High-power Nd:YAG-Laser Feasibility

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LPP: HVM power estimates

Required HVM power in intermediate focus:	**200 W**
Gas Transmission:	**85 %**
Average collector reflectivity:	**55 %**
Etendue acceptance factor:	**1**
Collection efficiency (5sr/2πsr):	**80 %**
Transmission DMT:	**90%**
Required HVM power in 2π sr:	**600 W**

Necessary driver laser power on target:	**Xenon (CE=1%)**	**Tin (CE=3%)**
	60kW	**20kW**

LPP: Diode costs

Necessary driver laser power on target:	Xenon (CE=1%)	Tin (CE=3%)
	60 kW	20 kW
Optical-optical efficiency:	20%	
Wall-plug efficiency:	10%	
Diode power:	300 kW	100 kW
Capital cost for diodes:	3 M$	1 M$
Lifetime of driver diodes:	15000h → 2 years	
Operational costs/year (diodes):	1.5 M$	0.5 M$

LPP: Additional costs

Power of single laser module:	**5 kW**	
Number of laser modules:	**Xenon (CE=1%)**	**Tin (CE=3%)**
	12	**4**
Investment costs per module diodes:	**250k$**	
Investment costs per module w/o diodes:	**1.75 M$**	
Investment cost for laser system:	**24 M$**	**8 M$**
Consumables cost per laser module:	**100 k$**	
Lifetime of laser consumables:	**1 year**	
Operational costs/year (consumables):	**1.2 M$**	**0.4 M$**

LPP: Summary costs

	Xenon (CE=1%)	Tin (CE=3%)
Investment cost for laser system:	24 M$	8 M$
Operational costs/year for laser system:	2.7 M$	0.9 M$

- These are just the cost for building and running the laser system.
- The lower cost for the use of tin might be offset with the increased complexity /costs for the source / debris mitigation.

LPP: Feasibility of Nd:YAG-laser

- From a technical point of view ND:YAG-laser seem to be a viable option
- To reach the specifications (power, beam quality) multiplexing will be necessary
- Multiplexing complies with the design requirements for an HVM LPP source
- Costs for laser system (investment and operational costs) very high

→ LPP EUV source driven with Nd:YAG-laser is only an option if power requirements are 115W