



Beams for European Neutrino Experiments

CARE BENE Network: Yearly Report 2007

The BENE Steering Group

M. Mezzetto, A. Donini (PHYSICS WP)
M. Zito (DRIVER WP)
C. Densham (TARGET WP)
M. Dracos (COLLECTOR WP)
K. Long (Novel Beams WP/MuFRONT)
F. Meot (Novel Beams WP/MuEND)
M. Lindroos (Novel Beams WP/BETABEAM)
S. Pascoli (Deputy NA Coordinator)
V. Palladino (NA Coordinator)

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 Experiments¹. It comprises 13 nodes. The table of the participants and their implication in the BENE Work Packages is given below.

Participant number	Participant	PHYSICS	DRIVER	TARGET	COLLECTOR	NOVEL NEUTRINO BEAMS
1	CEA	X	C	X	X	C
2	UCLN	X				X
3	CNRS	X			X	X
	CNRS-Orsay	X			X	X
	CNRS-LPNHE	X			X	
	CNRS-CENBG	X				
	CNRS-IPNL	X			X	
	CNRS-LPSC					Cb
	CNRS-IReS	X			C	
4	GSI					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	C				
17	CERN	X	X	X	X	Cc
18	UNI-GE	X		X	X	X
19	PSI			X		
20	CCLCR	X	X	C	X	X
	CCLRC-RAL	X	X	C	X	X
21	ICL	X		X		Ca

The overall management is done by INFN-Na. During the period our new Deputy Coordinator (S. Pascoli, from Univ. of Durham, associated to ICL) has been improving our dissemination tools². Less new WP coordinators have been consolidating hold of the PHYSICS (A. Donini,

¹BENE's mandate is that to promote clear awareness, in our particle physics peer community, a) the physics interest of superior accelerator neutrino beams (Superbeams, Betabeams, Neutrino Factories) b) the promising on-going developments of accelerator technology that will make them possible c) the opportunities that exist to plan, fund and realize, on a realistic time scale, a much enhanced European accelerator neutrino complex .

² She also started the CERN TH Neutrino Coffee Seminar tradition, now continued by T. Schwetz-Mangold.

co-coordinator), DRIVER (M. Zito), TARGET (C. Densham) and COLLECTOR (M. Dracos) WPs.

2007 marked the approval of the EuroNu DS proposal, after 2006 had been a key year for the BENE Network. Its strategy, including its attention to international collaborations in a truly global context, was recognized valid by CERN Council in its Strategy Document issued in July 2006 in Lisbon.. A more powerful accelerator neutrino complex is regarded since as an emerging facility of EU interest, in the context of the ESFRI road map.

This was confirmed, following the first FP7 call of Spring 2007, when we could finally submit our EuroNu DS, by the highest rank achieved by our proposal and its admission to negotiation for the largest EC contribution of its call. The EC negotiations are still in progress, we should be able to start the DS in the first part of 2008

Lead by STFC, this Design Study will review all three currently accepted methods of realizing this facility (the so-called neutrino Super-Beams, Beta Beams and Neutrino Factories). In the Neutrino Factory sector, it will be also our contribution to an International Design Study with America and Asia. It includes a detailed study of the key technical challenges of the accelerator facilities. It will use the available information baseline detector option best suited to measure physical quantities governing neutrino oscillation parameters to make a comparison of the physics reach of these facilities. The construction of such a facility in Europe would reassert Europe's position as the leading region for high energy particle physics.

BENE looks now forward to deploy the strongest possible effort to contribute to the establishment of another coordinated European participation to a structured European and International R&D program. Our main task remains that of assembling a large and solid collaboration of laboratory and university teams supported by all the European agencies willing to contribute increasing funds and human resources to our sector. This EU collaboration would participate to a global effort, clustering around a small but freshly re-motivated CERN task force .

Another FP7 Design Study Proposal, LAGUNA, originated from the astro-particle physics community, focusing on underground laboratory facilities of great interest also for accelerator neutrinos, **has also been admitted to negotiation.**

In the second part of the year, BENE has switched the focus of its attention **to the** preparation of proposals for the first FP7 IA call.

The IA Proposal in preparation in the particle accelerator sector, has become known as **EuCARD** and **includes** Work Packages of great interest ALSO for neutrino beams.

- 1) a NA, **NEU20012** aiming at structuring of the accelerator neutrino community tighter than BENE will be able to. The name NEU20012 is meant to convey clearly the message that indeed Neutrino users in Europe will meet the 2012 date recommended by Council.
- 2) **MICE-TA**, a Trans-national Access centred around the muon facility in advanced construction at the ISIS synchrotron at the Rutherford Laboratory in the UK
- 3) several **JRA's** either of
 - direct interest and involvement of the neutrino beams community, like the one including Fixed Field Alternating Gradient **FFAG** accelerators of protons and/or neutrino parents or the one including Superconducting Proton Linacs **SPL** that can possibly reach the high power level desirable for neutrino facilities.
 - interest for possible synergy with the upgrade of the EU proton collider LHC, like the

one including R&D on high field magnets **HFM** (usable in accelerators and storage rings of neutrino parents) or the one including R&D on the behaviour in high power radiation environment of materials considered for LHC collimators **COLMAT** (but also for high power targets producing neutrino parents and high power collection devices collecting them)

-interest for possible synergy with the R&D towards more powerful electron linear colliders, like the one including R&D on normal conducting radiofrequency (applicable to muon ionization cooling) **NRF** or on superconducting radiofrequency **SRF** (applicable in several sectors of both conventional and novel neutrino beams.

A long intense phase of preparation of this proposal, that has had to involve several senior members of BENE, is approaching its deadline of 29 Feb.

BENE is giving its contribution also to another IA Proposal in preparation in the particle detector sector. That has become known as **DEVDET** (development of detectors) and includes Work Packages on neutrino detectors of great interest for neutrino beams.

The activities of BENE interest in the FP7 IA proposals try to move further on the path of the set by the on going program of R&D and design work. We hope that the entire set of EuCARD and DEVDET initiatives of interest for neutrino beams will be approved and strongly supported by European agencies in the years 2009-2012.

The year 2012 was set by Council as the milestone for the next major undertaking in this field. Studies of the scientific case for future neutrino facilities and the R&D into associated technologies are required to be in a position to define the optimal neutrino program based on the information available in around **2012. The BENE effort on FP7 proposals works now in that prospective.** A possible, desirable, model is the establishment by CERN Council of an oversight body for neutrino physics whom NEU2012 could submit in 2012 its proposal an of optimal programme of accelerator neutrino experiments.

2012 is likely to have been indicated as it is the year when solid physics results should have arrived from LHC, giving general direction to particle physics, and the T2K and Double-CHOOZ experiments, giving great guidance to identify the optimal step in the exploration path of neutrino transitions. Meanwhile financial resources will be liberated by the end of the payments for LHC and its detectors. Major decisions will be mature, for ILC, for accelerator neutrino and for other sectors. The deadline must be met.

In addition to this strong focus on FP7 proposals, during 2007 the BENE³ Network has

- 1) **monitored the physics results of the accelerator neutrino experiments in progress and their implications for the directions of the field.** The main result of the year was the null result⁴ of the MiniBoone experiment on the Fermilab Booster neutrino line. The long standing LSND claimed evidence for a neutrino transitions over a distance much shorter than those of both “solar” or “atmospheric” transitions was, in the end, dismissed. The possibility of a fourth sterile neutrino was thus pushed to much higher energy. **The 3*3 mixing matrix scenario emerges stronger:** if so, its

³ BENE's mandate is that to promote clear awareness, in our particle physics peer community, a) the physics interest of superior accelerator neutrino beams (Superbeams, Betabeams, Neutrino Factories) b) the promising on-going developments of accelerator technology that will make them possible c) the opportunities that exist to plan, fund and realize, on a realistic time scale, a much enhanced European accelerator neutrino complex .

⁴ Reference to MiniBoone result needed

one and only one CP violating phase is now certainly a decisive physical quantity to measure.

- 2) **followed closely progress of the CNGS.** First, the successful repairs in view of the main run of 2007 that resulted in a few days of high intensity running in September. Reaching full nominal intensity was prevented by new problems in the ventilation control electronics that forced an early 2007 shutdown and are now being tackled so that finally the run of 2008 can be a productive physics run. In view of the rapid progress of the **OPERA** detector, BENE follows that with great concern
- 3) **taken interest in the studies of the ultimate performance of the CNGS.** These have been stimulated in 2007 by the ICARUS group⁵ (envisaging a new much larger Li-Ar detector module and a new shallow underground detector hall not far from the present LNGS site where an incremental multi **ModuLAr** detector could take shape). While BENE looks forward to more ambitious future facilities, it is well aware that these can only be rooted in the expertise that has produced the CNGS and its predecessors, the WANF and the PS neutrino beams. It does therefore follow closely exploration of the upgrade paths to maximal CNGS performance under study by the CERN/AB CNGS team and recommends a more complete and conclusive study of the accelerator and physics performance.
- 4) **followed closely the progress of the EU Team in the T2K experiment in Japan.** This is a large team of about 150 physicist that is contributing major components of the T2K near (280m) detector, including the refurbished European NOMAD (former UA1) big magnet. T2K has recently become a CERN recognized as experiment (RE13), with establishment of a regular MoU⁶. The community supporting future neutrino facilities in Europe includes this team, as well as the smaller EU team working in **MINOS at Fermilab.**

In addition to detectors, Europe is preparing to contribute to T2K the result of a small dedicated experiment, known as NA61 or SHINE, on a secondary CERN SPS 40 GeV proton beam, measuring hadro-production of neutrino parents in the proton energy region of interest for T2K. Now approved NA61 is preparing to collect its data. Contribution to the T2K beam line are being provided by the RAL and Saclay Accelerator Divisions.

