

NA61/SHINE experiment at CERN SPS: Recent results, current status and perspectives

Thursday, 25 October 2018 15:30 (30)

NA61/SHINE is a fixed-target experiment at the CERN Super-Proton-Synchrotron (SPS) measuring the hadron production in hadron-nucleus and nucleus-nucleus collisions with a large acceptance detector system. The measurements performed for a wide range of reactions provide valuable data for studying properties of hadronic matter under extreme conditions. They also provide precise results on hadron production for determining the neutrino flux in long-baseline neutrino experiments and for more reliable simulations of cosmic-ray showers.

The primary aim of the experiment is the investigation of the transition from hadron gas to quark-gluon plasma and the search for associated critical point. A broad region of the phase diagram is probed by varying energy and size of the collision system (from p+p to Pb+Pb at beam momenta 13A – 150 /158A GeV/c). Various observables, e.g. quantities measuring event-to-event fluctuations of the particle multiplicity, which are expected to reveal the occurrence of phase transition or critical behavior are examined. The observed non-monotonic pattern in the excitation function of the K^+/π^+ ratio in NA49 Pb+Pb reactions has been interpreted as the onset of deconfinement. This ratio is currently studied in p+p, Be+Be and Ar+Sc collisions by NA61/SHINE.

Analysis of the system-size dependence of hadron production properties has shown a distinct qualitative change in passing from p+p and Be+Be to Ar+Sc system, which indicates a threshold for formation of large clusters of strongly interacting matter - the onset of fireball.

Recently, the experimental program was extended by measurements of production properties of open charm mesons that are expected to provide a better insight into the phase transition behavior of hadronic matter. For this purpose, the NA61/SHINE spectrometer was supplemented with a Vertex Detector, which allowed identification of D^0 mesons in the first test measurements performed for Pb+Pb collisions at 150A GeV/c.

This talk will present the recent experimental results and the physics program for future measurements beyond 2020, after the Long Shutdown 2 of the CERN accelerators, as well as the planned upgrade of the NA61/SHINE facility.

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Session Classification : Plenary