
XTREME Technologies

First Tin Beta SoCoMo ready for Wafer Exposure

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and the whole XTREME and EUVA Gotemba team

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October 19, 2010



Taking light to new dimensions...

USHIO
GROUP

Bringing together all DPP knowledge under 1 strong roof

2001 Founding of

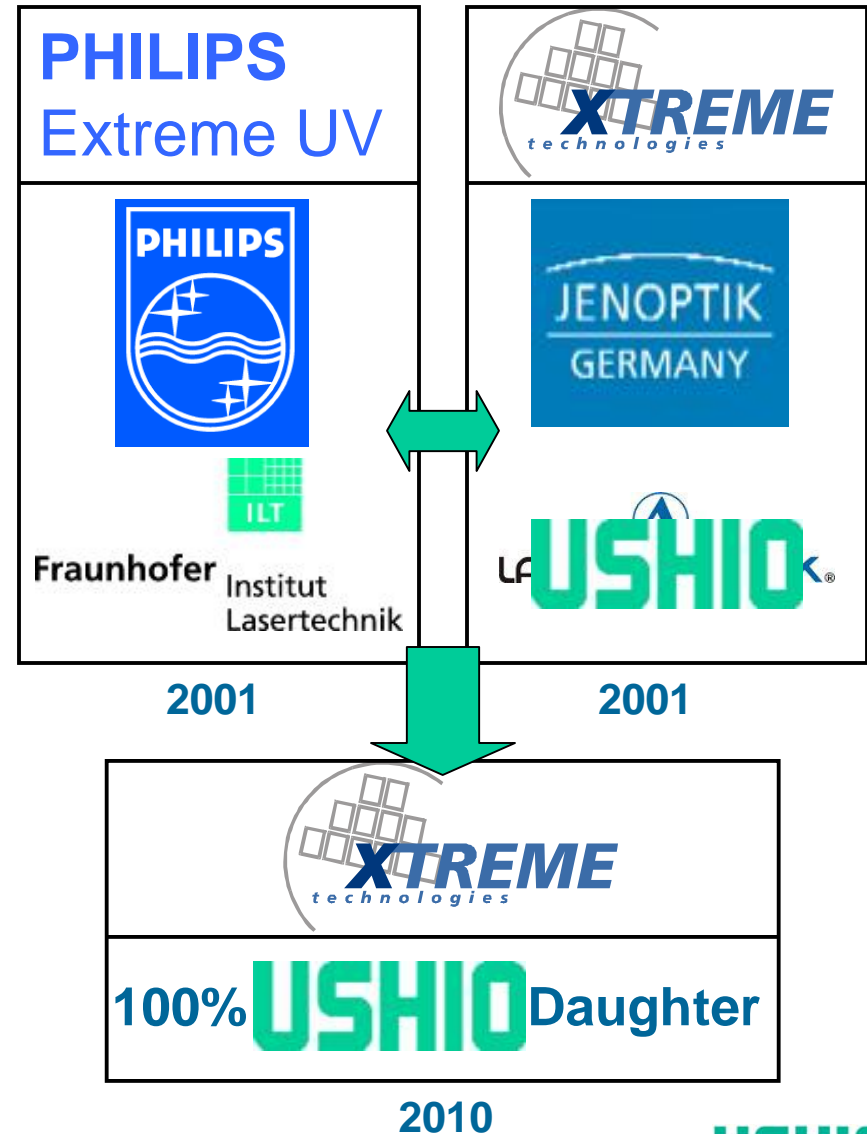
- PHILIPS Extreme UV
- XTREME Technologies GmbH (XT)

2005 Ushio buys Lambda Physik's
50% share in XT

2007 Joint development of Beta platform
by XT and PHILIPS EUV starts

2008 Ushio buys Jenoptik share in XT

2010 Ushio buys PHILIPS Extreme UV



Taking light to new dimensions...



Ushio: Lighting Edge Technologies -> EUV at the core

- Established in 1964
- Headquarters Tokyo, Japan
- Consolidated financial figures (2010/03)
 - Net sales 119 billion yen
 - Net profit 7 billion yen
 - Net asset 157 billion yen
 - Number of employees 4,700
- Core business segments:
 - **Electronics (UV lamps for photolithography, Excimer, EUV)**
 - Visual image equipment (Cinema projector, non-cinema projectors)
 - Office automation equipment (Light sources for copiers)
 - Illumination



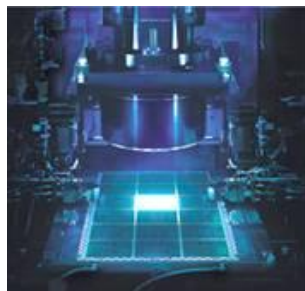
Mr. Ushio
Chairman
USHIO Group



Mr. Sugata
Pres. & CEO
USHIO Inc.
CEO of XTREME



i-line lamp



PCB Stepper



Xe excimer dry cleaner

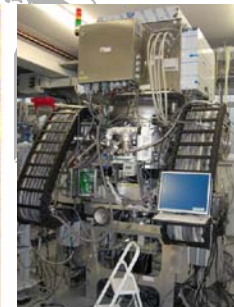


Taking light to new dimensions...

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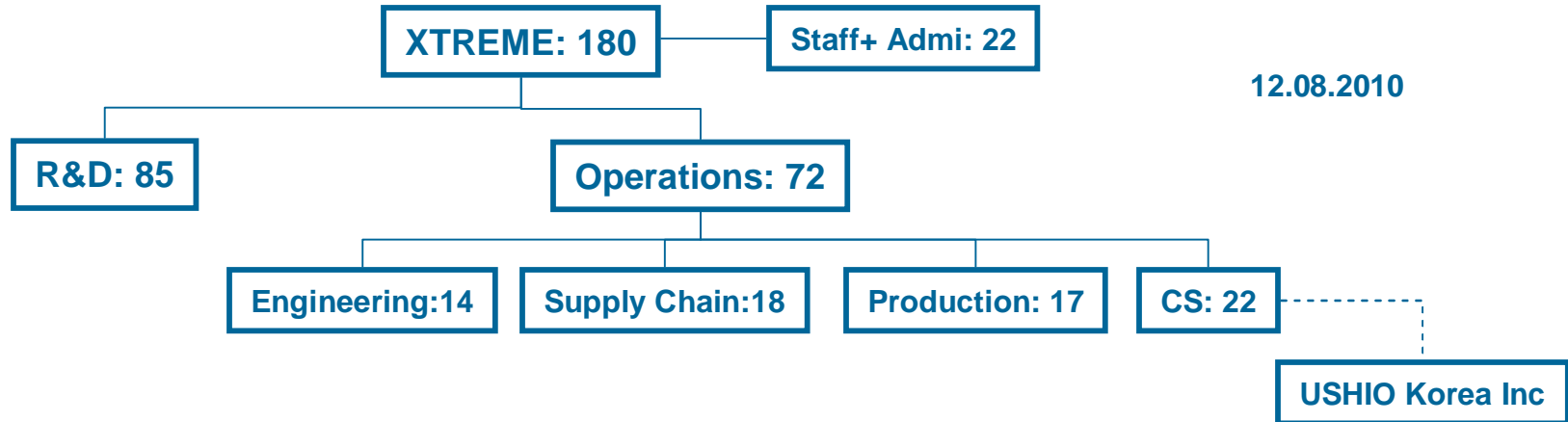
Managing all commercial DPP sources world-wide

