

# V&V Reference Report

## L2 ASCDS Version : 10.7.1

Observation 22173 - L2 Version 2  
Chandra X-Ray Center

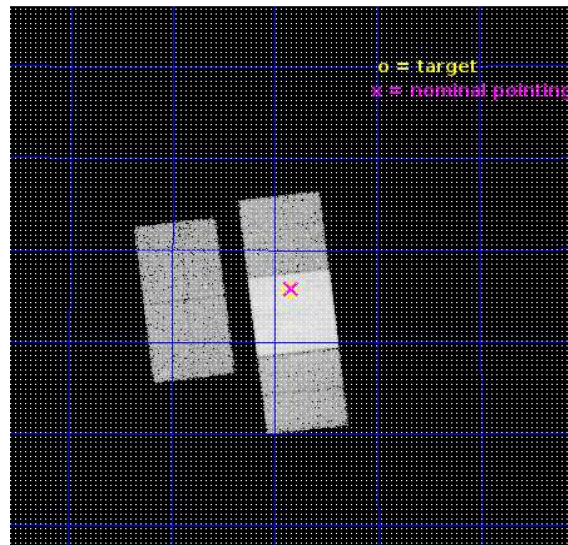
L2 Processing Date : Apr 18 2019

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# 1 Front

|          |                                                            |                                             |
|----------|------------------------------------------------------------|---------------------------------------------|
| seq_num  | 502997                                                     | Sequence number                             |
| obs_id   | 22173                                                      | Observation id                              |
| title    | PSR J2030+4415: A Breakthrough Target for Bowshock Studies | Proposa                                     |
| observer | Roger Romani                                               | Principal investigator                      |
| object   | PSR J2030+4415                                             | Source name                                 |
| dtcycle  | 0                                                          | &#160                                       |
| cycle    | P                                                          | events from which exps?<br>Prim/Second/Both |
| ra_targ  | 307.714167                                                 | Observer's specified<br>target RA [deg]     |
| dec_targ | 44.260861                                                  | Observer's specified<br>target Dec [deg]    |
| ra_nom   | 307.70943196931                                            | Nominal RA [deg]                            |
| dec_nom  | 44.263416784333                                            | Nominal Dec [deg]                           |
| roll_nom | 83.15995603237                                             | Nominal Roll [deg]                          |
| revision | 2                                                          | Processing version of<br>data               |
| ontime   | 22515.24283278                                             | Sum of GTIs [s]                             |
| livetime | 22221.064609689                                            | Livetime [s]                                |
| ontime2  | 22511.937702537                                            | Sum of GTIs [s]                             |
| ontime3  | 22515.160752773                                            | Sum of GTIs [s]                             |
| ontime6  | 22515.201792836                                            | Sum of GTIs [s]                             |
| ontime7  | 22515.24283278                                             | Sum of GTIs [s]                             |
| ontime8  | 22508.837732196                                            | Sum of GTIs [s]                             |
| l2events | 160254                                                     | Number of level 2 events                    |

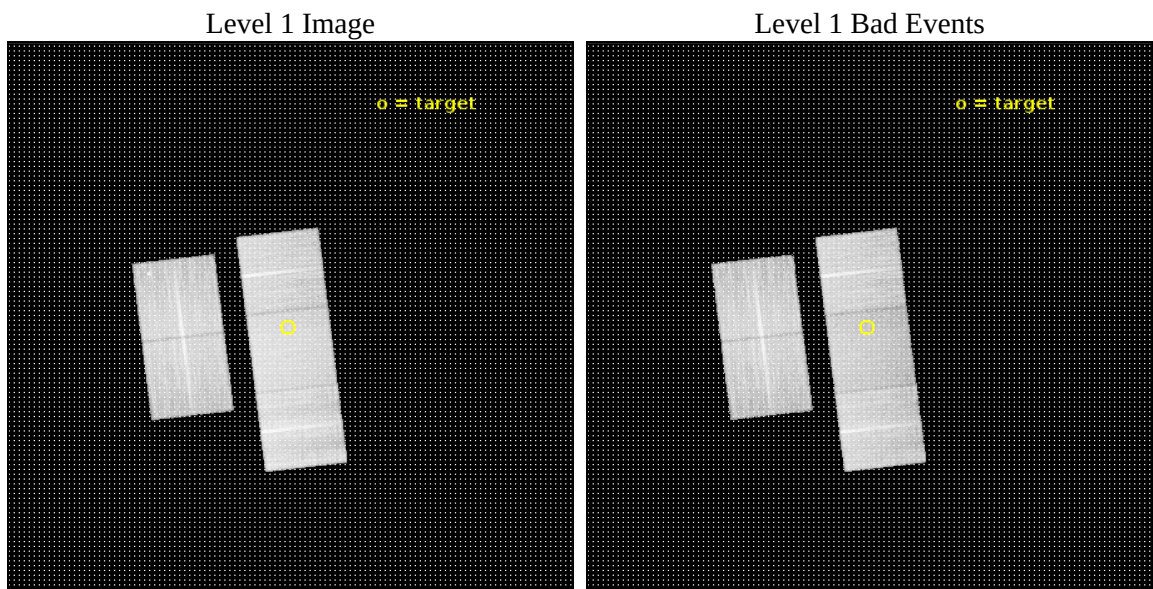




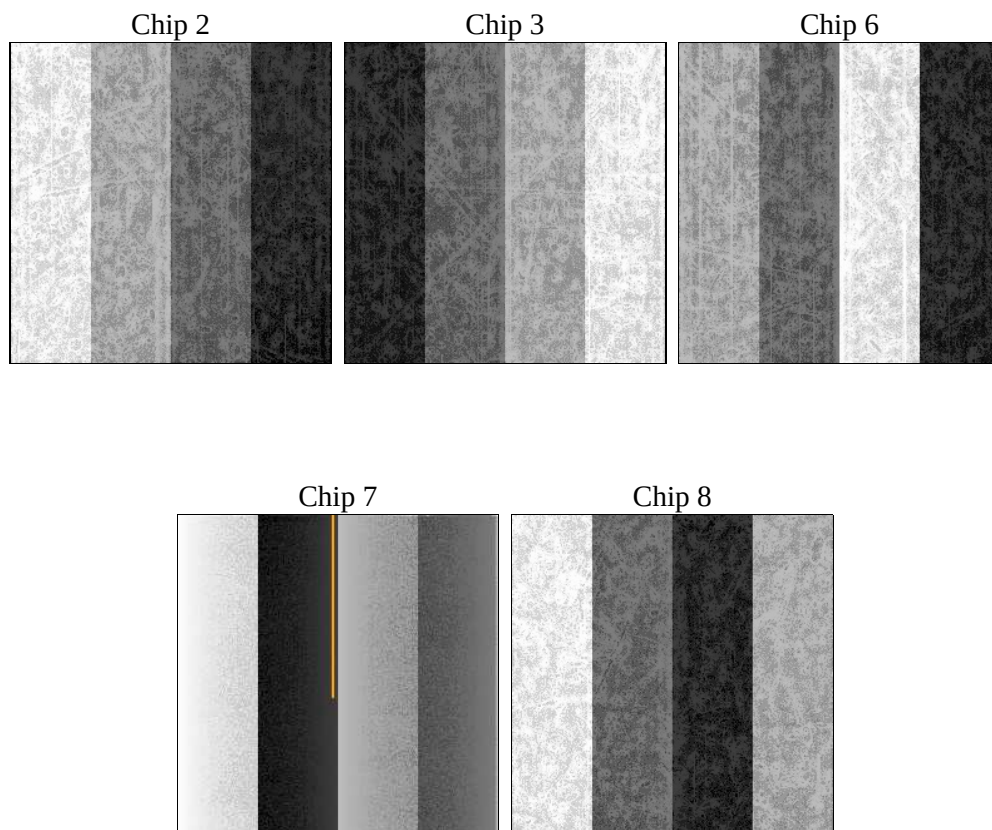
## 2 OBI

### 2.1 OBI

#### 2.1.1 Images



#### 2.1.2 Bias



### 2.1.3 Parameters

|          |                     |                                |                |                 |                                         |
|----------|---------------------|--------------------------------|----------------|-----------------|-----------------------------------------|
| obi_num  | 0                   | Obi number                     | sched_exp_time | 22465.920000    | [s] Scheduled observation exposure time |
| ascdsver | 10.7.1              | Processing system revision     | ontime         | 22515.24283278  | Sum of GTIs [s]                         |
| caldsver | 4.8.2               | &#160                          | ontime2        | 22511.937702537 | Sum of GTIs [s]                         |
| date     | 2019-04-18T19:42:50 | Date and time of file creation | ontime3        | 22515.160752773 | Sum of GTIs [s]                         |
| revision | 2                   | Processing version of data     | ontime6        | 22515.201792836 | Sum of GTIs [s]                         |
|          |                     |                                | ontime7        | 22515.24283278  | Sum of GTIs [s]                         |
|          |                     |                                | ontime8        | 22508.837732196 | Sum of GTIs [s]                         |
|          |                     |                                | l1events       | 996739          | Number of level 1 events                |

