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## Low frequency vertical inertial sensor improvements

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Nowadays, sensors' resolution limits their performance at low frequency which reduces their operating range. Sensors with a good resolution at low frequency are required to improve the performance of gravitational wave detectors in the sub-Hz frequency range. We are currently developing an inertial sensor with a sufficient resolution at low frequency from 10 mHz to 100 Hz. We are focusing on the improvement of different characteristics of the sensor, among others, its compactness and its thermal noise mitigation. The readout consists of a long-range Michelson interferometer fed by a 1550 nm laser and whose signal is measured by InGaS photodetectors. The use of InGaS photodetector in our interferometer will allow better resolution for future sensor projects. The inertial mass is connected to the frame by a fused silica flexure joint to limit internal damping. Then, translational guidance is implemented to allow the use of a flat mirror. The actual sensor developed at the Precision Mechatronics Laboratory has a resolution of  $2 \times 10^{-13} \text{ m}/\sqrt{\text{Hz}}$  at 1 Hz. Our goal is to reach the same resolution with a compact version:  $10 \times 10 \times 10 \text{ cm}^3$ .

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