

# V&V Reference Report

## L2 ASCDS Version : 10.7

Observation 20917 - L2 Version 1  
Chandra X-Ray Center

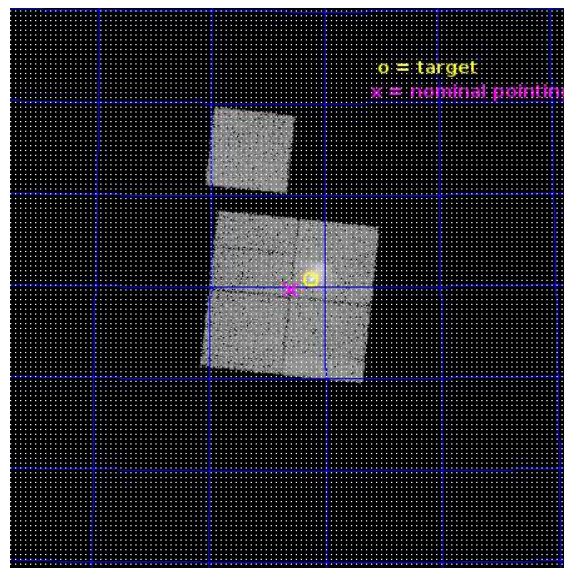
L2 Processing Date : Dec 6 2018

## 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 5 . . . . .	10
2.4.3	Slot 6 . . . . .	11
2.4.4	Slot 7 . . . . .	12
2.5	FID Slots . . . . .	13
2.5.1	Slot 0 . . . . .	13
2.5.2	Slot 1 . . . . .	14
2.5.3	Slot 2 . . . . .	15
<b>A</b>	<b>Summary</b>	<b>16</b>
A.1	Status . . . . .	16
A.2	Comments . . . . .	16

# 1 Front

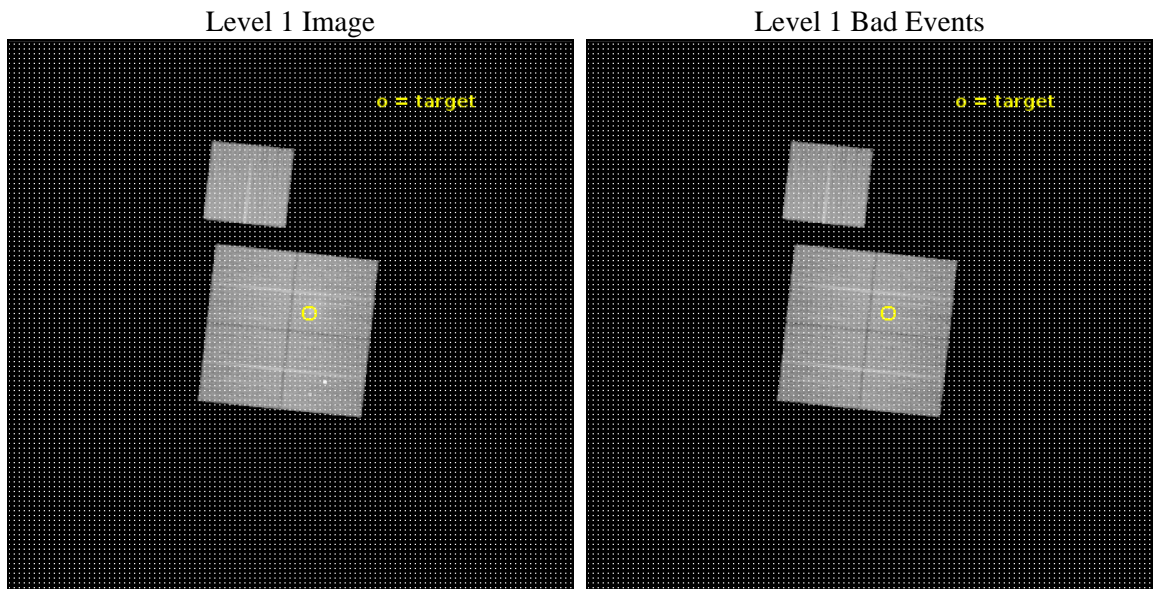
seq_num	801762	Sequence number
obs_id	20917	Observation id
title	Shock structure, the electron-ion equilibration timescale and the disintegrating cool core in A2146	Proposal title
observer	Helen Russell	Principal investigator
object	Abell 2146	Source name
dtcycle	0	&#160
cycle	P	events from which exps? Prim/Second/Both
ra_targ	239.06125	Observer's specified target RA [deg]
dec_targ	66.346917	Observer's specified target Dec [deg]
ra_nom	239.14648928416	Nominal RA [deg]
dec_nom	66.328337213211	Nominal Dec [deg]
roll_nom	6.1306021809973	Nominal Roll [deg]
revision	1	Processing version of data
ontime	22056.418209314	Sum of GTIs [s]
livetime	21768.234867711	Livetime [s]
ontime0	22062.700169802	Sum of GTIs [s]
ontime1	22050.136158824	Sum of GTIs [s]
ontime2	22056.418149471	Sum of GTIs [s]
ontime3	22056.418209314	Sum of GTIs [s]
ontime6	22062.700169802	Sum of GTIs [s]
l2events	88841	Number of level 2 events



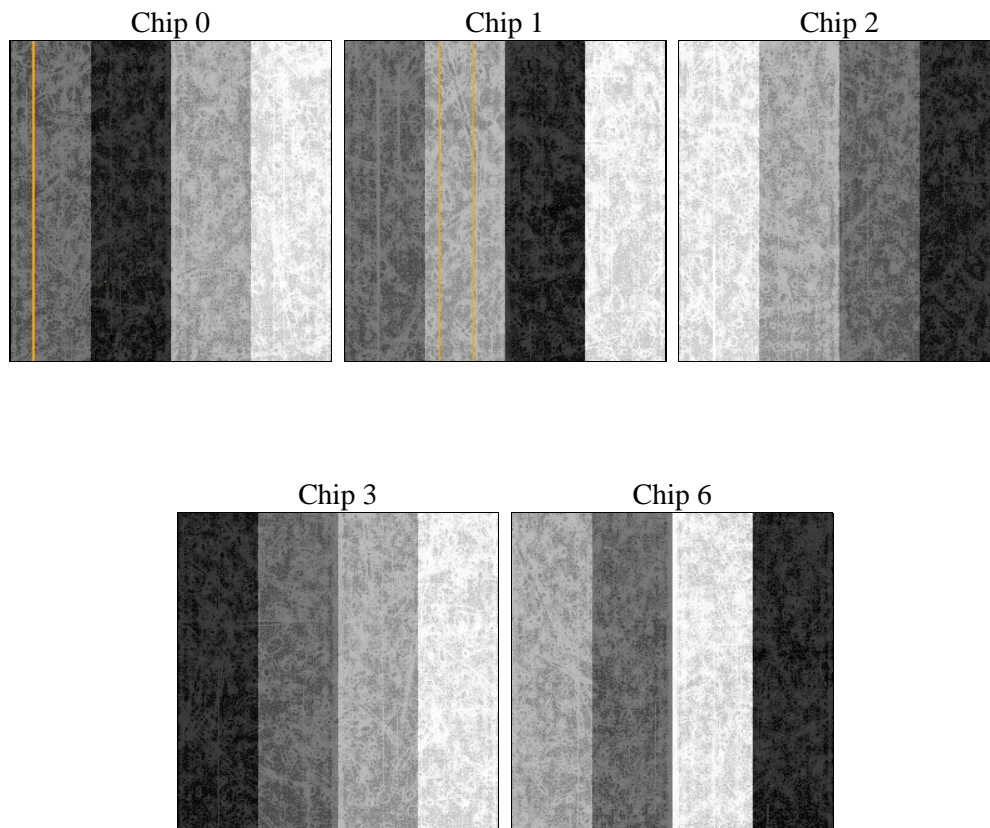
## 2 OBI

### 2.1 OBI

#### 2.1.1 Images



#### 2.1.2 Bias



### 2.1.3 Parameters

obi_num	0	Obi number	sched_exp_time	22000.000000	[s] Scheduled observation exposure time
ascdsver	10.7	Processing system revision	ontime	22056.418209314	Sum of GTIs [s]
caldbver	4.8.0.1	&#160	ontime0	22062.700169802	Sum of GTIs [s]
date	2018-12-07T01:00:10	Date and time of file creation	ontime1	22050.136158824	Sum of GTIs [s]
revision	1	Processing version of data	ontime2	22056.418149471	Sum of GTIs [s]
			ontime3	22056.418209314	Sum of GTIs [s]
			ontime6	22062.700169802	Sum of GTIs [s]
			l1events	859040	Number of level 1 events

