DAWN-FC

DAWN - Framing Camera

DC018 Report

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Distribution Record

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		D	1	2							
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MPS											
KMA	Aye										
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1 General aspects

1.1 Scope

This document reports the results of the operation of the Dawn Framing Cameras in the frame of DC018.

1.2 Introduction

The Framing Camera test slot within DC018 was intended to be a verification that the measures identified to counter the phenomenon known as “extra charge” were working properly.

To this end, both cameras were operated one at a time, performing the set of operations known as “CCD mini cal”. This set includes some image acquisitions aimed at the detection and evaluation of extra charge.

Operationally, the test was a success: all 72 images were retrieved from each of the cameras with only the minor hiccups known to be tied to the pause and resume of continuous playback.

The functional performance of the extra charge countermeasures is reported in the section below.

Section 3 includes the operational log from the F]\C team.

1.3 Applicable Documents

no.	document name	document number, Iss./Rev.
AD1		

1.4 Reference Documents

no.	document name	document number, Iss./Rev.

2 Extra charge measurements

2.1 FC1

2.1.1 DC014

The extra charge measurements during DC014 where done with different pre illumination times, allowing the extra charge to accumulate prior to the exposure. Figure 1 shows the frequency of DNs all the 1024x1024 pixels. The six different graphs show the level of extra charge for six different illumination times (from bottom to top: 1.3s, 2.3s, 3.3s, 4.3s, 6.3s, 11.3s). The most effected pixels show extra charge of up to 200 DNs.

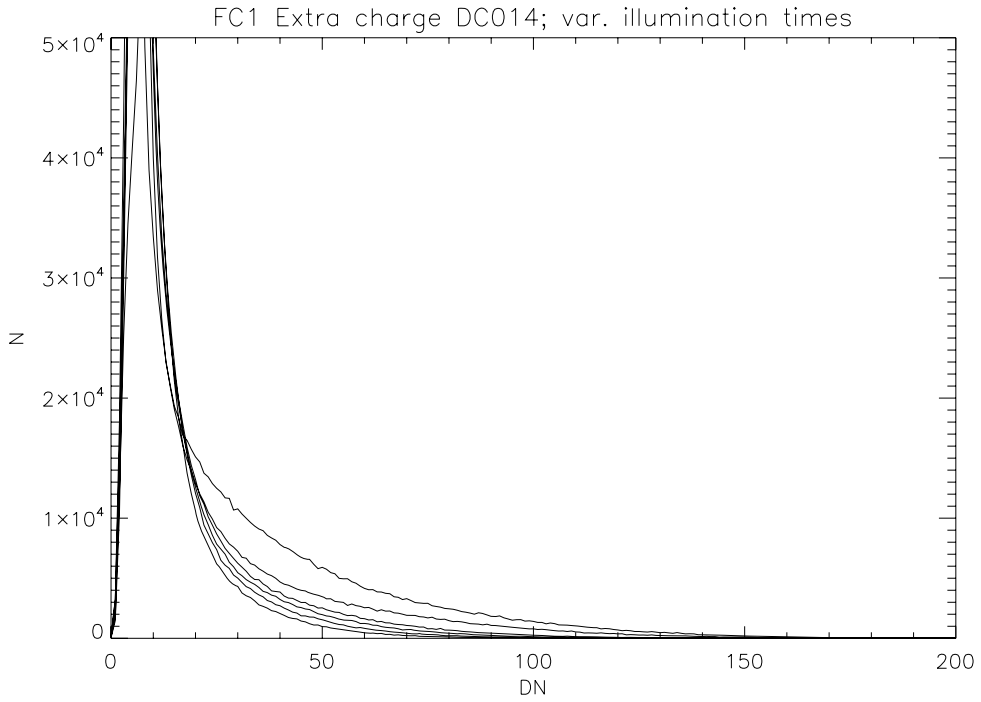

Figure 1: Histogram of pixels showing extra charge for FC1 in DC014

Figure 2 shows how many percent of the pixels show less DNs of extra charge as plotted on the y-axis (from top to bottom: 1.3s, 2.3s, 3.3s, 4.3s, 6.3s, 11.3s). In the best case 90% of all pixels have less than 20 DNs of extra charge.

