1. Introduction

AOTs define the way in which the different types of SPIRE observations are implemented. They are defined using the Herschel Common Uplink System (CUS), which converts user input into a sequence of satellite and instrument commands with appropriate timing. These command sequences use both simple DRCU commands and Command Lists defined specifically for SPIRE observations. One purpose of these tests was to execute as many different AOT types as possible in order to determine if the command sequence and timing was correct, and to exercise the Command Lists used..

For each AOT tested the user inputs were taken from the relevant section of RD01 and the command sequence generated was executed by the instrument.

1.1 Scope

The purpose of this document is to record the current status of the AOT testing at the conclusion of the FM Instrument-Level Test programme. Subsequent testing will continue with

- Integrated System Tests - the Reference Mission Scenario will execute a set of nominal observations
- FS Instrument-Level Test Programme
- FS additional cooldowns
- AVM Tests

1.2 Reference Documents

Ref	Document	Name	Version/Issue No.
RD01	SPIRE AOT Test Plan	SPIRE-RAL-DOC-002720	Issue 1.0
RD02	PFM3 AOT Test Report	SPIRE-RAL-REP-002719	Issue 1.0
RD03	PFM4 AOT Test Report	SPIRE-RAL-REP-002844	Issue 1.1

1.3 Change Record

Document	Change date	Changes
Issue 1.0	**26/09/07**	First Version

2. Summary of AOT Test Status

AOT	Operating Mode	Status	Outstanding SPRs	Comments
Point Source Photometry	POF1 (Chopping)	Not Tested		Non-baseline mode
	POF2 (7 point Jiggle map No nodding)	Not Tested		Non-baseline mode
	POF2 (7 point Jiggle map Nodding)	Successful		Multiple integrations not tested
Small Map Photometry	POF3	Successful		
Large Map Photometry	POF4	Not Tested		Non-baseline mode
	POF5	Successful		Restricted to no-source observations
Spectroscopy Single Pointing	SOF1 (sparse spatial sampling)	Successful		
	SOF2 (int/full spatial sampling)	Successful	SPR-0582	No BSM data generated
	SOF3 (sparse spatial sampling)	Not Tested		Non-baseline mode
	SOF4 (int/full spatial sampling)	Not Tested		Non-baseline mode
Spectroscopy Raster Map	SOF1 (sparse spatial sampling)	Not Tested		Cannot control telescope movement
	SOF2 (int/full spatial sampling)	Not Tested		Cannot control telescope movement
	SOF3 (sparse spatial sampling)	Not Tested		Non-baseline mode
	SOF4 (int/full spatial sampling)	Not Tested		Non-baseline mode

SUBJECT:	**SPIRE AOT Test Plan**		
PREPARED BY:	Tanya Lim, **Sarah Leeks &** Ken **King**		
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Change Record

ISSUE	DATE	Changes
Draft 0.1		First Draft
Draft 0.2	23 February 2006	Updated for PFM3 AOT tests
Issue 1.0	13th December 2006	Updated for PFM4 AOT tests
Issue 1.1	27th September 2007	Clarified Spectral Mapping modes

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TABLES

Glossary

FM	Flight Model
ILT	Instrument Level Testing
PFM3	Proto-Flight Model 3 – the final build of the flight model
TCL	Test Control
TOPE	Test Operations & Procedures Environment

1. INTRODUCTION

1.1 Scope

This document describes the test procedures for the ground operations tests of the SPIRE AOTs. It supersedes two previous documents RD1 and RD2 which were focussed on the PFM1 and PFM2 test campaigns. The format of this document will be similar to the format of the PFM3 calibration and performance test plan (RD3) i.e. each test will be specified using the same format as RD3 with a procedure giving pre-requisites, conditions to be specified when run, manual setup of the test facility and the steps of the automated script to be run.

The purpose of these tests is to check the feasibility and adequacy of the instrument operations defined for the SPIRE AOTs and to generate input data for testing of ground segment data processing software, especially the SPG pipeline.

As with RD3 this document will not provide a detailed schedule and it will be assumed that the observations tests will appear in the daily test plan according to the pre-requisites specified.

All tests will be carried out using the CUS scripts written to implement the SPIRE AOTs. These scripts will be run from TOPE (Test Operations & Procedures Environment, an external interface to SCOS) via Test Control (TCL) scripts that are run from TOPE. These TCL scripts provide the user a way to enter necessary parameters for the test [these are listed under Input sub-sections].
Note that with the nFlash parameters one can make CUS to schedule PCAL flashes during observations as well as at start and end.
Note TCL scripts do not currently give user the chance to say how often Gyro Calibration is done for these tests.

Description of the Input tables found in Sections 4 and 5.
Column "Parameter" gives the name of the relevant parameter that the TCL script gives the user the chance to modify. WARNING, the parameter name may not well describe the parameter so it is essential to read the column description rather than the parameter name (I might remove the parameter name in the future from this document cause of this).
Column "Description" gives a short description of the parameter. The default value is given in brackets. Where applicable the min and max values and their units are given. This is the value that will be used if the user doesn't select anything.
The remaining columns are headed by the test name and within the column the relevant parameters for that test are given.

1.2 Documents

1.2.1 Applicable Documents

1.2.2 Reference Documents

RD1	PFM2 AOT Test List	Tom Babbedge
RD2	Instrument Observations Tests with PFM1 (SPIRE-RAL-Not-002374)	Ken King
RD3	SPIRE PFM3 Performance and Calibration Test Plan	Tanya Lim
RD4	Instrument User Manual (SPIRE-RAL-PRJ-002395)	
RD5	Operating Modes for the SPIRE Instrument (SPIRE-RAL-DOC-000320)	Matt Griffin et al.

2. STANDBY MODES

The CUS scripts assume that the instrument is configured into one of the two SPIRE standby modes – either PHOT_STBY or SPEC_STBY - prior to the test starting. These scripts shall return the instrument to the corresponding standby mode after completion of the observation.

The definition of the standby modes is given in RD4 but is repeated here for clarity

2.1 PHOT_STBY

- The photometer JFETS are powered on, the detector bias set and sampling frequency set
- The detector signals are NOT sampled
- The BSM is powered on, and held in the 'HOME' position.
- MODE = 0x0300
- STEP = 0x0000
- Nominal Housekeeping sampling at 1.0 Hz

2.2 SPEC_STBY

- SMEC is initialised, all trajectory parameters are set to their required values, the scan speed is set to its nominal value and the SMEC is held at the 'HOME' position
- The spectrometer JFETS are powered on, the detector bias set and sampling frequency set
- The detectors signals are NOT sampled
- The BSM is powered on, and held in the 'HOME' position.
- MODE = 0x0400
- STEP = 0x0000
- Nominal Housekeeping sampling at 1.0 Hz
- SCAL is powered on and at the temperature necessary to offset the 'telescope' background
- Selected Telemetry from the SMEC is enabled

3. UPLINK CALIBRATION PARAMETERS

Before AOTs can be run it is necessary to collect calibration parameters used by the operating modes. These are detailed below.

3.1 Nominal Detector Settings

These settings are set when entering STBY mode and remain unchanged during all tests.

Parameter	Comments

Photometer	
Photometer Nominal Bias Frequency	To be finalised during testing. The current adopted value is 130 Hz.
Photometer Nominal Sample Rate	An integer divider of the bias frequency this nominally about 16 Hz. For the 130 Hz frequency setting a divider of 8 (commanded 7) is adopted giving a sample rate of 16.25 Hz
Photometer Nominal Bias Amplitude	This parameter depends on analysis of load curves. The currently adopted value is 16mV.
Photometer Phase	This parameter depends on the bias frequency and amplitude setting. It is also potentially different for different arrays. The values will be determined during the test campaign but it is assumed that this will be similar to the previously determined values of 184.9 degrees for PSW and PMW and 183.5 degrees for PLW for the 130Hz, 16mV combination.
Spectrometer	
Spectrometer Nominal Bias Frequency	To be finalised during testing. The nominal value should be 160 Hz however the current adopted value is 106 Hz as 160 Hz was found to coincide with a noise peak in the facility.
Spectrometer Nominal Sample Rate	An integer divider of the bias frequency this nominally should be 80 Hz i.e. half the 160 Hz value but 53 Hz is adopted for the 106 Hz frequency setting.
Spectrometer Nominal Bias Amplitude	This parameter depends on analysis of load curves. The currently adopted value is 10.71 mV.
Spectrometer Phase	This parameter depends on the bias frequency and amplitude setting. It is also potentially different for different arrays. The values will be determined during the test campaign but it is assumed that this will be similar to the previously determined values of 187.8 degrees for both SSW and SLW for the 106Hz, 10.71mV combination.

