

# Advanced LIGO Triple Pendulum Controls Prototype Mode Cleaner Suspension to LASTI

## Official Transfer

The Advanced LIGO triple pendulum controls prototype mode cleaner suspension's arrival at LASTI marks the transfer of the lead responsibility of the testing of this controls prototype suspension from the SUS group to the LASTI group. The SUS group will support the LASTI group during the testing, but the management/direction and scheduling of the test program and the responsibility for the data products becomes primarily a LASTI responsibility,

## Purpose

The purpose of the MC installation tests at LASTI is:

- 1) to reduce risk to the Advanced LIGO LHO and LLO suspension installations. By performing a dry-run now, at LASTI, procedures and equipment may be streamlined and optimized. Not only risk is reduced but the chance for cost and schedule delays are also reduced.
- 2) to develop a strategy for coordinated SEI and SUS controls (with the HEPI system and later if/when the SEI group delivers a HAM isolation system, with the entire HAM SEI AdL system).
- 3) to further characterize the dynamics and control of the MC suspension and gain operational experience on the design which may serve to inform the future design revisions, production and observatory operations.

## Document Transfer

A package will be sent to D. Ottaway that includes the following. Because this is a controls prototype delivery, a number of the following documents are in their preliminary configuration.

1. Advanced LIGO Mode Cleaner Triple Pendulum Suspension Assembly Specification, E030518.
2. Installation Procedure for Advanced LIGO Mode Cleaner into LASTI HAM Chamber, E040277.
3. Design Package for the Advanced LIGO Mode Cleaner Controls Prototype Overall Assembly, September 2003. Drawings may be out of date or referencing an old revision. Please reference the LIGO Document Control Center or a Caltech representative of the suspension team for the most up to date information or if you have any questions regarding this material.
4. OSEM test data sheets for hybrid and LIGO1 osem
5. Packing Slips, E040282, E040283
6. Suspensions Controls Prototype Test Plan, E030546
7. Revised LASTI experiment Plan Regarding SUS, RODA M040007.
8. LASTI Prototype Suspension Controller Operation Manual, E030513.
9. Mode Cleaner Check List, June 2004

10. Spacers and Standoffs for the Mode Cleaner Controls Prototype Upper Mass, D020534, September 2003.
11. Controls Prototype: - Library of Clamps for Cantilever Blades in the Mode Cleaner Suspension, June 2003. Includes the Excel spreadsheet summarizing the characterization of the cantilever blades.
12. Photograph highlighting the orientation of the upper wire assembly jig, May 2004.
13. Controls Prototype: - Measurements on the Mode Cleaner Triple Pendulum at Caltech, June 2003.
14. Guide for Specification of Imperial Bolts, Threads and Hole Fits in Advanced LIGO Parts, T030118.
15. Information relating to Allen key selection
16. Spring Steel Wire Flexure Point, D040183.. The flexure point was not included in the mode cleaner suspension. When comparing mode frequencies with the model, this calculation should be considered.
17. Magnet/Standoff Assembly Preparation Specification, E990196.

The following documents were distributed to Laurent Ruet during his visit to Caltech, May 2004

1. Thesis by Calum Torrie, December 1999
2. Thesis by Stuart Kilbourn
3. Advanced LIGO Suspension System Conceptual Design, T010103
4. MATLAB files related to the mode cleaner suspension, MC 2003 Sept 25.

## **Point of Contact**

All coordination concerning this suspension will be between David Ottaway and Janeen Romie .

## **Schedule for Tests**

The RODA M040007 covers this information. Test information is included in the Suspensions Controls Prototype Test Plan, E030546.

## **Document Redlines**

- 1) Assembly Document: I propose that Laurent Ruet make redlines to the assembly document, E030518. If this is not possible, David Ottaway will chose a designee to redline this document. These redlines should be submitted to Janeen Romie, via David Ottaway, by August 30, 2004
- 2) Installation Document: I propose that Ken Mason make redlines to the installation document, E040277. If this is not possible, David Ottaway will chose a designee to redline this document, These redlines should be submitted to Janeen Romie, via David Ottaway, by December 31, 2004 or before the HAM Cavity PDR, whichever comes first.

- 3) OSEM test sheets: I propose that Myron Macinnis provide test data required on the OSEM test sheets. If this is not feasible, David Ottaway will chose a designee to provide this testing and input. Copies of these completed test sheets should be submitted to Janeen Romie, via David Ottaway, by August 30, 2004.

## **Return of Equipment**

The packing slips for the equipment sent to LASTI includes a list of equipment that needs to be returned to CIT and LHO. Time schedule for returns and points of contact for those returns are included on the packing slips. David Ottaway will be in charge of facilitating all returns. He will coordinate with Janeen Romie for CIT returns and Doug Cook for LHO returns.

Personnel, MIT or otherwise, that may want to borrow, even for a short time, any of the SUS equipment need to contact David Ottaway who will contact Janeen Romie for approval or disapproval. Requests to borrow equipment (especially, for example, any of the osems) shall include the purpose of the parallel experiment, timeline of the experiment, responsible physicist and date of return.

## **Installation and Alignment Equipment**

Ken Mason will be the point of contact on all borrowed or fabricated installation equipment. Installation and alignment equipment is defined as any equipment needed to install the suspension into the chamber, onto the table or any equipment used to align the suspension/optic. Some equipment will be borrowed from LLO. Ken will organize this work and be responsible for the equipment's return in the timeframe required by LLO.

## **Deliverables from LASTO to SUS: Tests and Data**

David Ottaway will report, or designate someone else to report:

- 1) Revised/marked-up assembly procedures: any ergonomic or lessons-learned type of information above and beyond the information communicated by Laurent Ruet at Caltech in May.
- 2) Revised/marked-up installation procedures: Notes on the alignment work shall also be produced and transferred to Janeen at Caltech.
- 3) Functional and Performance test report: a written document on the results of LASTI dynamics and control characterization and operational experience including lessons learned and any suggested design changes. (Note that this deliverable may be a series of reports in order to provide timely information.)

## **Status of Mode Cleaner Design (or, the disclaimer)**

The mode cleaner suspension is a preliminary prototype. It is not the final design. Due to budgetary and other considerations, necessary changes to the components were put on hold by LIGO management in January 2004. For example, the mode cleaner does not meet the 150 Hz first mode resonance requirement. A re-designed structure along with many re-designed components will be required to meet this. The SUS group is aware of the design situation (for example, the tombstones need larger mounting holes and are

terribly bulky) and will address these issues as soon as LIGO management changes priorities.