I. Preamble

The Programme Advisory Committee for Particle Physics takes note of the information presented by JINR Vice-Director R. Lednický on the Resolution of the 123nd session of the JINR Scientific Council (February 2018) and on the decisions of the JINR Committee of Plenipotentiaries (March 2018).

The Scientific Council recognized the ramping up of the international visibility of JINR and of its flagship projects. The NICA project has already been included in the ESFRI roadmap and in the NuPECC long-range plan, and efforts are being taken in order for it to become also part of the European Strategy for Particle Physics.

The Scientific Council welcomed the plans to hold a three-day meeting at JINR in April 2018 to officially launch the MPD and BM@N international collaborations and strongly encouraged the initiative to establish a grant programme to attract and support research conducted at the NICA facility.

The Scientific Council supported the recommendations of the PAC for Particle Physics on the approval of new projects and the continuation of ongoing projects in particle physics within the suggested time scales, as outlined in the PAC recommendations.

Concerning neutrino physics, the Scientific Council reiterated its recommendation that all ongoing or planned neutrino experiments should be presented and discussed within a joint meeting of the PAC for Particle Physics and the PAC for Nuclear Physics leading to a more coordinated neutrino physics programme and therefore allowing implementation of priorities in a more concerted and efficient way.

II. Development of JINR’s strategic long-range plans

The PAC heard with interest the reports concerning the long-range plans of JINR’s development in the area of particle physics presented by N. Russakovich and in the area of relativistic heavy-ion and spin physics presented by R. Tsenov. The PAC highly appreciates the JINR Directorate’s efforts towards establishing priorities and shaping up the strategic plans for the future of JINR. The Committee looks forward to being informed about further developments and proposals to be considered at the next meetings.

III. Reports on the Nuclotron-NICA project

The PAC was very pleased to hear the report on the progress towards realization of the Nuclotron-NICA project presented by A. Sidorin. It congratulates the VBLHEP staff for the successful completion of Run 55 of the Nuclotron. The PAC particularly notes the successful operation of the KRION-6T heavy-ion source and the significant improvements in the quality of the beam structure. It encourages the accelerator team to improve on the emittance of the extracted beam.

The PAC takes note of the report presented by the Coordinator of the experimental programme with Nuclotron beams, E. Strokovsky. The users of the argon and krypton beams have shown good performance and the PAC expects physics results to be presented at the next meeting.

The PAC takes note of the report on the infrastructure developments at VBLHEP, including the Nuclotron facility, presented by N. Agapov. It acknowledges the progress achieved in the civil construction of the NICA collider complex, the efforts of the VBLHEP and JINR managements toward its timely completion and welcomes the steady progress in various other areas of this flagship project.

The PAC appreciates the presentation by VBLHEP Director V. Kekelidze about the First Collaboration Meeting of the MPD and BM@N experiments, which took place at JINR on 11–13 April 2018. The Committee congratulates the NICA management for this significant milestone. The PAC is pleased to note the great interest of the international scientific community in the MPD and BM@N experiments as reflected by the attendance of about 200 participants at the meeting and by the large number of new groups that are joining the Collaborations. The PAC endorses the clear road map for the establishment of the structure and management teams of the MPD and BM@N Collaborations. The PAC supports the management’s efforts to secure funding for NICA collaborators.

The PAC takes note of the report on the progress towards realization of the NICA/MPD project presented by V. Kolesnikov. The PAC appreciates the ongoing efforts for the preparation of the technical design reports for the MPD subsystems, in particular for the FHCAL detector developed by the teams from INR (Troitsk) and MEPhI (Moscow). The PAC urges the MPD team to finalize the ECAL TDR, including results of simulation for the recently adopted projective geometry, and to present a detailed scenario for the ECAL timely construction and commissioning as soon as possible.

The PAC appreciates the progress towards realization of the BM@N project presented by M. Kapishin. The Committee notes the successful commissioning of new equipment, including large area GEM detectors and the first silicon stations of the vertex detector. The PAC acknowledges the improved detector performance and large statistics of experimental data collected in the recent Nuclotron run with argon and krypton beams, and in the first run with carbon beam for the short-range correlations studies. The PAC urges the team to concentrate on the analysis of the collected data, on the completion of the detector configuration, and on the installation of the vacuum pipe through the experimental set-up.

