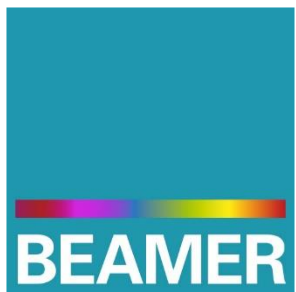
GenISys
Advancing the Standard

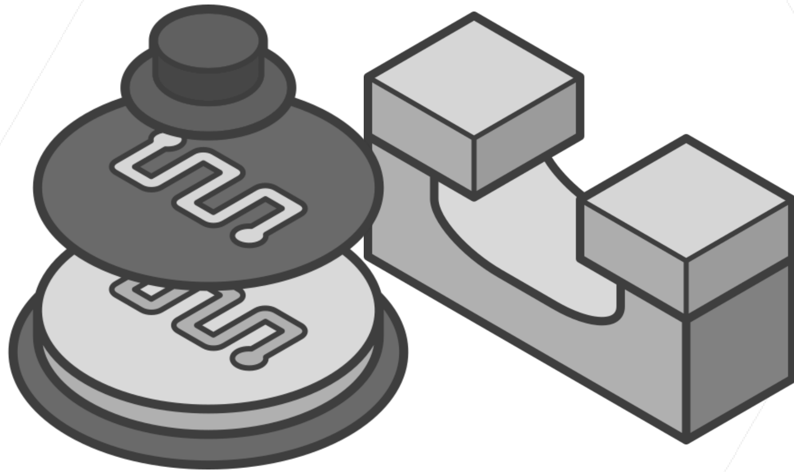
Advanced SEM Metrology

ProSEM and InSPEC Update

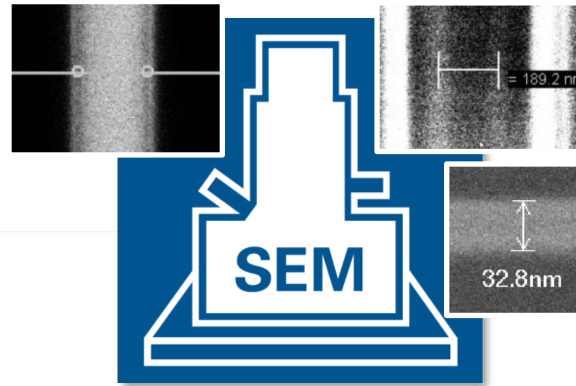


Metrology to support Fabrication

Lithography & Processing



Metrology & Monitoring



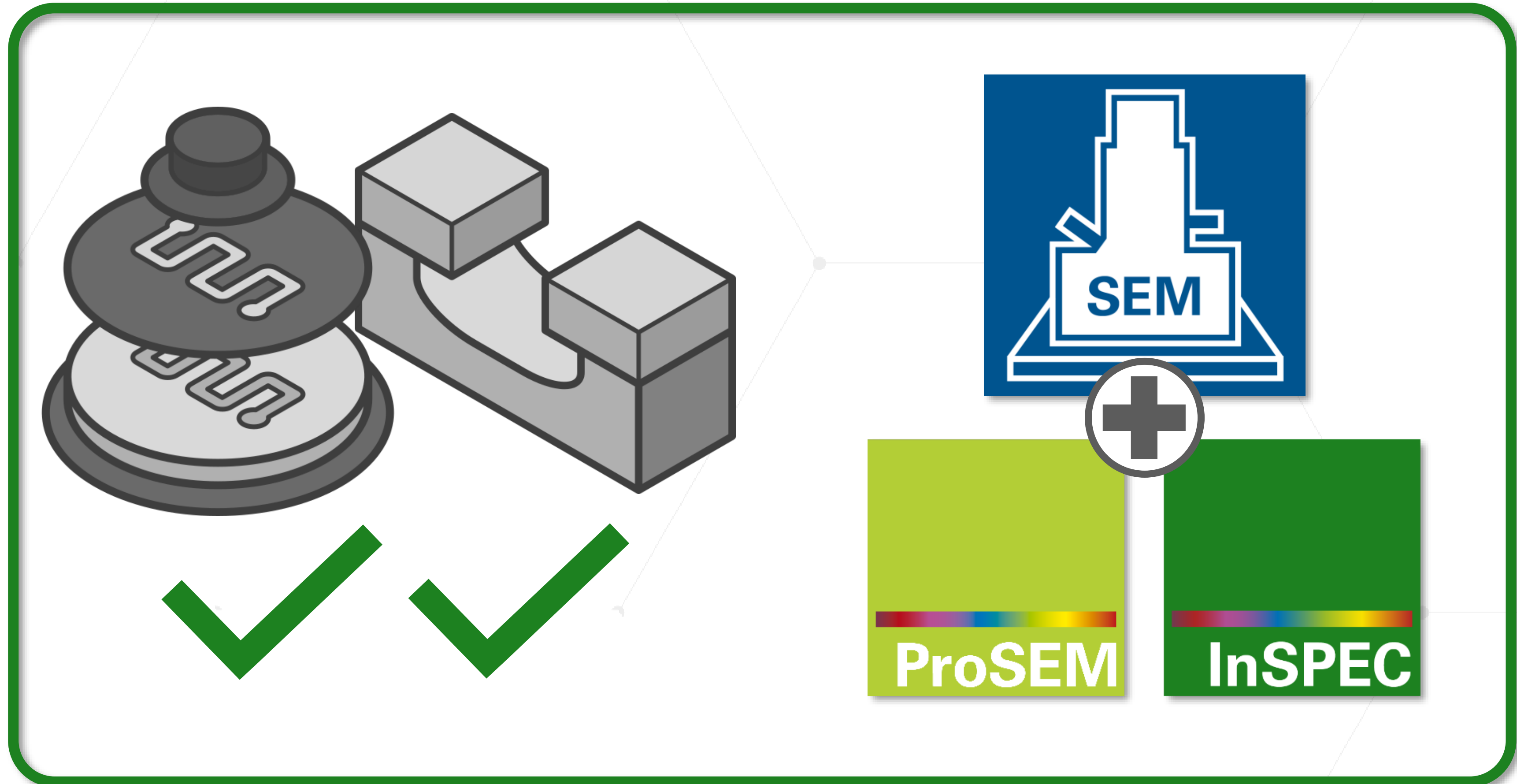
Semi Industry: Specialized CD-SEM

Image AMAT webpage

Metrology to support Fabrication

Lithography & Processing

Metrology & Monitoring



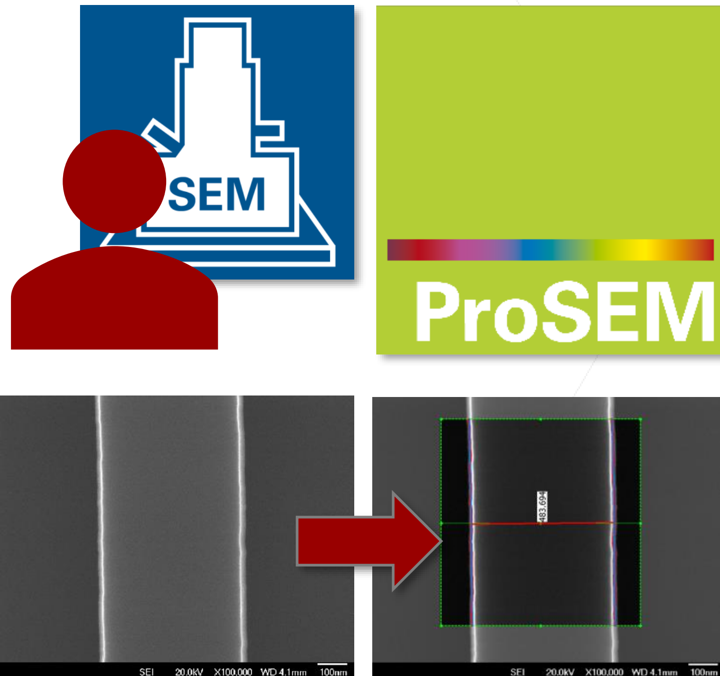
Semi Industry: Specialized CD-SEM

Image AMAT webpage

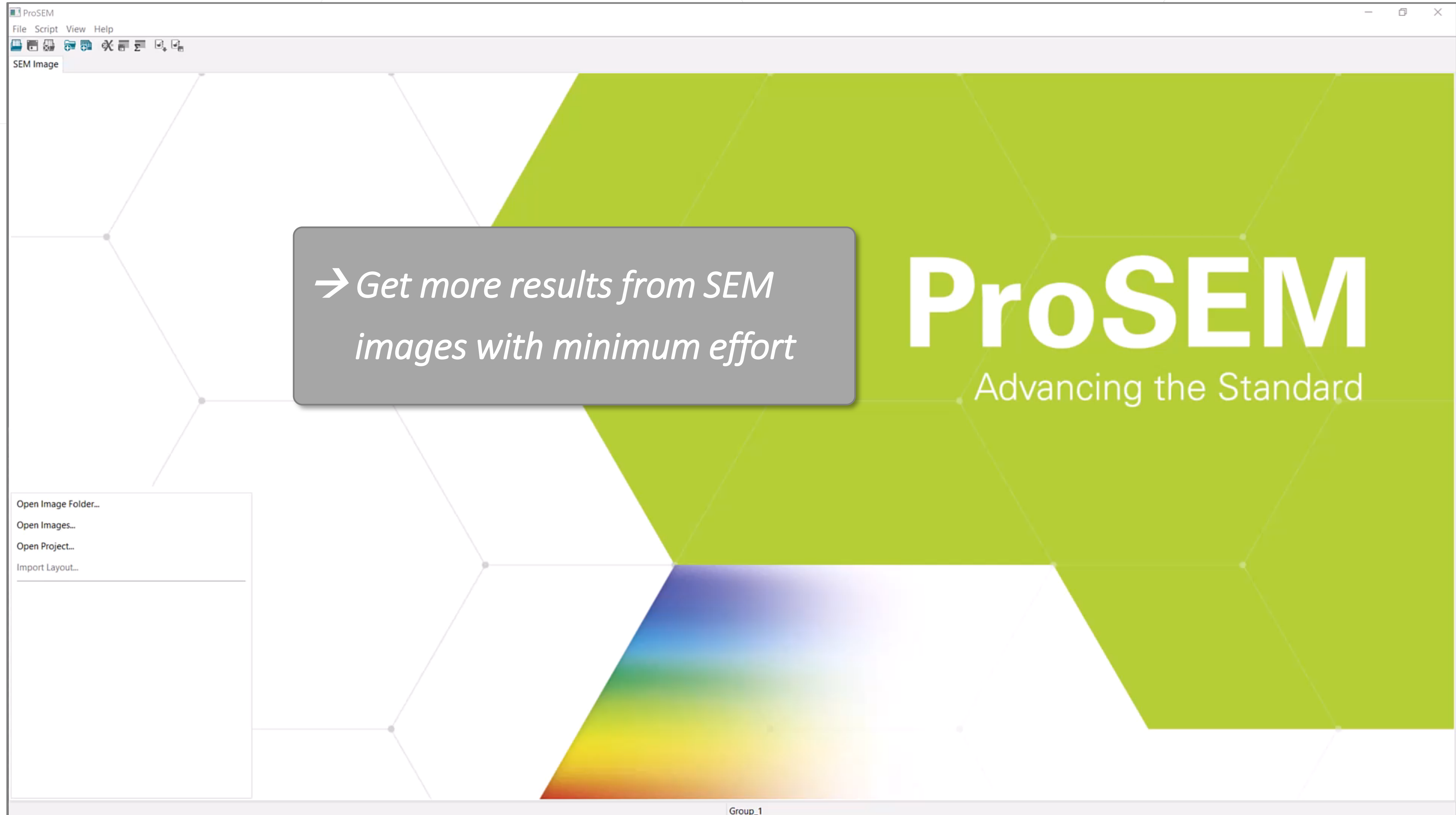
SEM Metrology Scenarios (1)

Offline SEM Image Metrology

Integrated Automation for SEM Metrology



Contour-based SEM Metrology



ProSEM 3.6 What‘s New

ProSEM 3.6 Key News

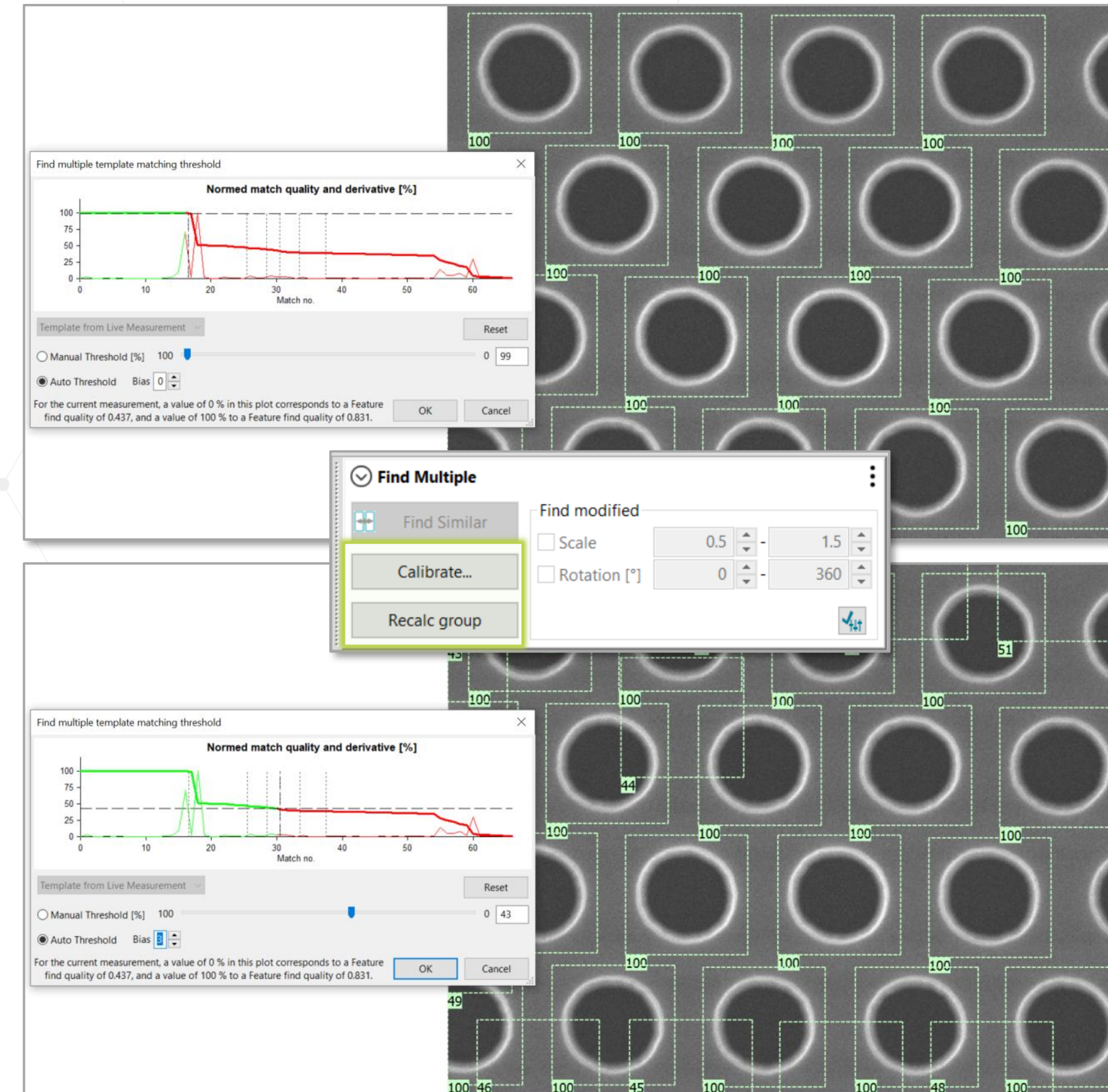
- General
  - Update on Operating System support
- Feature Detection and Measurements
  - Edge Roughness and PSD plots for groups
  - Advanced Package: User control for template matching
  - Advanced Package: Tilt projection correction of measurements
  - Advanced Package: New feature type “Rounded Rectangles”
- Layout Integration/ SEM Tool Control
  - Control of image polarity in registration
  - Image registration and standard measurements/ recipes
  - SEM drive with 1-click shortcut
  - New SEM interfaces available (JEOL, Hitachi, Thermo Fisher)

User Control for Template Matching

Find Multiple (similar and modified)

- Template matching used for multiple features
- Usually, threshold is set automatically
- Challenging cases require more user control
- New calibration of threshold allows for
  - Manual and Auto Threshold adjustment
  - Bias to control number of matches
  - Bias is useful for recipe/ batch
- Available in Advanced package or higher

