

Swift Observations of GRB 081016B

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1 Introduction

BAT triggered on and located GRB 081016B (trigger=331856; Page et al., GCN Circ. 8381) at 19:47:14 UT on 16th October, slewing immediately. Although the XRT did not centroid onboard, a fading afterglow was detected in the promptly downlinked SPER data. The best position is that derived from using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue to correct the X-ray location astrometrically: RA, Dec (J2000.0) = $00^h 58^m 15.52^s$, $-43^\circ 31' 49.0''$ with an estimated uncertainty of 1.9 arcsec (radius, 90% confidence).

ROTSE-IIIc observed the field 44.9 s after the burst, but did not detect the afterglow (Schaefer, Rykoff & Swan, GCN Circ. 8382).

The X-ray afterglow was no longer detectable after the first orbit of data.

2 BAT Observation and Analysis

The BAT ground-calculated position is RA, Dec = 14.582, -43.536 deg which is

$$\text{RA(J2000)} = 00^h 58^m 19.8^s$$

$$\text{Dec(J2000)} = -43^\circ 32' 07.9''$$

with an uncertainty of 2.3 arcmin, (radius, sys+stat, 90% containment). The partial coding was 98%.

The BAT mask-weighted (Figure 1) light curve showed a single peak of duration 2.5 seconds. T_{90} (15–350 keV) is 2.6 ± 0.8 s (estimated error including systematics).

The time-averaged spectrum from T–0.0 to T+3.0 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is $\Gamma = 0.92 \pm 0.32$. The fluence in the 15–150 keV band is $(9.9 \pm 1.8) \times 10^{-8}$ erg cm^{-2} . The 1-s peak photon flux measured from T+0.50 sec in the 15–150 keV band is 0.5 ± 0.1 ph cm^{-2} s^{-1} . All the quoted errors are at the 90% confidence level.

The results of the batgrbproduct analysis are available at <http://gcn.gsfc.nasa.gov/notices.s/331856/BA/>

3 XRT Observations and Analysis

The XRT began observing the burst 91 s after the BAT trigger. Using 2096 s of XRT Photon Counting (PC) mode data and one UVOT image for GRB 081016B, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA, Dec = 14.56434, -43.53015 which is equivalent to:

$$\text{RA (J2000): } 00^h 58^m 15.52^s$$

$$\text{Dec (J2000): } -43^\circ 31' 49.0''$$

with an uncertainty of 1.9 arcsec (radius, 90% confidence).

The X-ray light-curve is shown in Figure 2. The first orbit of data shows a decay of $\alpha = 1.1 \pm 0.3$; however, after the end of this orbit, the source is no longer detected, indicating a break to a significantly steeper decay occurred. If the break occurred immediately at the end of the first orbit, a decay slope of $\alpha > 2$ would be required to account for the later non-detection.

The spectrum of the first orbit of PC data can be modelled with a power-law ($\Gamma = 1.20 \pm 0.18$) absorbed at the Galactic value of $N_{\text{H}} = 1.96 \times 10^{20} \text{ cm}^{-2}$. The upper limit on the total absorbing column is $2.2 \times 10^{21} \text{ cm}^{-2}$. The observed (unabsorbed) flux over this time (114–264 s) is 2.43×10^{-10} (2.48×10^{-10}) $\text{erg cm}^{-2} \text{ s}^{-1}$.

The counts to observed flux conversion is $1 \text{ count s}^{-1} = 6.8 \times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1}$.

Detailed light-curves (in both count rate and flux units) and spectra are available from http://www.swift.ac.uk/xrt_products/00331856/

4 UVOT Observation and Analysis

The Swift Ultra-Violet/Optical Telescope (UVOT) began settled observations of GRB 081016B 93 s after the BAT trigger (Page et al., GCN Circ. 8381). No afterglow is detected at the enhanced XRT position (Osborne et al., GCN Circ. 8383) in the initial white finding chart or subsequent images. The limiting magnitudes (3-sigma in 3" radius apertures) in each of the UVOT filters are given in Table 1.

The values quoted above are in the UVOT photometric system (Poole et al. 2008, MNRAS, 383, 627). They are not corrected for the expected Galactic extinction corresponding to a reddening of $E(B-V)=0.01$ mag in the direction of the burst (Schlegel et al. 1998).

Filter	Tstart	Tstop	Exposure	Mag UL (3σ)
white	93	243	150	>21.5
b	4710	4823	113	>20.6
v	5373	5572	197	>20.0
u	5988	11724	960	>21.5
uvw1	5783	5982	197	>20.3
uvm2	5577	5777	197	>20.0
uvw2	5168	5368	197	>20.3

Table 1: UVOT magnitudes in all filters.

