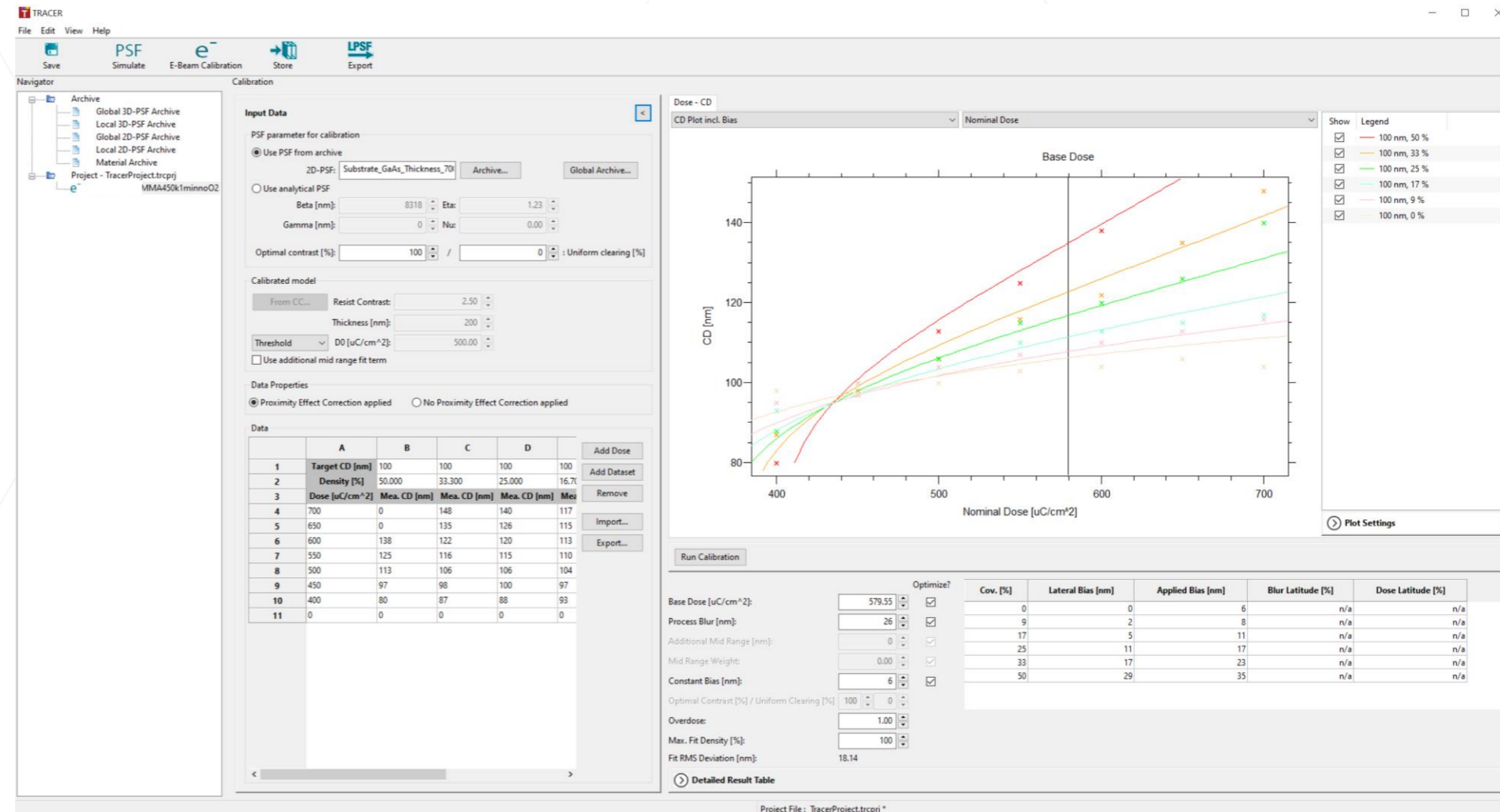


TRACER

What's new TRACER 2.10

Rework of user interface

- Major rework of the ebeam calibration interface and workflow, to improve the overview of input data and results.
 - easier recalibration and comparing of results



Input Data

PSF parameter for calibration

Use PSF from archive
2D-PSF: Substrate_GaAs_Thickness_70 | Archive... | Global Archive...

