

MPD prospects for the study of the strangeness production and strangeness-to-entropy ratio at NICA energies

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RFBR Grant 18-02-40037

Plan of the presentation

- Results achieved
- Current status of the study
- Future plans

I. Results achieved

Strangeness-to-entropy in Au+Au: MPD performance study

- Particle spectra, yields & ratios are sensitive to bulk fireball properties and phase transformations in the medium
- Uniform acceptance and large phase coverage are crucial for precise mapping of the QCD phase diagram

ISSN 1547-4771, Physics of Particles and Nuclei Letters, 2020, Vol. 17, No. 3, pp. 358–369. © Pleiades Publishing, Ltd., 2020.

METHODS OF PHYSICAL EXPERIMENT

Performance of the MPD Detector in the Study of the Strangeness to Entropy Ratio in Heavy-Ion Collisions at the NICA Accelerator Complex

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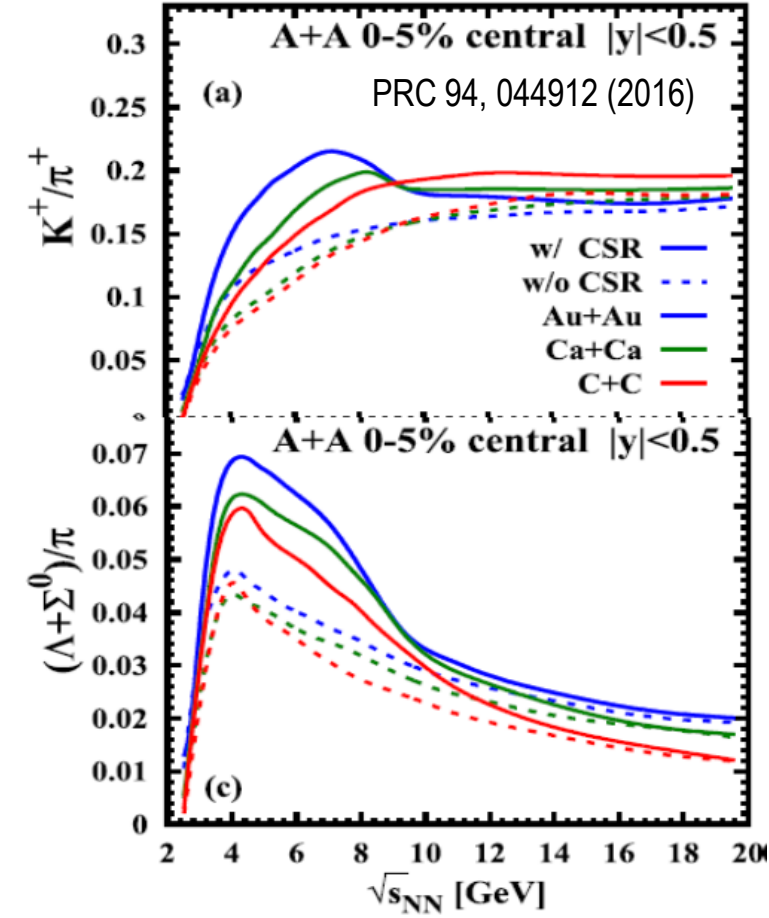
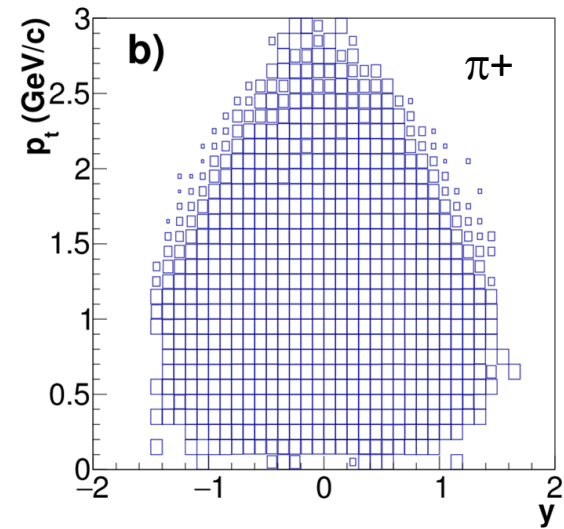
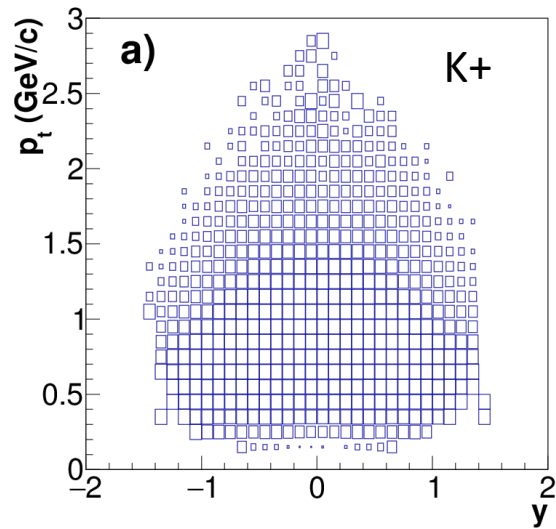
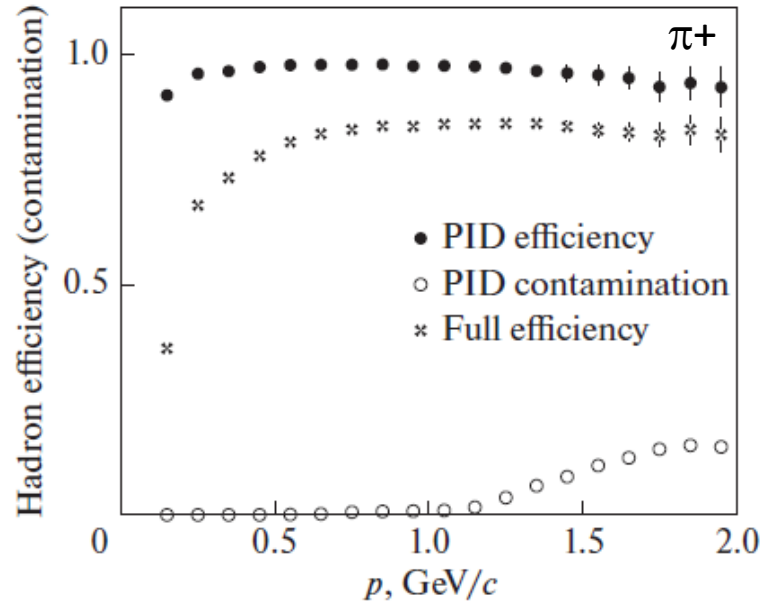
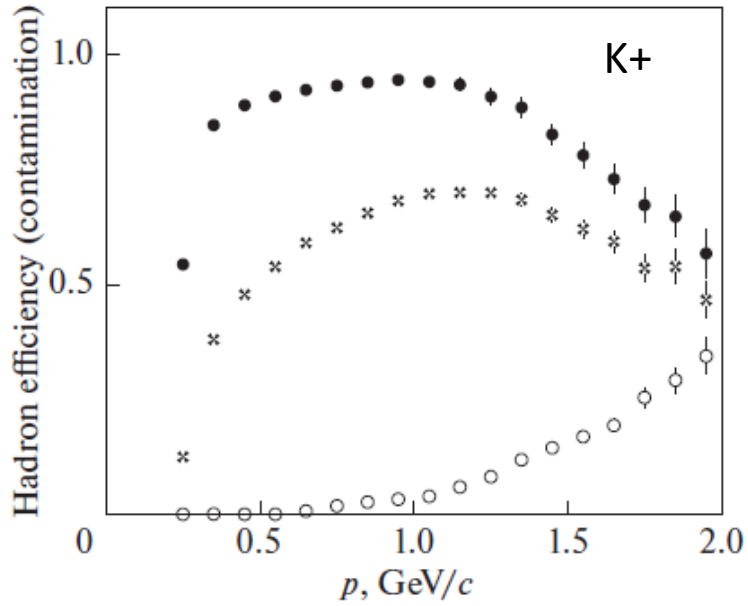
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Received December 27, 2019; revised January 13, 2020; accepted January 17, 2020

Abstract—Strangeness production in heavy-ion collisions is one of the main goals of the scientific program at the NICA accelerator complex. The MPD detector is designed to study the properties of strongly interacting matter at extreme baryon densities. In this article, the MPD performance to measure the excitation function of the strangeness to entropy ratio in central Au + Au collisions is reported. The investigation has been performed at the Laboratory of High Energy Physics, JINR.

