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CLIC vertex detector R&D

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A vertex detector is under development for CLIC, a future linear electron—positron collider with a maximum centre of mass energy of 3 TeV. In order to perform precision physics measurements in a challenging environment, the CLIC vertex detector must have excellent spatial resolution, full geometrical coverage extending to low polar angles, extremely low mass, low occupancy facilitated by time-tagging, and sufficient heat removal from sensors and readout. These considerations, together with the beam structure of CLIC, push the technological requirements to the limits. A detector concept based on hybrid pixel-detector technology is under development. It comprises fast, low-power and small-pitch readout ASICs implemented in 65 nm CMOS technology (CLICpix) coupled to ultra-thin (50 um) planar or active HV-CMOS sensors via low-mass interconnects. Prototype devices have been tested in the lab and with beams. The power dissipation of the readout chips is drastically reduced by means of power pulsing, allowing for a low-mass cooling system based on forced air flow through an optimised arrangement of detection layers. This talk reviews the requirements and design optimisation for the CLIC vertex detector and gives an overview of recent R&D achievements in the domains of cooling, supports, powering, detector integration, sensors and readout. First results with an innovative hybridisation concept based on capacitive coupling between active sensors and readout ASICs will be presented.

Collaboration

CLICdp

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