→ Enables the use of find multiple for challenging use cases



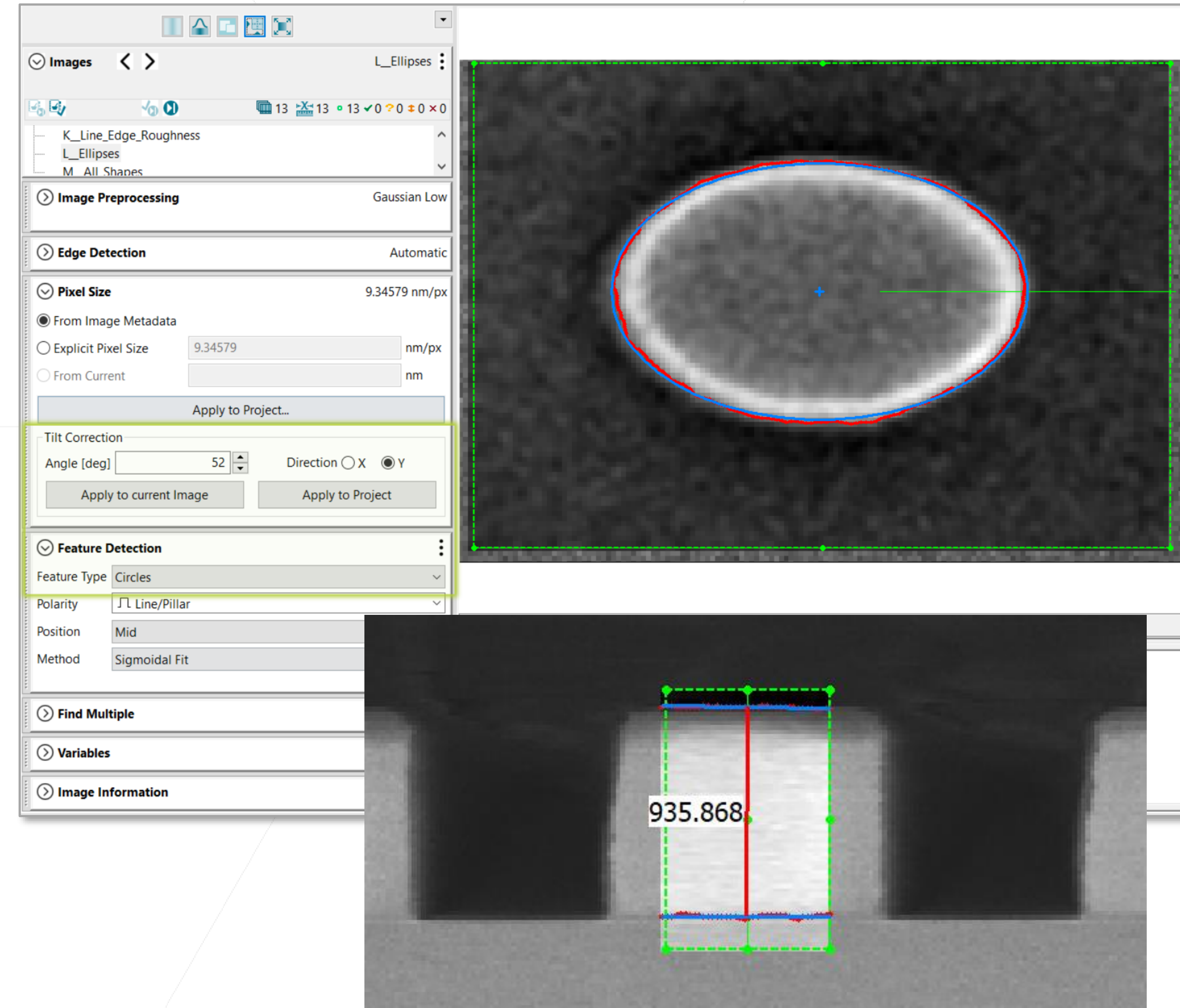
GenISys
Advancing the Standard

Tilt Projection Correction

Measurements on tilted images

- Set tilt angle/ direction of view on image
- Correction for:
  - Measurement results
  - Shape fitting
- Display of image and contour uncorrected
- Example shown: fitted as circle
- Available in Advanced package or higher

→ Especially for cross-section analysis
→ Better usability with less data processing

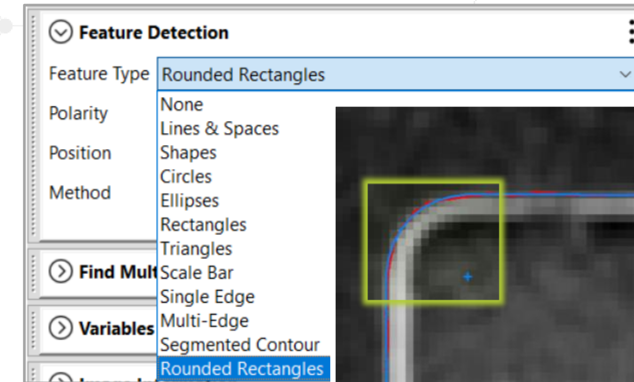


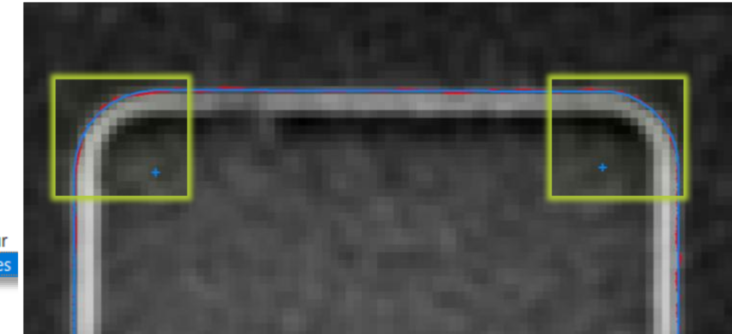
New Feature Type "Rounded Rectangles"

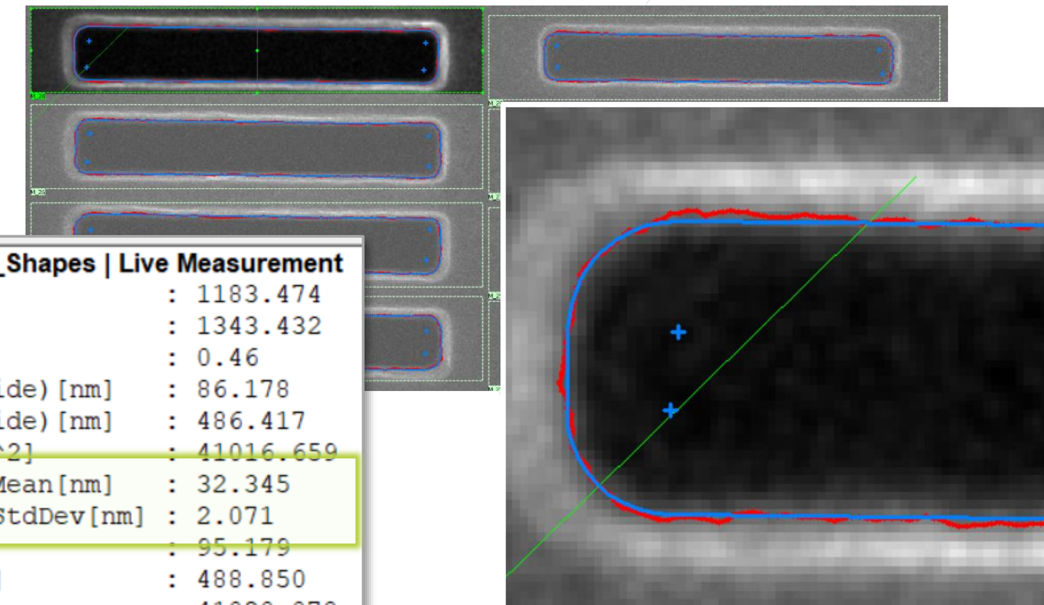
Fitted rectangles including corner rounding

- Measures corner radius mean and standard deviation
- Fits rectangle sides and 4 corners
- Individual results accessible via script
- Available in Advanced package or higher

→ Improves fitting being closer to SEM contour
→ Provides important results for process parameters





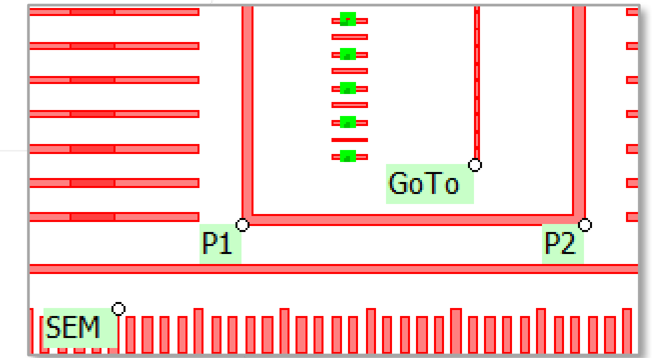


J__Rectangles_or_Shapes | Live Measurement	
Center X[nm]	: 1183.474
Center Y[nm]	: 1343.432
Rotation[deg]	: 0.46
Width (short side)[nm]	: 86.178
Height (long side)[nm]	: 486.417
Fitted Area[nm^2]	: 41016.659
Corner Radius Mean[nm]	: 32.345
Corner Radius StdDev[nm]	: 2.071
BBox Width[nm]	: 95.179
BBox Height[nm]	: 488.850
Area[nm^2]	: 41020.078

