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CRYOGENIC TECHNOLOGIES OF THE NICA ACCELERATOR COMPLEX

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Since 1992, the largest Russian cryogenic helium complex of the superconducting accelerator Nuclotron with the cooling capacity of 4000 W at 4.5 K has been operating at JINR in Dubna. The construction of this high efficient cryogenic system included a large number of technical ideas that had never been applied before in the world: the fast cycling superconducting magnets, cooling by the two-phase helium flow, parallel connection of cooling channels of the magnets, «wet» turbo expanders, screw compressors with the outlet pressure of more than 2.5 MPa and jet pumps for liquid helium. In the near future it is planned to construct a new accelerator complex, comprising besides the Nuclotron, a superconducting booster and collider to provide collisions of high-intensity beams of heavy ions up to gold Au+79. The helium cryogenics of the NICA complex will be based on the modernized liquid helium plant for the Nuclotron. The main goals of the modernization are: to increase the total refrigerating capacity from 4000 W to 8000 W at 4.5 K; to create a new system of liquid helium distribution; to ensure the shortest time of cooling down three accelerators rings with the total length of about 1 km and the “cold” mass of 290 tons. These goals will be achieved by means of commissioning of a new 1000 l/hour helium liquefier, “satellite” refrigerators of the booster and the collider. Besides, a new closed-cycle 2300 kg/h nitrogen cryogenic system for producing and distributing of liquid nitrogen and re-condensation of nitrogen vapors will be constructed. New technical solutions in the design of the NICA cryogenic systems will be discussed.

Submitters Country

Russia

Primary authors: Mrs MITROFANOVA, Iuliia (JINR); Dr AGAPOV, Nikolay (JINR); Mr KONSTANTINOV, Anton (JINR); Mr KRAKOVSKY, Boris (JSC “NPO GELIYMASH”); Mr POPOV, Oleg (JSC “NPO GELIYMASH”); Dr UDUT, Vadim (JSC “NPO GELIYMASH”)

Presenter: Mrs MITROFANOVA, Iuliia (JINR)

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