

## Swift Observations of GRB 100814A

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### 1 Introduction

BAT triggered on GRB 100814A at 03:50:11.3 UT (Trigger 431605) (Beardmore, *et al.*, *GCN Circ.* 11087). This was a 1.024 sec rate-trigger on a intermediate length burst with  $T_{90} = 174.72$  sec. Swift slewed to this burst immediately and XRT began follow-up observations at  $T + 87.4$  sec, and UVOT began settled exposures at  $T + 126$  sec. Our best position is the UVOT location  $RA(J2000) = 22.47338deg$  (01h29m53.61s),  $Dec(J2000) = -17.99545deg$  ( $-17d59'43.6''$ ) with an error of 0.6 arcsec (90% confidence, including boresight uncertainties).

### 2 BAT Observation and Analysis

Using the data set from  $T - 239$  to  $T + 963$  sec, further analysis of BAT GRB 100814A has been performed by Swift team (Krimm, *et al.*, *GCN Circ.* 11094). The BAT ground-calculated position is  $RA(J2000) = 22.479deg$  (01h29m55.0s),  $Dec(J2000) = -17.990deg$  ( $-17d59'25.7''$ )  $\pm 1.0$  arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 90%

The masked-weighted light curves (Fig.1) shows 3 FRED-like spikes starting around  $T - 4$ ,  $T + 60$  and  $T + 140$  seconds. These spikes peak around  $T + 5$  sec,  $T + 70$  sec and  $T + 145$  sec. The flux returns to background at about  $T + 235$  sec.  $T_{90}(15 - 350keV)$  is  $174.5 \pm 9.4$  (estimated error including systematics).

The time-averaged spectrum from  $T - 3$  to  $T + 235$  s is best fitted by a simple power law model. This fit gives a photon index of  $1.47 \pm 0.04$ , ( $\chi^2 = 32.91$  for 57 d.o.f.). For this model the total fluence in the 15 – 150 keV band is  $(9.0 \pm 0.2) \times 10^{-6} ergs/cm^2$  and the 1-sec peak flux measured from  $T - 0.06$  s in the 15 – 150 keV band is  $2.5 \pm 0.2 ph/cm^2/sec$ . All the quoted errors are at the 90% confidence level.

### 3 XRT Observations and Analysis

The refined XRT position of GRB 100814A, obtained by 5.03 ksec in Photon Counting mode) is  $RA(J2000) = 22.47308deg$  (01h29m53.54s),  $Dec(J2000) = -17.99503 deg$  ( $-17d59'42.1''$ )  $\pm 1.5$  arcsec (90% confidence, including boresight uncertainties). This position is within 6 arcsec of the initial XRT position, and 1.5 arcsec from the optical afterglow candidate, reported by Beardmore *et al.*, *GCN Circ.* 11087.

The X-ray light curve (Fig.2) initially rises by a factor of 2 in count rate, reaching a broad peak at approximately  $T + 160$  sec after the trigger, on top of which are superimposed three small flares at  $T + 146$ , 176 and 220 sec, respectively. At  $T + 295$  sec the light curve falls with a steep decay of  $\alpha=5.7$  (+0.4, -0.3), then breaks to a shallow decay at  $T+517$  s, after which it decays with an index of  $0.51 \pm 0.1$ .

The initial peak of the X-ray lightcurve and the following phases can be modeled with an absorbed power-law with spectral indices of  $0.66 \pm 0.02$  and  $0.95 \pm 0.03$ , respectively. The intrinsic NH column density is  $1.6 \times 10^{21} cm^{-2}$ . The average observed (unabsorbed) flux over 0.3 – 10 keV for this spectrum (spanning a time of 93-145233 seconds after the trigger) is  $3.83 \times 10^{-11}$  ( $4.17 \times 10^{-11}$ )  $ergs/cm^2/sec$ .

