GenISys
Advancing the Standard

LAB

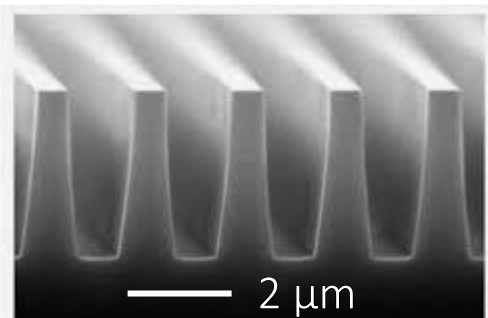
What‘s new v5.5

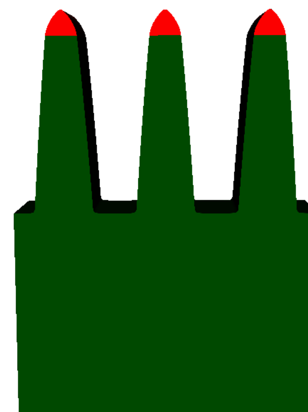
Etching

New Etching Model

A new etching model has been implemented to enhance etching simulation.

- The new model is based on the published paper: ***Etch Simulations for Lithography Engineers*** *by Robert Jones, etc. Optical Microlithography XV, SPIE Vol. 4691, pp. 1232-1242.*
- The etching parameters can be calibrated using the Calibration Module.





AZ3312
Si-crystalline

Etching ▶|

Etch Settings

General | Result Settings | Label/Comment

Database Parameters

☐ Load Parameters from Database

Process: etch1

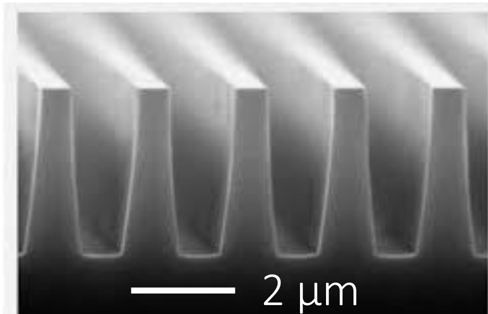
Etch time [s]: 350.000000

Material	Horizontal [nm/s]	Vertical [nm/s]	Faceting
AZ3312	0.081178	1.362070	0.356997
Si-crystalline	-0.081907	4.871520	0.006032

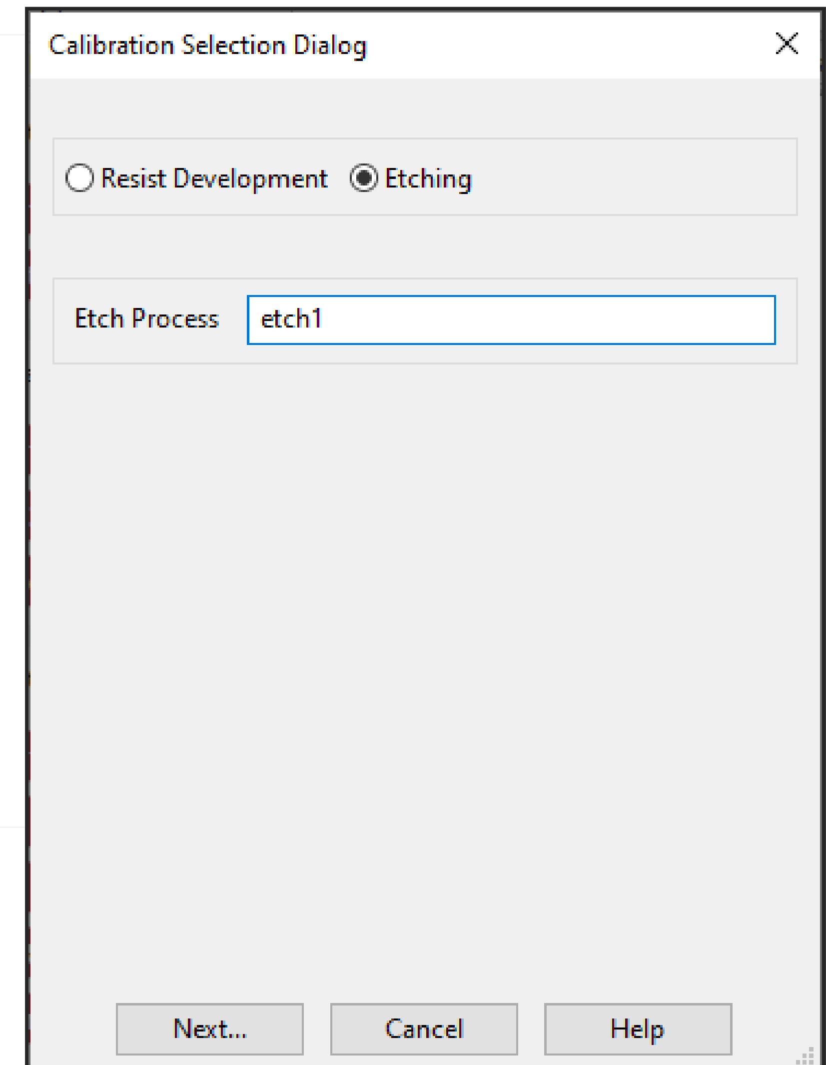
Etching Calibration

An etching process calibration is now available within the Calibration Module.

- The calibration is based on cross section CD measurements taken at different heights before and after the etching process.



Calibration



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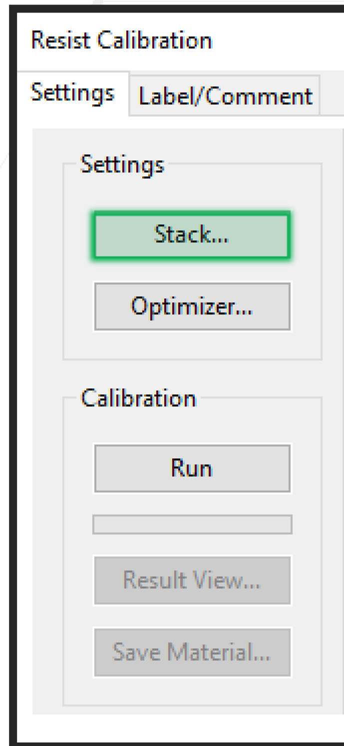
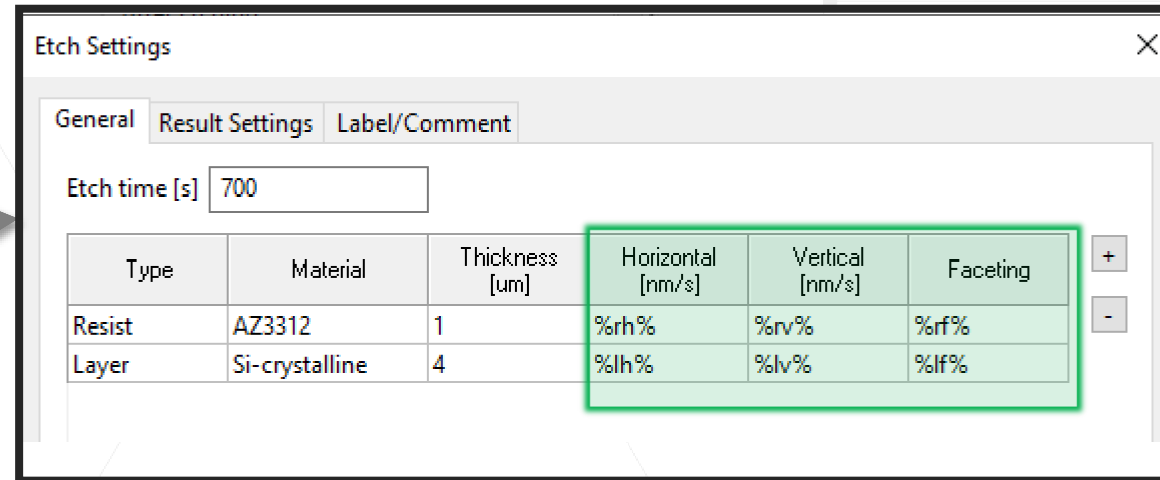
Etching Calibration Setup