- 24 DPP sources in use for wafer exposures and EUV R&D



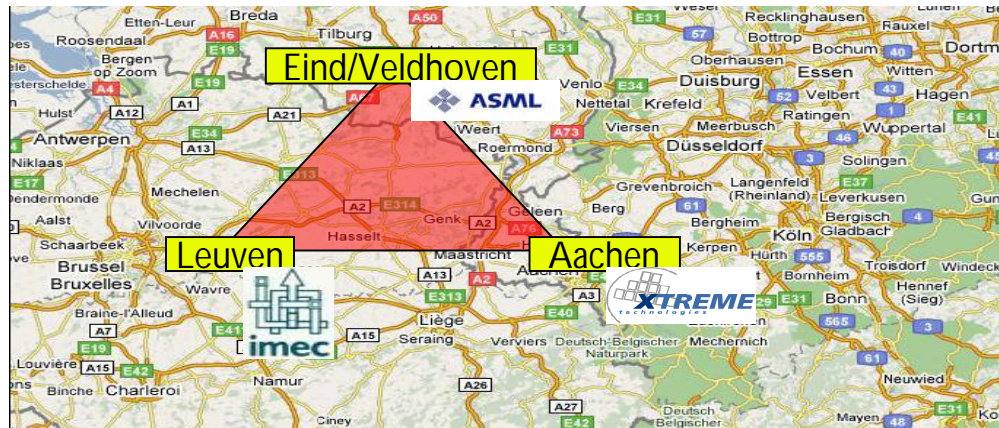
- Many years of runtime:
more than 100 billion DPP pulses used for exposures and source testing
- Delivering all the photons for all 12" wafer results presented to date
- Continuous Learning and Improvement

An organization with all competences on board to support you...



12.08.2010

Growing fast at 1 hour's drive from ASML and IMEC



Taking light to new dimensions...



Building several NXE 3100 sources

- Several full products for ASML to be delivered in coming months:



ASML will qualify the first product with the scanner in coming weeks.

Product close to being SEMI S2 qualified.

- Internal support platforms:

- Source for power scaling
- Full SoCoMo*
- SoCoMo* for module qualification
- Source + FT fully for reliability eng

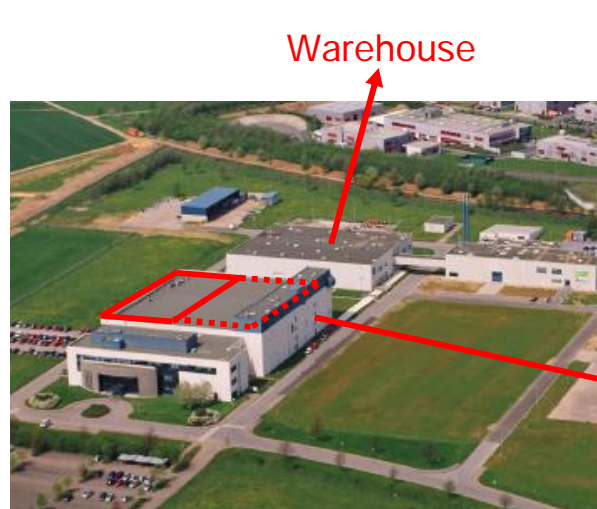
Availability

- R&D April 2008
- R&D September 2009
- Ops September 2010
- Ops January 2011

*SoCoMo = Source Collector Module (complete source upto IF)

Building the infrastructure to support this and future business

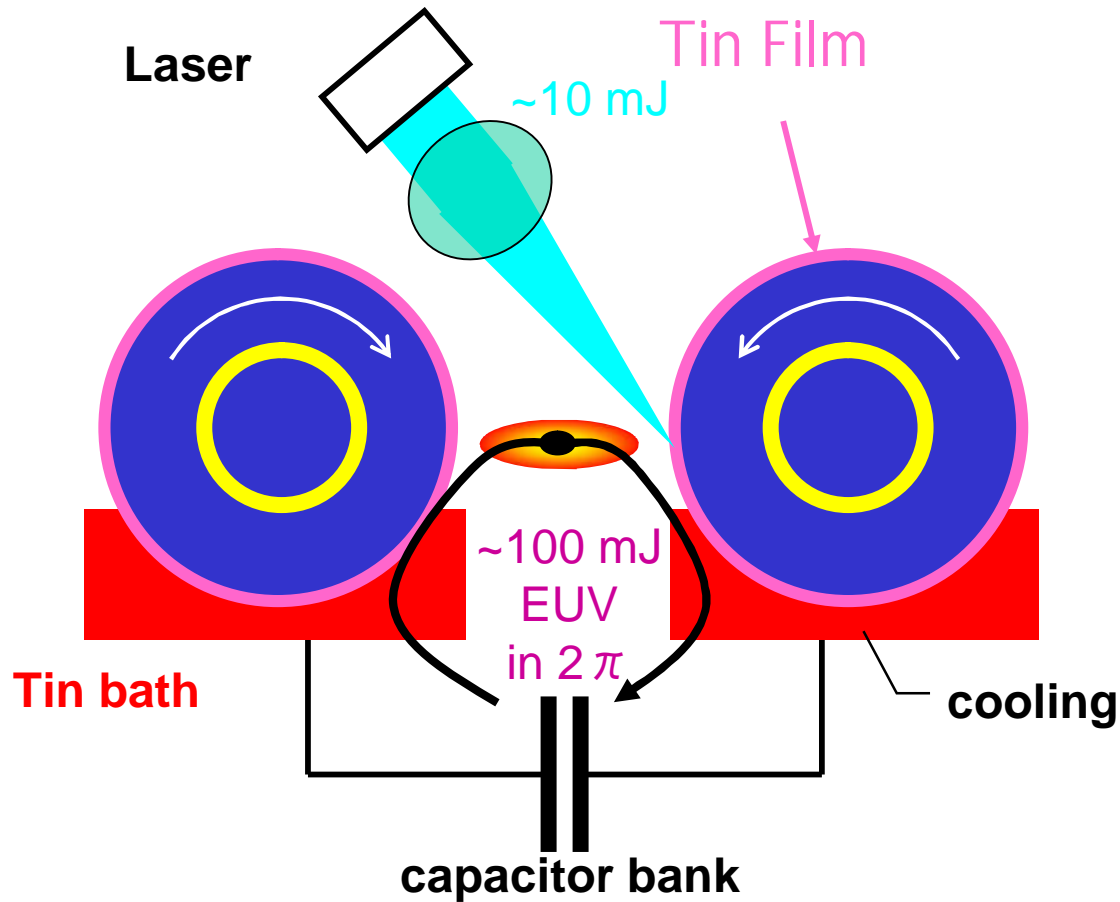
- New operations site since June 2010:
former Mitsubishi plant in Alsdorf (15 min from ILT)

