

# V&V Reference Report

## L2 ASCDS Version : 8.4.5

Observation 2741 - L2 Version 4  
Chandra X-Ray Center

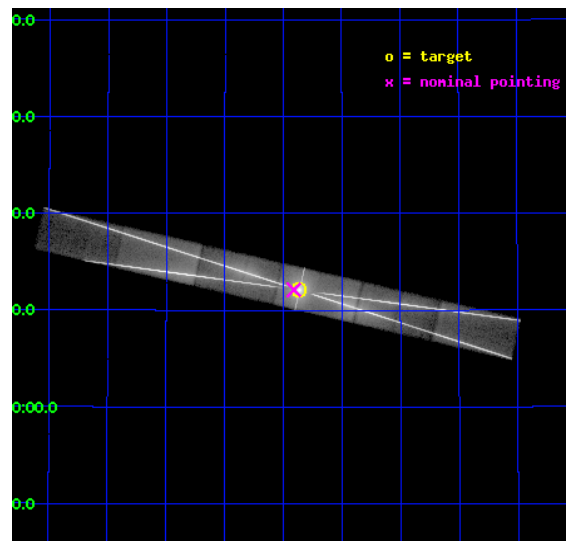
L2 Processing Date : Oct 1 2012

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# 1 Front

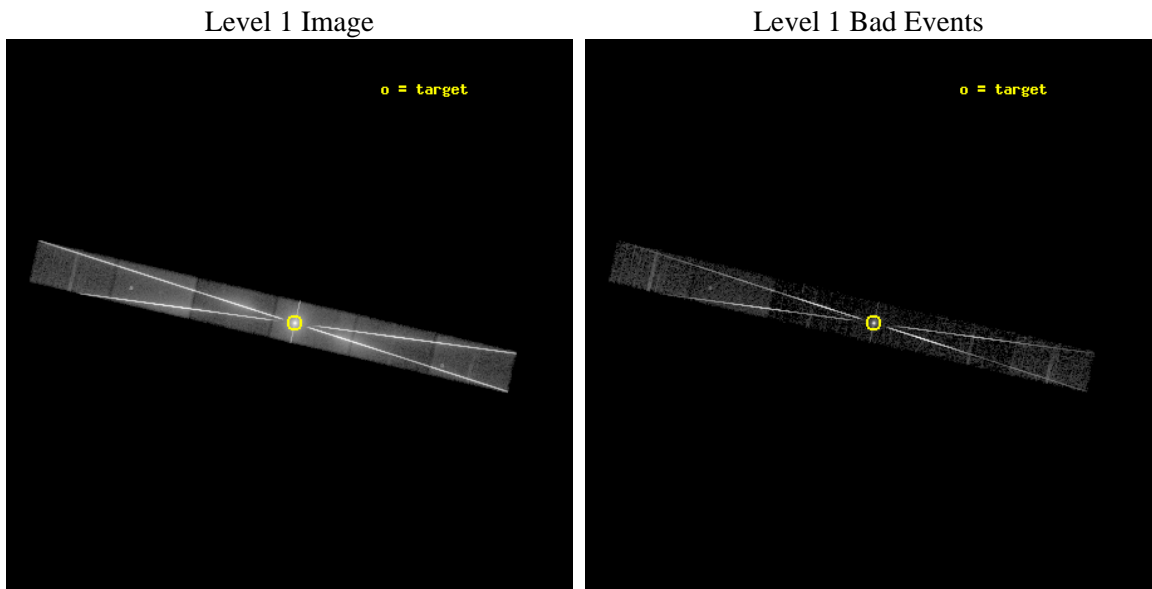
seq_num	400221	Sequence number
obs_id	2741	Observation id
title	PHASE RESOLVED HIGH ENERGY RESOLUTION SPECTROSCOPY OF THE BLACK HOLE X-RAY BAINARY CYGNUS X-1	Proposal title
observer	Dr. Shu Zhang	Principal investigator
object	CYG X-1	Source name
dtcycle	0	&#160
cycle	P	events from which exps? Prim/Second/Both
ra_targ	299.590417	Observer's specified target RA [deg]
dec_targ	35.201611	Observer's specified target Dec [deg]
ra_nom	299.60224098141	Nominal RA [deg]
dec_nom	35.202019215554	Nominal Dec [deg]
roll_nom	12.940152018754	Nominal Roll [deg]
revision	4	Processing version of data
ontime	1932.0680001378	Sum of GTIs [s]
livetime	1886.5250656127	Livetime [s]
ontime4	4484.4839387238	Sum of GTIs [s]
ontime5	4091.0203697681	Sum of GTIs [s]
ontime6	1451.6235905737	Sum of GTIs [s]
ontime7	1932.0680001378	Sum of GTIs [s]
ontime8	1852.1029318124	Sum of GTIs [s]
ontime9	4033.565362528	Sum of GTIs [s]
l2events	1615231	Number of level 2 events



## 2 OBI

### 2.1 OBI

#### 2.1.1 Images



### 2.1.2 Parameters

obi_num	0	Obi number	sched_exp_time	5000.000000	[s] Scheduled observation exposure time
ascdsver	8.4.5	Processing system revision	ontime	1932.0680001378	Sum of GTIs [s]
caldsver	4.5.2	&#160	ontime4	4484.4839387238	Sum of GTIs [s]
date	2012-10-01T04:29:06	Date and time of file creation	ontime5	4091.0203697681	Sum of GTIs [s]
revision	3	Processing version of data	ontime6	1451.6235905737	Sum of GTIs [s]
			ontime7	1932.0680001378	Sum of GTIs [s]
			ontime8	1852.1029318124	Sum of GTIs [s]
			ontime9	4033.565362528	Sum of GTIs [s]
			l1events	2049001	Number of level 1 events

### 2.1.3 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	101272	460121	408877	486403	382082	210246	grade 0 events	67866	114295	214483	66033	236980	155348
rejected events	16517	58076	87271	122056	57089	16237		67%	24%	52%	13%	62%	73%
rejected %	16%	12%	21%	25%	14%	7%	grade 1 events	619	5193	29780	4289	24470	2579
								0%	1%	7%	0%	6%	1%
							grade 2 events	9419	139717	47053	93790	42686	21575
								9%	30%	11%	19%	11%	10%
							grade 3 events	2938	33412	20139	37151	16856	6679
								2%	7%	4%	7%	4%	3%
							grade 4 events	2858	33206	19314	36465	16755	6690
								2%	7%	4%	7%	4%	3%
							grade 5 events	803	18620	24663	21180	15367	1666
								0%	4%	6%	4%	4%	0%
							grade 6 events	1820	82129	21001	131250	12037	4085
								1%	17%	5%	26%	3%	1%
							grade 7 events	14949	33549	32444	96245	16931	11624
								14%	7%	7%	19%	4%	5%

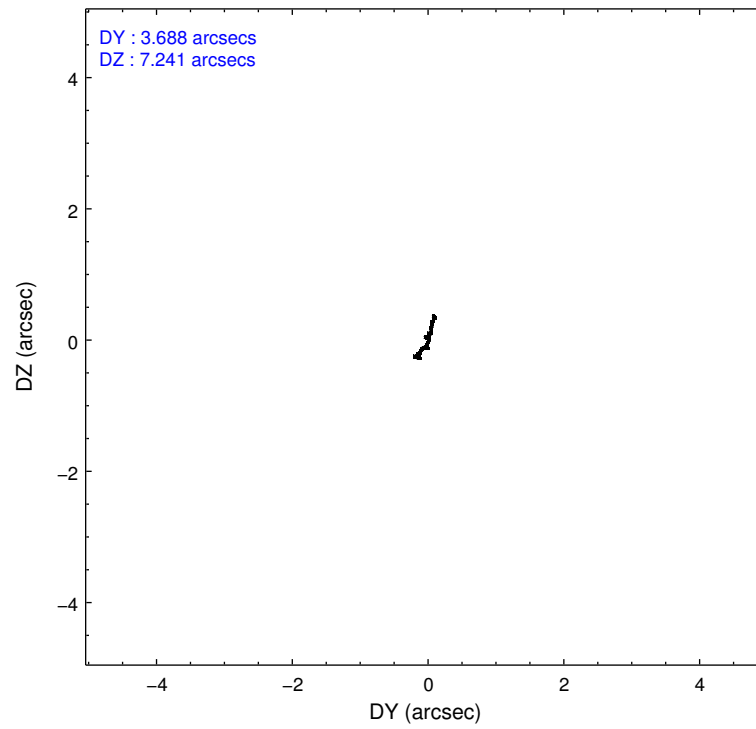
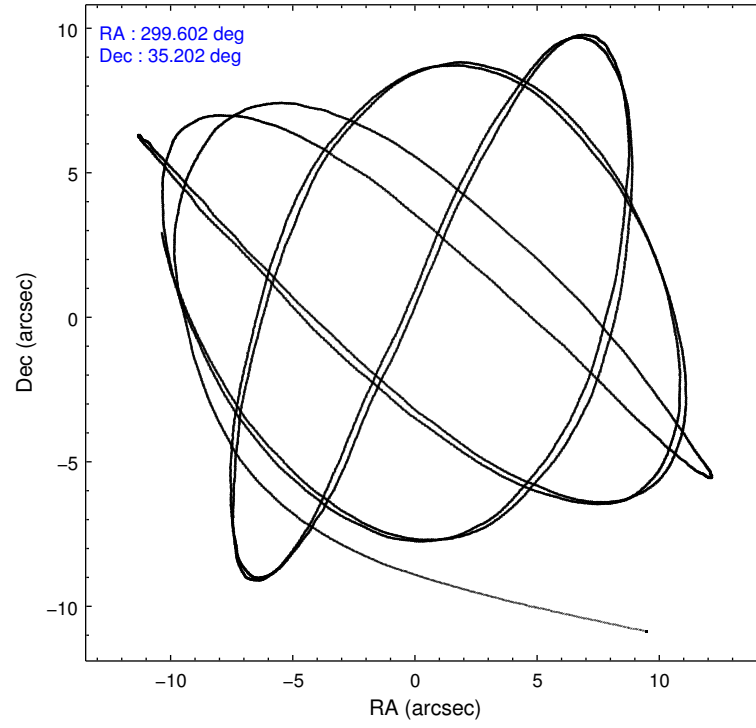


