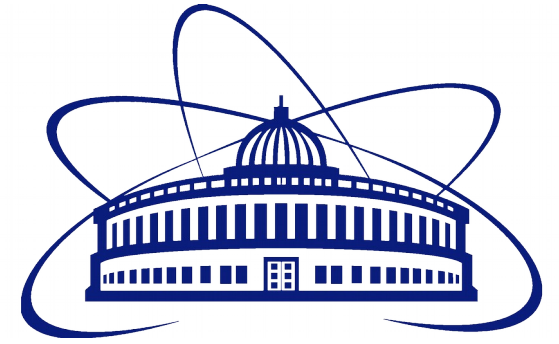


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"Investigation of the generation of light charged particles in heavy ion collisions at the energy of the NICA complex"

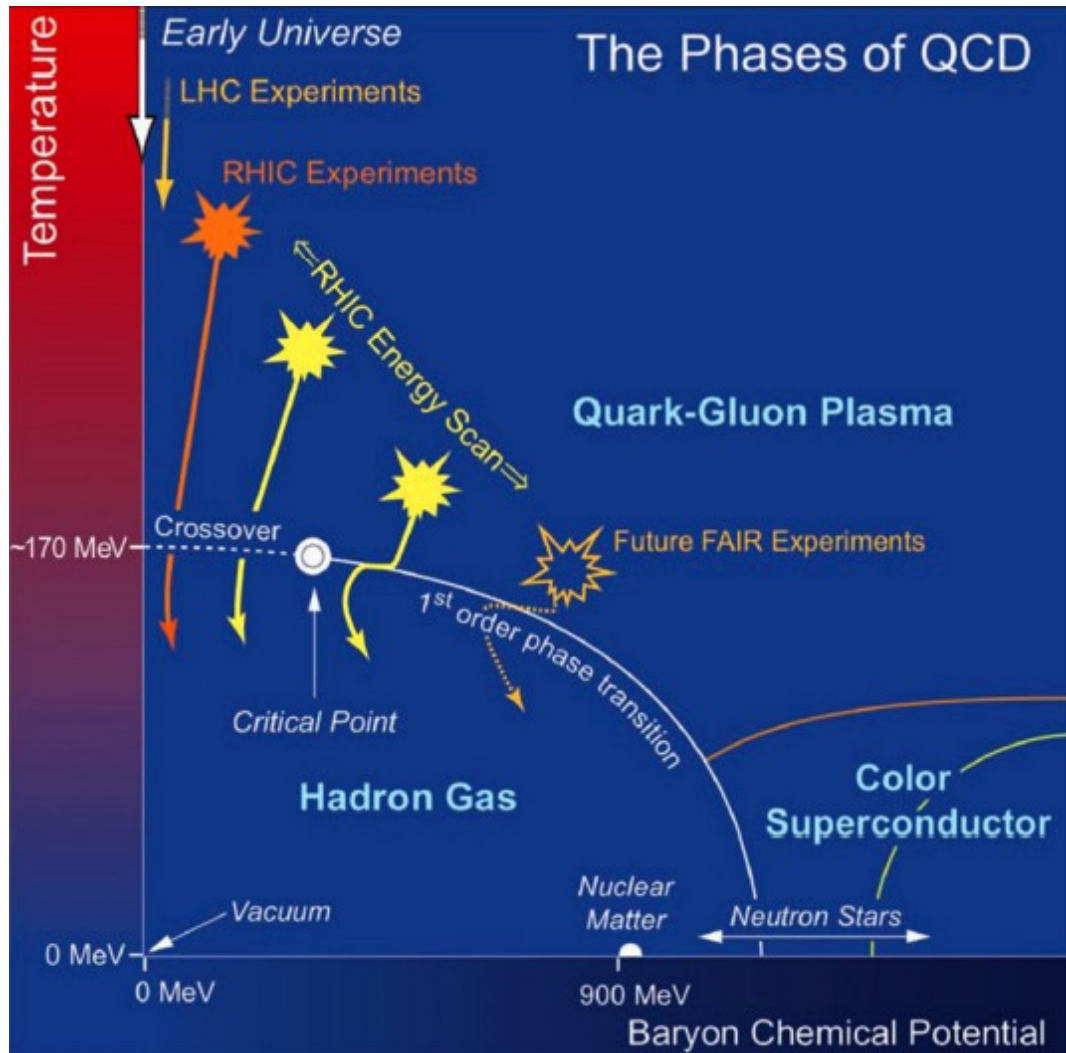


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Motivations

1. To analyze collisions of Bi-Bi ions at energies $\sqrt{s_{NN}}= 7.7, 9$ and 9.46 GeV and Au-Au ions at energies $\sqrt{s_{NN}}= 4, 7, 9$ and 11 GeV. Statistical data were collected using the Monte Carlo generator of Ultrarelativistic quantum molecular dynamics (UrQMD) for the MPD detector.
2. Plot the particle outputs as a function of the transverse momentum for the identified hadrons (kaons, pions, protons).
3. The main goal is to study the generation of kaons in relation to pions, as one of the signatures of the phase transition between the hadron state of matter and the state of quark-gluon plasma (QGP).

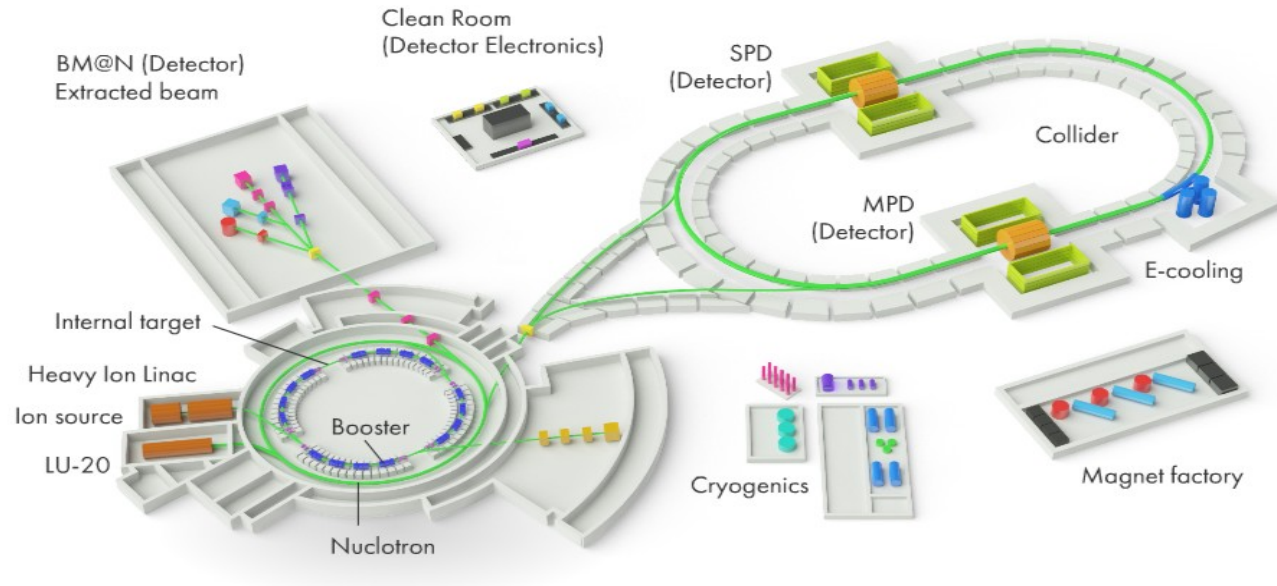
QCD phase diagram



The QCD phase diagram of a nuclear substance is considered in the coordinates of the baryon chemical potential (on the horizontal axis) and the temperature in energy units (on the vertical axis).

¹ STAR Collaboration, "Studying the Phase Diagram of QCD Matter at RHIC," (2014).

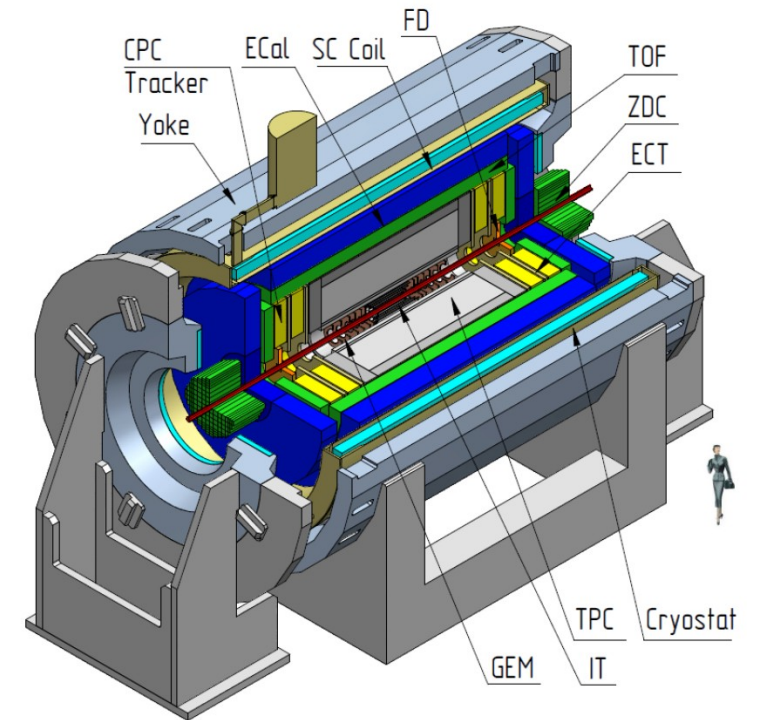
The NICA complex.



The MPD - 4π detector is a spectrometer capable of detecting charged hadrons, electrons, and photons produced by heavy ion collisions.

At the nica accelerator complex, experiments will be conducted that represent:

1. The ion beam from the Nuclotron, as displayed on a fixed target;
2. Counter ion beams in the Collider;
3. Counter proton-ion beams;
4. Colliding beams of polarized protons and deuterons.



