



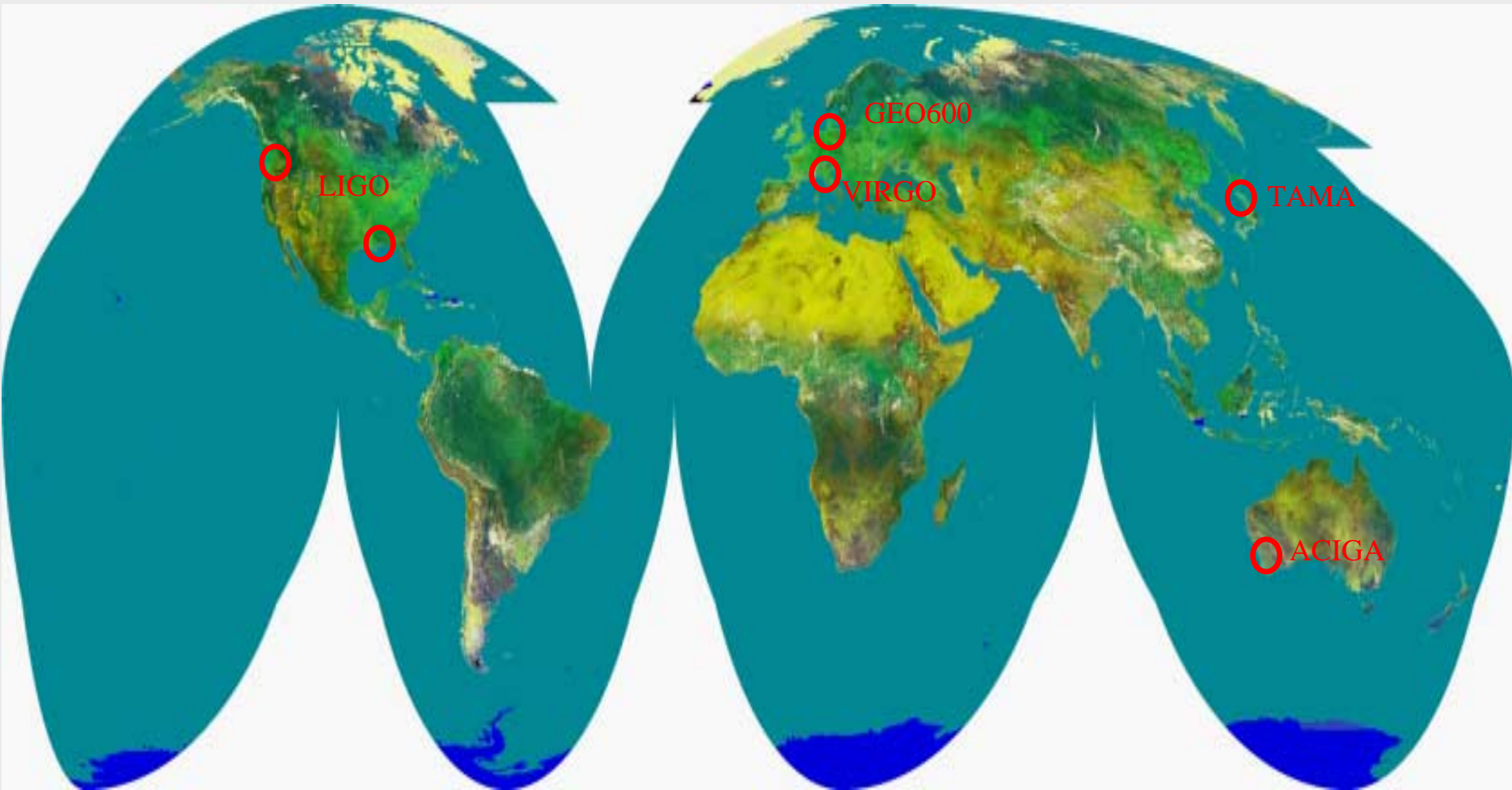
Status of the GEO600 detector

Benno Willke

Aspen Winter Conference on Gravitational Waves and their Detection
January 2001



where is GEO600





The GEO600 Team

Hannover
(600m detector)

- buildings
- vacuum system
- laser system

Glasgow
(10m prototype)

- seismic isolation
- monolithic suspensions
- computer control

Garching
(12m prototype)

- optics
- dual recycling

Potsdam / Cardiff

- data acquisition
- data analysis

GEO600 goals

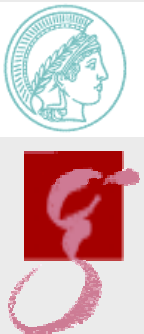
- GW search (in limited bandwidth similar sensitivity as long-baseline detectors)
- test and demonstration of new technology
 - corrugated vacuum tubes
 - monolithic suspensions / triple pendulum
 - signal recycling
- provide test bed for future detectors



GEO 600 Site



central building



tube / trench



vacuum system



dimensions:

- 400 m³ volume / 4000 m² surface
- 600m long tubes, 60cm diameter
- 2m tall tanks with 1m diameter

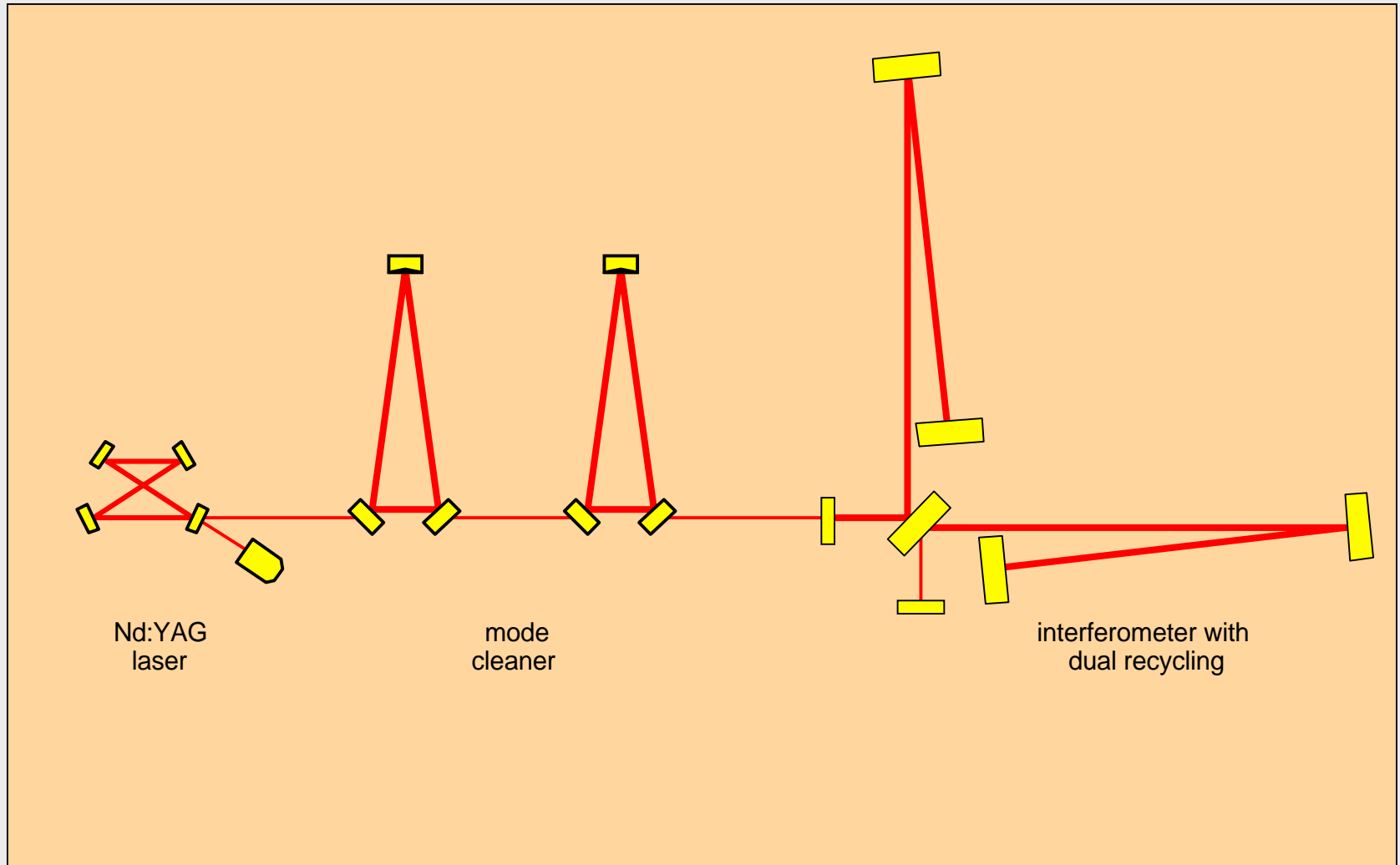
pumps:

- 4 Scroll pumps (25 m³/h, 10⁻² mbar)
- 4 Turbo-molecular pumps
(magnetic bearings, 1000 l/s for H₂)

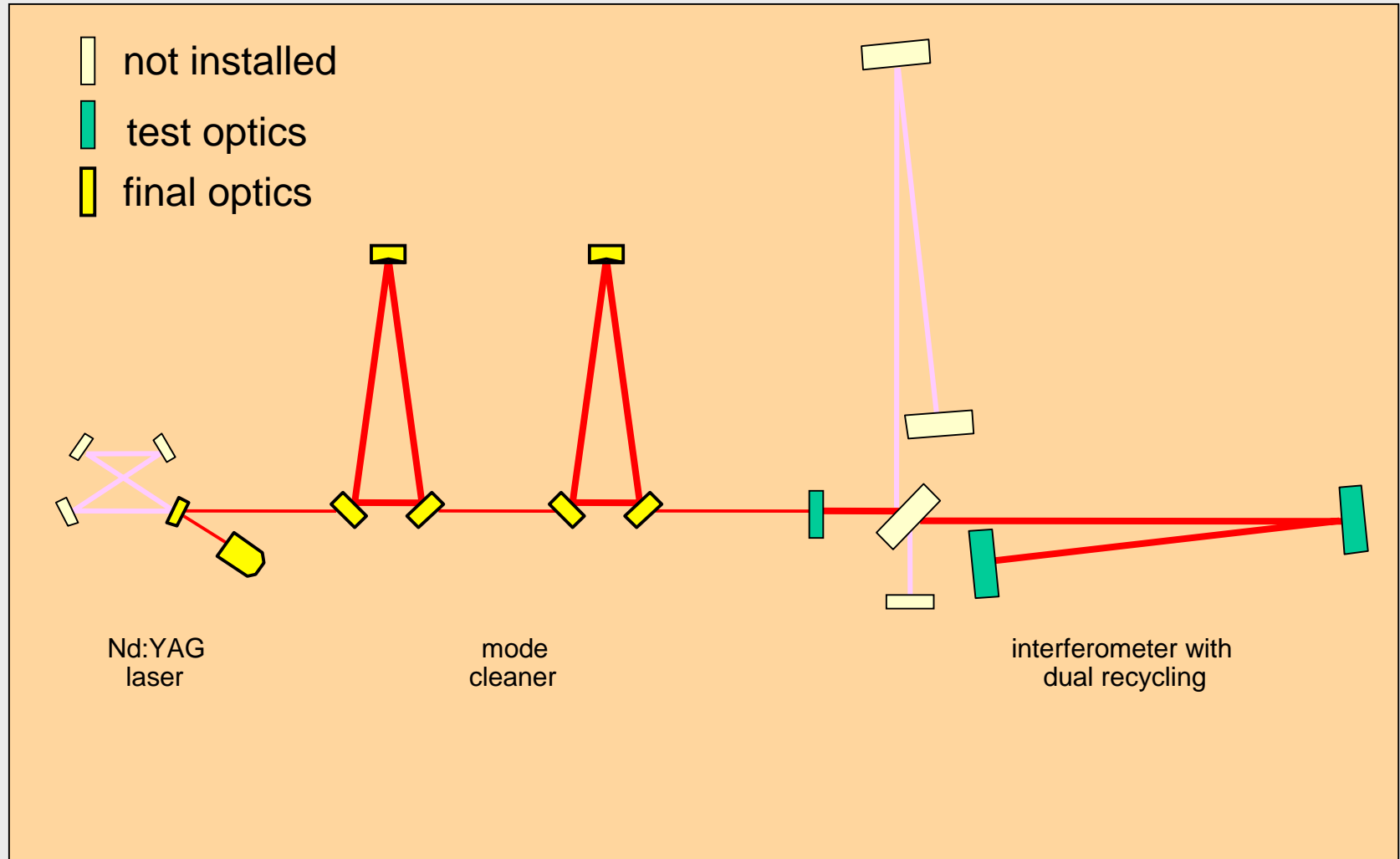
pressure:

- tubes : 1*10⁻⁸ mbar
- main tanks : 5*10⁻⁸ mbar

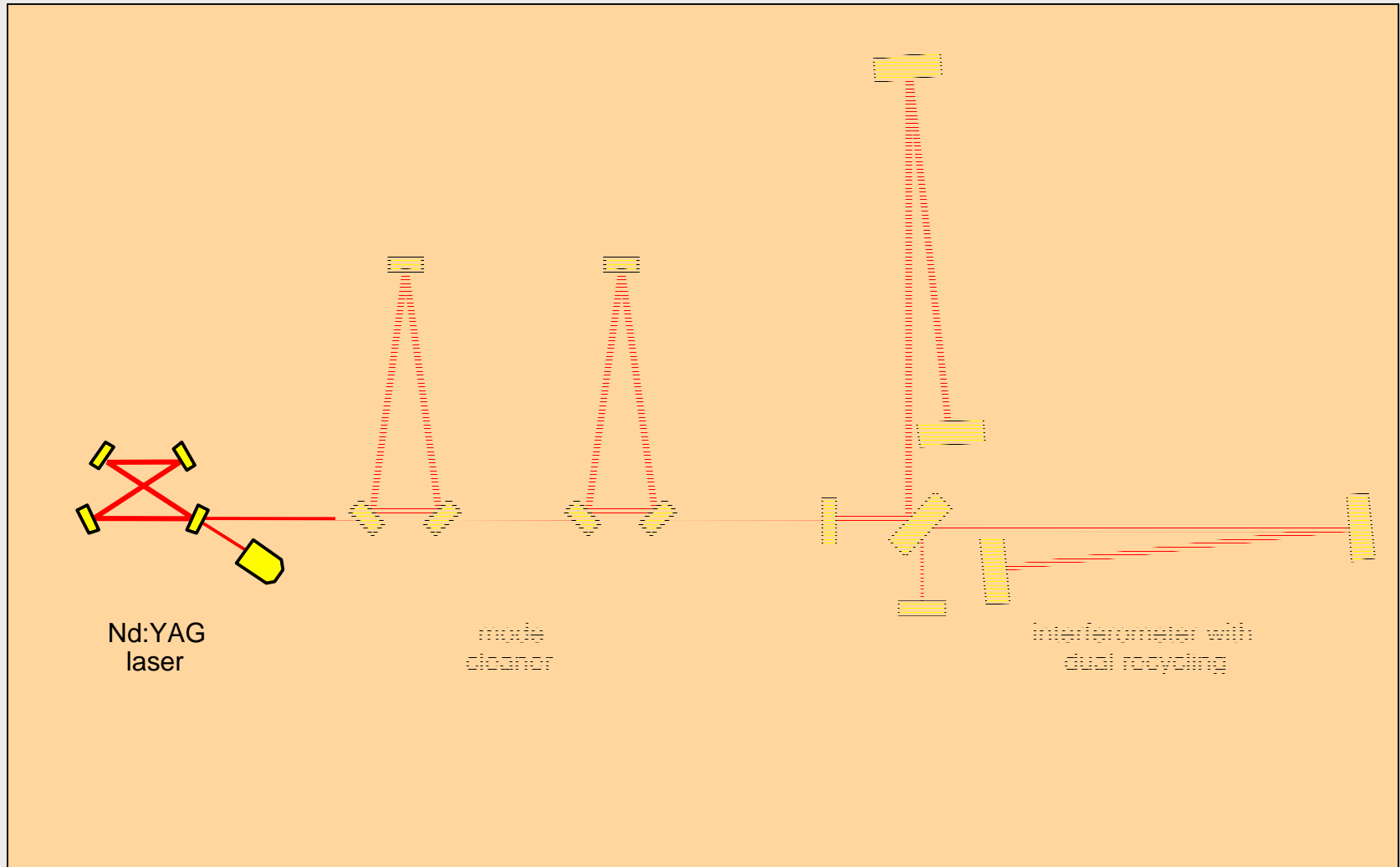
GEO600 – optical layout



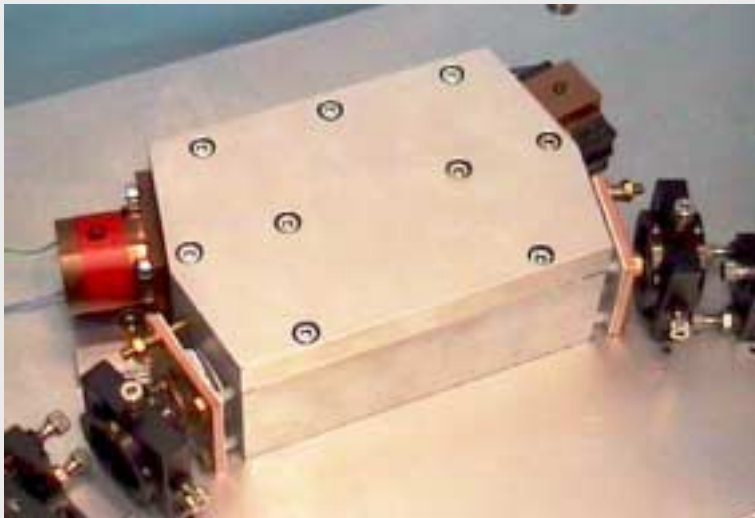
GEO600 status Jan2001



GEO600 – optical layout

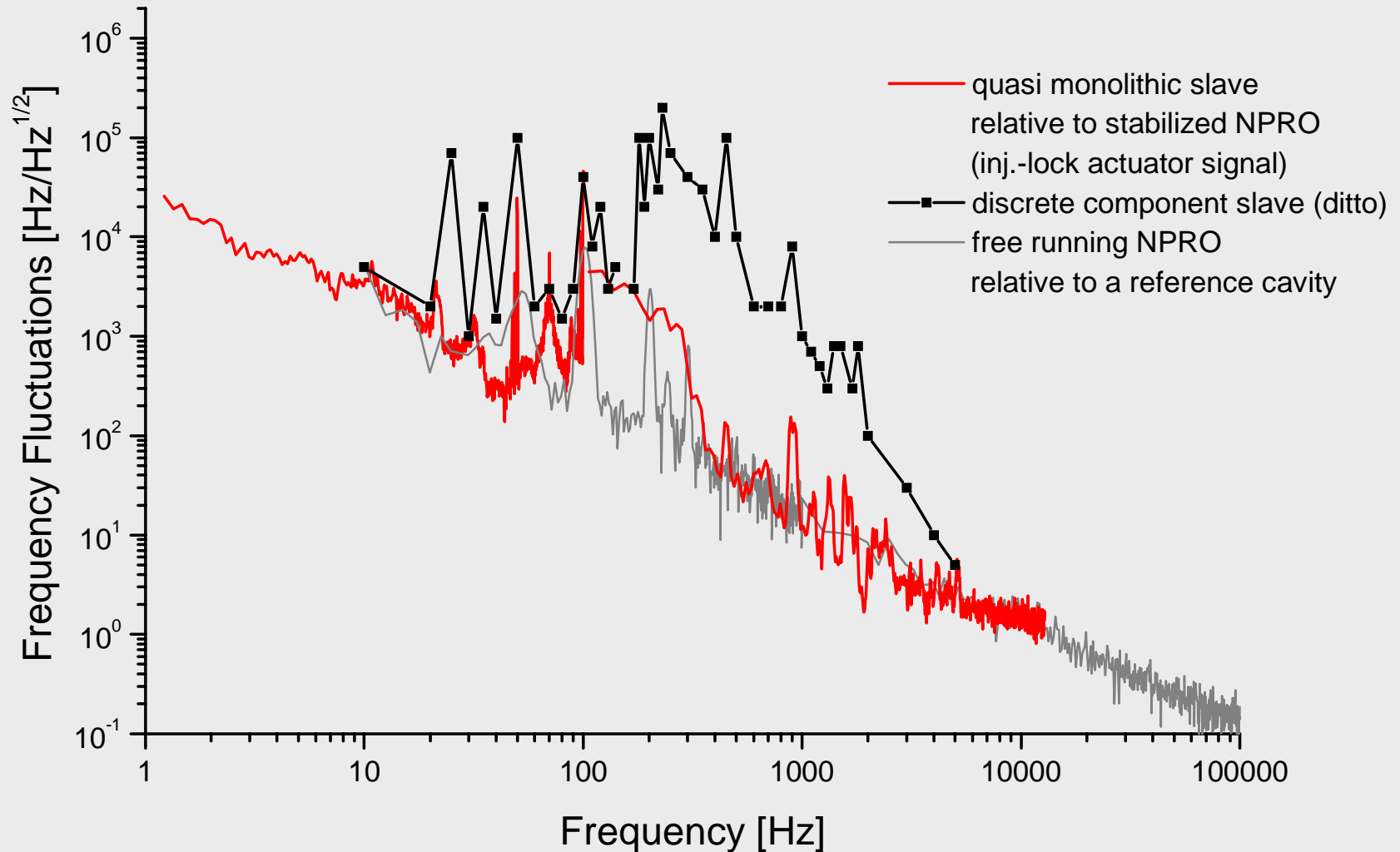


12W injection-locked laser-system

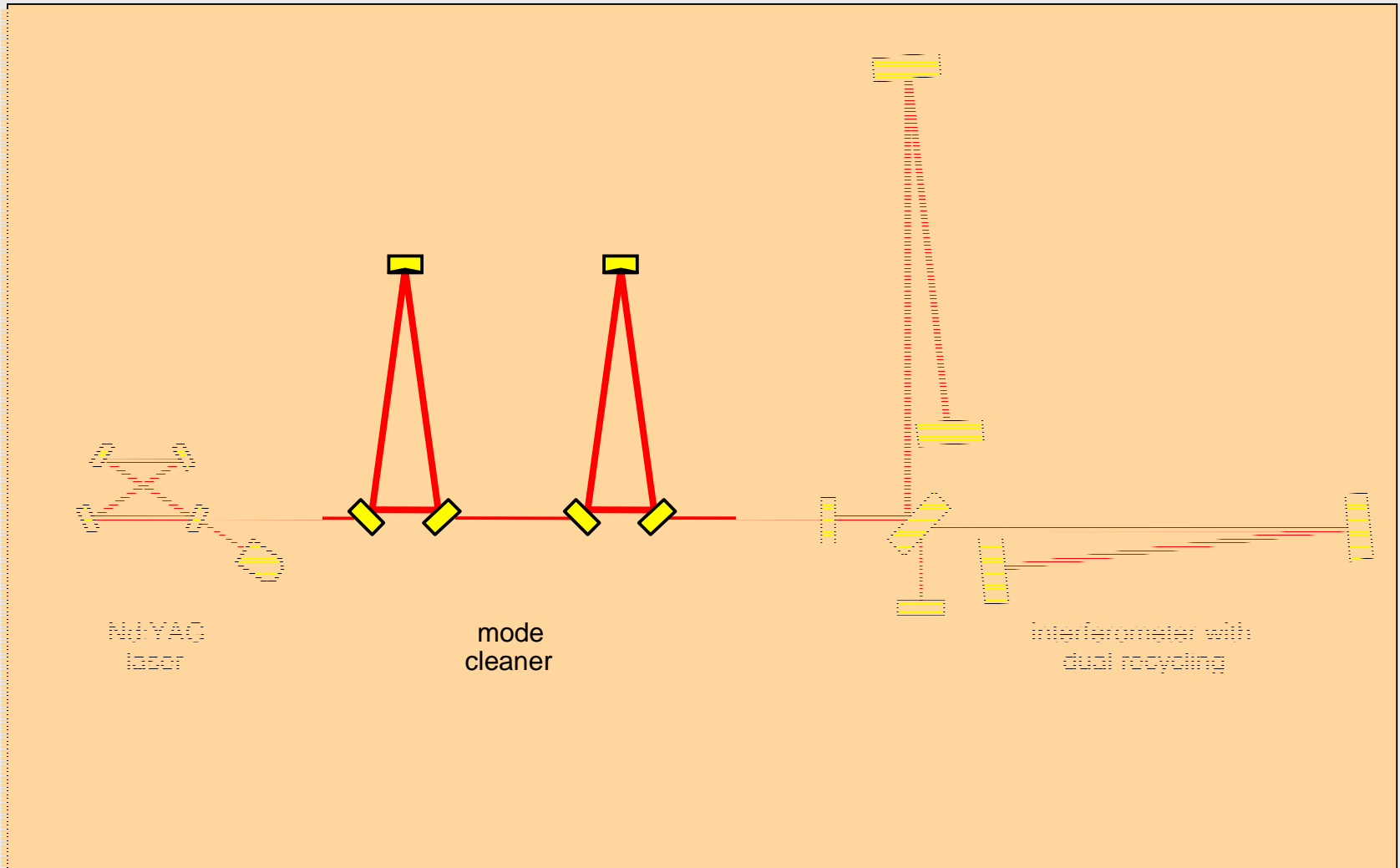


- NPRO (non-planar ring oscillator) master laser, output power: 800mW
- slave laser optical components mounted on rigid resonator-spacer (Invar)
- 12W output power (< 5% in higher TEM modes)
- injection-locking stable over days

