

# V&V Reference Report

## L2 ASCDS Version : 10.7.1

Observation 22245 - L2 Version 1  
Chandra X-Ray Center

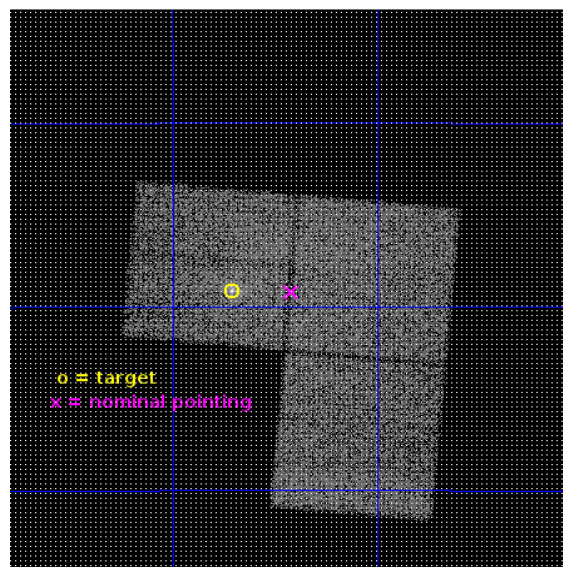
L2 Processing Date : Jun 10 2019

## Contents

|          |                               |           |
|----------|-------------------------------|-----------|
| <b>1</b> | <b>Front</b>                  | <b>2</b>  |
| <b>2</b> | <b>OBI</b>                    | <b>3</b>  |
| 2.1      | OBI . . . . .                 | 3         |
| 2.1.1    | Images . . . . .              | 3         |
| 2.1.2    | Bias . . . . .                | 3         |
| 2.1.3    | Parameters . . . . .          | 4         |
| 2.1.4    | Events . . . . .              | 4         |
| 2.2      | Compared Parameters . . . . . | 5         |
| 2.3      | Aspect . . . . .              | 6         |
| 2.4      | Star Slots . . . . .          | 9         |
| 2.4.1    | Slot 3 . . . . .              | 9         |
| 2.4.2    | Slot 4 . . . . .              | 10        |
| 2.4.3    | Slot 5 . . . . .              | 11        |
| 2.4.4    | Slot 6 . . . . .              | 12        |
| 2.4.5    | Slot 7 . . . . .              | 13        |
| 2.5      | FID Slots . . . . .           | 14        |
| 2.5.1    | Slot 0 . . . . .              | 14        |
| 2.5.2    | Slot 1 . . . . .              | 15        |
| 2.5.3    | Slot 2 . . . . .              | 16        |
| <b>A</b> | <b>Summary</b>                | <b>17</b> |
| A.1      | Status . . . . .              | 17        |
| A.2      | Comments . . . . .            | 17        |

# 1 Front

|          |                                                                |                                             |
|----------|----------------------------------------------------------------|---------------------------------------------|
| seq_num  | 502999                                                         | Sequence number                             |
| obs_id   | 22245                                                          | Observation id                              |
| title    | The Answer is Blowing in the Wind: Jet Sweepback in Three PWNe | Pro                                         |
| observer | Roger Romani                                                   | Principal investigator                      |
| object   | PSR J1709-4429                                                 | Source name                                 |
| dtcycle  | 0                                                              | &#160                                       |
| cycle    | P                                                              | events from which exps?<br>Prim/Second/Both |
| ra_targ  | 257.427724                                                     | Observer's specified target RA [deg]        |
| dec_targ | -44.485585                                                     | Observer's specified target Dec [deg]       |
| ra_nom   | 257.3550191928                                                 | Nominal RA [deg]                            |
| dec_nom  | -44.48651763739                                                | Nominal Dec [deg]                           |
| roll_nom | 5.1577454772742                                                | Nominal Roll [deg]                          |
| revision | 1                                                              | Processing version of data                  |
| ontime   | 28308.012181282                                                | Sum of GTIs [s]                             |
| livetime | 27938.147162078                                                | Livetime [s]                                |
| ontime1  | 28311.112201333                                                | Sum of GTIs [s]                             |
| ontime2  | 28308.012181282                                                | Sum of GTIs [s]                             |
| ontime3  | 28311.19428134                                                 | Sum of GTIs [s]                             |
| l2events | 76882                                                          | Number of level 2 events                    |

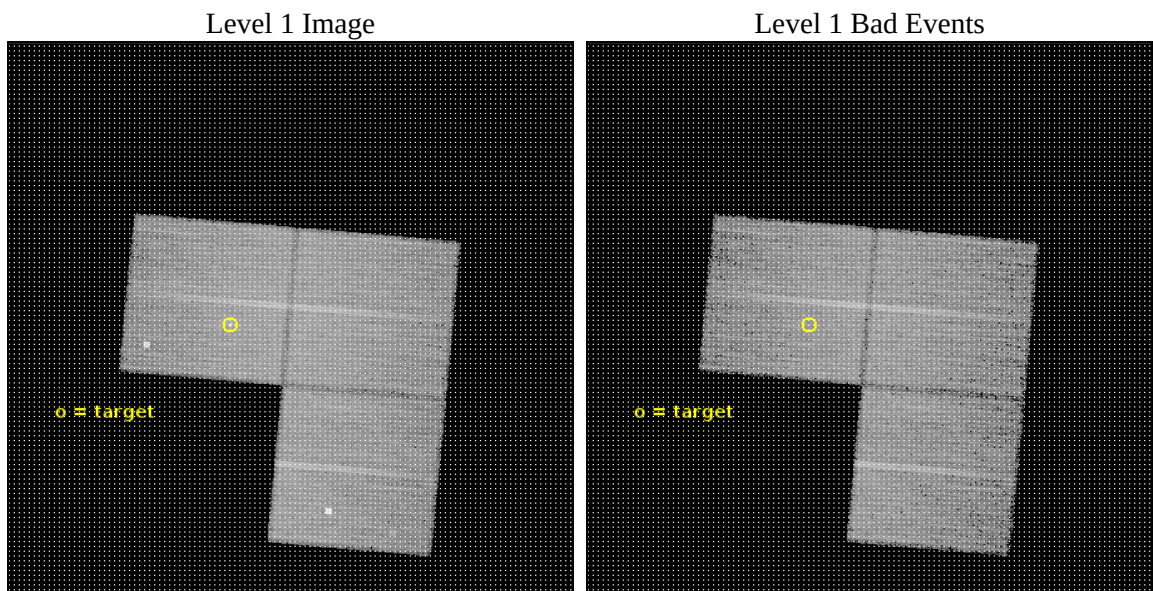




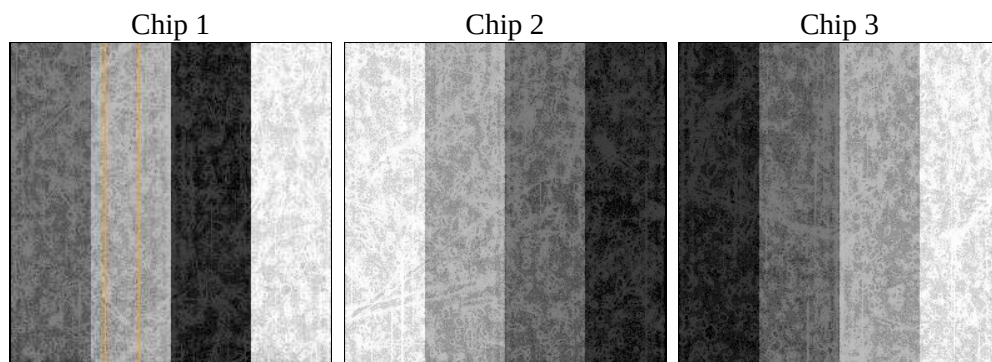
## 2 OBI

### 2.1 OBI

#### 2.1.1 Images



#### 2.1.2 Bias



### 2.1.3 Parameters

|          |                     |                                |                |                 |                                         |
|----------|---------------------|--------------------------------|----------------|-----------------|-----------------------------------------|
| obi_num  | 0                   | Obi number                     | sched_exp_time | 28184.242000    | [s] Scheduled observation exposure time |
| ascdsver | 10.7.1              | Processing system revision     | ontime         | 28308.012181282 | Sum of GTIs [s]                         |
| caldsver | 4.8.3               | &#160                          | ontime1        | 28311.112201333 | Sum of GTIs [s]                         |
| date     | 2019-06-10T10:36:06 | Date and time of file creation | ontime2        | 28308.012181282 | Sum of GTIs [s]                         |
| revision | 1                   | Processing version of data     | ontime3        | 28311.19428134  | Sum of GTIs [s]                         |
|          |                     |                                | l1events       | 659926          | Number of level 1 events                |

