



Status Report to ECFA:

ECFA Studies of a European Neutrino Factory Complex and Future Neutrino Beams

This interim and informal report summarizes the activities in 2003 and describes the main activities foreseen for 2004, for which we solicit ECFA endorsement.

The highlights of 2003 have been:

- i) The success of the Workshop on **beta-beams** that took place in Les Arcs in march 2003, in which representatives of the nuclear and neutrino communities met to evaluate the synergies between these two domains for what concerns the production of high energy beams of unstable nuclear isotopes. As a follow-up of this meeting a strong bound was established with the EURISOL project. At the end, the beta-beam group was invited to take part in the EURISOL FP6 Design Study proposal. The beta-beam, as well as the low-energy high intensity neutrino beam that could be produced in a conventional way from the SPL would offer very competitive neutrino physics possibilities if associated with a large international underground laboratory.
- ii) **The NUFACT03 workshop** in Columbia University was a large success. The Highlight of the workshop were a better resolution of the issue of degeneracy between neutrino mixing parameters, in particular the angle θ_{13} and the CP violating phase δ . The various experiments under study will be sensitive to different combinations, thus allowing unambiguous determination of these parameters, at least for θ_{13} larger than one degree, especially if the ‘silver channel’ $\nu_e \rightarrow \nu_\tau$, unique to neutrino factories, is used. On the accelerator side, first complete and matched solutions now exist for the design of muon cooling rings. Finally the workshop saw the launch of the Worldwide Neutrino Factory Study, which should accompany the European Design Study to be proposed to EU under FP6 in the context of ESGARD (see below).
- iii) **The approval of CARE** was a major success. The future neutrino programme at CERN will certainly greatly benefit from the approval of the Joint Research Activity on the High Intensity Pulsed Proton Injector (HIPPI). The approval of the networking activity Beams and Experiments for Neutrinos in Europe (BENE) will give a welcome impulse to the community that has been hard hit by the cuts at CERN end of 2001. The success of this EU funding validates the approach of transferring from CERN to a collaboration of European Institutions the studies and R&D on future neutrino facilities. From now on the ECFA meetings called “muon weeks” and the BENE meetings will be organized jointly and will be called “ECFA/BENE weeks”, since the two activities closely match each other.

Some success could be achieved in the development of R&D activities in collaboration with institutes outside of CERN. This has happened in the four critical areas underlined by the European Muon Coordination and Oversight Group (EMCOG), chaired by Carlo

Wyss (CERN-DG) and comprising representatives of the European national funding agencies.

- i) **The proton driver:** the SPL R&D, which is supported by CERN at a small level, is now performed in collaboration with several other institutes in Europe.
- ii) **The target studies:** a working group has continued quite actively. In addition to the observation of exposure of liquid jet targets to the beam in 2001, observation of ‘confinement effects’ when the jet flows through a high magnetic field have been observed in Grenoble. The next step will be the observation of a liquid jet exposed to both a high intensity beam and high magnetic field. This is the object of an experimental letter of intent which was recently proposed to the INTC at CERN.
- iii) **The horn studies:** after construction of a prototype at CERN, mechanical tests at reduced intensity and current have allowed characterization of the device. LAL Orsay has now taken responsibility for the continuation of this project which is essential for a SPL based superbunch as well as for the neutrino factory.
- iv) **The Muon Ionization Cooling Experiment MICE** experiment has been proposed and scientifically approved at the Rutherford Appleton Laboratory. This is an international (UK; Continental Europe, Japan, USA) and interdisciplinary (Accelerator and particle physicists) collaboration which aims at demonstrating ionisation cooling and studying its behaviour in detail. MICE is considered a critical test of the ideas that should validate the muon-based neutrino factory as a viable option.

The main activities foreseen in 2004 and for which we solicit the endorsement of ECFA are as follows:

1. **The NUFACT04 workshop**, which will this year take place in Osaka (Japan) 26-31 of July 2004.
This will be preceded by the third **NUFACT summer school**, also in Osaka, from 16 to 24 July 2004.
2. A dedicated **Workshop on Physics at the SPL**, which will take place May 25-26 at CERN. The aim of the workshop is to assemble the large community of various users, nuclear physicists, neutrino physicists as well as existing and possibly new other CERN users, that would benefit from the presence of a high intensity proton source. The conclusions of this workshop will be reported to the SPSC ‘Cogne meeting’ to be held in
3. The submission of **Design Studies for future neutrino facilities** within the framework of FP6 and ESGARD. As previously mentioned, the Design Study for beta-beams will be included in the EURISOL design study. The Design study of Neutrino Superbunch and Neutrino Factory will be prepared for submission in early March 2004. It is planned to include Work Packages for the following neutrino-specific items:
 - Target studies and experiments
 - Horn studies and experiments
 - Muon front-end and MICE
 - Muon acceleration and participation to FFAG R&D
 - Overall design study of a neutrino facility

The mother house will be RAL and the coordinator will be Prof. Peach with Rob Edgecock as deputy.
A final review of these design study proposals is foreseen in the ECFA/BENE week 16-19 February 2004.

We would like to express again our gratitude for ECFA continuous support. We will be happy to answer any further questions that may arise, and would be ready for a report to plenary ECFA in June 2004.

Geneva, 26 November 2003.

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a European Neutrino Factory Complex
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