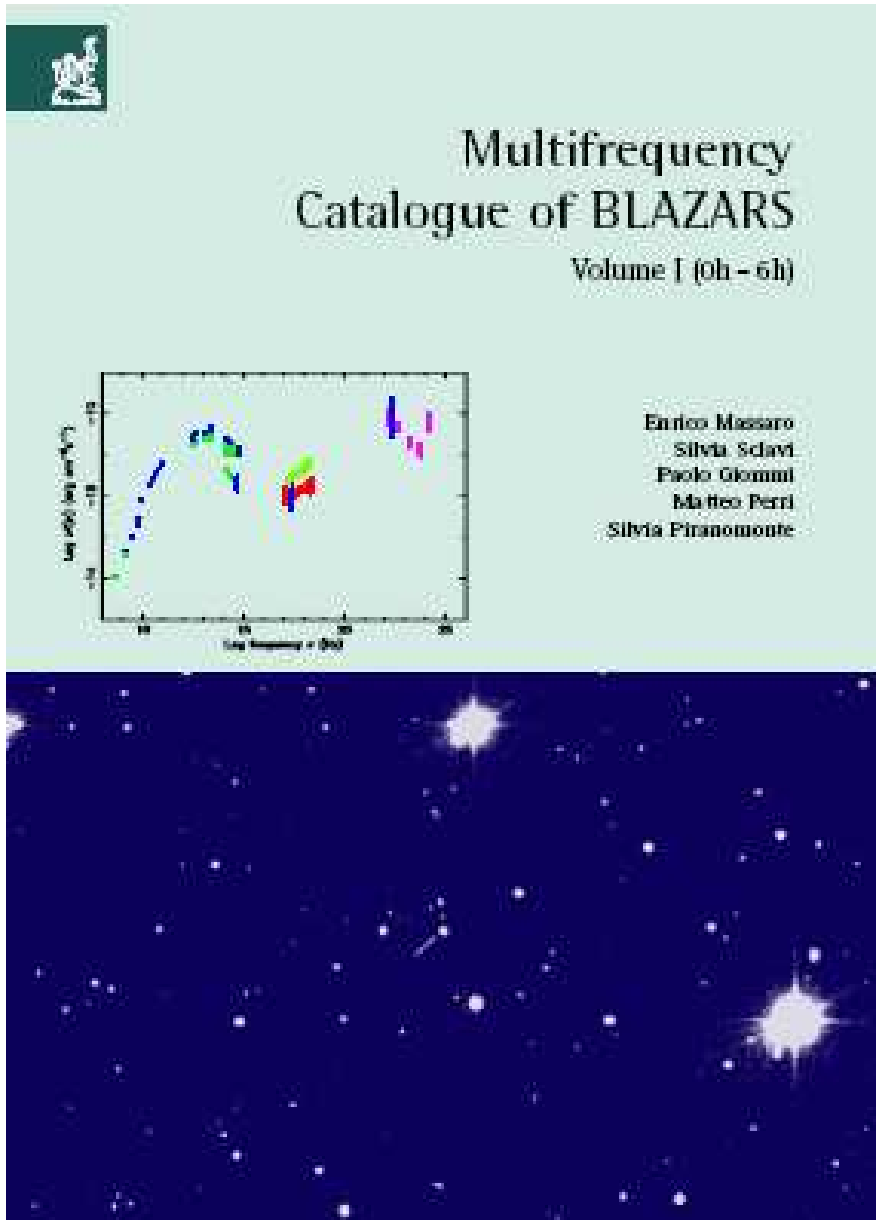


# The BZ catalogue

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Stockholm, August 2006

- The compilation of the BZ catalogue is the work of several people at the University of Roma “La Sapienza” (Dep. of Physics) and at the ASDC.

- The increase of the work because of newly discovered blazar requires that additional people will contribute to the catalogue compilation.

