

The European Strategy for Particle Physics

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LAL Orsay

HEPAP meeting, Oct 13 2006



The Strategy Group

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- R. Wade ApPEC
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Major Milestones

- **1. Publication of the web-page**
 - 19th of September
 - Interface to the community
 - Call for input from the community

- **2. Open Symposium in Orsay**
 - 30th of January to 1st of February 2006
 - Collect the views of the community

- **3. Workshop in Zeuthen/Berlin**
 - 2-6th of May
 - Draft Strategy Document

- **4. Council meeting in Lisbon**
 - 14th of July 2006
 - Aim: Unanimous approval of the Draft Strategy Document



Web-page

<http://cern.ch/council-strategygroup>
(18,000 hits so far, received 71 written contributions)

CERN Council Strategy Group

NEWS
(New posting July 14: strategy process completed)

CERN Council
[Convention](#)
[The European strategy for particle physics](#)
Strategy Group
[Mandate](#)
[Members](#)
Preparation Group
[Members](#)
[Action Plan](#)
[Meetings](#)
Open Symposium
[Web page](#)
[Final Agenda](#)
[Recorded webcast](#)
Briefing Book
[Volume 1](#)
[Volume 2](#)
[Volume 3](#)

Welcome to the CERN Council Strategy Group home page!

Our charge

The [Strategy Group](#) was set up on the initiative of the CERN Council to prepare a Draft Strategy Document aiming for unanimous approval by the CERN Council. This strategy should address the main lines of Particle Physics in Europe, accelerator-based and non-accelerator based, including R&D for novel accelerator and detector technologies. The strategy should also address the visibility of the field, the collaboration between the European laboratories, the coordinated European participation in world projects and knowledge transfer beyond our field. The complete mandate is available [here](#).

Previous work

The Work of the Strategy Group was preceded by two reports. The European Committee on Future Accelerators ([ECFA](#)) approved in 2001 a document for accelerator-based research, and the Consultative Group on High Energy Physics reported to the OECD Global Science Forum in 2002. Both these reports are accessible [from this page](#), as is the OECD Science Ministers 2004-communicue on these matters (see paragraph 21).

Why this Strategy Group?

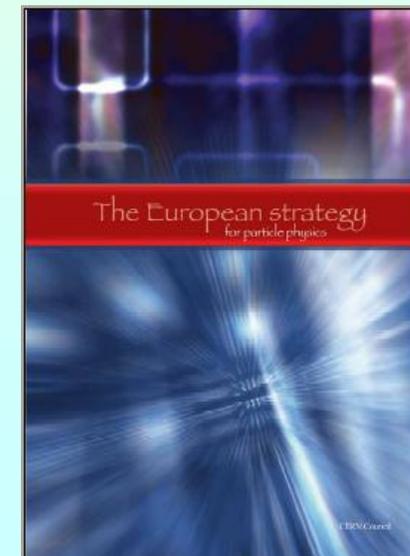
This group had the direct aim to propose a Strategy for approval by the CERN Council as an intergovernmental body. Since CERN is an international organization, its Council is composed of government representatives, so an approval in the CERN Council implies an agreement between governments. To use the CERN Council as an intergovernmental forum to agree on a Strategy for the European Research Area has indeed support in the [CERN Convention](#), but this is the first time that it is

