Mixed Garnet at 936 nm

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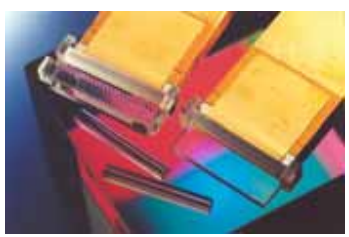
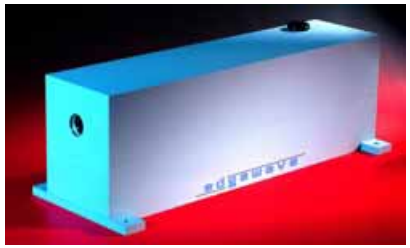
High Power Laser Development at ILT




1994 1996 1998 2000 2002 2004

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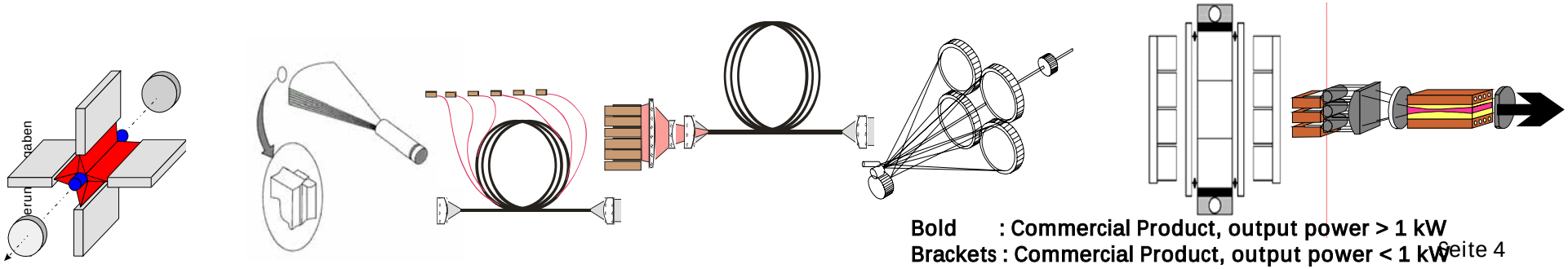
Mixed Garnet at 936 nm

Rod Laser		Fibre Laser		Disc Laser	Slab Laser	
side pumped	end pumped	side pumped	end pumped	end pumped	side pumped	end pumped
ROFIN / ILT **FANUC** **Trumpf** **Mitsubishi** Toshiba NEC Hughes Res.	LLNL LZH	HOYA	**IPG** **SPI** FSU Jena ILT/CLT/UoM	IFSW **Trumpf** **ROFIN** **(JENOPTIK)**	**CEO/TRW** Spectra Physics	ILT CEO/TRW HRL **(EdgeWave)**



Bold : Commercial Product, output power > 1 kW
Brackets : Commercial Product, output power < 1 kW

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Project goals

- investigate crystal quality and damage thresholds
- demonstrate Q-switched oscillator operation
- investigate amplification to 80 mJ regime
- investigate efficiency
- achieve first estimations on required system size, and weight
- investigate seeding requirements (without cavity control)

