

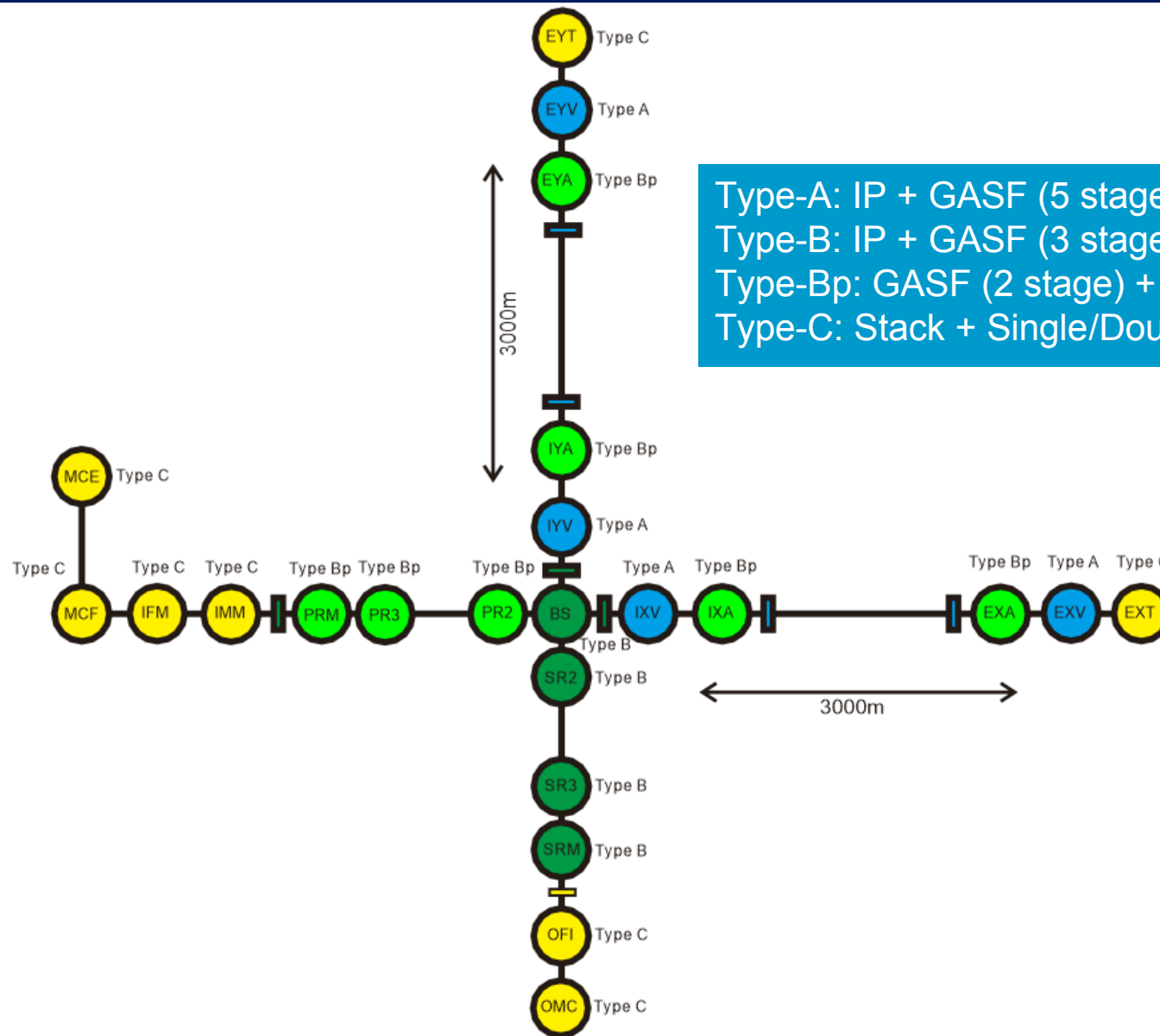
KAGRA用防振装置の開発 (2)

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1. 防振システムの構成
2. 開発・準備状況
3. まとめ

1. 防振システムの構成

KAGRAにおける防振システムの配置



Type-A: IP + GASF (5 stage) + Payload (23kg)
Type-B: IP + GASF (3 stage) + Payload (10kg/20kg)
Type-Bp: GASF (2 stage) + Payload (10kg)
Type-C: Stack + Single/Double-pendulum (~1kg)

Type-A/B system

Pre-isolator

Top filter
[Filter0]

Inverted Pendulum (IP)

Filter chain

Filter1 (Filter1~3 in Type-A)

Bottom Filter (BF)

