NICMOS Post Observation Processing, Software and Reference Files

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The calibration of NICMOS, Near Infrared Camera and Multi-Object Spectrometer, data has been evolving since its installation aboard HST in February 1997. This poster examines the versions of pipeline calibration software, calibration reference files, and software analysis tools available. Users should be aware of improvements that may have been made to both software and reference files since their observations were processed. Recalibration with in-flight, correct epoch reference files may greatly enhance the quality of their data.

Reference Files

The calibration of NICMOS is an ongoing task - see related paper 10.07, NICMOS Cycle 7 Calibration Plans, by L. Colina. The initial load of the CDB, Calibration Data Base, consisted of either ground-based or dummy placeholder data (for example, all the initial darks). Many reference files have since been replaced by on-orbit data. As new reference files are regularly being created and loaded, you may find that there are now better reference files available with which to (re)calibrate your observations than when they were taken.

There are two independent methods to determine the best reference files for your data. You can check the on-line Web page maintained by the NICMOS group at

http://www.stsci.edu/ftp/instrument_news/NICMOS/nicmos_doc_cal_list.html

or you can use the NICMOS Reference File page in STARVIEW.

The Web page lists all the reference files ever delivered to the CDB. The files are generally listed in order of delivery. Note that many of the earlier files are either obsolete or had mistakes which were fixed in later deliveries. In most cases one would want to use the last file in the list with mode (camera, filter, samp_seq, etc.) matching your observation.

For example, here is the selection of the NIC1 F108N flats from the Web page.

file_name	cam	filter	useafter	pedigree	comment
h1s1336qn_flt	1	F108N	01/01/97	GROUND	Initial launch delivery
h521332en_flt	1	F108N	01/15/97	INFLIGHT	Early on-orbit flat; normalization problem
h5j0950nn_flt	1	F108N	01/17/97	INFLIGHT	Early on-orbit flat; whole array normalized to 1
h5j1133sn_flt	1	F108N	01/18/97	INFLIGHT	Early on-orbit flat; norm. to 1 in [*,36:256]
ha911522n_flt	1	F108N	01/01/97	GROUND	Normalized to 1 in [*,36:256], then inverted
ha911540n_flt	1	F108N	01/18/97	INFLIGHT	Normalized to 1 in [*,36:256], then inverted

The first column has the reference file name. Note one can FTP the reference file by clicking on the name! The second and third columns are camera and filter. The fourth column is the USEAFTER date, the date after which the reference file is valid. In this case all the dates are pre-launch. Currently only the dark reference files are time-dependent. A flight software change on 21 August 1997 changed the structure of the dark and there are therefore two epochs of dark files - PRE and POST 21 August 1997. The fifth column is the PEDIGREE, which can be DUMMY, GROUND, INFLIGHT, or MODEL. The last column has (hopefully) useful comments.

The initial NIC1 F108N flat was created from thermal vacuum data. Next an early on-orbit flat was delivered. Normalization problems were discovered and the on-orbit flat was normalized to 1 over the whole array and later to 1 in [*,36:256]. Then it was noticed that the flat should have been normalized before being inverted and both the original ground-based and the on-orbit flat were correctly normalized, then inverted, and redelivered.

One can also use STARVIEW to determine the best reference files. Go to the HST Instrument Searches/NICMOS Reference Files screen.