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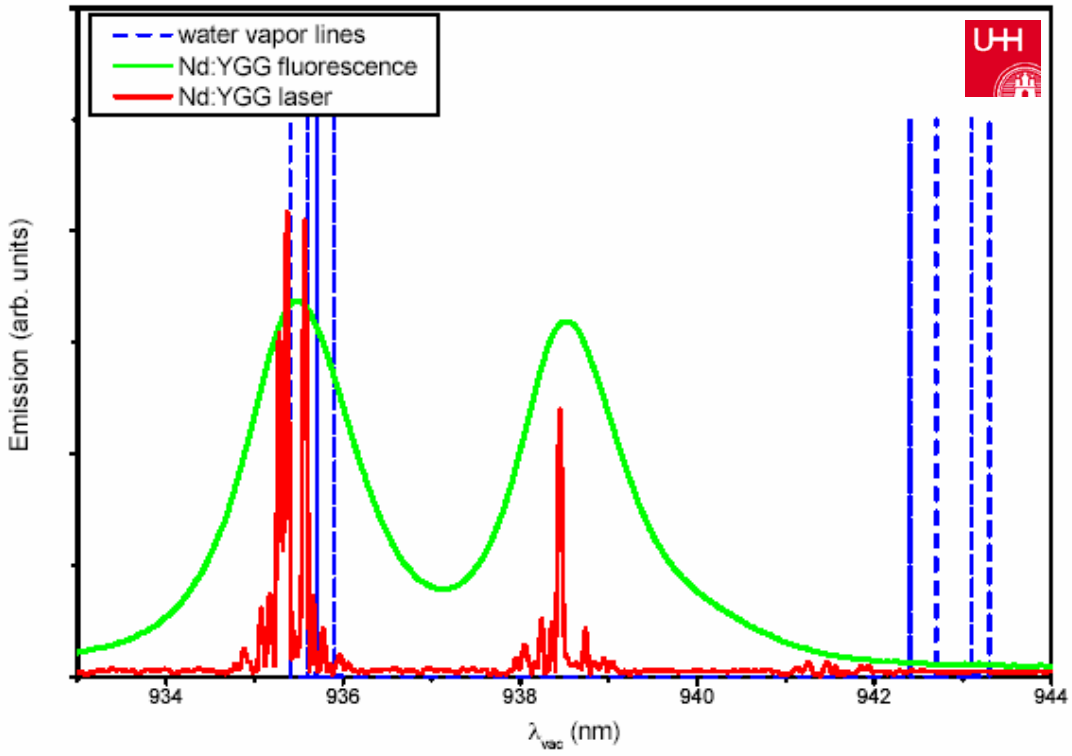
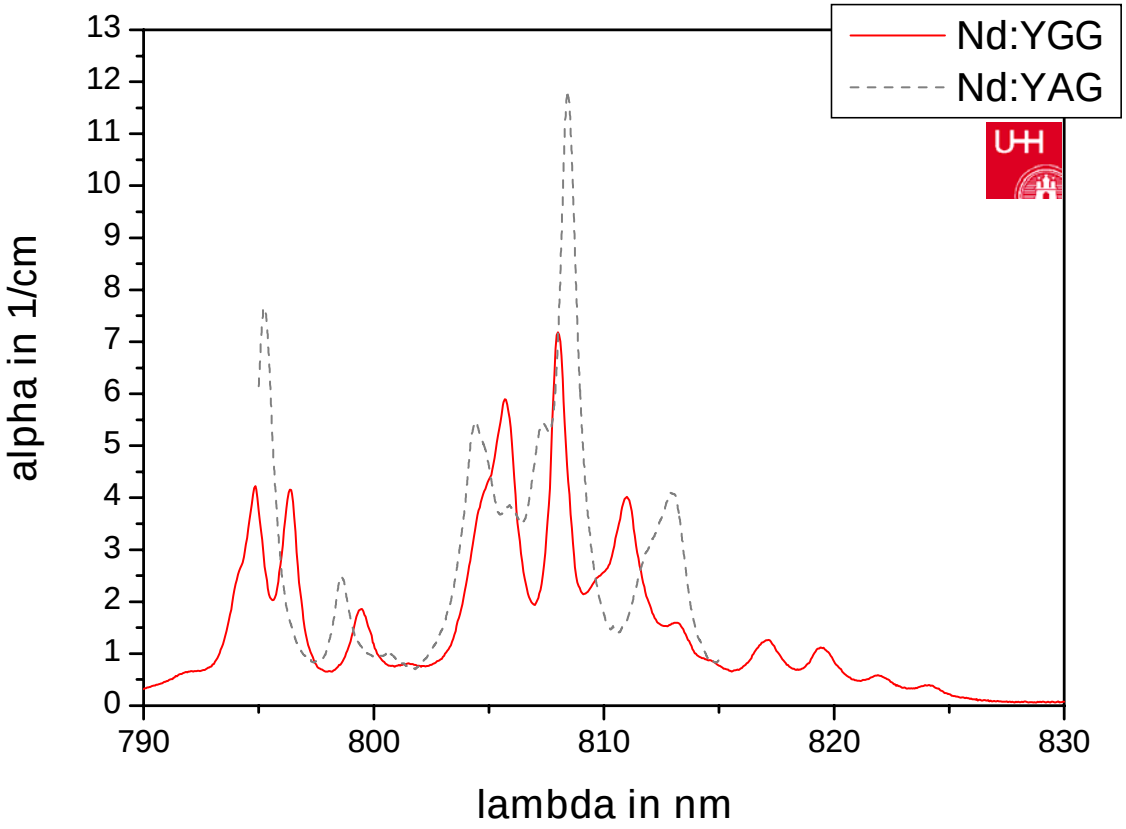
Nd:YGG as laser material – emission spectrum

