

# V&V Reference Report

## L2 ASCDS Version : 10.7.1

Observation 22223 - L2 Version 2  
Chandra X-Ray Center

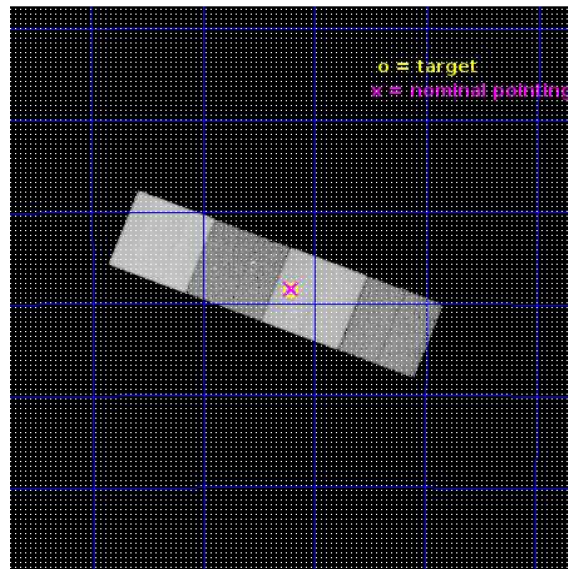
L2 Processing Date : May 22 2019

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# 1 Front

|          |                                                                             |                                             |
|----------|-----------------------------------------------------------------------------|---------------------------------------------|
| seq_num  | 201260                                                                      | Sequence number                             |
| obs_id   | 22223                                                                       | Observation id                              |
| title    | Identifying Accretion at a Key Stage of Pre-main Sequence Stellar Evolution | Proposal title                              |
| observer | Dr. Claude Canizares                                                        | Principal investigator                      |
| object   | SZ 96                                                                       | Source name                                 |
| dtcycle  | 0                                                                           | &#160                                       |
| cycle    | P                                                                           | events from which exps?<br>Prim/Second/Both |
| ra_targ  | 242.052667                                                                  | Observer's specified target RA [deg]        |
| dec_targ | -39.142633                                                                  | Observer's specified target Dec [deg]       |
| ra_nom   | 242.05228027572                                                             | Nominal RA [deg]                            |
| dec_nom  | -39.139455447461                                                            | Nominal Dec [deg]                           |
| roll_nom | 21.156367719576                                                             | Nominal Roll [deg]                          |
| revision | 2                                                                           | Processing version of data                  |
| ontime   | 40014.80030787                                                              | Sum of GTIs [s]                             |
| livetime | 39491.97748338                                                              | Livetime [s]                                |
| ontime5  | 40014.80030787                                                              | Sum of GTIs [s]                             |
| ontime6  | 40014.80030787                                                              | Sum of GTIs [s]                             |
| ontime7  | 40014.80030787                                                              | Sum of GTIs [s]                             |
| ontime8  | 40008.518167496                                                             | Sum of GTIs [s]                             |
| l2events | 436145                                                                      | Number of level 2 events                    |

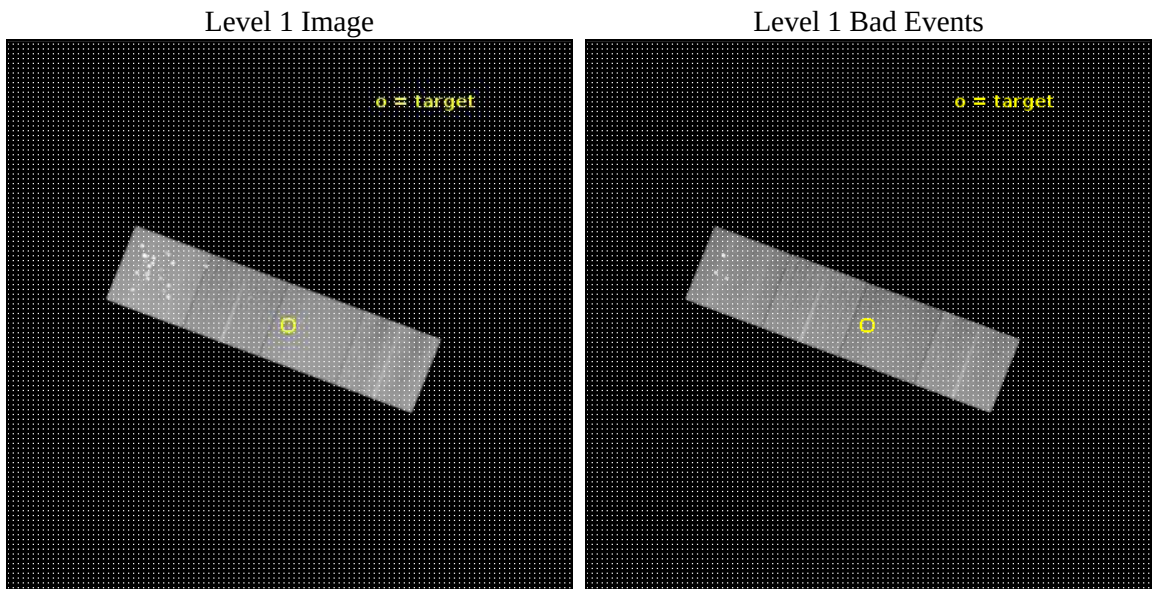




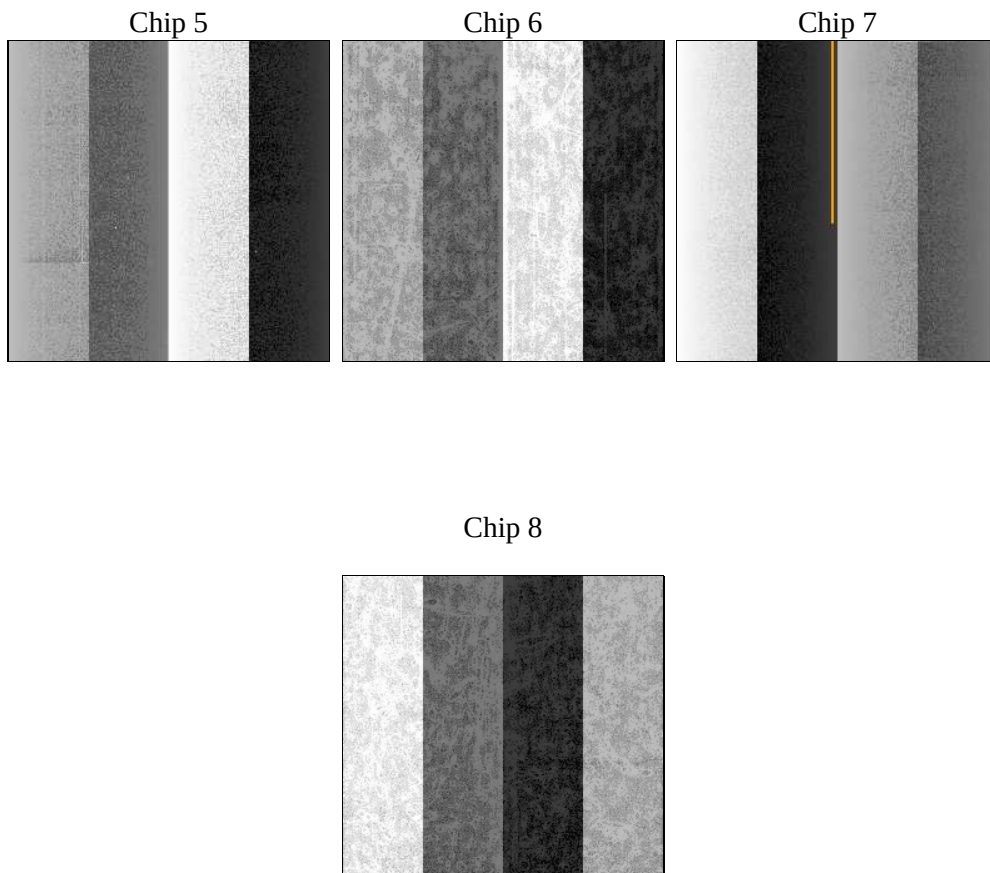
## 2 OBI

### 2.1 OBI

#### 2.1.1 Images



#### 2.1.2 Bias



### 2.1.3 Parameters

|          |                     |                                |                |                    |                                         |
|----------|---------------------|--------------------------------|----------------|--------------------|-----------------------------------------|
| obi_num  | 0                   | Obi number                     | sched_exp_time | 40000.000000       | [s] Scheduled observation exposure time |
| ascdsver | 10.7.1              | Processing system revision     | ontime         | 40014.80030787     | Sum of GTIs [s]                         |
| caldsver | 4.8.2               | &#160                          | ontime5        | 40014.80030787     | Sum of GTIs [s]                         |
| date     | 2019-05-22T23:25:24 | Date and time of file creation | ontime6        | 40014.80030787     | Sum of GTIs [s]                         |
| revision | 2                   | Processing version of data     | ontime7        | 40014.80030787     | Sum of GTIs [s]                         |
|          |                     |                                | ontime8        | 40008.518167496    | Sum of GTIs [s]                         |
|          |                     |                                | l1events       | 1708636            | Number of level 1 events                |
|          |                     |                                | tgmethod       | TGDETECT           | Method used to create src1a file        |
|          |                     |                                | zo_pos         | (4095.43, 4072.66) | src1a sky pixel position                |

### 2.1.4 Events

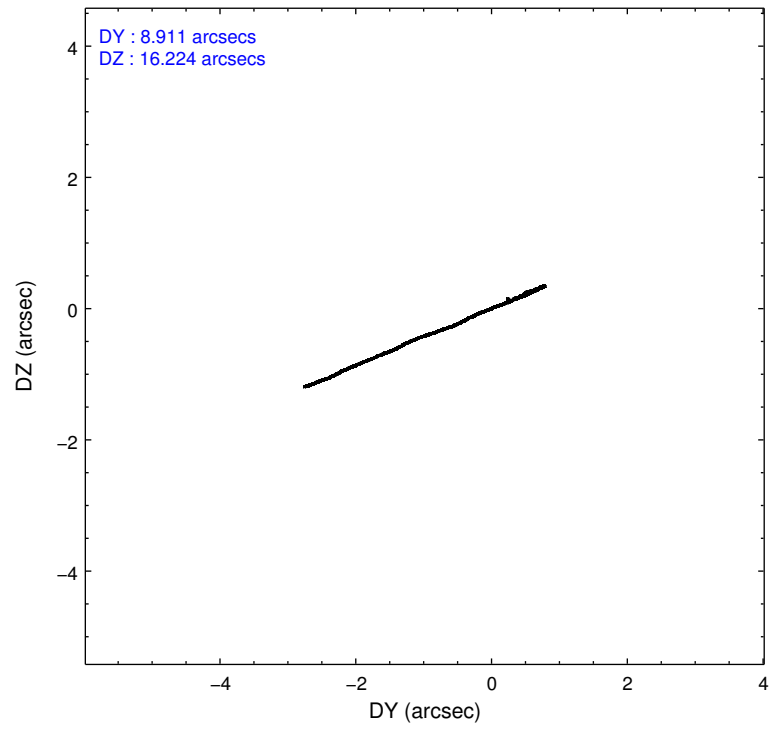
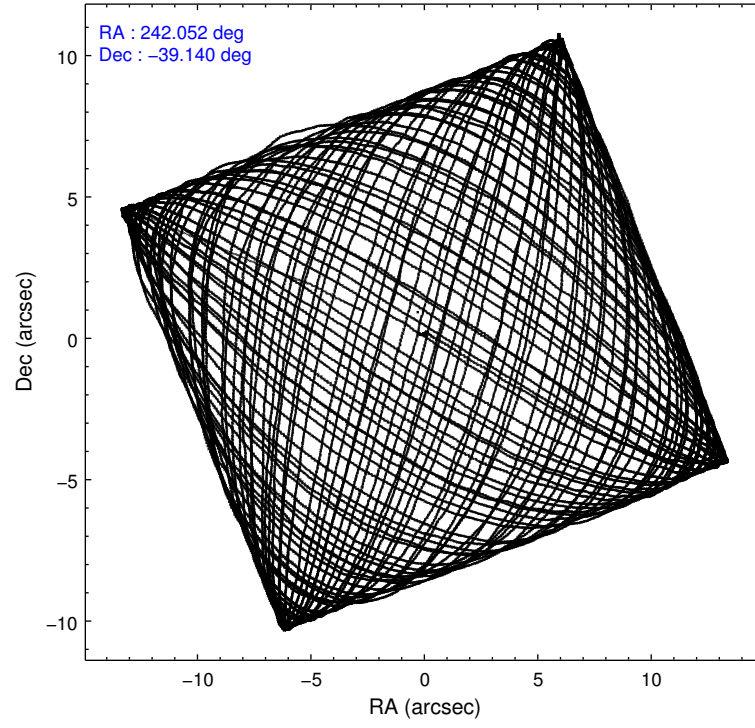
|                 | ccd 5  | ccd 6  | ccd 7  | ccd 8  |
|-----------------|--------|--------|--------|--------|
| level 1 events  | 628989 | 311881 | 382273 | 385493 |
| rejected events | 278821 | 276756 | 218824 | 287266 |
| rejected %      | 44%    | 88%    | 57%    | 74%    |