- 5) **followed closely the progress of the Betabeam DS** that is taking place within the Eurisol DS. This concerns only the original betabeam concept reusing the present SPS and using low Q value He and Ne ion decays, respectively for antineutrino and neutrino, meant to travel distances of the CERN-Frejus size. Major progress in the efficiency of extraction and reacceleration of ions as well as stacking and radiation containment in the storage ring has been achieved.

The use of different higher Q value ion decays, different production schemes, ion acceleration to higher Lorentz gamma factors (and consequently higher energy neutrinos travelling longer paths) and more will be tackled by the EuroNu DS. Different production schemes are particularly important, as a shortage in the production of Ne ions seems to affect the original ISOL scheme.

BENE experts contributed to a specific Betabeam meeting held in Aachen, 31 October-1 November, 2007 <http://bene.web.cern.ch/bene/071031BetabeamAachenBulletin.pdf> on the possibility of using the DESY HERA 800 GeV ring as a ion accelerator for betabeams applications. This is a new line of investigation that will be further explored and may lead to interesting developments.

⁵ LOI for a new very massive modular Li-Ar Imaging Chamber to detect low energy off axis neutrinos from the CNGS beam (22/12/2006) and Proceedings of the second CryoDet Workshop, Gran Sasso, June 2007

⁶ Memorandum of Understanding CERN/T2K, 24-Nov-2006

- 6) **followed the progress of R&D projects** in progress, **in Europe**, where much scientific, technical and organizational work has been done by BENE members in the collaborations
- a) **HARP** data analysis, providing finally more solid, experimental, production data of neutrino parents both in the forward and central production region
 - b) **HIPPI** design work of LINAC4, possibly the first backbone of a high intensity particle physics facility in Europe
 - c) **MICE** progress towards running the muon ionization cooling test facility being built at RAL
 - d) **MERIT** test installation of a target and solenoidal collection system exposed to a (single) CERN PS proton bunch comparable to the one foreseen at future higher power facilities
 - e) the non scaling FFAG demonstration electron model machine, **EMMA**, in preparation in Daresbury. 2007 marked the start of construction after approval of funding in 2006 that BENE follows very closely as it did in the design phase.

as well as outside Europe where also some work has been contributed by BENE members

- f) upgrade studies to a **NuMi+** facility, **Project X** studies for a new proton driver, the design of a new **FNAL-DUSEL conventional** neutrino beam line, the studies of the Neutrino Factory and Muon Collider Collaboration **NFMCC**, the **MUCOOL** project, developing and testing in the Fermilab Muon Test Area **MTA** components of a muon ionization cooling channel, in the US
 - g) the Japanese progress in the construction of the **T2K facility** and the planning a Japanese muon facility **PRISM** that may evolve into a neutrino factory (**NuFactJ**).
- 7) **contributed to all the few most important international events of the year:**
- WIN07 Workshop on Weak Interactions and Neutrino** January, India
 - the **Durham** Workshop in February
 - the late winter **Rencontres de Moriond** and **Rencontres de la Thuile**
 - the **Venice Neutrino Telescopes Workshop** in March
 - the 22nd PAC 2007** Particle Accelerator Conference, Albuquerque NM, 25-29 June
 - the **HEP Conference** in Manchester in July
 - the **Lepton Photon Conference** in Daegu, Korea in July
 - the **CARE07** and **BENE07 Workshops** at CERN in November
- and more, re-proposing updates on BENE basic strategy to aim at a Conceptual Design Report of a new ν -complex by 2012 or so, the main results of the Intern. Scoping Study on Neutrino Factory & Superbeam and progress of the Betabeam Design Study, advocating that a timely R&D program should not be procrastinated and recommending participation & commitment to the BENE FP7 projects and proposals and to its International Design Studies.
- 8) **contributed to its two main traditional yearly appointments.** A large BENE delegation was present to both meetings
- NuFact07**, in August, in Okayama. As stated earlier in BENE reports, the NuFact Workshop is the yearly international forum of a world-wide collaboration of several regional communities and has gained importance over the year, providing every year the most advanced review of the potential of both conventional and novel neutrino facilities. The BENE community has been presenting the work of one year giving almost 1/2 of the talks given in all parallel and plenary sessions of the workshop. <http://fphy.hep.okayama-u.ac.jp/nufact07/>
 - NNN07**, in October, in Hamamatsu. Very similarly, the NNN Workshop is also a yearly international forum of a world-wide collaboration of several regional communities, reviewing the physics case and the technical of Next very large mass

underground Neutrino and Nucleon decay detectors and structuring the international collaboration towards their realization. The concept of a large Megaton water detector has emerged independently in the 3 regions, under the name of Hyper-Kamiokande in Japan, of UNO in the USA, MEMPHYS in the Western Alps in Europe, where the Li-Argon option is also well alive (ModuLAr). The three designs have much in common, the collaborations have significant overlap and work in very close cooperation, with the aim of realizing commonly one such detector in the region that will offer the best and earliest opportunity. The BENE community has been presenting a significant fraction of the talks given at the workshop <http://www-rcen.icrr.u-tokyo.ac.jp/NNN07/>.

- 9) **been continuing its contributions to** the task forces set up by CERN set up to look into its options for proton accelerator of the future (**PAF**) and into the physics opportunities of those future proton accelerators (**POFPA**), with the decisive task of **designing the best possible proton complex** capable of best serving LHC and its upgrades, an ambitious neutrino program, some frontier aspects of kaon, muon and other fixed target physics, the nuclear physics of radioactive ion beams and possibly more. In addition, A. Blondel and P. Dornan have been our voices in the CERN **SPC**.
- 10) **contributed to the completion of the transition from ISS to IDS and to the start of the NF-IDS**. Launched at the BENE organized edition NuFact05 in Frascati and formally concluded in August 2006 at NuFact06, the International Scoping Study on Neutrino Factory and Superbeam <http://www.hep.ph.ic.ac.uk/iss/> had in reality to use almost entirely the year 2007 to complete its reports, now available on its Web Site. An overall study report is accompanied by the three reports of the three Physics, Accelerators, Detectors Working Groups. A detailed account of the results achieved was already provided in the BENE Yearly Report 2006.
The start of a four or so years long NF-IDS, International Design Study, <http://www.hep.ph.ic.ac.uk/ids/> focusing exclusively on the Neutrino Factory, was prepared during 2007. A transition meeting took place at CERN in March 2007 <http://www.hep.ph.ic.ac.uk/ids/communication/cern-2007-03-29/index.html>, an ad-hoc steering group presented its plans to NuFact07 in August. NuFact07 endorsed the **basic strategy to aim at a Design Report of a new v-complex** by 2012 or so.
A steering committee was set up and a first meeting of the NFS-IDS took place <http://www.hep.ph.ic.ac.uk/ids/communication/RAL-2008-01-16/index.html> in January 2008 at RAL. The study is going, now, and will work and meet together with the Neutrino Factory package of the EuroNu FP7 DS. Its work structure has Accelerator Design, Detector Design and Performance Evaluation task forces.
- 11) **been preparing a less lucky FP7 proposal for a Marie Curie Initial Training Network** centred around the themes of BENE. The potential of the activities of BENE interest for a ITN was acknowledged by the referees and we were advised to resubmit the proposal after more careful preparation. We will do so at next call. Admittedly, we did not foresee enough time for its preparation.
- 12) **been hosting for the first time in Europe an FFAG (Fixed Field Alternated Gradient) Workshop** April 12-17 at LPSC in Grenoble. <http://lpsc.in2p3.fr/congres/FFAG07/> We observe today a revival of this concept, that is as old as the principle of strong focusing, when pulsed field prevailed in the fifties for high energy applications. The use of fixed fields, not ramping, that implies growing orbits and so large acceptance and limited acceleration factor, per FFAG, is returning of interest today, pioneered in Japan by Mori, Machida et al. and then in the US. It can accelerate very rapidly, as necessary for unstable neutrino parents, and with very high currents, thus promising applications as a proton driver too. Over a wide range, low energies for cancer therapy applications and medium energies for particle physics applications. Part of a FP7 JRA being proposed in EuCARD concerns FFAGs. Two important achievements of the year in this sector have been the publication of

Franck Lemuët's' PhD thesis (April 2007) and of a 100 pages major publication on the subject of FFAGs in the ICFA BD News Letter #23 (Ch Prior Ed.)

