V&V Reference Report
L2 ASCDS Version : 10.2.2

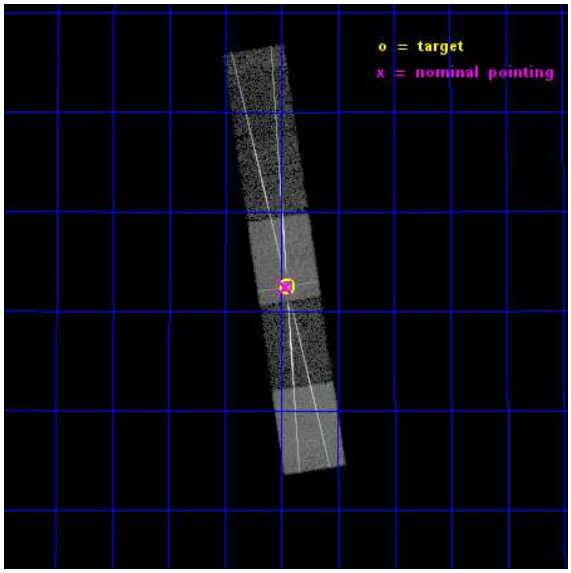
Observation 16424 - L2 Version 2
Chandra X-Ray Center

L2 Processing Date : Dec 12 2014

Contents

1 Front

seq_num	790264	Sequence number
obs_id	16424	Observation id
title	AO-15 Calibration Observations of Mkn421	Proposal title
observer	Dr. CXC Calibration	Principal investigator
object	MKN421	Source name
dtycycle	0	
cycle	P	events from which exps? Prim/Second/Both
ra_targ	166.113333	Observer's specified target RA [deg]
dec_targ	38.208806	Observer's specified target Dec [deg]
ra_nom	166.11630977361	Nominal RA [deg]
dec_nom	38.207070601016	Nominal Dec [deg]
roll_nom	261.30384043284	Nominal Roll [deg]
revision	2	Processing version of data
ontime	15049.725230157	Sum of GTIs [s]
livetime	14796.701632246	Livetime [s]
ontime5	15049.684190154	Sum of GTIs [s]
ontime6	15049.643150151	Sum of GTIs [s]
ontime7	15049.725230157	Sum of GTIs [s]
ontime8	15049.602110147	Sum of GTIs [s]
ontime9	15049.561070144	Sum of GTIs [s]
l2events	219531	Number of level 2 events

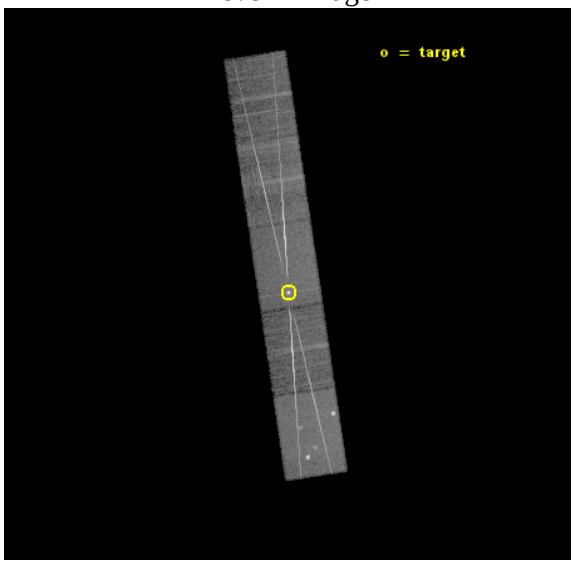


2 OBI

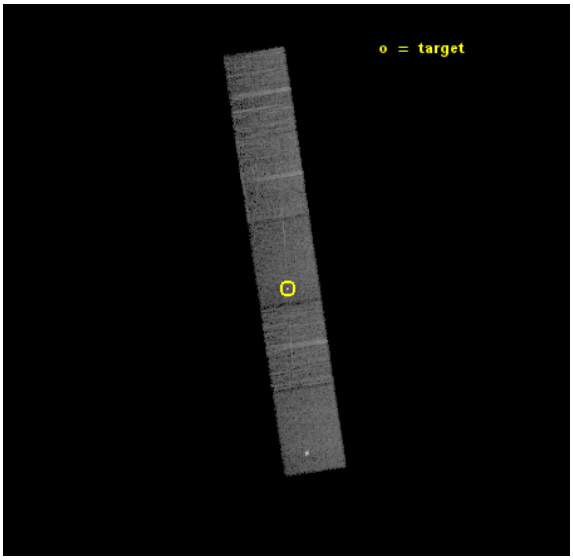
2.1 OBI

2.1.1 Images

Level 1 Image

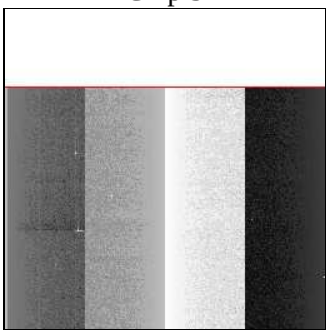


Level 1 Bad Events

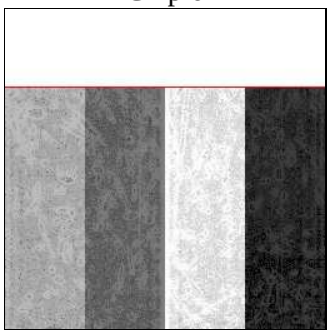


2.1.2 Bias

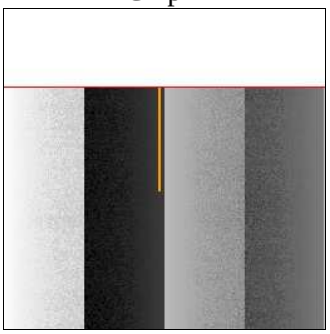
Chip 5



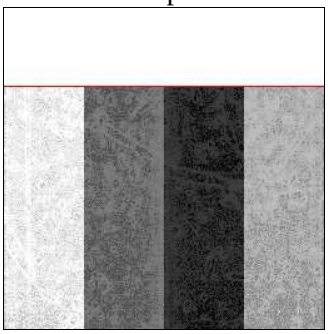
Chip 6



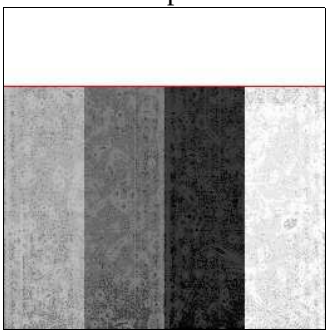
Chip 7



Chip 8



Chip 9



2.1.3 Parameters

obi_num	0	Obi number
ascdsver	10.3.1	Processing system revision
caldbver	4.6.4	
date	2014-12-12T06:36:06	Date and time of file creation
revision	2	Processing version of data

sched_exp_time	15000.000000	[s] Scheduled observation exposure time
ontime	15049.725230157	Sum of GTIs [s]
ontime5	15049.684190154	Sum of GTIs [s]
ontime6	15049.643150151	Sum of GTIs [s]
ontime7	15049.725230157	Sum of GTIs [s]
ontime8	15049.602110147	Sum of GTIs [s]
ontime9	15049.561070144	Sum of GTIs [s]
l1events	486881	Number of level 1 events
tgmethod	FINDZO	Method used to create src1a file
zo_pos	(4110.74, 4109.99)	src1a sky pixel position
		src1a sky pixel position via

2.1.4 Events

	ccd 5	ccd 6	ccd 7	ccd 8	ccd 9
level 1 events	115819	99322	118992	94592	58156
rejected events	47857	48169	43462	51069	46315
rejected %	41%	48%	36%	53%	79%

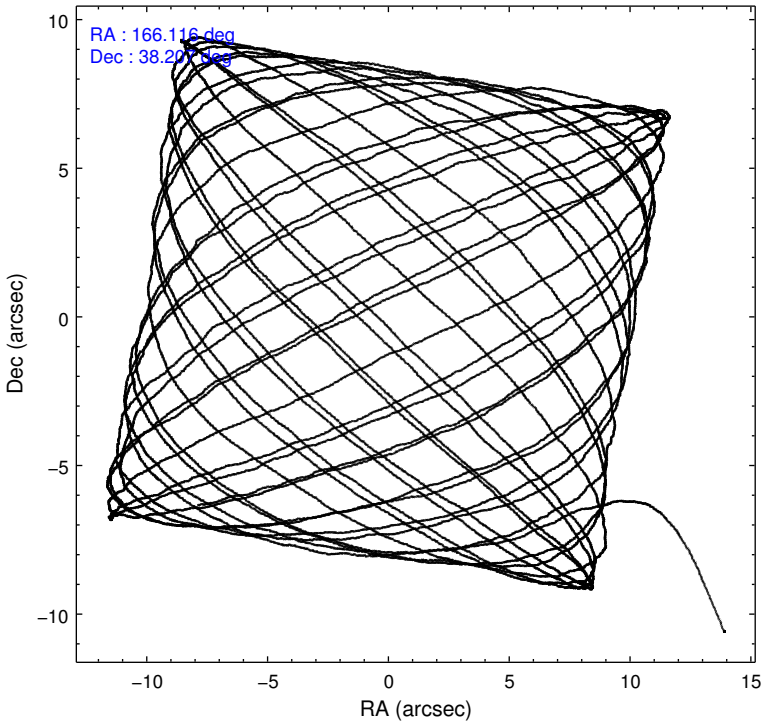
	ccd 5	ccd 6	ccd 7	ccd 8	ccd 9
grade 0 events	16824	38070	14393	26212	6532
	14%	38%	12%	27%	11%
grade 1 events	2281	231	292	126	32
	1%	0%	0%	0%	0%
grade 2 events	19629	6346	17747	6629	1963
	16%	6%	14%	7%	3%
grade 3 events	3447	2168	7553	2713	941
	2%	2%	6%	2%	1%
grade 4 events	3492	2167	7725	2634	849
	3%	2%	6%	2%	1%
grade 5 events	6951	2958	8396	4183	2975
	6%	2%	7%	4%	5%
grade 6 events	24603	2421	28139	5347	1556
	21%	2%	23%	5%	2%
grade 7 events	38592	44961	34747	46748	43308
	33%	45%	29%	49%	74%

