

# V&V Reference Report

## L2 ASCDS Version : 8.4.5

Observation 1793 - L2 Version 11  
Chandra X-Ray Center

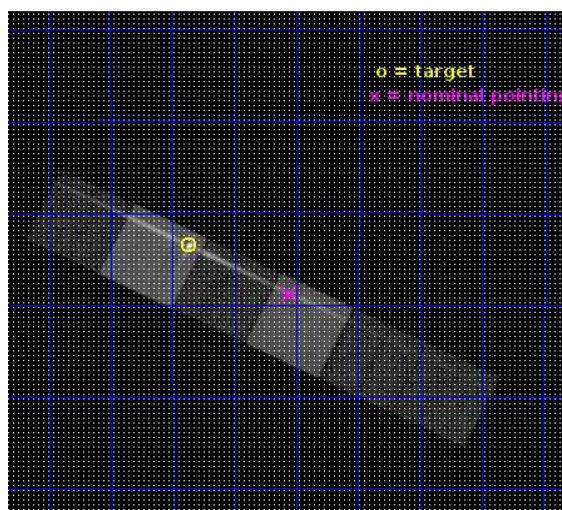
L2 Processing Date : Apr 4 2019

## 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>3</b>	<b>Gratings</b>	<b>17</b>
3.1	LETG Arm . . . . .	17
<b>A</b>	<b>Summary</b>	<b>19</b>
A.1	Status . . . . .	19
A.2	Comments . . . . .	19

# 1 Front

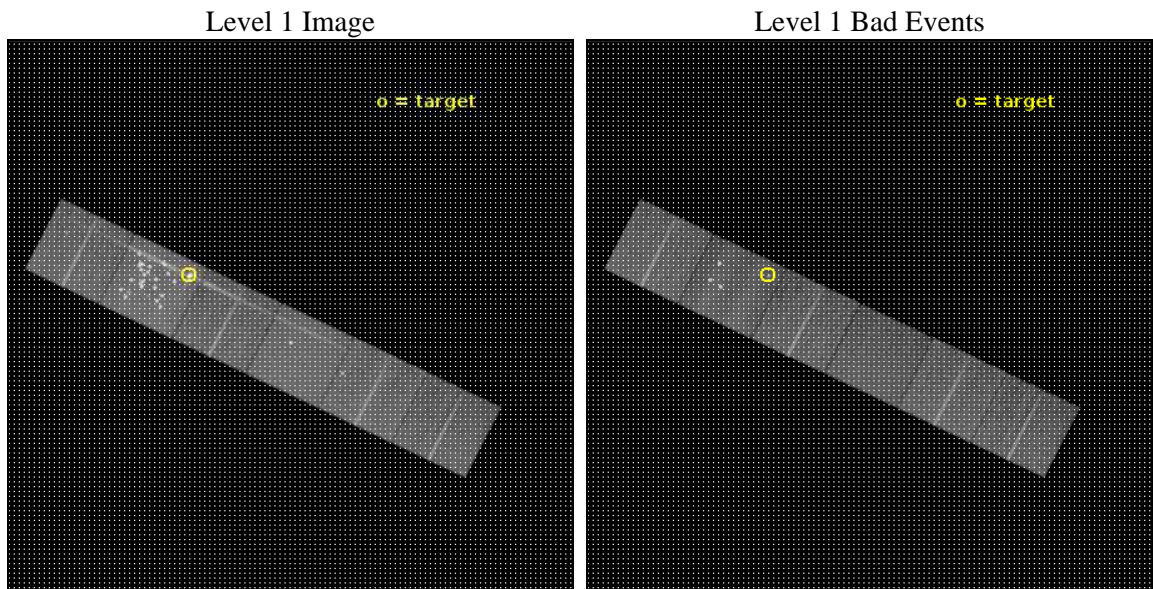
seq_num	390011	Sequence number
obs_id	1793	Observation id
title	GRATINGS CALIBRATION OBSERVATIONS OF PKS2155-304	Proposal title
observer	Dr. CXC Calibration	Principal investigator
object	PKS2155-304	Source name
dtcycle	0	&#160
cycle	P	events from which exps? Prim/Second/Both
ra_targ	329.716667	Observer's specified target RA [deg]
dec_targ	-30.225556	Observer's specified target Dec [deg]
ra_nom	329.514151618	Nominal RA [deg]
dec_nom	-30.313392343199	Nominal Dec [deg]
roll_nom	26.244106104089	Nominal Roll [deg]
revision	11	Processing version of data
ontime	21160.155836657	Sum of GTIs [s]
livetime	20892.213202337	Livetime [s]
ontime4	21160.237886757	Sum of GTIs [s]
ontime5	21160.155836657	Sum of GTIs [s]
ontime6	21160.114796668	Sum of GTIs [s]
ontime7	21160.196846753	Sum of GTIs [s]
ontime8	21160.073756665	Sum of GTIs [s]
ontime9	21160.032686755	Sum of GTIs [s]
l2events	272326	Number of level 2 events



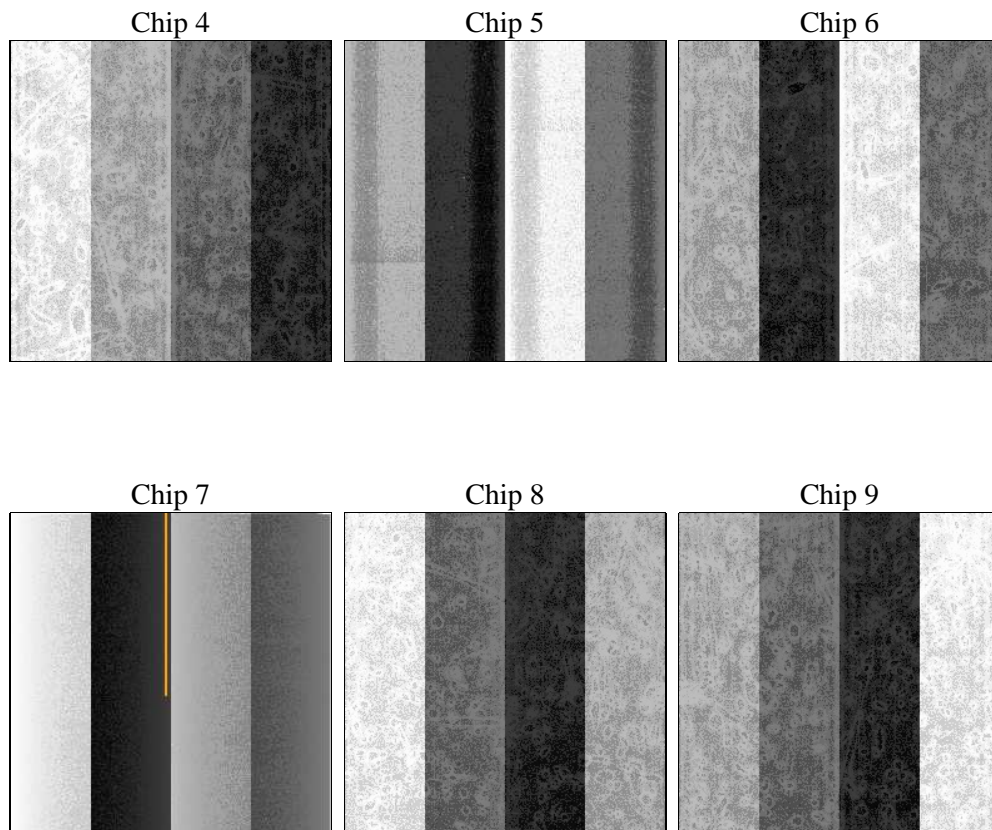
## 2 OBI

### 2.1 OBI

#### 2.1.1 Images



#### 2.1.2 Bias



### 2.1.3 Parameters

obi_num	0	Obi number	sched_exp_time	21400.000000	[s] Scheduled observation exposure time
ascdsver	10.7.1	Processing system revision	ontime	21160.155836657	Sum of GTIs [s]
caldbver	4.8.2	&#160	ontime4	21160.237886757	Sum of GTIs [s]
date	2019-04-04T19:24:45	Date and time of file creation	ontime5	21160.155836657	Sum of GTIs [s]
revision	6	Processing version of data	ontime6	21160.114796668	Sum of GTIs [s]
			ontime7	21160.196846753	Sum of GTIs [s]
			ontime8	21160.073756665	Sum of GTIs [s]
			ontime9	21160.032686755	Sum of GTIs [s]
			l1events	1115400	Number of level 1 events
			tgmethod	FINDZO	Method used to create src1a file
			zpc_pos	(2817.60, 4728.76)	src1a sky pixel position

