DAWN-FC

DAWN - Framing Camera

Dawn FC DC038 Report

Geometrical cross-calibration between FC2 and VIR

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1 General aspects

1.1 Scope

This document contains the results of the analysis of the data acquired by the Framing Camera 2 during the DC038 operational slot. The scope of the activities was exclusively engineering, so no associated science report will be released.

1.2 Introduction

This report is structured in several parts.

Section 2 describes the planned operations, including the different activities and a brief description of each.

Given that this was a re-run of a former activity, all sequences were merged into the background sequence, so no activity log is provided.

Section 3 reports on the general health status of the cameras.

Section 4 explains the evolution of the detector since launch and analyses its change in performance.

The conclusions are covered in section 5.

1.3 Applicable Documents

no.	document name	document number, Iss./Rev.
AD1	DC038 Walkthrough	DC038_Walkthrough_r2.ppt, 2/-

1.4 Reference Documents

no.	document name	document number, Iss./Rev.
RD1	Dawn FC DC034 Report	DA-FC-MPAE-RP-285, 1/-
RD2	DC018 Report	DA-FC-MPAE-RP-286, 1/-
RD3	DC014 Report	DA-FC-MPAE-RP-287, 1/-
RD4	Framing Camera ICO Report	DA-FC-MPAE-RP-268, D/c

2 Description of the activities

2.1 Overview

The operations of the Framing Cameras within the frame of DC038 were planned to be conducted between May 2nd 2010 (DOY 122) and May 3rd (DOY 123). There was only one major activity:

- Geometrical cross-calibration between FC2 and VIR

All the FC sequences were merged into the background sequence, so no tele-command slots were scheduled.

2.2 Geometrical cross-calibration

This activity is a re-run of DC034. It was developed to provide the co-alignment between the VIR instrument and the Framing Camera (FC2) by acquiring data with both instruments simultaneously. It consists of five concurrent observations of the star Canopus (Alpha Carinae, V_{mag} = -0.72) and was initiated and outlined by the VIR team.

The first 10-minute observation shows Canopus in the center of the FOV of both instruments with the FC acquiring a clear filter image at the beginning, in the middle, and at the end, followed by two OpNav images. The second observation shows Canopus in the upper left corner of the FC FOV. One clear filter image was acquired at the beginning, one after 5 minutes and one after 10 minutes. During the third observation the FC acquired 3 clear filter images with Canopus in the lower right corner of the FOV. In the fourth observation Canopus shows up again in the center of three images. During the final observation the spacecraft performed a slow slew that made Canopus appear to move through the FOV from bottom to top on twelve consecutive images.

The total number of FC images acquired with the door open was 26. Among these were 24 cross-calibration images (125 ms exposure time) and 2 windowed OpNav images (500 ms exposure time). All of them were acquired in the clear filter F1.

3 Health status assessment

During the operational slot the camera performed nominal from the engineering point of view.

All the images were acquired as scheduled and received without any missing packet.

4 Image analysis

The images acquired during the operational slot were analyzed in three aspects. First, we assessed whether the exposure times were adequate. Second, the dark current was determined to monitor its long term evolution. Finally, the position of the reference star Canopus throughout the observation run was calculated for comparison with the acquisitions made by VIR.

4.1 Exposure times

The updated exposure values worked better than the DC034 values; no image of Canopus was overexposed, except for the two OpNav images.

4.2 Dark current

The dark current generation rate was analyzed and compared with previous measurements, including some on ground. The bulk dark current, shown on Figure 1, is consistent with that determined during ICO/MGA (dotted line).

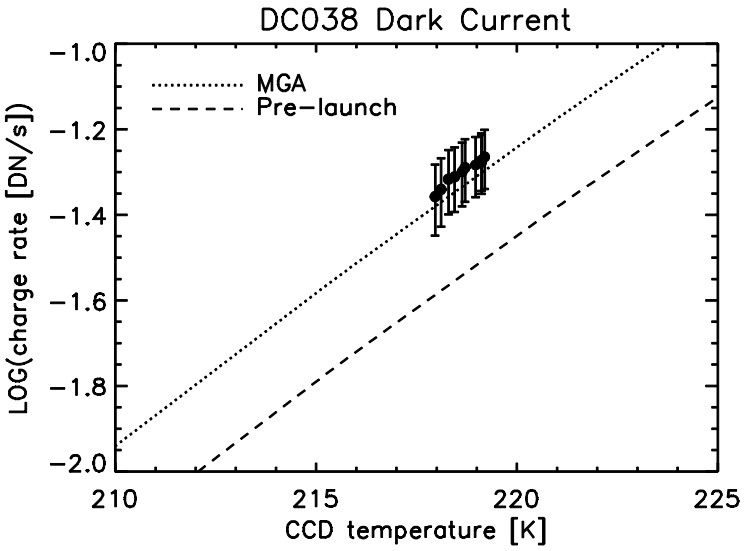

Figure 1: Comparison of FC2 dark current with previous measurements.

4.3 Canopus positions

The position of the star was calculated by fitting a 2D Gaussian to the stellar brightness profile for each of the 26 images acquired during the activity. The positions are numbered 0 to 25 indicating the sequence in which they were acquired. 0 to 4 are centered in Canopus, 5 to 7 on the upper left quadrant; 8 to 10 in the lower right, 11 to 13 close to the center and 14 to 25 were acquired during the slow slew. Figure 2 depicts the position of Canopus for each image in DC038.

