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Time resolution of silicon sensors

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Precision timing with solid state detectors is being employed in many areas of particle physics instrumentation. Applications for pileup rejection and time of flight measurements at the LHC are just two of many notable examples.

During the past years we studied the contributions to the time resolution for various types of silicon sensors. The principal contributors to the time resolution are Landau fluctuations, electronics noise, signal shape fluctuations due to a varying pad response function as well as gain fluctuations. We discuss silicon pad and silicon pixel sensors, LGAD sensors as well as SPADs and SiPMs. The analytic statistical analysis of the contributions to the time resolution has been performed, resulting in elementary expressions for the timing performance of these sensors. These expressions show the basic directions for optimization of these sensors as well as the fundamental limits to the time resolution.

Primary experiment

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