Status of High-Power Laser Development at Stanford

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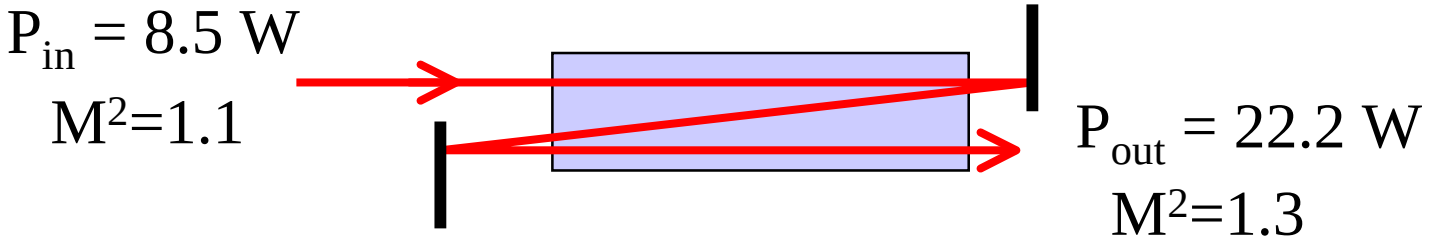
Outline

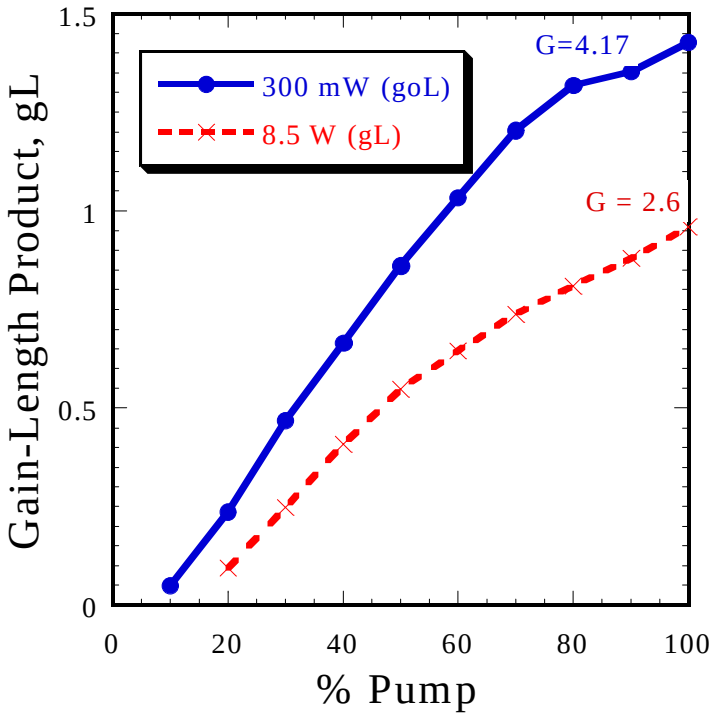
- Review
- Progress since last LSC
  - Preliminary results on wavefront distortion
  - Installation of new diodes
- (Near) Future Work

