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Estimation of aperture of the Tunka-Rex radio array for cosmic-ray air-shower measurements

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The recent progress in the radio detection technique for air showers paves the path to future cosmic-ray radio detectors. Digital radio arrays allow for a measurement of the air-shower energy and depth of its maximum with a resolution comparable to those of the leading optical detection methods. One of the remaining challenges regarding cosmic-ray radio instrumentation is an accurate estimation of their efficiency and aperture. We present a probabilistic model to address this challenge. We use the model to estimate the efficiency and aperture of the Tunka-Rex radio array. The basis of the model is a parametrization of the radio footprint and a probabilistic treatment of the detection process on both the antenna and array levels. In this way, we can estimate the detection efficiency for air showers as function of their arrival direction, energy, and impact point on the ground. In addition, the transparent internal relationships between the different stages of the air-shower detection process in our probabilistic approach enable to estimate the uncertainty of the efficiency and, consequently, of the aperture of radio arrays. The detail of the model and its application to the Tunka-Rex data will be presented in the contribution.

Keywords

Collaboration

other (fill field below)

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Subcategory

Experimental Methods & Instrumentation

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