European Strategy and PERLE

Remarks and Recollections ..

Max Klein

Meeting of LHeC/FCCeh Coordinators, June 5, 2019

Highlights from PERLE:

- Transfer of ALICE electron gun and related equipment from Daresbury to LAL on May 10th 2019.
- Interesting progress in injection line design and beam transport toward it is made in the framework of Ben Hounsell PhD work. Some of the results were presented at IPAC19 conference (poster session).
- A post-doc was hired at Orsay to work on HOM issue and other related full equipped cavity issues.
- A HOM review meeting with participation of CERN and JLAB colleagues still to be organised by Orsay labs.
- A second post-doc position is currently published (Beam dynamics profile).
- LAL/IPNo and BINP-Novosibirsk applied for the H2020 European program (CRIMLINplus) and ask for fund for dipole design & prototyping and for a post-doc position. Result of the call will be known on October 2019.
- PERLE was presented in the joint LAL-IPNo scientific council as the next big accelerator project of the future big lab at Orsay (LAL, IPNo and 3 other labs will merge to into a unique one starting from January 2020). Project achievements, progress, project phasing and timeline, cost estimation and needed manpower were presented to international accelerator expert members.

Walid Kaabi, 5.6.19

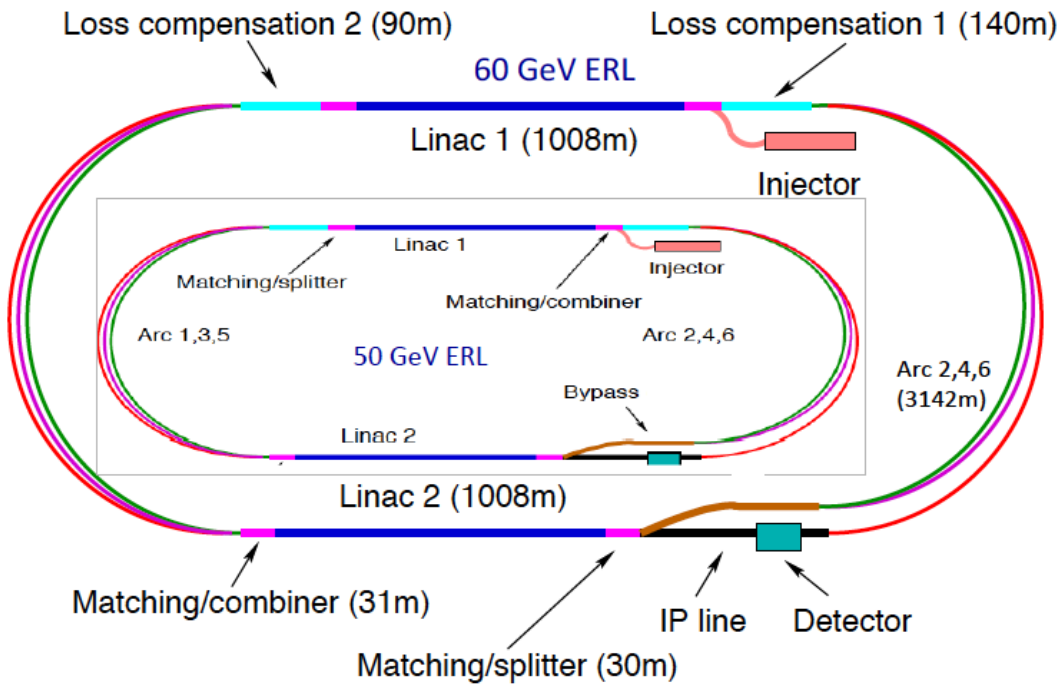
CERN-ACC-NOTE-2018-0084
December 18, 2018

