

# High Power Test Facility - a joint ACIGA/LSC Project?

## ‘Initial’ Report

David McClelland, David Blair  
ACIGA

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## Purpose: Preliminary list

- Diagnose cavity operation, stability and dynamics at LIGO II circulating power ( $\sim 1\text{MW}$ )
- Investigate thermal deformation and control in high power cavities
- Investigate ‘cold’ lock up to full operating power, including changes to control and alignment signals

## Purpose (ctd)

- field test a high power ( $>100$  W) laser.
- field test high power conditioned input optics
- validate optical cavity modelling codes
- integrate a high power laser system with a high power handling input optics system, a core optics system and a high power photo detection system.

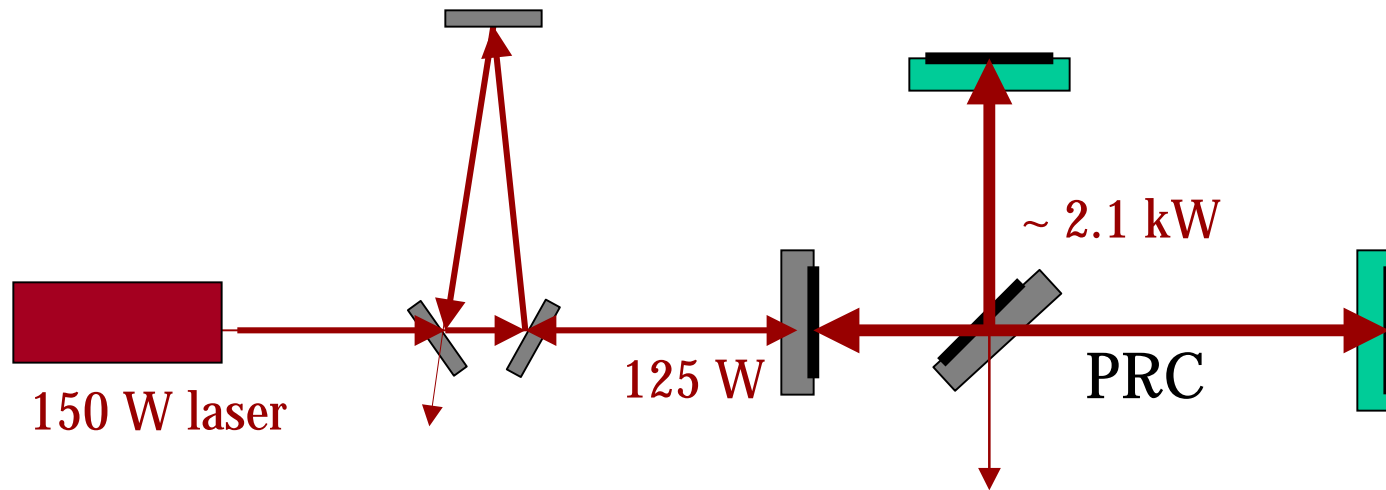
# Status

- ARC funding commenced January 2001
- LIGO commitment: core (2) and PR & MC optics
- Completed
  - Central laboratory end stations at 80m
  - 5 vacuum chambers, 160m vacuum pipe
- Current
  - Outfitting optics laboratory
  - Installing vacuum envelope (to LII level)
  - Building isolation stacks

# Optical Design

- **Rationale**
  - Should be as LIGOII like as possible
  - Input power, circulating power, spot sizes, cavity stability (g factors), cavity lengths
- **Allow results to apply to LIGOII**
  - Directly
  - Simple scaling
  - Model validation

# ?Steps 1: Power Recycling Cavity



■ Sapphire optics, rear coated,  $r \sim 0.9975$ , thermal correction

■ Fused silica optics, PRM thermal correction?