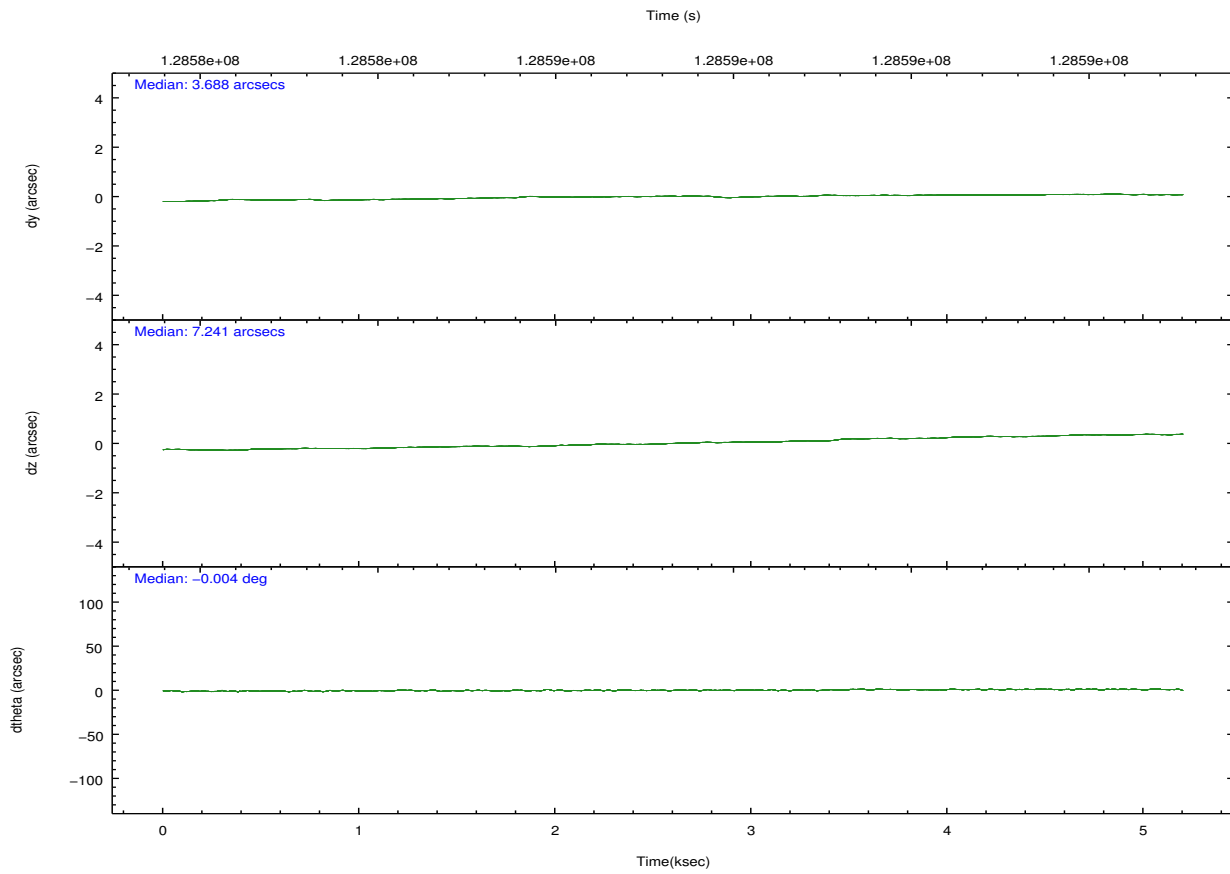
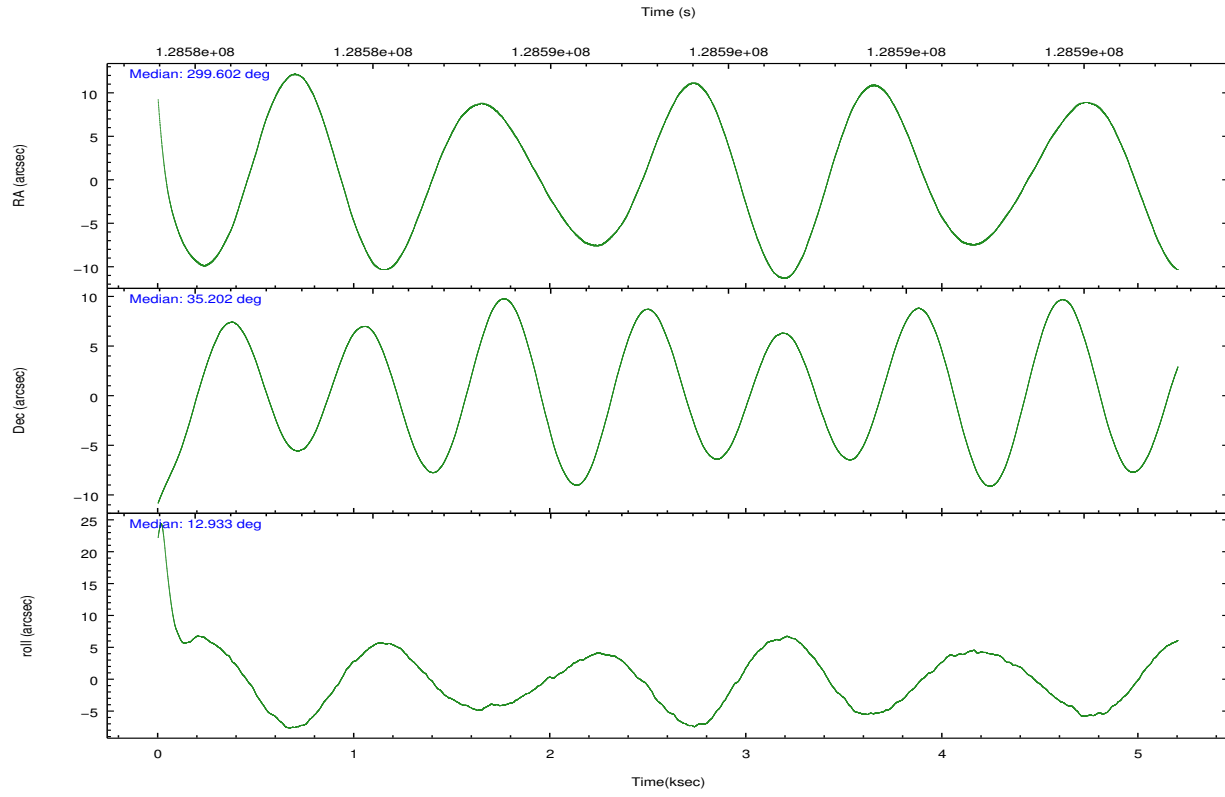
## 2.2 Compared Parameters

Parameter	Planned	Actual
Instrument	ACIS	ACIS
Detector	ACIS-456789	ACIS-456789
Grating	HETG	HETG
Data mode	GRADED	GRADED
Observation mode	POINTING	POINTING
[deg] Pointing RA	299.578160	299.6022409814087
[deg] Pointing Dec	35.183271	35.20201921555367
[deg] Pointing Roll	12.797349	12.94015201875409
[mm] SIM focus pos	-0.684267	-0.6828225247311905
[mm] SIM defocus	0	0.001444936568705701
[mm] SIM translation stage pos	-184.612523	-184.6110867017414
[mm] SIM translation stage offset	-5.52	-5.52143588126637
Phase constraints	Y	Y
[d] Phase period	5.599847	5.599847
[d] Phase epoch (MJD)	51998.668500	51998.668500
Phase start	0.250000	0.250000
Phase end	0.260000	0.260000
Phase start error	0.050000	0.050000
Phase end error	0.050000	0.050000
[s] Observation start time (MET)	128584261.184000	128583271.8565
Observation start date	2002-01-28T05:49:57	2002-01-28T05:34:31
[s] Observation end time (MET)	128589261.184000	128590228.01928
Observation end date	2002-01-28T07:13:17	2002-01-28T07:30:28
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	CUSTOM	1/2
Subarray start row	1	1
Subarray row count	512	512
Alternating exposures requested	N	N
[s] Primary exposure time	0.000000	1.7

