



## Science Verification Review (SVR) Procedure

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Herschel/HSC/DOC/0710 v3.0

### Scope: SPIRE SVR phase 3

This document explains the background to and provides the procedure for the conduct of Herschel Science Verification Reviews (SVRs). This document will be tailored for each particular review as required.

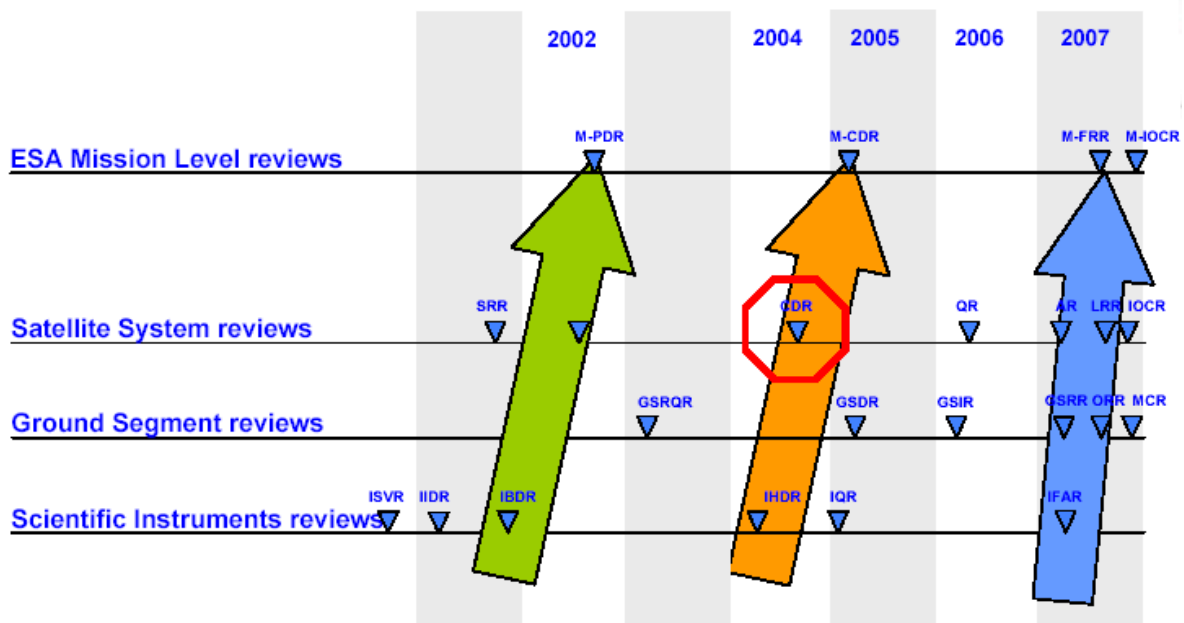
The current issue, v3.0, applies for the SPIRE SVR phase 3.

### Background and Introduction

Reviews are an important aid to the successful implementation of the Herschel mission. Consequently there are a number of instrument, telescope, spacecraft, (science) ground segment, and mission level reviews being held in successive ‘generations’ throughout mission implementation. This is illustrated in the figure below (which actually does not show the telescope reviews) taken from the introduction to the Satellite System Critical Design Review (CDR, circled red) presented by the Herschel/Planck Project Manager (PM).

However, despite the existence of a fair number of reviews, not one of them - with the possible exception of the Instrument Flight Acceptance Review (IFAR, in the blue arrow) - is addressing the issue of the scientific performance of Herschel as its main objective (and even so restricted to the science payload).

Providing a particular science capability to the astronomical community is the *raison-d’être* for the mission, thus, this is an important omission, in particular since at the time of the IFAR it would be unlikely that much time could be found to address any potential shortcoming identified at the time.



On the initiative of the Herschel Project Scientist (PS), supported by the Herschel Science Team, it has been decided by the Herschel/Planck Project that dedicated Science Verification Reviews (SVRs) will be conduct-



ed to address and rectify the omission of science performance oriented reviews. **The SVRs are ESA reviews organised by the PS dedicated (and restricted) to science performance issues.**

### Science Verification Reviews

**The primary objective of the SVRs is to ensure that** at the time of the Mission-level Flight Readiness Review (M-FRR) it will be possible to conclude that - on the assumption of a successful launch and commissioning - **it can be expected that Herschel will live up to reasonable expectations by the scientific user community** based on a proper assessment of design and actual testing.

