

Report of the LASTI Technical Advisory Committee

Based on its 3rd meeting, 16 March 2001, at the LSC meeting, Baton Rouge

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

David Shoemaker and Ken Mason presented an update on LASTI status and new information about plans for the program. There were two topics of the plan that received special emphasis: a new idea for an optical layout with better sensitivity, and integration of the facility plan with subsystem test plans.

1. Review since last meeting of the TAC

We note that the ideas that had been discussed at our previous meeting (17 August 2000) and endorsed by the TAC have been incorporated into the LASTI plan.

- LASTI will not attempt a “heroic” test to the same displacement sensitivity as the Advanced LIGO goal.
- LASTI has revised its schedule to ensure that it harmonizes with the need to provide timely input into the rest of the Advanced LIGO design process.
- A test of the Advanced LIGO IO and PSL subsystems is now built into LASTI’s plan.
- A test of a Recycling Mirror suspension is now incorporated into the LASTI plan.
- An early test of the “cartridge installation” procedure will be carried out.

2. New optical layout

David Shoemaker presented a brand-new (one week old!) idea for an optical layout that will allow a test of the noise in sapphire optics at a level that is competitive with performance that could previously only be promised with silica optics. The design has two key features. First is the use of a long (16 meter) cavity geometry so that beam spots can be bigger, and hence thermoelastic noise will be smaller. A drawback of the long cavity is that it no longer provides dilution of frequency noise. The second feature of the new idea deals with this problem, by adding a second (parallel) long cavity, so that a balanced-arm interferometer is created. This will give enough rejection of laser frequency noise (which will be common-mode for the two arms) for the resulting noise budget to offer excellent performance.

The TAC felt that this plan offered the best balance yet between the competing demands of the need to test subsystems’ form, fit, function and installation with high fidelity and the need to verify noise performance. One additional suspension (for an RM) is required, but this seems a small price to pay for the benefits. *The TAC wants to encourage the LASTI team to pursue this idea.*

The new idea was new enough that David was not able to show detailed layout drawings, and indeed it is not entirely clear that the new optical scheme will fit in the

vacuum envelope. *Carrying out a detailed layout should be a high priority, to learn for certain whether this idea can be carried out.*

At our meeting, there was some discussion about whether silica test masses ought to be used to try to reach lower levels of displacement noise. The TAC ended up arguing against such a perturbation of the present plan. It goes against the guiding philosophy of the LASTI program of not trying to do “heroic” noise measurements. Among the elements of heroism that this would have required would be a separate design of suspensions just for this test. (The difference in mass density between silica and sapphire is substantial. A member of the SUS team who was present at our meeting appeared distraught at the prospect of having to make another set of SUS designs just for this test.) Thus, a silica test for noise would compete for LASTI’s attention with a faithful sapphire test for form, fit, and function. Of course, there is a conflict only because we are assuming here that the choice of test mass material for Advanced LIGO will be sapphire; if the choice is made to use silica, then silica would then naturally be the choice as well for LASTI’s “noise prototypes.”

3. Schedule of LASTI and subsystems

Since the TAC’s last meeting, the LASTI team revised its schedule to ensure that results would be delivered at the times required by the overall Advanced LIGO schedule. Now, however, the estimated time for delivery of the first SEI system has slipped from the 1st quarter of 2002 to the 3rd or 4th quarter of 2002. This needs to be propagated through the LASTI schedule. It is possible that the later parts of the LASTI schedule might not need to slip, but that needs to be investigated.

4. Staffing issues

The LASTI team has been augmented by the hiring of Gregg Harry at MIT. He will also work on measurements related to the issue of the mechanical Q of mirror coatings, but his commitment to that work was described as an “accordion”, to be squeezed when LASTI needs the major part of his attention. The LASTI plan calls for the hiring of an additional postdoc; filling this position will be important.

A strong case was also made by the SEI team for the need for concentrated support during subsystem installation from the cadre of technicians resident at LHO and LLO.

David reiterated his call for long-term visits from LSC members, both SEI or SUS team members and others. The most appropriate time for this help would come after subsystem installation, during the times set aside for performance testing. It is not too soon for the LASTI leadership to start asking for detailed commitments.