### 2.1.4 Events

|                 | ccd 1  | ccd 2  | ccd 3  |
|-----------------|--------|--------|--------|
| level 1 events  | 212344 | 228878 | 218704 |
| rejected events | 177811 | 194696 | 189832 |
| rejected %      | 83%    | 85%    | 86%    |

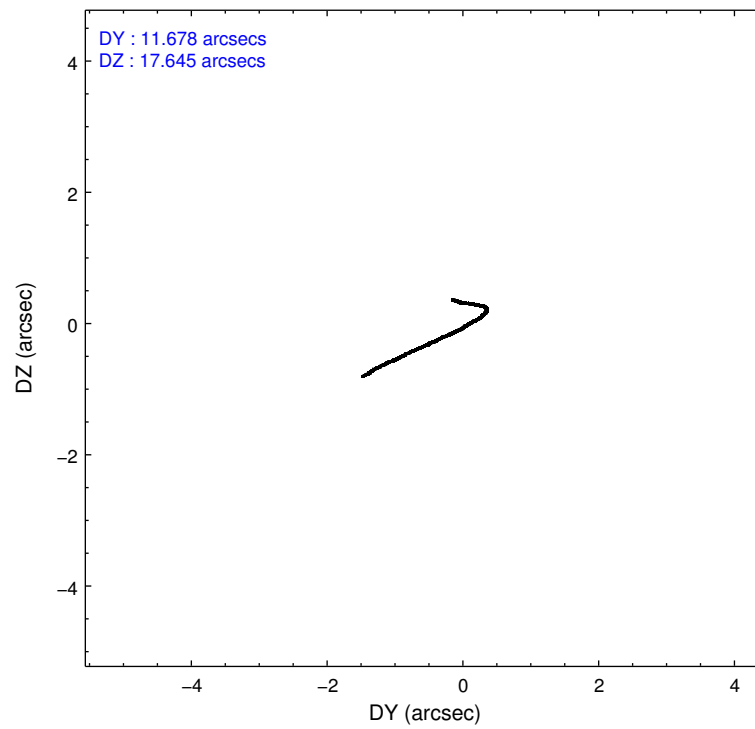
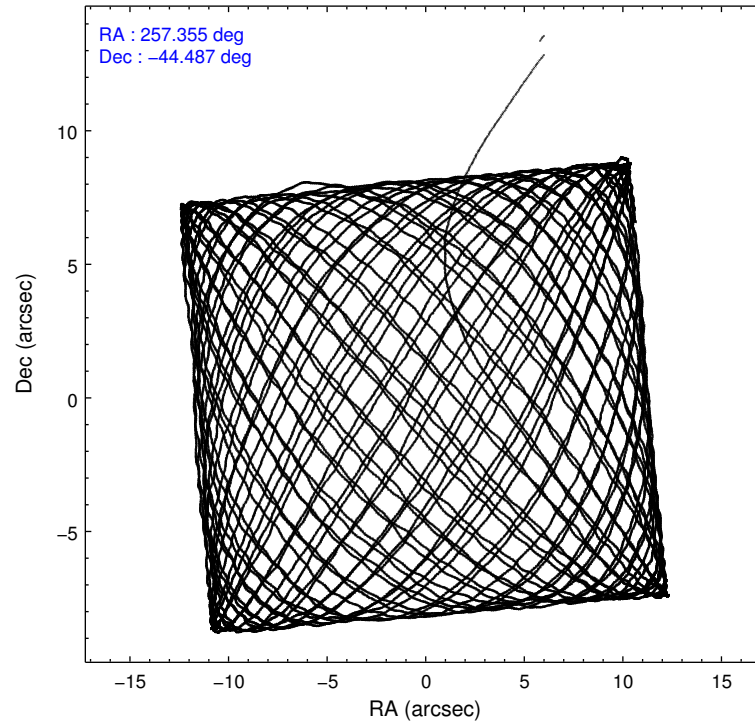
|                | ccd 1  | ccd 2  | ccd 3  |
|----------------|--------|--------|--------|
| grade 0 events | 15849  | 17513  | 12520  |
|                | 7%     | 7%     | 5%     |
| grade 1 events | 163    | 219    | 151    |
|                | 0%     | 0%     | 0%     |
| grade 2 events | 7545   | 6399   | 5743   |
|                | 3%     | 2%     | 2%     |
| grade 3 events | 2556   | 2597   | 2587   |
|                | 1%     | 1%     | 1%     |
| grade 4 events | 2384   | 2639   | 2665   |
|                | 1%     | 1%     | 1%     |
| grade 5 events | 9061   | 8730   | 9830   |
|                | 4%     | 3%     | 4%     |
| grade 6 events | 6208   | 5041   | 5367   |
|                | 2%     | 2%     | 2%     |
| grade 7 events | 168578 | 185740 | 179841 |
|                | 79%    | 81%    | 82%    |