SEM Tool Control

Convenience shortcut for SEM drive

- 1-click command for stage navigation (Alt + left click)
- Available with valid global alignment
- Shortcut for: pick XY – GoTo – Move to

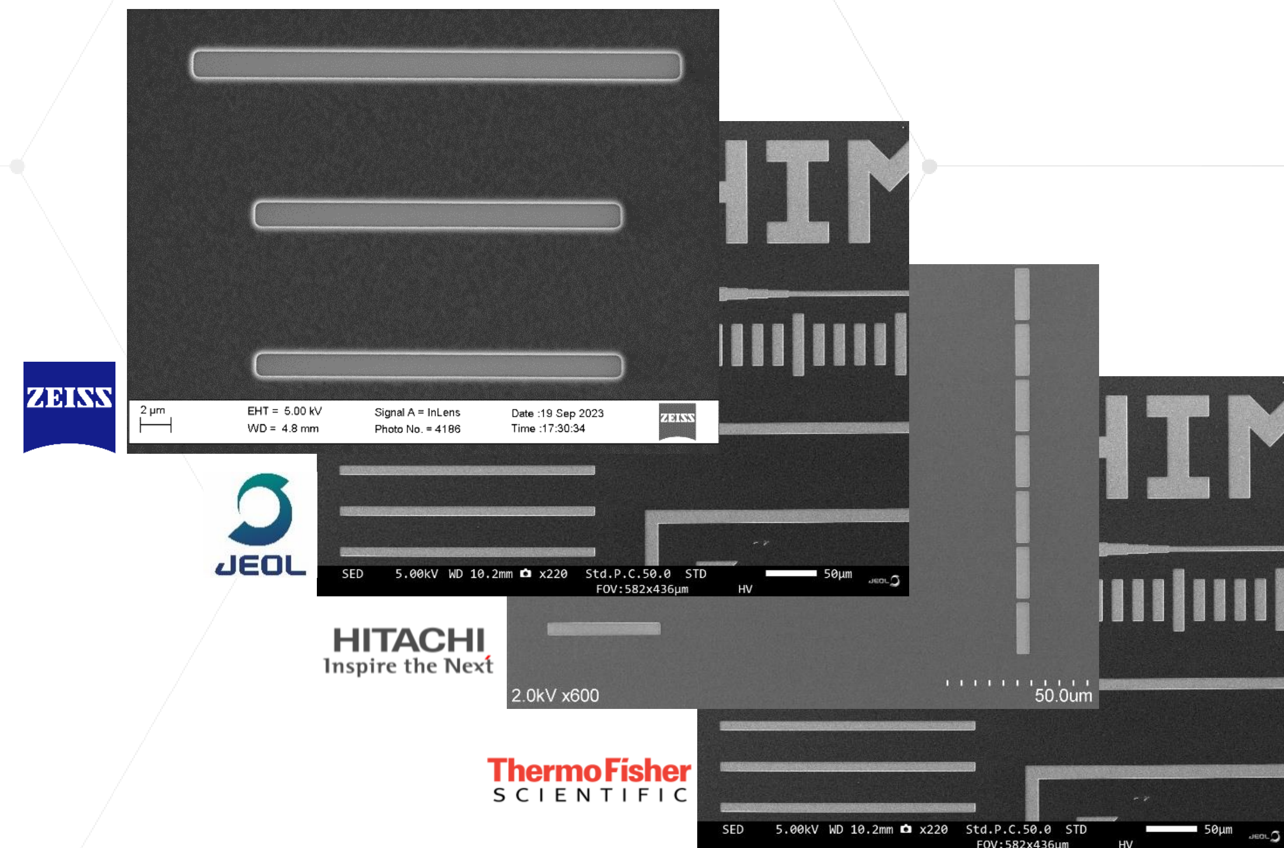


Supported SEM interfaces

- ZEISS serial interface (Remcon32)
- JEOL ethernet interfaces (Eik, MEC)
- Hitachi interfaces (RS232, ethernet)
- Thermo Fisher (new ethernet)

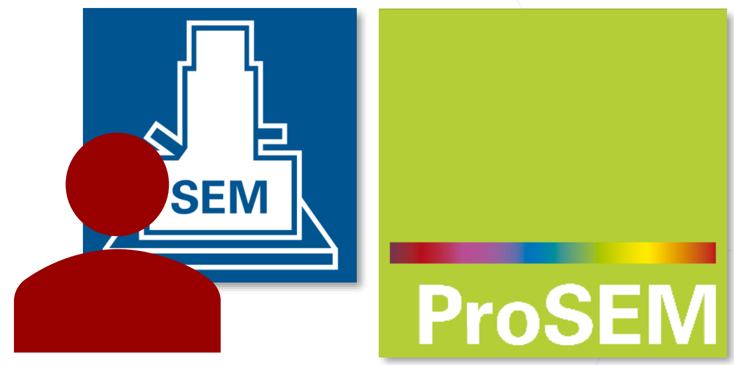
- Other (Tescan) possible and pilot sites welcome

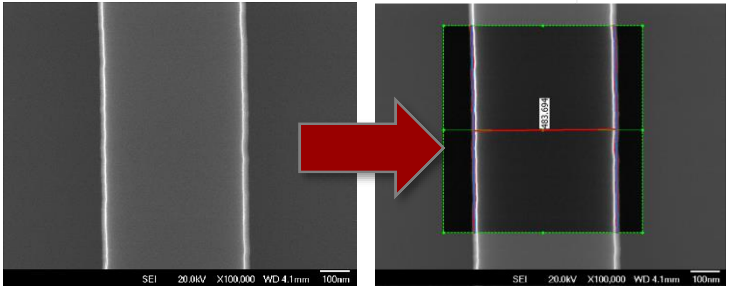
→ Please contact GenISys team for details



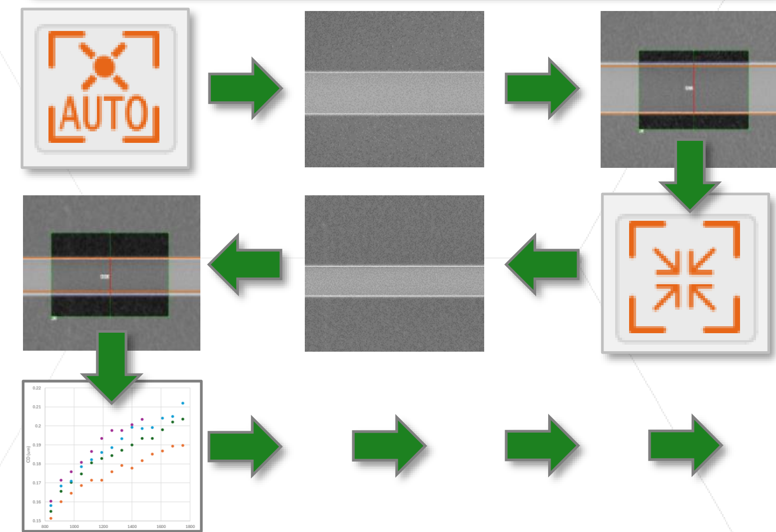
SEM Metrology Scenarios (2)

