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Development of Advanced Room Temperature Silicon Drift Detectors and Electronics for Synchrotron Radiation, X-ray Astronomy and Astrophysics

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The realization of a tracking system based on large area silicon drift detectors (SDD), within the frame of the ALICE-LHC experiment, has given rise to a coherent effort to adapt the whole technological framework of large area SDD to the field of low energy X-ray detection with high spectroscopy resolution. The scientific drive that have set the specifications for this effort, which is involving a large collaboration, comes from the needs of synchrotron light beam lines and X-ray astrophysics projects. The results that will be presented have motivated a large community in using the versatility and performances of our detection systems in different directions.

Summary

With the delivery and commissioning in 2007 of the ALICE tracking system which included two layers of silicon drift detectors for a total surface of more than one square meter we achieved two main results. The first is to demonstrate that such a refined device, requiring extreme care, can be mass-produced with high yield in a constructive and rewarding collaboration with industry. But also a proof that with an iterative work between user's detector modeling and a dedicated evolution of the photolithography technology high quality performances could be obtained. The consequences brought to the idea to step into applications requiring large area and low leakage currents hence, high performances low energy X-ray detection systems. Through a dedicated evolutionary development of the ALICE detectors new detection systems for X-ray astrophysics and advanced light sources have been proposed. At the same time the development of very low noise VLSI front-end has allowed valuable steps in the crucial field of tailor-made detection systems.

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