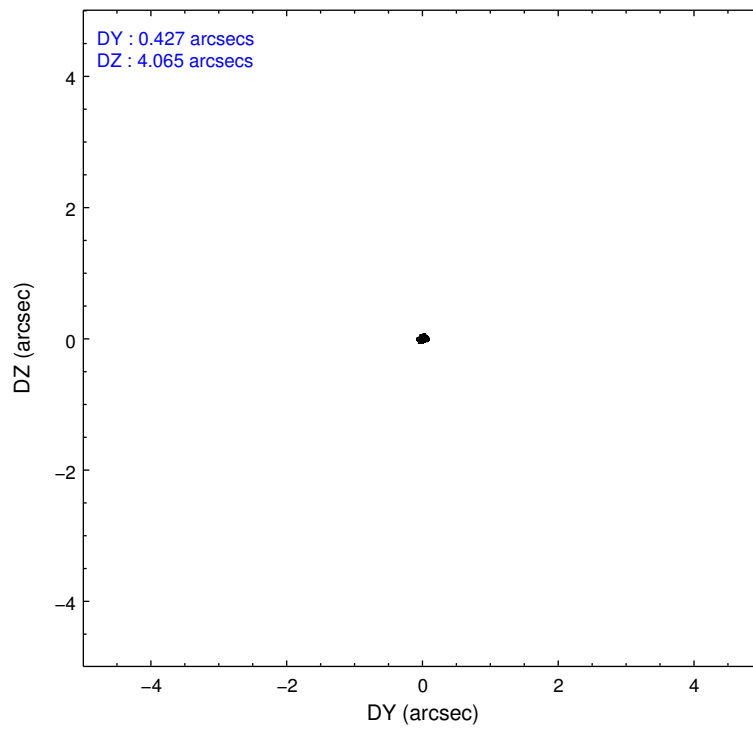
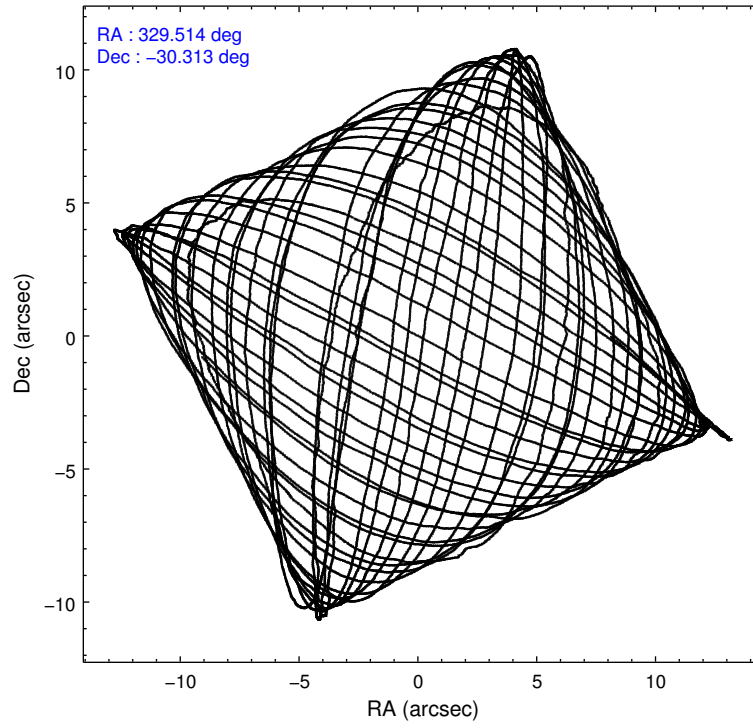
### 2.1.4 Events

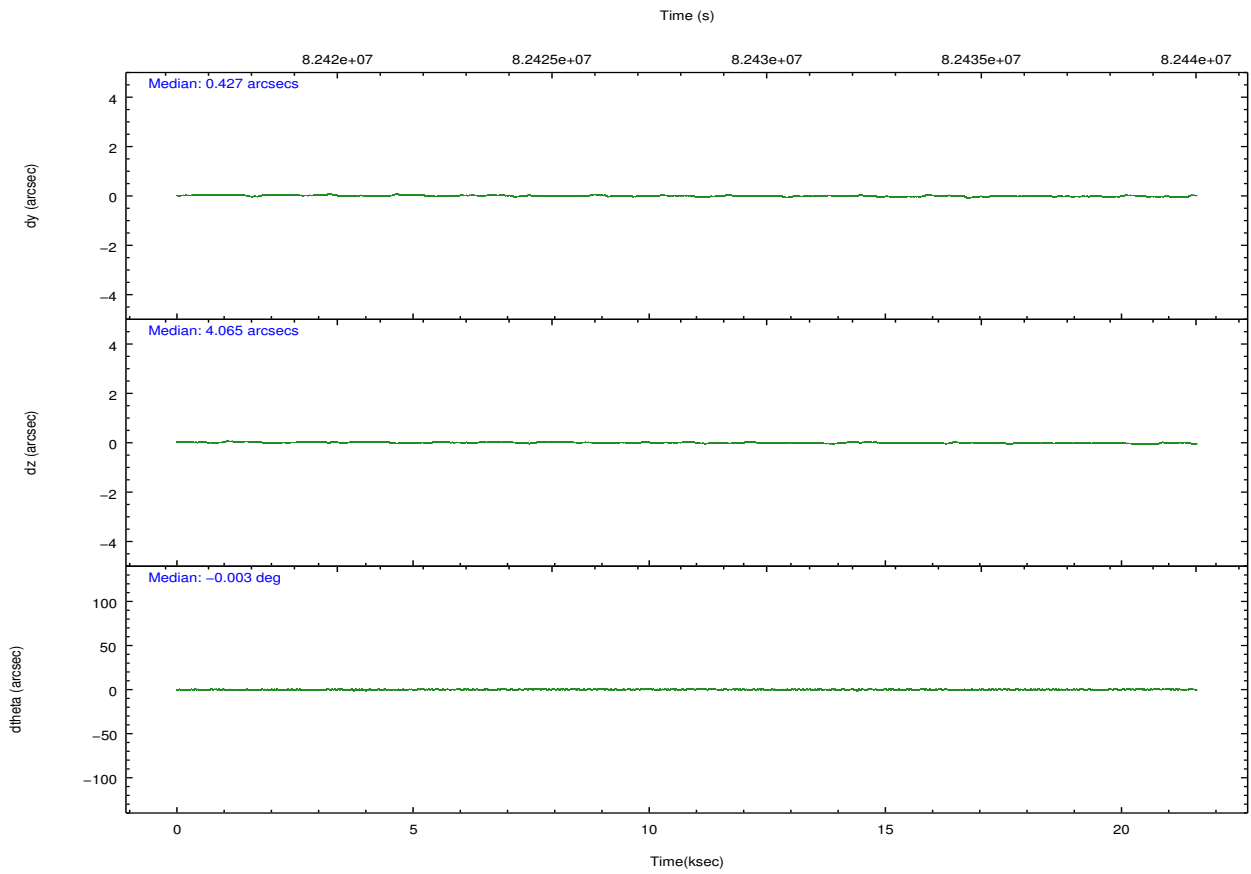
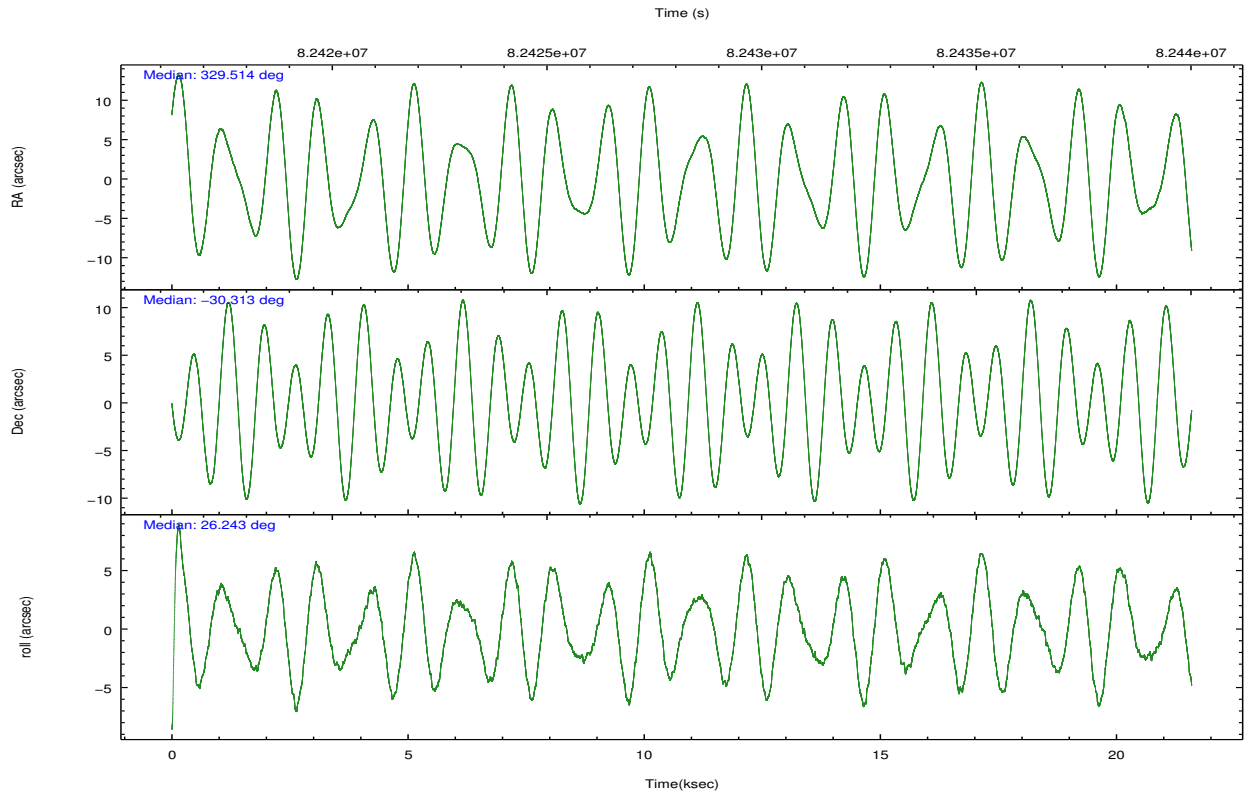
	ccd 4	ccd 5	ccd 6	ccd 7	ccd 8	ccd 9		ccd 4	ccd 5	ccd 6	ccd 7	ccd 8	ccd 9
level 1 events	140696	396220	138322	165502	153550	121110	grade 0 events	4780	156992	13817	14233	9709	2974
rejected events	123333	117987	110779	89787	122836	106185		3%	39%	9%	8%	6%	2%
rejected %	87%	29%	80%	54%	79%	87%	grade 1 events	49	324	56	86	76	17
								0%	0%	0%	0%	0%	0%
							grade 2 events	7505	40923	7415	14316	9585	6548
								5%	10%	5%	8%	6%	5%
							grade 3 events	734	12014	1109	4200	2133	786
								0%	3%	0%	2%	1%	0%
							grade 4 events	666	8799	1106	3787	2035	718
								0%	2%	0%	2%	1%	0%
							grade 5 events	2416	17289	2975	8698	3959	2928
								1%	4%	2%	5%	2%	2%
							grade 6 events	3679	59540	4102	39190	7255	3901
								2%	15%	2%	23%	4%	3%
							grade 7 events	120867	100339	107742	80992	118798	103238
								85%	25%	77%	48%	77%	85%