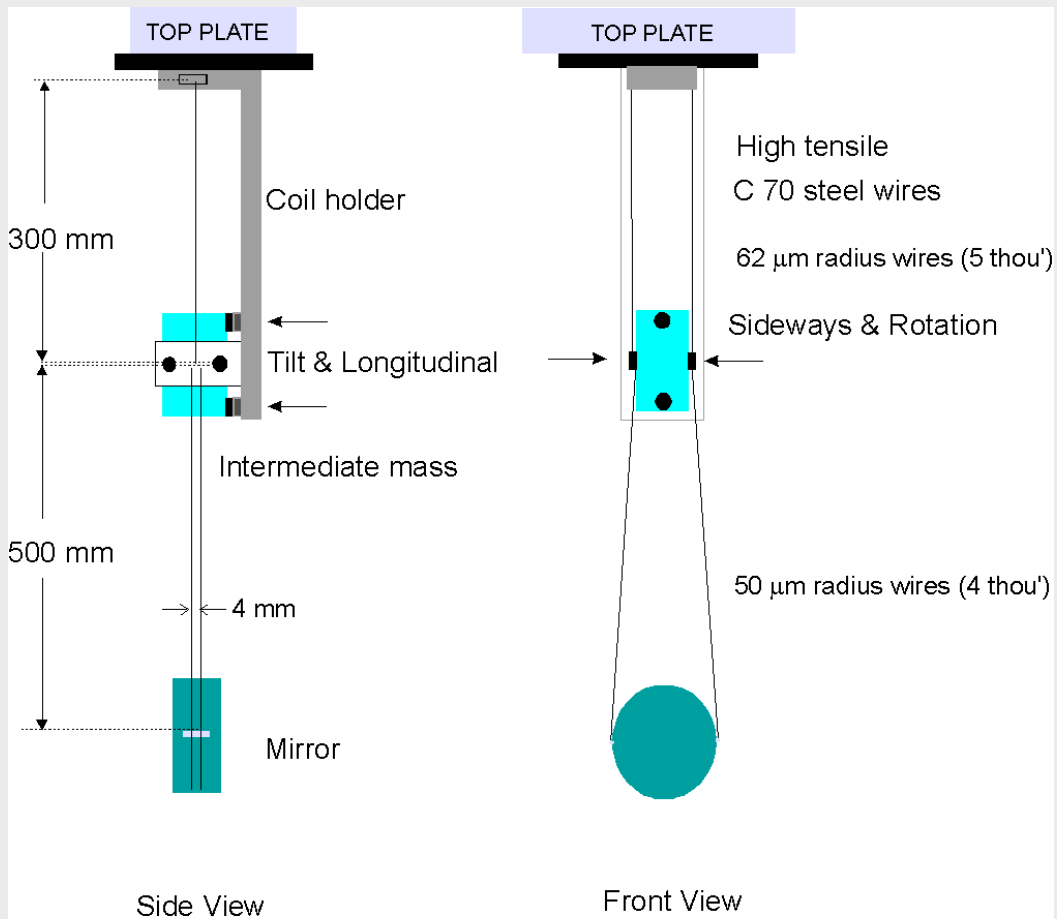
GEO 600 Slave Laser Prototype II



GEO600 – modecleaner



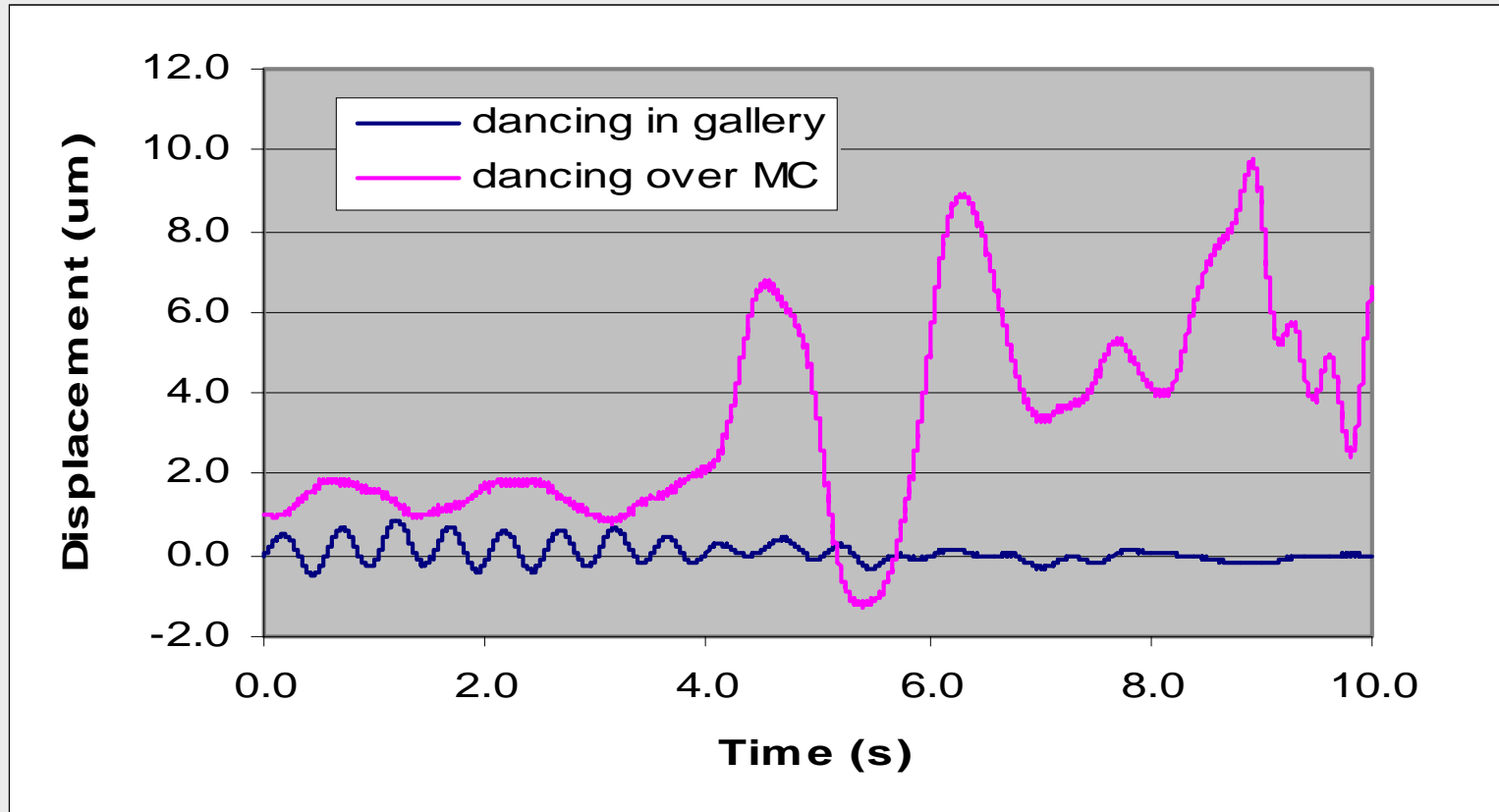
modecleaner suspension



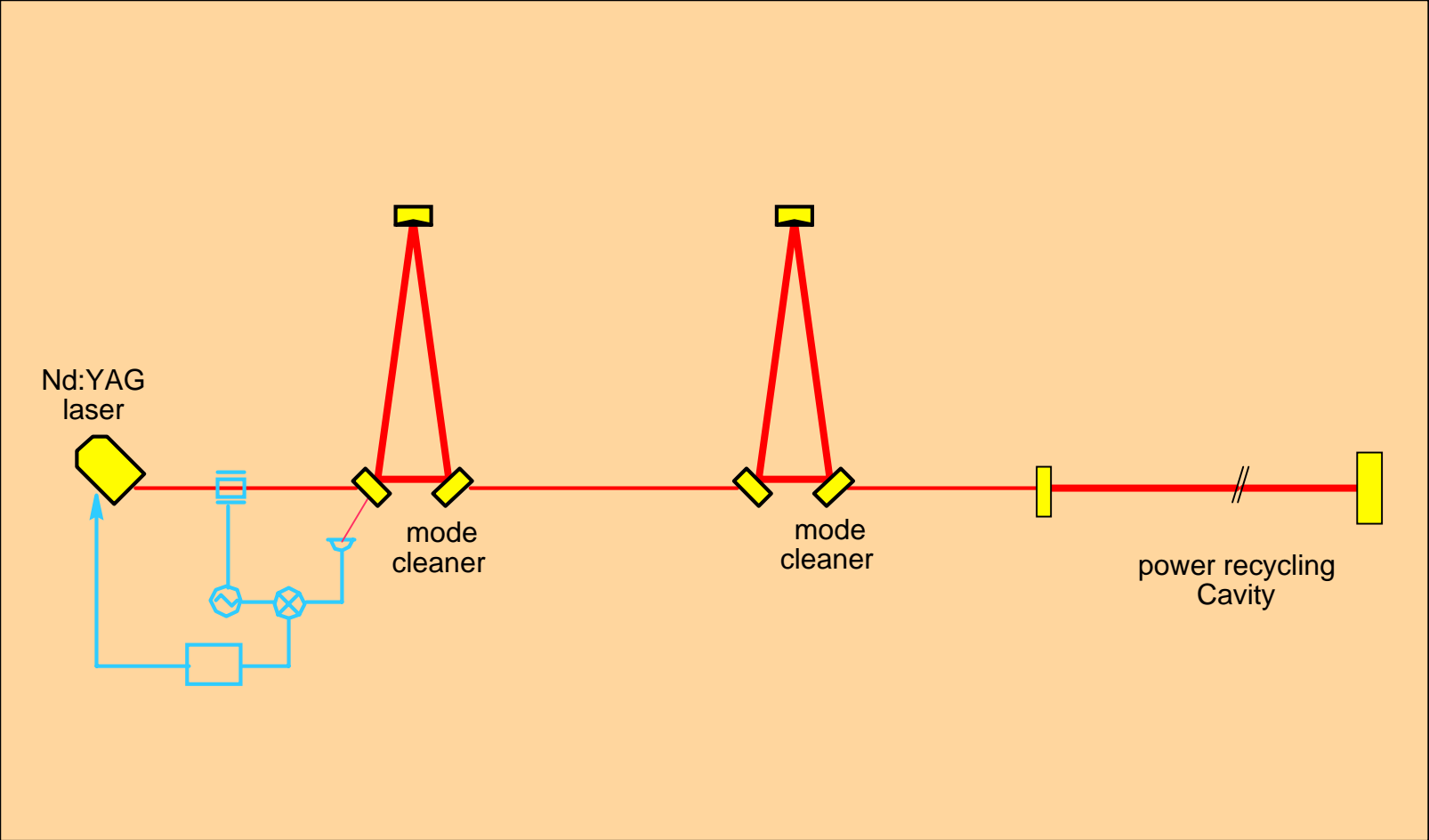
Schematic of Modecleaner suspension



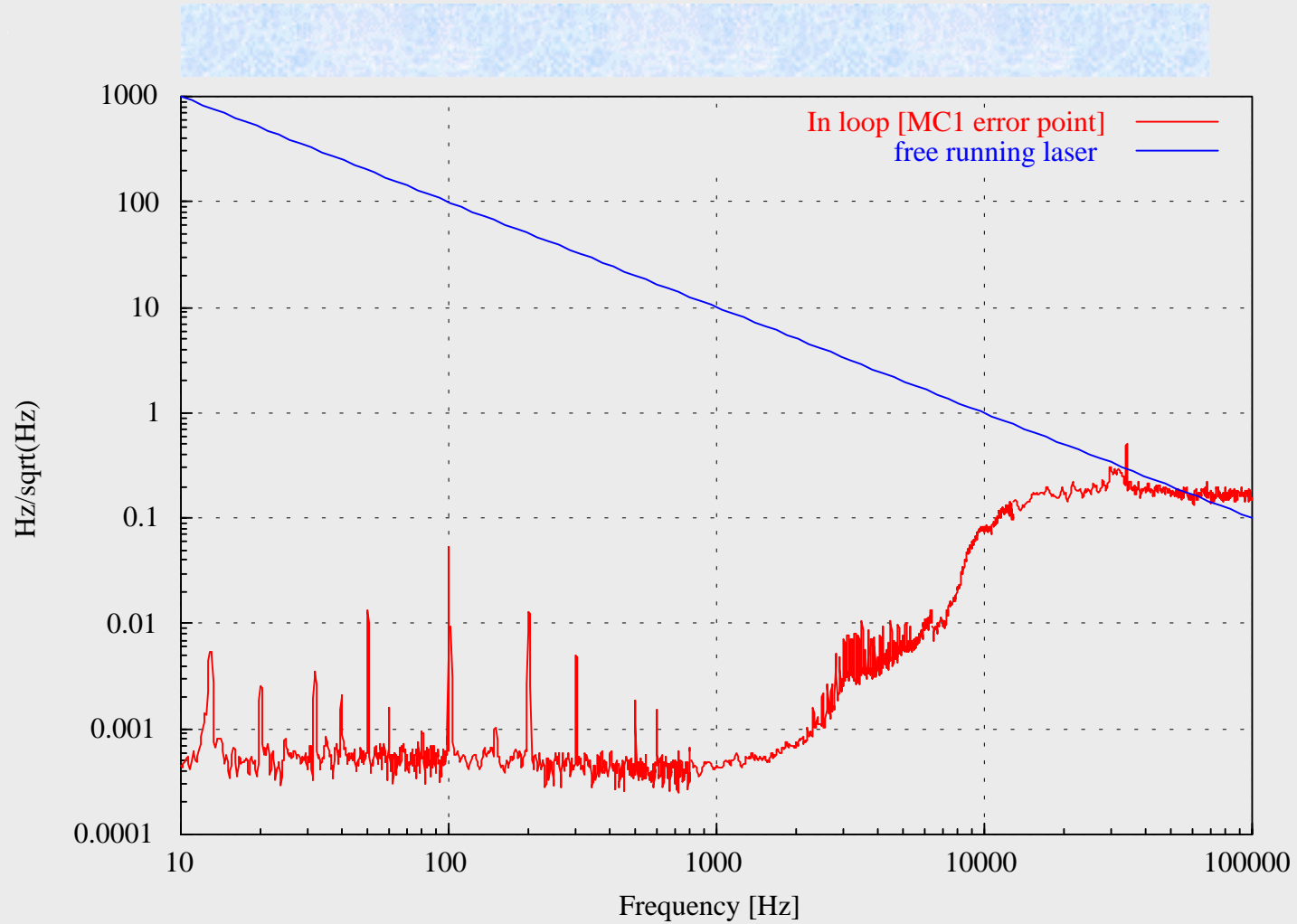
