

VIS upgrade plan toward O4

**R. Takahashi and A. Shoda on behalf of VIS
(National Astronomical Observatory of Japan)**

PAB

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Outline

1. Overview
2. Repair plan
3. Upgrade plan
4. Control
5. Schedule

Vibration isolation system in KAGRA

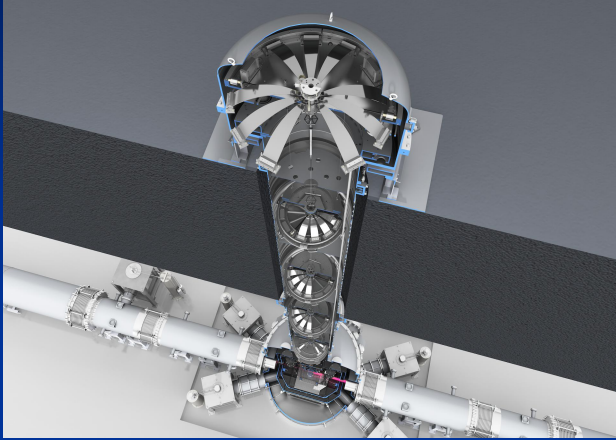
Type-A

Type-A: for cryogenic mirrors

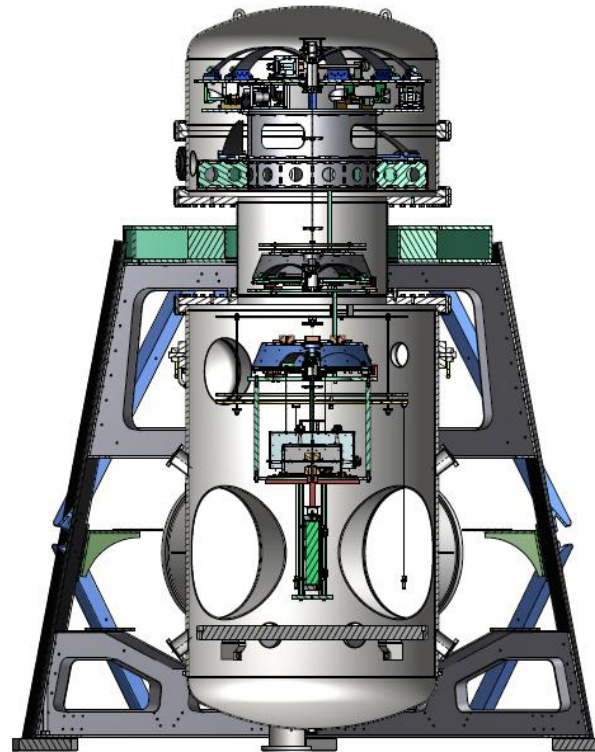
Type-B: for room temperature mirrors

Type-Bp: simpler Type-B

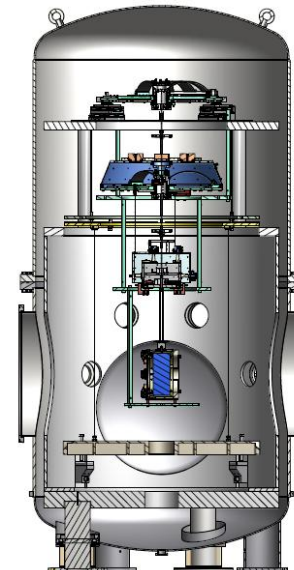
Type-C: for small optics



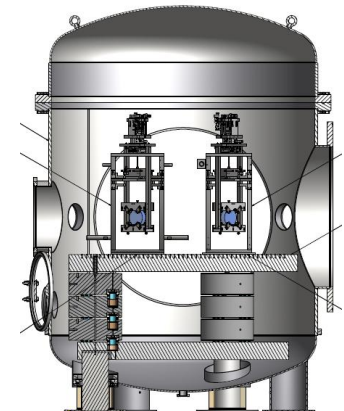
Type-B



Type-Bp



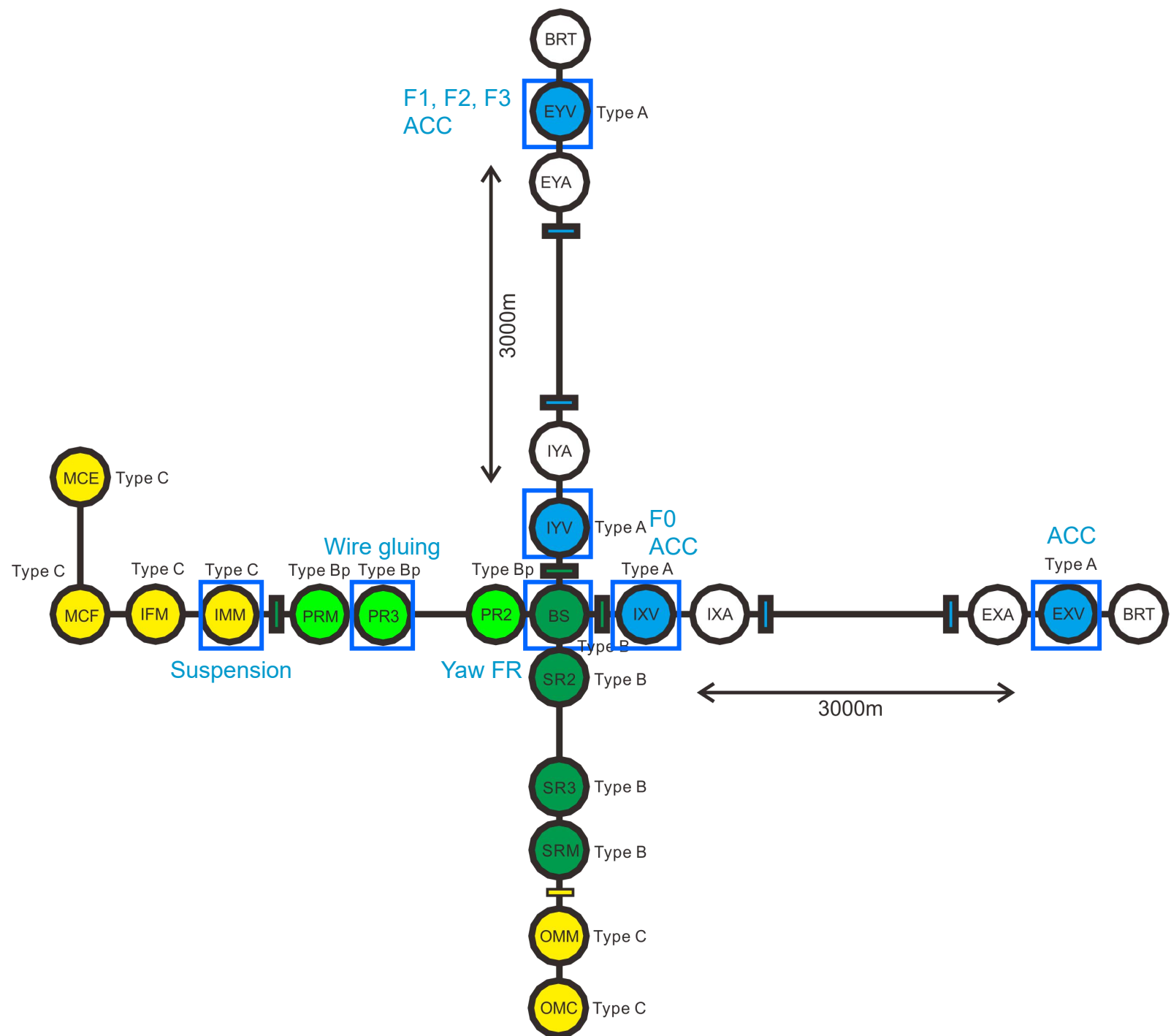
Type-C



1. Overview

Item	Priority	Type	Time needed
Reinstallation of the GAS filters in ETMY	5	Repair	14 weeks
Replacement of the F0 blades in ITMX/ITMY	1	Repair	2 days per suspension
