Lasers Working Group - Summary

Benno Willke

LSC Meeting

Livingston, March 2004

LIGO-G040184-00-Z

HPTF Test Objectives

- Measure optical distortions in ITM substrate and coatings, validate MELODY

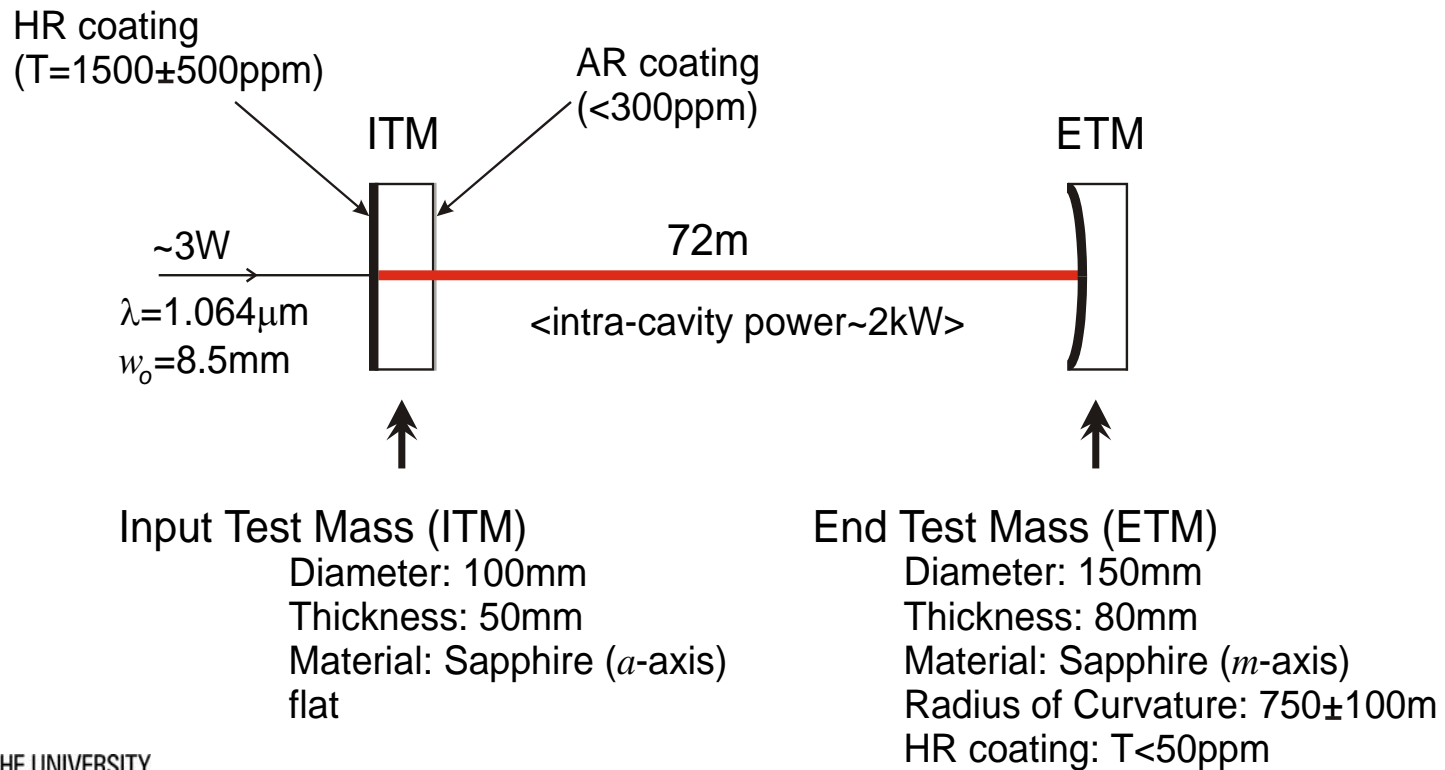 Test 1: Substrate absorption as in Adv LIGO

