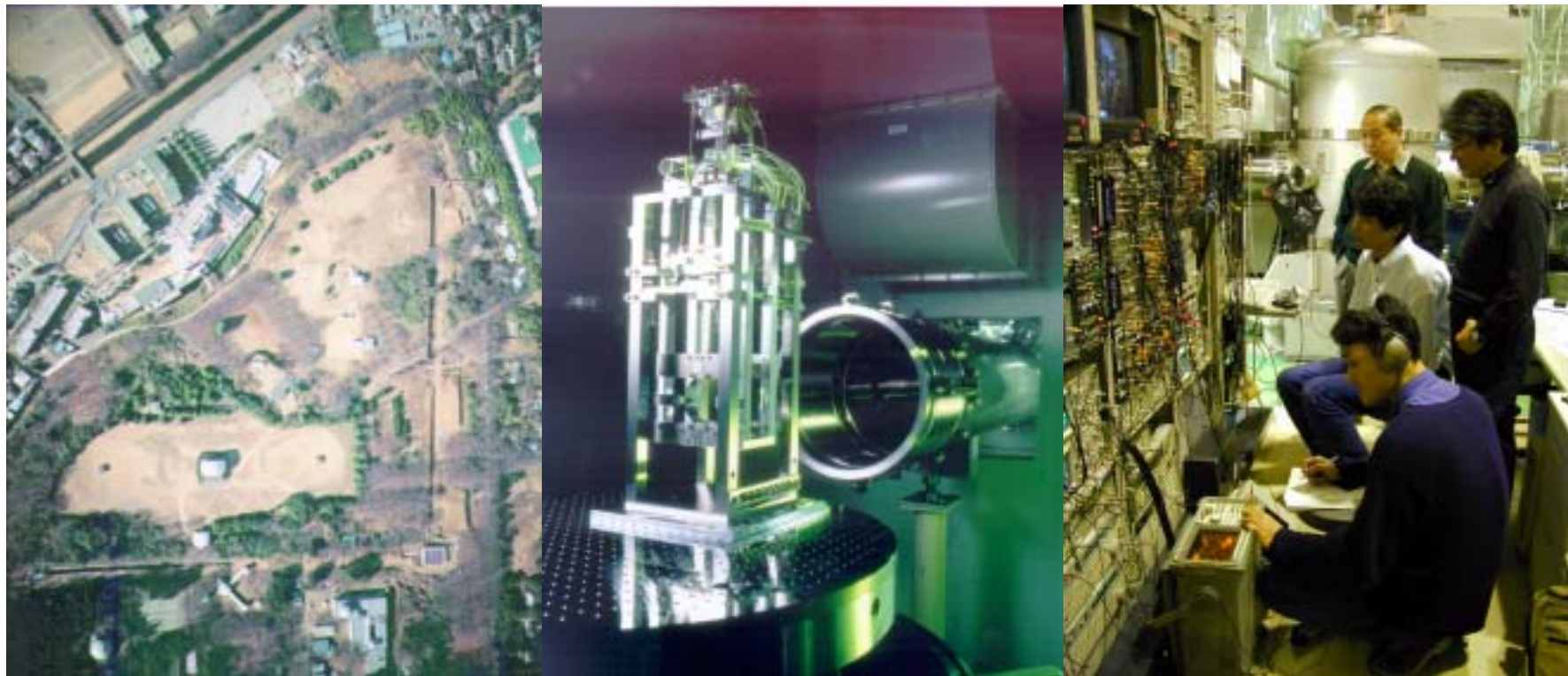


The result of TAMA300



National Astronomical Observatory, The University of Tokyo,
The Institute for Cosmic Ray Research, Institute for Laser Science,
High Energy Accelerator Research Organization, Miyagi University of Education,
Osaka University, Yukawa Institute of Theoretical Physics



