SPIRE-ESA-REP-001875

DOCUMENT

SPIRE

Instrument Hardware Design Review

Board Report

Herschel / Planck Project

9 – 10 July 2003
RAL

prepared by C. Scharmberg (SCI-PT)
approved by G. Crone (SCI-PT)
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CHANGE LOG

date	issue	revision	pages	reason for change
22/07/03	Draft	1	All	New Document
25/08/03	Draft	2	All	Document reviewed by Board Members
22/09/03	1	0	5	Forth paragraph has been added
			9	Fifth paragraph has been added
			15-60	Rework of comments to documentation

Table Of Contents

1 INTRODUCTION

The Instrument Hardware Design Review (IHDR) presentation meeting of the Spectral and Photometric Imaging REceiver (SPIRE) was held in the Rutherford Appleton Laboratory (RAL) in Oxfordshire on 9th and 10th July 2003. One CD containing the relevant data package was provided one month before the meeting to all Board Members. A delta data package was provided on 25th June 2003 by email. In addition the data package is available via Livelink.

This report provides the Review Board findings, recommendations and conclusions.

2 REVIEW OBJECTIVES

The review objectives have been defined in conjunction with the instrument teams, in the view of the actual timeframe, the IHDR is being held, together with the status of the instrument and spacecraft development, and are defined in "Instrument Hardware Design Review Proceedings (Ref.: SCI-PT-16746).

The Objectives shall be to demonstrate:

- The assessment of the instrument AVM/CQM programme status
- Definition of the acceptance criteria of the AVM/CQM models for spacecraft system level
- The acceptance and freeze of the on-board software (Architectural Design Document)
- Review of the ground facilities (H/W and S/W) required to support the ILT's

SPIRE introduces additional objectives:

- Subsystem technical status, with emphasis on test reports
- STM test results
- Spacecraft interfaces, especially FPU thermal interfaces
- Instrument AIV plan and schedule
- Configuration status

3 SPIRE INSTRUMENT HARDWARE DESIGN REVIEW BOARD

Name	*Affiliation*	*Function*
G. Crone	ESA	Chair
G. Pilbratt	ESA	Co-Chair
C. Scharmberg	ESA	Secretary
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G. Coe	ESA	Member
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O. Bauer	MPE	PACS Representative
F. O'Callahan	NASA	Funding Agency Representative
K. Mercier	CNES	Funding Agency Representative
R. Carvell	PPARC	Funding Agency Representative

The Board was supported by a team of experts from ESTEC and Industry.

4 PROCEEDINGS OF THE REVIEW

4.1 Documentation reviewed

The list of documents reviewed is attached in Annex 8.1. The documents, with the very few exceptions given below, were delivered on time.
The Board's major points together with the detailed comments raised by the review team on the documentation were transmitted by email to SPIRE for consideration, one week prior to the review meeting. All of these items have been addressed during the presentations.

Due to the SPIRE instrument team being in a particularly busy phase, in particular with the STM/CQM programme, not all required documents had been updated in time. Therefore the Board accepted to consider the IHDR presentations as an integral part of the review documentation.
The presentations were given by various members of the SPIRE Team on 9 and 10 July 2003 in RAL U.K.

4.2 Panel Meetings

The Board members, with the exception of M. Linder, T. van der Laan, and F. de Bruin (all excused), attended the presentations at RAL. G. Doubrovik (Alcatel) attended the review as an observer.

The board met at the end of each day of presentations. The observers from Industry were invited to attend the board meetings.

5 BOARD FINDINGS

Progress, Overall Status, and Programmatics

- The Board notes with satisfaction the very good progress made since the IBDR, which became visible from the documentation, presentations and, in particular, the presented recent test results.

- The Boards notes, however, that SPIRE has not demonstrated that all issues raised at IBDR have been closed, or even are in the process of being solved with a clear way forward.

- The Board notes with some concern that the change in model philosophy ‘de facto’ already implemented by SPIRE leads to a higher risk, because the CQM will not be flight representative. However, assessing the pros and cons it finds the change acceptable given the boundary programme constraints and therefore formally endorses SPIRE’s approach. However, the new model philosophy does imply mandatory qualification on subsystem level for elements not implemented inside CQM.

- The Board notes with grave concern that the ASI funding situation on the DPU for both, industrial contracts and IFSI personnel, is not clear. It was stated that each month delay in funding will delay the delivery date by another month. The Board is further concerned that in order to preserve the schedule the DPU FM ATP must be given before the EQM test results are available.

- The Board notes with concern that the baseline DRCU QM and FM schedule as presented by CEA is not compatible with Instrument and industry planning. Alternative solutions have to be worked out between SPIRE, CEA, CNES, ESA, and industry.

- The Board notes with some concern, that several instrument deliveries (i.e. CQM filter) contain no margin, and are very much success oriented. SPIRE shall take measures to ensure compliance with the overall Project schedule.

- The Board notes, that the instrument TMM has not been updated to cover the recent L0 interfaces and FPU foot design changes. In general the iteration process between SPIRE and industry to adjust their TMMs is too slow. The analysis shall include also thermal stability and transient cases.

- The Board notes, that whilst JPL has spent great effort in solving the kevlar suspension problem, this has led to a delay in the overall BDA qualification and test programme which is still not completed at JPL.

- The Board is still concerned about the BDA manufacturing approach. Taking into account that CQM and PFM BDA's are manufactured in series, a failure during CQM testing would not only have an impact on schedule but also result in funding problems, since JPL funding contingency is known to be needed elsewhere.

Top-level requirements documents

- The Board is pleased to note that the overall system design generally is in a mature state. Results of tests at unit level give confidence that the required scientific performance is reachable, however, it is recognised that the spacecraft thermal interfaces are not fully designed and agreed upon (see below).

Instrument Design Description and Development Plan

- The Board notes that the recently modified build standard philosophy of the SPIRE CQM FPU has been introduced in order to meet the schedule of the CQM programme. This implies an increased risk, since the spectrometer part will not be present at all during CQM testing. In addition only one out of three bolometer arrays will be implemented in the FPU CQM photometer part. However, since all three bolometer arrays are similar, the test of only one BDA should ensure a sufficient representation w.r.t. flight configuration.

- The Board notes that the instrument system and subsystem designs are generally mature. The resulting instrument model predicts performance fulfilling the

instrument requirements and probably the performance goals. However, the Board notes with some considerable worry that this conclusion is based on incomplete testing and incomplete telescope background/straylight level knowledge. In particular the whole bolometer signal chain (BDA & electronics) has not yet been tested. The only performance evidence is based on analysis. In addition the performance of the thermal interface will have a major impact on the achievable scientific performance.

- The Board notes with concern that it appears that active temperature stabilisation of the bolometer arrays is deemed necessary. This can only be done by heating, which means additional dissipation and a higher operating temperature. This will mean shorter ^{3}He cooler lifetime and contribute negatively to the sensitivity of the detectors. Furthermore, JPL did not state they were prepared to deliver the necessary hardware. All of this needs further investigation, in particular whether thermal modelling done on which the decision is based is adequate.

- The Board is highly concerned with the late introduction of a new foot design for FPU and detector boxes based on CFRP instead of the previously baselined stainless steel design. It is very unlikely, that these major changes can be implemented in time for the CQM testing, which would be necessary in order to have a flight representative thermal interface during CQM testing. Assessment of the mechanical performance of these items (stiffness and strength) therefore relies on analysis, test at component level and test at PFM level. This has the risk that some undesirable characteristics may only become apparent during PFM testing. In addition, the level 0 strap is also undergoing re-design to improve the thermal conduction. The design is not yet completed and also needs to be both thermally and mechanically qualified.

- The use of Kevlar cable for thermal isolation on BDAs, Sorption Cooler and 300mK Strap still appears problematic. The characteristics of Kevlar have been the subject of continuing studies by JPL, CEA and Cardiff University. This has identified pre-conditioning techniques for mitigating the undesirable aspects, but concerns remain over installation and pre-tensioning the cable as well as long term creep aspects. In addition, JPL has noted fraying of the cable on QM BDA. JPL has identified this damage as resulting from the initial installation, and that by analysis sufficient strength is retained for SPIRE CQM testing. In order to avoid delay incurred by re-stringing the QM it is agreed to continue with damaged cable. However, this carries the risk that a failure during SPIRE CQM testing could not be clearly identifiable as being due to the SPIRE mechanical environment.

IID-B and related documents

- The Board notes with concern, that the cryoharness design is not finalised and agreed. SPIRE's current grounding scheme requires over-shielding of the cryo-harness inside the CVV. SPIRE has not yet provided a consolidated assessment on the EMI impact of not implementing the overshield inside the CVV. However, although it has not justified the CVV internal shielding, SPIRE consider as necessary in order to minimize the risks, known by experiences with similar applications.

- The Board notes with great dissatisfaction, that SPIRE has not yet verified and certified the correctness of the cryoharness pin to pin routing that has been provided by ASED.

- The Board notices with concern, that the increased DPU power budget (depending on software activity) requested by SPIRE, cannot be provided by the spacecraft. More detailed analysis has to be done to assess the real DPU power consumption based on realistic software activities furthermore than on component specifications.

- The Board notes with great concern that a consolidation of all interfaces to the spacecraft has not yet been achieved. It is acknowledged that SPIRE has a clear view to resolve most of these issues. The most important interfaces are considered:

    - 300 mK strap support
    - L0 and L1 thermal interfaces.
    - Cryoharness design.

Industry needs to take the initiative to urgently further complete all pending interface definitions work, to speed up processing/resolution of the pending Change Requests and to reach a documented agreement (via implementation in the interface documents, IID-A and IID-B). However, SPIRE has not yet verified the cryoharness pin to pin design, and in addition the SPIRE L0/L1 thermal strap design should be improved in terms of conductivity by the instrument team as well.

OBS

- The Board notes with concern the overall lack of visibility on the OBSW, as well as the fact there is no evidence of a clear planning for the on board software development. In order to achieve the needed visibility, it is mandatory to generate as a matter of urgency a DPU Software Project Management Plan.

- The Board notes with concern, that the SPIRE Data ICD is in contradiction in several places with the high level applicable PS-ICD.

- The Board notes with concern, that the FDIR document and associated Hardware-Software Interaction Analysis are not taken into account in the Software Specification Document.

- The Board notes with some concern, that the SW non conformance reporting tool is different from the hardware NCR handling tool. In general hardware and software non conformances should be handled in a similar way for better traceability.