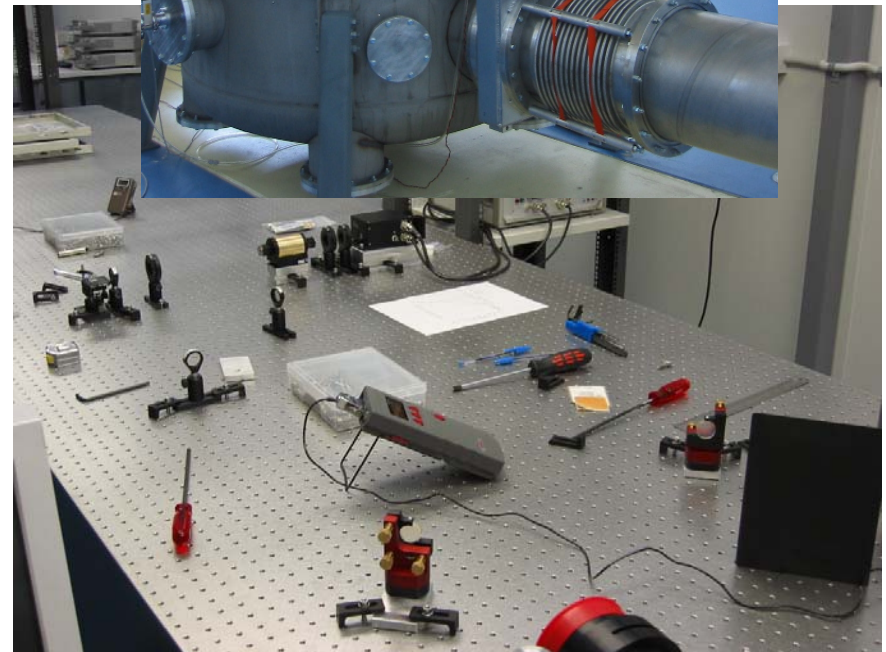 Test 2: High Reflectivity ITM coating absorption

  Test 3: Power recycled FP with unstable recycling cavity at low power as in AdvL

- Test wavefront sensors

- Test actuators for control in cavity