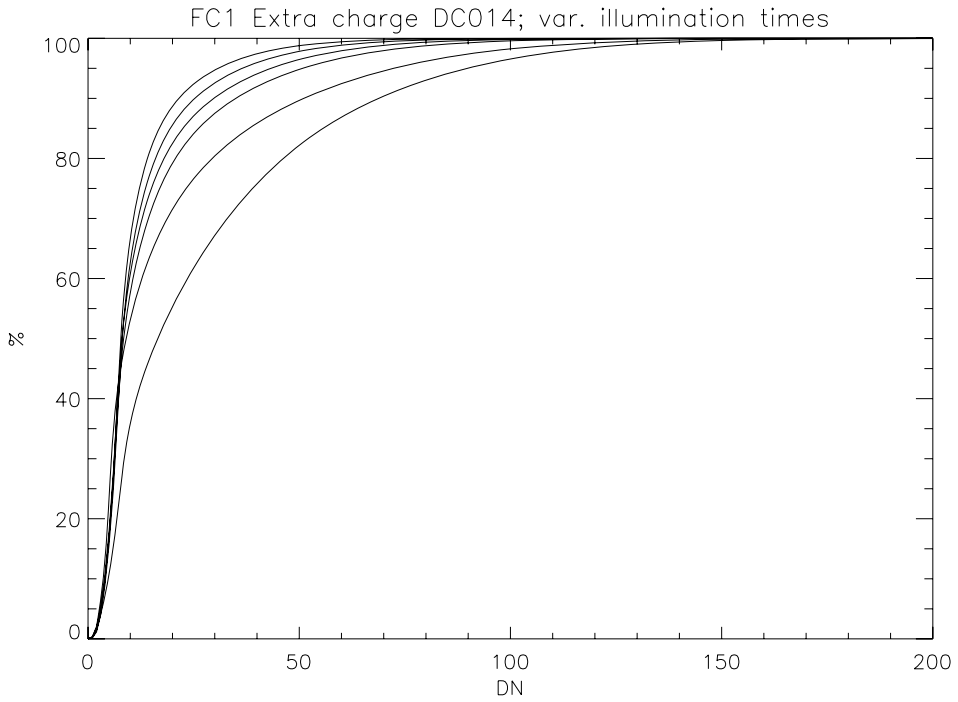

Figure 2: Accumulated histogram of pixels showing extra charge for FC1 in DC014

2.1.2 DC018

With the new UDP for "pre-clearing" the CCD uploaded in DC018, the minimum time between clearing the CCD and readout was reduced from 1.35 s to 0.200 s. This shorter illumination time allows less extra charge to accumulate. But since the extra charge charges on an exponential function, still most of the extra charge is present prior to the exposure (compare Figure 3 and Figure 4).