Payload

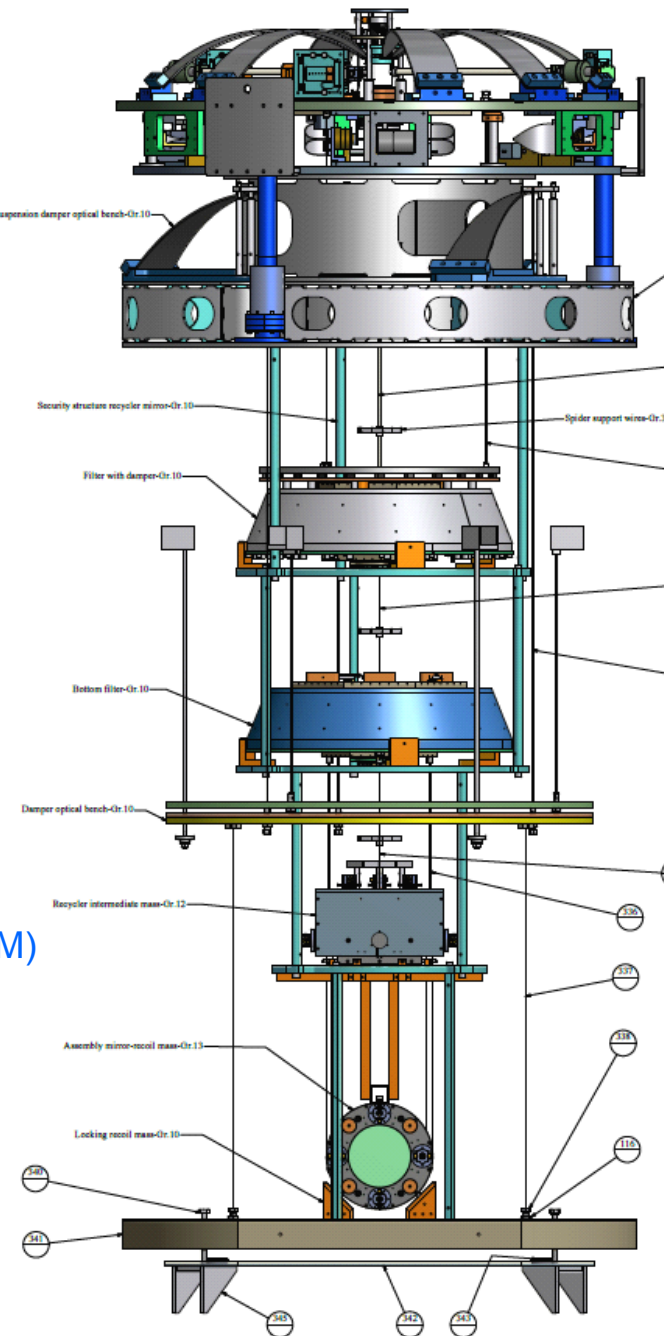
Intermediate Mass (IM)

Intermediate Recoil Mass (IRM)