- 13) **been fostering the establishment of a detector R&D effort**, mandatory for the achievement of its goals. The themes and collaborations of the neutrino related activities being proposed in the DEVDET IA have been identified at NNN07 and at **Golden07**, First International **Workshop on the Golden Channel at a Neutrino Factory**. <http://evalu29.ific.uv.es/golden07//Welcome.html>. The baseline detector for this electron to muon neutrino golden transition is currently considered to be a Magnetised Iron Neutrino Detector (MIND) of the MINOS type. Alternative is a Totally Active Scintillation Detector (TASD) of the NOvA type. A complementary approach is the one of Magnetized Emulsion Cloud Chambers (MECC) extending the functionality of OPERA like ECCs.
- 14) **contributed to the organization of the 3rd International High-Power Targetry Workshop** organized in September 10 – 14, 2007 Bad Zurzach, Switzerland by the Paul Scherrer Institut, Villigen PSI. <http://asq.web.psi.ch/hptrgts/index.html> The High-Power Targetry Workshop brings together interested scientists and engineers from the international community. In particular scientist from the major high-energy laboratories in the US, Japan and Europe are addressed. Subject matter of the workshop focuses on problems and solutions for targetry utilizing MW class future accelerators. Both high average power and high peak power issues are explored. For the third workshop, the organizing committee had decided to focus on future activities which will lead toward successful implementation of targets for proposed new multi-MW class proton drivers.
- 15) **been following with great attention a renewed push in the USA on a Muon Collider and Neutrino Factory option for Fermilab** and the establishment and first results of a Muon Collider Task Force (MCTF) at Fermilab, in addition and in close collaboraton with the long established US NFMCC Collaboration. Among the most promising aspects there is the renewed discussion of a high power 8 GeV proton linac (the X Project) capable of driving Main Injector neutrino lines and possibly a Neutrino Factory, before a Muon Collider.
The UK Neutrino Factory (UKNF) Collaboration has organized in Abingdon, Oct 21-24, a very stimulating Topical Workshop on the physics and R&D programs of Neutrino Factory & Muon Collider, to exchange experience with this effort. <http://indico.cern.ch/conferenceDisplay.py?confId=16035>
- 16) **organized during the annual CARE07** <http://care07.web.cern.ch/CARE07/> meeting. **its yearly BENE07 Workshop** <http://bene.web.cern.ch/bene/BENE07Agenda.pdf>. Its presentations <http://care07.web.cern.ch/CARE07/Presentations/> reviewed extensively the achievements of the year in Europe and elsewhere listed above. The orientation of our IA proposals was discussed and endorsed by the community.
- 17) **been starting preparation of the NuFact08 and NNN08 Workshops, both in Europe**. The first returns after the canonical three years and will be organized in Valencia in late June <http://ific.uv.es/nufact08/>. NNN08 International Workshop on Next Nucleon decay and Neutrino detectors will take place in Paris 10-13 September 2008. <http://nnn08.in2p3.fr/>
2008 thus promises to be an intense year for European initiative in our sector.

N2.1 MEETINGS

The major events organized or co-organized by BENE in 2007 were:

- 1) **WIN07 the 21 International Workshop on Weak Interaction and Neutrinos**, Jan 15-20 in **Kolkata, India**

- 2) **Open meeting of the BENE SG, Feb 21 2007, CERN, Geneva, Switzerland**, <http://bene.web.cern.ch/bene/070221Open%20Meeting%20of%20the%20BENE%20Steering%20Group.doc>, organized to review the work in progress in the preparation of the FP7 Design Study proposals, EuroNu and also Laguna
- 3) **Plenary ISS/IDS meeting, March 29-31 2007, CERN, Geneva, Switzerland** <http://www.hep.ph.ic.ac.uk/ids/communication/cern-2007-03-29/> that defined the ways of the transition from scoping to design study.
- 4) **FFAG07, Apr 12-17 2007, LPSC Grenoble, France** in Grenoble. <http://lpsc.in2p3.fr/congres/FFAG07/>
- 5) **Golden07**, First International Workshop on the Golden Channel at a Neutrino Factory. <http://evalu29.ific.uv.es/golden07//Welcome.html>, Jun 27-30 2007, Valencia, Spain, focusing on magnetic detectors for the so called "golden transition channel" at the Neutrino Factory
- 6) **NuFact07 Summer school, 6th International School on Neutrino Factories, Superbeams and Betabeams**, Jul 27 – Aug 04 2007, KEK Tsukuba, Japan, coupled yearly to the NuFact07 Workshop, with the aim of the school is to provide young particle physicists with an introduction to both particle and accelerator physics aspects of conventional and novel neutrino beams. We had many EU lecturers as usual, a few EU students attended, most being of course Asians, this year http://fphy.hep.okayama-u.ac.jp/nufact07/summer_school
- 7) **the NuFact07 International Workshop**, the 9th International Workshop on Neutrino Factories, Superbeams & Betabeams, 6-11 August, Okayama, Japan as detailed in several places in this report.
- 8) **the 3rd International High-Power Targetry Workshop** organized in September 10 – 14, 2007 Bad Zurzach, Switzerland by the Paul Scherrer Institut, Villigen PSI. <http://asq.web.psi.ch/hptrgts/index.html>
- 9) the **NNN07 Workshop on Next Nucleon decay & Neutrino** <http://www-rcen.icrr.u-tokyo.ac.jp/NNN07/>, 2-5 October, Hamamatsu, Japan, 6th edition of this international Workshop, as detailed in several places in this report. .
- 10) A regular (short) week of meetings of BENE related work packages, study groups and R&D projects (**BENE07**) took place during **CARE07** in Frascati. We had parallel meetings of several WPs. Then a plenary session of all accelerator WP together, where the themes of each of them (DRIVER, TARGET, COLLECTOR, MUFRONT, MUEND and BETABEAM) and those specific of the R&D experiments in progress will each covered Plans for the IA proposal were discussed and **the agenda of BENE** in 2008 was finalized.

At the WP level, it felt wise to limit dedicated meetings, in addition to the BENE meetings, the many plenary and parallel meetings of the IDS and ISS and the proliferating multiple international appointments.

The PHYSICS WP met in the occasion of the plenary and parallel meetings of the ISS/IDS Physics and Detector Group g, of the meetings preparing the proposal of the Physics and Detector WP of the EuroNu DS proposal, in the WG1 of NuFact07 and at the BENE07 Workshop.

The Accelerator WPs, DRIVER, TARGET; COLLECTOR, NOVEL NEUTRINO BEAMS met in the occasion of the plenary and parallel meetings of the ISS/IDS Accelerator Group, of the meetings preparing the proposal of the Superbeam, Neutrino Factory and Betabeam WPs of the EuroNu DS proposal, in the WG3 of NuFact07 and at the BENE07 Workshop.

Phone-meeting are the common practice to prepare the major events.

MuEND organized FFAG07, chaired by F. Méot.

In addition, BENE has been present to all major neutrino events in the year. In 2007 we will mention only two most important and representative events, the **European Physical Society High Energy Physics Conference** in Manchester, 19-25 July <http://www.hep.man.ac.uk/HEP2007/> and the XXIII International Symposium on **Lepton and Photon** Interactions at High Energy. Aug 13-18, Daegu, Korea, http://chep.knu.ac.kr/lp07/htm/s11_01_01.htm, both attended by a small BENE delegation with speakers in some sessions and/or panel discussions.

BENE has also made reports at regular ECFA meetings in the year. It also keeps regular contact with the Chairs of the CERN scientific committees (SPSC, SPC) and 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.

Regular update of the database of publications by the work package convenors and the BENE deputy coordinator has been hindered by the lack of a deputy coordinator. It has now been resuming as documented by the preliminary list of not yet properly filed publications assembled in the Appendix

N2.3 Web Sites

The BENE Main Web Page has been improved and refurbished at <http://bene.web.cern.ch/bene/>.

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, continues. 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.

The Mailing List of members, bene@cern.ch, has been further extended. 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 2006

Perhaps the best summary of the technical achievements stimulated this year by BENE is the list of presentations, in part supported by BENE funds, made by EU speakers at the two main yearly events of interest for BENE: NuFact07 and NNN07.

Those at NuFac07 include neutrino phenomenology (T. Schwetz), the optimization of a Neutrino Factory (W. Winter), the transition from ISS (the International Scoping Study)

to the NF-IDS the Neutrino Factory Int. Design Study (K. Long), the achievements of the ISS Physics Group (P. Hernandez) Accelerator Group (C. Prior) and Detector Group (A. Cervera) , the status of hadro-production measurements and precise neutrino flux calculations (J. Panman), calculations of neutrino interactions from MeV to GeV (J. Nieves), the technical challenges of the Eurisol Betabeam (S. Hancock), future options for betabeams focusing on production issues (M. Lindroos), the status of MICE (R. Sandstrom), target R&D for high power proton beam applications (A. Fabich), the general conclusion of the Workshop (A. Blondel), tracking and interaction studies in the betabeam ring (A. Fabich), the options for the Eurisol betabeam within the CERN upgrade plans (A. Fabich), the EuroNu Design Study (M. Lindroos), the T2K and NuFact targets and windows (C. Densham), the MERIT experiment (A. Fabich), the muon Dogbone Cooler (C. Roger), non-scaling FFAGs (S. Machida), muon rings for cooling and acceleration (J. Pasternak), the RACCAM FFAG R&D (F. Meot), the status of HARP (G. Catanesi), the status of NA61-SHINE (N. Abgrall) , the role of near detectors at neutrino factories (A. Laing), performance and prototypes of magnetized iron neutrino detectors (A. Cervera and F. Terranova), low energy neutrino factories (M. Ellis), quark lepton complementarity (W; Winter), sterile neutrinos after the MiniBoone result (T. Schwetz), CPV from non unitary leptonic mixing (J. Lopez-Pavon), particle production at MICE target (P. Soler), recent K2K results (C. Mariani), first muon lifetime results from FAST (C. Casella) . Those at the smaller NNN07 event include summary from OPERA (M. Spinetti), present understanding of neutrino oscillations (J. Valle), future prospects on neutrino oscillation phenomenology (P. Huber), report of European design study EUROnu (M. Dracos), report of LAGUNA (L. Mosca), report of MEMPHYS (N. Vassilopoulos), report of GLACIER (A. Rubbia) PMm2 readout electronics (J. E. Campagne).

