

TRACER

What's New in 2.8.0

Process Calibration

Calibration

Data
Name:
Description: Data with 50% OC/UC

Preconditions for the TRACER Calibration include:
1. An analytic PSF or a PSF from the archive
2. A Dose vs. Density table obtained by exposing and evaluating a PEC corrected density varying pattern, obtainable from GenISys.
3. Resist contrast value.

PEC parameter used to process the calibration pattern

Use analytical PSF
Beta [nm]: 8318 Eta: 1.29
Gamma [nm]: 0 Nu: 0.00

Use PSF from archive
2D-PSF: Substrate_InP_Thickness_700000_Energy_100_Layers_Resist_PMMA 200 nm_Z-Position_0.05_Electrons_1000000_Alpha_0_Beta_0_Eta_0_Gamma1_0_! Archive...

Optimal contrast [%]: 50 / 50 : Uniform clearing [%]

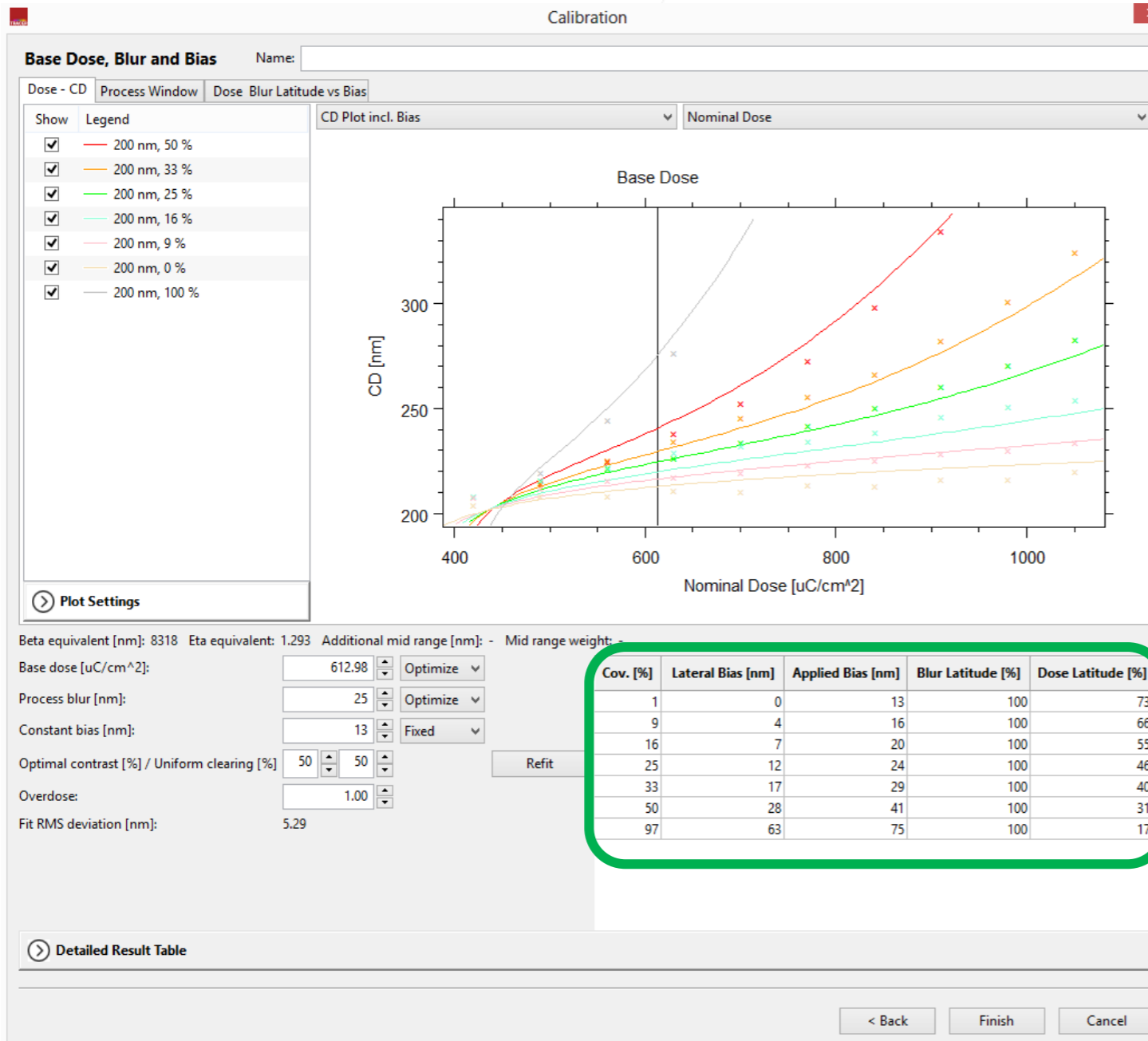
Calibrated model
Resist: Resist contrast: 3.50 Thickness [nm]: 200 D0 [uC/cm^2]: 400.00 From CC...

Use additional mid range fit term
 Fit mix factor

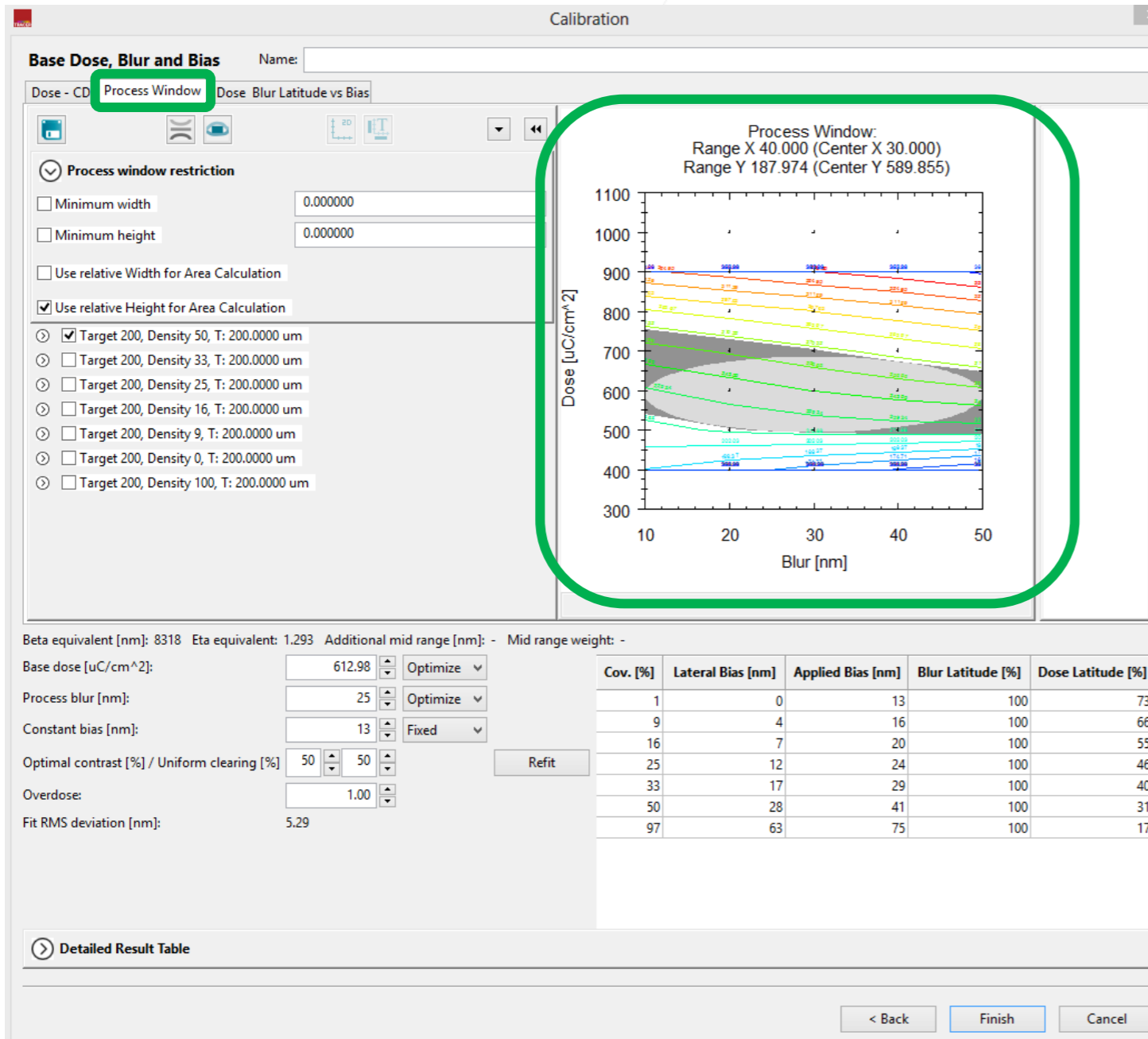
| | A | B | C | D | E | F | |
|---|----------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1 | Target CD [nm] | 200 | 200 | 200 | 200 | 200 | 200 |
| 2 | Density [%] | 50.000 | 33.300 | 25.000 | 16.000 | 9.000 | 0.000 |
| 3 | Dose [uC/cm^2] | Mea. CD [nm] | Mea. CD [nm] | Mea. CD [nm] | Mea. CD [nm] | Mea. CD [nm] | Mea. CD [nm] |
| 4 | 1050 | 0 | 325.1 | 283.5 | 254.6 | 234.7 | 220.7 |
| 5 | 980 | 0 | 301.7 | 271.5 | 251.8 | 230.9 | 216.8 |
| 6 | 910 | 335.1 | 283.1 | 260.9 | 246.5 | 228.9 | 216.9 |