## 2.2 Compared Parameters

Parameter	Planned	Actual	Parameter	Planned	Actual
Instrument	ACIS	ACIS	Obspar format version number	7	7
Detector	ACIS-456789	ACIS-456789	Obspar file type	PREDICTED	ACTUAL
Grating	LETG	LETG	Obspar update status	NONE	UPDATED
Data mode	FAINT	FAINT	Number of optional ACIS chips dropped	0	0
Observation mode	POINTING	POINTING	On-chip summing requested	N	N
[deg] Pointing RA	329.496641	329.5141516179977	Subarray requested	NONE	NONE
[deg] Pointing Dec	-30.336238	-30.31339234319869	Alternating exposures requested	N	N
[deg] Pointing Roll	26.078633	26.24410610408854	[s] Primary exposure time	0.000000	3.2
[mm] SIM focus pos	-0.684267	-0.6828225247311905			
[mm] SIM defocus	0	0.001444936568705701			
[mm] SIM translation stage pos	-182.131972	-182.1344861297048			
[mm] SIM translation stage offset	-8.000551	-7.998036453302973			
[s] Observation start time (MET)	82417540.184000	82417161.92399301			
Observation start date	2000-08-11T21:44:36	2000-08-11T21:39:21			
[s] Observation end time (MET)	82438940.184000	82439076.93731301			
Observation end date	2000-08-12T03:41:16	2000-08-12T03:44:36			
Read mode	TIMED	TIMED			

## 2.3 Aspect





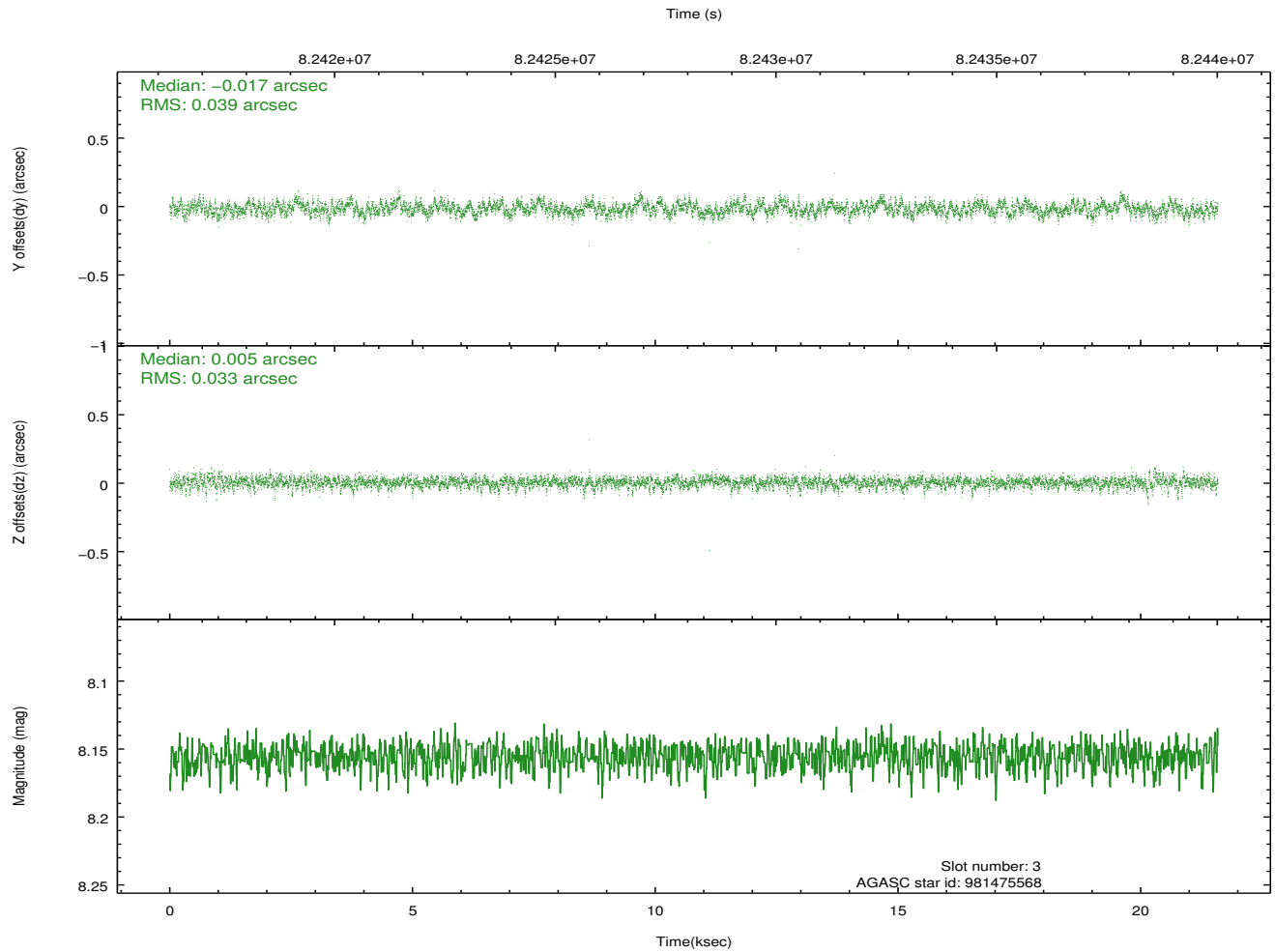
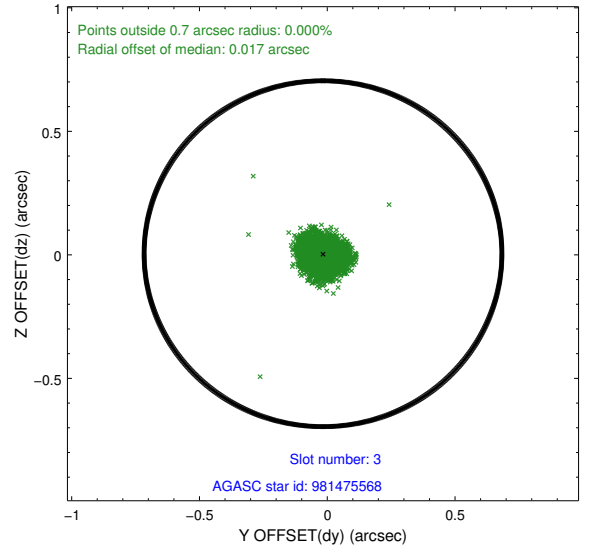
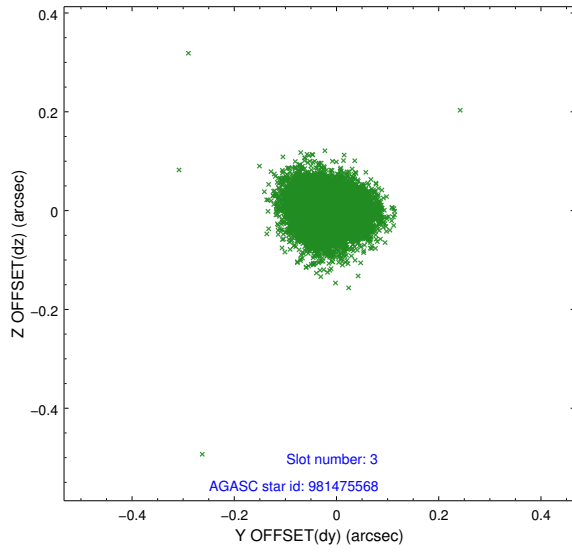
### Slot Statistics

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	7.10	5266	1.000	-0.061	-0.110	0.008	0.012	0.000000	0.000000	-752.51	-1890
1	FID		ACIS-S-4	7.18	5266	1.000	0.091	0.059	0.006	0.011	0.000000	0.000000	2160.87	18
2	FID		ACIS-S-5	7.22	5267	1.000	-0.062	0.059	0.008	0.013	0.000000	0.000000	-1805.12	12
3	GUIDE	used	981475568	8.16	10533	1.000	-0.017	0.005	0.054	0.089	328.999408	-30.923402	-2309.63	-1227
4	GUIDE	used	912275088	9.05	10531	1.000	-0.050	-0.034	0.081	0.134	329.619228	-29.738698	1289.86	1762
5	GUIDE	used	981478152	9.41	10528	1.000	-0.030	0.025	0.073	0.120	329.415589	-30.057192	215.19	1012
6	GUIDE	used	981468128	9.36	10528	1.000	0.100	-0.033	0.070	0.115	329.756350	-30.158334	1007.75	218
7	GUIDE	used	981469488	9.60	10531	1.000	-0.005	0.036	0.083	0.135	329.261199	-30.045155	-198.23	1262