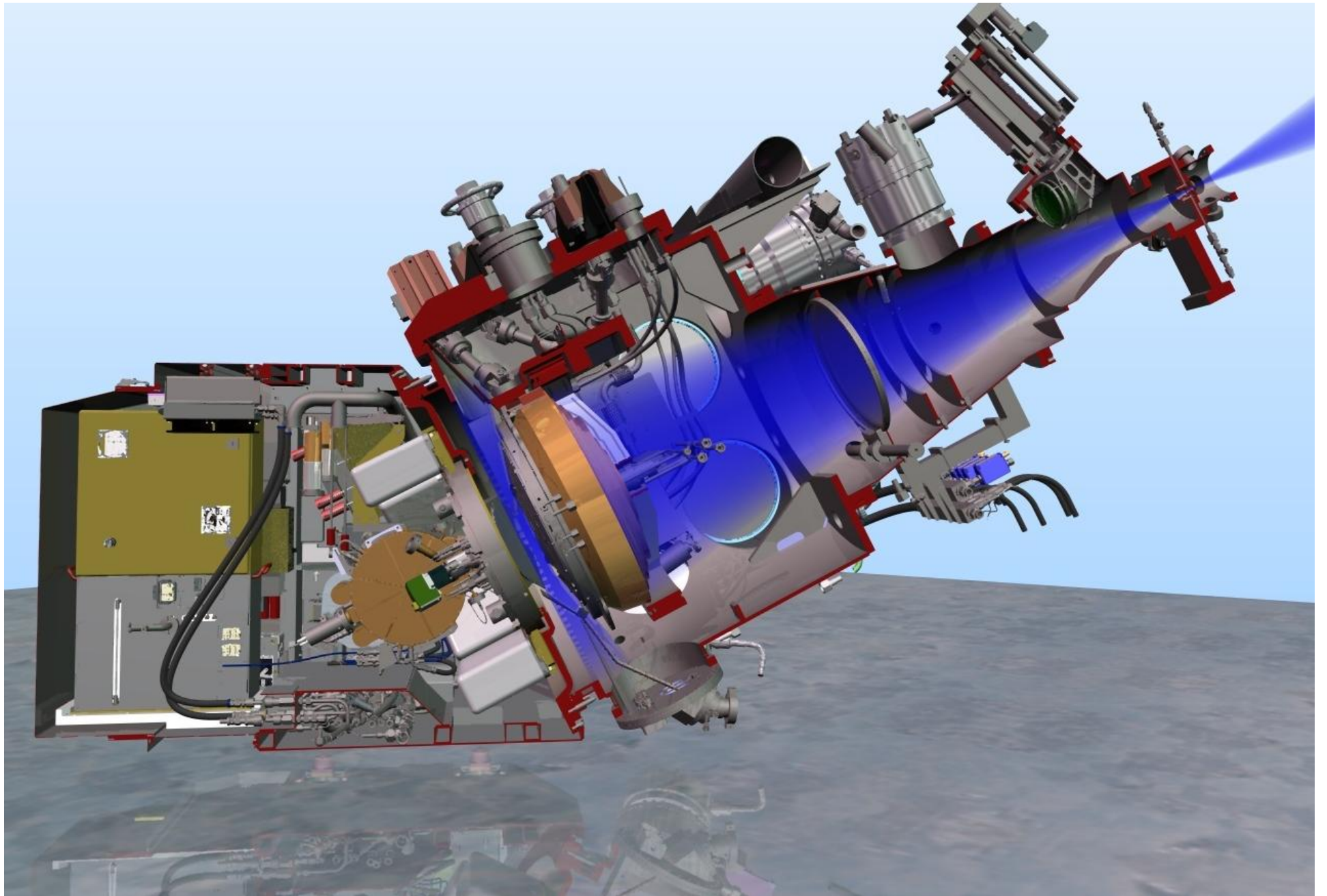


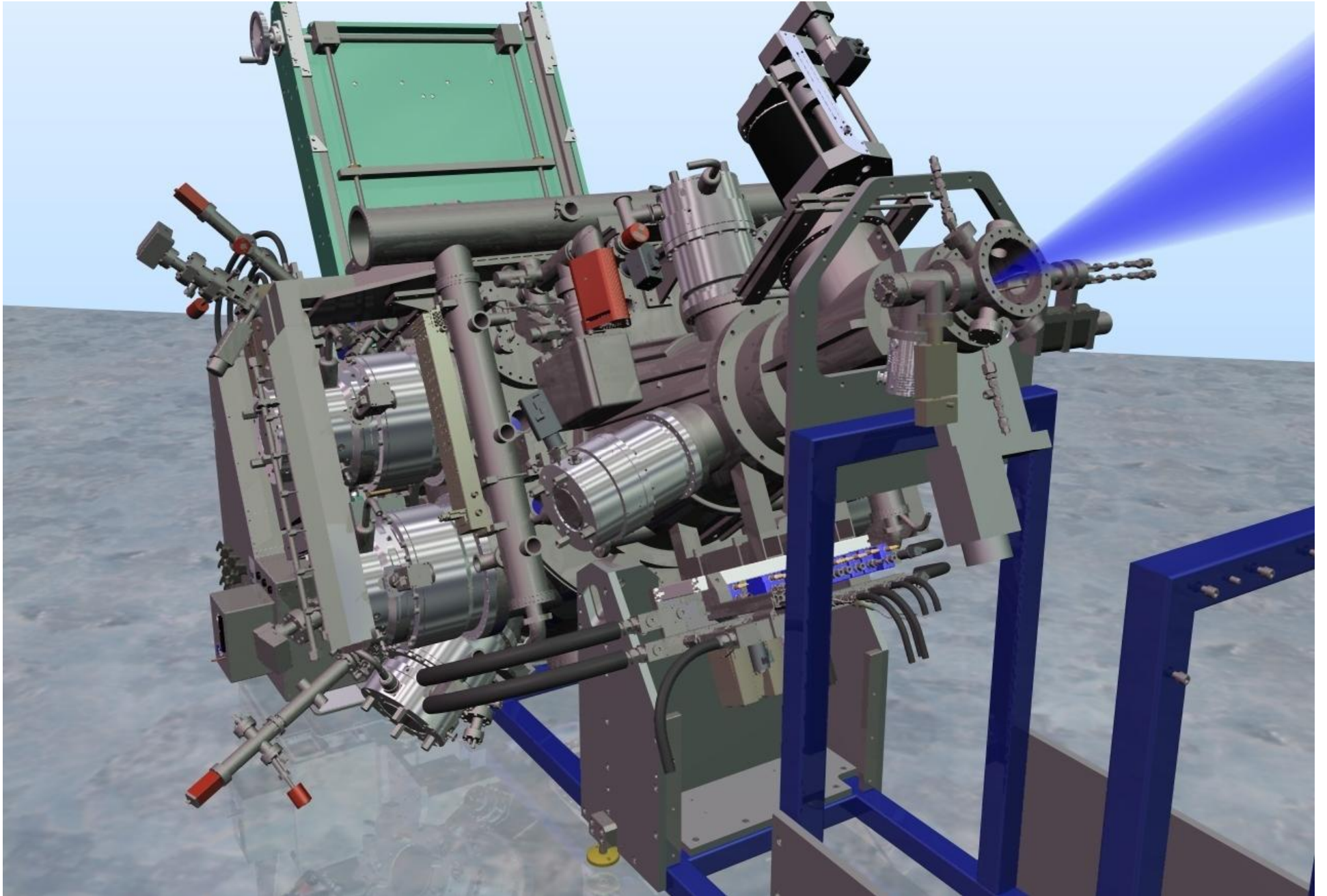
- Brand new 1100 m2 cleanroom (ready October 2010)
- Expansion for NXE 3300 source business secured for 2011

