I. Preamble

The Chairman of the PAC, D. L. Nagy, introduced the members of the PAC, in particular the new member P. Mikula and the invited expert A. Ioffe, the ex officio members from JINR and members of the JINR Directorate and presented an overview of the PAC report delivered at the session of the JINR Scientific Council in September 2017 concerning the implementation of the recommendations of the previous PAC meeting.

JINR Vice-Director M. Itkis informed the PAC about the Resolution of the 122nd session of the JINR Scientific Council (September 2017) and the decisions of the JINR Committee of Plenipotentiaries (November 2017). The PAC congratulates the JINR Directorate on the successful implementation of the JINR scientific programme in 2017 — the starting year of the new Seven-year plan for the development of JINR, and takes note of major events in the activities of JINR and its international cooperation.

The PAC is pleased to note that the recommendations of the previous PAC meeting concerning JINR research in the areas of condensed matter physics have been accepted by the Scientific Council and the Directorate. In particular, the Scientific Council took note of the discussion of plans for the preparation of a concept for JINR's new neutron source replacing IBR-2 after the decommissioning of the reactor. The Scientific Council agreed that starting the strategic planning of a possible project for a new source is an important task and welcomed further follow-up of this activity by the PAC. The Scientific Council noted that the first step in the planning process should be developing a comprehensive paper containing a clear science case and identifying the specific added value of the future JINR neutron source within the global and the European neutron source landscapes as well as the realistic user needs. The Scientific Council appreciated the PAC's intention to be involved in preparing this document. The Scientific Council also acknowledged the high quality of implementing the User Programme of IBR-2 which has made this basic JINR facility one of the world's leading open-access neutron sources. The Scientific Council also supported the PAC's recommendations on the continuation of ongoing activities and on the opening of new themes and projects in condensed matter physics and related fields, appreciating the scientific and technical results obtained.

II. Development of the scientific case for JINR's new neutron source

The PAC heard with interest a report on the development of the scientific case for a new source of neutrons at JINR, presented by N. Kučerka. The PAC supports the activities of FLNP in this direction and appreciates the attention being paid to the requirements of the scientific community in the context of modern sciences. The design of the future source must take into account the role of neutron experiments that is changing in accordance with the landscape of relevant scientific facilities.

Recommendation. The PAC supports the ongoing discussions on the scientific case of the new source and recommends their continuation in close connection with the scientific plans of FLNP. In particular, potential instruments should be considered in developing this scientific case.

The PAC appreciated the report "A 20-year forward look at JINR's high-flux pulsed neutron source" presented by V. Aksenov. The PAC takes note of the principles of construction and the parameters of a neutron source — a superbooster. If successfully implemented, such a source will take one of the world's leading positions among the high-flux pulsed sources that will be in operation in the middle of the current century. Nevertheless, taking a univocal position by the PAC in the matter of the physical scheme of the new neutron source would be premature at this stage. For selecting the optimal physical scheme, all reasonable options should be carefully analysed and compared with each other by an expert group properly representing the potential user community both from national and topical point of view. The suggested timeline of the preparatory phase of JINR's new neutron source with estimated deadlines includes:

– establishing an international working group (IWG) (in 2018);

– organizing international workshops by FLNP and scientifically coordinated by the IWG (from 2018 until the conceptual design report will be concluded);

– publishing a short (up to 50 pages) kick-off document elaborated by the IWG on the idea of the new facility (until mid-2019);

– elaborating and publishing a detailed scientific case (until early 2020);

– elaborating a detailed conceptual design report (until the end of 2020);

– elaborating the administrative and financial model for the construction, commissioning, operation and decommissioning phases (until 2021);

– taking decision on the construction of the new facility (until 2023).

Recommendation. The PAC considers the subcritical assembly of ^{237}Np with a mechanic reactivity modulation controlled by a proton accelerator (superbooster) to be a possible conception of the future neutron source. At the same time, the PAC

recommends continuing the work of studying other options with a clear analysis of the parameters of the new source in terms of strengths, weaknesses, opportunities and threats with respect to the envisaged long-term user programme. Instrument background should be considered in the design of the source.

III. Cooperation between JINR and the National Synchrotron Radiation Centre SOLARIS

The PAC heard with interest the report on the concept of JINR's synchrotron radiation laboratory at the SOLARIS synchrotron of the Jagiellonian University in Kraków, presented by V. Shvetsov. The PAC considers fruitful the idea of establishing a synchrotron radiation laboratory belonging to JINR in one of the Member States. The PAC supports this idea and believes that its implementation will significantly enhance the experimental capabilities of the JINR teams working in the field of condensed matter physics at the Institute. Therefore it invites the directorates of JINR Laboratories to elaborate the details of envisaged cooperation based on a more detailed scientific case and in terms of well-established user demands and the existing synchrotron radiation landscape.

Recommendation. The PAC recommends that the JINR Directorate, together with the Jagiellonian University, form a working group of representatives of both organizations with the participation of interested representatives of scientific centres of JINR Member States and provide it with the necessary financial support in order to develop the concept of the laboratory and a forward-looking scientific programme. Relevant materials should be presented at the next PAC meeting in June 2018.

