GRBCAT: Bursts from Vela to Swift

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ABSTRACT

Gamma ray burst (GRB) astronomy started when the first event was recorded on July 2, 1967, by Vela 4a and 4b. Since then many missions have flown experiments capable of detecting GRBs. The events collected by these older experiments are mostly available in paper copy, each containing a few ten to a few hundreds bursts. No systematic effort in cataloging of these bursts has been available. In some cases the information is unpublished and in others difficult to retrieve. The first major GRB catalog was obtained by GRO with the BATSE experiment. It contains more than 2000 bursts and includes homogeneous information for each of the burst. With the launch of Swift, the first Gamma X-ray mission dedicated to the study of the GRBs and their afterglows, a wealthy of information is collecting by the Swift instruments as well as from ground based telescopes. This talked will describe the effort to create a comprehensive GRBCAT, its current status and future prospects.

1. Overview

On Jul 2 1967 with the first GRB detection by Vela (Fig.1) started the field of Gamma ray Bursts astronomy. Since then many missions with experiments capable to detected GRBs were flown. The events collected by most of these old experiments are published in paper copy. No systematic effort to cataloging these bursts has been available. Information in cases was unpublished or difficult to retrieve. The first major GRB catalog was obtained by GRO with the BATSE experiment, which contains more than 2000 events with homogeneous information. With the launch of Swift, the first mission dedicated to GRB and their afterglow a new wealthy of information is collected from Swift instrumentation and from ground based telescopes. GRBCAT is a cataloguing effort to create comprehensive catalogs of GRBs.

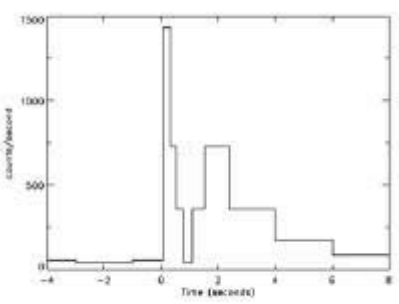


Fig.1. The first GRB with Vela 4a and 4b.

2. GRBCAT

GRBCAT contains currently GRB prior the Swift era. GRBCAT has been built including sources from paper published in the referee journal, unpublished papers (mostly provided from K.Hurley), events in PhD thesis and compilation of bursts already present in the HEASARC database. GRBCAT contains two kinds of information. There are basic parameters that characterized the detected event and for most recent bursts include information of their afterglow For each burst the literature and databases were searched for a number of information as

- Time of the trigger
- Duration
- Fluxes
- Fluence
- Position or the geometry of the region containing the position

The parameters of GRBCAT has been reported as they published in literature since there is no standards or single units of how these quantities has been reported. For example:

- Fluxes and/or fluence are reported either in different units or for individual one. Or more than one measurement are reported.
- Duration is not always the canonical T50 or T90.
- Time of the trigger arrival uses different time reference system or unspecified.

These quantities therefore are layout using several fields. For these older bursts one major problem was to obtain the accurate position.

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- The GRO/BATSE has an accuracy of few degrees.
- Interplanetary GRB network exists since 1976. It uses the arrival time of these events as detected from different satellites. The positions reported in literature are from complicated regions. GRBCAT includes parameters to describe each of the regions.
- BeppoSAX GRBM working with the WFC was the first to get arcmin position.

GRBCAT currently contains 5814 unique GRBs from 1967 up to December 2004. Events were collected from over 23 satellites. If an event has been detected from more than one satellite, both are listed. Events are considered "different", if they occur in a time interval of 5 minutes apart. Note that SGR are not included.

The catalog is not complete and does not include events detected :

- by Ginga
- only by the BeppoSAX GRBM
- by HETE-2 and Integral after Dec 2004.

There is not a comprehensive publication for Ginga. For Integral and HETE-2 information were taken mainly from the GCN. BeppoSAX/GRBM or Ginga events are present only if other satellites have seen them.

