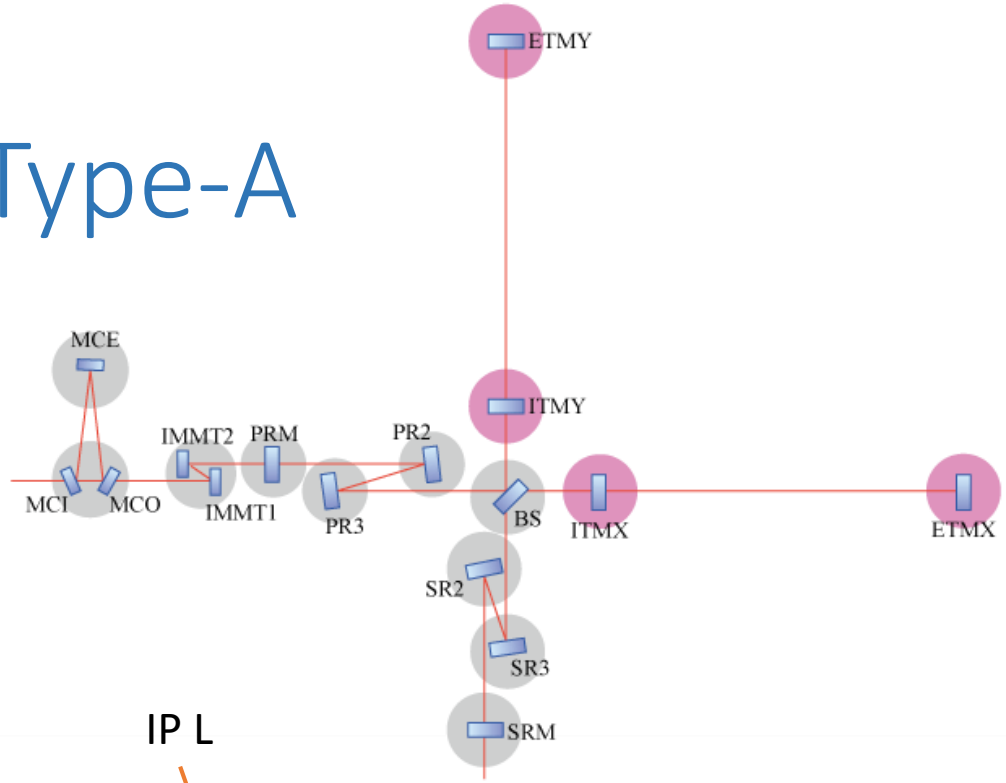
Damping control for KAGRA suspensions

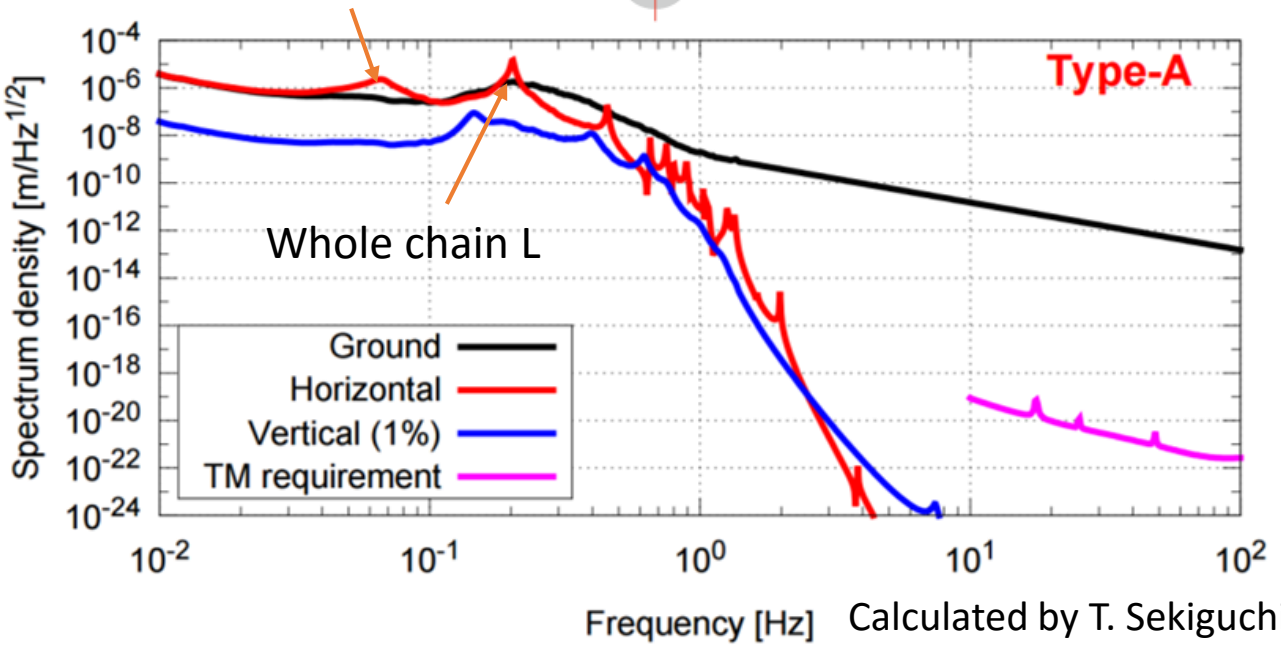
Requirement for the damping

Caution: The values are old!!

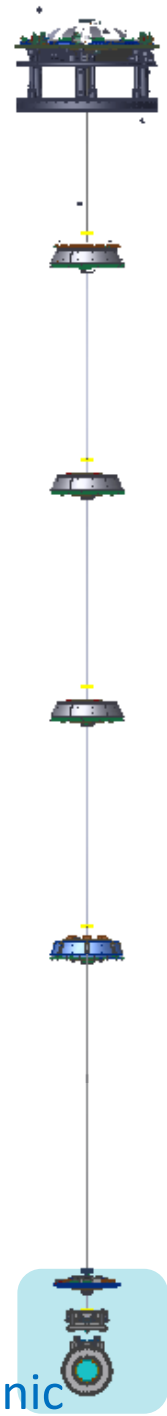
		Type-A	Type-B	Type-Bp
Lock-acquisition phase	RMS velocity	50 um/sec (for green lock)	0.7 um/sec	0.5 um/sec
	RMS angle	0.1 urad	1 urad	1 urad
Observation phase	Control noise @ 10Hz	1×10^{-19} m/rtHz	5×10^{-18} m/rtHz	1×10^{-15} m/rtHz