BENE's further acceleration of initiative in 2007 is driven by the work of its Steering Committee that has created the necessary networking tools for this and organized the main meetings and the other events. Regular phone-conferences are the main tool of coordination in the interval between meetings. Closed or Open meeting of the SG in person occur then at each of the major events that BENE supports.

The BENE SG was the core of the editorial board of the FP7 proposals

The following text and five tables highlight the progress of work done by each work package by listing the lowest level subtasks of the BENE detailed implementation plan. No major deviations are reported, with one notable exception in the driver sector (see below, as already remarked last year).

All WP s have had regular phone-meetings over the year.

WP1 (PHYSICS) During 2007 the report about future neutrino beams and in particular neutrino factories performed in conjunction with the ISS study group (A. Bandyopadhyay et al. [ISS Physics Working Group], "Physics at a future Neutrino Factory and super-beam facility, arXiv:0710.4947 [hep-ph]) has been completed.

This report performs a complete comparison of SuperBeam, Beta Beam and Neutrino Factory performances as far as the discovery potential of θ_{13} is concerned.

Leptonic CP violation and neutrino mass hierarchy. It represents also an important effort in individuating the most sensitive areas of improvement for such facilities.

The problematic of systematic errors in SuperBeam experiments, potentially the most important limiting factor of these facilities, have been studied by P. Huber, M. Mezzetto and T. Schwetz ("On the impact of systematical uncertainties for the CP violation measurement in superbeam experiments", arXiv:0711.2950 [hep-ph]) where the impact of close detectors, their needed performances and the impact of external experimental informations like direct measurements of neutrino cross sections and hadro-production have been quantified

On the Beta Beam side, the exploitation of the potential of a Beta Beam based on Boron and Lithium ions has been fully assessed by P.Coloma, A.Donini, E.Fernandez-Martinez and J. Lopez-Pavon (" θ_{13} , δ and the neutrino mass hierarchy at a $\gamma=350$ double baseline Li/B beta-Beam", arXiv:0712.0796 [hep-ph]), while in A.Donini et al., "Neutrino hierarchy from CP-blind observables with high density magnetized detectors", Eur. Phys. J. C 53 (2008) 599, arXiv:hep-ph/0703209) the physics reach of an iron magnetized detector detecting atmospheric neutrinos and Beta beam neutrinos has been quantified.

An innovative setup to make available low energy neutrinos from a standard Beta Beam has been proposed by R.Lazauskas, A.B.Balantekin, J.H.De Jesus and C.Volpe, ("Low-energy neutrinos at off-axis from a standard beta-beam", Phys. Rev.D 76 (2007) 053006, arXiv:hep-ph/0703063).

The Globes open source package, now worldwide used in simulation of sensitivities of future neutrino beam experiments had a major new release, as described in P.Huber, J.Kopp, M.Lindner, M.Rolinec and W.Winter, "New features in the simulation of neutrino oscillation experiments with GLoBES 3.0", Comput. Phys. Commun. 177 (2007) 432, arXiv:hep-ph/0701187].

WP2 (DRIVER) has continued its comparative study of M-Watt proton driver designs. An important element in this comparison is the recently published report CERN-AB-2007-014 that describes a low power version of SPL, compares it to a RCS solution and consider the potential for future projects. The report concludes that: "An RCS-based injector is the logical choice if cost is the only concern. However, if the ease of operation for LHC and the potential for other users (including future ones which could be served by an upgrade) are of more importance, then an SPL-based injector makes full sense." Of special interest for the neutrino community is this observation: "There is also a significant difference between the proton flux that can be delivered by the low energy accelerators (up to 50 GeV) to the other users, once the needs of the high energy machine are satisfied. In most cases, there are approximately 2.5 times more protons available at 50 and 4 GeV when using the SPL."

Clearly the BENE network should continue to closely follow these promising developments and provide input to optimise the physics potential of proton at CERN.

An important new contribution toward a proton driver for neutrino physics is the publication of the report by the International Scoping Study of a Future Neutrino Factory and Superbeam Facility "Accelerator design concept for future neutrino facilities" (RAL-TR-2007-23) which summarizes the findings of the Accelerator Working Group. This report embodies the ideas and discussions at the various ISS meetings in which representatives of the BENE network actively contributed. Here we will mention in particular the conclusion that the desired range for the proton energy is 10 ± 5 GeV reflects the consensus reached in the broad international community on the requirements for the proton driver of a Neutrino Factory,

Finally, a good part of the activities in this WP has been devoted to the preparation of the FP7 proposal of the EuroNu design study. In this context, new energies from RAL and Saclay have been attracted to the BENE framework. Thanks to the active role of the BENE framework a strong european collaboration was formed and an important fraction of EuroNu resources will tackle most difficult aspects of the SuperBeam project. Clearly this design study will provide an excellent focussing point for the studies related to the proton driver.

Concerning FP7, in the context of the EuCARD IA , several JRA (COLMAT and SRF) are of particular importance to the proton driver plans and these studies and their implications should be closely monitored .

WP3 (TARGET) registered this year the successful achievement of the MERIT experiment, a major milestone in the high power neutrino target programme. This US led experiment took place at CERN over October-November 2007 with the involvement of BENE network staff. A 20 m/s mercury jet was injected into a solenoid with a magnetic field ranging up to 15 T, with

the simultaneous interaction with a proton beam pulse of up to 30×10^{12} protons of 24 GeV in a 2.5 μ s beam spill. In addition a number of experiments were carried out to study the effect of a lower intensity two bunch pulse structure with bunch separations in the range 2 - 700 μ s. The initial observations from these experiments were very positive, with indications that the magnetic field suppressed the proton beam induced mercury jet filamentation. Analysis of the experimental data is ongoing.

In addition, there have been a number of parallel contributions in the study of solid targets at RAL. (1) The T2K target and beam window systems design and development have been completed, and the 1st beam window and target manufactured ready for installation in 2008. (2) The study of shock waves generated in thin tungsten wires using a pulsed power supply has demonstrated that the material can withstand the conditions of shock and fatigue that would be generated in a solid tungsten neutrino factory target, with samples experiencing over 10^7 cycles at 2000K. (3) A new study into flowing powder targets has also been initiated, with early experiments generating a tungsten powder jet with material density of 25-30 % flowing at up to 15 m/s.

Finally, there have been a number of highly productive workshops and meetings on the subject of high power targets, principally (1) a joint BENE/EURISOL high power targets meeting held at CERN and (2) the 3rd High Power Targetry Workshop hosted by PSI. Presentations by BENE contributors have been made at the usual forums, e.g. Nufact07 and at the regular T2K collaboration meetings. There have also been numerous private meetings involving BENE members held at various locations e.g. ORNL in Tennessee and IPUL in Latvia.

WP4 (COLLECTOR) The WP has concentrated its efforts on the definition of a horn-type collector which is a critical element for a 4 MW Super-Beam. All components of this collector are under study with the main aim to increase as much as possible the reliability of the system. New ideas are now under investigation in order to better afford the 4 MW primary proton beam as for instance the split in 4 of the primary beam and send it on 4 target/horn systems. This would be possible due to the small horn size needed for this application and to the short (20-50 m) length of the corresponding decay tunnel. This could also allow to use a solid target instead of a liquid one more difficult to handle.

In this study, the horn pulsing system is very important. Several options have been investigated with the help of private companies.

In order to well study the power dissipation in the horn, the presence of the target inside the horn has to be taken into account. Studies have been started on this subject and will continue in the framework of the EuroNu FP7 DS project. In EuroNu, studies will also be done about all mechanical aspects and possibilities of replacing remotely the whole system in case of failure.

The main achievements of the 3 components of **WP5 (NOVEL NEUTRINO BEAMS)**

WP5a (MUFRONT) has been active this year in the following sectors

- 1) preparation of the FP7 design study proposal submitted in May
- 2) further progress in the design and specification of the Neutrino Factory muon front-end was made during the ISS, outlining a baseline ionisation cooling channel in which lithium-hydride absorbers are interspersed with RF cavities in a solenoidal transport lattice.
- 3) the final effort to bring into operation the proof-of-principle of the ionisation cooling technique that will be provided by the international Muon Ionisation Cooling Experiment (MICE) which is being prepared at the Rutherford Appleton Laboratory. Over the reporting period, significant progress has been made in the preparation of infrastructure required in the MICE Hall. In spite of some delay originating from some unexpected technical difficulties

and from the recent revisions of the particle physics budget in the UK, this crucial demonstration experiment is progressing steadily and it will be taking data in 2008.

