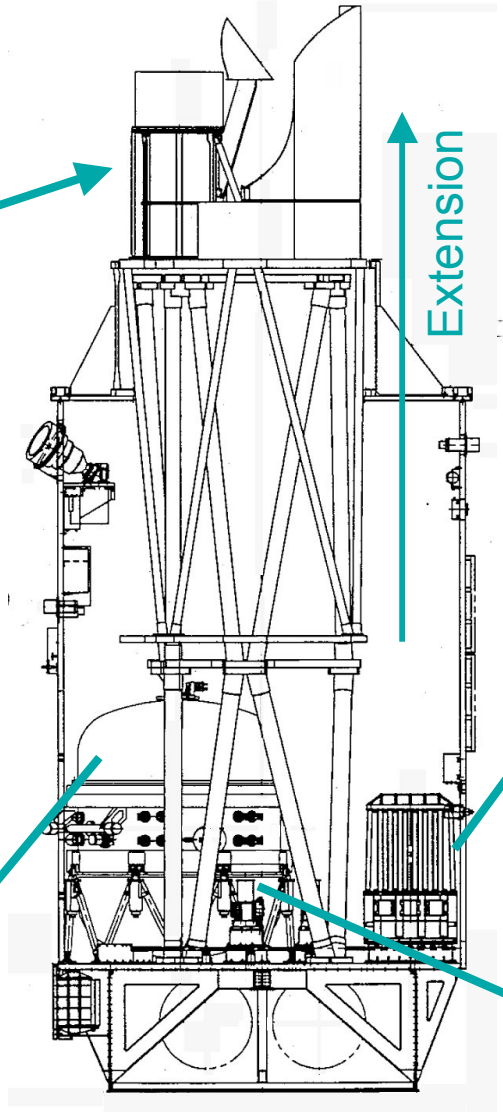
Calibration Status of *Suzaku*

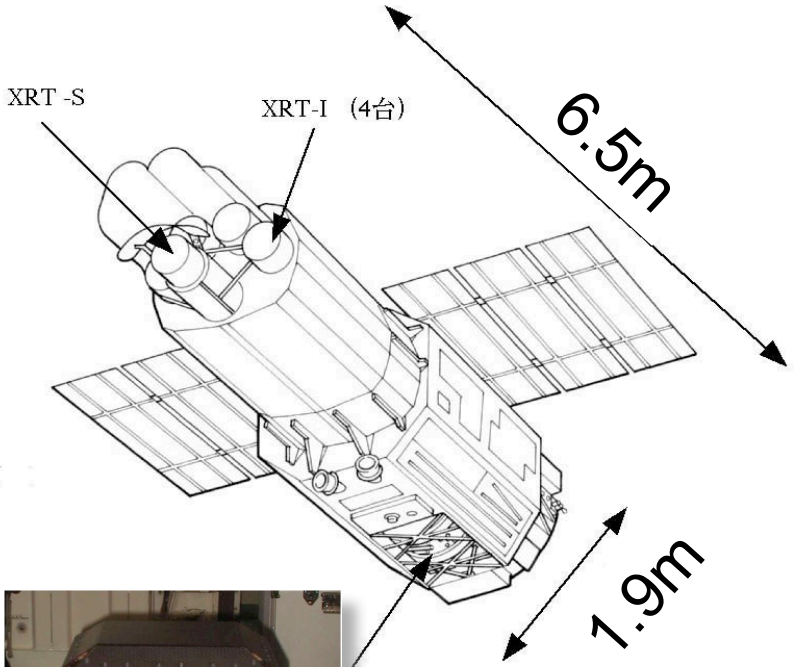
XRT: M. Ishida (ISAS/JAXA)
XIS: H. Matsumoto (Kyoto Univ.)
HXD: M. Kokubun (ISAS/JAXA)

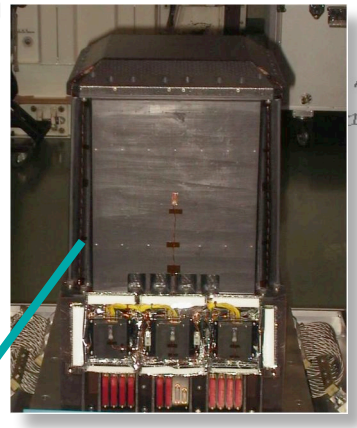
Scientific Instruments

X-ray Telescopes

XRT
NASA/GSFC-Nagoya-
ISAS/JAXA







Hard X-ray detector
HXD (10-600keV)
Tokyo-ISAS/JAXA-
Riken-Saitama-
HIroshima-Kanazawa-...

X-ray CCD camera
4 modules:1-BI
3-FI

XIS (0.2-12keV)
MIT-Kyoto-Osaka -
ISAS/JAXA-.....

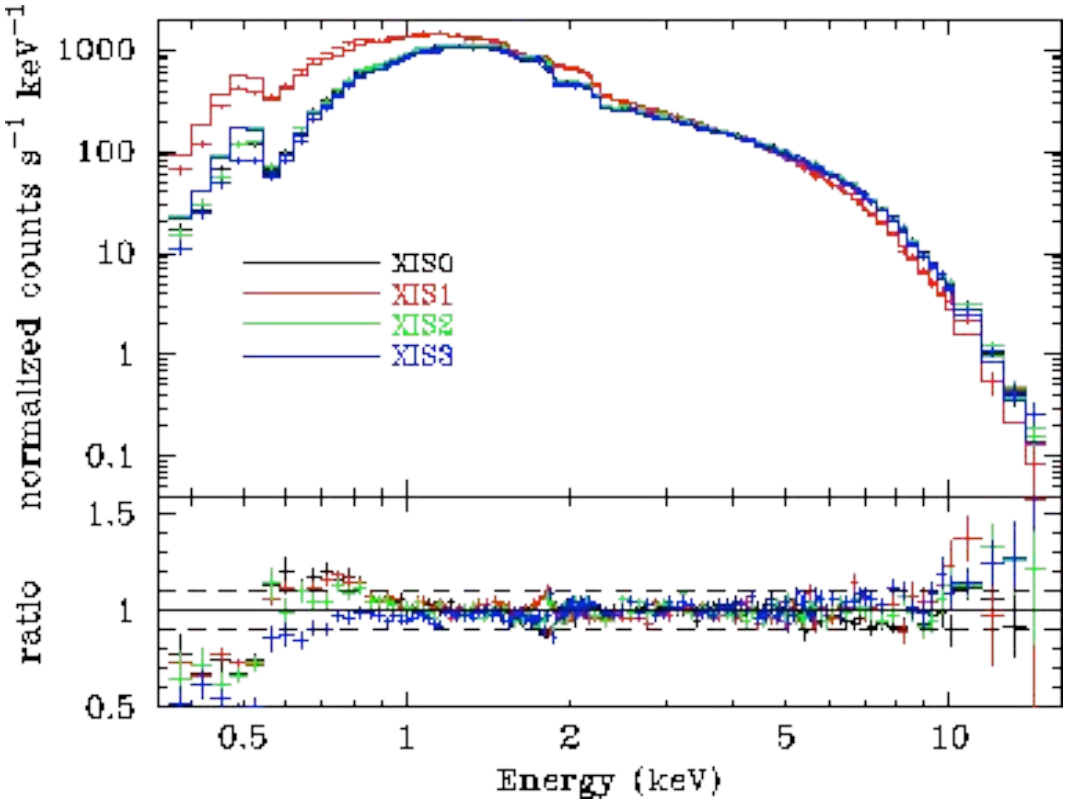
XRS
NASA/GSFC-Wisconsin
-ISAS/JAXA-TMU

X-ray micro calorimeter

X-Ray Telescope

M. Ishida & T. Maeda (ISAS/JAXA)

Effective Area



Crab (observed on 2005 Sep. 15-16)

- Current version for GOs (heasoft ver 6.2)
- Energy band: 1.0–1.5 and 2.0–10.0keV (excluding Si edge)
- $N_{\rm H} = (2.9\pm0.1)\times10^{21}$ cm^{-2}, $\Gamma = 2.08\pm0.01$
- F(2-10keV) $= (2.15\pm0.03)\times10^{-8}$ erg cm^{-2} s^{-1}