Type-A





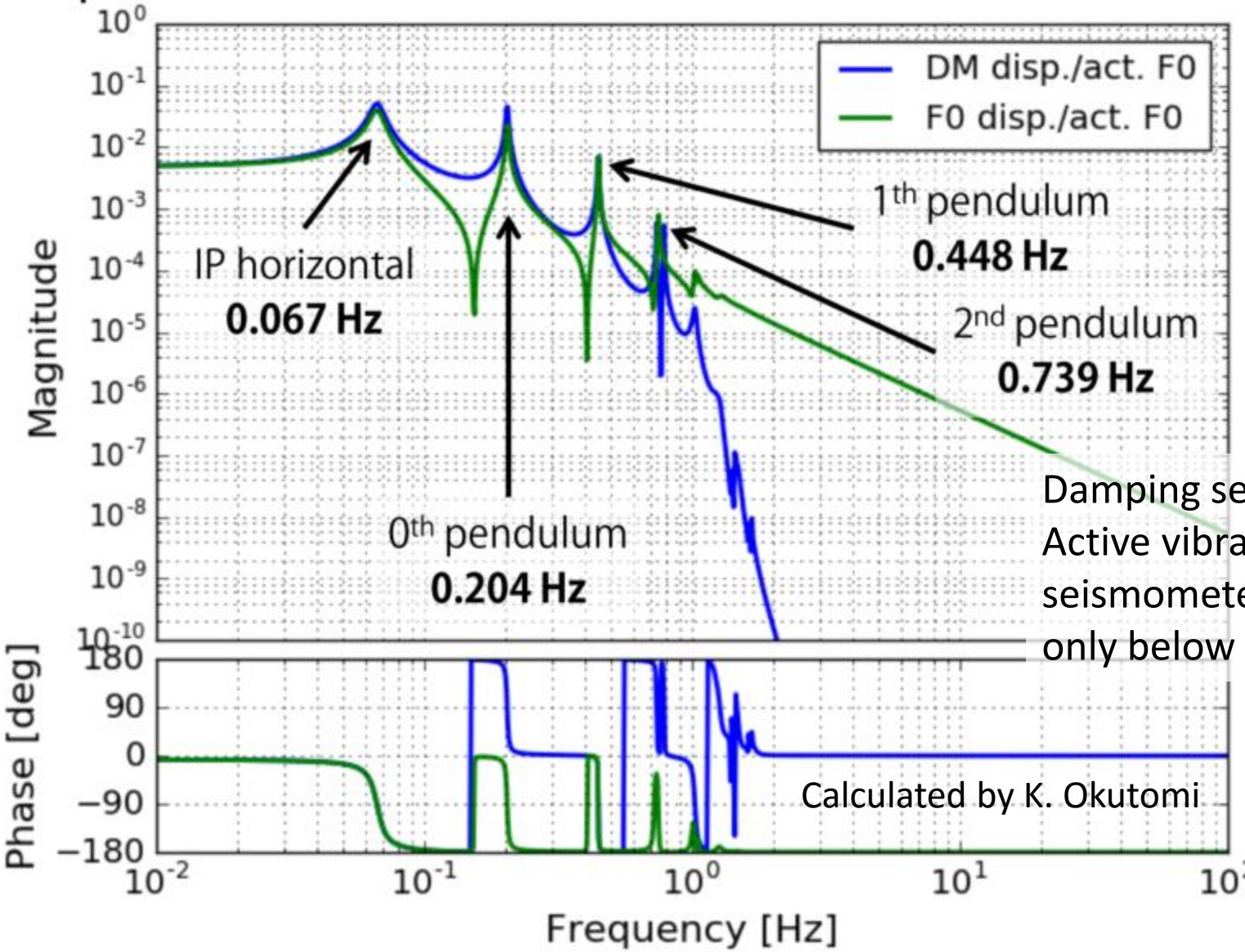
Calculated by T. Sekiguchi



IP	LVDT/seismometer	L, T, Y
GAS0	LVDT	V
GAS1	LVDT	V
GAS2	LVDT	V
GAS3	LVDT	V
GAS4	LVDT	V
GAS5		
Marionette		
IM	Reflective sensors??	
Optics		

Cryogenic

Displacement/Force Transfer Function L

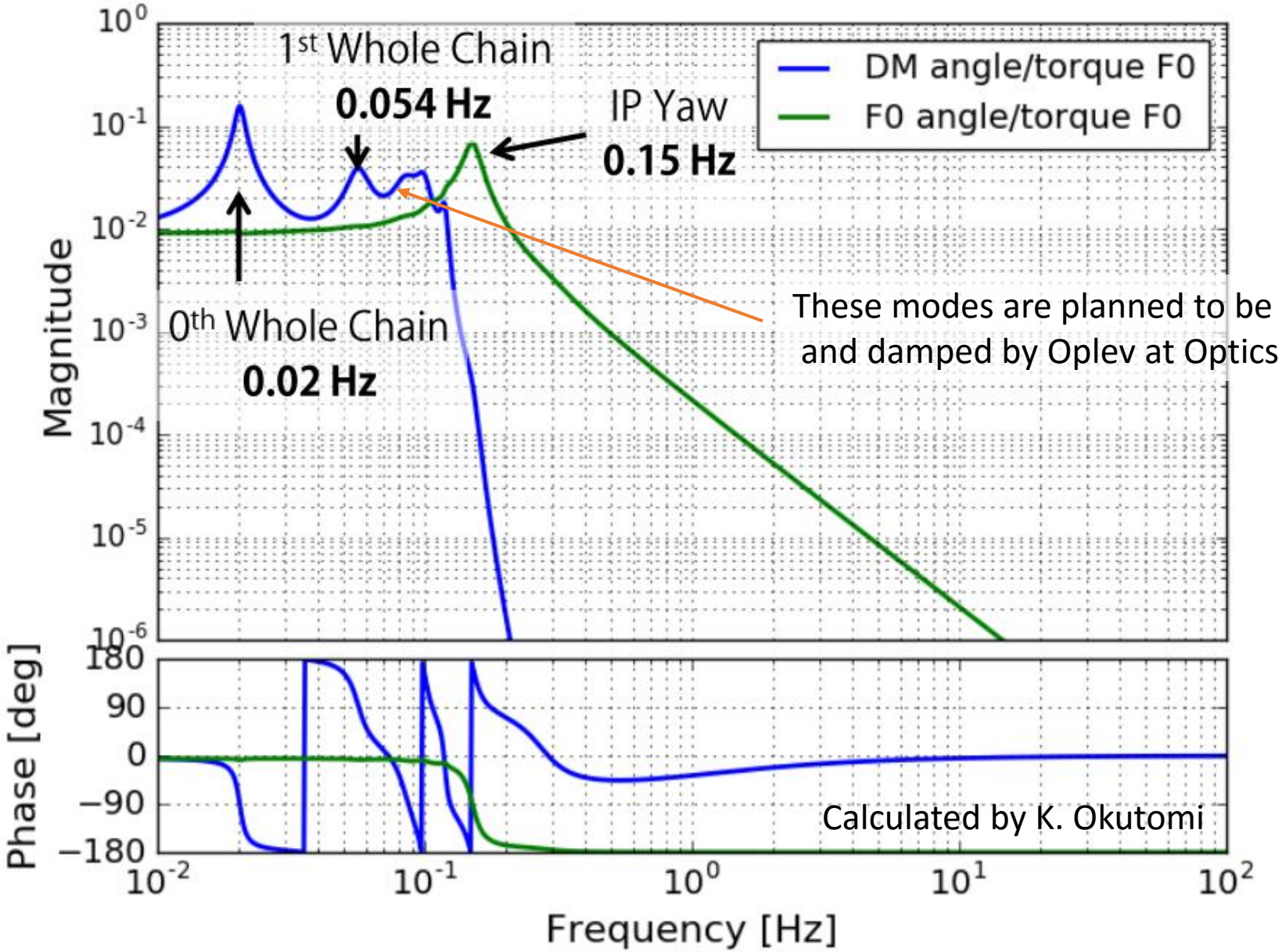


Damping seems to be possible.
Active vibration isolation by seismometer seems to be possible only below 0.1 Hz.