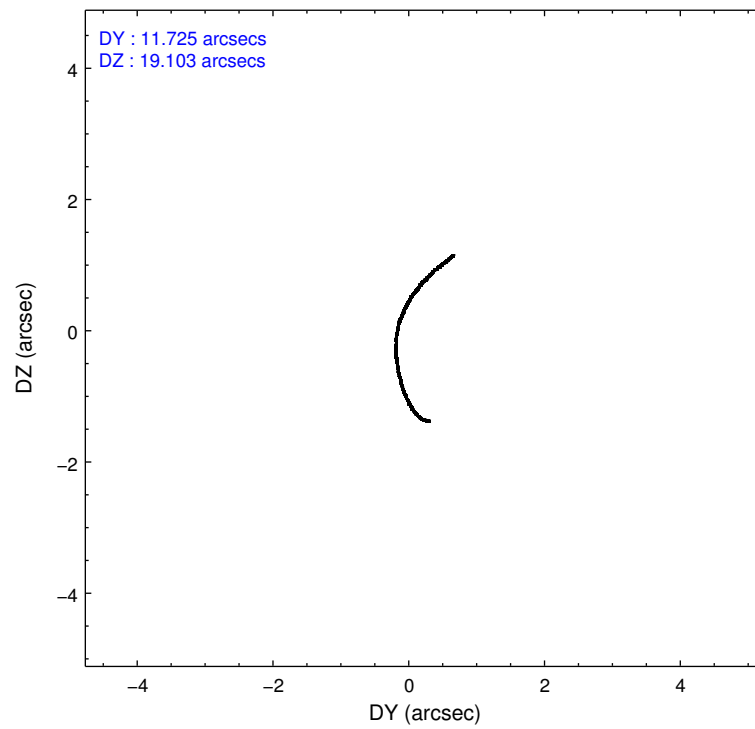
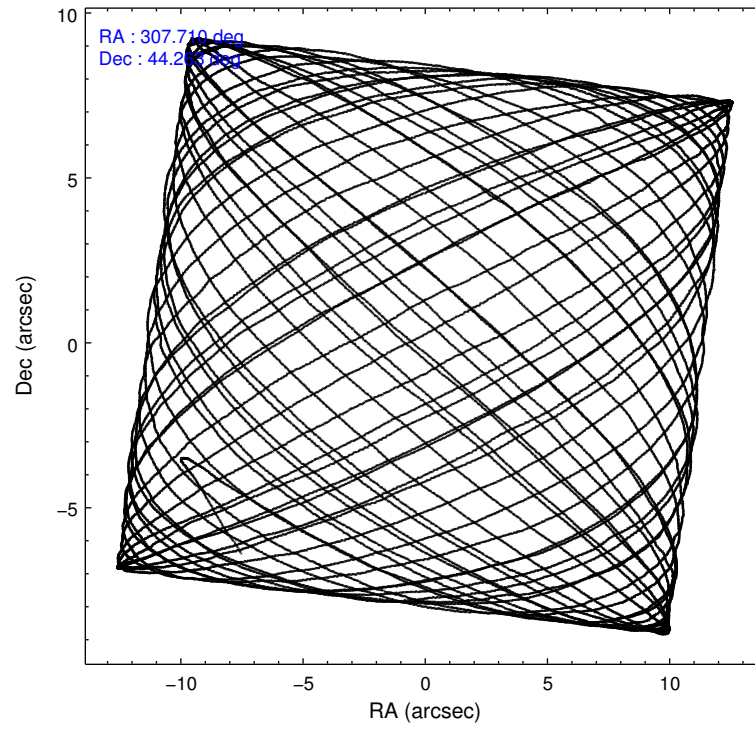
### 2.1.4 Events

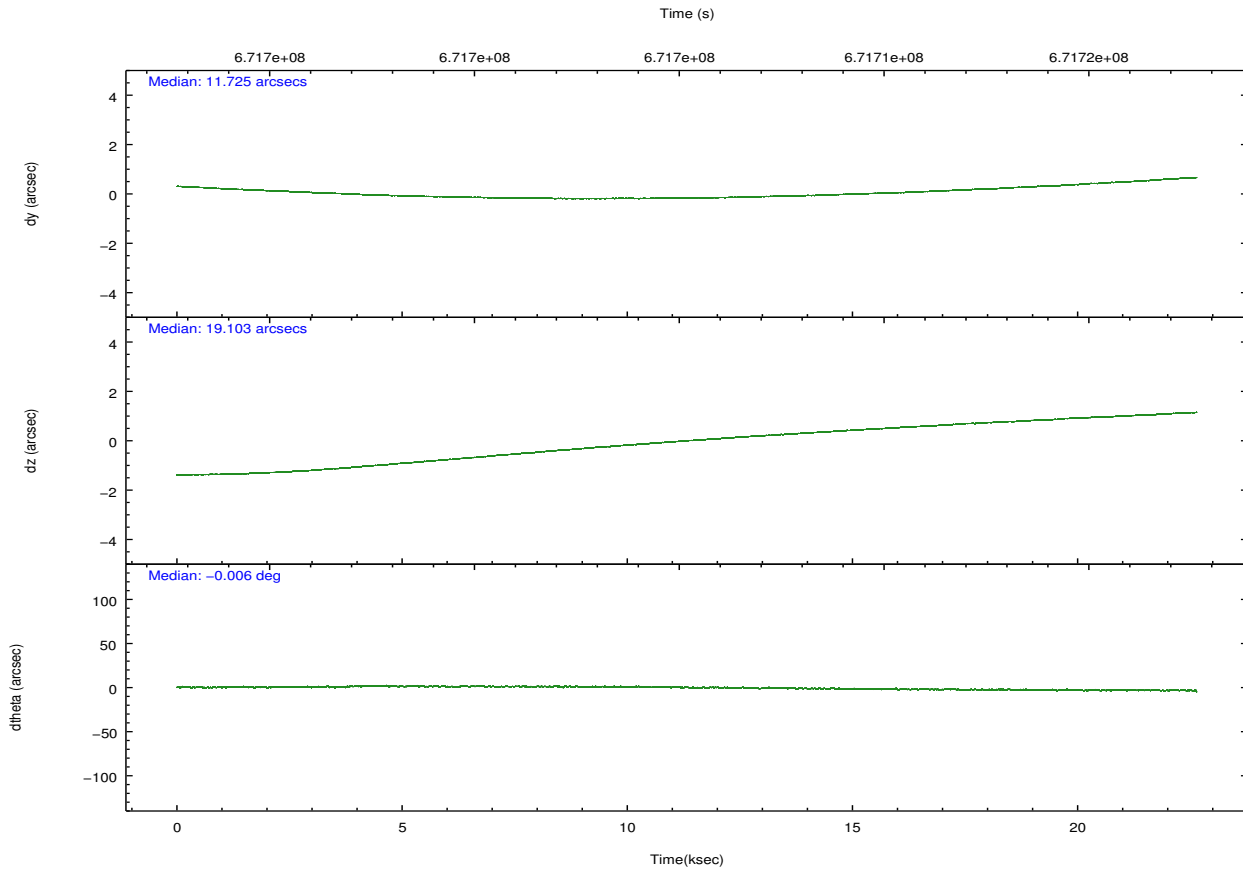
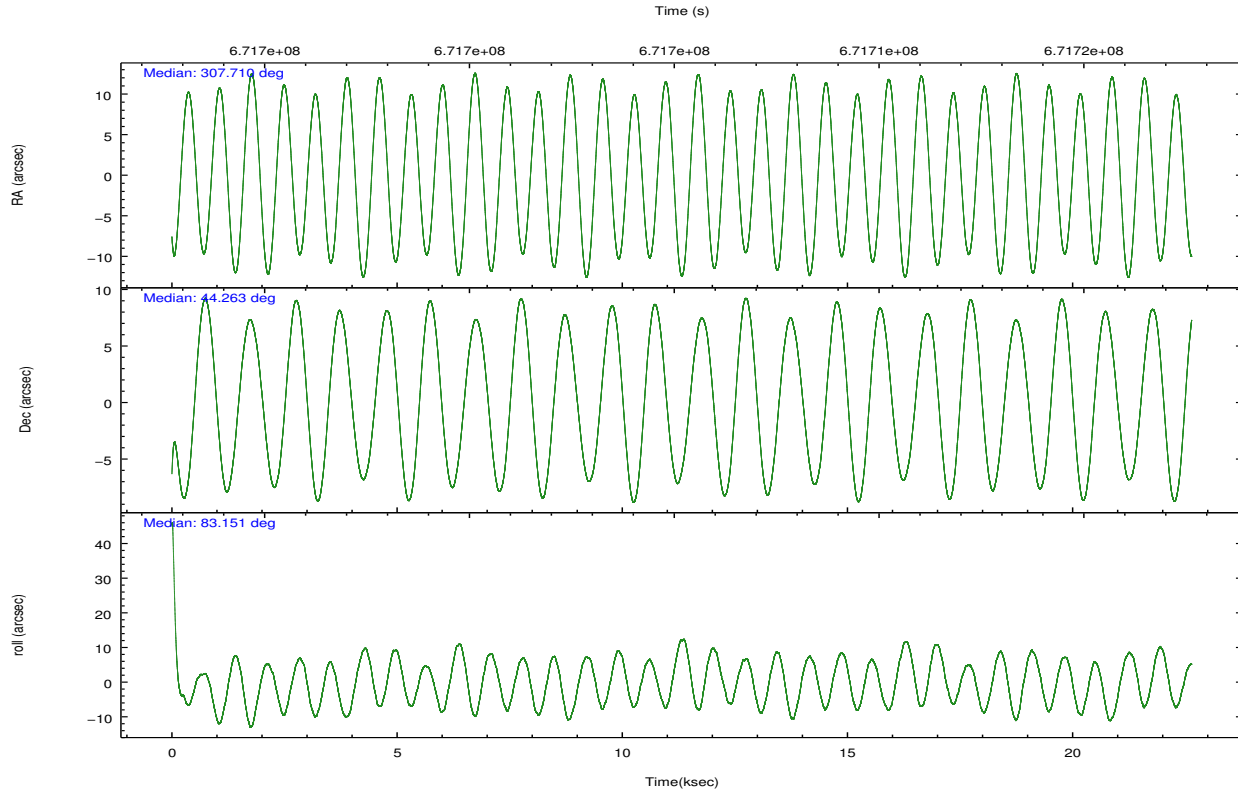
|                 | ccd 2  | ccd 3  | ccd 6  | ccd 7  | ccd 8  |                | ccd 2  | ccd 3  | ccd 6  | ccd 7  | ccd 8  |
|-----------------|--------|--------|--------|--------|--------|----------------|--------|--------|--------|--------|--------|
| level 1 events  | 181728 | 172695 | 191789 | 222335 | 228192 | grade 0 events | 6888   | 6105   | 5726   | 8000   | 15748  |
| rejected events | 163331 | 155320 | 171887 | 127066 | 170158 |                | 3%     | 3%     | 2%     | 3%     | 6%     |
| rejected %      | 89%    | 89%    | 89%    | 57%    | 74%    | grade 1 events | 85     | 83     | 81     | 360    | 184    |
|                 |        |        |        |        |        |                | 0%     | 0%     | 0%     | 0%     | 0%     |
|                 |        |        |        |        |        | grade 2 events | 4369   | 3862   | 5452   | 20099  | 14522  |
|                 |        |        |        |        |        |                | 2%     | 2%     | 2%     | 9%     | 6%     |
|                 |        |        |        |        |        | grade 3 events | 1681   | 1790   | 1664   | 7388   | 5556   |
|                 |        |        |        |        |        |                | 0%     | 1%     | 0%     | 3%     | 2%     |
|                 |        |        |        |        |        | grade 4 events | 1774   | 1703   | 1597   | 7116   | 5397   |
|                 |        |        |        |        |        |                | 0%     | 0%     | 0%     | 3%     | 2%     |
|                 |        |        |        |        |        | grade 5 events | 6082   | 7442   | 7358   | 21280  | 11639  |
|                 |        |        |        |        |        |                | 3%     | 4%     | 3%     | 9%     | 5%     |
|                 |        |        |        |        |        | grade 6 events | 3690   | 3920   | 5468   | 52692  | 16815  |
|                 |        |        |        |        |        |                | 2%     | 2%     | 2%     | 23%    | 7%     |
|                 |        |        |        |        |        | grade 7 events | 157159 | 147790 | 164443 | 105400 | 158331 |
|                 |        |        |        |        |        |                | 86%    | 85%    | 85%    | 47%    | 69%    |

