

Model and Update Machine Constants - ...ion/Image Plane/Single Energy Intrafield  
Operator:MKANE Machine:5633 Release:5.0.0 Date:08/16/2021 Time:06:05

OK: Test finished successfully

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Intrafield Focal Plane Calibration

Exposure	: First	Second
Date	: 16 Aug 2021	16 Aug 2021
Time	: 05:36:04	05:44:00
Machine ID	: 5633	5633
Chuck ID	: 1	2
Cal. State ID	: ASML_4PAR	ASML_4PAR
Reticle ID	: 45562152C007	45562152C007
Reference Grid	:	
Lens Type	: 07	07
Lens ID	: 0130361z	0130361z
Elle ID	: 195154	195154
Energy [mJ/cm2]	: 15.0	15.0
Focus Offset [um]	: -0.375	-0.375
Illumination Mode	: Annular	Annular
Blade ID	:	
Numerical Aperture	: 1.200	1.200
Sigma Inner	: 0.740	0.740
Sigma Outer	: 0.940	0.940
Clean-Up Aperture	: 0	0
Pol. changing ID	: 4	4
Pol. shaping ID	: 1	1
Meas chuck meander	: OFF	OFF
Temperature [degC]	: 22.00	22.00
Pressure [mbar]	: 1014.62	1014.73
Wavelength [nm]	: 193.380	193.380

Recipes:  
Recipe Exposure First Layer : FO\_1700i\_300wN\_R6  
Layer Exposure First Layer : EXPO\_SINGLE  
Recipe Exposure Second Layer : FO\_1700i\_300wN\_R6  
Layer Exposure Second Layer : EXPO\_SECOND  
Recipe Measure Mark Positions : ASML/FO\_1700i\_300wN\_R6  
Layer Measure Mark Positions : READ\_SINGLE

Comments from:  
'Exposure First Layer' :  
'Exposure Second Layer' :  
'Exposure Third Layer' :  
'Measure Mark Positions' :  
'Modelling' :

Test Log Name : FODSU\_Focal\_Verify\_16Aug2021.tlg  
Measurement Machine ID: : 5633  
Measurement Chuck ID: : 1  
Number of Wafers Measured : 1  
Number of Fields per Wafer : 1  
Number of Marks per Field : 91  
Number of Failed Wafers : 0  
Alignment Errors in Data : 0  
Wafer Size [mm] : 300  
Max Field Size X [mm] : 26.0  
Y [mm] : 32.0

Settings used during readout  
Global Align Timeout(seconds) : 100000  
Number of scans per mark SA : 1  
Number of scans per mark WA : 1

Modelling Options

Field Curvature : yes  
Focus Offset : yes  
Focus Tilt : yes  
Linear Wedge : no  
Quadratic Wedge : no  
Linear Roll : no  
Wafer Tilt : no  
Z-Mirror X-Curvature : no  
Z-Mirror X Third Order : no  
Z-Mirror X Fourth Order : no

Levelling MA Map Correction Usage:

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	Chuck 1	Chuck 2
Percentage applied Interfield [%]	0.0	0.0
Percentage applied Intrafield [%]	100.0	100.0

Model Result Lens-Related Parameters:

		Correction
Wavelength shift	[pm]	0.154
Lens element 1	[um]	0.019
NEXZ Element 1 Rx tilt	[urad]	0.264
NEXZ Element 1 Ry tilt	[urad]	0.054
Lens element 2	[um]	-0.094
NEXZ Element 2 Rx tilt	[urad]	0.096
NEXZ Element 2 Ry tilt	[urad]	0.004
Lens element 3	[um]	-0.395
NEXZ Element 3 Rx tilt	[urad]	0.105
NEXZ Element 3 Ry tilt	[urad]	0.010
Lens element 4	[um]	-0.123
NEXZ Element 4 Rx tilt	[urad]	0.115
NEXZ Element 4 Ry tilt	[urad]	-0.318
Lens element 5	[um]	-0.197
NEXZ Element 5 Rx tilt	[urad]	0.107
NEXZ Element 5 Ry tilt	[urad]	0.070
Lens element 6	[um]	0.194
NEXZ Element 6 Rx tilt	[urad]	-0.028
NEXZ Element 6 Ry tilt	[urad]	-0.004
Adaptive lens element 1	[bar]	0.071
Adaptive lens element 2	[bar]	-0.037
Reticle-stage height	[um]	1.439
RS linear wedge	[urad]	0.000
RS quadratic wedge	[nm/cm2]	0.000
RS linear roll	[urad/m]	0.000