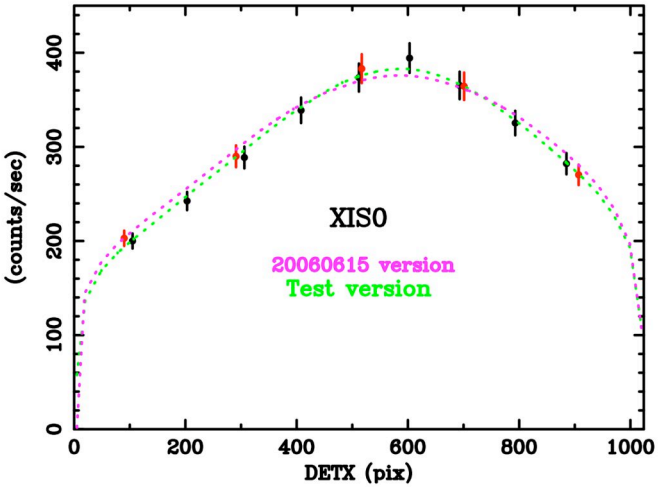
XRT-I0 (XIS0)

- 2006
- 2005

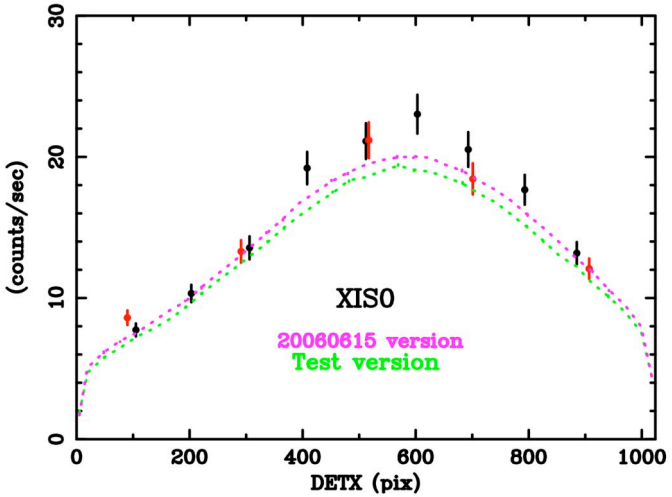
DETX

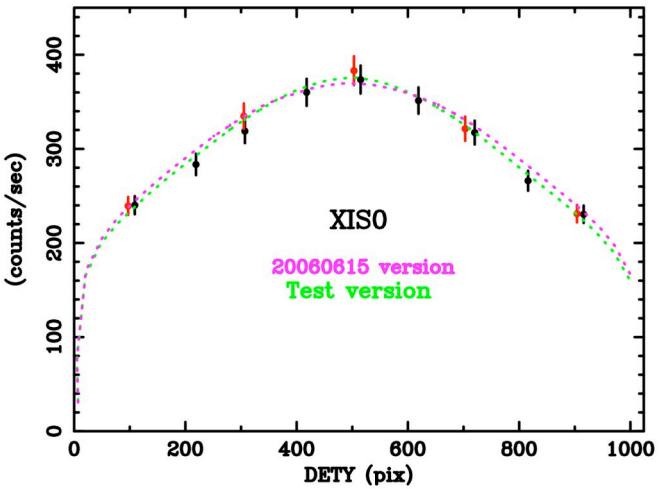
DETY

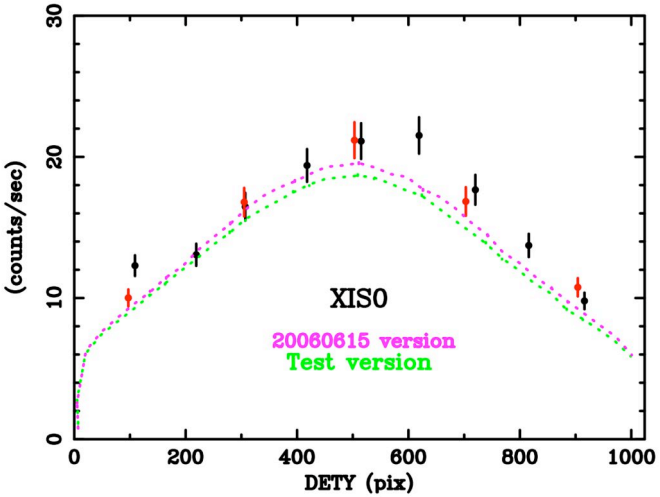
3-6 keV



8-10 keV

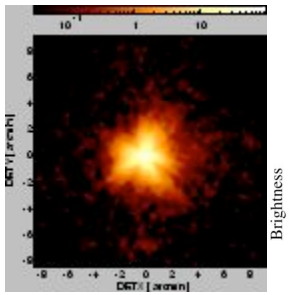


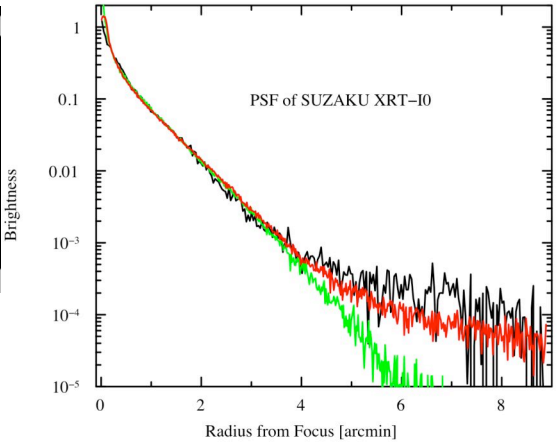




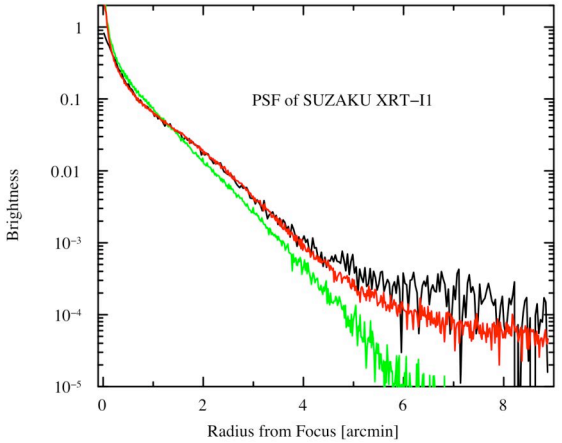
Point Spread Function

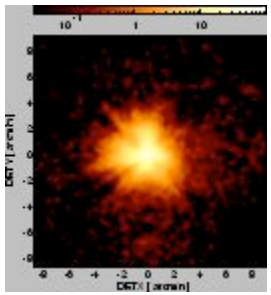
XRT-I0



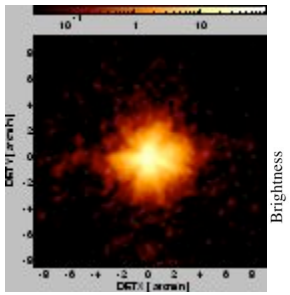


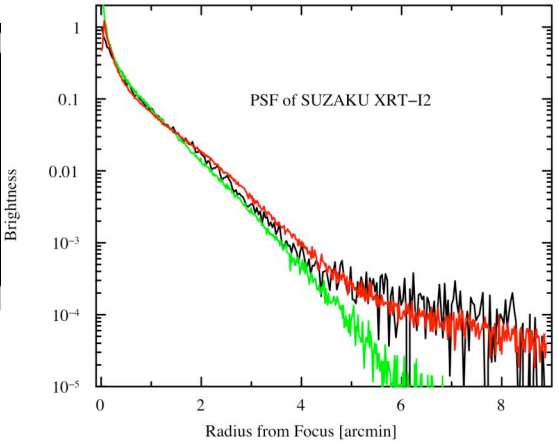
XRT-I1



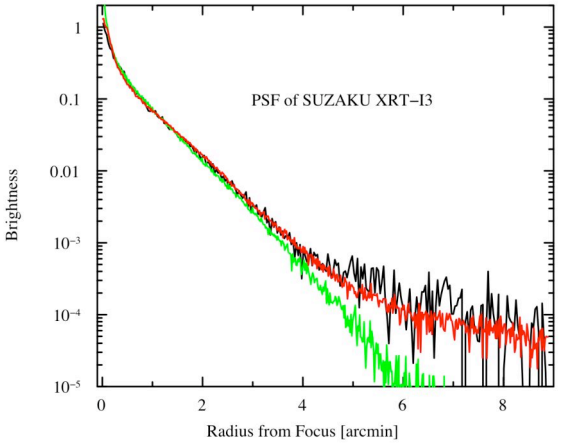


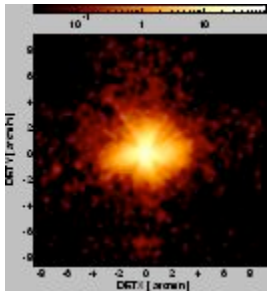