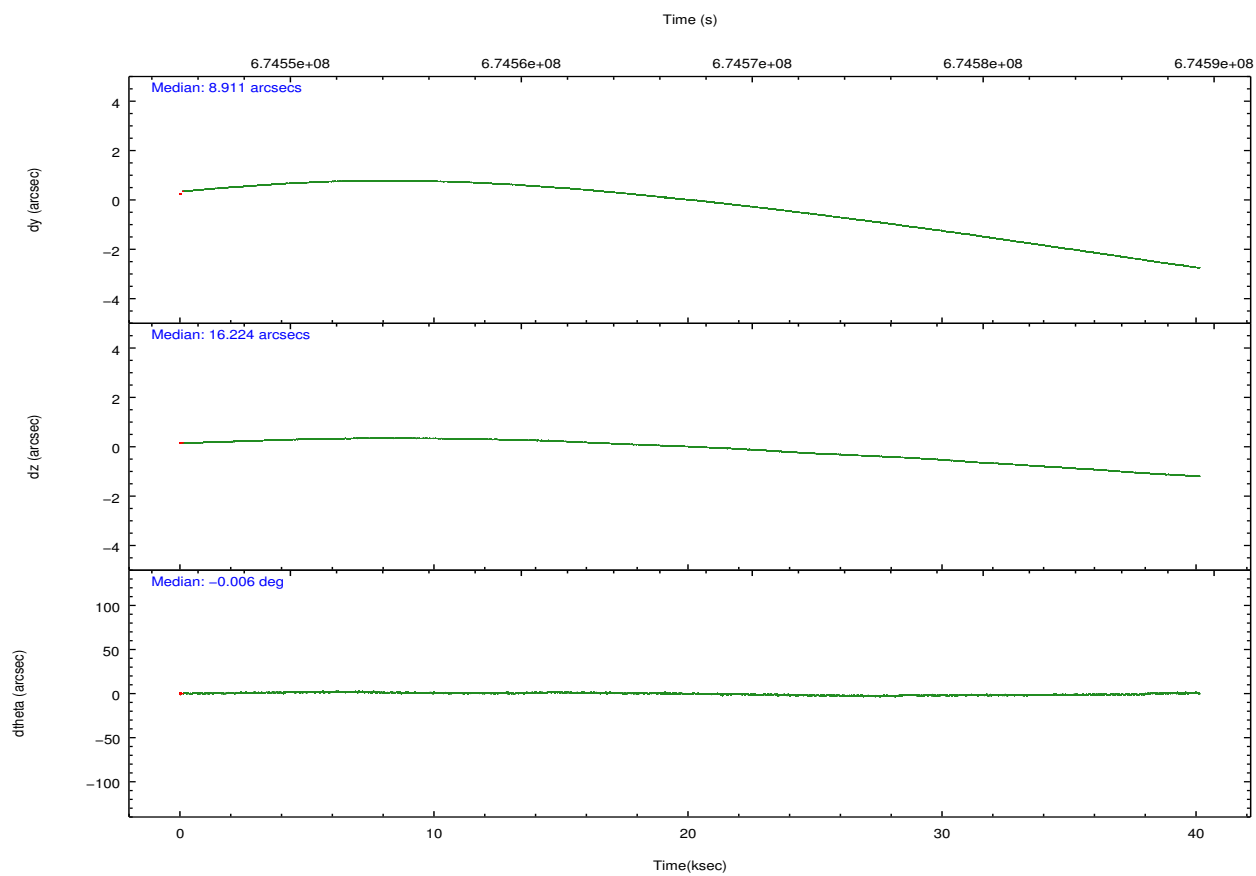
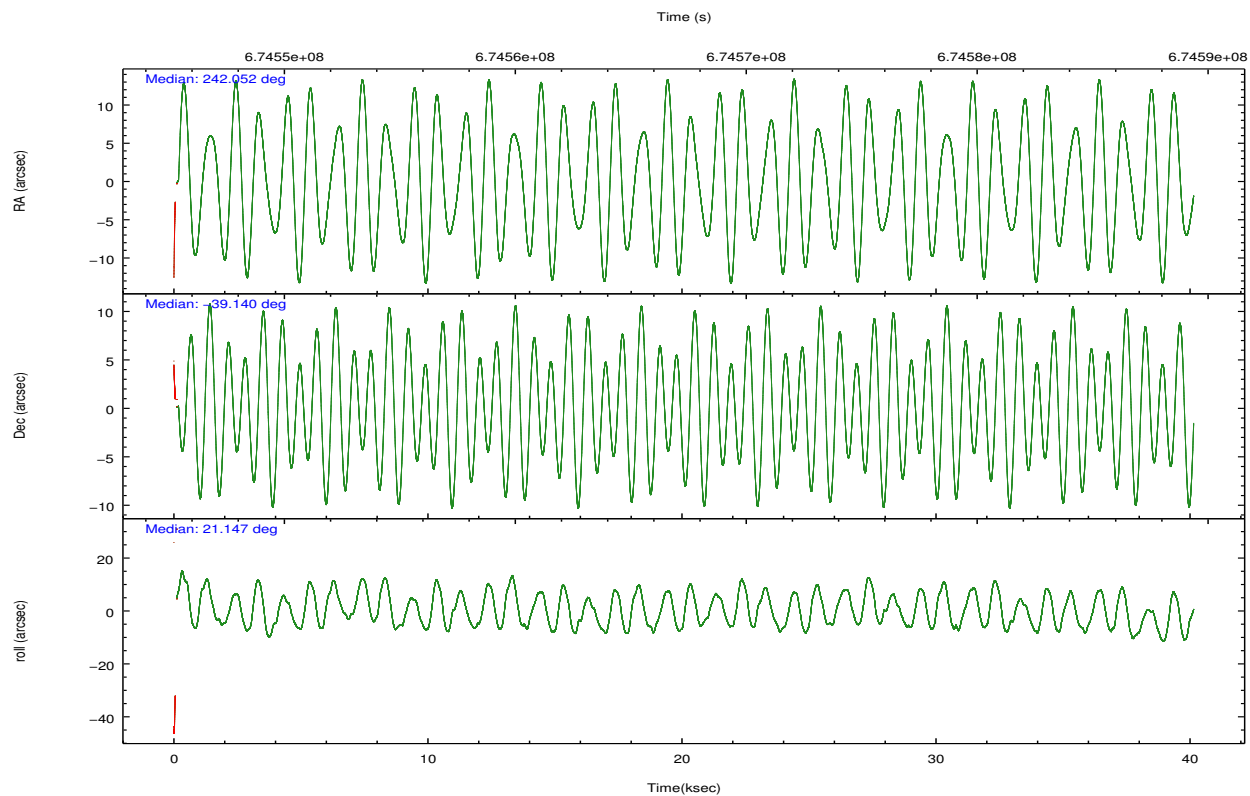
|                | ccd 5  | ccd 6  | ccd 7  | ccd 8  |
|----------------|--------|--------|--------|--------|
| grade 0 events | 118256 | 11127  | 13672  | 27069  |
|                | 18%    | 3%     | 3%     | 7%     |
| grade 1 events | 1374   | 148    | 586    | 281    |
|                | 0%     | 0%     | 0%     | 0%     |
| grade 2 events | 86736  | 9099   | 34079  | 24155  |
|                | 13%    | 2%     | 8%     | 6%     |
| grade 3 events | 8810   | 2866   | 12551  | 10064  |
|                | 1%     | 0%     | 3%     | 2%     |
| grade 4 events | 9231   | 2872   | 12309  | 9396   |
|                | 1%     | 0%     | 3%     | 2%     |
| grade 5 events | 35284  | 12339  | 36164  | 19841  |
|                | 5%     | 3%     | 9%     | 5%     |
| grade 6 events | 127475 | 9218   | 91059  | 27623  |
|                | 20%    | 2%     | 23%    | 7%     |
| grade 7 events | 241823 | 264212 | 181853 | 267064 |
|                | 38%    | 84%    | 47%    | 69%    |

## 2.2 Compared Parameters

| Parameter                         | Planned             | Actual               | Parameter                             | Planned   | Actual  |
|-----------------------------------|---------------------|----------------------|---------------------------------------|-----------|---------|
| Instrument                        | ACIS                | ACIS                 | Obspar format version number          | 7         | 7       |
| Detector                          | ACIS-5678           | ACIS-5678            | Obspar file type                      | PREDICTED | ACTUAL  |
| Grating                           | HETG                | HETG                 | Obspar update status                  | NONE      | UPDATED |
| Data mode                         | FAINT               | FAINT                | CCD I0 on                             | N         | N       |
| Observation mode                  | POINTING            | POINTING             | CCD I1 on                             | N         | N       |
| [deg] Pointing RA                 | 242.030446          | 242.0522802757159    | CCD I2 on                             | N         | N       |
| [deg] Pointing Dec                | -39.161049          | -39.13945544746068   | CCD I3 on                             | N         | N       |
| [deg] Pointing Roll               | 20.985978           | 21.15636771957573    | CCD S0 on                             | O2        | N       |
| [mm] SIM focus pos                | -0.684267           | -0.6828225247311905  | CCD S1 on                             | Y         | Y       |
| [mm] SIM defocus                  | 0                   | 0.001444936568705701 | CCD S2 on                             | Y         | Y       |
| [mm] SIM translation stage pos    | -190.132523         | -190.1425803651734   | CCD S3 on                             | Y         | Y       |
| [mm] SIM translation stage offset | 0                   | 0.01005778216563158  | CCD S4 on                             | Y         | Y       |
| [s] Observation start time (MET)  | 674547338.184000    | 674545730.59627      | CCD S5 on                             | O1        | N       |
| Observation start date            | 2019-05-18T06:14:29 | 2019-05-18T05:48:50  | Number of optional ACIS chips dropped | 2         | 2       |
| [s] Observation end time (MET)    | 674587338.184000    | 674588126.64881      | On-chip summing requested             | N         | N       |
| Observation end date              | 2019-05-18T17:21:09 | 2019-05-18T17:35:26  | Subarray requested                    | NONE      | NONE    |
| Read mode                         | TIMED               | TIMED                | Alternating exposures requested       | N         | N       |
|                                   |                     |                      | [s] Primary exposure time             | 0.000000  | 3.1     |

