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# Ultra lightweight support structures and gaseous cooling system for the novel silicon pixel detectors

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New research tasks in high-energy physics experiments require using the advanced materials and methods for the precise tracking and decay vertices registration of short-lived charged particles.
Therefore, very thin large area, coordinate-sensitive Si detectors with high granularity and the highest radiation transparency will be used for the innermost tracking layers on the next stage of the ALICE experiment at the LHC. Such vertex detectors can provide minimal distortions of the registered tracks because of the multiple scattering effects and their application is also being planned for NICA experiments at JINR. In present work, the conceptual ideas and results of developments of ultra lightweight support structures and cold nitrogen cooling system proposed for next-generation of radiation transparent vertex detectors are discussed [1].
Therefore, the lightweight and radiation transparent materials should be used to develop support structures and cooling system for new silicon pixel detectors. On the one hand, an ultra lightweight system has to be strong enough to support the detectors, on the other hand this system should be radiation transparent with the minimum material budget of its components. This means that all parts of the detector system, sensors, micro cables, support structures and cooling system should have a minimum amount of low-Z materials. The gaseous cooling of detectors is being considered as an appropriate option [2]. In this case, we need to avoid vibrations, that could happen for very thin (˜ 20 micron), large area Si detectors in case of the non-negligible speed required for the gas flow. In order to reduce these micro-vibrations the low-speed flow of the cold gas was proposed.
In present work, our developments of ultra lightweight, support structures with cold nitrogen cooling system for new generation of thin, large area, coordinate-sensitive Si detectors are presented.
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References:
1. First demonstration of in-beam performance of bent Monolithic Active Pixel Sensors, ALICE ITS project Collaboration, G. Aglieri Rinella (CERN) et al, Nucl.Instrum.Meth.A 1028 (2022)
2. Physics Briefing Book : Input for the European Strategy for Particle Physics Update 2020, Ellis, Richard Keith (Durham U., IPPP) et al. CERN, Report number: CERN-ESU-004 (See p.212, contribution 46: G. Feofilov et al., "Heavy-flavour production in relativistic heavy-ion collisions and development of novel generation of extra- low-material-budget Vertex Detectors for future experiments at CERN and JINR").

## The speaker is a student or young scientist

Yes

## Section

1. Intermediate and high energies, heavy ion collisions

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