

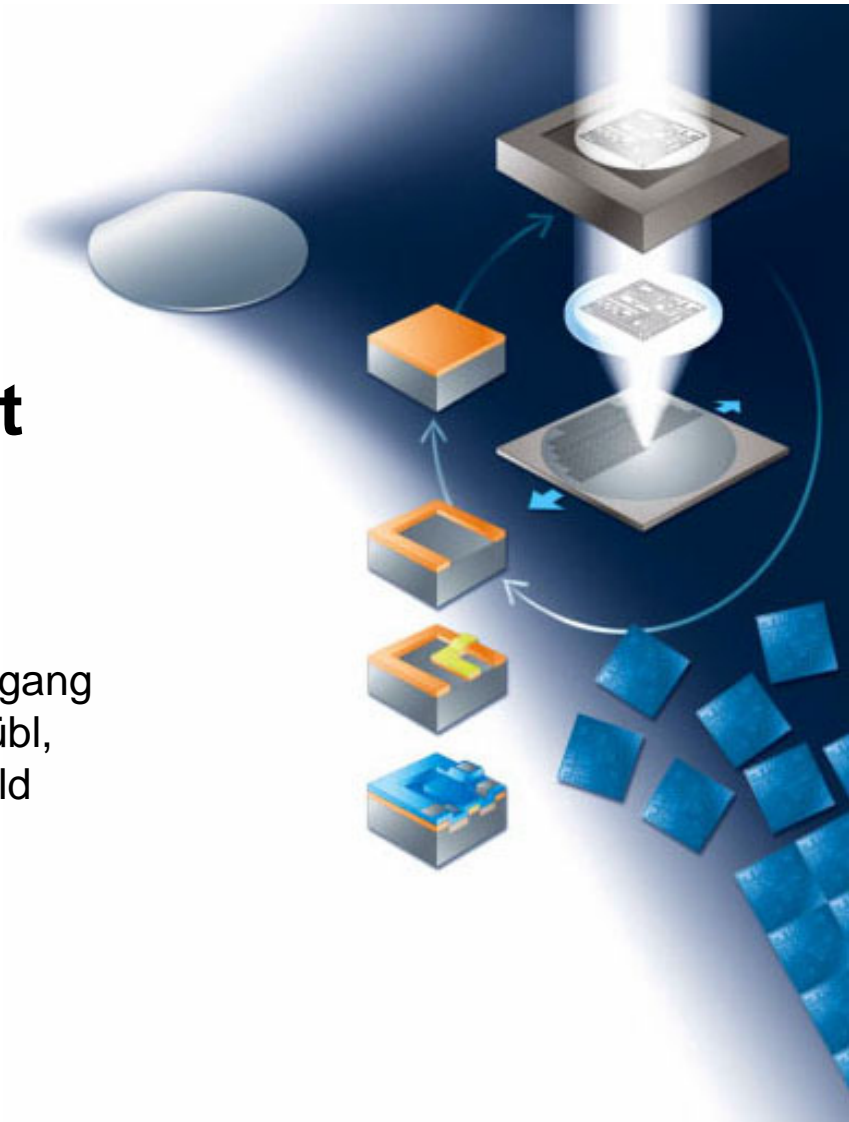
Carl Zeiss Microelectronic
Systems GmbH
Enabling the Nano-Age World

AIMS™ EUV Development Design Study

Karl-Heinz Bechstein, Mathias Esselbach, Wolfgang
Harnisch, Norbert Rosenkranz, Thomas Scherübl,
Holger Seitz, Roman Windpassinger, Axel Zibold
Peter Kuerz*, Erik Sohmen*

*Carl Zeiss SMT AG Litho Division

™: AIMS is a trademark of Carl Zeiss



AIMS™ = Aerial Image Measurement System



What is AIMS™?

- 4 An **actinic optical** technique to emulate any given stepper or scanner.

