Referee report on project

DANSS - Detector of the reactor AntiNeutrino based on Solid state plastic Scintillator,
proposed for prolongation in 2022-2024

Research of the neutrino properties is now the focus of all fundamental physics. What is the nature of neutrinos? What is the absolute mass scale? What is the mechanism of neutrino mass formation? Our understanding of the universe depends on the answers to these questions. Oscillations into a sterile neutrino - a candidate for a dark matter particle – is an interesting hypothesis that emerged as a scenario that explains a number of conflicting experimental results. Testing this hypothesis is a hot topic of research in various fields of fundamental physics.

The unique DANSS spectrometer, created by the JINR-ITEP groups, is designed to measure the energy spectra of reactor antineutrinos at record-breaking small different distances from the reactor - 10-12 m. The difference measurement method eliminates systematic errors associated with knowing the exact shape of the detector efficiency that is difficult to determine with great accuracy. In this case, the technique is sensitive to oscillations in sterile neutrinos in the range of interest to us.

The detector DANSS includes $1m^3$ sensitive part consisting of 2500 independent detector cells made of polystyrene-based scintillator. Contrary to liquid scintillators, the solid one has quite stable parameters and is fire-safe. which removes the restrictions on its application at an industrial nuclear power plant. As I know, today the DANSS detector is the only one which is allowed to operate at low distance from the industrial power reactor. More simple and small version of the detector (S-cube) seems to be even more suitable for such application.

During the implementation of the project (2016-2020), the collaboration has obtained a number of important results - monitoring of the reactor power and fuel composition is shown, a large area of the phase space of oscillations into sterile neutrinos has been excluded.

However, the intriguing result obtained in the NEUTINO-4 experiment forces to move on. To reach the region of the oscillatory signal set up by NEUTRINO-4 the DANSS collaboration should modernize to radically the setup in fact, to create a new DANSS-2 spectrometer. The documents contain a detailed description of the work, a timeline, from which it can be seen that the new phase of the project is well thought out and relevant in a modern environment.

The new detector DANSS-2 with improved resolution will also be used to investigate and possibly resolve the problem of the spectral reactor anomaly (the excess of the experimentally measured neutrino flux in the 4-6 MeV region in comparison with the calculations).

Thus, the second phase of the DANSS project is well thought out and justified, is of great interest for fundamental science, and its implementation is within the power of collaboration, taking into account the accumulated experience. I propose to support the project with the highest priority.

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