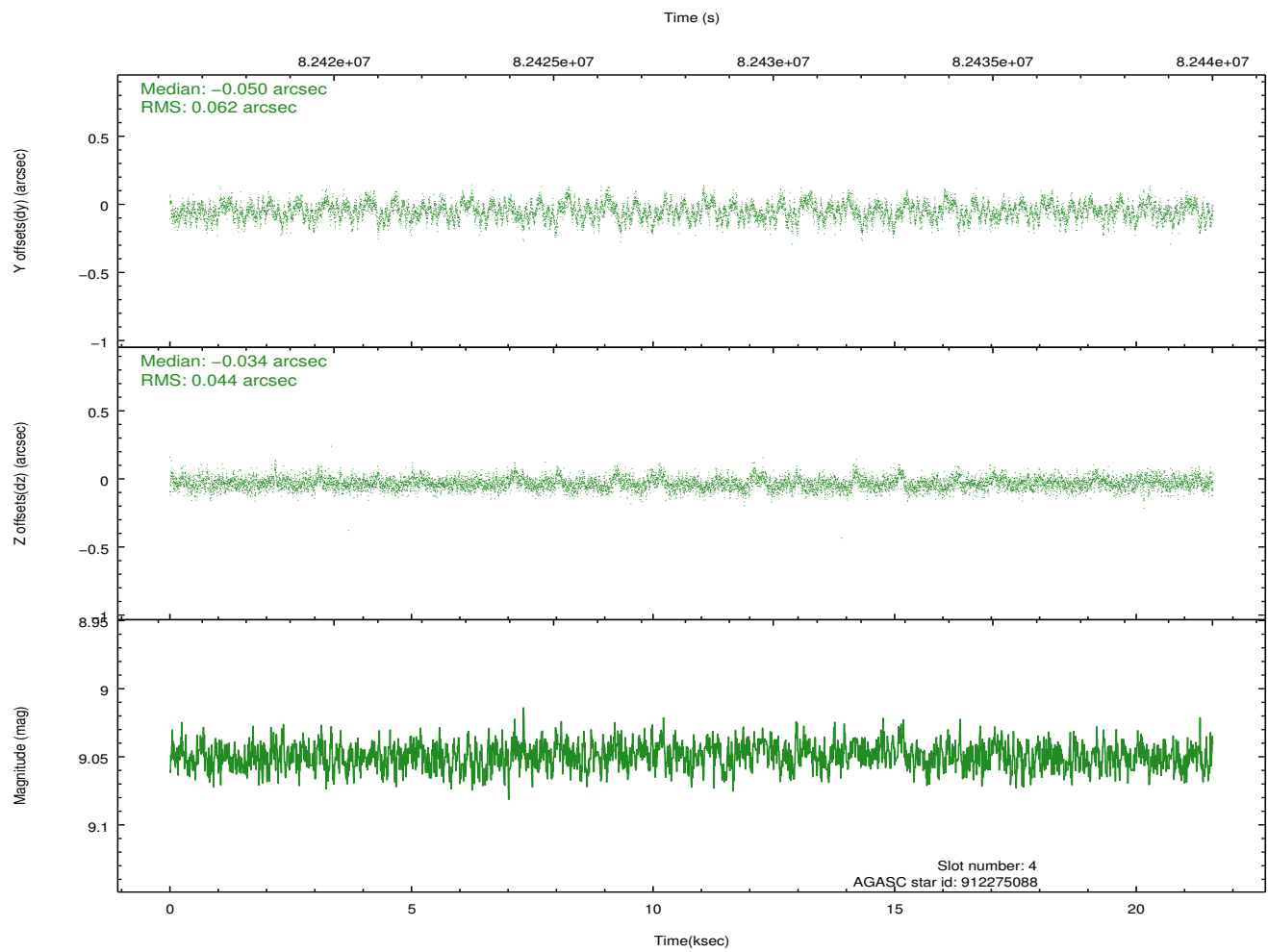
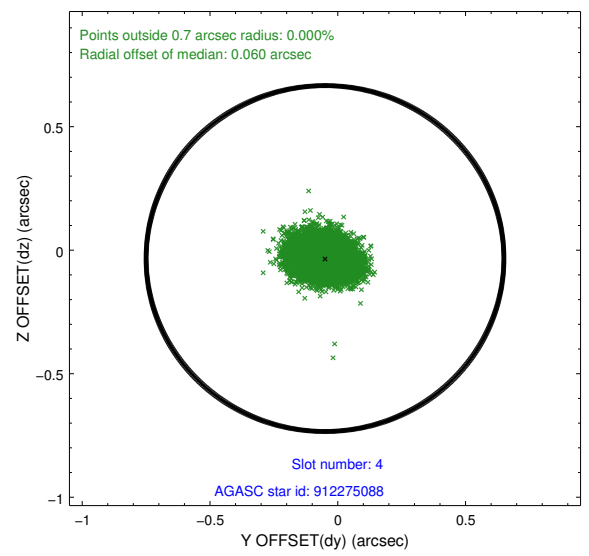
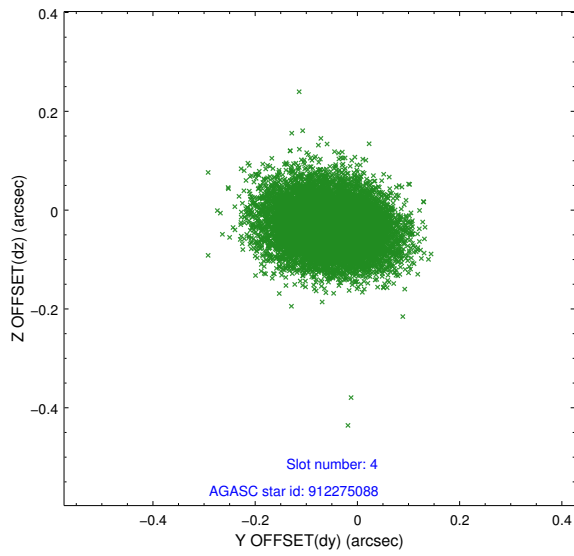
∞

## 2.4 Star Slots

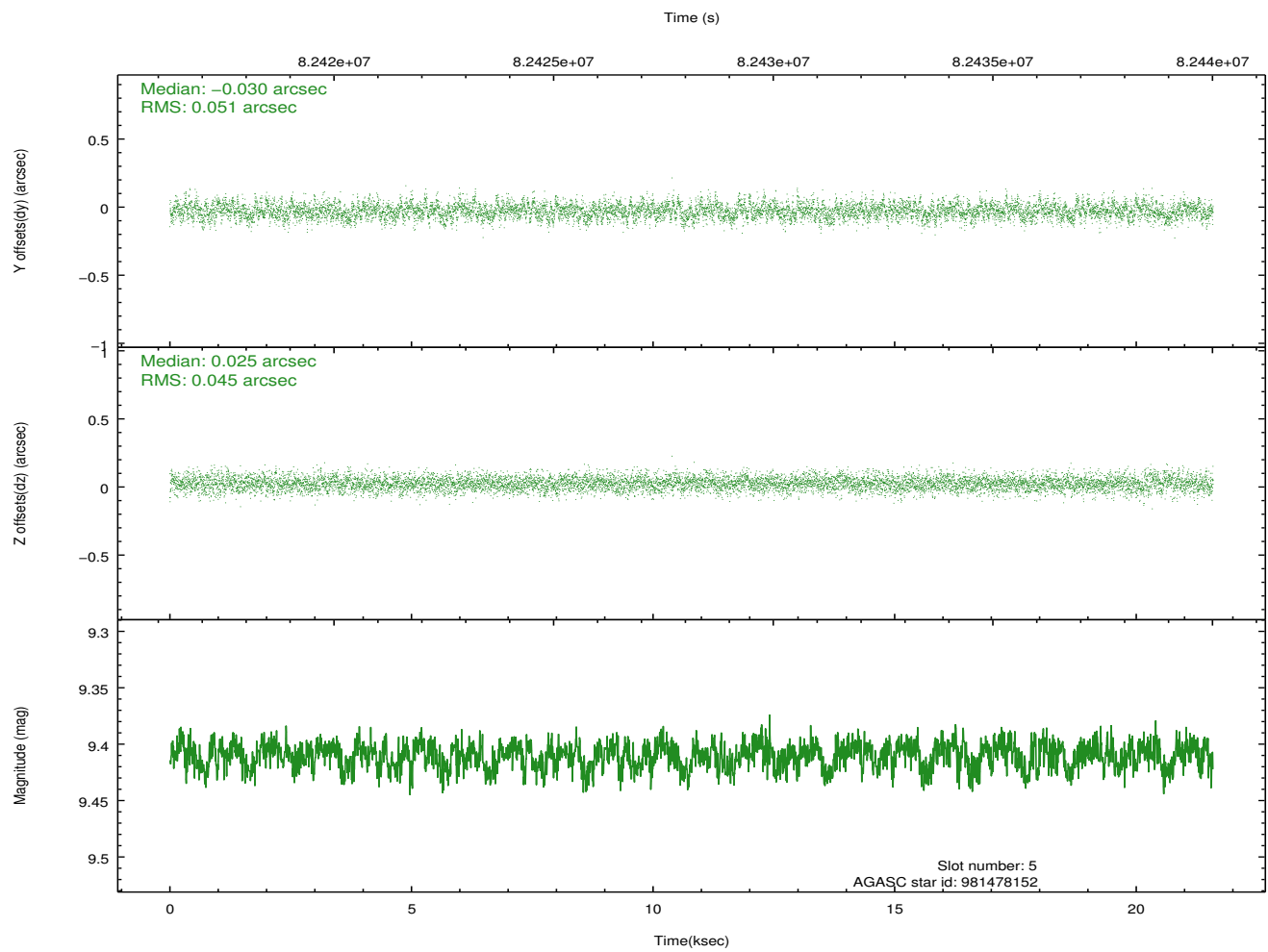
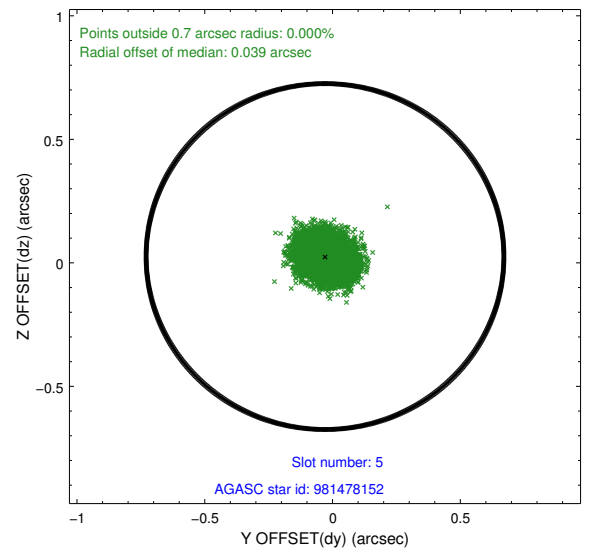
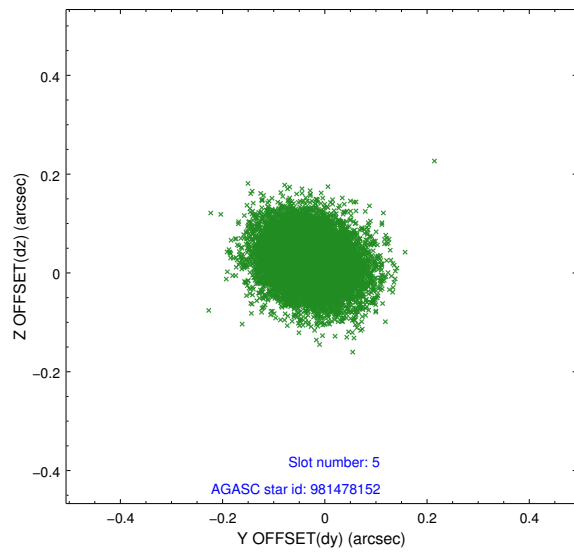
### 2.4.1 Slot 3