### 2.1.4 Events

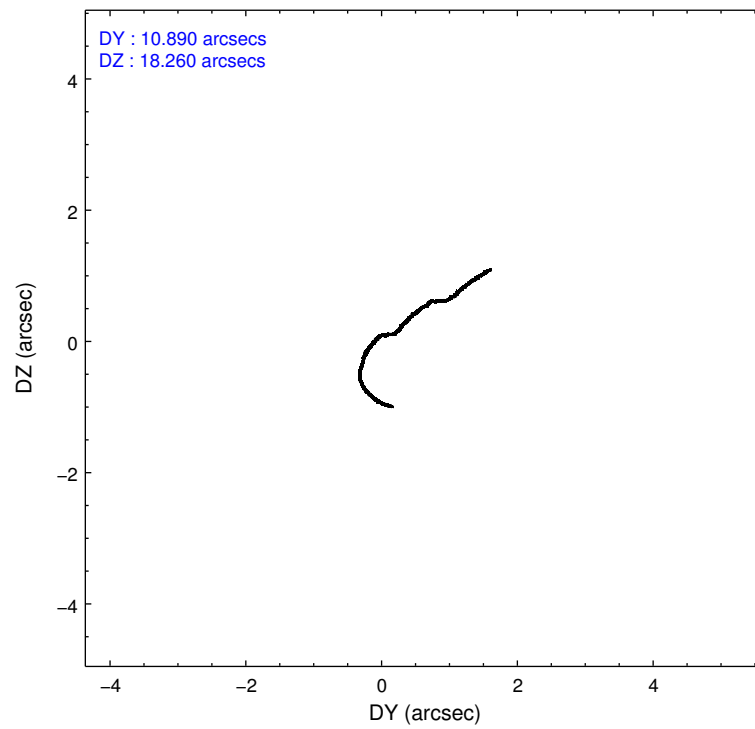
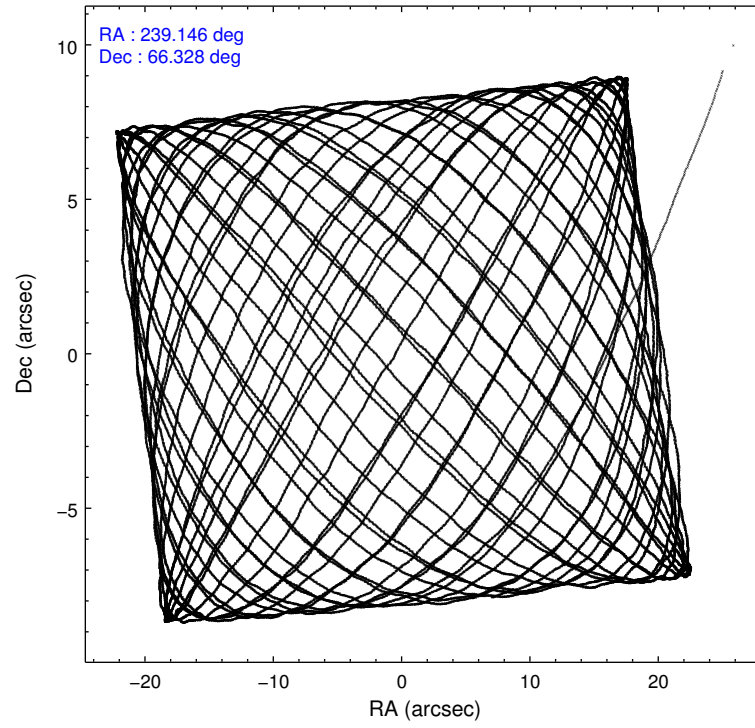
	ccd 0	ccd 1	ccd 2	ccd 3	ccd 6
level 1 events	155684	169335	175693	181793	176535
rejected events	137418	141106	157583	153700	157933
rejected %	88%	83%	89%	84%	89%