Movement of MC1 mirrors



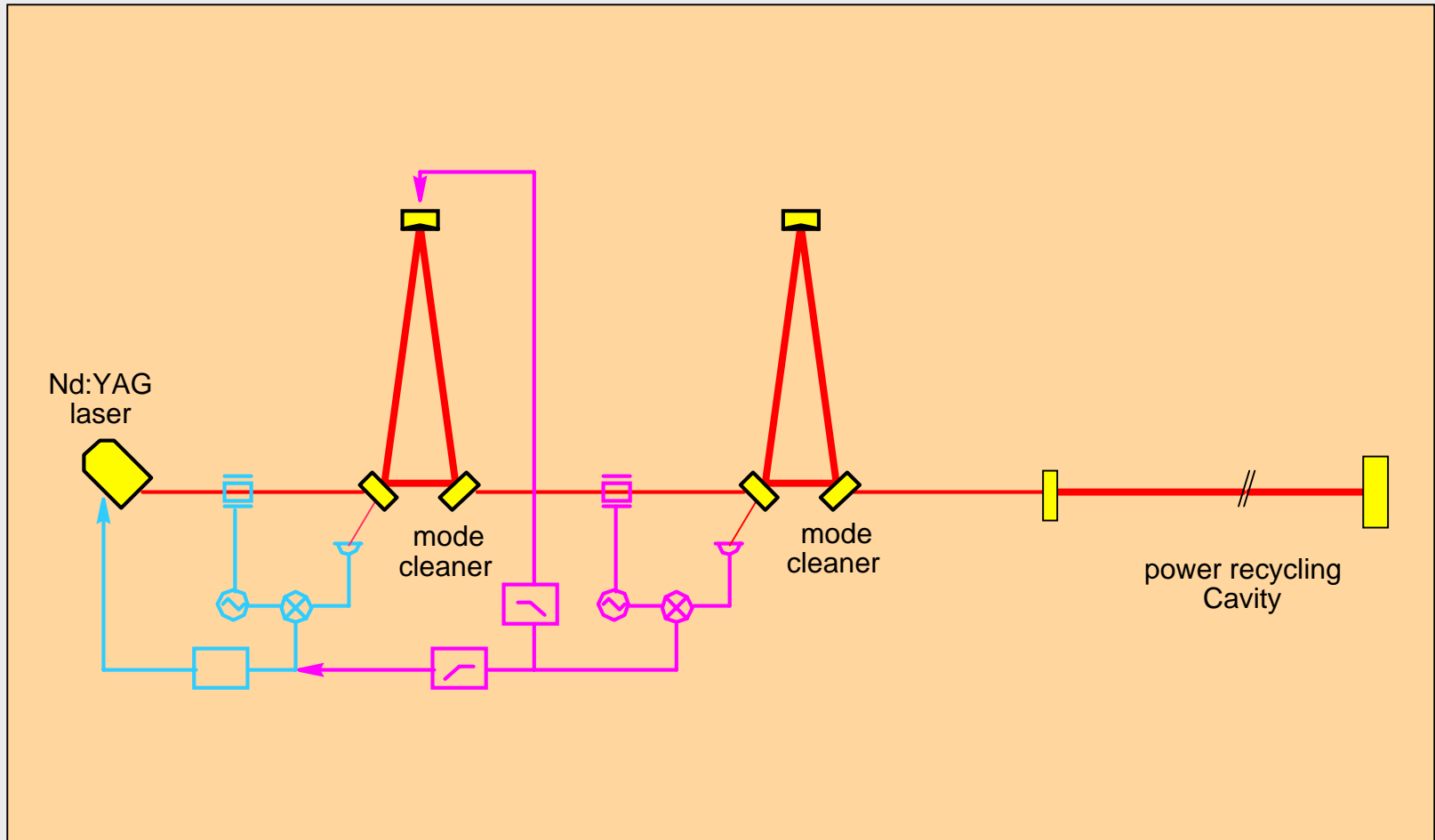
frequency and length control I



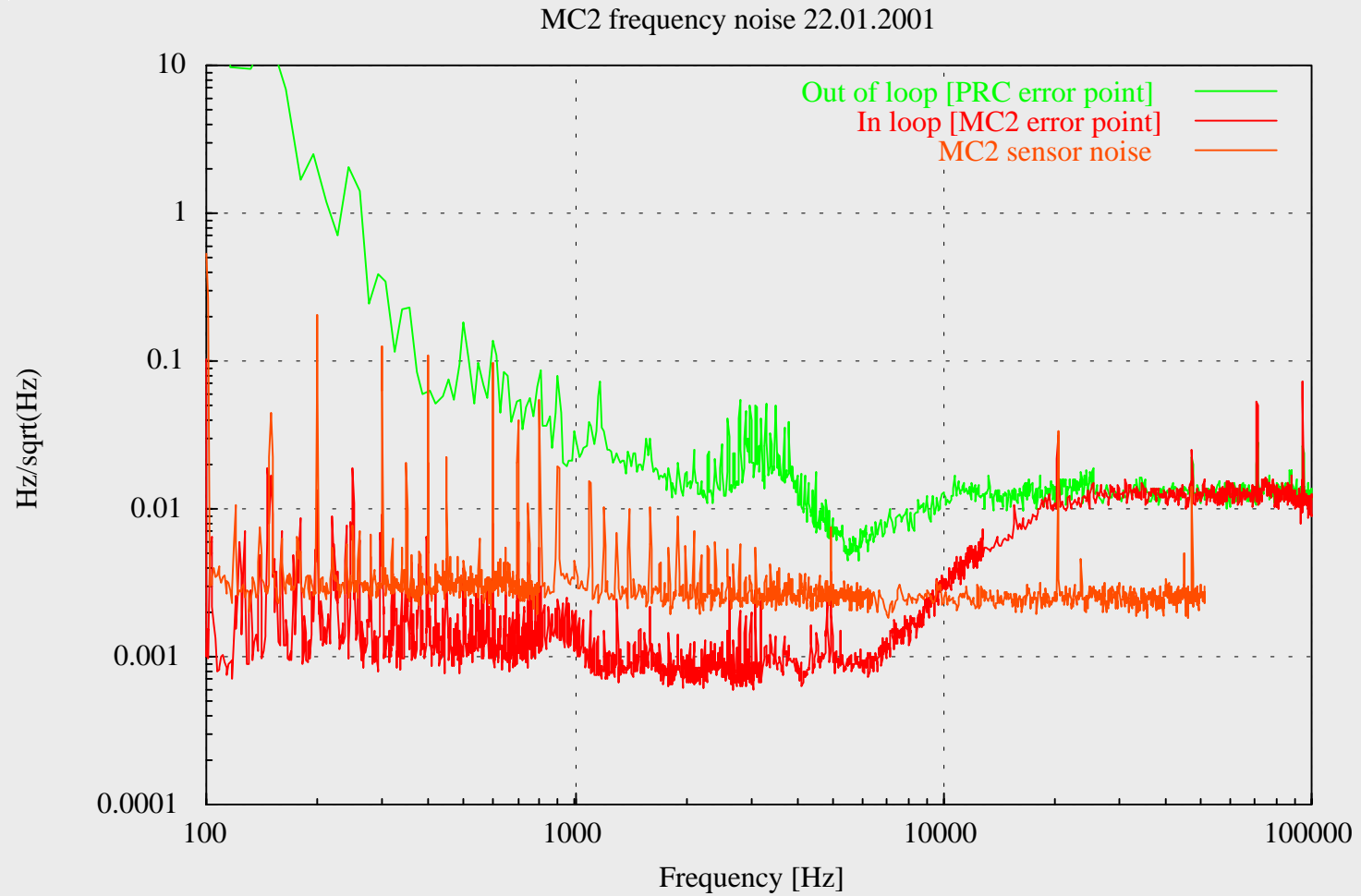
first mode cleaner frequency noise I



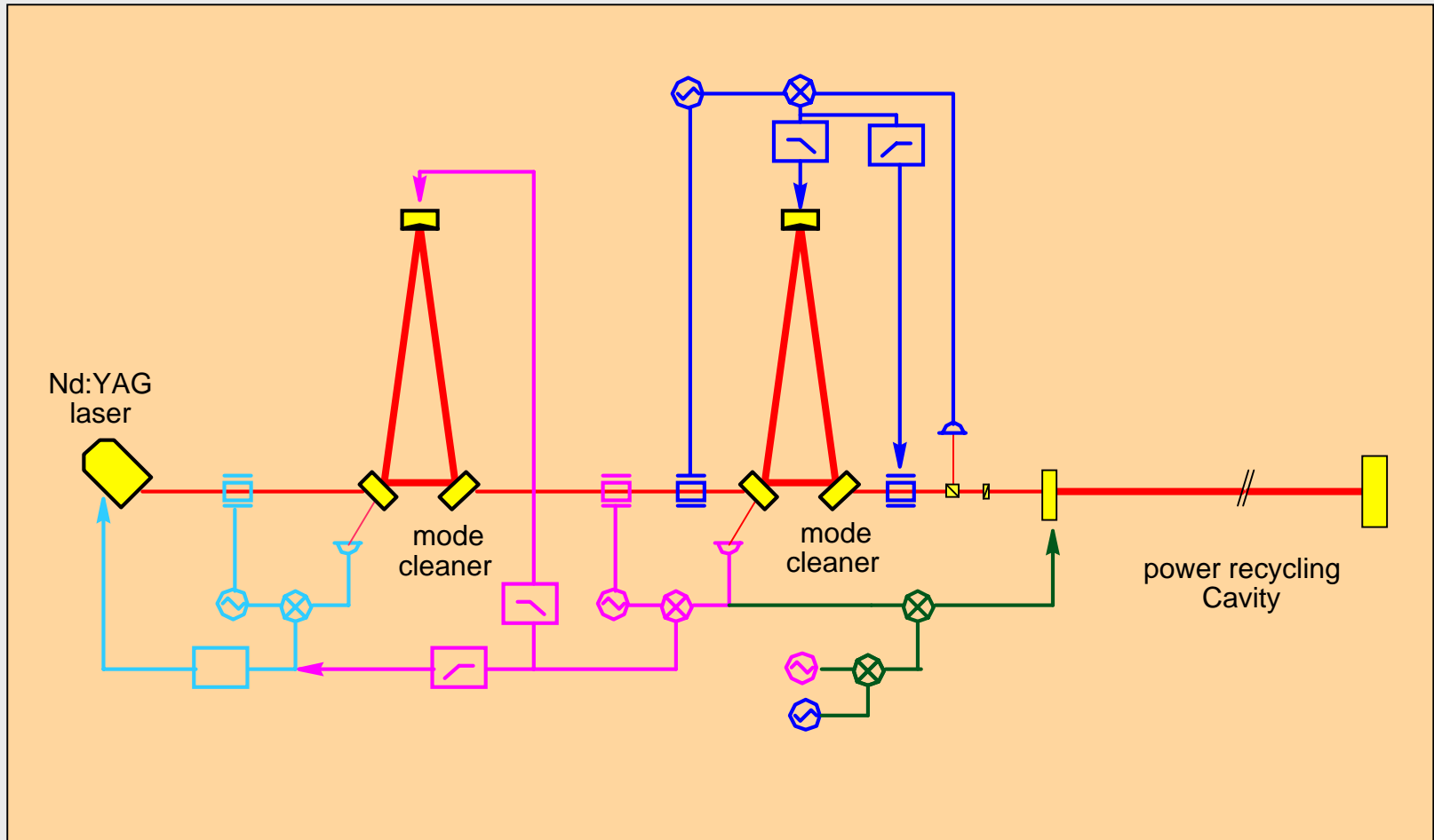
frequency and length control II



