Swiss Institute of Particle Physics

an Association according to Swiss law

# Swiss contribution to the Update of the European Strategy for Particle Physics

21 July 2012

*The CHIPP-Board has agreed to extend the current document later this year by a more focused strategic part, which emphasizes future activities that are expected to represent a major priority of the Swiss particle physics community. This part will be added after further discussions within CHIPP and including the latest physics results available after the summer 2012 conferences and the discussions at the Krakow Open Symposium.*

The Swiss particle physics community, represented by the Swiss Institute of Particle Physics (CHIPP), welcomes the process of updating the European Strategy for Particle Physics. CHIPP was created in October 2003. As a first activity, it had commissioned a study on the status and outlook of particle physics research and education in Switzerland published as a Road Map in 2004, and has recently worked out an implementation document "Achievements and Status of Particle Physics in Switzerland: Implementation of the Road Map (2005-2010) and Outlook". CHIPP transformed into an association under Swiss law in 2011. The members of the association are the particle, astroparticle and nuclear physicists holding a Master in physics and working for a Swiss academic or research institution, and the Swiss PhD nationals working at CERN.

CHIPP anticipates the open symposium in Krakow and the planned subsequent meetings of the strategy process as an important yet delicate exercise, whose role will be to formalize the list of long-term scientific options for particle physics in Europe, and bring clarity to the time-scales on which choices between options must be made. Since the establishment of the European Strategy in 2006 remarkable progress has been achieved in almost all outlined pathways but at the same time most activities are far from completion and continued strong support is mandatory. CHIPP supports the notion of an *update* of the strategy that is strongly oriented along optimizing return of investment, intellectually, scientifically and financially. Indeed, given the current financial constraints, it is unrealistic to hope that the many new projects presently discussed could all be included in a merely European strategy. Yet, CHIPP believes that the time is maturing, as many new results are expected in 2012, to define in the strategy update a possible road map for infrastructure in Europe on the one-hand, and for European participation in worldwide facilities on the other.

Therefore CHIPP proposes that the European Strategy session should come up with a list of priorities for the various options of research facilities. These priorities should be decided on the basis of the possible physics output w.r.t. the sensitivity to explore the limits of the standard model. At the same time it should be specified which facilities would be European priorities, and which ones are proposed as global projects, also in the context of the scientific and geographical enlargements of CERN, as defined by CERN Council in 2010. This way the European Strategy process may initiate a more global priority discussion, which is urgently needed, for particle physics to continue as a "Big Science" having a significant impact on global science and technology progress. Nevertheless, the definition of European priorities should take into account the local and regional experience and the existing European research infrastructure.

CHIPP believes that particle physics has undergone outstanding developments in the last decades, a success story to which the CERN laboratory has largely contributed. Despite these achievements a

number of fundamental physics questions remain unanswered. They will have to be tackled in the coming years within constant or slightly growing resource budgets. Within these budgets, Switzerland wishes to provide internationally visible contributions to an experimental and theoretical particle physics programme.

CHIPP recognizes that particle physics in Switzerland should encompass both accelerator and non-accelerator based research. Direct production of new particle states at high energy and experiments with beams of secondary particles is the mainstay of experimental particle research. Moreover, astro-particle physics is a rapidly developing branch of fundamental physics. CHIPP also acknowledges the important complementarities of flavour, neutrino and precision physics with respect to the experiments at the highest energies and accelerator luminosities.

Therefore the priorities for global projects should take into account a reasonable balance between high energy collider, cosmic ray, dark matter, neutrino, low energy and flavour precision physics. A European strategy may only set its priorities on a subset of these fields, if a reasonable counterweight in the global priorities can be achieved.

History has shown that the most fundamental 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 physics and technology, although the construction and operation of fundamental physics experiments will remain natural priorities.

Therefore CHIPP proposes to include in the European Strategy a vigorous accelerator and detector R&D programme. This should include the development of completely new accelerator technologies as well as following up new ideas on instrumentation for particle detection. Such a programme should be coordinated carefully between the university institutes and the national and international laboratories. This type of activities allows to attract good students and is thus of central importance for the long-term development of our research field. Thus, a strong visibility of such activities at as many universities as possible is crucial.

