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Studies for an upgrade of the ALICE Inner Tracking System

Heavy quarks are fundamental probes to investigate the properties of the hot and dense QCD matter formed at the extreme energy densities reached in Pb-Pb collisions at LHC. The heavy quark pairs (cc_bar and bb_bar), which are produced in the very initial stage of the collision, come out from the interaction region as hadrons, possibly as a part of a jet, and carry out information about the properties of the traversed medium. Such information can be obtained from the study of the open charm and beauty hadrons in the final state and of the associated jet. Charm and beauty hadrons decay weakly with a mean free path of the order of few hundred microns. Therefore, their identification relies on the possibility of resolving a decay vertex at distances of such order from the production one. The inner tracker of the ALICE experiment (ITS), made of six layers of silicon detectors, has been designed and built to this purpose and is providing the first results on the above mentioned item, though with some limitations. A detector based on today's frontier technologies would certainly offer new exciting possibilities within the physics scope described above.

This contribution will present the studies on the upgrade of the ALICE ITS detector. At the moment, several possible scenarios for the new detector layout and technologies are being considered. With respect to the current ITS, the baseline idea for the upgraded tracker is to have a detection layer closer to the beam line (which implies a beam pipe with smaller radius) and a larger number of layers instrumented with silicon pixels. The track position resolution at the primary vertex could be improved by a factor 2–3.

Besides the natural improvement of the measurement capabilities on the channels already well measured with the present ITS, the upgraded ITS will offer the possibility of exploring new physics items. Examples are the heavy flavor baryons, the exclusive decay channels of B-mesons, the production mechanisms of hadrons containing more than one heavy quark.

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