second mode cleaner frequency noise II

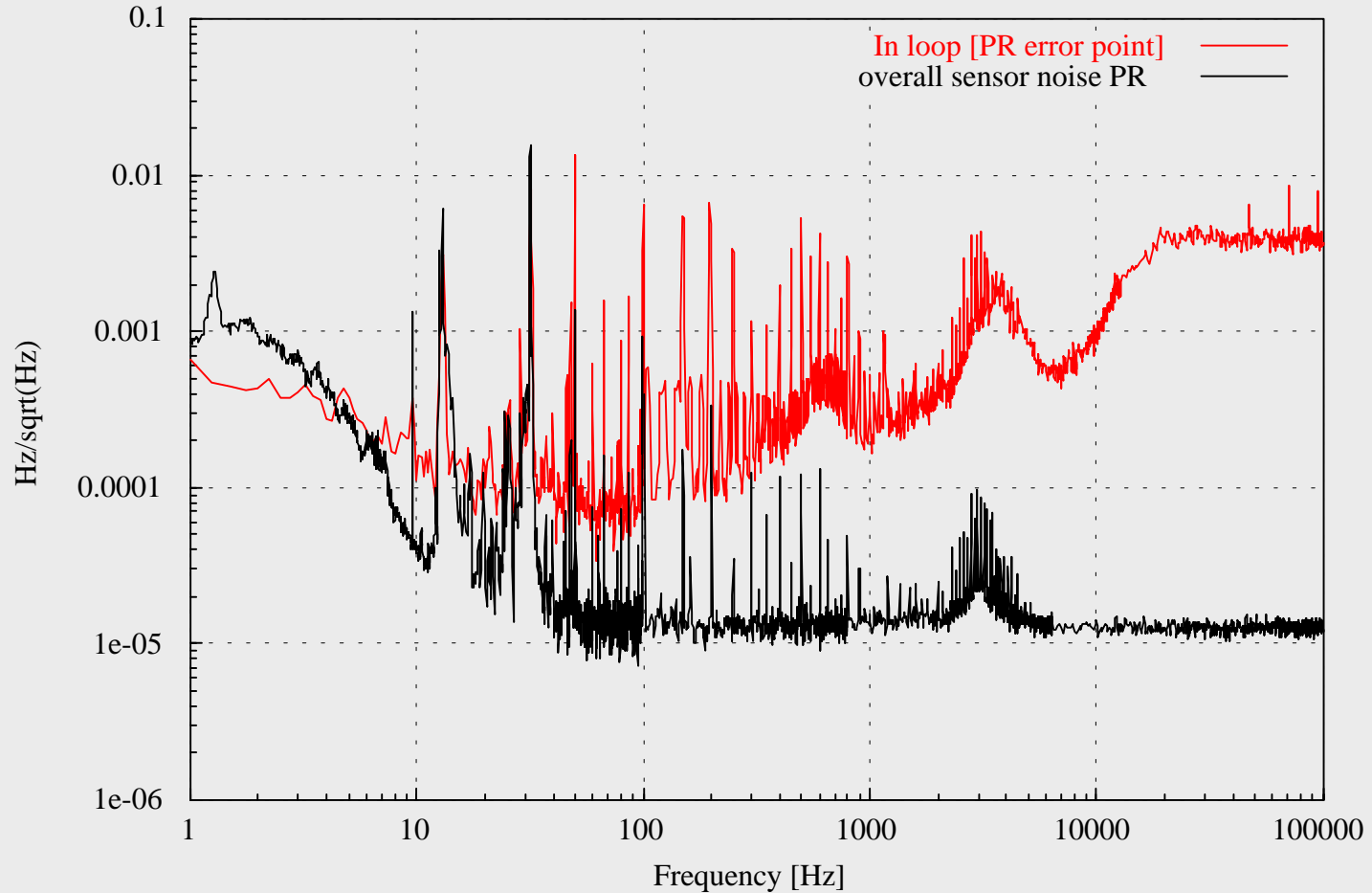


frequency and length control IV

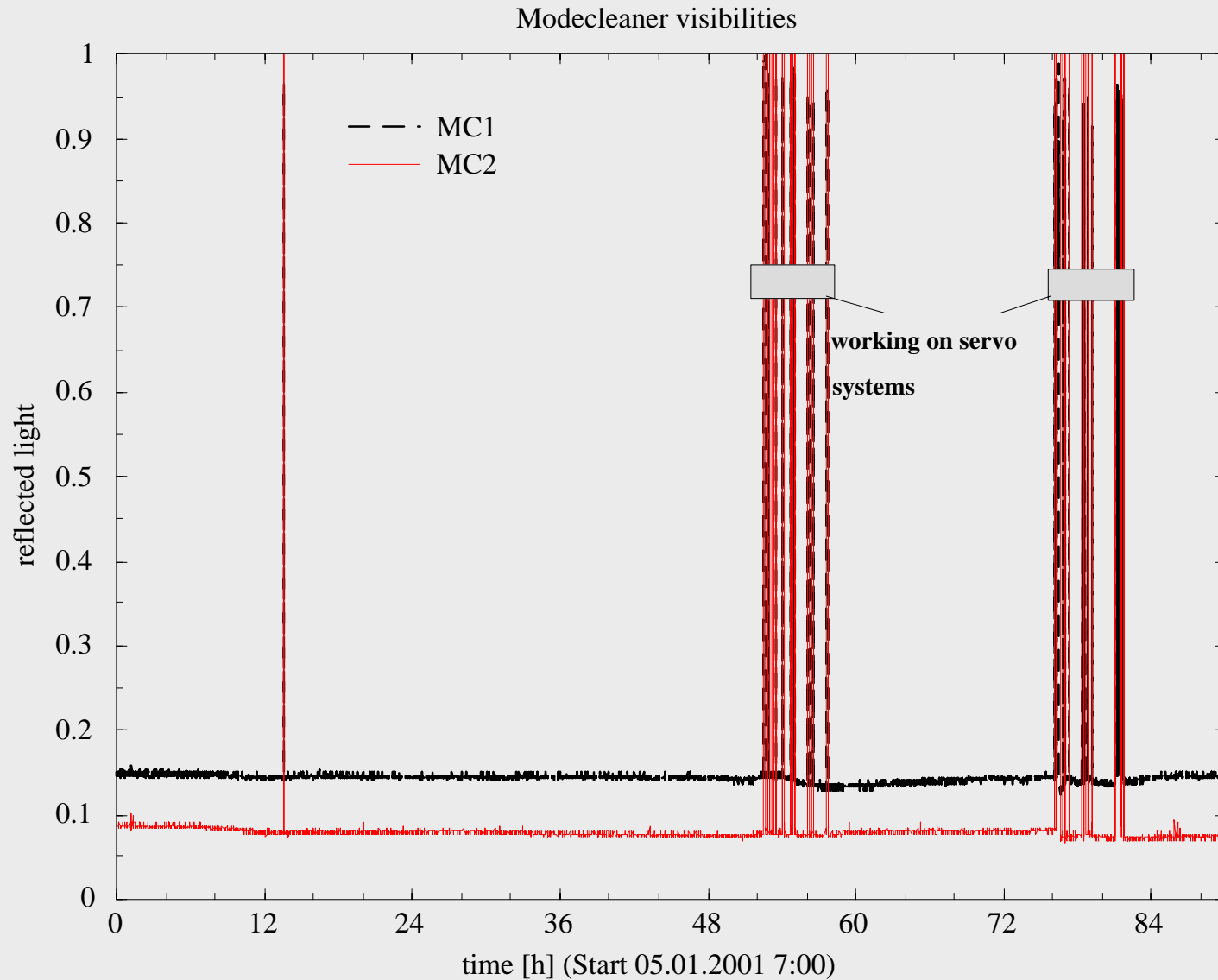


error point 1200m cavity lock

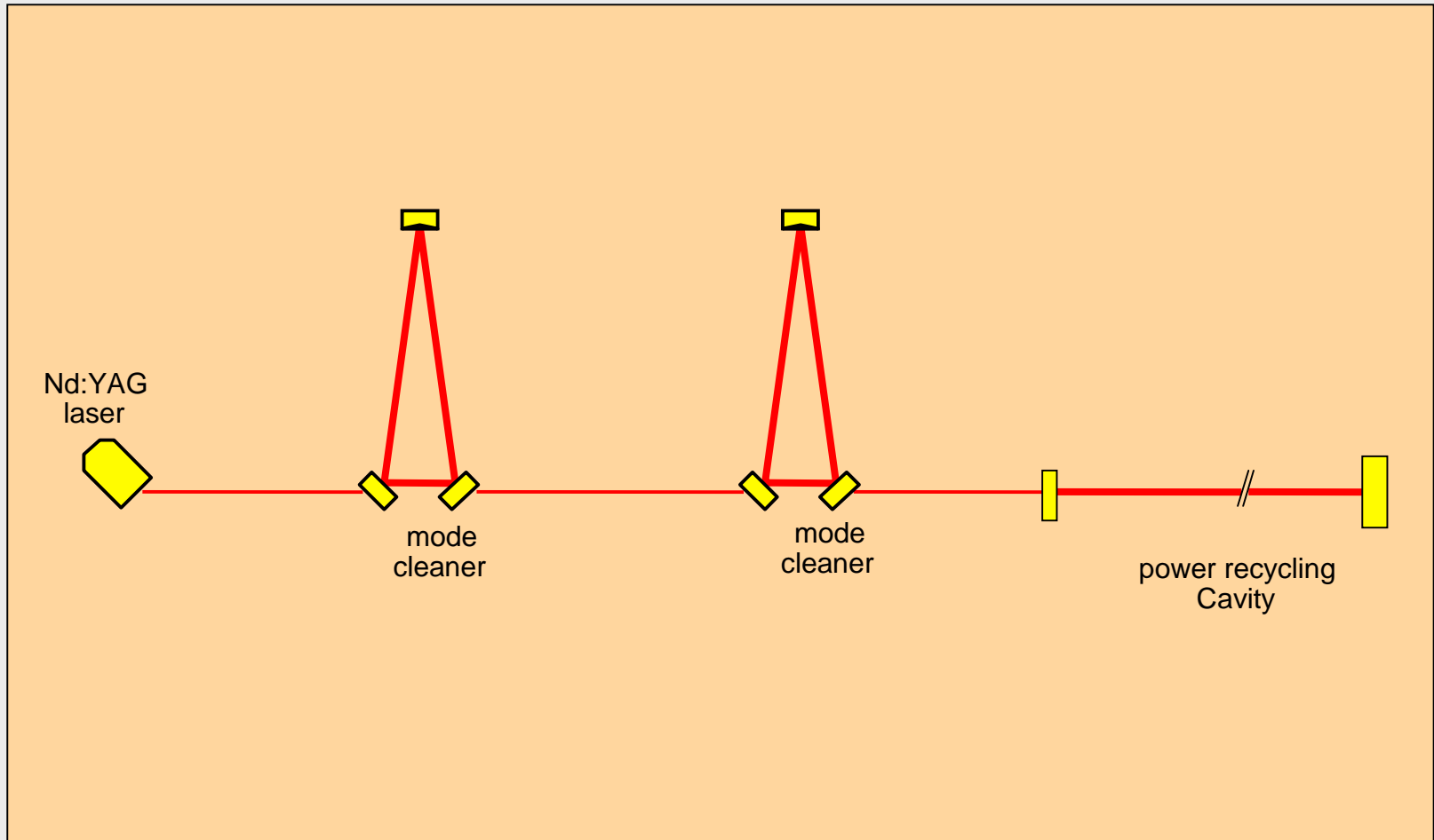
PR cavity frequency noise, date 22.01.2001



