



Advanced LIGO R&D Review

Input Optics

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for the University of Florida
(Dave Reitze, David Tanner, ...)
October 8, 2002.



Current Status

- Design Requirements Review (DRR) held May 2002
- results obtained for high power Faraday isolator
 - » > 45 dB isolation achieved
 - » throughput might be a problem
- results obtained with passive compensation of thermal lensing
 - » uses material of opposite dn/dT

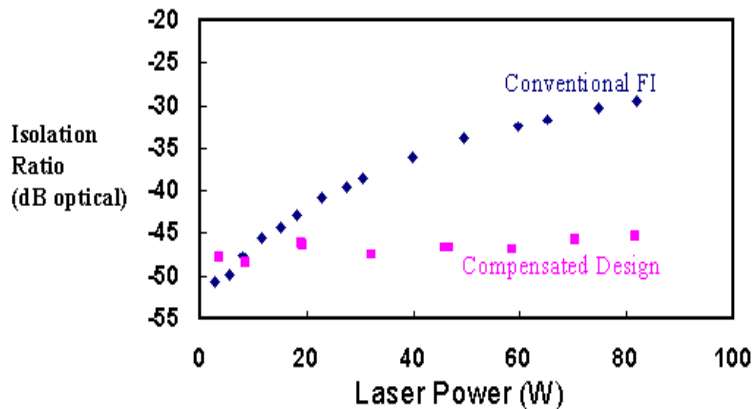
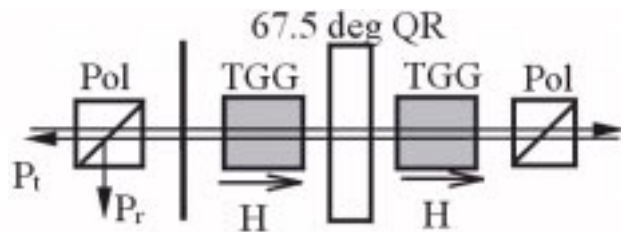


Handling High Powers in Advanced LIGO

High power Faraday isolation

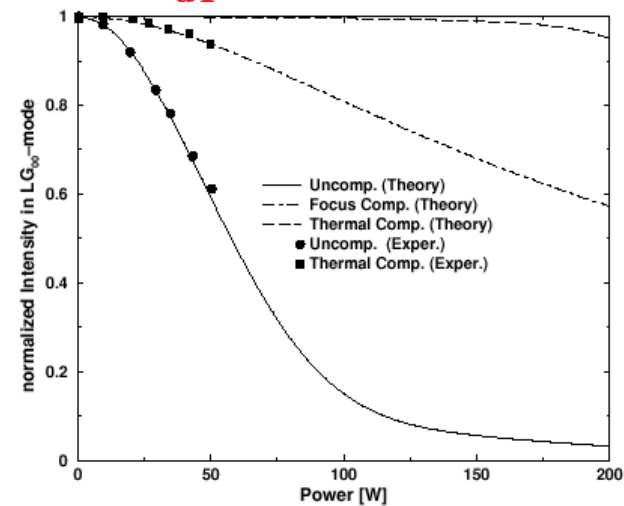
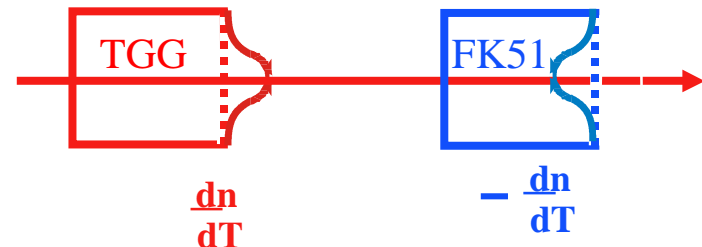
IAP, Nizhny Novgorod

- Thermally-induced stress birefringence reduces isolation at high powers
- dual-crystal design compensates for birefringence; > 45 dB isolation



