

Evolution of LHeC Coordination

Oliver Bruening, Max Klein



News
Past/Current Organisation
Thoughts from October 20
Proposal



Meeting of the Coordination Group and the Physics WG Coordinators, April 1st, 2021



Energy recovery Linac: ep-collider

Concept:

accelerate electrons to high energy → use the beam → decelerate
→ recover beam energy for machine operation → **Energy Saving**

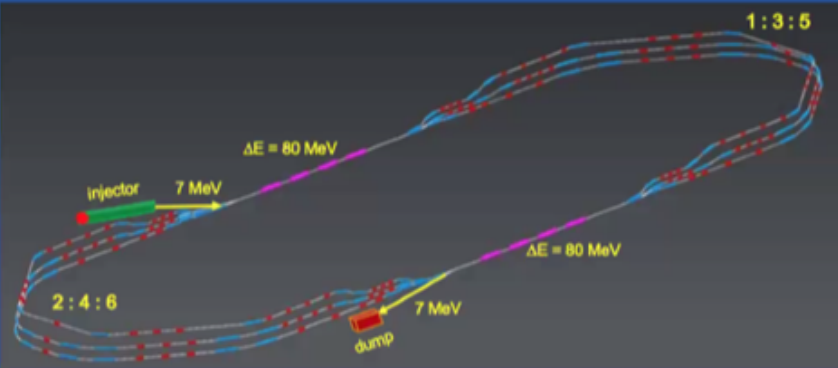
Worldwide developments :

p.ex BINP (Novosibirsk) CERN (KEK), CBETA-Cornell

projects: bERLinPro (light source), MESA...

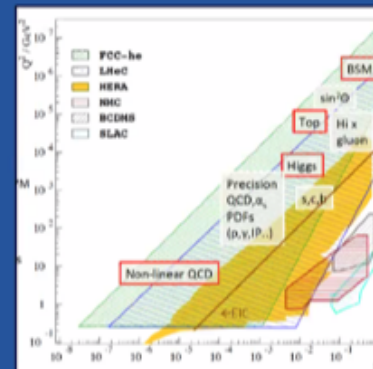
HEP: PERLE superconductive multipass demonstrator in Orsay (≈25M€)

TDR expected by 2022



High energy ep-collider:

- Independent proton-structure function measurements
- Higgs physics measurements
- Complementary to EIC



Selected Recent News

ERL Roadmap – 12/21

- 5 Energy and Intensity Frontier Physics - 30p
 - 5.1 High Energy Colliders
 - 5.1.1 LHeC and FCC-eh
 - 5.1.2 FCC-ee as an ERL
 - 5.1.3 ILC as an ERL
 - 5.1.4 Photon-Photon Collider
 - 5.2 Low Energy Particle Physics
 - 5.2.1 Elastic Electron-Hadron Scattering . .
 - 5.2.2 Weak Interaction at Low Energy . .
 - 5.2.3 Dark Photons
 - 5.3 Low Energy Nuclear Physics
 - 5.4 Photo-Nuclear Physics

Detector Presentations (21)

M Klein to Hongkong Conference
L Musa: to ECFA (LHeC,A3, EIC)
Meeting with M Doser on Quantum
Abstract to Off-Shell Conference

Special thanks to Peter

PERLE

CERN, Jlab, Daresbury officially coming in

“The Future of the LHC”

Book Project with Universe -12/21,tbc
O.Bruening, M.Klein, P.Spagnolo, L.Rossi eds

The First Decade
The HL-LHC Project
Physics with 3 (4) ab-1
Electron-Hadron Scattering
Energy Upgrade of the LHC
The LHC in the FCC Era

Tentative chapter headlines

Note BSM Workshop: Bruce and Oliver F

Talks at DIS Workshop

12-17.4.

<https://indico.bnl.gov/event/9726/>

Project: Christian Schwanenberger
ep+pp: Ludovica Bella
Partons: Claire Gwenlan
Higgs: Uta Klein
BSM: Oliver Fischer
Top: Mukesh Kumar
Electroweak: Daniel Britzger
Ions: Heikki Mantysaari

Special thanks to Nestor

Part of **Snowmass** process
Accepted for **Sustainability Workshop**

"The Large Hadron-Electron Collider at the HL-LHC”

Yesterday mail:

Dear Dr Britzger,

.. We are pleased to tell you that we have now formally accepted your Major Report..

