Req. 4.3.10D Dark Current Measurements in Spectroscopy

4.3.10D - A. History

Version	Date	Author(s)	Change description
1.0	February 25, 2009	C. Jean, P. Royer	First issue

4.3.10D - B. Summary

This report presents the OBSID=3221226430 data obtained during the SOVT-2 tests campaign in order to measure the dark current in both arrays and in different configurations of the grating, the chopper and the filter wheel. The conclusion is that the dark current in the red array is much higher than in the blue array and that we clearly in this array the different behaviour between the two supply groups.

4.3.10D - C. Data Reference Sheet

Ref.	**Date**
SOVT-2 OBSID=3221226430	**16-Dec-2008**

4.3.10D - D. Test Description

The test consists of a succession of 16 9-minute long "exposures" with different positions of the grating, the chopper and the filter wheel. For both arrays, the smallest capacitance (0.14 pF) was used.

The first group of 8 exposures were carried out with the chopper set to the position "CS1" and the second group to the position "CS2". The calibrations sources CS1 and CS2 were switched off all along these exposures.

For each group, 4 different grating positions were programmed: 50000, 675000, 740000, 800000. Each exposure at a given grating position was supposed to be executed twice, one exposure with the filter wheel at a given position (A or B) immediately followed by a second one with the filter wheel set to a null position (see Tab. 1). Because of a bug in the commanding script, the grating moved back to an arbitrary position when the filter wheel was put to the null position (see Fig. 1).

The figure 1 shows the positions of the grating, the chopper and the filter wheel as a function of time. We can see that the grating moves to an arbitrary position when the filter wheel is set to the null position (-1 on the plot). The other filter wheel positions are A (0) and B (1).

4.3.10D - E. Analysis

For each 9-minute "exposure", we fit a Gaussian model to the histogram of the signal values (slope of the average ramps) of all the pixels, excluding the rows 0 and 17 (open and resistor channel) as well as the known bad pixels. The fitted parameters of the Gaussian model give us a measure of the average dark current and its standard deviation. In addition, we distinguish the two supply groups of each array.

The figures 2 and 3 present, for the blue and the red arrays respectively, the average dark current and its standard deviation in electrons / second for each exposure and for each supply group.

