Swift Observations of GRB 071021

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0. REVISIONS

- Final report of the Swift observation: XRT light curve up to T+10^6 sec.

1. INTRODUCTION

At 09:41:33 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 071021 (trigger=294974). Swift slewed immediately to the burst. At the time of the burst, UVOT was still in engineering mode after the gyro restorations, so there were no data for this trigger. The XRT light curve shows a couple of flaring activity up to 200 sec and even a strong flare at 6000 sec post-trigger. Based on the burst characteristics seen in the BAT and the XRT data, we alerted the community as a possible high-z candidate for this burst (GCN Circ 6967). The afterglow has been detected in H, K, Z, R filters and also in radio. The best position is at RA(J2000) = 22:42:34.31, Dec(J2000)= +23:43:06.5 from the IR afterglow (GCN Circ 6968).

2. BAT OBSERVATION AND ANALYSIS

The BAT ground-calculated position is RA, Dec = 340.573, 23.764 deg, which is
RA(J2000) = 22h 42m 17.6s
Dec(J2000) = +23d 45' 49"
with an uncertainty of 3.4 arcmin, (radius, sys+stat, 90% containment). The partial coding was 78%. The incident angle was 20 deg.

The mask-weighted light curve (Fig 1) shows a slow rise starting at ~T-30 sec and peaking around T+85 sec. The remaining portion of the lightcurve is consistant with either a low-level constant emission out to ~T+225 sec or with a decline to background around T+150 sec and then another weak peak from ~T+180 to ~T+220 sec. This latter interpretation is consistant with a flare in the XRT afterglow lightcurve around T+220 sec (see Fig 2). T90 (15-350 keV) is 225 +- 10 sec (estimated error including systematics).

The time-averaged spectrum from T-31.4 to T+252.2 sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.70 +- 0.21. The fluence in the 15-150 keV band is 1.3 +- 0.2 x 10^-6 erg/cm2. The 1-sec peak photon flux measured from T+87.32 sec in the 15-150 keV band is 0.7 +- 0.1 ph/cm2/sec. All the quoted errors are at the 90% confidence level.

3. XRT OBSERVATION AND ANALYSIS

The XRT data up to T+10^6 sec has been analyzed. Using the PC data we derive a refined position of RA, Dec = 340.6431 deg, +23.7181 deg, which is equivalent to
RA(J2000) = 22h 42m 34.35s
Dec(J2000) = +23d 43' 05.1"
with an estimated error radius of 3.9 arcsec (90 percent containment). This is 4.8 arcsec from the onboard XRT position.

The X-ray light-curve (Fig 2) is initially quite flat, remaining at around 40-50 count/s until 230 seconds after the trigger. There follows a very steep decay, until about 700 seconds post-trigger, when a series of strong flares are seen; there is also a strong flare about 6000 seconds after the trigger. After these flares, the X-ray afterglow is decaying in a power-law decay slope of 0.95 +/- 0.07 without any significant break.

There is spectral evolution during the initial light-curve, although the WT data before the steep decay (135-245 seconds) can be modelled as an absorbed power-law, with Gamma = 2.12 +/- 0.09 and a total

absorbing column of NH = (1.8 +/- 0.2)e21 /cm2, considerably in excess of the Galactic value of 4.8e20 /cm2. The 0.3-10 keV observed (unabsorbed) flux during this time is 1.3e-10 (1.9e-10) erg/cm2/s.

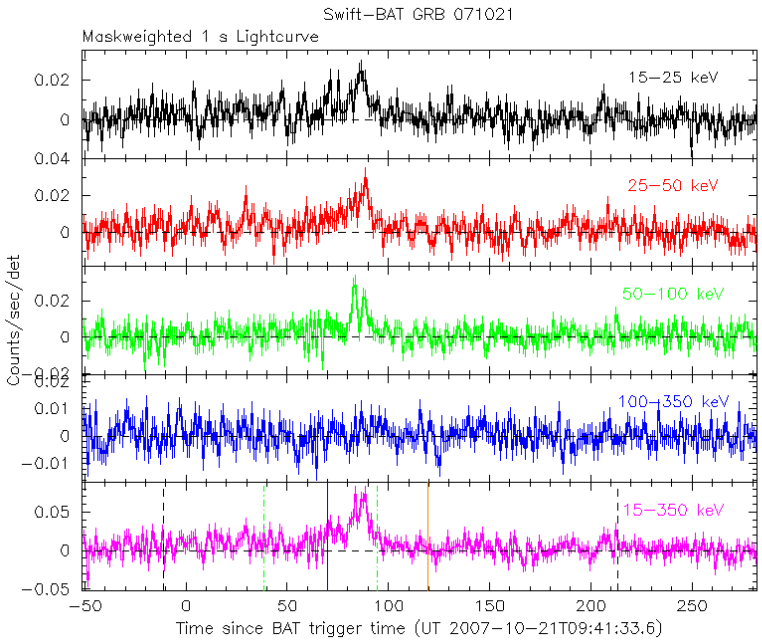

Fig.1: BAT Lightcurve. The light curve is in the 4 individual plus total energy bands. The black and green dotted lines show the time interval of T90 and T50 respectively. The blue solid line is the spacecraft slew start time and the orange solid line is the spacecraft slew settled time.

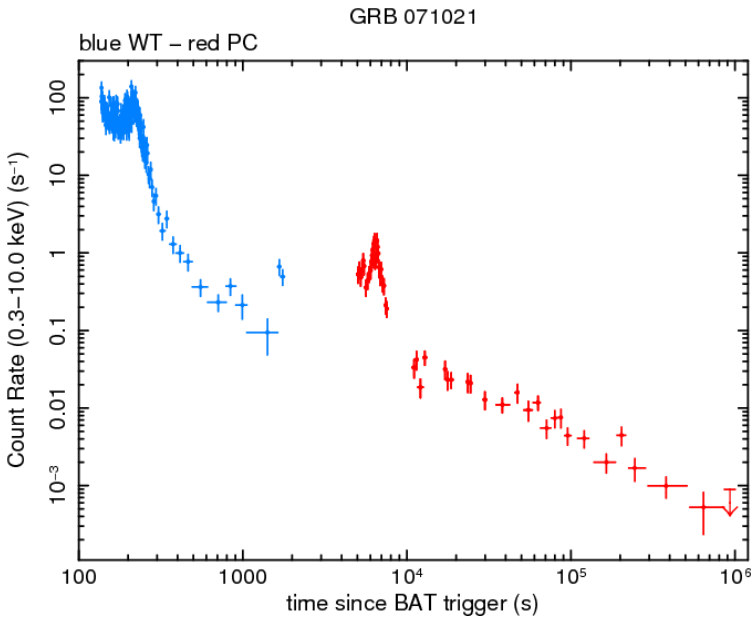

Fig. 2: XRT Lightcurve in the 0.3-10 keV band. The blue and the red data points are the WT and PC mode respectively. The conversion factor is 1 count/s = 6.4e-11 erg/cm2/s.