Replacement of the inertial sensors to the improved accelerometers in Type-A	5	Upgrade	2 weeks per suspension
Installation of the ribbon heaters around the chambers	3	Upgrade	
Installation of the limit switches for FR stepper motors	1	Upgrade	2 days per suspension
Installation of the yaw stepper motor in BS	4	Repair	2 days
Adjustment of GAS filter height in BS/SR3	1	Repair	2~5 day per suspension
Inspection of the BF condition in SRM	1	Repair	1 day
Cleaning of the LVDT-ACT units in BS	1	Repair	1 week
Tuning of the IP in BS	1	Repair	1 week
Fixing of the In-vac D-Sub connectors around the IP in ETMY	2	Repair	1 day
Replacement of the damaged PTFE cable in ETMY	4	Repair	1 day
Replacement of the in-vac cable for the traversor in PR3	4	Repair	1 day
Gluing of the suspension wire in PR3	4	Repair	3 days
Installation of additional beams for the outer frame	2	Upgrade	
Installation of the better OpLev covers	4	Upgrade	
Modification of the IMMT2 suspension	3	Upgrade	
Installation of the new electronics (SG card, LVDT combiner, RS monitor)	4	Upgrade	1 day per suspension

Type-A
 Type-B
 Type-Bp
 Type-C



2. Repair plan

ETMY

- The F1-F3 are not working in ETMY. Fishing rods are too weak. They are still using old blades. **Reinstallation** is necessary.

ITMX/Y

- The F0 overloads by 4-10kg. The keystons were fixed. Replacement of three (of six) blades (for 297kg load) to original three blade (for 347kg load) is planed.

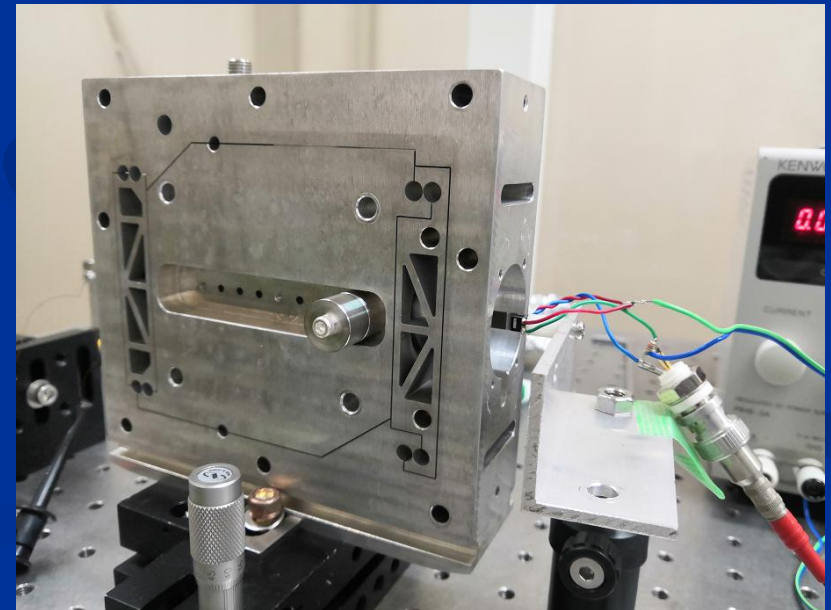
Type-B/Bp

- The yaw fishing rod in BS has not been installed yet.
- The suspension wire for the PR3 should be glued to avoid the TM jump.