Specification



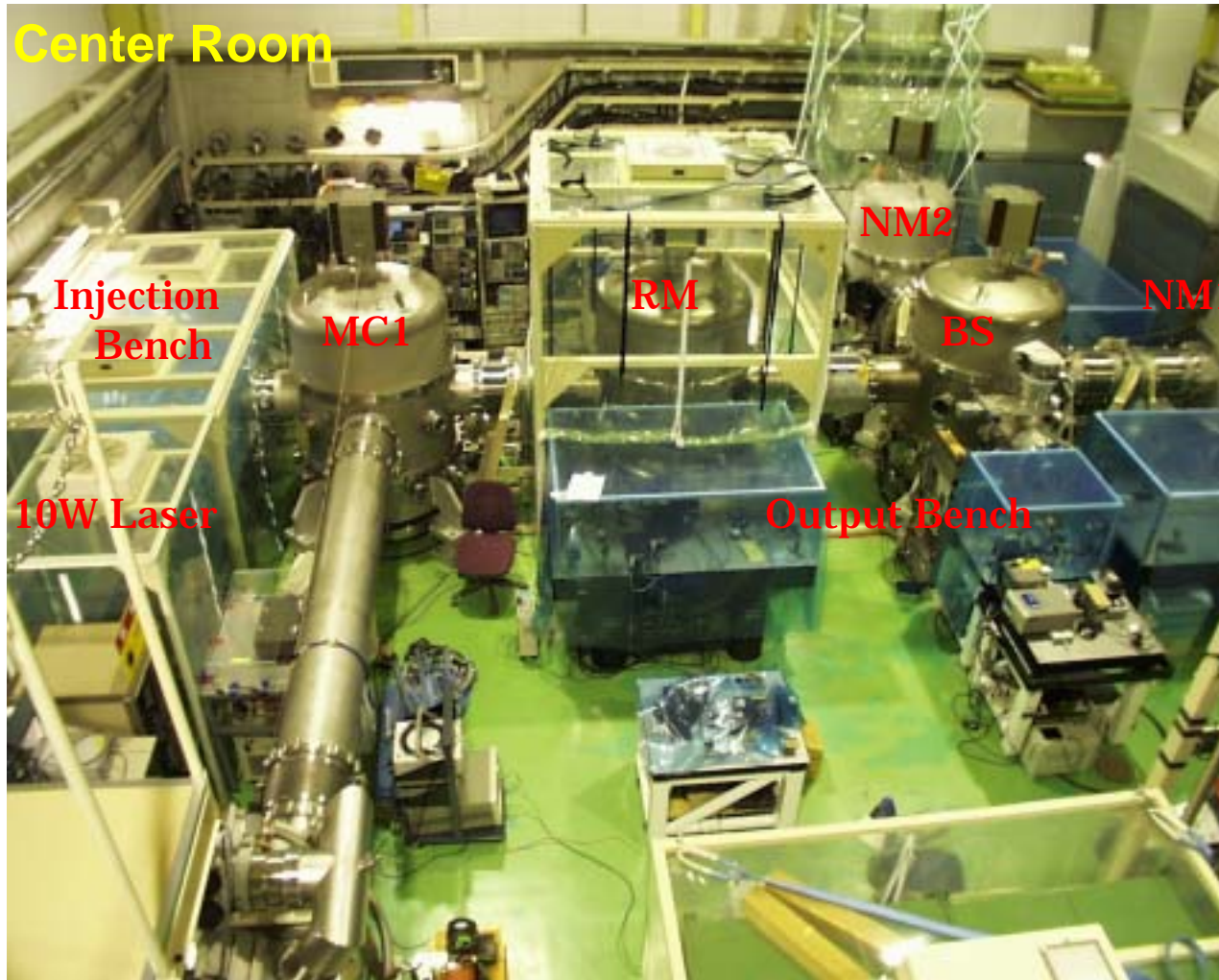
Location	Mitaka Campus of NAOJ (E139.32.21 N35.40.25)
Aimed sensitivity	$h = 3 \times 10^{-21}$ @300Hz
Baseline length	300m
Type of Interferometer	Fabry-Perot Michelson
Finesse of Cavity	520
Laser	Injection-lock Nd:YAG Output:10W, $\lambda = 1,064\text{nm}$
Power Recycling Gain	10
Vacuum	10^{-6}Pa



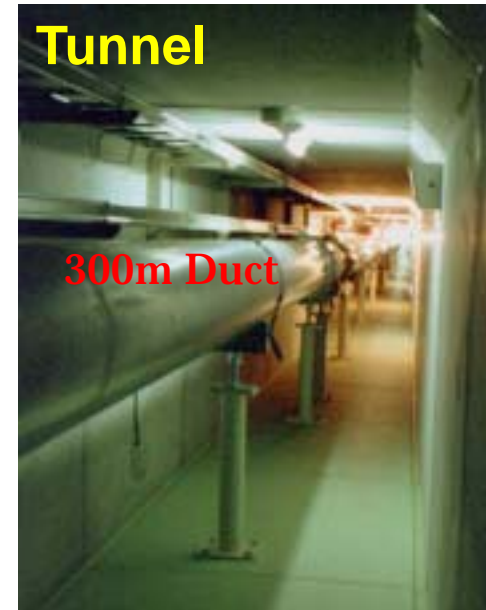
Facility



Center Room



Tunnel



End Room



Vibration Isolation System



3-layers Stack

Isolation $>10^3$ around 300Hz

Vacuum Compatible:

Enclosed rubber with bellows

Double Pendulum

Isolation $>10^5$ around 300Hz

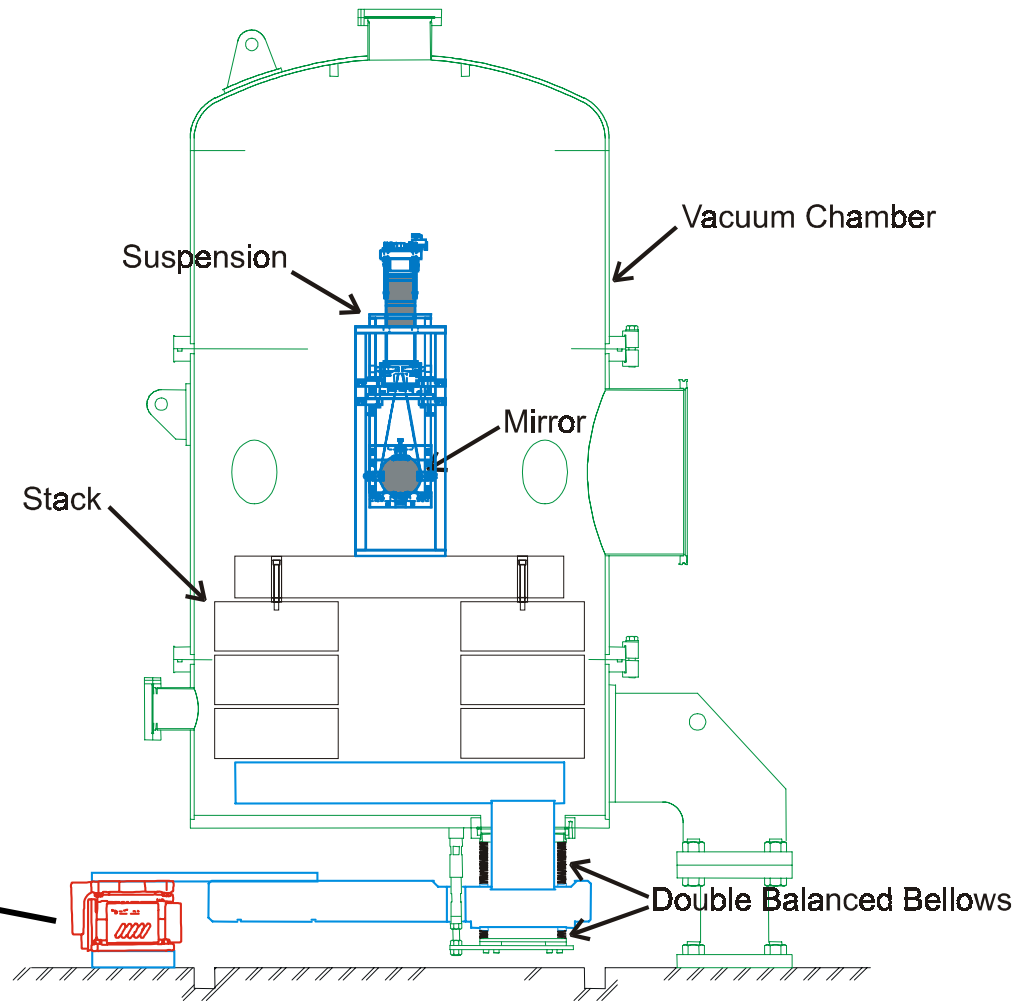
Flexible eddy current damping

Active Isolation

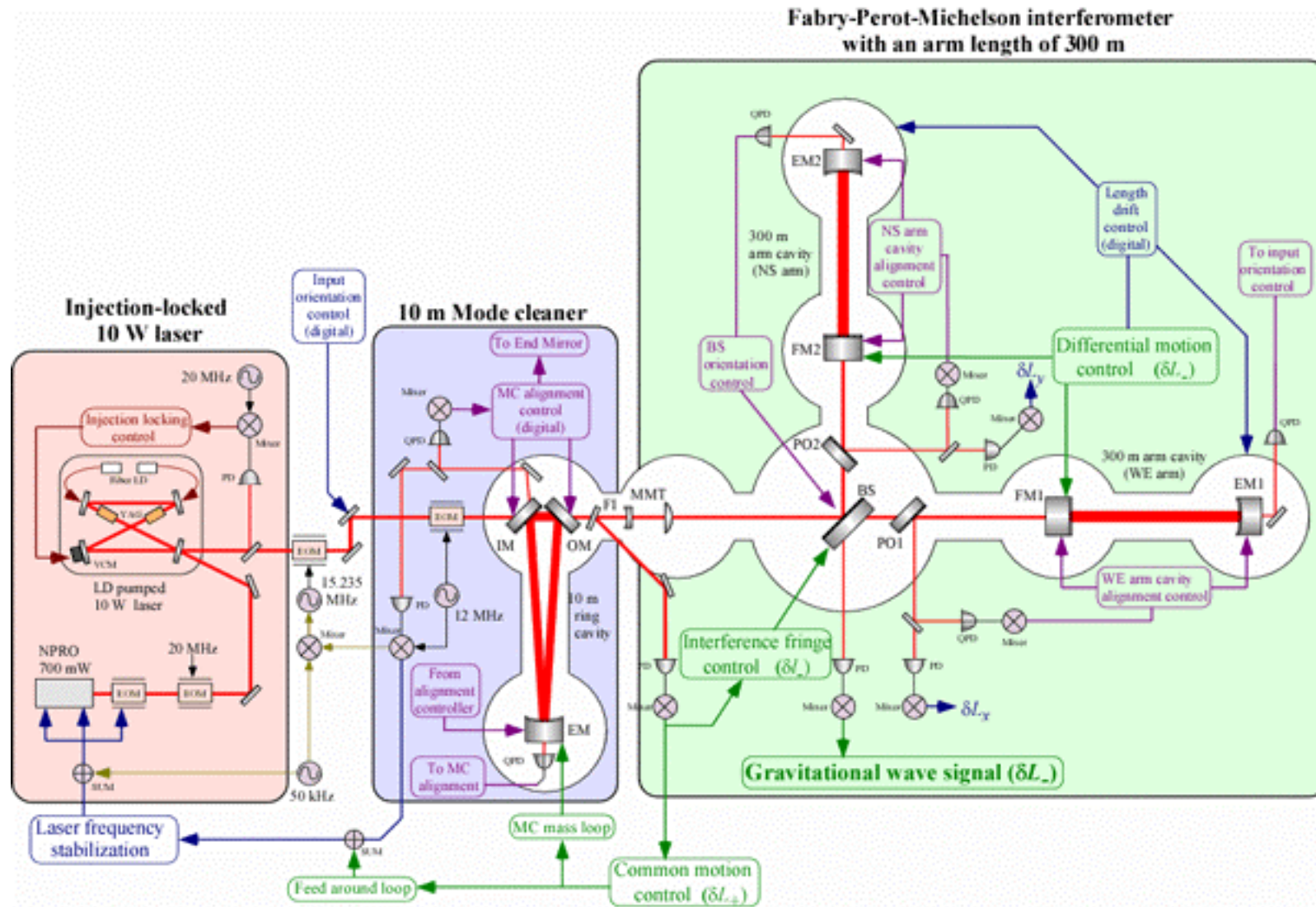
For low frequency ($<10\text{Hz}$)

