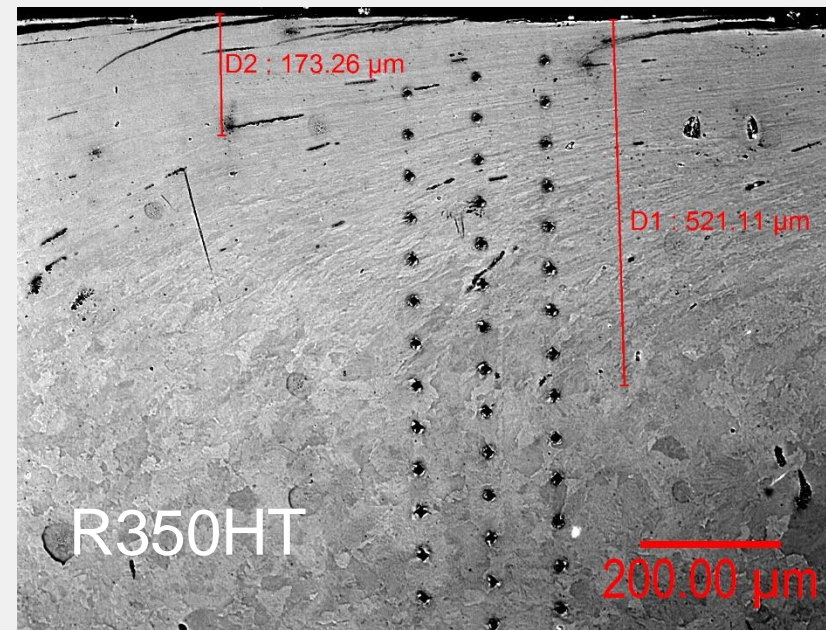
+1000 cycles, 5% slip +4000 cycles



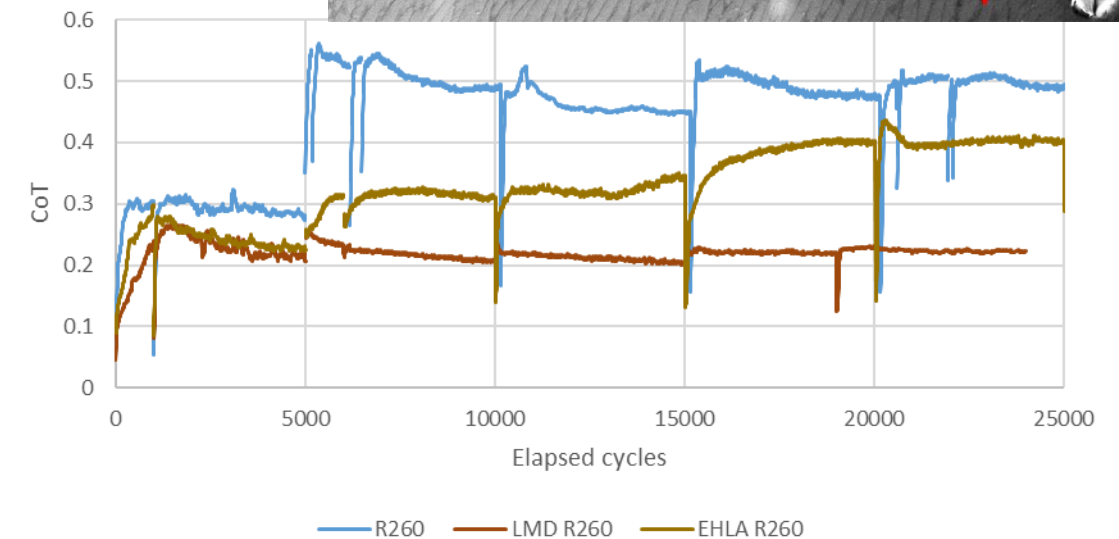
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# LMD and EHLA

