# Status of Adelaide 100W Laser Development

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**ACIGA / LIGO / Stanford collaboration**

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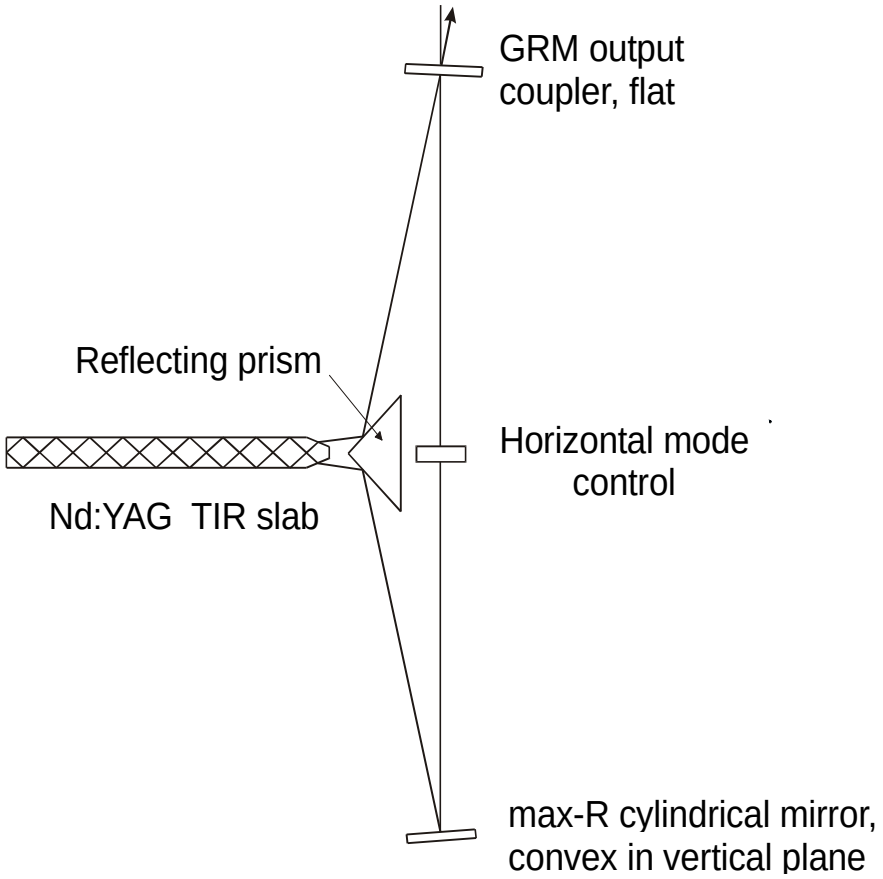
# 100W Laser Configuration




- slab is side-pumped by 520W of fibre-coupled diode lasers
- resonator is stable in the zig-zag (horizontal) direction, unstable in the vertical direction

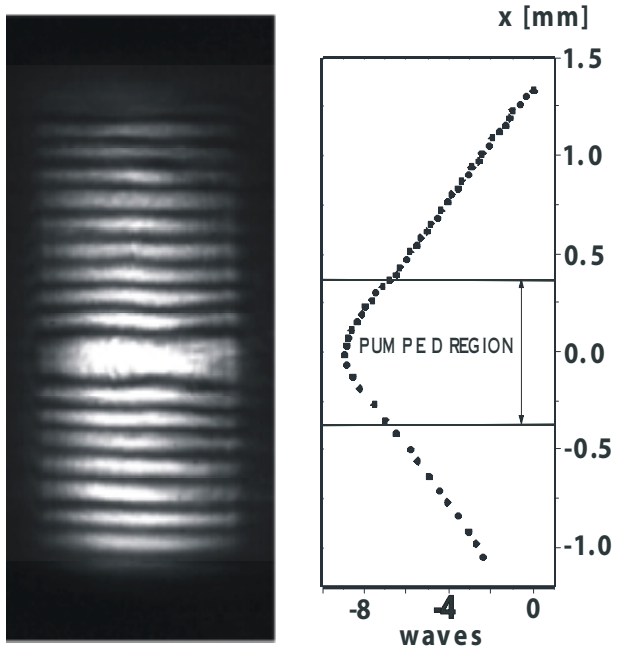
# Proof-of-principle experiments successfully completed

