LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

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Capacitance Position Sensor Performance Requirements

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This is an internal working note
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Capacitance Position Sensor Requirements:

1. **Support frame to outer stage performance (Coarse)**
    a. +/- 1 mm dynamic range required
    b. Positional stability of less than 0.01 mm and 10 µrad of angular drift in a 30-day period. Ambient temperature is 22 ± 2 ºC
    c. 6×10^{-10} m/√Hz noise required at 10 Hz
    d. Bandwidth of 50 Hz or more
    e. Sensor to sensor isolation of 60 dB or more at 10 Hz
    f. UHV compatible sensor (1×10^{-9} torr or better) with bake out temperature of 125 ºC minimum
    g. Maximum non-linearity of 1% over required dynamic range
    h. 7 channels needed for the prototype

2. **Inner stage to outer stage performance (Fine)**
    a. +/- 0.25 mm dynamic range required
    b. Positional stability of less than 0.01 mm and 10 µrad of angular drift in a 30-day period. Ambient temperature is 22 ± 2 ºC
    c. 6×10^{-11} m/√Hz noise required at 10 Hz
    d. Bandwidth of 50 Hz or more
    e. Sensor to sensor isolation of 60 dB or more at 10 Hz
    f. UHV compatible sensor (1×10^{-9} torr or better) with bake out temperature of 125 ºC minimum
    g. Maximum non-linearity of 1% over required dynamic range
    h. 7 channels needed for the prototype