SPIRE CQM Instrument Level Test Plan

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11-Jan-2002	0.1	All	First Draft
15-May-2002	1.0	5 7 9 10, 11 14	Updates to document list Correction to CQM detector specification Definition of test campaigns and activities Identified inspection points in flowchart Cross references to CQM performance test specification and EMC control plan included

Contents

1 Scope of Document

This document describes in detail how the SPIRE CQM AIV will be implemented. It describes the step-by-step sequence of activities, high-level procedures, organisation, resources and facilities required.

2 Documents

2.1 Applicable Documents

	Title	Author	Reference	Date
AD 1	SPIRE Instrument Qualification Requirements	B. Swinyard	SPIRE-RAL-PRJ-000592 Issue 1.1	29-Mar-2001
AD 2	SPIRE Instrument CQM Requirements	B. Swinyard	SPIRE-RAL-NOT-000389 Issue 1.0	18-April-2000
AD 3	Instrument AIV Plan	B. Swinyard	SPIRE-RAL-PRJ-000410 Issue 2.1	29-Mar-2001
AD 4	Instrument Integration Plan	B. Winter	SPIRE-MSS-PRJ-000652 Issue 0.1D	Apr-2001
AD 5	SPIRE Calibration Requirements	B. Swinyard	SPIRE-RAL-PRJ-001064 Issue 0.1D	3-Jan-2002
AD 6	SPIRE CQM Performance Test Specification	T. Lim	SPIRE-RAL-DOC-001123 Issue 0.3	28-Feb-2002
AD 7	SPIRE EMC Control Plan	D. Griffin	SPIRE-RAL-PRJ-852 Issue 0.2	3-Feb-2002
AD 8	CQM Thermal test specification	S. Heys	TBD	
AD 9	SPIRE Optical Alignment Verification Plan	K. Dohlen	SPIRE-LAM-PRJ-000445 Issue 3	10-Apr-2001
AD 10	SPIRE Product Assurance Plan	D. Kelsh	SPIRE-RAL-PRJ-000017 Issue 1.0	11-Apr-2001
AD 11	Cleanliness Plan	B. Swinyard	SPIRE-RAL-PRJ-001070 Issue 1.0	9-Jan-2002
AD 12	SPIRE Alignment Tools Specification	K. Dohlen, A. Origne	LAM.PJT.SPI.SPT.20000x	26-Oct-2000

2.2 Reference Documents

	Title	Author	Reference	Date
RD 1	SPIRE STM Instrument Level Test Plan	D.L. Smith	SPIRE-RAL-PRJ-001048 Issue 1.0	15-May-2002
RD 2	SPIRE Test Facility Requirements Specification	D.L. Smith	SPIRE-RAL-PRJ-000463 Issue 1.3	2-April-2001

3 CQM AIV Requirements

3.1 CQM Definition

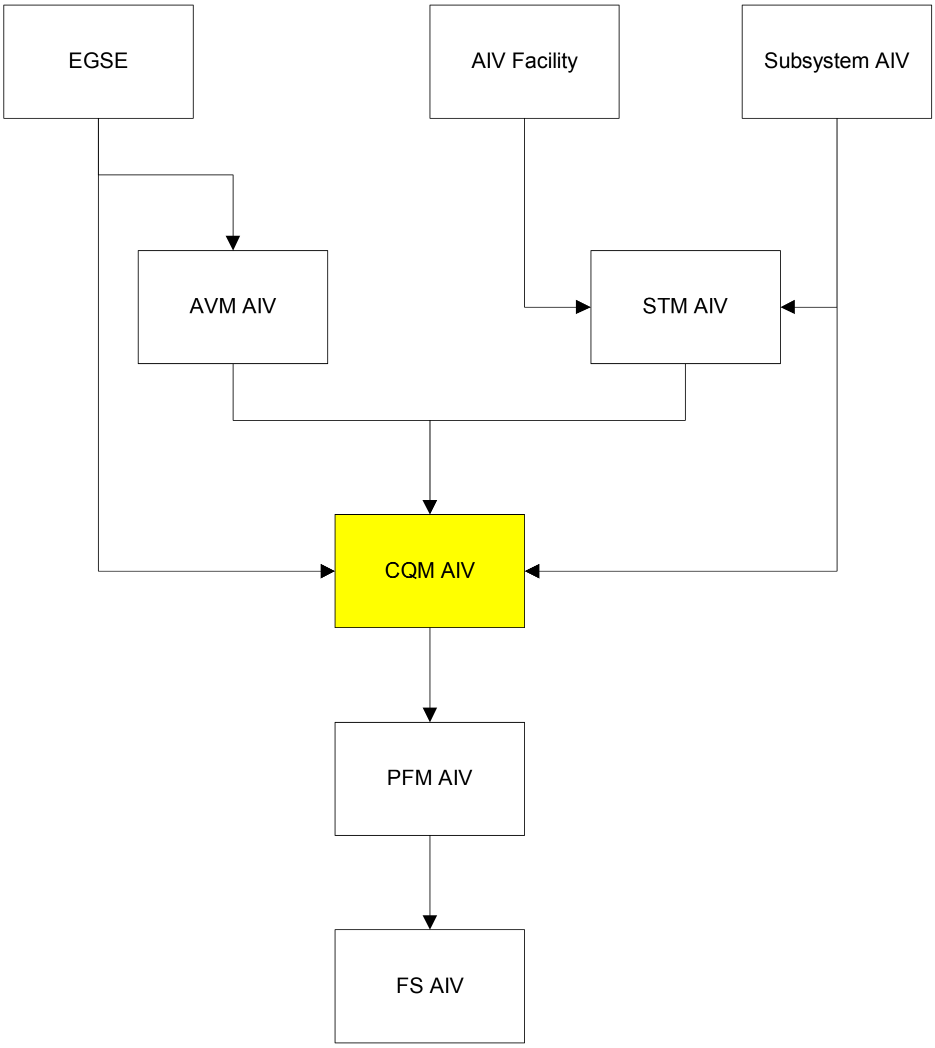


Figure 1: Flow chart showing the logical association of the SPIRE CQM model within the SPIRE development programme.