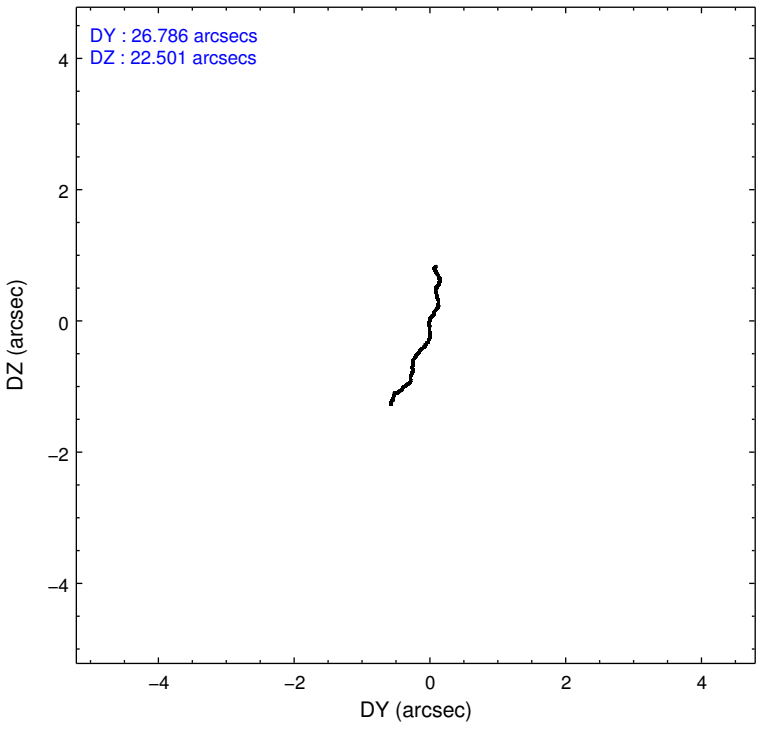
2.2 Compared Parameters

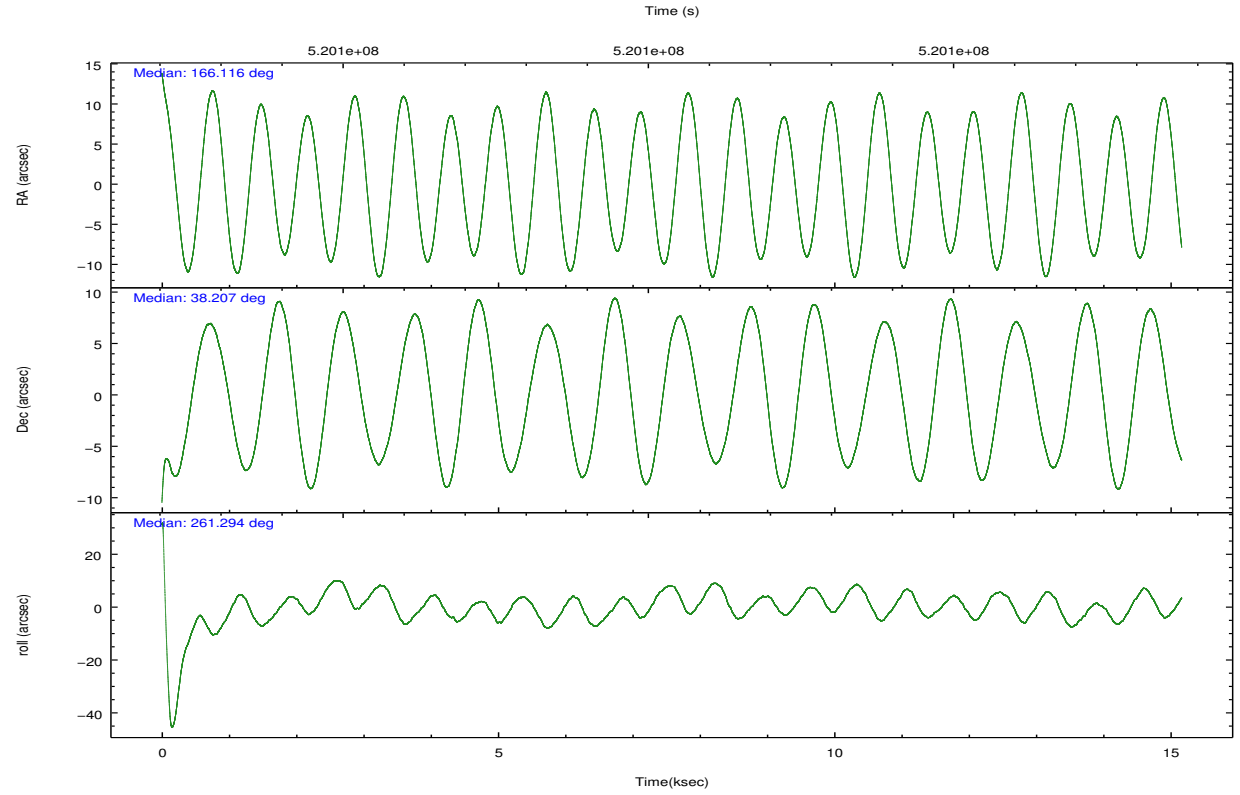
Parameter	Planned	Actual
Instrument	ACIS	ACIS
Detector	ACIS-56789	ACIS-56789
Grating	HETG	HETG
Data mode	FAINT	FAINT
Observation mode	POINTING	POINTING
[deg] Pointing RA	166.103196	166.1163097736133
[deg] Pointing Dec	38.232421	38.20707060101635
[deg] Pointing Roll	261.155253	261.3038404328397
[s] Window start time (MET)	517968067.184000	517968067.184000
[s] Window stop time (MET)	525830467.184000	525830467.184000
[mm] SIM focus pos	-0.684267	-0.6828225247311905
[mm] SIM defocus	0	0.001444936568705701
[mm] SIM translation stage pos	-187.132523	-187.1228876879999
[mm] SIM translation stage offset	-3	-3.009634895007935
[s] Observation start time (MET)	520092956.184000	520091744.73033
Observation start date	2014-06-25T14:14:49	2014-06-25T13:55:44
[s] Observation end time (MET)	520107956.184000	520108999.06879
Observation end date	2014-06-25T18:24:49	2014-06-25T18:43:19
Read mode	TIMED	TIMED

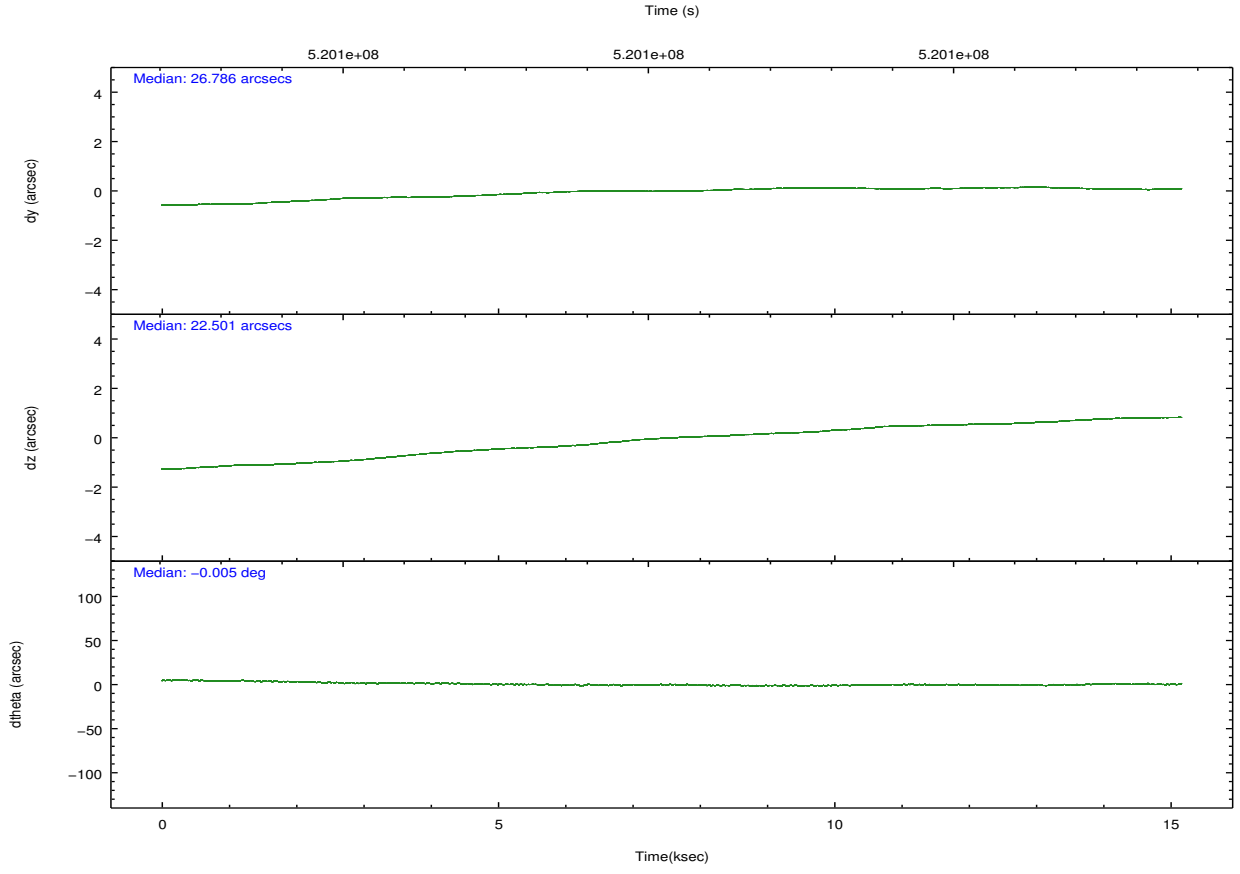
Parameter	Planned	Actual
Obspar format version number	7	7
Obspar file type	PREDICTED	ACTUAL
Obspar update status	NONE	UPDATED
CCD I0 on	N	N
CCD I1 on	N	N
CCD I2 on	N	N
CCD I3 on	N	N
CCD S0 on	N	N
CCD S1 on	Y	Y
CCD S2 on	Y	Y
CCD S3 on	Y	Y
CCD S4 on	Y	Y
CCD S5 on	O1	Y
Number of optional ACIS chips dropped	0	0
On-chip summing requested	N	N
Subarray requested	CUSTOM	CUSTOM
Subarray start row	1	1
Subarray row count	774	774
Alternating exposures requested	N	N
[s] Primary exposure time	0.000000	2.4

2.3 Aspect


RA : 166.116 deg
Dec : 38.207 deg
Dec (arcsec)
RA (arcsec)
10
5
0
−5
−10
−10
−5
0
5
10
15


DY : 26.786 arcsecs
DZ : 22.501 arcsecs
DZ (arcsec)
DY (arcsec)
4
2
0
−2
−4
−4
−2
0
2
4


Time (s)
5.201e+08
5.201e+08
5.201e+08
Median: 166.116 deg
RA (arcsec)
Median: 38.207 deg
Dec (arcsec)
Median: 261.294 deg
roll (arcsec)
Time(ksec)

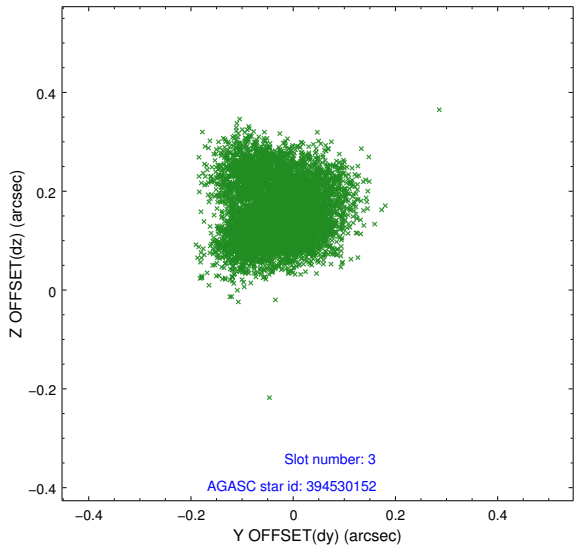

Time (s)
5.201e+08
5.201e+08
5.201e+08
Median: 26.786 arcsecs
dy (arcsec)
Median: 22.501 arcsecs
dz (arcsec)
Median: −0.005 deg
dtheta (arcsec)
Time(ksec)

