JX-ISAS-SUZAKU-MEMO-2015-05
Title: An anomaly of XIS0 from 2014/04 and 2015/03
Category: XIS
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1 Summary

After the XIS0 segment A anomaly in June 2009 reported in Suzaku memo 2010-01, the dead area has steadily expanded. The area discrimination was changed three times to follow the development.

Besides segment A, the dead area further expanded to the other segments after 2015/03/11. We speculate that this is because the leakage expanded to the serial register common among the segments. For data reduction, users are advised to remove telemetry saturation periods, but there is no apparent difference beyond that for the segments B–D.

2 Expansion of the dead area in XIS0

2.1 Segment A

An anomaly was observed in the XIS0 segment A on 2009/06/23 (Suzaku memo 2010-01). A part of the segment A is dead due to a severe charge leakage presumably because of a micrometeorite hit.

Since then, the charge leakage area expanded gradually. Figure 1 shows the frame dump images taken on 2006/08, 2009/06, and 2014/07. In response to the expansion, the XIS team changed the area discrimination region three times on 2009/06/27[1], 2014-10-02[2]. and 2015-04-17[3]. After the last change, a very small region of a rectangle of ACTX=230-255 and ACTY=124-1023 is left to keep monitoring the segment A status.

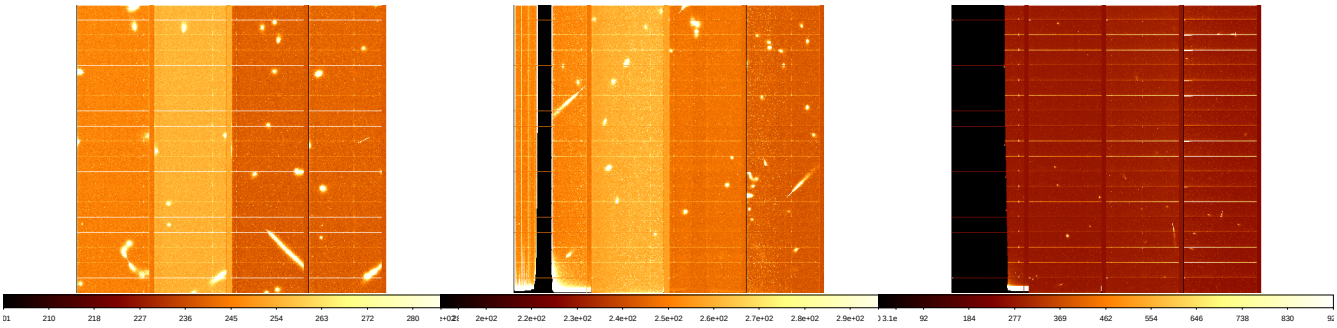

Figure 1: Frame dump images of XIS0 taken on 2006/08, 2009/06, and 2014/07. The segments A, B, C, and D are displayed from right to left.

2.2 Other segments

After the power off/on cycle of the XIS0 on 2015/03/11 (XIS0 was powered off to support some HXD observations in a limited battery condition prior to this), the charge leakage area expanded also to

[1] http://www.astro.isas.jaxa.jp/suzaku/analysis/xis/xis0_area_discriminaion/
[2] http://www.astro.isas.jaxa.jp/suzaku/analysis/xis/xis0_area_discriminaion2/
[3] http://www.astro.isas.jaxa.jp/suzaku/analysis/xis/xis0_area_discriminaion3/