Stack definition




Etch Settings

General | Result Settings | Label/Comment

Etch time [s] 700

Type	Material	Thickness [um]	Horizontal [nm/s]	Vertical [nm/s]	Faceting
Resist	AZ3312	1	%rh%	%rv%	%rf%
Layer	Si-crystalline	4	%lh%	%lv%	%lf%

1. Each material has horizontal and vertical etching rates and a faceting parameter to describe the etching process
2. Variable is defined by a % symbol.
3. All the materials involved are defined in the stack.

Etching Calibration Setup

Cross section definition

Cross Section Definition

Before Etching

Z [um]	CD [um]
4.9	1.12
4.5	1.04
4	1

After Etching

Z [um]	CD [um]
4	1.29
2.31	1.06
0.62	0.82

Cross section defined by CD measurement for different heights

Import... Export... Import... Export...

Stack Height [um] 5.000000 Stack Height [um] 4.500000

Tolerance [nm] 20.000000

Criterion to stop the optimizer

Cross section contour view

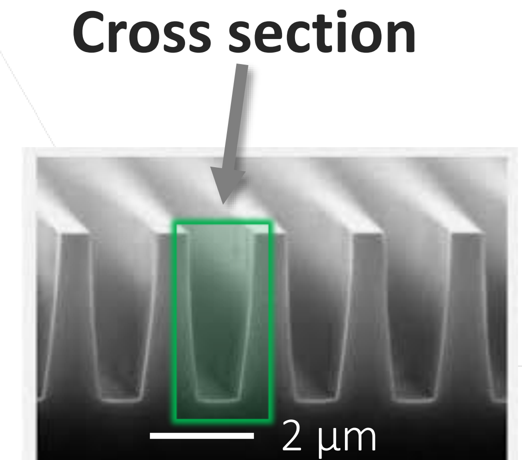
Contour View

Contour View

Z [um]

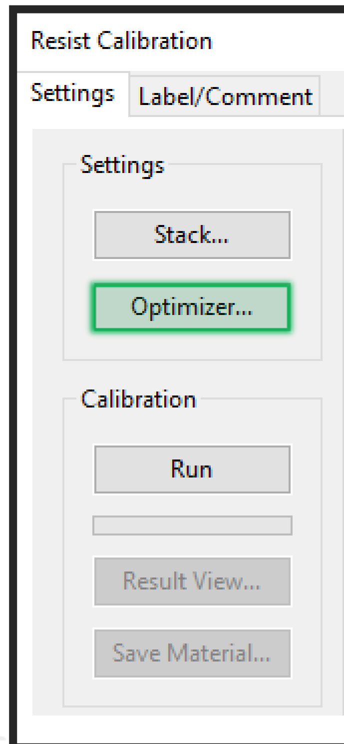
X [um]

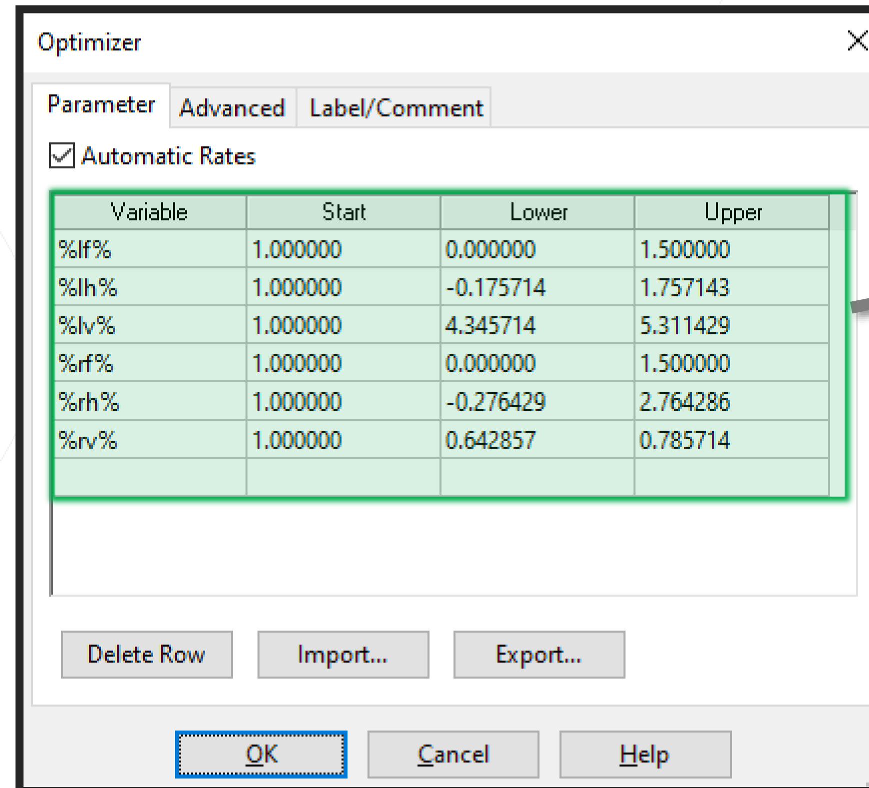
Cross section



Etching Calibration Setup

Variable definition in optimizer



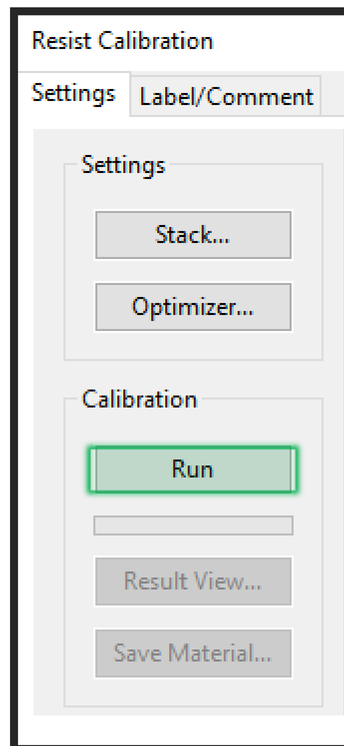


Variable range can be automatically or manually set by user.