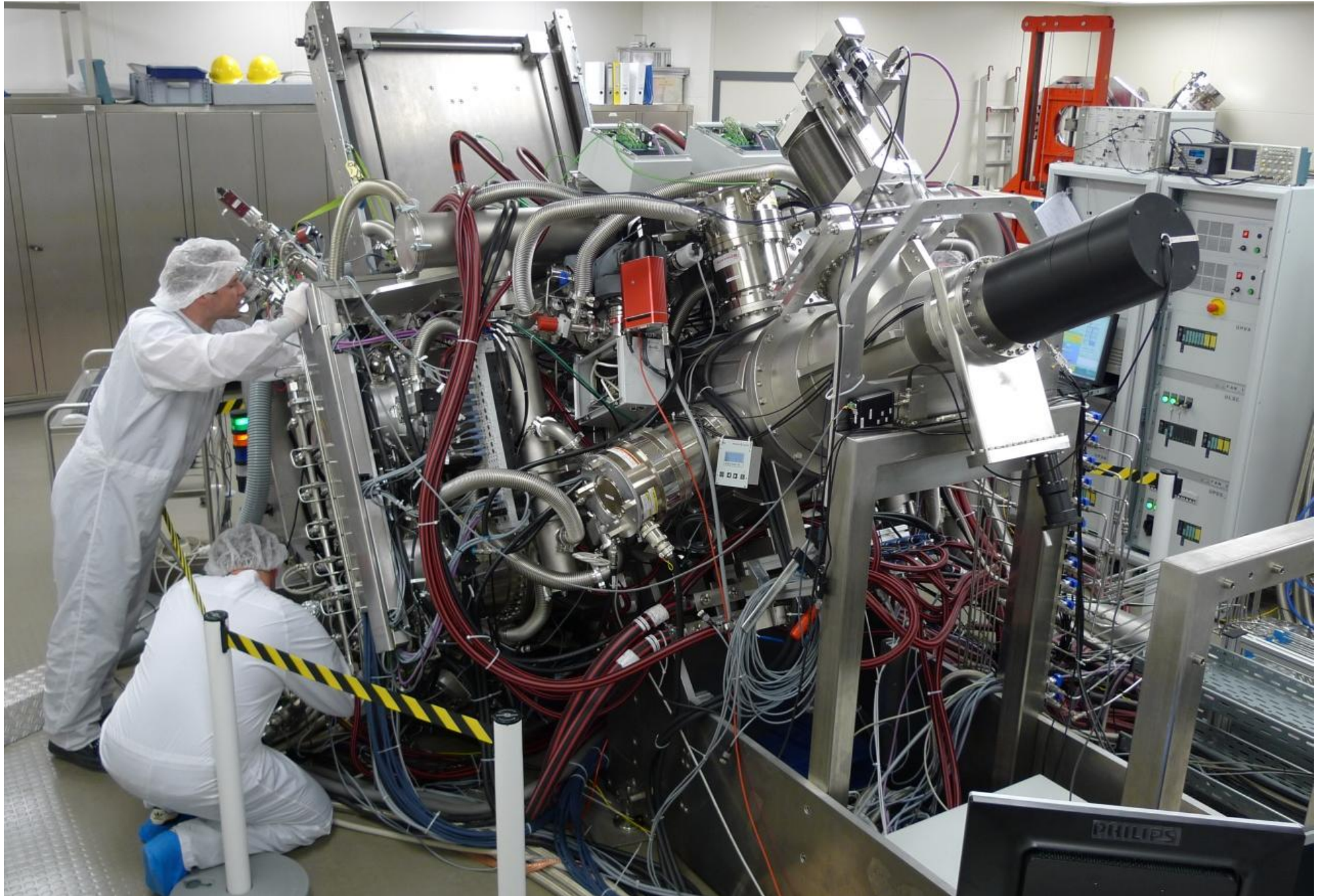


Building an NXE 3100 SoCoMo...









Modular architecture → easy exchange of modules

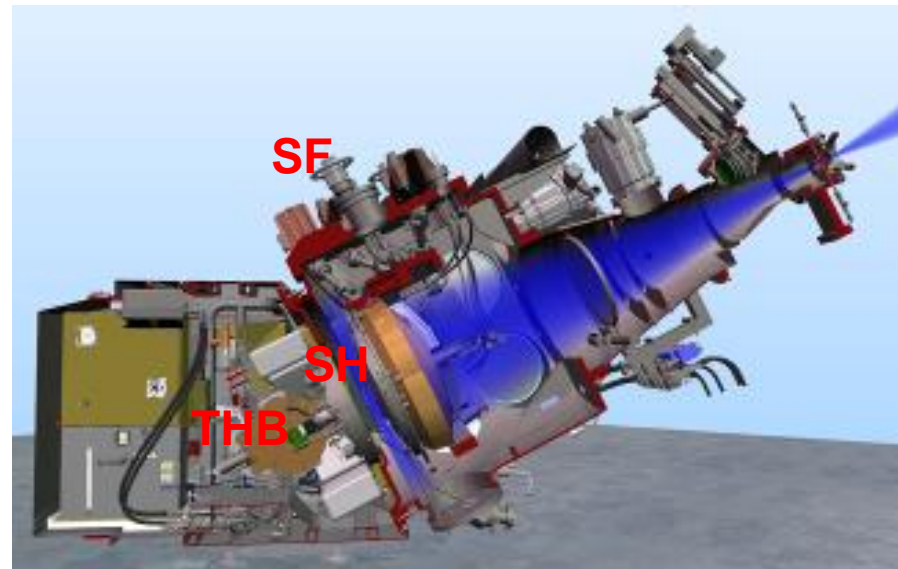
Modular SoCoMo architecture:

allowing typically a module swap in 1 shift:

SF: Swap Flange incl. Collector and Foiltrap

SH: Source Head

THB: Tin Handling Box



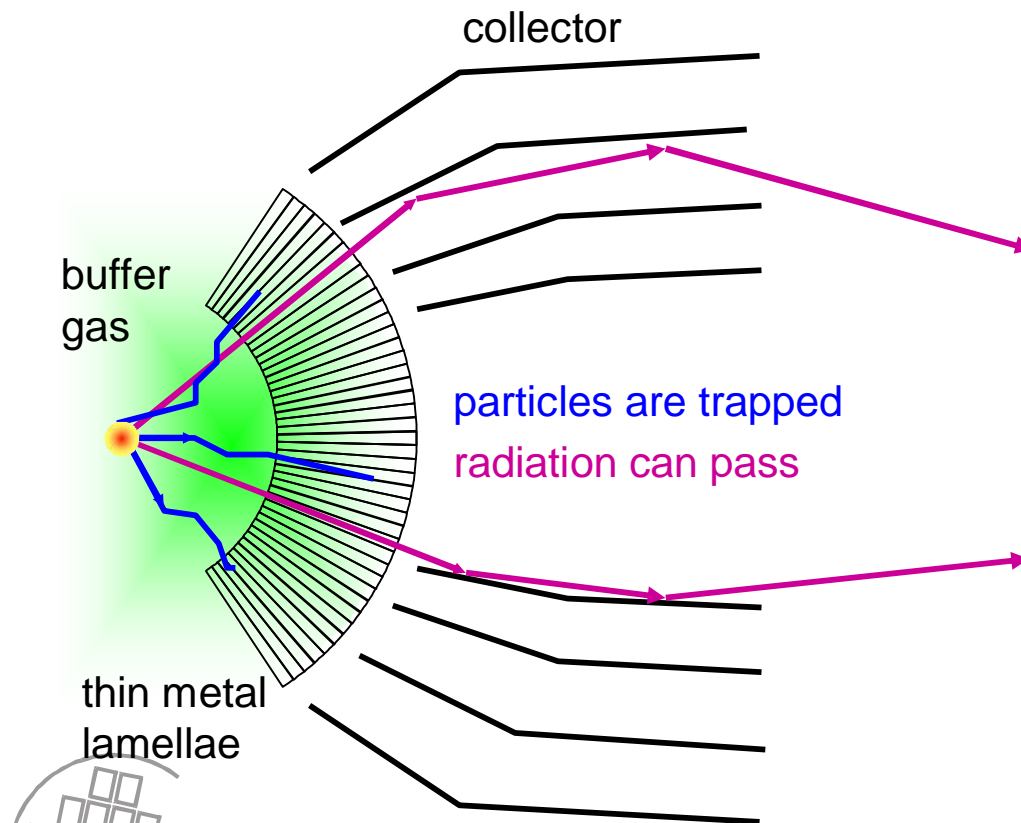
Power and reliability upgrades based on on-site module swaps of SH, THB, SF

