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Silicon sensors with resistive read-out: ML and analytics techniques for ultimate spatial resolution

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Without an external magnetic field, the position resolution of silicon sensors is about $pitch\ size/\sqrt{12}$: in identical conditions, silicon sensors with resistive read-out achieve a resolution of a few percent of the pitch size. This remarkable improvement is due to the introduction of resistive read-out in the silicon sensor design. Resistive silicon sensors are based on the LGAD technology, characterised by a continuous gain layer and by an internal signal-sharing mechanism. Thanks to an innovative electrode design aimed at maximising signal sharing, the second FBK production of RSD sensors, RSD2, achieves a position resolution on the whole pixel surface of about 3 microns for 200-micron pitch, 15 microns for a 450-micron pitch and less than 40 microns for a 1300-micron pitch. RSD2 arrays have been tested in the Laboratory for Innovative Silicon Sensors in Torino using a Transient Current Technique setup equipped with a 16-channels digitizer, allowing simultaneously recording all the detector channels. In this contribution, I will present the characteristics of RSD2 and the results obtained with analytic methods and with machine learning algorithms.

Collaboration

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