Board Report

The SPIRE Warm Electronics Review (part II of the ISVR) took place on Dec 6/7 at IFSI, Rome. Taking into account that this review should be seen as a review internal to SPIRE, no RIDs will be raised. The RID system will be applied to the final ISVR meeting in March and those comments that will not have been answered by than will be transformed into RIDs.

The Board would like to thank the SPIRE team for their detailed presentations and for the open and fruitful discussions.

Statements and comments from SPIRE have been included wherever available.

Comments to the SPIRE Warm Electronics Review:

#1: Sorption Cooler Recycling
- It is not clear whether the sorption recycling is planned to be performed autonomously, ground controlled or any other way and which parameters are to be monitored. The impact of recycling of the cooler on the system operation need further to be clarified.
- How would SPIRE see the scenario if a recycling of the sorption cooler would be missed, i.e. one of the parameters to be monitored would indicate the cooler not being ready?

#2: S/C pointing accuracy during line scanning
- The pointing accuracy during the line scanning to be defined/specified by ESA.

#3: Safety switch off
- It is proposed by SPIRE to switch off safety parameters during commissioning and calibration. Since this is expected to be relevant for only a small subset of parameters, could SPIRE provide further information.

#4: Definition of modes
- Could SPIRE further elaborate on the difference between the standby and the observing mode, also, especially w.r.t. the system.

#5: Peak up mode
- In the case of the peak up mode SPIRE will feed back information into the AOCS, is this already defined properly.

#6: Compression of data
- The compression approach obviously depends on the detectors selected and is important for the warm electronics design. However, no approach is defined yet. Could SPIRE provide the plan to implement data compression in the instrument design.

#7: Burst Mode (?)
- It was not clear from the discussion whether there is a need from SPIRE of a burst mode or not. SPIRE to clarify the data transfer philosophy.

SPIRE:
The details of the data rate budgets (average and burst mode) are in need of clarification. SPIRE is assuming that an average data rate (science + H/K) of 100 kbs over 24 hrs is available. The value of the burst mode and the period for which it applies are not fully clear at present, and some definite specifications will be needed soon to allow the SPIRE electronics and OBS to be designed.

Action: Bruce Swinyard/Ken King to write a note explicitly detailing how the instrument is to be operated and how the data transfer occurs.

#8: Partner Mode

- The scientific benefit of the partner mode of SPIRE with PACS is not evaluated yet, could however affect the S/C and GS interfaces and resources. SPIRE should, together with PACS, perform an evaluation of the scientific benefit of the partner mode.

SPIRE:
The feasibility and desirability of this mode are still uncertain. ESA would prefer to keep the operating modes as simple as possible and avoid this mode if possible. Neither the SPIRE nor PACS instruments are being designed with partner mode observations in mind. Its feasibility will depend on observing modes, sensitivities and compatibility with FPU power dissipation and data rate budgets, and presumably on ground segment/scheduling constraints.

SPIRE recommends keeping it as a possibility for now and making a decision once the instrument designs are finalised. In the meantime, Matt Griffin will consult with Albrecht Poglitsch to provide an up-to-date assessment of the viability of Partner mode to the next FST meeting.

#9: Model Philosophy

- The use of the different units for the different tests appear not yet optimum and should be reviewed with ESA, i.e. use of QM1 instead of the AVM for the CQM tests?

SPIRE:
We accept that more clarity is needed from SPIRE on the purpose and specification of the various units and on the kind of parts to be used.
ESA also need to be clear on what they need each of the instrument models for and what the test philosophy will be with each of the instrument models – this will help SPIRE to clarify what functionality and tests are required for each of the models and simulators.

Action: Bruce Swinyard/ESA to consult and clarify the requirements on the CQM and AVM.

It was noted that the first model of the DPU must be built before the appointment of a spacecraft contractor. This will pose potential problems with interface definition, and may limit the subsequent design flexibility on the spacecraft side.

#10: Harness capacities

- One of the detector options requires a maximum capacity (and knowlegde in advance ?) on the cryo harness wires. It is not yet clear what system impact this requirement has (ESTEC to evaluate).

