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Single-layer track reconstruction using drift-time

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A precise measurement of the arrival time distribution of ionisation charges in a reverse-biased single silicon pixel sensor layer can be used to determine the impact point, incident angle and direction of minimum ionising particles. This concept of a Silicon Time-Projection-Chamber could for example be used to reduce the number of sensor layers in large-area tracking detectors, or to improve the track-prediction resolution of beam telescopes with inclined sensor planes. First tests of the concept have been performed using sensors of different thicknesses with 55 micron pitch and Timepix3 readout in a 120 GeV hadron beam at the CERN SPS. The fine binning of 1.56 ns for the Timepix3 arrival time measurement allows for a precise determination of the depth of charge deposition in each pixel. This information is used in a multi-variate analysis in combination with the charge measurement and cluster shape, in order to reconstruct the track impact point, incident angle and direction. The CLICdp Timepix3 beam telescope in the H6 beam line of the SPS is used as a reference detector to predict the track position and incident angle on the device under test (DUT). In this contribution we introduce the multi-variate track reconstruction method for the DUT and present results for different sensor thicknesses and various track incident angles.

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