3.2 Standard PCAL Flash

This is executed by the VM with Command List 70
Parameters are:

PCAL Low bias value	
PCAL High bias value	
Number of cycles	
Period of a cycle (us)	
DCU data mode (frame type)	
Number of DCU samples per level (half cycle)	
Td, delay to start of DCU sampling (us)	
SCU data mode (frame type and frequency)	
Number of SCU samples per level (half cycle)	

3.3 BSM PID Parameters

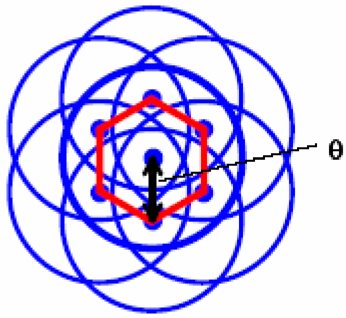
These will be determined during testing.

3.4 BSM Chop Positions

TBD.

3.5 BSM Jiggle Map Positions

3.5.1 Photometer Seven Point Jiggle Map



The positions in the table below assume the jiggle map is defined with the orientation of the chop axis along the horizontal. It is assumed that the source is centred on PSW E8 and the chopping is between PSW E6 and PSW E10.

Position	Chop A	Chop B	Jiggle A	Jiggle B	Comment
1	24677	40859	32768	32768	Centre position, A beam on E6, B beam on E10
2	24009	40191	33833	33833	Upper left
3	24677	40859	34898	34898	Top
4	25344	41527	33833	33833	Upper Right
5	25344	41527	31703	31703	Lower Right
6	24677	40859	30638	30638	Bottom
7	24009	40191	31703	31703	Lower Left
8	24677	40859	32768	32768	Centre position

3.5.2 Photometer Sixty Four Point Jiggle Map

TBD

3.5.3 Spectrometer Ten Point Jiggle Map

TBD

3.5.4 Spectrometer Forty Nine Point Jiggle Map

TBD

3.6 SMEC Standard Positions

Position	**Value**	**Description**
ZPD	*8000 (nominal)*	Zero path difference
HOME	*5000 (Nominal)*	Home position

3.7 SMEC Scan Settings

The nominal scan speed will be set to 0.5mm per second.

Resolution	Scan range (mm)	Start Position	End Position	Scan Time (secs)
High	-3.4 mm to +34mm	HRSTART *(4600)*	HREND *(42000)*	74.8
Medium	-3.4 mm to +3.4 mm	MRSTART *(4600)*	MREND *(11400)*	13.6
Low	-1.0 mm to +1.0 mm	LRSTART *(7000)*	LREND *(9000)*	4.0

3.8 SMEC Step and Integrate Positions

The number of samples per interferogram depends on the required resolution:

Low resolution (R = 1 cm^{-1}):	Scan range	= -0.14 cm to + 0.14 cm = 2,800 μm
	Step size	= 6 μm
	No. of steps	= 466
Medium resolution (R=0.4 cm^{-1})	Scan range	= -0.35 cm to + 0.35 cm = 7,000 μm
	Step size	= 6 μm
	No. of steps	= 1167
High resolution (R=0.04 cm^{-1})	Scan range	= -0.35 cm to + 3.5 cm = 38,500 μm
	Step size	= 6 μm
	No. of steps	= 6417

Spectrometer Tests

3.9 Point Source Observations

These tests will execute a set of scans of the spectrometer at a single pointing. They are implemented using the SpireSpectroPoint CUS script, with different spatial sampling, which utilises the SOF1/SOF2 instrument operating modes.

3.9.1 Assumptions/Open Issues

- The default is to include a PCAL flash at the beginning and end of each observation
- For each resolution start and end positions and scan rate are taken from a calibration file.
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to SPEC_STBY at the end of the AOT
- For laser execution, only one array will be useful.

3.9.2 Procedure

Pre-Requisites

1. Nulling parameters for the lab have been established (via ILT-PERF-SRN see RD3)
2. The hot black body is stable at its operating temperature (1200°C) or an in-band laser line is available.
3. SCAL is on

Conditions Specified When Run

1. Pixel to place the source on (nominally the co-aligned central pixels SSW-D4 and SLW-C3) [how to get this into CUS*]

Manual Procedure

1. Check that the BSM is at the home position
2. Check that the flip mirror is open (lab in view)
3. Check that the external chopper is off and set such that the hot black body is visible to the instrument.
4. Peak up the source on the specified pixel
5. If necessary reset offsets to put the source within range
6. Stop data generation (This assumes that we are now in SPEC_STBY mode)

CUS Procedure

1. Run CUS procedure for SpireSpectroPoint (It is assumed this procedure will automatically do the following)
    a. Moves SMEC to home position
    b. Executes sequence appropriate to entered resolution
    c. Moves the SMEC back to the home position
    d. Puts the mode back to SMEC_STBY

Manual Procedure

1. Restart science data generation

3.9.3 Configurations

All durations are for CUS script only, an additional 20 minutes should be added for peakup, if required.

3.9.3.1 Point source, Sparse sampling, laser (ILT-OPS-SOF1-A)

Source: Laser, Spectral Resolution: High, Priority:1, Duration:10 mins

3.9.3.2 High resolution, point source, black body (ILT-OPS-SOF1-B)

Source: Hot Black Body, Spectral Resolution: High, Priority:1, Duration:10 mins

3.9.4 Inputs

The SpireSpectroPoint.tcl script will ask user for the parameters given in Table 3-1. This script calls the CUS script SpireSpectroPoint. The necessary parameters to be selected for each configuration are given with the corresponding test name in Table 3-1.

Parameter	**SOF1-A**					**SOF1-B**	**SOF2-A**			**SOF2-B**	
	a	b	c	d	e		a	b	b	a	b
sampling	sparse	sparse	sparse	sparse	sparse	sparse	int	int	int	full	full
resolution	H	H+L	H	M	L	H	H	H	DM	H	L
Nrepetitions1	2	2	10	10	20	8	2	20	2	2	2
Nrepetitions2	2	10	2	2	2	2	2	2	2	2	2
nMaps	1	1	1	1	1	1	1	1	1	1	1
NHCycles	2	2	10	0	0	8	2	20	0	2	0
NMCycles	0	0	0	10	0	0	0	0	2	0	0
NLCycles	0	10	0	0	20	0	0	0	0	0	2
nFlashes	0	0	0	0	0	0	0	1	0	0	0
tFlash	2700.0	2700.0	2700.0	2700.0	2700.0		2700.0	1537.5	2700.0	2700.0	2700.0

Table 3-1 Inputs for point source spectrometer test

3.10 Raster Map Observations

These tests will execute a set of scans of the spectrometer at a set of telescope positions forming a raster pattern on the sky. It is implemented using the SpireSpectroRaster CUS script, with differentspatial sampling, which utilises the SOF1/SOF2 instrument operating modes.

3.10.1 Assumptions/Open Issues

- During the tests, to simulate telescope movement to different raster points, the telescope simulator must be moved to a series of new positions. These need to be tabulated before the tests begin (see section 3.10.4
- During the running of the tests the STEP housekeeping parameter indicates when the telescope is moving and to which raster point. It may be necessary to 'tweak' the CUS script to allow enough time to set up the telescope simulator to the correct position.
- For each resolution start and end positions and scan rate are taken from a calibration file.
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to SPEC_STBY at the end of the AOT

3.10.2 Procedure

Pre-Requisites

1. Nulling parameters for the lab have been established (via ILT-PERF-SRN see RD3)
2. The hot black body is stable at its operating temperature (1200°C)

Conditions Specified When Run

1. Raster points to place the source on *Manual Procedure*

1. Check that the BSM is at the home position
2. Check that the flip mirror is open (lab in view)
3. Check that the external chopper is off and set such that the hot black body is visible to the instrument.
4. Peak up the source on the specified pixel
5. If necessary reset offsets to put the source within range
6. Stop data generation (This assumes that we are now in SPEC_STBY mode)

CUS Procedure

1. Run CUS procedure for SpireSpectroRaster (It is assumed this procedure will automatically do the following)
    a. Move SMEC to home position
    b. Execute standard PCAL Flash
    c. Move telescope to first raster position
    d. Execute scans
    e. Repeat raster then scan for all raster positions
    f. Execute standard PCAL Flash
    g. Move the SMEC back to the home position
    h. Put the mode back to SMEC_STBY

Manual Procedure

1. Restart science data generation
2. Move source back to selected pixel using the telescope simulator

3.10.3 Raster positions

Rasters will be implemented by moving the telescope simulator to a set of positions. The raster array will be a 3 x 3 array at the following positions *** how overlap etc the 3x3? Is the CUS assuming the same? Does it matter to CUS without telescope?