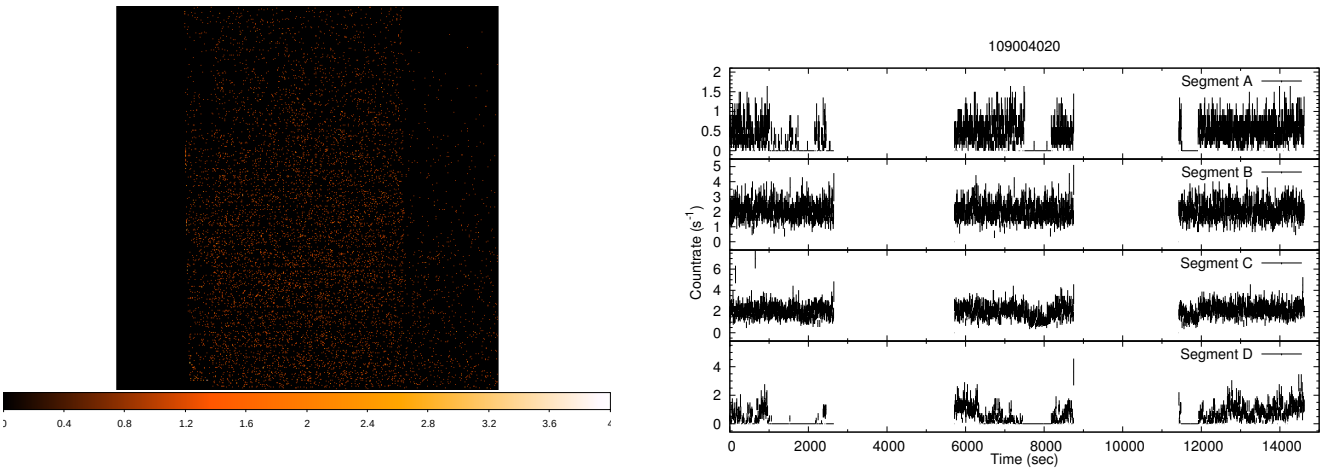

Figure 2: (Left) XIS0 image of Cygnus loop P8 taken on 2014/12/05. The axes are ACTX/RAWY, and the segments A, B, C, and D are displayed from right to left. (Right) Light curves of Cygnus loop P8 on each segment.

the other segments. It is most noticeable in the lines before and after the charge-injected lines (the charge-injected lines themselves are discarded onboard).

The left panel of Figure 2 shows the XIS0 image of Cygnus loop taken on 2014/12/05 (ID=109004020) created from the cleaned events. Segments A and D exhibit a lower apparent intensity than segments B and C. The right panel shows the light curves of segments A, B, C, and D. Some parts of the data are lost.

We speculate that the charge leakage of the segment A has expanded to the serial register for the charge injection, and the amount of the injected charges went out of control in all the segments. Because of this, the telemetry is saturated in a significant fraction of the observation time.

3 Impact to the science data

3.1 Sample science data : W49B

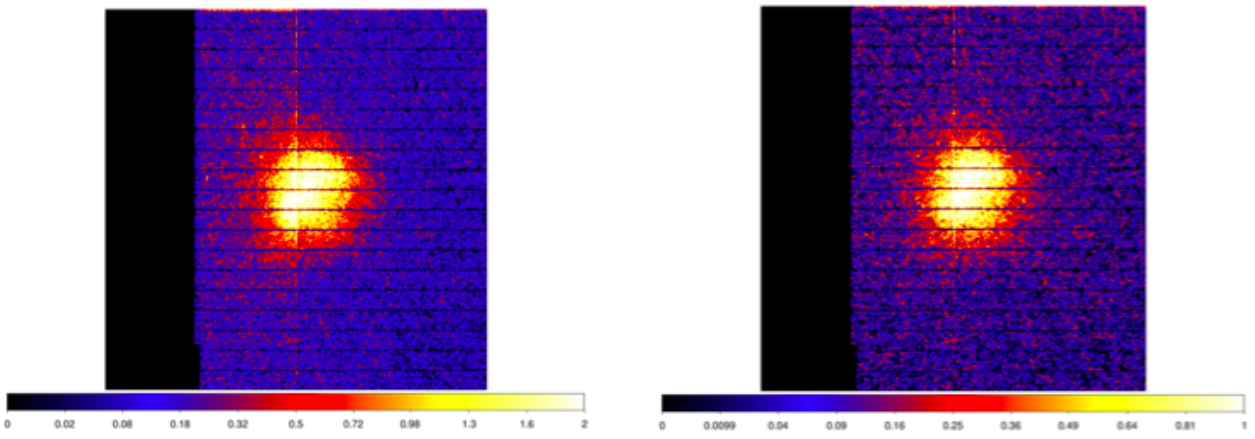

Figure 3: W49B images of XIS0 before and after removing the period when telemetry saturation occurs.

