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Subject: Re: AI6 of HOWG meeting d.d. 11 march 2002



Card for Douwe Beintema

HIFI response to AI 6 of the Herschel Optical system Working Group Meeting of 13 March 2002

1. Focus alignment - marginally OK

The required alignment budget is inversely proportional to frequency. According to the HIFI alignment budget philosophy, we have the following requirements for the different bands:

Band 1 (<= 640 GHz)	allowed internal or external error: 14 mm
Band 2 (<= 800 GHz)	allowed internal or external error: 11 mm
Band 3 (<= 960 GHz)	allowed internal or external error: 9.5 mm
Band 4 (<= 1120 GHz)	allowed internal or external error: 8.2 mm
Band 5 (<= 1250 GHz)	allowed internal or external error: 7.3 mm
Band 6L (<= 1703 GHz)	allowed internal or external error: 5.4 mm
Band 6H (<= 1910 GHz)	allowed internal or external error: 4.8 mm

These errors each correspond to <1% of coupling loss with 95% confidence. Two of these errors in series could cause a 4% coupling loss.

The internal errors are representative of the feasibility of direct verification at submm wavelengths of the focus accuracy of the mixers within the mixer sub-assemblies. Positioning of the mixer does not effect the focus location. The geometry of the common optics assembly is verified with visible light to a much higher accuracy.

The external errors are more stringent than the budget proposed by Astrium. However, a 95%-confidence tolerance of order 10 mm would be acceptable in view of the worse losses expected from pointing errors, even if the pointing goals are met.

Conclusion: a 95%-confidence internal error of 3 mm is not achievable in HIFI. But internal focussing is in principle no problem.

Adequate external focusing accuracy is obtained only at the lowest frequencies, but a 95%-confidence of 10 mm is acceptable (causing a coupling loss of 5% in band 6H, half of what is expected from pointing errors).

2. Pupil alignment - No problem at all

By the same philosophy as outlined above for the focus alignment, the pupil alignment tolerance is 12 mm in one dimension, or roughly 17 mm half-cone, 95% confidence. Both internally and externally. This is independent of frequency.

In HIFI, again the major source of inaccuracy is within the mixer subassemblies. But again, the alignment of the mixer sub-assemblies will be verified at sub-mm wavelengths.

Although the internal pupil alignment can not be verified to the Astrium values, the overall pupil alignment will not be a problem, due to the insensitivity of HIFI to pupil misalignment. This insensitivity stems from the tapering of the submm beams.