Ultra-Fast Silicon Detectors for 4D tracking

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We review the progress toward the development of a novel type of silicon detectors suited for tracking with a picosecond timing resolution, the so called Ultra-Fast Silicon Detectors. The goal is to create a new family of particle detectors merging excellent position and timing resolution with GHz counting capabilities, very low material budget, radiation resistance, fine granularity, low power, insensitivity to magnetic field, and affordability. We aim to achieve concurrent precisions of ~ 10 ps and ~ 10 μm with a 50 μm thick sensor. Ultra-Fast Silicon Detectors are based on the concept of Low-Gain Avalanche Detectors, which are silicon detectors with an internal multiplication mechanism so that they generate a signal which is factor ~ 10 larger than standard silicon detectors.