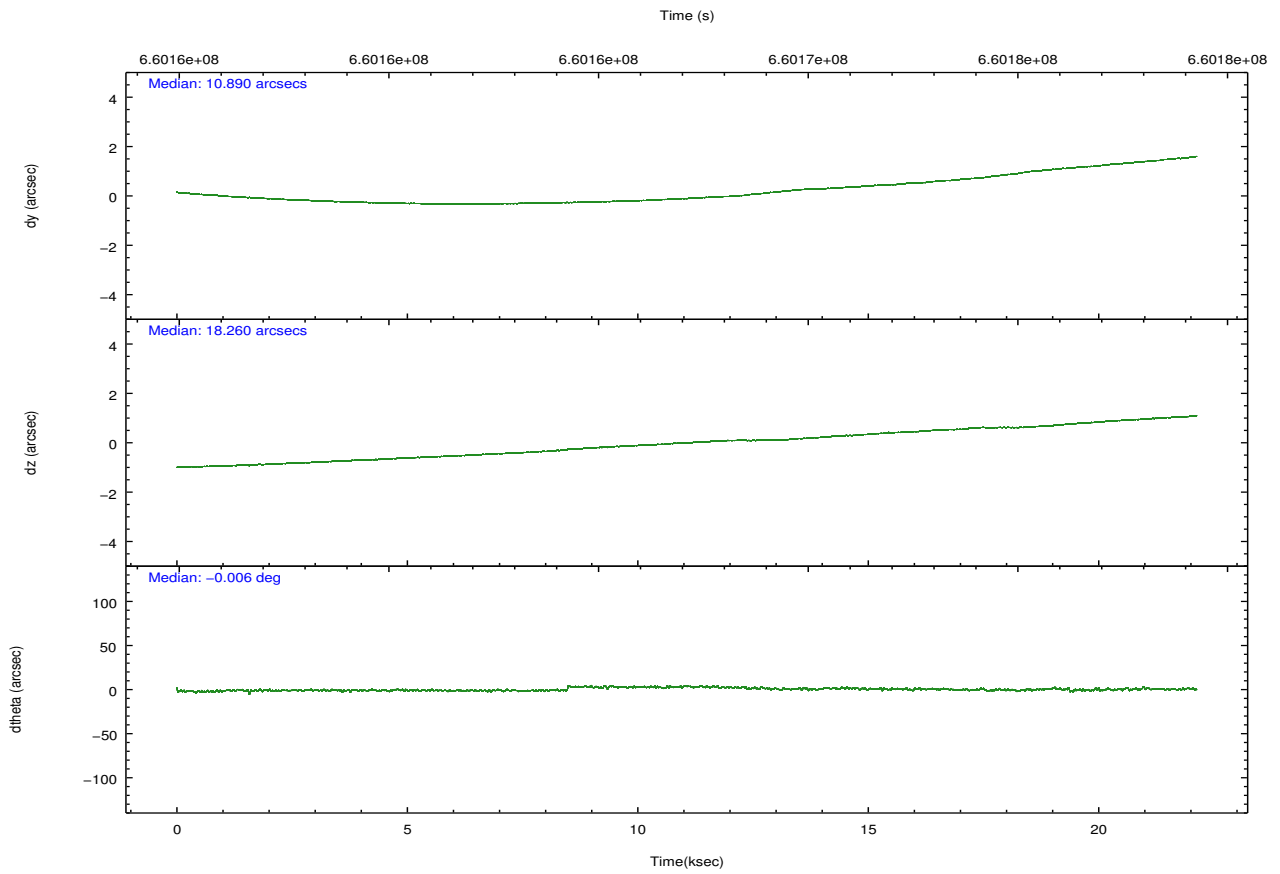
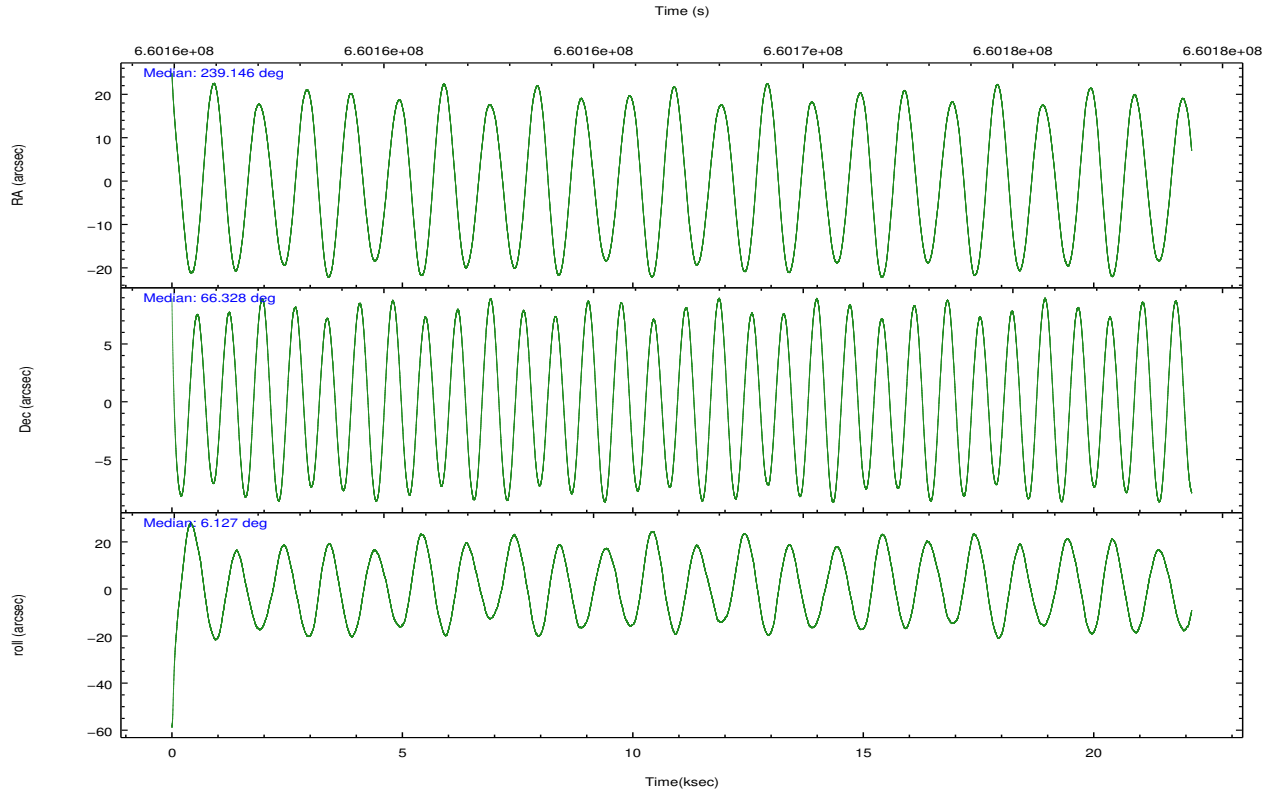
	ccd 0	ccd 1	ccd 2	ccd 3	ccd 6
grade 0 events	5995	7257	6282	14652	5740
	3%	4%	3%	8%	3%
grade 1 events	76	92	109	154	79
	0%	0%	0%	0%	0%
grade 2 events	4762	12421	4545	5038	4728
	3%	7%	2%	2%	2%
grade 3 events	1889	1872	1818	2183	1755
	1%	1%	1%	1%	0%
grade 4 events	1730	1830	1787	2173	1702
	1%	1%	1%	1%	0%
grade 5 events	7028	7347	6608	7956	7463
	4%	4%	3%	4%	4%
grade 6 events	3895	4855	3680	4051	4682
	2%	2%	2%	2%	2%
grade 7 events	130309	133661	150864	145586	150386
	83%	78%	85%	80%	85%

## 2.2 Compared Parameters

Parameter	Planned	Actual	Parameter	Planned	Actual
Instrument	ACIS	ACIS	Obspar format version number	7	7
Detector	ACIS-01236	ACIS-01236	Obspar file type	PREDICTED	ACTUAL
Grating	NONE	NONE	Obspar update status	NONE	UPDATED
Data mode	VFAINT	VFAINT	CCD I0 on	Y	Y
Observation mode	POINTING	POINTING	CCD I1 on	Y	Y
[deg] Pointing RA	239.091133	239.1464892841569	CCD I2 on	Y	Y
[deg] Pointing Dec	66.311975	66.32833721321143	CCD I3 on	Y	Y
[deg] Pointing Roll	5.972630	6.130602180997263	CCD S0 on	N	N
[mm] SIM focus pos	-0.782348	-0.7809083437167272	CCD S1 on	N	N
[mm] SIM defocus	0	0.001439871863259334	CCD S2 on	O1	Y
[mm] SIM translation stage pos	-233.592463	-233.5874344608287	CCD S3 on	N	N
[mm] SIM translation stage offset	0	-0.005018542100998502	CCD S4 on	N	N
[s] Observation start time (MET)	660156189.184000	660154936.27362	CCD S5 on	N	N
Observation start date	2018-12-02T16:42:00	2018-12-02T16:22:16	Number of optional ACIS chips dropped	0	0
[s] Observation end time (MET)	660178189.184000	660178977.13755	On-chip summing requested	N	N
Observation end date	2018-12-02T22:48:40	2018-12-02T23:02:57	Subarray requested	NONE	NONE
Read mode	TIMED	TIMED	Alternating exposures requested	N	N
			[s] Primary exposure time	0.000000	3.1