## 2.3 Aspect



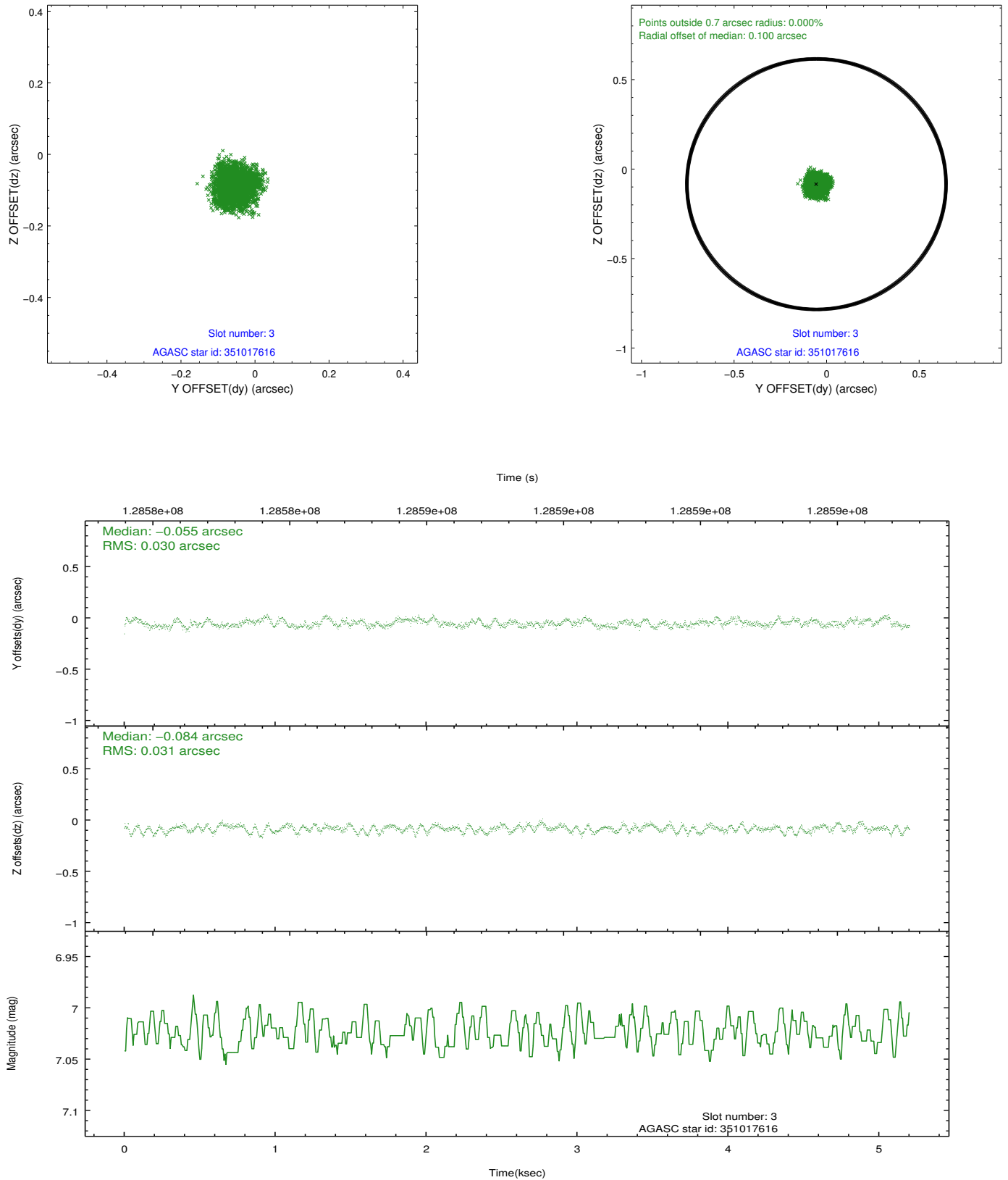


### Slot Statistics

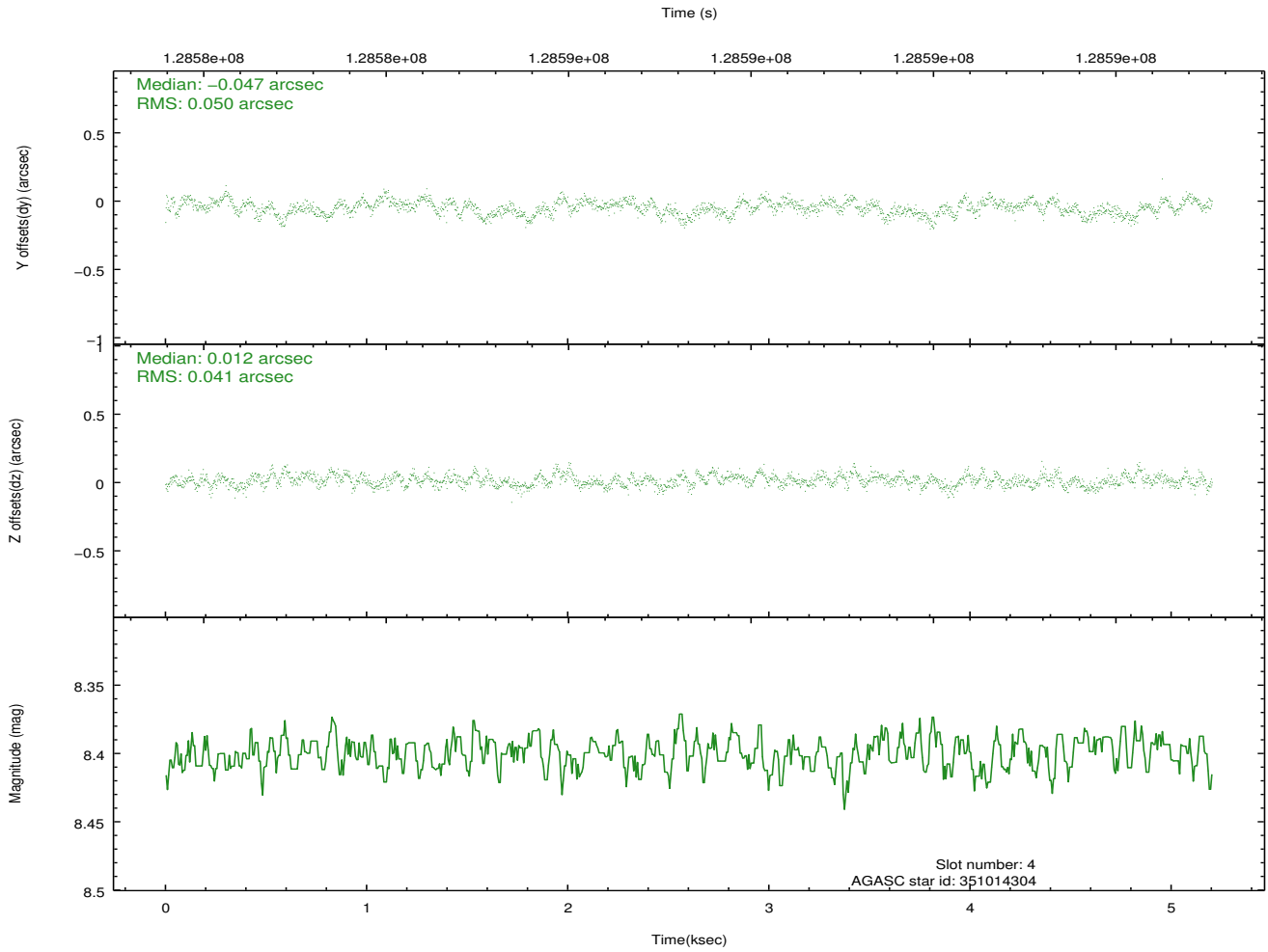
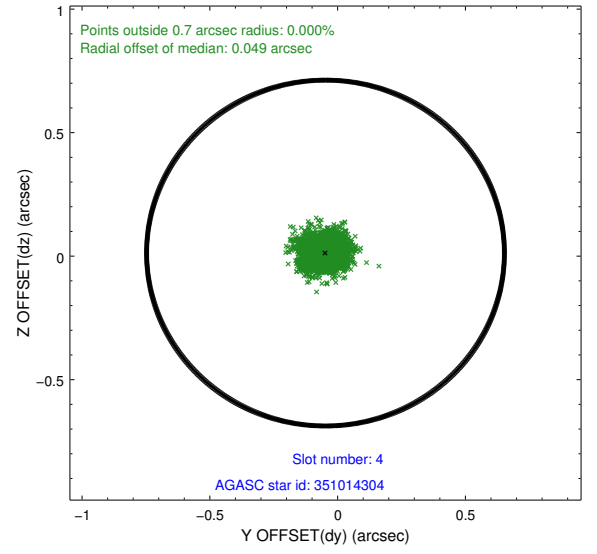
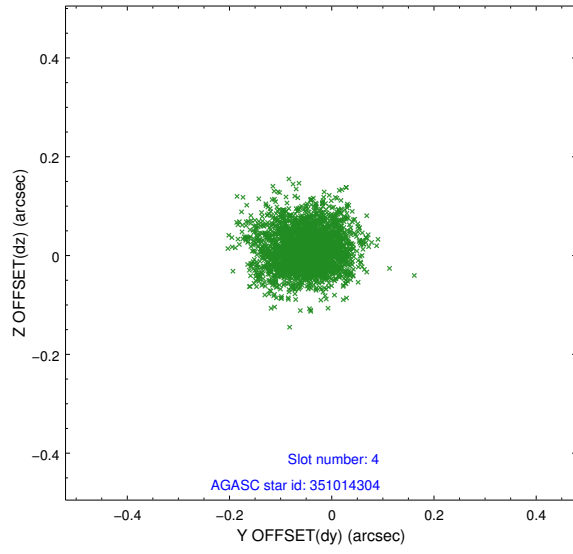
slot	status	id	mag	n_pts	med_dy	med_dz	dr1	dr2	ra	dec	mean_y	mean_z
0	FID	ACIS-S-2	7.10	1269	-0.037	-0.071	0.011	0.019	0.000000	0.000000	-755.97	-1842.34
1	FID	ACIS-S-4	7.19	1269	0.022	0.037	0.005	0.010	0.000000	0.000000	2156.83	64.96
2	FID	ACIS-S-5	7.23	1269	-0.017	0.042	0.011	0.017	0.000000	0.000000	-1807.30	59.95
3	GUIDE	351017616	7.03	2539	-0.055	-0.084	0.047	0.072	300.079295	35.358356	1576.07	292.21
4	GUIDE	351014304	8.40	2538	-0.047	0.012	0.068	0.111	299.690883	35.621541	672.56	1465.64
5	GUIDE	351018080	8.32	2539	0.011	-0.010	0.065	0.104	299.327312	34.581247	-1203.47	-1947.72
6	GUIDE	351016136	8.59	2532	0.009	0.073	0.061	0.098	300.302636	34.786391	1774.82	-1860.95
7	GUIDE	350889888	9.13	2533	0.086	0.004	0.080	0.125	299.019639	35.534865	-1312.67	1600.08

