

# Update on the Advanced LIGO PSL Program

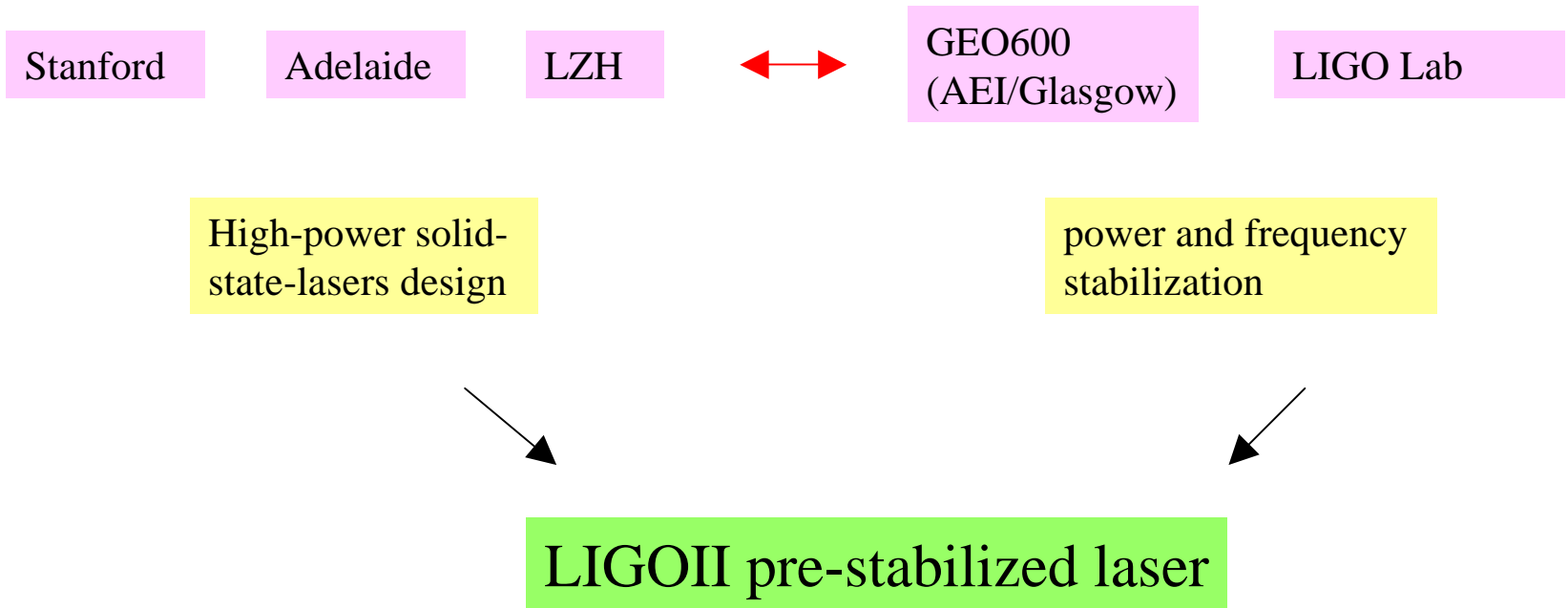
Benno Willke

LSC meeting  
Hanford, Aug 2002

# The AdvLIGO Laser Team

---

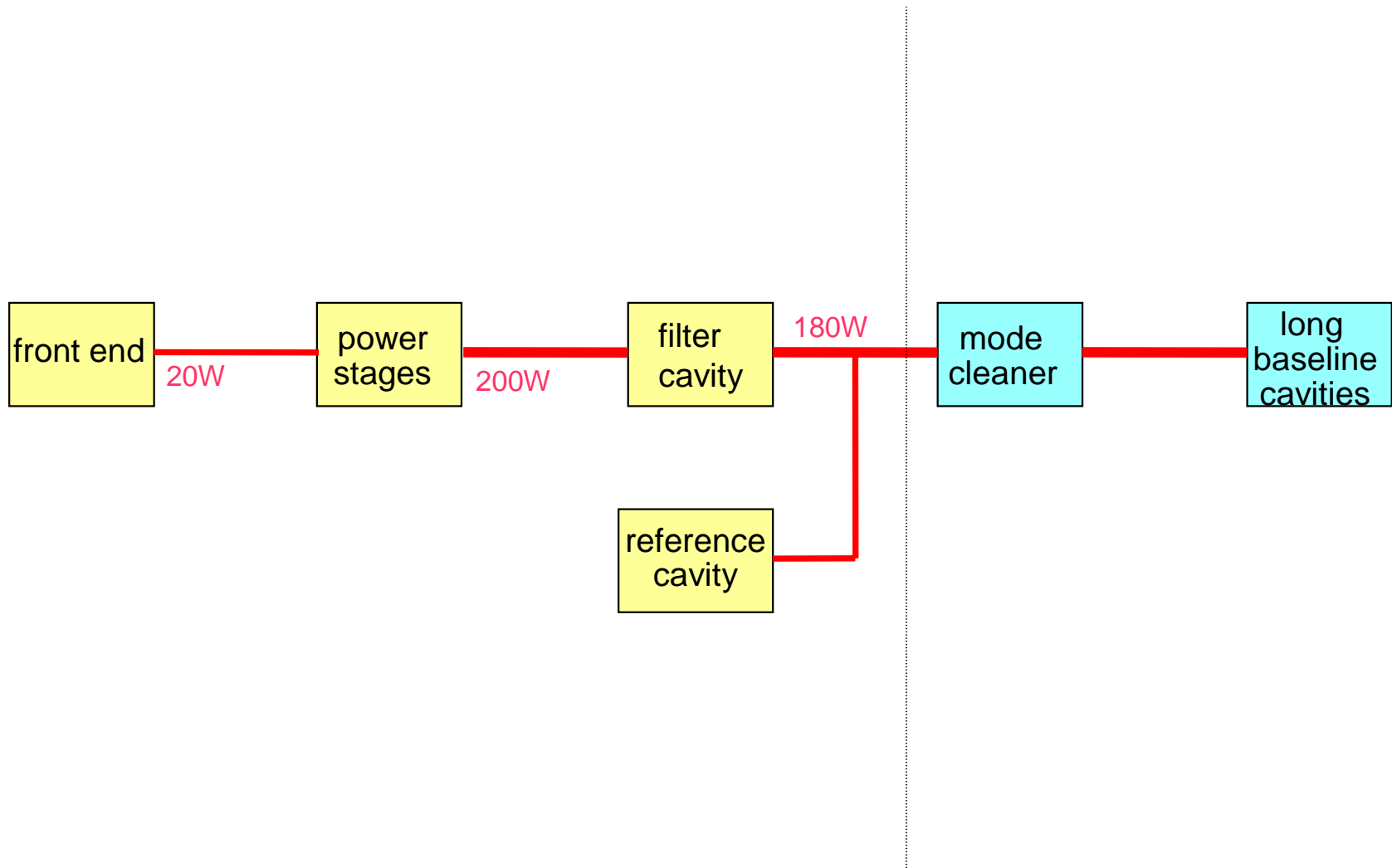
---



