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Muon Analysis in the Peripheral Region of INO-ICAL

The proposed magnetised Iron Calorimeter (ICAL) detector at the India-based Neutrino Observatory aims in determining the neutrino oscillation parameters precisely with atmospheric muon neutrinos, matter effect in neutrino oscillations and to determine the sign of Δm²32 using the
matter effect. ICAL is mostly sensitive to atmospheric muon neutrinos, which are detected through their interaction with iron layers via charged-current (CC) and neutral-current (NC) interactions producing muons and hadrons. The most crucial part to determine the neutrino
oscillation paramaters is to determine the energy and direction of muons and hadrons. Muon momentum can be reconstructed through the curvature of their track whereas hadrons can be reconstructed through the shower produced by them. Here we present the preliminary results on muon momentum and angular resolution and momentum reconstruction and charge identification efficiencies in the peripheral region. The INO-ICAL detector simulation has been implemented in GEANT-4 framework. The softwares used for this purpose are: Geant4.9.4p02, inoical0_20112011
(with inhomogeneous magnetic field) (officially released version). Muons with fixed energy and direction are generated in the peripheral part of the detector where the magnetic field is rapidly changing in both magnitude and direction. The muons are reconstructed according to INOICAL code through a Kalman filter algorithm that returns both the magnitude and direction of the muon momentum. Selection criteria is applied to select muons whose track is closest to the vertex.
The results are analysed to obtain the resolution in both magnitude and direction (cosθ) of muons as a function of their energies. As anticipated, vertically passing muons are reconstructed better than those at larger angles because they traverse more layers. We find the quality of reconstruction worse than, but still comparable to the reconstruction of tracks produced in the central region of the ICAL detector where there is an almost constant and large magnetic field
of roughly 1.4T. This has implications for the fiducial volume of the detector as well as accuracy of reconstruction. The resolutions functions obtained in this manner have then been made available for analysis of physics processes with ICAL, for studying neutrino
oscillation phenomena.

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