V&V Reference Report
L2 ASCDS Version : 10.7.1

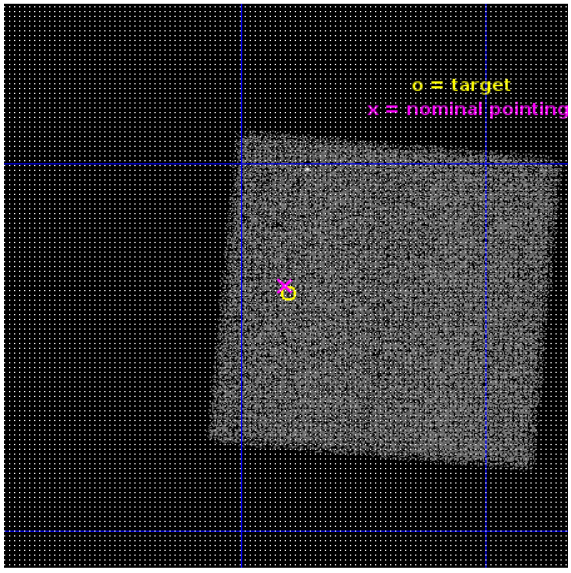
Observation 22209 - L2 Version 1
Chandra X-Ray Center

L2 Processing Date : May 4 2019

Contents

1 Front

seq_num	703889	Sequence number
obs_id	22209	Observation id
title	Chandra-NuSTAR synergy in the NuSTAR serendipitous survey	Proposal
observer	Dr David Alexander	Principal investigator
object	Cen_X4_s2	Source name
dtycycle	0	
cycle	P	events from which exps? Prim/Second/Both
ra_targ	224.600525	Observer's specified target RA [deg]
dec_targ	-31.725735	Observer's specified target Dec [deg]
ra_nom	224.60237405155	Nominal RA [deg]
dec_nom	-31.722005635596	Nominal Dec [deg]
roll_nom	5.1576103635887	Nominal Roll [deg]
revision	1	Processing version of data
ontime	20382.0	Sum of GTIs [s]
livetime	20106.937100466	Livetime [s]
ontime7	20382.0	Sum of GTIs [s]
l2events	84537	Number of level 2 events

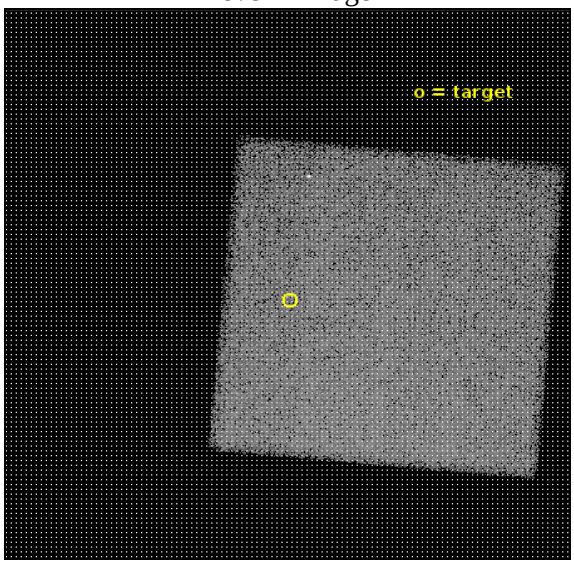


2 OBI

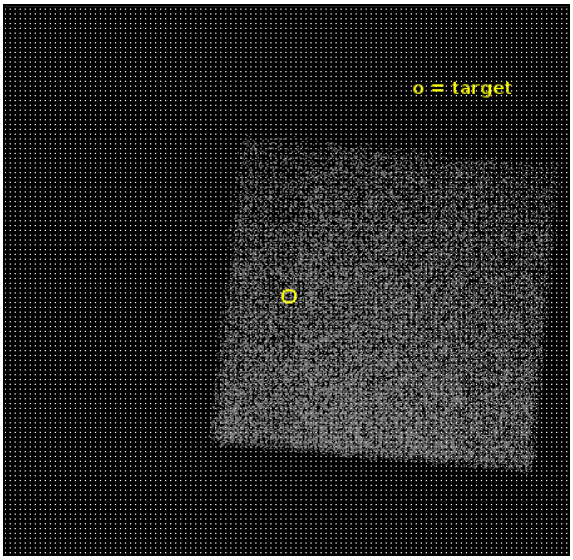
2.1 OBI

2.1.1 Images

Level 1 Image

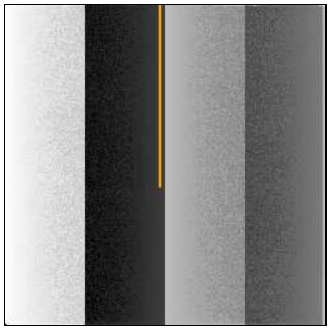


Level 1 Bad Events



2.1.2 Bias

Chip 7



2.1.3 Parameters

obi_num	0	Obi number
ascdsver	10.7.1	Processing system revision
caldbver	4.8.2	
date	2019-05-04T14:35:43	Date and time of file creation
revision	1	Processing version of data

sched_exp_time	20292.086000	[s] Scheduled observation exposure time
ontime	20382.0	Sum of GTIs [s]
ontime7	20382.0	Sum of GTIs [s]
l1events	199706	Number of level 1 events

2.1.4 Events

	ccd 7
level 1 events	199706
rejected events	112869
rejected %	56%

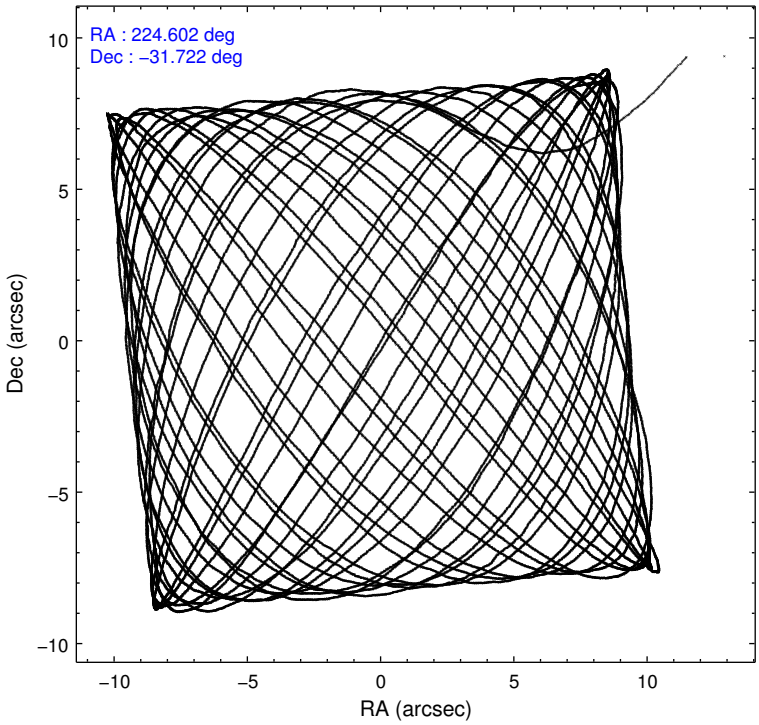
	ccd 7
grade 0 events	7292
	3%
grade 1 events	308
	0%
grade 2 events	17789
	8%
grade 3 events	6808
	3%
grade 4 events	6761
	3%
grade 5 events	18877
	9%
grade 6 events	48218
	24%
grade 7 events	93653
	46%