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Yields as a function of the transverse momentum for identified hadrons

Bi-Bi ion collisions at energies $\sqrt{s_{\text{NN}}} = 7.7, 9$ and 9.46 GeV.

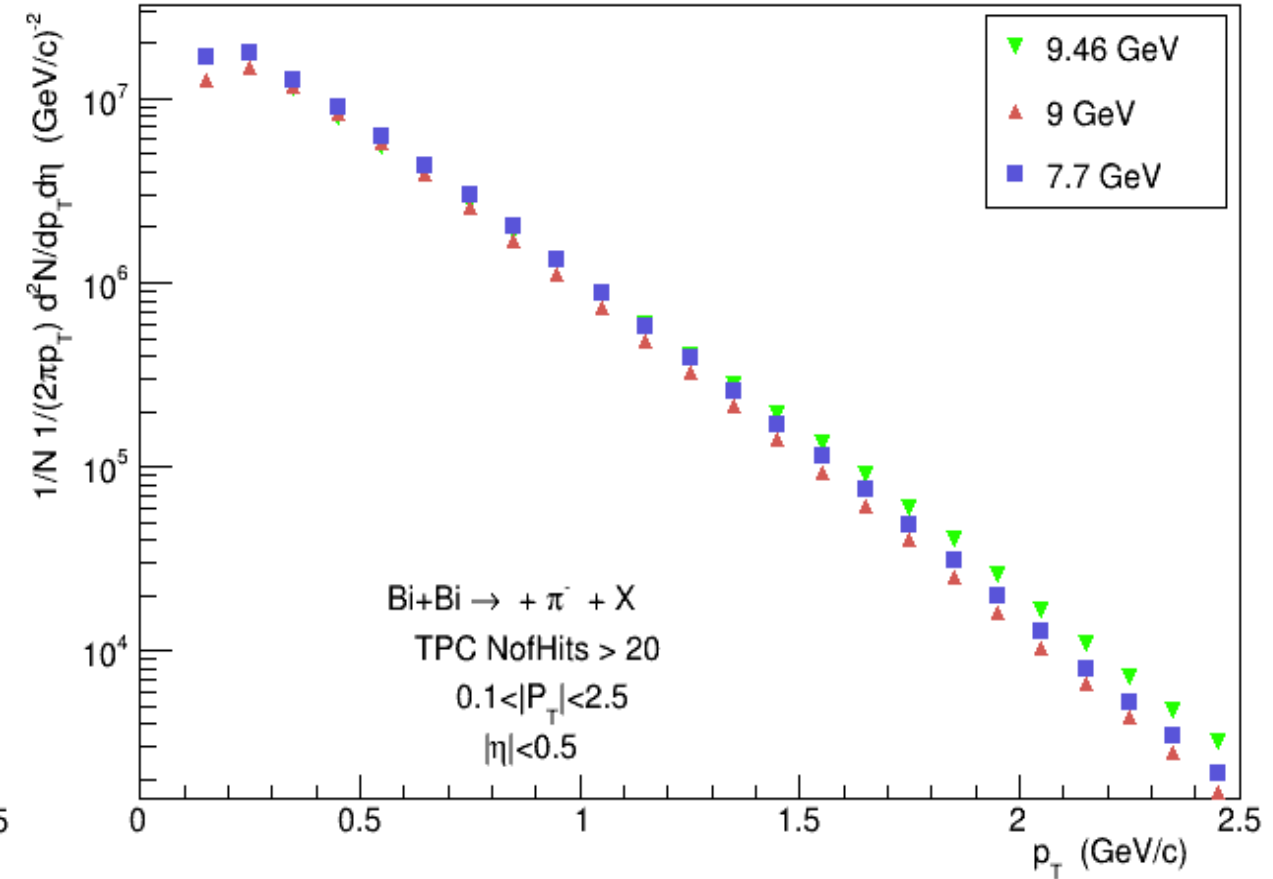
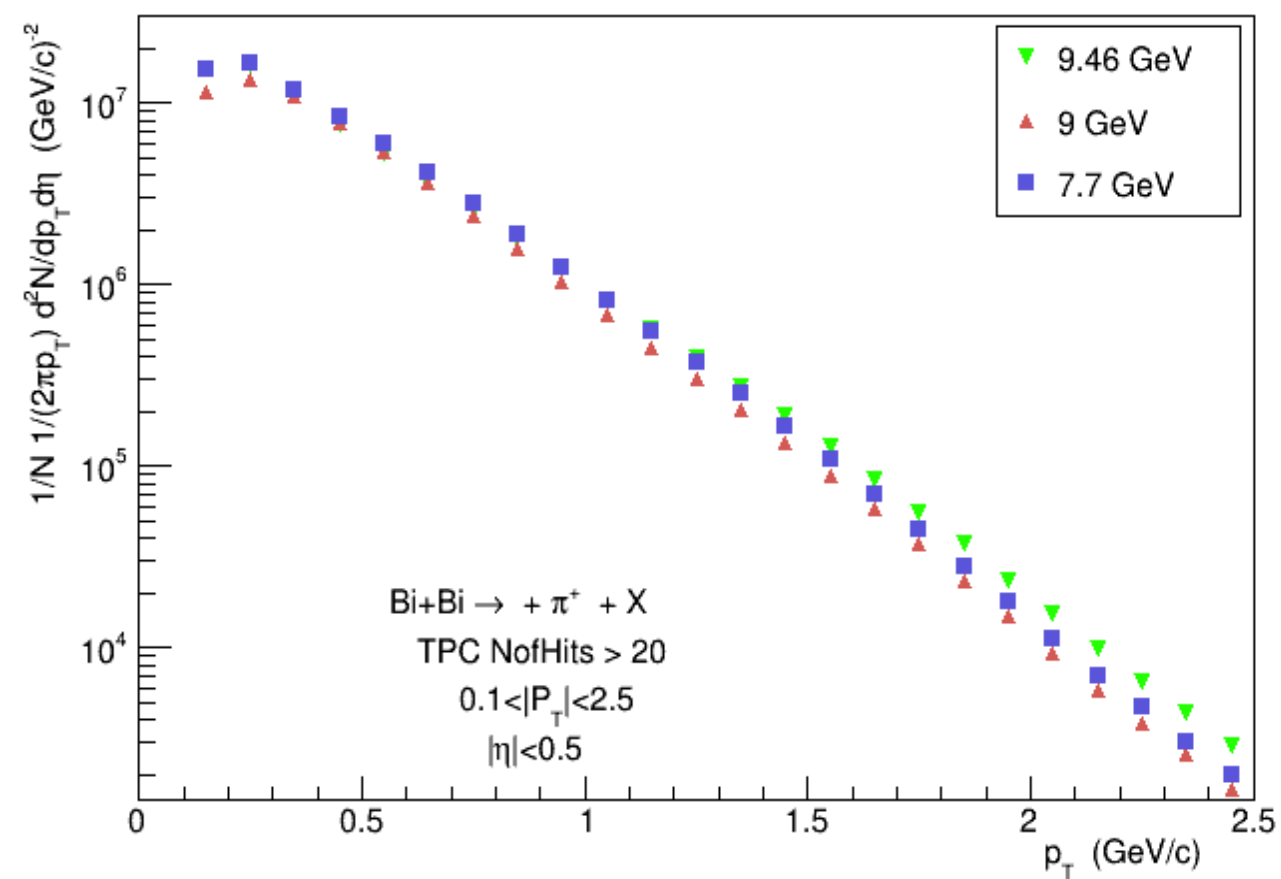
Au-Au ion collisions at energies $\sqrt{s_{\text{NN}}} = 4, 7, 9$ and 11 GeV.

Statistics of 10^6 events for each energy were obtained using the Monte Carlo generator of Ultrarelativistic quantum molecular dynamics (UrQMD) for a multi-purpose detector (MPD) made in the Geant 3 and Geant 4 model.

