Bottom filter damping in KAGRA

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Type-A

Type-A suspension has a long chain.

- 1st YAW mode is difficult to damp
 (Same as the Virgo super attenuator)
- Add the additional sensors & actuators at the bottom filter (BF).



Type-Bp

Type-Bp chain is not long, but does not have sensors to sense the whole pendulum mode, such as IP in Type-A.



Whole pendulum mode is difficult to damp.

Add the additional sensors & actuators at the bottom filter (BF).



Sensors & Actuators for the BFs

- We want the sensors and actuators with wide linear range.
- We do not want to use 'bland new' sensors and actuators. We want almost the same system as we are already using.



The concept of the F7 LVDTs seem to be suitable also for KAGRA suspensions.

It is great if we can contribute to the demonstration of the universality of F7 LVDTs.

The BF is suspended by a single wire. We cannot adjust the BF position in YAW direction finely.

Model we used

System Dimensions (mm)



to check the space.



The structure around the coil is just an example.

LVDT for BF damping (Type-A Horizontal)











Simulation for Type-Bp

Example: BFRM = 10 kg



BFRM design



XThe structure around the coil is just an example.

Available space

Space for 6 F7 LVDTs are tight, but possible if horizontal and vertical LVDTs can be set close. If we have a bit smaller units (~10 cm in height?), we can set the LVDTs at more proper places.



Here is more proper for the horizontal LVDTs, but it will touch to the suspension wires for



Almost at the same height as COM (adjustment required)



How close can we set two LVDTs??

Schedule

	Туре-А		Туре-Вр		
Jul.	Design the details Fix 3D drawings		Design the details Fix 3D drawings		
Aug.	Prepare 2D drawings		Prepare 2D drawings Negotiate with companies		
Sep.	Order		Order		
Oct.	Procurement	Preparation of		Procurement	Preparation of installation
Nov.	Delivery		Delivery		
Dec.	hanging		Test hanging		
2017 Jan.					

Summary

- F7 LVDTs are good sensors & actuators for the BF damping in KAGRA
- We checked the space available.
 - It seems to be possible to place the F7 LVDTs somehow.
 - If we can have smaller LVDTs, we can have more choices of the arrangement for the LVDTs.
 - Some concerns: how far these LVDTs should be separated?
- The structures related to the modification are almost fixed.
 - The structures to attach the magnets and primary coils at BFs are designed.
 - The BFRM for Type-Bp is designed.
 - Other parts related to this modification is designed.
- All 2D drawings should be ready before the end of this August.