XRT-I2





XRT-I3



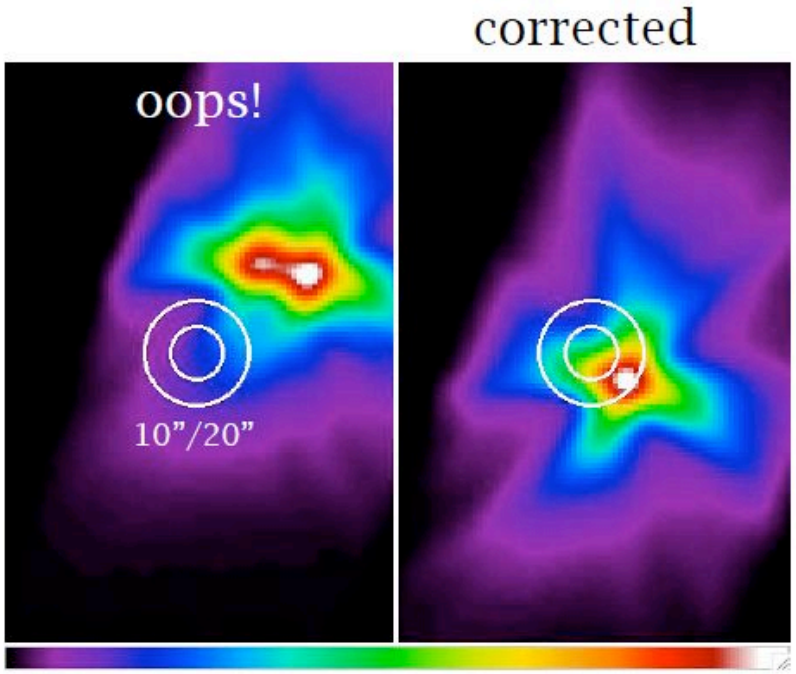


SS Cyg　　XISSIM 20060615　　Current Test version

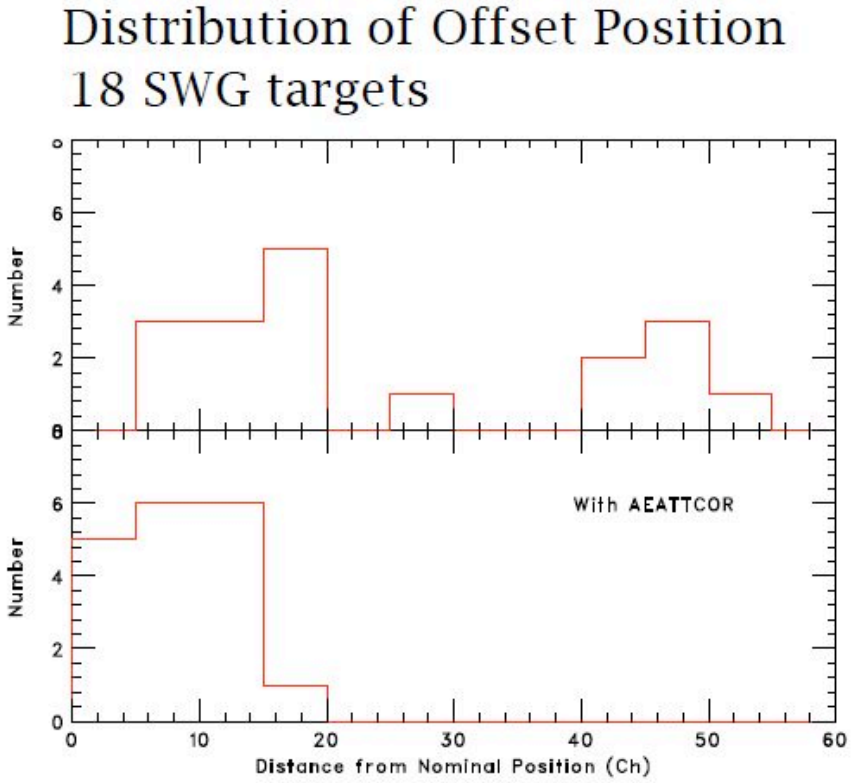
Caution: Not to be reflected in heasoft 6.3

Image Quality

- Attitude error due to thermal wobbling can be corrected in the next release of HEASOFT (ver 6.3).



Using FTOOLS `aeattcor` ,
(1) absolute positions improved
(2) PSF shapes improved



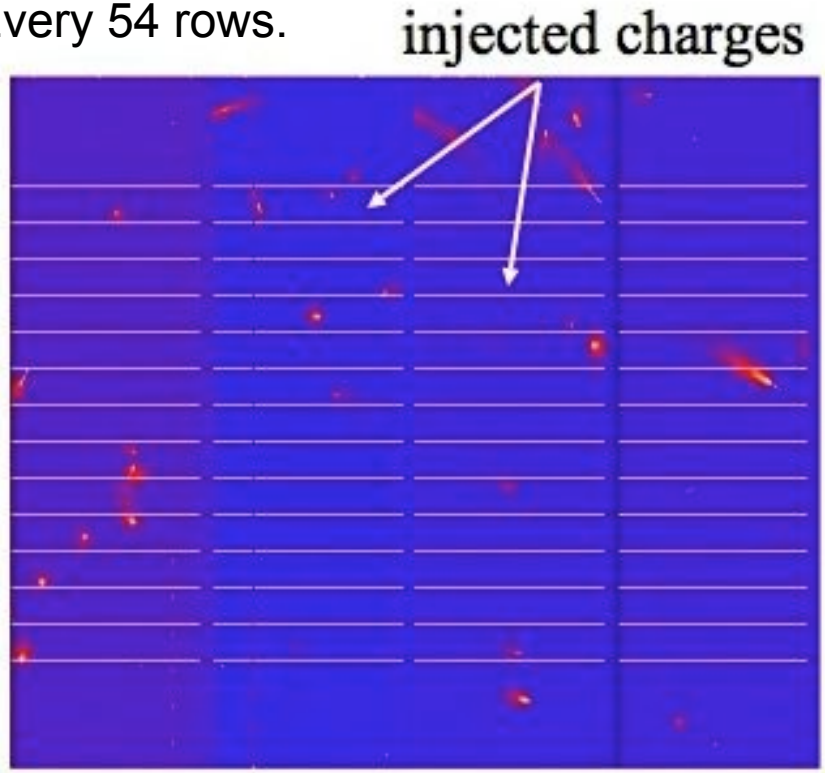
Position error < 20”

The Suzaku XIS calibration status

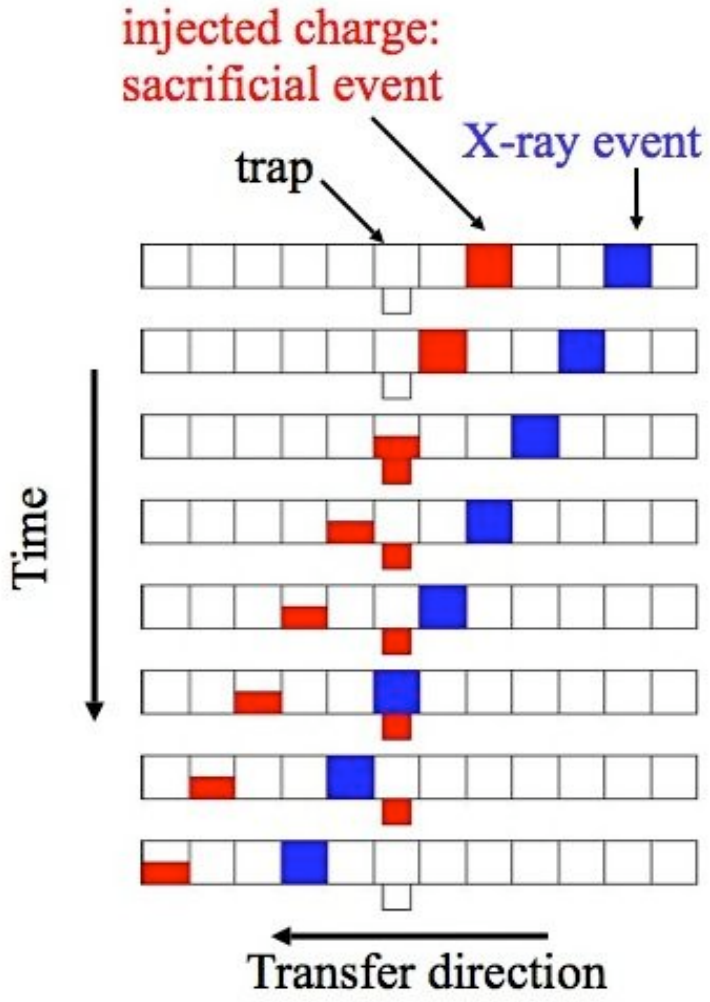
Summarized by H. Mastumoto

Spaced-row Charge Injection (SCI)

Every 54 rows.