- The Board notes with considerable concern that as a result of the problems mentioned above it is impossible to assess the maturity of the software w.r.t. the Project Schedule because there is no firm baseline to evaluate against. It would be conceivable that the onboard software could be the schedule driver without this fact being identified.

AIV Plan

- The board notes, that a draft verification matrix has been prepared to cope with the new instrument model approach. However, the document has to be finalized, clearly showing the verification/acceptance approach broken down to subsystem level.

- The Board notes with great concern, that a flight representative SMEC (i.e. with flex pivots) is not yet qualified, either by analysis or test (analysis for design margins with respect to revised random vibration levels from FPU warm vibration test is currently in progress), nor have the flex pivots themselves been qualified at component level with respect to lifetime requirements. System level qualification will only be confirmed by the PFM test campaign, due to use of STM without flex pivots for the CQM test campaign.

- The Board is pleased to see, that the AVM DPU together with the DRCU simulator and I-EGSE is performing nominal at the RAL ILT facility.

- The Board is concerned that the CQM will not be fully flight representative due to the change in model philosophy which leads to a higher risk for the programme. In order to mitigate the risk a detailed plan for the delta-qualification of all subsystems that need to be qualified at unit level has to be prepared and carefully assessed.

GSE

- The Board is pleased to note that the overall instrument level GSE is available and operational at RAL.

- The Board notes with satisfaction that the smooth transition concept from ILT procedures to system level test procedures and Observatory is in the process of being successfully implemented.

- The Board notes with satisfaction, that the test cryostat facility at RAL is operational. Initial tests confirmed the needed performance for ILT purpose.

PA

- The Board notes with concern that the Configuration Control is not yet adequate and the CIDL is not complete nor up to date so it was not possible to determine the Configuration Baseline at the review.

- The Board notes with concern, that the product assurance documentation has not yet reached the level that it should have in this phase of the programme, nor was it possible to fully assess the compliance of the PA programme with respect to the requirements at this point.

- The Board notes with concern that although the design is generally mature and close to finalisation the Derating Analysis was not performed on all EEE parts for all SPIRE subsystems, nor was the Worst Case analysis completed for all interfaces to the Spacecraft, hence there is not full evidence that the design is reliable.

- The Board also notes with concern that although the design is generally mature and most materials and processes are known the Declared Materials Lists and the Declared Processes Lists are far from being complete and are missing from several sub-systems.

- The Board also notes with equally concern that the Declared Components Lists are not as mature as would generally be expected at this stage especially with respect to self-procured components and PAD status and little information has been provided concerning the qualification status of self-procured components.

- The Board notes that the FMECA has not yet been updated. In addition, there is not yet an overall FDIR approach in place, although bottom up work has been initiated in several areas.

- The Board notes with great concern that the product assurance documentation has not yet reached the level that it should have in this phase of the programme.

6 BOARD RECOMMENDATIONS

1. Provide all means to close out open interface issues, and to freeze the interfaces with the spacecraft urgently.

2. Ensure schedule stability and close monitoring of subsystem activities to retain, and possibly advance, delivery dates. In particular, qualification and acceptance sequences need to be optimised while still ensuring full characterisation. As much as possible overall logistics/transportation shall be optimised.

3. It is recommended that instrumentation, that has been implemented for the SPIRE FPU warm vibration test to measure the SMEC mechanical environment should be also included for the CQM cold vibration testing at CSL.

4. Assess impact of microvibrations and microphonics on SMEC, BSM and BDA, which was already highlighted in the IBDR Board Report.

5. Investigate the implementation of the CRFP mounting brackets into the CQM test programme, in order to get early measured results on stiffness and strength.

6. Define and plan OBSW (DPU) performance tests in order to supplement the functional tests currently carried out.

7. Ensure proper documentation of OBSW for DPU. In particular the Software Specification Document (SSD) and SPIRE Data ICD shall be updated in order to be brought in line with the latest version of the PS-ICD. The Acceptance Test Plan (and corresponding Test Reports) shall be updated in order to reflect the actual status of DPU OBSW Validation and testing. In addition a Software Project Management Plan has to be issued urgently.

8. Implement as quickly as possible the DPU Virtual Machines (VMs), the associated language and compiler and a minimum set of VM code in order to validate the overall VM approach.

9. To ensure a coherent system approach, an agreed set of documents and a documentation tree shall be established between SPIRE system and subsystems and with ESA and Industry in the timeframe of the spacecraft CDR.

10. Urgently assess the Configuration Management systems at system and sub-systems in order to achieve adequate control over the design configuration and establish the design baseline.

11. Ensure and closely monitor appropriate PA approach at subsystem level and close communications between system and subsystem PA. Investigate ways of optimising/(re)distributing the PA work between system and subsystems.

12. Ensure that a Derating and Worst Case Analysis has been properly conducted prior to manufacturing in order to ensure adequate reliability of the instrument.

13. Ensure that the Declared Materials Lists and the Declared Processes Lists are established updated and finalised so they can be properly assessed and accepted.

14. Ensure that the Declared Components Lists is finalised and the PADs of all self-procured components are submitted for review and acceptance.

15. Review of the NCR management processes internally within the consortium to ensure that SW NCRs are properly handled and reported through the appropriate channels in the same way and format as HW NCRs.

7 BOARD CONCLUSIONS

The Board congratulates SPIRE team for their efforts to arrive at the design maturity demonstrated in their documentation and during the presentations.

Instrument Design and Internal Interfaces
The Board considers the instrument design and internal interfaces as consolidated and under basic configuration control for the FPU.
The status of the Warm Boxes is less satisfactory (in particular DRCU and DPU OBSW documentation). EMC (CVV overshielding) and grounding scheme need to be finalized urgently.

External Interfaces
The Board does not consider the interfaces to the spacecraft fully consolidated, however, it sees these issues properly identified and expects industry to take the lead and to close out the pending issues with no delay.

AIV and GSE
The model philosophy and verification approach need to be consolidated.
Manufacturing flow charts need to be issued.

Schedule

The Schedule remains highly critical and SPIRE needs to establish means to ensure close monitoring and follow-up with subsystems.

PA and Configuration Management
Although the PA and Configuration Management is not yet at the level that would be required at this stage of the project the board notes with satisfaction that considerable improvement has been made since the previous review. The board is thus confident that although much still has to be done, these related actions can be successfully handled and solved outside of the frame of a delta-review.

Summary
While the Board considers that formally not all objectives of the IHDR have been fully met, it sees no need for a delta review. However, the Board expects the issues raised in the recommendations in this report, as well as in the RIDs transmitted to SPIRE, and the detailed comments, to be addressed and resolved in the timeframe given in the recommendations, and where no particular timeframe is given, well in advance of the spacecraft CDR.

8 ANNEX

8.1 Documentation reviewed:

Document	Reference	Issue	Date
Top-level requirements documents			
Scientific Requirements Document	SPIRE-UCF-PRJ-000064	3.0	21/11/2000
Instrument Requirements Document	SPIRE-RAL-PRJ-000034	1.2	30/05/2003
Calibration Requirements Document	SPIRE-RAL-PRJ-001064	DRAFT	03/01/2002
Instrument Design Description and Development Plan			
SPIRE Design Description Document	SPIRE-RAL-PRJ-000620	2.0	15/05/2003
SPIRE Sensitivity Models	SPIRE-QMW-NOT-000642	3.0	06/06/2003
Instrument Development Plan	SPIRE-RAL-PRJ-000035	1.1(Draft)	12/04/2001
Major Milestone List	SPIRE-RAL-PRJ-000455	1.4	02/06/2003
SPIRE Instrument Schedule			05/06/2003
SPIRE Instrument AIV Plan	SPIRE-RAL-PRJ-00410	3(Draft)	May-03
SPIRE CQM Instrument Level EMC Test Specification	SPIRE-RAL-NOT-001681	DRAFT	05/06/03
SPIRE Block Diagram	SPIRE-RAL-DWG-0646	5.3	05/05/03
SPIRE Instrument Level Microphonic Susceptibility Testing	SPIRE-RAL-NOT-1672	1.0	02/06/03
IID-B and related documents			
H/P Instrument Interface Document Part A	SCI-PT-IIDA-04624	3.0	01/07/02
H/P Instrument Interface Document Part B	SCI-PT-IIDB/SPIRE-02124	2.3(Draft-1)	22/11/02
Cryogenic Interface Thermal Mathematical Model	SPIRE-RAL-PRJ-000728	2.1	20/01/03
FPU Mechanical Model [*1]	SPIRE-MSS-PRJ-001141	?	?
Harness Definition Document	SPIRE-RAL-PRJ-000608	1.1	05/03/03
SPIRE Stray light model reference document	SPIRE-RAL-NOT-001124	1	31/01/02
SPIRE Instrument Budgets	SPIRE-RAL-PRJ-000450	4.0	01/06/2003
OBS			
On Board Software User Requirements Document	SPIRE-IFS-PRJ-000444	1.2	15/05/2003
OBS Software Specification Document [*1]	SPIRE-IFS-PRJ-001036	?	?
Operating Modes for the SPIRE Instrument	SPIRE-RAL-PRJ-000320	3.0	04/01/2002
Operating the SPIRE Instrument	SPIRE-RAL-DOC-000768	0.5(Draft)	31/05/2003
SPIRE Data ICD	SPIRE-RAL-PRJ-001078	1.0(Draft2)	15/01/2003