Add Dose
Add Dataset
Remove
Import...
Export...

- In process calibration, the additional fit option is added for optimization:
 - mix factor for optimal contrast and uniform clearing composition in PEC. The mix factor fit shows its advantage when the calibration has difficulty in matching both isolated and dense patterns.

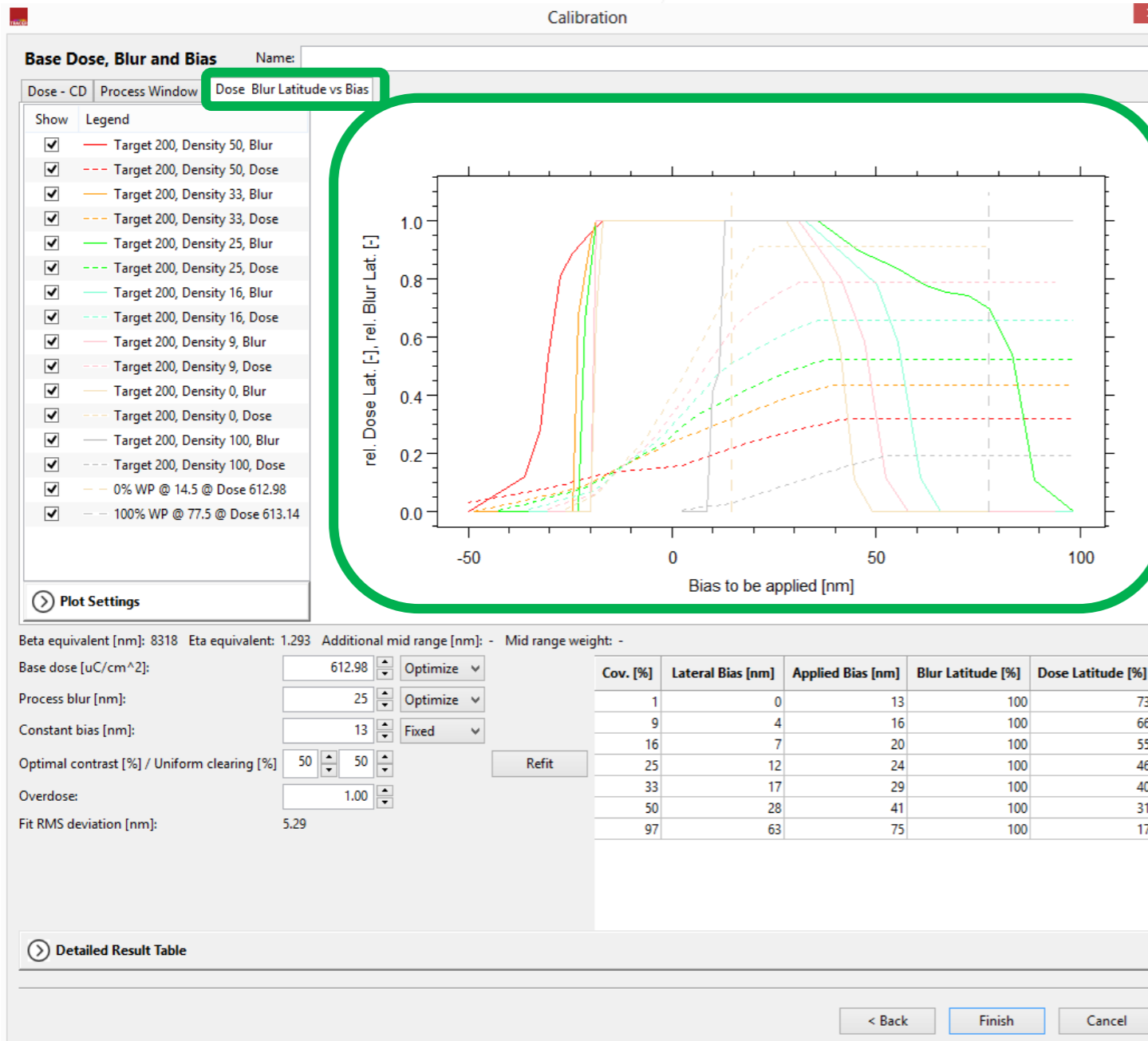


- The results of the calibration are summarized in an condensed table.
 - The details help users understand the influence of parameters in calibration by changing them one at a time.
 - Lateral bias, blur and dose latitude are listed for corresponding coverage density.

