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Recent results from NA61/SHINE

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Abstract

The NA61/SHINE fixed-target experiment at the CERN SPS studies the onset of deconfinement and searches for the critical point of strongly interacting matter by measuring hadron production as a function of the collision energy and the colliding system size.

This contribution summarises recent results on hadron spectra and fluctuations, in particular new results on charged kaon production in ^{7}Be+^{9}Be collisions. Also an overview of the proposed future program of NA61/SHINE is presented.

Keywords: critical point, onset of deconfinement, CERN, SPS

1. Two-dimensional scan program of the NA61/SHINE experiment at CERN SPS

NA61/SHINE scans the phase diagram of strongly interacting matter in baryon density and temperature. The programme is motivated by the evidence for the onset of deconfinement in Pb+Pb collisions at 30*A* GeV/*c* found by the NA49 experiment [1, 2]. Measurements of hadron production in a two-dimensional scan in beam momentum (13*A*–150/158*A* GeV/*c*) and system size (p+p, p+Pb, ^{7}Be+^{9}Be, Ar+Sc, Xe+La and Pb+Pb) are conducted in parallel to the RHIC beam energy scan. Figure 1 shows the data taking progress.

NA61/SHINE studies the onset of deconfinement by measurements of the hadron spectra and searches for the critical point of strongly interacting matter by measuring event-by-event fluctuations.

The detector is based on a system of five Time Projection Chambers providing acceptance in the full forward hemisphere, down to $p_{\mathrm{T}} = 0$. Time of Flight walls provide additional particle identification. A zero-degree calorimeter, Projectile Spectator Detector, allows the selection of central collisions based on the measurement of the forward energy.

2. Recent results from NA61/SHINE

2.1. Study of the onset of deconfinement

2.1.1. Negatively charged pion spectra

Negatively charged pion spectra in p+p [3], central Be+Be [4, 5] and central Ar+Sc collisions [6, 7, 8] were derived in large acceptance from unidentified negatively charged hadron spectra using the h^- method. Figure 2 (*left*) shows the transverse mass spectra at 40*A* GeV/*c*, compared with the NA49 results for central Pb+Pb collisions [2]. The spectra are approximately exponential; a deviation from the exponential function at low and high m_{T} in heavier systems indicates collective radial flow.

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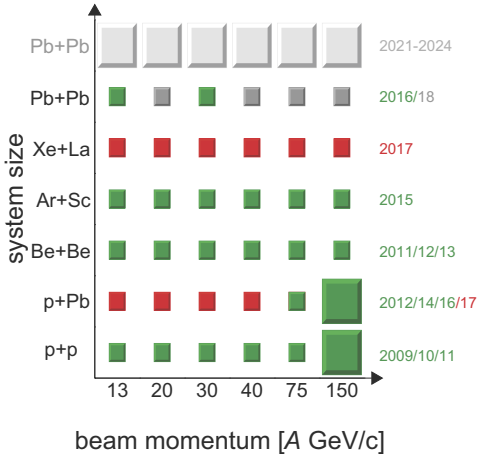

Fig. 1. Data taking progress of the NA61/SHINE two-dimensional scan. The small boxes correspond to $2 \cdot 10^6$ events and the large ones to $50 \cdot 10^6$. The green boxes show data collected as of spring 2017. The reactions planned to be measured within the approved and extended NA61/SHINE programs are shown in red and grey, respectively. The light grey boxes show the large statistics Pb+Pb beam momentum scan planned for 2021–2024.

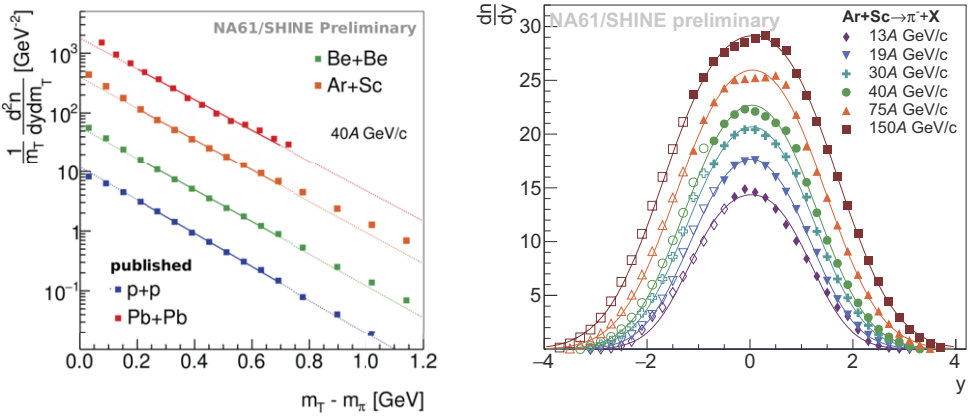

Fig. 2. Negatively charged pion spectra. *Left:* Transverse mass spectra at mid-rapidity at 40*A* GeV/*c*. An exponential function was fitted in the region $0.2 < m_T < 0.7$ GeV/c^2. *Right:* Rapidity spectra in Ar+Sc collisions at six beam momenta. A sum of two symmetrically displaced normal distributions of independent amplitudes was fitted to the data.