SPIRE

SUBJECT: **ICD 1.1/1.5.2 Structure - SMEC-m**

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Change Record

ISSUE	DATE	
0.1	20/09/1999	New draft issue
1.0	14/06/2000	First issue, included interface drawing. Added orientation dowel hole and defined the need for a thermal strap.

Table of Contents

Glossary

BSM	Beam Steering Mechanism
C.G.	Centre of Gravity
FTS	Fourier Transform Spectrometer
NA	Not Applicable
PDBX	Photometer Detector Box
SDBX	Spectrometer Detector Box
SMEC	Spectrometer MEChanism
SOB	SPIRE Optical Bench
SPIRE	Spectral and Photometric Imaging REceiver

References

Applicable Documents

REFERENCE DOCUMENTS

RD1 SPIRE Instrument Requirements Document, issue .30, SPIRE/RAL/N/0034

DRAWINGS

DR1 A1-5264-909, issue 1, interface drawing structure – SMEC-m

1. INTRODUCTION

1.1 Purpose of Document

The purpose of this document is to define the interface between the SPIRE structure and the FTS mechanism (SMEC). Within this document the mechanical, thermal, optical and electrical requirements are given.

This issue is a draft issue. The purpose of this issue is to define the interface, such that an agreed baseline interface is available at the beginning of the final design process. During the final design process the definitions may be refined and possibly changed, however at the end of the final design process the interface definition is frozen.

1.2 SCOPE

The document is divided in 5 parts.

The first part gives the status and description of the document itself

The second part gives the functional description.

The third part deals with the mechanical, thermal and optical interfaces.

The forth part gives the electrical interfaces.

The fifth part defines the data interfaces.

The following interface is considered:

- SOB – FTS mechanism

2. FUNCTIONAL INTERFACE

2.1 Functional Description and Block Diagram

The FTS mechanism holds the central corner cube mirror's of the FTS part of the FIRST/SPIRE instrument. These mirrors need to travel between the two ray paths within the FTS, shortening one ray path and simultaneously lengthen the other. The total travel is 32 mm in +X direction and 3.2 mm in –X direction (RD1, IRD-SMEC-R01) (Where X is the launch direction)

Mechanism Interface with other components

- Spire optical bench (SOB)
- Optics

The function of the SOB (reviewing the interface between the SOB and the ~FTS mechanism) is to support the mechanism. The mechanical interface should provide for a precise defined and accurately machined mounting surface. The mechanical interface should provide for sufficient stiffness, such that the mechanical loads on the FTS are minimised.

There is no block diagram

2.2 Inputs

No inputs

2.3 Outputs

No outputs

3. MECHANICAL, THERMAL AND OPTICAL INTERFACES

3.1 Mechanical and thermal interface data sheets

The following holds for all interfaces considered in section 3.1.1 up to 3.1.13.

Mechanical environment

The sine and random input at the interfaces considered in this document will be updated after the coupled analysis. The input spectra hold for all interfaces.

Quasi-Static

The qualification levels are **provisiona**l, copied from the qualification loads of ISO.

Quasi Static levels	Case 1	Case 2	Case 3	Case 4
x-direction	22.5 g (TBC)	22.5 g (TBC)	-	-
y-direction	3 g (TBC)	-	6 (TBC)	-
z-direction	-	3 g (TBC)	-	6 (TBC)

Table 3.1-1: Qualification levels for quasi static vibration

Sine

The qualification levels are **provisiona**l copied from the qualification loads of ISO.

Sine vibration levels	Frequency range	Input at base (QUAL)
X-direction	5-18 Hz 18-100 Hz	22 mm (peak-peak) 100 g
Y-direction	5-18 Hz 18-100 Hz	22 mm (peak-peak) 100 g
Z-direction	5-18 Hz 18-100 Hz	22 mm (peak-peak) 100 g

Table 3.1-2: Qualification levels for sine vibration

Random

The qualification levels are **provisional**, copied from the qualification loads of ISO.

