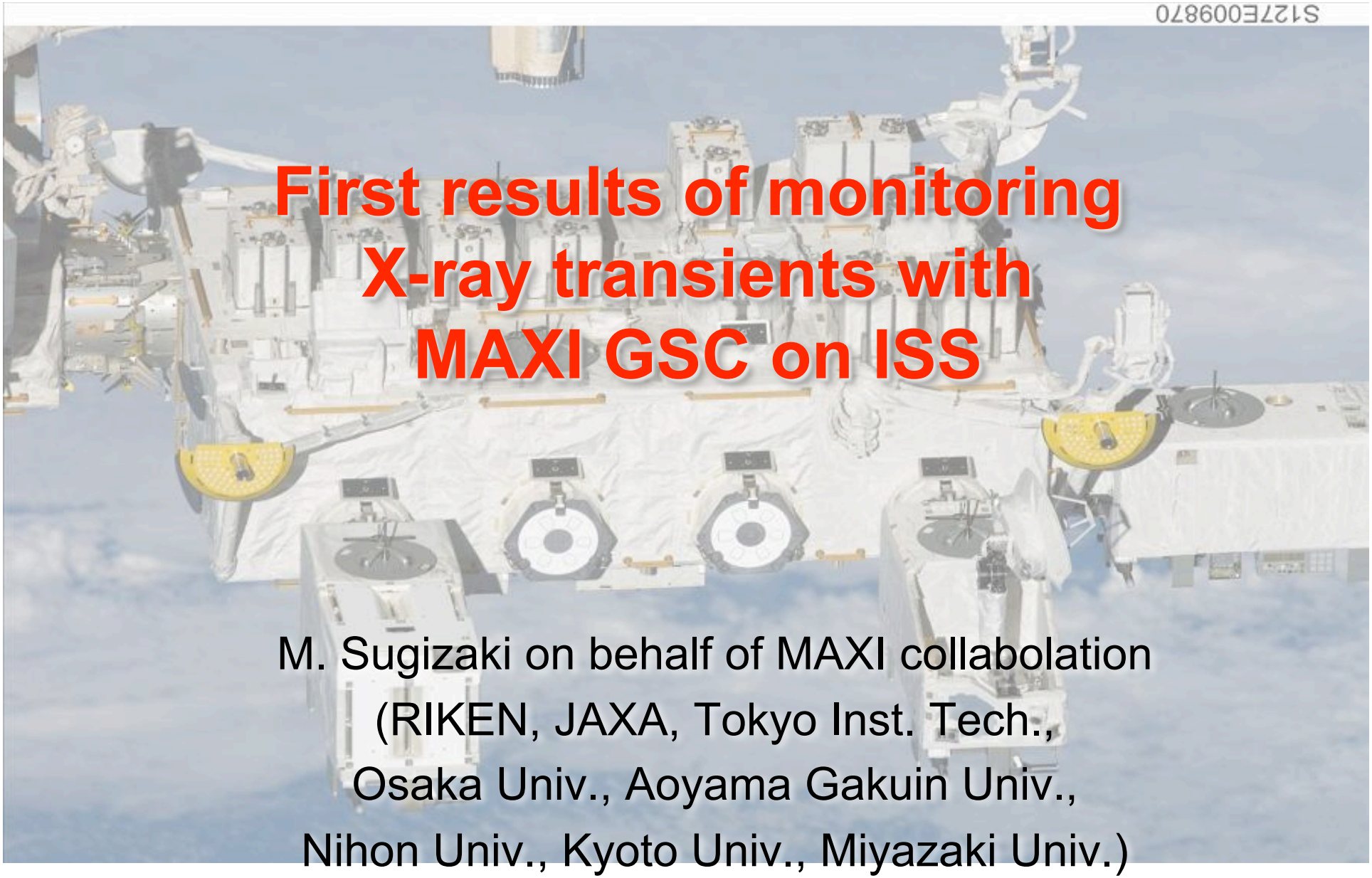

First results of monitoring X-ray transients with MAXI GSC on ISS

M. Sugizaki on behalf of MAXI collabolation
(RIKEN, JAXA, Tokyo Inst. Tech.,
Osaka Univ., Aoyama Gakuin Univ.,
Nihon Univ., Kyoto Univ., Miyazaki Univ.)

MAXI Team

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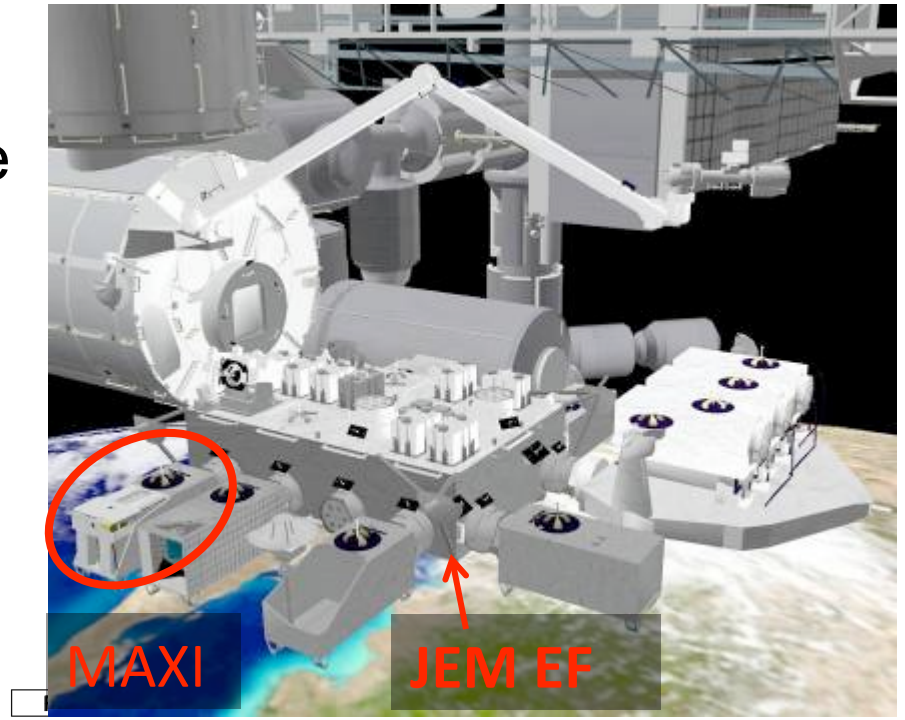
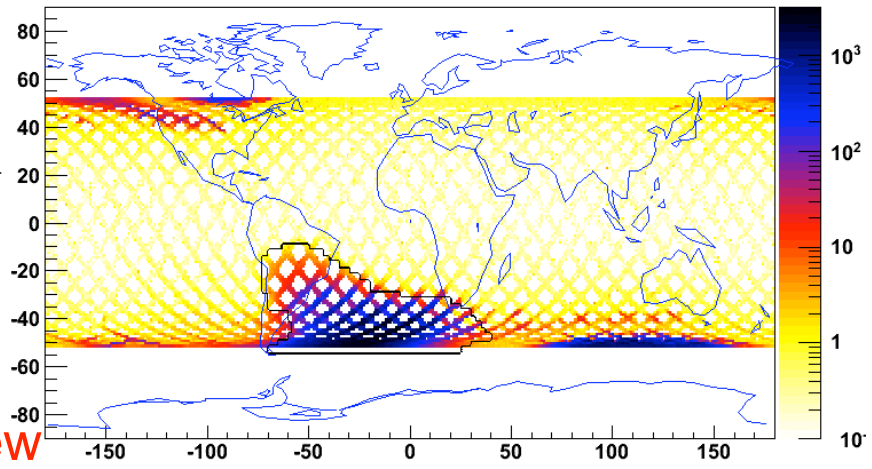
- **Aoyama Gakuin Univ.:** A.Yoshida, K.Yamaoka, S.Nakahira, I.Takahashi
- **Nihon Univ. :** H.Negoro, M.Nakajima, S.Miyoshi, R.Ishiwata, H.Ozawa
- **Kyoto Univ.:** Y.Ueda, N.Isobe, S.Eguchi, K.Hiroi
- **Miyazaki Univ.:** M.Yamauchi, A.Daikyuj

MAXI Mission on ISS

- X-ray all-sky monitor on ISS
- Transported by Space Shuttle STS-127 on July 16, 2009
- Installed on JEM (Japanese Experiment Module) EF (Exposed Facility) on July 23.
- Commissioning started on Aug 3.
- First light image on Aug 15.

