

# KAGRA f2f Meeting Laser

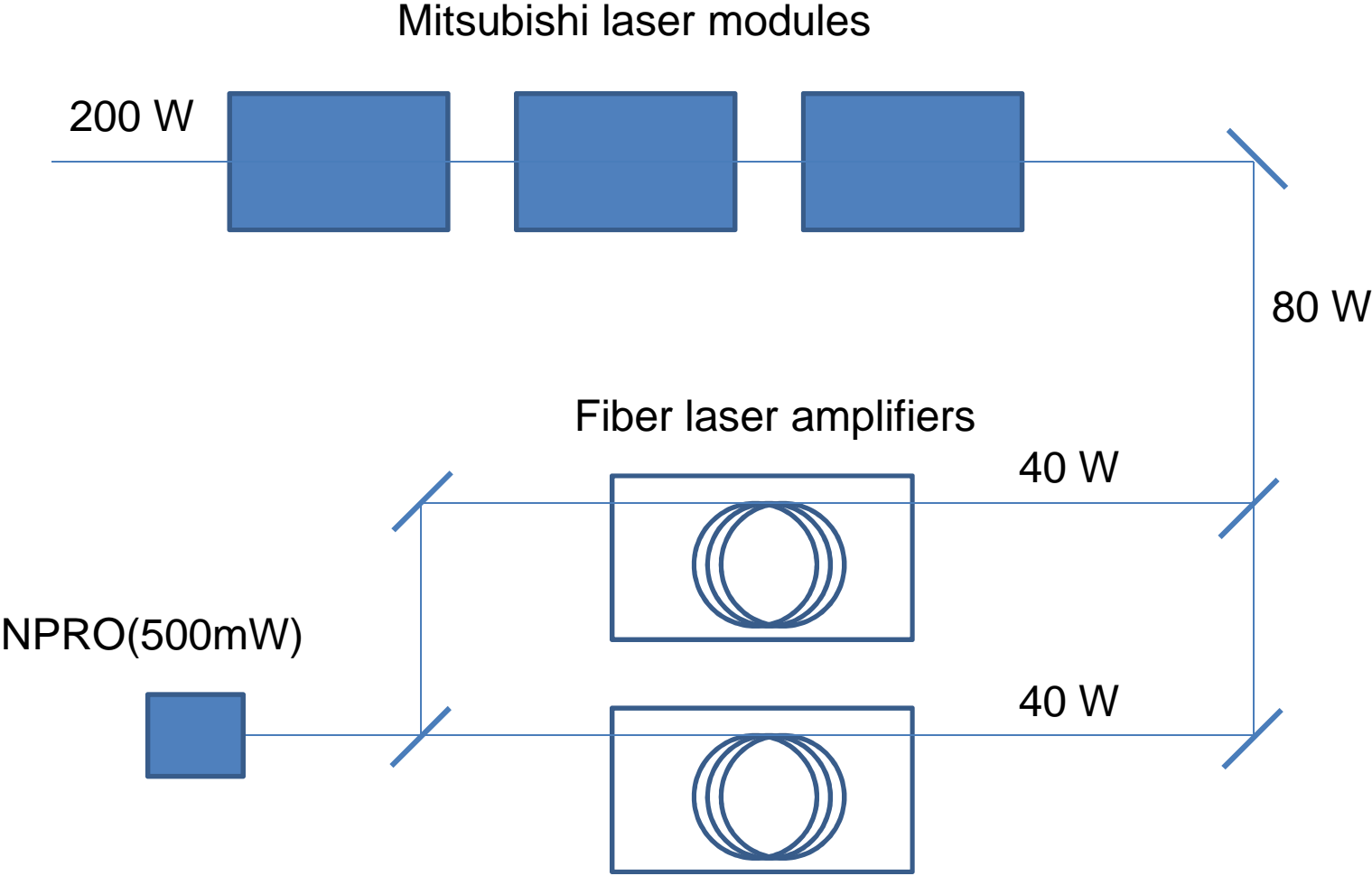
16 February, 2013

Norikatsu Mio

# Requirements for the laser

- Power  $> 180$  W
- Single frequency
- Linear polarization
- Single transverse mode
- Wide-band control for stabilization systems
  - About 1MHz for frequency control
  - About 100kHz for intensity control