We will contact you again soon when proofs of your article are ready for final approval.

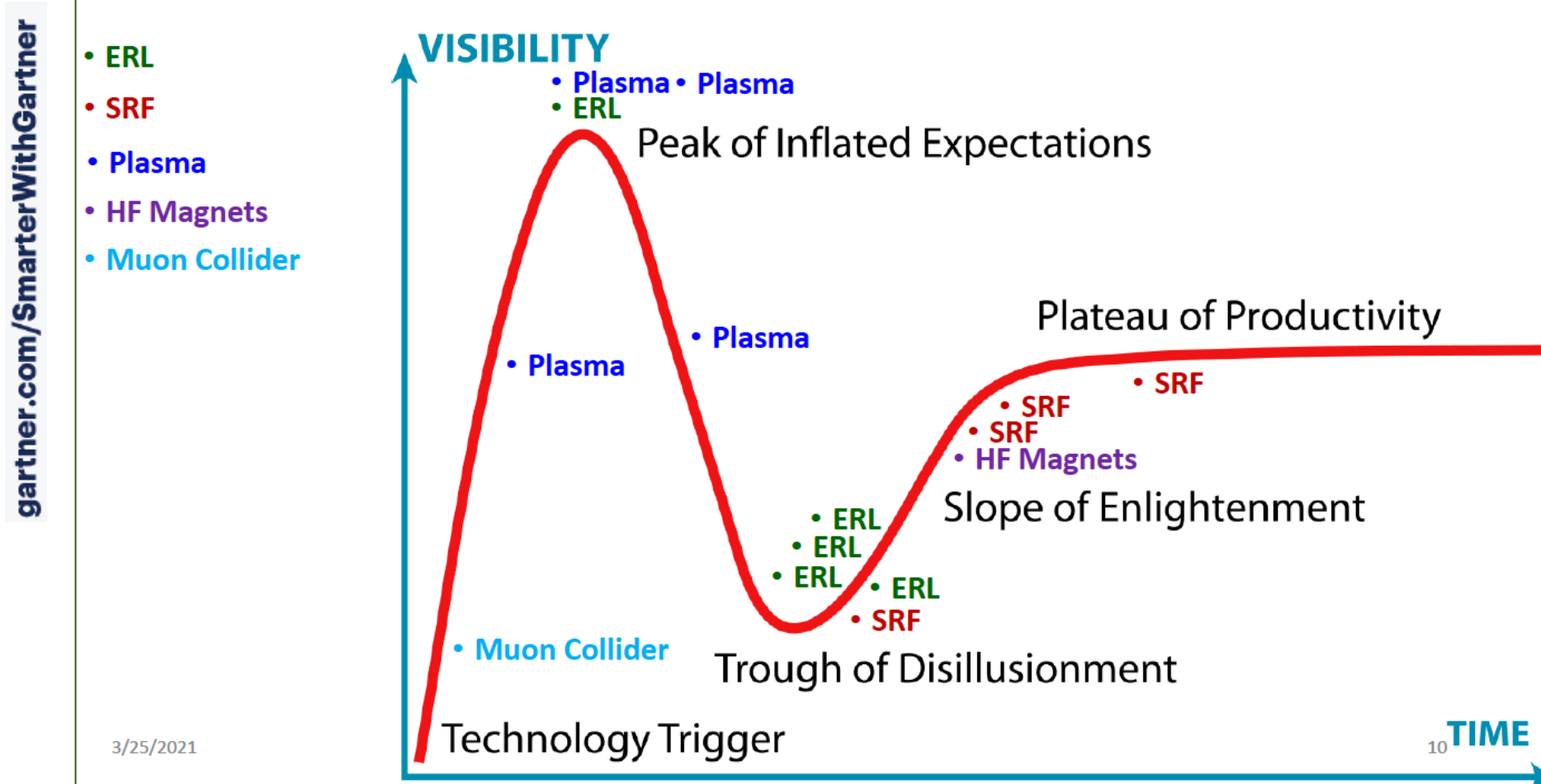
Article reference: JPhysG-103489.R1

Special thanks to Daniel

Olga: the brand ERL:

“Products are made in the factory, but brands are created in the mind.”