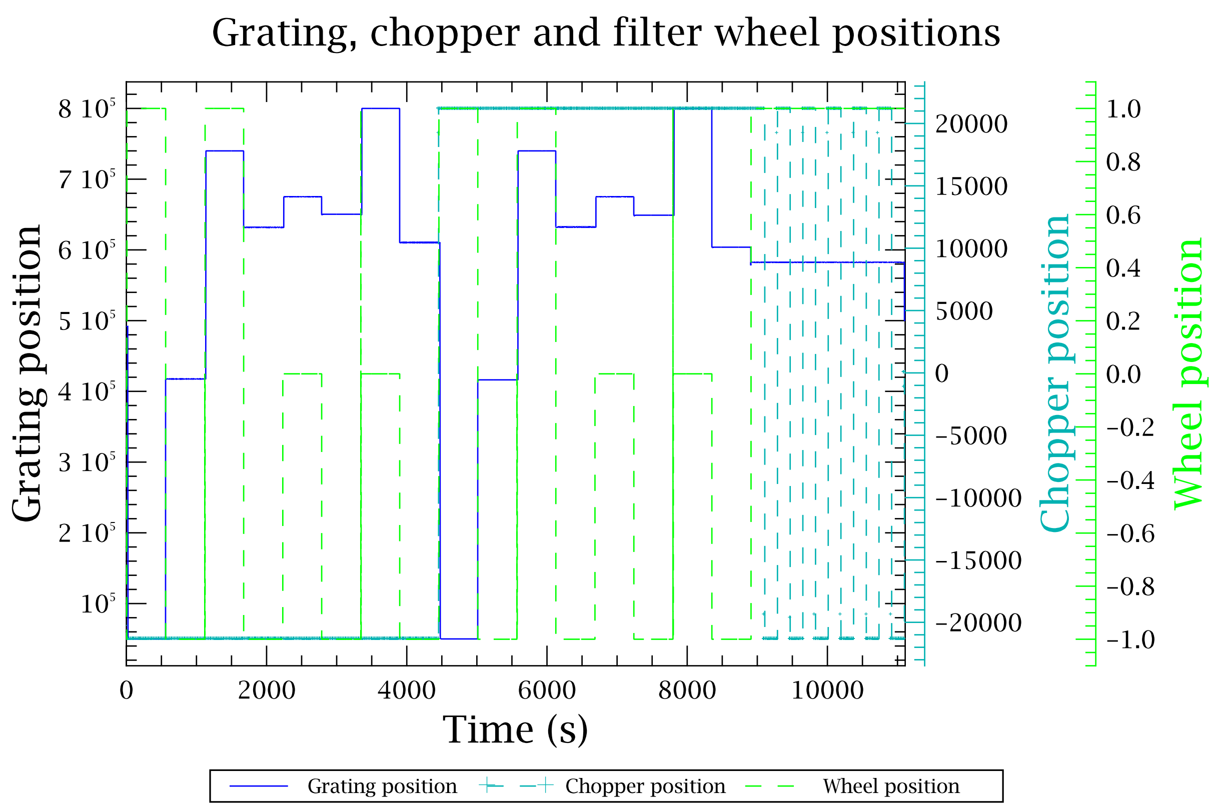

Figure 1: The grating, chopper and filter wheel positions as a function of time. The three filter wheel positions are -1 (null), 0 (A) and 1 (B).

GPR	CPR	WPR
50000	CS1	B
50000	CS1	Off
675000	CS1	B
675000	CS1	Off
740000	CS1	A
740000	CS1	Off
800000	CS1	A
800000	CS1	Off
50000	CS2	B
50000	CS2	Off
675000	CS2	B
675000	CS2	Off
740000	CS2	A
740000	CS2	Off
800000	CS2	A
800000	CS2	Off

Table 1: The positions of the grating, the chopper and the filter wheel as they were initially planned for the 16 9-minute "exposures".