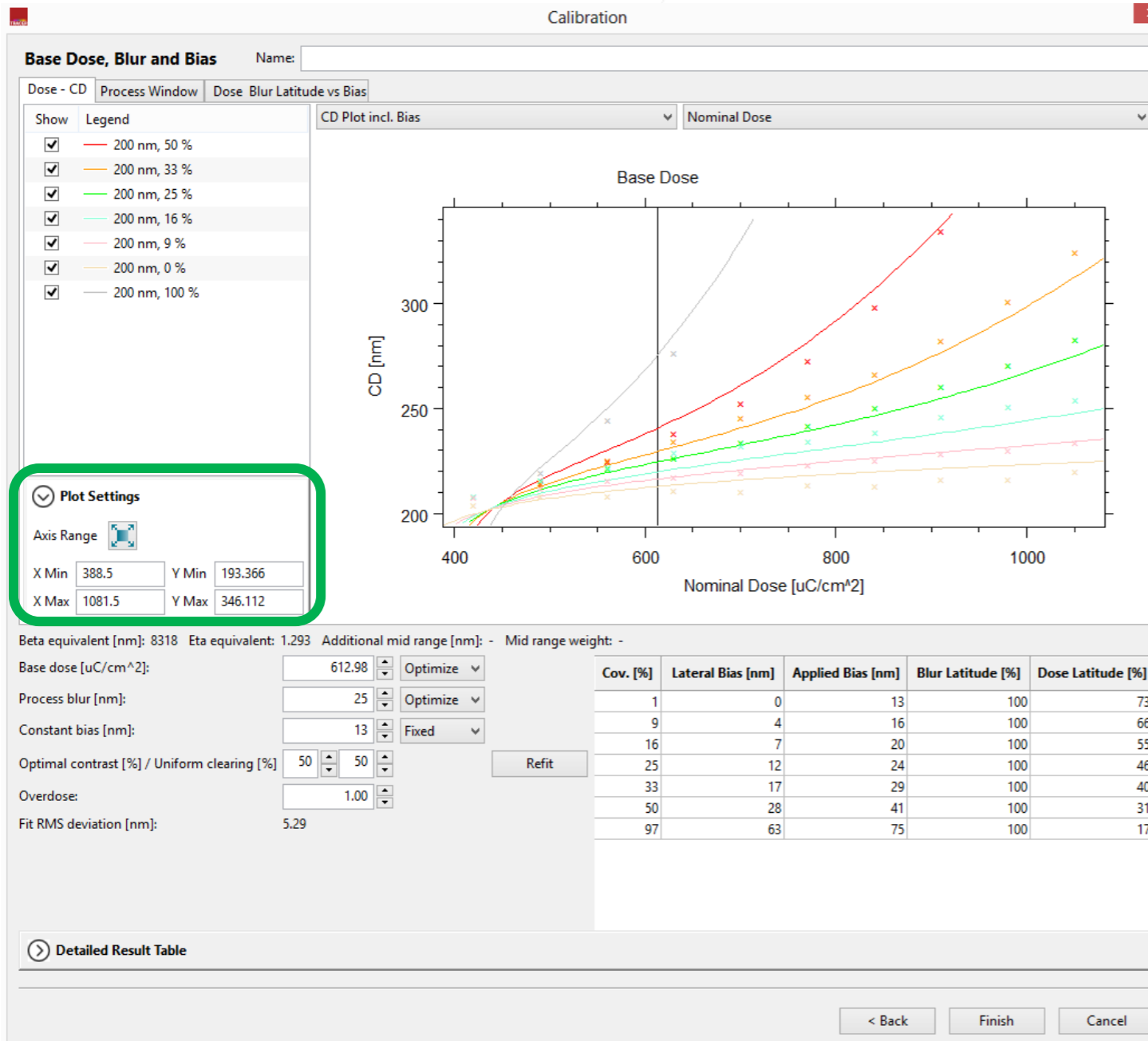


- Details of the process calibration result can be visualized:
 - Dose/blur process window is calculated for each pattern density.
 - The process window has the CD range to be $\pm 10\%$ of the expected CD including bias.

