V&V Reference Report
L2 ASCDS Version : 7.6.11.1

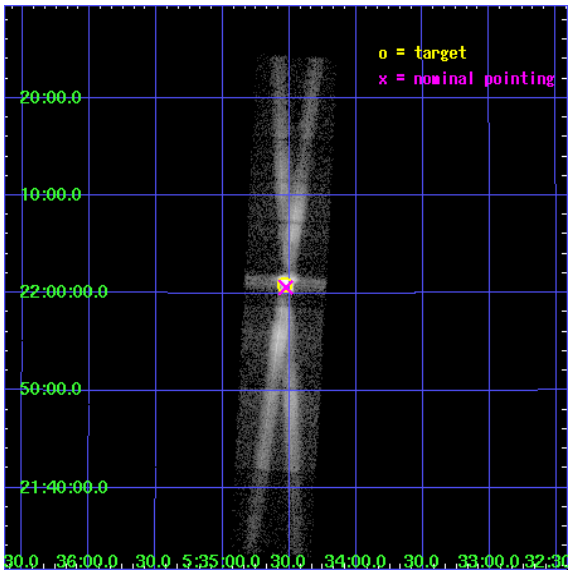
Observation 169 - L2 Version 5
Chandra X-Ray Center

L2 Processing Date : Sep 15 2007

Contents

1 Front

seq_num	590037
obs_id	169
title	CALIBRATION OF HETGS USING THE CRAB PULSAR AND NEBULA
observer	Dr. CXC Calibration
object	CRAB PULSAR
dtycycle	0
cycle	P
ra_targ	83.633333
dec_targ	22.014472
ra_nom	83.631596563644
dec_nom	22.010003740729
roll_nom	273.05381435582
revision	5
ontime	462.41419693828
livetime	39.507273273456
ontime4	1547.424433738
ontime5	2351.5258713663
ontime6	955.26254615188
ontime7	462.41419693828
ontime8	1069.8794751465
ontime9	1684.3674733341
l2events	105977

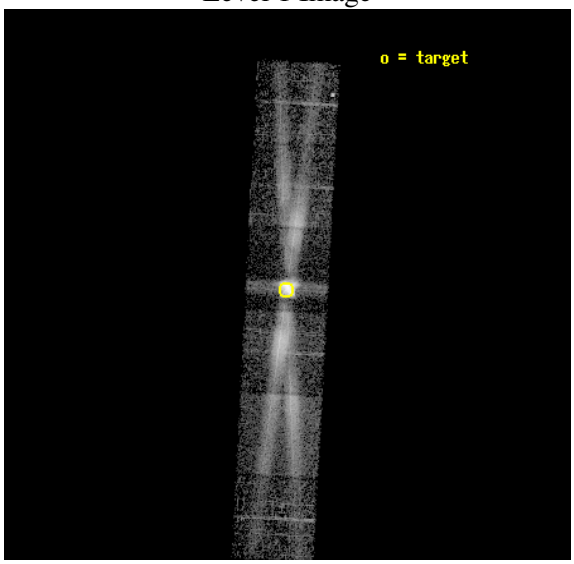


2 OBI Primary

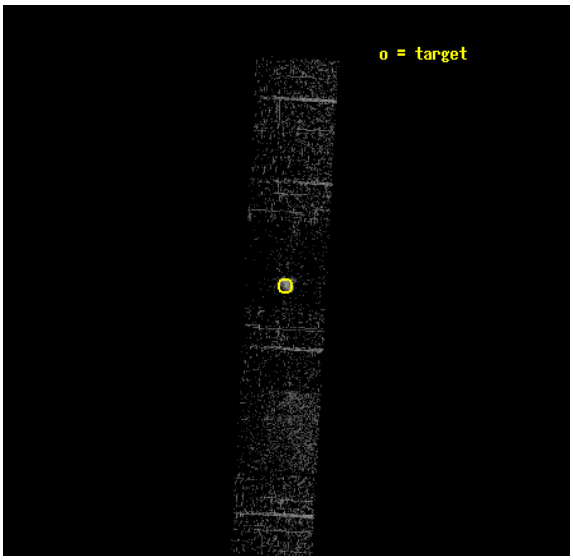
2.1 OBI

2.1.1 Images

Level 1 Image



Level 1 Bad Events



2.1.2 Parameters

obi_num	0
ascdsver	7.6.11.1
caldbver	3.4.0
date	2007-09-15T16:48:24
revision	5

sched_exp_time	9900.000000
ontime	462.41419693828
ontime4	1547.424433738
ontime5	2351.5258713663
ontime6	955.26254615188
ontime7	462.41419693828
ontime8	1069.8794751465
ontime9	1684.3674733341
l1events	141638

2.1.3 Events

	ccd 4	**ccd 5**	**ccd 6**	**ccd 7**	**ccd 8**	**ccd 9**
level 1 events	10171	26636	32665	35809	23764	12593
rejected events	6477	5468	4006	2539	5160	6077
rejected %	63%	20%	12%	7%	21%	48%

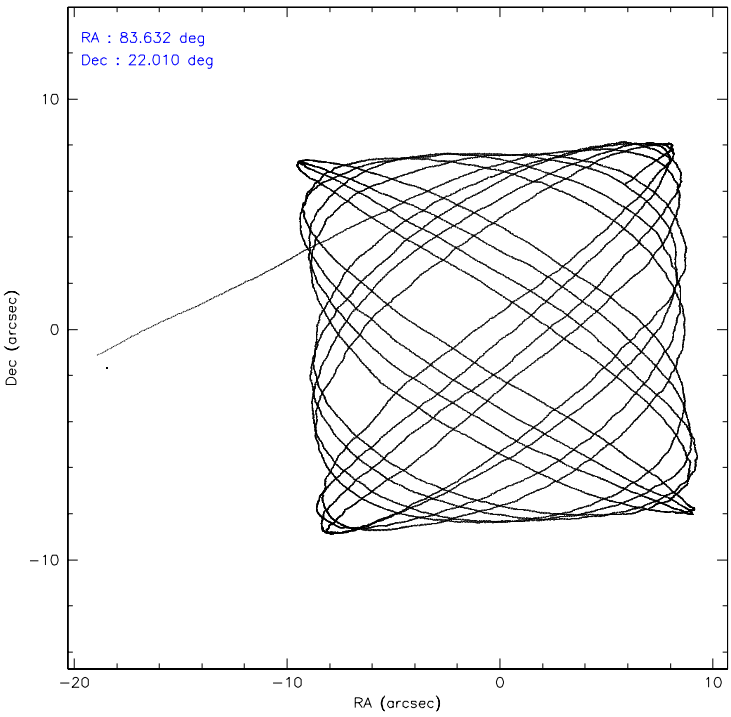
	ccd 4	**ccd 5**	**ccd 6**	**ccd 7**	**ccd 8**	**ccd 9**
grade 0 events	2861	5915	22626	7913	15394	5198
	28%	22%	69%	22%	64%	41%
grade 1 events	5	7	71	86	29	10
	0%	0%	0%	0%	0%	0%
grade 2 events	480	7775	3312	9300	1879	721
	4%	29%	10%	25%	7%	5%
grade 3 events	144	1511	905	3556	519	233
	1%	5%	2%	9%	2%	1%
grade 4 events	116	1598	986	3579	507	213
	1%	5%	3%	9%	2%	1%
grade 5 events	121	598	134	495	157	138
	1%	2%	0%	1%	0%	1%
grade 6 events	121	4531	830	9444	427	187
	1%	17%	2%	26%	1%	1%
grade 7 events	6323	4701	3801	1436	4852	5893
	62%	17%	11%	4%	20%	46%

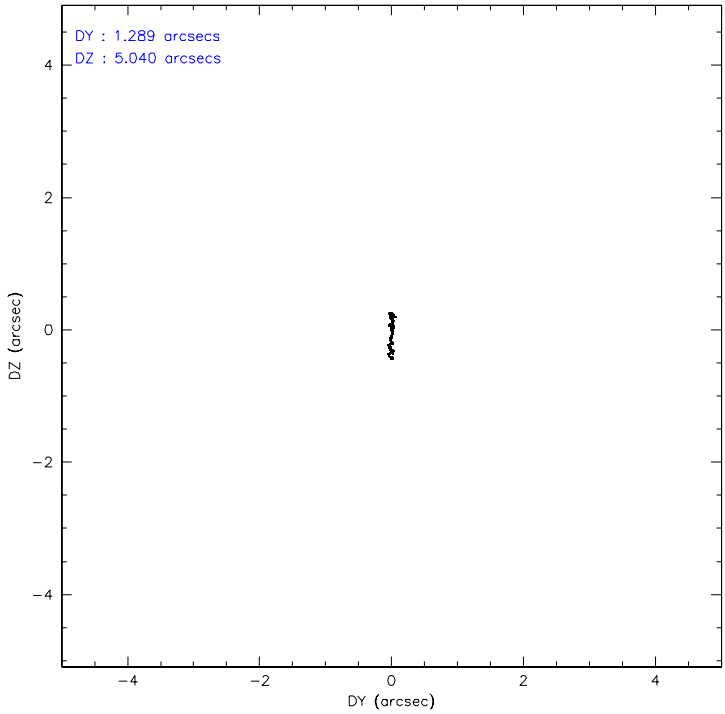
2.2 Compared Parameters

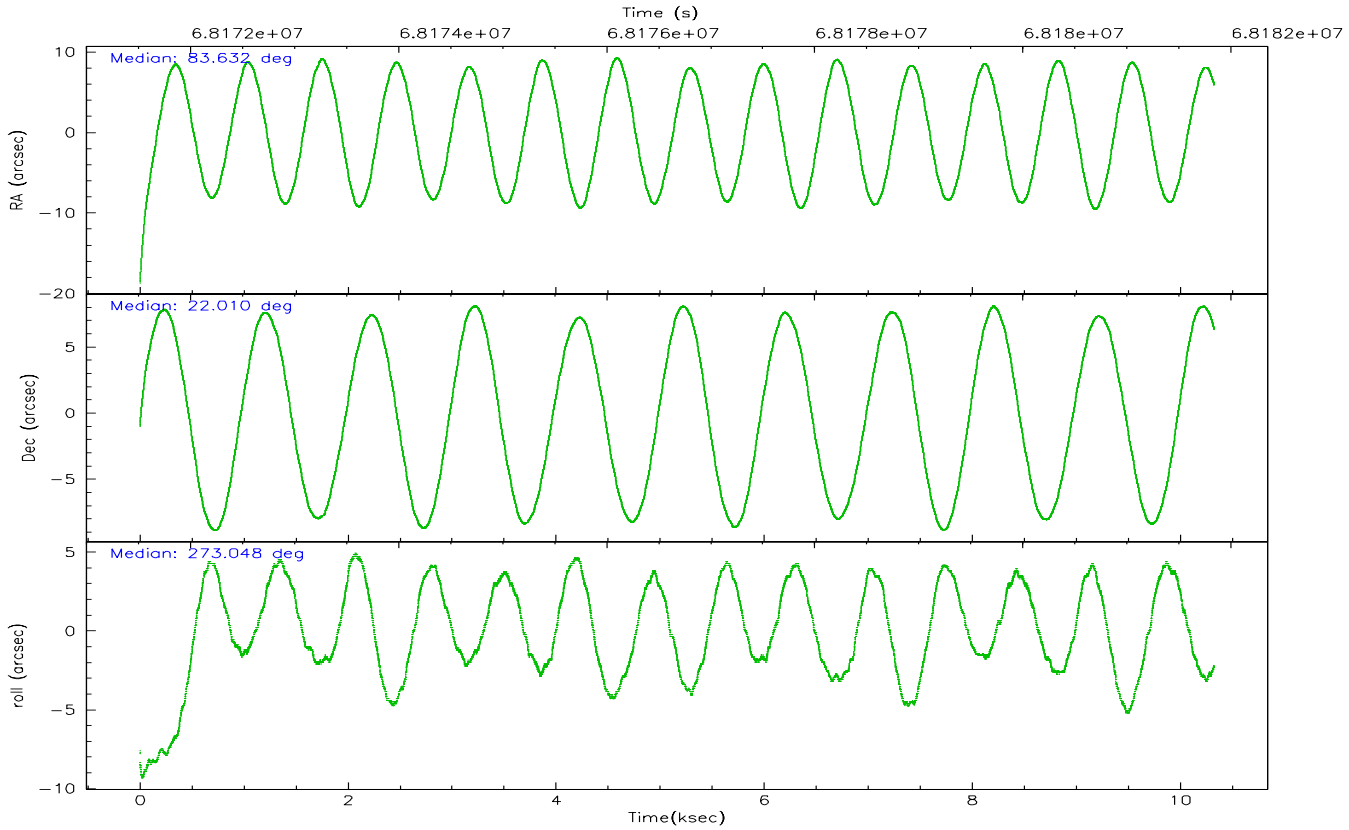
Parameter	Planned	Actual
Instrument	ACIS	ACIS
Detector	ACIS-456789	ACIS-456789
Grating	HETG	HETG
Data mode	GRADED	GRADED
Observation mode	POINTING	POINTING
Pointing RA	83.615402	83.63159656364439
Pointing Dec	22.032987	22.01000374072886
Pointing Roll	272.903262	273.0538143558217
Window start time	65750464.184000	65750464.184000
Window stop time	69465664.184000	69465664.184000
SIM focus pos (mm)	-0.684267	-0.6828225247311905
SIM defocus (mm)	0	0.001444936568705701
SIM translation stage pos (mm)	-190.132523	-190.1425803651734
SIM translation stage offset (mm)	0	0.01005778216563158
Observation start time	68171938.184000	68170578.262308
Observation start date	2000-02-29T00:37:54	2000-02-29T00:16:18
Observation end time	68181838.184000	68182344.237737
Observation end date	2000-02-29T03:22:54	2000-02-29T03:32:24
Read mode	TIMED	TIMED

