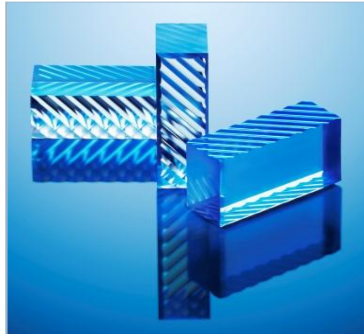


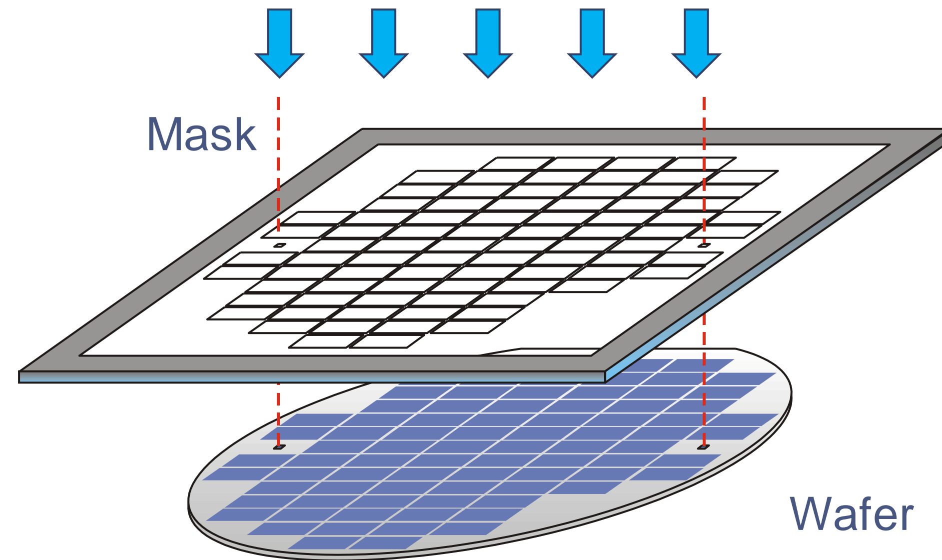
MO EXPOSURE OPTICS®

The New Illumination System for all SUSS Mask Aligners

SÜSS MicroTec AG, www.suss.com
SUSS MicroOptics SA, www.suss.ch, info@suss.ch

„Shadow Printing“ Lithography

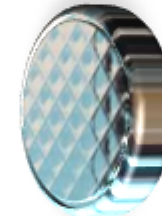
- Mask illumination using collimated UV light
- Resolution ⇔ proximity gap



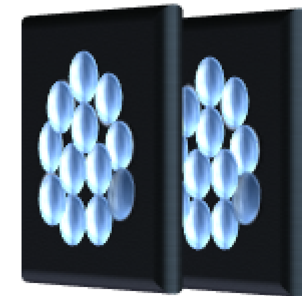
CONVENTIONAL MASK ALIGNER ILLUMINATION

SÜSS MicroTec

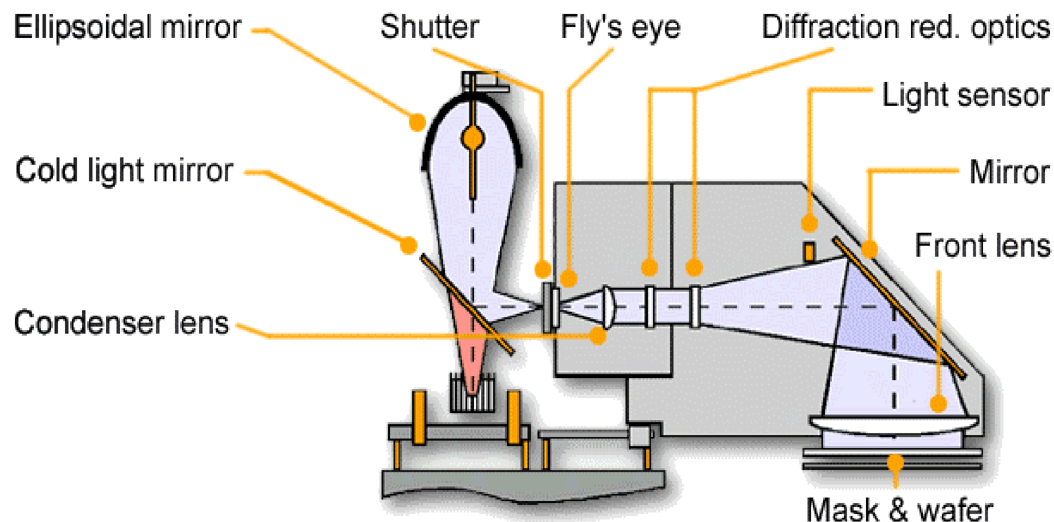
- Lamp readjustment required
- Uniformity change over lamp lifetime
- Daily uniformity test required
- Variation of illumination light over mask (angular spectrum)