- Investigate control of power recycled FP cavities.

THE UNIVERSITY OF ADELAIDE AUSTRALIA

Jesper Munch

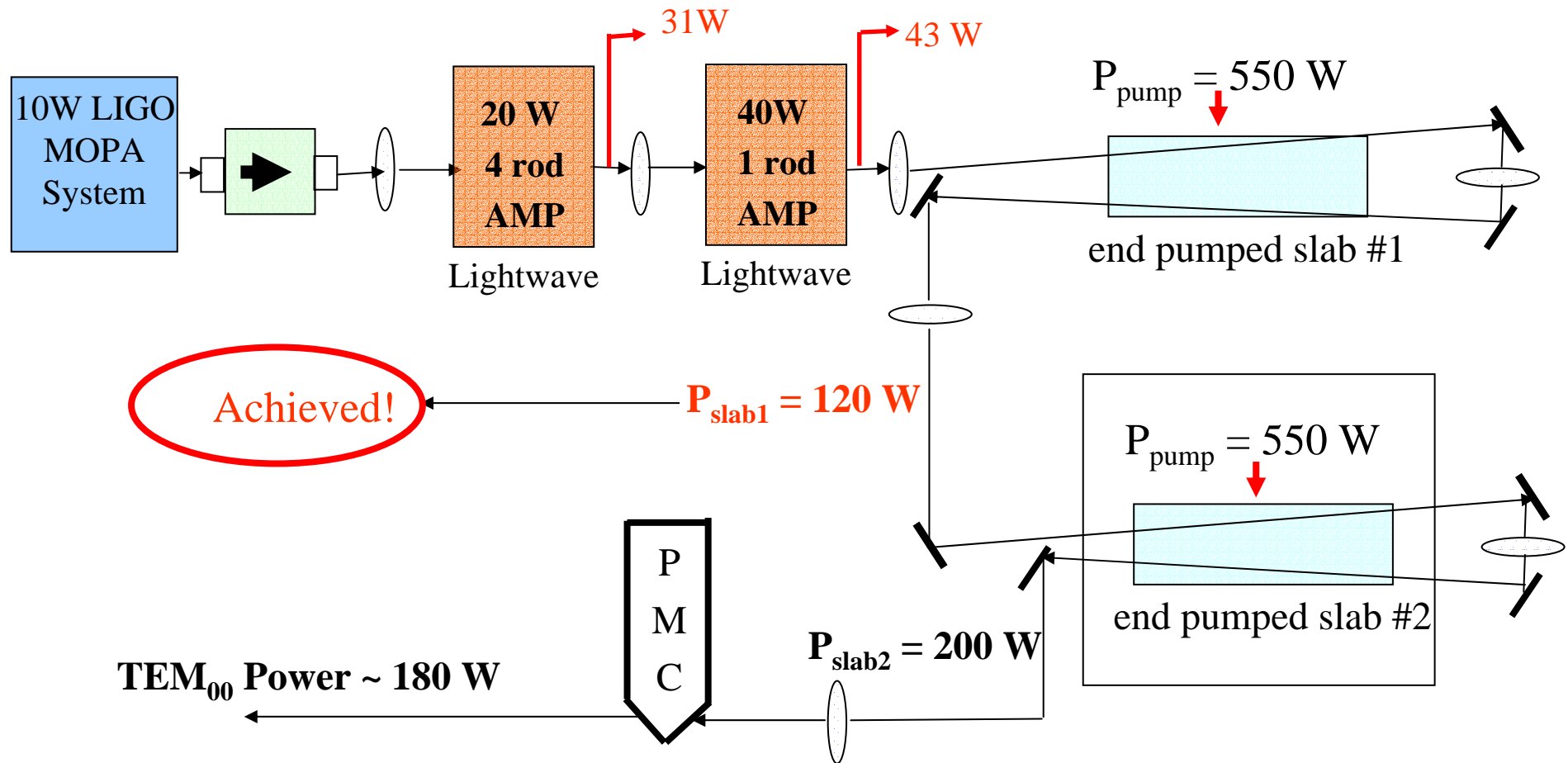# HPTF TEST 1: Measure wavefront distortion due to absorption in **test mass substrate**

