

## Swift Observation of GRB 061126

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### 0 Revisions

This version updates the XRT and UVOT paragraph. The XRT paragraph has been updated with informations from the reduction of all data (up to 2000 *ks* after the trigger) for this burst in their final version. XRT position, spectral and temporal information have been modified accordingly with results from this reduction. The UVOT paragraph and light curve have been updated with data from the first 50 *ks* after the trigger, when the source faded below the threshold for detection.

### 1 Introduction

BAT triggered on GRB 061126 at  $T = 08:47:56$  UT (Trigger 240766) (Sbarufatti, *et al.*, *GCN Circ.* 5854). This was a 1.024 s rate-trigger on a long burst with  $T_{90} = 191$  s. Swift slewed to this burst after 23 minutes due to the Earth-limb constraint and XRT began follow-up observations at  $T + 1603$  s, and UVOT at  $T + 1656$  s. Our best position is the UVOT location  $\text{RA}(J2000) = 86.6019\text{deg}$  ( $05\text{h}46\text{m}24.46\text{s}$ ),  $\text{Dec}(J2000) = 64.2107\text{deg}$  ( $+64\text{d}12'38.5''$ ) with an error of 0.5 *arcsec* (68% confidence, including boresight uncertainties).

### 2 BAT Observation and Analysis

Using the data set from  $T - 239$  to  $T + 574$  s, further analysis of BAT GRB 061126 has been performed by Swift team (Krimm, *et al.*, *GCN Circ.* 5860). The BAT ground-calculated position is  $\text{RA}(J2000) = 86.615\text{deg}$  ( $5\text{h}46\text{m}27.6\text{s}$ ),  $\text{Dec}(J2000) = +64.201\text{deg}$  ( $+64\text{d}12'3.0''$ ) with an error of 1.1 *arcmin*, (radius, systematic and statistical, 90% containment). The partial coding was 49%.

The masked-weighted light curves (Fig.1) starts before the trigger time, at  $T - 10\text{s}$  with four main overlapping peaks. The brightest peak occurs at  $T + 7$  s. The last peak ends at  $\sim T + 25$  s with an on-going low level emission out to  $\sim T + 200$  s.  $T_{90}(15 - 350\text{keV})$  is  $191 \pm 10\text{s}$  (estimated error including systematics).

The time-averaged spectrum from  $T - 6.0$  to  $T + 411.0$  s is best fitted by a simple power law model. This fit gives a photon index of  $1.34 \pm 0.08$ , ( $\chi^2 = 0.73$  for 57 d.o.f.). For this model the total fluence in the 15 – 150 *keV* band is  $(7.2 \pm 0.3) \times 10^{-6}\text{ergs/cm}^2$  and the 1-s peak flux measured from  $T + 6.66$  s in the 15 – 150 *keV* band is  $9.8 \pm 0.4\text{ph/cm}^2/\text{s}$ . All the quoted errors are at the 90% confidence level.

### 3 XRT Observations and Analysis

The first 203 s of XRT observations were taken in Windowed Timing (WT) mode. The remainder of the first orbit and the whole second orbit, observed in Photon Counting (PC) mode, were affected by pile-up. The improved XRT position was thus calculated using PC data from the third orbit, unaffected by pile-up. With these data, the refined XRT position is  $\text{RA}(J2000) = 86.6020\text{deg}$  ( $05\text{h}46\text{m}24.5\text{s}$ ),  $\text{Dec}(J2000) = 64.2101\text{deg}$  ( $+64\text{d}12'36.7''$ )  $\pm 3.5\text{arcsec}$  (90% confidence, including boresight uncertainties). This position is within 0.08 *arcsec* from the XRT position given by Sbarufatti *et al.*, *GCN Circ.* 5862.

The  $0.3 - 10$  keV light curve (Fig.2) shows a power-law decay with a slope of  $-1.290_{-0.008}^{+0.008}$  (coherent with the BAT spectrum), from the beginning of the XRT observations up to  $T + 1.76 \times 10^6$  s, the end of Swift observations. The average conversion factor from count-rate to flux in the  $0.3 - 10$  keV energy band is  $2.34 \times 10^{-11}$ .