#11: Delivery of PFM instrument

- The delivery of the PFM instrument is, according the presented planning 5 months after the need date. This seems driven by the warm box electronics. SPIRE to provide detailed planning for the warm boxes and propose ways to recover the delay.

SPIRE:
Potential schedule delay is building up. A slip in the launch date is to be avoided at all costs. Once the instrument development plans are complete, it will be useful to revisit the issue of the PFM instrument development and the spacecraft AIV schedules with the aim of optimising the overall AIV schedule consistent with an early 2007 launch.

There is a lack of homogeneity in the subsystem development plans which is difficult to avoid at this stage as the detector selection has not yet been made, and the overall AIV flow is still not certain. Much attention will need to be paid to this in the immediate aftermath of the detector selection.

Action: Bruce Swinyard/Ken King to review the AIV plan and make it all more realistic and coherent.

#12: Document control

- The documentation referred to in various SPIRE documents are not in all cases at the last status. SPIRE to correct/update the document references in their documents. (ESA to consider a central document status lists)

SPIRE:
It was noted during the meeting that there is a need to ensure the availability and use of up-to-date versions of key documents. Some thought on how best to do this is needed on the part of ESA and the instrument teams. Having documents deposited on DMS is insufficient as updates may pass unnoticed. A better scheme might be to maintain a well-publicised web page with the current versions of all key documents.

#13: Temperature measurements

- SPIRE requires the s/c to measure temperatures at various locations in the SPIRE units. Nominally the s/c would control interface temperatures only. Could SPIRE clarify the needs for temperature monitoring by the s/c inside their units, also considering that the baseline is that all instrument warm units will be on all time.

#14: SPIRE Budgets

- The presented budgets for the different units of SPIRE are not always compatible. Could SPIRE assure consistency?

SPIRE:
No definite figures are available from ESA for the instrument teams to work to.
The SPIRE DRCU box may need to be split in two for thermal/mechanical reasons.
The table summarising the SPIRE power dissipation for each option needs to be filled in.
The accounting for power converter efficiency should be uniform for the different detector options so that their warm electronics power requirements can be properly compared.

Action: Christophe Cara or Jean-Louis Augueres to write a document explicitly laying out the expected system design of the DRCU; grounding scheme; subsystem interfaces; power distribution etc. and the array groups to take this as their starting point (the information exists it just needs clarification and collation).

#15: DRCU Nominal operation

- In the nominal operation modes of SPIRE the DRCU dissipates different amounts of power. This will affect the SVM temperatures. It is expected that SPIRE goes to one single dissipation

mode, when non prime, to be in line with the needs of HIFI. The rule that should apply is that only the prime instrument is allowed to change its power dissipation (warm units and FPU).

#16: Detector Selection

- The three detector options of SPIRE do have different needs of resources from the spacecraft. SPIRE to summarise the resource requirements for the three detector options and elaborate with ESA the corresponding attribution of needs to the selection.

#17: OBDH interfaces

- It appeared from the presentation that SPIRE needs further information on the interface to the OBDH. SPIRE to provide questionnaire on information needs.

#18: Component quality level

- The proposed component quality level for the different units are not consistent within SPIRE and not in line with the ESA requirements. SPIRE to clarify.

#19: DRCU to DPU high speed communication link

- What is the reason to implement a high speed communication link between DRCU and DPU if the compression is already performed in the DRCU, i.e. the data rate should be compatible with the 1553B?

#20: Microprocessor selection

- Two different microprocessors are planned to be implemented for SPIRE. In view of the commonality with the other four instruments of FIRST and Planck and the fact that a separate microprocessors will be very costly, from procurement, development tools and maintenance point of view, SPIRE should revisit the selection. SPIRE to clarify why the DSP 21020 cannot be used in the DRCU.

  SPIRE:
  The SPARC has been identified as a good solution for SPIRE, and is close to being space qualified. Although SPIRE is the only one of the five instruments using the SPARC, and this is a departure from total commonality, SPIRE does not see this as a major issue.

#21: DRCU Conceptual Design Completion

- The presented design concept of the DRCU exclude the detector readout part since the detector selection has not yet been performed. However, it is considered that this element of the unit will require considerable effort. SPIRE to initiate work on the conceptual design of the detector readout part of the DRCU, especially w.r.t. sharing of tasks and control between DRCU and DPU, OBSW, and data compression.