Walter Landor



Presented by Olga Tanaka to ERL panel 26.3.21

We agreed that ERL is in the “Trough of Disillusionment”, i.e. “the most likely to leap forward with a bit of support.” Andrew Hutton

LHeC is where ERL is, we passed the “peak of inflated expectations” and approach the “slope of enlightenment”

The Large Hadron Electron Colliders at CERN – LHeC and FCC-he

Welcome

Basics

Coordination

Steering Group

Coordination Group

Advisory Committee

Workshops

Institutions

People

Accelerators

The 50 GeV ERL

LHeC

FCC-he

PERLE

Physics

History of DIS

Summary

Working Groups

Detector

Introduction

Plots

Software

Components

Installation

Public

Popular Articles

Photo Gallery

Selected Figures

Official Statements

Documentation

Talks

Publications

New webpage: Elias Malwa, Mukesh Kumar,
with Eduardo Alvarez Fernandez (CERN), Nestor Armesto, Max Klein, Alessandra Valoni (babe*)
Decided to archive the previous page, new one to start from 2019
Previous name <http://lhec.web.cern.ch> will be kept for the new one
Need the most attractive one picture for the title page. Weekly meetings → May

Organisation

International Advisory Committee

Mandate by CERN (2014+17) to define
“..Direction for ep/A both at LHC+FCC”

Sergio Bertolucci (CERN/Bologna)
Nichola Bianchi (Frascati)
Frederick Bordry (CERN)
Stan Brodsky (SLAC)
Hesheng Chen (IHEP Beijing)
Eckhard Elsen (CERN)
Stefano Forte (Milano)
Andrew Hutton (Jefferson Lab)
Young-Kee Kim (Chicago)
Victor A Matveev (JINR Dubna)
Shin-Ichi Kurokawa (Tsukuba)
Leandro Nisati (Rome)
Leonid Rivkin (Lausanne)
Herwig Schopper (CERN) – Chair
Juergen Schukraft (CERN)
Achille Stocchi (LAL Orsay)
John Womersley (ESS)

We miss Guido Altarelli.

Coordination Group

Accelerator+Detector+Physics

Gianluigi Arduini
Nestor Armesto
Oliver Brüning – Co-Chair
Andrea Gaddi
Erk Jensen
Walid Kaabi
Max Klein – Co-Chair
Peter Kostka
Bruce Mellado
Paul Newman
Daniel Schulte
Frank Zimmermann

**5(12) are members of the
FCC coordination team**

OB+MK: co-coordinate FCCeh

Working Groups

PDFs, QCD

Fred Olness,
Claire Gwenlan

Higgs

Uta Klein,
Masahiro Kuze

BSM

Georges Azuelos,
Monica D’Onofrio
Oliver Fischer

Top

Olaf Behnke,
Christian
Schwanenberger

eA Physics

Nestor Armesto

Small x

Paul Newman,
Anna Stasto

Detector

Alessandro Polini
Peter Kostka

Thanks to all
for your work
and support
for reaching
to here and
to a very
remarkable
status and
prospect for
energy frontier
DIS

Presented
to Snowmass
8/2020

Statement of the IAC to DG, published in 2007.14491

In conclusion it may be stated

- The installation and operation of the LHeC has been demonstrated to be commensurate with the currently projected HL-LHC program, while the FCC-eh has been integrated into the FCC vision;
- The feasibility of the project as far as accelerator issues and detectors are concerned has been shown. It can only be realised at CERN and would fully exploit the massive LHC and HL-LHC investments;
- The sensitivity for discoveries of new physics is comparable, and in some cases superior, to the other projects envisaged;
- The addition of an ep/A experiment to the LHC substantially reinforces the physics program of the facility, especially in the areas of QCD, precision Higgs and electroweak as well as heavy ion physics;
- The operation of LHeC and FCC-eh is compatible with simultaneous pp operation; for LHeC the interaction point 2 would be the appropriate choice, which is currently used by ALICE;
- The development of the ERL technology needs to be intensified in Europe, in national laboratories but with the collaboration of CERN;
- A preparatory phase is still necessary to work out some time-sensitive key elements, especially the high power ERL technology (PERLE) and the prototyping of Intersection Region magnets.

