

Calibration Status of the *Suzaku* XIS

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for the *Suzaku* XIS Team



IACHEC 2014 – Airlie Center



Suzaku/XIS – Overview

- 4 CCDs with independent X-ray telescopes (XRTs)
- 3 front-illuminated (FI) XIS0 ~~XIS2~~ XIS3
1 back-illuminated (BI) XIS1



XIS

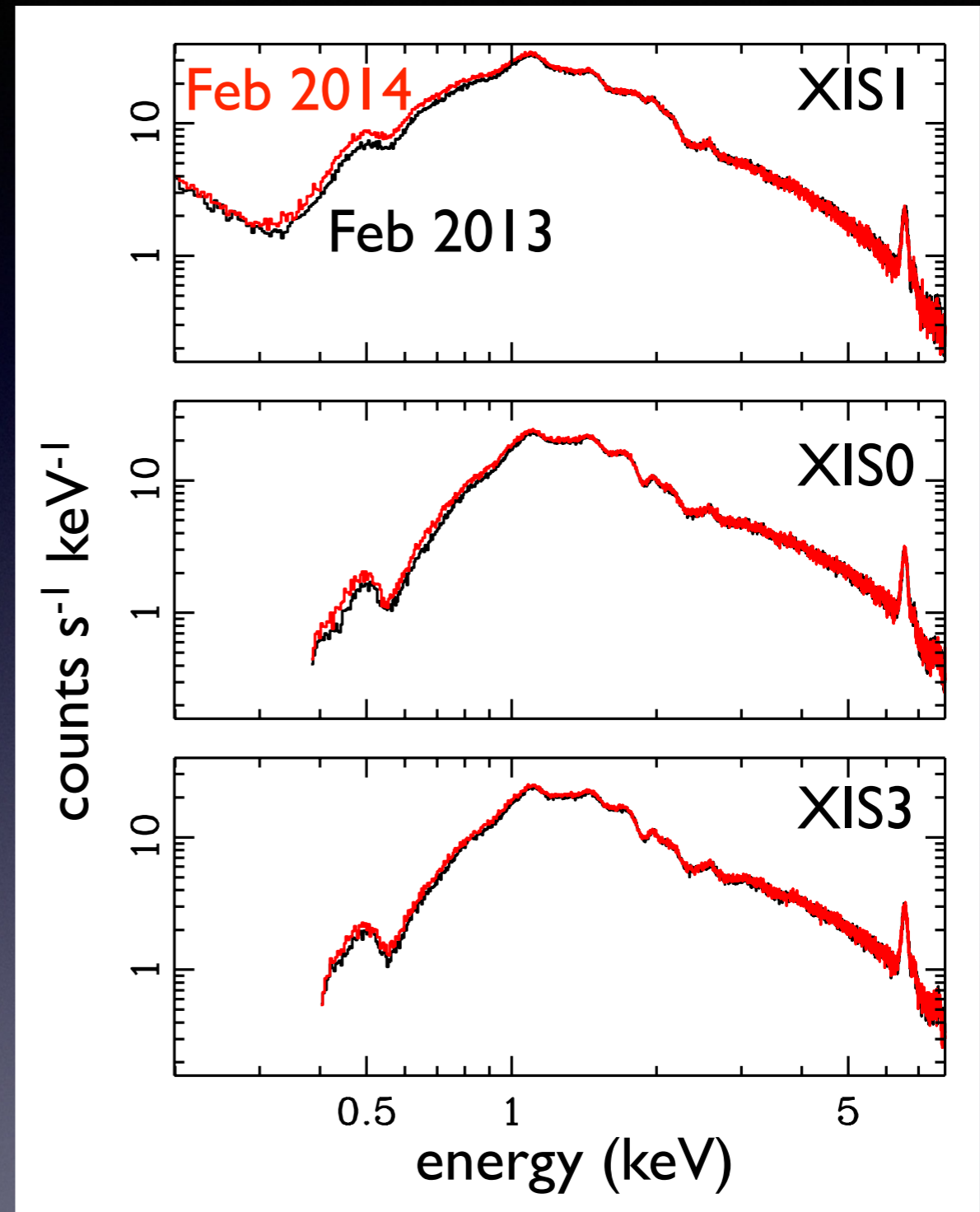
Status & Operations

Post-UVC Performance

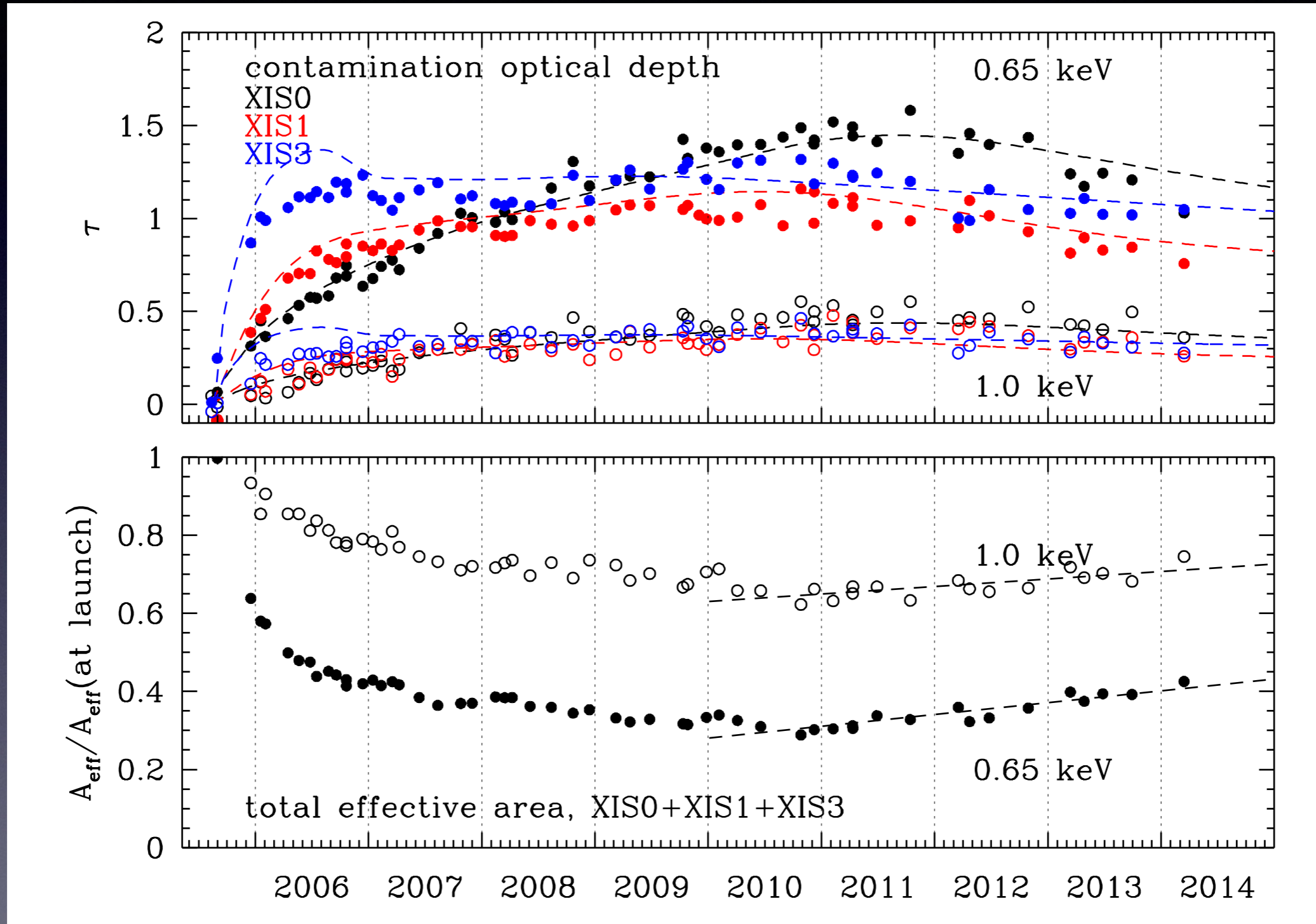
Perseus cluster

Feb 2013 XIS1

Feb 2014 XIS1



XIS Contamination: On-Axis

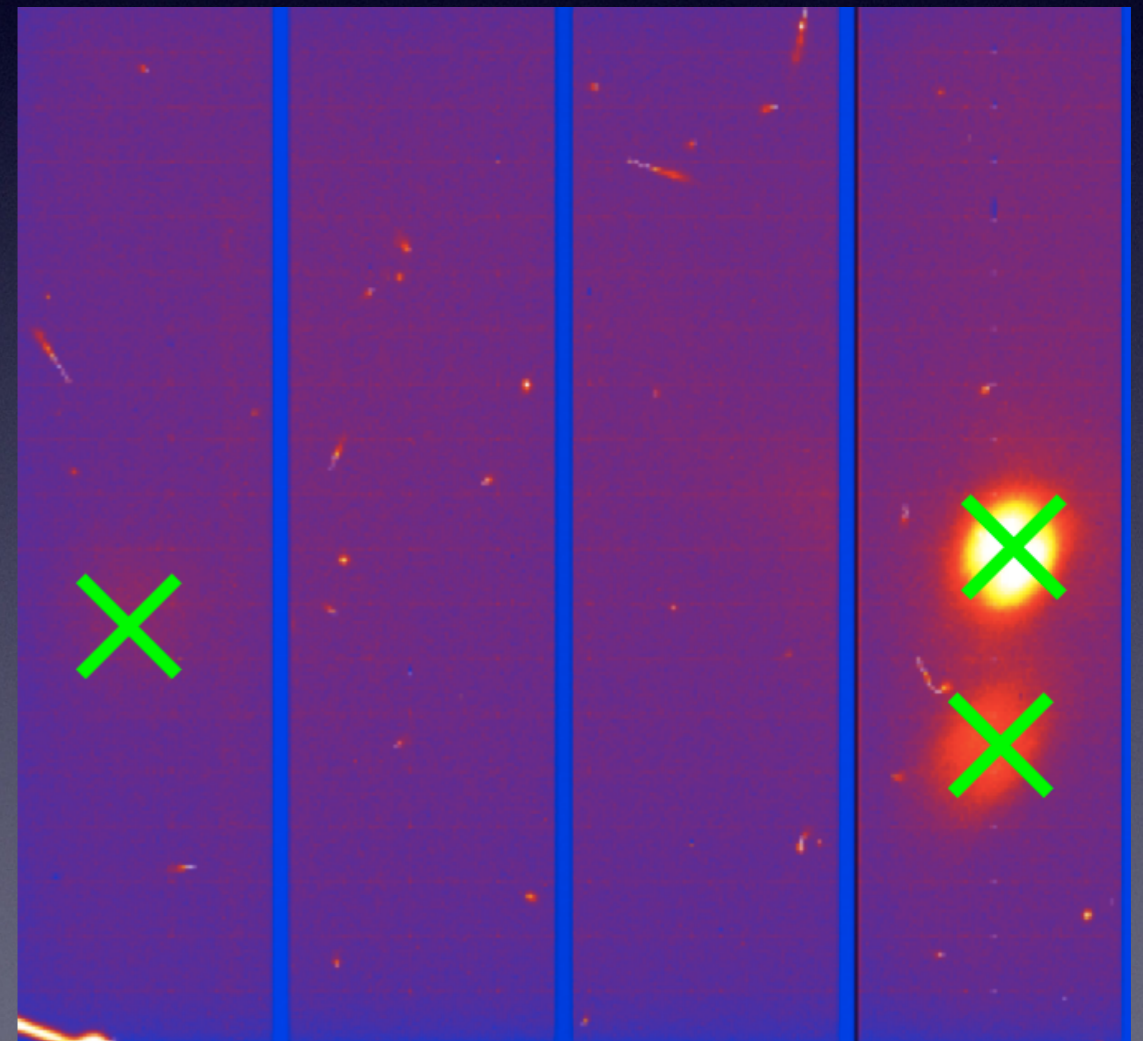
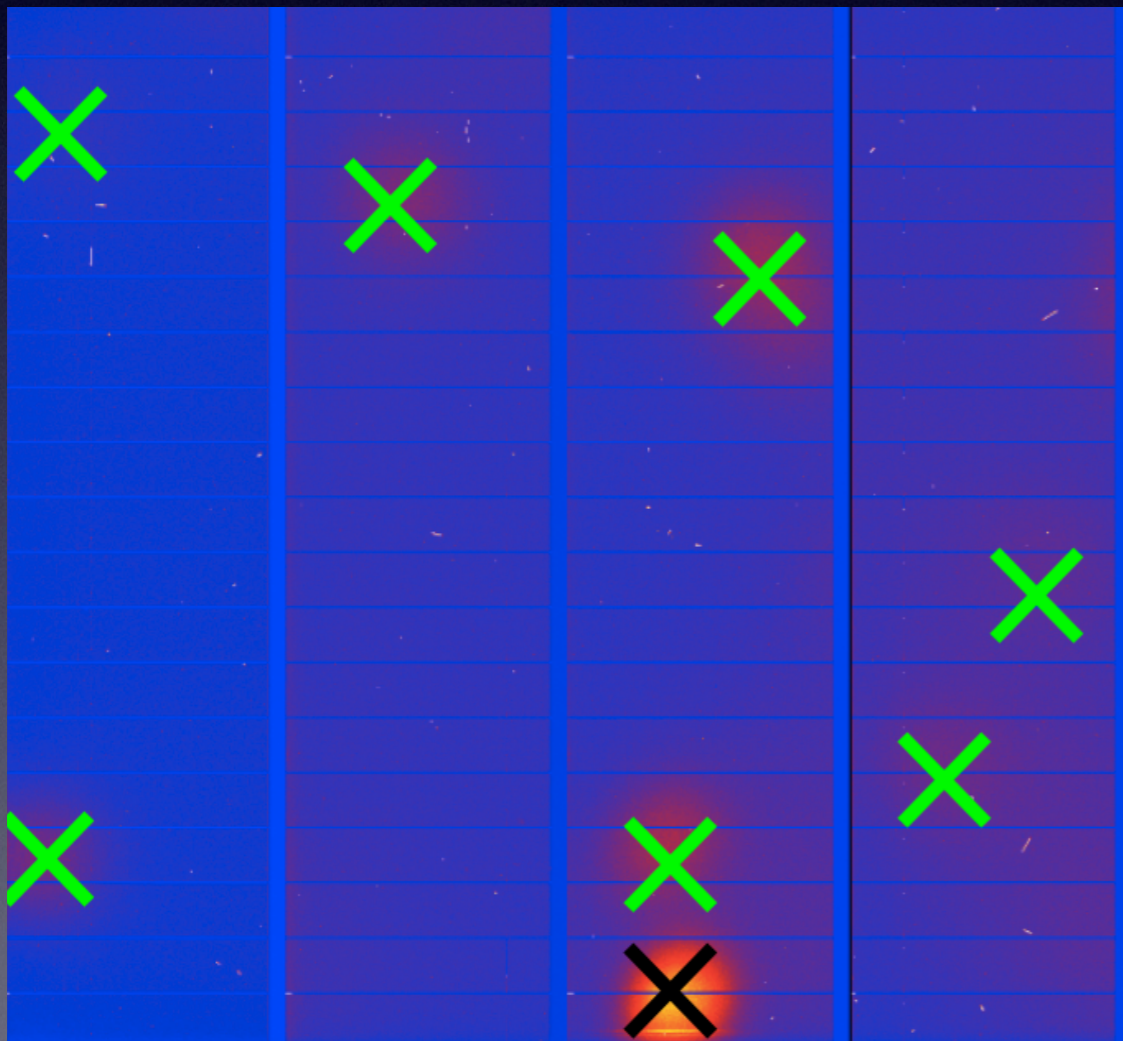