## 2.4 Star Slots

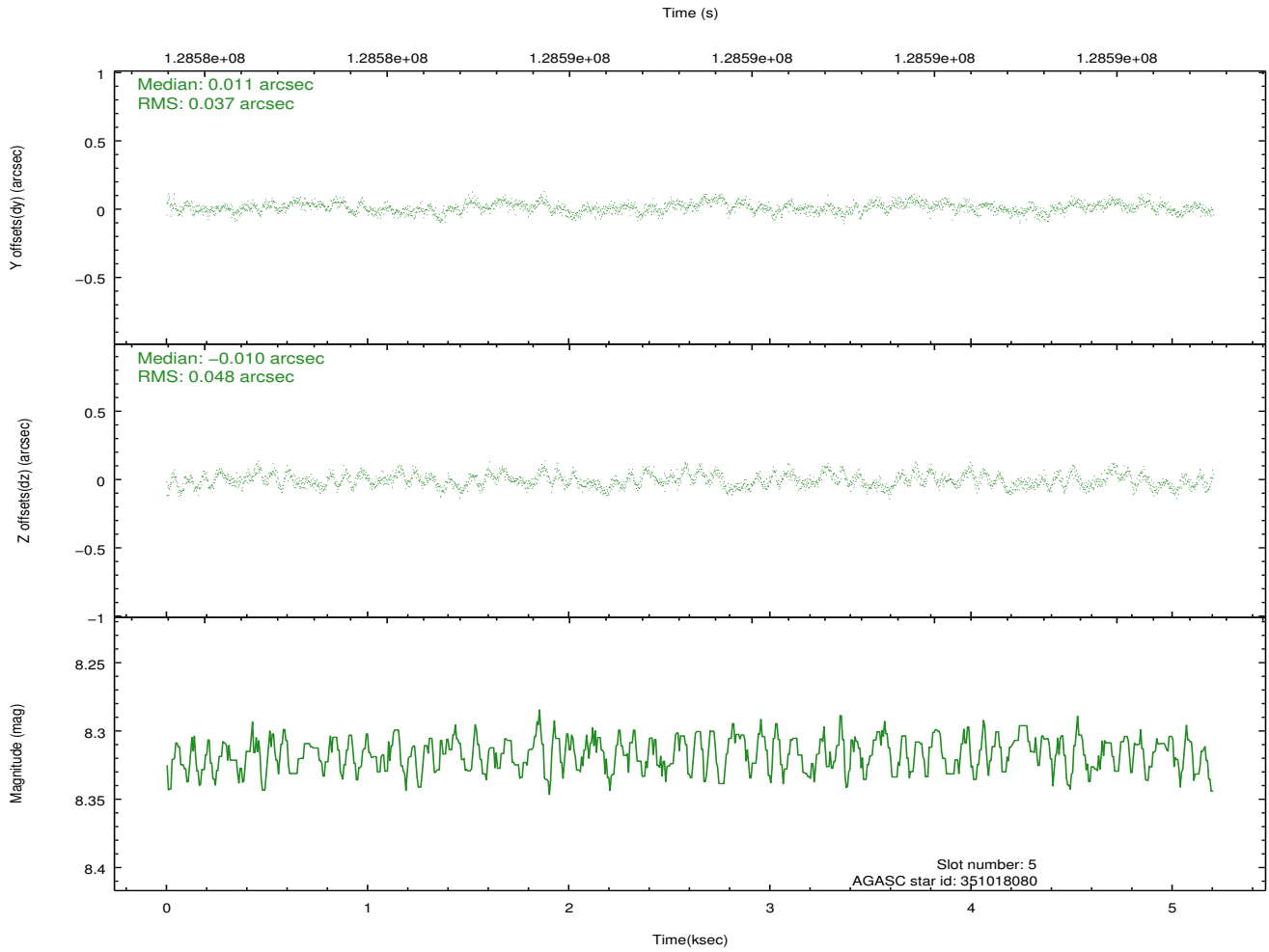
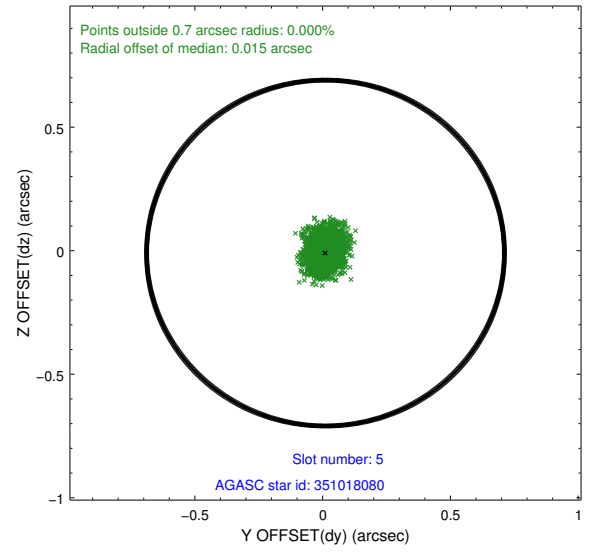
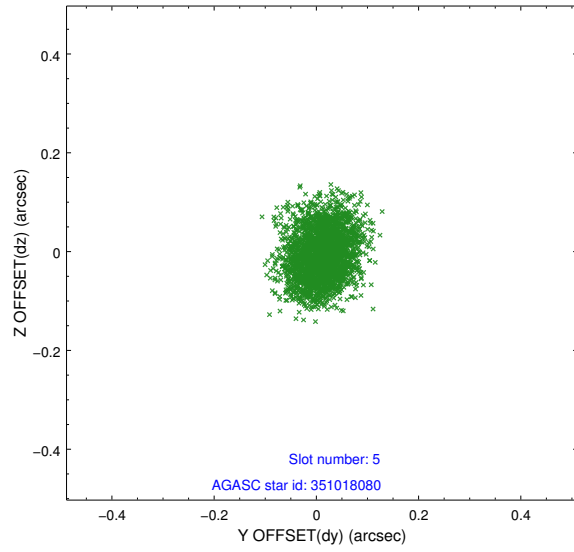
### 2.4.1 Slot 3



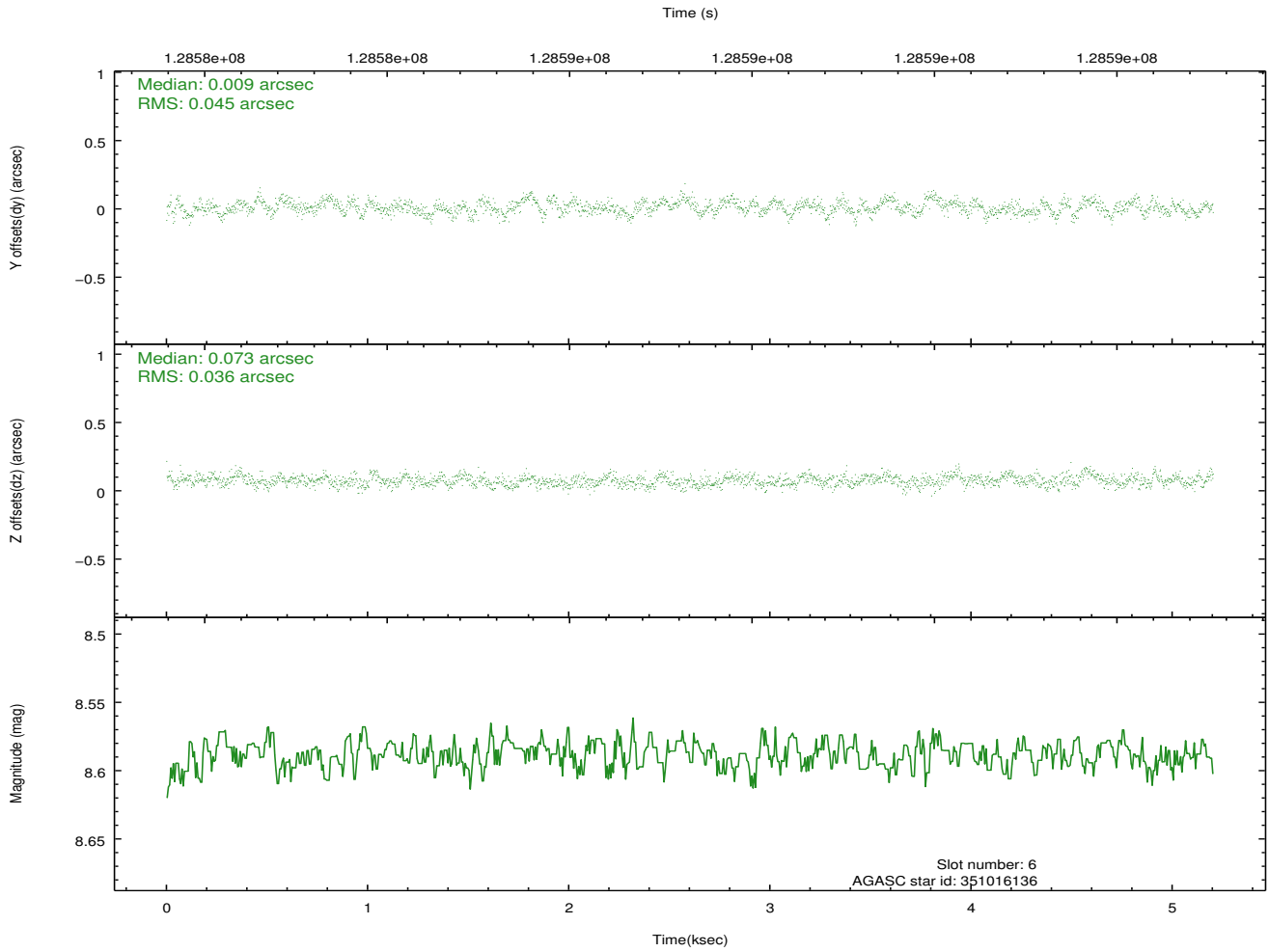
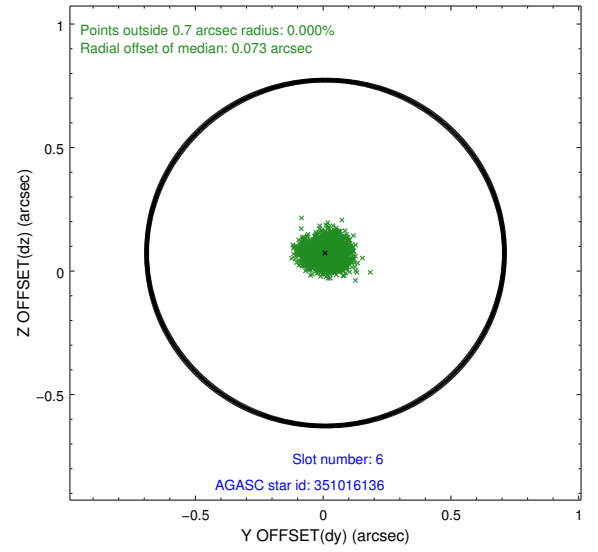
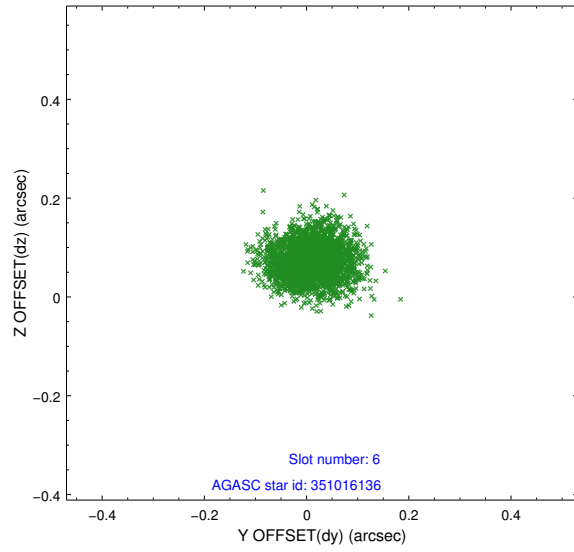
## 2.4.2 Slot 4



