



RAVEN

RAPID ANALYSIS OF VARIOUS EMERGING NANOELECTRONICS

INTELLIGENCE VALUE

The RAVEN program seeks to develop technology that will ensure the manufacturing quality of integrated circuits used in advanced computing and communications technologies. The RAVEN program aims to develop a prototype analysis tool for acquiring images from all layers in a 1 cm² area of a 14 nm integrated circuit, within 25 days.

The semiconductor industry continues to advance both the scaling of integrated circuits and the integration of multiple die into a single package. The sheer magnitude of these technology nodes requires high-speed and high-resolution image acquisition for process verification

and failure analysis – a process that provides information necessary for technology advancement and for corrective action to improve quality and reliability.

The RAVEN program launched in 2016 and its objective is to develop prototype tools for acquiring images from all layers in a 1 cm² area of a 10 nm integrated circuit within 25 days. RAVEN encompasses four major areas for the tool development that will define success: (1) rapid acquisition of images from a bare die; (2) real-time image analysis with in-situ feedback to minimize or eliminate reworks due to image anomalies; (3) innovative algorithms for reconstructing the images of individual device layers and the overall device; and (4) computational resources for acquiring, moving, storing and analyzing petabyte size data files.

PRIME PERFORMERS

- Varioscale Inc
- Massachusetts Institute of Technology



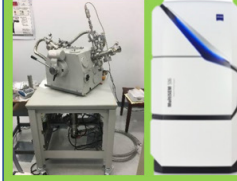
TESTING AND EVALUATION PARTNERS

- Argonne National Laboratory
- Los Alamos National Laboratory
- National Institute of Standards and Technology
- Sandia National Laboratories
- SLAC National Accelerator Laboratory

KEYWORDS

- Microelectronics
- Integrated circuit
- Chip
- Sample preparation
- Imaging
- Reconstruction
- Failure analysis
- Counterfeit detection
- Deep neural network (DNN)
- Machine learning (ML)
- Scanning electron microscope (SEM)
- Synchrotron
- Multibeam SEM (mSEM)

Three RAVEN Approaches:

<p>Non-destructive Resolution: ≤ 10 nm Facility-sized Imaging Time Risk</p> 	<p>Non-destructive Resolution: ≥ 10 nm Laboratory-sized Beam Stability Risk Material ID</p> 	<p>Destructive Resolution: 10 nm Laboratory-sized Delaying Risk</p> 
Light Source	Dual-Modal Beam	Multiple Electron Beams



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