longterm behavior GEO600 modecleaner

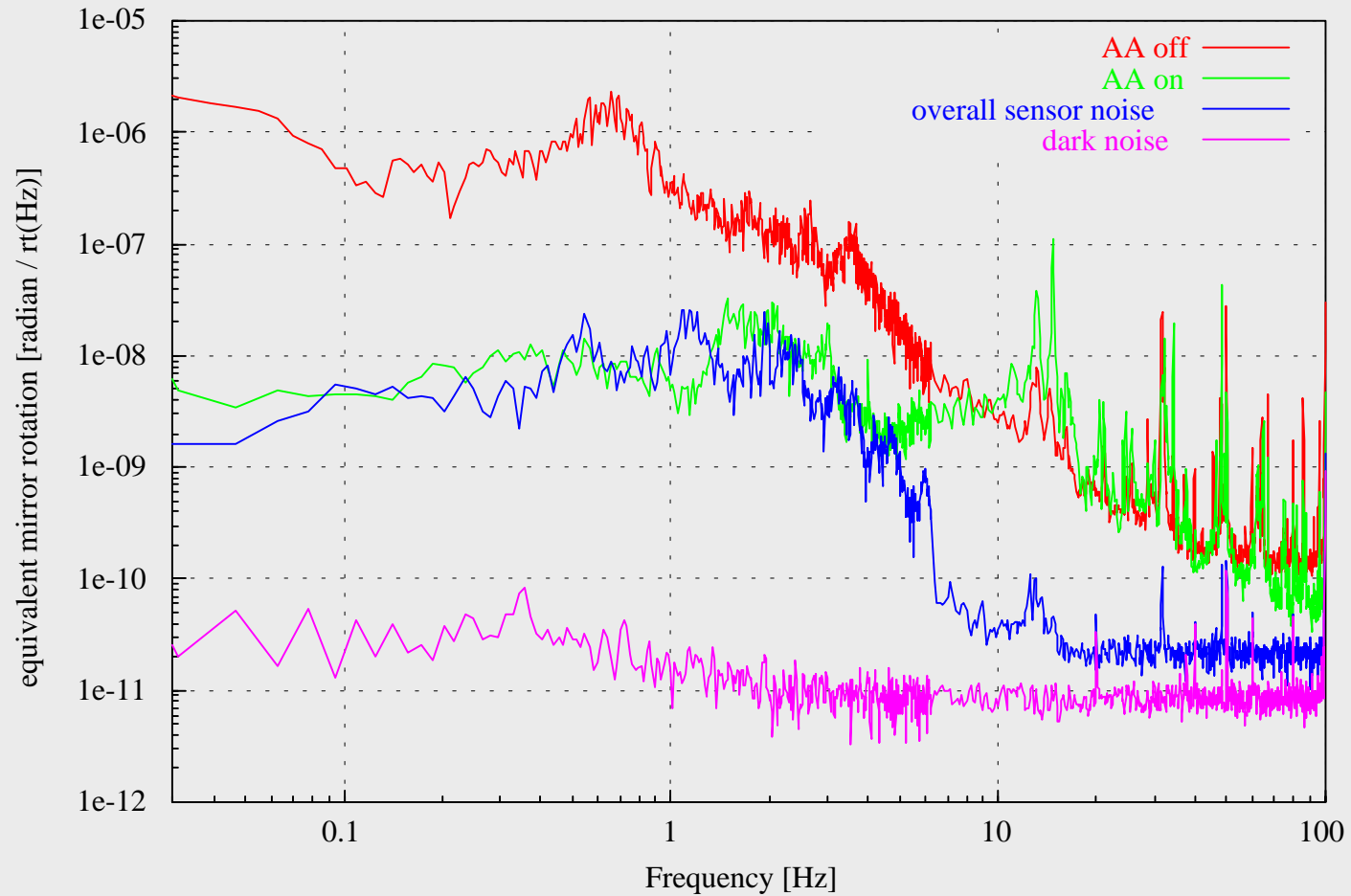


automatic alignment control

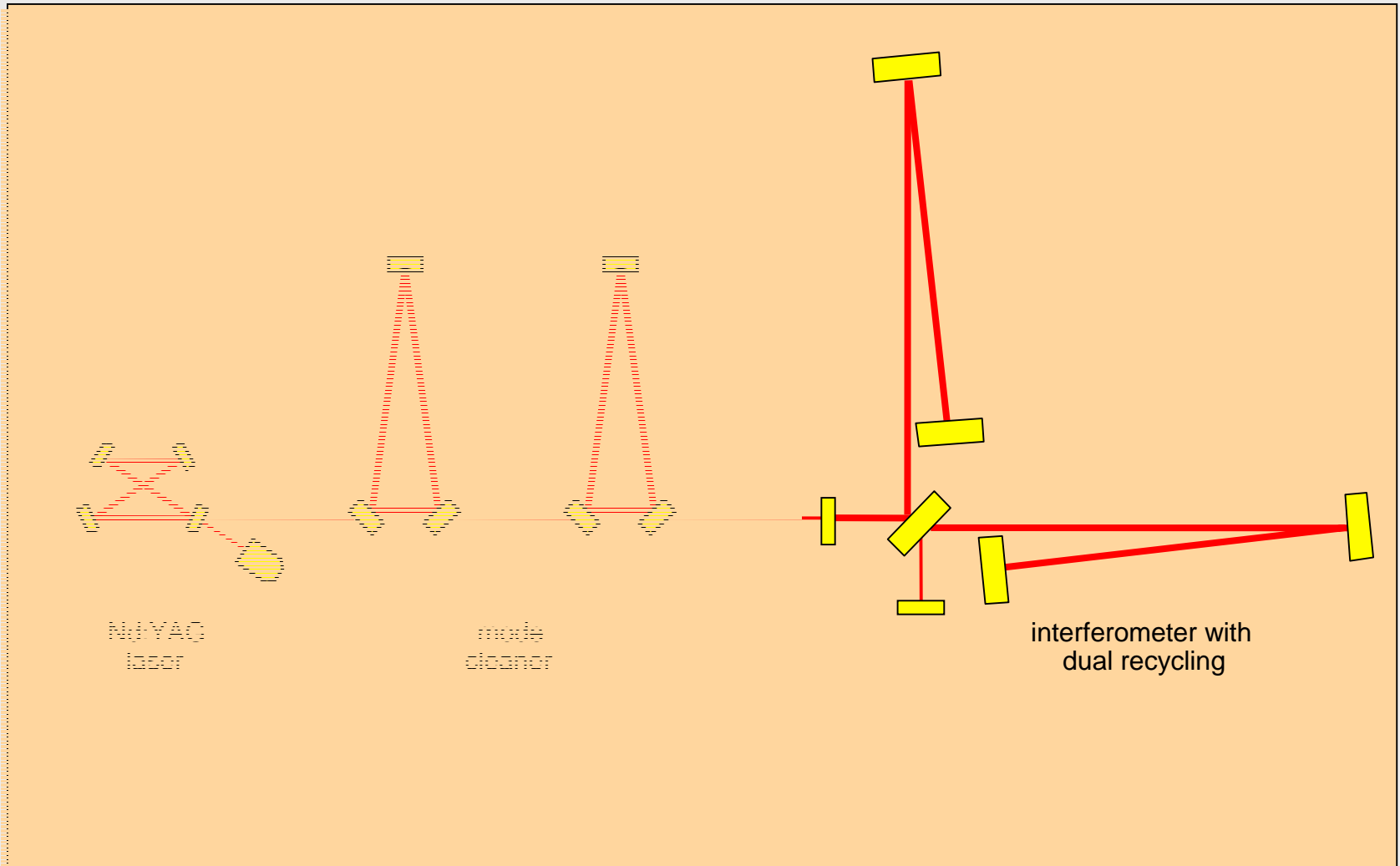


autoalignment of 1200m cavity

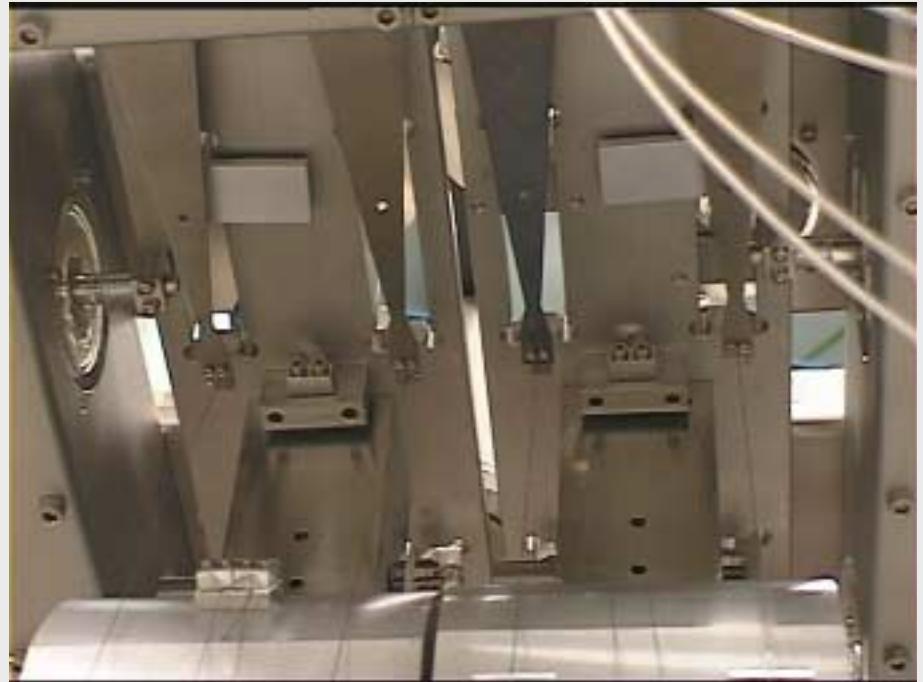
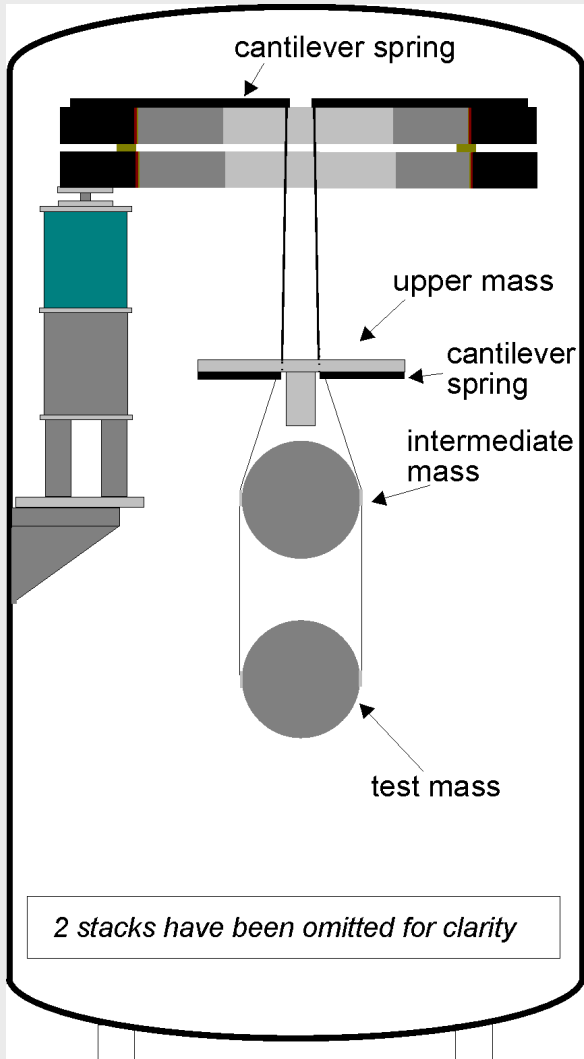
bdipr rotation autoalignment errorsignal, date 12.1.2001



