

# SPIRE

**SUBJECT: Statement of Work for SPIRE Cold Blackbody and Cryostat Filters**

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**DOCUMENT No: SPIRE-RAL-DOC-000765**

**ISSUE: 0.1**

**Date: 23-July-2001**

**RAL Approval K. King**

**Date:**

**Cardiff Approval M. Griffin**

**Date:**

## Distribution

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**SPIRE**

**Project Document**

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**Change Record**

<b>Issue</b>	<b>Date</b>	<b>Affected Pages</b>	<b>Reason For Change</b>
0.1	24-July-2001	All	First draft for comment

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## Glossary

SPIRE	Spectral and Photometric Imaging REceiver
ITS90	International Temperature Scale of 1990
CBB	Cold BlackBody
RAL	Rutherford Appleton Laboratory
UCW	University of Wales, Cardiff

## 1. REFERENCES

### 1.1 Applicable Documents

	Title	Author	Reference	Date
AD 1	SPIRE AIV Test Facility Requirements Specification	D.L. Smith	SPIRE-RAL-PRJ-000463 Issue 1.3	10-April-2001
AD 2	SPIRE Cryostat Interface Drawings	M.R.Harman		

### 1.2 Reference Documents

	Title	Author	Reference	Date
RD 3	The International Temperature Scale of 1990		<a href="http://www.Its-90.com">www.Its-90.com</a>	

## 2. INTRODUCTION

A calibration cryostat is being developed for the SPIRE AIV testing at RAL (AD1) to enable the cryogenic calibration and characterisation of the instrument. The cryostat will house the SPIRE FPU and two JFET boxes, and will simulate the thermal environment presented by Herschel, namely 1.7K, 4.2K and 9-15K. The SPIRE instrument will view 'hot' calibration sources through an exit window on the cryostat via a telescope simulator. A cold (4K-20K) blackbody mounted within the cryostat will provide an absolute calibration reference. This document describes the work packages for Cardiff University to develop the cryogenic blackbody and cryostat optical filters.

## 3. MILESTONES

<b>Milestone</b>	<b>Ref.</b>	<b>Resp.</b>	<b>Baseline</b>	<b>Current</b>	<b>Actual</b>
Cold BB Delivered	AD1	UWC	02/12/01	06/01/02	
Filters Delivered	AD1	UWC	-	06/01/02	

## 4. COLD-BLACKBODY

A cryogenic blackbody is required to provide an absolute calibration source that can be viewed 'directly' by SPIRE (i.e. not via cryostat filters, window or telescope simulator optics). The source will uniformly illuminate all SPIRE detectors simultaneously to aid flat field characterisations, and will operate over the range 4.2K to 20K to allow dynamic range, gain and linearity measurements. The blackbody will be mounted alongside SPIRE within the 10K environment of the cryostat off a 4.2K cold finger. A flip-mirror will be used to bring the blackbody into SPIRE's field of view when required and removed when external sources are to be used. The detailed requirements for the blackbody are defined in AD1 and the interface to the calibration cryostat in AD2.

Work Package Description					
<b>Project :</b>	<b>SPIRE Calibration Facility</b>	<b>Phase:</b>		<b>WP Number:</b>	1000
<b>WP Title:</b>	<b>Cold Blackbody</b>			<b>Issue:</b>	0.1
<b>Assigned To:</b>	Dr Peter Hargrave, University of Wales, Cardiff			<b>Issue Date:</b>	23-Jul-2001
<b>Start Event:</b>	Project Start	<b>and/or Planned Start Date:</b>		01-Jul-2001	
<b>End Event:</b>	Delivery of blackbody	<b>and/or Planned End Date:</b>		01-Jan-2002	
<b>Additional partners</b>	Mr P. Collins, University of Wales, Cardiff			<b>Sheet:</b>	1 of 1
	Prof. P. Ade, University of Wales, Cardiff			<b>Estimated Effort:</b>	
<b>Objectives:</b>					
<ul style="list-style-type: none"> <li>Design and Manufacture cryogenic blackbody for SPIRE calibration facility</li> </ul>					
<b>Task Description:</b>					
<ul style="list-style-type: none"> <li>Design and build a blackbody to operate over the temperature range 4K to 20K to fit within the SPIRE calibration cryostat.</li> <li>Design control unit for blackbody</li> <li>Write the control and monitoring software for the blackbody in Labview.</li> <li>Calibrate blackbody temperatures and radiances.</li> </ul>					
<b>Inputs:</b>					
<ul style="list-style-type: none"> <li>Requirements Specification</li> <li>Interface Drawings</li> </ul>					
<b>Outputs:</b>					
<ul style="list-style-type: none"> <li>Blackbody design spec</li> <li>Blackbody drawings – including interface drawings</li> <li>Blackbody unit – incorporating the cold plate, thermometers, heaters, heat switch, internal harness</li> <li>Control unit</li> <li>Calibration report</li> <li>Integration procedure</li> <li>Blackbody software documents including:               <ul style="list-style-type: none"> <li>User Requirements</li> <li>Design Specification</li> <li>Acceptance test plan and procedures</li> <li>User Manual</li> </ul> </li> </ul>					

## 5. CRYOSTAT FILTERS

Under nominal flight-operations conditions, the radiometric flux entering the SPIRE optics will be dominated by the signal from the 80K telescope with emissivity of 0.04. Filters are required in the cryostat at the 77K, 10K and 4K stages to exclude the thermal infrared from the 300K environment and to simulate the predicted in-flight photometric fluxes.



Work Package Description					
<b>Project :</b>	<b>SPIRE Calibration Facility</b>	<b>Phase:</b>		<b>WP Number:</b>	2000
<b>WP Title:</b>	<b>Cryostat Filters</b>			<b>Issue:</b>	0.1
<b>Assigned To:</b>	Dr Peter Hargrave, University of Wales, Cardiff			<b>Issue Date:</b>	23-Jul-2001
<b>Start Event:</b>	Project Start	<b>and/or Planned Start Date:</b>		01-Jul-2001	
<b>End Event:</b>	Delivery of filters	<b>and/or Planned End Date:</b>		01-Jan-2002	
<b>Additional partners</b>	Mr P. Collins, University of Wales, Cardiff			<b>Sheet:</b>	1 of 1
	Prof. P. Ade, University of Wales, Cardiff			<b>Estimated Effort:</b>	
<b>Objectives:</b>					
<ul style="list-style-type: none"> <li>Design and Manufacture optical filters for SPIRE calibration facility</li> </ul>					
<b>Task Description:</b>					
<ul style="list-style-type: none"> <li>Design and manufacture filters for the SPIRE calibration cryostat to operate at 77K, 10K and 4K.</li> <li>Model the heat fluxes at each temperature stage of the cryostat so that the heat load on the instrument can be estimated.</li> <li>Model the radiometric signal entering the instrument over the wavelength range 1.0 to 1000µm</li> <li>Mount the filters in the frames provided by RAL</li> <li>Calibrate the filter transmissions over the wavelength range from 1.0 to 1000µm.</li> </ul>					
<b>Inputs:</b>					
<ul style="list-style-type: none"> <li>Requirements Specification</li> <li>Interface Drawings</li> <li>Filter mounting frames</li> </ul>					
<b>Outputs:</b>					
<ul style="list-style-type: none"> <li>Design specification for the filters – including predicted transmissions and fluxes.</li> <li>Mounted filters</li> <li>Calibration report</li> </ul>					