Commercial pneumatic actuator

Improved RMS displacement



Schematic Diagram of the Interferometer



Light Source



Injection-locked 10W Laser

Master Laser: LD-pumped Nd:YAG laser 700mW(NPRO)

Slave Laser: LD (fiber-coupled)-pumped Nd:YAG laser with VCM

10m Ring-type Mode Cleaner

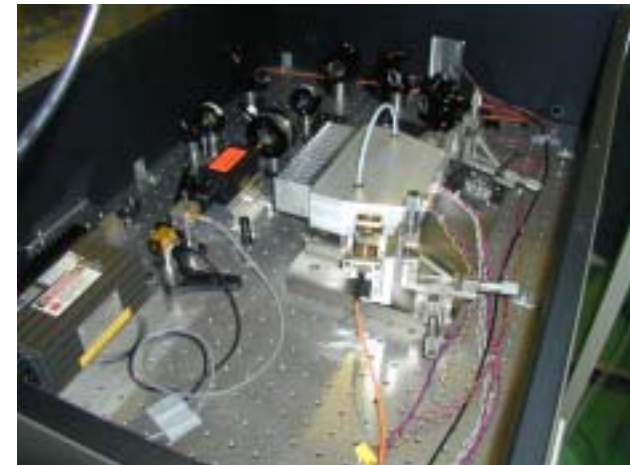
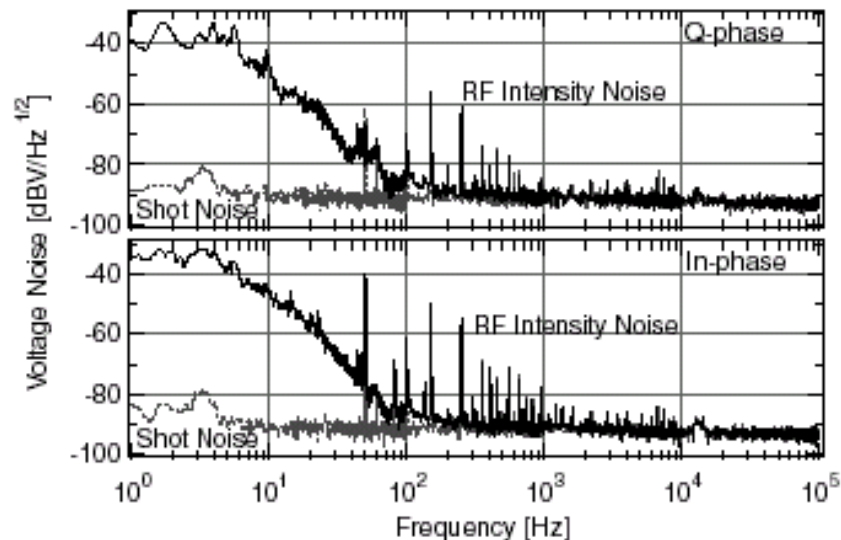
Finesse: 1700

Sidebands (15.235MHz) transmittance: Excess noise free

Achieved Stability

Frequency: $\delta\nu \sim 1 \times 10^{-4} \text{ Hz/Hz}^{1/2}$ around 300Hz

Intensity: $\delta I/I \sim 5 \times 10^{-8} / \text{Hz}^{1/2}$ around 300Hz



Automatic Operation



Devices

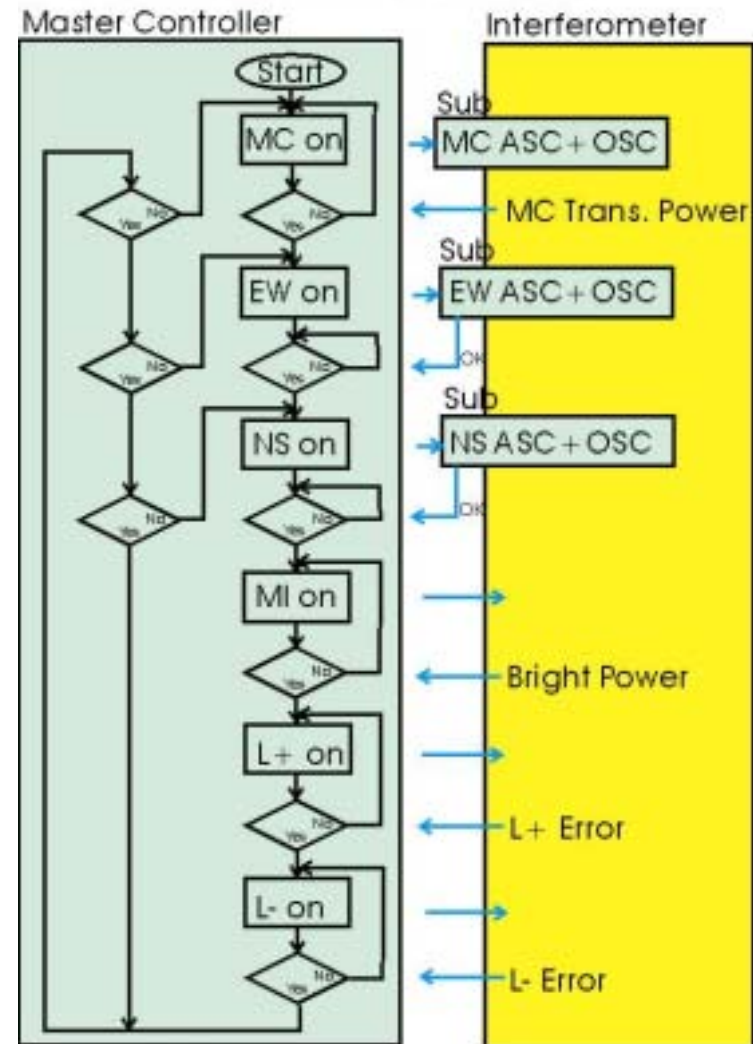
- Master Controller
PC + PCI Board (NI 6025E, NI 6711)
- Sub Controller
Microprocessor (Hitachi H8/3048)
PC + PCI Board (DT 322)

