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Calibration, Simulation and test-beam characterization for hybrid-pixel readout assemblies with ultra-thin sensors

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A vertex-detector concept based on the hybrid planar pixel-detector technology is currently under development for the proposed Compact Linear Collider (CLIC). The low material budget of only 0.2% X0 per layer corresponds to an equivalent thickness of 200 μm of silicon and includes the infrastructure for powering and mechanical support. To reach this material budget, sensors and readout ASICs will each have to be thinned down to approximately 50 μm . In a first phase of R&D, assemblies were produced using thin planar pixel sensors (50-300 μm) hybridised to Timepix readout ASICs. Both standard thickness ASICs and ASICs thinned to 100 μm are used. Sensors include active-edge sensors from Advacam with 50 μm thickness and Micron semiconductor sensors with 100 μm thickness hybridised by IZM. The assemblies have been calibrated with sources and X-ray fluorescence measurements and characterised in beam telescope tests at DESY with a 5.5 GeV electron beam. In this talk we present the current status of sensor calibration, test-beam analysis and comparison with GEANT4 simulation using a sensor and electronics digitization model. We also show first measurement results for the recently produced CCPDV3 active HV-CMOS sensors matching the 25 μm pitch of the 65 nm CLICpix readout ASIC prototypes.

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