Advanced LIGO UK
Project management meeting number 51
Telecon, Dec 17th 2008

Ken Strain, Justin Greenhalgh, Stuart Aston, Amanda Brumitt, Joe ODell, Ron Cutler, Deepali Lodhia, Marielle vanVegel

1 Participants

Justin Greenhalgh (chair)
Stuart Aston (SMA)
Ron Cutler (RMC)
Deepali Lodhia (DL)
Ken Strain (KAS)

2 Comments on minutes from last meeting

There were no comments on the minutes from the previous meeting.

3 Actions from previous meeting

These are noted under item 13 below.

4 UK/US interactions

4.1 SUS and design meeting telecon issues

4.1.1 Sus telecons:

In the bullets below, bold face indicates discussion during the PMC meeting.

- Metal hang at LASTI set for 12 Jan
- Quad training at RAL and LLO discussed. LLO dates Jan 26th – Feb 6th.
- Need for Ergo arm at LLO (agreed that this would be the baseline but with a robust standby plan).
- The interface tooling between quad and Ken Mailand's tooling. Has been put on the back burner because it was not needed for sleeve installation, so will not be available for the metal hang – when it had been hoped to use it for shifting the quad.
- Ear redesign.
- 24 BOSEMs ready to ship (**reported as "shipped" in the sus notes).**
- Minor mods to BS/FM following assembly training

4.1.2 Additional items from BSC SUS technical meetings:

- Breakoff prism design
- Grooves or no grooves in masses
- Hardware required for quad training
- Gap alignment. Some confusion over the requirements - but they are given in T080128.

- Good talk by Sheila Rowan on debonding.
- VM sensors

4.2 RODAs

For RODAs, see:
http://www.ligo.caltech.edu/~coyne/AL/project_management/RODA/RODA_status.htm

Summary of recent/current RODAs affecting UK work

None yet	SPI interface	Details still not clear, in discussion
	Details of prism materials	A document was in draft by NAR and Calum Torrie. When complete, this will lead to a RODA. The principle is that we will use sapphire for most of the prisms, and metal for secondary prisms where noise is not an issue.
Existing RODA may need updating	Wedge angles	Work has already been done on this; from which an updated RODA may result; see the document T080075-05, table 1. For those who know the LVC password, the document can be found at http://ilog.ligo-wa.caltech.edu:7285/advligo/OptomechanicalLayout Since the angles are known to be small they have no further bearing on UK work. It was agreed to remove this item from the list.
None yet	VM dampers interaces	AV had agreed to push this forward. A sketch of the device had been added to the Birmingham wiki. http://www.sr.bham.ac.uk/dokuwiki/doku.php?id=bal:vms

4.3 Other news

There had been some interactions between KAS, NAR, Dennis Coyne and AV on the electronics requirements and delivery schedules.

4.4 Reviews

There was not yet a formal outcome from the FM/BS review but RJSG had discussed it informally with Dennis Coyne. There were no major outstanding issues and RJSG had decided to go ahead with the procurements on the basis of that discussion.

The review of the triple suspension had been held on 16th December. At the request of David Shoemaker, the electronics had been included. This had highlighted the fact that that the specs still do not seem to be settled. It was agreed at this meeting that KAS would attempt to conclude the discussion between himself, NAR and Dennis Coyne on this issue.

4.5 Visits and trips etc.

4.5.1 Past

Training at RAL – visit by four LIGO staff. w/b 1 dec This had gone very well once the problems with flights had been overcome.

Alan Cummings at LASTI

MB was at LASTI for ~2 weeks.

4.5.2 Future

Wire hang of glass suspension at LASTI 12th Jan

ITM training in US (Livingston?) ~w/b 26th Jan and 2nd Feb 2009.

AV to LSC meeting Dec 15-18

5 PAG/OsC issues

The minutes from the previous OsC had now been published. Actions included

- The formal request to STFC for a grant extension would need to be made early in 2009, for which three scenarios had been suggested. RJSG and KAS were working on this.
- A dated list of deliverables had been requested (RJSG had drafted; nearly complete)
- A finance report for spend to the end of the FY. A report had been submitted.
- Check that shipping insurance was being used on the more valuable shipments. RJSG had checked at RAL.