Function

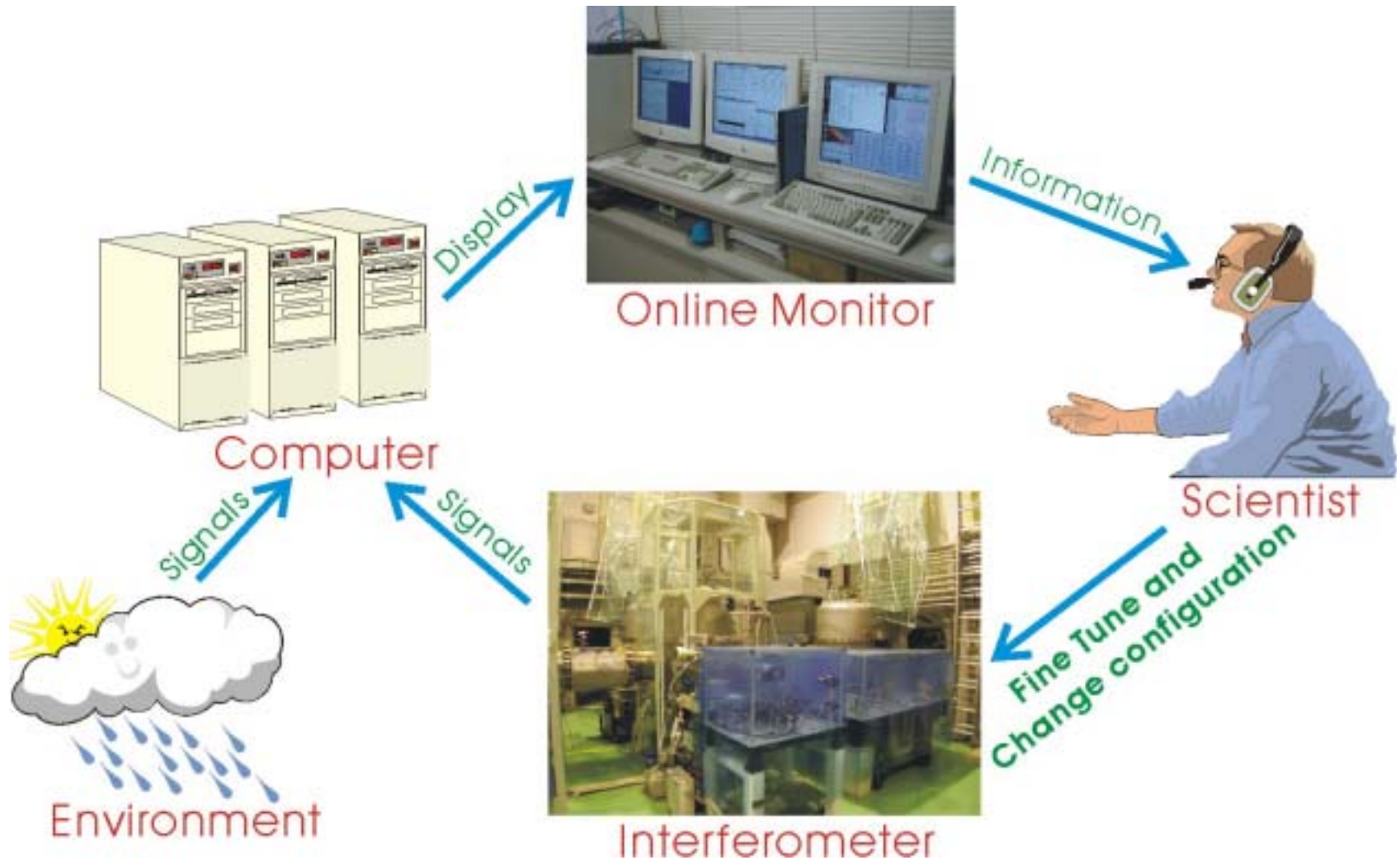
- Sensing of lock status, Switching,
- Gain adjustment, Offset adjustment,
- Digital filtering