Calculated by K. Okutomi

*Eigenmode idenfitication will be added

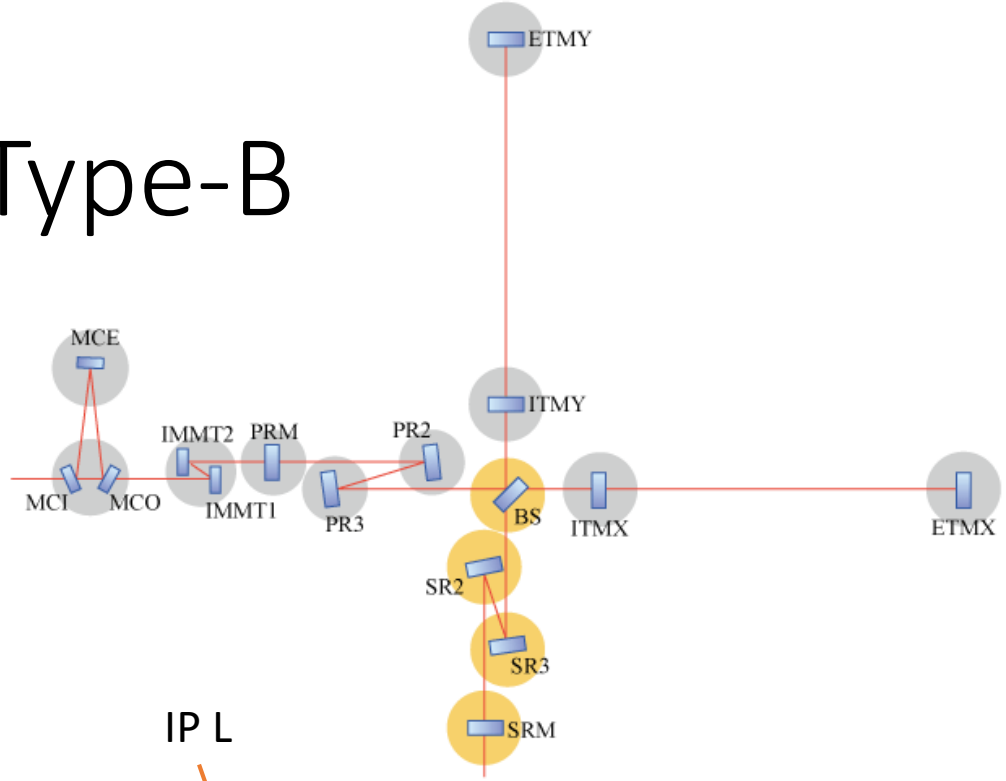
Displacement/Force Transfer Function Y

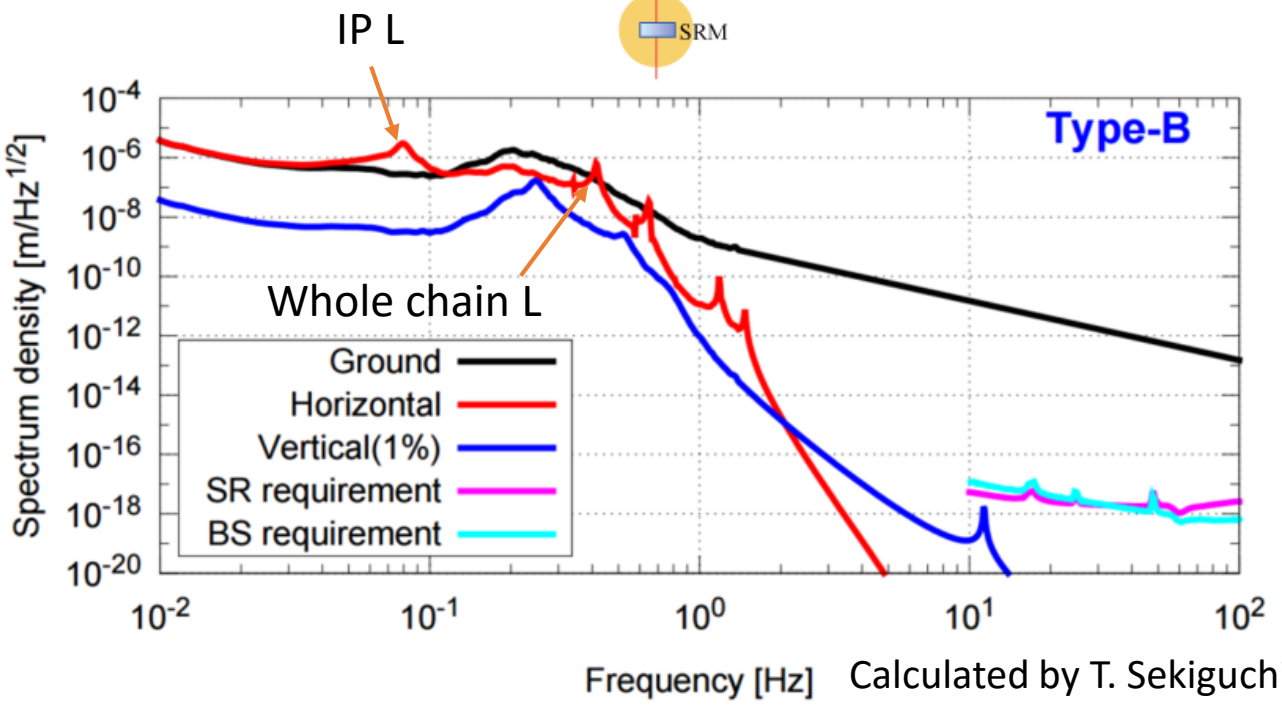


These modes are planned to be measured and damped by Oplev at Optics

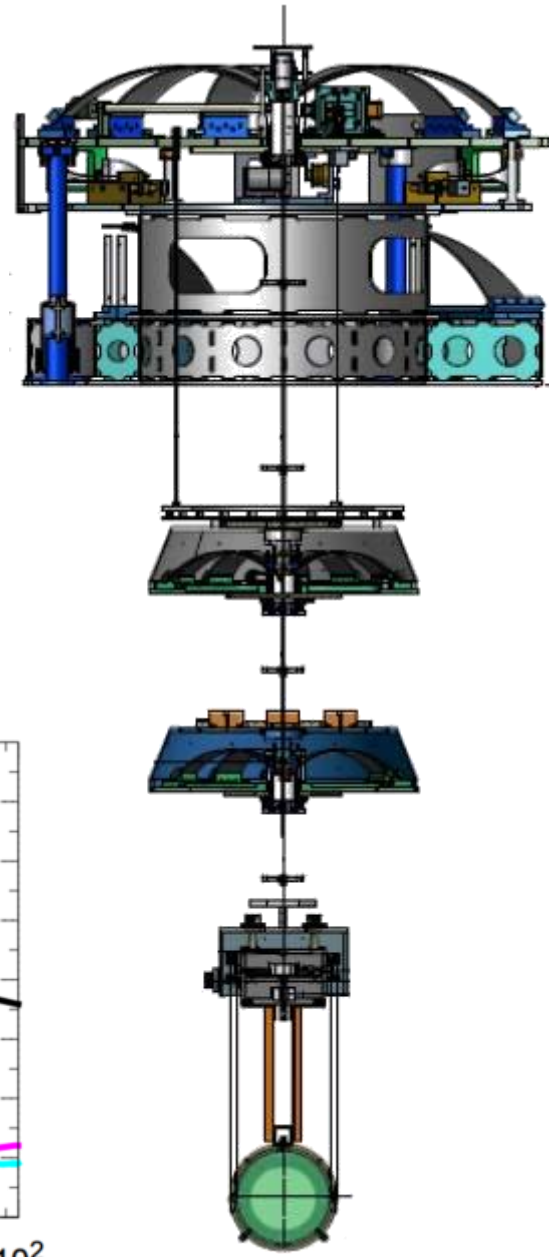
Further investigation is necessary…

Type-B



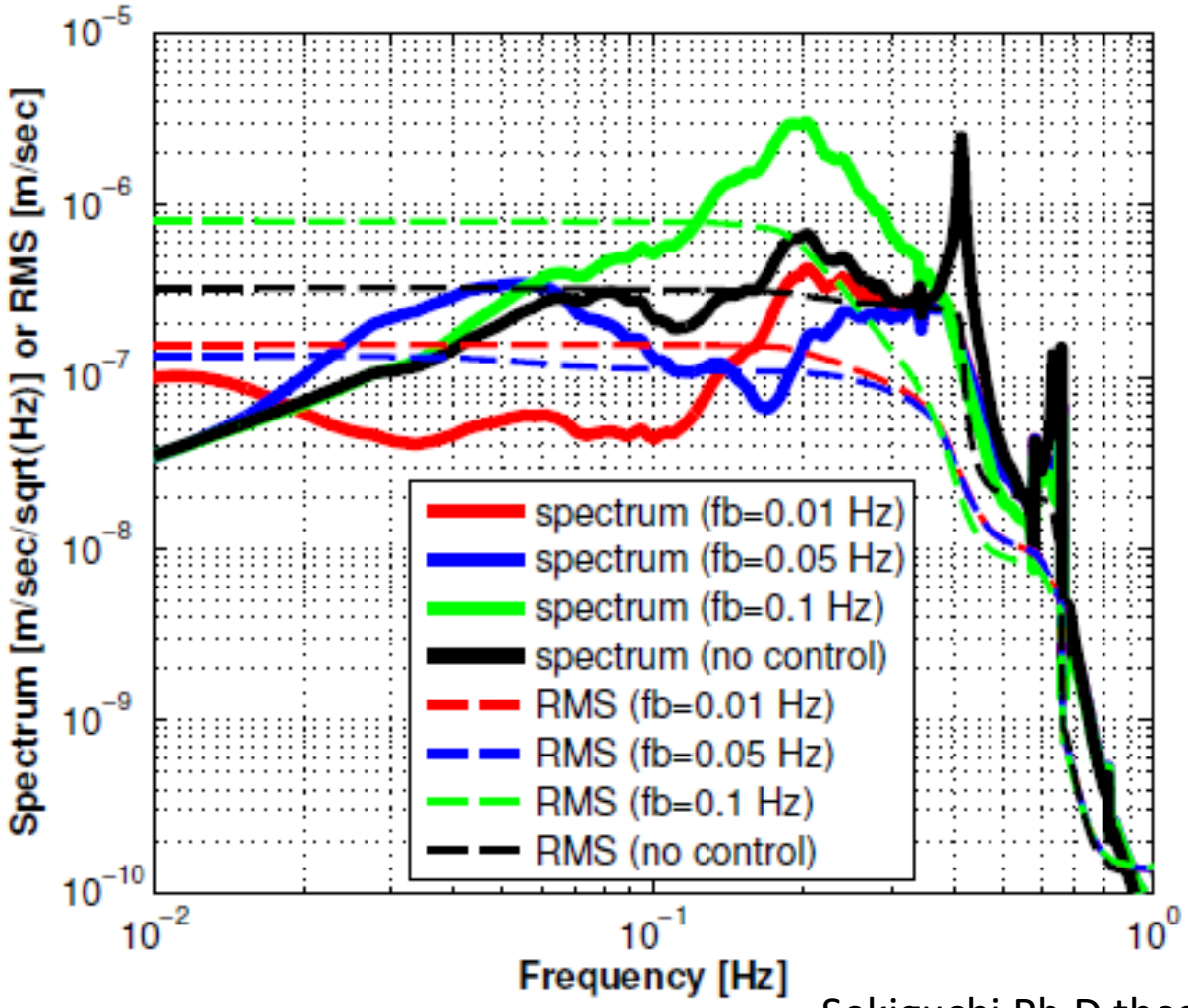


