

SPIRE Science Verification Review Phase 3

Stockholm, 29-30 September 2007

Status of SVR-2 Review Board Actions and Recommendations

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1. Introduction and scope

The SPIRE SVR-2 Review meeting was held at RAL on Sept. 26 2006. The Review Board met afterwards, and noted various comments, actions and recommendations. No formal Review Board report was produced, due to pressure of other work on the Board chairman and members, but the main points raised during the Board meeting are listed and addressed here.

2. List of SVR-2 Board Actions and Recommendations

2.1 Instrument Level Testing

Board comments/recommendations:

- There may be conflict between ILT and other activities, but it is not acceptable to de-prioritise non-ILT activities to such an extent that the overall progress of the project, leading to instrument delivery, is compromised. Is there enough redundancy/backup within the team? Can Bruce Swinyard’s jury service be deferred?
- The planned PFM 5 campaign should be done if possible.
- The problem of the non-operational half of SSW array in PFM-3 is unresolved.
- Spectrometer noise performance is not yet demonstrated.

Response:

- **ILT staffing etc.:** With some staffing difficulties, the ILT and other activities were adequately covered; Swinyard jury service was deferred on appeal from the PI.
- **PFM 5:** The planned campaign was successfully completed.
- **Non-operational half of SSW:** The cause was identified as harness connector problem, and eliminated in PFM 5.
- **Spectrometer detector noise:** Baseline noise level is now demonstrated. See BDA noise performance doc., which also addresses microphonic susceptibility.

2.2 FDIR

Board comments/recommendations:

- Hardware should be robust against un-plugging. Is the instrument robust against sudden loss of 28 V in flight?

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- Do we need an FDIR test campaign or have sufficient tests been done on units? Avoid doing it at S/C level if possible.

Response:

- **Robustness in event of power loss:**
 - Full power loss occurred once and system behaved nominally afterwards. The DPU, DRCU and JFETs are safe wrt loss of 28 V. DRCU and DPU have been tested at unit level for correct behaviour after loss of 28 V. JFETs have been successfully tested against loss of DCU power.
- **FDIR**
 - The FDIR has two parts:
 - Internal instrument actions taken in the event of an anomaly
 - to be checked using the AVM at RAL (schedule TBD, but before FS testing) – already part of the plan;
 - Spacecraft actions in response to instrument flags
 - to be verified during IST 1 at Friedrichshafen (decision at AIT meeting at RAL on Oct. 2). Detailed procedures to be defined.

2.3 Sensitivity model

Board comments/recommendations:

- SPIRE should devise a realistic model of instrument performance, with no hidden pessimism factors, and then add explicit security factors to that.
- The impact of the slight non-conformance of the filter edges should be clarified.
- The impact of dead pixels in AOTs should be determined.
- The spectrometer throughput is not fully understood.

Response:

- **Sensitivity model revision:** The sensitivity model has been revised and updated (and used to generate HSpot inputs), taking this recommendation into account.
- **Dead pixels:**
 - Photometer: No impact for scan-map or point source. Minor impact for jiggle map – needs to be simulated.
 - FTS: No impact for point source spectroscopy. For spectral mapping, there are some problems with holes in the maps. Some simulations are in progress. The approach will be to live with this as spectral mapping is too time consuming to fill in all gaps.
- **Spectrometer throughput:** This is still not fully understood, but substantial progress has been made. See SVR3-9 (Instrument Throughput) and SVR3-11 (Spectrometer Performance) for details.

2.4 He-leak susceptibility

Board comments/recommendations:

- The vulnerability of bolometer performance to low-level helium leaks is a concern for the ILT and the flight cryostat.

Response:

- Countermeasures taken with the ILT cryostat eliminated the problem successfully. ILT experience shows that “hot-cycling” the cooler is enough to clear He contamination (at least for some period - not fully clear as tests done without He contamination) The SPIRE Project Team and JPL are concerned that the FM cryostat must be protected against any such leaks and effects which could accumulate over the lifetime of the mission. These concerns have been made known to the ESA Project. Our understanding is that the cryostat will be leak-tested during pump-out and in the initial phase of cooling, and that any level of detectable leak will be regarded as unacceptable. We believe this to be absolutely essential.

2.5 EMC

Board comments/recommendations:

- The radiated susceptibility of the bolometers is still a major concern.

Response:

- This has been a high priority focus for testing. Countermeasures proposed at the time of SVR-2 were shown not to be effective. Further evaluation is planned at system level - see SVR3-30 (EMC Test Plan). Any future countermeasures will have to be on spacecraft side (e.g., shielding of the SVM).

2.6 Spectrometer mechanism qualification

Board comments/recommendations:

- It has not yet been shown that the power dissipation is not a problem.
- The reliability of the launch latch is questionable.
- The scientific performance of the FM has yet to be tested.

Response:

- **Power dissipation:** this is being addressed in thermal transient analysis - see SVR3-8 (Thermal Performance).
- **Latch reliability:** Continuing investigations led to a decision to power the latch on launch and system-level vibration testing.
- **Scientific performance:** The performance of the FM as measured in PFM-4 is on spec. or better - see SVR3-11 (SMEC and spectrometer performance).

2.7 Photometer Thermal Control System

Board comments/recommendations:

- The PTC system is not coherently documented.
- It will be important to ensure that the Herschel scheduling is not made too complicated in the event of it being used.

Response:

- Thermal analysis (see SVR-8) is covering thermal stability after cooler recycle.
- Cooler hold-time: this is still not validated.
 - Some additional analysis and system-level testing will be needed and are being planned incorporating updated interface temperatures (1.65 K at L0 and < 5 K at L1). The full dynamic thermal model of the cryostat plus instrument is now available.
 - PTC operation will reduce the quiescent hold-time by approximately 2 hrs. Compliance with the hold-time requirement with the PTC on is not certain – an assessment of the impact will be made based on thermal analysis.
- A nominal time period will be defined during which scan maps should not be done after cooler recycle.

2.8 Thermal modelling

Board comments/recommendations:

- Continuing thermal modelling is needed, especially on SPIRE-induced thermal transients.

Response:

- Transient modelling using the combined SPIRE + Astrium models has been carried out and is reported in SVR3-8. This activity is continuing.