Dose/Blur Latitude vs Bias



- Details of the process calibration result can be visualized:
 - Relative dose/blur latitude vs applied bias is calculated from the process window.
 - The goal of the calibration is to find optimized process work points for iso and dense structures. They are merged into one proximity effect correction (PEC) by adjusting the optimal contrast/uniform clearing dose range.

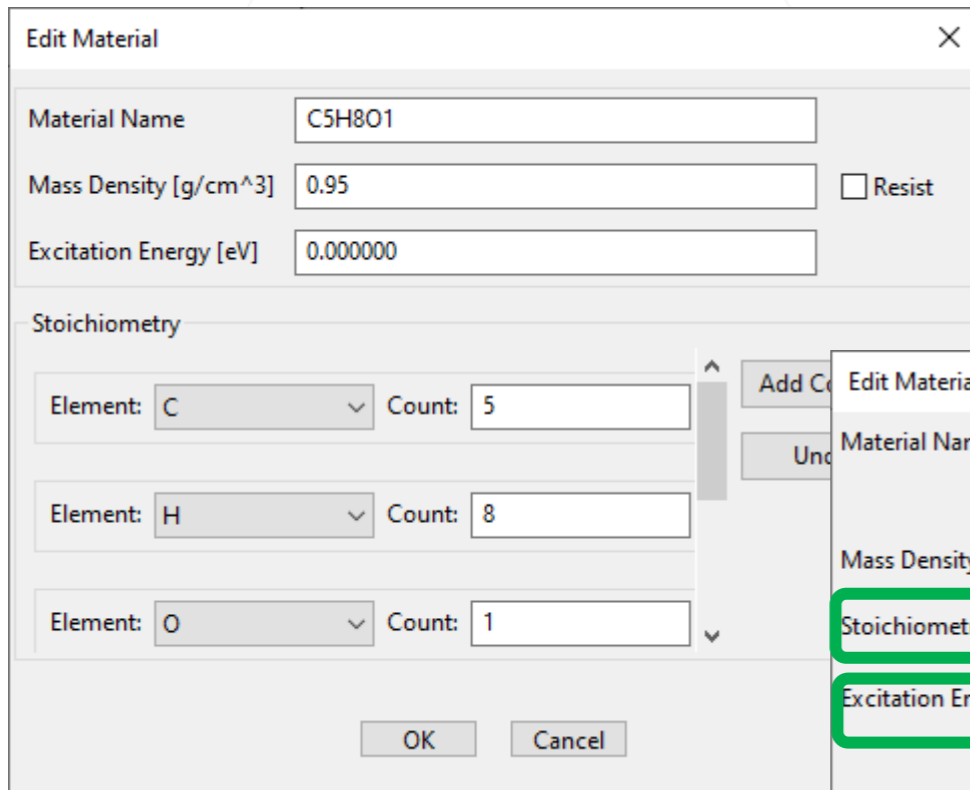


- The plot range is controllable:
 - The x axis and y axis can be set via „Plot Settings“.
 - The zoom via mouse works in all plot views.

