

REVIEW

of the scientific and technical reasoning for the renewal of large research infrastructure project “New advanced neutron source at JINR” with the subproject “Research and development for the justification of the draft design of the new advanced neutron source at JINR – NEPTUN pulsed fast reactor” for 2024-2028

Several generations of research pulsed fast neutron reactors have been successfully operating at FLNP JINR for more than 60 years. The currently operating IBR-2M pulsed reactor is actively used by scientists from different countries for research in the field of condensed matter physics, molecular biology, structural chemistry, and materials science. To continue these studies and expand the range of tasks to be solved, it is important to start now developing a neutron source based on a pulsed reactor of the next generation.

This project is a natural development of the previous work within the framework of the theme 04-4-1140-2020/2022 “Development of the conceptual design of a new advanced neutron source at JINR”, carried out in 2020-2023 and aimed at developing the design of the NEPTUN pulsed reactor, which will make it possible to take a leading position in the world in the field of neutron research.

Based on the results of the previous stage, a report on the R&D "Development of a technical proposal for a reactor facility with a pulsed reactor with neptunium-based fuel" was prepared, which proposes several variants of the core configuration for the NEPTUN reactor with the respective neutron-physical, thermal and strength calculations.

Within the framework of the subproject “Research and development for the justification of the draft design of the new advanced neutron source at JINR – NEPTUN pulsed fast reactor”, as one of the key steps towards creating a neutron source with record characteristics, it is planned to carry out a number of research activities, the results of which will make it possible to proceed to the preliminary design phase. Work will be carried out to optimize the design of the reactivity modulator and the reactor vessel. Pre-irradiation studies of the properties of fuel compositions for fuel elements of the NEPTUN reactor are planned. Special attention will be paid to the construction of models of pulsed reactor dynamics and its experimental substantiation in order to study the stability of the reactor. All this will make it possible to select a specific configuration of the core for the draft design of the NEPTUN reactor.

The implementation of the project involves 20 employees of the Sector of the New Source and Complex of Moderators, including scientists, engineers and support staff. Their expertise and experience leave no doubt that the proposed project will be successfully implemented.

The requested resources and work schedule appear to be reasonable.

Considering all of the above, we recommend approving the project “New advanced neutron source at JINR” with the subproject “Research and development for the justification of the draft design of the new advanced neutron source at JINR – NEPTUN pulsed fast reactor” for 2024-2028 with the first priority.

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