## 2.3 Aspect





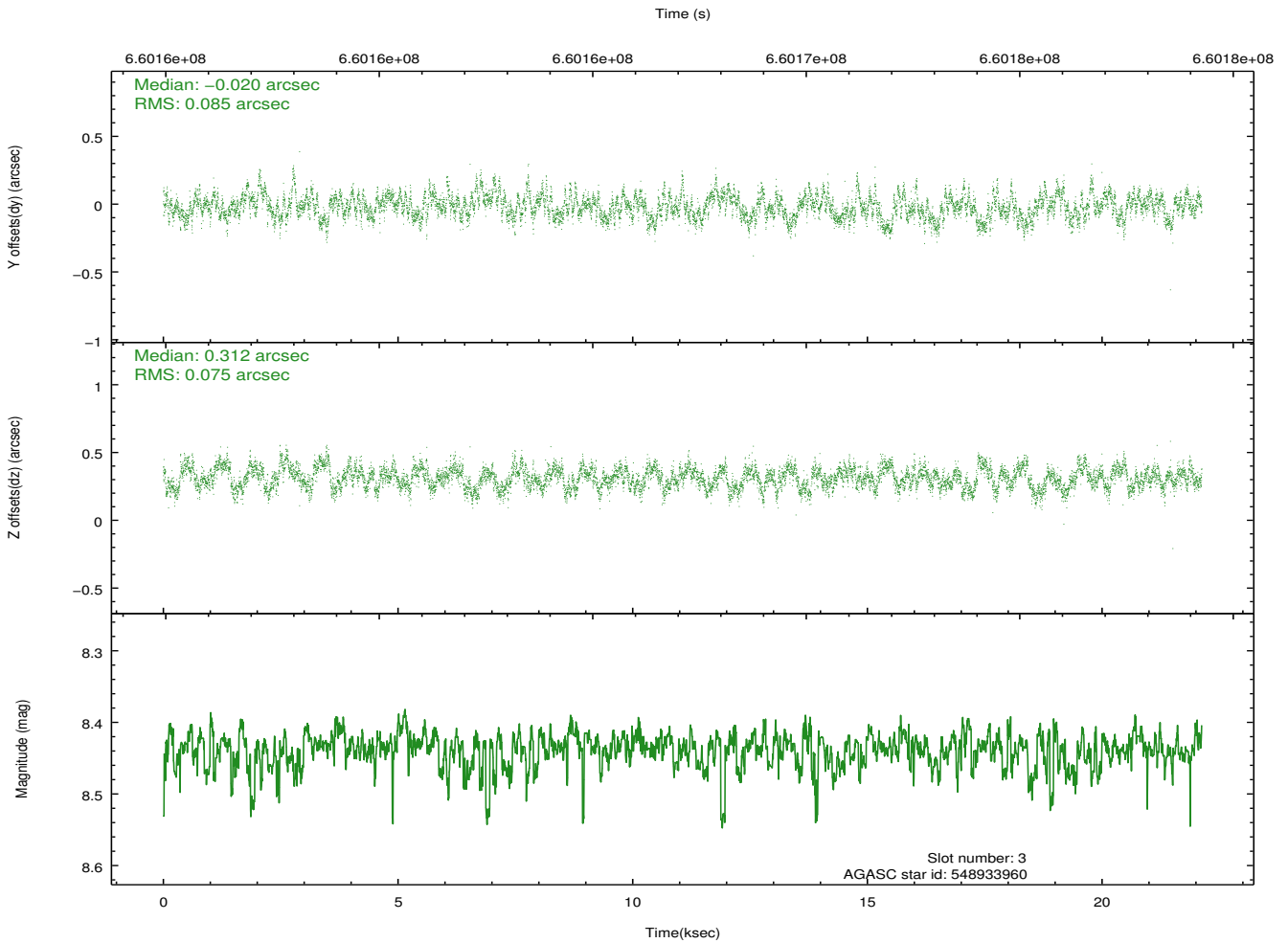
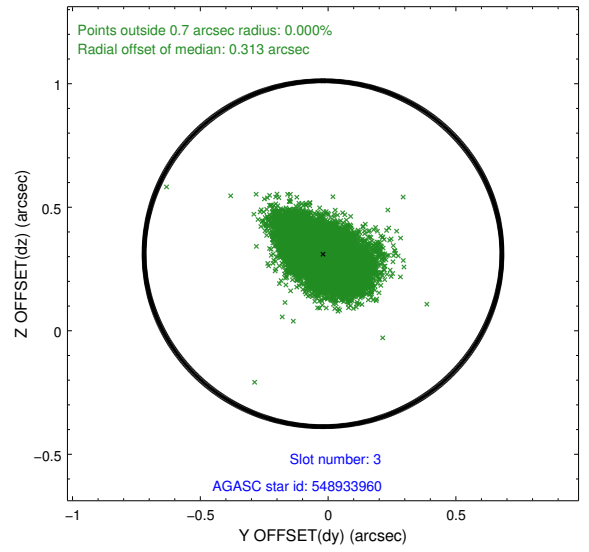
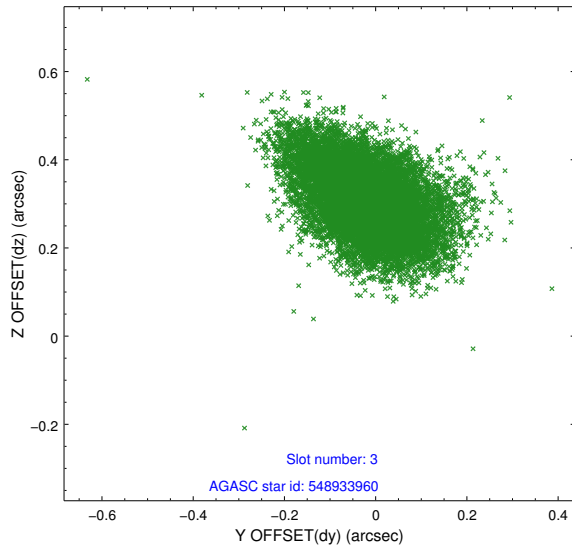
### Slot Statistics

slot	status	used	id	mag	n_pts	frac_pts	med_dy	med_dz	dr1	dr2	ra	dec	mean_y	mean_x
0	FID		ACIS-I-2	7.11	5397	1.000	-0.377	-0.111	0.054	0.078	0.000000	0.000000	-766.06	-848
1	FID		ACIS-I-4	7.16	5395	1.000	0.733	0.221	0.024	0.033	0.000000	0.000000	2148.92	1058
2	FID		ACIS-I-5	7.21	5396	1.000	-0.453	-0.041	0.030	0.048	0.000000	0.000000	-1819.88	1055
3	GUIDE	used	548933960	8.44	10790	1.000	-0.020	0.312	0.119	0.200	237.671184	66.428675	-1986.61	652
4	OMITTED			0.00	0	0.000	0.000	0.000	0.000	0.000	0.000000	0.000000	0.00	0
5	GUIDE	used	549849072	9.22	10780	1.000	-0.341	-0.384	0.167	0.256	240.420863	66.802816	2060.95	1580
6	GUIDE	used	549849656	9.17	10768	1.000	0.355	-0.058	0.212	0.366	240.650889	65.694358	2071.04	-2422
7	GUIDE	used	548932512	8.62	10784	1.000	0.025	0.134	0.114	0.188	239.727627	66.054972	830.14	-1011

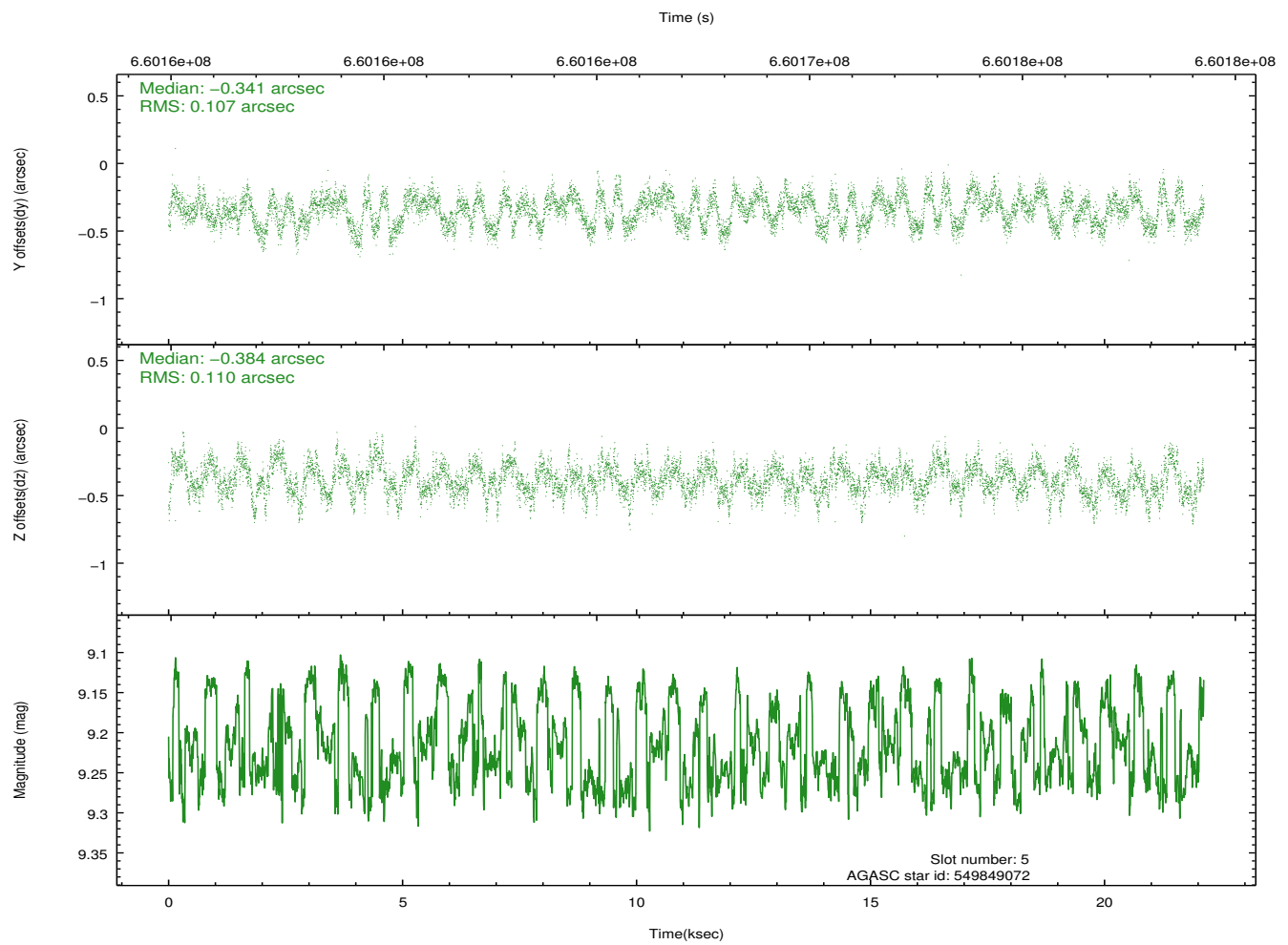
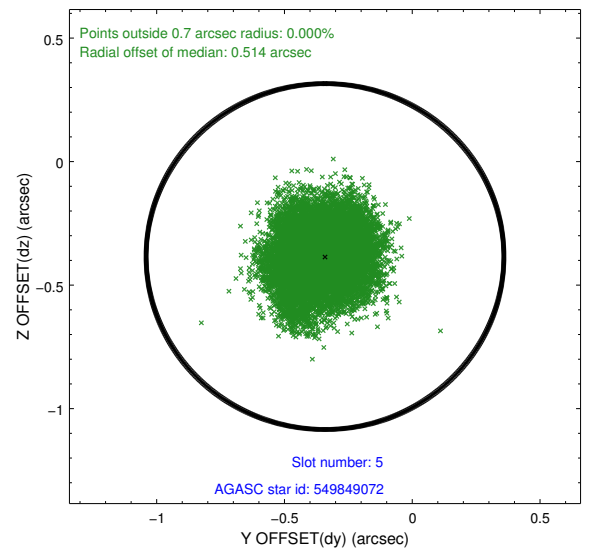
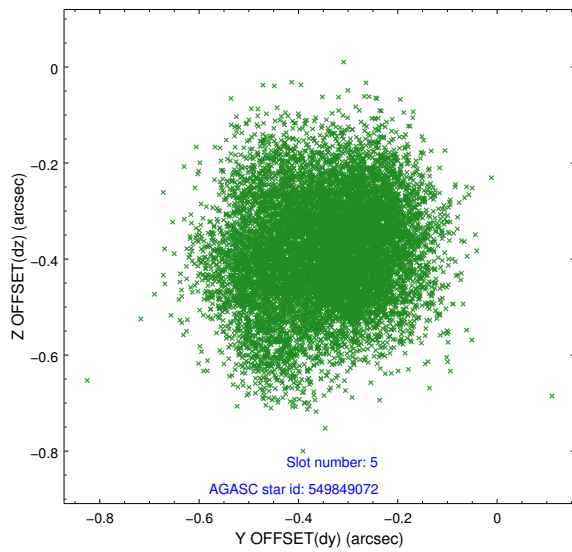
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## 2.4 Star Slots

