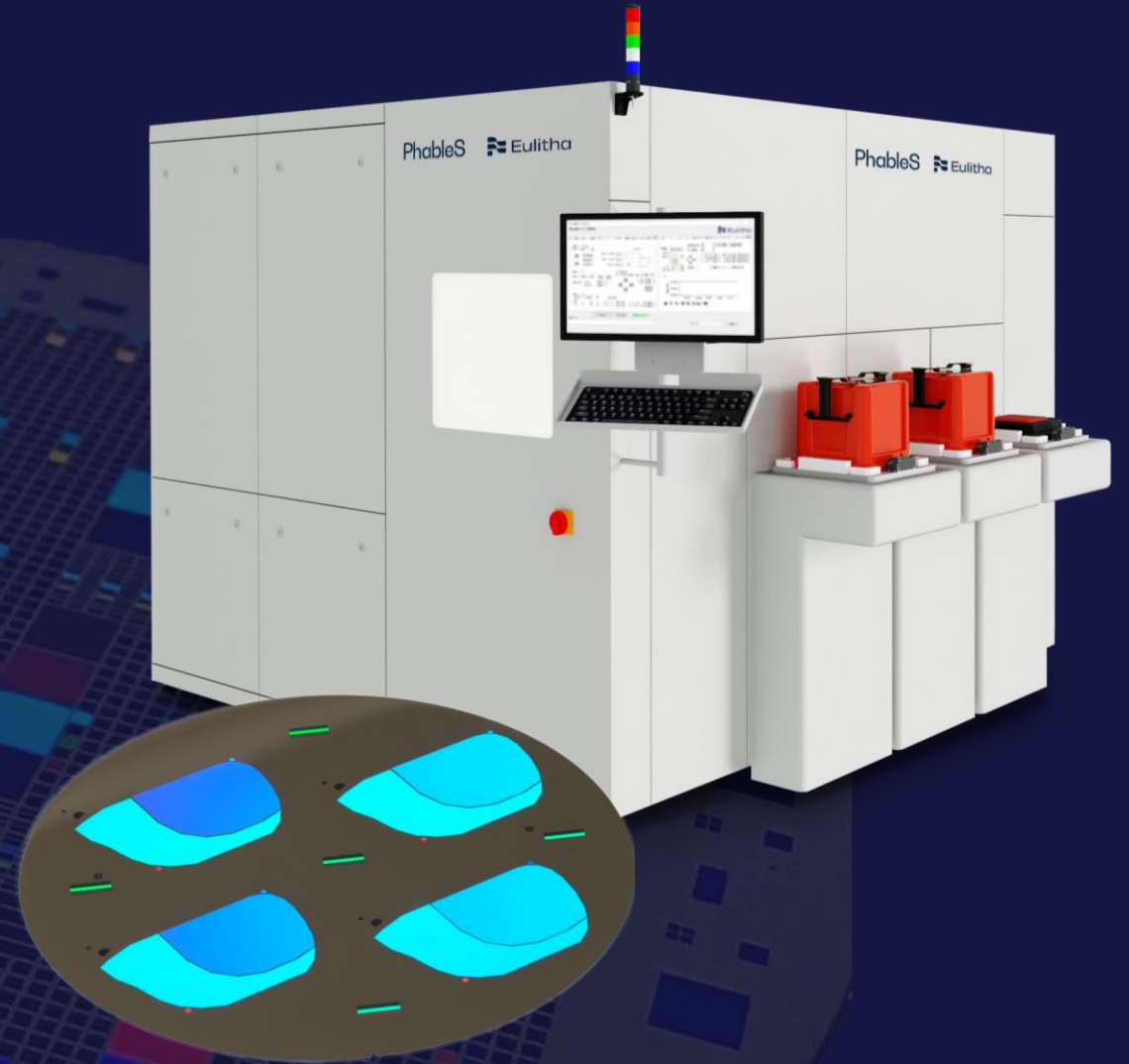
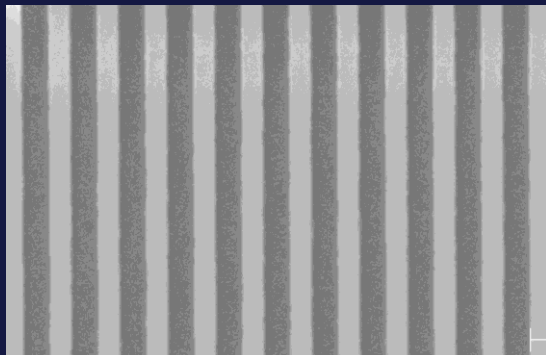
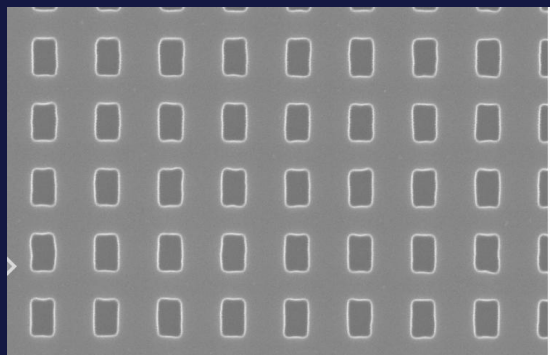
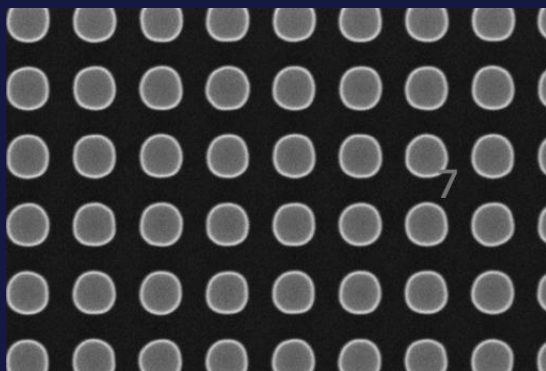