Tribaloy T-400



1500MPa

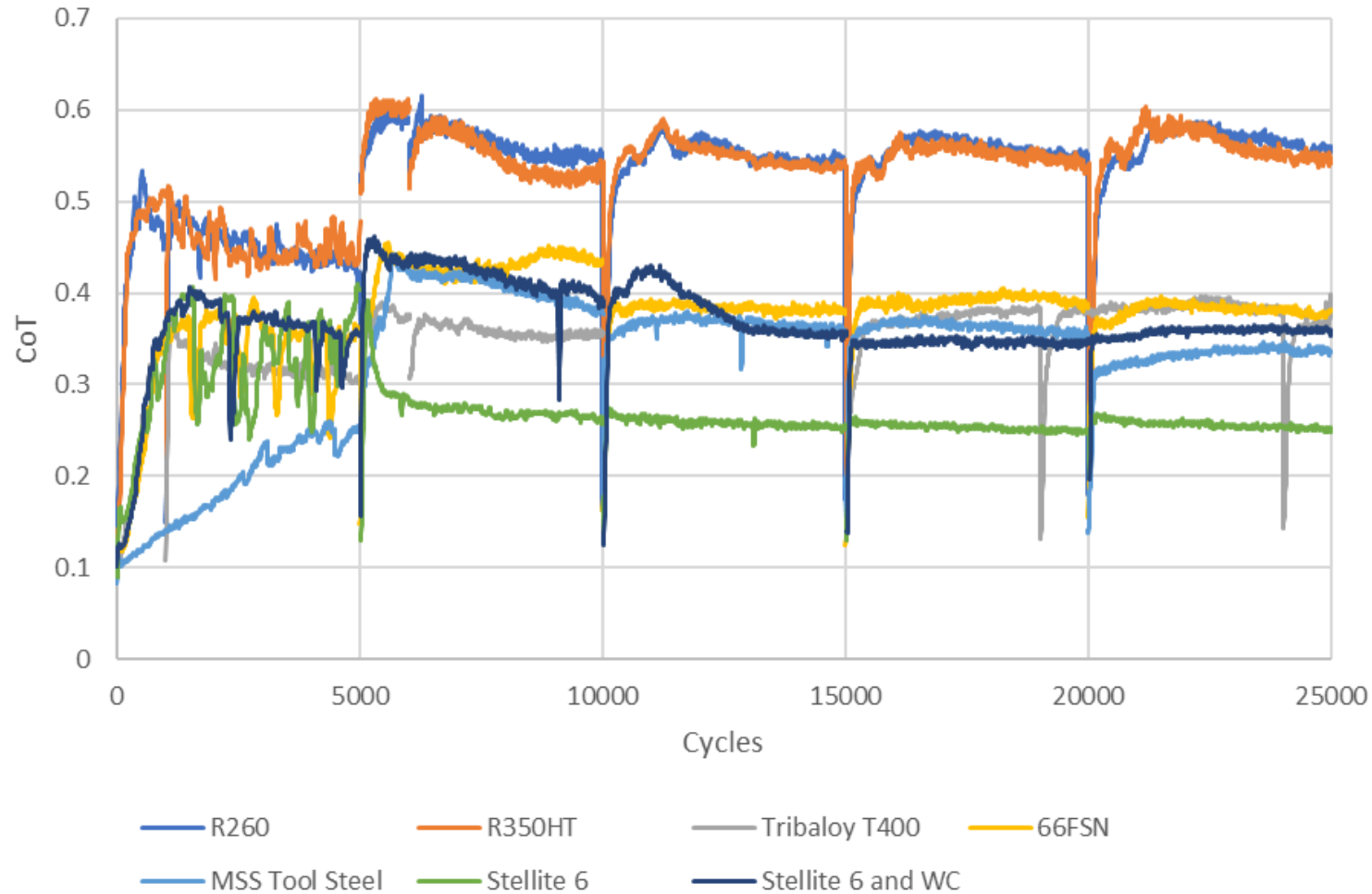


2100MPa

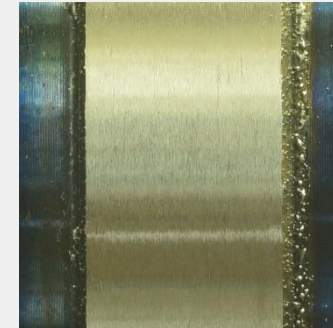




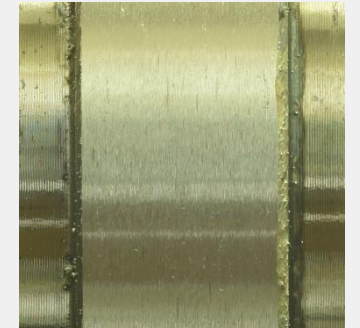
