

# REALISATION OF A VACUUM SYSTEM OF AN EUV EXPOSURE SYSTEM

Nevac day 2017 | Freek Molkenboer, Norbert Koster, Alfred Abutan, Alex Deutz, Hans Diesveld, Christiaan Hollemans, Andre Hoogstrate, Peter Kerkhof, Pim Muilwijk, Wouter Mulckhuysen, Bjorn Nijland, Bastiaan Oostdijk, Michel van Putten, Edwin te Sligte, Peter van der Walle, Jeroen Westerhout



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# OUTLINE

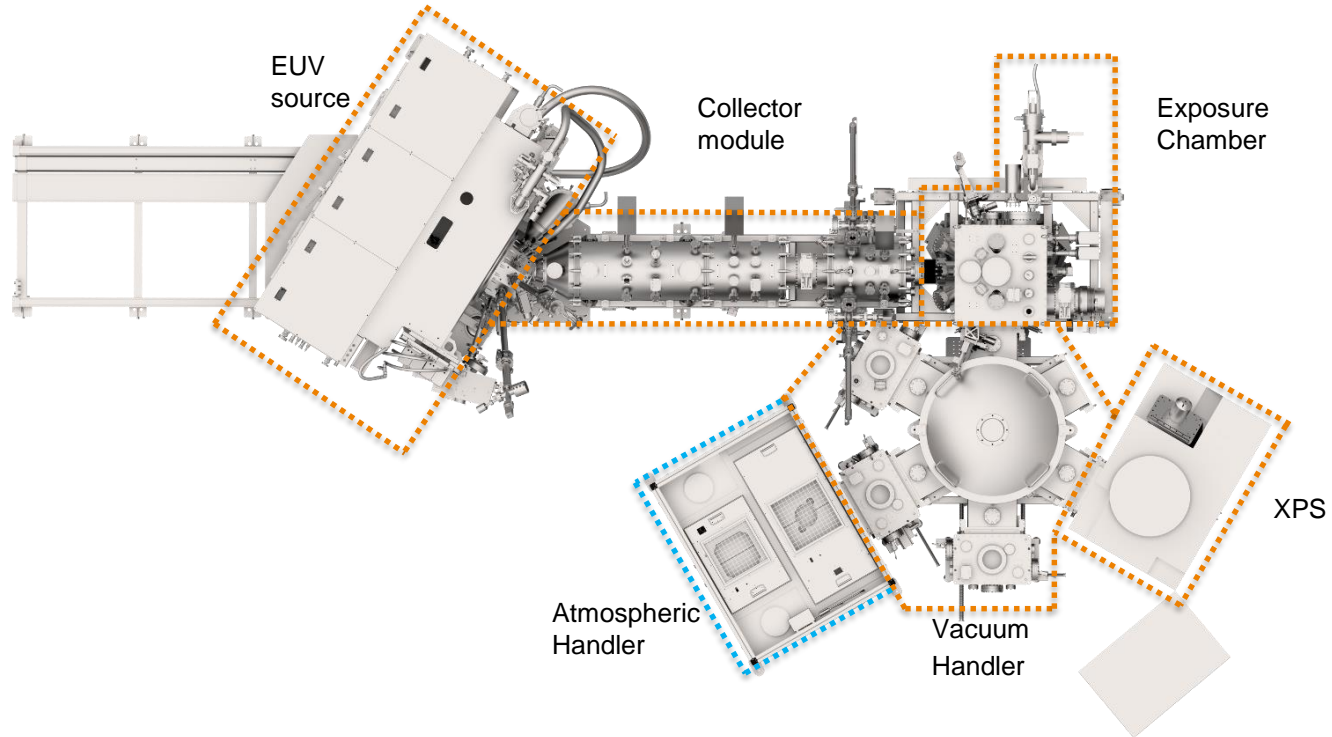
- › What is EBL2
- › Overview EBL2
- › Realization of EBL2
- › Differential pumping assembly
- › Sample handling in vacuum
- › Conclusion

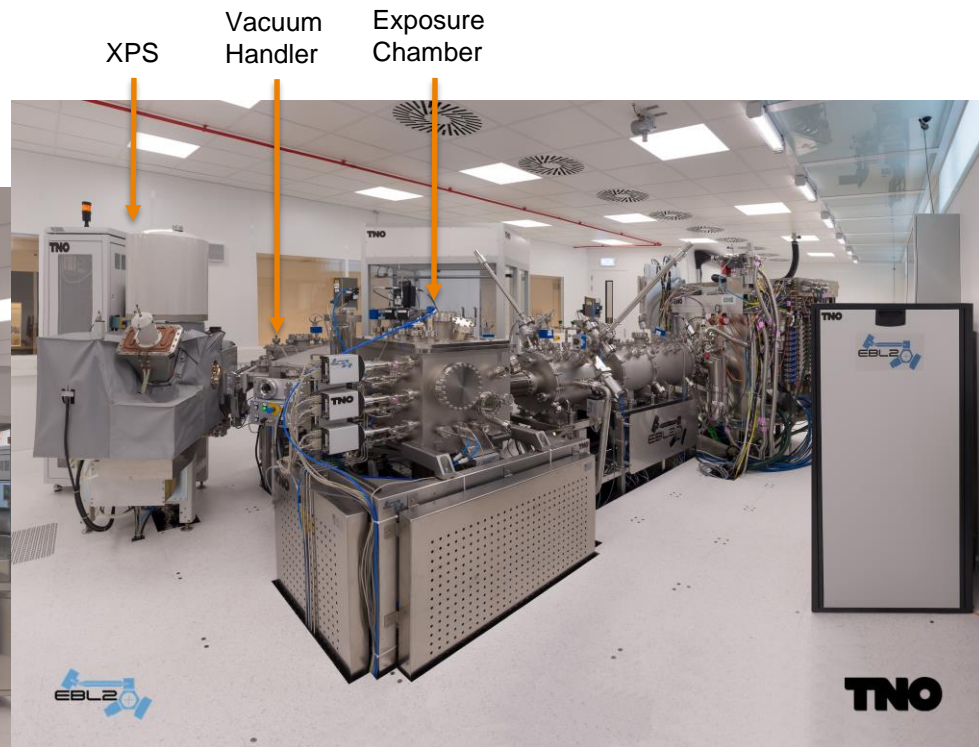
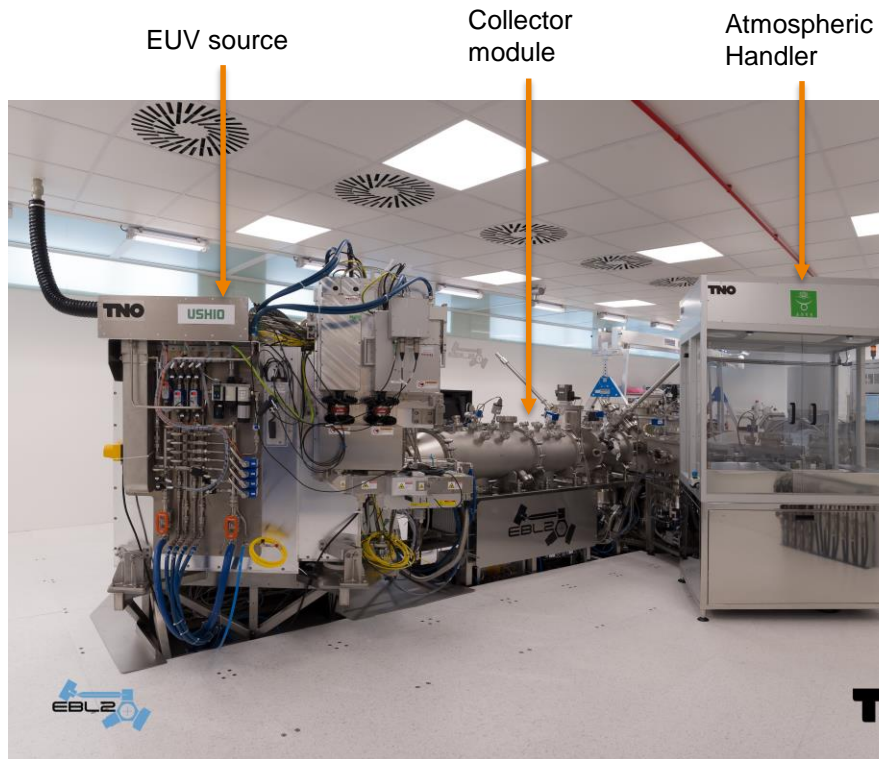
# WHAT IS EBL2

