

CONTRIBUTION TO THE ESTABLISHMENT OF LOCAL REFERENCE FRAMES AROUND ICRF OPTICAL SOURCES

R. POPESCU¹, P. POPESCU¹, A. NEDELICU¹

¹ Astronomical Institute of the Romanian Academy

Str. Cușitul de Argint, no. 5, sect. 4, RO-040558 , Bucharest, Romania

e-mail: [pradu, petre, nedelcu@aira.astro.ro]

ABSTRACT. At Bucharest Observatory we started an observational program aiming the improvement of positions for optical counterparts of ICRF radiosources by narrow-field CCD observations carried out in Belogradchik Observatory, Bulgaria ($43^{\circ}37'36''$ E, $22^{\circ}40'06''$ N) using the 60-cm telescope. First results are presented in this paper.

1. INTRODUCTION

International Celestial Reference Frame is the radio realization of International Celestial Reference System and is formed by VLBI radio positions of 212 extragalactic radiosources distributed over the entire sky. In addition to the 212 defining sources were also reported : 294 candidate sources less-observed, potentially defining as more observations will become available, 102 other sources less-stable, included primarily to densify the frame and 109 new sources, based on recently VLBI observation (Fey et al. 2004).

Realization of ICRS at optical wavelengths is given by HIPPARCOS Celestial Reference Frame (HCRF). Relatively low density of objects in HCRF - 3 objects per square degree require its densification and extension to fainter magnitudes by means of ground based astrometry to allow an easier and direct access to the frame.

We started an observational program aiming:

- Improvement of positions for optical counterparts of ICRF radiosources by narrow-field CCD observation
- Accurate densification of the optical frame and extension to fainter magnitudes
- Estimation of errors in UCAC2, USNO B1.0 and 2MASS catalogs by CCD observations of ICRF sources
- Building a catalog of intermediary reference stars around ICRF optical counterparts
- Studies concerning the non-coincidence between radio and optical centers at least for ICRF extended sources.

2. OBSERVATIONS AND RESULTS

Observations were carried out in Belogradchik Observatory, Bulgaria ($43^{\circ}37'36''$ E, $22^{\circ}40'06''$ N) using the 60-cm telescope equipped with 1k×1k Apogee 47P CCD camera ($13\mu\text{m}$ pixel size, QE > 92% at 650 nm, Peltier cooled) leading to a resolution of $0.721''/\text{pixel}$ when 2×2 binned mode was used and an image size of $6.15'\times 6.15'$. During 4 observations runs (October 2004,

February, April, July 2005) with a total of 15 clear sky nights, 101 objects have been observed. In order to derive a good statistic of data, 30 images were acquired (on average) for each object.

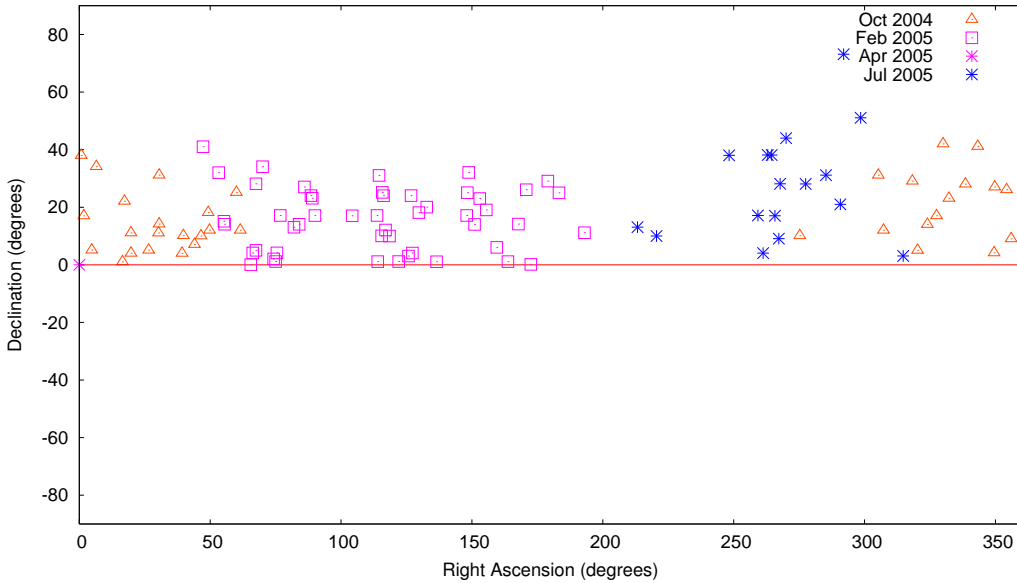


Figure 1: Sky distribution of 101 optical counterparts of ICRF sources observed during 4 runs

ICRF Source	USNO B1.0 - ICRF		2MASS - ICRF		UCAC2 - ICRF	
	$\Delta\alpha^*$	$\Delta\delta$	$\Delta\alpha^*$	$\Delta\delta$	$\Delta\alpha^*$	$\Delta\delta$
0400+258	$-260_{\pm 170}$	$260_{\pm 140}$	$-160_{\pm 160}$	$160_{\pm 160}$	$-120_{\pm 170}$	$80_{\pm 160}$
1633+382	$31_{\pm 22}$	$186_{\pm 23}$	$28_{\pm 19}$	$72_{\pm 29}$	-	-
1749+096	$29_{\pm 13}$	$151_{\pm 17}$	$6_{\pm 16}$	$77_{\pm 19}$	$13_{\pm 18}$	$-11_{\pm 19}$
1928+738	$11_{\pm 20}$	$298_{\pm 27}$	$3_{\pm 19}$	$155_{\pm 30}$	-	-
1954+513	$44_{\pm 50}$	$281_{\pm 57}$	$27_{\pm 50}$	$-27_{\pm 45}$	-	-
2059+034	$-30_{\pm 40}$	$243_{\pm 57}$	$-44_{\pm 35}$	$95_{\pm 55}$	$-100_{\pm 39}$	$40_{\pm 67}$
2200+420	$29_{\pm 41}$	$129_{\pm 34}$	$1_{\pm 28}$	$17_{\pm 31}$	$14_{\pm 29}$	$33_{\pm 35}$
2319+272	$-53_{\pm 49}$	$198_{\pm 62}$	$-56_{\pm 49}$	$86_{\pm 65}$	$-27_{\pm 48}$	$-18_{\pm 67}$

Table 1: Means and standard deviations, in *mas*, of the observed (reduced using USNO B1.0, 2MASS, UCAC2) minus ICRF coordinates for a set of data. $\Delta\alpha^* = \Delta\alpha \cos\delta$.

For all stages of data reduction we have chosen Image Reduction and Analysis Facility - IRAF (<http://iraf.noao.edu>) used in batch mode analysis of data.

REFERENCES

- Feissel-Vernier, M., 2003, “Selecting stable extragalactic compact radio sources from the permanent astrometric VLBI program”, *A&A* 403, 105
- Fey, A. L., Ma, C., Arias, E. F., et al. 2004, “The second extension of the international celestial reference frame: ICRF-EXT.1”, *AJ*, 127, 3587
- Popescu, P., Popescu, R., et al. 2005, “Astrometry Test of MSCRED IRAF Software Package”, *Serb. Astron. J* 170, 123