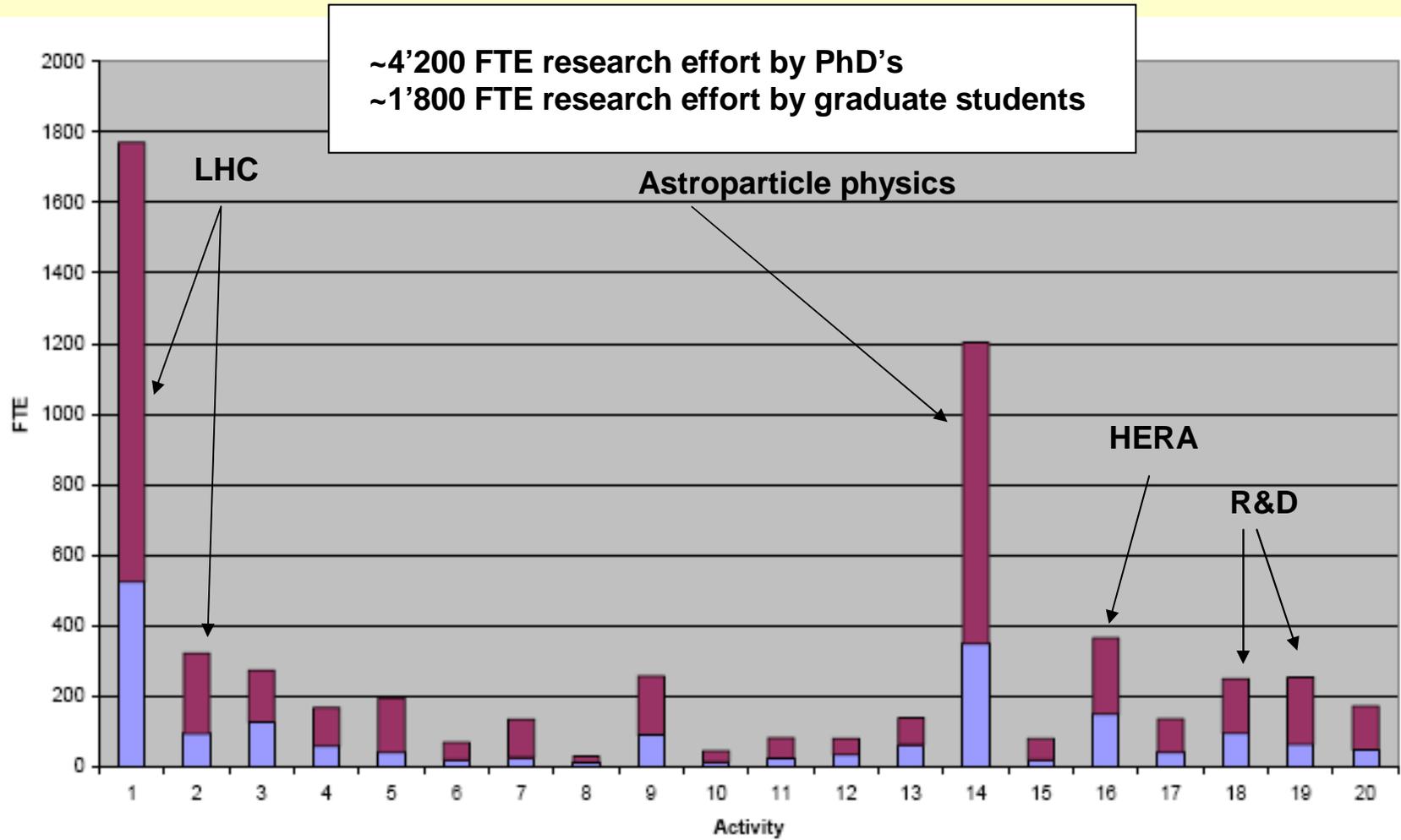
http://council-strategygroup.web.cern.ch/council-strategygroup/doc.html

2 pages Strategy document

25 pages accompanying document

1 glossy brochure





Label	1	2	3	4	5	6	7	8	9	10
Area	LHC: ATLAS, CMS and LHCb	LHC: ALICE	Ongoing Tevatron experiments	Preparations for a linear collider	Ongoing accelerator neutrino programmes	Preparing for future accelerator neutrino programmes	Ongoing non-accelerator based neutrino programmes	Preparing for future non-accelerator based neutrino programmes	Ongoing b-, quarkonium-factories	Next generation b-, quarkonium-factories
Label	11	12	13	14	15	16	17	18	19	20
Area	Double beta decay & electron neutrino mass	Future precision measurements of particle properties (e.g. EDM, g-2,)	Ongoing heavy ion physics	Astroparticle physics	Observational cosmology	HERA	Spectroscopy, muon/neutrino DIS (COMPASS...)	Detector R&D	Accelerator R&D	Others

Revised version in the repository: Errors from Italy, Poland and Greece corrected.

ECFA/RC/06/342/Rev.2
24 August 2006

ECFA EUROPEAN COMMITTEE FOR FUTURE ACCELERATORS

SURVEY OF EUROPEAN EXPERIMENTAL ELEMENTARY
PARTICLE PHYSICS

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Researchers in experimental elementary particle physics

Total number: 4 022 FTE

Normalized to population: 8.7 FTE/million inhabitants

Normalized to GDP: 0.39 FTE/G€

Graduate students in experimental elementary particle physics

Total number: 1 807 FTE

Normalized to population: 3.9 FTE/million inhabitants

Normalized to GDP: 0.18 FTE/G€

Available under documents
on the ECFA WWW



Special Restricted CERN Council Lisbon 14 July 2006

7

Press release 14th of July 2006

CERN Council adopts European strategy for particle physics

Lisbon, 14 July 2006.

