Referee report on the Super NEMO experiment (JINR participation)

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The reports given to the Program Advisory Committee of JINR on 21 January 2021 outline the proposal submitted by JINR researchers to carry on activities on the Super NEMO experiment, to search for neutrinoless double beta decay ($0\nu\beta\beta$). This is a fundamental process whose existence would prove the Majorana nature of the neutrino. There are presently sensitive lower limits to the half-life of $0\nu\beta\beta$ (around 10^{26} years) coming from various experiments worldwide exploiting different detection techniques (i.e., Xenon, Germanium, Tellurium amongst the most relevant), hence determining a strong international competition. Large projects involving correspondingly large collaborations and investments are planned or approved for the near and far future.

The JINR group is involved since many years in the NEMO project carried out in the underground Modane laboratory in France. Already with the NEMO-3 detector, several interesting results were obtained by exploiting several isotopes. The experiment proposed here is the Super NEMO setup, based on the use of tracking and calorimeter detectors to independently address different theoretical mechanisms. The program of Super NEMO should start with the so-called Demonstrator, able to reach a limit on the process half-life of about 5 x 10^{24} years and act as a major technology demonstrator in view of the final experiment. The Demonstrator is expected to be installed by the end of 2022, with data taking and analysis taking place in 2023-2024. The contributions of the JINR group includes several aspects: plastic scintillator for the calorimeter, procurement of PMTs, isotopes and related purification facilities.

The referee considers that the physics subject explored by the experiment is of outmost interest. However, there are some critical remarks:

1) The delay of the project (Super NEMO Demonstrator) is huge. The question is how relevant the expected results will be in more that 3 years from now, taking into account the harsh international competition. Moreover, the reasons for the delay are unclear to the referee. From the reports, the date of completion of the Demonstrator was originally expected to be 2016.

2) The group is relatively large (14 head counts) but 8 participants have an FTE lower-equal than 0.3.

3) The project was already reviewed in the joint PACs meeting in 2019, being ranked as second priority on a scale of three. The main concern was the impact on the data

analysis with emphasis to the work of young people. This point is still unclear as well as the general progress of the project (Super NEMO Demonstrator) since then.

The above issues make the cost effectiveness of the experiment questionable. Given the information currently available the referee is not in the position of recommending the continuation of Super NEMO for the years 2022-2024. The JINR laboratory should probably first address its participation in prominent $0\nu\beta\beta$ experiments aiming at high sensitivity within a reasonable amount of time.

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