



# GEO600 – Status and Plans

Benno Willke

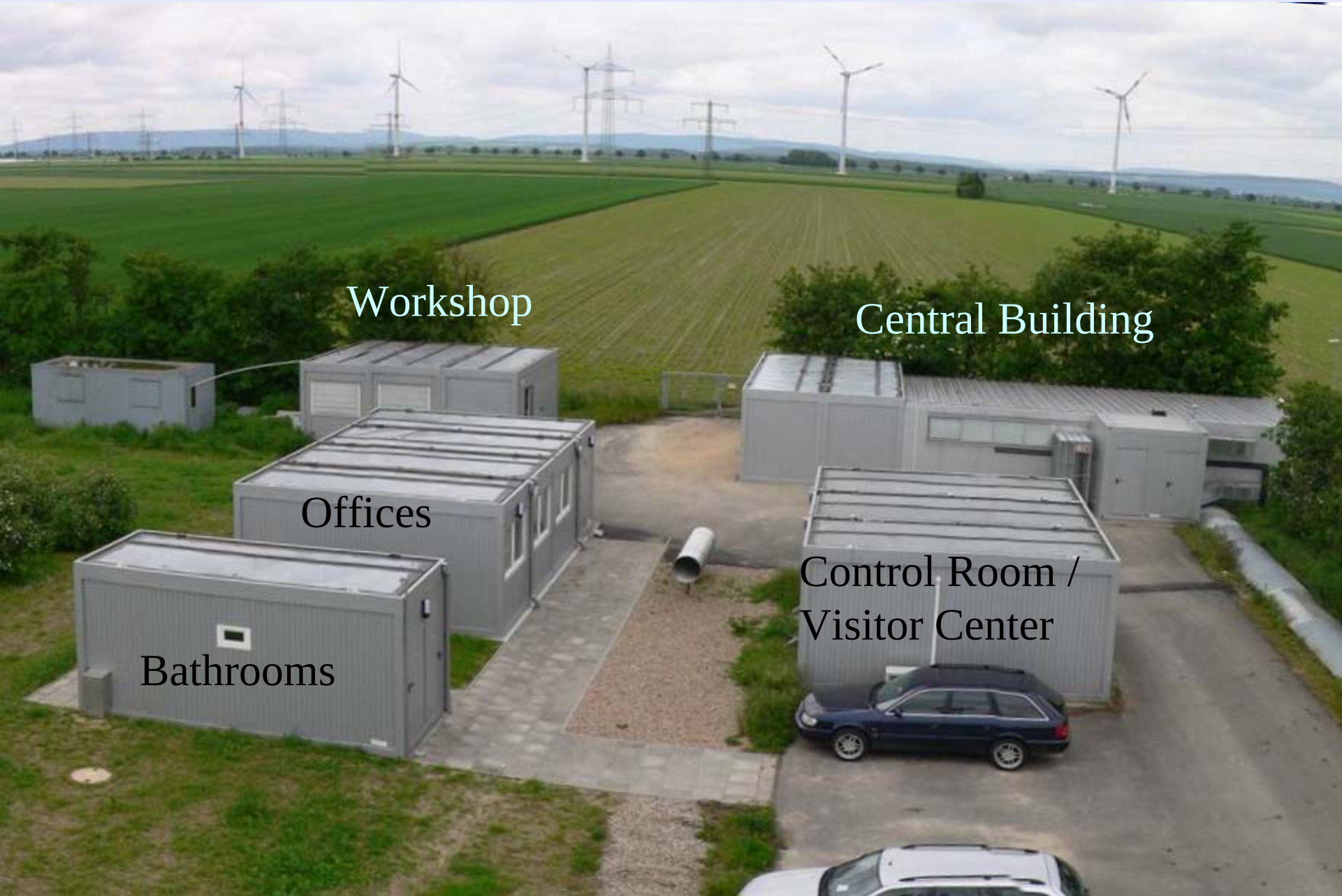
for the LSC

GWDAW 06

Potsdam, Germany 2006

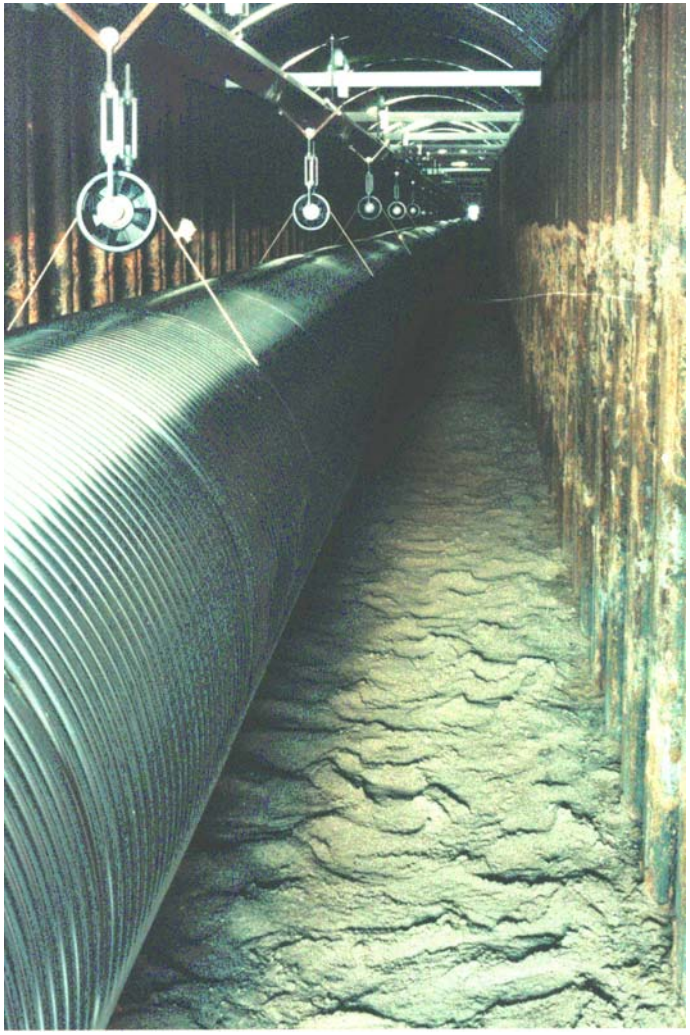
LIGO-G060629-00-Z

# container cluster 2005

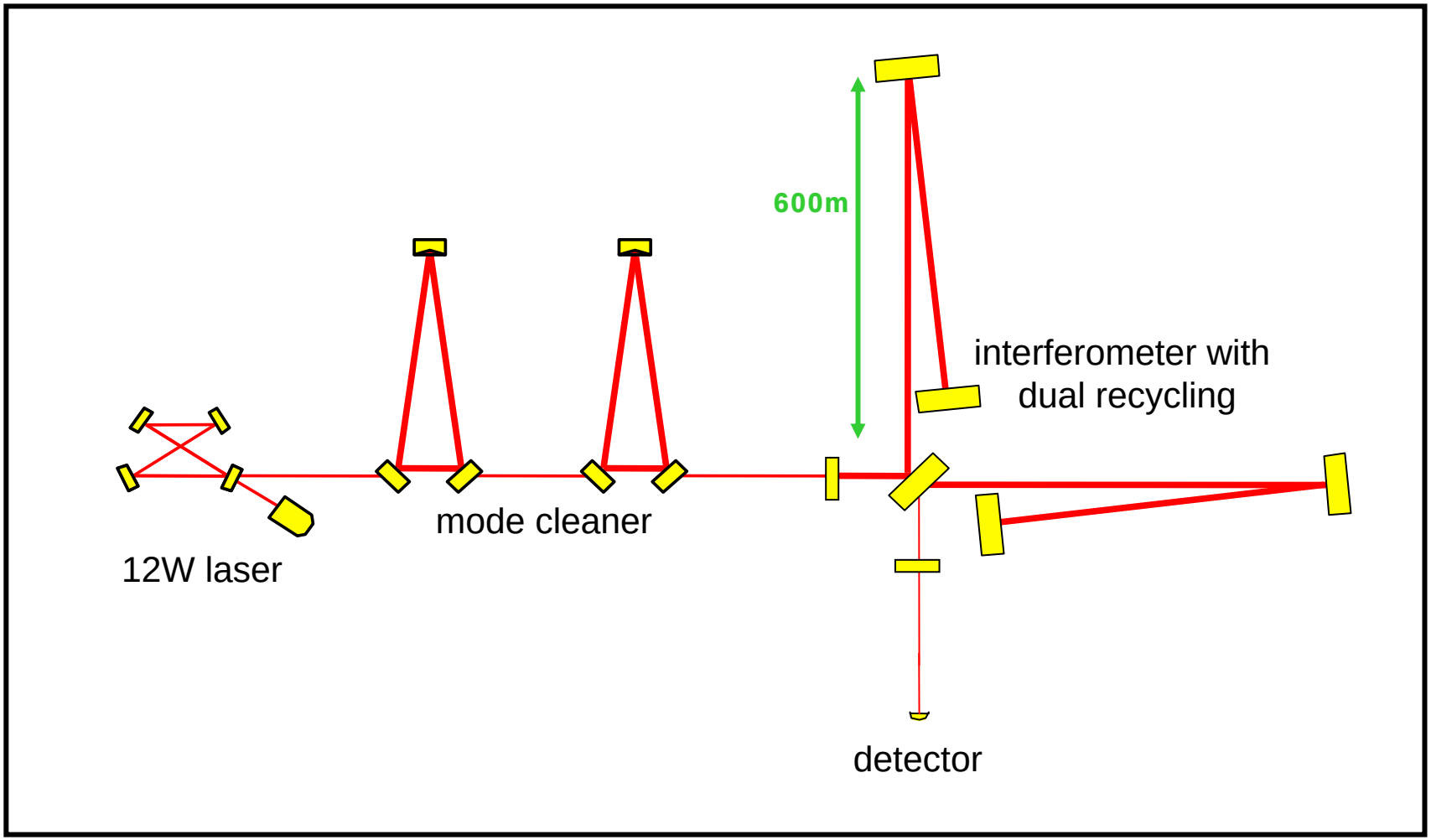


# Clean Room / Control Room

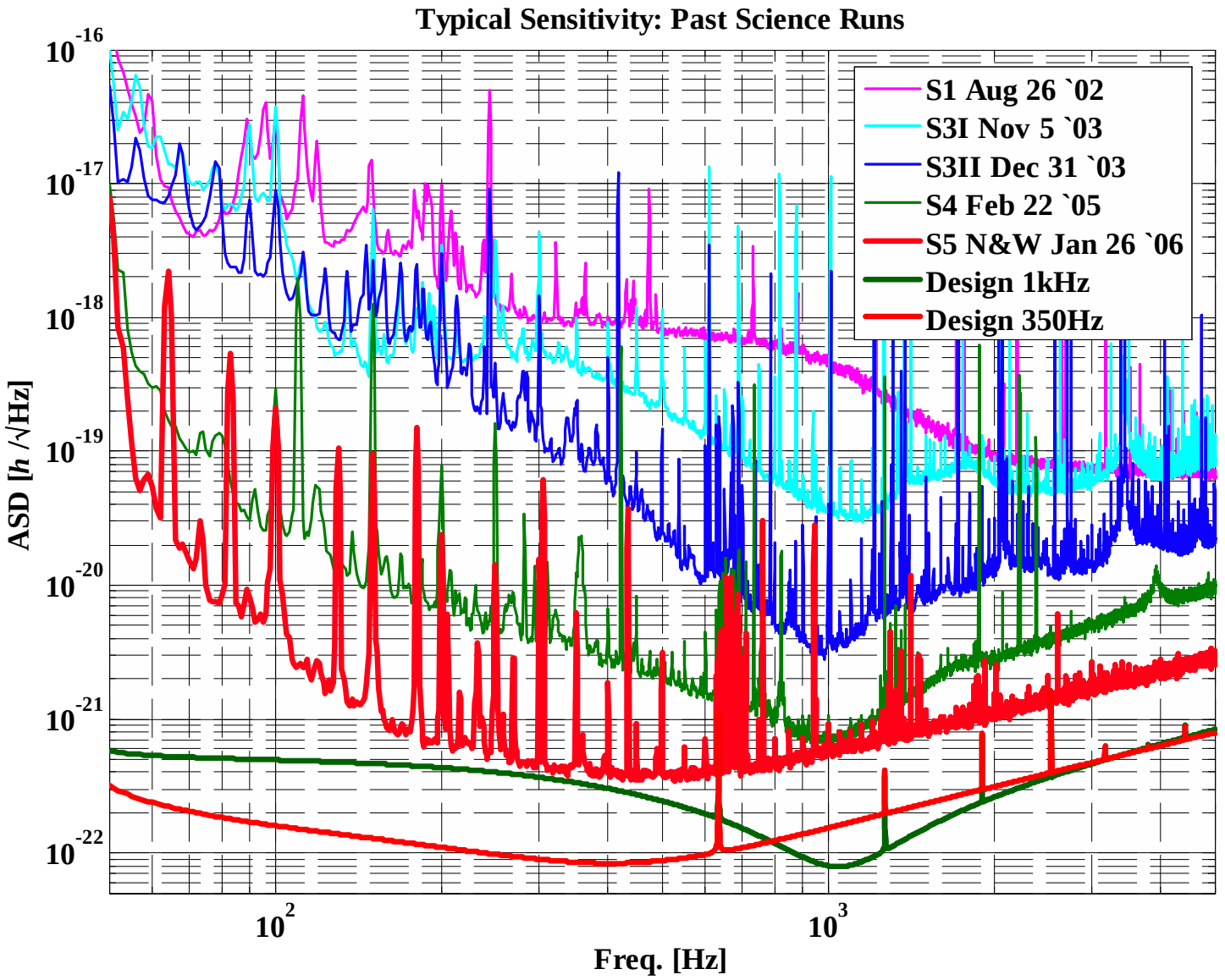
# Tube / Trench



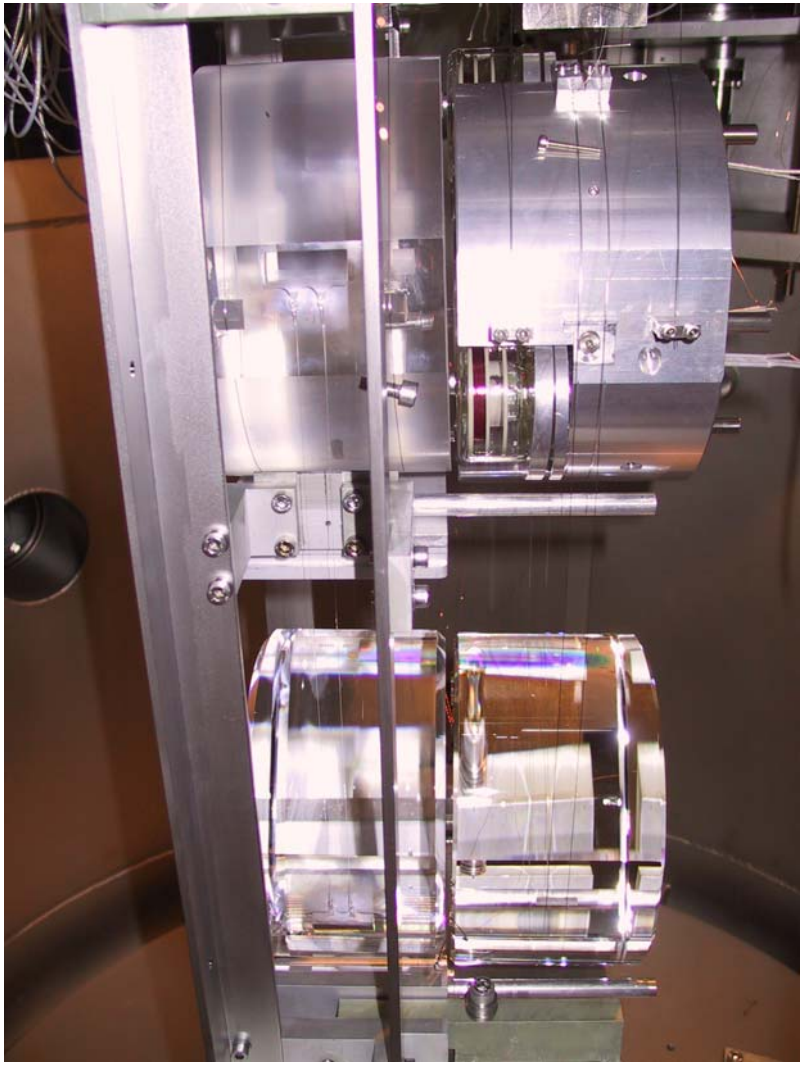
