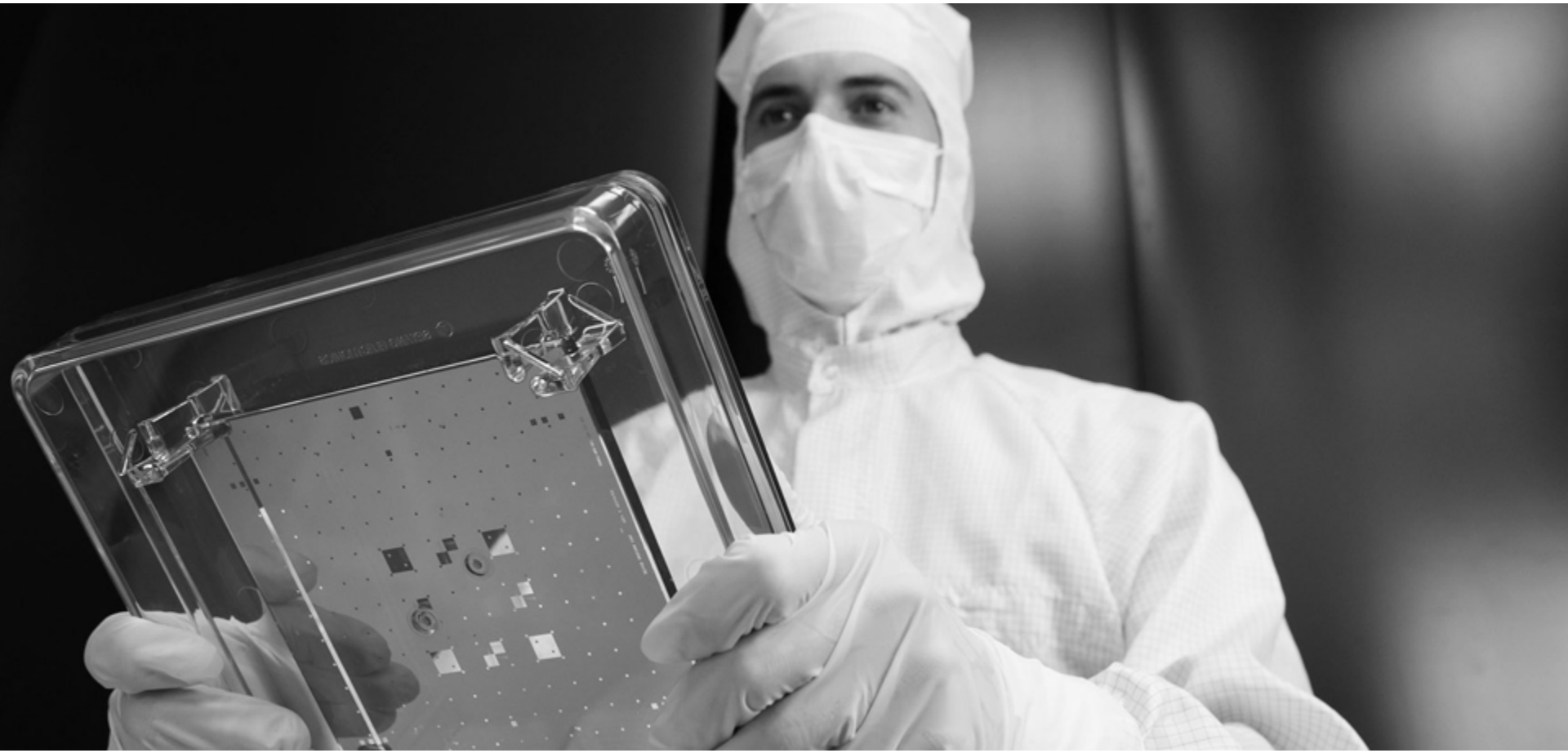
AIMS™ EUV

Status and recent achievements of the AIMS™ EUV System for Actinic Review of EUV masks



Sascha Perlitz, Jan Hendrik Peters: Carl Zeiss SMT GmbH, Carl-Zeiss-Promenade 10, 07745 Jena, Germany
Markus Weiss, Dirk Hellweg, Renzo Capelli, Krister Magnusson: Carl Zeiss SMT GmbH, Rudolf-Eber-Strasse 2, 73447 Oberkochen, Germany
Matt Malloy, Stefan Wurm: SUNY Poly SEMATECH, 257 Fuller Rd, Suite 2200, Albany, NY 12203, US

