

HERSCHEL-SPIRE: Optical cubes

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Issue 2 resumes discussions concerning SC1 position,
culminating in the proposal of a new cube design.
Issue 3: Cube design does not affect structure interface.

SPIRE requirements

The SPIRE alignment sequence for assembly & integration verification as well as the cold calibration phase (SPIRE inside the calibration cryostat) requires the use of three cubes whose top surface (face A) is of optical quality and engraved with a set of five cross-hairs. All three must be visible through the optical port of the SPIRE calibration cryostat (red circle in Figure 1).

The three cubes are:

- HC1: Mounted on the Herschel optical bench simulator (HOB). Materializes the position and direction of the Herschel telescope axis (Herschel ref. point).
- HC2: Mounted on the Herschel optical bench simulator (HOB). Allows verification of the orientation of the bench.
- SC1: Mounted on the top edge of the SPIRE optical bench (SOB). Verifies orientation and location of the instrument with respect to the HOB.

Herschel requirements

The Astrium alignment plan relies on horizontal access to two faces of an alignment cube on each instrument, as detailed in document "Herschel Alignment Concept, HP-2-ASED-TN-0002, Draft 1, 12.07.01. This is used during integration of instruments on the optical bench (HOB), see Figure 2, before integration of the HOB within the cryostat. After integration in the cryostat, alignment measurements will only be possible through the HiFi Local Oscillator (LOU) window. It will probably not be possible to access the SPIRE cube.

The baseline concept is to equip the cube SC1 with optical surface and cross hairs on two of its lateral faces (B and C). These will face the directions accessible by the Astrium alignment devices. If our understanding of Fig. 2 is correct, they should therefore face the $-Z$ and $+Y$ directions.

NOTE: In case of incompatibility between the position of SC1 (dictated by SPIRE requirements), a fourth cube (SC2, identical to SC1) may be located in a different position along the top edge of the SOB.

Cube design and location

The cubes have dimensions $31 \times 31 \times 31 \text{ mm}^3$, following the design shown in Figure 3. Location of the centre of the cube SC1 is:

$$\mathbf{X} = 445.52 + 31/2 = 461.02 \text{ mm}$$

$$\mathbf{Y} = 93 + 1.5 + 31/2 = 110.00 \text{ mm}$$

$$\mathbf{Z} = -(40.91 + 31/2) = -56.41 \text{ mm}$$

SC1 (or SC2 if present) will be mounted in such a way that faces B and C face towards the Astrium alignment devices. If our understanding of Fig. 2 is correct, they should therefore face the $-Z$ and $+Y$ directions.