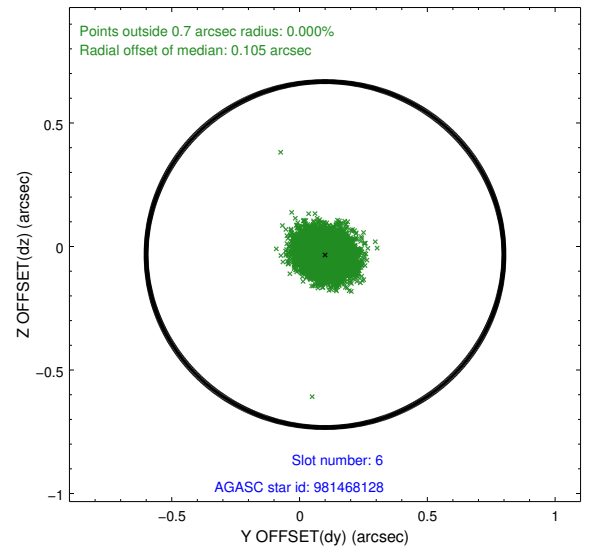
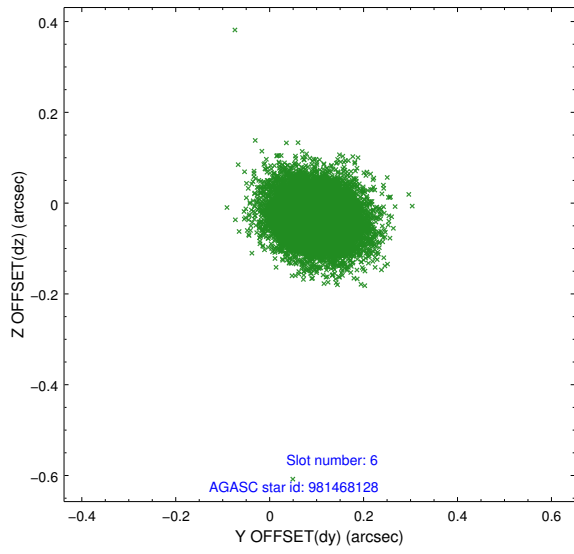
## 2.4.2 Slot 4



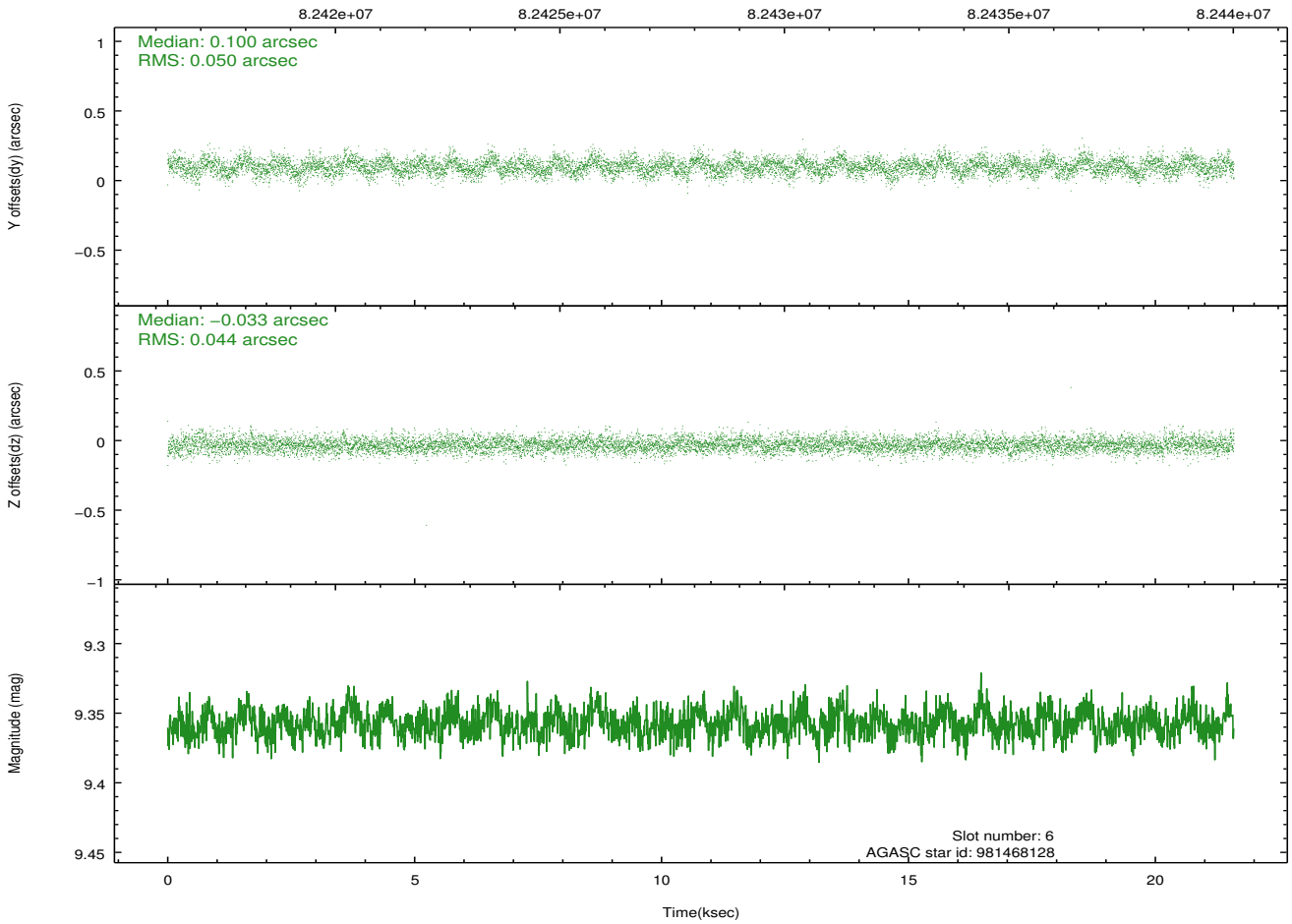
### 2.4.3 Slot 5



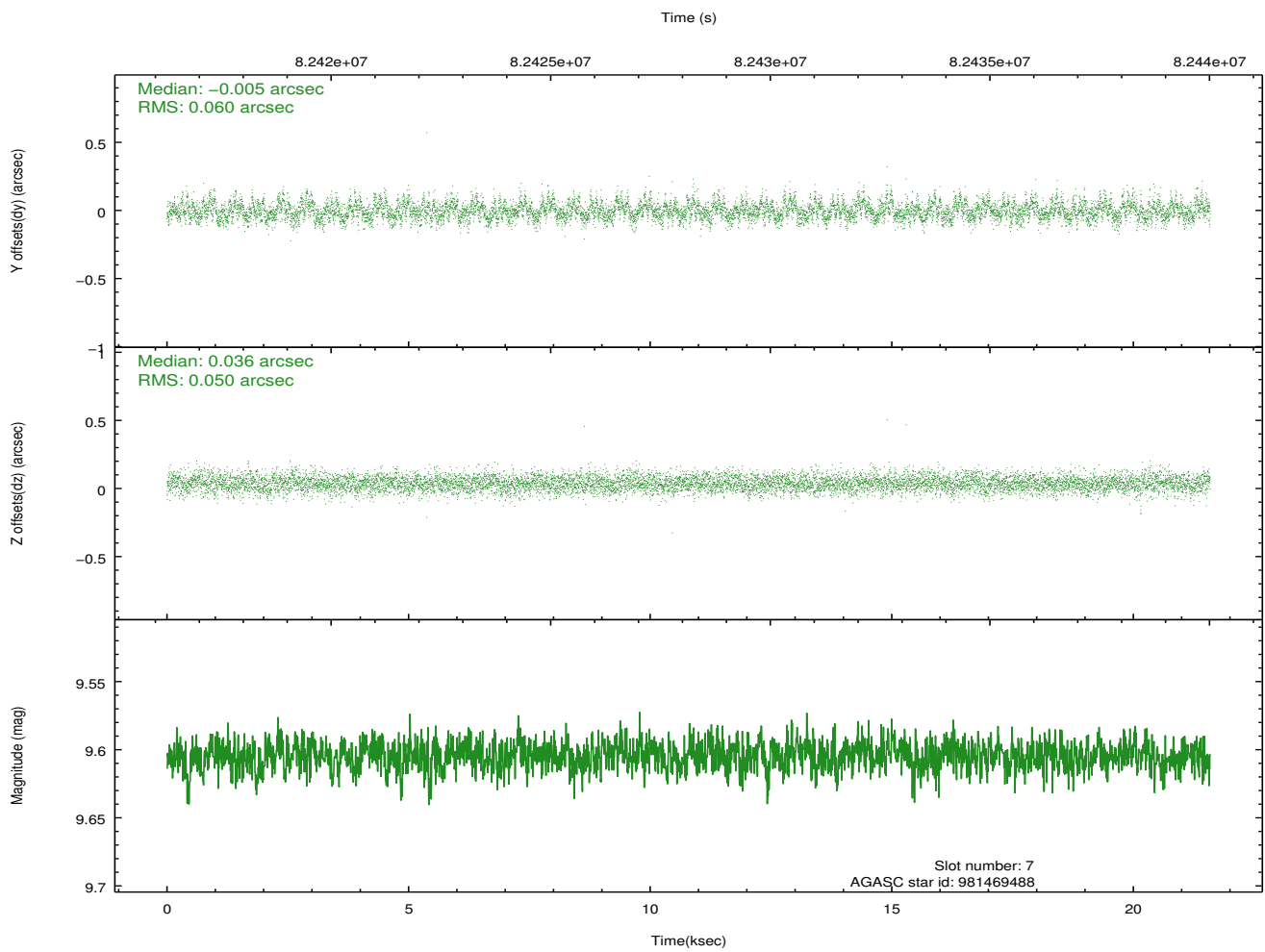
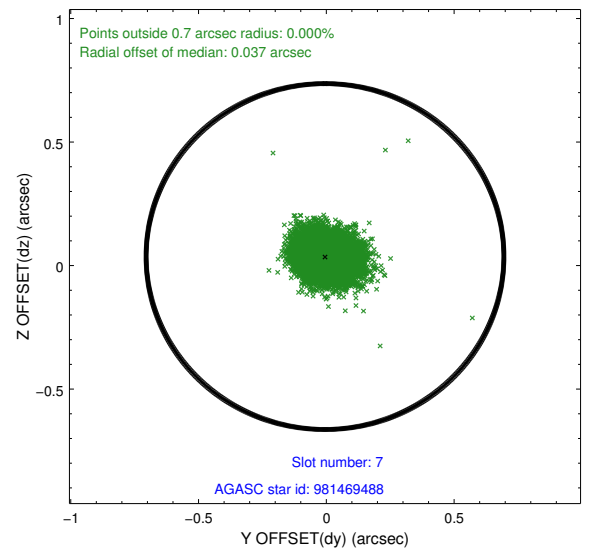
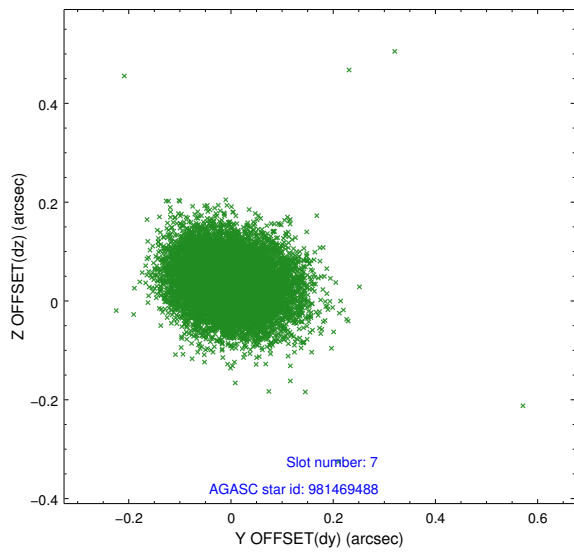
### 2.4.4 Slot 6



