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High performance 4D tracking with 100% fill-factor and very fine pitch silicon detectors

In our contribution we present the performance of RSD (Resistive AC-Coupled Silicon Detectors), an evolution of the LGAD (Low-Gain Avalanche Diode) technology, developed through a collaboration between the Torino division of INFN (the Italian National Institute for Nuclear Physics) and Fondazione Bruno Kessler (FBK), Trento. In this new design, the multiplied charges are slowed down on the detector surface by a resistive n^+ implant and then they induce a signal on the readout metal pads thanks to a dielectric layer, acting as a coupling capacitor. Having a continuous p -gain implant over the whole detector area, the RSD technology gets rid of all the isolation structures used to produce standard pixelated trackers by simply transferring the segmentation from the multiplication layer to the readout scheme, given by the AC-pad size and pitch. By properly designing such scheme, we achieved the challenging goal of producing detectors for 4D tracking with very high spatial granularity (up to 50 μm pitch) and 100% fill-factor while maintaining good timing performances proper of LGAD-based devices (few tens of ps). After reviewing the RSD paradigm and presenting the first batch of sensors fabricated by FBK, we will show several characterizations before and after irradiation.

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