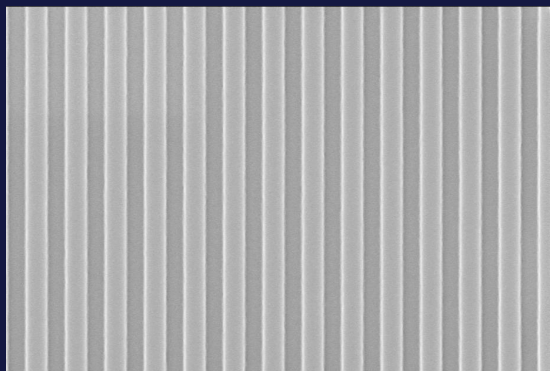
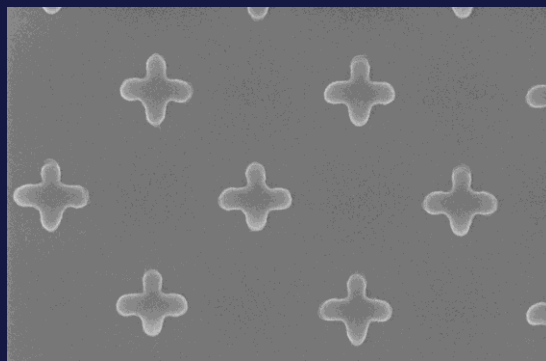
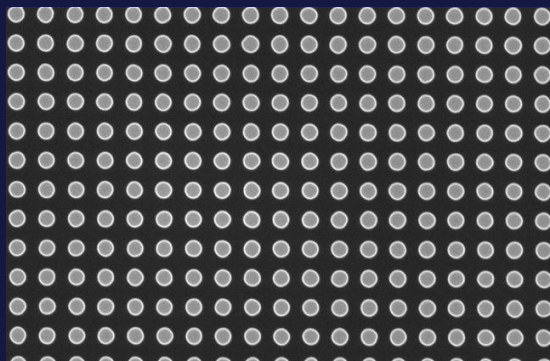