# The BZ catalogue

- Main goals:

1. **to have the most complete list of published blazars**
2. **to have a basic sample for the identification of $\gamma$-ray sources detected by LAT**
3. **to have a source population useful to select samples for statistical studies of blazar properties and evolution**
4. **to have a large database of broad-band spectral energy distributions (SED) of different types of blazars to investigate radiation processes**

# The two main types of Blazars

- BL Lac objects (BL)
- Flat spectrum radio Quasars (FSRQ)

and

- Peculiar Blazars (e.g. Uncertain classification, intermediate types, etc…)

- Sources' naming:

- BZB J(coordinates)
  for BL Lac objects and BL Lac candidates

- BZQ J(coordinates)
  for Flat Spectrum Radio Quasars

- BZU J(coordinates)
  for Blazars of uncertain classification and peculiar sources

# Catalogue organization

- Part 1 - List of Blazars

- Part 2 – Data and SEDs of selected sources (e.g. detected in hard X-ray or $\gamma$-ray band)

- Basic information:

Existing catalogues of AGNs, multifrequency surveys, data from general literature

- Deadline:

The first version including the entire sky should be available by the end of 2007

TABLE 1
BL Lac objects (continued)

| Source name | RA(2000) [h m s] | DEC(2000) [° ′ ″] | R [mag] | $F_{1.4GHz}$ [mJy] | $F_{0.1-2.4keV}$ [$10^{-12}$erg cm$^{-2}$s$^{-1}$] | z | Notes |
|---|---|---|---|---|---|---|---|
| BZB J0200+2712 | 02 00 29.49 | +27 12 39.1 | 18.4 | 15 | 1.57 | | |
| BZB J0201+0034 | 02 01 06.18 | +00 34 00.2 | 18. | 13 | 3.76 | 0.298 | |
| BZB J0202+0849 | 02 02 26.39 | +08 49 13.7 | 19. | 134 | 1.06 | | |
| BZB J0203+7232 | 02 03 33.38 | +72 32 53.7 | 20.Bp | 229 | | | nX |
| BZB J0204−3333 | 02 04 13.22 | −33 33 33.7 | 19.B[1] | 6 | 1.56 | 0.617 | |
| BZB J0208+3523 | 02 08 38.19 | +35 23 12.7 | 18.8 | 5 | 2.94 | 0.318 | |
| BZB J0213+1213 | 02 13 05.20 | +12 13 10.9 | 19.9 | 132 | | 0.252 | nX |
| BZB J0214+5144 | 02 14 17.93 | +51 44 52.0 | 16.5p | 294 | 4.71 | 0.049 | 2 close obj. |
| BZB J0219−1725 | 02 19 05.52 | −17 25 13.7 | 15.7 | 62 | 0.77 | 0.128 | |
| BZB J0219−1842 | 02 19 21.16 | −18 42 38.7 | 19. | 302 | | | nX |
| BZB J0220−0842 | 02 20 48.46 | −08 42 50.4 | 17.8 | 65 | 1.05 | | sl |
| BZB J0222+4302 | 02 22 39.61 | +43 02 07.8 | 14.5 | 2303 | 2.34 | 0.444? | |
| BZB J0227+0202 | 02 27 16.58 | +02 02 00.1 | 18.9 | 36 | 18.95 | | |
| BZB J0232+2017 | 02 32 48.46 | +20 17 16.2 | 14.g | 82 | 5.75 | 0.139 | |
| BZB J0235−2938 | 02 35 36.70 | −29 38 43.6 | 19. | 5 | 1.73 | | |
| BZB J0238+1636 | 02 38 38.93 | +16 36 59.3 | 18.5 | 1941 | 5.17 | 0.940 | nsl |
| BZB J0240−0504 | 02 40 56.19 | −05 04 43.0 | 18.7 | 237 | | | nX |
| BZB J0243+0046 | 02 43 02.93 | +00 46 27.3 | 18.7 | 30 | $<1.85$[2] | 0.409 | |
| BZB J0243+7120 | 02 43 30.88 | +71 20 17.9 | 18.4 | 211 | | | nX |
| BZB J0248−1631 | 02 48 07.73 | −16 31 46.4 | 19.3 | 520 | | | nX |