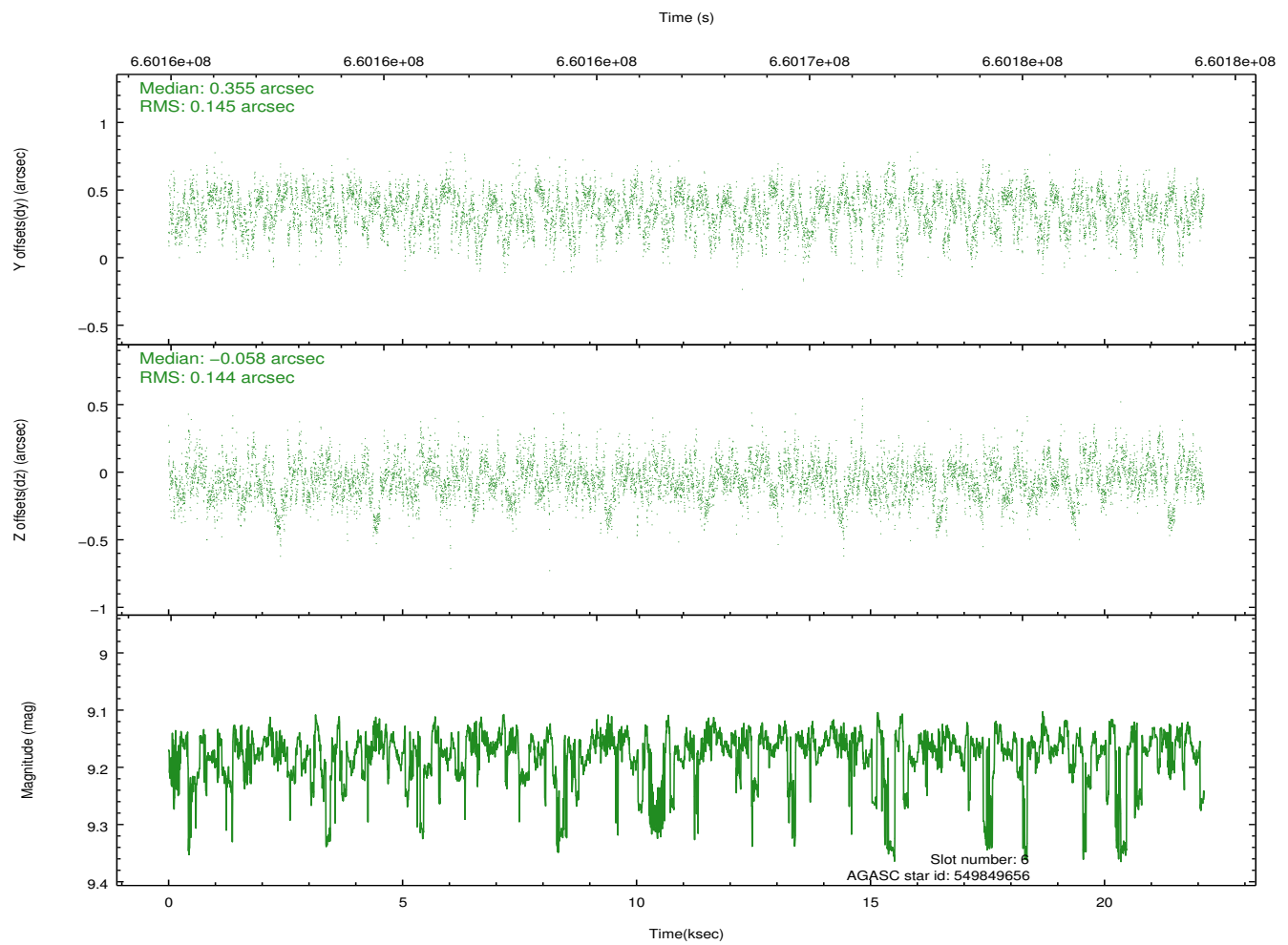
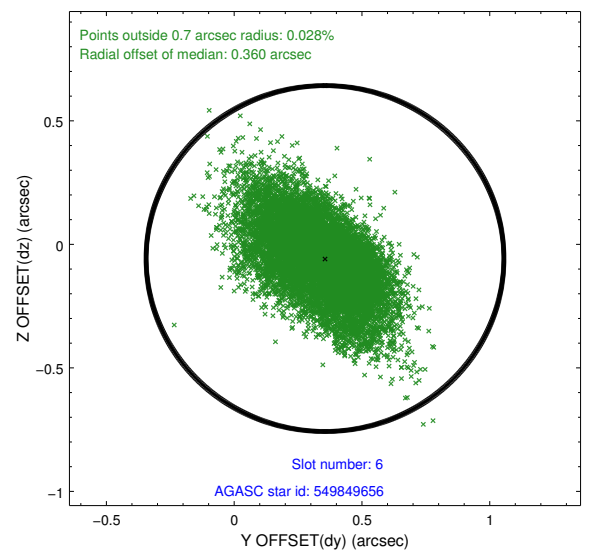
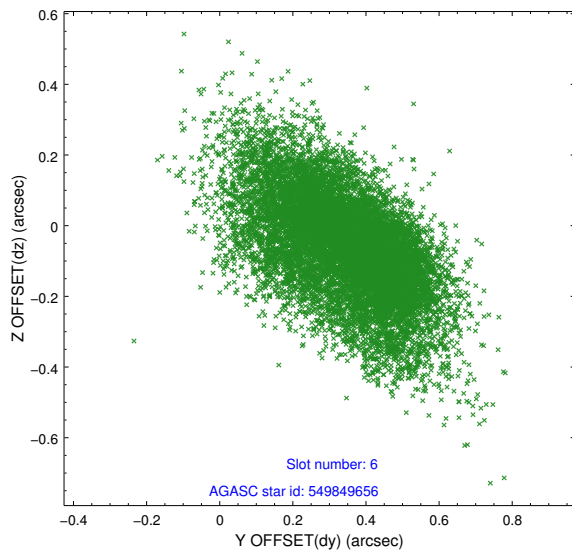
### 2.4.1 Slot 3



