

Timing performance of small cell 3D silicon detectors

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A silicon 3D detector with a single cell of 50x50 μm^2 was produced and evaluated for timing applications. The measurements of time resolution were performed for ^{90}Sr electrons with dedicated electronics used also for determining timing resolution of Low Gain Avalanche Detectors (LGADs). The measurements were compared to those in LGAD and also simulations. The studies showed that the dominant contribution to the timing resolution comes from the time walk originating from different induced current shapes for hits over the cell area. This contribution decreases with high bias voltages, low temperature and small cell size. The values reached are around 30 ps for (50x50 μm^2 , 150 V, -20C) which is comparable to time walk due to Landau fluctuations in LGADs. It improves for inclined tracks and larger pads composed of multiple cells. A good agreement between measurements and simulations was obtained, thus validating the simulation results.

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