FIRST CATALOGUE OF THE INTEGRAL¹/IBIS OFF-AXIS GAMMA-RAY BURST

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ABSTRACT

We present the first catalogue of the gamma-ray bursts (GRB) taking place outside of the INTEGRAL¹/IBIS field of view.

Key words: GRB; gamma-ray.

1. GRBS IN THE INTEGRAL

INTEGRAL (International Gamma Ray Astrophysics Laboratory) is an ESA mission devoted to space research in gamma-ray energy range. The INTE-GRAL/IBIS/ISGRI instrument is a coded mask telescope with a field of view covering only a small area of the sky (\sim 4%) and therefore it detects and localizes about 10 GRB per year [1] in the field of view. ISGRI allows to localize GRBs in near real time with the accuracy of a few arc minutes. Moreover, it can measure the GRB spectra in the energy range between 15 and 1000 keV. Additionally INTEGRAL detects GRBs using anticoincidence scintillation system SPI ACS [2, 3]. SPI ACS detects more than 100 confirmed GRBs per year and provides GRBs' localizations as a node in the Interplanetary Network (IPN).

2. GRBS OUTSIDE THE INTEGRAL FIELD OF VIEW

We have developed algorithms to detect, localize and extract spectra of the GRBs outside the INTEGRAL field of view. These methods make use of the Compton mode IBIS/INTEGRAL data. Table 1 shows 28 localized offaxis GRBs detected by INTEGRAL between November 2002 and December 2004. The columns off-axis and azimuth contain the position of the burst in the satellite coordinates (coded area is a square shape covering about $16-20^{\circ}$ around the axis). The last column shows a list of the INTEGRAL's instruments seeing the given burst, where: I: ISGRI, P: PICSIT, C: IBIS Compton mode and PH: PICSIT histogramming mode (so called: SPTI). The GRBs in the table were localized by IPN except 030722A and 041226A. For GRB030722A IPN provided only an annulus, while using the IBIS Compton mode localization method [4] we determined the unique position of the burst. For 041226A position has been determined only using the IBIS Compton mode. Three GRBs, 021125A, 030320A and 041219A, occurred in the IBIS field of view, are at the bottom of the table since they have been detected at a significant level by the IBIS Compton mode and we used them for tests and calibration. During the period covered by this study, IBIS/INTEGRAL instruments have detected additional 30 bursts confirmed by the other satellite missions. Positions of these bursts have only been determined as annuli by the IPN. These bursts are not listed in the table.

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	GRB	time of day [IJD]	duration [s]	R.A. [°]	Dec [°]	off-axis [°]	azimuth [°]	"mode"
	021206A	22:49:08	7.5	240.18	-9.72	71.79	341.6	I PH C
	030204A	12:45:29	34.0	0.83	32.72	125.92	5.17	I PH
	030217A	02:45:37	50.8	186.59	-11.86	105.47	169.79	Ι
	030325A	14:15:11	1.8	70.77	19.10	149.68	299.0	Ι
	030326A	10:43:42	5.0	292.96	-11.72	39.19	62.21	I PH C
	030329A	11:37:25	20.4	161.20	21.50	79.79	168.61	Ι
	030405A	02:17:27	4.0	248.20	-24.15	31.31	108.46	I PH C
	030406A	22:42:03	62.1	285.42	-68.07	36.90	281.01	I PH C
	030414A	13:48:24	21.7	119.88	-48.58	98.97	252.69	Ι
	030422A	07:51:12	7.8	265.61	-6.90	25.35	95.01	I PH C
	or			286.39	13.78	50.78	70.33	
	030501B	01:17:17	8.0	290.60	28.40	37.98	79.08	I PH
	030509A	05:50:23	5.7	78.70	11.13	145.85	5.27	I PH
	030721A	23:41:07	30.3	273.63	-40.48	96.26	156.55	I C
	030722A	13:31:41	14.7	106.50	-15.50	76.57	29.58	I C
	030725A	11:46:24	25.7	308.48	-50.70	90.78	148.94	Ι
	030726A	06:38:24	39.0	253.70	-21.11	82.26	227.32	I C
	030801A	16:51:49	28.8	130.17	-25.86	108.1	46.78	Ι
	030827A	16:08:40	8.0	223.18	48.59	87.65	296.09	Ι
	031024A	09:24:10	5.2	225.44	-16.15	135.42	0.05	Ι
	031026A	01:26:29	0.4	336.00	0.11	114.37	171.22	Р
	031108A	14:11:00	33.0	66.72	-5.93	92.57	155.75	Ι
	031109B	11:10:20	100.0	327	20	44	200	I PH C
	031111A	16:45:12	9.9	71.7	18.1	53.55	208.13	I PH C
	031214A	10:10:49	0.45	245.47	-11.5	106.32	340.75	I PH
	040322A	07:29:02	0.25	236.	21.0	90.13	126.91	I PH C
	040511A	13:01:49	30	221.95	-44.25	35.94	163.31	Р
	041016A	04:39:35	6	26.0	-4.28	110.88	162.35	Ι
	041211A	11:31:47	17	100.8	20.39	104.09	196.66	Ι
	041226A	17:22:26	12	343.5	14.4	46.00	44.77	I PH C
	021125A	17:58:23	30.0	296.85	28.26	7.32	34.94	I P C
	030320A	10:12:09	269.0	267.90	-25.30	15.48	31.24	I PH C
	041219A	01:43:00	540.0	6.12	62.84	3.16	66.65	I PH C

Table 1. List of the localized INTEGRAL off-axis GRBs detected in the INTEGRAL instruments during two years of mission. For detailed description see the text