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A compact, high resolution tracker for cosmic ray muon scattering tomography using semiconductor sensors

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ABSTRACT:

A semiconductor tracker for muon scattering tomography is presented. The tracker contains silicon strip sensors with an 80 μm pitch, precision mechanics and integrated cooling. The electronic readout of the sensors is performed by a scalable, inexpensive, flexible, FPGA-based system, which is demonstrated to achieve an event rate of 30 kHz. The tracker performance is compared with a Geant4 simulation. A scattering angle resolution compatible with 1.5 mrad at the 4 GeV average cosmic ray muon energy is demonstrated. Images of plastic, iron and lead samples are obtained using an Angle Statistics Reconstruction algorithm. The images demonstrate good contrast between low and high atomic number materials.

KEYWORDS:

Search for radioactive and fissile materials; Front-end electronics for detector readout; Particle tracking detectors (Solid-state detectors); Interaction of radiation with matter;

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