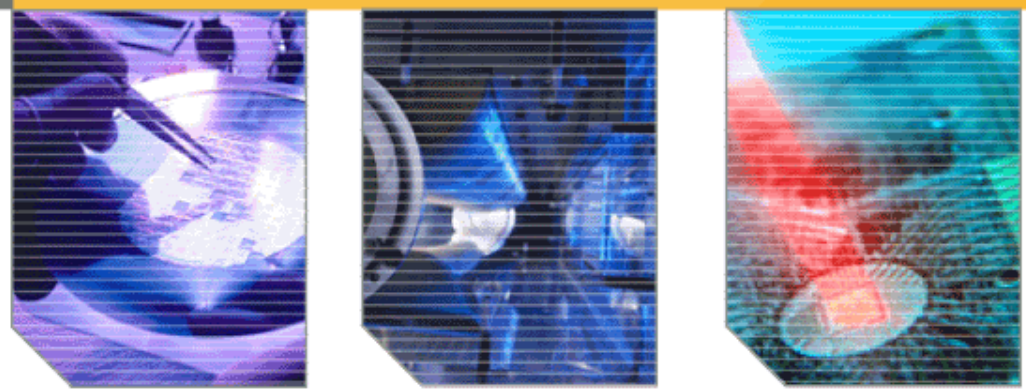
Feasibility of Updated Source Requirements



