Introduction to Vibration Isolation System

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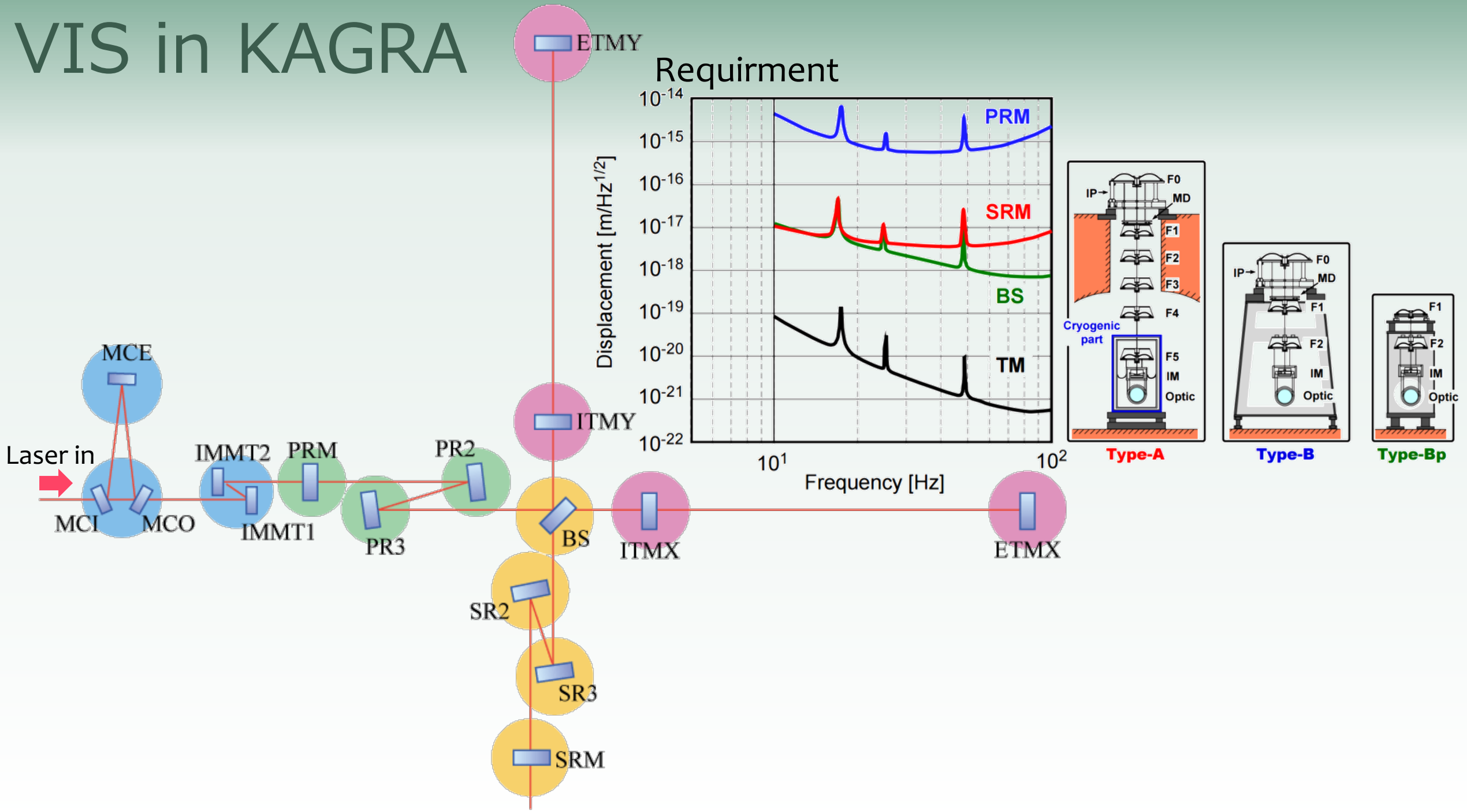
