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The superconducting magnet of the Multipurpose Detector

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Abstract content

The multipurpose detector (MPD) is a 4π spectrometer to be used for studying charged hadrons, electrons, and photons generated in heavy ion collisions at energies provided by the NICA collider of the Joint Institute for Nuclear Research (Dubna). A constituent part of the MPD is a solenoid magnet with a superconducting NbTi coil and a steel flux return yoke. The magnet weighs eight hundred tons and is intended for providing a highly homogeneous magnetic field of 0.5 T in an aperture 4596 mm in diameter to ensure the transverse momentum resolution within the range of 0.1-3 GeV/c at NICA. Structurally, the MPD magnet yoke is a cylindrical barrel-like structure, which consists of 24 beams that return the magnetic flux of the coil, two support rings, two poles, and two support cradles that carry the total weight of the detector. The stainless cryostat with the superconducting coil is rigidly fixed inside the yoke barrel. The adopted structural arrangement of the yoke guarantees high rigidity of the whole magnet and will ensure the required field homogeneity (integral of the radial magnetic induction component) in the TPC region after subsequent withdrawals of the poles and multiple movements of the magnet to the assembly site for updating or repair. The coil is a one-layer solenoid made of a superconducting NbTi cable in the aluminum matrix. The conductor is wound onto inside the aluminium support cylinder. The cooling method chosen for the MPD magnet is based on the forced two-phase helium flow using a helium refrigerator. The coil conductor is cooled indirectly via the thermal contact with the aluminum cylinder and heat removal through the cylinder to the aluminum tube with circulated liquid helium.

Summary

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