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Advancing the Standard

BEAMER

Update – What‘s new / What‘s coming up

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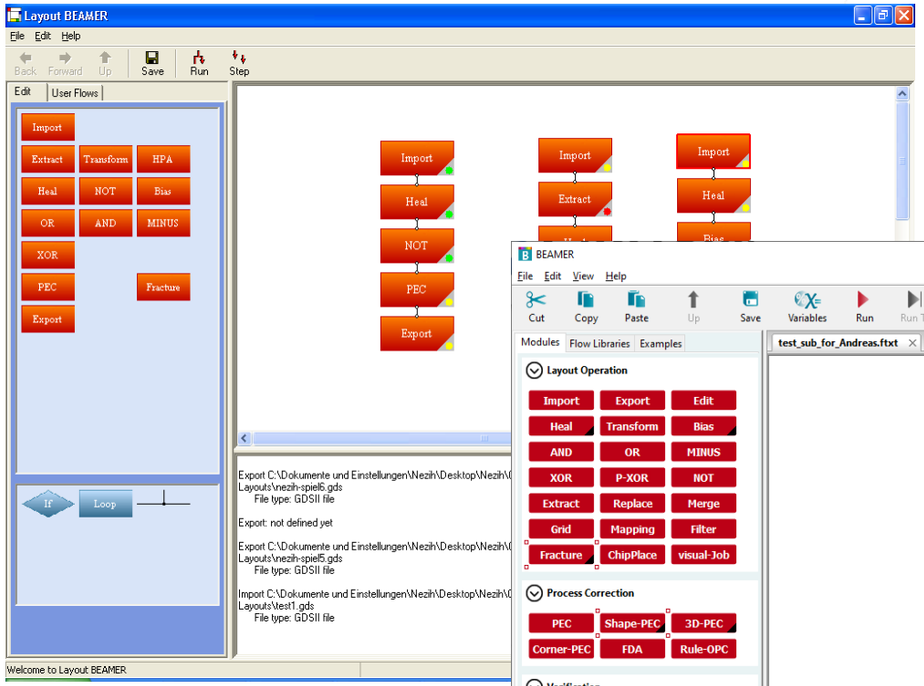
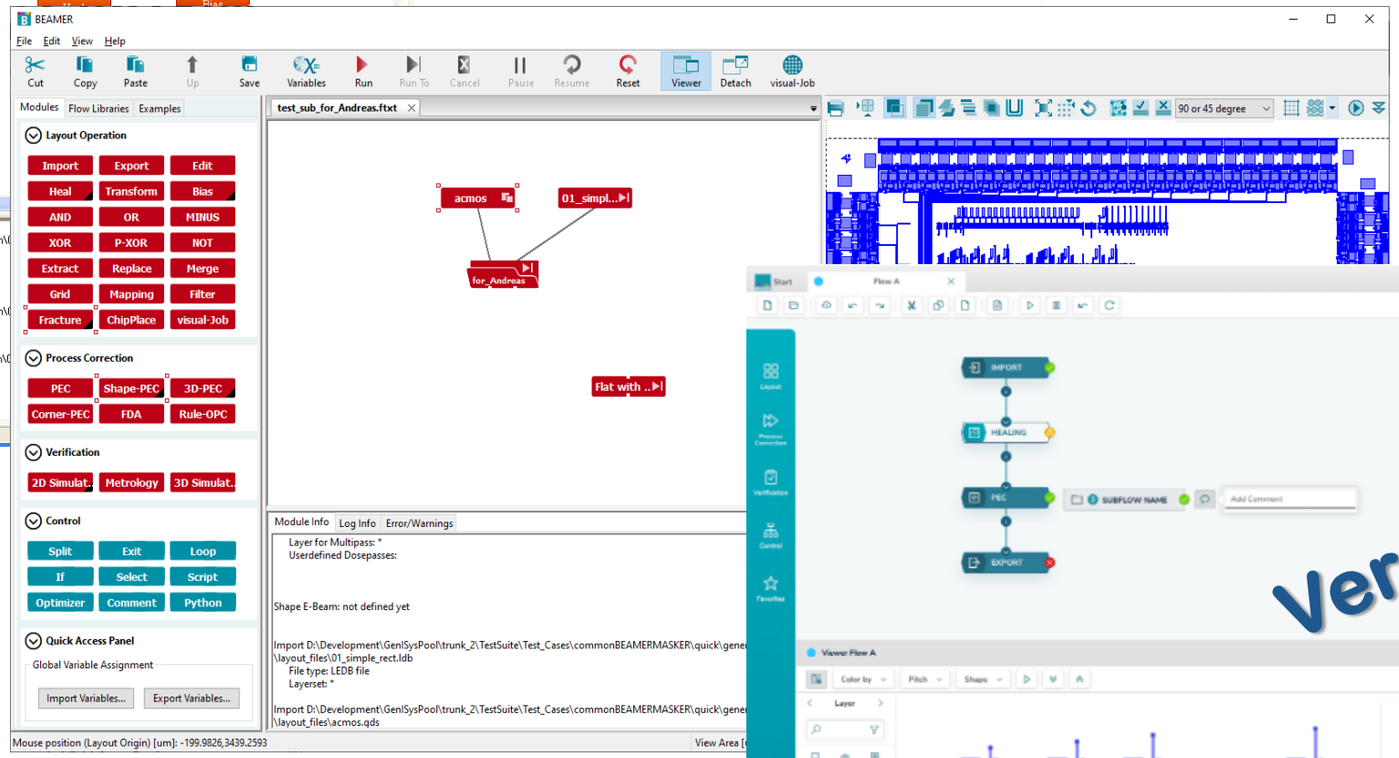
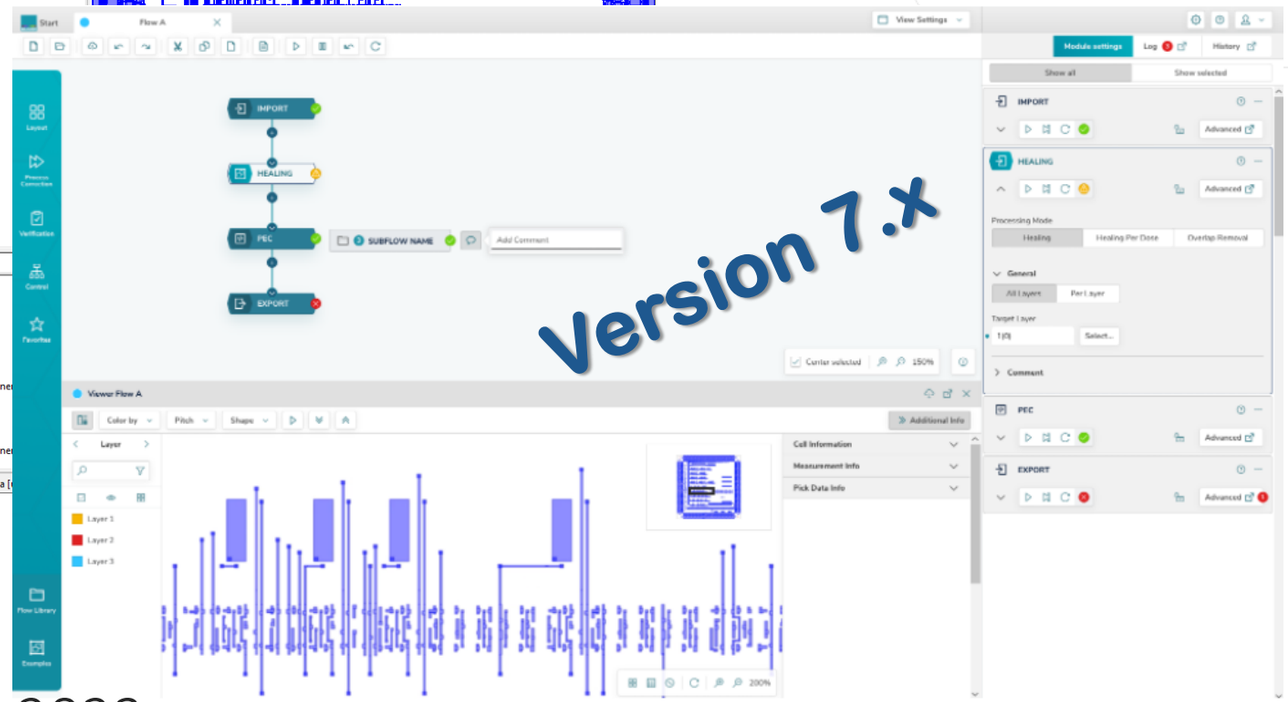
BEAMER Generations



2006 - 2010



2010 - 2022



2023 ...