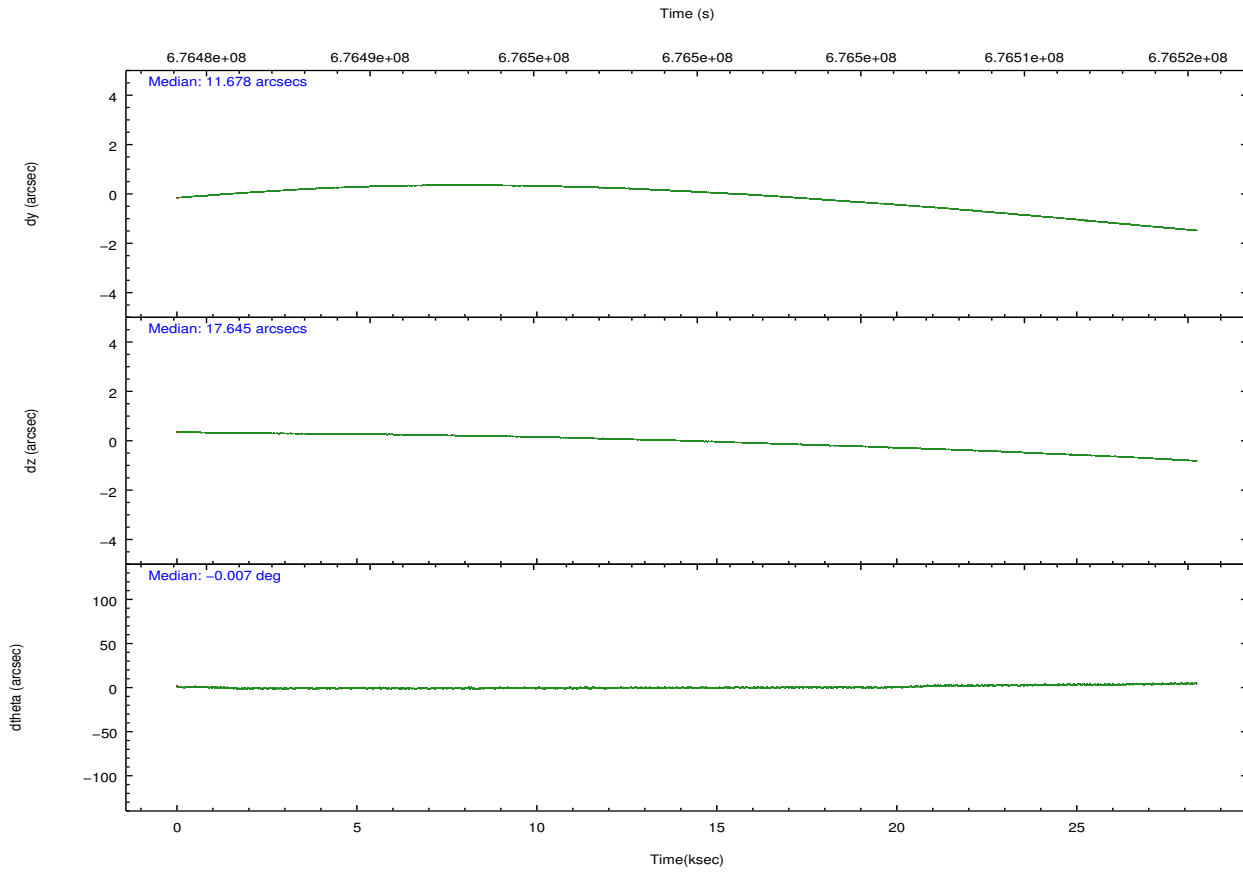
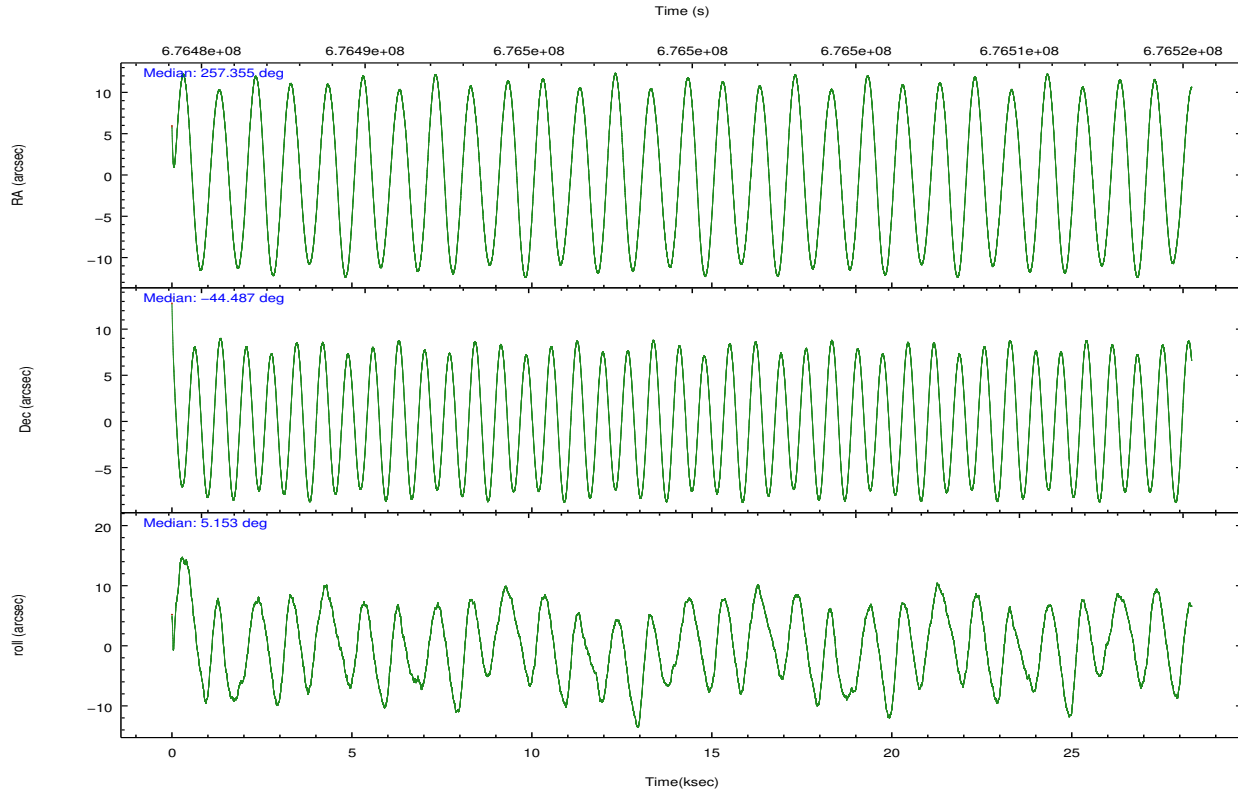
## 2.2 Compared Parameters

| Parameter                         | Planned             | Actual               |
|-----------------------------------|---------------------|----------------------|
| Instrument                        | ACIS                | ACIS                 |
| Detector                          | ACIS-123            | ACIS-123             |
| Grating                           | NONE                | NONE                 |
| Data mode                         | VFAINT              | VFAINT               |
| Observation mode                  | POINTING            | POINTING             |
| [deg] Pointing RA                 | 257.323440          | 257.3550191928049    |
| [deg] Pointing Dec                | -44.502500          | -44.48651763739034   |
| [deg] Pointing Roll               | 4.926919            | 5.157745477274218    |
| [mm] SIM focus pos                | -0.782348           | -0.7809083437167272  |
| [mm] SIM defocus                  | 0                   | 0.001439871863259334 |
| [mm] SIM translation stage pos    | -226.279963         | -226.2858628250985   |
| [mm] SIM translation stage offset | -7.3125             | -7.306590177831225   |
| [s] Observation start time (MET)  | 676485671.184000    | 676483917.56247      |
| Observation start date            | 2019-06-09T16:40:02 | 2019-06-09T16:11:57  |
| [s] Observation end time (MET)    | 676513855.184000    | 676514913.0518301    |
| Observation end date              | 2019-06-10T00:29:46 | 2019-06-10T00:48:33  |
| Read mode                         | TIMED               | TIMED                |

| Parameter                             | Planned   | Actual  |
|---------------------------------------|-----------|---------|
| Obspar format version number          | 7         | 7       |
| Obspar file type                      | PREDICTED | ACTUAL  |
| Obspar update status                  | NONE      | UPDATED |
| CCD I0 on                             | O1        | N       |
| CCD I1 on                             | Y         | Y       |
| CCD I2 on                             | Y         | Y       |
| CCD I3 on                             | Y         | Y       |
| CCD S0 on                             | N         | N       |
| CCD S1 on                             | N         | N       |
| CCD S2 on                             | N         | N       |
| CCD S3 on                             | N         | N       |
| CCD S4 on                             | N         | N       |
| CCD S5 on                             | N         | N       |
| Number of optional ACIS chips dropped | 1         | 1       |
| On-chip summing requested             | N         | N       |
| Subarray requested                    | NONE      | NONE    |
| Alternating exposures requested       | N         | N       |
| [s] Primary exposure time             | 0.000000  | 3.1     |