Using 100W-pumped laser head, demonstrated

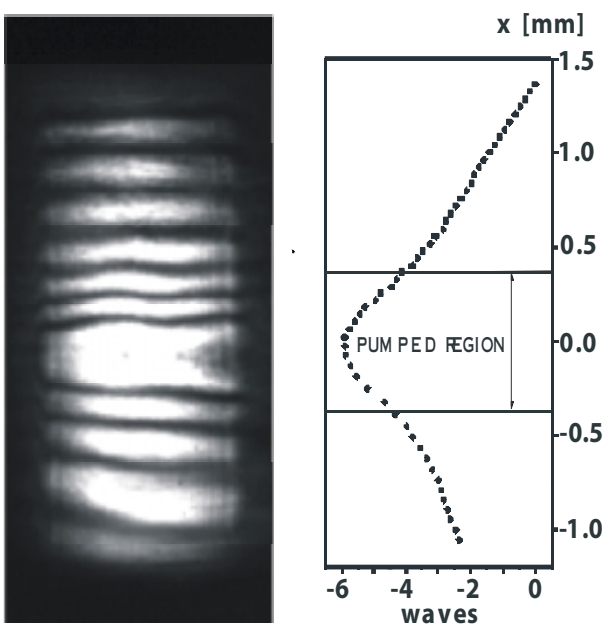
- efficient lasing in flat/flat stable resonator (30W output)
- control of thermal lensing in the unstable (vertical) direction
- mode control in stable/unstable standing-wave laser
- single frequency operation of stable/unstable laser (by injecting 200mW from NPRO)

