

Consiglio di Sezione INFN Pavia

Relazione su Strategy

18/11/2019

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European Strategy for Particle Physics

- Istituita dal CERN Council nel 2006
- Update ogni 7 anni
- Report su discussioni in pre-CD di ottobre e al Piano Triennale (8-9 novembre)
- Materiale dalla presentazione di F. Ferroni al PT

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ESG INVITEES

President of the CERN Council	Dr Ursula Bassler	<i>Major European National Labs</i>	
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States with special Observer status (LHC)		PSI	Prof. Klaus Kirch
Japan	Prof. Yasuhiro Okada	STFC-RAL	Prof. Mark Thomson
Russian Federation	Prof. Vladimir Kekelidze		
United States of America	Dr Abid Patwa		
Organisations with Observer status			
European Commission	Mr Adam Tyson		
JINR	Prof. Boris Sharkov		
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F. Zwirner
fino a Luglio

Preparatory Group

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Timeline

2017

2018

2019

2020

✓ **Jan.2018**
Call for proposals
for venues for Open
Symposium and
Strategy Drafting
Session

✓ **Febr.2018**
Call for scientific input

✓ **March.2018**
Call for nominations of
PPG & ESG members

✓ **June 14,2018**
Council decision on
venues and dates

✓ **Sept 27,2018**
Council launches the
Strategy Update process &
establish the PPG and ESG

*organisation &
input preparation
by community*

✓ **Dec 18.2018**
Closing submission
community input

May 13-16,2019
Open Symposium
Granada, ES

Sept.2019
Physics Briefing
Book available

*consultation &
consensus building*

*Physics results appearing
after May 2019 will be taken
into account in the process*

Jan 20-24,2020
Strategy Update
Drafting Session
Bad Honnef, DE

March.2020
Strategy Update
submitted to Council

May.2020
Council to approve
Strategy Update

Physics Briefing Book

Input for the European Strategy for Particle Physics Update 2020

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References

c'è tutto !

<https://arxiv.org/pdf/1910.11775.pdf>

Scenari e domande

	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	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

tanto per parlare di soldi....

- CLIC-all costa 17 GEuro (tunnel 3.3 GE)
- FCC-all costa 26 GEuro (tunnel 5.4 GE)
- CLIC-FCC costa 31 GE (tunnel 6.7 GE)
- LE-FCC + HE-FCC costa 32 GE (tunnel 5.4 GE)
(probabilmente la fase LE ne costa 15)
- LHeC + FCC costa 28 GE (tunnel 5,4 GE)

tutto con serie incertezze (no TDR !)

La posizione INFN

Scenario	Main pro-contra arguments	INFN involvement, community support
CLIC	Precision measurements limited to Higgs and top. Indirect sensitivity to new physics comparable to FCC-hh only at 3 TeV	Very limited
CLIC+FCC-hh	Precision measurements limited to Higgs and top. Cost higher than full FCC.	Involvement only for the FCC-hh part
FCC	Precision measurements at Z, W, H and top, relatively easy machine, followed by direct broad exploration of new territory	Strong INFN community for both FCC-ee and FCC-hh
LE-to-HE-FCC	Could be an interesting option should ILC (or other e^+e^- colliders) start construction	Involvement from the LHC and FCC-hh communities
LHeC+FCC-hh	Gain from LHeC on Higgs couplings after HL-LHC limited. Investigations on u,d couplings and proton structure.	Expect limited participation to LHeC program, expect involvement mostly on HL-LHC and FCC-hh preparation.

INFN arguments for the FCC-all option

- We think that the ESPP update should be based on significant jump in precision (e.g. in [Higgs boson properties](#)) and broad exploration (e.g. [search of new physics at the energy frontier](#))
- We believe that, out of the five proposed scenarios, the FCC-all option is the best one in this respect.
- **In the FCC-ee phase electroweak physics will be studied with unprecedented precision not only in the sector related to the newly discovered scalar boson, but also in the Z, W and top quark sectors.**
- **The FCC-hh phase would guarantee in the best way direct broad exploration of new territories.**

Strong support for accelerators R&D

- We would like to add that we believe that the ESPP conclusive document should include a **strong statement in support of continuing the R&D of new technologies for accelerators**. In particular, studies and experiments aimed at the development of a **muon collider** should be explicitly encouraged, as well as activities related to **plasma-based accelerators** and **high-temperature superconducting magnets**. In the context of these R&D a collaboration framework between CERN and laboratories of member states should be defined.

