

The report on

**SCIENTIFIC AND TECHNICAL REASONING FOR THE RENEWAL OF  
LARGE RESEARCH INFRASTRUCTURE PROJECT “New Advanced Neutron Source  
at JINR” IN RESEARCH AREA “Condensed Matter Physics, Radiation and  
Radiobiological Research” WITHIN THE TOPICAL PLAN FOR JINR RESEARCH**

The project is based on the idea that new reactor NEPTUN will provide opportunity to go beyond the possibilities of the IBR-2 reactor and expand the JINR scientific program to new areas of research, both in condensed matter physics and in structural biology, as well as in nuclear physics and ultracold neutron physics.

The requirements for the neutron source increase: it is necessary to have a time-average thermal neutron flux density of  $\geq 10^{14} \text{ cm}^{-2}\cdot\text{s}^{-1}$  (a peak density of  $> 10^{16} \text{ cm}^{-2}\cdot\text{s}^{-1}$ ). That is approximately an order of magnitude increase with respect to IBR-2.

the main **objective** of the work on the implementation of the LRIP is the development of a draft design of the new NEPTUN pulsed reactor

In 2024-2028, it is planned to carry out the following R&D work on the development of the NEPTUN reactor:

1. Development and elaboration of the scientific program and the concept of the suite of instruments for conducting research in condensed matter physics, nuclear physics and applied research:
2. Development and verification of the model of the dynamics of power pulses and vibrational stability of the reactor, experimental studies on the physical model of fuel rods:
3. Development of neptunium-nitride fuel and neptunium-nitride-based fuel rods:
4. calculation substantiation of design solutions for the reactivity modulator and the vessel of the NEPTUN pulsed reactor, development of technical specifications for the draft design and infrastructure projects of the NEPTUN reactor; development of a test bench (prototype) of the reactivity modulator of the NEPTUN reactor:
5. Optimization of the configuration of cryogenic moderators based on liquid hydrogen and hydrogen-containing materials and development of a technology for a fast change of the working material:

Man power requested is 14 (JINR)

In collaboration with JSC VNIINM AO NIKIET RFNC-VNIITF

The detailed plan for 2024 year and mail risks estimation are presented

Total project cost estimated to about 15 millions USD, about 70% for R&D,

Positive referee report (D.V. Khmel'nitsky) without remarks and objection is presented by the reviewers from FNC-VNIITF.

Chief Researcher, RRC “Kurchatov Institute”  
Doctor of Science in Physics and Mathematics



P.A. Alekseev