# GEO600 optical layout

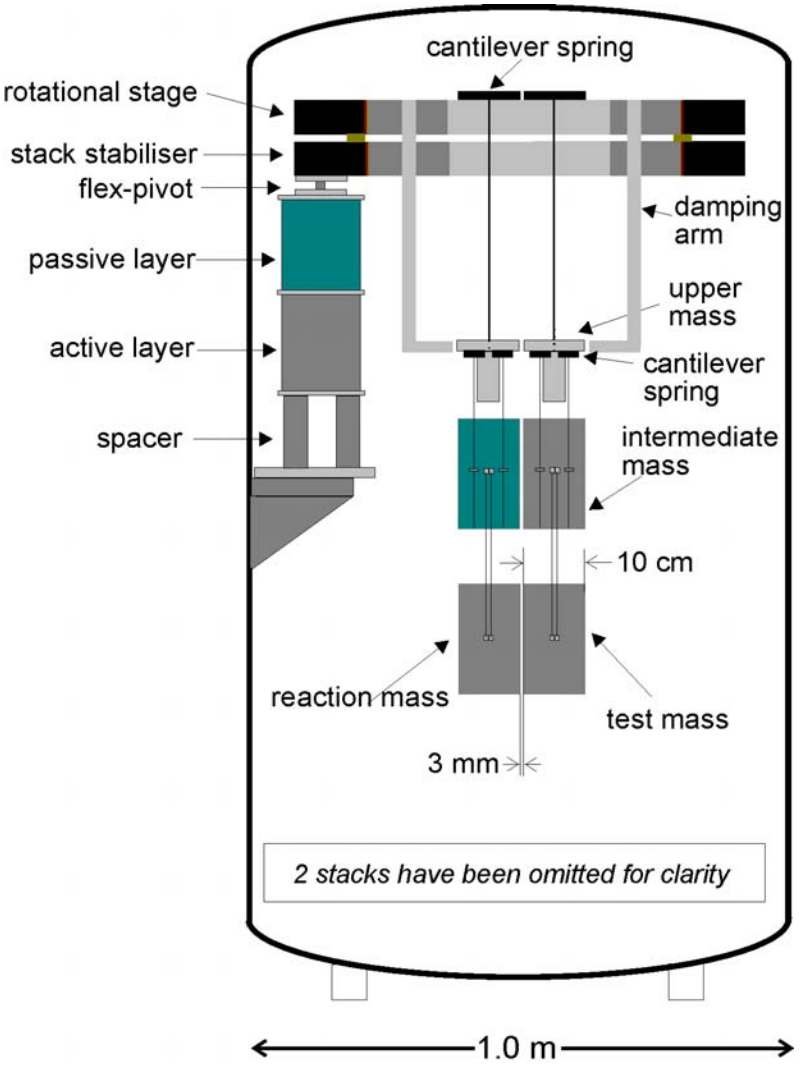


# Sensitivity Improvements

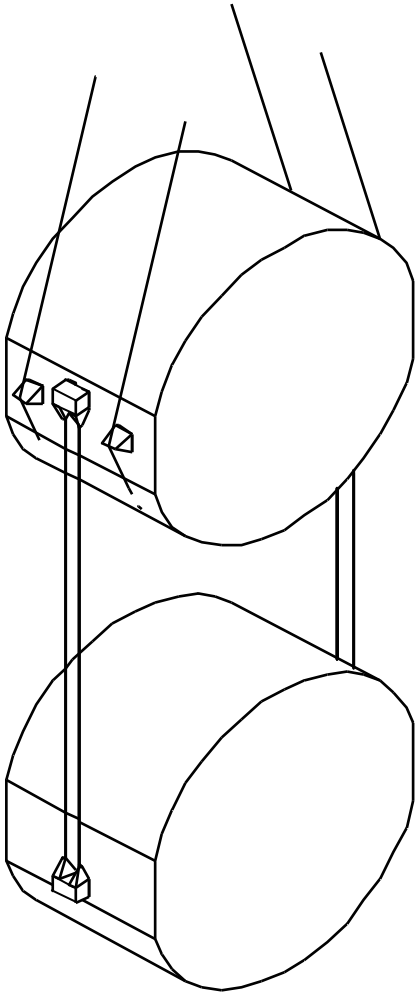


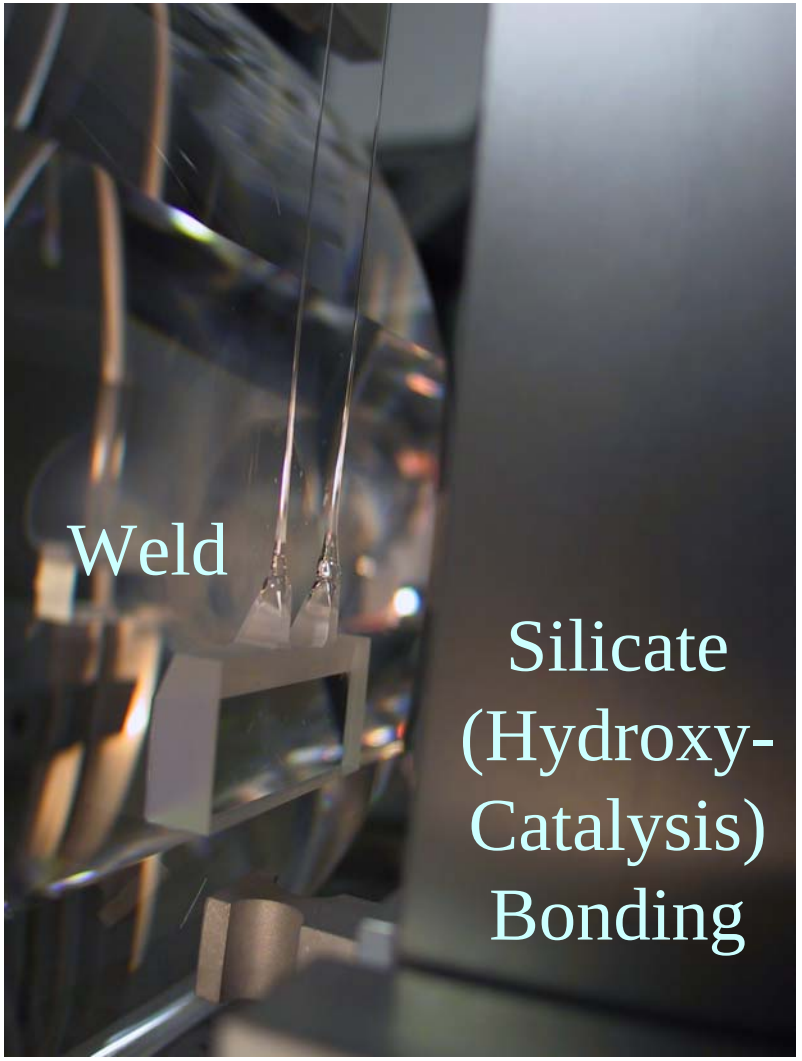
# Reaction Pendulum





# Thermal Noise / Monolithic Suspension

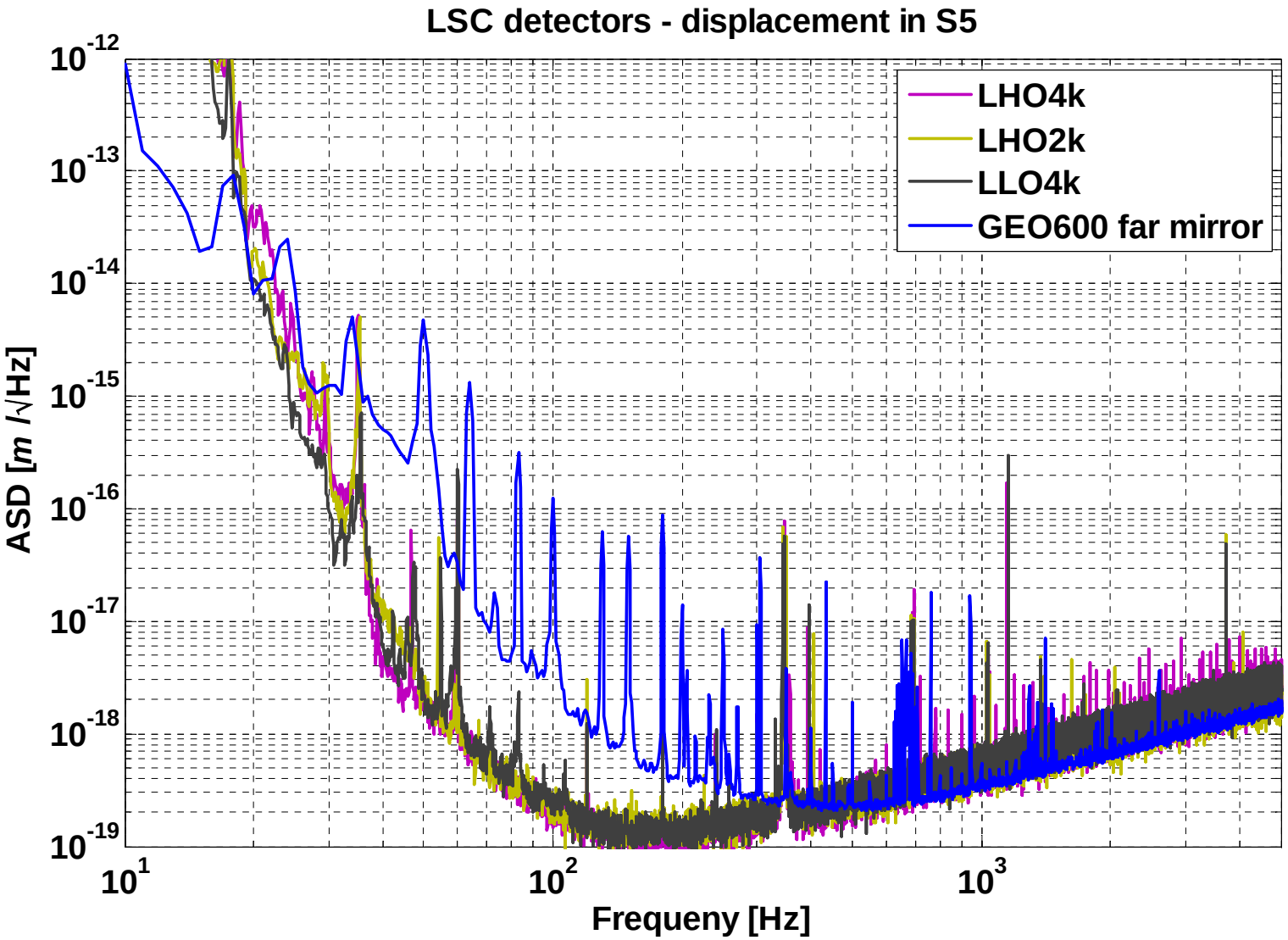




# commissioning challenges

- thermal compensation of a ROC mismatch
- couplings in triple-monolithic-suspension
- dual recycling