# Sources' data and SED

BZB J0238+1636

[HB] 0235+164
AO 0235+16, PKS B0235+164, OD +160, NVSS J023838+163658
1ES 0235+164, 3EG J0237+1635, GEV J0237+1638

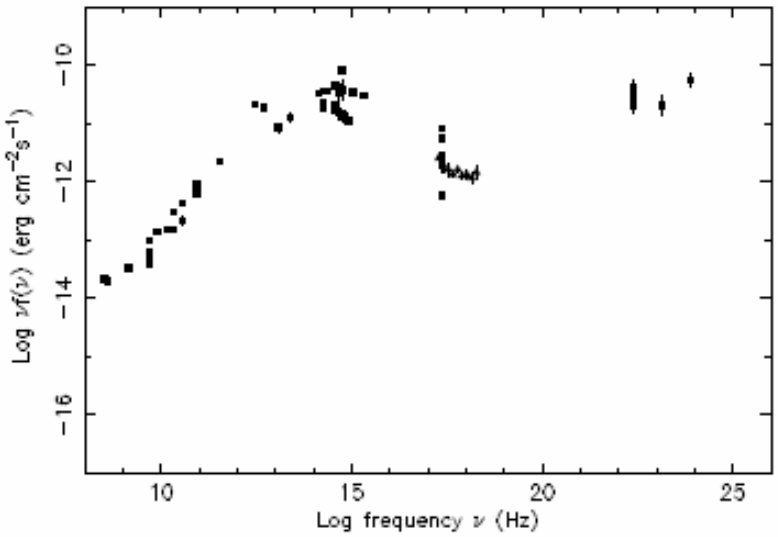
**1. Coordinates**

RA(J2000) = $02^h\ 38^m\ 38^s.93$, Decl.(J2000) = $+16°\ 36'\ 59''.3$
$l = 156°.771$, $b = -39°.109$

**2. Radio-mm Data**

**2.1. Flux and Spectrum**

0.318 GHz: 0.73±0.05 ÷ 1.67±0.06, <1.24> Jy [7]
0.365 GHz: 1.031±0.023 Jy (TXS)
0.408 GHz: 1.260 Jy (PKSCAT90), 1.23±0.09 ÷ 1.95±0.11 Jy [12]
0.430 GHz: 1.9±0.10 Jy (1Jy), 0.81±0.22 ÷ 2.05±0.15, <1.48> Jy [7]
0.750 GHz: 1.35±0.10 Jy (1Jy)
0.960 GHz: 0.469±0.084 Jy (RATAN)
0.968 GHz: 1.72±0.11 Jy (1Jy)
1.379 GHz: 2.61±0.13 Jy [1]
1.4 GHz: 2.355 Jy (NORTH20), 1.942±0.058 Jy (NVSS)
1.41 GHz: 0.87±0.01 Jy (NRAO-MPIFR)
1.484 GHz: 2.01±0.10 Jy [14]
2.3 GHz: 0.613±0.009 Jy (RATAN)
2.5 GHz: 0.85 ÷ 3.7 Jy [3]
2.695 GHz: 1.94±0.09 Jy [14]
2.70 GHz: 1.86±0.09 Jy (PKSCAT90), <1.31> Jy [6]
3.90 GHz: 0.959±0.014 Jy (RATAN)
4.585 GHz: 1.934±0.265 Jy (87GB)
4.8 GHz: 0.4 ÷ 3.9 Jy [5]
4.885 GHz: 1.99±0.10 Jy [14]
5.0 GHz: 2.79±0.3 Jy [15], 1.64 Jy (PKSCAT90), 1.48±0.15 Jy [9], 0.36 ÷ 3.22 Jy [4], <1.19> Jy [6], 4.26 Jy [22]
5.009 GHz: 1.99±0.10 Jy (1Jy)
7.70 GHz: 1.617±0.045 Jy (RATAN)
8.0 GHz: 1.81±0.06 Jy [9], 0.34 ÷ 6.8±0.1 Jy [5]
8.085 GHz: 1.97±0.10 Jy [14]
8.2 GHz: 0.69 ÷ 5.1 Jy [3]
8.3 GHz: <2.48> Jy [6]
8.40 GHz: 1.90 Jy (PKSCAT90), 0.36 ÷ 4.58 Jy [4]
10.695 GHz: 2.83±0.12 Jy [15], <1.83> Jy [6]
11.2 GHz: 1.914±0.027 Jy (RATAN)
14. GHz: 1.94±0.04 Jy [9]
14.5 GHz: 0.49 ÷ 7.6±0.2 Jy [5]
15.06 GHz: 2.45±0.14 Jy [1]
21.65 GHz: 1.985±0.085 Jy (RATAN)
22. GHz: 2.48 Jy (PKSCAT90), 2.16±0.19 Jy [9], 1.67±0.09 Jy [11], 0.55 ÷ 1.60 Jy [4]



# Numbers

- Volume 1 includes
  190 (BZB sources)
  132 (BZQ sources)
  26 (BZU sources)

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348 +
95 FSRQ from PKQJ

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443

# Numbers

- Volume 2 includes

  235 (BZB sources)

  242 (BZQ sources)

  56 (BZU sources)