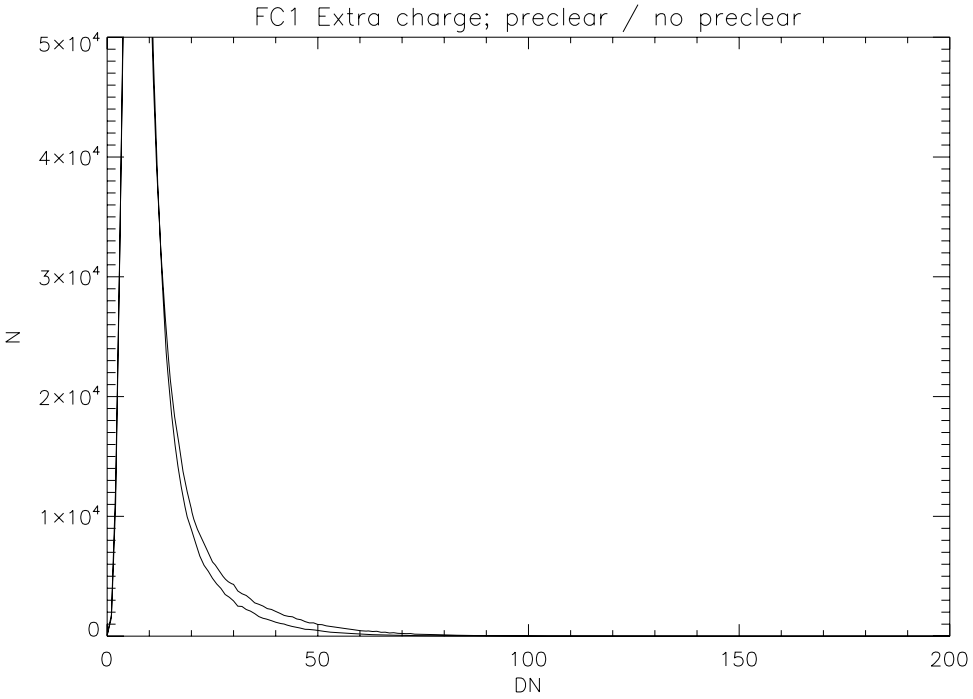

Figure 3: Histogram of pixels showing extra charge (DC014 vs. DC018) for FC1

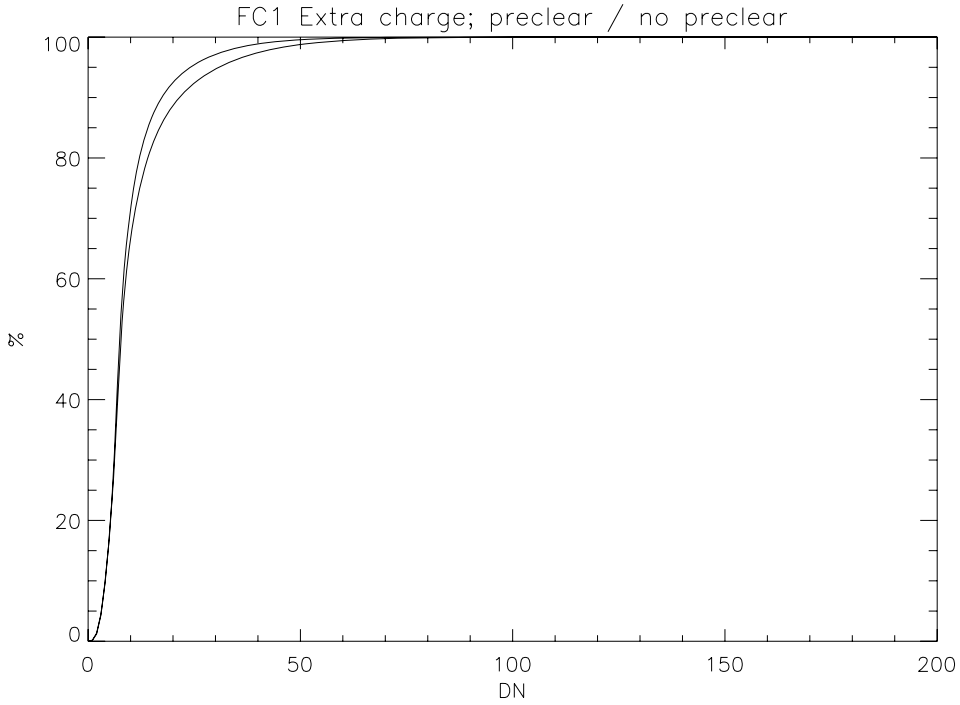

Figure 4: Accumulated histogram of pixels showing extra charge (DC014 vs. DC018) for FC1

2.1.3 Comparison of different parts of the CCD

The varying flux of the cal lamp, depending on the location on the CCD, produces a signal of 15 DN/ms in the rightmost column and 5 DN/ms in the leftmost column. In addition to the non-uniform flux, the CCD even with uniform flat fields produces more extra charge in the upper right corner. This results in a distribution of the extra charge as seen in Figure 5