The SPIRE instrument model philosophy is described in AD 1 and AD 3. The CQM model will be used to characterise and verify the instrument scientific performance, having functionally representative cold subsystems and warm electronics. All other subsystems will be fully functional with close to flight performance. The structure, optics, cooler and FPU harnesses will be reused from the STM program.

Because of the project constraints it is not possible to provide 5 complete detector arrays for the CQM program. However, there is a requirement that all detector modules must have the correct mass, interfaces and be thermally representative. Similarly the JFET modules must also be structurally and thermally representative. All signal lines will have a signal, albeit from a dummy load. To ensure that the optical performance of the instrument can be characterised adequately, the CQM will be fitted with detector arrays with reduced numbers of active pixels. The requirements for each band as specified in AD 2 are:

Spectrometer

LW: Fully populated array

SW: Part way through the CQM a fully flight quality array will be provided although this will be untested.

Photometer:

500μm: Fully populated array of 43 detectors but not fully optimised

The CQM thermal verification tests will be performed with the development model DPU and QM1 DRCU as specified in AD 2. EMC tests will require the full QM warm electronics.

3.2 CQM Qualification Requirements

The qualification requirements are presented in detail in the SPIRE instrument qualification requirements AD 2 and are summarised below for completeness.

3.2.1 Mechanical

Qualification of the FPU structure and JFET boxes will have been performed during the STM program.

Any susceptibility of the detector signals to micro-phonic vibrations will be investigated to verify that the instrument can operate within the Herschel environment, and that the operation of the instruments mechanisms does not affect the performance.

3.2.2 Thermal

A series of thermal verification tests will be performed to demonstrate that all parts of the instrument will run at the correct temperatures and will function correctly at the predicted environment conditions. The test conditions will be specified in the thermal test plan, AD 8.

3.2.3 Optical

The CQM mirrors will have been installed and aligned as part of the STM program. The optical integration will be completed and further alignment checks made. The CQM will allow the far-infrared and sub-mm optical performance to be characterised, in particular the stray-light performance will be evaluated.

3.2.4 Electrical

The CQM tests will be the first opportunity to run the SPIRE instrument as a complete system and to test all electrical interfaces. Throughout the test program, attention will be given to any possible electrical interference from the instrument subsystems on the detector performance with a view to remedying any problems.

An EMC test will be conducted to demonstrate that the proposed method of providing the Faraday cage will be sufficient to protect against radiated EMI in a laboratory environment. The test will be limited in that the test environment will be very different to the Herschel cryostat. Conducted susceptibility tests will also be performed.

3.2.5 Performance

The CQM will allow the scientific performance of the instrument to be tested. The performance checks will cover:

- Detector performance and characterisation
- Performance and characterisation of the photometer optics
- Performance and characterisation of the spectrometer optics
- Spectrometer performance
- BSM performance
- Calibrator performance and characterisation
- Shutter performance

3.2.6 Operations Modes

The CQM will present an opportunity to evaluate the operations modes of the instrument and test the ground segment concept with ‘real’ instrument data.

4 CQM AIV Flowchart

The AIV phase is broken down into a series of ‘activities’ and ‘test campaigns’.

‘Activities’ include integration of the FPU, preparation for a test campaign, single test or task within a campaign and other tasks.

A ‘test campaign’ covers a complete test period from the test readiness review to the completion of the test activities.

Each test campaign will start with a test readiness review, at which all test procedures must be ready and the EGSE configuration will be ‘frozen’. A formal post-test review will be held at the end of the test campaign after which the instrument can proceed with the next activity.

The test campaign will be broken down into ‘activities’ and ‘tests’, see Figure 2. Activities include pump-down, cool-down, warm-up, and let-up. Each ‘Test’ within the campaign will comprise a series of ‘test cases’. For example, a functional test will include test cases to checkout individual mechanisms, i.e. the cooler, BSM, SCAL etc. The test campaign will be controlled by a master procedure that references the specific test procedures, e.g. functional test procedure. The test procedure will identify the necessary EGSE test sequences and pass-fail criteria.

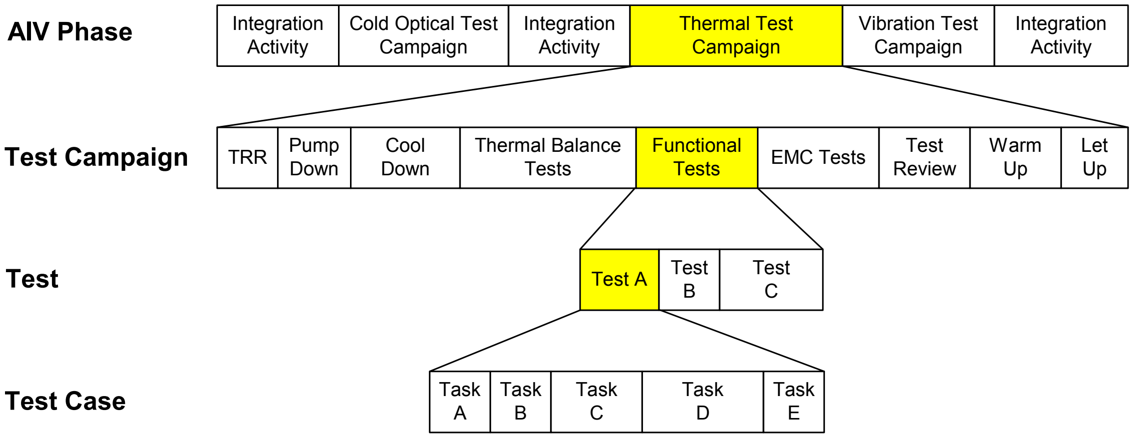


Figure 2: Definition of AIV Phase, Test Campaign, Tests and Test Case. (Note: the example given does not represent the actual SPIRE AIV)

The flowchart in this section is based on the flowchart presented in the SPIRE AIV Plan (AD 3) but expanded slightly to show each test campaign with the facilities and test equipment required to perform the activities.

