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Towards new tests of cosmic-ray correlations with BL Lac type objects

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Ultra-high energy cosmic rays (UHECR) can be produced in active galaxies, and directional correlations between them were studied extensively. One puzzling result was the correlations of arrival directions of UHECR and a particular class of active galactic nuclei, BL Lacertae type objects, discovered in 2004 with the HiRes stereo data set [1,2]. If confirmed, this result would definitely mean new physics or very unconventional astrophysics because it implies neutral particles travelling for cosmological distances. However, the HiRes resolution remains unsurpassed, and the hypothesis has not yet been tested with independent data. The original correlations [1] used the catalog [3] which is not complete by any criteria. Even though statistical methods of analysis were selected to minimize the associated uncertainties, random biases still could have affected the result. That's why it is needed to repeat this analysis with the use of a complete sample of sources. This report is dedicated to the methods used in construction of such a complete and isotropic set of BL Lacs adopted for future tests of the enigmatic correlations with the new data of the Telescope Array experiment.

[1] – D. S. Gorbunov, P. G. Tinyakov, I. I. Tkachev, S. V. Troitsky, arXiv:astro-ph/0406654v1

[2] – HiRes Collaboration 2005

[3] – M. P. V'eron-Cetty and P. V'eron, ESO scientific report (2000); M. P. V'eron-Cetty and P. V'eron, Astron. Astrophys. 374 (2001) 92.

Primary author(s) : Mrs. KUDENKO, Maria (Physics Department M. V. Lomonosov Moscow State University, Institute for Nuclear Research Russian Academy of Science)

Presenter(s) : Mrs. KUDENKO, Maria (Physics Department M. V. Lomonosov Moscow State University, Institute for Nuclear Research Russian Academy of Science)

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