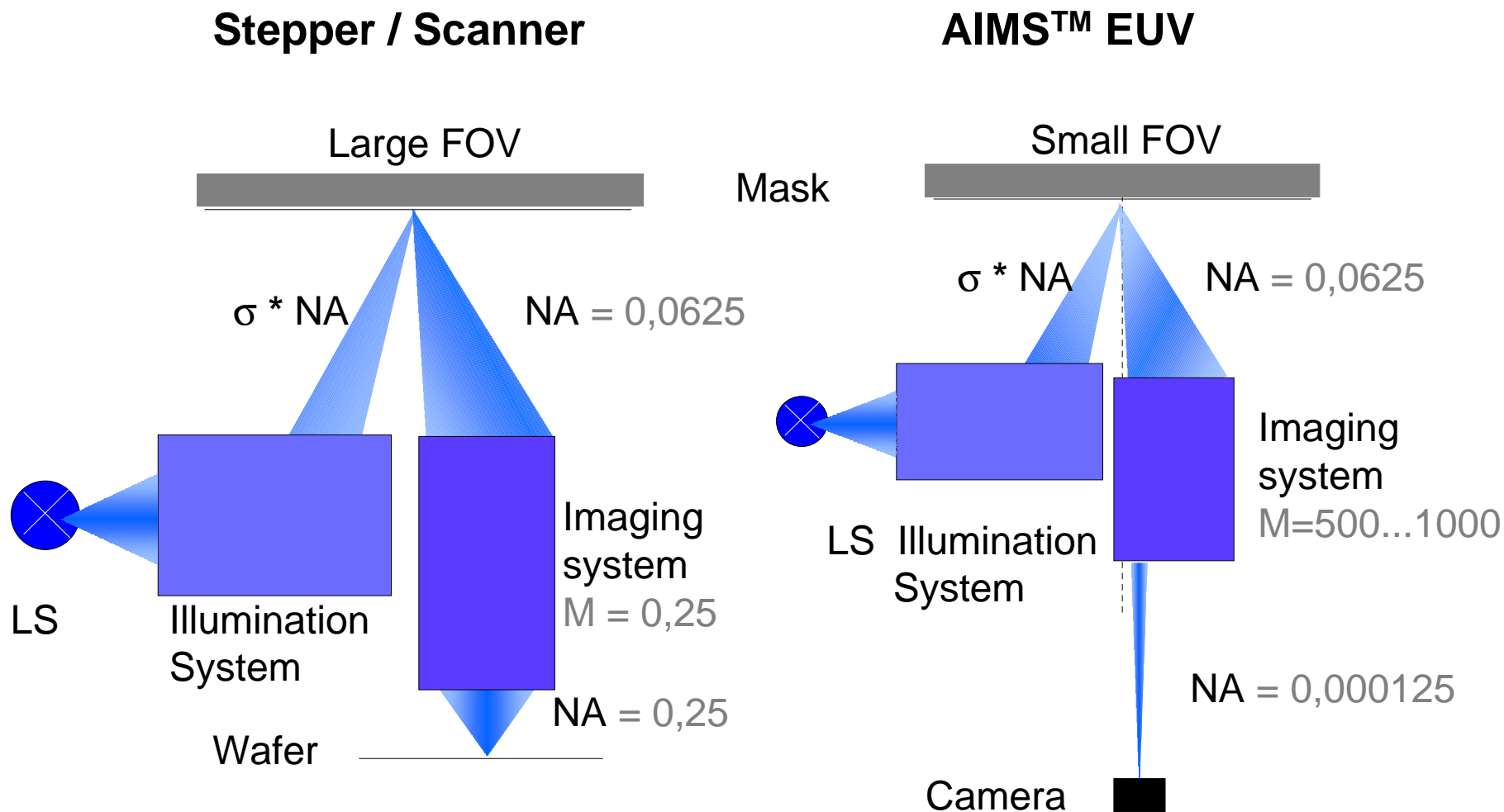
What is AIMS™ good for?

- 4 Actinic optical printability analysis of reticle defects, repairs and critical areas on all kinds of reticles **without the need of stepper prints**.