Difficulties with the pion-production target are being recently successfully overcome in the ISIS proton beam. Construction of beam-line components and refurbishment of the magnets required for the beam line (from RAL and PSI) is nearing completion. The first elements of the particle identification system (time-of-flight counters, a Cherenkov detector, and a calorimeter) are being installed. The spectrometer solenoids as well as the scintillating-fibre trackers for the experiment are also close to final installation.

4) the continuing work on the study of novel cooling- and phase-rotation schemes based on helicoidal cooling channels, non-scaling FFAGs and more.

5) preparation of some sections of the FP7 IA proposal EuCARD, submitted then on Feb 29, 2008. This includes the transnational access program for MICE and studies relevant for the front end of a neutrino factory in the two JRAs proposed for normal conducting and superconducting RF.

WP5a physicists have given presentations on MICE and the other activities at a number of international meetings and workshops including the International Neutrino Factory, beta-beam, and super-beam Workshop (NuFact07), which took place in Okayama, Japan, in August.

Special attention is being devoted to the renewed efforts developing in this sector in the US in general and at Fermilab in particular. The very stimulating Topical Workshop on the physics and R&D programs of Neutrino Factory & Muon Collider organized by the UK Neutrino Factory (UKNF) Collaboration in Abingdon, Oct 21-24 provided a rewarding exchange experience in this sector.

WP5b (MUEND) has been promoting

- design studies concerning the pumplet lattice muon accelerator and its application as proton driver, and electron model of a pumplet lattice proton driver

- design studies concerning the muon FFAG accelerators : beam dynamics, effects of defects, design optimizations. Milestones : ISS-NuFact Design Report, to be published in 2008. The first PhD thesis on the topic [BibLemuet] has been presented in April 2007 at Paris-XI Orsay University. WP5b. The “harmonic number jump” method, a possible way of combining scaling FFAGs and high frequency RF, is subject of a thesis at KURRI-Institute, Kyoto University, in collaboration with LPSC, Grenoble.

- design studies concerning the muon storage rings : machine design, beam dynamics, effects of defects, design optimizations, spin transport. Milestones : ISS-NuFact Design Report, to be published in 2008. The first PhD thesis on the topic has been presented in April 2007 at Paris-XI Orsay University. WP5b.

- participation in EMMA construction, started at Daresbury in April 2007. EMMA involves scientists from CARE/BENE, BNL, FERMILAB, RAL, Daresbury Lab., KEK, KURRI, LPSC-Grenoble. EMMA has yielded many thesis subjects, is fostering formation of young students to FFAG theory and technology. Regular phone meetings (about every 2-3 weeks), design review meetings at Daresbury (Feb. and Dec. 2007). Hardware design and fabrication now well advanced, quadrupoles to be ordered by end 2007. Detailed status of the project available at <http://hepunix.rl.ac.uk/uknf/wp1/emodel/>. EMMA will organize the 2008's FFAG workshop, in the Daresbury Lab. region.

- participation in RACCAM design study, all details available at http://lpsc.in2p3.fr/service_accelerateurs/raccam.htm. RACCAM has organized and hosted the FFAG 2007 workshop in Grenoble. In Nov. 2007 RACCAM has launched the fabrication of the first 200 MeV-proton class prototype of a spiral scaling FFAG magnet, proper to use in proton driver or muon lattice, as well as in medical and industrial applications. RACCAM has organized a Miniworkshop at the Lacassagne anti-cancer Hospital, Nice, Dec. 2007, “Medical

application of FFAG accelerators”, all details on http://lpsc.in2p3.fr/service_accelerateurs/raccam.htm (meetings).

These studies are performed in collaboration with the ISS accelerator working group. They have been subject to contributions to FFAG-2007 (Grenoble), FFAG07 (Kyoto Univ.), PAC 07, NuFact 07, the EU Cyclotron Conference (Catania), ICFA Beam Dynamics News Letter 43, and in the many BENE, EMMA and RACCAM meetings (available via web links).

In addition, the proposal of an FP7 : EUROFFAG JRA, first drafted by WP5b in 2006 in view of CARE-Next IA, has finally become the “FFAG” task (Rob Edgecock Coordinator) within “Assessment of Novel Accelerator Concepts” (ANAC) JRA in EuCARD FP7 IA. Fundings will be dedicated to EMMA upgrade.

Within RACCAM, WP5b is preparing now an application to the Agence Nationale de la Recherche, France for 2008's funds for further R&D in the domain of spiral scaling FFAG lattice (the LICORNE project). A new team is being constituted in that aim : LPSC (Grenoble, Coordinator Lab.), AIMA-Developpement (Nice, Lacassagne Hospital), IBA (Louvain-la-Neuve, Belgium), ETOILE (Lyon, Carbon Synchrotron Installation for hadrontherapy), SIGMAPHI (Vannes, magnet Industrial).

WP5c (BETABEAM) The beta-beam BENE WP serves as a link between the beta-beam activities (the betabeam WP within the FP6 design EURISOL DS, the preparation of the proposal of a WP in the FP7 EuroNu design study and more) and the neutrino physics community. The Eurisol design study is making good progress and the BENE community has been updated on a regular basis through the BENE meetings on this progress. As there is no work package on oscillation physics with electron (anti-)neutrino beams within the design study and that the BENE meetings are also the only forum for these two communities to meet. In 2007 the beta-beam was discussed at the BENE07 and other meetings and presented at NUFACT 07. A course with tutorials was given for beta-beams at the NUFACT School at KEK in Japan.

With the approval of the EuroNu DS, betabeam design work will continue, addressing novel issues as high gamma and/or high Q-value beta-beams and new scenarios for production and bunching of isotopes.

An informal meeting to assess Louvain's last measurements of production rate of ions was held in Louvain-la-Neuve, 27 July, 2007

A possible green-field study for DESY-Hamburg for a high-gamma beta-beam facility was discussed at a special <http://bene.web.cern.ch/bene/071031BetabeamAachenBulletin.pdf> meeting in Aachen Oct 31-Nov 1 and it was agreed to advance on first feasibility studies for such a facility in the coming year.

BENE has been made aware of an extensive study undertaken at CERN and TRIUMF of collimation and magnet protection issues for the beta-beam. The work included i) an adaptation of the ACCSIM tracking code to enable parallel tracking of mother and daughter nuclei within the full dipole aperture, ii) development of an interface between ACCSIM and the particle-matter interaction code FLUKA, iii) a tracking campaign of beta-beam isotopes using the modified ACCSIM code and iv) FLUKA studies for particle losses in the magnets and the magnet protection elements.

BENE was also exposed to a study of cross sections using recently updated Nuclear Physics cross section codes from GSI done at CERN, with the objective of identifying new production channels for beta-beam isotopes.

The web site for the beta-beam at <http://cern.ch/beta-beam> is documenting the progress within the design study and gives reference to new published work.

Work Package 1: PHYSICS.

	Title	Original begin date (Annex 1)	Original end date (Annex1)	Estimated Status	Revised end date
WP1	PHYSICS				
1.1	Improvement of the WP Web Site	Jan. 2007	Mar 2007	95%	Continuously improving
1.2	WP Spring Meeting	Mar 2007	Mar 2007	100 %	held jointly with ISS
1.3	Close in on physics analysis, motivate EuroNu DS	May 2007	May 2007	100%	
1.4	Topical Workshop at WP Summer Meeting	Aug 2007	Aug 2007	100 %	joint with NuFact07
1.5	WP Fall Meeting	Oct 2007	Oct 2007	100 %	
1.6	Physics sections of EuroNu Proposal	May 2007	May 2007	100%	

Work Package 2: DRIVER

	Title	Original begin date (Annex 1)	Original end date (Annex1)	Estimated Status	Revised end date
WP2	DRIVER				
2.1	Improvement of the WP Web Site	Jan 2007	Mar. 2007	95%	Continuously improving
2.2	Finalize criteria of SPL vs RCS comparison	Jan 2006	Mar. 2006	40% Taking longer!!	> 2008, arger picture emerging, CERN Council oversees
2.3	Identify R&D beyond HIPPI, motivate EuroNu	May 2007	May. 2007	100 %	
2.4	WP Spring Meeting	Mar 2007	Mar 2007	100 %	held jointly with ISS
2.5	Topical Workshop at WP Summer Meeting	Aug 2007	Aug 2007	100 %	joint with NuFact07
2.6	WP Fall Meeting	Oct 2007	Oct 2007	100 %	
2.7	Driver sections of EuroNu Proposal	May 2007	May 2007	100%	

Work Package 3: TARGET

	Title	Original begin date (Annex 1)	Original end date (Annex1)	Estimated Status	Revised end date
WP3	TARGET				
3.1	Improvement of the WP Web Site	Jan 2007	Mar. 2007	95%	Continuously improving
3.2	Close in on hi power target choice, motivate EuroNu & R&D post MERIT	May 2007	May 2007	100%	
3.3	WP Spring Meeting	Mar 2007	Mar 2007	100 %	held jointly with ISS
3.4	International Target Workshop	Sep 2007	Sep 2007	100 %	
3.5	WP Fall Meeting	Oct 2007	Oct 2007	100 %	
3.6	Target sections of EuroNu Proposal	May 2007	May 2007	100%	