< NICMOS Reference Files – Search Results >

File Searches Constraint View Retrieve Customize Options Comments Help

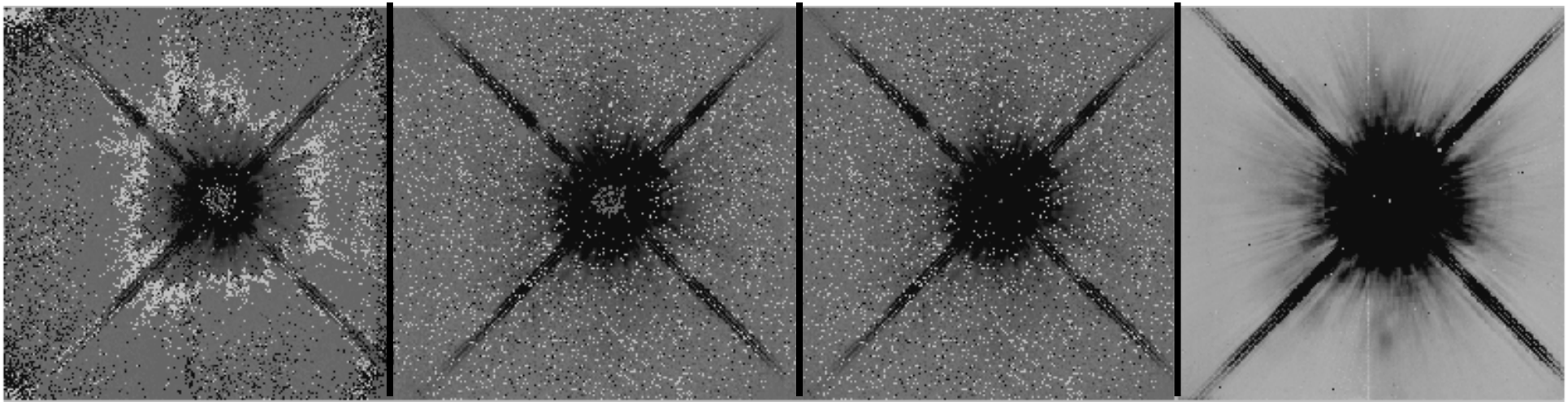
PI (last name):	MACKENTY	Proposal ID:	7045
Dataset Name:	N3XD02ZQM	Release Date:	04/26/97 17:
Target Name:	HD106965	Requested Lock:	FINE

Camera:	2	Aperture:	NIC2	Nread:	1
Filter:	F160W	Orient.:	-104.311	Readout:	FAST
Mode:	MULTIACCUM	Image Type:	SCIENCE	Samp Seq:	MIF512

CALNICA:	USED	RECOMMENDED	LEVEL OF CHANGE	PERFORMED
Bad Pixel/DQ File:	H4214599N_MSK.FITS	H4214599N_MSK.FITS	NO CHANGE	PERFORMED
Detector Read-Noise File:	H4216218N_NOI.FITS	H4216218N_NOI.FITS	NO CHANGE	PERFORMED
Dark Current File:	H1S1025AN_DRK.FITS	H7F1346RN_DRK.FITS	SEVERE	SKIPPED
Detector Linearity File:	H3V1404NN_LIN.FITS	H7N1654BN_LIN.FITS	SEVERE	PERFORMED
Flat-Field Response File:	H1S1337DN_FLT.FITS	HBI1346EN_FLT.FITS	SEVERE	PERFORMED
Photometric Calibration Table:	H1T0826LN_PHT.FITS	HA914251N_PHT.FITS	SEVERE	PERFORMED
Background Model Table:		N/A	N/A	OMITTED
CALNICB:				
Illumination Pattern File:	H241323QN_ILM.FITS	H241323QN_ILM.FITS	NO CHANGE	

N3XD02ZQM was taken 25 April 1997. The USED column shows the reference files that were used to calibrate the dataset when it went through the calibration pipeline and into the archive. The RECOMMENDED column has the names of the best reference files currently available. There has been no change to the bad pixel mask or the noise reference file. There are new files for the dark, linearity correction, flat field, and photometric table. The original dark reference file was DUMMY data, causing the dark correction step to be skipped by the **calnica** routine. For more information on **calnica**, see poster 10.06, The STScI NICMOS Calibration Pipeline, by H. Bushouse.

The image on the left below is the calibrated N3XD02ZQM dataset in the archive. The next two images show the improvements made just by changing the dark and then the dark and linearity reference files. The image on the right was calibrated with the latest **calnica** and the best reference files.



calnica2.2

calnica2.2 & new dark file

calnica2.2, new dark & new linearity file

calnica3.1 and best reference files

REFERENCE FILE HISTORY SUMMARY

BAD PIXEL MASKS NIC1 & NIC3, no updates since launch. Ground-based data. NIC2 update 02 April 1997 deleted coronographic hole.
NOISE FILES No updates since launch. Ground-based data.
NON-SEQUENCE DARKS No updates since launch. Note that all are DUMMY.
SEQUENCE DARKS Initial load was all DUMMY. {h1s reference files} On-orbit dark population started March 1997. Pre-flight software change synthetic dark population started 11 July 1997. Early SPARS256 in NIC2 & NIC3 populated 9 June 1997. Post-flight software change synthetic dark population started 13 October 1997.
LINEARITY FILES Ground-based data. On-orbit files under construction. Error arrays added 31 March 1997. Zero-charge corrected files with [ZSCI] & [ZERR] extensions for use with **calnica**3.0 and higher installed 27 October 1997.

