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Results of the TREND experiment

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We demonstrate here the ability of TREND, a self-triggered radio array, to autonomously detect and identify air showers induced by cosmic rays. TREND (Tianshan Radio Experiment for Neutrino Detection) is an array of 50 dipolar antennas, deployed over a total area of 1.5km² on the site of the 21CMA radio interferometer in the radio-quiet Tianshan mountains (China), and running between 2009 and 2014. TREND DAQ system was designed to allow for a trigger rate up to 200Hz per antenna, based on a very basic signal-over-threshold trigger condition. The reconstruction and discrimination of air showers from the ultra-dominant background noise is then performed through an offline treatment.

We present here, for the first time, the complete analysis of the TREND data. We first detail the background-rejection algorithm which allowed to select about 500 air shower radio candidates from the ˜10ˆ9 radio pulses recorded with the TREND array. We then show that the distribution of the directions of arrivals of these 500 candidates is compatible with what is expected for air showers. We finaly compute the TREND air shower detection efficiency, thanks to an end-to-end simulation chain which will be detailed here. Given the fairly basic TREND acquisition chain, these results can be considered extremely encouraging in the perspective of future experiments using radio as a way to detect air showers, such as the Giant Radio Array for Neutrino Detection.

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