They should cover:

- science instrument performance
- telescope performance
- spacecraft performance directly related to scientific performance
- 'integrated' Herschel (observatory) science performance

In addition there are secondary objectives related to providing the best possible estimate of the expected science performance as input to various activities, in particular for the preparation of the initial Announcement of Opportunity (AO), for community information purposes, and for the (science) ground segment development.

### Science Instrument SVRs

In the winter 2004/05 the Instrument Qualification Reviews (IQRs) were conducted, at the time there were no further formal instrument reviews planned before the IFARs. It has to be emphasized that the IQRs were mainly concerned with the instrument CQM models, while the IFARs will deal with (P)FM models, and that there is a period in excess of 2 years (see figure on page 1) inbetween.

Although in the IQR proceedings it was emphasized that it *'is of particular importance to confirm the qualification of the entire instrument at the time of the delivery to industry, and to demonstrate that the required scientific performance is achieved'* in reality this neither could nor (consequently) did it happen due to the facts the neither the instrument CQM build standards themselves nor the EQM testing facility enabled this. The confirmation of *'required scientific performance'* is thus left to the instrument FM programmes, this is a major transfer of risk!

The SVRs for the FM instruments will be conducted to bridge the time interval between the IQRs and IFARs, in order to ensure successful IFARs.

Preliminary three phases are foreseen for the science instrument SVRs. The detailed conduct will be tailored for each review, by mutual agreement between ESA and the respective PI.

### Science Instrument SVR phase 1

The Science Instrument SVR phase 1 review takes place at the beginning/early part of the FM ILT programme and is conducted to:

- take stock of the CQM ILT results
- take stock of the IQR action responses wrt science performance issues
- take stock of the CQM EQM (IMT and EMC) programme results
- on the basis of the above assess and confirm the FM ILT requirements and agree on the FM ILT plan, ensuring that nothing is missed with an understanding that FM instrument verification after delivery at module (IMT) and satellite level (IST) is limited in scope and time
- perform the best possible current assessment of expected scientific performance, to feed into initial AO preparations and community information

The date/venues for the phase 1 SVRs were:

- SPIRE: 26-27 January 2006, at RAL
- HIFI: 20-21 April 2006, at SRON, Groningen



- PACS: 22-23 June 2006, at MPE, Garching

### Science Instrument SVR phase 2

The Science Instrument SVR phase 2 review takes place at towards (thus *before*) the (nominal) end of the FM ILT programme and is conducted to:

- take stock of the FM ILT results so far, assessing what has been achieved wrt plans
- assess, update as appropriate, agree and confirm the remaining part of the FM ILT plan, to ensure all necessary FM ILT activities will be appropriately executed
- assess and confirm instrument verification at ‘module’ (IMT) and ‘spacecraft’ (IST) level requirements (and agree on plans (TBC))
- perform the best possible current assessment of expected scientific performance, to feed into the initial AO issue and community information

The detailed conduct will be tailored for each review, by mutual agreement between ESA and the respective PI. The SVR phase 2 is expected to be restricted to one day with a limited data package.

The date/venues for the phase 2 SVRs were:

- SPIRE: 26 September 2006, at RAL
- HIFI: 5 December 2006, at SRON, Groningen
- PACS: 18 January 2007, at MPE, Garching

### Science Instrument SVR phase 3

The Science Instrument SVR phase 3 review takes place before the IFAR (or it may be incorporated into the IFAR, but this is not the case for SPIRE) and is conducted to:

- take stock of the fully assessed FM ILT results
- take stock of instrument verification plans at module and satellite level
- perform the best possible current assessment of expected scientific performance
- generate the required instrument input for feeding into higher level Herschel science verification reviews, and the construction of in-flight commissioning and performance verification plans

The detailed conduct will be tailored for each review. There may be additional instrument consortium specific objectives outside the ESA review. The overall objective of the IFAR is to feed into the spacecraft Flight Acceptance Review (FAR - labelled AR in the blue arrow in the figure on page 1) which is held to authorise shipment of the satellite to the launch site.)

The date/venues for the phase 3 SVRs are:

- SPIRE: 29-30 October 2007, at Stockholm Observatory
- PACS: 8-9 November 2007, at MPE, Garching
- HIFI: TBD date, at TBD location

### Telescope SVR

TBW.

