

Swift Observation of GRB 061222B

J. L. Racusin (PSU), S. B. Pandey (UCL-MSSL), S. R. Oates (UCL-MSSL), J. Cummings (GSFC/UMBC), S.D. Barthelmy (GSFC), D.N. Burrows (PSU), P. Roming (PSU), and N. Gehrels (GSFC) for the Swift Team

1 Introduction

BAT triggered on GRB 061222B at 04:11:02 UT (Trigger 252593) (Racusin, *et al.*, *GCN Circ.* 5957). This was a $S/N = 10.8$ image-trigger on an intermediate length burst with $T_{90} = 40 \pm 5$ sec. Swift slewed to this burst immediately and XRT began follow-up observations at $T + 145$ sec, and UVOT at $T + 136$ sec. Our best position is the XRT location $RA(J2000) = 105.35321deg$ ($7h01m24.77s$), $Dec(J2000) = -25.8594deg$ ($-25d51'33.9''$) with an error of 3.7 arcsec (90% confidence).

2 BAT Observation and Analysis

Using the data set from $T - 239.0$ to $T + 903.1$ sec, further analysis of BAT GRB 061222B has been performed by the Swift team (Barbier *et al.*, *GCN Circ.* 5974). The BAT ground-calculated position is $RA(J2000) = 105.352deg$ ($7h1m24.6s$), $Dec(J2000) = -25.865deg$ ($-25d51'55.6''$) with a 1.2 arcmin error radius (systematic and statistical, 90% containment). The partial coding was 15%.

The masked-weighted light curves (Fig.1) start at trigger time $T - 250$ sec with a single gradual peak with several sub peaks, and returns to background at about $T + 300$ sec. $T_{90}(15 - 350keV)$ is 40 ± 5 (estimated error including systematics).

The time-averaged spectrum from $T + 35.1$ to $T + 84.3$ is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.98 ± 0.13 . The fluence in the 15 – 150 keV band is $2.2 \pm 0.2 \times 10^{-06} ergs/cm^2$. The 1-sec peak photon flux measured from $T + 59.16$ sec in the 15 – 150 keV band is $1.5 \pm 0.4 ph/cm^2/sec$. All the quoted errors are at the 90% confidence level.

3 XRT Observations and Analysis

Using the first two orbits of XRT data on GRB 061222B (906 sec in Photon Counting mode), the refined XRT position is $RA(J2000) = 105.35321(7h01m24.77s)$, $Dec(J2000) = -25.8594$ ($-25d51'33.9''$) with a 3.7 arcsec error radius (90% confidence). This position is within 1.8 arcsec of the initial XRT position, and 3.1 arcsec from the optical afterglow candidate reported by Berger *et al.*, *GCN Circ.* 5956.

The 0.3 – 10 keV light curve (Fig.2) shows an initial steep decline with a slope of 3.26 ± 0.1 , followed by a shallower slope of 1.33 ± 0.08 , beginning at $T + 443 \pm 28$ sec.

The X-ray spectrum from the WT data covering the time period from $T + 145s$ to $T + 264s$ is well fit by an absorbed power-law with a spectral index of 2.6 ± 0.2 and column density of $(4.0 \pm 0.6) \times 10^{21} cm^{-2}$. We note the Galactic column density in the direction of the source is $2.7 \times 10^{20} cm^{-2}$. The average observed (unabsorbed) 0.3 – 10 keV flux for this spectrum is $8.7 \times 10^{-10} ergs/cm^2/sec$.

4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 061222B at 04:13:18 UT, 136 sec after the initial BAT trigger (Racusin *et al.*, *GCN Circ.* 5957). We do not detect the afterglow candidate reported in *GCN Circ.* 5956 in our V band exposures. This is in agreement with the observed redshift of $z = 3.355$

(GCN Circ. 5962) for the burst. Upper limits are summarized in Table 1. These upper limits are not corrected for Galactic extinction $E(B - V) = 0.38$.