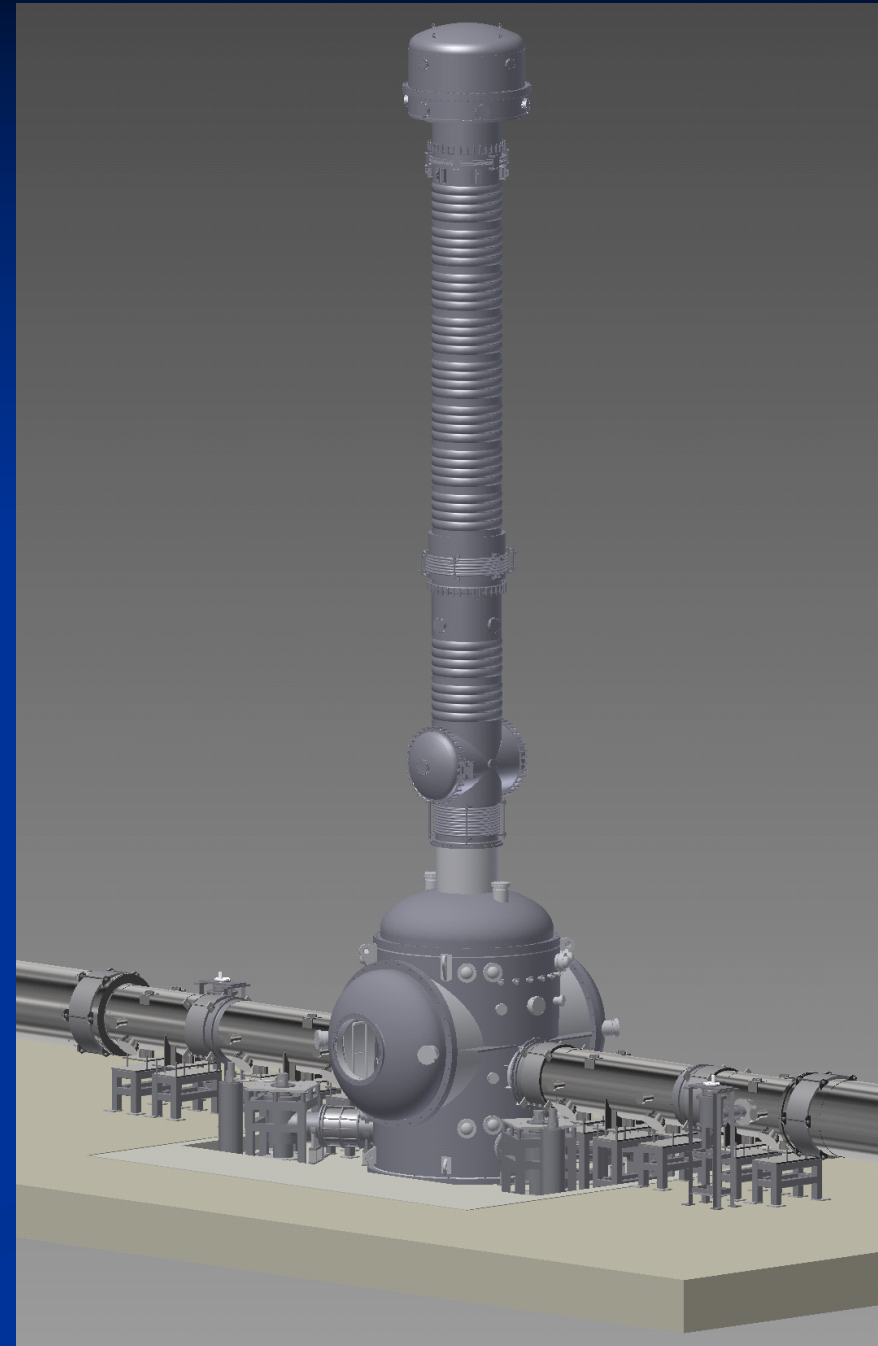
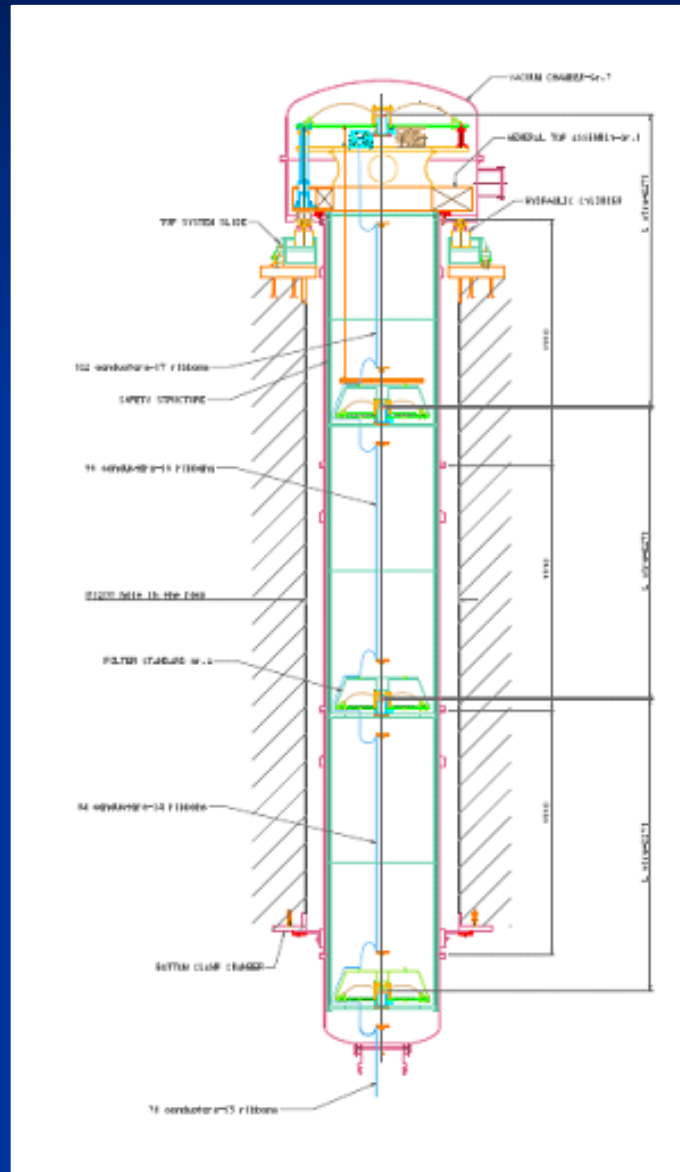
Test Mass (TM)

Recoil Mass (RM)

