

## Review on the JINR VBLHEP project "Nuclotron - NICA"

The main goal of the NICA project, which is being realized within the framework of theme 02-0-1065-2007 / 2023, is to create an accelerator complex that will allow research with colliding ion beams of high-intensity (up to  $\text{Au}^{+79}$ ) with an average luminosity  $L = 10^{27} \text{ cm}^{-2} \text{ s}^{-1}$  in the energy range in the center-of-mass system  $\sqrt{s_{\text{NN}}} = 4\text{--}11 \text{ GeV} / n$ , with beams of polarized protons ( $\sqrt{s_{\text{NN}}}$  up to 26 GeV) and deuterons ( $\sqrt{s_{\text{NN}}}$  up to 12 GeV / n) with longitudinal and transverse polarization, as well as with extracted beams of ions and polarized protons and deuterons.

The Nuclotron-NICA project was started in 2011. At the first stage of its realization, its main tasks were to complete the modernization of the superconducting synchrotron Nuclotron, to optimize the structure and parameters of the newly created NICA accelerator complex, to determine the optimal location of the collider at the VBLHEP site, and to develop a technical design for the accelerator complex. This work was carrying out under permanent international expertise provided on the accelerator complex by the Machine Advisory Committee (MAC), and ended with the approval in 2015 of the technical design of the NICA complex. The technical design of the building to locate the collider and the beam transport channels was developed by a specialized design company and passed the state expertize. The buildings for the line for assembly and testing of the superconducting magnets and newly created accelerating facilities were repaired. The assembly and testing line of superconducting magnet was constructed and put into operation in 2016.

At the second stage of the project realization, it was planned to complete the construction and commissioning of the main accelerators of the NICA complex. For the period 2016 - 2020 a significant amount of work was performed, including substantial modernization or construction of all elements of the injection complex. The optimality of the chosen technical solutions was confirmed by the results of the Nuclotron runs, during which the important results were obtained in the physics and technology of polarized beams, radiobiology. The realization of a program of physical research on experimental facilities with a fixed target was started. At present, the construction of an injection chain for heavy ions is at the final stage. The newly created linear accelerator was tuned to the design parameters; the transport channel to the Booster was built and tested with a beam, all the Booster systems were manufactured, tested, placed and mounted at their regular places. By the end of 2020, the Booster is scheduled to be tested with the ion beam.

However, in a number of key positions there is a noticeable lag behind the previously outlined plans. This concerns, first of all, the commissioning of the Booster, which was scheduled for 2018. There is a serious delay in the construction of the building of the new compressor station; accordingly, the modernization of the VBLHEP cryogenic complex has not been completed. The reasons for the lag were analyzed in detail and reported to the Supervisory Board of the project. In addition to making changes to the project during its realization, in my opinion, there was an underestimation of the volume of installation and technical work on the commissioning of the Booster, as well as a deficit of qualified personnel.

The main task of the project for the next 3 years is the completion of the basic configuration of the accelerator complex and the beginning of the research program at the NICA collider. To

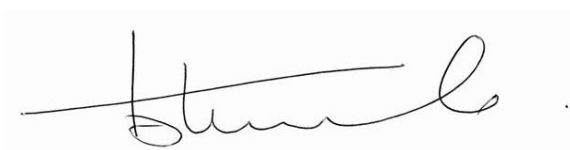
accomplish this task, there is the necessary groundwork: design work has been completed for the main elements of the complex and their manufacture is underway. However, since the time frame is extremely tight, more detailed risk analysis and management are required, including those associated with work performed by third parties.

It has to be pointed out the great work performed to attract highly qualified specialists and talented youth to the project. Despite this, the deficit of personnel can significantly affect the term of the project realization and the Advisory Committee (MAC) attracted the attention to this.

Planning of the Project budget is carrying out at a high professional level using the EVM system.

I recommend the approval of the Nuclotron-NICA project and to present it for consideration by the Program Committee.

JINR vice director,  
Academician RAS

A handwritten signature in black ink, appearing to read 'B. Yu. Sharkov', is written over a light gray rectangular background.

B.Yu.Sharkov

21.10.2020