## 2.3 Aspect



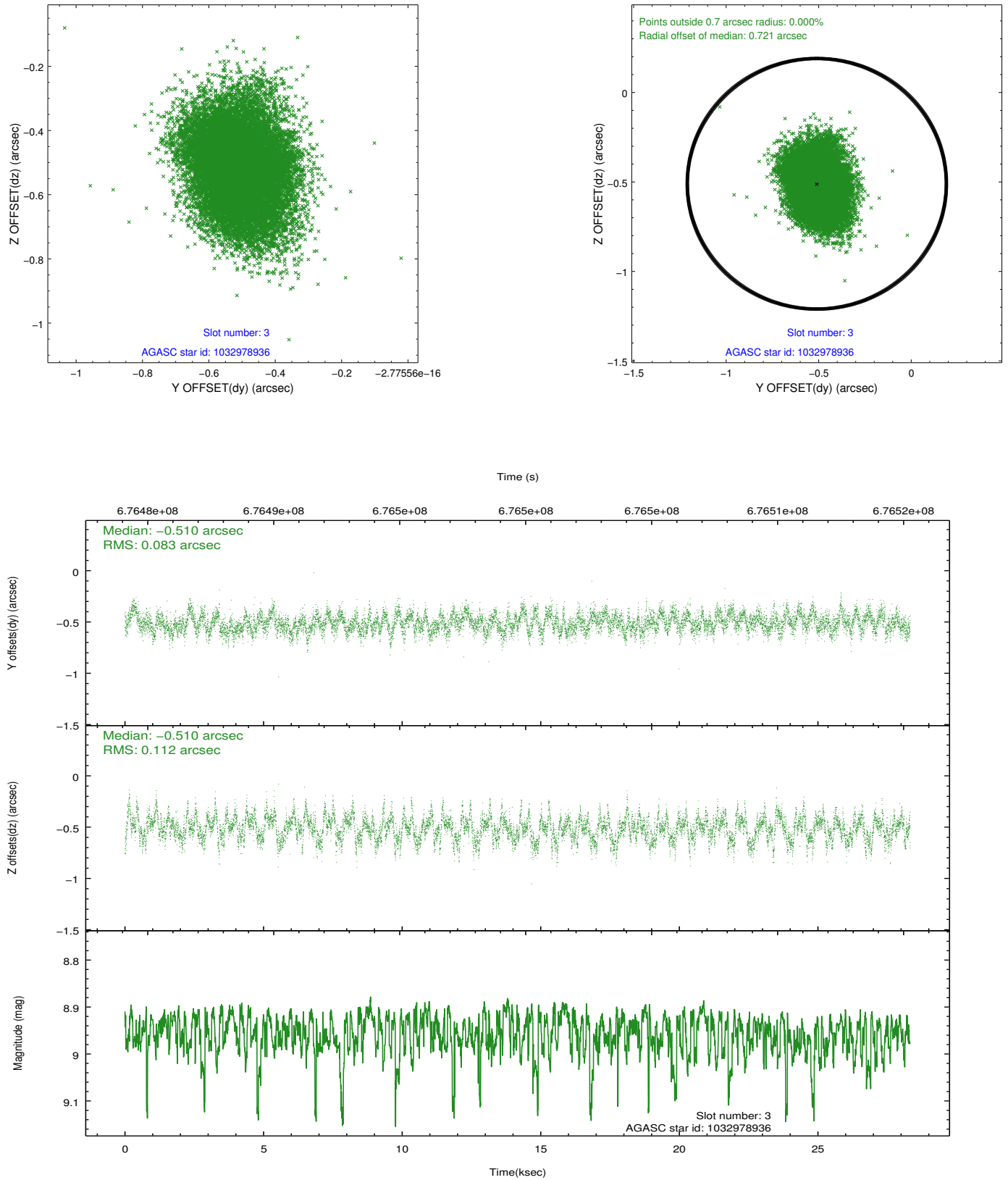


# Slot Statistics

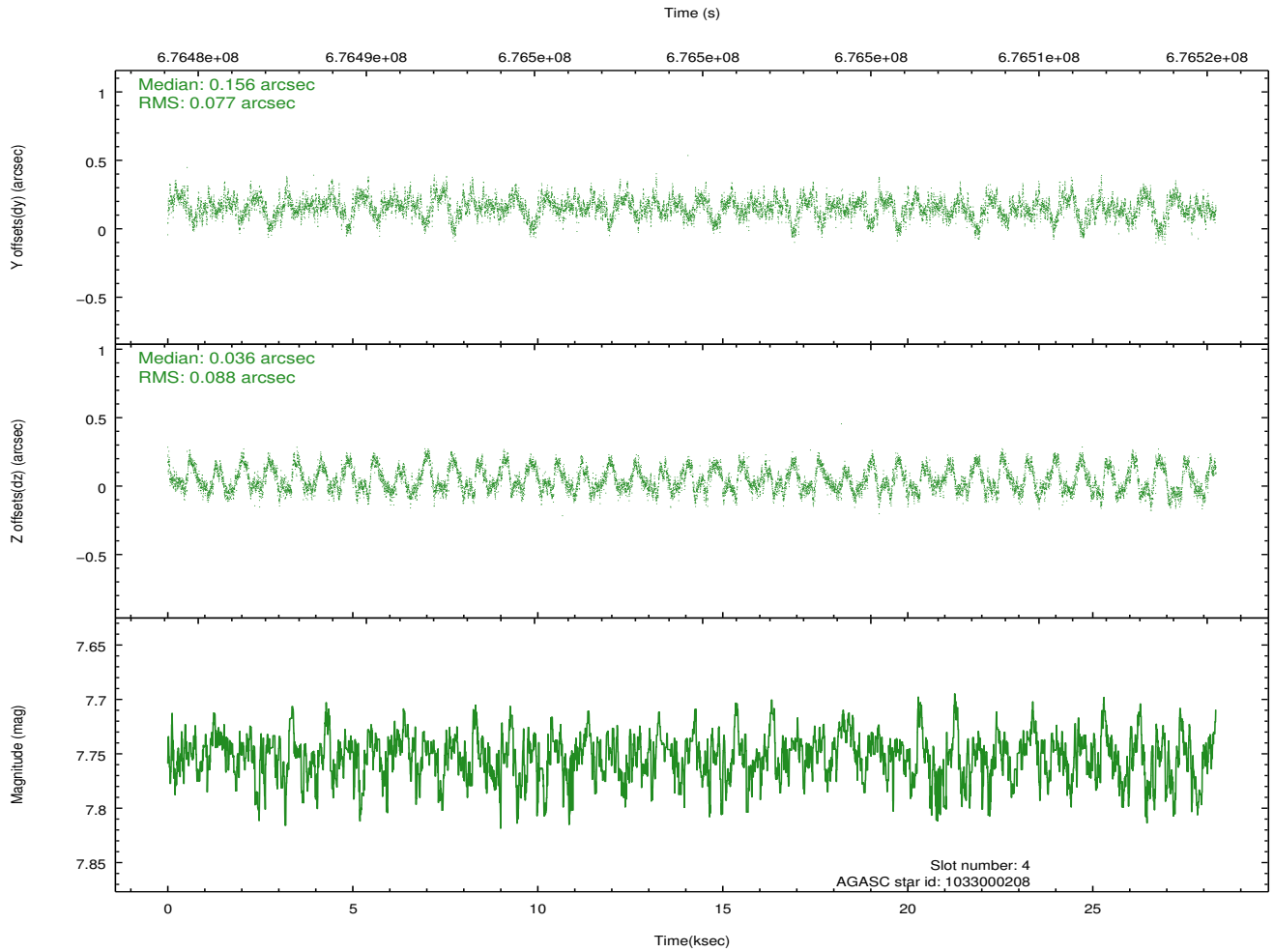
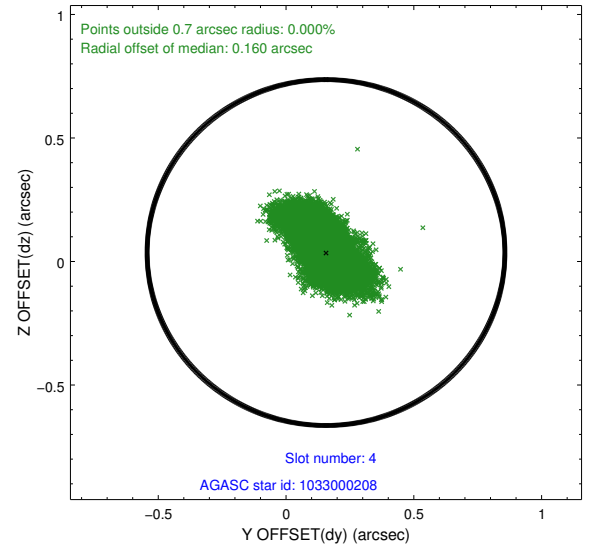
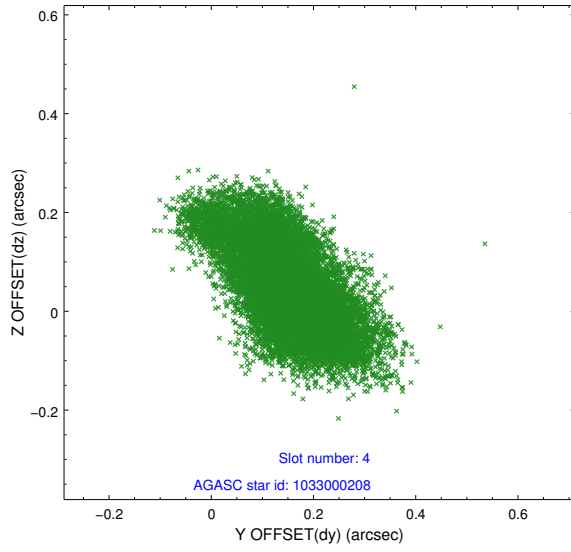
| pt | status | used | id         | mag  | n_pts | frac_pts | med_dy | med_dz | dr1   | dr2   | ra         | dec        | mean_y   | mea   |
|----|--------|------|------------|------|-------|----------|--------|--------|-------|-------|------------|------------|----------|-------|
| 0  | FID    |      | ACIS-I-1   | 7.15 | 6909  | 1.000    | 0.118  | -0.067 | 0.015 | 0.037 | 0.000000   | 0.000000   | 928.15   | -991  |
| 1  | FID    |      | ACIS-I-5   | 7.19 | 6911  | 1.000    | -0.511 | 0.034  | 0.012 | 0.023 | 0.000000   | 0.000000   | -1820.71 | 906   |
| 2  | FID    |      | ACIS-I-6   | 7.20 | 6911  | 1.000    | 0.300  | 0.105  | 0.011 | 0.020 | 0.000000   | 0.000000   | 393.55   | 1550  |
| 3  | GUIDE  | used | 1032978936 | 8.96 | 13801 | 1.000    | -0.510 | -0.510 | 0.148 | 0.241 | 257.447182 | -44.360307 | 361.37   | 482   |
| 4  | GUIDE  | used | 1033000208 | 7.75 | 13817 | 1.000    | 0.156  | 0.036  | 0.123 | 0.209 | 256.502750 | -44.372681 | -2063.92 | 636   |
| 5  | GUIDE  | used | 1033111224 | 8.93 | 13804 | 1.000    | -0.113 | -0.240 | 0.219 | 0.329 | 257.844751 | -44.847109 | 1219.25  | -1354 |
| 6  | GUIDE  | used | 1091569256 | 8.36 | 13809 | 1.000    | 0.176  | 0.345  | 0.120 | 0.196 | 257.146819 | -45.037377 | -612.04  | -1880 |
| 7  | GUIDE  | used | 1091578128 | 8.58 | 13811 | 1.000    | 0.297  | 0.379  | 0.134 | 0.213 | 257.198938 | -45.154577 | -515.05  | -2311 |

