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Investigation of the Time Resolution of LGADs and 3D sensors using a beta source and a laser system

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Collider experiments as the upcoming high-luminosity LHC or the future FCC will increase the demands of the detectors used for tracking. In the FCC, sensors will not only face fluences of up to $1 \cdot 10^{17}\ n_{\mathrm{eq}}/\mathrm{cm}^2$, but also high pile-up scenarios. Thus sensors are needed which have a high radiation tolerance, but also an excellent time resolution while still providing a good spatial resolution. Currently Low Gain Avalanche Diodes (LGADs) are the prime candidate when it comes to timing, reaching a resolution of below 30 ps. However, 3D sensors are promising candidates as well, as they have not only a good time resolution but also a proven superior radiation hardness.
In this study, the time resolution of both LGADs and 3D sensors was investigated with measurements using a beta source, as well as measurements using a laser with infrared wavelength. These timing-TCT measurements allow the investigation of the position dependence of the time resolution. This is interesting especially for the 3D sensors, where the time walk component due to the more complex electric field structure influences the time resolution strongly.

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