Offline SEM Image Metrology

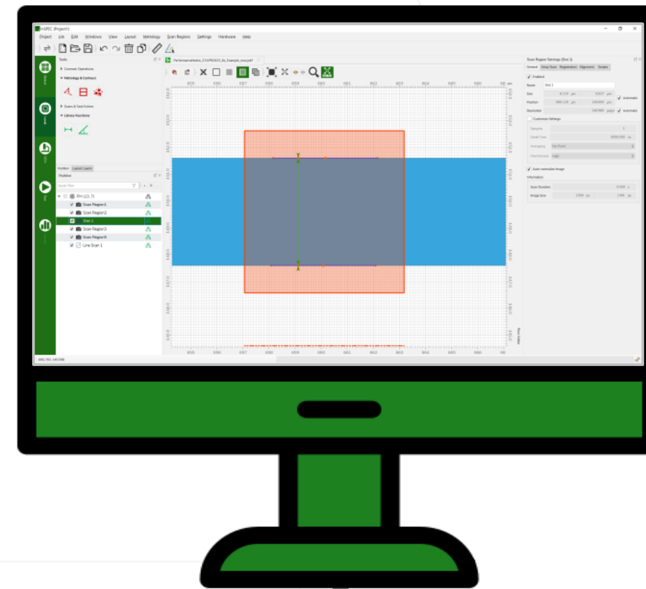




Integrated Automation for SEM Metrology

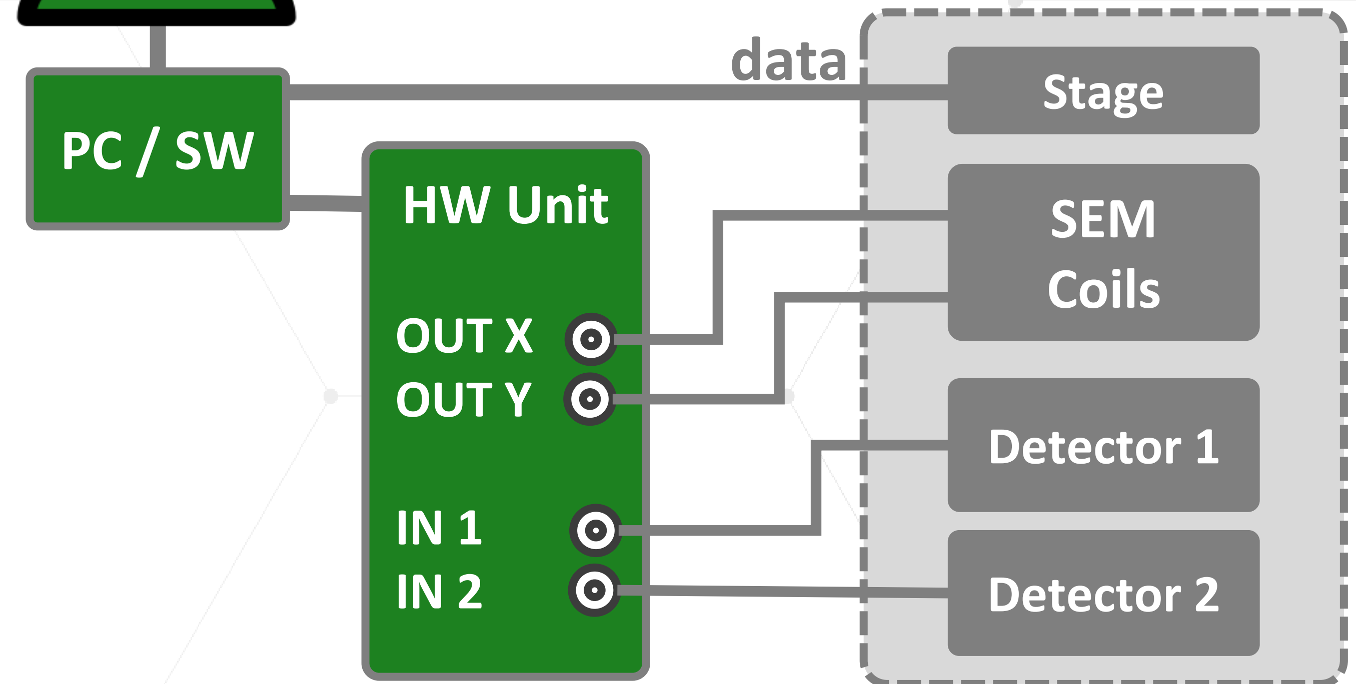


InSPEC SEM Upgrade Kit



Integrated Metrology & Inspection Kit

- Software package (tool + office)
- PC and screen
- Scanning and I/O hardware



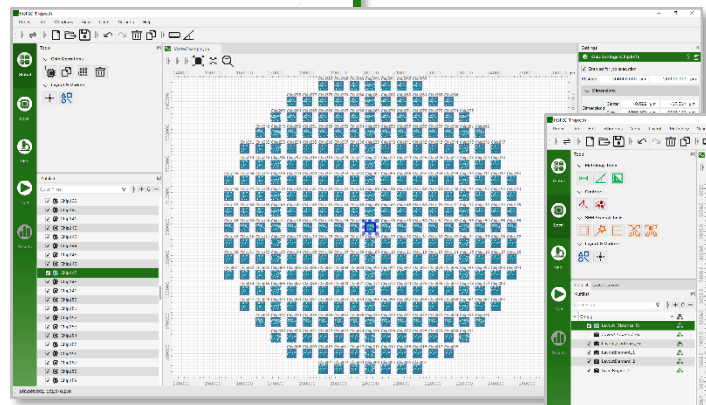
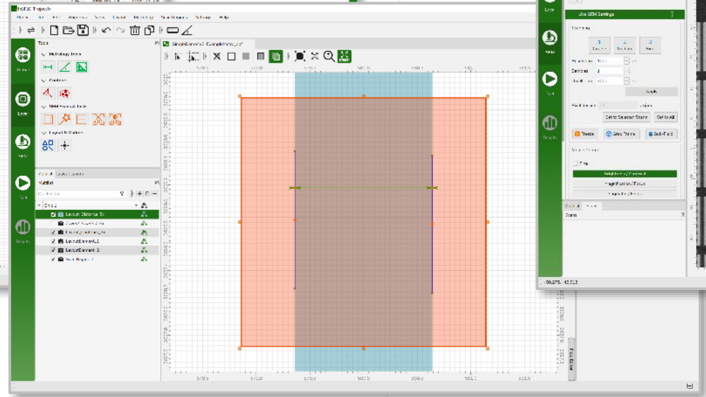
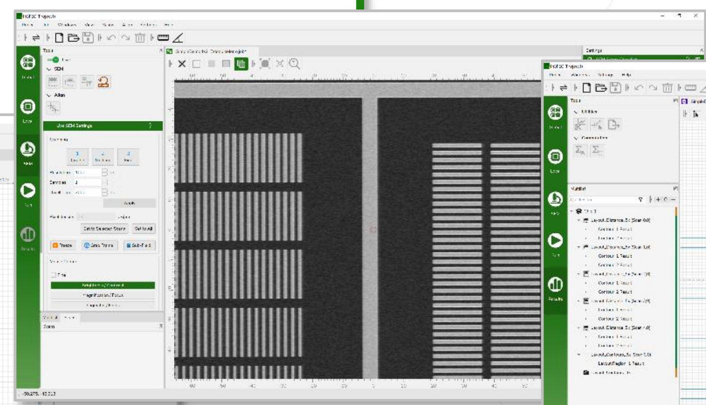
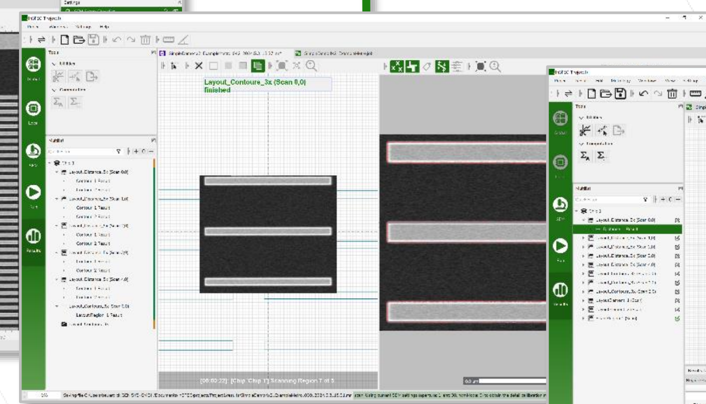
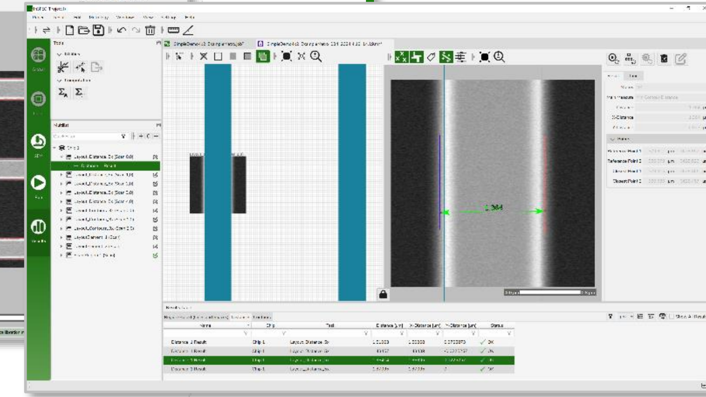
→ Analog integration for SEM beam and detectors