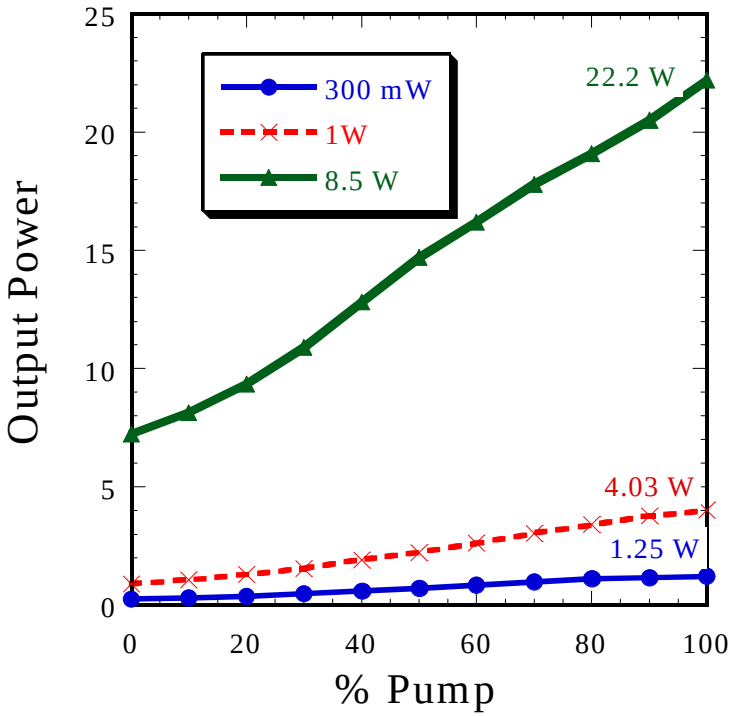
Configuration

- Two zig-zag slab amplifiers
  - Brewster ends
  - 3:1 aspect ratio (width/thickness)
- About 900 W total pump power
- Use Lightwave 10 W as master oscillator
- Goal: 100 W, low M^2

The Single -Triple Pass Amplifier







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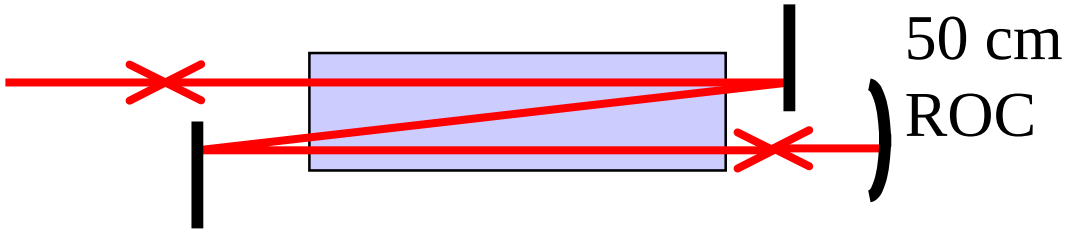
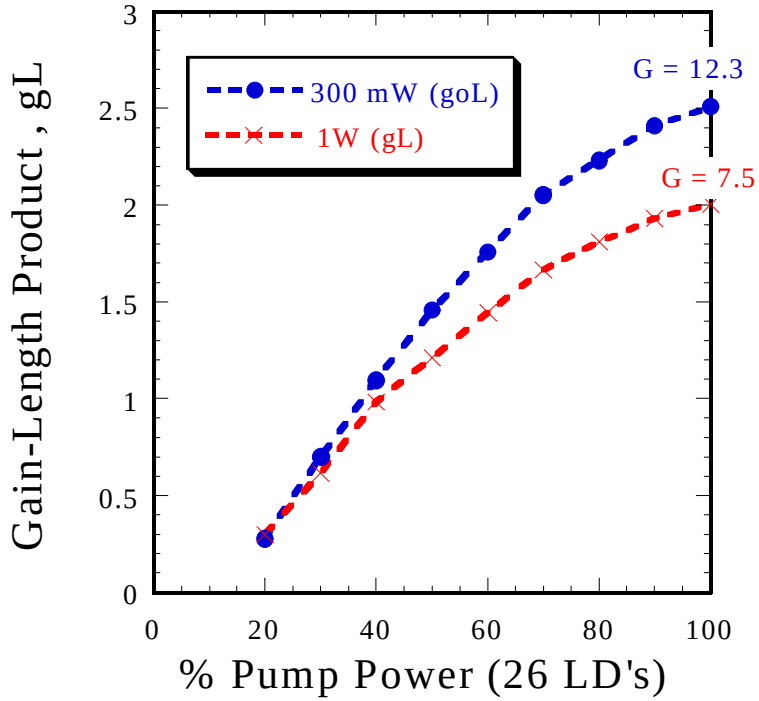
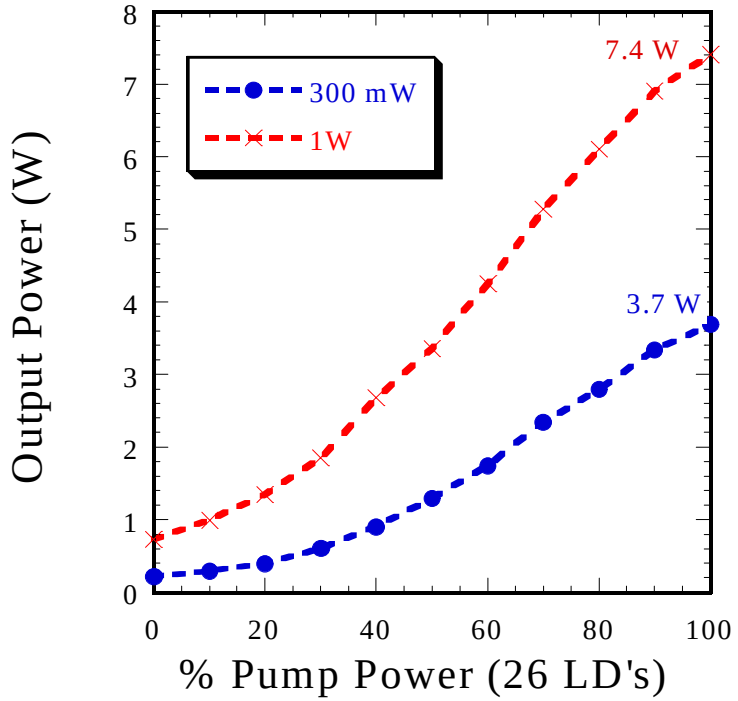
The Double-Triple Pass Amplifier