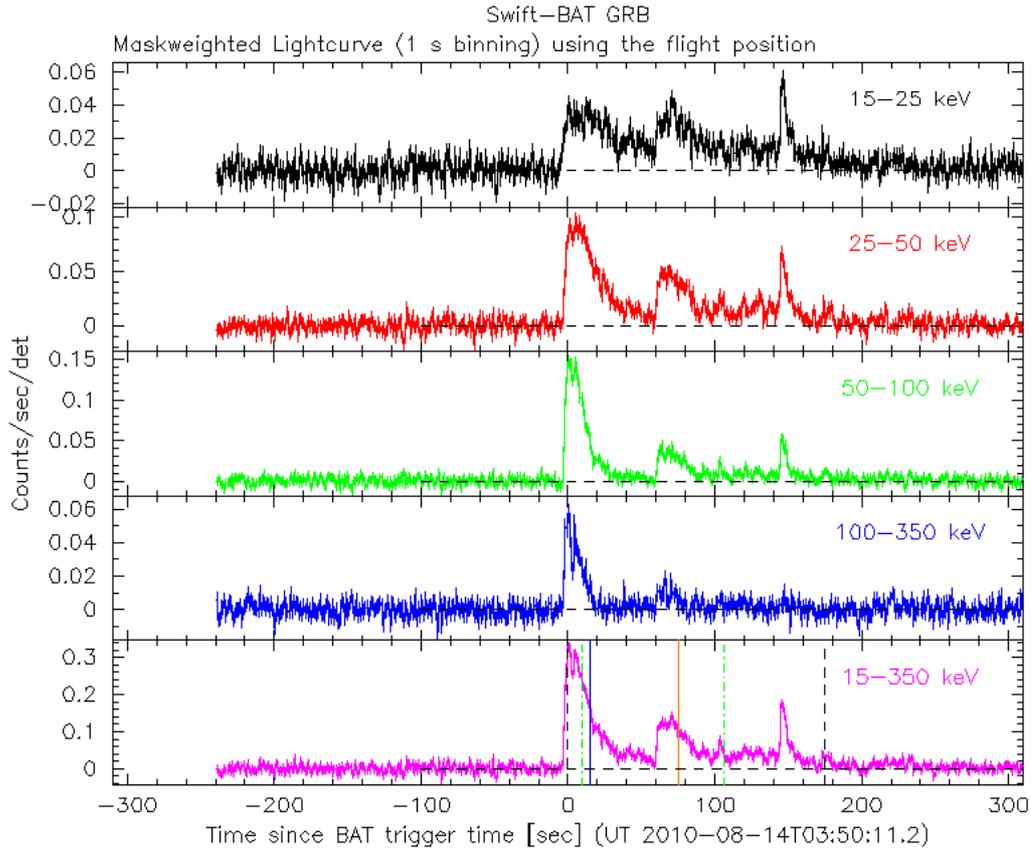


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and  $T_0$  is 03:50:11.1 UT.

## 4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 100814A at 03:51:32 UT, 81 sec after the initial BAT trigger (Beardmore *et al.*, *GCN Circ.* 11087). Settled exposures began 153s after the trigger. A new source was detected within the XRT error circle in the u (250 s) finding chart (fc) exposure and in other filter exposures but uvw2. Epochs, exposures and magnitudes are summarized in Table 1. Magnitudes and  $3\sigma$  upper limits are not corrected for Galactic extinction  $E(B-V) = 0.02$ .

