

## Swift Observations of the short GRB 090916

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### 1 Introduction

The Swift BAT triggered on and located GRB 090916 at 07:00:44 UT (Trigger 362818) (Troja, *et al.*, *GCN Circ.* 9913). Swift did not slew promptly to the GRB due to a Moon constraint. XRT and UVOT began follow-up observations at  $T + 9.3hrs$ .

No afterglow has been detected for this burst. Our best position is the BAT location  $RA(J2000) = 126.582 deg (08h26m19.6s)$ ,  $Dec(J2000) = 25.941 deg (25d56'27.3'')$  with an uncertainty of 2.7 arcmin (radius, systematic and statistical, 90% containment).

### 2 BAT Observation and Analysis

Using the data set from  $T - 239$  to  $T + 963 sec$ , further analysis of BAT GRB 090916 has been performed by the Swift team (Barthelmy, *et al.*, *GCN Circ.* 9915). The BAT ground-calculated position is  $RA(J2000) = 126.582 deg (08h26m19.6s)$ ,  $Dec(J2000) = 25.941 deg (25d56'27.3'')$  with an uncertainty of 2.7 arcmin (radius, systematic and statistical, 90% containment). The partial coding was 34%.

The masked-weighted light curves (Fig. 1) consist of a single peak of 0.32 sec duration starting at T-0.128 sec, followed by low-level emission extending out to about T+70 sec. T90 (15-350 keV) is  $63 \pm 15 sec$  (estimated error including systematics).

The time-averaged spectrum from  $T + 0.0$  to  $T + 68.5 sec$  is best fit by a simple power law model. The photon index of the time-averaged spectrum is  $1.42 \pm 0.33$ . For this model the total fluence in the 15-150 keV band is  $9.5 \pm 1.8 \times 10^{-7} ergs/cm^2$ . The 1-sec peak measured from T-0.036 sec to T+0.064 sec is best fit by a simple power-law model. The power law index of the 1-sec peak spectrum is  $1.41 \pm 0.28$ . The 1-sec peak fluence in the 15-150 keV band is  $1.5 \pm 0.26 \times 10^{-7} ergs/cm^2$ . The 1-sec peak photon flux in the 15-150 keV band is  $1.9 \pm 0.3 ph/cm^2/sec$ . All the quoted errors are at the 90% confidence level.

### 3 XRT Observations and Analysis

Due to a Moon constraint, the Swift/XRT could not observe the field of the BAT short GRB 090916 (Troja *et al.*, *GCN Circ.* 9913) until 9.3 hours after the trigger. In 12.3 ks of Photon Counting mode data (from T+33.5 ks to T+126.6 ks) we do not detect any source within the BAT refined error circle of Barthelmy *et al.* (*GCN Circ.* 9915). The 3 sigma upper limit in the 0.3-10 keV band is  $8 \times 10^{-4} count s^{-1}$ , which corresponds to an observed flux limit of  $3 \times 10^{-14} erg cm^{-2} s^{-1}$  (assuming a typical count-to-observed flux conversion factor of  $3.8 \times 10^{-11} erg cm^{-2} ct^{-1}$ , Evans *et al.*, 2009, MNRAS, 397, 1177).

## 4 UVOT Observation and Analysis

Due to a Moon constraint, the Swift/UVOT began settled observations of the field of GRB 090916 9.3 hours after the BAT trigger (Troja et al., *GCN Circ.* 9913). Comparison with archival DSS imaging reveals no new sources within the BAT error circle. UVOT magnitude 3-sigma upper limits for this field are reported in Tab. 1. The quoted upper limits have not been corrected for the expected Galactic extinction along the line of sight, corresponding to a reddening of  $E(B-V) = 0.06$  mag (Schlegel et al. 1998, *ApJ*, 500, 525). All photometry is on the UVOT photometric system described in Poole et al. (2008, *MNRAS*, 383, 627).

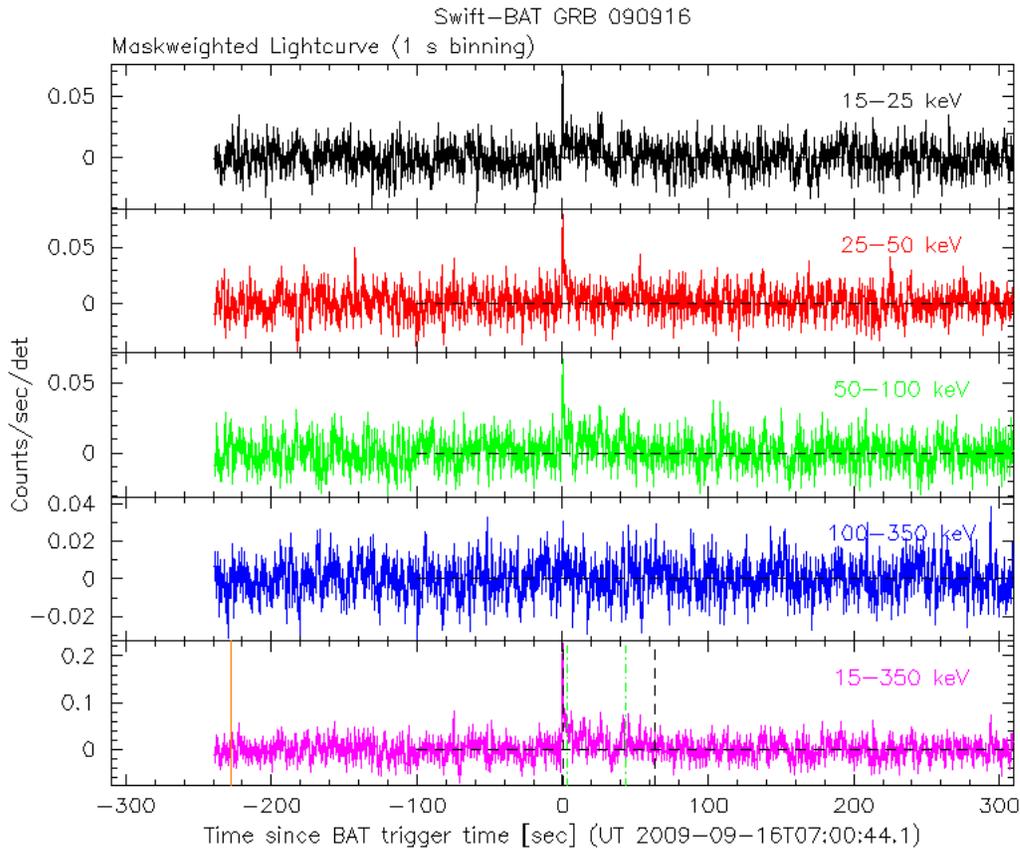


Figure 1: BAT Light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector.

Filter	Start	Stop	Exposure	3-Sigma UL
v	35090	47519	1378	>19.7
u	33472	45813	2390	>20.8
white	34280	46633	1272	> 21.3

Table 1: Magnitude limits from UVOT observations