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MODERN DETECTOR TECHNOLOGIES FOR NUCLEAR PHYSICS EXPERIMENTS AND DIAGNOSTIC STUDIES IN NUCLEAR MEDICINE

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Today, one of the nuclear physics tasks of experiments at high-energy accelerator complexes is the study of the superdense nuclear matter phase diagram. It is assumed that during the formation of such matter there will be an increased yield of particles, which include heavy c- and s-quarks. Due to the short life-time of these particles for precise reconstruction of their decay vertex the new tracking detector systems are needed. In this work a new concept of a vertex detector for the MPD (Multi-Purpose Detector) experiment at the NICA collider is proposed. In this detector, 3 inner layers based on monolithic active pixel sensors are maximally close to the collider beams interaction point and consist of a large area flexible ultra-thin silicon wafers. For the proposed concept the evaluation of the spatial resolution has been done. It was shown that the transition to such thin inner layers with smaller radii allowed reconstructing the decay vertices of D_s^+, D^0 and D^+ mesons.

In this work also an overview of modern detector technologies using silicon pixel sensors is provided for development of proton computed tomography for the diagnostics of tumor in hadron therapy methods. The development of new detector systems for digital track calorimeters will be shown, both for reconstruction of a large number of proton tracks and for proton energy measurements.

The results of experimental work (proton beams of 100 - 200 MeV) on the creation of digital track calorimeters will also be presented, together with the results of properties and characteristics studies of silicon pixel sensors in the context of high accuracy charged particle tracks reconstruction tasks.

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