Time (s)

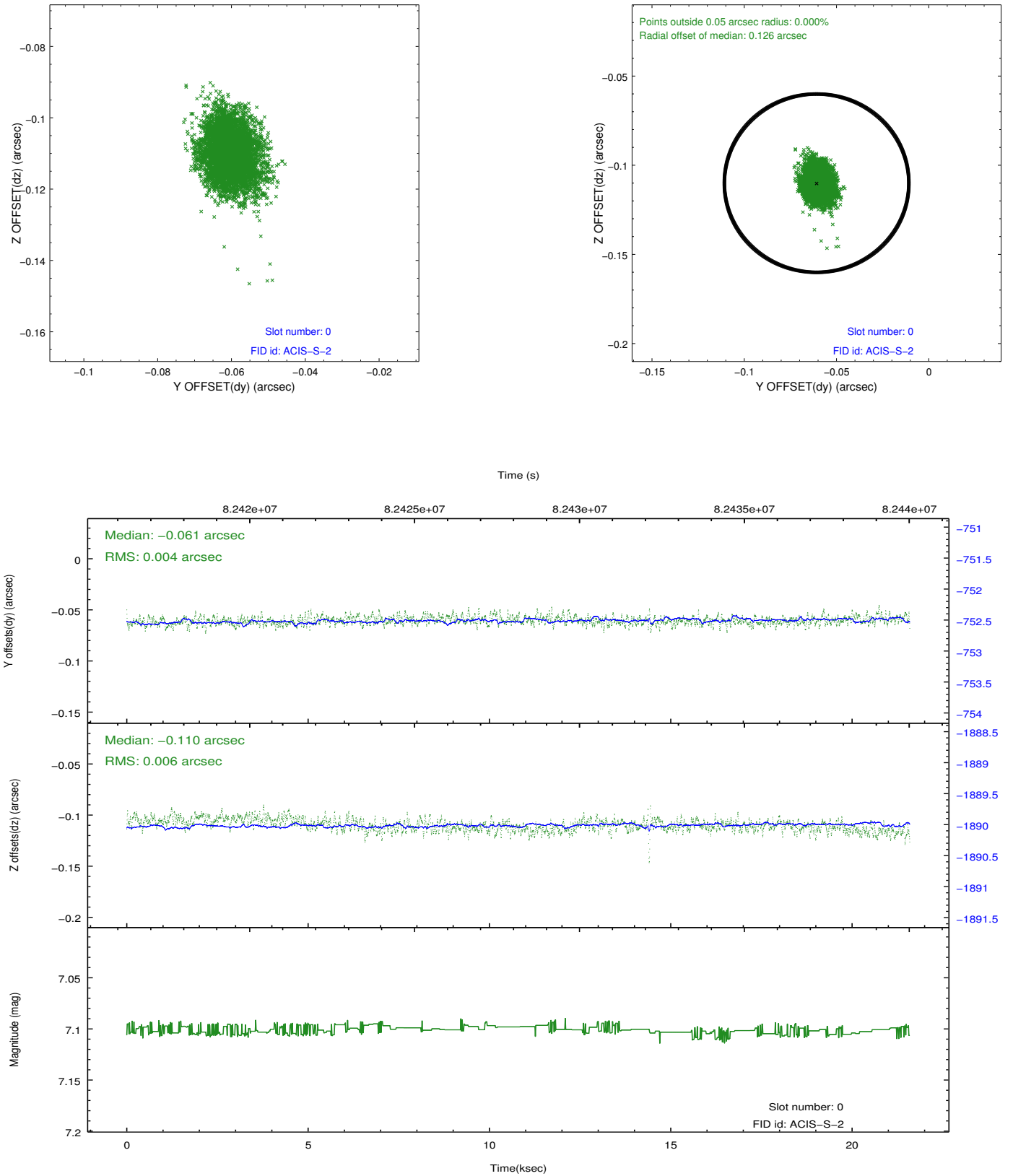


## 2.4.5 Slot 7

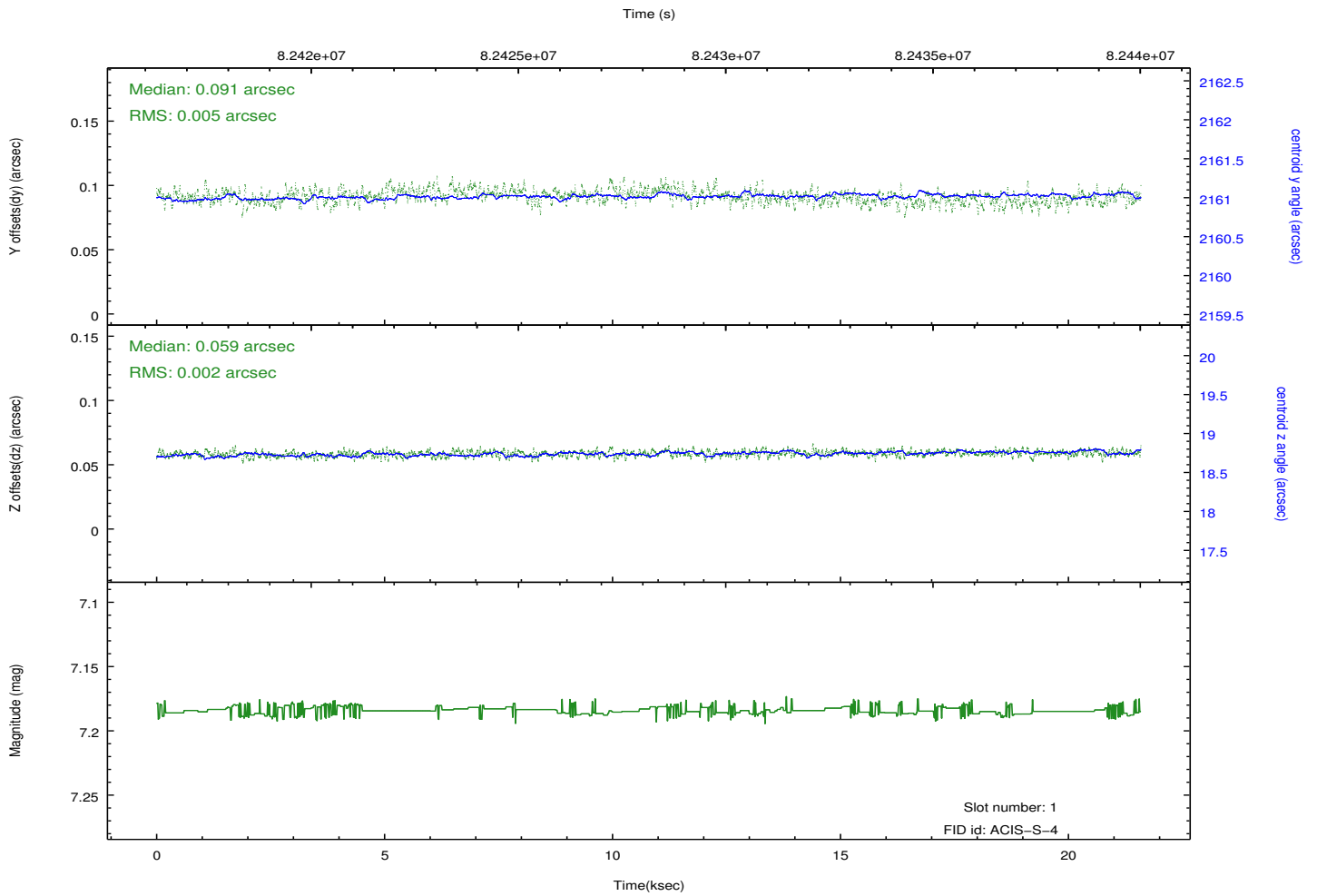
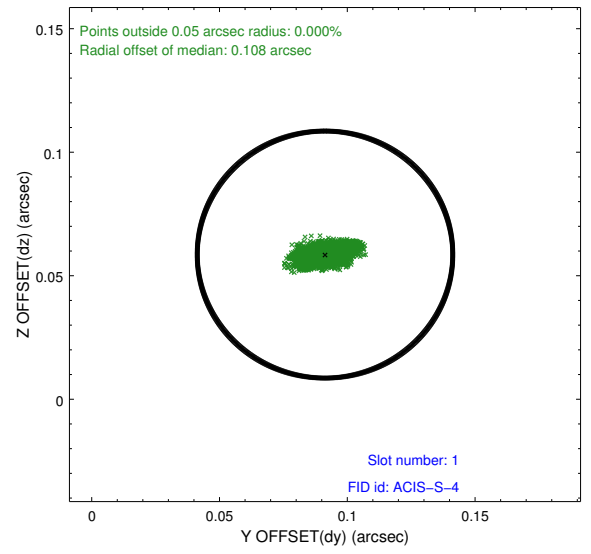
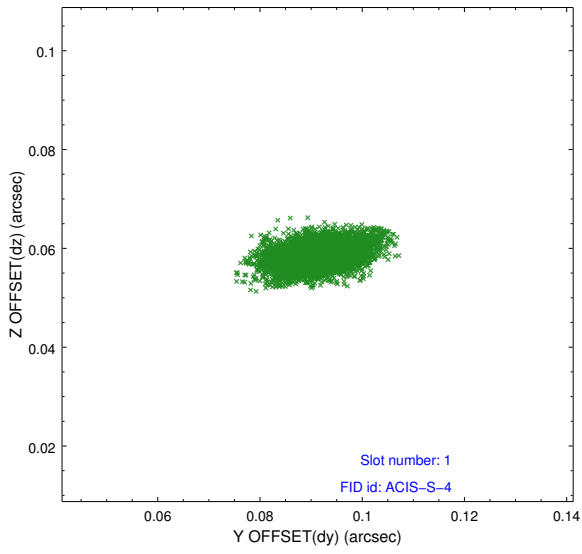