## 2.3 Aspect



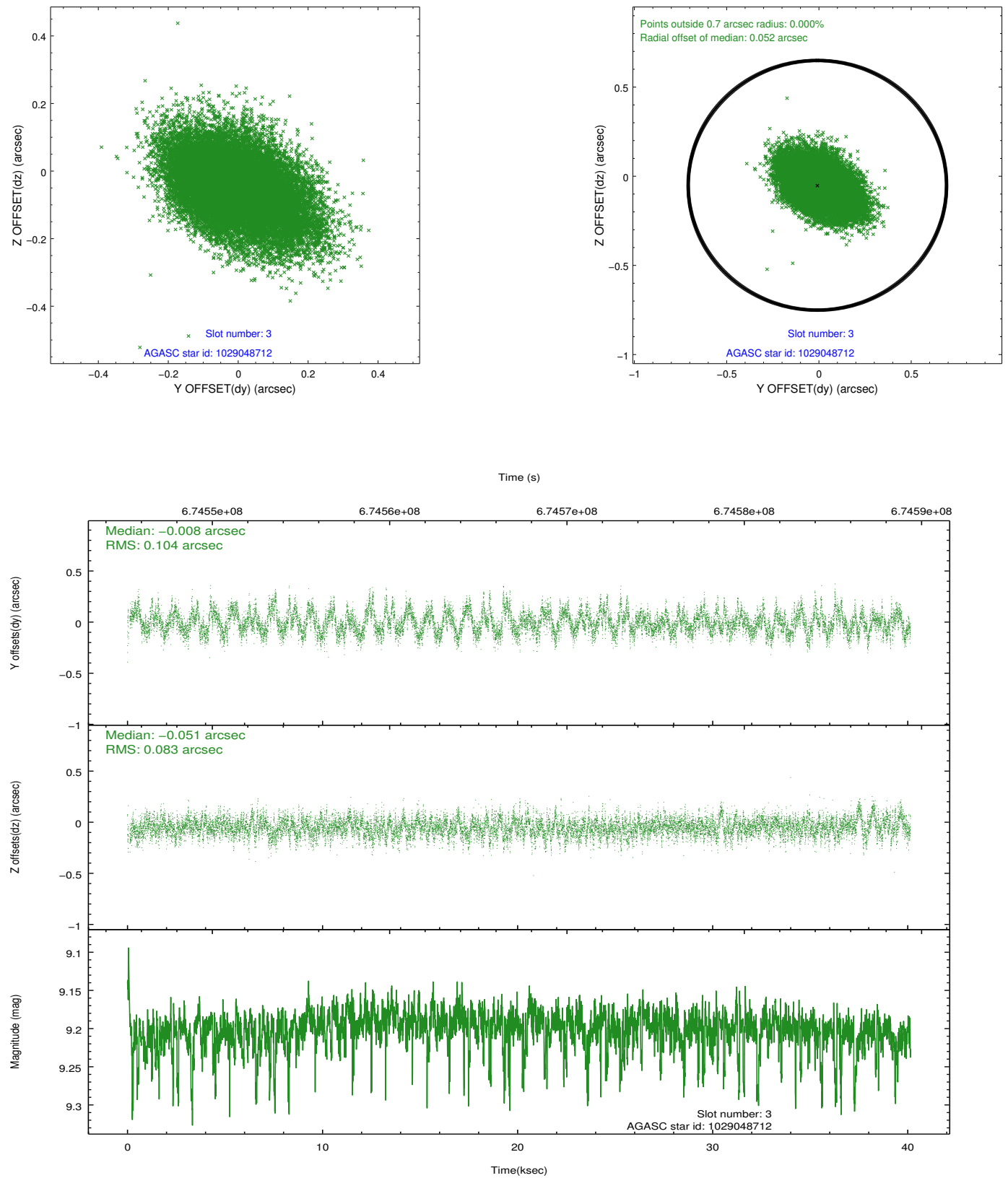


# Slot Statistics

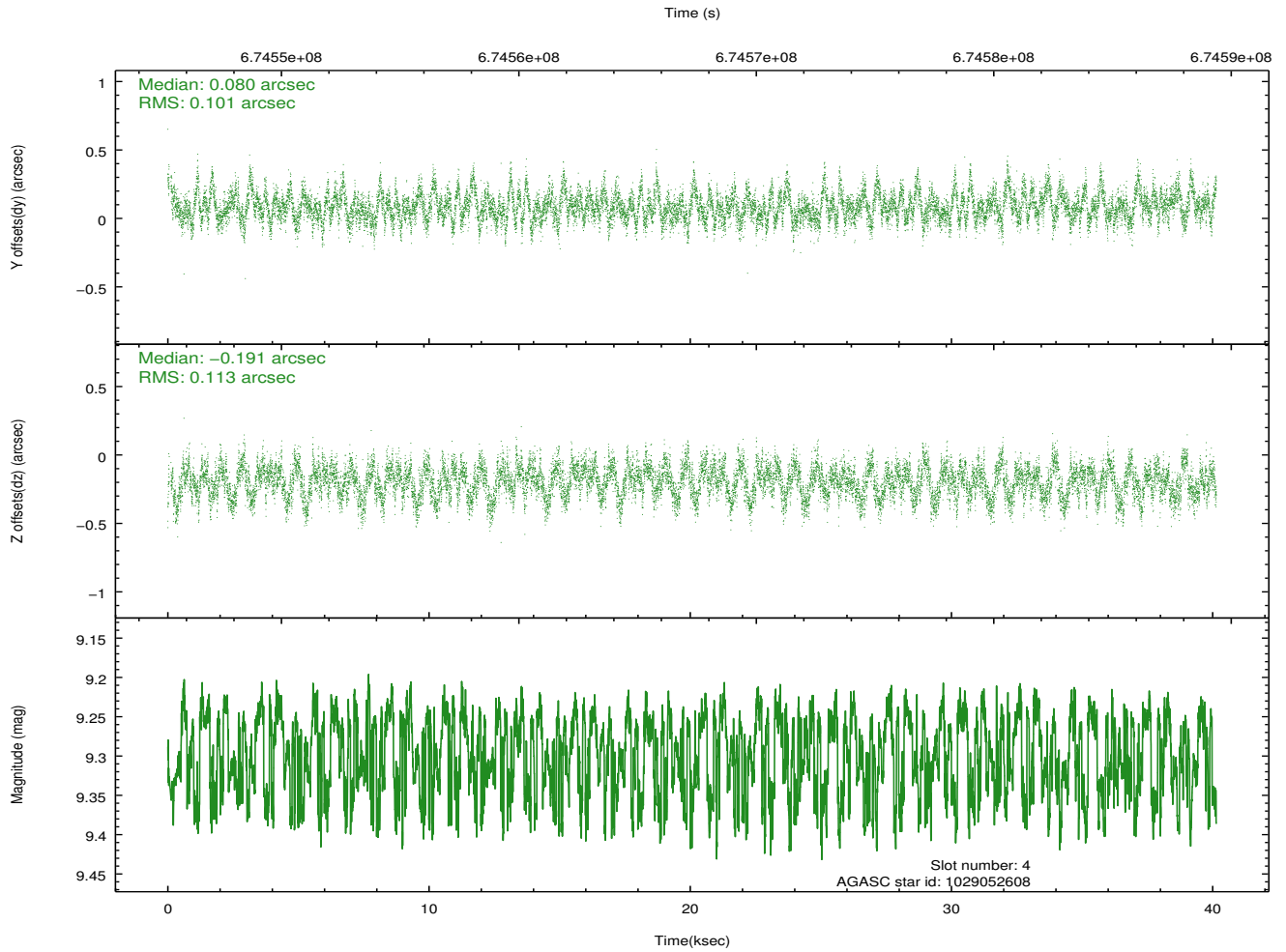
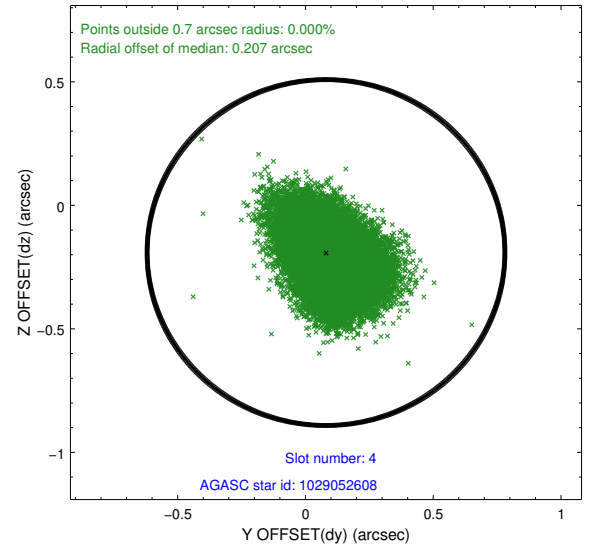
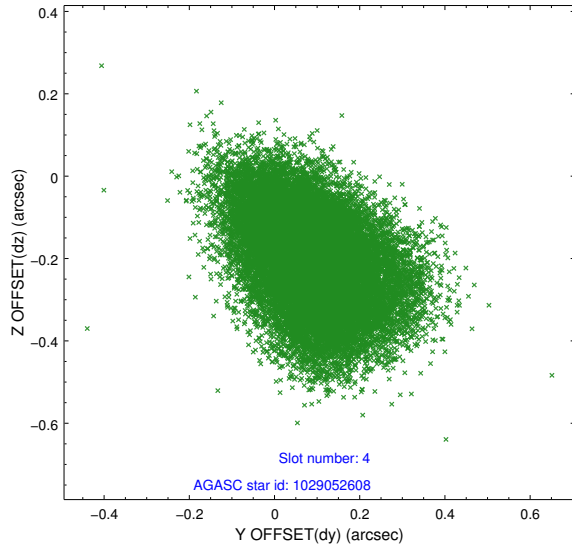
| pt | status  | used   | id         | mag  | n_pts | frac_pts | med_dy | med_dz | dr1   | dr2   | ra         | dec        | mean_y   | mea   |
|----|---------|--------|------------|------|-------|----------|--------|--------|-------|-------|------------|------------|----------|-------|
| 0  | FID     |        | ACIS-S-2   | 7.09 | 9776  | 1.000    | -0.258 | -0.110 | 0.024 | 0.040 | 0.000000   | 0.000000   | -761.52  | -1737 |
| 1  | FID     |        | ACIS-S-4   | 7.22 | 9777  | 1.000    | 0.643  | 0.155  | 0.040 | 0.059 | 0.000000   | 0.000000   | 2152.58  | 171   |
| 2  | FID     |        | ACIS-S-5   | 7.19 | 9774  | 1.000    | -0.419 | -0.035 | 0.034 | 0.088 | 0.000000   | 0.000000   | -1814.55 | 164   |
| 3  | GUIDE   | used   | 1029048712 | 9.20 | 19530 | 1.000    | -0.008 | -0.051 | 0.140 | 0.236 | 241.237794 | -38.954366 | -1809.43 | 1479  |
| 4  | GUIDE   | used   | 1029052608 | 9.30 | 19512 | 1.000    | 0.080  | -0.191 | 0.162 | 0.263 | 241.909057 | -39.099888 | -238.65  | 326   |
| 5  | GUIDE   | used   | 1029059360 | 8.27 | 19546 | 1.000    | 0.001  | -0.011 | 0.107 | 0.184 | 241.638388 | -39.259513 | -1148.09 | 57    |
| 6  | GUIDE   | used   | 1029580280 | 9.16 | 19521 | 1.000    | -0.083 | 0.264  | 0.188 | 0.303 | 242.322361 | -39.646406 | 129.26   | -1921 |
| 7  | MONITOR | unused |            | 0.00 | 0     | 0.000    | 0.000  | 0.000  | 0.000 | 0.000 | 0.000000   | 0.000000   | 0.00     | 0     |