Each test campaign will start with a test readiness review, at which all test procedures must be ready and the EGSE configuration will be ‘frozen’. A formal post-test review will be held at the end of the test campaign after which the instrument can proceed with the next activity.

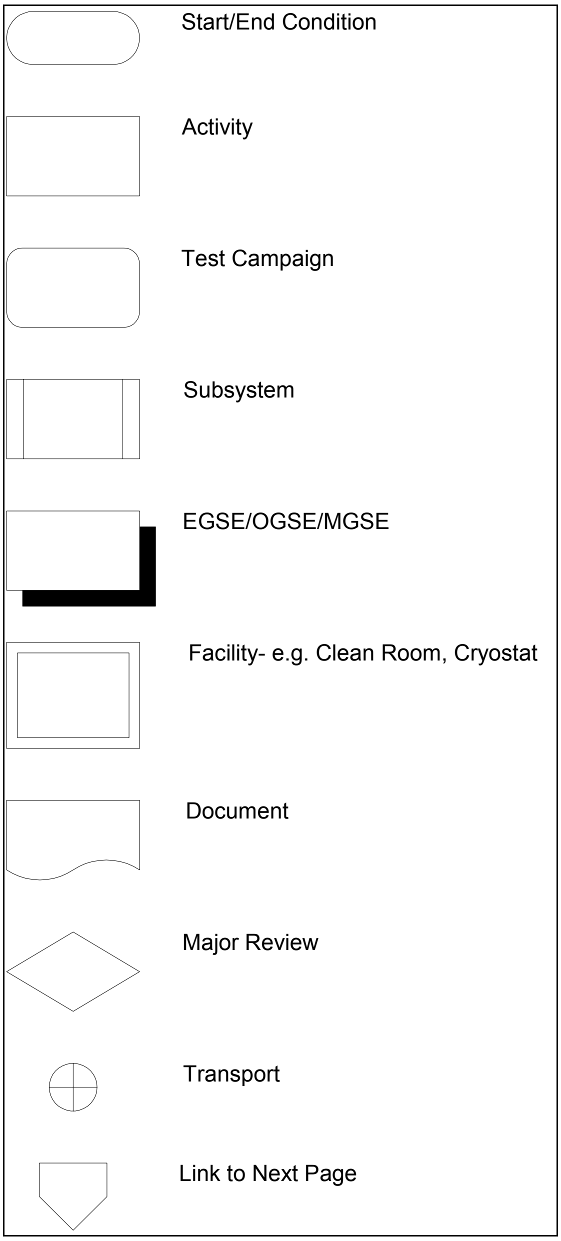
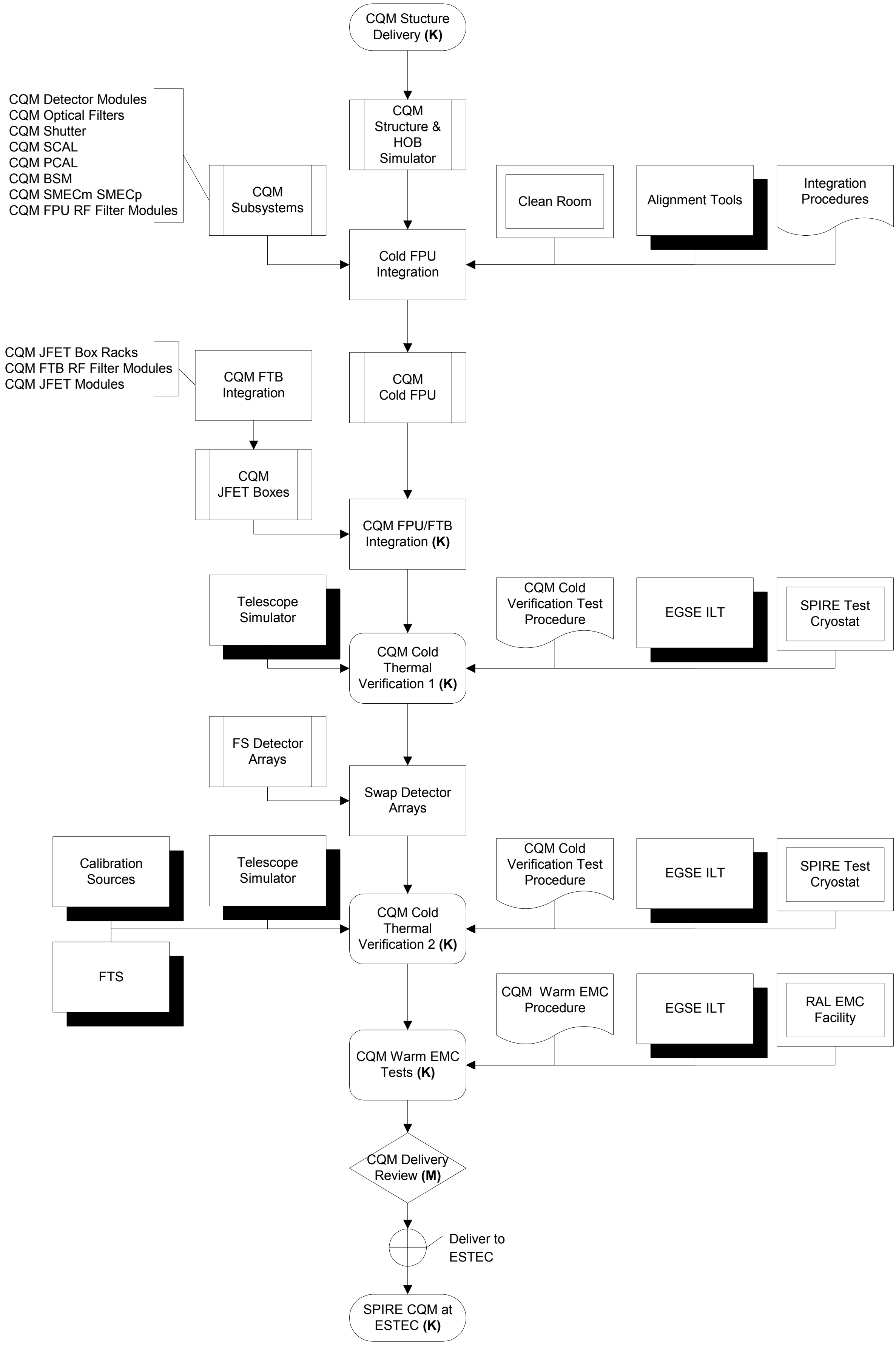


