Swift Observations of GRB 120403B

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1 Introduction

The Swift BAT triggered on and located GRB 120403B at 20:33:56 UT (trigger=519256) (D'Elia et al., GCN Circ. 13203). Swift slew to the burst was delayed by 12.9 minutes because of an observing constraint. XRT and UVOT observations of the field started 907.5 and 910 seconds after the trigger, respectively. The best Swift position is the XRT localization at RA(J2000)= 55.27819 deg, Dec(J2000)= -89.00861 deg, RA(J2000)= $03^\text{h}41^\text{m}6.77^\text{s}$, Dec(J2000)= -89^d 00' 31.0", with an error radius of 2.2 arcsec (90% confidence).

The optical afterglow was not detected by UVOT, nor by any ground-based facility.

2 BAT Observations and Analysis

Using the data set from $T-240$ to $T+70$ sec (Stamatikos et al., (GCN Circ. 13207), the BAT ground-calculated position is RA, Dec(J2000) = 54.302, -89.029 deg, which is RA(J2000) = $03^\text{h}37^\text{m}12.6^\text{s}$ Dec(J2000) = $-89^\text{d}01'45.1$" with an uncertainty of 2.4 arcmin, (radius, sys+stat, 90% containment). The partial coding was 47%.

The mask-weighted light curve (Figure 1) shows several overlapping peaks starting at $\sim T-5$ sec and ending at $\sim T+0.10$ sec. T_{90} ($15-350$ keV) is 7.3 ± 1.9 sec (estimated error including systematics).

The time-averaged spectrum from $T-3.0$ to $T+5.3$ sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.79 ± 0.31. The fluence in the $15-150$ keV band is $(2.1 \pm 0.4) \times 10^{-7}$ erg/cm^2. The 1-sec peak photon flux measured from $T-0.92$ sec in the $15-150$ keV band is 0.9 ± 0.2 ph/cm^2/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/519256/BA/

3 XRT Observations and Analysis

Swift-XRT began observing the field of GRB 120403B at 20:49:04.0 UT, 907.5 seconds after the BAT trigger (D'Elia et al., GCN Circ. 13203, Goad et al., GCN Circ. 13205, Littlejohns et al., GCN Circ. 13223).

Using 1035 s of XRT Photon Counting mode data and 1 UVOT image for GRB 120403B, the astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA(J2000)= 55.27819 deg, Dec(J2000)= -89.00861 deg, RA(J2000)= $03^\text{h}41^\text{m}6.77^\text{s}$, Dec(J2000)= -89^d 00' 31.0", with an uncertainty of 2.2 arcsec (radius, 90% confidence).

XRT data for GRB 120403B (Littlejohns et al. GCN Circ. 13223), from 920 s to 8.9 ks after the BAT trigger, are entirely in Photon Counting (PC) mode. The enhanced XRT position for this burst was given by Goad et al. (GCN. Circ. 13205).

Analyzing 4.5 ks of XRT data, the 0.3–10 keV light curve (Figure 2) can be modelled with a power-law decay with a decay index of $\alpha_1 = 0.80^{+0.15}_{-0.14}$.

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon

spectral index of $\Gamma = 2.2 \pm 0.3$ and a best-fitting absorption column of $N_H = 2.2^{+0.9}_{-0.8} \times 10^{21}$ cm^{-2}, in excess of the Galactic value of $N_H = 9.5 \times 10^{20}$ cm^{-2} (Kalberla et al. 2005). The counts to observed (unabsorbed) $0.3 - 10$ keV flux conversion factor deduced from the PC spectrum is 3.5×10^{-11} (5.8×10^{-11}) erg cm^{-2} count^{-1}.

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

4 UVOT Observation and Analysis

The UVOT observed the field of GRB 120403B settling 911 s after the BAT trigger (Breeveld & D'Elia, GCN Circ. 13206).