At a special meeting in Lisbon today, the CERN Council unanimously adopted a European strategy for particle physics. This is an important step for the field, outlining a leading role for Europe in this increasingly globalised endeavour.

The strategy adopted by the Council today provides for European engagement and leadership in the field. It builds on European strengths at Universities, in national laboratories – frequently of international standing – and at the CERN laboratory.



Preamble

Particle physics stands on the threshold of a new and exciting era of discovery. The next generation of experiments will explore new domains and probe the deep structure of space-time. They will measure the properties of the elementary constituents of matter and their interactions with unprecedented accuracy, and they will uncover new phenomena such as the Higgs boson or new forms of matter. Long-standing puzzles such as the origin of mass, the matter-antimatter asymmetry of the Universe and the mysterious dark matter and energy that permeate the cosmos will soon benefit from the insights that new measurements will bring. Together, the results will have a profound impact on the way we see our Universe; *European particle physics should thoroughly exploit its current exciting and diverse research programme. It should position itself to stand ready to address the challenges that will emerge from exploration of the new frontier, and it should participate fully in an increasingly global adventure.*



General Issues

1. **European particle physics is founded on strong national institutes, universities and laboratories and the CERN Organisation; *Europe should maintain and strengthen its central position in particle physics.***
2. **Increased globalisation, concentration and scale of particle physics make a well coordinated strategy in Europe paramount; *this strategy will be defined and updated by CERN Council as outlined below.***



Scientific Activities (1)

- 3. The LHC will be the energy frontier machine for the foreseeable future, maintaining European leadership in the field; *the highest priority is to fully exploit the physics potential of the LHC, resources for completion of the initial programme have to be secured such that machine and experiments can operate optimally at their design performance.* A subsequent major luminosity upgrade (SLHC), motivated by physics results and operation experience, will be enabled by focussed R&D; *to this end, R&D for machine and detectors has to be vigorously pursued now and centrally organized towards a luminosity upgrade by around 2015.***



Scientific Activities (2)

4. In order to be in the position to push the energy and luminosity frontier even further it is vital to strengthen the advanced accelerator R&D programme; *a coordinated programme should be intensified, to develop the CLIC technology and high performance magnets for future accelerators, and to play a significant role in the study and development of a high-intensity neutrino facility.*

Why this statement is before ILC support?

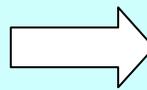
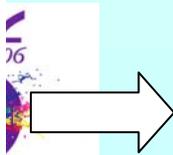
CERN has to be in position to propose a post LHC project. Does not imply that Europe will not strongly support a ILC abroad



Scientific Activities (3)

“fundamental” = “absolutely necessary for advancement”

5. It is fundamental to complement the results of the LHC with measurements at a linear collider. In the energy range of 0.5 to 1 TeV, the ILC, based on superconducting technology, will provide a unique scientific opportunity at the precision frontier; *there should be a strong well-coordinated European activity, including CERN, through the Global Design Effort, for its design and technical preparation towards the construction decision, to be ready for a new assessment by Council around 2010.*



1. Scientific importance of the infrastructure

Fundamental

Project/infrastructure that is absolutely necessary for advancement. It is hoped to deliver a suite of results that will form our broad understanding of elementary particle physics. There is, or could be, a danger of stagnation without this project/infrastructure.

Scientific Activities (4)

6. **Studies of the scientific case for future neutrino facilities and the R&D into associated technologies are required to be in a position to define the optimal neutrino programme based on the information available in around 2012; *Council will play an active role in promoting a coordinated European participation in a global neutrino programme.***



Scientific Activities (5)

7. A range of very important non-accelerator experiments take place at the overlap between particle and astroparticle physics exploring otherwise inaccessible phenomena; *Council will seek to work with ApPEC to develop a coordinated strategy in these areas of mutual interest.*



Scientific Activities (6)

8. **Flavour physics and precision measurements at the high-luminosity frontier at lower energies complement our understanding of particle physics and allow for a more accurate interpretation of the results at the high-energy frontier; *these should be led by national or regional collaborations, and the participation of European laboratories and institutes should be promoted.***



Europe and US strategies in a nutshell

Europe

- 1) LHC (and LHC consolidation)
- 2) Accelerator R&D
- 3) ILC
- 4) Neutrino
- 5) astrophysics and cosmology
- 6) Flavour physics