- Laser emission at 936 nm fits water vapor lines
- Quasi-4-Level-System (approx 2,4% of lower laser level is populated at 300 K)
- Emission cross section at 935 nm: $\sigma=1.43x10^{-20}$ cm^2 (9 times smaller than at 1062 nm)



Nd:YGG as laser material – absorption spectrum

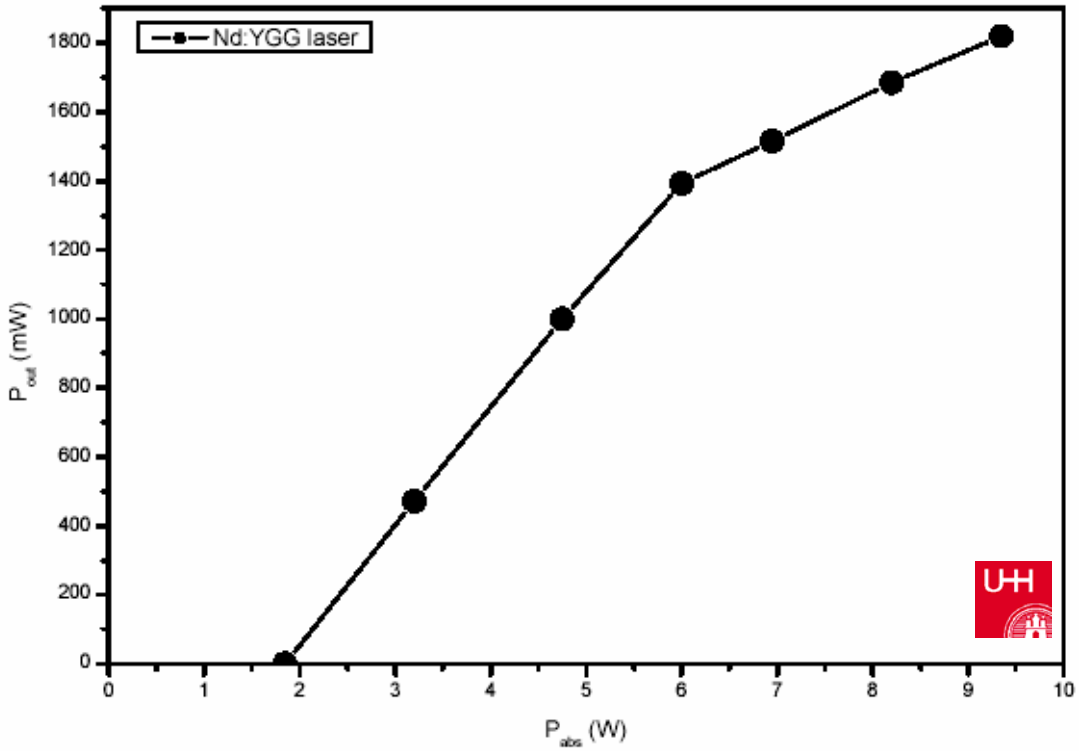
- Absorption spectrum very similar to Nd:YAG
- Efficient pumping at 808 nm possible



First results (University Hamburg)

