

# LAIPH™ Wafer CD Metrology

Computes in-die mask CD metrology and simulated wafer CD uniformity

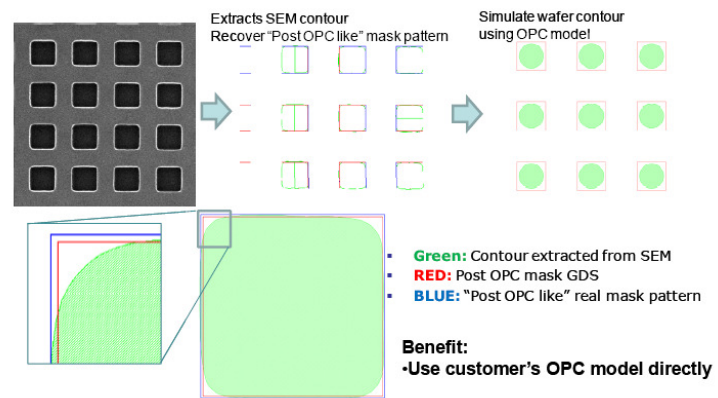
## Product Features:

- Extracts mask contour from SEM images and renders the rounded contour to straight edges without any corner rounding
- Uses Luminescent's patented constrained inversion engine to accurately reconstruct the real mask SEM contour back to OPC GDS type of polygon thereby incorporating actual mask manufacturing process CDs and edge locations into the OPC-like design
- Centralized server accommodates multiple SEM tools (e.g., Holon™ EMU-series™ and Hitachi™ S-9380M)

## Product Benefits:

- Enables in-die mask CD metrology and simulation of expected wafer impact
- Enables wafer fabs to estimate mask-contribution to total CDU measured on wafer, and hence the ability to correct this signature during scanner exposure
- Provides OPC engineers with the capability to diagnose mask-related sources of OPC inaccuracies
- Provides a thorough CD characterization of 1D, 2D and complicated in-die mask patterns for mask shops to monitor and meet Mean-To-Target (MTT) and CD uniformity (CDU) requirements

## Input-Output



### Wafer CD (WCD) metrology using mask CD SEM flow

Pang, L. et al, "Computational Lithography & Inspection (CLI) and its Applications in Mask Inspection, Metrology, Review and Repair", Proc. SPIE 7823, 78230V (2010)

## Need in mask & wafer manufacturing

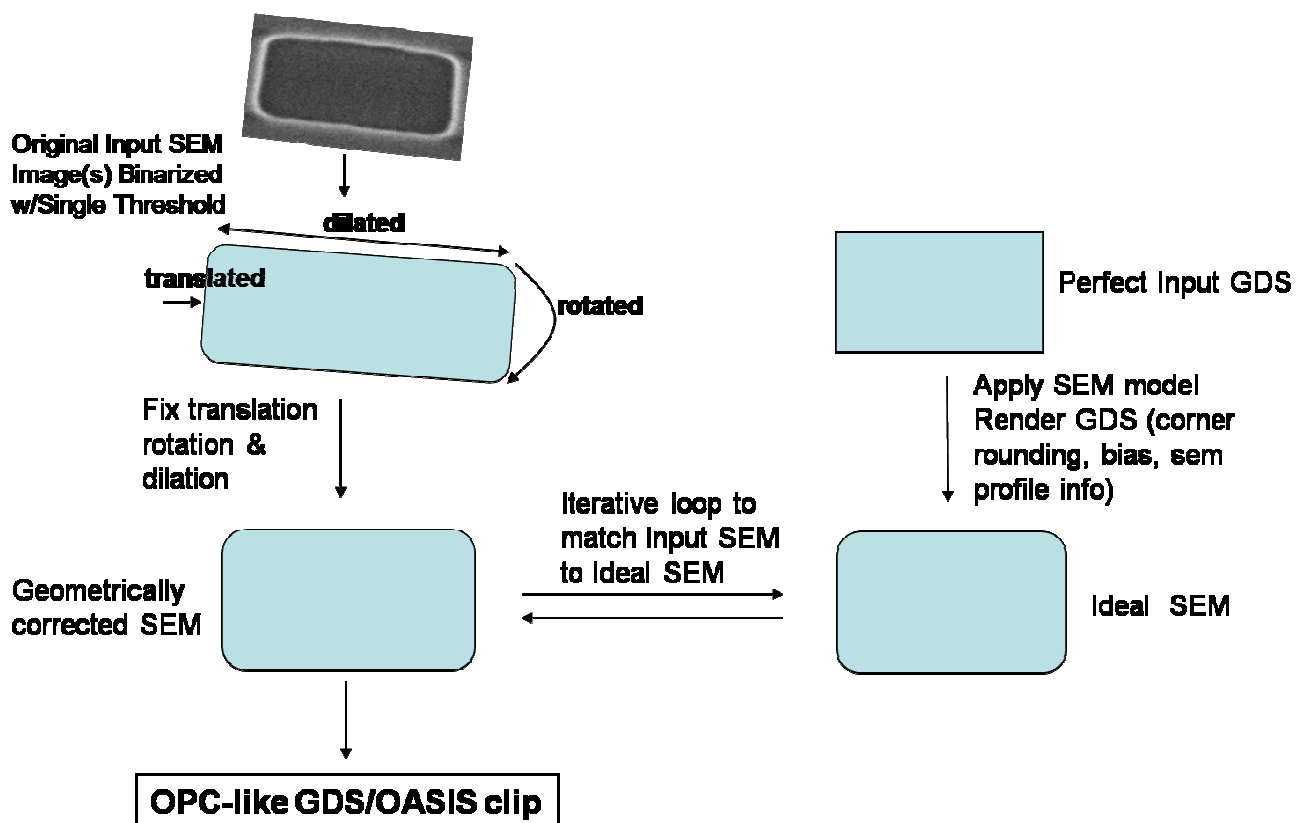
Mask CD uniformity (CDU) is taking up an increasing budget of the total wafer CDU in low-k1 lithography. However, it's often not clear how much contribution mask CDs have to total wafer CDU. Furthermore, mask CDs are generally characterized on simple arrays that do often do not represent actual device patterns and hence their CD signatures. As a result, even though masks may meet some stringent specifications on CD metrology cells, it may not be a reliable indicator of performance on wafer.

## Wafer CD Metrology Solution

The Wafer CD (WCD) metrology algorithms effectively extract actual mask pattern edges (without corner rounding) from mask SEM images and outputs these in the usual OPC-like GDS or OASIS format. This enables accurate, and fast measurement of CDs in these design patterns for not only simple array but also complicated in-die device structures. Furthermore, the "real" OPC patterns can be simulated with the same calibrated OPC-models that were used to compute the mask, to determine expected wafer CD impact and hence an accurate predictor of mask-contribution to wafer-level CDU.

## Integrated data flow makes WCD easy-to-use

User mainly provides the mask SEM images and a corresponding OPC clips. WCD has all image processing, SEM model calibration, application, and verification functionalities integrated to automatically output the rendered OPC mask pattern.



## Enables In-Die CD metrology

In-die CD metrology is often considered challenging for SEM algorithms to handle the complexity of patterns and measurements encountered. With the WCD product however, a design GDS/OASIS is effectively generated that represents the “real” in-die mask edges, and measuring in-die CDs on the GDS is a significantly easier and faster than on the SEM images itself. Integrated scripts can be written to measure and report CDs on the GDS at the desired in-die locations.