

## SWIFT-UVOT-CALDB-08-R03b

Date Original Submitted: 2006-07-27

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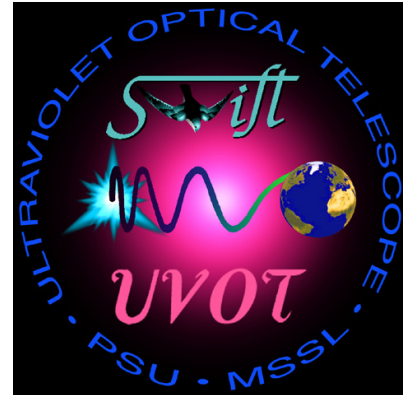
Date Revised: 2020-10-28

Revision #03b

Revised by: A. A. Breeveld

Pages Changed: many

Comments: Added corners



## SWIFT UVOT CALDB RELEASE NOTE

SWIFT-UVOT-CALDB-08-R03b: Bad pixels

### 0. Summary:

This CALDB product gives the locations of UVOT bad pixels.

### 1. Component Files:

FILE NAME	VALID DATE	RELEASE DATE	VERSION
swubadpix20050105v102.fits	2005-01-04 - 2007-12-31	2006	1
swubadpix20080101v001.fits	2008-01-01- current	2009	2r
swubadpix20050105v103.fits	2005-01-04 - 2007-12-31	2020	3b
swubadpix20080101v002.fits	2008-01-01- current	2020	3b

### 2. Scope of Document:

This document describes changes from the previous product (released 2009), reason for update, expected future updates, warnings for the user, a list of data the product is based on and finally the analysis methods used to create the product.

### 3. Changes:

This is the third on-orbit calibration for this product. The number and location of bad pixels has not changed significantly since launch, but this is the first product with corners marked as bad. Two new CALDB files have been released to cover the periods launch-2008 and 2008 onwards.

### 4. Reason For Update:

There is significant vignetting in the corners of the field of view. Although these areas are not 'bad' pixels, they should not be considered as active areas of the detector.

#### 5. Expected Updates:

The numbers and locations of bad pixels are monitored regularly, with updates made to the CALDB product if they are observed to change over time.

#### 6. Caveat Emptor:

The bad pixels are selected using flat field data, in terms of CCD pixels (i.e. 256x256 pixels). The bad pixel map is delivered in terms of subpixels (2048x2048), therefore the bad pixels are given in blocks of 8x8 subpixels.

#### 7. Data Used:

This product is derived from a total of  $1.6 \times 10^{10}$  counts taken with the blocked filter with LED switched on, in 2018/2019. There were 156 OBSIDS many with more than one exposure. This number of counts ensures that the Poisson error on the counts per CCD pixel is less than 1%.

The corners were defined using the flat field data from 2018/9 divided by that from 2005 such that the corners show up as bright regions (because the detector has not suffered from loss of throughput in these areas). The radius of the corner vignetting were checked using raw white data collected for GRB 171010A.

#### 8. Description of Analysis:

Throughout the year exposures are taken periodically with the blocked filter and LED illumination. These exposures are co-added into binned (256x256) images. A combined image is produced from all the data gathered each year, and is used (appropriately scaled) to divide out the lamp signature from the individual images. Histograms are produced of the pixel counts in each smoothed image (see Figure 1). Low pixels are defined to be those 3 sigma below the mean (0.825) counts per pixel and high pixels are defined to be those with counts per pixel 3 sigma above the mean (1.175). Low and high pixels were found for each year and compared with those from previous years.