"Fly's Eye"

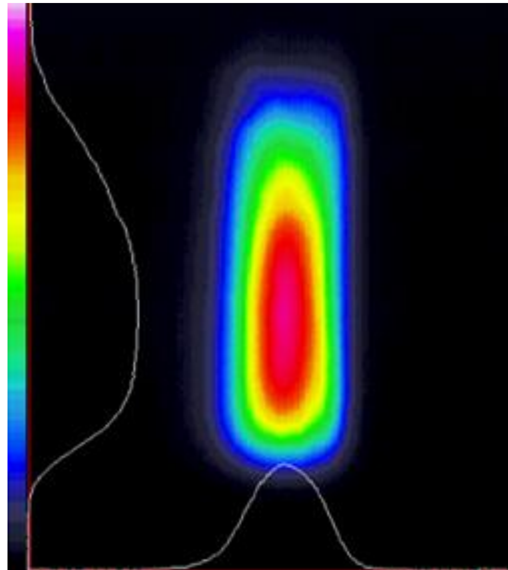


HR or LGO Lens Plates

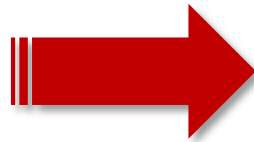


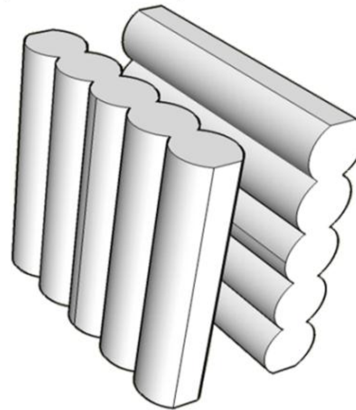
Forgot to control light uniformity this morning.