### Spacecraft SVR

TBW.

### Herschel SVR

TBW.



## **SPIRE SVR phase 3: Detailed Procedure**

The detailed procedure has been iterated and agreed between the Review Chair and the SPIRE Principal Investigator.

### **Review format**

This is a formal ESA review; it has been agreed that it will be most effective as a 'working review' to aid the SPIRE consortium effort rather than a 'stand-up-and-give-a-good-impression' event. It will be held at a very busy time for both the SPIRE and ESA teams, and it will be important to use the available limited effort effectively. The organisation and scope of the review has been tailored to facilitating the essential work that needs to be accomplished, while limiting unnecessary overheads. The review will consist of two parts:

- a review of the documentation package
- a review meeting involving presentations, discussion, Review Board meeting, and initial feedback

The documentation package will consist of technotes and reports, together with an overview document, and shall be made available electronically 10 days before the review meeting (19 October).

During the review of the documentation, a list of points to be clarified and discussed will be generated by the Review Board and forwarded to the instrument team before the review meeting.

The viewgraphs package shall be made available electronically working 2 days before the review meeting (25 October).

The review data package will be considered to consist of the documentation package, the presentations, and the information provided to the Board during the review meeting.

### **Review meeting dates and venue**

- Venue: Stockholm Observatory, Stockholm
- Address: AlbaNova University Center, Roslagstullsbacken 21, SE-106 91 Stockholm
- Websites: <http://www.astro.su.se/English/> and <http://www.albanova.se/>
- Date: 29-30 October 2007, agenda see Appendix 2

### **Review Board composition**

The Review Board will be comprised of:

- |                          |   |
|--------------------------|---|
| • Göran Pilbratt (Chair) | ESA Herschel Project Scientist                                |
| • Gerry Crone            | ESA Herschel Payload Manager                                  |
| • Carsten Scharmberg     | ESA SPIRE Instrument Manager (observer)                       |
| • Sarah Leeks            | ESA HSC SPIRE Instrument and Calibration Scientist            |
| • Ivan Valtchanov        | ESA HSC SPIRE Instrument and Calibration Scientist (observer) |
| • Helmut Feuchtgruber    | PACS ILT expert   |
| • Paul Harvey            | Herschel Mission Scientist                                    |
| • Ray Carwell            | PPARC representative  |
| • Karine Mercier         | CNES representative   |
| • Ulf Israelsson         | NASA representative   |
| • Matt Griffin           | SPIRE Principal Investigator (observer)                       |

### **Review guidelines**

In both the review documents and presentations be as brief and concise as possible (use appendices if necessary to make details available), while highlighting:



- analyses that relate to scientific performance
- results and their implications rather than detailed accounts of the data taking, reduction and analysis
- compliance with explicit system and subsystem requirements (as detailed in the Instrument Requirements Document and the subsystem specification documents)
- shortcomings/incomplete aspects of the currently available data and needs for additional tests, characterisation, and calibrations, and implications for in-orbit operations
- a list of identified concerns/problems

In the presentations in particular:

- assume that the Review Board will be familiar with the instrument system and subsystem designs as presented at a number of previous reviews
- emphasise key issues from the documentation and assist the Review Board in concentrating on the important aspects mentioned above
- focus on key conclusions from tests that have a direct bearing on instrument scientific performance;
- present compliance with explicit system and subsystem requirements
- describe lessons learned and implications for the remaining FM cold test campaigns, and implications for in-orbit operations

A standard viewgraph template will be provided by the SPIRE PI for presenters to use.

### **List of review documents**

The review documents collectively as a data package should deal with all of the review objectives as given in these Procedures. The list of documents have been mutually agreed between the Review Chair and the SPIRE PI. The starting point is the review document package for the SVR phase 2, revised and updated as appropriate. See Appendix 1.

### **Agenda for review meeting**

The agenda has been mutually agreed between the Review Chair and the SPIRE PI. See Appendix 2.