- › EBL2 is not a setup for producing semiconductor devices
- › The experiments for which EBL2 is intended are:
  - › Accelerated lifetime tests for:
    - › EUV Mirrors
    - › EUV Reticles and pellicles
    - › Materials used in EUV lithography
  - › This kind of research is needed due to the harsh EUV environment, and
  - › EUV lithography is coming to market
- › EBL2 is able to manipulate and illuminate EUV reticles with scanner compatibility

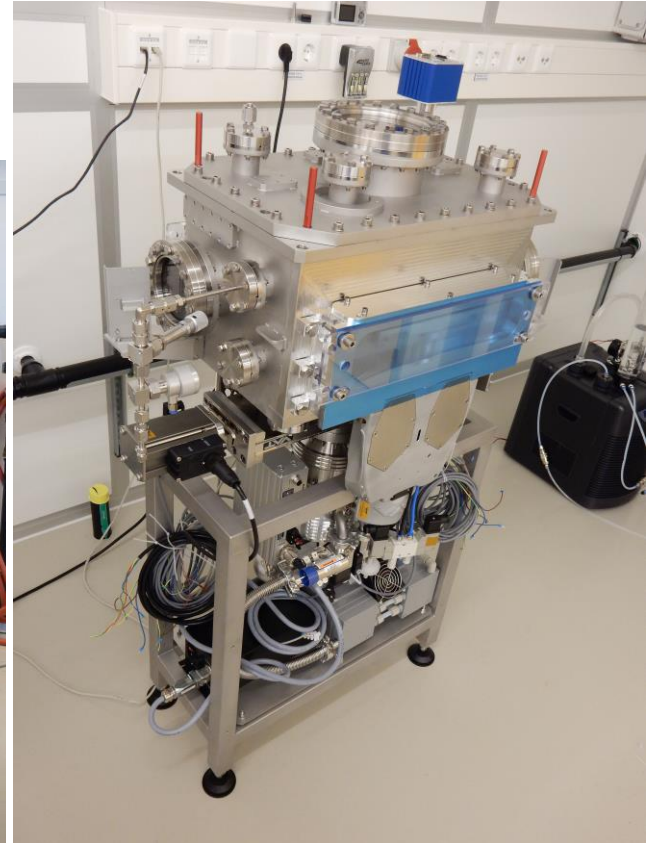
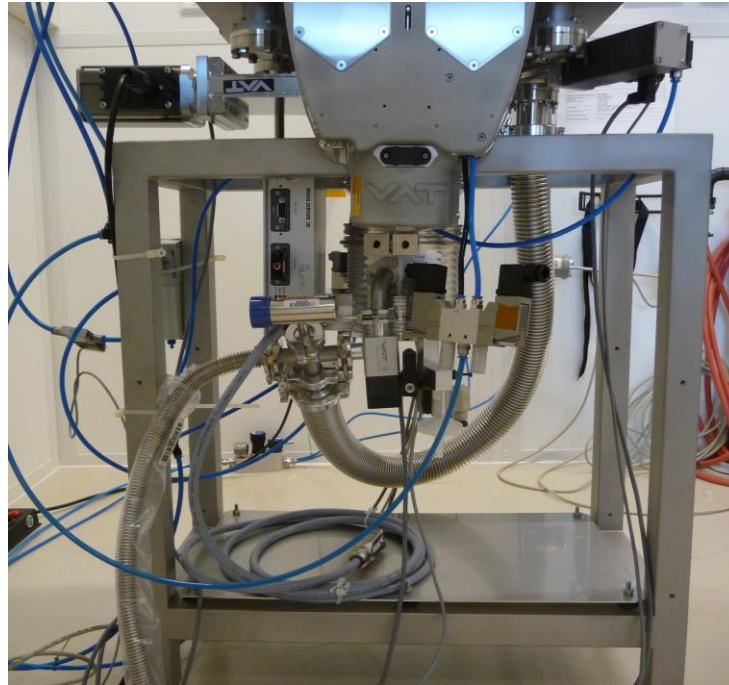
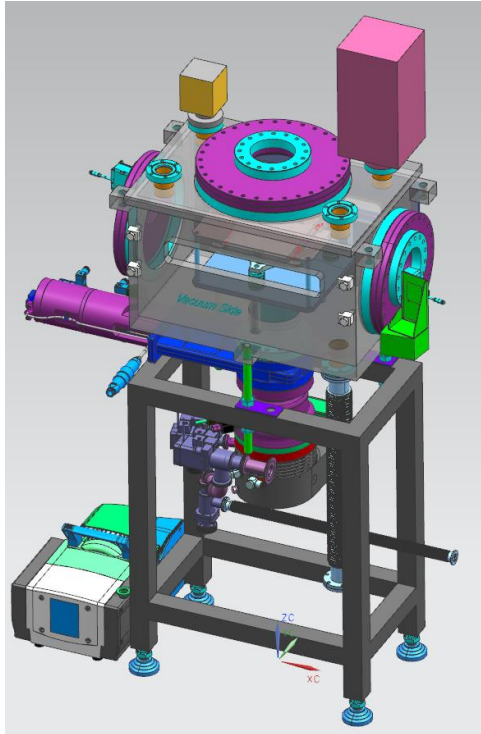


