Swift Observation of long GRB 081102

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1 Introduction

BAT triggered on GRB 081102 at 17:44:39 UT (Trigger 333427) (Ukwatta, *et al.*, *GCN Circ.* 8462). This was a 2.048 sec rate-trigger on a long burst with $T_{90} = 63 \pm 16$ sec. Swift slewed immediately to the burst. Narrow field instruments started observations at $\sim T + 83$ sec, and our best position is the UVOT-enhanced XRT location RA($J2000$) = 331.1724 deg (22h04m41.38s), Dec($J2000$) = +52.9942 deg (+52d59′39.3″) with an uncertainty of 1.5 arcsec (90% confidence, including boresight uncertainties), reported by Osborne *et al.*, *GCN Circ.* 8467.

This burst has also been observed by Fermi GBM as reported by Kouveliotou *et al.*, *GCN Circ.* 8476.

2 BAT Observation and Analysis

Using the data set from $T - 240$ to $T + 962$ sec, further analysis of BAT GRB 081102 has been performed by BAT team (Fenimore, *et al.*, *GCN Circ.* 8468). The BAT ground-calculated position is RA($J2000$) = 331.178 deg (22h04m42.6s), Dec($J2000$) = 52.991 deg (+52d59′27.7″) $\pm$ 1.1 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 36% (the bore sight angle was 32.7 deg).

The mask-weighted light curve (Fig. 1) shows two overlapping peaks, the first starting at $\sim T - 20$ sec, peaking at $\sim T - 15$ sec, and hitting a minimum between the two peaks at $\sim T - 7$ sec. The second peak peaks at $\sim T + 1$ sec, and returns to background at $\sim T + 90$ sec. T90 $(15 - 350$ keV) is 63 ± 16 sec (estimated error including systematics).

The time-averaged spectrum from $T - 20.2$ to $T + 62.8$ sec is best fit by a simple power-law model. The power law index of the time–averaged spectrum is 1.73 ± 0.13. The fluence in the $15 - 150$ keV band is $2.3 \pm 0.2 \times 10^{-6}$ erg cm^{-2}. The 1-sec peak photon flux measured from $T + 0.08$ sec in the $15 - 150$ keV band is 1.4 ± 0.3 ph/cm2/sec. 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/333427/BA/

3 XRT Observations and Analysis

The XRT team has analyzed data collected during the first ten orbits of observation of GRB 081102, covering 151 s of Windowed Timing mode data (from T+98 s to T+251 s) and 14 ks of Photon Counting (PC) mode data (from T+251 s to T+42.1 ks).

The X-ray light-curve (Fig. 2) can be fitted with a broken power law model with slopes $\alpha_1 = -2.35 \pm 0.15$ and $\alpha_2 = -1.22\,(-0.11 + 0.22)$ and break time $T_{\text{break}} = T + 560\,(-160 + 500)$ s. After the break, we observe a strong flare at $T + 960\,(-11 + 21)$ s with decay time 157 ± 15 s.

The WT spectrum is best fit by a simple absorbed power law with photon index 2.7 ± 0.1 and an absorbing column consistent with the Galactic value of 4.9×10^{21} cm^{-2} (Kalberla *et al.*, 2005). The observed (unabsorbed) flux in the 0.3 - 10 keV band is $4.0 \times 10^{-10}\,(1.3 \times 10^{-9})$ erg cm^{-2} s^{-1}. The PC spectrum is best fit by a simple absorbed power law with photon index 1.97 ± 0.1 and an absorbing column consistent with the Galactic value. The observed (unabsorbed) flux in the 0.3 - 10 keV band is $1.1(1.8) \times 10^{-11}$ erg cm^{-2} s^{-1}. All quoted errors are at 90% confidence level.

Detailed light curves in both count rate and flux units are available in both graphical and ASCII formats at http://www.swift.ac.uk/xrt curves/

4   UVOT Observation and Analysis

The Swift Ultra-Violet/Optical Telescope (UVOT) began observing GRB 081102, 83 seconds after the BAT trigger. No afterglow is detected at the enhanced XRT position (Osborne *et al.*, *GCN Circ.* 8467) in the initial v-filter finding chart or subsequent images. The following table gives the 3 sigma upper limits in all filters.

Filter	Tstart (s)	Tstop (s)	Exposure (s)	3-Sigma UL
white	100	19051	1246	>21.9
v	83	35803	1423	>20.3
b	433	24833	1808	>21.3
u	408	30614	2717	>21.3
uvw1	383	29977	2922	>21.1
uvm2	359	36395	2701	>20.9
uvw2	309	34890	1434	>20.7