# Thermal lens compensation using TECs on top/bottom surfaces of slab

**cooling**

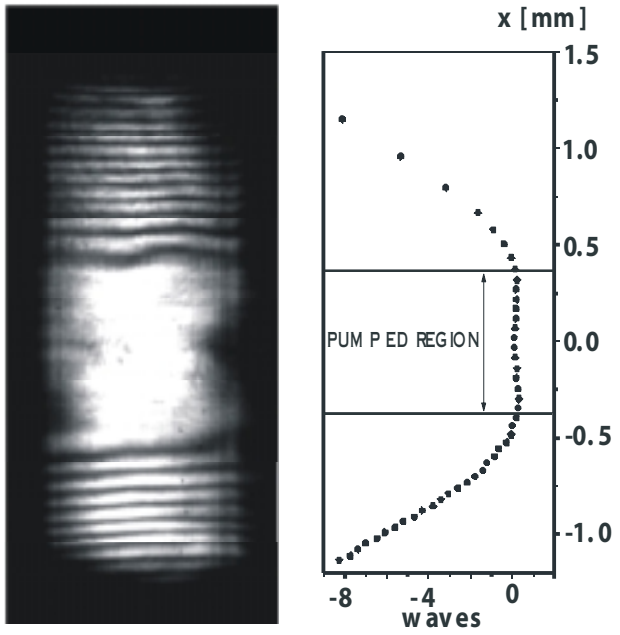



TEC I=+0.9 A



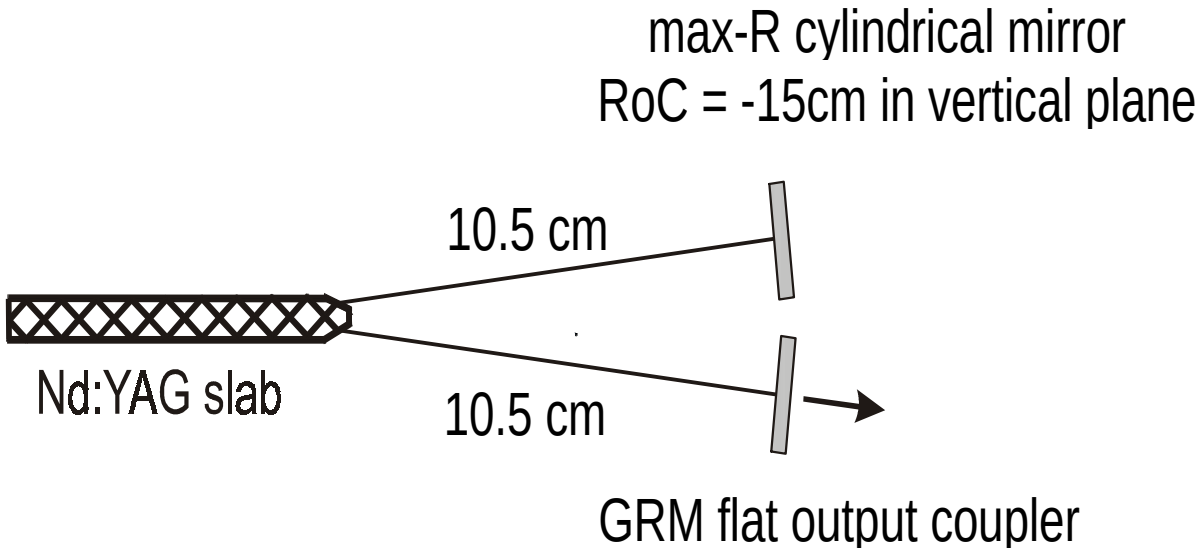

TEC I=0.0 A

**heating**




TEC I=-0.8,-0.85 A

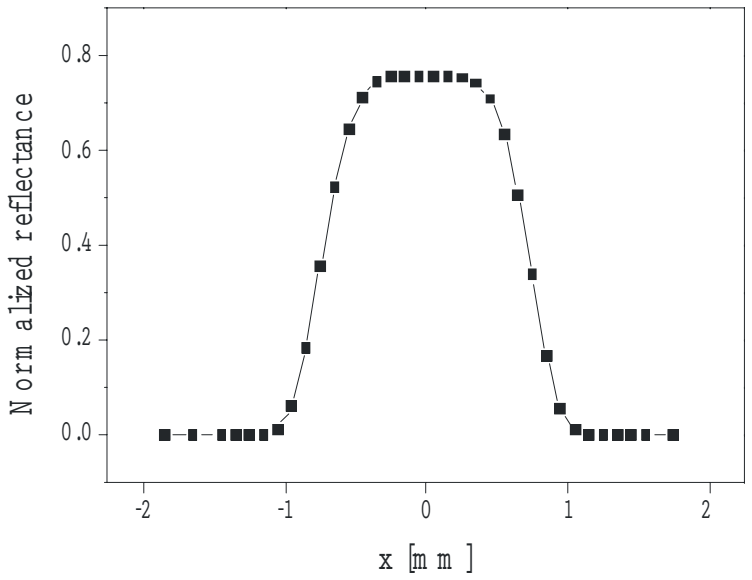
# Stable/unstable standing-wave laser




Thermal lens = 32cm
Geometric magnification = 1.3

# GRM parameters

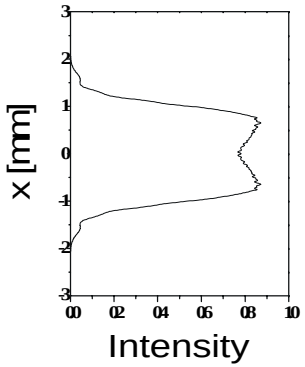
**Measured GRM profile (manufactured by INO)**