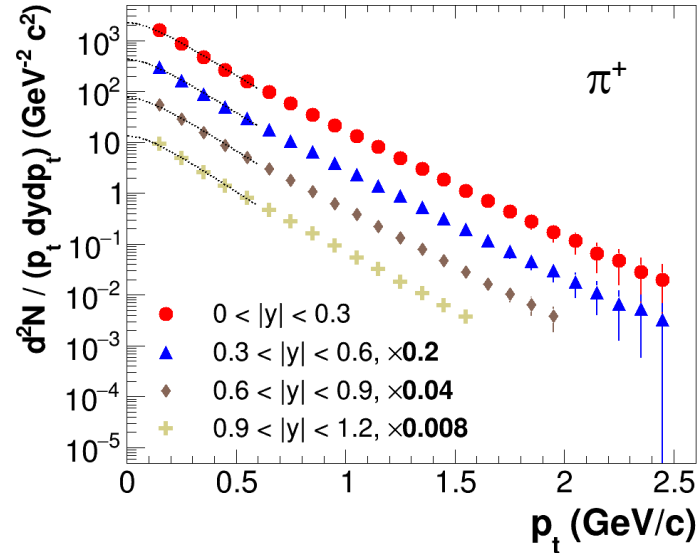
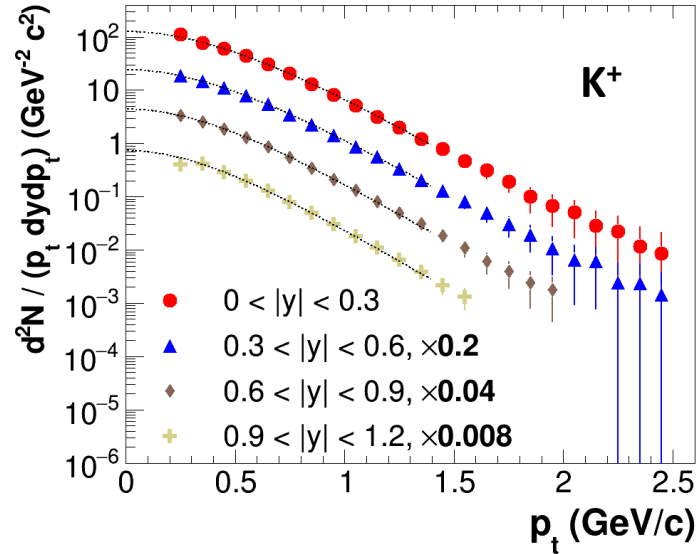
Study of the K/π -ratio in MPD: analysis details

- ✓ 0-5% central Au+Au at 5 energies from the PHQMD model, which implements partonic phase and CSR effects
- ✓ Recent reconstruction chain, combined $dE/dx+TOF$ particle ID, spectra analysis

