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Phase-One LHeC

In *White Paper* on the Large Hadron electron Collider (LHeC), submitted to the ESPP Update, its commissioning is proposed several years after the completion of the HL-LHC programme in 2041. Here an alternative staged approach is considered in which a phase-one LHeC is using a 20 GeV single-pass Energy Recovery Linac (ERL), to be commissioned at P2 after LS4 allowing for unique studies of the electron-hadron interactions already during Run5. In this case, the project financial stress will be distributed over more years, and the experience acquired during the first phase of the LHeC will allow for a more robust design of the final stand-alone LHeC and possibly also allow its earlier startup. Moreover, such a phase-one LHeC is expected to provide important and timely scientific feedback to the hadron-hadron experiments at the HL-LHC already two years after commissioning, especially in the domain of the parton distribution functions. Conceptual studies indicate high luminosity performance, and this in turn guarantees excellent original scientific output, including, for example, unique research in the physics of the Higgs boson, top quark and $\gamma\gamma$ interactions at the electron-proton centre-of-mass energy of 0.75 TeV, as well as interesting comparative studies of eA and AA interactions, since the proposed design of the interaction region allows for both types of collisions at IP2. Last but not least, the new detector at the P2 site can be designed by extension of the ALICE 3 proposal, which offers strong synergies and benefits in several areas.

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