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Reconstruction of Nearly Horizontal Muons in the HAWC Observatory

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Executive Summary

This contribution describes techniques used to identify, reconstruct and simulate muons with nearly horizontal trajectories in the HAWC observatory. These tools will hopefully extend to greater depths the measurement of the muon integral intensity as a function of material depth using the volcanoes surrounding HAWC. We have modified existing Hough transform software to calculate uncertainties on reconstruction parameters on an event-by-event basis directly from data, simulated or actual. We have developed and started validating a semi-analytic simulation of the PMT response to nearly horizontal muons that will be used to calculate detector resolution and acceptance. The semi-analytic simulation has been incorporated in an inverse Monte Carlo method to perform trajectory reconstruction with improved resolution. After optimizing selection criteria, to suppress the considerable background, we will analyze the HAWC observatory data that provides several years of exposure potentially sensitive to intensities associated with neutrino-induced muons.

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