Document	Reference	Issue	Date
AIV Plan			
Warm Electronics Integration Plan	SPIRE-RAL-DOC-001132	0.1	10/01/2002
SPIRE Structure Assembly, Integration and Handling Plan	SPIRE-MSS-PRJ-001650	2.0(Draft)	Mar-03
SPIRE Optical Alignment Verification Plan	SPIRE-LAM-PRJ-000445	3	10/04/2001
SPIRE Alignment Sequence	SPIRE-LAM-PRJ-000637	4	27/09/2002
SPIRE STM Instrument Level Test Plan	SPIRE-RAL-DOC-001048	1.0	15/05/2002
SPIRE CQM Performance Test Specification	SPIRE-RAL-DOC-001123	0.4(Draft	29/05/2002
SPIRE CQM Instrument Level Test Plan	SPIRE-RAL-DOC-001049	1.0	15/05/2003
SPIRE Cryostat Integration and Test Plan	SPIRE-RAL-DOC-001701	1.1	06/06/2003
GSE			
GSE Overview	SPIRE-RAL-DOC-001133	0.1	03/02/2002
PA			
SPIRE Product Assurance Plan	SPIRE-RAL-PRJ-000017	1.1	14/05/2003
SPIRE/HERSCHEL System Interface FMECA	SPIRE-RAL-PRJ-001260	1.0	01/11/2002
SPIRE Pixel Map Spreadsheet Description	SPIRE-RAL-NOT-001540	0.1(Draft)	06/03/2003
SPIRE Pixel Maps	SPIRE-RAL-NOT-001541	0.1(Draft)	06/03/2003
SPIRE Configuration Management Plan	SPIRE-RAL-PRJ-000626	1.3	28/01/2002
SPIRE Cleanliness Plan	SPIRE-RAL-PRJ-001070	1.0	09/01/2002
Configured Items Data List	SPIRE-RAL-PRJ-001134	1.2	15/05/2003
SPIRE Critical Items List	SPIRE-UCF-PRJ-001138	2.0	06/06/2002
SPIRE Safety Submission	SPIRE-RAL-DOC-001293	3	15/05/2003
Worst Case Analysis - DPU Analysis is to be found in the DPU subsystem folder			
Part Stress Analysis and Derating Analysis - DPU Analysis is to be found in the DPU subsystem folder			
FDIR Philosophy [*1]	SPIRE-RAL-PRJ-001128	?	?
Combined DMPL	SPIRE-RAL-PRJ-001094	2.0	15/03/2003
Combined DML	SPIRE-RAL-PRJ-001092	2.0	15/03/2003
Combined DPL	SPIRE-RAL-PRJ-001093	2.0	15/03/2003
Combined EEE Parts	SPIRE-RAL-PRJ-001095	2.0	15/03/2003
PAD Status Report	SPIRE-RAL-PRJ-001670	2.0	15/03/2003
Engineering Change Requests - Status Report	SPIRE-RAL-PRJ-1080	2.0	15/03/2003

Document	Reference	Issue	Date
Non-Conformance Report - Status Report	SPIRE-RAL-PRJ-0001079	2.0	15/03/2003
Request for Waiver - Status Report	SPIRE-RAL-PRJ-001081	2.0	15/03/2003
SPIRE Configurable Documents Tree	SPIRE-RAL-PRJ-000033	3.5	21/08/2001
Draft Procedure for moving SPIRE	SPIRE-RAL-NOT-001651	1.0(Draft)	12/05/2003
Procedures EGSE	various files		
Procedures JPL	various files		
Procedures QLA	various files		
SPIRE Cold Optical Alignment Procedure	SPIRE-RAL-DOC-001578	0.2	09/05/2003
SPIRE Cryostat Operating Procedures	SPIRE-RAL-DOC-001558	0.3	03/04/2003
SPIRE Functional Test Specifications	SPIRE-RAL-DOC-001652	0.3(Draft1)	02/06/2003
HW/SW interaction analysis	SPIRE-RAL-NOT-001719	1.0	25/06/2003

8.2 Comments to Documentation

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
Subject	**Reference/ DOC**	**Paragraph**	**Comment**	Recommended Solution	**Priority**	**Org.**
General Comments						
SMEC			Documents concerning SMEC inside DP are almost 2 years old (SMEC MCU DDR).	Development Status update needed.		CS
Test results from development units, BB's	Several (general comment)	Several	General comment: the documentation should give more emphasis to recent test reports as performed on BB's and development units	Provide dedicated test summaries on key SS or test units (e.g. mirror mechanisms, cooler, BDA's, etc.)	Medium	NR
SPIRE thermal interface	SPIRE-RAL-NOT-001579	NA	Status of SPIRE thermal I/F not clearly defined. This is critical to sorption cooler (and thus to the instrument) performance.	Provide clear statement on latest situation. See link with thermal budget and load on 0.3K stage	HIGH	NR
Kevlar suspension	RAL-MOM-001653	NA	A complete characterization (actual operating T and load) of the behavior of the Kevlar suspension is still missing	Perform representative tests at 2-4 K (cold vibration) in order to provide a full picture	HIGH	NR

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
				(see link to very many SS)		
Top-level requirem. Document						
Radiative environment	SPIRE instrument requirement document SPIRE RAL-PRJ-000034	1.4. reference	AD1 should be IID-A 3.0 at least (July 2002). RD1 is out of date. Best radiative environment is described in GDIR (RD1 of IIDA)	Update references	low	ASP-BC
	SPIRE RAL-PRJ-000034	2.2.3 Operating mode 2.3.3 Commanding Requirements	IRD-MODE-R01 refers to RD8 (SPIRE budget SPIRE-RAL-PRJ-000450) instead of SPIRE operating modes SPIRE-RAL-PRJ-000320 Same for IRD-CMD-R08	Add operating modes in ref document list & correct	low	ASP-BC
Cold units subsystem requirements	" SPIRE RAL-PRJ-000034	Section 2 & 3	The following requirements refer to RD8 (instrument budgets) which is a living document (status) and can hardly be considered as a requirement IRD-SUBS-R03 IRD-STRC-R05 IRD-STRC-R14, IRD-STRP-R09 IRD-STRS-R08 IRD-COOL-R12 IRD-COOL-R13 IRD-DETP-R13		High	ASP-BC

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			IRD-DETS-R14 IRD-BSMP-R12 IRD-SMEC-R11 IRD-CALP-R12 IRD-FTB-R05 IRD-WE-R33 IRD-WE-R34 IRD-WE-R35			
Verification	SPIRE RAL-PRJ-000034	2.6	This paragraph should be updated wrt new model philosophy, rather than to refer to a RFW.	Update		ASP-BC
safety	SPIRE RAL-PRJ-000034	2.7	Safety requirements related to the sorption cooler (pressure vessel) are missing.			ASP-BC
JFET	SPIRE RAL-PRJ-000034	3.5.10	JFET boxes requirement should reflect the update of the design (level 3)			ASP-BC
Requirements	SPIRE instrument requirement document SPIRE RAL-PRJ-000034	3.5.6.2	Requirements for DQE and Spectral response at >400um are 'as large as possible'. A requirement really should have a value.	Give a minimum target values		SL
PSF	Calibration RequirementDocument SPIRE-RAL-PRJ-1064	2.1 SRD-R5	As stated in document, the accuracy of the point spread function needs a value			SL
Detector co-alignment	Calibration RequirementDocument SPIRE-RAL-PRJ-1064	SRD-15	Will the detector array co-alignment be checked in space?			SL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
Linearity	Calibration RequirementDocument SPIRE-RAL-PRJ-1064	SRD-18	As document states, need to decide if the linear requirement for the spectrometer is the same as photometer.			SL
Response	Calibration RequirementDocument SPIRE-RAL-PRJ-1064	2.2 CRD-SR1	Requirement value of relative response across an individual array shall be known within TBC% with respect to any given pixel on array	TBC needs to be changed to a value.		SL
Requirements	Calibration RequirementDocument SPIRE-RAL-PRJ-1064	CRD-SR2 and 3	These requirements contain further TBCs	TBCs need to be changed into values.		SL
Straylight	Calibration RequirementDocument SPIRE-RAL-PRJ-1064	CRD-SR5	Straylight requirement. The indicator as to whether this needs instrument level calibration has been omitted.			SL
Instrument Design Description & Development Plan						
general	SPIRE design description SPIRE RAL-PRJ-000620	general	Remove references to shutter			ASP-BC
T stability FPU	SPIRE RAL-PRJ-000620	3.6.3 temp stability	Temperature stability for levels 0, 1, & telescope given in this section are not expressed in IID-B			ASP-BC
Instrument level	SPIRE design description	Chapter 2	The up-dated instrument budgets	Provide an up-date (to	High	NR

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
budgets	RAL-PRJ-000620		(mass, power, thermal load) should be included in the doc. package	be later pasted into IID-B)		
Gas gap switch	SPIRE design description RAL-PRJ-000620	4.11.4	Actual qualification and testing / performance status of the thermal switch is not specified. See also lack of test reports.	Provide information on the progress achieved on the thermal switch, including representative test results.	Medium	NR
BSM/SMEC mechanisms	SPIRE design description RAL-PRJ-000620	4.8 / 4.9	No information is available on the testing of development units and the qualification of the different model. This is a concerning area given the critical role of such mechanisms.	Provide information on available test results and planned vibration tests, including modeling / mechanical analysis.	high	NR
Spectrometer	**Design Description Document SPIRE-RAL-PRJ-000620**	2	Talks about the two FTS modes and then says 'in this mode, signal modulation will be provided by the BSM'.	Change wording so that it is clear that for the step and integrate movement of the SMEC the signal modulation is via the BSM.	low	SL
BMS	**Design Description Document SPIRE-RAL-PRJ-000620**	2.3.1.1	BSM can operate with efficiency of 90%	What type of efficiency? Power? Observation Time?	low	SL
	Design Description Document SPIRE-RAL-	2.3.2.1	Typo error. SCAL not PCAL is at the 2nd input port of the spectrometer.		lowest	SL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
	PRJ-000620					
Shutter	**Design Description Document SPIRE-RAL-PRJ-000620**	Tables 3-1,3-2, Figure 4-1	Needs to be updated to reflect removal of shutter from SPIRE		low	SL
Spectrometer	**Design Description Document SPIRE-RAL-PRJ-000620**	3.4.2 and Figure 3-12	Update text and figure to reflect use of roof-top option rather than corner-cube		low	SL
Budget	**Design Description Document SPIRE-RAL-PRJ-000620**	3.10 table 3.4	Budget allocation averages – for when SPIRE is prime or average of prime and non-prime time?		low	SL
	Design Description Document SPIRE-RAL-PRJ-000620	4.4	Two sentences are incomplete		low	SL
PCAL	**Design Description Document SPIRE-RAL-PRJ-000620**	4.7.1	There does not seem to be a requirement on S/N ratio on PCAL observations.	What is the requirement?		SL
SMECm	**Design Description Document SPIRE-RAL-PRJ-000620**	4.9.3	What is the redundancy for the SMECm launch latch?			SL
	Design Description Document SPIRE-RAL-PRJ-000620	5.4.4	Typo, the number of observing mode for fully-sampled spectral map with step and integrate is SOF4 (not 2)		lowest	SL
BSM	**Design Description Document SPIRE-RAL-PRJ-000620**	5.3.1	BSM chop throw can be set to any value within the range	Will the BSM be tested for various chop throws?		SL
	SPIRE Sensitivity	4.1	Bolometer DQE for photometer given	The requirement is		SL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
	Models		by the models are in the range 0.3-0.5	>0.6 at 2Hz. Therefore the model DQE is not within requirement. May compromise science goals		
Schedule	**Schedule**		Late delivery of bothe STQ/CQM and PFM	The schedule shall be optimized to respect the nominal delivery dates		ESA/OP
EMC Test at EPLM level	**Instrument level EMC Test Spec**		Because no representative power supply is used, no conducted EMC test is performed. This can have impacts on other instruments conducted EMC test as well.	To review the build STD of the HSFCU		ESA/OP
	SPIRE Instrument Level Microphonic Susceptibility Testing SPIRE-RAL-NOT-001672	Background	Concern over the susceptibility levels of detectors.	Will SPIRE be characterised at the biases that do not suffer any vibrations? Once the actual vibration levels are known will there be further testing of SPIRE at favoured biases?		SL
microphonics		3.7 microphonics	Susceptibility of SPIRE to microphonics is vague and should be	When the data will be available. (FPU test)?		ASP-BC

