

Timing performance of a 3D silicon sensor on Timepix4

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The upcoming high-luminosity era of the LHC will impose strict requirements on detector technology, particularly in achieving timing resolutions on the order of 50 ps for every pixel of the pixel detectors.

A possible solution is obtained with 3D silicon sensors. They are structured with electrodes penetrating into the substrate, which improves radiation hardness and reduces drift distance, making them strong candidates for the VELO upgrade in the LHCb experiment.

In this study, the timing performance of a 3D silicon sensor coupled with a Timepix4 ASIC assembly is presented, utilizing data collected from the latest testbeam conducted in August with the Timepix4 telescope. A comprehensive analysis was performed, incorporating corrections for the timewalk effect and for frequency variations in the clocks provided by Voltage Controlled Oscillators (VCO). Applying these corrections yielded a time resolution of 150 ps.

Conclusively, limitations encountered during the analysis and potential further improvements in timing precision will be discussed.

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