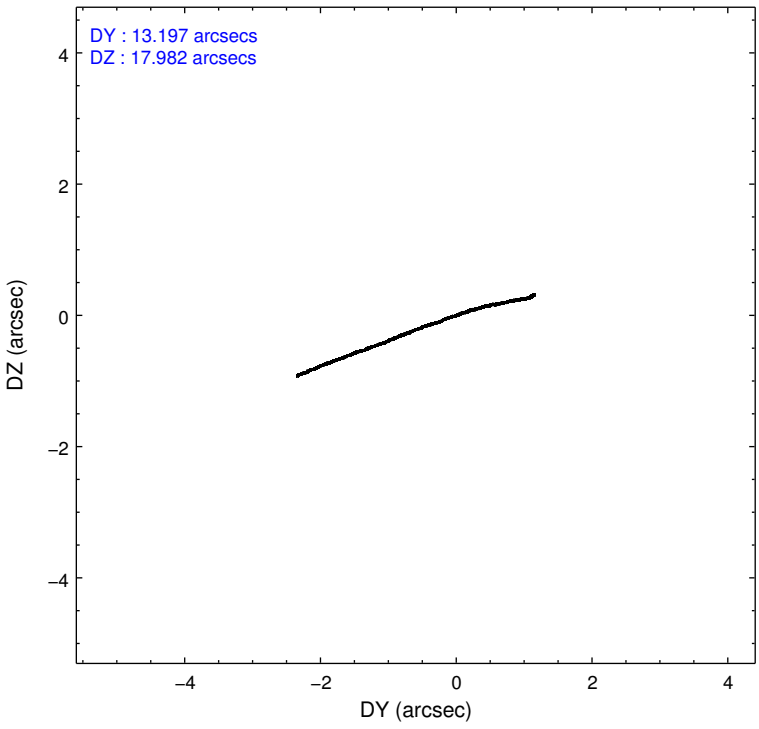
2.2 Compared Parameters

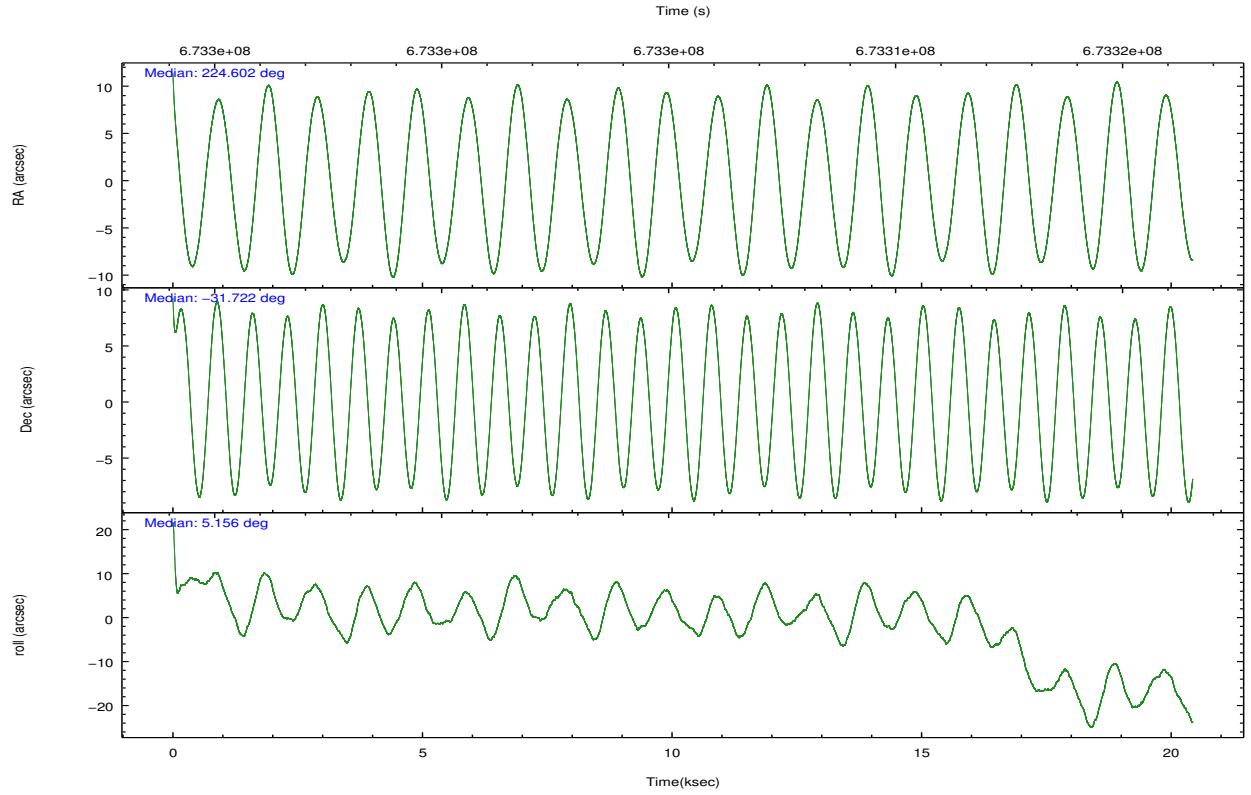
Parameter	Planned	Actual
Instrument	ACIS	ACIS
Detector	ACIS-7	ACIS-7
Grating	NONE	NONE
Data mode	VFAINT	VFAINT
Observation mode	POINTING	POINTING
[deg] Pointing RA	224.576256	224.6023740515514
[deg] Pointing Dec	-31.738121	-31.72200563559635
[deg] Pointing Roll	4.987236	5.157610363588719
[mm] SIM focus pos	-0.684267	-0.6828225247311905
[mm] SIM defocus	0	0.001444936568705701
[mm] SIM translation stage pos	-190.132523	-190.1425803651734
[mm] SIM translation stage offset	0	0.01005778216563158
[s] Observation start time (MET)	673295261.184000	673293891.8712699
Observation start date	2019-05-03T18:26:32	2019-05-03T18:04:51
[s] Observation end time (MET)	673315553.184000	673316877.49764
Observation end date	2019-05-04T00:04:44	2019-05-04T00:27:57
Read mode	TIMED	TIMED

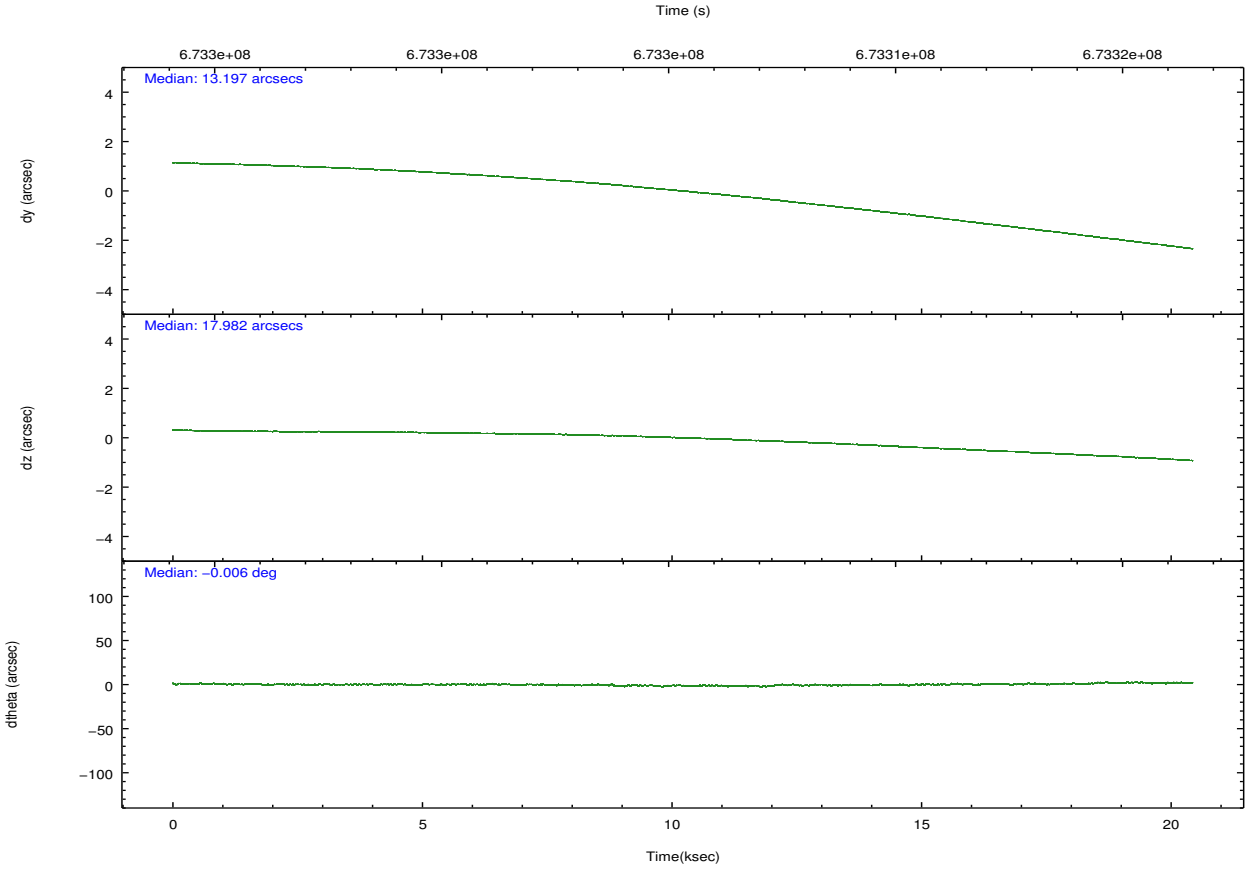
Parameter	Planned	Actual
Obspar format version number	7	7
Obspar file type	PREDICTED	ACTUAL
Obspar update status	NONE	UPDATED
Number of optional ACIS chips dropped	0	0
On-chip summing requested	N	N
Subarray requested	NONE	NONE
Alternating exposures requested	N	N
[s] Primary exposure time	0.000000	3

2.3 Aspect


RA : 224.602 deg
Dec : −31.722 deg
Dec (arcsec)
RA (arcsec)
10
5
0
−5
−10
−10
−5
0
5
10