Lo stato della discussione (as from 6/11 meeting)

- L'opzione FCC-all gode di largo consenso (12 delegazioni)
- qualche delegato suggerisce anche esplicitamente l'opzione LE-to-HE-FFChh nel caso di ILC
- CLIC e' l'opzione preferita dalla Norvegia e tollerata da pochi altri (ES, O, forse NL) che però vogliono comunque una macchina a elettroni come priorità
- UK , F, DK non hanno a questo punto forti indicazioni dalla comunità
- La Germania è in pausa di riflessione in attesa di un incontro della comunità il 14 Novembre

Because of the competition for the Interaction Region at Point-2@LHC, should we consider for the period beyond LS4 a choice between the next generation heavy-ion experiments at the HL-LHC and the LHeC?

As our community does not give high priority to LHeC, we do not think this point needs to be solved now. Currently, INFN groups are heavily involved in the next generation of heavy ion experiments at HL-LHC. It is however possible an interest in the LHeC + ions physics programme, developing after the completion of HL-LHC .

Do we remain open towards strong participation in future collider programs outside Europe? Should such a statement remain among the highest priorities? Should we extend the scope to include a variety of options like ILC@Japan, EIC@US, CEPC@China, ... ?

We should mention participation to colliders programs outside Europe, remind the previous support given to ILC, however the support must remain compatible with giving the proper resources to the main European program

Anno 2013: *“CERN should develop a neutrino programme to pave the way for a substantial European role in future long-baseline experiments. Europe should explore the possibility of major participation in leading long-baseline neutrino projects in the US and Japan.”* Is the continuation of the CERN Neutrino Platform appropriate? Should we propose to extend the scope of the Neutrino Platform beyond long-baseline neutrino projects?

The CERN Neutrino Platform can be mentioned, however possible extensions should be discussed within next strategy, with results from the present platform at hand. CERN should rather act, more in general, as a technological pole to make more effective the participation of members states to experiments in the fields of astroparticle physics and cosmology.

Anno 2013: *“Europe should support a diverse, vibrant theoretical physics programme, ranging from abstract to applied topics, in close collaboration with experiments and extending to neighbouring fields such as astroparticle physics and cosmology. Such support should extend also to high-performance computing and software development.”*

Should we strengthen this statement? Should we provide guidance how to achieve this?

We believe these statements are highly appropriate: a strong theoretical physics program must be supported. This is mandatory, given the significant jump in experimental precision and broad exploration expected at future colliders. In addition, as mentioned in the answer to the previous question, CERN could act as a pole for participation of members states to experiments in the fields of astroparticle physics and cosmology, and this should happen in close collaboration with the theory community.

Should we make concrete the technology collaboration with the gravitational wave community?

INFN has pioneered experimental research in the field of gravitational waves and it is presently on the front run with Virgo and with the preparation of future programs. We strongly support the idea of collaboration among accelerator-based experiments and gravitational wave community

Should the HE-LHC feature in our strategy update?

We believe it should not. It has been clearly shown in the presentations in Granada and in the most recent studies that an upgrade of LHC to centre-of-mass energies around 27 TeV would not significantly increase the explored territory and it would represent, at the same time, a major enterprise with very significant use of resources.

In the context of the LE-to-HE-FCC-h/e/A scenario, would an adiabatic evolution from 6T to 16T/HTS magnets for FCC-h/e/A be an avenue to explore?

LHC present performance is outstanding and we expect HL-LHC will follow the same path. Any new pp collider should represent a very significant jump in explored territory with respect to what is expected from HL-LHC. The production of magnets for the FCC ring will be major enterprise, which cannot be repeated several times in an adiabatic way. Physics reach, magnet production costs and timescales must be carefully evaluated before defining a multi-step scenario for FCC-hh.