Etching Calibration Process

Run the calibration

- Grey dotted line in contour view shows the simulated contour to compare with the target.



Contour View

Before etching (solid dark line)

After etching (dark dashed line)

calibration (grey dotted line)

Etching Calibration Process

Check the details of the calibration result

Resist Calibration

Settings | Label/Comment

Settings

Stack...

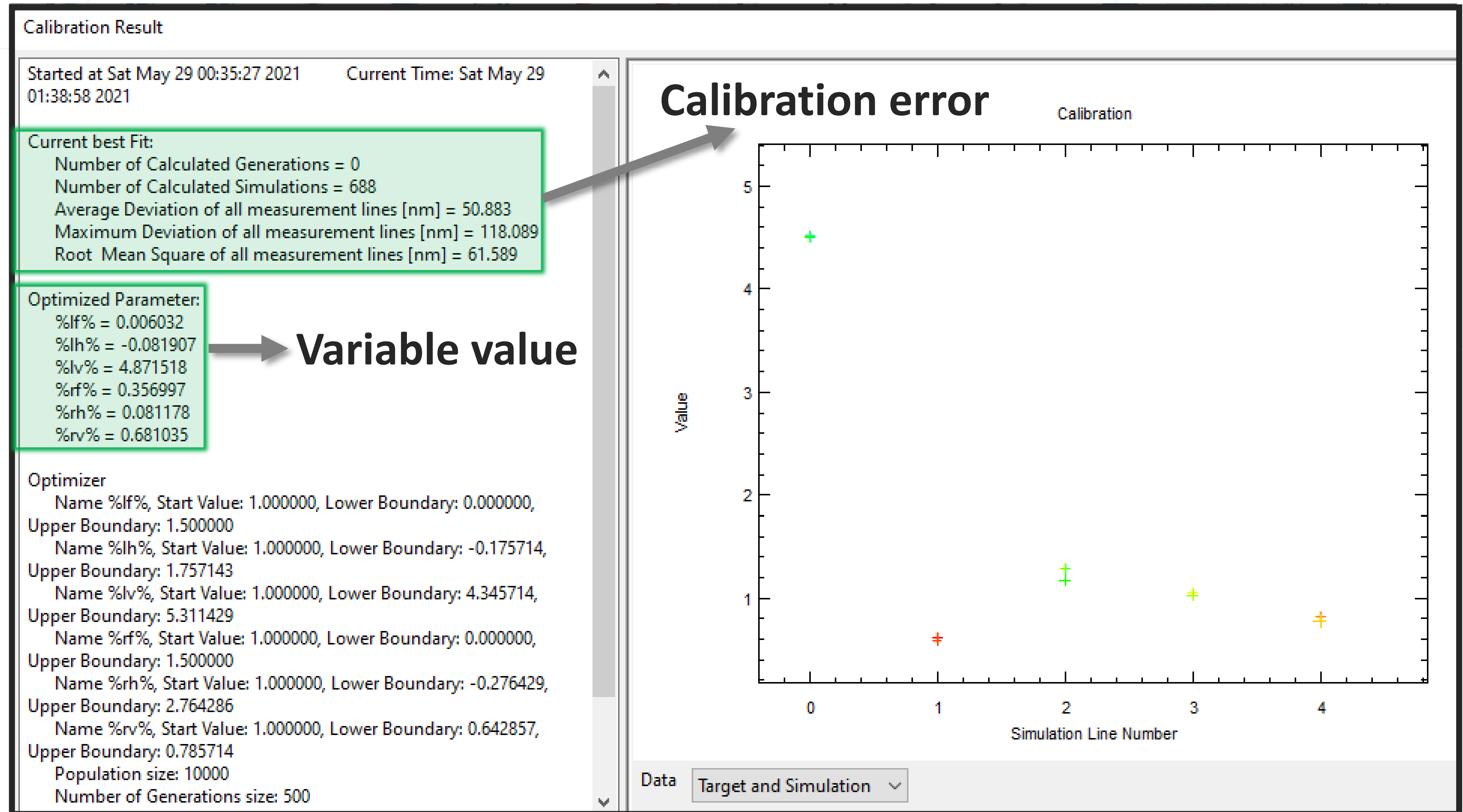
Optimizer...

Calibration

Stop

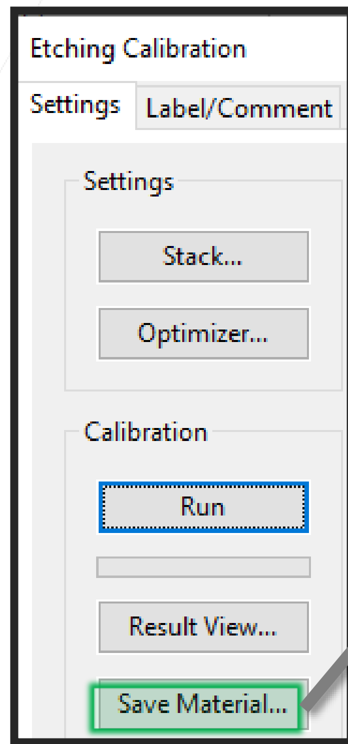
Result View...

Save Material...