Displacement Talbot Lithography for Scalable AR Waveguide Manufacturing

Kelsey Wooley, Jonathan Spring, Harun Solak
EPIC AR Technology Meeting
October 14, 2026





Eulitha's Optical Lithography

- Swiss lithography equipment supplier near Zurich, with offices in Beijing, China and Redmond, WA US
- Innovative optical lithography for periodic patterns, Displacement Talbot lithography (DTL)
- Low cost, high-resolution DUV and UV patterning for R&D through HVM
- 1D and 2D periodic structures
- Ability to pattern many patterns, pitches, duty cycles, and areas simultaneously

DTL for AR Waveguide Patterning

Non-contact
Lithography

Standard
Photolithography
Materials & Processes

Uniform
Reproducible

Computational
Lithography Support

High Resolution

Variable Duty Cycle

Precise Pitch and
Phase Control

High Throughput

Large Depth
of Focus

Stitching-free Large
Area Printing

FS and BS
Overlay Alignment

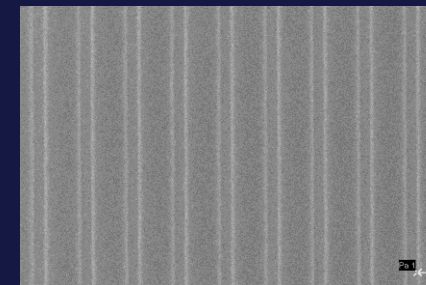
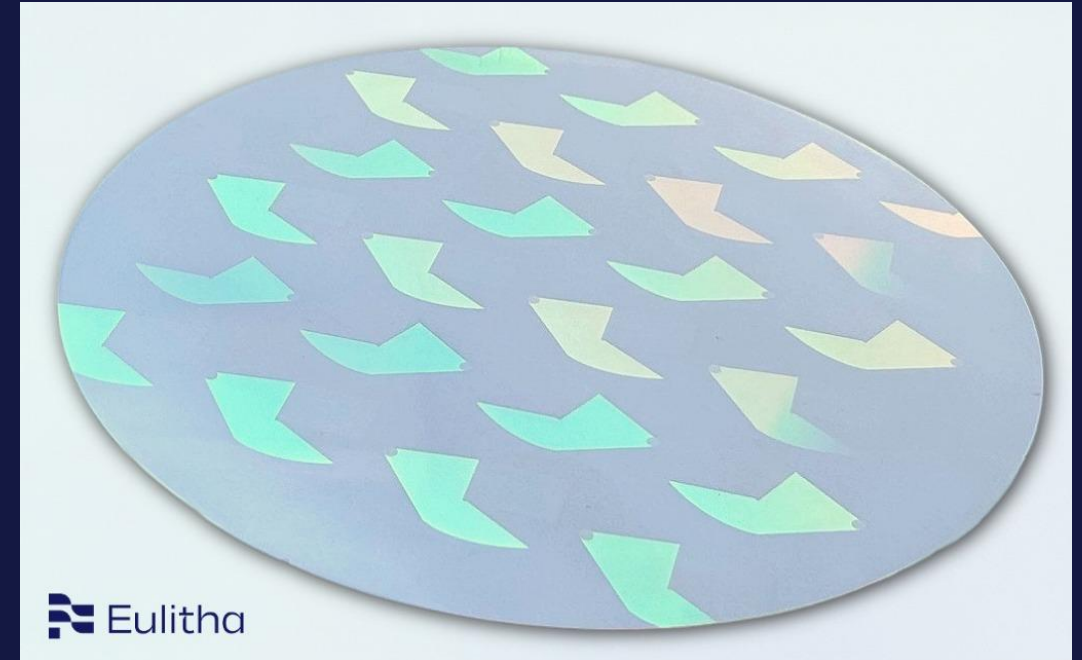
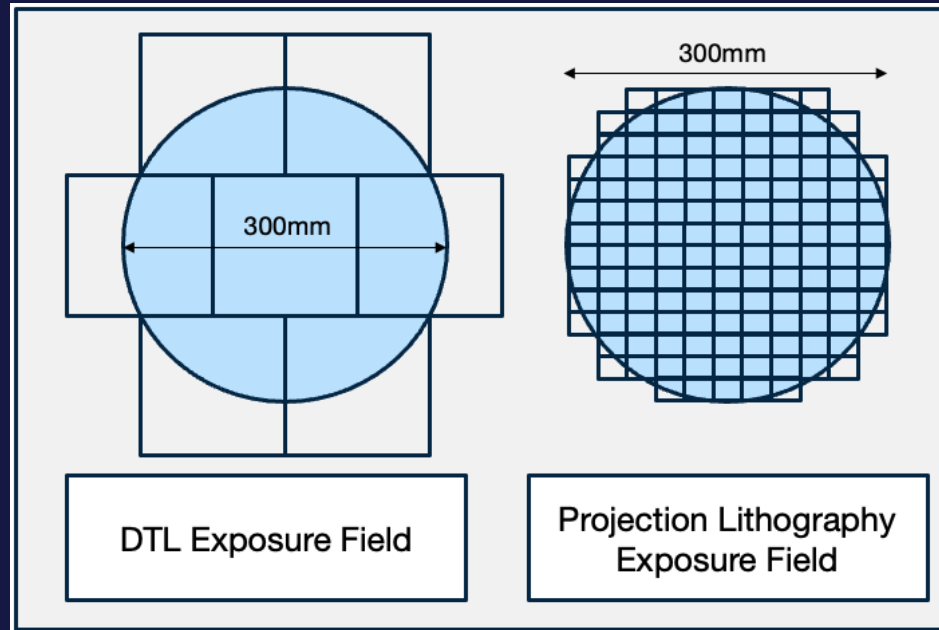
Low Cost

