

# Detector solutions for Lepton-hadron Scattering based on the LHC and FCC

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## ABSTRACT

The Large Hadron-electron Collider (LHeC) is a proposed upgrade of the HL-LHC, in which energy recovery linac technology is used for an electron accelerator, producing beams of 50 GeV leptons to collide with the proton and ion LHC beams. A similar design can later be applied to provide electrons to collide with the hadron beams at the Future Circular Collider (FCC-eh). The diverse physics programmes at the LHeC and the FCC-eh require a large acceptance detector with high resolution tracking and calorimetry and carefully considered beam-line instrumentation in both the forward and backward directions. Following on from the 2012 Conceptual Design Report [1], a revision of the detector design has recently been made [2], reflecting the significantly enhanced expected luminosities and corresponding changes to the primary physics targets, and also incorporating the developments in particle detection technologies in the intervening years. In this LoI, we outline the latest detector design and summarise its expected performance based on simulation studies.

## I. NOTE

This placeholder will be replaced by a full letter in early September, as per the Snowmass 2021 LOI instructions.

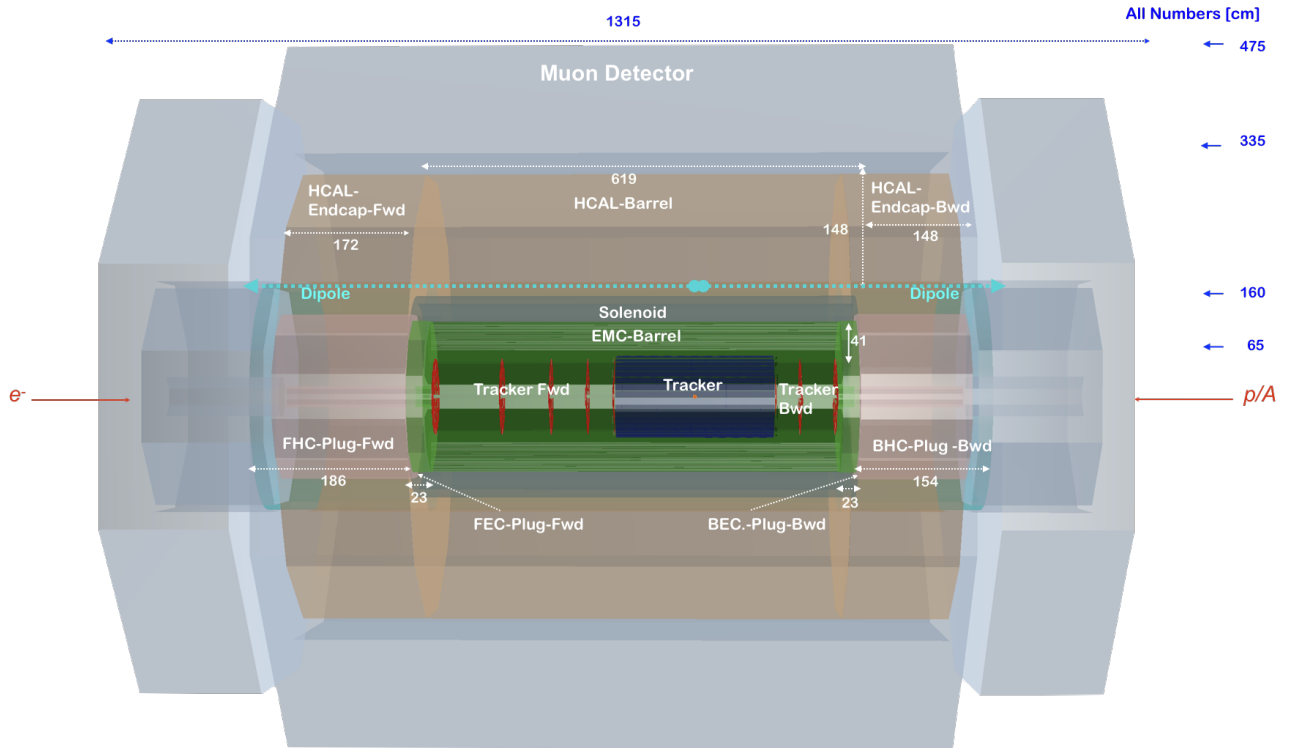


FIG. 1. Side view of the updated baseline LHeC detector concept, providing an overview of the main detector components and their locations. The detector dimensions are about 13 m length and 9 m diameter. The central detector is complemented with forward ( $p$ ,  $n$ ) and backward ( $e$ ,  $\gamma$ ) spectrometers mainly for diffractive physics and for photo-production and luminosity measurements, respectively. See text for details.

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- [1] LHeC Study Group, “*A Large Hadron Electron Collider at CERN*”, J. Phys. G 39 (2019) 075001, arXiv:1206.2913.  
[2] LHeC and FCC-eh Study Group, “*The Large Hadron-Electron Collider at the HL-LHC*”, arXiv:2007.14491 [hep-ex].