Use analytical PSF

Beta [nm]: 8318 | Eta: 1.23
Gamma [nm]: 0 | Nu: 0.00

Optimal contrast [%]: 100 / 0 : Uniform clearing [%]

Calibrated model

From CC... Resist Contrast: 2.50
Thickness [nm]: 200
Threshold: D0 [uC/cm²]: 500.00
 Use additional mid range fit term

Data Properties

Proximity Effect Correction applied No Proximity Effect Correction applied

Data

	A	B	C	D	
1	Target CD [nm]	100	100	100	100
2	Density [%]	50.000	33.300	25.000	16.7
3	Dose [uC/cm ²]	Mea. CD [nm]	Mea. CD [nm]	Mea. CD [nm]	Mea. CD [nm]
4	700	0	148	140	117
5	650	0	135	126	115
6	600	138	122	120	113
7	550	125	116	115	110
8	500	113	106	106	104
9	450	97	98	100	97
10	400	80	87	88	93
11	0	0	0	0	0

Base Dose Plot

CD [nm] vs Nominal Dose [uC/cm²]

Legend:

- 100 nm, 50 %
- 100 nm, 33 %
- 100 nm, 25 %
- 100 nm, 17 %
- 100 nm, 9 %
- 100 nm, 0 %

Run Calibration

Optimize?

Base Dose [uC/cm²]: 579.55
Process Blur [nm]: 26
Additional Mid Range [nm]: 0
Mid Range Weight: 0.00
Constant Bias [nm]: 6
Optimal Contrast [%] / Uniform Clearing [%]: 100 / 0
Overdose: 1.00
Max. Fit Density [%]: 100
Fit RMS Deviation [nm]: 18.14

	Cov. [%]	Lateral Bias [nm]	Applied Bias [nm]	Blur Latitude [%]	Dose Latitude [%]
0	0	0	6	n/a	n/a
9	2	8	n/a	n/a	n/a
17	5	11	n/a	n/a	n/a
25	11	17	n/a	n/a	n/a
33	17	23	n/a	n/a	n/a
50	29	35	n/a	n/a	n/a

Detailed Result Table

- The input data and calibration result are shown side by side.

Calibration

Input Data

PSF parameter for calibration

Use PSF from archive

2D-PSF: Substrate_InP_Thickness_7000 Local Archive... Global Archive...

Use analytical PSF

Beta [nm]: 8318 Eta: 1.29

Gamma [nm]: 0 Nu: 0.00

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

Calibrated model

From CC... Resist Contrast: 3.50

Thickness [nm]: 200

Resist-positive D0 [uC/cm²]: 400.00

Use additional mid range fit term

Fit mix factor

Data Properties

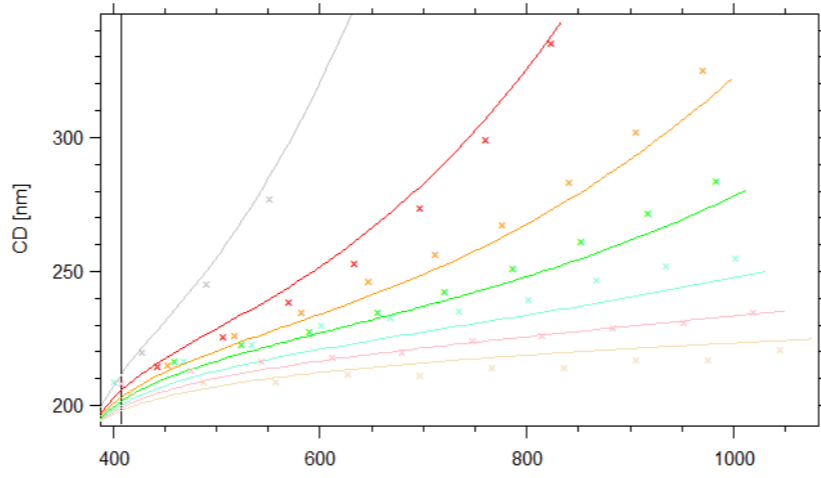
Proximity Effect Correction applied No Proximity Effect Correction applied

