



**SUBJECT:** **SPIRE AOT Test Plan**

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## Project Document

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**Change Record**

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### 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
-----------	----------





<b>Photometer</b>	
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 <u>and</u> 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.
<b>Spectrometer</b>	
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 <u>and</u> 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**

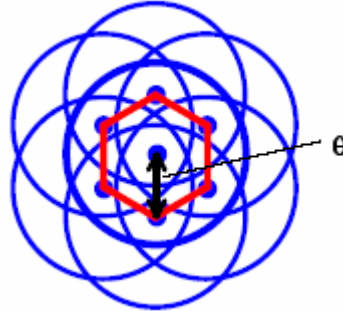
These will be determined during testing.

### 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.

<b>Resolution</b>	<b>Scan range (mm)</b>	<b>Start Position</b>	<b>End Position</b>	<b>Scan Time (secs)</b>
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)	LTREND (9000)	4.0

**3.8 SMEC Step and Integrate Positions**

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

- Low resolution ( $R = 1 \text{ cm}^{-1}$ ):
  - Scan range = -0.14 cm to + 0.14 cm = 2,800  $\mu\text{m}$
  - Step size = 6  $\mu\text{m}$
  - No. of steps = 466
- Medium resolution ( $R=0.4 \text{ cm}^{-1}$ ):
  - Scan range = -0.35 cm to + 0.35 cm = 7,000  $\mu\text{m}$
  - Step size = 6  $\mu\text{m}$
  - No. of steps = 1167
- High resolution ( $R=0.04 \text{ cm}^{-1}$ ):
  - Scan range = -0.35 cm to + 3.5 cm = 38,500  $\mu\text{m}$
  - Step size = 6  $\mu\text{m}$
  - 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 for the PFM3 Campaign

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

#### 3.9.3.1 High resolution, point source, 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

**3.9.3.3 Medium resolution, point source, laser (ILT-OPS-SOF1-C)**

Source: Laser, Spectral Resolution: Medium, Priority:3, Duration:10 mins

**3.9.3.4 Medium resolution, point source, black body (ILT-OPS-SOF1-D)**

Source: Hot Black Body, Spectral Resolution: Medium, Priority:3, Duration:10 mins

**3.9.3.5 Low resolution, point source, laser (ILT-OPS-SOF1-E)**

Source: Laser, Spectral Resolution: Low, Priority: 2, Duration:10 mins

**3.9.3.6 Low resolution, point source, black body (ILT-OPS-SOF1-F)**

Source: Hot Black Body, Spectral Resolution: Low, Priority: 2, Duration:10 mins

**3.9.3.7 High plus Low resolution, point source, laser (ILT-OPS-SOF1-G)**

Source: Laser, Spectral Resolution: Low, Priority: 3, Duration:10 mins

**3.9.3.8 High plus Low resolution, point source, black body (ILT-OPS-SOF1-H)**

Source: Hot Black Body, Spectral Resolution: High+Low, Priority: 3, Duration:10 mins

**3.9.3.9 Medium resolution, intermediate spatial sampling, black body (ILT-OPS-SOF1-I)**

Source: Hot Black Body, Spectral Resolution: Medium, Priority: 2, Duration:60 mins

**3.9.3.10 Medium resolution, full spatial sampling map, black body (ILT-OPS-SOF1-J)**

Source: Hot Black Body, Spectral Resolution: Medium, Priority: 2, Duration:260 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	Description (default value)	SOF1-A SOF1-B	SOF1-C SOF1-D	SOF1-E SOF1-F	SOF1-G SOF1-H	SOF1-I	SOF1-J
sampling	spatial sampling (sparse)	sparse	sparse	sparse	sparse	intermediate	full
resolution	spectral resolution (H)	H	M	L	H+L	M	M
nMaps = 1	(1)						
nHMScans	total number of High or Medium resolution scans at each pointing and jiggle position (0)	8	44		4	22	22
nLScans	total number of Low resolution scans at each pointing and jiggle position (0)			220	110		



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nFlash	number of cycles between flashes (999999) <sup>1</sup>	3	3	3	3	6	6
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**Table 3-1 Inputs for point source spectrometer test**

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<sup>1</sup> Note that a number greater than the number of cycles\*\*\* results in no extra PCAL flashes during the observation, i.e. there will then only be ones at the start and end of the observation.



### 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 **Error! Reference source not found.**).
- 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?

<b>Raster_ID</b>	<b>T/S Offset Z</b>	<b>T/S Offset Y</b>	<b>STEP</b>
(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

<b>Parameter</b>	<b>Description (default)</b>	<b>SOF2-A</b>	<b>SOF2-B</b>	<b>SOF2-C</b>
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





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	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:  $226 * 2 \text{seconds} * 2 \text{scans} = 904 \text{ seconds} = 15.06 \text{ minutes} + 5 \text{ minutes overheads due to detector offsets, PCAL flashes and SMEC movement} = 20 \text{ minutes}$

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

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

**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.

<b>Parameter</b>	<b>Description (default)</b>	<b>SOF3-A</b>	<b>SOF3-B</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*



- Restart science data generation

### 4.2.3 Configurations for the PFM3 Campaign

#### 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.**



### 4.3 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 with 7-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 for the PFM4 Campaign**

**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
<b>Total Time</b>		<b>7m</b>	<b>24m</b>	<b>1hr 9m</b>	<b>7m</b>	<b>24m</b>	<b>1hr 9m</b>



## 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 for the PFM4 Campaign**

**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
<b>Total Time</b>		<b>6m</b>	<b>29m</b>	<b>1hr 26m</b>	<b>6m</b>	<b>29m</b>	<b>1hr 26m</b>



## 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. Approximately 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 for the PFM4 Campaign

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

Source: None (CBB or lab in fov)





**Project Document**

**SPIRE AOT Test Plan**

<b>Ref:</b>	<b>SPIRE-RAL-DOC-002720</b>
<b>Issue:</b>	<b>Issue 1.0</b>
<b>Date:</b>	<b>13th December 2006</b>
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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
<b>Total Time</b>		<b>7m</b>	<b>21m</b>	<b>53m</b>	<b>4h15m</b>	<b>11h24m</b>	<b>7m</b>	<b>53m</b>