Swift Observations of the GRB 071010B

C. B. Markwardt (CRESST/U.Md/NASA/GSFC), J. Kennea (PSU), V. Mangano (INAF/IASF)
S.D. Barthelmy (GSFC), D.N. Burrows (PSU), P. Roming (PSU), N. Gehrels (GSFC)
for the Swift Team:

1. INTRODUCTION

At 10 Oct 2007 20:45:47 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 071010B (trigger=293795). Swift did not slew promptly to the burst because automated slewing was disabled. Our best position is from the Swift XRT, which is:
RA(J2000) = 10h 02m 09.2s,
Dec(J2000) = +45d 43m 52.2s,
with an uncertainty of 5 arcsec (radius, 90 percent confidence, including boresight uncertainties). The bulk of the gamma-ray light curve is a single FRED-like peak of about 20 seconds duration, but there is precursor and extended tail emission as well. A bright X-ray counter part was detected by Swift XRT. In addition, an optical transient was detected by Oksanen et al (GCN #6873).

2) BAT OBSERVATION AND ANALYSIS

The following analysis uses data from from T-119 to T+183 (Markwardt, et al., GCN Circ. 6877). The BAT ground-calculated position is RA, Dec = 150.531, 45.733 deg which is
RA(J2000) = 10h 2m 7.5s
Dec(J2000) = 45d 44' 0"
with an uncertainty of 1.0 arcmin, (radius, sys+stat, 90% containment). The partial coding was 84%, and the burst was 29.4 deg off-axis.

The mask-weighted light curve shows a pre-trigger pulse starting at ~T-45 sec, peaking at ~T-20 sec, and returning almost to background at ~T-8 sec. The main FRED pulse started at ~T-8 sec, peaked at ~T+2 sec, and ends around T+60 sec. Swift slewed to a pre-planned target at T+130 sec, at which point the burst location went out of the BAT FOV, so we have no more data about activity on this burst after that time. A small third peak starts at ~T+95 sec and is terminated by the spacecraft slew. T90 (15-350 keV) is at least 35.7 ± 0.5 sec (estimated error including systematics).

The time-averaged spectrum from T-35.7 to T+24.1 sec is best fit by a power law with an exponential cutoff. This fit gives a photon index 1.53 ± 0.22, and E_{peak} of 52.0 ± 6.4 keV (chi squared 31.19 for 56 d.o.f.). For this model the total fluence in the 15-150 keV band is (4.4 ± 0.1) x 10^{-6} erg/cm2 and the 1-sec peak flux measured from T+1.40 sec in the 15-150 keV band is (7.7 ± 0.3) ph/cm^2/sec. A fit to a simple power law gives a photon index of 2.01 ± 0.05 (chi squared 46.71 for 57 d.o.f.). All the quoted errors are at the 90% confidence level.

3. XRT OBSERVATION AND ANALYSIS

At 22:29:34 UT Swift/XRT began observing the field of the burst (6800 sec after the trigger; Kennea et al., GCN #6878). XRT took 807s of PC mode data, and detected an uncatalogued point source at the following coordinates:
RA(J2000) = 10h 02m 09.2s,
Dec(J2000) = +45d 43m 52.2s,
with an estimated error of 5 arcseconds radius (90% confidence). This position lies 20 arcseconds from the refined BAT position, and 1.9 arcseconds from the tentative optical counterpart reported by Oksanen et al. (GCN #6873).

The source had an XRT count rate of ~0.3 ct/s. The count rate appeared to be approximately constant during the 800 sec exposure, with no clear trend and fluctuations which are consistent with statistical noise.

However, burst afterglows often have a “plateau” at this stage after the trigger, so non-fading behavior does not necessarily rule out an identification as the afterglow.

For the spectrum of the source, we fit an absorbed power law model with Cash statistics (extraction region restricted to 10 pixel radius). The best fit model had absorption of NH = (9.5 ± 8.0) x 10^{20} cm^{-2}, and a photon index of 2.1 ± 0.4. Note that the Galactic absorption for the position of the source is about 1 x 10^{20} cm^{-2}.

The absorbed [unabsorbed] flux of the source in the 0.3-10 keV band is 1 x 10^{-11} [1.7 x 10^{-11}] erg cm^{-2} s^{-1}.

4. UVOT OBSERVATION AND ANALYSIS

The Swift Ultraviolet/Optical telescope (UVOT) did not observe this burst.