Model Result Parameters:

	Chuck 1	Chuck 2	Chuck avg	Chuck dif
Image height	[um]	0.002	0.005	-0.003
Image tilt (Ry)	[urad]	-0.266	-0.152	-0.114
Wafer tilt (Ry)	[urad]			
Z-mirror x-curv.	[nm/cm2]			
Z-mirror x-3rd.	[nm/dm3]			
Z-mirror x-4th.	[nm/dm4]			

Model Result Delta LoCo Reference Symmetric Zernike Parameters

Item	Offset[nm]	Tilt[nm/cm]	Curvature[nm/cm2]	3rd order[nm/cm3]
Z4	N.A	N.A	-0.191	N.A
Z5	1.302	N.A	-0.128	N.A

Intrafield Residues Before and After Correction:

	Before	After	Diff.
	[nm]	[nm]	[nm]
Focus Range Chuck 1	47.1	40.6	6.6
Focus Range Chuck 2	39.3	36.7	2.6
Astigmatism Range Chuck 1	24.4	21.0	3.3
Astigmatism Range Chuck 2	24.9	27.3	-2.4

New Machine Constants Saved : N

THE FOLLOWING CORRECTIONS SHOULD BE APPLIED TO THE MACHINE CONSTANTS:

	Reference	Correction	New
LENS-RELATED MCs			
IMAGE QUALITY (K1) MCs			

Wavelength shift	[pm]	11.907	0.154	12.062
Reticle-stage height	[um]	0.000	-0.000	0.000
Lens element 1	[um]	7.907	0.019	7.025
NEKZ Element 1 Rx tilt	[urad]	21.102	0.264	21.366
NEKZ Element 1 Ry tilt	[urad]	9.793	0.054	9.847
Lens element 2	[um]	2.989	-0.094	2.895
NEKZ Element 2 Rx tilt	[urad]	2.174	0.096	2.270
NEKZ Element 2 Ry tilt	[urad]	2.362	0.084	2.446
Lens element 3	[um]	14.293	-0.395	13.898
NEKZ Element 3 Rx tilt	[urad]	27.946	0.105	28.051
NEKZ Element 3 Ry tilt	[urad]	39.810	0.019	39.829
Lens element 4	[um]	0.696	-0.123	0.573
NEKZ Element 4 Rx tilt	[urad]	17.756	0.115	17.871
NEKZ Element 4 Ry tilt	[urad]	5.609	-0.318	5.290
Lens element 5	[um]	6.877	-0.197	6.680
NEKZ Element 5 Rx tilt	[urad]	21.629	0.107	21.736
NEKZ Element 5 Ry tilt	[urad]	-13.446	0.070	-13.376
Lens element 6	[um]	0.051	0.194	0.259
NEKZ Element 6 Rx tilt	[urad]	-4.231	-0.028	-4.259
NEKZ Element 6 Ry tilt	[urad]	0.504	-0.004	0.500
Adaptive lens element 1	[bar]	0.069	0.071	0.140
Adaptive lens element 2	[bar]	-0.048	-0.037	-0.084
LENS FINGERPRINT				
RMS Z2 - Z3	[nm]	0.932	0.043	0.975
RMS Z4 - Z5	[nm]	0.922	0.324	1.246
RMS Z5 - Z37	[nm]	1.374	0.227	1.601
Std Z2 - Z3	[nm]	2.587	0.013	2.600
Std Z5 - Z37	[nm]	1.894	-0.012	1.881
SYCO REFERENCES				
RMS Z2 - Z3	[nm]	10.422	0.025	10.447
RMS Z4 - Z5	[nm]	22.891	0.309	23.200
RMS Z5 - Z37	[nm]	2.326	-0.273	2.053
SYCO TOTAL DRIFT				
RMS Z2 - Z3	[nm]	0.585	0.000	0.585
