	Centre National d'Etudes Spatiales	
SCA _RAD_12 TRO-34-NT-2825-CNES	**Activity : CAL/VAL** **Channel 1 gain compared with channel 2 sensitivity.**	**Prepared by :** **A Rosak** **Verified by :** **N Karouche**

Contents

1. OBJECTIVE

The Scarab gain can be measured in-flight with the on board calibration module (CALM).

This module has one lamp for Channel 1, and three high performance black bodies for Channel 2,3&4.

For Channel 2, in nominal mode, a solar filter is front of the detector. During the calibration sequence, this solar filter (on a filter wheel) is removed, and the thermal gain can be measured for this “solar” channel. The high performance black bodies (and the channel 2) have been found very stable.

For channel 1, the lamp was found not enough stable to compute the gain accurately. A new method to follow the gain of the channel 1 is proposed here.

The general idea is to compare the response of the channel 1 and the response of the channel 2, when measuring typical bright and cold scene. With this comparison, we can detect any change in the gain of the channel 1, so we can update the IODD value if necessary.

Note that the channel 1 requirement for stability is about 1%.

2. METHODS

The idea is to select area where the short wave luminance is very high (L_{sw}> 250 W/m²/sr), and where the long wave luminance is very low (L_{ir} of Channel 4 < 5W/m²/sr).

It corresponds to cold and bright clouds.

To improve the accuracy of this comparison, we select only homogenous area. To be considered, a pixel is compared to his 4 neighbours. The difference between the radiance of the pixel and each of his neighbours must be lower than 10%.

To minimize the noise of this estimation, the number of selected pixels must be higher than 25 in the image. Otherwise, the calculus is not done.

Then, we compute for the image, with the selected pixels :

$$\frac{G_1}{G_2} = \frac{L_{2\_sw}}{L_1}$$

Note : This calculus is made simultaneously with the calculus of A' on nominal images. We use the same bright and cold clouds for the 2 computations.

3. SUCCESS CRITERIA

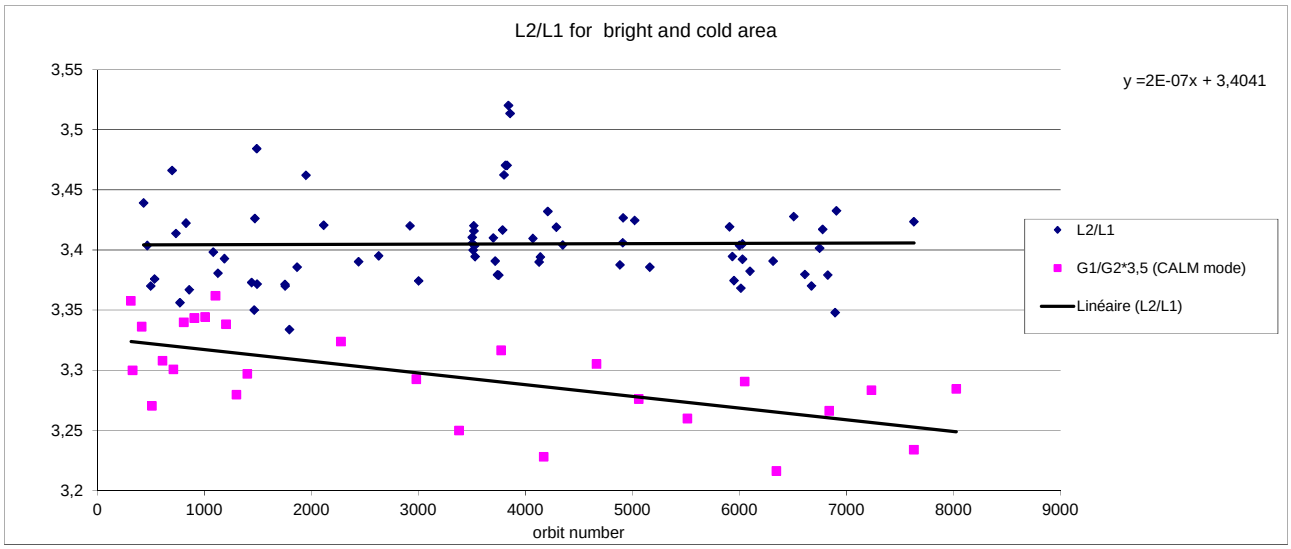
An evolution of 1% of the ration G1/G2 must be carefully instructed.

4. RESULTS

Orbits with large clouds are selected to estimate the G1/G2 factor.

The blue curve presents the result L_{2_sw} / L_1.

The pink curve presents the ratio G1/G2, measured from the CALM mode. G1 is measured with the lamp of the CALM. G2 is measured with the high performance black body of the CALM. A "3.5" factor is applied to facilitate the comparison.



We can see the drift of the lamp (pink curve).

When we compare directly channel 1 luminance for bright/cold area to channel 2 luminance, we can demonstrate that there is no drift of the channel 1, compared to the channel 2.

The drift measured by the linear regression for L_{2_sw} / L_1 is about 2E-7*8000/3.4 = 0.05%

As the channel 2 stability is about 0.1% per year, we can assume that the channel 1 stability is probably better than 0.2% for one year and a half.

The lamp is no longer used to follow the channel 1 gain.