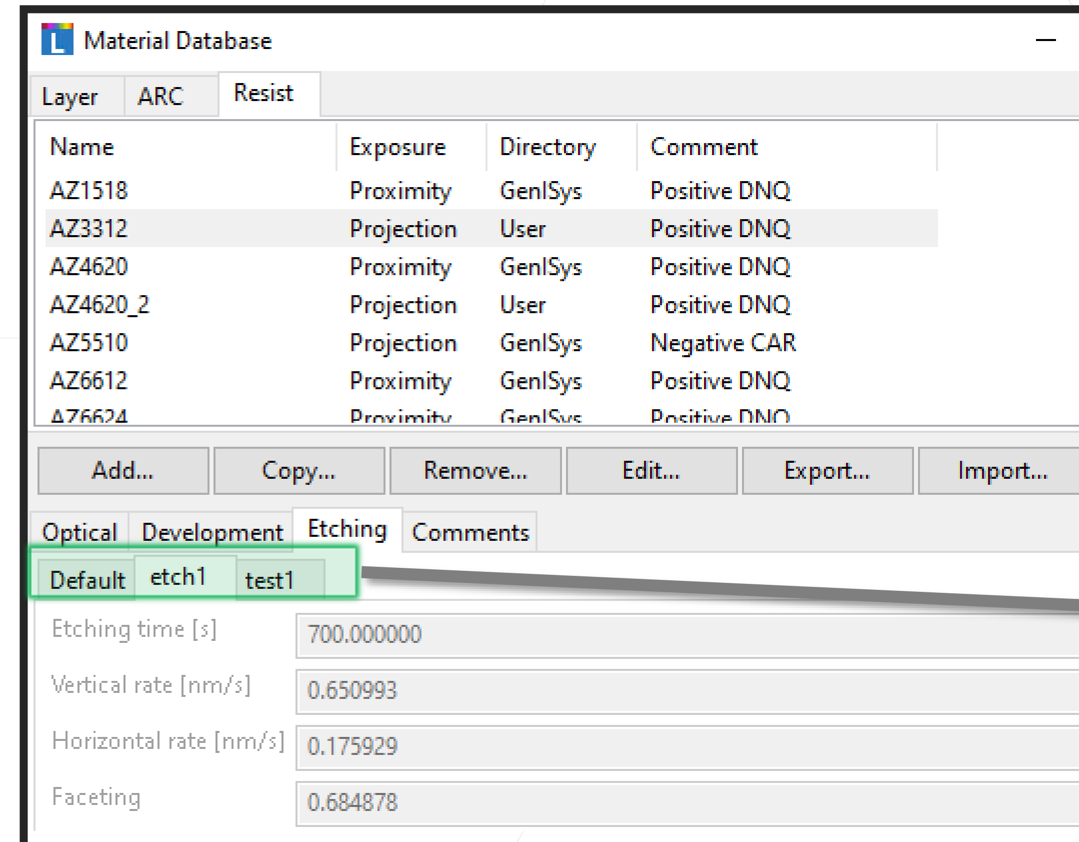


Save Etching Parameters

Save calibrated etching process in the database



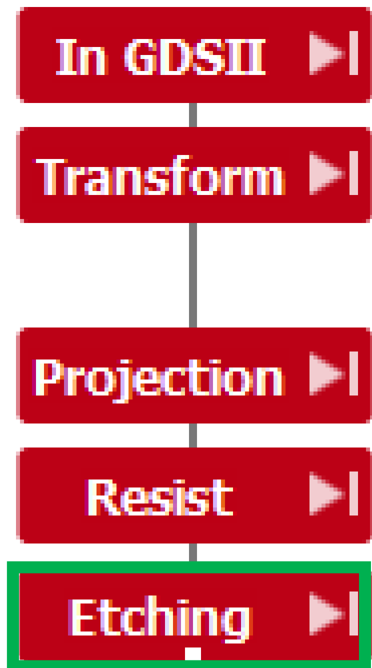
Save etching parameters in the material database

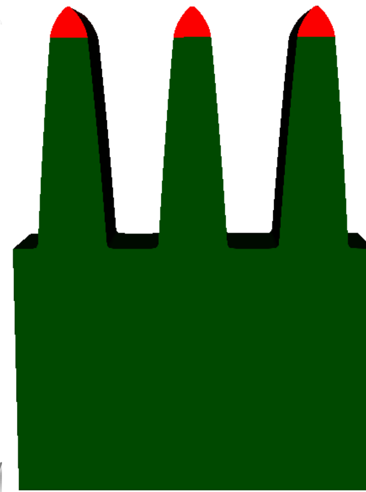


Etching parameters are saved with the process name

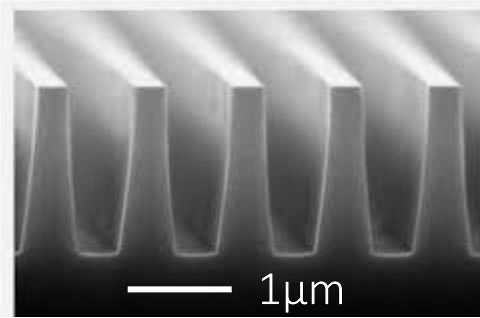
Etching Simulation

Load etching parameters from the database





AZ3312
Si-crystalline



Etch Settings

General | Result Settings | Label/Comment

Database Parameters

☑ Load Parameters from Database

Process: etch1

Etch time [s]: 700.000000

Material	Horizontal [nm/s]	Vertical [nm/s]	Faceting
AZ3312	0.175929	0.650993	0.684878
Si-crystalline	-0.382059	4.955090	0.769517

