

# ProSEM

What's New in ProSEM 3.6

## *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)

# General

## Operating system (OS) supported by ProSEM

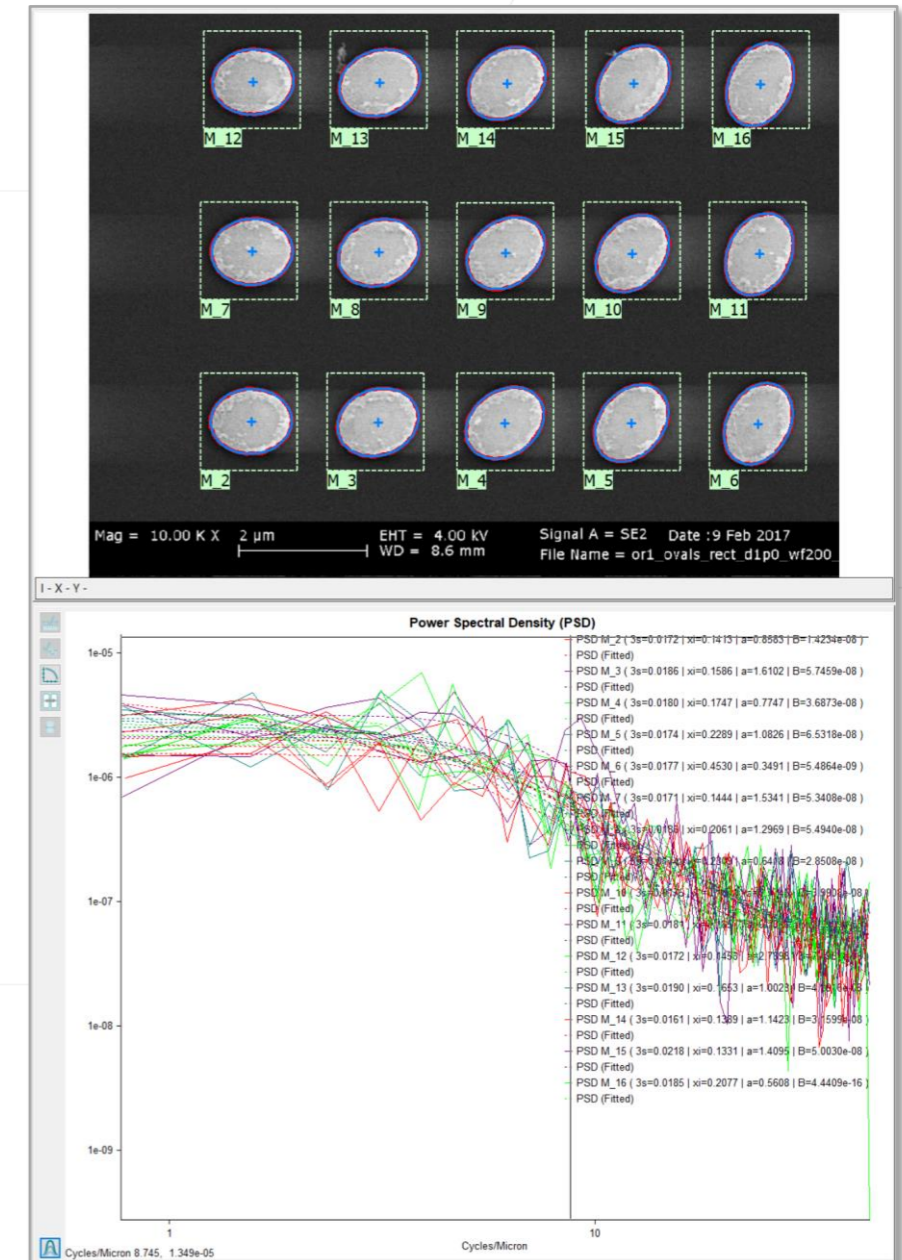
- Release 3.5
  - Windows: 10 or 11, 64-bit
  - Redhat/Centos Linux: 7 or 8, 64-bit
  - Ubuntu Linux: 18.04 or 20.04, 64-bit
- NEW Release 3.6
  - Windows: 10 or 11, 64-bit
  - Redhat/Centos Linux: 7, 8, or 9, 64-bit
  - Ubuntu Linux: 20.04 or 22.04, 64-bit