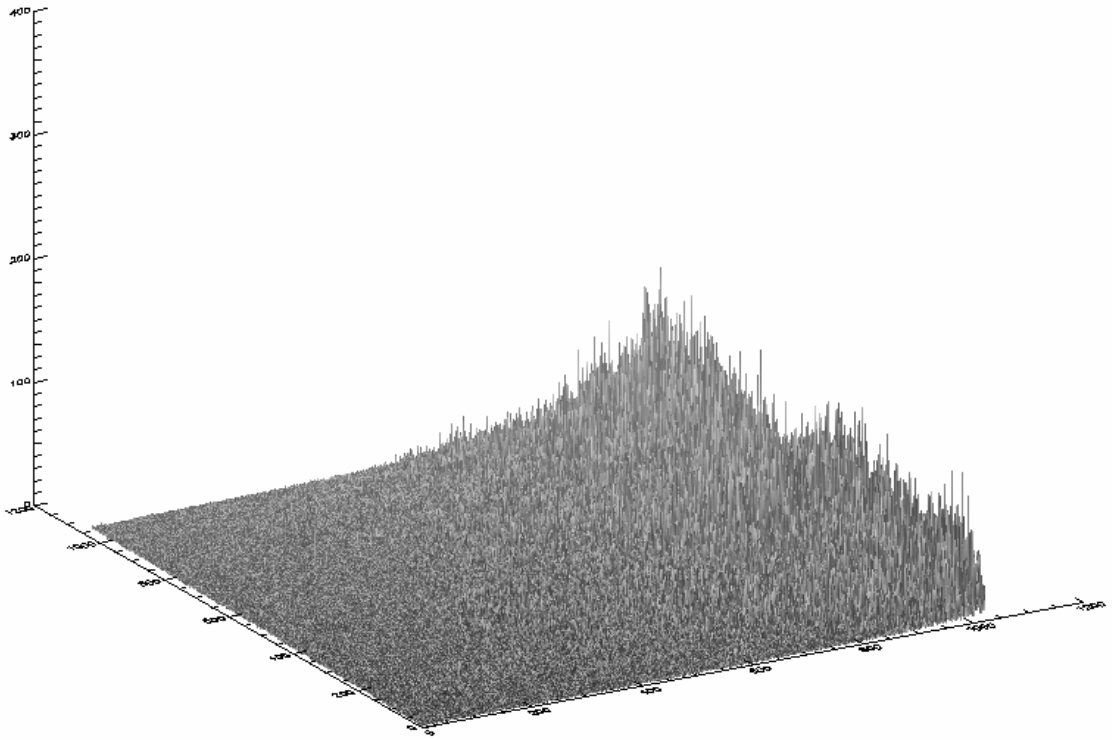

Figure 5: Extra charge on FC1 with pre-clear

Two different squares of the whole 1024 x 1024 CCD were analyzed: The most affected 256 x 256 upper right pixels and the least affected 256 x 256 lower left pixels.