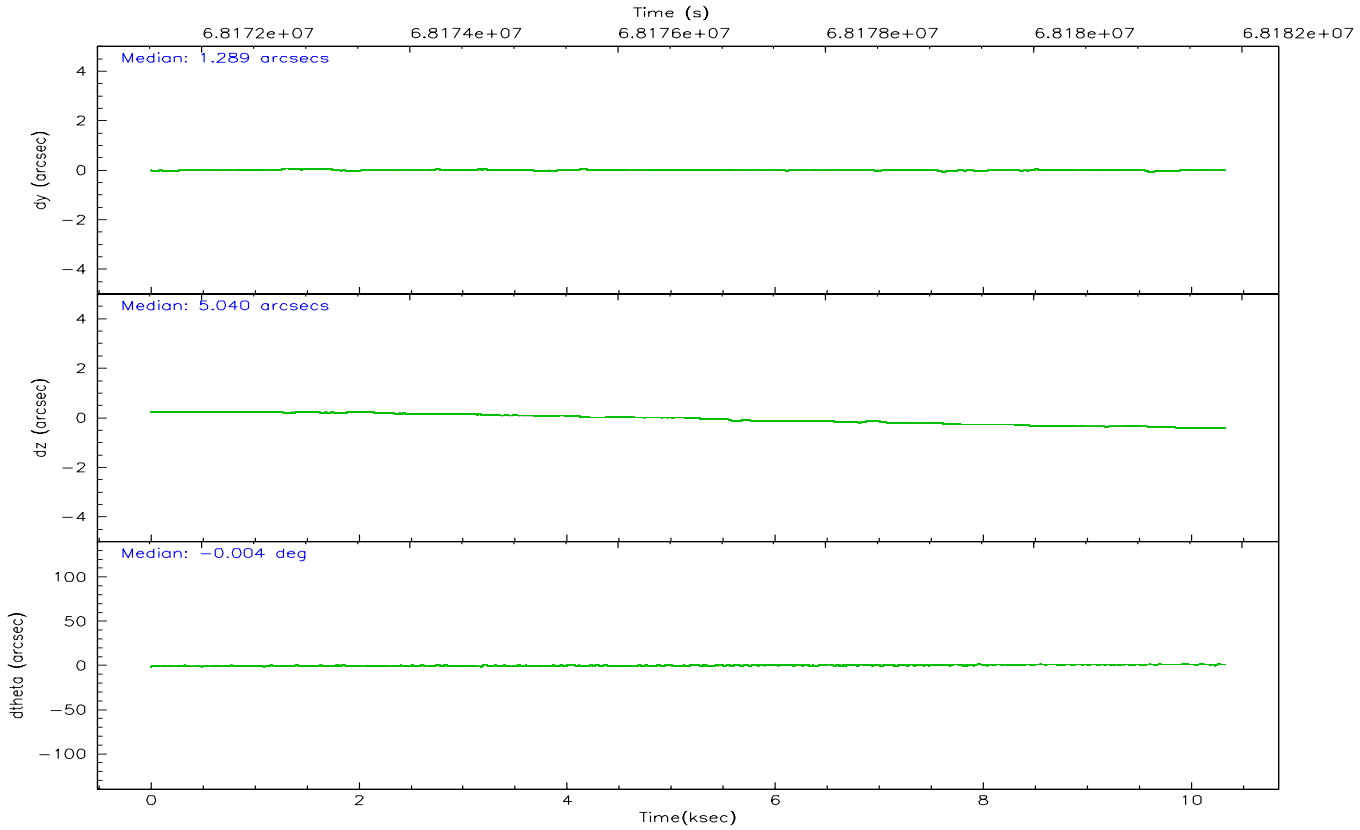
Parameter	Planned	Actual
Obspar format version number	6	6
Obspar file type	PREDICTED	ACTUAL
Obspar update status	NONE	UPDATED
Number of optional ACIS chips dropped	0	0
On-chip summing requested	N	N
Subarray requested	NONE	NONE
Alternating exposures requested	Y	Y
Primary exposure time	0.300000	0.3
Secondary exposure time	3.200000	3.2
Duty cycle	3	3

2.3 Aspect


RA : 83.632 deg
Dec : 22.010 deg
10
0
−10
Dec (arcsec)
−20
−10
0
10
RA (arcsec)


DY : 1.289 arcsecs
DZ : 5.040 arcsecs
4
2
0
−2
−4
DZ (arcsec)
−4
−2
0
2
4
DY (arcsec)


Time (s)
6.8172e+07
6.8174e+07
6.8176e+07
6.8178e+07
6.818e+07
6.8182e+07
Median: 83.632 deg
RA (arcsec)
Median: 22.010 deg
Dec (arcsec)
Median: 273.048 deg
roll (arcsec)
Time(ksec)

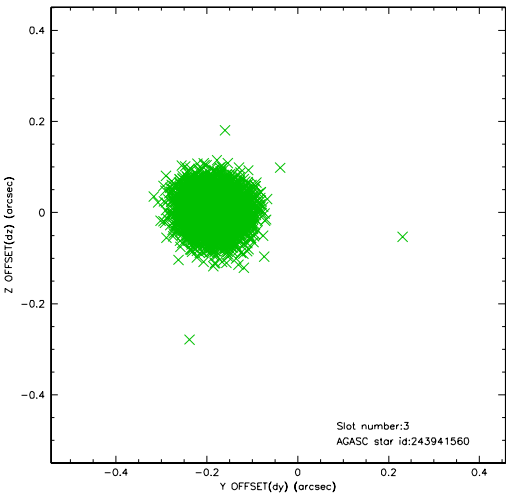

Time (s)
6.8172e+07
6.8174e+07
6.8176e+07
6.8178e+07
6.818e+07
6.8182e+07
Median: 1.289 arcsecs
dy (arcsec)
Median: 5.040 arcsecs
dz (arcsec)
Median: −0.004 deg
dtheta (arcsec)
Time(ksec)

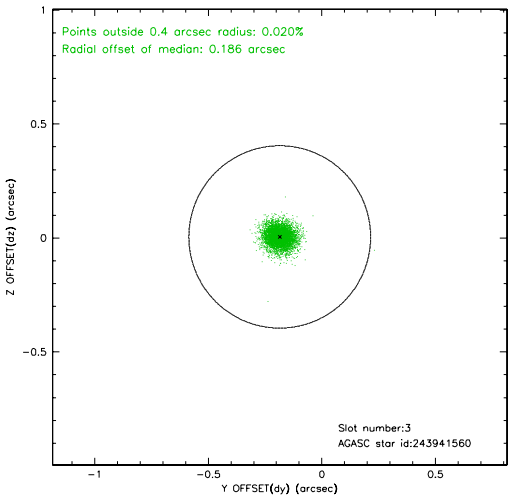
Slot Statistics

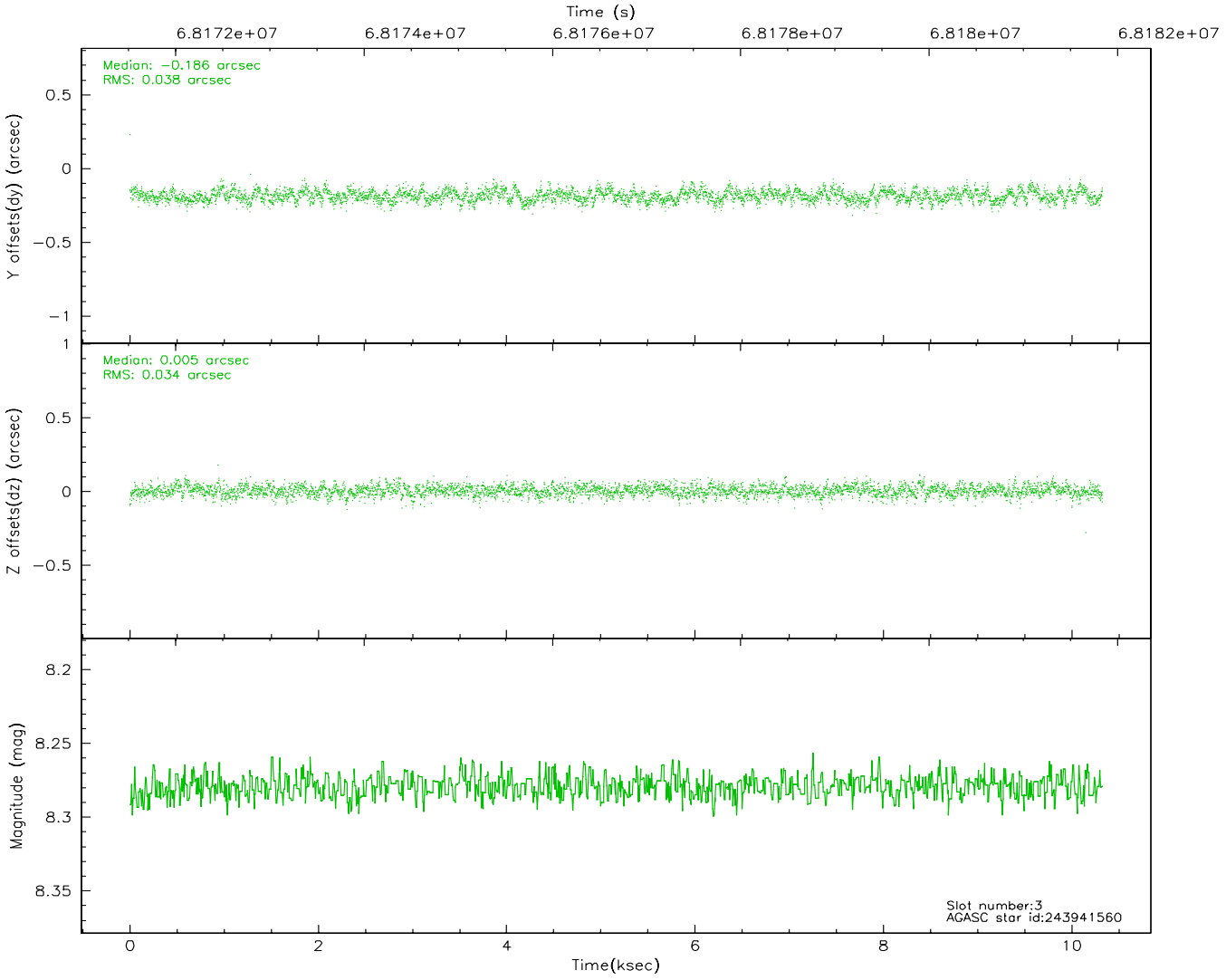
slot	status	id	mag	n_pts	med_dy	med_dz	dr1	dr2	ra	dec	mean_y	mean_z
0	FID	ACIS-S-2	7.11	2517	-0.020	0.017	0.009	0.014	0.000000	0.000000	-753.91	-1726.03
1	FID	ACIS-S-4	7.21	2518	-0.033	0.005	0.005	0.008	0.000000	0.000000	2159.13	181.90
2	FID	ACIS-S-5	7.23	2518	0.021	-0.013	0.009	0.014	0.000000	0.000000	-1806.05	176.15
3	GUIDE	243941560	8.28	5038	-0.186	0.005	0.054	0.087	83.733264	22.568598	-1906.18	488.29
4	GUIDE	171586976	8.46	5036	-0.114	0.074	0.073	0.115	83.857953	22.438065	-1416.68	879.47
5	GUIDE	171597832	9.17	5038	0.199	-0.107	0.087	0.139	83.183230	21.366702	2320.35	-1568.71
6	GUIDE	171721904	9.22	5035	0.020	0.176	0.100	0.163	84.272676	22.116922	-195.12	2204.14
7	GUIDE	171600224	9.67	5034	0.073	-0.148	0.103	0.165	82.941815	21.636094	1308.29	-2323.41