US

- 1) LHC
- 2) ILC
- 3) ILC hosting efforts
- 4) astrophysics and cosmology
- 5) Neutrinos
- 6) Flavour Physics



Scientific Activities (7)

9. A variety of important research lines are at the interface between particle and nuclear physics requiring dedicated experiments; *Council will seek to work with NuPECC in areas of mutual interest, and maintain the capability to perform fixed target experiments at CERN.*



Scientific Activities (8)

10. **European theoretical physics has played a crucial role in shaping and consolidating the Standard Model and in formulating possible scenarios for future discoveries. Strong theoretical research and close collaboration with experimentalists are essential to the advancement of particle physics and to take full advantage of experimental progress; *the forthcoming LHC results will open new opportunities for theoretical developments, and create new needs for theoretical calculations, which should be widely supported.***



Organizational Issues (1)

11. There is a fundamental need for an ongoing process to define and update the European strategy for particle physics; *Council, under Article II-2(b) of the CERN Convention, shall assume this responsibility, acting as a council for European particle physics, holding a special session at least once each year for this purpose. Council will define and update the strategy based on proposals and observations from a dedicated scientific body that it shall establish for this purpose.*



Organizational Issues (2)

12. **Future major facilities in Europe and elsewhere require collaborations on a global scale; *Council, drawing on the European experience in the successful construction and operation of large-scale facilities, will prepare a framework for Europe to engage with the other regions of the world with the goal of optimizing the particle physics output through the best shared use of resources while maintaining European capabilities.***



Organizational Issues (3)

13. Through its programmes, the European Union establishes in a broad sense the European Research Area with European particle physics having its own established structures and organizations; *there is a need to strengthen this relationship for communicating issues related to the strategy.*



Organizational Issues (4)

14. Particle physicists in the non-Member States benefit from, and add to, the research programme funded by the CERN Member States; *Council will establish how the nonmember States should be involved in defining the strategy.*



Complementary Issues (1)

- 15. Fundamental physics impacts both scientific and philosophical thinking, influencing the way we perceive the universe and our role in it. It is an integral part of particle physics research to share the wonders of our discoveries with the public and the youth in particular. Outreach should be implemented with adequate resources from the start of any major project; *Council will establish a network of closely cooperating professional communication officers from each member state, which would incorporate existing activities, propose, implement and monitor a European particle physics communication and education strategy, and report on a regular basis to Council.***



Complementary Issues (2)

16. Technology developed for nuclear and particle physics research has made and is making a lasting impact on society in areas such as material sciences and biology (e.g. synchrotron radiation facilities), communication and information technology (e.g. the web and grid computing), health (e.g. the PET scanner and hadron therapy facilities); *to further promote the impact of the spin-offs of particle physics research, the relevant technology transfer representatives at CERN and in member states should create a technology transfer forum to analyze the keys to the success in technology transfer projects in general, make proposals for improving its effectiveness, promoting knowledge transfer through mobility of scientists and engineers between industry and research.*



Complementary Issues (3)

17. The technical advances necessary for particle physics both benefit from, and stimulate, the technological competences available in European industry; *Council will consolidate and reinforce this connection, by ensuring that future engagement with industry takes account of current best practices, and continuously profits from the accumulated experience.*



Final remarks

- **In adopting the European Strategy for Particle Physics, the CERN Member States have through the CERN Council realised the vision set out in the CERN Convention to promote and co-ordinate the research activities of the CERN laboratory and of the national particle physics laboratories and institutes**
- **Europe stand therefore better prepared to engage with the other regions in the world in the increasingly globalized research environment**
- **Elementary particle physics in Europe is in an excellent position to enter the exciting era of discoveries that lays in front of us**



The next steps

- CERN is preparing a budget request to increase its baseline budget by ~80 MCHF (8%) for the next years aimed at priorities set by the strategy document
 - 50% to be covered by the Host states
- CERN Council should work out the details to create its permanent Strategy group
- CERN council meeting at the Research minister level early 2007
- EU ESFRI roadmap will be officially issued next week
 - Contains XFEL, KM3NET, SKA + explicit reference to Strategy document
 - FP7 will contain calls explicitly reserved for projects listed in ESFRI roadmap (500 M€) (design phase and construction phase later)
 - Will be exercised for
 - large SCRF test facility at CERN
 - Neutrino facility design study
 - Italian SuperB factory ?