FLAT FIELDS

Initial load was ground-based.
Early on-orbit flat population started 02 May 1997.
Early on-orbit flat renormaliztion started 19 May 1997.
Normalization and then inversion fix for both ground-based and onorbit flats started 09 October 1997. New photometric table delivered with revised PHOTFLAM and PHOTFNU values to match flat renormaliztion.
Cycle 7 on-orbit flat population started 18 November 1997.

PHOTOMETRIC TABLES

Initial launch delivery had gain values at 10e-/DN.
New gain values (NIC1,NIC2 5.4e-/DN; NIC3 6.5e-/DN) added 23 May 1997.
New transmission values installed 18 July 1997.
New bandpar results installed 06 October 1997.
Revised PHOTFLAM & PHOTFNU values installed 09 October 1997 to match renormalized flat delivery.

ILLUMINATION FILES (for use with **calnicb** only)

No updates since launch. Note that all are DUMMY.

calnica Software

There have been five builds of **calnica** since launch. The CAL_VER keyword in the global header of your calibrated data, _cal.fits[0], will tell you which **calnica** version was used to calibrate your data. If the keyword doesn't exist or isn't populated, your data was processed with version 2.2 or earlier. If your observations weren't processed with **calnica**3.0 or higher, you should seriously consider recalibrating.

calnica2.1 Initial launch build.
calnica2.2 Installed 19 May 1997. Minor changes.
calnica2.3 Installed 19 June 1997. Major rewrite of CRIDCALC, cosmic ray rejection algorithm, using new linear fit routine. Populate CAL_VER keyword.
calnica3.0 Installed 11 November 1997. Correct for non-zero signal in MULTIACCUM zeroth-read from bright sources. Major rewrite of CRIDCALC to compute mean differences and reject samples. Pixels flagged as saturated in a given MULTACCUM readout stay flagged in all subsequent readouts.
calnica3.1 Installed 23 December 1997. Added recognizance of new target acquisition raw filename suffixes rwf & rwb and produces output calibrated file names with corresponding suffixes clf & clb.