Raster_ID	T/S Offset Z	T/S Offset Y	STEP
(0,0)	TBD	TBD	0x0000
(0,1)	TBD	TBD	0x0001
(0,2)	TBD	TBD	0x0002
(1,2)	TBD	TBD	0x0022
(1,1)	TBD	TBD	0x0021
(1,0)	TBD	TBD	0x0020
(2,0)	TBD	TBD	0x0040
(2,1)	TBD	TBD	0x0041
(2,2)	TBD	TBD	0x0042

3.10.4 Configurations for the PFM3 Campaign

3.10.4.1 High resolution sparse map black body (ILT-OPS-SOF2-A)

Source: Hot Black Body, Spectral Resolution: High, sparse spatial resolution Priority:1, Duration :10 mins

3.10.4.2 Medium resolution intermediate map black body (ILT-OPS-SOF2-B)

Source: Hot Black Body, Spectral Resolution: Medium, intermediate spatial resolution Priority:2, Duration :1 hour

3.10.4.3 Medium resolution map black body (ILT-OPS-SOF2-C)

Source: Hot Black Body, Spectral Resolution: Medium, full spatial resolution, Priority:2, Duration : 4.5 hours

3.10.5 Inputs

A TCL script to run CUS script with default parameters and will ask user for the parameters given in Table 3-2 Inputs for raster map spectrometer tests. This script calls the CUS script SpireSpectroRaster. The necessary parameters to be selected for each configuration are given with the corresponding test name in Table 3-2 Inputs for raster map spectrometer tests

Parameter	Description (default)	SOF1-C	SOF2-C	SOF2-D
ssampling	spatial sampling (sparse)	sparse	intermediate	full
resolution	spectral resolution (H)	H	M	M
mapSizeX	Size of map in arcmins. Min 0.0, max 30.0 arcmins (0.0)	TBD	TBD	TBD
mapSizeY	Size of map in arcmins. Min 0.0, max 30.0 arcmins. (0.0)	TBD	TBD	TBD
nRasters	Number of repeats of raster pattern (1)			
nPoints	Number of points in raster pattern (1)	9	9	9
nMaps	Number of jiggle maps at each	1	1	1

	raster point (1)			
nJiggles	Number of jiggle positions in jiggle map (1)	1	10	49
nHMScans	total number of High or Medium resolution scans at each pointing and jiggle position (nHMScans)	8	22	22
nLScans	total number of Low resolution scans at each pointing and jiggle position (nLScans)	0	0	0
nFlash	number of cycles between flashes (999999)	3	6	6

Table 3-2 Inputs for raster map spectrometer tests

3.11 Point Source spectroscopy, using step and integrate scanning (SOF3)

This test will execute a low or medium resolution step and integrate scan of the spectrometer. CUS and TCL scripts to be written. This mode is not offered in HSPOT.

3.11.1 Assumptions/Open Issues

- The same CUS script is used for all applicable resolutions
  - Low resolution
  - Medium resolution
- The SMEC positions are read in from a calibration file
- The BSM chopping parameters are hard coded or read from a calibration file i.e. 2Hz chopping, for 2 seconds
- The BSM chop positions are read from calibration file
- The location of the PCAL flashes is hard coded into the CUS script, 2 PCAL flashes are used for both low and medium resolution scanning.
- The parameters for a PCAL standard flash are hard coded
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to SPEC_STBY at the end of the AOT

3.11.2 Procedure

Pre-Requisites

3. Nulling parameters for the lab have been established (via ILT-PERF-SRN see RD3)
4. The hot black body is stable at its operating temperature (1200°C)

Conditions Specified When Run

1. Pixel to place the source on (nominally the co-aligned central pixels SSW-D4 and SLW-C3)

Manual Procedure

1. Check that the BSM is at the home position
2. Check that the flip mirror is open (lab in view)
3. Check that the external chopper is off and set such that the hot black body is visible to the instrument.
4. Peak up the source on the specified pixel
5. If necessary reset offsets to put the source within range
6. Stop data generation (This assumes that we are now in SPEC_STBY mode)

TOPE Procedure

1. Run TOPE procedure for CUS for SOF3 (It is assumed this procedure will automatically do the following)
   a. Move SMEC to home position
   b. Execute standard PCAL Flash
   c. Chop the BSM for 2 seconds
   d. Move the SMEC to the next position
   e. Repeat chop and move until all positions done
   f. Execute standard PCAL Flash
   g. Move the SMEC back to the home position
   h. Put the mode back to SMEC_STBY

Manual Procedure

3. Restart science data generation
4. Move source back to selected pixel using the telescope simulator

3.11.3 Configurations for the PFM3 Campaign

3.11.3.1 Low resolution step and integrate (ILT-OPS-SOF3-A)

Source: Hot Black Body
Spectral Resolution: Low
Priority: 2
Duration: 226*2seconds*2scans = 904 seconds = 15.06 minutes + 5 minutes overheads due to detector offsets, PCAL flashes and SMEC movement = 20 minutes

3.11.3.2 Medium resolution step and integrate (ILT-OPS-SOF3-B)

Source: Hot Black Body
Spectral Resolution: Medium
Priority: 4
Duration: 1168*2seconds*1scan = 2336 seconds = 40 minutes + 5 minutes overheads = 45 minutes

3.11.4 Inputs

-
- CUS script to be written.

A TCL script to run CUS script with default parameters and will ask user for the parameters given in. This script calls the CUS script SpireSpectro****. The necessary parameters to be selected for each configuration are given with the corresponding test name in. These need to be confirmed once script is written.

Parameter	Description (default)	SOF3-A	SOF3-B
sampling	spatial sampling (sparse)	sparse	sparse
resolution	spectral resolution (H)	L	L
isChopped	Is step-and-integrate mode? (false)	true	true
nLScans	total number of Low resolution scans at each pointing and jiggle position (0)	TBD	TBD
nFlash	number of cycles between flashes (999999)	3	6

4. PHOTOMETER TESTS

4.1 POF1: Point Source with Chop and no Nod

Simple chopping observation. Note this is not offered in HSPOT. CUS (and TCL) script to be written.

4.1.1 Assumptions/Open Issues

- The conditions when running the A version are assumed to be following a cooler recycle
- The BSM chopping parameters are hard coded i.e. 2Hz chopping
- The BSM chop positions are read from calibration file
- The location of the PCAL flashes calculated by HSPOT based on the maximum time between flashes.
- The parameters for a PCAL standard flash are hard coded
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to PHOT_STBY at the end of the AOT
-

4.1.2 Procedure

Pre-Requisites

1. The hot black body is stable at its operating temperature (1200°C)

Conditions Specified When Run

2. Pixel to place the source on (nominally PSW E8)

Manual Procedure

1. Check that the BSM is at the home position
2. Check that the flip mirror is open (lab in view)
3. Check that the external chopper is off and set such that the hot black body is visible to the instrument.
4. Peak up the source on the specified pixel
5. If necessary reset offsets to put the source within range
6. Stop data generation (This assumes that we are now in PHOT_STBY mode)

CUS Procedure

1. Run CUS procedure for POF1 (It is assumed this procedure will automatically do the following)
    a. Execute standard PCAL Flash
    b. Chop the BSM for entered number of seconds
    c. Execute standard PCAL Flash
    d. Put the BSM back to the home position
    e. Put the mode back to PHOT_STBY

Manual Procedure

1. Restart science data generation

4.1.3 Configurations for the PFM3 Campaign

4.1.3.1 Chop Stabilisation (ILT-OPS-POF1-A)

Source: Hot Black Body (does not have to be at stable temperature)
Priority: 1
Duration: 120 minutes

4.1.3.2 Chop When Stable (ILT-OPS-POF1-B)

Source: Hot Black Body
Priority: 1
Duration: 5 minutes

4.1.4 Inputs

- number of chops
- We turn off nodding by not doing it!
-
- Note CUS script is one for POF1 so doesn't do 7-point jiggle.
- CUS script is TBW. Once scripts is written input parameters can be decided.