  - lock acquisition – coupling alignment – SRC slope, 2f signal, definition of downtuning parameter
  - resonance conditions of MI sidebands
  - frequency dependent distribution of GW signal on P/Q quadratures
- scattering
- low noise electronic (rf system, ESD HV, digital control)
- radiation pressure effects

# Displacement sensitivity



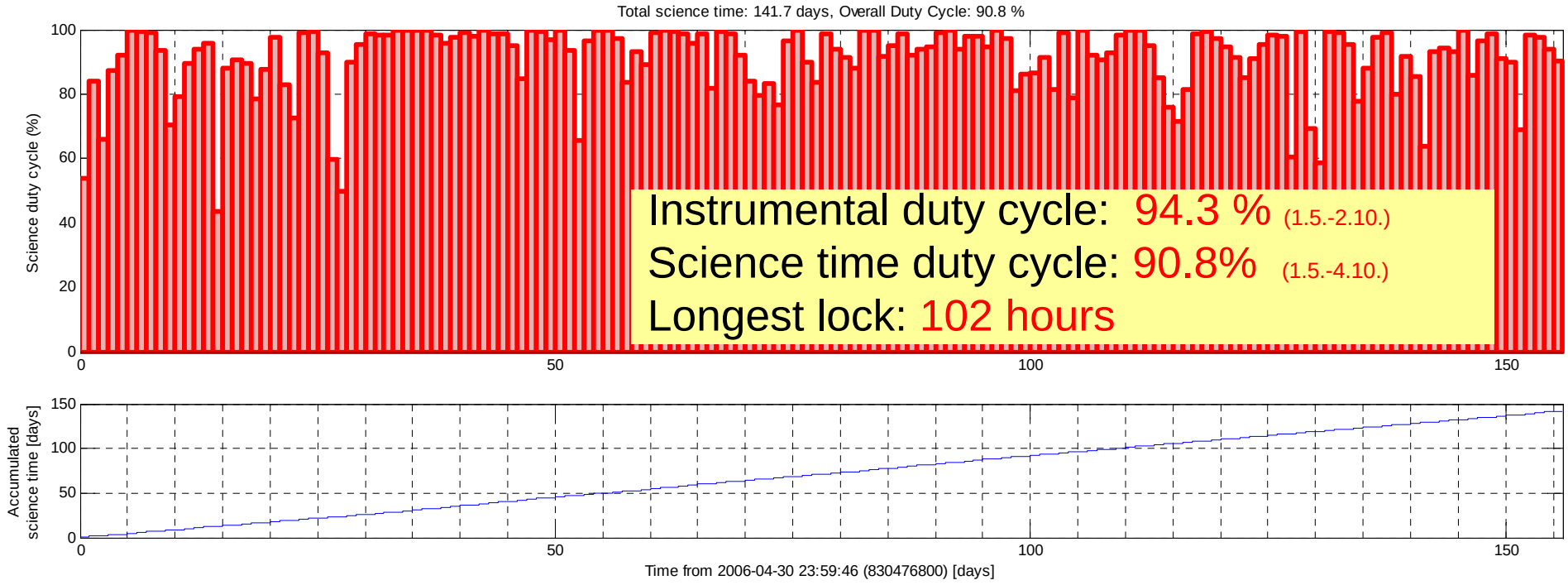
# GEO600 uses Advanced Technology

- Signal recycling
  - lock acquisition
  - optimal calibration method for dual recycled detectors
  - importance of resonance conditions for heterodyne sidebands in detuned detectors
- monolithic suspensions
  - welding and bonding technique
  - careful design of fiber neck is required
  - longterm stability test
- electrostatic actuation
  - square root law
  - charges on test masses