## 2.4 Star Slots

### 2.4.1 Slot 3

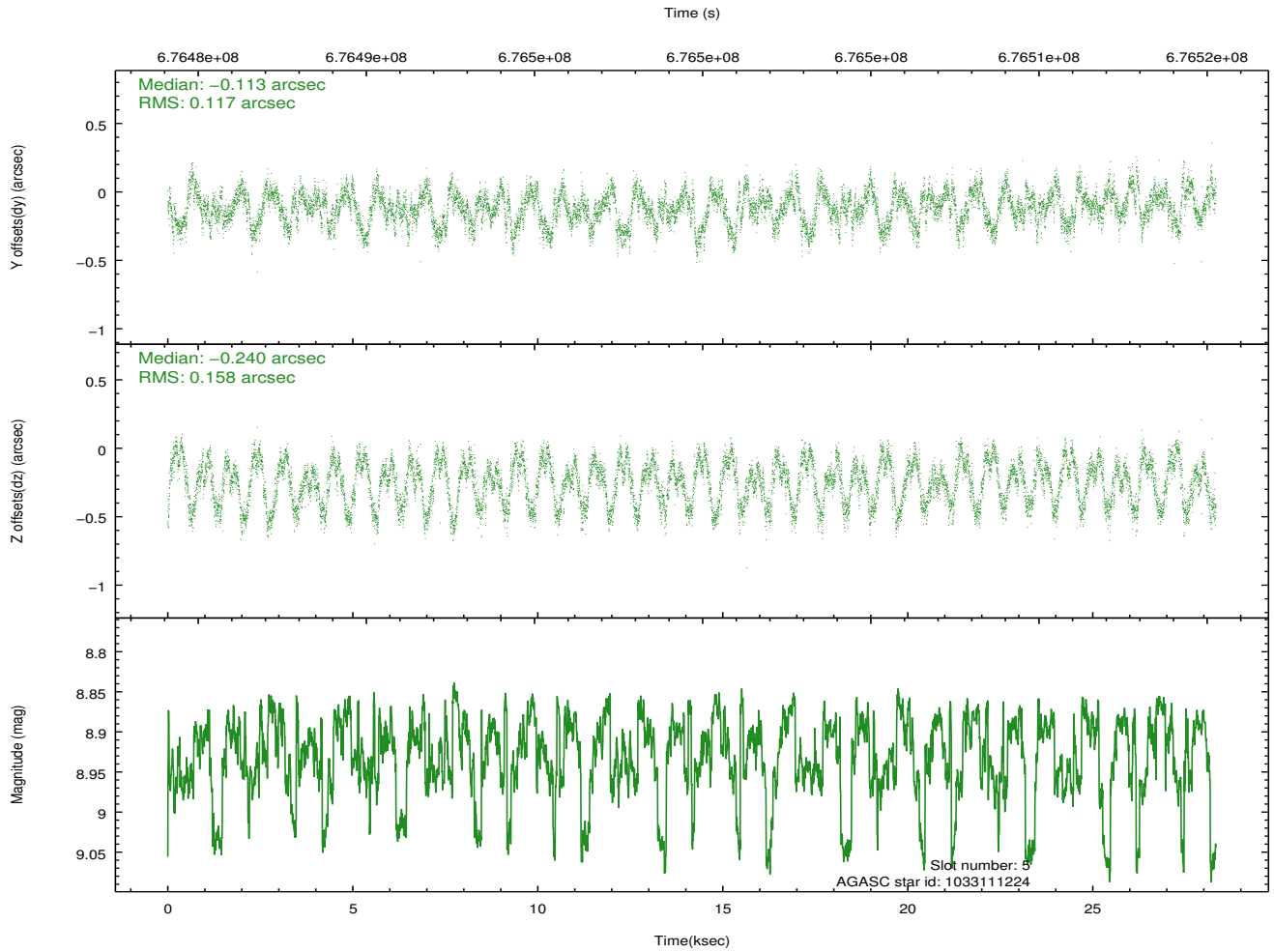
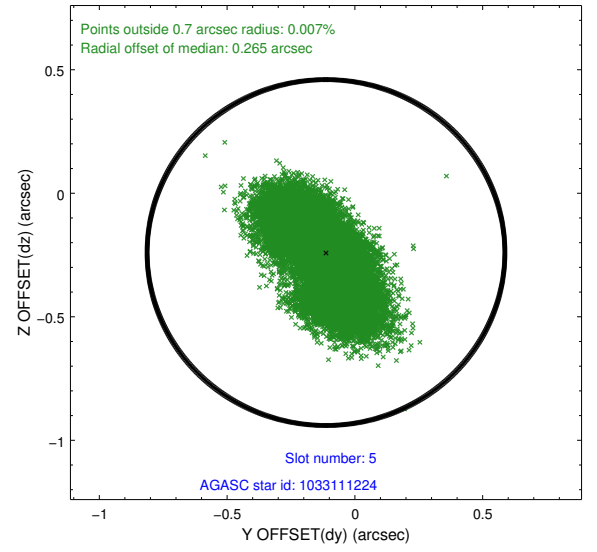
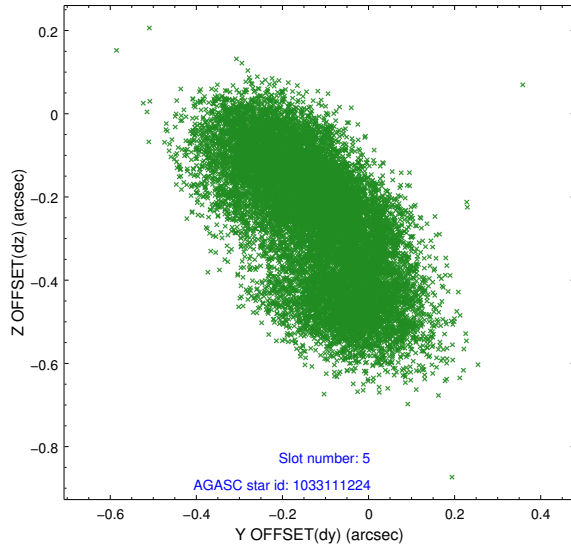