When the data obtained after 2015/03/11 are reduced, the telemetry saturation periods need to be removed, Beyond that, there are no particular differences.

Figure 3 shows the XIS0 image of W49B taken on 2015/04/19 (ID=509001040). The left panel

shows the image created by the cleaned events, and some discontinuity is seen because of the telemetry saturation. The right panel shows the image after removing the telemetry saturation periods. The analysis recipe and the script can be found in a Suzaku web site[4].

3.2 Day-earth data

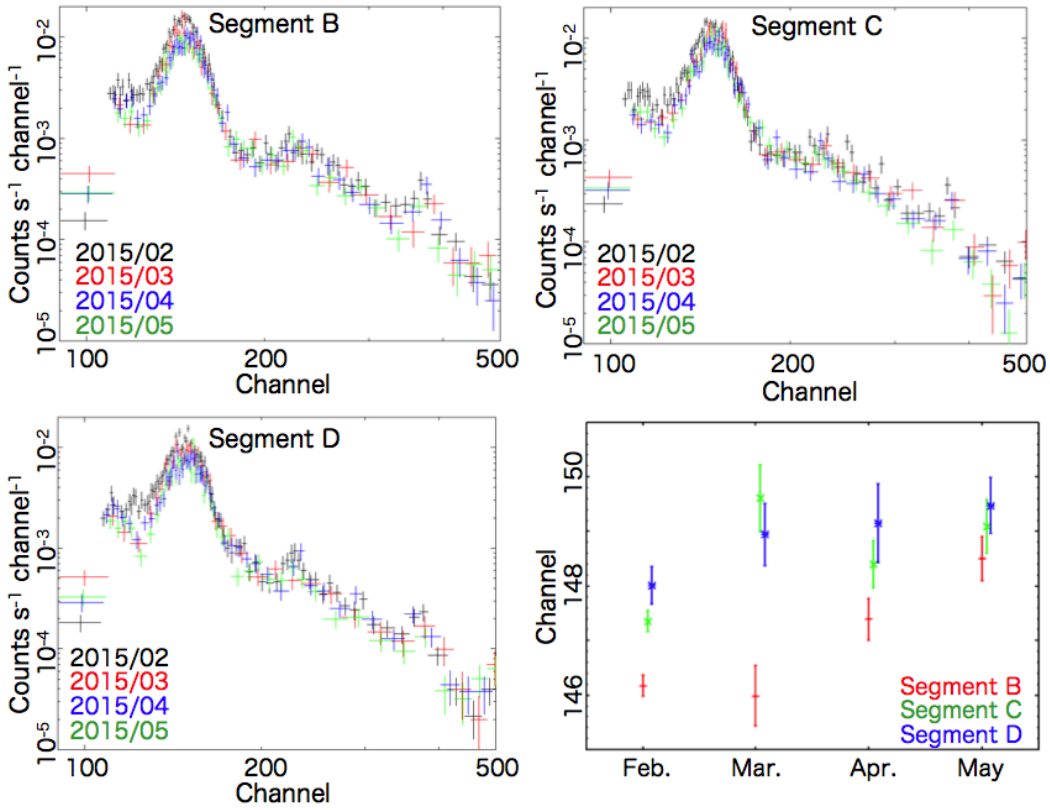

Figure 4: X-ray spectra of day earth taken on 2015/02, 03, 04, and 05 after removing the period when the telemetry saturation occurs. The right bottom panel shows the central PI channel of Oxygen Kα line (524.9 eV).

Figure 4 shows the X-ray spectra of day earth separately for the segments B, C, and D taken on 2015/02, 03, 04, and 05 after removing the telemetry saturation periods. There is no apparent difference among the spectra. The right bottom panel shows the central PI channel of Oxygen Kα line (524.9 eV). The difference of PI is within $\sim$3 channel ($\sim$10 eV), which is presumably due to the slight change of the transfer inefficiency during day-earth observations.

[4] http://www.astro.isas.jaxa.jp/suzaku/analysis/xis/xis0_area_discriminaion3/