Data

	A	B	C	D	E	F	G	⊖
1	Target CD	200	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]							
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	
7	840	298.9	267.1	250.8	239.4	226.1	213.8	
8	770	273.5	256.4	242.2	235.1	224	214	
9	700	253	246.2	234.5	232.6	219.9	211	
10	630	238.6	234.8	227.2	229.7	217.9	211.4	
11	560	225.6	225.9	222.4	222.8	216.4	208.9	
12	490	214.5	215	216.4	216.4	212.8	208.9	
13	420	0	0	0	208.7	208.4	204.7	
14	0	0	0	0	0	0	0	

Dose - CD

CD Plot incl. Bias Nominal Dose



Base Dose

Run Calibration

Optimize?

Base Dose [uC/cm²]: 407.78

Process Blur [nm]: 25

Additional Mid Range [nm]: 0

Mid Range Weight: 0.00

Constant Bias [nm]: -2

Optimal Contrast [%] / Uniform Clearing [%]: 15 / 85

Overdose: 1.00

Max. Fit Density [%]: 100

Fit RMS Deviation [nm]: 5.43

Detailed Result Table

	Cov. [%]	Lateral Bias [nm]	Applied Bias [nm]	Blur Latitude [%]
0	0	0	-2	n/a
9	9	2	-1	n/a
16	16	3	0	n/a
25	25	4	2	n/a
33	33	5	3	n/a
50	50	8	6	n/a
100	100	14	12	n/a

Calibration

Input Data

PSF parameter for calibration

Use PSF from archive
 2D-PSF:

Use analytical PSF

Beta [nm]: Eta:

Gamma [nm]: Nu:

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

Calibrated model

From CC... Resist Contrast:

Thickness [nm]:

Resist-positive

Use additional mid range fit term
 Fit mix factor

Data Properties

Proximity Effect Correction applied No Proximity Effect Correction applied

Data

	A	B	C	D	E	F	G	
1	Target CD	200	200	200	200	200	200	<input type="button" value="Add Dose"/>
2	Density [%]	50.000	33.300	25.000	16.000	9.000	0.000	<input type="button" value="Add Dataset"/>
3	Dose [uC/cm^2]	Mea. CD [nm]	Mea. CD [nm]	Mea. CD [nm]	Mea. CD [nm]	Mea. CD [nm]	Mea. CD [nm]	<input type="button" value="Remove"/>
4	1050	0	325.1	283.5	254.6	234.7	220.7	<input type="button" value="Import..."/>
5	980	0	301.7	271.5	251.8	230.9	216.8	<input type="button" value="Export..."/>
6	910	335.1	283.1	260.9	246.5	228.9	216.9	
7	840	298.9	267.1	250.8	239.4	226.1	213.8	
8	770	273.5	256.4	242.2	235.1	224	214	
9	700	253	246.2	234.5	232.6	219.9	211	
10	630	238.6	234.8	227.2	229.7	217.9	211.4	
11	560	225.6	225.9	222.4	222.8	216.4	208.9	
12	490	214.5	215	216.4	216.4	212.8	208.9	
13	420	0	0	0	208.7	208.4	204.7	
14	0	0	0	0	0	0	0	

PSF parameters

Experimental data: CD measurements for varied doses and pattern densities

E-Beam Process Calibration

Calibration

Input Data

PSF parameter for calibration

Use PSF from archive
 2D-PSF: Substrate_InP_Thickness_7000 Local Archive... Global Archive...