Debris mitigation: principle

Source emits around 0.5 kg/day in HVM phase

Particles are stopped by collisions with buffer Ar gas and deflected to foils

These foils are transparent for the light



Debris mitigation: fast ions

The source emits fast ions with energies above 10 keV

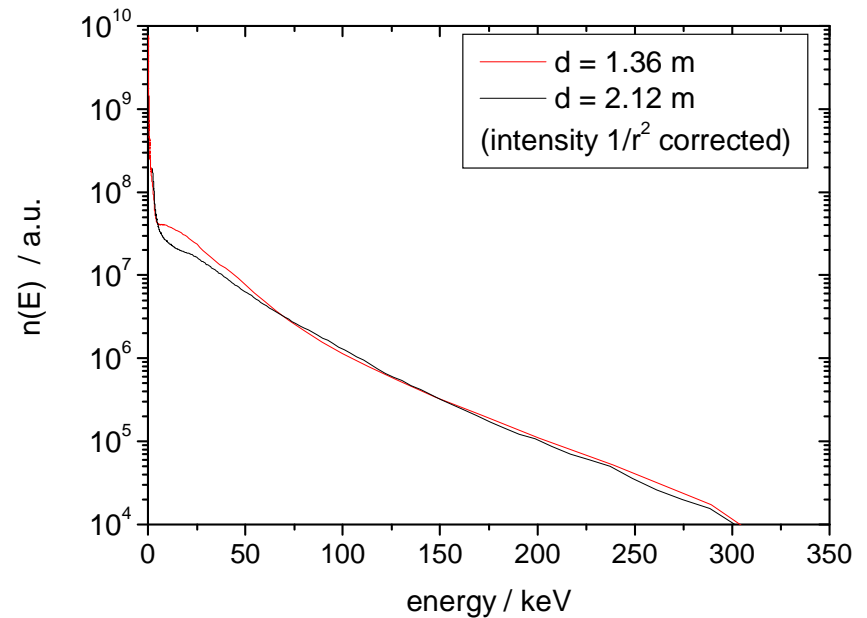
These ions can not be stopped by the FT and end up at the collector

which is of the grazing incidence type

There they will sputter the optical coating

Consequences:

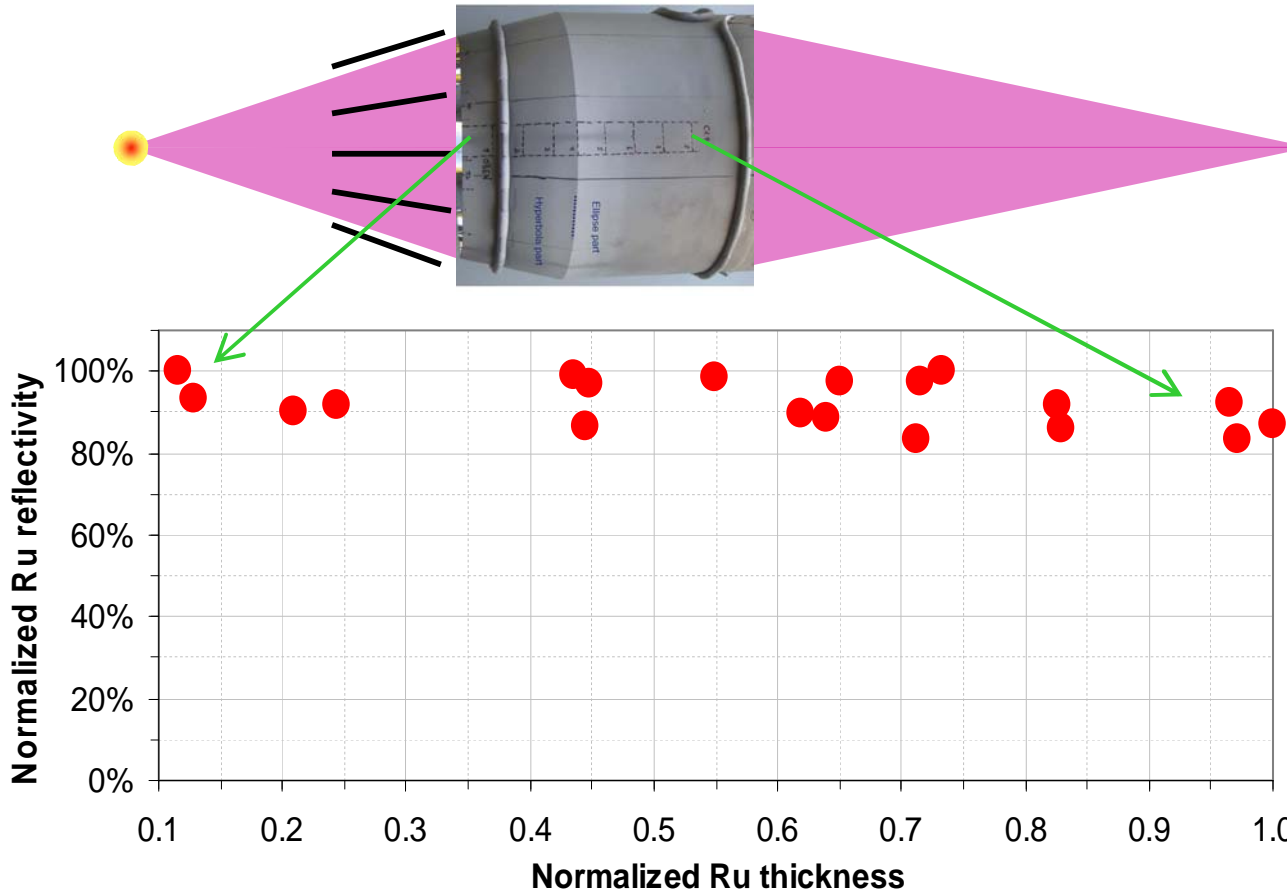
- no growth of tin on the optical coating
- thickness of coating determines the life-time of collector, see next slides



Collector: constant optical performance over lifetime

Exposed collector was cut in samples and analysed:

- hardly any tin deposition found
- thickness of ruthenium coating was reduced due to sputtering
- no increase in roughness found
- reflectivity was independent of removed material



ruthenium coating
can be used as
sacrificial material
with constant
optical performance
of the collector

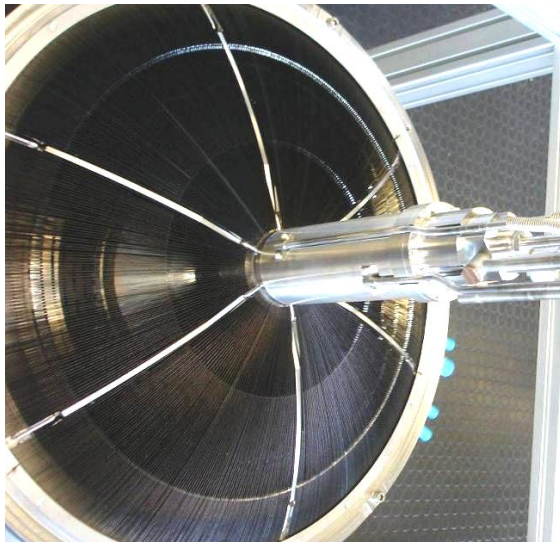
ensions...