## 2.2 Compared Parameters

| Parameter                         | Planned             | Actual               | Parameter                             | Planned   | Actual  |
|-----------------------------------|---------------------|----------------------|---------------------------------------|-----------|---------|
| Instrument                        | ACIS                | ACIS                 | Obspar format version number          | 7         | 7       |
| Detector                          | ACIS-23678          | ACIS-23678           | Obspar file type                      | PREDICTED | ACTUAL  |
| Grating                           | NONE                | NONE                 | Obspar update status                  | NONE      | UPDATED |
| Data mode                         | VFAINT              | VFAINT               | CCD I0 on                             | N         | N       |
| Observation mode                  | POINTING            | POINTING             | CCD I1 on                             | N         | N       |
| [deg] Pointing RA                 | 307.724964          | 307.7094319693137    | CCD I2 on                             | O1        | Y       |
| [deg] Pointing Dec                | 44.238358           | 44.26341678433293    | CCD I3 on                             | O2        | Y       |
| [deg] Pointing Roll               | 82.992468           | 83.15995603237043    | CCD S0 on                             | N         | N       |
| [mm] SIM focus pos                | -0.684267           | -0.6828225247311905  | CCD S1 on                             | N         | N       |
| [mm] SIM defocus                  | 0                   | 0.001444936568705701 | CCD S2 on                             | O4        | Y       |
| [mm] SIM translation stage pos    | -190.132523         | -190.1400660498719   | CCD S3 on                             | Y         | Y       |
| [mm] SIM translation stage offset | 0                   | 0.00754346686406393  | CCD S4 on                             | O3        | Y       |
| [s] Observation start time (MET)  | 671694064.184000    | 671692874.57538      | CCD S5 on                             | N         | N       |
| Observation start date            | 2019-04-15T05:39:55 | 2019-04-15T05:21:14  | Number of optional ACIS chips dropped | 0         | 0       |
| [s] Observation end time (MET)    | 671716530.184000    | 671717518.65186      | On-chip summing requested             | N         | N       |
| Observation end date              | 2019-04-15T11:54:21 | 2019-04-15T12:11:58  | Subarray requested                    | NONE      | NONE    |
| Read mode                         | TIMED               | TIMED                | Alternating exposures requested       | N         | N       |
|                                   |                     |                      | [s] Primary exposure time             | 0.000000  | 3.1     |