## 2.4 Star Slots

### 2.4.1 Slot 3

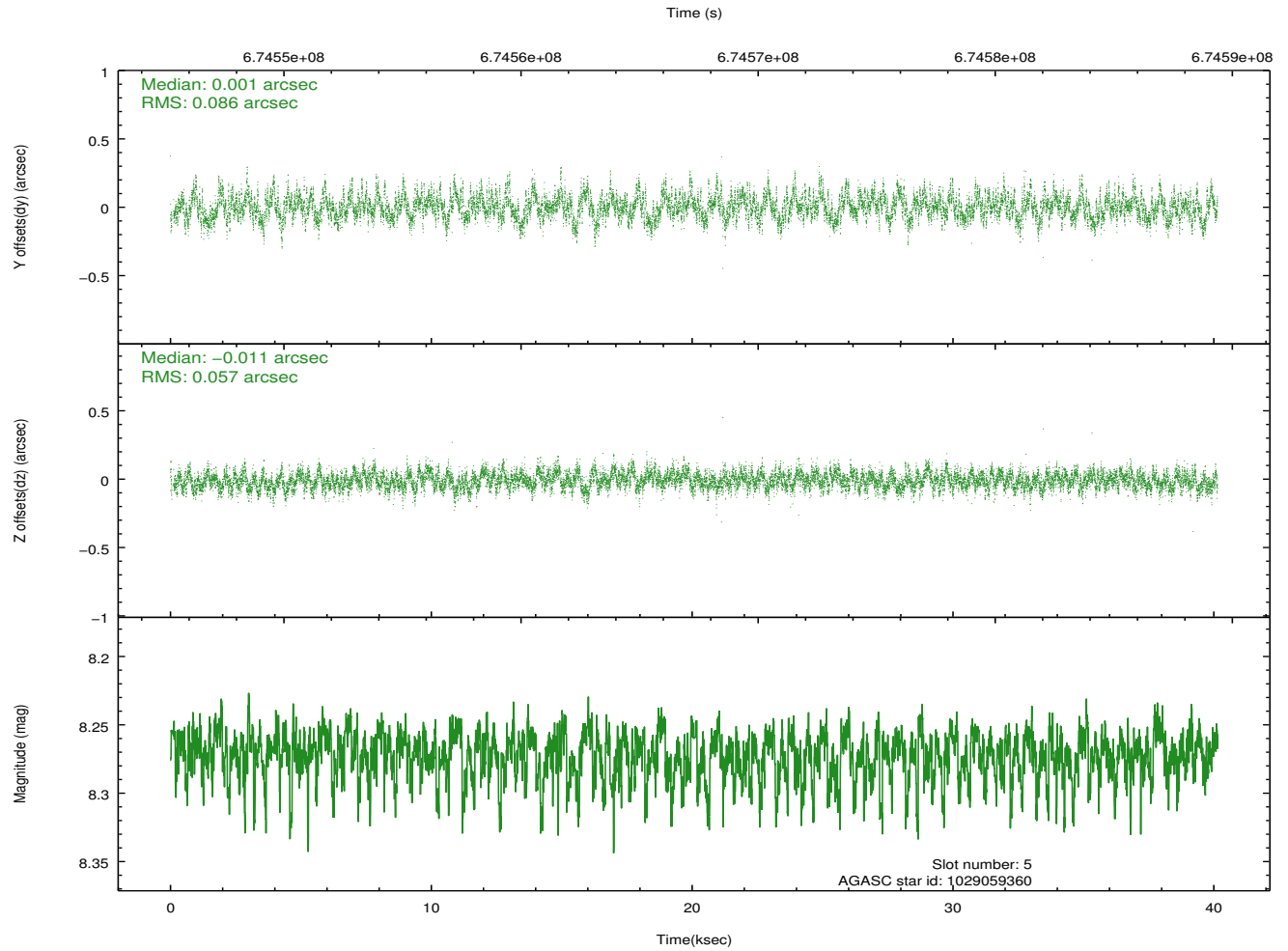
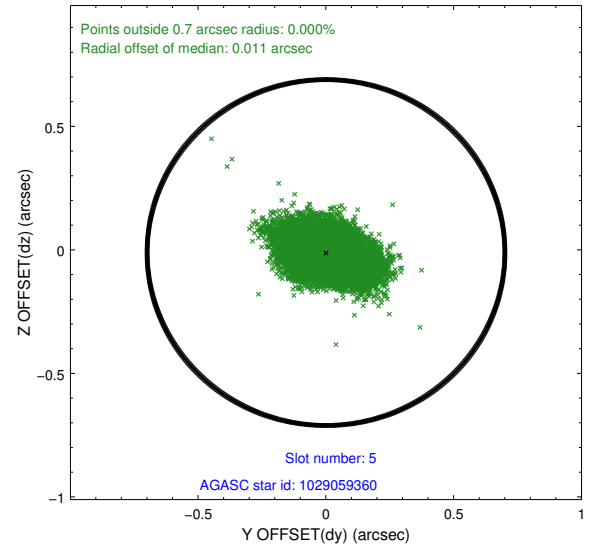
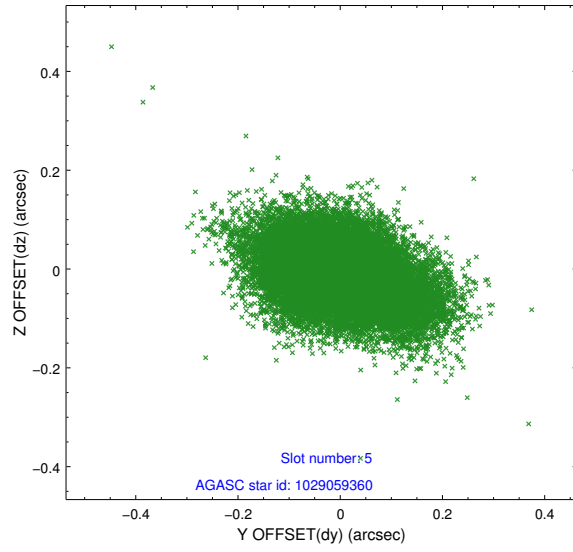


## 2.4.2 Slot 4

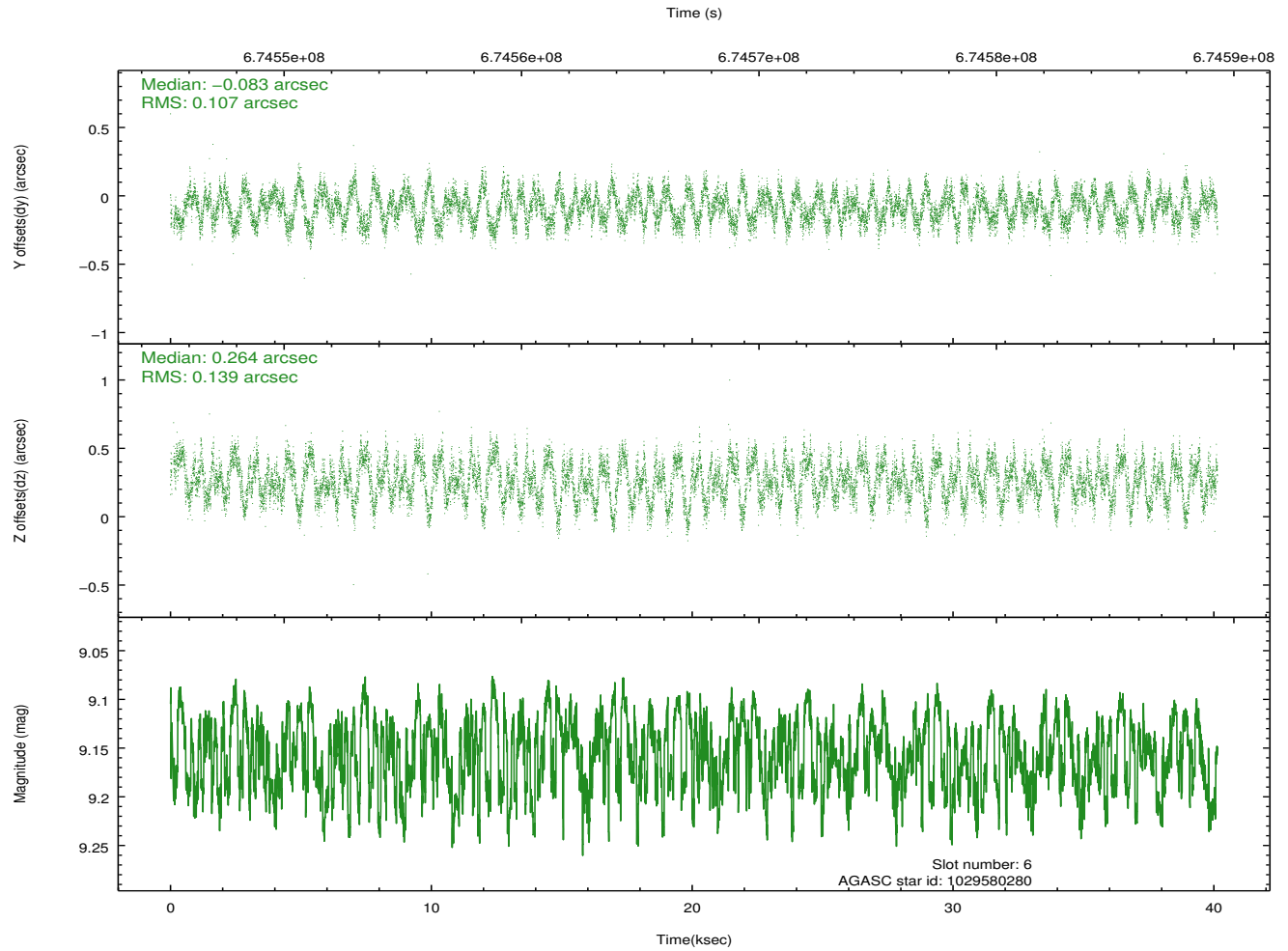
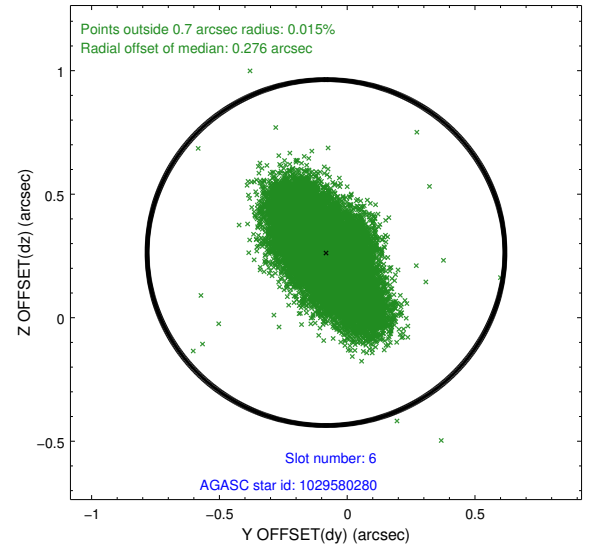
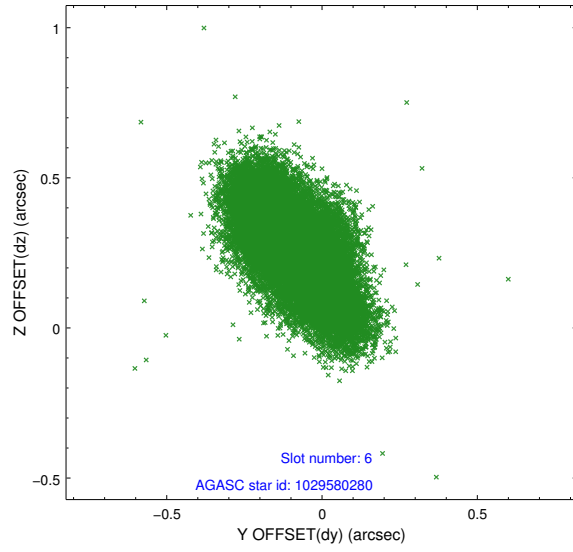