GEO600 – main optics



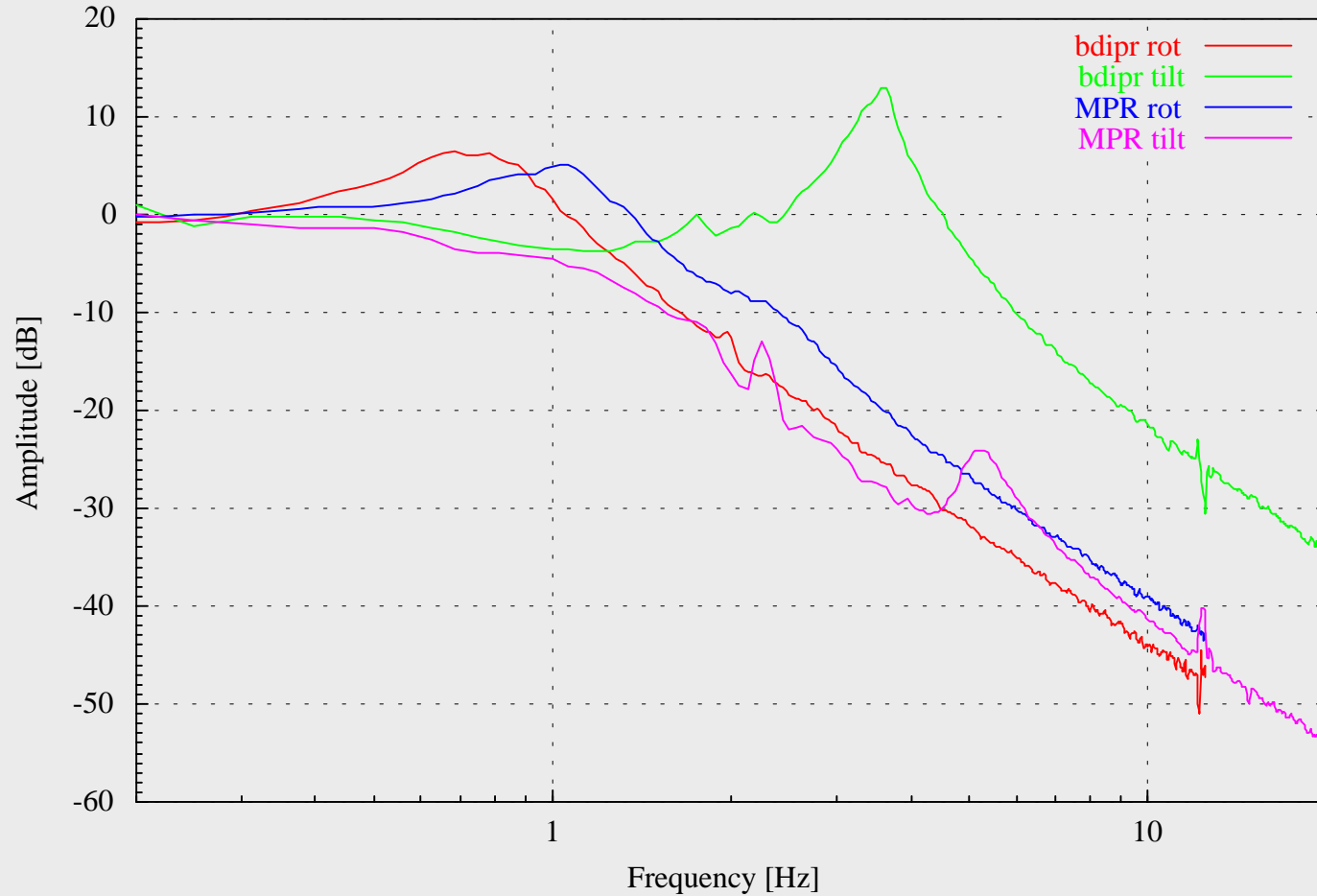
GEO triple pendulum suspension



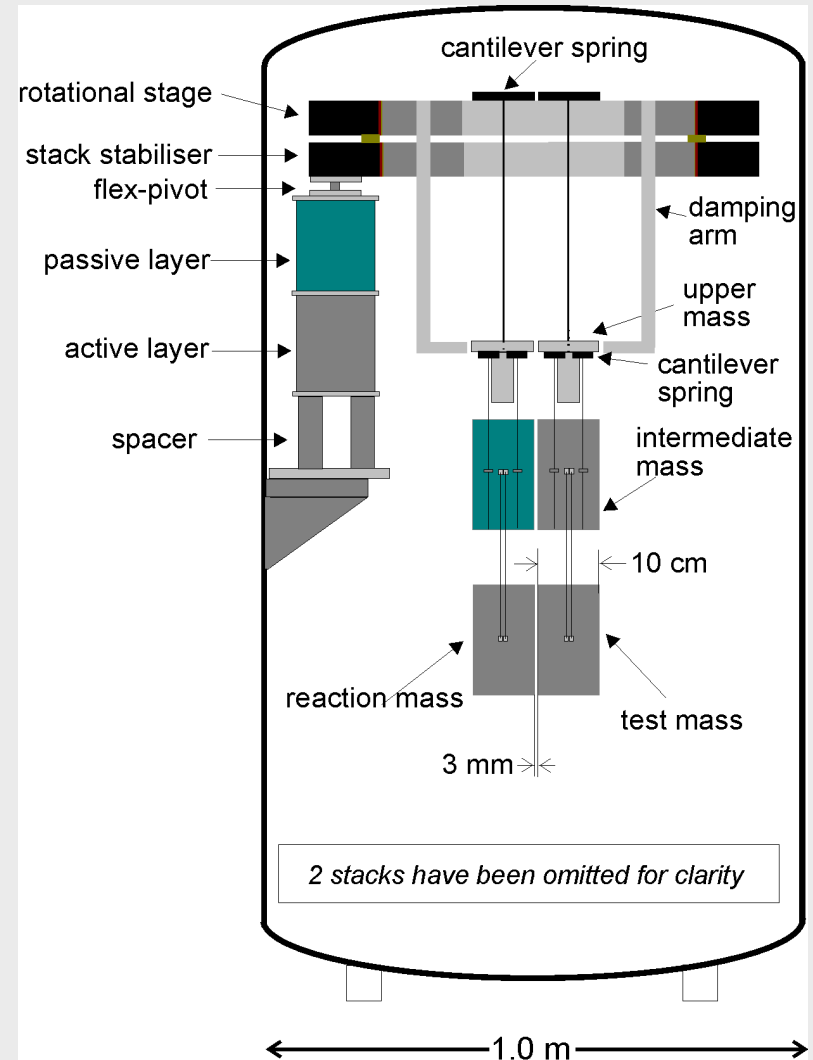
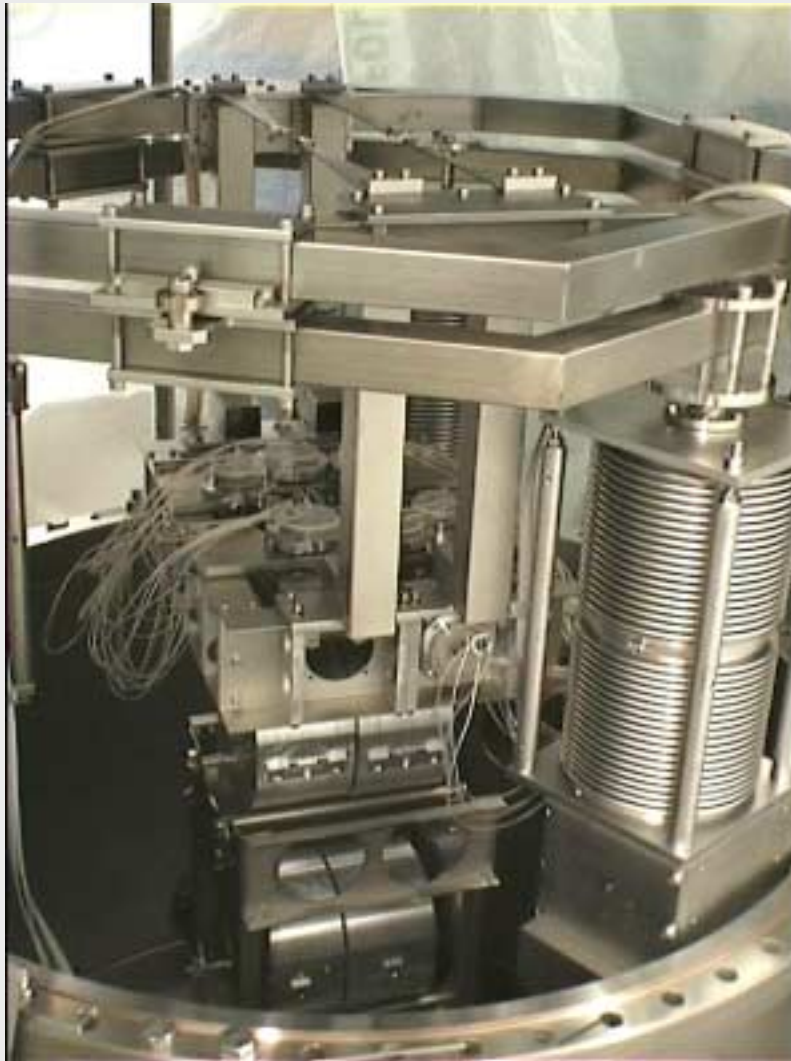
lower cantilever stage (view from below)

transferfunction MPR

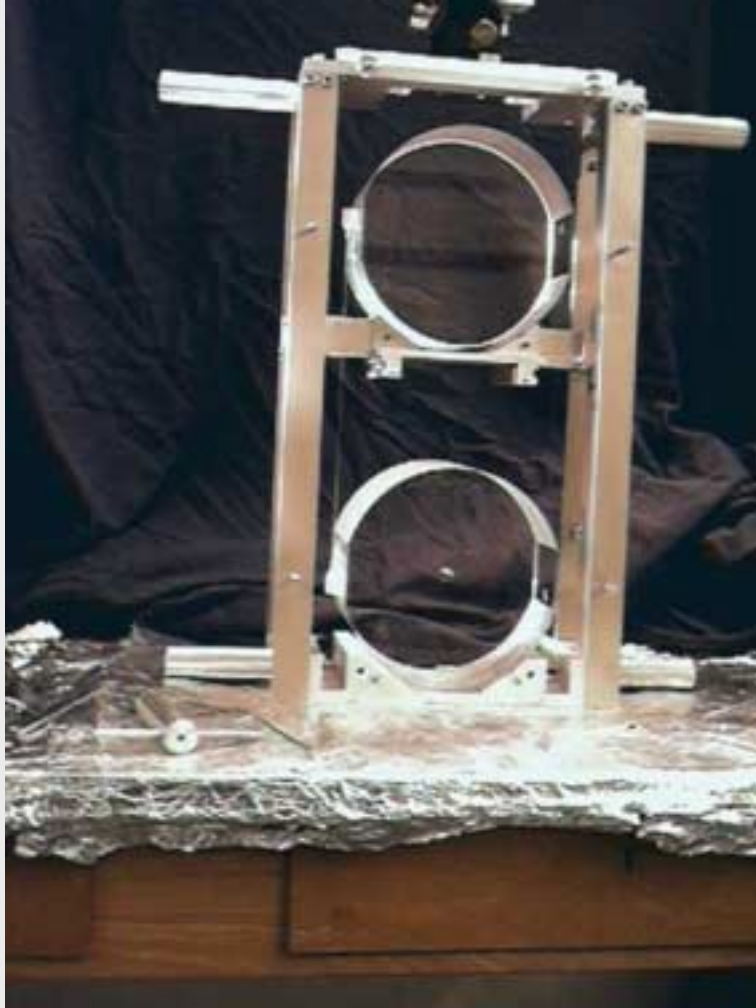
Transferfunctions of mirror actuators to AA-camera spot pos., date 4.1.01