Making high-performance direct
etch waveguides more affordable!

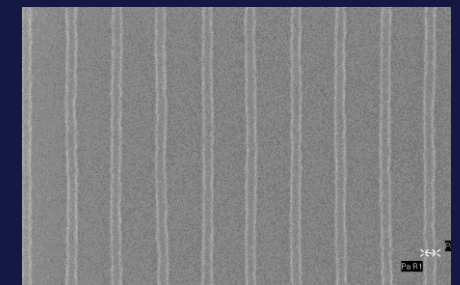
Advantages of DTL for AR Waveguides

Designs by:
dispelix

- Extremely large depth of focus
 - Compatible with large substrates with poor flatness
- No reduction to exposure field
 - Standard 6 in mask has 140 mm x 140 mm active area
 - Seamless device patterning within active area



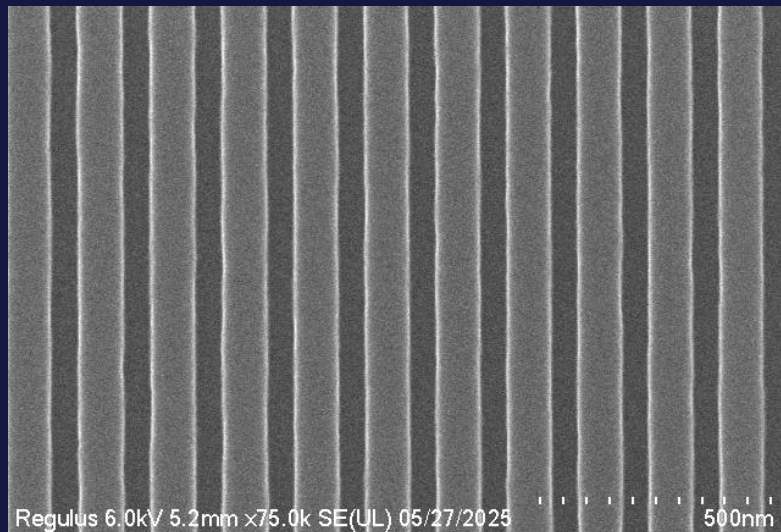