Table 1: Magnitude limits from UVOT observations

The values quoted above are in the UVOT photometric system (Poole *et al.*, 2008, MNRAS, 383, 627). They are not corrected for the high (and unreliable) Galactic extinction at the low Galactic latitude of the burst of < 5 degrees.
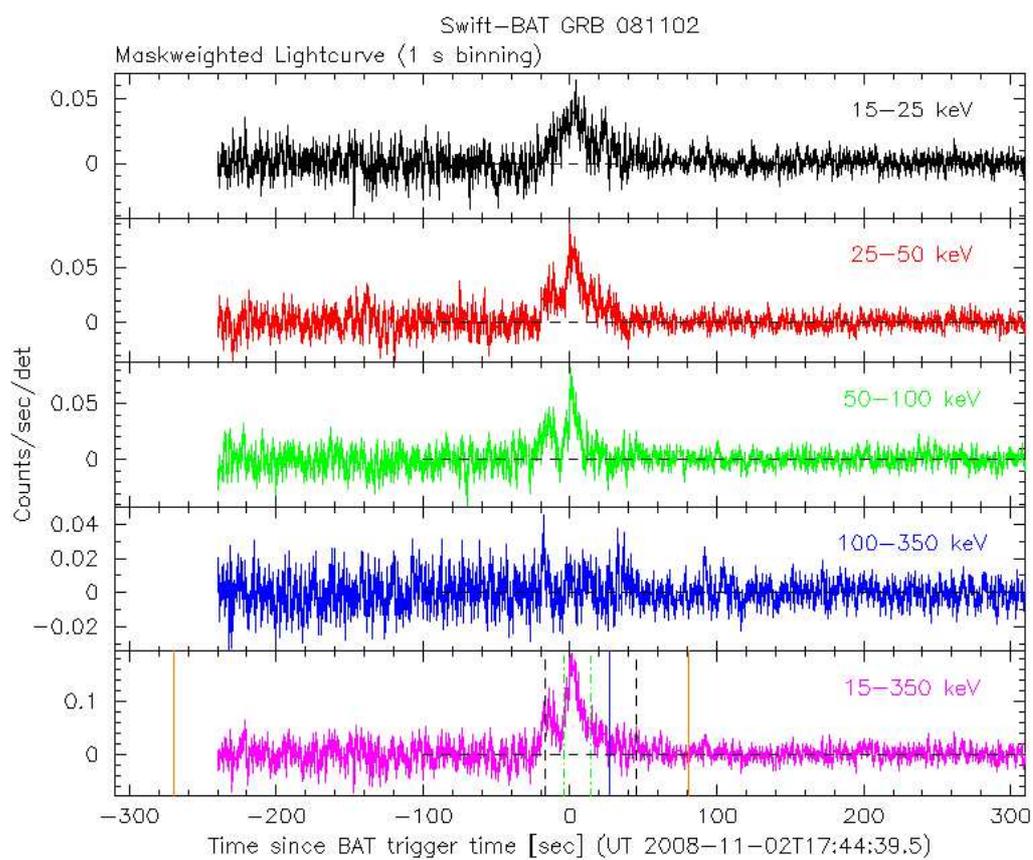
Figure 1: The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 17:44:39 UT.
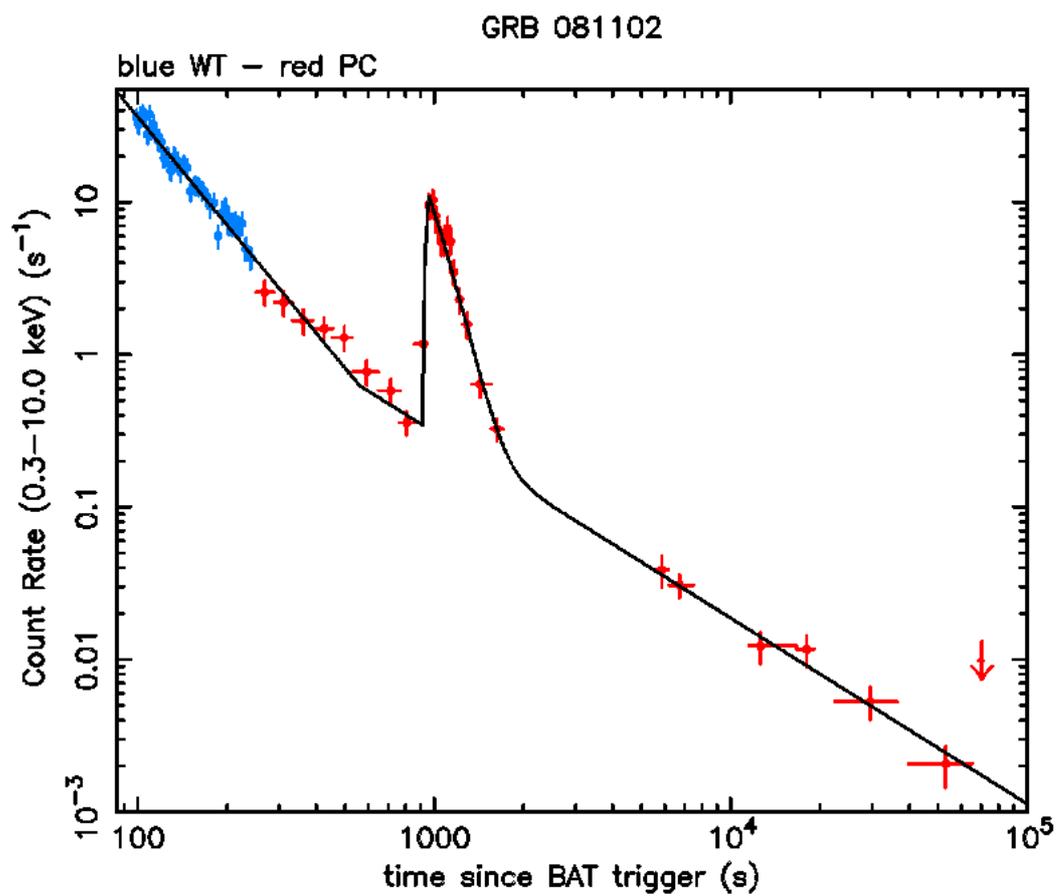
Figure 2: XRT Lightcurve. Counts/sec in the $0.3 - 10$ keV band: Window Timing mode (blue), Photon Counting mode (red). The approximate conversion is 1 count/sec $= \sim 7.1 \times 10^{-11}$ ergs/cm^2/sec.