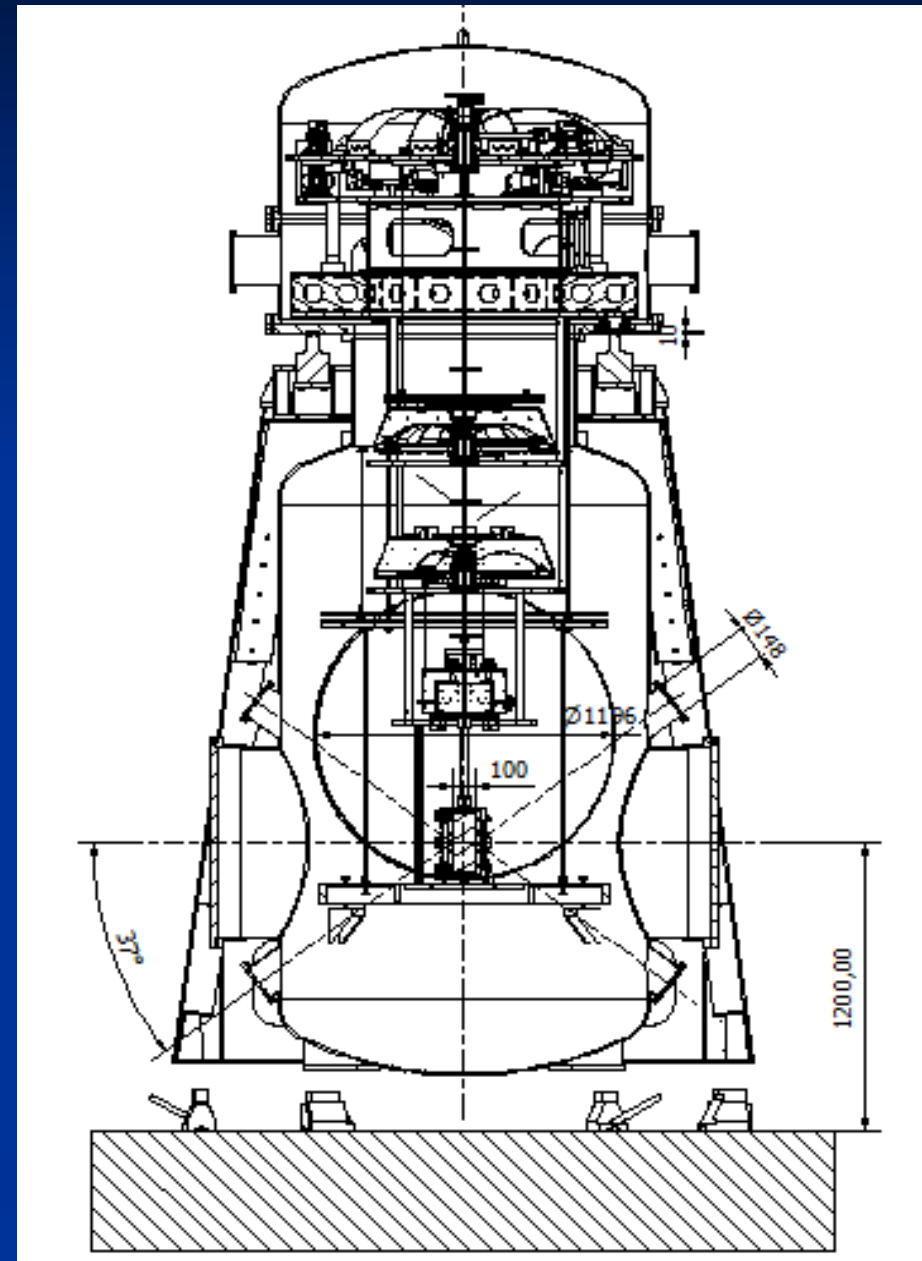
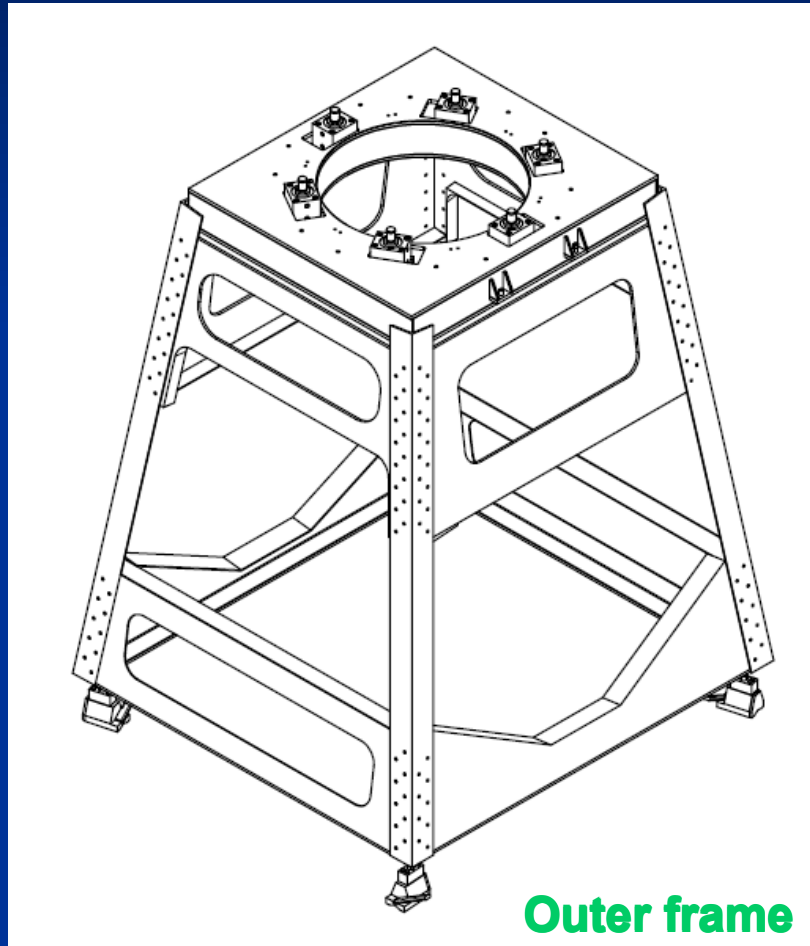
Optical Bench
[Breadboard]