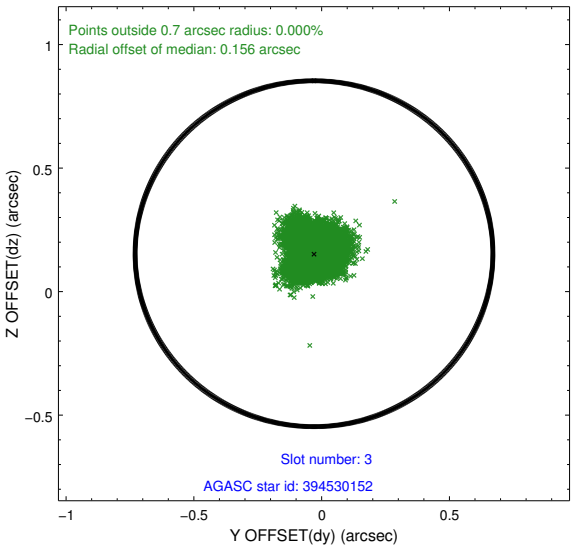
Slot Statistics

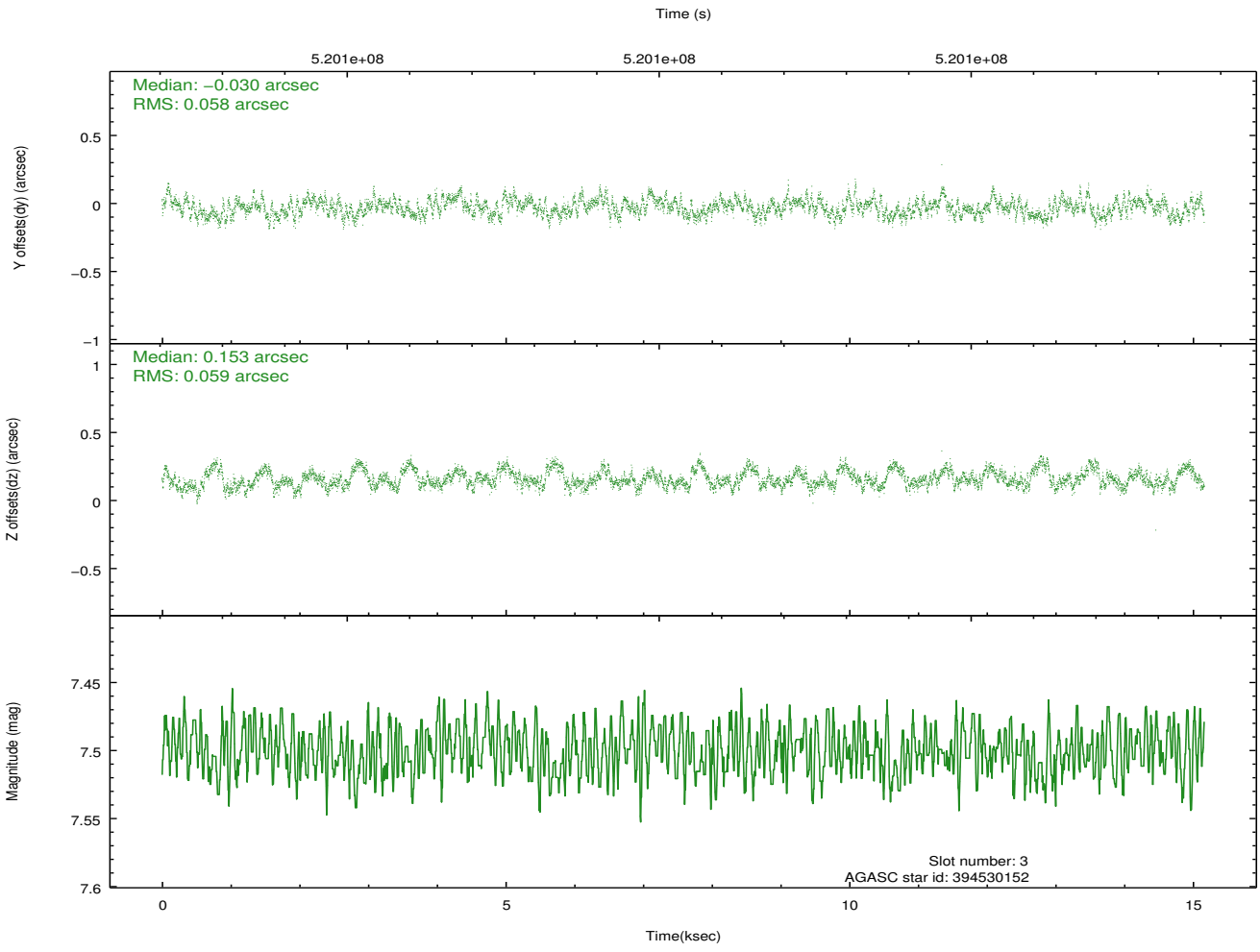
slot	status	used	id	mag	n_pts	med_dy	med_dz	dr1	dr2	ra	dec	mean_y	mean_z
0	FID		ACIS-S-2	6.96	3699	-0.215	-0.021	0.012	0.042	0.000000	0.000000	-779.96	-1806.14
1	FID		ACIS-S-4	7.03	3699	0.353	0.111	0.006	0.011	0.000000	0.000000	2133.71	102.21
2	FID		ACIS-S-5	7.07	3699	-0.168	-0.080	0.012	0.041	0.000000	0.000000	-1832.42	95.95
3	GUIDE	used	394530152	7.50	7398	-0.030	0.153	0.089	0.140	166.075805	38.868252	-2249.62	-427.85
4	GUIDE	used	394533848	8.73	7394	0.083	0.406	0.113	0.175	166.382906	38.276007	-277.93	752.37
5	GUIDE	used	394543960	9.80	7380	0.149	0.216	0.150	0.245	165.802757	37.787371	1713.75	-597.62
6	GUIDE	used	394546712	6.60	7398	-0.297	0.276	0.105	0.164	166.451462	38.394357	-728.45	880.28
7	GUIDE	used	394546720	6.43	7397	0.103	-1.042	0.112	0.167	166.130115	38.241361	-43.20	69.56