New OBF Holes

bright Earth raw frames (images)
from July 2013

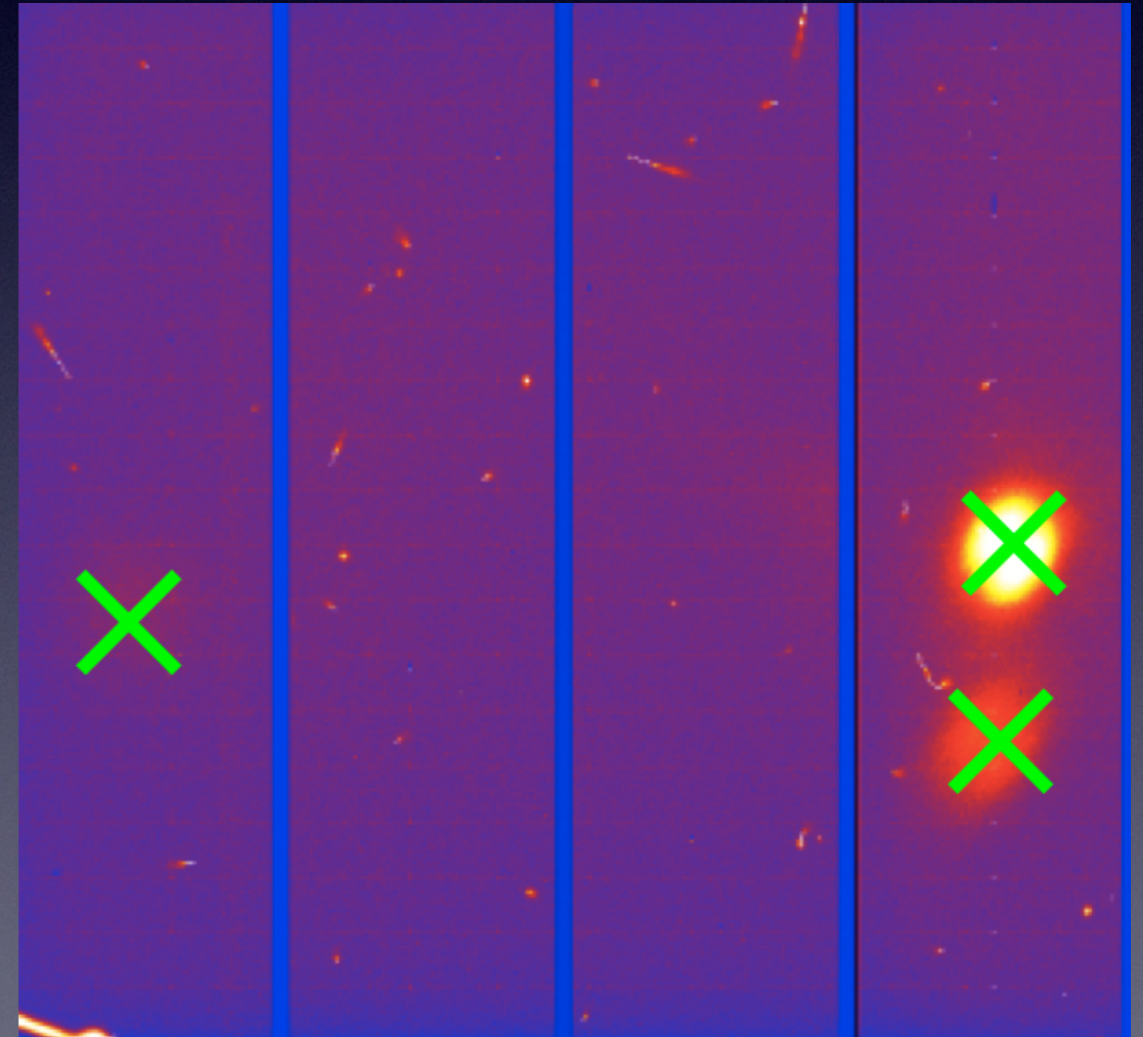
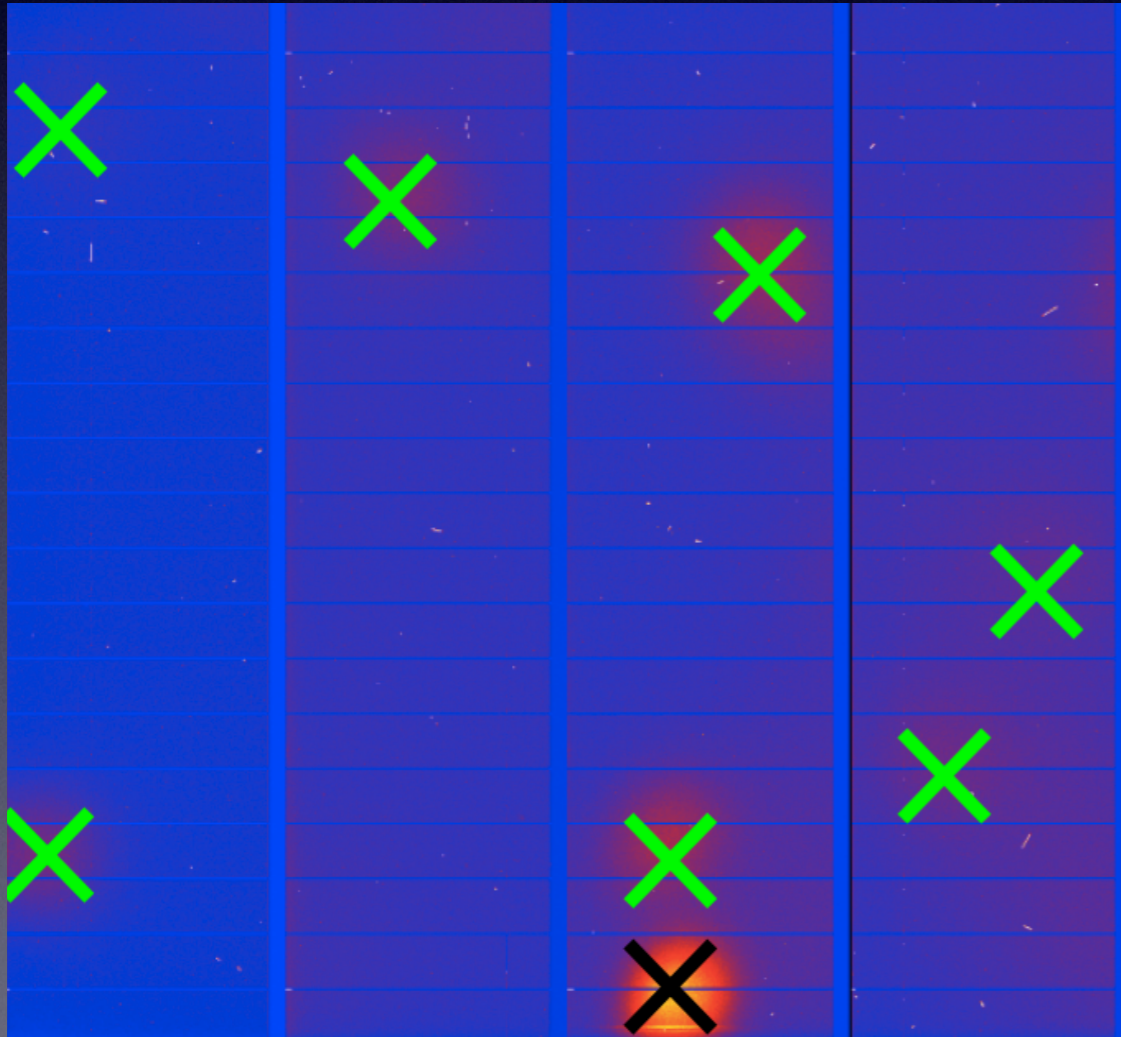
XISI