→ Stage via digital I/F with safety mechanisms

→ Scanning and tool operation through **InSPEC**

GenISys
Advancing the Standard

Integrated Workflow along 5 Main Modes

General sample/ job arrangement

Chip/ field level scans & metrology

SEM beam and imaging control

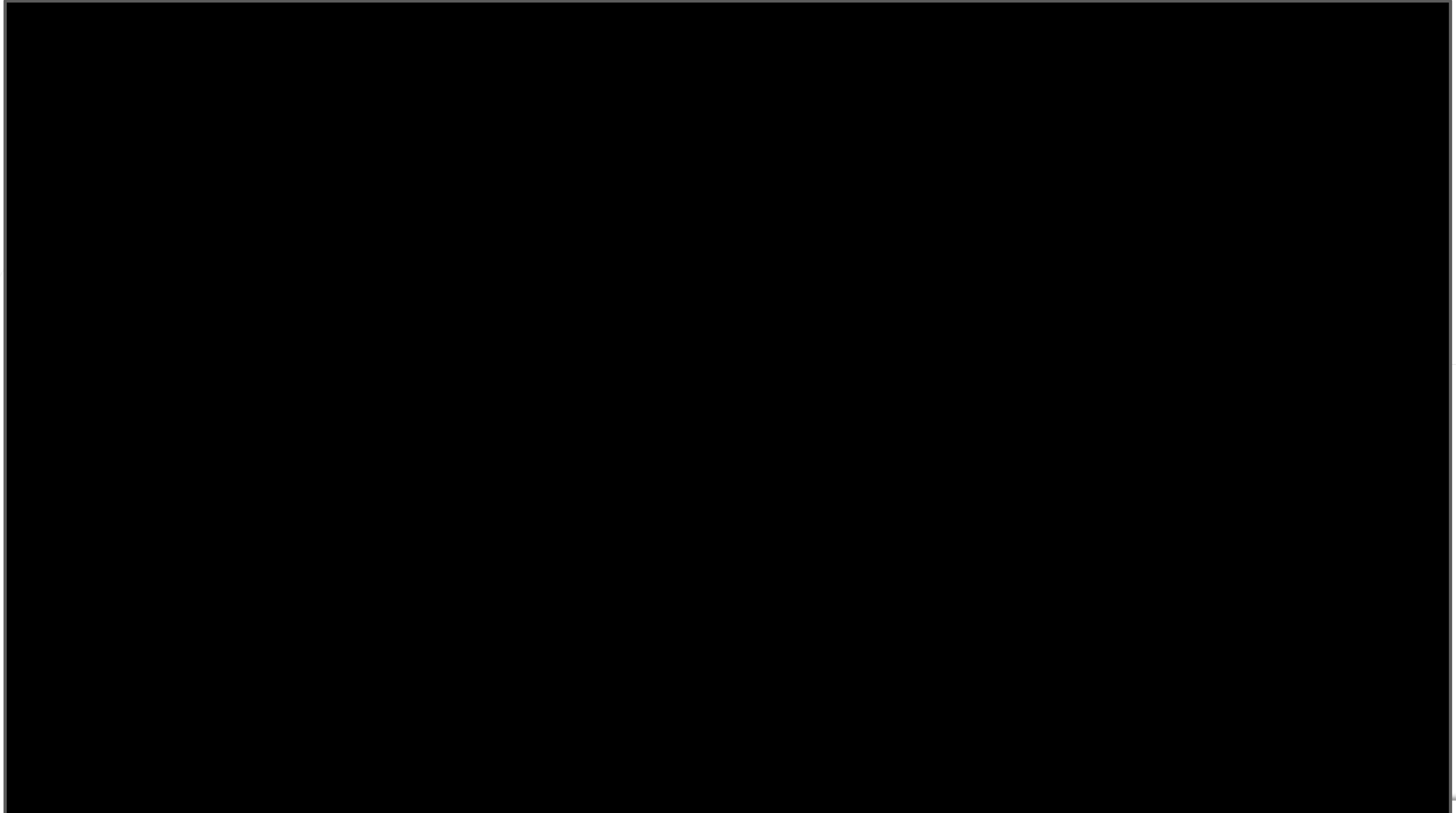
Automatic job execution

Review & tune metrology data

→ See introduction movie on:
www.genisys-gmbh.com/products/inspec.html

GenISys
Advancing the Standard

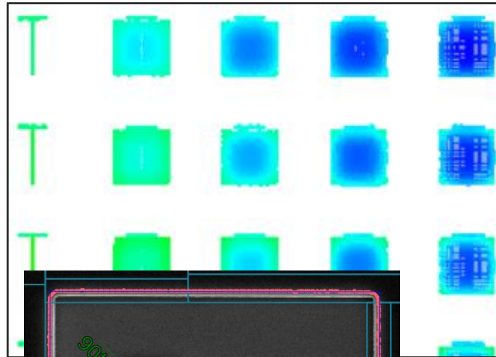
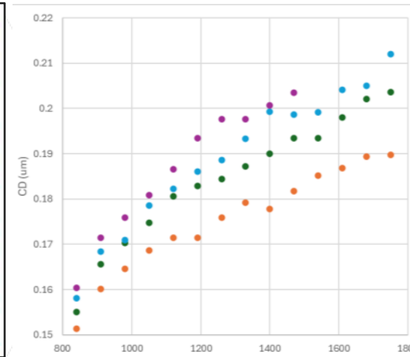
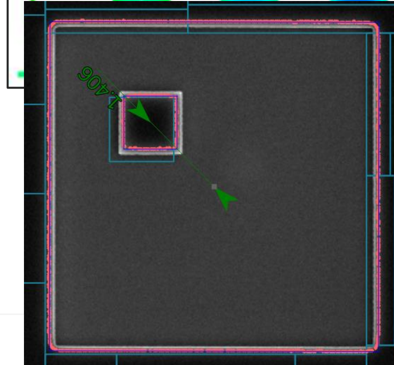
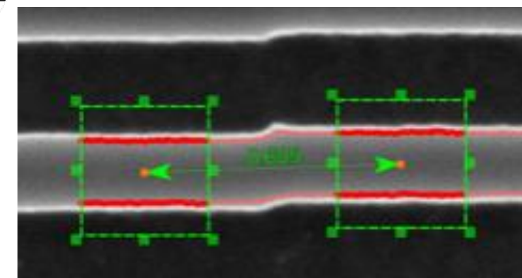
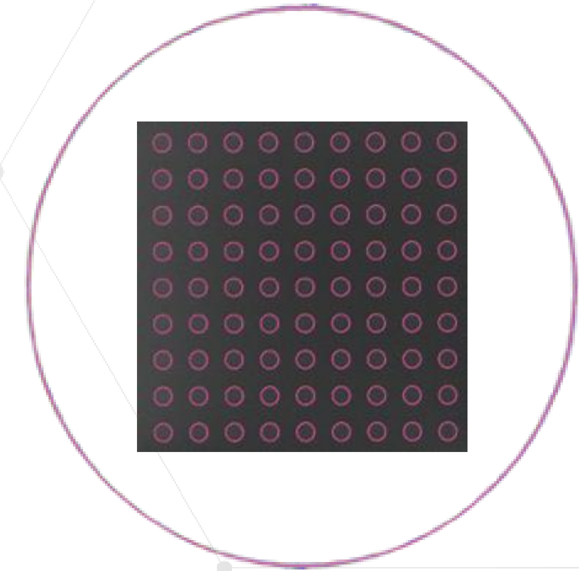
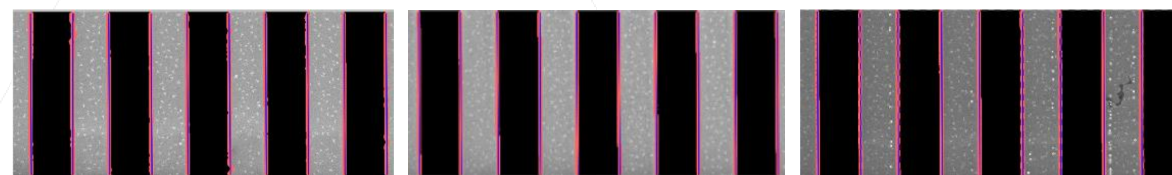
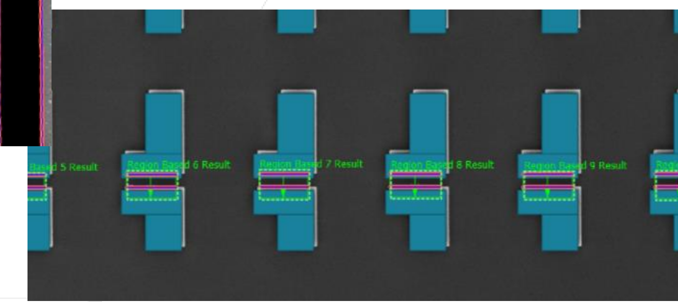
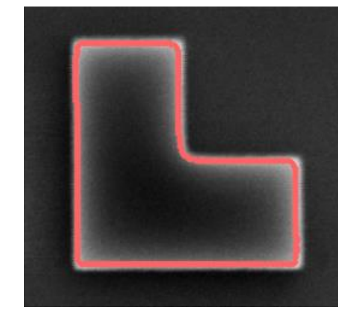
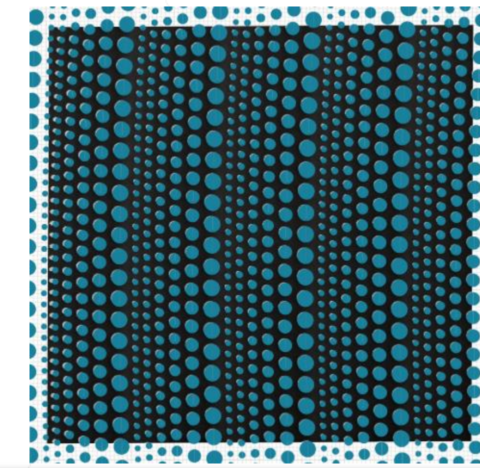
InSPEC Integrated Workflow



