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Vertex and tracking detector R&D for CLIC

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The physics aims at the future CLIC high-energy linear e+e- collider set very high precision requirements on the performance of the vertex and tracking detectors. Moreover, these detectors have to be well adapted to the experimental conditions, such as the time structure of the collisions and the presence of beam-induced backgrounds. The principal challenges are: a point resolution of a few micron, ultra-low mass ($\sim 0.2\% X_0$ per layer for the vertex region and $\sim 1\% X_0$ per layer for the outer tracker), very low power dissipation (compatible with air-flow cooling in the inner vertex region) and pulsed power operation, complemented with ~ 10 ns time stamping capabilities. A highly granular all-silicon vertex and tracking detector system is under development, following an integrated approach addressing simultaneously the physics requirements and engineering constraints. For the vertex-detector region, hybrid pixel detectors with ultra-small pitch (25 μm) and analogue readout are explored. For the outer tracking region both hybrid concepts and fully integrated sensors are under consideration. Recent R&D achievements include results from beam tests with prototypes of a novel hybridisation concept based on capacitive coupling between active HV-CMOS sensors and CLICpix readout ASICs implemented in 65 nm CMOS technology. Simulations based on Geant4 and TCAD are used to validate the experimental results and to optimise the detector designs. An overview of the R&D program for pixel and tracking detectors at CLIC will be presented.

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