Swift Observations of GRB 081118

E. A. Hoversten (PSU), L. Vetere (PSU), D. Palmer (LANL), S. D. Barthelmy (GSFC), D. N. Burrows (PSU), P. Roming (PSU), & N. Gehrels (GSFC) for the Swift Team

1 Introduction

BAT triggered on GRB 081118 at 14:56:36.7 UT (Trigger 334877: Hoversten, et al., *GCN Circ.* 8524). This was an image trigger with $T_{90} = 67$ s. Swift slewed to this burst immediately and XRT began follow-up observations at $T+153.3$ s, and UVOT at $T+164$ s. Our best position is the enhanced XRT location RA($J2000$) = 82.5928 deg ($05h30m22.28s$), Dec($J2000$) = -43.3009 deg ($-43d18'03.1''$) with an uncertainty of 2.0 arcsec (radius, 90% confidence, including boresight uncertainties). An optical afterglow was detected by both GROND (Loew, et al. *GCN Circ.* 8529) and ESO-VLT (D'Avanzo, et al. *GCN Circ.* 8528). The observed redshift from ESO-VLT is $z = 2.58$ (D'Elia, et al., *GCN Circ.* 8531).

2 BAT Observation and Analysis

Using the data set from $T-239$ to $T+963$ s further analysis of BAT GRB 081118 has been performed by the Swift team (Palmer, et al., *GCN Circ.* 8526). The BAT ground-calculated position is RA($J2000$) = 82.572 deg ($05h30m17.3s$), Dec($J2000$) = -43.305 deg ($-43d18'16.2''$) with an uncertainty of 1.6 arcmin (radius, systematic and statistical, 90% containment). The partial coding was 61%.

The masked-weighted light curves (Fig.1) start at trigger time T and show a roughly symmetrical peak starting at $\sim T + 10$ s, peaking at $\sim T + 25$ s, and ending at $\sim T + 105$ s. $T_{90}(15 - 350keV)$ is 67 ± 27 s (error estimate includes systematics).

The time-averaged spectrum from $T + 19.6$ to $T + 118.6$ s is best fitted by a simple power law model. This fit gives a power law index of 2.10 ± 0.16. For this model the total fluence in the $15-150$ keV band is $(1.2 \pm 0.1) \times 10^{-6}$ erg cm^{-2} and the 1-sec peak flux measured from $T + 46.97$ s in the $15 - 150$ keV band is 0.6 ± 0.2 photon cm^{-2}s^{-1}. All quoted errors are at the 90% confidence level.

3 XRT Observations and Analysis

The UVOT-enhanced XRT position of GRB 081118 is RA($J2000$) = 82.5928 deg ($05h30m22.28s$), Dec($J2000$) = -43.3009 deg ($-43d18'03.1''$) with an uncertainty of 2.0 arcsec (radius, 90% confidence, including boresight uncertainties). This position is within 1.3 arcsec of the initial XRT position, and 2.3 arcsec from the optical afterglow candidate, reported by D'Avanzo, et al., *GCN Circ.* 8528.

The $0.3 - 10$ keV light curve (Fig.2) can be modelled with a broken powerlaw with an initial rapid decay with a slope of 4.8 ± 1.0, a break time of 580 s, followed by a shallower decay with slope of 0.58 ± 0.06 which continues to the end of *Swift* observations.

The spectrum of the WT data can be well fit by an absorbed powerlaw with a photon index of 2.6 ± 0.3 and an absorbing equivalent hydrogen column density consistent with the Galactic value in the GRB direction (3.7×10^{20} cm^{-2}; Kalberla, et al. 2005). The observed (unabsorbed) 0.3-10 keV flux is 1.79 (2.28) $\times 10^{-10}$ erg cm^{-2} s^{-1}.

The PC spectrum (T+250 s to T+19 ks) is best fit by a photon index of 2.5 ± 0.3 and an absorbing equivalent hydrogen column density consistent with the Galactic value in the GRB direction (3.7×10^{20} cm^{-2}; Kalberla, et al. 2005). The observed (unabsorbed) 0.3-10 keV flux over this interval is 7.6 (9.4) $\times 10^{-13}$ erg cm^{-2} s^{-1}.