Use analytical PSF
 Beta [nm]: 8318 Eta: 1.29
 Gamma [nm]: 0 Nu: 0.00
 Optimal contrast [%]: 50 / 50 : Uniform clearing [%]

Calibrated model

From CC... Resist Contrast: 3.50
 Thickness [nm]: 200
 Resist-positive D0 [$\mu\text{C}/\text{cm}^2$]: 400.00
 Use additional mid range fit term
 Fit mix factor

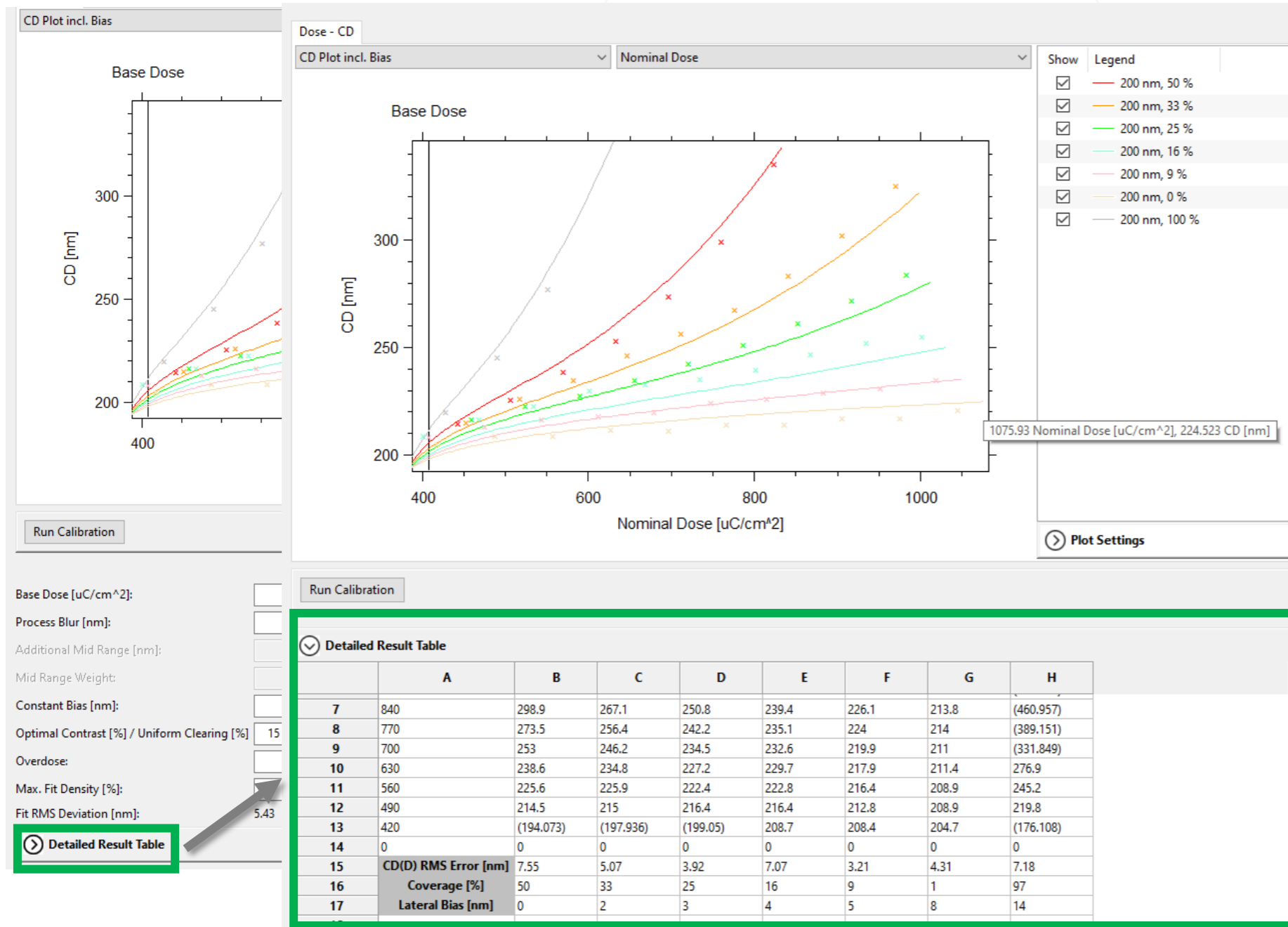
Data Properties

Proximity Effect Correction applied No Proximity Effect Correction applied

Data

	A	B	C	D	E	F	G	
1	Target CD	200	200	200	200	200	200	Add Dose
2	Density [%]	50.000	33.300	25.000	16.000	9.000	0.000	Add Dataset

- During model definition,
 - both positive and negative resists are supported.
 - the mid-range term can be activated for a better fit when the mid-range effect is non-negligible.
- The selection in data properties allows
 - calibrations on measurements made on exposure data with or without PEC.