AIMS™ Applications

- 4 Mask **development**
- 4 Defect **review** and **disposition**
- 4 Repair **verification**
- 4 Mask quality **analysis**

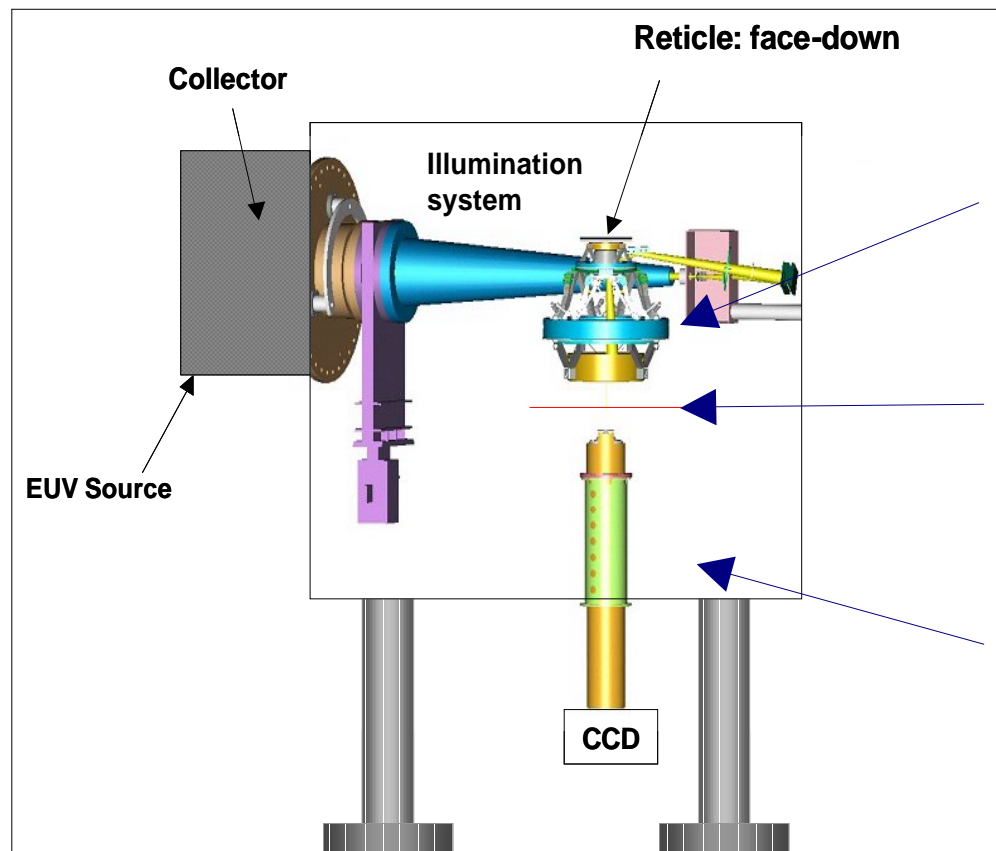
Comparison Stepper vs. AIMS™



AIMS™ EUV design study



„AIMS™ EUV lite“



First Magnification EUV
5x Optics from Carl Zeiss SMT

Photocathode at intermediate image: EUV → electrons

Second Magnification:
Photo **Electron** Emission
Microscope (PEEM)
Magnification: 200x
Resolution < 150nm

AIMS™ EUV lite: Key specifications



Optics

- Ø EUV Optics: 5x modified MET
- Ø 2nd magnification: PEEM 200x variable
- Ø Total magnification: 50x ... 1000x
- Ø NA, fixed: 0.0625
- Ø Sigma: $\sigma_{\text{outer}} = 0.2 - 0.65$, $\sigma_{\text{inner}} = 0.2$
- Ø Source: Plasma Discharge

Reticle stage

- Ø Face down
- Ø Option: Interferometer stage

Carl Zeiss AIMS™ measurement and analysis software

- Ø Recipe operation, up-date of inspection files
- Ø Connectivity: link to all major inspection tools

AIMS™ EUV design study: AIMS™ performance



Differences to current EUV Scanner Design

	AIMS-EUV lite	Scanner α -tool
Chief ray angle (CRA)	7.5° due to modified MET	6°
Bandwidth	3.5% due to 2 mirror optics	2%

Impact on AIMS™ performance ?

- 4 Detection sensitivity of nano-particles in mask blanks?
- 4 CD variation due to different CRA?

