

Swift Observations of GRB 100615A

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1 Introduction

The Swift BAT triggered on and located GRB 100615A at 01:59:03 UT (trigger=424733) (D'Elia et al., GCN Circ. 10841). Swift slewed immediately to the burst and XRT and UVOT observations of the field started 62 and 150 seconds after the trigger, respectively. The best Swift position is the XRT localization at RA(J2000)= 177.20522 deg, Dec(J2000)= -19.48118 deg, RA(J2000)= 11^h48^m49.25^s, Dec(J2000)= -19^d 28' 52.2", with an error radius of 1.7 arcsec (90% confidence).

The optical/IR afterglow was not detected from the ground (Dhillon et al., GCN Circ. 10842, Morgan et al., GCN Circ. 10843). The strongest upper limits are reported by GROND (Nicuesa et al., GCN Circ. 10844).

The prompt emission of GRB 100615A was also detected by the Fermi Gamma-Ray Burst Monitor (Foley and Briggs, GCN Circ. 10851), and by INTEGRAL/SPI-ACS, confirming the multi-peak structure.

2 BAT Observations and Analysis

Using the data set from T-61 s to T+242 s (Palmer et al., GCN Circ. 10850), the BAT ground-calculated position is RA(J2000)= 177.208 deg, Dec(J2000)= -19.483 deg, RA(J2000)= 11^h48^m49.9^s, Dec(J2000)= -19^d 29' 00.0", with an uncertainty of 1.0 arcmin, (radius, sys+stat, 90% containment). The partial coding was 99%.

The mask-weighted light curve (Figure 1) shows 3 slightly overlapping FRED peaks with the first starting at \sim T-0.2 s and peaking at \sim T+2 s. The second peaks at \sim T+10 s. The third peaks at \sim T+30 s and ends at \sim T+120 s. T_{90} (15–350 keV) is 39 ± 2 s (estimated error including systematics).

The time-averaged spectrum from T-0.0 s to T+47.4 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.87 ± 0.04 . The fluence in the 15–150 keV band is $(5.0 \pm 0.1) \times 10^{-6}$ erg cm⁻². The 1-second peak photon flux measured from T+10.26 s in the 15–150 keV band is 5.4 ± 0.2 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/424733/BA/

3 XRT Observations and Analysis

Swift-XRT began observing the field of GRB 100615A at 02:00:06.4 UT, 62.4 seconds after the BAT trigger (D'Elia et al., GCN Circ. 10841, Margutti et al., GCN Circ. 10847).

Using 1489 s of XRT Photon Counting mode data and 2 UVOT images for GRB 100615A, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA(J2000)= 177.20522 deg, Dec(J2000)= -19.48118 deg, RA(J2000)= 11^h48^m49.25^s, Dec(J2000)= -19^d 28' 52.2", with an uncertainty of 1.7 arcsec (radius, 90% confidence).

The 0.3–10 keV light curve (Figure 2) from T+68 s up to \sim T+100 ks can be modelled with an initial power law decay with an index $\alpha_1 = 4.17(+0.23, -0.22)$, followed by a break at T+191 s to an alpha

GCN 285.1230 Jun 2010 of $\alpha_2 = -0.03(+0.23)(-0.25)$. A second break is found at $t+7.1$ ks to a final power law decay with an index $\alpha_3 = -0.87 \pm 0.05$. At later times there are no more observations.

A spectrum formed with the 73s of WT mode data can be fitted with an absorbed power-law with a photon spectral index of $\Gamma = 2.20(+0.16, -0.15)$. The best-fitting absorption column is $N_H = 8.5(+1.1, -1.0) \times 10^{21} \text{ cm}^{-2}$ in excess to the Galactic one in the direction of the source ($N_H = 3.3 \times 10^{20} \text{ cm}^{-2}$ (Kalberla et al. 2005)). The 6.2 ks of PC mode data have a photon index of $\Gamma = 2.39(+0.16, -0.15)$, with a best-fitting absorption column of $N_H = 1.13(+0.13, -0.12) \times 10^{22} \text{ cm}^{-2}$. The counts to observed (unabsorbed) 0.3–10 keV flux conversion factor deduced from the PC spectrum is $5.2 \times 10^{-11} (1.6 \times 10^{-10}) \text{ erg cm}^{-2} \text{ count}^{-1}$.

All the quoted errors are at the 90% confidence level.

4 UVOT Observation and Analysis

The UVOT observed the field of GRB 100615A starting 53 s after the BAT trigger (D’Elia, et al., GCN Circ. 10841).

Settled observations started at 72 s. We do not find any new source, relative to the DSS, USNO-B1.0, or 2MASS at the position of the XRT afterglow (Goad, et al. 2010, GCN Circ. 10848). Preliminary 3-sigma upper limits for detecting a source in the finding charts, and in the co-added images, using a 2.5 arcsecond radius circular aperture, are listed in Table 1. The quoted upper limits have not been corrected for the expected Galactic extinction along the line of sight corresponding to a reddening of $E_{(B-V)} = 0.05 \text{ mag}$ (Schlegel, et al., 1998, ApJS, 500, 525). All photometry is on the UVOT photometry system described in Poole et al. (2008, MNRAS, 383, 627).