Work Package 4: COLLECTOR

	Title	Original begin date (Annex 1)	Original end date (Annex1)	Estimated Status	Revised end date
WP4	COLLECTOR				
4.1	Improvement of the WP Web Site	Jan 2007	Mar. 2007	95%	Continuously improving
4.2	Close in on collector choice, motivate EuroNu & further R&D	May 2007	May 2007	100%	
4.3	WP Spring Meeting	Mar 2007	Mar 2007	100 %	held jointly with ISS
4.4	International Topical workshop	Aug 2007	Aug 2007	100 %	joint with TARGET
4.5	WP Fall Meeting	Sep 2007	Sep 2007	100 %	joint
4.6	Collector sections of EuroNu Proposal	May 2007	May 2007	100%	

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	Improvement of the WP Web Site for the three areas of interest of the WP	Jan 2007	Mar. 2007	95%	Continuously improving
5.2	Assemble NuFact and Betabeam guidelines for EuroNu	May 2007	May 2007	100%	
5.3	WP Spring Meeting	Mar 2007	Mar 2007	100 %	held jointly with ISS
5.4	Topical Workshop at WP Summer Meeting	Aug 2007	Aug 2007	100 %	joint with NuFact07
5.5	WP Fall Meeting	Oct 2007	Oct 2007	100 %	
5.6	WP multiple sections of EuroNu Proposal	May 2007	May 2007	100%	

N2.5 SIGNIFICANT ACHIEVEMENTS

- Submission and approval of FP7 EuroNeutrino and Laguna Design Studies
- Transition from International Scoping to Design Studies
- Timely progress on the preparation of FP7 IA Proposals

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	Proposal of EuroNu Design Study s	All WPs	CCLRC, INFN-Na,	41	41
D	Draft of FP/ IA Proposal, to be delivered by month 50	All WPs	INFNNa CERN	48	48

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

Date	Title/subject	Location	Number of participa nts	Web Site Address
Jan 15-20	21 st International WIN Workshop	Kolkata	110	http://www.saha.ac.in/anp/win07.sinp/win07/index.htm
Feb 21	Open meeting of the BENE Steering Group	CERN	25	http://bene.web.cern.ch/bene/070221Open%20Meeting%20of%20the%20BENE%20Steering%20Group.doc
Mar 29-31	Plenary ISS/IDS meeting	CERN	45	http://www.hep.ph.ic.ac.uk/ids/communication/cern-2007-03-29/
Apr 12-17	FFAG07	Grenoble	40	http://lpsc.in2p3.fr/congres/FFAG07/
Jun 27-30	<u>Golden07</u>	Valencia	50	http://evalu29.ific.uv.es/golden07//Welcome.html
6-11 Aug	<u>NuFact07 International Workshop</u>	Okayama	160	http://fphy.hep.okayama-u.ac.jp/nufact07/
Sep 10 – 14	3 rd International High-Power Targetry Workshop	Bad Zurzach	55	http://asq.web.psi.ch/hptrgts/index.html
Sep30- Oct05	Cyclotron Confence 2007	Giardini Naxos	150	http://www.lns.infn.it/Cyclotrons2007/
2-5 Oct	<u>NNN07 Workshop on Next Nucleon decay & Neutrino</u>	Hamamatsu	84	http://www-rcen.icrr.u-tokyo.ac.jp/NNN07/
Nov 8-15	FFAG07	Kyoto	40	http://hadron.kek.jp/FFAG/FFAG07_HP/
Nov 14-17	BENE07	CERN	40	http://bene.web.cern.ch/bene/BENE07Agenda.pdf http://care07.web.cern.ch/CARE07/Presentations/

Appendix: informal list of BENE related publications**3+1 neutrinos at the CNGS**

A. Donini, M. Maltoni, D. Meloni, P. Migliozzi, F. Terranova . Apr 2007. 23pp.
Temporary entry e-Print: arXiv:0704.0388.

Determination of the neutrino mass hierarchy in the regime of small matter effect

Thomas Schwetz
CERN-PH-TH-2007-060, Mar 2007. 13pp.
e-Print: hep-ph/0703279.

Neutrino hierarchy from CP-blind observables with high density magnetized detectors

A. Donini, E. Fernandez-Martinez, P. Migliozzi, S. Rigolin, L.Scotto Lavina, M. Selvi, T. Tabarelli de Fatis, F. Terranova
Mar 2007. 12pp.
e-Print: hep-ph/0703209.

Self-Calibration of Neutrino Detectors using characteristic Backgrounds

Joachim Kopp, Manfred Lindner, Alexander Merle
Mar 2007. 6pp.
e-Print: hep-ph/0703055.

Which long-baseline neutrino experiments?

V. Barger, P. Huber, D. Marfatia, W. Winter
Mar 2007. 30pp.
e-Print: hep-ph/0703029.

Neutrino mixing sum rules and oscillation experiments

S. Antusch, P. Huber, S.F. King, T. Schwetz
CERN-PH-TH-2007-036, FTU-AM-07-03, IFT-UAM-CSIC-07-08, SHEP-07-05, Feb 2007.
18pp.
e-Print: hep-ph/0702286.

Discovery reach for non-standard interactions in a neutrino factory

Joachim Kopp, Manfred Lindner, Toshihiko Ota
Feb 2007. 15pp.
e-Print: hep-ph/0702269.

Low energy neutrino factory for large theta(13)

S. Geer, O. Mena and S. Pascoli
arXiv:hep-ph/0701258.

New features in the simulation of neutrino oscillation experiments with GLoBES 3.0: General Long Baseline Experiment Simulator

Patrick Huber, Joachim Kopp, Manfred, Mark Rolinec, Walter Winter
TUM-HEP-656-07, Jan 2007. 14pp.
e-Print: hep-ph/0701187.

What is the probability that theta(13) and CP violation will be discovered in future neutrino oscillation experiments?

Thomas Schwetz
CERN-PH-TH-2006-266, Dec 2006. 11pp.
e-Print: hep-ph/0612223.

Physics with a very long neutrino factory baseline

Raj Gandhi, Walter Winter

Dec 2006. 27pp.

*Published in Phys.Rev.D75:053002,2007. e-Print: hep-ph/0612158.***Leptogenesis and low energy CP violation in neutrino physics**

S. Pascoli, S. T. Petcov and A. Riotto,

*e-Print: hep-ph/0611338.***Comparison of the CERN-MEMPHYS and T2HK neutrino oscillation experiments**

Thomas Schwetz

CERN-PH-TH-2006-241, Nov 2006. 3pp. Talk given at Workshop on Neutrino Oscillation Physics (NOW 2006), Otranto, Lecce, Italy, 9-16 Sep 2006.

*e-Print: hep-ph/0611261.***Upgraded experiments with super neutrino beams**

V. Barger, Patrick Huber, Danny Marfatia, Walter Winter

Oct 2006. 4pp.

*e-Print: hep-ph/0610301.***Towards the European strategy for particle physics: the Briefing Book**

T. Akesson et al. Sep 2006. 199pp.

*Temporary entry e-Print: hep-ph/0609216.***Connecting low energy leptonic CP-violation to leptogenesis**

S. Pascoli, S.T. Petcov, Antonio Riotto

CERN-PH-TH-2006-179, IPPP-06-63, DCPT-06-126, Sep 2006. 4pp.

*e-Print: hep-ph/0609125.***Physics opportunities with future proton accelerators at CERN**

A. Blondel, L. Camilleri, A. Ceccucci, J. Ellis, M. Lindroos, M. Mangano, G. Rolandi

CERN-PH-TH-2006-175, Sep 2006. 39pp.

*e-Print: hep-ph/0609102.***MEMPHYS: A Large scale water Cerenkov detector at Frejus**

A. de Bellefon et al.

Jul 2006. 33pp.

*e-Print: hep-ex/0607026.***Reactor Neutrino Experiments with a Large Liquid Scintillator Detector**

Joachim Kopp, M. Lindner, Alexander Merle, M. Rolinec

TUM-HEP-635-06, Jun 2006. 16pp.

*Published in JHEP 0701:053,2007. e-Print: hep-ph/0606151.***Optimization of a neutrino factory oscillation experiment**

P. Huber, M. Lindner, M. Rolinec, W. Winter

TUM-HEP-634-06, MADPH-06-1459, Jun 2006. 51pp.

*Published in Phys.Rev.D74:073003,2006. e-Print: hep-ph/0606119.***Future neutrino oscillation facilities**

A. Blondel, A. Cervera-Villanueva, A. Donini, P. Huber, M. Mezzetto, P. Strolin

Jun 2006. 39pp.

Published in Acta Phys.Polon.B37:2077-2113,2006. e-Print: hep-ph/0606111.

Global fits to neutrino oscillation data

Thomas Schwetz

SISSA-31-2006-EP, Jun 2006. 5pp. Talk given at 2nd Scandanavian Neutrino Workshop (SNOW 2006), Stockholm, Sweden, 2-6 May 2006.

Published in Phys.Scripta T127:1-5,2006. e-Print: hep-ph/0606060.

A Beta Beam complex based on the machine upgrades of the LHC

A. Donini, E. Fernandez-Martinez, P. Migliozzi, S. Rigolin, L. Scotto Lavina, T. Tabarelli de Fatis, F. Terranova

Apr 2006.