2.4 Star Slots

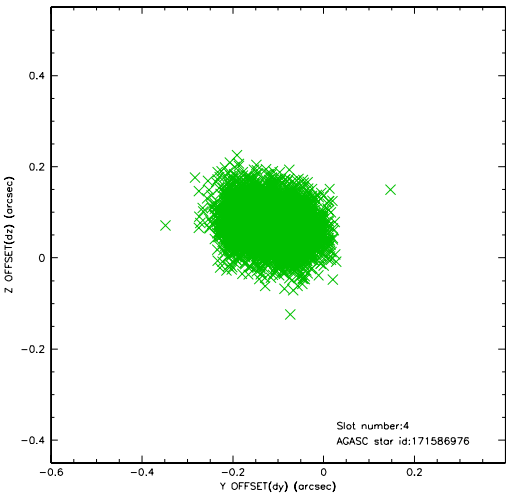
2.4.1 Slot 3

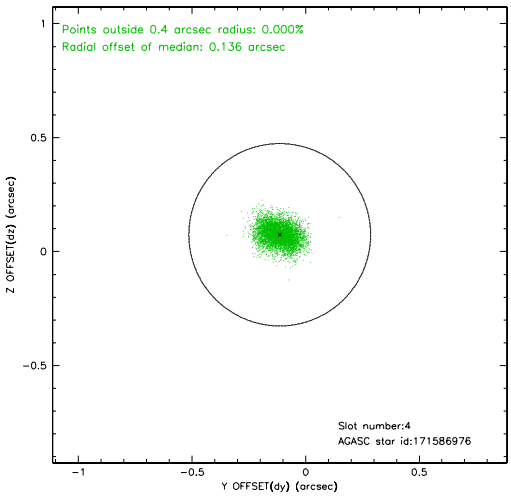


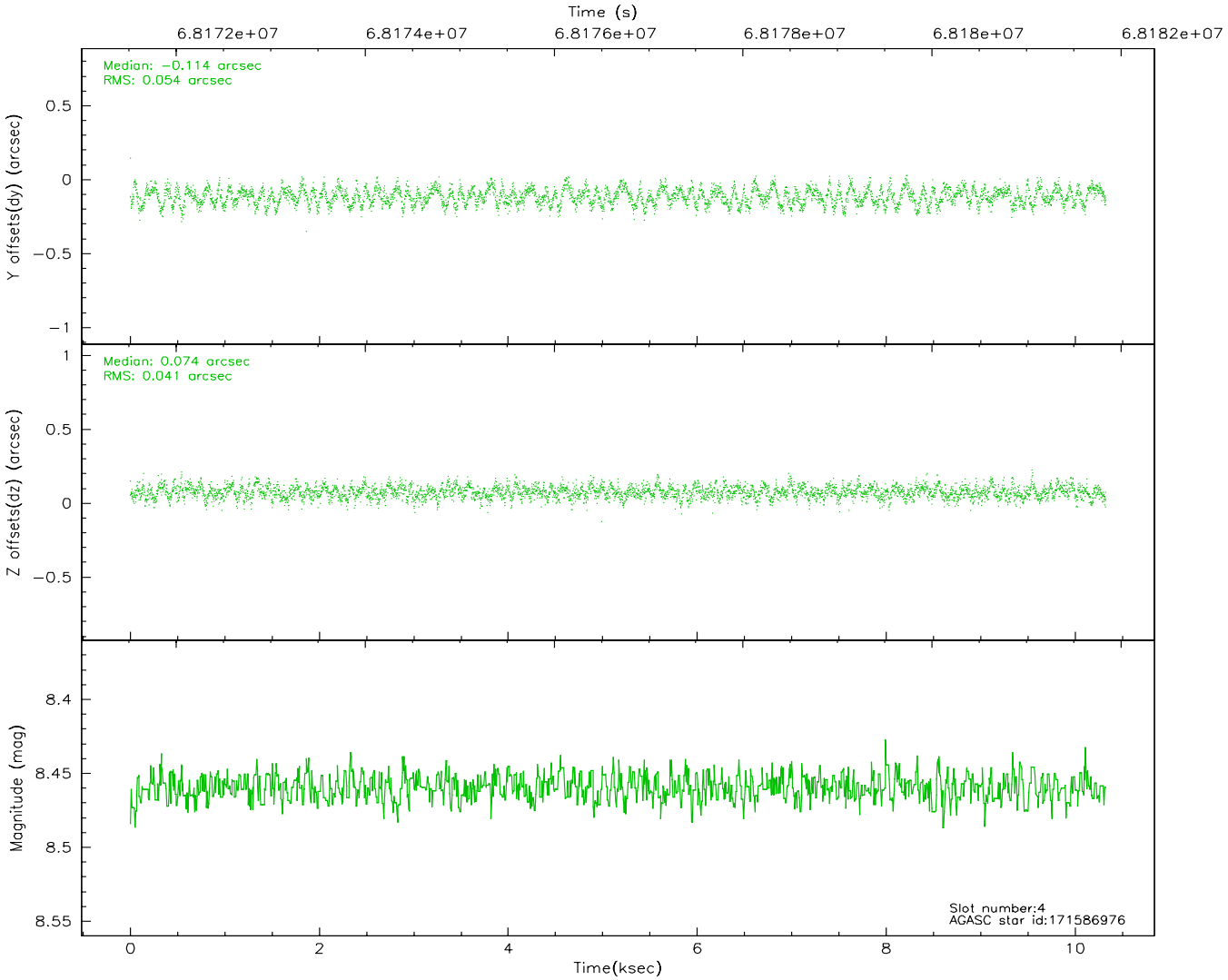




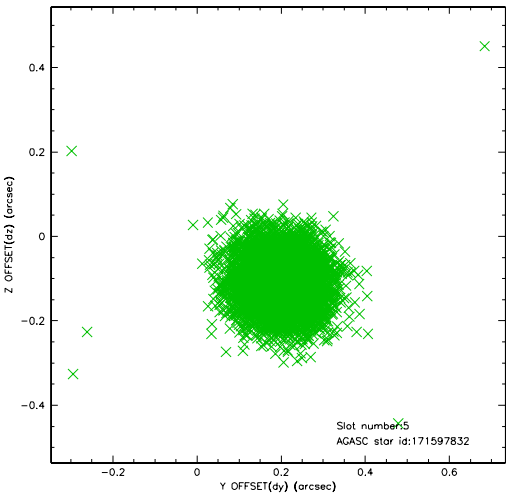
2.4.2 Slot 4

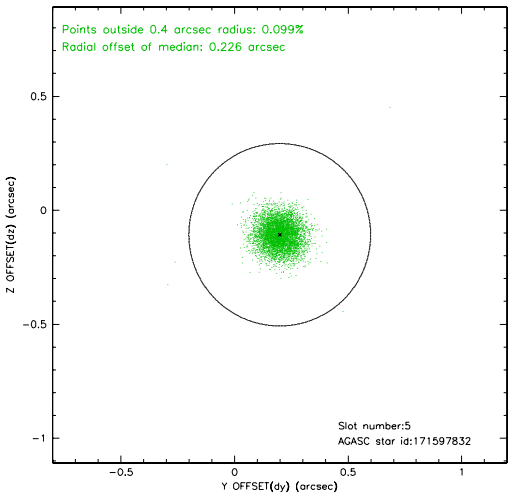

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:4
AGASC star id:171586976

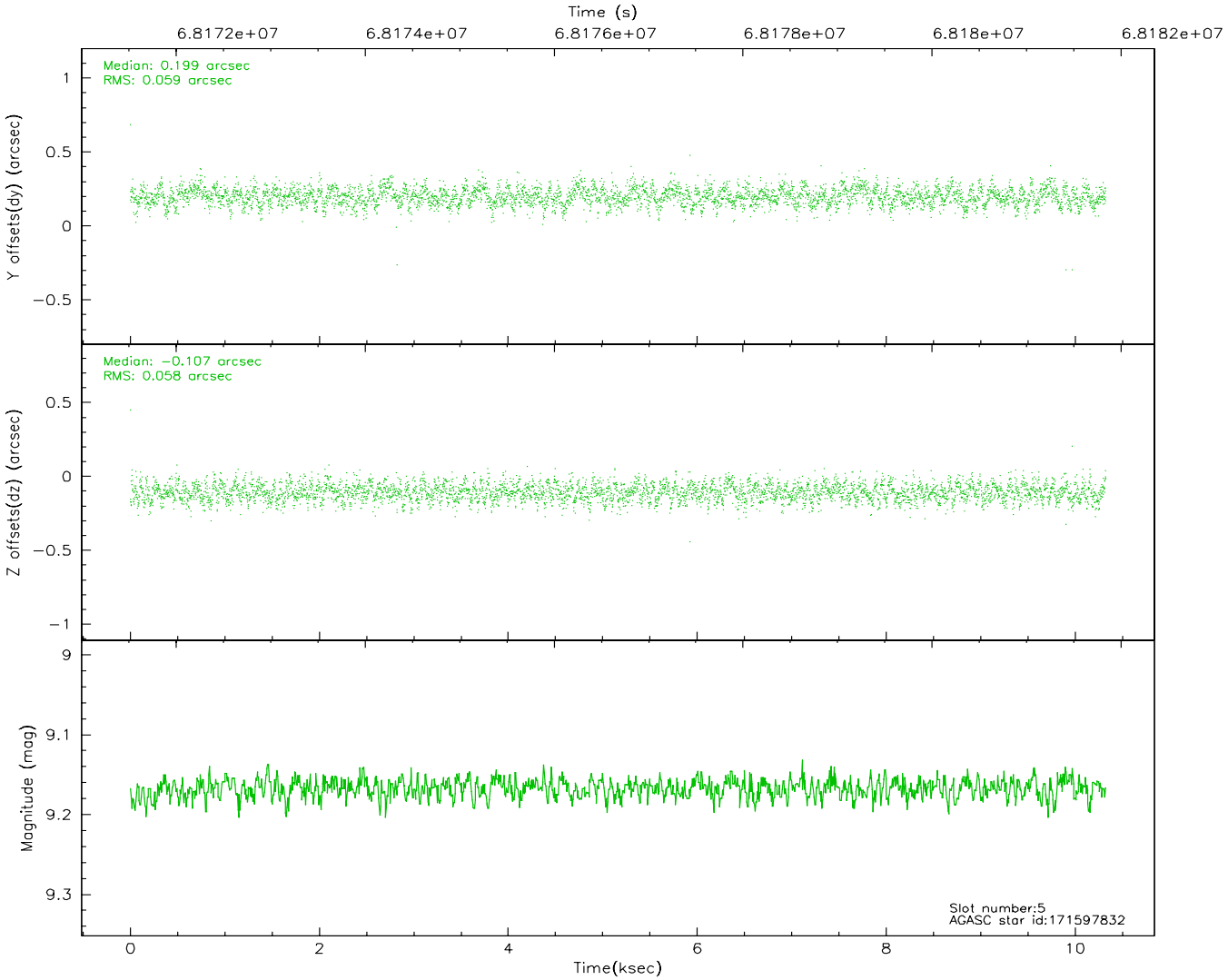

Points outside 0.4 arcsec radius: 0.000%
Radial offset of median: 0.136 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:4
AGASC star id:171586976


Time (s)
Median: −0.114 arcsec
RMS: 0.054 arcsec
Y offsets(dy) (arcsec)
Median: 0.074 arcsec