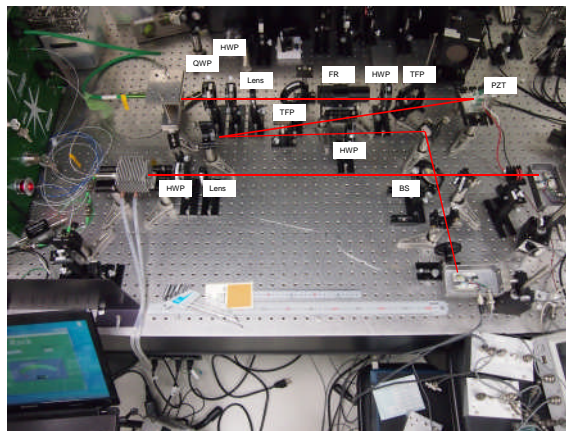
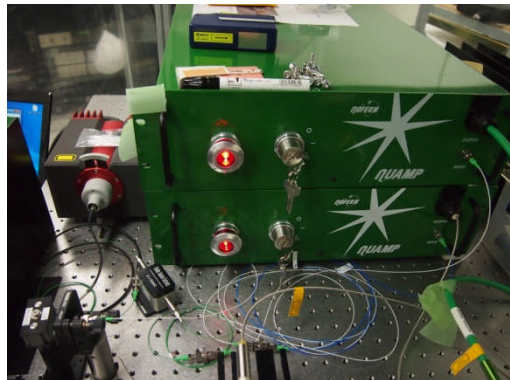
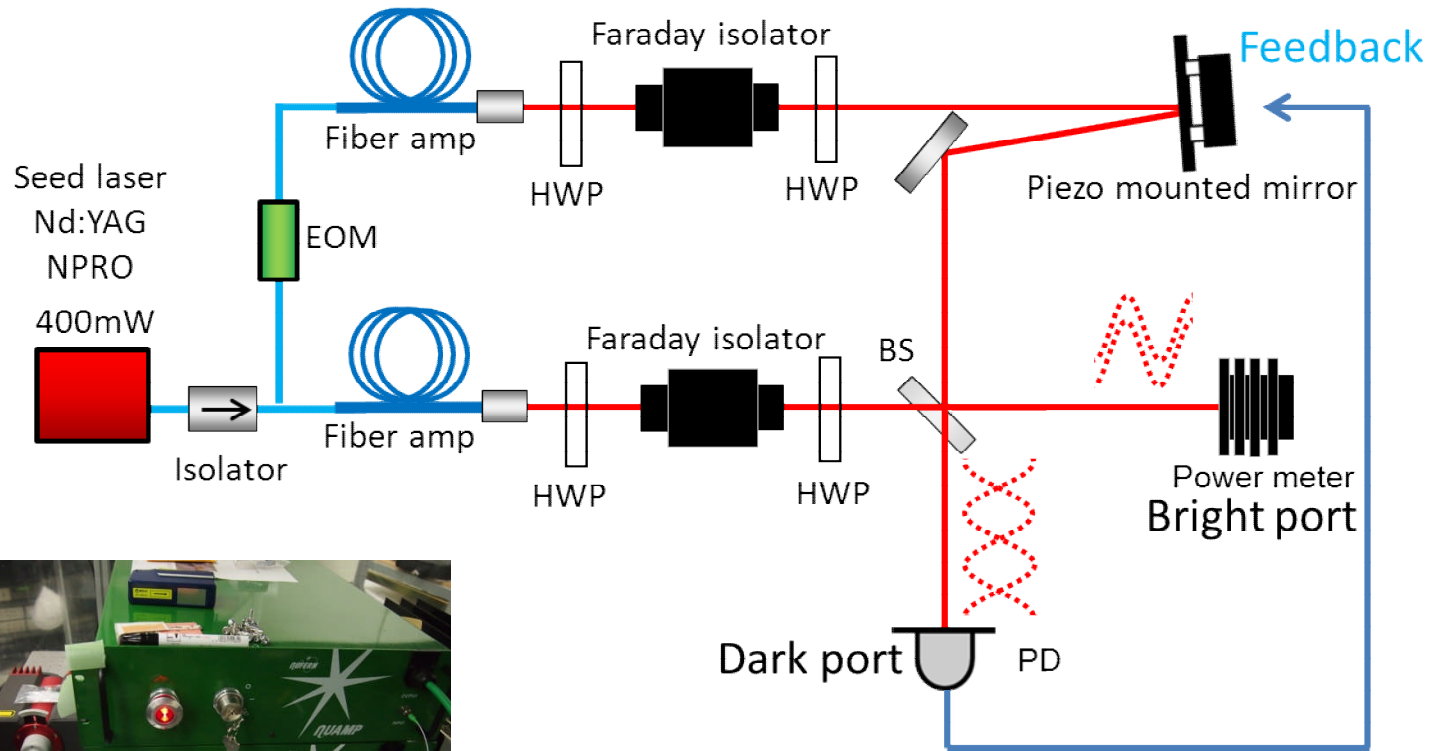
# Schematic diagram