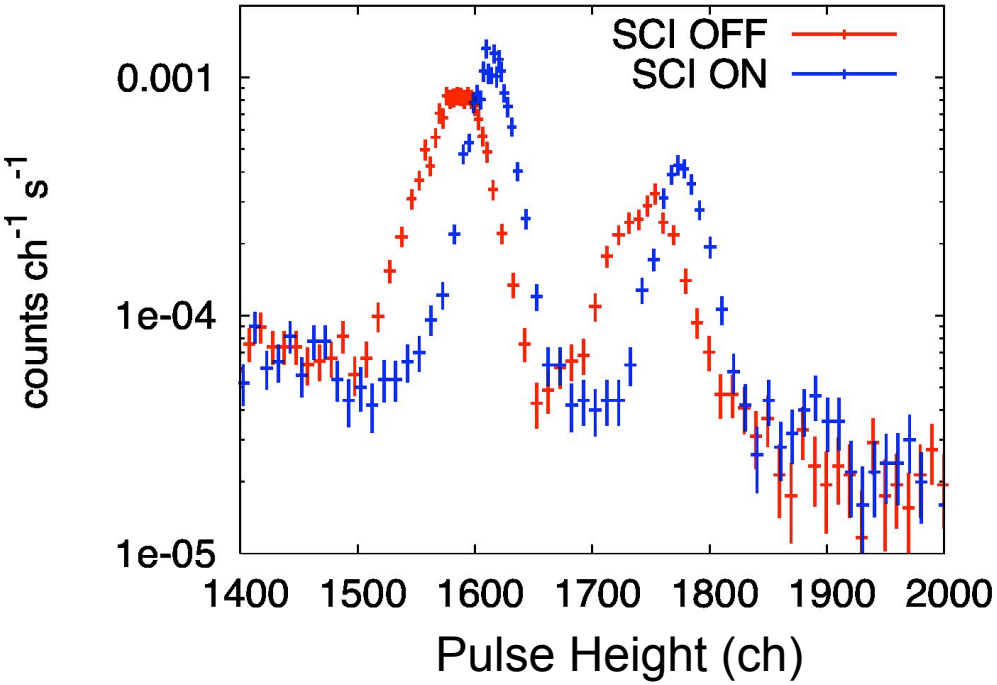


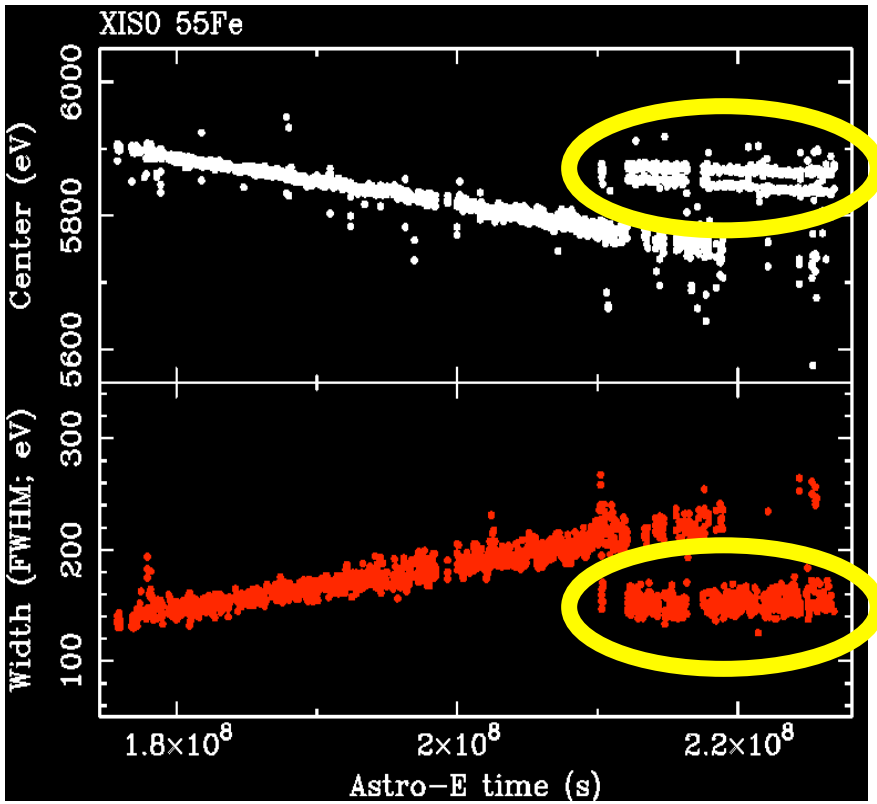
Frame image of the XIS doing the SCI



The SCI has been implemented since Oct. 2006

Effect of the SCI



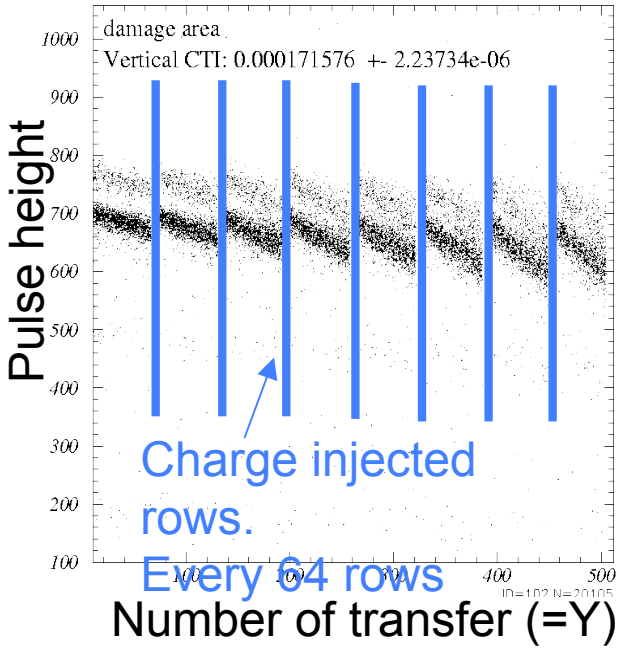


ΔE(FWHM)
SCI OFF: 210eV
SCI ON : 140eV
(No CTI correction)

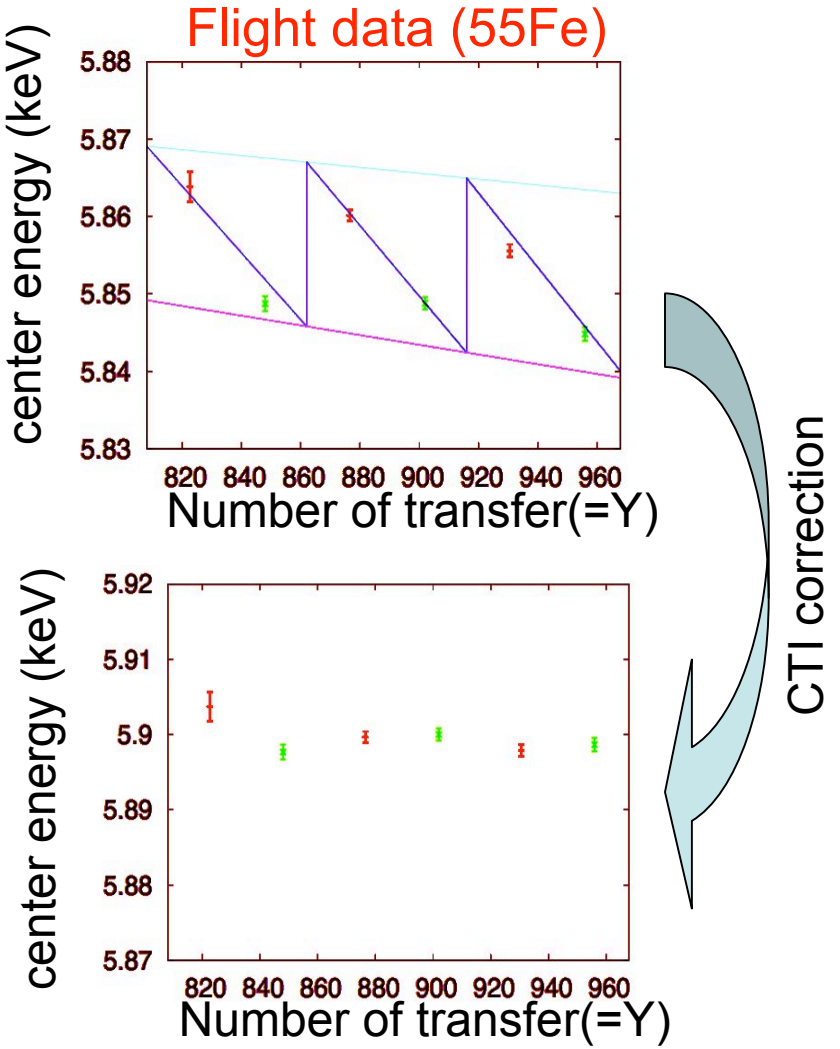
Without any specific corrections, the energy resolution recovered.

