

Actuator modification for cryopayload

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Motivations

- Nominal actuator parameters were set to meet the noise requirement for final bKAGRA
Y. Michimura+, [CQG 34, 225001 \(2017\)](#)
- High Power Coil Drivers for TM used in O3 (see [JGW-T1910142](#))
- High Power Coil Drivers are also used for IM and MN in O3
- We want higher actuation also for O4
- Three-stage whitening filter assumed

* NB model used for the calculation lives in <https://granite.phys.s.u-tokyo.ac.jp/svn/LCGT/trunk/kagranoisebudget/Suspensions>

* See, also [JGWwiki/KAGRA/Subgroups/VIS/ActuatorDesign](#)

Actuation Range and Noise

- Design for O3 summarized below
 - High power coil drivers were used for TM instead of the default low power coil drivers (x97.5 efficiency at DC)
- Note that the noise written below is for one of the ETMs

	Coil magnet [N/A]	Coil Driver	Max force [N]	Efficiency at DC [m/V]	Sum of noises at 10 Hz [m/rtHz]
Test Mass	0.0015 N/A	Low power (nominal)	7.7e-6	1.8e-9	1.0e-19
		High power (used in O3)	7.4e-4	1.7e-7	3.8e-18
Intermediate mass	0.015 N/A	Modified low	1.5e-4	1.7e-8	4.4e-20
		High power (used in O3)	1.9e-3	2.1e-7	2.2e-19
Marionette	0.45 N/A	Modified low	8.2e-3	3.9e-7	3.6e-20
		High power (used in O3)	1.1e-1	5.1e-6	1.8e-19

Noise requirement: 2e-19 m/rtHz @ 10 Hz (with safety factor of 10)

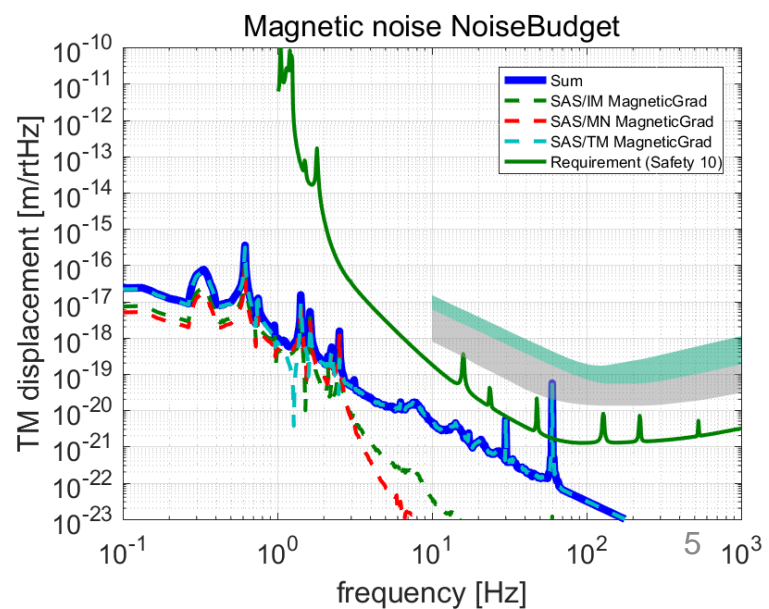
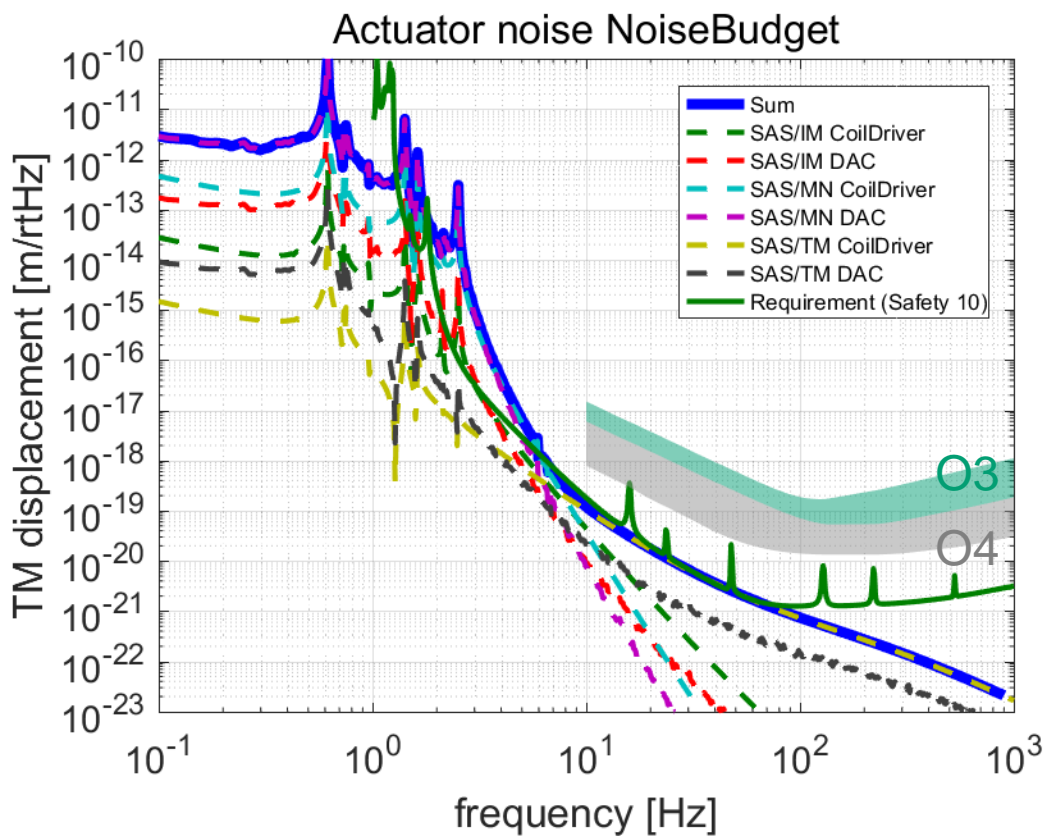
Actuation Range and Noise