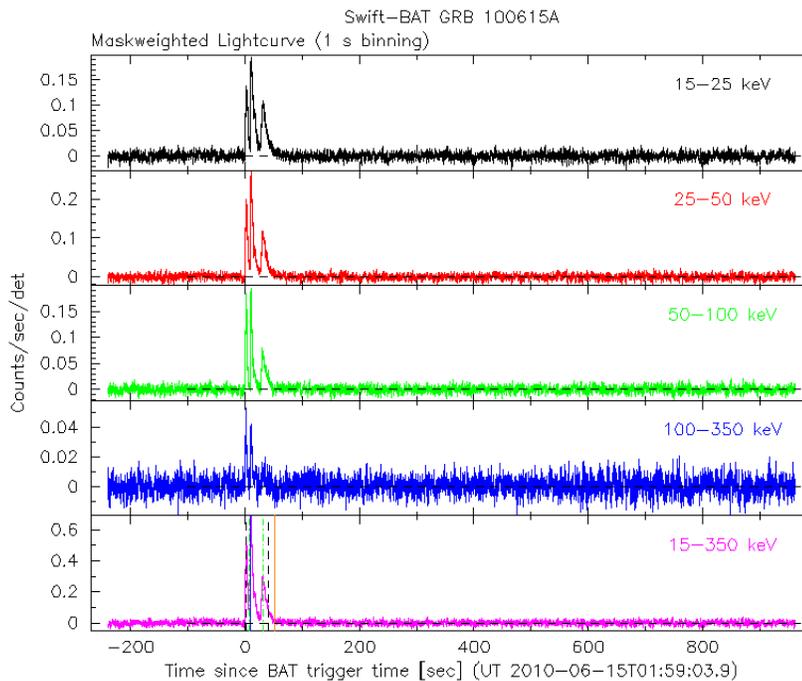


Figure 1: BAT light-curve. The mask-weighted light curve in the 4 individual plus total energy bands. Green dotted line: T_{50} , Black dotted line: T_{90} . Blue: Slew start, Orange: Slew end Time. The units are $\text{counts s}^{-1} \text{ illuminated-detector}^{-1}$ (note illum-det = 0.16 cm^2).

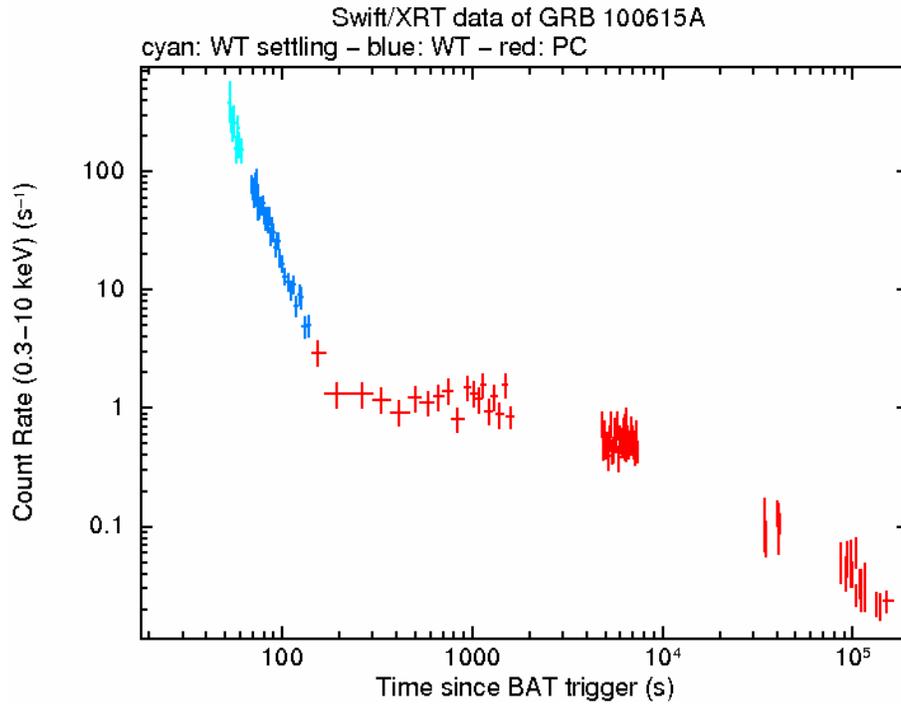


Figure 2: XRT light-curve. Count rates in the 0.3–10 keV band taken in Windowed Timing (WT) and Photon Counting (PC) mode are plotted. The approximate conversion of the 0.3–10 keV observed flux is 1 count/s $\sim 5.2 \times 10^{-11}$ erg cm $^{-2}$ s $^{-1}$.

Filter	T_start (s)	T_stop (s)	Exp (s)	Mag
white (fc)	72	222	147	> 21.5
	864	1014	147	> 21.5
u (fc)	284	534	246	> 20.7
v	613	7037	510	> 20.6
b	539	6422	490	> 21.1
u	284	6216	539	> 21.1
uvw1	663	7436	499	> 21.1
uvm2	813	7242	413	> 20.7
uvw2	589	6832	471	> 21.1
white	72	6627	785	> 22.2

Table 1: 3-sigma upper limits from UVOT observations.