# OVERVIEW OF EBL2

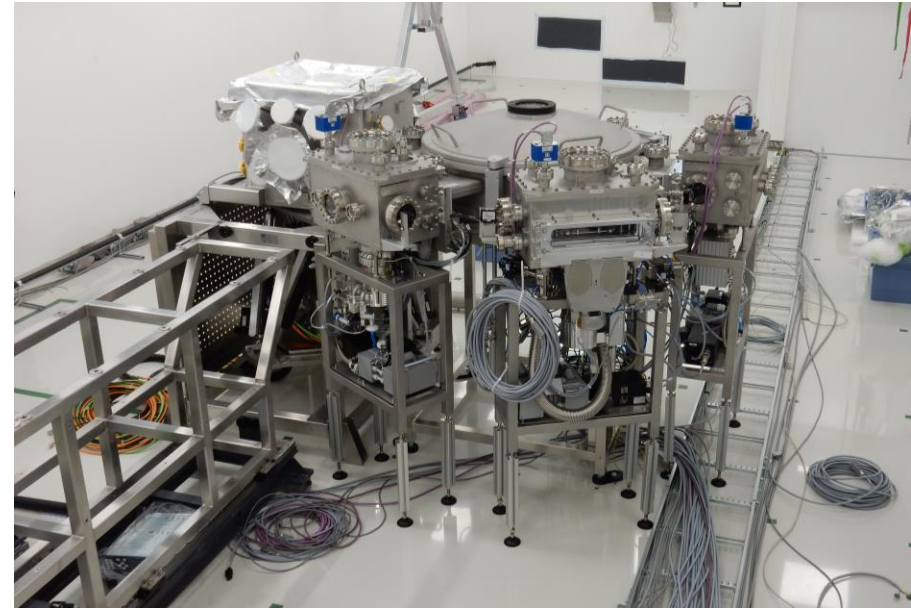




# REALIZATION: LOAD LOCK



# REALIZATION: EXPOSURE CHAMBER AND VACUUM HANDLER

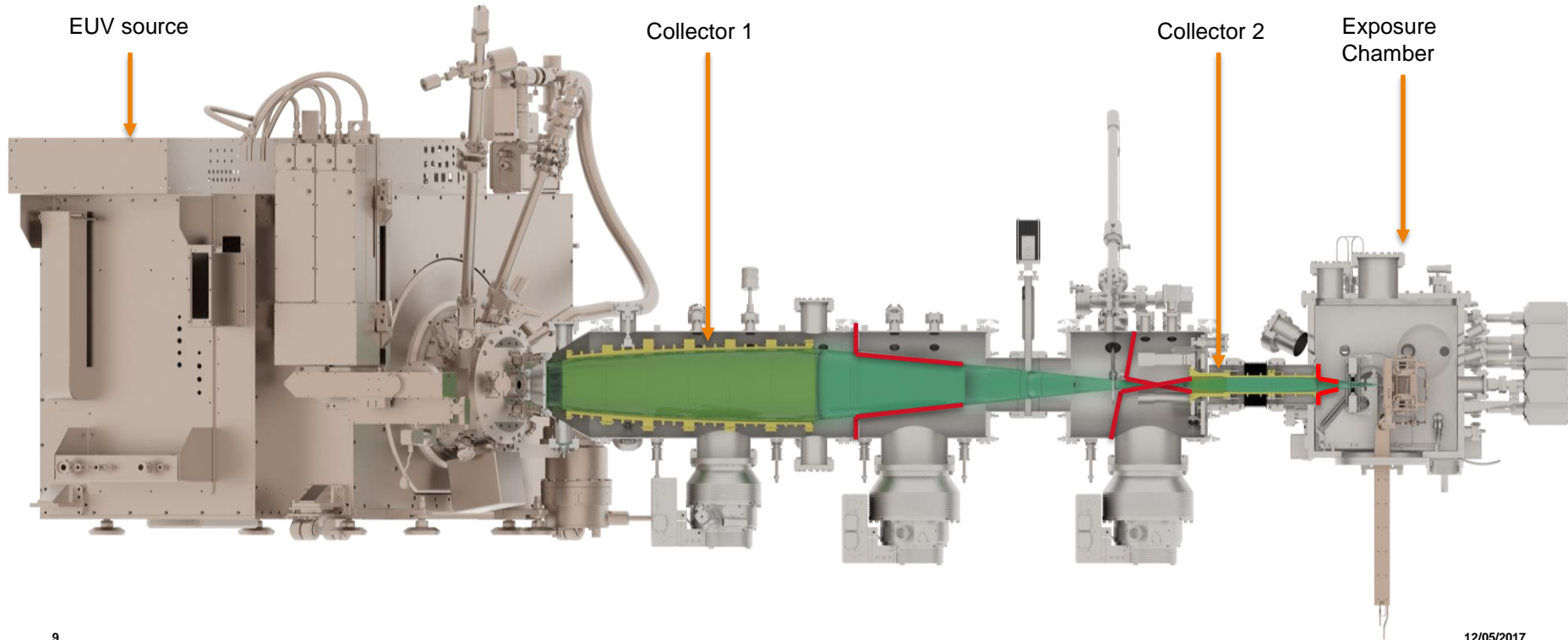


# DIFFERENTIAL PUMPING ASSEMBLY

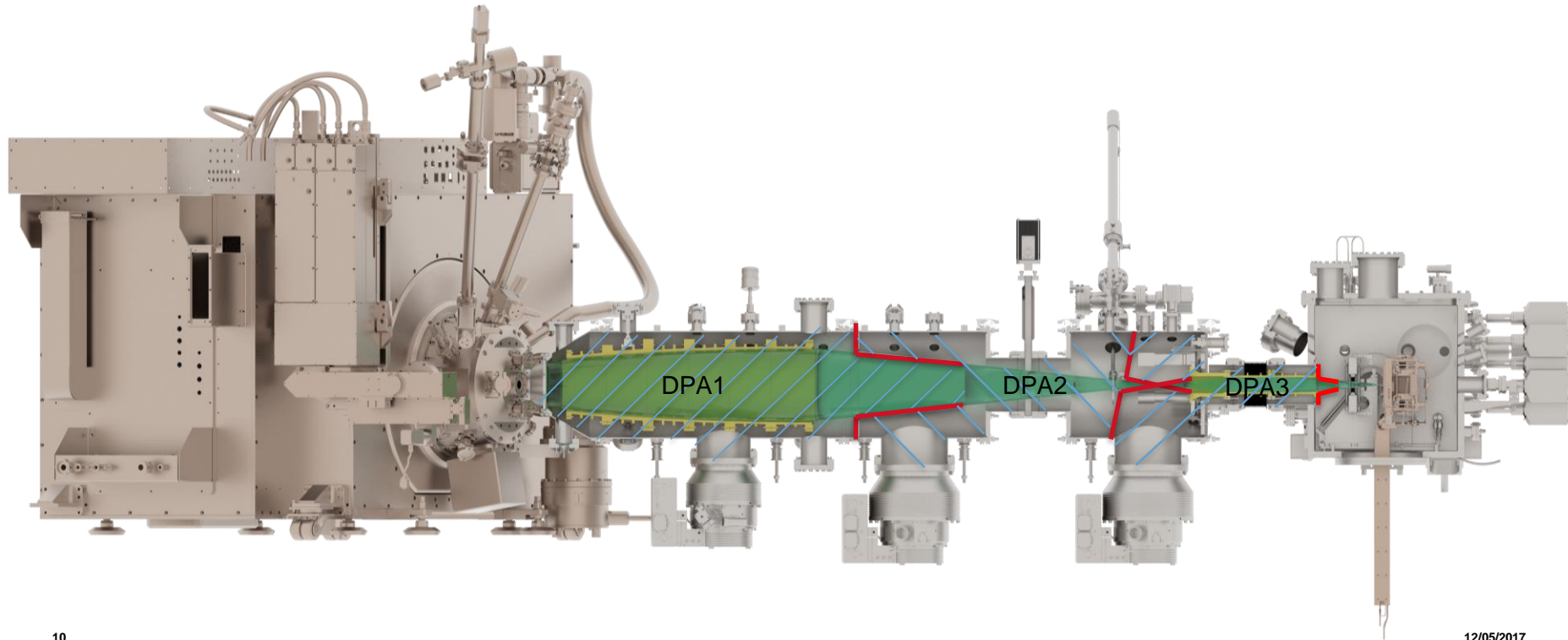
- › Problem statement:
  - › The gas environments from both the exposure chamber and the source may not influence each other
  
- › Filters or windows are not an option, so another solution had to be found and is implemented



