Corrections suggested by ASED to the minutes

The corrections are inserted by bold characters, the text with normal characters is unchanged. Please remove the bold format before copying/inserting (the bold format shall only indicate where changes have been done).

F. Herschel stray light status– see ASED presentation in annex 6

The work presented ASED is at an intermediate status, as the final results will be presented at the H/P QPM in the July15-18, 2003 period.

Major changes since last meeting in October 2002 are listed below:

- enlarged sunshade
- telescope model with new hexapod bars
- cryo-cover with 2 mirrors **for ground testing of instruments; side of short cone of cryocover is made black**
  - **in favour of lower temperatures for the experiments during ground testing**
  - **this is a disadvantage for stray light both in orbit and during ground testing**
- SPIRE ASAP model (new scattering function introduced for the thermal filter **no. 1**)
- PACS ASAP model (introduction of new commands in the model **for all mirrors as suggested by PACS**).

Additional models have been created for assessing the gap effect between the M1 mirror and the sunshade and for checking the influence of LOU windows on straylight levels on SPIRE and PACS instruments.

The gap between the M1 and sunshade has proven to have values lower than 0.5% compared to the few percent found before (reminder 100% = telescope background transmission).

For the LOU windows, the stray light levels are also found to negligible below 0.16% worst case for SPIRE at 230 microns.

Diffraction calculations:

- Diffraction at rim within a pupil plane→ fairly homogeneous distribution on the detector plane --> worst source: gap with sunshade and diffraction at M2 mirror
- Diffraction at rim within an image plane→ steep increase from center to rim on the detector plane --> worst source: warm object during ground testing and diffraction at rim of opening or filters in the instruments

SPIRE is mentioning that the apodisation factor is wavelength dependant. The results for diffraction at the rim of M2 with source being the gap near the sunshade has been decreased by a factor 10: 5% down to 0.5% (**due to the new detailed model,** see above).

Diffraction on rim of thermal filter 1 of SPIRE (the thermal filter is in the image plane) with source being the warm CVV rim in ground testing.

For details of the calculation: see the presentation.

At 80 micron **(PACS)**, no results obtained due to numerical problem→ no problem due to extremely low levels.

Conclusion on diffraction:

*The opinion of the people present today is that the diffraction cases analyzed by ASED are worst case and have low contribution to the overall stray light budget with the exception of the ones mentioned in the presentation (longest wavelength of SPIRE and the possible misalignment **within SPIRE and PACS**). In conclusion, neither the fears of PACS (N.Geiss) nor its calculation are fully understood by the stray light specialists present today. One diffraction contributor mentioned by PACS is the cryostat opening rim: it is estimated to be less detrimental **to PACS than to SPIRE, the PACS beam is more "far away" from the cryostat rim than the SPIRE beam**.*

*It is reminded that the **experiment-**internal alignment should ensure that illuminated rims **near the expriment input** are not seen by the detector, especially **for illumination by** hot sources (ground testing). **In case of visibility of the rims due to misalignment, a dramatic increase of straylight is to be expected.***

The illuminated rims of the M2+hexapod are considered to be visible by the detector (in the straylight analysis) since it is not possible/foreseen that they are invisible by the detectors. The resulting straylight was found not important.

On this subject, SPIRE (MF) is mentioning that they have currently problems manufacturing the CM3 mirror for the STM creating alignment problems, which could give stray light problems at the end.

Scattered radiations

Latest data with revised temperature shows no dramatic change since October 02 for the in-orbit case:

- 31.85% for PACS
- 19.36% for SPIRE.

Data for PACS and SPIRE are in % with 100% for the total telescope irradiation (70 K, emissivity of 0.03).

NB: Error bars on the scattering results are factors (may be 2) not percent.

The 7.68% of structure and slits around cryocover for PACS should be clarified : the seems to be driven from on-ground testing and thermal (instrument temperature) considerations. Can it be corrected ? What is the design driver?

The 12.5% is coming from stray light analysis carried out by ASEF.

Results look quite high but this inherent to the telescope design with an aperture in the middle of the Primary Mirror (M1). Likely, a more complex telescope design with an off-axis design would have given better results !! It should be clarified whether this 12.5% do not take into account obscuration from hexapod structure and scattercone.

Recommendation:

The Herschel OWG recommends that all stray light results and analysis be revisited in order to make new budgets with

- optimum and nominal cases from real emissivity data of aluminized Kapton, preferably measurements
- and eventually temperatures (less influencing factor).

This work is strongly encouraged for the justification of the waiver, which is intended to be presented by ASED for the straylight requirement.

The above work shall be supported by the following actions:

- check emissivity values of aluminized Kapton (from Sheldahl) used for the hexapod, including Al thickness. If possible, choose aluminized Kapton foil with the highest Al thickness in order to decrease emissivity at longest Herschel wavelength
- If needed, measurement of emissivity of thermal aluminized Kapton used on hexapod and M1 central baffle at Herschel wavelength (LEMTA). To be done at same time as mirror sample.
- ASED to send aluminized Kapton sample to ASEF urgently for test campaign.

Warning on result interpretation: The self-emission on PACS/SPIRE detectors with closed cryo-cover during ground testing shall be understood as follows: PACS stray light ratio will be 0.375 % extra of background radiation instead of 30% extra for in-orbit case, if the cryocover is correctly designed i.e the cryocover is designed to match the in-orbit telescope background.