• Use rear surface ITM. Measure degradation of finesse with increasing stored power
.
• Use Hartmann wavefront sensor to characterize distortion.

HR coating
(T=1500±500ppm)

AR coating
(<300ppm)

ITM

ETM

~3W

72m

λ=1.064μm

<intra-cavity power~2kW>

w_o=8.5mm

Input Test Mass (ITM)
    Diameter: 100mm
    Thickness: 50mm
    Material: Sapphire (a-axis)
    flat

End Test Mass (ETM)
    Diameter: 150mm
    Thickness: 80mm
    Material: Sapphire (m-axis)
    Radius of Curvature: 750±100m
    HR coating: T<50ppm

THE UNIVERSITY
OF ADELAIDE
AUSTRALIA

Jesper Munch

Jesper Munch

Scaling to 200 W : Experimental Plan

31W

43 W

$P_{pump} = 550$ W

10W LIGO
MOPA
System

20 W
4 rod
AMP

40W
1 rod
AMP

Lightwave

Lightwave

end pumped slab #1

Achieved!

$P_{slab1} = 120$ W

$P_{pump} = 550$ W

end pumped slab #2

P M C

$P_{slab2} = 200$ W

TEM$_{00}$ Power ~ 180 W

Shally Saraf
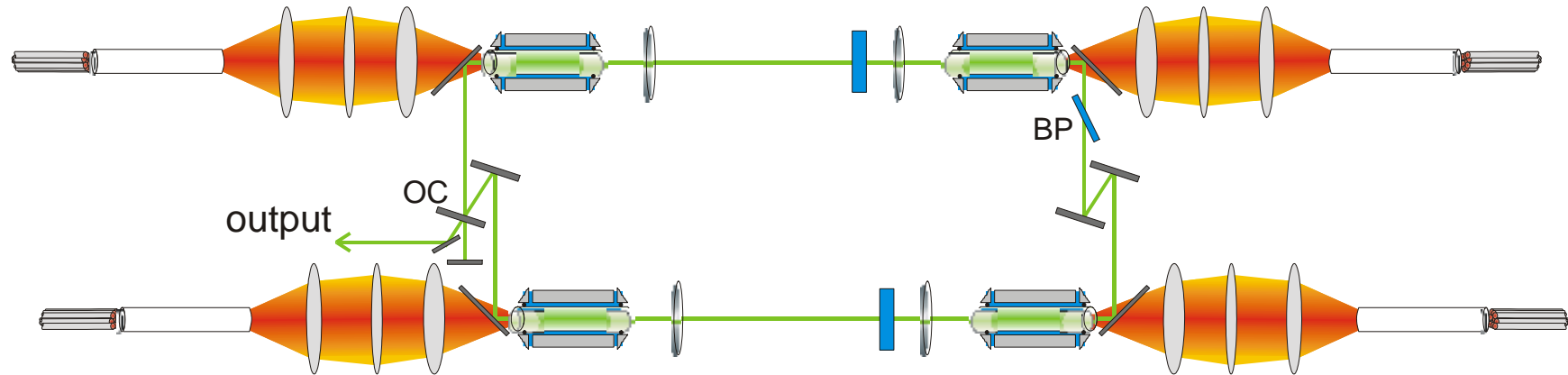
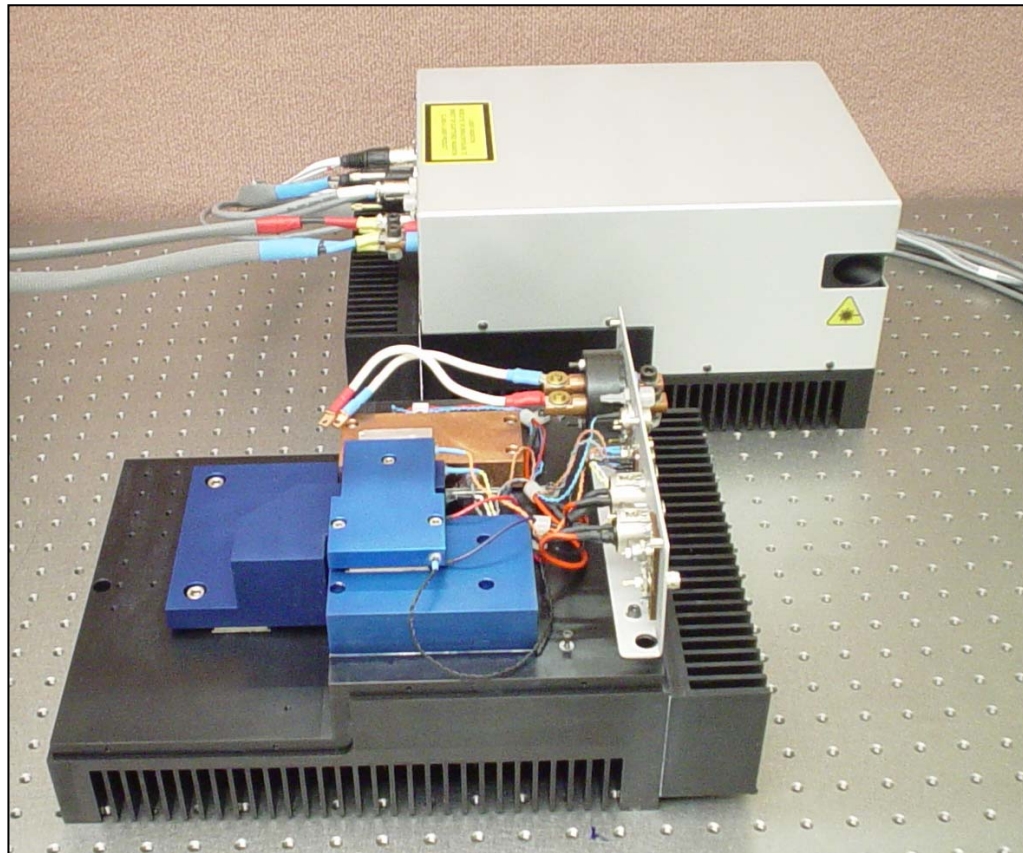# LZH - High Power Stage