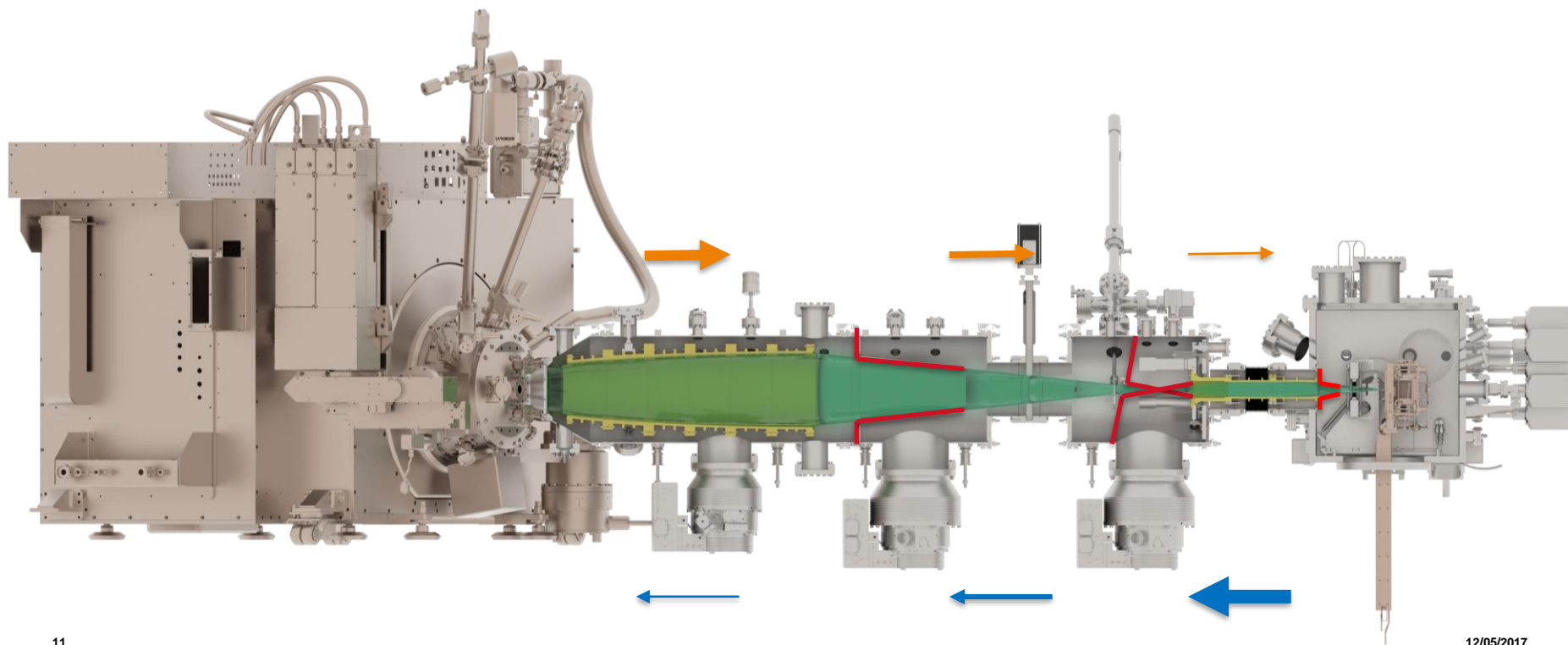
# DIFFERENTIAL PUMPING ASSEMBLY

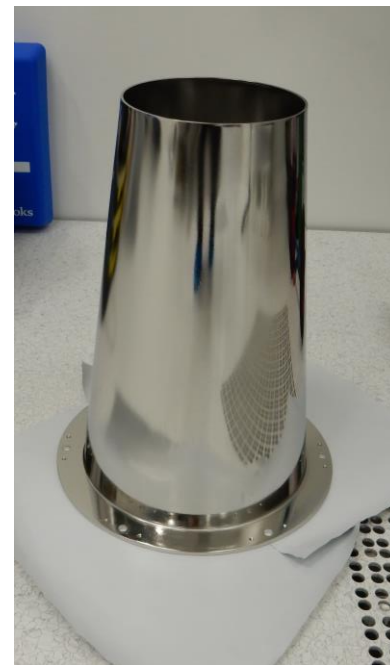


# DIFFERENTIAL PUMPING ASSEMBLY



# DIFFERENTIAL PUMPING ASSEMBLY





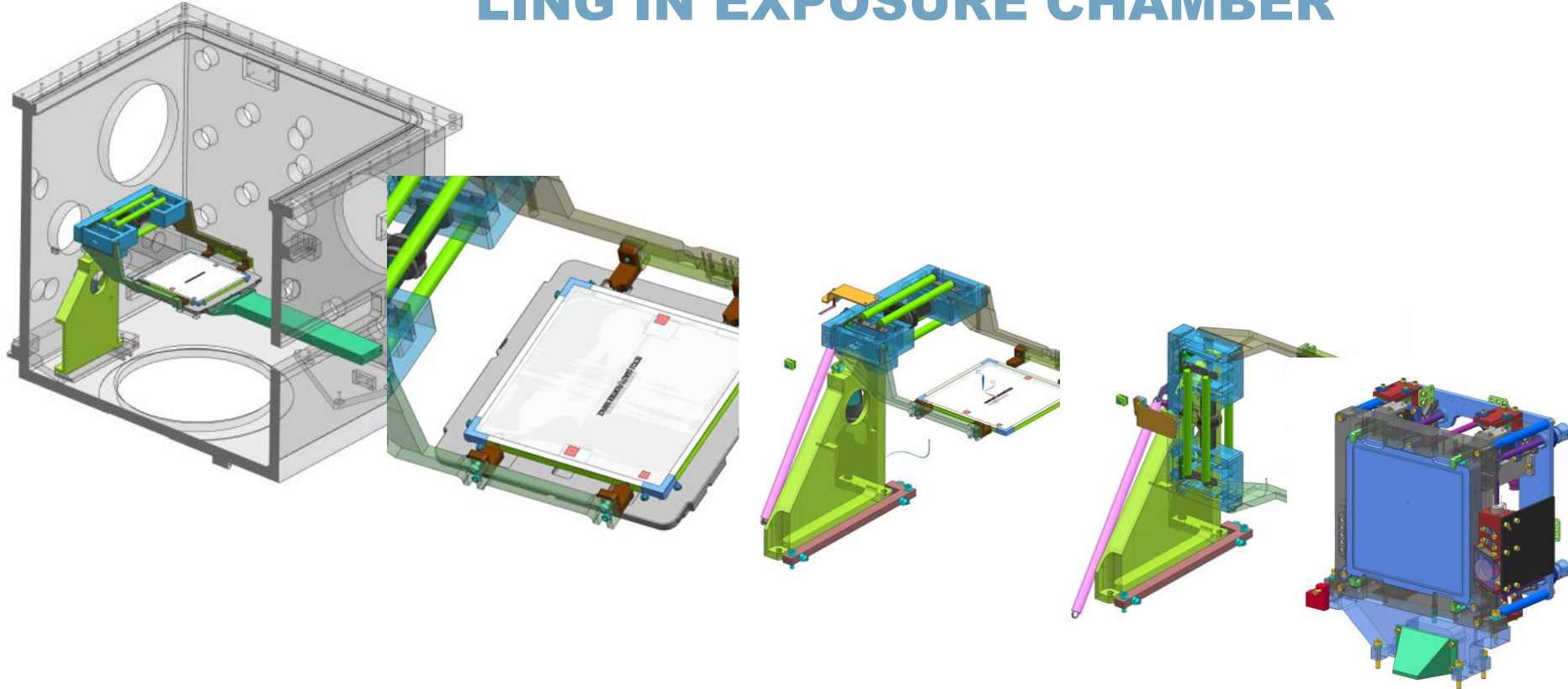
