

Minutes of SPIRE Project Team Meeting, 23 May 2003

Matt Griffin, 23 May 2003

Present: Matt Griffin (Chair), Pete Hargrave, John Coker, Berend Winter, Chris Brockley-Blatt, Eric Sawyer, Ken King, John Delderfield, Doug Griffin, Bruce Swinyard, Dave Smith

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1. 300-mK STM vibration Kevlar failure MRB HR-SP-RAL-NCR-038v2 refers.

1.1 Summary by Pete of his document of May 8

- Unit was central when delivered from Cardiff
- Before vibration: not exactly central but not touching by visible inspection.
- After vibration: not touching on visible inspection outside but touching inside as measured electrically.
- Kevlar cord visibly damaged - two of three cords broken - asymmetry leading to misalignment
- Black coating undamaged
- Close inspection showed cord failure as radiused hole - badly machined with slight discontinuity instead of smoothly radiused transition from one hole to another
- Signs of minor Kevlar fibre abrasion on inner hub - scuffing during handling? - but this is not the failure mode. Handling and jiggling procedures may be revised.
- Unit was originally designed for lower preloads - bends are too tight for higher preload now being used to prevent the Kevlar from slipping and make the unit stiff.
- Manufacturers used ball-ended cutter but profiled cutter was requested.- will be addressed at rebuild - processes will be specified and inspected.

1.2 Proposed Redesign (presentation by Pete)

- Kevlar diameter 0.5 mm to be retained (needed to accommodate the pre-load)
- Larger radiused holes (4-mm dia bend) on both the inner and outer parts (even though inner part is less critical) with some rerouting of the Kevlar
- No change to interfaces or volume envelope
- Small (advantageous) increase in Kevlar angles
- 1-mm radiused sections where Kevlar exits
- Disk thickness will be increased from 2 mm to 3 mm
- Disk now to be threaded instead of using a locked screw - still to be detailed

1.3 Options - keep existing design or redesign?

- Berend: It was a workmanship/inspection failure, but approve of redesign to provide more margin.
- Doug: Agree.
- Bruce: Agree provisionally, but need to inspect the spectrometer baffle unit. Danger of bringing in unforeseen phenomena in a new design - e.g., will it slip more?
- Berend: New design should slip less.
- Doug: Larger radiused hole should reduce compressing stress if the cord goes over a raised feature.
 - *Note: Inspection of spectrometer side light baffle support by Berend later in the day showed it to exhibit no anomalies.*

1.4 Conclusions

- Failure is attributed to sharp edges at radiused holes (workmanship/inspection) combined with too-small radiused holes (vulnerability to such workmanship errors)
- Very careful inspection will be needed of the new units

1.5 Proposed plan (assuming redesign goes ahead)

- Already slipped by a few days wrt Pete's plan as distributed in the note.
- Review of drawings of new unit after ~ 1 week preparation - internal Cardiff review but to be circulated to MSSL
- 4-week manufacture (est.) - MIPS need to be included in the plan.
- Six sets of outer rings and central hubs to be procured
- A few days needed for acceptance - RAL Talysurf machine to be used.
- Assemble DM2 to all procedures for unit-level test (mid-July) at MSSL
- Pete's plan has CQM delivery end July
- Cold shake with analogue of photometer 2-K box at RAL would be ideal next test.
- PLW BDA goes in 20 July - so there's no time for this cold test.
- 2-K box would need 400-mm envelope - too big for the cryostat.
- John: Note that Kevlar touching other side of radiused hole needs to be considered in the new design.
- Non-Cardiff effort needed to implement the recovery plan:
 - MSSL: support from for review of drawings, warm shake, definition of integration and handling procedures
 - RAL: Talysurf facility; manufacturing/advice (John Spencer's team)
- Doug: Suggest implementing an imbalance in the warm shake to make the test more severe.
- **Action: Pete to updated plan to include the following, timetabled appropriately:**
 - Document handling procedures and review with MSSL (Chris)
 - Provide (by repolishing/inspection and choice of the best units) a unit of the existing design as well as a fallback.
 - Test how much torque needed to misalign and restore the alignment of the unit.
 - Include workmanship shake of the unit that goes into the CQM