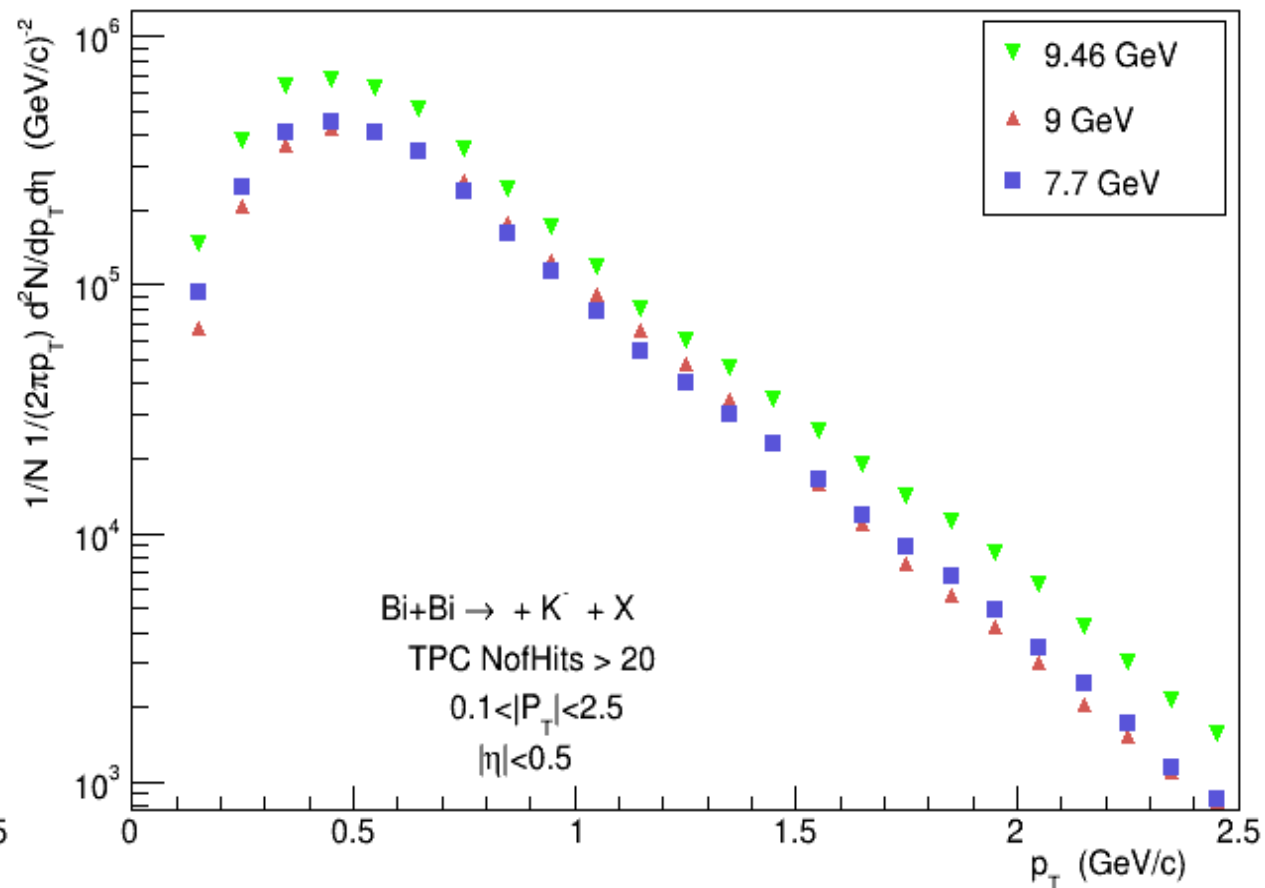
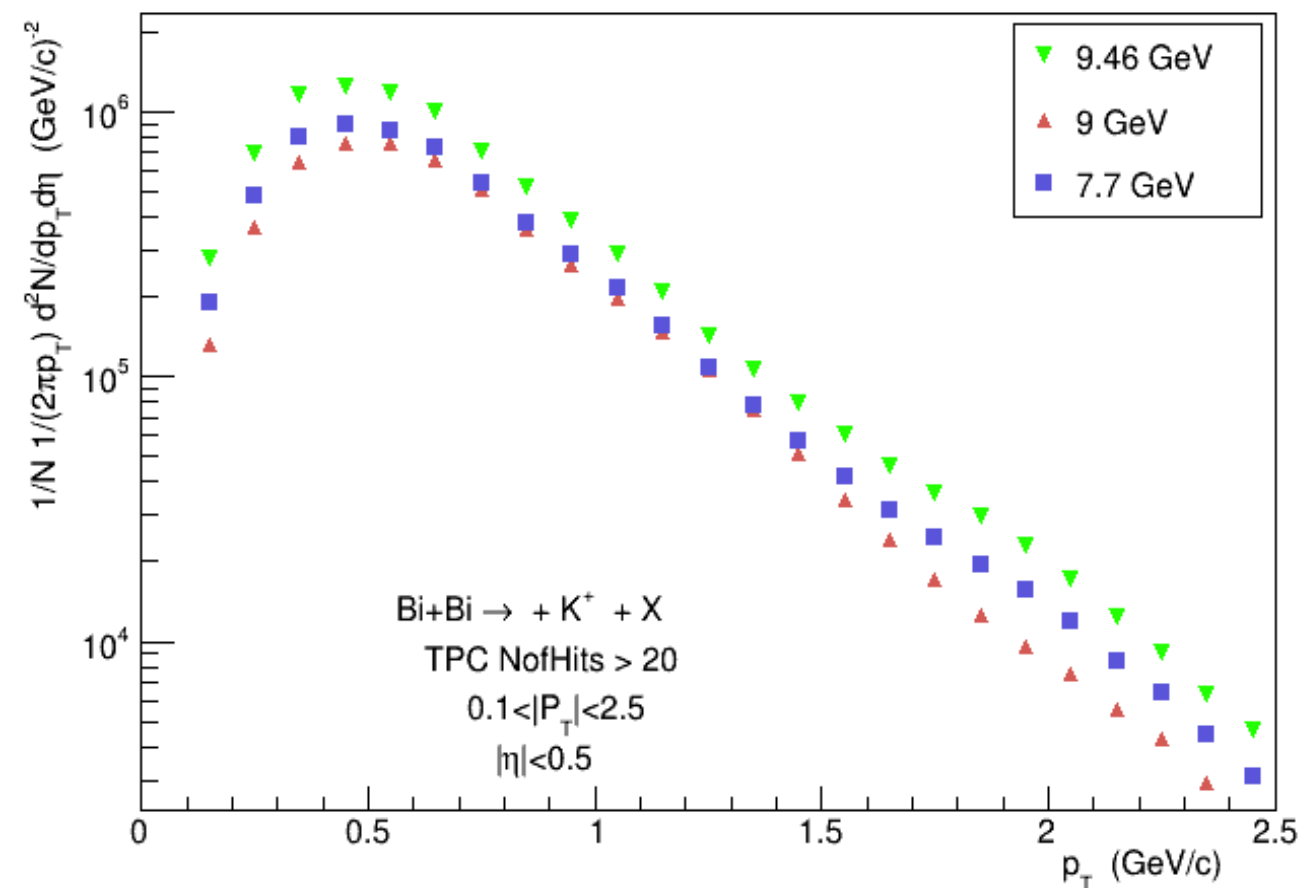
The conditions imposed on the spectra:

- TPC NofHits > 20;
- $|\eta| < 0.5$;
- $0.1 < p_{\text{T}} < 2.5$ GeV;

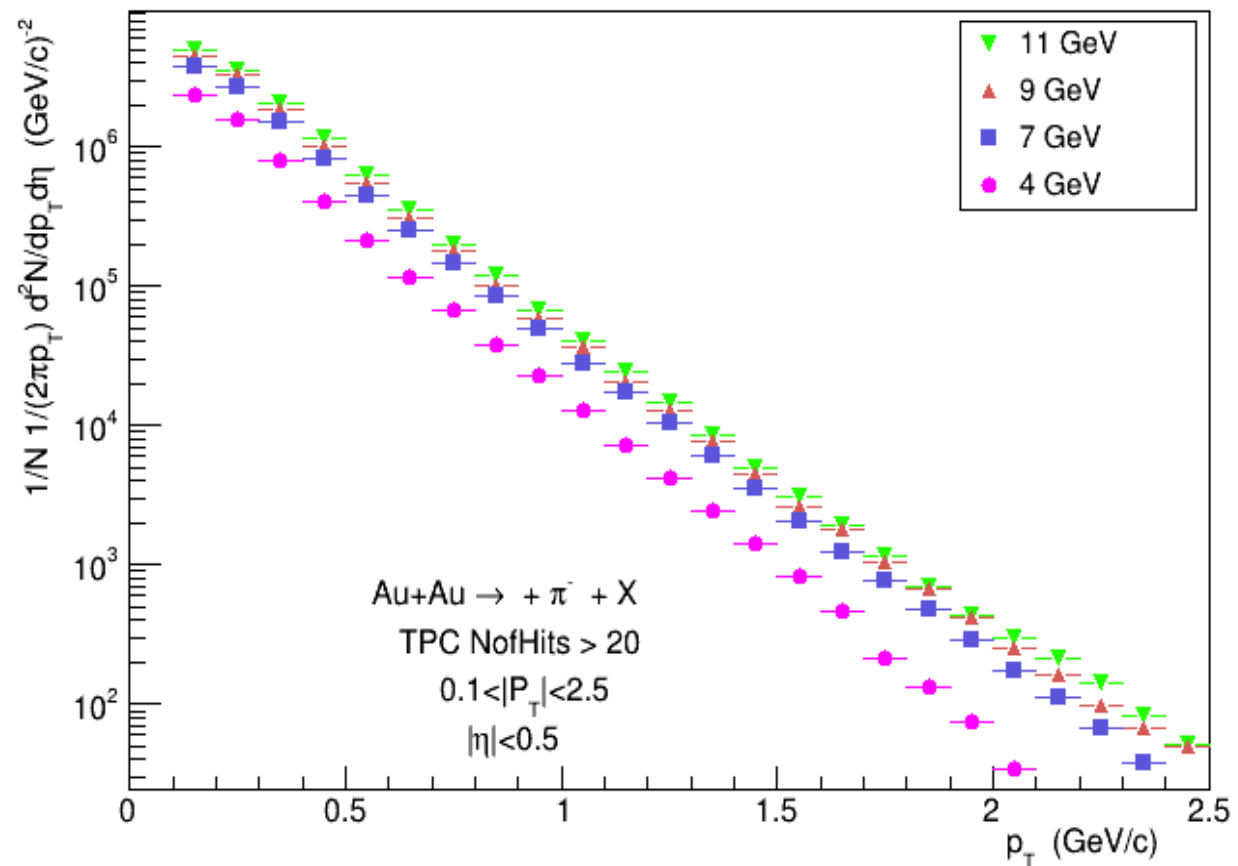
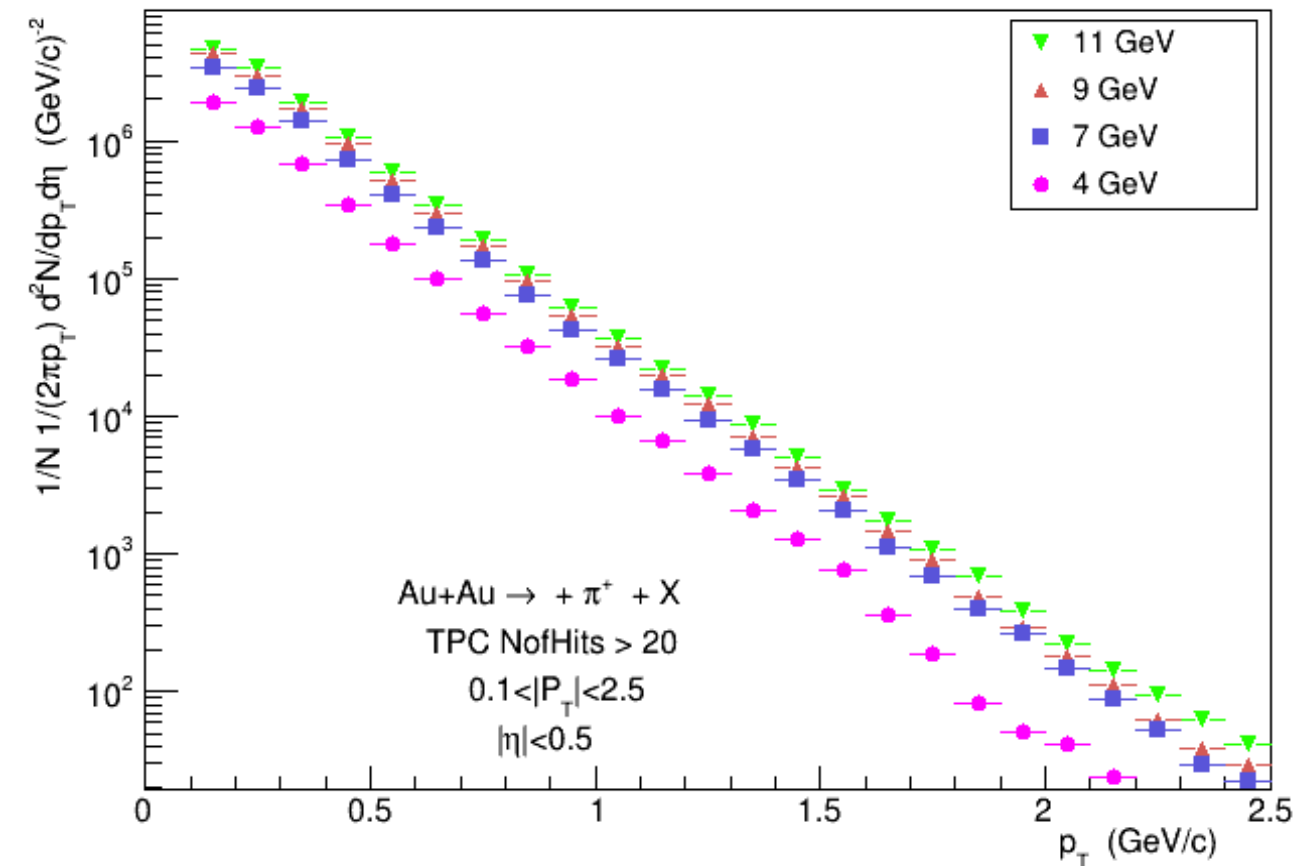
Yields as a function of the transverse momentum for pions



