



New Trends in Nuclear Physics Detectors

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Automatization systems for NICA MPD Magnet tests

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At JINR (Joint Institute for Nuclear Research) in Dubna, a project called NICA (Nuclotron-based Ion Collider Facility), (NICA is the JINR flagship project for the next decade), is being implemented to create an ionic collider based on the Nuclotron as part of a program to study nuclear matter in a hot and dense state. The main objectives of the program: the creation of an accelerator complex of ions with high luminosity in the energy range up to 11 GeV/nucleon and a modern multi-functional detector for the study of heavy-ion collisions.

The collider has two meeting points for the beams, which makes it possible to install two detectors and simultaneously carry out two experiments.

One of the detectors, the MPD (Multi-Purpose Detector), is planned to study the properties of hot and dense nuclear matter formed during collisions of high-energy heavy ions, in particular, to search for effects associated with deconfiguration and/or restoration of chiral symmetry, to study the properties of phase transitions and mixed hadron and quark-gluon phases.

The planned accelerator-accumulative complex will open new great opportunities for carrying out applied programs at JINR in the fields of radiation technology, biology, and medicine.

An important goal of the NICA project is to provide users with a research machine that will allow them to acquire new scientific knowledge, research, and understand the physical properties of a substance at an early stage of its occurrence.

The multi-functional MPD detector is an advanced technical device. Some of its sub-detectors require a homogeneous magnetic field for proper operation.

To ensure a homogeneous magnetic field, a great size superconducting solenoid was produced. To exhibit superconducting properties, it will be cooled with the use of gaseous and liquid nitrogen (thermal shield) and gaseous and liquid helium (cold mass). Four tests are required to ascertain that the magnet will perform correctly during experiments: vacuum test, leak test, electrical test, and magnetic field test.

The poster describes automation systems prepared for two of four required tests - vacuum test and leak test. For vacuum pumping, a vacuum system has been designed, consisting of three different pumps that must work in a strictly defined sequence. A leak test will be performed using the MFS (Magnet Flushing Station), which allows regulating gaseous nitrogen temperature on the outlet of the station. Using it, the magnet will be slowly cooled down to the close to liquid nitrogen temperature.

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