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MultiPurpose Detector (MPD) at the Collider NICA: design and main parameters

The major goals of the NICA/MPD Project is the study of the in-medium properties of hadrons and the nuclear matter equation of state, including a search for possible signals of deconfinement and/or chiral symmetry restoration phase transitions and the QCD critical endpoint in the region of the collider energy $\sqrt{s_{NN}}$ = 4 - 11 GeV. The basic strategy is to measure a large variety of signals systematically changing collision parameters (energy, centrality and system size). Reference data (i.e. pp and pA collisions) will be taken in the same experimental conditions. A tentative list of experimental observables includes: total particle yields and ratios, event-by-event fluctuations and correlations, collective flow of identified hadron species, strangeness production, femtoscopy, and electromagnetic probes (electrons and gammas). The hadrons containing heavy strange quarks and anti-baryons are of particular interest.

The detector will comprise a precise 3-D tracking system based on TPC and a particle identification (PID) system based on the time-of-flight measurements and shashlyk type Electromagnetic Calorimeter.

The energy of the projectile spectator nucleons will be measured by the Forward Hadron Calorimeter (FHCal) which is located at distances of 2.9 m from the center of the interaction region. The Fast Forward Detectors (FFD) will provide the TOF with the start signal. FFD consists of two identical arrays of granulated Cherenkov counters situated symmetrically around the interaction point.

At the design luminosity, the event rate in the MPD interaction region is about 6 kHz; the total charged particle multiplicity exceeds 1000 in the most central Au+Au collisions at $\sqrt{s_{NN}}$ = 11 GeV. As the average transverse momentum of the particles produced in a collision at NICA energies is below 500 MeV/c, the detector design requires a very low material budget.

The first stage of the MPD includes TPC, TOF, ECal, FFD and FHCal will start operation in 2020.

Experimental Collaboration

MPD/NICA Collaboration

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