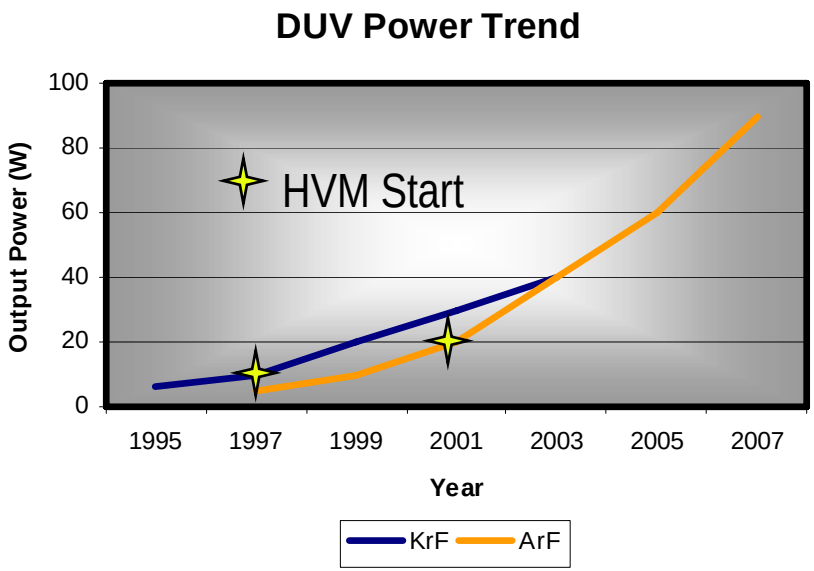
Igor Fomenkov

November 10, 2005

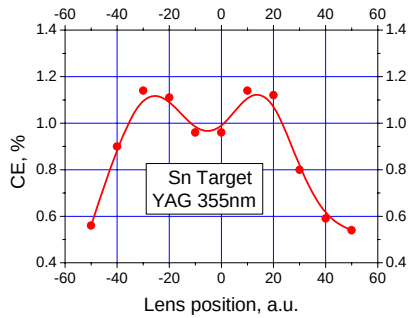
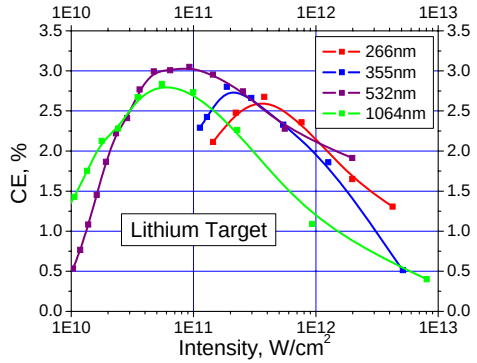
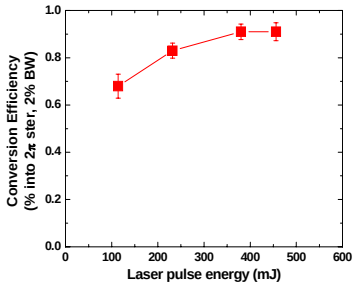
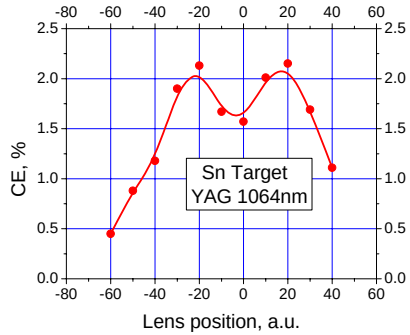
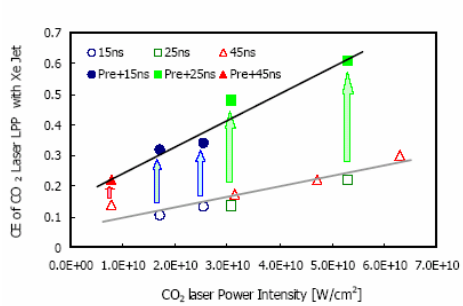
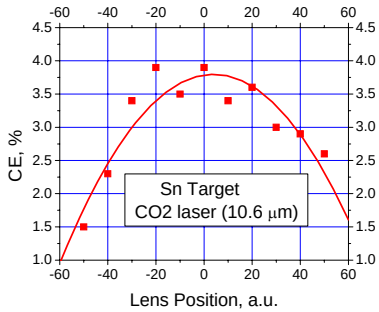
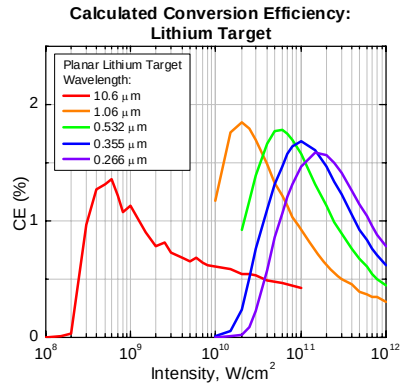
Source Performance Roadmap to HVM and Beyond

LPP EUV Source Performance Roadmap			
	Gen 1	**Gen 2**	**Gen 3**
Total Rep Rate (kHz)	48	60	72
Laser power (kW)	**9.6**	**12.0**	**14.4**
In-band CE	3.5%	4.0%	4.5%
Geometric collection effy (sr)	5	5	5.5
Collector average reflectivity	50%	50%	50%
Optical transmission	80%	82%	84%
Total power at IF (W)	**110**	**155**	**230**

- Cymer is committed to commercializing an HVM EUV light source
- Laser Produced Plasma (LPP) technology is the most viable HVM EUV source solution
  - Due to flexibility and scalability of power
- Cymer is targeting the most feasible and cost effective LPP technology solutions
  - Excimer & Li, Solid State & Sn or Li, or CO_2 & Sn



Today's Known CE Results

	Xe	Sn	Li
Excimer	TBD		
Solid State	 Source: CEO division of TRW		
CO2	 Source: EUVA SPIE Aug 2005		

Conversion Efficiency Summary (peak values)

	Xe	Sn	Li
Excimer (351nm)	TBD	0.5-1.0%	2.0-2.5%
Solid State (1064nm)	0.5-1.0%	2.0-2.5%	2.0-2.5%
CO_2 (10.6μm)	0.5-1.0%	3.5-4.0%	1.0-1.5%*

* As suggested by modeling

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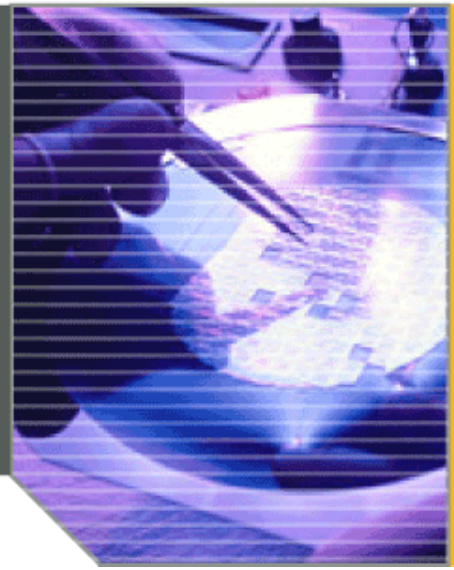
Feasibility of Lithium as a Source Fuel



Diffusion Barrier Materials

- At least three promising Li diffusion barrier materials have been demonstrated in the MLM, however each has limitations
  - Thermal stability
  - Maximum reflectivity
- Formation of Li compounds on collector surface
- Further research is necessary to enable Li as source fuel

