



Beams for European Neutrino Experiments

CARE BENE Network: Annual Report 2004

V. Palladino (INFN), E. Gschwendtner (Univ. Geneva)

We acknowledge the support of the European Community-Research Infrastructure Activity under the FP6 “Structuring the European Research Area” programme (CARE, contract number RII3-CT-2003-506395).

N2 : Beams in Europe for Neutrino Experiments (BENE)

BENE is the CARE network for Beams for European Neutrino Experiments. It comprises 13 countries. The table of the participants and their implication in the BENE Work Packages is given in the table below. The overall management is done by INFN-Na, the Deputy Coordinator is from UNI-GE.

| Participant number | Participant | PHYSICS | DRIVER | TARGET | COLLECTOR | NOVEL NEUTRINO BEAMS |
|--------------------|---------------|----------|----------|----------|-----------|----------------------|
| 1 | CEA | X | C | X | X | C |
| 2 | UCLN | X | | | | X |
| 3 | CNRS | X | | | C | X |
| | CNRS-Orsay | X | | | C | X |
| | CNRS-LPNHE | X | | | X | |
| | CNRS-CENBG | X | | | | |
| | CNRS-IPNL | X | | | X | |
| | CNRS-LPSC | | | | | X |
| 4 | GSJ | | | | | X |
| 7 | FZJ | | X | X | | |
| 8 | TUM | X | | | | X |
| 10 | INFN | C | X | X | X | X |
| | INFN-LNF | X | | | | X |
| | INFN-Ba | X | | | | X |
| | INFN-Ge | | | | | X |
| | INFN-GS | X | | | | |
| | INFN-LNL | X | X | | | X |
| | INFN-Mi | X | | | | X |
| | INFN-Na | X | | | | X |
| | INFN-Pa | C | | | | X |
| | INFN-Pi | X | | | | |
| | INFN-Tr | X | | | | X |
| | INFN-Ro3 | X | | | | X |
| | INFN-To | X | | | | |
| 16 | CSIC | X | | | | |
| | UBa | X | | | | |
| | IFIC | X | | | | |
| | UAM | X | | | | |
| 17 | CERN | X | X | X | X | C |
| 18 | UNI-GE | X | | X | X | X |
| 19 | PSI | | | X | | |
| 20 | CCLCR | X | X | C | X | C |
| | CCLRC-RAL | X | X | C | X | C |
| 21 | ICL | X | | X | | X |

The BENE Network has come promptly into existence in 2004, aiming from its start at a clear presentation, to our particle physics peer community, of

- 1) the physics interest of superior accelerator neutrino beams (superbeams, betabeams, neutrino factories)
- 2) the promising on-going developments of accelerator technology that will make them possible
- 3) the opportunities that exist to plan, fund and realize, on a realistic time scale, a much enhanced European accelerator neutrino complex .

The key event was the “Physics with a multi MegaWatt proton source” Workshop at CERN, May 24-26; in short, the MMW Workshop. A MMW proton source (driver) is decisive for all present and future options of neutrino beams and the establishment of its physics case was naturally to be the first major BENE initiative. The BENE coordinator was co-chairman and many others in BENE were essential: the MMW Workshop was organized in strict cooperation with the management of the EURISOL project, whose nuclear physics scientific program calls for a MMW driver similar and compatible with the one of a neutrino complex and for the construction of infrastructures which is also indispensable for neutrino betabeams.

The Workshop was organized in view of the special “strategic” Cogne IX session of the CERN SPSC (Super Proton Synchrotron Committee) that was held in Villars, CH, Sep 22-28, with the explicit goal of examining prospects for the future of European fixed target particle physics. A Summary Report (140 page) of the MMW Workshop and nine talks were delivered by BENE in Villars. Before that, the coordinator gave additional presentations to two ordinary SPSC sessions in March and July. Thanks to the Workshop BENE established direct contact with the new CERN management, that has welcome warmly the initiative and its follow ups.

In Villars, the SPSC recognized the strategic interest of accelerator neutrino physics and

- 1) identified the possibility a construction window, roughly in the decade 2010-20, after LHC and before CLIC, for a new European accelerator neutrino complex at the frontier of the field;
- 2) endorsed the strategic importance of a MMW proton driver for neutrino physics and for other aspects of fixed target particle physics;
- 3) recommended that, in the immediate future, CERN and European agencies reinforce and support the R&D necessary for a future initiative.

During the year, the coordinator and A. Blondel, a senior member of BENE, gave several reports also to the CERN SPC (Scientific Policy Committee) and to the sessions of ECFA and RECFA.

In December, the Chair of the SPSC presented its recommendations to the SPC and the Chair of the SPC presented its recommendations to the CERN Council.