XIS 3



Dec 2009

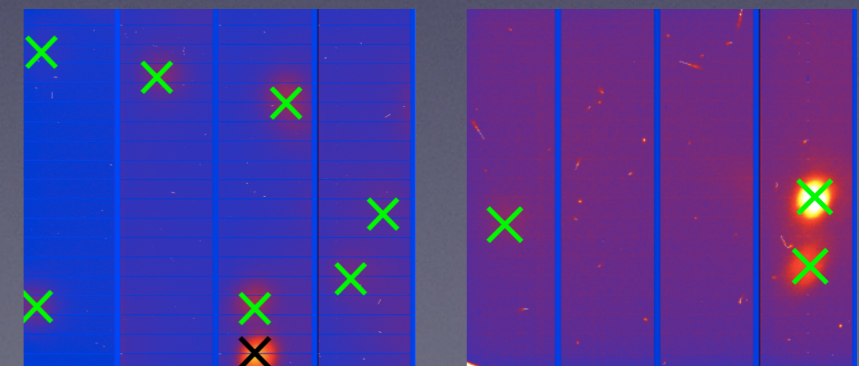
New OBF Holes



New OBF Holes

- spots seen in bright Earth data Nov 2010–Dec 2011
XIS1, XIS3, but *not* XIS0
- **no measurable excess in X-ray flux in these areas**
(from Perseus cluster)
- likely holes in OBF, $\sim 8 \mu\text{m}$ or 1/3 pixel

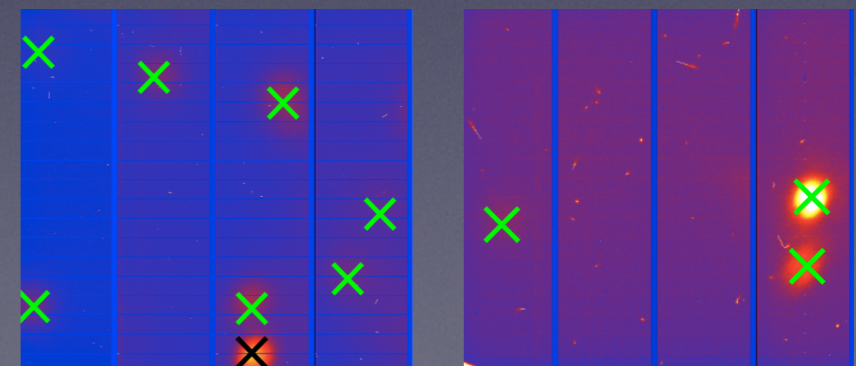
No.	Sensor	DETX	DETY	First appearance ^a
1	XIS1	57	627	2009/12
2	XIS1	197	619	2010/11
3	XIS1	278	875	2010/11
4	XIS1	764	706	2010/11
5	XIS1	830	375	2011/12
6	XIS1	183	37	2011/12
7	XIS1	478	964	Unknown
8	XIS1	904	69	Unknown
1	XIS3	148	475	2010/05
2	XIS3	135	292	2010/05
3	XIS3	898	427	Unknown