SÜSS MicroTec

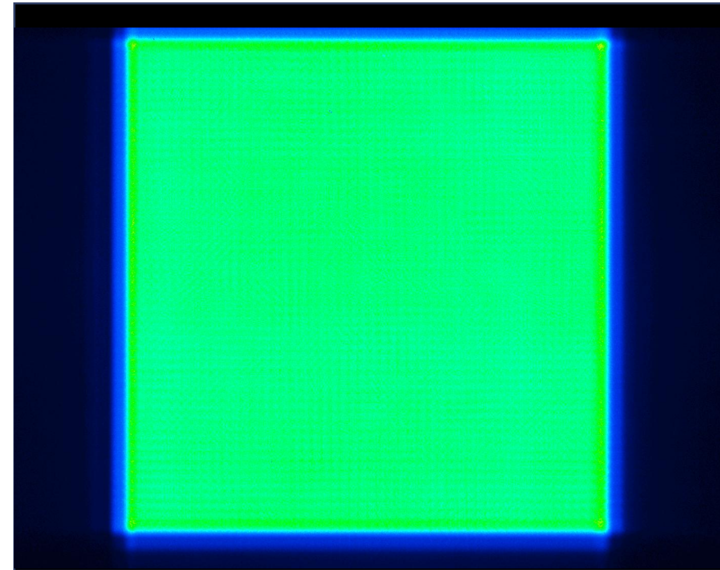


Light Source





Microlens Optical Integrator



Flat-Top Illumination

SÜSS MicroOptics

- SUSS MicroTec confidential -

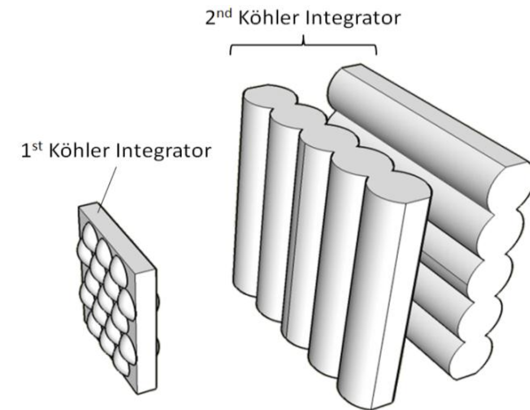
SÜSS MicroTec

NO Lamp readjustment required

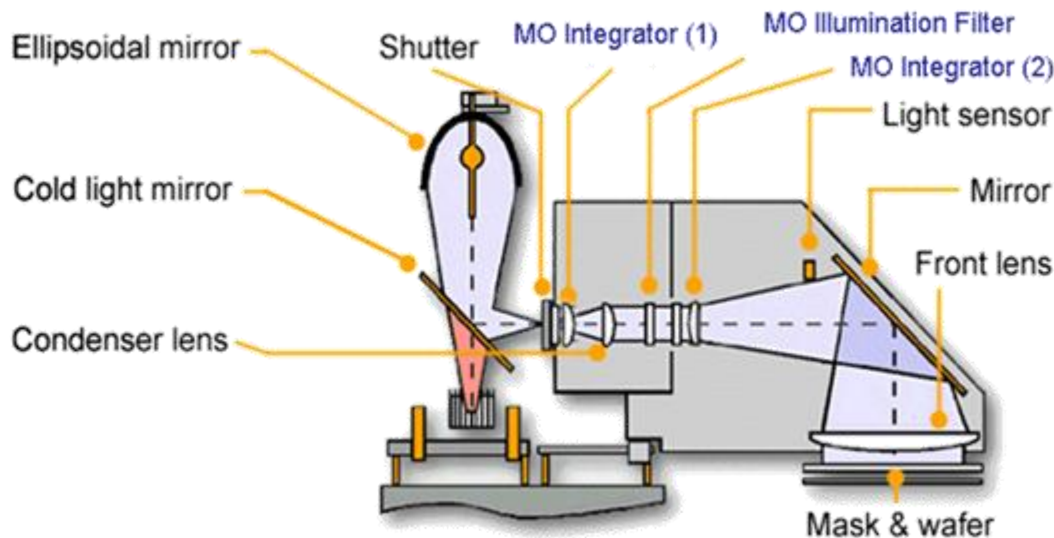
NO Uniformity change over lamp lifetime

NO Daily uniformity test required

NO Variation of illumination light over mask (angular spectrum)