Graphical user interface

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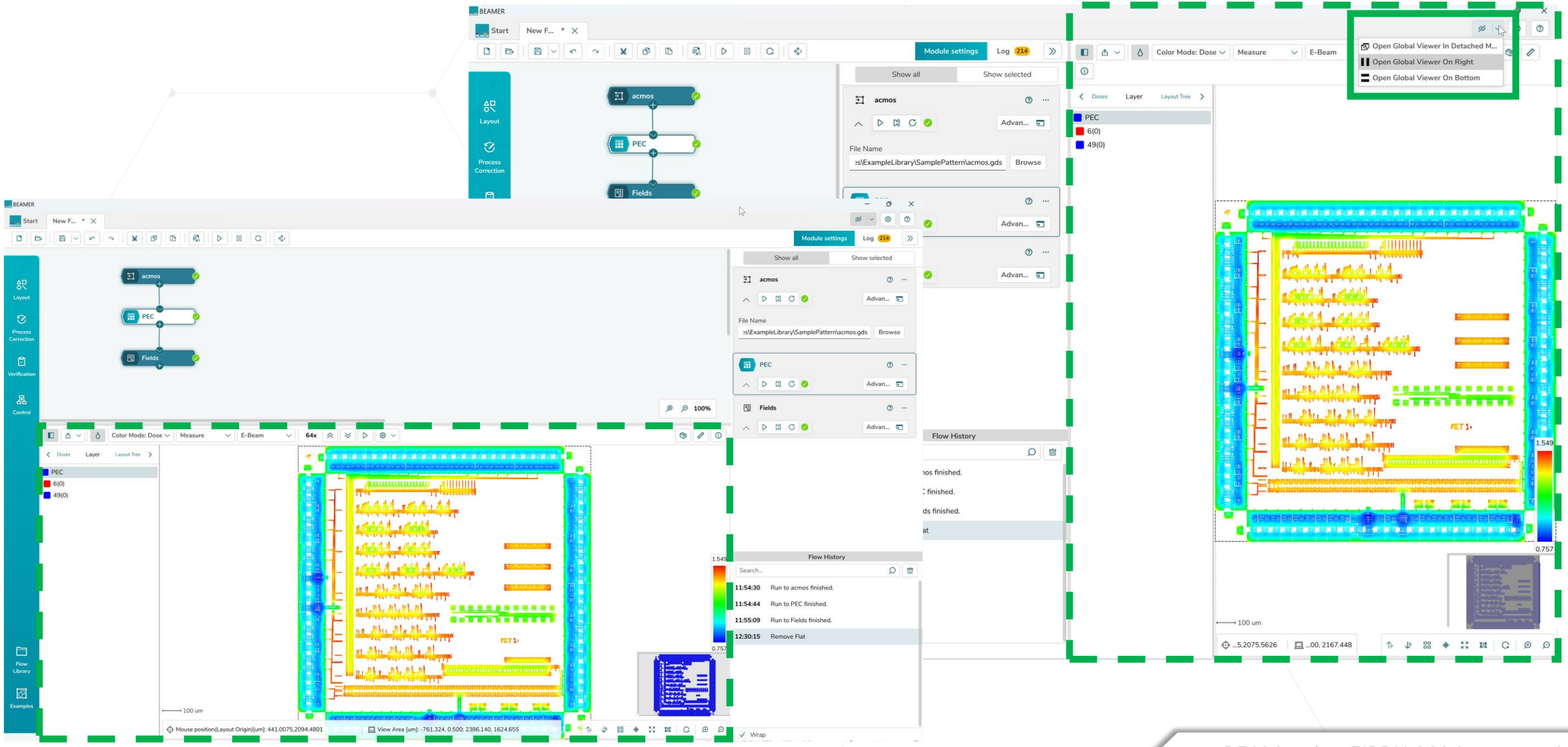
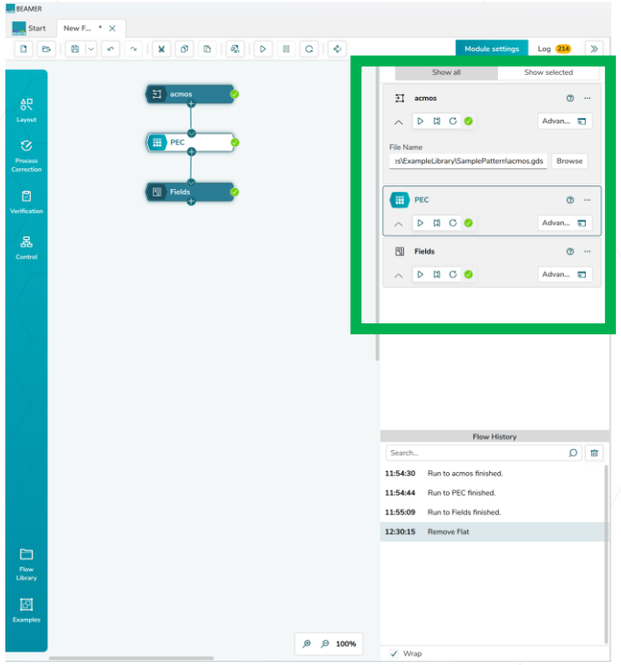
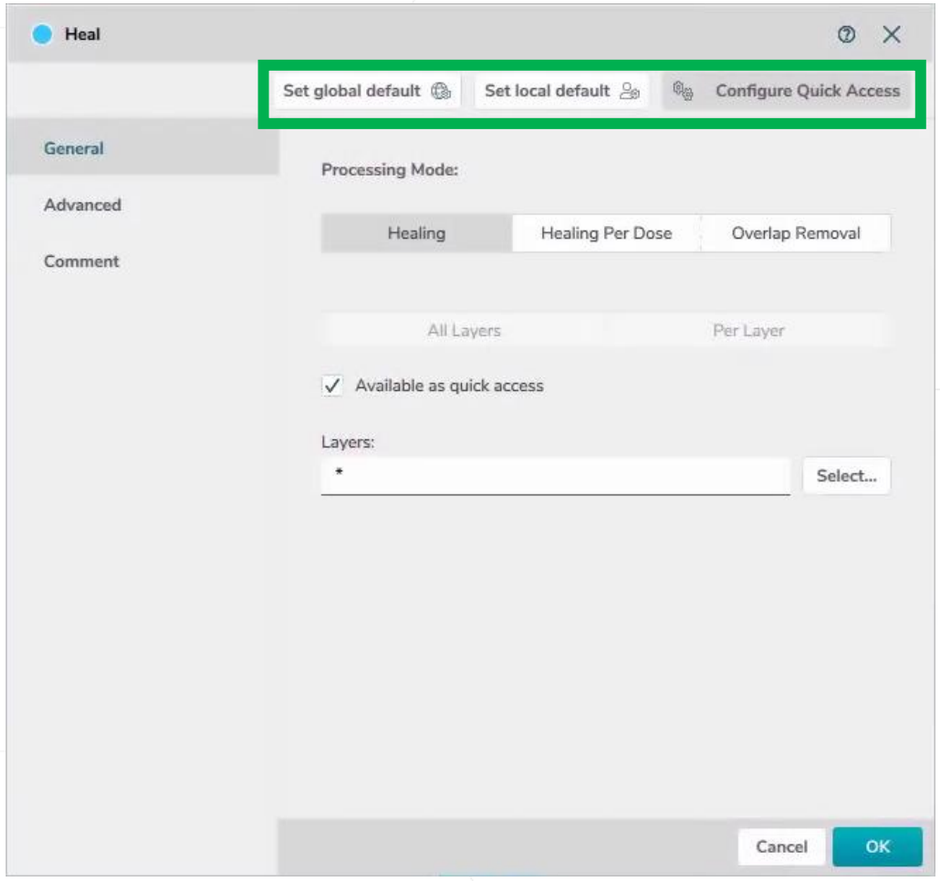
Integrated VIEWER



Quick Access Configuration

Quick Access can now be configured for the current user either as a *local default*, or as a *global default* in which case for all **BEAMER** users Quick Access applies for the selected values. The local default overrides the global setting.

