The Bordeaux VLBI Image Database

www.obs.u-bordeaux1.fr/BVID

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1. Database context

The VLBI (Very Long Baseline Interferometry) group at the Laboratoire d'Astrophysique de Bordeaux (LAB) collaborates to the International VLBI Service for Geodesy and Astrometry (IVS) [1]. In this framework, one of its contribution consists in producing VLBI images of extragalactic radio sources, and especially sources from the International Celestial Reference Frame (ICRF).

ICRF sources typically exhibit extended and time-variable structures on VLBI scales [2][3], setting limits on the accuracy of astrometric source positions unless the effect of the source structure is considered. In practice, source structure modelling requires imaging the sources on a regular basis with a network of 15 to 20 VLBI antennas in order to monitor the structural evolution and positional stability of the reference frame sources. The "Research and Development with the VLBA" (RDV) sessions, conducted six times a year, are ideally suited for this purpose.

The "Bordeaux VLBI Image Database" (BVID) gathers and provides an easy access to such VLBI images. While the primary BVID goal is to contribute to the maintenance and the improvement of the ICRF, astrophysical goals are also being pursued. See Zhang's poster: "A VLBI Image Model-Fitting Pipeline", which presents a method to model-fit sources of RDV sessions in order to study VLBI jets.

The BVID completes the "Radio Reference Frame Image Database" (RRFID) [4] maintained at the United States Naval Observatory (USNO).
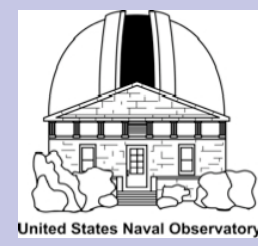
2. BVID content

The "Bordeaux VLBI Image Database" (BVID) currently provides more than 1500 VLBI images at 8.4 et 2.3 GHz (respectively X- and S-band) and/or 24 and 43 GHz (resp. K- and Q-band) for more than 700 extragalactic radiosources (Fig. 1).
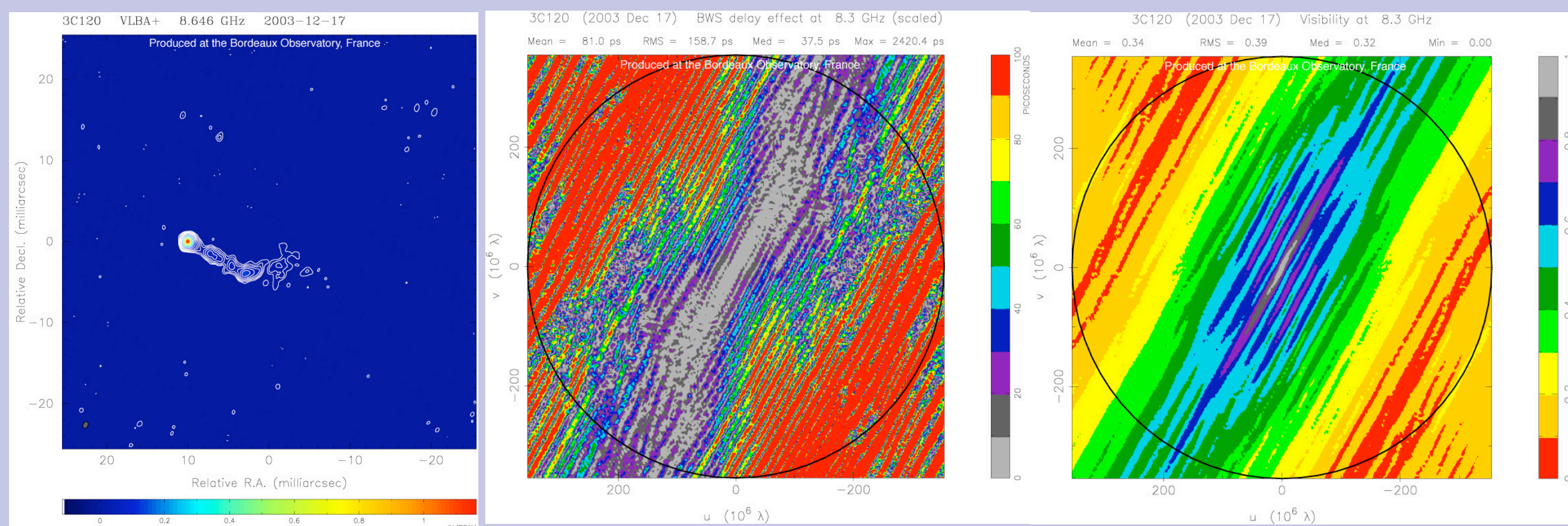

Figure 1: Excerpt from the BVID for the source 3C120 observed on December 17, 2003 at 8.4 GHz (X-band). From left to right: VLBI image, structure correction map and visibility map. The calculated structure index is 4 since the source is very extended.

In addition to revealing source structures, the VLBI images are used to determine structure correction maps. These maps represents the magnitude of intrinsic source structure effects on the bandwidth synthesis delay measurements as a function of the interferometer resolution.

From each of these structure correction maps a "structure index" is calculated, which characterizes the astrometric suitability of the observed source (Fig. 2) [2][3]. Structure correction maps and structure indices are specificities of the BVID compared to other VLBI image databases, such as the RRFID.