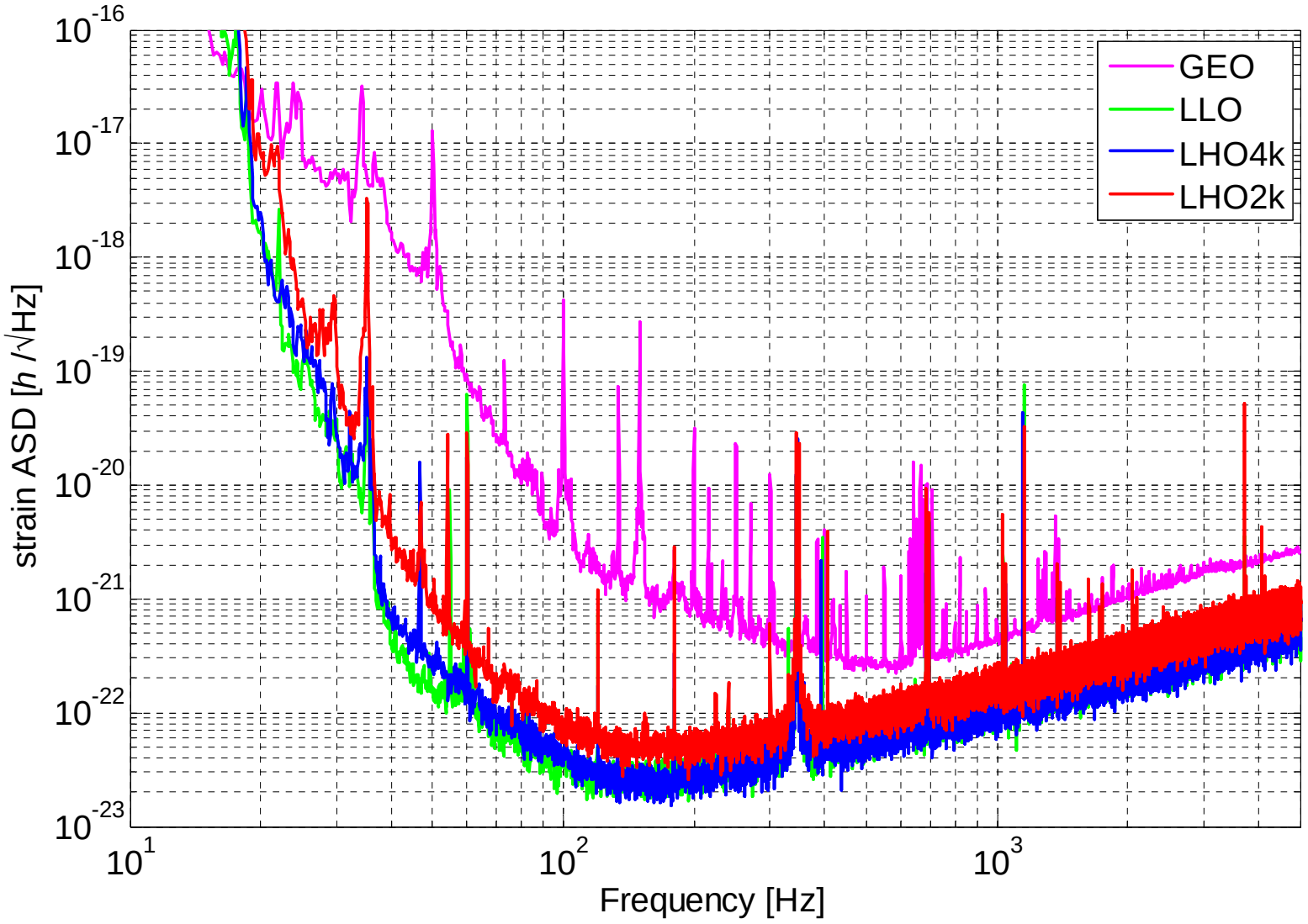
the high displacement sensitivity of GEO600 allows for a meaningful demonstration of new technologies

# Last year‘s work on GEO600

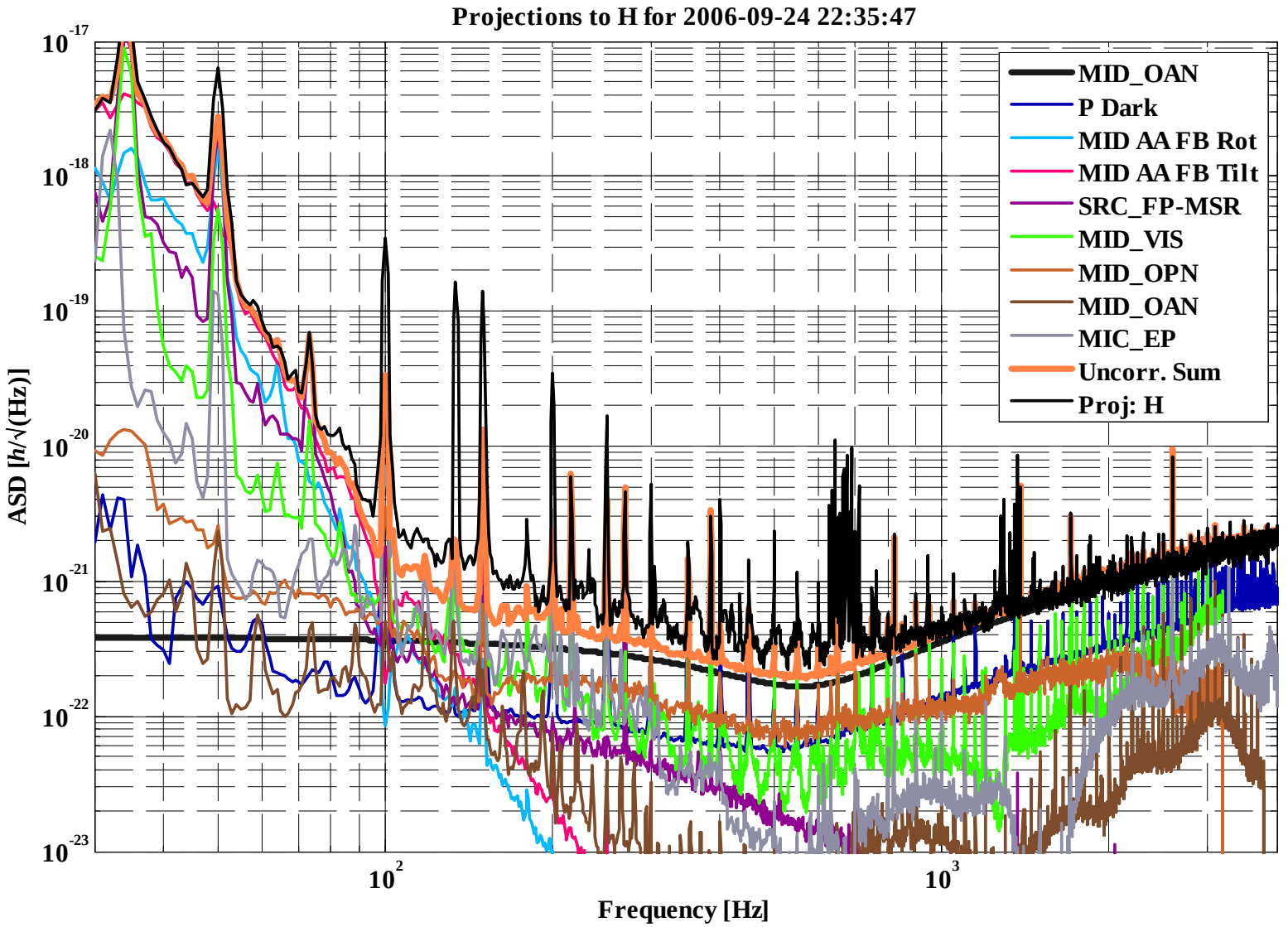
- Comissioning in late 2005:
- Joined S5 in *overnight & weekend mode* (January 20th)
- Joined S5 in *24/7 mode* (May 1st)