Microlens Optical Integrators

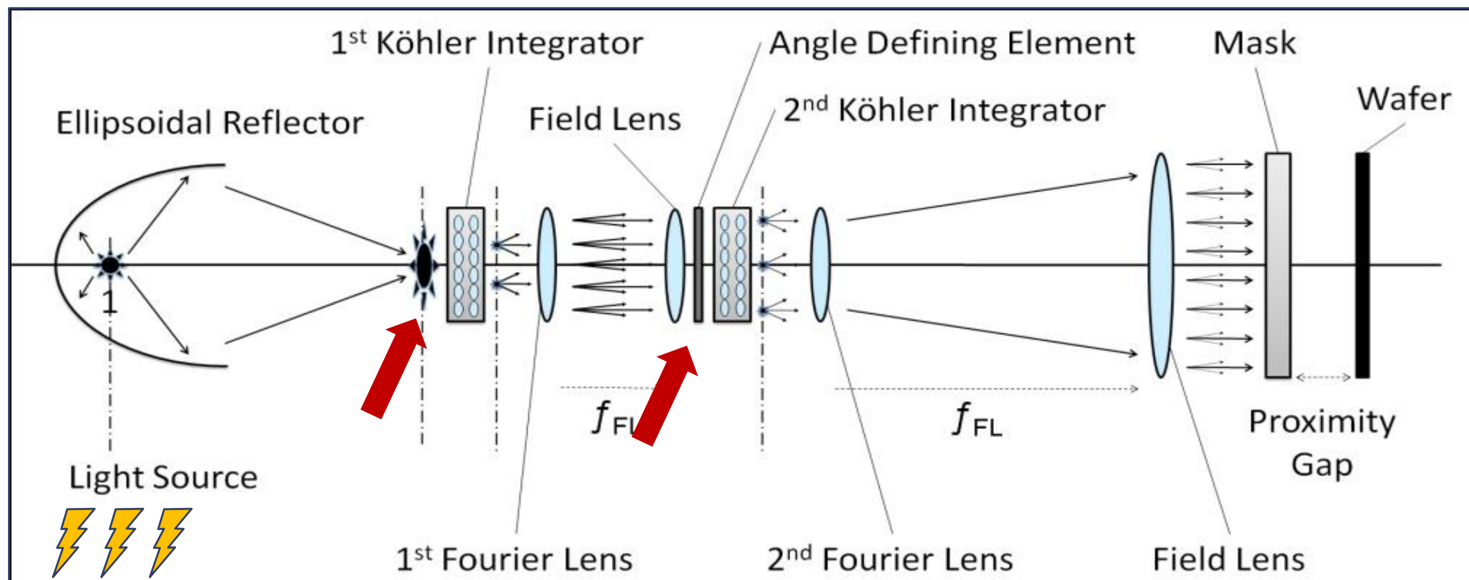


SÜSS MicroOptics

- SUSS MicroTec confidential -

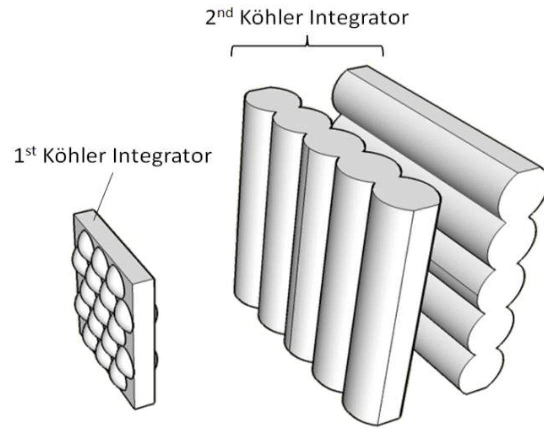
MO EXPOSURE OPTICS®

- 2x Microlens Optical Integrators in the Mask Aligner illumination system
- Light homogenization in both Fourier planes
- Self calibrating light source
- Illumination filter plate (IFP)

