

Minutes of the Core Optics Subgroup, 3/8/01

9 am PST US/Europe meeting

CIT: Jordan Camp, Bill Kells, Gari Billingsley, Gary Sanders

MIT: David Shoemaker, Gregg Harry

Glasgow: Jim Hough, Sheila Rowan

Stanford: Alex Alexandrovski, Marty Fejer

UF: David Reitze

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1) Coating Status (many people)

David Reitze Visited the Lyon facility and came away with a favorable impression of the facility and operations. The large coating chamber at Lyon is still in shake-out mode, waiting on VIRGO optics from GO. David was impressed also with their process control, cleanliness, and metrology. The raster scan capability is now on line

Gary brought up the impact of the new Q results on the coating program? In particular, how do we incorporate Q testing into a coating development program? One or more meetings will be needed to refine our ideas and develop a workable strategy.

Jordan discussed the meeting with MLD at Stanford. In particular, Advanced LIGO coating requirements w.r.t. Q, birefringence and absorption were discussed. Marty came up with an idea for a systematic R&D program:

Phase 1; Methodically vary the coating parameters (# layers, layer thickness,...) and try to understand what drives each effect.

Phase 2; optimise coating for our purposes.

MLD does see work with LIGO as interesting. Gary DeBell of MLD expresses the opinion that coatings can be optimized.

Jordan also discussed getting Fused Silica substrates From Mindrum (a local polisher) for Q measurement, coating absorption and birefringence experiments. These would be 3"x1" Corning 7980 grade 0A, delivery 6 weeks.

Gregg Harry thinks that the substrates they are getting from Zygo are perhaps Corning 7940. Gari mentioned that 7940 is no longer made by Corning and has been replaced by 7980. David Shoemaker suggested that we restrict our testing to materials that we will be able to use in the future, so we should use 7980.

Gregg Harry would like 3" by 0.1 inch ideally. Jordan will ask Mindrum if they can do that in 7980

David Shoemaker noted that coatings are needed for TNI and asks if we can get in a Q measurement for these? Sheila said she would need to know if the barrels of the TNI optics are polished to know if a measurement will work. Jordan will look into the side polish issue.

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## 2) Sapphire polishing (Gari)

Gari spoke with Joel Askinazi (Project Manager, Advanced Window development for BFGoodrich, formerly HDOS) regarding our Sapphire polishing RFQ for the 25 cm piece. His main points: It appears that our requirements are tighter than has been demonstrated with computer controlled polishing on 8" diameter windows. He will send a paper on their best effort - polishing of a 12" diameter window. The crystal for this window was supplied by CSI as a "one off" ultra-homogeneous piece, CSI cautioned him that he cannot expect this kind of crystal in a production situation. Joel's ominous comment was that "the requirements of this window were trivial compared to the LIGO spec"

For this type of project BFG does not want to time-share the metrology set-up. They feel they would need to acquire a dedicated instrument, set up a collimator and calibrate it. Their estimate for this phase is 6 months. He estimates that the subsequent polishing would take 6 months as well.

Gari asked him to investigate whether de-coupling the front surface polish (which requires very precise metrology) from the compensation polish, would help the schedule. Gari made the point that this (compensation) was a primary concern for us; the Advanced LIGO "drop dead" date is June '02 for having a complete demonstration.

Gari is in touch with CSIRO about a Q measurement program there. The idea is to measure the Q of sapphire at various stages in the polishing process.

Jim Hough, pointed out that the ways in which polish affects Q of sapphire is well known. Jim reports that Phil Willems knows a lot about the subject. Apparently a good polish has very little effect on Q. Jim sent reference to papers after the meeting: DHS will follow up on these publications.

The consensus was to keep large sapphire dedicated to polishing demonstration, and not try to measure its Q before it goes to BFG.

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## 3) Sapphire Absorption (Alex)

Only 2 crystals have arrived, these were annealed at 1450 in Hydrogen, there were no dramatic results. Still waiting for crystals annealed at high temperature. Alex reminds us of increase in absorption found before.

Jordan reports that we will share the cost of a new annealing oven with Crystal Systems. We're expecting a schedule from CSI for delivery of more samples. CSI is interested in getting the Hydrogen oven going at Stanford.

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4) Q measurements (Sheila)

The LIGO1 mass is hung, but there is no data on that yet.

Sheila will be collecting data on sapphire optical and mechanical properties. **She will serve as a central contact for this type of information. Please send any information you may have to her.**

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5) Thermophysical properties of sapphire (Jordan)

Ryan Lawrence's measurements disagree with measurements by commercial companies, although MIT measurements were performed on a different sample. This may be resolved by getting Ryan some better samples to measure. Jordan expects this to be done within the next month or so. The MIT thermal conductivity measurements are in agreement, but thermal expansion is lower by 30-40% than the vendor measurements (which agreed to a few percent)

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6) Wrap up, upcoming deadlines (Gary)

The NSF review went quite well; a very favorable report was issued. We should be able to circulate the final report within a week.

After the LSC meeting we need to take a good look at COC R&D schedule and see where we stand, if we need to de-scope or relieve the schedule.

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7) Post Meeting Addendum: (Gari and Bill)

**Gari Jordan and Bill Kells after the meeting ended: We need to make investigation of the scattering in the Hanford 2K an element in the L2 research. We need understand what is happening to these optics to have a hope of attaining our goals for the L2 optics.**

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Due to travel schedules of the UWA group, there was no afternoon telecon.