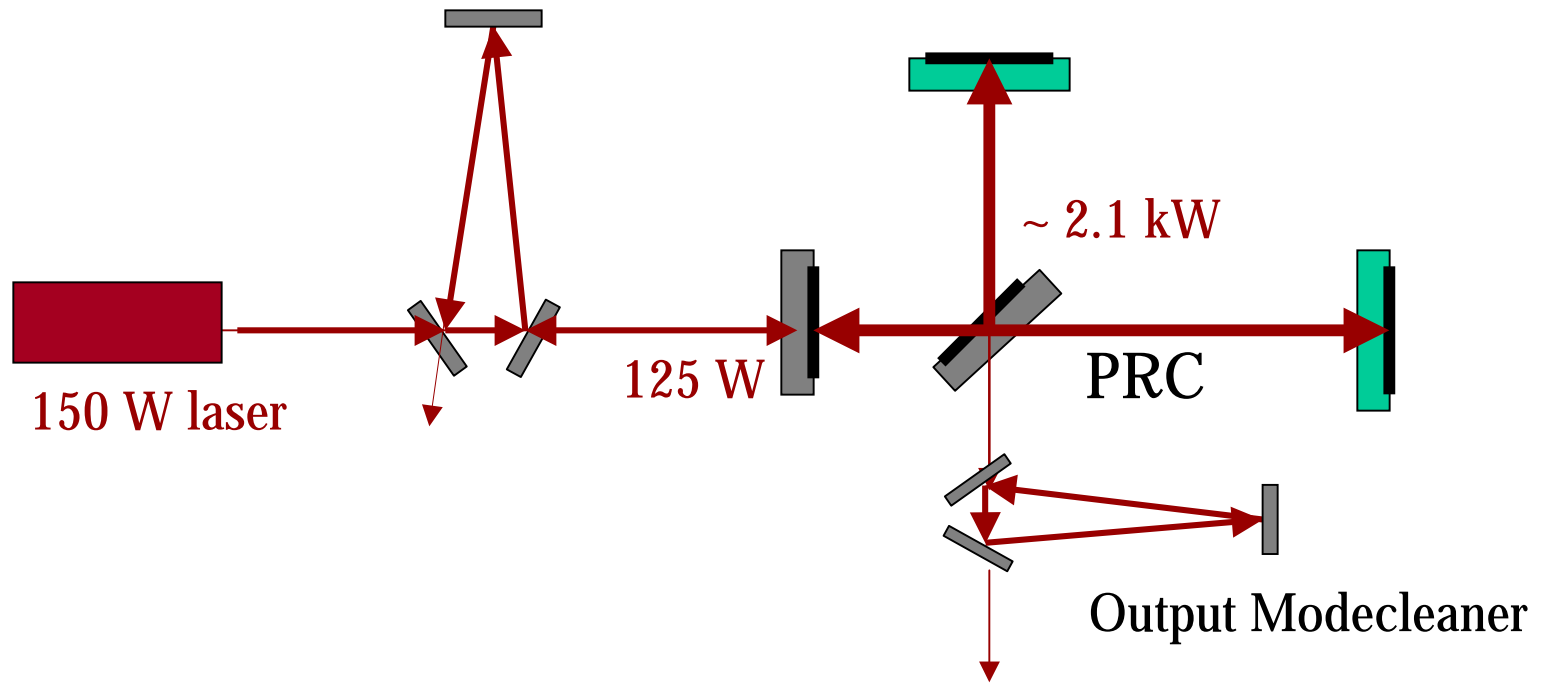
Modecleaner length: 12-18 m

PRC: length  $\sim 12$  -15 m, near unstable, spot size  $\sim$  LII, PRF  $\sim 17$ .

# Main problems

- PRC near unstable for both carrier and sidebands
  - ‘worst case scenario’?