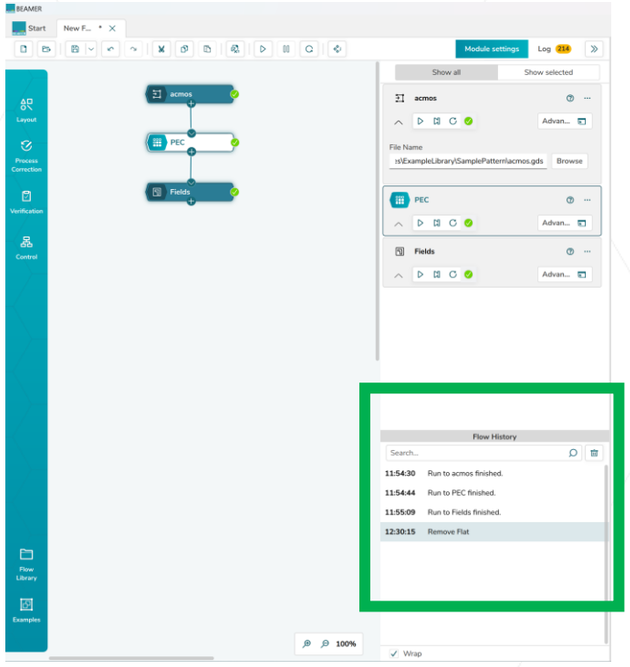


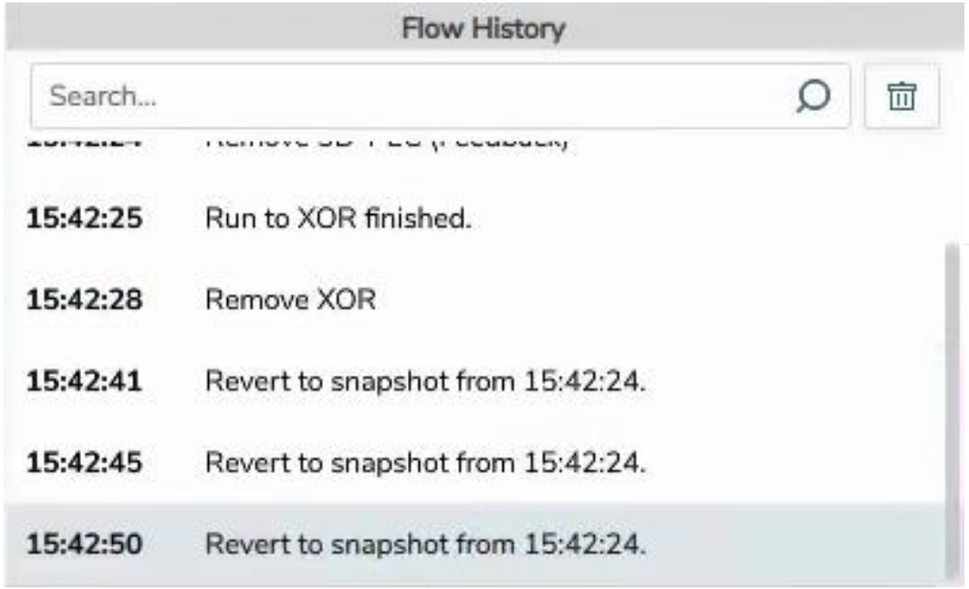


Flow History

The Flow history feature allows to revert to a previous status of a module whose parameters have been since updated.

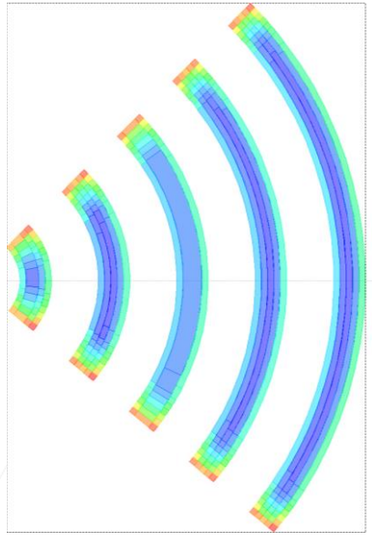
Also accidental deletes can be restored including results.

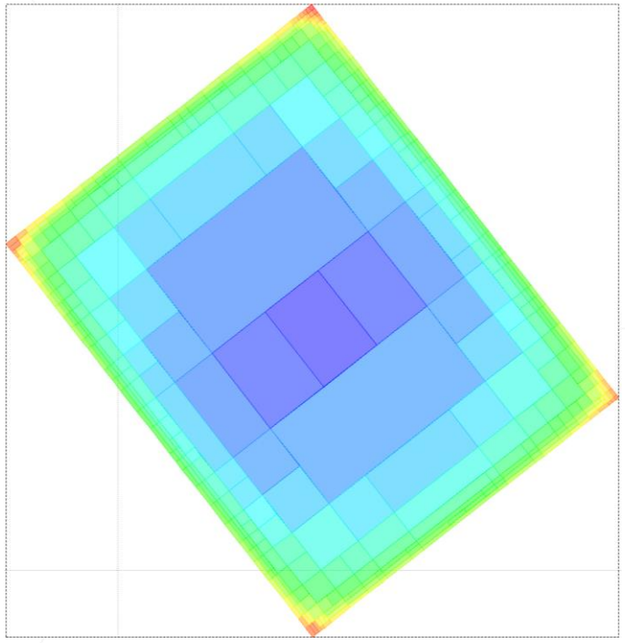


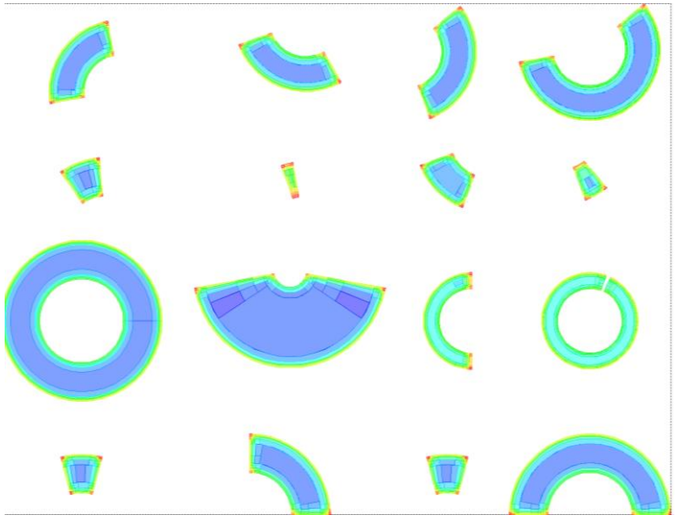


PEC

Improved PEC fracturing





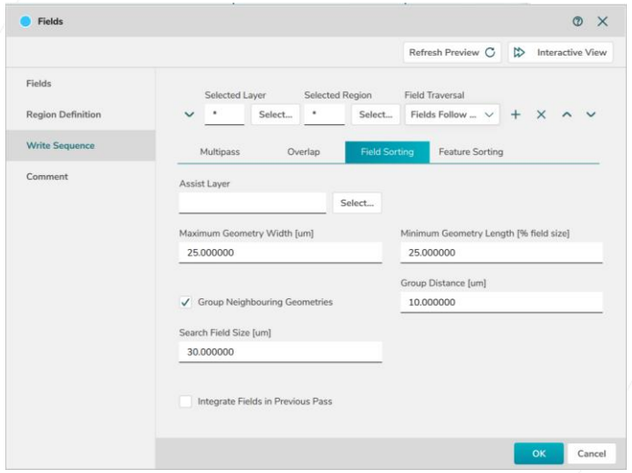


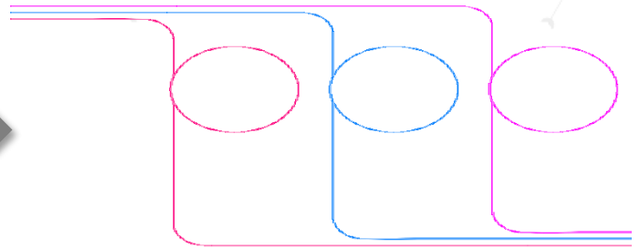
Generic element types like Circles / Arcs / Rotated Rectangles are maintained during fracturing. Dose fracturing of PEC will fracture e.g. ARC elements only into smaller ARC elements to improve the fracture quality.