- After clicking on the arrow, the detailed result are shown.

Calibration

Input Data

PSF parameter for calibration

Use PSF from archive
 2D-PSF:

Use analytical PSF
 Beta [nm]: Eta:
 Gamma [nm]: Nu:
 Optimal contrast [%]: / : Uniform clearing [%]

Calibrated model

Resist Contrast:
 Thickness [nm]:
 Resist-positive D0 [uC/cm^2]:
 Use additional mid range fit term
 Fit mix factor

Data Properties

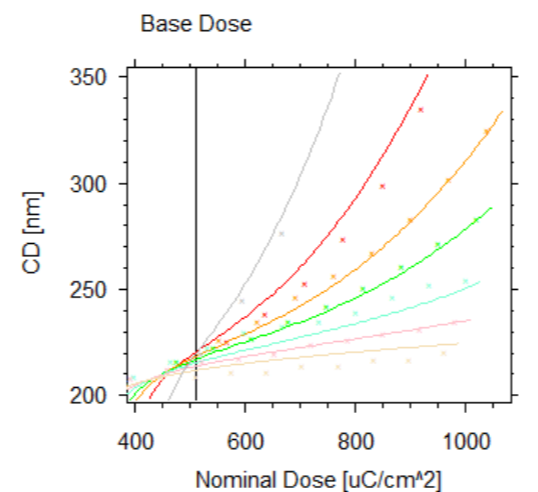
Proximity Effect Correction applied No Proximity Effect Correction applied

Data

	A	B	C	D	E	F	
1	Target CD	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	224.0
5	980	0	301.7	271.5	251.8	230.9	221.0
6	910	335.1	283.1	260.9	246.5	228.9	221.0
7	840	298.9	267.1	250.8	239.4	226.1	221.0
8	770	273.5	256.4	242.2	235.1	224.0	221.0
9	700	253.0	246.2	234.5	232.6	219.9	221.0

Dose - CD Process Window Dose Blur Latitude vs Bias
 CD Plot incl. Bias Nominal Dose