# MOTION IN VACUUM



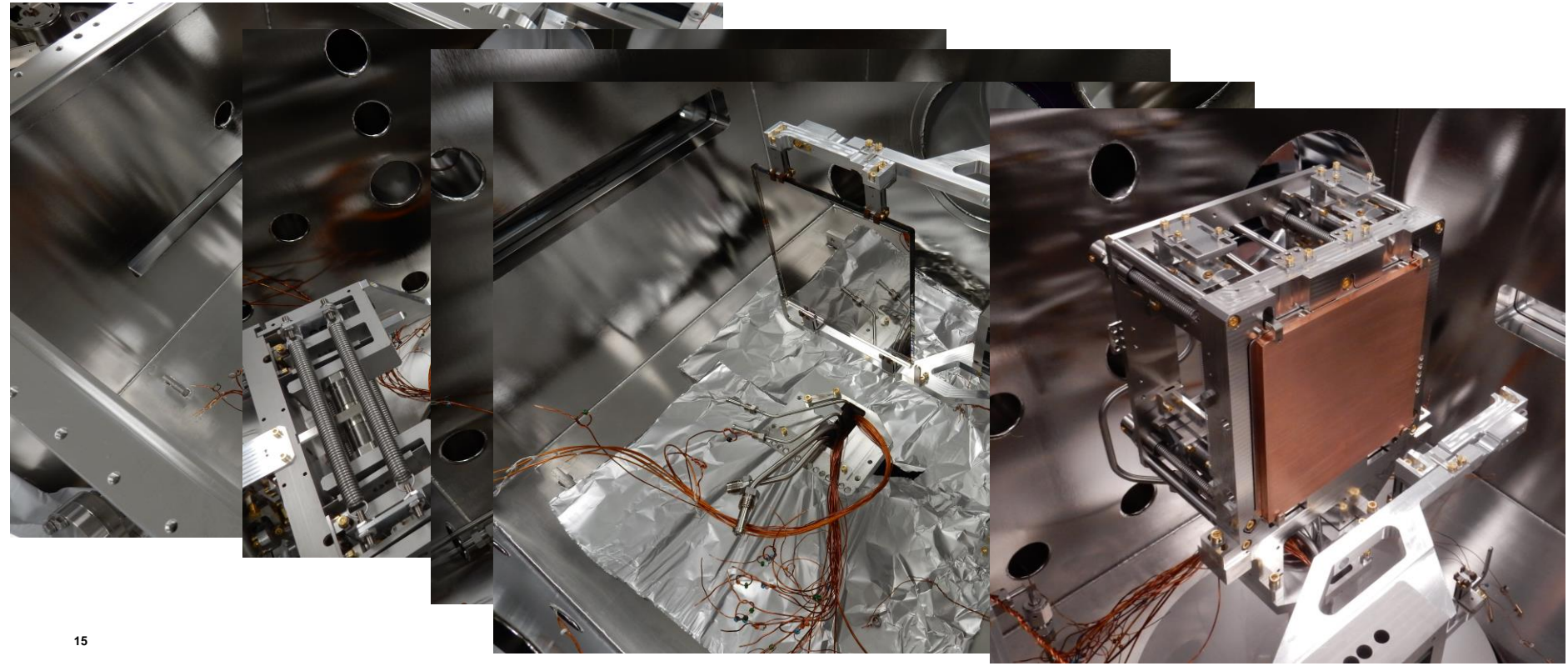
Dummy reticle  
on base plate

End effector of  
vacuum robot

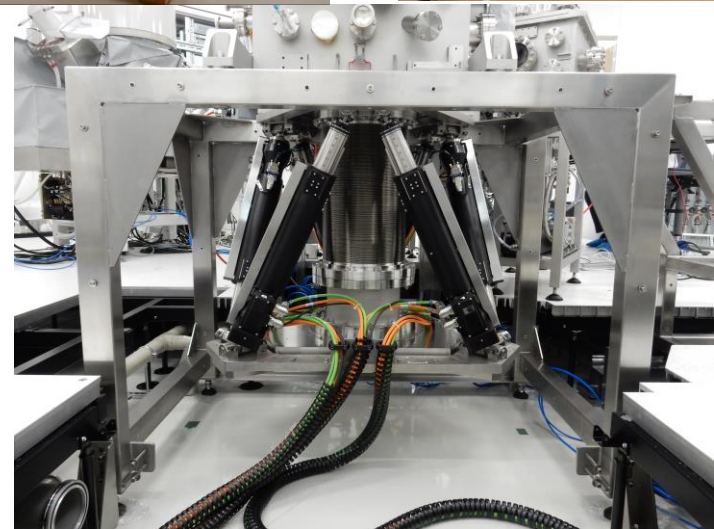
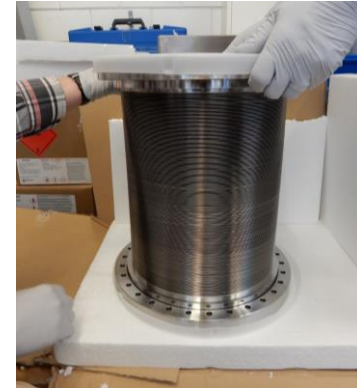
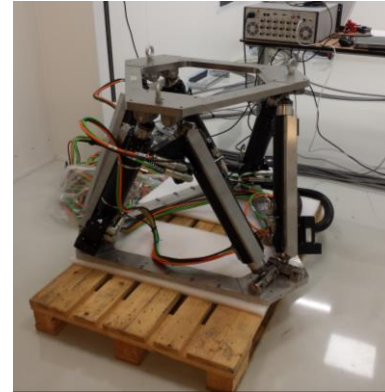