DY : 13.197 arcsecs
DZ : 17.982 arcsecs
DZ (arcsec)
DY (arcsec)
4
2
0
−2
−4
−4
−2
0
2
4


Time (s)
6.733e+08
6.733e+08
6.733e+08
6.7331e+08
6.7332e+08
Median: 224.602 deg
RA (arcsec)
Median: −31.722 deg
Dec (arcsec)
Median: 5.156 deg
roll (arcsec)
Time(ksec)

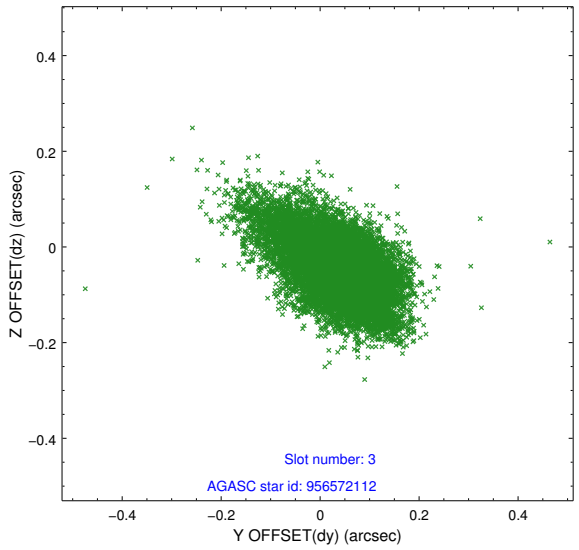

Time (s)
6.733e+08
6.733e+08
6.733e+08
6.7331e+08
6.7332e+08
Median: 13.197 arcsecs
dy (arcsec)
Median: 17.982 arcsecs
dz (arcsec)
Median: −0.006 deg
dtheta (arcsec)
Time(ksec)

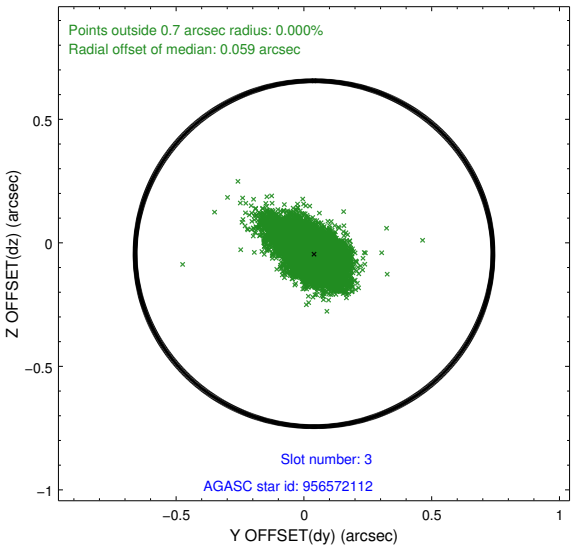
Slot Statistics

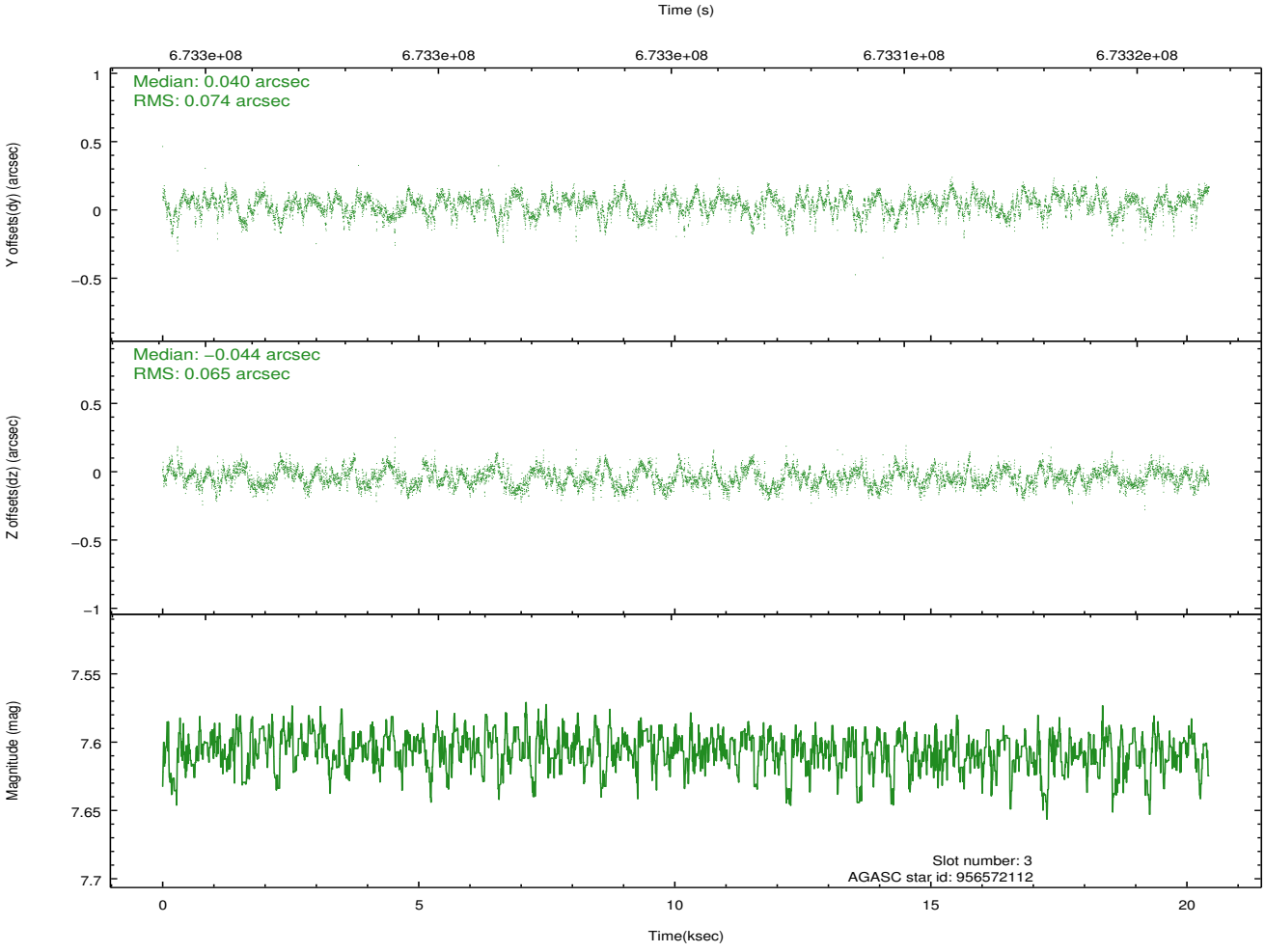
ot	status	used	id	mag	n_pts	frac_pts	med_dy	med_dz	dr1	dr2	ra	dec	mean_y	mea
0	FID		ACIS-S-2	7.17	4982	1.000	-0.274	-0.236	0.027	0.045	0.000000	0.000000	-766.12	-1739
1	FID		ACIS-S-4	7.30	4983	1.000	0.783	0.191	0.043	0.069	0.000000	0.000000	2148.07	169
2	FID		ACIS-S-5	7.27	4982	1.000	-0.546	0.050	0.029	0.089	0.000000	0.000000	-1819.04	162
3	GUIDE	used	956572112	7.61	9964	1.000	0.040	-0.044	0.100	0.176	223.861077	-31.418161	-2089.61	1331
4	GUIDE	used	956575352	8.48	9962	1.000	0.109	0.081	0.088	0.149	223.873030	-31.529443	-2084.66	929
5	GUIDE	used	956577088	8.23	9966	1.000	0.149	0.133	0.096	0.155	224.540686	-31.774008	-119.42	-119
6	GUIDE	used	957091448	7.80	9964	1.000	0.055	0.356	0.147	0.236	224.977023	-32.370724	1016.60	-2377
7	GUIDE	used	958277040	8.86	9963	1.000	-0.315	-0.520	0.148	0.278	225.059014	-31.205389	1647.02	1777