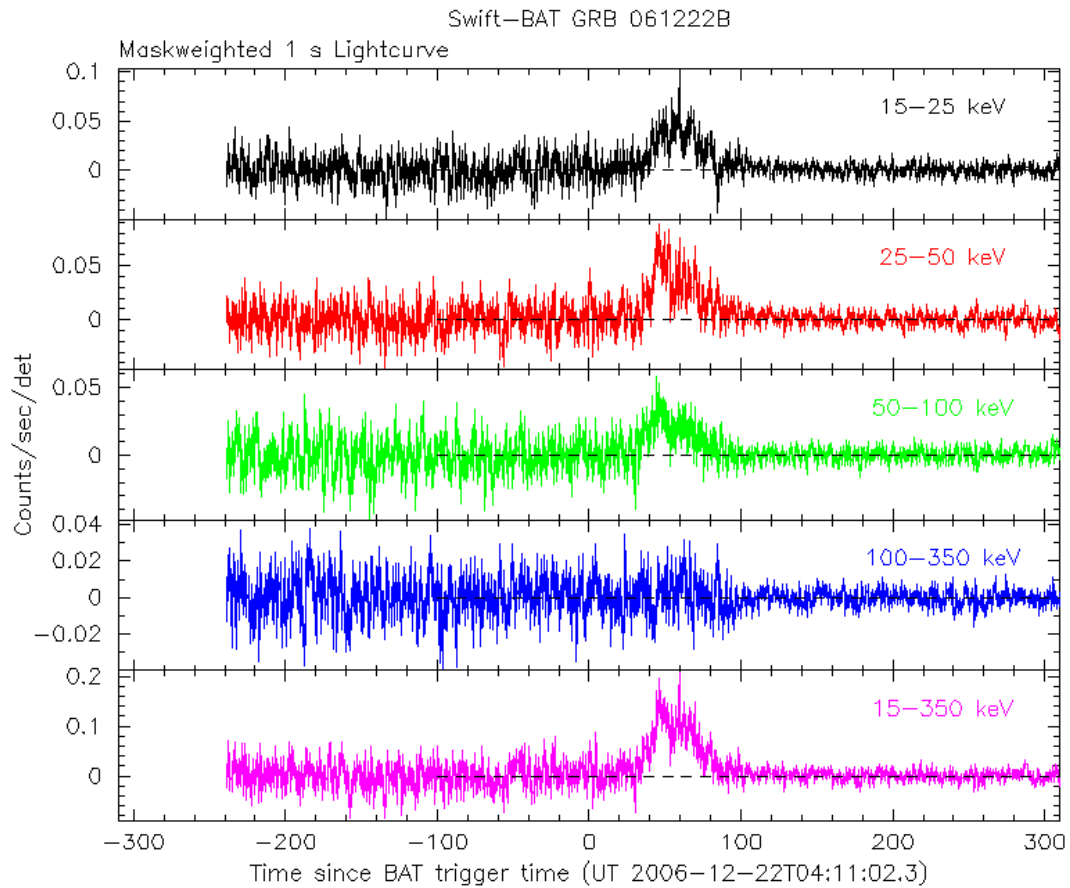


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 04:11:02 UT.

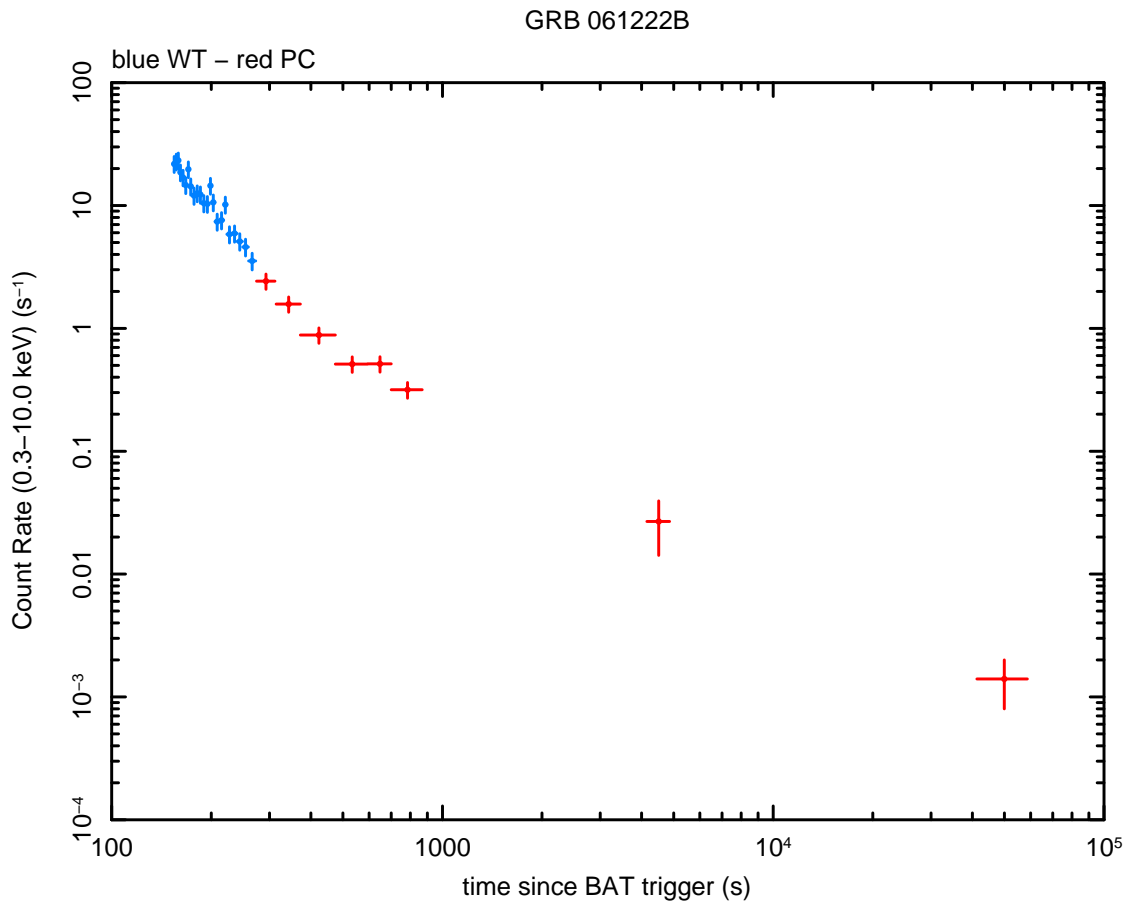


Figure 2: XRT Lightcurve. Counts/sec in the 0.3-10 keV band: Windowed Timing mode (blue), Photon Counting mode (red). The approximate conversion is $1 \text{ count/sec} = \sim 4 \times 10^{-11} \text{ ergs/cm}^2/\text{sec}$.

| Filter | Start | Stop | Exposure | 3-Sigma UL |
|--------------|-------|------|----------|------------|
| V (settling) | 136 | 145 | 9 | 17.29 |
| V (finding) | 146 | 546 | 393 | 19.77 |
| V | 136 | 890 | 475 | 19.86 |
| B | 624 | 4884 | 141 | 20.29 |
| U | 600 | 4755 | 235 | 19.98 |
| UVW1 | 576 | 4551 | 255 | 19.76 |
| UVM2 | 552 | 4346 | 255 | 19.96 |
| UVW2 | 640 | 794 | 38 | 18.64 |

Table 1: Magnitude limits from UVOT observations