

Second NIC3 Campaign Results

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ABSTRACT

This report describes the point spread function (PSF) information for data taken in the second NICMOS camera 3 (NIC3) refocus campaign. Data is tabulated on the percent flux in the peak pixel, for J band images. These do not deviate significantly from the numbers for the first campaign (see NICMOS ISR 98-006), indicating that again optimal focus for NIC3 has been achieved.

1. Introduction

The NICMOS dewar anomaly prevents the wide-field NICMOS camera (NIC3) from being in exact focus during normal operations. While normally not a problem, particularly for extended sources, this defocus can limit sensitivity to point sources, particularly in the blue end of the NICMOS sensitivity range (the J band, around 1.1 μm wavelength). An Independent Science Review panel recommended that two campaigns be run, with the HST secondary moved to place NIC3 in exact focus. The first of these was executed in January of 1998, and the technical results are summarized in NICMOS ISR 98-006 (“Observed Camera 3 Performance”), referred to here as “Paper 1”.

As in the first campaign, a focus monitor observation the week before the campaign was to start was used to determine how far to move the HST secondary. This observation led to a request to move the secondary 16.8 microns away from the primary, and HSTP moved it 16.6 microns. A focus monitor made immediately after the secondary move indicated that the focus had shifted considerably less than this amount. This discrepancy was explained by the use of the focus “breathing” correction used in the reduction of the data. The standard reduction used the “4-Temperature” model, but this doesn’t account for long-period swings in HST focus (see SESD document 97-01 (version 2) or NICMOS ISR 98-009). Re-reduction of the data using a better “analytical” model indicates that the focus changed as expected. Investigation of the application of the breathing correction is ongoing, however.

The continued deterioration of fine guidance sensor 2 (FGS2) had led to the inclusion of “clearing slews” when that sensor was used for pointing control in the campaign. These slews moved the mechanisms in such a way as to minimize the reversal bumps caused by buildup of lubricant in the FGS bearings during acquisition or reacquisition procedures. Unfortunately, there was an error in the code used to implement the clearing slews, so that guidestar lock was lost if dithered observations were made in orbits that started with a reacquisition using FGS2. This loss of lock was usually for only a short time (a few minutes) and had no immediately apparent effect on the NIC3 data. These events are summarized in Appendix A.

Appendix A tabulates all guidestar failures, including some more serious ones that resulted in entire visibility periods being done under gyro control. These images showed drift rates while under gyro control of 2-3 mas/sec. Approximately 4% of the NICMOS HDF observations (program 7817, PI Mark Dickinson) were lost to this problem. Unfortunately, the effected visits were among the first analyzed and this loss was erroneously connected with the loss of lock problem. These are separate kinds of failure, however.

The return to focus took place on June 28th at 17:30 UT. A commanding glitch prevented the post-move NICMOS focus sweep from having all its data recorded, but the NIC3 data indicate that the focus returned to the near nominal position. A subsequent WFPC2 focus sweep indicated that the HST secondary mirror had indeed returned to the desired operational position. Note that this included a small shift to allow for desorption of the OTA.

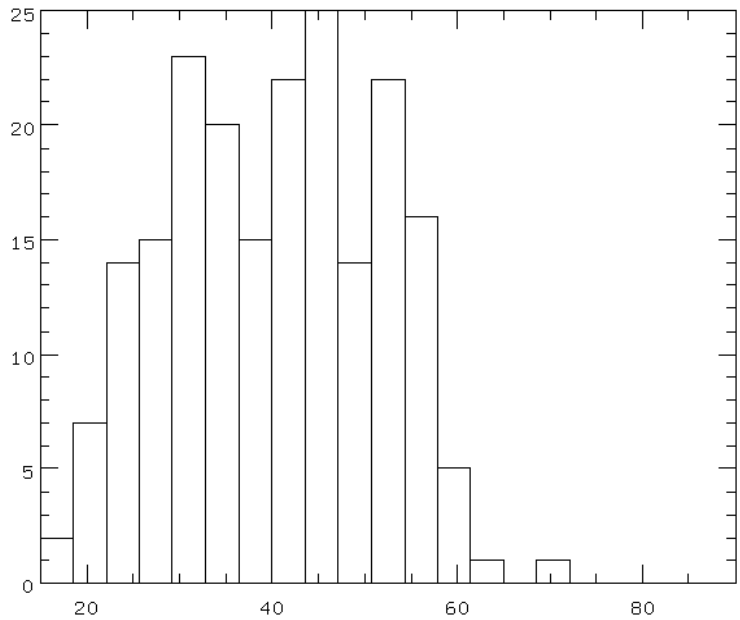
2. Analysis

Table 1. J band observations.