The next OsC was scheduled for Friday 22nd May 2009.

A PAG meeting had been set for April 22nd.

The formal request to STFC for a grant extension would need to be made early in 2009.

6 Finance

Finance reports up to Sep 2008 from Glasgow, Birmingham and RAL had been circulated to WP leaders.

The Glasgow WA request was approved having been circulated to the PAG.

7 Changes

No recent changes noted.

8 Web sites etc

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

Most recent updates:

- RAL May 2008
- ALUK Jun 2007.
- Glasgow: some extra photos added.
- The Birmingham Wiki is up and running, and is being updated consistently. The pages can be found at: http://www.sr.bham.ac.uk/dokuwiki/doku.php?id=bal

9 UK project plans

RJSG was concerned that the decision process on electronics specifications was perhaps being clouded by of a lack of knowledge about the impacts of delays. SMA agreed to

ensure that the Birmingham plan was updated to split out the quad and triple electronics and set out the detail of the plan (at a ~week resolution) from now to completion. RJSG emphasised that where details were as yet unknown, a best guess should be made so the we could make assertions, on the basis of the plan, of the form "If we get a decision on this by this date, then we expect delivery by that date".

ACTION 51.01 SMA to update Birmingham plan by ~12 Jan 2009

10 Activity/plans

10.1 Glasgow

The next few monthly reports will be of the same form as this one, i.e. a general report plus a section covering the ear redesign and procurement (the latter prepared by Marielle van Veggel, who is managing this sub-task).

10.1.1 General report

- Cost estimates. There have been no upward increases in costs of ears, prisms or other deliverables within the last month.
- The fibre-pulling machines and associated equipment at LASTI (excluding welding equipment and tooling, subject to modifications to cope with the new ears) have been "signed off" by the US as operational. Some work is still needed to complete documentation, and we are cooperating with Mark Barton to ensure that gets completed.
- Apart from the ears, the longest-lead procurement item is the laser-machining of the sapphire prism grooves. Discussions with the chosen vendor have led to the realisation that the process can be accelerated, and this will provide additional margin (there is time to do it the slow way).

10.1.2 Ear redesign and related developments

- The ear redesign process for the test ears has been completed. The questions of ear position, manufacturability, weldability, finite element stress analyses, thermal-noise calculations have all been addressed and discussed with the LIGO community on 21/11/2008.
- The blank material for 60 ears and 60 disc inserts for suspension tests was delivered on the 12th of December 2008 and the order for the production of the ears and disc inserts has been placed with "vendor 1". Production will start early January.
- The ears will be flame polished by a second vendor. Discussions about how we will proceed are should be finalised before the end of 2008.
- In parallel the laboratory in Glasgow is being prepared to do full suspension tests in March 2009. This includes preparing the articulated arm, building a mock-up of the lower structure assembly tooling, preparing the strength tester, developing imaging tooling to asses the welds in a non-destructive way and developing fibre holding and cutting tooling. The first 3 items are aimed to be finished before the end of 2008. The latter two are scheduled to be finished in January.

Scheduled dates remain unchanged:

05/01/2009 – 09/02/2007	Production of ears and disc inserts
	Welding tests with mock weld horns
	Amendment of weld tooling for the redesigned ears

09/02/2009 – 26/02/2009	Preparing full test hangs Glasgow
26/02/2009 – 26/03/2009	2 full test hangs Glasgow
19/03/2009 - 01/04/2009	Test hang LASTI
09/04/2009 – 23/04/2009	Training hang LASTI

These activities will be reported at the appropriate time.