Published in Eur.Phys.J.C48:787-796,2006. e-Print: hep-ph/0604229.

A European neutrino program based on the machine upgrades of the LHC

A. Donini, E. Fernandez, S. Rigolin, P. Migliozzi, L. Scotto Lavina, T. Tabarelli de Fatis, F. Terranova

2005. 4pp. Prepared for EPS International Europhysics Conference on High Energy Physics (HEP-EPS 2005), Lisbon, Portugal, 21-27 Jul 2005

Published in PoS HEP2005:178,2006.

Beta beams

M. Mezzetto (INFN, Padua)

2006. 3pp. Prepared for 9th International Conference on Astroparticle and Underground Physics (TAUP 2005), Zaragoza, Spain, 10-14 Sep 2005.

Published in J.Phys.Conf.Ser.39:329-331,2006.

Physics opportunities with future proton accelerators

A. Blondel, L. Camilleri, A. Ceccucci, J. Ellis, M. Lindroos, M. Mangano, G. Rolandi
Received May 2006. 13pp.

Resolving parameter degeneracies with atmospheric neutrinos

T. Schwetz

2006. 2pp. Prepared for 7th International Workshop on Neutrino Factories and Superbeams (NuFact 05), Frascati, Italy, 21-26 Jun 2005.

Published in Nucl.Phys.Proc.Suppl.155:166-167,2006.

The neutrino factory: Physics and accelerator concepts

K. Long

2006. 17pp. Prepared for Cracow Epiphany Conference on Neutrinos and Dark Matter, Cracow, Poland, 5-8 Jan 2006.

Published in Acta Phys.Polon.B37:2059-2075,2006.

Alternating ions in a beta-beam to solve degeneracies

A. Donini, E. Fernandez-Martinez

IFT-UAM-CSIC-06-15, Mar 2006. 14pp.

Published in Phys.Lett.B641:432-439,2006. e-Print: hep-ph/0603261.

Physics potential of the CERN-MEMPHYS neutrino oscillation project

J.E. Campagne, M. Maltoni, M. Mezzetto, T. Schwetz

LAL-06-35, IC-2006-011, SISSA-16-2006-EP, Mar 2006. 27pp.

Published in JHEP 0704:003,2007. e-Print: hep-ph/0603172.

Optimization of the beta-beam baseline

M. Benedikt, A. Fabich, S. Hancock, M. Lindroos

2006. 3pp. Prepared for 7th International Workshop on Neutrino Factories and Superbeams (NuFact 05), Frascati, Italy, 21-26 Jun 2005.

Published in Nucl.Phys.Proc.Suppl.155:211-213,2006.

The technical challenges of beta-beams

M. Lindroos

2006. 5pp. Prepared for 7th International Workshop on Neutrino Factories and Superbeams (NuFact 05), Frascati, Italy, 21-26 Jun 2005.

Published in Nucl.Phys.Proc.Suppl.155:48-52,2006.

Future neutrino oscillation facilities: Physics priorities and open issues

Alain Blondel

Jan 2006. 25pp. Plenary talk at 7th International Workshop on Neutrino Factories and Superbeams (NuFact 05), Frascati, Italy, 21-26 Jun 2005.

Published in Nucl.Phys.Proc.Suppl.155:131-142,2006. e-Print: hep-ph/0601158.

A monochromatic electron neutrino beam

M. Lindroos, J. Bernabeu, J. Burguet-Castell, C. Espinoza

2005. 7pp. Prepared for EPS International Europhysics Conference on High Energy Physics (HEP-EPS 2005), Lisbon, Portugal, 21-27 Jul 2005.

Published in PoS HEP2005:365,2006.

Neutrino factory roadmap 2006

K. Long

UKNF-NOTE-31, Oct 2001. 15pp.

MEMPHYS: A Large scale water Cerenkov detector at Frejus

Alain de Bellefon et al.

Jan 2006. 30pp. Contribution to the CERN strategic committee.

Precision measurement of neutrino oscillation parameters: The Case for a dedicated R&D programme

C. Cavata, M. Dracos, K. Long

Jan 2006. 2pp.

Beams for European Neutrino Experiments (BENE): Midterm scientific report

By BENE Steering Group (A. Baldini et al.)

Jan 2006. 118pp.

Summary of the neutrino oscillations working group at NuFact05

K. Long, M.D. Messier, O. Yasuda

2006. 9pp. Prepared for 7th International Workshop on Neutrino Factories and Superbeams (NuFact 05), Frascati, Italy, 21-26 Jun 2005.

Published in Nucl.Phys.Proc.Suppl.155:102-110,2006.

Perspectives in neutrino physics: Monochromatic neutrino beams

J. Bernabeu, J. Burguet-Castell, C. Espinoza, M. Lindroos

Dec 2005. 15pp. To appear in the proceedings of GUSTAVOFEST: Symposium in Honor of Gustavo C. Branco: CP Violation and the Flavor Puzzle, Lisbon, Portugal, 19-20 Jul 2005.

*Published in *Lisbon 2005, CP violation and the flavour puzzle* 71-84 e-Print: hep-ph/0512299.*

nu(μ) disappearance at the SPL, T2K-I, NO nu A and the neutrino factory

A. Donini, E. Fernandez-Martinez, D. Meloni, S. Rigolin
IFT-UAM-CSIC-05-48, ROMA-1419-05, Dec 2005. 40pp.
Published in Nucl.Phys.B743:41-73,2006. e-Print: hep-ph/0512038.

Perspectives for a neutrino program based on the upgrades of the CERN accelerator complex

A. Donini, E. Fernandez, P. Migliozzi, S. Rigolin, L. Scotto Lavina, T. Tabarelli de Fatis, F. Terranova
Nov 2005. 5pp.
e-Print: hep-ph/0511134.

Physics potential of the gamma=100,100 beta beam

Mauro Mezzetto
Nov 2005. 4pp. To appear in the proceedings of 7th International Workshop on Neutrino Factories and Superbeams (NuFact 05), Frascati, Italy, 21-26 Jun 2005.
Published in Nucl.Phys.Proc.Suppl.155:214-217,2006. e-Print: hep-ex/0511005.

Neutrinos and CP-violation

S. Pascoli
CERN-PH-TH-2005-087, Feb 2005. 19pp. Prepared for 11th International Workshop on Neutrino Telescopes, Venice, Italy, 22-25 Feb 2005.
*Published in *Venice 2005, Neutrino telescopes* 257-275.*

Neutrino oscillations: Current status and prospects

Thomas Schwetz
SISSA-79-2005-EP, Oct 2005. 10pp. Talk given at 29th International Conference of Theoretical Physics: Matter to the Deepest: Recent Developments in Physics of Fundamental Interactions, Ustron, Poland, 8-14 Sep 2005.
Published in Acta Phys.Polon.B36:3203-3214,2005. e-Print: hep-ph/0510331.

Physics reach of electron-capture neutrino beams

J. Bernabeu, J. Burguet-Castell, C. Espinoza, M. Lindroos
Oct 2005. 5pp. Talk given at 7th International Workshop on Neutrino Factories and Superbeams (NuFact 05), Frascati, Italy, 21-26 Jun 2005.
Published in Nucl.Phys.Proc.Suppl.155:222-224,2006. e-Print: hep-ph/0510278.

Neutrino factory R&D

K. Long
IC-HEP-05-02, Oct 2005. 12pp. Talk given at High Intensity Frontier Workshop (HIF05), La Biodola, Isola d'Elba, Italy, 28 May - 1 Jun 2005.
*Published in Nucl.Phys.Proc.Suppl.154:111-122,2006. Also in *La Biodola 2005, High intensity frontier* 111-122 e-Print: physics/0510157.*

Physics at a neutrino factory complex

A. Blondel
2005. 7pp. Prepared for 21st International Conference on Neutrino Physics and Astrophysics (Neutrino 2004), Paris, France, 14-19 Jun 2004.
*Published in Nucl.Phys.Proc.Suppl.143:282-288,2005. Also in *Paris 2004, Neutrino physics and astrophysics* 282-288.*

Precision physics at a neutrino factory

A. Blondel

2005. 4pp. Prepared for International Workshop on Parity Violation and Hadronic Structure (PAVI04), Grenoble, France, 8-11 Jun 2004.

Published in Eur.Phys.J.A24S2:183-186,2005.

Determining the neutrino mass hierarchy and CP violation in NO ν A with a second off-axis detector

O. Mena, S. Palomares-Ruiz and S. Pascoli,

Published in Phys.Rev.D73:073007-073028,2006. e-Print: hep-ph/0510182.

$\nu(\mu)$ disappearance at the SPL, T2K-I and the neutrino factory

A. Donini, E. Fernandez-Martinez, S. Rigolin

Sep 2005. 2pp. Presented at 7th International Workshop on Neutrino Factories and Superbeams (NuFact 05), Frascati, Italy, 21-26 Jun 2005.

Published in Nucl.Phys.Proc.Suppl.155:176-177,2006. e-Print: hep-ph/0509349.

Summary of the neutrino oscillation physics working group at NuFact04

S. Brice, K. Long, T. Nakaya

2005. 8pp. Prepared for 6th International Workshop on Neutrino Factories and Superbeams (NuFact 04), Osaka, Japan, 26 Jul - 1 Aug 2004.