BENE must provide in 2005 clear indications to the management of CERN and EU funding agencies. R&D activities that deserve priority must be clearly presented, approved and launched, in view of a first round of proposals for new investments in research infrastructures, which the CERN management may present to the CERN Council in 2006.

The largest coordination among different communities is needed. The task ahead is indeed the one to design the optimal evolution of the CERN proton complex. This will have to be capable to provide competitive performance for physics programs as different as the ones of the upgraded LHC, neutrino oscillations, other fixed target particle physics experiments, Eurisol and possibly more.

N2.1 MEETINGS

The major events so far organized or co-organized by BENE were:

- 1) the [1st BENE Week Feb 18-21](#). This was the regular week of meetings of BENE related work packages, study groups and R&D projects.
- 2) the [2nd regular BENE Week](#) of meetings of study groups and R&D projects in May the week at CERN.

- 3) the [“Workshop on Physics at a Multi Mega Watt Proton Source”](#), May 25-27. This international meeting had about 150 participants and is likely to prove an important milestone in our progress towards a new European Neutrino Complex.
- 4) the [Nufact04 International Workshop](#) on Neutrino Factory and Superbeams in Osaka. This Workshop is the annual world-wide forum in our sector. BENE participated in its preparation and contributed to the sessions. So it did for the associated [NuFact04 School](#). The proposal to hold [NUFact05](#) in Europe was presented and approved.
- 5) a joint [Workshop](#) of WP1 (PHYSICS) and WP5 (NovelNeutrinoBeams), “Exploring the impact of new neutrino beams”, that took place in Trento, with the patronage of ECT, October 18-22, devoted to explore the comparative merits of the different options.
- 6) the 3rd general BENE meeting in DESY, that was a [mini-Workshop](#) BENE04 on “The future of accelerator neutrino physics in Europe”, Nov 2-3., during the general CARE04 meeting.

We will also mention [MICE Proto-Collaboration Meetings](#) at the end of March at CERN, in [Osaka](#) immediately after NuFact04 and at [Rutherford Lab](#) at the end of October (BENE is fostering the success of this international effort, a Muon Ionization Cooling Experiment, proposed to RAL/UK where MICE passed the decisive Gateway on December 23. [Proto-Collaboration Meetings](#) of a Target Test Area Experiment, based at CERN (BENE is fostering also the success of this international effort, headed to approval too).

In addition, BENE was present to all major neutrino events in the year. In 2004 we will mention only the most important and representative event, [Neutrino 2004](#). Held on even years, this XXI International Conference on Neutrino Physics and Astrophysics was in Paris, June 14-19. It was attended by a significant BENE delegation and we had several speakers in many of the sessions, only plenary, by invitation only, of the conference.

BENE is also often present at regular ECFA meetings in the year and reports periodically to meetings of the CERN scientific committees (SPC, SPSC) and to the CERN Directorate.

N2.2 Publications

An overview of BENE documents and publications can be found in:

<http://bene.web.cern.ch/bene/publications/>

From there one can link to the documents created by each work package. They are structured in the same way as it is proposed for the general CARE publication policy, i.e. CARE-Note/Report/Conf/Pub/Document.

The database of publications is regularly updated by the BENE deputy coordinator and the work package convenors.

N2.3 Web Sites

The BENE Main Web Page is <http://bene.na.infn.it/>.

It displays the general plan of BENE activities for about 1 year ahead. Basic informations are kept up to date. BENE federates several pre-existing working groups and relies on their several pre-existing Web sites

<http://muonstoragerings.web.cern.ch/muonstoragerings/Welcome.html>

<http://nfwg.home.cern.ch/nfwg/nufactwg/nufactwg.html>

<http://beta-beam.web.cern.ch/beta-beam/>

The process of re-organization into a unitary site, in tune with the BENE federative process, is in progress. In each BENE WP Web page, the fraction of the material relevant to the scope of WP is being reorganized in a coherent set of links.

A Mailing List of members, bene@cern.ch, is operational. In addition there exist mailing lists of each work packages. (hep-mgt-betabeam@cern.ch, hep-mgt-bene-collector@cern.ch, hep-mgt-bene-drivers@cern.ch, hep-mgt-bene-muend@cern.ch, hep-mgt-bene-mufont@cern.ch, hep-mgt-bene-physics@cern.ch, hep-mgt-bene-target@cern.ch). Other lists of more loosely connected colleagues are also maintained.

N2.4 Activities of BENE in 2004

The coming into existence of BENE in 2004 meant an important acceleration of initiative in the sector of accelerator neutrinos. Our Steering Committee has created the necessary networking tools for this and organized the 3 main meetings and the other events. Regular phone-conferences are the main tool of coordination in the interval between meetings.