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			estimated.			
		3.10 Budgets	FPU budgets allocation are not compliant with IID-A (Should be made using average operating/non operating)			ASP-BC
Instrument Development Plan	SPIRE-RAL-PRJ-000035	All	Document is still a "draft" dated April 2001, and had been released for the IIDR. Document does not reflect the current planning (i.e.): - shutter still included - DRCU Power bench not mentioned. - CQM still contain 5 Bolometer Arrays. - …	**Document need to be updated, after decision on new SPIRE model philosophy.**	High	CS
Test Flow	**AIV Plan**		A detailed activity flow should be provided	As requested		ESA/OP
CQM Objectives	**AIV Plan**	2.2 deliverables (CQM)	Because the CQM will be integrated with the EQM (ISO), it shall be compatible with it and compatible with the defined test objectives.	Update paragraph		ESA/OP
HSFCU CQM Build standard	**AIV Plan**	3.2 Model Build Standard	The HSFCU CQM (AVM) is not form, fit and function so contradicting the IID-A	Conform the build standard to the IID-A		ESA/OP
Delivery for AVM	**AIV Plan**	5.2.2 on page 25 (AVM …)	The DRCU should be part of delivery for AVM together with FPU and	Update delivery for AVM		ESA/OP

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			JFET simulator.			
Data Base	**AIV Plan**		The approach for data base population shall be clarified	As requested		ESA/OP
Test sequences	**AIV Plan**		The approach for the development of the test sequence shall be clarified	As requested		ESA/OP
Instrument level field-to-wire simulation	**SPIRE-RAL-NOT-001681**	3	Tricky to correlate voltage between external and internal shields with RS field value.	Bulk Current Injection should be considered instead, with e.g. 2mArms.	Major	ASP
IID-B & related documents						
Thermal	**SPIRE Instrument ITMM**		No information on the achieved cryogenic performance on the sub-systems is available. To which extend the conductivity and dissipations are based on measurements or requirements? What are the predictions from the detailed model	Update document	Medium	ML
Thermal	**SPIRE ITMM** **Design Description** **IID-B**		Thermal design is not consistent in these documents, e.g Design description is not mentioning Level3 IID-B is referring to two L1-straps, model only include one strap The heat load budget in the design	Update documents	low	ML

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			description (10mW at Level 0…) is the overall Instrument budget and not the SPIRE budget			
Thermal	**He3 sorption cooler and 300mK stage**		The He3-sorption cooler and the 300mK stage are one of the critical elements, but no detail information's are provided. How does the performance of the PACS cooler affect the SPIRE design, performance of the SPIRE cooler and relation to ECR 8-9? 300mK design (Kevlar)?	Provide information	high	ML
FPU Mechanical Model	SPIRE-MSS-PRJ-001141	All	Document not yet delivered !	**SPIRE to provide document**	High	CS
SPIRE Instrument Budget	SPIRE-RAL-PRJ-000450	4. Thermal Budget	Missing completely	**Update document after finding agreement on ECR 8 & 9.**	High	CS
OBS						
Application of Software Development standards	**General**		According of the IIDA (section 2.1, SCI-PT-IIDA-04624), the ECSS software development standard ECSS-E-40B is applicable to the development of the instrument on-board software	Establish which software standard shall be adhered to. Optionally and with justification, tailor the standard to the needs	Major	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			The software documentation that is presented in the HIDR data package does comply with the requirements that ECSS-40B puts on flight software. The fact that the IIDA also makes applicable the 'Guide to applying the ESA software engineering standards to small software projects' might have caused some confusion. This guide applies to PSS05 and not ECCS-40B. Regardless of which standard is being followed (ECSS-E-40B or PSS-05), a major shorting coming is the fact that the software development plans appears to be missing. In particular the Software Project Management Plan, Software Validation Verification Plan, and the Software Configuration Management Plan (although for the latter there appears to be some reference to software configuration management)	of the project software development. Issue the missing plans and documents.		

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			in the overall PA. Even the overall Instrument Development Plan (SPIRE-RAL-PRJ-000035) does not have any software development specifics. The SPIRE Configuration Management Plan (SPIRE-RAL-PRJ-0000626) spends some words on software. In fact, for the on-board software it refers to a specific document IFSI/OBS/PL/2000-001, which is not part of the IHDR data package. Its status is therefore unclear to me. This situation is unsatisfactory. It places serious doubt on the quality of the development process. It also makes it impossible to judge the maturity of the software with respect to the project schedule			

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			because there is no baseline to evaluate against.			
Software design based on virtual machines	**General**		It turns out that a lot of the software functions (see SSD sections on Autonomy Function Requirements, Functional Requirements, and Operating Modes Requirements) are implemented via a virtual machine/interpreter. The justification for this approach is given in the note 'SPIRE-DPU Virtual Machine' (CNR-IFSI.2003.TR01). In section 2 on page it is stated that '*the driving requirement for the VM is the time sequence constraint between SS commands during an observation.*" There are various problems with this. First, it is not obvious what exactly is this 'time sequence constraint': there is no reference or further substantiation. Is the ± 5 microseconds accuracy really	Re-assess the timing accuracy of the SS command to verify that ± 5 micro seconds is really necessary. Establish a rigid validation program for the VM itself, its supporing tools, and the applications that will be written in VM code.	Major	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			required? If it, is the proposed breakdown that pushes this requirement onto the software the most optimum? Have you considered alternatives? Second, it is questionable whether the virtual machine implementation is the best (software) way to achieve this accuracy. The introduction of a virtual machine has enormous consequences for the development and validation efforts. In addition to developing/testing/validating the virtual machine, one has to develop/validate the compiler. On top of that, the application software that runs on the VM needs to be developed, tested, and validated. The VM coder needs to ensure that his code confirms to all kinds of real-time restrictions, like the number of non-critical commands shall not drive			