Foil-trap Test-stand: integrated experiment

Debris mitigation tests performed with collector samples during 8-hour runs:

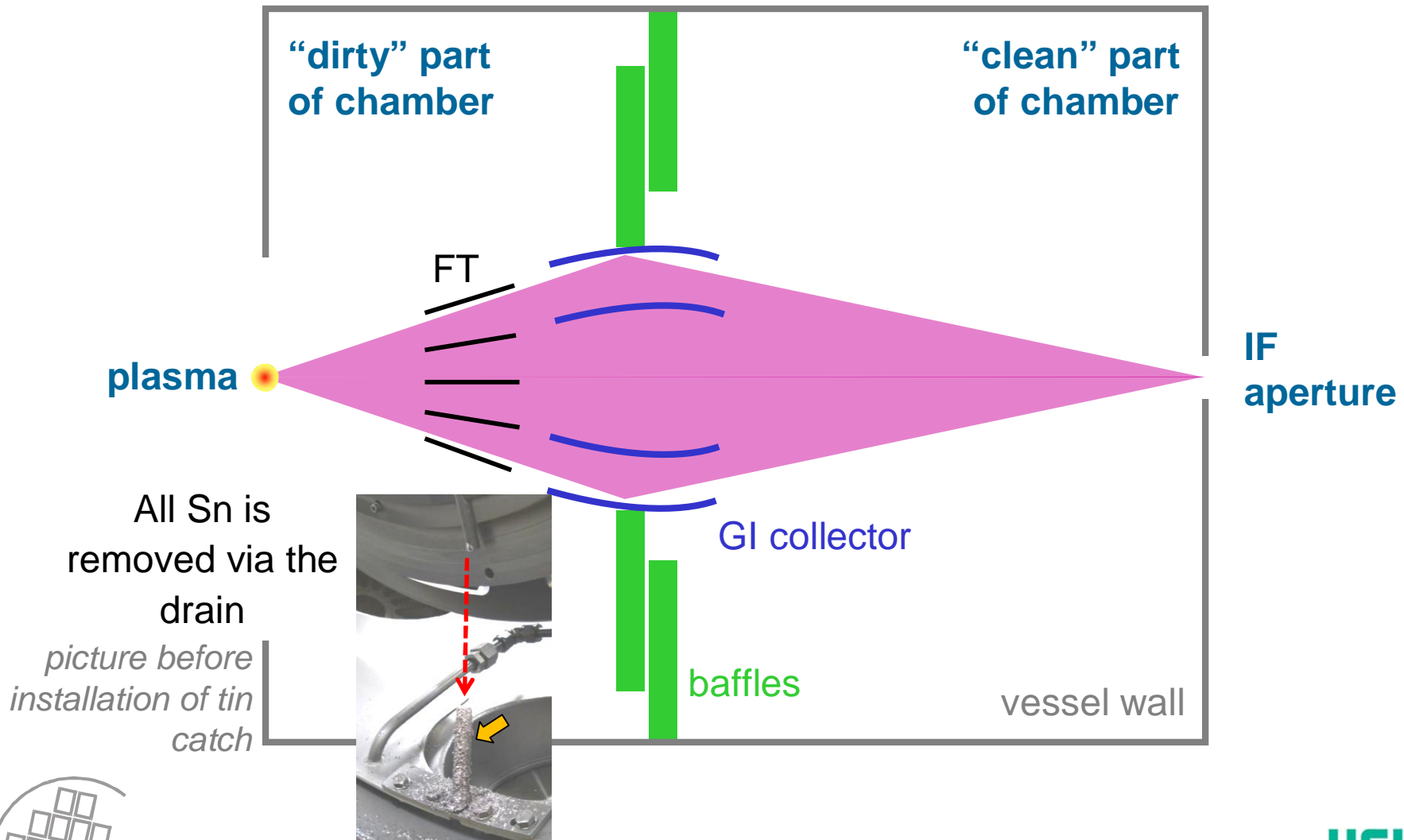
- Very low levels of Sn deposition: 0.1 nm
- Very low Ru sputter rates: 2 nm/Gshot (about 2 nm/day for 3300)