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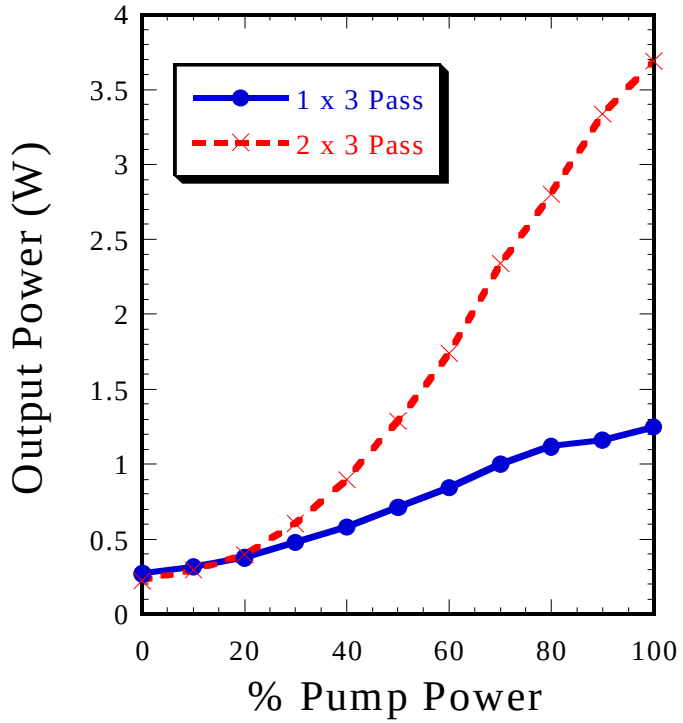
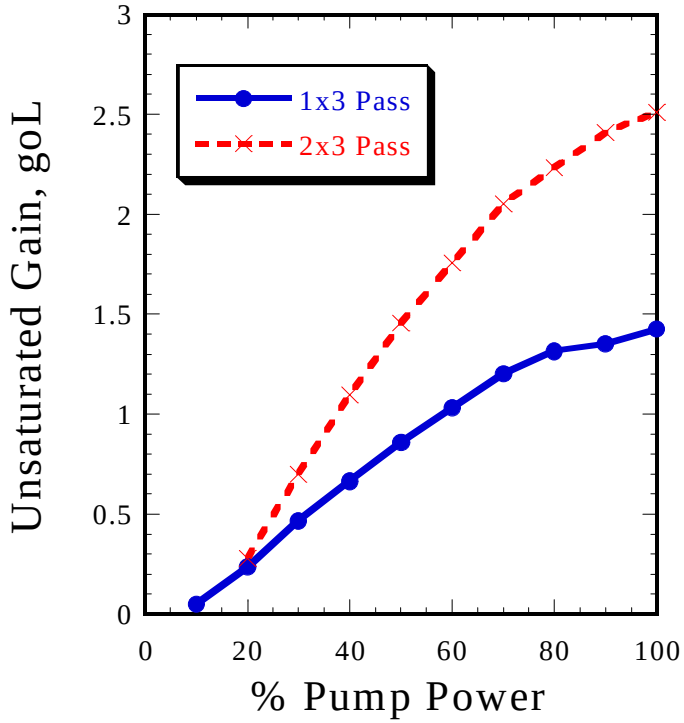
Unsaturated Amplifier

