

Swift Observations of GRB 061006

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1. INTRODUCTION

BAT triggered on GRB 061006 at 16:45:50 UT (Trigger 232585) (Schady, et al., GCN Circ.5699). The BAT light curve showed a large peak about 5 sec long during the preplanned slew immediately preceding the start of the 64-sec image in which the burst was found. BAT did not trigger on the initial spike because Swift was slewing. It imaged and triggered on the longer soft emission following the primary burst. The peak count rate was ~ 5500 counts/sec (15-350keV) at ~ 24 sec before the trigger. $T_{90} = 130 \pm 10$ sec (15-350keV). Swift slewed to this burst immediately and XRT began follow-up observations at T +143 sec, and UVOT at T +140 sec. Our best position is the XRT location RA(J2000) = 07h24m07:33s, Dec(J2000) = -79d11'77" with an error of 2.2 arcsec (90% containment).

2. BAT OBSERVATIONS AND ANALYSIS

Using the data set from T-240 to T+300 s, further analysis of BAT GRB 061006 has been performed by Swift team (Krimm, et al., GCN Circ. 5704). The BAT ground-calculated position is RA(J2000) = 110.998deg (07h23m59.6s), Dec(J2000) = -79.151deg (-79d11'2") ± 1.8 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 73% (33.7 deg off the bore sight).

The mask-weighted light curve (Fig 1) starts at trigger time T-240 sec. This burst began with an intense double spike from T-22.8 to T-22.3 sec, this spike was also seen as a short GRB by RHESSI, KONUS and Suzaku (Hurley, et al., GCN Circ. 5702). This was followed by lower level persistent emission at least until $\sim T+110$ sec. $T_{90}(15-350\text{keV})$ is 130 ± 10 (estimated error including systematics). The peak count rate was ~ 5500 counts/sec (15-350keV) at ~ 24 sec before the trigger.

The time-averaged spectrum from T-23.2 to T+137.7 s is best fitted by a simple power law model. This fit gives a photon index of 1.74 ± 0.17 , ($\text{Chi}^2 = 49.5$ for 57 d.o.f.). For this model the total fluence in the 15-150 keV band is $(1.43 \pm 0.14) \times 10^{-6}$ erg/cm² and the 1-sec peak flux measured from T-23.2 sec including the initial spikes in the 15-150keV band is 5.36 ± 0.22 ph/cm²/sec. All the quoted errors are at the 90% confidence level.

3. XRT OBSERVATIONS AND ANALYSIS

Using the first 22 ks of XRT data of GRB 061006 (Photon Counting mode), the refined XRT position is RA(J2000) = 07h24m07.33s, Dec(J2000) = -79d11'55.77" ± 6 arcsec (90% containment). The position is 1.1 arcsec from the optical afterglow candidate reported by Malesani et al.(GCN Circ. 5718).

The 0.2-10 keV light curve (Fig 2) initially decays with a slope of 2.3, followed by a shallow slope of 0.69 ± 0.05 , beginning at T + 300 s.

The X-ray spectrum can be modeled with an absorbed power-law with spectral indices of 1.7 ± 0.3 . The NH column density is $(1.7 \pm 0.8) \times 10^{21}$ cm⁻². The Galactic value in the direction of the burst is $\text{NH} = 1.33 \times 10^{21}$ cm⁻². The average observed (unabsorbed) flux over 0.2-10keV for this spectrum is 1.4×10^{-12} (1.9×10^{-12}) ergs cm⁻²s⁻¹.

4. UVOT OBSERVATIONS AND ANALYSIS

The UVOT began observing the field of GRB 061006 at 16:47:59 UT, 129 s after the initial BAT trigger (Pandey et al., GCN Circ. 5711). No new source was detected within the XRT error circle in the V (400 s) finding exposure, or in the co-added images in any filter down to 3-sigma magnitude. Upper limits are summarized in Table 1. These upper limits are not corrected for Galactic extinction $E(B-V) = 0.32$.

