LIGO - Seismic Platform Interferometer

Supplementary low frequency sensor for seismic platform control

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Hanford / Livingston Observatories
Advanced LIGO Sensitivity
LIGO Vacuum Chambers
Almost 10 orders of magnitude isolation needed

Ground: $2 - 6 \times 10^{-10} \, \text{m} / \sqrt{\text{Hz}}$ at 10 Hz

HEPI: $3 - 10 \times 10^{-9} \, \text{m} / \sqrt{\text{Hz}}$ at 10 Hz

ISI: $3 \times 10^{-12} \, \text{m} / \sqrt{\text{Hz}}$ at 10 Hz

Optic: $1 \times 10^{-19} \, \text{m} / \sqrt{\text{Hz}}$ at 10 Hz
Tilt-Horizontal Coupling
SPI Schematic
SPI, The TDP / RPP Link
SPI Measured Differential Motion
Active Platform Control

TDP ISO, RPP Damped - SPI LPY Control

ΔGS13 No CTRL
ΔGS13 CTRL
• Long arm high sensitivity mode
• Automatic switching between modes
• Vacuum compatibility
  – Fiber launching / FC-APC
  – 1550 nm polyimide fiber
• Control Design
• Laser Frequency Stability
Thank You!

NASA/ESA/HEIC and The Hubble Heritage Team (STScI/AURA)