Unsaturated Amplifier
P_{in} = 300 mW





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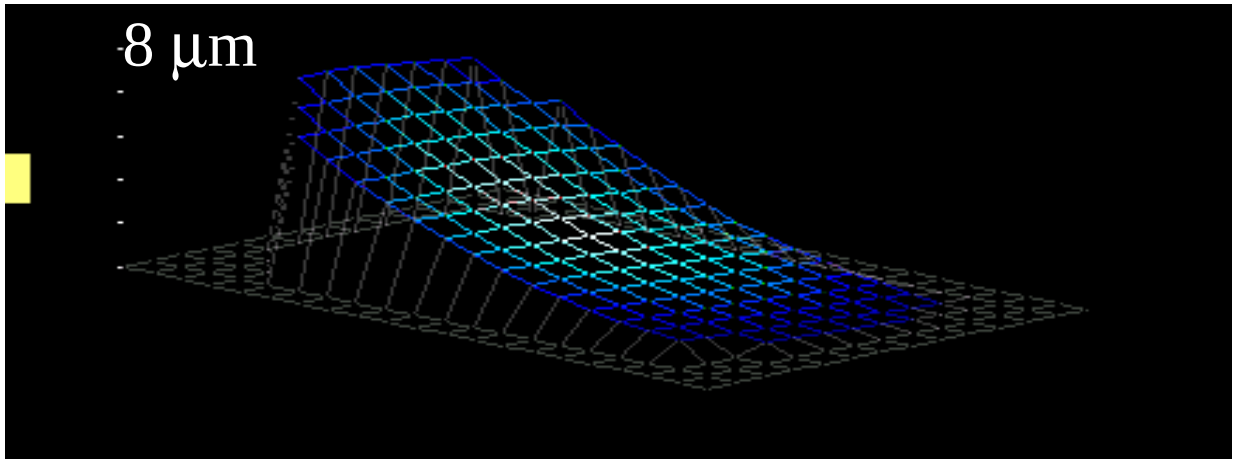
Slab Wavefront

- Measured with Shack-Hartmann wavefront sensor
- Dominant distortion is tilt
- More detailed analysis in progress