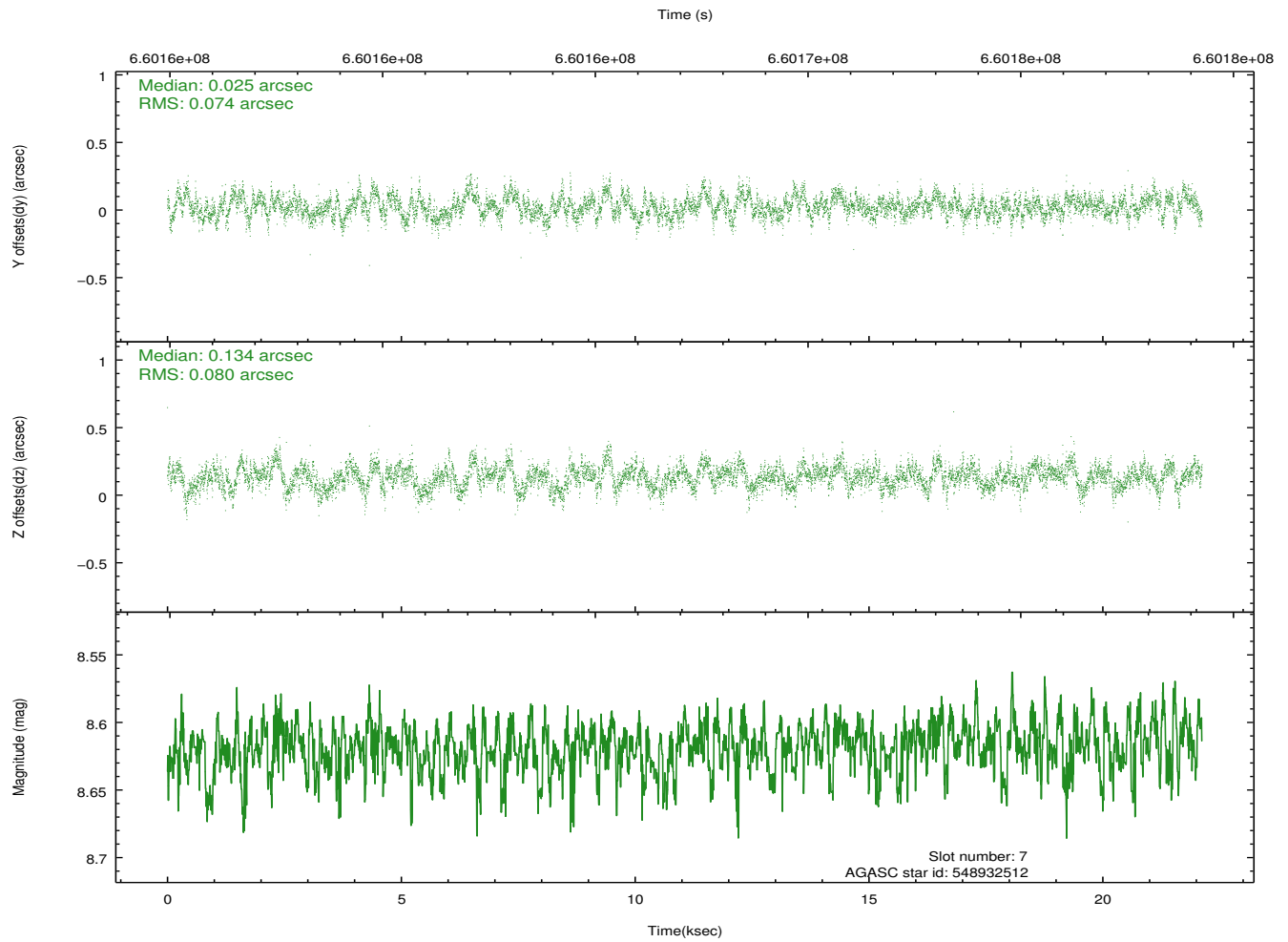
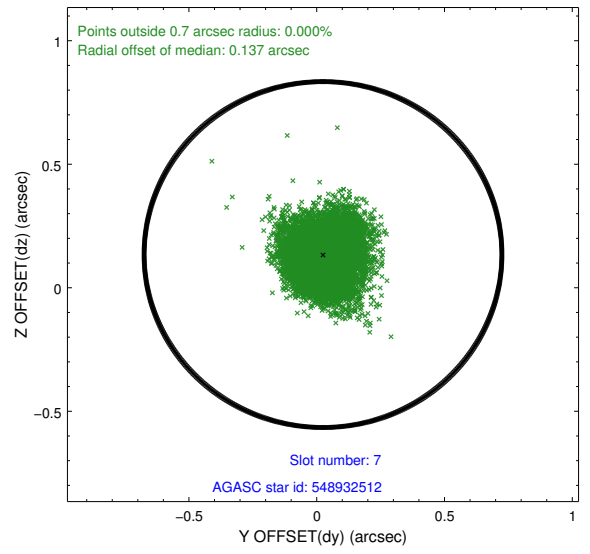
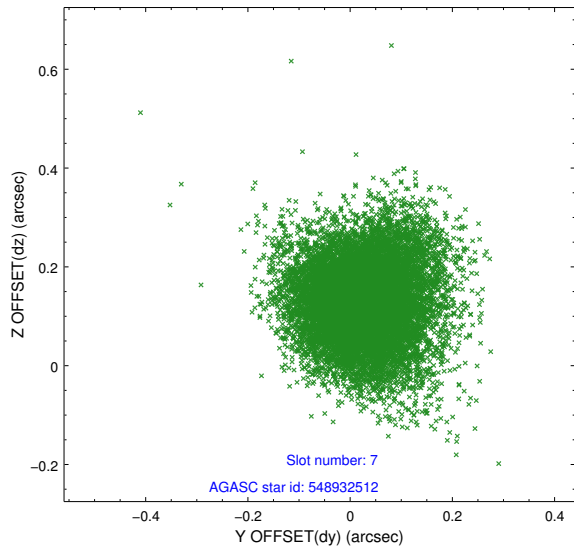
## 2.4.2 Slot 5