The lower left part of the CCD showed only

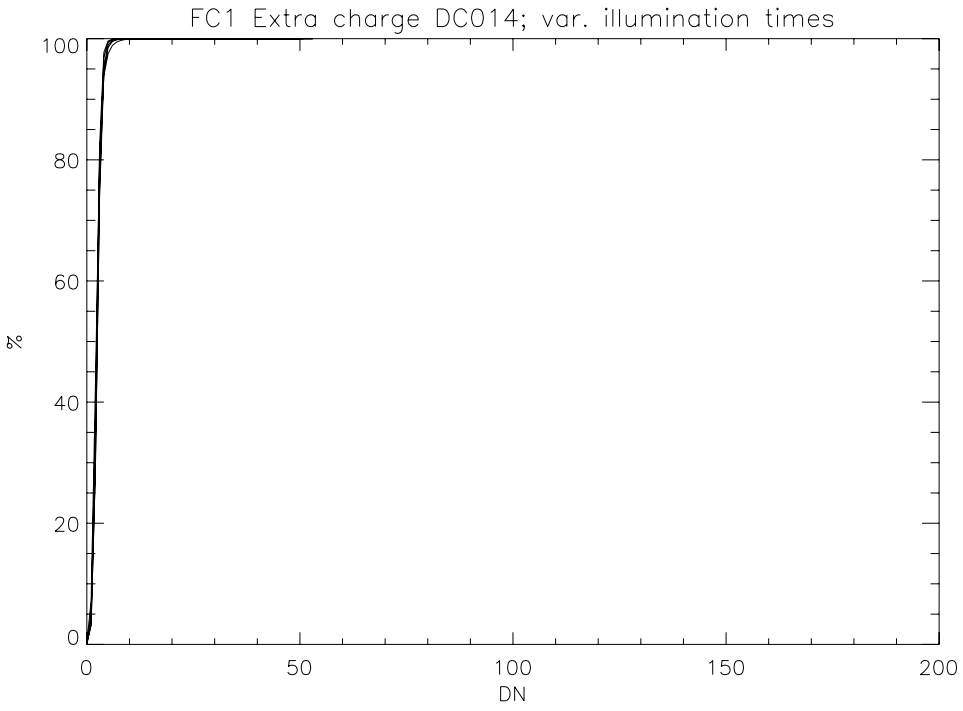

Figure 6: Accumulated histogram of lower left 256 x 256 pixels of FC1 in DC014

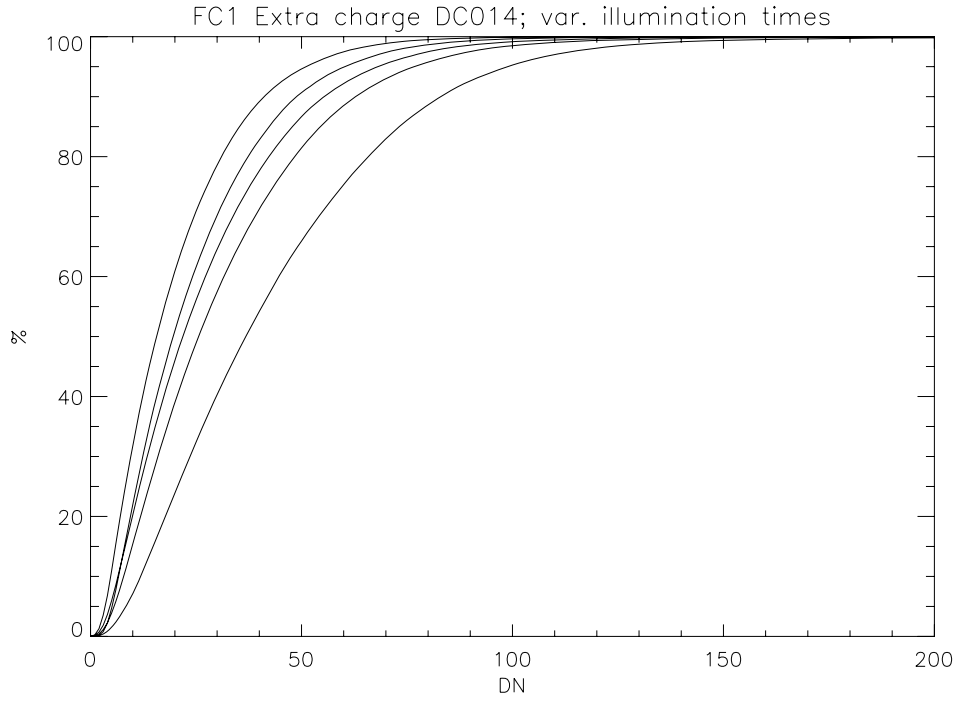

Figure 7: Accumulated histogram of upper right 256 x 256 pixels of FC1 in DC014

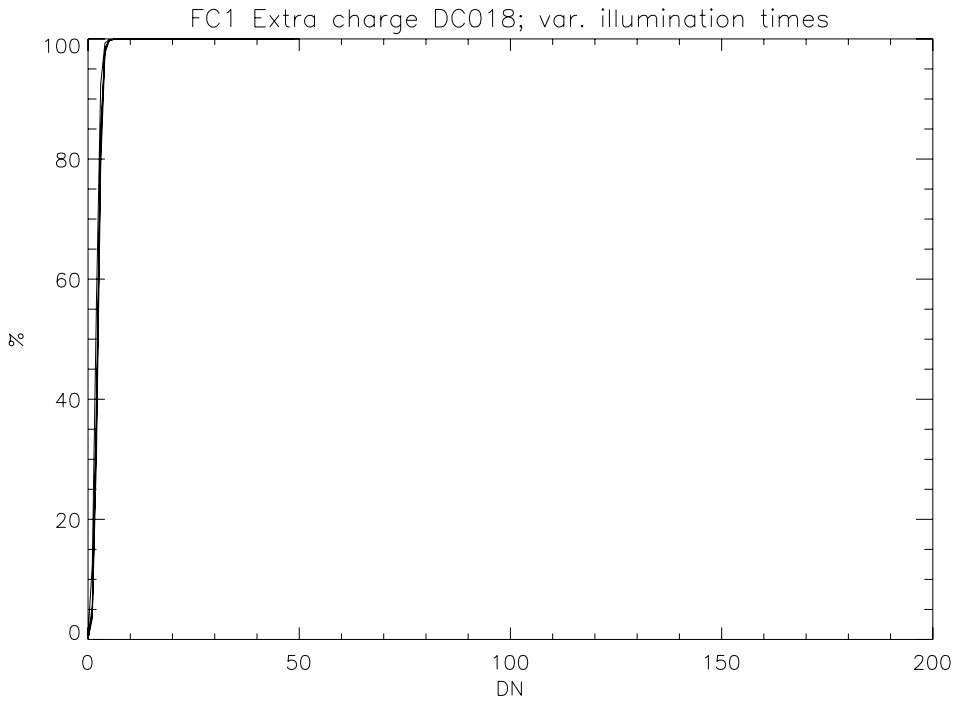

Figure 8: Accumulated histogram of lower left 256 x 256 pixels of FC1 in DC018

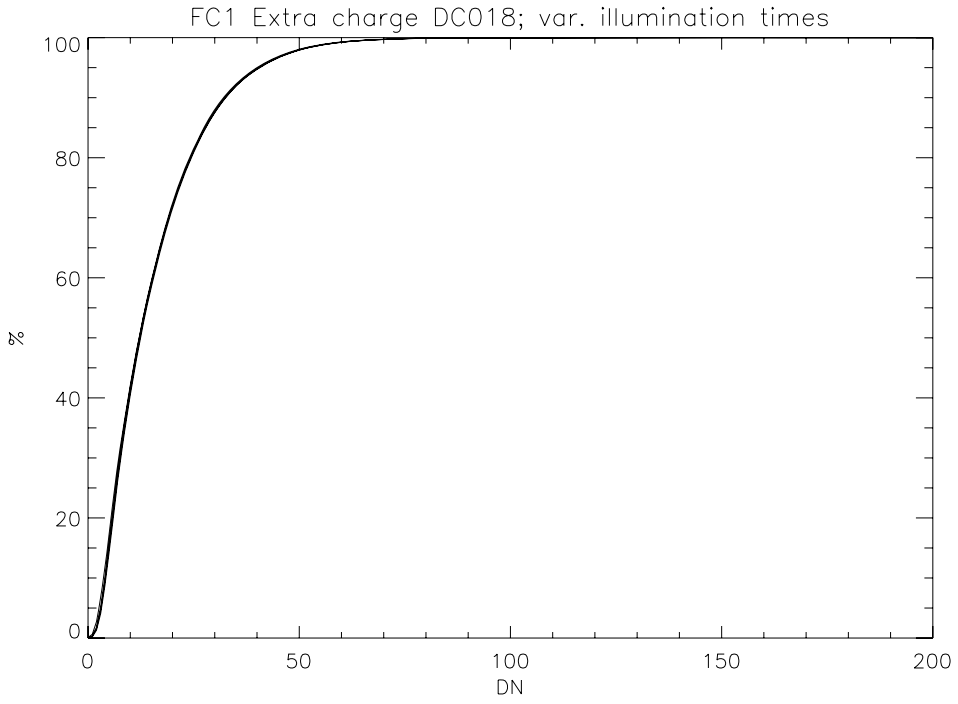

Figure 9: Accumulated histogram of lower left 256 x 256 pixels of FC1 in DC018

2.2 FC2

2.2.1 DC014 and DC018

In both, DC014 and DC018 no traces of extra charge could be found in the data from FC2. Figure 10 shows the random distribution of noise on FC2 (left graph), maximum is less than 5 DNs, in comparison with the best case extra charge on FC1 (right graph) where 95% of the pixels show less than 25 DNs of extra charge.