- MRB to be reconvened before installation of new unit into the CQM

2. Level-0 thermal strap implementation plan

2.1 Current status and assessment

- PACS ECR has changed interface to M4
- John: That poses a potential problem
- Doug has telecon with Lionel next Wednesday - JC should join in if possible
- JC worried about increasing mass on the cooler interface; long distance between cooler and light trap
- JD: Lionel's getting 140 mW/K at that interface - significant but not dominating
- Lionel runs cooler with large straps to get 1.6 K at the interface. He needs much better conductance outside the cooler than inside.
- The current strap design works mechanically but not thermally
- Berend: to unload the cooler need to support the L0 strap off the instrument.
- Bruce: cartoon of concept using vespel ring to support strap from the instrument wall and taking the mechanical load off the cooler.
- The 2-K load will go up - by how much? (John: more than about a mW could be a problem negotiation with Alcatel)
- Design drivers in order of priority:
 - Mechanical robustness
 - Thermal conductance to the helium tank
 - Thermal load from 4 K to 2 K
- Schedule and AIV constraints (Eric)
 - For alignment: a non-electrically-isolating strap to short 2 K and 4 K - OK
 - End July ideally for first cold verification.
 - Could retrofit by October as backup option.
 - AnSo is doing modelling to determine whether the cooler can be recycled in the AIV facility with the current straps.
 - Electrical isolation will be needed - has to be sorted out at least as a fix.
 - What's available for the test in July?
 - Existing STM parts - whether they're good enough depends on AnSo's modelling.
 - Berend: For new design need to do various manufacturing tests on E-beam welding aluminium and develop electrical isolation - could we do that in 3 months
 - Bruce: Useful to investigate if Astrium can help (have done some development work)

2.2 Level-0 splinter summary

Phase 1

- Outcome of thermal analysis required. This should include assessment of the electrical isolation based on 50-75 micron Kapton.
- This is expected in 1 week (30/5/03) and is essential before the plan can be implemented.
- Remaining tasks.
 - New inter-box strap - designed but electrical isolation is not yet agreed.
 - All parts should be ready end June except welded items.
 - Retest of e-beam welding needs to be done, this can be started now.
 - Electrical isolation:
 - JD to check if electrical isolation between the detector boxes is required for the CQM.
 - Electrical isolation is an MSSSL responsibility.
 - All parts ready for integration into SPIRE by end July.

Phase 2

- Testing of isolating joints - possible use of Cardiff test facility.
- Pure alum wire being tested at MSSSL.
- MSSSL will be responsible for manufacture and thermal testing of samples.
- MSSSL have experience of bonding for cryo application.
- MSSSL to order material, five nines alum. And epoxy Stycast 1266 and 2850.
- First measurements in mid July. This could be the final release for manufacture.
- Design activities in parallel with testing.
- Manufacture should take to mid Sept.
- This just fits the instrument planning.
- The detector boxes need electrical isolation from the optics bench.
- John and Peter Bonhome will be involved in these activities.
- Production effort conflict may delay FM, MSSSL will investigate.
- This activity will be managed and run from MSSSL with regular (weekly) updates to RAL.

3. LAM optics bench mods:

- LAM's proposed change won't work.
- MSSSL can propose something similar - LAM need to verify if it's doable.
- **Action:** Eric to get LAM to provide layout details of the PCB and the unit interface by Tuesday visit if possible.

4. FPU support modification plan

4.1 Modifications needed to baseline

- Improvement in thermal isolation by factor of 4 is aimed for without compromising mechanical or electrical performance
- FPU and detector box are roughly comparable in their effects
- Berend:
 - Need to get B3 to redesign parts and remanufacture, cold testing etc.
 - Est. 7 months min. for availability = end of this year.
 - Critical uncertainty is B3 workload.
- Detector box supports needed earlier than FPU supports
- Stainless supports for PFM detector boxes are available
- Baseline will be to keep the current interface points
- **Action:** Matt to ask Reinhard Katterloher about PACS/Kayser Threde information/design.
- **Action:** Matt to ask JPL (Viktor) for a spec. on the allowed electrical resistance.

4.2 Schedule compatibility

- Redesign not to be implemented for the CQM
- Ideally needed in Oct. (Spect.) and Feb. (Phot.) . Oct. not realistic.
- Cold vibration is April. Will need to be at qual. levels rather than acceptance levels (subsystems may not like that).

4.3 Outline of programme

1. Feasibility study - is it technically possible
 - Provisionally yes - TBC by Berend.
 - Issues like outgassing, positional stability etc. to be looked at.

2. Schedule feasibility analysis:
 - MSSL need to verify with B3. Feb. may be optimistic.
3. Detailed design and analysis:
 - OK
4. Manufacture and test
 - Should be OK
5. Qualification (at instrument level)
 - First qual. tests at unit level (maybe at RAL or in the US)
 - Need to requalify at flight level. No need for extra cold vibration if early enough.

4.4 Estimated cost

- Requirement: Should not displace existing SPIRE commitments.
- Berend: availability of additional effort at MSSL should be OK - much of the work will be outsourced
Provisional indicative ROM cost: ~ £100k at MSSL + TBC at RAL
- **Action:** Berend and Eric to provide cost estimates by June 13. Include commentary on impact on existing commitments.