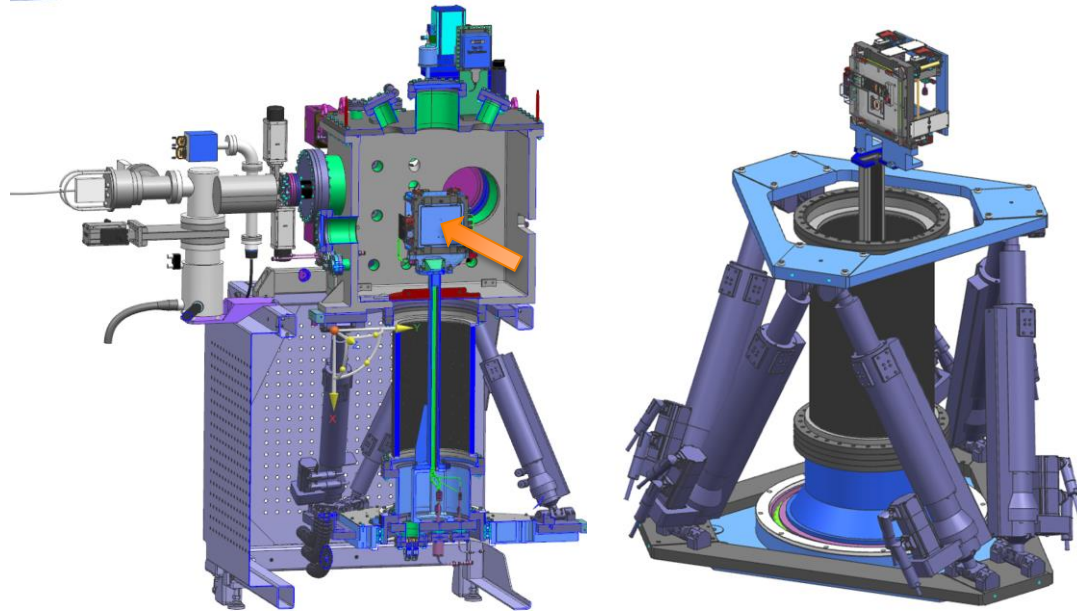
# SAMPLE HANDLING IN EXPOSURE CHAMBER



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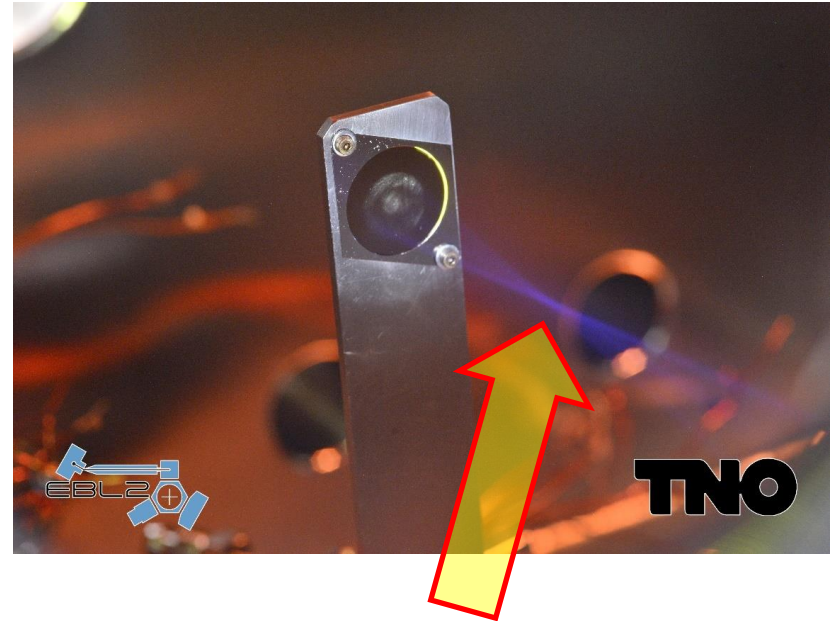
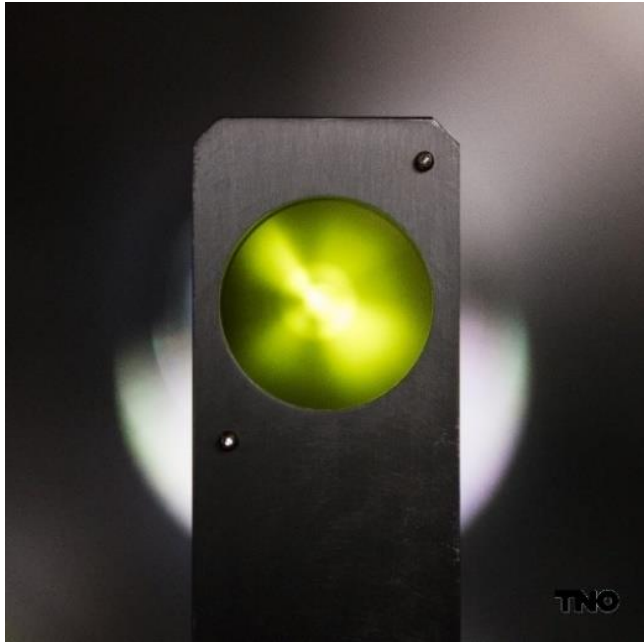