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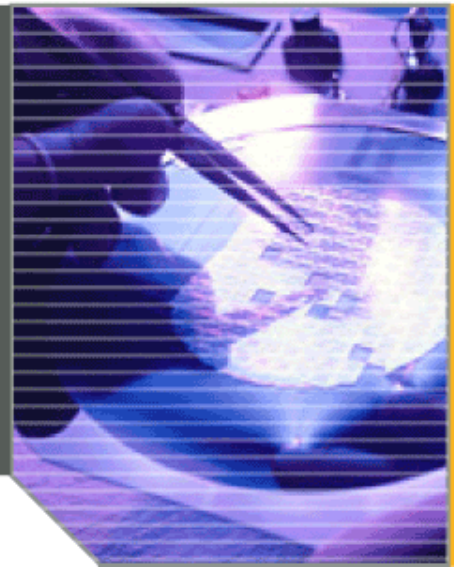
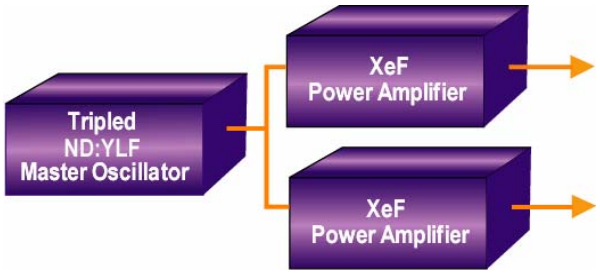
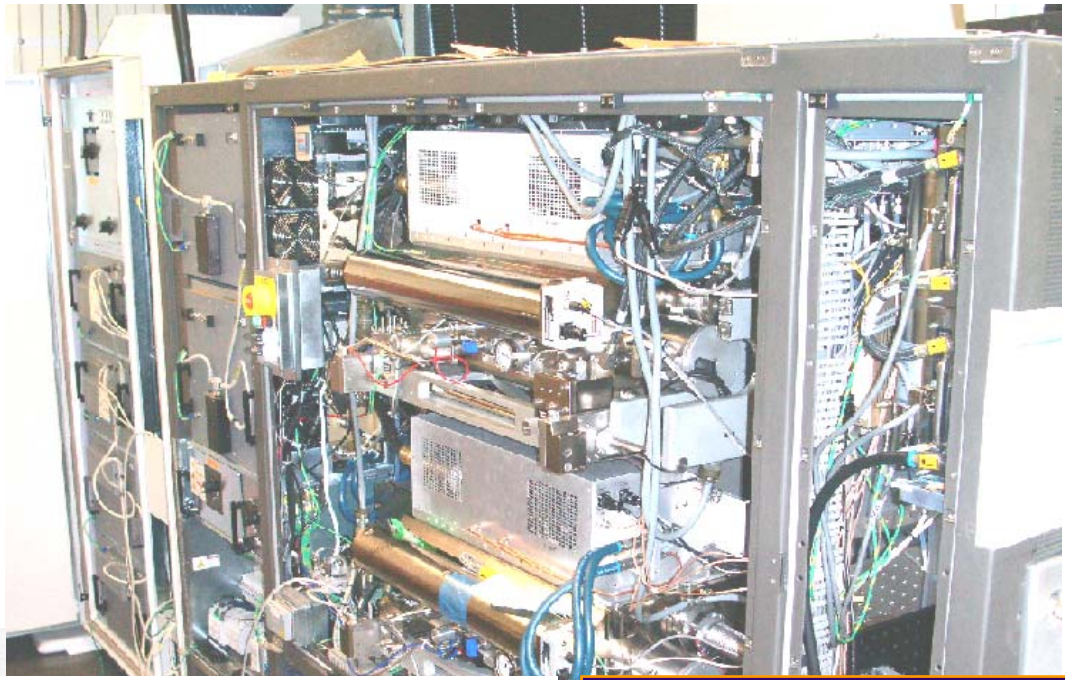
High Power Lasers



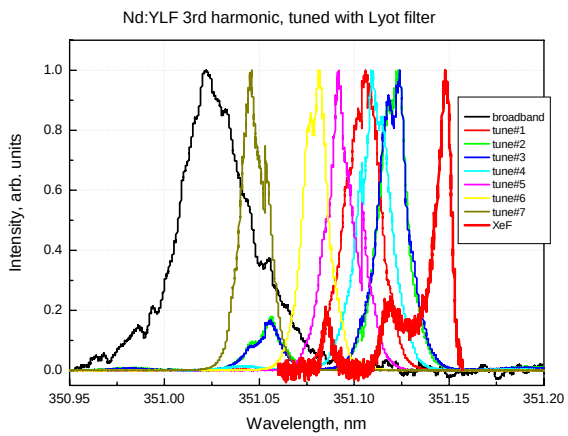
Excimer Drive Laser Development



- Solid State MO provides required high beam quality
- XeF power amplifiers provide reliable pulse energy



