

Referee report on the Daya-Bay/JUNO projects (JINR participation)

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The report given to the Program Advisory Committee of JINR on 29 June 2020 outlines the proposal submitted by JINR neutrino physics researchers to extend their participation in the Daya-Bay and JUNO experiments in China, for the period 2021-2023. Actually, with the end of the Daya-Bay data taking in 2020, one can assume that the group will essentially concentrate on the follow up JUNO project.

Several experiments worldwide are planned or running to address some of the outstanding open issues in the study of the PMNS neutrino mixing-matrix, such as the neutrino mass eigenvalue hierarchy and the existence of a possible CP violation phase in the matrix. The relevance of these subjects and the smallness of the expected effects set serious constraints to the projects and justify their complexity, their long-term schedules and their cost. Daya-Bay and its larger-scale follow up JUNO experiments are in some sense unique in the international scenario. Daya-Bay has made a fundamental discovery by measuring a non-zero θ_{13} mixing angle, a major result in neutrino physics, by studying the anti-neutrino flux from nuclear reactors. Even more is expected to come from JUNO, a larger and complex liquid scintillator neutrino reactor detector, whose main goal will be the first determination of the neutrino mass hierarchy at the 3-4 sigma level by ~2028 (with some delay w.r.t. the original schedule due to the problems with the Taishan plants), in addition to a rich side program.

The JINR group has been very active and productive so far, both in the running and exploitation of the data from Daya-Bay, and in the construction of JUNO, with relatively large financial and person power contributions from JINR. As far as JUNO is concerned, being the group a major international player within the international collaboration, they took relevant responsibilities (and some more could be still envisioned): 1) responsibility for the design and realization of the high-voltage units for both large- and small-size PMTs; 2) contribution to the construction and operation of the Top Tracker detector; 3) testing and commissioning of the large PMTs by a new testing stations; 4) contribution to the design and construction of the JUNO newly approved near detector (TAO). Moreover, the JINR group is also commissioning a computer center aimed at Monte Carlo data production, storage and processing. This will be one of the three European centers handling the experiment data.

From the report, the referee can notice that an effort has been paid in trying to secure student and young scientist participation. The number of heads is large (39 in 2021) but with an acceptable

FTE quota. The referee appreciates that there are no 10% participations and that the number of students of all kinds is adequate, although in some cases with a low percentage. This last feature, in particular, must be cured, to be in line with international standards that envision full engagement of students in one specific project.

As a general remark, having said that the JINR group is large, one should therefore make sure that the impact to the JUNO experiment be proportionally high. One should aim at increasing the scientific and managerial responsibilities of group members within the collaboration. Moreover, it is important that JINR scientists get immediately involved in the various data analyses that will develop in the next years, in order to provide qualifying contributions to the scientific publications, once more, with emphasis to the work of fully committed students. Last, one can make the same comment made for the JINR participation in the USA neutrino program, as one sees a large personnel overlap between the two projects. This must be solved at regime, due to the rather different scientific programs, to the large size of the two experiments, to the very different experimental techniques, and to the international competition.

The JUNO experiment, in any case, is a flagship JINR project. This implies a high level of support but also a consequent request for high performance, important deliverables and international impact from the participants.



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