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Design of 6T superconducting solenoid system for spin polarization control at NICA collider

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Particle spin physics research at Nica collider deals with polarized proton and deuterium beams. Special solenoids are proposed to control the spin direction of the polarized beams in NICA. Spin direction can be controlled by adjusting the integral of axial magnetic field of the solenoids. We present design results for 6T polarization control superconducting magnets for NICA collider. The maximal integral of static field is 50 T·m. The polarization control magnet system is composed of several identical stand-alone units. Each unit has a warm bore or two warm bores connected to the collider vacuum ring. An active study of the dynamics of the spin of a relativistic particle made it possible to detect a wide range of instabilities of spin motion. The instabilities of spin motion (depolarizing resonances) lead to a rapid loss of beam polarization upon acceleration and is the main problem in obtaining a polarized beam of high-energy protons. Active interest in solving this problem is due to a wide range of spin phenomena found in the high-energy region. Magnet design, field maps are calculated and the optimal solenoid configuration is discussed. This paper is dedicated to memory of professor Kovalenko A.D. , who recently passed away. The authors thank the Russian Foundation for Basic Research (RFBR) for the financial support of the project № 19-29-10007.

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