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Design and development of muon tagging optical modules (mTOMs) for calibration of reconstruction algorithms in Cherenkov neutrino detectors PETR JAKUBCIK, JANET CONRAD, SPENCER AXANI, MIT, KATARZYNA FRANKIEWICZ, Boston University, COSMICWATCH TEAM — CosmicWatch is a pocket-size muon detector developed at MIT originally for outreach. It comprises a slab of plastic scintillator, a silicon photomultiplier, and a read-out circuit board. CosmicWatch served as a prototype for the muon tagging optical modules (mTOMs), which would aid in assessing and improving reconstruction algorithms in Cherenkov detectors like the IceCube Neutrino Observatory. In the future, these could be fitted with optically isolated muon taggers recording direct hits by the abundant cosmic ray muons at several locations in the array. The viability of this proposition was studied using a simulation of cosmic ray showers passing through a proposed upgrade to IceCube. It was demonstrated that the angular resolution, in even the most basic track reconstruction algorithms, would improve dramatically for events in which a cosmic ray muon triggered one or two of the muon taggers. This dataset could then be used to improve track reconstruction algorithms, and in the case of IceCube, would help localize astrophysical sources more accurately. The upgraded design reflects the need for affordability, simplicity, low noise, and anticipates possible communication channels with future digital optical modules.

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