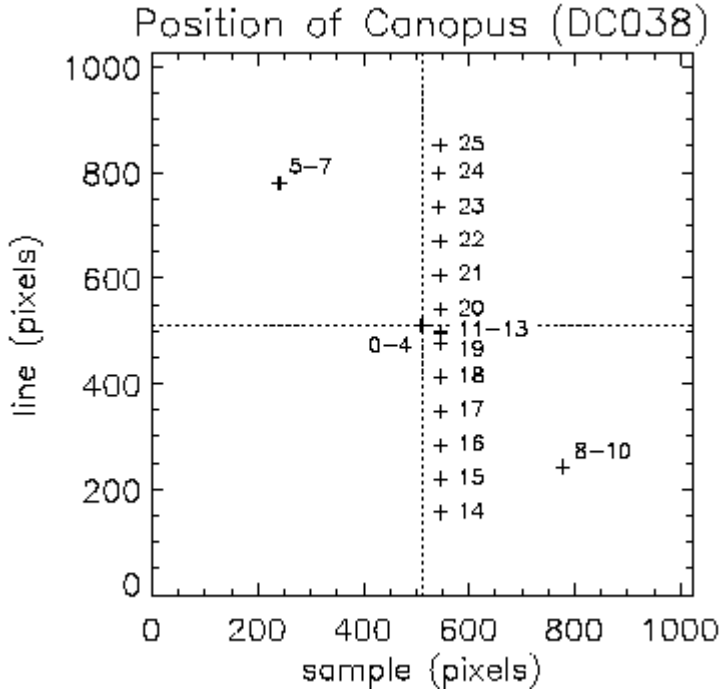

Figure 2: Canopus position in the CCD frame during DC038

Correspondingly, Figure 3 displays the position of the star during DC034. It is remarkable that, while the pattern is obviously the same for both runs, DC034 shows a poorer alignment with the s/c Y axis. This is due to the fact that the pointing commands were not updated for DC034 from the originally planned DC033.

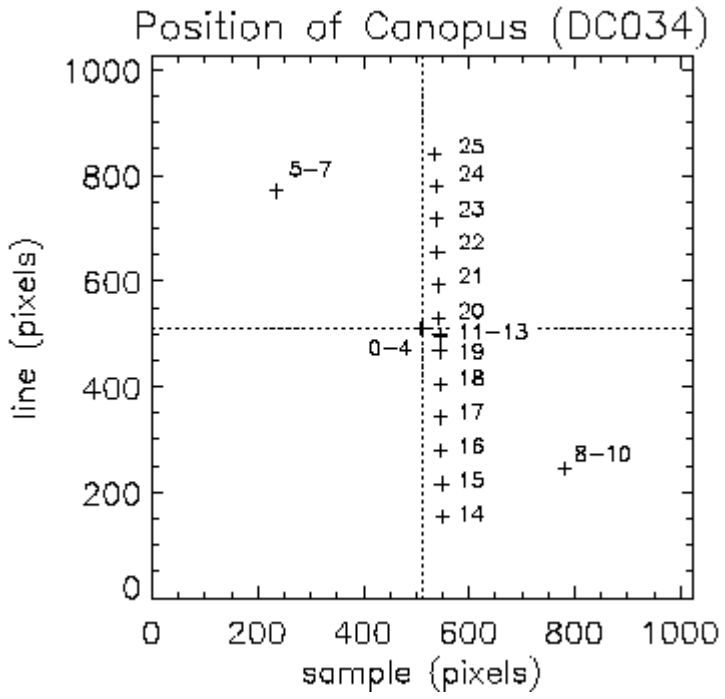

Figure 3: Canopus position in in the CCD frame during DC034

Table 1 shows the value of the calculated positions of Canopus both for DC034 and DC038.

Table 1: Canopus position in the CCD frame during DC034 and DC038 (in pixels)

Img #	DC034 X	DC034 Y	DC038 X	DC038 Y
0	510.451	509.143	508.936	510.767
1	509.231	509.777	511.565	510.801
2	509.934	509.878	510.935	510.836
3	510.037	510.142	509.188	510.707
4	510.389	510.055	510.929	510.911
5	234.973	771.372	240.134	778.978
6	236.017	770.362	240.516	778.197
7	234.594	770.631	241.163	778.308
8	781.964	246.225	778.212	241.795
9	782.938	246.197	778.121	243.105
10	782.423	246.302	778.152	242.956
11	545.692	498.817	545.454	498.707

12	545.420	497.978	545.210	498.081
13	544.821	498.164	545.387	497.998
14	549.760	155.548	546.673	156.030
15	548.061	216.444	545.203	220.138
16	547.123	280.189	545.112	284.178
17	546.739	342.886	545.084	348.794
18	545.286	404.469	545.230	413.049
19	544.014	467.282	545.013	477.326
20	542.886	530.045	546.101	541.485
21	541.821	592.255	544.800	605.823
22	540.931	654.616	544.037	669.866
23	539.097	717.196	543.792	734.005
24	537.240	779.850	543.653	798.783
25	534.042	841.975	544.153	851.045

5 Conclusions

Concerning the hardware, the operational slot demonstrated that the camera health status is nominal, including the mechanisms.

With respect to the operational procedures, this slot demonstrated again an excellent performance of the instrument, spacecraft and mission teams.

At mission level, we can confirm that no streak [RD4] was found in the images acquired during this operational slot. This does not mean that there are none, because the exposure times were so short that a streak, if present, would also be very short and easy to mistake for a high-energy particle hit. The FC team will continue to monitor the images acquired in flight in search for occurrences of streaks.

Finally, the observation of Canopus under different pointing conditions was successful and avoiding saturation enabled better determination of the position of the star compared to the earlier D034 observations. The quality of the data set is sufficient to determine the geometric co-alignment between FC and VIR.