Oct 5th, 2015

Agenda

1. Current program phase and status
2. Achieved tool capabilities
3. First qualification results
4. Summary

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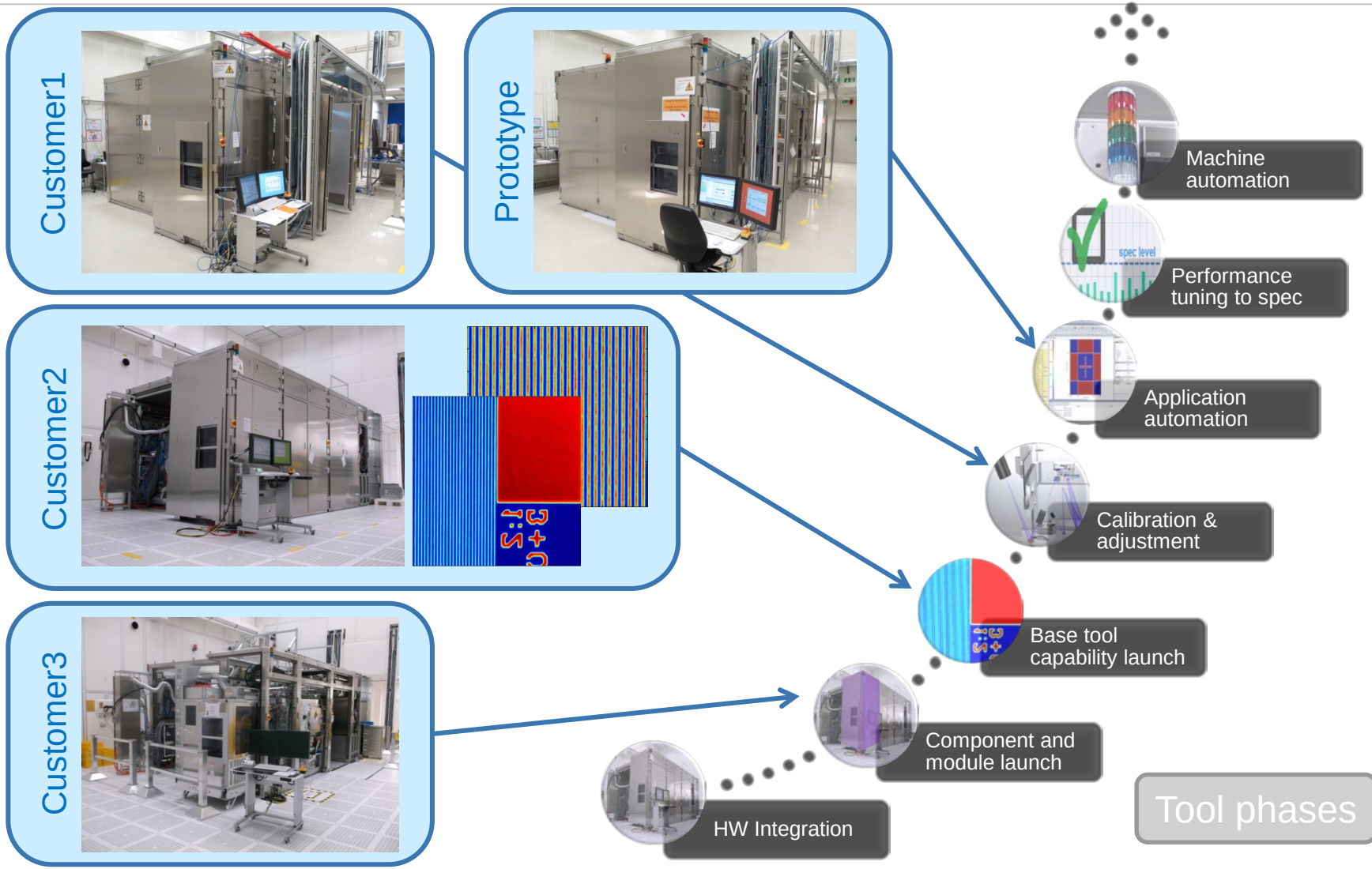
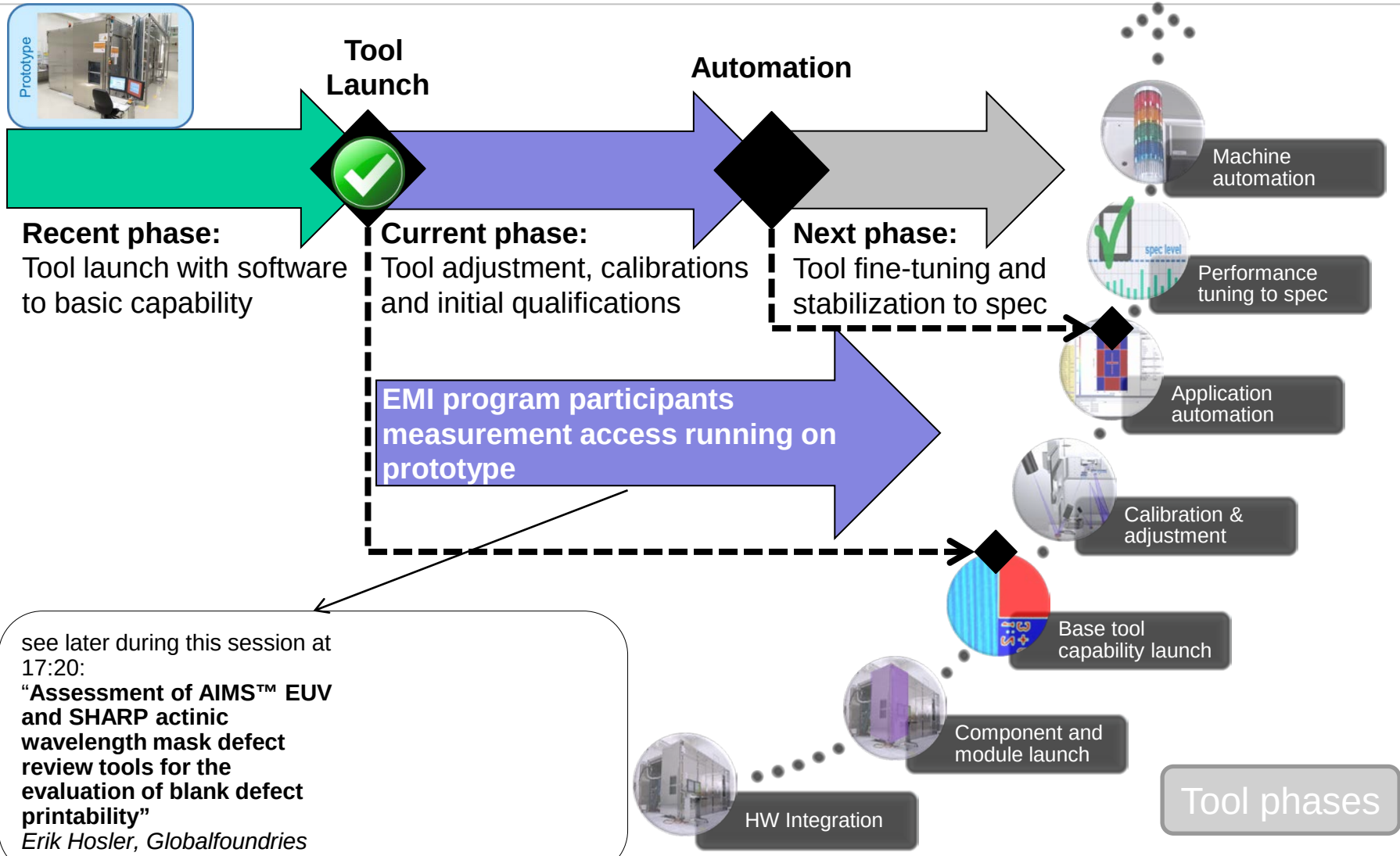
AIMS™ EUV program status:
3rd tool has achieved First Light