2.4 Star Slots

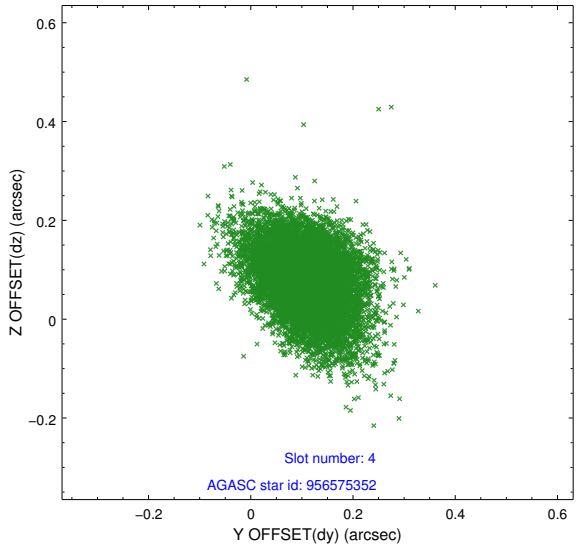
2.4.1 Slot 3

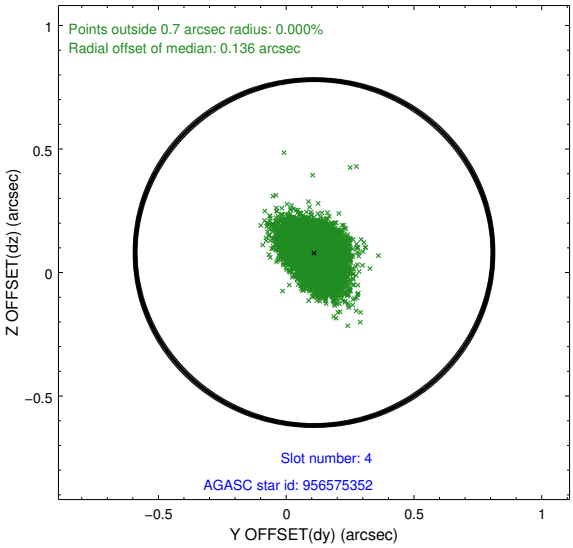


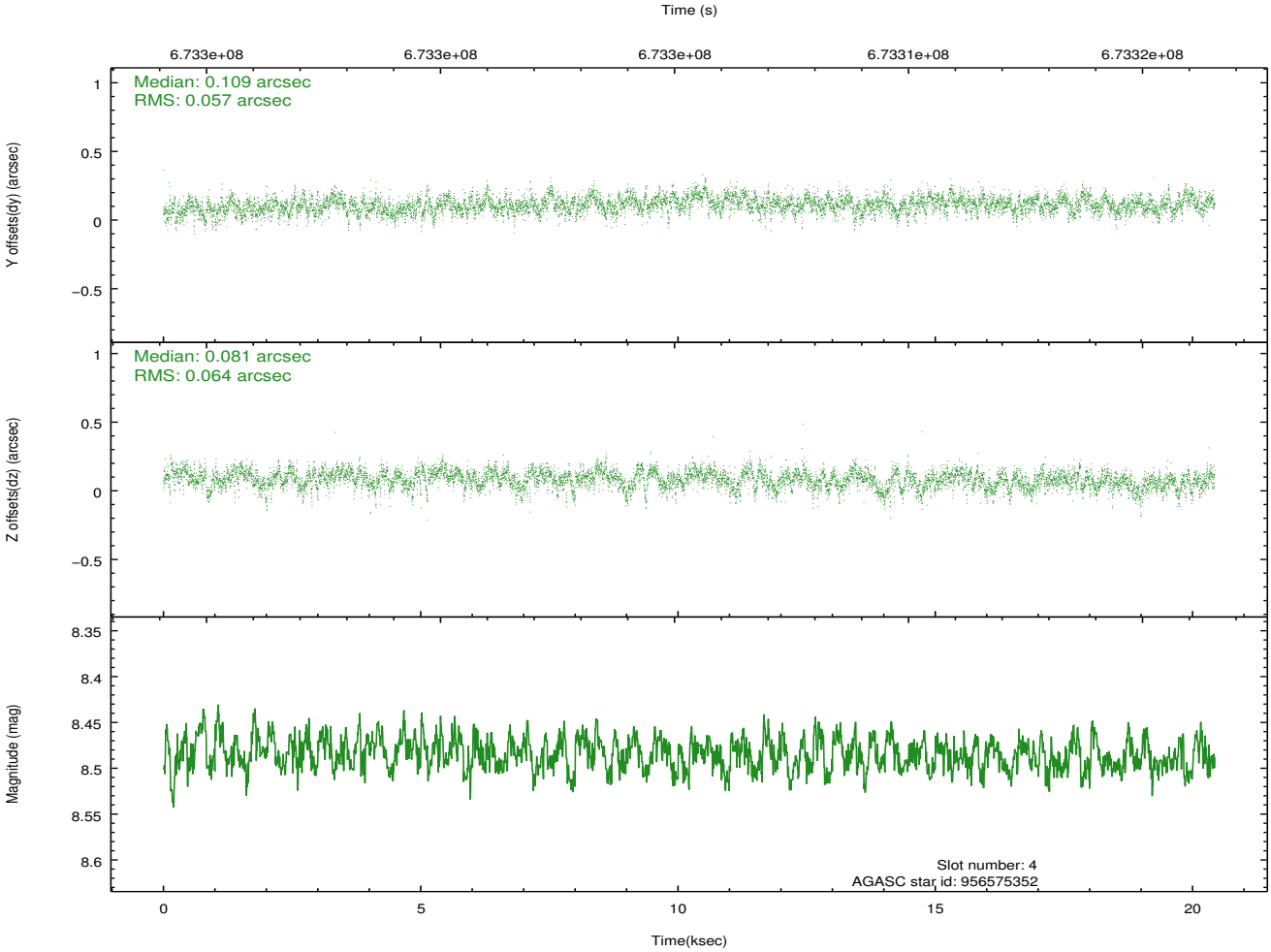




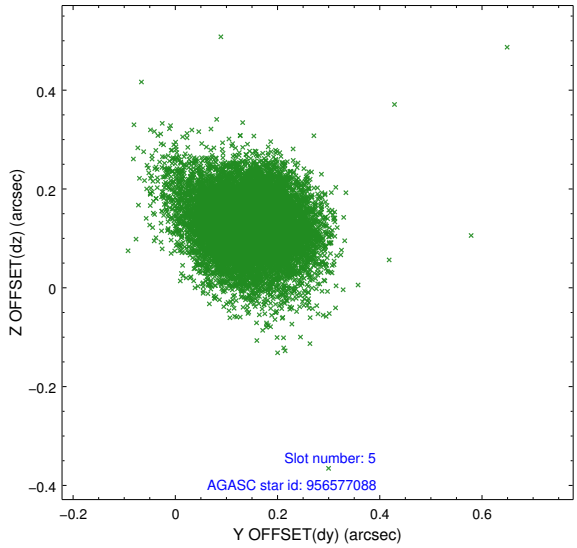
2.4.2 Slot 4

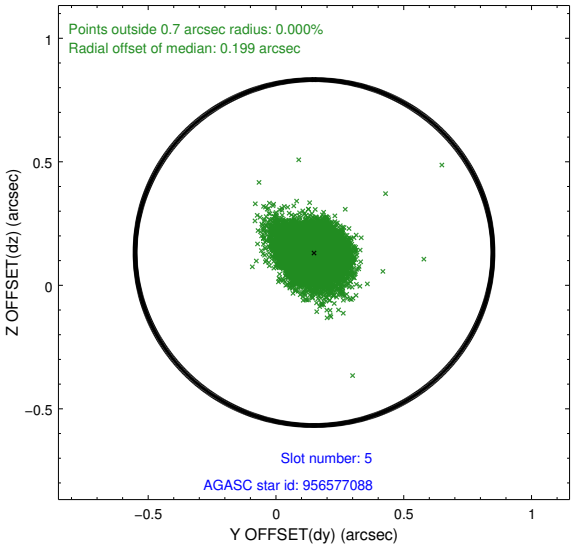

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 4
AGASC star id: 956575352

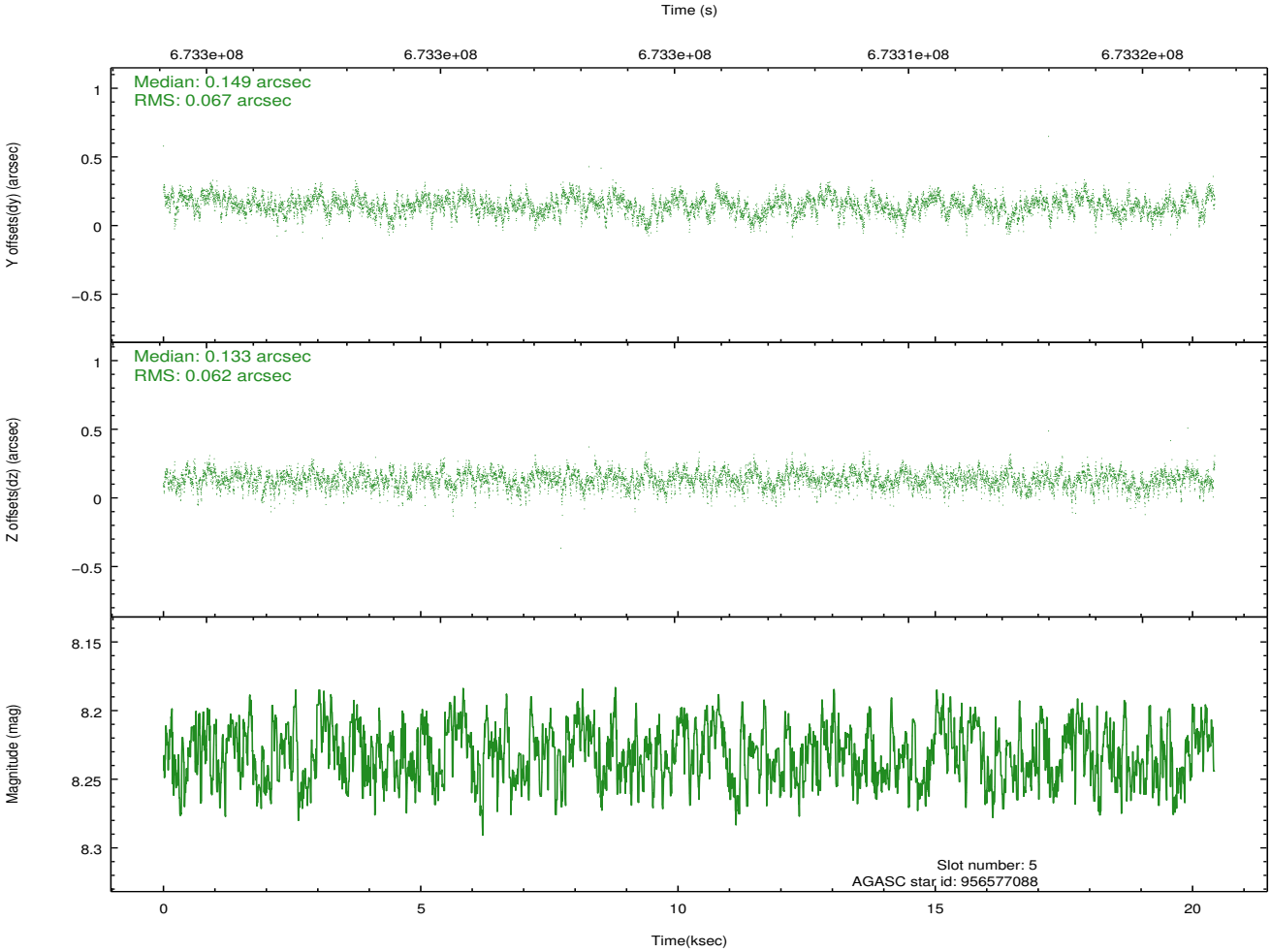

Points outside 0.7 arcsec radius: 0.000%
Radial offset of median: 0.136 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 4
AGASC star id: 956575352


Time (s)
6.733e+08
6.733e+08
6.733e+08
6.7331e+08