XRT spectra were extracted separately for the WT (from T+ 1603 s to T+ 1807 s, 203 s exposure) and PC (from T +1807 s to T+ 15280 s, 6063 s exposure) parts of sequence 000 and for the PC data of sequences 001–006 (from T+15280s to T+ 570 ks, 84.5 ks exposure). No spectral evolution was detected. The three spectra can be modeled with an absorbed powerlaw with spectral index  $1.94 \pm 0.05$ . The  $N_{\text{H}}$  column density is  $2.5 \pm 0.2 \times 10^{21} \text{cm}^{-2}$  slightly in excess with respect to the galactic absorption of  $1.0 \times 10^{21} \text{cm}^{-2}$ . The average observed (unabsorbed) fluxes over  $0.3 - 10$  keV for these spectra are:

- $2.2 \times 10^{-10} (3.3 \times 10^{-10}) \text{ergs/cm}^2/\text{s}$ , from T+ 1603 s to T+ 1807 s;
- $4.9 \times 10^{-11} (7.1 \times 10^{-11}) \text{ergs/cm}^2/\text{s}$ , from T +1807 s to T+ 15280 s;
- $1.0 \times 10^{-12} (1.5 \times 10^{-12}) \text{ergs/cm}^2/\text{s}$ , from T+15280s to T+ 570 ks.

## 4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 061126 at 09:14:41 on 2006-11-26, 1605 s after the initial BAT trigger (Schady *et al.*, *GCN Circ.* 5861). An optical counterpart is detected in the V, B, U, UVW1 and UVM2 filters, as well as in the White-band filter (160 – 650nm) at a position consistent with that reported by Vanden Berk *et al.*, *GCN Circ.* 5856. We can, therefore, put a photometric upper limit on the redshift of GRB 061126 of  $z \lesssim 1.5$ .

The photometry results for each UVOT filter, from the beginning of the observations up to  $T + 50$  ks are given in Table 1.  $T+$  is the average time of the exposure, in seconds, since the BAT trigger. The source faded below the sensitivity limits of UVOT in all filters, starting from the fourth orbit. The corresponding upper limits ( $3\sigma$ ) are given (see Fig. 3).

The quoted errors do not include the 0.1 mag systematic uncertainty in the photometric zero points. These values are not corrected for the expected Galactic extinction of  $E_{\text{B-V}} = 0.18$  mag (Schlegel *et al.* 1998).

Filter	T+ (s)	Exp (s)	Magnitude
V	1872	68	19.27±0.63
V	2386	39	19.22±0.83
V	2623	19	18.43±0.59
V	3423	196	19.72±0.22
V	8723	59	20.56±0.72
V	9178	295	19.86±0.78
V	43761	1186	> 20.01
B	1850	39	19.55±0.49
B	2166	39	19.64±0.49
B	2482	39	19.09±0.32
B	2809	197	19.75±0.24
B	7907	197	21.04±0.75
B	42952	1186	> 21.29
U	1746	19	18.33±0.35
U	1904	19	19.48±0.85
U	2062	19	18.49±0.42
U	2220	19	18.73±0.47
U	2378	19	19.00±0.54
U	2536	19	19.17±0.66
U	2694	19	18.60±0.44
U	7702	197	19.54±0.27
U	15180	405	20.34±0.80
U	28111	361	20.66±0.52
U	48578	826	21.33±0.61
UVW1	1802	39	19.28±0.80
UVW1	2355	97	> 18.78
UVW1	5665	280	19.34±0.37
UVW1	14515	886	> 21.26
UVW1	42531	2374	> 20.77
UVM2	1935	39	19.56±0.70
UVM2	2251	39	18.85±0.54
UVM2	3103	236	19.98±0.59
UVM2	11695	1149	> 20.50
UVM2	44049	3386	> 20.89
UVW2	5108	510	> 20.18
UVW2	43319	4752	> 21.48
White	1655	98	18.50±0.11
White	1789	10	18.16±0.29
White	1947	10	18.56±0.40
White	2105	10	18.79±0.46
White	2263	10	19.32±0.72
White	2421	10	19.07±0.57
White	2579	10	19.38±0.77
White	3013	197	18.87±0.12
White	8111	197	19.72±0.22

Table 1: Magnitude values from UVOT observations.