# LMD coating comparisons



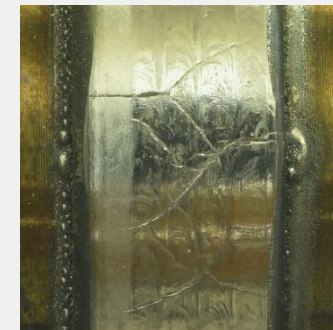
No observed defects



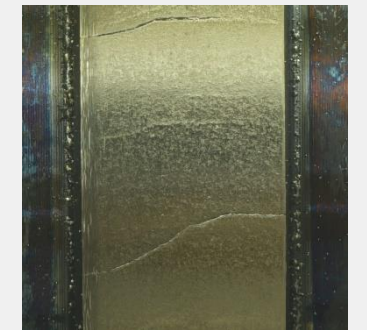
Stellite 6



MSS



66FNS

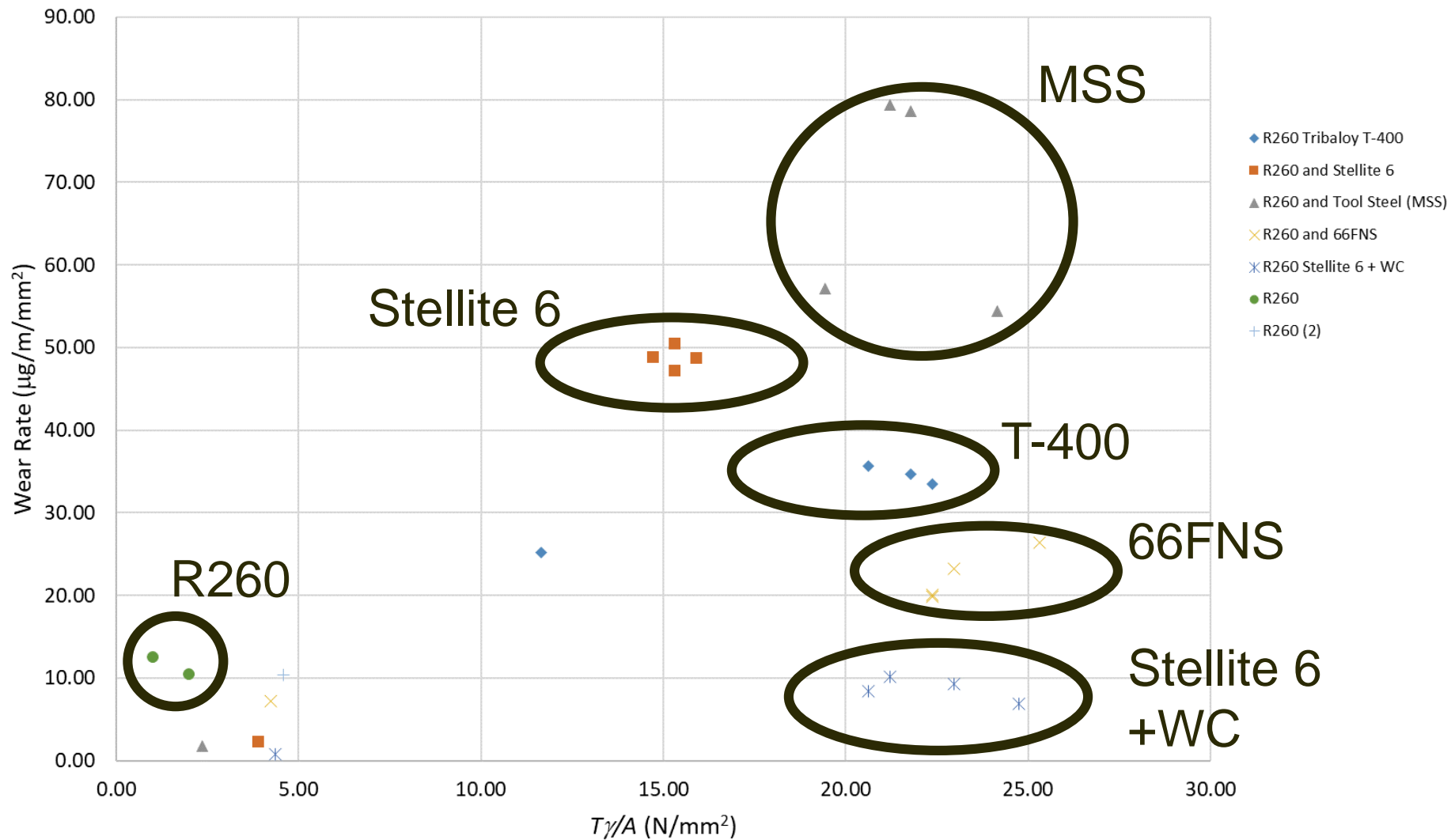


Stellite 6  
+ WC





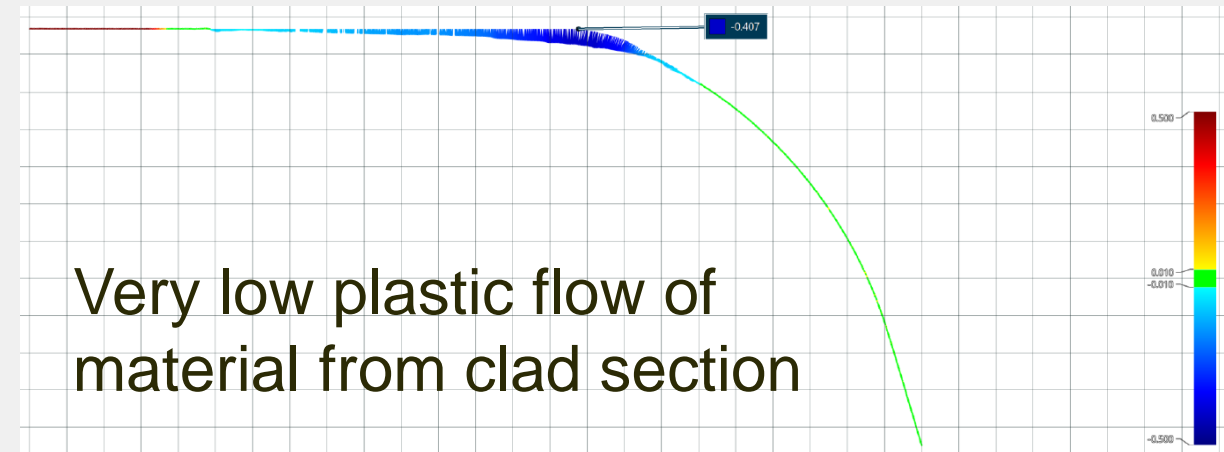
