



International scoping study of a future
Neutrino Factory and super-beam facility
Physics working group

Physics working group workshop #1

14th to 21st November 2005

*Department of Physics, Blackett Laboratory, Imperial College London,
Exhibition Road, London, SW7 2AZ*

Second bulletin

1. Goals, and preparatory tasks for the workshop

The Physics working group of the international scoping study (ISS) met for the first time during the first ISS plenary meeting ([CERN, 22 – 24 September](#)). The [objectives](#) for the working group were discussed and agreed. Further, in order to prepare for the first workshop, [a set of preparatory studies](#) to be performed in time for the first workshop was defined. The tasks were chosen as necessary first steps towards the physics group's overall goals.

The preparatory tasks by sub-group are listed below. Those wishing to contribute to particular areas should contact the persons coordinating a particular activity (email contacts are given below).

Theoretical subgroup

The primary goal of the theoretical working group is to develop robust arguments motivating the need for the precision measurements of the properties of the neutrino. The arguments must be developed in such a way that they can be made accessible to general, scientifically literate, audiences (readers of *New Scientist* or *Scientific American*, for example), yet be technically and theoretically sound so that they survive the scrutiny of our peers.

In preparation for the first workshop, the following will be attempted:

- To evaluate the likelihood that a robust argument for the proposition that precision measurements of the properties of the neutrino are required to understand the origin of the Universe can be made ([S. King](#) (s.f.king@southampton.ac.uk) agreed to make a first survey of the argument);
- To review the link between possible lepton-number violating interactions occurring at a large mass scale and the large mass difference between the neutrinos and the charged leptons and quarks. In addition, models that explain the large neutrino-mixing angles will also be reviewed. [A. de Gouvea](#) (degouvea@northwestern.edu) agreed to make a first pass at presenting this review.

Phenomenological subgroup

One of the goals of the phenomenological subgroup is to understand the measurement precision required to investigate models of neutrino mass. Such models often predict relationships between the neutrino and quark mixing-matrix elements or imply that the neutrino mixing matrix is not

unitary. To prepare for the first workshop, it was agreed that a preliminary review of the precision required to test the various theoretical models that yield a non-unitary three-flavour neutrino mixing matrix would be presented ([O. Yasuda, myasuda@phys.metro-u.ac.jp](mailto:myasuda@phys.metro-u.ac.jp)).

Experimental subgroup

The experimental subgroup is required to make realistic estimates of the precision and sensitivity of the various proposed facilities on their own and in combination. The eventual goal is to make a critical performance comparison under various assumptions (such as large, and small, θ_{13}). This is a big task, and it was agreed that, for the first workshop, a comparison of the various codes would be presented for a small number of reference scenarios and assumptions. It was agreed that [P. Huber](#) and [K. Long](#) would provide documented [GLOBES](#) Abstract Experiment Definition Language (AEDL) files for the following baseline scenarios:

- Second-generation super beam:
 - Beam of the ‘SPL type’, the ‘T2K type’, and the ‘NOvA type’;
 - Megaton water Cherenkov, baselines to be defined.
- Beta beam:
 - Helium/neon beta beam in which the relativistic γ of the ions takes the values (100/100) and (350/350). This corresponds to a ‘reference’ beta beam and a ‘green-field site’ beta beam;
 - Baselines for the two beta-beam facilities of 130 km and 700 km respectively will be assumed;
 - Megaton water Cherenkov detector for (100/100)&130 km option, the detector for (350/350)&700 km option to be defined.
- Neutrino factory:
 - Two Neutrino Factory options with muon energies of 20 GeV and 50 GeV respectively. Assume that each facility will provide 10^{21} muon decays per year;
 - Baselines of 1000 km and 3000 km;
 - 100 kTon magnetised calorimeter.

For the comparison of the various codes, it was agreed that the sensitivity in the $\theta_{13} - \delta$ plane would be used. The following teams agreed to prepare results for comparison:

- Globes: [P. Huber](#), [P. Harrison](#)
- ‘Valencia code’: [P. Hernandez](#)
- ‘Madrid code’: [S. Rigolin](#)

The goal is to establish a baseline for the development of an evaluation of the performance of the facilities and a road-map for the combination of the simulated results.

Input from Detector working group

In addition to the tasks the Physics working group set itself, the need for a close dialogue with the Detector working group was clearly identified at the CERN meeting. To allow detailed discussions to take place, specific contributions to the workshop on the performance of the various detector technologies will be solicited.

2. Organisation

The workshop will be organised as a working meeting with the emphasis on time for informal discussions and periods of analysis of code development. It is not expected that all participants will

attend the workshop for the full week. It is hoped that a core group of people will be able to stay for much of the week so that those who can come only for a few days can still make a contribution.

A block diagram of the meeting is shown below. A detailed agenda for the first day and the discussion with the Detector working group will be posted in due course. The detailed agenda for the second and subsequent days of the workshop will be influenced by the wishes of those who attend. The workshop is scheduled to finish at 13h00 on Monday 21st June 2005 to allow participants to travel to CERN to take part in the BENE meeting.

Time	Room	Session	
Monday			14-Nov-05
10:30	532	Theoretical subgroup session: status reports and discussion	
13:00		Lunch	
14:00	532	Phenomenological subgroup session: status reports and discussion	
15:30		Tea/coffee	
16:00	532	Experimental subgroup session: status reports and discussion	
18:00		Adjourn	
Tuesday			15-Nov-05
10:00	532	Orientation meeting, budget 1 hour. Rest of day free for discussion and work.	
Wednesday			17-Nov-05
10:00	532	Orientation meeting, budget 1 hour. Rest of day free for discussion and work.	
Thursday			16-Nov-05
10:00	532	Reserved for discussion with Detector working group	
13:00		Lunch	
14:00		Free for work.	
Friday			18-Nov-05
10:00	532	Orientation meeting, budget 1 hour. Rest of day free for discussion and work.	
Saturday			19-Nov-05
10:00	532	Orientation meeting, budget 1 hour. Rest of day free for discussion and work.	
Sunday			20-Nov-05
10:00		Free (also free for work!)	
Monday			21-Nov-05
10:00	532	Orientation meeting, budget 1 hour. Rest of day free for discussion and work.	
13:00		Lunch and adjourn	

3. Workshop site

The workshop will be held in the Physics Department of Imperial College London (the Blackett Laboratory). The Blackett Laboratory is located in Prince Consort Rd, London SW7 2BW (for maps of the South Kensington campus refer to <http://www.imperial.ac.uk/maps/sk.asp> - the Blackett Laboratory is No. 6 on the South Kensington Map).

4. Registration

Details of how to register will be posted on the ISS web-site (<http://www.hep.ph.ic.ac.uk/iss>) shortly. Please note that accommodation should be booked separately as described below.

5. Accommodation

Accommodation should be booked directly with the Imperial College Conference Office. All the hotels on their list are within walking distance of the Blackett Laboratory and may be reserved at discounted prices. Please consult the Conference Office web site, <http://www.ad.ic.ac.uk/conferences/>, for further information.

6. Transportation

For directions to Imperial College please refer to <http://www.imperial.ac.uk/research/hep/about/travel.htm>.

7. Correspondence

All correspondence concerning travel to the workshop and accommodation should be addressed to:

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