Figure 3: Legend for CQM AIV Flow Chart. Key Inspection Points are indicated by (**K**), Mandatory Inspection Points are indicated by (**M**).


CQM Stucture Delivery (K)
CQM Structure & HOB Simulator
CQM Detector Modules
CQM Optical Filters
CQM Shutter
CQM SCAL
CQM PCAL
CQM BSM
CQM SMECm SMECp
CQM FPU RF Filter Modules
CQM Subsystems
Clean Room
Alignment Tools
Integration Procedures
Cold FPU Integration
CQM JFET Box Racks
CQM FTB RF Filter Modules
CQM JFET Modules
CQM FTB Integration
CQM Cold FPU
CQM JFET Boxes
CQM FPU/FTB Integration (K)
Telescope Simulator
CQM Cold Verification Test Procedure
EGSE ILT
SPIRE Test Cryostat
CQM Cold Thermal Verification 1 (K)
FS Detector Arrays
Swap Detector Arrays
Calibration Sources
Telescope Simulator
CQM Cold Verification Test Procedure
EGSE ILT
SPIRE Test Cryostat
CQM Cold Thermal Verification 2 (K)
FTS
CQM Warm EMC Procedure
EGSE ILT
RAL EMC Facility
CQM Warm EMC Tests (K)
CQM Delivery Review (M)
Deliver to ESTEC
SPIRE CQM at ESTEC (K)

5 Task List

The following table defines the step-by-step sequence of activities for the SPIRE CQM AIV. The table will form the basis of the CQM AIV master procedure.

Step	Activity	Identifier	Brief Description	Instrument Requirement
CQM 1	**CQM FPU Integration**	**CQM_ILT_INTG**		
CQM 1-1	Verify alignment of optical components	ILT_ALIGN		VRD-06, VRD-07 VRD-10, VRD-11
CQM 1-2	Photometer detector box integration	DET_INTG	Install fully functional long-wavelength photometer array and thermally and mechanically representative BDAs in the other locations.	VRD-06, VRD-10 VRD-11
CQM 1-3	Spectrometer detector box integration	DET_INTG	Install fully functional long-wavelength spectrometer array and thermally and mechanically representative BDAs in the short wavelength location.	VRD-06, VRD-10 VRD-11
CQM 1-4	Detector box integration into FPU structure	ILT_INTG	Integrate detector boxes into structure and verify the alignment.	VRD-06, VRD-10 VRD-11
CQM 1-5	Subsystem Integration	ILT_INTG	Install instrument subsystems, filters and baffles.	VRD-04, VRD-05
CQM 2	**CQM FTB Integration**	**CQM_ILT_INTG**		
CQM 2-1	Inspect JFET modules on arrival	FTB_INTG	Visual inspection of JFET modules	VRD-04, VRD-05
CQM 2-2	Mount JFET modules into box structures	FTB_INTG	Integrate JFET Boxes	VRD-04, VRD-05
CQM 2-3	Perform warm functional test	FTB_WFT	Check function of JFET modules at room temperature.	VRD-24
CQM 3	**CQM FPU/FTB Integration**	**CQM_ILT_INTG**		
CQM 3-1	Mount JFET Boxes on HOB simulator and connect to FPU	CQM_ILT_INTG		VRD-04, VRD-05
CQM 3-2	Connect to Warm Electronics units	CQM_ILT_INTG		VRD-04, VRD-05
CQM 3-3	Perform warm functional test	ILT_WFT		VRD-21, VRD-24 VRD-27, VRD-28 VRD-29
CQM 3-4	Perform optical alignment check	ILT_ALIGN		VRD-06, VRD-07 VRD-10, VRD-11

Step	Activity	Identifier	Brief Description	Instrument Requirement
CQM 4	**CQM Cold Thermal Verification - 1**	**CQM_ILT_VER**		
CQM 4-1	Integrate SPIRE onto support frame	CQM_ILT_INTG	Bolt down covers, secure structure to HOB simulator. Lift instrument onto MGSE and build up support frame.	
CQM 4-2	Transfer SPIRE to Cryolab	CQM_ILT_INTG	Bag up the FPU and HOB simulator and transfer to cryolab.	
CQM-4-3	Integrate SPIRE into cryostat	CRY_INTG	Move instrument into cryostat, connect thermal straps, harness. Close up radiation shields, making light tight.	
CQM-4-4	Perform warm functional test - includes redundancy tests	ILT_WFT		VRD-21, VRD-24 VRD-27, VRD-28 VRD-29
CQM-4-5	Test Readiness Review			
CQM-4-6	Pump Down	CRY_PUMP		
CQM-4-7	Cool Down to operational temperatures	CRY_COOL		VRD-12, VRD-14
CQM-4-8	Perform cold functional tests - includes redundancy tests	ILT_CFFT		VRD-16, VRD-17 VRD-21, VRD-24 VRD-27 to 42
CQM-4-9	Verify thermal performance	CQM_ILT_THER		VRD-12, VRD-14
CQM-4-10	Measure optical alignment	CQM_ILT_ALIGN		VRD-06, VRD-07 VRD-10, VRD-11
CQM-4-11	Perform cold functional tests - includes redundancy tests	ILT_CFFT		VRD-16, VRD-17 VRD-21, VRD-24 VRD-27 to 42
CQM-4-12	Post Test Review			
CQM-4-13	Warm up	CRY_WARM		
CQM-4-14	Let up to air	CRY_LETUP		
CQM-4-15	Perform warm functional test	ILT_WFT		VRD-21, VRD-24 VRD-27, VRD-28 VRD-29
CQM-4-16	Remove from cryostat	CRY_DEINT	Disconnect FPU from cryostat, remove HOB simulator from cryostat and install on MGSE.	
CQM-5	**Swap detector arrays**	**CQM_ILT_INTG**		
CQM-5-1	Move to integration area	STM_ILT_INTG	Bag up the FPU and HOB simulator and transfer to clean rooms	
CQM-5-3	Replace short wavelength BDA	ILT_INTG	Install flight spare BDA to allow FTS performance to be evaluated.	
CQM-5-5	Perform warm functional test	ILT_WFT		VRD-21, VRD-24 VRD-27, VRD-28 VRD-29