User Interface

Improved Interface for Adding Material

Old version



Material Name: C5H8O1

Mass Density [g/cm³]: 0.95 Resist

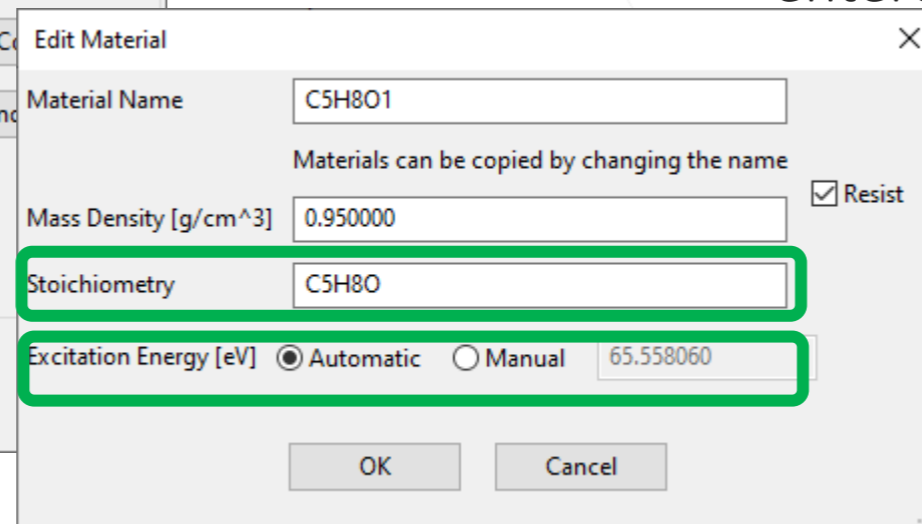
Excitation Energy [eV]: 0.000000

Stoichiometry

| | |
|------------|----------|
| Element: C | Count: 5 |
| Element: H | Count: 8 |
| Element: O | Count: 1 |