## 2.4.2 Slot 4

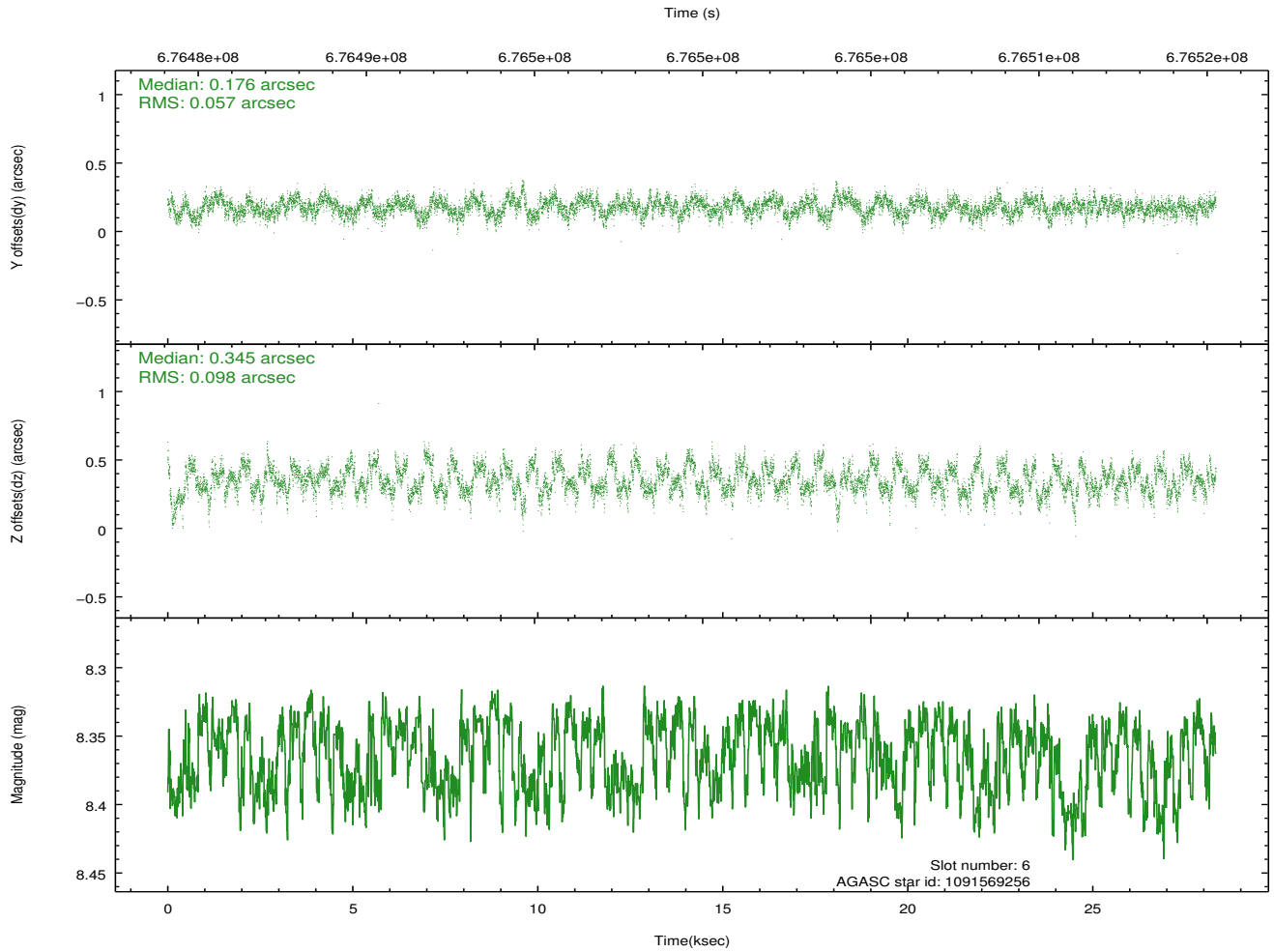
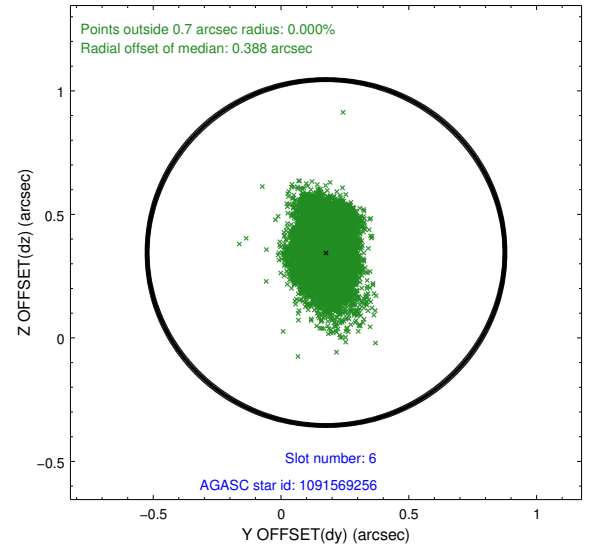
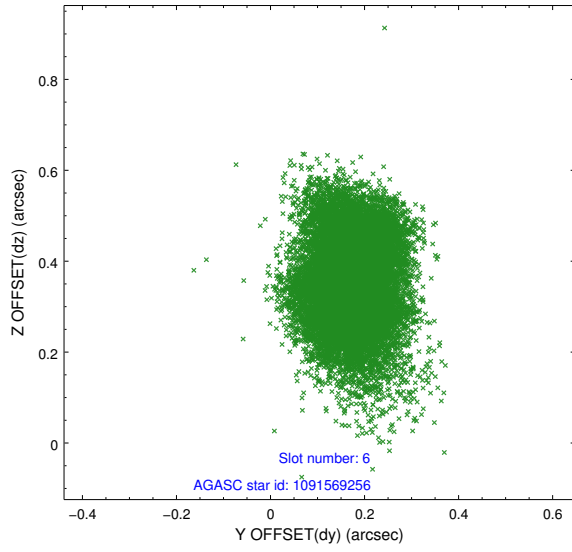




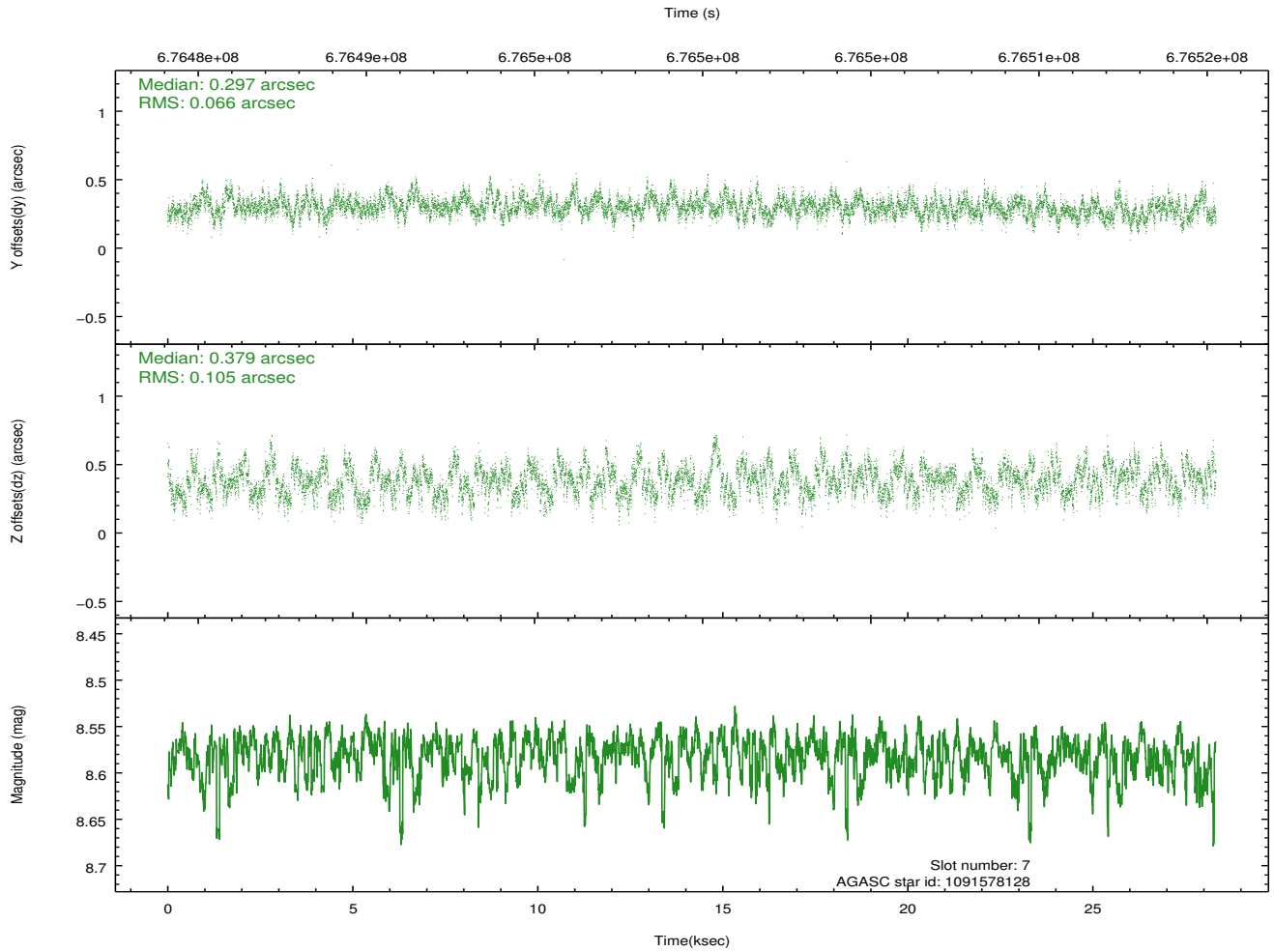
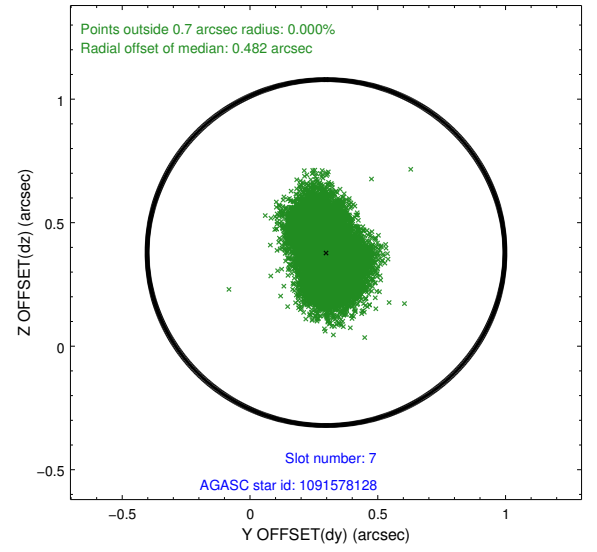
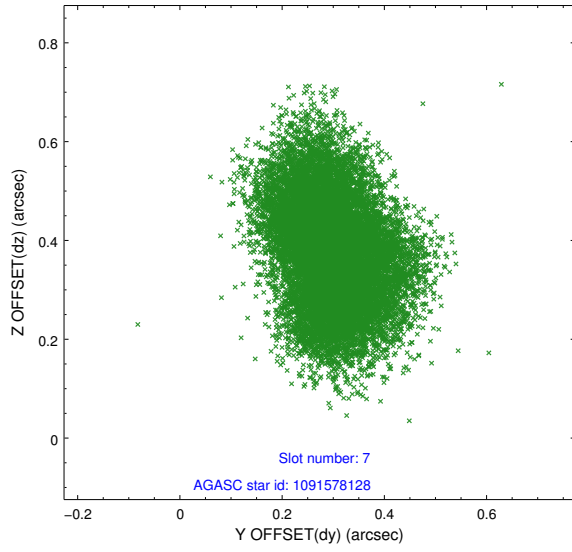
### 2.4.3 Slot 5