Step	Activity	Identifier	Brief Description	Instrument Requirement
CQM-6	**CQM Cold Thermal Verification - 2**	**CQM_ILT_VER**		
CQM-6-1	Integrate SPIRE onto support frame	STM_ILT_INTG	Bolt down covers, secure structure to HOB simulator. Lift instrument onto MGSE and build up support frame.	
CQM-6-2	Transfer SPIRE to Cryolab	STM_ILT_INTG	Bag up the FPU and HOB simulator and transfer to cryolab.	
CQM-6-3	Integrate SPIRE into cryostat	CRY_INTG	Move instrument into cryostat, connect thermal straps, harness. Close up radiation shields, making light tight.	
CQM-6-4	Perform warm functional test	ILT_WFT		VRD-21, 24, 27, 28, 29
CQM-6-5	Test Readiness Review			
CQM-6-6	Pump Down	CRY_PUMP		
CQM-6-7	Cool Down to operational temperatures	CRY_COOL		VRD-12, VRD-14
CQM-6-8	Perform cold functional tests - includes redundancy tests	ILT_CFFT		VRD-16, 17, 21, 24, 27 - 42
CQM-6-9	Verify thermal performance	ILT_THER		VRD-12, VRD-14
CQM-6-10	Micro phonics Susceptibility	ILT_PERF	Measure susceptibility of detector signals to low-level vibration inputs.	VRD-15
CQM-6-11	Cold EMC Tests	ILT_EMC	Conducted susceptibility, compatibility and radiated susceptibility? AD 7	VRD-23, VRD-25 VRD-26
CQM-6-12	Measure instrument performance characteristics	ILT_PERF	Detector performance and characterization, Photometer and spectrometer optics characterization, spectrometer performance, BSM performance, Calibrator performance and characterization, shutter performance (Defined in AD 6)	VRD-06, 07, 08, 09, 11, 12, 15, 16, 17, 18, 19, 20, 22, 24, 25, 27, 28, 29, 30
CQM-6-13	Instrument Calibration	ILT_CAL	DC responsivity, optical throughput, cross talk, photometric response, point spread function, beam profile, detector time constants, spectral response, field distortion (Defined in AD 6)	VRD-43-49
CQM-6-14	Exercise instrument operations modes	ILT_OPS	POF-1 to POF-8, SOF-1, SOF-2 (Defined in AD 6)	VRD-48, VRD-49

Step	Activity	Identifier	Brief Description	Instrument Requirement
CQM-6-15	Perform cold functional tests - includes redundancy tests	ILT_CFFT		VRD-16, 17, 21, 24, 27 - 42
CQM-6-16	Post Test Review			
CQM-6-17	Warm up	CRY_WARM		
CQM-6-18	Let up to air	CRY_LETUP		
CQM-6-19	Perform warm functional test	ILT_WFT		VRD-21, 24, 27, 28, 29
CQM-6-20	Remove from cryostat	CRY_DEINT	Disconnect FPU from cryostat, remove HOB simulator from cryostat and install on support trolley.	
CQM-7	**CQM Warm EMC Tests**	**CQM_ILT_EMC**		
CQM-7-1	Transfer to EMC facility		Move instrument to EMC facility. Connect warm electronics and EGSE.	
CQM-7-2	Perform warm CQM tests	CQM_ILT_EMC	Determine radiated susceptibility.	VRD-23, VRD-25 VRD-26
CQM-8	**CQM Delivery to ESA**			
CQM-8-1	Prepare SPIRE for shipping to ESA			
CQM-8-2	Pre-delivery review			
CQM-8-3	Ship to ESA			
CQM-8-4	Unpack SPIRE and inspect on arrival at ESA			
CQM-8-5	Perform warm functional test	ILT_WFT		VRD-21, 24, 27, 28, 29
CQM-8-6	Acceptance review			

6 Test Procedure List

This section lists the main test procedures to be used for the STM AIV. For each major step there is a high level procedure that references other standard procedures such as those for operating the facilities.

6.1 CQM Master AIV procedure (CQM_ILT_AIV)

The master procedure will cover the complete CQM AIV phase from completion of the CQM program to delivery of the CQM instrument to ESTEC.

6.2 CQM structure Mechanical Integration (CQM_ILT_INTG)

This procedure will describe the integration of the CQM subsystems into the instrument (ILT_ALIGN), and preparation of the instrument for thermal verification and delivery to ESTEC. The mechanical integration will also include optical alignment checks (ILT_ALIGN).

6.3 CQM Thermal Verification Procedure (CQM_ILT_VER)

Umbrella procedure for cold thermal verification tests. The procedure will call up sub-procedures for specific test activities, i.e. thermal performance, instrument performance, calibration and operating mode tests.

6.3.1 ILT Thermal Performance Test Procedure (ILT_THER)

This procedure will define all instrument level thermal performance tests. The procedure will define the test conditions, all instrument operations to be performed (e.g. cooler recycling), data analysis and all success/failure criteria.

