

## Notes on SPIRE-ESA Meeting, ESTEC, 15 March 1999

Matt Griffin

16 March 1999

<b>Present:</b>	<b>SPIRE:</b>	Matt Griffin	<b>ESA:</b>	Thomas Passvogel
		Ken King		Harm Schaap
		Colin Cunningham		Göran Pilbratt
		Bruce Swinyard		

These notes are to provide a quick summary of the meeting. Harm Schaap will issue the formal minutes. Overall, it was a very constructive meeting, although a number of problem areas were exposed which we clearly need to address – in particular, the need to keep the detector evaluation plan on the rails and to prepare for the PDR.

### 1. Next meeting

Date: 22 July (TBC)

Main purpose: Review outcome of SPIRE PDR Part 1  
Prepare information for spacecraft ITT to industry

### 2. Status of action items on SPIRE from previous meetings

AI-SPIRE-4: Provide update on thermal design options covered in IID-B update  
AI-SPIRE-6: Provide outline structure design: covered under item 3  
AI-SPIRE-7: BAU update: CEA design is baseline. Implications of larger fov must be defined. Design for FET option must be defined.

Various others were tidied up.

### 3. Instrument design and development status

Bruce and Colin presented the current status of SPIRE, covering:

- FTS choice
- Photometer optical design
- Study of 4 x 8 arcmin. photometer fov and corresponding spacecraft resource tradeoffs
- Focal plane sharing
- Implications of telescope design for SPIRE FPU structure design

#### Discussion:

- Warm power of around 100 W is high but is not categorically ruled out
- ESA appreciated our intention to build the most scientifically powerful instrument possible and will not try to make things difficult by requiring us to stick to predefined or unreasonable budgets. To answer the question of what are the most critical resource budgets, TP will need to assess the requirements of all three instruments (still needs information on HIFI status, which will be available when ESA meet with HIFI later this month).
- The baseline on focal plane sharing is that SPIRE needs to keep to its current envelope in the vicinity of HIFI (i.e., we cannot promise to give up the corner of our box).

- The impact of telescope thermal gradients must be reviewed. The thermal time constants are expected to be very long compared to SPIRE observations.
- Telescope focus position must not change wrt current optical bench (otherwise SPIRE will not have enough headroom between the optical bench and the cryostat cover).
- It may be thermally sensible for ESA to strap the optical bench to the "15-K" temperature level.
- SPIRE is being very slow in defining its FPU mechanical design and footprint (action item to do so by this meeting has not been met).
- The available data rate will have a major impact on the architecture of the SPIRE warm electronics and OBSW. We need to know very soon what number we should assume.

#### 4. IID-B update

Revised versions of Chapters 3, 4 and 5 were presented

**Chap 3:** Admin information has been updated and made compatible with the SPIRE Management Plan.

**Chapter 4:** Has been re-written to bring it up to date wrt the current instrument design status. Sensitivity predictions have been updated (same as in current SRD).

Comment from TP: The most important part of Chapter 4 is the table of performance data: this will need to be verified before launch through a combination of measurement and analysis.

**Chapter 5:** This has been updated to incorporate the draft Array Systems Design documents. The different detector options are presented separately and the requirements for the 4 x 8 fov are spelled out.

#### Discussion:

- ESA are concerned about the lack of definition for the TES option cryoharness, particularly if there are to be any special requirements on R, L, C.
- The requirements for SPIRE-AOCS interaction will be covered in a forthcoming meeting that ESA are setting up with the three instruments on this subject.
- Various minor changes and clarifications to Chapter 5 were noted.

#### 5. Status of early development items

We came in for a very hard time here on the Detector Selection Plan and on mechanism development. Other items discussed were the cooler, the internal calibrators and the instrument-and spacecraft-level testing plans.

**Detector selection plan:** The plan presented to ESA in October (based on the schedule as defined at the Goddard detector meeting in September) was used to bash us into a pulp. Hardly any of the milestones have been met and the schedule has already suffered considerable slippage. ESA were skeptical about us meeting the schedule and having any viable options at the time of selection.

Our response (based on the conclusions of the January Detector Array Group meeting):

The Detector Selection Plan was out of date and needed to be updated following the January Detector Group meeting. Some sub-options had been eliminated (e.g., TES + Spider webs). We undertook to provide an updated version.

Detector selection will be made on the basis of

- (i) experimental test results
- (ii) full system design
- (iii) schedule for fabrication, testing and delivery of QM hardware
- (iv) qualification plan
- (v) compatibility with spacecraft resources.

The schedule between now and selection is very tight and the selection date can't be delayed. If an option is not yet demonstrated or fully developed in terms of SPIRE systems design by the time of selection then it will not be selected.

It is a requirement that the feedhorn option, being the only one based on proven technology, be selectable (i.e., be developed to cover the above points) by the time of selection. Should one of the other options, which have yet to be proven in the lab., be demonstrably better then it will be selected.

**Chopper and FTS mechanism:** ESA regard these as high risk items. They would like to see our preliminary designs to be reassured that the development is proceeding to a reasonable schedule, and to have them looked at by their mechanism experts for comments/advice. By the time of PDR Part 1 in July, proper preliminary designs should be available. Development plans should be available well before this (end May), covering milestones and steps leading up to qualification. The SPIRE chopper requirements go well beyond the capabilities of the ISOPHOT chopper which is being used as the starting point. The SPIRE FTS mechanism development must not be hampered by resource limitations in 1999.

More generally, such considerations apply to all our sub-systems. TP was mildly critical of our PDR philosophy – to establish budgets and have black boxes for the sub-systems if they haven't got preliminary designs. He wants to see it the other way round - the preliminary designs of the sub-systems and then an overall systems design that will accommodate real sub-systems – a fair point.

