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Improvement of reconstruction and background suppression for track events in baikal-gvd based on zenith angle estimation from individual strings

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Baikal-GVD is a gigaton-scale neutrino telescope deployed at a depth of about 1 km in the waters of Lake Baikal. The detector registers Cherenkov radiation using vertical strings of optical modules. Each string comprises 36 modules with a 15 m spacing, providing an instrumented length of 525 m, and a group of 8–9 such strings forms an independent cluster.

Since standard track reconstruction methods require hits in at least two strings, a significant fraction of the data remains unused. This work is devoted to the development of an algorithm for reconstructing the muon zenith angle based on information from a single string. The goal is to extend the existing track dataset with nearly vertical events and to employ independent zenith angle estimation for the suppression of atmospheric muon background.

The performance of the algorithm has been tested on simulated samples of neutrinos and atmospheric muons. It is shown that for upgoing near-vertical (with zenith angle 170°-180°) neutrinos, the median accuracy of zenith angle reconstruction reaches 1° (depending on the zenith angle and the number of hit modules).

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