6.3.2 ILT Performance Test Procedures (ILT_PERF)

This procedure will describe all instrument performance tests to be performed during cold thermal verification. The procedure will define the EGSE test scripts, data analysis, test conditions, all instrument operations and all success/failure criteria.

6.3.3 ILT Calibration Procedure (ILT_CAL)

This procedure will describe all instrument level calibration tests to be performed during cold thermal verification. The procedure will define the EGSE test scripts, data analysis, test conditions, all instrument operations and all success/failure criteria.

6.3.4 SPIRE Operating Mode Test Procedure (ILT_OPS)

This procedure will describe the operating mode tests. The procedure will define the EGSE test scripts, data analysis, test conditions and all success/failure criteria.

6.4 General Procedures

The following are more general procedures that will be called up by the main test procedures.

6.4.1 Cryostat integration procedures

SPIRE test facility procedure describing the steps to prepare and install SPIRE into the test cryostat (CRY_INT) and removal of SPIRE from the test cryostat (CRY_DEINT)

6.4.2 Cryostat operations procedures

This will be a set facility procedures describing the safe operation of the calibration cryostat. The procedures will cover the sequence for pumping down (CRY_PUMP), cryogenic cool-down (CRY_COOL), operation at test conditions, warm-up (CRY_WARM) and let-up to air (CRY_LETUP).

6.4.3 ILT Functional Test Procedures

To ensure that the instrument subsystems are performing correctly, functional tests will be executed at the various stages of the AIV phase. The test procedures will identify the EGSE test scripts that are to be used, the instrument configuration and all success criteria. The following test levels are proposed:

6.4.3.1 Warm Functional Test (ILT_WFT)

This will be a basic test performed at room temperature to check the integrity of the electrical interfaces.

6.4.3.2 Cold Full Functional Test (ILT_CFFT)

An end-to-end test verifying all instrument subsystem functions will be exercised and where applicable will be repeated for redundant units. This test will be performed during the cold verification campaigns.

6.4.3.3 Cold Short Functional Test (ILT_CSFT)

The minimum level of tests required for checking that the instrument subsystems are functioning correctly.

7 Organisation

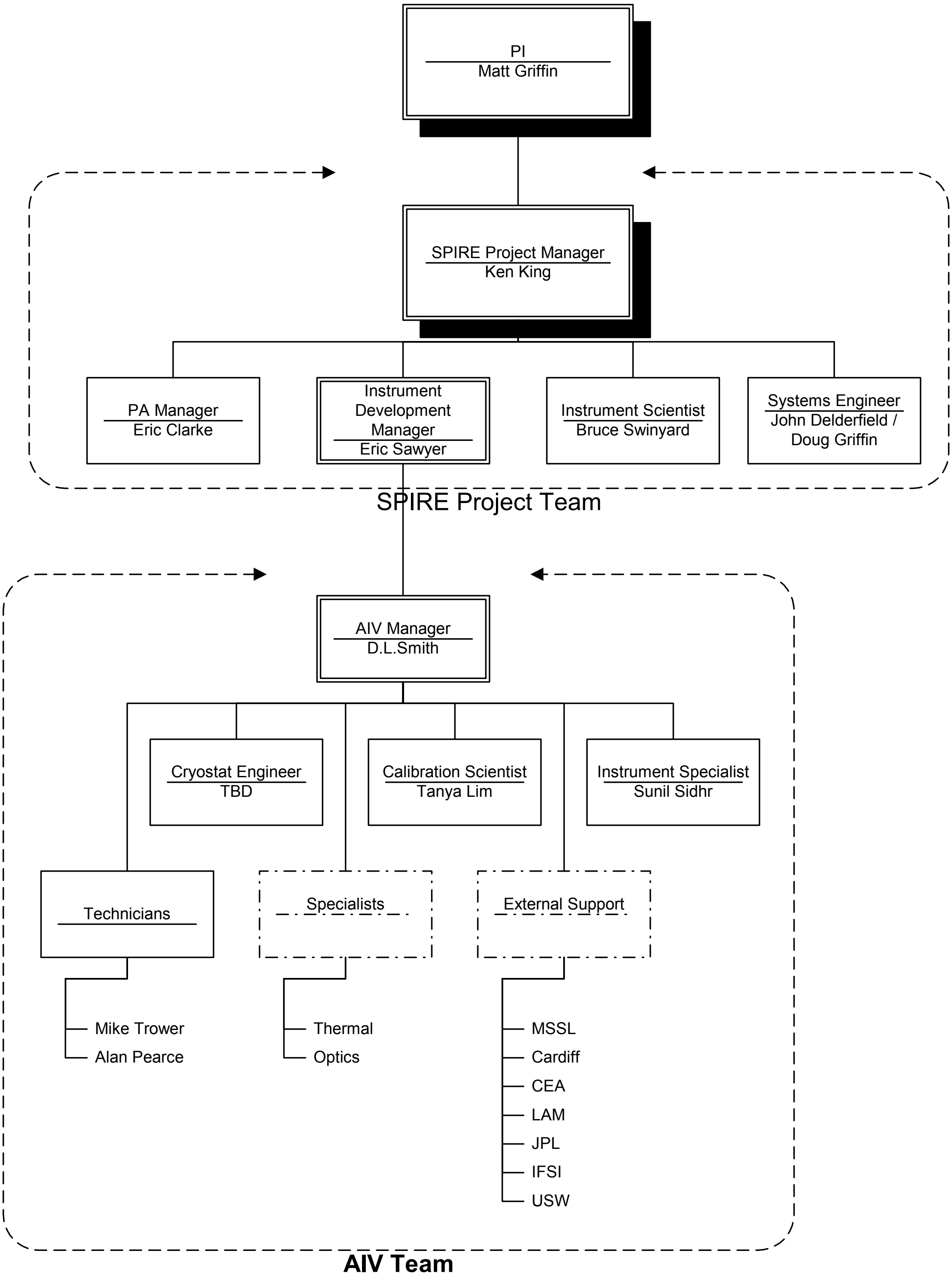


Figure 4: CQM AIV Organisation

8 Resource Requirements

8.1 Manpower

This section describes the roles and responsibilities of the personnel required to support the CQM integration and test activities. The roles defined are specific to the CQM AIV activities and do not necessarily reflect overall roles and responsibilities within the SPIRE project. The majority of the team will be from RAL, but specialists from the SPIRE subsystem providers will also be required to support the AIV activities.