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  533 +

  73 FSRQ from PKQJ

  ---

  606

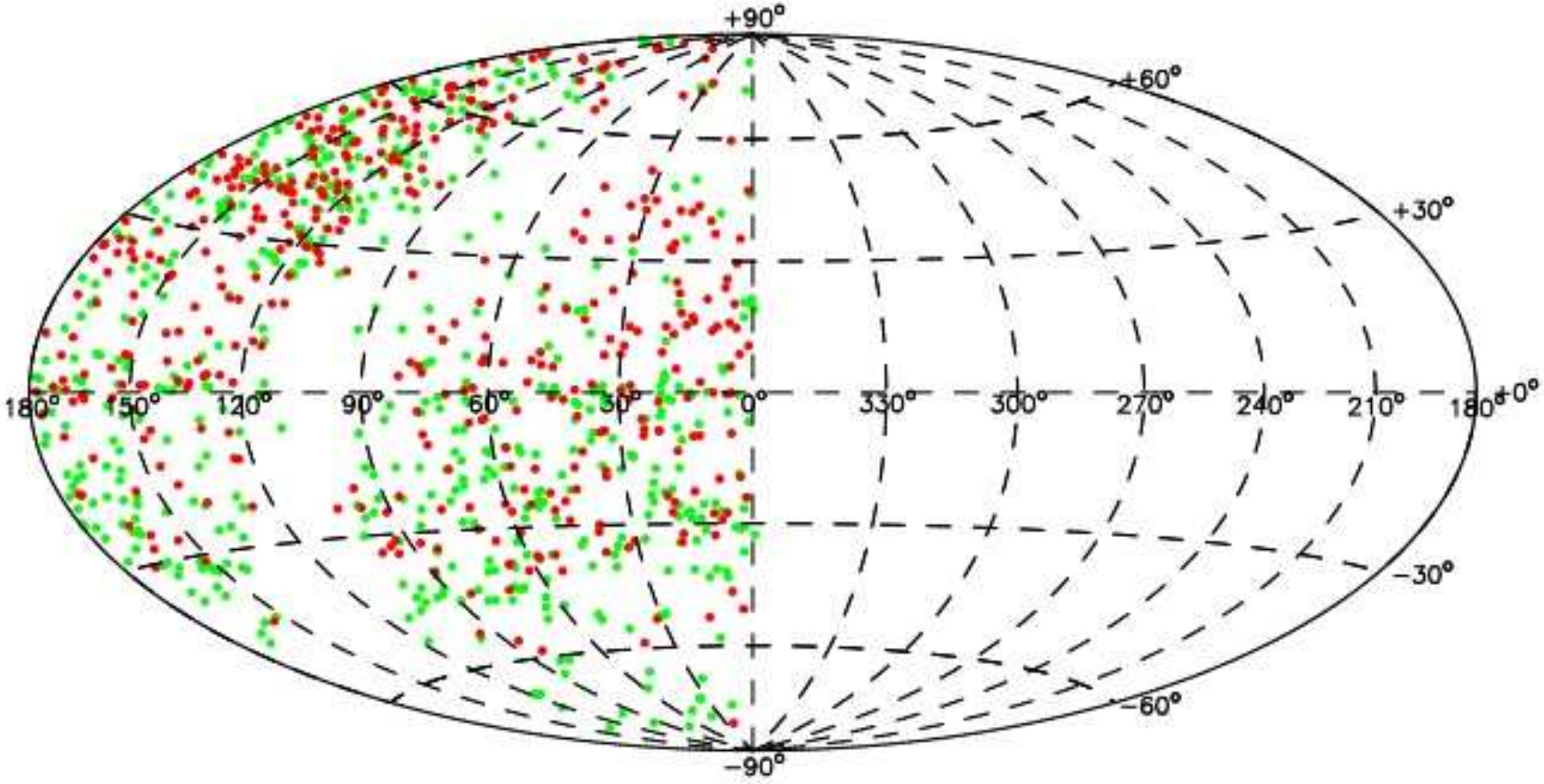
  Total Vol1 + Vol2 = 1049 sources