6.7332e+08
Median: 0.109 arcsec
RMS: 0.057 arcsec
Y offsets(dy) (arcsec)
Median: 0.081 arcsec
RMS: 0.064 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number: 4
AGASC star id: 956575352
Time(ksec)

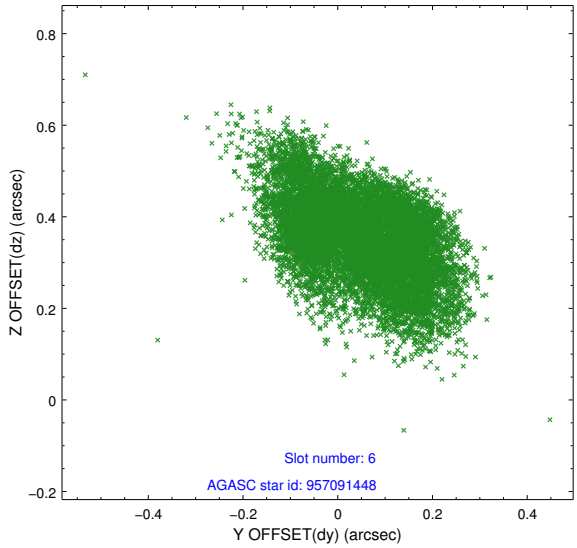
2.4.3 Slot 5

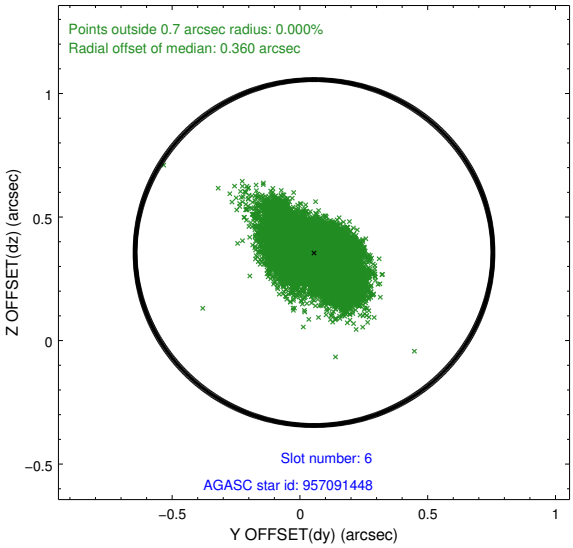

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 5
AGASC star id: 956577088

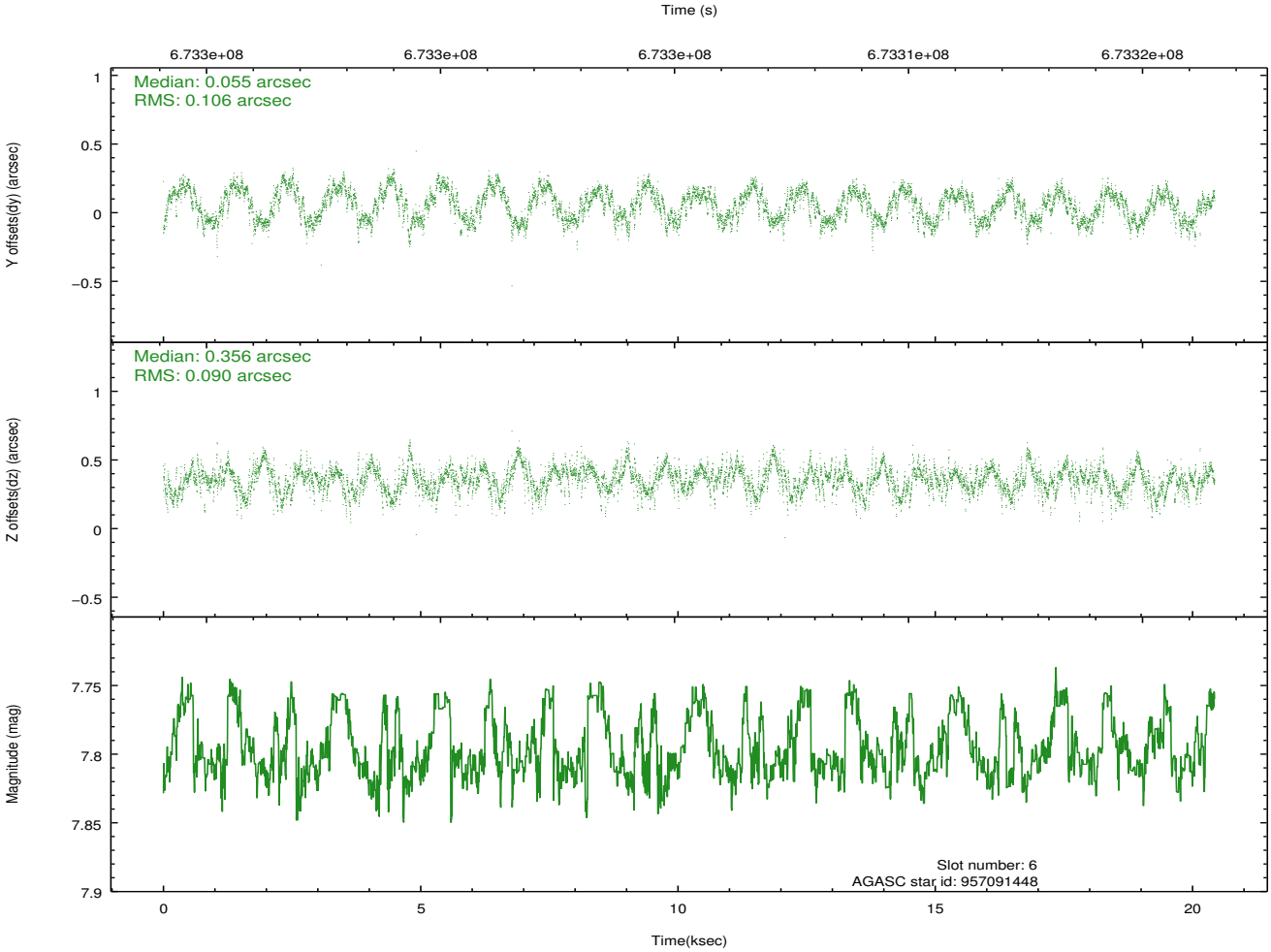

Points outside 0.7 arcsec radius: 0.000%
Radial offset of median: 0.199 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 5
AGASC star id: 956577088