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			the time of the ISR3 routine above the timer interval time, there shall be no conflicts in handling the mutex between the Hard_VM and the Soft_VM, etc.. Because of the newly designed assembler language there won't be any tool support available in the market. In summary, I am very much concerned that the VM design brings more problems than it will solve			
Status of SPIRE specific software	**General**		The information (requirements, design) presented in the HIDR does not cover the SPIRE specific control, mode, and autonomy functions. It is stated that these functions will be implemented in VM code. It is not clear how the specification, development, and validation of this software will be kept under control. In the current HIDR data package	Augment the software development plan (that still needs to be written) with the SPIRE "ASW" development process.	Major	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			there is no further information about it.			
Reduced science data rate	**SPIRE-IFS-PRJ-000444/ OBS URD**	OBS-UR-TM7	The requirement states that the OBS shall be able to reduce the data rate to 20kbps. To which high-level requirement is this traced? How is the instrument configured into this degraded mode (I could not find a command in the Data ICD to support this).	Please clarify	Minor	FDB
Immediate versus normal command	**SPIRE-IFS-PRJ-000444/ OBS URD**	OBS-UR-TC6	This requirement makes a differenct between normal and immediate commands. It is not obvious how this difference is indicated in the TC structure. The named example command 'ABORT MEASUREMENT' cannot be found in the SPIRE Data ICD.	Please clarify	Minor	FDB
DPU not booting	**SPIRE-IFS-PRJ-000444/ OBS URD**	OBS-UR-ON4	This requirement states that the CDMS shall assume that SPIRE did not correctly boot if no event report has been received within 10 seconds. It is not obvious what the CDMS shall do after asserting this case. I could not trace this event in the SPIRE Data ICD.	Please clarify	Minor	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
Packing of event packets	**SPIRE-IFS-PRJ-000444/ OBS URD**	OBS-UR-TC17	This requirement about packing events is not understood. The requirement is not covered by the SSD.	Please clarify	Minor	FDB
No checking of TC sequence counter	**SPIRE-IFS-PRJ-000444/ OBS URD**	OBS-UR-TC21	This requirement states the OBS shall check the TC sequence counter. This is a violation of PS-ICD section 3.1.1.2.2 that states that the OBS is not to check this counter. In any case, the event that is referred to in this requirement cannot be found in the SPIRE Data ICD.			FDB
Immediate versus normal command	**SPIRE-IFS-PRJ-000444/ OBS URD**	OBS-UR-TC6	This requirement makes a differenct between normal and immediate commands. It is not obvious how this difference is indicated in the TC structure. The named example command 'ABORT MEASUREMENT' cannot be found in the SPIRE Data ICD.	Please clarify	Minor	FDB
Uncovered user requirements	**SPIRE-IFS-PRJ-001036/ OBS SSD**		A number of URD requirements are marked as 'not covered' in the traceability matrix A lot of the requirements have been deferred with a reference to the VM	Complete the traceability	Major	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			code still to be written.			
Coverage of PSICD requirements	**SPIRE-IFS-PRJ-001036/ OBS SSD**		It is not obvious that all the PS-ICD requirement, in particular those of Appendix 9, have been taken into account	Please provide a traceability matrix.		FDB
FDB Interface with naming convention	Operating the SPIRE Instrument	All paragraphs describing TM / TC objects	How is done the link with the naming convention	Add the naming convention identifier or provide the way the link is done.	Low	ASP-FC
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768 And Operating Modes for the SPIRE Instrument SPIRE-**RAL-DOC-000320**	Figure 3 Figure 3-1	Arrow between ON START and DPU OFF probably should go between ON and DPU OFF as ON START is a command and not a mode			SL
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	5.1	Says assume BSM not switched off for PCAL operation. However, page 98 of Design Document (and page 45 of Operating Modes for the SPIRE Instrument) says that it is a	Clarify.		SL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			requirement of PCAL that the BSM is switched off (fixed at rest position) and telescope pointing is fixed.			
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	5.2	Is possible that when jiggling the BSM return to central jiggle position after each of the other six jiggle positions.	Presumably data would be taken at the central pixel? Will increase the amount of signal data but at expense of observing time. Which is more important for a typical SPIRE point source?		SL
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	5.4	BSM chop in Y direction. This may not be perpendicular to lines in raster map.	Can the raster lines ever be parallel to Y? How useful would the data be		SL
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	5.5,5.6,5.8	There is no NPOINT command listed for POFs 5,6(7),8	Is this command included in TRASTER or TSCAN command? POF8 may want to be performed when pointing at a certain (or known) position	low	SL
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	5.4	Should SPIRE be keeping track of raster point number or the S/C?			SL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	5.5,5.6	Scanning across sky before start taking data	Make sure start taking data in time to get the data from the area requested by the users.		SL
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	5.6	No PSCAN command			SL
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	5.7	POF7 – to be written			SL
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	5.8	Will POF8 (PCAL) be used within other POFs to perform PCAL operations?	POF8 is much more detailed than the PCAL command in other POFs		SL
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	6.2	No mention of SMEC being on			SL
	Operating the SPIRE Instrument SPIRE-RAL-DOC-000768	6.3,6.4	Should there be a DPU:WAIT command.			SL
	Operating Modes for the SPIRE Instrument SPIRE-	Table 5-1	Table mentions POF9 for special engineering commissioning modes (TBD). There is no mention of this option in the document Operating the SPIRE Instrument.		lowest	SL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
	SPIRE- **RAL-DOC-000320 and Operating the SPIRE Instrument SPIRE-RAL-DOC-000768**					
Modes	Operating modes for the SPIRE instrument	3.2	ON mode	Should be chapter 3.3	lowest	ASP-FC
Modes and telemetry rate	Operating modes for the SPIRE instrument	table 4-3	Why the OBSV mode is not in the table ?	Justify or add it	high	ASP-FC
Modes and total telemetry rate	Operating modes for the SPIRE instrument	Table 4-3	There should be a total line per operating mode (could be dependent of serendipity and parallel TM configuration)	Add a "total" line to figure out the full telemetry rate	low	ASP-FC
	Operating Modes for the SPIRE Instrument SPIRE- **RAL-DOC-000320**	5.1.1	Points 7 and 8 are identical		lowest	SL
	Operating Modes for the SPIRE Instrument	5.1.5	Point 4. The scan direction must be in spacecraft directions.	Be more specific – along S/C coords or defined in S/C		SL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
	the SPIRE Instrument SPIRE- **RAL-DOC-000320**			coordinates?		
	Operating Modes for the SPIRE Instrument SPIRE- **RAL-DOC-000320**	5.1.7	Typo error. Point 1 says POF6, should be POF7.		lowest	SL
	Operating Modes for the SPIRE Instrument SPIRE- **RAL-DOC-000320**	5.2.2	Mis-numbering of points – number 4 is missing. Or should there be a point 4 with some information?		lowest	SL
	Operating Modes for the SPIRE Instrument SPIRE-	5.2.4	SOF4: Steps 1-6 of SOF1 apply… however, one of these is that the BSM isn't used. Whereas step 7 of SOF4 says that the BSM is used. Also point 5 is that SMEC is scanned.	Conclusion is that the description for SOF4 should read 1-6: As for SOF3 or even SOF2. Points 7 and 8 are identical to points 5	low	SL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
	SPIRE- **RAL-DOC-000320**			and 6 of SOF2.		
	Operating Modes for the SPIRE Instrument SPIRE- **RAL-DOC-000320**	6.1	Automatic cooler recycling. What happens to the schedule while this happens? What will make sure that cooler does not need to be recycled during long observation?			SL
	Operating Modes for the SPIRE Instrument SPIRE- **RAL-DOC-000320**	6.2	Slow chop mode. How slow would still be acceptable. This would make jiggle observations take a long time.			SL
	Operating Modes for the SPIRE Instrument SPIRE- **RAL-DOC-000320**	6.7	Typo. Line 3 should read either the photometer or the spectrometer		lowest	SL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
Interface with naming convention	SPIRE data ICD	All paragraphs describing TM / TC objects	How is done the link with the naming convention	Add the naming convention identifier or provide the way the link is done.	Low	ASP-FC
Ground / Board I/F	SPIRE data ICD	All TM and TC (type, sub-type) referring to Parameter-ID	In case the following (type, subtype) : (12,2), (12,2), (12,5), (12,6), (12,9) are used, the allocation of parameter_ID shall be done according to project rules (it should be unique over Herschel due to SCOS limitation)	The next issue 2.0 of "naming convention" will provide the range allocation per users.	Low	ASP-FC
TC[3,1] layout non-compliant with PS-ICD	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.3.1	Definition of TC[3,1] command structure not compliant with PS-ICD. Note that the underlying reason for this deviation has been removed from the PS-ICD: the TC[3,1] can now be used for the definition of long TM packets.	Bring TC[3,1] inline with PS-ICD requirements.	Major	FDB
Checksum field in TCs	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.3.1 (and others)	The command structure in 3.2.3.1 (and subsequent paragraphs) contains a field 'checksum'. It is assumed that this is the 'Error Control' field belonging to the Data Field as defined paragraph 3.1.2.3 of the PSICD. This field is already included in	Confirm that only once checksum field is included. Remove the field 'checksum' from the detailed TC structure definitions.	Major	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			paragraph 2.1.3 of the SPIRE ICD. This is confusing.			
TM[3,10] layout non-compliant with PS-ICD	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.3.5	The text suggest that the TM[3,10] layout deviates from the PS-ICD defined structure. This might lead to problems at the MOC. The TM[3,10] is not explicitly included in the SPIRE ICD	Include a TM[3,10] layout defining the ICD that is compliant with the PS-ICD	Major	FDB
Use of TC[8,1]/TC[8,2]	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.8.1/ 3.2.8.2	The paragraph on 'Start Function' only lists functions that cannot be started. Are there any functions that can be started? Idem for 'Stop Function' What happens if a Start/Stop command is sent for a function that cannot be started/stopped. (there is no corresponding TM[1,2])	Include list of functions that can be started (stopped) or make explicit statement that there are no such functions.	Minor	FDB
TM(21,4) in response to the TC(8,4,0x01,0x02)	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.8.3.1	The textual description of TC(8,4,0x01,0x02) states that a table dumps are made using TM(21,4). This seems to be in conflict with the definition of TM(21,4) in section 4.2.21.4 "Auxiliary Science Data Report"	Please clarify	Major	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
Burst mode implementation	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.8.3.20	The ICD contains a function to switch SPIRE into burst mode but there is no requirement or specification in either URD or SDD to cover this.	Please clarify burst mode	Minor	FDB
Reaction to TC[9,7]/TC[17,1]	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.9.1/ 3.2.17.1	The text reads that the instrument should issue a Time Verification Report TM[9,9] on reception of a TC[9,7] Idem for TC[17,1]	Please replace 'should' with 'shall	Minor	FDB
Untitled Sections	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.10 3.2.13	These sections are said to be 'Not Available' but it is not clear what they are about. In fact, they same to be place holder to keep the number of the paragraphs in line with the number of the services	Please add a dummy header and a short explanation why these paragraphs are in.	Minor	FDB
On-Board Monitoring still TBW	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.12	The section on On-Board Monitoring is still TBW.	Fill in the details on this section. Note that the layout of the service 12 TM/TC are already defined in the PS-ICD	Major	FDB
Usage of service 20	**Spire-RAL-PRJ-001070/ Spire Data ICD**	3.2.20	To my understanding the service 20 has been descoped and will not be	Confirm that service 20 is not used in	Major	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			used in Herschel/Planck. Indeed, I cannot find any clear reference to this service in the OBS user requirements and the software specification documents. Also, there is no explanation on the use of the service in the ICD.	SPIRE and remove the commands from the ICD.		
Use of TM[5,4]	**Spire-RAL-PRJ-001070/ Spire Data ICD**	4.1	According to the table event report TM[5,4] is not used. However, section 4.2.5.3 introduces the TM[5,4,0x0540)	Update table	Minor	FDB
Peak report layout undefined	**Spire-RAL-PRJ-001070/ Spire Data ICD**	4.2.5.1.2	The parameter layout for the peak up report (event TM(5,1,0x504) is still TBD. This information is needed by the CDMU ASW contractor to process the packet.	Specify the layout of the peak up report	Major	FDB
Resumption of SPIRE commanding	**Spire-RAL-PRJ-001070/ Spire Data ICD**	4.2.5.2.4	The event description details that commanding of the SPIRE instrument can be resumed with the next subschedule. This connection with the subschedule is unclear. Can the event be interpreted to resume SPIRE commanding in more general terms?	Please clarify the use of subschedules in SPIRE	Major	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			The way the CDMS is currently specified is to stop releasing commands from the MTL to the SPIRE instrument up reception of an event (i.e. TM[5,2,0x0530). Upon receiving of TM(5,2,0x0531) this stop on the MTL will be released. It is not straightforward to link this behaviour to subschedules. This is explained in the ESA MTL Guidelines note SCI-PT-16783.			
CRC algorithm undefined	**Spire-RAL-PRJ-001070/ Spire Data ICD**	5.1.1	The table lists the CRC algorithm still TBD. Given the state of the software (SSD issued) this algorithm should have been specified. However, searching the SSD for it, I find no reference	Please add CRC algorithm to be used to the SSD. Note that an algorithm has been specificied in the PSICD appendix 4, although this one seems to be limited to block sizes of maximum 32768 bits	Minor	FDB
Empty section 5.2.3 Constraints	**Spire-RAL-PRJ-001070/ Spire Data ICD**	5.2.3	This section on constraints is empty. Is this intentional?	Please clarify	Minor	FDB