2.4 Star Slots

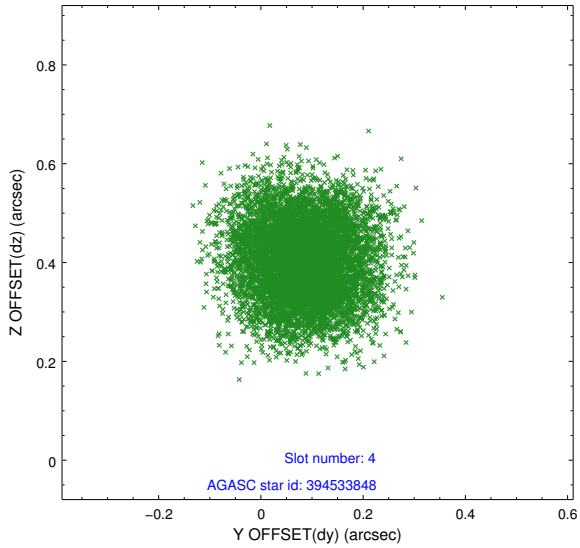
2.4.1 Slot 3

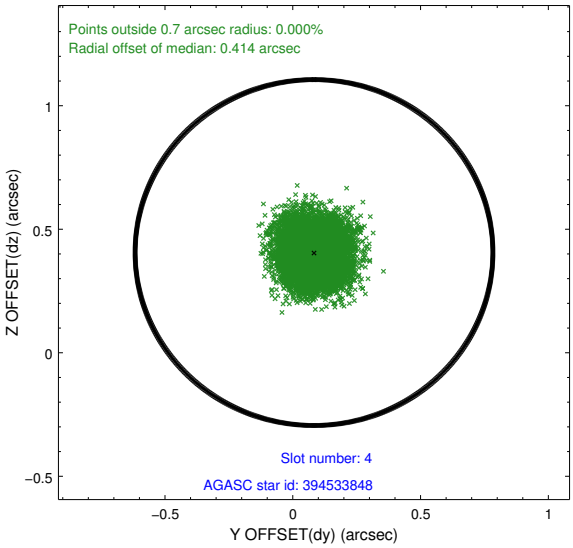


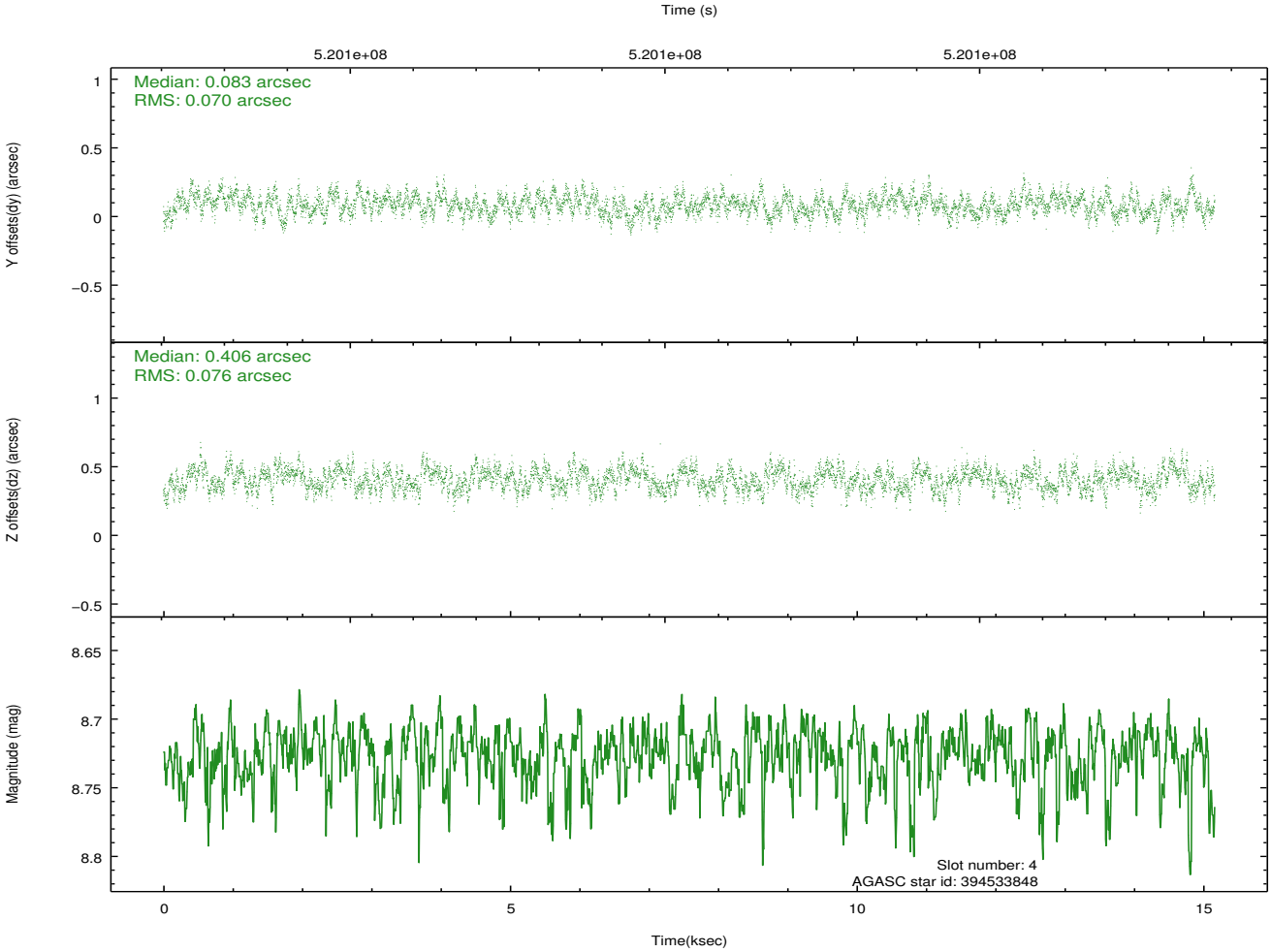




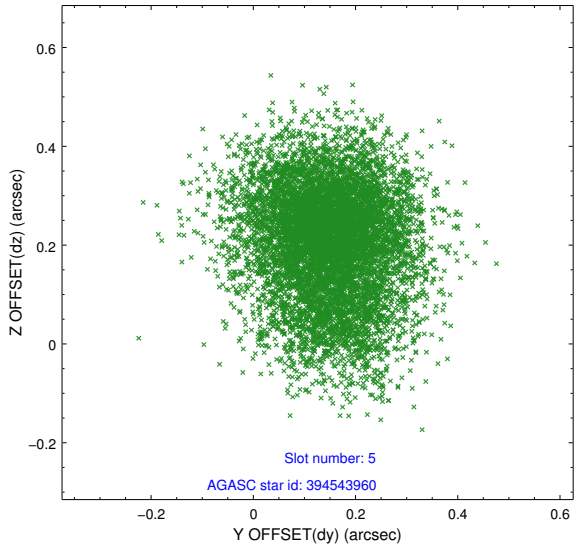
2.4.2 Slot 4

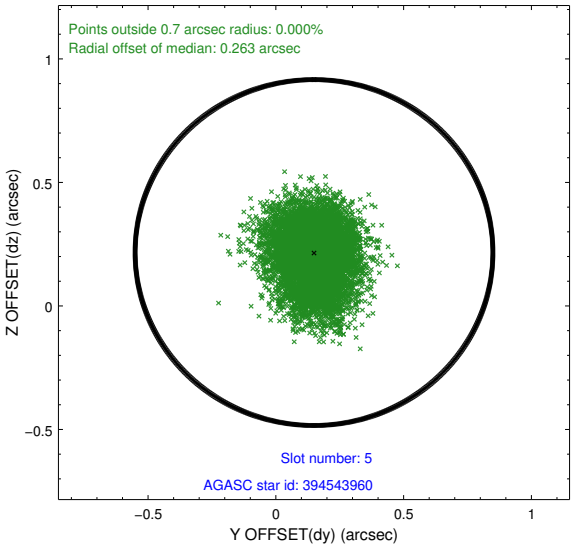

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 4
AGASC star id: 394533848

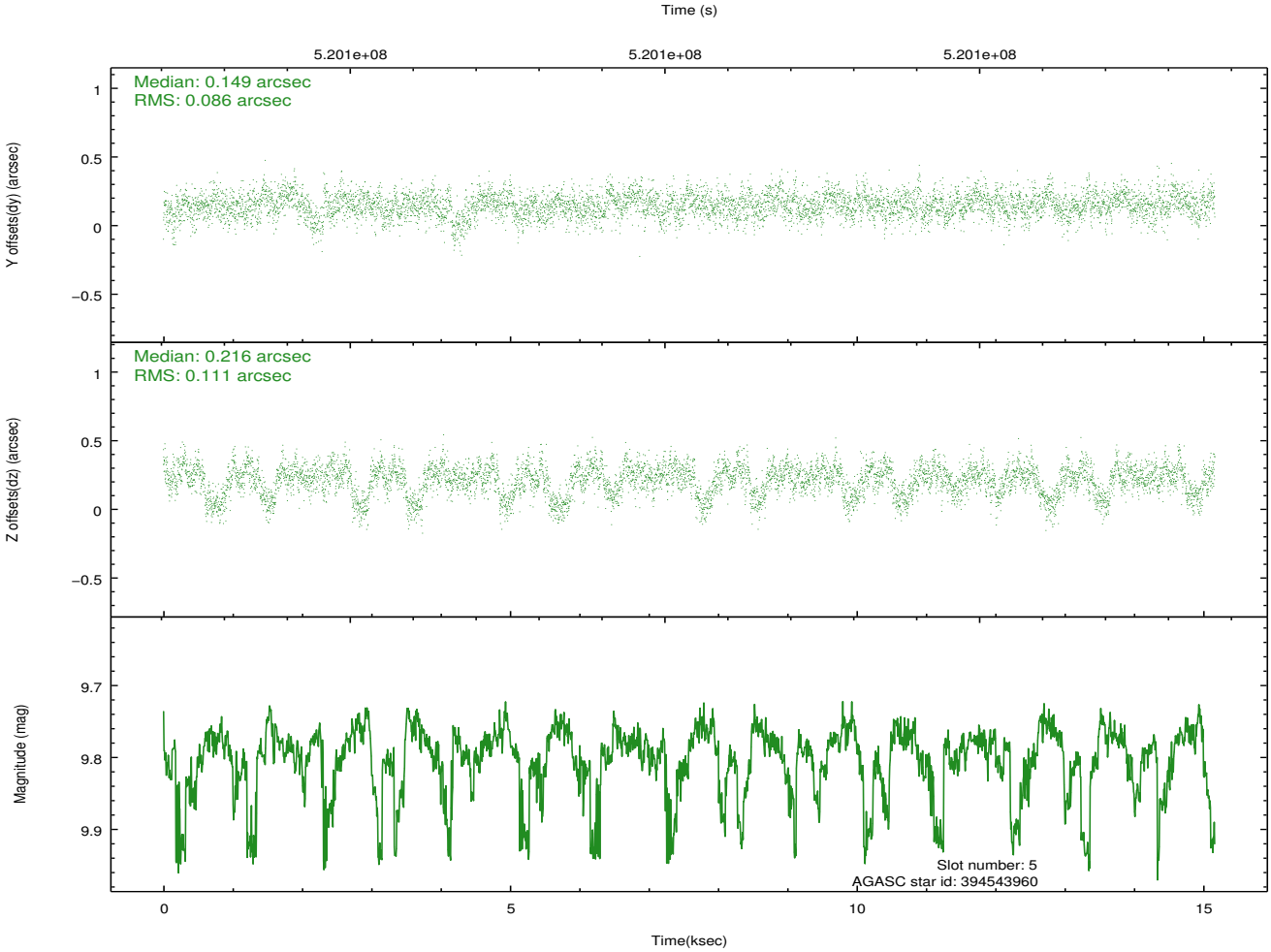

Points outside 0.7 arcsec radius: 0.000%
Radial offset of median: 0.414 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 4
AGASC star id: 394533848


Time (s)
5.201e+08
5.201e+08
5.201e+08
Median: 0.083 arcsec
RMS: 0.070 arcsec
Y offsets(dy) (arcsec)
Median: 0.406 arcsec
RMS: 0.076 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number: 4
AGASC star id: 394533848
Time(ksec)

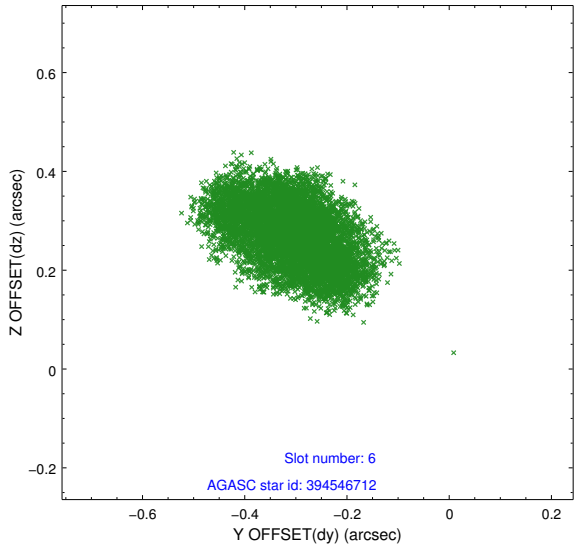
2.4.3 Slot 5

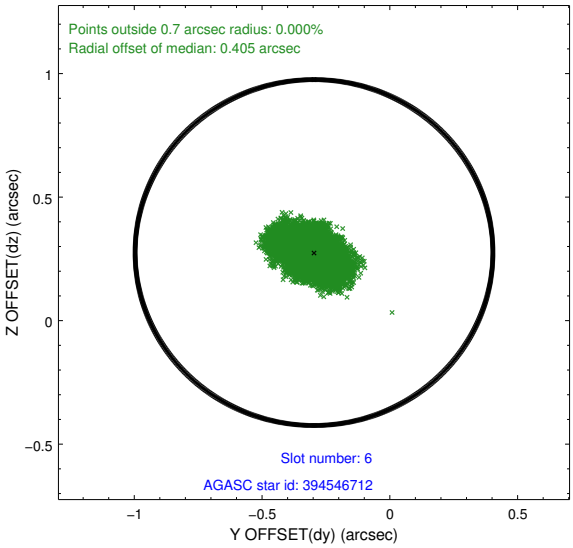

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 5
AGASC star id: 394543960

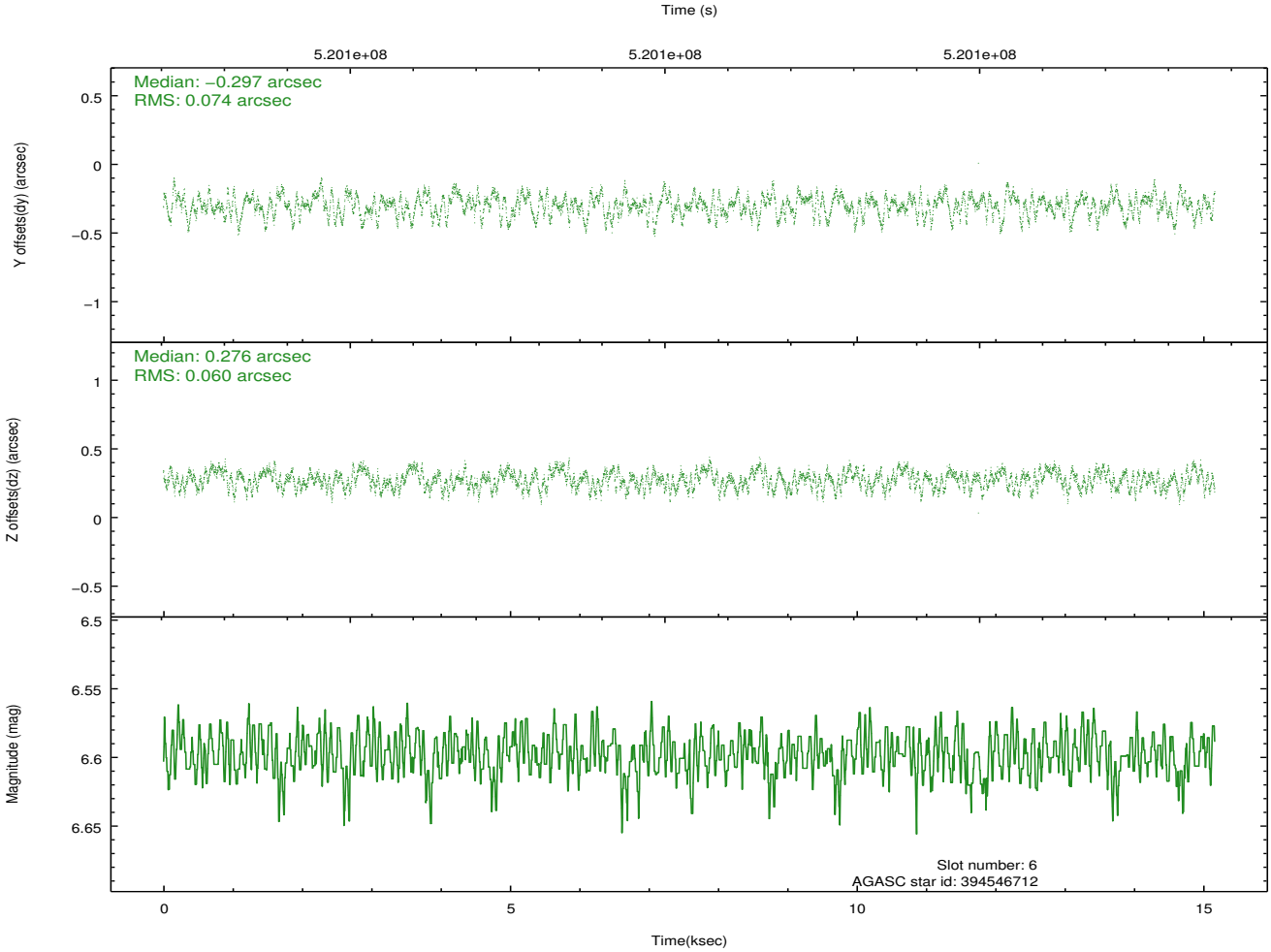

Points outside 0.7 arcsec radius: 0.000%
Radial offset of median: 0.263 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 5
AGASC star id: 394543960


Time (s)
5.201e+08
5.201e+08
5.201e+08
Median: 0.149 arcsec
RMS: 0.086 arcsec
Y offsets(dy) (arcsec)
Median: 0.216 arcsec
RMS: 0.111 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number: 5
AGASC star id: 394543960
Time(ksec)