RMS Z4 - Z5	[nm]	0.000	0.000	0.000
RMS Z5 - Z37	[nm]	0.401	0.000	0.401
LOCO REFERENCES: Chuck 1				
RMS Z2 - Z3	[nm]	36.165	-0.008	36.157
RMS Z4 - Z5	[nm]	19.426	0.122	19.548
RMS Z5 - Z37	[nm]	2.246	-0.478	1.768
LOCO REFERENCES: Chuck 2				
RMS Z2 - Z3	[nm]	36.165	-0.008	36.157
RMS Z4 - Z5	[nm]	19.426	0.122	19.548
RMS Z5 - Z37	[nm]	2.246	-0.478	1.768
MEAS. SYS. INTERFEROM. (MI) MCs				
Reticle-stage height	[um]	-5.905	1.439	-4.467
RS linear wedge	[urad]	28.466	0.000	28.466
RS quadratic wedge	[nm/cm2]	-5.941	0.000	-5.941
RS linear roll	[urad/m]	-82.920	0.000	-82.920
NON-LENS-RELATED MCs				
IMAGE QUALITY (KI) MCs				
RSC Reference FC	[nm/cm2]	-4.315	0.762	-3.552
HEIGHT AND TILT EXPOSURE (KU) MCs				
Chuck: 1				
Image Height (BFO)	[um]	-0.067	0.002	-0.065
Image Ry Tilt (BFO)	[urad]	-1.450	-0.266	-1.716
Wafer Ry Tilt (BFO)	[urad]	0.474	0.000	0.474
Z-Mirror X-Curvature	[nm/cm2]	0.829	0.000	0.829
Z-Mirror X 3rd Order	[nm/dm3]	25.732	0.000	25.732
Z-Mirror X 4th Order	[nm/dm4]	-14.373	0.000	-14.373
Lens2stage Offset Height	[um]	0.319	-0.212	0.107
Lens2stage Offset Ry Tilt	[urad]	-148.650	-0.047	-148.697
Chuck: 2				
Image Height (BFO)	[um]	-0.084	0.005	-0.079
Image Ry Tilt (BFO)	[urad]	-1.487	-0.152	-1.638
Wafer Ry Tilt (BFO)	[urad]	0.300	0.000	0.300
Z-Mirror X-Curvature	[nm/cm2]	0.829	0.000	0.829
Z-Mirror X 3rd Order	[nm/dm3]	25.732	0.000	25.732
Z-Mirror X 4th Order	[nm/dm4]	-14.373	0.000	-14.373
Lens2stage Offset Height	[um]	0.445	-0.144	0.301
Lens2stage Offset Ry Tilt	[urad]	-175.833	-0.088	-175.921

THE FOLLOWING CORRECTIONS SHOULD BE APPLIED TO ILIAS LOCO REF MC's FOR CHUCK 1

Item	Reference	Correction	New
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1	22.7	0.9	6.4	16.2	34.4	0.7	12.7	-16.2
2	22.2	1.5	4.2	16.2	33.4	0.7	12.7	-16.2
3	21.6	0.2	2.1	16.2	28.4	1.4	-4.2	10.8
4	21.5	0.9	6.4	16.2	28.0	4.6	2.1	16.2
5	21.3	0.2	2.1	16.2	27.0	19.1	4.2	16.2

Intrafield Minimum Focal Coarse Data:

Nr	Hor [nm]	StDev [nm]	Position in Field			Ver [nm]	StDev [nm]	Position in Field	
			X [mm]	Y [mm]	X [mm]			Y [mm]	
1	-5.0	4.1	-6.4	-5.4	-12.8	4.9	-6.4	-10.8	
2	-4.5	4.0	-8.5	-5.4	-12.7	5.8	-6.4	-5.4	
3	-4.1	3.3	-6.4	-10.8	-12.4	4.7	-8.5	-5.4	
4	-3.0	2.7	-4.2	-5.4	-11.4	4.2	-8.5	-10.8	
5	-3.0	2.5	0.0	-5.4	-10.8	4.1	-12.7	-5.4	