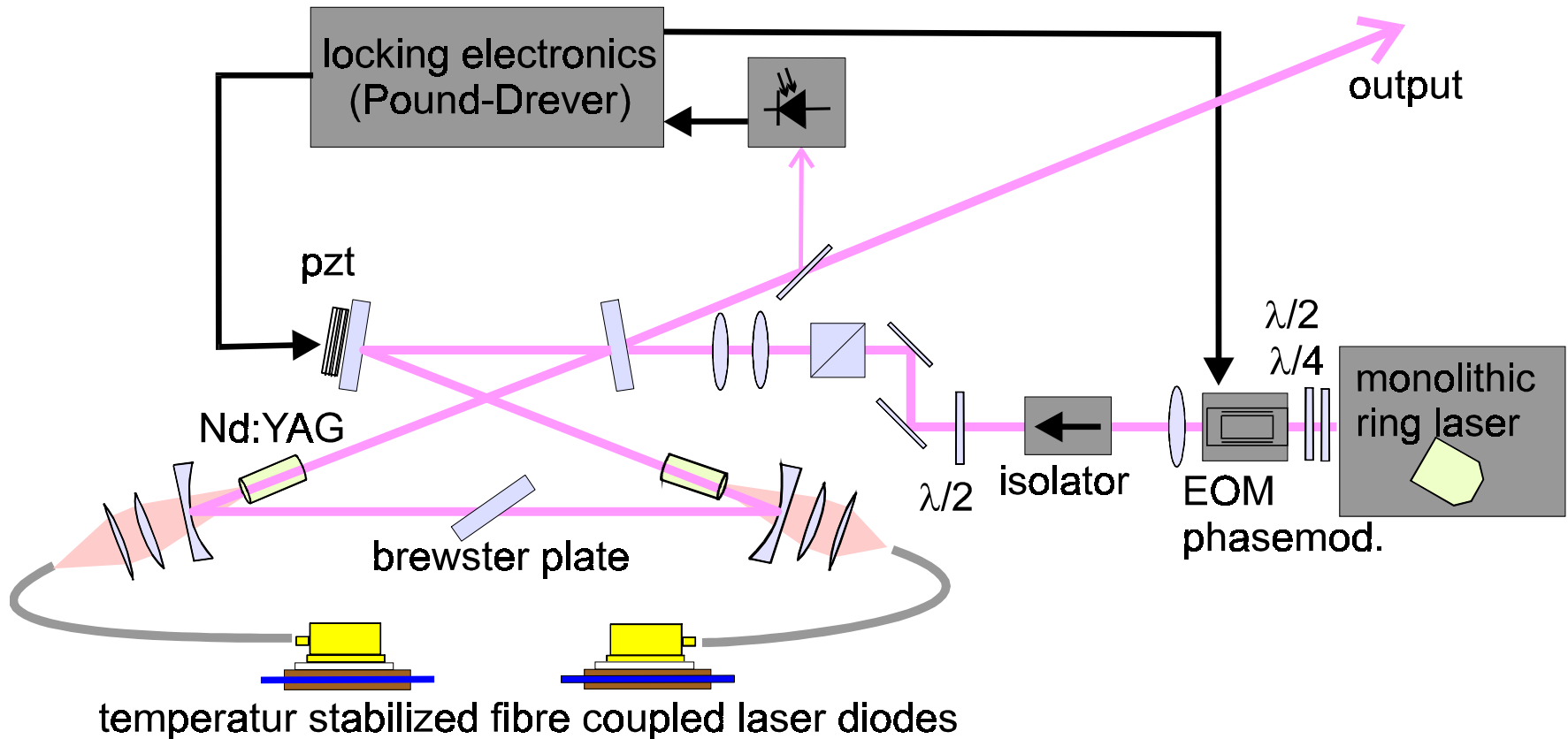
# LIGOII PSL – subsystem layout

---

---



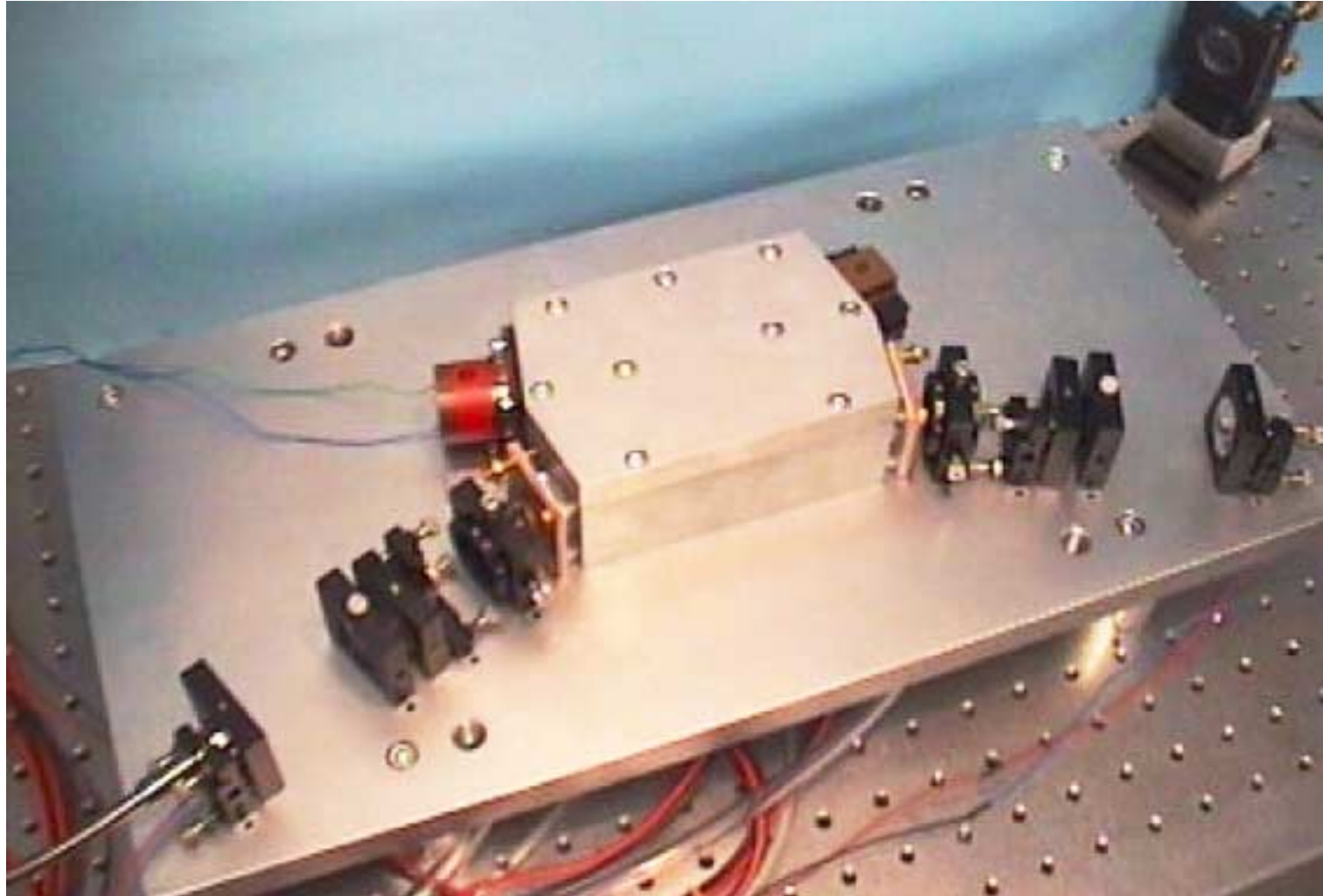
# GEO600 Injection Locked Ring Laser



# GEO 600 Slave Laser

---

---



# high power stage

---

---

- **which design ?**
  - MOPA slab (Stanford)
  - stable-unstable slab ( Adelaide)
  - rod oscillator (Hannover)
  - a combination
- **key questions**
  - spatial mode (active vs. passive filtering)
  - low-frequency power-noise
  - rf power noise

