

Max-Planck-Institut
für Radioastronomie

A Global 86GHz VLBI Survey of Compact Radio Sources

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Introduction

A new global VLBI (Very Long Baseline Interferometry) survey of compact radio sources at 86 GHz has been started in October 2001. Its main aim was to increase the total number of objects accessible for future 3mm-VLBI imaging by a factor of 3~5. The participation of large and sensitive European antennas (like the 100m RT at Effelsberg, the 30m MRT at Pico Veleta, the 6x15m interferometer on Plateau de Bure) provides a single baseline sensitivity of up to ~ 0.1Jy, an image sensitivity of better than 10 mJy/beam, and a global uv-coverage for each source. In combination with European antennas (Onsala, Metsähovi) and the VLBA, the survey will be more sensitive and contain more sources than previous 3mm-surveys (i.e. Lonsdale et al. 1998, Lobanov et al. 2000).

VLBI surveys at 86 GHz

Survey	Antennas	Observed	Detected	Imaged
1	3	45	12	...
2	2-5	79	14	...
3	6-9	67	16	12
4	3-5	28	26	17
Total of Unique		124	44	24
This Survey	12	127	122	109

Columns: 1 - Surveys; 2 - Number of participating stations; 3 - Number of objects observed; 4 - Number of objects detected; 5 - Number of objects imaged.
References : Survey 1 - Beasley et al. (1996); 2 - Lonsdale et al. (1998); 3 - Rantakyrö et al.; 4 - Lobanov et al. (2000)