# HEXAPOD





## FIRST LIGHT (DEC 2016)



Focal point

# CONCLUSION

- › [www.tno.nl/EBL2](http://www.tno.nl/EBL2)
- › From end of Q3 2017, EBL2 will be an unique facility, accessible for semiconductor industry, that enables EUV lifetime research with:
  - › EUV scanner relevant conditions
  - › Up to EUV mask sample size
  - › High flexibility in environmental conditions
  - › Automated reticle handling
  - › Real time, in-situ data on sample status
  - › In vacuum surface analysis
- › **Acknowledgements**
  - › SeNaTe, E450LMDAP, NanoLabNL (Sponsors)
  - › USHIO and ASYS (Technology Partners)
  - › Zeiss SMT (Discussions)



Lighting—Edge Technologies

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› THANK YOU FOR YOUR  
ATTENTION

[WWW.TNO.NL/EBL2](http://WWW.TNO.NL/EBL2)

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TNO



TNO

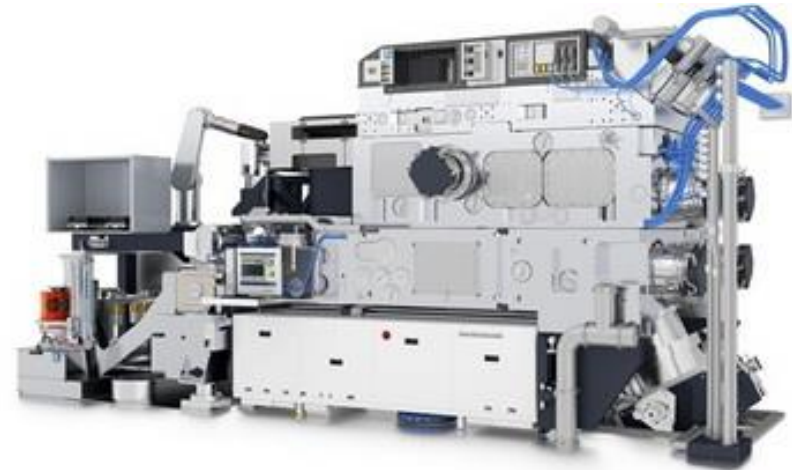
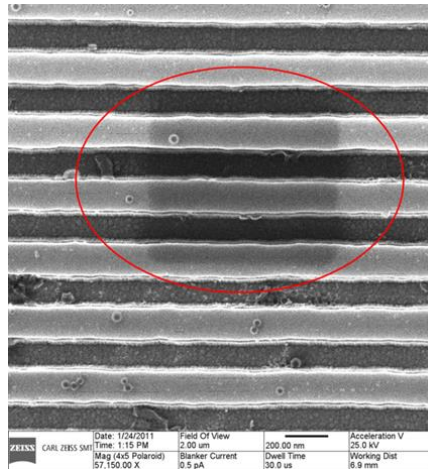
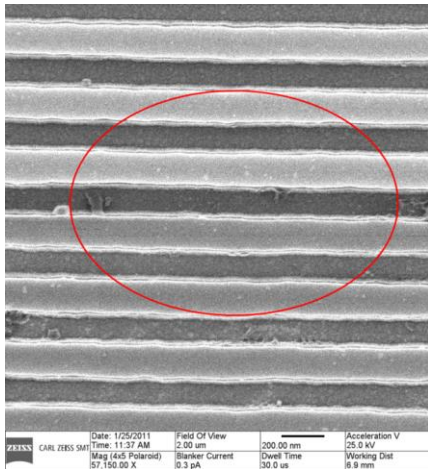
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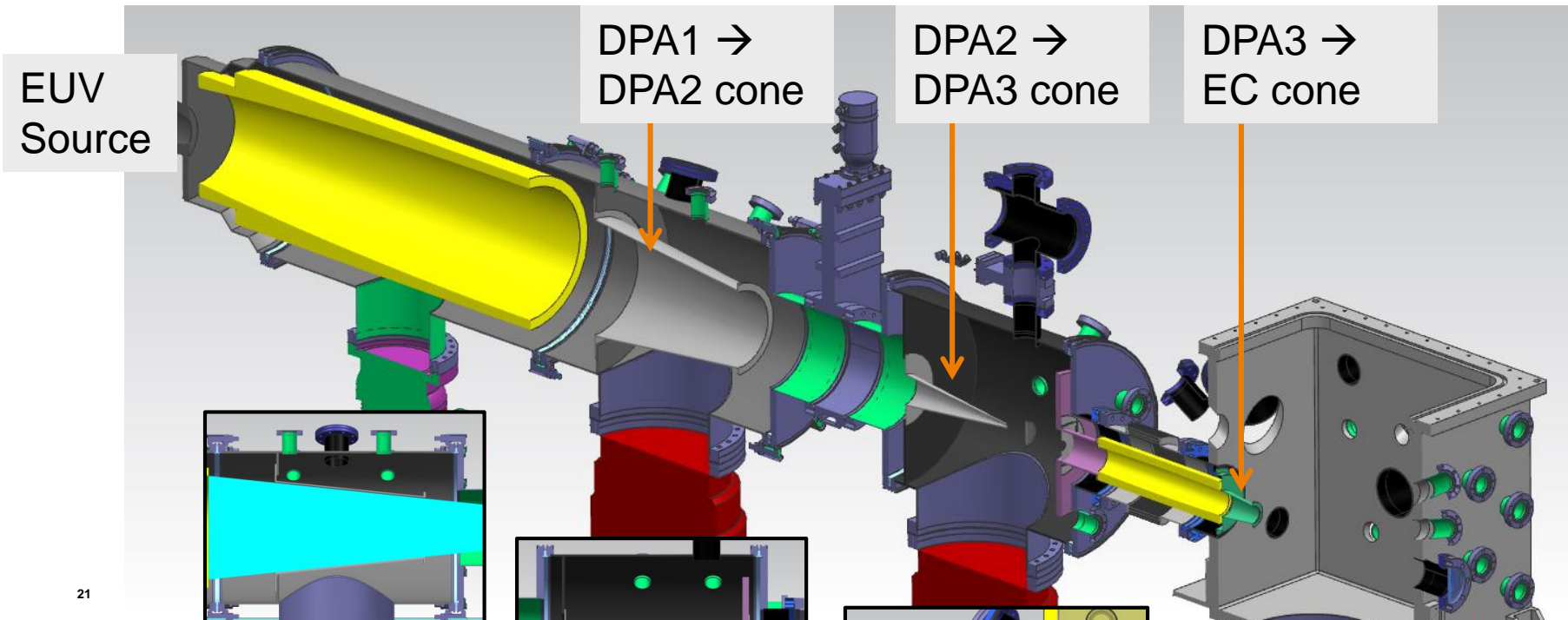
EBL2

