



Actinic Patterned Mask Inspection

Oleg Khodykin

Nov 3, 2014

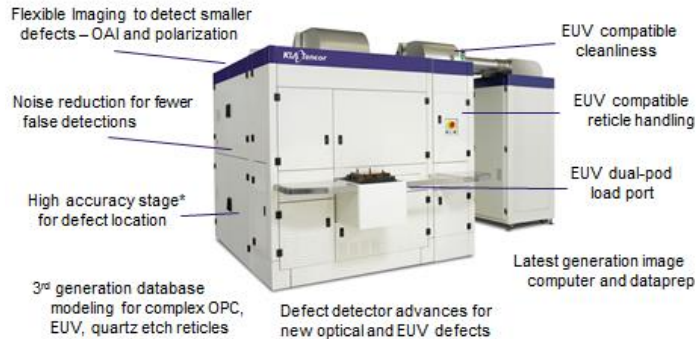
EUV and soft x-ray sources workshop



Teron 630 – uses 193nm laser source

Latest Reticle Inspection Advances

Teron 630 Series for 10nm / 1xhp Generation – Optical and EUV



* in development – available 1H 2014

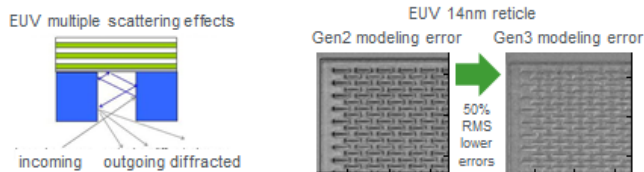
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Latest Database Modeling Advances

new Gen3 modeling for EUV, quartz etch, complex OPC

- Advanced physics-based 3D modeling
- Models complex EUV and quartz etch illumination physics
- Low errors for best defect detection SNR – find small defects
- Optimized for high speed reticle inspection (10x10cm in ~2hr)
- Extendable to standard optical reticles with aggressive OPC



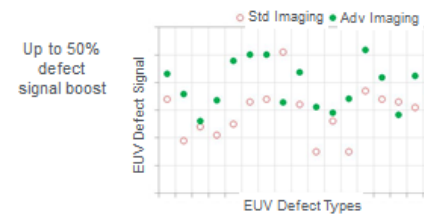
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Latest Reticle Inspection Imaging Advances

Imaging advances to boost defect signal / reduce noise

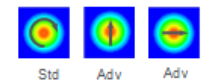
- Flexible imaging conditions – NA, sigma, pupil, polarization
- Reduced aberrations, vibration, focus error
- EUV demonstrated – applicable to optical



630 Flexible Apertures



630 Flexible Polarization



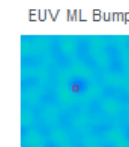
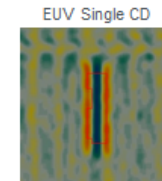
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Latest Defect Detector Advances

Detect emerging reticle defect types – local CD, shift, etc.

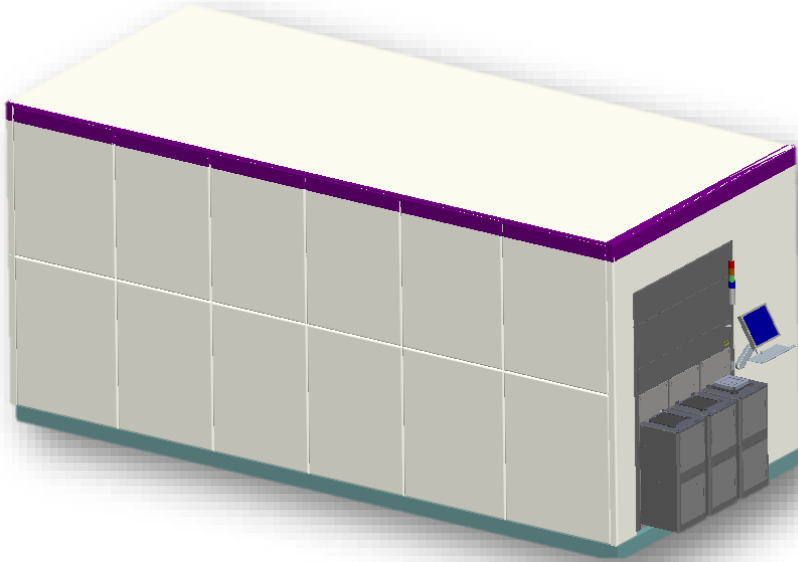
- Detect reticle defects with $\geq 10\%$ $\Delta CD/CD$ litho impact
- new detectors for emerging defect types
 - local CD defects – single or multiple
 - mis-placed geometry defect (shift)
 - CD or shift defect stripes
- Detectors for blank masks
 - particles
 - pits and bumps