## 2.3 Aspect



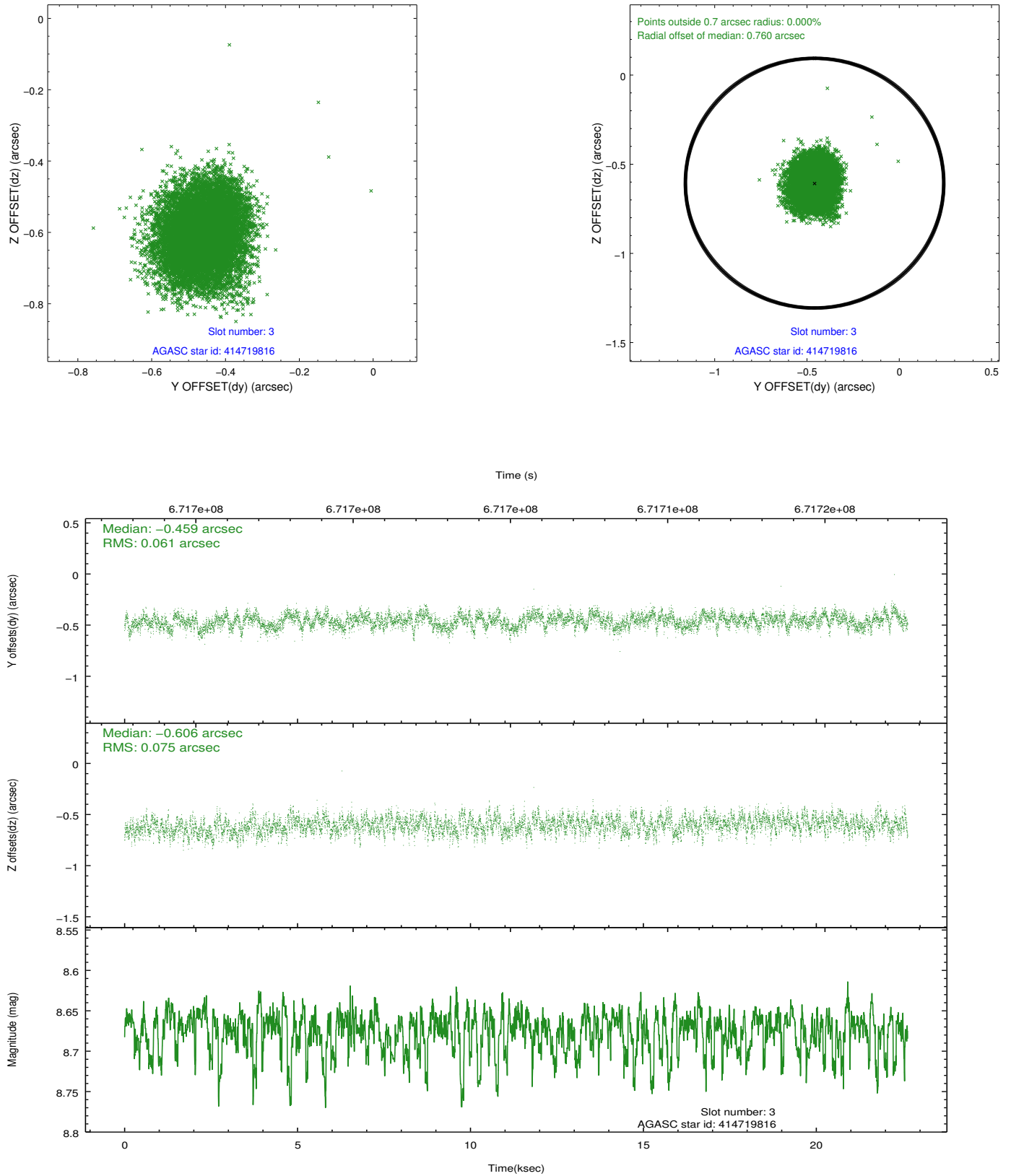


# Slot Statistics

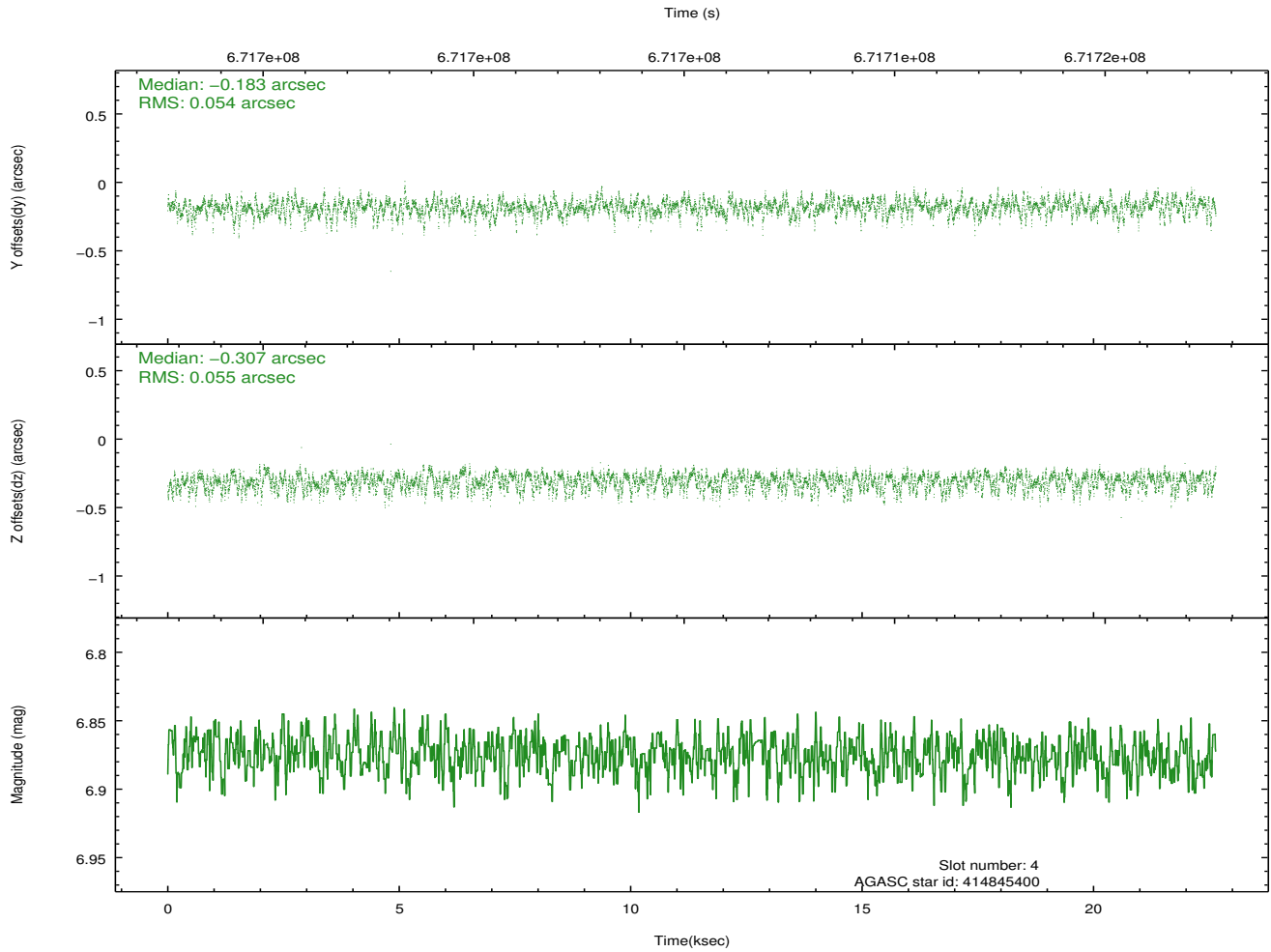
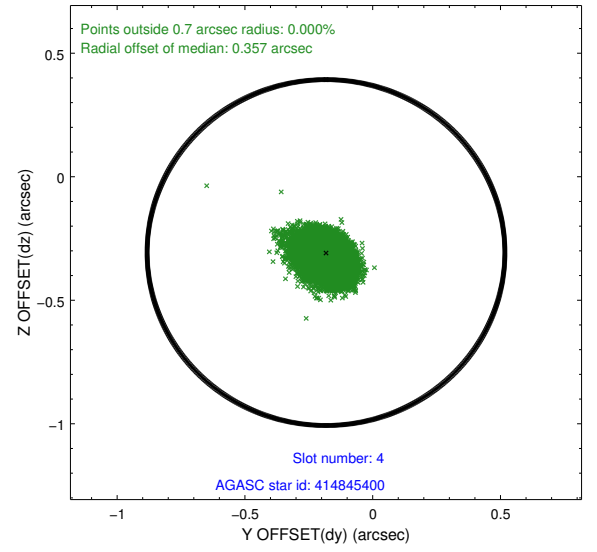
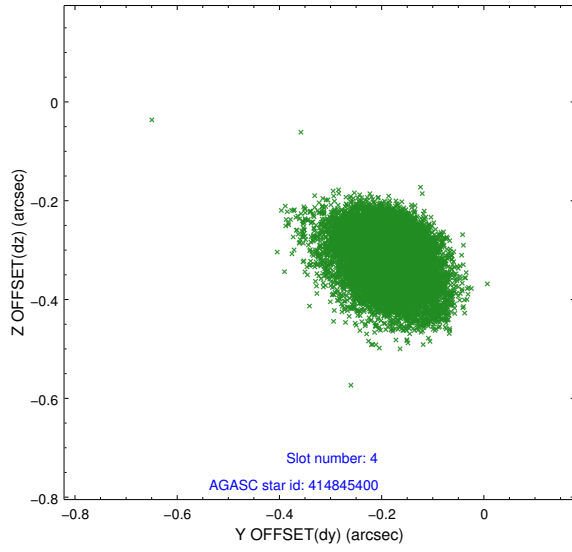
| pt | status | used | id        | mag  | n_pts | frac_pts | med_dy | med_dz | dr1   | dr2   | ra         | dec       | mean_y   | mea   |
|----|--------|------|-----------|------|-------|----------|--------|--------|-------|-------|------------|-----------|----------|-------|
| 0  | FID    |      | ACIS-S-2  | 7.14 | 5523  | 1.000    | -0.277 | -0.181 | 0.037 | 0.046 | 0.000000   | 0.000000  | -764.88  | -1740 |
| 1  | FID    |      | ACIS-S-4  | 7.28 | 5523  | 1.000    | 0.720  | 0.182  | 0.009 | 0.019 | 0.000000   | 0.000000  | 2149.26  | 168   |
| 2  | FID    |      | ACIS-S-5  | 7.26 | 5523  | 1.000    | -0.473 | 0.007  | 0.034 | 0.051 | 0.000000   | 0.000000  | -1817.80 | 161   |
| 3  | GUIDE  | used | 414719816 | 8.67 | 11038 | 1.000    | -0.459 | -0.606 | 0.104 | 0.164 | 306.965041 | 44.477406 | 624.89   | 2043  |
| 4  | GUIDE  | used | 414845400 | 6.87 | 11047 | 1.000    | -0.183 | -0.307 | 0.081 | 0.137 | 307.645708 | 44.315241 | 249.97   | 236   |
| 5  | GUIDE  | used | 414850000 | 8.39 | 11038 | 1.000    | 0.336  | 0.257  | 0.150 | 0.216 | 307.967222 | 44.111985 | -373.51  | -676  |
| 6  | GUIDE  | used | 414844656 | 8.33 | 11042 | 1.000    | 0.409  | 0.845  | 0.107 | 0.164 | 308.466261 | 43.520199 | -2320.57 | -2234 |
| 7  | GUIDE  | used | 414721960 | 8.51 | 11038 | 1.000    | -0.097 | -0.182 | 0.101 | 0.172 | 306.992291 | 43.980466 | -1145.00 | 1771  |