A TCL script to run CUS script with default parameters and will ask user for the parameters given in. This script calls the CUS script SpirePhotoPointChop?*. The necessary parameters to be selected for each configuration are given with the corresponding test name in

4.2 POF1: Point Source with Chop and Nodding

ABBA nod without jiggle. Note this is not offered in HSPOT. CUS (and TCL) script to be written.

4.2.1 Assumptions/Open Issues

- The BSM chopping parameters are hard coded i.e. 2Hz chopping
- How is the fact that we are (or are not) nodding conveyed to the script? – Not known yet, always nodding in flight – in tests just don't move T/S
- As this script requires manual operations of the telescope simulator, what is the trigger on SCOS to do this?
- The BSM chop positions are read from calibration file, these are the same for both nod positions
- The location of the PCAL flashes calculated by HSPOT based on the maximum time between flashes.
- The parameters for a PCAL standard flash are hard coded
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to PHOT_STBY at the end of the AOT

4.2.2 Procedure

Pre-Requisites

1. The hot black body is stable at its operating temperature (1200°C)

Conditions Specified When Run

1. Pixel to place the source on (nominally PSW E8)
2. Nod pixel (nominally either PSW E4 or PSW E12)

Manual Procedure

1. Check that the BSM is at the home position
2. Check that the flip mirror is open (lab in view)
3. Check that the external chopper is off and set such that the hot black body is visible to the instrument.
4. Peak up the source on both the specified pixels noting the T/S position for each
5. If necessary reset offsets to put the source within range
6. Stop data generation (This assumes that we are now in PHOT_STBY mode)

CUS Procedure

1. Run TOPE procedure for CUS script for POF1 (SpirePhotoPointChop?*) (It is assumed this procedure will automatically do the following)
    a. Execute standard PCAL Flash
    b. Chop the BSM for entered number of seconds
    c. Move source to Nod position
    d. Chop the BSM for entered number of seconds
    e. Move source to Point position
    f. Chop the BSM for entered number of seconds
    g. Move source to Nod position
    h. Chop the BSM for entered number of seconds
    i. Move source to Point position
    j. Chop the BSM for entered number of seconds
    k. Execute standard PCAL Flash
    l. Put the BSM back to the home position
    m. Put the mode back to PHOT_STBY

Manual Procedure

2. Restart science data generation

4.2.3 Configurations

4.2.3.1 Chop and Nod (ILT-OPS-POF1-C)

Source: Hot Black Body
Priority: 1
Duration: 5 minutes

4.2.4 Inputs

- number of chops
- CUS script is TBW. (same as previous but with nod on). Once script is written, parameters for test can be decided upon.

4.3 A TCL script to run CUS script with default parameters and will ask user for the parameters given in. This script calls the CUS script SpirePhoto****. The necessary parameters to be selected for each configuration are given with the corresponding test name in.

POF2: Point Source with 7-point Jiggle without nodding

7 point jiggle map no nodding [actually it is 8 points as the first, centre, point is repeated as per Section 3 and Observing Modes document]

4.3.1 Assumptions/Open Issues

- The BSM chopping parameters are hard coded i.e. 2Hz chopping
- Jiggle cycle is the fixed time – given in a calibration file – freq of chop no of chops to do plus no of jiggle positions – 8s per jiggle position, assume no overhead in BSM movement one pixel to another
- User enters number of cycles
- The location of the PCAL flashes calculated by HSPOT based on the maximum time between flashes.
- On target time does not include PCAL flashes
- Will use a few arc seconds for the offset
- The jiggle positions are read from a calibration file.
- The parameters for a PCAL standard flash are hard coded
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to PHOT_STBY at the end of the AOT

4.3.2 Procedure

Pre-Requisites

1. The hot black body is stable at its operating temperature (1200°C)

Conditions Specified When Run

1. Pixel to place the source on (nominally PSW E8)

Manual Procedure

1. Check that the BSM is at the home position
2. Check that the flip mirror is open (lab in view)
3. Check that the external chopper is off and set such that the hot black body is visible to the instrument.
4. Peak up the source the specified pixel
5. If running the B version of this test offset the source by ?? position units in the chop direction?
6. If necessary reset offsets to put the source within range
7. Stop data generation (This assumes that we are now in PHOT_STBY mode)

CUS Procedure

1. Run TCL procedure for CUS script SpirePhotoPointJiggle (POF2) (It is assumed this procedure will automatically do the following)
    a. Execute standard PCAL flash
    b. Execute 7 point jiggle map
    c. Execute standard PCAL flash
    d. Put the BSM back to the home position
    e. Put the mode back to PHOT_STBY

Manual Procedure

1. Restart science data generation

4.3.3 Configurations for the PFM3 Campaign

4.3.3.1 Compact Jiggle (ILT-OPS-POF2-A)

Source: Hot Black Body

Priority: 3
Duration: 5 minutes

4.3.3.2 Compact Jiggle Offset Source (ILT-OPS-POF2-B)

Source: Hot Black Body
Priority: 3
Duration: 5 minutes

4.3.4 Inputs

- Ask for point source you get small jiggle automatically.
- We turn off nodding by not doing it!
- number of chops

CUS script performs a 7-point jiggle (actually it is 8 point as the centre point is repeated at the end of each jiggle cycle)
A TCL script to run CUS script with default parameters and will ask user for the parameters given in. This script calls the CUS script SpirePhotoPointJiggle. The necessary parameters to be selected for each configuration are given with the corresponding test name in.

Parameter	Description (default)	POF2-A	POF2-B
nCycles	Total number of nod cycles to perform [note the number of chop cycles per nod is a parameter in a file.]. Not sure what happens if put nCycles to zero. (1)		
nNodInts	Number of times to repeat jiggle pattern at each nod position (1)		
nFlash	Number of nod cycles per PCAL flash [if set to > number of nod cycles then do not get flashes during observation, only at the start and end]. (999999)		

4.4 POF2 Point Source with 7-point Jiggle with nodding

ABBA nod with7-point jiggle

4.4.1 Assumptions/Open Issues

- The BSM chopping parameters are set in the CUS calibration file 'chopping.txt'
- This script requires manual operation of the telescope simulator to 'move' the source between two pixels in order to simulate the nodding operation of the satellite. These movement times are indicated in the STEP housekeeping parameter, which is set to 0 when the telescope is moving. The telescope moves between the two positions A and B in the following pattern: ABBAABBAABB…….
- The location of the PCAL flashes calculated by the CUS script based on the maximum time between flashes, which is specified in the calibration file 'SpireParms.txt'.
- The parameters for a PCAL standard flash are set in the CUS calibration file 'flash.txt'
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to PHOT_STBY at the end of the AOT
- The telescope simulator has been calibrated such that the beam can be commanded to either of the two pixels representing the on and off source positions (nominally PWSE8 and PSWE12) within 30 secs.

4.4.2 Procedure

Conditions Specified When Run

1. Pixel to place the source on (nominally PSW E8)
2. Nod pixel (nominally either PSW E4 or PSW E12)
3. Parameters to the Tope script

Pre-Requisites

1. The instrument is in PHOT_STBY mode (hsk at 1Hz, BSM on at HOLD position), but the detectors data sampling is on (ILT PHOT_STBY mode)
2. The hot black body is stable at its operating temperature (1200°C)
3. The external chopper is off and set such that the hot black body is visible to the instrument.
4. The flip mirror is open (lab in view)

Procedure

1. Set the telescope simulator to the on-source position
2. If necessary reset offsets to put the source within range
3. Stop science data generation
4. Run Tope procedure for SpirePhotoJiggle (POF23) with the parameters given below

(It is assumed this procedure will automatically do the following)

   a. Execute standard PCAL Flash
   b. Execute 7-pnt jiggles at positions ABBAABBAA………, inserting PCAL flashes as necessary
   c. Execute standard PCAL Flash
   d. Put the mode back to PHOT_STBY
   e.