AIMS™ EUV program status:
EMI program participants access to prototype running



see later during this session at 17:20:
"**Assessment of AIMS™ EUV and SHARP actinic wavelength mask defect review tools for the evaluation of blank defect printability"**
Erik Hosler, Globalfoundries

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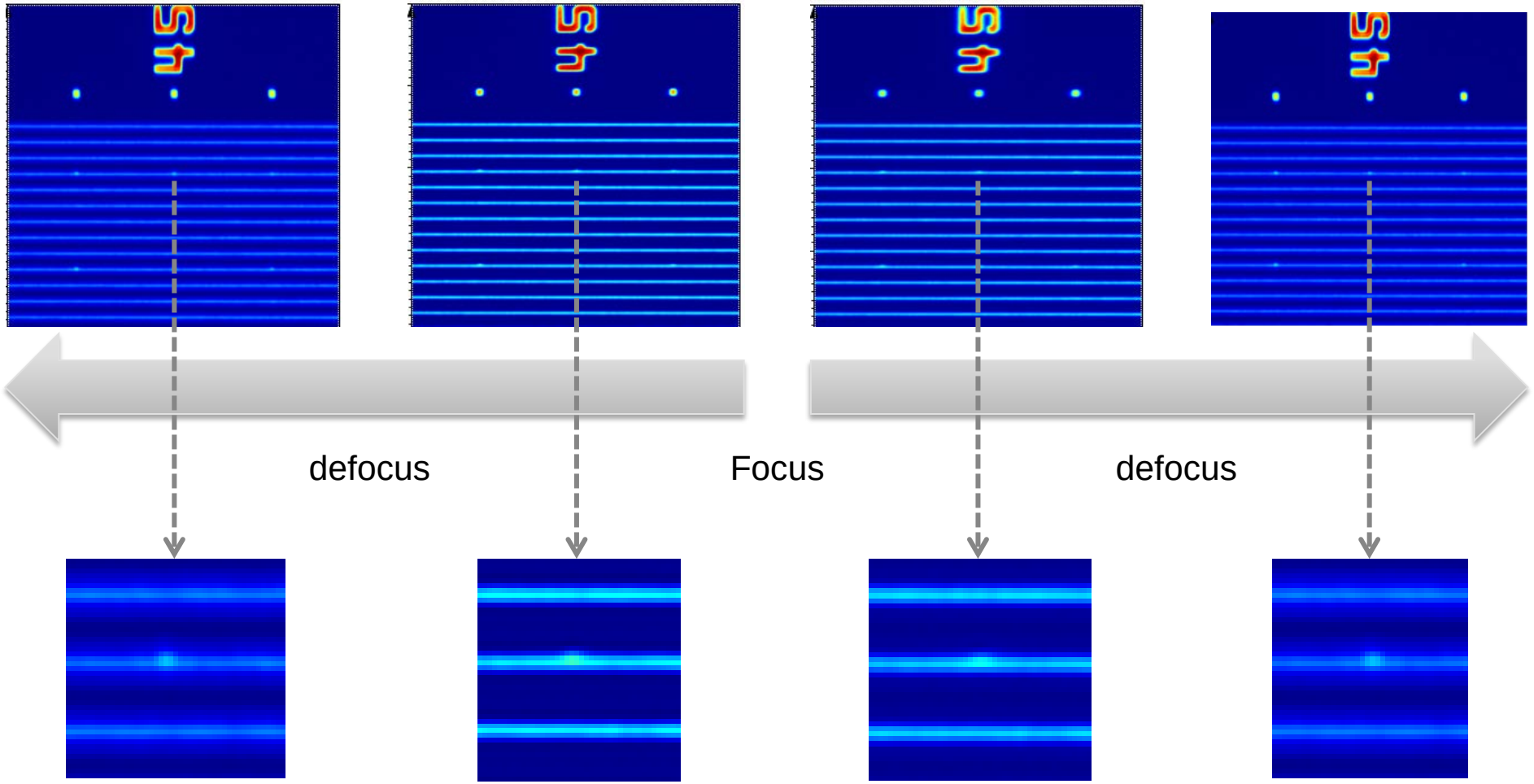
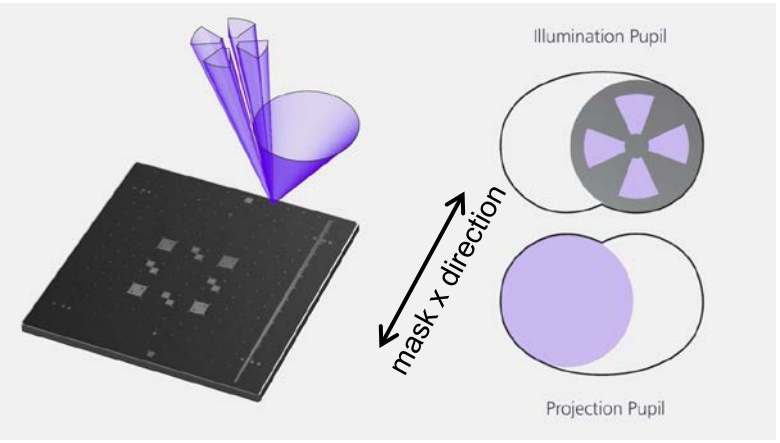
EUV aerial image acquisition capability:
Automated stack acquisition launched