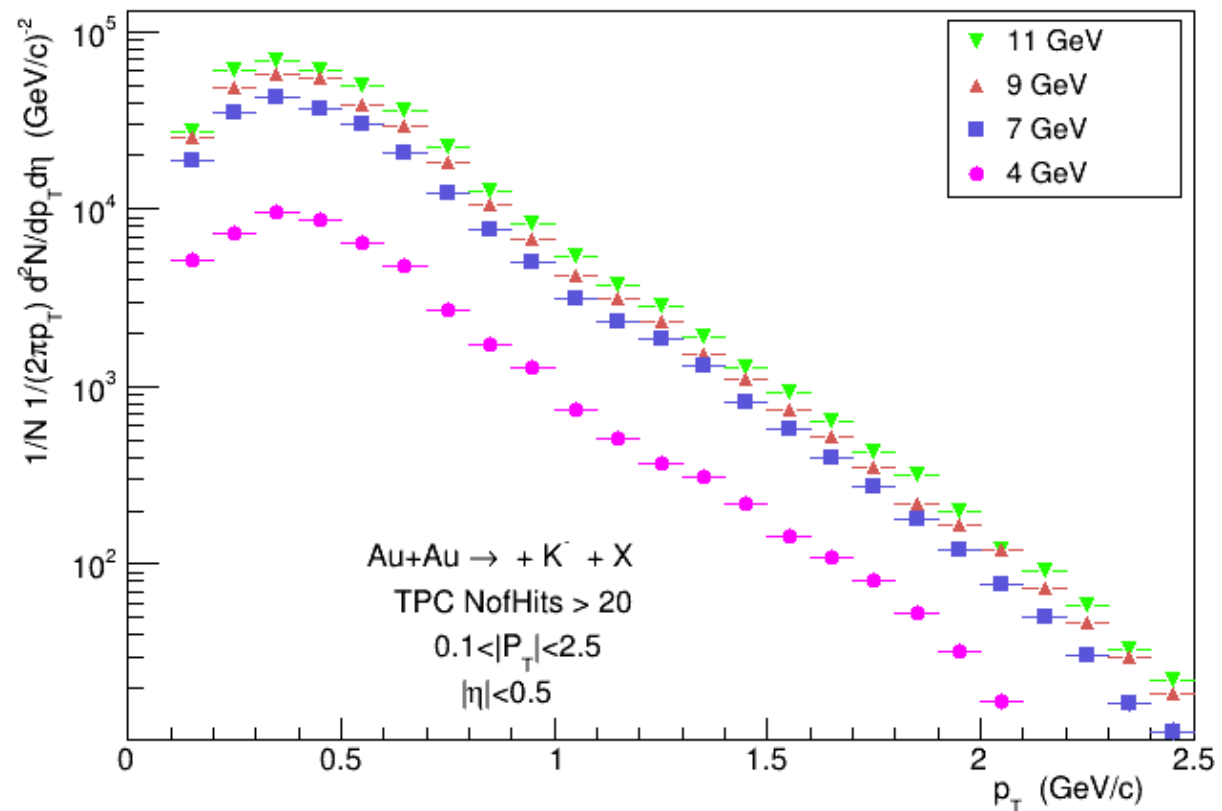
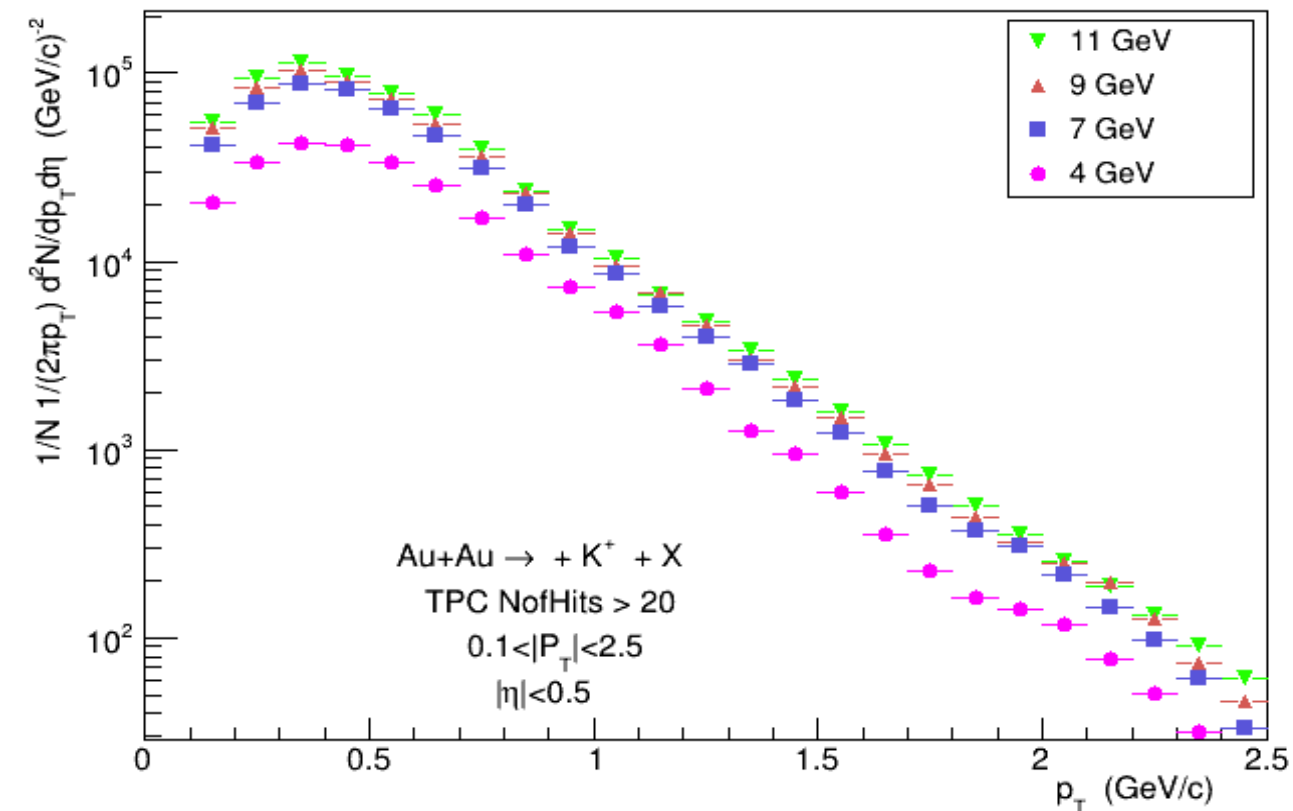
Yields as a function of the transverse momentum for kaons