## 2.5 FID Slots

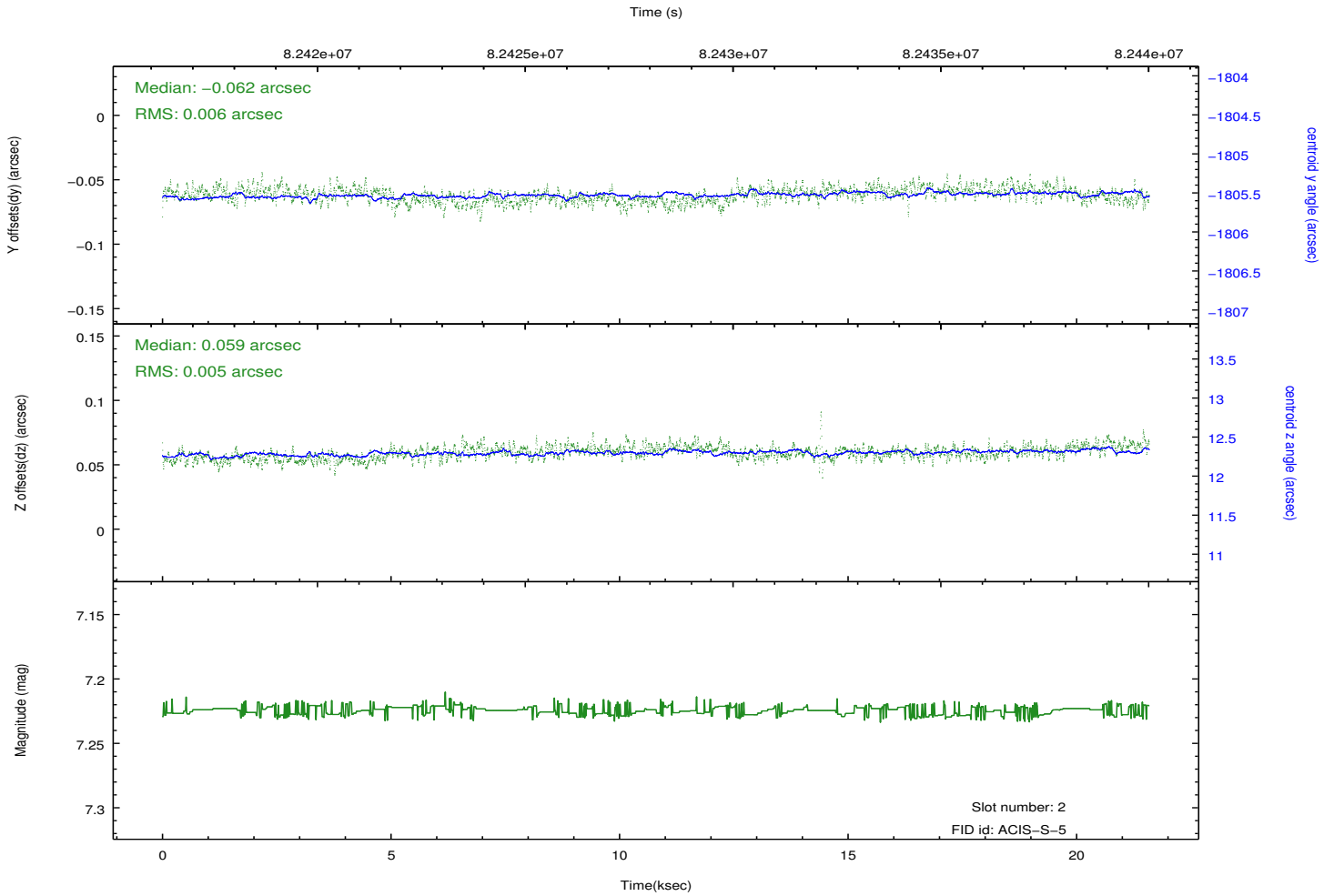
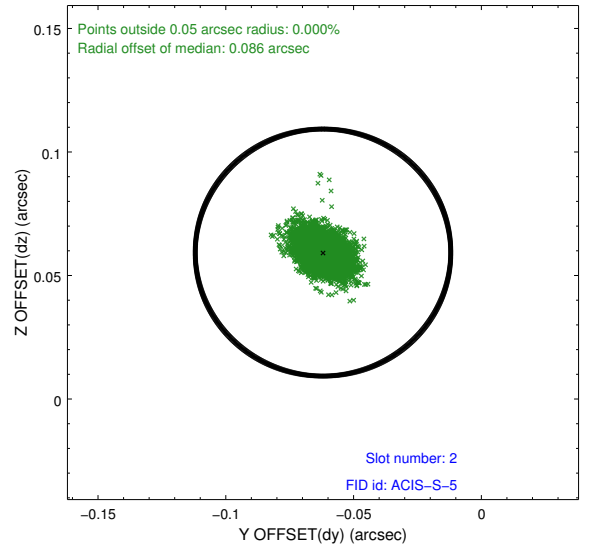
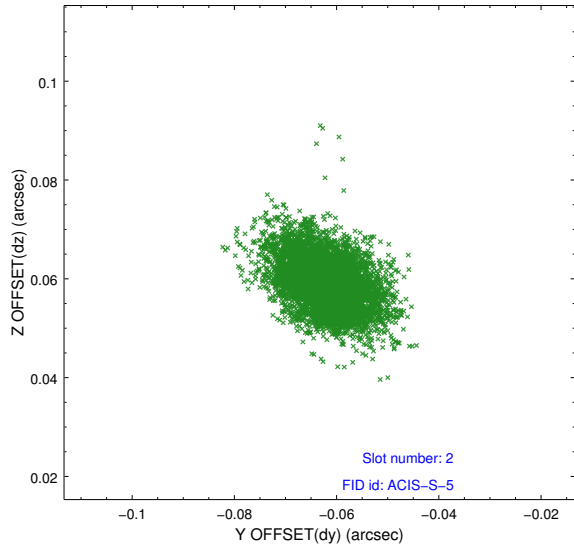
### 2.5.1 Slot 0