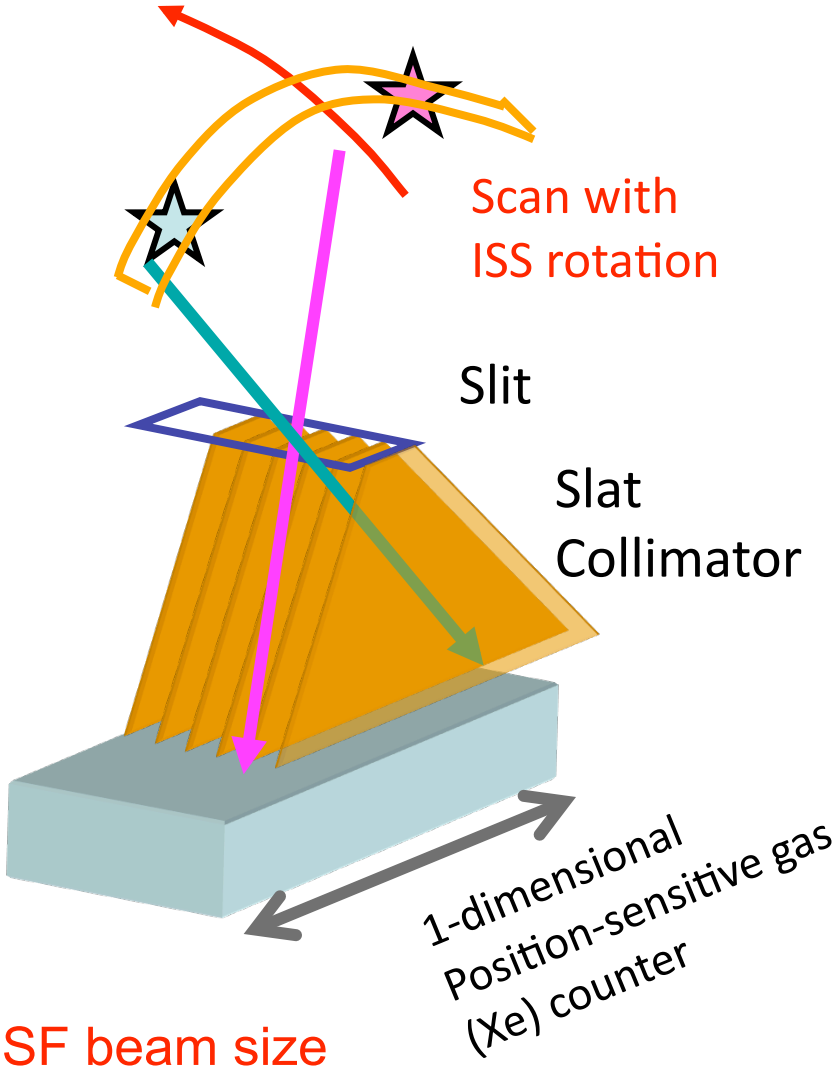


ISS orbit and particle count-rate map
orbit inclination = 51.6 deg.



See P5 – 211 (Kawai) for mission overview

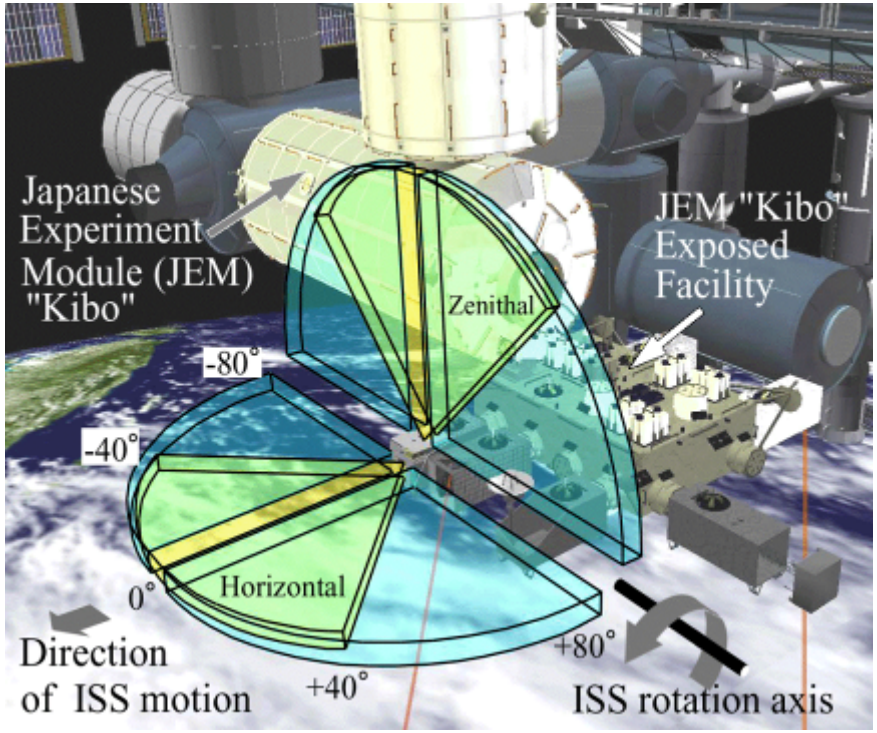
Gas Slit Camera (GSC) on MAXI

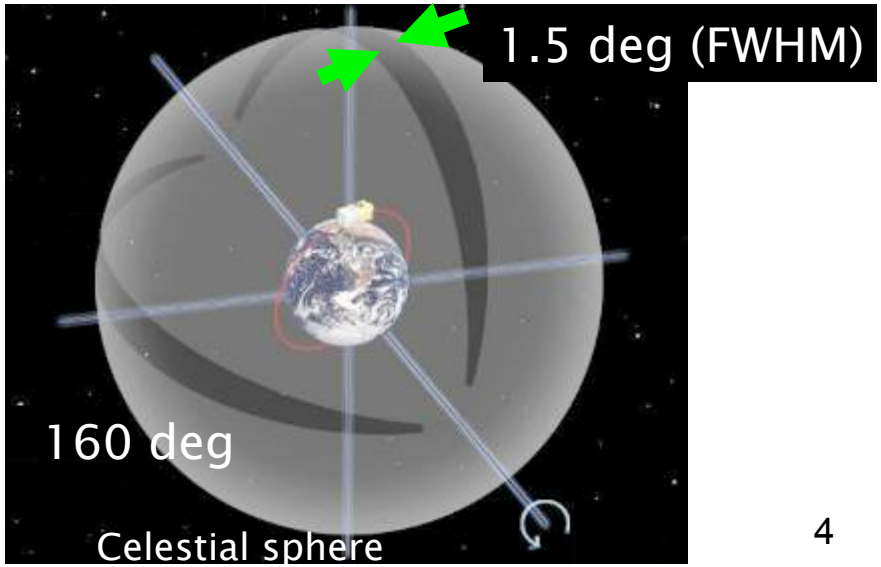


PSF beam size
~ 1.5x1.5 deg.

Energy band: 2-30 keV

Field of Views

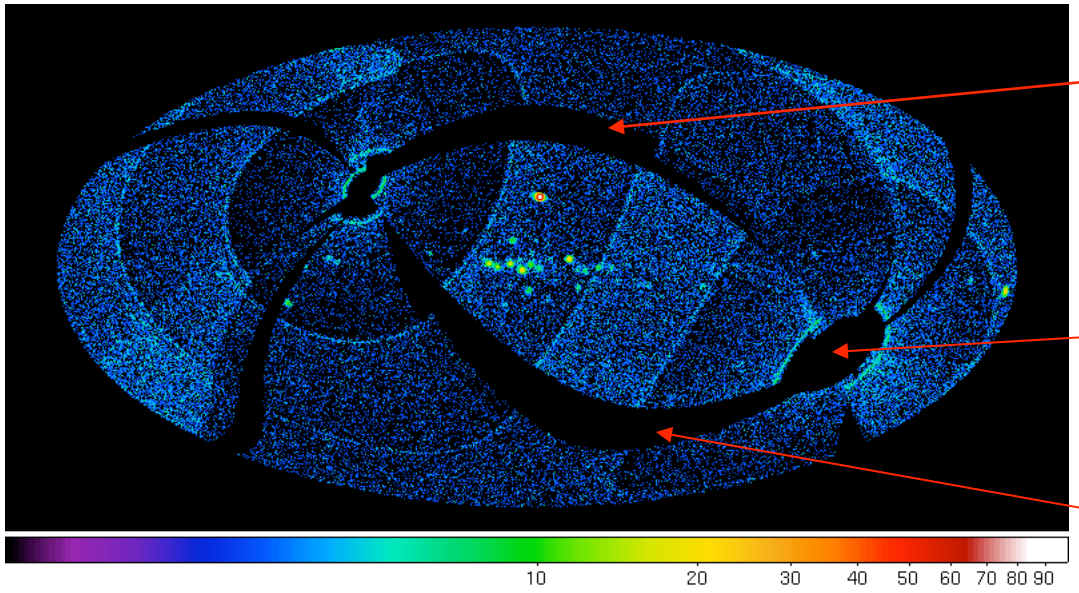




GSC sky coverage

2009/10/25

1 orbit scan
(90 min.)



