

(ep program in) EUROPEAN STRATEGY

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* **FLUO** (Fundamental Laws of the Universe in Orsay). New laboratory will start to operate on 1st Jan 2020 from the merging of five laboratories (CSNSM, IMNC, IPNO, LAL, LPT) in Orsay. About 800 people working on the domains of particles, nuclear, astroparticles, cosmology, theory, energy, health, accelerator and detector + technological and support departments

I used the document

CERN/ESG/05
29 September 2019

SUPPORTING NOTE FOR BRIEFING BOOK 2020
Towards an update of the ESPP
prepared by the Strategy Update Secretariat

For each scenario a new collider would be operational in Europe in the 2040-2060 era, i.e. as short as possible after the HL-LHC.

In general, around 2045 the community will have to consider which technologies are available for high-energy and high-luminosity colliders in the 2060-2080 era and plan accordingly.

	2020-2040	2040-2060	2060-2080
		1st gen technology	2nd gen technology
CLIC-all	HL-LHC	CLIC380-1500	CLIC3000 / other tech
CLIC-FCC	HL-LHC	CLIC380	FCC-h/e/A (Adv HF magnets) / other tech
FCC-all	HL-LHC	FCC-ee (90-365)	FCC-h/e/A (Adv HF magnets) / other tech
LE-to-HE-FCC-h/e/A	HL-LHC	LHeC	FCC-h/e/A (Adv HF magnets) / other tech
LHeC-FCC-h/e/A	HL-LHC	+ LHeC	FCC-h/e/A (Adv HF magnets) / other tech

LHeC in of course also here !!

Comment. The scenario 5 is included in scenario 4. We do not really need this scenario, which introduce some confusion. We cannot even imagine that we have 20y in the period 2040-2060, for LHeC alone...

Being a bit over schematic

The first three scenarios “ask” for an e+e- machine at CERN in 2040-2060, independently of any decision from outside CERN



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CLIC-all	HL-LHC	CLIC380-1500	CLIC3000 / other tech	
CLIC-FCC	HL-LHC	CLIC380	FCC-h/e/A (Adv HF magnets) / other tech	
FCC-all	HL-LHC	FCC-ee (90-365)	FCC-h/e/A (Adv HF magnets) / other tech	
LE-to-HE-FCC-h/e/A	HL-LHC	LHeC	LE-FCC-h/e/A (low-field magnets)	FCC-h/e/A (Adv HF magnets) / other tech
LHeC-FCC-h/e/A	HL-LHC	+ LHeC	LHeC	FCC-h/e/A (Adv HF magnets) / other tech

LHeC in of course also here !!