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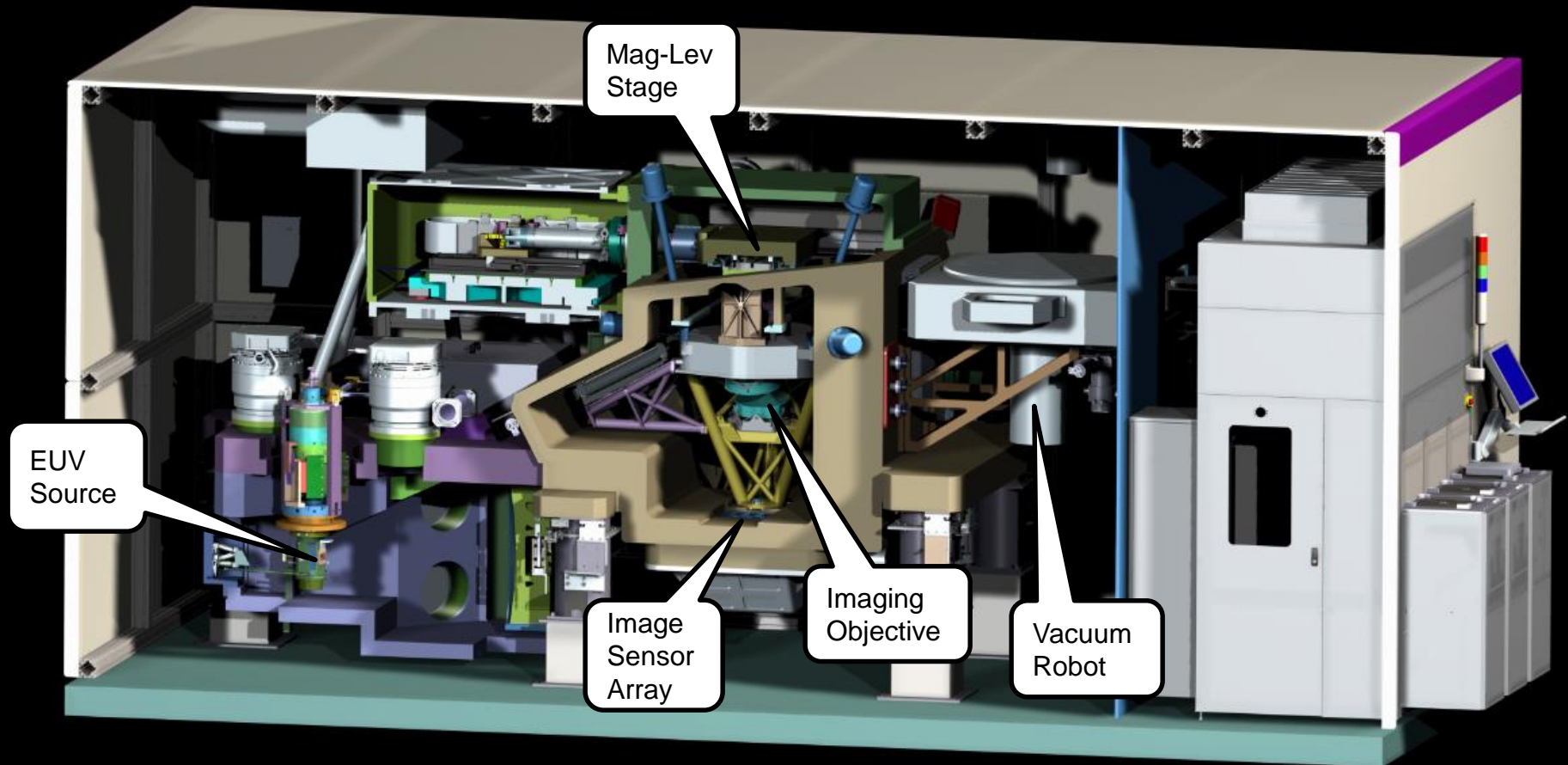
Teron 710 – needs 13.5nm source



- EUV actinic inspection needed for EUVL High Volume Manufacturing due to:
 - Phase defects
 - ML Blank defects
 - Contamination defect risks
 - Throughput
 - Through-pellicle inspection

EUV Actinic Patterned Mask Inspection (APMI) System

710 System Concept – Cross-section



Actinic Patterned Mask Inspection

- EUV source requirements

Oct 2014

<u>Property/parameter</u>	<u>Target Value</u>	<u>Units</u>
Wavelength	13.5	nm, centroid
Pulse repetition rate	> 10	kHz
Pulse duration	> 10	ns, FWHM
Duty Cycle	> 95%	- minimum burst > 15 sec
Etendue	1.0×10^{-2}	mm ² -sr
Radiance at I/F	> 20	W/mm ² -sr
(Averaged over etendue, lifetime)		2.2% band, pre-SPF
Footprint (m)	2.8W x 2.8D x 2.8H	
Availability	> 95%	
Cost of Service (annual)	< 10%	Relative to CoGs / Price
Cost of Operation (annual)	< 5%	

Thank You