5. When the STEP parameter goes to 0, check if the telescope simulator needs to be moved and if so, move it to the next position
6. At end of AOT Restart detector data generation

Post-test configuration

1. The instrument is in PHOT_STBY mode, except that the detector data sampling is on (ILT PHOT_STBY mode)

4.4.3 Configurations

4.4.3.1 Compact jiggle nod small source (ILT-OPS-POF2-C)

Source: Hot Black Body
Priority: 1
Duration: 5 minutes, 30 minutes, 1 hour

4.4.3.2 Compact jiggle nod small offset source (ILT-OPS-POF2-D)

Source: Hot Black Body offset by ¼ pixel
Priority: 2
Duration: 5 minutes, 30 minutes, 1 hour

4.4.4 Inputs

Parameter	**Description (default)**	**POF2-C**			**POF2-D**		
		a	b	c	a	b	c
nCycles	Total number of nod cycles to perform	1	4	12	1	4	12
nNodInts	Number of times to repeat jiggle pattern at each nod position (1)	1	1	1	1	1	1
nFlash	Number of nod cycles per PCAL flash [if set to > number of nod cycles then do not get flashes during observation, only at the start and end].	2	5	7	2	5	7
Total Time		**7m**	**24m**	**1hr 9m**	**7m**	**24m**	**1hr 9m**

4.5 POF3: Point Source in Full Jiggle Map no Raster = Small Map

ABBA nod with 64-point jiggle

4.5.1 Assumptions/Open Issues

- The BSM chopping parameters are set in the CUS calibration file ‘chopping.txt’
- This script requires manual operation of the telescope simulator to ‘move’ the source between two pixels in order to simulate the nodding operation of the satellite. These movement times are indicated in the STEP housekeeping parameter, which is set to 0 when the telescope is moving. The telescope moves between the two positions A and B in the following pattern: ABBAABBAABB…….
- The location of the PCAL flashes calculated by the CUS script based on the maximum time between flashes, which is specified in the calibration file ‘SpireParms.txt’.
- The parameters for a PCAL standard flash are set in the CUS calibration file ‘flash.txt’
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to PHOT_STBY at the end of the AOT
- The telescope simulator has been calibrated such that the beam can be commanded to either of the two pixels representing the on and off source positions (nominally PWSE8 and PSWE12) within 30 secs.

4.5.2 Procedure

Pre-Requisites

1. The hot black body is stable at its operating temperature (1200°C)

Conditions Specified When Run

1. Pixel to place the source on (nominally PSW E8)
2. Nod pixel (nominally either PSW E4 or PSW E12)

Manual Procedure

1. Check that the BSM is at the home position
2. Check that the flip mirror is open (lab in view)
3. Check that the external chopper is off and set such that the hot black body is visible to the instrument.
4. Peak up the source on both the specified pixels noting the T/S position for each
5. If necessary reset offsets to put the source within range
6. Stop data generation (This assumes that we are now in PHOT_STBY mode)

CUS Procedure

1. Run TOPE procedure for CUS SpirePhotoSmall (POF3) (It is assumed this procedure will automatically do the following)
    a. Execute standard PCAL Flash
    b. Execute 64 point jiggle map
    c. Move source to Nod position
    d. Execute 64 point jiggle map
    e. Move source to Point position
    f. Execute 64 point jiggle map
    g. Move source to Nod position
    h. Execute 64 point jiggle map
    i. Move source to Point position
    j. Execute 64 point jiggle map
    k. Execute standard PCAL Flash
    l. Put the BSM back to the home position

m. Put the mode back to PHOT_STBY

Manual Procedure

3. Restart science data generation

4.5.3 Configurations

4.5.3.1 Small map small source centred (ILT-OPS-POF3-A)

Source: Hot Black Body
Priority: 1
Duration: 30 minutes

4.5.3.2 Small map small offset source (ILT-OPS-POF3-B)

Source: Hot Black Body
Priority: 2
Duration: 10 minutes

4.5.4 Inputs

- [number of chop cycles ncycles??= this is set via OpsParams.txt so use that setting??? Or do we want to vary that in these tests? No I don't think so]

CUS script SpirePhotoPointJiggle.
The necessary input parameters are:

Parameter	**Description (default)**	**POF3-A**			**POF3-B**		
		a	b	c	a	b	c
nMaps	Number of times to repeat map	1	4	12	1	4	12
nCycles	Total number of nod cycles to perform	4	4	4	4	4	4
nNodInts	Number of times to repeat jiggle pattern at each nod position (1)	1	1	1	1	1	1
nFlash	Number of nod cycles per PCAL flash [if set to > number of nod cycles then do not get flashes during observation, only at the start and end].	5	16	24	5	16	24
Total Time		**6m**	**29m**	**1hr 26m**	**6m**	**29m**	**1hr 26m**

4.6 POF4: Point Source in Full Jiggle Map with Raster

ABBA nod with 64-point jiggle and raster. Note AOR is not implemented in HSPOT, so it is not available to users.

4.6.1 Assumptions/Open Issues

- The BSM chopping parameters are hard coded i.e. 2Hz chopping
- As this script requires manual operations of the telescope simulator, what is the trigger on SCOS to do this?
- The BSM chop positions are read from calibration file, these are the same for both nod positions
- The parameters for a PCAL standard flash are hard coded
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to PHOT_STBY at the end of the AOT
- CUS and TCL scripts TBW

4.6.2 Procedure

Pre-Requisites

1. The hot black body is stable at its operating temperature (1200°C)

Conditions Specified When Run

1. Pixel to place the source on (nominally PSW E8)
2. Nod pixel (nominally either PSW E4 or PSW E12)

Manual Procedure

1. Check that the BSM is at the home position
2. Check that the flip mirror is open (lab in view)
3. Check that the external chopper is off and set such that the hot black body is visible to the instrument.
4. Peak up the source on both the specified pixels noting the T/S position for each
5. If necessary reset offsets to put the source within range
6. Stop data generation (This assumes that we are now in PHOT_STBY mode)

CUS Procedure

1. Run CUS procedure for SpirePhotoLargeRaster (POF4) (It is assumed this procedure will automatically do the following) (This sequence to be updated)
    a. Execute standard PCAL Flash
    b. Execute 64 point jiggle map
    c. Move source to Nod position
    d. Execute 64 point jiggle map
    e. Move source to Point position
    f. Execute 64 point jiggle map
    g. Move source to Nod position
    h. Execute 64 point jiggle map
    i. Move source to Point position
    j. Execute 64 point jiggle map
    k. Execute standard PCAL Flash
    l. Put the BSM back to the home position
    m. Put the mode back to PHOT_STBY
    n. Raster bit****

Manual Procedure

7. Restart science data generation

4.6.3 Configurations for the PFM3 Campaign

4.6.3.1 Small raster map small source centred (ILT-OPS-POF3-A)

Source: Hot Black Body (Can change source for each sub-raster; 4 raster positions, flash in middle)
Raster Positions: Move 2 arc minutes each step + Y, -Z, -Y (3 steps)
Priority: 1
Duration: ***

[***note that cause of rastering this isn't a "small map" observing mode!***]

4.6.4 Inputs

CUS script performs a 7-point jiggle (actually it is 8 point as the centre point is repeated at the end of each jiggle cycle)
CUS script SpirePhoto*** - not written yet.
Probably necessary input parameters are (these need to be confirmed when scripts are written. Input table will be made then).
mapSizeX
mapSizeY
stepSizeX

- stepSizeY

and

```
bool isRasterMap = true;
   int nRasters = 1;
   int nPoints = 1;
   int nMaps = 1;
```

- int nCycles = 1;
- int nNodInts =1;

```
   int nCal = 999999;
   int nFlash = 999999;
```

4.7 POF5: SCAN MAP = LARGE MAP

Default is Scan map no chopping

4.7.1 Assumptions/Open Issues

- We cannot properly simulate a source passing through the fov during multiple scans in a map but we might try to simulate a source by having the hot BB in the fov but blocking it except for a short (~0.5sec) period during a single scan.
- It is assumed that HK data generation is unaffected and that science data generation is stopped by transition back to PHOT_STBY at the end of the AOT

