Suzaku X-ray Imaging Spectrometer Quick Reference

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[XIS support astronomer]

(The latest version at http://www.astro.isas.jaxa.jp/~tsujimot/pg_xis.pdf.)

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.

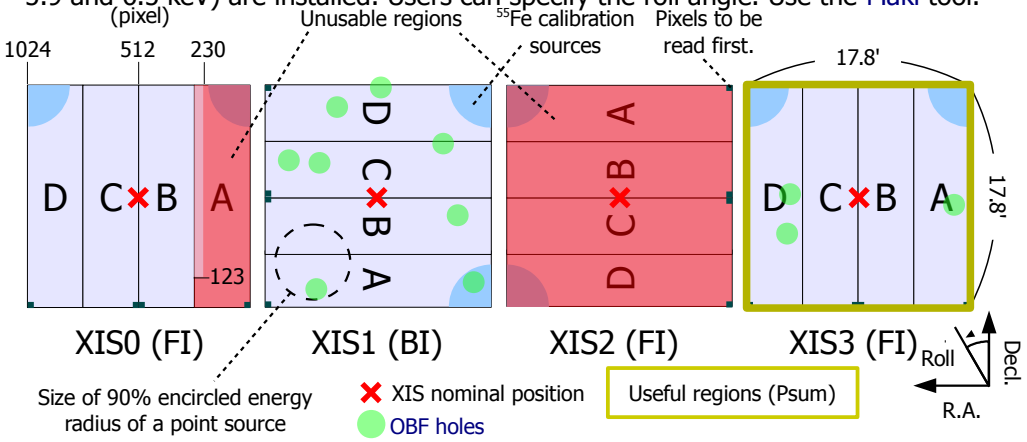
Field of view	17.8' x 17.8'
Energy range	0.2-12 keV
Energy resolution	~180 eV @6keV
Effective area	340 (FI)/390 (BI) cm^2 @1.5keV
Time resolution	8 s (Normal) - 7.8 ms (Psum)

Archive

Accepted targets : http://heasarc.gsfc.nasa.gov/docs/suzaku/tlminfo/
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 ^{55}Fe calibration sources (Mn I Kα and Kβ 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
Option	Win.	no	1/4	1/8	no	no	no	no	1/4	1/4	1/4	1/4	1/8	no
	Burst	no	no	no	2.0	0.6	0.5	0.1	1.0	0.5	0.3	0.1	0.5	no
Max cnt/s to avoid pile-up*1		12	48	96	48	1.6 10^2	1.9 10^2	9.6 10^2	96	1.9 10^2	3.2 10^2	9.6 10^2	1.9 10^2	1.5 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

*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.

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 perfromance severely degraded due to inefficient noise reduction, the unavailability of the the sacrificed charge injection technique, etc.