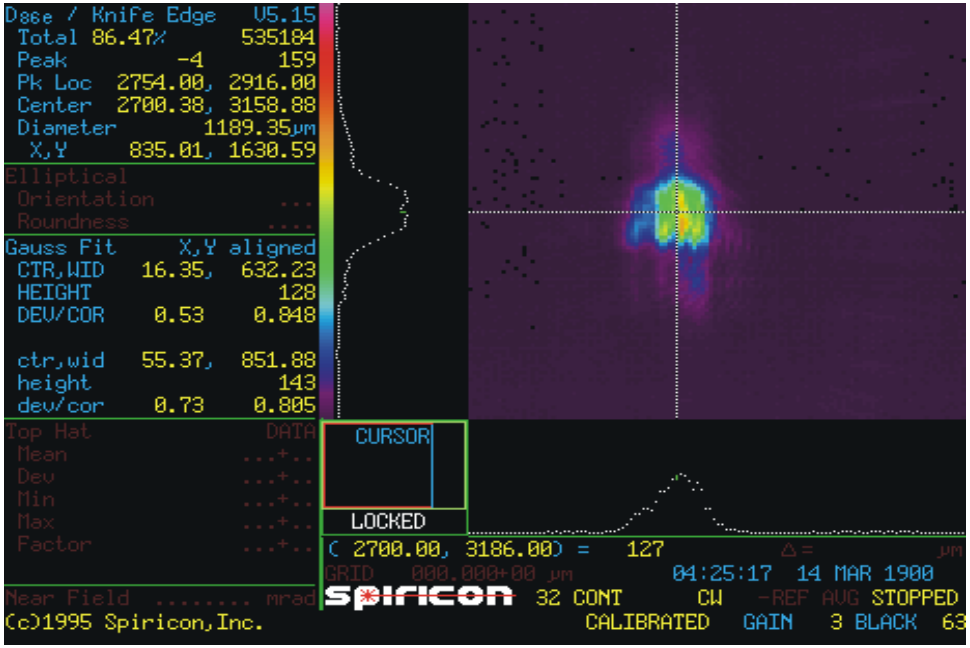



## Features

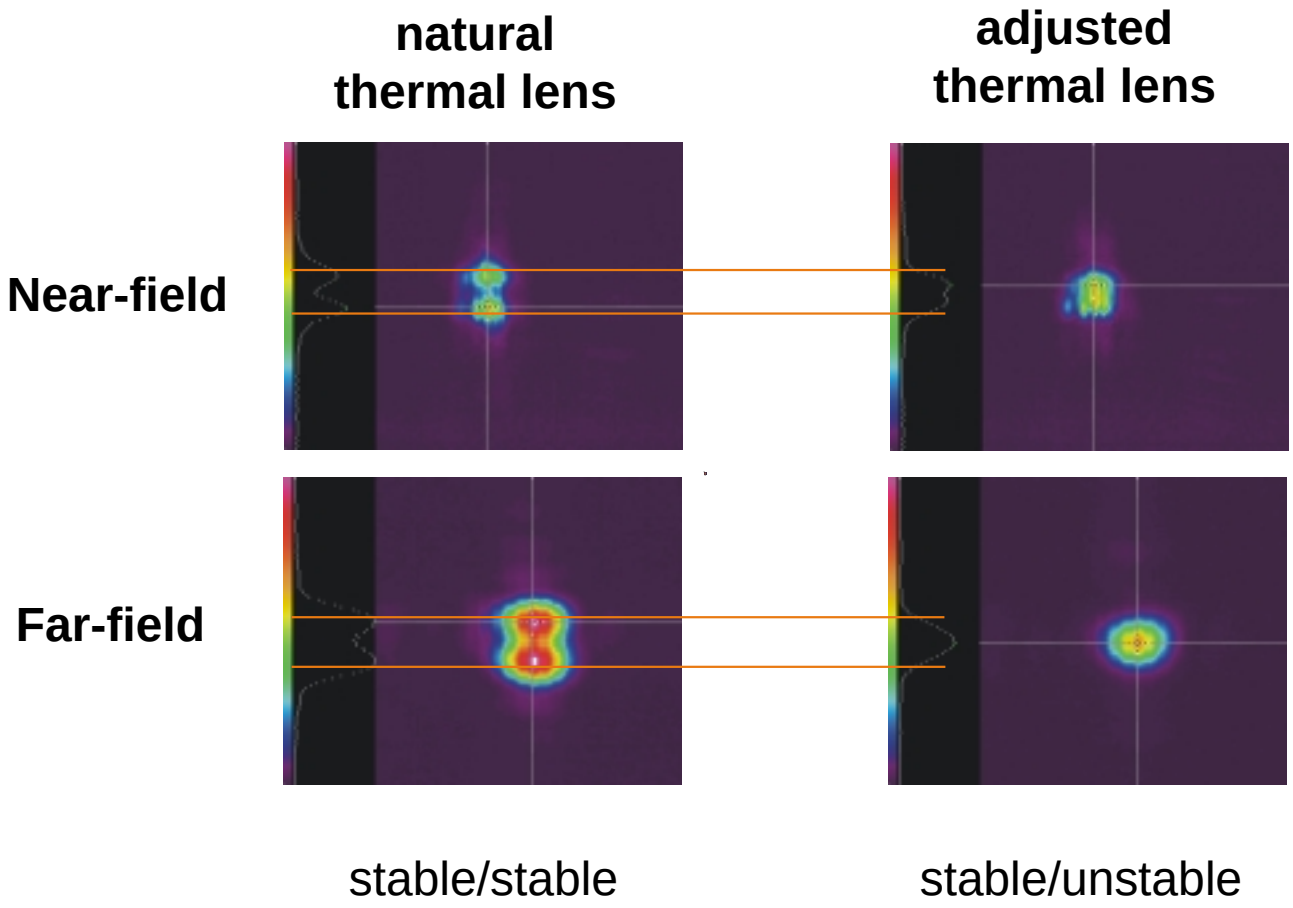
GRM flat (no curvature)
AR coated on back
Strip reflectance profile
Supergaussian order $n$ = 5
Peak reflectance, $R_o$ = 76%
Waist = 0.78 mm