4.7.2 Procedure

Conditions to be specified when run

1. Whether source is to be simulated or not
2. Parameters to AOT TOPE script

Pre-Requisites

1. The instrument is in PHOT_STBY mode (hsk at 1Hz, BSM on at HOLD position), but the detectors data sampling is on (ILT PHOT_STBY mode)
2. If a source is to be simulated check that:
    a. the Hot BB is stable at its operating temperature (1200°C)
    b. the external chopper is off and set such that the hot black body is visible to the instrument.
    c. the telescope simulator is set on the central photometer pixel
    d. the flip mirror is open (lab in view)
    e. the input beam is blocked and someone is ready to unblock it

Procedure

5. Stop science data sampling
6. Run Tope procedure for SpirePhotoLargeScan (POF5) with the parameters given below

(It is assumed this procedure will automatically do the following)

   f. Execute standard PCAL Flash
   g. Take detector data for the specified time (executing PCAL flashes at regular intervals)
   h. Execute standard PCAL Flash
   i. Put the mode back to PHOT_STBY

8. Approximatly half way through step 1b (the data taking) the source may be unblocked once for a period of ~ 0.5 secs, if required
9. At end of AOT Restart detector data generation

Post-test configuration

2. The instrument is in PHOT_STBY mode, except that the detector data sampling is on (ILT PHOT_STBY mode)

4.7.3 Configurations

4.7.3.1 Scan Map No Source (ILT-OPS-POF5-A)

Source: None (CBB or lab in fov)

Priority: 1
Duration(s): a) 5 minutes b) 20 minutes c)1 hour d) 4hours e) 12 hours

4.7.3.2 Scan Map With Source Short (ILT-OPS-POF5-B)

Source: Hot Black Body
Priority: 2
Duration: 5 minutes

4.7.3.3 Scan Map With Source Long (ILT-OPS-POF5-C)

Source: Hot Black Body
Priority: 2
Duration: 1hour

4.7.4 Inputs

CUS script SpirePhotoLargeScan.
The necessary input parameters (that CS/IE might want to change) are

Parameter	**Description (default)**	**POF5-A**					**POF5-B**	**POF5-C**
		a	b	c	d	e		
ScanLength	Length of map in arcmins. (Min value is 4.0 and max value is 1200.0)	10	30	60	200	600	10	60
CrossScanLength	Height of map in arcmins (Min value is 0.0 and max value is 120.0	10	30	60	120	120	10	60
nMaps	Number of times to repeat map (1) Must be 1	1	1	1	1	1	1	1
NCycles	Number of scan lines in map	4	9	16	32	32	4	16
nFlash	Number of scan lines between PCAL flashes	5	10	17	6	3	5	17
Total Time		**7m**	**21m**	**53m**	**4h15m**	**11h24m**	**7m**	**53m**

1. INTRODUCTION

This document reports the results of the execution of several instantiated AOTs during the PFM3 test campaign.

AOTs define the way in which the different types of SPIRE observations are implemented. They are defined using the Herschel Common Uplink System (CUS), which converts user input into a sequence of satellite and instrument commands with appropriate timing. These command sequences use both simple DRCU commands and Command Lists defined specifically for SPIRE observations. One purpose of these tests was to execute as many different AOT types as possible in order to determine if the command sequence and timing was correct, and to exercise the Command Lists used.

For each AOT tested the user inputs were taken from the relevant section of RD01 and the command sequence generated was executed by the instrument.

1.1 Scope

The purpose of this test was

- To execute as many different instantiated AOT types as possible in order to confirm correct command sequencing and timing, and correct execution of command lists. (*This was limited by both the number of AOTs defined at the time and the instrument operational modes previously verified*)
- To generate data for testing the latest version of the SPIRE pipeline (version 0.3). (*This was limited to baseline operational modes only*)

1.2 Reference Documents

Ref	Document Name	Version/Issue No.
RD01	SPIRE AOT Test Plan (SPIRE-RAL-DOC_002720)	Issue 0.2
RD02	SPIRE Instrument User Manual (SPIRE-RAL-PRJ-002395)	Issue 1.0

1.3 Change Record

Document	Change date	Changes
Issue 1.0	**22/08/06**	First Version

TABLE OF CONTENTS

2. Summary of AOT Tests

2.1 Instrument Configuration

- All tests start with the instrument in the appropriate standby mode (PHOT_STBY or SPEC_STBY) see RD02. (*Note: During these tests it was not possible to switch on the SCAL. Thus the instrument was not configured completely into the SPEC_STBY mode. This may partially explain the saturation of detectors during spectrometer observations.*)

- All observations have a PCAL flash at the beginning and end (some also have PCAL flashes within the operations)

2.2 Executed AOT Tests

Test Case	Test Purpose	OBSIDs
ILT-OPS-POF2-C	Jiggle Map with source on central pixel	3000E420
ILT-OPS-POF2-D	Jiggle Map with source offset from central pixel	3000E425
ILT-OPS-POF2-Da	Jiggle Map with source offset from central pixel, full ABBA nod cycle	3000E426
ILT-OPS-POF5-A	Scan Map with no PCAL flashes inserted	3000E41C
ILT-OPS-POF5-Aa	Scan Map with PCAL flashes inserted	3000E449, 3000E44A
ILT-OPS-SOF1-B	Point Source Spectrum, High Resolution	3000E440, 3000E444

2.3 AOT Results

Test Case	Result	SPRs Raised
ILT-OPS-POF2-C	• Missing last jiggle cycle data	SPR-0508
	• STEP parameter was always set to 1 for all Nod positions	SPR-0509
	• Non-optimal sampling of the BSM position and detector signal	SPR-0510
	• BSM performance (movement to chop position) was noted as being poor	
ILT-OPS-POF2-D	• Missing last jiggle cycle data	SPR-0508
	• STEP parameter was always set to 1 for all Nod positions	SPR-0509
	• Non-optimal sampling of the BSM position and detector signal	SPR-0510
	• BSM performance (movement to chop position) was noted as being poor	

ILT-OPS-POF2-Da	• Missing last jiggle cycle data	SPR-0508
	• STEP parameter was always set to 1 for all Nod positions	SPR-0509
	• Non-optimal sampling of the BSM position and detector signal	SPR-0510
	• BSM performance (movement to chop position) was noted as being poor	
ILT-OPS-POF5-A	Completed Successfully	
ILT-OPS-POF5-Aa	Completed Successfully	
ILT-OPS-SOF1-B	• Detector data was saturated during the FTS scans.	SPR-0511
	• The last FTS scan did not complete before the reconfiguration of the SMEC	SPR-0512
	• The SMEC hit the mechanical stop at the maximum Optical Path Difference	SPR-0525
	• The scan range used for the high resolution spectral scans runs from the 'home' position to maximum OPD – this is inefficient	SPR-0526
All Tests	During PCAL Flashes, part of the data from a Building Block (a few samples) is found in the subsequent BB data	SPR-0507

3. Detailed Test Results

3.1 7-pnt Jiggle Mapping

3.1.1 Configuration

- The instrument was placed into the PHOT_STBY mode before execution of the AOT
- In order to be able to simulate nodding of the Herschel telescope the movement time between on-source and nodding positions was increased to 3 mins to allow time for the operator to 'move' the input beam. This should have no affect on the data.
- For on-source BBs (Nod position A) the beam was centred on pixel PSWE8 and chopped between PSWE6 and PSWE10. For off-source BBs (Nod position B) the beam was centred on pixel PSWE12 and chopped between PSWE10 and PSWE14

3.1.2 Test Case: ILT-OPS-POF2-C

OBSID: 3000E420

Description: 7-pnt jiggle with one complete jiggle cycle on-source and one at the nod position (i.e AB nodding)
Source (Hot BB) is at the centre of the beam

Results:

- Completed successfully

- BSM performance (movement to chop position) was noted as being poor

- The sampling of the BSM position and detector signal did not seem to be set in the most optimal way:

  - For the detector data, the first sample for each chop half-cycle seemed to be taken too early. This meant that the last point in the previous chop half cycle was very close in time to the first point in the next half-cycle.