## 2.4 Star Slots

### 2.4.1 Slot 3

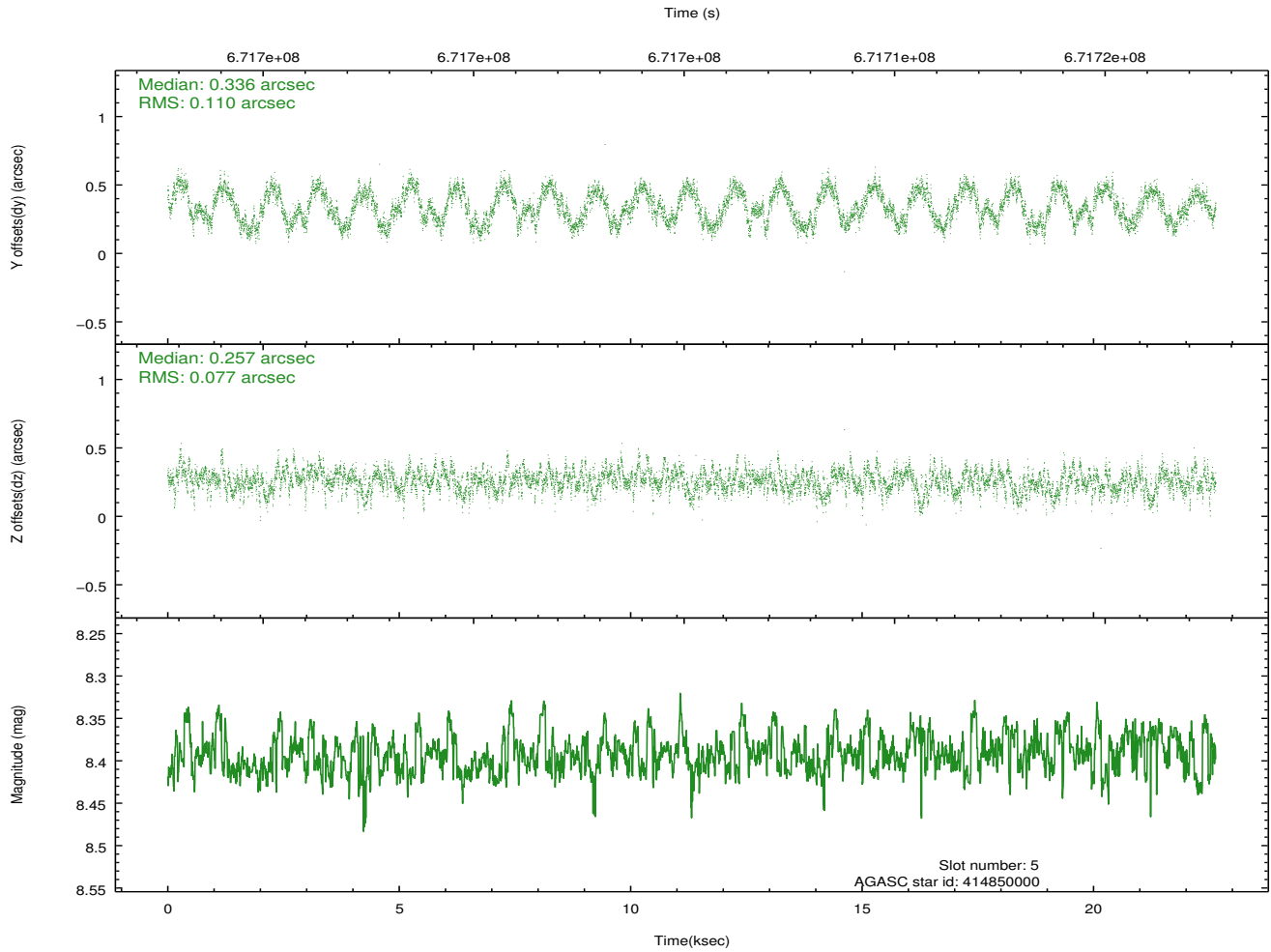
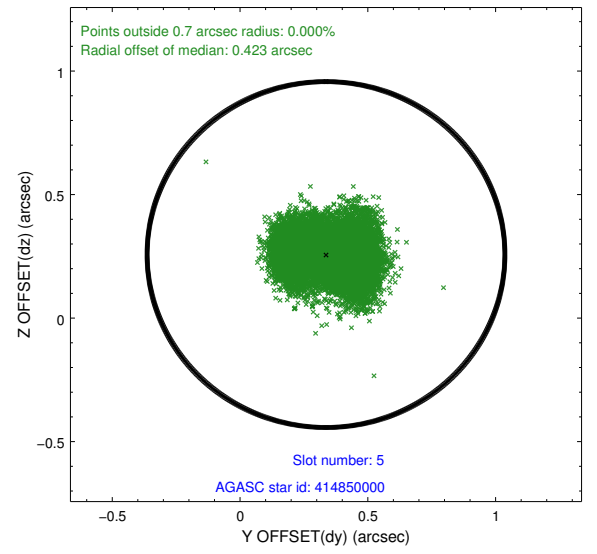
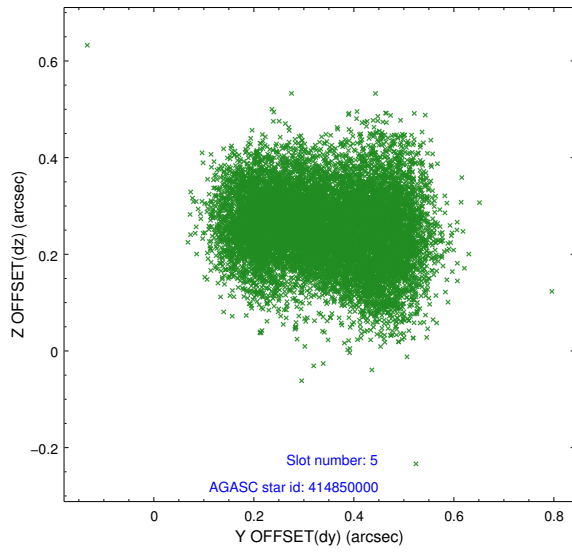