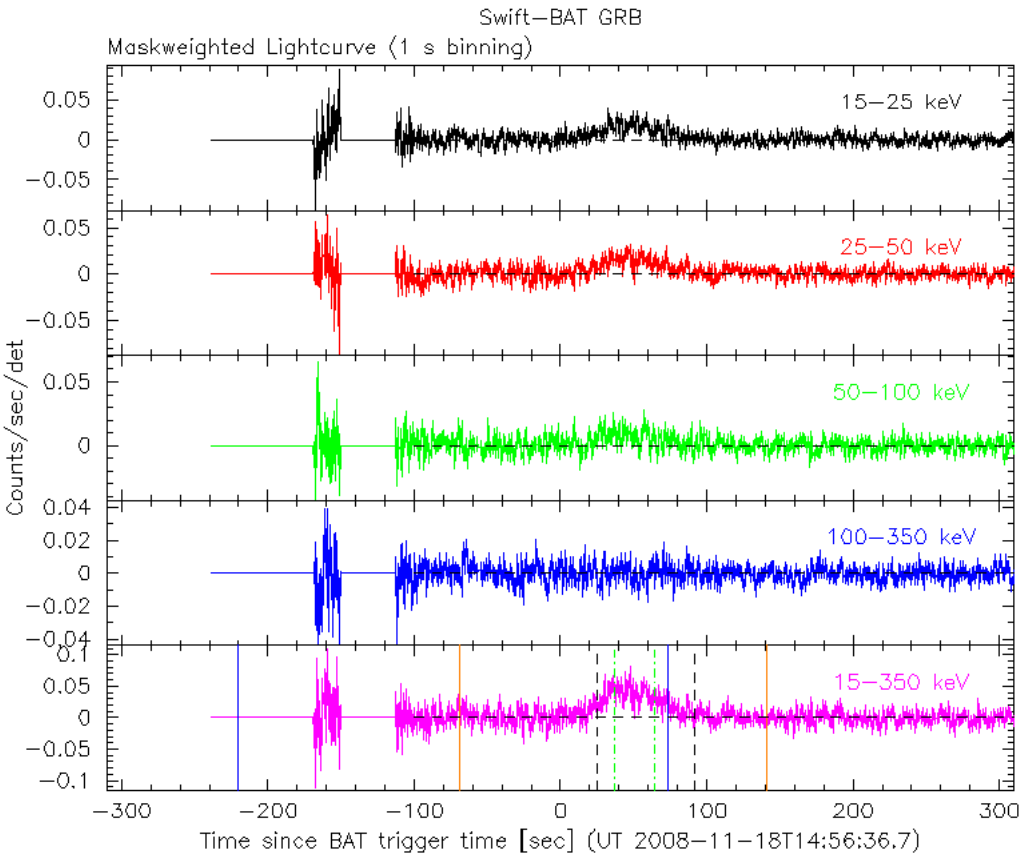

Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 14:56:36.7 UT.

4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 081118 150 seconds after the initial BAT trigger (Hoversten, *GCN Circ.* 8527). No new source was detected within the XRT error circle in the white (150 s) or in the co-added images in any filter down to 3-sigma magnitude. Upper limits are summarized in Table 1. Photometry is on the UVOT photometric system (Poole, et al. 2008). These upper limits are not corrected for the Galactic extinction of E(B-V) = 0.04 (Schlegel, Finkbeiner, & Davis, 1998).

