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Advanced technologies of radiation transparent support structures for novel thin silicon detectors.

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The current developments in the field of very thin large area coordinate sensitive Si detectors for precise tracking of short-lived charged particles in future high-energy physics experiments requires the state-of-the-art solutions for systems of cooling, mechanics and engineering. This task represents a strong challenge due to contradictive demands of high thermo- and mechanical stability of the large ultra thin silicon sensors arrays (of many square meters) vs. minimal weight of low-Z materials of all services in the sensitive region[1].
In the giving report we present the conceptual ideas and results of developments of technology for production of several configurations of extremely lightweight carbon fiber structures for large area, thin (˜20 um), silicon sensors. A very promising option of cylinder geometry bent thin silicon coordinate sensitive detectors, that is being considered by ALICE [2] for the innermost sensitive tracking layers, could be also beneficial for other collider experiments (for MPD or SPD experiments at the NICA collider) due to the obvious gain in accuracy of determination of secondary vertices of short-lived particles.
Results obtained in the present work in the mechanical tests of the produced extra lightweight carbon fiber mechanical support structures show the limits of deformation under the forces relevant to bending of silicon sensors. Technology for manufacturing of new configurations of carbon fiber structure is discussed. It is shown that these technologies are capable to ensure a high level of thermo-mechanical stability with enough the minimum of matter applied in the sensitive area of novel generation of extra-low-material-budget Si-Vertex Detectors for future experiments at CERN and JINR.

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