### 2.4.3 Slot 5

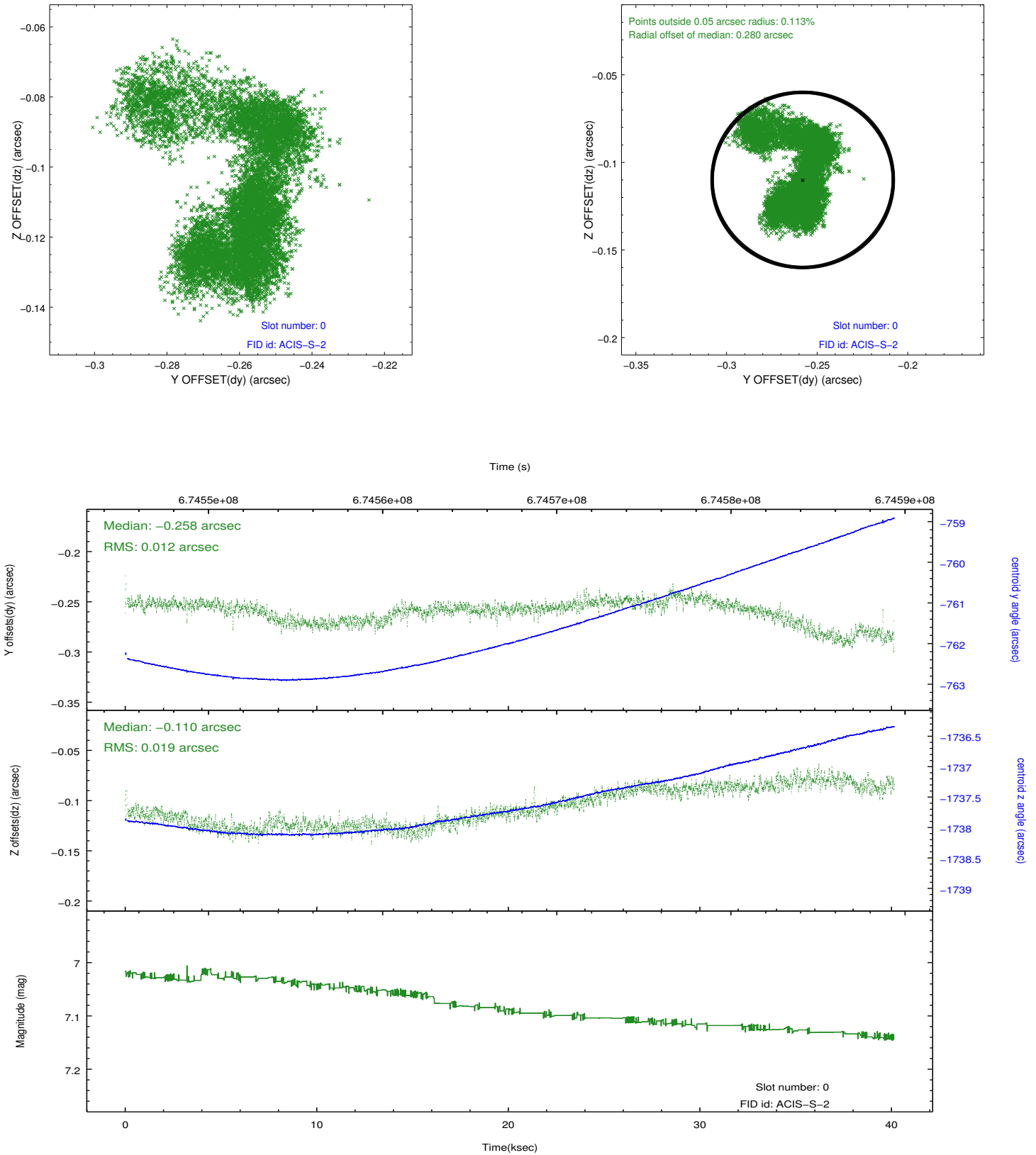


## 2.4.4 Slot 6

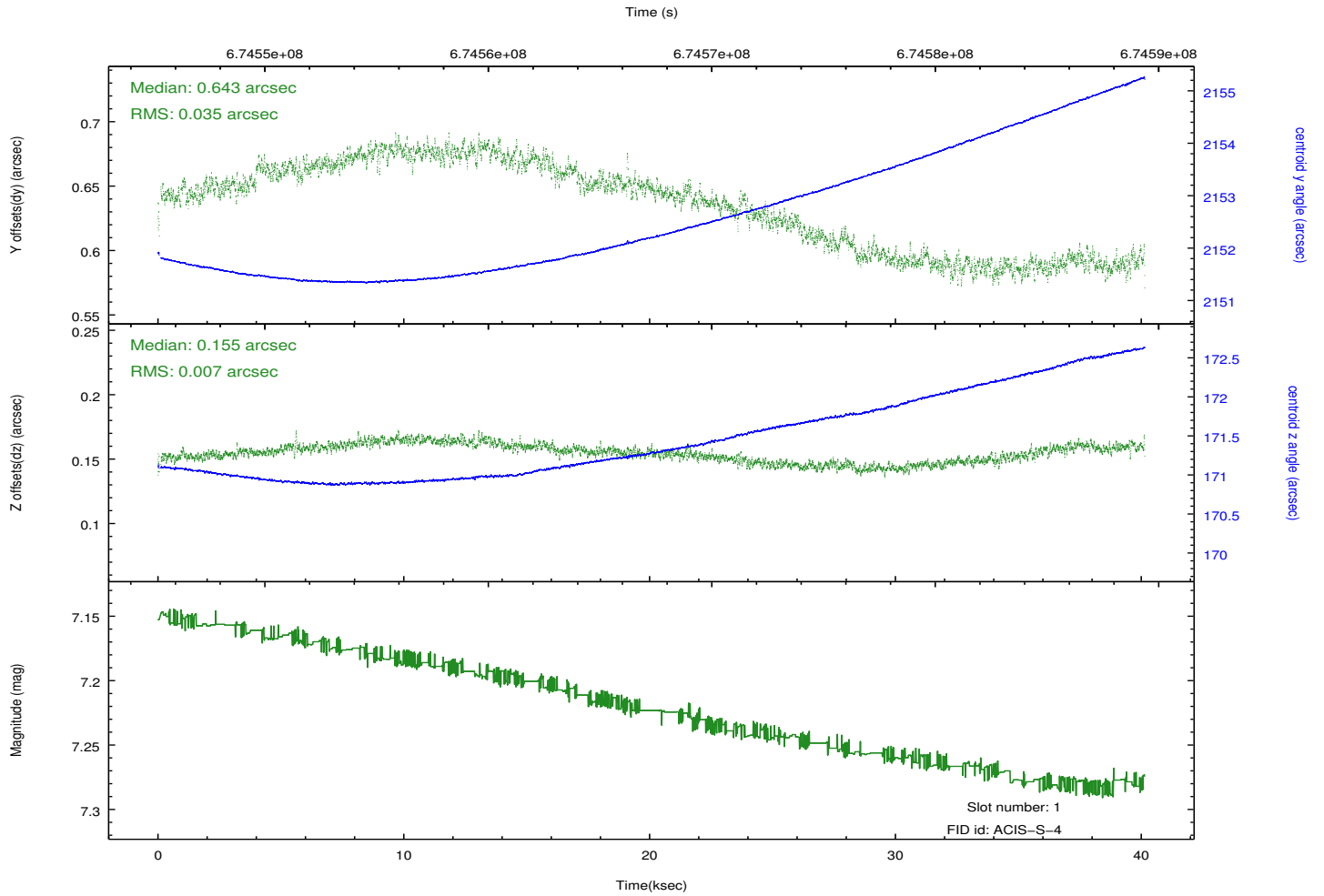
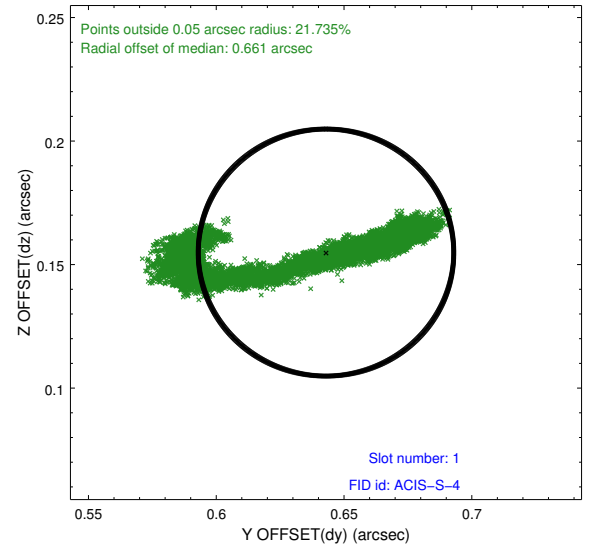
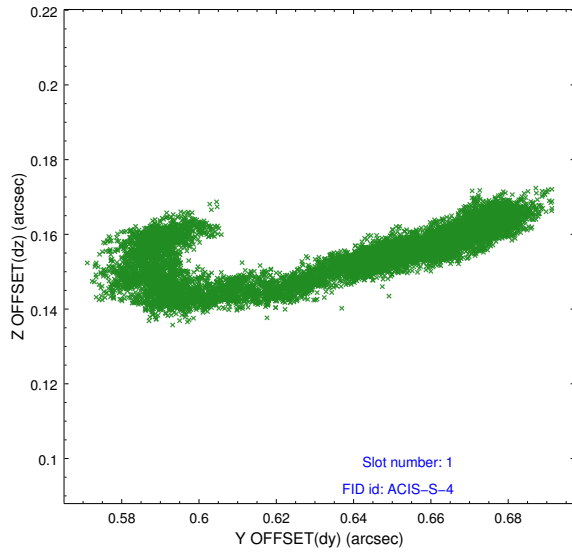