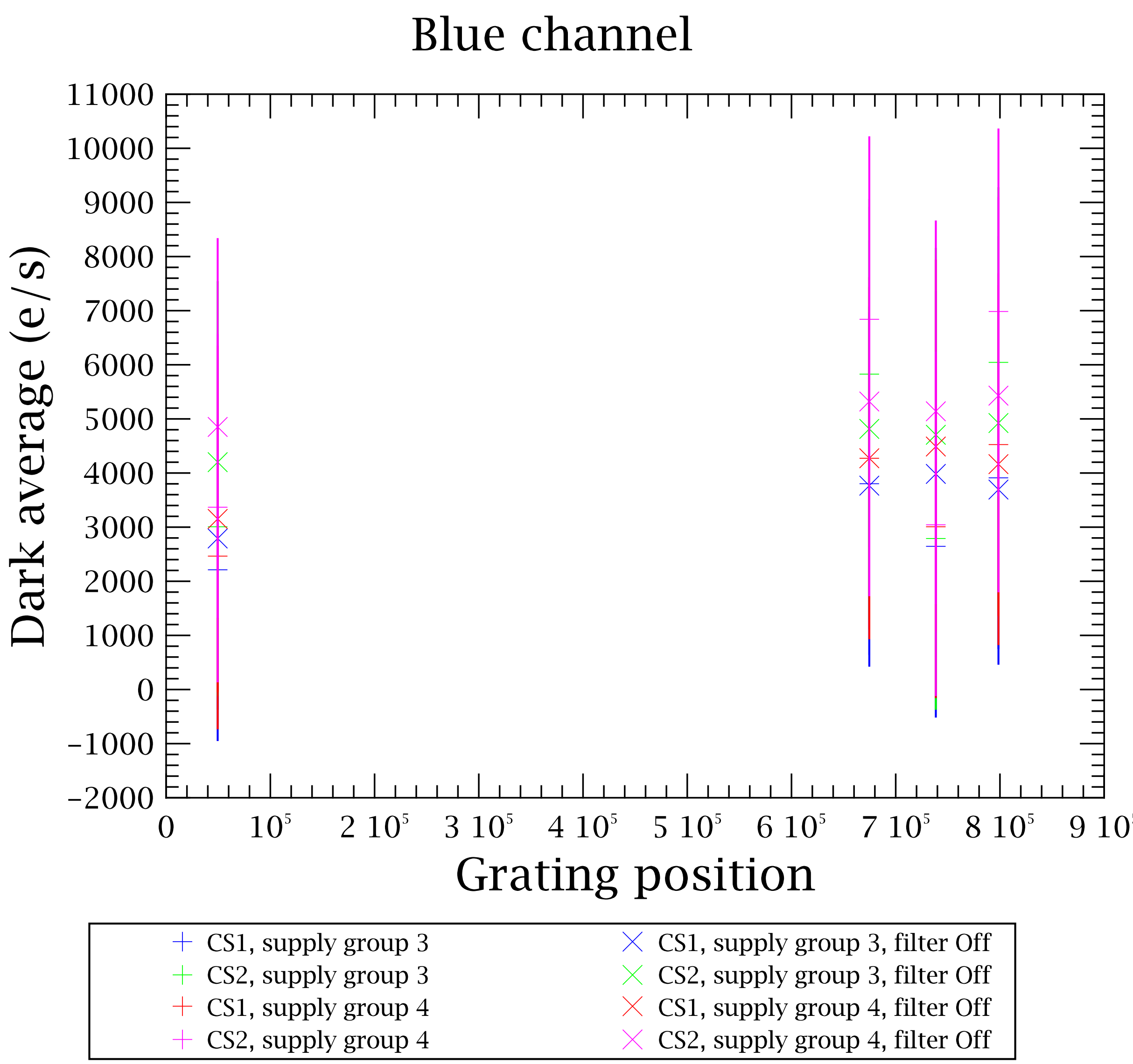

Figure 2: The average dark current for each exposure and for the two supply groups in the blue array.

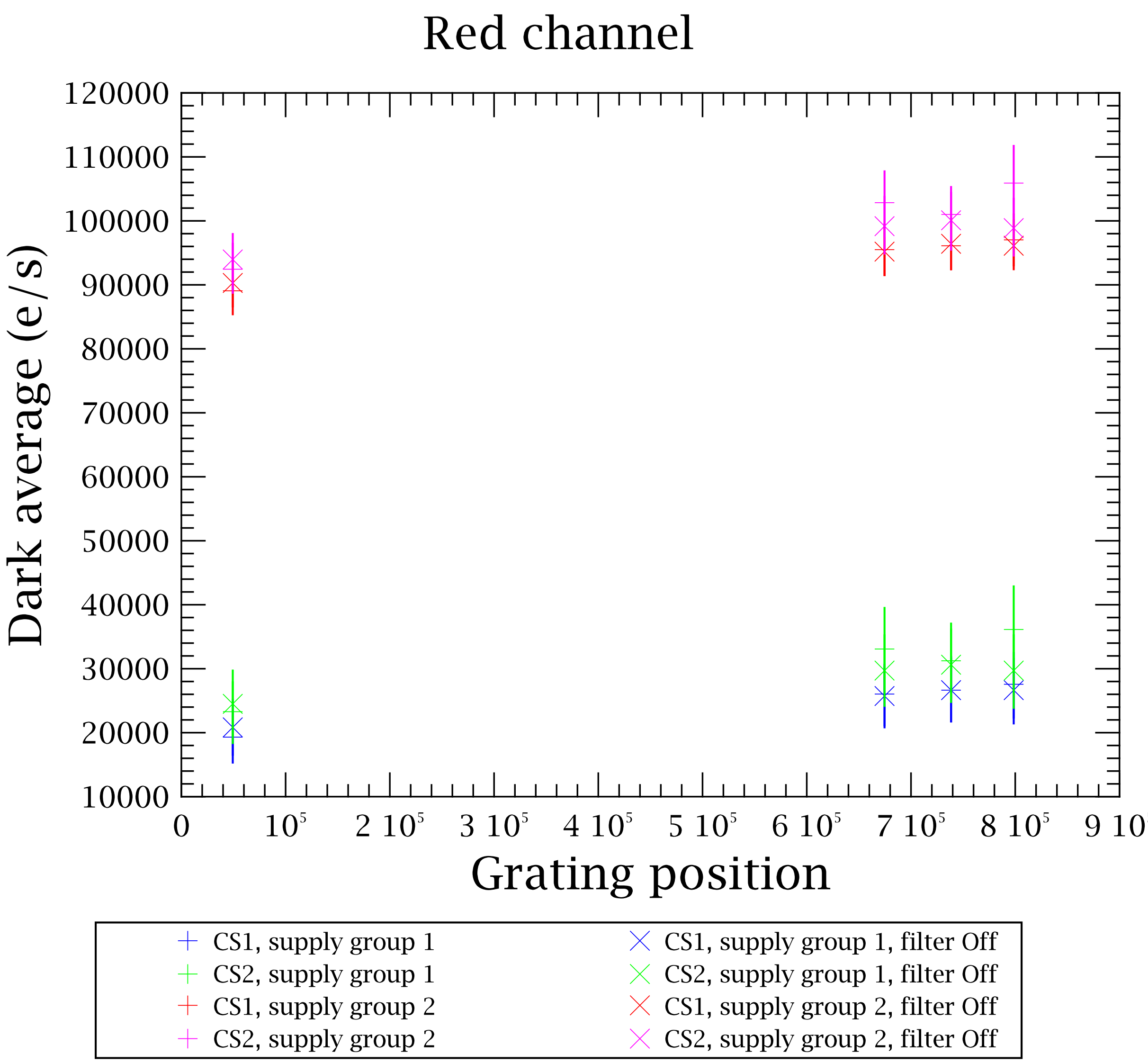

Figure 3: Same as before for the red array.