4.5 Decision on implementation

- SPIRE Project needs to decide mid June on implementation. Based on technical assessment, feasibility, schedule and cost.
- Plan to be presented to UK H-P Steering Committee on June 18

5. Status of Cardiff deliveries

5.1 Cryogenic black body

- Parts sent out for manufacture three weeks ago; due now - Pete will check on Tuesday. Design is based on RAL interface drawing.
- Primary structure and thermally isolating supports with ND installed elements can be pre-delivered. RAL need date is 30 June. Pete confirms that this is OK.
- Integration of the BB and flip mirror assembly can be done at RAL after thermal testing at Cardiff. These parts needed July 24. Compliance to be confirmed by Pete.
- Control box and LabView V-I: all components at Cardiff. To be assembled and tested. Also needed at RAL July 24.
- **Action:** Pete to define LabView S/W interface by Tuesday May 27
- Cryoharness: RAL to sort out independently

5.2 AIV Facility filters

- Production problems at Cardiff have delayed delivery
- ND filter:
 - Rings and substrates ready. Proposed to deliver several of different values.
- 77-K filter:
 - Now ready for cutting, cleaning and packing - can be delivered end next week.
 - RAL need date is June 24.
- 10-K filter:
 - Delaminated and is being redone. Expect update middle next week.
 - RAL need date is June 24. Pete to keep Eric fully apprised in weekly telecons

5.3 SCAL change request

- Pete can implement changes to reduce dissipation but it's schedule dependent - design change can't be guaranteed unless/until higher priority activities have been addressed

- Ideally needed Oct. - very last opportunity ~ Feb. 04

5.4 Black coating

- Bruce has tested a sample of carborundum-loaded epoxy - it's "very black"
- Simple Epotek-920 without carborundum loading is OK as proven in STM
- Bruce has defined where it's to go; MSSSL need to define the tiles
- We only need loaded epoxy at cold stops and input baffle
- Action: Bruce to take care of tile definition etc. Timescale to be decided.
- Action: Pete to do unloaded samples: by June 7 (pref more than one - different thicknesses)
- Action: Pete to draw up written procedure for unloaded E-920 application by June 7.
- Action: Pete to draw up loaded procedure by June 30

6. Next meeting

- 10 June at RAL

7. Action list (not including IHDR preparation actions)

Green = closed at this meeting

Blue = updates and new actions

No. + Mtg	Action	Responsible	Due date	Status
1 Apr. 30	Brief Jean-Louis, Lionel, Laurent by E-mail as to the nature of the cooler schedule problem	Eric	Before May 7 telecon	Closed. Lionel wants to wait until end of SPIRE CQM programme. Propose wait until end PACS CQM vibration programme at latest. New action: Doug to e-mail Lionel forewarning Lionel. Eric to take part in Wednesday's telecon to confirm absolute need for cooler delivery for PFM integration in - need to start building now.
2 Apr. 30	Define a schedule with appropriate milestones to get us from now to completed manufacture ready for cold test - installation 7 August.	Chris	May 15	Closed.
3 Apr. 30	Take steps immediately to institute weekly subsystem telecons.	Organisers	May 7	In progress. Needs to be started with Cardiff (Thursdays)
4 Apr. 30	E-mail institute PMs explaining the new system and stressing the telecons and monthly reports are mandatory.	Eric	May 7	Closed
5 Apr. 30	E-mail Co-Investigators emphasising the importance of professional and sustained communication between institute managers and the SPIRE Project.	Matt	May 7	Closed
6 Apr. 30	Send out e-mail to local PA managers about the configuration control procedure.	Eric C.	May 7	Closed
7 Apr. 30	Draw up a list of to-be-signed-off documents and distribute to subsystem telecon organisers listed above.	Ken + Eric	May 7	Open
8	Update 300-mK recovery plan wrt	Pete	May 30	

May 23	MRB conclusions as noted above			
9 May 23	Ask LAM to provide layout details of the PCB and the unit interface by Tuesday visit if possible.	Eric	May 27	
10 May 23	Ask Reinhard Katterloher about PACS/Kayser Threde information/design.	Matt	May 30	
11 May 23	Ask JPL (Viktor) for a spec. on the allowed electrical resistance	Matt	May 27	
12 May 23	Provide cost estimates for FPU and detector box support re-engineering programme Include commentary on impact on existing commitments.	Berend/Eric	June 13	
13 May 23	Liase with MSSL on black tile definition etc.	Bruce	Timescale TBD	
14 May 23	Send unloaded E-920 samples to Bruce for testing	Pete	June 7	
15 May 23	Provide written procedure for unloaded E-920 application.	Pete	June 7	
16 May 23	Provide written procedure for unloaded E-920 application.	Pete	June 30	
17 May 23	Provide LabView S/W interface to Dave	Pete	May 27	