Swift Observation of GRB 070125

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1 Introduction

GRB070125 was detected by Mars Odyssey (HEND and GRS), Suzaku (WAM), INTEGRAL (SPI-ACS), and RHESSI at 07:20:45 UT during a Swift slew. BAT detected the source marginally after the slew, but did not trigger. The marginal BAT source is coincident with the IPN triangulation (Hurley *et al.*, *GCN Circ.* 6024) of the burst. With processing, the source is detectable in the first 4 BAT 64-second images (15-50 keV) after the slew, or 6 minutes after T0. $T_{90} = 60$ seconds. Swift observed GRB70125 as a ToO observation beginning at 20:18:48 UT, 46.7 ks after the trigger.

Our best position is the UVOT localization at RA($J2000$) = $117.82392deg$ ($07h51m17.74s$), Dec($J2000$) = $31.1617deg$ ($+31d09'4.2''$) with an error radius of 0.5 arcsec.

2 BAT Observation and Analysis

GRB070125 occured while Swift was slewing and was not in the BAT field-of-view during the beginning of the prompt emission. BAT did not trigger, but did detect GRB070125 in 4 64-seconds images after the slew with a significance of 8.2 sigma. The BAT ground-calculated position is RA($J2000$) = $117.850deg$ ($07h51m24s$), Dec($J2000$) = $+31.140deg$ ($-31d08'24.0''$) with an error radius of 2.5 $arcmin$, (systematic and statistical, 90% containment).

The raw BAT light curve (Fig.1) started during the burst as it came into the BAT field-of-view at $T + 12$ sec with a broad bump with superimposed peaks, and returns to background at about $T + 100$ sec. $T_{90}(15 - 350keV)$ is ~ 60 sec.

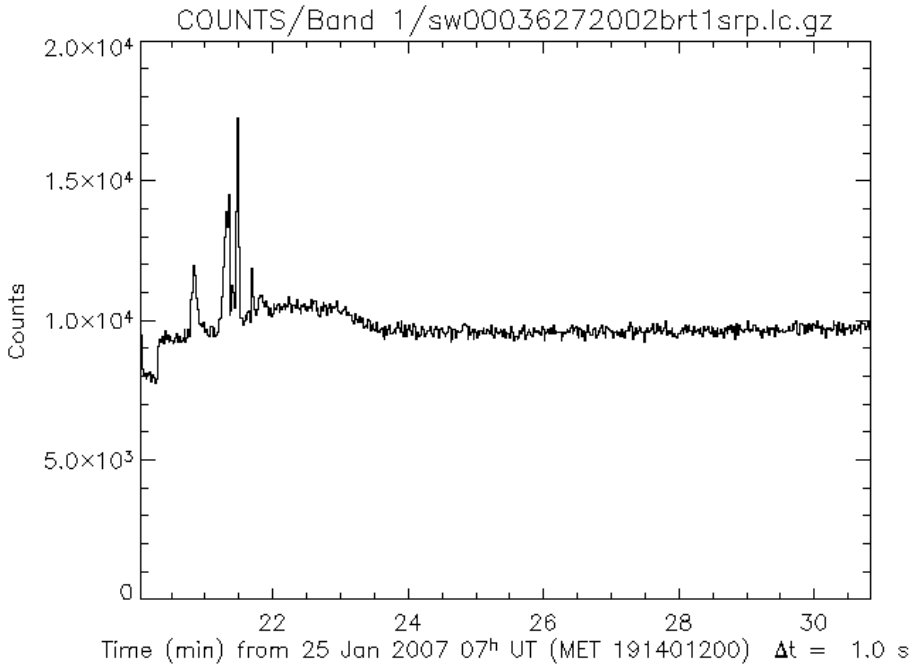

Figure 1: BAT Light curve. The raw BAT light curve in units of counts/sec/BAT.

3 XRT Observations and Analysis

Using the data from the first day of XRT data of GRB 070125 (5.4 $ksec$ in Photon Counting mode), the refined XRT position is RA($J2000$) = 117.82529deg ($7h51m18.07s$), Dec($J2000$) = +31.1508deg ($+31d09'02.9''$), with an error radius of 3.7 $arcsec$ (90% confidence, including boresight uncertainties). This position is 85 $arcsec$ of the initial BAT position, and 4.1 $arcsec$ from the optical afterglow candidate, reported by Cenko *et al.*, *GCN Circ.* 6034.

The $0.3-10$ keV light curve (Fig.2) begins at 46 ks and continues until it was no longer detectable at 1.6 Ms after the burst. The lightcurve can be fit by several models, but due to the faintness of the afterglow none is well distinguished. The simplest model is a single power-law with a slope of 1.56 ± 0.1 with the deviation at ~ 100 ks perhaps being due to slight flaring. It is slightly better fit by a broken power-law with initial slope of 1.2 ± 0.7 followed by a break at 117 ± 93 ks to a slope of 1.9 ± 0.1.

Halpern et al. *GCN Circ.* 6096 report an optical break after > 4 days to a decay slope of > 2.2 suggesting a jet break. In response to this claim, we attempt to fit the XRT data with a break at a similar time. The result is a fit with initial decay slope of 1.5 ± 0.1 followed by a break at 596 ± 328 ks (or 6.9 ± 3.8 days) to a slope of 2.5 ± 1.2. This model is consistent with that of the optical data, but not well constrained.