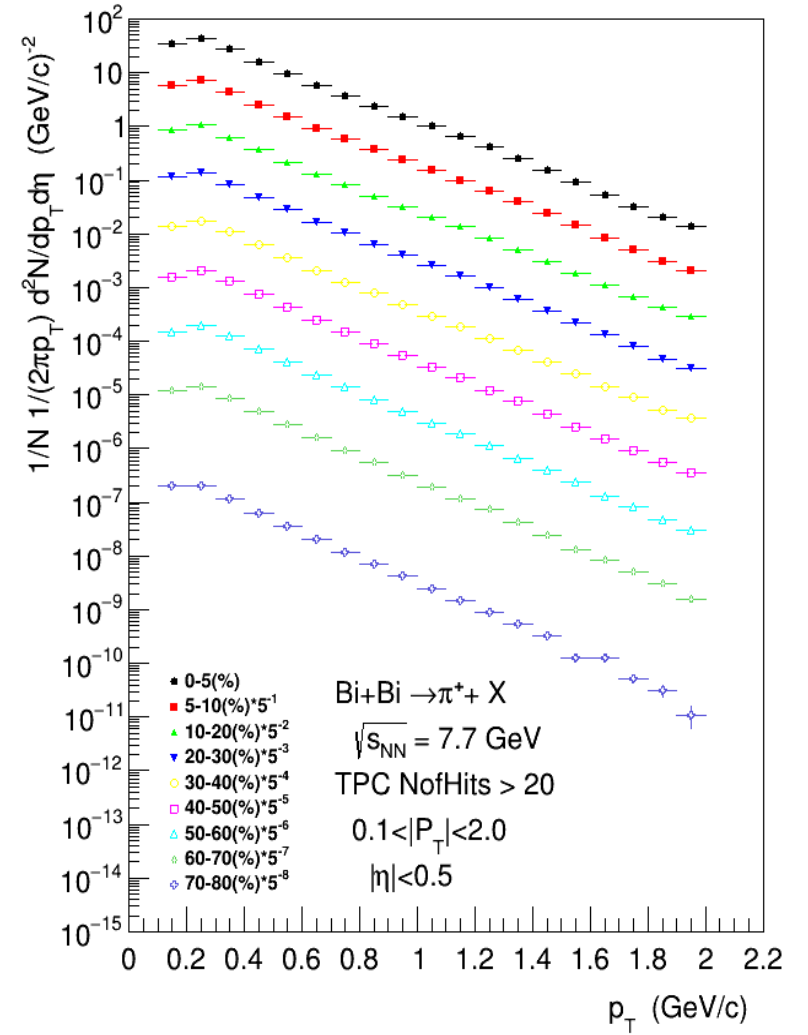
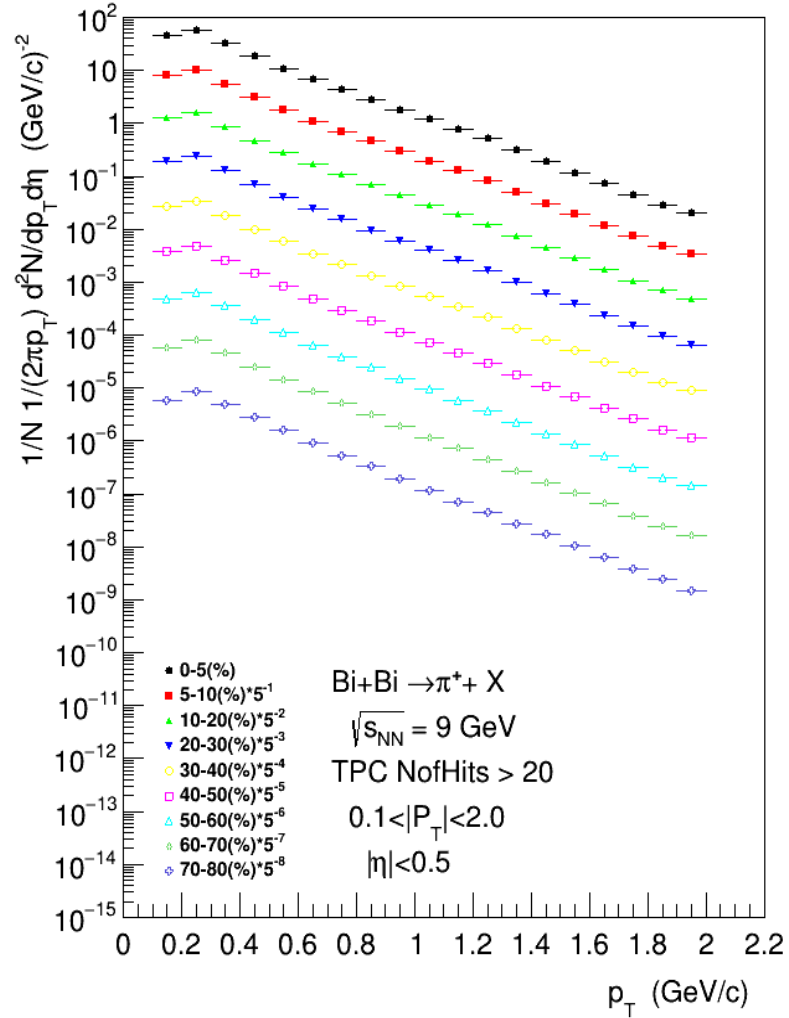
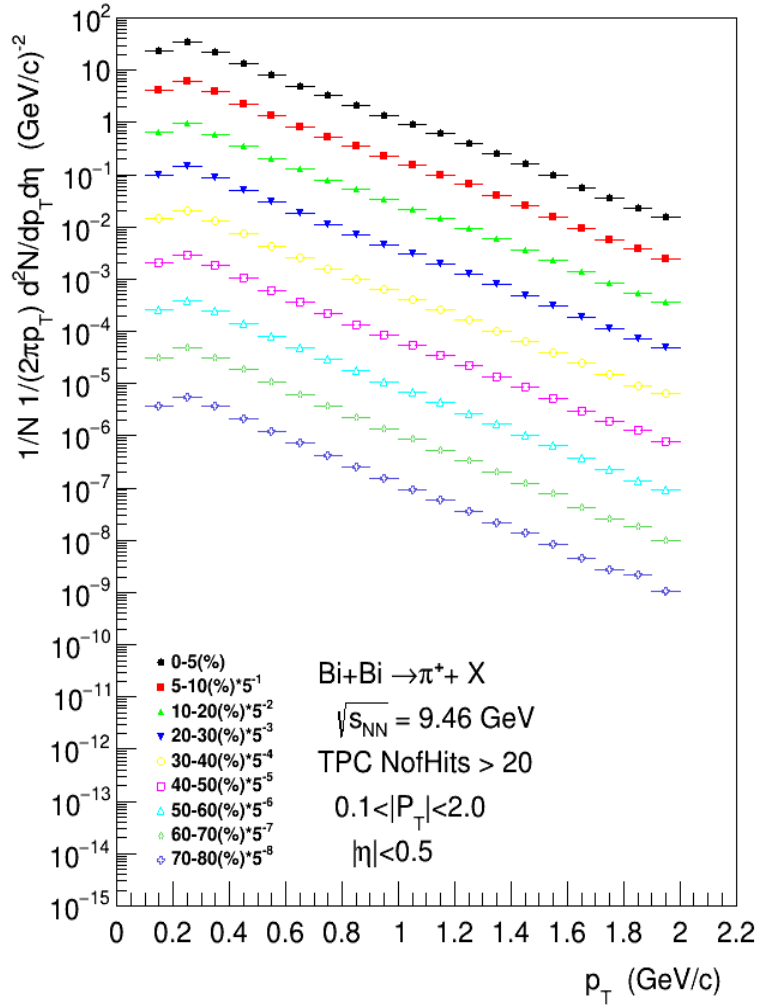
Yields as a function of the transverse momentum for pions



