For nearly 20 years, the LIGO laboratory has designed and built vibration isolation systems for gravity waves observatories [1] [2]. The new generation of active platforms designed for Advanced LIGO provides unprecedented levels of isolation and positioning accuracy [3] [4].

While they were designed for highly sensitive physics experiments, the systems features presented in the inner pages show the platforms are also adequate to carry a broad range of industrial applications requiring six degrees of freedoms isolation and nanopositioning capability.

This research and development program is led by the LIGO Seismic Isolation Group. This team of Engineers and Researchers at Caltech, MIT, Stanford and the two LIGO Observatories works full-time together on the design, testing, production and installation of these systems.

Massachusetts Institute of Technology

LIGO was constructed by the California Institute of Technology and the Massachusetts Institute of Technology with funding from the National Science Foundation. It operates under cooperative agreement PHY-0107417

These NSF-funded developments for seismic and vibration isolation may be of use to other high-sensitivity measurements or commercial applications. Please contact us for more information.

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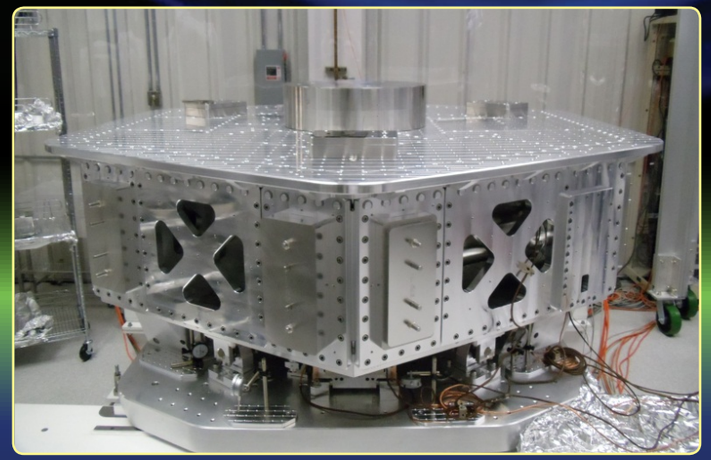
LIGO

Vibration Isolation and Positioning Systems



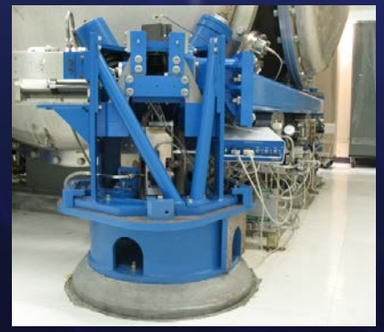
LIGO Vibration Isolation and Positioning Systems are designed to provide ultra-high levels of isolation over a very large frequency band. The platforms provide isolation from 0.1 Hz to several 100 Hz in six degrees of freedoms *(3 translations and 3 rotations)*. Passive and active isolation are combined to obtain up to four orders of magnitude of attenuation in the control bandwidth.

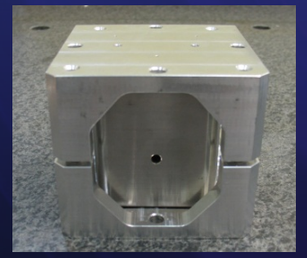
The platforms are compatible with ultra-high vacuum environments. They can carry a broad variety of applications and support over 1000 kg of equipment. The six degrees of freedom are actively controlled to servo-position the platforms with sub-nanometer and sub-nanoradian resolution.

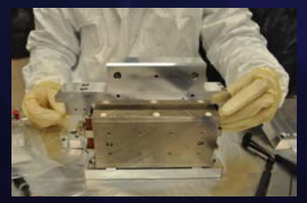
PRODUCTS AND ACTIVITIES
Overview

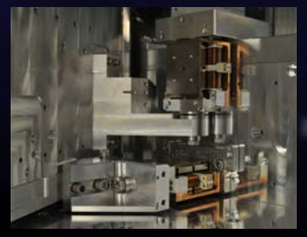
SYSTEMS AND SUB-SYSTEM COMPONENTS DEVELOPED BY LIGO:

- Hydraulic positioning and vibration isolation systems [5-6]
- Ultra High Vacuum compatible vibration isolation and positioning platforms [7-9]
- Passive vibration isolation systems [1-4]
- Sealed pods for using geophones and seismometers in UHV
- UHV compatible voice coil actuators
- UHV compatible low noise position sensors
- Vibration absorbers and tuned mass dampers
- Low noise electronics for inertial instruments
- Motion Limiters





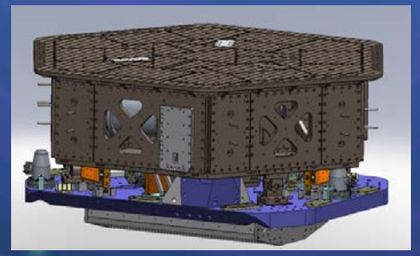


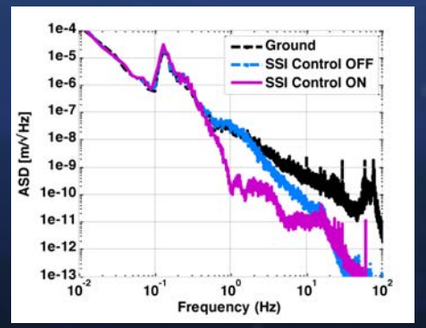


SINGLE STAGE
Vibration Isolation System

KEY FEATURES AND BENEFITS:

- 6 Degrees of Freedom Active /Passive Platform
- Ultra-high vacuum compatible
- Can carry up to 600 kg of payload
- Passive isolation: 1/f ^2 from a few Hz to ~100Hz
- Control bandwidth: up to 30Hz
- 6 Electromagnetic Actuators
- 6 Capacitive Position Sensors for DC and Low frequency Control
- 6 single axis Seismometers for Inertial Feedback Control
- Very low noise sensors and electronics
- Optional Feed-forward Instruments for enhanced performance





TWO STAGE
Vibration Isolation System

KEY FEATURES AND BENEFITS:

- Two Stages of Isolation
- 6 Degrees of Freedom per stage
- All degrees of freedom actively controlled
- Ultra-High Vacuum Compatible
- Can carry over 1000 kg of payload
- Passive isolation: 1/f ^4 from a few Hz to ~100Hz
- Control bandwidth: up to 30Hz
- 12 Electromagnetic Actuators
- 12 Capacitive Position Sensors for DC and Low frequency Control
- 12 single-axis and 3 three-axis seismometers blended for broadband inertial control
- Very low noise sensors and electronics