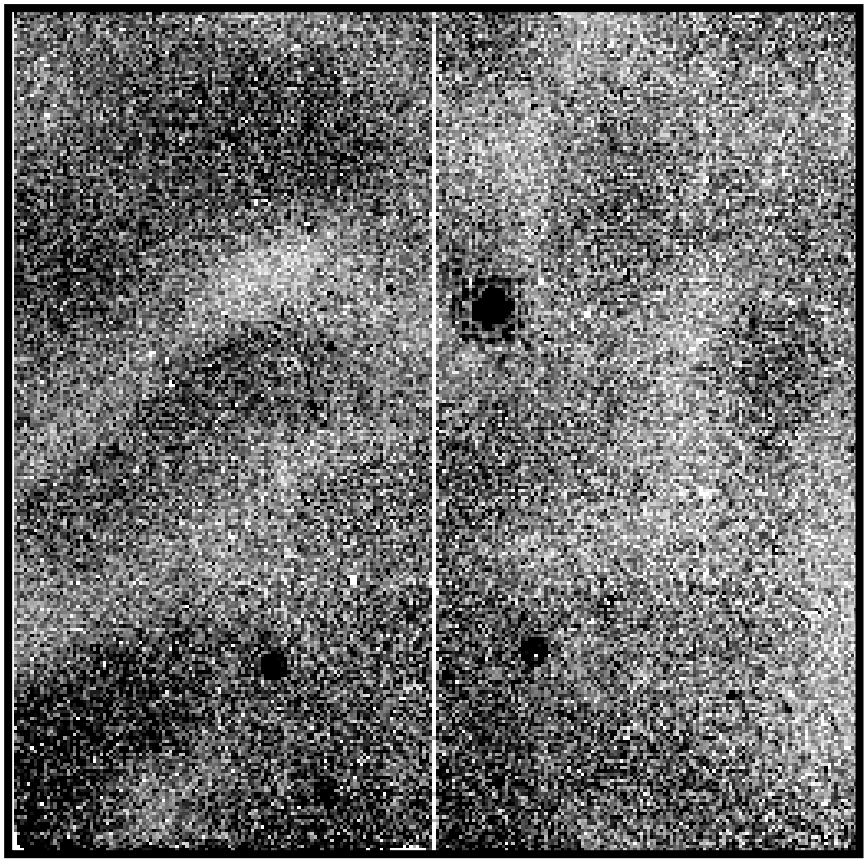
Pedestal Fix Software

STScI has been investigating software to fix pedestal problems in data. Pedestal is a random, quadrant-dependent additive signal that appears whenever the detector's amplifiers are switched on. The pedestal is a uniform offset without any flat field variations, and so the FLATCORR step in **calnica** will impose an inverted flat field response in the final calibrated image.

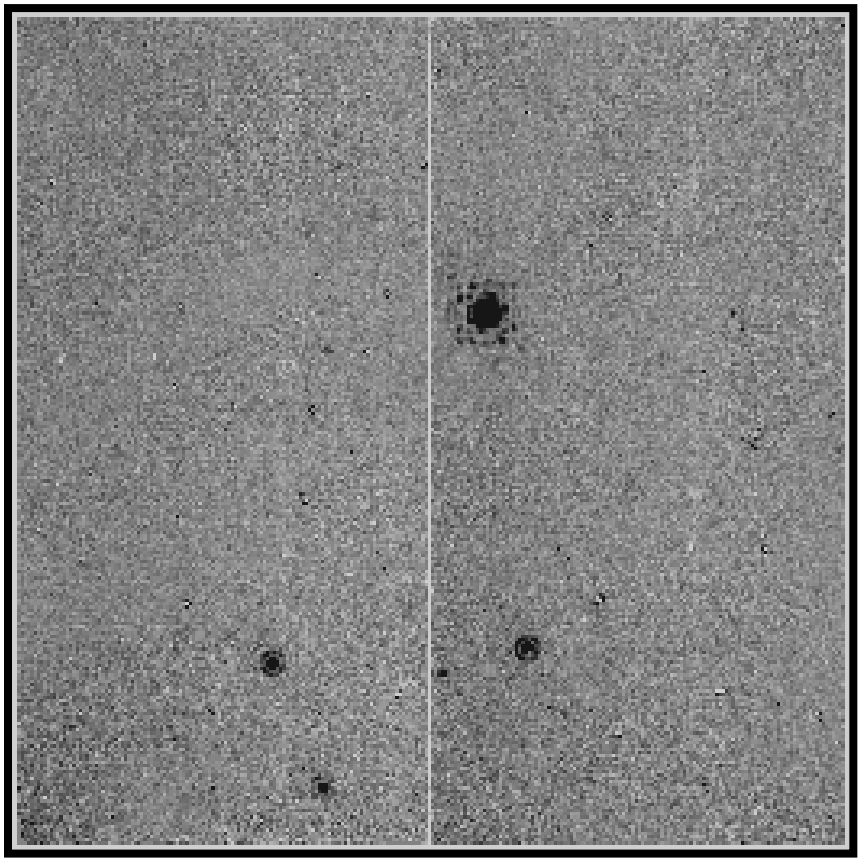
The pedestal removal software created to date works best on sparse fields. As new software and algorithms become available updates will be posted to the Web and in the Institute electronic newsletter, the STAN.