Addressing the CERN Strategy Group, CHIPP would like to stress the following additional points for inclusion in the update of the European Strategy for Particle Physics:

1. Switzerland has made large investments in the LHC project. The Swiss community is strongly involved in exploiting these investments by engaging in many different data analyses and producing many of the impressive physics results of LHC. It is thrilled by the machine performance achieved so far, the huge amount of high quality data acquired by the LHC experiments and in particular by the recent discovery of a new boson so far consistent with the Standard Model Higgs particle. It is looking forward to achieving design energy and luminosity within the next few years, and recommends the full physics exploitation of the LHC operating at its design parameters as top priority for the years to come.
2. The physics results based on LHC data including a successful 2012 run should allow the definition of the optimal next step in high energy physics. In parallel to the progressive gathering of LHC results, CHIPP supports the pursuit of the necessary R&D studies for luminosity upgrades of the LHC and its detectors, for an $e^+e^-$ collider and for future neutrino beam facilities.
3. In view of the latest results of particle physics research, CHIPP welcomes the assessment of a physics programme for future pp colliders exploring physics at higher energy and for precision measurements at future $e^+e^-$ colliders. Different collider options[1] should be evaluated in detail. These studies should include technical, financial and political aspects of the projects.

[1] It is presently under discussion in the CHIPP Board and will be one issue of the second input after the Krakow meeting, which examples out of the list (ILC, CLIC, LEP3, muon collider, a significant increase of the LHC energy, a completely new 100 to 200 TeV proton collider, LHeC, R&D for a new generation of superconducting magnets) to mention and how to qualify them.

4. Swiss physicists are strongly involved at the forefront of neutrino physics and would like CERN to continue to foster the required environment for an active neutrino physics community in Europe. CHIPP believes that Europe, and CERN in particular, should be ready to host or to participate with adequate visibility and impact in the realization and exploitation of the next large scale, international neutrino beam facility and non-accelerator experiments, in particular in view of the emerging possibility to search for leptonic CP violation and to the measurement of the neutrino mass hierarchy.

5. The physics potentials of all the projects mentioned above should be investigated using the latest results from LHC and other experiments, in order to allow a detailed comparison of the potential for discoveries as clearly only some of them can be realized.

6. Swiss physicists are very much engaged in astroparticle physics experiments. In the context of the decision of the CERN Council to continue the future development of the scientific enlargement of CERN in the framework of the European Strategy session of Council, CHIPP recommends that CERN supports and actively engages in this process covering a rapidly evolving branch of fundamental physics as documented in the 2011 ApPEC roadmap. Important synergies exist, for example, in the field of Dark Matter where direct search experiments, observation or exclusion of direct production of candidate particles at LHC and indirect astrophysical observations ideally complement each other. Another example is the multi-messenger approach to observe particle acceleration up to extreme energies.

7. Opportunities also exist for CERN's accelerators and expertise to bear on cross-disciplinary areas of particle, astroparticle, accelerator and detector physics such as the investigation of a possible influence of galactic cosmic rays on climate, and medical applications. The privileged role of CERN providing fora for new ideas, mutual exchange between subfields and critical synergies must be stressed and promoted.

8. The national laboratories and universities often enable smaller scale precision experiments, like those projects being conducted or planned at PSI. They deserve attention because of their complementary and unique reach. CHIPP recommends that the European strategy process contributes to establishing effective collaborations between laboratories in Europe in the definition and development of these activities.

9. We suggest to study how the scientific scrutiny of future large scale particle and astroparticle experiment proposals and the monitoring of running experiments could be organized. This could be possibly accomplished by creating new scientific committees dealing with each of the future projects, or by a suitable enlargement of the terms of reference of the existing CERN Scientific Committees.

10. CHIPP realizes that this is a long wish list to the European particle physics laboratory at CERN. It will require either new resources or a strong prioritization. We recommend to the European strategy process to study explicitly how the communities interested in a scientific enlargement would be able to make additional resources available to the CERN laboratory.

- o x o -