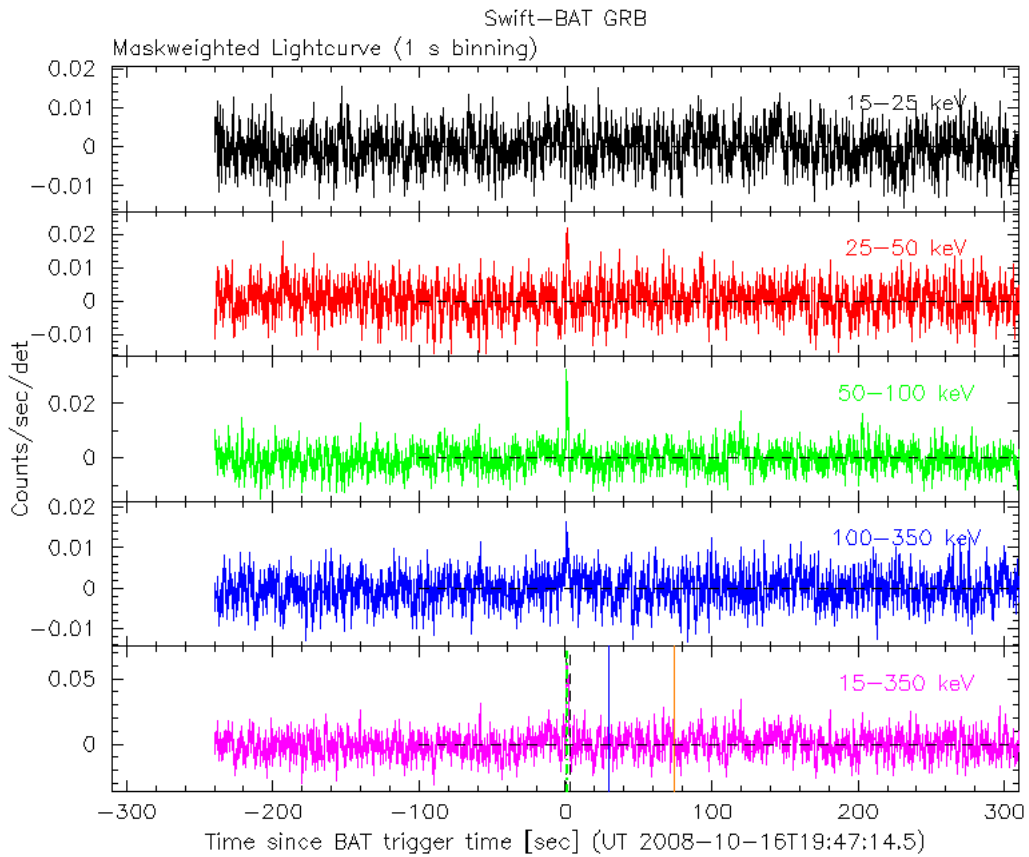


Figure 1: BAT light-curve. The mask-weighted light-curve in the 4 individual plus total energy bands. The units are counts/s/illuminated-detector (note illum-det = 0.16 cm²).

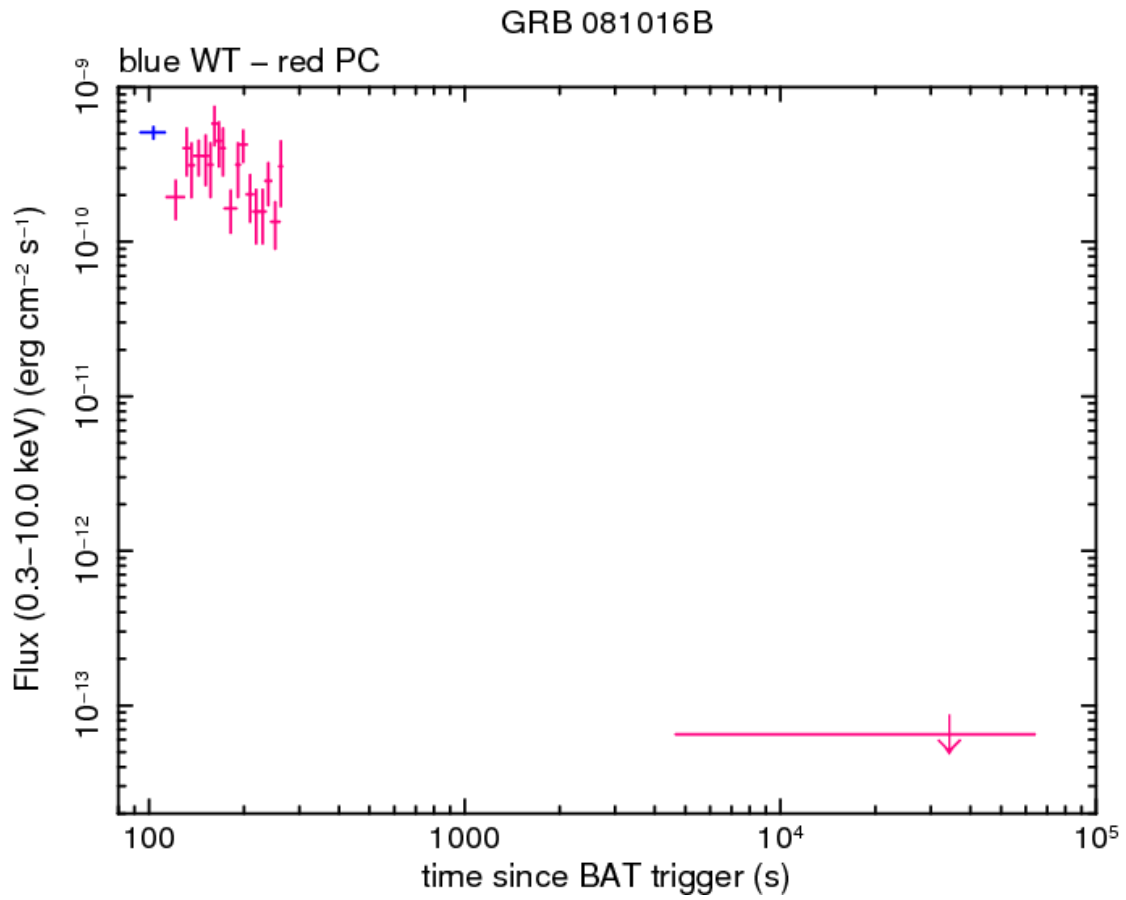


Figure 2: XRT flux light-curve. Windowed Timing mode is shown in blue, Photon Counting mode in red. The approximate counts to flux conversion is $1 \text{ count s}^{-1} = 6.8 \times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1}$.