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Integrated CMOS sensor technologies for the CLIC tracker

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The tracking detector at the proposed high-energy CLIC electron-positron collider will be based on small-pitch silicon pixel- or strip sensors arranged in a multi-layer barrel and end-cap geometry with a total surface of about 90 sqm. The requirements include single-point position resolutions of a few microns and time stamping with an accuracy of approximately 10 ns, combined with a low material budget of less than 2% of a radiation length per layer, including cables, cooling and supports. Mainly fully integrated CMOS sensors are under consideration. One of the candidate technologies is based on a 180 nm CMOS process with a high-resistivity substrate. Test beam measurements and TCAD simulations were performed for demonstrator chips consisting of an array of analog pixel matrices with different pixel pitch and a variety of collection-electrode geometries and process options. The analog signals of each matrix are read out by external sampling ADCs, allowing for a precise characterisation of the signal response. In this contribution we present the sensor design and show results from recent test-beam campaigns, as well as comparisons with TCAD simulations. The results show good spatial and timing resolution in line with the requirements for the CLIC tracker.

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