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Cosmic Muon Explorer: A Portable Detector for On-Site Measurements and Outreach

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In this study, we present the development of a portable cosmic muon tracker tailored for both on-site measurements of cosmic muon flux and outreach activities. The tracker comprises two 7cm x 7cm plastic scintillators, wavelength shifting (WLS) fibers, and Hamamatsu SiPMs (S13360-2050VE). The detector utilizes plastic scintillator panels optically coupled to WLS fibers, transmitting scintillation light to the SiPMs. SiPM outputs are routed to a PCB board equipped with op amp amplifiers and a peak hold circuit, connected to an ESP32 microcontroller module. When muons traverse both scintillators, the light emitted triggers the SiPMs, generating equivalent signals proportional to light intensity. These signals are then amplified, and the pulse peak is held for 500 microseconds. The peak analog voltage is subsequently digitized using the onboard ADC in the ESP32. Continuously measuring and recording peak values, the ESP32 triggers muon detection when both peaks surpass a set threshold. The SiPMs are powered by a High Voltage bias supply module, while a BMP180 Module measures temperature and pressure. For real-time event tagging, a GPS module is interfaced with the ESP-32. Housed within an acrylic box measuring 10 x 10 x 10cm, the detector can be powered using a 5V 1A USB power bank. Additionally, a mobile app allows for real-time monitoring. This versatile and cost-effective portable detector facilitates cosmic muon research in various experimental settings. Its portability and low power requirements enable on-site measurements in environments such as tunnels, caves, and high altitudes.

Mini Symposia (Invited Talks Only)

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