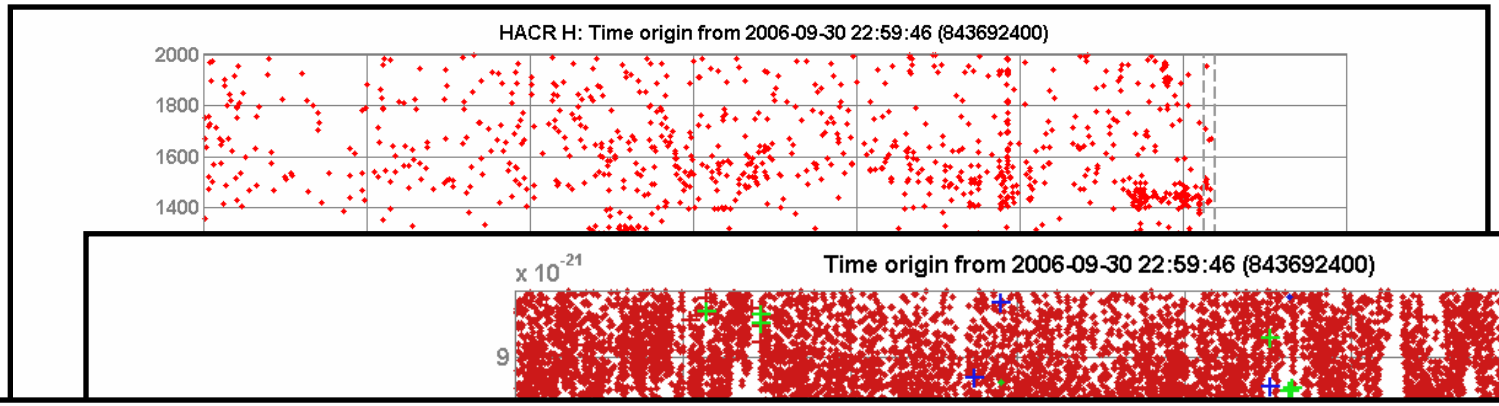
# sensitivity of LSC detectors in S5

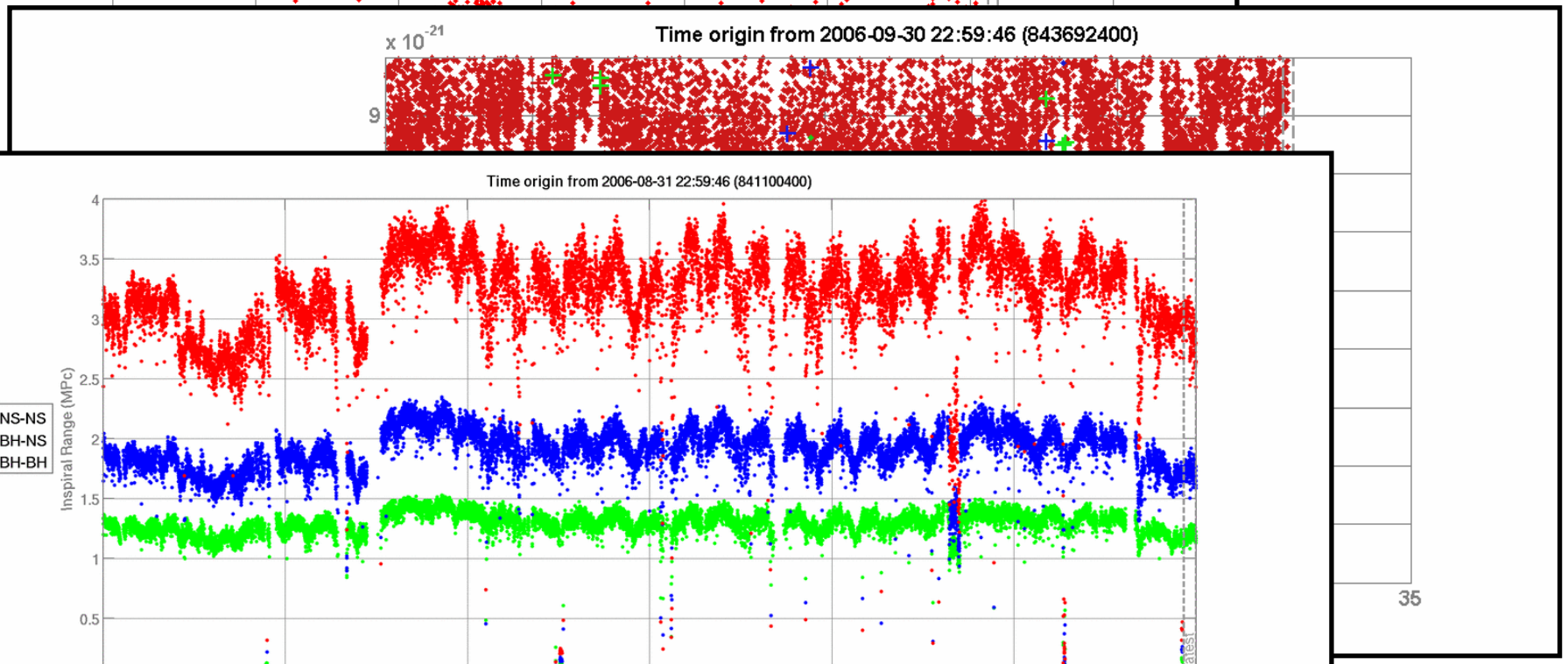


# Noise Projections

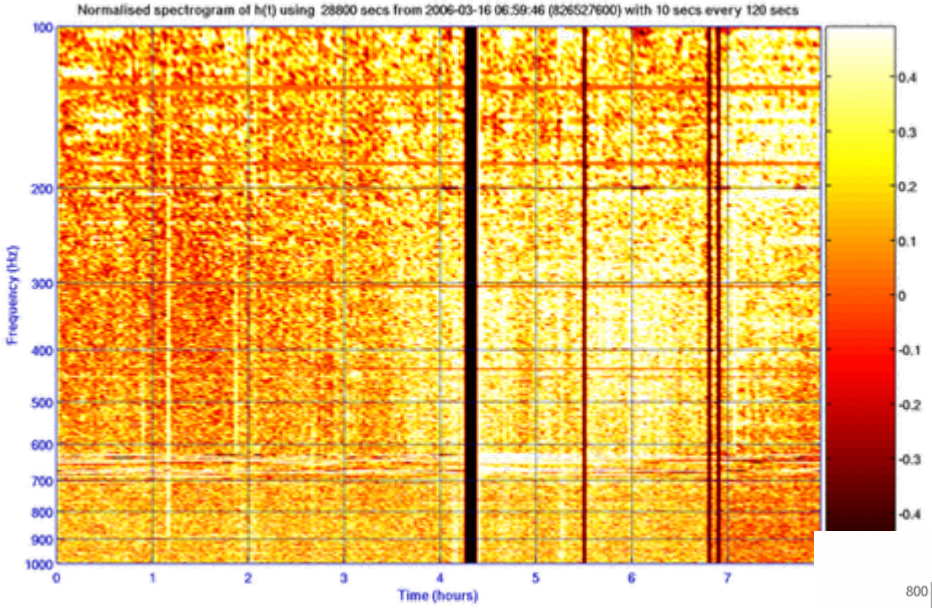


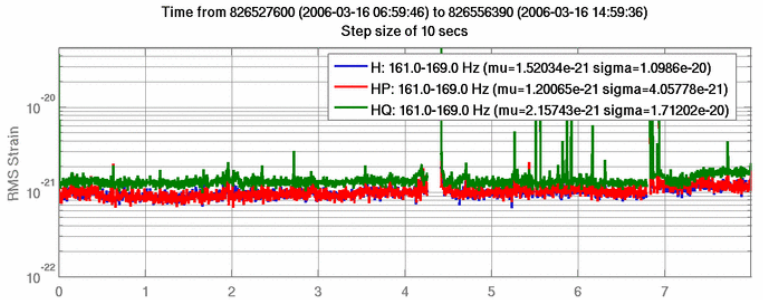
# Stationarity & Glitch Rate

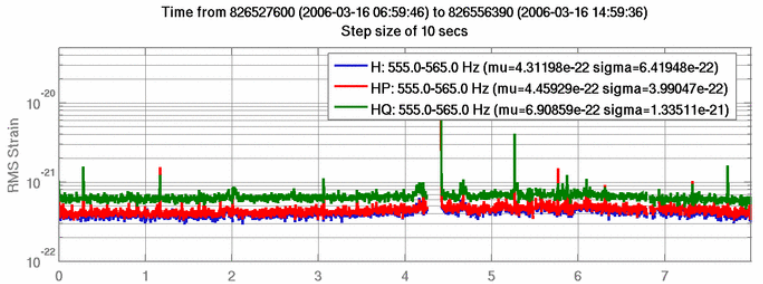


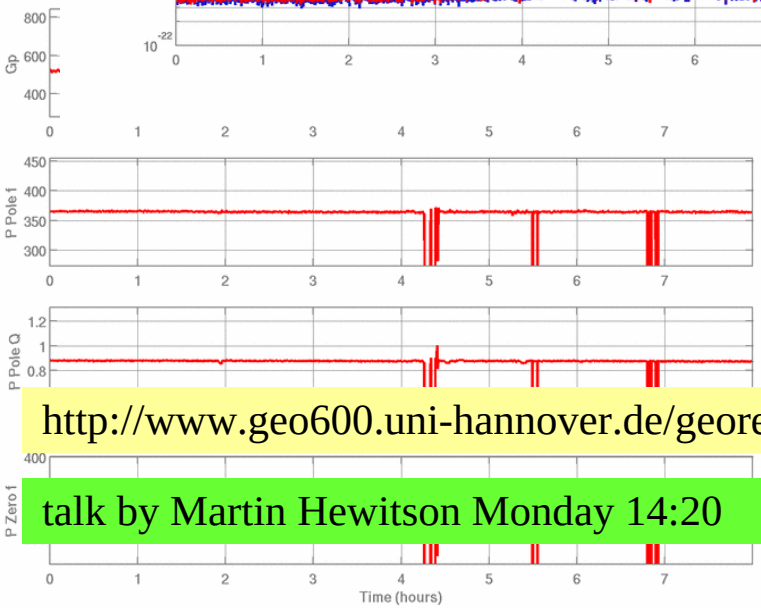



# Detector Characterization




segments of 8 hours:

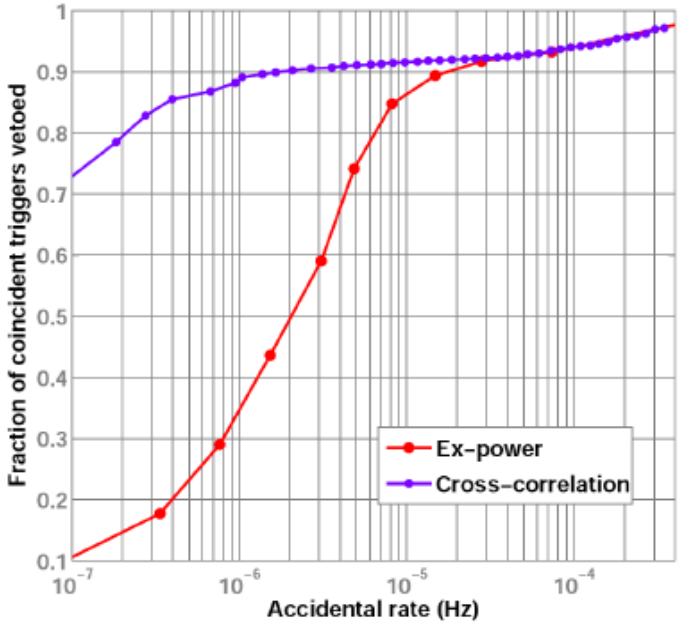
- h(f), best single and max/min
- inspiral monitor
- HARC events (h(f), null-stream, detector channels (13 channels)
- band-limited rms
- calibration quality
- line, glitch, saturation monitor

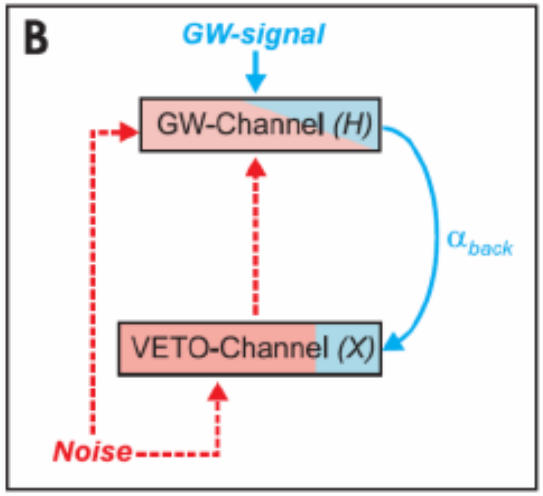