## 2.4.2 Slot 4

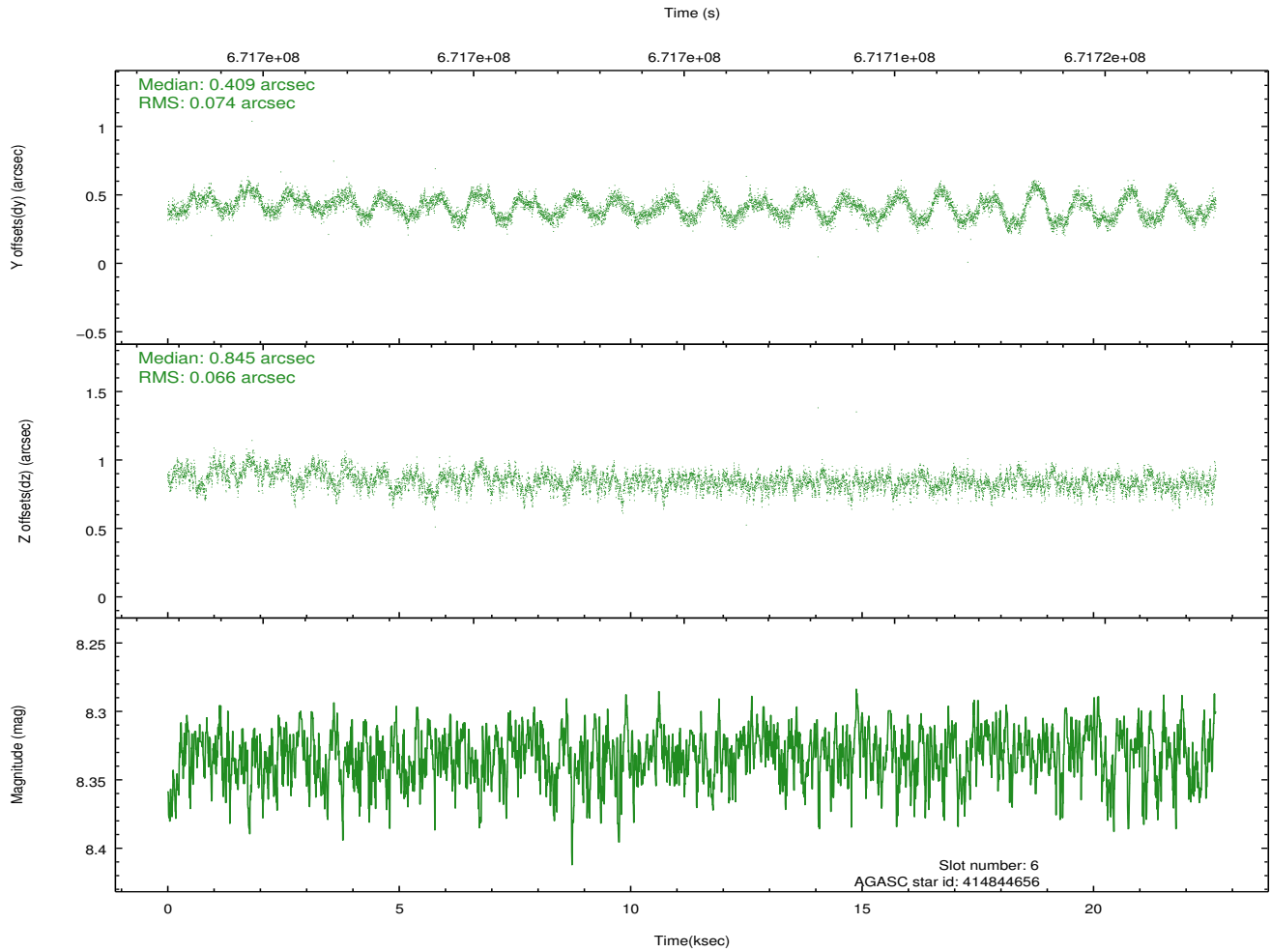
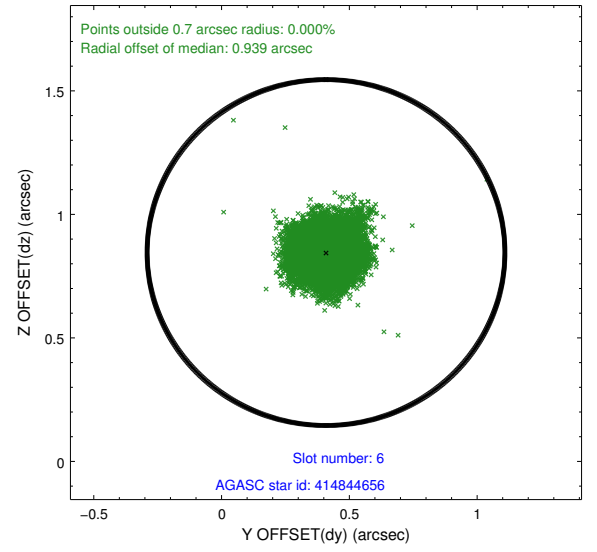
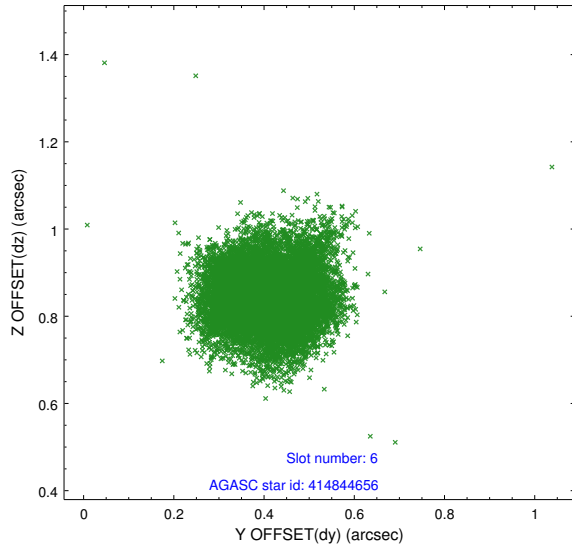




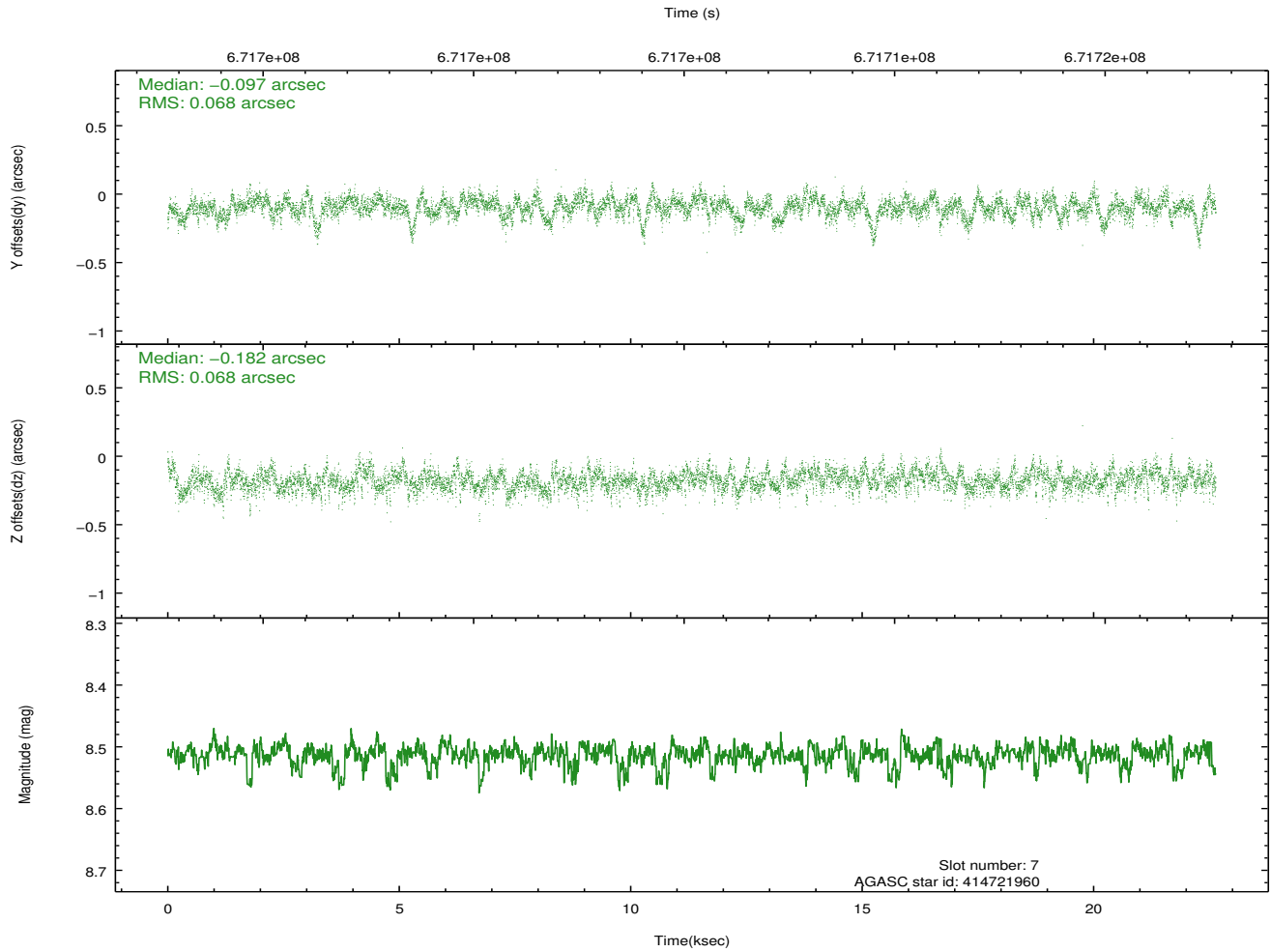
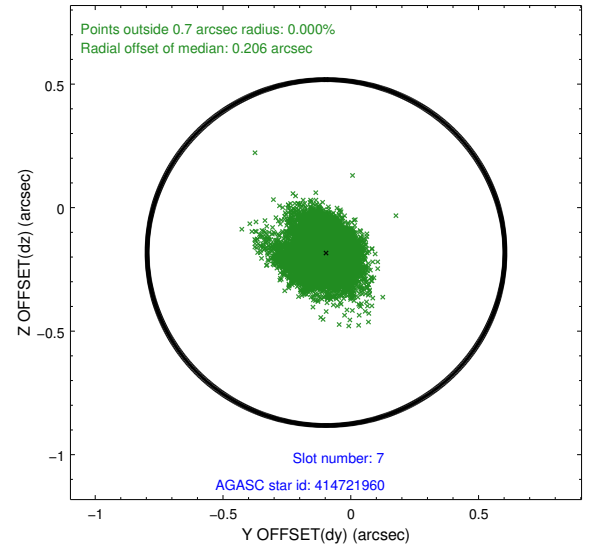
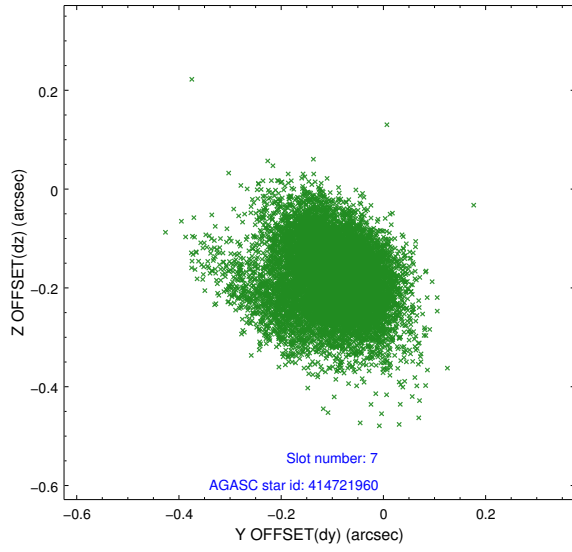
### 2.4.3 Slot 5