*Published in Nucl.Phys.Proc.Suppl.149:111-118,2005. Also in *Osaka 2004, Neutrino factories and superbeams* 111-118.*

Measurement of three-family neutrino mixing and search for CP violation

A. Guglielmi, M. Mezzetto, P. Migliozzi, F. Terranova

Aug 2005. 26pp.

e-Print: hep-ph/0508034.

Physics and optimization of beta-beams: From low to very high gamma

P. Huber, M. Lindner, M. Rolinec, W. Winter

TUM-HEP-593-05, MADPH-05-1428, Jun 2005. 33pp.

Published in Phys.Rev.D73:053002,2006. e-Print: hep-ph/0506237.

SPL and beta beams to the Frejus

M. Mezzetto

2005. 3pp. Prepared for 6th International Workshop on Neutrino Factories and Superbeams (NuFact 04), Osaka, Japan, 26 Jul - 1 Aug 2004.

*Published in Nucl.Phys.Proc.Suppl.149:179-181,2005. Also in *Osaka 2004, Neutrino factories and superbeams* 179-181.*

Neutrino superbeams in Europe

M. Mezzetto.

2005. 5pp.

*Published in Nucl.Phys.Proc.Suppl.145:194-198,2005. Also in *Conca Specchiulla 2004, Neutrino oscillation* 194-198.*

The Impact of solar and atmospheric parameter uncertainties on the measurement of θ_{13} and δ

A. Donini, D. Meloni, S. Rigolin

IFT-UAM-CSIC-05-27, ROMA-1406-05, Jun 2005. 42pp.

Published in Eur.Phys.J.C45:73-95,2006. e-Print: hep-ph/0506100.

Leptogenesis and neutrino physics

S. Pascoli

2005. 3pp. Prepared for DPF 2004: Annual Meeting of the Division of Particles and Fields (DPF) of the American Physical Society (APS), Riverside, California, 26-31 Aug 2004.
Published in Int.J.Mod.Phys.A20:3115-3117,2005.

Explaining LSND by a decaying sterile neutrino

Sergio Palomares-Ruiz, Silvia Pascoli, Thomas Schwetz
CERN-PH-TH-2005-083, SISSA-34-2005-EP, May 2005. 23pp.
Published in JHEP 0509:048,2005. e-Print: hep-ph/0505216.

Monochromatic neutrino beams

J. Bernabeu, J. Burguet-Castell, C. Espinoza, M. Lindroos
May 2005. 11pp.
Published in JHEP 0512:014,2005. e-Print: hep-ph/0505054.

Super-NOnuA: A Long-baseline neutrino experiment with two off-axis detectors

Olga Mena Requejo , Sergio Palomares-Ruiz, Silvia Pascoli
CERN-PH-TH-2005-050, FERMILAB-PUB-05-050-T, Apr 2005. 17pp.
Published in Phys.Rev.D72:053002,2005. e-Print: hep-ph/0504015.

Future precision neutrino oscillation experiments and theoretical implications

Manfred Lindner
TUM-HEP-580-05, Mar 2005. Talk given at Nobel Symposium 2004: Neutrino Physics, Haga Slott, Enkoping, Sweden, 19-24 Aug 2004.
Published in Phys.Scripta T121:78-85,2005. e-Print: hep-ph/0503101.

The CARE accelerator R&D programme in Europe

O. Napoly et al.
CERN-AB-2005-028, PAC-2005-RPPE001, Jun 2005. 3pp.
*Published in *Knoxville 2005, Particle Accelerator Conference* 749.*

Optimal beta-beam at the CERN-SPS

J. Burguet-Castell, D. Casper, E. Couce, J.J. Gomez-Cadenas, P. Hernandez
IFIC-05-16, FTUV-05-0303, Mar 2005. 22pp.
Published in Nucl.Phys.B725:306-326,2005. e-Print: hep-ph/0503021.

Resolving parameter degeneracies in long-baseline experiments by atmospheric neutrino data

Patrick Huber, Michele Maltoni, Thomas Schwetz
MADPH-05-1412, YITP-SB-04-69, SISSA-3-2005-EP, Jan 2005. 25pp.
Published in Phys.Rev.D71:053006,2005. e-Print: hep-ph/0501037.

From parameter space constraints to the precision determination of the leptonic Dirac CP phase

Patrick Huber (Wisconsin U., Madison) , Manfred Lindner (Munich, Tech. U.) , Walter Winter
TUM-HEP-571-04, MADPH-04-1411, Dec 2004. 32pp.
Published in JHEP 0505:020,2005. e-Print: hep-ph/0412199.

Beta beams

M. Lindroos, C. Volpe
2004. 5pp.
Published in Nucl.Phys.News 14:15-19,2004.

Combined potential of future long-baseline and reactor experiments

P. Huber, M. Lindner, M. Rolinec, T. Schwetz, W. Winter
SISSA-97-2004-EP, TUM-HEP-570-04, MADPH-04-1410, Dec 2004. 4pp. Talk given at
NOW 2004: Neutrino Oscillation Workshop, Conca Specchiulla, Otranto, Italy, 11-17 Sep
2004.

*Published in Nucl.Phys.Proc.Suppl.145:190-193,2005. Also in *Conca Specchiulla 2004,
Neutrino oscillation* 190-193 e-Print: hep-ph/0412133.*

Appearance and disappearance signals at a beta-beam and a super-beam facility

A. Donini, E. Fernandez-Martinez, S. Rigolin
IFT-UAM-CSIC-04-60, Nov 2004. 15pp.

Published in Phys.Lett.B621:276-287,2005. e-Print: hep-ph/0411402.

Beta beams

Mauro Mezzetto

Oct 2004. 8pp. To appear in the Proceedings of the 21st International Conference on Neutrino
Physics and Astrophysics (Neutrino 2004), Paris, France, 14-19 Jun 2004.

*Published in Nucl.Phys.Proc.Suppl.143:309-316,2005. Also in *Paris 2004, Neutrino physics
and astrophysics* 309-316 e-Print: hep-ex/0410083.*

Simulation of long-baseline neutrino oscillation experiments with GLoBES (General Long Baseline Experiment Simulator)

Patrick Huber, M. Lindner, W. Winter
TUM-HEP-553-04, Jul 2004. 9pp.

Published in Comput.Phys.Commun.167:195,2005. e-Print: hep-ph/0407333.

Base line design for a beta-beam neutrino facility

M. Benedikt, S. Hancock, M. Lindroos
EPAC-2004-MOPLT007, CERN-AB-2004-084, Jul 2004. 3pp. Prepared for 9th European
Particle Accelerator Conference (EPAC 2004), Lucerne, Switzerland, 5-9 Jul 2004.

Study of the eightfold degeneracy with a standard beta-beam and a super-beam facility

A. Donini, E. Fernandez-Martinez, P. Migliozzi, S. Rigolin, L. Scotto Lavina
IFT-UAM-CSIC-04-30, Jun 2004. 25pp.

Published in Nucl.Phys.B710:402-424,2005. e-Print: hep-ph/0406132.

Status of global fits to neutrino oscillations

M. Maltoni, T. Schwetz, M.A. Tortola, J.W.F. Valle
IFIC-04-19, TUM-HEP-548-04, YITP-SB-04-29, May 2004. 39pp.

Published in New J.Phys.6:122,2004. e-Print: hep-ph/0405172.

A low energy storage ring for partly stripped radioactive ions

T. Fritioff, M. Lindroos, M. Grieser, A. Trzcinska
CERN-AB-2004-005-OP, Jan 2004. 11pp. Prepared for 6th International Conference on
Radioactive Nuclear Beams (RNB 6), Argonne, Illinois, 22-26 Sep 2003.

Published in Nucl.Phys.A746:384-388,2004.

ECFA/CERN studies of a European neutrino factory complex

A. Blondel, (Ed.) et al.
CERN-2004-002, ECFA-04-230, Apr 2004. 378pp.

Prospects of accelerator and reactor neutrino oscillation experiments for the coming ten years

Patrick Huber, M. Lindner, M. Rolinec, T. Schwetz, W. Winter
TUM-HEP-545-04, MPP-2004-28, Mar 2004. 37pp.

Published in Phys.Rev.D70:073014,2004. e-Print: hep-ph/0403068.

Study of the reconstruction of neutrino oscillation parameters using spectral information from a Cherenkov detector

A. Blondel, M. Campanelli, M. Fechner
CERN-NUFACT-NOTE-120, Oct 2002. 14pp.

A brief case for the MICE experiment

A. Blondel, D. Kaplan, K. Long, M.S. Zisman
LBNL-58357, Jul 2004. 4pp.

Series expansions for three flavor neutrino oscillation probabilities in matter

Evgeny K. Akhmedov, Robert Johansson, Manfred Lindner, Tommy Ohlsson, Thomas Schwetz

TUM-HEP-542-04, Feb 2004. 34pp.

Published in JHEP 0404:078,2004. e-Print: hep-ph/0402175.

Collection and muon acceleration in the neutrino factory project

Franck Lemuët, PhD thesis, CEA and CERN, April 2007, English version. Report CNRS/IN2P3/LPSC-07-83 (2007)