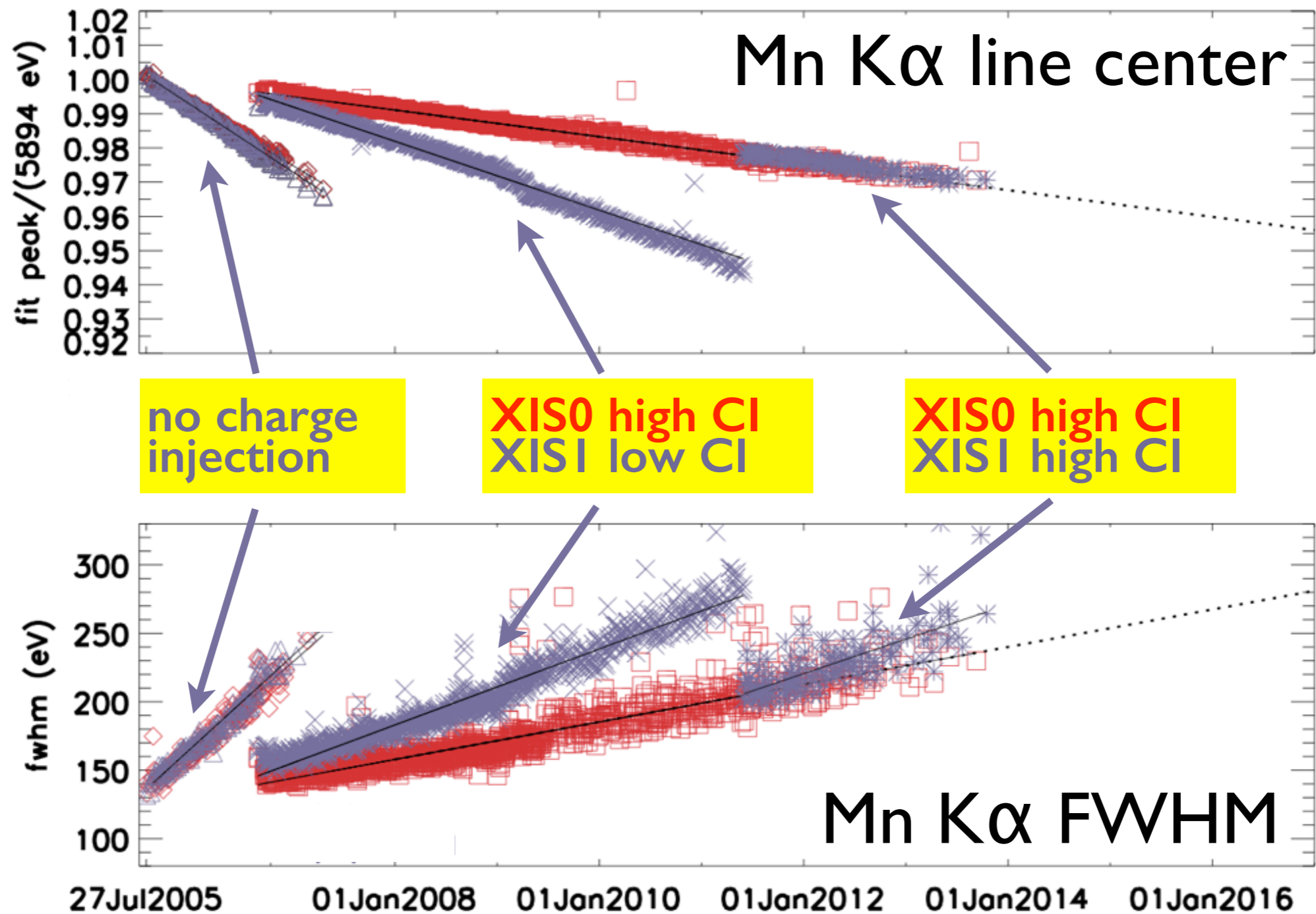
New OBF Holes

- spots seen in bright Earth data Nov 2010–Dec 2011
XIS1, XIS3, but *not* XIS0
- **no measurable excess in X-ray flux in these areas**
(from Perseus cluster)
- likely holes in OBF, $\sim 8 \mu\text{m}$ or $1/3$ pixel

No effect for observers,
unless **very bright optical/UV**
source is over hole.



XIS CCD Performance

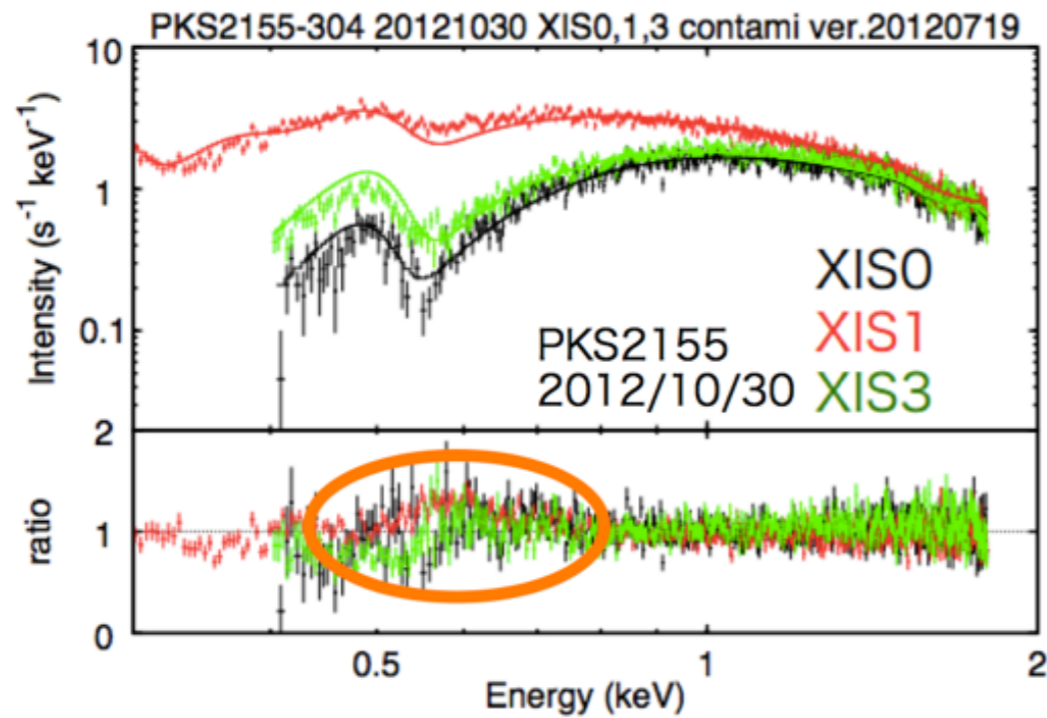


CAUTION: CALIBRATION NOT APPLIED!