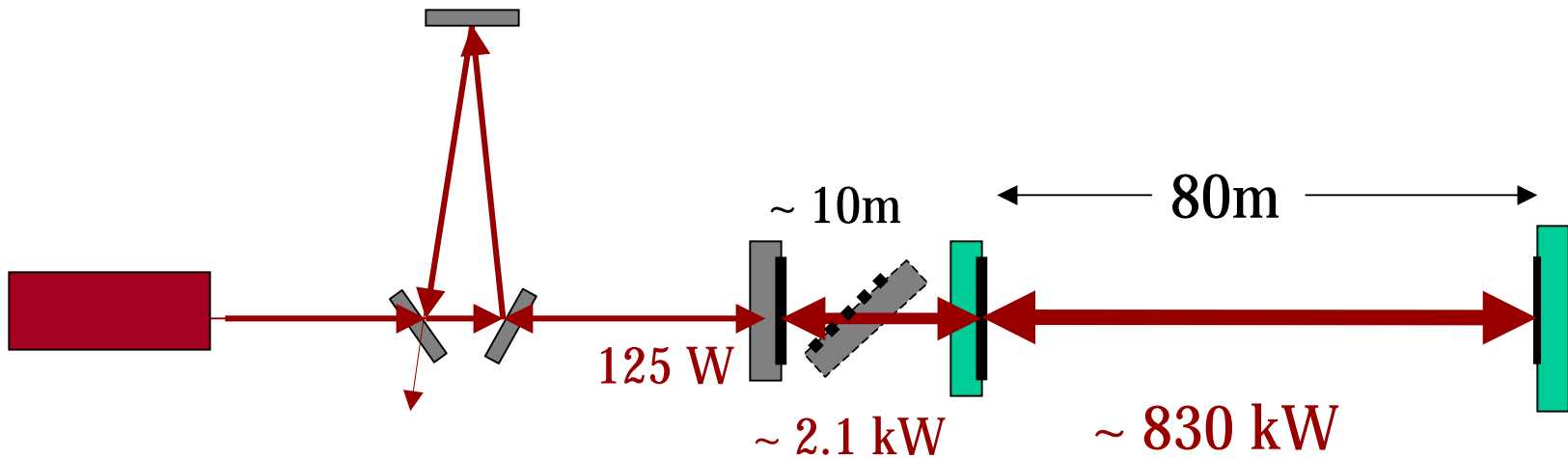
## Step 2: Output modecleaner?





# Steps 3: PR arm cavity

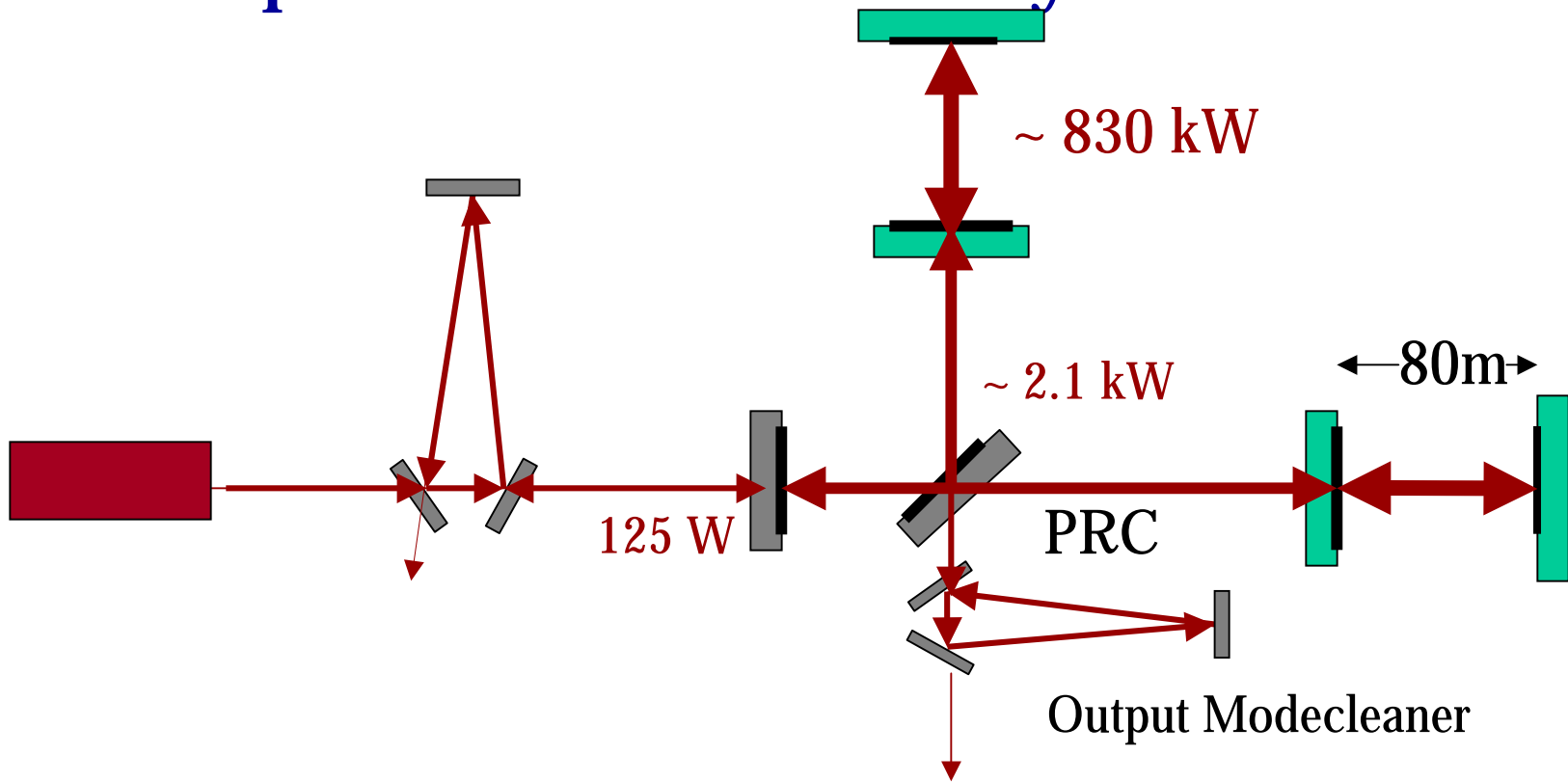
primary outcome for LII?