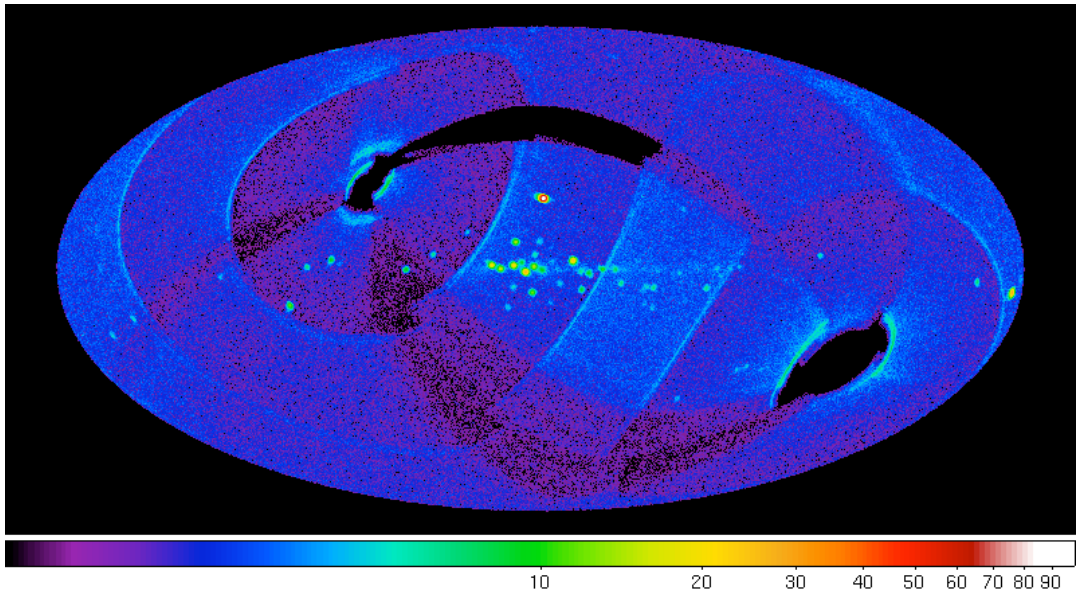
Solar-protection area

Scan-rotation axis

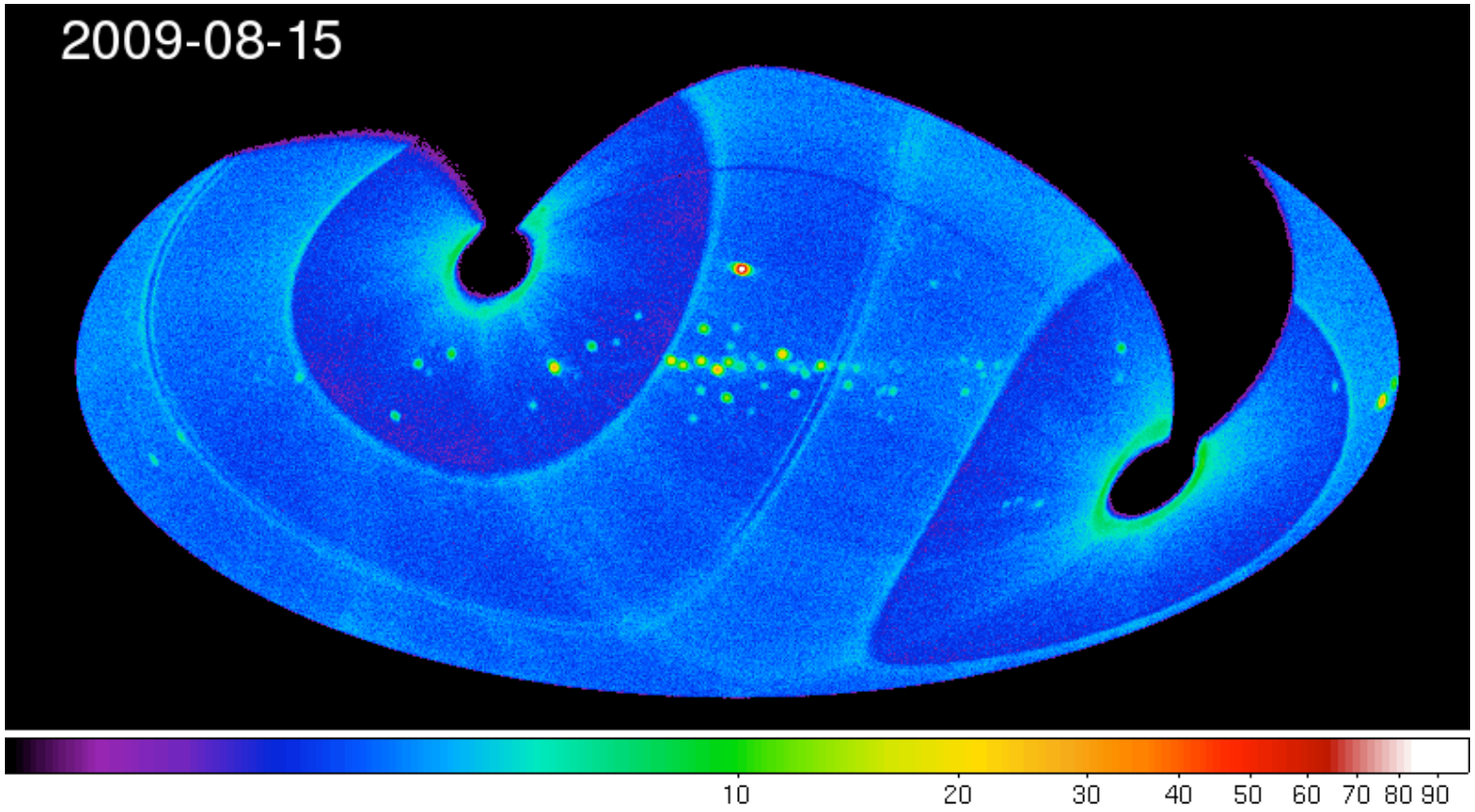
Aurora, SAA (high-radiation) area

1 day

coverage
> 95%
per day

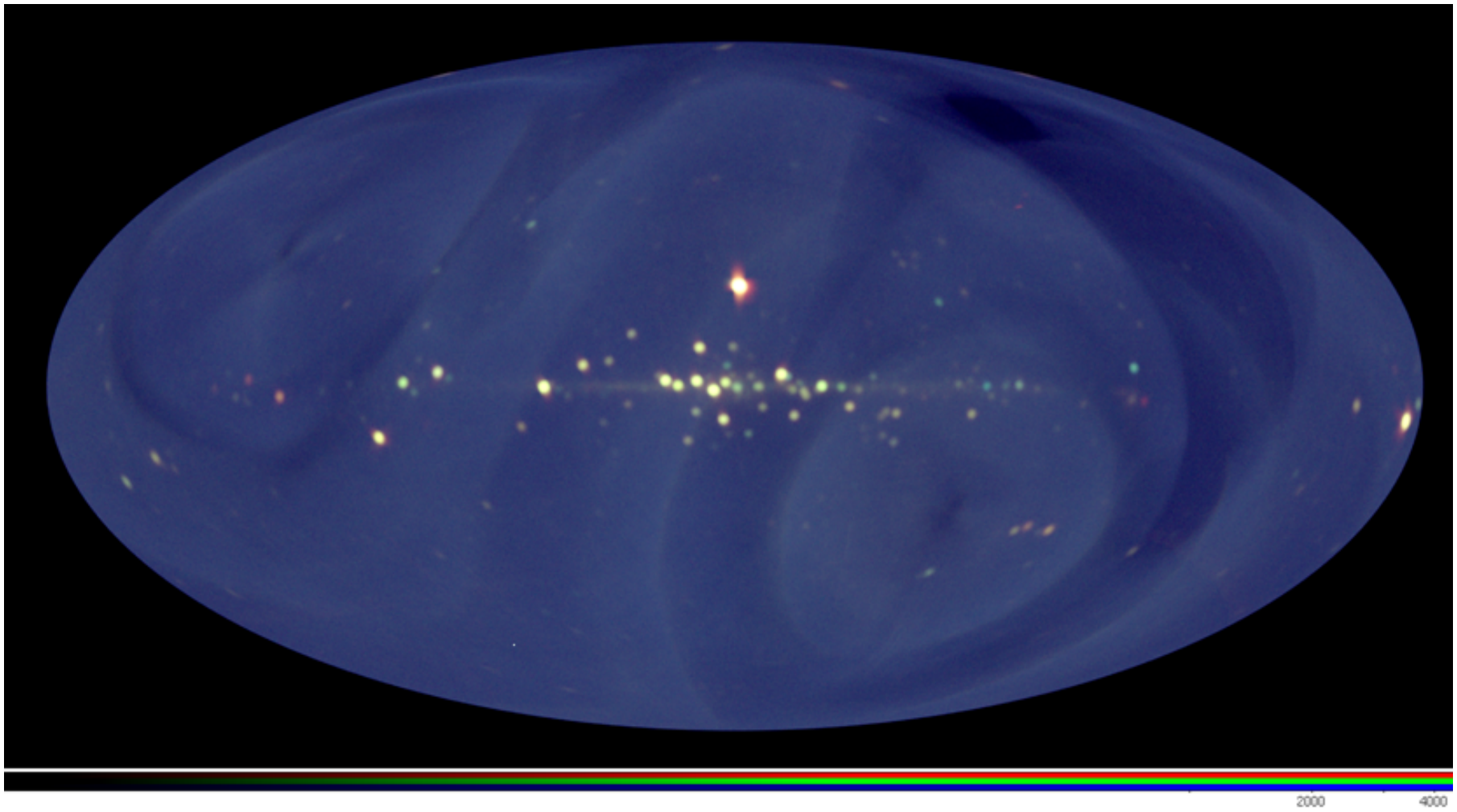


Daily all-sky image (Aug.15-Oct.28 movie)



