Study of neutrino oscillations in the JUNO experiment (participation of JINR)

Referee report on the project

The project describes JINR participation in the JUNO experiment. The experiment started to accumulate the data at middle of 2025 and published its first results recently. From the first published data it become absolutely clear that the JUNO experiment, is an experiment that will certainly shape our understanding of physics in the coming decades and perhaps become the first experiment in New Physics beyond the Standard Model. Neutrino physics is continued to be the field of science that helps to understand how the Universe works and to reveal its most incredible properties. The start of the JUNO data taking was anticipated by everyone, and JUNO undoubtedly has the potential to become one of the most impressive modern experiments.

Primary target and now the most waiting result for next 5 years of the project is the neutrino mass hierarchy with a sensitivity corresponding to 3-4 standard deviations. Supplementary scientific program including searches for proton decay, supernova neutrinos, detection of geo-, atmospheric and solar neutrinos, as well as searches for physics beyond the Standard Model will make an important impact to the particle physics.

To be successful the JUNO experiment already resolved many challenging tasks: achieving of unprecedented energy resolution for huge volume of liquid scintillator, energy scale precision for all types of events, localization of events, backgrounds, etc. All of those tasks require development of new technologies, experimental techniques and approaches for the project. It is important that the JINR team is participating in different parts of the project and thus will bring home these new know how and innovations in the experimental physics.

During the phase of active development and construction of the JUNO in China JINR group made a number of major contributions. JINR contributions to the JUNO experiments are valuable and highly visible. In the JUNO, JINR is responsible for design and production of high voltage units for photomultipliers. JINR contributed to the construction of the Top Tracker detector; to mass tests and commissioning of large PMTs. JINR contributed to the design and construction of JUNO's near detector. After start of the data taking JINR group contribution to the analysis and obtaining of physics results is become its main priority. JINR is one of the sites of the JUNO Distributed Computing Infrastructure, designed for data storage, processing and analysis. The JINR group is solid and is help the project from both experimental and theoretical sides. The JINR has already gained huge experience in the neutrino physics participating during last 20 years in the Day Bay and JUNO experiment, the JINR visibility increased on both national and international levels with the Day Bay and first JUNO world leading results.

Taking all these into account I would strongly support the JUNO experiment and the team, and recommend the participation of the Institute in the project with high priority.

Evgeny Yakushev
Director, DLNP JINR

yakushev@jinr.ru