# Feature Detect & Measure

## Groups and edge roughness measurements

- Updated functionality for LER with groups
- For Lines&Spaces/ Gratings
  - Average PSD shown when selecting group
- For 2D shapes new behavior
  - All PSD shown when selecting group
  - Single PSD shown for each feature

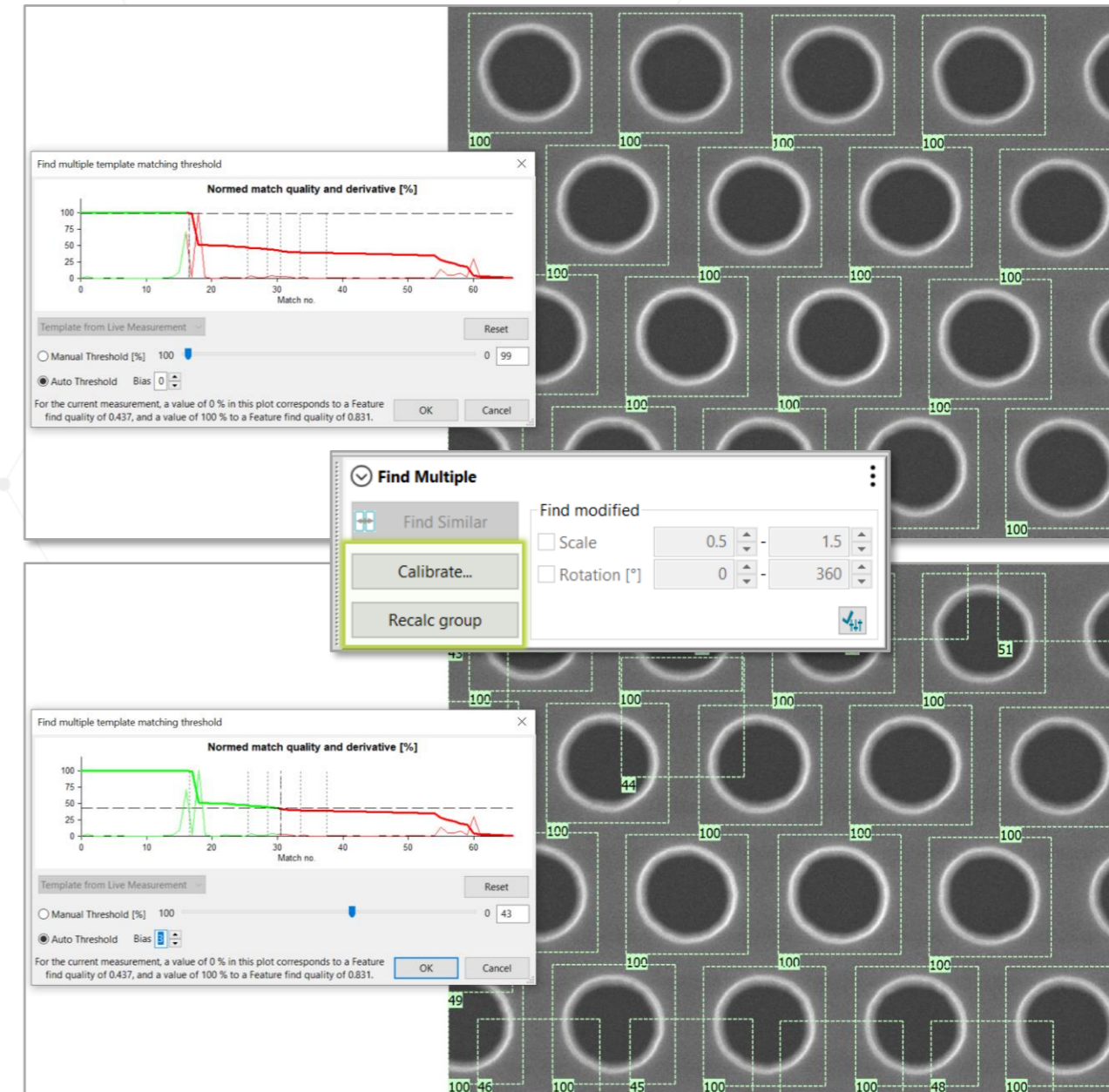
→ Improves the usability for edge roughness of 2D shapes



## 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



The screenshot displays a grid of circular features with green dashed bounding boxes. Each feature is labeled with a percentage value, mostly 100, indicating high match quality. Two control panels are overlaid on the image:

**Find multiple template matching threshold** (top panel):

- Graph: Normed match quality and derivative [%] vs Match no. (0 to 60). The y-axis ranges from 0 to 100. A red line shows the match quality, which starts at 100 and drops to approximately 50 after match 15. A green line shows the derivative, which peaks at match 15.
- Template from Live Measurement: Reset button.
- Manual Threshold [%]: 100 (slider at 0, input field at 99).
- Auto Threshold: Bias 0 (input field).
- Text: For the current measurement, a value of 0 % in this plot corresponds to a Feature find quality of 0.437, and a value of 100 % to a Feature find quality of 0.831.
- Buttons: OK, Cancel.

**Find Multiple** (middle panel):

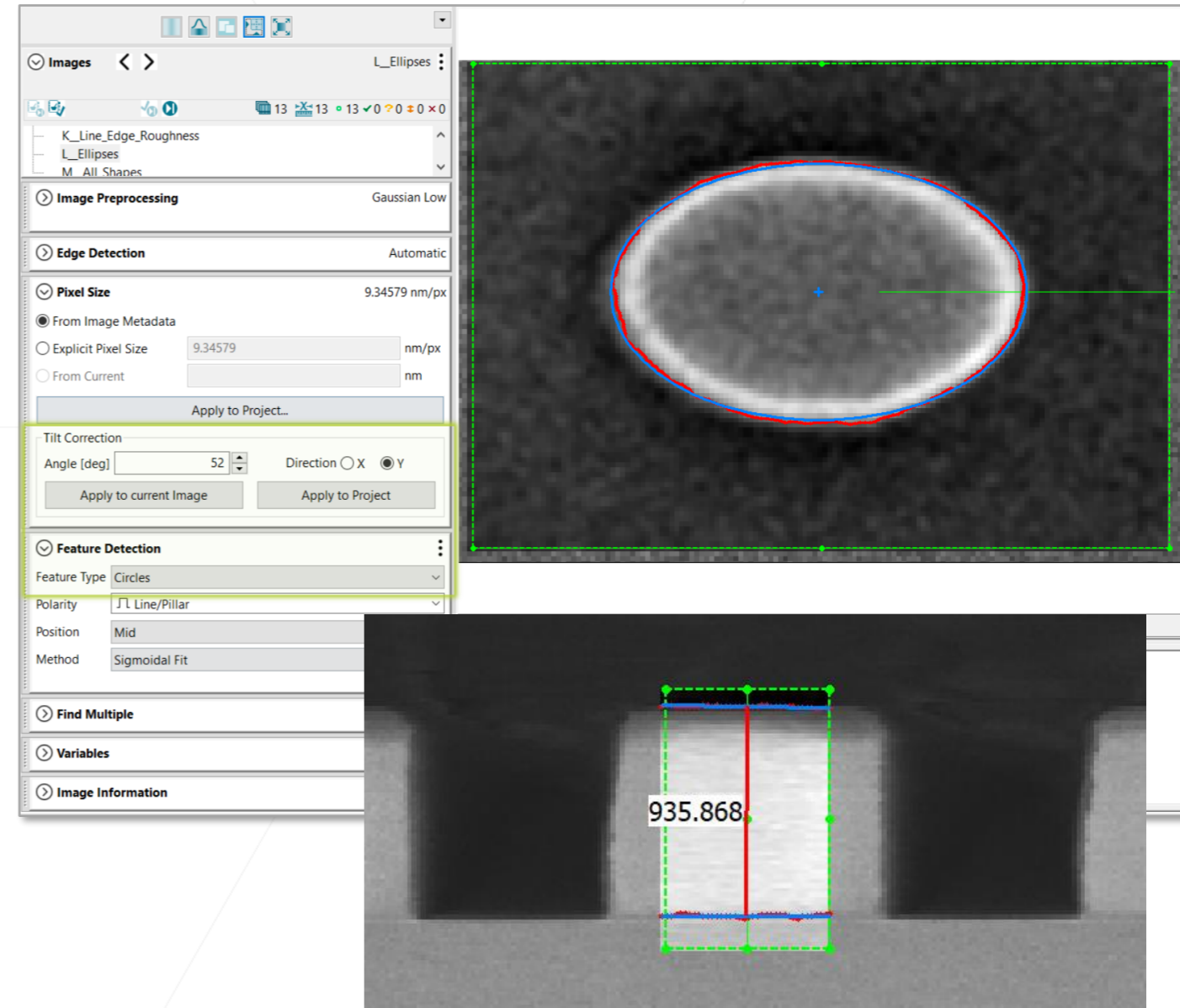
- Find Similar: + icon.
- Calibrate... button (highlighted with a green box).
- Recalc group button.
- Find modified:
  - Scale: 0.5 (input field) to 1.5 (input field).
  - Rotation [°]: 0 (input field) to 360 (input field).
- Buttons: OK, Cancel.