# Laser

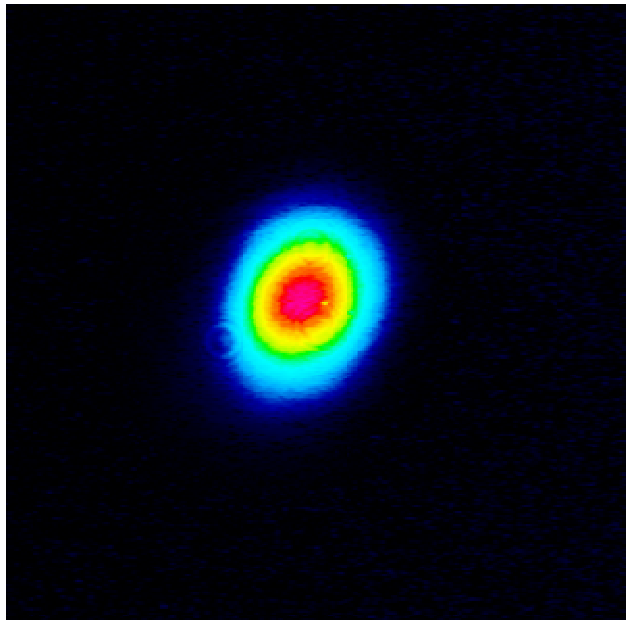
- Coherent addition of two amplifier outputs has been tested. The current best was  $41\text{ W} + 41\text{ W} \rightarrow 78\text{ W}$ .
- Wave front distortion by a solid state amplifier has been measured.
- Wave front distortion correction system has been tested.