Load etching parameters from database

Projection module

Focus Drill Exposure

Focus Drill

Mask | Stack | Tool | Simulation

Projection

Exposure Dose [mJ/cm^2] 100

Focus Offset [um] -0.3

☑ Focus Drill Exposure

Focus Drill Parameters

Focus range [um] 1

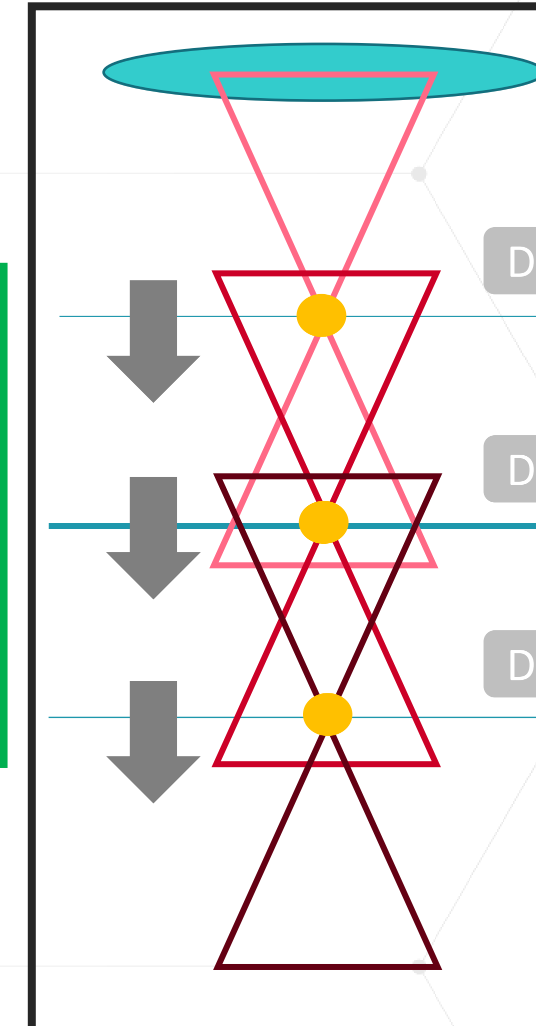
Exposure steps 3

Focus Range

-0.3+0.5 um

-0.3 um

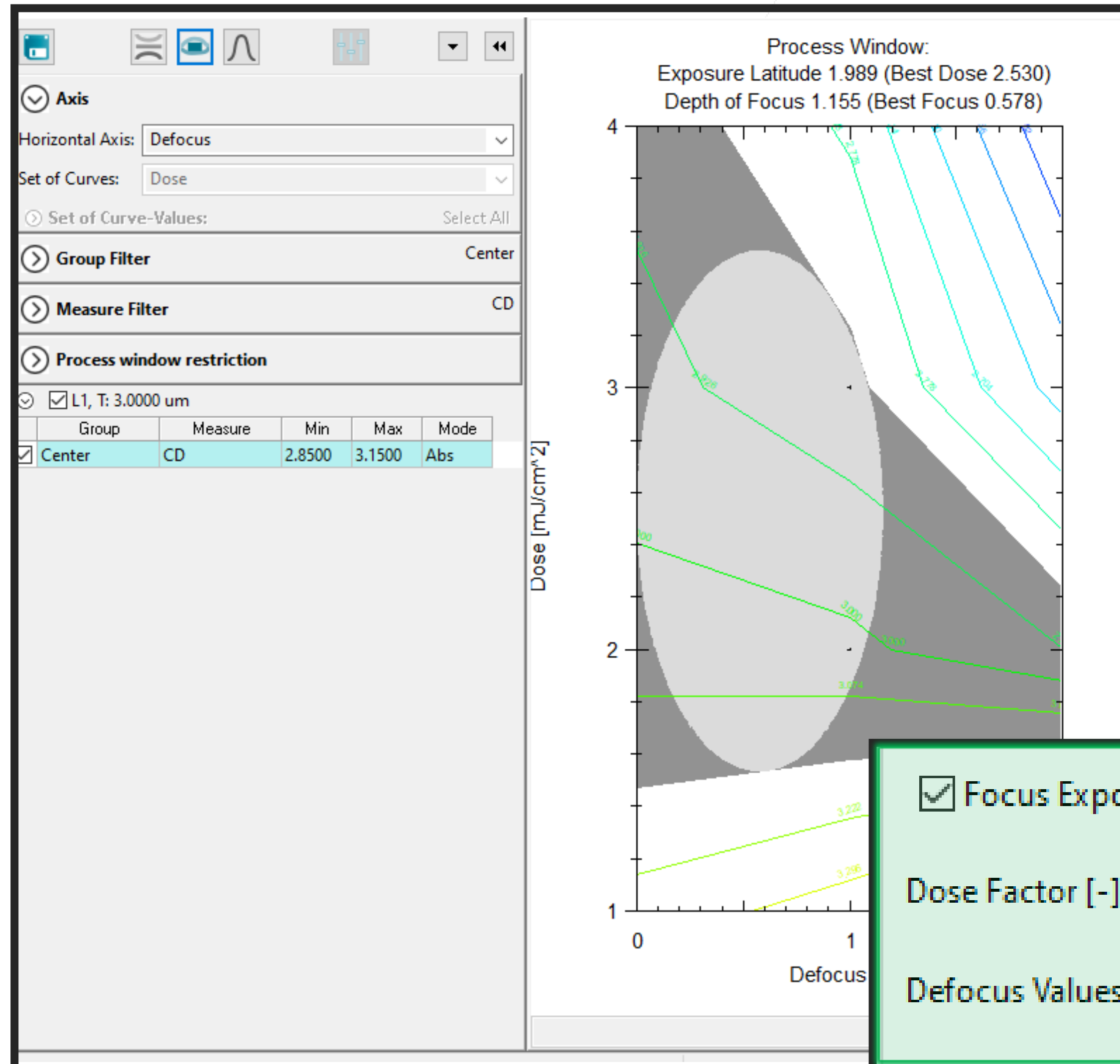
-0.3-0.5 um



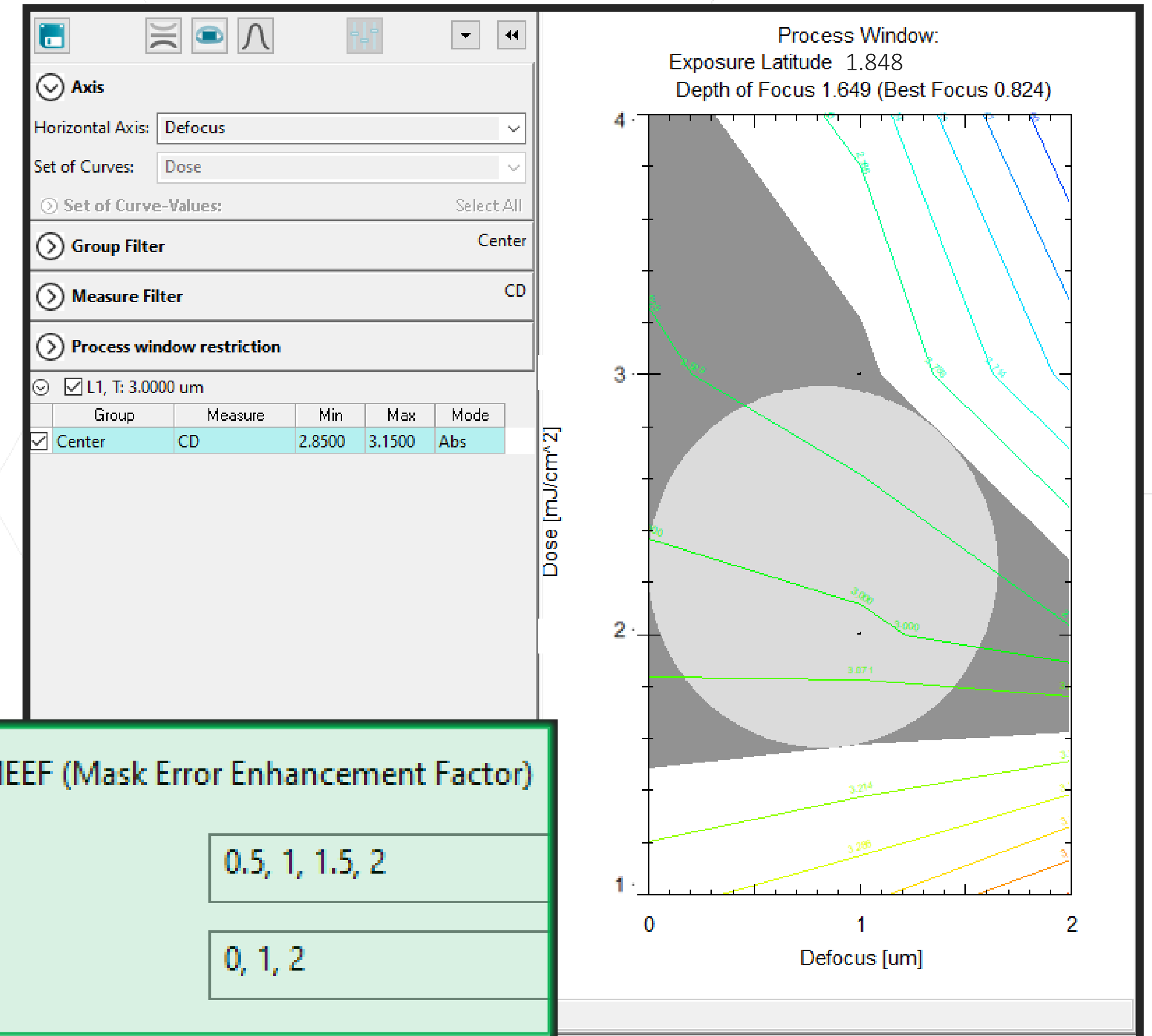
The Projection module is equipped with a Focus Drill exposure function.
The exposure is performed over a defined focus range stepped by a defined number of exposure steps. The overall exposure dose is equal to the user assigned value (Exposure Dose).

