Abstract

The cryogenic system of the NICA collider will be constructed as a result of the modernization of the existing equipment for cryogenic supply of the Nuclotron.

Helium Liquefier OG-1000

The cryogenic system of the NICA complex will include the latest Russian developments. The helium liquefier, OG–1000, is a new accelerator complex designed to study properties of the dense baryon matter. Accelerator complex will consist of three superconducting rings: the Nuclotron, the booster and the collider. After putting of the NICA collider into operation the scientists will be able to create a special state of matter in which our Universe stayed shortly after the Big Bang – the Quark-Gluon Plasma (QGP).

Since 1992, the largest Russian cryogenic helium complex of the superconducting accelerator Nuclotron with the refrigerating capacity of 4000 W for 4.5 K has been operating at JINR in Dubna, Russia. The construction of this high efficient cryogenic system included a large number of technical ideas never used before in the world practice: the fast cycling superconducting magnets, cooling by the two-phase helium flow, parallel connection of cooling channels of the magnets, vacuum-free bellows, screw compressors with the outlet pressure of more than 2.5 MPa and jet pumps for liquid helium.


The helium cryogenic system 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 6000 W for 4.5 K, to create a new system of liquid helium distribution, to ensure the short 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/hour helium liquefier, "satellite" refrigerators of the booster and the collider, 6600 Nm3/h helium screw compressor aggregates.

Heliium Compressor “Kaskad-110/30”

The cryogenic system of the NICA complex will use compressors of various types and modifications. The smaller capacity piston machines will be used for stage-by-stage regulation of flow rate of the compressed helium. But the main mass flow of sub-cooled screw compressor aggregates 5000 nm3/h “Kaskad-40/25” and 6600 nm3/h “Kaskad-110/30” will be used.

Fast Cycling Magnets and Refrigeration by Two-phase Helium Flow

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NICA Cryogenics

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