Fine CTI correction for the SCI

Ground experiment (MIT).
Damaged CCD irradiated by 55Fe.



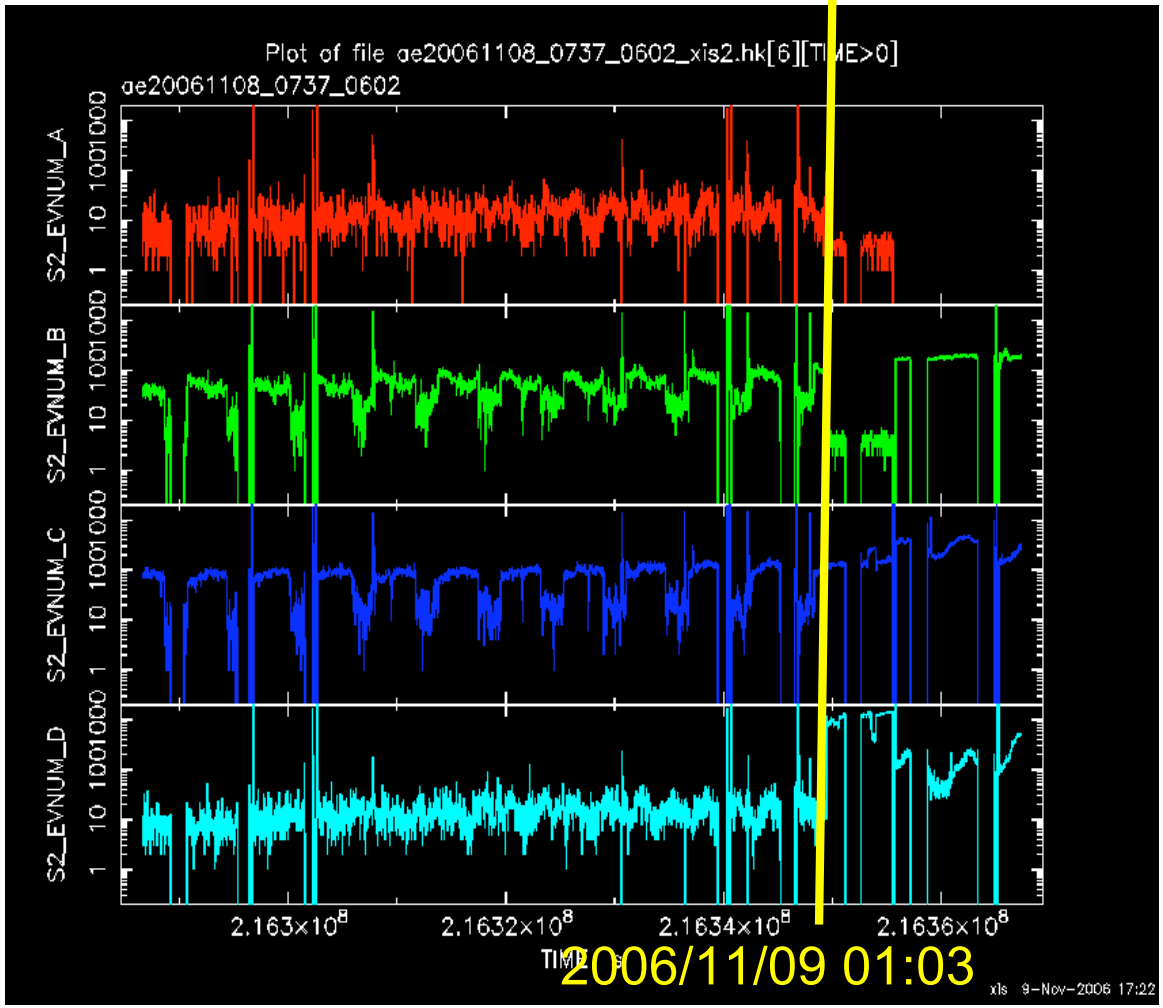
The CTI depends both on the number of transfer and on the distance from the charge injected rows, which results in the saw-like structure.



In real flight data, we can barely measure the saw-like structure with the 55Fe.
We take into account the complex CTI.

XIS2 malfunction

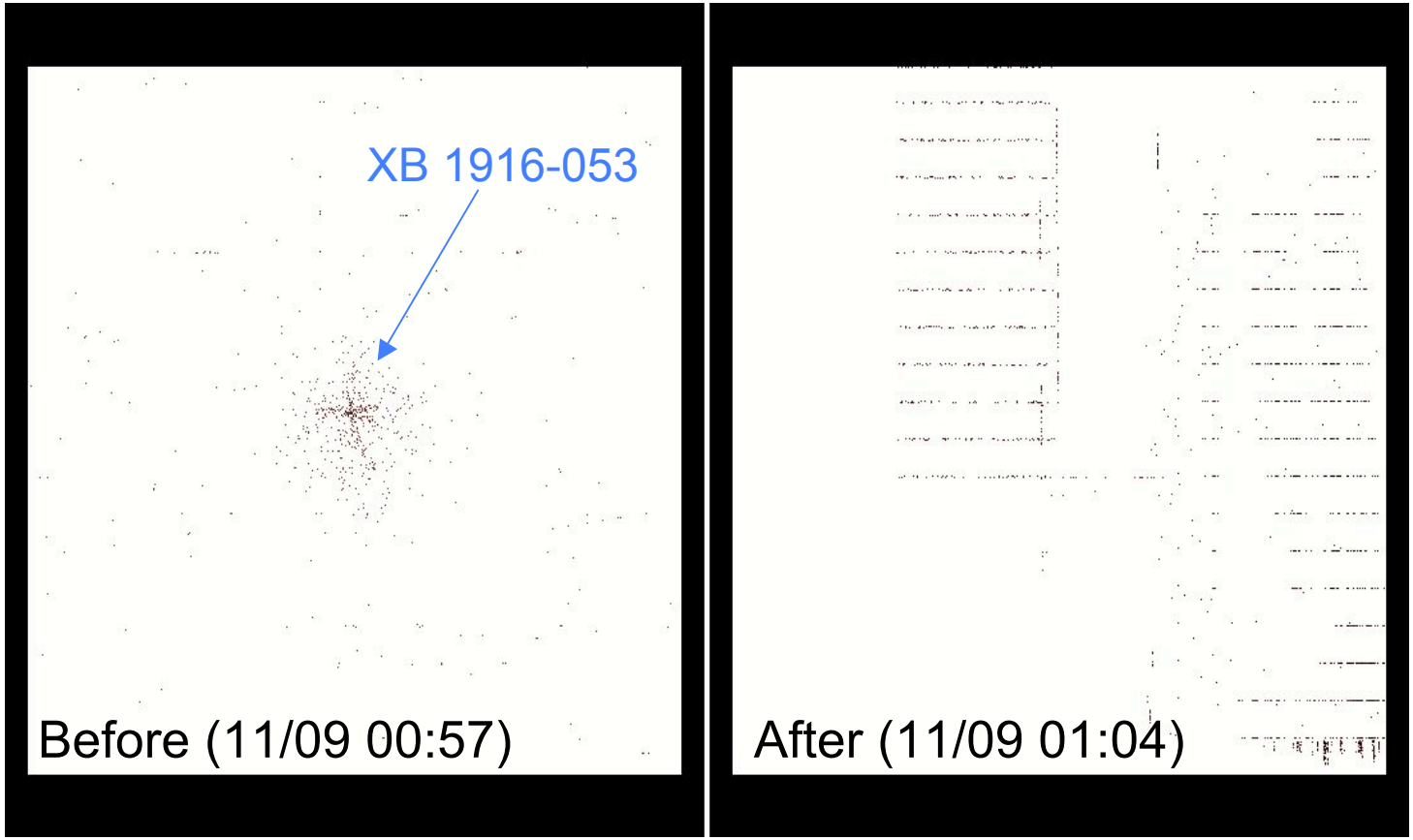
Light curve of each segment of XIS2



Event number suddenly changed, although HK values such as voltage did not show any anomalies.