**Find multiple template matching threshold** (bottom panel):

- Graph: Normed match quality and derivative [%] vs Match no. (0 to 60). The y-axis ranges from 0 to 100. A red line shows the match quality, which starts at 100 and drops to approximately 50 after match 15. A green line shows the derivative, which peaks at match 15.
- Template from Live Measurement: Reset button.
- Manual Threshold [%]: 100 (slider at 0, input field at 43).
- Auto Threshold: Bias 0 (input field).
- Text: For the current measurement, a value of 0 % in this plot corresponds to a Feature find quality of 0.437, and a value of 100 % to a Feature find quality of 0.831.
- Buttons: OK, Cancel.

## 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





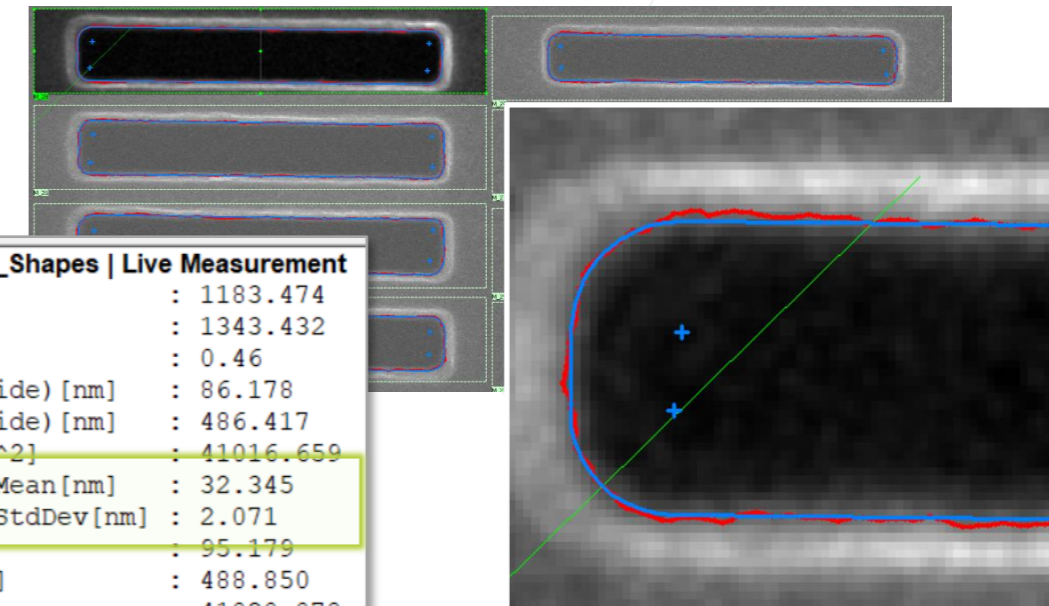
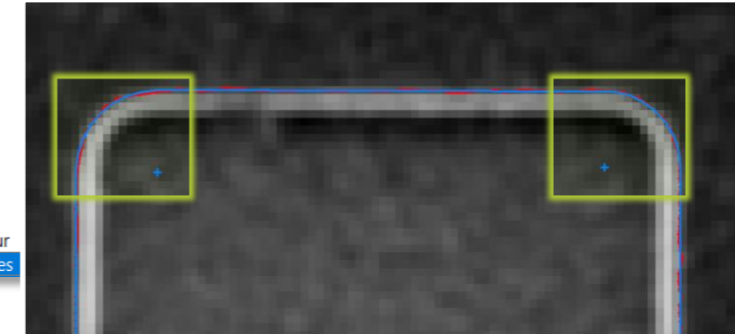
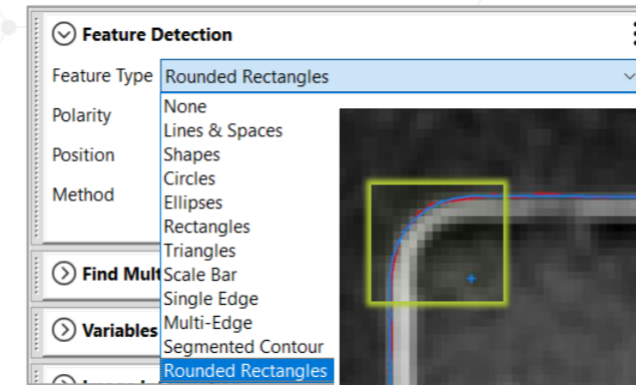
# New Feature Type “Rounded Rectangles”

## 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

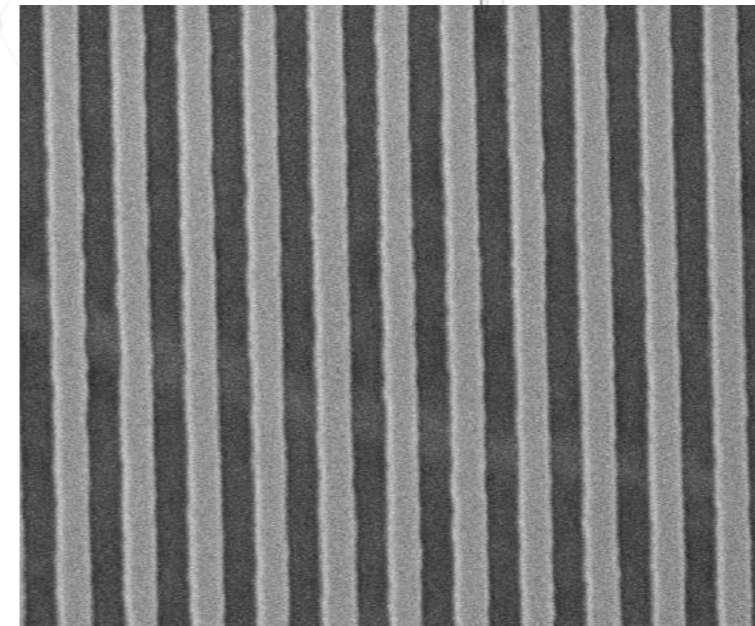
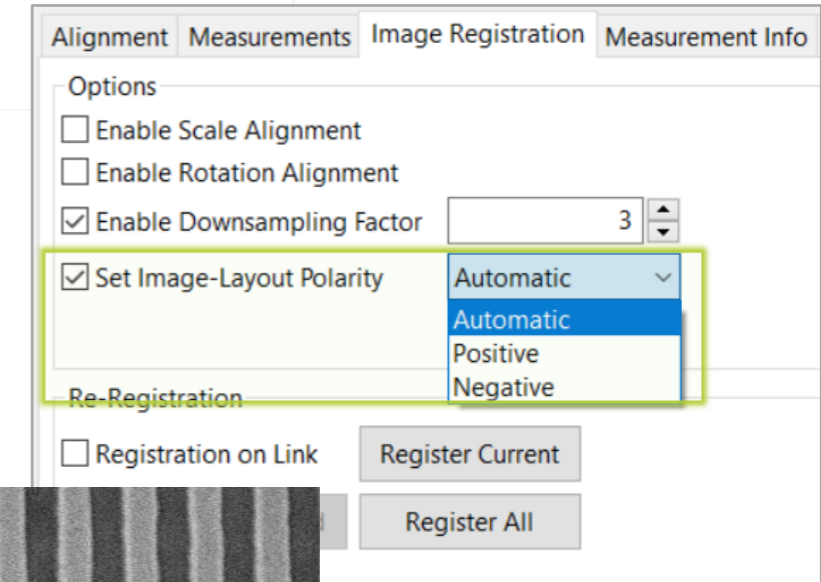


