



**SUBJECT:** SPIRE Routine Phase Calibration Plan

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**DOCUMENT No:** SPIRE-RAL-DOC-003131

**ISSUE:** Draft 0.1 **Date:** 6th August 2008

**APPROVED BY:** **Date:**





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**Change Record**

<b>ISSUE</b>	<b>DATE</b>	<b>Changes</b>
Draft 0.1		First Draft



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## Glossary

AOT	Astronomical Observation Template
ICC	Instrument Control Centre
ILT	Instrument Level Test
IST	Integrated System Test
LEOP	Launch and Early Orbit Phase
OE	Optical Encoder
OPD	Optical Path Difference
PTC	Photometer Thermal Control
PV	Performance Verification
SPIRE	Spectral and Photometric Imaging REceiver
SPT	System Performance Test
ZPD	Zero Path Difference



## 1. INTRODUCTION

This document is the routine phase calibration plan for SPIRE. It starts in section 2 by laying out the objectives and top level requirements of routine phase calibration. The working framework is then detailed in section 3. Section 4 then describes the details of the plan for routine calibration.

This document is (very) draft, it will be updated in November and be presented to the HCalSG in December. After that meeting it will be updated further leading to a version 1 a few months before launch.

### 1.1 Scope

This document covers routine calibration it does not cover health monitoring (the log of which is documented in RD4).

### 1.2 Structure of Document

### 1.3 Documents

#### 1.3.1 Applicable Documents

AD1	SPIRE PV Phase Plan	SPIRE-RAL-DOC-003131
AD2	SPIRE Calibration Requirements Document	SPIRE-RAL-PRJ-1064
AD3	Sciops Routine Phase Plan	TBW
AD4	SPIRE Operating Modes	SPIRE-RAL-DOC-000320
AD5	SPIRE Uplink Calibration Data	SPIRE-RAL-DOC-002947
AD6	SPIRE AOTs in HSPOT: Entry of Observations and Return of Time and Sensitivity Information	SPIRE-UCF-DOC-002554
AD7	SPIRE Pipeline Description	SPIRE-RAL-DOC-002437

#### 1.3.2 Reference Documents

RD1	SPIRE Science Demonstration Observations	SPIRE-RAL-DOC-002437
RD2	SPIRE Calibration Observation Definitions	SPIRE-RAL-DOC-000000
RD3	SPIRE Astronomical Calibration Sources for Herschel-SPIRE	SPIRE-UCF-NOT-003016
RD4	SPIRE Operational Day Logging Tools Requirements	SPIRE-RAL-DOC-003092

## 2. OBJECTIVES OF ROUTINE PHASE CALIBRATION

### 2.1 General Objectives of Routine Phase Calibration

The main objectives of Routine phase calibration are:



- Perform routine checks on selected calibration parameters;
- Routinely monitor time dependent calibration parameters;
- Use calibration observations to investigate anomalies found the processed data which may be a result of unforeseen changes in calibration parameters;
- Re-establish the fundamental calibration of a selected set of parameters at specific points during routine phase;
- Update calibration files to provide the best possible calibration of SPIRE;
- Verification, validation, optimisation and calibration of any new instrument operating modes that may be deemed necessary to use;
- Verification, validation, optimisation and calibration of any backup mode that may be deemed necessary to use.

### **3. OPERATIONAL FRAMEWORK/ASSUMPTIONS**

#### **3.1 Spacecraft Operations**

TBW

##### **3.1.1 PV Phase and Scientific Demonstration Phase Outcome**

The status of the AOTs and Calibration at the end of the PV Phase (AD1) and Scientific Demonstration (RD1) is assumed to be:

- That the AOTs and the data processing pipelines are verified, optimised, calibrated - ready to use by the astronomical community.

##### **3.1.2 Division of Calibration Time between the Instruments in Routine Phase**

We assume that the nominal 1/7 of the observatory time will be split evenly between the three instruments. We also assume that our sub-instruments will be used regularly enough such that our regular monitoring observations can be carried out as part of a normal sub-instrument operational day.

#### **3.2 SPIRE Operations**

##### **3.2.1 Documentation**

The governing documents are the SPIRE Calibration Requirements Document (AD2), the Sciops Routine Phase Plan (TBW, AD3), and the SPIRE Operating Modes document (AD4). This document is also dependent on: SPIRE Pipeline Description (AD7), SPIRE Uplink Calibration Data (AD5), SPIRE AOTs in HSPOT: Entry of Observations and Return of Time and Sensitivity Information (AD6).

This document then describes how these will be checked, monitored and re-established. It should be used in conjunction with the SPIRE Calibration Observation Definitions (RD2) which gives the procedures to be carried out (although wherever possible observations will be performed with astronomer AOTs) and with SPIRE Astronomical Calibration Sources for





Herschel-SPIRE (RD3) which gives the sources which can be used for calibration observations.

An initial detailed plan scheduling the observations is will be listed in appendix 1.

### 3.2.2 Planning Tools

It is assumed that the observations to be carried out, along with constraints on when they will be observed will be provided to the HSC who will schedule these observations (TBC). These will be provided to the HSC as block for the next period of time (~1 month?), although it might be that changes are required to these observations as our knowledge rapidly increases. The whole of the routine phase calibration will not be provided at the start of the phase.

It is assumed that the latest acceptance tested software necessary for planning observations will be made available to the SPIRE time.

## 4. THE PLAN

Our philosophy will be to observe a few well-known sources many times rather than many different sources. These sources wherever possible should be in regions of long visibility duration, the primary calibrators are not visible most of time and will be observer often whenever possible. Where there are gaps in visibility a source will be found to bridge the gap.

Calibration observations will be done with the AOTs as used by the astronomer wherever possible.

PCAL is used very regularly to transfer and monitor calibration.

Some calibration parameters (TBD) will be checked regularly via calibration observations of the few sources. These calibration parameters will include flux calibration.

Time dependent calibration parameters (to be listed and detailed) will be monitored routinely.

Routine phase Calibration includes the investigation of anomalies although these can not be given (in detail) in this plan, the plan will have to be adapted when these arise. Similarly the verification, validation, optimisation and calibration of any new instrument operating modes or backup modes can not be given in any detail.

Fundamental calibration will be re-established at nominally 6 months, 1 year, 2 year, 3 year since the start of routine phase (points TBC).

All observations will feedback into the calibration tables of SPIRE to procedure the best possible calibration of SPIRE data.



**Project Document**

SPIRE Routine Phase Calibration Plan

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The operational day log will provide a helpful overview of all SPIRE observations (RD4).