Swiss Institute of Particle Physics

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European Strategy for Particle Physics:
The CHIPP input of 2006

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Cover page

In the 2006 process of establishing a European Strategy for Particle Physics, CHIPP decided to provide a substantial input, thereby supporting the task of the Swiss delegate in the European Strategy Group. This scientific input was complemented by guidelines from the State Secretariat for Education and Research SER, mainly regarding the role of CERN in the whole strategy.

The CHIPP EB suggests to repeat this process, but would like to profit from the existence of the 2006 CHIPP document; that paper is to be regarded as a first draft and will have to be updated and revised (in some way like the roadmap has been updated in 2011 with the implementation paper).

The 2006 CHIPP paper is attached.

At the level of the SER, the Swiss CERN Council Delegate has suggested a similar process regarding the SER's guidelines, which has been accepted.

Swiss Institute of Particle Physics	Contribution to the CERN strategy group	15 April 2006	

Swiss contribution to the CERN Strategy group

The Swiss particle physics community, regrouped into the Swiss Institute of Particle Physics (CHIPP), welcomes the proposal by the CERN Council to set up the European Strategy group. CHIPP has been created in October 2003 and one of its first missions has been commissioning a study of the status and outlook of particle physics research and education in Switzerland.

CHIPP saw the Orsay Symposium and anticipates the Zeuthen meeting as important yet delicate exercises, whose role could formalize the list of long-term scientific options in particle physics in Europe, and bring clarity to the timescales on which options must be selected. Indeed, given the financial reality, it is unrealistic to hope that the many projects mentioned at the Orsay meeting can be all included in a purely European strategy. Yet, CHIPP believes that time is mature to define a possible roadmap for infrastructures in Europe on one-hand, and on desirable European participation to worldwide facilities on the other.

Due to the privileged role as host member state for CERN and the existence of the national Paul Scherrer institute PSI in Villigen, Switzerland and its physics institutes and universities have played an important role in particle physics. Conversely, CERN being located in Geneva has had a major impact on particle physics in Switzerland. CHIPP foresees that this will likely continue to be the case and that the future scientific choices of CERN will necessarily have an impact on the future of particle physics in Switzerland.

CHIPP believes that particle physics has undergone outstanding developments in the last decades, a success story to which CERN has largely contributed. Despite these successes, a number of fundamental physics questions remain unanswered. CHIPP has recently made an attempt to develop a Swiss strategy (Roadmap) to maintain within constant resources an internationally visible experimental and theoretical particle physics program, which should be effective in elucidating the above-mentioned fundamental questions over the coming 15 years.

Concerning experimental physics, the CHIPP Roadmap aimed at a *balanced* program along three complementary "directions", called pillars:

1) Experiments at the accelerator energy and luminosity frontier
2) Experiments to explore flavor physics, in particular on the study of neutrino oscillations and to ultimately search for CP-violation in the lepton sector
3) Experiments at the interface between particle physics and astrophysics, or astroparticle physics, with emphasis on understanding the nature of "dark matter" and "dark energy".

CHIPP therefore recognized that, on one hand, particle physics in Switzerland should encompass both accelerator and non-accelerator based research, since astroparticle physics is a rapidly developing branch of particle physics where new discoveries and break-throughs can be expected in the next 10-15 years, and on the other hand the important complementarity of flavor neutrino physics with respect to the experiments at the highest energies and luminosities.

Moreover, history has shown us that the most fundamental experimental discoveries in particle physics have resulted from the development of new particle accelerators and of novel particle detection techniques. CHIPP considers that this is likely to continue and therefore expresses the view that it is necessary to maintain important R&D efforts in detector and accelerator technologies, although experiments will remain priorities. CERN, in particular, has played a key role in these developments and CHIPP looks forward to a vital accelerator and detector R&D CERN program for the forthcoming years.