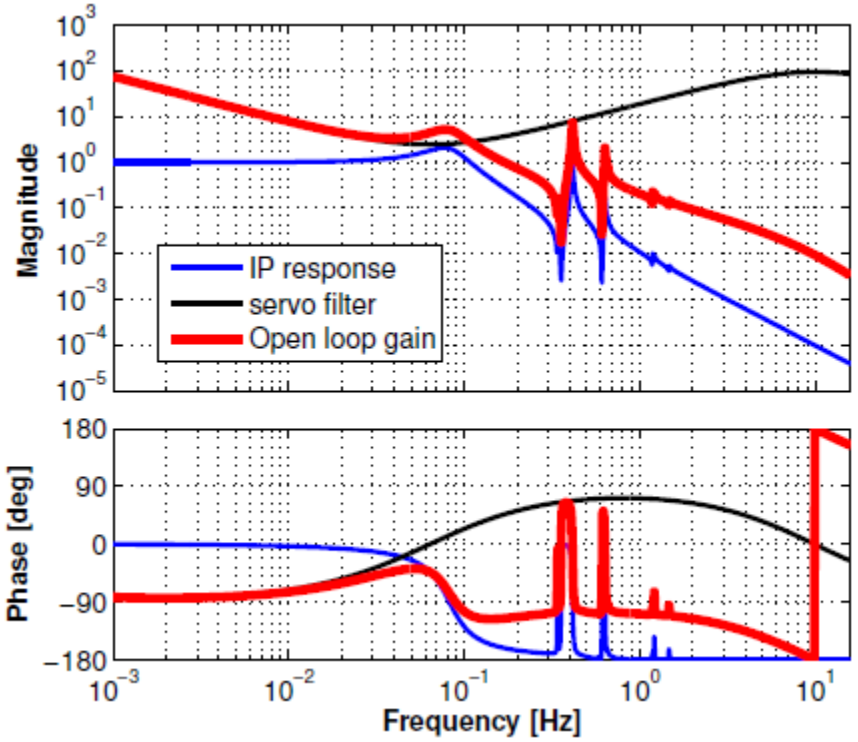
Calculated by T. Sekiguchi



IP	LVDT seismometer	L, T, Y
GAS0	LVDT	V
MD		
GAS1	LVDT	V
GAS2	LVDT	V
IM	OSEM	L, T, V Y, R, P
Optic	OSEM	L, P, Y

IP control in TAMA prototype experiment





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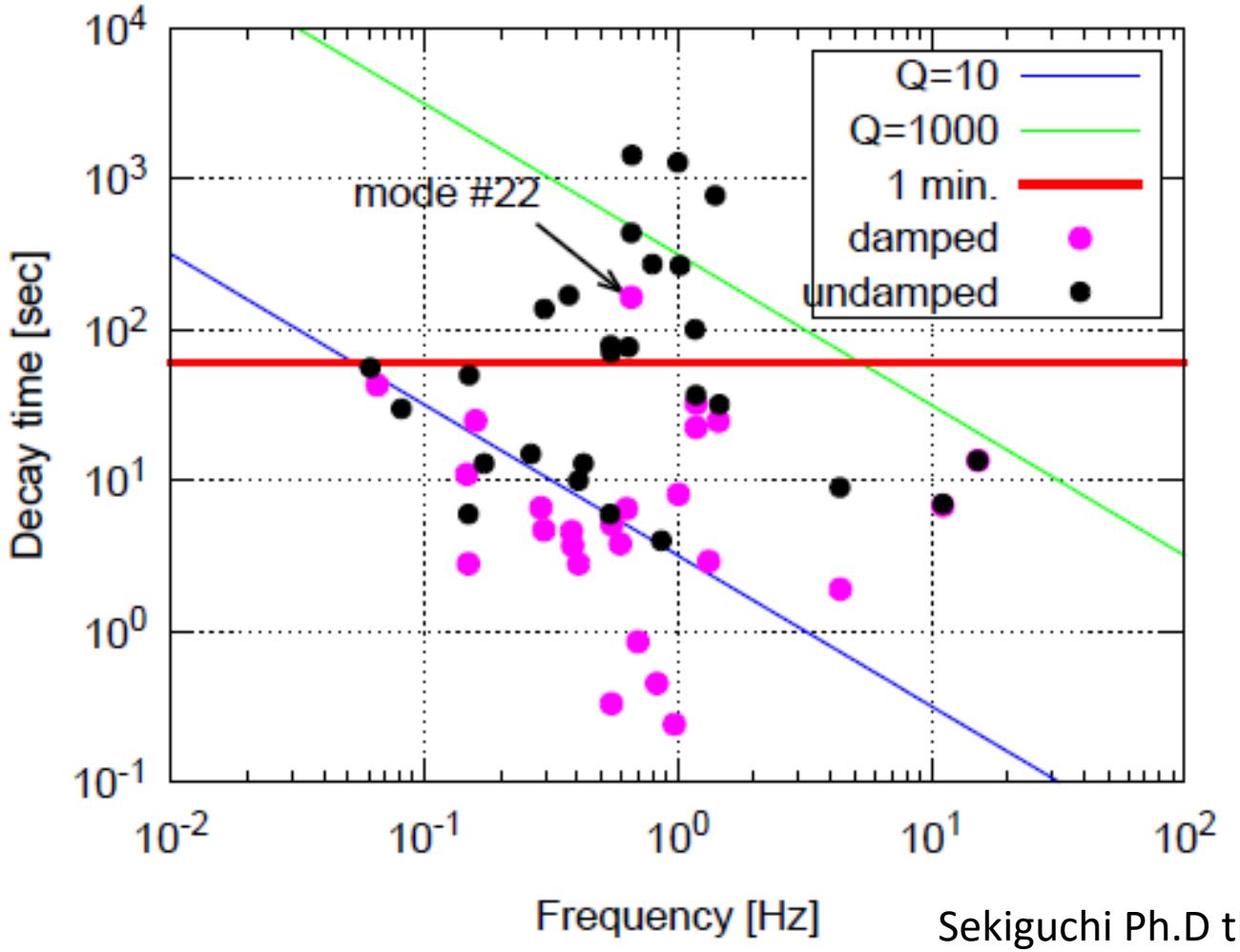
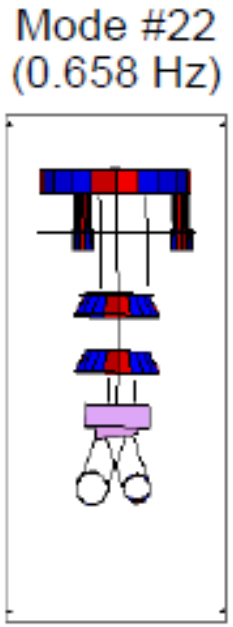
Q factors





