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3D silicon sensors with columnar shaped electrode geometry for fast timing tracking detectors

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We present accurate and extensive studies on 3D-column silicon sensors, aimed at high-resolution space-time (4D) tracking for future collider experiments.
Such studies are a follow-up of the TimeSPOT-project and AIDAInnova initiative, where we developed 3D-trench silicon sensors, which have been proved to reach a time resolution around 10 ps rms up to extreme fluences (10ˆ17 new/cm2).
In this study, three configurations, 1E, 2E, and 3E, based on a parallel electrode configuration are designed, simulated, and compared with the established parallel trench geometry. Additionally, the impact of varying pitch sizes (45 µm, 50 µm, and 55 µm) on performance are investigated. The simulation methods (Synopsys TCAD, Geant4, and the simulation tools we developed –TFBoost, and TCoDe) are validated using data from recent test beam and TCT scans from a dedicated LASER setup at INFN Cagliari on the already available 3D-trench geometry. A layout of the final structures has been submitted to FBK for production. Expected performance are illustrated.

Primary experiment

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