RMS: 0.041 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number:4
AGASC star id:171586976
Time(ksec)

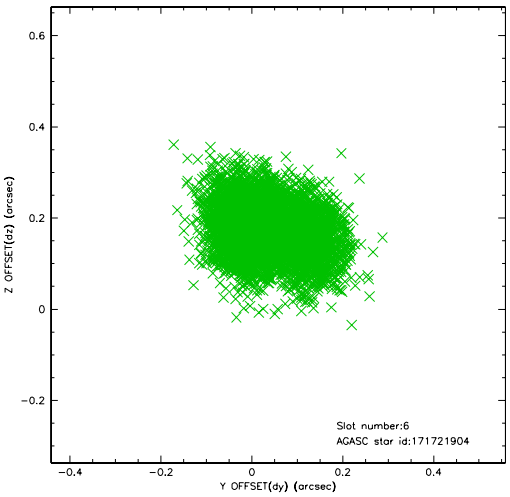
2.4.3 Slot 5

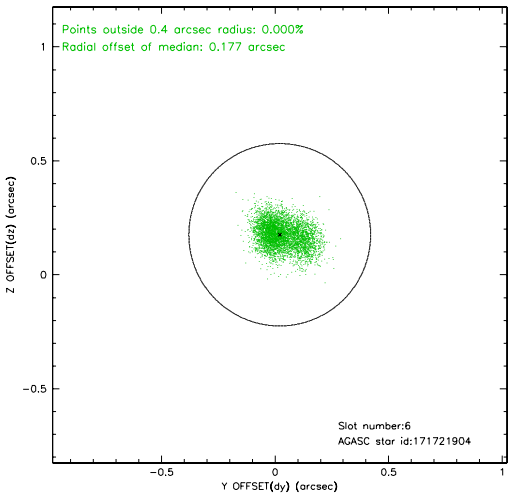

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:5
AGASC star id:171597832

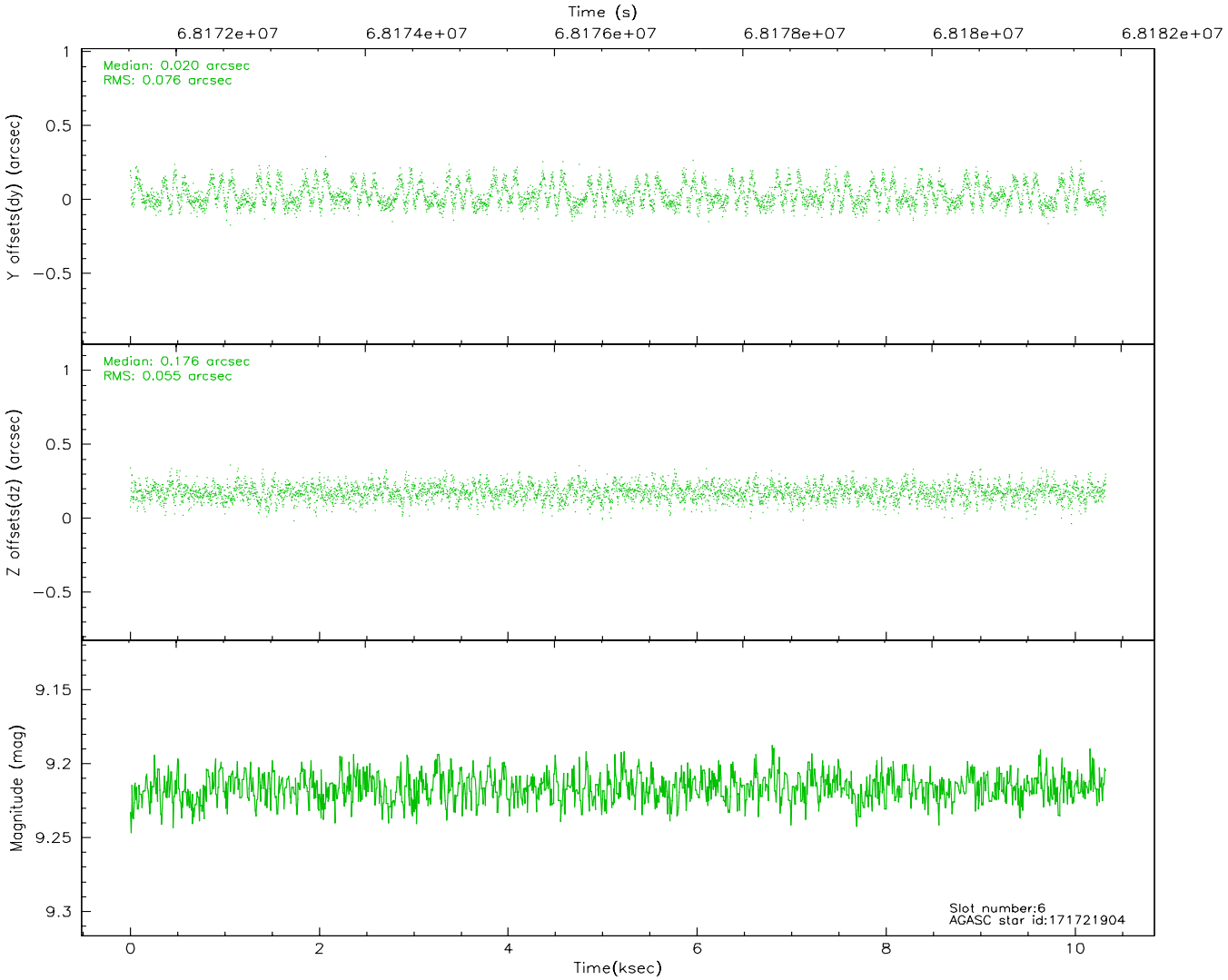

Points outside 0.4 arcsec radius: 0.099%
Radial offset of median: 0.226 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:5
AGASC star id:171597832


Time (s)
Median: 0.199 arcsec
RMS: 0.059 arcsec
Y offsets(dy) (arcsec)
Median: −0.107 arcsec
RMS: 0.058 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number:5
AGASC star id:171597832
Time(ksec)