http://www.geo600.uni-hannover.de/georeports/

talk by Martin Hewitson Monday 14:20

'illke

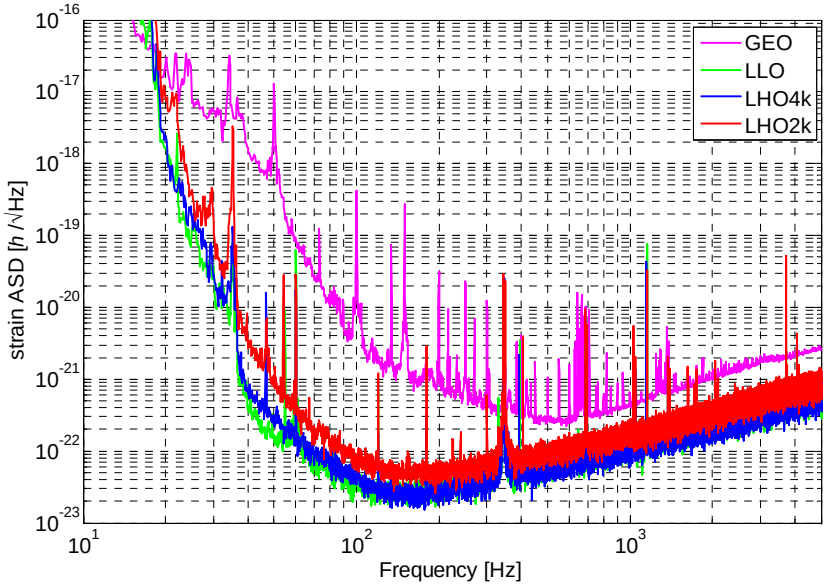
# Veto methods



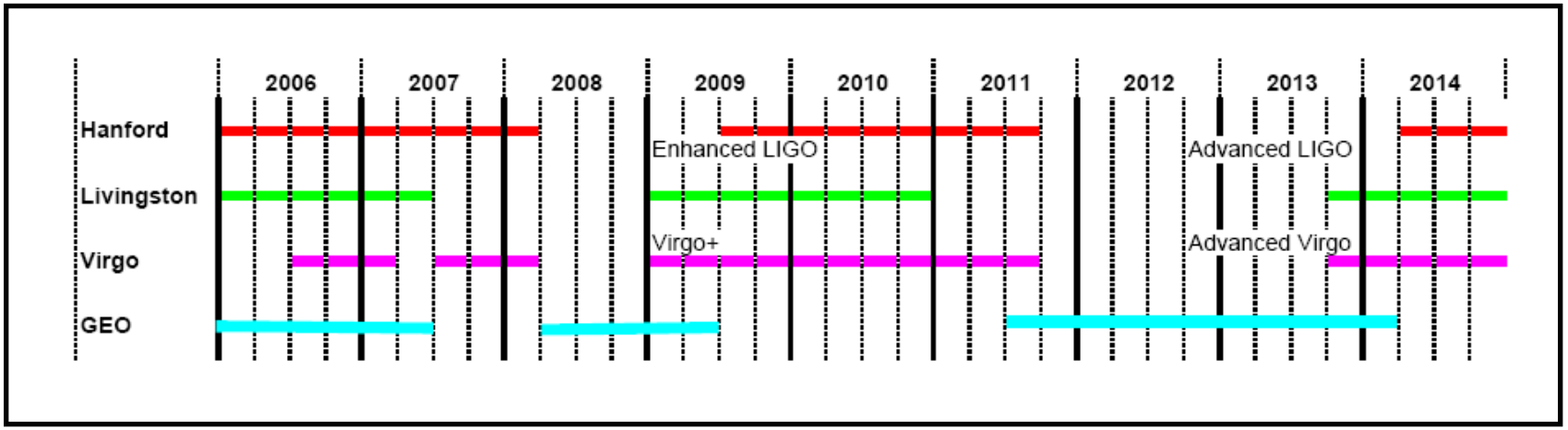




- GEO600 data is most significant in search for burst-like events
- for un-known waveforms the reduction of false alarms is very important
- experimentally reduced glitch rate in detector
- worked on veto strategies and pipelines that use additional detector information (transferfunctions) to make veto “safe”
- ‘GW burst vetoes using known instrumental couplings’
  P. Ajith (Monday 15:00)
- ‘A statistical veto method employing a back-coupling consistency check’
  S. Hild (Monday 15:20)

