GCN Report 273.1 06-Mar-10

Swift Observations of GRB 100205A

J. L. Racusin (NASA/GSFC), R. L. C. Starling (U. Leicester), E. Hoversten (PSU), T. Sakamoto (GSFC/UMBC), for the Swift Team

1 Introduction

BAT triggered on GRB 100205A at 04:188:43 UT (Trigger 411248) (Racusin, *et al.*, *GCN Circ.* 10361). This was a rate-trigger on a burst with $T_{90} = 26$ *sec*. Swift slewed to this burst immediately and XRT began follow-up observations at $T + 174.9$ *sec*, and UVOT at $T + 177$ *sec*. Our best position is the XRT enhanced position (Evans *et al.*, *GCN Circ.* 10367) RA($J2000$) = $141.38751deg$ ($09h25m33.00s$), Dec($J2000$) = $+31.74050deg$ ($+31d44'25.8''$) with an error of 1.7 arcsec (radius, 90% confidence).

A NIR afterglow candidate was identified with Gemini-N observations (Tanvir *et al.*, *GCN Circ.* 10366, Cucchiara *et al.*, *GCN Circ.* 10374). However, deep optical searches using NOT (Malesani *et al.*, *GCN Circ.* 10362), Super-LOTIS (Updike *et al.*, *GCN Circ.* 10364), Gemini-South (Cobb *et al.*, *GCN Circ.* 10365), Swift-UVOT (Hoversten *et al.*, *GCN Circ.* 10370), CFHT (Urata *et al.*, *GCN Circ.* 10375), GROND (Nicuesa *et al.*, *GCN Circ.* 10383), BOAO/LOAO (Jeon *et al.*, *GCN Circ.* 10398), and Keck (Perley *et al.*, *GCN Circ.* 10399) did not show any evidence of an optical afterglow. These limits imply that this GRB could be at a large redshift of $\sim 11 - 13.5$ (Cucchiara *et al.*, *GCN Circ.* 10374, Perley *et al.*, *GCN Circ.* 10399), or be at a low-intermediate redshift with significant host dust extinction.

2 BAT Observation and Analysis

Using the data set from $T - 240$ to $T + 962$ *sec*, further analysis of BAT GRB 100205A has been performed by the Swift team (Sakamoto, *et al.*, *GCN Circ.* 10371). The BAT ground-calculated position is RA($J2000$) = $141.385deg$ ($09h25m32.5s$), Dec($J2000$) = $+31.740deg$ ($+31d44'23.7''$) with an error of 2.1 $arcmin$, (radius, systematic and statistical, 90% containment). The partial coding was 80%.

The masked-weighted light curves (Fig.1) shows a roughly symmetric peak starting at $\sim T - 15$ *sec*, peaking at $\sim T + 5$ *sec*, and ending at $\sim T + 30$ *sec*. T_{90} ($15 - 350keV$) is 26.0 ± 8.0 (estimated error including systematics).

The time-averaged spectrum from $T - 12.6$ to $T + 25.6$ *sec* is best fitted by a simple power law model. This fit gives a photon index of 1.60 ± 0.25. The total fluence in the $15 - 150$ keV band is $(4.0 \pm 0.7) \times 10^{-7} ergs\ cm^{-2}$ and the 1-*sec* peak flux measured from $T + 8.12$ *sec* in the $15 - 150$ keV band is 0.4 ± 0.1 $ph\ cm^{-2}\ sec^{-1}$. All the quoted errors are at the 90% confidence level.

3 XRT Observations and Analysis

XRT began follow-up observations at $T + 157$ *sec* with 11 *sec* of Windowed Timing (WT) settling mode observations, followed by 47 ks of Photon Counting (PC) mode observations (Starling *et al.*, *GCN Circ.* 10369).

Using 1394 *sec* of XRT PC mode data and 2 UVOT images of GRB 100205A, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA($J2000$) = 141.38751 *deg* ($09h25m33.00s$), Dec($J2000$) = $+31.74050$ *deg* ($+31d44'25.8''$) with an error of 1.7 $arcsec$ (radius, 90% confidence). This position is 0.8 $arcsec$ from the NIR afterglow candidate, reported by Tanvir *et al.*, *GCN Circ.* 10366.