J_Rectangles_or_Shapes   Live Measurement	
Center X[nm]	: 1183.474
Center Y[nm]	: 1343.432
Rotation[deg]	: 0.46
Width (short side)[nm]	: 86.178
Height (long side)[nm]	: 486.417
Fitted Area[nm <sup>2</sup> ]	: 41016.659
Corner Radius Mean[nm]	: 32.345
Corner Radius StdDev[nm]	: 2.071
BBox Width[nm]	: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

# Layout/ SEM tool control

## User control for image-to-layout registration

- Control over image polarity for registration
  - Important for measurement of periodic structures
  - Set image polarity according to
    - Positive: layout bright in SEM
    - Negative: layout dark in SEM
- Improves robustness and accuracy
- Better control for truly periodic patterns

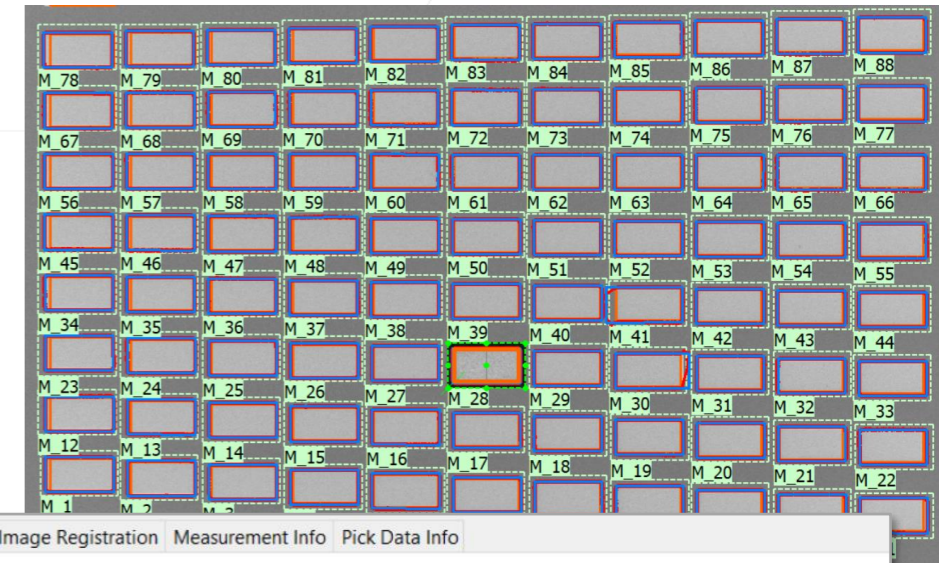


## Layout registration with standard measurements

- Automation list supports different feature types
- Usually, includes fitting and measurement
- New type “None”: no measurement, registration only
- Easier combined with standard metrology
- Apply recipes to registered images