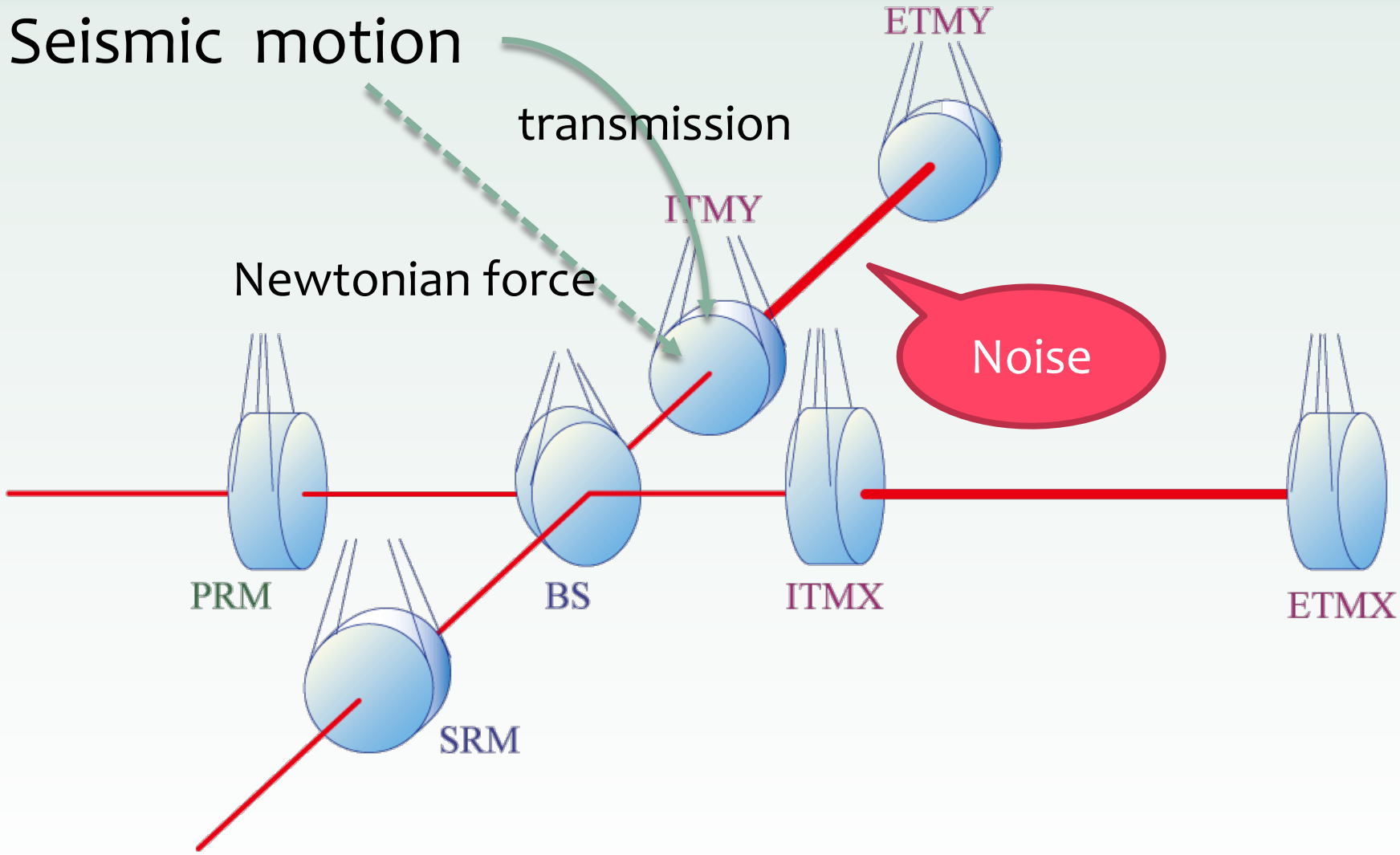
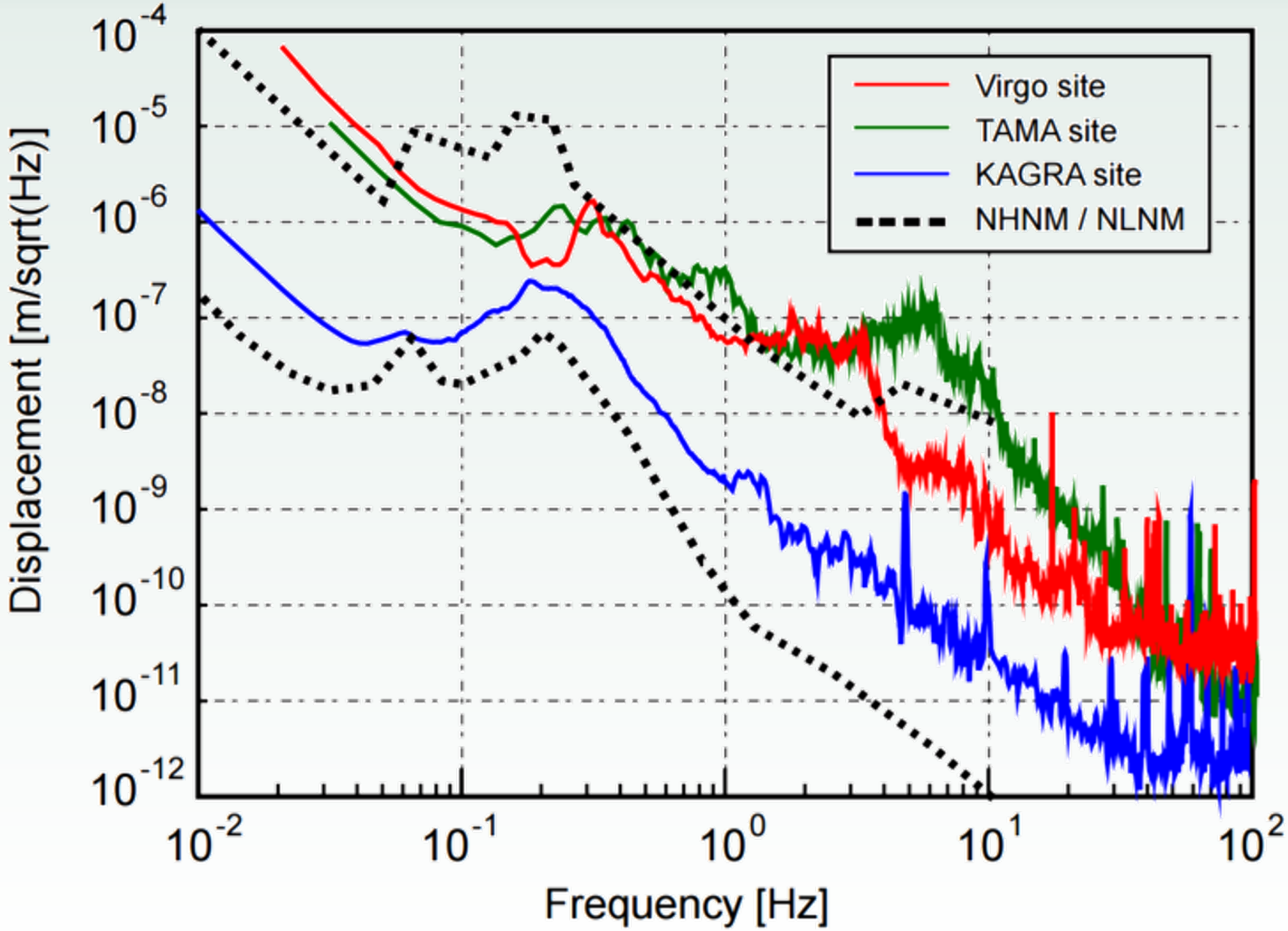
VIS in KAGRA