The $0.3 - 10$ keV light curve (Fig.2) can be fit with a doubly broken power law. The difference between

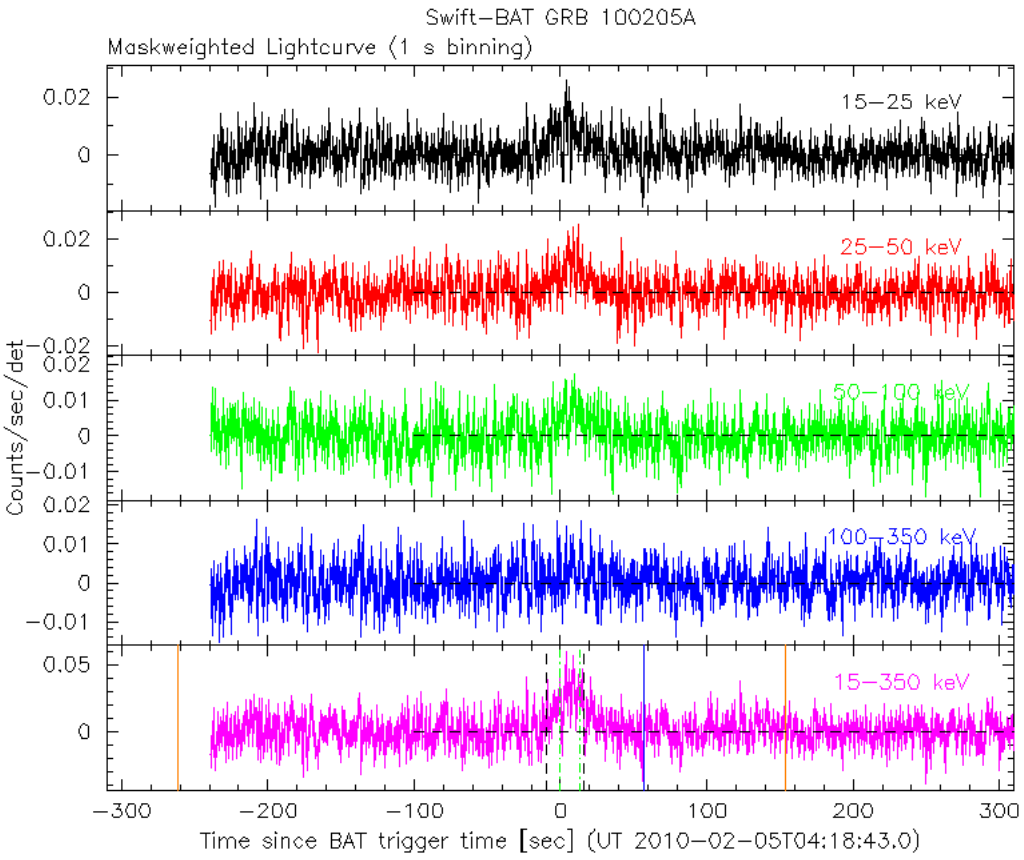

Figure 1: BAT Light curves. The mask-weighted light curves in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 04:18:43 UT.

the initial WT mode settling data and the first PC data suggest a steep initial decay of ~ 9.5. This power law decay breaks at $\sim T + 180$ *sec* to a plateau with a slope of ~ -0.05, which breaks at $T + 330^{+140}_{-60}$ *sec* to a decay of $2.5^{+0.4}_{-0.3}$.

The time-averaged PC mode spectrum can be fit with an absorbed power law with spectral index of 2.2 ± 0.3. The N_H column density (intrinsic at $z = 0$) of $(7^{+6}_{-5} \times 10^{20} cm^{-2})$, in excess of the Galactic column of $1.65 \times 10^{20} cm^{-2}$ (Kalberla et al. 2005). The average observed (unabsorbed) flux over $0.3 - 10$ *keV* for this spectrum is 9.0×10^{-12} (1.2×10^{-11}) *ergs* cm^{-2} sec^{-1}.

