

# Researchers complete first stage of experiment to study giant air showers

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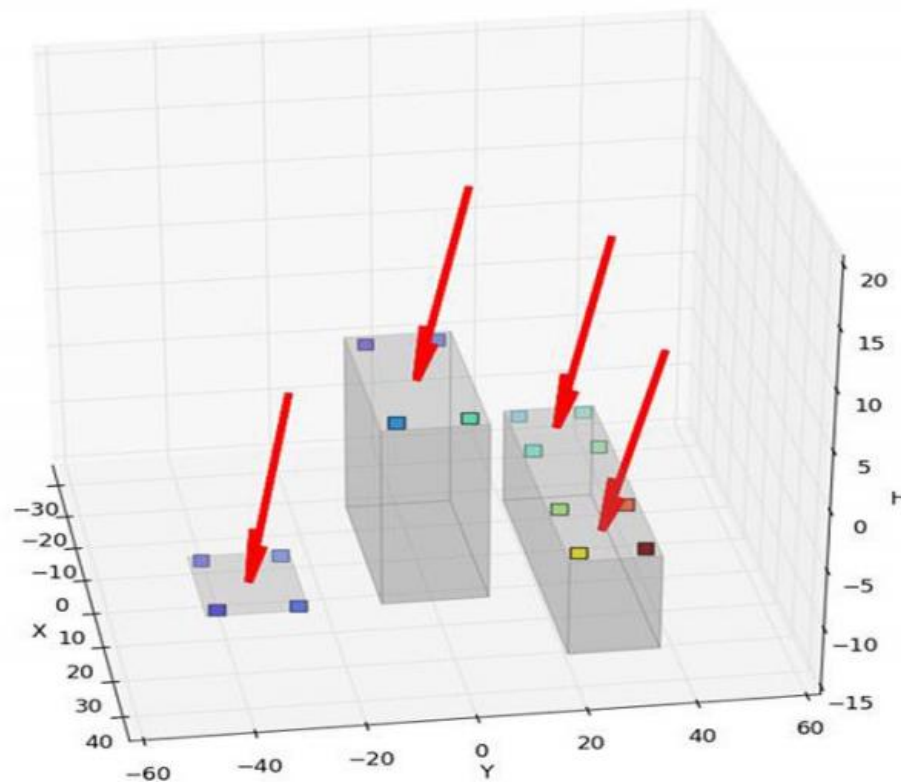
Credit: National Research Nuclear University

The first stage of a study on giant air showers has been completed at NEVOD-SHAL, a new facility created at the territory of the National Research Nuclear University MEPhI (Russia) as a part of a Russian-Italian collaboration.

The NEVOD-SHAL facility detects the electron-photon component of giant [air showers](#) with energies of one to 100 petaelectronvolts and determines their power, arrival direction and axis position. Currently, there is no way to conduct direct research on [cosmic rays](#) beyond the atmosphere in this energy range, as it is too expensive and difficult. That is why the only way to study energy spectrum and content of cosmic rays

in this range is to research giant air showers at above-ground launchers. The central part of NEVOD-SHAL facility in MEPhI is a system of five clusters of scintillation detection stations placed on the rooftops of university buildings and on the ground near NEVOD. Each cluster comprises four detection stations. Clusters are networked for synchronization, assembly, and processing of data using fibre-optic links.

The Italian researchers from University of Turin and INFN delivered 192 scintillation detectors equipped with photomultipliers. For the first time, a cluster approach has been applied to the determination of SHAL characteristics. The technical result of the invention is determining the arrival direction of giant air showers independent of land topology due to nonuniform distribution of device detectors in space, in which detectors can be placed at any point in 3-D space and have any geometrical shape.



Example of a recorded event. Arrows mark directions of arrival of giant air showers, restored by separate clusters. Credit: National Research Nuclear University

Several years ago, scientists realized that the number of muons recorded by land detectors is much higher than it should be according to existing theories. The solution of this "muon puzzle" will give a better understanding of nuclear cascades in the interaction of ultrahigh energy particles, which is necessary for the research of characteristics of the universe.

To solve the problem, it is necessary to simultaneously measure muon energy release and the position of the axis of giant air showers. Such an experiment was started at the experimental complex "NEVOD" at MEPhI Institute of nuclear physics and technologies. The experiment continues this year after the launch of five more clusters, which are now being constructed and aligned.

Provided by National Research Nuclear University

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