# Coherent addition of two laser outputs

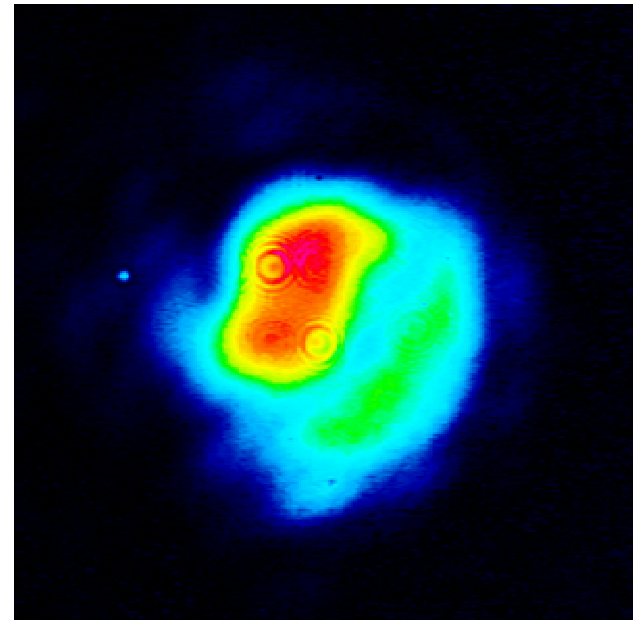


# Result of the coherent addition

$41\text{W} \times 2 \Rightarrow 78\text{W}$  Efficiency 95%