IV. Status reports on upgrades of IBR-2 instruments

The PAC took note of the report presented by D. Kozlenko on the current state of the IBR-2 spectrometer complex and plans of its development. The PAC appreciates the significant upgrade of the IBR-2 spectrometers and development of new instruments, resulting in improvement of their parameters and extension of research areas, as well as making them more attractive for potential users. The development plans take into account specific features of the IBR-2 reactor (high flux, long pulse, availability of cryogenic moderator) and will assure the maintenance of the parameters of the instruments at the level comparable with other leading research centres in the world, as well as further extension of research areas and improvement of research quality.

Recommendations. The PAC recommends further development of IBR-2 instruments taking into account the current trends in the progress of neutron scattering techniques.

The PAC heard a report on the activities at the high-pressure neutron diffractometer DN-6 for investigation of microsamples under extreme conditions, presented by E. Lukin. The PAC notes the ongoing work to improve this instrument, which is a first-priority task in developing the IBR-2 spectrometer complex. The neutron flux on the sample has been increased by replacing part of the neutron guide with the neutron beam focusing system. Full-scale experiments are underway with high-pressure diamond anvil cells of various configurations. The PAC finds it reasonable to consider the possibility of further increasing both the neutron flux and the solid angle of the facility's detector system.

Recommendation. Taking into account that the DN-6 diffractometer becomes one of the world-leading instruments for neutron scattering studies of matter under extreme conditions, the PAC recommends that further development of DN-6 and its introduction to the User Programme remain one of the first-priority activities at FLNP.

V. FLNP User Programme

The PAC took note of the comprehensive report presented by D. Chudoba on the progress in implementing the FLNP User Programme, including details about the organization of the assessment of proposals and the statistics of their realization during 2015–2017. The PAC highly appreciates the efforts of the FLNP Directorate and the FLNP User Office to run the User Programme at an internationally highly recognized level. At the same time, technical shortcomings of the proposal assessment web applications were identified as a bottleneck of the evaluation process.

Recommendation 1. The PAC considers the FLNP User Programme to be the key instrument for securing the position of IBR-2 as one of the leading neutron sources in the world and encourages the FLNP Directorate to further support this highly important activity. The PAC recommends that the FLNP Directorate upgrade the IBR-2 proposal assessment web application to a professional system supporting the work of proposers, reviewers and the FLNP management and that it consider entrusting this task to the Laboratory of Information Technologies.

Recommendation 2. The PAC recommends that the FLNP User Office strictly insist on submitting experimental reports by all successful proposers as the necessary feedback.

VI. Scientific reports

The PAC heard with interest the scientific reports “Cultural heritage research using neutron imaging at the IBR-2 reactor” and “Planar graphene tunnel field-effect transistor: effect of edge vacancies on performance” presented by I. Saprykina and V. Katkov respectively.

VII. Information about a scientific conference

The PAC took note the information about the International Conference “Condensed Matter Research at the IBR-2” (Dubna, 9–12 October 2017) presented by T. Ivankina. The conference was organized by FLNP and dedicated to the 60th anniversary of this laboratory. The PAC notes that the conference contributed to attracting the attention of the international scientific community to the modern experimental equipment at the IBR-2 facility. The PAC appreciates the wide range of discussed problems on the application of neutron scattering and supplementary experimental techniques in condensed matter physics, chemistry, biophysics, materials science, engineering and Earth sciences. The PAC emphasizes the importance of similar interdisciplinary conferences contributing to the enlargement of the group of scientists from JINR Member States using IBR-2 instruments in their studies.

Recommendation. The PAC recommends that the holding of similar international conferences be continued in future.

VIII. Poster presentations

The PAC reviewed 24 poster presentations by young scientists in fields of condensed matter physics and information technology and took note of the summarizing report presented by T. Tropin. The poster “Fullerene-based complexes in solutions for anticancer therapy and neurodegenerative diseases” by O. Kyzyma was selected as the best poster at the session. The PAC also noted two other high-quality posters: “Investigation of the crystal and magnetic structure of nanostructured complex oxides of transition metals in a wide pressure and temperature range” by N. Belozerova and “Clusterization aspects of fullerenes C_{60} and C_{70} in toluene/N-methyl-2-pyrrolidone mixture according to SANS, SAXS and DLS data” by T. Nagorna. The authors of these posters will receive diplomas at the next meeting.

Recommendation. The PAC recommends the poster “Fullerene-based complexes in solutions for anticancer therapy and neurodegenerative diseases” to be reported at the session of the Scientific Council in February 2018.

IX. Next meeting of the PAC

The next meeting of the PAC for Condensed Matter Physics will be held on 14–15 June 2018.

Its tentative agenda will include:

– information by the PAC Chairperson on the report at the next session of the Scientific Council, and the implementation of the recommendations of the current PAC meeting;
– information by the JINR Directorate on the sessions of the Scientific Council (February 2018) and of the Committee of Plenipotentiaries (March 2018);
– reports and recommendations on themes and projects to be completed in 2018;
– discussion of the progress of the scientific case for JINR's new neutron source;
– discussion on the cooperation between JINR and the National Synchrotron Radiation Centre SOLARIS;
– progress in implementing the FLNP User Programme;
– status reports on the upgrades of FLNP instruments in the context of the JINR Seven-year plan;
– information on the update of the JINR Seven-year plan by the Laboratories involved in condensed matter research;
– information about scientific meetings;
– scientific reports;
– poster session.

D. L. Nagy

Chairman of the PAC
for Condensed Matter Physics

O. Belov

Scientific Secretary of the PAC
for Condensed Matter Physics