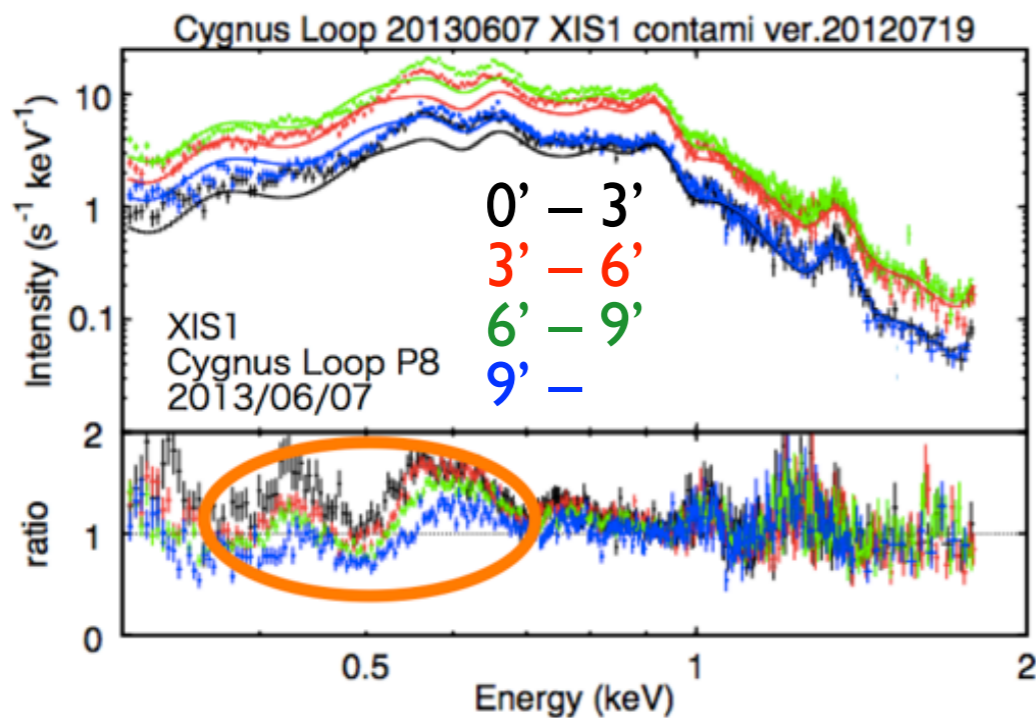
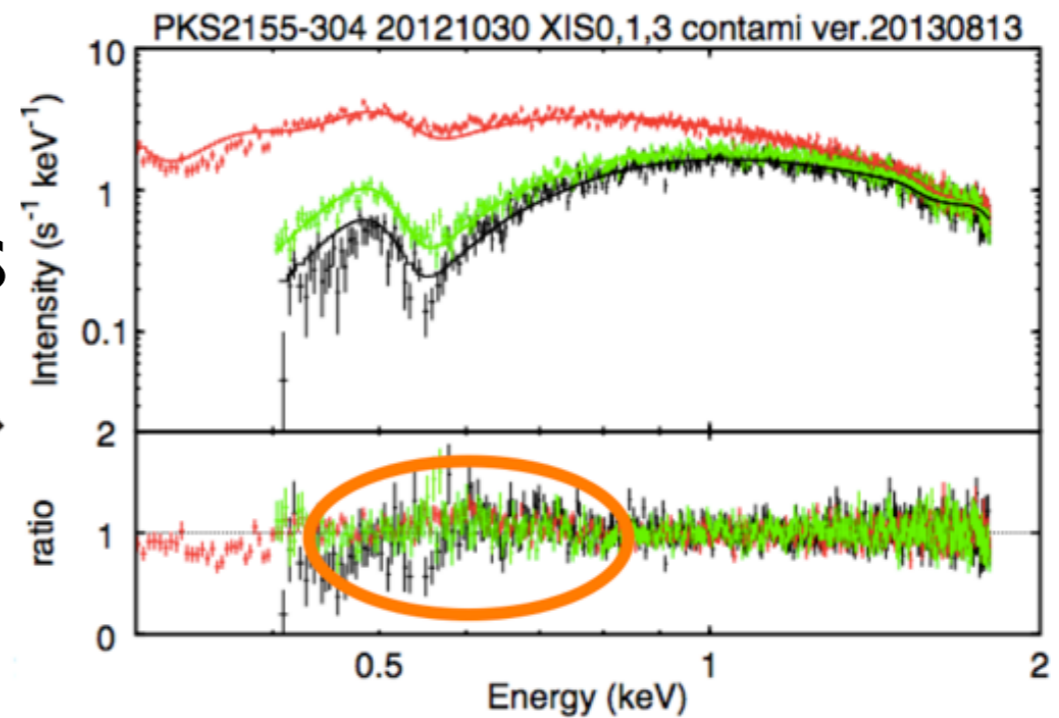
XIS

