Swift Observations of GRB 081126

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1   Introduction

BAT triggered on GRB 081126 at 21:34:10 UT (Trigger 335647) (Margutti *et al.*, *GCN Circ.* 8554). This was a 1.024-s rate-trigger on a long burst. XRT observations began at $T + 65.7$ s and discovered the fading X-ray afterglow. UVOT began observing at $T + 75$ s and found the optical counterpart of 18.8 ± 0.1 mag (white band). A number of robotic, ground based telescopes promptly detected it: e.g., TAROT (Gendre *et al.*, *GCN Circ.* 8555); Z-600 telescope (Andreev *et al.*, *GCN Circ.* 8558); GRT (Sakamoto *et al.*, *GCN Circ.* 8568); Crni Vrh (Skvarc *et al.*, *GCN Circ.* 8569). Our best position is that given by UVOT (Holland *et al.*, *GCN Circ.* 8564) at RA(J2000)= 323.51496 deg ($21^{\mathrm{h}}34^{\mathrm{m}}03.59^{\mathrm{s}}$), Dec(J2000)= $+48.71064$ deg ($+48^{\mathrm{d}}42'38.3''$), with an estimated uncertainty of 0.5 arcsec (radius, 90% confidence).

GRB 081126 was also detected by Konus-Wind (Golenetskii *et al.*, *GCN Circ.* 8562); by Fermi-GBM (Bhat *et al.*, *GCN Circ.* 8589) and by SPI-ACS/*INTEGRAL* (Volodymyr Savchenko, private comm.). A VLA Radio upper limit of 24 ± 64 uJy at a frequency of 8.46 GHz was provided by Chandra *et al.*, (*GCN Circ.* 8587) 1.7 h after the trigger.

2   BAT Observations and Analysis

Using the data set from $T - 120$ to $T + 183$ s, the BAT ground-calculated position is RA(J2000) = 323.526 deg ($21^{\mathrm{h}}34^{\mathrm{m}}06.3^{\mathrm{s}}$), Dec(J2000)= $+48.714$ deg ($+48^{\mathrm{d}}42'51.0''$) with an uncertainty of 1.0 arcmin (radius, sys+stat, 90% containment). The partial coding was 67%.

The mask-weighted light curve shows a small peak starting at $\sim T - 30$ s, peaking at $\sim T - 18$ s, and returning almost to zero at $T - 7$ s, at which time the second peak starts to rise. It peaks at $\sim T + 1.5$ s and reaches a maximum at $\sim T + 7$ s. The third one peaks at $\sim T + 31.5$ s and ends at $\sim T + 100$ s (see Fig. 1). T_{90} (15–350 keV) is 54 ± 4 s (estimated error including systematics).

The time-averaged spectrum from $T - 21.4$ to $T + 45.9$ s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.27 ± 0.06. The fluence in the 15–150 keV band is $(3.3 \pm 0.1) \times 10^{-6}$ erg cm^{-2}. The 1–s peak photon flux measured from $T + 0.75$ s in the 15–150 keV band is 3.7 ± 0.2 ph cm^{-2} s^{-1}. All the quoted errors are at the 90% confidence level (Sato *et al.*, *GCN Circ.* 8557).

The results of the batgrbproduct analysis are available at
`http://gcn.gsfc.nasa.gov/notices_s/335647/BA/`.

3   XRT Observations and Analysis

The XRT began observing GRB 081126 in Windowed Timing mode, 65.7 s after the BAT trigger. Using 2 ks of overlapping XRT and UVOT data, the UVOT-enhanced XRT position was found to be RA(J2000)= 323.5147 deg ($21^{\mathrm{h}}34^{\mathrm{m}}03.54^{\mathrm{s}}$), Dec(J2000)= $+48.7098$ deg ($+48^{\mathrm{d}}42'35.2''$), with an uncertainty of 1.8 arcsec (radius, 90% confidence); (Osborne *et al.*, *GCN Circ.* 8556).

The light curve (Fig. 2), totalling 67 ks exposure and spanning from 65.7 to 5×10^5 s, can be modelled with a double broken power law with the following best-fitting parameters: $\alpha_{x1} = 1.24 \pm 0.15$, $t_{b1} =$

197^{+117}_{-30} s, $\alpha_{x2} = 0.57^{+0.04}_{-0.07}$, $t_{b2} = 6.9^{+0.8}_{-0.4}$ ks, $\alpha_{x3} = 1.57 \pm 0.10$ with $\chi^2/\text{dof} = 148/90$. The high value of the χ^2 could be due to the presence of small time scale variability in addition to the smooth double power law behaviour.

The WT mode spectrum spanning from 65.7 to 160 s can be fit by an absorbed power-law model, with a photon index of 1.9 ± 0.2. The PC mode spectrum extracted in the time interval 3 to 30 ks can be modelled with an absorbed power-law, with a photon index of 2.0 ± 0.1 and a column density of $(5.0 \pm 0.7) \times 10^{21}$ cm^{-2}, which is compatible with the average Galactic column density in this direction of 4.1×10^{21} cm^{-2}. For both spectra there is no strong evidence for intrinsic neutral hydrogen column density. The corresponding observed (unabsorbed) 0.3–10 keV flux is 7.1×10^{-12} (1.2×10^{-11}) erg cm^{-2} s^{-1} Uncertainties are given at 90% confidence, (Margutti *et al.*, *GCN Circ.* 8561).

