

Characterisation of fast sensors at the Timepix4 Telescope

Tuesday 3 December 2024 15:30 (20 minutes)

A beam telescope based on the Timepix4 ASIC was built in order to perform tests of synchronous multiple-detector readout and track reconstruction with fast timing capability. The beam telescope is an excellent tool to study novel sensors with both high spatial and time resolution, and is capable of operating at high rates. The Timepix4 is a readout ASIC for hybrid pixel detectors that is designed to record both the time of arrival (ToA) and the time over threshold (ToT) of each discriminated signal. It has a 448×512 pixel matrix with square pixels at a $55 \mu\text{m}$ pitch. The ToA is digitized by a TDC with time bins of 195 ps, while the ToT is proportional to the charge collected by the silicon sensor, and is used to achieve sub-pixel spatial resolution. The ToT is also used to correct for time-walk and thereby improve the ToA resolution. The telescope consists of eight planes with n-on-p silicon sensors. Four of these planes are instrumented with $300 \mu\text{m}$ thick planar sensors, which are tilted and rotated by 9° with respect to the beam incidence to provide highly accurate spatial measurements. The other four planes have $100 \mu\text{m}$ thick sensors to achieve a better time response. Each detector assembly (sensor + Timepix4 ASIC) is cooled by circulating chilled glycol through a 3D-printed titanium block that is directly attached to the carrier PCB. The assemblies are readout by SPIDR4 systems that send the data via 10 Gbit ethernet to the data acquisition (DAQ) computers. Three scintillators and two micro-channel plate (MCP) detectors provide precise time-reference signals that are recorded by a PicoTDC chip, which has time bins of 3 ps. The time references are used to characterise and calibrate the time measurements of the telescope and fast-sensor prototypes. Several fast sensor technologies are being studied such as iLGAD, TI-LGAD, and 3D silicon. The telescope will be presented together with an overview of the ongoing analyses of fast sensor prototypes that have been operated in the telescope as DUT.

Type of presentation (in-person/online)

in-person presentation

Type of presentation (I. scientific results or II. project proposal)

I. Presentation on scientific results

Authors: AKIBA, Kazu (Nikhef National institute for subatomic physics (NL)); Dr HEIJHOFF, Kevin (Nikhef National institute for subatomic physics (NL)); VAN BEUZEKOM, Martin (Nikhef National institute for subatomic physics (NL))

Presenter: Dr HEIJHOFF, Kevin (Nikhef National institute for subatomic physics (NL))

Session Classification: WG5 - Characterization