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Residual RMS

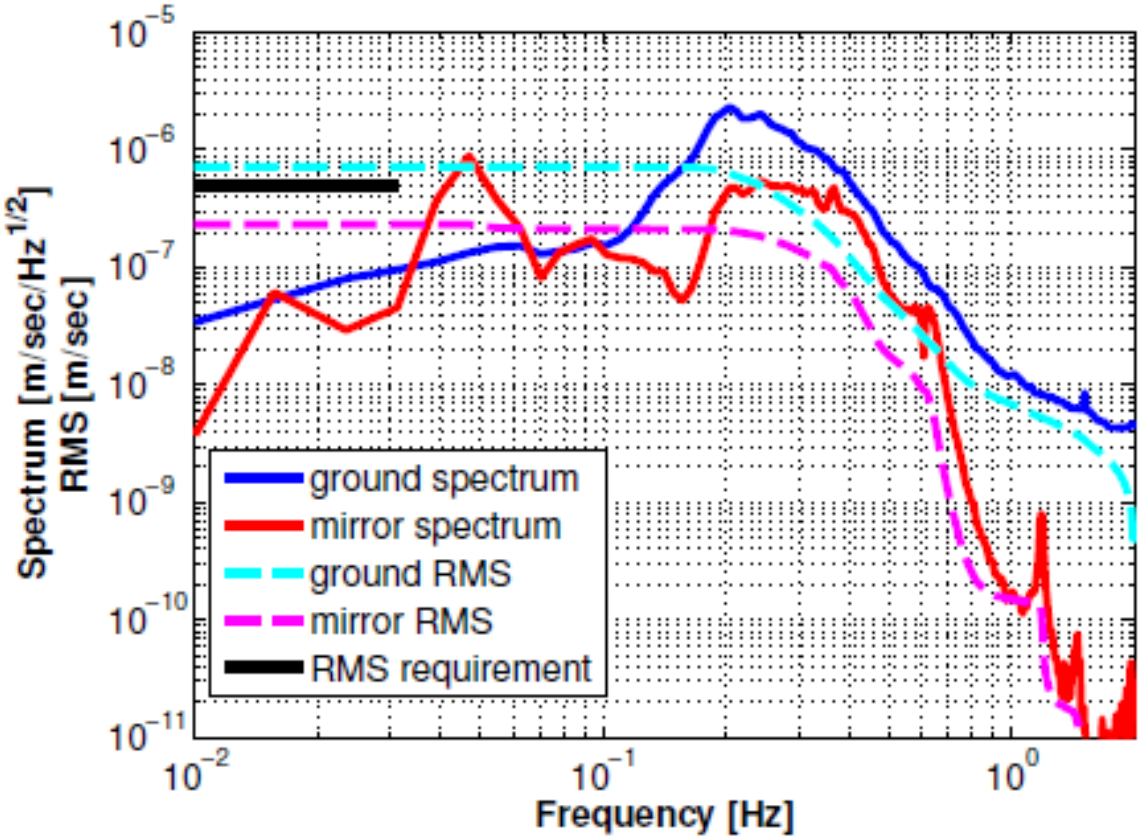

Figure 8.17: The mirror longitudinal vibration spectra estimated with the measured transfer function, assuming seismic vibration in the KAGRA site.

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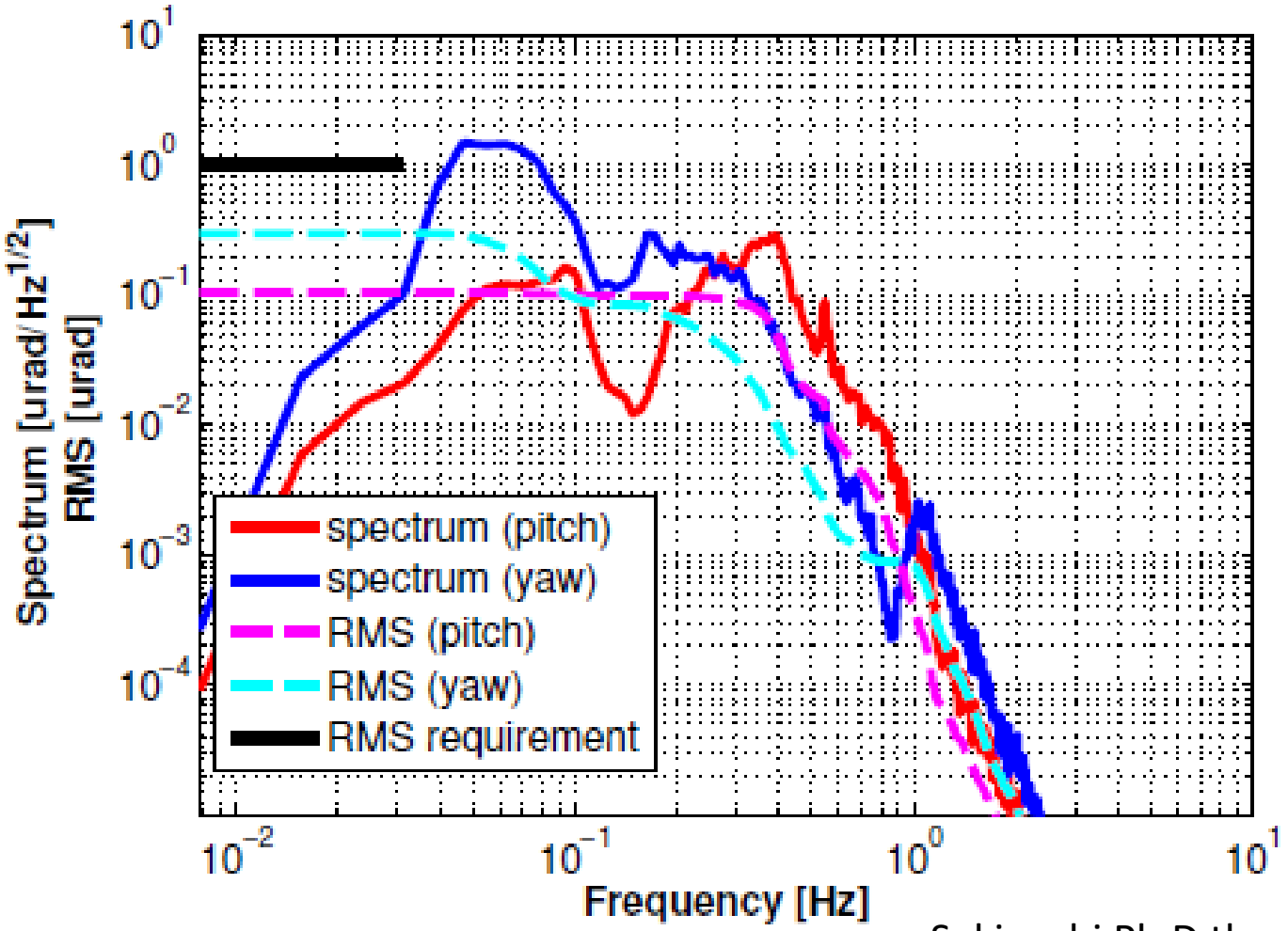
Residual RMS measured by Oplev (tilt)