# GEO meeting Oct: Strategic Decision




- Continue to run GEO600 with L1/H1/H2 (Virgo) in S5 ?
- Concentrate on commissioning break of H1, (H2), L1 and Virgo?
  - improve GEO sensitivity
  - make necessary infrastructure an detector changes before start of L1 downtime to achieve high duty factor
- Start GEO-HF upgrades after S5 ?



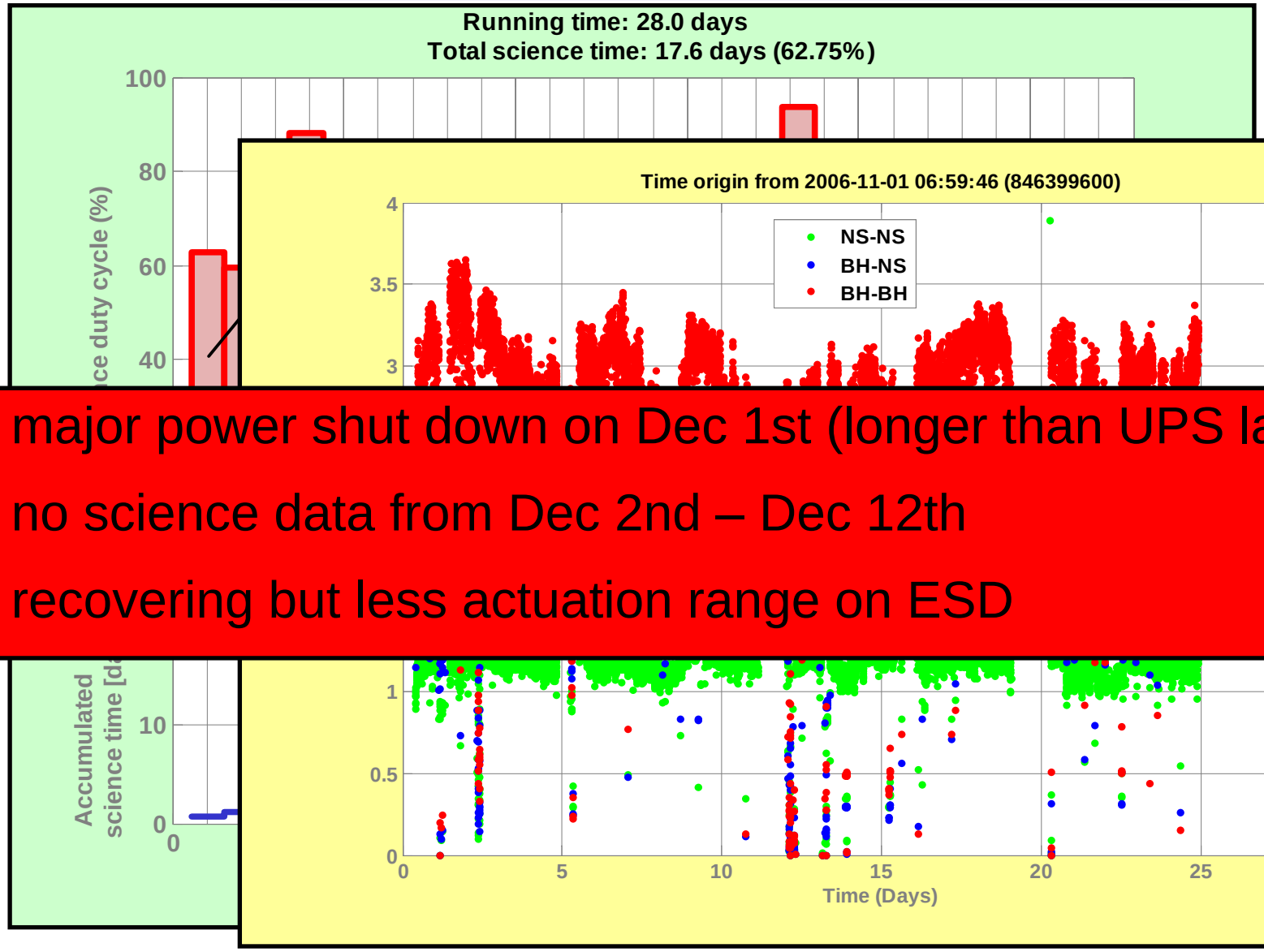
# Strategic Decision – Input

- strong LSC involvement
  - asked data groups how useful GEO in its current sensitivity is during S5
  - discussed options in LSC operations committee
  - asked LIGO directorate for advice
- commissioning team was charged to analyze how GEO could be improved and what “maintenance” work was required to prepare GEO for a long science run in 2008
  - possible benefit
  - risk
  - resources required
  - how useful is this for GEO-HF ?

# decision

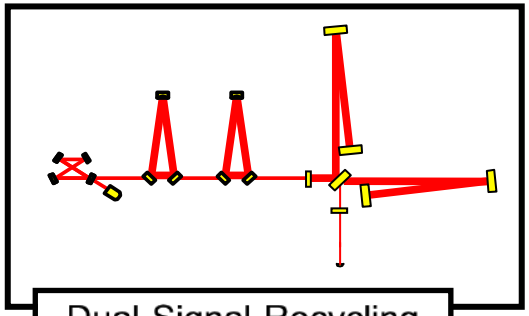
- Investigation 'week' in November
  - Power glitches (2-3 d)
  - Power measurements / shotnoise investigation (2 d)
  - Tuning to higher SR freq. (1 d)
- Time to January:
  - Preparations
  - Glitch investigations
- Commissioning period in Jan. ... +-March (9-12 w)
  - HEPA filter for cleanroom (2 d)
  - MI ESD autoalignment (2 w)
  - Power glitches (1-4 w)
  - Power build-up investigation (2 d)
  - Mains (6 d)
  - TCC venting: scattering, transl. Stages, HV feedthroughs (~3 w)
  - Few more small items (2f-LO, lenses, AC-decoupl., TCOc only if 2.HPD, ...) (~1 w)

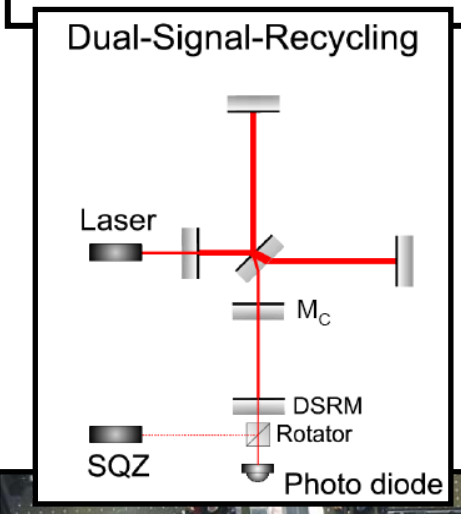
# November Performance




- major power shut down on Dec 1st (longer than UPS last)
- no science data from Dec 2nd – Dec 12th
- recovering but less actuation range on ESD

# Plans of the GEO collaboration






- operate GEO600 / GEO-HF as LSC detector
- LSC data analysis
- laser and suspensions for AdvLIGO (laser for Enh. LIGO)
- contribute to AdvVIRGO design
- R&D and design towards third generation detectors