Passive compensation of thermal lensing

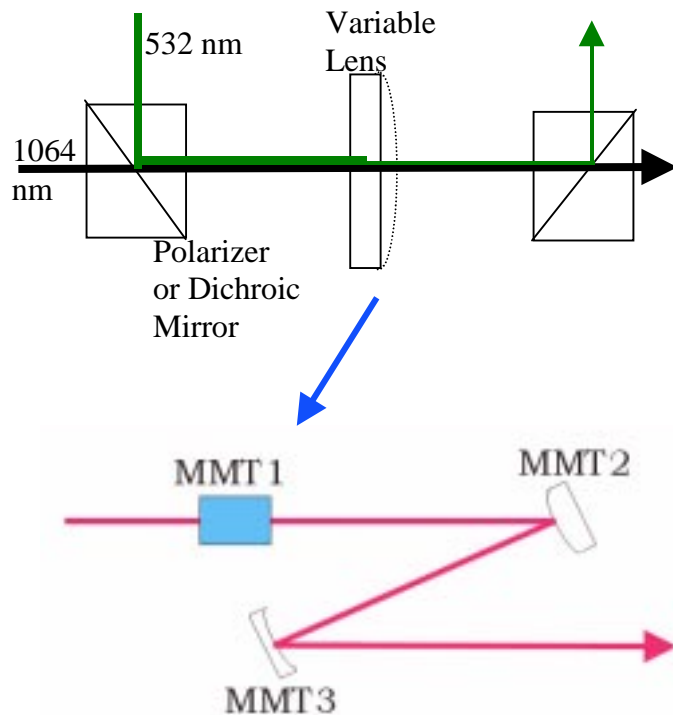
- $\Delta\text{OPD}(r)$ compensated by introduction of opposite signed dn/dT
- 97.5% retention of TEM_{00} mode (60% with no compensation)





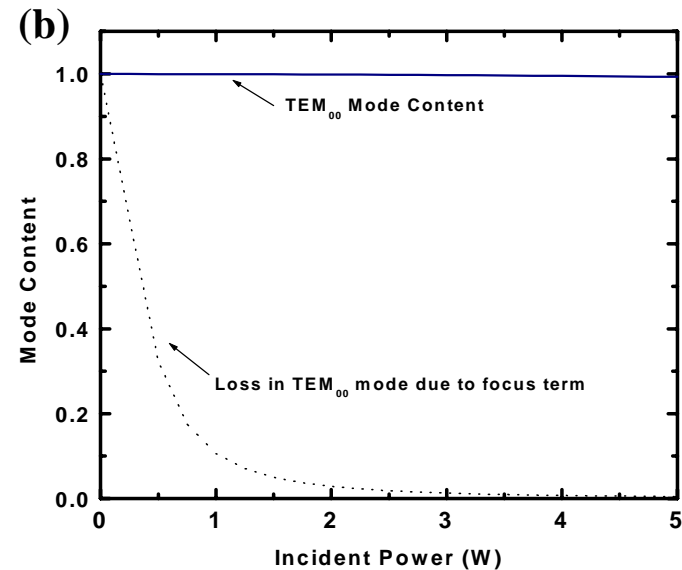
Adaptive Mode Matching in Advanced LIGO

- 125 W into interferometer
 - thermal lensing alters mode-matching
 - two operational points (125W, 20 W) for different searches
- *in situ* adjustment of mode matched based on laser/radiative heating



Thermal modal modeling of laser heating:

- $1 \text{ m} < f_{\text{MMT1}} < \infty$; 99.5% TEM_{00}





Schedule

- LASTI optics design Aug. 2002
- Preliminary Design Review (PDR) July 2003
- modulator and isolator prototype fabricated, Dec. 2004
- Final Design Review (FDR) Aug. 2006



Cost Baseline & Issues

- funds for a cw 100-W high power laser requested
 - » VersaDisk-1030-100 Yb:YAG laser, ~\$100k
 - 20 week delivery
 - to be stationed at LLO
 - will be purchased once suitable UF personnel are at LLO
- planning on hiring an electronics engineer
- funding figures (from DRR)
 - » sub-system management \$225,150
 - » design \$1,360,977
 - » fabrication \$3,170,122
 - » total \$4,756,250



Staffing

- 2 scientists, 2 postdoctoral scholars, 2 graduate students
 - » scientists are not full-time
- hope to hire an electronics engineer