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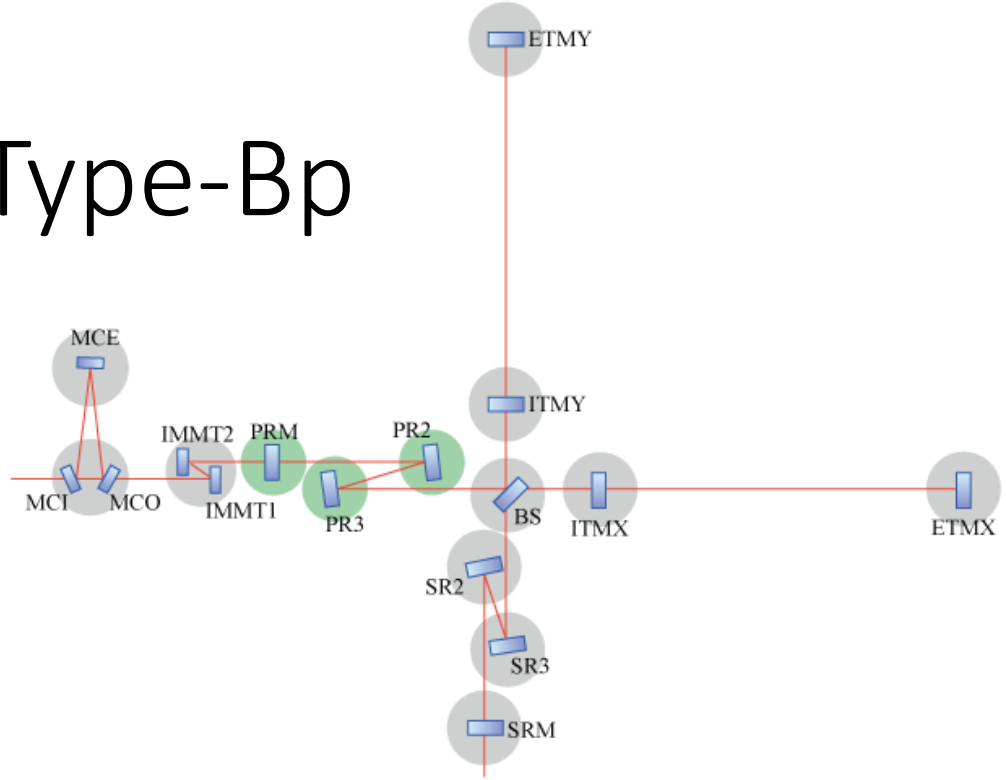
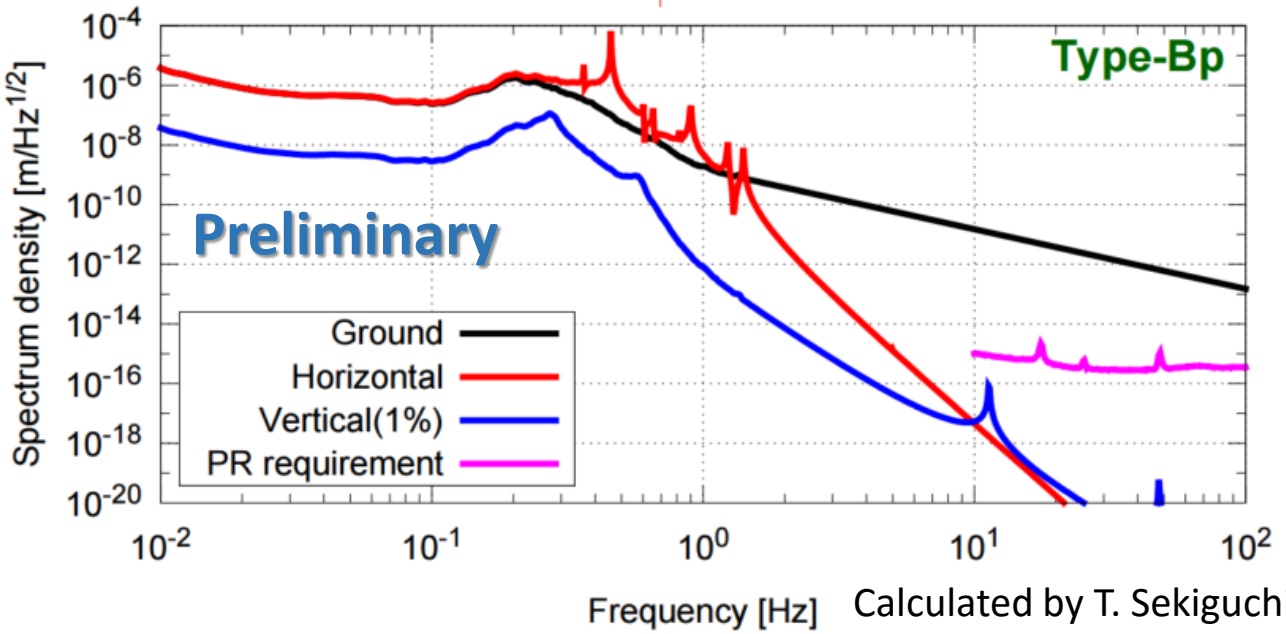
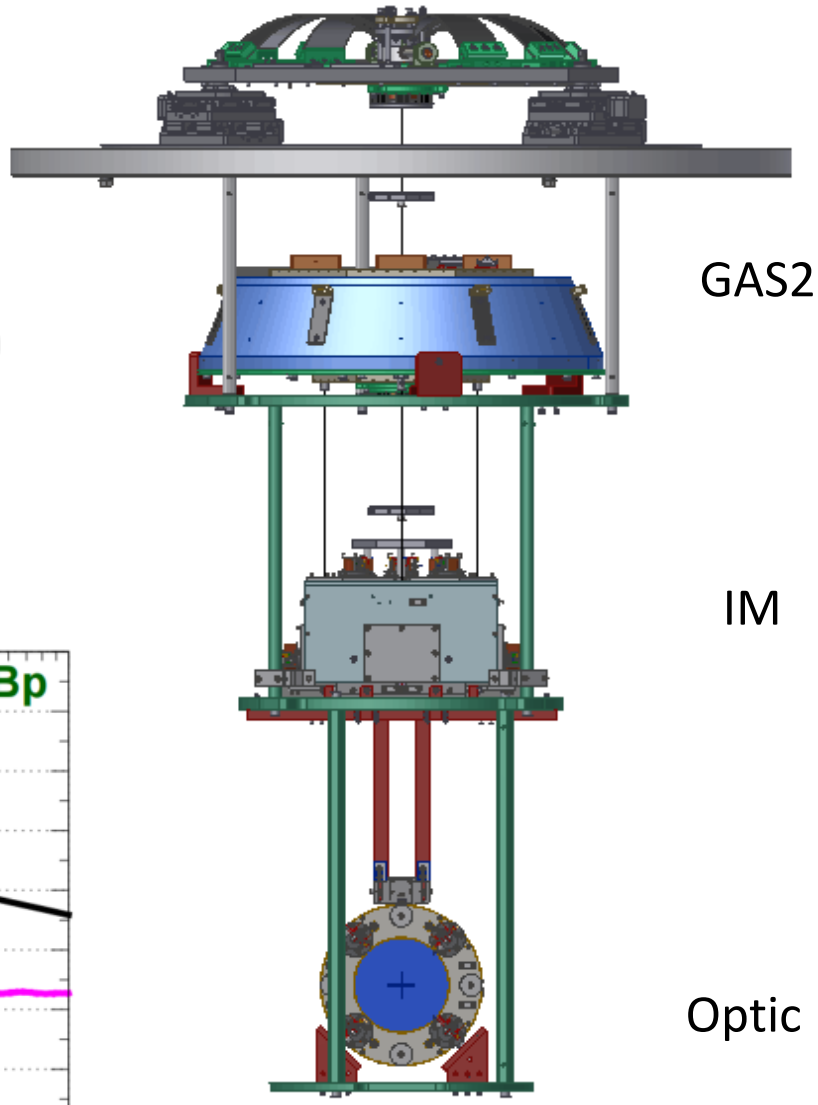
Type-Bp



