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4D Tracking: 28nm sub-10ps TDC ASIC design and characterization

Muon collider detectors will require 4D trackers capable of determining the track time of arrival with tens of pico-second timing precision to reject beam induced backgrounds. As one of the critical components necessary to enable 4D tracking, we developed an innovative 4-channel sub-10ps Time-to-Digital Converter (TDC) ASIC in the 28nm CMOS technology node. The developed TDC is based on a novel 2D Vernier ring-oscillator structure with embedded sliding-scale technique for conversion linearity improvement that will simplify calibration of the TDCs, especially useful in high-channel count implementations such as 4D trackers. In this presentation we will discuss the TDC design and features, simulated results, and recent tests from a TDC prototype ASIC.

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