Exploring the Energy Frontier with Deep Inelastic Scattering at the LHC

A Contribution to the Update of the European Strategy on Particle Physics

LHeC and PERLE Collaboration

From the addendum



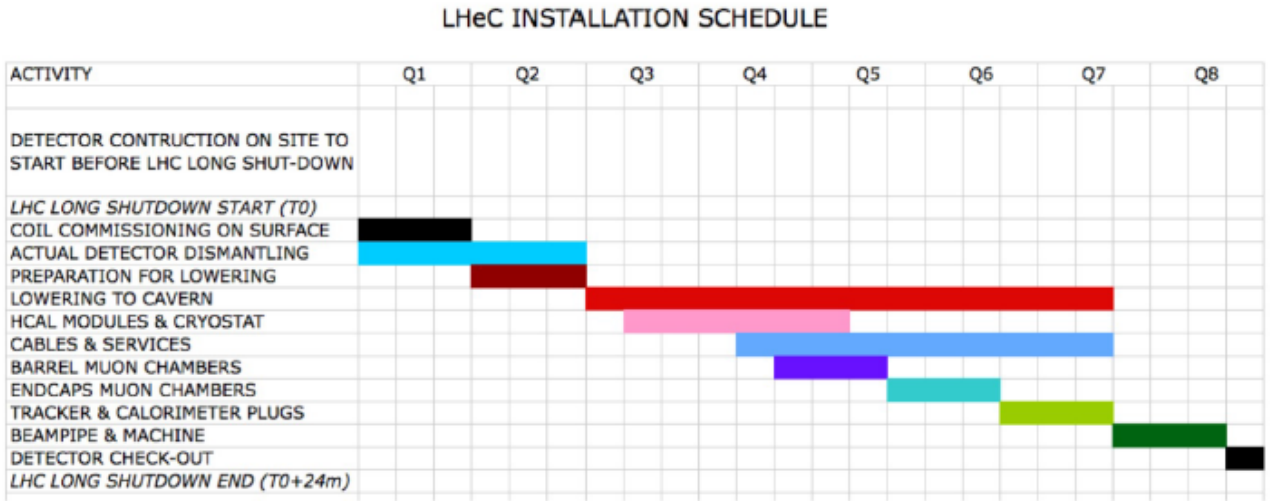


Figure 4: LHeC detector installation sequence in 8 quartals Qi.

3 documents sent of high quality: need further distribution. offer by Jphys for publication (need help to take this up)

Project	Type	Energy [TeV]	Int. Lumi. [a^{-1}]	Oper. Time [y]	Power [MW]	Cost
ILC	ee	0.25	2	11	129 (upgr. 150-200)	4.8-5.3 GILCU + upgrade
		0.5	4	10	163 (204)	7.98 GILCU
		1.0			300	?
CLIC	ee	0.38	1	8	168	5.9 GCHF
		1.5	2.5	7	(370)	+5.1 GCHF
		3	5	8	(590)	+7.3 GCHF
CEPC	ee	0.091+0.16	16+2.6		149	5 G$
		0.24	5.6	7	266	
FCC-ee	ee	0.091+0.16	150+10	4+1	259	10.5 GCHF
		0.24	5	3	282	
		0.365 (+0.35)	1.5 (+0.2)	4 (+1)	340	+1.1 GCHF
LHeC	ep	60 / 7000	1	12	(+100)	1.75 GCHF
FCC-hh	pp	100	30	25	580 (550)	17 GCHF (+7 GCHF)
HE-LHC	pp	27	20	20		7.2 GCHF

Major progress as compared to previous strategy meetings:

Our CDR has near 500 citations.

Huge work resulted in recognition of ep.

Still see ignorance. obviously, hh and ee are in the focus, but ep could be done, see left, cost

← Part of the evaluation should get the cost reduced: 50 GeV 1/4 of U(LHC) → down to 1.3 GCHF

Principal Components for QCD

J de Hondt
ECFA Chair
QCD summary
Granada 16.5.19

Hot & Dense QCD

A coherent and complementary "hot & dense QCD program" at the SPS brings valuable and unique contributions in the exploration of the QCD phase diagram.

An (HL-HE-)LHC/FCC based AA/pA/fixed-target program is unique and provides essential science at the frontline towards a profound understanding of particle physics.

Precision QCD

A globally concerted "precision QCD program" provides a unique avenue to find new physics that breaks the Standard Model.

A high-luminosity e^+e^- collider at the EW scale and a high-energy ep collider provide a unique environment for high-precision QCD, essential for most of our aspirations in particle physics.

