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Input from the ALICE Collaboration

The ALICE Collaboration is planning to build a new experimental apparatus, ALICE3, to be installed during Long Shutdown 4, that will ensure the full exploitation, before the end of the HL-LHCoperations, of the unique environment for the study of the quark-gluon plasma (QGP) offered by nuclear collisions at the multi-TeV scale. The very high QGP temperatures, the abundant production of heavy flavours and the very large single-event multiplicities available at the LHC have already provided major inroads in the understanding of the emergent properties of the QGP and opened an era of systematic quantitative measurements of its physical parameters that is well under way for Run 3 and Run 4. The HL-LHC still allows access to a number of new, powerful, but as yet unexplored, experimental observables to understand the approach to thermal equilibrium, measure the temperature of the QGP and its evolution, provide access to fundamental aspects of the phase transition, and to use LHC as a laboratory for hadron physics. In order to make progress in these areas, excellent pointing resolution is required to identify heavy flavour hadrons, including beauty at low pT, multi-charm baryons, and to enable angular and momentum correlation measurements of charm hadrons. Furthermore, lepton and hadron identification are required to obtain clean access to thermal dielectron emission and signatures of chiral symmetry restoration. Large acceptance and high rate capabilities are needed to ensure sufficient coverage for correlation measurements, to map the rapidity dependence of key processes and to ensure sufficient precision for rare probes. Starting from today's state-of-the-art technology, such requirements can be satisfied with a compact experimental apparatus based on silicon sensors, as optimised in the ALICE3 design. Besides ensuring the accomplishment of the HL-LHC QGP physics campaign, the unique features of ALICE3 also offer opportunities for the study of exotic hadrons and searches for BSM particles, such as dark photons and axion-like particles.

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