

FAX MESSAGE FROM:

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Date : 7 April 2003
To : Thomas Passvogel, ESA ESTEC
Total number of pages : 3

Dear Thomas,

Attached is SPIRE's response to the recent fax informing us that internal overshielding of the SPIRE cryoharness is not to be implemented..

Best regards,

A handwritten signature in blue ink that reads 'Matt'.

CC: ESA Gerry Crone, Astrid Heske, Carsten Scharmberg
RAL: Eric Sawyer, Ken King, Bruce Swinyard, John Delderfield, Doug Griffin, Judy Long
JPL: Jamie Bock, Gary Parks, Viktor Hristov
CEA: Jean-Louis Augueres, Laurent Vigroux, Christophe Cara

Dear Thomas,

This is in response to the fax SCI-PT16967 of March 14 2003, informing us that does not agree to the implementation of a harness overshield between the SPIRE FPU and the CVV connectors. This is a very important issue, and we make the following comments.

1. The need for this overshield has always been stated by SPIRE. For instance, it was included in the SPIRE IID-B version 2.0 (July 2001). While it may not have been in the version of the IID-B that was included in the ITT sent to industry, it was well known at the time that there were many out-of-date elements in that version. The SPIRE grounding review in September 2002 allowed us to clarify the implementation in more detail.
2. In the summer of last year, when this topic was discussed at various meetings, we were informed that the overshield was not viewed favourably because of a likely major impact on the helium lifetime. Now, many months later, when analysis has since shown this to be a relatively minor impact, we are told that the reason it cannot be implemented is that it will impact on industry's schedule. This is a very frustrating irony for us.
3. It is asserted that we do not need the overshield because there already are individual shields around various harness bundles. But it must be remembered that the main function of these shields is to extend the analogue ground-plane from the cold end to the warm end whilst providing some low-frequency shielding and minimising crosstalk. We have nV-level signals propagating over 7 metres of harness, and it is vital to ensure that this ground-plane is not itself compromised by RF or general noise pick-up. This is the essential function of the overshield.

It should be recalled that we agreed to the simplification of eliminating the Buffer Amplifier Unit on condition that we could place strong requirements on the harness implementation - it was certainly our assumption at the time that our shielding requirements would be met.

4. It is also stated the we have not managed to provide clear evidence through results and modelling that the overshield is needed. It would be completely impossible to do so - it is not known how to model the RF impedance of a bolometric detector. It is known, however - from bitter experience on previous bolometer instruments - that bolometers can be drastically affected by levels of RF which are harmless to other kinds of detector.

In this situation, we would be well advised to follow best design practice, which is to ensure that the signal lines between the cold and warm ends are very well shielded. (In fact, this should lead us in the direction of triple rather than single shields as are now being dictated.)

While the cryostat will provide some protection, it must be remembered that there will be many unfiltered wires entering it associated with the scientific instruments and spacecraft sensors. All of these will be capable of picking up external RF and conducting it into the cryostat wherein it can be re-radiated.

5. The cryoharness for the SPIRE AIV cryostat has already been procured and is being installed now. We have no intention of modifying it or procuring another one without the overshield. All instrument-level testing will therefore be done with the overshield in place.
6. Should a problem with correct bolometer operation being prevented by RF interference during system-level EQM testing, then it will of course not be possible for SPIRE to verify instrument performance; and it would also then be necessary to modify the Herschel flight harness to include the internal overshield (undoubtedly with much greater financial and schedule impact). The system-level verification of SPIRE would also then need to await PFM system tests, which is clearly extremely risky;

and since those tests are going to be more basic and rudimentary than testing in the EQM, there must be a significant risk of a problem remaining unidentified until after launch.

7. The Annex to the fax is misleading concerning the claimed system susceptibility. Point (1) states the "the susceptibility of the detection chain cannot be claimed to be from DC to virtually infinite . . .". But we have never claimed this. It is the BOLOMETERS themselves that are capable of absorbing power of ANY KIND, with potential disastrous consequences (300-mK bolometers have been know to warm up to temperatures over 1-K due to RF).
8. Point (2) is correct on this issue, but states that "it has never been demonstrated by analysis/testing that the present configuration (without overshield) is not compatible with the Herschel cryostat". We do not accept that it is up to us to support the request for an overshield with an "adequate technical rationale" in the form of a quantitative analysis - as pointed out above, such analysis is not possible. What we have stated from the beginning of the project is that this overshield is necessary based on the long technical heritage of bolometer instruments. In the case of many ground-based systems, including ultimately very successful ones such as SCUBA and BOOMERANG, it took a great deal of time to sort out such problems. In the case of Herschel, it is surely agreed that we do not have this luxury with the schedule.
9. The only instructive tests that could be carried out at instrument level will be some additional conducted susceptibility tests involving injection of interference onto the overshield to see how this couples to the signal lines. Clearly, however, this is not a definitive test.
10. We must henceforth regard the absence of the internal overshield as one of the greatest technical risks to the success of SPIRE. Whilst we will work to mitigate it as much as possible, the scope for so doing by modelling and testing is extremely limited.

In summary, we believe that this is an unwise decision and that it poses very high risk for SPIRE and Herschel. We therefore request that it be reconsidered.

Best regards,

A handwritten signature in blue ink that reads "Matt". The letters are cursive and fluid, with the 'M' and 'H' being particularly prominent.