	Flux in peak
Before	$34\% \pm 1.3\%$
1st Campaign	$40\% \pm 1.7\%$
2nd Campaign	$40\% \pm 0.8\%$

Figure 1 shows the histogram of percentage flux in the peak pixel, for J band observations of point sources during the second NIC3 campaign. This is very similar to Figure 1 of Paper 1. Once again, the bulk of the observed point sources clump around 40% of the flux in the peak pixel, while a “tail” of sources with much more of the flux (up to 60%) in the peak pixel trails off toward higher percentages. This is due to fortuitous centering of the well-focussed PSF within the NIC3 pixels. Outside of the campaign, the out-of-focus PSF is less sensitive to placement with respect to the pixel grid, and this “tail” is not seen.

Figure 1: Histogram of percentage flux in the peak pixel, for observations in the J band (1.1 μm).



Note that no differentiation is made between bright and faint stars. Paper 1 concluded that this difference is not significant. The data quality in the second campaign is at least as good as that in the first campaign.

While it is too early to have a quantitative assessment of the scientific success of the campaigns, informal comments have been very positive. NICMOS PI Rodger Thompson reports that the HDF observations in the first campaign had a limiting sensitivity of under one nanoJansky, corresponding to a limiting magnitude of $H=30$. Mark Dickinson is quite optimistic about the results of his observations of the whole HDF, as well.

3. Appendix A

Table 2. Second NIC3 Campaign Problems:

DOY:time	Type of failure	Program	Data i.d.
156:01:11	GS ACQ fail	7919	N4K44Q
157:16:34	GS LOL	7871	N4UF08
157:20:24	GS LOL	7871	N4UF08
157:21:28	GS LOL	7871	N4UF08
158:04:39	GS reACQ fail	7872	N4U804
158:09:02	GS LOL	7871	N4UF02

DOY:time	Type of failure	Program	Data i.d.
159:12:20	GS LOL	7871	N4UF01
159:12:42	GS LOL	7871	N4UF01
159:12:46	GS LOL	7871	N4UF01
159:14:15	GS LOL	7871	N4UF01
159:14:19	GS LOL	7871	N4UF01
159:22:59	GS LOL	7821	N4L560
160:00:18	GS LOL	7821	N4L560
160:00:36	GS LOL	7821	N4L560
160:01:55	GS LOL	7821	N4L560
160:02:14	GS LOL	7821	N4L560
160:02:24	GS LOL	7821	N4L560
160:02:28	GS LOL	7821	N4L560
160:05:22	GS LOL	7872	N4U805
160:05:38	GS LOL	7872	N4U805
160:08:48	GS LOL	7871	N4UF04
160:09:16	GS LOL	7871	N4UF04
160:09:38	GS LOL	7871	N4UF04
160:09:43	GS LOL	7871	N4UF04
160:09:46	GS LOL	7871	N4UF04
160:12:30	GS LOL	7871	N4UF03
160:12:52	GS LOL	7871	N4UF03
160:12:56	GS LOL	7871	N4UF03
161	no failures reported		
162:06:30	GS LOL	7871	N4UF11
162:06:56	GS LOL	7871	N4UF11
162:06:58	GS LOL	7871	N4UF11
162:07:40	GS LOL	7871	N4UF11
162:08:05	GS LOL	7871	N4UF11
162:08:28	GS LOL	7871	N4UF11
162:08:33	GS LOL	7871	N4UF11
162:08:44	GS LOL	7871	N4UF11
162:21:56	GS LOL	7821	N4L570

DOY:time	Type of failure	Program	Data i.d.
162:23:32	GS LOL	7821	N4L570
163:00:54	GS LOL	7821	N4L570
163:00:55	GS LOL	7821	N4L570
163:00:56	GS reACQ late	7821	N4L570
163:01:09	GS LOL	7821	N4L570
163:01:21	GS LOL	7821	N4L570
163:02:27	GS reACQ late	7821	N4L570
163:02:46	GS LOL	7821	N4L570
163:02:47	GS LOL	7821	N4L570
163:02:49	GS LOL	7821	N4L570
163:06:15	GS LOL	7872	N4U807
163:06:30	GS LOL	7872	N4U807
163:09:38	GS LOL	7872	N4U808
163:12:57	GS LOL	7872	N4U807
164:04:44	GS reACQ fail	7817	N4UX16
164:05:06	GS reACQ fail	7817	N4UX16
164:06:21	GS reACQ fail	7817	N4UX16
164:07:24	GS ACQ fail	7919	N4K495
164:08:01	GS ACQ fail	7817	N4UX38
164:09:01	GS ACQ fail	7817	N4UX38
165:01:05	GS LOL	7822	N4TN03
165:05:28	GS LOL	7817	N4UX25
165:16:50	GS SS bu	7919	N4K427
166:10:32	GS LOL	7817	N4UX12
167:10:00	GS LOL?	7817	N4UX26
168:09:16	GS LOL	7817	N4UX15
168:10:52	GS LOL	7817	N4UX15
168:19:52	Fix Clearing Slew Group		
170:12:29	GS=>SS BU	7830	N4MH20
177:20:30	GS=>FL BU	7265	N4T202

DOY= day of year, GS= guide star, LOL= loss of lock, ACQ= acquisition, SS BU= single-star backup, FL BU= fine lock backup.