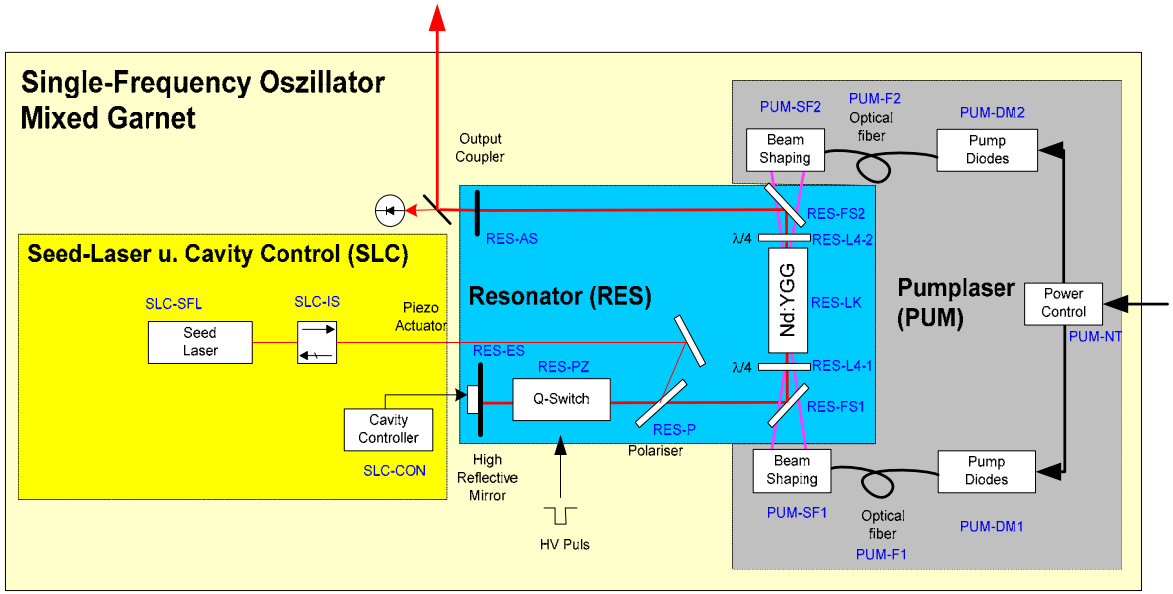
- Simple cavity, two mirrors and crystal (length 30 mm)
- CW operation with 1.8 W output at 9.5 W pump power demonstrated

- No gain measurements available
- No experience in pulsed operation available
- No damage threshold data available



Q-Switch Oscillator

- End-pumped configuration
- 100 Hz repetition rate
- Up to 8 mJ pulse energy
- Single frequency operation via Pulse-Build-up