AIMS™ EUV sample through focus stack acquired on prototype:



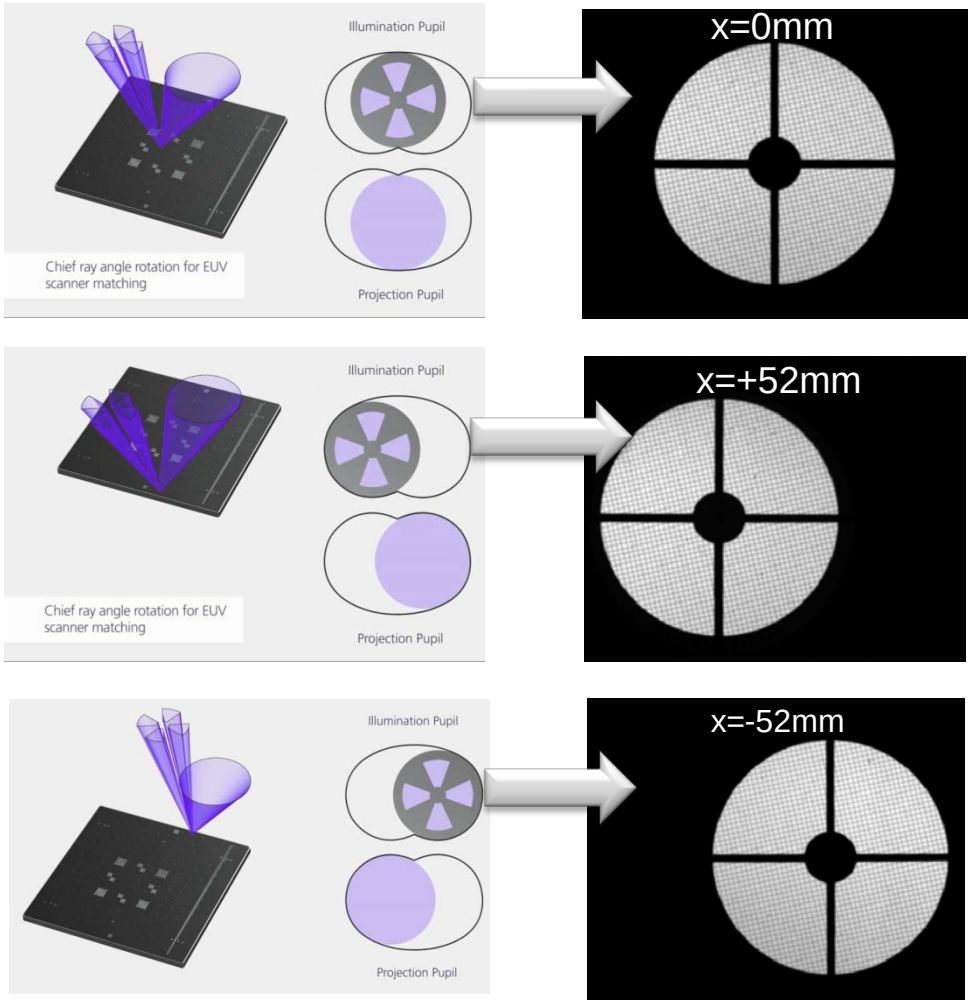
Zoom-in on programmed defects

EUV aerial image acquisition capability: : Automated chief ray angle (CRA) rotation emulation launched



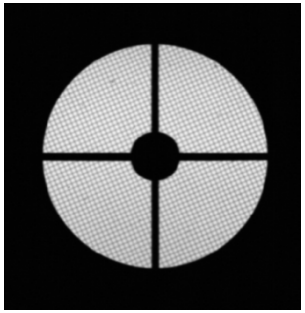
- CRA rotation emulation capability launched
- Automated CRA adjustment depending on mask x position of measurement site

