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Magnetic field compensation system for the Baksan large neutrino telescope

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The Baksan large neutrino telescope is a large-scale liquid scintillation detector under development at the Baksan neutrino observatory of the Institute for Nuclear Research of the Russian Academy of Sciences. The detector will employ a large number of photomultiplier tubes (PMTs). The Earth's magnetic field can significantly affect PMT perfomance and, consequently, the energy and timing characteristics of the detector. Therefore, a magnetic field compensation system is required to ensure stable operation of the photodetectors. The influence of the Earth's magnetic field on the Hamamatsu R7081-100 WA-S70 PMT, selected for the 5-ton BLNT prototype, was experimentally investigated. The measurements were performed under controlled magnetic fields generated by Helmholtz coils.The PMT gain, peak-to-valley ratio of the single-photoelectron charge spectrum, and transit-time characteristics were studied as functions of the magnetic field components. The results demonstrate that magnetic fields of the order of 0.1 G can already affect the PMT response. Thus, developing a magnetic field compensation system is a necessary task. The developed system provides an active approach for producing a homogeneous compensating magnetic field over a large detector volume.

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