# high power stage decision criteria

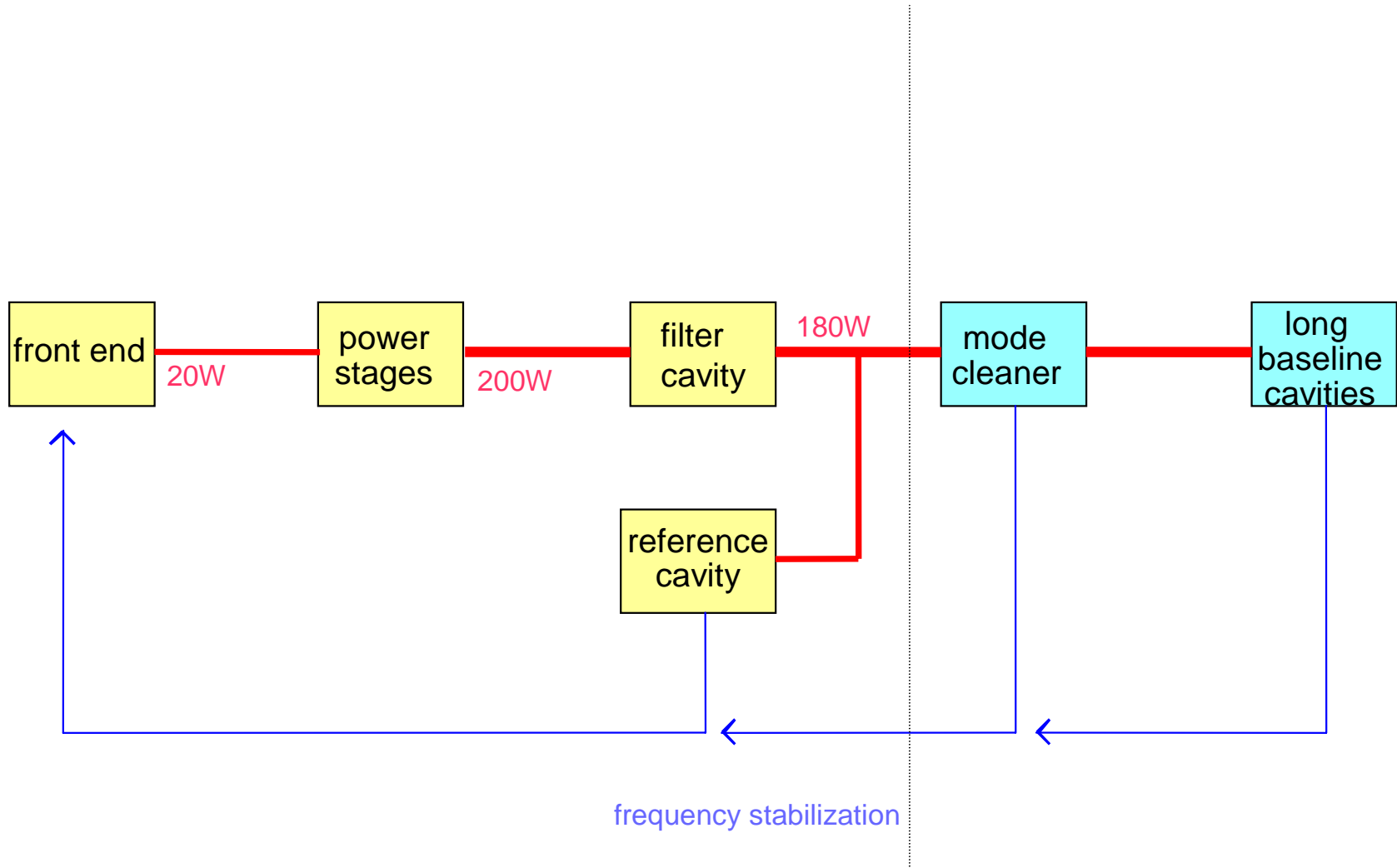
---

---

- 100W output power
- TEM<sub>00</sub> power – visibility cavity
- RIN 10-10kHz
- RIN 10MHz – 40MHz, measured at 10mA
- frequency noise
- pointing – quadrant photo diode
- phasefront fluctuations
- efficiency, cost
- robustness, maintainability
- scalability