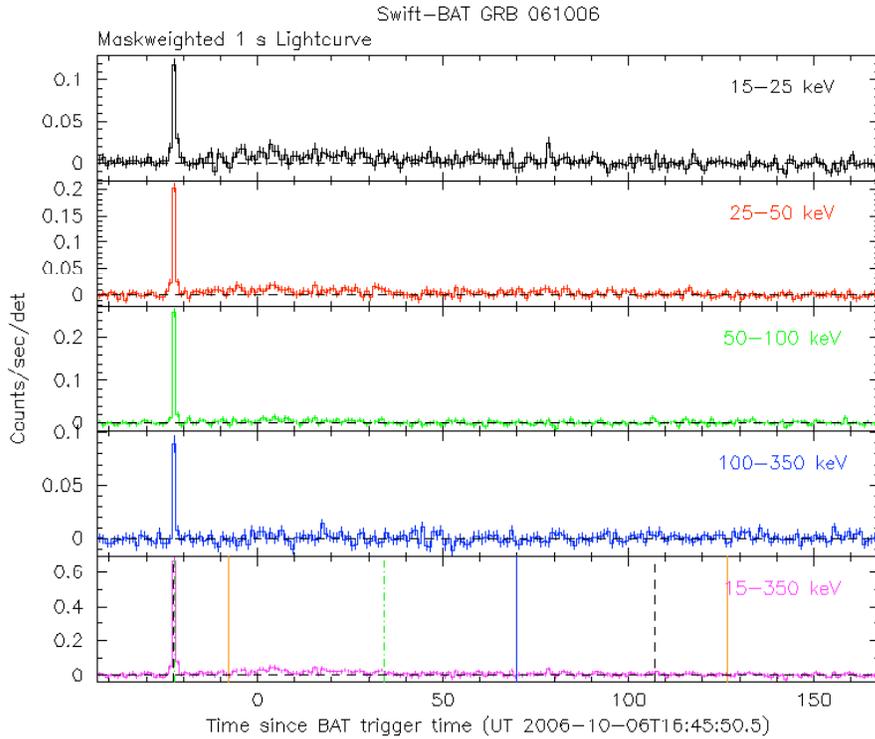


Fig.1: BAT Lightcurve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated_detector (note illum_det = 0.16 cm²) and T_zero 16:45:50 UT. The start and end of Swift slew maneuvers are marked with blue and yellow vertical lines, respectively, and the T90 and T50 times are shown by black and green vertical lines, respect.

GRB061006: PC lightcurve

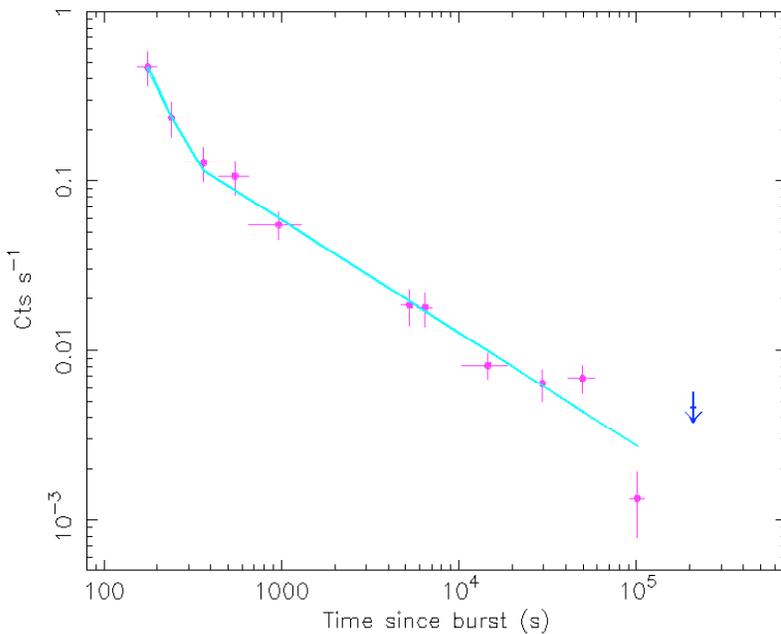


Fig. 2: XRT Lightcurve. Counts/sec in the 0.2-10 keV band Photon Counting mode. The approximate conversion is 1 count/s = $\sim 7.5 \times 10^{-11}$ ergs cm⁻²s⁻¹.

Table 1: UVOT Upper Limits

Filter	T_range (s)	Exposure (s)	3sigma UL
V	129-57685	3016	21.14
B	617-30237	789	21.18
U	593-45827	2534	21.53
UVW1	570-62553	2935	21.68
UVM2	545-58590	4348	21.78
UVW2	633-51898	2203	21.44