- Design for O4 summarized below
 - x5 magnet for IM and MN
 - High power coil driver for MN? (x13 efficiency at DC)
- Note that the noise written below is for one of the ETMs

	Coil magnet [N/A]	Coil Driver	Max force [N]	Efficiency at DC [m/V]	Sum of noises at 10 Hz [m/rtHz]
Test Mass	0.0015 N/A	Low power (nominal)	7.7e-6	1.8e-9	1.0e-19
		High power (used in O3)	7.4e-4	1.7e-7	9.8e-18
Intermediate mass	0.075 N/A	Modified low	7.5e-4	8.3e-8	2.2e-19
Marionette	2.1 N/A	Modified low	4.1e-2	2.0e-6	1.8e-19
		High power (in O4 ?)	5.3e-1	2.5e-5	8.9e-19

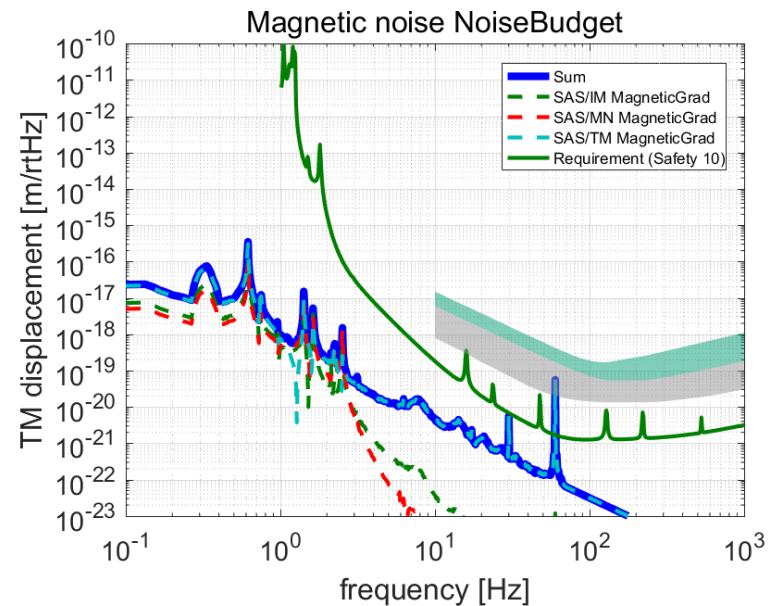
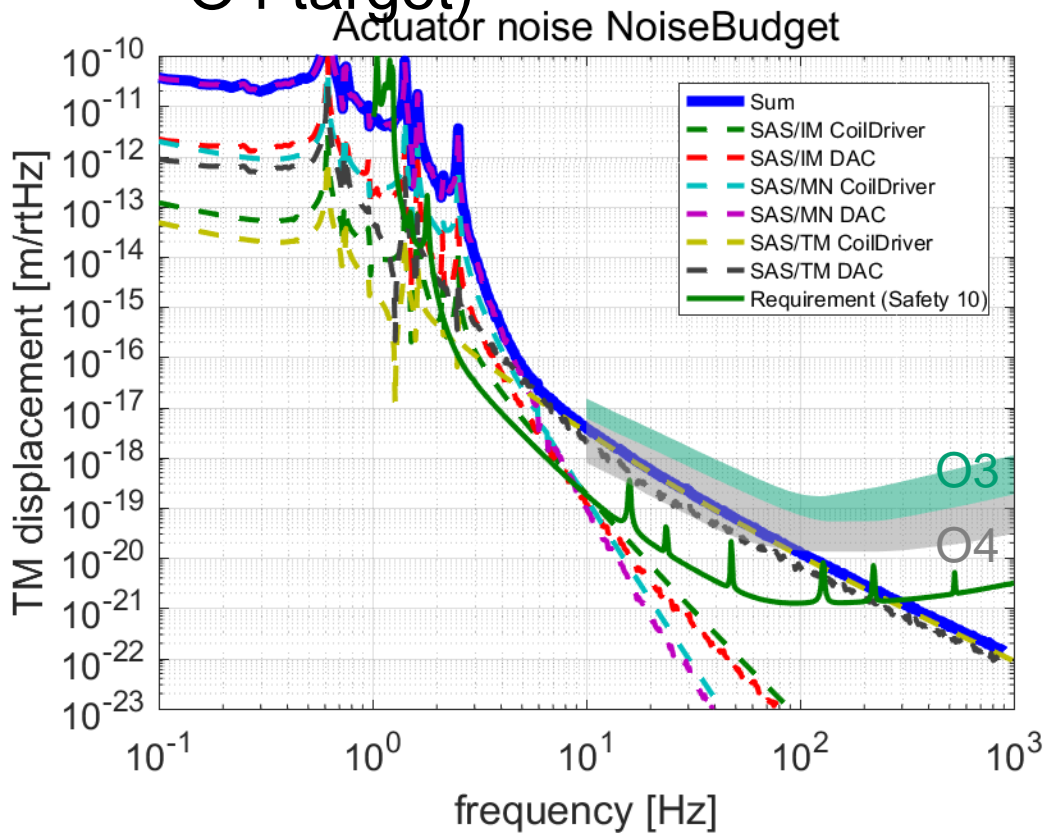
Actuator Noise (Nominal)