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
Control loops	**Spire-RAL-PRJ-001070/ Spire Data ICD**	Appendix B	This appendix defines control loops to be implemented in the OBS. I have difficulties relating these control loops definition to the SSD "SPIRE IFS PRJ 001036"	Please clarify		FDB
AIV Plan						
EMC tests on CQM	**SPIRE-RAL-DOC-001049**	3.1	"EMC tests will require the full QM warm electronics" : contradiction with technical note "SPIRE CQM Instrument Level EMC Test Specification", stating that "there will not be a representative power supply in the DCU".	Explain or solve discrepancy.	Major	ASP
CQM AIV flowchart	**SPIRE-RAL-DOC-001049**	4	CQM cold EMC tests not mentionned in flowchart	Explain.	Minor	ASP
Doc obsolete	**Warm electronics Integration Plan**		To be updated wrt the new development approach	As mentioned		ESA/OP
GSE						
Test Language	**GSE Overview**		Document top be updated also considering the improved test language and approach for IST	As mentioned		ESA/OP
PA						
(TL-01) No compliance matrix	**SPIRE PA Plan/-RAL-PRJ-00017v1.1**	1 and 2.1	In chapter 1 it states that no compliance matrix will be produced,	Either: a) make all applicable documents fully		TL

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			also stating that it is NOT intended to be fully compliant with the applicable documents, it also states that agreement with ESA project office is to be obtained. To reach agreement both sides need to know what the planned activities and requirements are. Section 2.1 says basically that the PA plan is based on PSS-01-0 and a number of documents listed in 1.1.1 and that ESA is to agree this PA plan with the SPIRE project, but no where is it clear to what extent the applicable documents are being "tailored "in applicability and which requirements in the PA Plan itself extend or replace requirements of the applicable standards. (see related comments TL-02, TL-03, TL-04 and TL-06)	applicable and measure what is not achieved by audits and reporting as the project progresses, or: b) provide a compliance matrix based on the clauses of each applicable document.		
(TL-02) Tailoring of applicable documents in 1.1.1 too	**As above**	1.1.1	The table of applicable documents in section 1.1.1 implies a tailoring of the	Give precise applicability in the table, or better still,		TL

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vague			standard by the text written in the 3rd column. This tailoring is too vague and must use section and clause numbers of the documents	provide a detailed compliance matrix.		
(TL-03) Clarification of Tailoring statement needed	**As above**	9.1	The last paragraph of the general section on S/W PA, (section 9.1), says: Standards will be tailored…" a)Which "standards" are meant here ? b) The Customer should tailor requirements for the supplier to comply with. c) Where will the tailored standards be documented or the tailoring results be recorded? d) Where will agreement of tailoring be recorded ?	Reply to questions a, c and d.		TL
(TL-04) Many Requirements are set but are not clearly identifiable and some are ambiguous	**As above**	9.2.1, 8.4.2 and others	Ref 9.2.1 (page 42) The contents of the SVVP are further defined with the introductory statement: : "The plan shall address the following:" but the text that follows is inconsistently formatted and not clear enough, Ref 8.4.2 This section (PAGE 34) includes many apparent requirements, e.g. "… a test readiness review should be	If this PA plan is to include requirements for QA and /or engineering activities, then each one is to be numbered in a unique way. Please update the text at the top of page 42 and reformat it.		TL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			held…" If this section contains activities to be performed, they should be numerically identified and use "shall" Ref 8.4.3 This section defines many requirements on "Equipment logbooks" But there is only one section number a reference – each req. should be numbered. ECSS-Q-20B provides a Logbook definition with document template – Why not make Q-20 applicable ? (is Q-20 in AD-1PT-RQ-04410 anyway ? Ref 2.3 Audits. It even says in this section "…performed by PA against the requirements referenced herein…" But the req.s are not adequately referenced in the PA Plan.	Please indicate what "should" means – For example; if something should occur but does not, is that a problem ? Does someone have to decide first if something that should occur will not be done ? Or replace all occurrences of "should" with "shall".		
(TL-05) Why list technical documents info in section 9.2.2	**As above**	9.2.2	The documents to be produced during a software project are usually defined by title in the Software Project Management plan and the details left to the agreed applicable software engineering	Remove details on "Technical documents" contents as is presently shown in 9.2.2 and make a S/W engineering		TL

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			standards, e.g PSS-05-0 or ECSS-E-40A or B A PA plan should plan activities to monitor and ensure the development follows the management plans and agreed engineering development requirements.	standard applicable. Some information may be kept in this PA plan if thought useful to help other readers know which type of documents can be expected from such a development.		
(TL-06) PA plan based on PSS-01-0	**As above**	2.1	Section 2.1 a) states that this PA plan is based on PSS-01-0 but this document is not listed in the applicable or ref. documents list; is it in AD-1 ?	Please clarify if PSS-01-0 is made applicable in PT-RQ-04410		TL
(TL-07) PSS-01-40		7.2	Section 7.2 page 29; Standards PSS-01-40 are mentioned here, but: a) they are incorrectly mentioned, firstly a typo (PPS-40) and secondly no issue of the standards is given b) if these are applicable requirements they should be listed in chapter 1	Correct typo Give issue of the standards document , (Issue 2 from 1988 ?) Add to applicable documents list or state that it is applicable and listed in PT-RQ-04410		TL
(TL-08) Which s/w standards are meant		9.1 page 40	The 3rd paragraph on page 40 starts: "Software standards and specifications shall be checked to assure completeness…" But which s/w standards are meant and applicable here ?	Please state explicitly which software standards are meant in section 9.1		TL

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			No s/w engineering standards appear in the applicable document tables, so I can only assume they are directly reference in AD-1: PT-RQ-04410			
(TL-09) FMECA, analyse software failures	**As above**	6.2 page 26	Section 6.2 addresses analysing the effects of failures and mentions specifically electronic circuits and mechanical mechanisms. This section should explicitly mention software as a source of failures. Note: section 9.1 on page 40 states that software failures are to be include in the FMECA.	Please update section 6.2 to mention software as a potential source of (critical) failures.		TL
(TL-10) Clarify column header	**As above**	11.1	The tables in section 11. Are these tables to be used to record the availability of items at the acceptance review ? What is the meaning of Req. as a column header – this seems to imply the table is to form a check list for items to be submitted for the Acceptance review.	Please clarify whether these tables are to be used to record items submitted at the review or whether the tables are to help build a list of items (Required) to be provided.		TL
(TL-11) Need a reference to a handling standard	**As above**	8.4.3 page 36	This section concludes with a seemingly important statement: “NB Coated boards must not be handled with fabric gloves”	Such an important and specific reminder seems out of place in a Plan, but if it stays in it should be expanded to give the reader proper reference to the standards which		TL

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
				cover handling of covered boards.		
(TL-12)	**As above**	Figure 2	The document tree needs to include document identifier numbers And needs to be readable	Add document numbers to each document in the tree and re-format to make the tree readable for a document printout		TL
(TL-13) The meaning of table 2	**As above**	Table 2	What is table 2 intended to explain or describe ?	Please introduce and explain the title of table 2 and what table 2 intends to summarise and tell the reader. (Also, row 4 seems incomplete)		TL
(TL-14) Table column headers	**As above**	Tables 1 and 2	Table 1 needs a title for column one; Table 2 needs a title for all columns.	Please update the tables 1 and 2.		TL
(TL-15) Some applicable documents listed without Issue number	**As above**	1.1.1	Some standards are listed without the appropriate Issue	Ensure all document references include their Issue information.		TL
(TL-16) Editorials	**As above**		Page 1 says 1 or 55, other pages Show page n of 57 Figure 7 should be figure 5 2.3 page 10;and 7.2 on page 29: bullet points labelled with ? and not with or a number.	Please correct the editorial errors.		TL
Cleanliness	**SPIRE-RAL-PRJ-001070**		The system cleanliness analysis	Justify this increase		ASP-

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			have been built with a value of molecular contamination of the FPU of 3 10 - 6 g/cm² at instrument delivery. In the table 6 there is a value of 5 10 -5 g/cm² which is not compatible			CM
Mat	**SPIRE-RAL-PRJ-001092**	General	In DML for some materials the outgassing rate is missing also the SCC or Cor code	Complete the document		ASP-CM
processes	**SPIRE-RAL-PRJ-001093**		No cleaning process are mentionned	Complete the document		ASP-CM
Missing data	**Combined EEE parts list SPIRE RAL_PRJ 0001095 iss2.0**	INTRODUCTION	A few lists are missing	Provide them	Medium	FM
Crystek		All	The 'famous' Crystek MDM filtered connectors could not be found.	Clarify.	High	FM
Mature EEE		AppA 1 + LAM list	It appears that LAM list may be not mature as comes from 1/2/2001and only presents QM baseline	Confirm.	High	FM
Missing PAD?		DRCU list	Two items identified as self-procured should be covered with a PAD.	Provide PADs	HIGH	FM

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minor correction		CGS list	Some ceramic capacitors are presented with termination letter W while CPPA is only buying termination U. The use of ceramic chip capacitors with Termination style "W" is NOT recommended as "W" gives the manufacturer the option to use either **pure tin** and pure tin finishes are susceptible to the growth of tin whiskers capable of bridging electrically isolated surfaces.	Include part numbers in line with CPPA procuremnt	Medium	FM
Non conformance	**SPIRE-RAL-PRJ-001079**		The class of the NCR is missing in the table As is this table reflect that all the NCR are open. Is this truth?	Update the document		ASP-CM
Waiver	**SPIRE-RAL-PRJ-001081**		The 3 waivers listed are pending prime contractor status. These waivers have not been distributed	Transfer these waivers to ASP if needed		ASP-CM
Unidentified Documents						
Mat	**SPIRE-IFS--DOC-001031**		The sleeve RT 876 has a high outgassing rate there is an alert from CNES on the material	Analyse the impact of this material under contamination aspect		ASP-CM
Mat	**MSSL/SPIRE/PA002.01**		Only the chemglase 9924 is written while this is primer for the Z306 paint this later is not reported in the list	Complete the inforamtion		ASP-CM
Processes	**DPL LAM PRJ 000919**		Only 3 processes mentionned .Are	Com^plete the		ASP-

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			they all	document if needed		CM
processes	**DPL HSO SBT LI 005**		Lot of information missing such as soldering , criping specification, justification for critical process	Complete the document		ASP-CM
Rutherford Appleton Laboratory	**Spire-ATC –RJ-708**	general	Not mature enough: Several specifications to be written, associated items in DML not numbered, the criticality of the processes is not clear (what are the means considered for lowering risk), TBD shall be removed	Update and provide information		LP
ATC	Spire-ATC-PRJ-708	General	Processes, even critical ones, such as bonding, are not yet written	Update document	high	MVE
Rutherford Appleton Laboratory	**Spire-ATC –RJ-710**	general	Does not provide all relevant information. Many TBCs, TBDs. No link between DML and DPL (see e.g. item DML 25 with reference to an item not listed in the DPL)	Update and complete		LP
Rutherford Appleton Laboratory	**Spire-ATC –RJ-710**	Item 21	Ni plating may induce hydrogen embrittlement of metals	Verify that there is no issue with this magnet		LP
ATC	Spire-ATC-PRJ-710	General	Material list is too premature. Too many TBD's, TBC's,	Update document	high	MVE
CEA-DSM	**SAp-SPIRE-NC-0060-02**	general	The TBD have to be removed. Note that there is no PCBs according to the list and it will be difficult to solder on top of nothing.	Update for next issue – including the flux to be used for solders. Give information on the PCBs to be used.		LP