Focus Drill - Process window

Focus drill off



Focus drill on



☑ Focus Exposure Matrix ☐ MEEF (Mask Error Enhancement Factor)

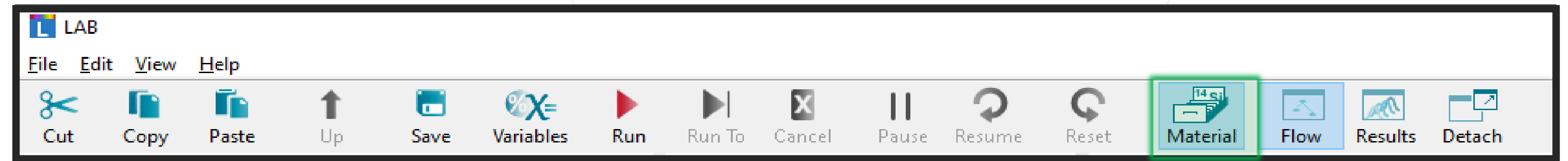
Dose Factor [-] 0.5, 1, 1.5, 2

Defocus Values [um] 0, 1, 2

Focus Drill function is compatible with Focus Exposure Matrix (FEM) analysis.

Other Modules

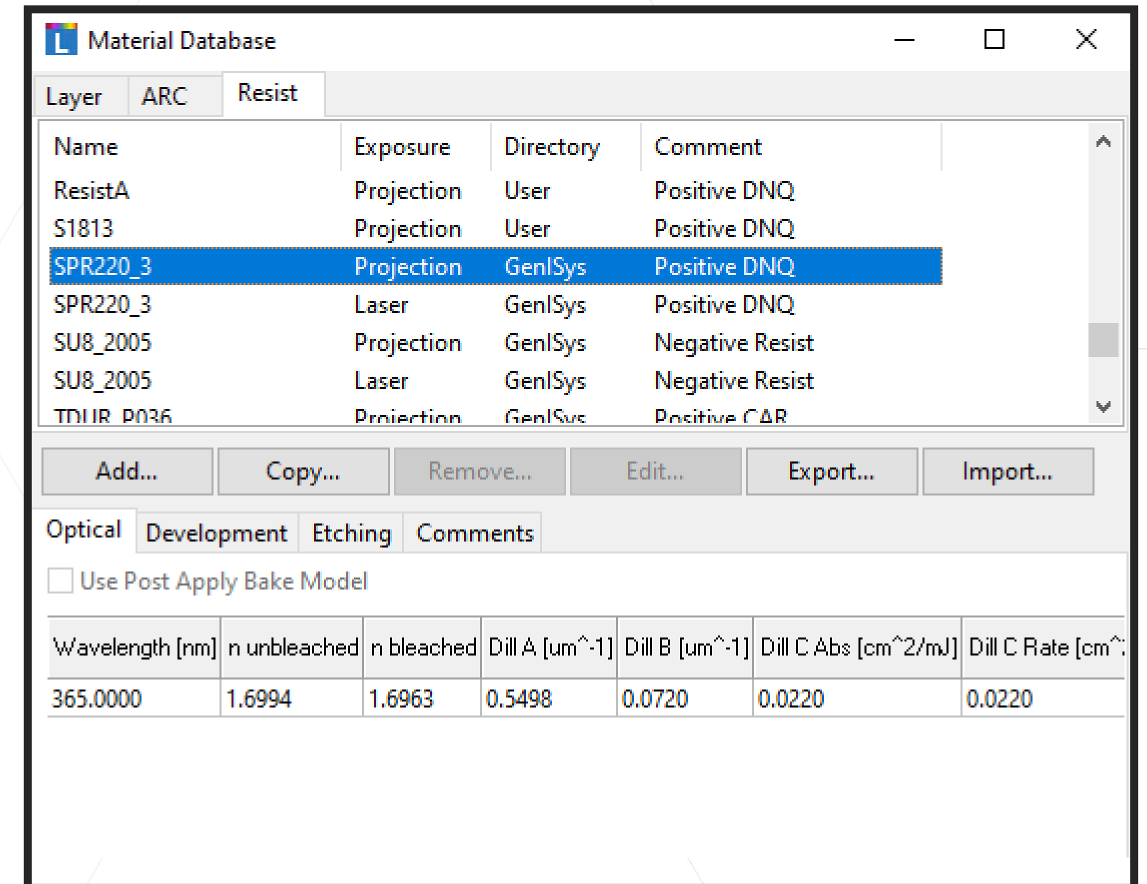
New Material in Database



- New material added in the database based on contrast curve calibration:

Resist	Thicknss	Exposure Type
AZMiR701	~ 1µm	Laser and Projection
SPR220 3.0	~ 3 µm	Laser and Projection
SU8 2005	~ 4 µm	Laser and Projection

- The source calibration flow is attached in the comments panel of the resist file.