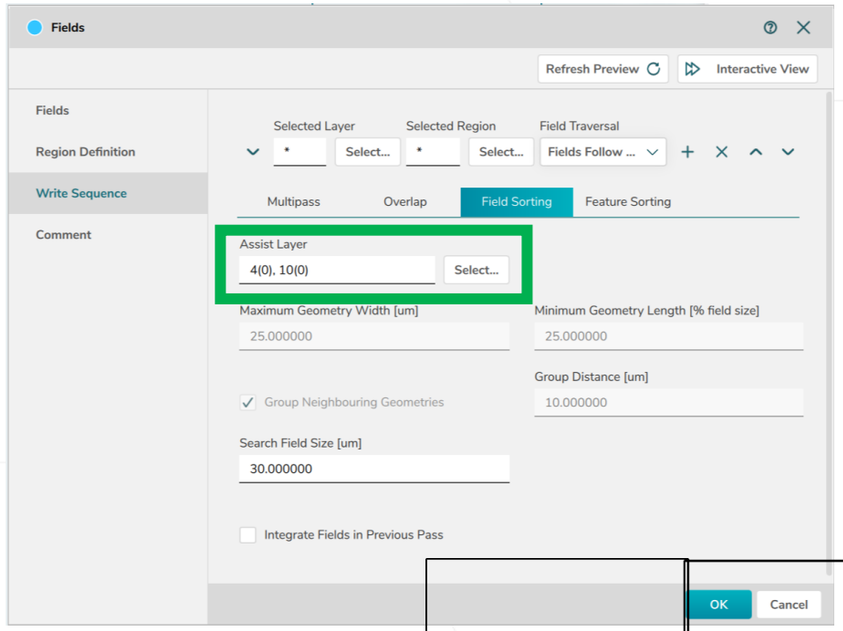
Field control

Fields Module - Fields Follow Geometry - Assist Layer

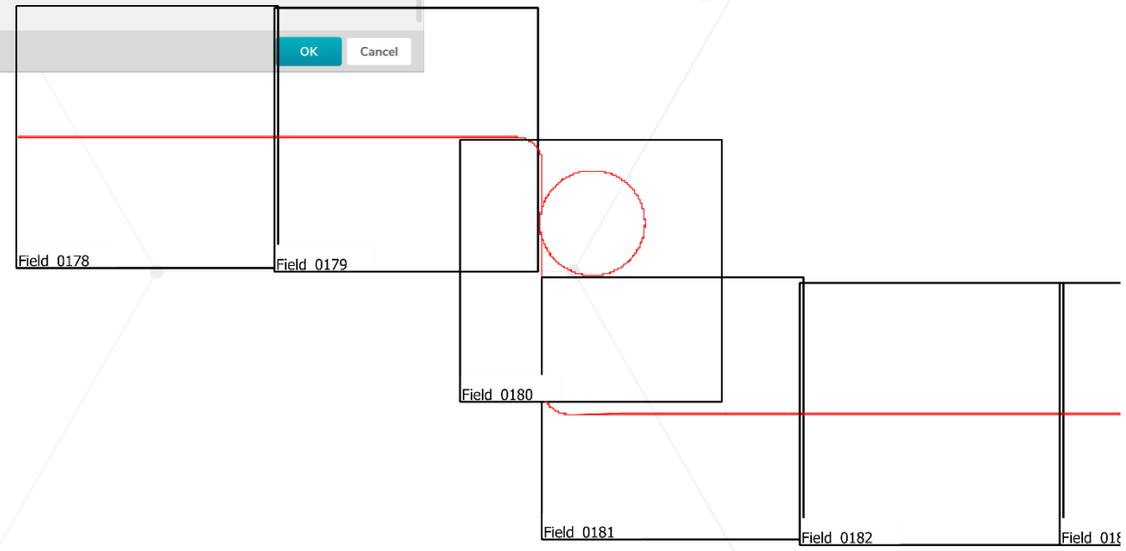
Fields Follow Geometry includes a new feature that helps to improve the quality of the results.





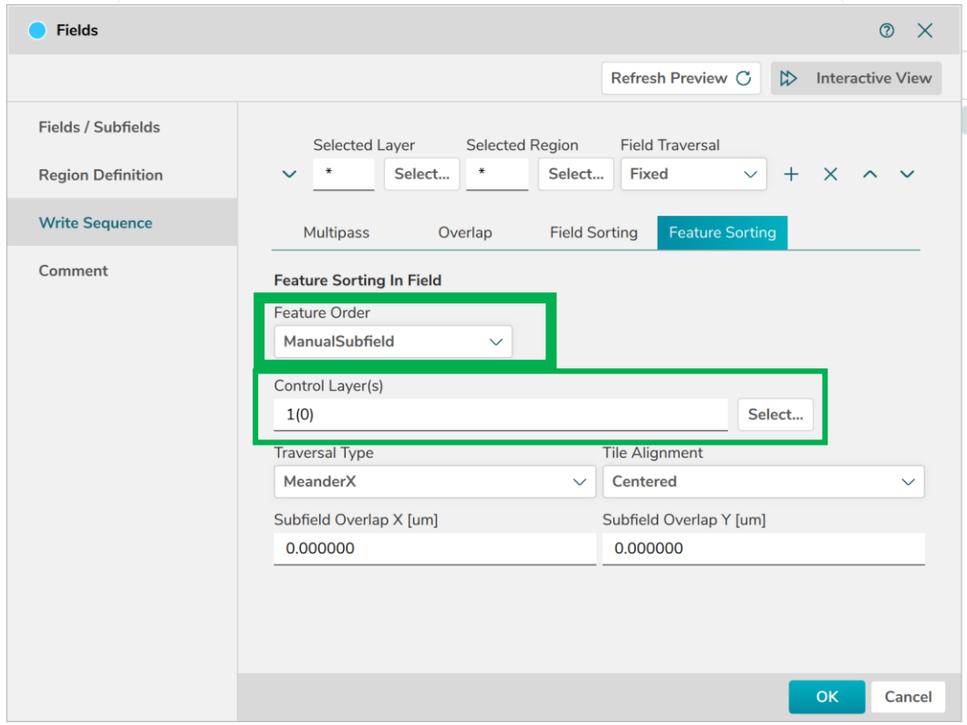


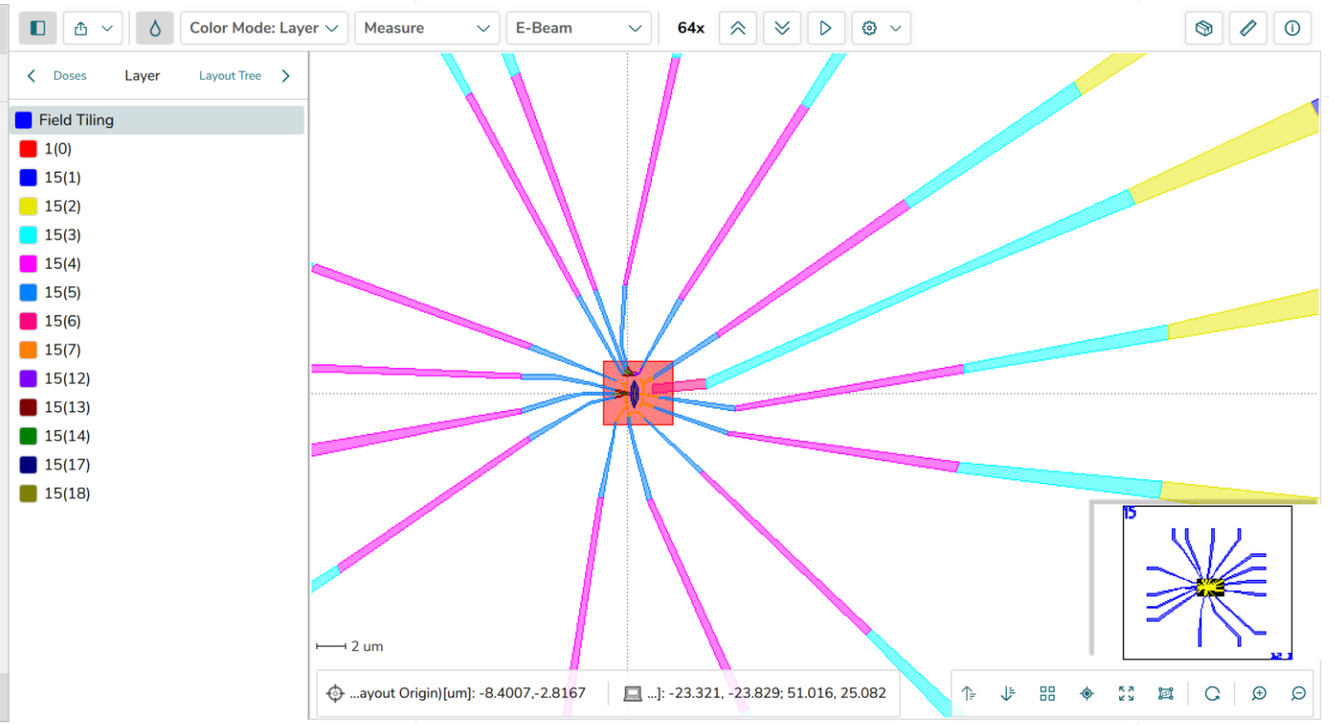
An *Assist Layer* can be included in the design narrowing down the geometry data that will be processed by the writing algorithm.



Fields module – ManualSubfield mode

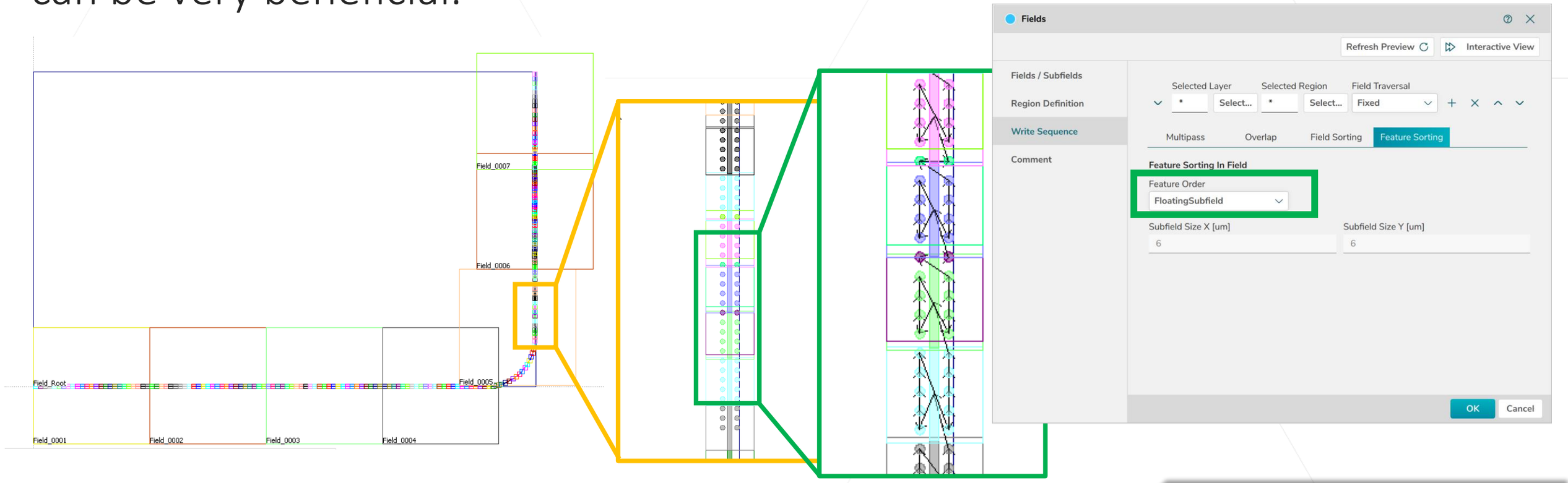
- The exposure order of critical regions within a Field are optimized using ManualSubfield
- The Control layer can be used to identify critical layout parts