ETMY
ITMY
MCE
Laser in
MCI
MCO
IMMT2
IMMT1
PRM
PR3
PR2
BS
ITMX
ETMX
SR2
SR3
SRM
Requirment
Displacement [m/Hz^1/2]
10^-14
10^-15
10^-16
10^-17
10^-18
10^-19
10^-20
10^-21
10^-22
PRM
SRM
BS
TM
10^1
10^2
Frequency [Hz]
IP
F0
MD
F1
F2
F3
F4
Cryogenic part
F5
IM
Optic
Type-A
Type-B
Type-Bp

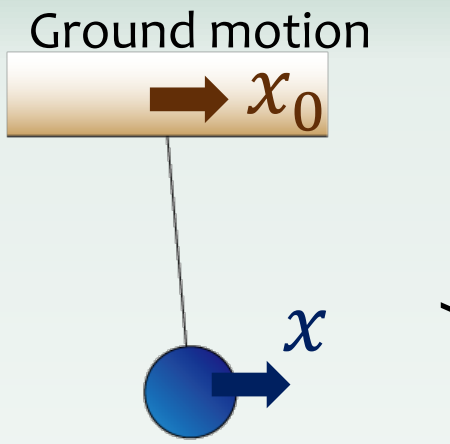
How do we reduce the mirror motion?