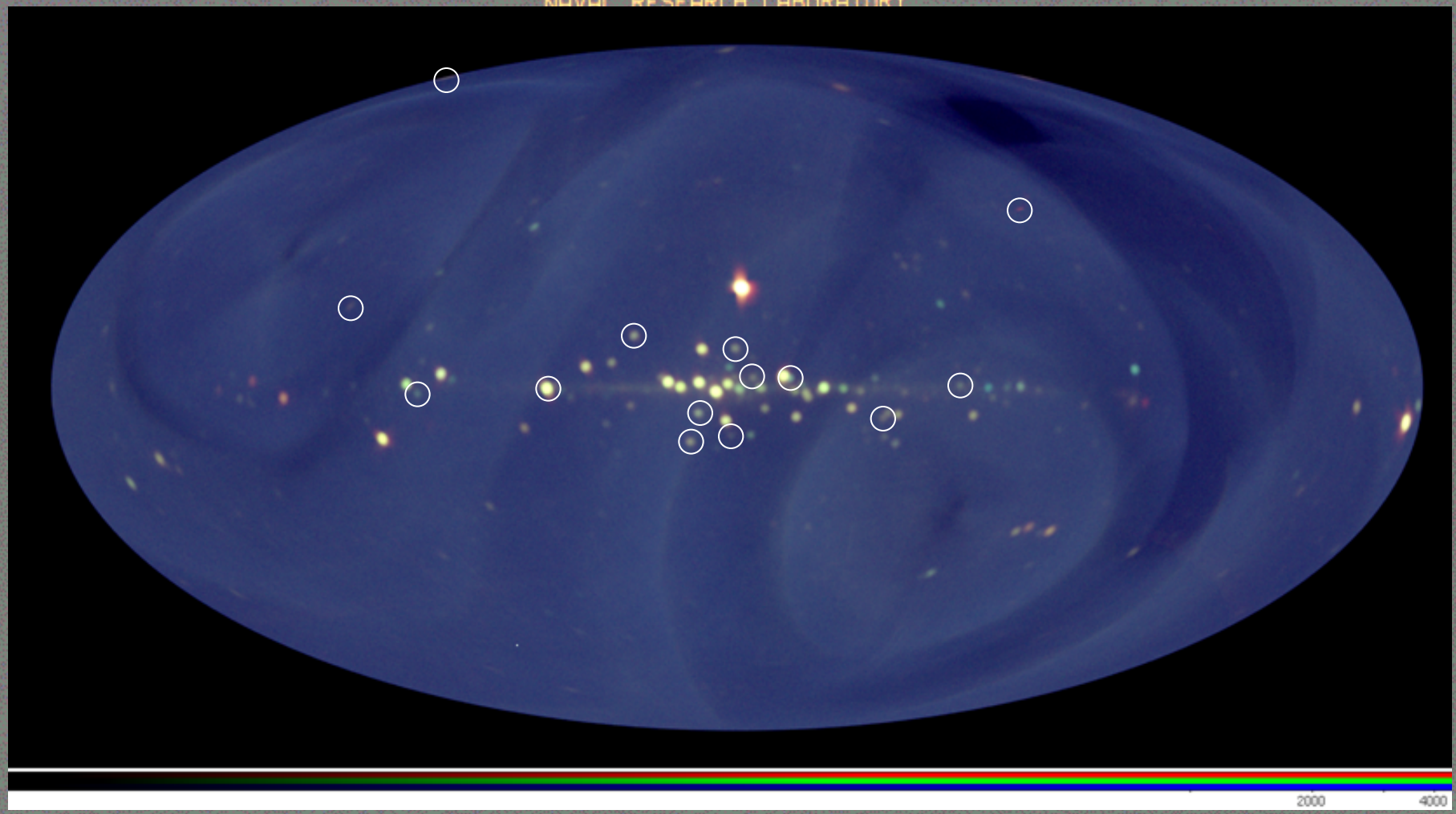
- Axis of rotation moves due to the precession of the ISS orbit by 44 days.
- Dead area for solar protection is reduced from 15 deg. to 5 deg. during the commissioning operation.

2-month image (Sep 1– Oct 22, 2009)



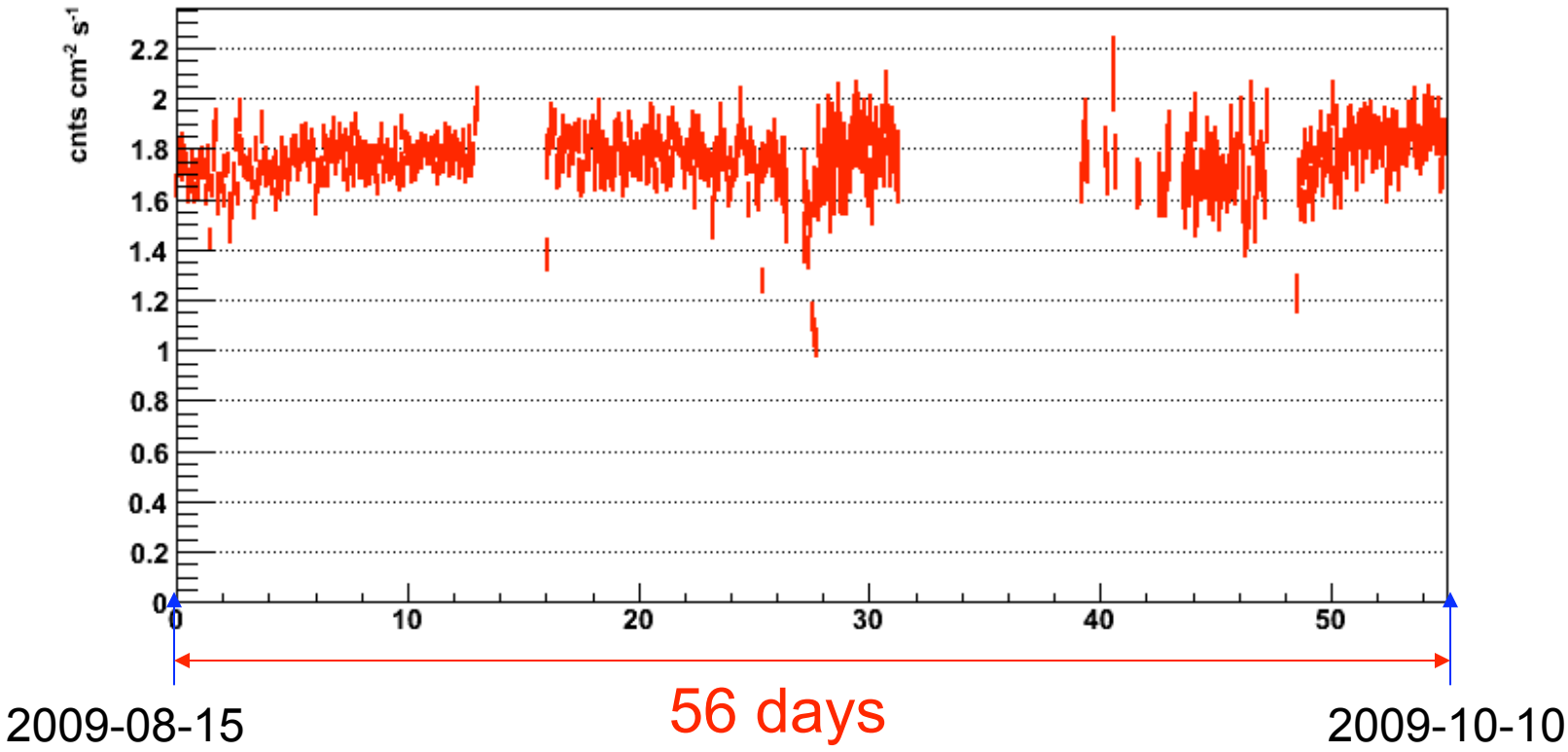
MAXI GSC Red (2–4 keV), G (4–8 keV), B (8–16 keV)
no background subtraction, not corrected for exposure

Comparison with HEAO A-1



~A about 160 sources visible by the eye. Some of the bright sources not in the HEAO A-1 catalog are marked with circles.