4.3.10D - F. Results

In the blue array, the average dark current ranges from approximately 2200 to 7000 electrons / second. We can see small differences in the dark currents between the two filter wheel positions. In addition, the dark current very slightly increases with the grating position for a given filter wheel position. The dark current for the supply group 4 is a bit higher than for the supply group 3. The chopper position also has an influence on the dark current, especially for the high grating position: the dark current at the “CS2” position is higher than at the “CS1” position.

In the red array, the dark current is much higher than in the blue array and we clearly see a distinction between the two supply groups. The dark current for the supply group 1 ranges from approximately 19000 to 35100 electrons / second while it ranges from around 89000 to 106000 electrons / second for the supply group 2.

Like the blue array, the red array has a higher dark current when the grating position increases and when the chopper position is set to “CS2”. On the other hand, we do not see a difference with the filter wheel position.

The figures 4 and 5 show, as an example, the mean dark current frame for the last exposure in the blue and the red arrays respectively. We clearly see on both arrays the much higher dark current in rows 15 and 16 due to a crosstalk effect with the dummy channel (row 17).

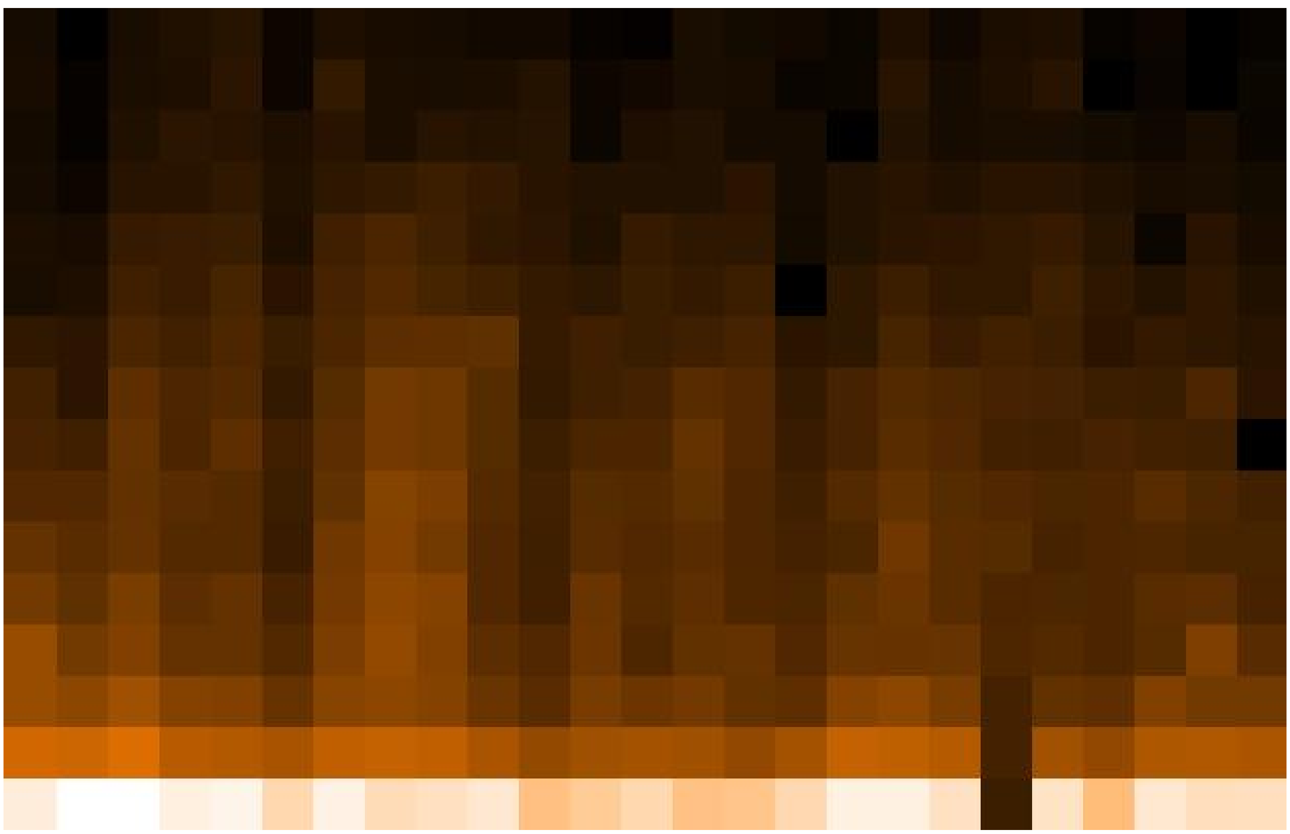

Figure 4: The mean dark current frame for the last exposure in the blue array. The higher dark current in rows 15 and 16 is due to a crosstalk effect with the dummy channel (row 17).