Tunable 12kHz Nd:YLF MO



XeF Power Amplifier

Energy/pulse	150-200mJ
Beam Divergence	<150 uRad
Energy Stability (30pulse)	1%
Repetition Rate	6000 Hz
Efficiency	3.5%
Pulse Length	<16ns
Pointing Stability	<25uRad

351nm Excimer Laser Capability

Parameter	XeF Limit
Pulse Energy	200 mJ
Repetition Rate	8 kHz (per amp)
Pulse Width	16 ns
Energy Stability	1%
Pointing Stability	25 μRad
Beam Divergence	150 μRad
Wall-plug Efficiency	3.5%

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High Power Laser Summary

Laser Type	λ (nm)	Power & effcy	Beam Quality	Optical Matls	Polar-zation	Pulse width	Fab Exp.	System Cost	CoO	Resist sens.
XeF	351	😐	☺	😐	☺	☺	😐	😐	😐	😐
DPSS	1064	☺	☺	😐	☺	☺	☹	☹	☹	😐
CO_2	10.6 μm	☺	😐	😐	☺	☹	☹	😐	☺	😐

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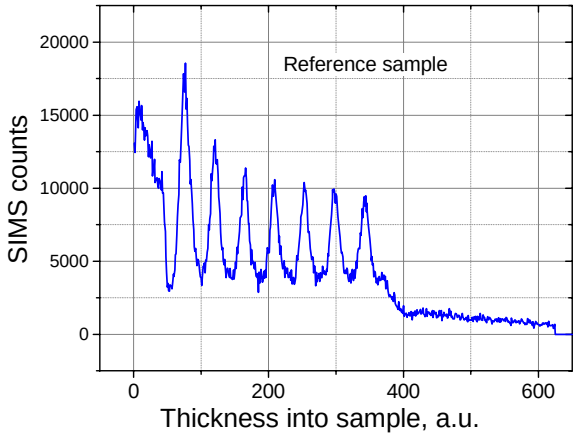
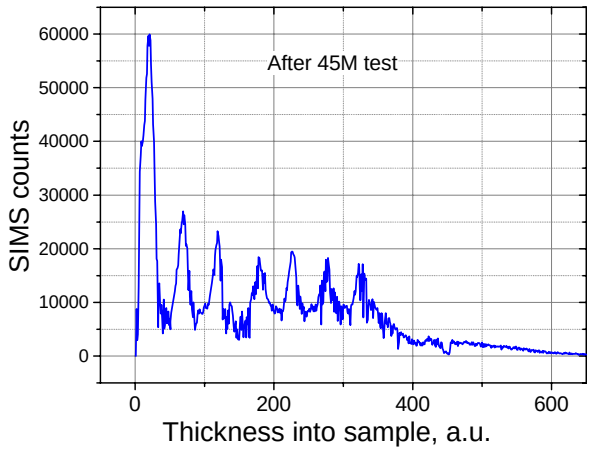
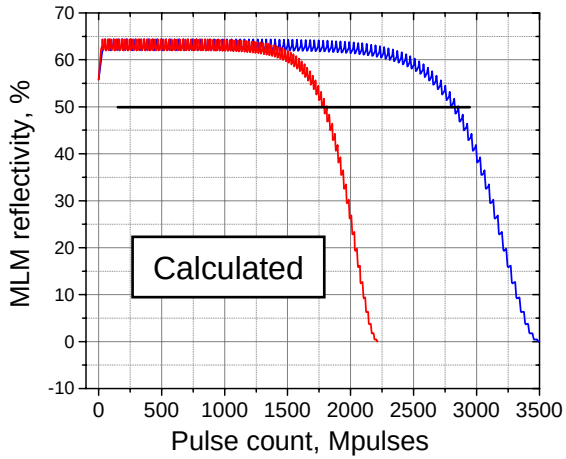
Collector Lifetime Limits

Sn LPP Collector Life-test Results







- SIMS analysis shows only one peak missing after 45 million pulses
- No Sn deposition on the mirror achieved
- Projected lifetime 2 – 3 B pulses based on 10% reflectivity drop
- Combining two debris mitigation techniques or use of Li supports expected lifetime goal of 45B pulses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