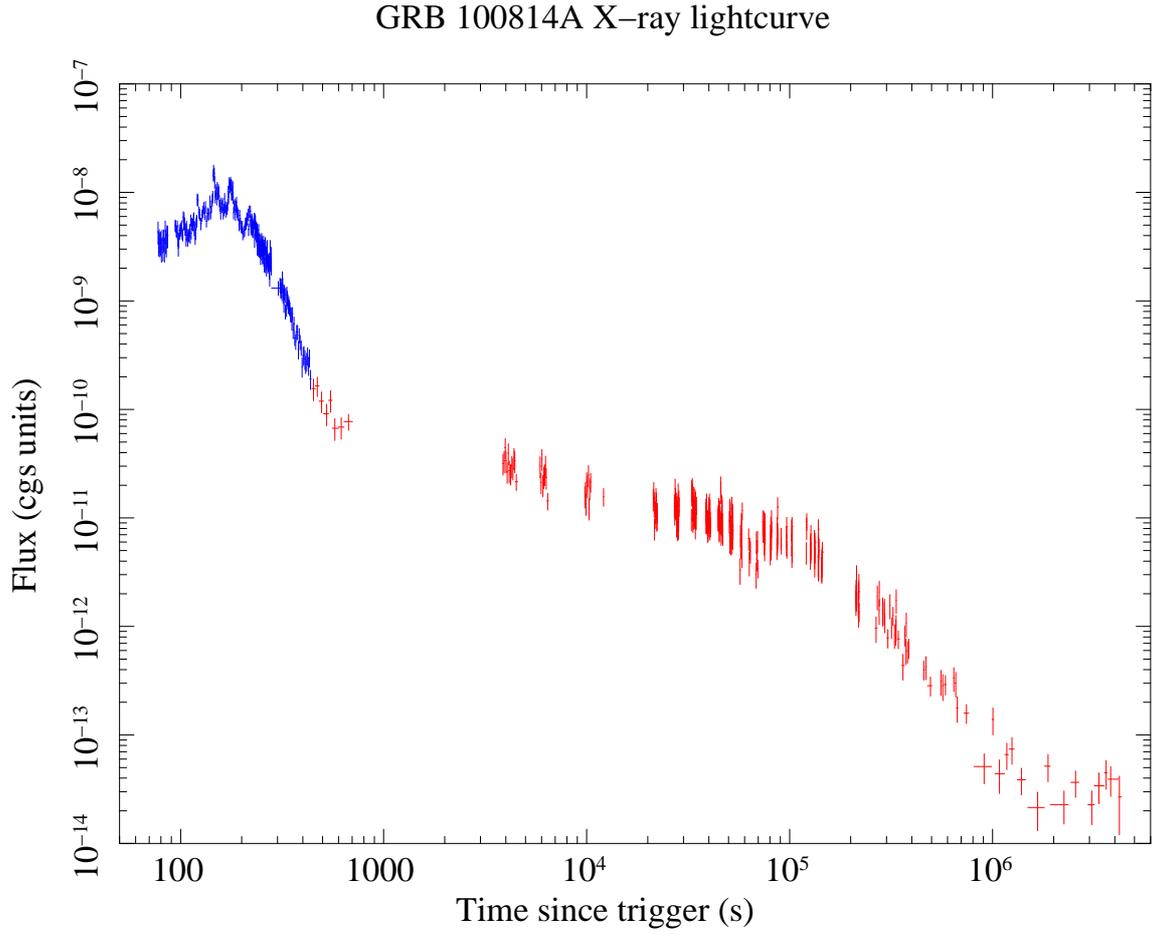


Figure 2: XRT Lightcurve. Flux is in the 0.3-10 keV band: Window Timing mode (black), Photon Counting mode (red). The approximate conversion (unabsorbed) is 1 count/sec =  $\sim 4.3 \times 10^{-11}$  *ergs/cm<sup>2</sup>/sec*.

Filter	Start	Stop	Exposure	Magnitudes and $3\sigma$ UL
WHITE	3858	4211	344	$18.63 \pm 0.07$
V	458	627	39	$17.91 \pm 0.32$
B	408	721	53	$18.51 \pm 0.28$
U (fc)	153	403	246	$16.84 \pm 0.06$
U	536	556	19	$17.10 \pm 0.19$
UVW1	507	676	39	$17.33 \pm 0.20$
UVM2	483	651	39	$17.80 \pm 0.43$
UVW2	434	602	39	$> 18.40$

Table 1: Magnitudes and  $3\sigma$  upper limits from UVOT observations.