8.1.1 AIV Team

8.1.1.1 AIV Manager

- Planning and coordinating the AIV activities including the mechanical and electrical integration, verification tests and calibration.
- Responsible for obtaining agreement, prior to the commencement of any activity, of test plans and procedures.
- Responsible for decisions requiring work-around plans, modification of test procedures, repeat tests etc arising from non-conformance reports.
- Co-ordinate activities of technical experts, technicians during AIV phase.
- Prepare review documentation and acceptance data packs.
- Reports to Instrument Development Manager

8.1.1.2 Calibration Scientist

- Definition of the instrument calibration, performance and operations modes tests.
- Preparation analysis software
- Execution of calibration tasks
- Real-time assessment of the test results using QLA
- Detailed analysis of test data.
- Preparation of calibration report.
- Preparation of the instrument calibration database and associated documentation.

8.1.1.3 Instrument Specialist

- Preparation of instrument test sequences on EGSE
- Execution and analysis of instrument functional tests
- Maintenance and development of EGSE
- On-board software maintenance
- Definition of instrument flight operations procedures

8.1.1.4 Cryostat Engineer

- Preparation of cryostat for instrument tests
- Operation of cryostat during instrument tests
- Ensure supply of cryogens
- Clean room maintenance

8.1.1.5 Technicians

- Mechanical integration of instrument
- Test support
- Preparation of instrument for testing and transport

8.1.2 Specialist Support

8.1.2.1 Optics Specialist

- Optical alignment verification
- Stray light analysis

8.1.2.2 Thermal Engineer

- Thermal modeling and analysis
- Thermal test plan
- Support for thermal tests.

8.1.3 SPIRE Project Team

8.1.3.1 SPIRE Project Manager

- SPIRE Project Management
- UK SPIRE Management

8.1.3.2 Instrument Development Manager

- Subsystem Development
- Subsystem Deliveries
- Instrument Deliveries

8.1.3.3 Instrument Scientist

- Instrument performance
- AIV Plan
- Calibration Plan
- Optical Straylight Analysis

8.1.3.4 Systems Engineer

- Systems engineering
- System thermal design
- Parts procurement

8.1.3.5 PA Manager

- Product assurance
- Quality assurance
- Acceptance data packages

8.1.4 External Support

Support from the instrument subsystem providers will be required during the AIV activities. They will not be expected to perform the integration tasks but rather be on hand to provide technical support when needed.

8.1.4.1 MSSL

- Support mechanical integration, optical alignment and thermal tests.

8.1.4.2 LAM

- Support optical alignment activities.
- Support the integration and testing of the STM SMEC.

8.1.4.3 Cardiff

- Support integration of the SCAL, PCAL, 300mK strap system, optical filters
- Support the cold thermal verification and instrument performance tests.

8.1.4.4 JPL

- Support integration and alignment of detector modules, and integration of JFET units.

8.1.4.5 ATC

- Support integration and testing of the BSM units.

8.1.4.6 Grenoble

- Support integration of the cooler systems and thermal verification tests.

8.1.4.7 USW

- Support integration and tests of the STM shutter.

8.2 Facilities

The following facilities will be used for the SPIRE CQM AIV activities.

8.2.1 Cryogenic Test Facility

The SPIRE dedicated cryostat facility will be used for the cold optical alignment and thermal verification tests [RD 2]. The instrument and cryostat will be in a class 1000 clean area. Access to the clean room will be limited to key personnel to minimise any potential contamination of the optics.

8.2.2 Assembly Clean Rooms

Mechanical and electrical integration of the SPIRE FPU will be conducted in Clean Room 2 within building R25 at RAL. The room comprises[1]

- Main area: 12m x 7m class 10,000
- Horizontal laminar flow unit: 5m x 3m at class 100
- 2 laminar flowbenches: 1m x 0.5m at class 100
- Central changing room: lockers for up to 20 people
- Cleaning facility: Ultrasonic bath, fume cupboards

8.2.3 EMC Facility

The EMC tests will be performed in the RAL EMC Facility. The facility is capable of both conductive/radiated emissions and conductive/radiated susceptibility testing of spacecraft instruments and sub-systems to MIL STD 461/462. The facility is a 5m x 4m x 3m anechoic chamber located within a class 10,000 clean-room, capable of testing items up to a maximum size of 1m x 1m x 1m.

[1] Extracted from RAL document ISO9:SPAP/AIV/000

8.3 EGSE

The full EGSE-ILT configuration will be required for the CQM test campaign, Figure 5. The main components that are required are: -

- TFCS
- CDMS simulator
- Packet Router
- SCOS-2000
- Test Control
- RTA
- MIB
- HCSS
- QLA
- OBSM

