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The BeppoSAX/GRBM catalog of GRBs: Current status(*)

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Summary. — We report on the status of the GRB catalog obtained with the BeppoSAX/GRBM instrument. Thanks to the GRBM response function now well calibrated for all directions we are converting the background subtracted count rate profiles of all GRBs in physical units with the evaluation of position, duration, peak flux, fluence, and spectral information. In this poster we present preliminary results of a sample of 8 GRBs which will appear in the GRBM catalog of GRBs now in preparation.

PACS 95.80.+p – Astronomical catalogs, atlases, sky surveys, databases, retrieval systems, archives, etc.
PACS 98.70.Rz – γ-ray sources; γ-ray bursts.
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1. – Introduction

The catalog of BeppoSAX Gamma-Ray Burst Monitor (GRBM) is the largest one but that of BATSE. It counts 1082 GRBs: 670 of them were on-board triggered, 53 were detected also by the Wide Field Cameras (WFCs). The GRBM catalog will represent a considerable contribution for the study of GRBs and will be important also for a cross-check with the BATSE results.

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2. – GRBM data

The GRBM data consist of

- 1 s ratemeters in the 40–700 keV and > 100 keV energy bands;
- 223 channels energy spectra in the 40–700 keV energy band accumulated over 128 s time intervals;
- high time resolution (down to 0.48828125 ms) count rates in the 40–700 keV energy band (avaliable for a limited time interval around the trigger time).

3. – Cross-calibration

Fluence, peak flux, hardness ratio and photon index (Γ) have been extracted from the 1 s light curves in the 40–700 keV and > 100 keV bands, with the assumption of a power law (PL) spectrum. We will refer to these spectra as "2 channel spectra".

The PL model is a forced choice for those GRBs for which the 223 channel spectra (integrated on 128 s) do not provide useful results. This choice introduces a systematic error that will be quantified.

The 2 channel GRB spectra have been widely cross-calibrated with the corresponding 128 s spectra. On the basis of this analysis we have determined the 2 channel response function, which has permitted us to derive the photon index, peak flux and fluence which will be reported in the catalog. This is a complicated and delicate operation because of the payload surrounding the GRBM units.

For the cross-calibration, we have used only GRBs for which:

- the 40–700 keV integrated net counts are higher than 10000-1;
- the time profile is not affected by spurious intense spikes due to high energy particles interacting with the detector;
- the variability of background before and after the GRB is low enough to allow a satisfactory background subtraction for the spectrum.

The results is that we have used about 100 GRBs for this cross-calibration.

This cross-calibration has been performed for each one of the four GRBM detection units, given the different response function of each one.

4. – Catalog sample

Table I shows a sample of the BeppoSAX/GRBM catalog. Uncertainties are 1σ. The GRBs selected for this table

1) came from various directions with respect to the GRBM, to test the procedure for all GRBM detection units, and for several incidence angles;
2) are in common with BATSE, so as to be compared with BATSE results;
3) are intense burst, with high signal-to-noise ratio.

We have also compared the BATSE fluence and peak flux (on a temporal scale of 1024 ms) in 50–300 keV energy band with our results. In 50–300 keV energy band, the GRBM fluences and peak fluxes are tipically slightly lower than the BATSE ones. These lower values can be justified by the approximation used of a PL as input model.

TABLE I. – *Sample of the GRBM catalog. Top panel - 1st column: GRB name in format YYMMDD (Year, Month, Day). 2nd column: trigger time (U.T.) obtained with ground S/W using the 1 s ratemeters. 3rd column: On-board (B) and ground (G) S/W which was triggered by the GRB. 4th, 5th, 6th, 7th columns: the best known equatorial (RA, DEC) and galactic (ℓ, b) coordinates (in degree, at J2000.0) of the GRB arrival direction. 8th column: error on the arrival detection, in degree. Bottom panel - 1st column: source used for the best direction information; 4B means the fourth BATSE catalog* [2]. *2nd column: estimate of the duration T_{90} derived from the GRBM data. 3rd column: 40–700 keV fluence, obtained from the integration of the background subtracted light curve on the entire duration of the burst. 4th column: 40–700 keV peak flux, obtained from the background subtracted light curve integrated over the least temporal scale for which the signal-to-noise ratio is higher than 5. 5th column: hardness ratio (> 100 keV)/(40–700 keV) measured with the most illuminated detection unit. 6th column: photon index of the PL fitted to the data.*

GRB	S/W Trig U.T.	G/B Trigger	RA (deg)	dec (deg)	ℓ (deg)	b (deg)	err (deg)
970420	20:14:03	G	212.99	−15.91	329.72	42.74	1.6
990123	09:47:10	B	231.37	44.75	73.09	54.65	0.0
000402	14:30:58	B	343.53	6.65	78.59	−45.88	1.8
000421	12:23:34	B	174.91	16.98	240.67	70.55	3.5
960806	22:28:36	G	182.93	−2.19	232.66	−64.98	2.3
000115	14:49:32	B	116.55	−15.79	233.24	4.51	2.3
970405	03:42:01	B	98.84	22.84	190.75	6.86	1.7
960703	13:42:54	G	4.62	−7.75	99.47	−69.11	1.9

CAT	T_{90} (s)	S(40–700 keV) (10^{-6} ergs/cm^2)	F_p(40–700 keV) (10^{-7} ergs/cm^2/s)	HR	α
4B	9.0±1.4	43.1±0.24	134±0.08	0.870±0.139	1.55±0.15
4B	63±3	177±0.14	97.0±0.79	0.812±0.112	1.11±0.17
4B	120±13	7.97±0.73	12.1±0.11	0.730±0.0947	1.64±0.20
4B	46±2	12.2±0.10	4.29±0.47	0.604±0.095	2.35±0.17
4B	173±13	15.3±0.09	10.2±0.07	0.782±0.105	1.90±0.14
4B	14.1±0.1	21.5±0.13	69.2±0.41	0.874±0.139	1.66±0.15
4B	62±4	5.13±0.39	2.71±0.27	0.606±0.093	2.25±0.18
4B	69±6	9.73±0.65	9.54±0.74	0.702±0.100	1.77±0.14

The preliminary version of the catalog, see [1], did not report the photon index, while fluence and peak flux were related in counts. Now we are converting them in physical units. The final version of the catalog will also includes the GRB duration defined as the time elapsed between the first and the last time in which the 40–700 keV signal exceeds the 2σ level, and the most illuminated detection unit which is used to evaluate the hardness ratio. The work is in progress. The final goal is to put the final results also on the web, including all the products as light curves and other useful information.

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