# Comparison of measured and numerically modelled near-field intensity profiles

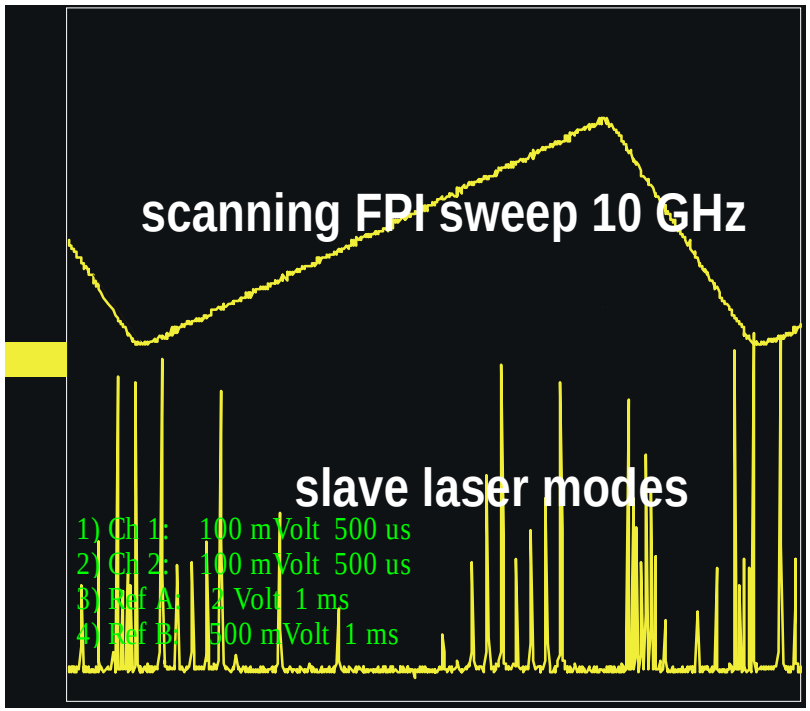


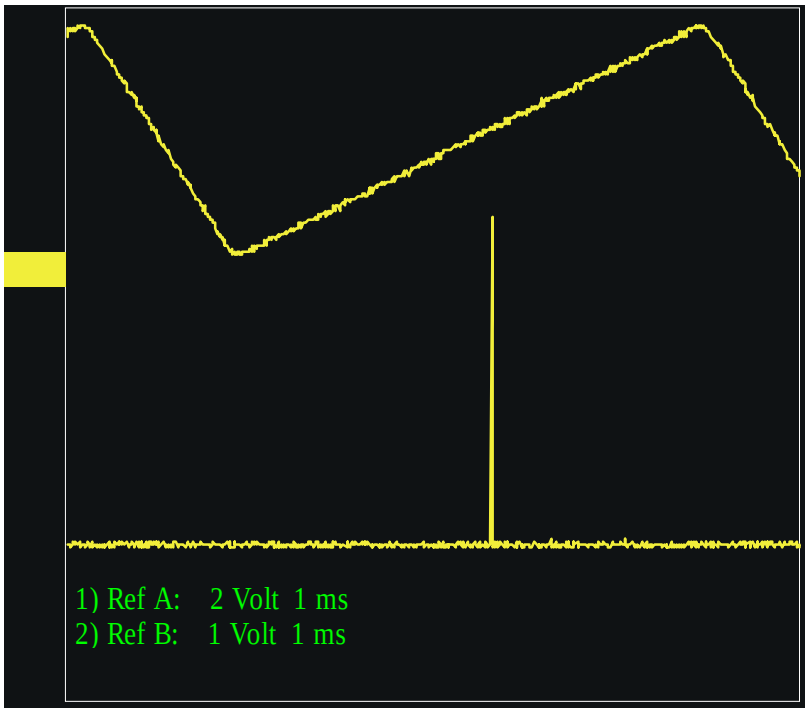
# Thermal lens control improves beam quality