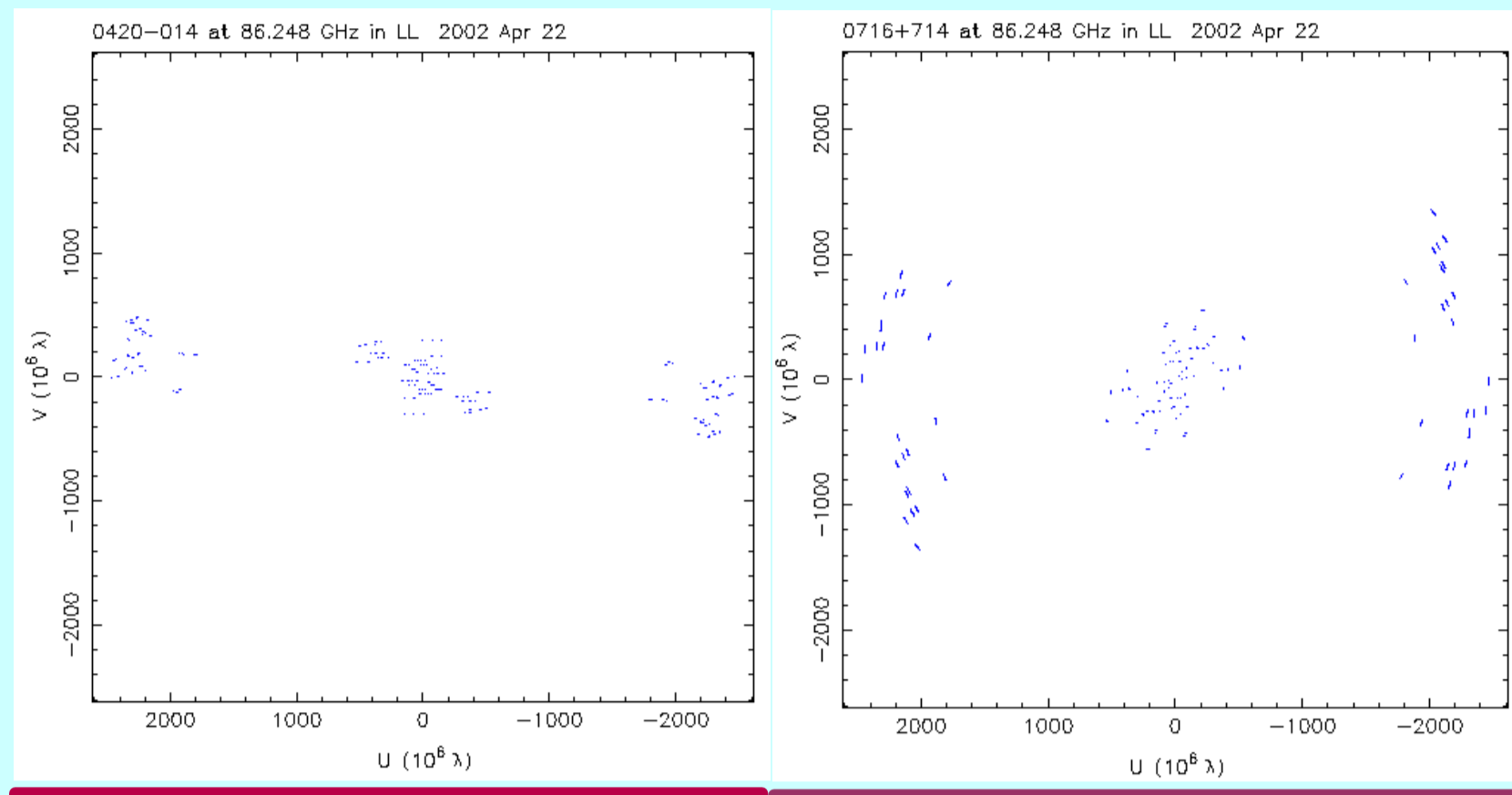
Survey Observation

Participating Stations

Station	Diameter (m)	Tsys (K)	Gain (K/Jy)	Eta (%)
Effelsberg	100	130	0.14	7
Haystack	37	200	0.58	15
Plateau de Bure	31	120	0.18	65
Pico Veleta	30	120	0.14	55
VLBA	25	120	0.03	17