## 2.5 FID Slots

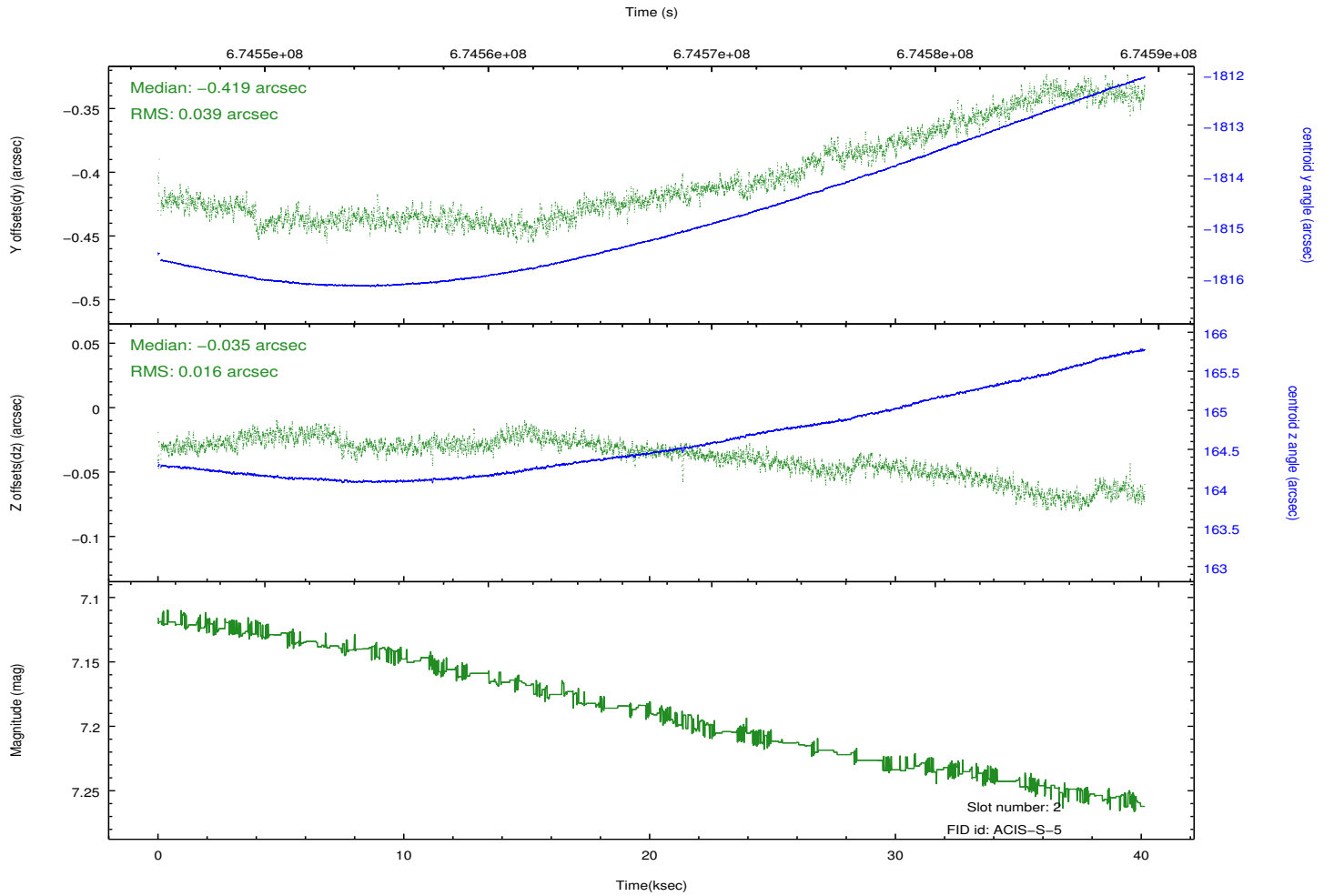
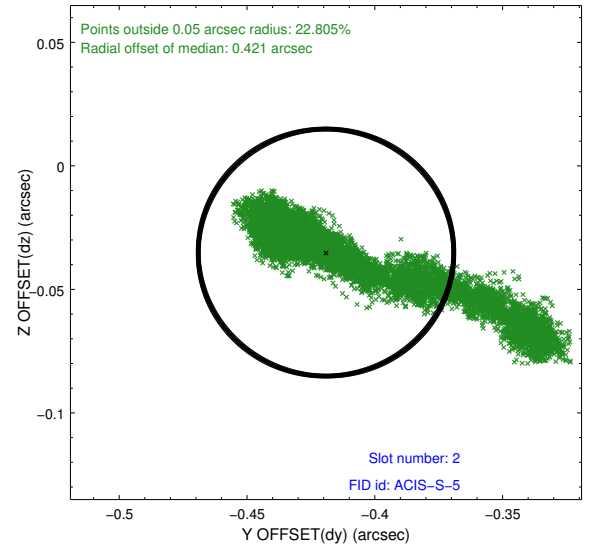
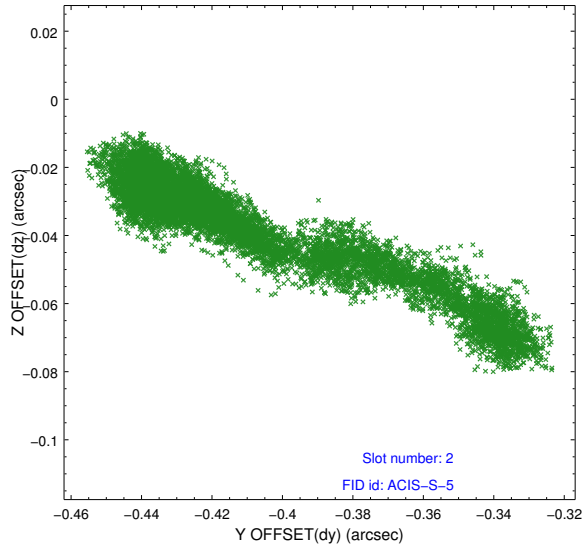
### 2.5.1 Slot 0



