



LIGO Laboratory / LIGO Scientific Collaboration

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Advanced LIGO UK

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Visit report – Stanford, CIT, MIT

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Inform `aligo_sus`

This is an internal working note
of the Advanced LIGO Project, prepared by members of the UK team.

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http://www.eng-external.rl.ac.uk/advligo/papers_public/ALUK_Homepage.htm.

I travelled with Ian Wilmot. Caroline Cantley and Stuart Aston were present at Caltech.

1 Monday 13th - Stanford

Visited Norna Robertson and Brian Lantz. Also met with Vlad Kondilenko, who showed us the optics transmissibility rig and with Dan Debra, emeritus professor of Aeronautics and Astronautics. A very useful day – extremely valuable to see the actual SEI system. The blade springs are surprisingly short and chunky – deflect around 8mm under load. Discussions on the way the SEI and SUS will interact, under three headings: adjustability, mechanical interface, socket for pigtailed.

The SEI first stage will provide up to 300 microns motion in all three directions, and the second stage up to 100. But it is desirable to use only a small fraction of these (say, 10 microns) for static offsets. Since there will in some cases be more than one optic on a table, it is of course questionable how much use one could make of static offsets in the SEI for alignment..

The mechanical interface will, from the point of view of the SEI, consist of an array of tapped holes. There is no decision yet on metric vs imperial,

The bulkhead fitting or socket for the pigtail can be mounted at a convenient location – we could for example say it needs to be within so many inches of a particular corner of the SUS structure.

We also had an explanation of the way the ends of the wires are fixed off center in the blade springs so that bending moments in the wires don't cause perturbations when transferred to the blades. We may need to check this for the largest springs in the quads.

2 Tue 14th – Fri 17th, Caltech

This was the suspensions workshop organized by Calum Torrie and Janeen Romie. Included introductory talks and then a chance to assemble a controls prototype triple MC suspension – invaluable to become acquainted with the design as it stands and start to understand some of the design issues. Excellent information package to supplement the other information on the web (See access via Calum's page, currently at

<http://www.ligo.caltech.edu/~ctorrie/SUS%20WORKSHOP%201/sus%20workshop%201.html>)

By following a draft assembly procedure and making notes and comments, it is hoped that we helped Helena Armandula with the process of refining the procedures.

We also had useful talks on alignment of the optics as currently done for LIGO 1 by Doug Cook, Betsy Bland and Ken Mason. We clearly need to consider assembly and alignment during the design – I hope this was the first of a series of such discussions with the staff at the sites.

A very useful clarifying talk from Dennis on organization and decision trees – see web page above, G030536 (item A5 on web page). Also a good session with Carol Wilkinson which was a chance for the UK team to meet her and start to discuss planning issues. She got the UK and US staff to write down areas of interaction on “post-it” notes and try to match them up; several revealing insights! Thomas Frey documented the post-its and this will be taken forward into the re-planning currently underway.

Also had discussions on the work that the UK, and RAL in particular, will undertake over the coming period. The general conclusions were

- The effort at RAL will be tight for the design of the BSC suspensions – there are several suspensions to design and they will be different in detail even though the principles may be common. I need to look in detail at all the tasks involved and make some better estimates of the effort required. This job was planned and the time is now right.
- The effort requirements for the design work at Caltech are not fully understood. It was felt that some of the work may be further forward than had been supposed, and that in any case a re-planning exercise was needed. Janeen, Calum, and Dennis Coyne agreed to study the figures along with Glasgow effort being input by Caroline Cantley.
- A plan that was discussed was to have a quad controls prototype by ~June 2004.
- My belief is that the best use that can be made of UK effort now is to work collaboratively towards the quad controls prototype. Arguably such work is beyond the scope of the PPARC proposal – it had been intended that we would benefit from a complete controls prototype design when we started. On the other hand I would in any case have wanted to build a working model as early as possible as part of the RAL learning curve and the controls prototype could be seen as fulfilling that role.
- LIGO Lab clearly expressed the desire that this change in scope for the UK would be compensated by complementary work by the US team on scope that had been in the original UK effort
- Out of the effort studies above it was hoped would come a better feeling for what “quid pro quo” could be agreed between work in the UK before the controls prototype is built, and possible payback in terms of help with the final design later.

We tried some data exchange – Calum had arranged to have two adjacent machines running Pro/E and SolidWorks that sliced through a host of difficulties. STEP seemed to be the best bet – but it would only exchange models as single parts with no knowledge of features. For example, a hole in a received model could be removed and replaced, but could not be moved or changed in size. Data exchange would work better if both sides used the same package, but I tried to explain the pain that RAL has been through in standardizing on Pro/E. We agreed that the pragmatic way forward would be to try using what we have and then get a better handle on the strengths and weaknesses of that approach before reconsidering if an attempt should be made to install SolidWorks at RAL. We agreed that on his return to RAL Ian would start regular communication with Calum. It is planned that Ian will soon spend a week in Glasgow and he will obviously learn more at that time. We discussed the idea of Ian spending some time at Caltech and I need to flesh this out with dates etc.

We also talked about the kinds of metadata that could be included with drawings. Both SolidWorks and Pro/E support such data, but the amount that would be transferred using STEP is probably small (or zero). This should be kept under review and borne in mind when considering the SolidWorks at RAL option. Finally we talked about metric vs imperial sizes and fasteners – we decided to use imperial fasteners for the time being (and likely, for the final design work).

Caroline gave a very useful talk on modal testing and asked for input on exactly what system she should be procuring.

This workshop was an extremely useful time and thanks are due to our hosts and the other presenters for all the work that went into it.

3 Mon 20th – Tue 21st, MIT

David Shoemaker, Dave Ottoway, Ken Mason, Rich Mittleman, Myron MacInnis.

We had another good look over the quad and it was interesting to see that some of the features have evolved into the MC triple design. A discussion with David Shoemaker and Carol Wilkinson by telecon went over some of the points from last week.

Also a discussion about exactly what the sequence of events will be with the noise prototypes. One issue we need to resolve is whether there will be a fibre/ribbon pulling machine at LASTI or whether the fibres/ribbons will be made elsewhere and shipped.

Justin Greenhalgh

21-30 October 2003.

Version 01, 31 October – minor comments from Calum included for completeness.