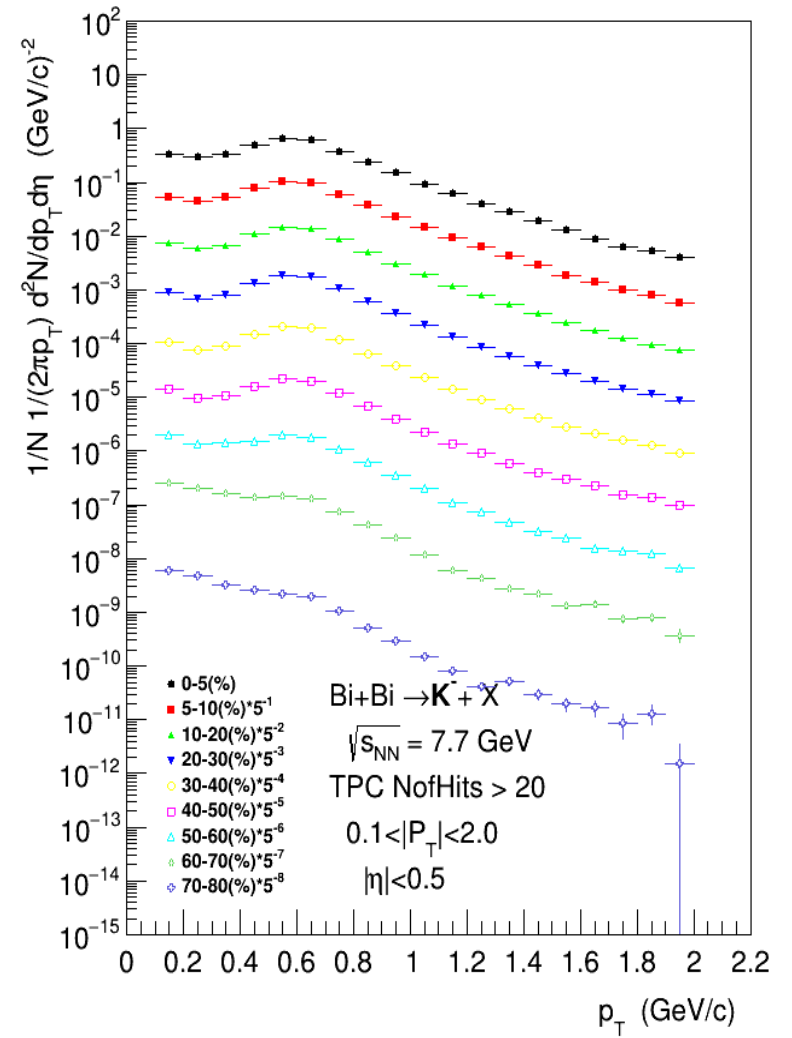
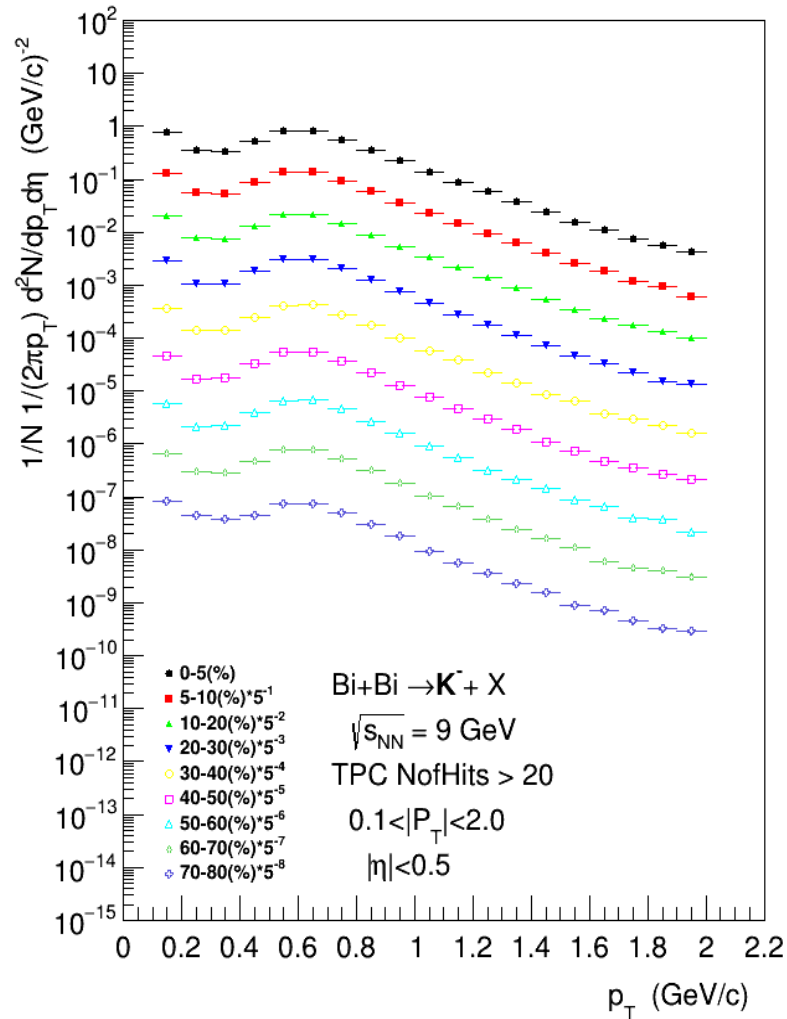
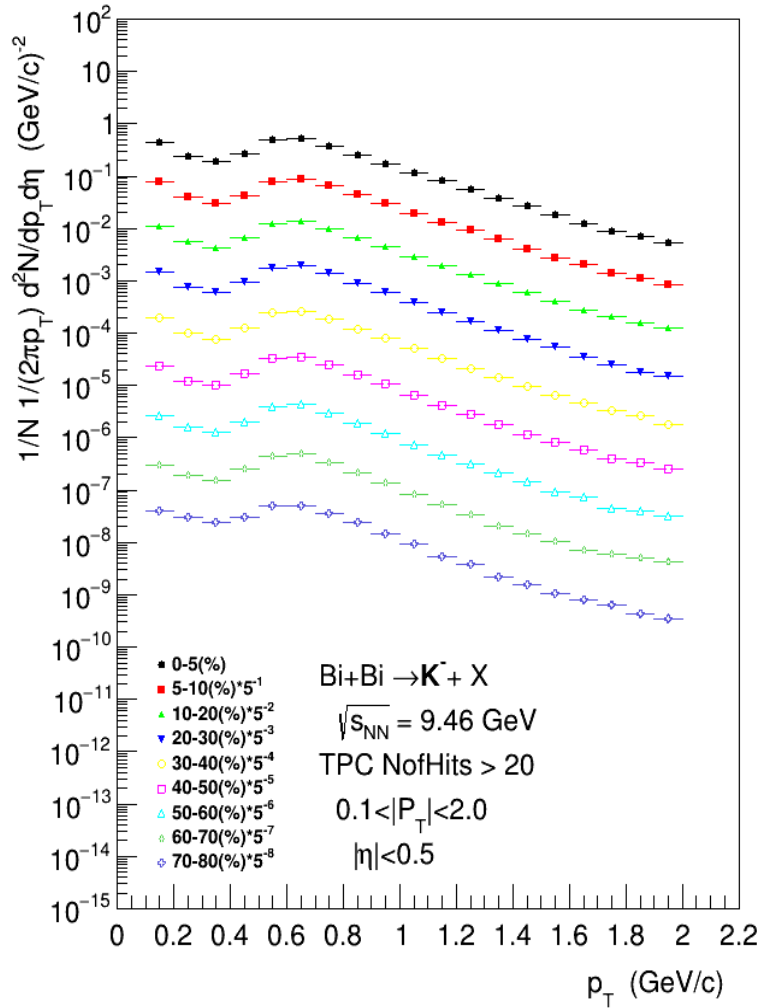
Yields as a function of the transverse momentum for kaons



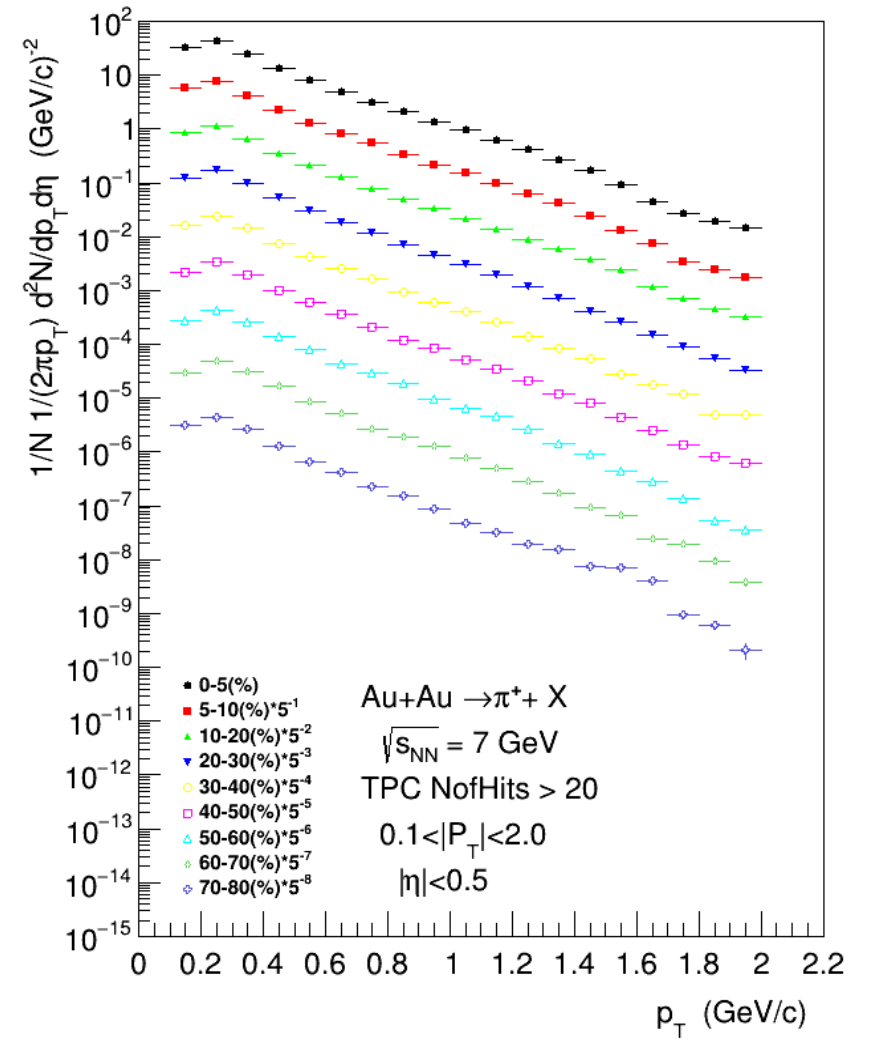
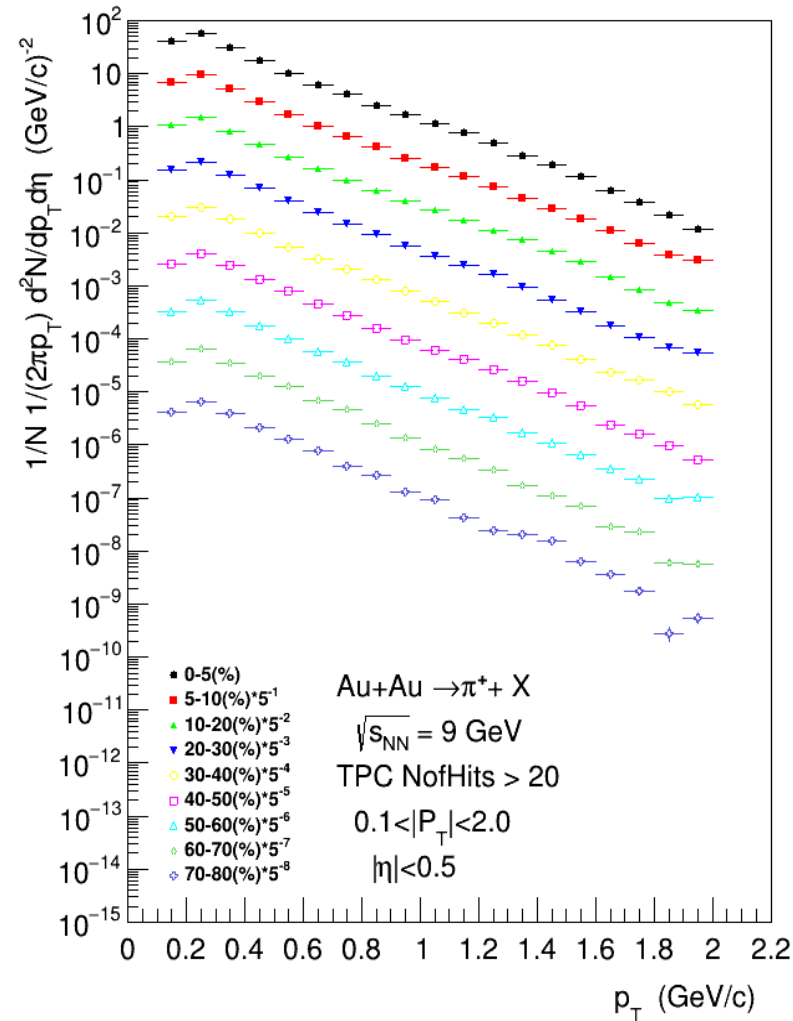
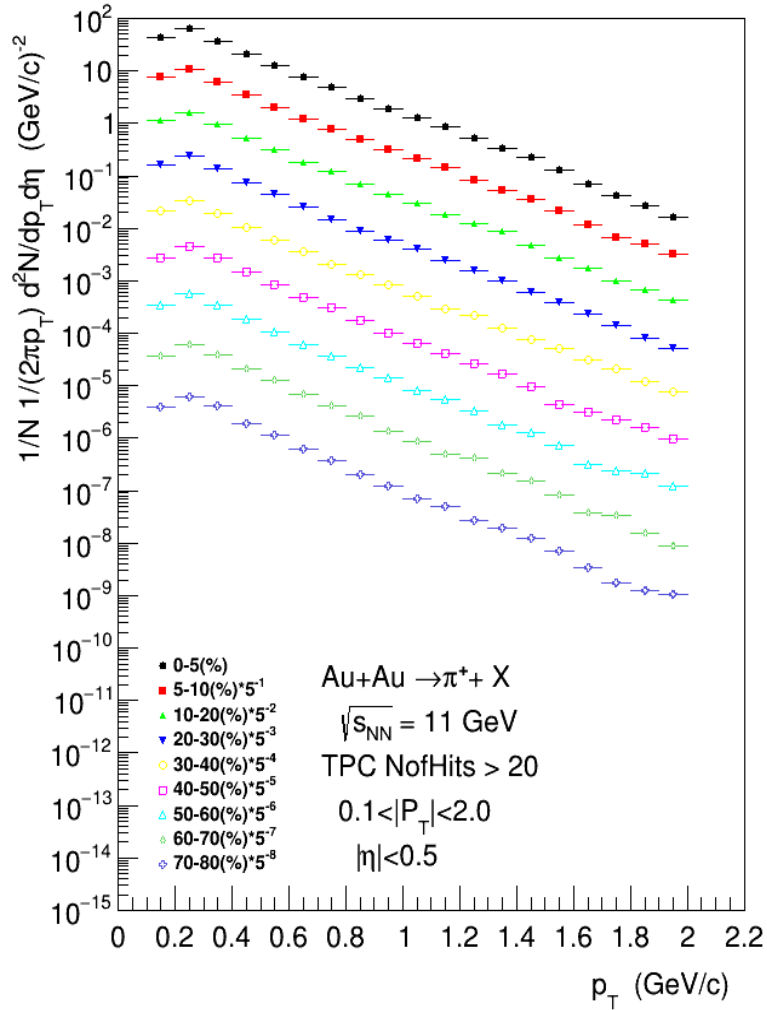
Yields π^+ for different centrality classes