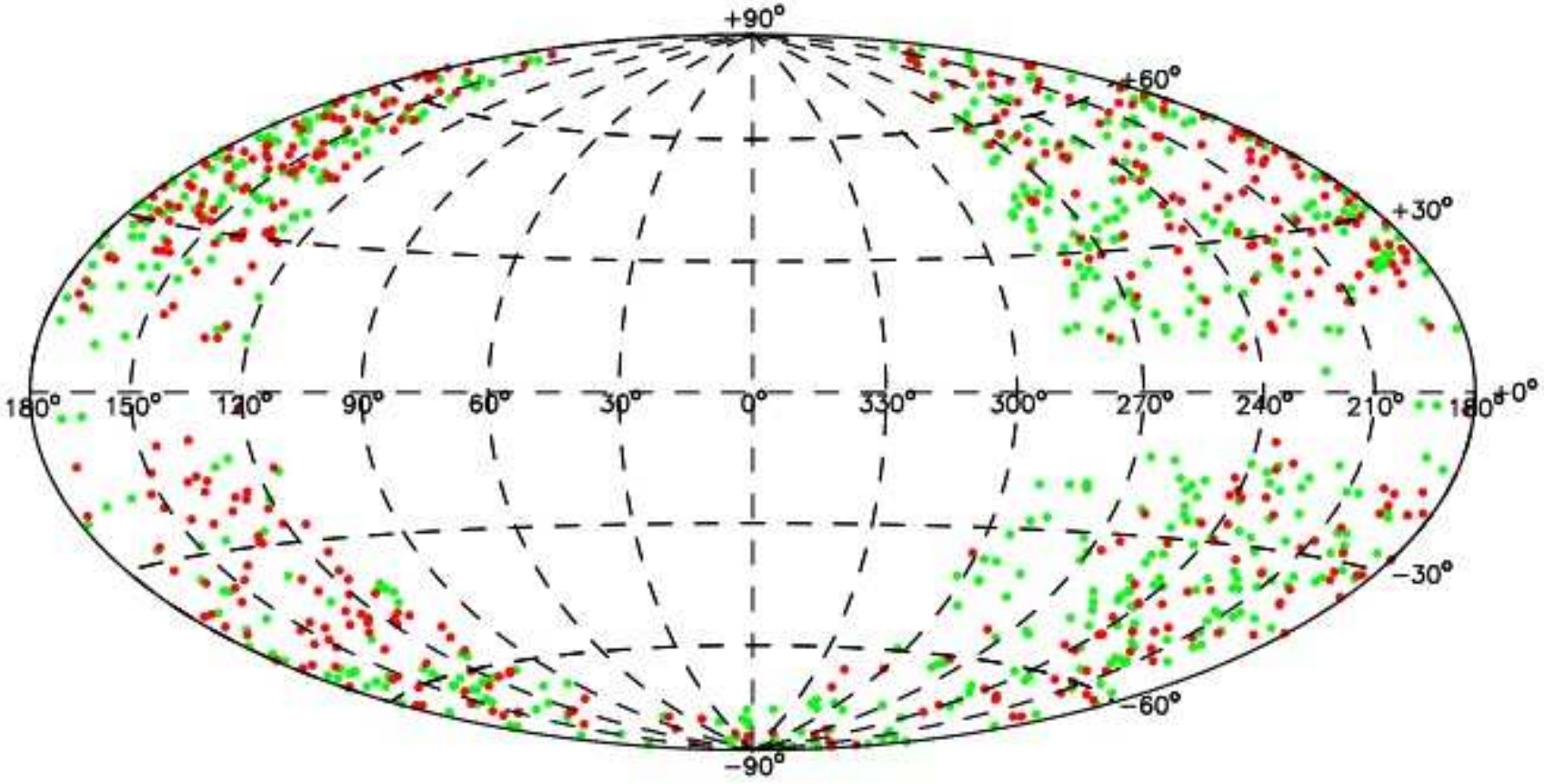
- The number of sources from Vol. 1 to Vol. 2 is increased by about 50%.
- Publication of new surveys:

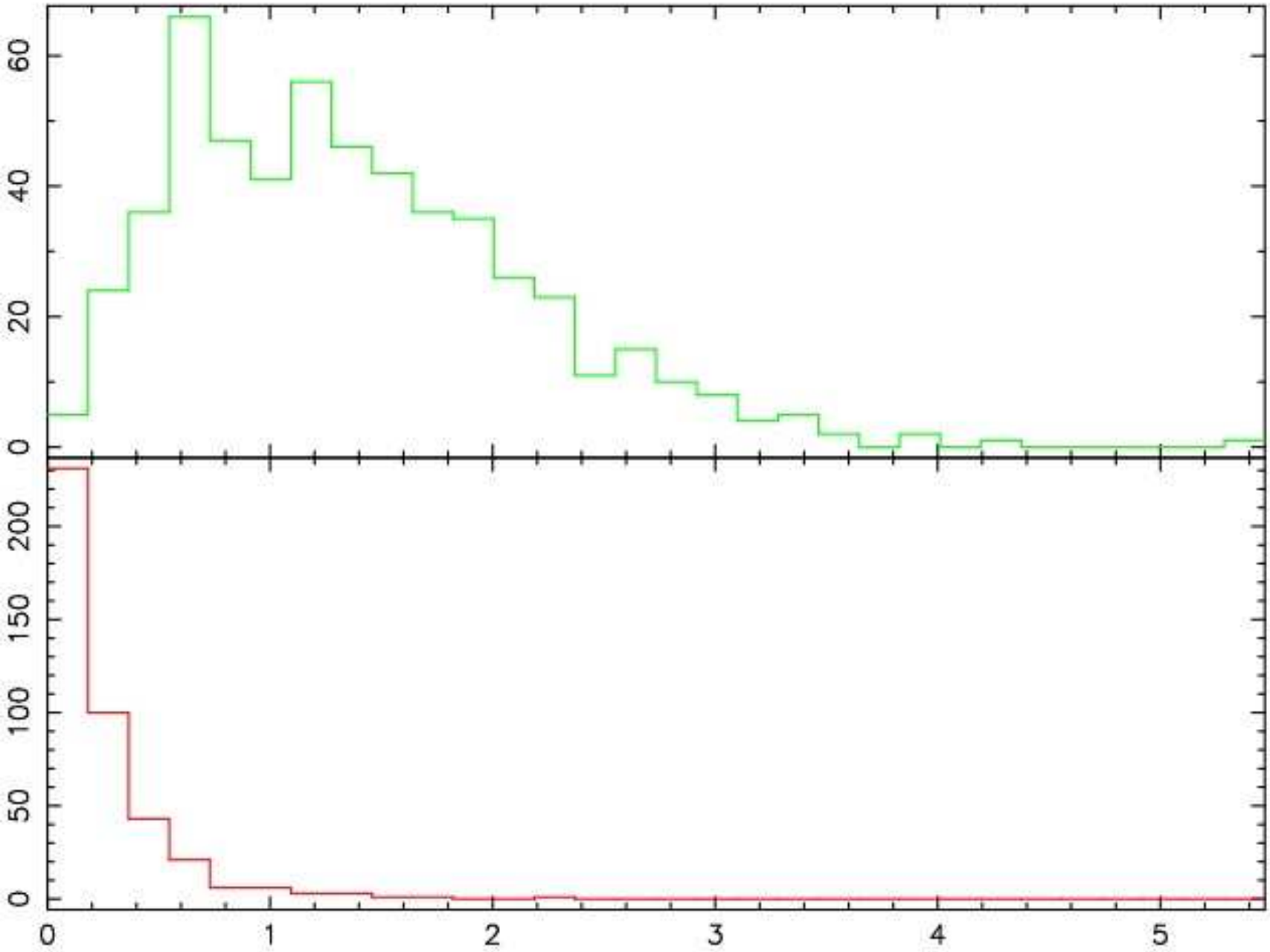
  e.g. Sowards-Emmerd et al. 2003, 2005

  Turriziani et al. 2006 (ROXA)

When the sources from new surveys will be added to Vol.1 (work in progress) we expect that the number of catalogued blazars in half sky will be around 1200 and about 2400 in the whole sky.


+90°
+60°
+30°
0°
−30°
−60°
−90°
180°
150°
120°
90°
60°
30°
0°
330°
300°
270°
240°
210°
180°
+0°


+90°
+60°
+30°
180°
150°
120°
90°
60°
30°
0°
330°
300°
270°
240°
210°
180°
+0°
-30°
-60°
-90°


60
40
20
0
200
150
100
50
0
0
1
2
3
4
5

# Completeness (not statistical)

- **BL Lac objects**:  very high – practically all BL (and candidates) appeared in literature are in the catalogue

- **FSRQ**: uncertain – many sources can be missed for poor data, particularly at low radio flux

# Source information

- A rather small number of sources of all types have been observed many times and there is a good information on their SEDs and variability

- Most sources, unfortunately, have been observed only occasionally during surveys and very little is known about them.

# Data quality

- We found that some literature data on a few small sources are uncorrect, but are still present in databases: all data were been inserted in the BZ Catalogue after verification on the original papers (when possible): see the Paolo Giommi contribution.
- X-ray association of blazars with ROSAT sources may be uncertain when the error boxes are large (off-axis detections).
- Photometric data from USNO or GSC2 may also be uncertain for faint sources, calibration, and host galaxy contamination.

# On-line version

- The BZ Cat will available as a printed version (book), and (soon) as an on-line catalogue at the ASDC website.

  The latter version will contain all the data of the general tables and a link to NED, other archives and databases for each source.