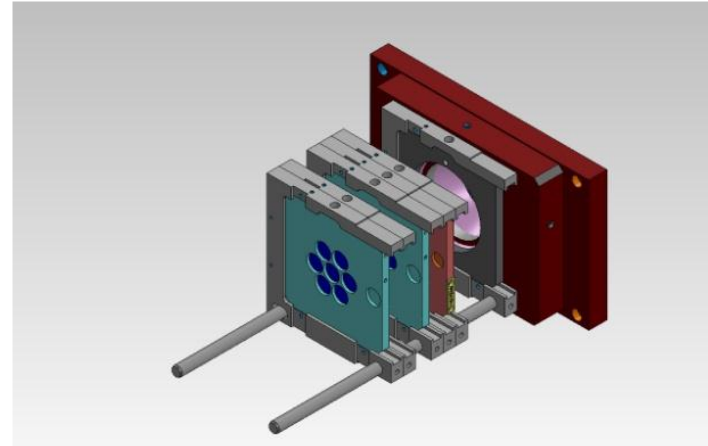


- SUSS MicroTec confidential -

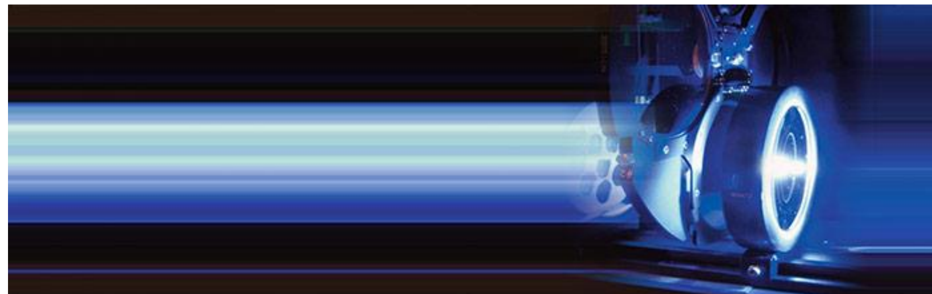
MO EXPOSURE OPTICS® : QUICK INSTALLATION



Microlens Optical Integrators



Quick Installation in Mask Aligner



SÜSS MicroOptics

SELF CALIBRATING LIGHT SOURCE – SAVES TIME & MONEY

SUSS MicroTec

+ Conventional Mask Aligner in Production

- Daily light measurement (9 or 12 points uniformity)
  - ⇨ 5 min x 365 day ~ 30 hours per year
- 12x lamp exchange per year
  - ⇨ 30 min x 10 ~ 6 hours per year
  - ⇨ 36 hours less productive time & labor costs per year

Forgot to control light uniformity this morning.

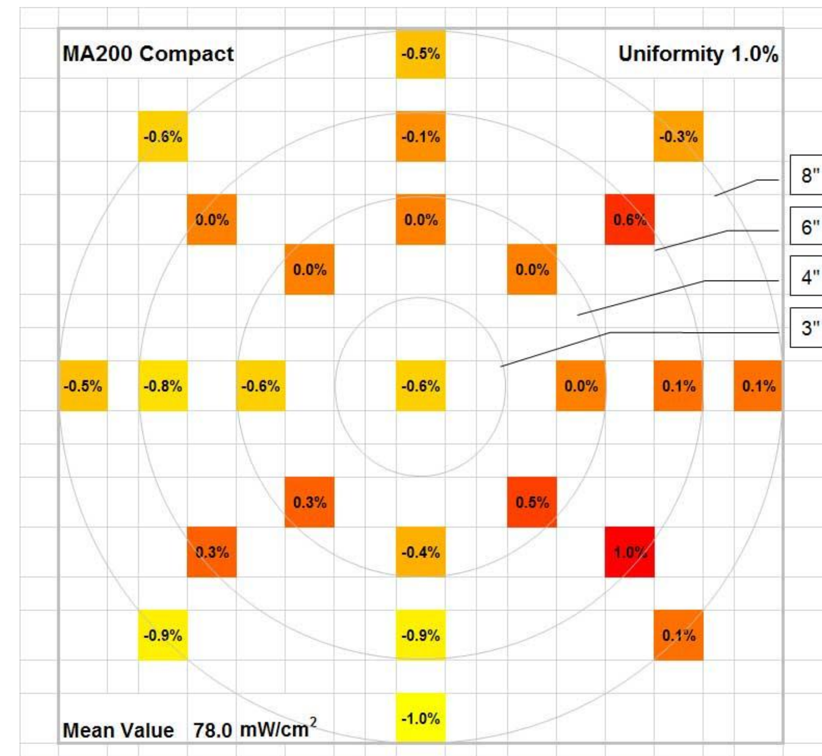
+ MO Exposure Optics®

- No uniformity measurements, no lamp alignment!
- Improved uniformity, telecentric illumination
- CD uniformity improvement = Yield!
- Process stability assurance = Yield!
- Convenience!