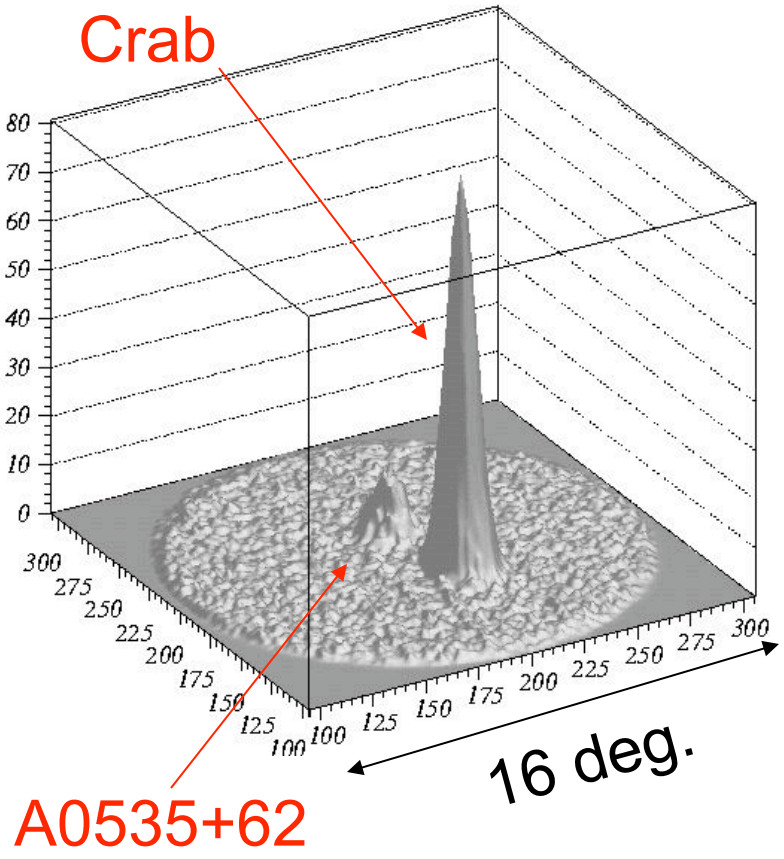
Crab Nebula: 2-month Light Curve

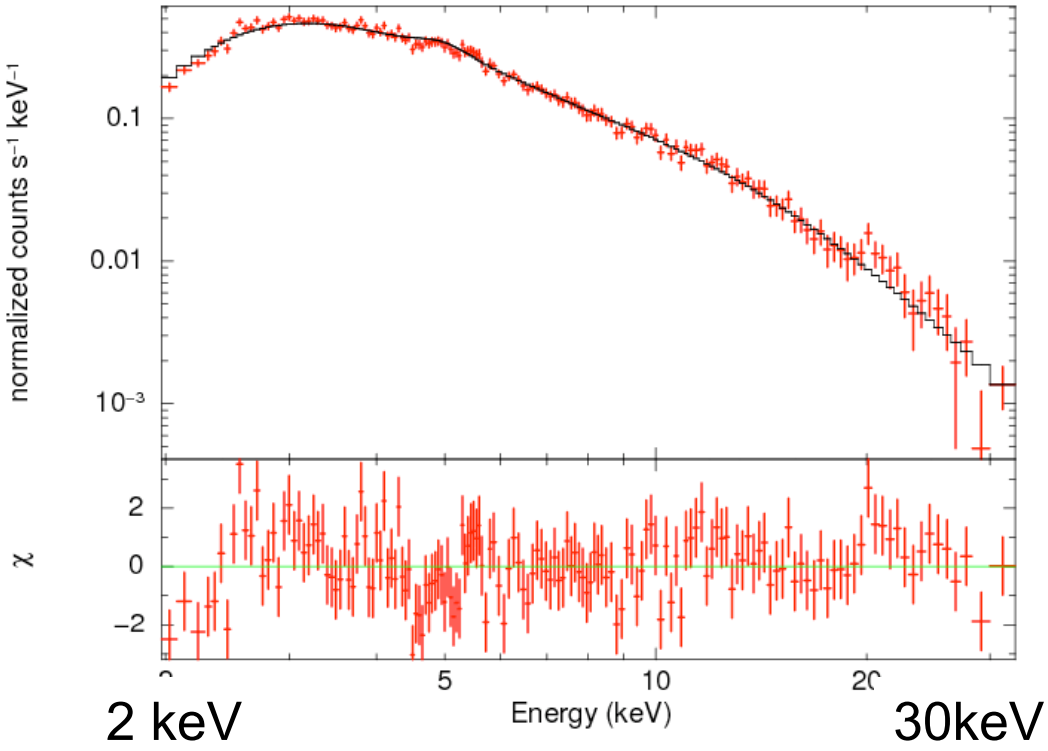


- 1 bin = 90 min = 1 orbit scan
- Effective area variation is corrected (but not perfect).
- systematic errors ~ 5%

Crab Nebula: Image and Spectrum

1-day data (8/15)



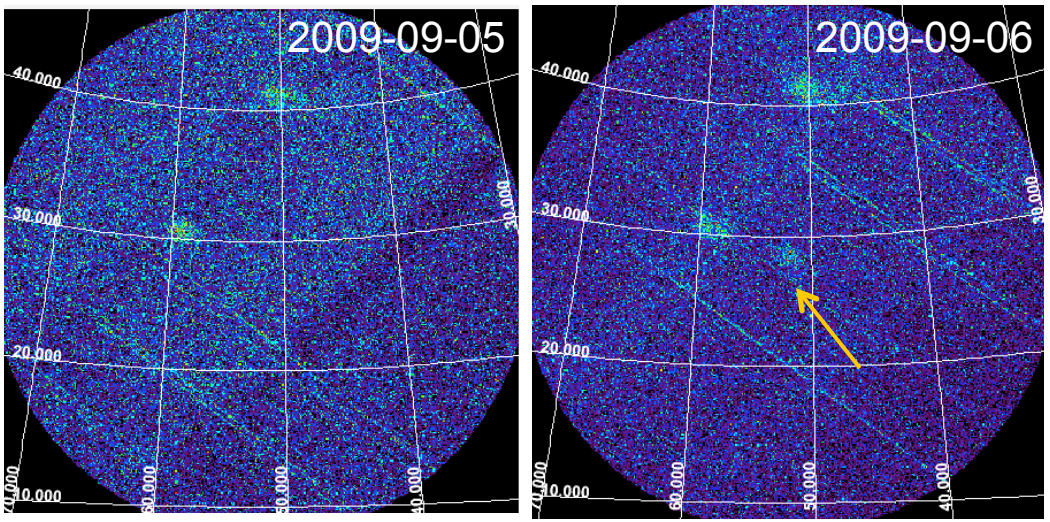


PSF FWHM ~ 1.5 deg.

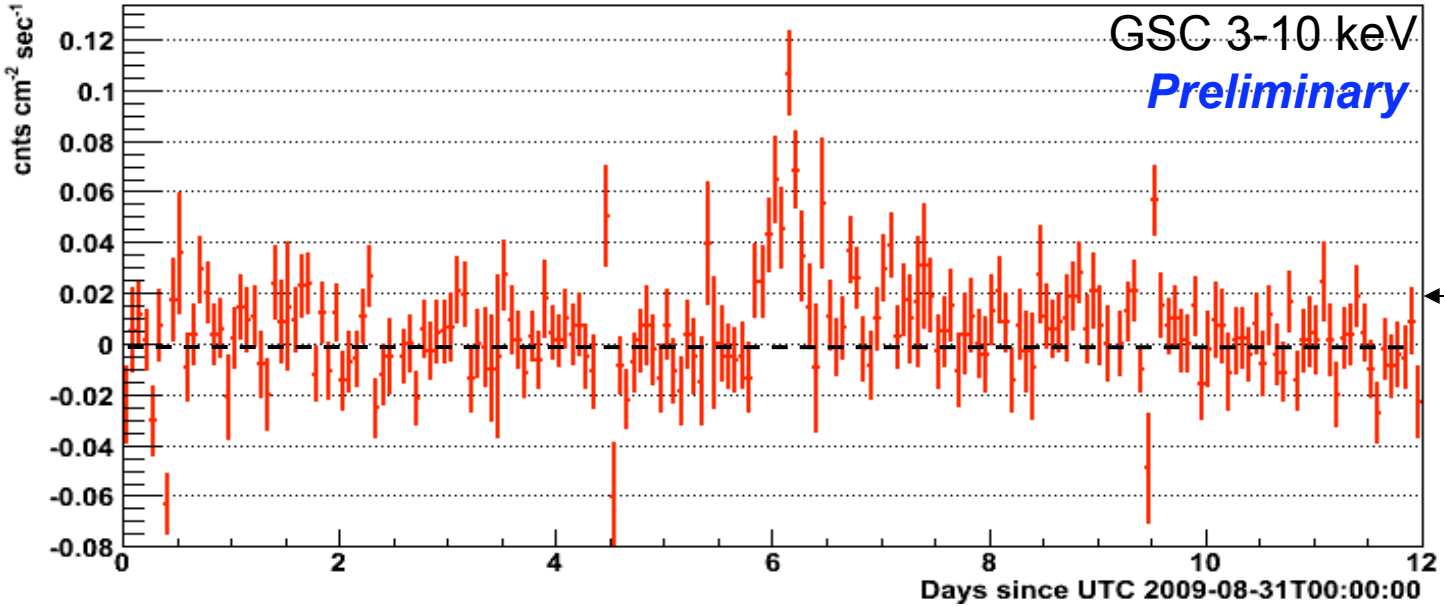
Preliminary spectral fit

1. normalization, power-law index: OK
2. N_H (low-energy absorption): needs calibration

Flare of UX Ari (an RS CVn star)