Fields module – FloatingSubfield mode

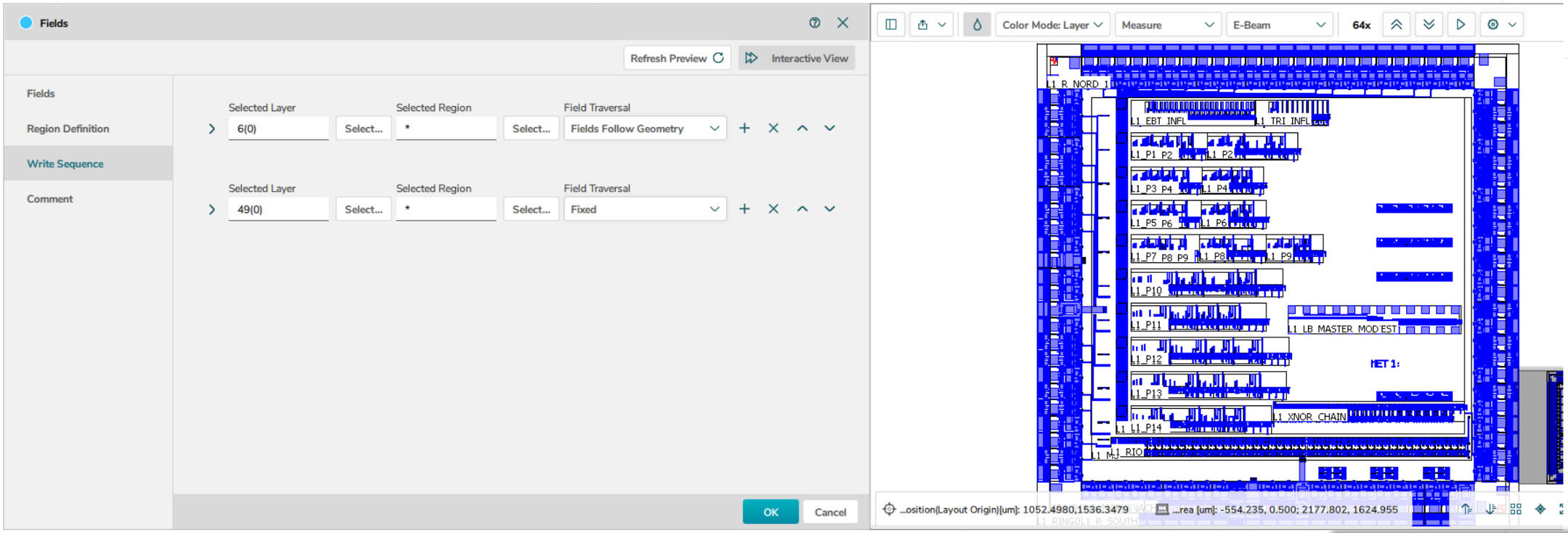
A floating subfield algorithm has been implemented that analyses the pattern and follows the path of the layout based on the feature distribution. This works very similar to the floating algorithm in the main field sorting. For sparse patterns, to follow a path, this method can be very beneficial.



Fields module

New field sorting module – for advanced Region and field sorting applications

- The fields module can create field and region/ sub fields within a layout
- During the system specific export, the user makes use of this structure via cell to field / cell to SF



Shape Sleeving

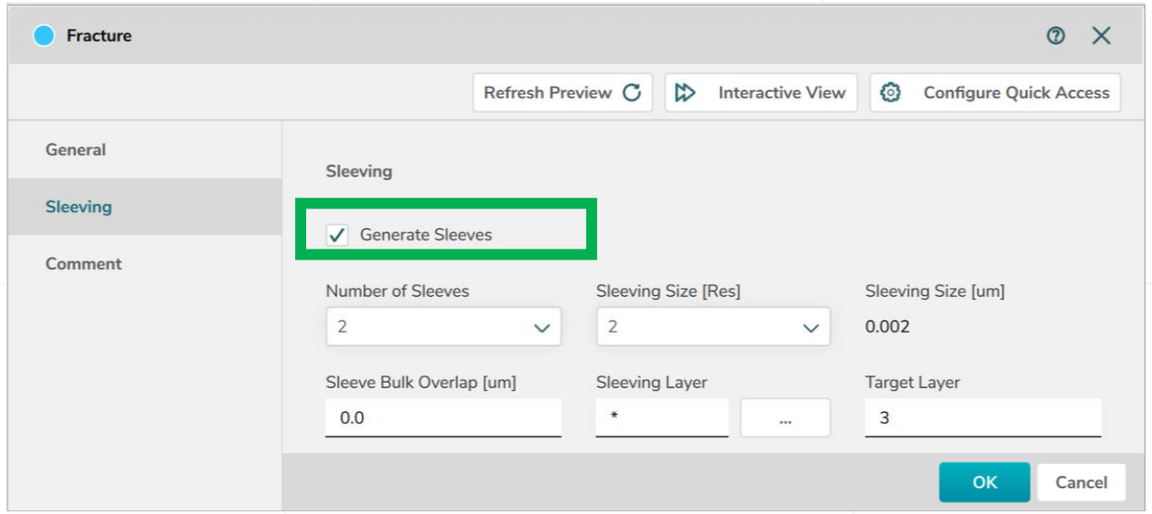
New Fracture Feature

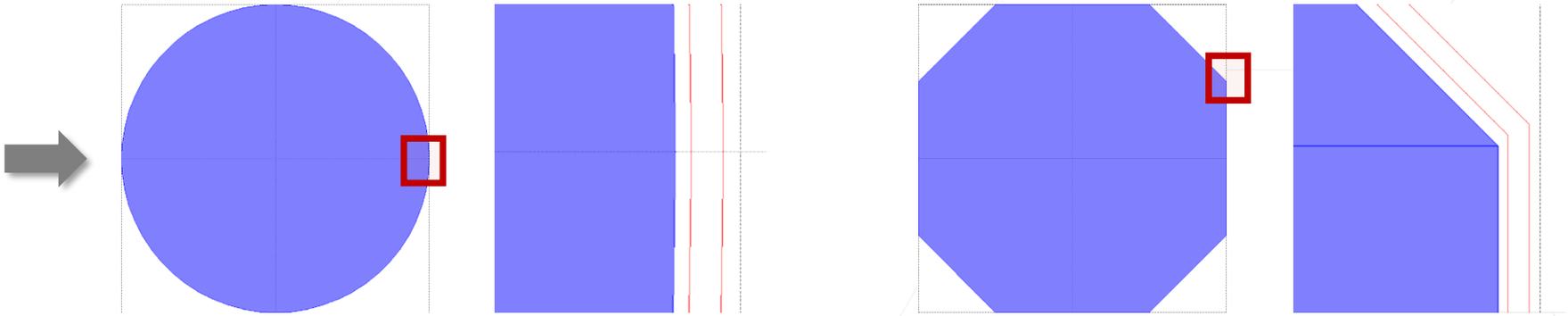
Generate Sleeves

The *Fracture* module includes a fast and easy way to *Generate Sleeves* on target layers using zero width path exposure characteristics increasing pattern quality without affecting throughput.

Parameters to control:

- Number of Sleeves
- Sleeving Size
- Overlap between Sleeve and Bulk
- Sleeving Layer





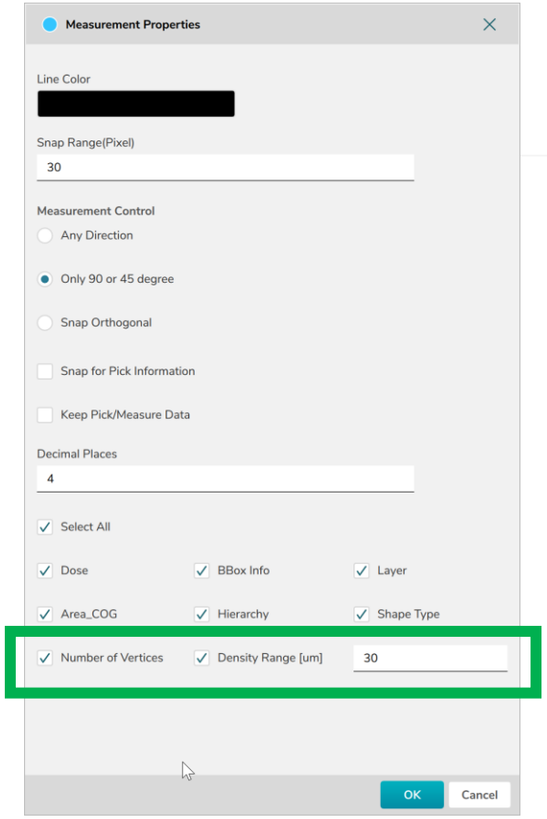
Sleeves in the Export

Sleeves generated by this method can find use in the capability of several tool exports:

- taking benefit of the unique treatment during the exposure
- utilizing FDA to assign a compesational dose factor for example to benefit from a improved contrast at the edge of the shape
- utilizing Extract & Transform to duplicate the sleeves and create an intentional pattern smoothing (shift by half a beam step size and halving the dose)

Usability

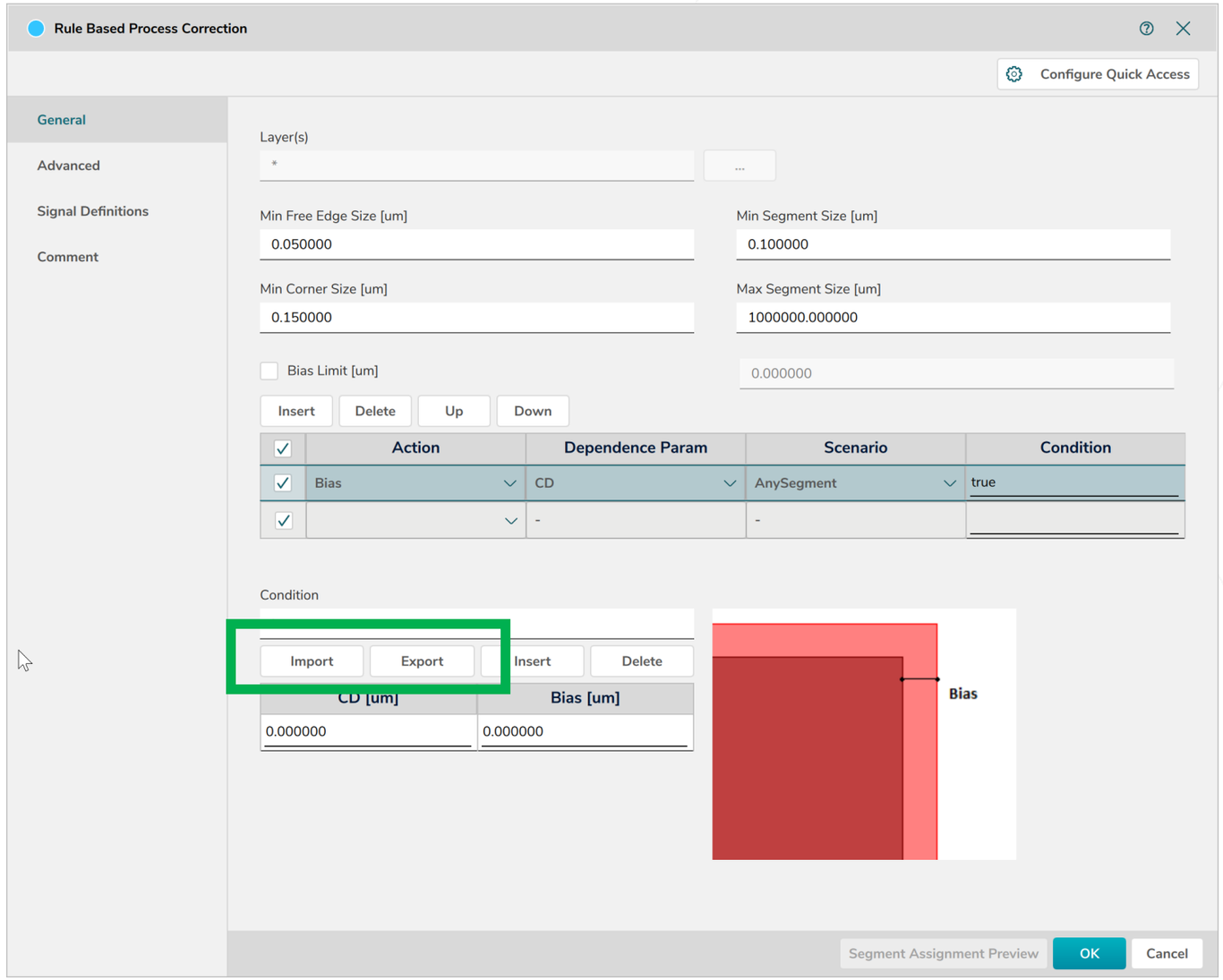
VIEWER – pick information



The VIEWER pick information has been extended to cover:

- Number of verticies
- Pattern density in a certain range

RuleOPC – Import/Export



For easier rule setup an import/export option has been added for the CD dependend bias correction

Python module - Formatting improvements

BEAMER 7.0

BEAMER.bias(**gobject**, { 'SoftFrame' : 0.300000, 'Bias' : 0.000000, 'CornerExtension' : 1.000000, 'SuppressExtensionOfTinyCorners' : False, 'Mode' : 'X-Y', 'HierarchicalProcessing' : True, 'LayerAssignment' : 'AllLayer', 'TargetLayer' : '0(0)', 'ExtentType' : 'Automatic' })

BEAMER.fracture(**gobject**, { 'FractureLayer' : '*', 'KeepResolution' : True, 'Resolution' : 0.001000, 'BeamStepSize' : 1, 'CurveApproxTolerance' : 0.100000, 'CurveTolerance' : 1.000000, 'FractureAxis' : 'X_AND_Y', 'FractureMode' : 'LRFT', 'BssFracturing' : False, 'Symmetric Fracturing' : False, 'FractureAngle' : 'AnyAngle', 'FractureTolerance' : 1.000000, 'FractureType' : 'Flat' })

The formatting of Phyton code has been improved for better readablity.

BEAMER 7.1

```
BEAMER.bias( **gobject**,
    {'SoftFrame' : 0.300000,
     'Bias' : 0.000000,
     'CornerExtension' : 1.000000,
     'SuppressExtensionOfTinyCorners' : False,
     'Mode' : 'X-Y',
     'HierarchicalProcessing' : True,
     'LayerAssignment' : 'AllLayer',
     'TargetLayer' : '0(0)',
     'ExtentType' : 'Automatic'} )
```

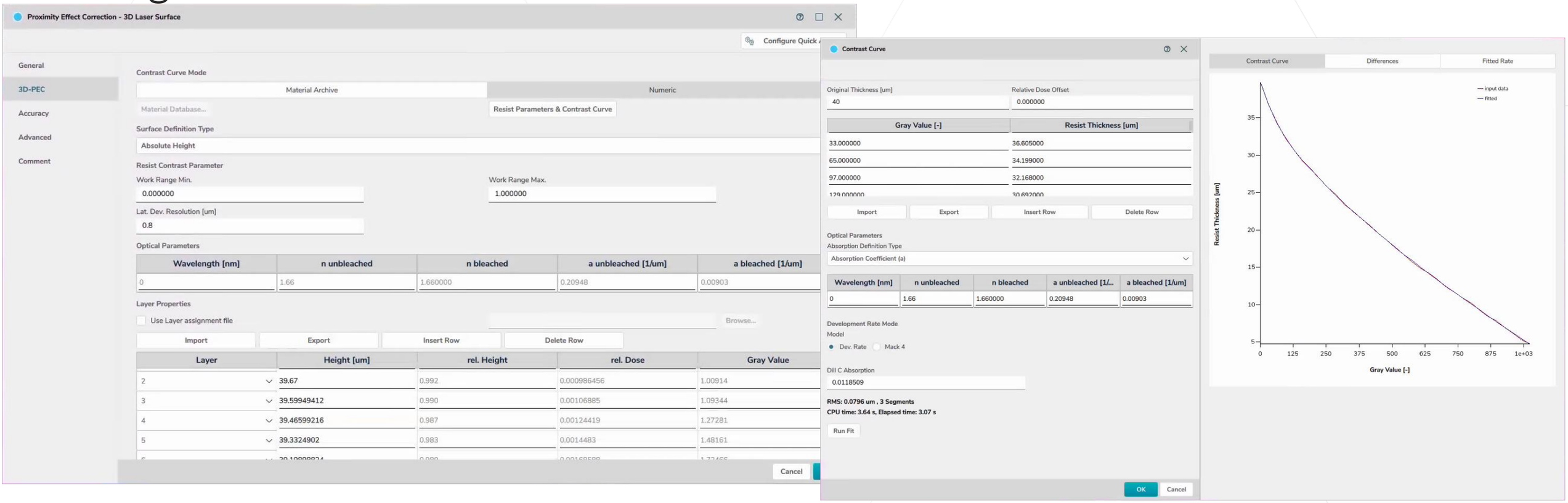
```
BEAMER.fracture( **gobject**,
    {'FractureLayer' : '*',
     'KeepResolution' : True,
     'Resolution' : 0.001000,
     'BeamStepSize' : 1,
     'NumberSleeves' : 1,
     'SleevingSize' : 1,
     'SleeveBulkOverlap' : 0.0,
     'SleevingLayer' : '*',
     'SleevingTargetLayer' : '',
     'CurveApproxTolerance' : 0.100000,
     'CurveTolerance' : 1.000000,
     'FractureAxis' : 'X_AND_Y',
     'FractureMode' : 'LRFT',
     'BssFracturing' : False,
     'SleeveGeneration' : False,
     'Symmetric Fracturing' : False,
     'FractureAngle' : 'AnyAngle',
     'FractureTolerance' : 1.000000,
     'FractureType' : 'Flat'} )
```

3D Laser Surface

3D PEC dialog update

Optimized user interface to follow a top-to-bottom approach setting up the correction.