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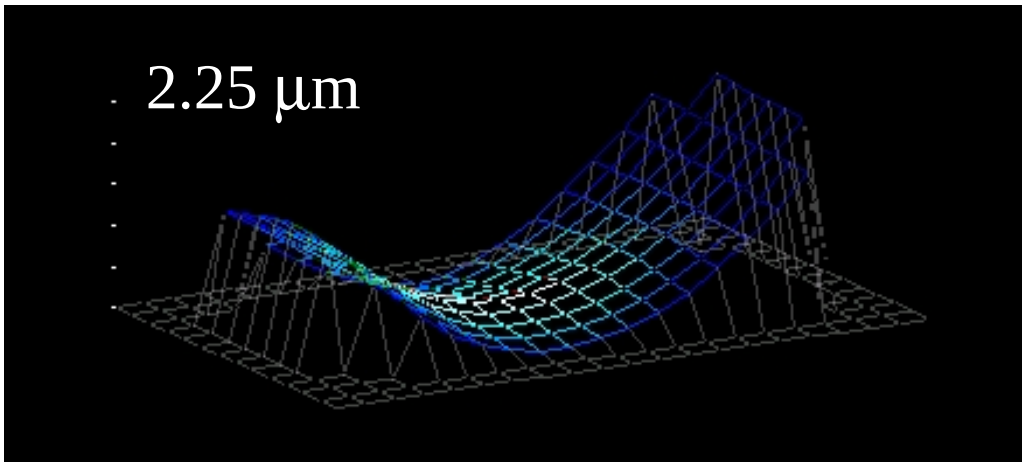
Tilt Removed



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Laser diode upgrade

Laser diodes

- Manufacturer: Coherent
- 30 W each
- 808 nm
- Fiber coupled
  - 400 μm core
  - 0.2 NA
- 24 units
- 720 W total

Power Supplies

- Manufacturer: Newport
- 100 A, 14 V
  - Drive 6 bars in series
- Temperature Control
  - PID controllers
  - TEC drivers
- GPIB/RS-232
- Fault protection

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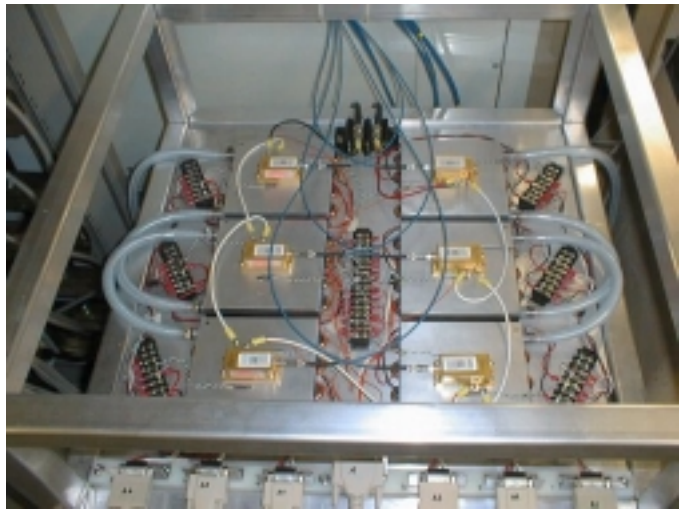
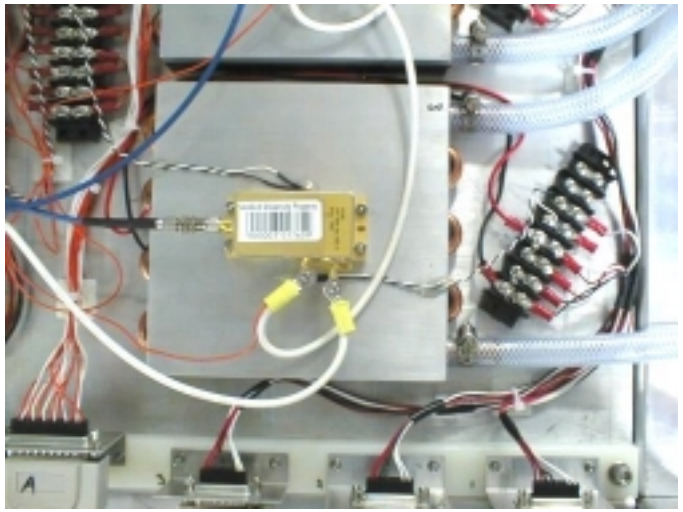
Installation Complete



