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Development of superconducting magnetic energy storage for the power system of the particle accelerators Booster and Nuclotron of NICA

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A power supply system with transformer type superconducting magnetic energy storage (SMES) is being created to power the superconducting magnets of the particle accelerators Booster and Nuclotron of the NICA complex at JINR. The system includes a solenoid made of HTS cable, with an operating temperature of 28 K, with flow cooling by liquid neon, and an operating current of up to 8 kA with 4 s pulse period. The solenoid will consist of 3 inductively coupled windings with dielectric frames, to which semiconductor converters are connected to charge Booster magnets, Nuclotron magnets, and to feed the SMES from the distribution grid. The power supply system with the SMES will improve a power supply quality of the accelerator magnets, eliminate the influence of the accelerators operations on the distribution grid, and provide galvanic isolation of the power supply circuits of Booster and Nuclotron from the distribution grid and from each other. The work is being carried out in cooperation with ASIPP. Both JINR and ASIPP develop their own similar 2G HTS cabling technologies and different solenoid winding technologies –layer winding with screw-on frames (JINR) and double pancakes (ASIPP). A comparative description of the technologies, test facilities and research methods developed in Dubna and Hefei, R&D results obtained, and samples prepared is presented. Based on the results of R&D the technical design of the power supply system and the SMES will be developed by the end of 2021.

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