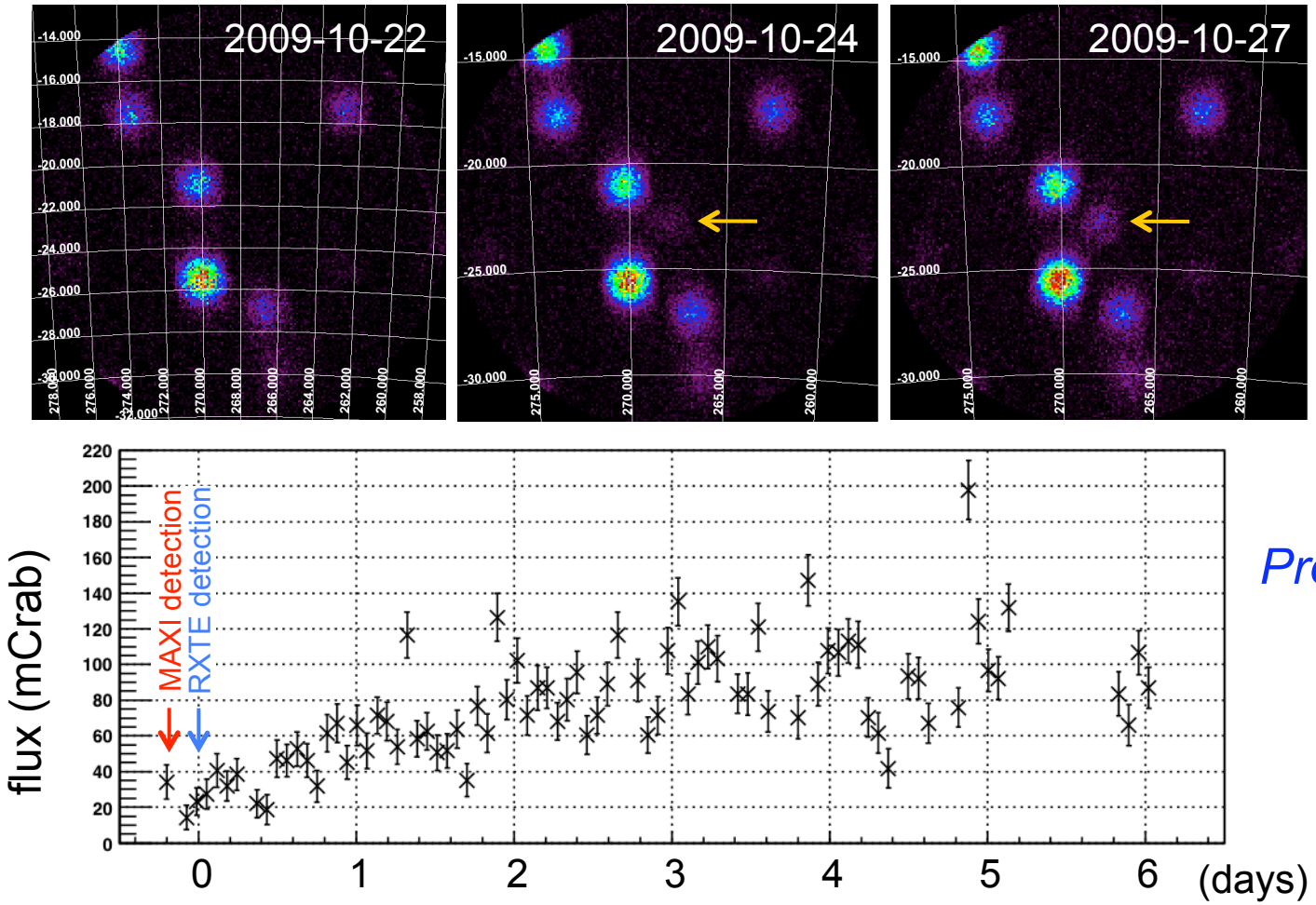


- Sep 06, 2009
- peak flux ≈50 mCrab
- duration ≤ 1 day



← 10mCrab

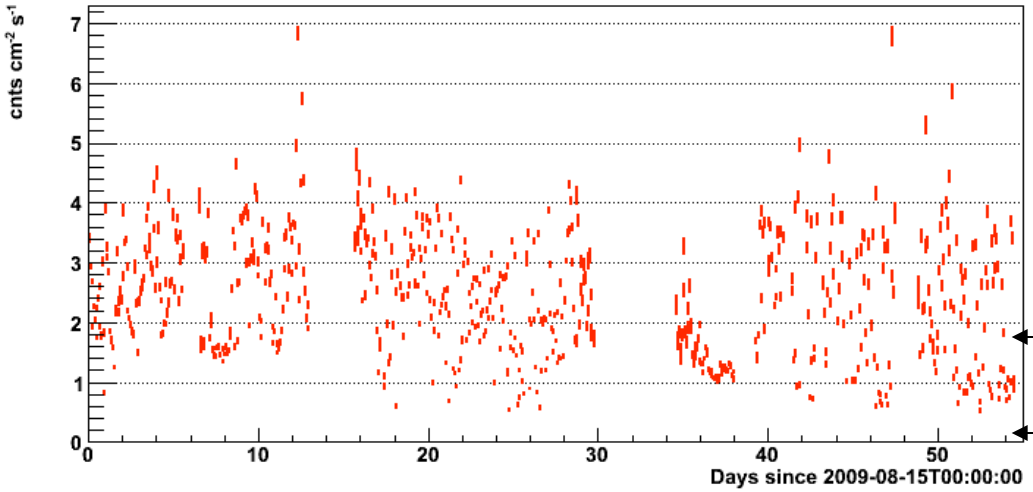
XTE J1752-223 (new black hole candidate)



XTE J1752-223 is a new black hole candidate discovered on 2009-10-23 at 19:55 (UT) with the RXTE/PCA scan (ATEL#2258, Markwardt et al.). MAXI recorded its flux since the onset of the outburst, preceding the first RXTE detection.

Bright Galactic X-ray Binaries (1)

GRS1915+105

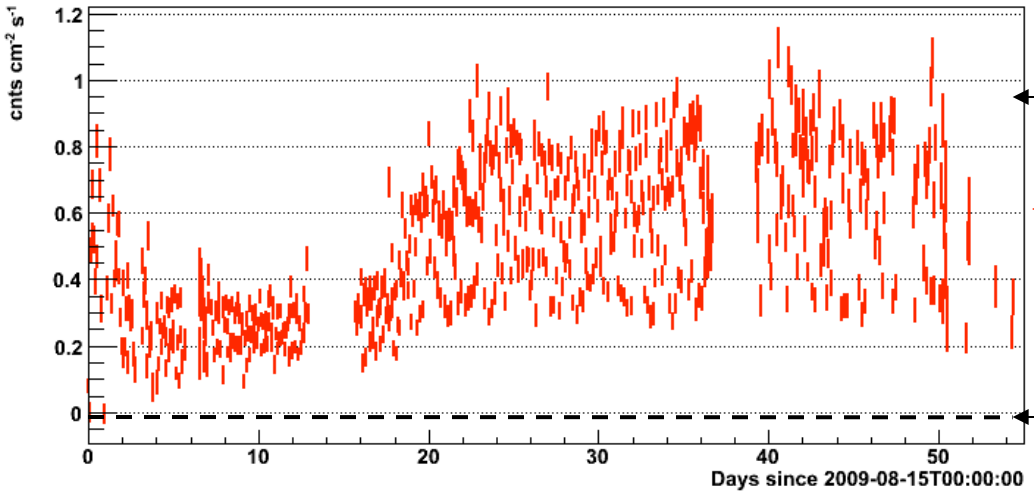


GSC 3-10 keV
90 min/bin
Preliminary

1 Crab

0

Cyg X-3



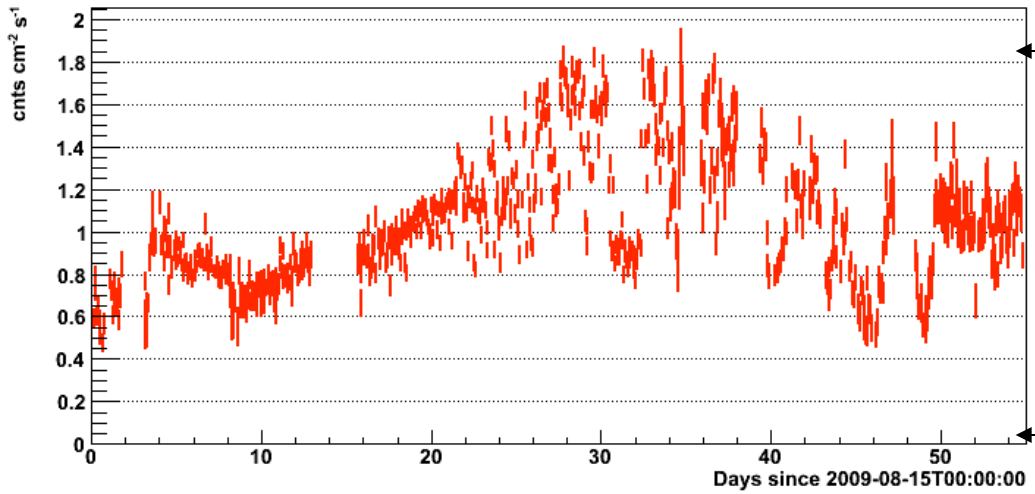
0.5 Crab

Periodicity by 4.8-h orbital period

0

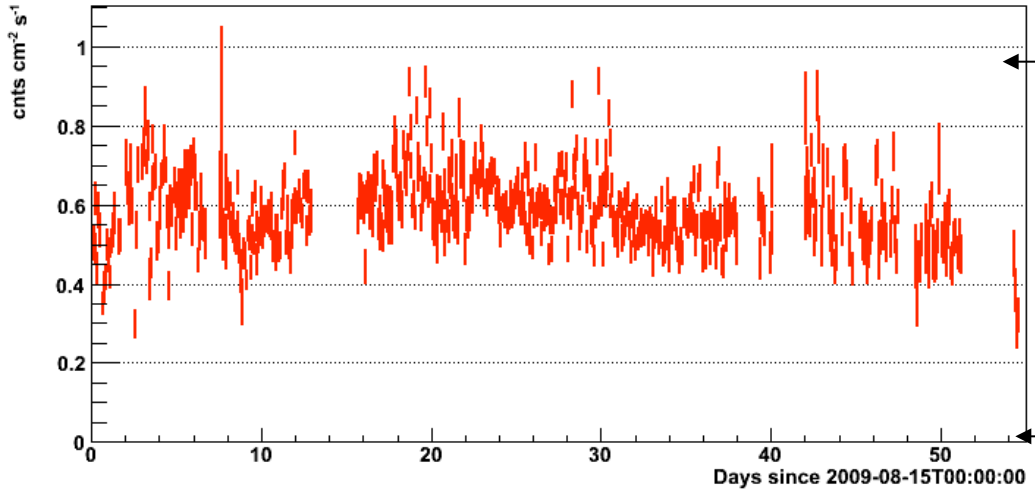
Bright Galactic X-ray Binaries (2)