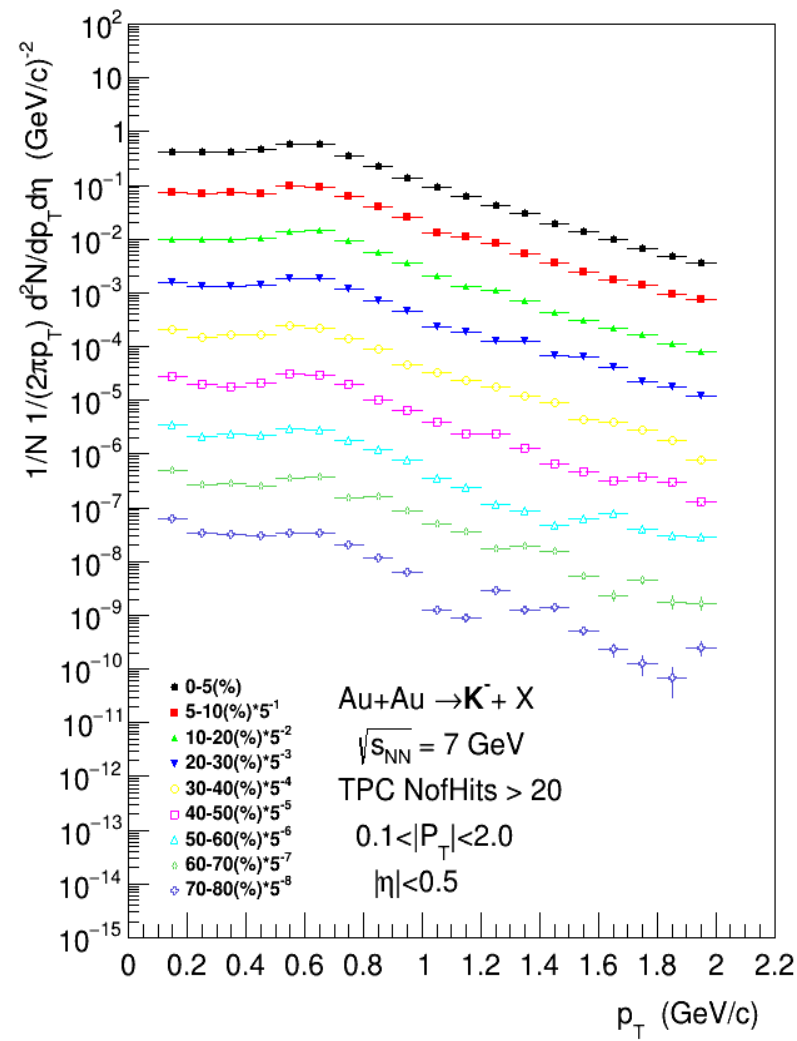
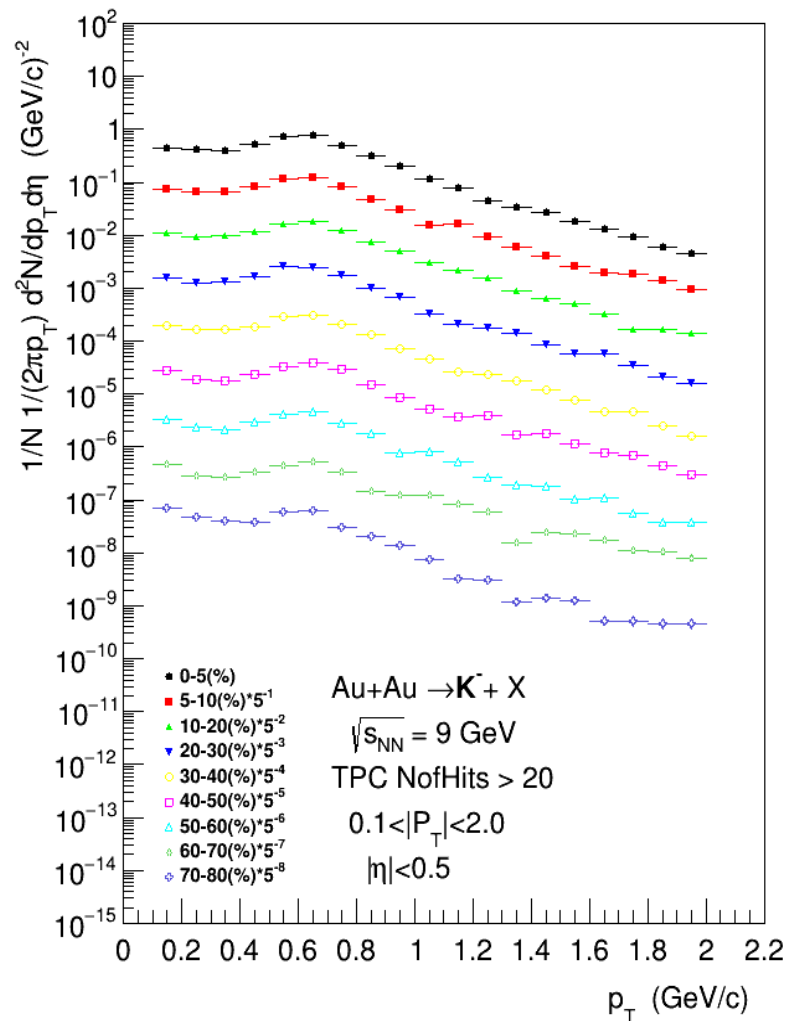
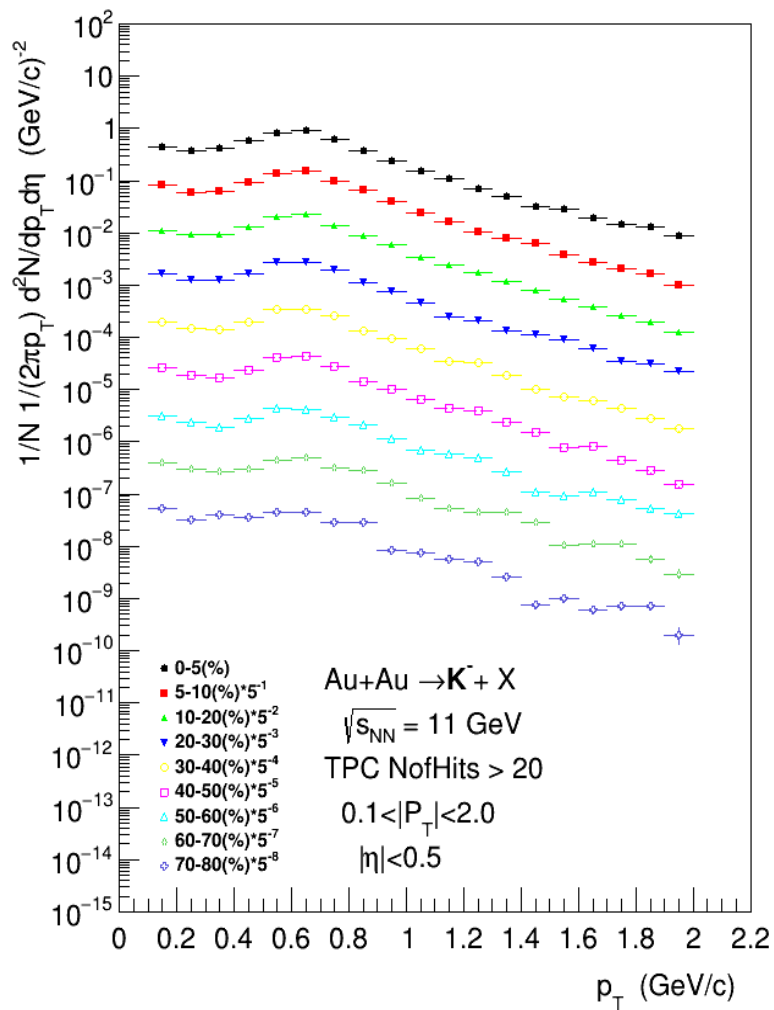
Yields K^- for different centrality classes