- Both electronics noise and magnetic noise are OK



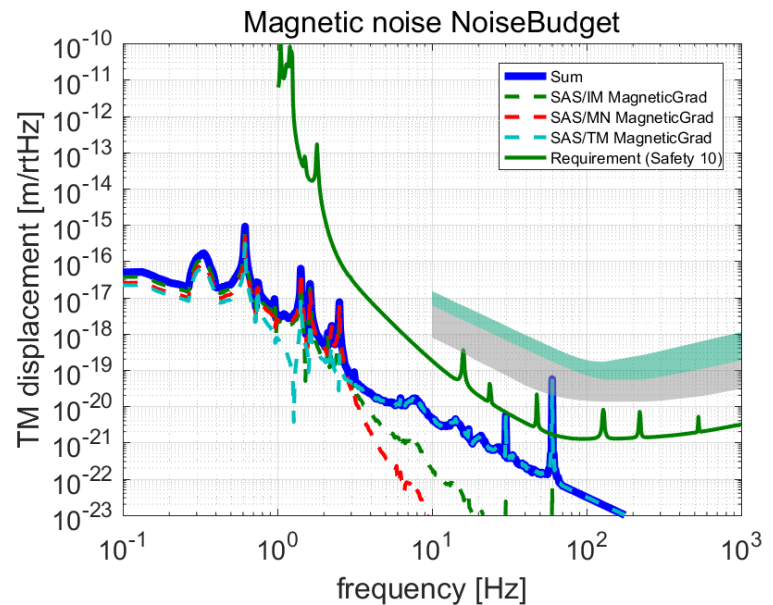
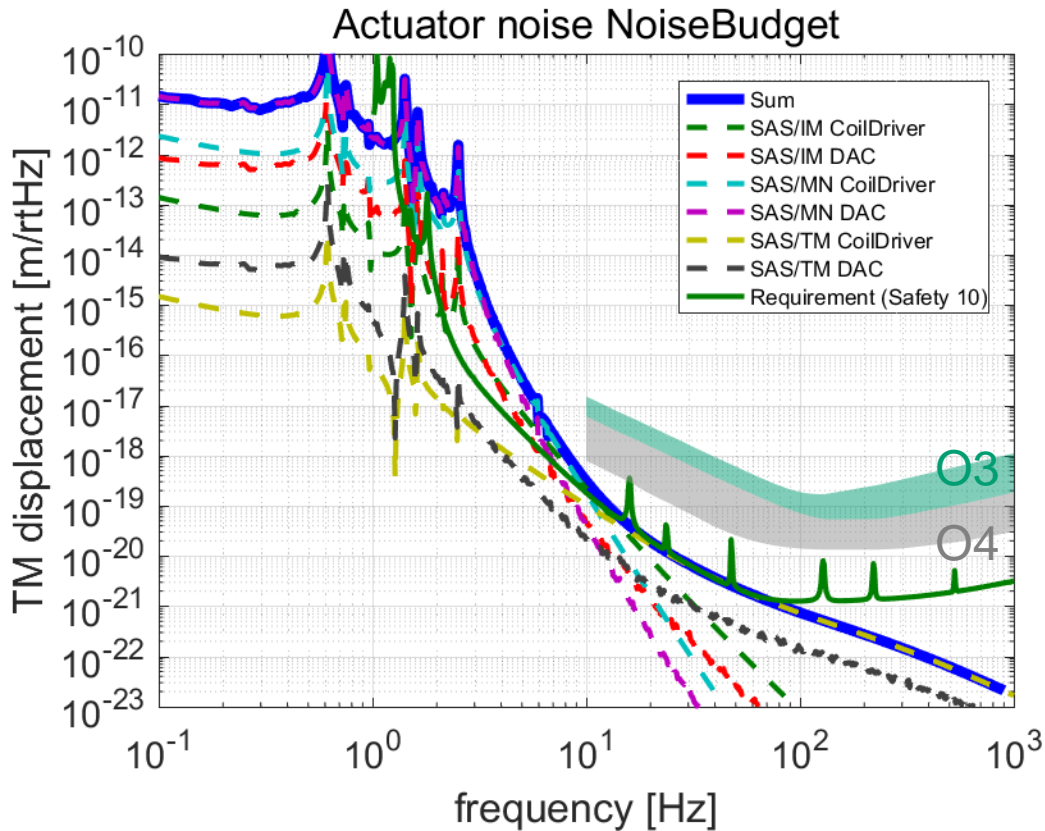
Actuator Noise (HP for TM/IM/MN)

- O3 situation
- TM electronics noise kind of OK for O3, but not for O4
- Note that noises plotted below are for one ETM and there are no safety factor included for the shaded area (O3 and O4 target)



Actuator Noise (x5 IM/MN)

- Electronics noise and magnetic noise for IM and MN increase by x5
- OK for O4, but not for final requirement



Actuator Noise (x5 IM/MN HP for MN)

- Further electronics noise increase for MN
- OK for O4, but not for final requirement