Two segments of the X-ray lightcurve can be modeled with an absorbed power-law with spectral indices of 2.05 ± 0.25, and 2.10 ± 0.28, respectively. The fit NH column density is $8.6 \pm 5.8 \times 10^{20} cm^{-2}$ consistent with galactic column density ($4.8 \times 10^{20} cm^{-2}$). The average observed (unabsorbed) flux over $0.3-10$ keV for this spectrum (spanning a time of $46-120$ ks, and $120-227$ ks after the trigger) is 3.0×10^{-12} and 6.5×10^{-13} $ergs/cm^2/sec$, respectively.

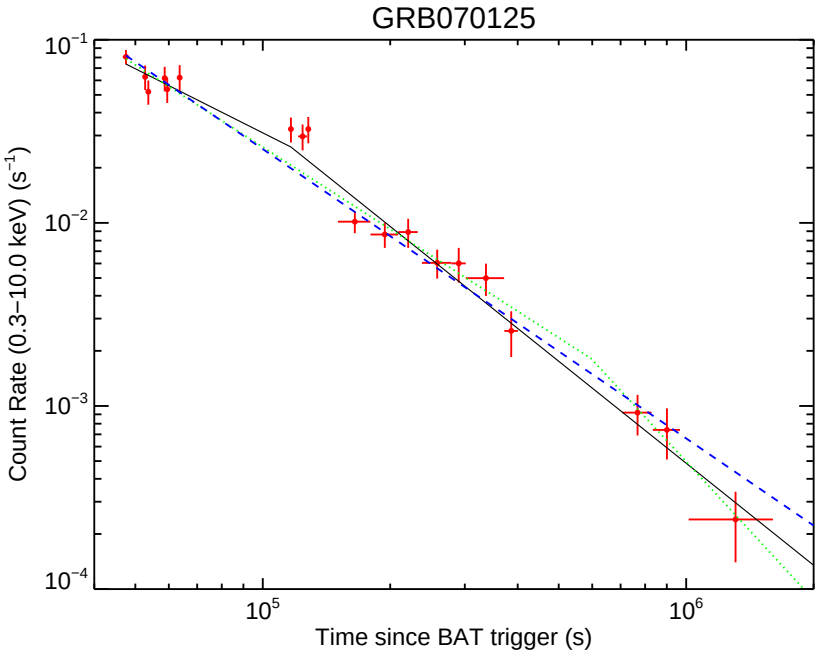

Figure 2: XRT Lightcurve. Counts/sec in the 0.3-10 keV band: Photon Counting mode (red). The approximate conversion is 1 count/sec = $\sim 2.5 \times 10^{-12}$ $ergs/cm^2/sec$. Solid black line shows broken power-law fit, blue dashed line shows single power-law fit, and green dotted line shows broken power-law fit with initial break guess at > 4 days.

4 UVOT Observation and Analysis

The afterglow of GRB 070125 (Hurley *et al.*, *GCN Circ.* 6024) was detected in all 6 UVOT filters ranging from V (central wavelength of 546 nm) to UWW2 (central wavelength of 193 nm) until ~ 5 days after the burst. The V filter lightcurve (Fig. 3) is fit by a power-law with decay slope of 1.1 ± 0.25.

Detection of absorption lines by Fox et al. (*GCN Circ.* 6071) establish a lower limit to the redshift of 1.547, and the detection in all 6 UVOT filters indicates that the redshift cannot be much higher. This is consistent with the prior reports by Prochaska et al. (*GCN Circ.* 6031, *GCN Circ.* 6032), and Pelangeon et al. (*GCN Circ.* 6033, *GCN Circ.* 6059).

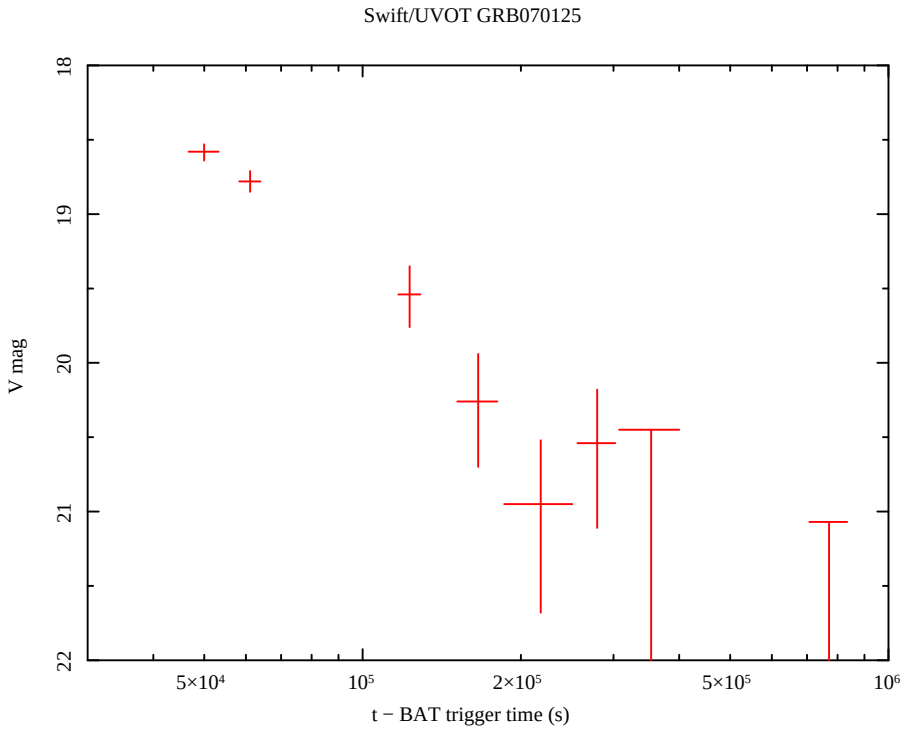

Figure 3: UVOT V filter Lightcurve.