After this trouble, XIS2 has not been used for observations.

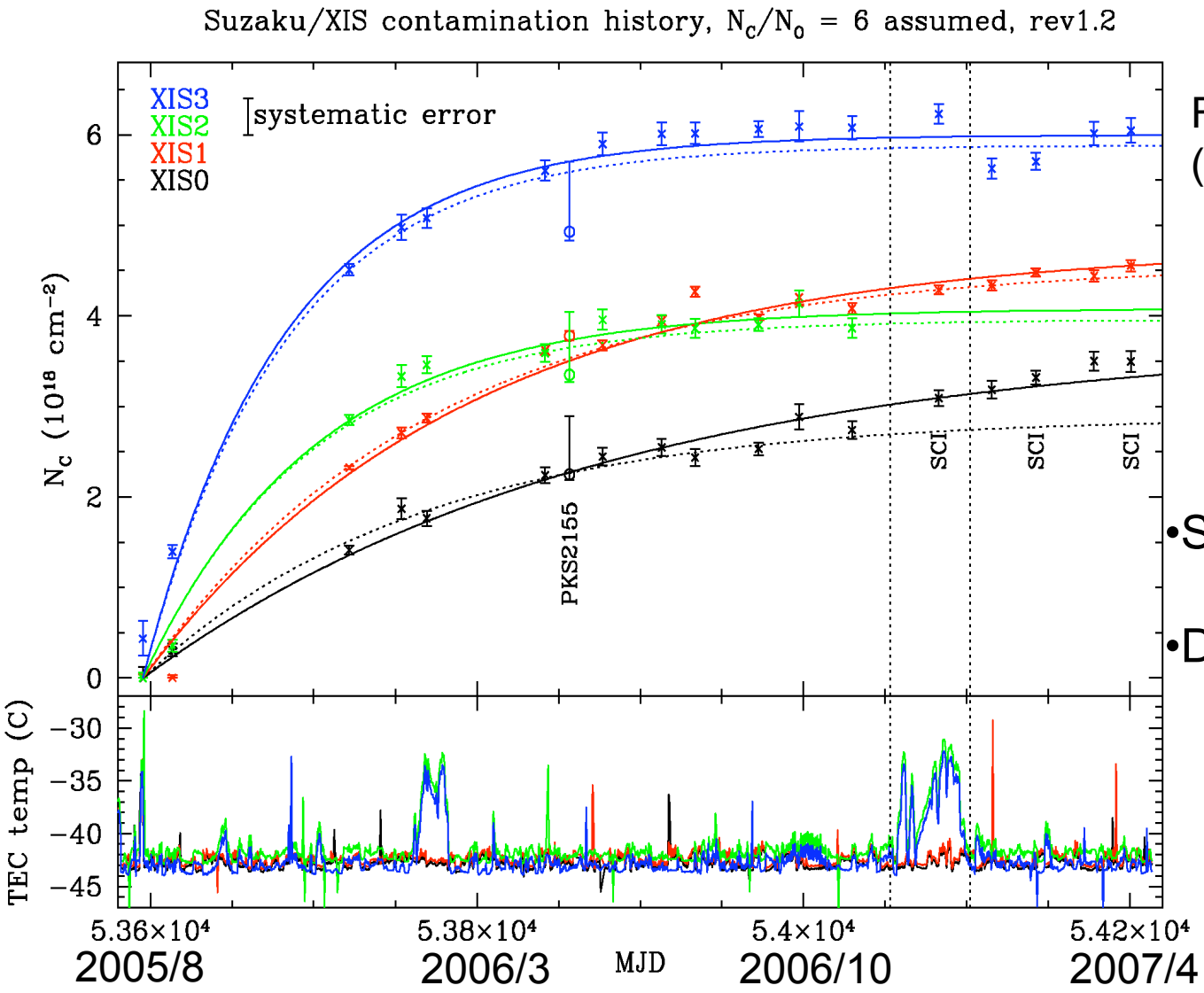
What happened?



•Not clear so far.

•It seems that large amounts of charge are generated some places in the imaging area. The charges bloom into the charge injection register and then to the other parts of the CCD.

Contamination



From E. Miller's (MIT) analysis.

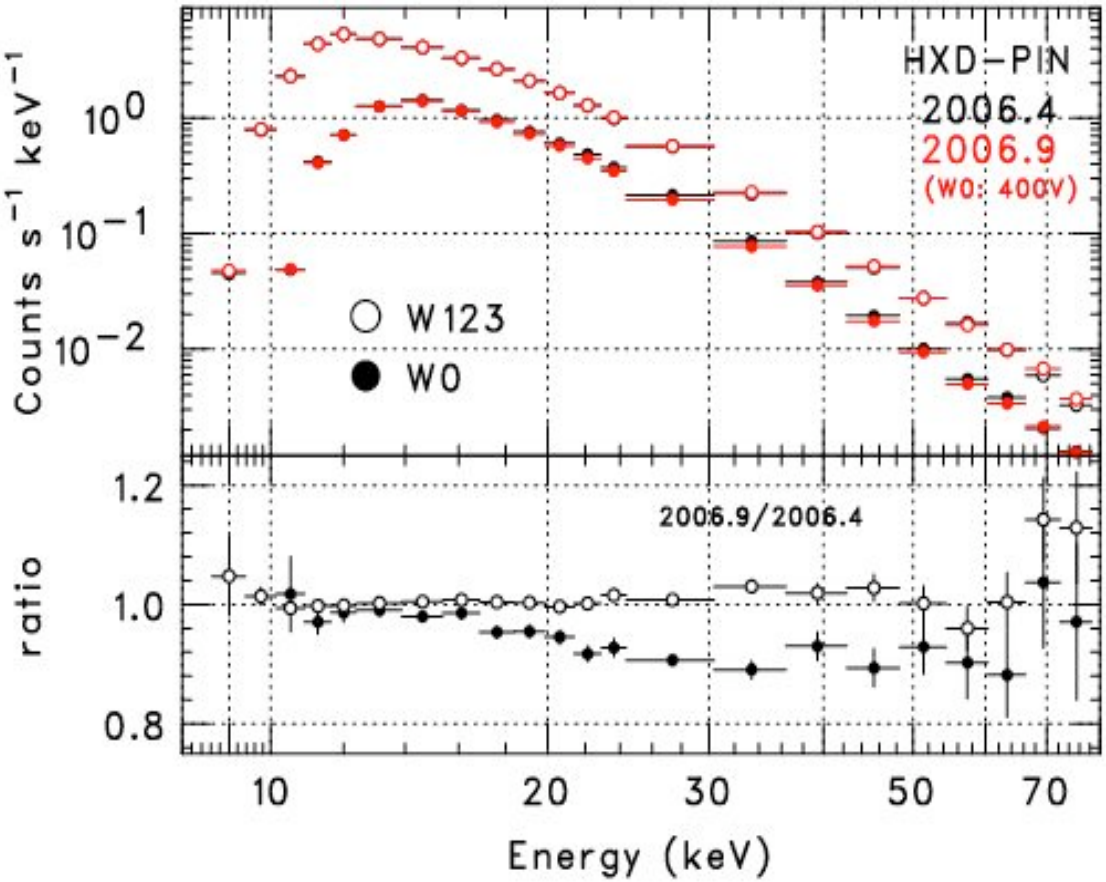
- Solid line
  … old estimation
- Dotted line
  … revised version

The Suzaku HXD calibration status

- Progress since the ICWG meeting -

Summarized by M. Kokubun (ISAS/JAXA)
and Y. Terada (RIKEN)

