

I. Preamble

The Chair of the PAC for Condensed Matter Physics, D. L. Nagy, welcomed the PAC members, the ex officio members from JINR, the invited experts A. Ioffe and F. Schilling, as well as the members of the JINR Directorate. The Chair presented an overview of the implementation of the recommendations made at the previous PAC meeting concerning the JINR research in the area of condensed matter physics.

JINR Vice-Director L. Kostov informed the PAC about the resolution of the 130th session of the JINR Scientific Council (September 2021) and the decisions of the Committee of Plenipotentiaries of the Governments of the JINR Member States (November 2021).

II. Status of the IBR-2 facility

The PAC took note of the progress report on the replacement of air heat exchangers of the secondary cooling circuit of the reactor and preparation for obtaining a license to operate the IBR-2 facility presented by V. Shvetsov. The expected schedule for the restart of IBR-2 should be clarified at the next meeting of the PAC. The PAC supports the FLNP plans for the next seven years including manufacturing a new fuel load for IBR-2 in order to provide the conditions required for extending its service life for the period after 2032.

Likewise, the PAC took note of the FLNP activity towards studying the mechanism of fluctuations in the IBR-2 power pulses which was continued in cooperation with the N. A. Dollezhal Research and Development Institute of Power Engineering (JSC NIKIET) and other organizations of the Rosatom State Corporation.

Recommendation. The PAC supports the FLNP activity on studying the mechanism of fluctuations in the IBR-2 power pulses and recommends continuing this work.

III. FLNP User Programme

The PAC heard information presented by D. Chudoba on the statistics of the FLNP User Programme at the IBR-2 spectrometers. The PAC took note of several changes in the set of neutron instruments operated under the User Programme in 2021. The PAC emphasized the importance of the first experiments at the neutron activation analysis instrument REGATA within the User Programme.

The PAC showed understanding concerning the suspension of the FLNP User Programme in the second semester of 2021 due to the operation status of the IBR-2

reactor and expressed the hope that the User Programme will be resumed soon after the license is obtained, which will restore the operation of the IBR-2 facility.

The PAC took note of the information about the User Committee of the FLNP User Programme.

Recommendation. The PAC supports further development of the FLNP User Programme. The PAC appreciates the establishment of the User Committee and asks the User Committee Chair to regularly share their impressions on submitted proposals with the PAC. The PAC urges the JINR Directorate to take care of continuation of experiments, especially those with participation of students due to the temporary shut-down of IBR-2.

IV. Status report on the upgrade of FLNP instruments

The PAC took note of the information on the EPSILON and SKAT experiments operated by German universities (KIT and the University of Bonn, respectively) in the frame of the BMBF–JINR collaboration as presented by F. Schilling. The stress-strain diffractometer EPSILON and the texture diffractometer SKAT are specifically developed for geoscientific samples and allow for sample characterization in a wide range of energies with high resolution.

The PAC appreciated that, despite the strong COVID-19 restrictions, the research programme of SKAT and EPSILON was successfully continued last year, owing to the scientists' in-house step-up efforts. The PAC welcomed the idea of using the temporary suspension of the IBR-2 operation for upgrading both instruments.

Recommendation. The PAC supports the presented upgrade programme for the SKAT and EPSILON diffractometers which includes an upgrade of the neutron guide, detectors, collimators, pressure device and sample positioning system, and recommends that modernization status updates on these two instruments be regularly reported to the PAC.

V. Development of the new neutron source at FLNP

The PAC took note of the report on the status and further plans for the development of the new neutron source at JINR presented by M. Bulavin. The PAC appreciated the importance of the studies carried out by the specialists of the FLNP Sector of New Source and Complex of Moderators in 2021 to calculate the vibrational stability of the projected NEPTUNE reactor (IBR-3) with neptunium-nitride fuel. The obtained results will make it possible to define the core layout and method of suspending the fuel elements that would ensure the vibrational stability of the reactor.

Calculations were carried out to optimize the composition of the reactivity modulator of the NEPTUNE reactor by introducing additional reflectors (material — nickel or beryllium). This reduces thermal loads on titanium hydride while maintaining the main characteristics of the new neutron source — its pulse duration and relatively low background.

To proceed to the next stage in the design of the NEPTUNE reactor (preliminary design stage), the PAC recommended that the R&D work on optimizing the reactor vessel and reactivity modulator should be carried out jointly with NIKIET, ROSATOM State Corporation.

The PAC took note of the start of work on principal points: the design of the cold moderators and radiation biological shielding of the reactor; it however also noticed that the work on the design of primary neutron optics has not been actually started yet.

Recommendation 1. The PAC recommends continuing studies of the dynamics of pulsed reactors. It also recommends taking into account the NEPTUNE reactor core layout when developing the technical specification for the R&D of the development of nitride-neptunium fuel rods.

Recommendation 2. The PAC recommends that a progress report on the work for developing the new neutron source made under the JINR–VNIINM contract and by JINR–NIKIET should be presented at the PAC meeting scheduled for January 2023.

Recommendation 3. The PAC expects to hear a detailed report on analysis of performance of different cold moderators (not only mesitylene but also e.g. volume and low-dimensional parahydrogen moderators) and on the design of primary neutron optics and shielding at the next meeting.