ESHD

# WHAT IS EUVL

- › EUVL uses  $\lambda$  13,5 nm, generated with a Sn fuelled plasma
- › An EUV stepper needs to be an ultra clean vacuum (UCV) system
  - › Very sensitive for molecular and particle contamination



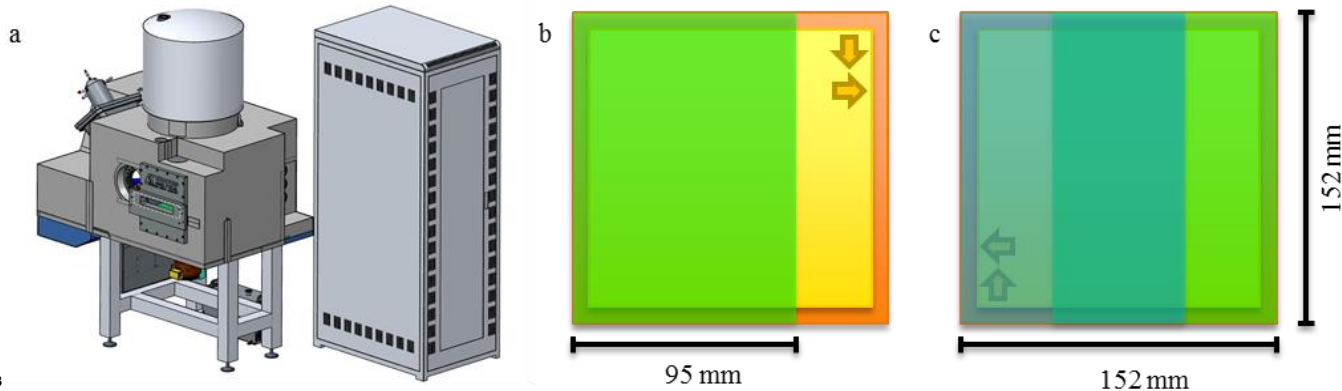
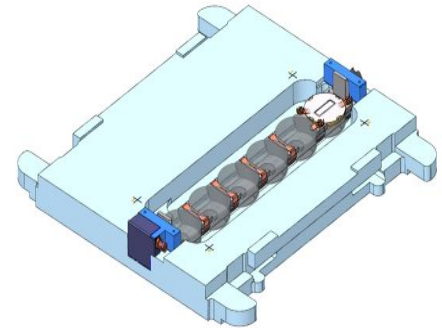


# XPS AT TNO

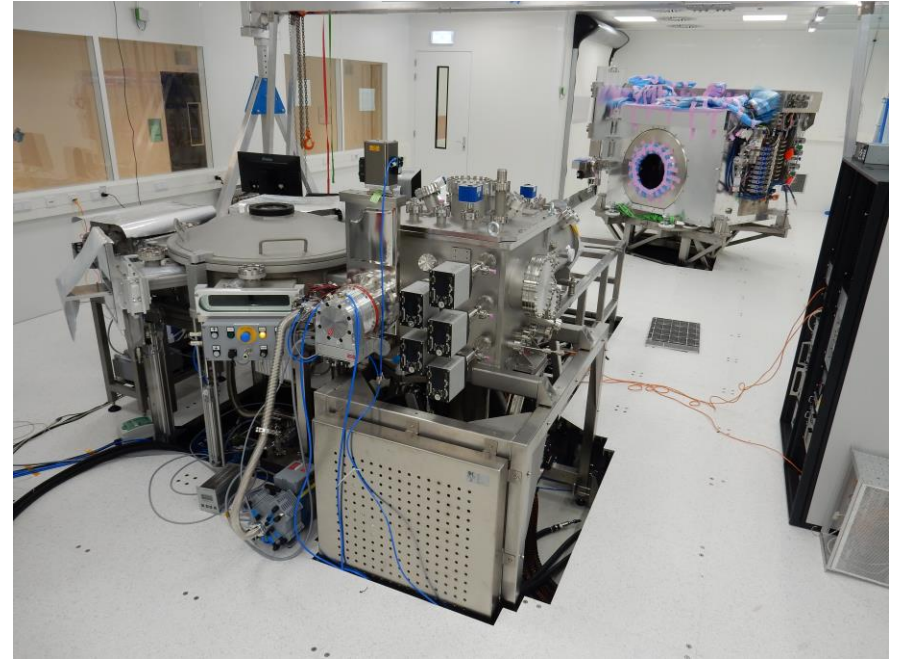
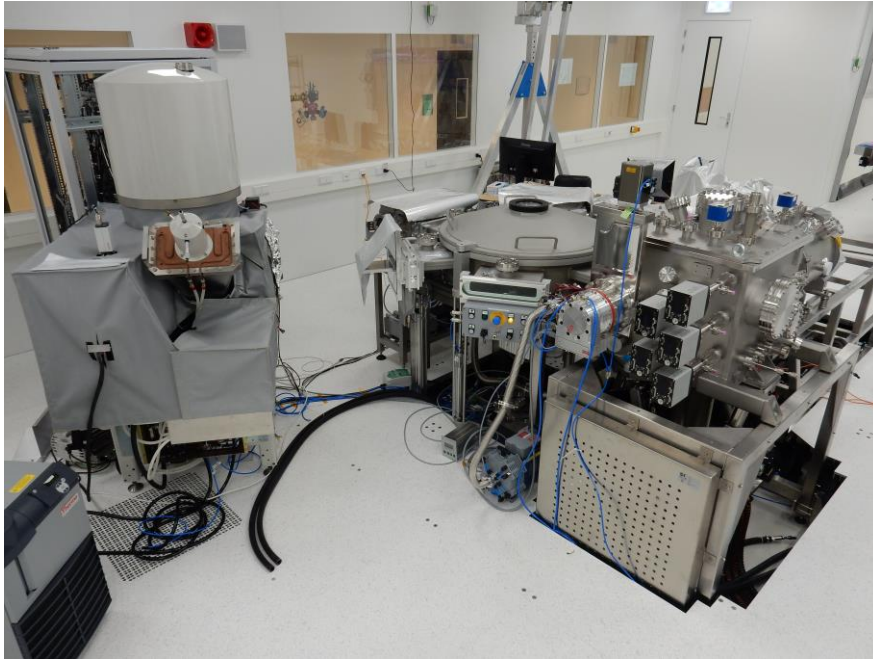


# XPS

- › Modified Kratos Axis Nova system
  - › Handling reticles: 100% coverage with one rotation
  - › Batch processing of multiple samples
  - › Angle resolved measurement for better surface sensitivity
  - › Automated movement to predefined position (defect mapping)



# REALISATION





# COLLECTOR MODULE