The PAC heard with interest the report on the first measurement of short-range correlations in a carbon nucleus using reverse kinematics in the BM@N set-up presented by E. Piasetzky. The PAC congratulates the Collaboration for the rapid realization of this project and looks forward to the results of the physics analysis.

IV. Reports on projects approved for completion in 2018 and proposed for continuation

The PAC takes note of the report on the NA61 experiment presented by V. Kireev. It is proposed to continue studying hadron production and nuclear fragmentation processes in hadron-nucleus and nucleus-nucleus reactions. The PAC is pleased that the present project has been prepared taking into account recommendations of the 47th meeting of this PAC: the participation of the JINR group in the data analysis is boosted and the number of participants is optimized keeping in view their involvement in the NICA project. The PAC congratulates the JINR NA61 team for the three PhD theses and two doctoral dissertations successfully defended. However, the PAC considers that the travel budget, which represents most of the requested fund, is relatively high in particular keeping in mind that there will be no run in 2019 and 2020. Assuming that the travel request will be significantly reduced, the PAC recommends continuation of JINR's participation in the NA61 experiment until the end of 2021 with second priority.

The PAC takes note of the report on the results of the NA62 experiment presented by D. Madigozhin. The experiment aims at measuring the very rare kaon decay $K^+ \to \pi^+ \nu\nu$. The PAC appreciates the results of the 2016 dataset analysis, the observation of the first candidate event of $\pi^+ \nu\nu$ decay and the publication of the first results on searches for heavy neutral leptons. However, beam properties (background and intensity) could impact on the final sensitivity of the experiment. To mitigate this impact, the Collaboration is taking a series of corrective measures that are expected to

still keep this unique experiment at the forefront of its research field. Therefore, the PAC recommends continuation of JINR's participation in the NA62 experiment until the end of 2021 with first priority.

The PAC takes note of the report on the HyperNIS project presented by D. Krivenkov. The first part of the experimental programme is the study of the lightest neutron-rich hypernuclei. The HyperNIS spectrometer upgrade has been successfully completed: new trigger electronics, power supply systems, FEE and DAQ have been installed and tested. Noting the importance of background studies, the PAC supports the proposed hypernuclei experiment to be carried out at the Nuclotron with light-ion beams of sufficient intensity and recommends continuation of the HyperNIS project until the end of 2021 with first priority.

The PAC takes note of the report on the ALPOM-2 experiment presented by N. Piskunov. To increase the analysing power, the set-up has been upgraded. A large-size calorimeter has been installed to eliminate multiparticle final states in reactions with protons and neutrons of 3.0, 3.75 and 4.2 GeV/c momenta. For the first time, a collection of data has been obtained on the azimuthal asymmetries for the charge exchange polarized-n+CH2→n+X reactions, as well as for C, CH (scintillator) and Cu polarimeter analysers. As expected from previous analyses, the charge-exchange analysing power is much larger for heavy targets than for the forward process, np→pn. The PAC considers these results to be very important for JLab experiments and recommends continuation of the APLOM-2 project until the end of 2021 with first priority.

The PAC takes note of the report on the DSS experiment at the Nuclotron's internal target, presented by M. Janek. The PAC recognizes the significant progress in obtaining experimental data on the analysing power in deuteron-proton elastic scattering. The advances in development of the deuteron and proton beam polarimetry for NICA by using the new source of polarized ions are also acknowledged. At the same time, since the data are coincidence/correlation measurements, a good coverage of the phase space by the detector set-up is important. The Committee encourages the Collaboration to find funding for an appropriate upgrade of their experimental set-up. The PAC recommends continuation of the DSS project until the end of 2021 with first priority.

The PAC takes note of the report on the STAR experiment, presented by Yu. Panebrattsev. The PAC appreciates the results obtained by the JINR group in the study of antiproton-antiproton and Lambda-Lambda correlations performed with high

statistics, the analysis of scaling properties of the charged hadrons spectra, and the JINR team's participation in the event plane detector upgrade. The Committee also notes the preparations for the "Beam Energy Scan Phase II". The PAC encourages the team to share its experience with the MPD team and recommends continuation of JINR's participation in the STAR experiment until the end of 2021 with first priority.

