



## BENEFITS:

- Enables CD metrology for complex mask shapes, including ILT shapes
- Speeds wafer-level CD metrology through GPU-accelerated aerial simulation
- Reduces the cost of a wafer-level CD metrology solution as compared to optics-based aerial plane CD metrology tools
- Provides highly repeatable wafer-level CD metrology results based on CD SEM contours
- Integrates with industry-standard CD metrology tools for easy adoption and use
- Reduces the load of AIMS™ equipment during post-inspection mask dispositioning through more accurate defect review
- Improves post-inspection mask dispositioning by using industry-standard, high-resolution SEM images for defect details and resolution, and by using simulated aerial image for defect printability
- Expands to support other CD SEM and SEM repair tools

## FEATURES

- Aerial wafer plane simulation covering up to 23µm x 23µm at a time for Advantest E3640
- GPU-accelerated simulation for interactive speed
- Aerial simulation of ArF, KrF, iLine with various light sources
- CD SEM interface for overlay analysis of pictures with simulations
- Fully integrated into Advantest GUI
- Inputs: CD SEM contours, illumination conditions, CD key, ROI position, defect review conditions
- Outputs: Aerial images, CD plot (focus-CD plot, threshold-CD plot), intensity profiles, defect review results

# D2S Wafer Plane Analysis Engine

## FOR ADVANTEST MVM-SEM® E3640

The D2S Wafer Plane Analysis Engine uses D2S GPU-acceleration technologies to provide aerial image simulation of 2D contours extracted by Advantest Mask MVM-SEM E3640 SEM machines at interactive speeds from within the Advantest user interface.

## COMPLEX MASK PATTERNS REQUIRE A NEW CDU SOLUTION

When CDU was a one-dimensional problem, CD SEM alone was sufficient for verification. Today, however, non-orthogonal patterns and complex shapes, including ILT shapes, present a two-dimensional (2D) challenge. In addition, with these complex mask patterns comes an increase in the number of mask defect issues flagged during mask inspection. But not all of these mask issues will result in a problem on the wafer, so mask shops need to understand the wafer-level impact of mask-level issues.

Wafer plane (aerial) analysis has emerged as the solution of choice for identifying mask-level CDU issues that will impact the wafer. Wafer plane analysis solutions based on real optics (light), are expensive and can be slow. In addition, repeatability is a challenge for optical systems (1.5-2.0 nm at 1X, 8nm on mask). Mask shops need a new wafer plane analysis solution that is less expensive, faster, highly repeatable, and one that preferably does not require new equipment or new additions to the inspection process.

## D2S WAFER PLANE ANALYSIS ENGINE

D2S, Inc., a supplier of GPU-accelerated software for semiconductor manufacturing, has teamed with Advantest, the world's largest provider of automatic test equipment, to provide wafer plane analysis as an addition to the Advantest E3640 environment.

The D2S Wafer Plane Analysis Engine provides aerial simulation of the 2D mask contour extracted by the Advantest machine for today's complex mask patterns, including memory patterns, logic patterns, and ILT shapes. The D2S Wafer Plane Analysis Engine is integrated fully into the Advantest environment and is accessed as a menu option in the Advantest graphical user interface (GUI). This high level of integration enables mask shops to access the benefits of 2D wafer plane analysis without adding costly iterations with a standalone optical system.

Based on the inherent accuracy and repeatability of Advantest CD SEM, the D2S Wafer Plane Analysis Engine performs aerial simulation of the mask using the 2D contours extracted during the CD SEM process. Advantest users can perform accurate wafer plane analysis from within the familiar Advantest environment, with interactive speed (1.3sec for 23µm x 23µm mask area for the E3640) and without the need for specialized training. Using the D2S Wafer Plane Analysis Engine, Advantest users can perform concurrent checks of mask CDU via CD SEM and wafer CDU via wafer plane analysis.

## SPECIFICATIONS/SYSTEM REQUIREMENTS

The D2S Wafer Plane Analysis Engine for Advantest is GPU-accelerated, and is integrated fully into the Advantest E3640 graphical user environment. The workstation is comprised of a dual-GPU, desk-side, air-cooled, computer with dual large-screen monitors, keyboard and mouse. The 4-teraFLOPS computer has 128 GB internal memory. For use in typical, air-conditioned, ambient temperatures without additional cooling.