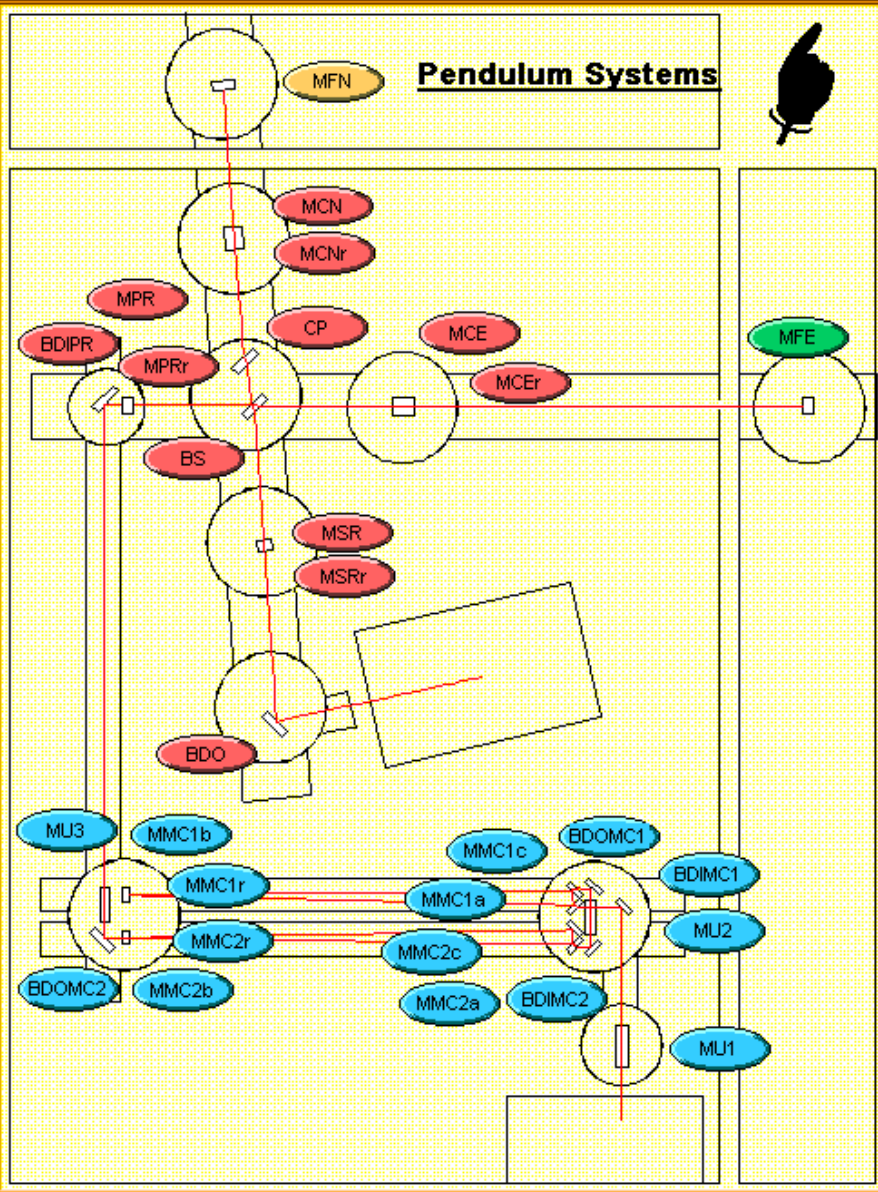


GEO triple pendulum suspension



full scale monolithic suspension





Other Systems

Program Control

CIN errors

MCEr

MCE

File Edit Operate Project Windows Help

Feedback Signals (V)

1638457 1638559

GAINS

44
44
44
42
40
36

Display

- Channel 1
- Channel 2
- Channel 3
- Channel 4
- Channel 5
- Channel 6

OFFSETS (slide)

DAC Power OFF

0 0 0

Long. Rot. Tilt

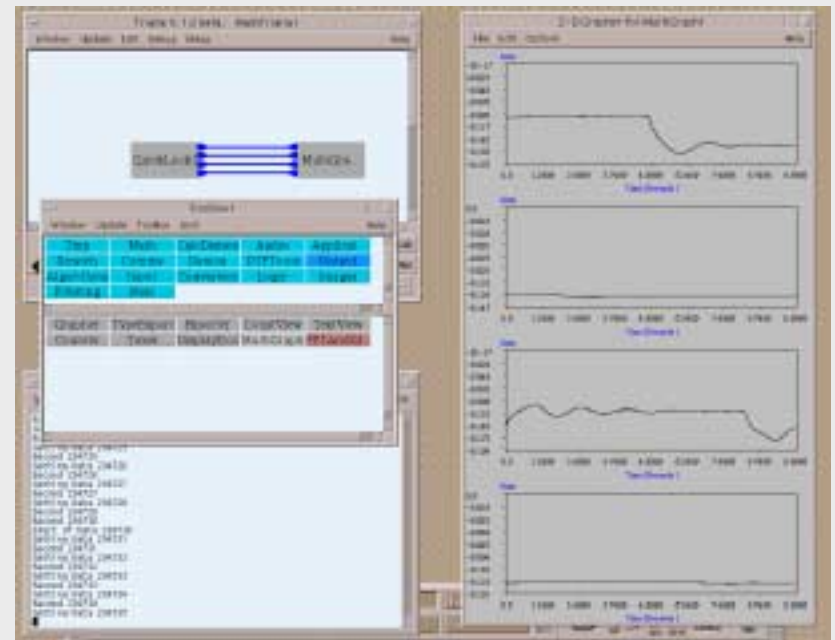
STEP INPUT

5.00 500

GEO600 Data Acquisition System



- VxWorks/Tornado based DAQ
- 2 SUN Ultra5 (redundant DAQ hosts)
- 25 channels 8kHz, 16bit
100 channels 512Hz
- tape storage in Hannover (1.5 Mbit/s)



Triana based
detector diagnostic



data analysis

data distribution: over night via internet to Potsdam
40Gbyte tapes via mail to Cardiff

cw signal search: Postdam (20 Gflops, 600 Gbytes)

burst searches: Cardiff (20 Gflops, 600 Gbytes)

time critical search: Hannover (10 Gflops, 300 Gbytes)

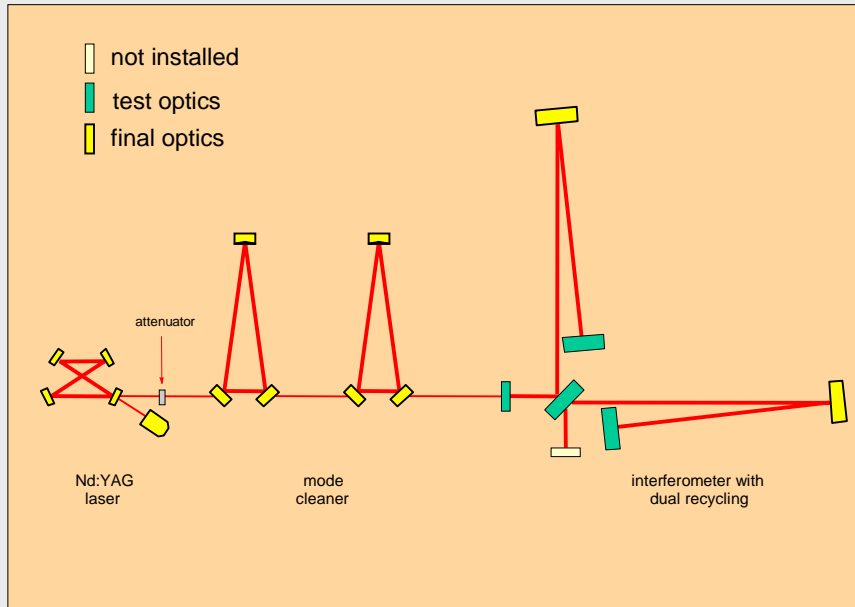


Beowolf cluster in Hannover
installed summer 2000

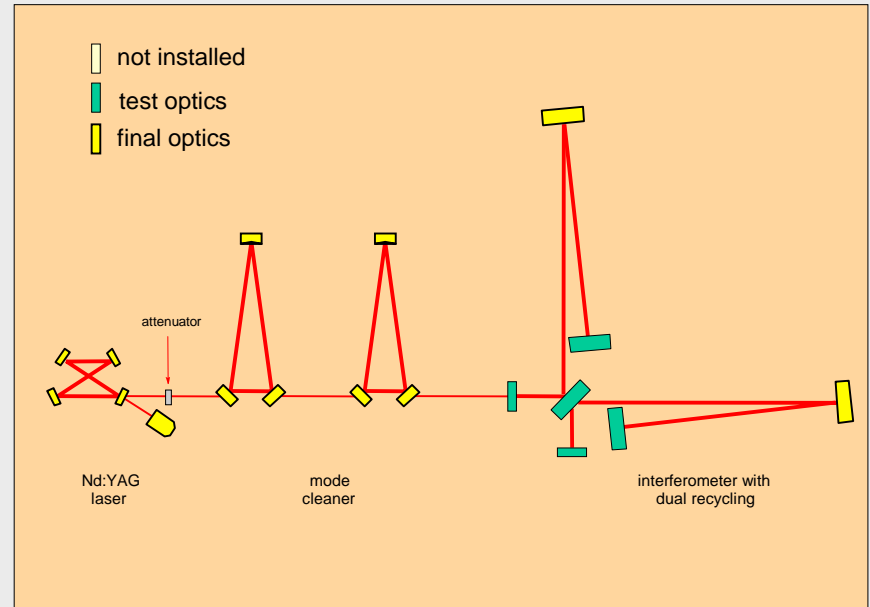


special data taking periods

two weeks in July: first h(t)
(LIGO E5)



October: narrow band operation
(LIGO E6)



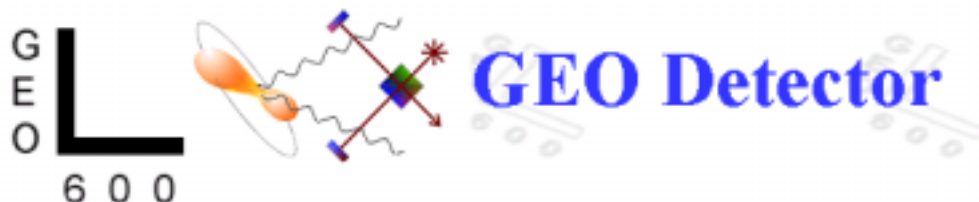
from December 2001:
continuous data taking during detector optimization



GEO DC homepage - Netscape

File Edit View Go Communicator Help

Bookmarks Location http://www.aei-potsdam.mpg.de/~sintes/GEO_DC/ What's Related



GEO Detector

Characterization

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Document Done

http://www.aei-potsdam.mpg.de/~sintes/GEO_DC/

Glasgow 10m Prototype

- converted to 1064nm illumination (5×10^{-19} m/Hz^{1/2} in the few hundred Hz range)
- spoiling the Q to about 2000 (using strips of Apiezon grease) allows direct measurement of off resonance thermal noise (good agreement with structural damping) (Glasgow/Hannover/Garching publication in preparation)
- currently used to investigate signal recycling with arm cavities in place (Ken Strain) for the next year.
- New 10m Glasgow prototype will come on line around fall 2001 and signal recycling work will move to it
- Original 10 m prototype will then be used for more direct thermal noise measurements.



Garching 12m prototype

- vacuum enclosure was move to new location and shortened to 12m and all optics are suspended again
- pre-stabilized laser system is currently installed
- dual recycling experiment with increased recycling gain are planned over the near future



new developements in Hannover

- two new experimental groups of the Albert-Einstein-Institute will be founded in Hannover
- joint appointments of the Max-Planck-Society and the University of Hannover
- new labs (including one prototype lab) will be ready within three years time)