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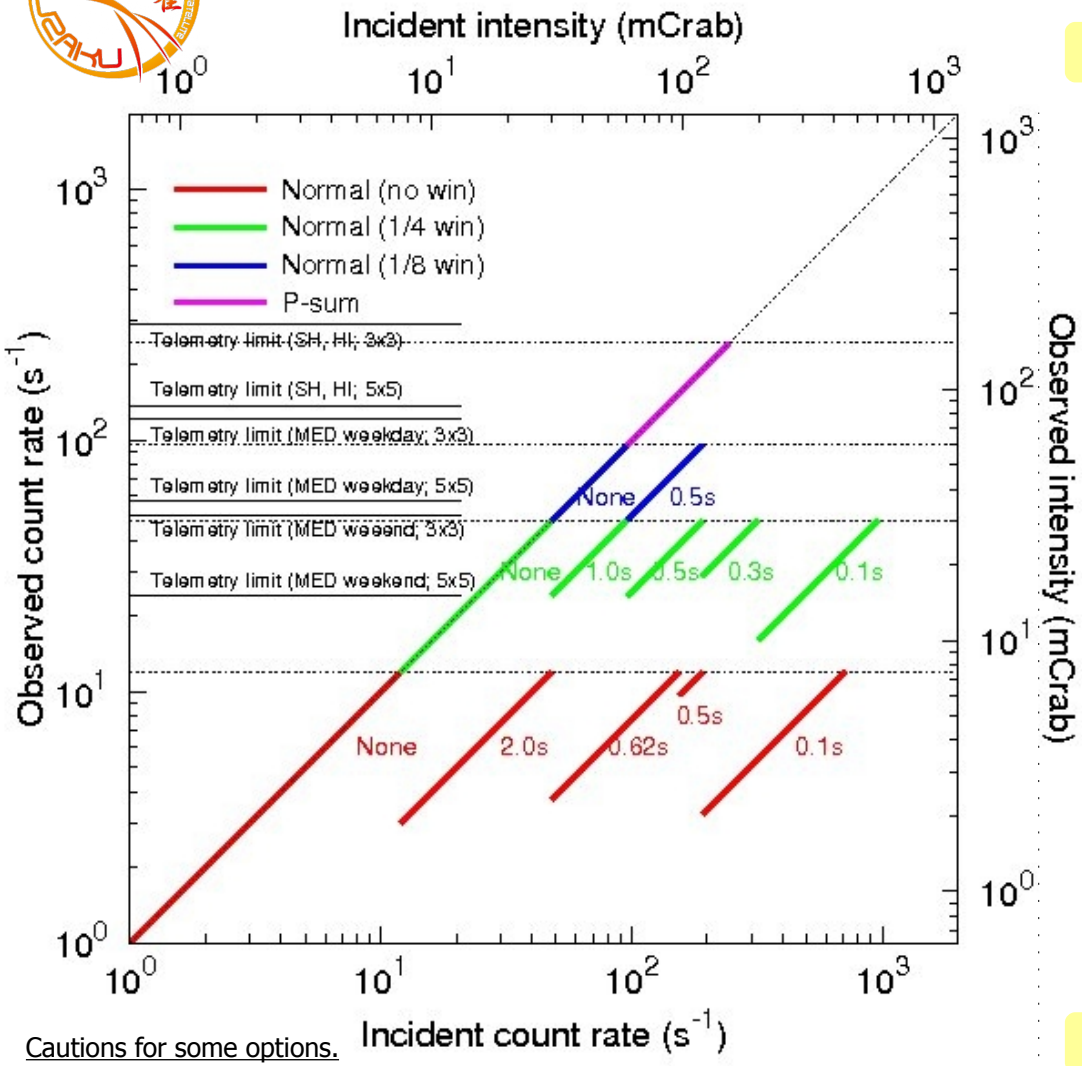

Cautions for some options.
(1) Too-narrow (1/8) window option: The window size is 2.25 arcmin, which is comparable to the attitude fluctuation of 40--60 arcsec in an orbit. This causes artificial modulation in the the X-ray signals.
(2) Too-short (<=0.5s) burst option: In such a short exposure, a proper estimation of out-of-time events becomes difficult.

Editing

The editing mode (telemetry format) is selected automatically depending on the count rate estimate and the clocking mode provided by users. Use limit calculator for explicit choices of edit mode & PPU ratio For point-like sources, the telemetry saturation is not an issue when appropriate clocking mode is chosen to avoid pile-up.

Max incident count rates (/s/sensor) to avoid telemetry saturation

Data Rate	Telem limit (kbps/XIS)	Editing mode (Size/event) [Sensor] 5x5 (40byte) [FI & BI]	3x3 (19 byte) [FI & BI]	f2x2_b3x3 (9 byte) [FI]	f2x2_b3x3 (19 byte) [BI]
SH	144	138.24	291.03	460.8	436.55
HI	144	138.24	291.03	460.8	436.55
MED (weekday)	60	57.6	121.26	192.0	181.89
MED (weekend)	25	24	50.53	80.0	75.79
LOW (weekday)	15	14.4	30.32	48.0	45.47
LOW (weekend)	1	0.96	2.02	3.2	3.03

* These numbers include 10% overheads (telemetry header and HK). The background event rates (FI ~ 10/s/sensor; BI ~ 20/s/sensor) not included.
* Choose 5x5 → 3x3 → f2x2_b3x3 not to exceed the telemetry limit for the three effective data rates (SH, HI, MED).
* Modification of limits by window/burst options & P-sum. Use XIS limit calculator.
  1. No window + *m* [s] burst option … telemetry limit increases by 8/*m* times.
  2. 1/*n* window + *m* [s] burst option … telemetry limit increases by 8/*m*/*n* times.
  3. P-sum has different telemetry allocation among the sensors.

Others

Careful simulation leads to a successful observation. Other things to consider include: (1) the increasing contamination materials for soft sources, (2) the non X-ray background for low-surface brightness sources, (3) telemetry saturation for bright extended sources, (4) changes in gain and energy resolution, (5) OBF holes. Note that the injection charge amount was increased for XIS1 in AO6. Monthly updates are presented by the XIS team.

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