Onsala	20	250	0.05	45
Metsähovi	14	300	0.02	30

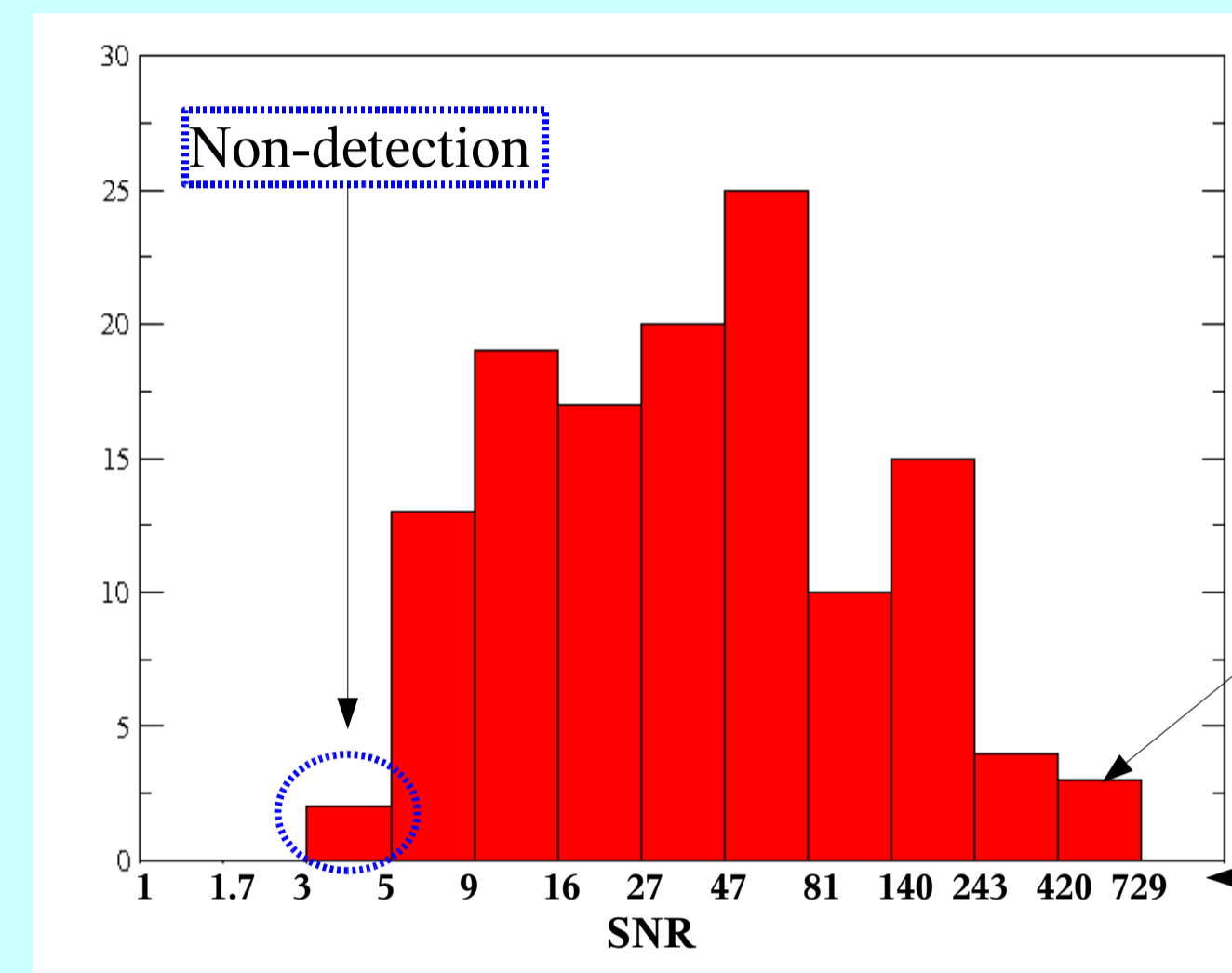
The survey was conducted in three observing sessions of CMVA (The Coordinated mm-VLBI Array), which has been succeeded by GMVA (The Global mm-VLBI Array) since 2003.