0.3 DC at
300 nm pitch



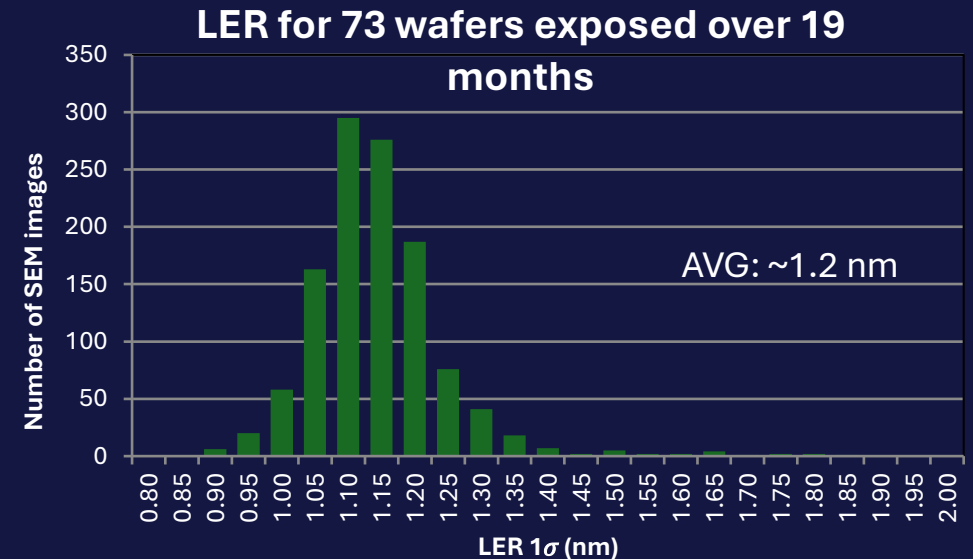
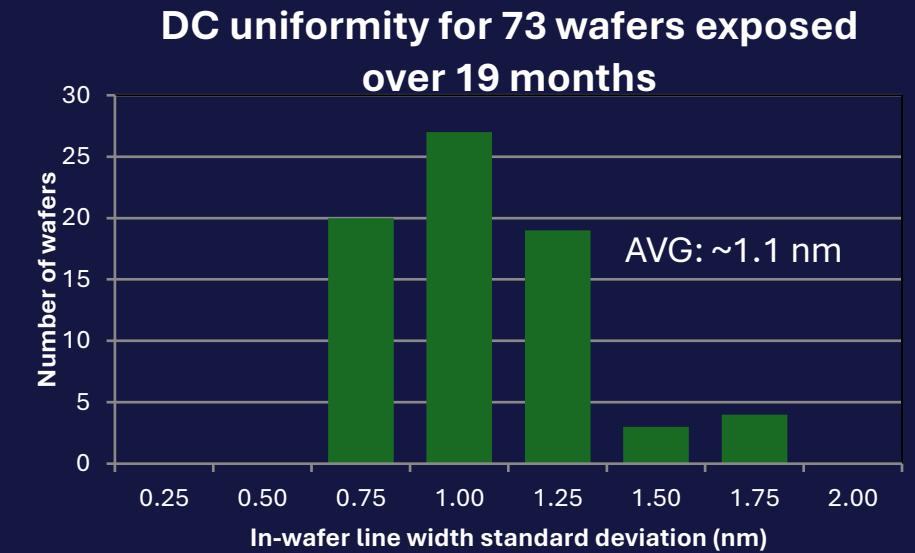
0.7 DC at
300 nm pitch

Line Width (CD) Uniformity & Line Edge Roughness (LER)

- Exposures performed every 2 weeks on PhableX DUV system
- **150-nm pitch** linear grating
- Wafer analyzed by SEM in 16 locations
- **Average LER of ~1.2 nm**
- **Average line width (CD) variation ~1.1nm**