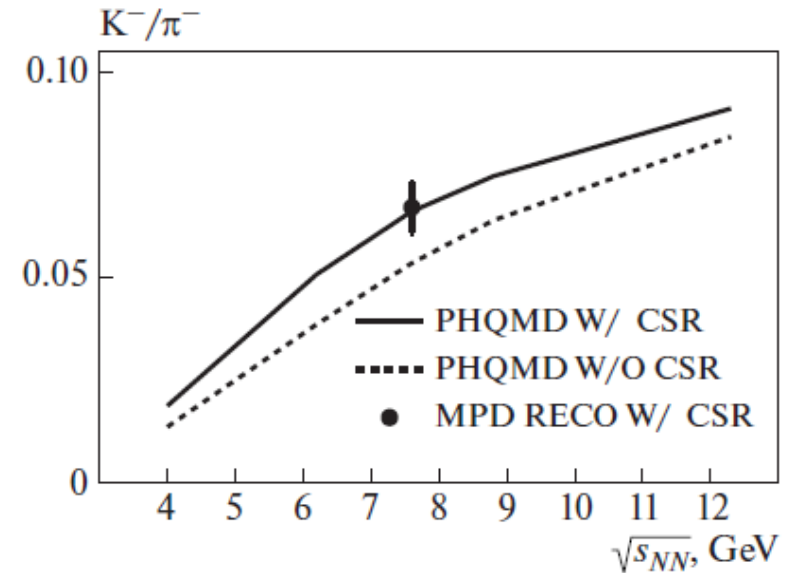
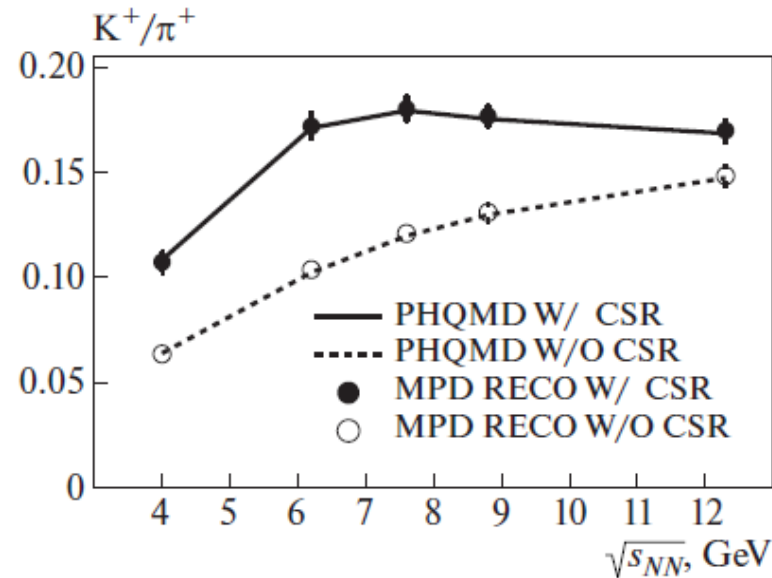
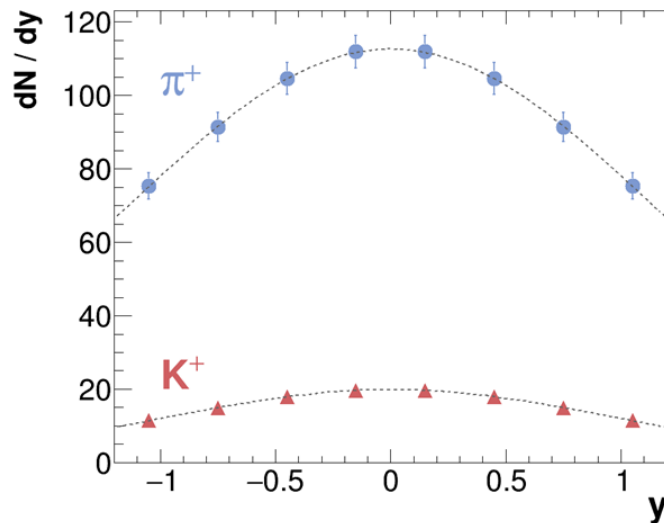


MPD provides large coverage for identified pions and kaons (> 70% of the full phase space at 9 GeV)

Study of the K/ π -ratio in MPD: results



- Hadron spectra can be measured from $p_T=0.2$ to 2.5 GeV/c
- Extrapolation to full p_T -range and to the full phase space can be performed exploiting the spectra shapes (see BW fits for p_T -spectra and Gaussian for rapidity distributions)
- A few percent error for the ratios



II. Current status of the study

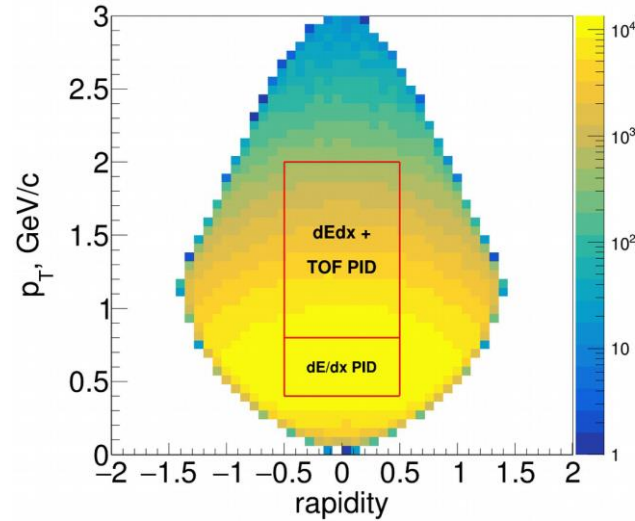
Will be based on a reference to A.Mudrokh's report

