

**Annotation of the report on the theme “Development of the IBR-2 Facility with a Complex of Cryogenic Neutron Moderators”: report for 2017-2019 and rationale for theme extension for 2020-2022**

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The report provides information on the major activities carried out in the framework of the theme in accordance with the JINR Topical Plan in 2017-2019 and a rationale for the theme extension for 2020-2022.

- **Project "Construction of a Complex of Cryogenic Moderators at the IBR-2 Facility"**

During the reporting period, the project of the construction of a complex of cryogenic moderators at the IBR-2 pulsed reactor has been progressively implemented. A cryogenic moderator CM-202 for beamlines 7, 8, 10, 11 has been constructed and successfully operated. In accordance with the project, a cryogenic moderator CM-201 for beamlines 1, 4, 5, 6, 9 has been produced. Its installation and commissioning for trial operation are scheduled to be completed by the end of 2019.

In 2020-2021, to ensure the most efficient use of the suite of IBR-2 instruments for working with cold neutrons, it is planned to put the second cryogenic refrigerator KGU 1200/10 (“Linde”) into operation. By the end of 2022, it is planned to carry out the optimization of the operation of the cryogenic complex, develop requirements specification and project documentation for a cryogenic moderator CM-203 for beamlines 2 and 3. The construction of the complex of cryogenic moderators will make it possible to ensure the implementation of a highly competitive program of advanced research using cold neutrons.

- **Construction of a backup movable reflector MR-3R**

At present (as of 01.06.2019), the existing movable reflector MR-3 has reached 50% of its expected mechanical service life. To ensure the normal operation of the reactor until the end of its service life, a backup movable reflector MR-3R has been manufactured. In 2019-2021, a large complex of activities should be performed on its check assembling, adjustment and testing at the FLNP test bench.

- **Research activities under contracts to ensure safe operation of the reactor.  
Monitoring, diagnostics and prognostics of the state of the reactor.**

The nuclear-physical and operational characteristics of IBR-2 vary significantly in the process of its operation. To maintain a high level of nuclear, radiation and technical safety of the facility, and ensure control over the state of the reactor, it is necessary to conduct regular monitoring of the operating parameters of the movable reflector, basic technological equipment, materials and constructions of the core, vessel and other reactor equipment using modern hardware systems, computational and analytical methods of diagnostics and prognostics. On the basis of the performed analysis, appropriate measures are planned to compensate for negative trends in the changing characteristics of the reactor.

- **Upgrading of safety-related equipment**

In the process of operation of the reactor, appropriate activities are regularly planned and conducted to maintain the design performance efficiency of the equipment of the IBR-2 safety systems. An effective way to improve or ensure high-level performance of the equipment is its phased upgrading. This work is performed at the reactor by specialized organizations and

encompasses several stages including design, manufacturing, installation, commissioning operations and testing. The major tasks of upgrading the equipment of the IBR-2 facility by the end of 2022 are shown.

- **Licensing of operation and extension of service life**

The Rostekhnadzor license for operation of the IBR-2 nuclear research facility will expire on September 30, 2022. In this regard, it is necessary to ensure the timely preparation of a package of documents for obtaining a new license and accomplishment of routine maintenance for the extension of the service life of equipment and components of the IBR-2 safety systems.

- **Development of a concept for a new neutron source at JINR**

One of the tasks of the Seven-Year Plan for Development of JINR for 2017-2023 is the development of a concept of creating and using a new neutron source at JINR in view of the fact that the design service life and serviceability limits of the IBR-2 basic technological equipment and nuclear fuel are expected to expire by the end of the 2030s. A substantiated concept of creation of a new neutron source should be presented for consideration to the scientific community and governing bodies of the Institute by 2020.

Within the framework of the concept, the substantiation of the physical model of the source and its basic neutron-physical characteristics, which would be attractive for users and ensure the leading position of the neutron source for solution of a wide range of world-class experimental research, will be presented. In view of the importance and significant amount of work on the creation of the new neutron source, starting from 2020, it is planned to accomplish these tasks within the framework of a new JINR research theme.