Cyg X-2



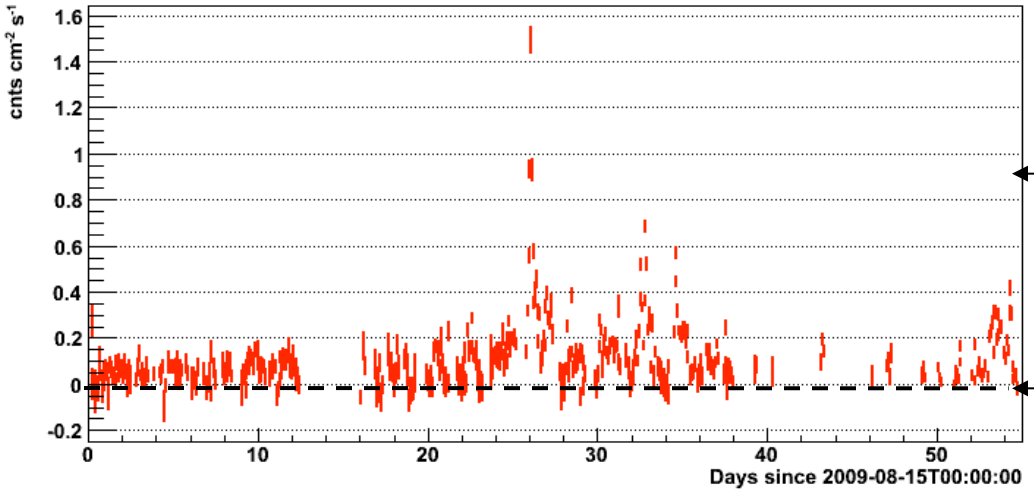
GSC 3-10 keV
90 min/bin
Preliminary

Cyg X-1



Galactic X-ray variables

Cen X-3

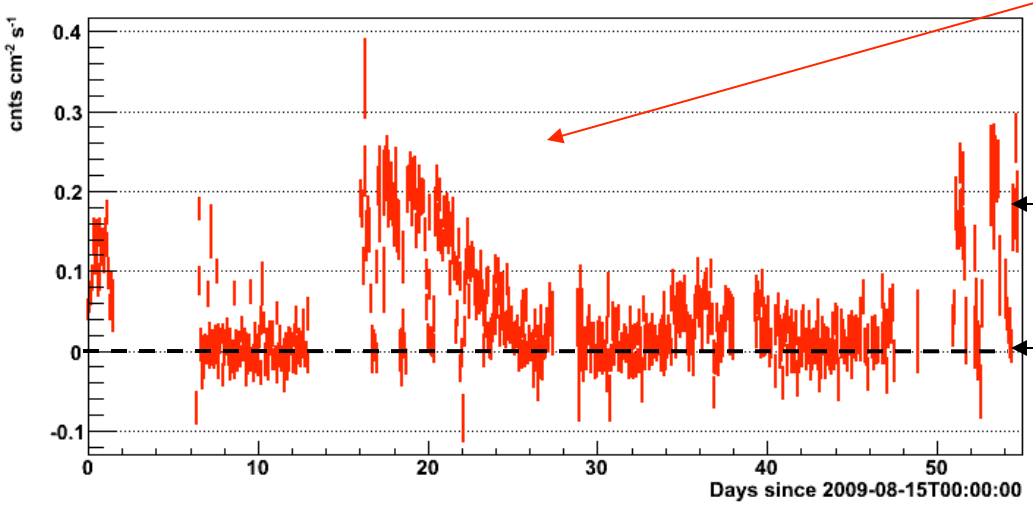


GSC 3-10 keV
90 min/bin
Preliminary

0.5 Crab

0

Her X-1



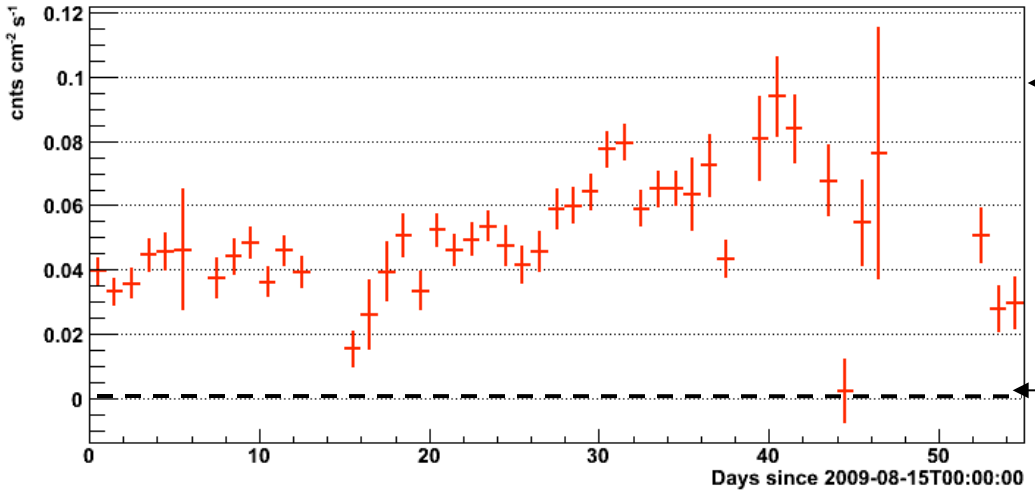
- Eclipse by 1.7-day orbital period
- 35-day activity period

0.1 Crab

0

AGN

Cen A

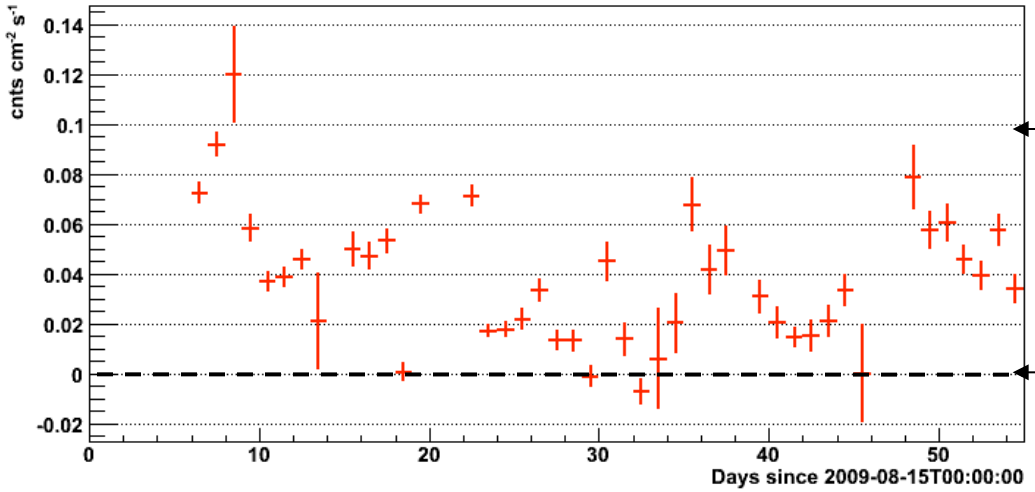


50 mCrab

0

GSC 3-10 keV
1 day/bin
Preliminary

Mkn 421



50 mCrab

0

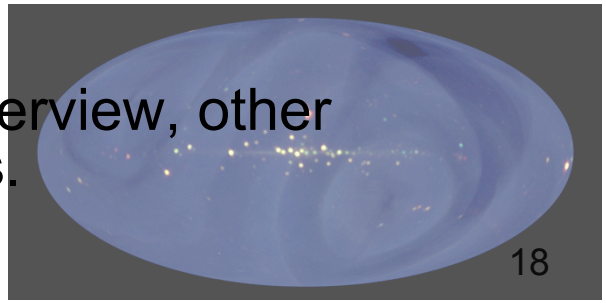
GSC 3-10 keV
1 day/bin
Preliminary

Current Status

- Hardware
  - 8 (out of 12) GSC cameras are operational in regions with low particle flux (~50% of orbits) .
    - 2 GSC cameras had high voltage breakdown
    - 2 more GSCs have similar symptoms
- Sensitivity
  - 20 mCrab/scan, 5 mCrab/day, 1 mCrab/week (goals)
  - achieved: somewhat lower due to high background, limited live time (< 50%), and insufficient calibration
- Calibrations: under progress
  - alignment and position encoding:
    PSF and localization accuracy to be improved
  - energy response
- Software pipeline : under testing
  - “Nova Search”: under testing
  - Light curves: in preparation.

Summary

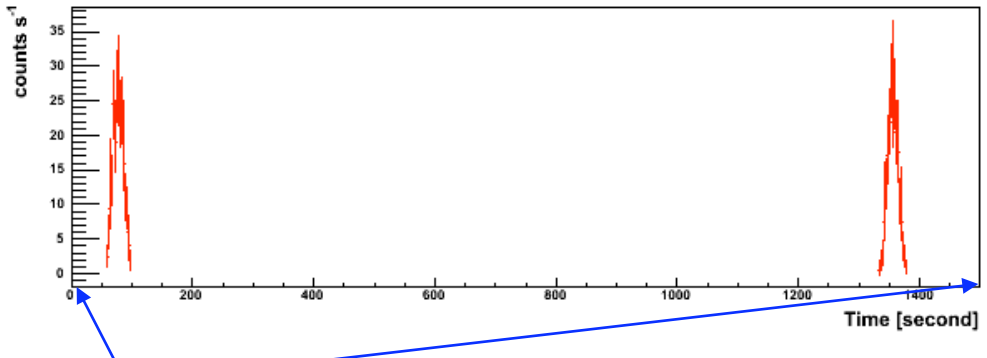
- MAXI started observation in August 2009, currently in the commissioning phase
- Achieving <10 mCrab sensitivity per day
- Performance somewhat compromised due to high particle flux and operation constraints on the ISS
- Instrument calibration, background study, and data processing pipeline are under progress.
- Distribution of light curves of monitored sources starting in December 2009 at http://maxi.riken.jp/ .
- Transient/nova alert distribution planned to start in Dec or Jan.
- Contact us for including your favorite sources in the monitor list.
- Cooperative works with other wavelength missions, which include Fermi, will be helpful to study high-energy transient phenomena.
- See poster P5 – 211 (Kawai) for mission overview, other science topics including X-ray bursts, GRBs.



Backup

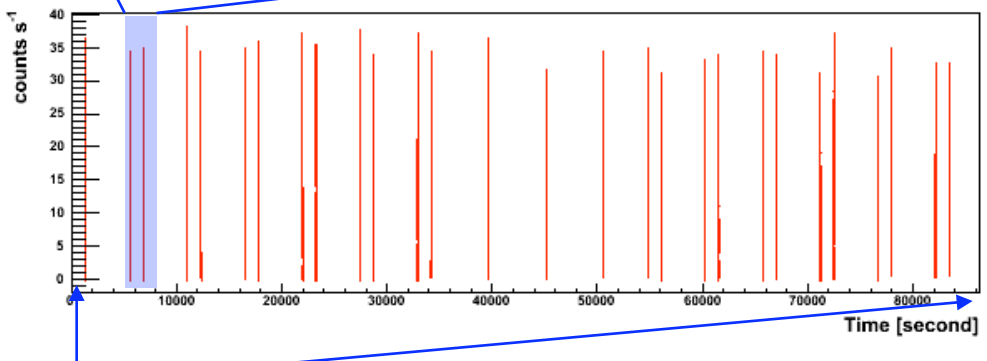
Exposure for a single target

Effective area time variation for a position on the sky



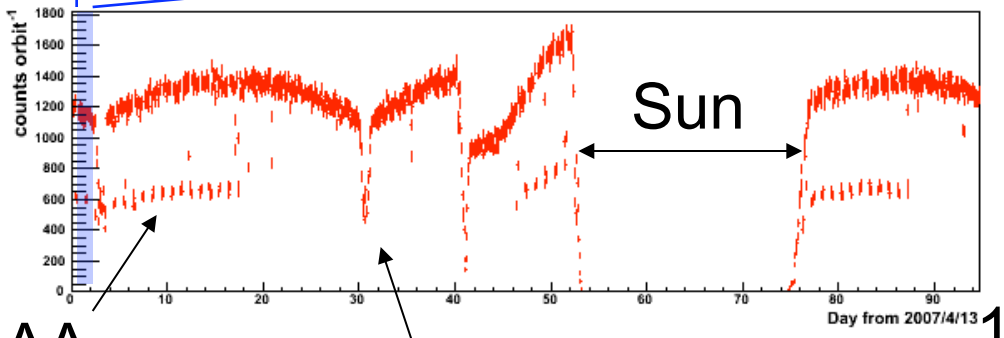
Coverage:
45 sec. x 2
/ 90 minutes
~ 1.7%

1 orbit = 90 min.