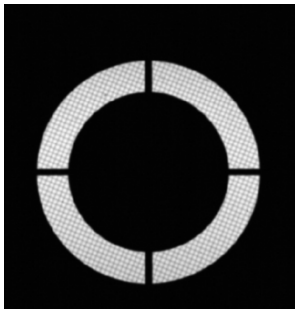
Prototype pupil images

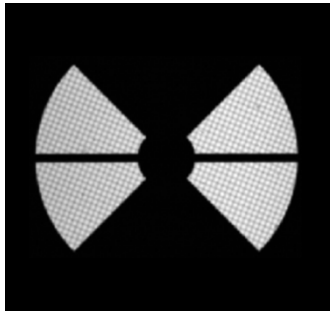


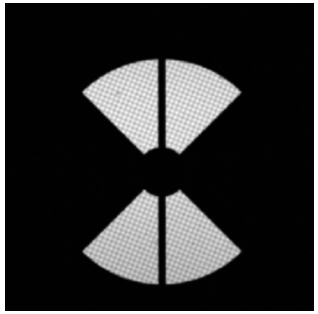
Handling capability:
Mask and aperture handling capability established

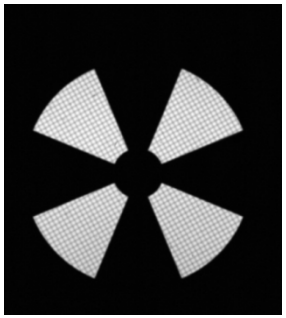
- Handling system launched
- Mask handling from load port to stage established for dual pod and RSP loading
- Inner handling system (in vacuum) also utilized to exchange illumination sigma apertures stored inside vacuum
- Pupil images of varying illumination settings used during prototype EMI access program


Conventional


Annular


Dipole X


Dipole Y


Quasar

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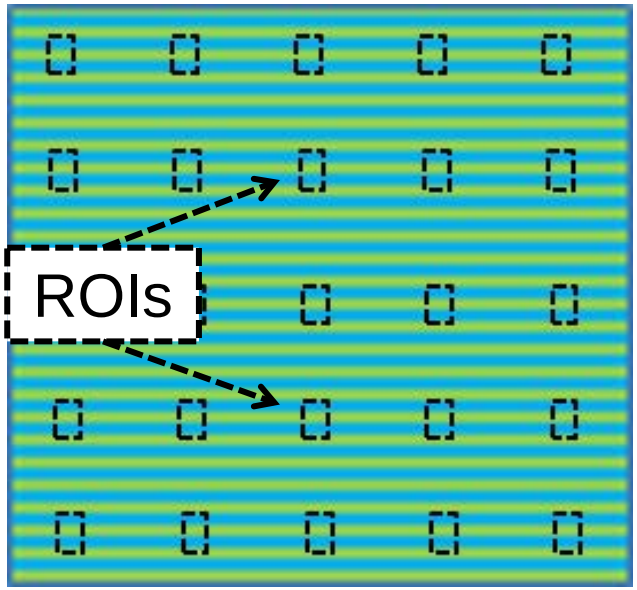
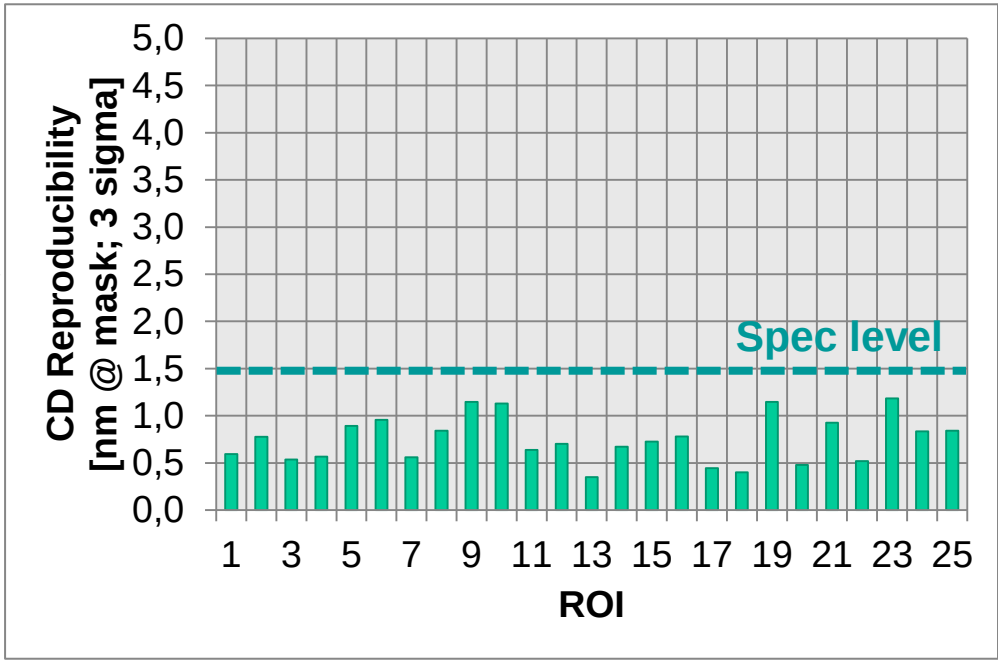
First prototype qualification results:
CD reproducibility champion data