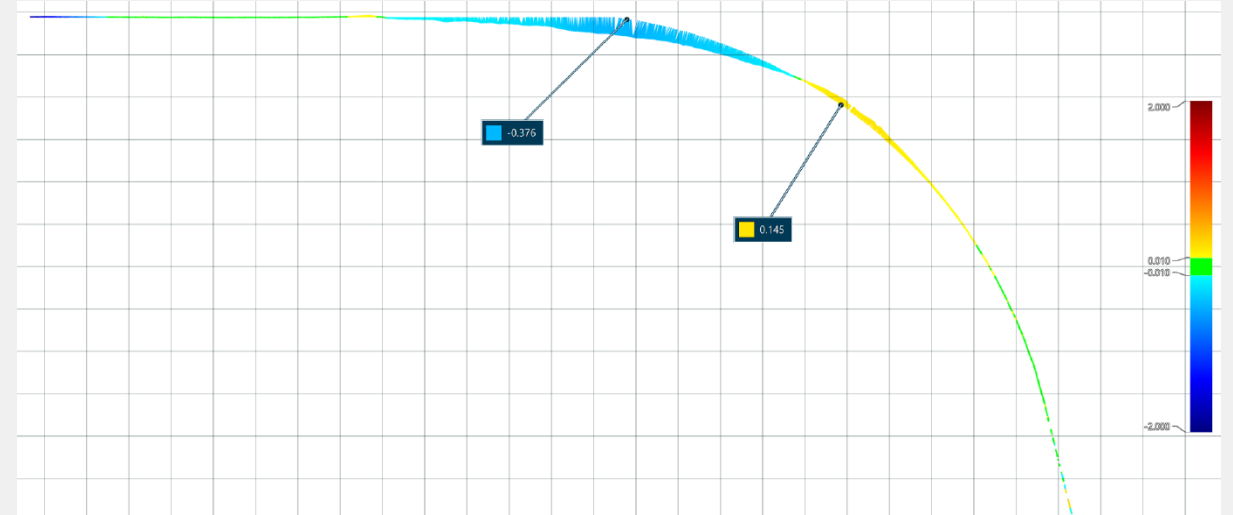
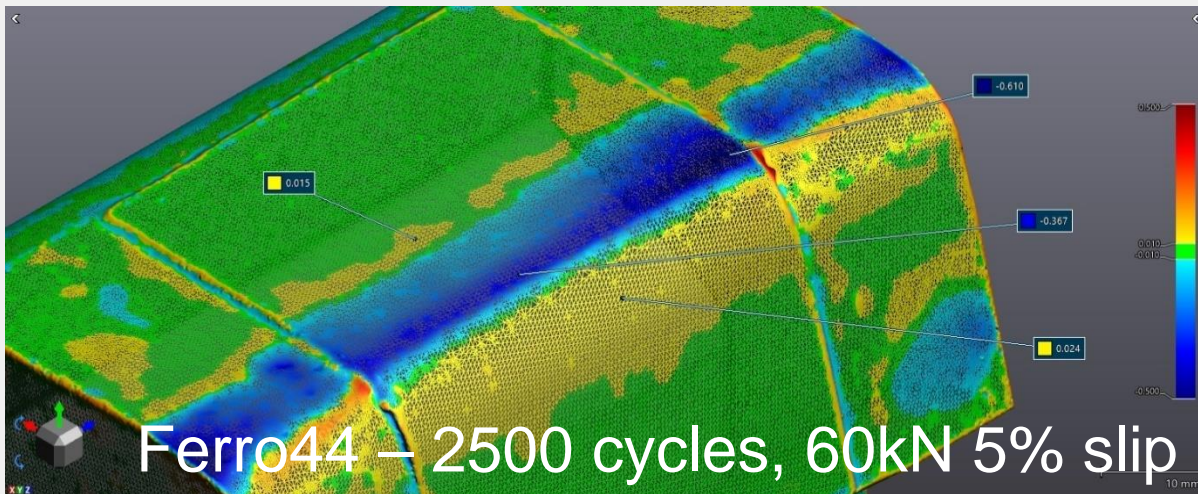
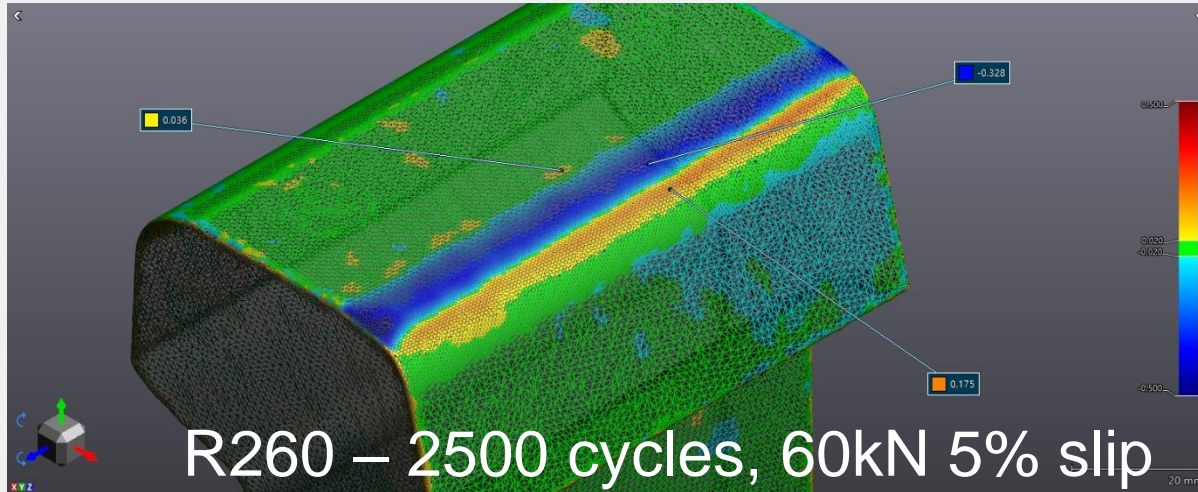
# LMD coating comparisons - wear