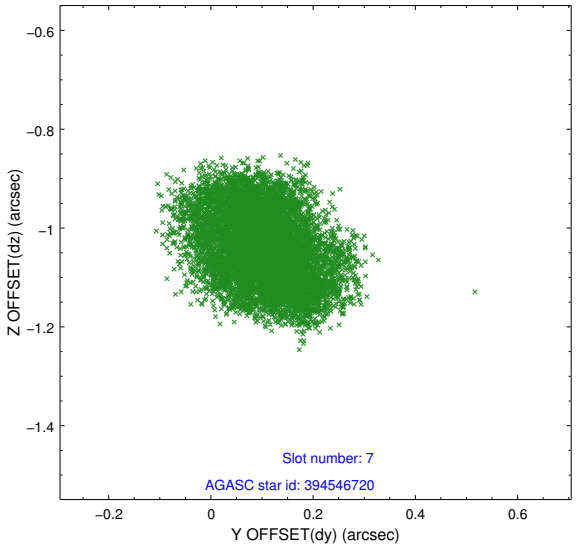
2.4.4 Slot 6

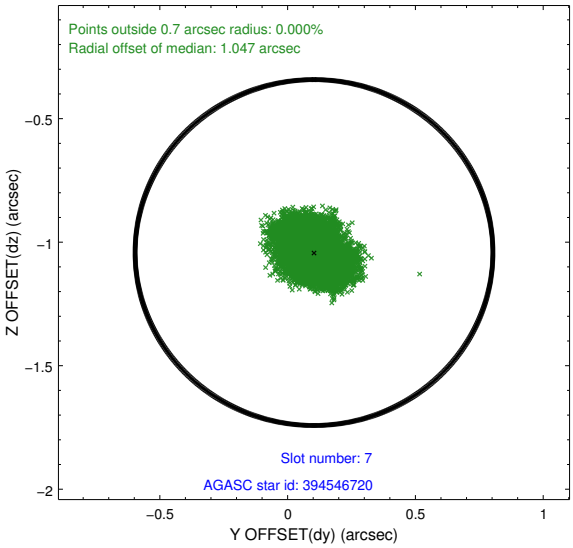

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 6
AGASC star id: 394546712

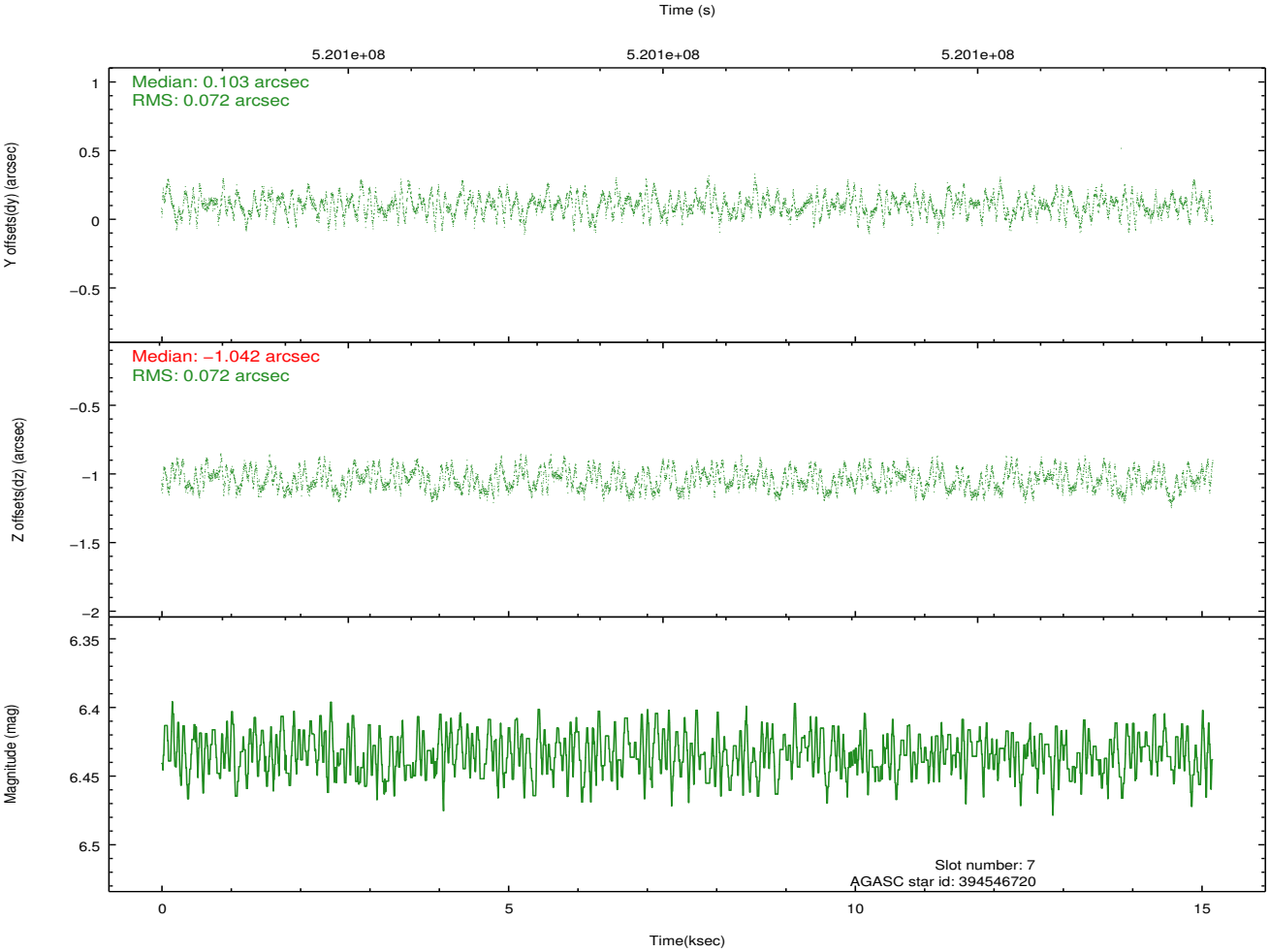

Points outside 0.7 arcsec radius: 0.000%
Radial offset of median: 0.405 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 6
AGASC star id: 394546712


Time (s)
5.201e+08
5.201e+08
5.201e+08
Median: –0.297 arcsec
RMS: 0.074 arcsec
Y offsets(dy) (arcsec)
Median: 0.276 arcsec
RMS: 0.060 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number: 6
AGASC star id: 394546712
Time(ksec)

2.4.5 Slot 7

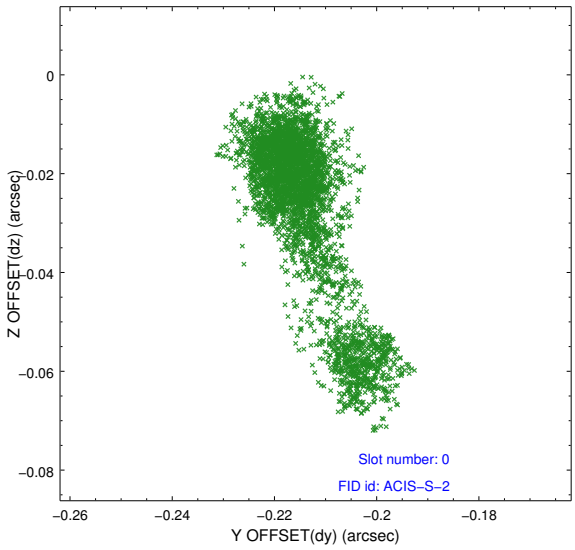

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 7
AGASC star id: 394546720

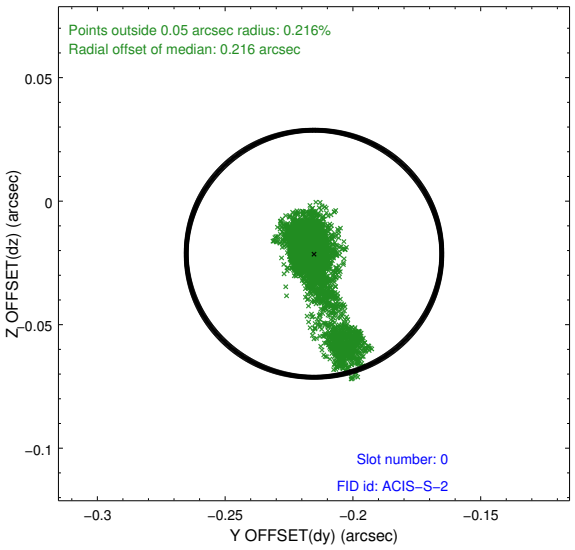

Points outside 0.7 arcsec radius: 0.000%
Radial offset of median: 1.047 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 7
AGASC star id: 394546720

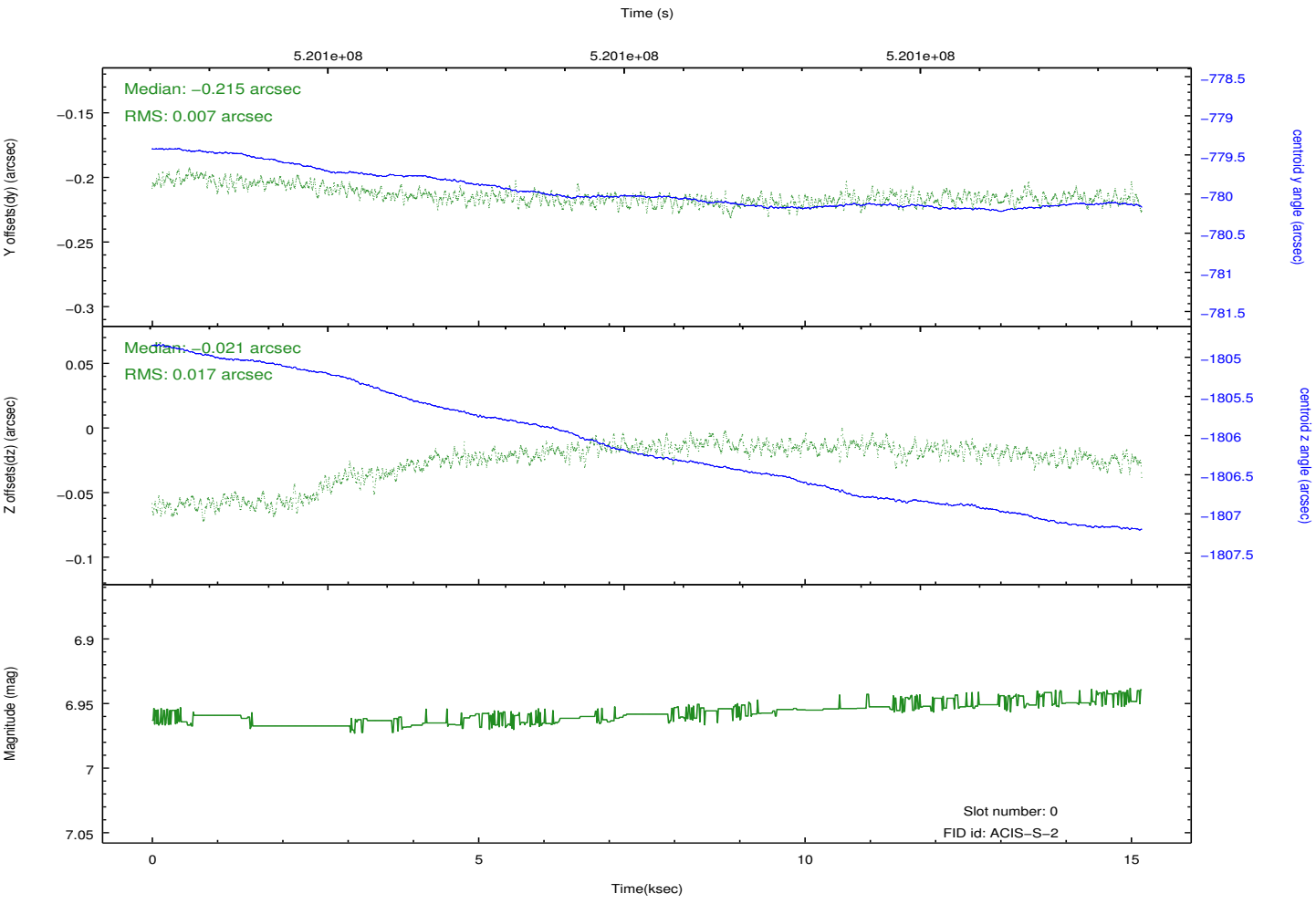

Time (s)
5.201e+08
5.201e+08
5.201e+08
Median: 0.103 arcsec
RMS: 0.072 arcsec
Y offsets(dy) (arcsec)
Median: −1.042 arcsec
RMS: 0.072 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number: 7
AGASC star id: 394546720
Time(ksec)