Random vibration levels	Frequency range	Input at base (QUAL.)
X-direction	5 – 150 Hz 150-700 Hz 700 – 2000 Hz	+6 dB Hz 1.44 g^2/Hz -3 dB
Y-direction	5 – 150 Hz 150-700 Hz 700 – 2000 Hz	+6 dB Hz 1.44 g^2/Hz -3 dB
Z-direction	5 – 150 Hz 150-700 Hz 700 – 2000 Hz	+6 dB Hz 1.44 g^2/Hz -3 dB

Table 3.1-3: Qualification levels for random vibration (45 g_{rms})

Alignment

The following requirements hold for the flatness of the I/F plane/points between the FTS mounts and the structure.

Off centre 0.1 mm all directions simultaneously (TBC)

Tilt 2 arcminute (TBC)

Allowable interface loads

1.5 kN in each direction seperately (Maximum for qualification loads per I/F point, TBC)

INTERFACE DATA SHEET (TBC)

SUBSYSTEM: **SOB – FTS mechanism** UNIT CODE:

UNIT DESIGNATION

TOTAL NUMBER: IN OPERATION: IN REDUNDANCY: ***NA***

MECHANICAL CHARACTERISTICS

DIMENSIONS [mm]: X: 150 Y: 160 Z 150 (TBC)

MASS (including fasteners) 1200 gr + 240 gr contingency

C.G.LOCATION [mm] (wrt reference hole R)

X: 70 Y: 80 Z: 70 Uncertainty: (5%)

INERTIA (wrt C.G.) [m^2kg]: Ixx: Iyy: Izz Uncertainty:

MATERIAL OF HOUSING: ***NA***

SURFACE FINISH:

TOTAL CONTACT AREA:

SURFACE ROUGHNESS OF CONTACT AREA:

EIGEN FREQUENCY: The first eigenfrequency of the FTS mechanism mounted against a rigid interface shall be higher than 145 Hz, with a goal: higher than 180 Hz.

FOOT THICKNESS:

THERMAL CHARACTERISTICS SOB - CIPM
FOOT MATERIAL AND THICKNESS:
SURFACE PROPERTIES:
Thermal capacity: J/°K Conductive coupling: W/°K

QUALIFICATION TEMPERATURE LIMIT (ºC) SOB – FTS mechanism

GROUND STORAGE &TRANS		OPERATING MODE		NON OPERATING MODE		START UP
MIN	MAX	MIN	MAX	MIN	MAX	MIN
10	40	-271	-269	-271	40	-271

HEAT DISSIPATION (W) SOB – FTS mechanism

MODE	AVERAGE	MIN	MAX
OFF Bench-Mechanism Bench-Wiring	***?***	***?***	***?***
STAND-BY Bench-Mechanism Bench-Wiring	***?***	***?***	***?***
OPERATING Bench-Mechanism Bench-Wiring	***?***	***?***	***?***