## Appendix 1

### Review documents package

- Documents are divided into the following categories
  - SVR status and plan
  - Requirements documents
  - Test reports
  - Pipelines and Calibration Files
  - System Level and In-Flight Test Plans
  - Scientific performance estimation
- **Blue:** Existing document with no update needed
- **Yellow:** Existing document to be updated
- **Green:** New document

No.	Details and plan	
	<b>SVR status and plan</b>	
1	Title:	Review plan and agenda (final version of the SVR plan document)
	Doc. No	SPIRE-UCF-REP-****
	Author	Matt
2	Title	Report on progress on SVR-2 recommendations
	Doc. No.	SPIRE-UCF-REP-****
	Author	Matt
	<b>Requirements Documents</b>	
3	Title:	SPIRE Scientific Requirements
	Doc. No	SPIRE-UCF-PRJ-000064 (Version 3.0, Nov. 21 2000)
	Author	Matt
4	Title:	SPIRE: Instrument Requirements Document
	Doc. No	SPIRE-RAL-PRJ-000034 (Issue 1.3, 14 July 2005)
	Author	Bruce
5	Title:	SPIRE: Calibration Requirements Document
	Doc. No	SPIRE-RAL-PRJ-001064 (Issue 1, 17 Jan. 2006)
	Author	Bruce
6	Title:	SPIRE FM Calibration and Performance Test Plan
	Doc. No	SPIRE-RAL-DOC-002535 (Draft 0.1, 13 Jan. 2006)
	Author	Tanya
7	Title:	SPIRE Cryogenic Thermal Design Requirements
	Doc. No	SPIRE-RAL-PJR-002075 (Issue 1, 13 Jan. 2006)
	Author	Bruce
	<b>Test reports</b>	
8	Title	Thermal performances
	Doc. No.	SPIRE-RAL-REP-002557
	Author	Allan Dowell will extend Anneso's doc.
9	Title	SPIRE ILT Test Report: Instrument Throughput
	Doc. No.	SPIRE-RAL-REP-00****
	Author	Bruce
10	Title	BSM performance in PFM2
	Doc. No.	SPIRE-RAL-REP-002565 (Issue 1, 17 January 2006)
	Author	Tanya





11	Title	SPIRE ILT Report: SMEC and spectrometer performance
	Doc. No.	SPIRE-RAL-REP-00***
	Author	Trevor (with Jean-Paul; David; Ed)
12	Title	SPIRE ILT Report: PCAL performance
	Doc. No.	SPIRE-UCF-REP-00***
	Author	Pete
13	Title	SPIRE ILT Report: SCAL performance
	Doc. No.	SPIRE-UCF-REP-***
	Author	Pete
14	Title	Detector Channel Performance Estimation from Unit-Level tests and ILT
	Doc. No.	SPIRE-UCF-REP-00****
	Author	Matt
15	Title	SPIRE ILT Report: Bolometer Channel Noise Performance
	Doc. No.	SPIRE-JPL-REP-00***
	Author	Bernhard et al.
16	Title	Bolometer Array Performance: Summary
	Doc. No.	SPIRE-UCF-REP-002571
	Author	Matt
17	Title	SPIRE ILT Report: Instrument Optical Performance
	Doc. No.	SPIRE-RAL-REP-00***
	Author	Marc
18	Title	SPIRE EMC DRB Status Summary
	Doc. No.	SPIRE-RAL-REP-002853
	Author	Doug
19	Title	Microphonics Test Report
	Doc. No.	SPIRE-RAL-REP-00***
	Author	Doug
20	Title	CQM Cold Test 1 Performance Test Report
	Doc. No.	SPIRE-RAL-REP-002083 (Draft, 14 July 2004)
	Author	Bruce
21	Title	Straylight testing during EQM
	Doc. No.	SPIRE-RAL-NOT-002688 (Issue 1, 17 July 2006)
	Author	Bruce
22	Title	Report on analysis of STM-2 straylight testing
	Doc. No.	SPIRE-RAL-REP-002799 (Issue 1.0, 12 Jan. 2007)
	Author	Bruce
23	Title	SPIRE ILT Report: AOT Tests
	Doc. No.	SPIRE-RAL-REP-00***
	Author	Ken
24	Title	SPIRE IID-B Requirements Verification Matrix
	Doc. No.	SPIRE-RAL-DOC-002874 (Issue 1.0, 15 June 2007)