# Single-frequency operation of stable/unstable laser

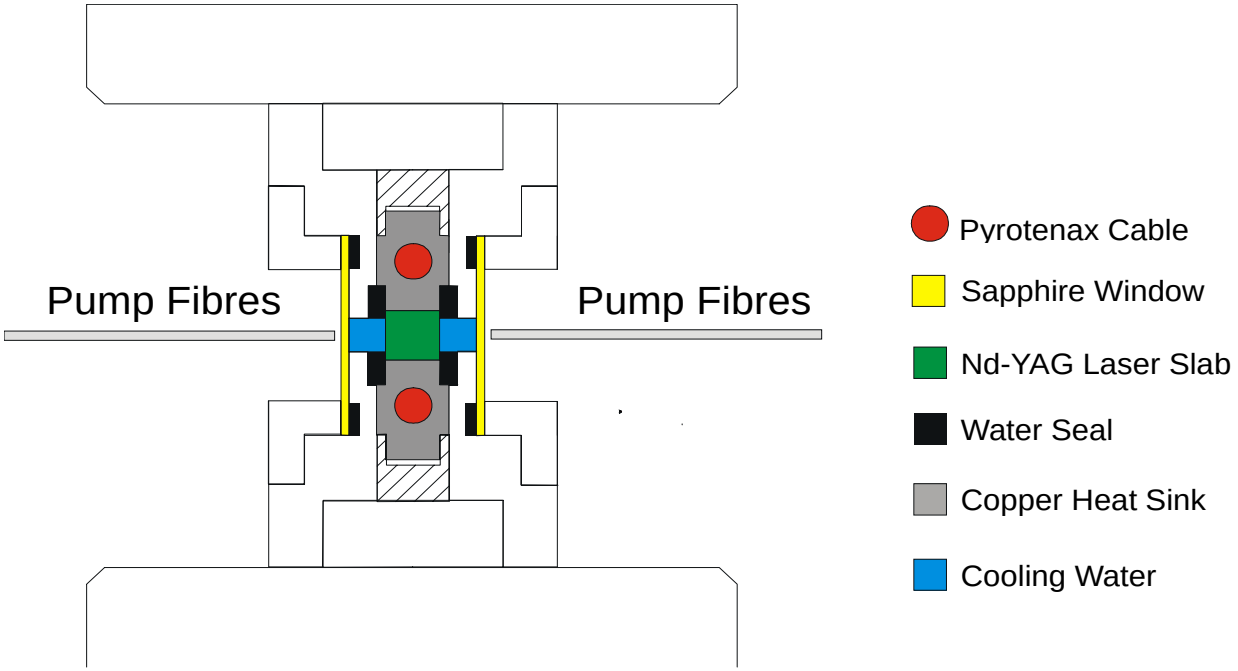



free-running slave




master laser on

# Improved Laser Head




- water seals are now pure latex
- heater bars used for control of vertical thermal lens

# Current Issues and Schedule

**Problem**

Gain media for 200W and 500W-pumped stable/unstable lasers were cut with wrong crystal orientation

**Solution**

New gain media for 500W-pumped laser ordered from Litton - expected delivery mid-September

**Schedule**

- fabricate new head for 500W-pumped laser
- debug head using dud gain medium
- establish thermal lens control when new gain medium delivered
- GRM for 500W-pumped laser due late September
- begin lasing tests