

Swift Observations of GRB 140103A

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1. Introduction

At 00:30:43 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 140103A (trigger=582773) (Mangano *et al.* GCN Circ. [15656](#)). Swift slewed after 100 s to the burst. At the time of the trigger, the initial BAT position was 77° from the Sun (3.4 hours West) and 86° from the 4%-illuminated Moon. **Table 1** contains the best reported positions from Swift, and the latest XRT position can be viewed at http://www.swift.ac.uk/xrt_positions.

Table 2 is a summary of GCN Circulars about this GRB from observatories other than Swift.

Standard analysis products for this burst are available at http://gcn.gsfc.nasa.gov/swift_gnd_ana.html.

2. BAT Observations and Analysis

As reported by Baumgartner *et al.* (GCN Circ. [15664](#)), the BAT ground-calculated position is RA, Dec = 232.114, 37.752 deg which is RA(J2000) = $15^{\text{h}}28^{\text{m}}27.2^{\text{s}}$ Dec(J2000) = $+37^\circ45'08.4''$ with an uncertainty of 1.7 arcmin, (radius, sys+stat, 90% containment). The partial coding was 48%.

The mask-weighted light curve (**Figure 1**) shows two peaks. The first weak peak starts at $\sim T-13$ s, peaks at $\sim T-11$ s and ends at $\sim T-6$ s. The second peak starts at $\sim T-4$ s, peaks at $\sim T+1$ s and ends at $\sim T+9$ s. T_{90} (15-350 keV) is 17.3 ± 1.9 s (estimated error including systematics).

The time-averaged spectrum from T-12.52 to T+6.94 s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 2.6 ± 0.2 . The fluence in the 15-150 keV band is $(6.0 \pm 0.7) \times 10^{-7}$ erg cm^{-2} . This fluence is larger than that of 24% of the long GRBs in the Second BAT GRB Catalog (Sakamoto *et al.* 2011). The 1-s peak photon flux measured from T+0.39 s in the 15-150 keV band is 2.1 ± 0.3 ph $\text{cm}^{-2} \text{s}^{-1}$. All the quoted errors are at the 90% confidence level.

The results of the batgrbproduct analysis are available at http://gcn.gsfc.nasa.gov/notices_s/582773/BA/.

3. XRT Observations and Analysis

Analysis of the initial XRT data was reported by Mangano (GCN Circ. [15666](#)). We have analysed 6.9 ks of XRT data for GRB 140103A, from 153 s to 59.7 ks after the BAT trigger. The data comprise 2.6 ks in Windowed Timing (WT) mode (the first 7 s were taken while Swift was slewing) with the remainder in Photon Counting (PC) mode.

The light curve (**Figure 2**) can be modelled with an initial power-law decay with an index of $\alpha=0.18$ (+0.17, -0.19), followed by a break at $T+3221$ s to an α of 1.18 (+0.51, -0.28).

A spectrum formed from the WT mode data can be fitted with an absorbed power-law with a photon spectral index of 2.6 (+0.5, -0.4). The best-fitting absorption column is 2.5 (+1.9, -1.3) $\times 10^{21}$ cm^{-2} , in excess of the Galactic value of 1.3×10^{20} cm^{-2} (Kalberla *et al.* 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is 2.7×10^{-11} (6.1×10^{-11}) $\text{erg cm}^{-2} \text{count}^{-1}$.

A summary of the WT-mode spectrum is thus:

Total column: 2.5 (+1.9, -1.3) $\times 10^{21}$ cm^{-2}

Galactic foreground: 1.3×10^{20} cm^{-2}

Excess significance: 3.0σ

Photon index: 2.6 (+0.5, -0.4)

The results of the XRT team automatic analysis are available at http://www.swift.ac.uk/xrt_products/00582773.

4. UVOT Observations and Analysis

The Swift/UVOT began settled observations of the field of GRB 140103A 172 s after the BAT trigger (Siegel and Mangano GCN Circ. [15671](#)). No optical afterglow consistent with the XRT position (Mangano *et al.*, GCN Circ. [15666](#)) is detected in the initial UVOT exposures. **Table 3** gives preliminary magnitudes using the UVOT photometric system (Breeveld *et al.* 2011, AIP Conf. Proc., 1358, 373). No correction has been made for the expected extinction in the Milky Way corresponding to a reddening of E_{B-V} of 0.01 mag. in the direction of the GRB (Schlegel *et al.* 1998).