  - For the BSM position sampling, there was a gap (~30ms) at the end of each chop half-cycle before the sampling of the next half-cycle started. For the pipeline software, it may make it easier to more accurately pinpoint the moment the BSM changed position if the sampling of BSM was continuous (independent of BSM position).

- The detector timeline in the 7-point jiggle maps correctly shows data for 8 different chop/jiggle positions. However, the BSM timeline does not contain any data giving the BSM position during the last jiggle cycle (only 7 positions are present). These data are completely missing - ie. they were not spuriously placed into a different building block or between building blocks: no packets were received for that position at all.

- The housekeeping STEP parameter was always set to 1 for all Nod positions

- During PCAL Flashes, part of the data from a Building Block (a few samples) is found in the subsequent BB data.

3.1.3 Test Case: ILT-OPS-POF2-D

OBSID: 3000E425

Description: 7-pnt jiggle with one complete jiggle cycle on-source and one at the nod position (i.e AB nodding)
Source (Hot BB) is offset from the centre of the beam by approximately 0.5 of the PMW beam size

Results:

- Completed successfully
- BSM performance (movement to chop position) was noted as being poor
- Non-optimal sampling of the BSM position and detector signal (see 3.1.2 Test Case: ILT-OPS-POF2-C)
- Missing last jiggle cycle data (see 3.1.2 Test Case: ILT-OPS-POF2-C)
- The housekeeping STEP parameter was always set to 1 for all Nod positions
- During PCAL Flashes, part of the data from a Building Block (a few samples) is found in the subsequent BB data.

3.1.4 Test Case: ILT-OPS-POF2-Da

OBSID: 3000E426

Description: 7-pnt jiggle with one complete jiggle cycle on-source and one at the nod position, repeated twice (i.e ABBA nodding)
Source (Hot BB) is offset from the centre of the beam by approximately 0.5 of the PMW beam size

Results:

- Completed successfully
- BSM performance (movement to chop position) was noted as being poor
- Non-optimal sampling of the BSM position and detector signal (see 3.1.2 Test Case: ILT-OPS-POF2-C)
- Missing last jiggle cycle data (see 3.1.2 Test Case: ILT-OPS-POF2-C)
- The housekeeping STEP parameter was always set to 1 for all Nod positions
- During PCAL Flashes, part of the data from a Building Block (a few samples) is found in the subsequent BB data

3.2 Scan Mapping

3.2.1 Configuration

- The instrument was placed into the PHOT_STBY mode before execution of the AOT
- No movement of the telescope simulator was made so no source is expected to be seen in the map

3.2.2 Test Case: ILT-OPS-POF5-A

OBSID: 3000E41C

Description: Scan Map: 60 arcmin x 40 arcmin, no source in beam
10 scan lines of length 60 armin

Results:

- Completed successfully
- During PCAL Flashes, part of the data from a Building Block (a few samples) is found in the subsequent BB data

3.2.3 Test Case: ILT-OPS-POF5-Aa

OBSID: 3000E449

Description: Scan Map: 180 arcmin x 120 arcmin, no source
30 scan lines of length 180 armin, with a PCAL flash every 8 scan lines

Results:

- Completed successfully
- During PCAL Flashes, part of the data from a Building Block (a few samples) is found in the subsequent BB data

OBSID: 3000E44A

Description: Scan Map: 180 arcmin x 120 arcmin, no source
30 scan lines of length 180 armin, with a PCAL flash every 8 scan lines

Results:

- Completed successfully
- During PCAL Flashes, part of the data from a Building Block (a few samples) is found in the subsequent BB data

3.3 Spectrometer Point Source

3.3.1 Configuration

- The instrument was placed into the SPEC_STBY mode before execution of the AOT

Note: during these observations the last scan did not complete.

3.3.2 Test Case: ILT-OPS-SOF1-B

OBSID: 3000E440
Description: 8 High Resolution FTS scans of Hot BB

Results:

- During these observations the last FTS scan did not complete before the reconfiguration of the SMEC
- The detectors were saturated during the FTS scans. This may be due to the fact that the SCAL was not used to null the Spectrometer signal.
- During PCAL Flashes, part of the data from a Building Block (a few samples) is found in the subsequent BB data

OBSID: 3000E444
Description: 8 High Resolution FTS scans of Hot BB

Results:

- During these observations the last FTS scan did not complete before the reconfiguration of the SMEC
- The detectors were saturated during the FTS scans. This may be due to the fact that the SCAL was not used to null the Spectrometer signal.
- During PCAL Flashes, part of the data from a Building Block (a few samples) is found in the subsequent BB data

1. Introduction

This document reports the results of the execution of several instantiated AOTs during the PFM4 test campaign.

AOTs define the way in which the different types of SPIRE observations are implemented. They are defined using the Herschel Common Uplink System (CUS), which converts user input into a sequence of satellite and instrument commands with appropriate timing. These command sequences use both simple DRCU commands and Command Lists defined specifically for SPIRE observations. One purpose of these tests was to execute as many different AOT types as possible in order to determine if the command sequence and timing was correct, and to exercise the Command Lists used.

For each AOT tested the user inputs were taken from the relevant section of RD01 and the command sequence generated was executed by the instrument.

1.1 Scope

The purpose of this test was

- To execute as many different instantiated AOT types as possible in order to confirm correct command sequencing and timing, and correct execution of command lists. (*This was limited by both the number of AOTs defined at the time and the instrument operational modes previously verified*)
- To generate data for testing the latest version of the SPIRE pipeline (version 0.5).

1.2 Reference Documents

Ref	Document Name	Version/Issue No.
RD01	SPIRE AOT Test Plan (SPIRE-RAL-DOC_002720)	Issue 1.0
RD02	SPIRE Instrument User Manual (SPIRE-RAL-PRJ-002395)	Issue 1.0

1.3 Change Record

Document	Change date	Changes
Issue 1.0	**01/03/07**	First Version

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2. Summary of AOT Tests

2.1 Instrument Configuration

- All tests start with the instrument in the appropriate standby mode (PHOT_STBY or SPEC_STBY) see RD02.

- All observations have a PCAL flash at the beginning and end (some also have PCAL flashes within the operations)

2.2 AOT Tests Summary

This table lists the AOTs carried out during POF4.
Highlighted tests have severe problems identified with them and should not be used for pipeline testing.

OBSID	Test Case	Description
30011547	ILT-OPS-POF2-Ca	Data for the 'on' part of the third PCAL flash in each cycle is missing.
3001154A	ILT-OPS-POF3-Aa	COLLECT_GARBAGE cmd failed at start and all subsequent cmds failed
300115AB	ILT-OPS-POF2-Ca	Only half a PCAL flash performed at each end of the test. At the end of the test, the BSM was seen to be along way from the nominal position in the chop direction.
300115AC	ILT-OPS-POF2-Ca	Only half a PCAL flash performed at each end of the test. At the end of the test, the BSM was seen to be along way from the nominal position in the chop direction.
300115B1	ILT-OPS-POF2-Ca	At the end of the test, the BSM was seen to be along way from the nominal position in the chop direction.
300115B5	ILT-OPS-POF2-Ca	At the end of the test, the BSM was seen to be along way from the nominal position in the chop direction. Source was being moved during the observation
30011626	ILT-OPS-POF2-Ca	Jiggle Map with source on central pixel
30011627	ILT-OPS-POF3-Aa	Didn't go to correct position s for 64 pnt map
30011628	ILT-OPS-POF5-Aa	Large Scan Map (7mins)
30011647	ILT-OPS-POF5-Aa	Large Scan Map (7mins)
30011648	ILT-OPS-POF5-Ab	Large Scan Map (21mins)
30011649	ILT-OPS-POF5-Ac	Large Scan Map (53mins)
3001164A	ILT-OPS-POF5-Ad	Large Scan Map (255mins) – not known if successful – unable to read data into DP
300116DC	ILT-OPS-SOF1-Aa	Wrong scan speed (0.0525mm/s instead of 0.525)
300116DD	ILT-OPS-SOF1-Aa	Wrong scan speed (0.0525mm/s instead of 0.525). Scan end out of limit at 42.1 mm
30011701	ILT-OPS-POF2-Ca	Manual 'nod' of telescope position carried out at wrong time External chopper was on
30011702	ILT-OPS-POF2-Ca	Jiggle Map with source on central pixel
300117FD	ILT-OPS-SOF1-Aa	Possibly no source
300117FE	ILT-OPS-SOF1-Aa	Sparse High Res Spectrum, Laser on SSWD3, SCAL @ 67.90K
300117FF	ILT-OPS-SOF1-Aa	Sparse High Res Spectrum, Laser on SSWD2, SCAL @ 67.90K
30011800	ILT-OPS-SOF1-Ad	Sparse Medium Res Spectrum No Source (HotBB warming up), SCAL @ 67.90K
30011801	ILT-OPS-SOF1-Ae	Sparse Low Res Spectrum No Source (HotBB warming up), SCAL @