Yields π^+ for different centrality classes



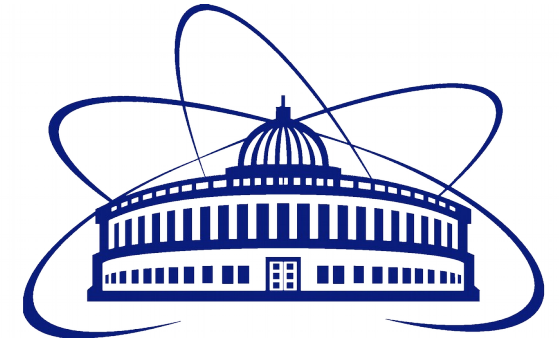
Yields K^- for different centrality classes



Conclusions

- Monte Carlo data of Bi-Bi heavy ion collisions in the center-of-mass energy range are analyzed $\sqrt{s_{NN}} = 7.7, 9$ and 9.46 GeV and Au-Au ions at energies $\sqrt{s_{NN}} = 4, 7, 9$ and 11 GeV.
- Statistics of 10^6 events for each energy were obtained on the generator on UrQMD.
- The spectra of particles were plotted as a function of the transverse momentum for the identified particles (kaons, pions, and protons) for different collision energies.
- For further analysis, it is necessary to analyze more statistical data using different Monte Carlo models for different values of the collision energy of the center of mass.

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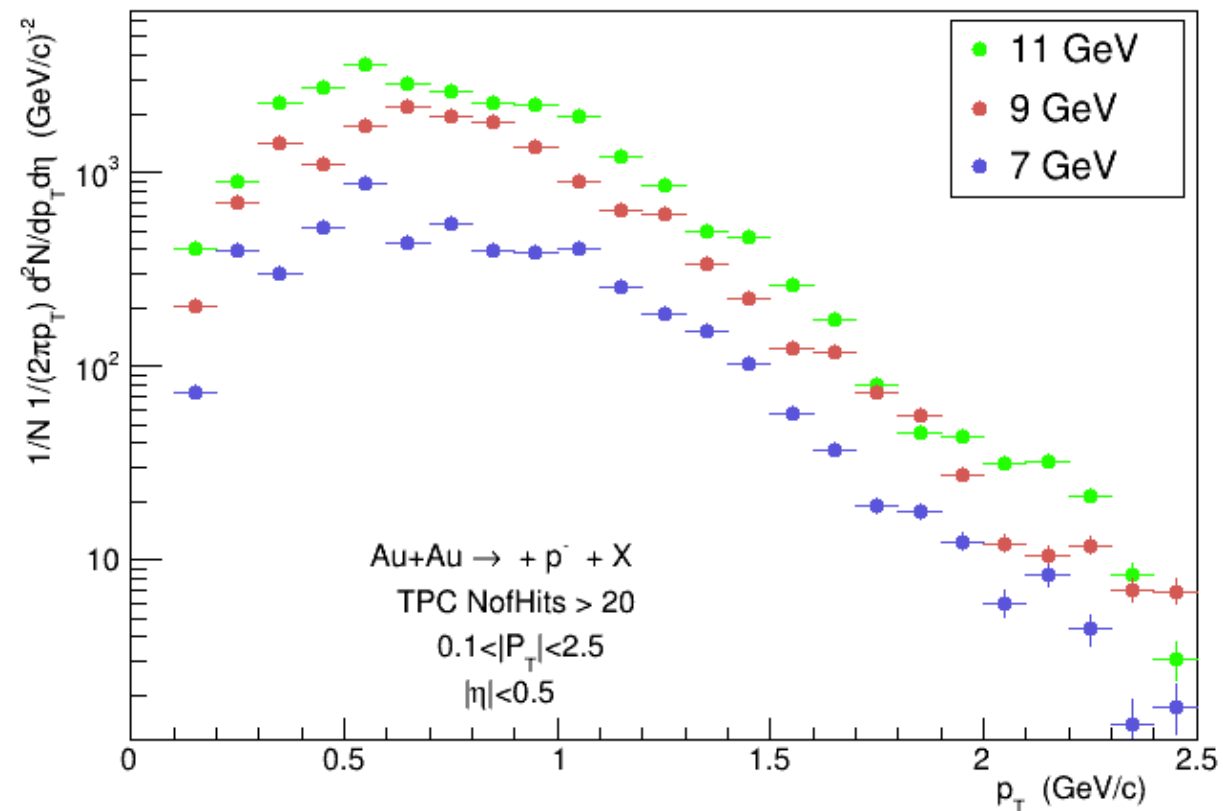
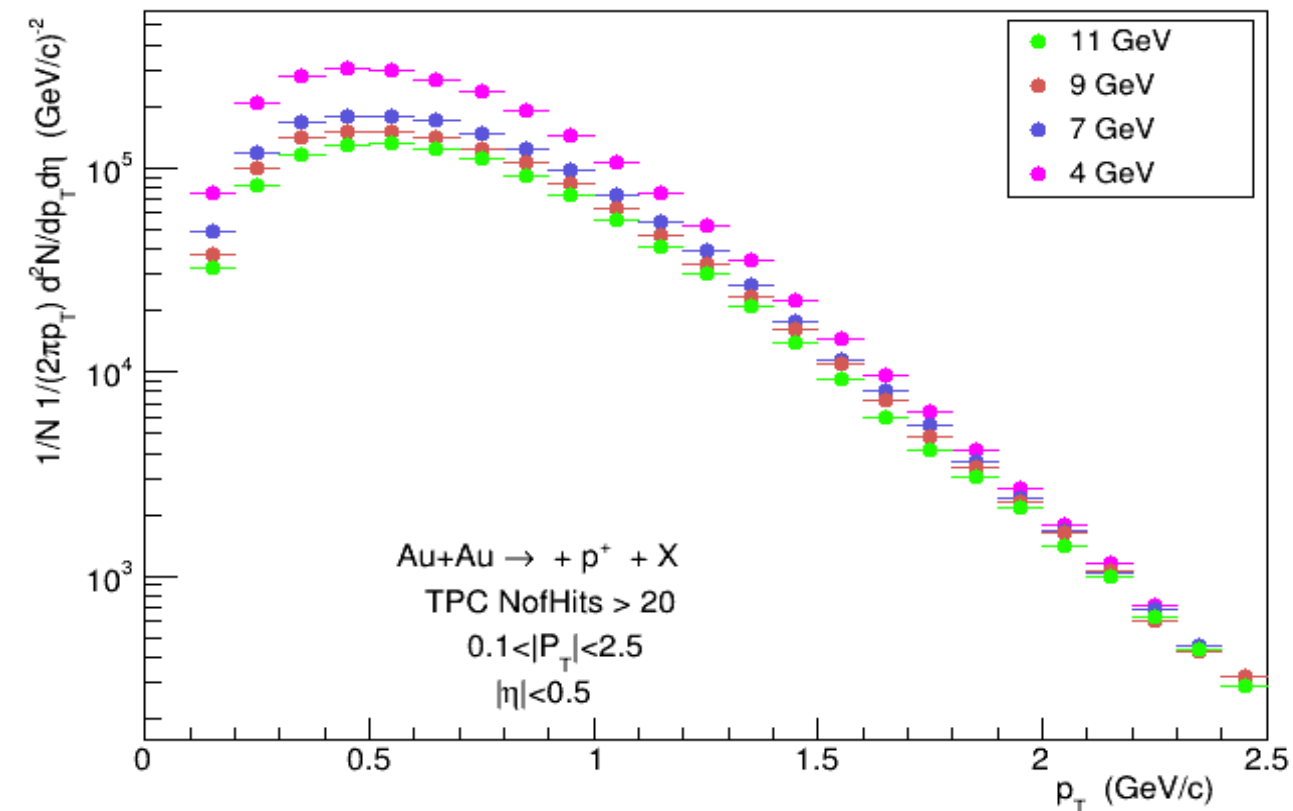


Thank you for your attention!



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Yields as a function of the transverse momentum for proton



Yields as a function of the transverse momentum for proton