Buttons: Add C, Unc, OK, Cancel

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Material Name: C5H8O1

Materials can be copied by changing the name

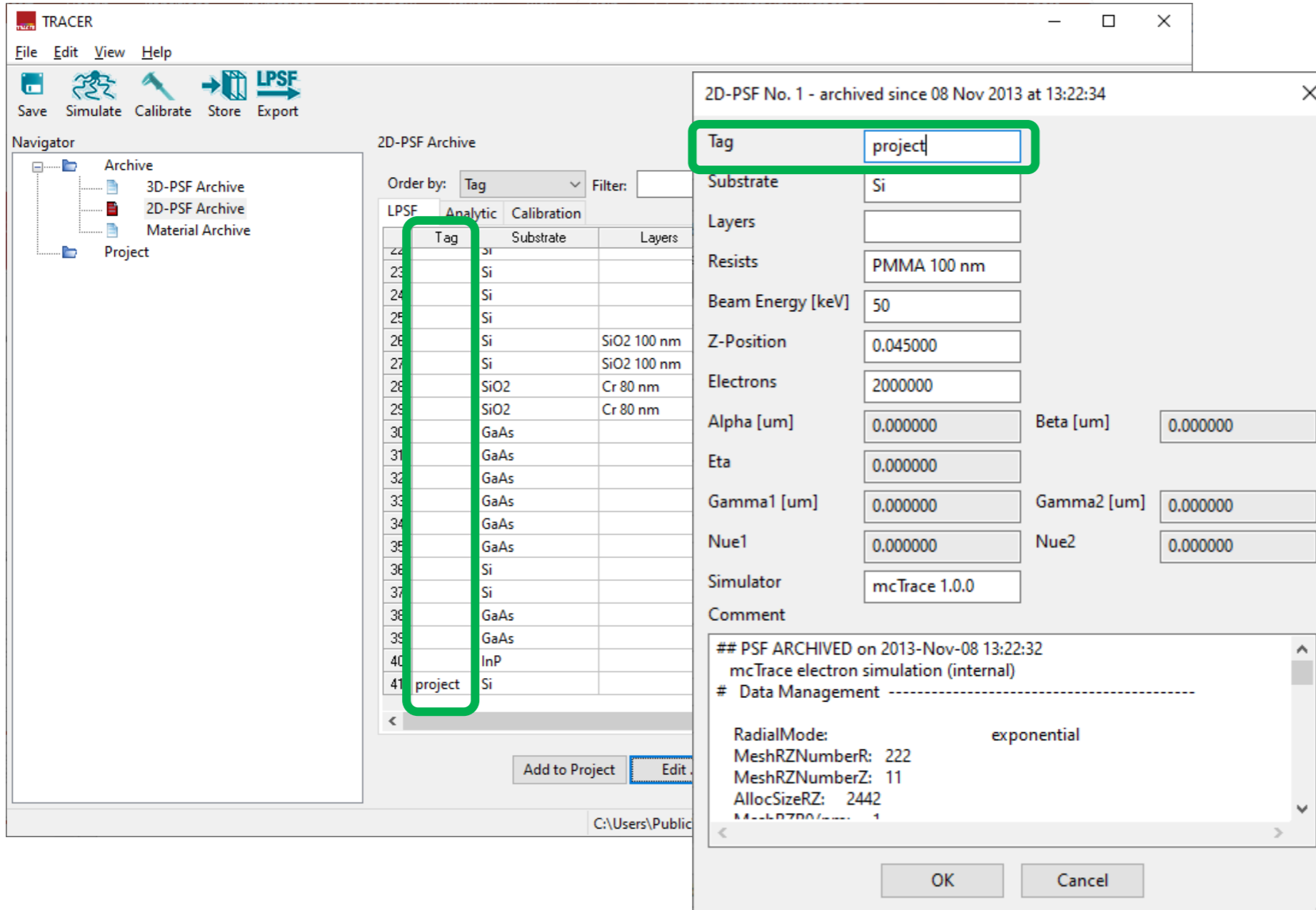
Mass Density [g/cm³]: 0.950000 Resist

Stoichiometry: C5H8O

Excitation Energy [eV]: Automatic Manual 65.558060

Buttons: OK, Cancel

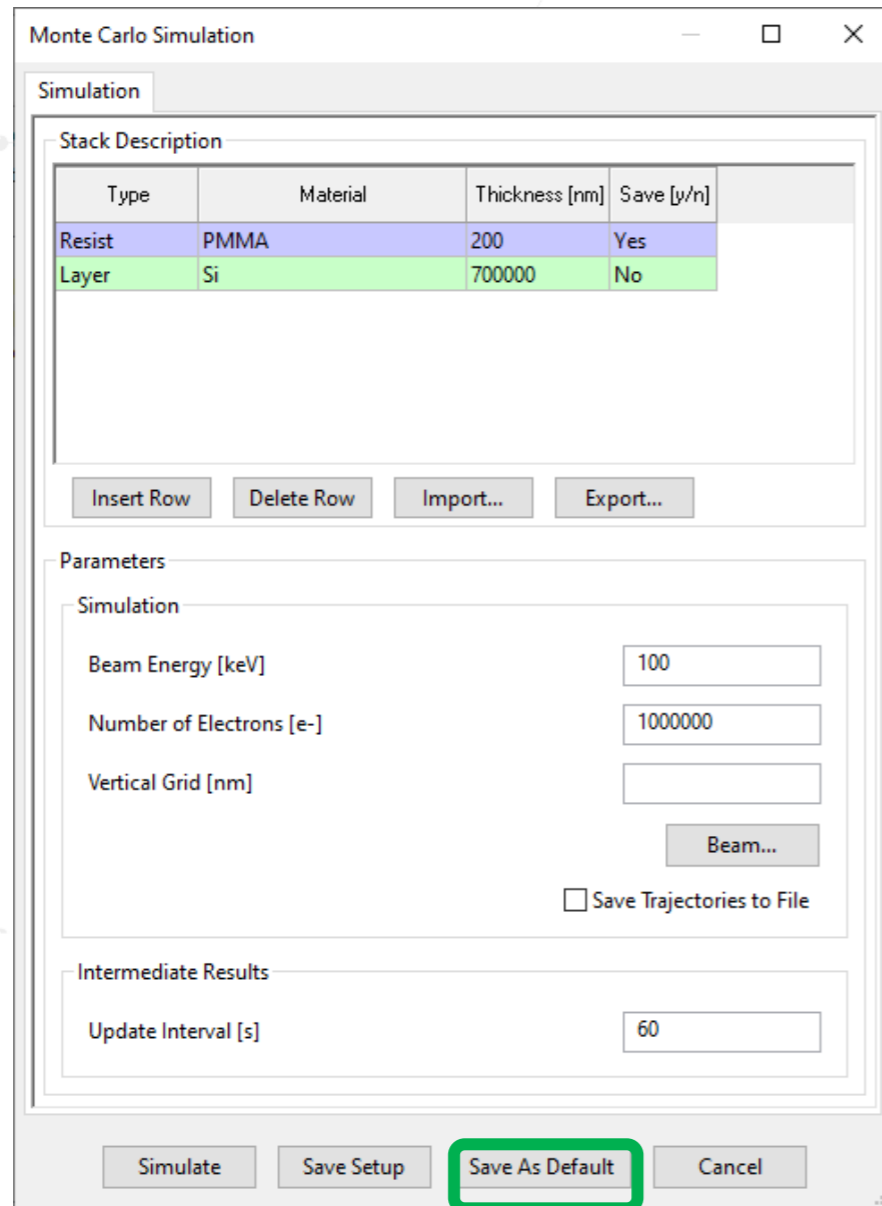
- When a new material is added in Material Archive, the user interface is enhanced for convenience.
- The stoichiometry composition is simplified as shown in the example.
- The excitation energy of the material can be either calculated automatically or entered manually.