Afterglow information is given for any bursts detected after May 11 1996 until Dec 2004. Afterglow information has been retrieved mainly for the GCN and includes: flux or level of detection and redshift. There are information for :

- 188 individual bursts follow up observations
- 108 detected or possible detected afterglows
- 80 with positive afterglow detections

A total of 2646 observations among radio, optical, infrared and X-ray are included:

- 32 detected in radio out of 52 observed.
- 43 detected in optical and IR out of 89 observed.
- 36 detected in X-ray EUV out of 46 observed.

The layout of GRBCAT is shown in Fig. 2. GRBCAT is not a single table but is composite of several tables of

- Mail Table : General and GRB duration
- Fluxes and Fluences
- Regions
- Afterglow

There is dedicated thematic web site

http://grbcat.gfsc.nasa.gov

Note that the beta version is currently populated and it is not searchable. Next will be to include the Swift GRB and complete the Integral, HETE-2, Suzaku, Agile and the IPN. It includes all source of information used to populated the catalog. Ready to go on-line within this month.

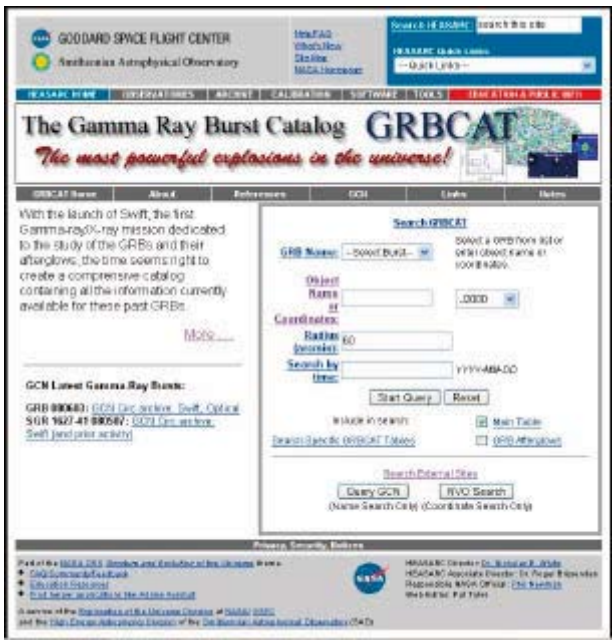


Fig.2. GRBCAT layout. http://grbcat.gfsc.nasa.gov

3. Swift GRB catalog

Current version of the Swift GRB catalog contains all GRBs up to GRB 070429B. The total is 259 bursts. They are all bursts discovered by Swift or discovered by others & followed by Swift. It is created by contribution of the Swift IT and mainly GCN circular. Several data products are associated with the catalog:

- Lightcurves and Images all three instruments & combine BAT XRT lightcurve
- Spectra (BAT and XRT)
- Informative tables listing parameters used in the processing
- HTML file to include all plots & link to files as well as information from the Swift GRB catalog

The Swift GRB catalog are generated by scripts using as much possible the current software. Addition routines will be included in the Swift software package. They run in automatic fashion (but for the XSPEC fitting of the XRT LC), and visually inspected and corrected if the automatic process fails.

The products will be linked to the Swift GRB catalog. We will start populating the archive by end of July from old bursts and it is expected to catch up with the latest burst within 6 months.

To each bursts associated several parameters :

- Position from the 3 instruments and best position
- If detected by the XRT or UVOT
- Time interval Swift followed the burst and first time on source
- Redshifts, galactic N_H, Galaxy association
- If follow up in the O R I and if detected
- Several measurements from the BAT, XRT and UVOT

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The catalog is in the HEASARC develop area, but soon it will be moved in the public area.

4. Conclusion

GRBCAT and Swift GRB catalog are new resources, which will come on-line soon. The Swift GRB catalog will be ultimately part of GRBCAT. GRBCAT will be updates for not only Swift GRBs but also HETE-2, Integral, Suzaku, Agile, IPN and MAXI.

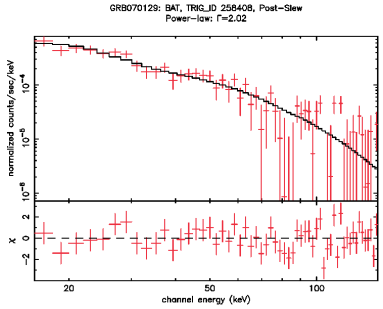


Fig.3. Example of the BAT GRB spectral plot.