Automatic Operation for TAMA300



Observation

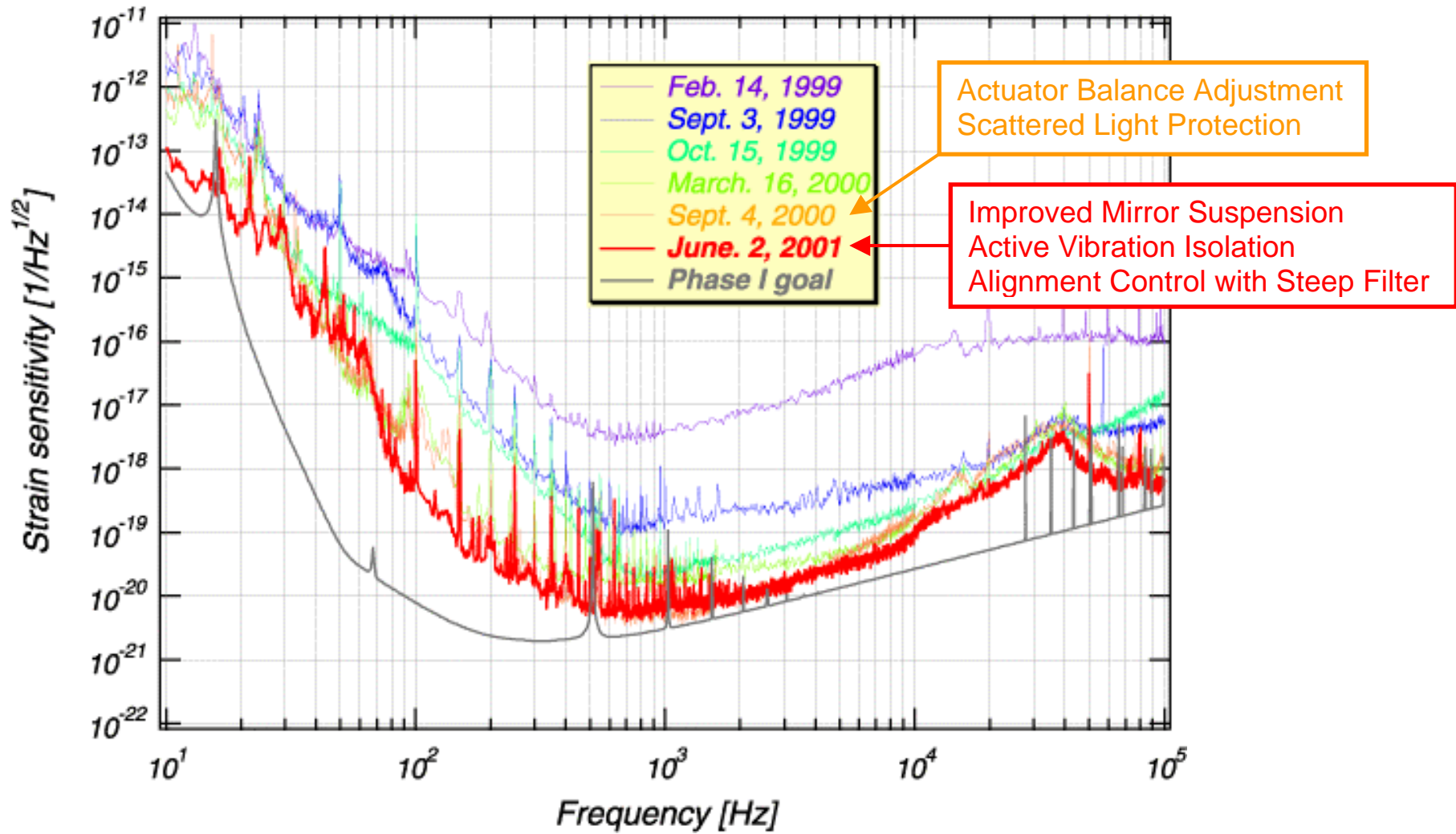


7 years of TAMA300 (1995-2002)



1995		Construction started
1997	11/29	300m cavity locked
1998	5/18-23	Absolute-length measurement of 300m cavity <i>Appl. Opt. 38, 2848-2856, 1999</i>
	9/18	Operation of Fabry-Perot Michelson Interferometer succeeded
1999	5/22	Operation of FPMI with 10W laser succeeded
	8/6-7	Data Taking 1 (11 hours)
	9/17-20	Data Taking 2 (31 hours) <i>Phys. Rev. D63, 062001.1-5, 2001</i>
2000	4/20-24	Data Taking 3 (13 hours)
	8/14	Best sensitivity (World record) $h = 5 \times 10^{-21} \text{ /Hz}^{1/2}$ <i>Phys. Rev. Lett. 86, 3950-3954, 2001</i>
	8/21-9/4	Data Taking 4 (167 hours)
2001	3/2-8	Data Taking 5 (111 hours)
	8/1-9/20	Data Taking 6 (1038 hours)
	12/25	Operation of Power Recycled FPMI succeeded