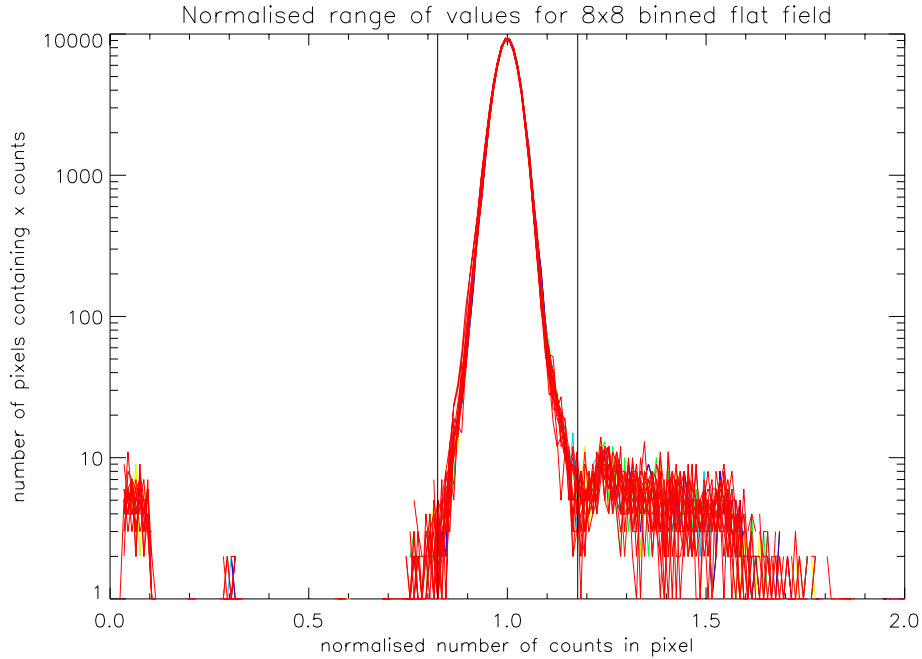


Figure 1: These are log plots of the histograms obtained for 6 normalised files, subsets of the 2018/2019 flatfield data. Pixels with values less than 0.825 and greater than 1.175 are labelled as low or high bad pixels respectively (vertical lines).

The combined image is used to produce the pixel lists for the low and high pixels. There have been no significant differences between the numbers and locations of bad pixels found since the previous release. The pixel lists were used to create the CalDB product. The CalDB product lists the positions in terms of subpixels (2048x2048 image) even though the bad pixels were detected using CCD pixels (256x256 image).

A QUALITY flag is set in the CALDB file to indicate the type of bad pixel:

Good pixel	0
Dead pixel (Low bad pixel)	1
Hot pixel (High bad pixel)	2
Cold pixel (none of these)	4
Flickering pixel (none of these)	8
Corner pixel	16

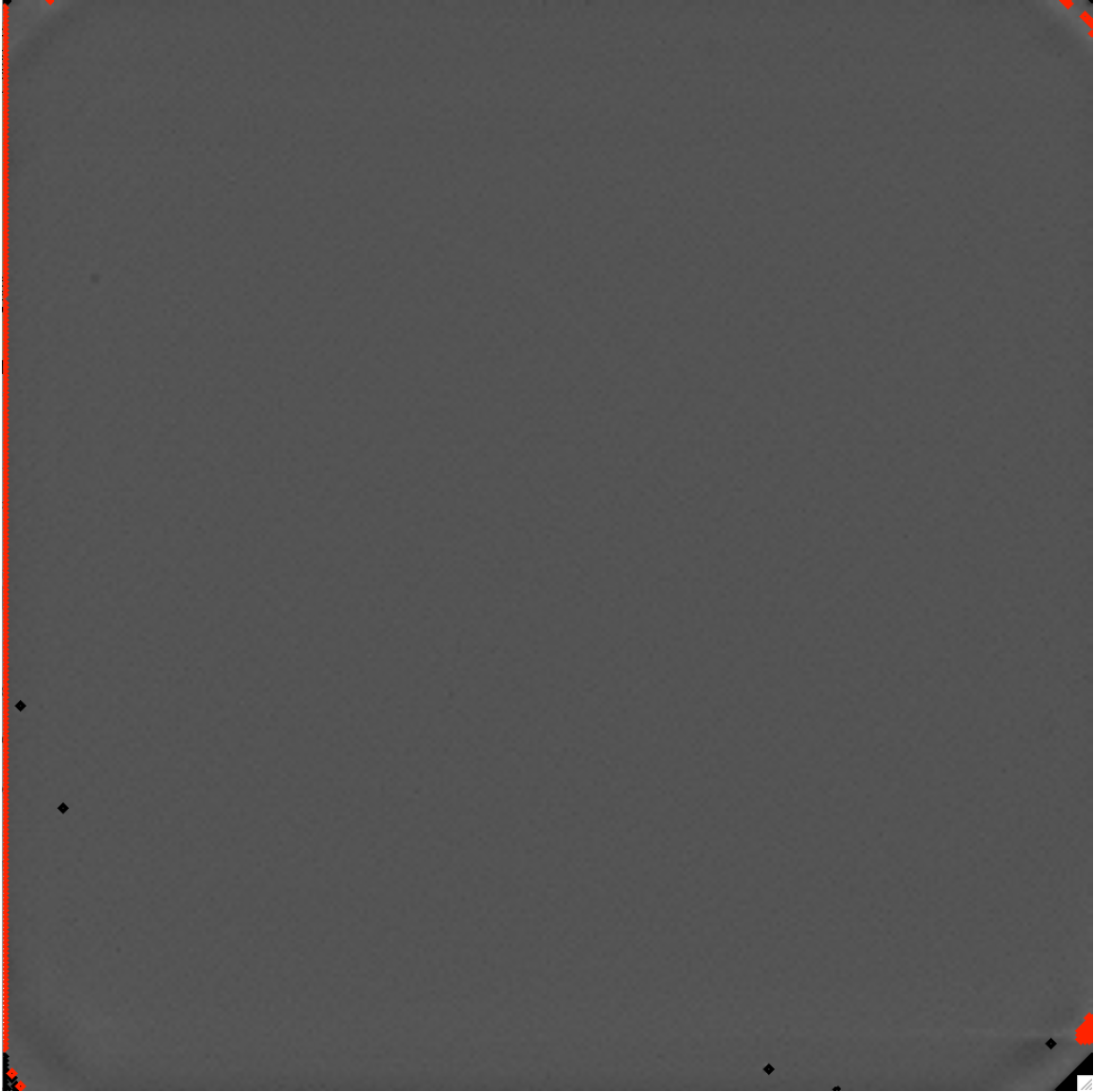


Figure 2: This is an image of the 2019 combined flat field. Low sub-pixels are marked in black; high ones in red.