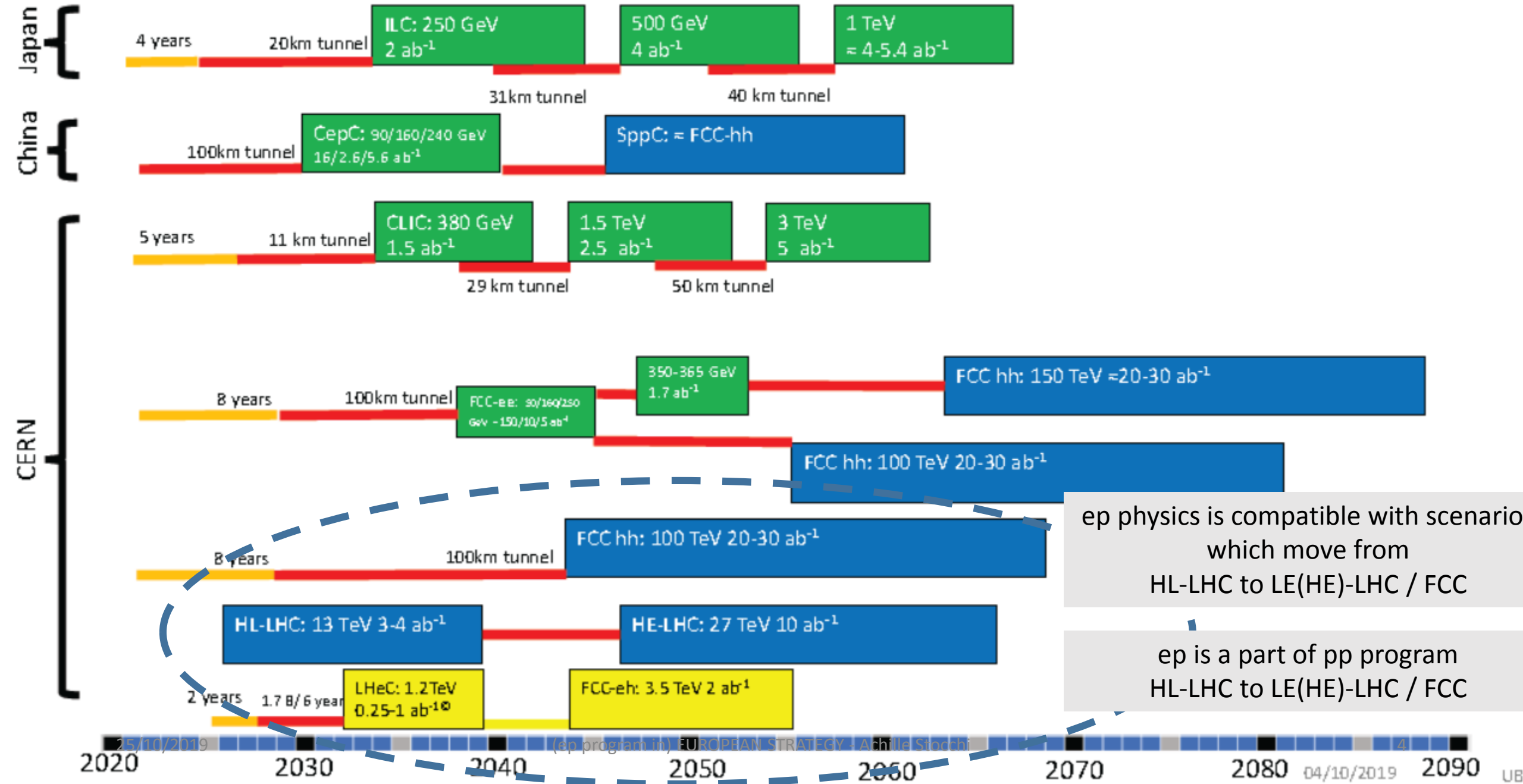
Scenario 3,4 have

- a convergence on 2nd generation : FCC
- could agree in saying that we have to wait still few years before deciding for the 1st generation machine

The SCENARIO 4 (and 5) say that we can go “more or less” adiabatically from LHC to FCC 100 TeV.
 Protons are CERN , e+e- machines in Asia
Comment again the scenario 5 is included in scenario 4

Possible scenarios of future colliders

- Proton collider
- Electron collider
- Electron-Proton collider
- Construction/Transformation: heights of box construction cost/year
- Preparation



ep physics is compatible with scenario which move from HL-LHC to LE(HE)-LHC / FCC

ep is a part of pp program HL-LHC to LE(HE)-LHC / FCC

As a general remark

“ The chosen scenario will have to be reassessed at the time of the next strategy update, typically 7 years after the current one, taking into account the global context (e.g. ILC, CEPC, EIC, etc).”

To realize a particular scenario, the following objectives should be considered in the overall strategy update.

1. Main expectations of the next Strategy update (in about 7 years)

- o Observe the global status of major colliders outside Europe, and decide to concretely engage in the 1st generation of the scenario, or to revive another option
- o Receive the TDR for 1st generation of the scenario for final approval, or commission a TDR for an alternative option
- o Decide on the strategy for further development of high-field magnets
- o Decide on the basis of CDRs to construct a muon and/or plasma-based collider demonstration facility

2. Goals to reach by the time of the next Strategy update (within ~7 years)

- o Concrete technical and administrative plans for the civil engineering for the 1st generation scenario, including cost optimization studies
- o Concrete financial organization plan for civil engineering, accelerator and experiments for 1st generation scenario, including cost optimization studies
- o In the context of the particular scenario, set up proto-collaborations for experiments to propose initial detector designs
- o Verify the technical feasibility and cost optimization for alternative scenarios
- o CDRs for demonstration collider facilities for a muon collider and a plasma-based collider

3. Would require from the 2020 Strategy update

- o Strong statement to investigate the full program of the scenario, including technical and administrative plans, and commission a TDR for the 1st generation of the scenario
- o Commission CDRs for demonstration facilities for a muon collider and a plasma-based collider, and support statements for the development of high-field magnets
- o Openness towards opportunities for a major collider outside Europe

Considering the information summarized in the Physics Briefing Book, we seek input for each of the five scenarios on the following aspects:

- o Arguments pro & con on the physics program
- o Arguments on the technical, financial and organization feasibility
- o Arguments on the community support
- o Verification if we collect with the above list, adequate and sufficient elements to be considered for this and the next strategy update

A meeting on 6/11/2019 is foreseen for giving the national positions on these scenarios.

The close meeting is fixed on January (20-22) to write the ESPP conclusions.

Comment/observation:

The positions from different countries seem to be quite different.

Consequences :

There is a serious possibility that no firm decision is taken.

It appears more and more that “it is too early”.

What about “us”, , “our community” ? - I

ep physics is showing up more and more as a credible and very (the only ?) realistic option in the future landscape (even more with ERL staging options 30GeV, 50 GeV...)

Could be really called **electrons at LHC scenario**.

ep physics (LHeC) is a part of full pp program for LHC → FCC...

A lot of work has been done to strength the physics case in the HEP landscape. We have now to capitalise these efforts and to move forward.

Important that all that is clearly stated and written in the final ESPP report

Important to keep momentum in this delicate phase (short time before ESPP) and to move to a new phase.

→ After ESPP recommendations find a new organisation : “ep detector collaboration”, including prototyping of key elements

What about “us”, , “our community” ? - II

Very good synergy and convergence of interests between

a very ambitious **physics program (ep physics)**

a very ambitious **accelerator project (high current multi-turn, high energy ERL)**

In addition ERL is also important since today could also be used **as injector with Top-Up Capabilities for FCC** [when being operated in Recirculating-Linac mode.

Working on ERL is an investment into the HEP future + great low energy applications

Agreement on the fact that **PERLE is the next ERL** machine for making **ERL** machines **usables for HEP !**

Important that all that is clearly stated and written in the final ESPP report

We should keep the track and soon after the ESPP update move from the TDR → project phase.

We have a strong international Coll. such that PERLE demonstrator will be starting “well” before the next strategy update.