SWIFT-XRT-CALDB-03
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Pages Changed: all

SWIFT XRT CALDB REV 2.0 RELEASE NOTE

SWIFT-XRT-CALDB-03: Background Spectrum

1. Component Files:

FILENAME	VALID DATE	RELEASE DATE	CAL VERSION
swxlrbkgpha20010101v001.pha	01 January 2001	15 October 2004	001
swxpcbkgpha20010101v001.pha	01 January 2001	15 October 2004	001
swxwtbkgpha20010101v001.pha	01 January 2001	15 October 2004	001

2. Scope of Document:

This document contains a description of the creation of the background spectrum calibration files for the XRT calibration database performed at Penn State.

3. Changes:

This is the first released version of the Background Spectrum document.

4. Scientific Impact of this Update:

This is the first released version of the Background Spectrum document.

5. Caveat Emptor:

The background spectrum files described in this document are produced from Thermal Vacuum Chamber Testing data and consist only of events from the onboard calibration sources (^{55}Fe corner and door sources) and detector noise. The cosmic X-ray background which will be seen by the XRT in orbit is not accounted for in any way in this release of the background spectra.

The spectrum for PC mode includes counts from the on-board calibration sources (or "corner sources"). These will not be present in most flight data. Flight background estimates should be made for the specific region of the CCD of interest (to get the correct vignetting) and should therefore be made for each desired application from the background events files in PC mode.

6. Expected Updates:

Spectra of blank fields will be collected in orbit to account for the cosmic X-ray background which is not presently accounted for in these background spectra. An update to these files will be released early during the orbital mission including the cosmic background.

7. Description of Low-Rate Photodiode Mode Calibration:

In Low-Rate Photodiode (lrpd) mode where the entire array is effectively clocked out into each pixel read at the amplifier, there will be a significant background event rate due primarily to the four ^{55}Fe calibration sources mounted on the XRT CCD. In this analysis we have used lrpd data from thermal vacuum testing at Goddard Space Flight Center (GSFC) (with CCD temperature of –100 C) to create a spectrum that can be used in the SDC pipeline to remove this background.

Data were processed through the PSU software packages '*pass1*' and '*event browser*' to extract lrpd PHA values (in DN) from the following list of days/observations from thermal vacuum testing (with the CCD at –100 C):
163_0114
163_0256
163_0439
163_0623
163_0808
163_0951
163_1134

163_1316
163_1459
163_1643
163_1829
163_2339

To convert from DN (reported by the *pass1* and *event browser* software) to PI bins, which are expected in the CALDB file, we first multiply the DN values of the events by the nominal gain factor (see the PSU Gain and CTI Calibration report) for the lrpd mode of 2.55 eV/DN. This gain correction produces a spectrum of discrete lines spaced at 2.55 eV intervals. When the conversion from PHA to PI is done (by dividing by 10eV/PIbin) this produces discrete binning effects roughly every 120 eV, at the point when 3 discrete lines 'fit' into the PI bin rather than 4 as is usually the case. To remove this discreteness effect we subsequently convolve the spectrum with an 11 bin Gaussian kernel with FWHM=4.7 bins (sigma=2) to produce the final PI format spectrum.

8. Description of PC Mode Calibration:

In Photon Counting mode, events occurring anywhere on the detector are clocked out in 3x3 pixel blocks. Thus, the corner sources continue to be a significant source of background in this mode (if no spatial filtering is done on the data). We once again using Thermal Vacuum Testing data to create the PC mode background spectrum.

Data were processed through the PSU software packages '*pass1*' and '*event browser*' to extract PC PHA values (in DN) from the following list of days/observations from Thermal Vacuum testing:

150_0355
150_0448
150_0719
150_1050
162_1635
162_1820

We use a Gaussian smoothing procedure similar to that used in the LRPD section to remove the discrete binning effect, this time using the PC nominal gain value of 2.529.

9. Description of WT Mode Calibration:

In Window Timing mode, events are only read out from a subset of the detector pixels, excluding the pixels illuminated by the corner sources. Thus the main contribution to the background as determined during ground calibration is detector noise. We once again use thermal vacuum test data to create the WT mode background spectrum.

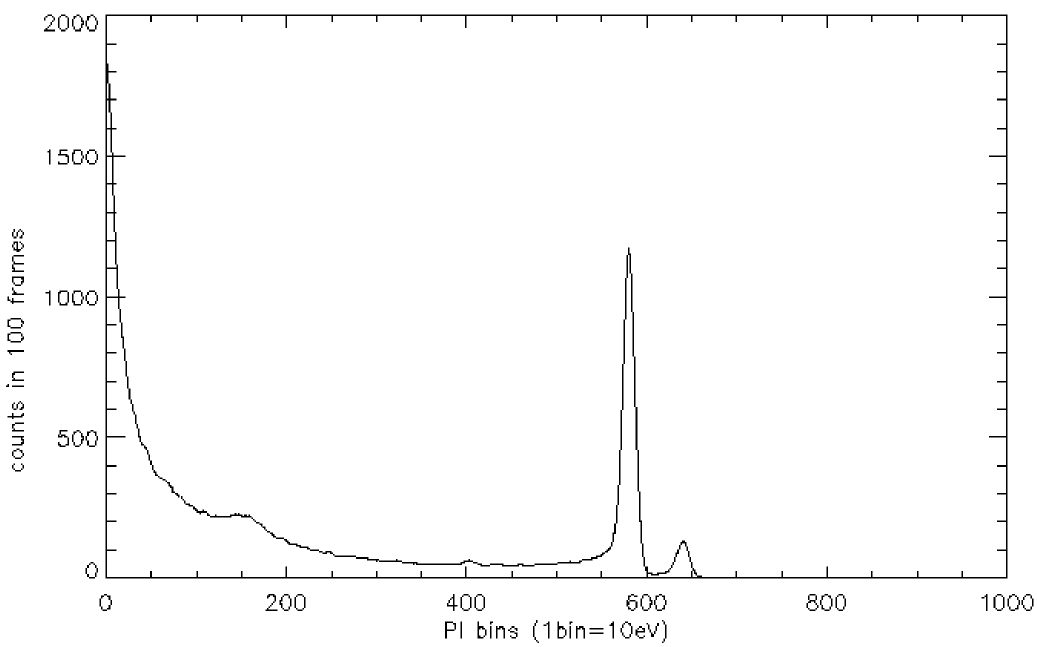
Data were processed through the PSU software packages '*pass1*' and '*event browser*' to extract WT PHA values (in DN) from the following list of days/observations from Thermal Vacuum testing:

162_1635
162_1820

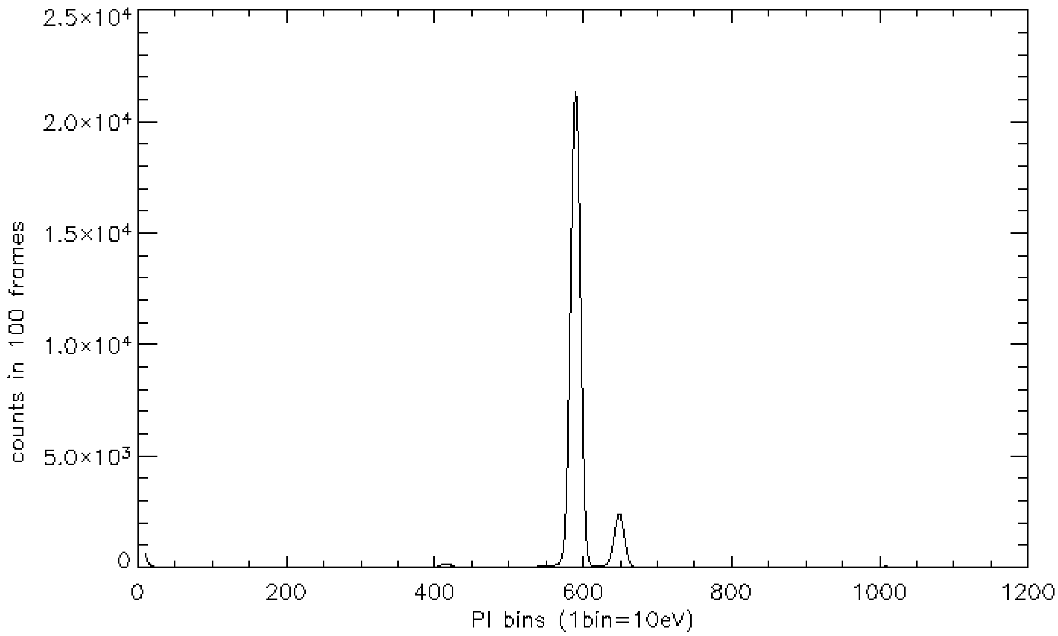
We use a Gaussian smoothing procedure similar to that used in the LRPD section to remove the discrete binning effect, this time using the WT nominal gain value of 2.529.

We include here plots of the PI bin format background spectra for each of the modes discussed above:

LRPD:

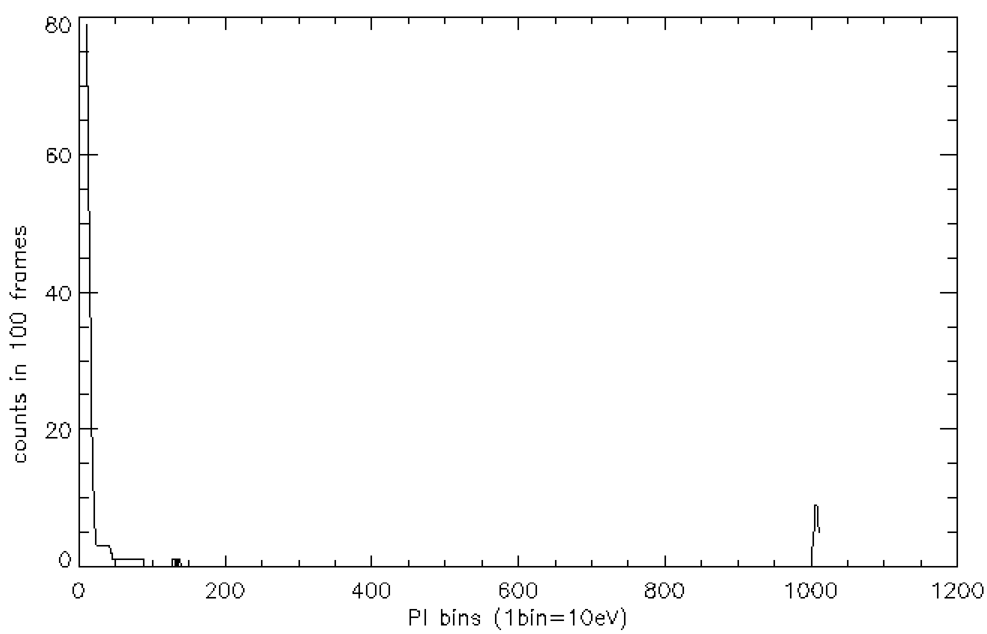


PC:



2.5×10⁴
2.0×10⁴
1.5×10⁴
1.0×10⁴
5.0×10³
0
counts in 100 frames
0
200
400
600
800
1000
1200
PI bins (1bin=10eV)

WT:



80
60
40
20
0
counts in 100 frames
0
200
400
600
800
1000
1200
PI bins (1bin=10eV)