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The Tunka Radio Extension: Latest Analysis Results

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Abstract. Tunka-133 is an air-Cherenkov array placed in Siberia, near the southern tip of Lake Baikal, which registers air showers induced by cosmic rays from initial particles with energies of 10^{16}–10^{18} eV. After several years of successful data collection, this array was extended by other detector arrays. One of them is the Tunka Radio Extension (Tunka-Rex): the radio array consists of presently 25 antenna stations connected to the data acquisition of Tunka-133. This combination provides hybrid measurements and the possibility for cross-calibration between the air-Cherenkov and radio measurement techniques. The main goal of Tunka-Rex is to determine the precision of the reconstruction of air-shower parameters using the radio detection technique. We present the latest results on the event reconstruction.

1. Introduction

Radio emission from extensive air showers was theoretically predicted [1, 2, 3, 4] and first detected [5, 6, 7] about 50 years ago. The radio detection techniques became popular in the last decade again, because standard detection methods are going to reach technological and economical limits, contrariwise, the digital processing of radio data became possible. Thus, a number of modern experiments [8, 9, 10, 11] aims at obtaining the main properties of extensive air showers using the radio detection technique.

Tunka-Rex, the radio experiment in the Tunka valley, is motivated by the well-developed infrastructure and unique possibility of hybrid air-Cherenkov and radio measurements. These conditions give a chance to show the prospects of a low-cost, scalable radio detector for cosmic rays. The main goal of Tunka-Rex is to determine the precision for the reconstruction of the primary energy, $E_{\rm pr}$, and the atmospheric depth of the shower maximum, $X_{\rm max}$, based on the cross-calibration with an air-Cherenkov detector.

The Tunka-133 air-Cherenkov detector [13] is taking data since 2009. In 2012 two new extensions were introduced: HiSCORE [14] and Tunka-Rex [15]. Moreover, the development of a new gamma-astronomy facility named TAIGA started [16]. This new facility will consist of