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To: "ctorrie" <ctorrie@ligo.caltech.edu>,
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David Shoemaker <dhs@ligo.mit.edu>
Cc: "Greenhalgh, RJS (Justin) " <J.Greenhalgh@rl.ac.uk>,
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Subject: RE: Flexible for sapphire and silica
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Hi all,

Thanks for this excellent summary of the work required. Further to the various mails below:

1. On production costs (a query from Dennis): I assume that by the time we reach production we would have made up our minds on a substrate and so there would be no need to buy, for example, two penultimate masses for every suspension. Even though we are only buying one, however, is it possible that the one we choose will be more expensive than the current estimate?
2. Note that we are holding a meeting in Birmingham on Tuesday. I am not sure what people's return travel plans are but some of (Ken, Caroline, Justin) MAY not be able to make the sus meeting.
3. Further to the design recycling comments: I think that in order to meet the noise prototype timescales we will be recycling all we can of the design - are we all still agreed that the test mass mass is likely to stay the same between the two designs? (A longer term project, perhaps when/if I come to Caltech in December, would be to figure out as far as we currently can what elements of the design will need modifying from contols to noise.)
4. I note David's question about the actual costs vs estimated costs. If the design is taking significantly more than the estimates, the increments in design time for the flexible design might also need increasing. However, 7 staff months extra for the noise ptype sounds reasonable.
5. My current perception is that to delay the downselect by 2 months to 1 November will cost us nothing; a further 2 months (1 Jan 05) will probably involve us in minor rework if we guess wrong; a further 2 months (1 Mar 05) will probably commit us to a flexible design. I would welcome views of Calum and Janeen.
6. Finally, and here again Calum ond/or Janeen can make a better-informaed comment than me: any design involves compromise. Adding constraints (flexibility) will inevitably mean that other features are compromised (ease of assembly, production cost; natural frequency; etc). So I don't think that once we paid the 7 months plus however many \$k, the flexibility is thereafter "free". Bear this in mind. But I welcome Calum and Janeen's comments.

Thanks again for the estimate!

Cheers - Justin.

| -----Original Message-----

From: ctorrie [mailto:ctorrie@ligo.caltech.edu]
Sent: 10 September 2004 01:32
To: Dennis Coyne; Janeen Romie; David Shoemaker
Cc: greenhalgh, RJS (Justin); Caroline Cantley; k.strain@physics.gla.ac.uk; Norna Robertson; janeen@ligo.caltech.edu
Subject: Re: Flexible for sapphire and silica

Hi Dennis

We will try and answer your questions below.

At 02:43 PM 9/9/2004 -0700, Dennis Coyne wrote:

Calum & Janeen,

Thanks -- looks like much thought & effort went into your tally.

In looking through the details, I got lost or confused a bit and ask for some clarification. It seems that for the noise prototype you include for many items (e.g. penultimate mass, penultimate reaction mass, test mass, catcher, ...) a "controls ptype" version and a "glass noise version". Was the intent to include noise ptype parts to check out the design for both options (sapphire & FS)? If so, were the noise ptype parts chosen just as a fit check and not intended as part of the noise (limit) testing (e.g. metal penultimate reaction mass)? i.e. assuming only the need to "fully outfit" one of the versions for the LASTI noise testing?

We assumed that the noise prototype suspension would be built up with metal masses etc ... prior to installing glass. We further assume no recycling from the controls to noise and were conservative wrt technology transfer and logistics. Does that answer your question?

I was surprised at how much higher the unit equipment cost increases were for the noise ptype than for the controls ptype. A summary of the increment in noise ptype equipment costs breaks down to the following:

1) additional \$34K assumed for FS instead of heavy SF2 glass

Helena said she thought a piece of FS would be more expensive to prepare than a piece of SF2

2) additional \$5K for catcher for alternate COC substrate

Conservative estimate that x2 designs would be needed

3) additional \$5K for ergo-arm modifications to handle both COC optic dimensions

Again conservative! The existing interface plate only works for the ETM size with no flats. We we not only needs alternate plates we would also need to re-design the arm.