Schematic view of CD analysis in 25 ROIs over FoV

10x repeats

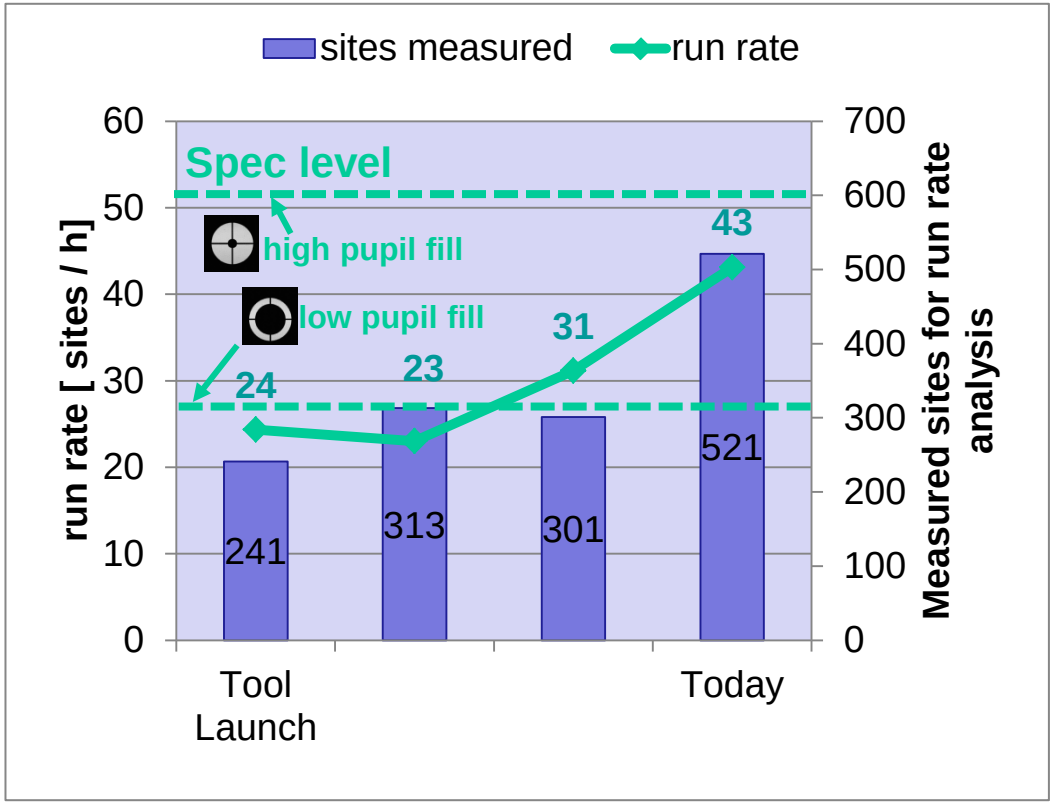


champion data without outliers

- CD evaluated on 25 regions of interest (ROI) over field of view (FoV)
- 10x Repeated dense L&S measurements
- Champion results indicate potential to reach in spec performance
- Outliers still need to be addressed
- Still high preparation effort on tool to produce such champion data

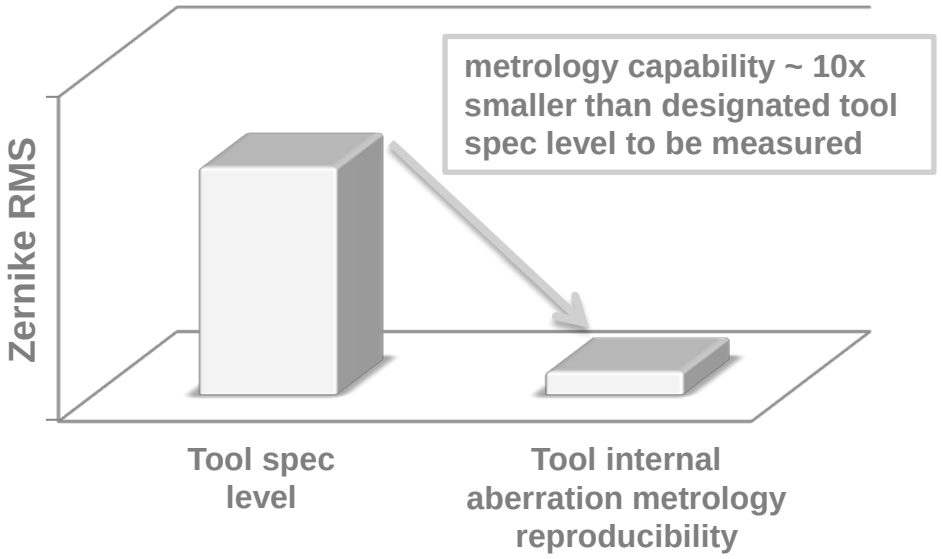
First prototype qualification results:
Run-rate continuous improvements

