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Tracking the Time: Single cell 3D pixel time resolution and Landau contribution evaluation via test-beam and laboratory measurements

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The proven potential of 3D geometries at higher than $10^{16} n_{eq}/cm^2$ radiation fluences, in combination with a small cell approach, makes them an excellent choice for a combined precision timing tracker. In this study, the timing resolution of a single 50 x 50 μm 3D pixel cell is presented in various temperatures through charge collection measurements with discrete electronics in a laboratory setting. The series is complemented by an extensive test-beam campaign with 160 GeV SPS pions, using a multi-plane timing telescope with an integrated pixelated matrix. Through a varied incidence angle study, field uniformity, Landau contribution and collected charge are treated at incidence angles of +/- 12^o. Using state of the art numerical methods, the choice of instrumentation on signal composition and induced bias on results is also evaluated. Finally, with the help of the EUDAQ telescope, a detailed timing, field and efficiency map is presented with a 5 μm spacial resolution through MIMOSA CMOS tracking at CERN SPS pion beams.

Collaboration

LHCb

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