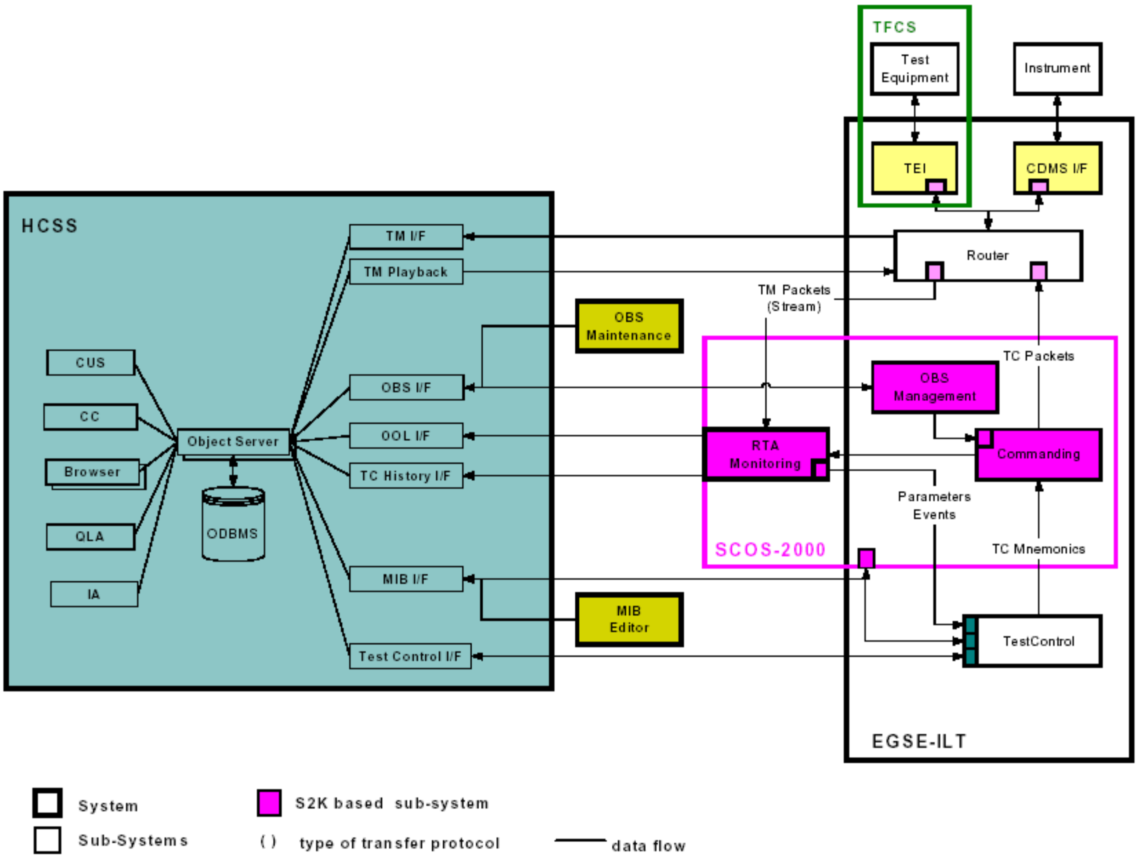


Figure 5: EGSE-ILT Configuration

At the start of each test campaign (e.g. Thermal Verification), the EGSE configuration will be 'frozen' and will be run continuously until the completion of the test campaign, i.e. when the cryostat has fully warmed up. The only breaks in operation will be for routine maintenance or troubleshooting as agreed by the AIV manager. All changes to the EGSE configuration shall be through a formal change request to ensure that any changes do not have any negative impact on the test campaign. Changes to the EGSE configuration that are not essential to the success of the test campaign may have wait before implementation. The main priority throughout the test campaign will be the safety of the instrument, and it is therefore vital that the thermal environment and instrument status is monitored and logged continuously.

8.4 OGSE

8.4.1 Alignment Tools
A Suite of dedicated alignment tools will be provided by LAM as defined in AD 12.

8.4.2 Telescope Simulator
The telescope simulator will reproduce the Herschel telescope f8.68 beam, such that a point source is imaged at the SPIRE input focal plane. Many of the test & calibration procedures will require this beam to be steered & focused over the field-of-view range of the instrument, in order to check or measure such properties as pixel response, spatial resolution and image scale. A beam control system will use a series of movable mirrors to steer & focus the beam according to geometric 'control laws'.

8.4.3 Cold Blackbody
A 4K-20K-blackbody source provided by Cardiff University will be used as an absolute radiance standard. This will be mounted within the 4K enclosure of the cryostat and viewed via a relay mirror.

8.4.4 Fourier Transform Spectrometer
A Fourier transform spectrometer (FTS) will be provided by Cardiff University to allow the spectral response of the photometer channels to be measured.

8.4.5 Hot Blackbody
A hot, 1000°C blackbody with wavelength coverage over 200μm to 700μm will be used to back illuminate a point source at the input of the telescope simulator.

8.4.6 FIR Laser
The FIR laser used for the ISO LWS calibration will be used. This is an Edinburgh Instruments PR5 gas FIR laser with lines from 30μm to 1000μm and power up to 100mW.

8.4.7 Reference Detector
A calibrated reference detector will be fitted in the cryostat to measure the FIR transmission through the cryostat filters, and to measure the straylight in the closed cryostat.

8.4.8 Beam Monitor
The output of the telescope simulator (i.e. input signal to SPIRE) will be picked off by a beam splitter and measured using a reference detector (probably a Golay cell). The output of the detector will be logged by the TFCS to allow correlation with the SPIRE measurements.

8.5 MGSE

8.5.1 Transportation Container

A purpose built (TBC) transportation container provided by MSSL will be used whenever SPIRE is to be moved between facilities (i.e MSSL, RAL, CSL, ESTEC).

8.5.2 HOB Simulator

The HOB simulator will be the primary mechanical interface between the SPIRE FPU and the calibration cryostat. It will have a number of optical references to enable optical alignment measurements to be performed. To ensure that optical alignment between the references on the SPIRE optical bench and the HOB are maintained throughout integration and testing, the HOB simulator will act as the main integration plate and will travel with the instrument in the transportation container.

8.5.3 Support Trolley

SPIRE will be mounted on the HOB simulator with the +X axis up during mechanical integration and transport. However, because the SMEC cannot work against gravity the instrument has to be rotated by 90° so that the +Y axis is up. A purpose built support trolley will be provided to rotate the integrated FPU and JFET units on the HOB simulator about 90° in a controlled manner. The trolley will also allow the instrument to be moved between the AIV clean rooms and the cryogenic test facility.