		67.90K
30011802	ILT-OPS-SOF1-Ab	Sparse H+L Res Spectrum No Source (HotBB warming up), SCAL @ 67.90K
30011803	ILT-OPS- SOF2-Ac	BSM did not move during observation
30011804	ILT-OPS- SOF2-Bb	BSM did not move during observation
3001180D	ILT-OPS-POF3-Aa	Map positions not correct
300118E3	ILT-OPS-POF2-Ca	Jiggle Map viewing ColdBB at 6.7k
300118E5	ILT-OPS-POF2-Ca	Viewing lab (HotBB switched on part way through test)
300118E6	ILT-OPS-POF2-Ca	Jiggle Map with source (HotBB) on central pixel
300118E7	ILT-OPS-POF2-Da	Jiggle Map with source (HotBB) offset from central pixel (~4" +y, +z)
300118E8	ILT-OPS-POF3-Aa	Small Map with central source (HotBB) (1' beam)
300118E9	ILT-OPS-POF3-Ba	Small Map with offset source (HotBB) (1' beam)
300118EA	ILT-OPS-POF3-Ca	Small Map, viewing chopper, No source
300118EB	ILT-OPS-POF3-Ab	Small Map with HotBB central source (0.4' beam)
300118FE	ILT-OPS-SOF1-Aa	Sparse High Res Spectrum, Signal saturated as SCAL not on
30011900	ILT-OPS-SOF1-Aa	Sparse High Res Spectrum, SCAL @80K
30011901,	ILT-OPS- SOF2-Ac	Done with Sparse sampling
30011902	ILT-OPS- SOF2-Ac	BSM did not move
30011904	ILT-OPS- SOF2-Ac	Intermediate Medium Res Spectral Map
30011905	ILT-OPS- SOF2-Bb	Full Low Res Spectral Map

2.3 AOT Results

Test Case	Result	SPRs Raised
ILT-OPS-POF2-Ca	Completed Successfully	
ILT-OPS-POF2-Da	Completed Successfully	
ILT-OPS-POF3-Aa	Completed Successfully	
ILT-OPS-POF3-Ab	Completed Successfully	
ILT-OPS-POF3-Ba	Completed Successfully	
ILT-OPS-POF3-Ca	Completed Successfully	
ILT-OPS-POF5-Aa	Completed Successfully	
ILT-OPS-POF5-Ab	Completed Successfully	
ILT-OPS-POF5-Ac	Completed Successfully	
ILT-OPS-SOF1-Aa	Completed Successfully	
ILT-OPS-SOF1-Ab	Completed Successfully	
ILT-OPS-SOF1-Ad	Completed Successfully	
ILT-OPS-SOF1-Ae	Completed Successfully	
LT-OPS- SOF2-Ac ILT-OPS- SOF2-Bb	No BSM data sampled during the AOTs.	SPR-0582

3. Detailed Test Results

3.1 7-pnt Jiggle Mapping

3.1.1 Configuration

- The instrument was placed into the PHOT_STBY mode before execution of the AOT
- In order to be able to simulate nodding of the Herschel telescope the movement time between on-source and nodding positions was increased to 3 mins to allow time for the operator to 'move' the input beam. This should have no affect on the data.
- For on-source BBs (Nod position A) the beam was centred on pixel PSWE8 and chopped between PSWE6 and PSWE10. For off-source BBs (Nod position B) the beam was centred on pixel PSWE12 and chopped between PSWE10 and PSWE14

3.1.2 Test Case: ILT-OPS-POF2-Ca

OBSID: 30011626, 30011702, 300118E3, 300118E6

Description: 7-pnt jiggle with one complete jiggle cycle on-source and one at the nod position (i.e AB nodding)
Source (Hot BB) is at the centre of the beam

Results:
- Completed successfully

3.1.3 Test Case: ILT-OPS-POF2-Da

OBSID: 300118E7

Description: 7-pnt jiggle with one complete jiggle cycle on-source and one at the nod position (i.e AB nodding)
Source (Hot BB) is offset from the centre of the beam by approximately 0.5 of the PMW beam size

Results:
- Completed successfully

3.2 Small Map

3.2.1 Configuration

- The instrument was placed into the PHOT_STBY mode before execution of the AOT

3.2.2 Test Case: ILT-OPS-POF3-Aa

OBSID: 300118E8

Description: Small Map with 4 nod cycles. Source at centre of map

Results:
- Completed successfully

3.2.3 Test Case: ILT-OPS-POF3-Ab

OBSID: 300118EB
Description: Small Map with 4 nod cycles. Source at centre of map. Repeated 2 times

Results:

- Completed successfully

3.2.4 Test Case: ILT-OPS-POF3-Ba

OBSID: 300118E9
Description: Small Map with 4 nod cycles. Source offset from centre of map

Results:

- Completed successfully

3.2.5 Test Case: ILT-OPS-POF3-Ca

OBSID: 300118EA
Description: Small Map with 4 nod cycles. No source

Results:

- Completed successfully

3.3 Scan Mapping

3.3.1 Configuration

- The instrument was placed into the PHOT_STBY mode before execution of the AOT
- No movement of the telescope simulator was made so no source is expected to be seen in the map

3.3.2 Test Case: ILT-OPS-POF5-Aa

OBSID: 30011628, 30011647
Description: Scan Map: 10 arcmin x 10 arcmin, no source in beam
4 scan lines of length 10 armin
Results:

- Completed successfully

3.3.3 Test Case: ILT-OPS-POF5-Ab

OBSID: 30011648
Description: Scan Map: 30 arcmin x 30 arcmin, no source
9 scan lines of length 30 arcmin

Results: • Completed successfully

3.3.4 Test Case: ILT-OPS-POF5-Ac

OBSID: 30011649
Description: Scan Map: 60 arcmin x 60 arcmin, no source
16 scan lines of length 60 arcmin
Results:
- Completed successfully

3.3.5 Test Case: ILT-OPS-POF5-Ad

OBSID: 3001164A
Description: Scan Map: 200 arcmin x 120 arcmin, no source
32 scan lines of length 200 arcmin
Results:
- Completed successfully???? This test was carried out overnight. I have been unable to read the data using DP as the memory used is too great.

3.4 Spectrometer Point Source

3.4.1 Configuration

- The instrument was placed into the SPEC_STBY mode before execution of the AOT

3.4.2 Test Case: ILT-OPS-SOF1-Aa

OBSID: 300117FE, 300117FF, 30011900
Description: 4 High Resolution FTS scans of Hot BB

Results:
- Completed successfully

3.4.3 Test Case: ILT-OPS-SOF1-Ab

OBSID: 30011802
Description: 4 High Resolution + 10 Low resolution FTS scans

Results:
- Completed successfully

3.4.4 Test Case: ILT-OPS-SOF1-Ad

OBSID: 30011800
Description: 10 Medium Resolution FTS scans

Results:
- Completed successfully

3.4.5 Test Case: ILT-OPS-SOF1-Ae

OBSID: 30011801
Description: 20 Low resolution FTS scans

Results:

- Completed successfully

3.5 Spectrometer Map

3.5.1 Configuration

- The instrument was placed into the SPEC_STBY mode before execution of the AOT

3.5.2 Test Case: ILT-OPS-SOF2-Ac

OBSID: 30011904
Description: 4 Medium Resolution FTS scans with Intermediate spatial sampling

Results:

- Completed successfully
- No BSM data sampled during the AOTs

3.5.3 Test Case: ILT-OPS-SOF2-Bb

OBSID: 30011905
Description: 4 Low Resolution FTS scans with Full spatial sampling

Results:

- Completed successfully
- No BSM data sampled during the AOTs