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First results from the Timepix4 Telescope

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A double arm beam telescope based on the recently developed Timepix4 ASIC was built in order to perform tests of synchronous multiple-detector readout and track reconstruction with fast timing capability. The Timepix4 is a hybrid pixel detector readout ASIC designed to record time-of-arrival (TOA) and time-over-threshold (TOT) simultaneously in each pixel. It has a 448x512 pixel matrix with square pixels at a 55μm pitch. The TOA is digitised with a 195 ps TDC bin size and the TOT is proportional to the charge collected by the silicon sensor. The telescope is composed of eight planes with n-on-p silicon sensors. Two of these planes are instrumented with 300⌧ thick sensors tilted with respect to the beam, to provide high quality spatial measurements, while the remaining two have100 ⌧⌧ thick sensors to achieve a better time response. Each detector assembly (sensor + Timepix4 ASIC) is cooled by a 3D printed titanium block directly attached to the test PCB, through which a cooling fluid is circulated. Both the cooling block and PCB have a circular cut-out to minimise the amount of material traversed by incident particles. The assemblies are readout by SPIDR4 systems. In addition to the Timepix4-based detectors, scintillators and a Cherenkov-MCP were placed in the beam acceptance in order to give reference timing measurements. The reference timing signals are digitised using the PicoTDC chip, that provides a fine timestamp of 3ps in its fastest configuration. First tracks were reconstructed using information from all four planes, which allows the assessment of temporal resolution using high energy particles. In this presentation, the initial results of the timing and spatial resolution of this telescope and plans for future R&D tests involving state-of-the-art sensors will be discussed.

Submission declaration

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