- SUSS MicroTec confidential -

BETTER UNIFORMITY – INDEPENDENT OF LAMP POSITION

- Excellent light uniformity
- No lamp misalignment
- No uniformity change due to degradation of lamp electrode during lifetime cycle

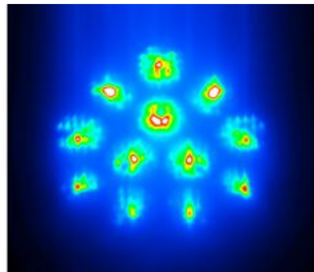


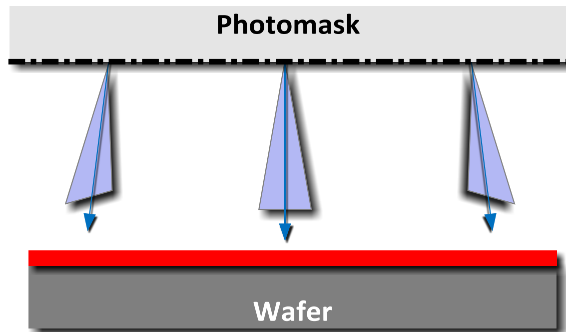
Deviation from mean value in [%] for Ø200mm in MA200 Compact

- SUSS MicroTec confidential -

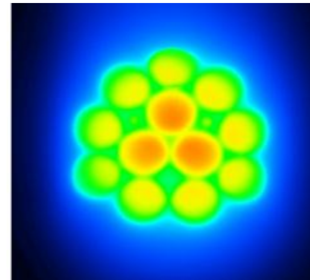
SUSS MicroTec

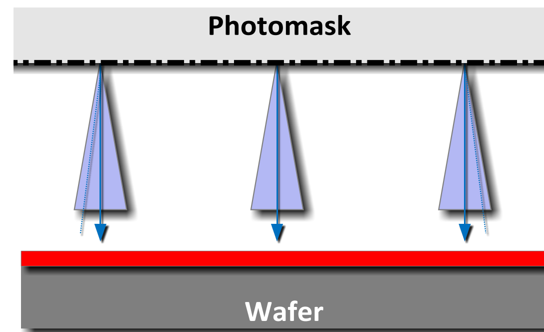
Conventional





MO Exposure Optics®





Angular spectrum illumination light

Near-field light distribution behind photomask

Uniform angular distribution over the entire mask plane

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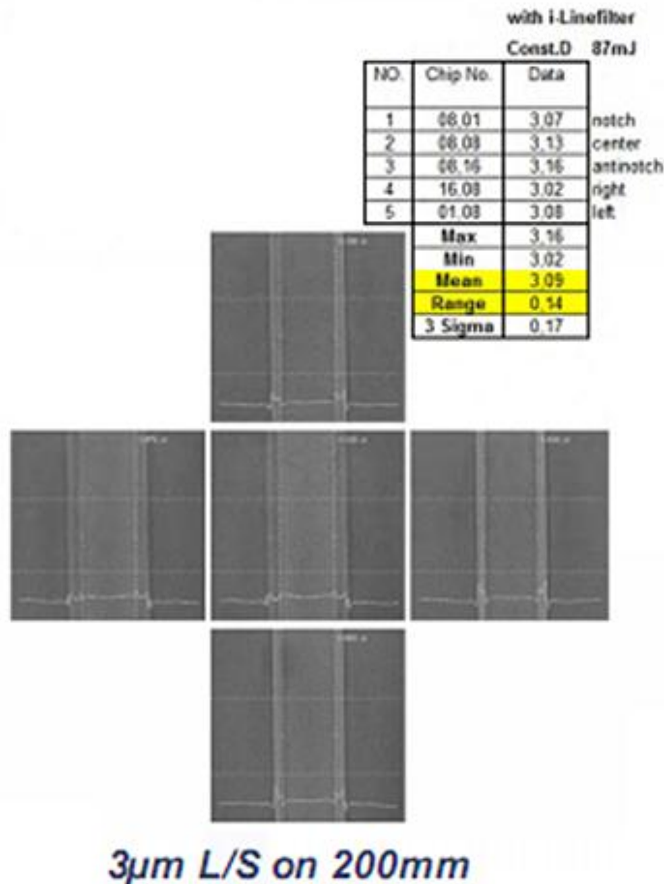


with i-Linefilter

Const.D 87mJ

NO.	Chip No.	Data	
1	08.01	3.07	notch
2	08.03	3.13	center
3	08.16	3.16	antinotch
4	16.08	3.02	right
5	01.08	3.08	left
	Max	3.16	
	Min	3.02	
	Mean	3.09	
	Range	0.14	
	3 Sigma	0.17	