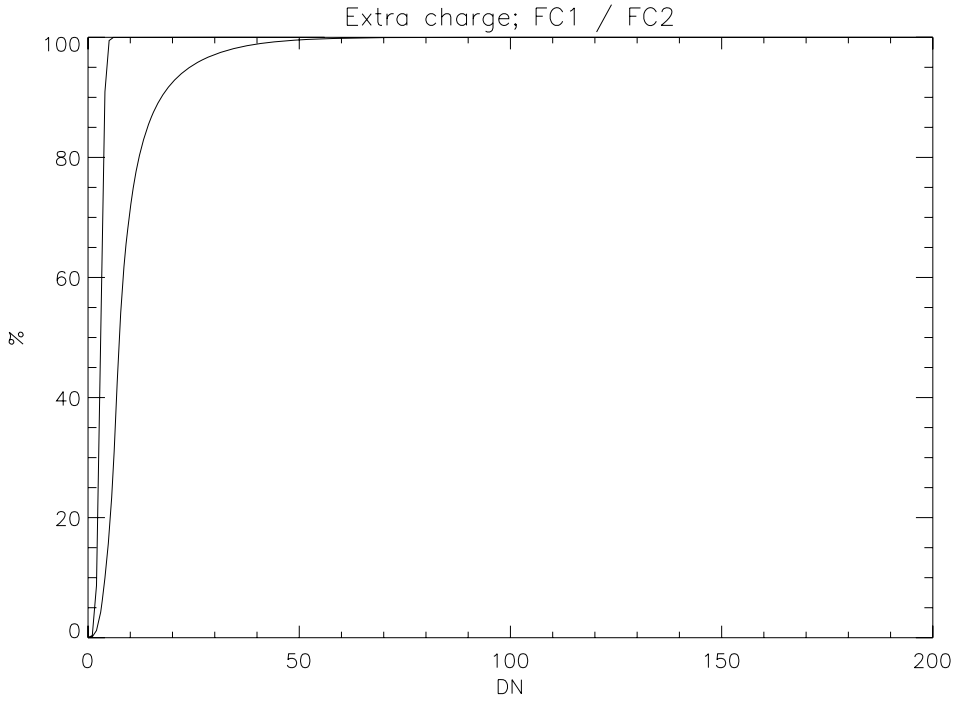

Figure 10: Accumulated histogram of pixels showing extra charge (FC1 vs. FC2)

3 Operational log

2008-08-25T22:15:00

EGSE server setup. Connection received at low speed

22:35:00 S/C changed to RT124 K

FC1 CCD 19 to 21 C

FC1 CCD heater duty cycle ~50%

FC1 CH -18.8 to -18.4 C

FC1 CH heater duty cycle ~15%

FC1 I/F -2.4 to -2.1 C

FC2 CCD 20 to 22 C

FC2 CCD heater duty cycle ~55%

FC2 CH -18.8 to -18.4 C

FC2 CH heater duty cycle ~15%
FC2 I/F -3.4 to -3.2 C

22:37:11 Radiated dz097a (ERT 23:16:22)

22:42:31 Radiated dz109a (ERT 23:21:42)

23:17:00 As expected, FC1 CCD heater is off

23:20:40 FC1 CCD -10 C
CH heater duty cycle on the rise

23:23:20 FC1 CCD -20 C

23:24:20 FC2 CCD heater is off

23:25:00 FC1 CCD -24.6 C
FC2 CCD 10.0 C

23:26:30 FC1 CCD -27.5 C
FC2 CCD 0.0 C

23:28:00 FC1 CCD -30.0 C
FC2 CCD -7.5 C

23:31:50 FC1 CCD -35.4 C
FC2 CCD -20.0 C

23:35:30 FC1 CCD -39.4 C
FC1 CCD heater duty cycle 0%
FC1 CH -18.8 to -18.4 C
FC1 CH heater duty cycle ~30%
FC1 I/F -2.4 to -2.1 C
FC2 CCD -27.5 C
FC2 CCD heater duty cycle 0%
FC2 CH -18.8 to -18.4 C
FC2 CH heater duty cycle ~25%

23:40:00 FC Off net

2008-08-26T18:56:26 Connection received at low speed

FC on Dawn Ops network

19:09:22 Radiated dz286g (ERT 19:48:32)

19:15:50 FC1 CCD -63.2 C
FC1 CCD heater duty cycle 0%
FC1 CH -18.9 to -18.3 C
FC1 CH heater duty cycle ~0.45%
FC1 I/F -2.5 to -2.4 C
FC2 CCD -64.2 C
FC2 CCD heater duty cycle 0%
FC2 CH -18.9 to -18.3 C
FC2 CH heater duty cycle ~40%
FC2 I/F -3.6 to -3.5 C

19:50:40 FC1 is on
FC1 Primary 28V current 0.288 A
After boot 0.355
The current profile matches that of a typical FC boot

19:55:00 The UDP library was properly patched

19:57:50 FEE is on

20:50:30 As in previous runs of CCD mini cal, the last images
of the CALExtraChargeBlock (IDs 964 and 965) are dark because the
cal lamp was switched off too early.