Partonic Structure

A "hadronic structure program" exploring the complementarity of ep/pp/eA colliders provides vital ingredients for the high precision exploration in searches for new physics and as well steps into uniquely unknown territories of QCD.

Theory

It is vital to support coherently the QCD theory community to succeed in all these programs and to link QCD to the rest of the particle physics research program, especially for our HL-LHC exploration.

Organization

Strengthening the synergies in research and technology with adjacent fields will reinforce our efforts.

Global platforms, networks and institutes have the potential to enhance the research exchange among experts worldwide and to provide essential training opportunities.

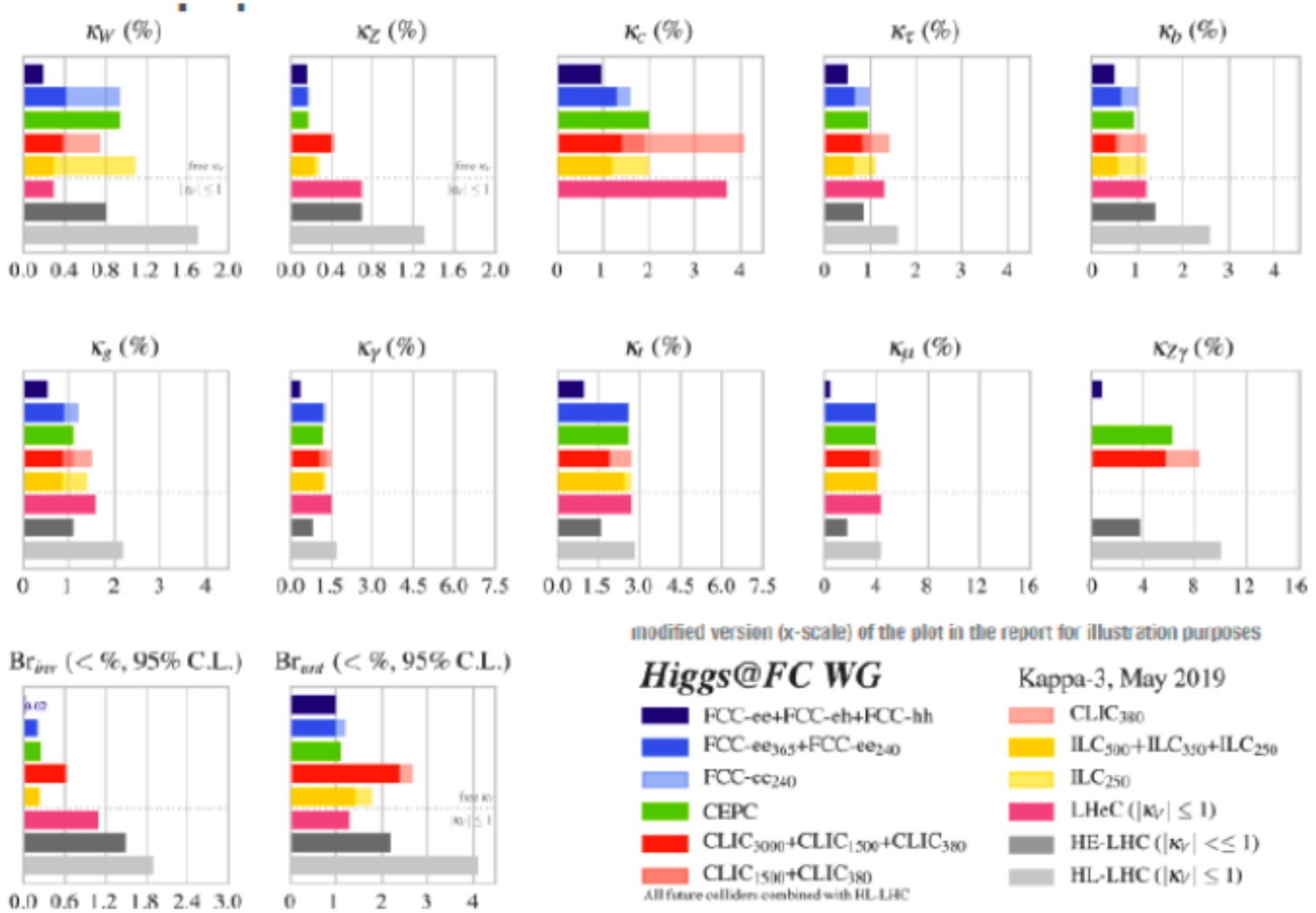
Important emphasis on QCD and high energy ep collider