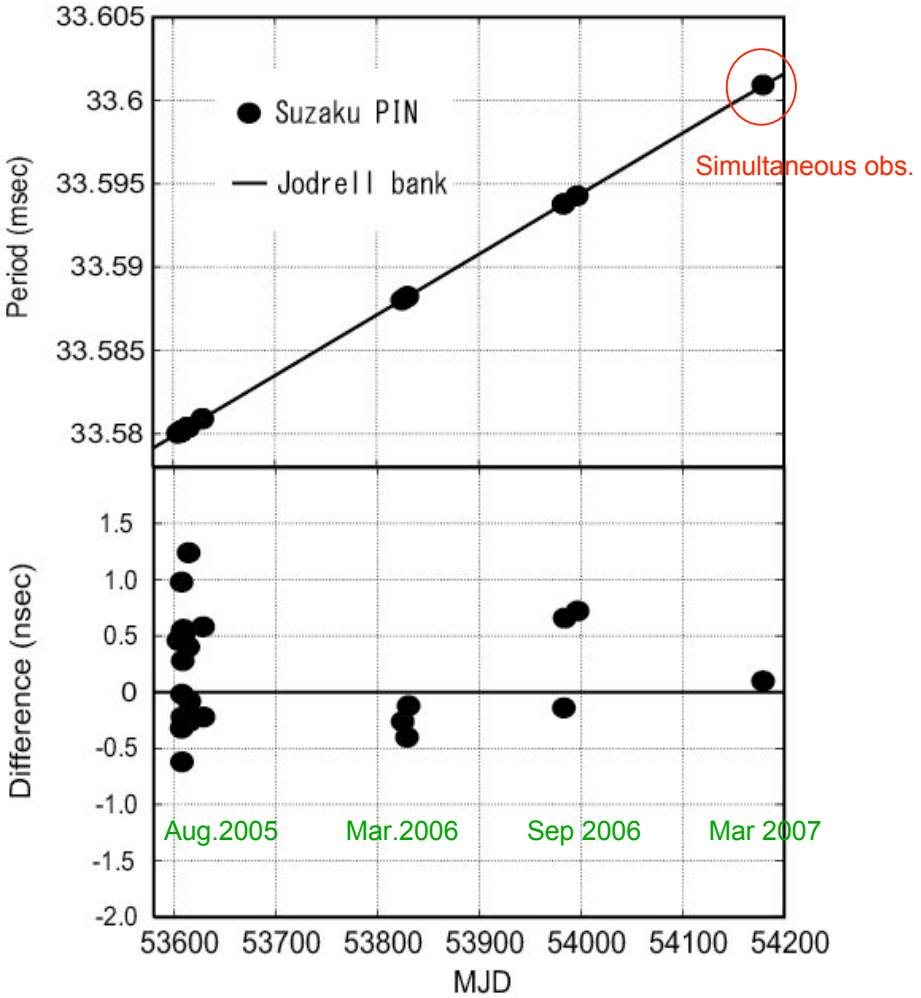
Energy response of PIN-Si at different bias

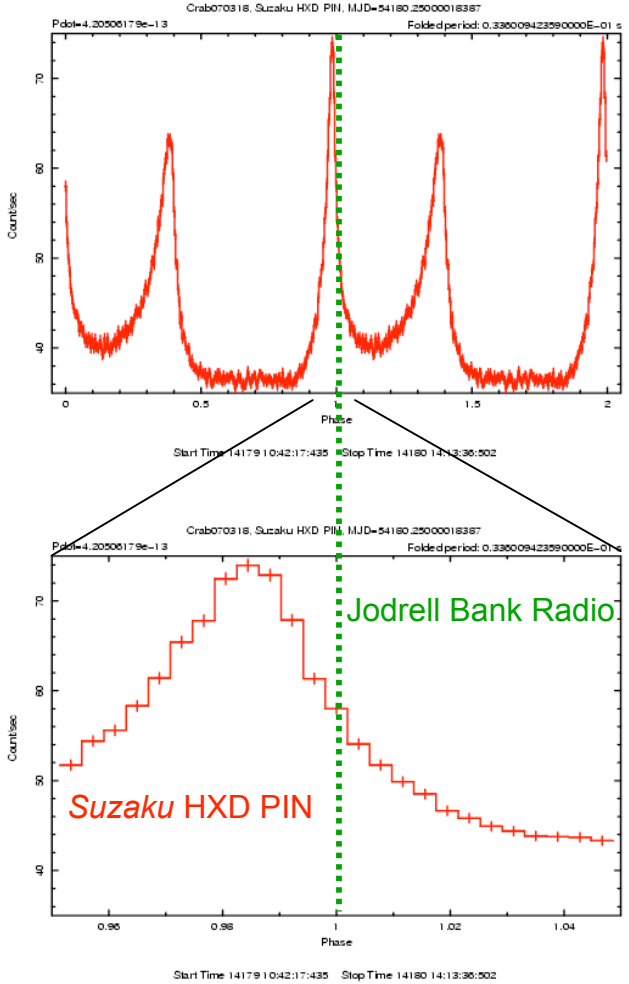


HXD-PIN Crab spectra at different bias

The operation bias voltage of 16 out of 64 PIN-Si diodes was changed from 500 V to 400 V. Above 20 keV, the effective area of 16 PIN diodes biased with 400 V decreased ~10% from those with 500 V, which means ~3% loss of the total effective area. The modified response matrices were thus created.