No optical afterglow consistent with the enhanced XRT position (Goad et al, GCN Circ. 13205) is detected in the initial UVOT exposures. Preliminary 3-sigma upper limits for detecting a source in the finding charts and in the following exposures 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 $E_{(B-V)} = 0.13$ mag (Schlegel, et al., 1998, ApJS, 500, 525). All photometry is on the UVOT photometric system described in Breeveld et al. (2011, AIP Conf. Proc. 1358, 373).
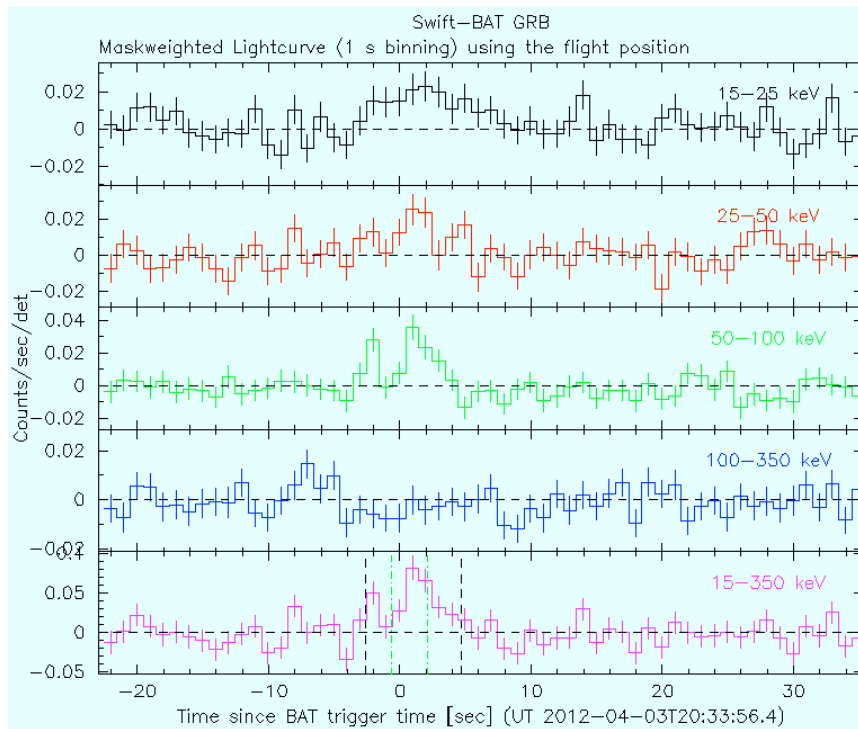

Figure 1: BAT light-curve. The mask-weighted light curve in the 4 individual plus total energy bands. Green dashed line: T_{90}. Black: Slew start. The units are counts s^{-1} illuminated-detector^{-1} (note illum-det = 0.16 cm^2).
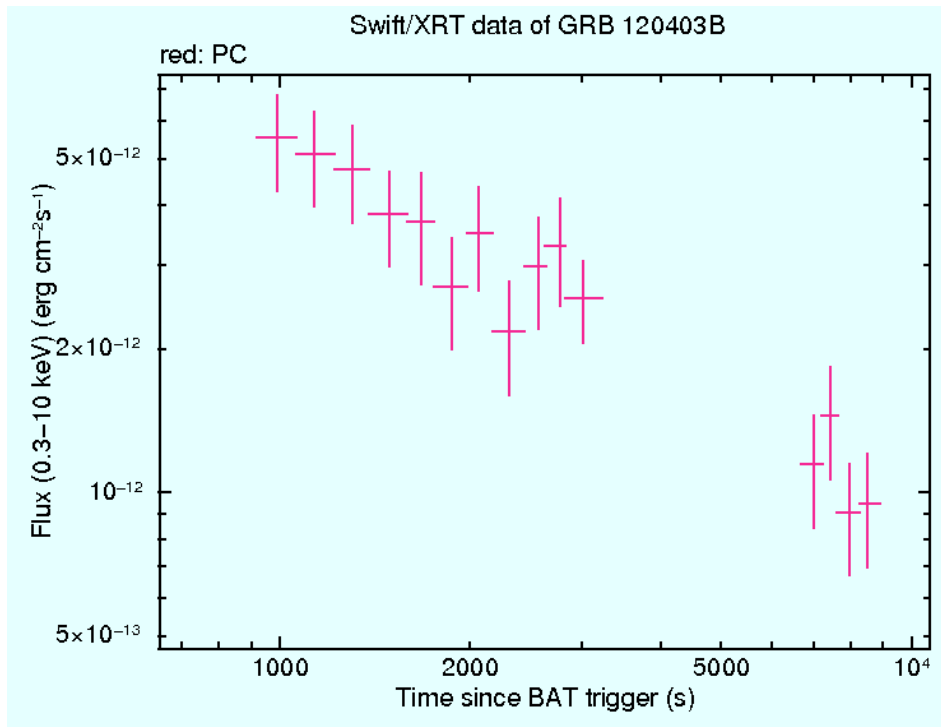
Figure 2: XRT light-curve. Count rates in the 0.3–10 keV band taken in Photon Counting (PC) mode are plotted. The approximate conversion of the 0.3–10 keV observed flux is 1 count/s $\sim 3.5 \times 10^{-11}$ erg cm^{-2} s^{-1}.

Filter	T_start (s)	T_stop (s)	Exp (s)	Mag
white (fc)	911	1061	147	> 21.7
white	1190	7931	568	> 22.0
v	1068	8342	588	> 20.7
b	1166	7726	568	> 21.3
u	1141	12488	404	> 21.1
uvw1	1117	9020	851	> 21.1
uvm2	1092	8547	568	> 20.8
uvw2	1216	8137	485	> 21.0

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