### 2.4.3 Slot 5

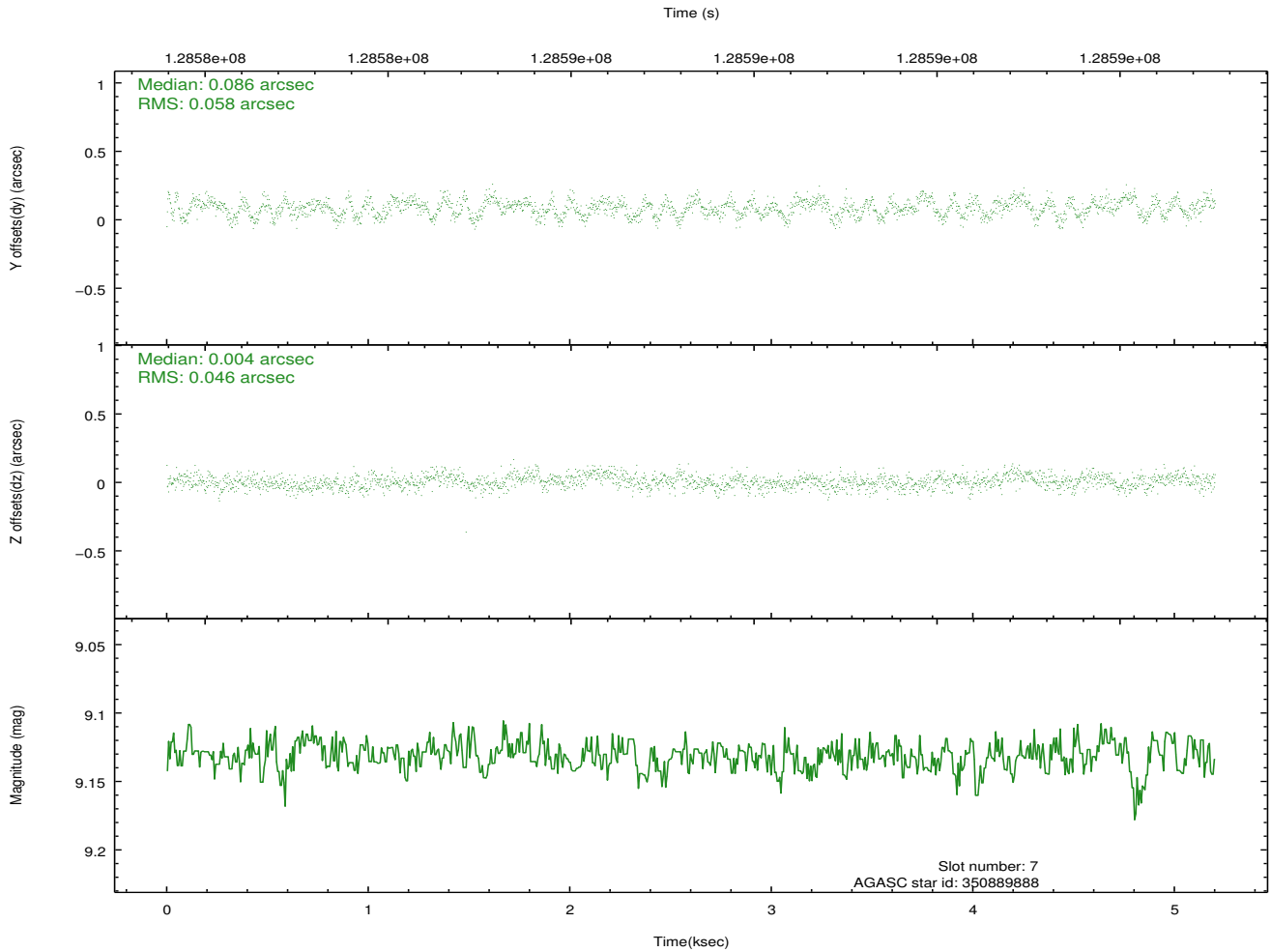
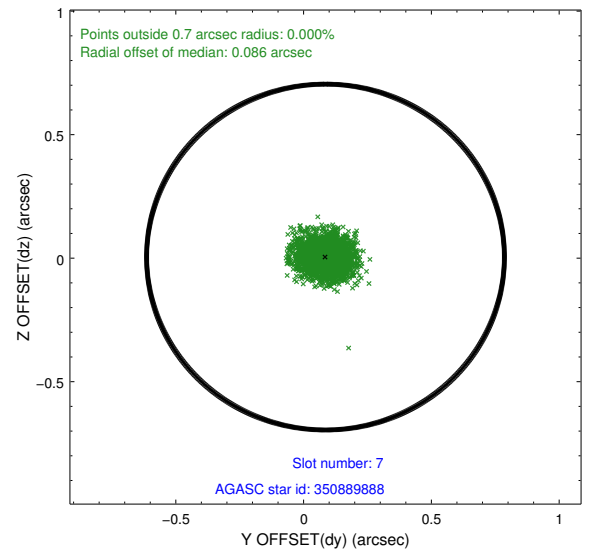
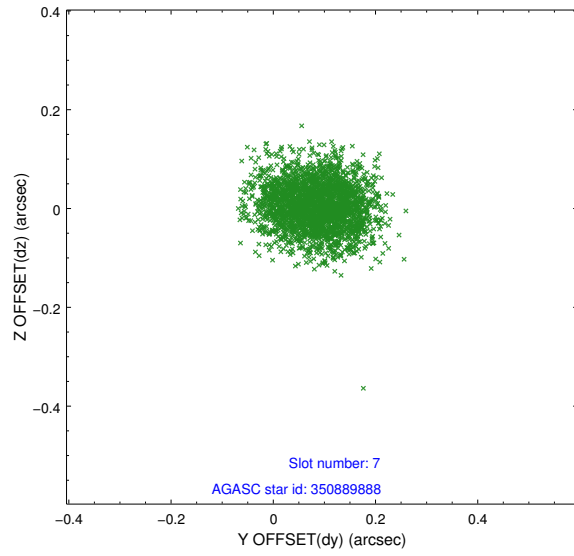