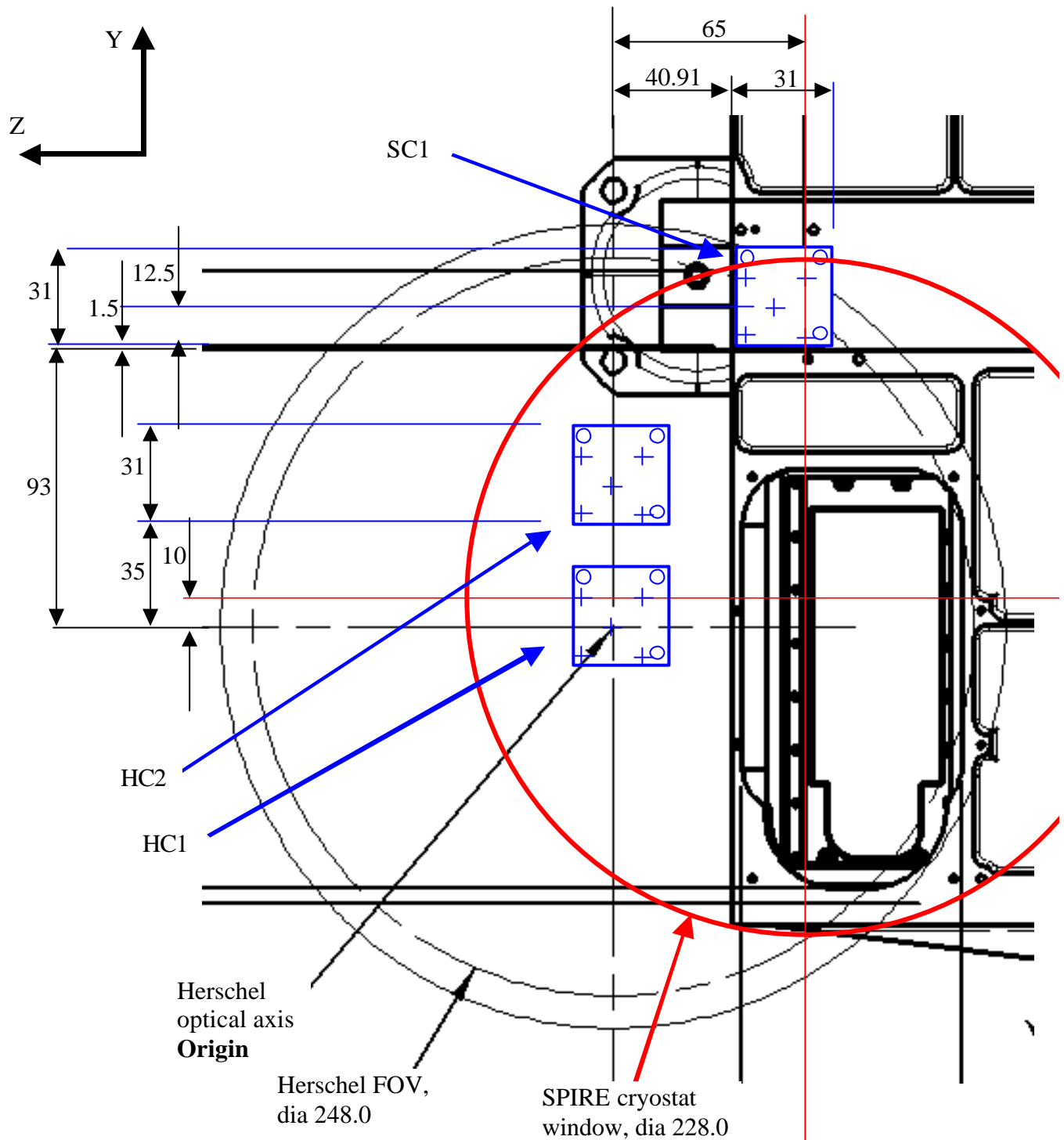


Figure 1. View along the telescope optical axis of the SPIRE entrance port. SPIRE cryostat window shown in red. Alignment cubes shown in blue.