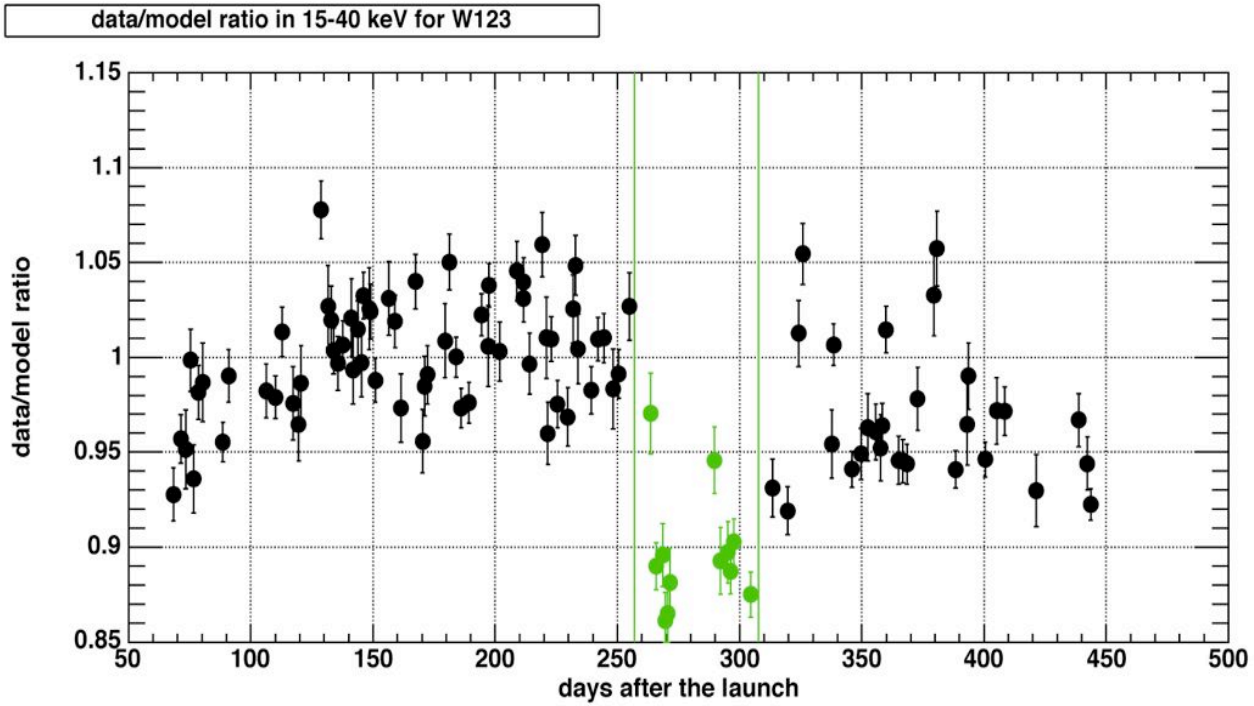
Timing calibration with Crab





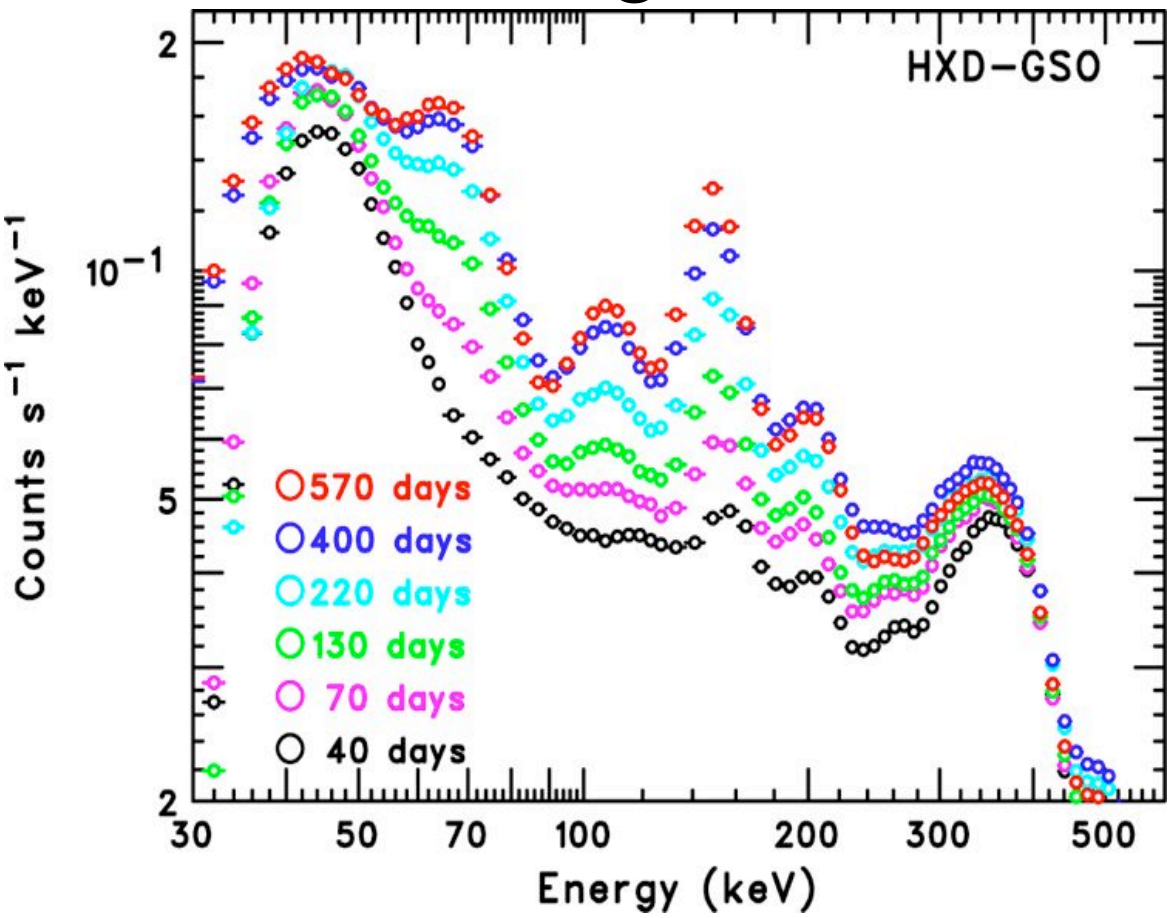
Best period by PIN is consistent with Jodrell Bank Period within nsec.
The arrival time of the first pulse comes ~250usec faster than Jodrell Bank.
(→344 +- 40 usec; Arnold et al 2004, RXTE)

PIN background reproducibility



PIN background model is built based on the empirical relationship between the cosmic-ray flux counted by PIN and the residual detector background, by use of the earth occultation database. The reproducibility of the PIN background can be estimated to be smaller than 5% if the observation include the sufficient earth occultation, while some periods still show significantly large deviations.

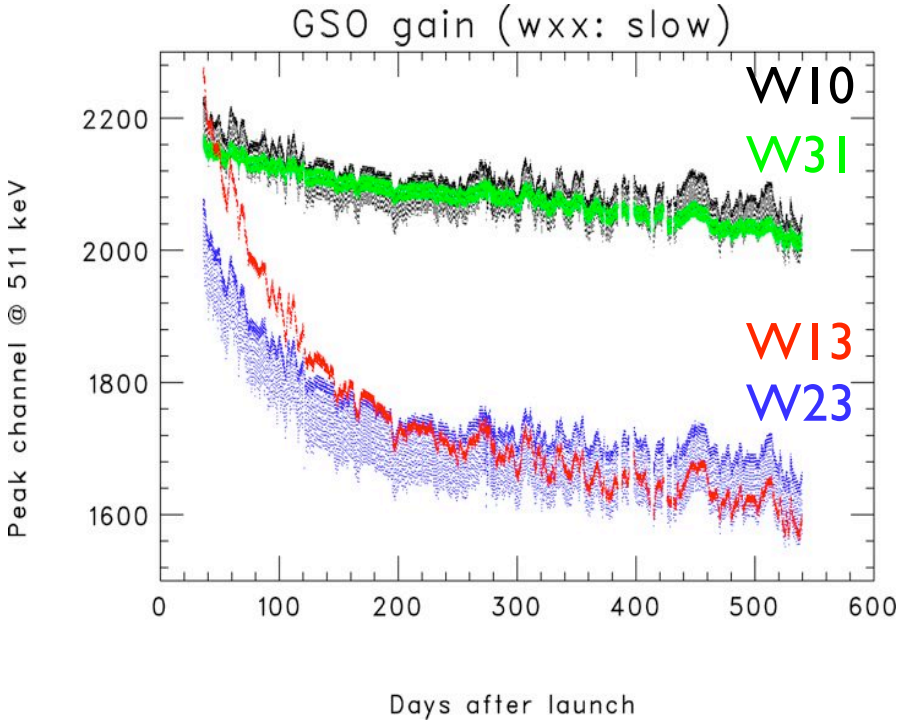
Long-term variation of GSO background

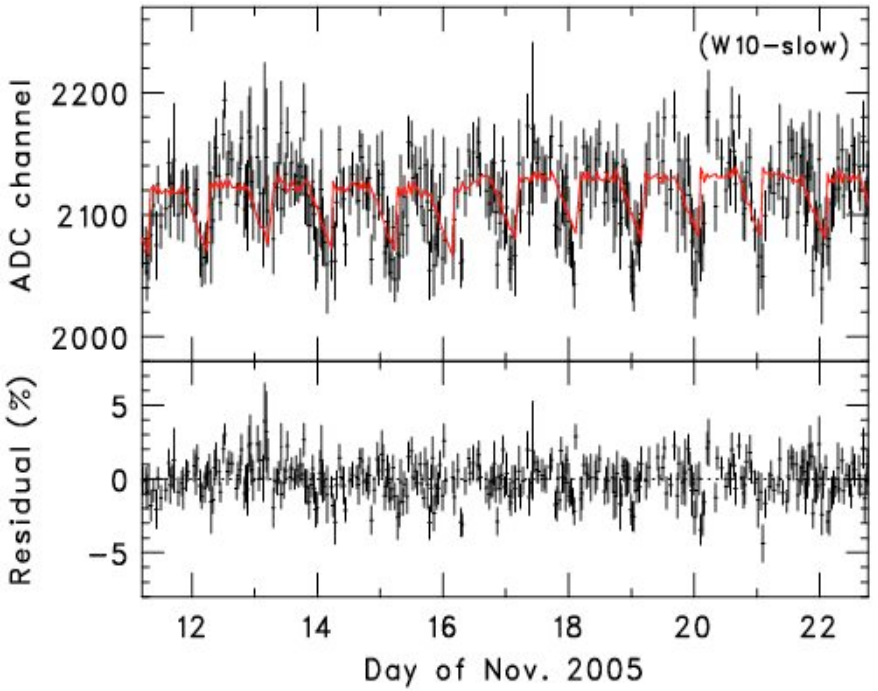


Characteristic peaks correspond the delayed emissions from RI products of the in-orbit activation. They showed rapid growths after the launch, but most of them have recently reached the equilibrium.

-- additional --

Long-term gain trend of GSO scintillator





GSO data showed both of long-term and short-term gain variations, and their behaviours from 16 units are individual. The long-term trend is caused by the degradation of the PMT gain, while the short one is due to both of the temperature dependence of the GSO light-yield and aging effect in PMT gain during the SAA.

The “gain-history” file has been conducted with in-orbit data.

Timing calibration with Crab