BENE has also been the promoter of a European Design Study (DS) of a Neutrino Factory & Superbeam complex. Our SG has been the kernel of the team preparing the DS Proposal in view of the expected March 2005 deadline, according to the priorities set by ESGARD. After the cancellation of this DS call, work continues very actively, always under the coordination of R. Edgecock, aiming at the first FP7 deadline. For FP6, instead, we have recently identified the possible objective of a I3, specifically integrating EU infrastructures related to accelerator neutrinos. Though a strong burst of activity is in progress, we are not yet sure to match the fast approaching application deadline.

The Betabeam team is participating to the Eurisol DS, whose WP11 will be a Betabeam work package, for which about 1 M Euros was requested and approved, after submission of the DS Proposal on the March 4, 2004 deadline. This will focus on reacceleration and storage of neutrino beta-emitting ions. Notice that also some most promising DRIVER and TARGET concepts, common to EURISOL and neutrino factory & superbeam applications, are also subject of the Eurisol DS. The coordinators of BENE and HIPPI represent CARE in the governing board of the EURISOL DS.

The following five tables highlight the progress of work planned for the year 2004 for each work package by listing the lowest level subtasks of the BENE detailed implementation plan. No major deviations are reported.

Concerning WP2, the discussion of criteria of comparison of SCL and RPS has to be enlarged in consultations with other communities of potential users of the proton driver. It is therefore likely to last longer than expected. The benefit of the larger consultation will largely compensates the additional effort, as the choice of the appropriate proton driver is a corner stone of the future of particle physics in Europe.

Work Package 1: PHYSICS

| | Title | Original begin date (Annex 1) | Original end date (Annex1) | Estimated Status | Revised end date |
|------------|--|-------------------------------|----------------------------|------------------|-----------------------|
| WP1 | PHYSICS | | | | |
| 1.1 | Development of the WP Web Site | Jan. 2004 | Mar 2004 | 85% | Continuously improved |
| 1.2 | WP Spring Meeting | Feb. 2004 | Feb 2004 | 100 % | |
| 1.3 | WP Summer Meeting | May 2004 | May2004 | 100 % | |
| 1.4 | WP Fall Meeting | Nov. 2004 | Nov 2004 | 100 % | |
| 1.5 | Plan strategy of unambiguous measurement of all oscillation parameters | Jan. 2004 | Nov 2004 | 85 % | Being refined |
| 1.6 | MS: Topical Physics Workshop (proceedings within months) | Oct. 2004 | Oct 2004 | 100 % | |
| 1.7 | Assess potentials of different beam baseline detector configurations | Dec. 2004 | Jun 2005 | 10 % | In progress |

Work Package 2: DRIVER

| | Title | Original begin date (Annex 1) | Original end date (Annex1) | Estimated Status | Revised end date |
|------------|---|-------------------------------|----------------------------|------------------|----------------------------------|
| WP2 | DRIVER | | | | |
| 2.1 | Development of the WP Web Site | Jan 2004 | Mar. 2004 | 85% | Continuously improved |
| 2.2 | WP Spring Meeting | Feb. 2004 | Feb. 2004 | 100 % | |
| 2.3 | WP Summer Meeting | May2004 | May 2004 | 100 % | |
| 2.4 | WP Fall Meeting | Nov. 2004 | Nov. 2004 | 100 % | |
| 2.5 | Define criteria of SPL vs RCS. Perform comparison. Identify R&D plans beyond HIPPI. | Jan 2004 | Jun. 2005 | 50 % | In progress (almost) as expected |

Work Package 3: TARGET

| | Title | Original begin date (Annex 1) | Original end date (Annex1) | Estimated Status | Revised end date |
|------------|---|-------------------------------|----------------------------|------------------|--------------------------|
| WP3 | TARGET | | | | |
| 3.1 | Development of the WP Web Site | Jan. 2004 | Mar. 2004 | 50% | Acceleration in progress |
| 3.2 | WP Spring Meeting | Feb. 2004 | Feb. 2004 | 100 % | |
| 3.3 | WP Summer Meeting | May 2004 | May 2004 | 100 % | |
| 3.4 | WP Fall Meeting | Nov 2004 | Nov 2004 | 100 % | |
| 3.5 | Review present status of high power target studies. | Jan 2004 | Feb. 2005 | 100 % | |