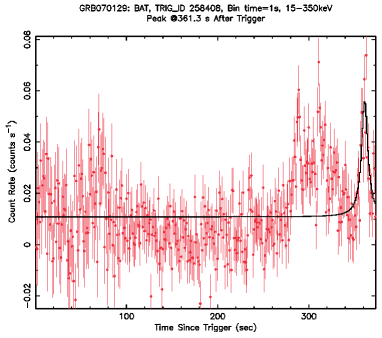


Fig.4. Example of the BAT GRB light curvel plot.

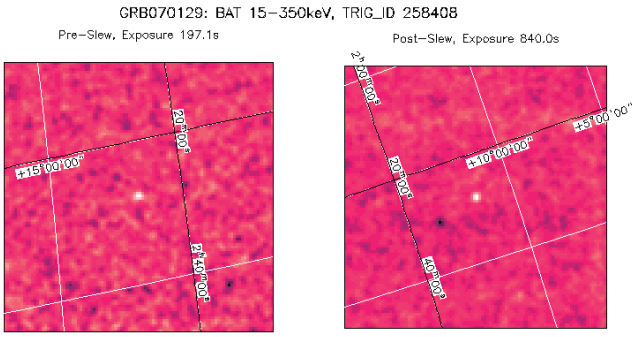


Fig.5. Example of the BAT GRB images.

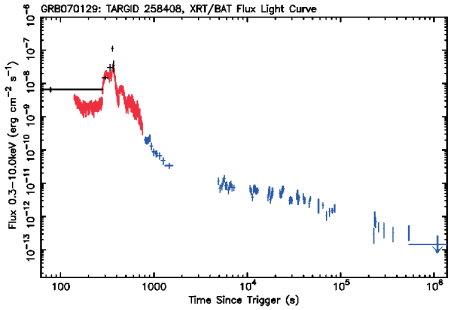


Fig.6. Example of XRT/BAT combined product

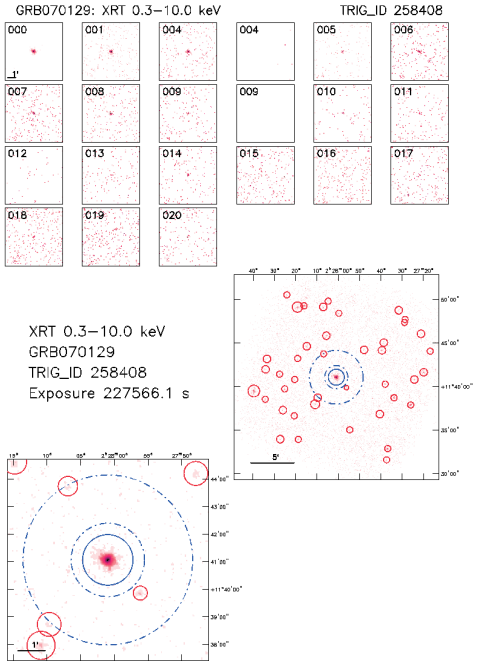


Fig.7. Example of XRT GRB image plot

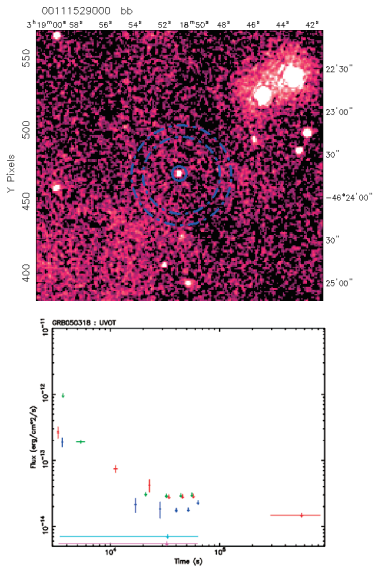


Fig.8. Example of UVOT GRB plot product

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