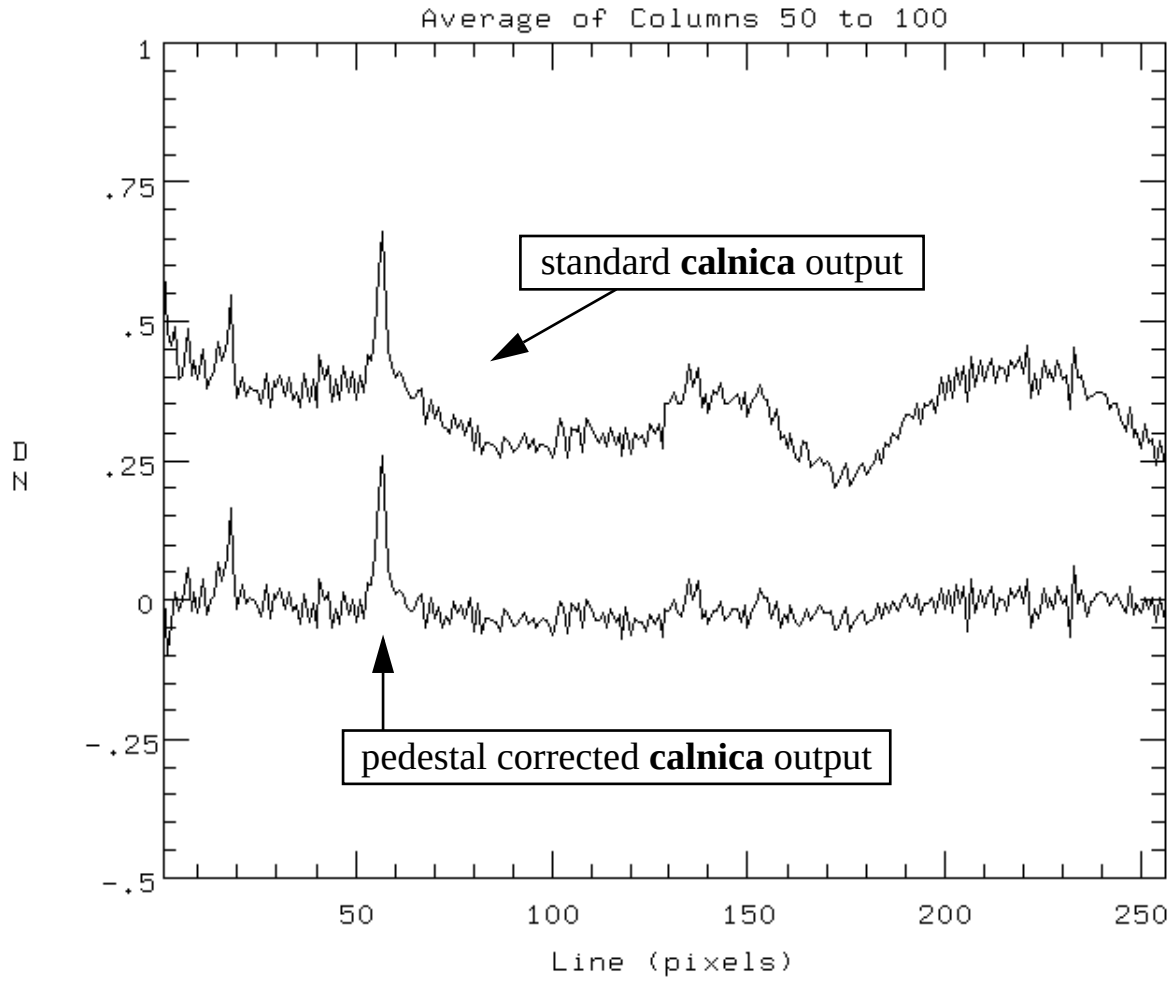
Below is an image of a standard star from the 7691 calibration program. On the left is the standard **calnica** output showing pedestal in the image. At the right is the same dataset run through a simple IRAF pedestal-correcting script. This script first calibrates the data up through the dark correction, DARKCORR. Next the mode of each quadrant in each extension of the _ima file is calculated and subtracted. Finally, the resulting image is run through **calnica** again performing the FLATCORR, UNITCORR, and CRIDCALC steps.

