

Selection of the External Preisolator (M030123-00-M)

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Operation of the Livingston 4 km interferometer has been limited by local vibrational disturbances. This has prevented operation during most daytime periods and on some heavy activity weekend periods. The interferometer has operated successfully for scientific running during night and other quiet periods.

At its outset, the design of the LIGO interferometers included provision for additional isolation for implementation for upgrades and, if needed, due to encountered conditions. The provision was a design allowance in the external supports at each vacuum chamber. This design allowance now permits us to respond to the high level of disturbances in Livingston.

LIGO development foresaw that the additional isolation would be provided by active systems. During early LIGO development, fully active pre-isolators were studied by the LIGO MIT group using modified commercial hardware from Barry Controls.

Insights gained from this work motivated custom pre-isolator development in the LIGO Scientific Collaboration for Advanced LIGO. The Stanford group proposed a pre-isolator based upon a hydraulic actuator. In January 2001, this system was selected, after careful review, as the baseline pre-isolator for Advanced LIGO.

The hydraulic pre-isolator was also considered to be a candidate for pre-isolation in Livingston when it became apparent that earlier implementation of supplementary isolation would be needed. A review in March 2002 adopted the hydraulic pre-isolator (HEPI) as the baseline choice for this application and approved a rapid development program. As insurance against a shortfall in HEPI performance, a vigorous program to develop a backup actuator was also initiated. The LIGO group at MIT proposed a magnetic actuator (MEPI) for this alternate test program.

Based upon an April 2003 comparative review of the HEPI and MEPI test programs, a May review report, responses to set of specific questions from us and several discussions with the involved scientists, we have decided to select the HEPI system for implementation in Livingston. Both actuators promise to meet the LIGO requirements and it is a tribute to the MEPI team that they were able to achieve such performance in a short time.

However, based upon the HEPI:

- "Robustness" - the ability of its design to function reliably and safely, with good engineering margins and without excessive fine-tuning, and
- Superior suitability for application in Advanced LIGO

We have concluded that HEPI is the advantageous option. We have carefully considered many other factors, including other projected performance issues, cost, schedule, implementation, etc. in making this final decision.

We authorize the implementation of HEPI at Livingston, funded by LIGO operating accounts, as a needed upgrade based upon LIGO operating experience to date. We authorize the implementation of HEPI at LASTI, as a platform for Advanced LIGO development from accounts supporting this R&D at LASTI.

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