  SPIRE:
  A proper description of how the detector data stream is generated is needed for all options. The JPL design is not currently compatible with the requirements or the proposed interfaces to the DRCU.
  As noted above, a document is needed clearly setting out the DRCU system design, as noted above. The contents exist in various viewgraph presentations, notes and e-mails - it just needs to be brought together. The sub-systems can then design against this.
  Complete FPU sub-system specification documents are needed so that the design of the warm electronics can proceed.
  Detailed system operation must be defined shortly after detector selection.
  The overall AIV plan contains a number of inconsistencies and is incomplete: it must be defined in more detail and made to be internally consistent.

#22: Buffer amplifier unit

- Is it correct that the BAU will be requested by all three detector options?

#23: FTS preamplifier

- It appears that is a potential need for a preamplifier of the FTS at the level of the CVV. Could this be clarified by SPIRE?

SPIRE:
The location of the 100-K ampifiers for the FTS position sensing system should be clearly specified.

Action: Didier Ferand/Bruce Swinyard to confer and make the specification.

#24: DRCU compatibility with the needs from the FTS

- It was not clear from the presentation that the DRCU is compatible with the needs of the FTS. Could SPIRE further elaborate on the implementation?

#25: Thermometry

- It is noted that the inner temperatures of the SPIRE FPU will not be measured during cryostat bake out at around 80°C.

#26: Shutter Specification

- There is no specification on the SPIRE shutter existing at present. SPIRE should provide an outline of the requirements and needs from electronics (DRCU).

SPIRE:
The warm electronics to drive the shutter is in the DRCU for two reasons:
(i) operation of the shutter in flight is still, under consideration;
(ii) this is convenient for ground testing.

#27: Instrument Operation

- The actual instrument operation will to some extent depend on the selected detector option. How and when will this be included in the SPIRE definition?

#28: On-board Software

- It was noted that the on-board software was not addressed in detail during this review.

SPIRE :
The OBS was not included in this review, for a number of reasons:
- A common framework for instrument commanding is not yet defined (a paper has been produced by Ken King and is under review).
- The SPIRE detector selection in early February will have implications for the OBS.
- We intend to split the OBS requirements into two separate URDs (respectively for the DPU and the DRCU) and a DPU/DRCU ICD. A first draft of the DPU/ICU OBS URD has recently been produced by IFSI, and needs to be reviewed and revised if necessary to take into account the sharing of tasks between the DPU and the DRCU which has not fully defined yet.

The OBS will be covered in Phase 4 in April.

Additional comments from SPIRE:

#29: Grounding scheme, cryoharness definition and EMC

- We need electrical definition of the FPU + cryoharness for the grounding scheme definition. The final grounding scheme for SPIRE will therefore need to be defined after detector selection. A working group involving ESA and the instrument teams is needed to address grounding and EMC issues.

#30: RF filtering

- This is customary for sensitive bolometer instruments, and is only specified as a requirement for the NTD germanium detector option. The reasons why it is thought not to be required for the other options need to be clarified, or else it should be baseline for them also. Note that the RF filter box is specified as a deliverable for the array-providing group in the *SPIRE Product Tree*.

#31: DC-DC converter synchronisation

- SPIRE wishes to have the option of synchronising the DC-DC converters and expects to receive the necessary synch pulse from the spacecraft. This shold be included in the relevant section of the IID-B.

#32: Cooler thermal control

- It is not clear who is actually responsible for this – there is an inconsistency between the presentations by Bruce Swinyard and Louis Rodriguez.
  Better resolution on the temperature control will be needed.

  Action: Bruce Swinyard to consult with array groups to define specification for required temperature resolution.

#33: BSM control system

- PACS are planning to carry out the real time control of their chopper using the CPU in the DEC/MEC (the equivalent of our DRCU). The possibility of doing the same for the SPIRE BSM should be analysed as it may avoid the need for dedicated control electronics.

  Action: ATC to check their control system processing requirements against the performance of the SPARC chip.

#34: BSM flex pivots (not really a subject of this review but noted in passing):

- The reliability of the commercially available flex pivots proposed for the BSM needs to be verified.

Garching, Dec 23, 1999
O.H. Bauer