Typical UV-Coverages on Low/High Dec.



0420-014 : Dec = -01h 20m 33s 0716+714 : Dec = 71h 20m 36s

Almost every sources were observed with 3 ~ 4 scans (7min per each). Due to the larger number of the participated stations (> 12), we improved the baseline sensitivity and image sensitivity by a factor of 3 ~ 5 times, compared with the existing surveys.



Histogram of the fringe SNR distribution in the whole Survey data

In the Survey, 122 out of 127 sources observed have yielded fringe detections with SNR > 6.

The highest SNRs are 425 on the Pico Veleta - Plateau de Bure of 1741-038 and 425 on the Effelsberg - Pico Veleta of 1633+382

The X-axis is in logarithmic scale of $\sqrt{3}$. A few sources with SNR < 5 are non-detected.

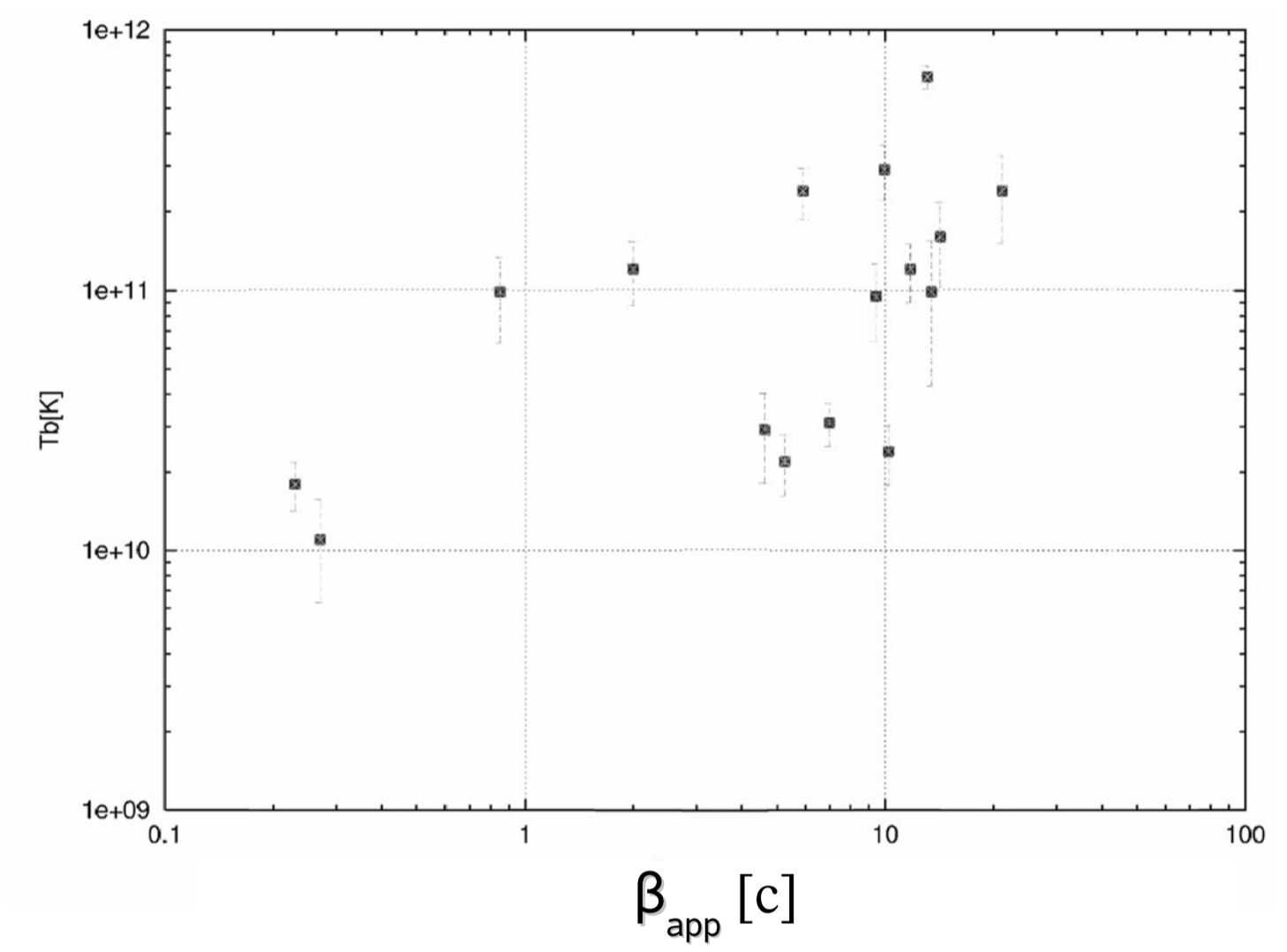
Preliminary Results

The survey was conducted in 3 observing session (October 2001, April 2002 and October 2002). A total of 127 compact radio sources selected on the basis of their flux density and northern declination was observed. Some of the objects were observed repeatedly. The data analysis is not yet completed. Out of 127 sources, 92 sources are now fringe-fitted, calibrated and mapped. The rest sources are fringe-fitted, calibrated and ready to be mapped. Among a total of 127 sources observed, only 5 sources (0710+439, 3C309.1, 1749+701, 2021+614, MWC 349) are not detected, and 13 sources are not able to be imaged due to insufficient uv-coverages. So, totally 109 sources are expected to be imaged. For those 109 sources, the flux densities and sizes of core and jet components will be measured using Gaussian modelfitting within the DIFMAP program. The component sizes and flux densities lead to brightness temperature estimates for each structure component. A preliminary result is the correlation of the brightness temperature of the jet components with their apparent jet speed (jet speed measured at longer wavelengths).

The Correlation of the Brightness Temperatures of the VLBI cores with their jet speed

On the right plot, β_{app} implies the apparent speed of the jet components at 15 GHz. If we assume that the apparent speed of the jet component at 86 GHz is similar to the apparent speed at 15 GHz, then this plot shows the correlation of the Brightness Temperatures (T_B) of the VLBI cores with the apparent speed of their jet components at 86 GHz.

The comparison of the brightness temperatures of core and secondary jet components from this survey, with similar estimates obtained from surveys at longer wavelengths, will be used further to study questions related to mechanisms of initial jet acceleration (accelerating or decelerating sub-pc jets?) and jet composition (electron-positron, electron-proton plasma?).



(Apparent Jet speed measured at 15 GHz)

The Source images at 86 GHz with the Global mm-VLBI