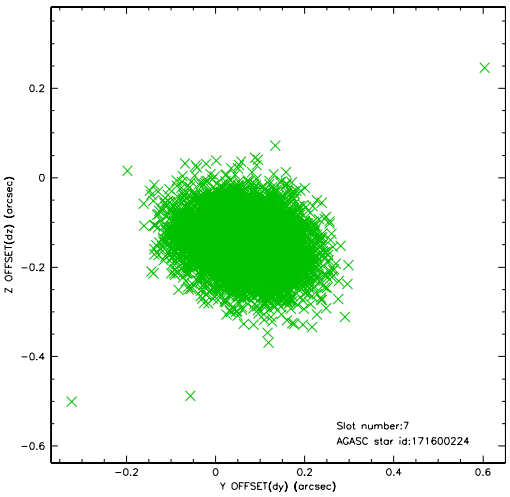
2.4.4 Slot 6

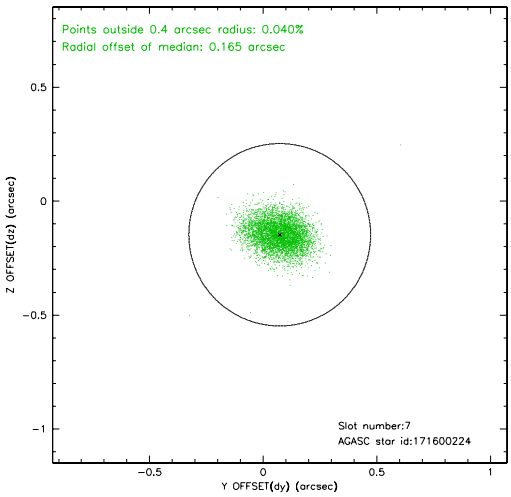

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:6
AGASC star id:171721904

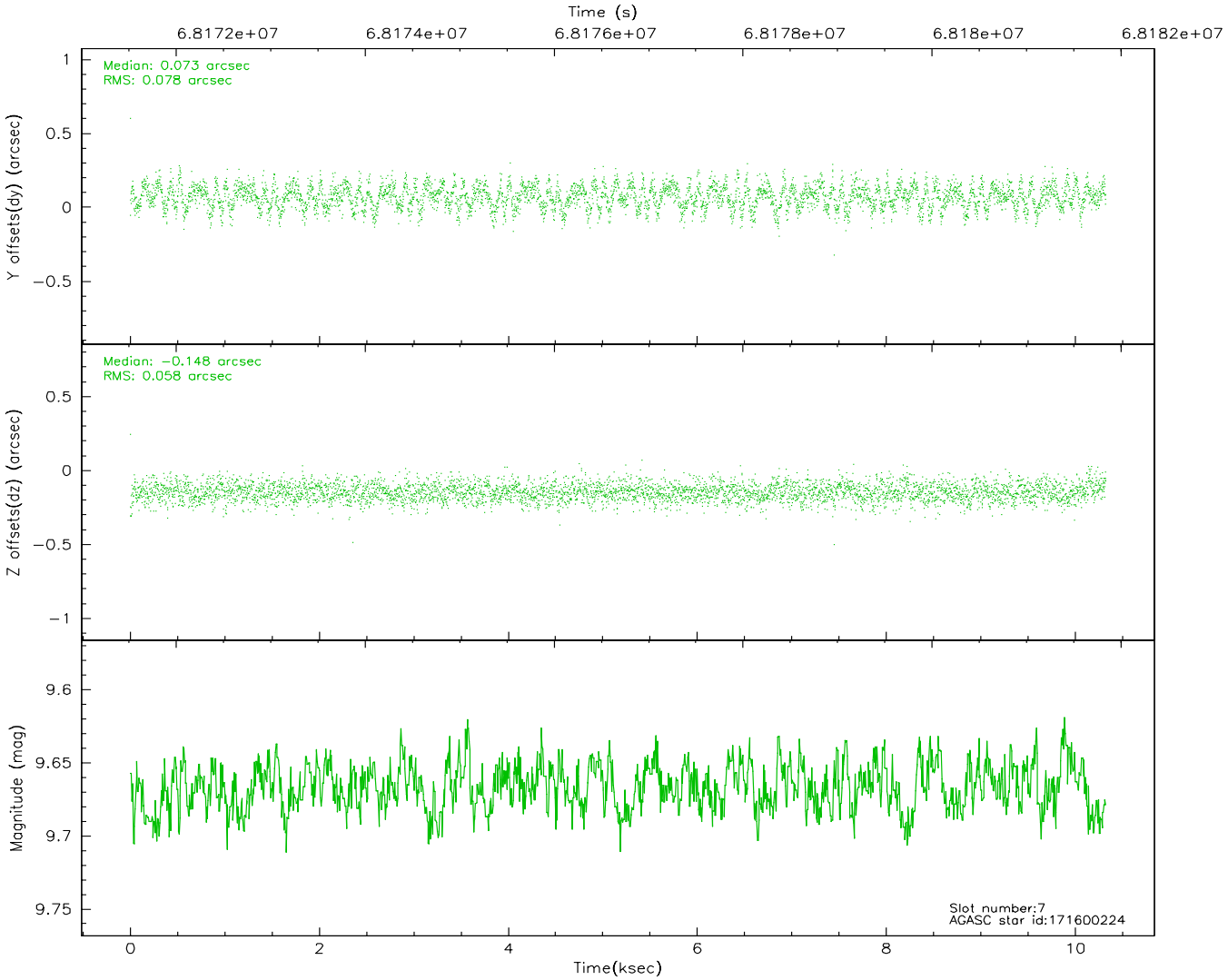

Points outside 0.4 arcsec radius: 0.000%
Radial offset of median: 0.177 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:6
AGASC star id:171721904


Time (s)
Median: 0.020 arcsec
RMS: 0.076 arcsec
Y offsets(dy) (arcsec)
Median: 0.176 arcsec
RMS: 0.055 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number:6
AGASC star id:171721904
Time(ksec)

2.4.5 Slot 7

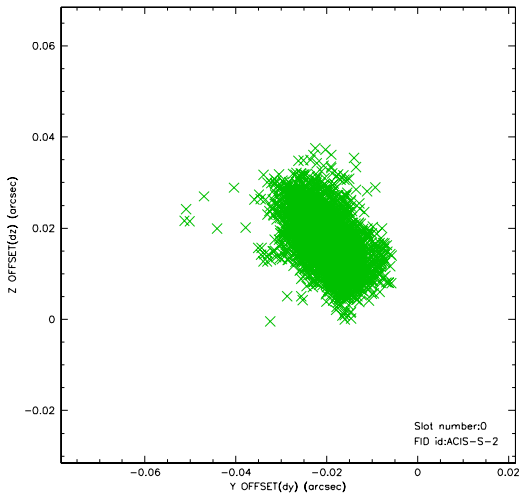

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:7
AGASC star id:171600224

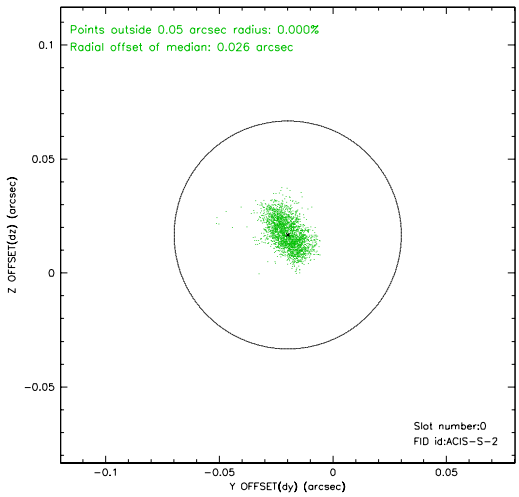

Points outside 0.4 arcsec radius: 0.040%
Radial offset of median: 0.165 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:7
AGASC star id:171600224

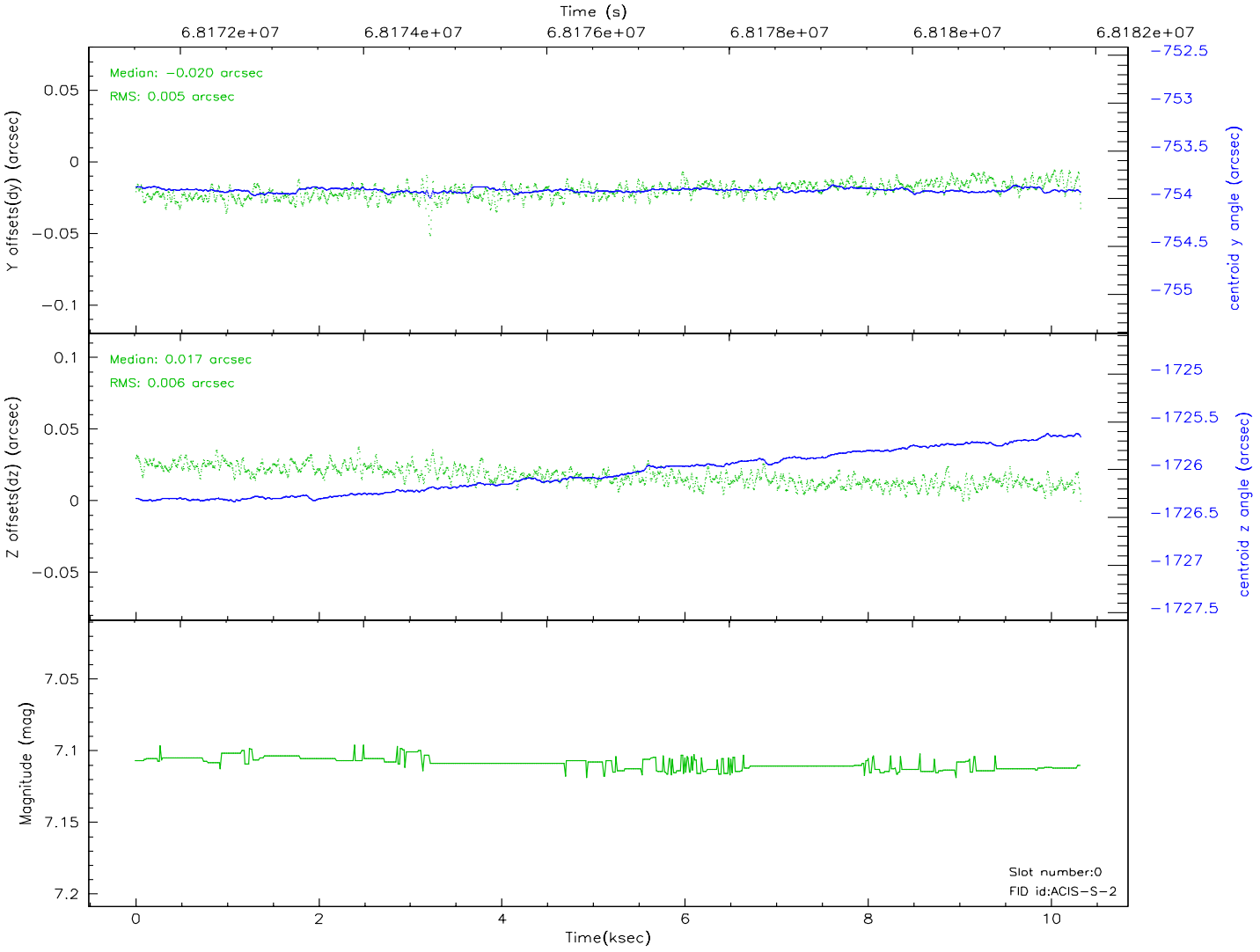

Time (s)
Median: 0.073 arcsec
RMS: 0.078 arcsec
Y offsets(dy) (arcsec)
Median: −0.148 arcsec
RMS: 0.058 arcsec
Z offsets(dz) (arcsec)
Magnitude (mag)
Slot number:7
AGASC star id:171600224
Time(ksec)