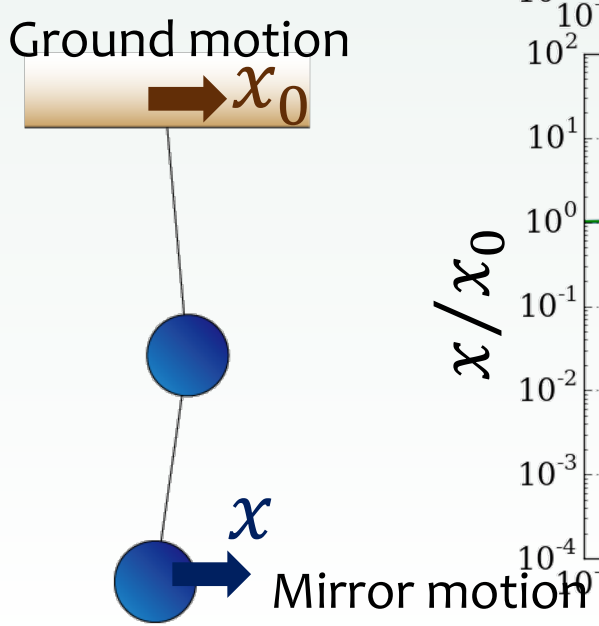


Choose quiet site

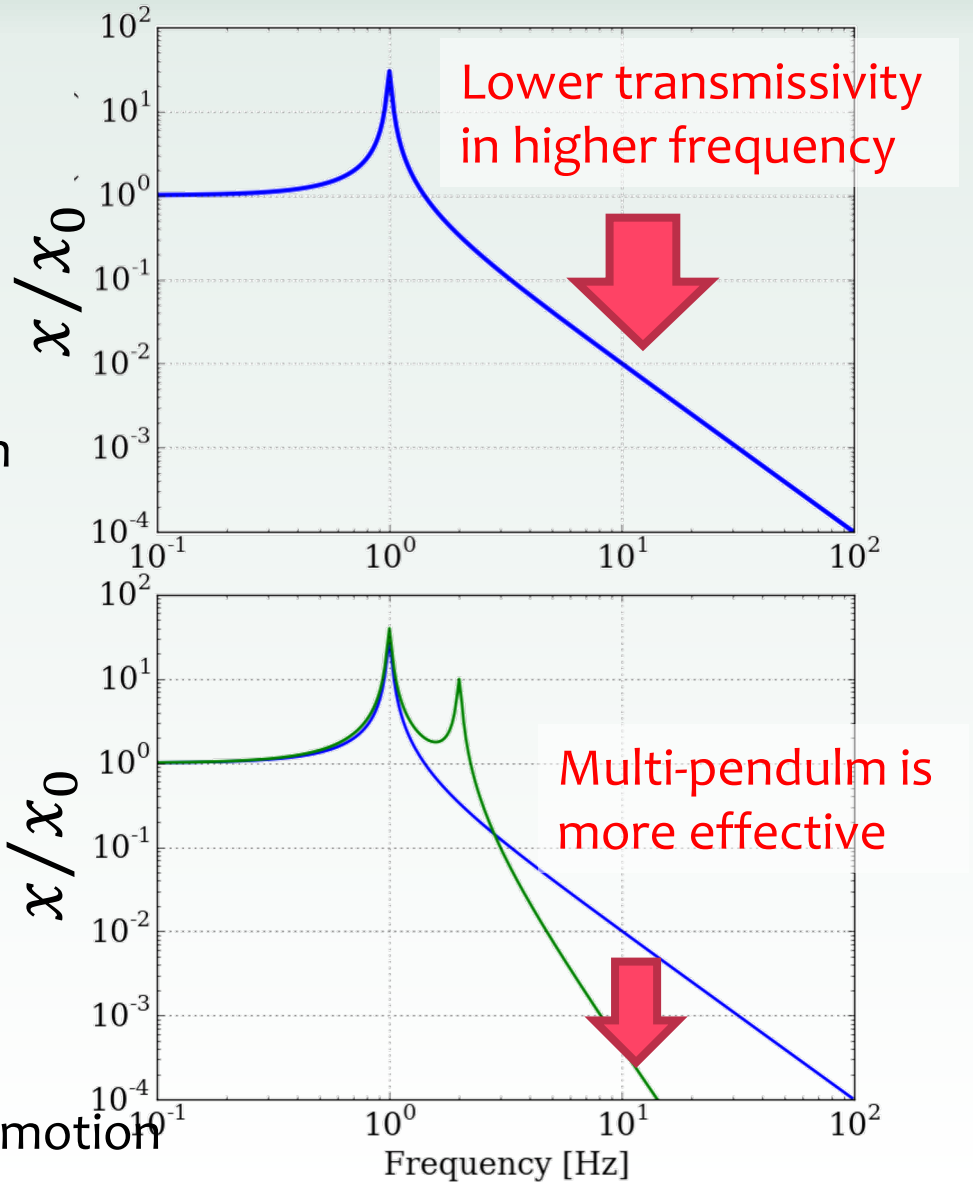


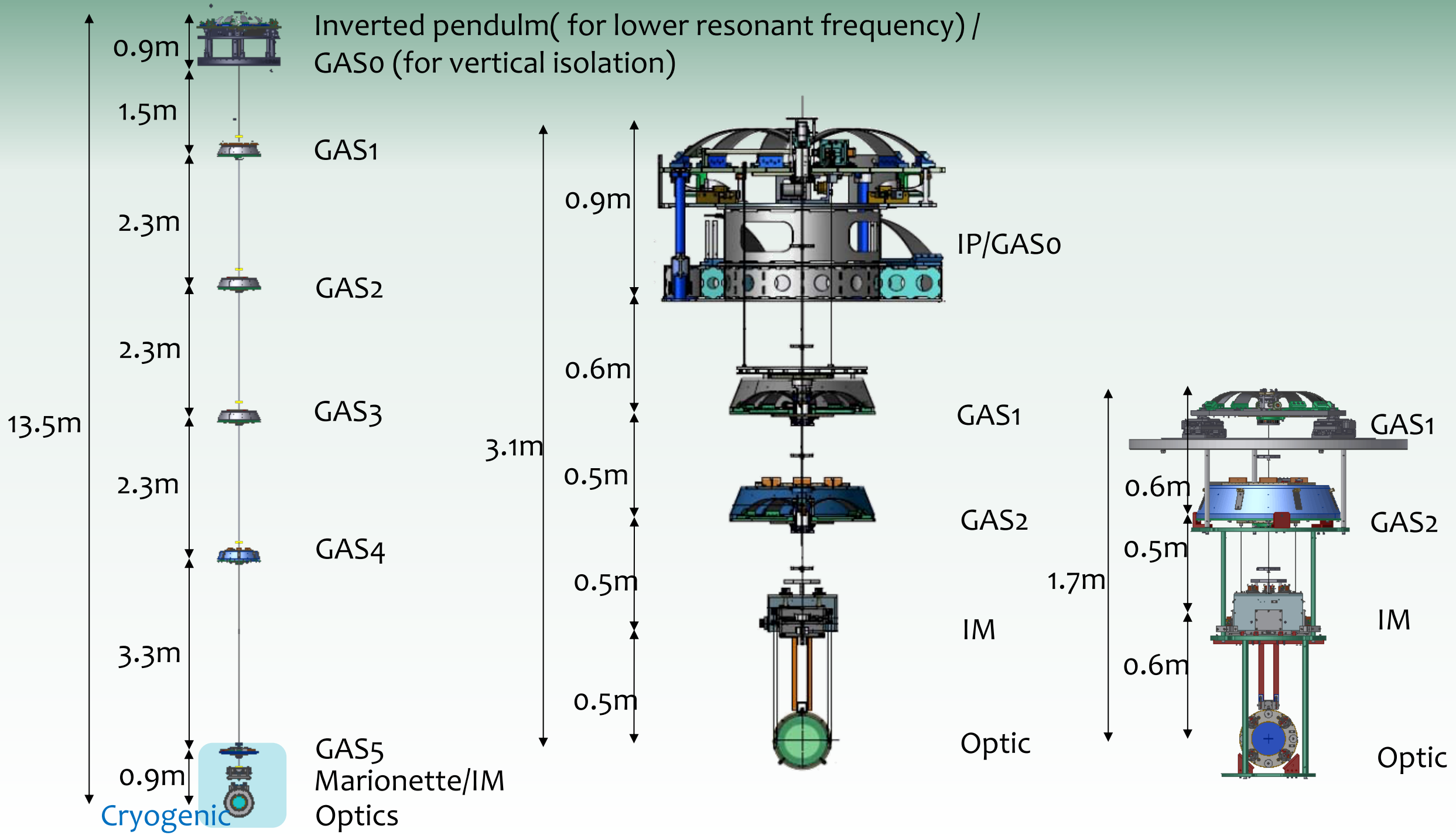