4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 100205A at 04:21:40 UT, 177 sec after the initial BAT trigger. No new source was detected within the enhanced XRT error circle, nor at the position of the Gemini-North K-band detection (Tanvir *et al.*, *GCN Circ.* 10361). UVOT magnitude 3σ upper limits are summarized in Table 1. These upper limits are not corrected for the expected Galactic extinction along the line of sight corresponding to a reddening of $E(B - V) = 0.02$ mag.

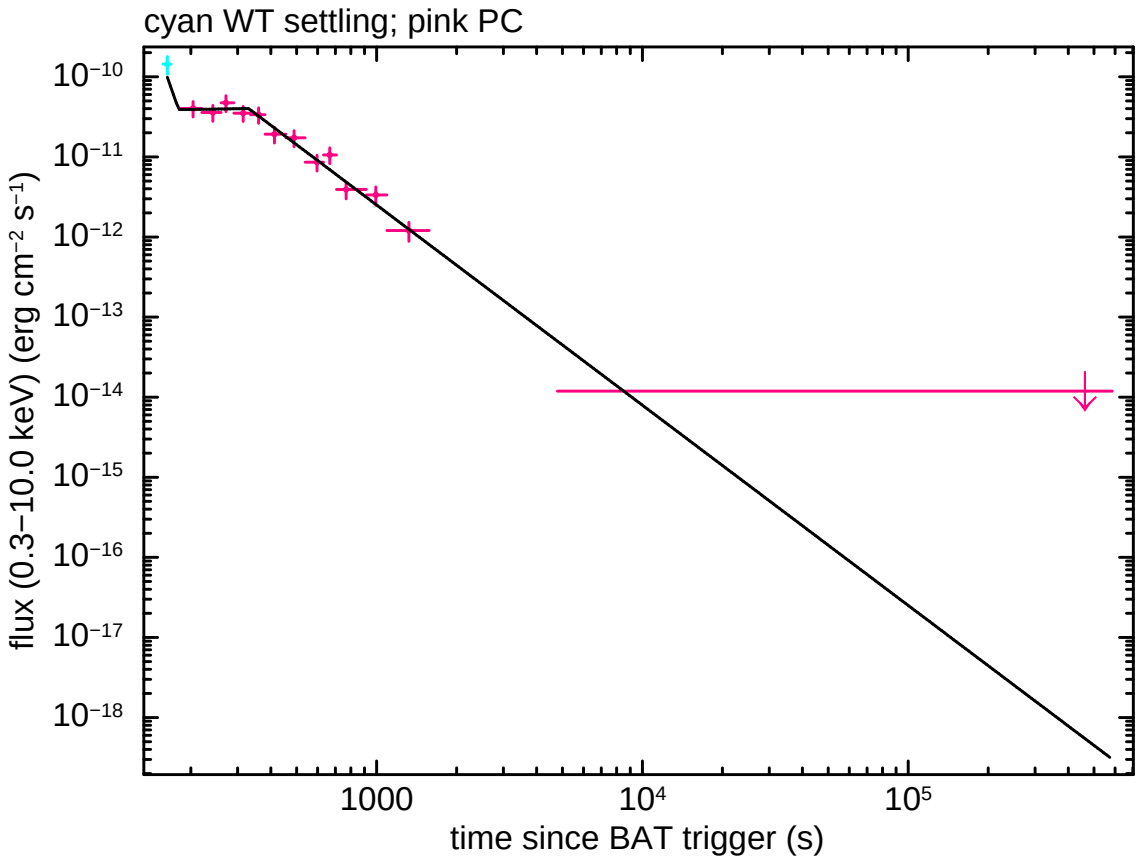

Figure 2: XRT flux Lightcurve. Flux in the 0.3-10 keV band: Window Timing settling mode (cyan), Photon Counting mode (red). The approximate observed (unabsorbed) conversion is 1 count/sec = $3.7 \times 10^{-11}(4.9 \times 10^{-11})$ $ergs\ cm^{-2}/sec$.

Filter	Start	Stop	Exposure	3σ UL
white	177	327	147	20.76
white	177	1533	392	21.31
v	665	1580	94	18.84
b	763	1162	38	19.25
u	335	1311	265	20.08

Table 1: Magnitude limits from UVOT observations