15 orbits per day

1 day



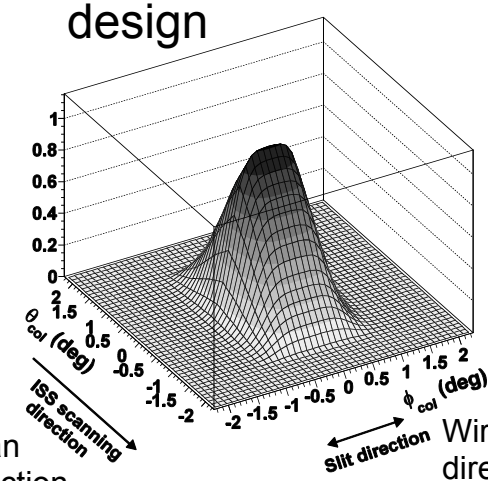
100 days

SAA

Detector boundaries

Image Response

design

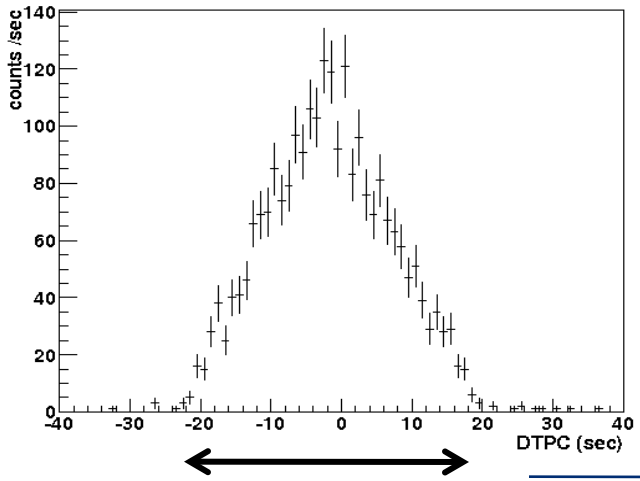


Scan direction

Wire direction

sourcecurve

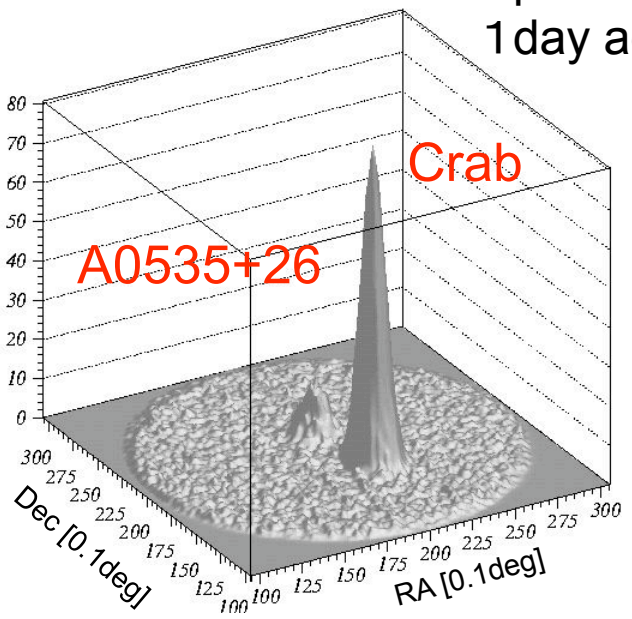
Sco X-1 in 1 scan



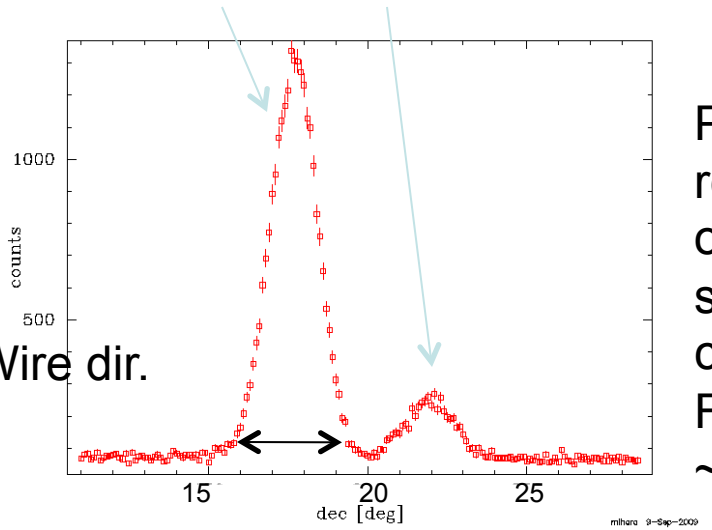
Transmission of collimator FWHM =1.5 degree.

Scan direction

Crab and A0535+26 sep=4.5 deg 1day acc.



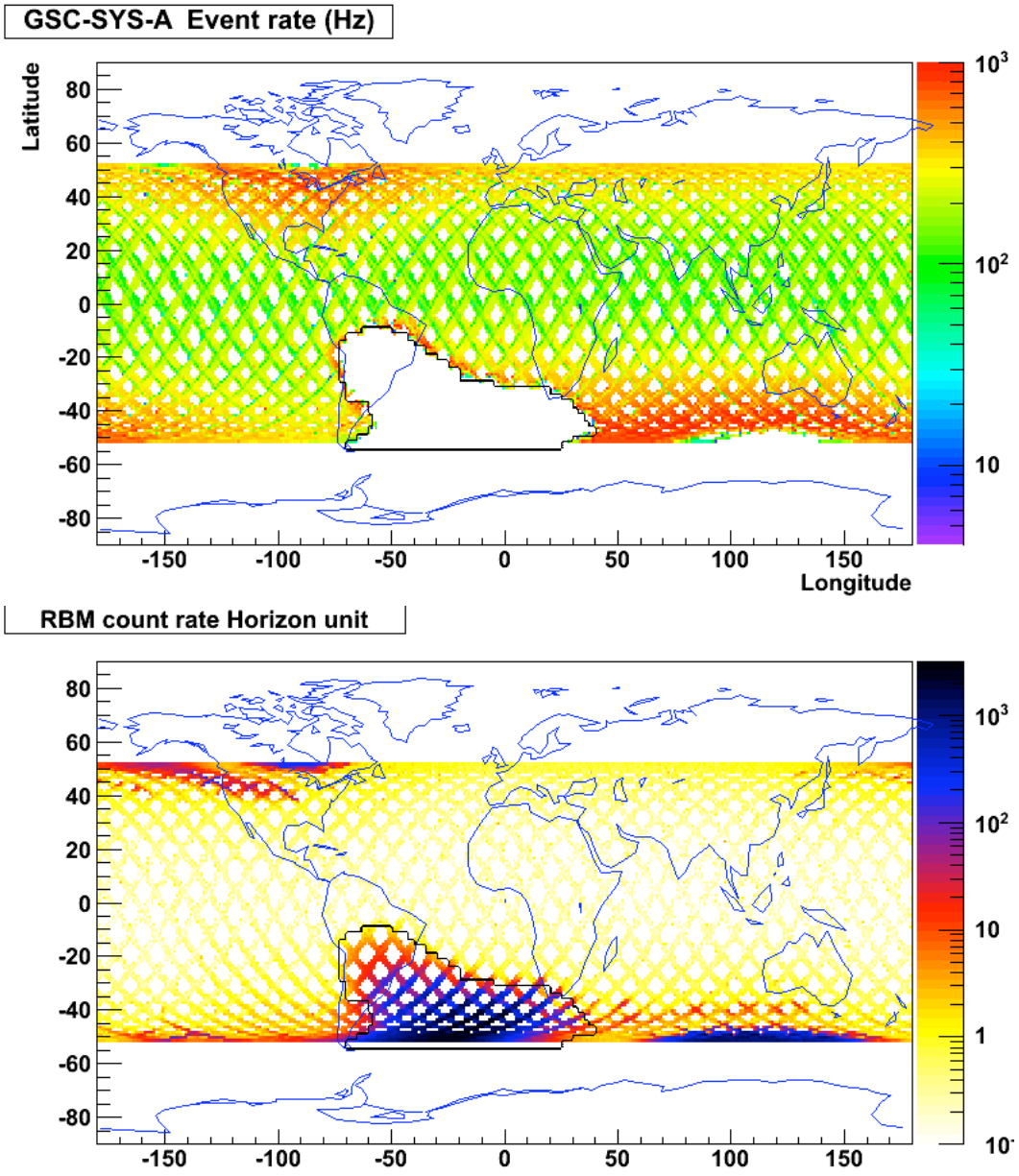
Crab and A0535+26 1day acc.



Wire dir.

Position resolution of 1-D position sensitive counter FWHM ~1.5 degree

ISS orbit and event-rate map



$i = 51.6$