Further improvement possible by optimisation of gas flows

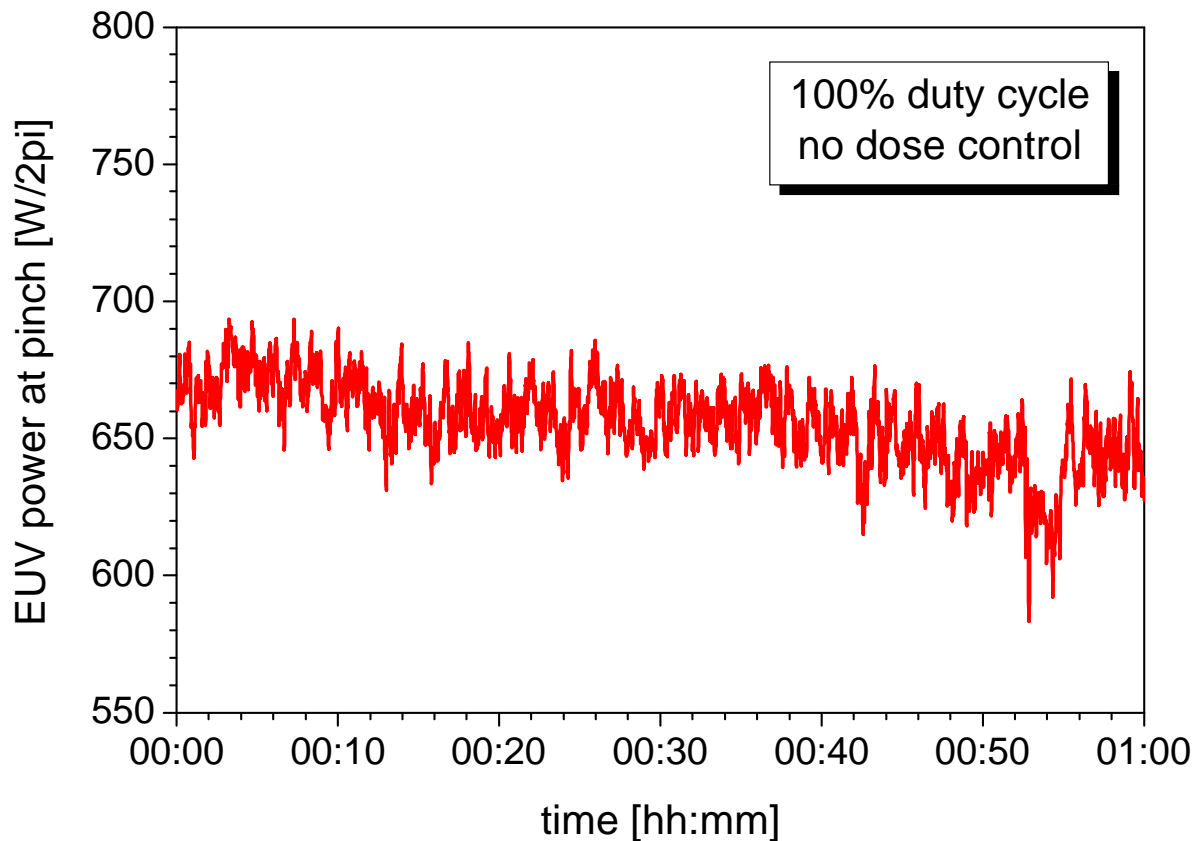


1 year collector HVM lifetime can be achieved

Foil-trap and baffles separate plasma area from IF area



Source power: 640 W/2 π continuous



2.13% conversion efficiency at 30 kW input power

100% duty cycle, no dose control

50% etendue match -> 320W collectable light at pinch level

NXE 3100 Power roadmap and status

100% Duty cycle
Clean photons (no SPF needed)
Dose controlled
After IF

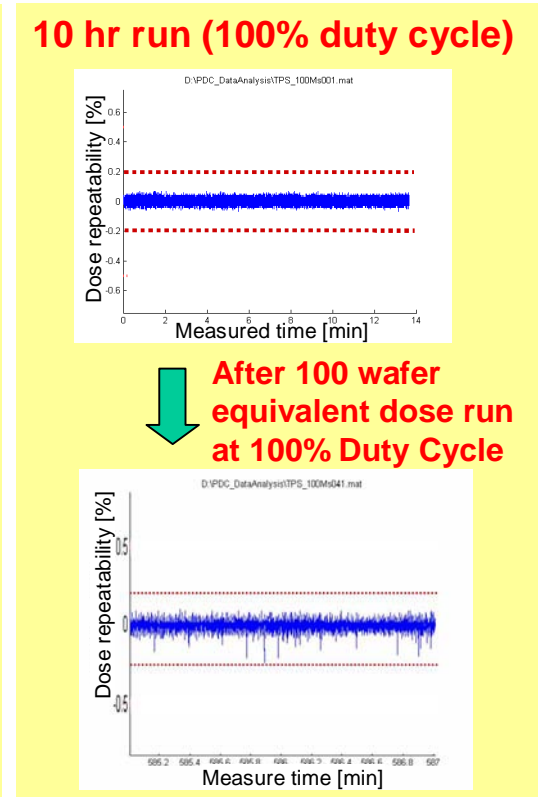
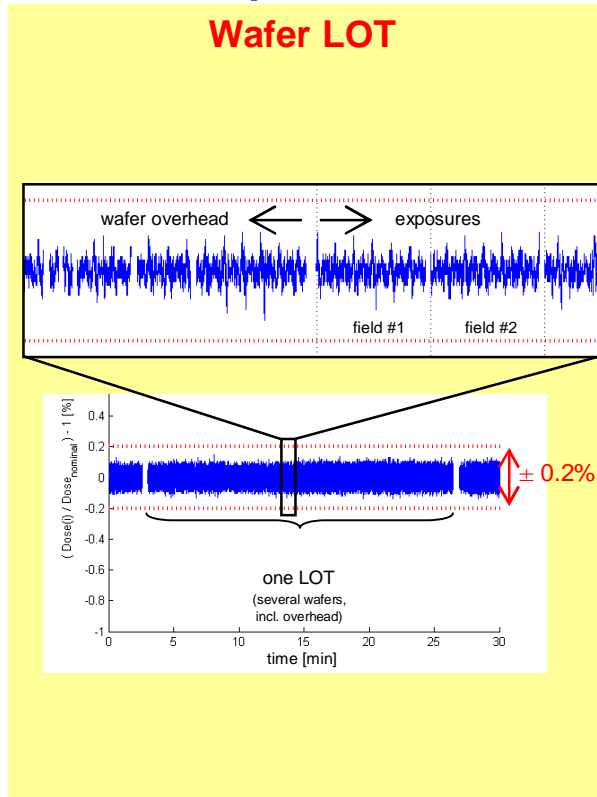
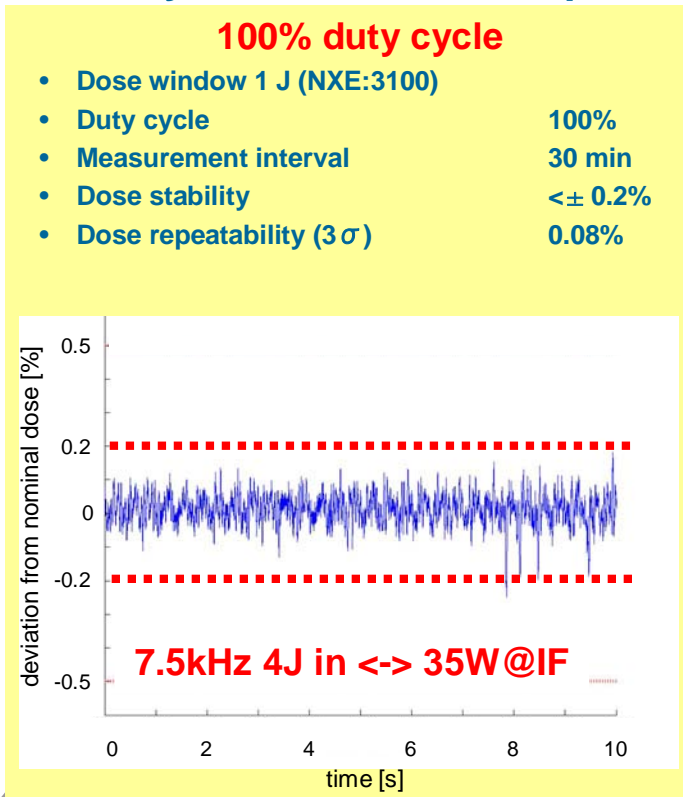
		timing	Measured	Nov	Q4 '10	Q1 '11	Q2 '11
Source Module	electrical energy per pulse	J			4	4	4
	frequency	kHz			7.5	12	19
	electrical power	kW			30	48	76
	conversion efficiency	%	2.13	2.3	2.3	2.3	2.3
	étendue match (6 mm Ø)	%			50	50	50
	collectable in-band power	W	320	345	345	552	874
Coll. Module	foil trap transmission	%	38	60	54	60	60
	gas transmission	%			90	90	90
	collector transmission (fraction of 2π sr)	%	15.2	20.9	20	23.5	24.0
	alignment performance	%			90	95	95
	DeCo transmission	%			10.2	12.0	12.3
	power @ IF	W	14.7	35	30	66	107

Timing	Source Config	LPP		DPP	
		Expose Power	Throughput	Expose Power	Throughput
Q3/2010	Integration	1W	<1wph*	3W	2wph**
Q4/2010	Integration	7W	4wph	15W	10wph
Q1/2011	Upgrade 1	40W	25wph	65W	35wph
Mid 2011	Upgrade 2	100W	60wph	100W	60wph

