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Timing Resolution Comparison between LGADs and 3D Sensors

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Current and future collider experiments are reaching luminosities at which pile-up causes tracking of single particles to become near impossible when using only three spatial coordinates. However, with high enough timing resolution, an additional measurement coordinate could be introduced to unambiguously discern particle paths.

When it comes to ultra fast silicon detectors (UFSD), Low Gain Avalanche Diodes (LGADs) are currently a premier choice, reaching a time resolution of below 30 ps. However, due to the limited radiation hardness (up to $\sim 2 \cdot 10^{15}\ \mathrm{n_{eq}/cm^2}$) of the gain layer, LGADs, in their current form, do not seem viable for future colliders such as the FCC, where fluences up to $10^{17}\ \mathrm{n_{eq}/cm^2}$ are expected.

An alternative approach for UFSD are 3D detectors due to their superior radiation hardness as well as high granularity allowing them to be used to resolve particle tracks precisely in four dimensions. In this talk, timing measurements conducted at the University of Freiburg with both a TCT and a Sr-90 source setup of LGADs and 3Ds are compared pre and post irradiation with reactor neutrons.

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