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Tangerine: Advancements in Sensor Development for Future Lepton Collider Vertex Detectors

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The Tangerine project focuses on the development of advanced sensor prototypes for silicon vertex detectors to be used in future lepton collider experiments. These detectors face stringent requirements, including excellent position resolution below 3um, minimal material budget with thicknesses below 50um, low power consumption of lower than 50mW/cm2, and time resolution on the nanosecond scale.

Over recent years, several prototypes have been designed and fabricated using a 65 nm CMOS imaging process with a small collection electrode. These range from chips equipped with analog front ends only, to the fully integrated hybrid-to-monolithic (H2M) chip. The latter employs a digital-on-top design flow and integrates a complete hybrid readout architecture within a monolithic chip. All prototypes have undergone extensive laboratory and beam testing, demonstrating full functionality.

In parallel, the project has developed a technology-independent simulation methodology that combines TCAD simulations with generic doping profiles and Monte Carlo simulations using the Allpix Squared framework. Despite limited process information, this approach has successfully produced results that align with experimental data across a range of observables.

This contribution presents an overview of the sensor prototypes and simulation workflow developed within the Tangerine project, along with an outlook on the ongoing efforts under the DRD3 collaboration.

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