Particle Physics in the ESFRI document

- ◆ “Particle physics stands on the threshold of a new and exciting era of discovery. The next generation of experiments will explore new domains and probe the deep structure of space-time. European particle physics is founded on strong national institutes, universities and laboratories and the CERN Organization. The CERN Council created a Strategy Group which elaborated a Roadmap for the needs of the field, with the following major elements (reference):
 - The Large Hadron Collider LHC at CERN will be the energy frontier machine for the foreseeable future and should fully exploit its physics potential. R&D has to be pursued now for a luminosity upgrade by around 2015.
 - In order to be in the position to push the energy and luminosity frontier even further it is vital to strengthen the advanced accelerator R&D programme (CLIC technology, high performance magnets, high intensity neutrino facility).
 - It is fundamental to complement the results of the LHC with measurements at a linear collider. In the energy range of 0.5 to 1 TeV, the ILC, based on superconducting technology, will provide a unique scientific opportunity at the precision frontier.”



CERN budgetary plans 2008-2010

Table 4: Additional resources with respect to CERN/2677 required for new activities

		Materials [MCHF]	Personnel [FTEs]
First Theme:	Highest priority, full exploitation of the LHC	103	246
Second Theme:	High priority, improvements of LHC injectors	55	185
Third Theme:	R&D for LHC luminosity upgrade and enhancement of CLIC qualifying tests	<i>68</i>	<i>287</i>
	Reduced to a minimum	58	212
Fourth Theme:	<i>Possible contributions for activities in which CERN could be a partner</i>	<i>41</i>	<i>145</i>
Total themes 1-3 (with minimum third theme)		216	643
External contributions and flexibility in the planning schedule		ca 10 %	ca 10 %
Funding request		190	570

(50 MCHF)



CERN plans 2011-2016

- 1) If results from the LHC, as is highly likely, suggest the need for an increase up in luminosity allowing a more extensive exploration of the new territory opened the by LHC, a **decision on the luminosity increase** (new RF system, new magnets for IR, increased cooling, new tracking in detectors, etc.) **will entail a simultaneous decision to build a new injector (SPL and PS) since higher LHC performance cannot be achieved reliably enough without a new injection line.**

The total cost of the investment, which is assumed to be realized in 6 years (2011-2016), is within the range 1000-1200 MCHF and will require a staff of 200-300 per year, thus a total budget of about 200-250 MCHF per year.

This new investment in CERN will require a complete revision of the layout of the Meyrin Site, but will provide CERN with a brand new installation, with no competitor for a long period.

- 2) Assuming positive results in 2010 from the CLIC technology qualifying programme with CTF3, it will be appropriate to **prepare a Technical Design for implementing the CLIC programme after the LHC upgrade is achieved.** This objective will require the construction of a large collaboration contributing resources, mainly manpower, between 2011 and 2016. The CERN contribution is estimated to be in the range 40 MCHF per year + 200 - 230 FTE per year for the design of the accelerator and detectors, giving a total of about $M + P = 250 \text{ MCHF} + 1000 - 1200 \text{ FTE}$ for the six years.

The preparation of the CLIC Technical Design, simultaneously with realization of the above-described LHC upgrade, will require a modest increase in the annual budget over and above the flat one (i.e. the normal contributions of Member States for 2007 with constant purchasing power) to support the increase in manpower, i.e. about 35 MCHF.

The consequences of not performing this Technical Design effort during this period will be serious, since it would mean that there would be no physics programme running at CERN at the end of LHC exploitation in around 2025.

The proposed Technical Design effort would allow the decision to build CLIC to be taken in 2016 or later, 20 years or more after the decision to build the LHC.

- 3) **The need for infrastructure consolidation** is evident and thus Management proposes to enhance this activity to some 30 MCHF + 40 FTEs from 2011 onwards.
- 4) During the same period of 2011-2016, effective participation of CERN in another large programme (ILC or a neutrino factory) will not be possible within the expected resources if positive decisions are taken on the two programmes mentioned above (LHC upgrade and CLIC Technical Design). This situation could totally change *if none of the above programmes is approved* or if a new, more ambitious level of activities and support is envisaged in the European framework.



Conclusion

- The existence of a process in Europe to define a common strategy is a major step forward.
- Its contents is remarkably similar with EPP2010
 - Build on the similarities, rather than the differences
 - Strongly supportive for ILC
- CERN council will have to learn how to exercise well its dual role
 - Anecdotal but meaningful progress : red papers, new numbering scheme!
- Powerful basis to strengthen international collaboration