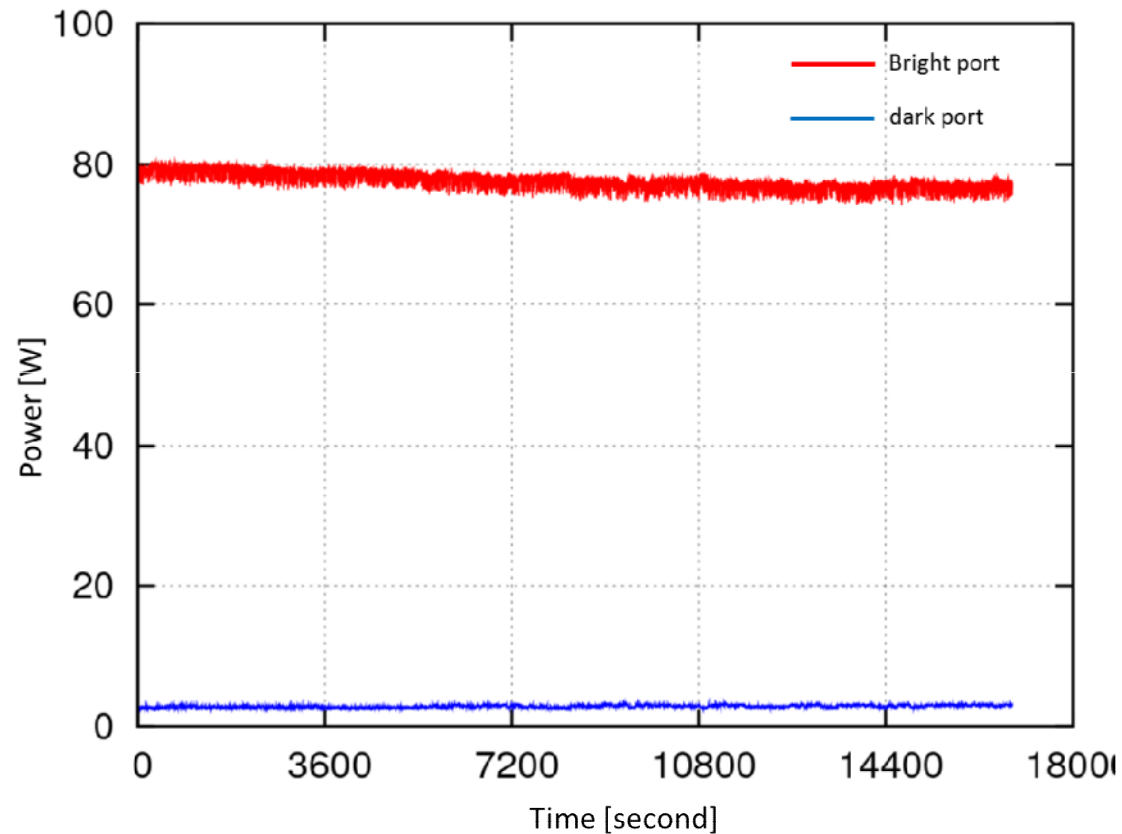


Bright port 78W



Dark port 4W

# Long-term operation



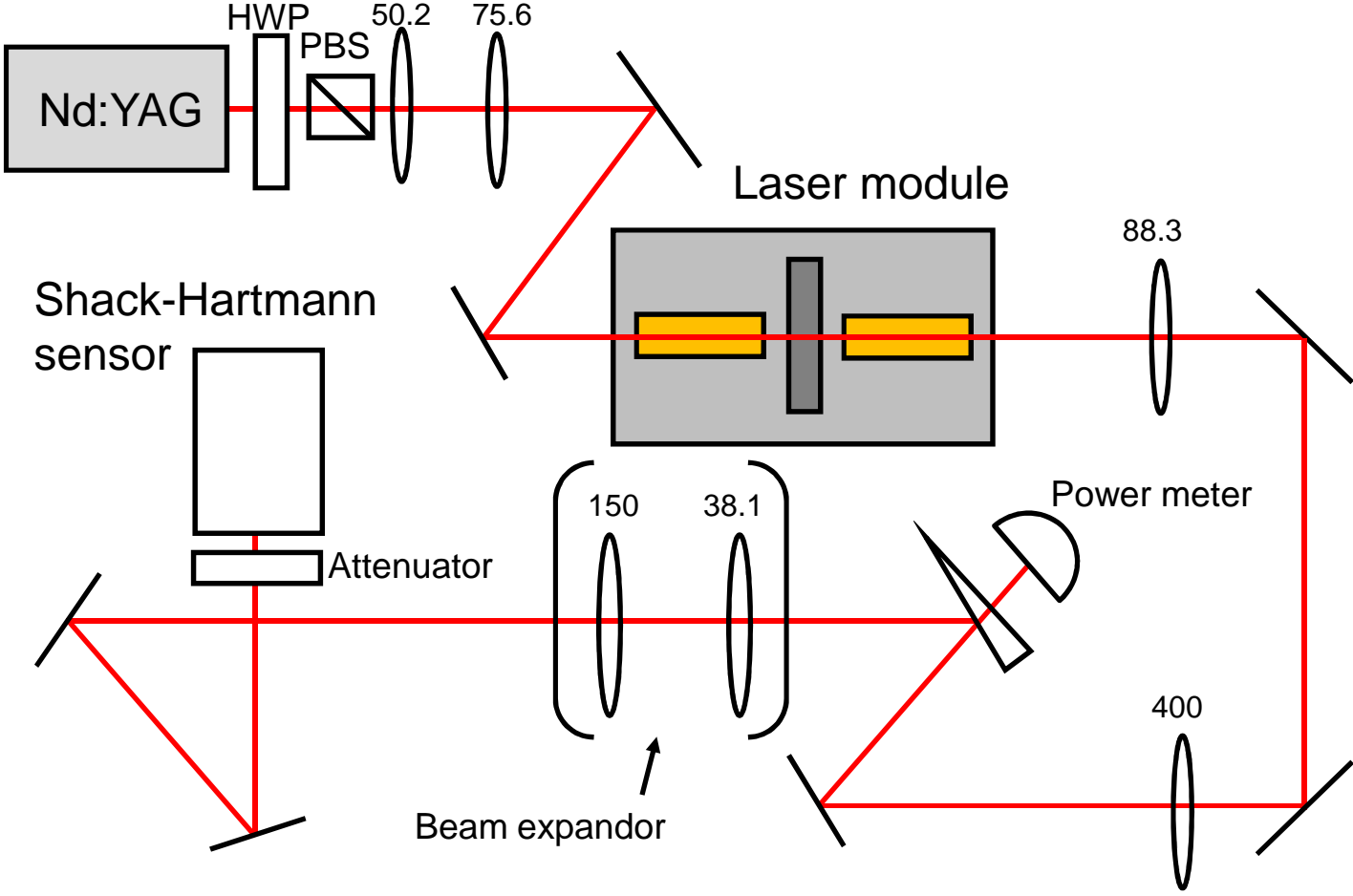
Continuous Locking has been maintained over 4 hours.