10.2 RAL

10.2.1 Joe Odell:

News and Comments

- Created BS tablecloth FEA model, with OSEMS.
- Removed plates in order to simulate model without artificial stiffness.
- Obtained an FEA result of around 140Hz for the first mode of the tablecloth. This has been reported to the US.
- As a last minute effort, new BS blades were ordered from 3TRPD. This was done to enable the suspension to be full suspended.
- The BS review response document has been updated, and awaits final sign off.
- The blade drawings have been updated and approved. Talks with Ben Granger are underway regarding the blade contracts documents.
- The G17 lab has been given a through tidy. All rubbish has been removed. All the quad hardware has been moved to the back room.
- All the BS hardware has been brought into the main lab, and all the necessary tooling has been prepared.
- The new components for the BS training build have been received, and the components have been laid around the lab, divided into sub systems.
- The BS training preparation documents have been prepared. This includes the following documents:
    - BS build risk assessment
    - BS top mass picture book procedure
- Other documents, like the BS Final design document, and all the part and assembly drawings were made available.
- The BS blades were not finished in time to be delivered for a weekend bake (heat treatment) so a van was hired, and the blades were collected from Newbury.
- The blades were then heat treated over the weekend.
- PPE was obtained for all visiting staff from the States
- Guests for BS training arrived, and training begun. Over the course of the week, the BS was taken down from the old gazebo, stripped down, and all the new components added.
- The wires were re-made, and new blades were added to the masses. These new blades allowed the whole system to be suspended, without blades on stops. The dynamic of the suspension was then tested.
- Because the blade tips curve up at the end, it was found that in order to achieve the right dynamic (d distances) the blade positions at the bridge point need to be 1 mm lower than previously specified. (Note this was discussed during the meeting. There was no formal test of the suspension

dynamics, but it was obvious during assembly from the very low frequencies, approaching instability, that the d distances were not right.)
- The BS was suspended from the new Gazebo.
- The BS training has been completed, and very positive feedback has been received from the US at the LIGO SUS.
- During the BS training week, a number of needs for modification were identified. These were marked on drawings during the week.
- All the modifications were made to BS models and drawings.
- Tadley were notified of changes to drawings, and the new drawings have been sent in PDF format (8 drawings in all).
- New blade drawings have been sent to Ben granger for the blade contracts.
- The ergonomic arm suction plate interface has been found, and Brett has been instructed how to check that the interface works.
- It has been reported that the interface seems to fit for all three variations of round mass at LASTI.
- Drawings of the latest round mass clamps have been sent to Brett, so that he can identify the hardware.
- The PFA 440hp pads have been modified, and the updated drawings sent to Brett for machining at LASTI. The drawings have been sent to Amanda for the Data base.

Actions Carried:

None

New actions:

- Send Brett the wire length for the quad wire loops
- Model the Violin mode dampers into the quad model
- Build the quad first article with Amanda
- Visit LASTI for the Monolithic build
- Visit Livingston for the quad training
- Prepare final assembly documents for the BS
- Design sleeve – Ken's tooling interface
- Send the assembly drawing for the triple hang tooling to Brett and Russell.

10.2.2 Amanda Brummitt:

News and Comments

All tenders now placed. Machining contract is progressing nicely on schedule. Structures are majorly behind; this is being dealt with by a change in process to speed up the testing section. Blade manufacture has begun with small delays on first supply. First 10 due mid January and the rest first week in April

Completed Actions

- Visits to NTE (structures contractors) to progress
- Inspection of the machined parts.
- Ordered packing crates for shipment to US
- Organise training session for first article at Livingston
- Dealt with issues with the blade manufacture
- Top stage tooling modifications

Actions Carried

- All docs to DCC post review
- Order things outside OJEU
- Update web pages
- Finish off assembly procedures
- Buy an extra laser
- First article assembly

10.3 Birmingham

10.3.1 Activities over the previous month

Mechanical

- Placed order for bespoke PEEK connectors (including pigtail)
- Completed the assembly and testing of 1st batch of production UHV clean BOSEMs (25 units)
- 24 units have been labeled and bagged, ready to ship to the US
- Investigated alternative shipping methods to the US (avoiding duty)
- Shielded harness fabrication (for LLO assembly training exercise is ongoing)
- Screening of IRLEDs and PDs is ongoing
- Inspection of BOSEM parts received from suppliers is ongoing
- Cleaning & Bake-out of BOSEM parts is ongoing

Electronics

- Board tests on the TOP boards have been completed
- Preliminary tests on all monitor boards have been completed
- The monitor boards are being modified to solve the interface problem
- The first monitor board has been successfully integrated into the UIM unit
- The noise floor of the noise monitor is satisfactory. The output noise level for the UIM is to specification
- The PUM artwork has been completed and checked, and the PCB is currently being manufactured
- Component procurement, assembly and FP Testing of the PUM boards have been arranged, and delivery of the completed boards is expected on 22nd January
- Final mechanical assembly of the first unit UIM unit was successful
- The first UIM unit has been successfully tested and delivered to the USA
- Wiring looms for the first two units have been completed
- All remaining pre-production front panels are now in manufacture

- Initial Top Driver outline designs have been submitted to the USA for discussion.

10.3.2 Plans for the coming month

Mechanical

- Complete shielded harnesses and ship to US (Caltech)
- Chase-up clean-room consumables order with UoB procurements office
- Update BOSEM Test Specification document for revised ATE Assign
- Continue to investigate BOSEM sensor noise @ 1Hz

Electronics

- Assemble and test the remaining PP UIM units and send to the USA
- Assemble the initial Top unit and send to the USA, with the remaining units to follow
- Test the complete PUM unit and ship to the USA
- Continue the design of the Triple Drives so as to facilitate easy manufacture

10.3.3 New Documents

(None)

10.3.4 Website

http://www.sr.bham.ac.uk/dokuwiki/doku.php?id=bal

ALUK UoB website has been updated with Violin Mode Damper drawings.

10.3.5 Progress against schedule

No schedule update

10.4 Strathclyde

10.4.1 Violin Mode Dampers

All the 'bespoke' cylindrical lenses, manufactured by Comar Ltd., in BK7 glass, have now been received, as have the custom glass-metal feedthroughs manufactured by Martec Ltd.

All the drawings for the mechanical parts for the Violin-Mode detector were submitted to the Science Faculty Workshop last month, and the Photodiode housings have now been completed. Fig 1 shows the base of one PD housing carrying one of its two feedthroughs, together with one of the 'bespoke' plano-concave lenses that will form the window of one of the LED housings. Each PD housing will carry two split-photodiode detectors, separated by 30.0 mm (the longitudinal pitch of the suspension fibres), one such split-detector being shown in the photo.

In order to relieve the Workshop, potentially, of some of the fine MACOR work, a quotation for these parts has been sought from The Technical Glass Company Ltd., of Steeple Bumpstead. A quotation has not yet been forthcoming.

Quotations had been sought from two suppliers who could mirror-coat (gold on chromium) sections of microscope slide – to be included as mirrors above and below the columns of LEDs in each LED housing, so as to increase the emitted infrared intensity. Suitable microscope slides, 28 mm wide, were ordered from Logitech Ltd., and once received they will be passed on to ICOS Ltd. for coating, ICOS having provided the lower quotation and best delivery for these parts. The slides are expected 'any day, soon.'

A way of connecting together in series the illumination source LEDs has been found, using folded 50 um copper-foil connectors. Strathclyde's department of Design, Manufacture, and Engineering Management has agreed to produce these, once suitable dies have been made.

In parallel, the Physics Electronics Workshop has been building-up the electronics for the sensing of all four suspension fibres' violin-modes, using a 3U Schroff 19" rack-mounting case. This unit houses 8 low-noise current-sources, each supplying 8 series-connected OP224 NIR LEDs. Pairs of current-sources are switchable 5-ways across the 5 columns of LEDs in each illumination source housing, in order to relocate the shadow of the respective fibre back across the split-photodiode detector. The unit also houses four Violin-Mode detector amplifiers - one for each suspension fibre. Each amplifier has three differential outputs: one DC output for each of its two split-photodiode detectors, separately, and one AC output that amplifies differentially the signals from the split detectors i.e. the actual 'Violin-Mode' signal from that particular fibre.

One US quart of Hysol ee4215 (black) epoxy has been ordered, and authority to use this (or something better) for sealing all of the housings (i.e., 6082 aluminium alloy-to-same, BK7 glass-to-6082 aluminium alloy, and the stainless-steel casing of the Martec feedthroughs-to-6082 aluminium alloy) is still awaited.

