

Report of the LASTI Technical Advisory Committee LIGO-T010096-00-R

Based on its 4th meeting, 14 August 2001, at the LSC Meeting at LHO

Members in attendance: Dennis Coyne, Riccardo DeSalvo, Brian Lantz, Fred Raab, Peter Saulson (chair), and Alan Weinstein.

Mike Zucker gave the overview and summary presentations. Dave Ottaway described issues concerning the optical configuration. Gregg Harry presented the results of noise modeling of various configurations. Ken Mason gave a status report on the hydraulic SEI pre-isolator.

1. Progress since the last meeting of the TAC

The TAC congratulates the LASTI team for the excellent progress they have made on completing the LASTI infrastructure. The rest of the LIGO Lab also deserves credit for contributions by a number of visiting experts.

We are also pleased by the success of the visit of LSC members from Glasgow, Norna Robertson and Calum Torrie. The installation of the quad pendulum prototype is an important milestone along the way to qualifying the SUS system for Advanced LIGO.

The LASTI staff has been filled out nicely. There are now three physicists associated with LASTI (Harry, Mittleman, and Ottaway), two of whom gave presentations to the TAC.

2. Optical configuration

Dave Ottaway presented the current thinking about the optical configuration for the main LASTI tests, and Gregg Harry described the noise budget of that configuration and of several variants. We were pleased to see that what had been a one-week-old idea at our last meeting has not only survived but has been fleshed out nicely. (Ottaway mentioned that a problem had just been noted, concerning the amount of light reflected onto the photodiode due to the high reflectivity of the cavity.)

The plan looks like a good one for meeting LASTI's goals. One issue deserves further thought, however. The noise models presented by Harry showed that a less risky optical design based on more stable cavities provides almost the same noise performance. We urge that the risk-benefit trade be weighed carefully before making the decision about the cavity parameters. The spirit in which the final judgment should be made is to obtain the best displacement noise possible without "heroic" measures.

There is plenty of time before the decision on cavity parameters has to be made. Nevertheless, making a best guess on this question could have some short-term benefits. This is because LASTI's excellent progress on completing the infrastructure has created a window of time before delivery of SEI prototypes, during which some useful preliminary work can be done. Ottaway presented a plan to use this time for gaining experience with

marginally stable cavities. Assuming that LASTI sticks with the newly proposed optical configuration for its main tests, this idea makes sense. But if there is only slight benefit for using the marginally-stable cavity configuration, then perhaps more stable cavities would be used instead, and then this interim period could be better spent. (See the next section.)

3. Hydraulic pre-isolators

An alternative use for this time may soon get top priority. If LIGO decides to install hydraulic pre-isolators at LLO to deal with the 1-3 Hz seismic noise problem, then LASTI would be the place where tests would be carried out. Work on the hydraulic pre-isolators has of course long been part of the LASTI program, ever since the “stiff” system was chosen for Advanced LIGO. Mason showed the substantial progress that has been made on design work.

Because of the substantial possibility that the hydraulic system may be called upon early to solve the LLO seismic noise problem, we think it is important for the LASTI team to think through how its program would be affected by such a choice. The present schedule calls for 6 DOF testing to be completed at the end of July 2002. If the decision is made to install promptly at LLO, it would be beneficial if this schedule could be shortened. An ideal test would involve installation on both HAM and BSC tanks with complete LIGO I stacks as loads; it may, however, be prudent to consider reasonable shortcuts (such as a fit test on a BSC without requiring a “live” stack as the load.) Discussion at our meeting suggested that in order to shorten the schedule significantly, the SEI effort would require additional engineering support.

While we do believe it is important to think through the impact such an effort would have on the LASTI program if early installation of hydraulics is chosen, we do NOT recommend any substantial change to the LASTI program at this time. LASTI should support the LLO seismic decision-making process as best it can, but needs to avoid “whiplash” in its program as various possibilities are considered.

4. Other short-cavity tests and “PSL-enabled” tests

The committee was asked for guidance on the value of a variety of additional optical tests, beyond the baseline LASTI program. But since there was little time for discussion of the details of these ideas, it isn't sensible for the TAC to offer specific advice.

We do want to remind LASTI of the hazard of straying too far from its core mission of testing Advanced LIGO components (especially SEI and SUS) at full scale, to qualify them for adoption and to prepare them for speedy installation. Of course changes to the program can be made. The criteria for judgment include importance for the LIGO program, consistency with LASTI's ability to fulfill its other goals, and whether there are other facilities available to make the tests.