The screenshot shows the TRACER software interface. On the left is a Navigator pane with a tree view containing 'Archive', '3D-PSF Archive', '2D-PSF Archive', 'Material Archive', and 'Project'. The main window displays a '2D-PSF Archive' table with columns for 'LPSF', 'Analytic', 'Calibration', 'Tag', 'Substrate', and 'Layers'. The 'Tag' column is highlighted with a green box, and the row with 'project' is selected. A configuration dialog box titled '2D-PSF No. 1 - archived since 08 Nov 2013 at 13:22:34' is open, showing various parameters. The 'Tag' field in this dialog is also highlighted with a green box and contains the text 'project'. Other parameters include Substrate (Si), Resists (PMMA 100 nm), Beam Energy (50 keV), Z-Position (0.045000), Electrons (2000000), Alpha (0.000000), Beta (0.000000), Eta (0.000000), Gamma1 (0.000000), Gamma2 (0.000000), Nue1 (0.000000), Nue2 (0.000000), Simulator (mcTrace 1.0.0), and Comment (## PSF ARCHIVED on 2013-Nov-08 13:22:32 mcTrace electron simulation (internal) # Data Management ... RadialMode: exponential MeshRZNumberR: 222 MeshRZNumberZ: 11 AllocSizeRZ: 2442).

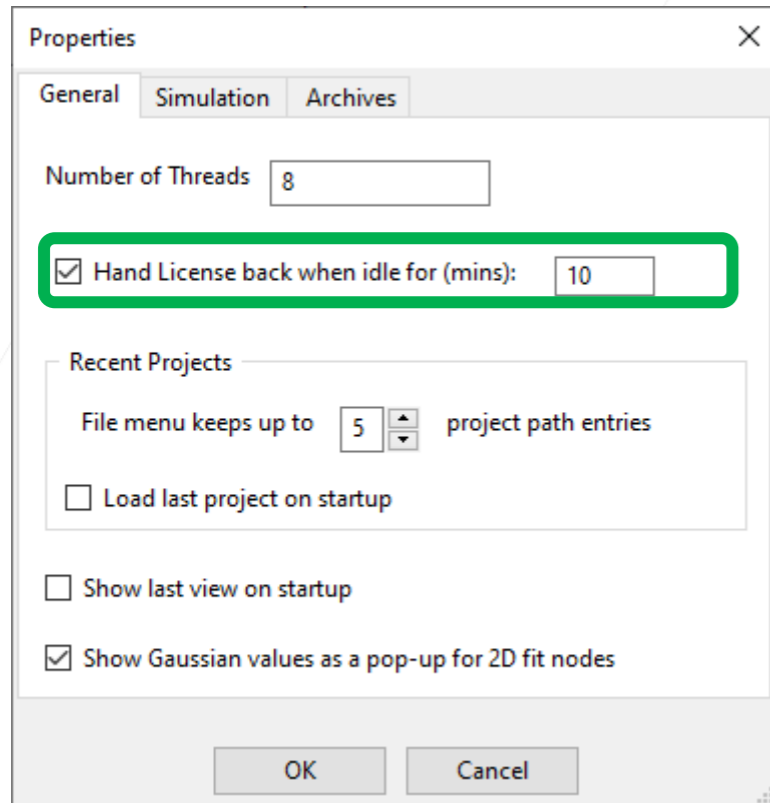
- A customer tag can be added for each 2D PSF. Thus user can easier recognize the desired PSF in the 2D-PSF Archive.

Save Default for Monte Carlo Simulation



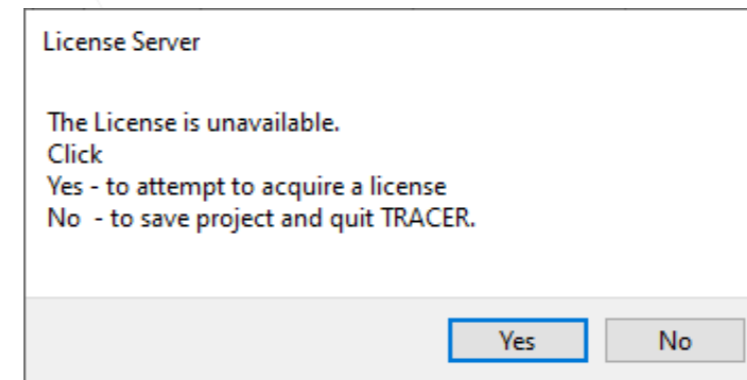
- In Monte Carlo simulation dialog, the „Save As Default“ button is added to save the simulation parameters: beam parameters and update Intervals

License Management



- License hand back

- License idle timeout can be activated via File->Properties dialog.
- When Tracer is not used for the assigned time, the license is released with a warning dialog.
- The user can re-take the license to save the project, or close the program.



Thank You!

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