Recommendations

- i) It is recommended to further develop the ERL based ep/A scattering plans, both at LHC and FCC, as attractive options for the mid and long term programme of CERN, resp. Before a decision on such a project can be taken, further development work is necessary, and should be supported, possibly within existing CERN frameworks (e.g. development of SC cavities and high field IR magnets).
- ii) The development of the promising high-power beam-recovery technology ERL should be intensified in Europe. This could be done mainly in national laboratories, in particular with the PERLE project at Orsay. To facilitate such a collaboration, CERN should express its interest and continue to take part.
- iii) It is recommended to keep the LHeC option open until further decisions have been taken. An investigation should be started on the compatibility between the LHeC and a new heavy ion experiment in Interaction Point 2, which is currently under discussion.

After the final results of the European Strategy Process will be made known, the IAC considers its task to be completed. A new decision will then have to be taken for how to continue these activities.

Herwig Schopper, Chair of the Committee,

Geneva, November 4, 2019

From i), ii) and iii) follows a programme, see below

Next on LHeC/FCC-eh?

A - Physics

Continue topical studies
Focus on eh-hh LHC gain
Join Snowmass as is useful
Join ECFA +FCC-eh studies

B - Detector

Form a detector collaboration
Go to LHCC end of 2021
Optional jointly with ALICE3

C - Accelerator

R+D: Prototype Q1
R+D: Beam Pipe
Bypass IP
Simulations: IR etc
Design Injector ..

D - FCC-eh

Develop 'eh' as
part of FCC-hh
Write the FCC-eh CDR

E - PERLE

Formal Foundation of Collaboration
Milestones as are being developed
Key PERLE experiments to be selected
TDR end of 2022
First beam in 2025
Participate in ESPP process



Organisation

Carefully develop from status 2019 to new structure

Keep coherent LHeC/PERLE/FCC-eh coordination
with two central coordinators and a steering group
[perhaps the leaders of A-I].

Co/Coordinators for A-I to be found

Build substructure, surely
in coordinating physics and detector

Invite new IAC, subject to CERN's d'accord
Fall 2021 – New Big Workshop

F - CERN

Approach CERN to support
the 'eh' R+D developments
Note: 120MCHF for FCC -25

G - Other laboratories

Attract [collaborators
from] other labs (link to B)
Form national LHeC/FCC-eh groups

H - Young Scientists

Create an ep Group
Define short time scale tasks
as in the detector R+D

I - Outreach

Update the web
Conferences
Social Media
PR Document for FAs

A Proposal for Future Organisation

Coordinators [day to day action]

Oliver Bruening and Acc/CERN Co-coordinator
Max Klein and Co-coordinator
Nestor Armesto +?

[prepare transition, share work and responsibility,
keep this group small, don't use EB,Steering,Management..]

IAC

The IAC has been very important. We had one in 2008+ (A Caldwell +) and one in 2014+ (H Schopper+). We shall argue for this to continue in an updated composition.

LHeC Board

Coordinators of WGs/Topics + few others

-Physics	[4]	→ (no "PC"?)
-Accelerator	[2]	
-Detector	[2]	
-FCC-eh	[2]	
-PERLE	[1]	
-CERN	[1]	
-Other Labs	[1]	
-Young Scientists	[1]	
-Outreach	[1]	

+ ?? → ~15 Members

Working Groups [LHeC/FCCeh]

- QCD/Partons (including small x and ions)
- Higgs, Top and Electroweak
- Beyond the Standard Model
- Low Energy Physics with PERLE
- Accelerator
- Detector – **needs to expand!**

Next steps when we agree on a structure

- establish names (continuation+new)
- discuss with the CERN Directorate especially the composition of the IAC

FCC-eh: integral part of this

PERLE: has its own collaboration but should be represented + physics WG (?)