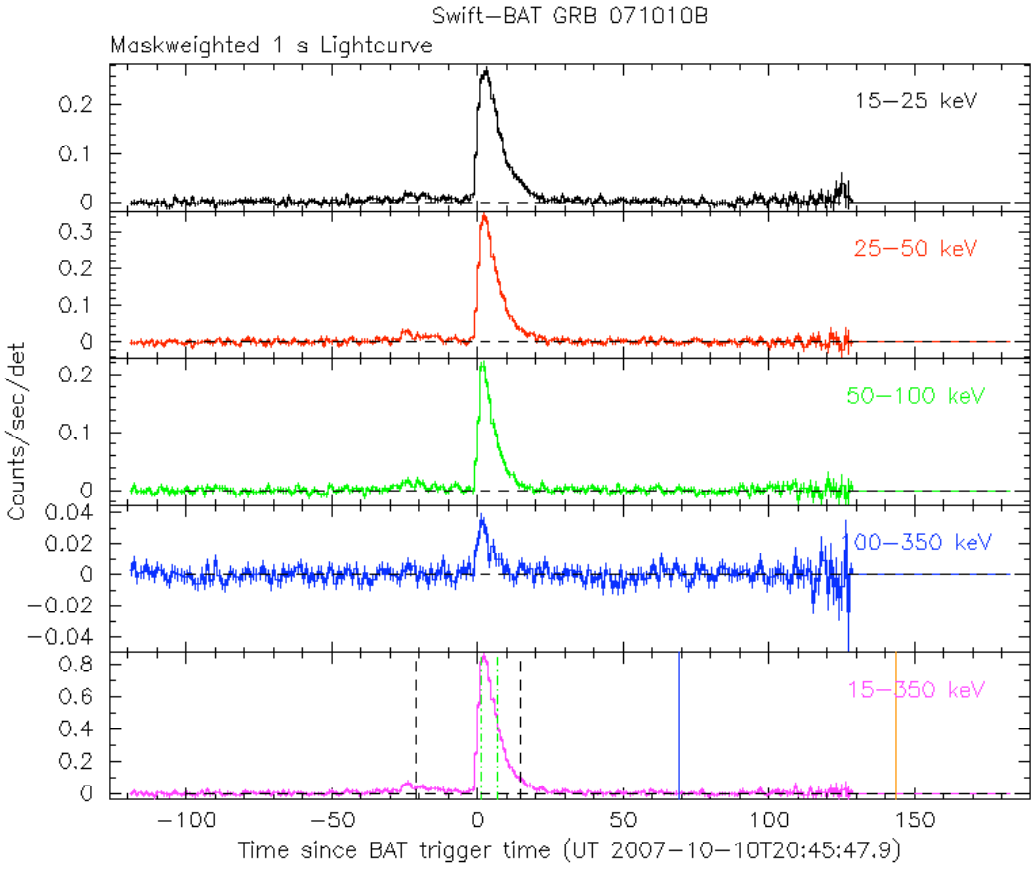

Fig.1: BAT lightcurve with 1 sec time bins. The lightcurve has 4 individual energy bands (15-25 keV, 25-50, 50-100, 100-150, starting from top), plus the total band (bottom). The vertical dashed lines indicate the T50 (green) and T90 (black) intervals. The light curve continues until the spacecraft slewed to another pre-planned target and the GRB passed out of the BAT field of view (the beginning and end of the slew are marked by blue and red vertical lines). Note the faint precursor emission near time T-40 to T-10.

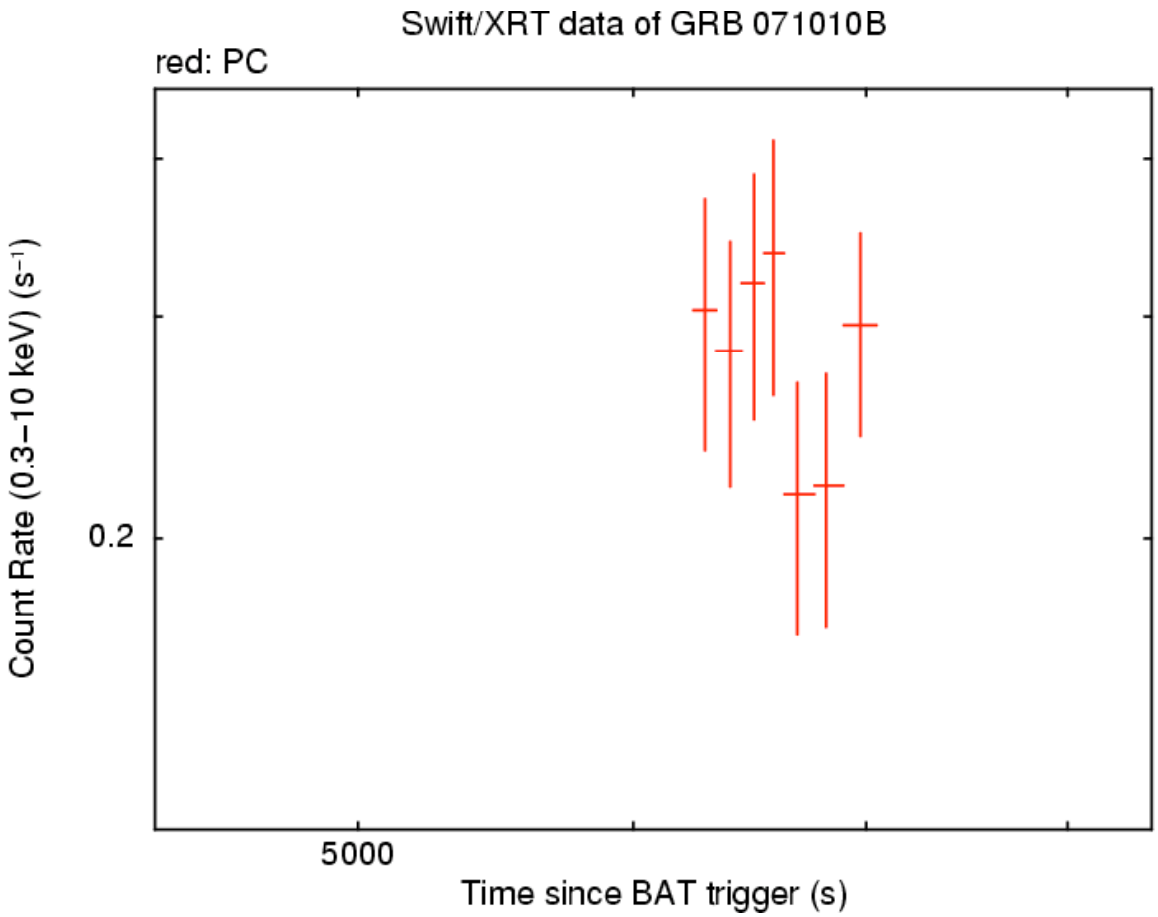

Fig. 2: Swift XRT lightcurve of the afterglow in count units. All data were taken in Photon Counting (PC) mode.