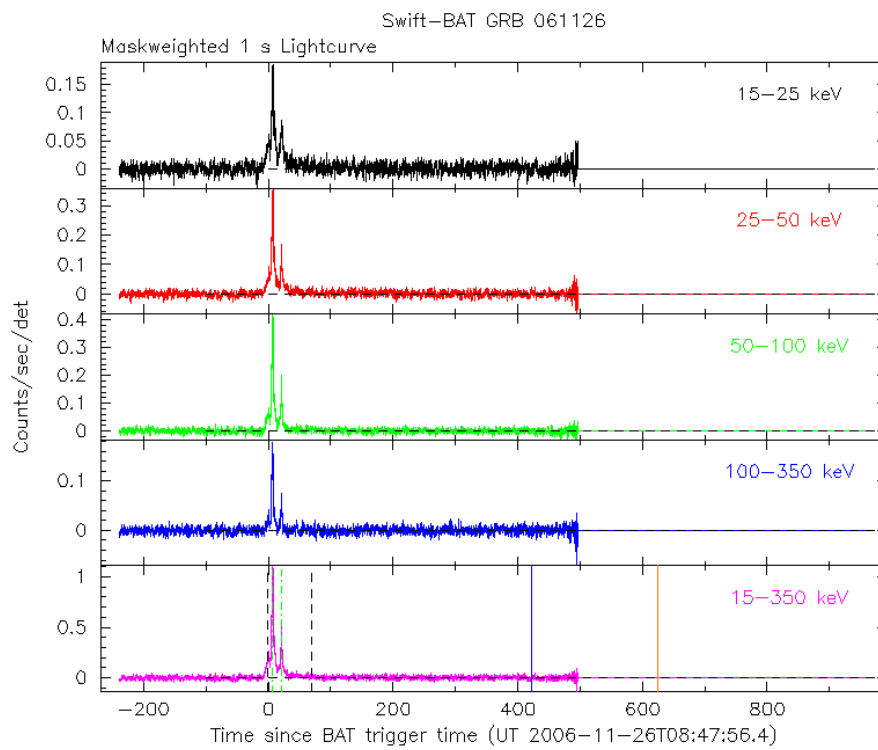


Figure 1: BAT Lightcurve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/s/illuminated-detector and  $T_0$  is 08:47:56.4 UT. Green dot-dash line:  $T_{50}$ , Black dashed line:  $T_{90}$ , Blue: Slew start, Orange: Slew end. Time of each bin is in the middle of the bin.