## 2.5.2 Slot 1

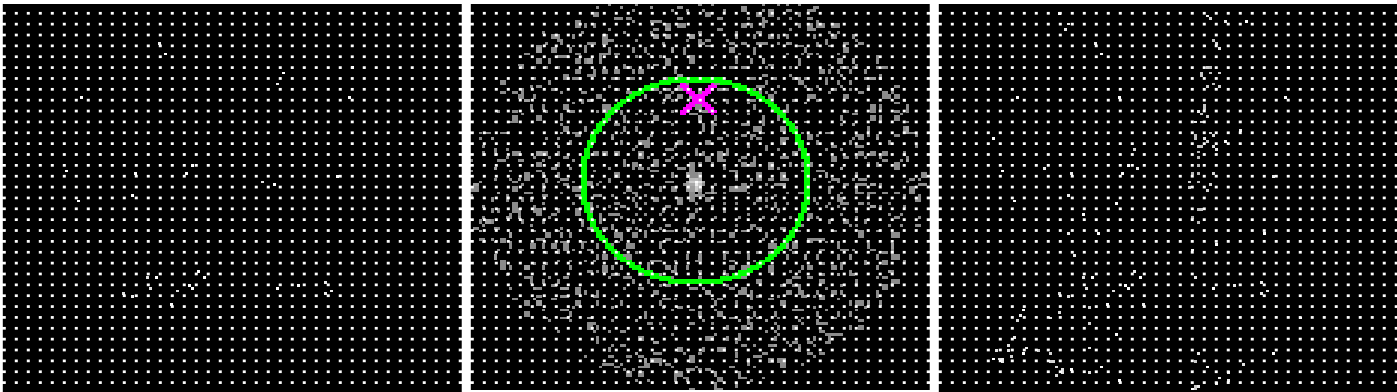


### 2.5.3 Slot 2



# 3 Gratings

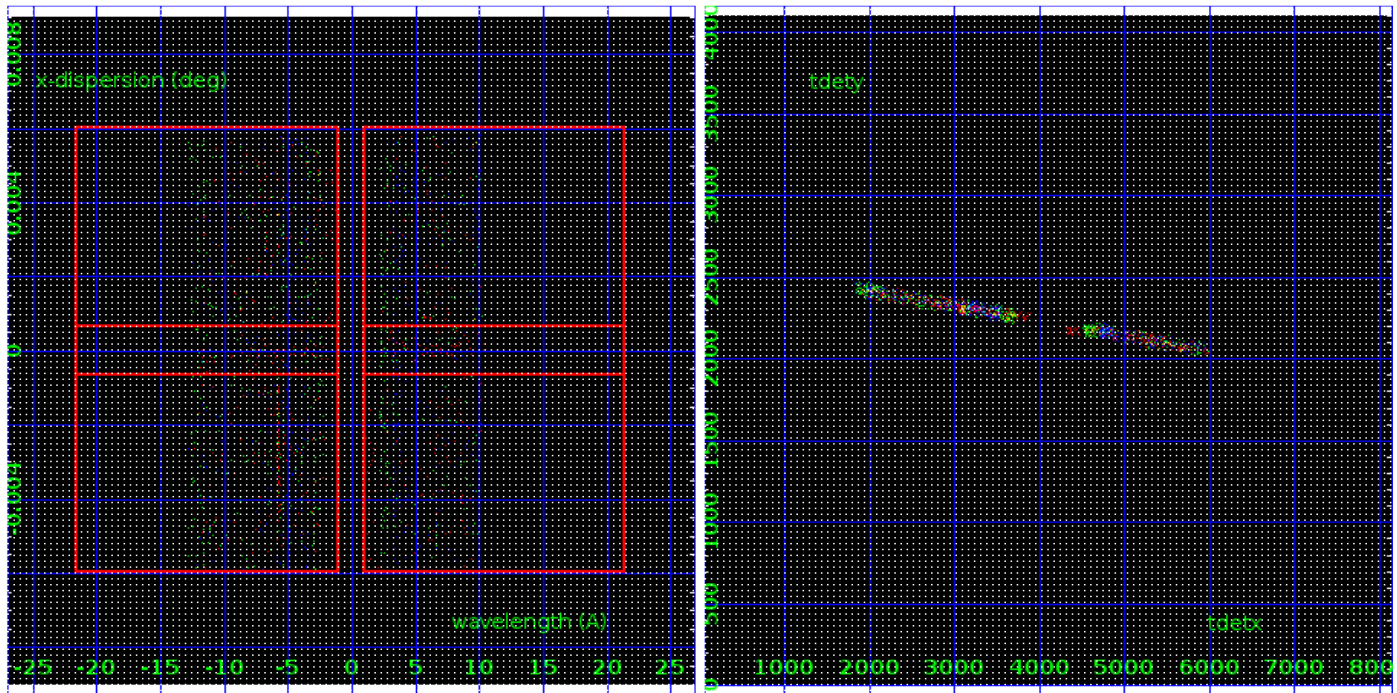
## 3.1 HEG Arm



HEG Order Sort 123

HEG Zero Order

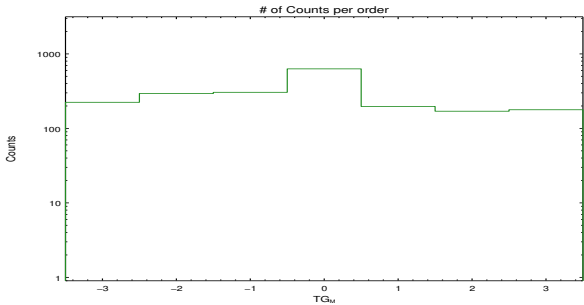
HEG Order Sort ALL

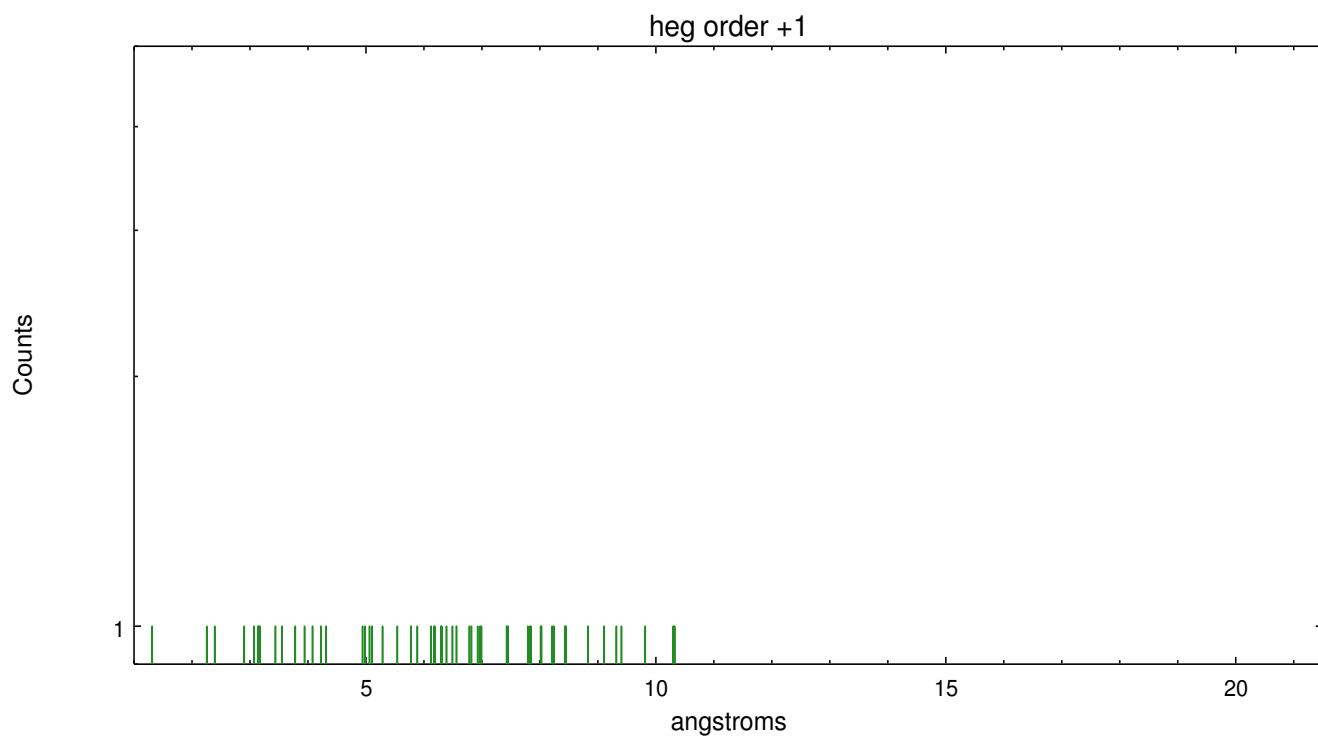
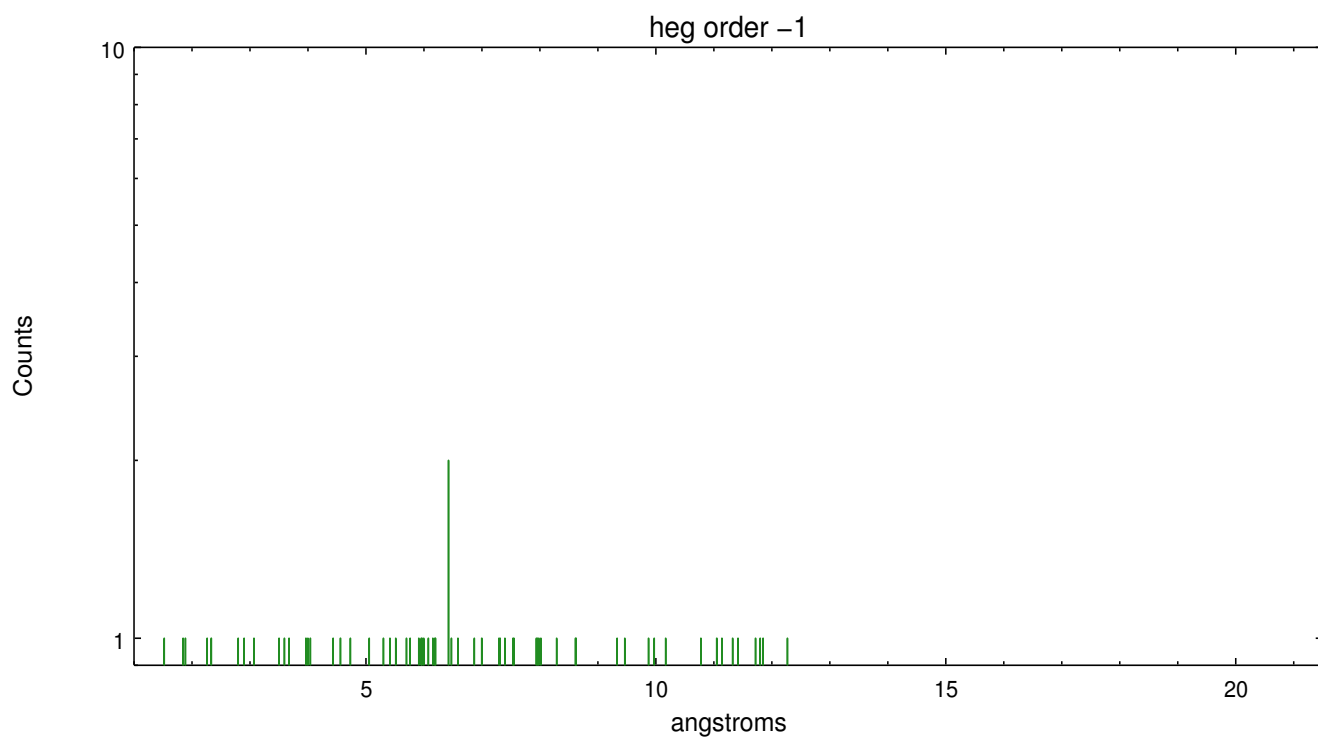


Spot Image HEG

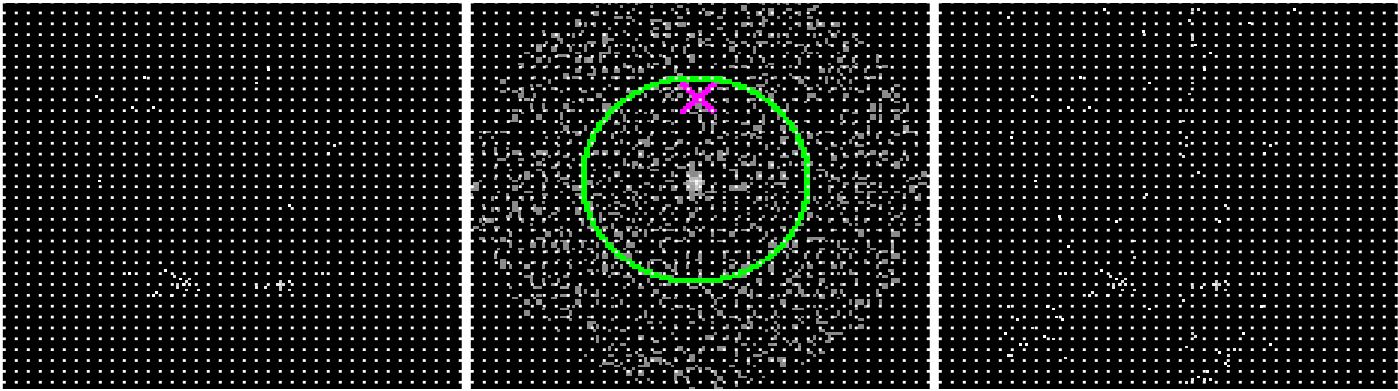
Full Detector HEG

|        | order<br>-3 | order<br>-2 | order<br>-1 | order<br>0 | order<br>1 | order<br>2 | order<br>3 |
|--------|-------------|-------------|-------------|------------|------------|------------|------------|
| Events | 224         | 294         | 305         | 630        | 197        | 170        | 178        |