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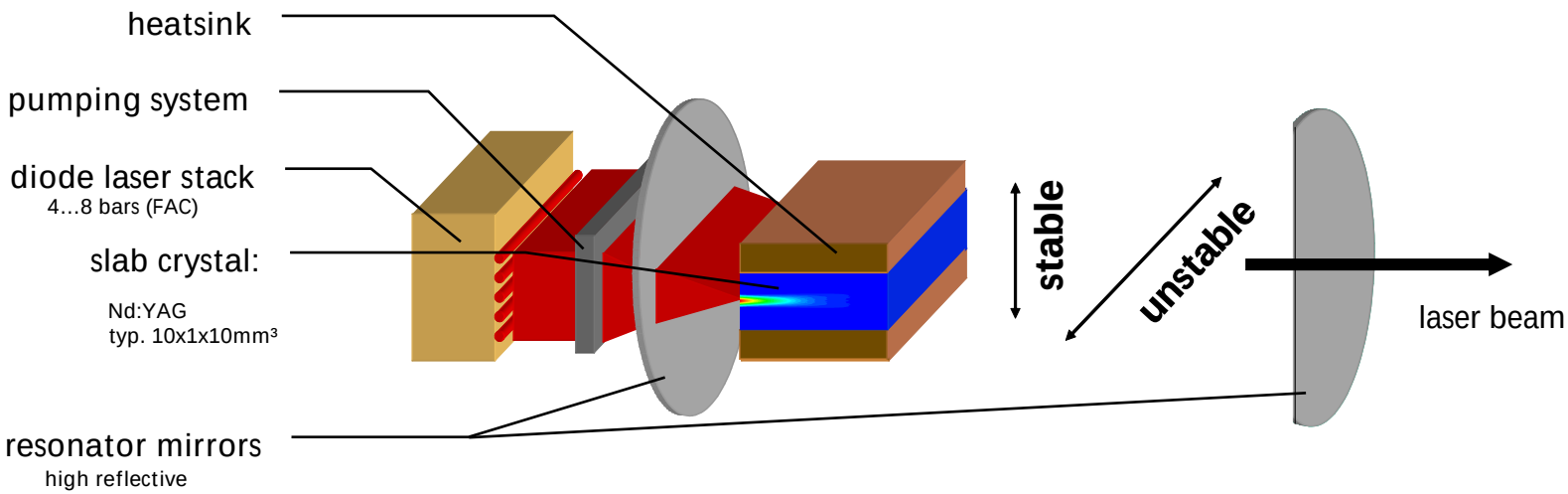
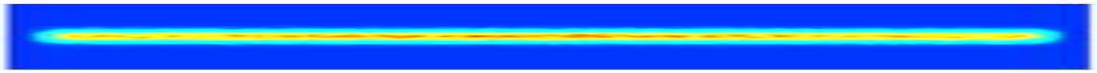
INNOSLAB – principle



- typical line focus of a diode laser stack is used to form a rectangular gain cross section
- Pump light homogenization enables homogeneous intensity distribution even at failure of a whole diode bar or stack



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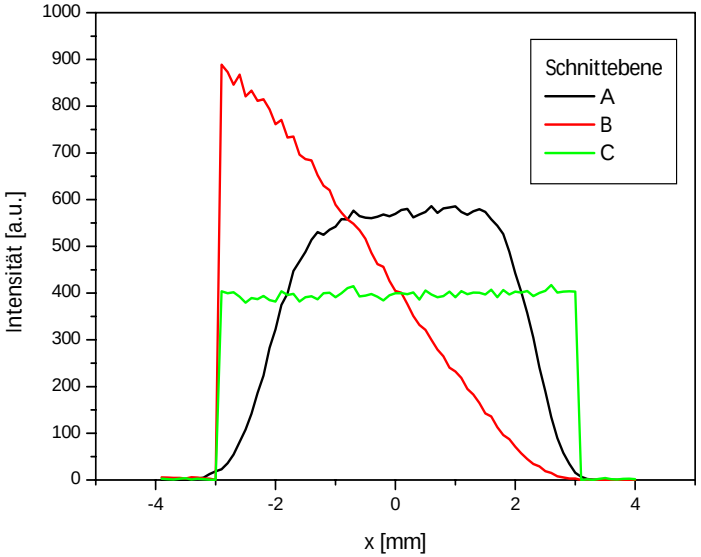
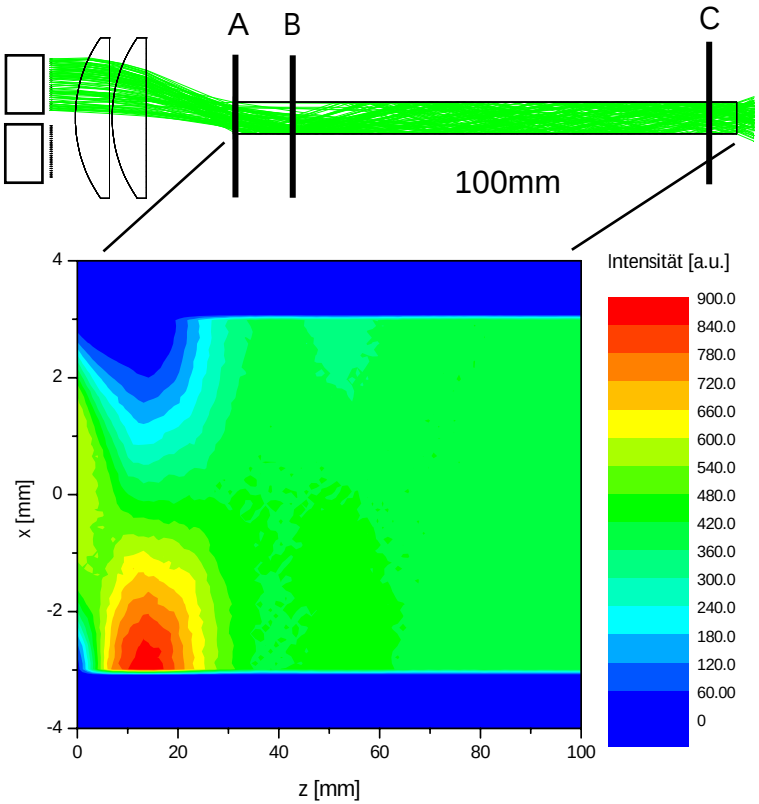
Planar waveguide