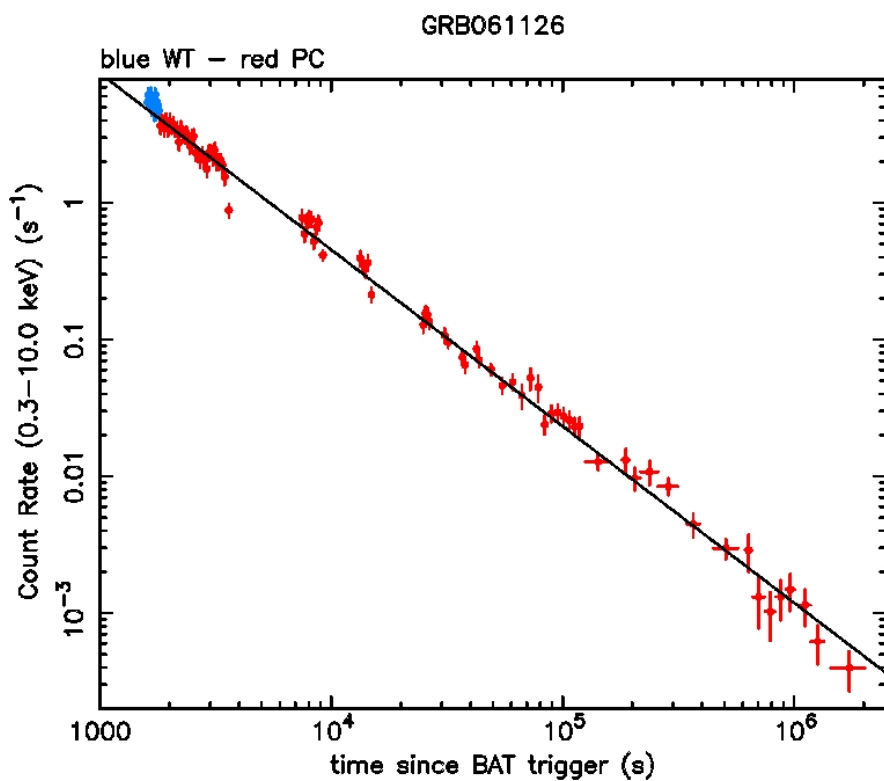


Figure 2: XRT Lightcurve. Count Rate (*counts/s*) in the 0.3-10 keV band: Window Timing mode (blue), Photon Counting mode (red). The conversion factor from count rate to flux is 1 count/s =  $\sim 2.34 \times 10^{-11}$  *ergs/cm<sup>2</sup>/s*.

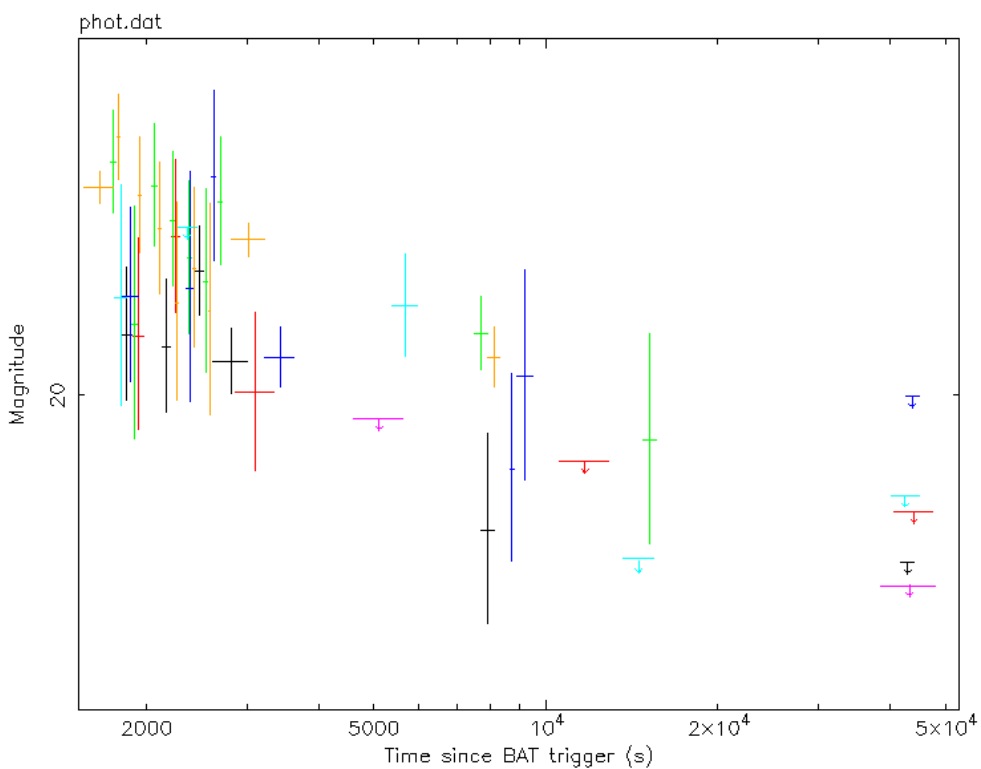


Figure 3: UVOT Lightcurve, using data from all 7 filters; White (orange), V (navy blue), B (black), U (green), UVW1 (cyan), UVM2 (red), UVW2 (magenta).