WP5 – Coordination office for neutrino detectors (draft 26.2.2008)

Unlike in other fields, the neutrino community does not know yet which the next neutrino oscillation facility will be. This decision strongly depends on the value of the mixing angle θ_{13}, which will be probably known by 2011, from Double-Chooz and T2K. The proposed facilities are Neutrino Factories, Beta-beams and Super-beams. The detector options: a large water cerenkov detector, a magnetised iron calorimeter, a totally active scintillating detector, an emulsion cloud chamber and a giant liquid argon TPC.

It is widely accepted that a Conceptual Design Report (CDR) of the facility(s) and detector(s) should be submitted by 2012. A comprehensive CDR requires a realistic performance, feasibility and cost evaluation. It's the task of this WP to contribute significantly to the CDR of the detector(s) for this future neutrino oscillation facility.

Input to the CDR should come from existing data[1], monte-carlo simulations, feasibility studies and dedicated test-beams. The CDR involves however other international networks: i) the International Design Study for a Neutrino Factory (IDS-NF), which includes the design studies for accelerator and detectors, based mainly on simulations; ii) EURISOL/Beta-beam, dedicated to the design of a Beta-beam accelerator facility ii) EURONU, a FP7 Design Study focused on monte-carlo simulations for all three facilities and the corresponding detectors; and iv) LAGUNA, a FP7 Design Study devoted to the underground excavation, construction and operation of large liquid detectors of three technologies (Water, Liquid Argon and Scintillator) and their safety and environmental impact at the potential sites hosting of the facility. It can be concluded that detector instrumentation R&D is not contemplated in any of the ongoing international projects. DEVDET is therefore the ideal framework to complement the above projects with detector prototyping and test-beams for the understanding of the key issues.

Given the complex structure described above, the success of the neutrino detector R&D program strongly depends on good communication and coordination procedures between the different international communities and also among different work packages in DEVDET. It is WP5 task to ensure that the information is correctly shared and that the correct physics output is obtained from DEVDET studies. Two main subtasks have been identified: i) information exchange, which includes web site, documentation and meetings; and ii) definition and planning of test-beam activities and coherent evaluation of detector options for the CDR.

Work package number	WP5		**Start date or starting event:**			M1			
Work Package title	Coordination office for neutrino detectors									
Activity type	COORD									
Participant number										
Participant short name	IFIC	UNIGLA	UNIGE-DPNC	UNIZH	ETHZ	UNIBE	APC	IPNL	LAL	RWTH Aachen
Person-months per participant	14	10	10	2	2	6	7	10	2	5

[1]From currently or soon running experiments: Super-Kamiokande, MINOS, T2K, OPERA, ICARUS T600, but also from others like MINERVA and INO that will be tested in the coming years. In addition, smaller scale prototypes will provide vital information and answers to specific issues of the instrumentation.

Objectives:

Task1: Information exchange

- Create and maintain a web site
- Help in writing documentation
- Coordinate information exchange with other international neutrino projects
- Organization of meetings.

Task 2: Definition and planning of test-beam activities and coherent evaluation of detector options for the CDR

- Collect information from IDS-NF and EURONU on simulation results
- Propose list of measurements to be done at the test-beams
- Collect requirement list for test-beam setup
- Coordinate the design of test-beam detector prototypes
- Coordinate test-beam data analysis
- Extract the relevant information from the analysis of the DEVDET test-beams to tune the IDS-NF and EURONU monte-carlo simulations
- Cost estimates for the different detectors options based on WP3 results
- Contribute to the Conceptual Design Report for the detector(s) of a future neutrino oscillation facility

Description of work:

Task 1. Information exchange.

The web site should be created soon. A professional web master is desirable since a considerable amount of work is needed. This person would be also in charge of helping writing the documentation and organizing the meetings.

An interactive (wiki, …) web site, where people can edit and add documents is recommended. It should contain the relevant information from other neutrino projects and from other DEVDET WPs (2, 3, 6, 7, and 11), information about meetings, current status of CDR, etc. The WEB site should be continuously updated.

All neutrino activities in DEVDET should be properly documented. This WP would be in charge of collecting the documentation (software manuals, technical drawings, detector designs, etc) to be posted on the WEB site. It will also help in writing the documentation.

This task also includes the organization of tele/video meetings and in-person meetings, both in the context of DEVDET and in the context of other international neutrino networks[2].

The groups involved are IFIC, UNIGLA, UNIGE-DPNC, UNIBE, APC, IPNL and RWTH Aachen.

Task 2 Definition and planning of test-beam activities and coherent evaluation of options for the TDR

While WP11 would be in charge of providing the infrastructure for the test-beams, WP5 should coordinate (in close cooperation with other networks) the definition of the measurements to be done and the detector prototypes to be tested. As described above, five detector options will be studied. There will be a coordinator for each of the options.

The first step is to understand from the current designs and performance evaluations what are the key issues to be understood at dedicated test-beams. A list of measurements to be done at the test-beams

[2] In some cases WP5 will not organize the meetings but the contribution of the DEVDET/neutrino to the meetings

should be proposed soon. This list should take into account the available test-beam areas and infrastructures defined by WP11, although some initial input to WP11 might be possible.

WP5 should coordinate the design of detector prototypes, ensuring that the proposed prototypes fulfill the requirements and that the list of measurements can be completed. The design process would be followed up by the usual CDR and TDR (Technical Design Report).

A possible upgrade of the test-beam infrastructure would require intensive feedback between WP5 and WP11. In this case a list of requirements for the test-beam infrastructure (input to WP11) should be proposed.

This WP should also coordinate the analysis of test-beam data and extract the relevant information required by the existing simulations (in the context of IDS-NF and EURONU).

The evaluation of detector options should be driven by physics performance, where the main indicator is the sensitivity to the oscillation parameters. However, cost and feasibility should be also taken into account. The results on electronics developments from WP3 can have serious implications on the cost and feasibility of the detectors, and therefore should be properly monitored and used by WP5.

It is WP5's final task is to make the final evaluation of detector options for the CDR, taking into account all the elements, and again, in cooperation with the other neutrino networks.

All groups are involved in this task.

Deliverables of tasks	**Description/title**	**Nature**[1]	**Delivery month**[2]
5.1.1	Web site ready	D	M12
5.1.2	Documentation	O	M24
5.2.1	List of test-beam requirements completed	R	M3
5.2.2	List of measurements to be done completed	R	M6
5.2.3	Test-beam detectors: Technical Design Report completed	R	M20
5.2.4	Performance report of each prototype completed	R	M40
5.2.5	Cost estimate based on WP3 results and current design of the detectors completed	R	M42
5.2.6	Contribution to the CDR ready	R	M48

Milestones	**Description/title**	**Tasks involved**	**Delivery month**[2]	**Means of verification**
1	First version of web site available	5.1	M3	Test functionality
2	First version of documentation ready	5.1	M24	
3	Preliminary list of test-beam measurements	5.2	M1	Publication on web
4	Test-beam detectors: conceptual design report ready	5.2	M10	Report
5	First feedback from WP3	WP3	M20	Publication on web
6	Preliminary cost estimate	5.2	M22	Publication on web
7	Second feedback from WP3	WP3	M40	Publication on web

[3]Nature: R=Report, P=Prototype, D=Demonstrator, O=Other
[4]Counted from the starting date

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