MPD prospects for the QCD critical end point search: net-proton cumulants

A. Mudrokh (JINR)

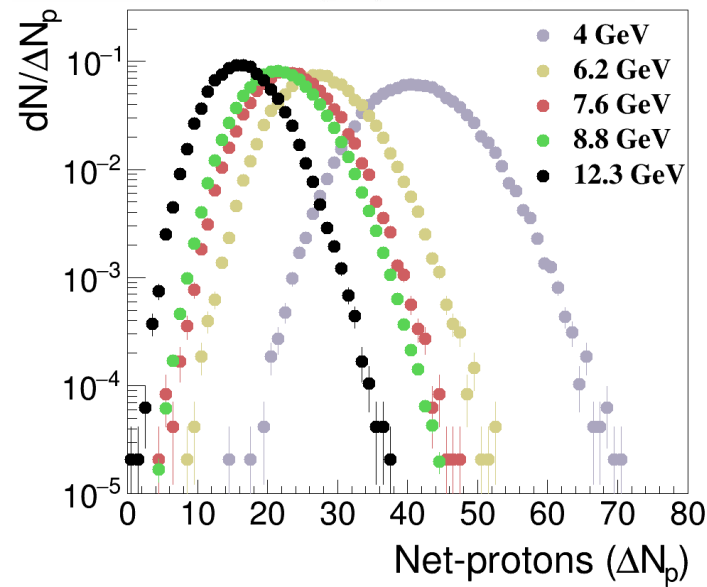
Cumulant ratios of net-proton multiplicity distribution are directly compared to susceptibilities, which diverge in the proximity of CEP in central A+A collisions

$$\frac{k_3}{k_2} = S \sigma \quad \frac{k_4}{k_2} = K \sigma^2$$



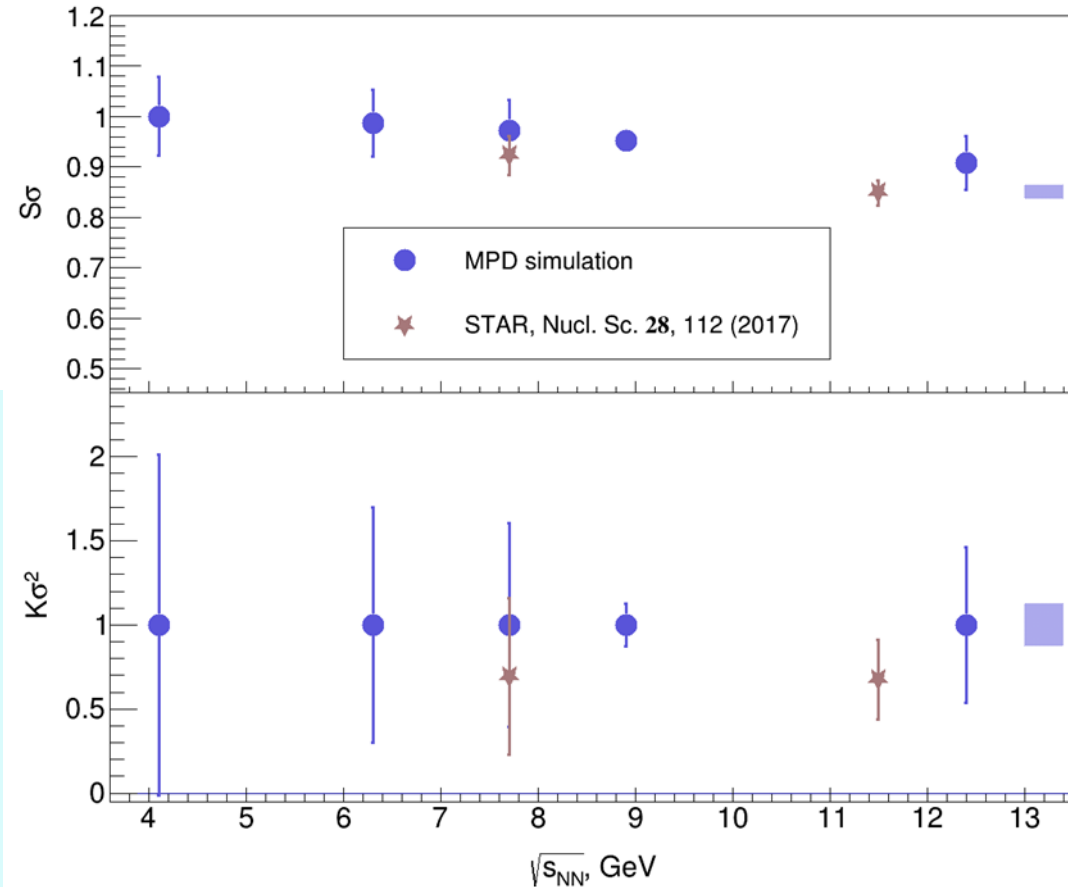
- Au+Au 5% central (PHSD model)
- Full MPD reconstruction
- Combined dE/dx+TOF particle ID