Calibration Updates

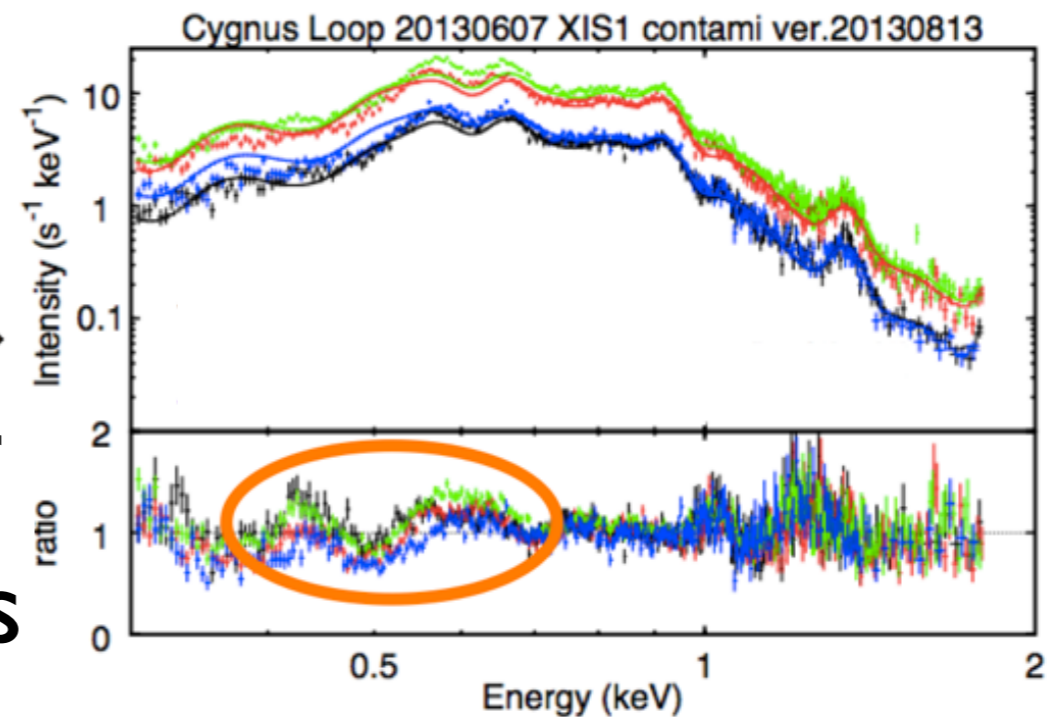
XIS Contamination Model



on
axis



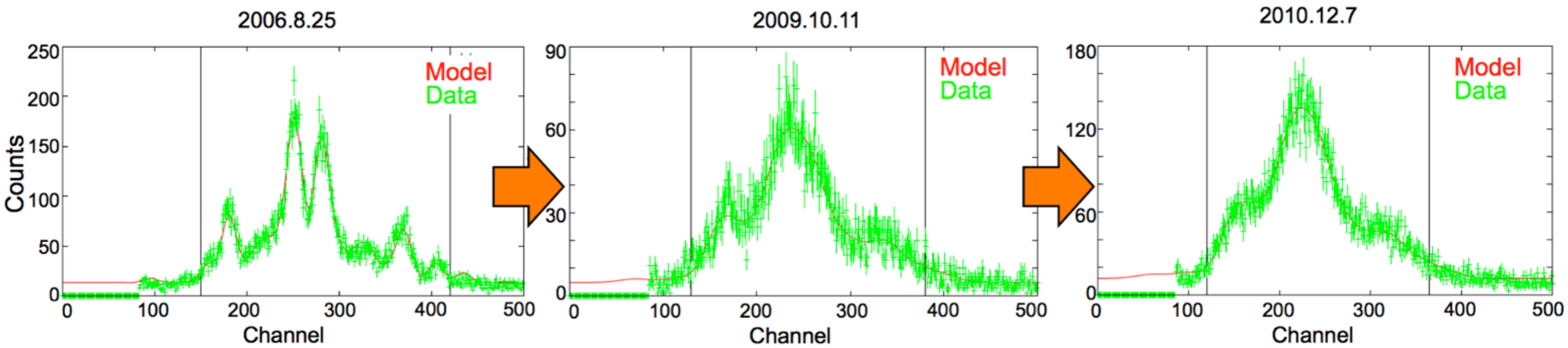
off
axis



v20120719

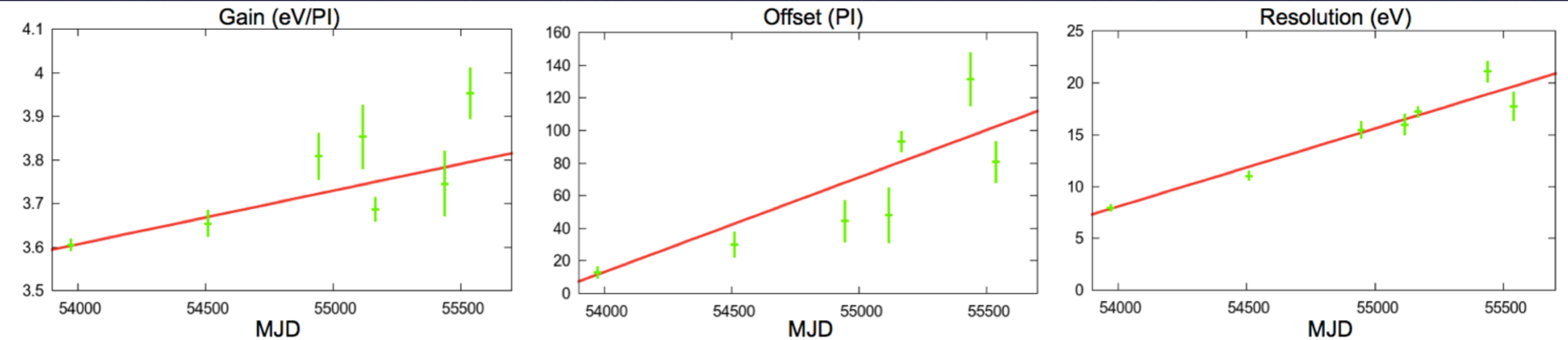
v20130813

XIS3 P-sum Calibration



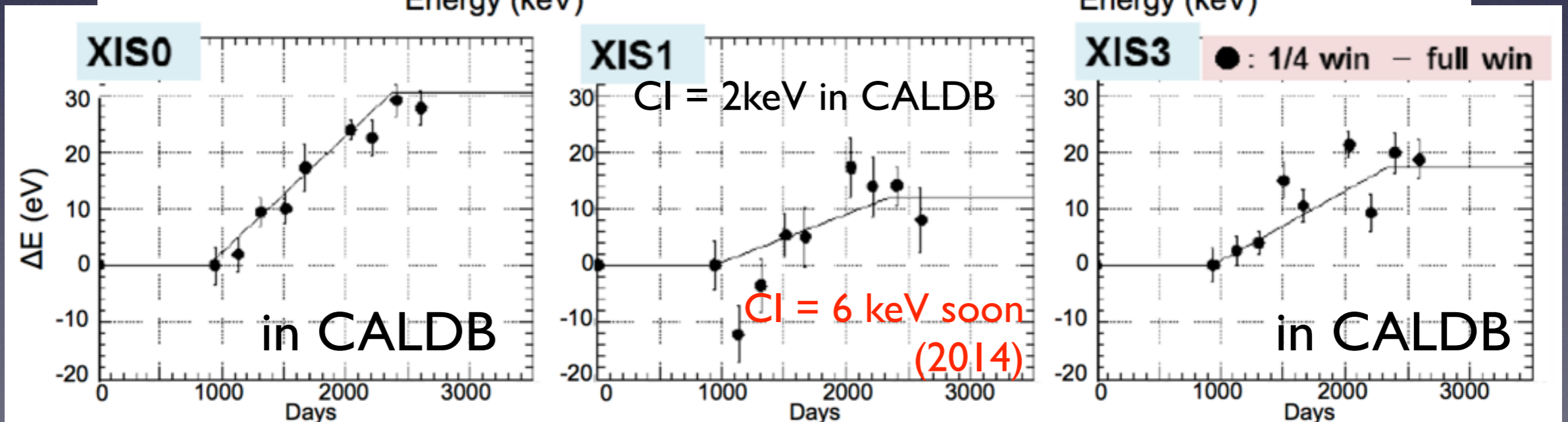
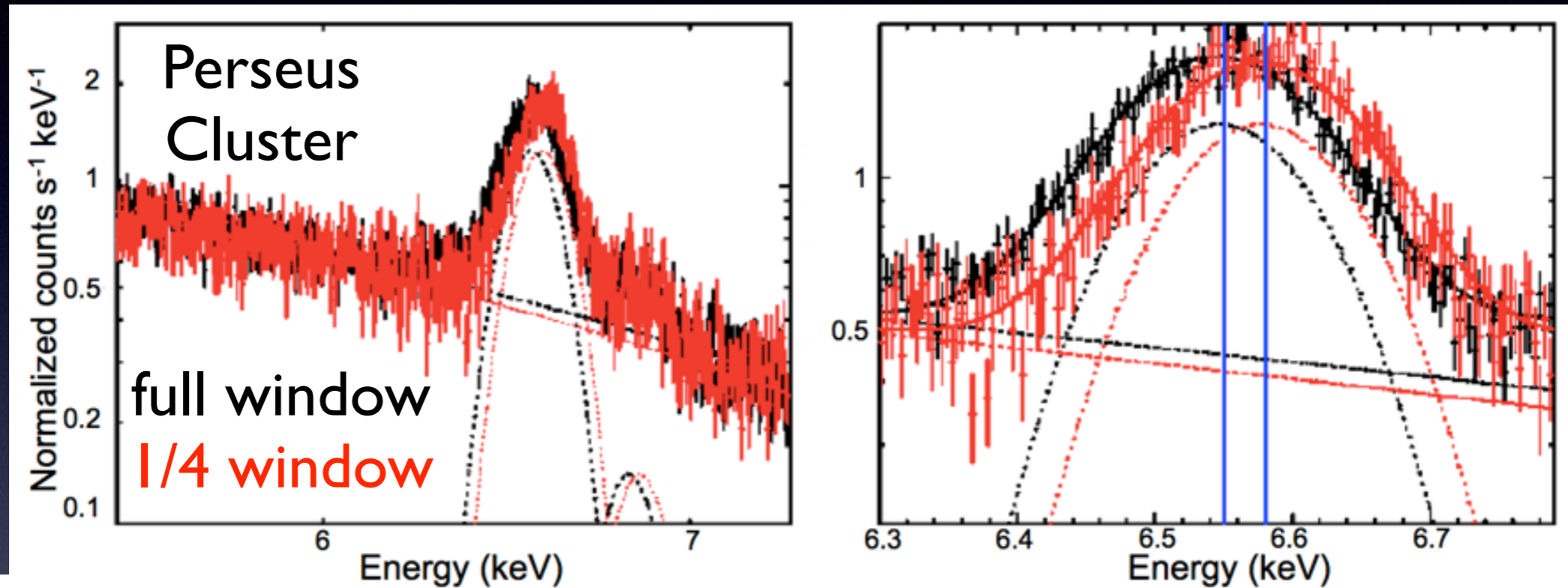
Now in CALDB