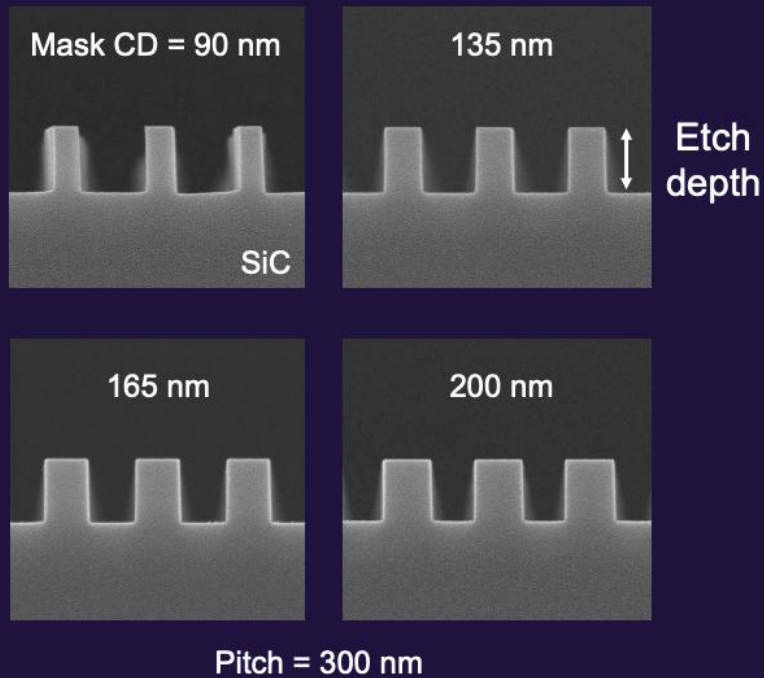


SEM of 150 nm-pitch line-and-space test exposure

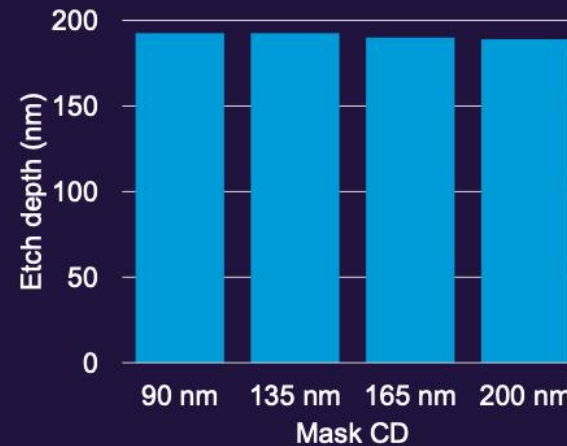


Manufacturability of AR Waveguides Collaboration with TEL

SiC grating structures with CD variations in a single etch step

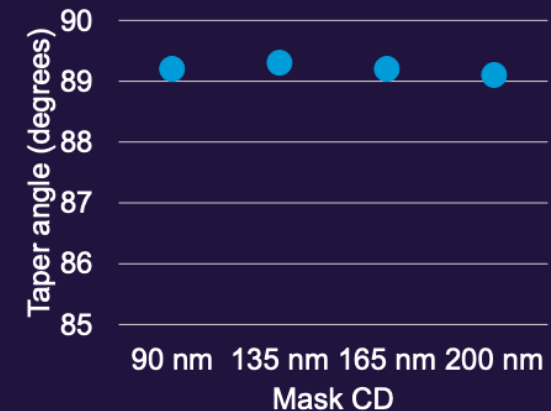


Negligible CD-dependent depth variation (< 2%)