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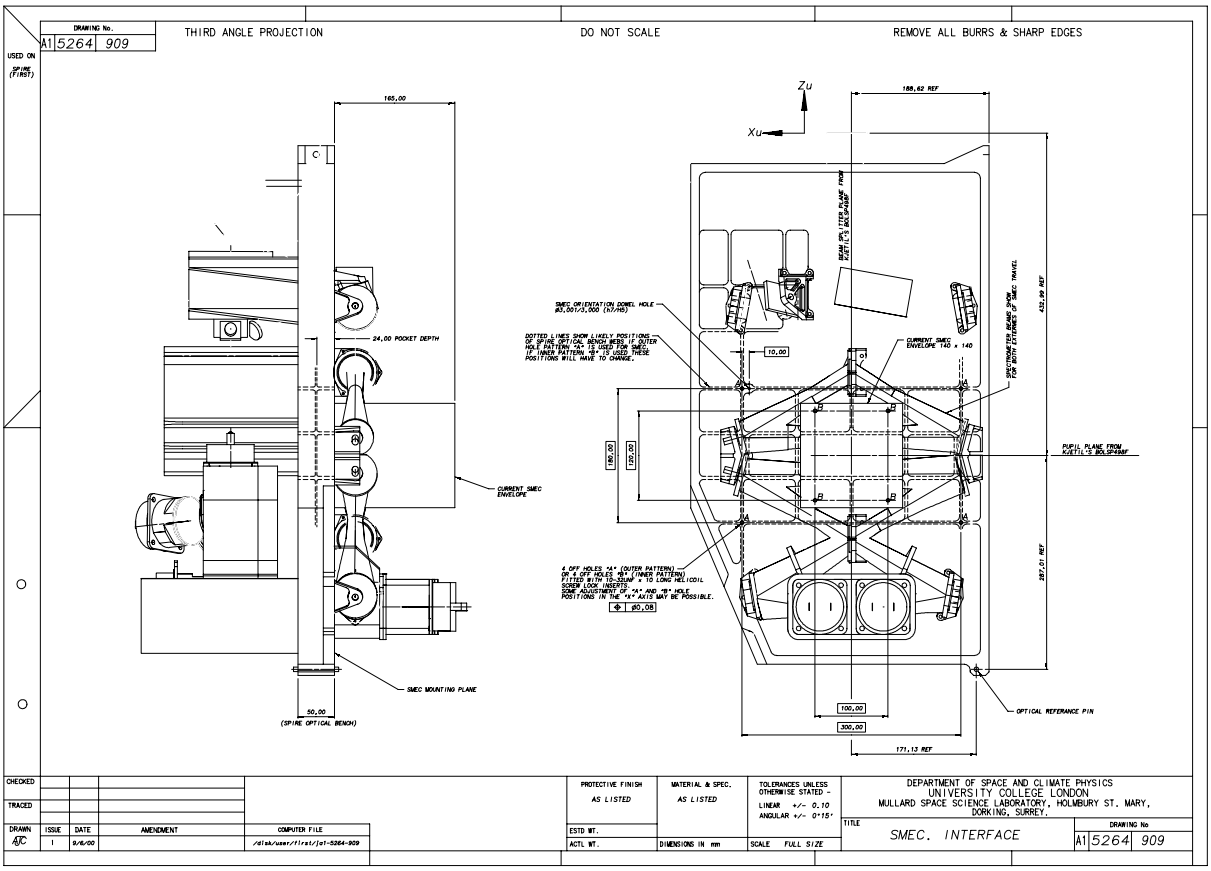
SUBSYSTEM:	UNIT CODE:

MECHANICAL INTERFACE CONTROL DRAWING SOB – FTS mechanism

Change control sheet		
Drawing Number A1-5264-909. (DR1)		
Issue:	Date	Change
1	09/Jun/2000	First issue

SUBSYSTEM: **SOB – FTS mechanism**	UNIT CODE:

MECHANICAL INTERFACE CONTROL DRAWING SOB – FTS mechanism



Interface drawing between structure (SOB) and the SMEC-m (DR1)

The SMEC-m is mounted on stiffeners running along the SPIRE optical bench in X-direction. Two interface patterns are indicated in the above listed drawing. Both are consisting of 4 bolt holes. The inner pattern for a 'narrow' SMEC-m design and the outer pattern for a 'wide' design. The latter is considered in order to enhance alignment of the mechanisms translation sensor with respect to the carriage during operation. The (SMEC-m internal) requirement on that alignment is strict.

Within the drawing the outline of the beams is pictured. These beams envelope the geometrical beam. An extrra 20% margin around the beams is required by the optics design.

With respect to the mechanical and thermal interface the following has been agreed between LAM and MSSL:

1. There will not be a launch lock interface.
2. There is no strict rotational alignment requirement, that is the 4 I/F bolt holes are positioned within +/- 0.1 mm accuracy with respect to each other in the XZ plane.
3. There will be 1 thermal contact
4. Warping of the SOB due to integration and built tolerances is not expected to be a significant problem at this stage. If the warping requires compensation it will be done using shims.
5. The beam splitters need to be as small as possible to allow for mounting space, extend the small available envelope as much as possible.
6. There will be a SMEC-m orientation dowel hole, to prevent the SMEC-m from being mounted 180° rotated.

3.2 Harness interface data sheets

INTERFACE DATA SHEET

SUBSYSTEM:	UNIT CODE:

HARNESS LAYOUT

Change control sheet		
Drawing Number		
Issue	Date	Change

SUBSYSTEM:	UNIT CODE:

HARNESS LAYOUT

Drawing TBD gives details of the SMEC-m – RF filter box harness routing + connectors

3.3 Optical interface data sheets

N.A.

4. ELECTRICAL INTERFACES.

The SMEC-m will be sufficiently conductive connected to the SOB, via 4 bolts and a theraml strap, to ensure proper grounding of the mechanism to the SOB.

5. DATA INTERFACES

Not applicable