

# Status of the “LHeC at HL-LHC” Paper

A Happy, Healthy, Productive 2020

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Meeting of the LHeC Coordination, 7 January 2020



# Preface

This paper represents the updated design study of the Large Hadron electron Collider, the LHeC, a TeV energy scale electron-hadron ( $eh$ ) collider which may come into operation during the third decade of the lifetime of the Large Hadron Collider (LHC) at CERN. It is an account, accompanied by numerous papers in the literature, for many years of study and development, guided by an International Advisory Committee (IAC) which was charged by the CERN Directorate to advise on the directions of energy frontier electron-hadron physics at CERN. End of 2019 the IAC summarised its observations and recommendations in a brief report to the DG of CERN, which is here reproduced as an Appendix.

The paper outlines a unique, far reaching physics programme, a design concept for a new generation collider detector, together with a novel configuration of the intense, high energy electron beam. This study builds on the previous, detailed LHeC Conceptual Design Report (CDR), which was published eight years ago [1]. It surpasses the initial study in essential characteristics: i) the depth of the physics programme, owing to the insight obtained mainly with the LHC, and ii) the luminosity prospect, for enabling a novel Higgs facility to be built and the prospects to search for and discover new physics to be strengthened. It builds on recent and forthcoming progress of modern technology, due to major advances especially of the superconducting RF technology and as well new detector techniques.

## The Large Hadron-Electron Collider at the HL-LHC

From resolving the partonic structure of matter to Higgs and BSM physics

LHeC Collaboration



Submitted to J.Phys. G

250 pages as of today morning

No foreword – skip ? IAC statement now in, appendix

No executive summary – no need with abstract, preface, introduction

Any comment on title, subtitle?

Authorlist: being established (Nestor, Oliver, Emilia, Daniel) - will need your active check, probably Friday

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2. Is cross read by Frank, will add here, as 2.6. the timeline (as presented with the addendum) [OB,MK}

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Various new parts in: Lucien 3.1.2., Max FL 3.2.5. Daniel 3.2.1 edited

Missing: PDFs (Claire/Max – 3.1.4/5) this week

Changes: delete 3.1.7, 3.2.3

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Looks complete, needs like most of other parts reading

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5.1 Final checks and edits being done (Uta, Max) → in this week

5.2. expected from Bruce nowish

5.3. written by Masahiro, to be inserted (Max)

5.4. unrealistic – final decision to be taken with Jorge

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Looks complete,  
needs treading  
like most other parts



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- 7.1 Mail by Maarten today: will be drafted and in by Thursday/Friday this week
- 7.2. 1.following latest analyses this is less obvious wrt other errors and deserves extra effort
- 7.2. 1. ep input with Jorge, we hope he manages
- 7.3 eA already ready

Crucial to have this maximally well done

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**Most of it in, missing:**

eA: John Jowett – to come

Positrons: Louis Rinolfi – perhaps  
[not crucial but good to eventually have]

ArcMagnets: needed a clarification with Alex  
→ Cynthia – to come

Infrastructure: hopes are with Erk

Cavity+Cryomodule: Sebastien/Gilles – to come

All read by Frank – his comments to be put in

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The ERL part written since October, needs to be read

PERLE: Walid – to come, had no news in 2020 so far, backup: the Dec18 strategy note

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Results all in and plots – outstanding work of Peter (who is now ill for a week or 2)

Needs text (Alex, Max, Paul) – will take the weekend for Max

10.5 Fwd/bwd was described in CDR 1 and should be deleted

10.6 Andrea Gaddi – all in

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11.1. to be written (Max)

11.2 will go into chapter 2

Appendix in (IAC statement) this should appear visible in the able of contents (Daniel please)

All in all: we shall be ready on Monday 13.1. By Friday 10 afternoon we will see whether we Will. We then shall decided on how to contact the co-authors. It should be with the full paper (bascially) – meeting with Daniel Nestor, Max (anyone else welcome)

PLEASE read and make sure things are ok. We shall release a V1 to the arXiv only if we are sure the quality is there and the crucial chapters too (PDFS, H, ep+pp, PERLE)