



3rd May 2001

To: Don Peterson

From: John Delderfield

cc: Bruce, Doug, Matt, Dave.

SPIRE-RAL-COM-000683

## **SHUTTER CLARIFICATIONS.**

Following on your visit to RAL, I've discussed the shutter's calibration function with Bruce.

In essence, at our recent meeting I presumed that when closed it was required to source a calibrated irradiance into the instrument, since it is radiometric calibration with which we are concerned. This is more stringent an approach than Bruce has in mind. The shutter's function can be simplified to that of providing fixed irradiance references, maybe three; one ambient equivalent to zero, one heated to source an irradiance equivalent to a blackbody at an intermediate temperature, and one baselined as sourcing an irradiance equivalent to a blackbody at  $26 \pm 1$  Kelvin.

This means that its surface facing inwards only has to be of a highish emissivity, not necessarily black, provided that its emissivity is known. The idea is that any scattering from this surface will give the Spire detectors a view back into the instrument's own optics, particularly the input baffle. This is cold.

The need for high precision remains, noting that Spire measures its fullscale to 19 binary bits! I personally think this is merely the extension of a noise performance from that needed at low levels, and Spire will be doing exceptionally well if it measures to 0.1%. You should try and propose a set of errors that amount to this total as a target, apportioning them between emissivity instability, temperature sensor drift, change in the impedance of the harness between sensors and the EGSE, drift in the conditioning electronics' reference (assuming it compares a reference to the sensor and does not attempt an absolute sensor measurement), the extent to which the shutter has differing temperature gradients across it, and any tendency for the temperature sensors to be affected by what comes down their leads rather than representing the temperature of the surface of the shutter facing the Spire optics. If you get down to less than 1% I reckon you will be doing wonderfully, even in producing just a stable irradiance and not a quantified one.

There would be every advantage if the shutter EGSE were to servo the shutter's heater so as to cause the chosen value of temperature readout to be obtained.

We know that unavoidably the shutter will radiatively load the Spire optics input, and probably with a wider solid angle than in flight they have a view out to the HERSCHEL telescope. It effectively radiates inwards into  $2\pi$  ster. How would you feel about a specification that the shutter at 26K should only couple additional heat of <10% of this radiance into the Spire FPU by means of conduction?

Can you respond to questions of whether sensor and drive grounds need separating, which seemed the main functional difference between your present proposal and my last suggestion.

I would hope Dave Smith will soon respond, if he has not already, as to how much of the 150mm clearance between cryostat and FPU can be made available for the shutter, given that up to now it had all been taken as available for viewing a blackbody mirror.

Cheers

John