## 2.4.4 Slot 6

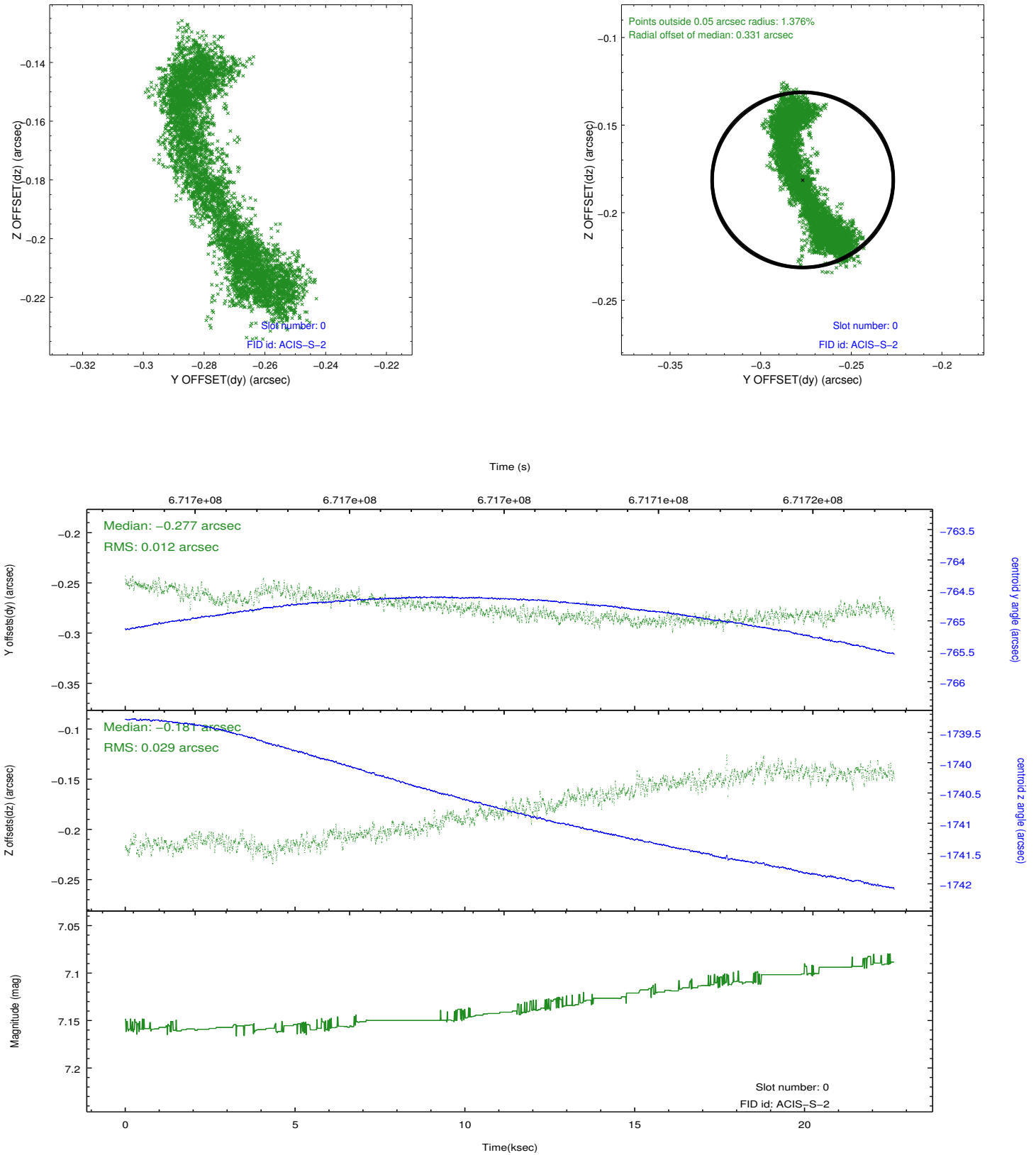


## 2.4.5 Slot 7

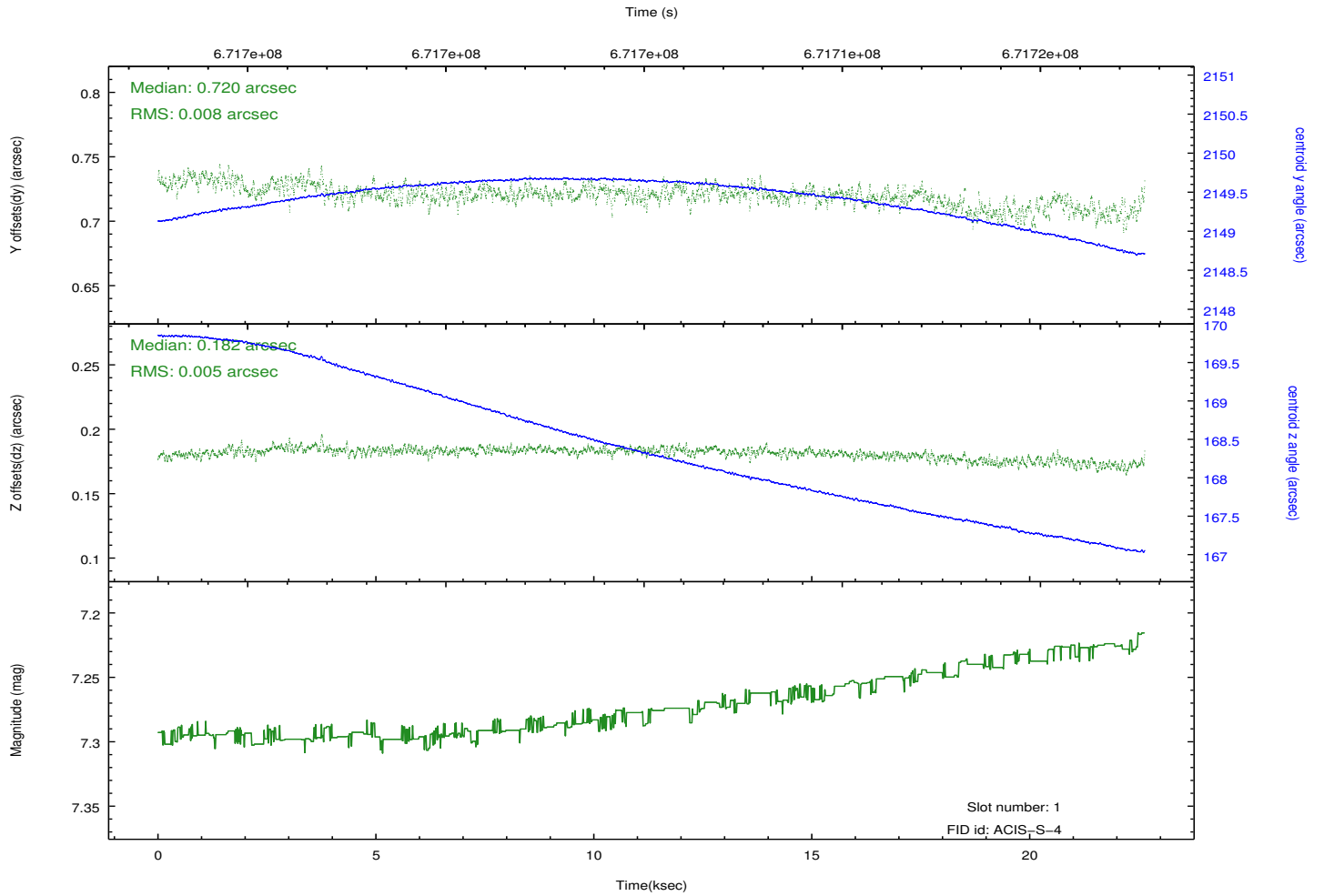
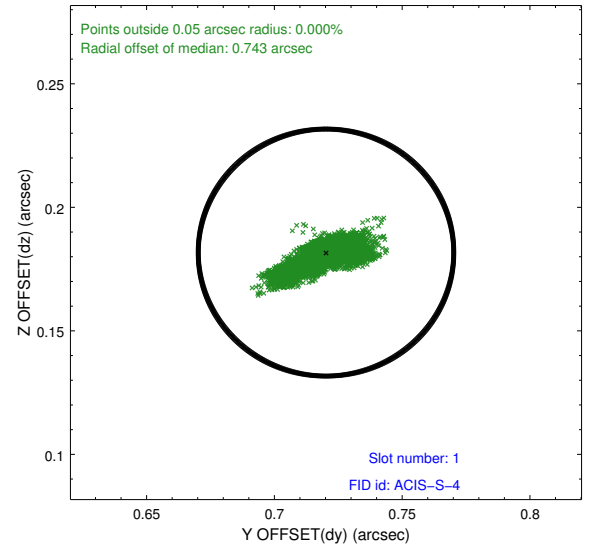
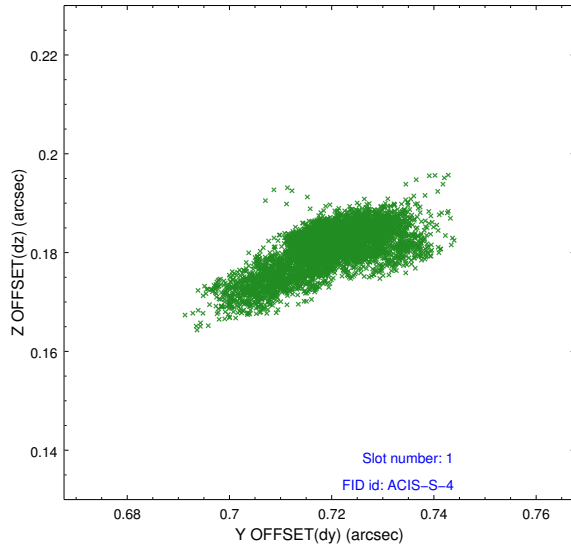


## 2.5 FID Slots

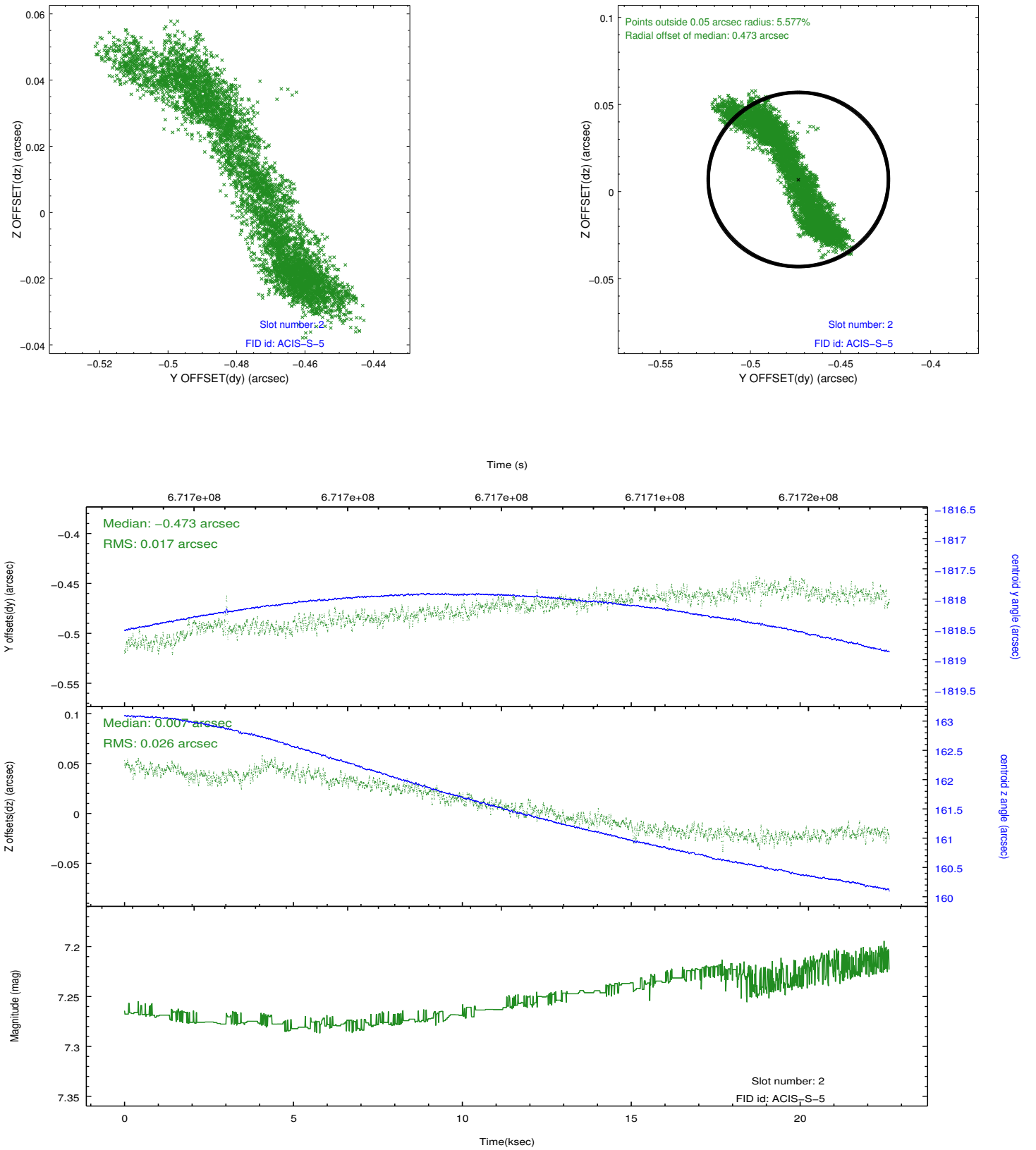
### 2.5.1 Slot 0



## 2.5.2 Slot 1



### 2.5.3 Slot 2



# A Summary

## A.1 Status

|                            |                |
|----------------------------|----------------|
| V&V Scientist              | Beth Sundheim  |
| V&V Date (YYYY-MM-DD)      | 2019.04.18     |
| V&V Edition                | 1              |
| V&V Disposition and Status | OK             |
| V&V Charge Time            | 22.51524283278 |

## A.2 Comments

A spatial region of the original bias map for CCD = 3 suffered from anomalously high data values. Pixels in the event data that were bias-corrected by one of the original affected bias pixels may have an apparent energy shift. While the change in energy is expected to be small ( $\sim 20$  eV), it depends on many parameters that have not yet been fully explored for this bias anomaly. The bias map for CCD = 3 has been reconstructed for this processing to remove this anomaly using scaled data from a comparable bias map from another observation. The pixels affected by the anomaly are bounded by sky coords:  
(307.85524,44.11127), (307.86221,44.11065), (307.86632,44.13487),  
(307.85771,44.12589).

==

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/ACIS\\_response\\_summary.html](http://asc.harvard.edu/cal/Acis/Cal_prods/Gain_and_Spectral_Resolution/ACIS_response_summary.html)

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.