Sensitivity Improvement

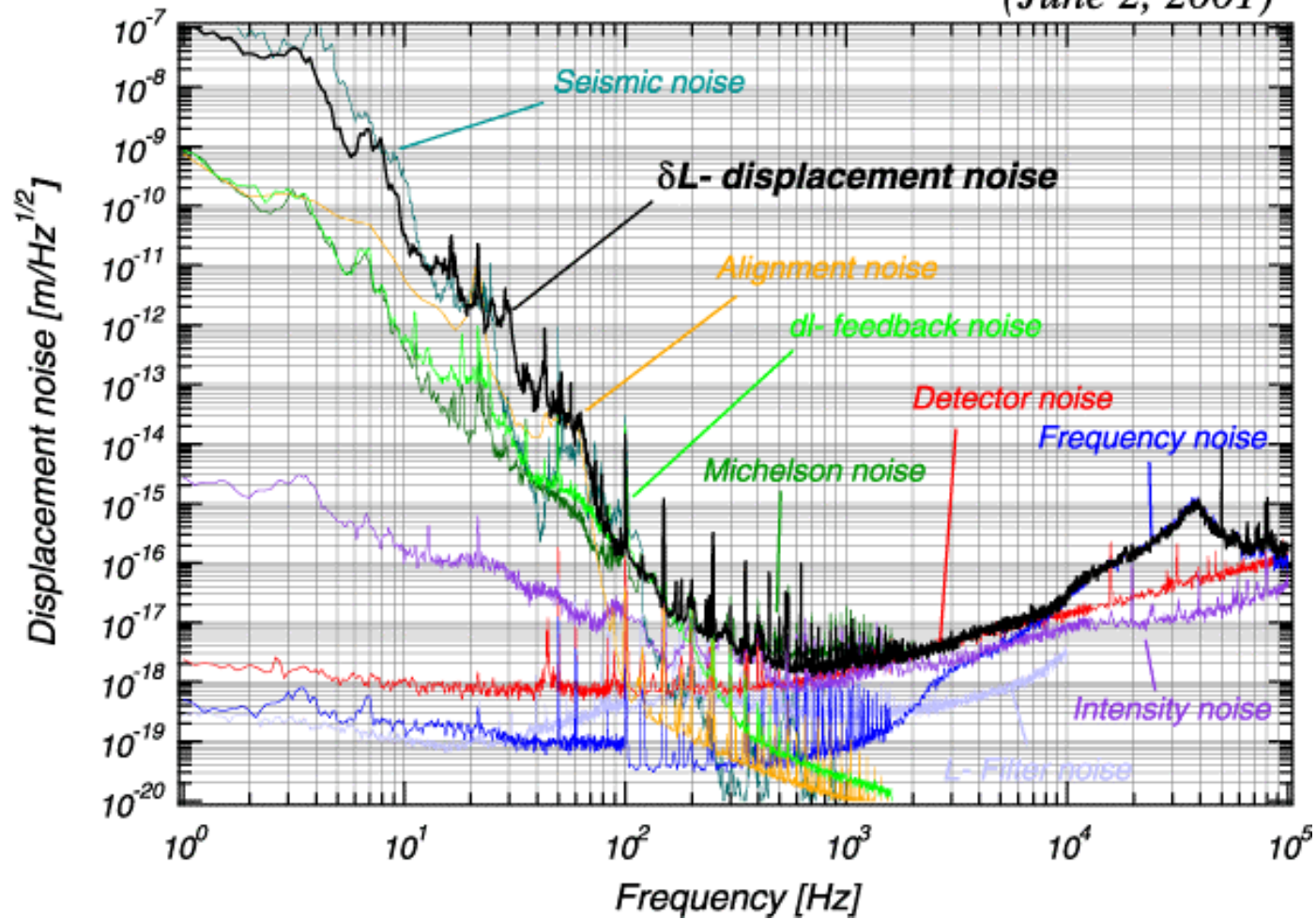


Noise Budget



Displacement noise level of TAMA300

(June 2, 2001)