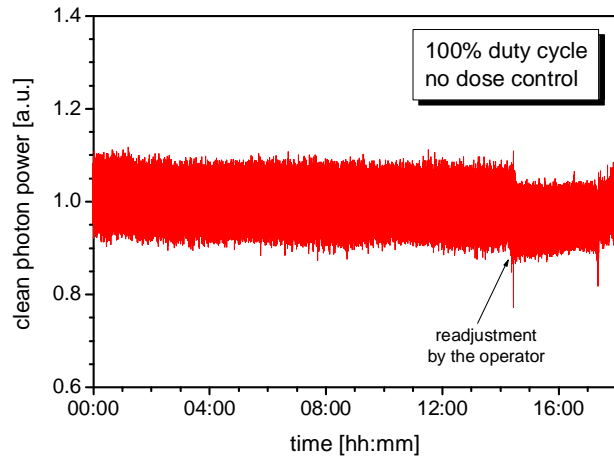
See ASML's pres. by Rard De Leeuw

Dose Control well within spec

- Feed-back loop from measured IF power on the electrical pulse energy by changing charging voltage from pulse-to-pulse
- Same principle that is being used within ADT for years
- No loss of EUV output
- LLB system under development allows for operation > 40 kHz

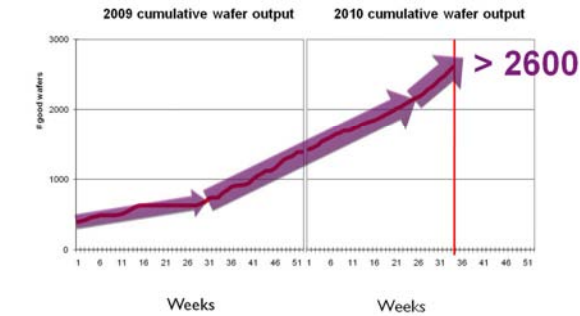


Source maturity

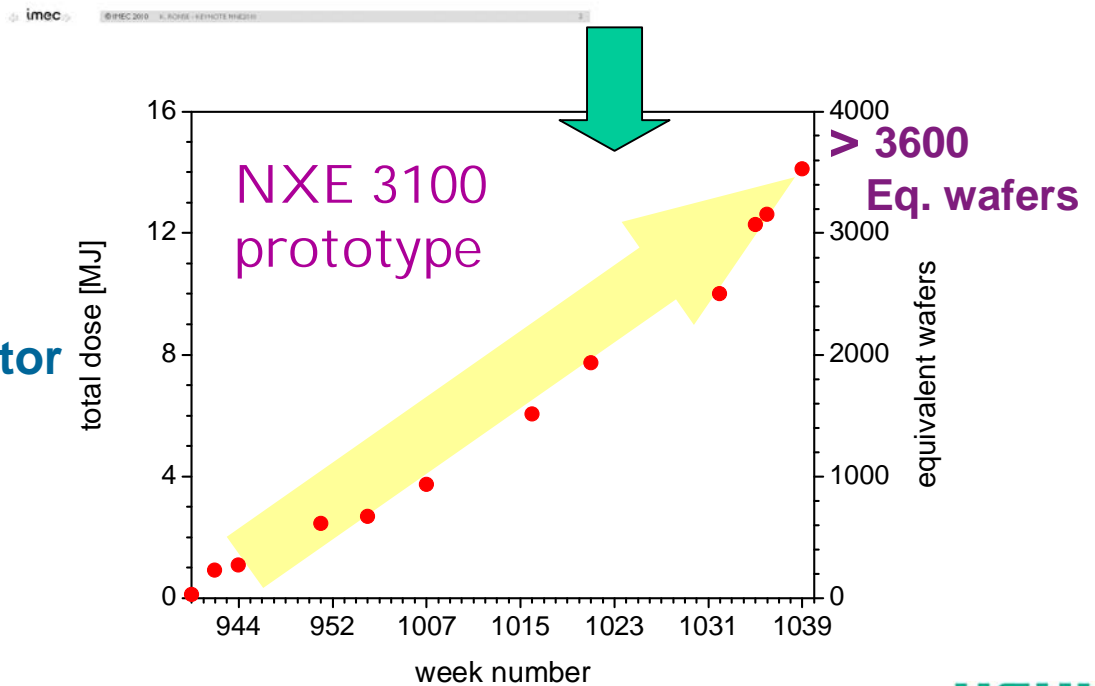
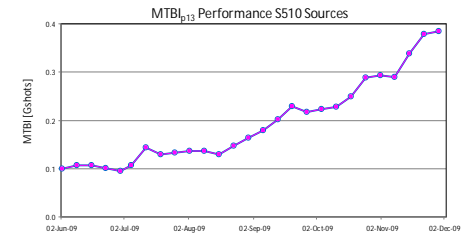


18 hours continuous light
without any interrupt
running mostly without operator

ASML EUV ADT WAFER OUTPUT



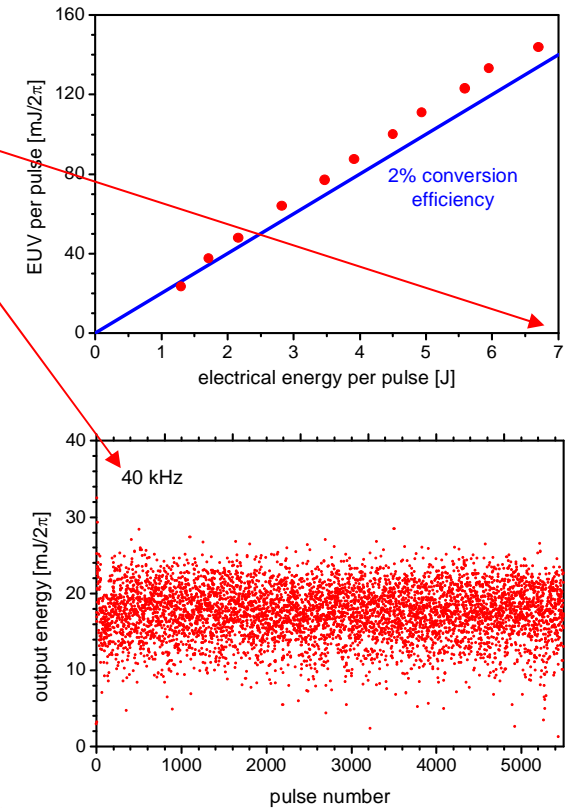
Alpha source MTBI 4x improvement



HVM roadmap: DPP scalability proven

Measured results

		Type	3100	3300		
Source Module	electrical energy per pulse	J	4	5	6	7
	repetition rate	kHz	19	28	32	37
	electrical input power	kW	76	141	191	262
	conversion efficiency	%	2.3	2.4	2.4	2.4
	étendue match	%	50	55	55	55
	collectable in-band power	kW	0.87	1.86	2.52	3.46
Coll. Module	FT transmission	%	60	62	62	64
	gas transmission	%	90	90	90	90
	collector transmission ($R^* \Omega / 2\pi$)	%	24	25	26	26
	alignment performance	%	95	96	97	97
	DeCo transmission	%	12.3	13.5	13.9	14.5
Peak	power after IF	W	107	250	350	500



Duty Cycle and Average power about halves
Thus: Thermal challenges do not scale linearly with peak power

- Evolutionary increase in efficiency and transmission
- Significant increase in peak source input power but half in average power
- Feasibility shown by proof-of-principle experiments

Conclusions

- **USHIO takes the lead in EUV business bringing all DPP knowledge under one roof and investing heavily in its future**
- **Several NXE 3100 source products being built for delivery in coming months**
- **Modular architecture allowing for easy field-upgrades in power and improved reliability**
- **Debris mitigation as the corner stone of constant optical performance and affordable cost of ownership**
- **Strong proof of power scalability as basis for designing NXE 3300 products and expanding our business**
- **Building a sizable & experienced EUV service crew for world-wide 24/7 support**



Acknowledgements

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USHIO

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