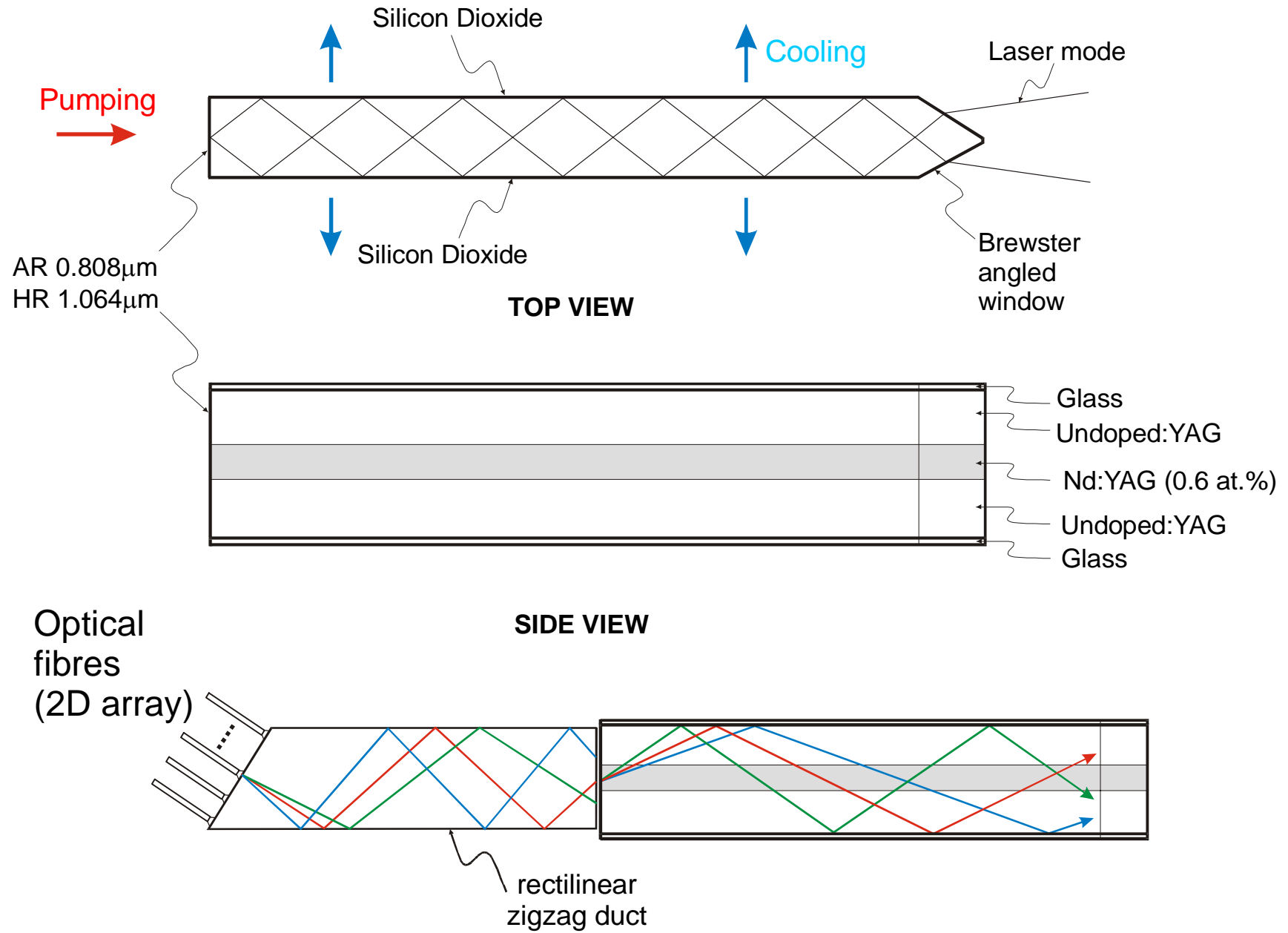- high power slave-laser

  - output power: 213 W

  - beam quality, M^2:   < 1.15

  - polarization: > 100:1

  - optical efficiency: 23 %

- front - end

  - components in place

Maike Frede

ACIGA HPTF and TAMA Lasers

David Hosken

Pumping

Silicon Dioxide

Cooling

Laser mode

AR 0.808μm
HR 1.064μm

Silicon Dioxide

TOP VIEW

Brewster
angled
window

Glass
Undoped:YAG
Nd:YAG (0.6 at.%)
Undoped:YAG
Glass

Optical
fibres
(2D array)

SIDE VIEW

rectilinear
zigzag duct

Damin Mudge

Laser Working Group Breakout Session

- **Peter King:**   LIGOI prestabilized laser system
  - Hanford 2k PSL: 37k
  - RIN behind MC: 2E-8 / sqrt(Hz) @10Hz

- **David Ottaway:**   MIT power stabilization experiment
- **Frank Seifert:**   AEI power stabilization experiment
  - RIN: 6E-9 / sqrt(Hz) @ 100Hz
  - not clear what limits out-of-loop performance

- **Dennis Ugolini:**   Trinity power stabilization experiment
  - correlation between NPRO current and RIN
  - once noise eater was turned on correlation disappears

PSL – Conceptual Design