

Project Review

“Development of the Conceptual Design of a New Neutron Source at JINR”

Theme 04-2-1132

Unique characteristics of neutron techniques offer exciting possibilities especially for investigations of magnetic properties or light elements. Being complementary to photon techniques (synchrotrons, FELs), neutron techniques are an indispensable tool in application-oriented research fields like energy, information technologies, biological and pharmaceutical research.

Research with neutrons is and will remain at the forefront of science. In an ever-increasing number of disciplines, it provides unique information on the condensed matter over many orders of magnitude in space and time. Therefore, there is a high demand for using neutrons, especially in materials science, research on soft matter and quantum materials.

The reactor IBR-2 that is operating at JINR at the average power of 2M since begin of 80th is the only pulsed neutron reactor in the world. Namely, due to the pulse nature of the reactor operation, it achieves the instantaneous power of about 1800MW, thus being the most brilliant neutron source in the world.

In the same time, the neutronic solutions at IBR-2 were made about 40 years ago and their improvements are strongly limited by the reactor construction. Indeed, available neutrons are not used in the same extent as at the most modern neutron sources.

As the initial neutron flux at a new source is projected to be significantly higher than at IBR-2 and due to the much more effective neutron delivery systems, the performance of neutron instruments at a new source is expected to be up to two orders of magnitude better than at IBR-2. (For comparison, the performance of instruments at a new European Spallation Source (ESS) will be 10-100 times better than for same classes of instruments at the high-flux reactor of ILL).

In my opinion, the stated technical aims of this project - feasibility study for the construction and the preparation of initial data for technical specifications for the design of the new neutron source - are within the reach during 3 years of this project. Important for this is the already established and rather effective cooperation of the LNF with the reactor designer NIKIET. Additional cooperation ties with accelerator experts from the Kurchatov Institute and the INR RAS makes me optimistic about the proper evaluation of the variant of the accelerator-driven neutron source. All these experts are actually already working together for one year within the international Working Group of the Commission for JINR Strategic Long-Range Planning.

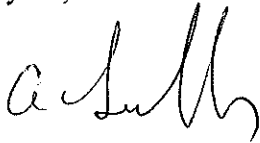
Another important issue is the timing of the suggested project. Taking into account a usual time that is required for the realization of a new project, about 15 years, a new source is expected to come just in time when the resource of the IBR-2 will be close to the end. In the same time, a certain overlap is foreseen that will allow for the continuous access to neutrons in JINR and for tests of new instrumental ideas/solutions at IBR-2. Indeed, this is the right time to start the presented project.

For the formulation of scientific and instrumental programs, LNF is suggesting not to rely exclusively on the own, though very qualified staff, but also profit from the expertise gained at most modern neutron sources worldwide by establishing collaborations and organizing open discussions of related matters at series of international workshops. First of such workshop dedicated to discussions of advanced ideas and potential experiments for the new source was convened at the end of 2018.

Requested financial resources are corresponding to the project objectives.

Summarising, I can state that the suggested development of the Conceptual Design of a New Neutron Source at JINR is of great importance both for the JINR scientists and for the world neutron scattering community and will further increase the possibilities of neutron techniques for solving the challenging problems of condensed matter and nuclear physics. I strongly recommend this theme for the implementation within the framework of the JINR topical plan.

May 26, 2019

A handwritten signature in black ink, appearing to read 'A. Ioffe', written in a cursive style.

Dr. Alexander Ioffe

Invited expert to the PAC for Condensed Matter Physics

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