The PAC takes note of the report on the HADES experiment at GSI/FAIR, presented by V. Ladygin. HADES is a versatile detector focused on the precise spectroscopy of e^+e^- pairs produced in proton, pion and heavy-ion induced reactions in the beam kinetic energy range of 1-3.5 GeV. The main experimental goal is to investigate properties of dense nuclear matter created in the course of heavy-ion collisions and ultimately to learn about in-medium modification of hadron properties. The PAC encourages the JINR team to shift its focus to the measurement of dileptons at NICA. The PAC recommends continuation of JINR's participation in the HADES experiment until the end of 2021 with second priority.

The PAC takes note of the report on implementation of the project "Precision laser metrology for accelerators and detector complexes" presented by M. Lyablin, and recognizes the important results achieved by the JINR group in collaboration with CERN. The PAC notes the further plan of the project's integration in the CERN network of PLIs, but considers that the group should implement its expertise in the NICA project. The PAC recommends continuation of this project until the end of 2021 with second priority.

V. Proposal of a new project

The PAC heard with interest the proposal of a new project entitled "ARIeL: Physics at future e^+e^- colliders" presented by I. Boyko. The main goal of the project is to develop the physics programmes for future electron-positron colliders, like CEPC, CLIC, FCC and ILC. These include precise measurement of the Higgs boson mass, measurement of the top polarization, study of the WW and ZZ couplings. The experimental part of the project has been developed within the CERN CLIC Collaboration. Although theoretical calculations performed within the project could be useful for any future electron-positron collider, there are serious points of concern: uncertainties on the choice of the future machine(s) beyond the HL-LHC; limited capacity of the CLIC to address Higgs studies; a harsh international competition on the proposed studies which would affect the expected impact of this research. The PAC recommends approval of this project until the end of 2021 with third priority.

VI. Reports and proposals on themes approved for completion in 2018

The PAC takes note of the written report presented by G. Shirkov on the results obtained under the theme “Advance Studies on Systems of New-Generation Accelerators and Colliders for Fundamental and Applied Research” and on the plans to continue this theme until the end of 2023.

The PAC takes note of the written report presented by A. Olshevskiy on the theme “Study of Neutrino Oscillations” and on the plans to continue this theme until the end of 2023.

The PAC takes note of the report presented by A. Filippov on the theme “Dubna International Advanced School of Theoretical Physics” (DIAS-TH) and on the proposal to continue this theme. The PAC appreciates the activities focused on the education of young scientists and students and the regular organization of dedicated training courses, lectures, workshops and schools. The PAC recommends continuation of the DIAS-TH activities within this theme until the end of 2023 with first priority.

The PAC takes note of the report presented by D. Kazakov on closing the theme “Theory of Fundamental Interactions” and on the proposal to open a new theme entitled “Fundamental Interactions of Fields and Particles” until the end of 2023. Given the high quality of the scientific productivity of the groups and the sound plans for future research, the PAC recommends approval of the new theme with first priority.

The PAC takes note of the report presented by A. Isaev on closing the theme “Modern Mathematical Physics: Strings and Gravity, Supersymmetry and Integrability” and on the proposal to open a new theme entitled “Modern Mathematical Physics: Gravity, Supersymmetry and Strings” until the end of 2023. Given the high quality of the scientific productivity of the groups and the sound plans for future research, the PAC recommends approval of the new theme with first priority.

VII. Young scientists at JINR

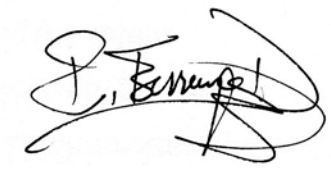
The PAC reviewed 9 poster presentations in particle physics by young scientists from DLNP, LIT, BLTP and VBLHEP. The Committee has selected the poster “How robust is a third family of compact stars against pasta phase effects?” presented by A. Ayriyan to be reported at the session of the Scientific Council in September 2018.

VIII. Next meeting of the PAC

The next meeting of the PAC for Particle Physics will be held on 21–22 January 2019.

The following items are proposed to be included in the agenda of the next meeting:

– follow-up on the to-do-list from this PAC meeting;
– consideration of new projects;
– reports and recommendations on the projects to be completed in 2019;
– status report on the Nuclotron-NICA project;
– status report on the MPD project including simulation results;
– status report on infrastructure issues including Nuclotron;
– report from the Coordinator of the experimental programme with Nuclotron beams;
– report on the BM@N project including simulation results and new addendum to the physics programme;
– Conceptual Design Report of the SPD experiment (and formation of the Collaboration);
– reports on the results of the LHC experiments;
– posters from young physicists.



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