

## Swift Observation of GRB 130603A

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### 1 Introduction

At 05:59:32 UT, the *Swift* Burst Alert Telescope (BAT) triggered and located GRB 130603A (Trigger = 557274; Melandri, *et al.*, *GCN Circ.* 14731). *Swift* could not immediately slew to the burst due to an Earth limb constraint. The best *Swift* position is the enhanced, astrometrically corrected X-ray position reported in Beardmore *et al.*, *GCN Circ.* 14737.

### 2 BAT Observation and Analysis

Using the data set from  $T-60$  to  $T+243$  s further analysis of BAT GRB 130603A has been performed by *Swift* team (Barthelmy, *et al.*, *GCN Circ.* 14736). The BAT ground-calculated position is RA(J2000) = 88.859 deg ( $05^h 47^m 26.1^s$ ), Dec(J2000) =  $+82.910$  deg ( $+82^\circ 54' 36.7''$ )  $\pm 1.6'$  (radius, sys+stat, 90% containment). The partial coding was 98%.

The mask-weighted light curve (Fig.1) shows mostly smooth peak starting at  $\sim T - 10$  s, peaking at  $\sim T + 11$  s, and ending at  $\sim T + 115$  s.  $T_{90}$  (15-350 keV) is  $76 \pm 19$  s (estimated error including systematics).

The time-averaged spectrum from  $T - 19.5$  to  $T + 104.5$  s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is  $1.83 \pm 0.12$ . The fluence in the 15-150 keV band is  $(1.9 \pm 0.1) \times 10^{-6}$  ergs/cm<sup>2</sup> and the 1-sec peak photon flux measured from  $T + 11.27$  s in the 15-150 keV band is  $0.8 \pm 0.1$  ph/cm<sup>2</sup>/sec. All the quoted errors are at the 90% confidence level.

### 3 XRT Observation and Analysis

We have analysed 13.8 ks of XRT data for GRB 130603A (Melandri *et al.*, *GCN Circ.* 14731), from 3.1 ks to 34.3 ks after the BAT trigger. The data are entirely in Photon Counting (PC) mode. The enhanced, astrometrically corrected X-ray position (Beardmore *et al.*, *GCN Circ.* 14737) for this burst is RA, Dec (J2000) = 86.89660, +82.90853 which is equivalent to:

$$\begin{aligned} \text{RA (J2000)} &= 05^h 47^m 35.18^s \\ \text{Dec(J2000)} &= +82^\circ 54' 30.7'' \end{aligned}$$

with an uncertainty of 1.5 arcsec (radius, 90% confidence).

The light curve can be modelled with a broken power-law decay (Fig.2) with a initial decay index of  $\alpha_1 = 0.27_{-0.18}^{+0.11}$ , followed by a break at  $t_b = (1.6 \pm 0.3) \times 10^4$  s and a final decay index  $\alpha_2 = 1.13_{-0.17}^{+0.18}$ .

A spectrum formed from the PC mode data can be fitted with an absorbed power-law with a photon spectral index of  $2.32 \pm 0.18$ . The best-fitting absorption column is  $(4.7 \pm 0.8) \times 10^{21}$  cm<sup>-2</sup>, in excess of the Galactic value of  $5.3 \times 10^{20}$  cm<sup>-2</sup> (Kalberla et al. 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is  $3.8 \times 10^{-11}$  ( $8.5 \times 10^{-11}$ ) erg cm<sup>-2</sup> count<sup>-1</sup> (Melandri, *GCN Circ.* 14740).

## 4 UVOT Observation and Analysis

The UVOT began settled observations of the field of GRB 130603A  $\sim 3325$  s after the BAT trigger. The uncatalogued source reported in Melandri *et al.*, *GCN Circ.* 14732 is detected in the summed exposures.