Work Package 4: COLLECTOR

| | Title | Original begin date (Annex 1) | Original end date (Annex1) | Estimated Status | Revised end date |
|------------|---|-------------------------------|----------------------------|------------------|--|
| WP4 | COLLECTOR | | | | |
| 4.1 | Development of the WP Web Site | Jan. 2004 | Mar. 2004 | 85% | Continuously improved |
| 4.2 | WP Spring Meeting | Feb. 2004 | Feb. 2004 | 100 % | |
| 4.3 | WP Summer Meeting | May 2004 | May 2004 | 100 % | |
| 4.4 | WP Fall Meeting | Nov. 2004 | Nov. 2004 | 100 % | |
| 4.5 | Evaluate progress: power supplies, irradiation, mechanical and thermal stresses | Jan 2004 | Feb 2005 | 90 % | |
| 4.6 | MS: WP Spring Meeting hosting Int. Workshop on Targets & Collectors (proceedings within months) | Mar 2005 | Mar 2005 | 0 % | Meeting planned as expected. Workshop postponed. |
| 4.7 | Assess merits of different collector schemes | Feb 2005 | Jun 2005 | 10 % | Planned as expected |
| 4.8 | WP Summer Meeting | Jun 2005 | Jun 2005 | 0 % | Planned as expected |
| 4.9 | MS: WP Interim Report for NuFact05 | Jun 2005 | Jun 2005 | 0 % | Planned as expected |

Work Package 5: NOVEL NEUTRINO BEAMS

| | Title | Original begin date (Annex 1) | Original end date (Annex1) | Estimated Status | Revised end date |
|------------|--|-------------------------------|----------------------------|------------------|---|
| WP5 | NOVEL NEUTRINO BEAMS | | | | |
| 5.1 | Development of the WP Web Sites for the three areas of interest of the WP | Jan 2004 | Mar 2004 | 85% | Continuously improved |
| 5.2 | Review of existing designs for NuFact (both front & back end) and Betabeams. | Jan 2004 | Jun 2005 | 60 % | |
| 5.3 | Define, implement and perfect dissemination mechanisms | gio 01/01/04 | Jun 2005 | 60 % | |
| 5.4 | WP Spring Meeting | Feb 2004 | Feb 2004 | 100 % | |
| 5.5 | WP Summer Meeting | May2004 | May2004 | 100 % | |
| 5.6 | MS: WP Fall Meeting hosting Betabeam Workshop (proceedings within months) | Fall 2004 | Fall 2004 | 100 % | Meeting and Workshop held separately in the end |

N2.5 SIGNIFICANT ACHIEVEMENTS

- Organization of the “Physics with a multi MegaWatt proton source” Workshop at CERN, May 24-26; in short, the MMW Workshop. This is likely to prove a significant turning point for EU initiative in our sector.
- A Summary Report of the MMW Workshop and nine talks delivered by BENE to the strategic CERN SPSC meeting in Villars (France). This recognized the strategic interest of accelerator neutrino physics. In December, the Chair of the SPSC presented its recommendations to the CERN Scientific Policy Committee (SPC) and in turn the Chair of the SPC presented them to the CERN Council.
- Approval of the Beta Beam Work Package of the EURISOL DS.

N2.6 List of all milestones and deliverables (D) during the reporting period

| Deliverable/ Milestone No | Deliverable/Milestone Name | Workpackage /Task No | Lead Contractor(s) | Planned (in months) | Achieved (in months) |
|------------------------------|----------------------------|-------------------------|-----------------------|------------------------|-------------------------|
| D | BENE Web Site | All WPs | INFN-Na | 4 | 4 |
| D | BENE Annual Report | All WPs | INFN-Na, Uni-Ge | 11 | 12 |
| D | BENE Physics Web Site | WP1 / 1.1 | INFN-Pa, CERN | 3 | 3 |

N2.7 List of major meetings organized under BENE during the reporting period

| Date | Title/subject | Location | Number of participants | Web Site Address |
|--------------------|--|-------------------|---------------------------|---|
| 16-19 Feb 2004 | BENE Week | CERN | 50 | http://muonstoragerings.web.cern.ch/muonstoragerings/Events/200402/agenda.html |
| 24-28 May 2004 | BENE Week | CERN | 50 | http://people.na.infn.it/%7epalladin/bene/Events/200405/Agenda.html |
| 25-27 May 2004 | MMW Workshop | CERN | 150 | http://physicsatmwatt.web.cern.ch/physicsatmwatt/ |
| 26-31 Jul. 2004 | NuFact04 International Workshop | Osaka (Japan) | 155 | http://www-kuno.phys.sci.osaka-u.ac.jp/%7enufact04/ |
| Oct. 18-22 2004 | WP1 & WP5 joint Workshop | Trento (Italy) | 25 | http://newbeams.in2p3.fr/ |
| 2-3 Nov. 2004 | Workshop “The future of Accelerator Neutrino Physics” | DESY | 60 | http://care04.desy.de |