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A high resolution scintillating fiber tracker with SiPM readout

Using thin scintillating fibers with Silicon Photo Multiplier (SiPM) readout a modular high resolution charged particle tracking detector has been developed. The fiber modules consist of eight layers of 128 round multicladd Bicon BCF-20 scintillating fibers of 0.250 mm diameter. They are mechanically stabilized by a carbon fiber airex structure (2 x 0.1 mm CF skins, 5 mm airex foam). The fibers are read out by four SiPM arrays (8 mm x 1 mm) each with 32 channels on both ends of the module. The use of SiPM arrays for the fiber readout allows a compact design and does not require any cooling, unlike existing scintillating fiber trackers. The basic features of this detector concept have been evaluated in a test beam in October 2006 using novel SiPM detectors with improved photon detection efficiency. We will present the measured spatial resolution, efficiency and signal-over-noise ratio for this setup and compare them to GEANT 4 simulations. Such a detector concept could be very interesting for future applications, for example as an outer layer of an ILC detector or for astroparticle physics experiments.

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