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Cosmic muons detection using a scalable 3d scintillator configuration optically coupled to SiPM arrays

This study presents a solution for cosmic muons detection using a 3d shaped stack of multiple layers of parallelepiped prism scintillators, each scintillator being optically coupled to a silicon photomultiplier (SiPM) in a SiPM array of 8x8. As muons traverse the stack, they produce fast scintillation pulses detected with high sensitivity by the SiPMs. The multilayer configuration is scalable and enables time-coincidence techniques for background suppression and trajectory reconstruction, allowing precise determination of the angular distribution of incident muons. In addition, the use of charge-sensitive electronics allows for the measurement of the energy deposited in each layer, enabling indirect estimation of the muon's electric charge magnitude and energy loss through the detector. This compact and scalable system offers a robust platform for angular and charge-resolved cosmic muon studies, with applications in astro-particle physics, environmental monitoring, and educational research.

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