Base Dose



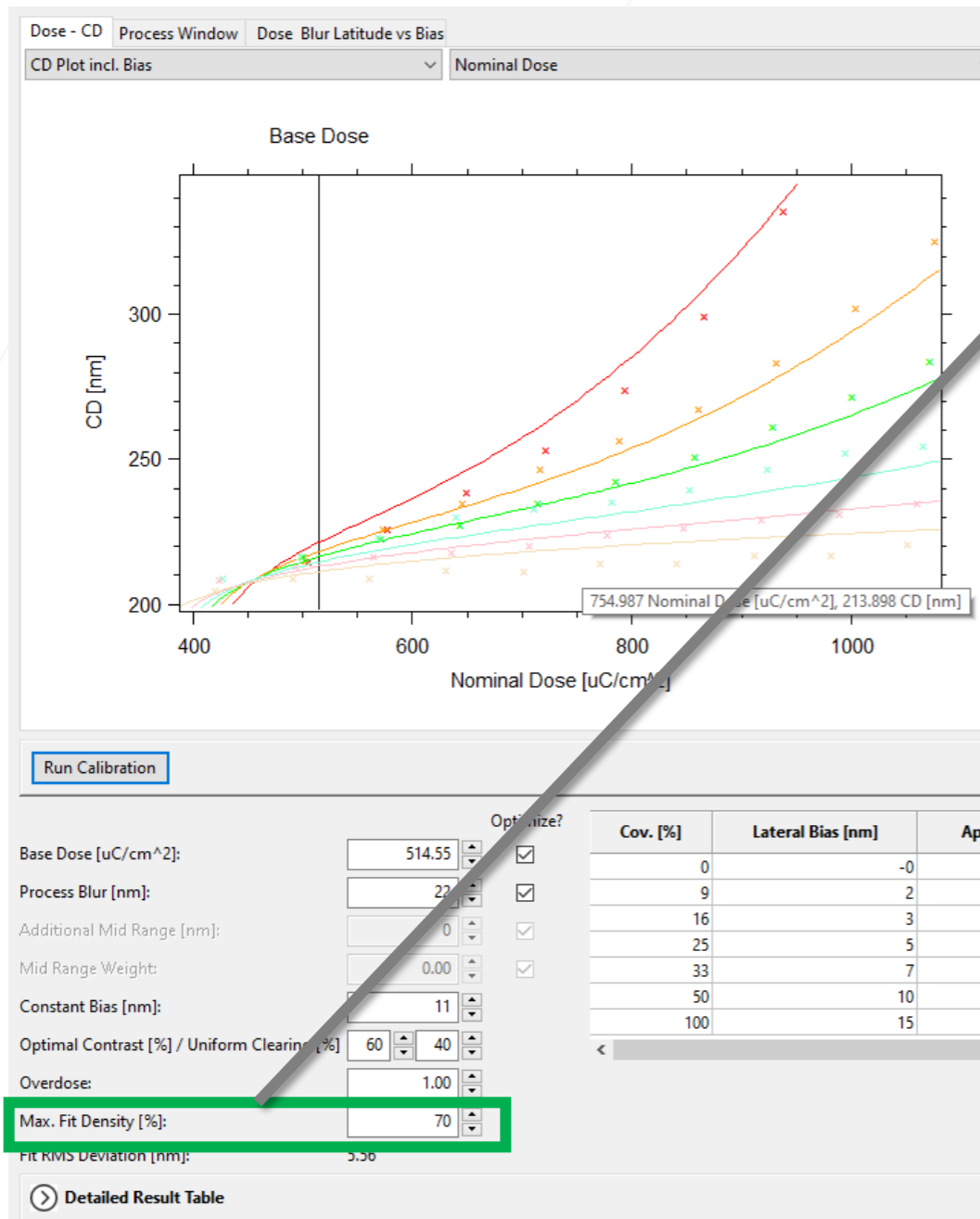
Base Dose [uC/cm^2]: Optimize?
 Process Blur [nm]: Optimize?
 Additional Mid Range [nm]: Optimize?
 Mid Range Weight: Optimize?
 Constant Bias [nm]:
 Optimal Contrast [%] / Uniform Clearing [%]: /
 Overdose:
 Max. Fit Density [%]:
 Fit RMS Deviation [nm]: 5.18

Project File: Project_test.trcprj *

Only the checked parameters are optimized.