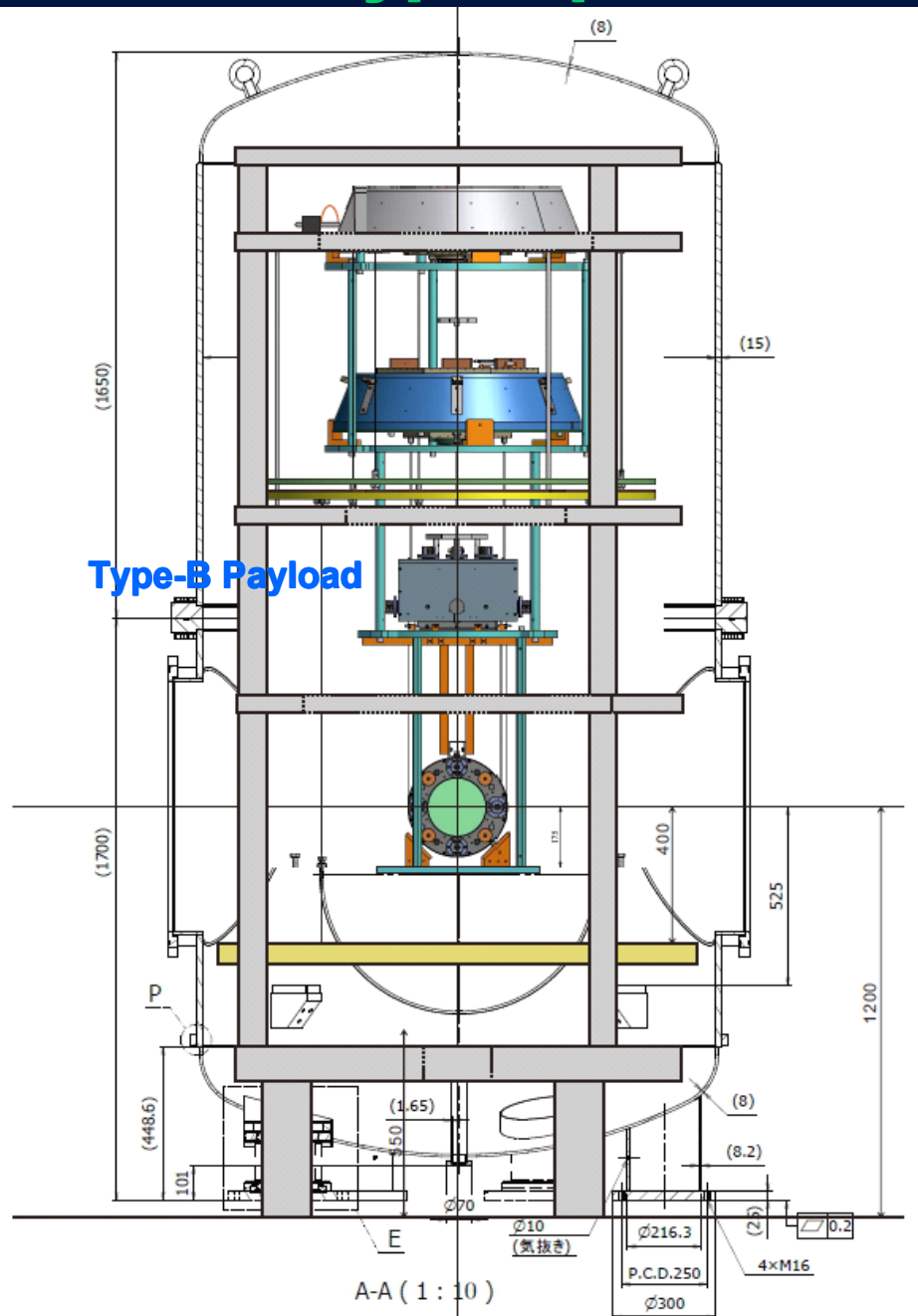
Type-A



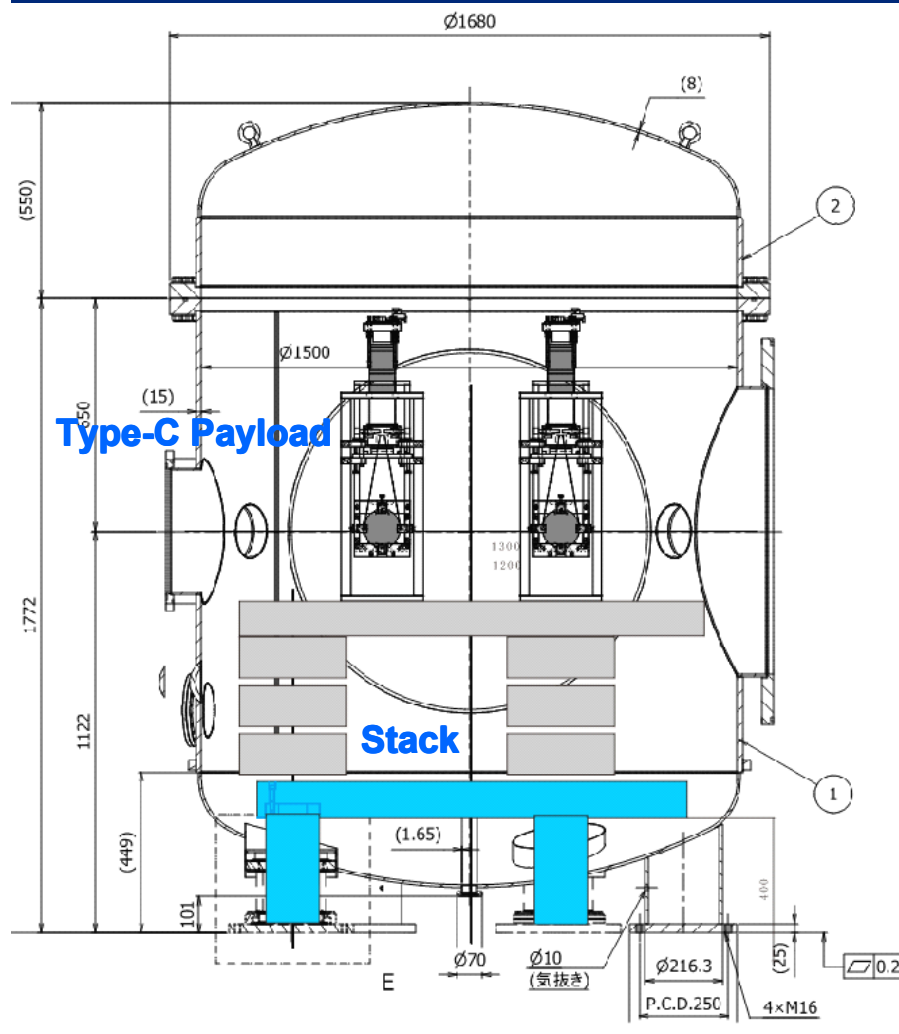
Type-B



Type-Bp



Type-C



2. 開発・準備状況

Suchedule

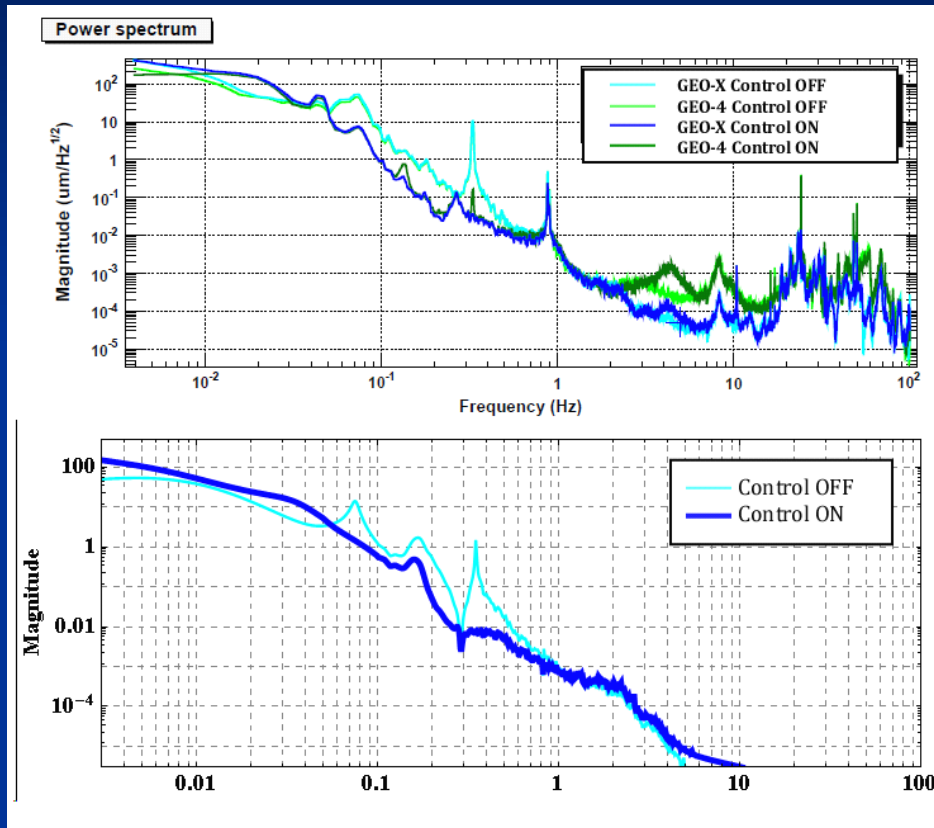
		2011	2012	2013	2014	2015	2016	
Standard GASF	Prototype test Procure Assembling							in Nikhef /Kashiwa
Pre-isolator	Prototype test Procure Assembling			6 SET	2 SET	2		in Akeno in Kashiwa
Type-B payload	Prototype test Procure Assembling Installation							in Akeno in Mitaka
Type-A SAS	Prototype test Installation					ETM ITM		in Kamioka
Type-B SAS	Prototype test Installation					BS SRM		in TAMA
Type-C System	Assembling Installation							in TAMA