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## GPU-ACCELERATION

D2S leverages its GPU-acceleration technologies to provide the complex modeling and simulation technologies of the D2S Wafer Plane Analysis Engine with interactive speed. The GPU-accelerated engine performs fast, accurate 2D lithography simulation. These aerial image simulations are used to perform wafer plane CD measurements to verify wafer CDU. In addition, the D2S Wafer Plane Analysis Engine may be used for mask defect classification via wafer plane analysis.

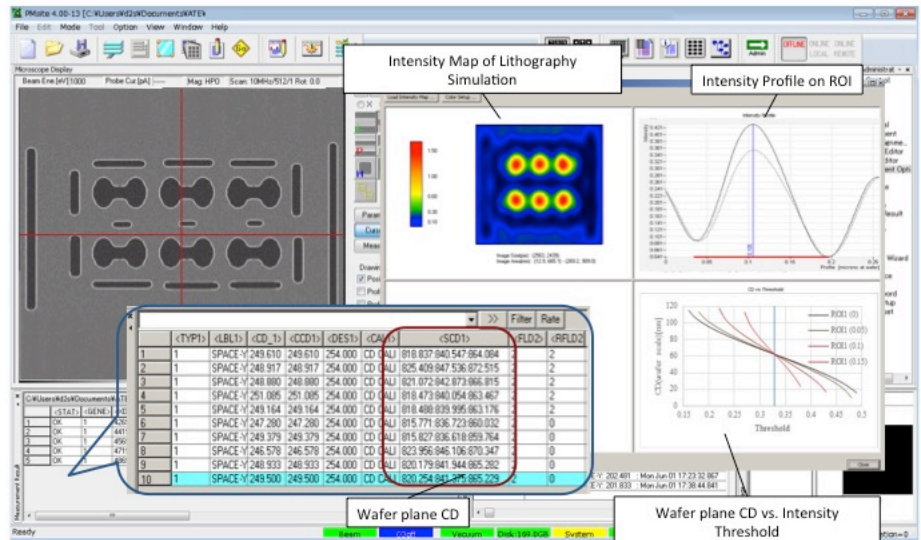


Figure 1. D2S Wafer Plane Analysis Engine verifies wafer CDU

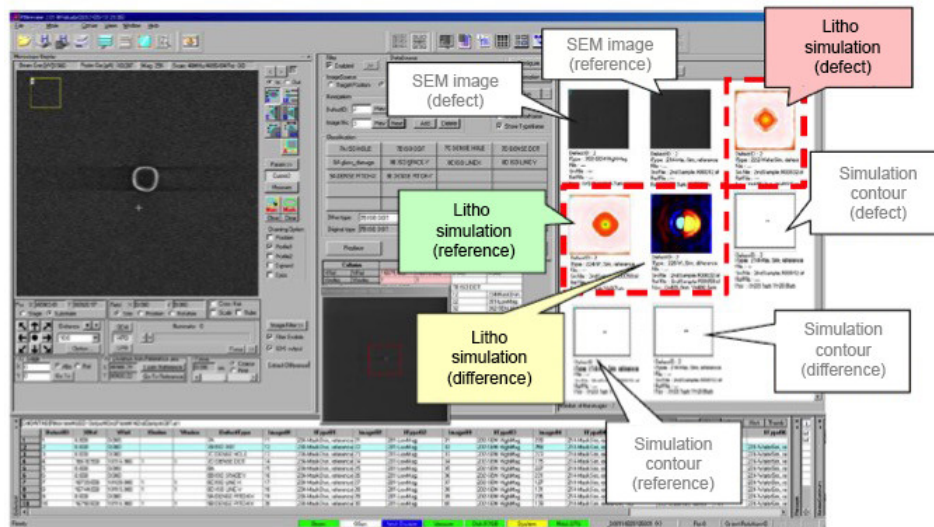


Figure 2. D2S Wafer Plane Analysis Engine can also be used for mask defect disposition