2.5 FID Slots

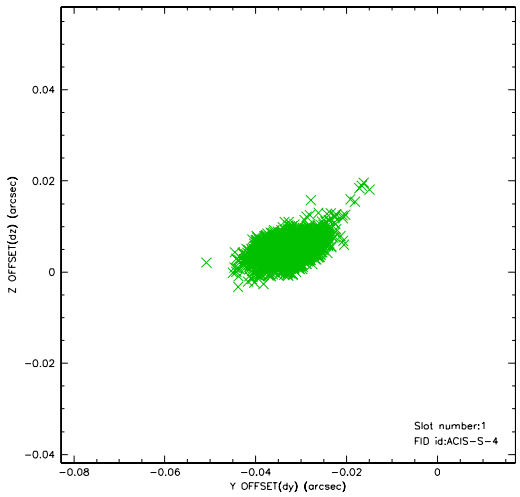
2.5.1 Slot 0

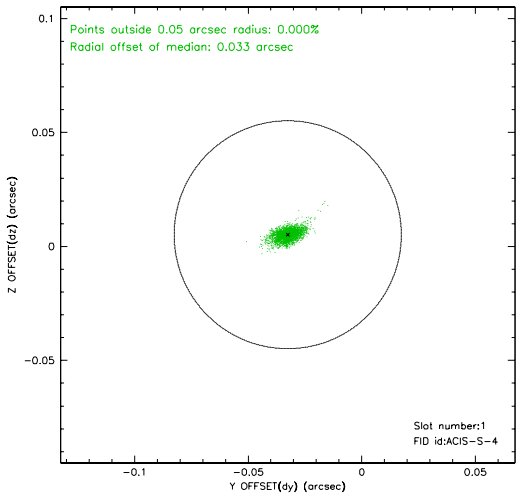


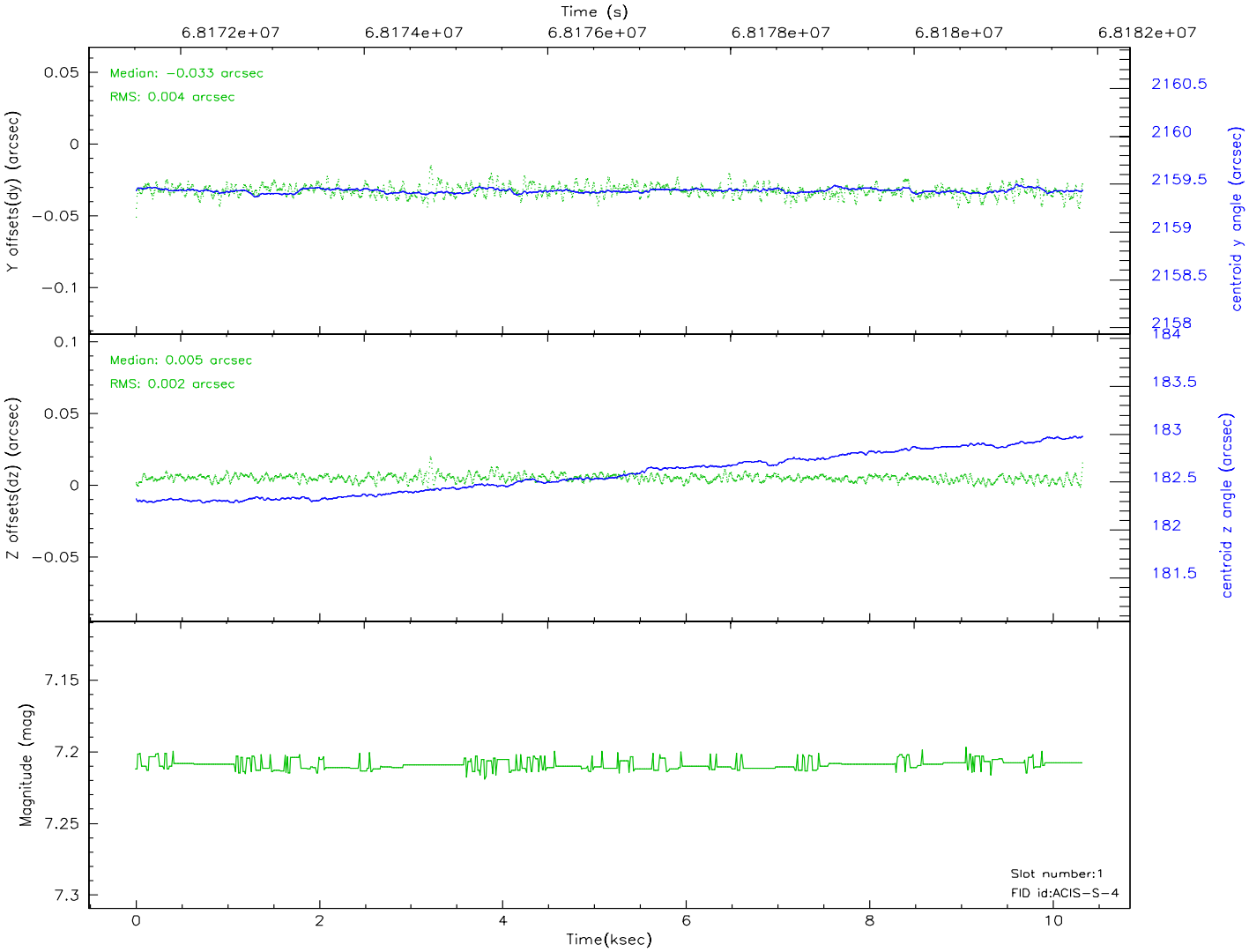




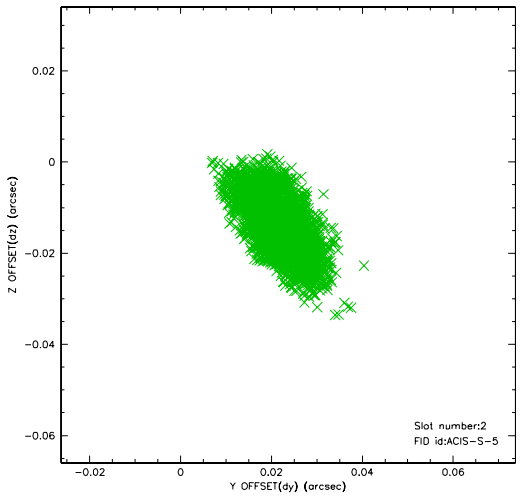
2.5.2 Slot 1

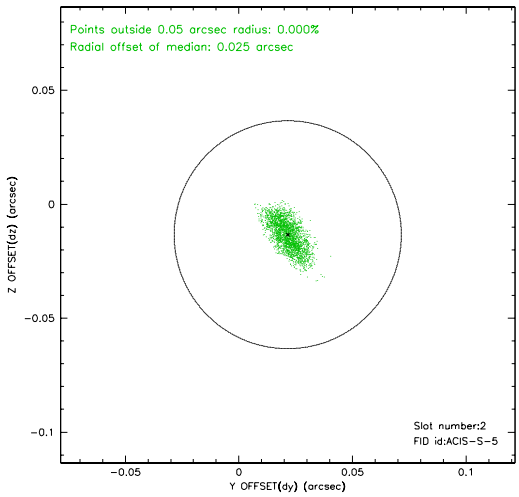

Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:1
FID id:ACIS-S-4

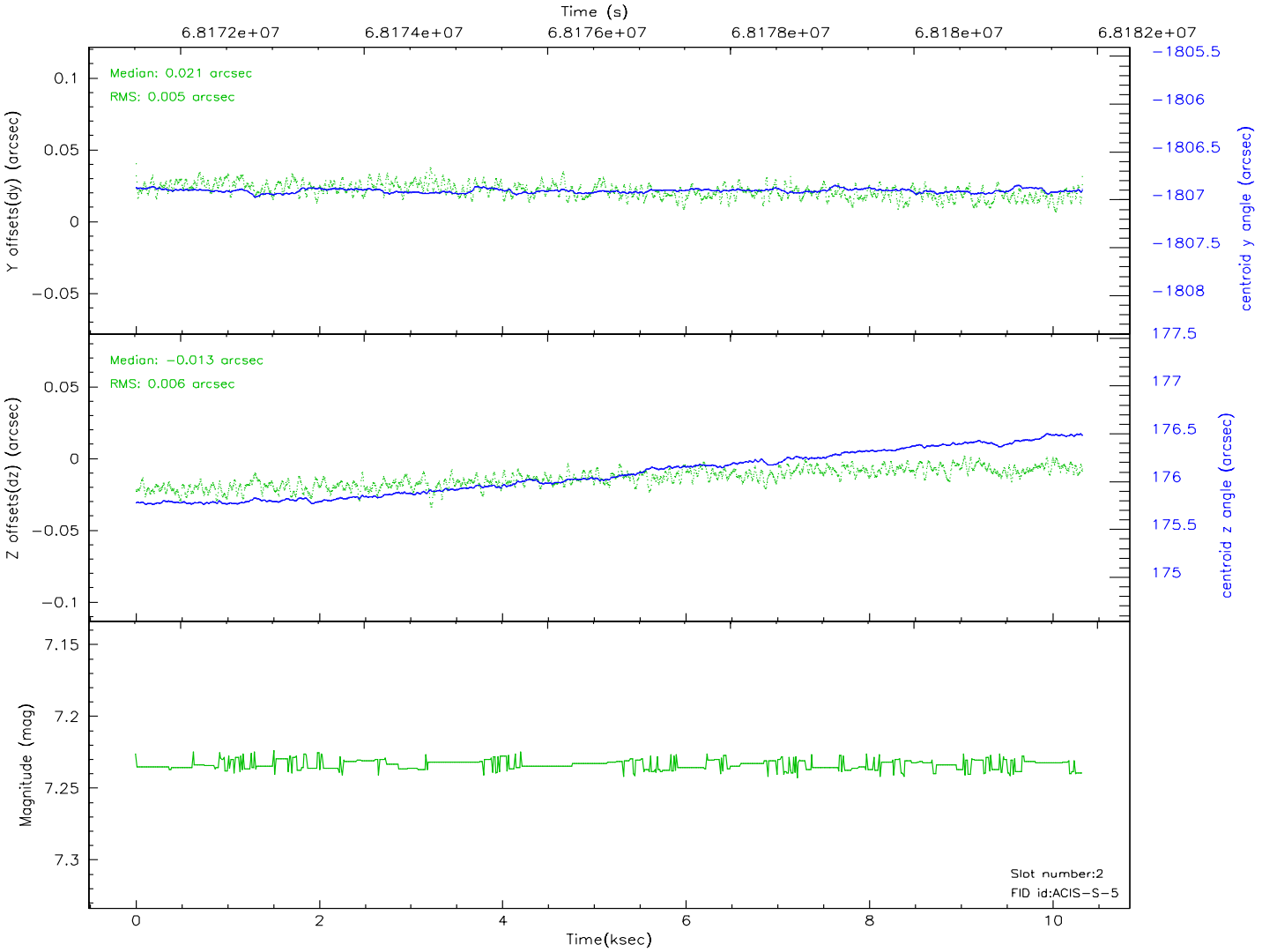

Points outside 0.05 arcsec radius: 0.000%
Radial offset of median: 0.033 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:1
FID id:ACIS-S-4


Time (s)
Median: −0.033 arcsec
RMS: 0.004 arcsec
Y offsets(dy) (arcsec)
centroid y angle (arcsec)
Median: 0.005 arcsec
RMS: 0.002 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: 0.000%
Radial offset of median: 0.025 arcsec
Z OFFSET(dz) (arcsec)
Y OFFSET(dy) (arcsec)
Slot number:2
FID id:ACIS-S-5

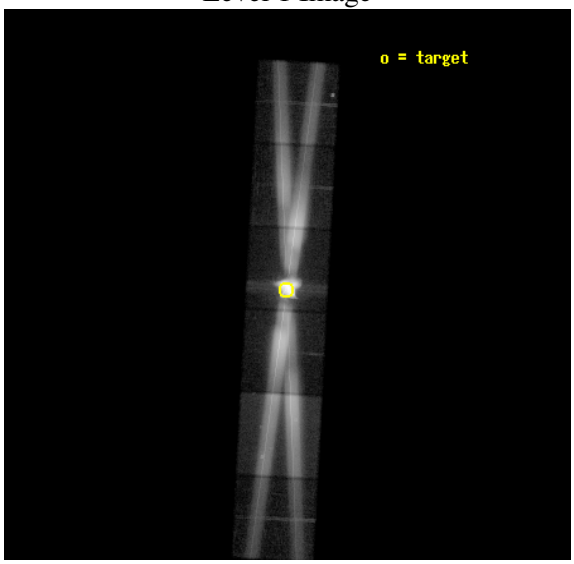

Time (s)
Median: 0.021 arcsec
RMS: 0.005 arcsec
Y offsets(dy) (arcsec)
Median: −0.013 arcsec
RMS: 0.006 arcsec
Z offsets(dz) (arcsec)
centroid y angle (arcsec)
centroid z angle (arcsec)
Magnitude (mag)
Slot number:2
FID id:ACIS-S-5
Time(ksec)

3 OBI Secondary

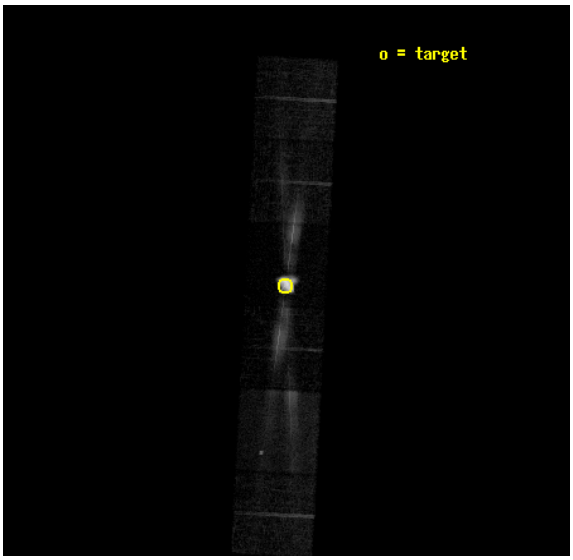
3.1 OBI

3.1.1 Images

Level 1 Image



Level 1 Bad Events



3.1.2 Parameters

obi_num	0
ascdsver	7.6.11.1
caldbver	3.4.0
date	2007-09-15T17:02:44
revision	5

sched_exp_time	9900.000000
ontime	1803.6967960447
ontime4	4443.6391854882
ontime5	6537.3142299652
ontime6	2374.2018646747
ontime7	1803.6967960447
ontime8	3229.8735242784
ontime9	5004.3287055194
l1events	3451057

