Advanced LIGO Pre-stabilized Laser (PSL) Design Requirements

- The Advanced LIGO PSL is based on a high power (180 – 200 W) laser.
- Design and fabrication of the laser is not the only challenge:
  - » non-TEM_{00} output power
  - » output power variations
  - » intensity noise suppression
  - » frequency noise suppression

LIGO

Output Power

- TEM_{00} output power >= 165 W
- non-TEM_{00} output power <= 5 W
- intensity noise (perhaps the greatest challenge)

$$\frac{\delta P(f)}{P} \le 2 \times 10^{-9} \left(\frac{f}{10\,\mathrm{Hz}} \right) \qquad 10\,\mathrm{Hz} < f < 150\,\mathrm{Hz}$$

$$\frac{\delta P(f)}{P} \le 3 \times 10^{-8} \qquad 150\,\mathrm{Hz} < f < 10\,\mathrm{kHz}$$

Frequency Noise

- frequency noise at the input to the suspended modecleaner

$$\delta\nu(f) \le 0.1 \times \left(\frac{100\,\mathrm{Hz}}{f}\right)^2 \qquad 10\,\mathrm{Hz} < f < 100\,\mathrm{Hz}$$

$$\delta\nu(f) \le 0.1 \times \left(\frac{100\,\mathrm{Hz}}{f}\right) \qquad 100\,\mathrm{Hz} < f < 10\,\mathrm{kHz}$$

$$\delta\nu(f) \le 5\,\mathrm{kHz} \qquad 0.1\,\mathrm{Hz} < f < 10\,\mathrm{Hz}$$

External Diagnostic Modes

- Specifications and modes still to be worked out. Expected to be based on current LIGO experience.
  - » cavity ringdown mode
  - » power modulation
  - » frequency modulation