2.5 FID Slots

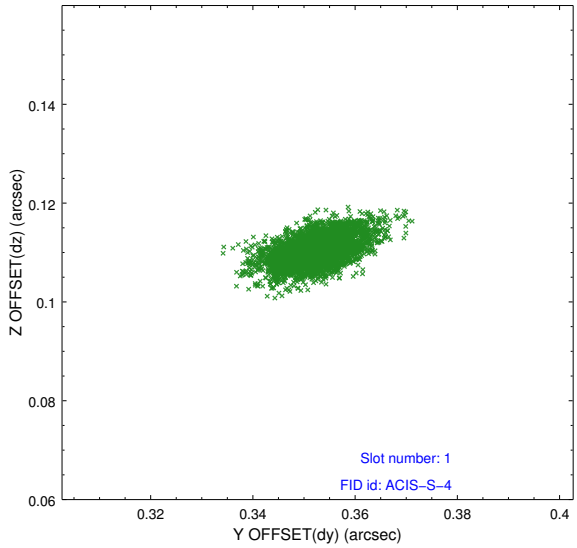
2.5.1 Slot 0

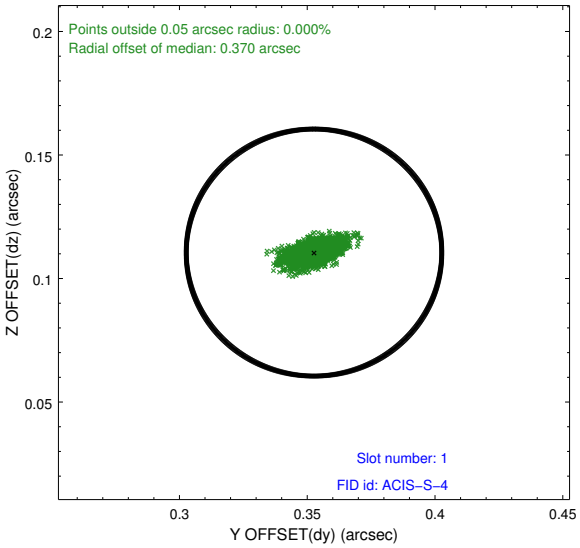


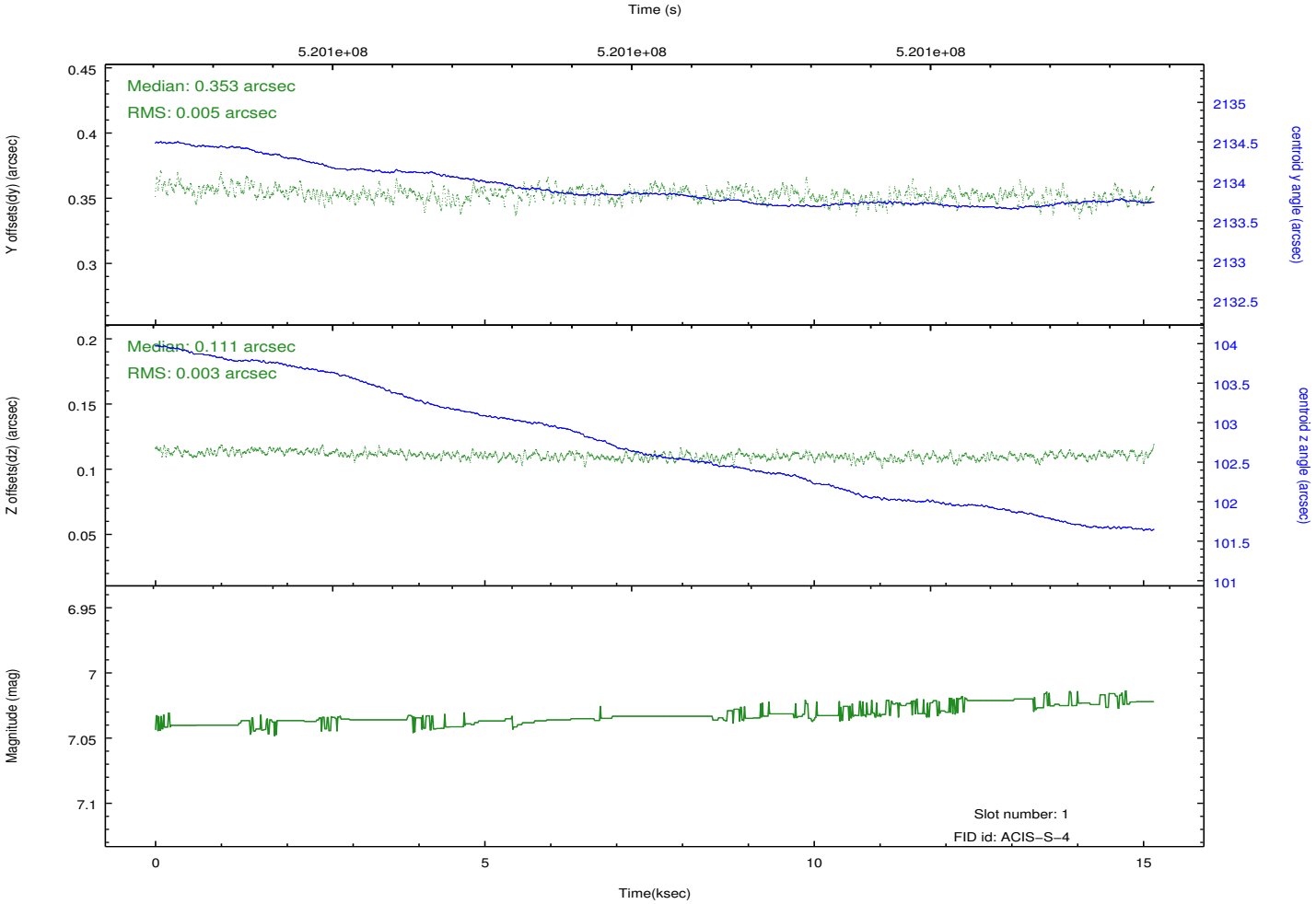




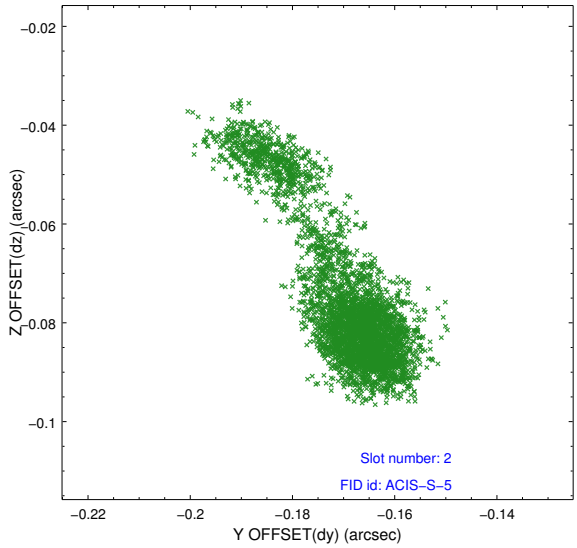
2.5.2 Slot 1

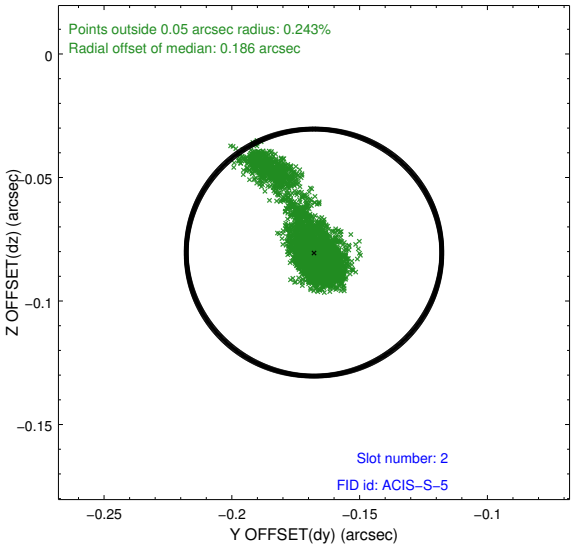

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 1
FID id: ACIS−S−4

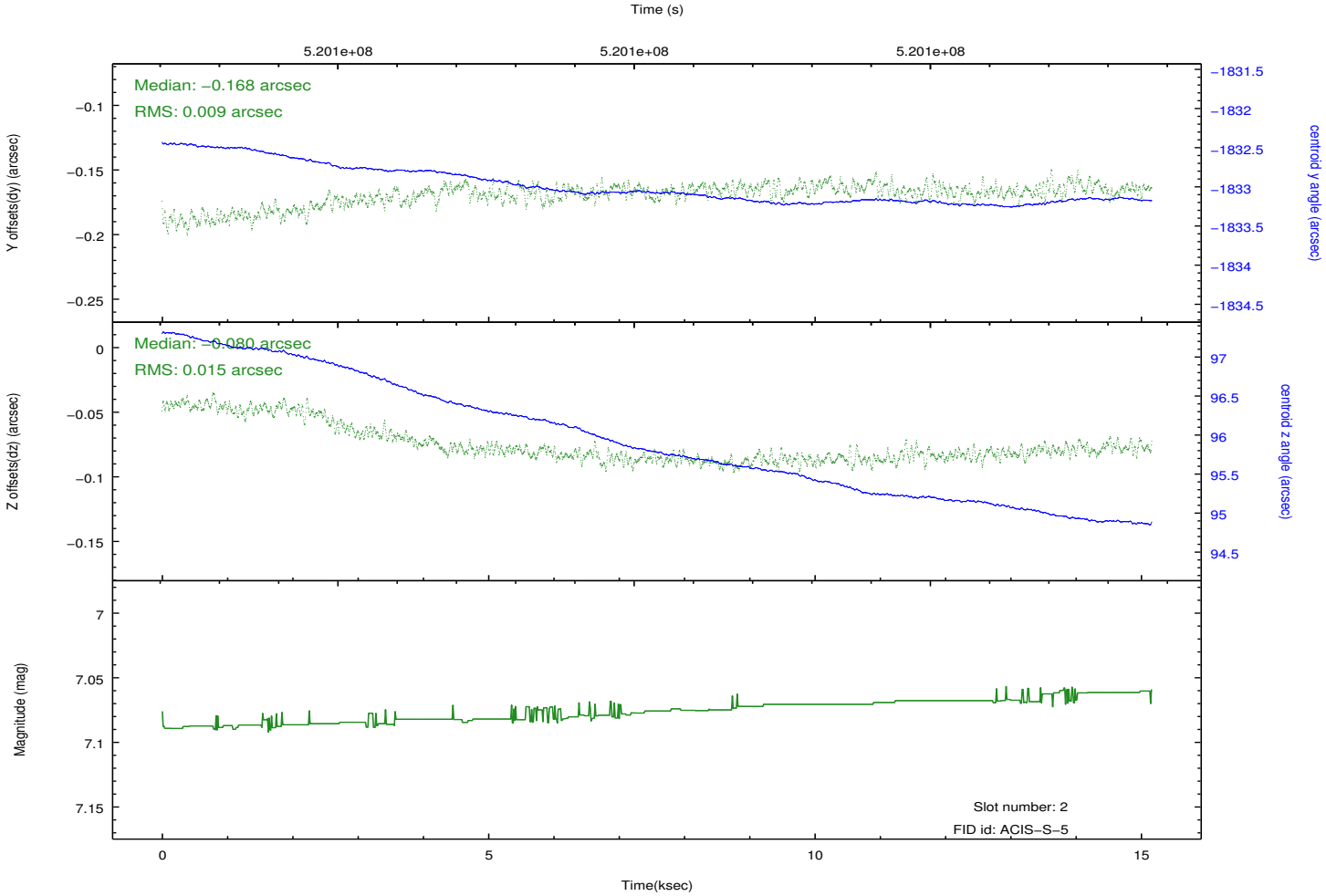

Points outside 0.05 arcsec radius: 0.000%
Radial offset of median: 0.370 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 1
FID id: ACIS−S−4


Time (s)
Median: 0.353 arcsec
RMS: 0.005 arcsec
Y offsets(dy) (arcsec)
centroid y angle (arcsec)
Median: 0.111 arcsec
RMS: 0.003 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

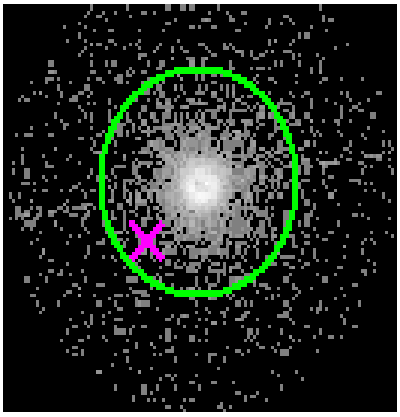

Points outside 0.05 arcsec radius: 0.243%
Radial offset of median: 0.186 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number: 2
FID id: ACIS−S−5