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 Observations and Analysis

The UVOT observed the field of GRB 081126 starting at 75 s after the BAT trigger. The afterglow is detected in the UVOT u,v and b bands at the position RA(J2000)= 323.51496 deg ($21^h34^m03.59^s$), Dec(J2000)= +48.71064 deg ($+48^d42'38.3''$), with an estimated uncertainty of 0.5 arcsec (radius, 90% confidence). This is consistent with the position reported by Andreev *et al.*, *GCN Circ.* 8558. The detection in the u filter, combined with the lack of detections in the UV filters, is consistent with the afterglow having a redshift of approximately 2.4 < z < 3.8. However, this result is uncertain due to the large Galactic reddening along the line of sight to this source (Holland *et al.*, *GCN Circ.* 8564). Table 1 reports UVOT photometry from early individual images.

Filter	T_{mid} (s)	Exposure (s)	Mag
white	500	147	18.82 ± 0.09
u	355	127	18.17 ± 0.13
v	5260	197	19.29 ± 0.32
b	4646	197	20.20 ± 0.38
u	5877	197	> 20.4
uvw1	5671	197	> 20.0
uvm2	5466	197	> 19.6
uvw2	5056	197	> 20.
white	4851	197	20.33 ± 0.21

Table 1: Magnitudes from UVOT observations.

These magnitudes are not corrected for the Galactic extinction corresponding to a reddening of $E_{B-V} = 0.78$ mag (Schlegel *et al.*, 1998). The photometry is on the UVOT flight system described in Poole *et al.* (2008, MNRAS, 383, 627).
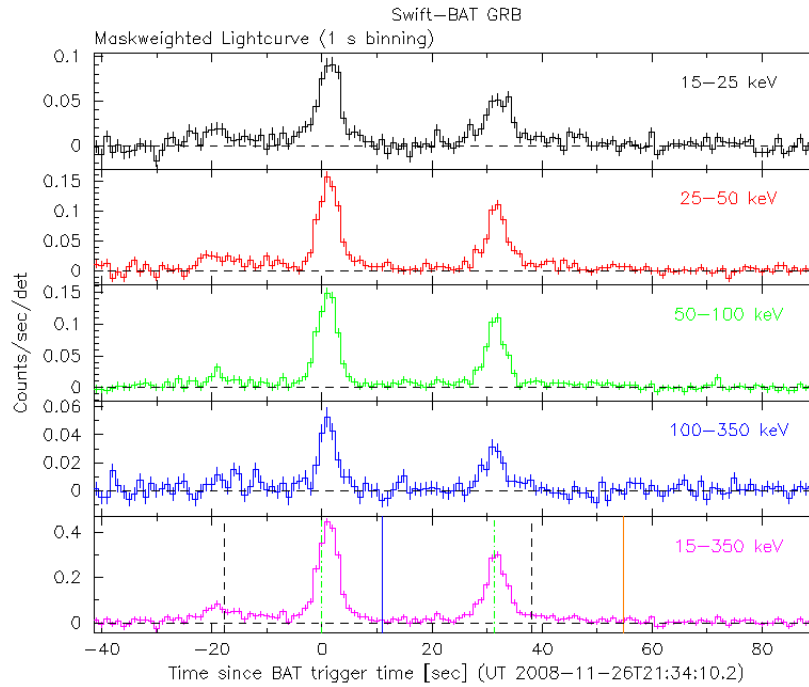
Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/s/illuminated-detector (note illum-det = 0.16 cm^2) and T_0 is 21:34:10 UT.
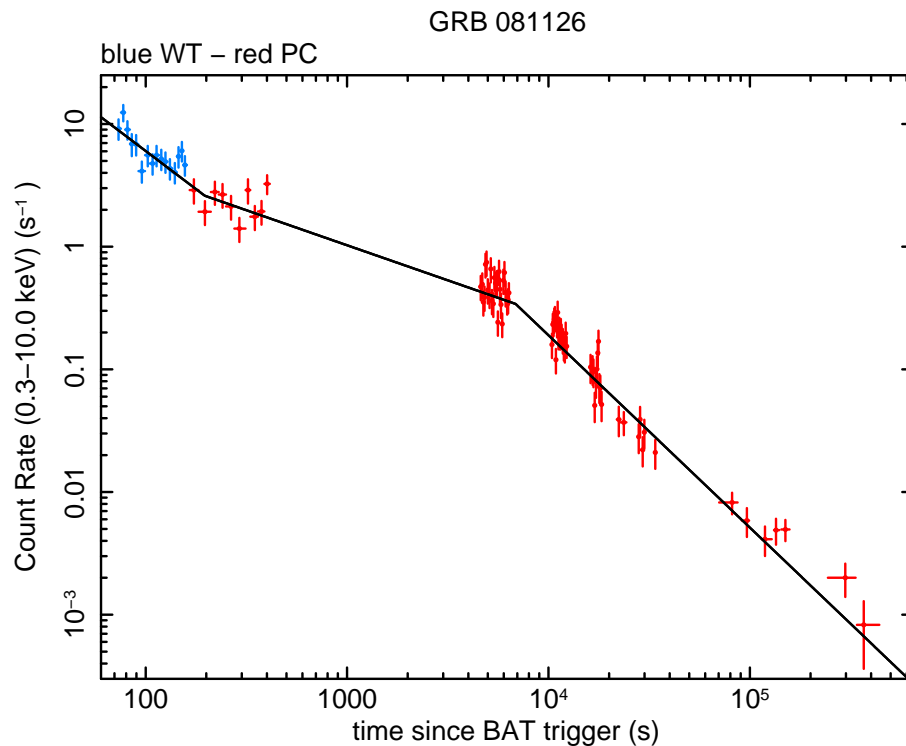

Figure 2: XRT Lightcurve. Flux in the 0.3-10 keV band: Windowed Timing (blue) and Photon Counting (red) modes. The approximate conversion is 1 count/s $\sim 5.2 \times 10^{-11}$ erg cm^{-2} s^{-1}.