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Penetrating Particle Analyser (PAN). Silicon tracker development. Beamtest results

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Penetrating particle Analyzer (PAN) is an instrument designed to be used in deep space and interplanetary missions. It can precisely measure and monitor the flux, composition, and direction of highly penetrating particles in the effective range between 100 MeV/nucleon and 10 GeV/nucleon. It is a versatile device, which can potentially have an application in cosmic ray physics, solar physics, space weather and space travel. PAN is a compact magnetic spectrometer (less than 20 kg of mass) with relatively low power budget (around 20 W). These features allow the spectrometer to potentially become one of the standard onboard devices accompanying future deep space human travel. The device consists of permanent magnet sections, high resolution silicon strip detectors, scintillating detectors and silicon pixel detectors. At the current stage of the device R&D, a first prototype, called MiniPAN, was built. The MiniPAN is a reduced version of PAN designed to estimate the capabilities and performance of a full-scale device - PAN. The MiniPAN consists of an aluminum supporting structure, 2 sections of permanent magnets, 6 silicon strip detectors measuring a single coordinate of a particle trajectory (X coordinate layers called StripX) and readout electronics. The StripX was designed as thin (150 μm) layer of long silicon strips with a fine pitch (25 μm) and 2048 readout channels in order to push the limit of a position resolution up to 2 μm and provide the best momentum resolution for penetrating particles within the effective energy range.
In the second half of 2021 the beamtests were performed at CERN (Geneva) to demonstrate the performance (signal/noise $\geq$ 8), the quality of the production of both single StripX layers and the MiniPAN protortype with 6 StripX layers (with/out magnets installed). The preliminary position resolution values obtained for 10 GeV/c negative pion beam are 6.4 $\pm$ 0.64 μm for the inner StripX module of the MiniPAN. The reconstructed momentum resolution studies are still ongoing and the data taking is continued using a cosmic ray setup built in the laboratory of the Department of Nuclear and Particle Physics of the University of Geneva. We will present current status of the hardware and the preliminary results from the beamtest and cosmic rays data.

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