Time (s)
Median: 0.149 arcsec
RMS: 0.067 arcsec
Y offsets(dy) (arcsec)
Median: 0.133 arcsec
RMS: 0.062 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number: 5
AGASC star id: 956577088
Time(ksec)

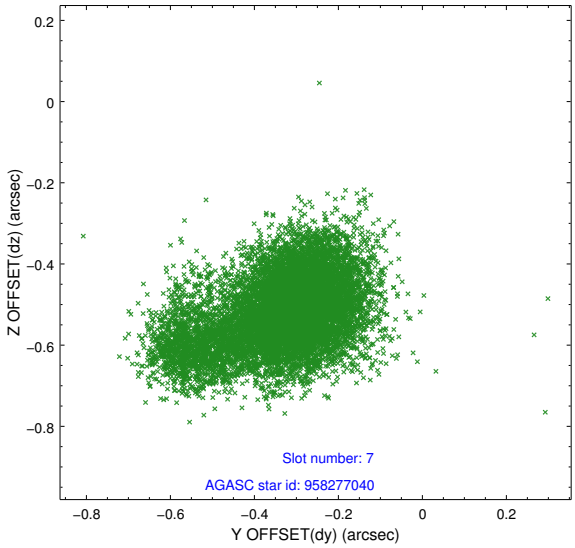
2.4.4 Slot 6

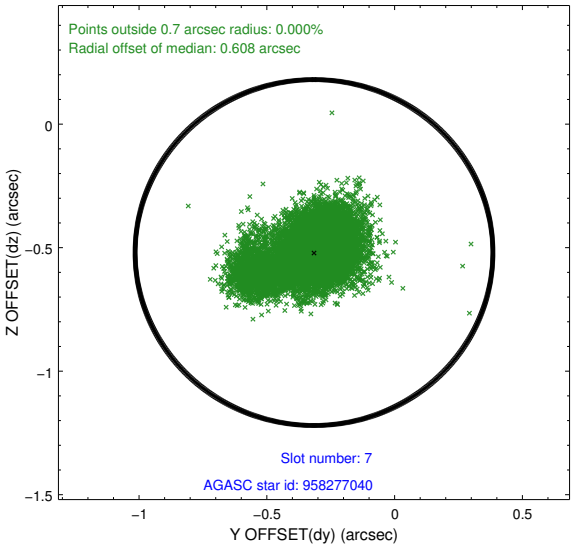

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 6
AGASC star id: 957091448

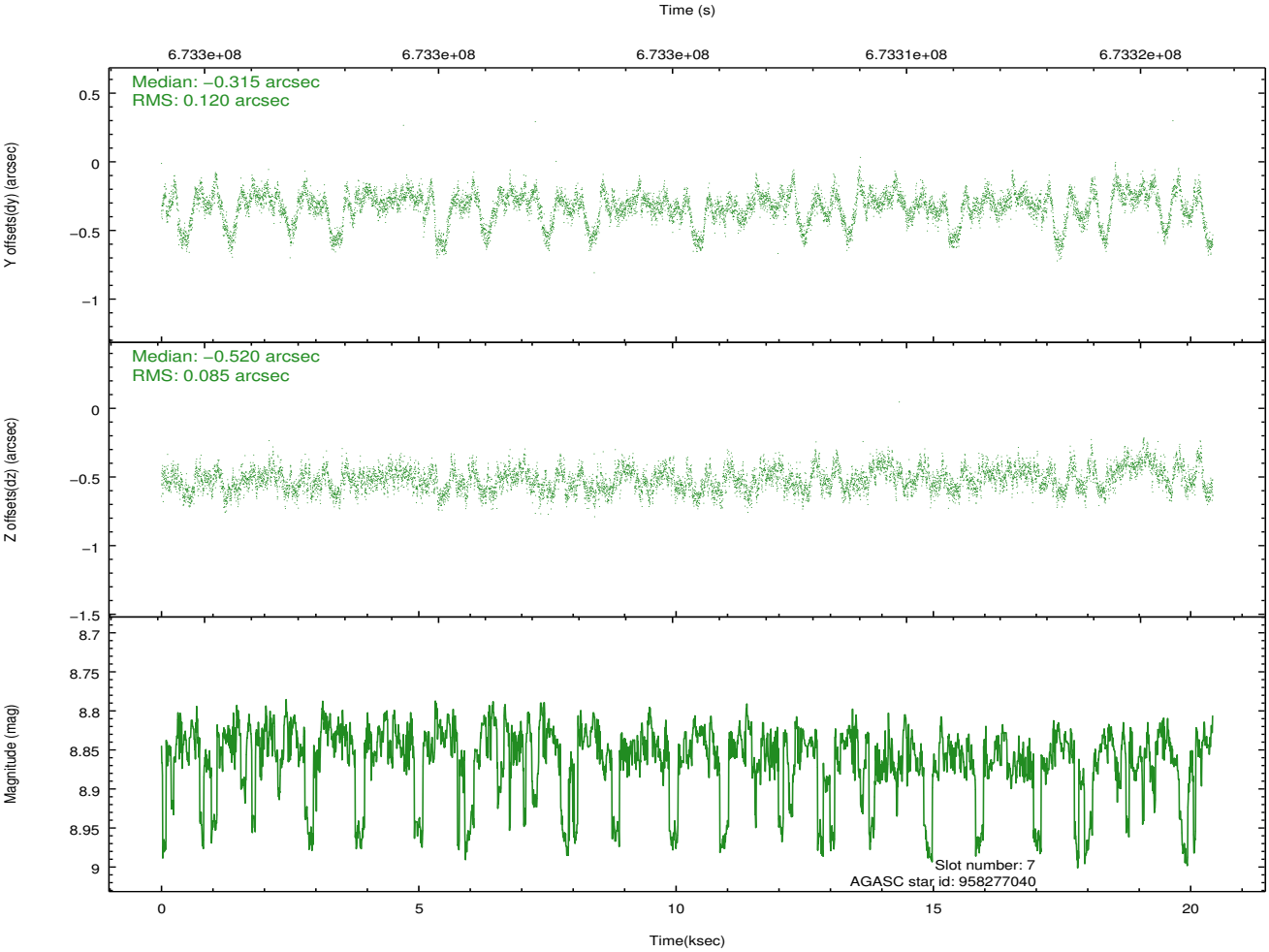

Points outside 0.7 arcsec radius: 0.000%
Radial offset of median: 0.360 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 6
AGASC star id: 957091448


Time (s)
Median: 0.055 arcsec
RMS: 0.106 arcsec
Y offsets(dy) (arcsec)
Median: 0.356 arcsec
RMS: 0.090 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number: 6
AGASC star id: 957091448
Time(ksec)

2.4.5 Slot 7

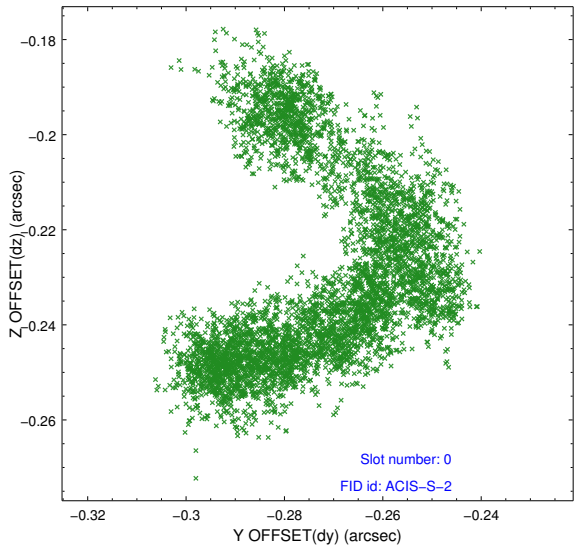

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 7
AGASC star id: 958277040

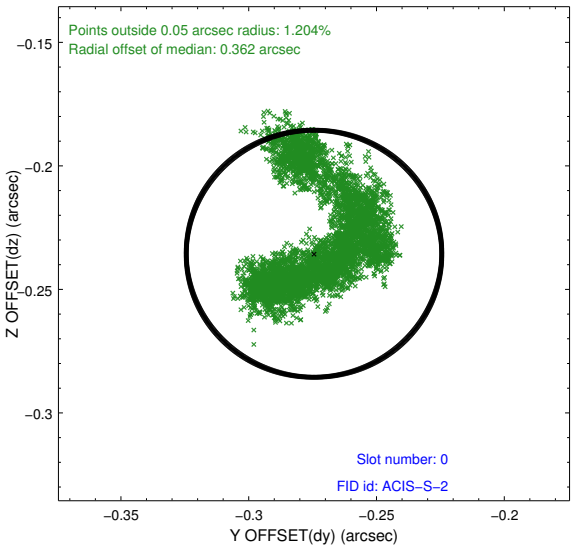

Points outside 0.7 arcsec radius: 0.000%
Radial offset of median: 0.608 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 7
AGASC star id: 958277040