# Wave-front distortion by solid-state amplifiers

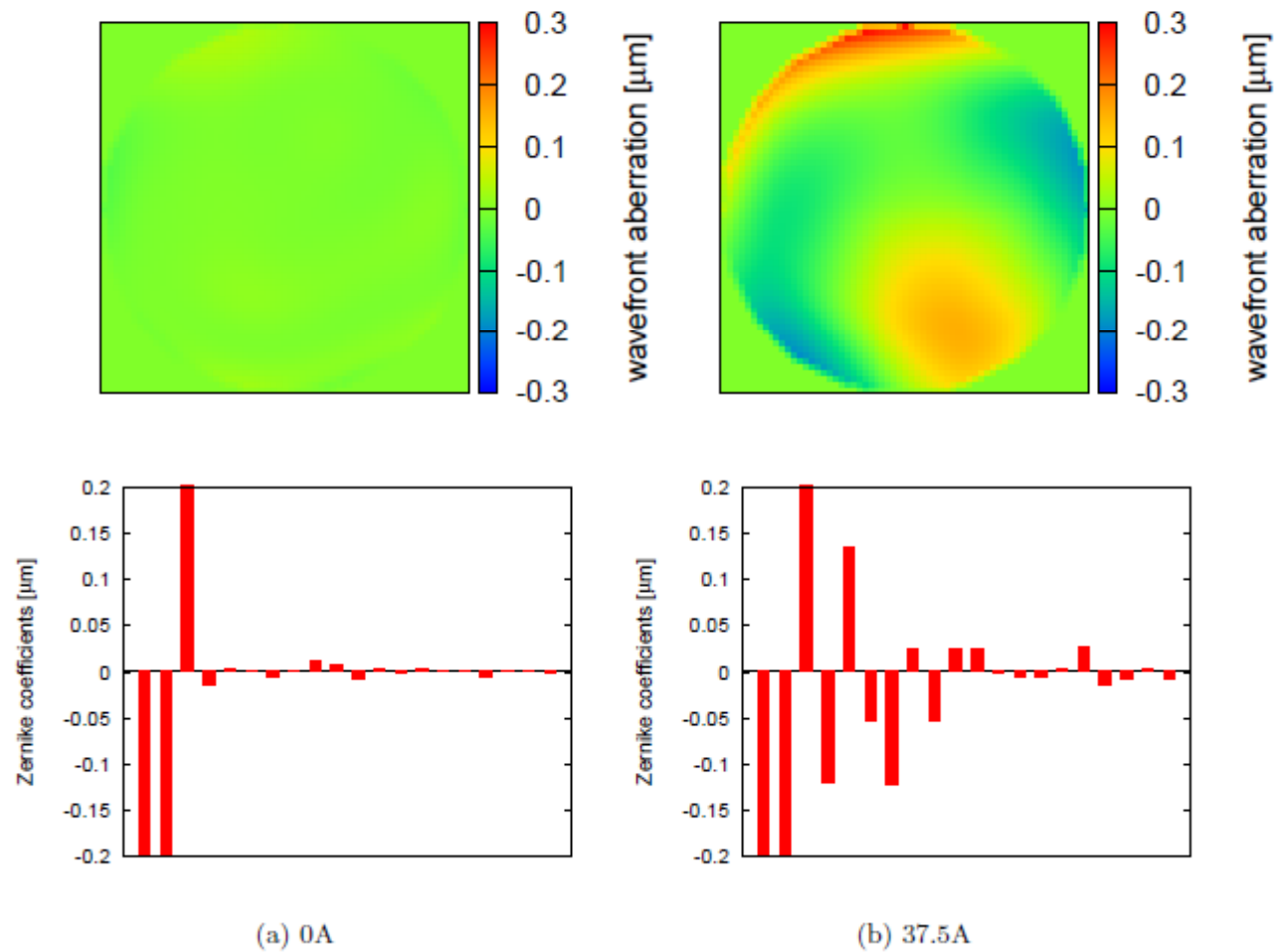
- Wave-front distortion is caused by solid-state amplifiers owing to
  - Imperfect laser crystal
  - inhomogeneous pumping.
- We are making an experimental system that can measure and correct the wave-front distortion.



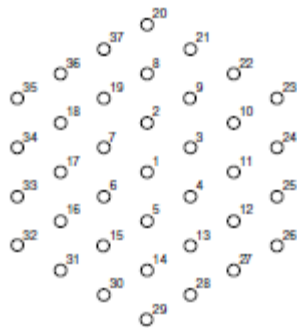
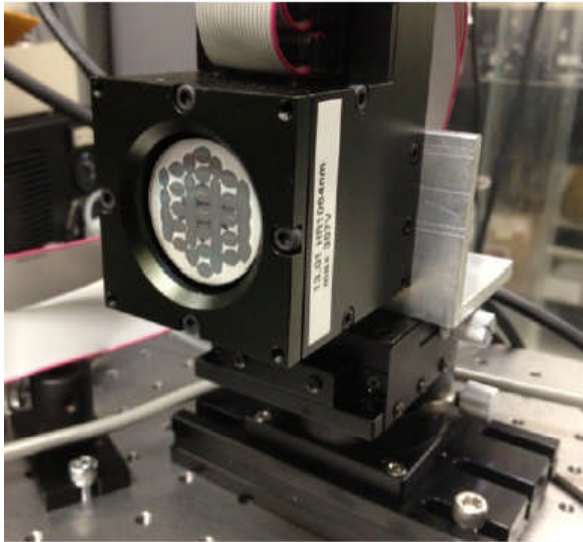
# Optical system