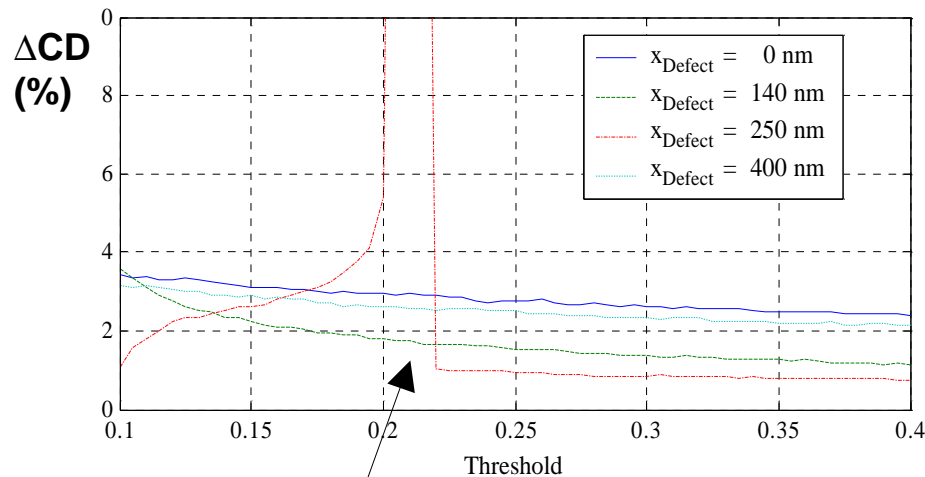


Simulate AIMS™ EUV performance for different CRA and bandwidths

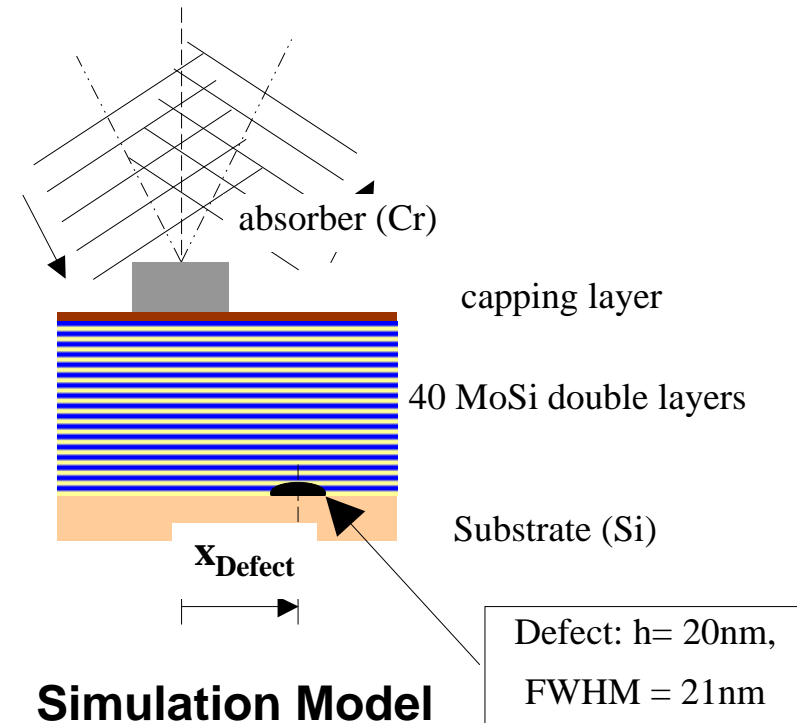
Simulation* results



$$\Delta CD = CD_{\text{AIMS EUV}} (7.5^\circ, 3.5\%) - CD_{\text{Stepper}} (6^\circ, 2\%)$$



Δ CD < 3% at threshold > 0.2



Carl Zeiss AIMS™ EUV lite with CRA = 7.5° and 3.5% bandwidth

- 4 No impact on sensitivity for particle detection in EUV multilayers and blanks**
- 4 Systematic CD difference of 3 % à compensation by calibration**

* Simulations made by P. Evanschitzky / A. Erdmann at Fraunhofer IISB Erlangen / Germany

Zeiss AIMS EUV lite

- 4 All key components are state-of-the art, available and tested**
- 4 Short lead time and price attractive tool**
- 4 Blank and patterned EUV mask development and qualification**
- 4 Fits requirements for 45 and 32 nm node**