Vibration isolation by pendulm

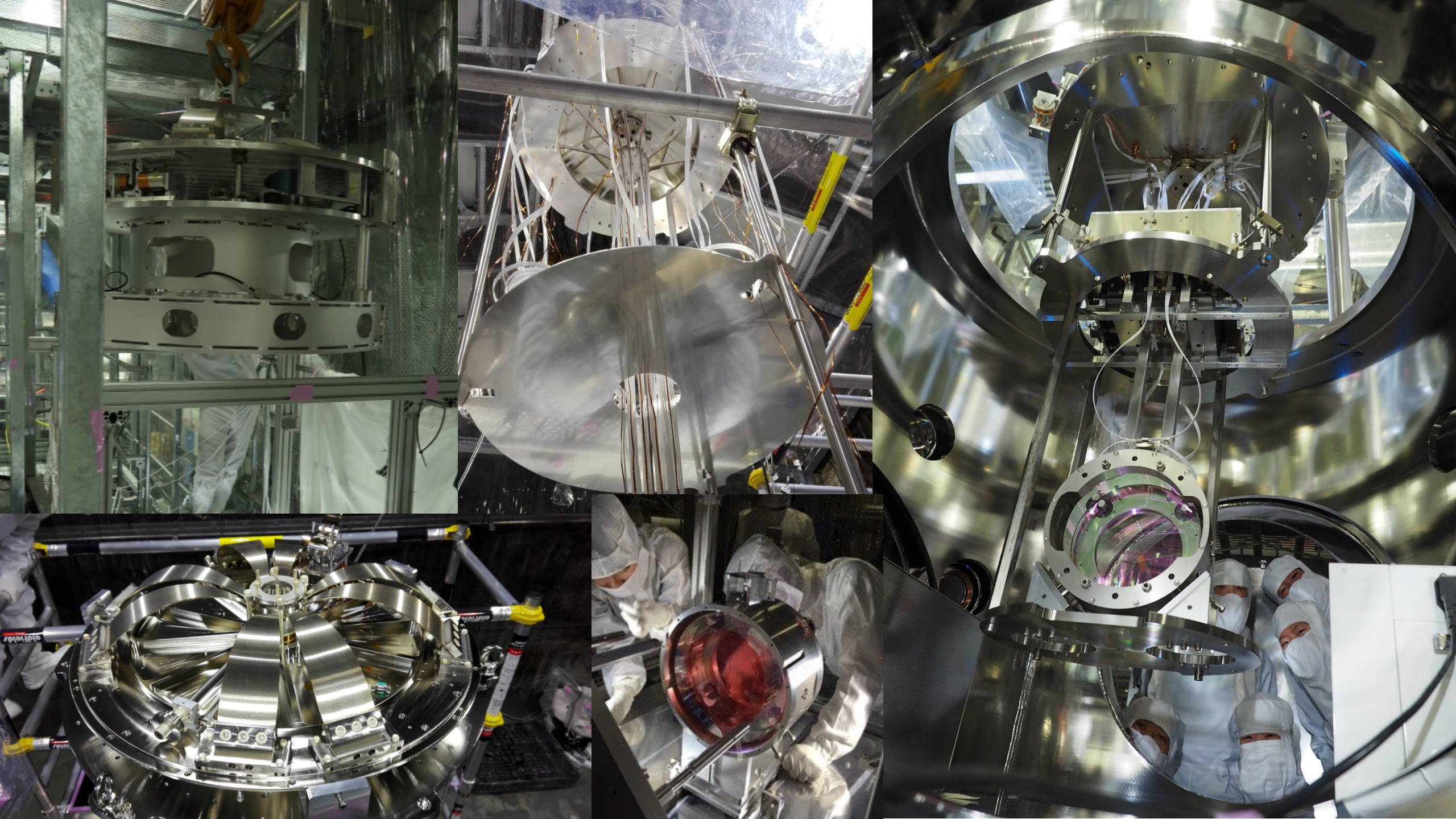




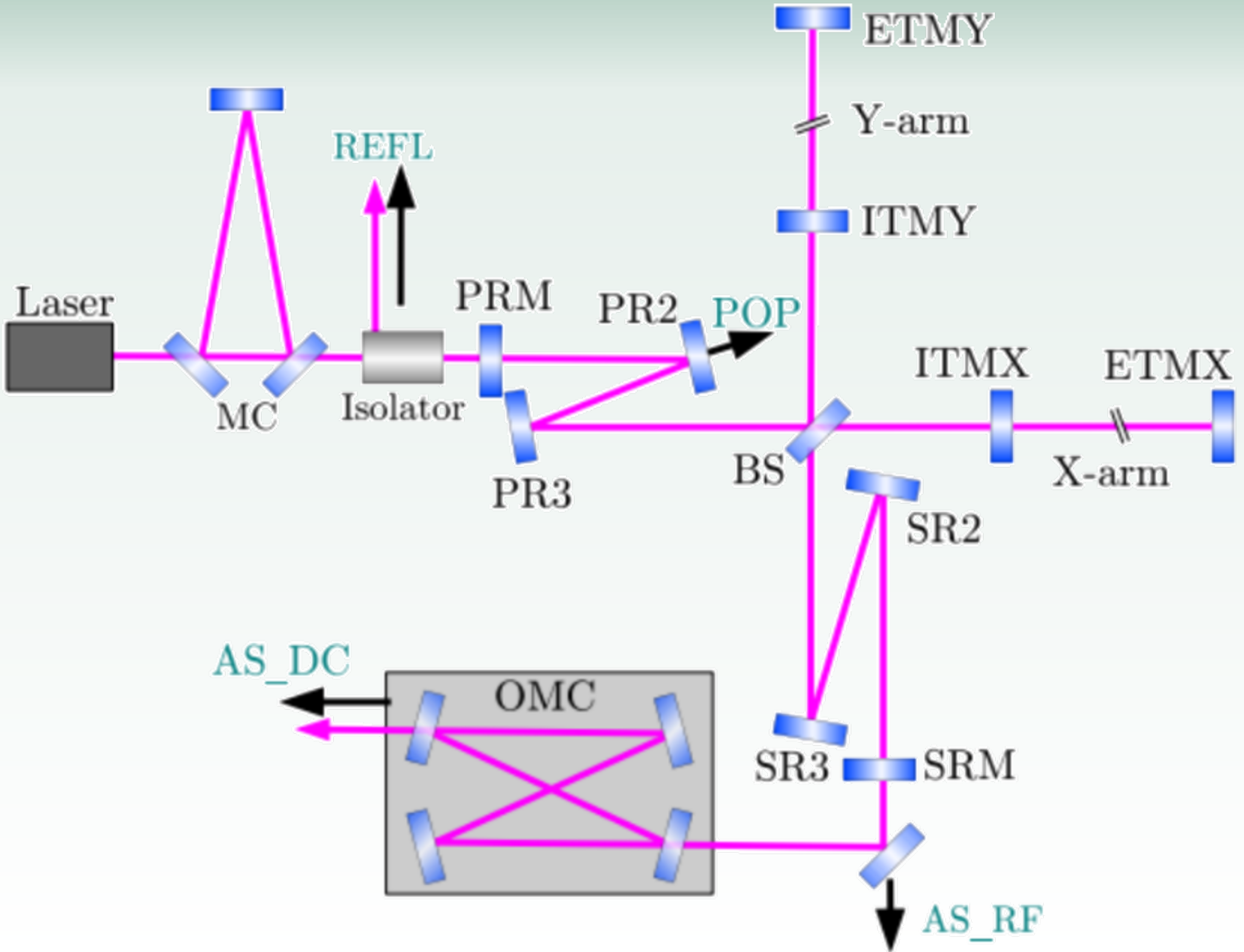
Transfer function from ground to mirror




Inverted pendulm(for lower resonant frequency) /
GAS0 (for vertical isolation)
13.5m
0.9m
1.5m
2.3m
2.3m
2.3m
3.3m
0.9m
GAS1
GAS2
GAS3
GAS4
GAS5
Marionette/IM
Optics
Cryogenic
3.1m
0.9m
0.6m
0.5m
0.5m
0.5m
IP/GAS0
GAS1
GAS2
IM
Optic
1.7m
0.6m
0.5m
0.6m
GAS1
GAS2
IM
Optic



