ČVUT
ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE

REVIEWER´S ASSESSMENT OF FINAL WORK

I. IDENTIFICATION DATA

Title:	Development of a script for calibration of individual optical modules in the segmented calorimeter of the SuperNEMO experimemt
Author´s name:	Bc. Filip Koňarík
Type of assignment:	Master Thesis
Faculty:	Faculty of Nuclear Sciences and Physical Engineering (FNSPE)
Department:	Department of Laser Physics and Photonics
Reviewer:	Amina Khatun
Reviewer´s affiliation:	Universite Libre de Bruxelles

II. ASSESSMENT OF CRITERIA

Work assignment — **demanding**

Assess how demanding the work topic is.

The topic of the thesis is the energy calibration of electron in the SuperNEMO experiment. This is a crucial step to measure the electron energy preceisely in the detector. The goal of the SuperNEMO experiment is to observe the neutrino less double beta decay which proves that the neturino is Majorana in nature. This can be acheived by measuring the total energy of two electrons emitted in such events. Therefore, the work done in this thesis contributes a lot towards fulfilling the goal of the experiment.

Fulfilling the assignment — **fulfilled**

Consider whether the work submitted meets the assignment. If necessary, give your comments on items of the assignment not fully answered, or judge whether the scope of the assignment has been broadened. If student failed to fully treat the assignment, try to assess the importance, impact and/or the reasons for the failings.

The work in the thesis improves the existing calibration method to measure the electron energy and its resolution.

Chosen approach to solution — **appropriate**

Assess whether student applied a correct approach or method of solution.

The improvement in the electron energy measurement is done by taking into account the nonlinearity in scintillation process, non-uniformality effects in optical modules, and energy loss in the medium by physics-based model.

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Professional standard — **excellent**

Assess the professional standard of the work, application of course knowledge, references, and data from practice.

The thesis provides detailed and proper understanding of the problem, used methods, and with scientific arguments.

Level of formality and of the language used — **excellent**

Assess the use of scientific formalism, the typography and language of the work.

The description of the results in the thesis is quite mature, detailed, and easy to follow the flow of the content.

Choice of references, citation correctness — **excellent**

Assess student´s effort in finding and using study sources for completing their work. Give characteristics of the references chosen. Assess whether student made use of all the relevant sources. Verify whether all items used are properly distinguished from the results obtained by student and their deliberations, whether there are no violations of citation ethics, and whether the bibliography presented is complete and complies with the citation usage and standards.

The thesis cites the sources of the results that are not produced by the author.

Further comments and assessment

Give your opinion on the quality of the main results obtained in the work, e.g. the theoretical results, or the applicability of the engineering or programming solutions obtained, publication outputs, experimental skills, and the like.

The work done in the thesis take into account the correction due to optical effects while collecting the scintillation photons by the optical module and energy loss in the medium by electron in its path and measure the electron energies precisely. The method adopted here for correction indeed improves the measurement and results are close to what is predicted theoretically. At the end, thesis also highlights that there are a few characteristic in the result not understood fully which can be explored further in future.

III. OVERALL ASSESSMENT, QUESTIONS TO BE ASKED DURING THE WORK DEFENCE, SUGGESTED GRADE

Summarize those aspects of the work that were significantly influential for your overall assessment. Suggest questions to be answered by student during the defence of the work before the examination board.

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The author might answer a few questions as follows

1. In section 2.1 on page 26, the sentence 'A higher Qbetabeta ….' ends with '(see 2.4)'. It is not clear whether it refers to figure 2.4 or section 2.4.
Another same type of typo is on page 45 when referring to 3.2. The 'table' is missing
The author should correct this type of typos in the thesis. Also a few sentences on page 60 are not clear, such as in the last paragraph of section 4.2.2.2 'but it arrived to it through …'. Use of two 'it' makes the reader difficult to understand what 'it' refers to. Again on the same page, in the first paragraph of section 4.3, the sentence 'we will still calculate the estimate of initial …..'. The 'estimate' may be not needed in the sentence.

2. In the section 1.2.2, the way PMNS matrix is defined is misleading. The superposition coefficients shown in Eqs 1.10 and 1.11 are not the element of PMNS matrix. PMNS matrix is popular way to paramatrize the neutrino mixing matrix. There can be other ways of paramatrization, for an example is Wolfenstein paramatrization. Therefore, eq. 1.12 shows the general mixing matrix of neutrino which can be paramatrize in different ways, and matrix U is the paramatrixation of PMNS matrix.

3. Why xcalo and gveto have different energy resolutions even though both use 5 inch PMTs (page 28).

4. In table 3.3, the peak at 1049 keV is seen not to be negligible, it contributes around 20% to the second peak of Fig. 3.17. Could author explain why 1049 keV is not considered while calibrating the second peak! Could this be reason behind resolution of the second peak could not be improved as much as the first peak by the corrections included in this thesis?

Suggested grade: A - excellent.

Date: 28/05/2024

Signature: