

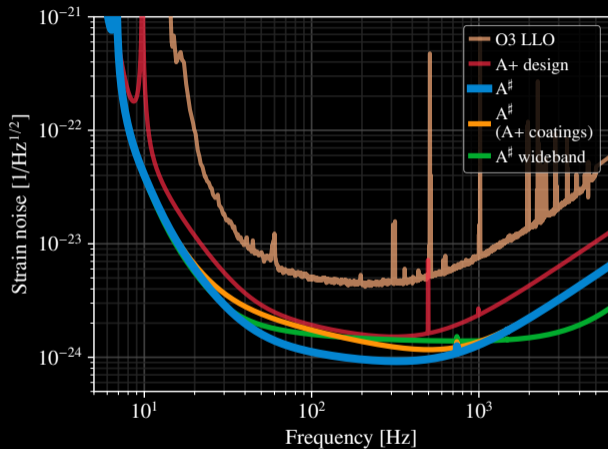
LIGO A#
Post-O5 Plans for LIGO

Kevin Kuns

May 22, 2023

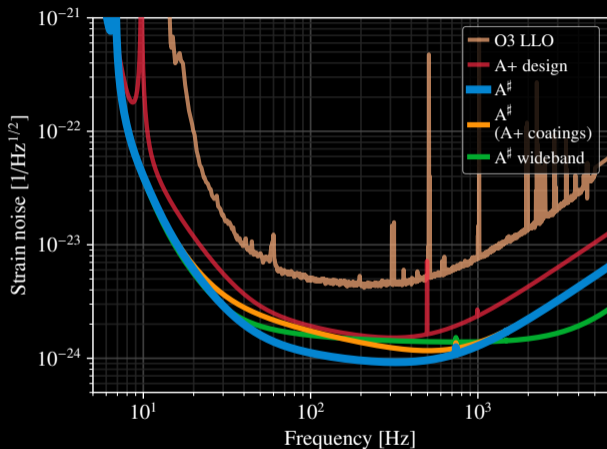
LIGO-G2301053

Post-O5 Era



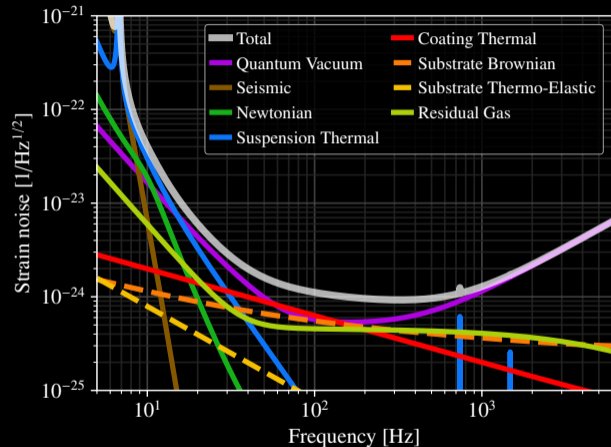
✦ The LSC recommended A[#] (aka CE^b) as LIGO's Post-O5 detector ([T2200287](#)).

Post-O5 Era



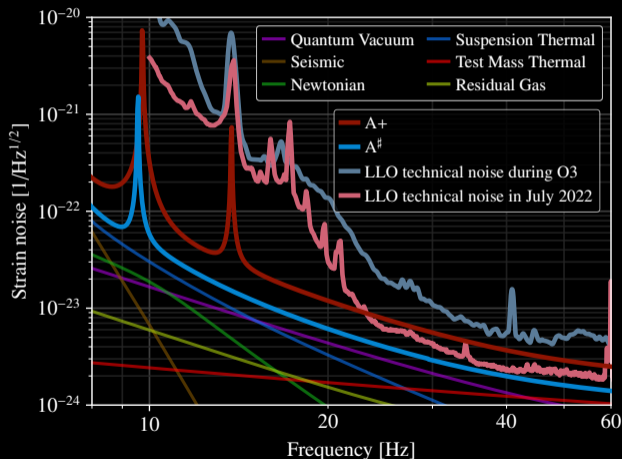
- ✦ The LSC recommended A[#] (aka CE^b) as LIGO's Post-O5 detector ([T2200287](#)).
- ✦ Baseline 2× reduction in CTN over A+.
- ✦ Possibility of wideband tuning.