Interferometer as GW detector

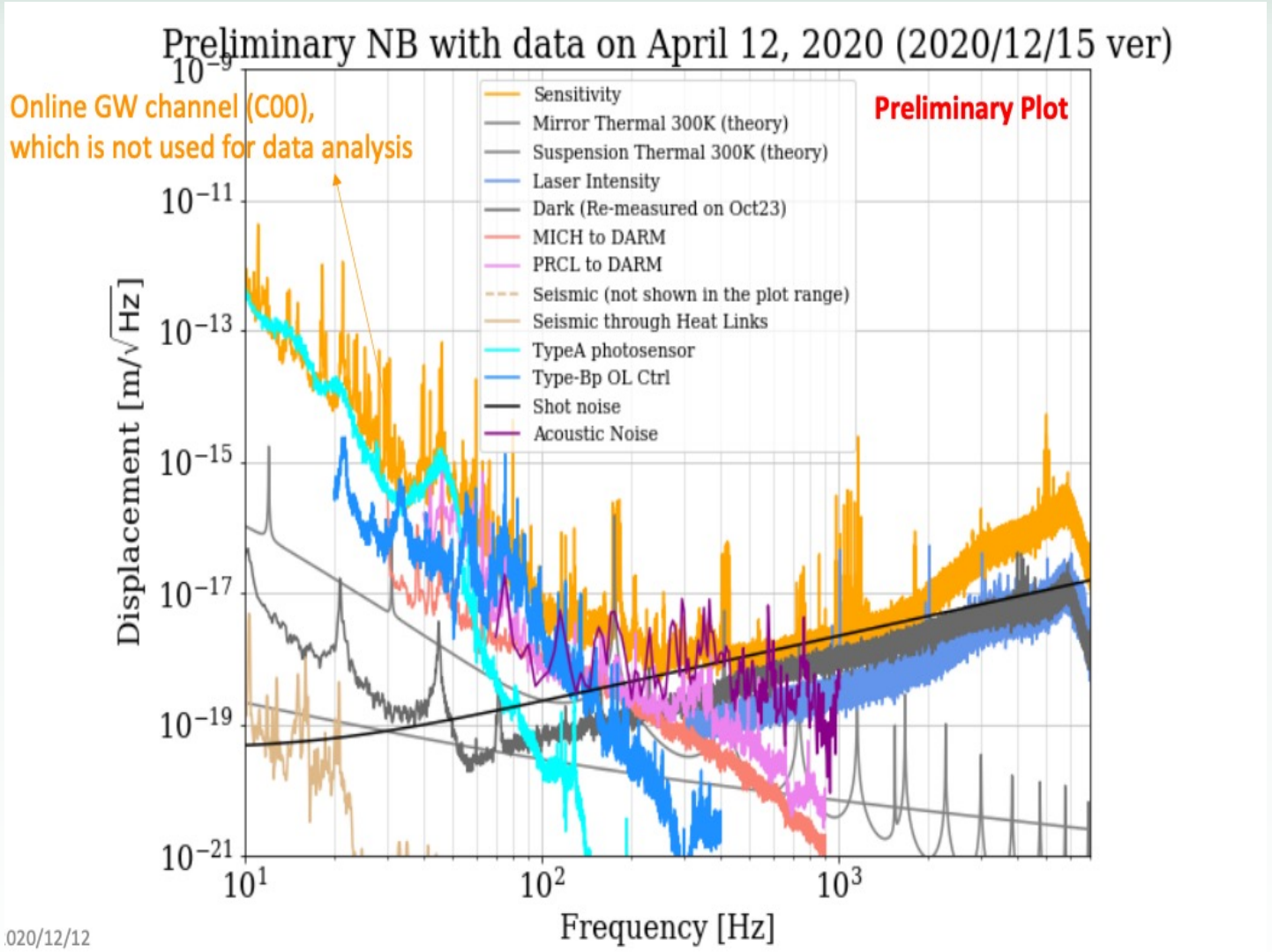


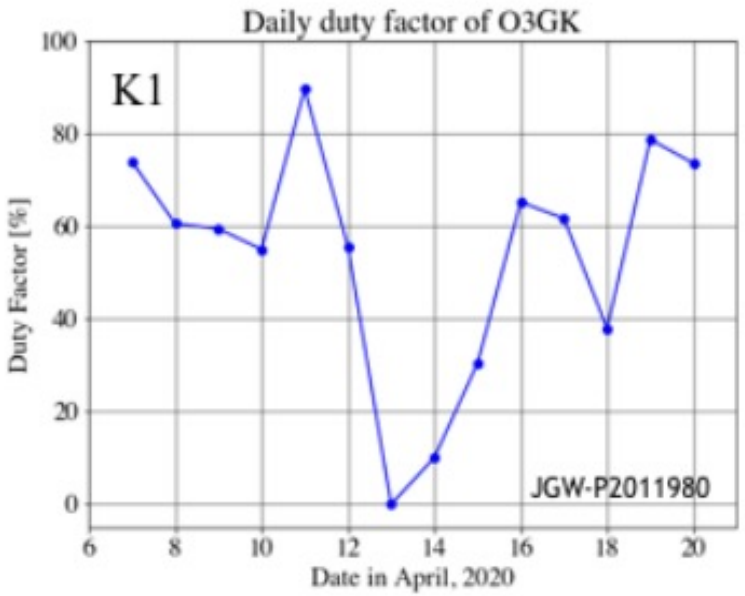
VIS as the very low noise actuator

Low noise actuator

How quickly do we damp the pendulum?
How do we provide low control noise?
How do we provide stable VIS operation?

Current performance of KAGRA





	Observation Time [s]	Duty Factor
GEO	940133 (11 days)	80%
KAGRA	628135 (7.3 days)	53%
Coincident	551340 (6.4 days)	47%

from Tagoshi-san material [?]

Research topics

VIS（Vibration Isolation System）

Sensor Development

- Development of new local sensor with high-sensitivity, wide-range and cryogenic use, replaced from OSEM and photo-sensor
- Development of new local sensor by using optical comb technology
- Development of inertial sensor (seismometer, accelerometer)

Performance Improvement

- Optimization of control, development of active filter
- Control of low frequency range by using GIF
- Improvement of lower frequency performance of IP
- Development of light and easy maintenance GAS filter