- focussing into a glass block
- mixing by TIR





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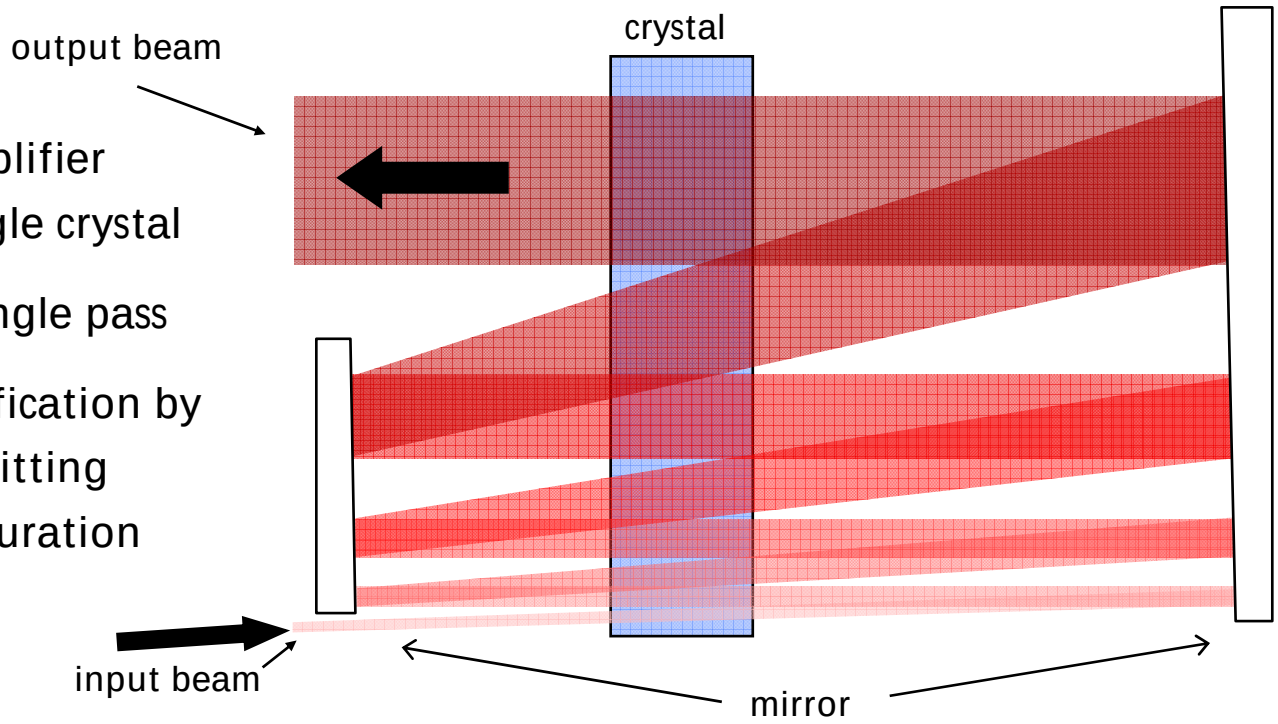
amplifier - principle