3µm L/S on 200mm

850W

CD

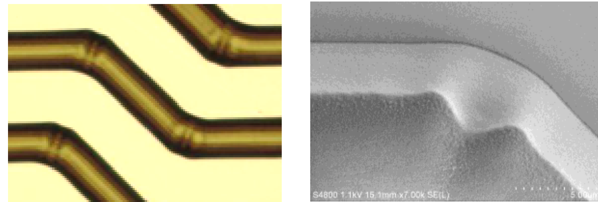
	Front	Center	Back	Right	Left	Range	3sig	MW	min	max	%+	%-	Dosis
1	3,07	3,13	3,16	3,02	3,08	0,00	0,17	3,09	3,0	3,2	2,5	-2,2	87mJ
2	3,06	3,15	3,19	3,08	3,09	0,14	0,17	3,12	3,1	3,2	1,8	-2,5	87mJ
3	3,09	3,06	3,14	3,14	3,07	0,13	0,12	3,10	3,1	3,1	1,3	-1,4	87mJ
4	3,12	3,10	3,17	3,10	3,12	0,08	0,09	3,12	3,1	3,2	0,8	-1,6	87mJ
5	3,19	3,20	3,27	3,17	3,14	0,08	0,14	3,20	3,1	3,3	1,8	-2,3	87mJ
6	3,08	3,06	3,14	3,13	3,02	0,13	0,15	3,09	3,0	3,1	2,2	-1,7	87mJ
7	3,20	3,15	3,21	3,20	3,18	0,12	0,08	3,19	3,2	3,2	1,3	-0,7	87mJ
8	3,22	3,11	3,23	3,19	3,13	0,11	0,15	3,18	3,1	3,2	2,0	-1,5	87mJ
MW	3,13	3,12	3,19	3,13	3,10	0,14	0,10	3,13					
3sigm	0,20	0,14	0,13	0,19	0,15	0,14	0,11	0,14					
							3,1	1,5	%+				
							3,2	-1,9	%-				

MA200 Compact

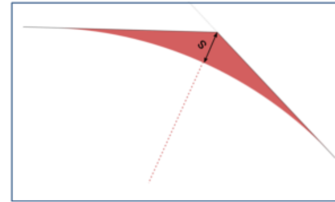
MOE(200mm production line in semiconductor fab)

- 3µm lines
- 30µm proximity gap
- i-line illumination (MO Exposure Optics)
- Resist IX335, 1.5µm thick
- 0.17µm variation (3 Sigma)

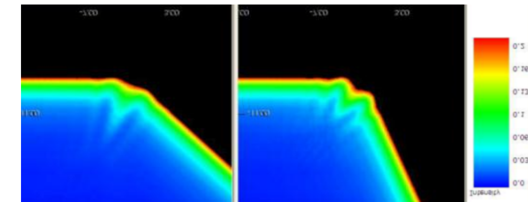
INDUSTRY EXAMPLE: REDUCTION OF PROXIMITY ARTIFACTS BY SMO



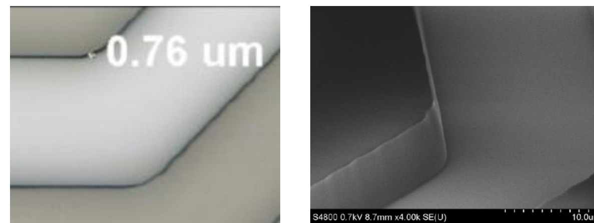
Proximity artifacts in redistribution lanes: Deformations in lane edges.