## 2.4.4 Slot 6



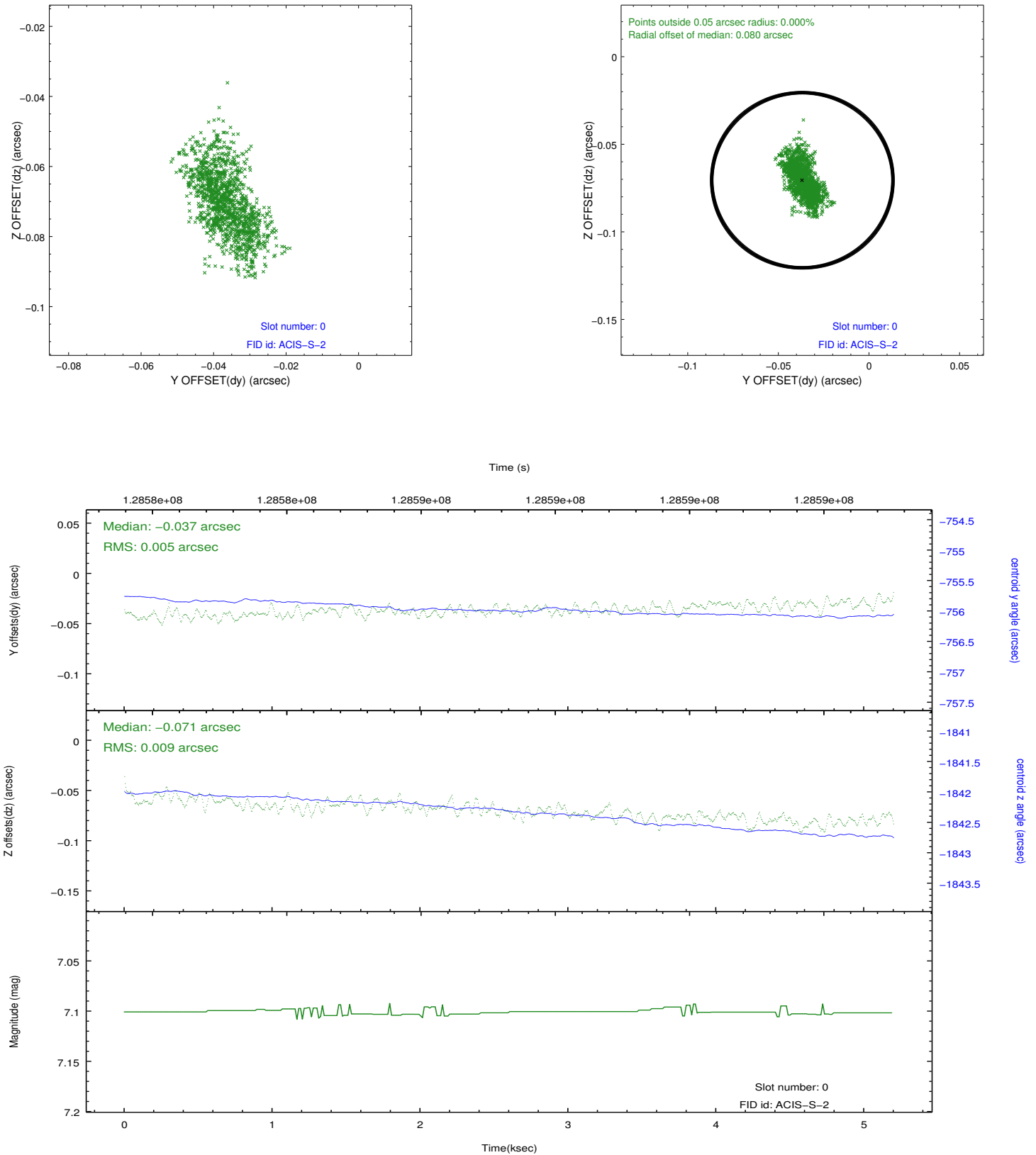


## 2.4.5 Slot 7

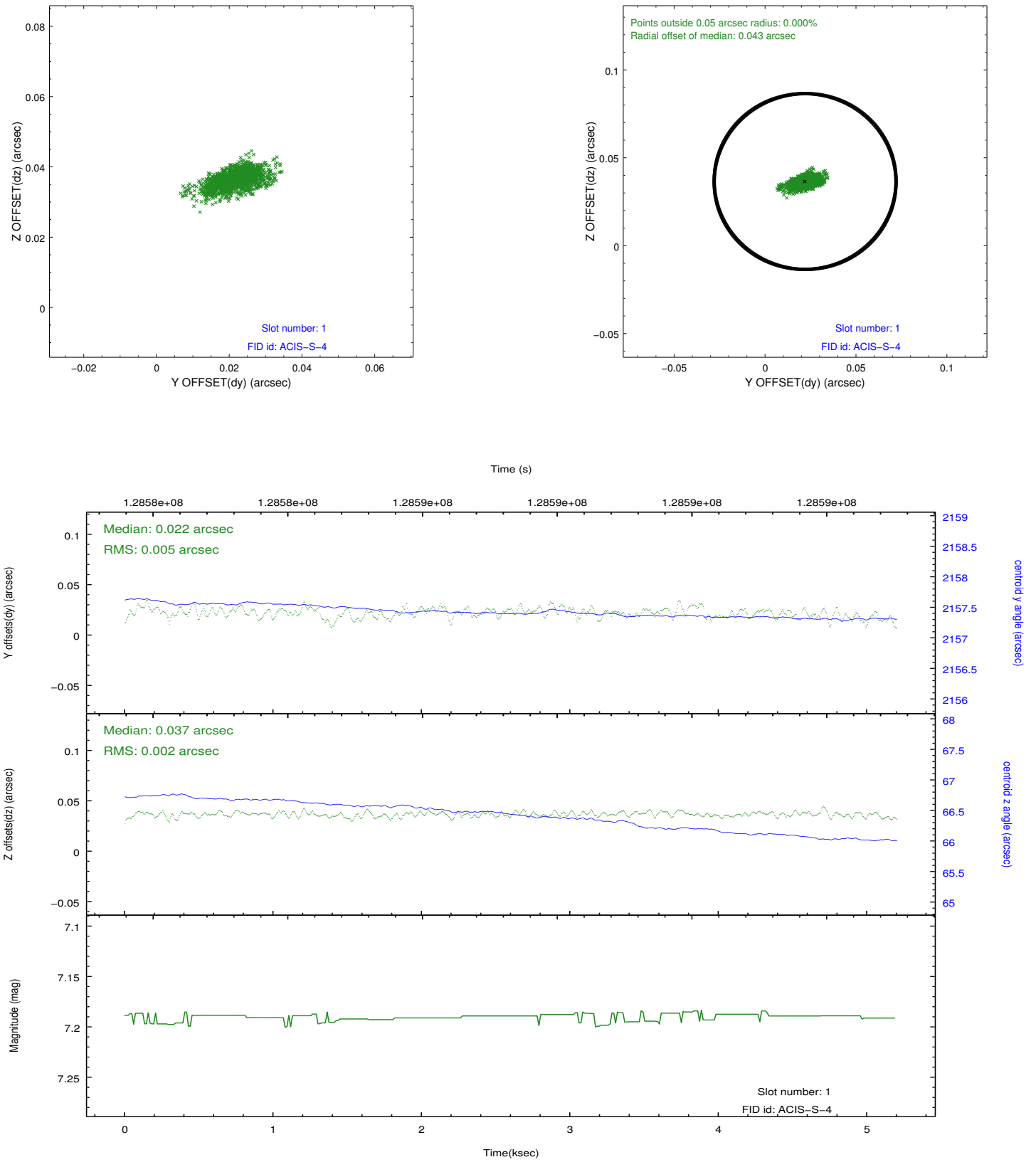


## 2.5 FID Slots

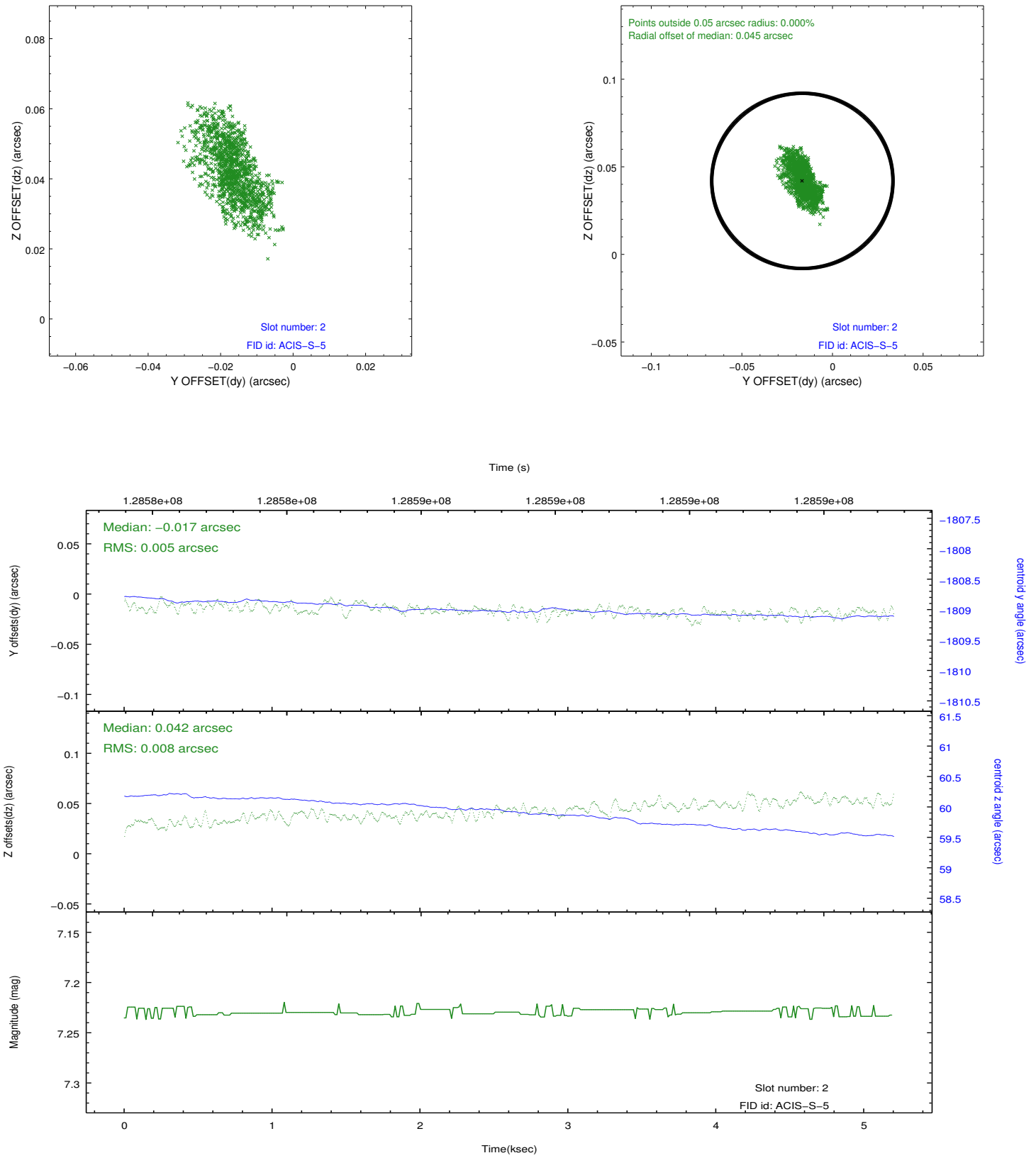
### 2.5.1 Slot 0



## 2.5.2 Slot 1

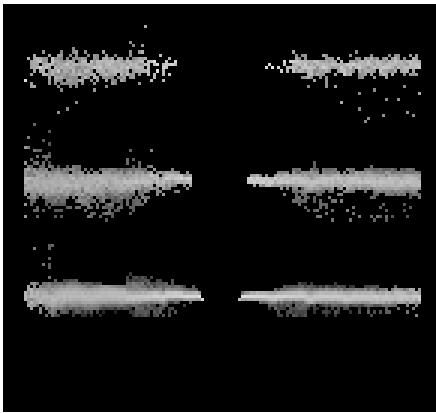


### 2.5.3 Slot 2

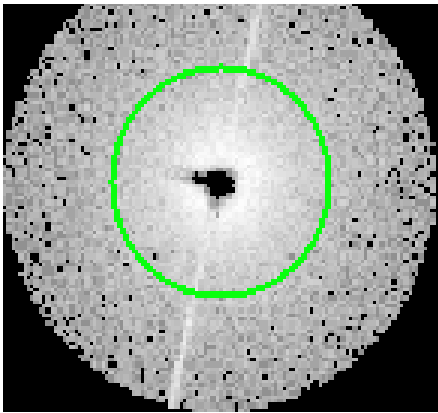


# 3 Gratings

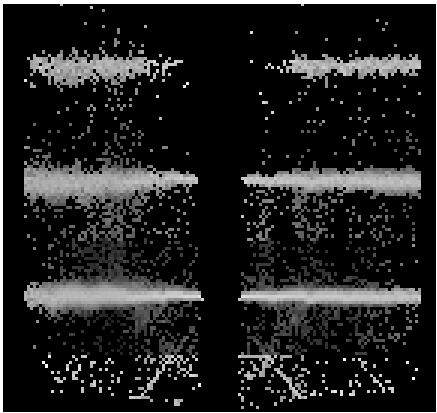
## 3.1 HEG Arm



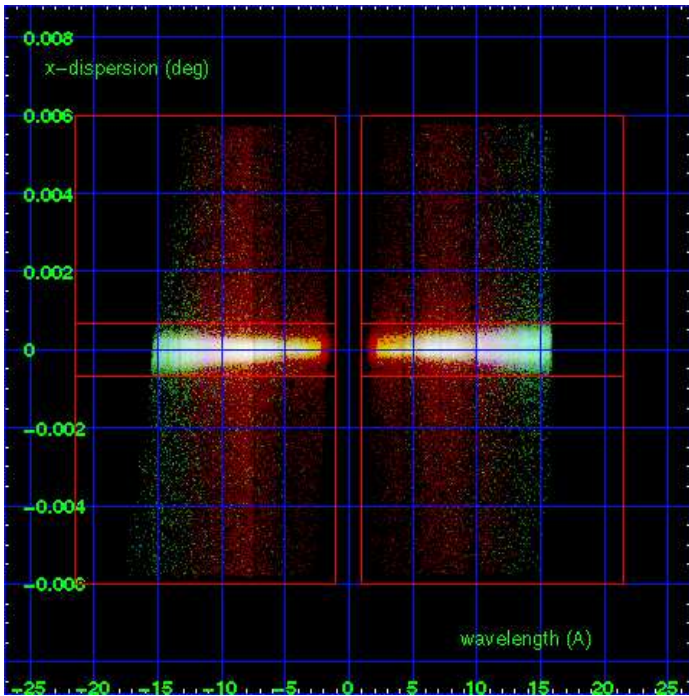