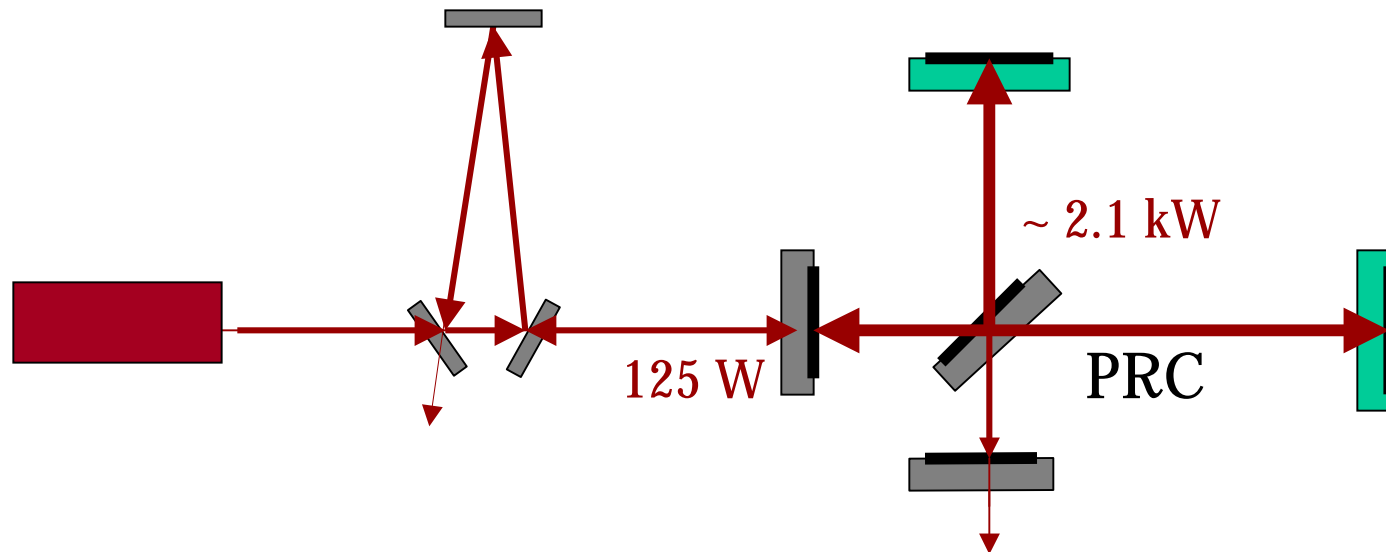
Staged:

- 80 m stable cavity ( $g_1 g_2 \sim 0.3?$ )
- add PR
- BS may be used as 'pick off' monitor