Time (s)
5.201e+08
5.201e+08
5.201e+08
Median: −0.168 arcsec
RMS: 0.009 arcsec
Y offsets(dy) (arcsec)
centroid y angle (arcsec)
Median: −0.080 arcsec
RMS: 0.015 arcsec
Z offsets(dz) (arcsec)
centroid z angle (arcsec)
Magnitude (mag)
Slot number: 2
FID id: ACIS−S−5
Time(ksec)

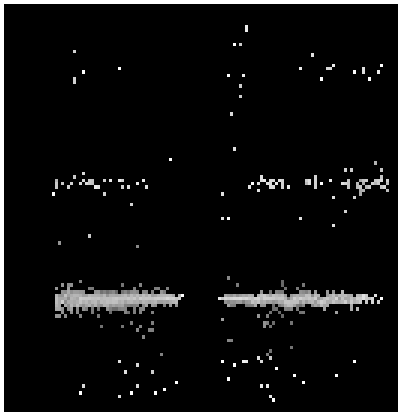
3 Gratings

3.1 HEG Arm

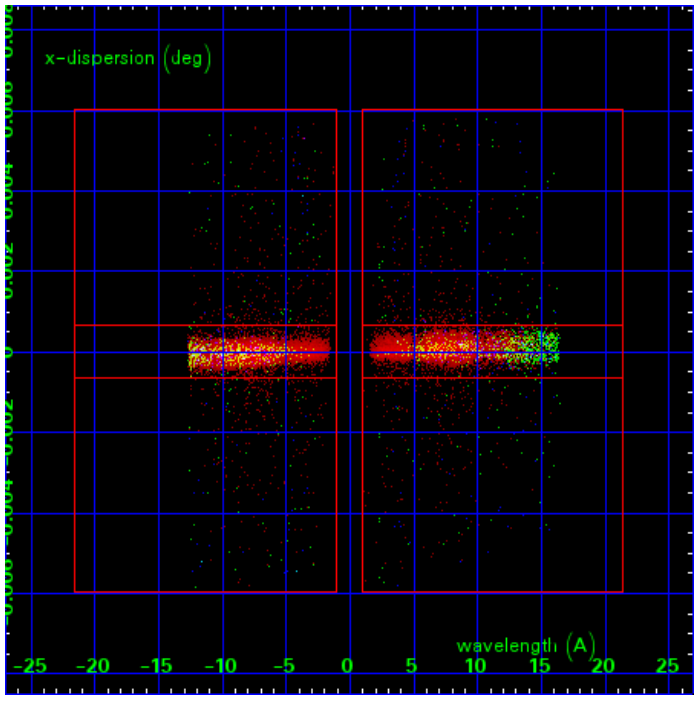
HEG Order Sort 123



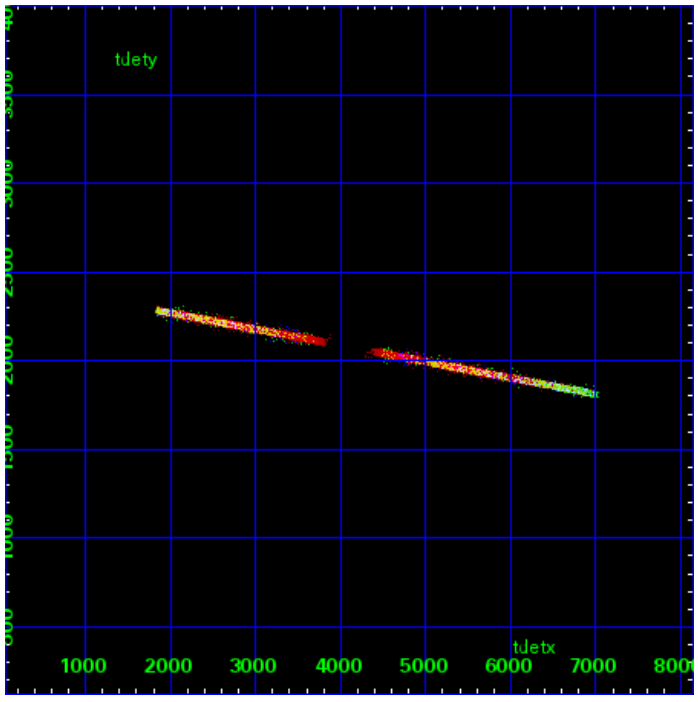
HEG Zero Order



HEG Order Sort ALL

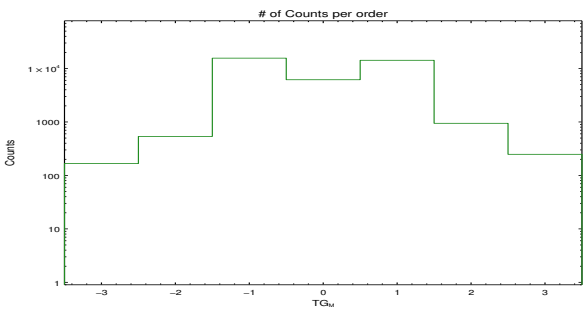


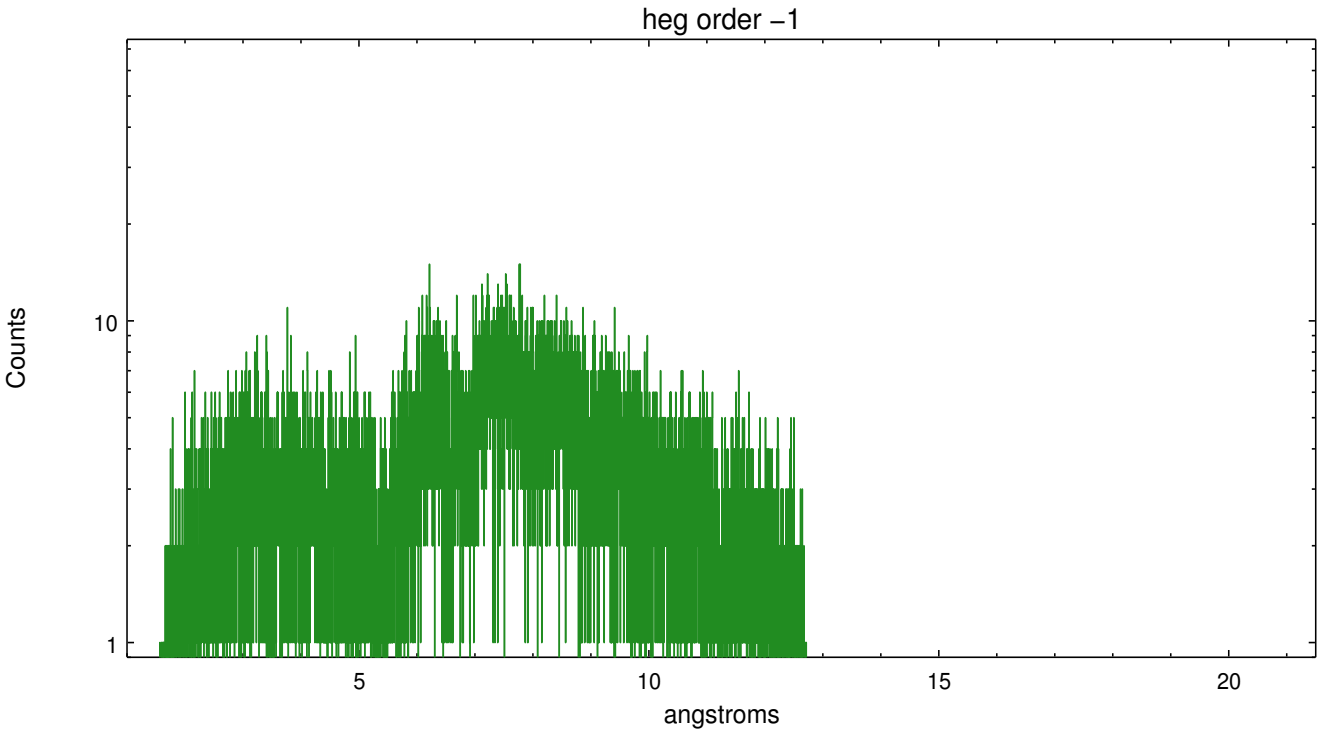
Spot Image HEG

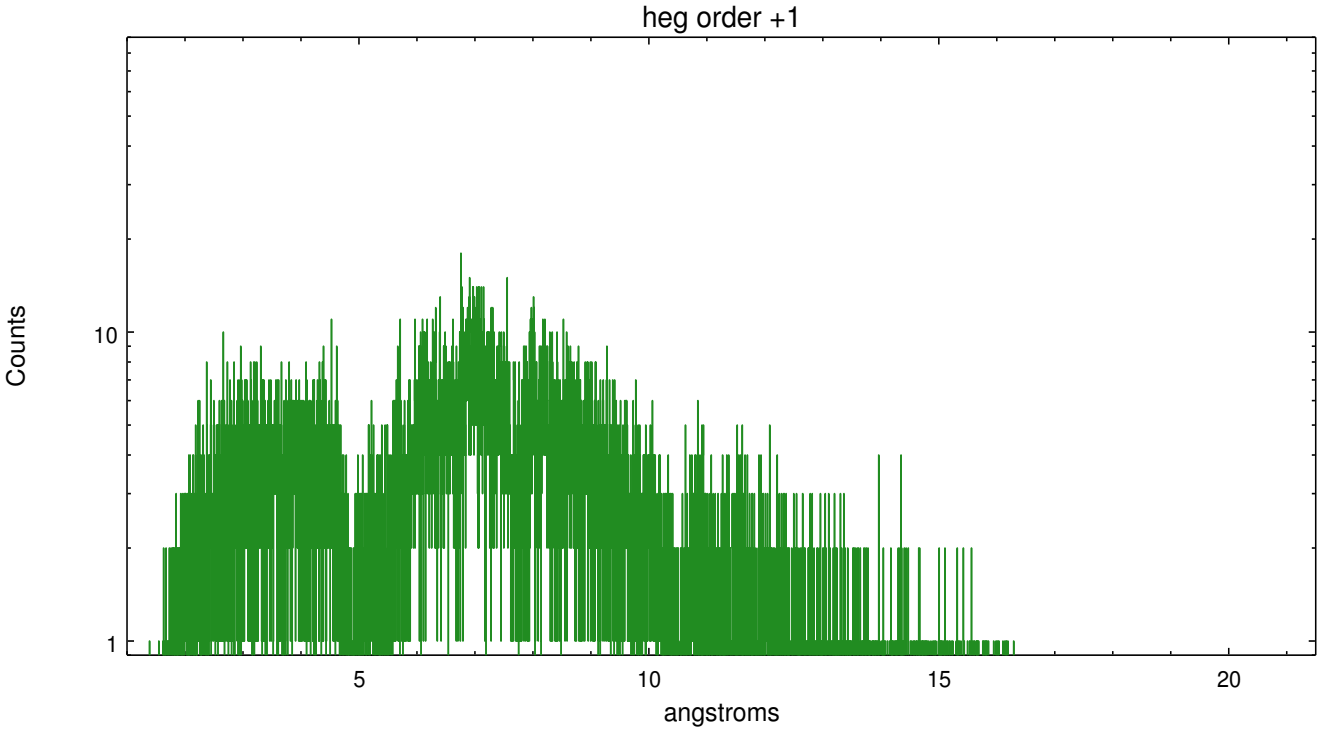


Full Detector HEG

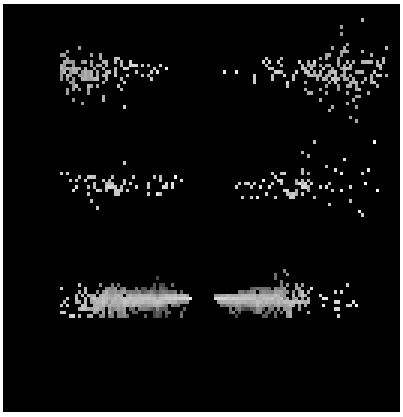
	order -3	order -2	order -1	order 0	order 1	order 2	order 3
Events	167	536	15616	6167	14233	943	248



