

*Barry Controls Isolators:
Are they useful for LIGO?*

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LIGO-G950051

Barry Controls Isolators

Are they useful for LIGO?

- Effect on length fluctuations

- ›› 4 km baseline

- $f = 0.1 - 1 \text{ Hz}$ (below servo band): $\Delta L_{\text{rms}} = 1 \text{ micron}$

- $f > 1 \text{ Hz}$ (in servo band): $\Delta L_{\text{rms}} = 0.003 \text{ micron}$ ($\lambda/150$)

- STACIS wouldn't reduce dynamic range required of mirror controller

- GW band: suppression factor of 30 at 30 Hz.

- ›› within vertex station (10 m baseline)

- $f > 0.1 \text{ Hz}$: $\Delta l_{\text{rms}} \ll 1 \text{ micron}$ (distortion of slab by microseismic peak ?)

- effect of STACIS would depend on effect of microseismic peak on the slab

- reduction of rms lengths would influence control system of $l_1 + l_2$, $l_1 - l_2$ loops

STACIS for LIGO ?

- Effect on relative velocities (lock acquisition)
 - ›› 4 km baseline
 - microseismic peak: $v_{rms} = 1 \mu\text{m}/\text{sec}$
 - stack modes, $Q \sim 10$, $v(2.5 \text{ Hz}) = 0.02 \mu\text{m}/\text{sec}$
 - STACIS wouldn't reduce relative velocities
 - ›› within vertex station (10 m baseline)
 - relative velocities dominated by stack modes? (case for 40m)
 - if so, v_{rel} would be reduced by factor of ~ 10
- To make big impact on control system, need to reduce 4 km length fluctuations due to microseismic peak
 - ›› reduce mirror controller dynamic range by factor of 10 (more?) Currently $10 \mu\text{m}$ pk-pk, noise $< 10^{-20} \text{ m}/\sqrt{\text{Hz}}$ at 100 Hz.
 - ›› reduce relative velocities: effect on acquisition ?
 - ›› additional feedback input from long-period seismometer along optic axis direction may be sufficient

STACIS for LIGO ?

- Barry Controls is satisfied with current STACIS, not interested in developing better performing product at this time
- Hood Technology (A von Flotow) has an Air Force SBIR for improving the performance of the STACIS system
 - ›› content of SBIR is loosely defined - Hood Tech willing and eager to get input on what improvements are desired
 - ›› SLAC has shown interest in working with Hood Tech - may supply long-period seismometer for incorporation into STACIS
- Load: STACIS can support 2500 lbs/foot
 - ›› design load bearing element
 - ›› reduce weight of isolation stack