### 2.4.3 Slot 6

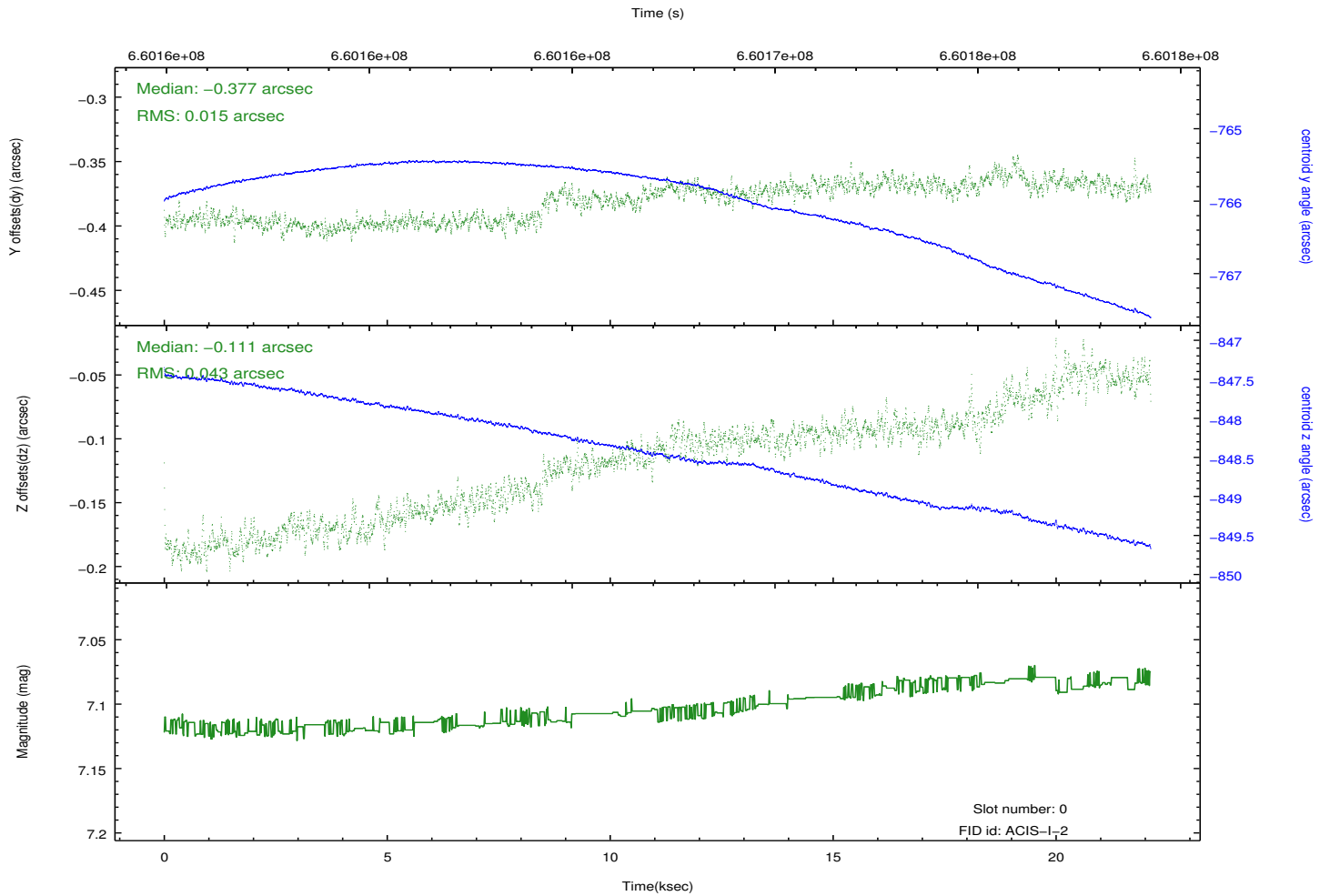
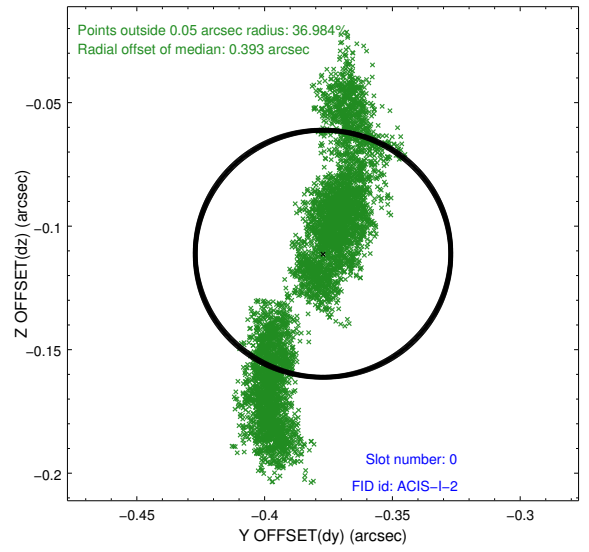
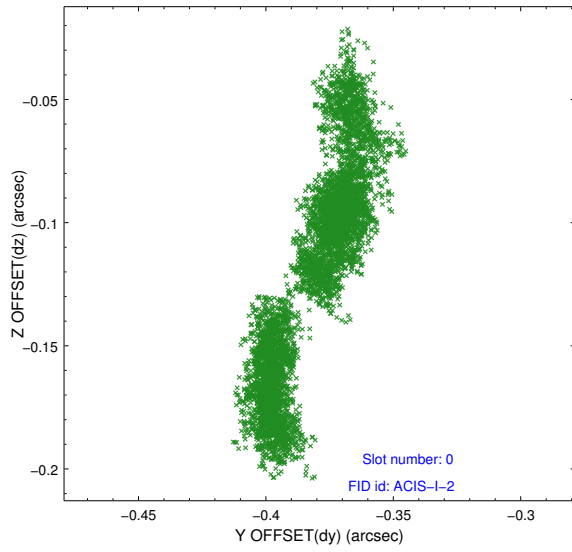


### 2.4.4 Slot 7

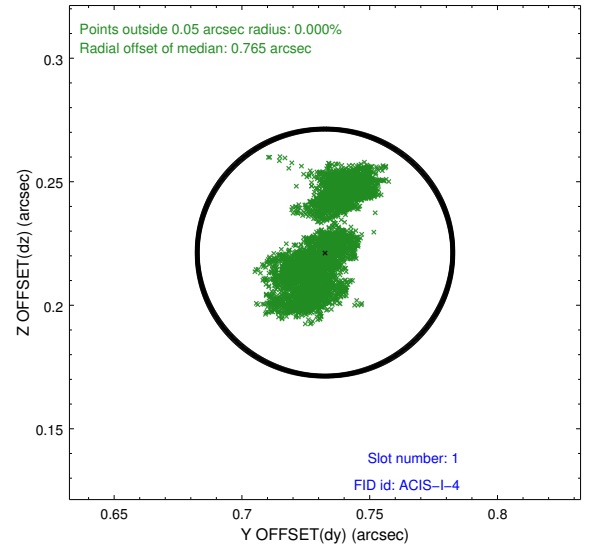
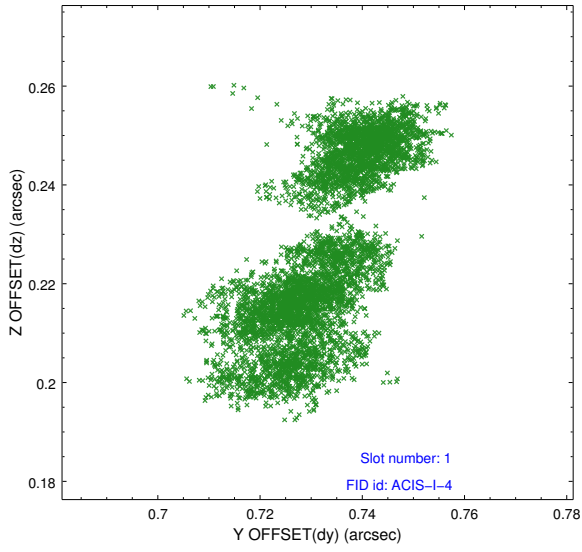