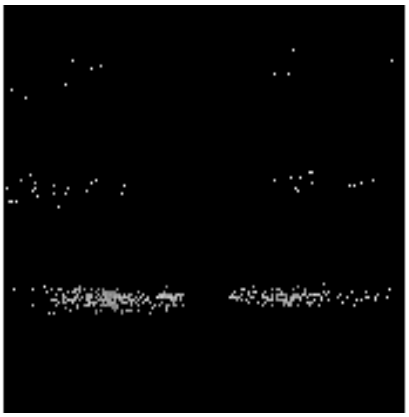
3.1.3 Events

	ccd 4	ccd 5	ccd 6	ccd 7	ccd 8	ccd 9
level 1 events	130971	623734	721842	1170608	591475	212427
rejected events	34582	50167	39415	178688	38306	35539
rejected %	26%	8%	5%	15%	6%	16%

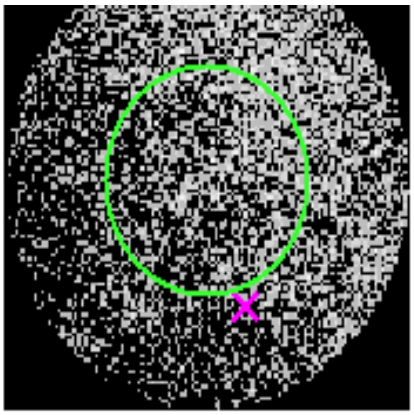
	ccd 4	ccd 5	ccd 6	ccd 7	ccd 8	ccd 9
grade 0 events	77819	167293	531696	197226	453913	144813
	59%	26%	73%	16%	76%	68%
grade 1 events	304	1256	7749	15905	4330	567
	0%	0%	1%	1%	0%	0%
grade 2 events	11249	218527	82473	274657	57062	18691
	8%	35%	11%	23%	9%	8%
grade 3 events	2560	41521	24212	101834	16213	4886
	1%	6%	3%	8%	2%	2%
grade 4 events	2662	41599	24085	99859	16045	5010
	2%	6%	3%	8%	2%	2%
grade 5 events	1170	9576	5556	50782	3343	1758
	0%	1%	0%	4%	0%	0%
grade 6 events	2169	105223	20846	320121	10445	3728
	1%	16%	2%	27%	1%	1%
grade 7 events	33038	38739	25225	110224	30124	32974
	25%	6%	3%	9%	5%	15%

4 Gratings

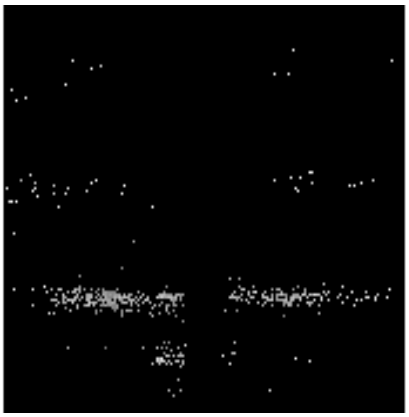
4.1 HEG Arm



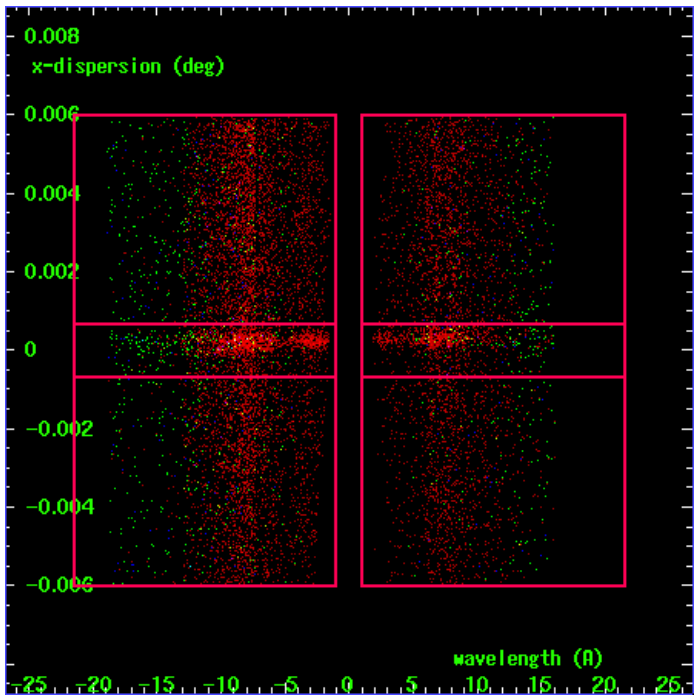
HEG Order Sort 123



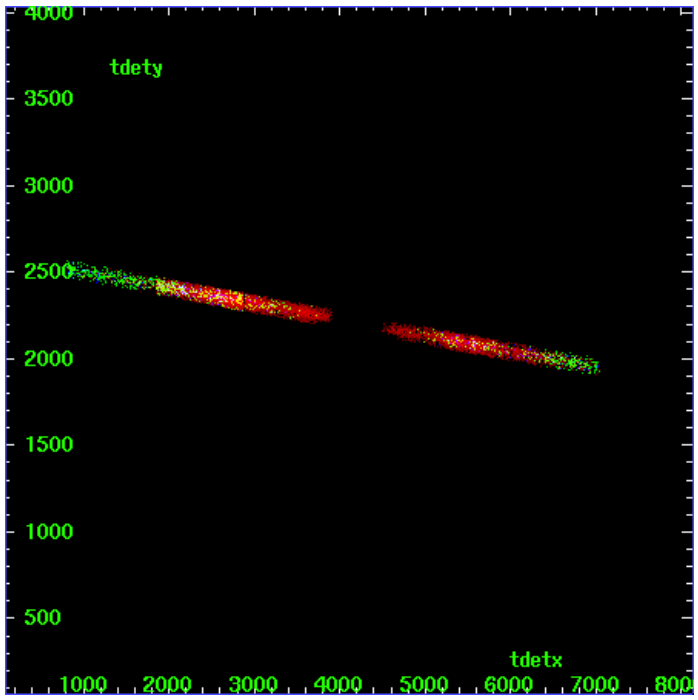
HEG Zero Order



HEG Order Sort ALL

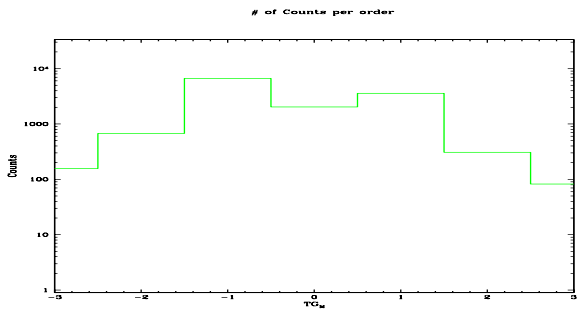


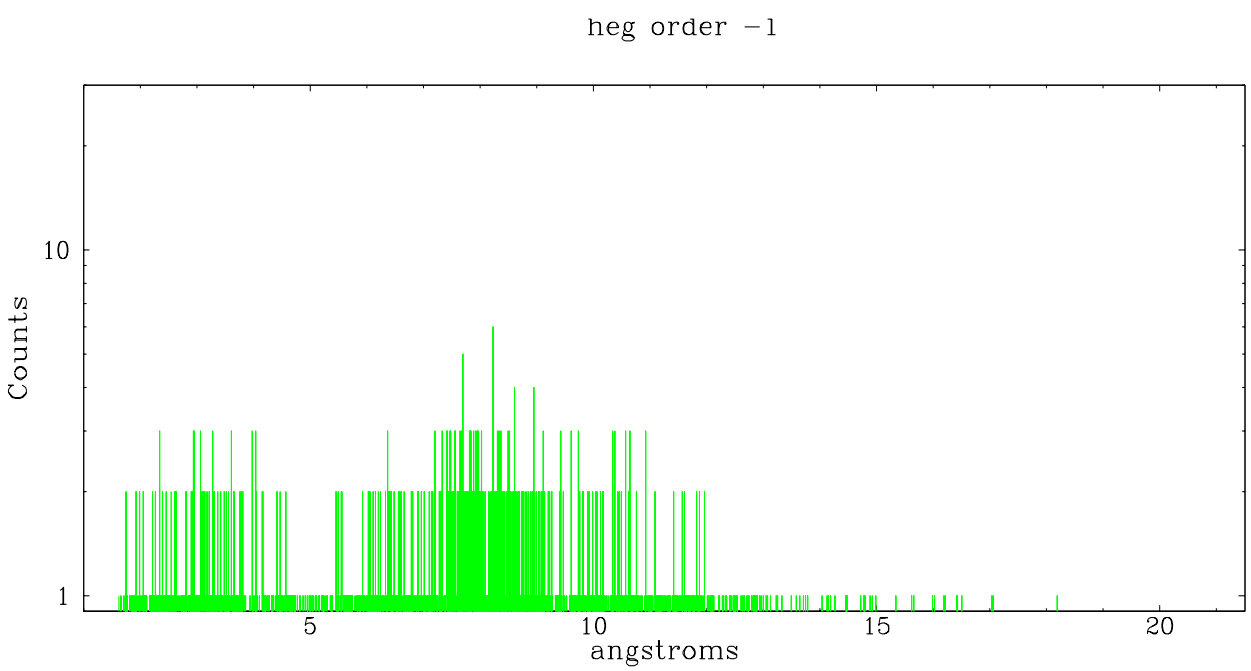
Spot Image HEG

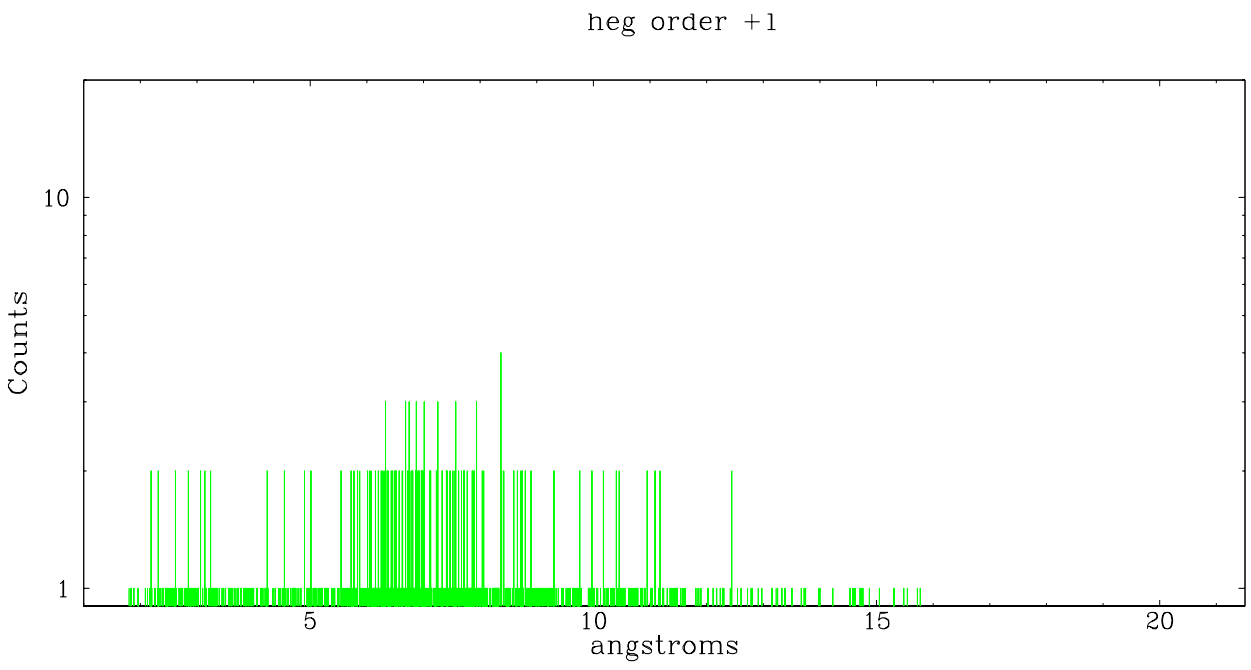


Full Detector HEG

	order -3	order -2	order -1	order 0	order 1	order 2	order 3
Events	157	675	6665	2024	3576	309	82