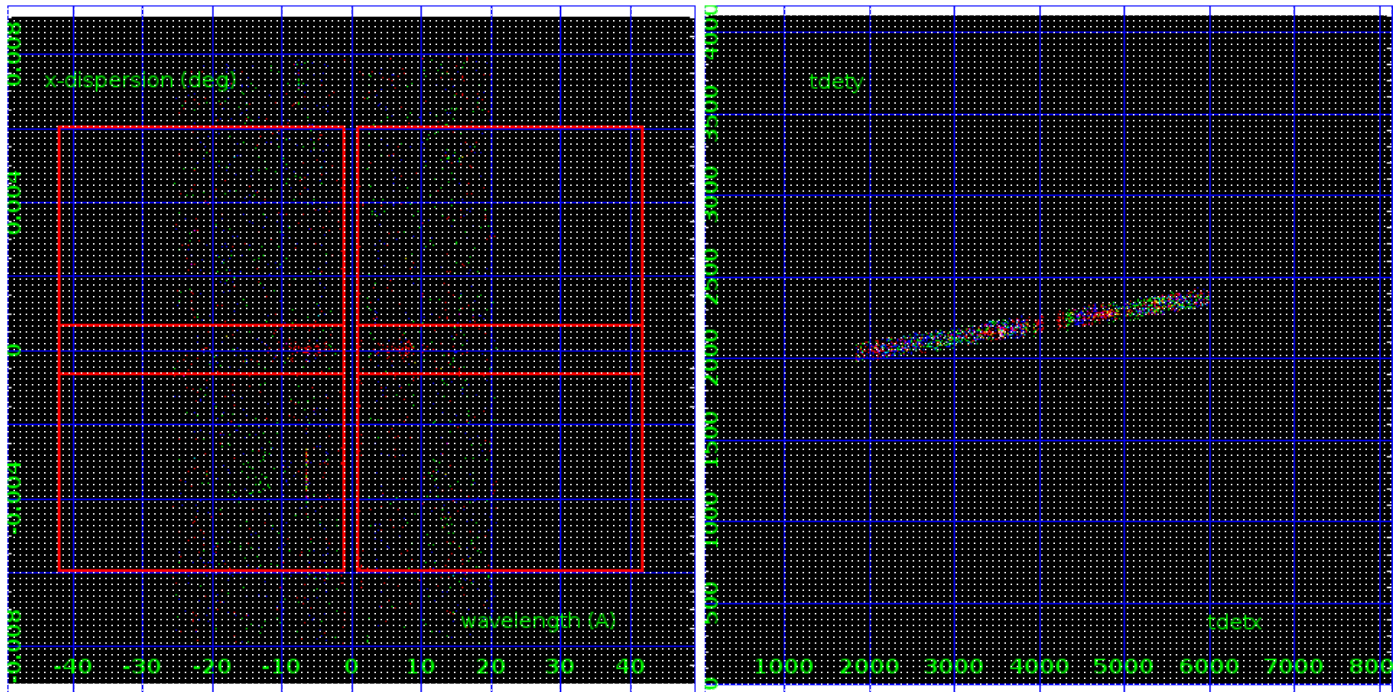
3.2 MEG Arm



MEG Order Sort 123

MEG Zero Order

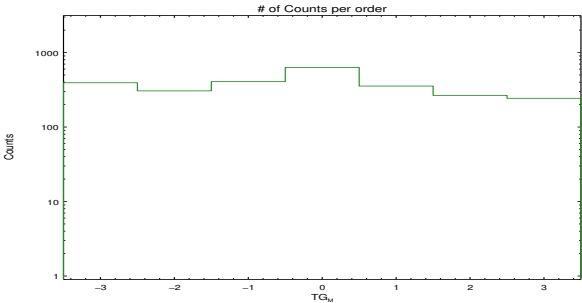
MEG Order Sort ALL



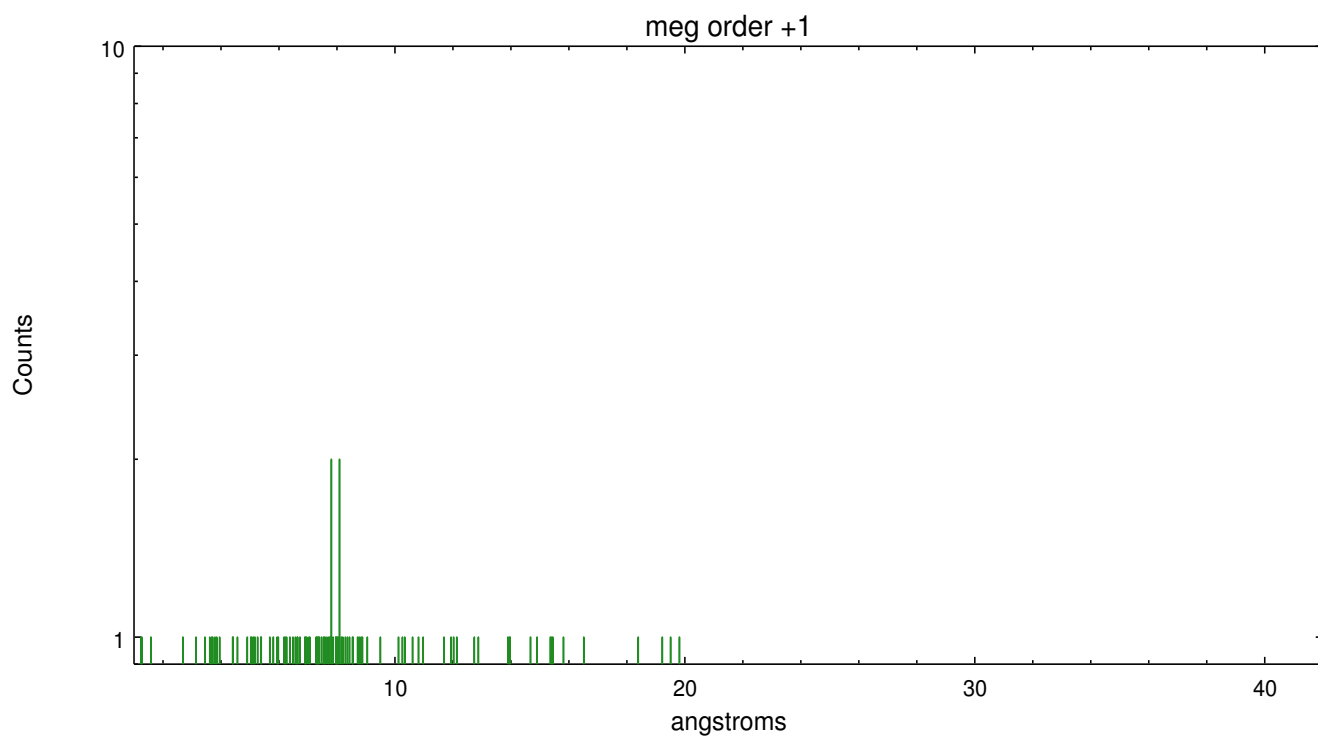
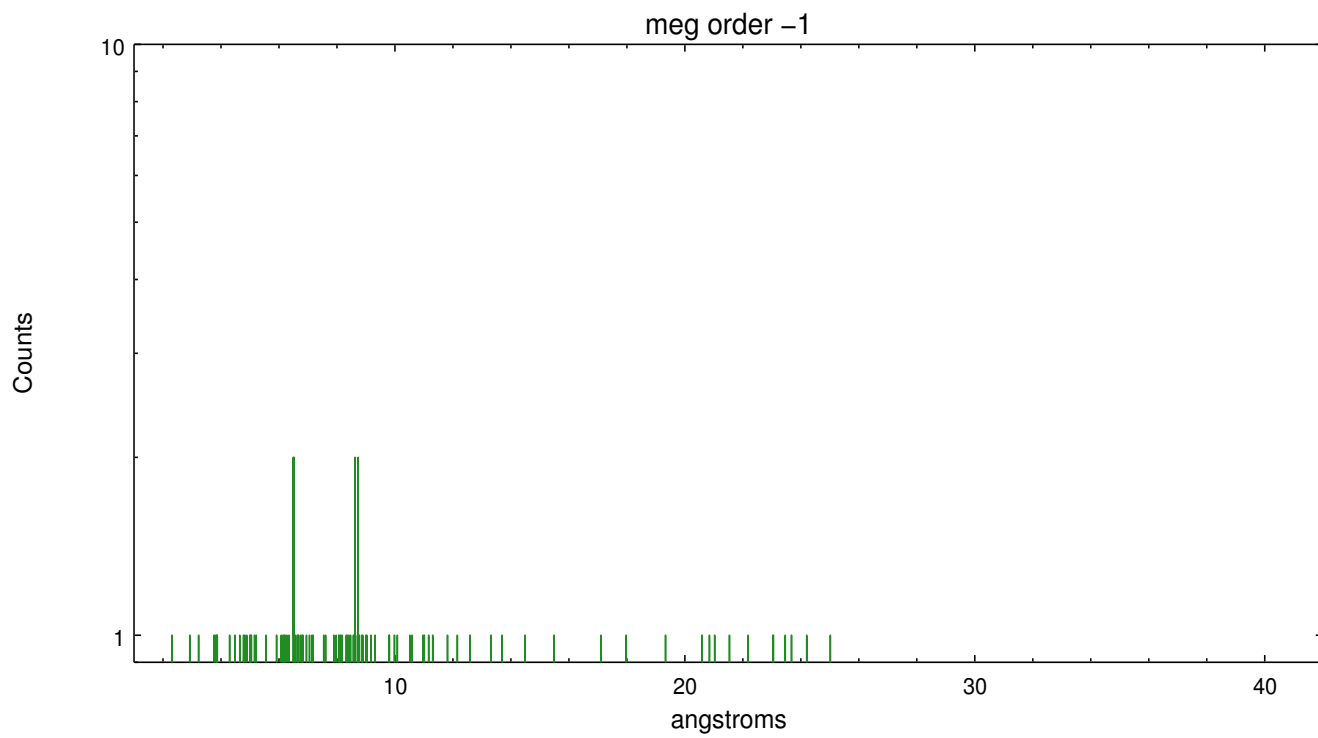
Spot Image MEG

Full Detector MEG

|        | order<br>-3 | order<br>-2 | order<br>-1 | order<br>0 | order<br>1 | order<br>2 | order<br>3 |
|--------|-------------|-------------|-------------|------------|------------|------------|------------|
| Events | 393         | 306         | 407         | 630        | 355        | 266        | 243        |







# A Summary

## A.1 Status

|                            |                |
|----------------------------|----------------|
| V&V Scientist              | Joy Nichols    |
| V&V Date (YYYY-MM-DD)      | 2019.05.23     |
| V&V Edition                | 1              |
| V&V Disposition and Status | OK             |
| V&V Charge Time            | 40.01480030787 |

## A.2 Comments

To compensate for a few bad pixels not marked as bad that were not removed in the Level 2 processing, a custom bad pixel file with additional bad pixels at (chipx, chipy) = (232:234,322:339) in S1 was added in this processing. As a result, the user will NOT find a relatively bright square of pixels on the S1 chip for level 2 data caused by the application of the dither algorithm to the bad pixels in question, as opposed to previous processing(s).

===

Target optically monitored in slot 7. The ACA has the capability to devote one or more of the eight image slots to "monitor" particular sky locations. This allows simultaneous optical photometry of one or more targets in the ACA field of view. These optical sources can be slightly fainter than the ACA guide star limit of  $m_{ACA} = 10.2$  mag. The bright-end limit for monitor star photometry is  $m_{ACA}=6.2$  mag. However, since there are a fixed number of image slots, devoting a slot to photometry instead of tracking a guide star results in a degradation of the image reconstruction and celestial location accuracy (Section 5.4). Using one monitor slot represents a 15 - 25% increase in the aspect image reconstruction RMS diameter, depending on the particular guide star configuration. Two monitor slots would increase the diameter by about 50 - 60%, but this configuration is not operationally allowed under normal circumstances. The photometric accuracy which can be achieved depends primarily on the star magnitude, integration time, CCD dark current, CCD read noise, sky background, and the CCD dark current uncertainty.

=====

The focal plane temperature is warmer than -112.0 C during the interval 674579556.25 - 674587327.95 (MET s) of this observation. This temperature is the upper limit of the verified ACIS calibration for the back-illuminated chips. The focal plane temperature during part of this observation was warmer than the upper limit for optimum calibration of the ACIS gain and spectral resolution (i.e., -114.0 C for ACIS-I and -112.0 C for ACIS-S). The Chandra calibration team calibrates the ACIS gain and spectral resolution using data from the external calibration source (ECS). ECS data show that the frontside-illuminated (FI) CCDs are more temperature sensitive than the backside-illuminated (BI) CCDs. A summary of the current calibration status of the ACIS gain and spectral resolution can be found at:

[http://asc.harvard.edu/cal/Acis/Cal\\_prods/Gain\\_and\\_Spectral\\_Resolution/A](http://asc.harvard.edu/cal/Acis/Cal_prods/Gain_and_Spectral_Resolution/A)

The main points are: 1) The gain on BI chips remains within 0.3% (i.e., the systematic uncertainty in the ACIS gain quoted on the Chandra Calibration Status Summary web page) at all measured temperatures. 2) The gain on FI chips remains within 0.3% below row 600 at all measured temperatures. 3) The gain on FI chips above row 600 can be underestimated by as much as 1% for focal plane temperatures exceeding -116 C. 4) The spectral resolution (i.e., FWHM) on BI chips is insensitive to the focal plane temperature. 5) Warmer focal plane temperatures increase the FWHM on FI chips by up to 30 eV near row 512 and by up to 70 eV near the top of the chips. In summary, the user should be cautious in the spectral analysis of high S/N emission lines detected on the top half of FI chips in this observation. Default processing with the current version of the CALDB will underestimate photon energies by up to 1% and broaden emission lines by up to 70 eV.