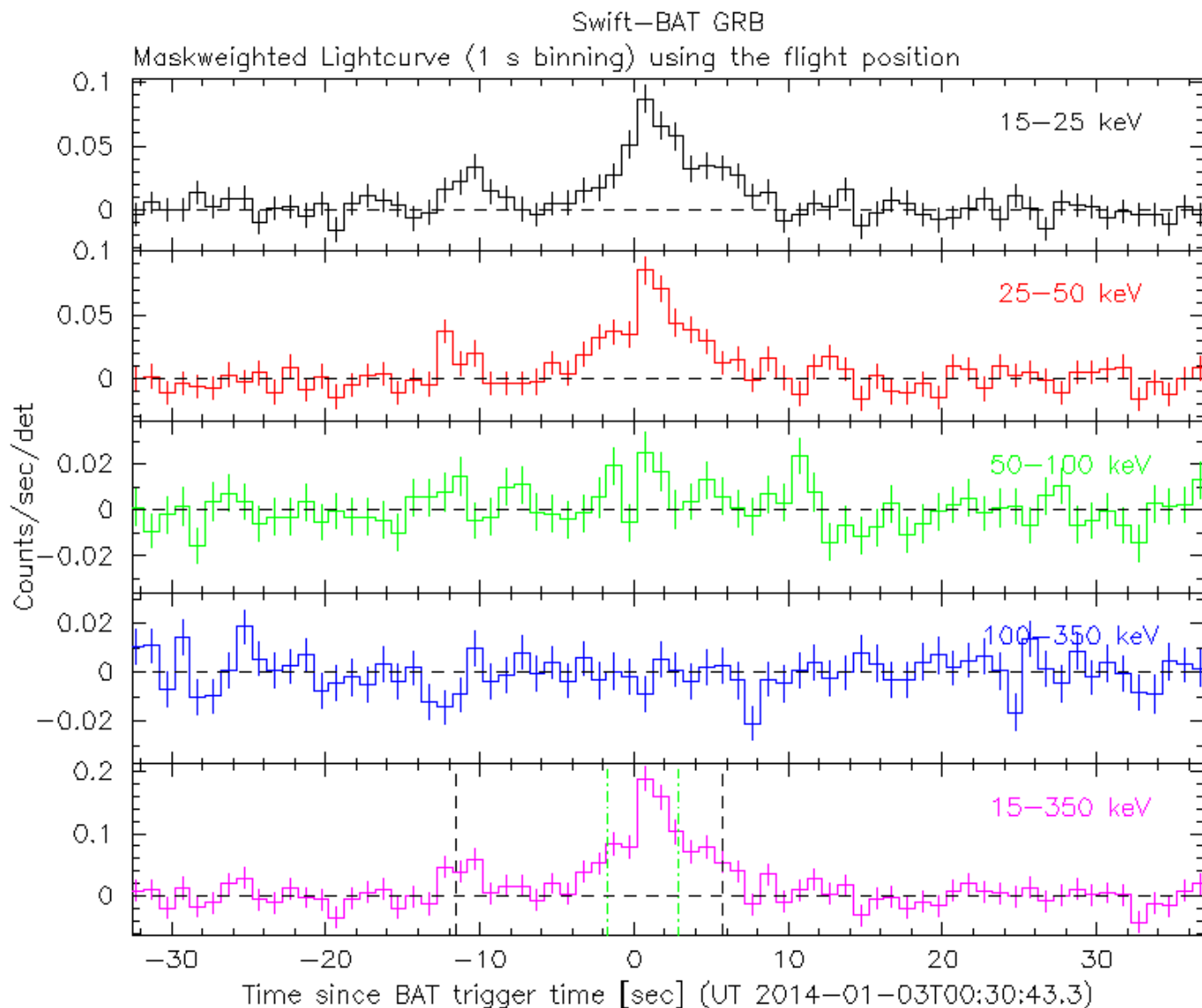


Figure 1. The BAT mask-weighted light curve in the four individual and total energy bands. The units are counts s^{-1} illuminated-detector $^{-1}$.