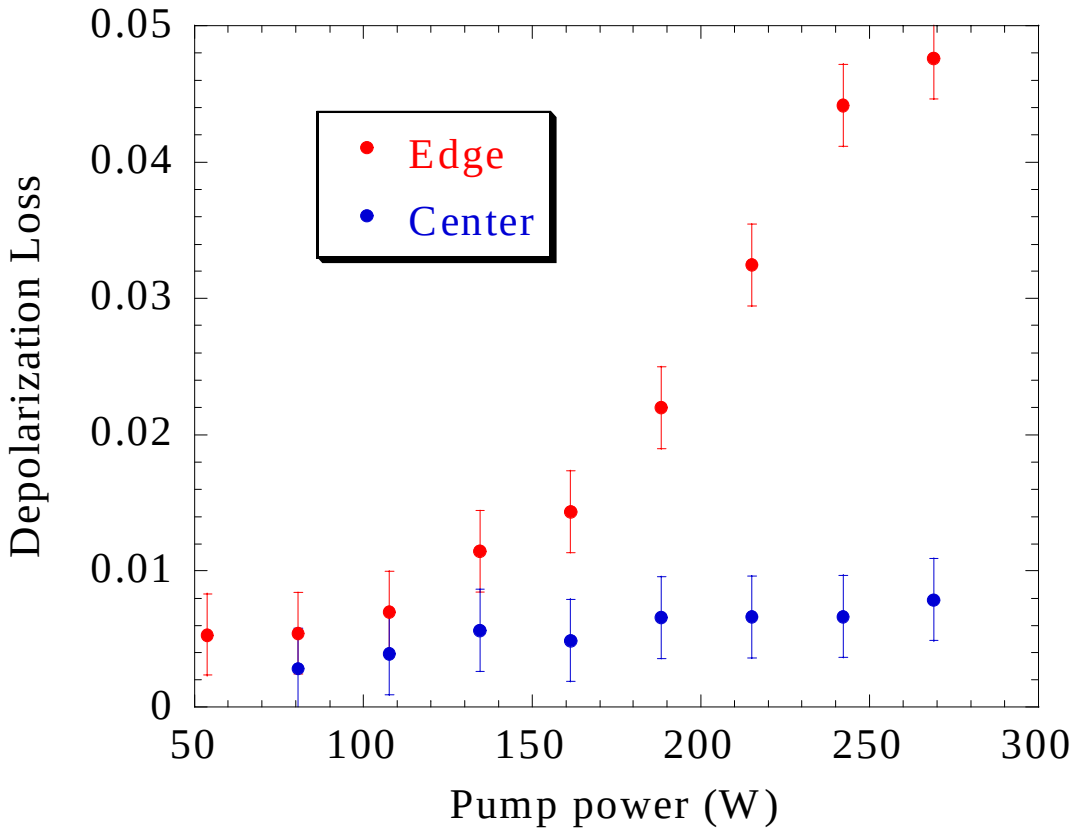
-Labview control of diode:
  -Current
  -Voltage
  -Temperature
-Interlocks



Power Scaling Challenges

- Beam Quality
  - Difficult to model
    - Distortions depend critically on slab boundary conditions
- RF Intensity noise
  - High circulating power in PMC(s)
  - Requirements eased with DC readout
- Parasitic Oscillations
- Depolarization
  - Near edges only
- Temperature detuning

Depolarization



- Stress near edge of slab is not completely aligned with polarization
- Sensitive to fiber position and distribution
- 300 W pump ~ 15 % stress fracture limit

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Future Work

- Calibrate Diodes (1 week)
  - Temperature for optimum absorption
  - Power vs Current curves
- Assemble second amplifier head (2 days)
  - Machining finished
- Mount fiber clamp to second head (1 week)
- Power tests of second head (2 weeks)
- Begin amplification experiments