# Option: PR Arm cavity Michelson



# Option: dual recycling?



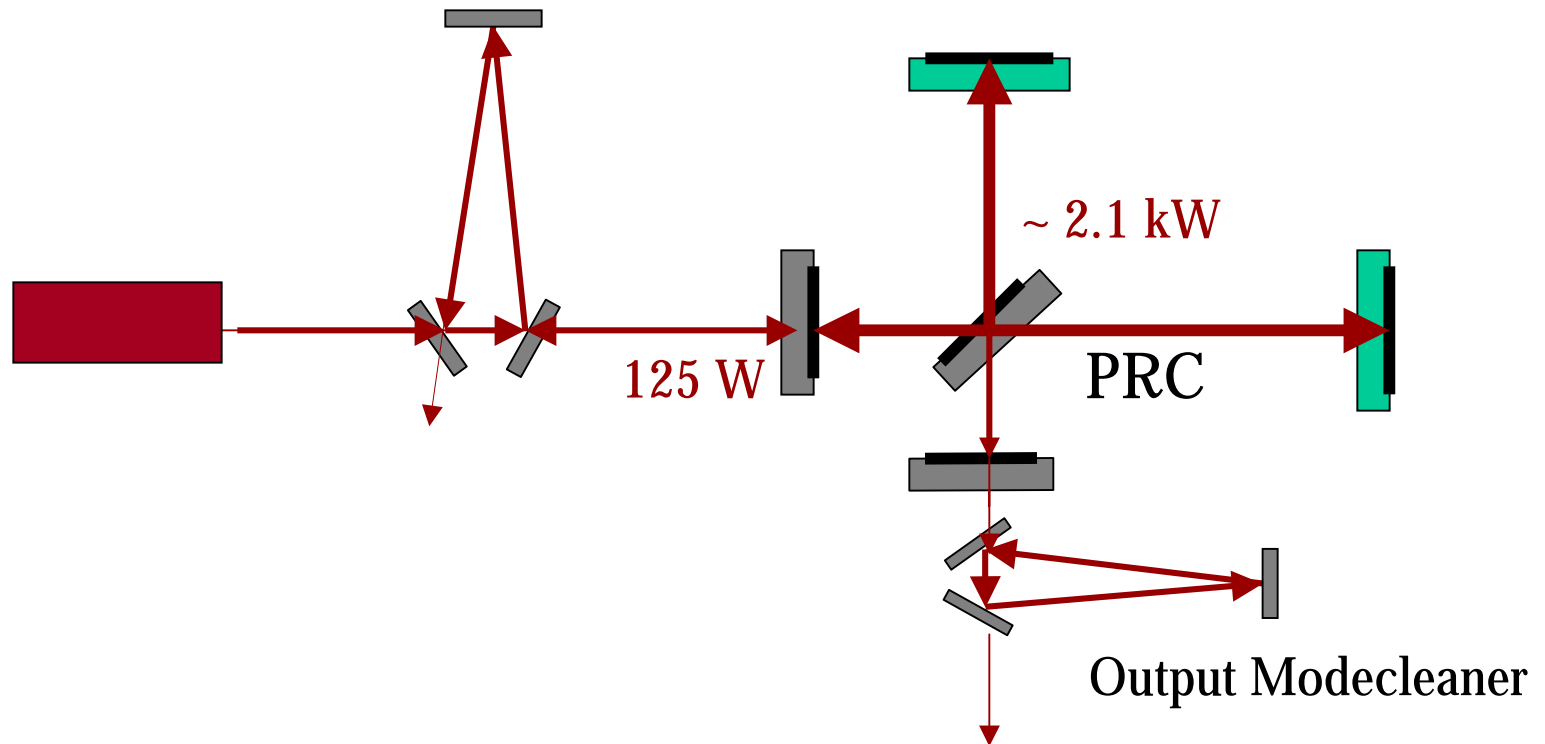
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PRC: length  $\sim 12 - 15$  m, near unstable, spot size  $\sim$  LII, PRF  $\sim 17$ .

SRC, factor variable?

# Option: dual recycling with OMC?



# Proposal:

- Establish the Gingin high power interferometer test facility (HPITFC) as an LSC Facility
- Advisory board:
  - Reitze, U. Florida
  - Zucker, MIT
  - Camp, Caltech (chair)
  - Willke, GEO
  - Sanders, Caltech
  - Blair, UWA
  - Munch, AU
  - McClelland, ANU
- Chair?
- Insert in LIGOII planning process

## Action:

- Advisory group to meet at Amaldi
- Brainstorm on :
  - short Michelson ?
  - PR Cavity but with what parameters?
  - PR arm cavity ?
  - Scheduling & Milestones?