Although they have not been qualified for use in LIGO, two alternative epoxies have been found: 'Epofix,' an 'embedding' resin designed to penetrate into fine cracks (so should be good for sealing). It is used for holding SEM samples, under vacuum, with minimal contamination. Struers Ltd. have provided us free of charge with an Epofix kit, to try it out: http://www.emsdiasum.com/microscopy/technical/datasheet/1232.aspx

And a NASA-approved epoxy has also been located. It is particularly suitable for High Vacuum use, called Master Bond EP21TCHT-1 epoxy:
http://www.masterbond.com/tds/ep21tcht-1.html

11 Visits etc and absences planned for the coming months

	Dec	Jan	Feb
General	Christmas period w/b 22 and 29		
KAS	22 Dec – 5 Jan vacation		
RJSG	2 weeks A/L over Christmas		
MB	To LASTI for ~2 weeks		
SMA	22 Dec – 5 Jan vacation		
RMC			
RAJ			
AB	BS/FM training at RAL 1st week		LLO for training
JO	BS/FM training at RAL 1st week	LASTI for glass wire hang	LLO for training
NAR	23 Dec to 4 Jan vacation		
Alan Cumming	To LASTI for ~2 weeks		

AB is at college on Mondays; JO on Fridays.

12 AOB

NAR had confirmed to RJSG that there was some reluctance to let the BS/FM model (from RAL) go permanently to the science museum just in case it was needed to explore some potential design changes or other issues.

13 Summary of actions

13.1 Closed

ACTION 50.2 RJSG to ask Jean Grieg to set up the next PAG meeting. Done.

ACTION 50.3 RJSG to forward the Glasgow WA request to the PAG. Done.

ACTION 50.4 RJSG to forward electronic copy of proposal to NL and AV. Done.

ACTION 50.5 RJSG to add glass cost and full glass hang delay to change log. Done.

ACTION 50.6 RJSG remind AB of the urgency of a list of infrastructure for the quad training. Done.

ACTION 50.1 NAR agreed to check the status on the earthquake stops for the test mass, which had been one of the outstanding items from the review. NAR had established that the preferred solution was to move the EQ stops to the dead area of the optic.

13.2 Outstanding

None.

13.3 New

ACTION 51.01 SMA to update Birmingham plan by ~12 Jan 2009

14 Next meetings

Next ALUK weekly Weds Jan 7th 2009 at 2pm

Next PMC Wednesday Jan 21st.

Justin Greenhalgh with reports from the other authors.
18 Dec 2009

15 Summary for LIGO newsletter

ALUK held its latest Project Management Committee on 17 Dec 2008 (See LIGO-M0810012-00-K). A brief activity summary follows:

- **RAL:** Contract let for FM/BS manufacture. Parts relevant to EQ stops being held up as far as possible. Training session in UK went very well (using blades made by rapid prototyping the week before); some minor mods to the design were identified and have been implemented, just before manufacture.
  Quad OJEU process status as follows:
  - **Machined items.** Deliveries to RAL continue.
  - **Weldments**. Continue to liaise closely with manufacturer; current issue is ensuring that RGA testing is being done to LIGO requirements. A second vacuum tank has been made to allow progress to be accelerated once the RGA testing is sorted out.
  - **Blade springs**. Blade manufacture continues – hope to have first batch for testing in January

- **Glasgow**: Fibre pulling machines etc now signed off as operational; some documentation outstanding. A way has been identified to gain time on the prism groove process. The ear redesign is complete; blank material has been delivered and an order placed for manufacture of a run of 60 ears for tests. A second vendor will do the flame polishing. Work in hand to prepare for suspension tests (using metal masses with glass inserts) in March 2009.

- **Birmingham/Strathclyde**: 24 BOSEMs are ready to ship. Harness manufacture in hand (shielded harness for tests icw quad assembly training Jan/Feb 09). Manufacture and preparation of BOSEM production parts continues. Work continues on the quad test-stand electronics; the first UIM unit has been delivered to the USA. Discussions continue to try to ensure that the triple electronics is not delayed by uncertainties in the specification.

- **Overall**: steady progress on production of parts and completing remaining design tasks.