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# Full Scale Testing



Very low plastic flow of  
material from clad section



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# ONGOING TESTING

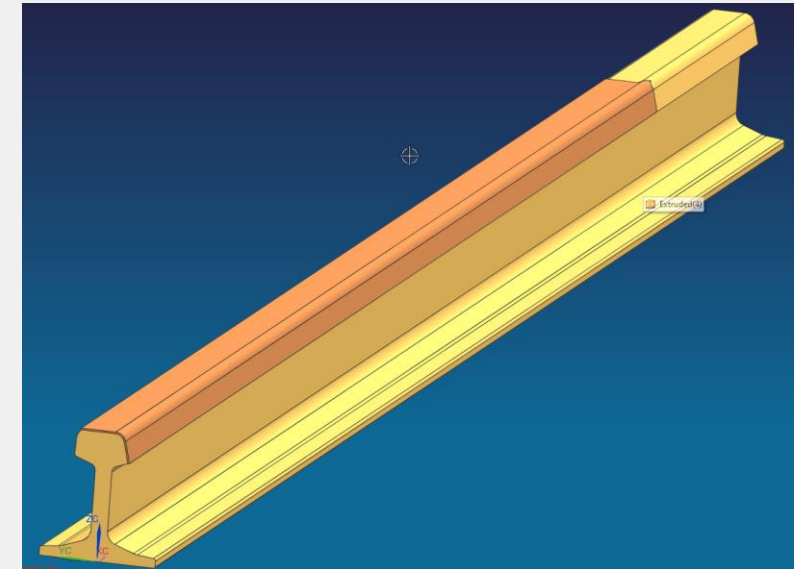




## Stellite 6 clad full scale samples

# Ongoing work

- Full scale machining and laser cladding integration
- Lab testing of full scale samples
- Switch wear monitoring campaign – UK mainline
- Demonstrator switch trials at private facility off the mainline





# Main challenges

- Design and optimisation of cladding and process parameters
  - Pre-heating and cooling
  - Integration with switch manufacturing
- Acceptance of new technology by industry



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# Thank you

## Questions?

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