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
DRCU	Spire-NC-0060-02	Item 10.4 (10 & (2)	Why different mixing rates?	explain		MVE
DRCU	Spire-NC-0061-02	General	Too many "to be filled out" Are we commenting a template or a list?	Update document		MVE
CEA-DSM	**SAp-SPIRE-NC-0061-02**	general	Some detail are missing or are still tbd, many sub-co have to be identified.	Update		LP
CEA-DSM	**SAp-SPIRE-NC-0061-02**	8.2 and 8.3	The components are crimped and not soldered according to the justification provided.	Modify and select a sub-co with required experience, i.e. SMD (certification for specific components to be mounted) and hand-soldering certification.		LP
CEA Grenoble	**HSO-SBT-LI-004**	general	The parts and materials are mixed. And the difference is not clear.			LP
CEA Grenoble	**HSO-SBT-LI-004**	6.1	Passivation treatment is missing	Indicate		LP
CEA Grenoble	**HSO-SBT-LI-004**	7.1	Pure tin is not allowed. Soldering, if hand made, shall be performed by certified operators.	Give adequate description of the soldering material and process.		LP
CEA Grenoble	**HSO-SBT-LI-005**	general	Several specifications are missing. The link with DML is not clear. Critical processes are not justified, nor means to check that process is successful given.	Give all required information.		LP
CEA Grenoble	HSO-SBT-LI-005	Item 1.1.	Info cure +post-cure	provide		MVE

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IFSI CNR	**SPIRE-IFS-DOC-001031**	Group 8 item 2	The soldering of SMD can only performed by certified operators, with reference to table giving details of the components that can be soldered	Provide reference.		LP
LAM	**SPI.PFM.00.LD.02.A**	general	The information provided is not relevant	Take the ESA-PSS-01-700 document to see what is asked.		LP
LAM	**SPI.PFM.00.LD.02.A**	general	The information provided is not relevant	Take the ESA-PSS-01-700 document to see what is asked.		LP
MSSL	**MSSL/SPIRE/PA002.01**	general	Information is incomplete, i.e. SCC, corrosion, outgassing, processing…	Update (take the ESA-PSS-01-700 document to see what is asked)		LP
MSSL	**MSSL/SPIRE/PA002.01**	Coherence of Information	What is the solder used for, as there are no PCBs?	Cross-check within the list		LP
MSSL	**MSSL/SPIRE/PA004.02**	Coherence of Information	Why can't we find soldering while there is a solder material?	Cross check between the lists.		LP
CEA-DSM	**SAp-SPIRE-NC-0100-03**	Item 52.3	Galvanic corrosion between SS and Aluminium has to be checked	State on galvanic corrosion.		LP
WCA	**missing**		The worst case analysis is missing (FCU)	Provide document - mandatory for all electronics interfacing with the spacecraft	High	JR
Derating	**missing**		Most of the derating analysis is missing (available DPU + harness)	Provide document - mandatory for all EEE components	High	JR
VCD	**missing**		The verification control document/matrix is missing (included in the SPIRE-RAL-	Provide document	High	JR

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			PRJ-000410, AIV plan issue 2.1 at the IBDR)			
Manufacturing flow charts with MIP/KIP	**missing**		The manufacturing flow charts including MIPs and KIPs are missing from system and sub-system levels	Provide document	High	JR
CIDL	**SPIRE-RAL-PRJ-001134 1.2**	3.1	The list of sub-system CIDLs is incomplete, with many CIDLs missing. The listed CIDLs are old issues even more than 2 years old, which is unacceptable at this stage.	One objective of the IHDR is to show that there is a configuration and that it is under control, so that it can be frozen as a baseline for the production phase. Therefore the current CIDLs from all subsystems are required to show that there is a configuration and that it is under control.	High	JR
		3.2	The list of drawings has only one drawing included. The “Instrument block diagram”. The IHDR is the point where formal go-ahead for the production phase is given which means that the design drawings must be listed or reference given to a separate drawings list which also needs to be submitted for the review.	Add the configured manufacturing drawings to the list, or list them in a separate drawings list document that has to be included in the CIDL	High	JR
		2	The IID-A, IID-B, Instrument PA	To be added	minor	JR

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			requirements are not included in the Applicable documents list			
		general	Many documents listed in the CIDL are very old, even as old as August 1999 (Structure Optics ICD). The OBSW URD is from September 2000. Missing documents are: ❑ SPIRE Design Description ❑ The Harness and Connector Derating Analysis ❑ Parts Approval Document (PAD) Status Reports ❑ FMECA ❑ FDIR ❑ Safety submission ❑ NCR status list The date of the CM plan is not the same as the submitted CM plan	All these discrepancies show that the configuration is not under control and that has to be urgently amended. The CIDL has to be completely revised and updated.	Major	JR
NCR status report	**SPIRE-RAL-PRJ-001079 2.0**	general	It is not explicitly stated if the report contains only open NCRs but since there are no references to close-out that is the assumption.	The NCR report needs to be complete with all NCR both open and closed so a complete review can be made.	High	JR
		general	There is no indication of the classification of the NCRs if they are major or minor and the column with "level" is not described either. All relevant data concerning the NCR shall	It needs to be clearly shown which NCRs are Major on SPIRE system level and which are minor. It is not enough to	High	JR

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			also be given. In some cases the title, model or subsystem is missing.	assume that if they have not been submitted they are minor. An update of the report is required.		
RFW status report	**SPIRE-RAL-PRJ-001081 2.0**	general	RFW number 2 does not have a reference number. The waivers have not yet been formally submitted	To be clarified	low	JR
PA plan	**SPIRE-RAL-PRJ-00017 1.1**	1	The section states that the plan does not attempt to be compliant with the applicable documents and thus no compliance matrix is provided. This is not acceptable.	A compliance matrix needs to be provided stating the compliance with the requirements and justification has to be given for non-compliance	High	JR
		4.4.5	PADs are required for all components that are self-procured	To be corrected	medium	JR
CM plan	**SPIRE-RAL-PRJ-000626 1.3**	6.4	The section references the Product Tree but the reference number to the PT is missing.	Give the full reference to the product tree or list it as a reference documents in section 3.2	low	JR
		6.5	The CI number is referred to as TBD	Remove the TBD and explain the numbering.	medium	JR
		6.7.3	It is stated that Each SW package will be allocated a CI number, but the numbering is not described and contains some TBDs	Please describe how the CI number is defined	medium	JR
Critical Items List	**SPIRE-RAL-PRJ-001138 2.0**	general	The numbering of the critical items in this issue is not consistent with the	To be taken into account for the next update of the	medium	JR

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
			numbering in the previous issue. The numbering, once given, of a critical item should not change since it needs to be unambiguous to allow for a continuous systematic follow-up of the critical items. Once the actions of a critical item have been performed and the status is closed it shall be noted as closed. The number of the closed item shall not be given to a new item later. It shall remain with the original item with the status closed	list		
		general	The filter connectors from Cristek should be included as an item in the list since they are not qualified for cryo-applications and there is a strong doubt that they can be used at extremely low temperatures	To be updated and qualification programme to be presented	High	JR
FMECA	**SPIRE-RAL-PRJ-001260 1.0**	general	No conclusions or recommendations are drawn.	A section with conclusions and recommendations shall be included in the documents. The conclusions should clearly state about the acceptability of criticalities and provide justification for retaining SPFs.	medium	PV

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
		1.2	The issue of RD1 Design Description is not given and the issue of RD2 SPIRE Block diagram is not the same issue as for the document provided for the review. Therefore it is not clear if the analysis is up to date and reflects the current design	To be clarified and updated. It must be clearly shown towards which design the analysis is made.	medium	JR
Safety submission	**SPIRE-RAL-DOC-001293 3.0**	general	The Analysis is a very descriptive and gives confidence that the equipment meets the requirements w.r.t. the safety level of their equipment but, there should be a reference to the FMECA so it is shown that the situation has been also considered in there.	References to the FMECA should be given for completeness	medium	PV
		general	As a recommendation, it would be better to include a Hazard Report where the information is filled out in a more systematic way, so that possible hazard situations are described and the completeness of the analysis is guaranteed.	Include a Hazard Report for completeness	medium	PV
		Annex A: Section 4.2.2	HSO-SBT-TN-076 issue 1.0. The table giving the Stress at MOP, burst pressure and MOS (margin of safety) is confusing. For the pumping line the stress at MOP is 250MPa, the burst pressure 35MPa and the MOS 2.2. This does not make sense.	This table needs to be clarified and updated. Also an explanation needs to be given for the statement that the cooler is designed with an operating pressure of 8MPA, and how that fits with the MOP given in	High	JR

Herschel SPIRE Instrument Hardware Design Review (IHDR)						
				the table and the burst pressure and MOS.		
FPU Harness and connector derating analysis	**SPIRE-RAL-NOT-001704 1.0**	general	The note does not show how the derating requirements are met. To do this the TN needs to present as a minimum in a table format the following information: ❑ Component ❑ Location ❑ Rated value ❑ Derating requirement, (derate to) ❑ Actual value ❑ Compliance Y/N ❑ Remarks justification, RFW	To be updated accordingly. Furthermore an example of the calculations leading to the actual values needs to be given.	High	JR
DPU /ICU Derating and WCA	**CNR.IFSI.2002TR06 1.3**	3.4	Even if the motherboard is purely passive the components still have to meet the derating rules of PSS-01-301.	All components (connectors, wires and other passive components) on the motherboard have to be derated according to the requirements	medium	JR
FDIR	**SPIRE-RAL-NOT-001128 0.1**	general	This FDIR is the same issue that was submitted for the IBDR and commented during that review.	Update the document according to the previous comments.	medium	JR

8.3 RID's:

Review Item Discrepancy

Rid Number : SPIRE-IHDR-001

HERSCHEL / PLANCK
SPIRE IHDR

Originator : Carsten Scharmberg

Subsystem or equipment : SPIRE	**Organisation/Company** : U Cardiff / RAL

Title of the RID :

INCOMPATIBLE SPIRE DELIVERY DATES

Document Identification (Title, Vol, Sect., Para...)

