

**Brief report on the meeting to discuss division of the FIRST focal plane at  
ESTEC on 29 Oct. 98:**

**Matt Griffin  
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## **Background**

1. Everyone agrees that the use of the centre of the FIRST focal plane is poor at the moment.
2. HIFI have some problems which incline them to move their M3 out a bit from the middle if they can.
3. This offers an opportunity to reconsider the whole arrangement and come up with a more sensible way of doing it.

## **Current arrangement**

The alley between SPIRE and PACs is 80 mm wide and the centre of our M3 is around 90 mm from the telescope optical axis.

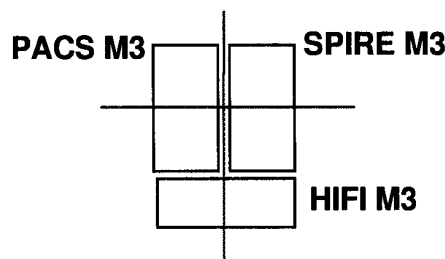
## **Possible new arrangements**

### **Option 1 (easy):**

HIFI move their M3 out a bit and we (PACS and/or SPIRE) give up some room in the corner of our boxes to accommodate the part of HIFI M3 which feeds their beam to the calibration unit. The alley width can be reduced to about 60 mm, allowing PACS and SPIRE to move in by around 10 mm each.

### **Option 2 (more difficult but very attractive for us and PACS):**

HIFI moves out of the alley. They turn their mirror through 90 degrees and occupy a region the outer part of the unvignetted field of view:



The gap between the SPIRE and PACS walls can be reduced to some small value compatible with ease of integration (say, 5 mm).

This would put the centre of our M3 at around 55 mm instead of 90 mm from the centre of the focal plane.

SPIRE and PACS will still be able to chop symmetrically about the Z axis, which is regarded as essential, by both.

For HIFI to do this is not easy:

- They need to look at whether/how they can revise their chopping scheme with the mirror rotated through  $90^\circ$ .
- It will be a problem to fit their M3 inside the radius of the unvignetted fov (currently 120 mm)

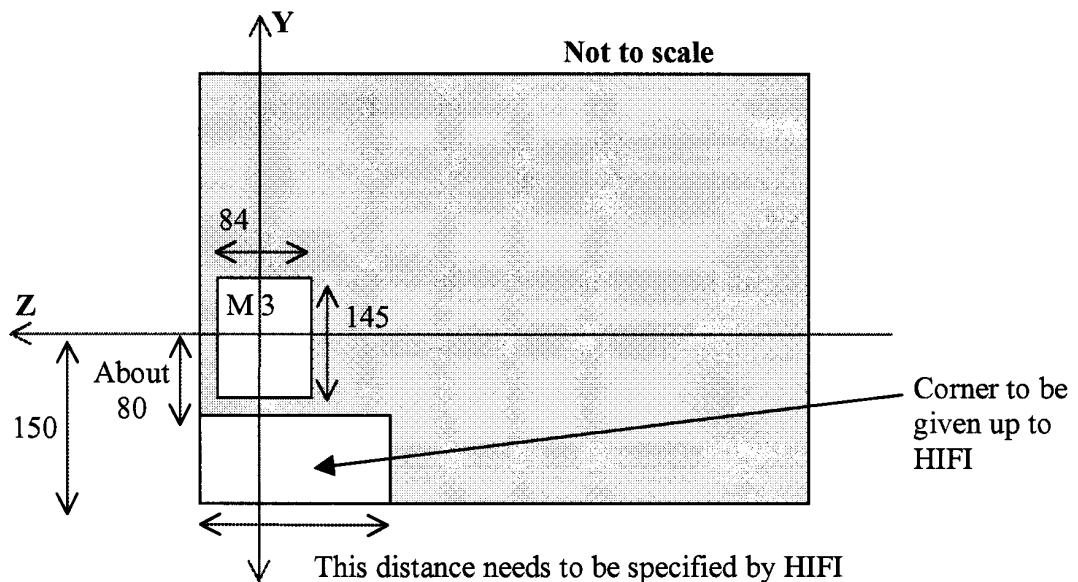
### Proposed solution for option 2:

1. PACS and SPIRE give them as much space as possible by moving our side walls closer to the centre of the focal plane

For SPIRE, we currently have (approximate figures):

distance between centre of M3 and the wall = 150 mm  
 distance between edge of M3 and the wall = 78 mm

To help HIFI to move out, we need to reduce give up about around 80 mm, and PACS will do the same.



Note: There are no severe constraints on space on the +Y and -Z sides of SPIRE, and we could also expand upwards (+X).

2. Even if PACS and HIFI can make this extra room available, that will probably not be quite enough, so the unvignetted field of view of the telescope needs to be expanded by around 10% by increasing the diameter of the hole in the primary. This would have

little impact on the obscuration, which is small. Making the aperture bigger will actually be to our advantage from a stray light point of view, especially at long wavelengths. The thermal input to the cryostat may be a bit larger than before, but this is not seen as a big drawback by ESA.

It would be good if we could give HIFI the extra room without reducing the size of M3. But even if we have to reduce it a little bit, I suspect that the improvement in image quality and simplification of the optical design will be well worth it.

### **Actions from the meeting**

1. Option 1 is seen as robust and easy to implement as a fall-back in case option 2 turns out to be impossible.
2. HIFI will examine the feasibility of changing their mirror orientation and moving it out as suggested. They will produce a drawing of their proposed division of the focal plane ASAP for option 2 and circulate to SPIRE and PACS for iteration and agreement by the end of November.
3. By early December we will present ESA with the proposed new scheme, together with a preliminary assessment and justification of why we think this is such a good idea (basically a list of pros and cons). I don't think we need to or should do a complete re-analysis for this – just make a reasonable qualitative assessment of the improvements in image quality, possible simplifications of the optics, better stray light, etc.

ESA will assess the impact on the cryostat and telescope designs.