Post-O5 Era



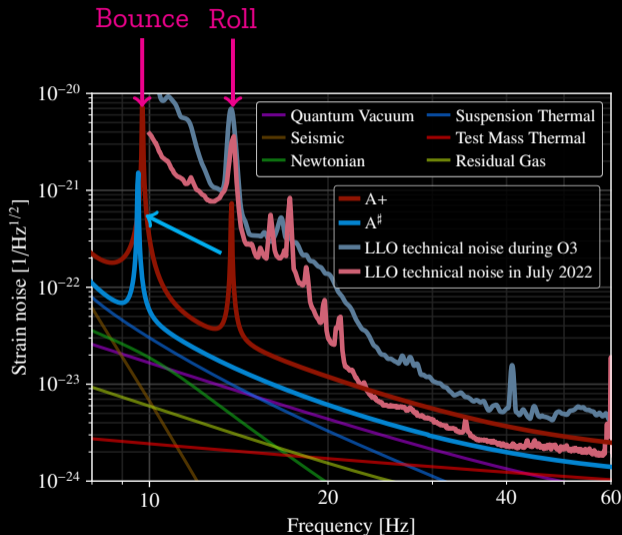
- * The LSC recommended A[#] (aka CE^b) as LIGO's Post-O5 detector ([T2200287](#)).
- * Baseline 2× reduction in CTN over A+.
- * Possibility of wideband tuning.
- * Continue with current room-temperature 1 μm A+ technology.
- * Larger masses, higher power, more squeezing, better suspensions, more isolation.
- * All detector improvements are necessary for Cosmic Explorer.

Low Frequency Improvements



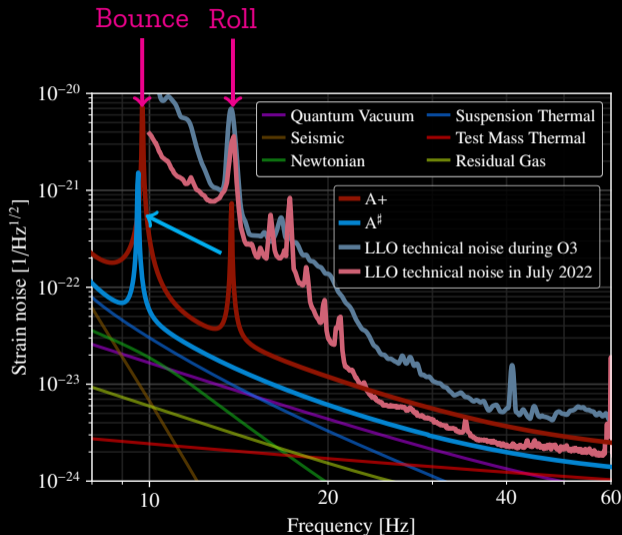
- * Test masses increased to 100 kg
- * Fiber stress increased to 1.6 GPa
- * Improved suspensions: "BSC Heavy Quadruple Suspensions" (BHQs)
- * Same suspension length
- * Improved seismic isolation with better sensors

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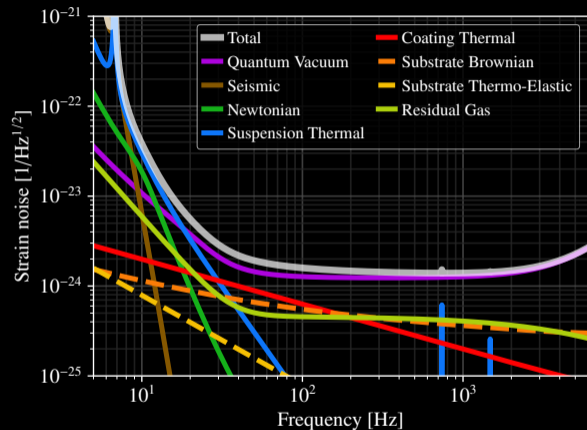


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- * Indirect reduction of controls noise
- * 2× suppression of Rayleigh wave Newtonian noise

Mid and High Frequency Improvements

- * Increased frequency dependent squeezing to 10 dB
 - ✧ Can currently generate sufficient squeezing but significant progress needed to reduce optical losses and improve mode matching.
- * Increased arm power to 1.5 MW
 - ✧ Poses significant TCS challenges in simultaneously achieving necessary power recycling gain and sufficiently minimizing squeezing degradations.
- * 2× reduction in coating Brownian noise over the, as yet unrealized, A+ target
 - ✧ Currently unspecified, but could be AlGaAs.

A# Wideband



A# with A+ Coatings

