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Tracking particles in space and time: the 4D tracking revolution

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Abstract: In the past few years, two design innovations have radically changed the performance of silicon detectors and turned silicon sensors into high-resolution timing detectors, fit to meet the very demanding requirement of future 4D trackers. In this presentation,I will review the performance improvements that these two design innovations, low-gain (LGAD) and resistive read-out (RSD) [1], have brought to silicon sensors. Due to the LGAD mechanism, large signals lead to improved temporal precision, while charge sharing, due to the RSD design, has removed the need for very small pixels to achieve excellent spatial precision. LGAD- and RSD- based silicon sensors are now adopted, or considered, in several future experiments and are the basis for almost every next 4D-trackers. In the final part of the presentation, I will show how the introduction of multiple sampling front-end electronics and reconstruction methods based on machine learning can further improve the performances of future 4D trackers.

Lecturer: Dot. Cartiglia is an experimental high-energy physicist. His field of research is detector design, construction, and commissioning. He has been a member of several large collaborations based both in Europe and the US. Throughout his carrier, he has complemented his work on detector innovation with a strong involvement in physics analyses. In the past 10 years, he has focused his efforts on developing innovative silicon detectors, specifically for tracking particles in space and time, the so-called 4D tracking. He has been the PI of important projects, including an ERC advanced grant and an Italian PRIN grant (Text informed by Lecturer).

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