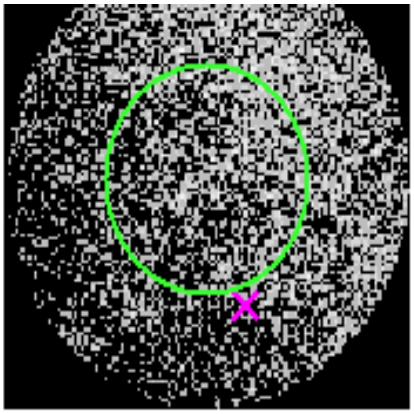



heg order −1
Counts
10
1
5
10
15
20
angstroms

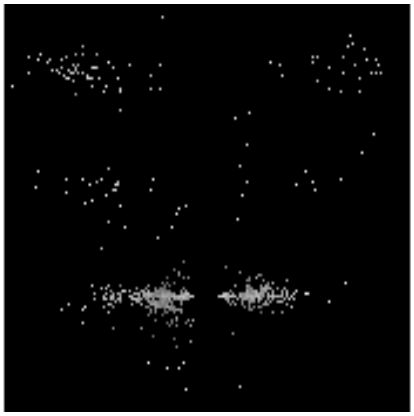

heg order +1
Counts
10
1
5
10
15
20
angstroms

4.2 MEG Arm

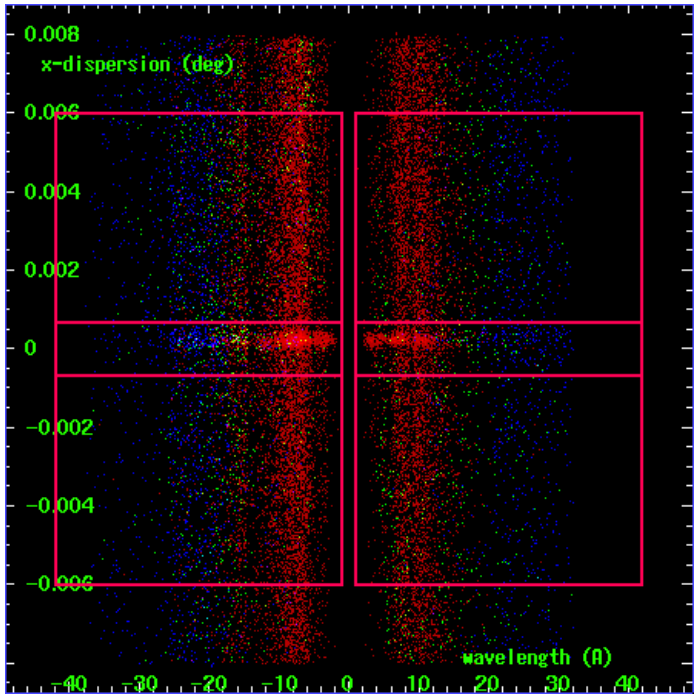
MEG Order Sort 123



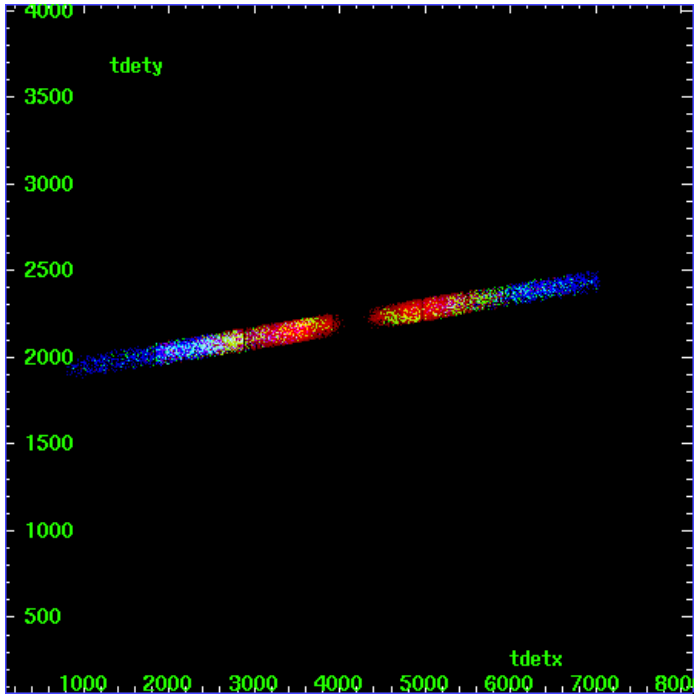
MEG Zero Order



MEG Order Sort ALL

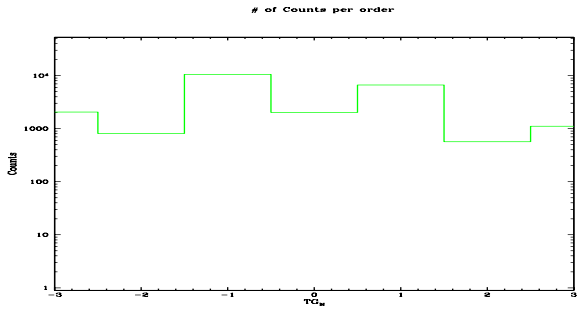


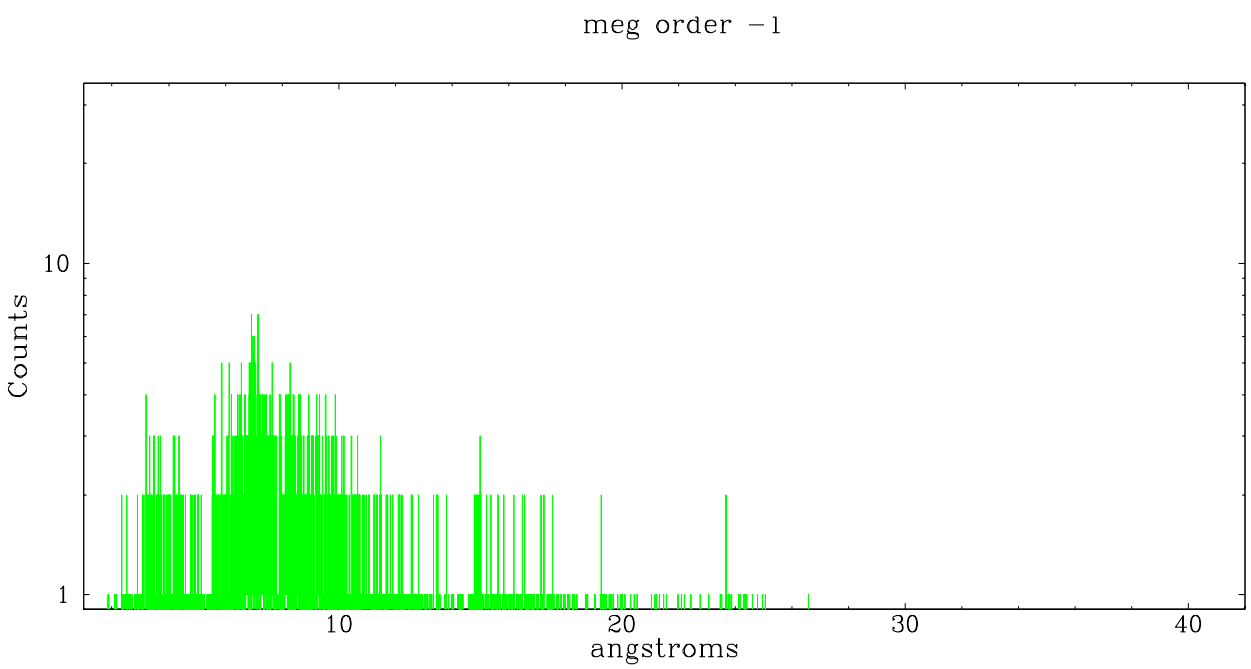
Spot Image MEG

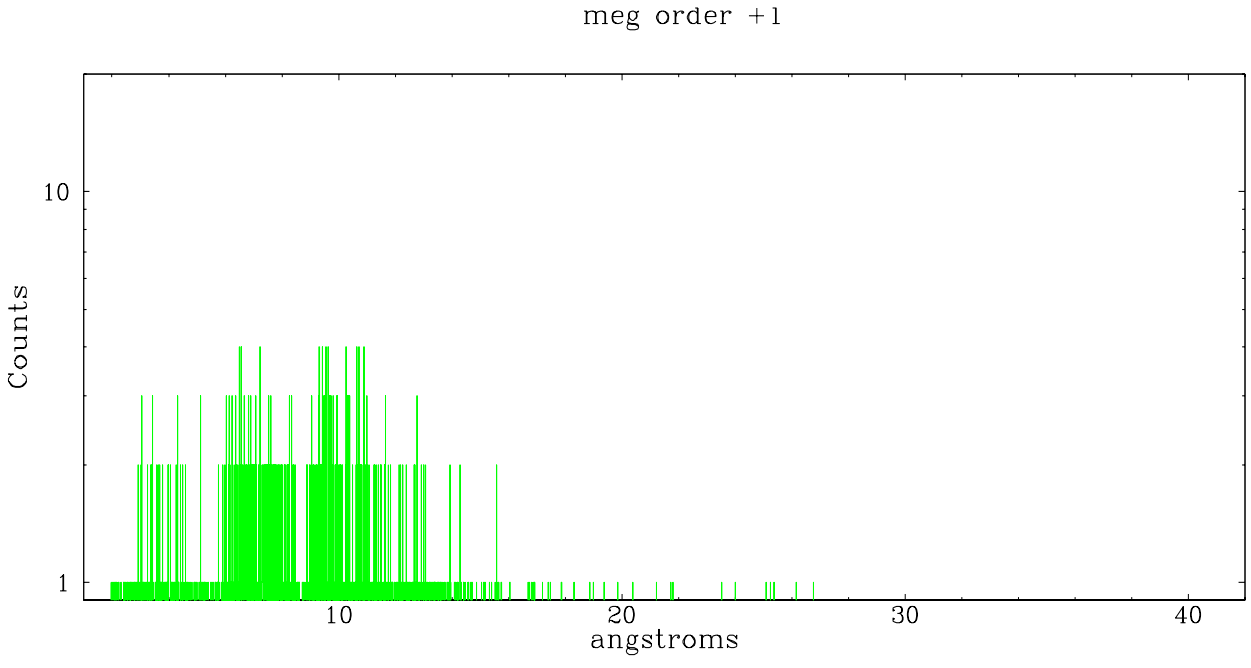


Full Detector MEG

	order -3	order -2	order -1	order 0	order 1	order 2	order 3
Events	2057	810	10523	2024	6645	566	1107




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


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

A Summary

A.1 Status

V&V Scientist	David Huenemoerder
V&V Date (YYYY-MM-DD)	2007.09.17
V&V Edition	1
V&V Disposition and Status	OK
V&V Charge Time	8.9

A.2 Comments

```
Charge time: Used ontime5 sum of P and S. Due to saturation by this
bright
a source, some chips have many dropped frames.

This is an extended source and will require custom processing with
parameters
dependent upon the analysis goals. Standard processing used the
centroid of
the zeroth order and extraction regions smaller than the nebular
extent.

The bad-events image (of Secondary exposure frames) shows the grating
arms, indicating that there is pileup in the dispersed spectrum.
```