## 2.5.2 Slot 1

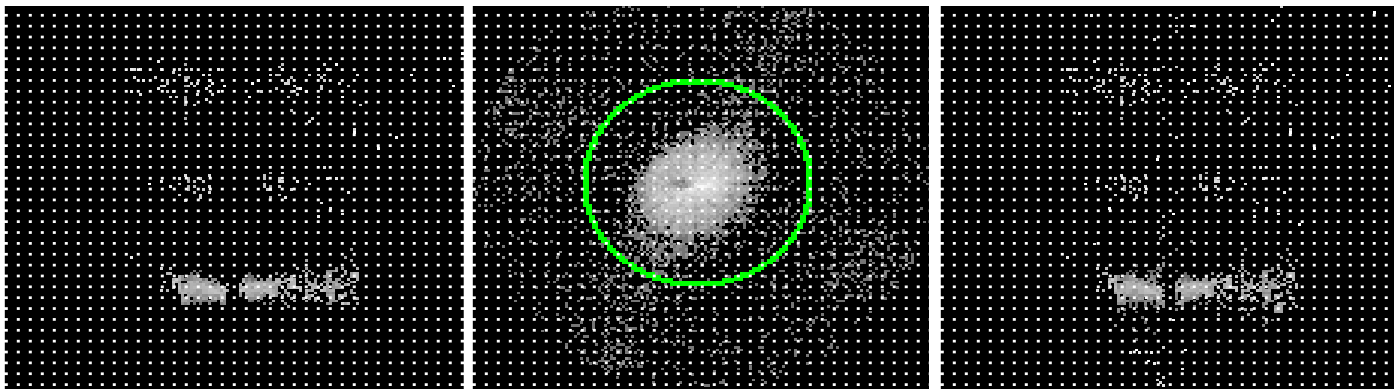


### 2.5.3 Slot 2



### 3 Gratings

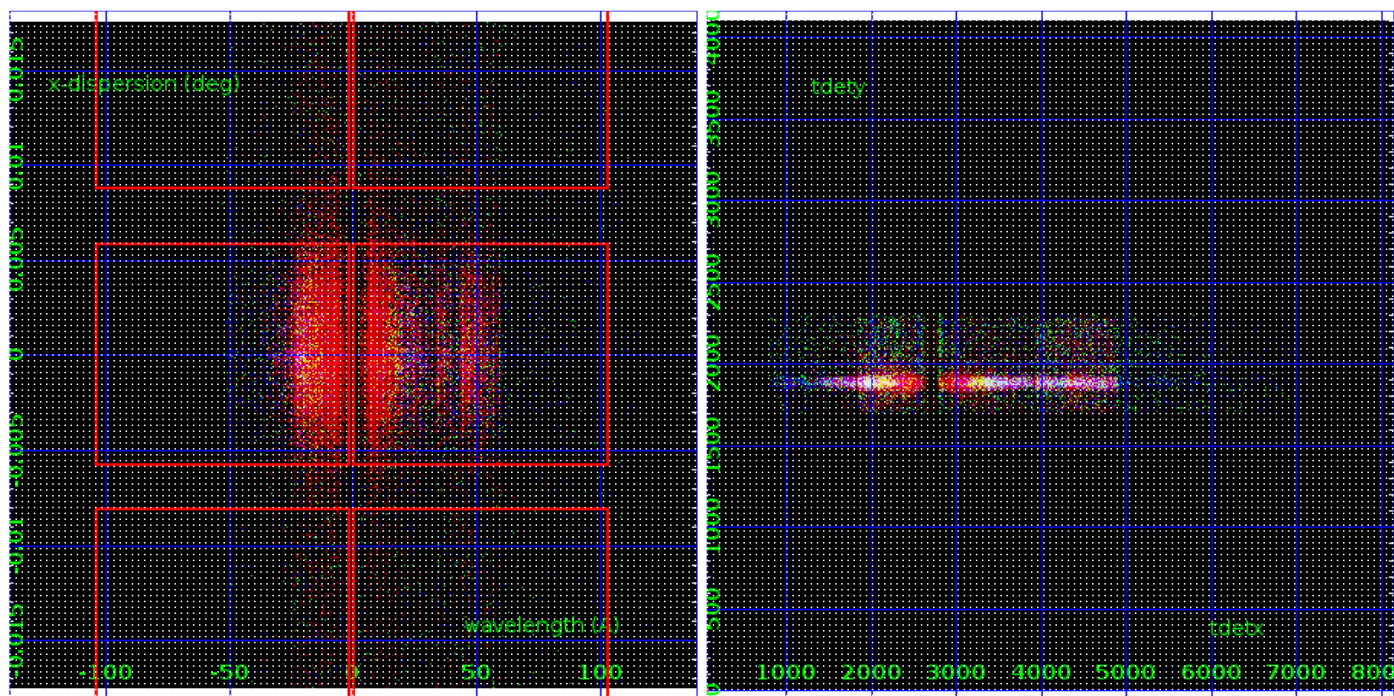
#### 3.1 LETG Arm



LETG Order Sort 123

LETG Zero Order

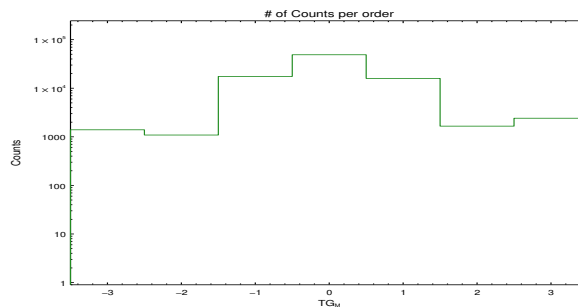
LETG Order Sort ALL

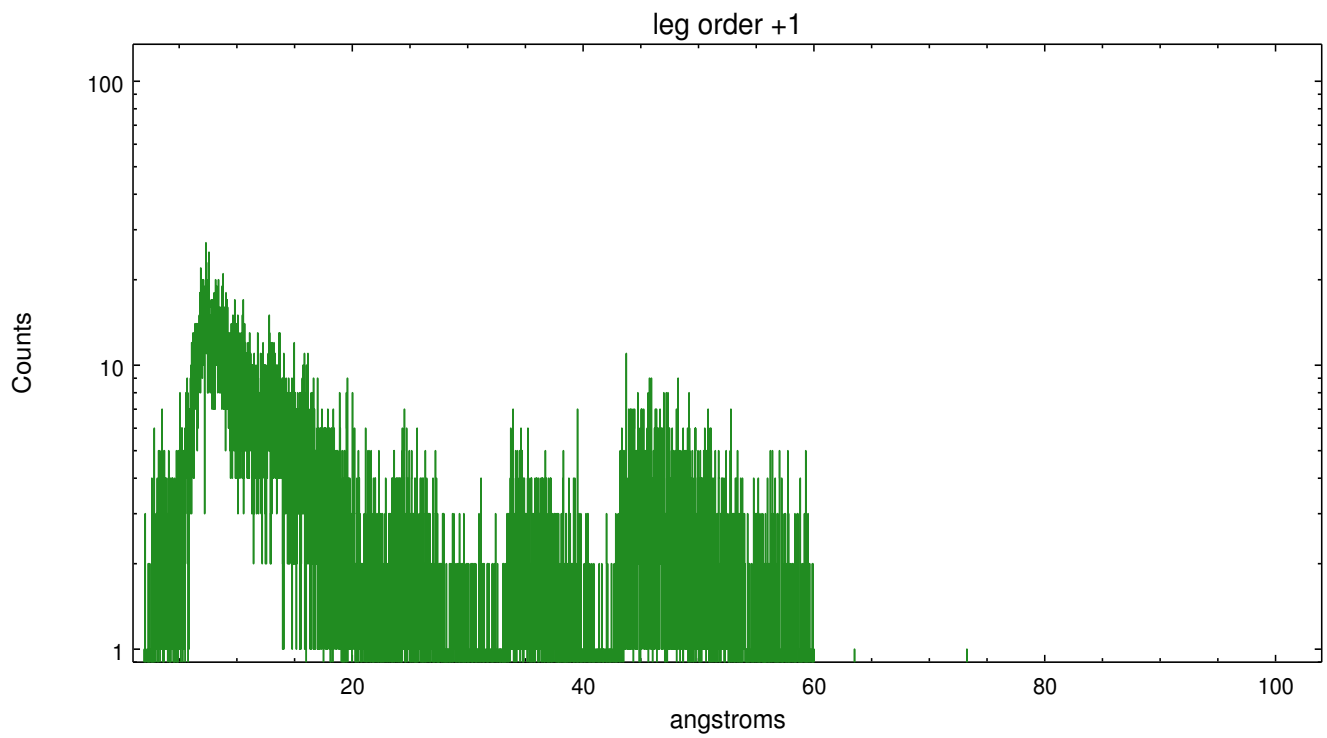
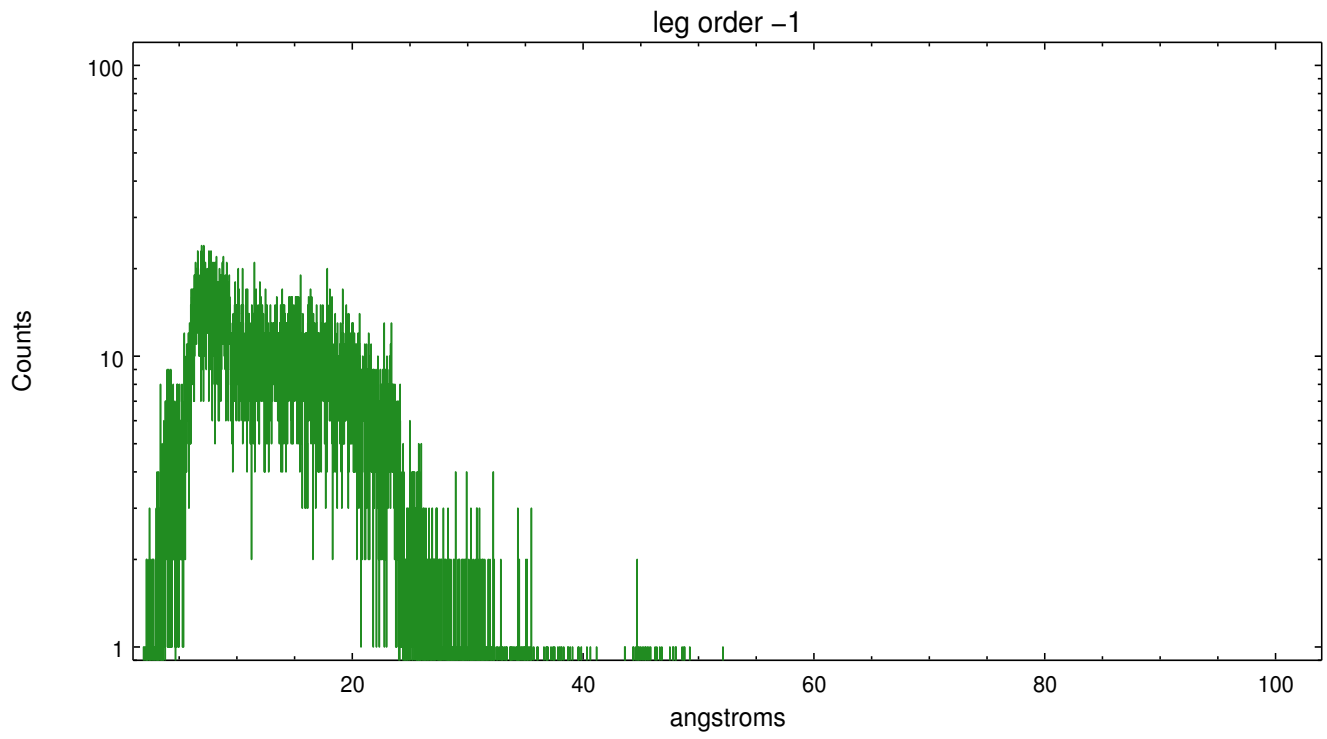


Spot Image LETG

Full Detector LETG

	order -3	order -2	order -1	order 0	order 1	order 2	order 3
Events	1395	1088	17476	48881	15932	1657	2411





# A Summary

## A.1 Status

V&V Scientist	Joy Nichols
V&V Date (YYYY-MM-DD)	2019.04.11
V&V Edition	1
V&V Disposition and Status	OK
V&V Charge Time	21.161

## A.2 Comments

Target far off-axis --- required custom region parameters (detailed below).

===

WARNING: the grating line-spread-function is not calibrated off-axis; there is no valid grating RMF data for this observation. Target very off-axis. In `tg_create_mask`, the zeroth order region needs to be decreased; off-axis, the default size is too large and causes short wavelengths to be omitted from grating region. In `tgextract`, the off-axis source extent requires the `tg_d` range to be increased.

===

Reprocessed using the following method: Columns x, y, r, w give parameters for `tg_create_mask` Columns s1, s2, d1, d2, u1, u2 give paramters for `tgextract`. Customized parts of the usage are as follows:  
`tg_create_mask use_user_pars = yes sA_zero_x = $x sA_zero_y = $y sA_zero_rad = $r sA_width_heg = $w sA_width_meg = $w sA_width_leg = $w tgextract min_tg_d = $s1 max_tg_d = $s2 min_downbkg_tg_d = $d1 max_downbkg_tg_d = $d2 min_upbkg_tg_d = $u1 max_upbkg_tg_d = $u2`  
PKS 2155 series (LETG/ACIS): # obsid x y r w s1 s2 d1 d2 u1 u2 1791 3242.07 4497.14 47.96 598.78 -3.401e-03 3.401e-03 -2.592e-02 -3.887e-03 3.887e-03 2.592e-02.

=====

Zeroth order is extended. The zeroth order sky position was determined using a software tool developed by CXC called `findzero`, which is available in CIAO as part of the `tgdetect2` tool. The tool calculates the point of intersection of the readout streak on the ACIS CCD and the meg dispersed spectral arm, rather than using a centroid position of the source. The `findzero` results are more accurate than source centroid in this case.

=====

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).

=====

The focal plane temperature is warmer than -112.0 C during the interval

82417774.72 - 82438933.12 (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/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.