## 2.4.4 Slot 6

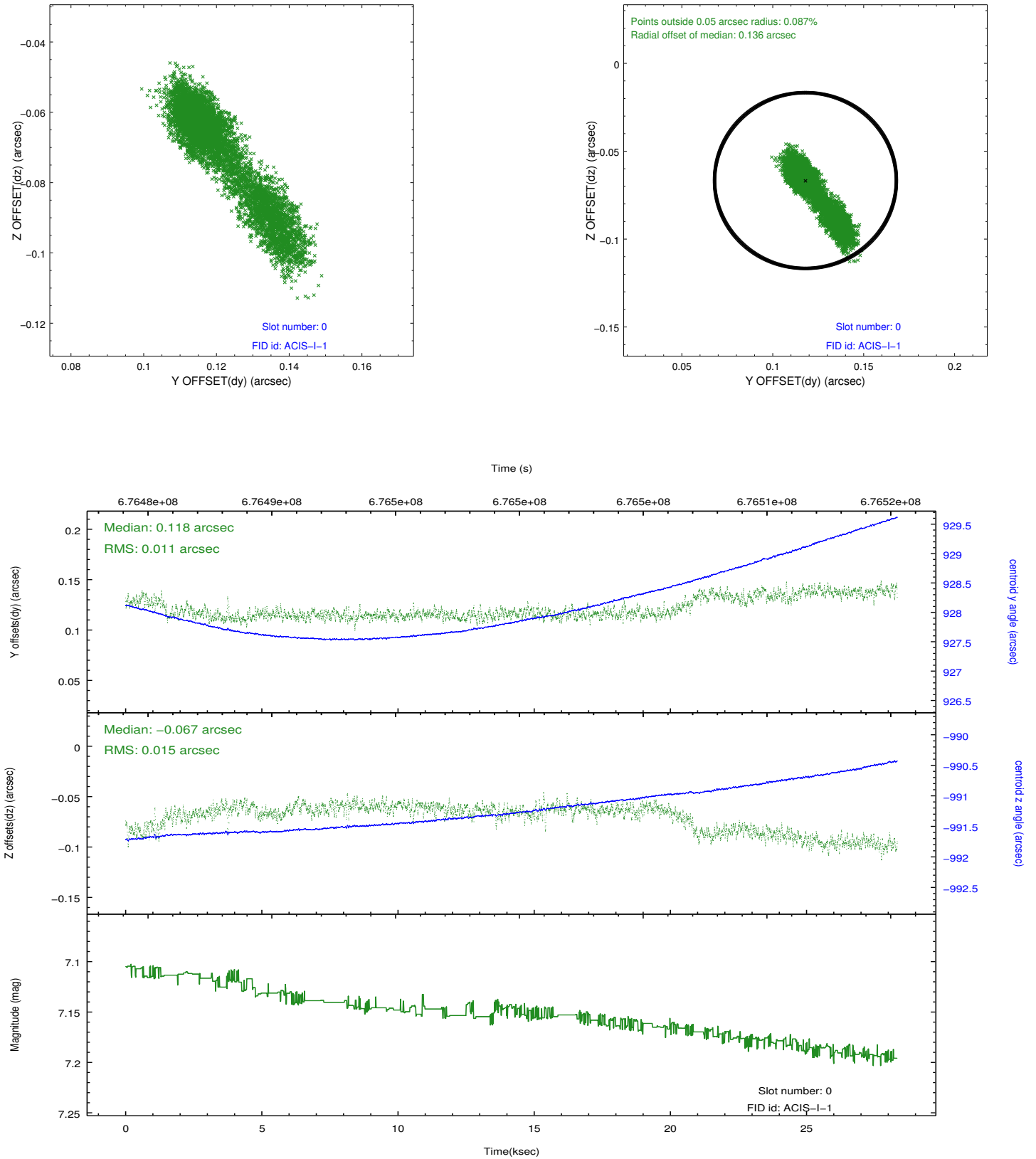


## 2.4.5 Slot 7

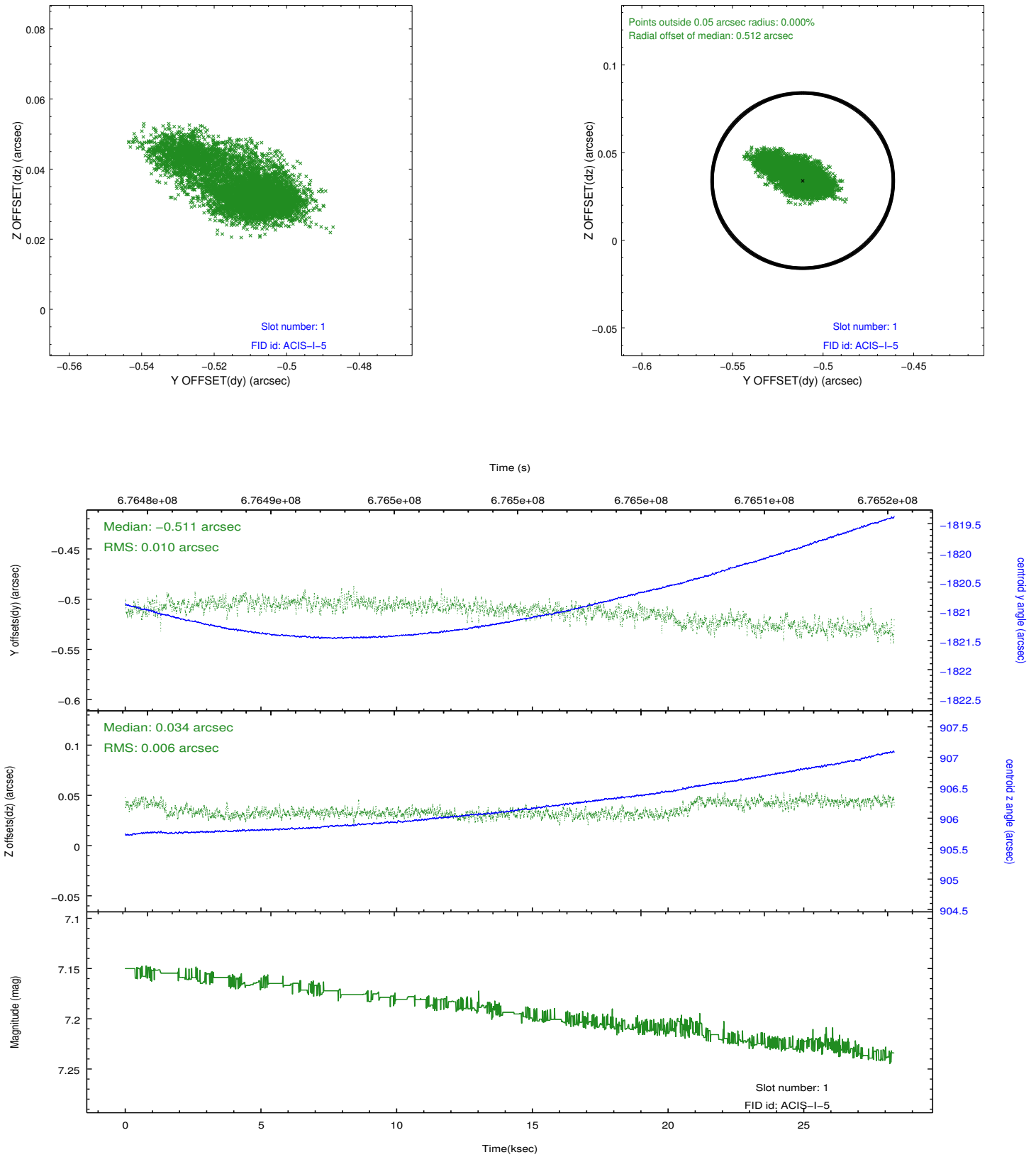


## 2.5 FID Slots

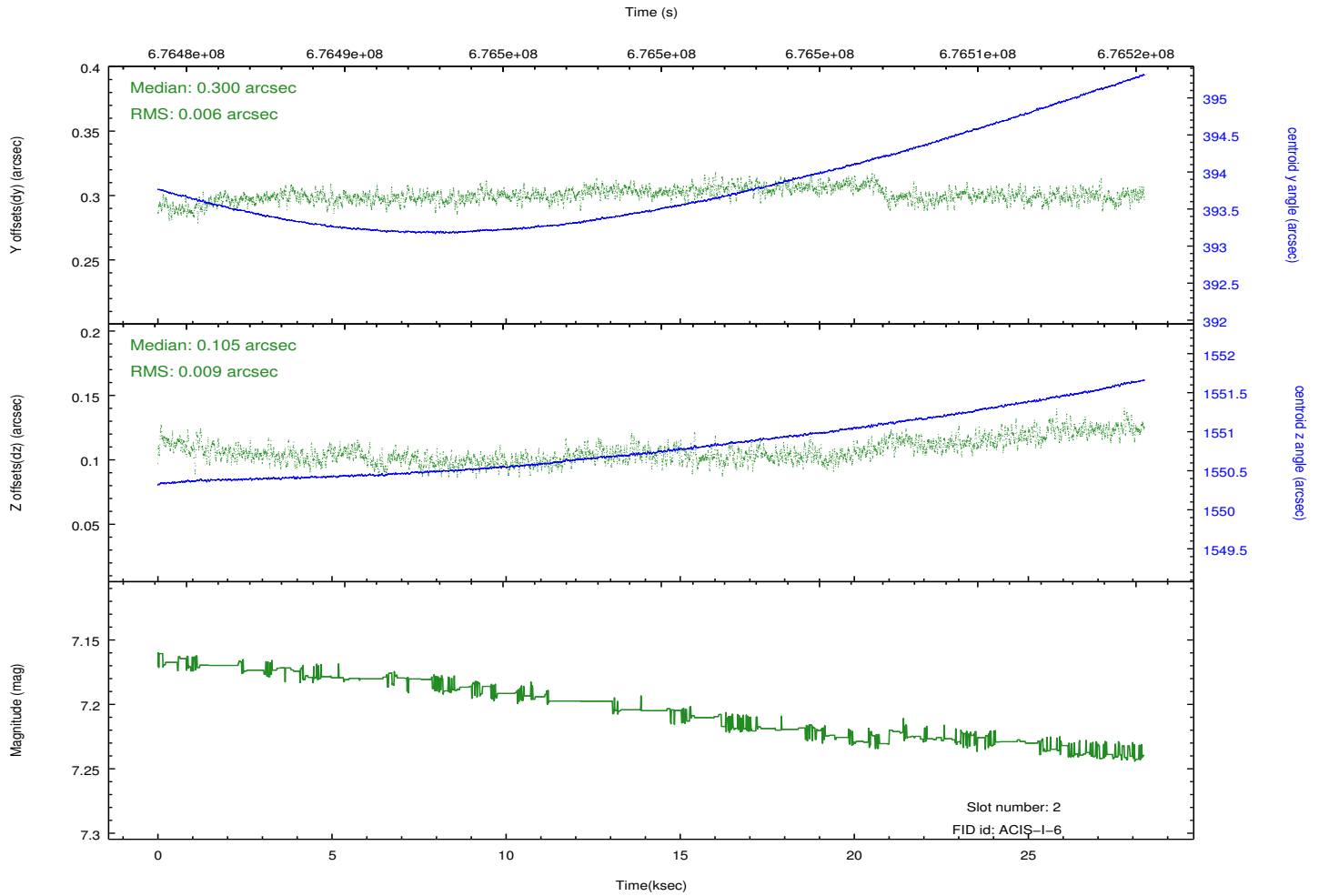
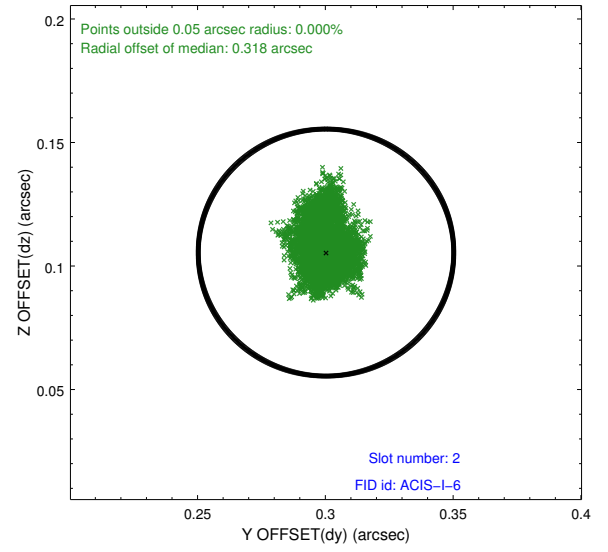
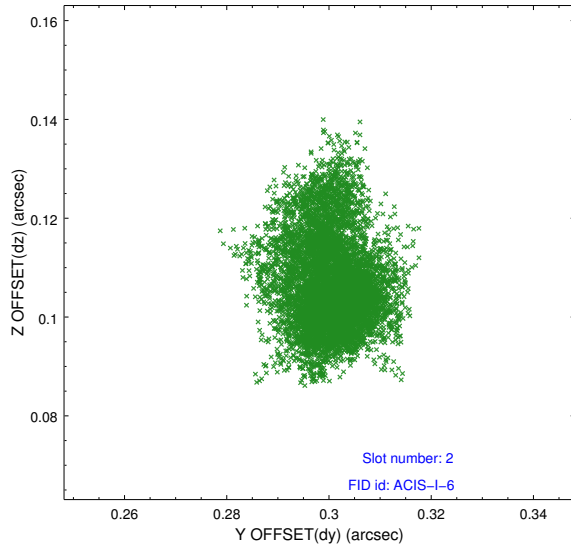
### 2.5.1 Slot 0



## 2.5.2 Slot 1



### 2.5.3 Slot 2



# A Summary

## A.1 Status

|                            |                 |
|----------------------------|-----------------|
| V&V Scientist              | Jen Lauer       |
| V&V Date (YYYY-MM-DD)      | 2019.06.10      |
| V&V Edition                | 1               |
| V&V Disposition and Status | OK              |
| V&V Charge Time            | 28.308012181282 |

## A.2 Comments

Roll preference met. Monitor constraint met. Optional chip I0 not included.

=====

The focal plane temperature during the interval 676512777.01 - 676513846.51 (MET s) 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\\_CIS\\_response\\_summary.html](http://asc.harvard.edu/cal/Acis/Cal_prods/Gain_and_Spectral_Resolution/A_CIS_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.