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Investigation of Suspension Upgrades for the Advanced LIGO Gravitational Wave Detector

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To increase the sensitivity of the current interferometric gravitational wave detectors, an upgrade plan for the US based detectors, or “Advanced LIGO (aLIGO),” is being studied. As part of this upgrade, changing the mass, stress, and length of the suspension for the mirrors in the interferometers is considered to improve noise sources. From the previous year’s Matlab modeling result, the higher stress in the fibre and the longer last stage showed improvements in the detector’s sensitivity. Since the last stage of the suspension is held by fused silica fibres, which have very low loss to minimise suspension thermal noise, one of the challenges for this upgrade will be producing thinner and longer fibres that can hold the test mass safely. In this report, the impact laser stabilisation on fused silica fibres’ geometry and strength is being investigated to allow further improvements on fibre production to achieve aLIGO upgrades.

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