4) additional \$5K for carry/ship cases for the alternate COC optics dimension

We assumed x2 designs. assumed carry case and "cake box" and covers

5) additional \$3K for template for ears for alternate COC optic

Again we assumed x2 designs to take account of different thickness of the masses

or \$52K more. The \$52K refers to totally your items 1 to 5!

Does the FS penultimate mass really cost \$61K?

The FS mass does not cost \$61k! It costs \$61k to buy both a FS and a SF2 pen mass (i.e. \$27k + \$34k)

The costs that you have presented are for including the FS or sapphire flexibility in the prototypes. If we are interested in projecting the per unit cost in the production phase, then

all of the above costs (as I understand them) would be zero (non-recurring), i.e. we expend the cost (in labor & equipment) in the design/prototype phase and then get the flexibility in the production phase "for free", to first order. Have I interpreted this correctly?

I believe your assumptions are valid! (JHR)

One Conclusion (perhaps simplistic and naive) I drew from the numbers was that to stay flexible through to the end of noise prototype we would need an extra 33% effort and an extra \$48k (assuming you don't buy the \$34k FS mass) (CIT)

Let me know if this helps with your questions and if you agree with my answers.

Janeen and Calum

Dennis

At 09:23 AM 9/9/2004, Janeen Romie wrote:

Dear David,

Norna, Calum and I spoke yesterday and are responding briefly to your questions **below, in red**. We will talk more on Tuesday. It will be interesting to get UK responses.

Janeen

David Shoemaker wrote:

That does sound fine, although any exchanges among those on this list before then are helpful so that the conversation on the 14th can move toward answers.

d.

At 07:42 9/8/2004 -0700, Janeen Romie wrote:

Dear David,

Good questions. We suggest that they be brought up at the Tuesday SUS meeting on Sept 14th. Can these wait for that?

We can provide a brief summary of the Excel work and the conclusions on Tuesday to everyone.

Janeen

David Shoemaker wrote:

Janeen, Norna, Calum,

thank you; I think your approach was a really good one. This will take some time and some discussion to digest. A couple of preliminary questions:

1) any idea how well the original estimate for the Controls design work is working out -- 91k and 20 mmonths labour (a tip of the hat) months? A measure of how well you think the new estimate corresponds to real labour.

A new estimate with actuals cannot be done until springtime 2005, when the work will should be complete. We may be able to provide an estimate of the effort so far, via Primavera and the task list, but not an estimate of work to do because of concerns about the precision of the cost estimate and our concept of progress w.r.t. Primavera.

2) how far are you all into the Controls design for the sapphire; could we take credit for some significant part of the design effort, and in particular for elements specific to the Sapphire design, reducing the amount of "x2" designs that are required?

Yes, we believe it to be valid and fair. X2 means design and drawings.

3) It appears you did not take much credit in the noise prototype for the design work already accomplished in the controls prototype. This is a cautious assumption, and was the right one for the Cost Book. Does it still look like a necessary assumption?

Yes, it is cautious, but the noise prototypes are to be built in another country so logistics and tech transfer are issues.

4) the UK folk are helping quite considerably with the Controls design (or maybe in fact the Controls and Noise design processes are somewhat melded?). Will the Caltech/Stanford team be contributing similarly to the Noise prototype design effort on the quad? this is to start to wonder how the additional effort would be distributed between the UK and US.

To perform the tech transfer and logistics, Caltech/Stanford will be supporting the UK in noise work.

thanks again

David

At 16:33 9/7/2004 -0700, ctorrie wrote:

Dear All

At the SUS meeting 2 weeks ago we were asked the following question: -

"What would it take to make the SUS design (quad) flexible for either sapphire or fused silica for both the controls and noise prototype?"

Using the task summary, cost book numbers and estimates of what is involved in a "glass" suspension and a list of assumptions we have come up with the following estimates. Please reference the attached .PDF with embedded .XLS file for our conclusions.

Regards, Calum, Janeen and Norna

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