→ Combines layout with existing standard recipes

→ Faster and without unwanted result data



Center X [um]	Center Y [um]	Width [um]	Height [um]	Feature Type	Find Similar	Layer	Status	Key / File
-1000.000	-1340.000	24.000	14.000	Rectangle	<input checked="" type="checkbox"/>	0(1000)	scan finished	<automatic>
-1000.000	-1220.000	24.000	14.000	None	<input checked="" type="checkbox"/>	0(1000)	scan finished	<automatic>
0.000	-1340.000	24.000	14.000	Lines & Space	<input checked="" type="checkbox"/>	0(1000)	scan finished	<automatic>
0.000	-1220.000	24.000	14.000	Circles	<input checked="" type="checkbox"/>	0(1000)	scan finished	<automatic>
1000.000	-1340.000	24.000	14.000	Ellipses	<input checked="" type="checkbox"/>	0(1000)	scan finished	<automatic>
1000.000	-1220.000	24.000	14.000	Rectangles	<input checked="" type="checkbox"/>	0(1000)	scan finished	<automatic>
1000.000	-1220.000	24.000	14.000	Shapes	<input checked="" type="checkbox"/>	0(1000)	scan finished	<automatic>

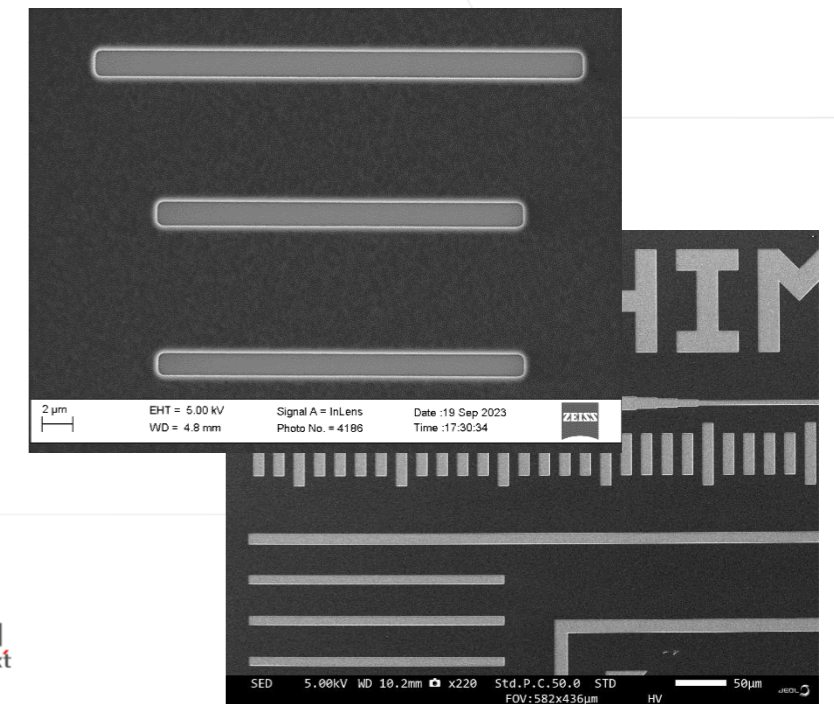
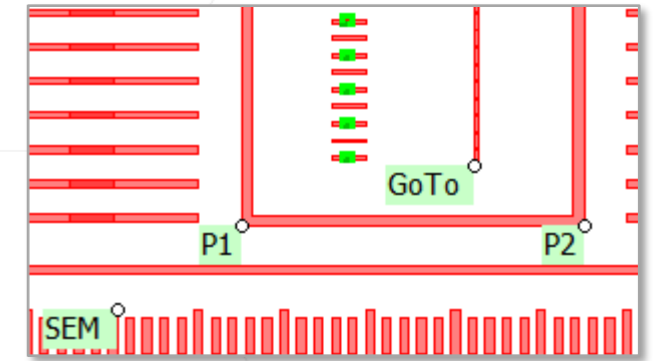


## Convenience shortcut for SEM drive

- 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



# Thank You!

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