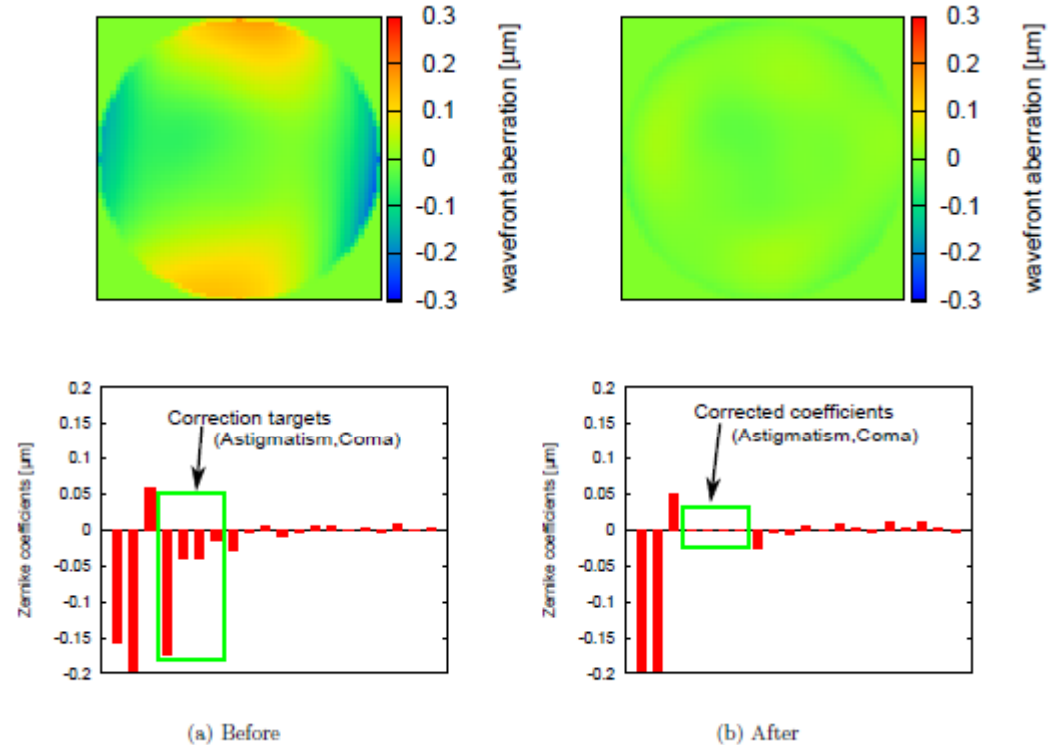
# Wave-front distortion



# Wave front correction



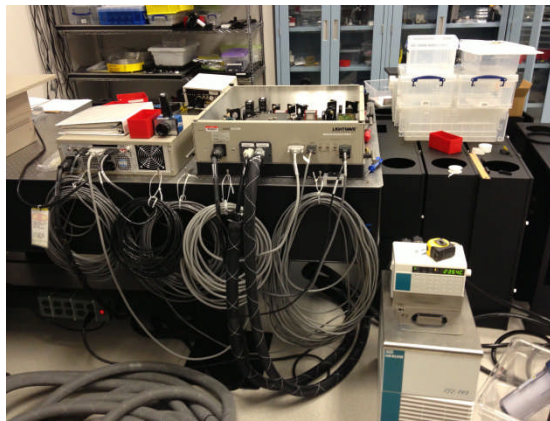
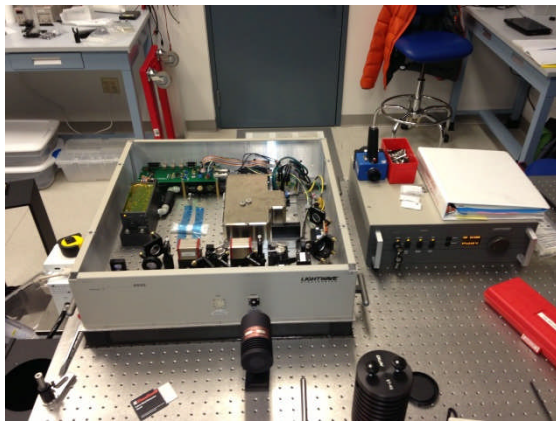
Deformable mirror:  
37 actuators



	Before pumping	After pumping	After correction
Strehl ratio	0.997	0.75-0.82	0.994

# iLIGO Laser

- Dr. Savage at LHO is rebuilding a laser system developed for iLIGO.
- We will use this laser for an optical absorption measurement system in order to evaluate the quality of large saphier crystals.



# Summary

- Preparation of the laser system is going on.
- The performance of the fiber laser amplifier and the coherent addition is almost satisfactory.