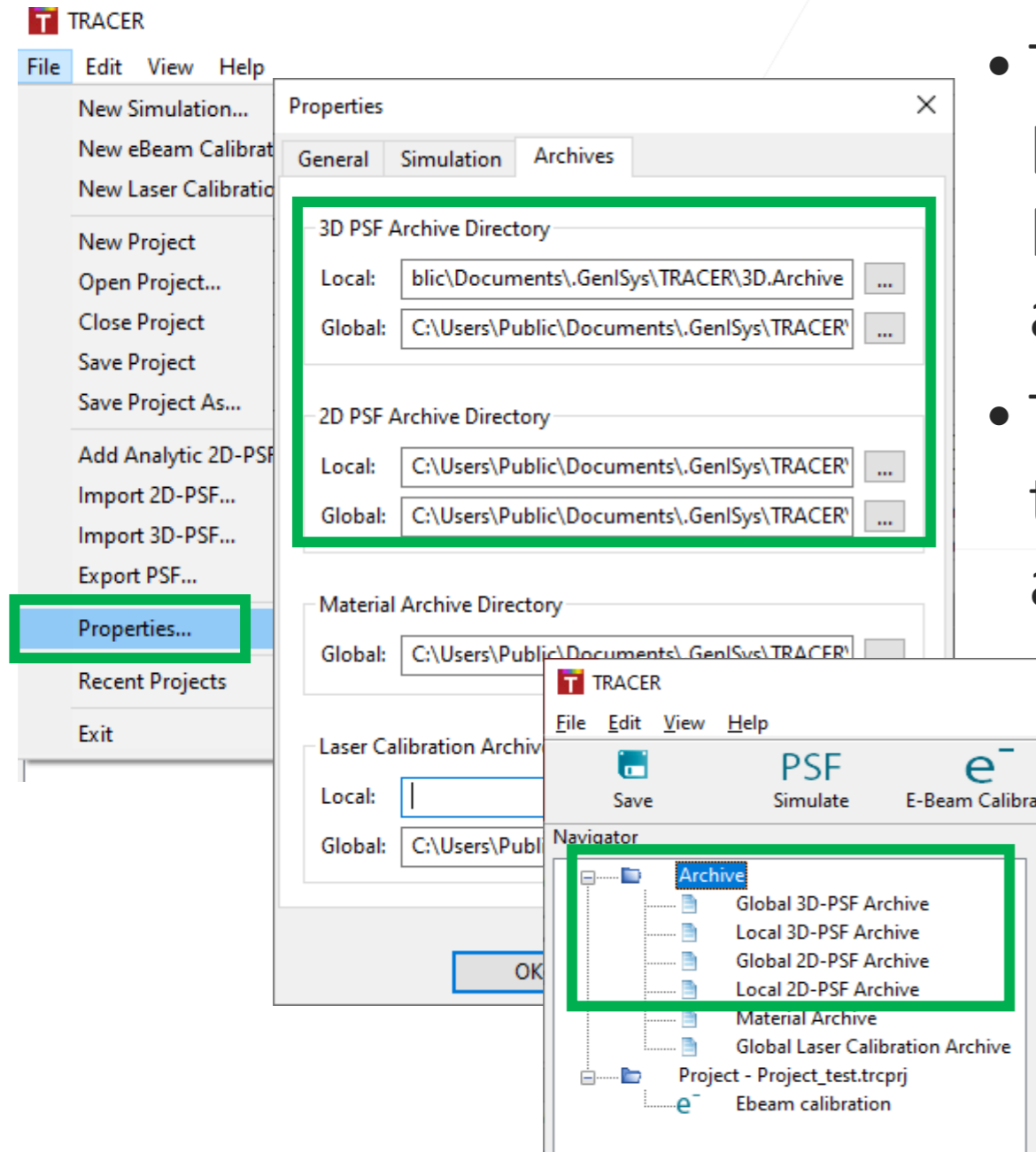
New functionalities

E-Beam Process Calibration



- The maximum correction density for fitting can now be set using an additional input field.
 - This allows an improved calibration for sparse layouts

Global and Local PSF Archive



- TRACER now supports storing PSFs to both Local or Global archives, for both 2D and 3D PSFs. When storing to an archive, the user is asked which archive should be used.
- The archive locations must be matched to those used by BEAMER, so that PSFs stored in archives are available in BEAMER's modules.
- If the archive locations are defined using the program's Properties dialog, the locations for 3D and 2D PSF Local and Global archives must be defined as shown at left.
- If the archive locations are defined using system Environment Variables, these will need to be updated; see the release notes for further details.

Thank You!

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