GenISys
Advancing the Standard

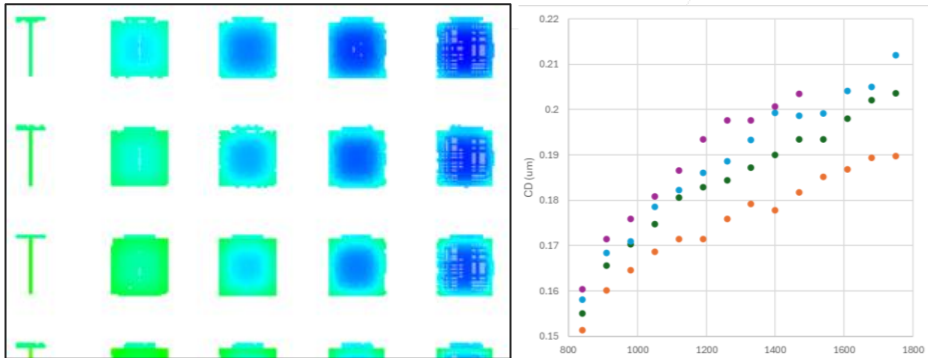
Application Examples

- Resist calibration
- Routine litho CD checks
- Placement/ stitching analysis
- Statistical check of Etching
- Device and pattern CD
- Corner rounding/ blur
- Layout comparison/ bias

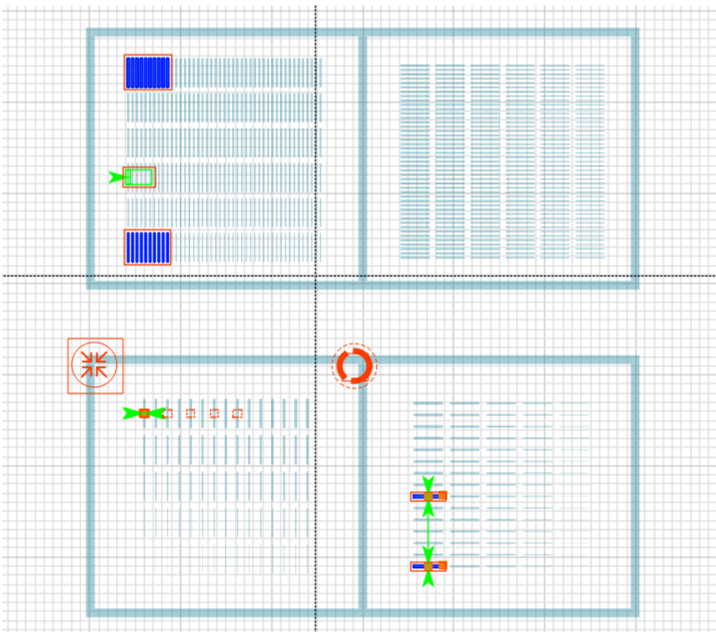










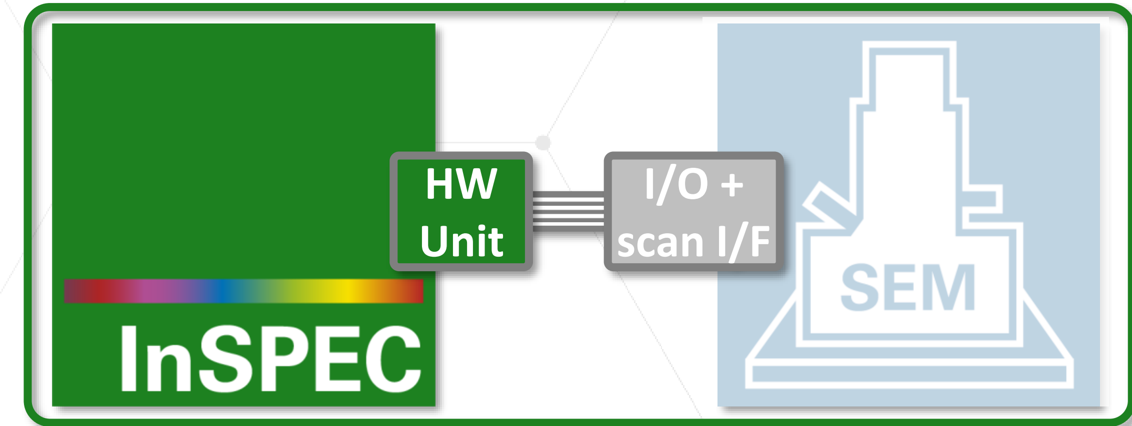
InSPEC Demo (Afternoon Session)

- Measurements for Process Calibration



- Multi-Chip Metrology Job





Upgrade Kit for a Metrology SEM

Integrated scanning, automation & metrology

Direct SEM control with hardware integration

Multi-Chip jobs with hierarchical structure

Comprehensive full layout-based workflow

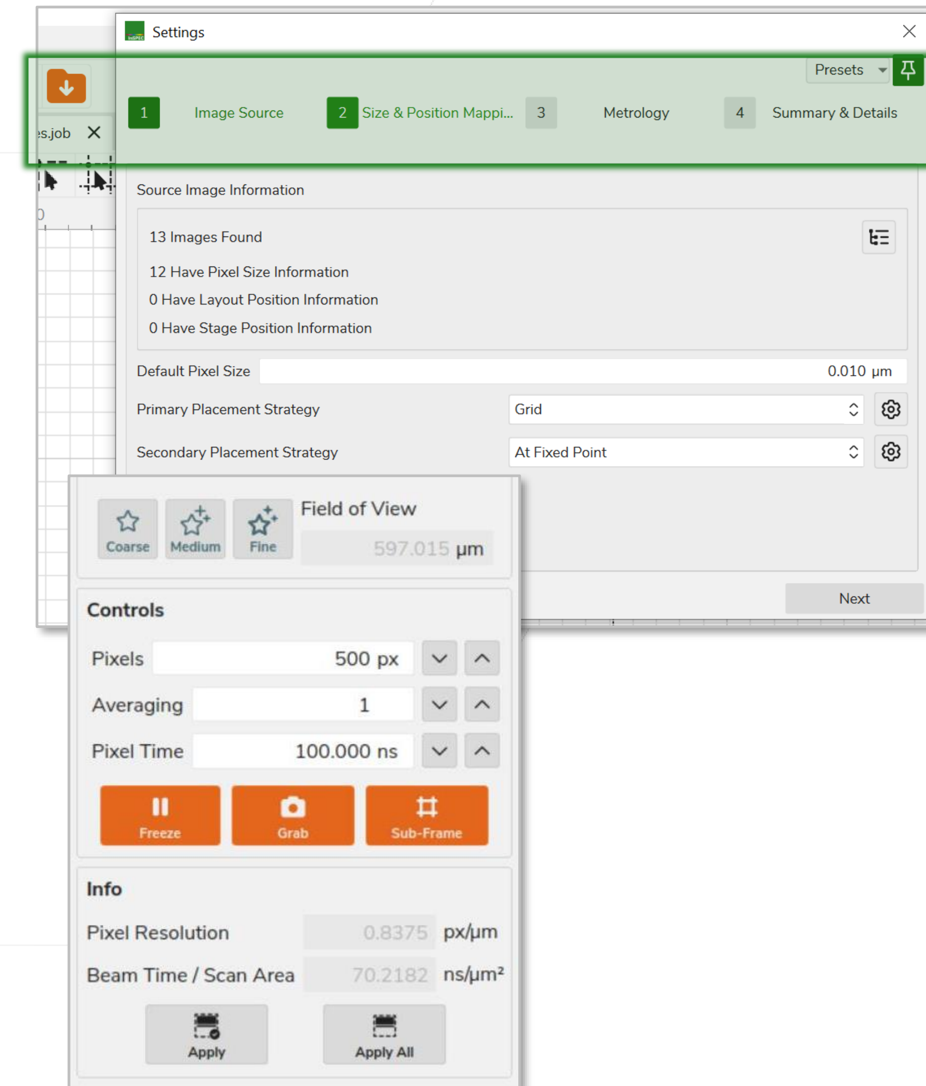
Expert metrology & data processing with “FLOW”