References

[1] D'Avanzo, P., et al. 2008, *GCN Circ.* 8528

[2] D'Elia, V., et al. 2008, *GCN Circ.* 8531

[3] Evans, P. A., et al. 2008, *GCN Circ.* 8525

[4] Loew, S., et al. 2008, *GCN Circ.* 8529

[5] Hoversten, E. A., et al. 2008, *GCN Circ.* 8524

[6] Hoversten, E. A. 2008, *GCN Circ.* 8527

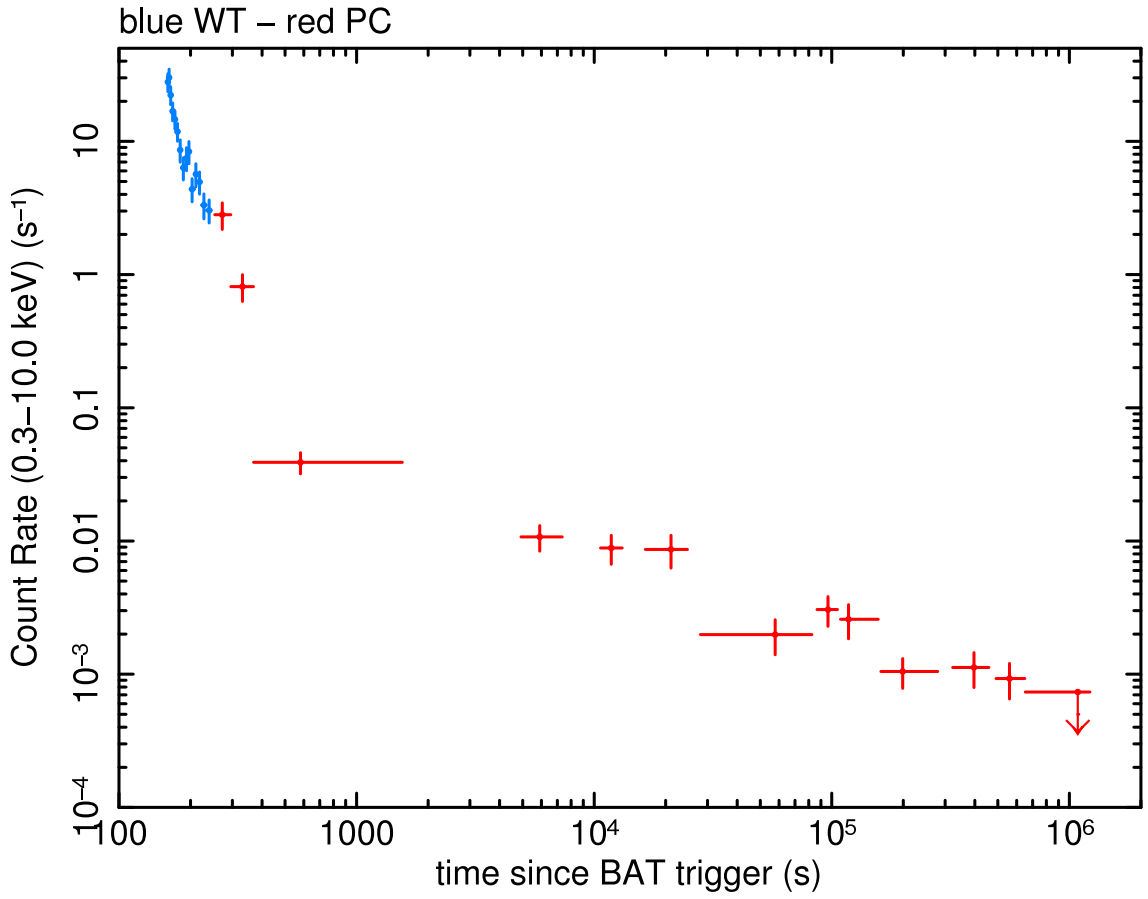

Figure 2: XRT Lightcurve. Counts s^{-1} in the 0.3-10 keV band: Window Timing mode (blue), Photon Counting mode (red). The approximate conversion is 1 count s^{-1} = $\sim 3.0 \times 10^{-11}$ erg cm^{-2} s^{-1}.

[7] Kalberla, P. M. W., et al. 2005, *A.& A.*, 440, 775

[8] Palmer, D., et al. 2008, *GCN Circ.* 8526

[9] Poole, T. S., et al. 2008, *MNRAS*, 383, 627

[10] Schlegel, D. J., Finkbeiner, D. P., & Davis, M. 1998, *ApJ.*, 500, 525

[11] Vetere, L. & Hoversten, E. 2008, *GCN Circ.* 8530

Filter	Start	Stop	Exposure	3-Sigma UL
WHITE (finding)	150	300	147	> 21.32
WHITE (finding)	854	1004	147	> 21.29
v	6137	6337	196	> 19.79
b	5522	5721	196	> 20.82
u	5316	5515	196	> 20.49
uvw1	5111	5310	196	> 20.26
uvm2	4905	5105	196	> 19.88
uvw2	5933	6132	196	> 20.24
WHITE	150	143588	16984	> 23.77
v	306	29819	2112	> 21.18
b	404	36254	1479	> 21.50
u	380	1041128	27613	> 23.28
uvw1	355	596888	21172	> 23.04
uvm2	331	1219790	33469	> 23.17
uvw2	455	1128188	19326	> 23.16

Table 1: Magnitude limits from UVOT observations