## 2.5 FID Slots

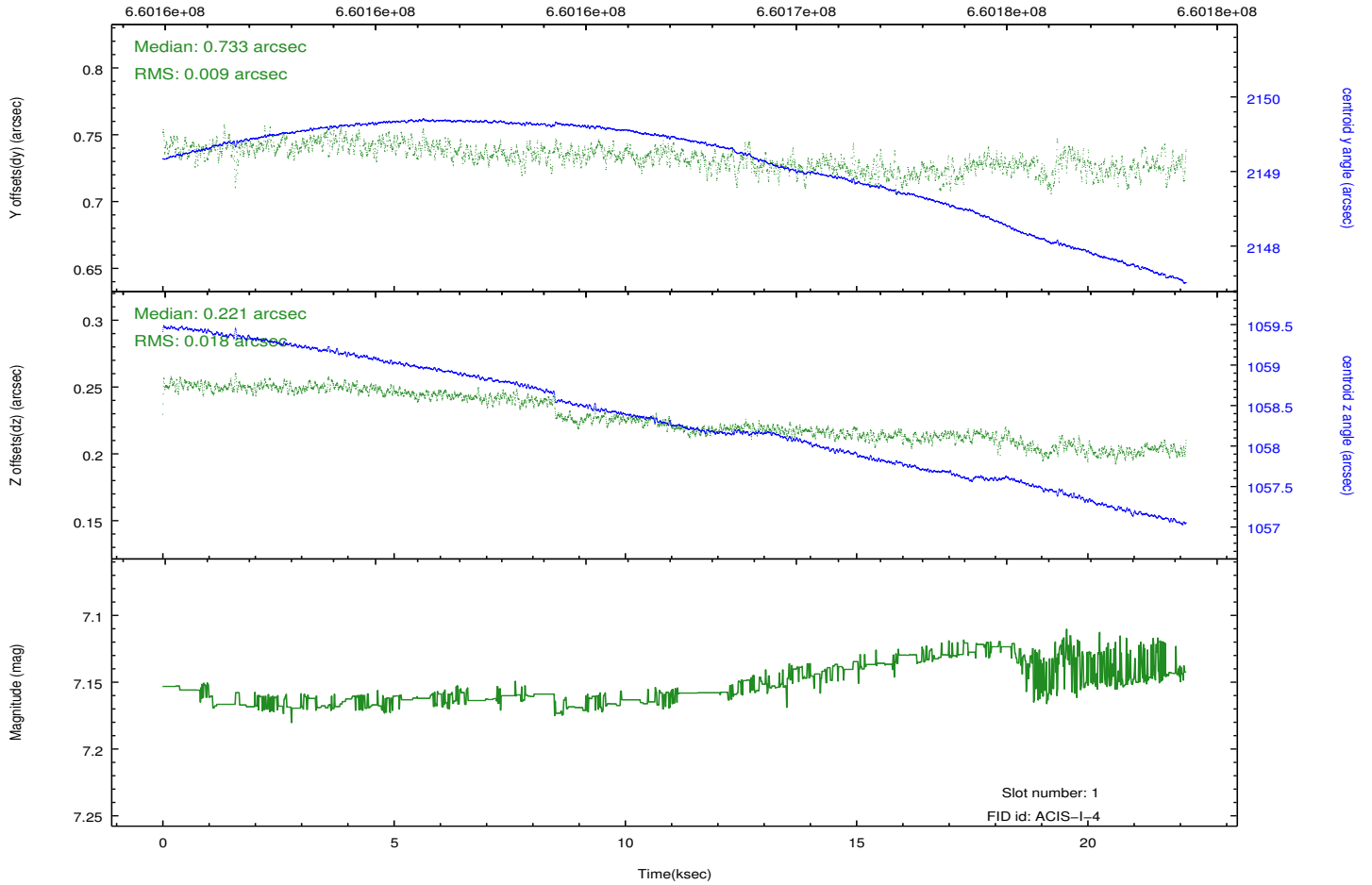
### 2.5.1 Slot 0



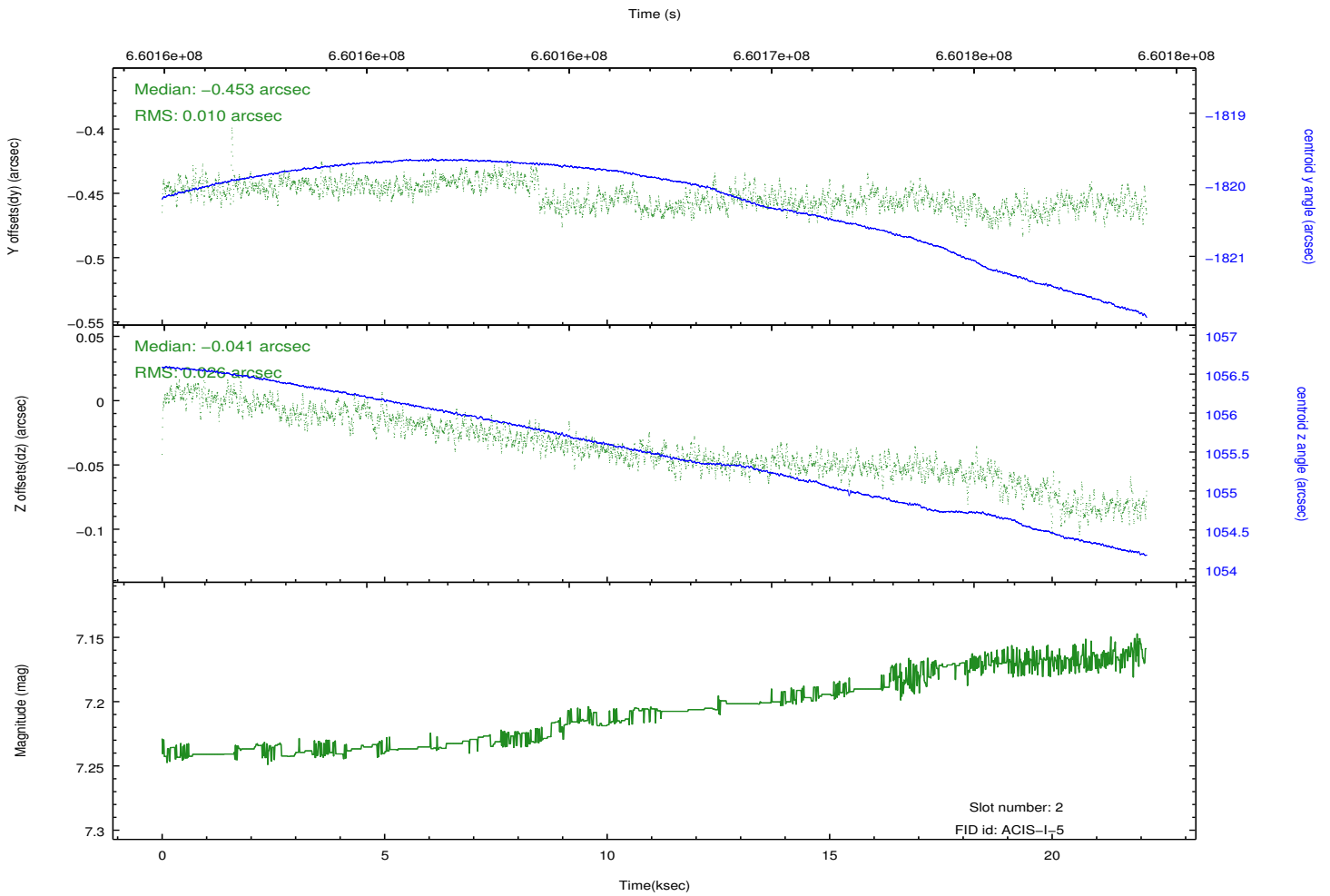
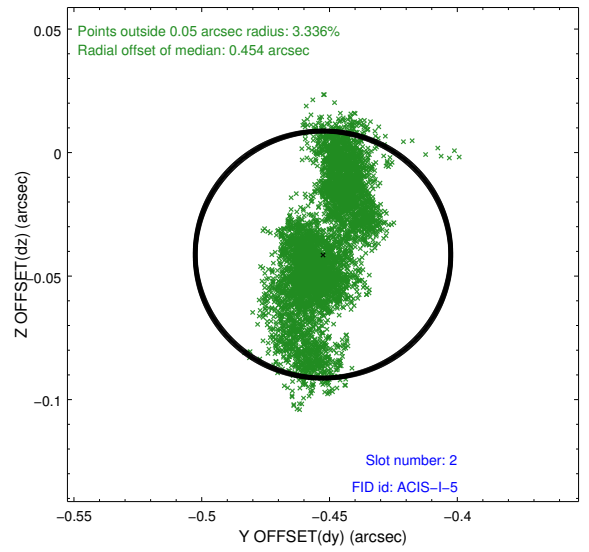
## 2.5.2 Slot 1



Time (s)



### 2.5.3 Slot 2



# A Summary

## A.1 Status

V&V Scientist	Beth Sundheim
V&V Date (YYYY-MM-DD)	2018.12.07
V&V Edition	1
V&V Disposition and Status	OK
V&V Charge Time	22.056418209314

## A.2 Comments

The guide star in slot 4 was removed from the aspect solution due to poor data quality. The aspect solution is improved by the removal of this slot from the solution.

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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.