E0102 with XIS3
(model from Plucinsky et al. 2008)



XIS 1/4 Window Calibration

(CTI correction is more complicated)



Suzaku XIS Status – Summary



- unaffected by January UVC event
- contamination is decreasing (?)
- OBF holes do not effect observations; will monitor
- XIS1 charge injection increase successful

X-RAY IMAGING SPECTROMETER (XIS) INSTRUMENT MONITORING

XIS INFO

HOME
NEWS
ABOUT
PEOPLE
GALLERY
CALIBRATION
MONITORING
TEAM PAGE

XIS COLLABORATORS

ISAS/JAXA
KYOTO U.
OSAKA U.

SUZAKU INFO

GO FACILITY
SUZAKU AT ISAS
XRS AT GSFC
HXD AT TOKYO U.
XRT AT GSFC

CCD PERFORMANCE MONITORING

[Cal Source Monitoring](#) Using information from the Fe55 calibration source regions, we track the gain, spectral resolution, hot pixels, and CTI indicators. SCI-off and SCI-on data are monitored separately. These data have not processed by the calibration software.

[Monthly Cal Source Spectra](#) Spectra of integrated monthly Fe55 cal source data, by sensor and SCI setting.

INSTRUMENT HEALTH MONITORING

[Instrument HK Monitoring](#) Tracking of the CCD temperature, baseplate temperature, and TEC voltage.

[CCD Temperature Anomalies](#) Summary of anomalous temperature excursions for each detector.

CONTAMINATION MONITORING

[Point Source Monitoring](#) Tracking the on-axis OBF contamination with regular observations of soft point sources (primarily E0102).

[Bright Earth Monitoring](#) Tracking the spatial dependence of the OBF contamination with monthly integrated observations of the sun-lit Earth, which emits field-filling O and N emission lines.

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for Atmospheric
and Space Research

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Suzaku X-ray Imaging Spectrometer Quick Reference

(The latest version at http://www.astro.isas.jaxa.jp/~tsujimot/pg_xis.pdf)
2013/08/25 M. Tsujimoto (ISAS) [XIS support astronomer]

This leaflet is intended to assist users to plan an XIS observation. The Suzaku web page and the "XIS Technical Description" document supplement the information. Consult xisope@astro.isas.jaxa.jp for further details.

Basics XIS is equipped with four X-ray CCDs (XIS0-3) for imaging and non-dispersive spectroscopy. The four CCDs are at the focus of four co-aligned telescopes and observe the same field. Three CCDs are front-illuminated (FI) and one is back-illuminated (BI) superior respectively in the hard- and soft-band. XIS is operated simultaneously with HXD.

Field of view	17.8' x 17.8'
Energy range	0.2-12 keV
Energy resolution	~180 eV @6keV
Effective area	340 (FI)/390 (BI) cm ² @1.5keV
Time resolution	8 s (Normal) - 7.8 ms (Psum)

Archive Accepted targets : <http://heasarc.gsfc.nasa.gov/docs/suzaku/tlinfo/Obs plan> : <http://www.astro.isas.jaxa.jp/suzaku/schedule/shortterm/>
XIS log : <http://darts.isas.jaxa.jp/astro/suzaku/suzakuxislog/top.do>

View XIS0-3 has 1024x1024 pixels composed of four segments (A-D) with one readout node for each segment. Due to unavoidable micro-meteorite hits, a part of XIS0 and the entire XIS2 (Normal) are not used. OBF holes are negligible for X-ray obs., unless a bright optical source is located within ~1'. Psum is available only for XIS3. Two ⁵⁵Fe calibration sources (Mn I K α and K β lines at 5.9 and 6.5 keV) are installed. Users can specify the roll angle. Use the Maki tool.

Counts/s Estimate the count rate using the PIMMS tool. Approximately, 1 mCrab flux yields 1.6 [/s/sensor] (FI) and 2.0 [/s/sensor] (BI). For bright variable sources, check MAXI. Count rate estimate is crucial for selecting XIS modes. PIs of ToO observations of bright variable sources may update the estimate at the planned time of the observation by a few days earlier.

Aim point From AO-7, only XIS-nominal position is officially supported.

Clocking XIS is operated in a combination of clocking and editing modes. Users are responsible to choose the appropriate clocking mode. For faint (<12 [/s/sensor]) sources, use Normal mode with no option. For bright (>12 [/s/sensor]) point-like sources, choose Normal mode with appropriate window and/or burst options. For high timing accuracy, choose Psum (XIS3) and others (XIS0,1). It is acceptable to use different clocking modes for different sensors. Users may request mode changes 1-2 days prior to observations if pre-arrangements are made with xisope@astro.isas.jaxa.jp.

Clock mode	Normal								Psum					
	Win.	no	1/4	1/8	no	no	no	no	1/4	1/4	1/4	1/8	no	
Opt ion	Burst	no	no	no	2.0	0.6	0.5	0.1	1.0	0.5	0.3	0.1	0.5	no
Max cr/s to avoid pile-up ¹	1.2	48	96	48	1.6	1.9	9.6	96	1.9	3.2	9.6	1.9	10 ²	
Obs efficiency ²	1.0	1.0	1.0	.25	.08	.06	.01	.50	.25	.15	.05	.5	0	
Support	OK	OK	*3	*5	*4	OK	*2	OK	OK	*3	*3	*3.5	*3.5	

Window option ... 1/n (n=4 or 8) option reads (1024x1024/n) pixels centered at the aim position in 8/n [s]. (Pros) Photons not lost for the observed area. (Cons) The observed area reduced by 1/n. The calibration sources not observed.

Burst option ... m [s] (m=0.1, 0.3, 0.5, 0.6, 2.0) option reads photons arriving in m out of 8 [s] in each image. (Pros) The calibration sources observed. The observation area not reduced. (Cons) A fraction (1-m/8) of photons lost.

* To be precise, the burst time for the 0.1s burst option is 0.135s (FI)/0.147s (BI).

Psum mode ... 128 rows are stacked along the readout direction, yielding (1024x8) pixel data. (Pros) High timing accuracy, 7.8 ms in recording event arrival time. (Cons) Spatial information lost along the readout direction. Spectral performance severely degraded due to inefficient noise reduction, the unavailability of the sacrificed charge injection technique, etc.

*1: The rates are "hard limits". A 5-10% margin should be considered. Annulus extractions can also work.
*2: Not including events out of window, out-of-time events. *3: Calibration not guaranteed. *4: BI only. *5: FI only.

<http://space.mit.edu/XIS/monitor>

http://www.astro.isas.jaxa.jp/~tsujimot/pg_xis.pdf