**Cooler:** The TRP contract will be helpful to SPIRE but will not qualify our cooler - we will have to do that separately.

**Calibrators:** While no major problems are foreseen, these need to be specified and developed, and preliminary designs must be available in July.

**Testing philosophy:** ESA would like more detailed information on what tests we would like to be carried out on the CQM. E.g., do we need the BAU to be cooled; do we need the proposed GSE for reducing the thermal background. Such questions have an impact on the requirements that ESA will put in the ITT. The important point here is that we saw – for the first time – ESA's proposed test environment for the CQM and it will look quite a lot like FIRST – including the presence of the cold cover thing. This means that we can make realistic and representative tests on the EMC and, possibly, straylight environments as well as debugging the test sequences etc for the PFM campaign.

## 6. Instrument management

It was agreed that the SPIRE Management Plan should now be formalised by the consortium.

## 7. Focal plane sharing

Covered under item 3.

## **8. SPIRE questions (submitted in writing before the meeting)**

### **8.1 What is the total thermal load on the CVV?**

It's a few W. If the SPIRE BAU dissipates 1-200 mW it can be bolted directly to the CVV. Otherwise (as is the case - nominal dissipation = 2.5 W) it must be thermally isolated. There will need to be a length of harness of length 0.5 - 1 m between the CVV and the BAU.

### **8.2 Who should be responsible for the thermal/mechanical design of the BAU and its interface to the CVV ?**

ESA will provide a platform to which the BAU will be bolted. They will need information on our dissipation for the thermal design.

### **8.3 At what level does warm electronics power get unacceptably high?**

Thomas will provide an answer in mid-April. 100 W made him wince.

### **8.4 Can Kapton ribbon cable be used for the cryoharness?**

No reason why not. Thomas would like information on the design and properties of the proposed cable technology.

### **8.5 Is there a limit on the allowed pin occupancy for MDM connectors?**

No - they may be fully populated.

### **8.6 What is the surface roughness specification for the telescope?**

It is actually specified in the telescope specification under "Workmanship": rms < 0.6 um

### **8.7 Will it be feasible to place passive RF filters on the CVV connectors?**

No, or at least it would be very difficult. This underscores the need for us to implement our own Faraday cage (planned for the 15-K box).

### **8.8 Is any information available on the level of spacecraft-induced microvibration at the level of the FPU, and are there plans for any analysis of this?**

No. Some information may be available from ISO. Thomas will check this.

### **8.9 What is the downlink rate which we should assume in the design of the on-board electronics and software?**

200 kbs is possible technically. It is a matter of cost for ESA (most of which is on the Ground Segment side). It will help if we provide a good case to justify why we want the higher data rate.

### **8.10 Can ESA comment on the use of the following parts which, to our knowledge, are not on the current ESA-approved list?**

- 51 and 100 way MDM connectors
- S3110409 family of connectors (non-magnetic)
- ADS7807 or 09 16-bit ADCs
- Actel FPGAs
- Xylinx 4000XL family

Some information on connectors was provided by Harm at the meeting (CRC to disseminate). Answers on the other components will be compiled. ESA would like to know which particular FPGAs are envisaged. The Commonality Working Group has an action to compile a full list of proposed components in May. We should add any other suggestions to the list before then.

**8.11 Can the Commonality Working Group refrain from deciding on the requirements for the DPU before SPIRE has decided whether or not the SPU is necessary?**

The DPUs for the three instruments are already beginning to look different. The CWG shouldn't impose an unnatural design if the instruments don't want it. One option would be to have a "maximal" design covering all options with some boards/capabilities not implemented unless they were actually needed. HIFI and PACS have requirements documents for the DPU - a similar one is needed for SPIRE.

**8.12 What are ESA's plans for establishing a FIRST EMC working team?**

ESA appreciate the problem but don't want to set up a formal group just yet, without more detailed information on the requirements and designs of the instruments. The ISO EMC spec. could be used as a starting point. Thomas will consider the issue and clarify the EMC approach by mid. April. SPIRE should compile a list of detailed questions if we are concerned about particular issues.

**9. List of main actions (formal list will appear in Harm's minutes)**

- |  |         |          |
|--|---------|----------|
| 1. Write note for ESA on advantages to SPIRE of 200 kbs data rate                          | MJG     | March 30 |
| 2. Provide update of SPIRE IDP with particular emphasis on schedule                        | KJK     | May 31   |
| 3. Formalise the SPIRE Management Plan   | KJK     | TBD      |
| 4. Update SPIRE WBS based on comments which TP will provide next week                      | KJK     | TBD      |
| 5. Update SPIRE Power Profiles Document  | BMS     | TBD      |
| 6. Provide answer to SPIRE question on acceptable warm electronics power                   | TP      | Apr. 15  |
| 7. Ask Terry Cafferty to send information on Kapton ribbon cables to TP                    | MJG     | March 22 |
| 8. Get detailed information from GSFC on particular FPGAs that they are proposing to use   | BMS     | TBD      |
| 9. Clarify the EMC approach for FIRST  | TP      | Apr. 15  |
| 10. Update BAU design and options (inc. 4 x 8 arcmin. fov)                                 | C. Cara | March 31 |
| 11. Provide GP with update on UK PR activities   | MJG     | March 22 |
| 12. Provide proposed SPIRE FPU envelope (including position of connectors/FET box)         | BMS     | March 31 |
| 13. Update SPIRE Detector Selection Plan   | KJK     | May 31   |
| 14. Provide update on SPIRE sensitivity to telescope temperature field and its variability | MJG     | TBD      |
| 15. Provide ESA with mechanism development plans   | KJK     | May 31   |