Preliminary detections and  $3\sigma$  upper limits using the UVOT photometric system (Breeveld *et al.* 2011, AIP Conf. Proc. 1358, 373) for the summed exposures are:

Filter	$T_{start}$ (s)	$T_{stop}$ (s)	Exp (s)	Mag
white	3686	5322	393	$19.61 \pm 0.15$
v	4097	5562	197	$> 19.02$
b	3481	16641	1278	$19.71 \pm 0.15$
u	3275	15729	1278	$19.19 \pm 0.13$
uvw1	4507	4707	197	$19.62 \pm 0.39$ ( $2.8 \sigma$ )
uvm2	4302	4502	197	$> 19.63$
uvw2	3892	5528	393	$20.25 \pm 0.37$ ( $2.8 \sigma$ )

Table 1: Detections and  $3\sigma$  upper limits from UVOT observations (De Pasquale & Melandri, *GCN Circ.* 14738). The values quoted above are not corrected for the Galactic extinction due to the reddening of  $E_{(B-V)} = 0.06$  in the direction of the burst (Schlegel *et al.* 1998).

The possible detection of the optical source in uvw2 filter indicates a redshift  $z < \sim 1.5$  for this event.

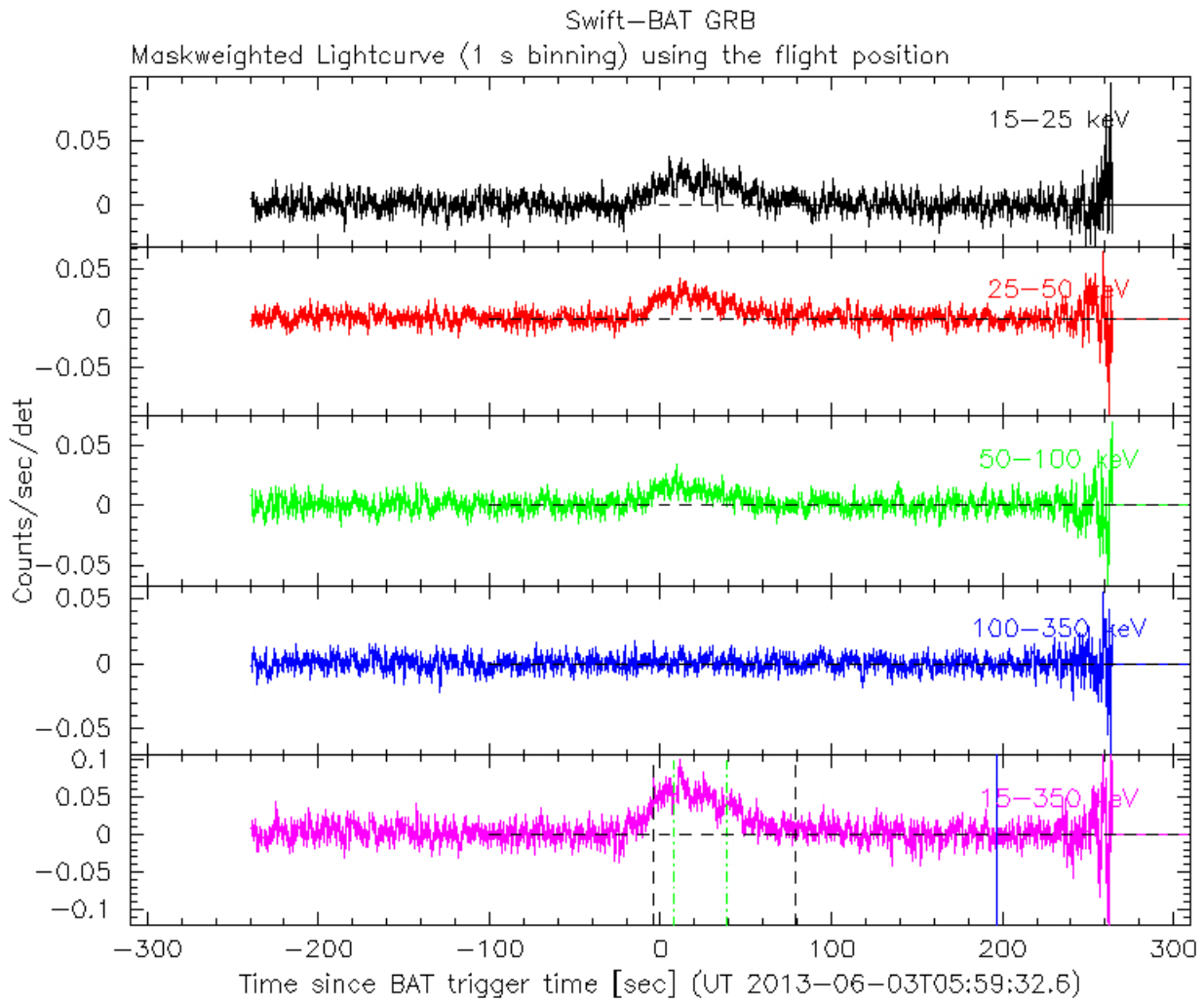


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands (15 - 25, 25 - 50, 50 - 100, 100 - 350 and 15 - 350 keV).

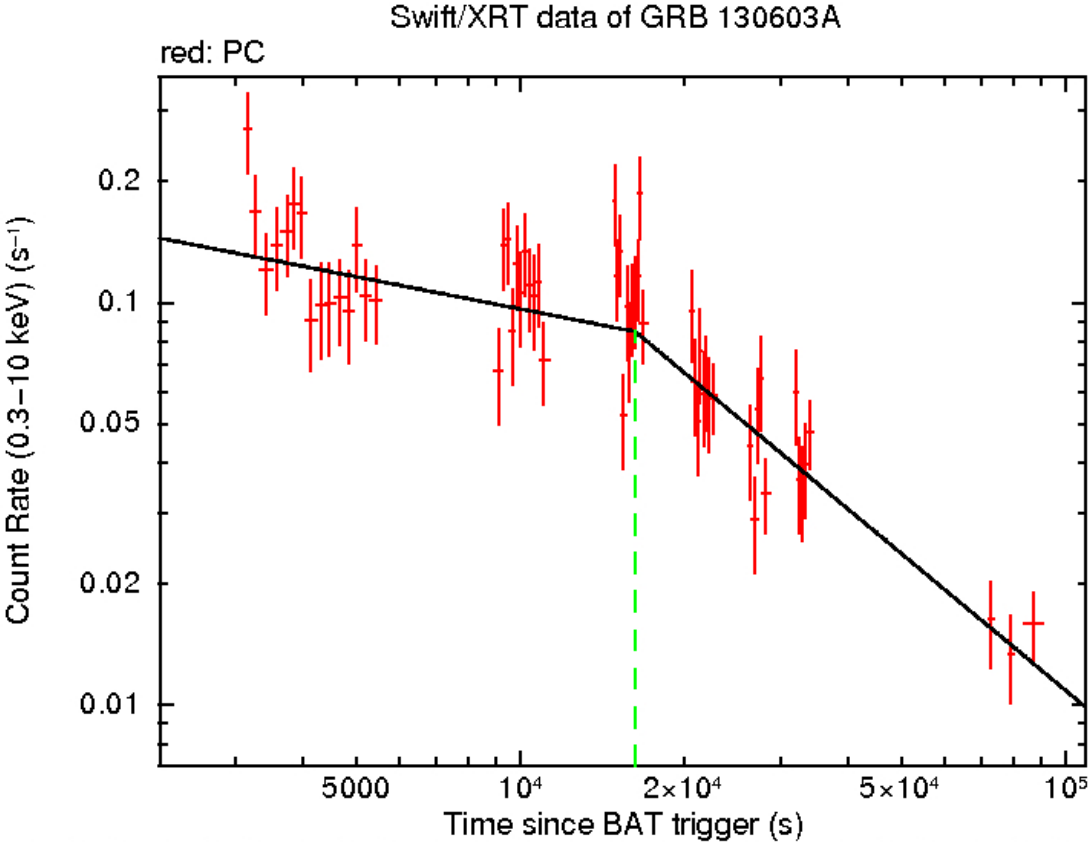


Figure 2: XRT Lightcurve. It can be modelled by a broken power-law.