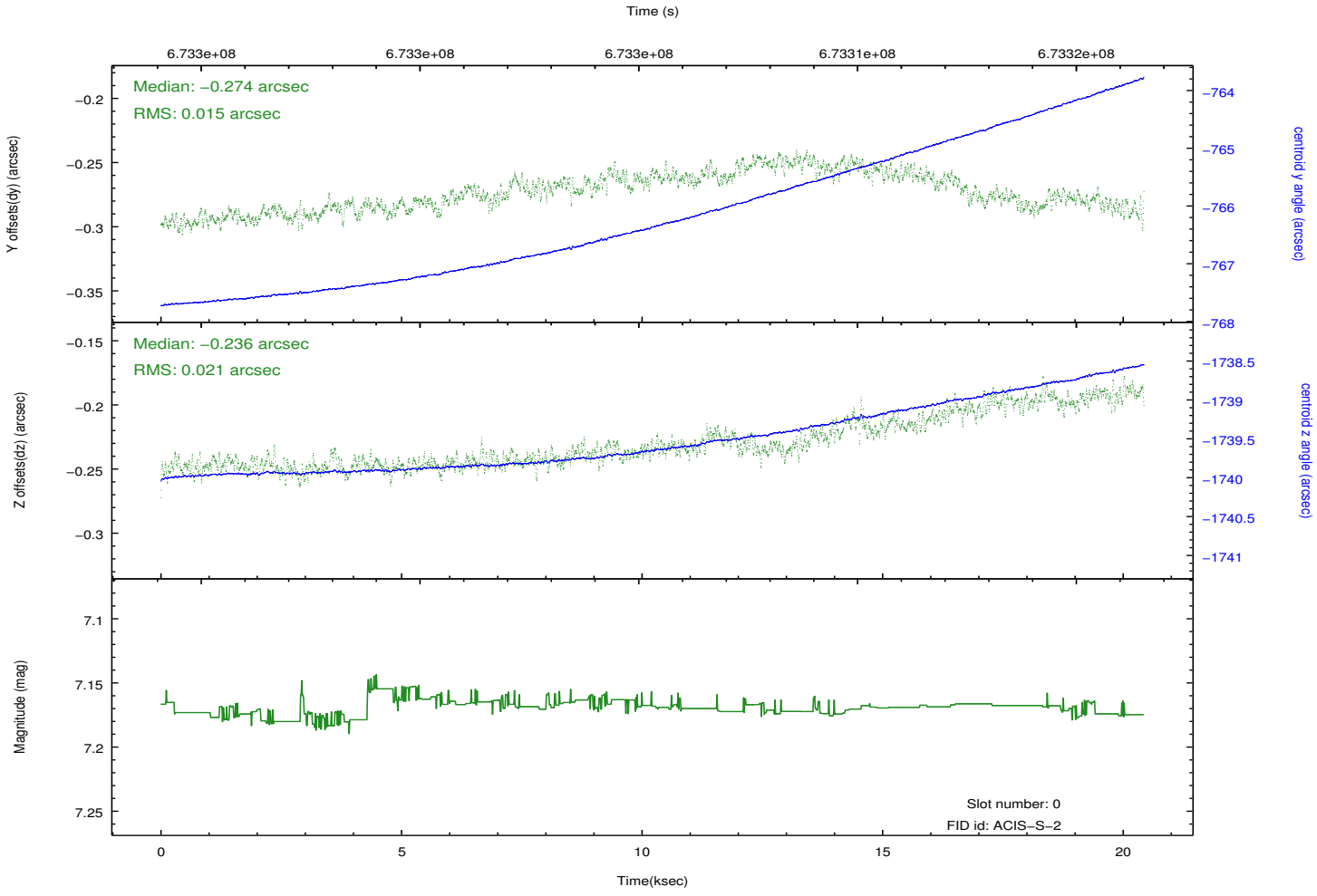

Time (s)
Median: −0.315 arcsec
RMS: 0.120 arcsec
Y offsets(dy) (arcsec)
Median: −0.520 arcsec
RMS: 0.085 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number: 7
AGASC star id: 958277040
Time(ksec)