standard **calnica** output



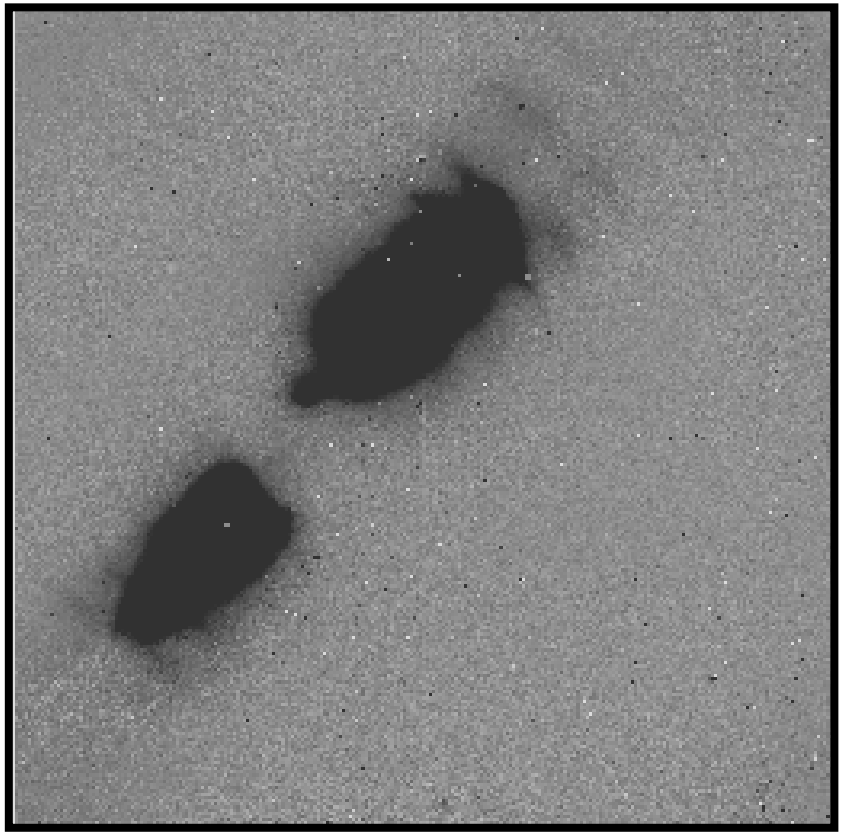
pedestal-corrected **calnica** output



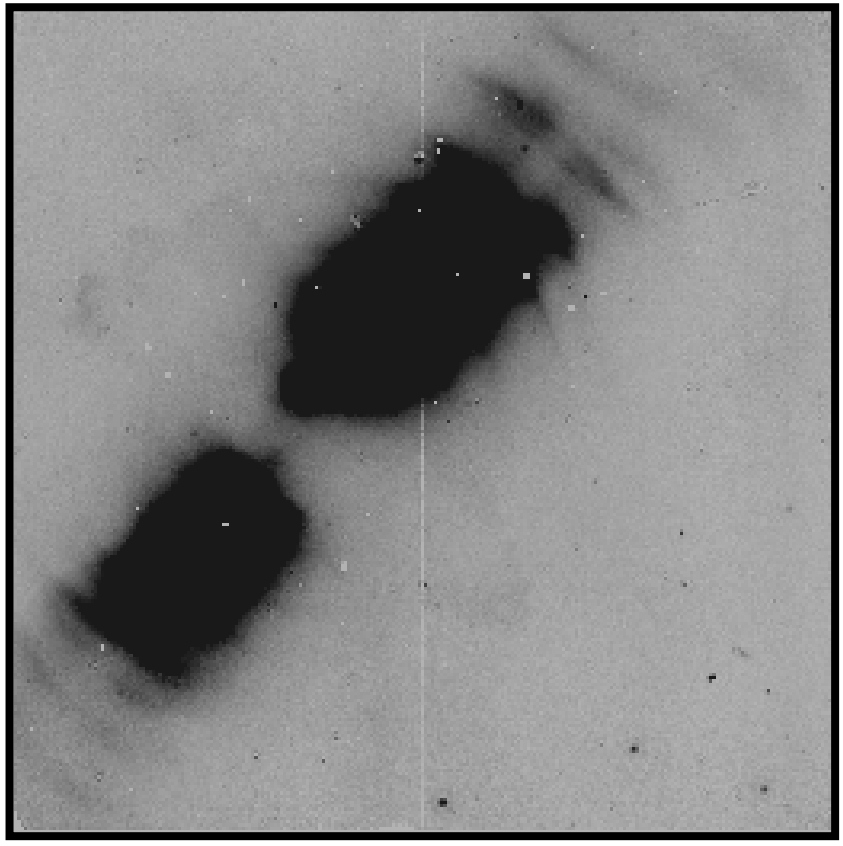


The plot above is the average of columns 50 through 100 of the standard star images above. The top line is from the non-pedestal fixed image. The bottom line is from the pedestal corrected image.

calnica2.2 output



calnica3.1 output



Same raw dataset, i.e., no change in reference files between the two images, run through both **calnica**2.2 and **calnica**3.1.