HEG Order Sort 123



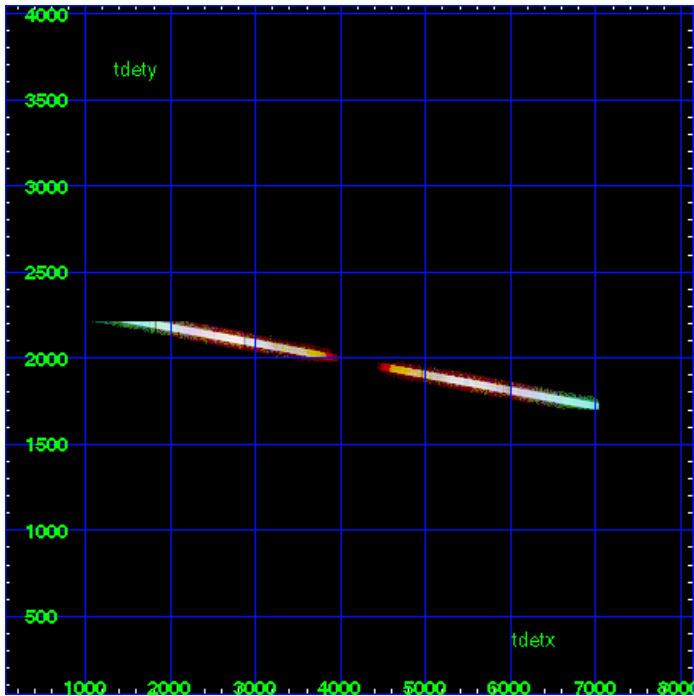
HEG Zero Order



HEG Order Sort ALL

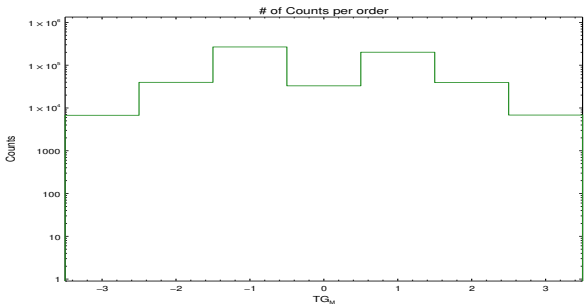


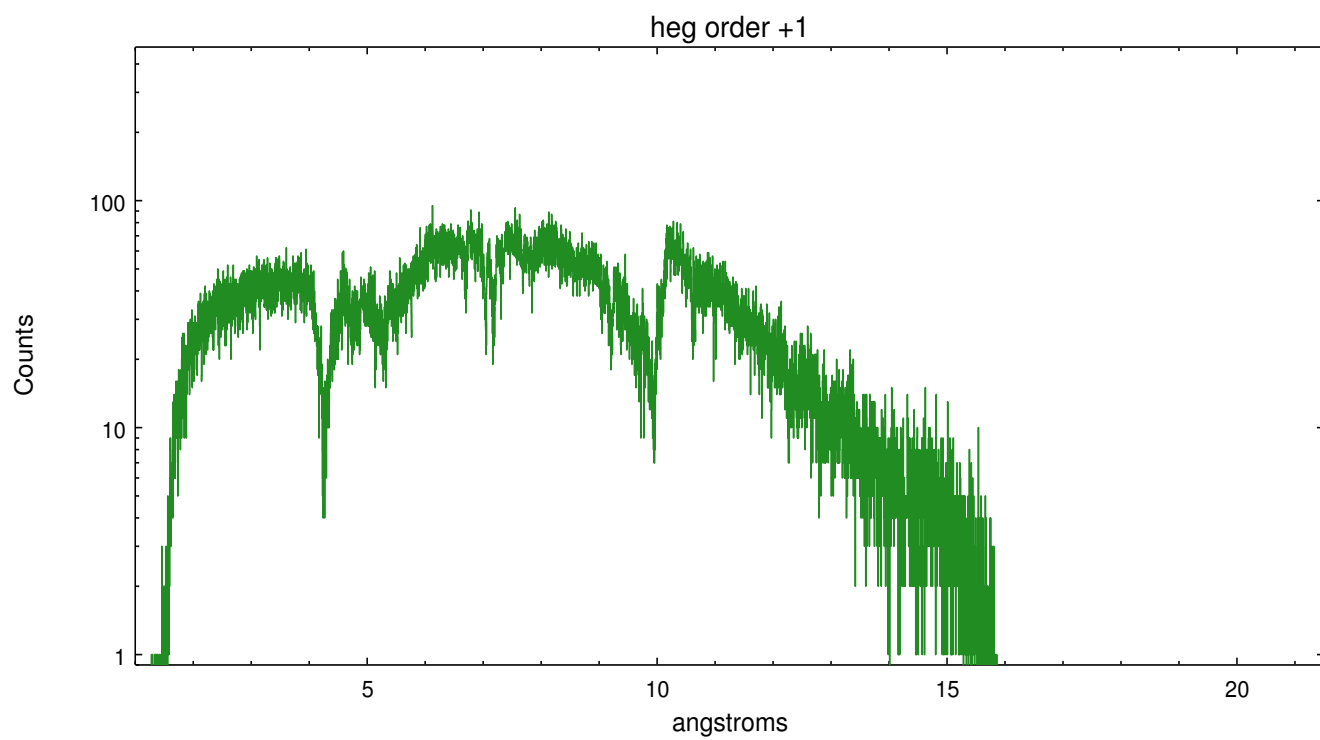
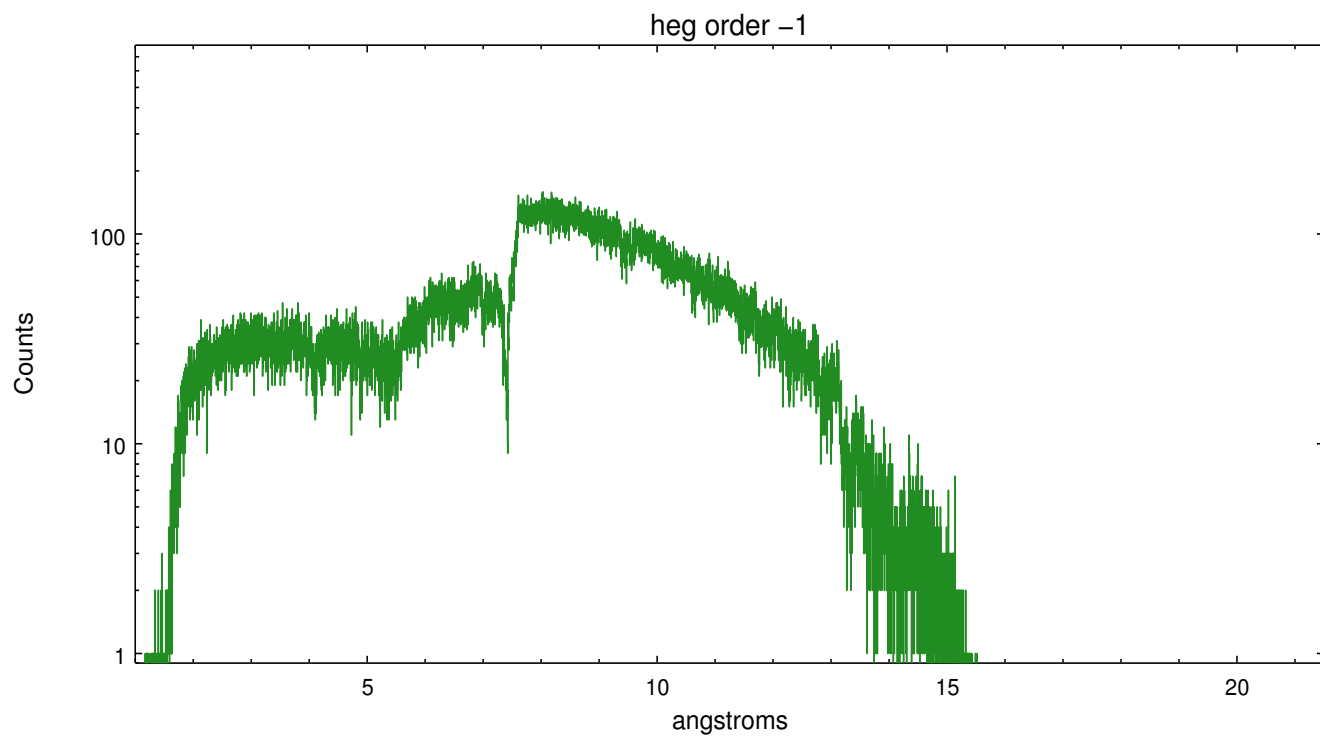
Spot Image HEG



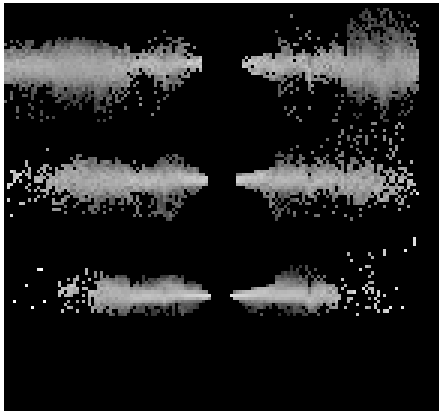
Full Detector HEG

	order -3	order -2	order -1	order 0	order 1	order 2	order 3
Events	6744	39737	267054	32942	201022	39213	6828