Comparison of Colliders: kappa-framework

Some observations:

- **HL-LHC** achieves precision of ~1-3% in most cases
  - In some cases model-dependent
- Proposed e^+e^- and ep colliders improve w.r.t. HL-LHC by factors of ~2 to 10
- Initial stages of e^+e^- colliders have comparable sensitivities (within factors of 2)
- **ee** colliders constrain $BR \rightarrow untagged$ w/o assumptions
- Access to κ_c at ee and eh

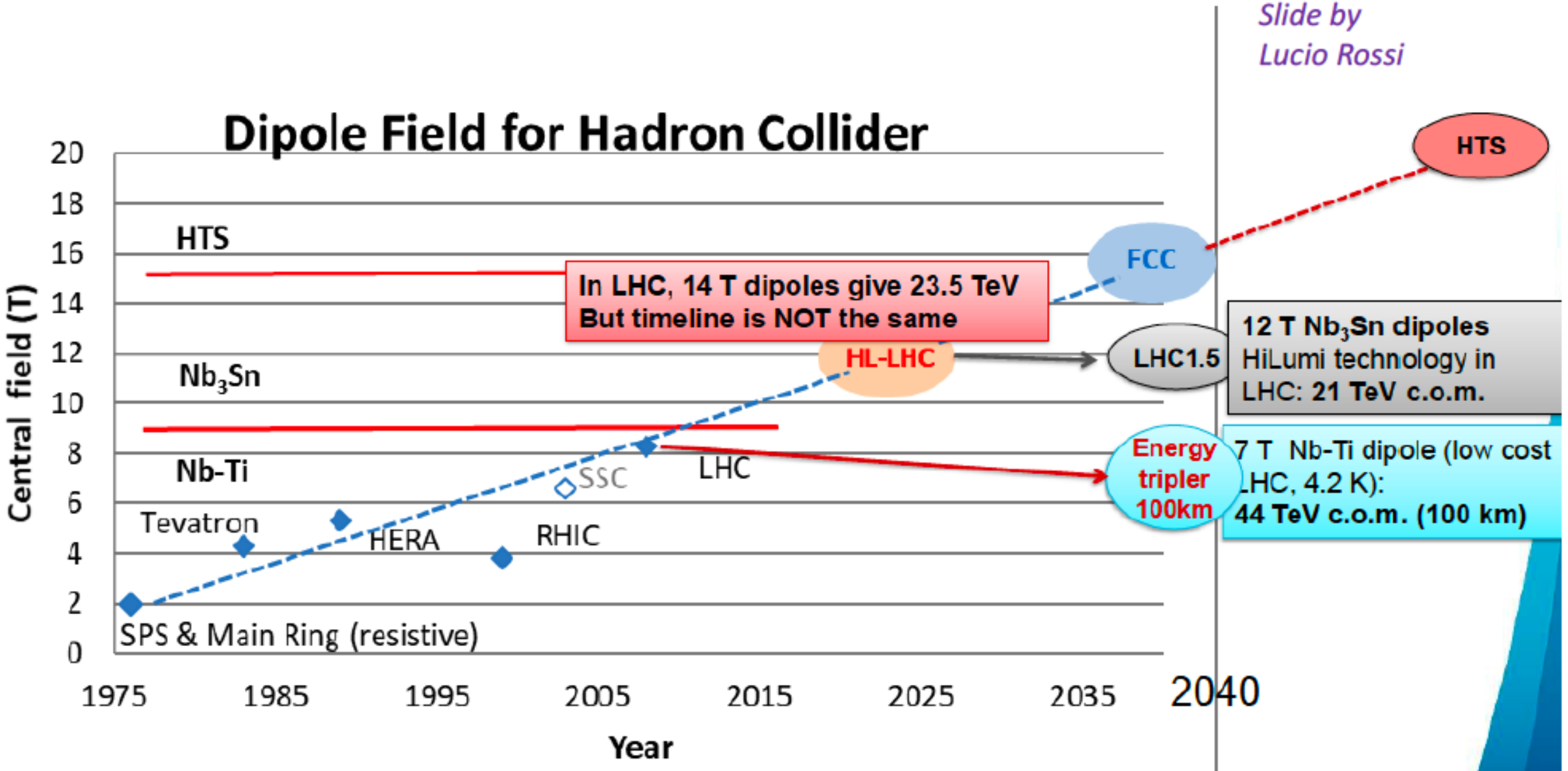
arXiv:1905.03764



Beate Heinemann to ATLAS weekly, 4.6.19

Major work on Higgs by Uta et al, currently EFT struggle, and paper out

Slide by Lucio Rossi



ee and pp colliders:

Personal (A. Yamamoto) View on Relative Timelines

Timeline	~ 5	~ 10	~ 15	~ 20	~ 25	~ 30	~ 35
Lepton Colliders							
SRF-LC/CC	Proto/pre-series	Construction		Operation		Upgrade	
NRF—LC	Proto/pre-series	Construction		Operation		Upgrade	
Hadron Collider (CC)							
8~(11)T NbTi /(Nb3Sn)	Proto/pre-series	Construction		Operation			Upgrade
12~14T Nb_3Sn	Short-model R&D	Proto/Pre-series		Construction		Operation	
14~16T Nb_3Sn	Short-model R&D		Prototype/Pre-series			Construction	

Note: **LHC experience**: **NbTi (10 T)** R&D started in 1980's --> **(8.3 T)** Production started in late 1990's, in ~ 15 years

A. Yamamoto 100512h

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pp collider schedule depends critically on progress in high field magnet R&D

Geoff Taylor (ICFA Chair, personal view) Granada 15.5.

- **Diversity is Critical to thrive in all environments, including HEP.**
  - ***Big and small facilities/experiments, at various stages of development and operation***
- **Push for e+e- colliders, both Linear and Circular, as soon as possible.**
  - ***Linear Collider: ILC***
    - **1 Collision point**
  - ***Circular Collider: CepC***
    - **2 Collision points**
- **Push for FCC tunnel to be ready at completion of HL-LHC**
  - ***Stage the energy frontier with best option magnets available for early 2040's***