	Author	Bruce
<b>Pipelines and Calibration Files</b>		
25	Title	Photometer Pipeline and Flux Density Calibration Scheme
	Doc. No.	SPIRE-UCF-DOC-002890
	Author	Matt
26	Title	Spectrometer Pipeline and Calibration
	Doc. No.	SPIRE-BSS-DOC-****
	Author	Trevor et al.
27	Title	SPIRE Pipeline Description
	Doc. No.	SPIRE-RAL-DOC-002437
	Author	Tanya
28	Title	Status of SPIRE Calibration Files
	Doc. No.	SPIRE-RAL-REP-****
	Author	Tanya, Pete, Ed
<b>System Level and In-Flight Test Plans</b>		
29	Title	SPIRE System Level Test Plan
	Doc. No.	SPIRE-RAL-DOC-00****
	Author	Bruce
30	Title	<a href="#">New title: SPIRE IST EMC Test Plan Overview</a>
	Doc. No.	SPIRE-RAL-PRC-00****
	Author	Doug (+ Filippo)
31	Title:	<a href="#">New title: SPIRE Calibration Observations Definition</a>
	Doc. No	SPIRE-RAL-DOC-****
	Author	Tanya
32	Title	SPIRE Instrument Commissioning Plan
	Doc. No.	SPIRE-RAL-DOC-****
	Author	Sunil and Bruce
33	Title	SPIRE Performance Verification Phase Plan
	Doc. No.	SPIRE-RAL-DOC-****
	Author	Tanya, Bruce, Matt, Pete, Ed
<b>Scientific Performance Estimation</b>		
34	Title	SPIRE Sensitivity Models
	Doc. No.	SPIRE-QMW-NOT-000642
	Author	Matt
35	Title	Spacecraft Performance, AOT Implementation and Impact on SPIRE Scientific Performance
	Doc. No.	***
	Author	Sarah (+ Matt/Bruce)





**Appendix 2**  
**Review meeting agenda**

<b>Day 1: 29 October</b>			
Start Time	End Time	Duration (Min.)	
14:00	14:05	5	Welcome and logistics <b>Purpose and organisation of the review</b>
			Olofsson
14:05	14:15	10	ESA and Review Board Perspective
			Pilbratt
14:15	14:20	5	SPIRE perspective <b>Review of ILT results</b>
			M Griffin
14:20	14:40	20	Overview of the SPIRE ILT Programme
			Swinyard
14:40	15:00	20	Thermal performance
			TBD
15:00	15:15	15	<b>Coffee</b>
15:15	15:35	20	Spectral passbands and throughput
			Swinyard
15:35	15:50	15	BSM performance
			Lim
15:50	16:10	20	SMEC and spectrometer performance
			Baluteau/Fulton
16:10	16:25	15	Optical performance
			Ferlet
16:25	16:55	30	Bolometer Array Performance
			TBD (JPL)
16:55	17:10	15	PCAL and SCAL performance
			Hargrave
17:10	17:30	20	EMC Tests: Status, Programme and Plan
			D Griffin
17:30	17:45	15	AOT Tests: FM report and FS plan <b>Instrument Compliance and Performance</b>
			King
17:45	18:00	15	Compliance with Inst. Req. Doc.
			Swinyard
18:00	18:15	15	Sensitivity Models
			M Griffin
18:15	18:30	15	AOT Implementation and Spacecraft Performance
			Leeks/Pilbratt
18:30	19:00	30	<b>Preliminary Review Board meeting</b> <b>Evening: Relaxing social event</b>
<b>Day 2: 30 October</b>			
<b>Data Processing Pipelines</b>			
09:00	09:20	20	Photometer Pipeline Status
			Griffin
09:20	09:40	20	FTS Pipeline Status
			Fulton
09:40	10:00	20	Status of Calibration Files <b>Future Plans</b>
			Lim/Hargrave
09:40	10:10	30	System-Level Test Plan
			D Griffin
10:10	10:25	15	<b>Coffee</b>
10:25	10:45	20	Inst. Commissioning Plan (inc. 10 min discussion)
			Swinyard
10:45	11:25	40	PV-Phase Test Plan (inc. 15 min. discussion)
			Lim/Hargrave
11:25	12:05	40	Calibration Plan (inc. 15 min. discussion) <b>Summary and conclusions</b>
			Lim/Hargrave
12:05	12:20	15	Progress with respect to SVR-2 recommendations
			M Griffin
12:20	12:40	20	Problem areas and conclusions
			M Griffin
12:40	13:00	20	Discussion
13:00	14:00	60	<b>Lunch</b>
PM			<b>In Parallel</b> - Review Board meeting - SAG Splinters