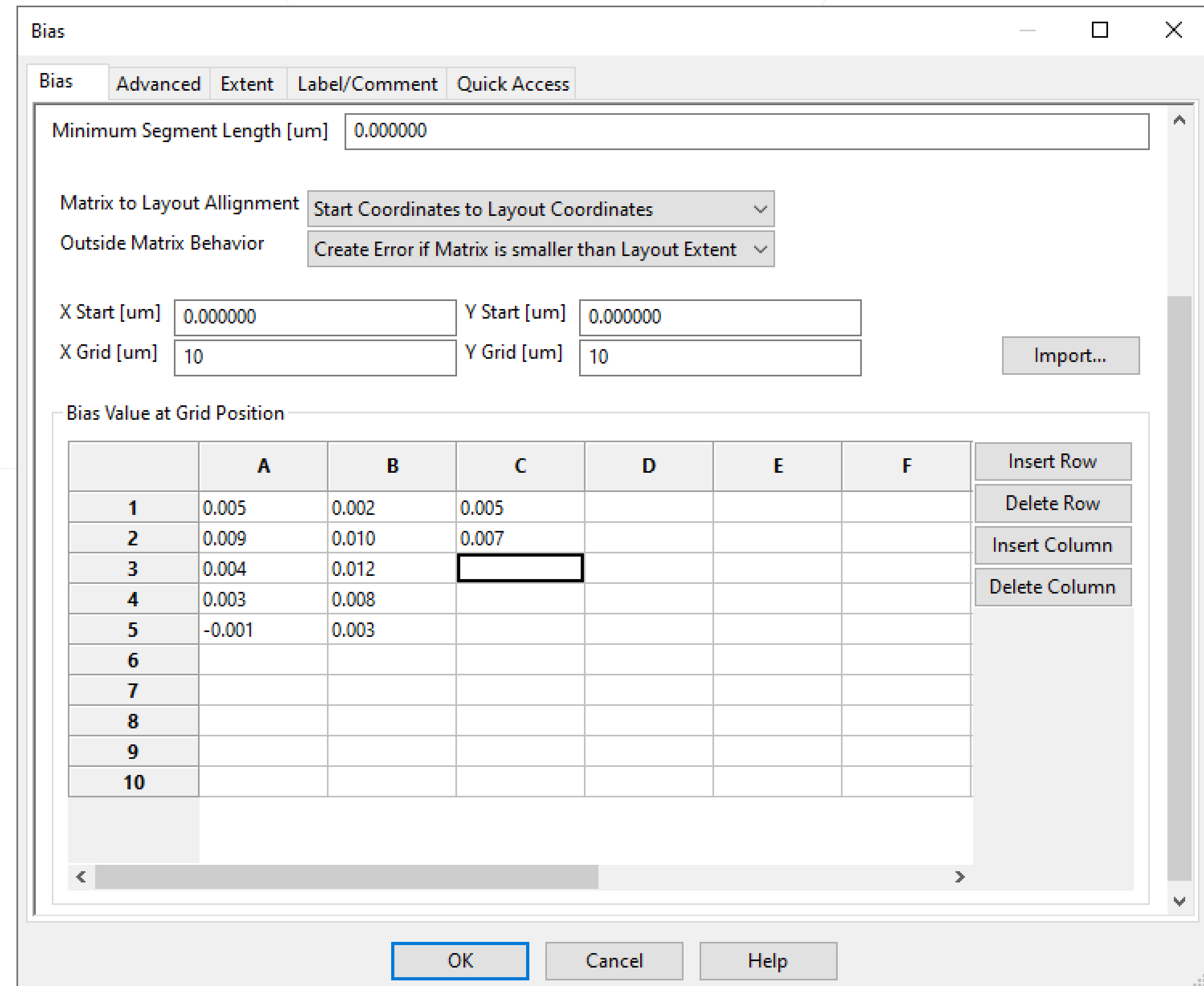


Position Dependent Bias

The BIAS can now be used with locally different biasing values depending on the location on a substrate.

The main idea is to compensate for non-uniform process effects across a larger area.

Input for the data can come from an automated measurement (via Import) or can be manually entered.



	A	B	C	D	E	F
1	0.005	0.002	0.005			
2	0.009	0.010	0.007			
3	0.004	0.012				
4	0.003	0.008				
5	-0.001	0.003				
6						
7						
8						
9						
10						

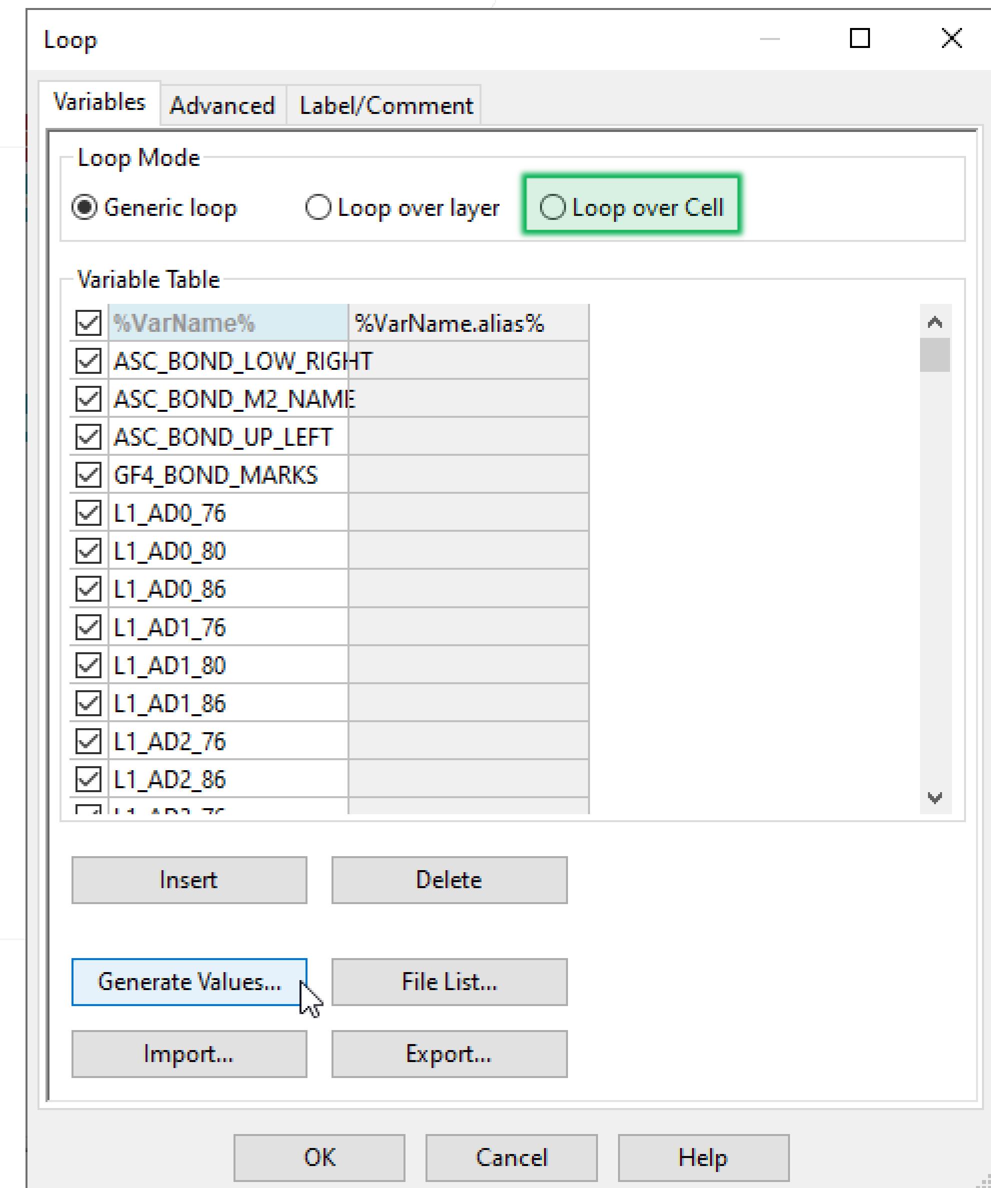
Loop over Cells

Previously - when working at the cell level of a design to iterate a process on these cells in a Loop it was necessary to know each cell name and then basically either enter these call names manually or store them in an external file and then load them.

Now –one can automatically populate the variable table with all the cells occurring in a design.

