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The physics potential of HE-LHC

This document summarizes the physics potential of the High-Energy LHC (HE-LHC), under consideration as a possible future project at CERN. The HE-LHC is a 27 TeV pp collider, to be installed in the LHC tunnel, relying on the 16 T magnet technology being developed for the 100 TeV Future Circular Collider (FCC-hh). The HE-LHC is designed to deliver $10\text{--}15\text{ ab}^{-1}$ of integrated luminosity to two general purpose detectors, during 20 years of operation. As for the LHC, the facility could host a dedicated interaction point focused on flavour physics, delivering 3 ab^{-1} of integrated luminosity to an upgraded LHCb detector, and would continue the programme of heavy ion collisions. The results presented here were obtained in the context of the Workshop on “The physics of HL-LHC, and perspectives on HE-LHC”, which ran for over a year after its kick-off meeting on 30 October – 1 November 2017. These studies complemented those focused on the engineering and technological aspects of the project, performed in the context of the FCC conceptual design report (CDR) for the HE-LHC, and documented elsewhere.

The activity has been carried out by five working groups (WGs): Standard Model (WG1), Higgs (WG2), Beyond the Standard Model (WG3), Flavour (WG4) and QCD matter at high density (WG5). The reports from the WGs, extending this executive summary with much more detail and many more results, are available on the CERN Document Server, and will appear on arXiv. The documents describing in full detail the HL-LHC and HE-LHC studies performed by the ATLAS and CMS Collaborations will be available in early 2019.

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