Lastly, the corners have been marked as 'bad' for those pixels more than 171 pixels from the centre. (see Fig. 3). These have been added to the list of bad pixels.

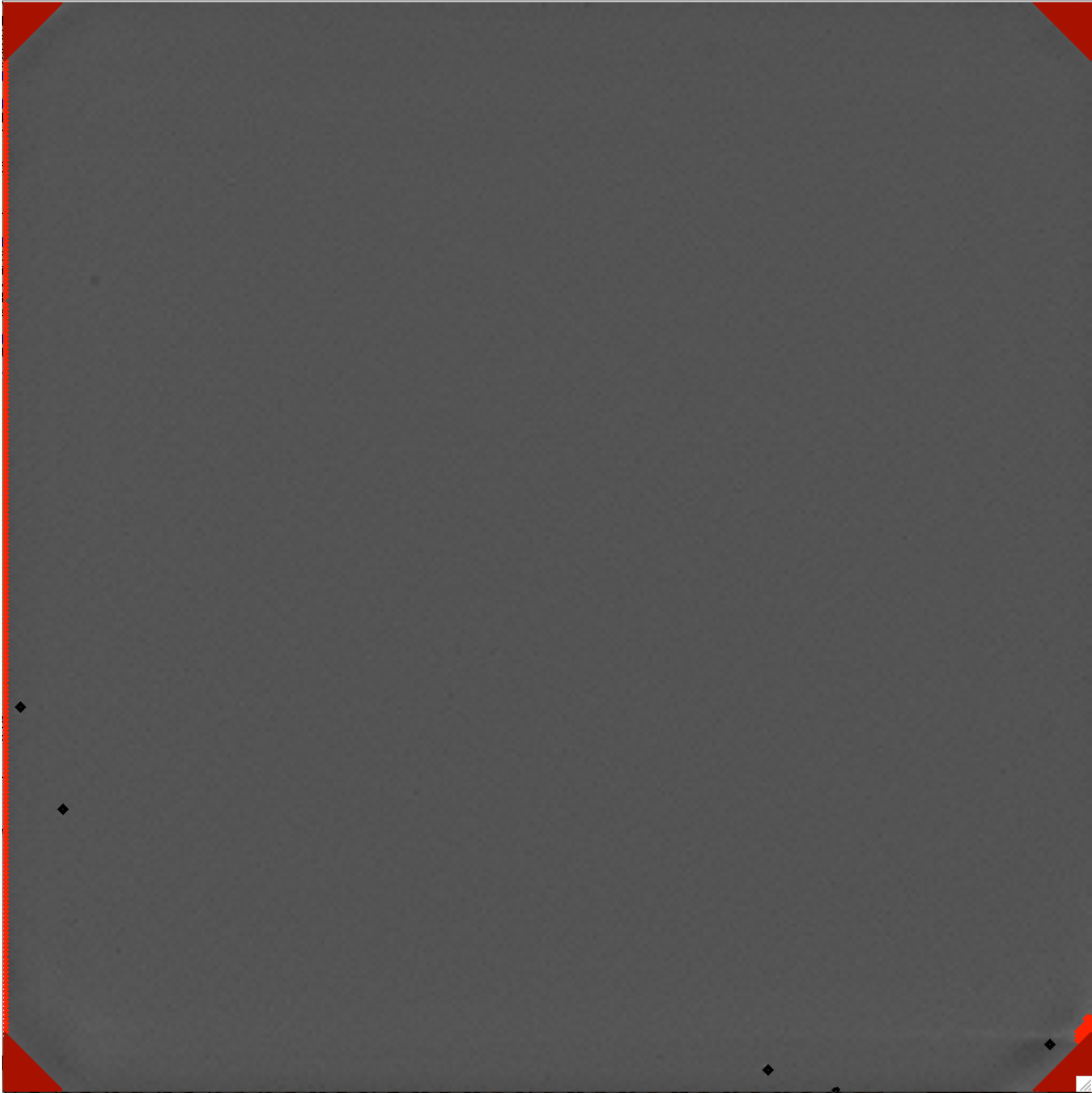


Figure 3. The flatfield data from 2018/2019. Bad pixels are marked as black diamonds, bright pixels as red diamonds. The corners are overplotted in brown.