Schedule provided during IHDR presentation meeting on 9./10. July 2003 at RAL.

Classification : . . Major

Discrepancy :

SPIRE delivery dates for CQM and PFM are not in line with the Herschel/Planck Project Schedule:

Model	Delivery dates according IID-A (SCI-PT-IIDA-04624 / Issue 3.0 / 01.07.2002)	Current SPIRE Schedule
CQM	1 Oct 2003	1 Feb 2004
PFM	1 Jan 2005	Taking into account the DRCU subsystem delivery to RAL, the final SPIRE delivery to ESA (End of 2005)will be to late in order to meet the launch date (15th Feb 2007)

Taking into account that the CQM delivery is under negotiation, it may be acceptable with the current programme planning. However the PFM delivery date is in any case much too late w.r.t. the Herschel/Planck launch date.

Date : 22th July 2003 Signature Originator:

Initiator recommended action or solution :

SPIRE together with CEA, CNES, industry, and ESA has to work out another scenario in particular w.r.t. the late delivery date of the warm boxes, that is compatible with the overall Herschel/Planck programme. In addition the ASI funding concerning DPU has to be guarantied to cope the programme schedule.

Date : 22th July 2003 Signature:

Position of Organisation/Company:

Date : Signature:

RID Disposition :	
Date :	Date :
Signature (Contractor) :	Signature (Board Chairman) :
RID Close Out :	
Date :	Date :
Signature (Contractor) :	Signature (Board Chairman) :

Review Item Discrepancy

Rid Number : SPIRE-IHDR-002

HERSCHEL / PLANCK
SPIRE IHDR

Originator : Pierre Estaria / Jan Rautakoski

Subsystem or equipment : SPIRE	**Organisation/Company** : U Cardiff / RAL

Title of the RID :

SPIRE ON BOARD SOFTWARE STATUS (DPU SOFTWARE)

Document Identification (Title, Vol, Sect., Para...)

OBS documentation in general.

Classification : . . Major

Discrepancy :

The On Board Software (OBSW) documentation provided with the Data Package does not provide sufficient visibility into the overall OBSW engineering and validation process. It is unclear if the OBSW is developed according to the ECSS 40-B standards, the PSS-05 “Guide to applying the ESA software engineering standards to small software projects” or to no specific standards. Regardless of the standard used a Software Project Management Plan (SPMP) shall be written. Such a document is essential to allow the implementers to control the overall process, ensure that the resources available are sufficient to carry out the software design, implementation and validation, define and track the corresponding Work Packages, identify the various SW versions to be released and establish priorities. The software Verification and Validation itself shall be carried out according to an Acceptance Test Plan which lists all the tests to be executed, with, for each of them, the corresponding success/failure criteria. None of these essential documents were available in the DP. (The ATP has been provided post-review). Furthermore the DPU OBSW Specification Document although of reasonably good quality marks a number of URD requirements as ‘not covered’ in its traceability matrix and does not refer to any of the Industry and/or SPIRE documents containing applicable FDIR requirements. Finally the SPIRE Data ICD is in contradiction in several places with the high level Applicable PS-ICD. As a result it is impossible to assess the maturity of the SW w.r.t. the Project Schedule because there is no firm baseline to evaluate against.

The DPU presentation (R. Cerulli) provided some insight into the ‘Virtual Machines’ approach selected to complete the overall OBSW. Although appealing at first sight because it allows to defer to a later stage the implementation of SPIRE-specific functionality the approach entails some risks, e.g. (i) the necessity to develop and validate the Virtual Machines and the corresponding compiler; (ii) the fact that the VM coder needs to ensure that his/her code complies with the related timing and other constraints inherent to the VM approach; (iii) the lack of sophisticated debugging tools; (iv) the fact that part of the SW implementation has to be carried out in the software ‘maintenance’ phase i.e. later and when resources may become tight (this makes availability of the SPMP all the more important).

SPIRE stated during the IHDR meeting that a dedicated tool for the reporting of SW problems is being used. An SPR (Software Problem Report) tool running on an ESA server. This tool is also planned to be used for reporting SW non-conformances. The requirement of NCR handling, for both HW and SW, is given in PT-RQ-04410 "Product Assurance Requirements Document for Herschel/Planck Scientific Instruments" section 8.6.

Date : 22th July 2003 Signature Originator:

Initiator recommended action or solution :

- Generate a proper SPMP as a matter of urgency (check that resources are commensurate with the needs and prioritise accordingly).
- Update (as required) the OBSW ATP and provide the corresponding Test Report (note that this activity must be carried out for **every** OBSW delivery. This include demonstration that software regression testing has been carried out to the required extent)
- Implement as quickly as possible the VMs, the compiler, and a minimum set of VM code, in order to validate the overall VM approach.
- Coordinate with PACS and HIFI since the same approach will be followed for all Herschel instruments.
- SPIRE shall demonstrate how it is planned to fulfill this requirement using the SPR tool and also to explain how this corresponds to their statement in the SPIRE PA Plan SPIRE-RAL-PRJ -000017 section 8.6.1 stating that "Software non-conformances shall be dispositioned and processed as hardware non-conformances". It shall also be explained how the reporting of Major SW non-conformances to upper level (ESA) is handled and how the status reporting of SW non-conformances is handled. The responsibilities at SPIRE for SW NCR handling and control shall also be explained.

Date : 22th July 2003 Signature:

Position of Organisation/Company:

Date : Signature:

RID Disposition :

Date : Date :

Signature (Contractor) : Signature (Board Chairman) :

RID Close Out :

Date : Date :

Signature (Contractor) : Signature (Board Chairman) :

Review Item Discrepancy

Rid Number : SPIRE-IHDR-003

HERSCHEL / PLANCK
SPIRE IHDR

Originator : Jan Rautakoski

Subsystem or equipment : SPIRE	**Organisation/Company** : U. Cardiff / RAL

Title of the RID :

SPIRE PA DOCUMENTATION

Document Identification (Title, Vol, Sect., Para...)

Classification : . . Minor . **Major**

Discrepancy :

SPIRE PA Documentation is not in line with "Product Assurance Requirements Document for Herschel/Planck Scientific Instruments – Ref. SCI-PT-RQ-04410. The following documents are not up to date and inputs from several sub-systems are missing:

- CIDL, Configuration Item Data List
- DML/DPL/DMPL, Declared Materials List/Declared Processes List/Declared Mechanical Parts List.
- DCL, Declared Components Lists
- PADs, Part Approval Documents. The list needs to be completed and the
- Derating Analysis (or PSA, Part Stress Analysis)
- WCA, Worst Case Analysis
- SPIRE PA Plan.

Date : 22th July 2003

Signature Originator:

Initiator recommended action or solution :

CIDL: To be updated in line with the detailed review comments provided. The identified discrepancies need to be corrected, the relevant drawings need to be included in the list and references to all the CIDLs from all sub-systems are needed before it can be acceptable as a configuration baseline. CIDLs from sub-systems may have to be updated and those sub-systems that have not provided a CIDL have to provide one.
DML/DPL/DMPL: The lists that were submitted are to be updated in line with the detailed review comments provided. The sub-systems that did not provide any lists need to provide their lists.
DCL: To be updated in line with detailed review comments provided. The DCL needs to be complete and references to the relevant PADs have to be provided.
PADs: The PADs for all self-procured components need to be submitted for formal approval of the components.
Derating Analysis: The derating analysis has to be provided for all EEE components giving evidence that no components are overstressed. The provided analysis to be updated in accordance with the detailed review comments provided.
WCA: To be provided for all electrical interfaces with the spacecraft.
PA Plan. To be updated in line with the detailed review comments provided. The PA plan has to be approved by ESA, but it is not compliant to the requirements. It is stated in the PA Plan that it is not intended to be fully compliant, but it is not stated specifically where it is compliant and where not. Therefore a Compliance Matrix has been provided stating clearly the compliances and non-compliances. When the Compliance Matrix is provided it will be reviewed and then it will be decided on a case by case basis if the non-compliances can be accepted or not. Note that formal RFW may be necessary.

Date : 22th July 2003 Signature:

Position of Organisation/Company:

Date : Signature:

RID Disposition :

Date : Date :

Signature (Contractor) : Signature (Board Chairman) :

RID Close Out :

Date : Date :

Signature (Contractor) : Signature (Board Chairman) :

Review Item Discrepancy

Rid Number : SPIRE-IHDR-004

HERSCHEL / PLANCK
SPIRE IHDR

Originator : Gerald Crone

Subsystem or equipment : SPIRE	**Organisation/Company** : U Cardiff / RAL

Title of the RID :

MECHANICAL QUALIFICATION

Document Identification (Title, Vol, Sect., Para...)

Viewgraphs from IHDR presentation meeting

Classification : . . Major

Discrepancy :

1. In order to improve thermal design margins the main supports of the SPIRE FPU (to the HOB), and internal supports (A-frames) for detector boxes, are being modified from stainless steel to CFRP. The design of these items is currently in progress, but the planning indicated by MSSL means that these items would not be available for the CQM test campaign. The mechanical performance of these items (stiffness and strength) therefore relies on analysis, test at component level and test at PFM level. This has the risk that some undesirable characteristics may only become apparent during PFM testing.

2. Failure in Kevlar support for 300mK thermal strap (at light baffle) during FPU warm vibration has been identified as mainly due to manufacturing defect. Subsequently a design modification has also been introduced, to reduce susceptibility to repeat of manufacturing defect.

3. The flight representative SMEC (i.e. with flex pivots) is not yet qualified, either by analysis or test (analysis for design margins with respect to revised random vibration levels from FPU warm vibration test is currently in progress). System level qualification will only be confirmed by PFM test campaign, due to use of STM without flex pivots for the CQM test campaign.

Date : 22th July 2003 Signature Originator:

Initiator recommended action or solution :

1. It is recommended to investigate the possibility to deliver one set of CFROP supports in time to support the CQM test campaign.

2. It is recommended to qualify this item.

3. It is recommended that instrumentation implemented for the SPIRE FPU warm vibration test to measure the SMEC mechanical environment should be included also for the CQM cold vibration testing.

Date : 22th July 2003 Signature:

Position of Organisation/Company:	
Date :	Signature:
RID Disposition :	
Date :	Date :
Signature (Contractor) :	Signature (Board Chairman) :
RID Close Out :	
Date :	Date :
Signature (Contractor) :	Signature (Board Chairman) :