- First run-rate results from EMI program participants access slots to prototype
- Continuous improvements on stack acquisition run-rate through software improvements seen after tool launch
- Current run-rate status is sufficient for optimizations for CD reproducibility
- Results based on mix of low and high pupil fill measurements



First prototype qualification results:
1st optics adjustment and tool internal EUV aberration metrology

- Prototype has entered phase of optics EUV fine alignment and adjustment
- In order to proceed in this fine alignment, tool internal aberration metrology was qualified
- metrology reproducibility capability tested to be ~10x smaller than designated spec level to be measured → metrology capability available
- First optics aberration qualification on prototype after initial alignment indicates safe in spec performance

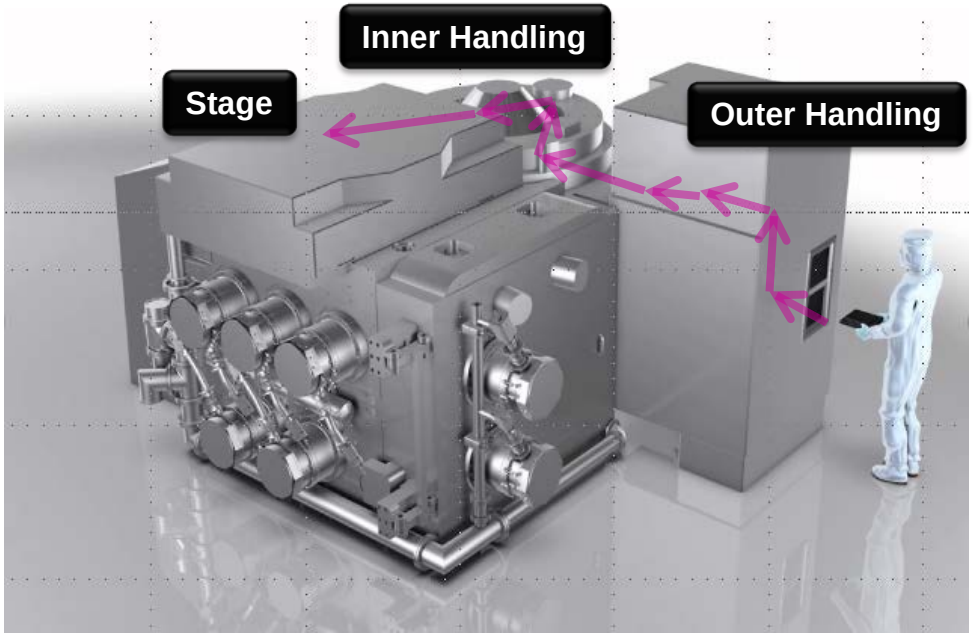


First prototype qualification results:
First handling cycles particle test

Test cycle:
- Cycles from Outer Handling load port to stage and back
- Number of cycles: 142
- Not included in cycle:
  stage movements + measurements

Adder analysis:
- In-house blank inspection: particles on quality area >100nm size evaluated

Result
- Good initial performance of:
  0.19 adders / cycle



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Program status:

- Base image acquisition and handling capability launched
- EMI program participants access phase running on AIMS™EUV prototype
- Three tools now have 1st light

Performance status:

- Continuous improvements on stack acquisition run-rate through software improvements seen after tool launch
- First CD reproducibility champion data show potential for in-spec performance
- Tool internal aberration metrology capability verified
- Good initial blank adder performance for handling cycles from load port to stage

Acknowledgments

The authors would like to thank SUNY Poly SEMATECH and the EMI consortium for their support and contributions to this project

We make it visible.