Long-term muon rate monitoring with the ICAL prototype detector of India-based Neutrino Observatory

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The India-based Neutrino Observatory (INO) collaboration is planning to build a 50 kton magnetized Iron Calorimeter (ICAL) detector to study atmospheric neutrinos and to make precision measurements of the neutrino oscillation parameters. The detector will mostly look for muon neutrino induced charged current interactions using magnetized iron as the target mass and around 28,800 Resistive Plate Chambers (RPCs) as sensitive detector elements. A prototype of the ICAL detector (without the magnet) has been constructed to develop and characterize the intrinsic sub-systems, like RPCs, gas system, electronics and data acquisition system, etc. The prototype detector consists of 12 layers of RPCs of 1 m x 1 m lateral area, and is continuously tracking cosmic ray muons over the last three years. This paper presents an overview of the setup being used for data acquisition and analysis and the long-term performance of the detector. Apart from detector development and characterization, the data collected is also used to carry out studies on cosmic ray muons, like obtaining the zenith angle and the azimuthal angle distributions. Studies have also been aimed at monitoring the long-term as well as the diurnal variations of muon counting rate, their correlation with the atmospheric parameters and the possible detection of solar flares. Results from such analysis are also discussed.

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