3. Upgrade plan

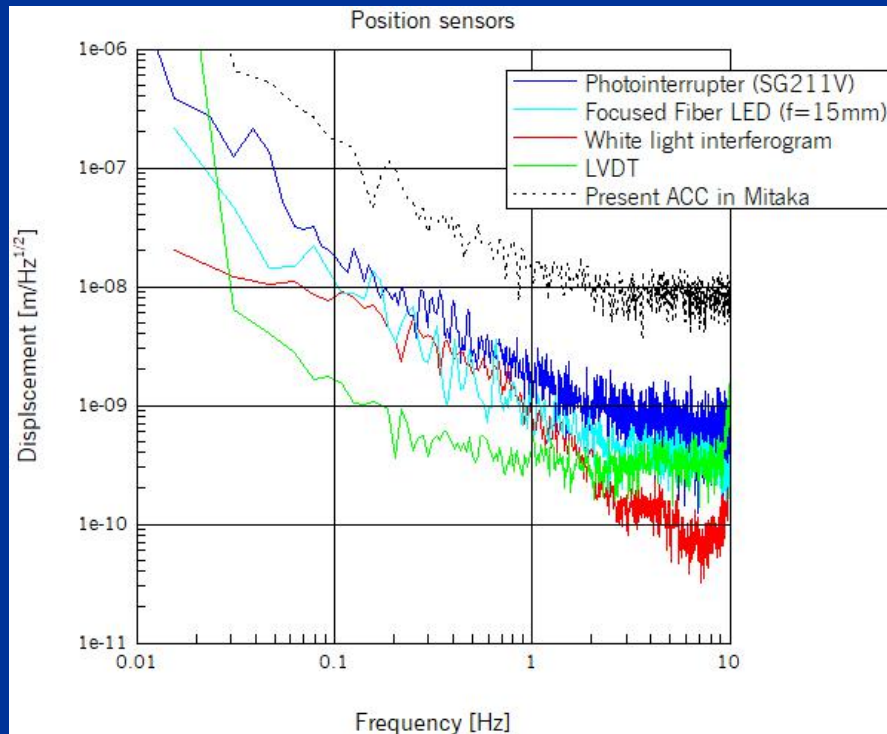
Improvement of inertial sensors for IP control

- The servo type accelerometers (IX, IY) and the commercial geophones (EX, EY) are used as inertial sensors in Type-A towers.
- The sensitivity of present inertial sensors are not good enough to control the IPs around 0.1Hz.
- We plan to replace the inertial sensors to better accelerometers.
 - Replace the present position sensors.
 - Tune the folded pendulums bellow 0.2Hz.