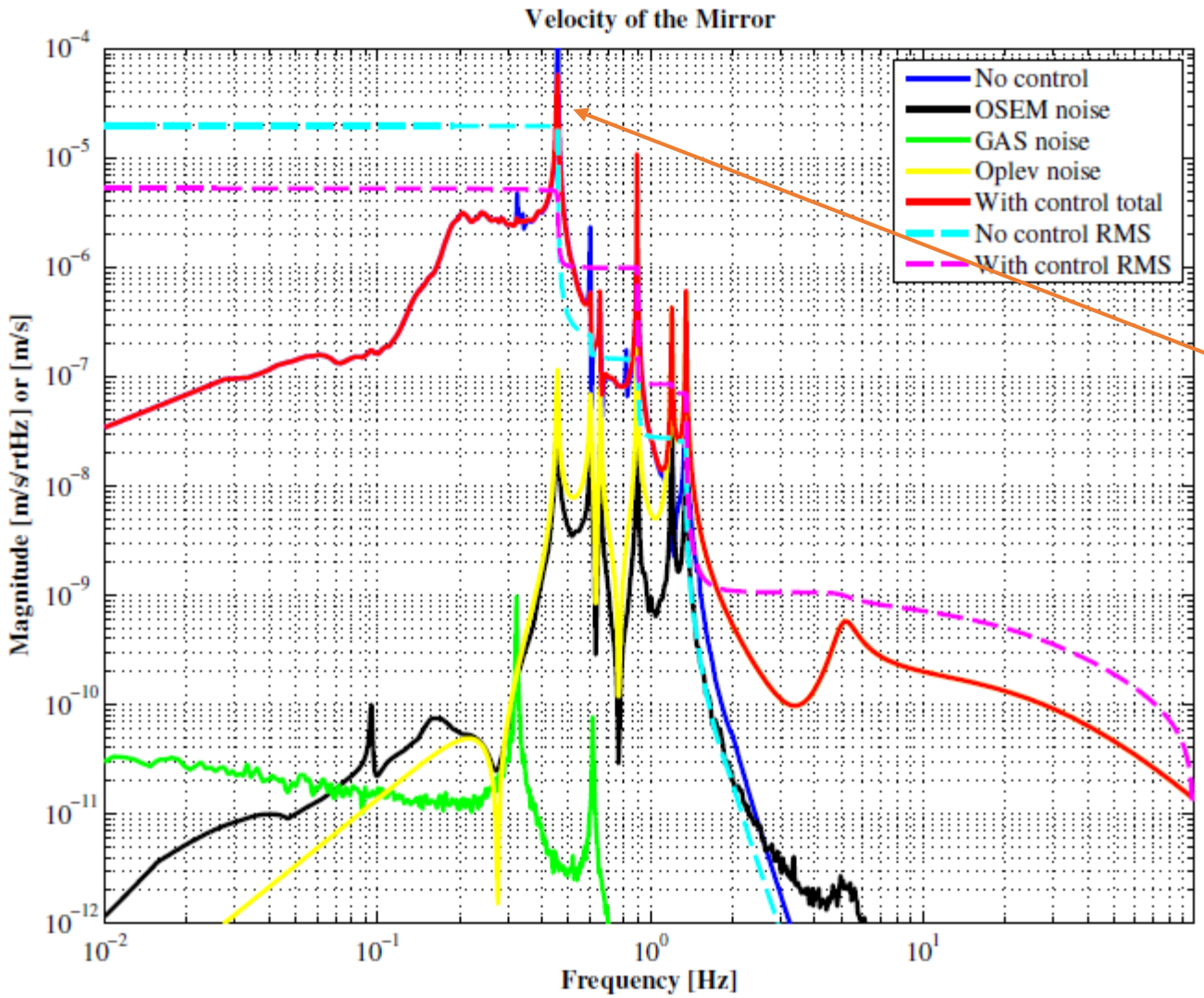


Calculated by T. Sekiguchi

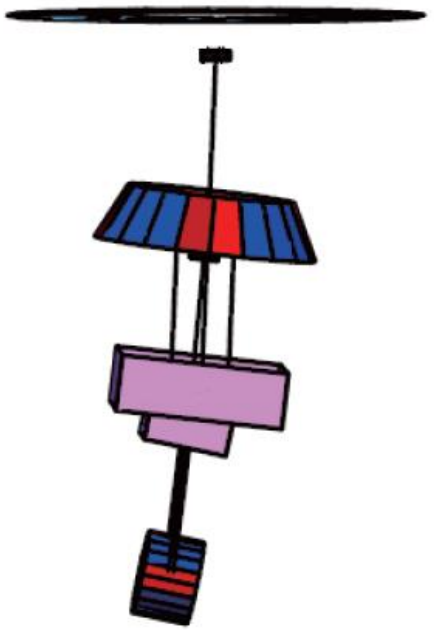


GAS1	LVDT	V
GAS2	LVDT	V
IM	OSEM	L, T, V Y, R, P
Optic	OSEM Oplev	L, P, Y

Problem in Type-Bp

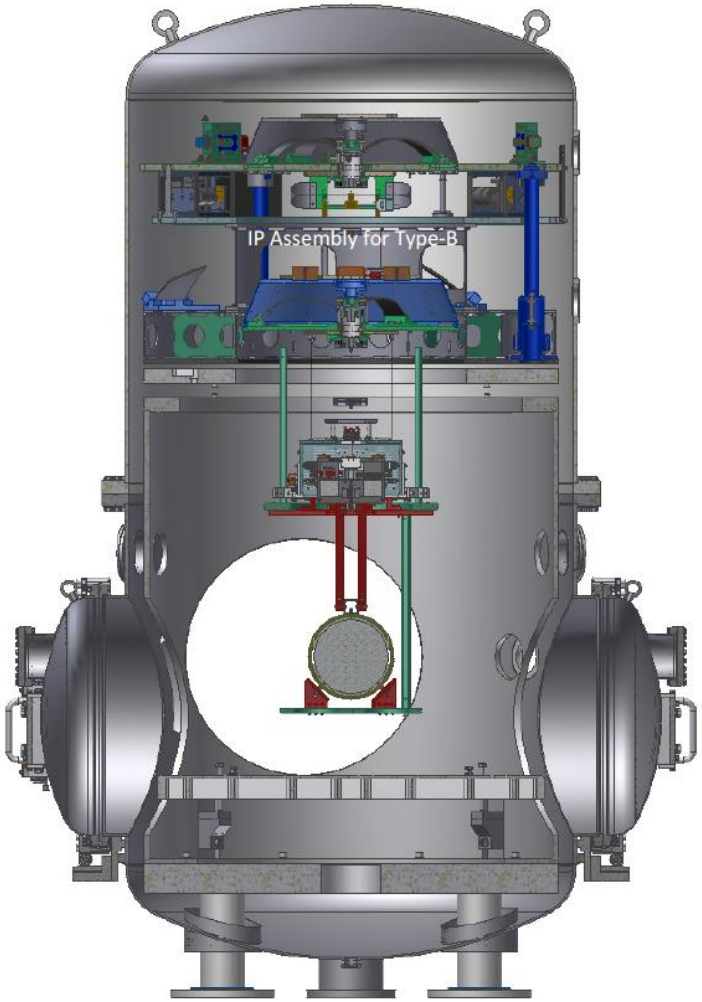


Cannot be damped!