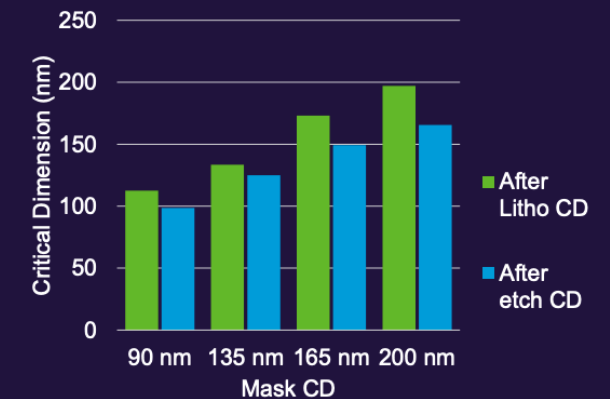


SPIE Photomask Technology + EUV Lithography (BACUS) 2026

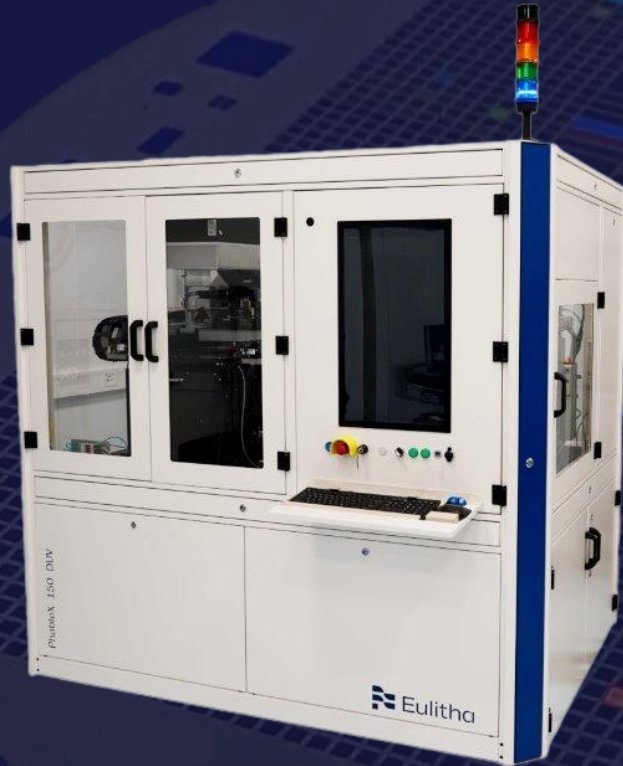
Nearly vertical (> 89 degrees) sidewall for all mask CDs



Well-controlled, systematic CD bias



The Eulitha Platforms



PhableX



PhableS



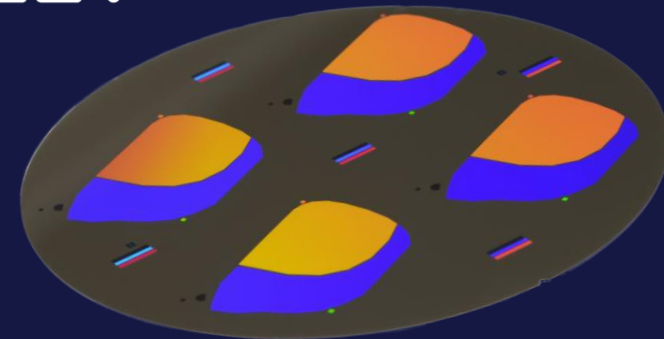
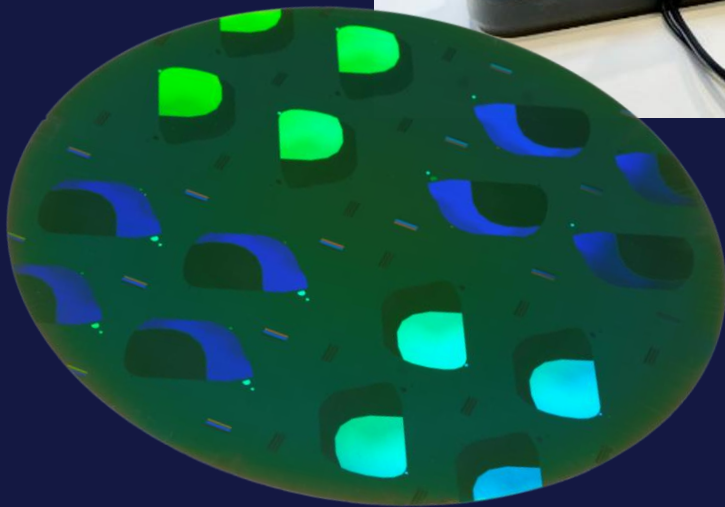
Eulitha's systems now surpass single-field exposure, combining DTL and step-and-repeat innovation.

AR Devices with Eulitha's Optical Lithography



dispelix

SEEV



In Summary



Making high-performance direct
etch waveguides more affordable!