Issue status:
Draft 27 July 2004 – Initial draft to flag problem – I missed the fact the there was some treatment of the LOU hole straylight
1.0 – 31 August 2004 – Revised version with the same conclusions but now with discussion of the limitations of modelling straylight diffusion.

The analysis presented in HP-2-ASED-TN-0023 iss 3 deals, as far as I can tell, with straylight from the LOU windows for three cases:

1. The light that scatters around the gap between the cryostat inner shield and the instrument shield
2. The light that gets through HIFI and scatters back from the surfaces forward of the instrument apertures.
3. The emission from the LOU windows themselves that enters the instrument shield via the holes for the LOU path and arrives at the instrument aperture

The third item here is discussed in section 5.2 of the report but the results are not explicitly given for this path (see table 1) hence my confusion in the previous issue of this note. On the basis of this analysis it seems that no baffle is provided on the inside of the instrument shield to prevent straylight from the LOU holes reaching PACS and SPIRE – this is despite our explicit request for such a shield and its inclusion in the original cryostat study – see figure 1.

We have severe reservations about accepting the proposed design based simply on analysis:

i) By admission the analysis only deals with specific identified paths as the software cannot deal with large numbers of ray paths.
ii) Only scattering and reflection are dealt with – the effects of diffraction are not (and cannot I suspect) be dealt with.
iii) In the end the process light scattering and diffraction at these wavelengths and temperatures is virtually one of diffusion and very difficult to model.
iv) The emission from the cavity between the inner shield and the first cryostat shield (at about 34 K) is not dealt with at all in any case.

All these concerns lead us to the question: “where has the LOU inner shield baffle it gone?” The CDR “design” no longer appears to show this baffle. This is completely unacceptable and SPIRE rejects this design forthwith. We indicate on the sketch provided an indication of where the baffle must be located in order to prevent unwanted radiation entering the instrument shield environment.

All our experience leads us to a “belt-and-braces” approach to preventing straylight problems. We have done our very best to seal our instrument box against straylight, but we cannot be certain that we have no leaks: we depend on each stage of the system doing its part in baffling against unwanted radiation and that includes baffling the LOU path properly.

Emitting object	temperature / emissivity	scattering(Sc)/ diffraction(D) on	PACS detector	SPIRE detector
Sunshade	204 K / 0.05	Sc: M1/M2, +spec.	2.326	0.611
gap between Sunshade and M1	204 K / 0.10	only Sc: M1 / M2	0.193	0.092
gap between Sunshade and M1	204 K / 0.10	only D: M2(rim)	0.5	1.3
Hexapod	70 K / 0.02		3.122	3.977
M1+M2 (without reference path)	70 K / 0.015		2.488	1.873
scattercone	70 K / 0.015		0.615	0
M1-Baffle flat	75 K / 0.05		1.382	1.098
M1-Baffle cone / cylinder	75 K / 0.05		3.537	0.499
gap (12 mm) between M1-Baffle cone and cylinder	75 K / 0.90		1.542	0.330
Cryocover mirrors	75 K / 0.05		0.676	0.025
other reflecting parts of Cryocover	75 K / 0.05		0.069	0.020
Cryocover black rim	75 K / 0.80		1.749	0.246
reflecting objects near Cryocover	75 K / 0.05		0.462	0.070
black gaps around Cryocover / M1-Baffle	75 K / 0.90		2.796	0.414
CVV top	75 K / 0.05		1.237	0.077
gap betw. CVV / Thermal Shield 2 Baffle	75 K / 0.90		0.500	0.119
Thermal Shield 2 Baffle black	43 K / 0.80	only specular	1.478	1.391
Thermal Shield 2 Baffle black	43 K / 0.80	only scattering in instrument.	0.071	0.805
Instrument Shield Baffle	12 K / 0.05		0.002	0.002
Gap below Instrument Shield Baffle	12 K / 0.90		0.076	0.033
LOU windows via HiFi	150 K / 0.90		0.05	0.04
LOU windows via heat shield gaps	150 K / 0.90		0.231	0.020
Holes in OB for cooling straps (worst case consideration only)	34 K / 0.90		0.2	0.02
sum			**25.3**	**13.1**

Table 1: From the straylight report – there is no explicit result for the path from the LOU holes in the inner shield to the instrument. Do we assume the results are negligible? Also the straylight from the 34-K environment via the LOU holes is not treated although the cooling strap holes are.

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There is a second optical interface to the instrument, the HIFI LO interface. To protect the PACS and SPIRE instrument from stray radiation of the LO reference signals a baffle between the HIFI instrument and the instrument shield is foreseen. It shall be consisting of two parts, one mounted to the HIFI instrument and one mounted to the instrument shield, overlapping each other to generate a labyrinth.

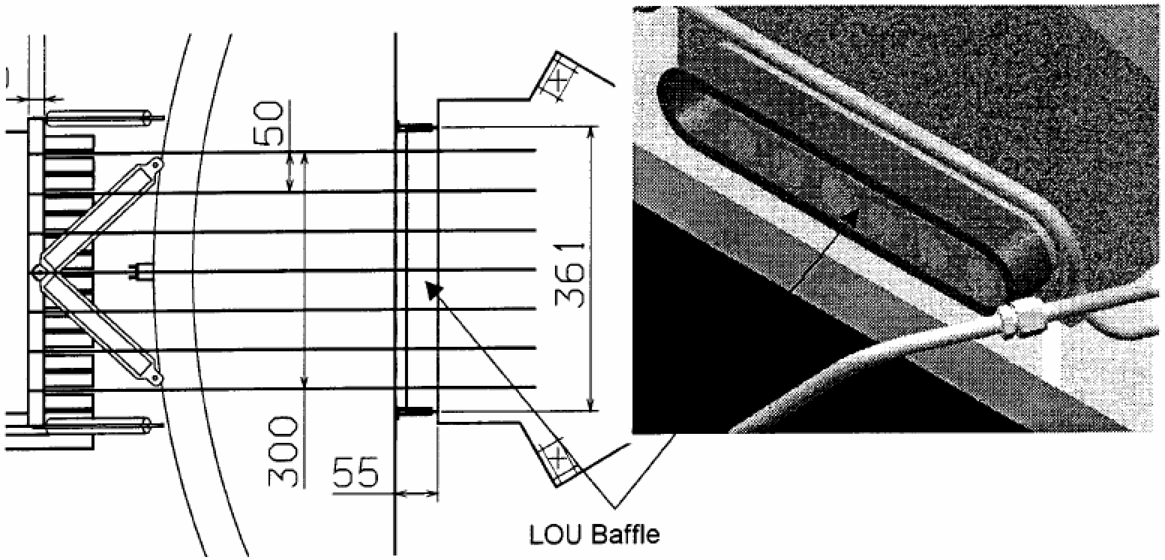

Figure 1: Extract from Cryostat Study final report from 2000 showing that industry accepted the need for an LOU baffle and that there was a notional design for it.

This page looses definition when made into a pdf version for LIvelink, word version available from SPIRE project office on request - Judy Long - j.a.long@rl.ac.uk

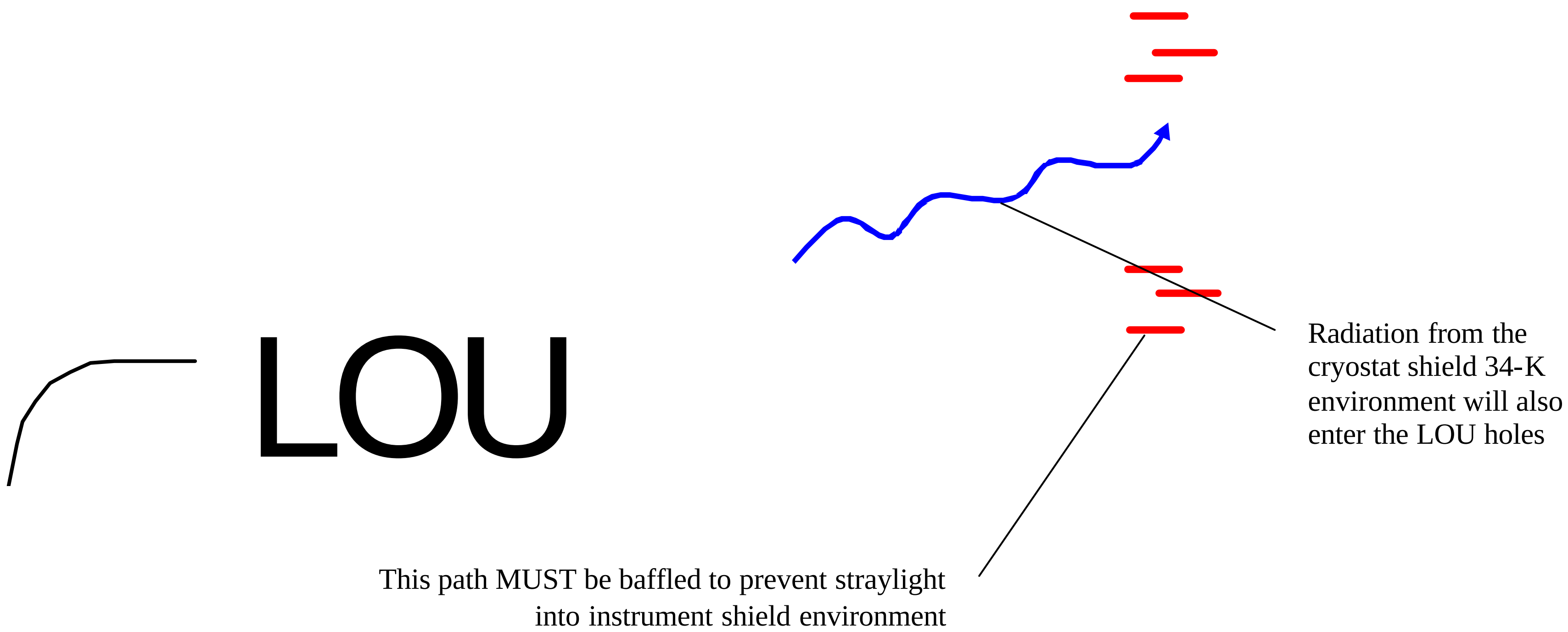

Figure 2: Sketch of design for LOU baffling from Astrium – the instrument shield baffle has gone missing – the red lines indicate where the baffle must be placed to minimise the straylight into the instrument shield. Also missing is any treatment from the 34-K environment indicated by the wavy line.