REFEREE REPORT on the
PROPOSAL of the PROJECT

"PANDA experiment at FAIR (JINR participation)"

The Facility for Antiproton and Ion Research (FAIR) in Darmstadt, Germany, builds on the experience and technological developments of the existing GSI laboratory, and provides unique possibilities for a new generation of hadron-, nuclear-, atomic- and plasma physics experiments. The future fixed-target experiment PANDA at FAIR, which features a modern multipurpose detector, offers a broad physics program with an emphasis on various aspects of hadron physics. The antiproton beams of High Energy Storage Ring (HESR) with momenta ranging from 1.5 to 15 GeV/c allow using a wide variety of physics channels. Understanding the strong interaction in the non-perturbative regime remains one of the greatest challenges in contemporary elementary particle physics and, to that end, the hadron beams provide several important advantages. Furthermore, the high-intensity low-energy domain of PANDA experiment will be suitable for Standard Model tests on the high-precision frontier.

Currently, the JINR physicists at PANDA develop a number of important areas. The most urgent of them are related to the detector construction and JINR has commitments on making the Muon System, very important part of PANDA detector.

PANDA Physics Pillars include study of: 1) the nucleon structure and its characteristics GDAs and TDAs, EMFFs; 2) the strangeness physics, such as hyperon production, spectroscopy and decays; 3) the physics of charm and exotics, such as glueballs, hybrids and multiquarks; 4) hadrons in nuclei: color transparency at intermediate energies, short-distance structure of the nuclear medium, influence of the nuclear potential on hadron properties.

Dubna group' studies give significant contribution to the physics program. The results obtained in the simulation of the standard benchmark process of the "muon-antimuon" pair production and its background modeling allowed to work out the requirements and geometric parameters of the proposed muon system of the PANDA detector. Currently, the more in-depth study of the backgrounds for the Drell-Yan process is being conducted to estimate the possibility of studying this process at the PANDA. A complete geometric description/model of the muon system has been accomplished and now it is ready to be implemented in the PANDARoot package. The development and improvement of the FTF model, implemented in Geant4 with cross-checking with experimental data from other experiments, allows to study charmed quark, strange quark-antiquark and diquark-antidiquark pair production, which is especially important for the initial phase of PANDA physics program. This model is also used for modeling and analyzing inelastic and elastic proton-proton interactions with 2, 4, 6 hadrons in the final states with large transverse momentum. In addition, simulation of proton interactions with C, Al, Cu and W nuclei was done using Geant4 FTF model, results of which can be useful in developing the p/bar-nucleus physical program in the energy range of the PANDA experiment. Development of research program of the exotic multiquark states at PANDA is also being carried out. JINR PANDA group as well involved in the preparation of the LoI for the 'Phase-C' of PANDA, which is devoted to the study the high Pt physics during commissioning of the PANDA setup. This list of physical activities of the JINR group complements the experimental achievements of the group on the construction of the PANDA muon system. Finally, let us hope to see the successful start of the PANDA experiment.

I suggest that the Program Advisory Committee should approve the prolongation of the proposed project on JINR group participation in the PANDA experiment for the next five years.

Doctor of physical and mathematical Sciences,
Leading scientist of BLTP JINR
A.E. Dorokhov

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