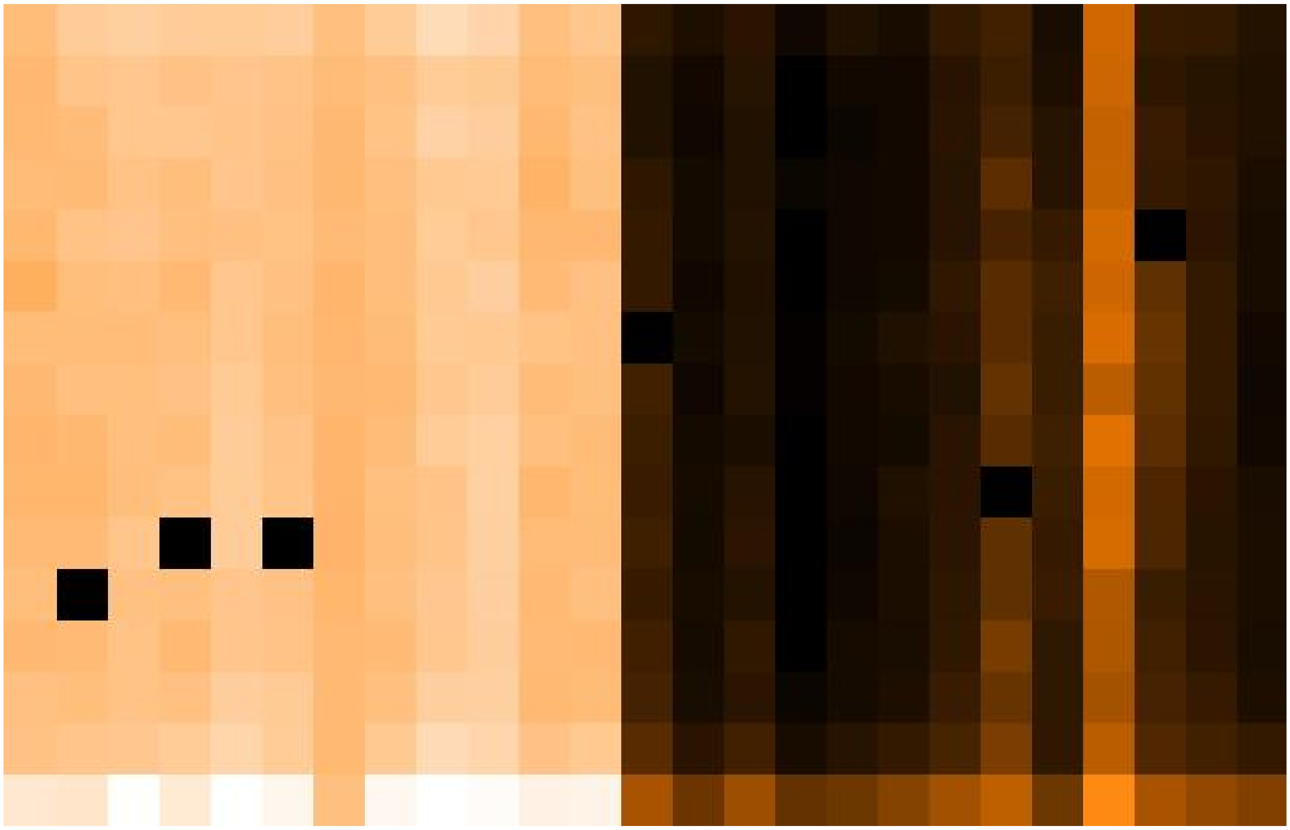

Figure 5: Same as before for the red array.

4.3.10D - G. Conclusions

In spite of a small bug in the commanding script, these tests allow us to compute dark currents for both arrays.

The dark current is much higher in the red array than in the blue array and it even exceeds the specifications (50000 electrons / second) in the supply group 2.

For both arrays, there is an influence of the chopper and the grating positions on the dark current. Moreover, the dark current in the blue array also slightly depends on the filter wheel position.

In addition, rows 15 and 16 of each array are obviously affected by a crosstalk effect with the dummy channel (row 17). We would therefore recommend to suppress the bias of the latter.