- Multistage amplifier within one single crystal
- High gain in single pass
- efficient amplification by automatically fitting intensity to saturation



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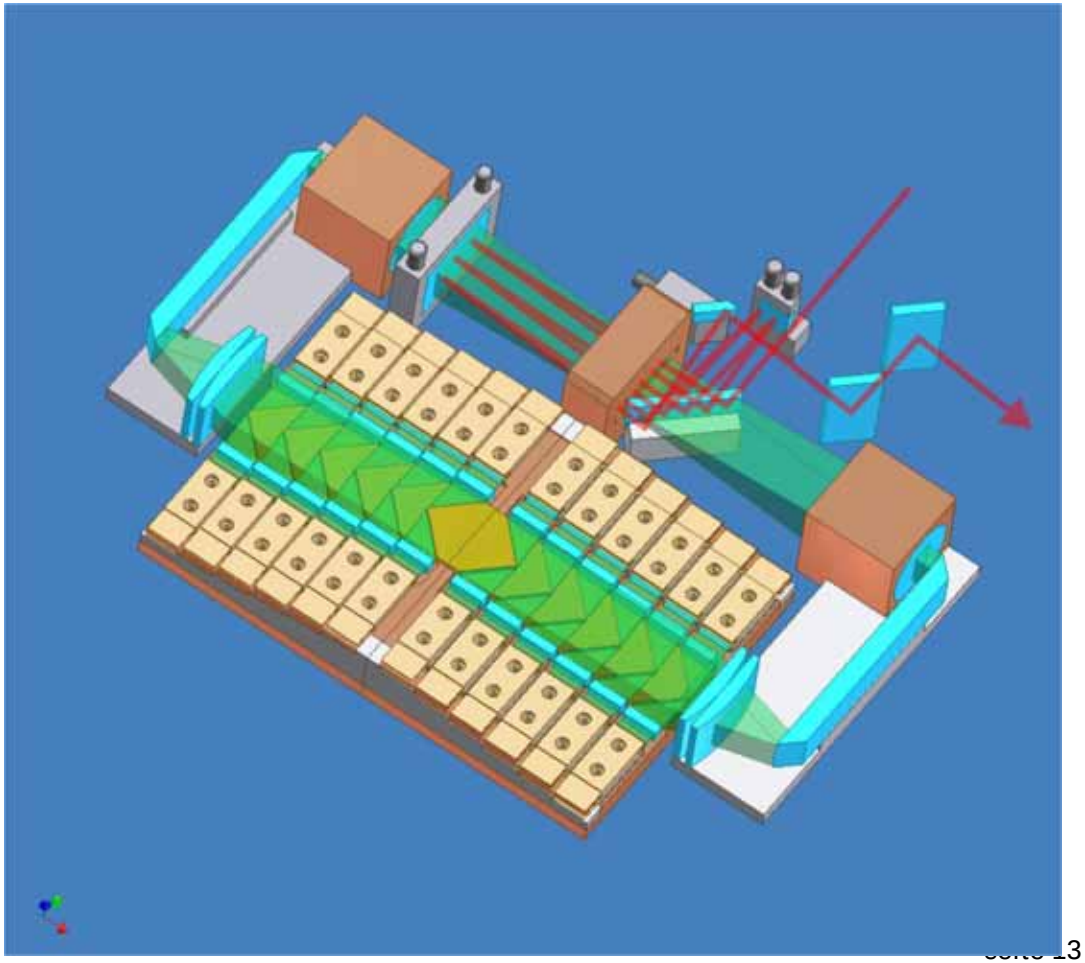
INNOSLAB amplifier

- Pump light homogenisation with waveguide or microlens arrays
- Output Energy ca. 80 mJ
- Folded, compact amplifier with conduction cooled optical stacks possible (Space operation)



Status / Time schedule

- Parts procurement and system design ongoing
- First crystals available
- First measurements of Nd:YGG properties (Gain, Fluorescence lifetime, etc.) expected in 2005
- First results of q-switched operation expected spring 2006
- Amplifier results expected summer 2006