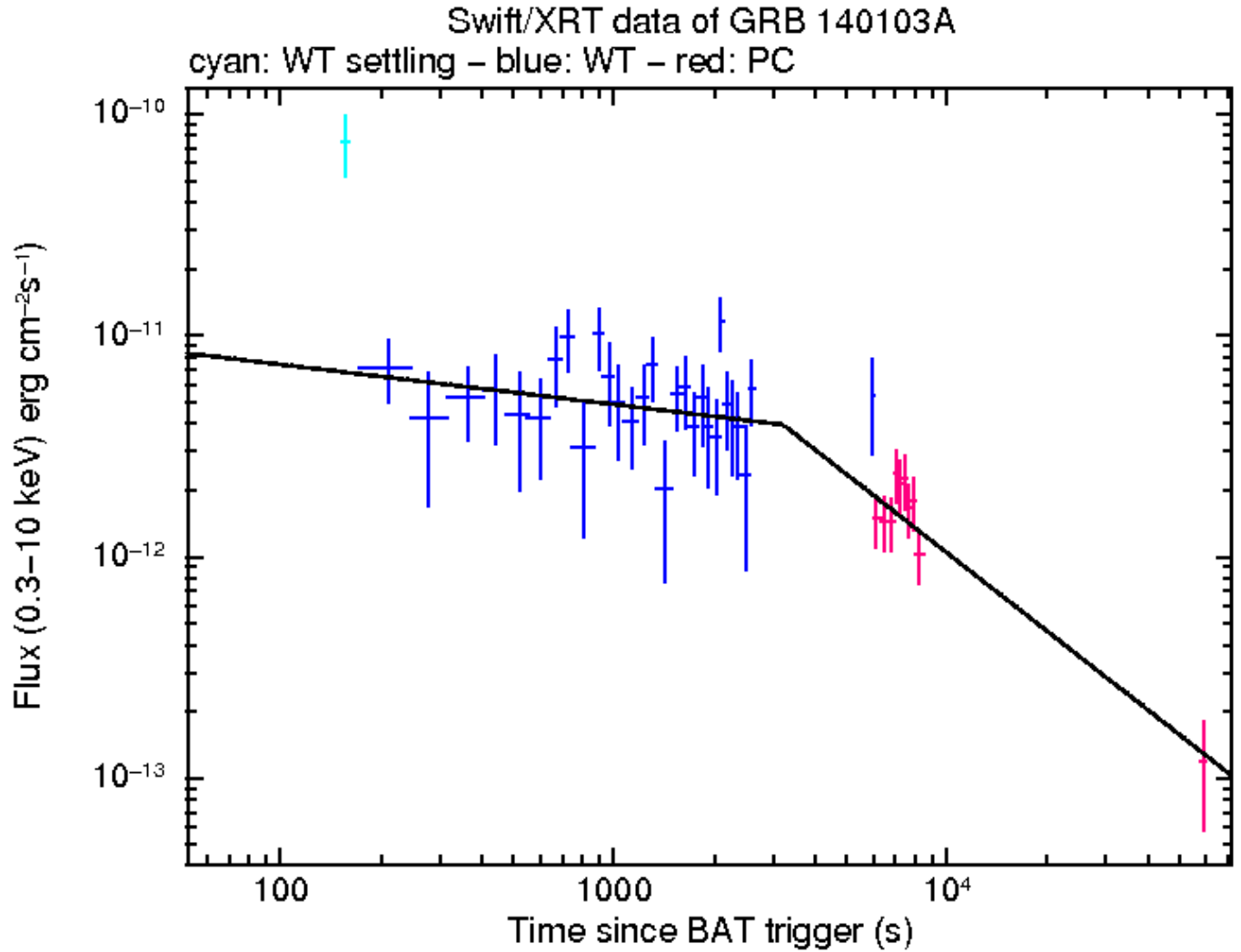


Figure 2. The XRT light curve.

RA (J2000)	Dec (J2000)	Error	Note	Reference
15 ^h 28 ^m 20.99 ^s	+37°45'33.0"	3.6"	XRT-final	UKSSDC
15 ^h 28 ^m 20.99 ^s	+37°45'33.0"	3.6"	XRT-refined	Mangano GCN Circ. 15666
15 ^h 28 ^m 27.2 ^s	+37°45'08.4"	1.7'	BAT-refined	Baumgartner <i>et al.</i> GCN Circ. 15664

Table 1. Positions from the Swift instruments.

Band	Authors	GCN Circ.	Subject	Observatory	Notes
Optical	Gorbovskoy <i>et al.</i>	15660	MASTER-Net optical observations	MASTER	upper limits
Optical	Cenko and Perley	15675	P60 Observations	Palomar 60-inch	
Optical	Huang and Urata	15682	Lulin Optical r-band Observations	Lulin	

Table 2. Summary of GCN Circulars from other observatories sorted by band and then circular number.

Filter	T_{start}(s)	T_{stop}(s)	Exp(s)	Mag
white _{FC}	172	321	147	>20.8
white	172	2581	361	>21.5
v	406	2631	252	>19.1
b	506	2557	233	>19.9
u	480	2704	252	>19.5
w1	456	2680	252	>19.6
m2	6760	8396	393	>20.0
w2	382	2607	252	>19.9

Table 3. UVOT observations reported by Siegel and Mangano (GCN Circ. [15671](#)). The start and stop times of the exposures are given in seconds since the BAT trigger. The preliminary 3- σ upper limits are given. No correction has been made for extinction in the Milky Way.