



European Strategy for Particle Physics and Ongoing Update

<https://europeanstrategygroup.web.cern.ch/EuropeanStrategyGroup/>
International Workshop on Future Linear Collider
LCWS12

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Current European Strategy

Current Strategy

- Current strategy was adapted by the Council in July 2006
- It consists of 17 strategy statements:
 - two General issues; necessity of strategy
 - **eight Scientific activities** (LHC, Accelerator R&D, ILC, Neutrino, Astroparticle, Flavour, Nuclear physics, Theory)
 - four Organizational issues
 - CERN Council's role in coordinating European particle physics
 - Globalization
 - Non-member state relation
 - Relation with EU
 - three Complementary issues
 - Outreach
 - Technology Transfer Network
 - Relation with industry

Current Strategy Relevant for LC (I)

- 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 focused 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.*

Current Strategy Relevant for LC (II)

- 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.*

Current Strategy Relevant for LC (III)

- 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.*

Preparation for Updating the Strategy, started in Summer 2011

Steps taken so far

- Council has set-up two groups with Scientific Secretary for the Strategy Session of the Council as the chair for both

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 - Preparatory Group
 - Members are from SPC, ECFA, CERN, **Americas and Asia**
 - Produce briefing books on scientific inputs for the Strategy Group based on the written submissions by the communities, funding agencies and policy makers, and on the Open Symposium
 - Organise Open Symposium
 - Strategy Group
 - Delegates from the Member States**, Associate States, Observer States (**incl. US**), ApPEC, ESFRI, EU, FALC, NuPEC, Large National Laboratories and CERN DG, and Members of the Scientific Secretariat for the Council
 - Discussion on organizational and other non-scientific (Technology and knowledge transfer, Outreach etc.) issues needed for the strategy update started
 - Draft the updated strategy for the Council

Cracow Open Symposium for the European Strategy Updates

NB. No conclusion yet

Overview

- On 10 to 12 September, two and half days of session
- Close to 500 participants
- Plenary speakers summarising the current status and future options, with long discussion sessions, for

- high energy frontier

- Flavour and symmetries

- Strong interactions

- Astroparticle physics

- Neutrino

- Theoretical physics

- Accelerator science

- Instrumentation, computing, and infrastructure

- Very good local organization!!

directly relevant for the
scientific strategy

relevant for the
axial issues of
the strategy not
discussed
today

Some of the discussed points (I)

- Direct-search of new particles at High Energy Frontier and
Indirect-search of new physics, i.e. precision measurements at any energy machines to study rare processes looking for a deviation from the Standard Model calculations, are providing fruitful complementary results. But no compelling sign of New Physics so far.
→ Continue pushing at two fronts is essential.

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- Direct-search of new particles at High Energy Frontier and Indirect-search of new physics, i.e. precision measurements at any energy machines to study rare processes looking for a deviation from the Standard Model calculations, are providing fruitful complementary results. But no compelling sign of New Physics so far.
→ Continue pushing at two fronts is essential.
- Discovery of “Higgs” like boson at LHC opens a new line of indirect-search: precision measurement of “Higgs” properties.
→ **Is LHC alone enough or a *new facility also needed?***
Linear or Circular e^+e^- colliders, Circular $\mu^+\mu^-$ collider $\gamma\text{-}\gamma$ collider based on circular e^- storage rings
→ **European attitude toward a possible LC in Japan?**

Some of the discussed points (II)

- LHC serves for a wide platform with open questions:
 - Direct (ATLAS&CMS) and indirect (LHCb) New Physics search, perturbative and non-perturbative QCD (ALICE, ATLAS, CMS, LHCb, etc.). Further exploitation is possible by upgrading the machine luminosity and detectors.
 - **What is the scientific scope for the upgrade from 0.3 to 1~3 ab^{-1} ? (W_L scattering, Trip.H. coupling, ..)**

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 - What is the scientific scope for the upgrade from 0.3 to 1~3 ab^{-1} ? (W_L scattering, Trip.H. coupling, ..)
- The next machine beyond LHC at CERN:
 - A machine **running concurrently with LHC possible?**
LHeC (possibly LEP3: circular e^+e^- in LHC tunnel?)
Is PDF measurements by LHeC crucial for High-Lumi LHC?
 - For a high energy frontier machine (VLHC etc.) need more input: from LHC run @ 13~14 TeV e.g.**

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- Major challenges in neutrino physics: **mass hierarchy**, precision measurement of the **mixing parameters** (in particular **the CP violation phase**), **sterile neutrinos**.

Some of the discussed points (IV)

- European neutrino community presented
 - **CERN SPS long baseline neutrino beam to Finland** with a massive liquid Ar detector for the mass hierarchy and mixing parameter measurements → ApPEC joint coordination?
 - **CERN SPS short baseline neutrino beam** for sterile neutrino search, with existing detector moving from GSNL to CERN
 - **Neutrino factory** for ultimate precision measurements of the mixing parameters **for a longer term future.**

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- Interest generated by an idea of muon storage ring without pre-cooling. A clean low energy neutrino source for sterile neutrino search, with conventional technology(?)
- **European neutrino programme must be set-up now, with global situation taken into account.**

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- JP community pushes **250-500 GeV linear e^+e^- collider** with a hope to start data taking before 2030, and **Hyper Kamiokande water Cherenkov** (or liquid-Ar in Okinoshima) detector for JPARC neutrino beam with a hope to start construction in ~ 2018 , while SuperKEKB construction is in progress.

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- For high baryon density environment, SPS can provide interesting data, as well as RICH, and new facilities, e.g. FAIR, NICA,:
→ **Do we need experiments at all the facilities?**

What will follow

Foreseen Steps

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- Outreach event in May in Brussels, also targeting at the EU parliament members.

Expected Documents

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describing the **scientific rational** for the strategy statements
and a possible **framework for implementing the strategy**
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- **Brochure** for **funding agencies, politicians, and public**
by CERN communication group and Strategy Group