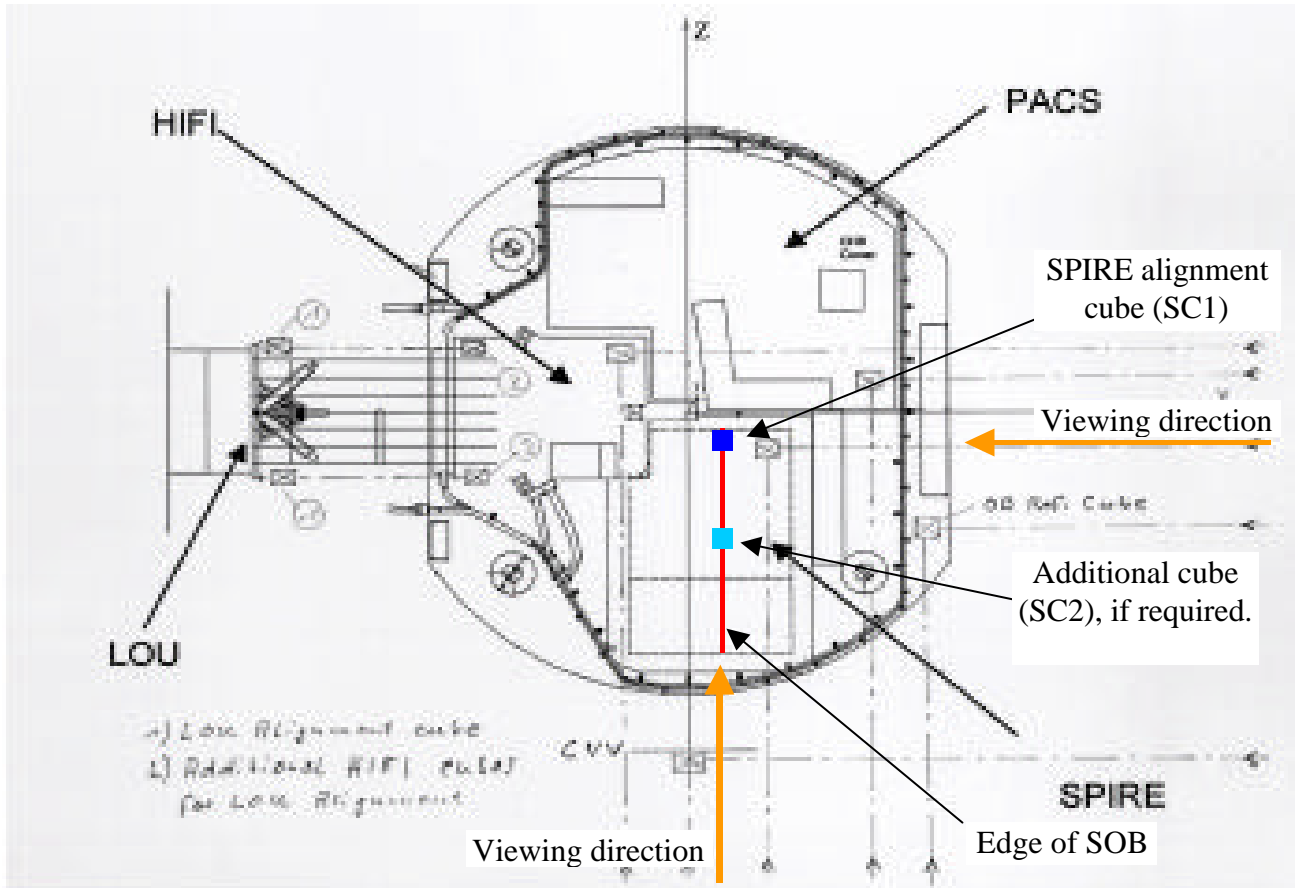


Figure 4-1: Alignment References

Figure 2: Extracted from Herschel Alignment Concept (document from Astrium, ref. HP-2-ASED-TN0002 draftv1, 27/09/2001 ?)

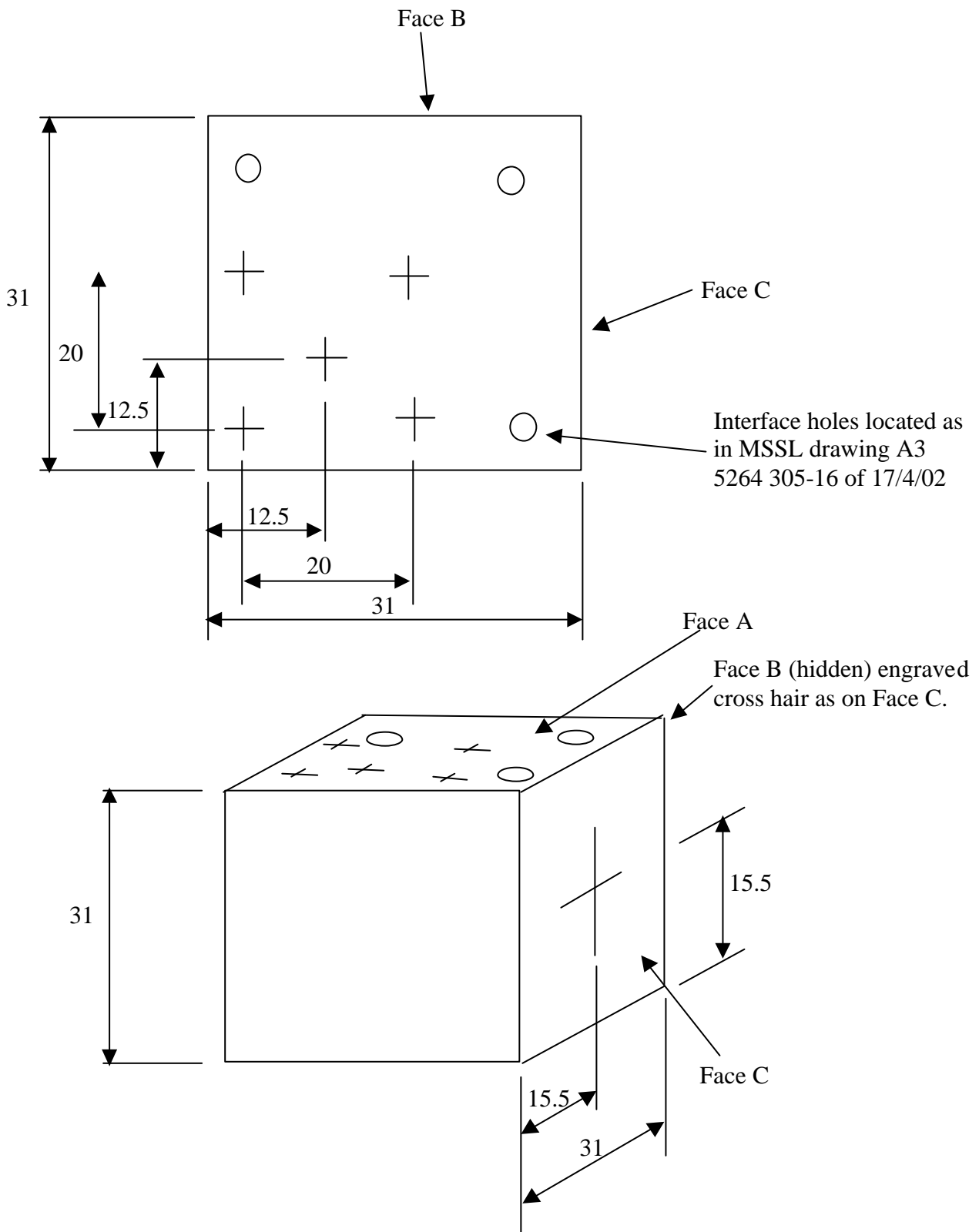


Figure 3: Sketch of alignment cubes. The cube is 31x31x31 with mounting holes through the top surface. Appropriate undercuts on base to be defined. Cross hairs on faces B and C are centred on each surface.