GenISys
Advancing the Standard

InSPEC Roadmap Topics

Short-term improvements – work in progress

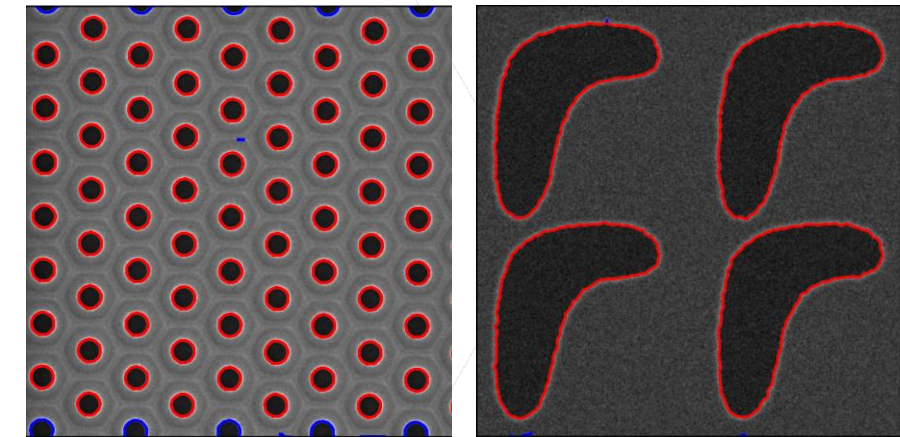
- Working with external images
  - InSPEC is designed to acquire scans and process (only) these
  - Will be extended to import and process of external SEM images
  - Workflow to be adapted (but not copy ProSEM approach)
- GUI improvements
  - SEM scan control for live and layout mode more intuitive
  - Refresh of column and stage control interface
- Focus and stigmation map
  - Easy way of defining many reference points (arrays, via chip hierarchy)
  - Guided semi-automatic focus/ stig check and optimization

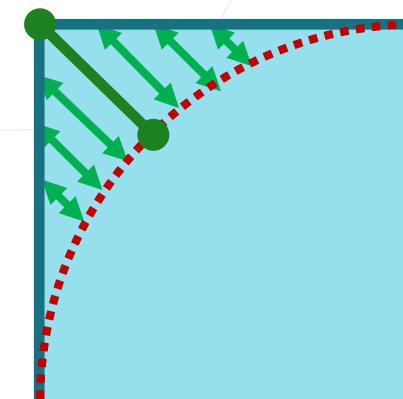


InSPEC Roadmap Topics

Mid-term improvements – major planned features

- SEM calibration and settings
  - Magnification calibration sets to be extended and linked to SEM settings
  - Employ for working with fine-calibrated scan fields
- Additional algorithms for contour detection
  - New approach for “raw” contour (same fine detection and metrology)
  - More flexible (no ROI, multiple features), faster, more robust
- Advanced contour analysis (with Layout)
  - Detection and analysis of arbitrary curvi-linear shapes
  - Comparison to layout or other references
    - Shift of reference points (corner, center)
    - Edge placement error EPE (complete shape or segments)
    - Area comparison, corner radius/ length, LER with arbitrary reference…





GenISys
Advancing the Standard

Thank You!

support@genisys-gmbh.com

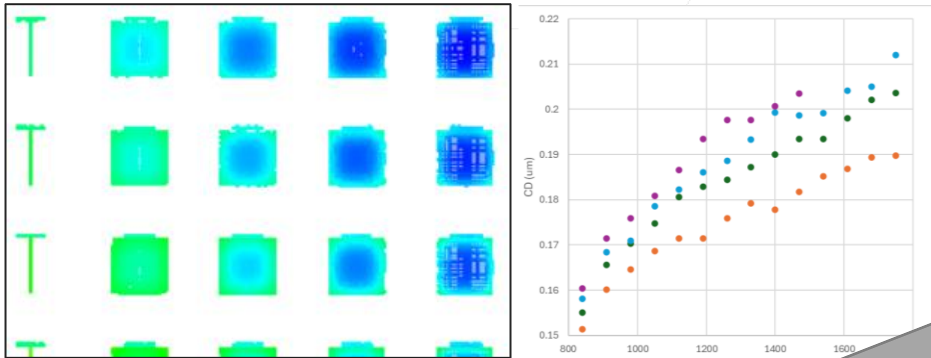
Headquarters
GenISys GmbH
Inselkammerstr. 5
D-82008 Unterhaching (Munich)
GERMANY
✆ +49 (0)89 954 5364 0
+49 (0)89 954 5364 99
✉ info@genisys-gmbh.com

USA Office
GenISys Inc.
P.O. Box 410956
San Francisco, CA
94141-0956
USA
✆ +1 (408) 353 3951
✉ usa@genisys-gmbh.com

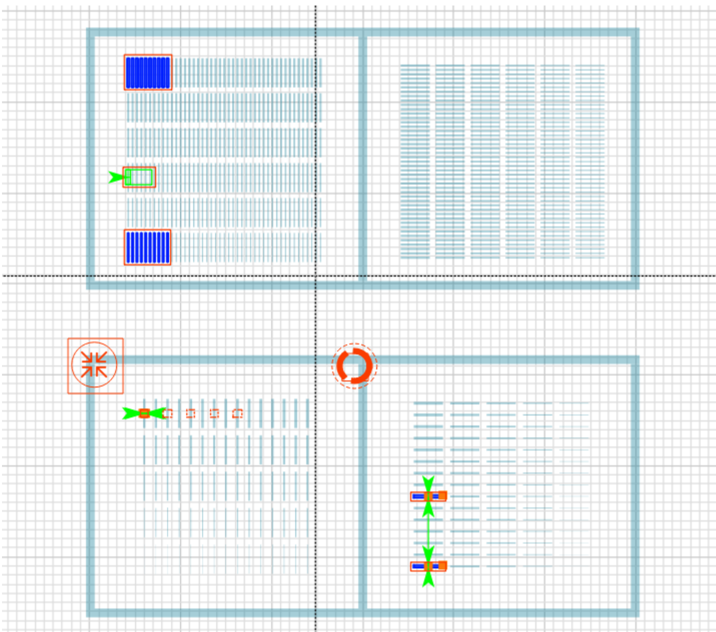
Japan / Asia Pacific Office
GenISys K.K.
German Industry Park
1-18-2 Hakusan Midori-ku
Yokohama 226-0006
JAPAN
✆ +81 (45) 530 3306
+81 (45) 532 6933
✉ apsales@genisys-gmbh.com

InSPEC Demo (Afternoon Session)

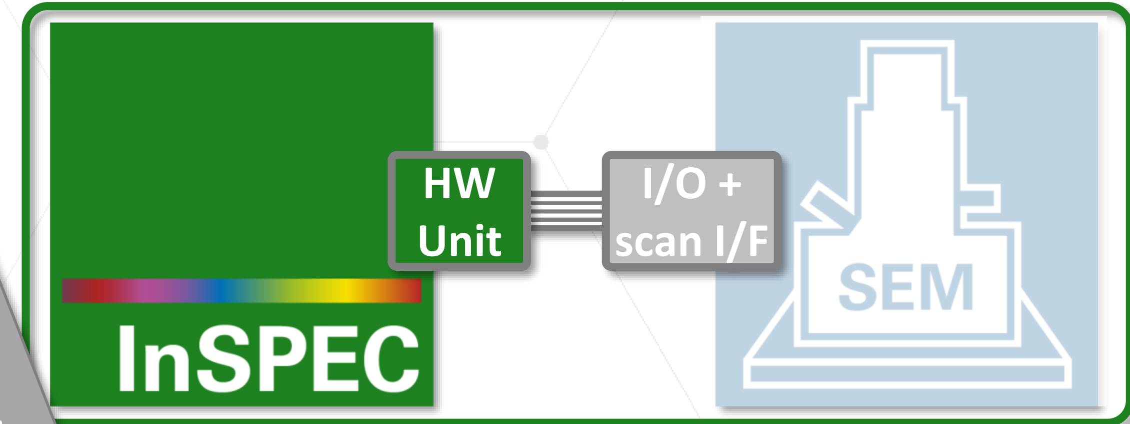
- Measurements for Process Calibration



- Multi-Chip Metrology Job



→ Session at 1:30 pm
Meeting room 1st floor



- Upgrade Kit for a Metrology SEM
- Integrated scanning, automation & metrology
- Direct SEM control with hardware integration
- Multi-Chip jobs with hierarchical structure
- Comprehensive full layout-based workflow
- Expert metrology & data processing with “FLOW”