Overall, the BVID comprises more than 7500 structure correction maps and structure indices, and as many visibility maps. These show the normalized visibility as a function of the interferometer resolution (Fig. 1) and are the basis for deriving source compactness.
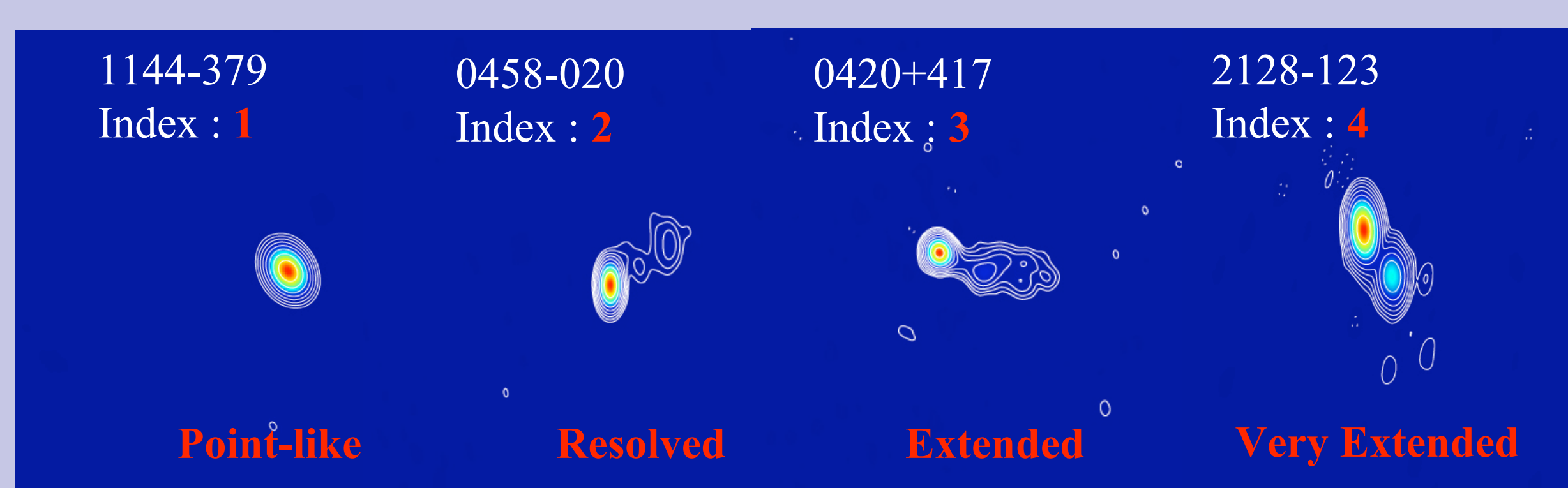

Figure 2: Illustration of the four possible values of the structure index depending on the structure complexity of the observed source.

3. BVID user interface

The BVID is a relational database handled by MySQL, an open source relational database management system. The database is accessible via the web interface:

http://www.obs.u-bordeaux1.fr/BVID/

DEMO

A. QUERY CRITERIA

Several query criteria are available within the BVID:

a. Source name

- IERS name (source main identifier)   *0430+052*
- ICRF name   *J043311.0+052115*
- Any other name resolved by SIMBAD   *3C120, DA140, NRAO182, etc.*

Shortcuts for displaying a list of all BVID sources or only ICRF sources, as well as a list of the most popular sources, make the searching process more convenient.

b. Coordinates

It searches all BVID sources within a specified radius, centered on a given J2000 position (Right Ascension and Declination coordinates).

c. Observing date or experiment name

The BVID provides a chronological chart to navigate through the available dates and/or experiment names. Additional query forms allow one to query by observing date, experiment code or by choosing the experiment in a list.

B. QUERY RESULT

A typical source page comprises three main panels as shown below:

Source details
-Common names
-Frequency bands
-ICRF category (defining, candidate, other, new or none)
-Coordinates (J2000)
-Data from the most recent session
-Links to other databases

Thumbnails of the most recent session images

Buttons are available to:

(i) Switch between different frequencies
(ii) Change the display of the experiments table
(iii) Modify the displayed years
(iv) Show the data for the displayed years

Experiments table
-Image links
-Structure indices
-Source compactness
-Total VLBI Flux

4. Future improvements

The following improvements are planned in the future:

✓ Regular addition of data as new VLBI experiments are processed, which amounts to about 600 VLBI images per year, along with the corresponding structure correction maps, the structure indices, the visibility maps and the compactness

✓ Provide continuous structure indices (instead of discrete ones)

✓ Enhance query possibilities (multi-criteria search, file submission,…)

✓ Provide graphical display of structure indices, flux and compactness time-series

✓ Keep on developing tools and improving the web interface

References
[1] IVS web page: http://ivscc.gsfc.nasa.gov/
[2] Fey, A. & Charlot, P. 1997, ApJS, 111, 95
[3] Fey, A. & Charlot, P. 2000, ApJS, 128, 17
[4] RRFID web page: http://www.usno.navy.mil/USNO/astrometry/vlbi-products/rrfid