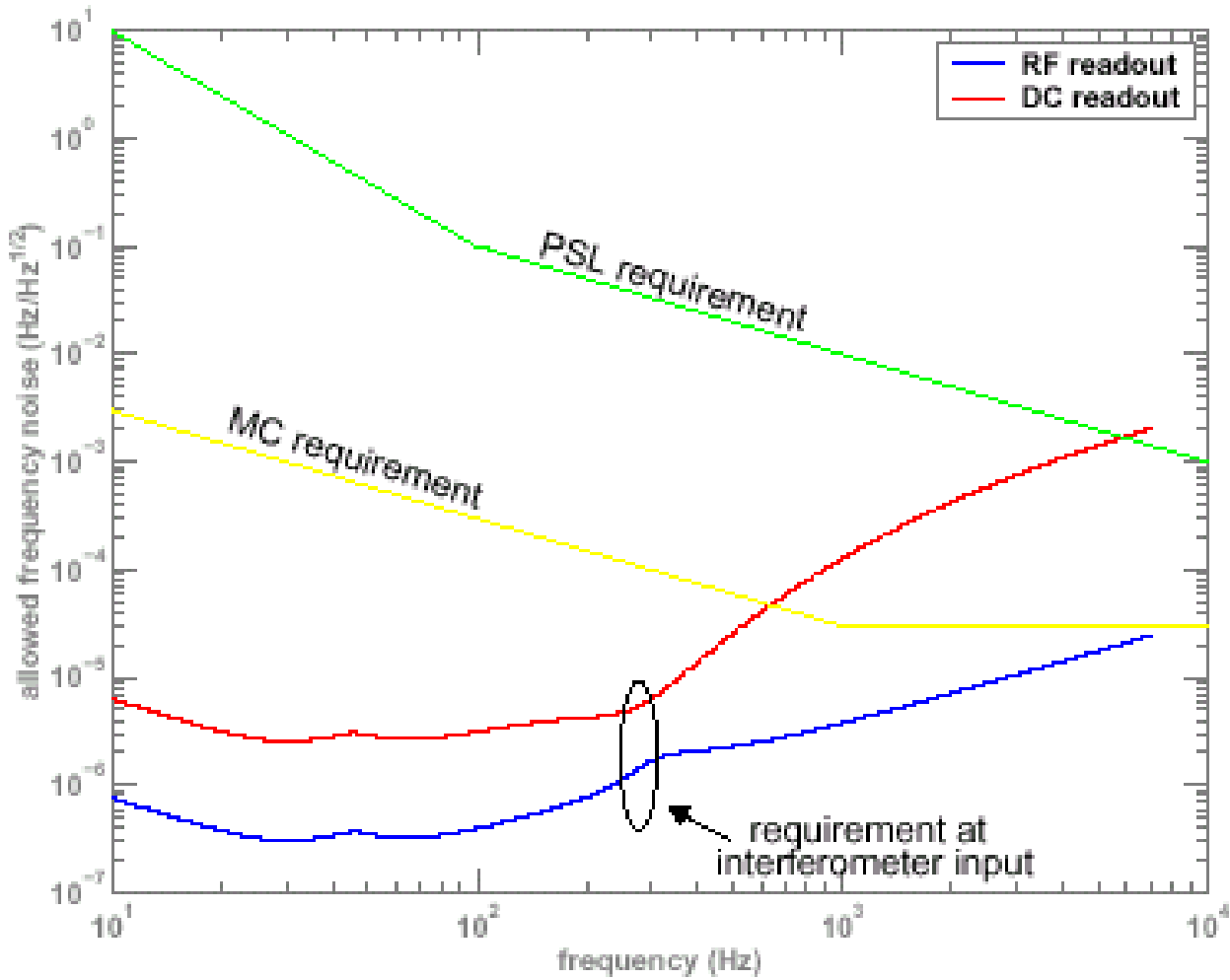


# LIGOII PSL – frequency stabilization

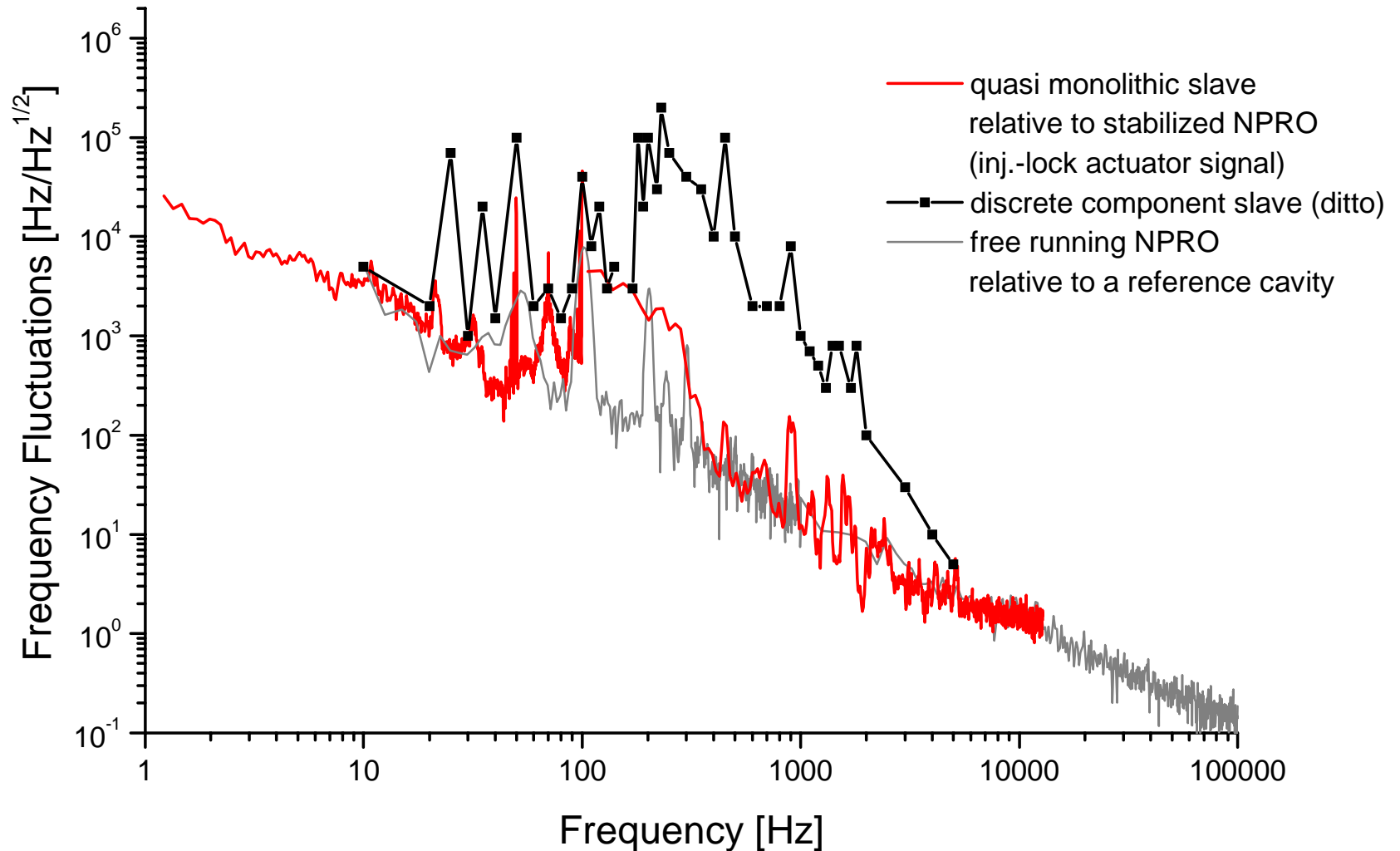




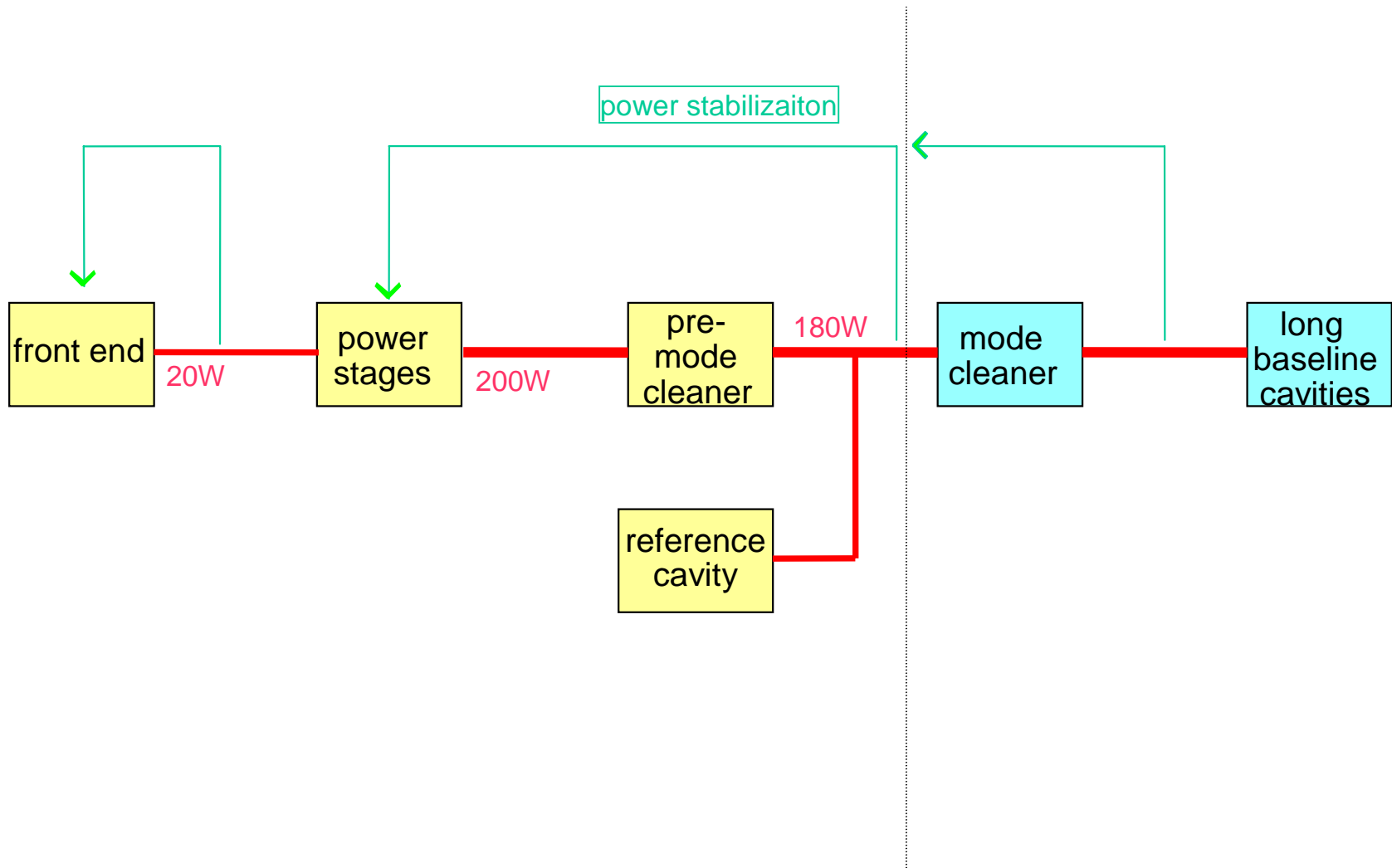
# frequency stability requirement



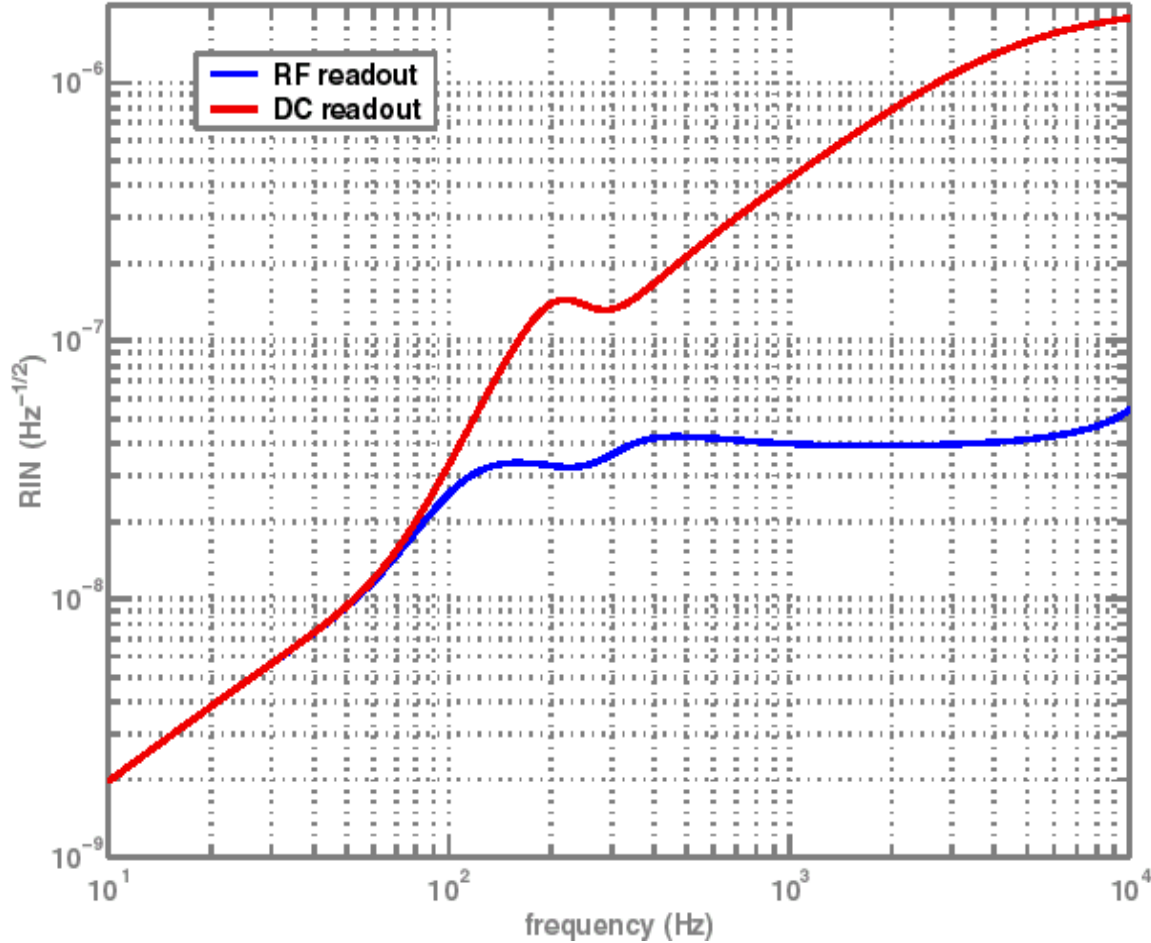
# free running frequency noise



# LIGOII PSL – power stabilization



# Power Stability Requirement



# Sensing the Power-Noise

---

---

- **shot noise limited photodiode for 150mW**
  - low electronic noise
  - good spatial uniformity
  - active spot position stabilization ?
- **environmental effects**
  - dust particle blocking beam
  - index of refraction variation
  - non stationary interference with scattered light
  - variable higher spatial mode content



# Control and DAQ interface

---

---

- **technology transfer LIGO - Hannover**
  - VxWorks environment and SUN workstations purchased and installed
  - analog and digital LIGO modules fabricated, currently tested at Caltech
  - full system will be installed by end of this year
  - design all PSL internal modules to LIGO standard
- **final integration test in LASTI**



# schedule

---

---

- select design Dec02
- build first 200W system/  
design stabilization systems Dec02 – Feb04
- longterm test Feb04 – Feb 05
- pathfinder ready Sep05