Data Taking 6

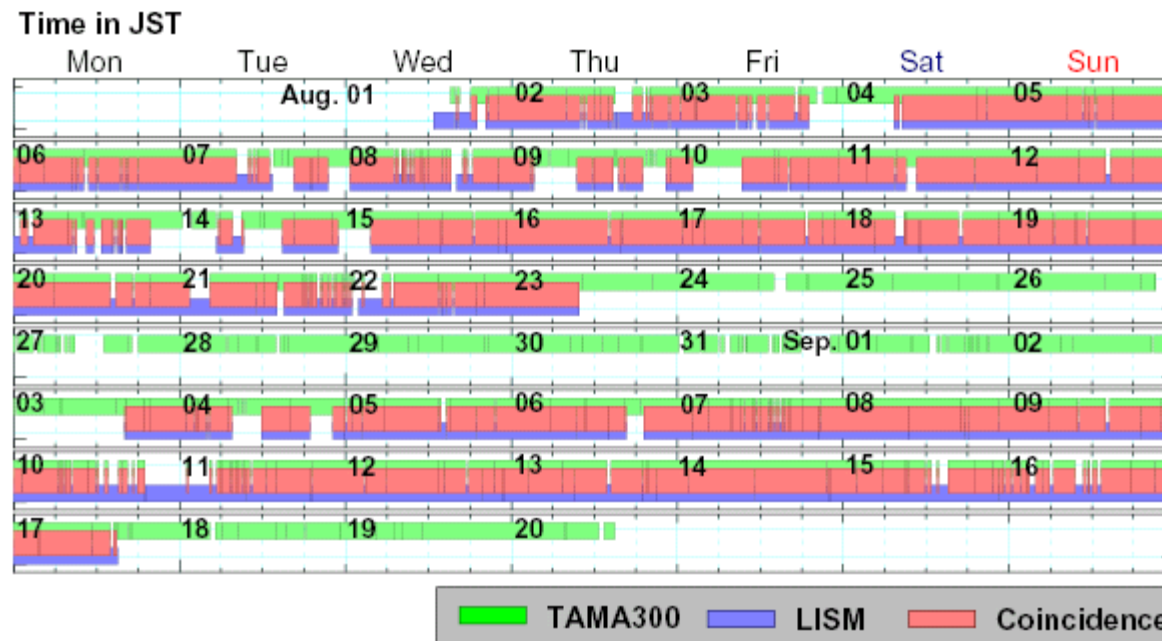


Summary

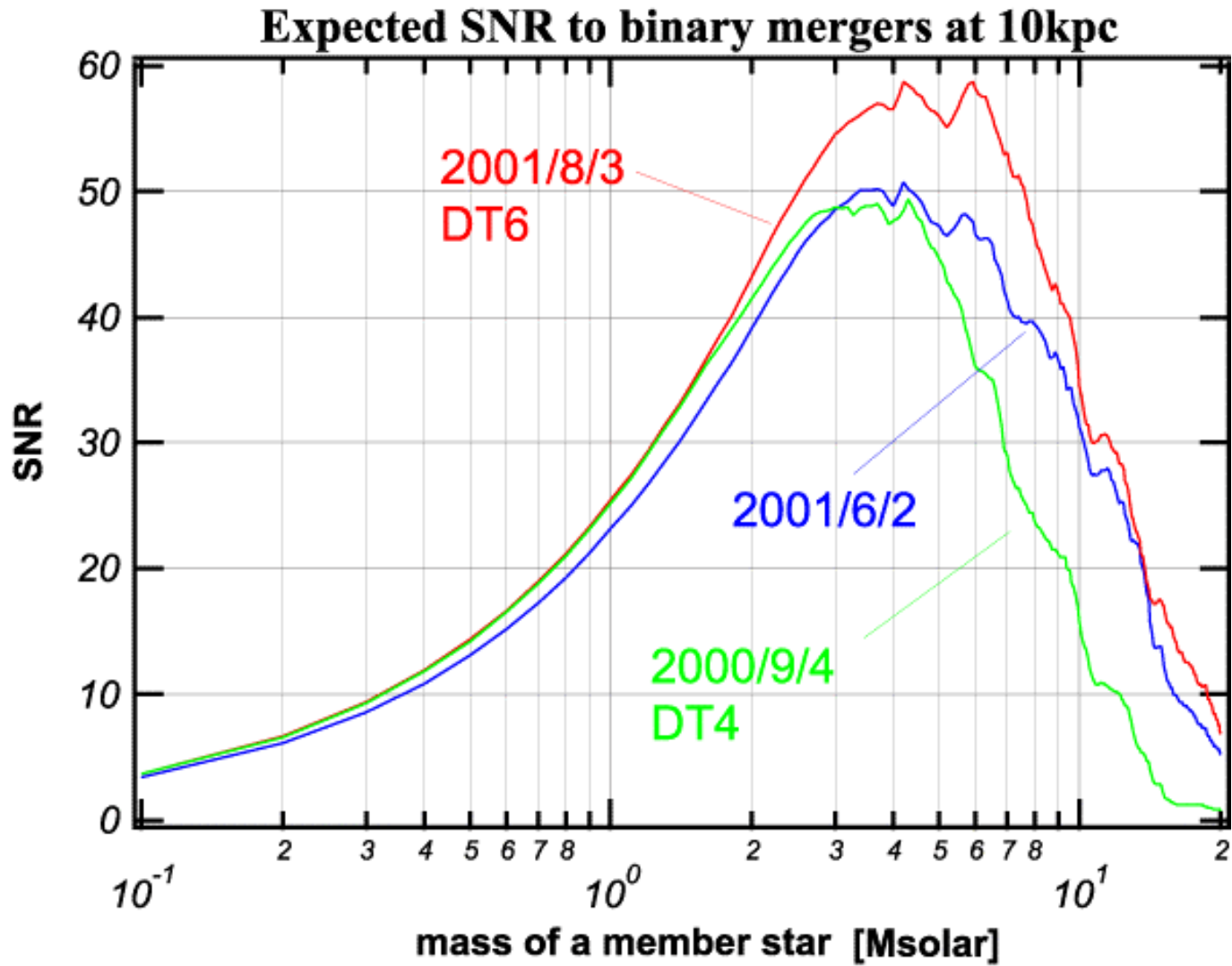
Period **Aug. 1 ~ Sep. 20, 2001 (1200 hours)**
Total Observation Time **1038 hours**
Duty Cycle **86.5%**
Shift Participants **65 people**

Coincidence Run with LISM (20m interferometer in Kamioka)

Overlap Locking Time **~700 hours**



Expected SNR



Future Plan



Power Recycling

Now going (G=4)

High gain (G=10) in 2002

Observation

Coincidence run with LIGO in 2002
with GEO, VIRGO, ...

Seismic Attenuation System (SAS)

For low frequency (0.1~10Hz)

R&D with Caltech

Installation in 2004

High Power Laser

More than 10W

R&D with Adelaide University

Installation in 2005