Current status

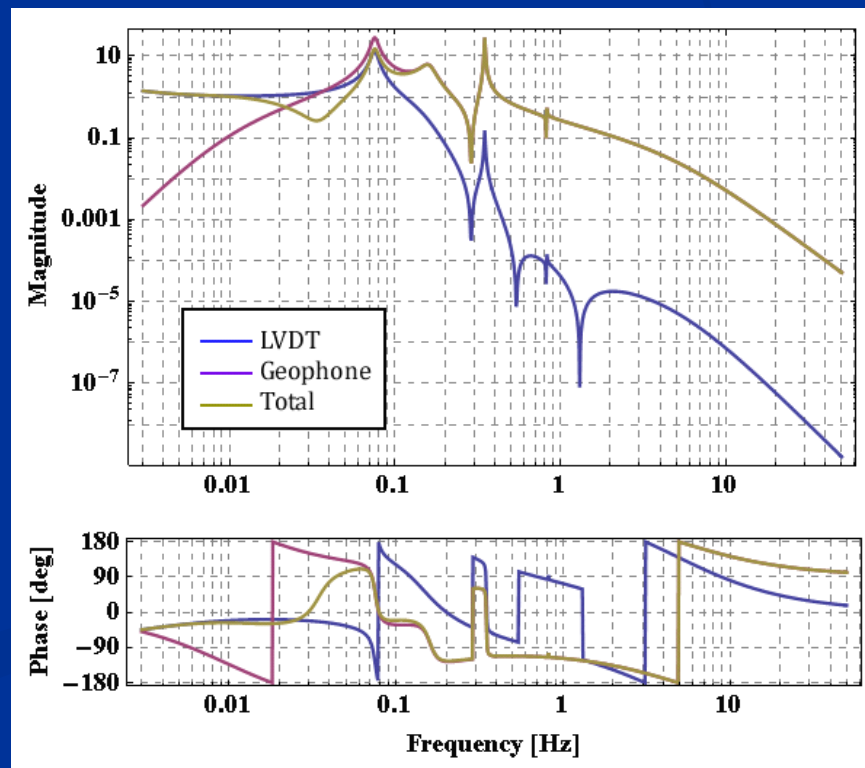
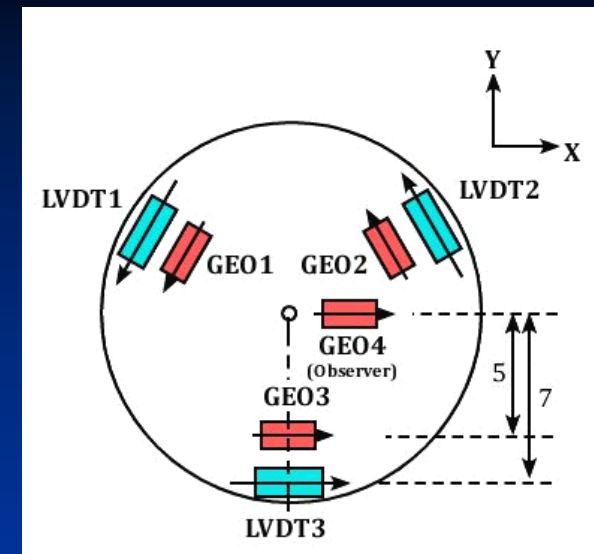
- The pre-isolator prototype is working with digital control system in Kashiwa (ICRR).
- Assembly of the payload prototype is going in Mitaka (NAOJ).
- Production of 6 top filters has been finished.
- Full prototype test is planned using TAMA300.