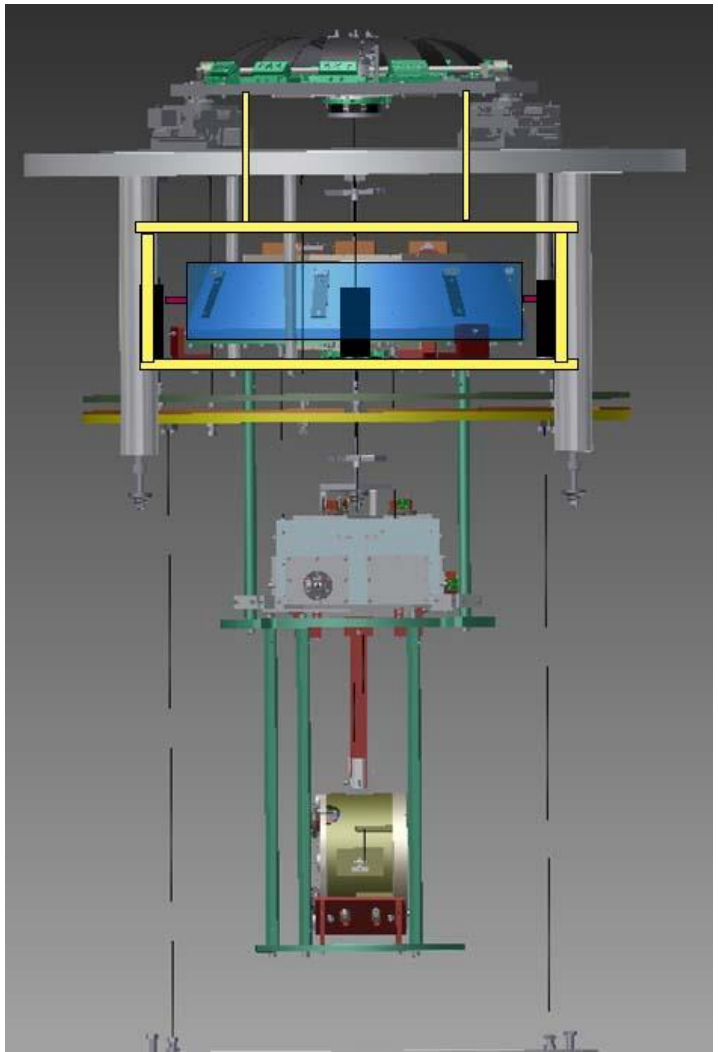


Modification plan

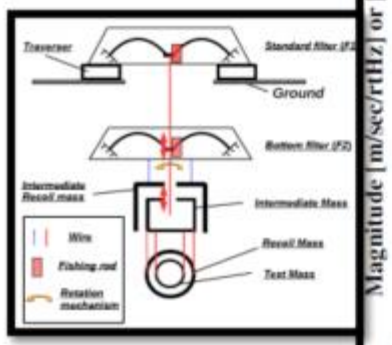
Plan A: Add IP

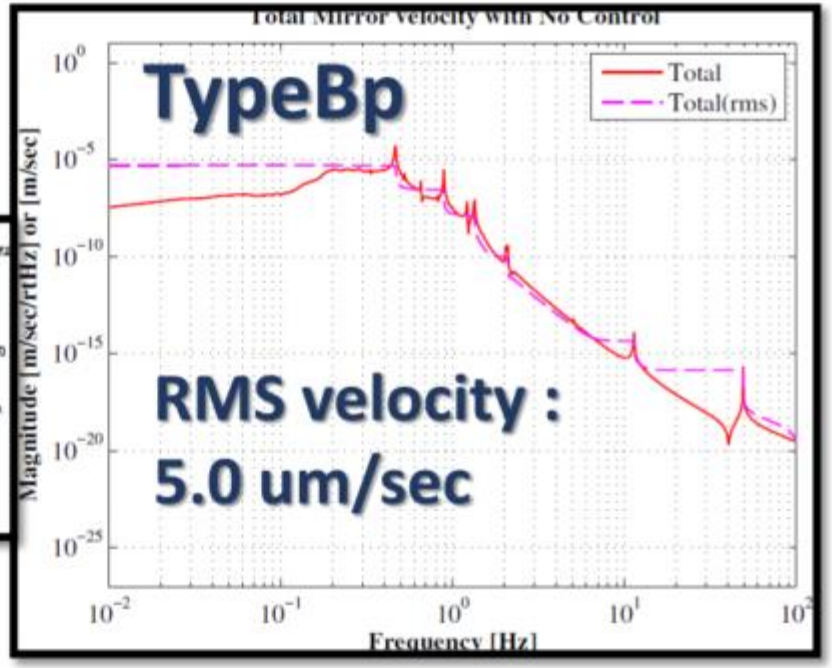


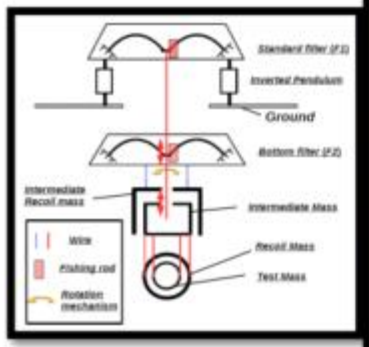
Plan B: Add active damping at the BF

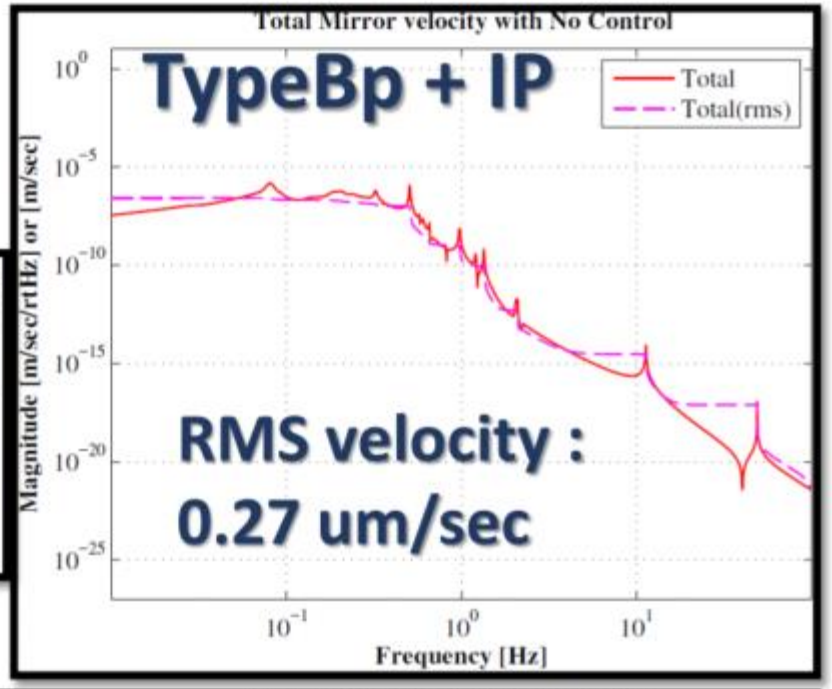


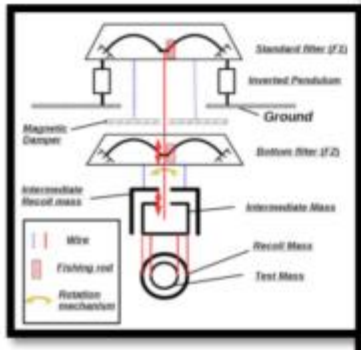
TM velocity without control

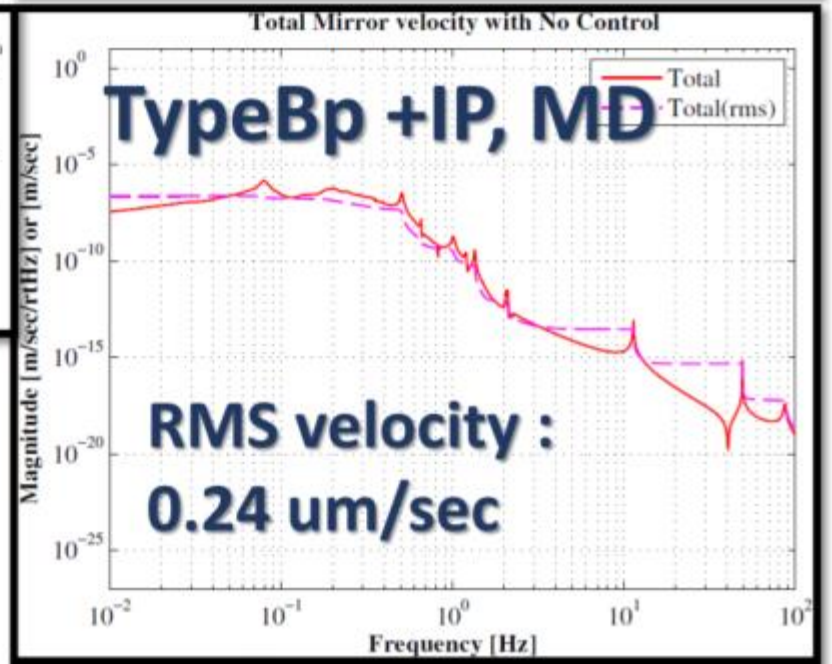












Calculated by Y. Fujii

MD doesn't bother the TM velocity.

Feedback on BF