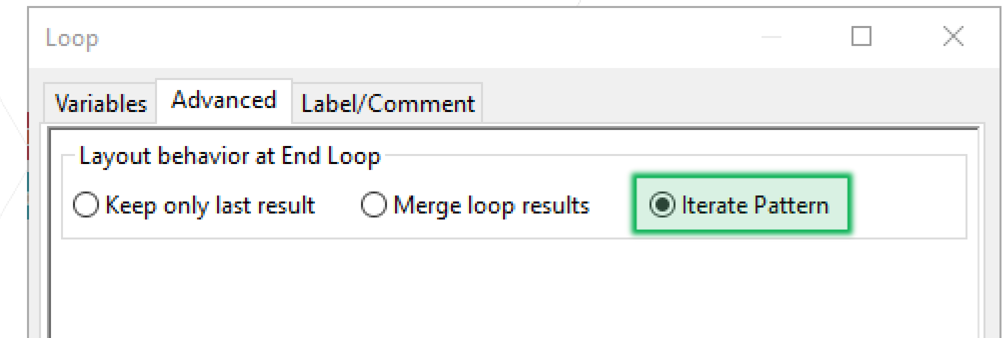
Clicking on the “Generate Values” when a pattern is attached will generate a list of all cells.

The feature works hand in hand with the “Iterate” option of loop processing on the Advanced tab.



Loop iteration of pattern

Processing a pattern cell-wise requires that the pattern is processed cell-by-cell or cells are skipped and then recombined.



With the new “Iterate pattern” feature the Loop module processes the selected cells only and thus can significantly facilitating the processing of patterns.

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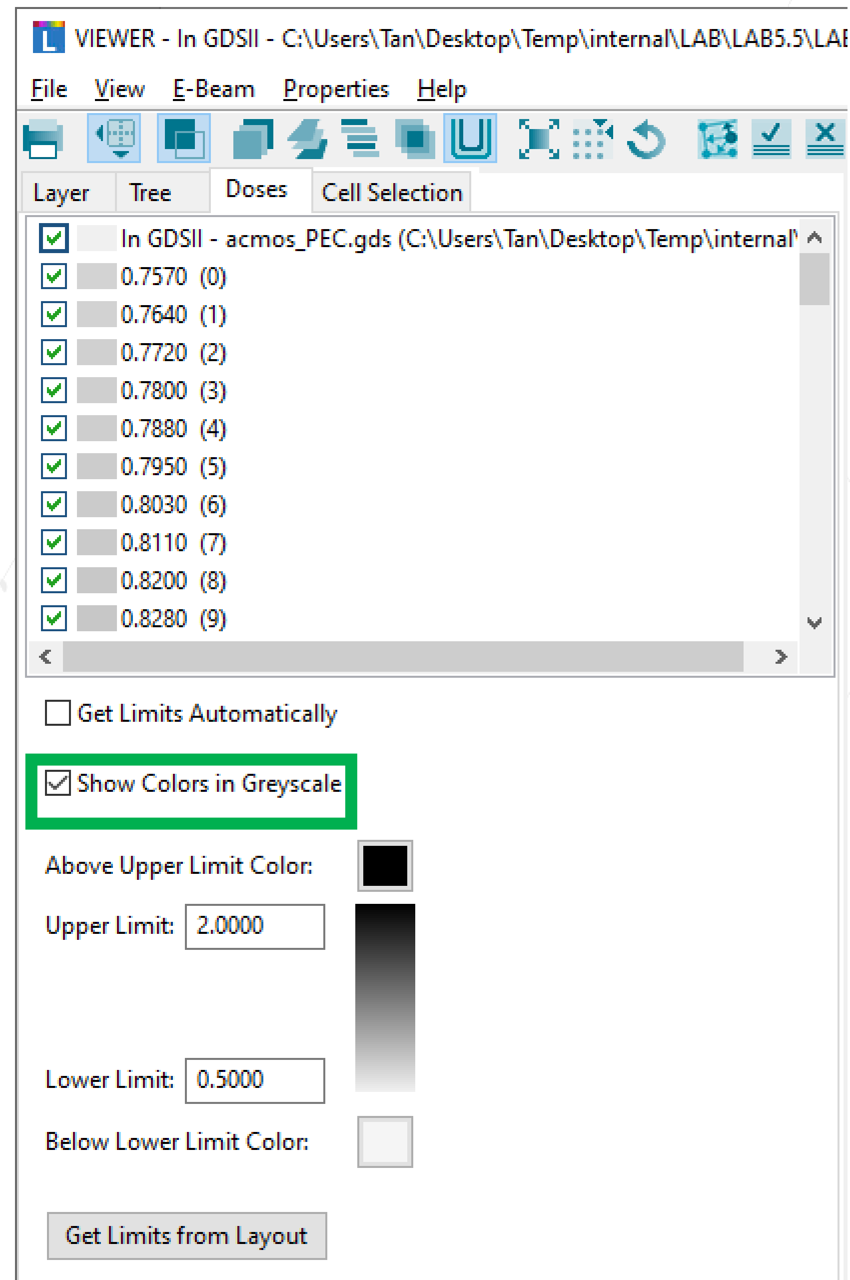
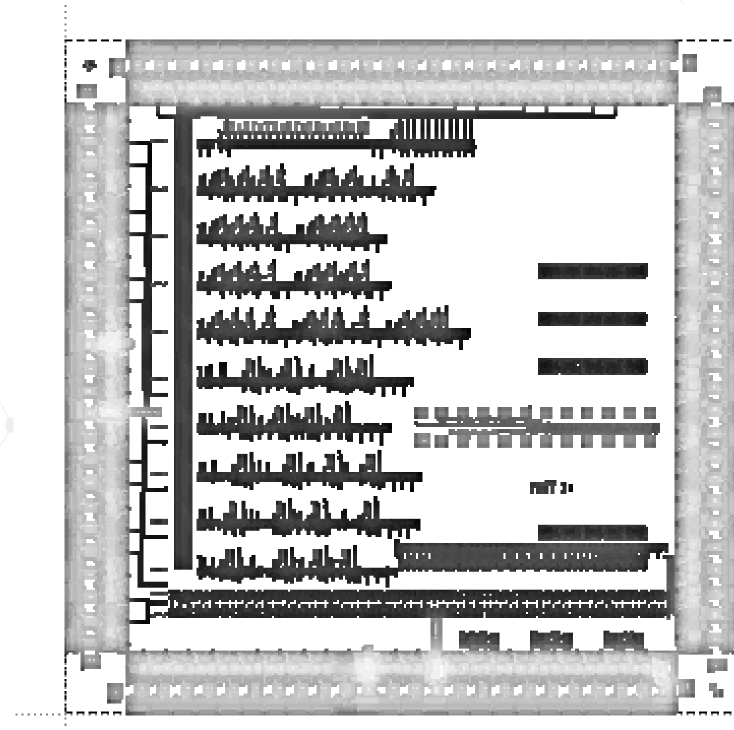
Greyscale Dose Display





- Color by Dose now allows monochromatic dose scale by selecting the checkbox “Show Colors in Greyscale”.
  - Useful for the visualization of greyscale layouts

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Thank You!

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