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CERN EP seminar: Innovative silicon sensors for future trackers

Friday 5 June 2020 11:00 (1 hour)

Abstract:

Future particle trackers require formidable position (~ 5 microns) and time (~ 10 ps) resolutions. In traditional silicon sensors, better position resolution implies smaller pixels and, consequently, much higher channel count and smaller area available for the electronics. This combination is at odd with the requirement of also measuring accurately the timing information, a request that increases considerably the complexity of the readout and its power consumption. In this seminar, we will present a novel design of silicon detectors, the so-called Resistive Silicon Detector (RSD). RSD uses internal gain, a resistive $n+$ junction contact on a p -bulk, and AC readout to achieve signal sharing among several readout pads (somewhat similar to the RPC concept). This design leads to a drastic reduction of the number of read-out channels for equal spatial resolution while it maintains the excellent time performances of low gain silicon sensors. The RSD design (also called AC-LGAD) has a 100% fill factor and it is easily adapted to any geometry since the segmentation is achieved uniquely by the metal AC pads. In the first part of the seminar, we will present the challenges in the design and production of the first prototypes at FBK, while in the second part we will cover the signal formation, reconstruction techniques, and preliminary laboratory and beam test results. The last part of the seminar will focus on the plans for design optimization and the introduction of machine learning in the reconstruction to exploit the distributed nature of the signal.

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