Swift Observation of GRB 071003

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1 Revisions

XRT section has been updated to include the final X-ray position, refined temporal and spectral analysis, and the XRT light curve has also updated (Fig. 2), and now includes the full set of Swift observations.

2 Introduction

BAT triggered on GRB 071003 at 07:40:55 UT (Trigger 292934) (Schady, et al., GCN Circ. 6837). This was a 1.024 sec rate-trigger with a significance of 105.73σ on long burst with $T_{90} = 150 \pm 10$ sec. At the time of this burst Swift was in the process of returning to normal operations, and automatic slewing to GRBs was disabled outside of business hours (US EDT). Our best position is the XRT location RA(J2000) = 301.85102 deg (20h07m24.25s), Dec(J2000) = 10.94688 deg (10d56′48.8″) with an error of 5.7 arcsec. Independent spectroscopic follow-up observations set a lower limit on the redshift of $z > 1.100$ (Perley, et al., GCN Circ. 6850) and $z > 0.937$ (Fugazza, et al., GCN Circ. 6851).

GRB 071003 was also detected by INTEGRAL/SPI-ACS (private communication; Volker Beckmann), showing the same, bright multi-peak structure as observed with the BAT, and it also triggered Konus-Wind (Golenetskii, et al., GCN Circ. 6849). The peak energy value as measured by Konus-Wind is $E_p = 799^{+124}_{-100}$ (Golenetskii, et al., GCN Circ. 6849).

3 BAT Observation and Analysis

Using the data set from $T - 7.6$ to $T + 167.4$ sec, the BAT ground-calculated position is RA(J2000) = 301.857 deg (20h07m25.8s), Dec(J2000) = 10.954 deg (10d57′16″) ± 1.0 arcmin, (radius, systematic and statistical, 90% containment) (Ukwatta, et al., GCN Circ. 6842). The partial coding was 34%%.

The masked-weighted light curves (Fig.1) shows a strong first peak with multiple overlapping sub-peaks starting at trigger time $\sim T - 20$ sec, peaking at $T + 0$ sec, and ending at $\sim T + 55$ sec. The second, much weaker peak starts at $\sim T + 130$ sec, peaks at $\sim T + 145$ sec, and ends at $\sim T + 220$ sec. $T_{90}$ (15 – 350 keV) is 150 ± 10 sec (estimated error including systematics).

The time-averaged spectrum of $T - 7.6$ to $T + 167.4$ sec is best fitted by a simple power law model. This fit gives a photon index of 1.36 ± 0.07, ($\chi^2 = 49.26$ for 57 d.o.f.). For this model the total fluence in the 15 – 150 keV band is $(8.3 \pm 0.3) \times 10^{-6}$ erg cm$^{-2}$ and the 1-sec peak flux measured from $T + 0.37$ sec in the 15 – 150 keV band is $6.3 \pm 0.4$ ph cm$^{-2}$ sec$^{-1}$. All the quoted errors are at the 90% confidence level.

4 XRT Observations and Analysis

The XRT began observations of GRB 071003 22 ks after the BAT trigger and detected a bright X-ray source. Using 29.9 ks of Photon Counting (PC) mode data, the refined XRT position is RA(J2000) = 301.85090 deg (20h07m24.22s), Dec(J2000) = 10.94722 deg (10d56′50.0″)±5.5 arcsec (90% confidence, including boresight uncertainties)(Starling, et al., GCN Circ. 6855). This position is 1.3 arcsec away.
from the initial XRT position (Starling, et al. *GCN Circ.* 6845) and 2.3 arcsec from the optical afterglow position (Li, *GCN Circ.* 6838).

The 0.3–10 keV light curve (Fig.2) goes out to $6.8 \times 10^5$ s after the BAT trigger and is best fit with a broken power law with initial decay slope of $\alpha_1 = 0.9 \pm 0.3$, $T_{bk} = 3.7^{+0.6}_{-0.7} \times 10^4$ s, and $\alpha_2 = 1.8 \pm 0.1$.

The time-averaged spectrum can be modelled with a power law of photon index $\Gamma = 2.1 \pm 0.2$ with fixed Galactic absorption of $N_H = 1.4 \times 10^{21}$ cm$^{-2}$. When allowing for intrinsic absorption at $z = 1.1$ (Perley, et al., *GCN Circ.* 6850) the column density at the GRB host galaxy is consistent with zero. The mean observed (unabsorbed) 0.3–10 keV flux at 7.4 ks after the BAT trigger was $7 \times 10^{-13}$ (1 $\times 10^{-12}$) erg cm$^{-2}$ sec$^{-1}$.

## 5 UVOT Observation and Analysis

*Swift* is in the process of returning to normal operations, thus there are no UVOT observations for this burst.

![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 is 07:40:55.0 UT.](image)
Figure 2: XRT Light curve. Counts/sec in the 0.3 – 10 keV band taken in Photon Counting mode (red). The broken power low fit is shown in black, and has an initial decay slope of $\alpha = 0.9 \pm 0.3$, a break at $T_{bk} = 3.7^{+0.6}_{-0.5} \times 10^4$ s, and $\alpha_2 = 1.8 \pm 0.1$. The approximate conversion of the absorbed flux is 1 count/sec $4.7 \times 10^{-11}$ erg cm$^{-2}$ sec$^{-1}$. 