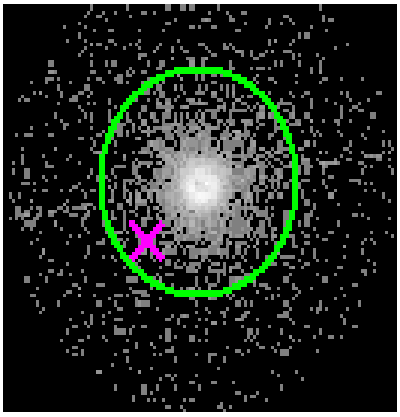

heg order −1
Counts
10
1
5
10
15
20
angstroms


heg order +1
Counts
10
1
5
10
15
20
angstroms

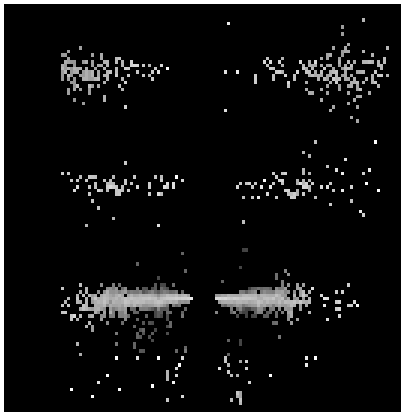
3.2 MEG Arm



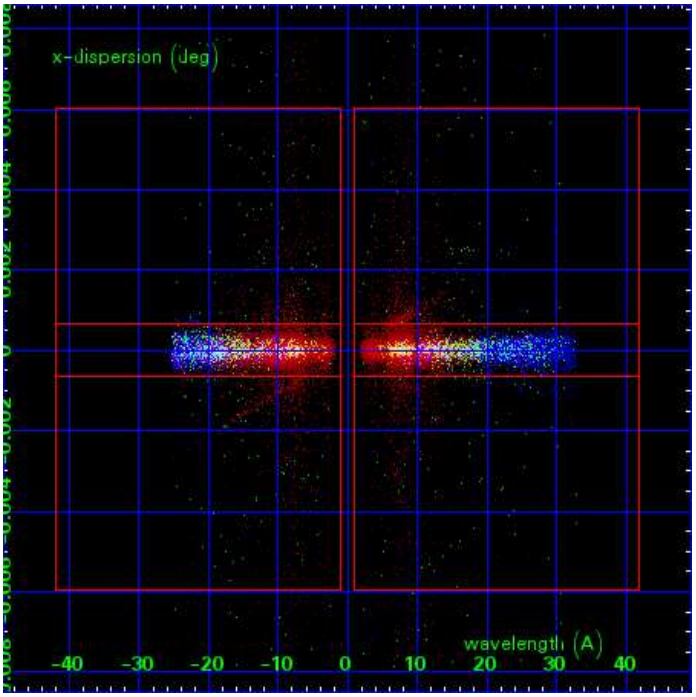
MEG Order Sort 123

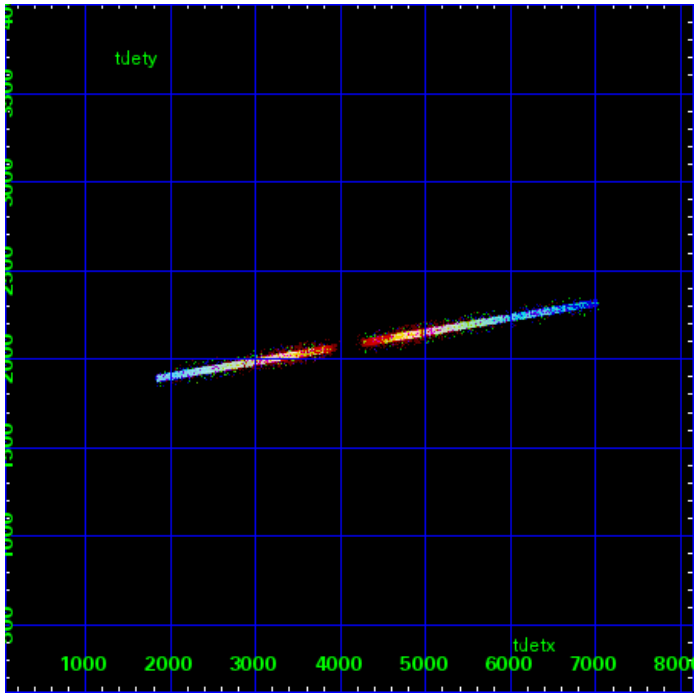


MEG Zero Order



MEG Order Sort ALL

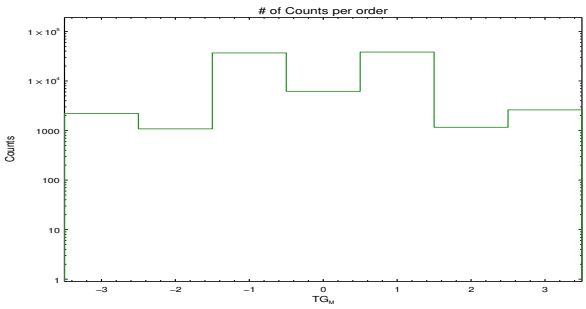


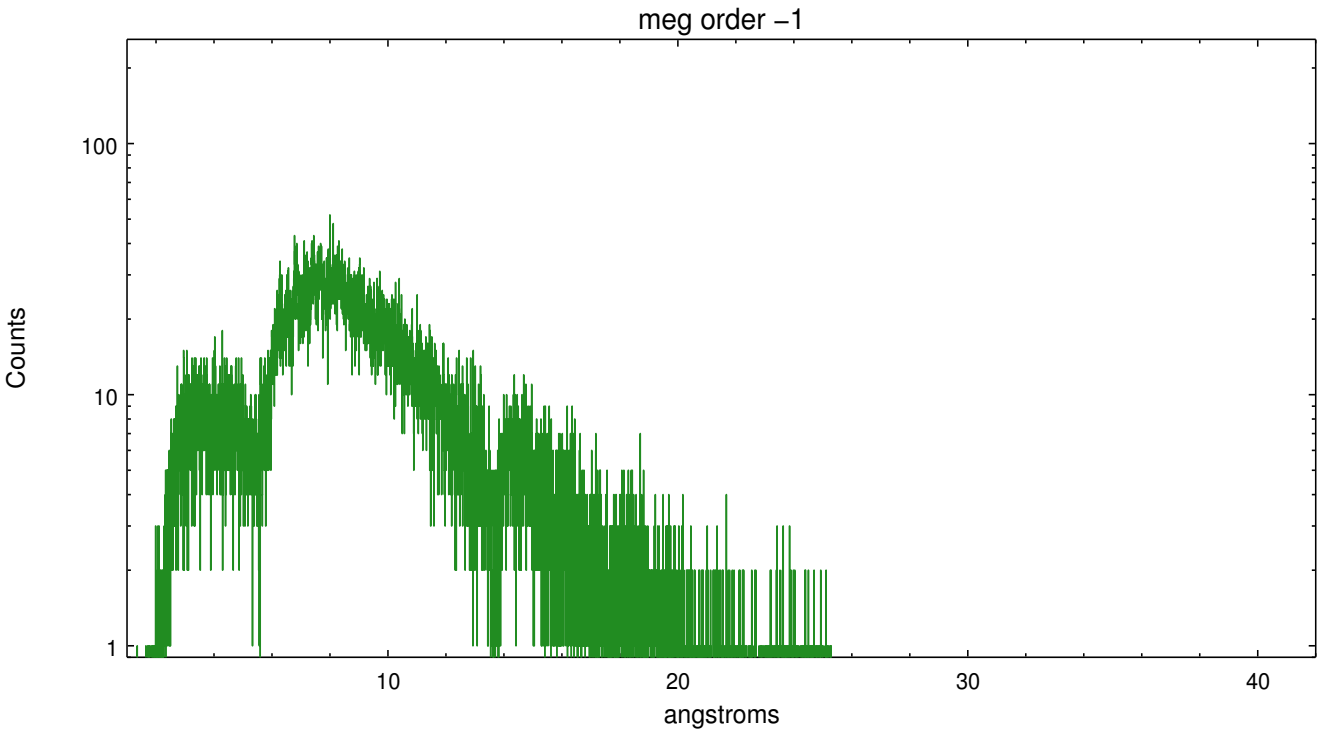


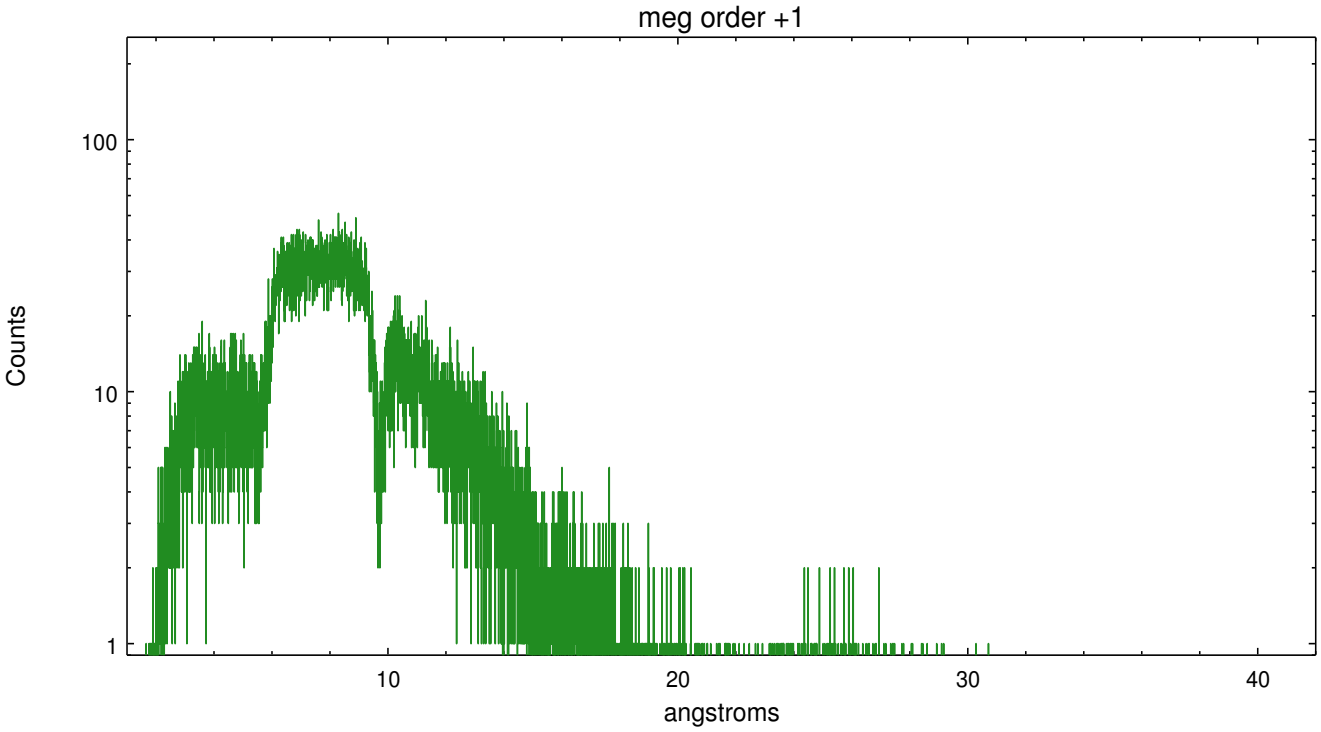
Spot Image MEG

Full Detector MEG

	order -3	order -2	order -1	order 0	order 1	order 2	order 3
Events	2204	1079	36789	6167	38286	1161	2608




meg order −1
Counts
100
10
1
10
20
30
40
angstroms


meg order +1
Counts
100
10
1
10
20
30
40
angstroms

A Summary

A.1 Status

V&V Scientist	Joy Nichols
V&V Date (YYYY-MM-DD)	2015.10.08
V&V Edition	1
V&V Disposition and Status	OK
V&V Charge Time	15.049725230157

A.2 Comments

```
These data have been reprocessed with new aspect alignment calibration
files that correct small mean offsets (up to 0.4 arcsecs) and improve
overall astrometric accuracy. The new calibration was determined using
data from the time period being reprocessed and was performed using
cross-correlation of X-ray sources with radio and optical counterparts.

=====
Zeroth order piled up. 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.
=====
WARNING: MEG spectrum is faintly visible in bad-events image, which
means it may have ccd event pile-up.
```