

Noise and range calculations for using High Power Coil Driver for the test mass stage of cryopayload

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Motivations

- Nominal actuator parameters were set to meet the noise requirement for final bKAGRA
Y. Michimura+, [CQG 34, 225001 \(2017\)](#)
- We want higher power actuation for the early phase of commissioning to ease the lock acquisition
- Noise requirements can be relaxed for O3
- How about using High Power Coil Driver for the test mass stage of the cryopayload (at least for one of the ETMs)?

* 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

- High Power Coil Driver gives x100 range and noise
- High Power Coil Driver can output 0.12 A to coils
- Maximum current we can apply to cryopayload coils is ~100mA (according to Ushiba and Miyamoto)

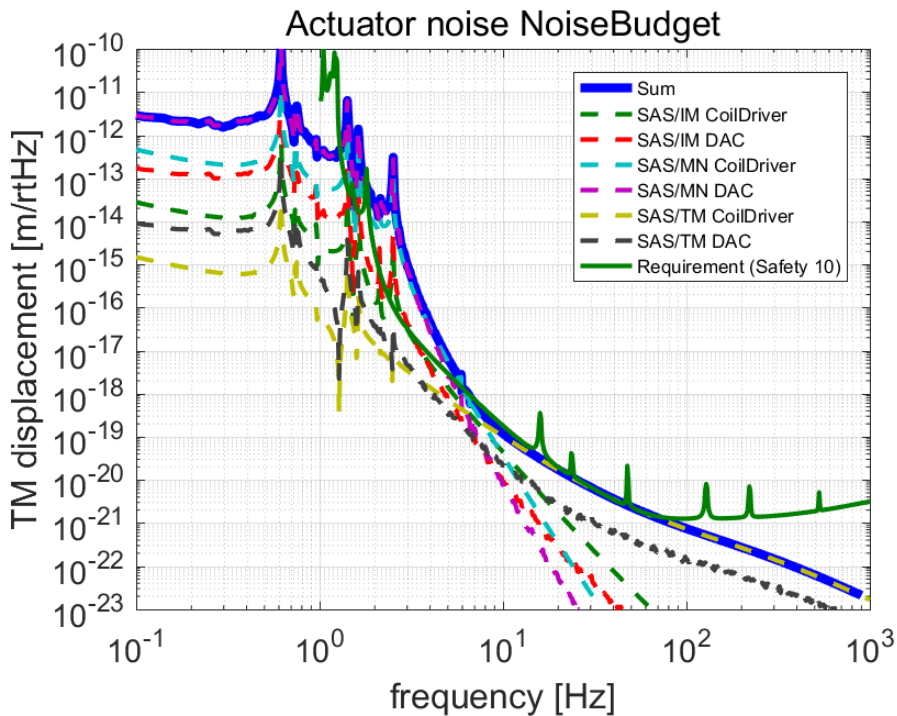
- Note that the noise written below is for one of the ETMs

	Coil Driver	Max force [N]	Efficiency at DC [m/V]	Sum of noises at 10 Hz [m/rtHz]
Test Mass	Low power	7.7e-6	1.8e-9	1.0e-19
	High power	7.4e-4	1.7e-7	9.8e-18
Intermediate mass	Modified low	1.5e-4	1.7e-8	4.4e-20
Marionette	Modified low	8.2e-3	3.9e-7	3.6e-20

Actuator Noise

- Actuator noise of $9.8e-18$ m/rtHz @ 10 Hz correspond to **$3.2e-21$ /rtHz @ 10 Hz** in strain, which is roughly aLIGO O1 excess noise x 12 (for one ETM)
- Within the range of O3 goal (see [JGW-T1809078](#)), but maybe not a good idea to use High Power for both ETMs

Nominal Case



High Power TM Case