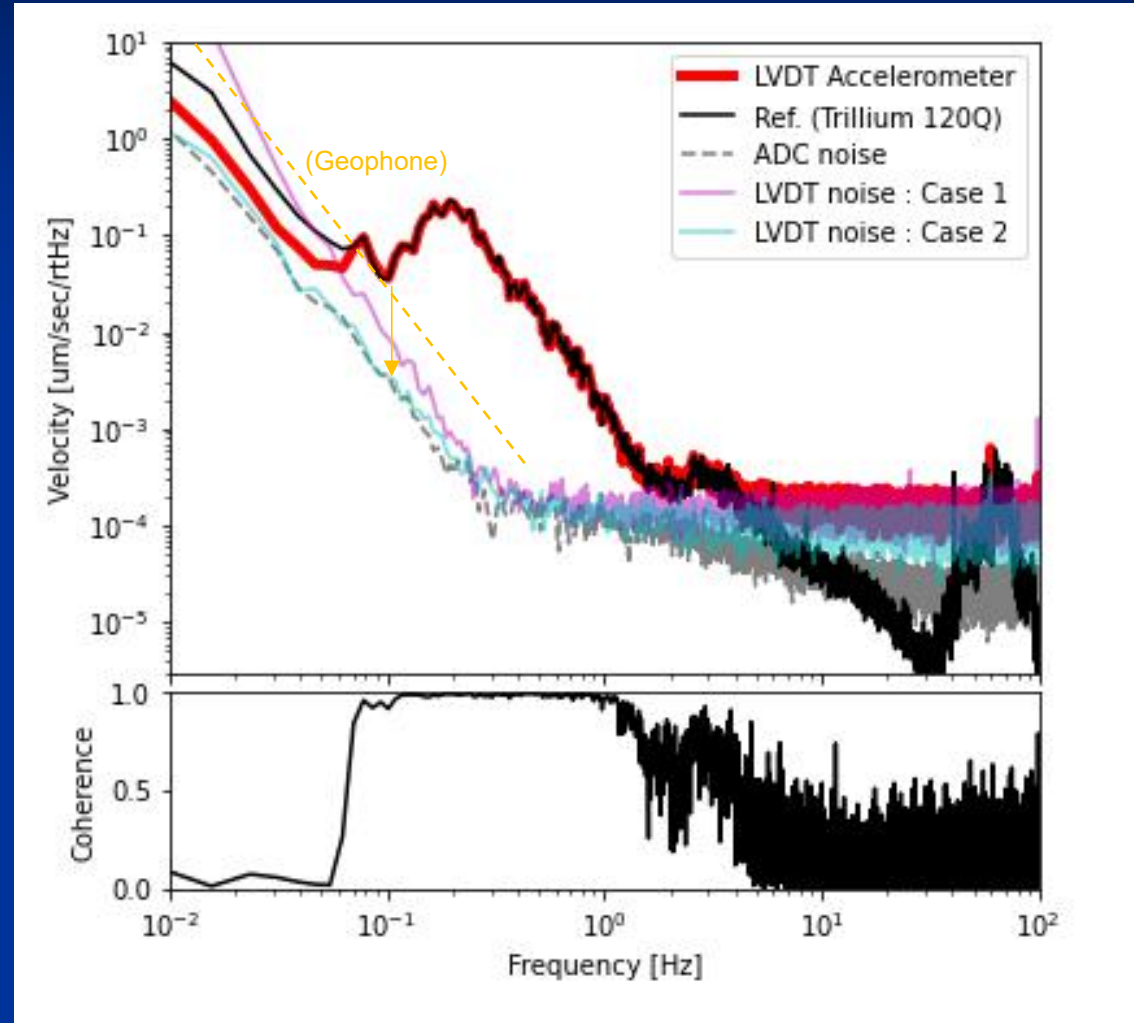


Prototype test at the KAGRA site

- Some kinds of position sensors (photointerrupter, fiber LED, white light interferogram, and LVDT) have been evaluated. The LVDT had the best sensitivity around 0.1Hz.
- Prototype accelerometer with the LVDT was tested at the KAGRA site.



Sensitivities of some kinds of sensors



Measured spectra at the KAGRA site

4. Control



For easy maintenance

Easy maintenance makes it easy to get the upgrade started.

- Clarify the acceptable situation of the suspension.

We did not have an agreed and shared acceptance criteria before.

Criteria for the IFO operations are also updated by the real IFO work from the initial requirements.



Make acceptance test documents (like spec sheets).

Make scripts to automatically check the suspension status.

- Enable easy handling/upgrade without conflicts

We used various methods to do the same thing (i.e., sensor/actuator diagonalization).

Also upgrades by many people only with a brief explanation on klog caused the confusion and made it difficult for other person to upgrade further.



Automate the common procedures as much as possible with scripts.

Version control to easily come back to the situation that surely make the IFO work.

Tasks towards O4

- Real time model update
 - PreQua model + a new structure
 - Medm screen update
- Guardian update
 - Add maintenance functions: Auto-diagonalization, auto-offloading...
 - Semi-auto update script in VIS_MANAGER
- Data management
 - Complete missing templates
 - Noise budget control
 - Version control using the git
 - Clear directory structure for measurement data
- Advanced control / modeling
 - Auto-optimization
 - System identification, etc...

5. Schedule