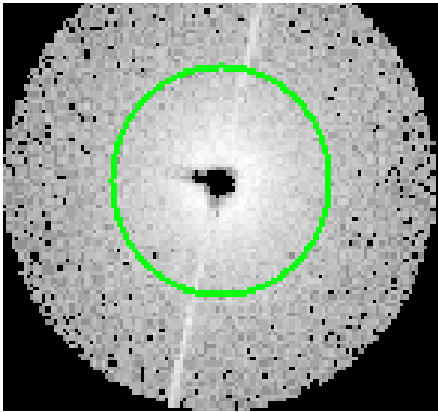




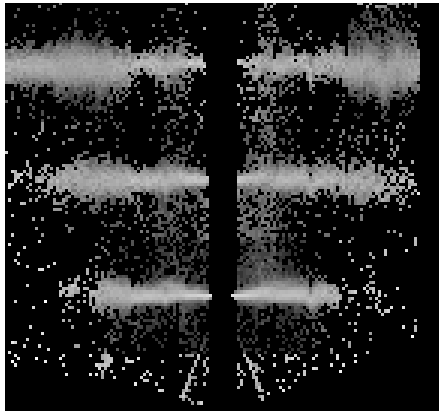
3.2 MEG Arm



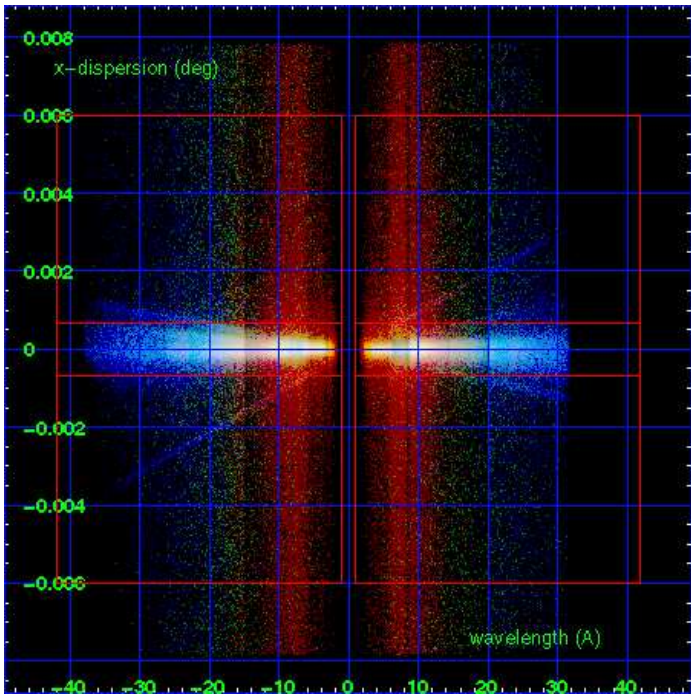
MEG Order Sort 123



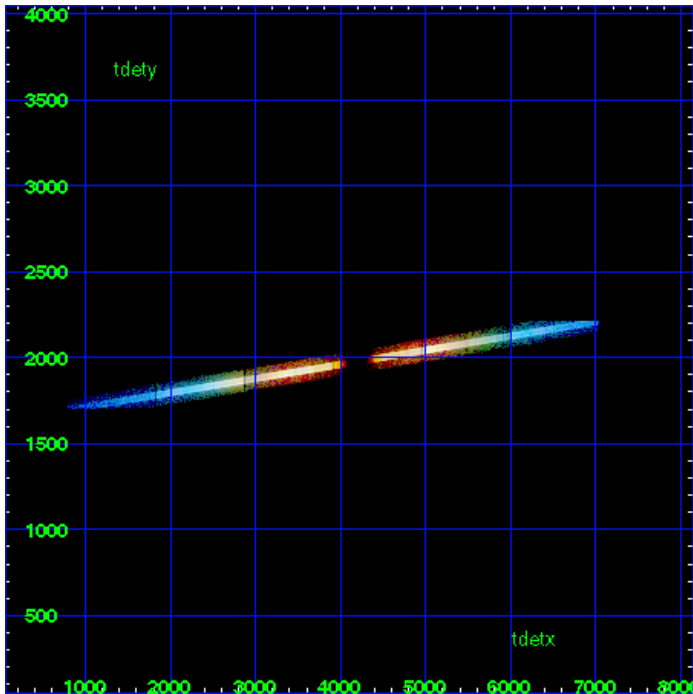
MEG Zero Order



MEG Order Sort ALL

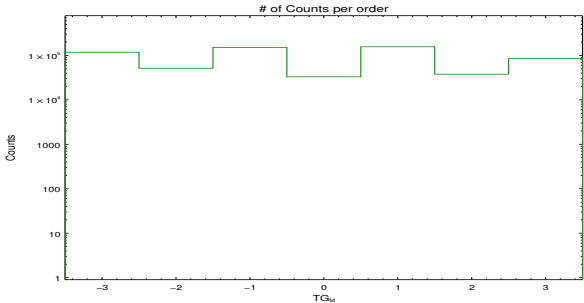


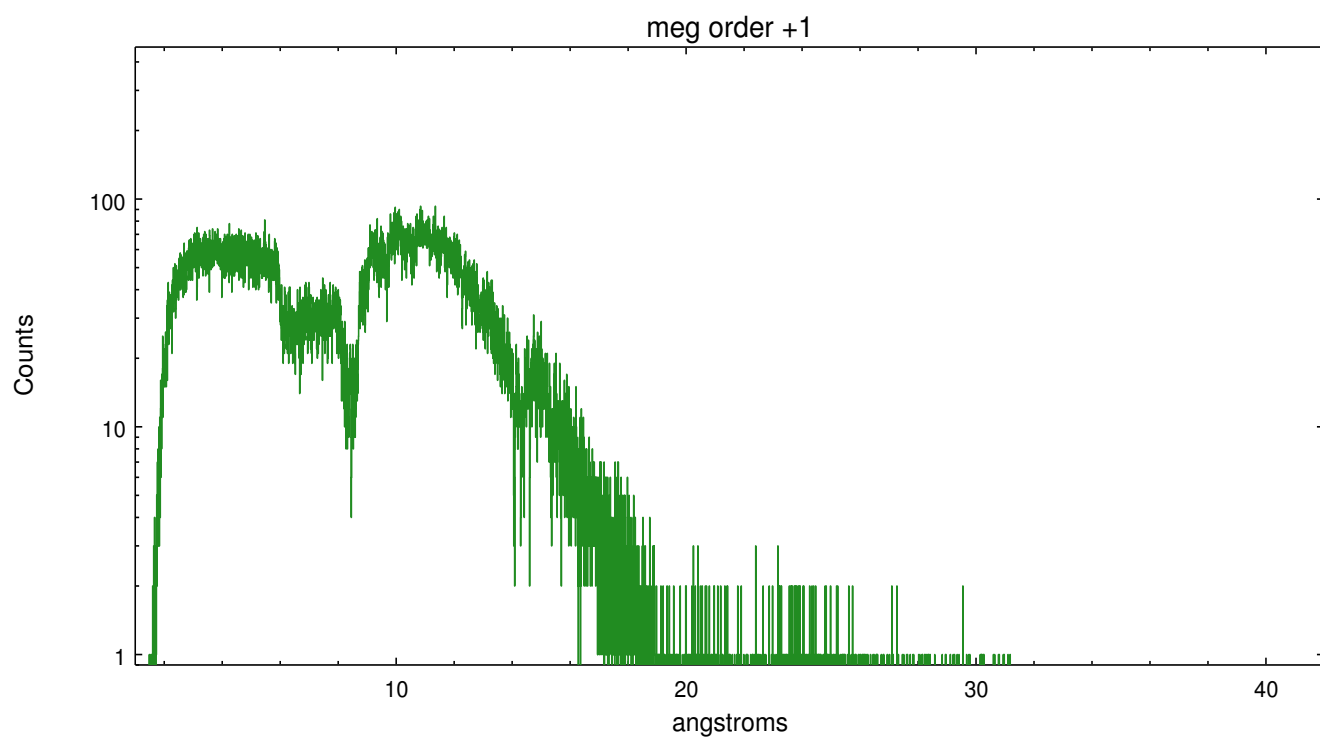
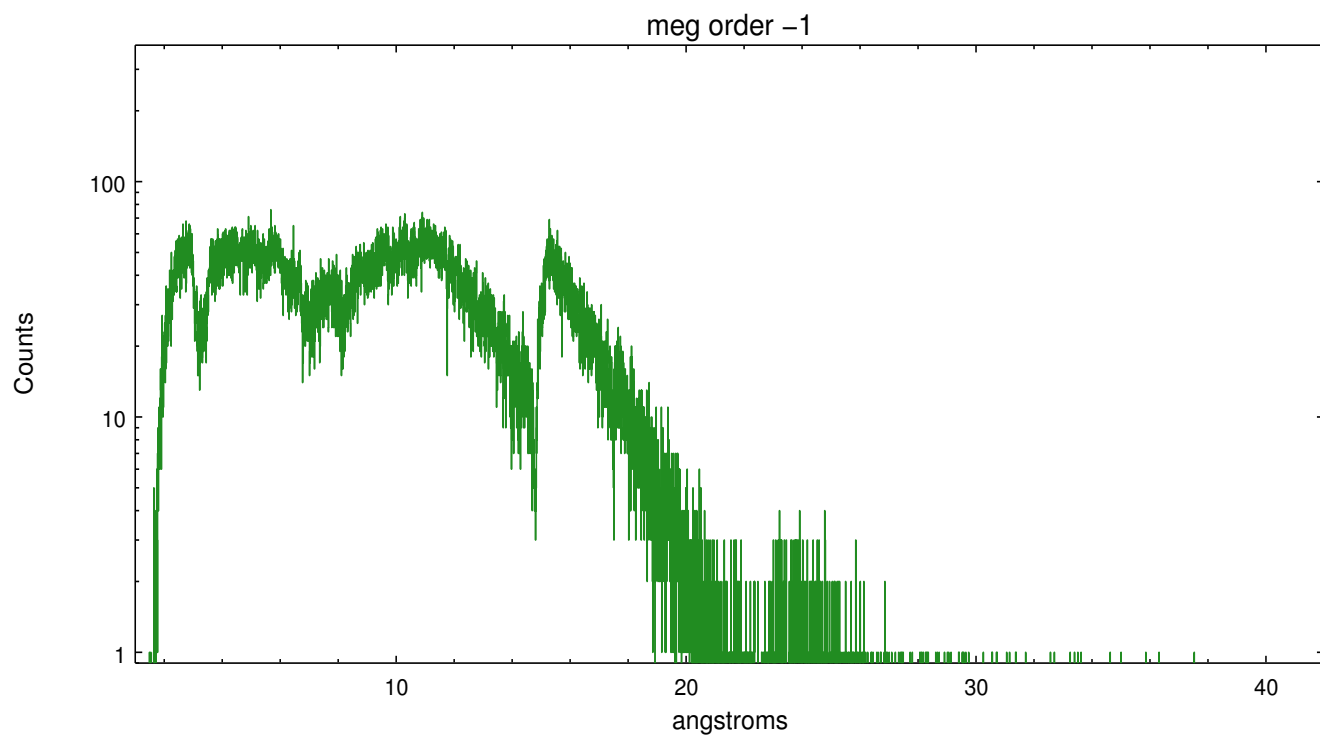
Spot Image MEG



Full Detector MEG

	order -3	order -2	order -1	order 0	order 1	order 2	order 3
Events	117585	51384	151158	32942	156406	37759	84906







# A Summary

## A.1 Status

V&V Scientist	Joy Nichols
V&V Date (YYYY-MM-DD)	2012.10.10
V&V Edition	1
V&V Disposition and Status	OK
V&V Charge Time	4.486

## A.2 Comments

Zeroth order piled up and cratered. Standard data processing software did not correctly locate the zeroth order due to pileup. Manual intervention was used to input the correct sky coordinates ( $x=4167.74$ ,  $y=4093.41$ ) into the `*src1a.fits` file table. These corrected coordinates were determined using a software tool developed by CXC called `findzero`, which is expected to be released in CIAO as `tg_findzo` (currently in ISIS as `findzo`). The tool calculates the point of intersection of the readout streak and the meg arm. The zeroth order source position determined by the standard pipeline processing using the tool `tgdetect` was not used in this processing. The newly determined zeroth order coordinates have been placed in the `*src1a.fits` file, replacing the coordinates determined by `tgdetect`. Note that these corrected coordinates of the zeroth order cannot be reproduced by running `tgdetect` on the data.

===

The charge time is based on `CCD_ID=4 (S0)`, which had the fewest dropped frames. Other chips have dropped frames due to telemetry saturation by the zeroth order (no mitigating zero order sample-cycle or exclusion region was requested) and dispersed spectra. Their effective exposures range from 1.45-4.09 ks.

===

For analysis of orders 3 and above, the data should be re-extracted using custom order-sorting boundaries (`osort_lo`, `osort_hi` in `tg_resolve_events`) to bypass the ccd response. For high orders, residual calibration uncertainties in the response are magnified, and MEG 3rd orders are clipped in PHA-space somewhat near the ends of the spectrum.