Moved optical parameters to the *Resist Parameters & Contrast Curve* dialog.

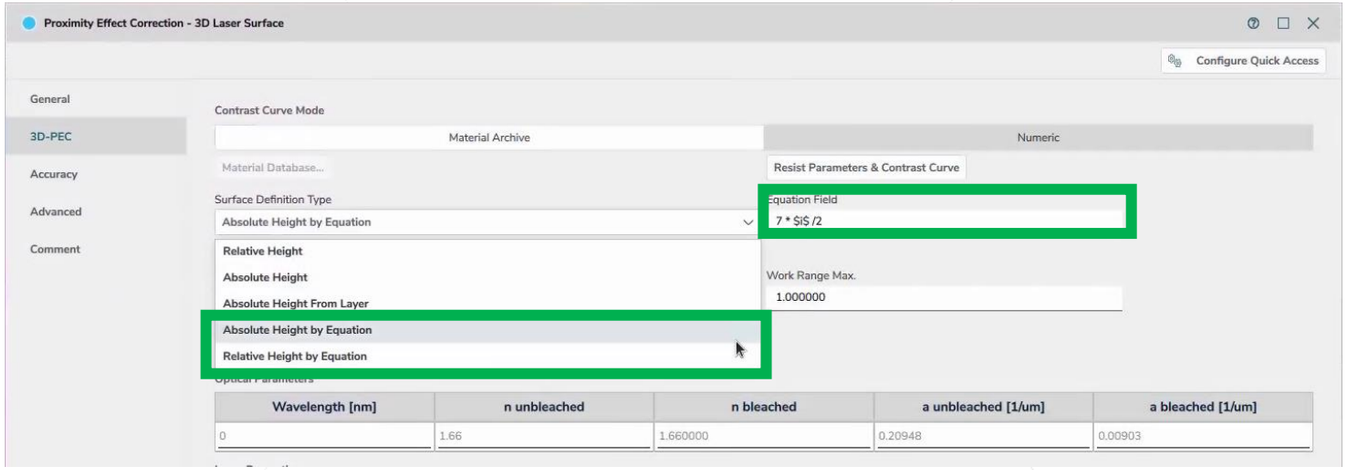


3D Laser PEC

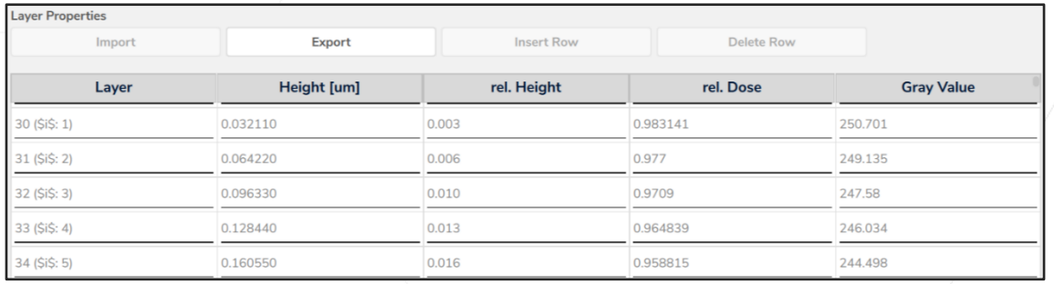
2 new *Surface Definition Types*:

Absolute Height by Equation

Relative Height by Equation



Layer properties table is filled using an equation defined by the user and the *Laser Contrast Curve*.



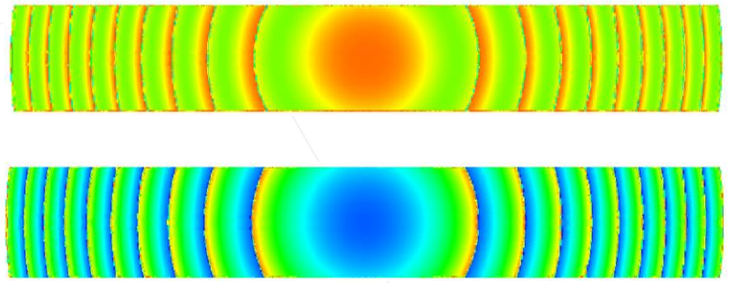
Only **i** is predefined, but any type of equation can be used under the Contrast Curve limits.

Example of Equations:

$$\sin\left(\$i\$ * \frac{3.1416}{180}\right)$$

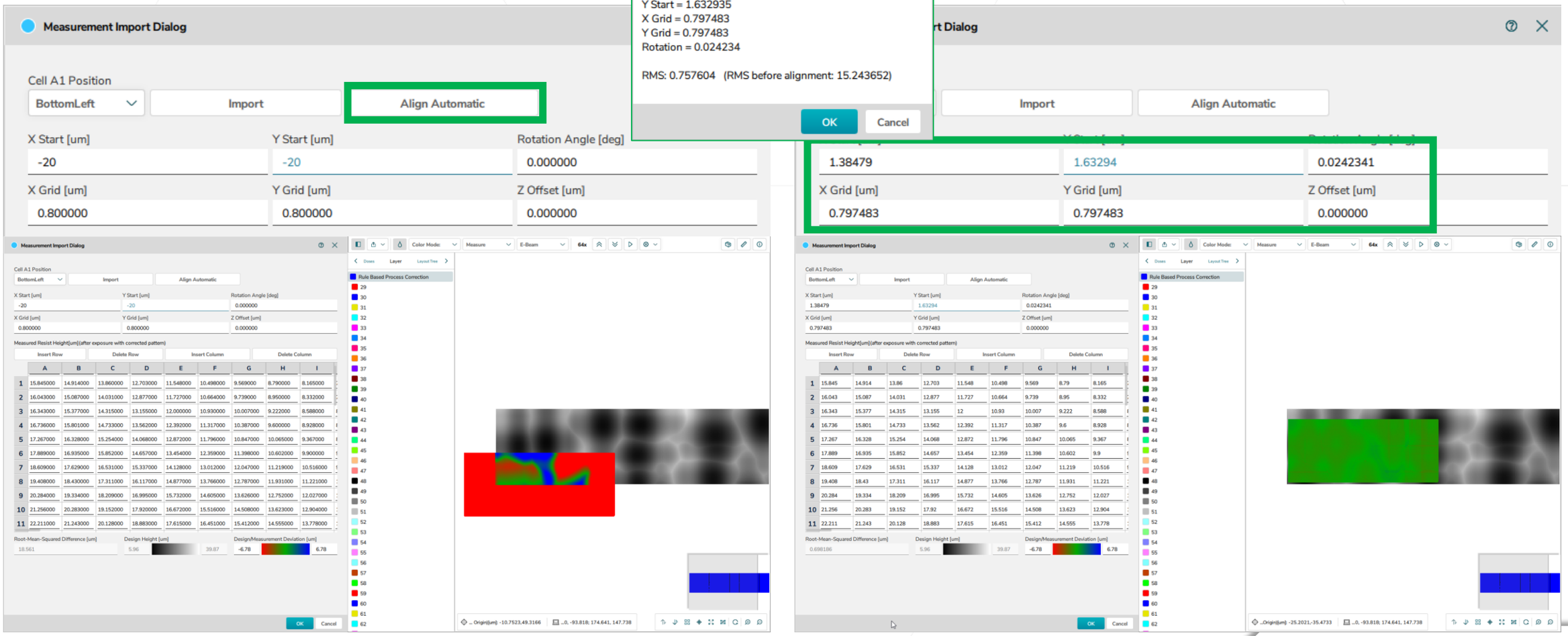
$$7 * \frac{\$i\$}{218}$$

Fresnel Lens



Feedback Loop – automatic alignment

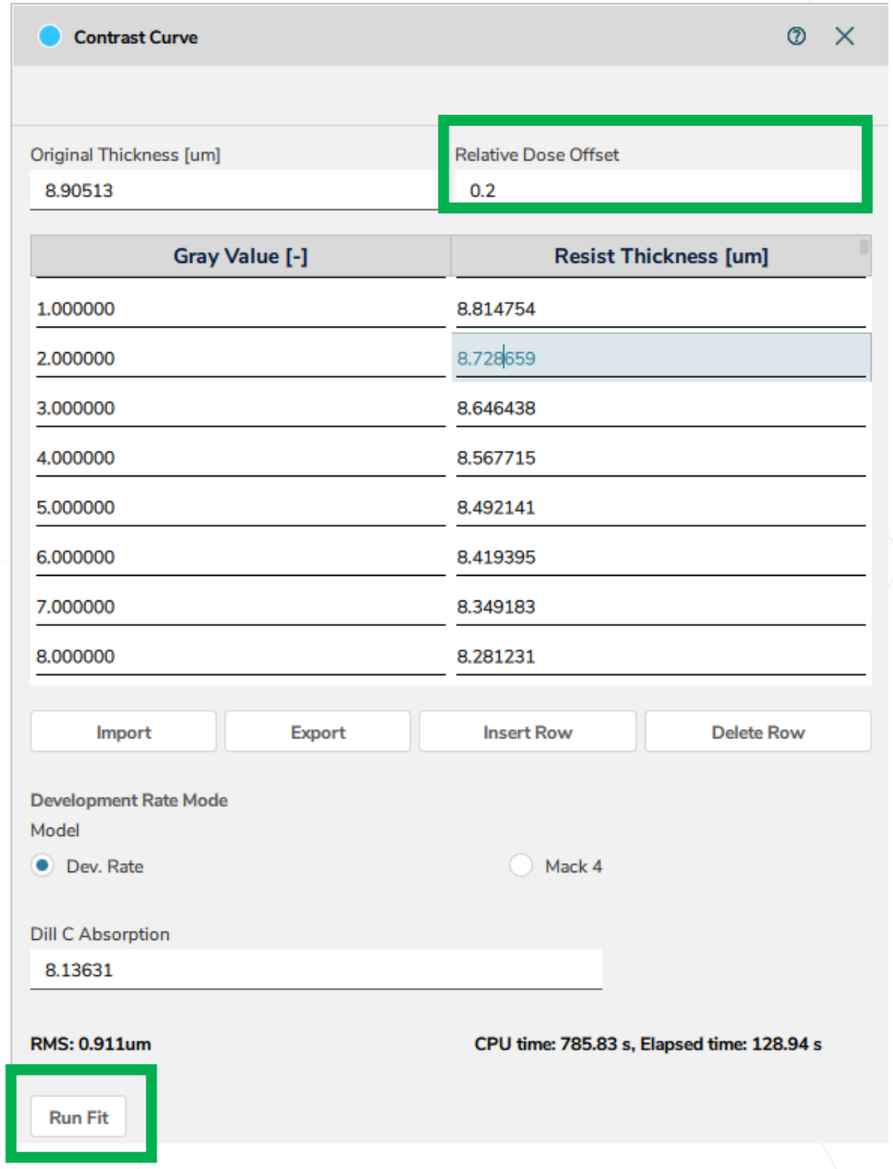
- Imported measurement data can be automatically aligned now to the correction target.



Dose Offset in Contrast Curve

The Relative Dose Offset is introduced to consider non-zero exposure dose for Gray value 0.

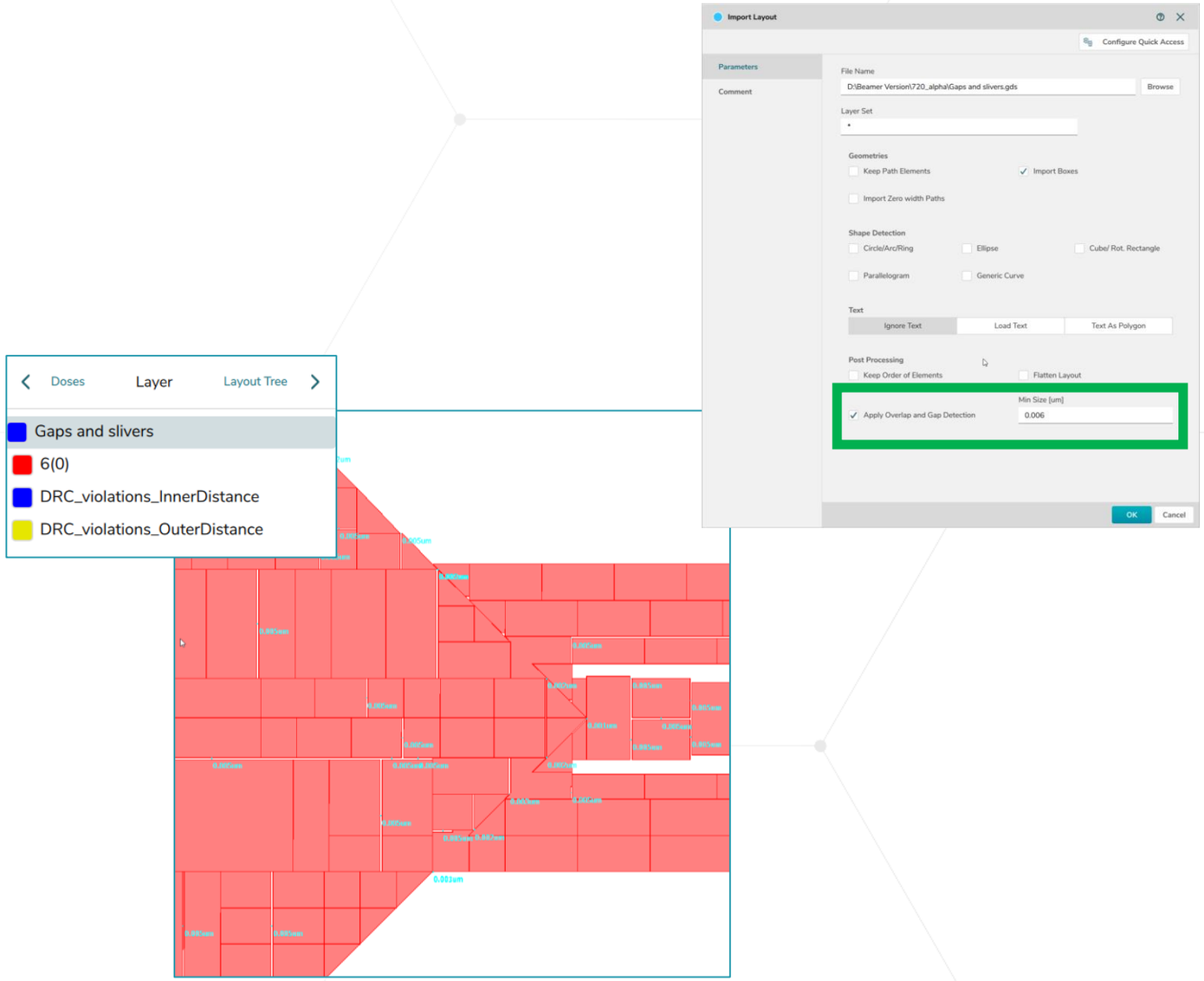
- The whole gray value range covers the relative exposure dose between relative dose offset and 1.
- The change of relative dose offset affects the contrast curve fitting result. User needs to rerun the fit.
- It offers the full number of gray values in a relevant dose range for finer granularity.



BEAMER 7.2

Layout check for small gaps and overlaps (BEAMER 7.2)

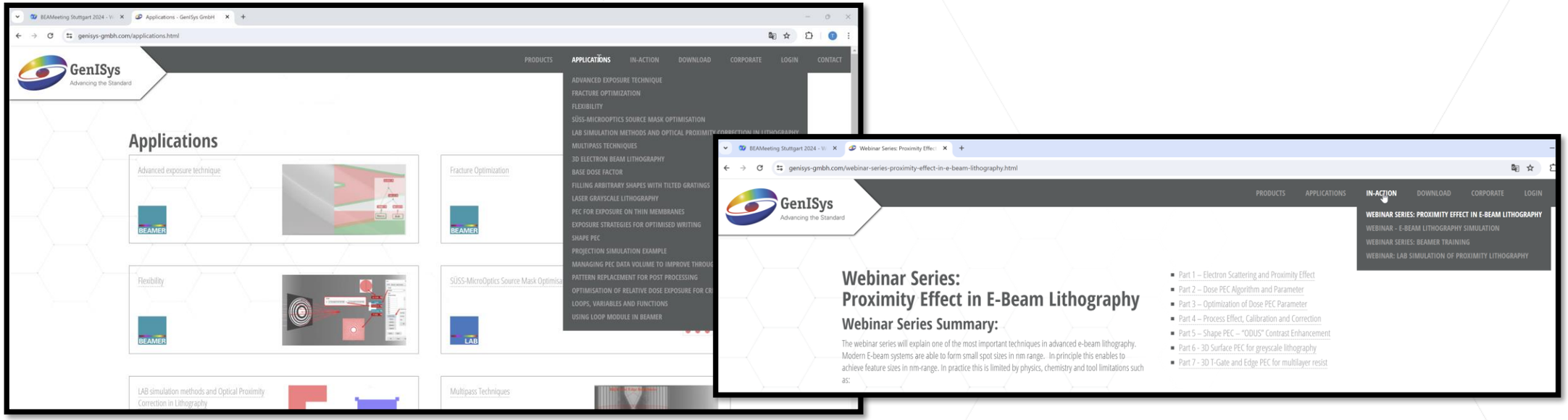
“Overlap and Gap Detection” will analyze *GDS and DXF* layouts for small gaps or overlaps. The gaps or overlaps are shown in the Layout VIEWER. This allows the user to detect layout issues at the start of the data preparation, which might negatively influence correction applied to the layout.



BEAMER 7.2

- Infrastructure – remove wx libraries completely
- Shape detection in DXF import
- Import: Layout check to identify small gaps / overlaps
- Fields module: Shape sorting within subfield
- Performance improvements: Floating fields / RuleOPC

BEAMER 7.2 release June 2024



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Thank You!

support@genisys-gmbh.com

Headquarters

GenISys GmbH
Eschenstr. 66
D-82024 Taufkirchen (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