

Swift Observations of GRB 110604A

J. R. Cummings (NASA/GSFC/CRESST), B. Sbarufatti (INAF-OAB/IASFPA), and M. De Pasquale (MSSL) on behalf of the Swift team

1. INTRODUCTION

At 14:49:45 UT, GRB 110604A triggered detectors on several IPN spacecraft, including Swift-BAT (trigger# 454779). It was a long-type GRB with multiple peaks with T90 about 30 seconds. Ground analysis of BAT data revealed a source on the very edge of the BAT field of view (about 1% coded). A Swift TOO (source number 20162) was begun at 2011-06-06T00:29:02. The XRT found a single source just outside the larger-than-usual estimated BAT error circle, about 9.3 arcmin from the BAT position but fully consistent with the IPN annuli. See Figure 1. The UVOT did not find a source.

The burst was also observed by Konus-Wind¹, MESSENGER (GRNS), INTEGRAL SPI-ACS, and Suzaku-WAM.

2. BAT OBSERVATION AND ANALYSIS

Since this burst did not trigger the automated processing onboard, the usual data products are not available. Two BAT positions were determined on the ground, one reprocessed from the automated imaging attempts (the “scaled-map” data), and one from the 10-second sample of photon events received in the case of rate triggers with no source found in automated imaging. The former was at RA, Dec 271.003, +18.472. The latter was at RA, Dec 270.827, 18.402. Both positions were consistent with the IPN annuli. The former position was 9.3 arcmin from the XRT position that was found subsequently and the latter was 1.8 arcmin from the XRT position.

3. XRT OBSERVATION AND ANALYSIS

XRT observations began about 121000 seconds after the burst.

Using 2497 s of XRT Photon Counting mode data and 2 UVOT images, the astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue) is RA, Dec = 270.85898, 18.39817 which is equivalent to:

RA, Dec (J2000): 18h 03m 26.16s, + 18° 23' 53.4"

with an uncertainty of 2.3 arcsec (radius, 90% confidence).

Using 40 ks of XRT data from 121 ks to 1573 ks after the BAT in Photon Counting (PC) mode, the X-ray light curve initially follows a shallow decay, with a decay index of 0.15 ± 0.15 . Later observations show greater fading, but possibly with a late plateau before fading below detectability.

4. UVOT OBSERVATION AND ANALYSIS

The Swift/UVOT began settled observations of the field of GRB 110604A 121 ks after the BAT trigger (Cummings et al., GCN Circ# 12063). No optical source is found within the XRT error circle. 3-sigma upper limits using the UVOT photometric system (Poole et al. 2008, MNRAS, 383, 627) are:

Filter	T_start (s)	T_end (s)	Exp (s)	mag
white	207930	237252	1399	>22.9
v	208162	237295	516	>19.6
u	207698	240533	2864	>21.5

The magnitudes in the table are not corrected for the Galactic extinction due to the reddening of $E(B-V) = 0.24$ in the direction of the burst (Schlegel et al. 1998).

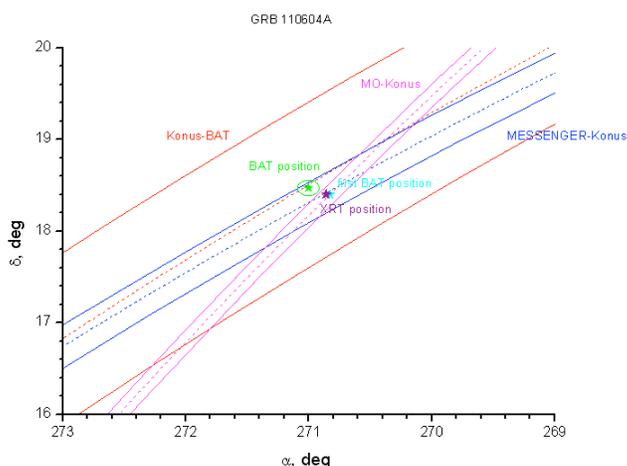


Fig 1: IPN localization (V. Pal'shin, private communication)

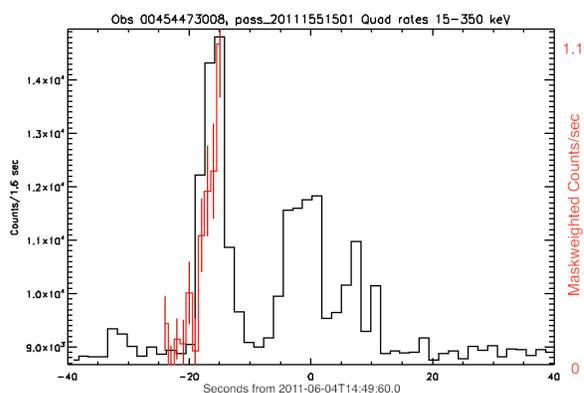


Fig.2: BAT Lightcurve. The light curve in a single energy band from 15 to 350 keV. The black line shows the unweighted counts in 1.6-second bins and the red line shows the mask-weighted counts in 1-second bins.

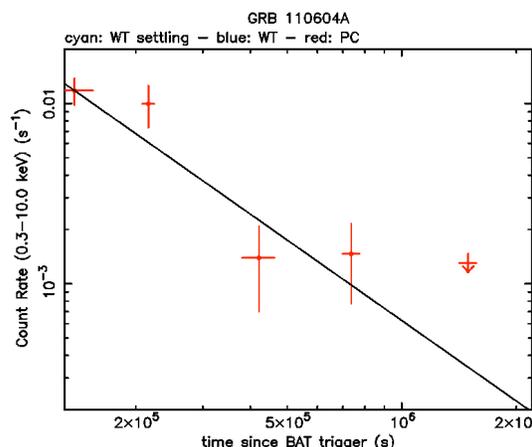


Fig. 3: XRT Lightcurve