Corrections for the MPD inefficiency:
A. Bzdak and V. Koch,
Phys. Rev. C 86, 044904 (2012)



- **MPD detector provides a large midrapidity phase-space**
- **From 35 to 65 identified p-pbar (Au+Au, |y|<0.5, pT<1.8 GeV/c)**
- **Event statistics above 1Mevents provides sufficient precision of measurements**

Cumulant ratio at MPD within
|y| < 0.5 and 0.2 < pT < 2.0 GeV/c



III. Future plans

Will be based on a reference to potential results from V. Vasendina on high- p_T (anti)hyperons and A. Aparin on p_T -dependence of the baryon-to-meson ratio.

Study of hadroproduction with MPD: first results

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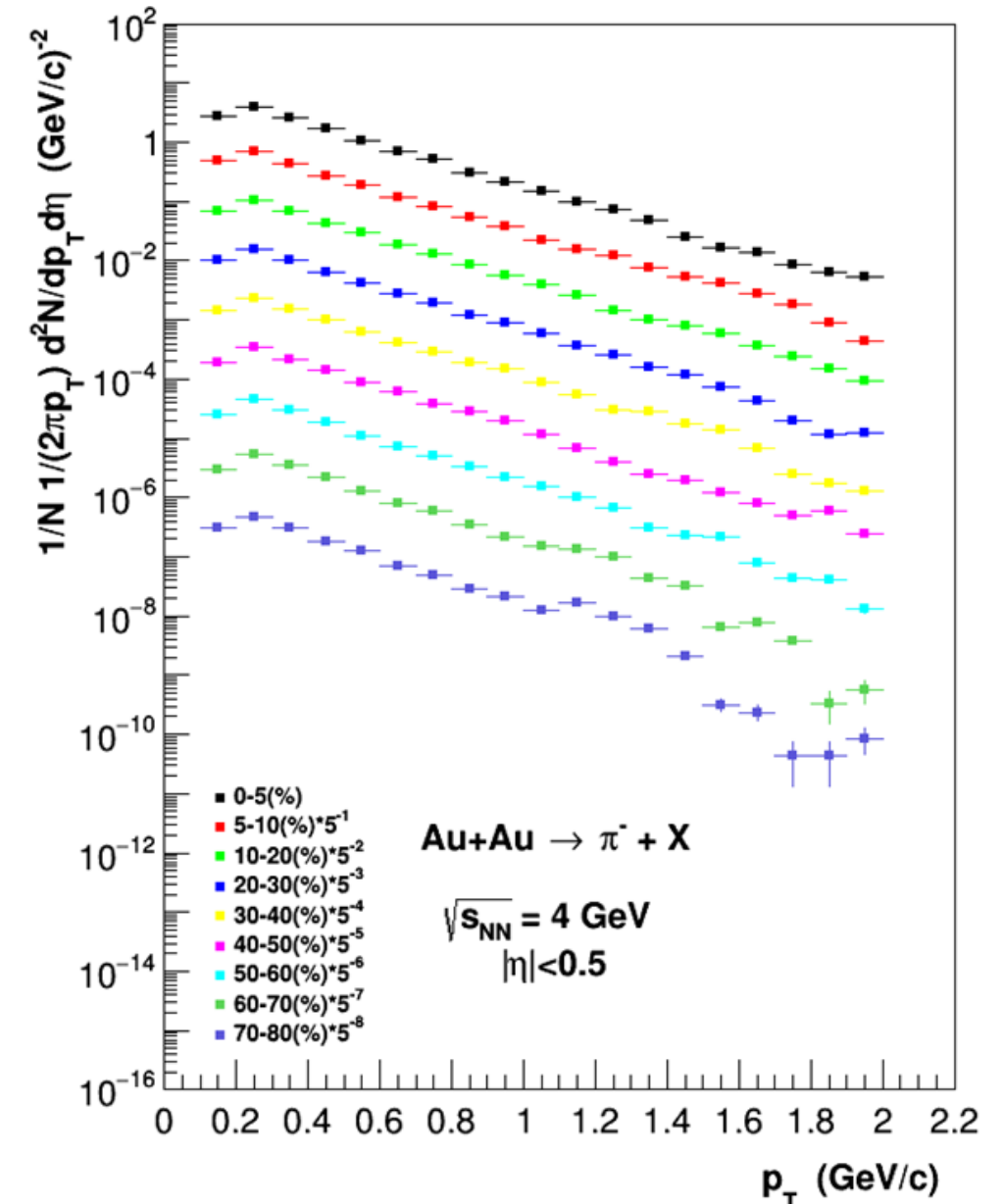
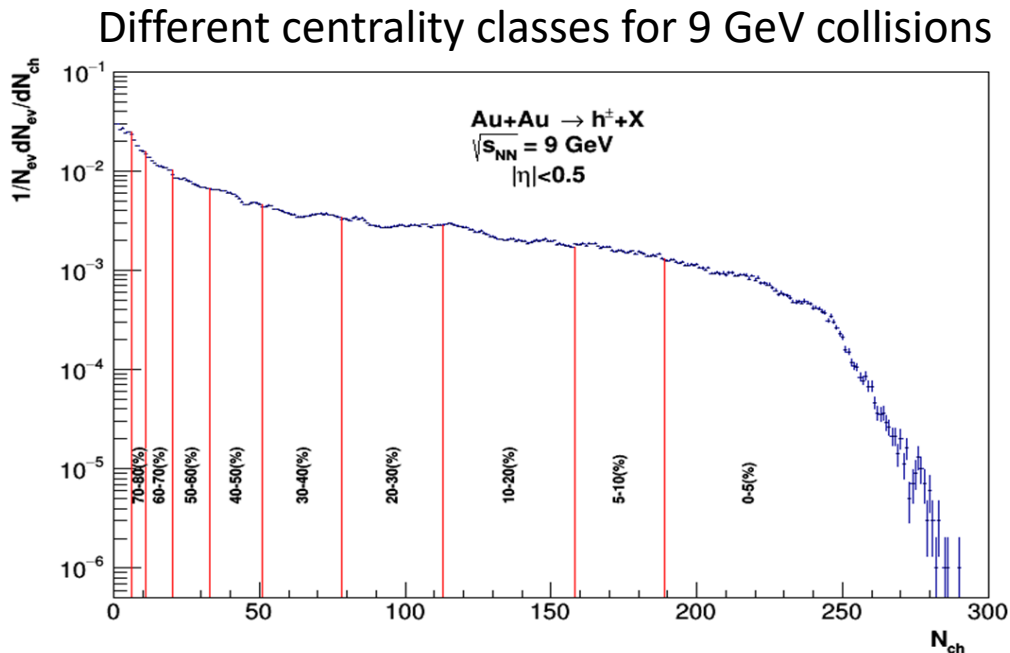
1. Joint Institute for Nuclear Research

2. Lomonosov Moscow State University

3. Al-Farabi Kazakh National University

- Min. bias Au+Au collisions (UrQMD)
- Centrality selection by charged multiplicity in TPC
- Primary, $N_{\text{hits}} > 20$, $p_T > 0.1$ GeV/c

No final corrections yet - Analysis is ongoing



Conclusions

Visibility of MPD PWG2 results in 2019-20

“Performance of the MPD detector in the study of the strangeness to entropy ratio in heavy-ion collisions at the NICA accelerator complex”,

V. Kolesnikov, V. Kireyeu, A. Mudrokh, A. Zinchenko, and V. Vasendina,
Physics of Particles and Nuclei Letters, Vol. 17, No 3 (2020), pp. 358–369.

“Prospects for the study of event-by-event fluctuations and strangeness production with the MPD detector at NICA”,

A. Mudrokh, V. Kolesnikov, V. Vasendina and A. Zinchenko,
Accepted in the Physics of Elementary Particles and Atomic Nuclei Letters, Vol. 20, No 3 (2020).

Several oral talks at Conferences: **WPCF2019**, **19th Lomonosov**, etc.

Plans

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