2.5 FID Slots

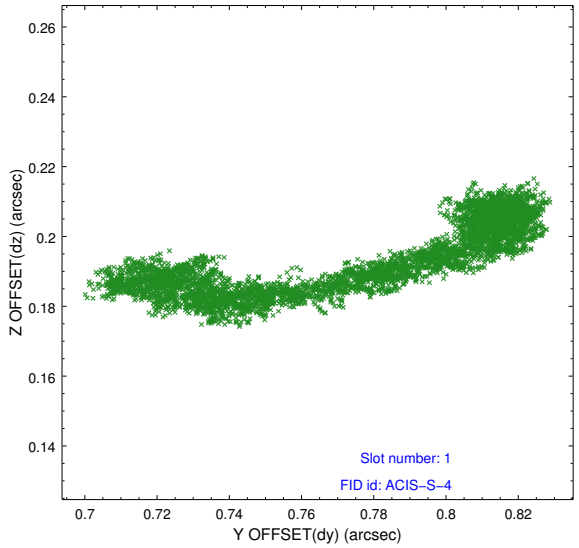
2.5.1 Slot 0

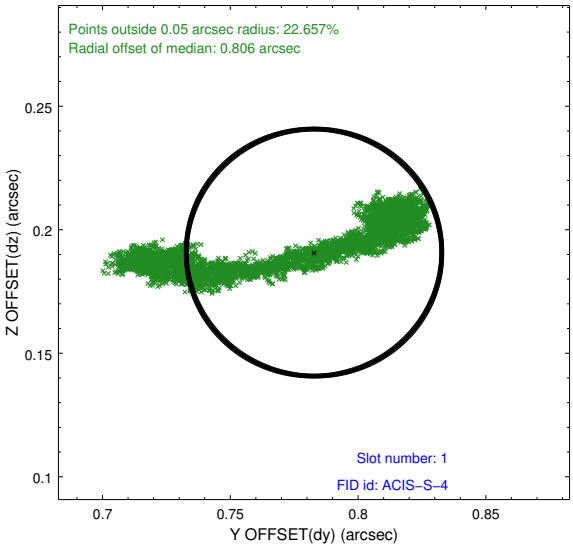


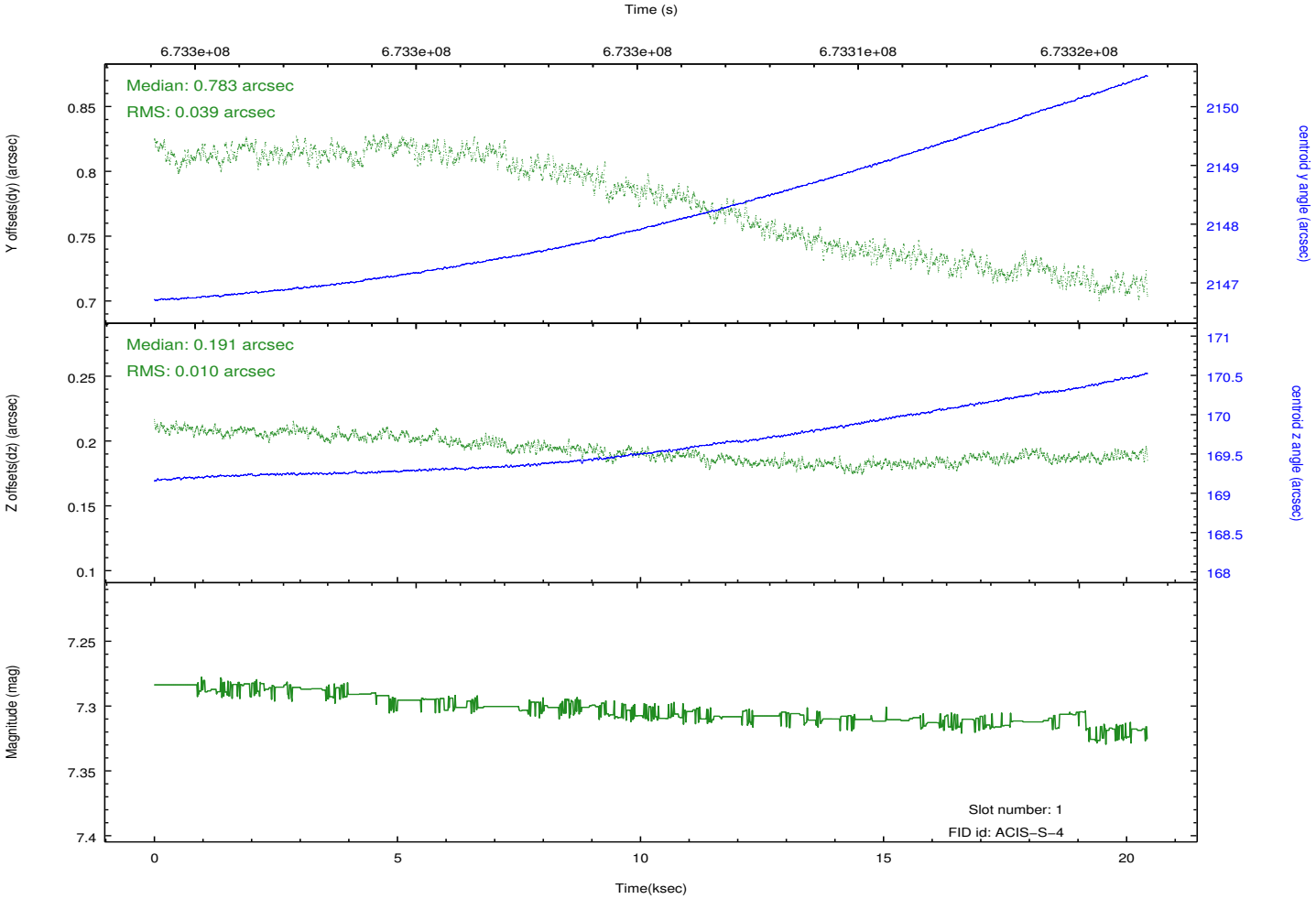




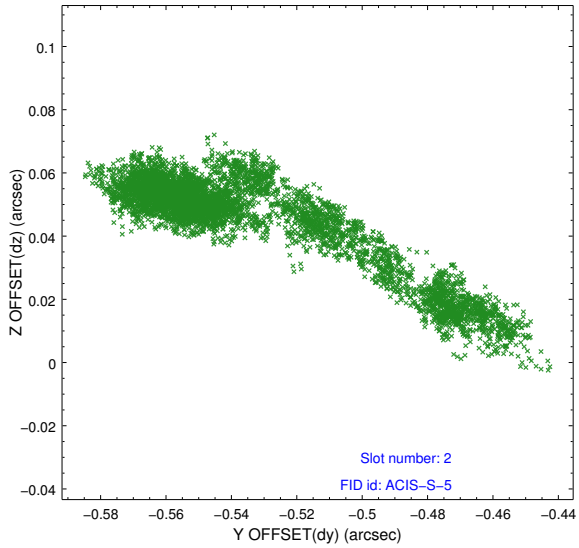
2.5.2 Slot 1

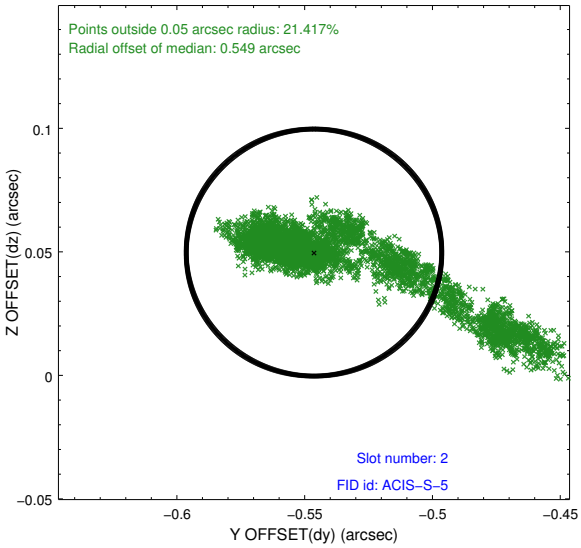

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 1
FID id: ACIS−S−4

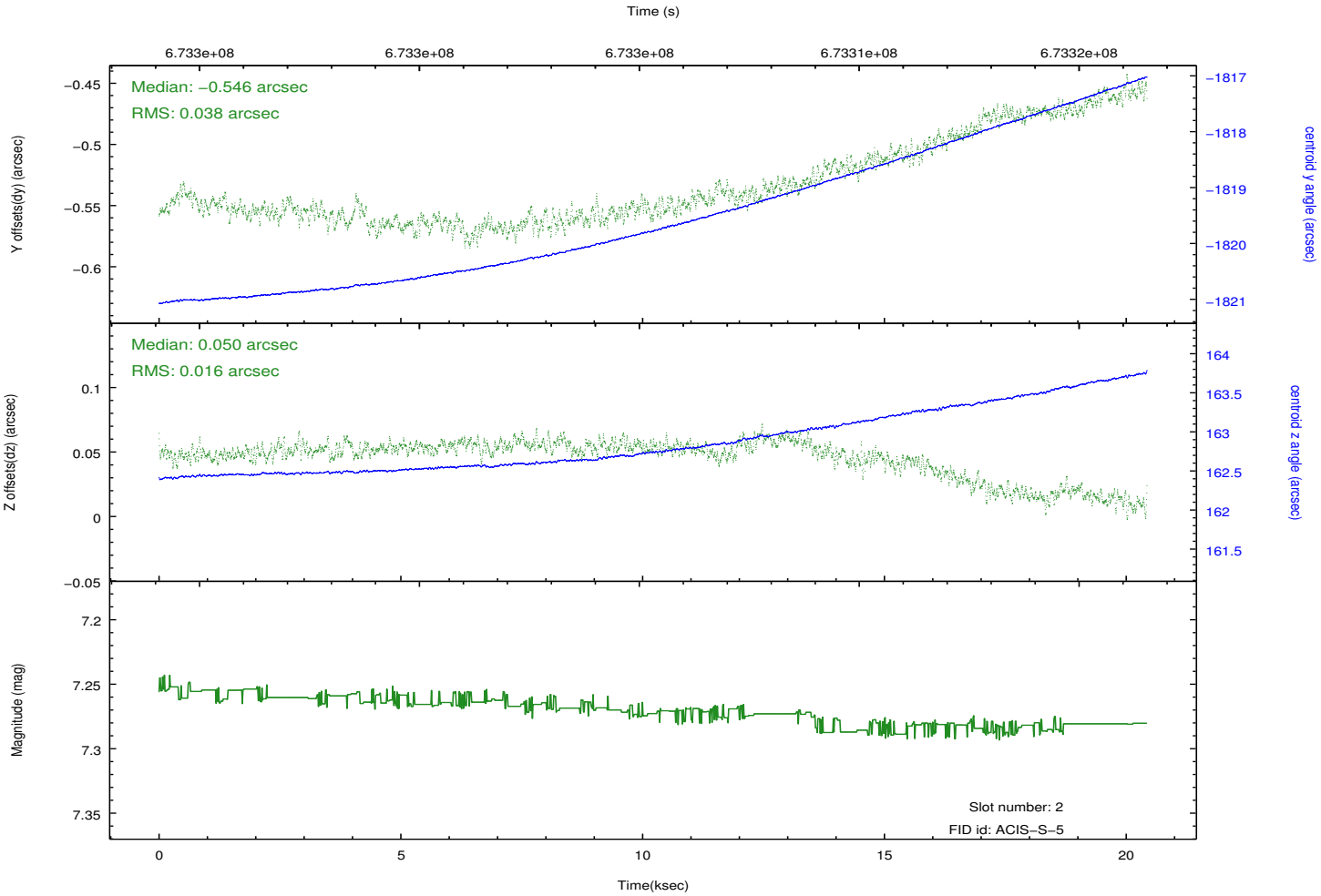

Points outside 0.05 arcsec radius: 22.657%
Radial offset of median: 0.806 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 1
FID id: ACIS−S−4


Time (s)
Median: 0.783 arcsec
RMS: 0.039 arcsec
Y offsets(dy) (arcsec)
centroid y angle (arcsec)
Median: 0.191 arcsec
RMS: 0.010 arcsec
Z offsets(dz) (arcsec)
centroid z angle (arcsec)
Magnitude (mag)
Slot number: 1
FID id: ACIS−S−4
Time(ksec)

2.5.3 Slot 2


Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 2
FID id: ACIS−S−5


Points outside 0.05 arcsec radius: 21.417%
Radial offset of median: 0.549 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 2
FID id: ACIS−S−5


Time (s)
Median: −0.546 arcsec
RMS: 0.038 arcsec
Y offsets(dy) (arcsec)
centroid y angle (arcsec)
Median: 0.050 arcsec
RMS: 0.016 arcsec
Z offsets(dz) (arcsec)
centroid z angle (arcsec)
Magnitude (mag)
Slot number: 2
FID id: ACIS−S−5
Time(ksec)

A Summary

A.1 Status

V&V Scientist	Beth Sundheim
V&V Date (YYYY-MM-DD)	2019.05.04
V&V Edition	1
V&V Disposition and Status	OK
V&V Charge Time	20.382

A.2 Comments

```
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
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.
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