20:54:45 Door opened nominally

21:00:00 Filter wheel started to turn

21:10:00 FC1 CCD -53.6 C
FC1 CCD heater duty cycle 0%
FC1 CH -16.0 C
FC1 CH heater duty cycle 0%
FC1 I/F +5.0 C
FC2 CCD -64.2 C
FC2 CCD heater duty cycle 0%
FC2 CH -18.8 to -18.4 C
FC2 CH heater duty cycle ~40%

FC2 I/F -1.2 C

21:12:20 Door closed nominally

21:17:40 FEE is off
23 images left for compression

21:30:40 Preliminary assessment of the early 60 s extra charge images already confirms an improvement by using the pre-clear. More detailed analysis is yet to come.

21:41:50 All images transmitted to VR8. SCET 21:21:16

22:09:10 Upon a first inspection of the images, no streaks were found. Mebsuta (Eps Gem) was easily identifiable as the brightest star, together with many other of lower brightness

Milbus noise was visible on images 969 and 970 (F1), and in serial readouts

Straylight due to Sun incidence was not visible. The angle between the sun and the boresight vector is 68.44 deg

22:28:30 FC1 is off. CCD heading for cruise temperature
FC1 CCD -18.2 C
FC1 CCD heaters duty cycle 70%
FC1 CH -18.9 C
FC1 CH heater duty cycle ~15%
FC1 I/F +5.0 C
FC2 CCD -64.2 C
FC2 CCD heaters duty cycle 0%
FC2 CH -18.3 C
FC2 CH heater duty cycle ~45%
FC2 I/F -0.3 C
The team is GO for upload of FC2 sequence dz296c

22:34:08 Radiated dz296c (ERT 23:13:18)

23:11:00
FC1 CCD -21.5 C
FC1 CCD heaters duty cycle ~50%
FC1 CH -18.3 C

FC1 CH heater duty cycle ~20%
FC1 I/F +1.2 C
FC2 CCD -64.2 C
FC2 CCD heaters duty cycle 0%
FC2 CH -18.3 C
FC2 CH heater duty cycle ~45%
FC2 I/F -1.2 C

23:16:00 FC2 is on. Current consumption is 0.269 A, then 0.349 A

23:17:20 FC2 is fully booted.

23:19:10 The UDP library was properly patched

23:21:10 FEE is on

2008-08-27T00:14:00 As in previous runs of CCD mini cal, the last images of the CALExtraChargeBlock (IDs 949 and 950) are dark because the callamp was switched off too early.

00:18:50 Door opened nominally

00:25:10 Filter wheel moved successfully

00:27:00 FC1 CCD -20.9 C
FC1 CCD heater duty cycle 50%
FC1 CH -18.3 C
FC1 CH heater duty cycle ~10%
FC1 I/F +0.5 C
FC2 CCD -55.2 C
FC2 CCD heater duty cycle 0%
FC2 CH -16.0 C
FC2 CH heater duty cycle 0%
FC2 I/F +4.5 C

00:36:20 Door closed nominally

00:41:20 FEE is off
21 images left for compression

Preliminary assessment of the images confirms that FC2 is free from

extra charge.

The final packet of the last image of FC1 was apparently not received.
It can probably be reconstructed offline from the data stream.

01:03:30 All images transmitted to VR8. SCET 00:43:17

01:27:30 As for FC1 all images were received except the last one, pending one packet.

On a preliminary inspection no streaks were found.

01:54:00 FC2 is off. CCD heading for cruise temperature
FC1 CCD 19.0 C
FC1 CCD heaters duty cycle 50%
FC1 CH -18.3 C
FC1 CH heater duty cycle ~15%
FC1 I/F +0.9 C
FC2 CCD -39.4 C
FC2 CCD heaters duty cycle 70%
FC2 CH -18.3 C
FC2 CH heater duty cycle 0%
FC2 I/F +4.1 C

After a final playback, the last packet(s) of FC2 data came to complete the last FC2 image.