  - ***?? Default: ~8T LHC magnets optimised for price***
    - **Minimum energy: >50TeV**
    - **Magnet upgrade foreseen.**
  - ***ep and ion-ion options available***
  - ***4 collision points***
  - ***Upgrade path to higher energy after 20 years operation?***

See A. Yamamoto, L. Rossi, V. Shiltzev talks this symposium

Personal Remarks for Discussion

We see a huge battle for resources, and a lack of guidance from physics and leadership of this Process.

Due to lack of money and unclear Asian situation and HL-LHC to start data taking in 8 years, it is most likely that this time nothing is really decided.

ALL projects struggle for survival and recognition, not just ep

What is important or new for us:

LHeC: The CDR Update: The LHeC at High Luminosity
for discussion later, important to be out in 11/19

PERLE: to really progress

FCC-eh: to keep developing eh as integrated part of hh
new: the option of a 45 TeV FCChh, to which the ERL would ideally fit.

ALICE ends LS4, there is a new proposal by some Members of the Collaboration (cf de Hondt)

The weakest point is the wide support, that is related to the recognition of DIS physics. We are progressing but it remains challenging.

IAC (HS) believes the time for ep will come, Yet the time for LHC moves.

Higgs has given us quite some support and attention, but as well resistance from ee sides.

The biggest potential is in the understanding that future hh needs future high energy eh. That goes with QCD, eweak, BSM, t, ions, and H

We shall keep stressing that this work has been mandated as a service to the community, the ep feature is the lack of resources.

Proposals

Publish the ES submission for LHeC and PERLE (need help to do this)

Publish the important papers on Higgs, PDFs, and?

Write and release the “LHeC at High Luminosity“ Paper with parts on FCCeh (100km with two energies)
LHeC: 50 GeV x 7 TeV. FCC-eh: 60 GeV with 22.5 and with 50 TeV

What else?