It is the role of CHIPP to ensure that the financial and human resources in the Swiss experimental program remain sufficiently flexible to achieve the CHIPP Roadmap. In this process Switzerland cannot proceed alone; in particular, a coherent roadmap for particle physics in Europe, in particular at CERN, is needed while keeping an eye open on other international developments.

Specifically to the CERN Strategy Group, CHIPP would like to make the following points:

1. Switzerland has made large investments in the LHC project and recommends the physics exploitation of the LHC as top priority for the years to come.

2. Solid results from LHC available sometime between 2010-2012 will allow defining the optimal next step beyond the LHC. In parallel to the progressive gathering of LHC results, CHIPP supports the pursuit of essential R&D studies for upgrades of LHC (SLHC, DLHC), for a possible Linear Collider (ILC, CLIC) option and for a future Neutrino Facility (Neutrino Factory).

3. A commensurate LHC luminosity increase is seen by CHIPP as a natural development of the LHC program, provided it does not strain large resources from other programs, which could become priorities by 2010-2012. The luminosity upgrade well beyond the design high luminosity of 10^{34} $cm^{-2}s^{-1}$ would require new consequent investments in detectors, which will have to be motivated by the emerging physics arguments.

4. Swiss physicists aim at playing an important role within the LHC exploitation, and therefore CHIPP is engaged in setting up the proper environment to reach this goal for the years to come. However, CHIPP notes that there is a well-documented and complementary physics programme of precision measurements at a potential e^+e^- collider in the TeV range. Therefore, CHIPP is ready to support and contribute to the worldwide effort towards the ILC as described in the GDE plan and schedule, and this regardless of the site finally chosen. CHIPP would like CERN to become an important forum to contribute

to the definition of the ILC programme. In the event that the LHC results would not indicate a clear case for ILC, CHIPP recommends a moment of reflection, leading to a possible choice between DLHC or CLIC as next logical steps.

5. The physics input to define the scientific case of the Neutrino Factory will, independently of LHC, come from ongoing or planned experiments such as the NUMI and CNGS programs in USA and Europe, the T2K experiment in Japan and possibly the NoVA experiment in USA. Swiss physicists have been and are strongly involved at the forefront of neutrino physics (CERN WANF, CERN CNGS, K2K, T2K) and hope that CERN will continue to foster the required environment for a strong neutrino physics community in Europe. In this spirit, CHIPP believes that Europe, and CERN in particular, should be ready to host or to participate with strong visibility to the realization and exploitation of a major international neutrino facility in the future.

6. Swiss physicists are strongly involved in astroparticle physics experiments. New discoveries and break-throughs in particle physics are likely to come from this emerging field in the years to come, as has been demonstrated in the ApPEC roadmap. CHIPP recommends that CERN, in its role of world laboratory for particle physics, carefully follows and supports directly or indirectly this rapidly evolving branch of particle physics.

7. The existing fabric of universities and national laboratories is essential for detector and accelerator research. They often lead to smaller scale precision experiments (as for instance the nEDM and the $\mu \rightarrow e\ \gamma$ projects at PSI) and deserve attention as part of a global scientific asset. CHIPP recommends that CERN, the world largest particle physics laboratory, contributes to establish strong collaboration between European laboratories in the definition and development of these activities.

8. It has been mentioned above that detector R&D is crucial. Unfortunately, the particle physics community is being confronted with a regrettable trend of reducing R&D activities in large laboratories, including CERN. This is a serious danger for the long-term future of particle physics. CHIPP recommends that this kind of R&D be organized and supported in the spirit of the successful DRDC programs that were initiated in the early phase of the LHC project.

9. Whenever the CERN Council will obtain the mandate to maintain and steer the European particle physics strategy, it will necessarily have to evolve beyond its current role of manager of the CERN laboratory to include the task of the scientific scrutiny of future particle and astroparticle experiment proposals and of the monitoring of running experiments. This could possibly be accomplished by a suitable reorganization of the existing CERN Scientific Committees, taking into account input from committees like EFCA, ApPEC, etc.