Inertial damping of the inverted pendulum (IP)

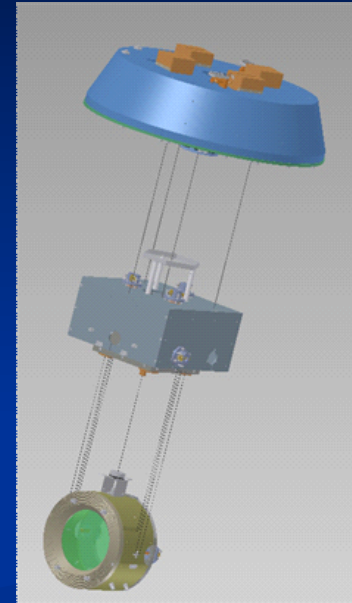
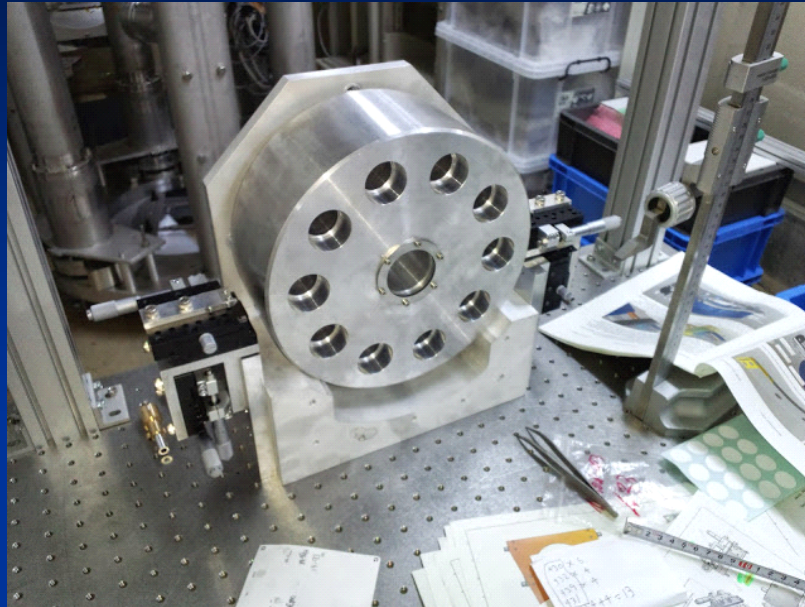


Displacement of IP. The IP was inertially damped by the active control. Tilt effects appeared above 2Hz.

Design of servo filter. The crossover frequency was set around 50mHz.



Assembly of the payload prototype



Assembly of the payload prototype is going.
Test mass was suspended by 0.2mm wires with 10mm gap.
Measured pitch mode frequency was 1Hz.



Production of the pre-isolators

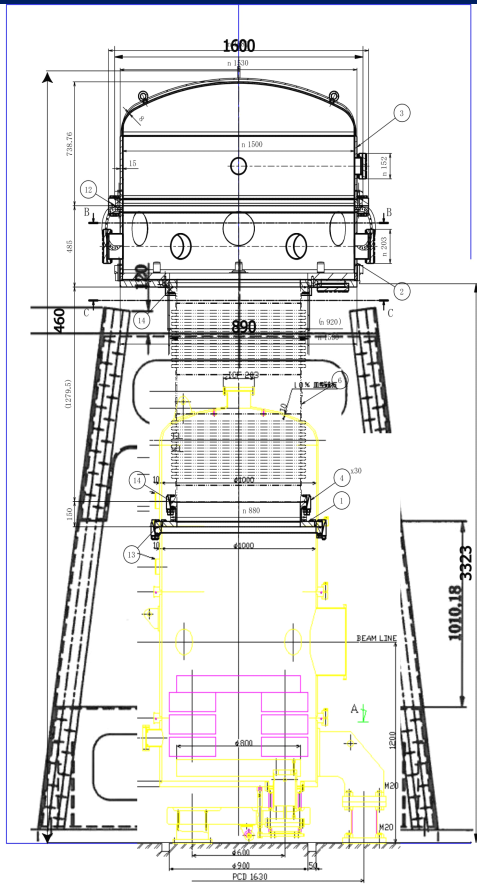
Production of the 6 top filters has been finished.

The resonant frequency of the filters was tuned to around 0.2Hz.



filter	Tune frequency [Hz]	Working point [mm]	Load at working point [kg]	Compression [mm]
B1-1	0.176	23.6	274	15.8
B1-2	0.186	24.6	276	15.4
B1-3	0.117	25.8	276	14.9
B2	0.138	18.4	301	15.5
A1	0.211	18.2	210	16.7
A2	0.168	25.1	209	15.7

Full Type-B Test in TAMA



Structure of the test chamber

- Top-chamber for KAGRA
- Bellows connection for KAGRA
- TAMA EM1 chamber
- Outer frame prototype
- Pre-isolator prototype
- GAS filter prototype
- Type-B payload prototype



Seal test of the top-chamber



Outer frame installed in February, 2013.

4. まとめ

- 変位センサ (LVDT) と慣性センサ (Geophone) を用いた倒立振り子 (IP) の慣性ダンピングを確立。
- Payload prototype を組み立て中。0.2mm のワイヤー 2 本による懸架で 1Hz の pitch モードを実現。
- Top filter 6 台の製造が終了。共振周波数を 0.2Hz にチューニング。
- TAMA300 を用いた試験の準備が進行中。