Fillet reduces erosion

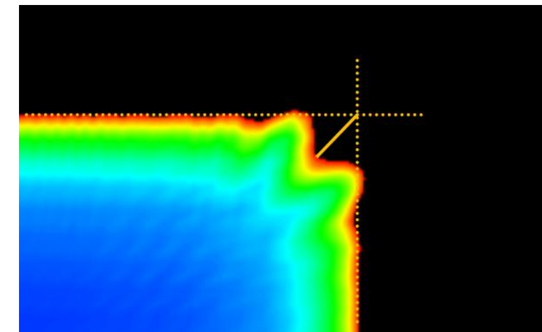


Simulation LayoutLAB software



Corrected: 30µm Exp Gap, SB 90°C, 300sec, 650mJ in MA200 Compact with MO Exposure Optics

Source Mask Optimization (SMO)

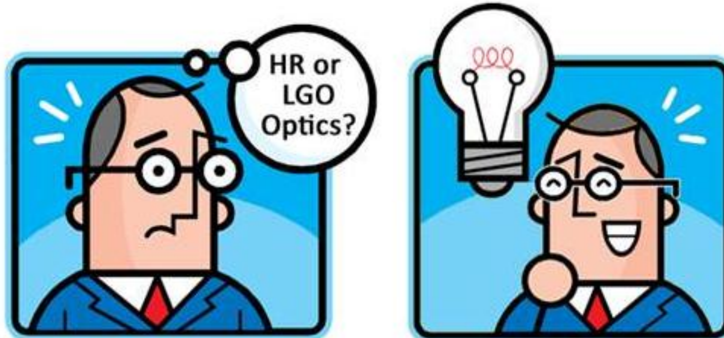


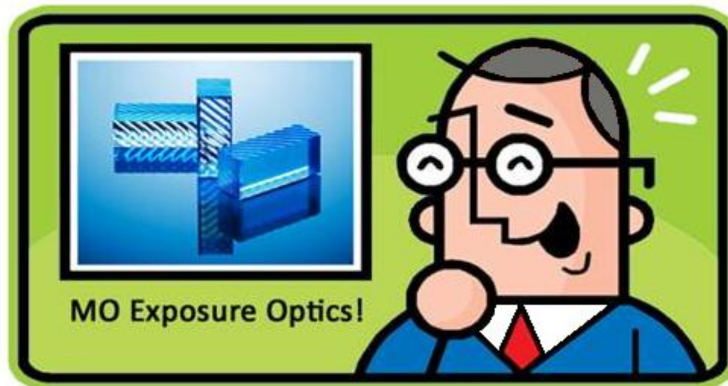
Proximity artifact: Deformation (protrusion) due to diffraction effects (simulation in LayoutLAB)

+ Simulation enables significant process improvements
+ Customer purchased five MA200 Compact Mask Aligners equipped with MO Exposure Optics®

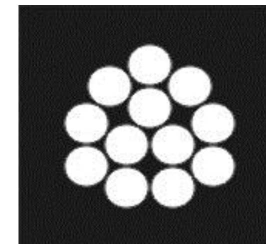
GenISys GmbH

SÜSS MicroTec

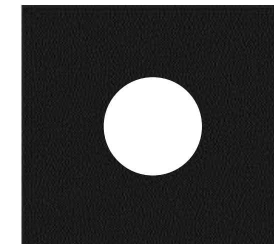




Changeover from HR-Optics to LGO-Optics in less than 5 minutes!



IFP-HR
„High Resolution“



IFP-LGO
„Large Gap“

- SUSS MicroTec confidential -

MO EXPOSURE OPTICS®

SÜSS MicroTec

+ Self calibrating light source - no periodic uniformity measurement required
+ Easy lamp change without lamp adjustment
+ Improved uniformity, telecentric illumination
+ Very convenient – higher yield!

+ One optics set for both Contact and Proximity Lithography
+ Advanced Mask Aligner Lithography (AMALITH)

- SUSS MicroTec confidential -

SÜSS MicroTec

ARE YOU STILL USING THE **CONVENTIONAL** MASK ALIGNER ILLUMINATION SYSTEM?

WE WOULD LIKE TO VISIT YOU TO SHOW YOU OUR NEW **SELF CALIBRATING** MO EXPOSURE OPTICS®!

"We love our MO Exposure Optics. It's so convenient!"

SÜSS MicroTec

MJB4

MA6, MA8

LithoPack 300

MA/BA8 Gen3

MA200Compact,
MA100e, MA150e

MA300 Gen2

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SÜSS MicroTec

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