VI. Progress report on the theme “Development of the SOLCRYS Structural Research Laboratory at the SOLARIS National Synchrotron Radiation Centre”

The PAC took note of the recent progress within the theme “Development of the SOLCRYS Structural Research Laboratory at the SOLARIS National Synchrotron Radiation Centre” presented by N. Kučerka. The PAC notes that various parts of the SOLCRYS structural research laboratory are currently at different phases of accomplishment. Namely, the superconducting wiggler was selected as a source of X-rays and its production was outsourced to the Budker Institute of Nuclear Physics. The final design has been almost finished recently with close consulting of the straight section concept by FMB-Berlin (the company is foreseen for construction of the front end and

beamlines). One more major activity is extending the experiment hall required for accommodating the new laboratory.

The PAC was pleased with the adoption of the technical parameters and preliminary design of the beamlines, the design and construction of which are approaching their bid phase this year. The PAC expected that all three major parts of the activity will not get behind the initial schedule significantly, provided that they are duly executed through the three-year of the theme. At the same time, the PAC assumed that some more time beyond this three-year term will be required for completing, integrating and commissioning the instruments and, crucially, for getting to their operation by users.

Recommendation. The PAC recommends that the theme team present, at the next PAC meeting, a detailed report, including the financial aspects, for the expired period of the theme and a proposal for its extension.

VII. Information on the new facility for neutron radiography and tomography at the WWR-SM reactor (INP AS RUz, Uzbekistan)

The PAC heard a report on the design and technical parameters of the new facility for neutron radiography and tomography at the WWR-SM reactor (INP, Tashkent, Uzbekistan) as well as on the first results obtained in the experiment, presented by B. Abdurakhimov.

Recommendation. The PAC considers that the obtained technical parameters of the jointly developed neutron imaging facility at the WWR-SM reactor meet the requirements of a wide range of interdisciplinary research in the field of materials science, engineering sciences, and cultural heritage. The PAC recommends actively developing a research programme for this facility, in particular in a non-destructive structural study of the cultural heritage of the Republic of Uzbekistan. The PAC recommends contacting external experts in order to gain an expertise on further optimization of the neutron imaging facility.

VIII. Discussion of the approach to assigning reviewers for themes and projects

Following the motion moved and passed at the previous meeting, the PAC discussed the principles for assigning reviewers for themes and projects submitted for the PAC's consideration. It was agreed that, in general, blind reviews are appropriate in case of ex-ante assessment exercises when themes or projects are being opened or continued under the same or slightly modified name and content. The blind reviews should come from at least two but preferably three reviewers including a PAC member. The person of the blind reviewers will be known by the jury consisting of the PAC Chair, the Scientific Secretary of the PAC and the PAC member-reviewer. The jury will treat this information confidentially.

During their duration, themes and projects should also be additionally reviewed at their interim status at least once. No blind review is necessary for either interim or finally concluding assessment exercises. The jury's decision shall be forwarded to the theme or project leaders and the JINR and Laboratory directorates. A patron by the PAC shall be assigned to each theme and project who will help to interpret the jury's position so that it can be used for improving the theme or project. The assessment should be performed by filling in a well-defined template. The PAC will develop and submit to the JINR Directorate the recommended template for assessment of themes and project before April 2022.

The PAC attaches importance to receiving undistorted and unbiased reviews in assessment exercises of themes and projects and intends using blind reviews in this process whenever necessary and appropriate. It is envisaged that theme and project leaders may propose reviewers and also may declare conflict of interest with some potential reviewers.

Recommendation. The PAC recommends using well-defined templates in assessment exercises. This practice should be used, for the first time, for themes and projects to be assessed at the 56th PAC meeting in June 2022.

IX. Virtual presentations by young scientists

The PAC reviewed 14 virtual presentations made by young scientists in the field of condensed matter physics and life science research. The presentation "Investigation of superconductivity and magnetism in layered nanostructures by polarized neutron reflectometry with secondary radiation registration" made by V. Zhaketov was selected as the best presentation of the session. The PAC also noted two more virtual presentations of a high level: "High-pressure effect on internal structure and atomic dynamics of pharmaceutical compounds" by N. Belozeroва and "Search for biomarkers in UV-induced NETosis" by Y. Arynbeke. The authors will be awarded diplomas of the PAC.

Recommendation. The PAC recommends poster "Investigation of superconductivity and magnetism in layered nanostructures by polarized neutron reflectometry with secondary radiation registration" for presentation at the session of the JINR Scientific Council in February 2022.

X. Next meeting of the PAC

The next meeting of the PAC for Condensed Matter Physics is scheduled for 23–24 June 2022.

The preliminary agenda for the next meeting of the PAC includes:

- report by the PAC Chair on the implementation of the recommendations above;
- report by the JINR Directorate on the sessions of the Scientific Council of February 2022 and of the Committee of Plenipotentiaries of March 2022;
- reports and recommendations on the themes and projects to be completed in 2022 and on new themes and projects;
- discussion of the draft of the next Seven-year development plan of JINR (2024–2030) regarding condensed matter physics;
- report on the status of the IBR-2 facility;
- progress report on developing the concept for the new neutron source of JINR;
- status reports on the upgrade of FLNP instruments;
- information about scientific meetings;
- scientific reports (not more than three);
- poster (or electronic presentation) session.



D. L. Nagy

Chair of the PAC
for Condensed Matter Physics



O. Belov

Scientific Secretary of the PAC
for Condensed Matter Physics