My Previous and Current Activities:

ϕ meson production analysis at PHENIX and TPC detector at sPHENIX

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Education

Peter the Great St.Petersburg Polytechnic University (SPbPU)

- Ph. D. – Physics of atomic nuclei and elementary particles, high energy physics.
  - 20^{th} April 2023 – PhD degree Production of ϕ mesons in p+Al, p+Au, d+Au, ^{3}He+Au collisions at $\sqrt{s_{NN}} = 200$ GeV at PHENIX

Some photos


Западное плечо
является корректировка
и западных плеч PHENIX

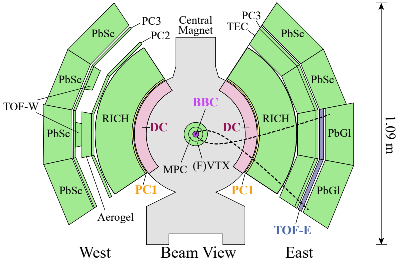

The ratio of the particles multiplicities in the coalescent model of correlated quarks
POLYTECH

Experimental setup – PHENIX (RHIC)

- **BBC** - Centrality selection
- Particle-tracking system (**DC**, **PC**) - determination of kinematic characteristics
- **TOF-E** - particle identification

Geometric parameters

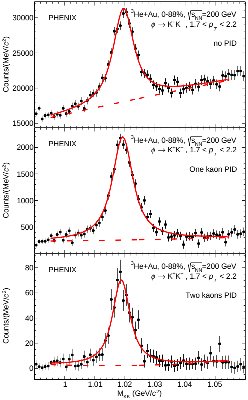
- N_{coll}, N_{part} - Monte-Carlo modelling of the BBC distributions using Glauber model



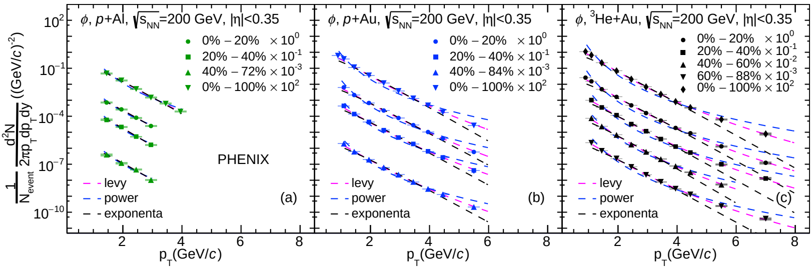
Decay channel - $\phi \to K^+K^-$
Data sets (at the energy of $\sqrt{s_{NN}} = 200$ GeV):

- p+Al, $\sim 2.0 \cdot 10^9$ events
- p+Au, $\sim 3.8 \cdot 10^9$ events
- ^{3}He+Au, $\sim 2.8 \cdot 10^9$ events

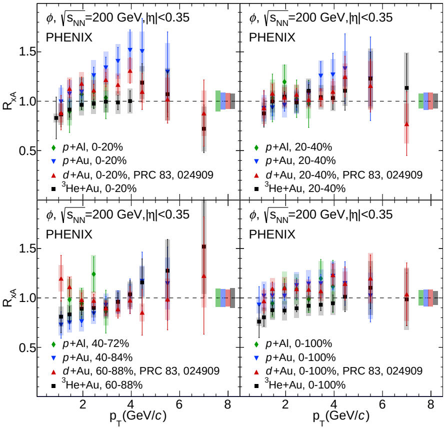
Charged track pair selection - noPID, one-kaon PID (p+Au, ^{3}He+Au - to increase the S/B ratio for $p_T < 2.2$ GeV/c), two-kaon PID (^{3}He+Au - cross check and for systematic uncertainties)
Raw yield - by integrating the invariant mass distribution in the range $\pm$ 9 MeV/c^2 around the ϕ meson mass after combinatorial background subtraction
Approximation – Breit-Wigner function convoluted with Gaussian function (signal) and a second order polynomial function (correlated background from other particle decays)
Reconstruction efficiency – simulation with a ϕ meson PDG width Γ
Systematic uncertainties – from raw yield comparison obtained with standard and varied parameters of the analysis



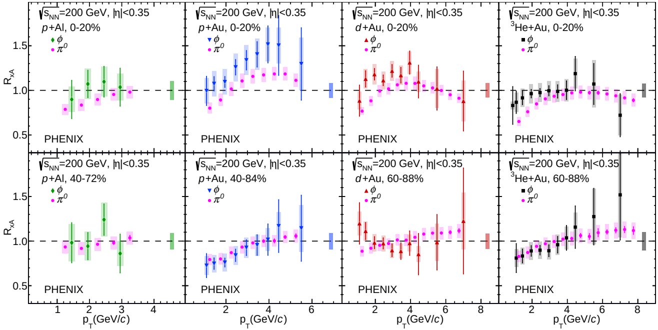
Invariant transverse momentum spectra of ϕ mesons in p+Al, p+Au, and ^{3}He+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV



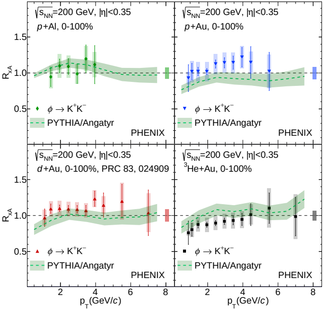
Nuclear modification factors of ϕ mesons in p+Al, p+Au, and ^{3}He+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV at midrapidity in four centrality bins

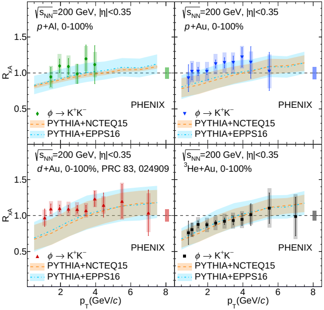


Comparison of ϕ-meson nuclear-modification factors in p+Al, p+Au, d+Au, and ^{3}He+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV at midrapidity in the most central and the most peripheral collisions

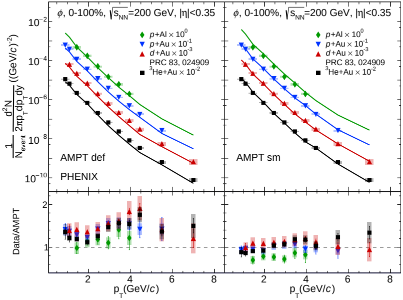


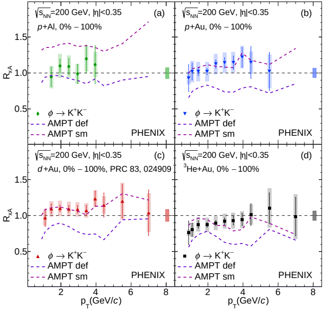
Experimental results on ϕ meson production in p+Al, p+Au, d+Au, and ^{3}He+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV at midrapidity and comparisons to PYTHIA/Angantyr (left) and PYTHIA+nCTEQ15 and PYTHIA+EPPS16 (right) model predictions





Experimental results on ϕ meson invariant p_T spectra (left) and nuclear modification factors (right) in p+Al, p+Au, d+Au, and ^{3}He+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV and comparisons to default [def] and string melting [sm] versions of the AMPT-model predictions

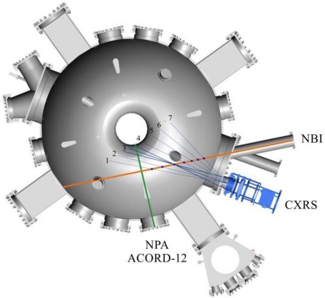




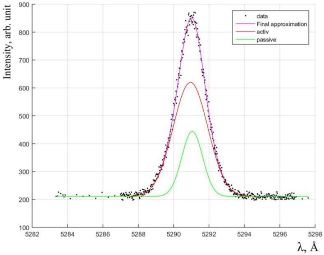
GLOBUS-M

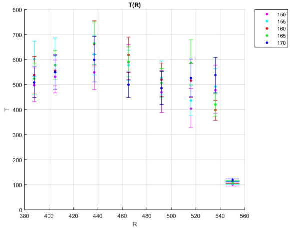
- Tokamaks confine plasma – a hot, ionized gas – using magnetic fields arranged in a torus

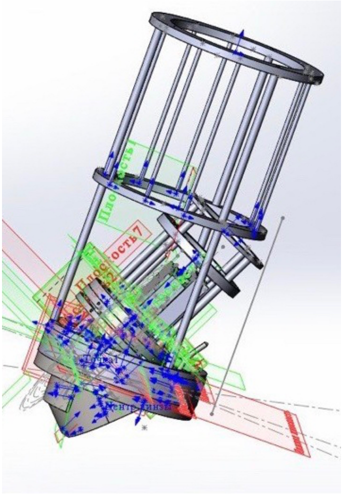
- Charge eXchange Recombination Spectroscopy (CXRS) diagnostic - the charge exchange process of light impurity nuclei on fast neutrals (hydrogen or deuterium atoms) of a diagnostic or heating beam (NBI)

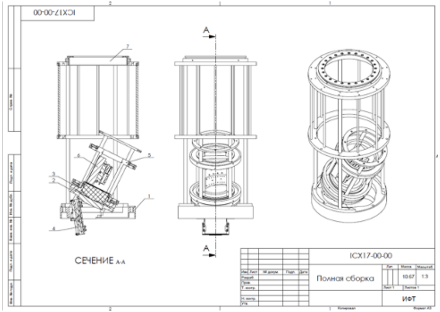


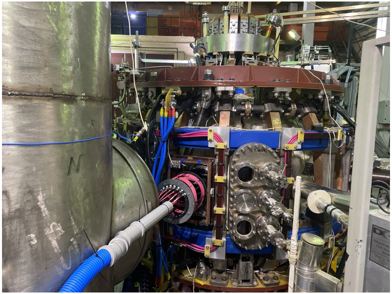
- Extraction of ion temperature profile from spectra, measured with Charge eXchange Recombination Spectroscopy
    - background (Bremsstrahlung radiation + dark signal of the detector)
    - ”passive” signal - plasma periphery
    - ”active” charge exchange component caused by the neutral beam

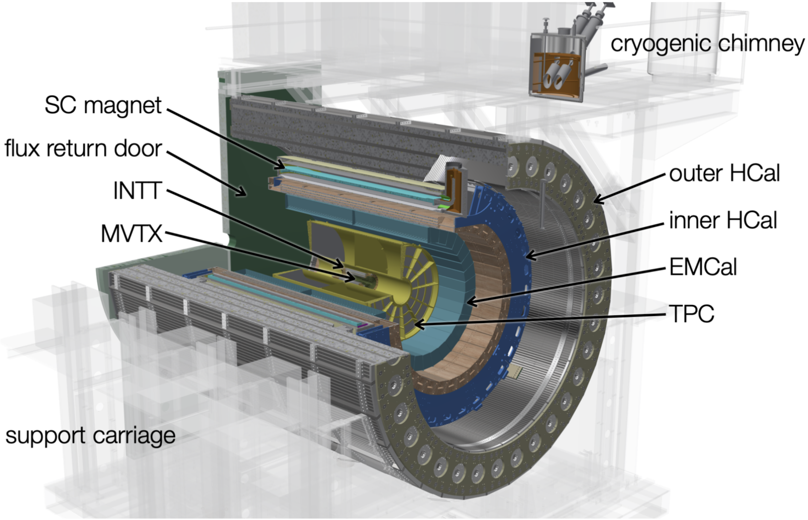


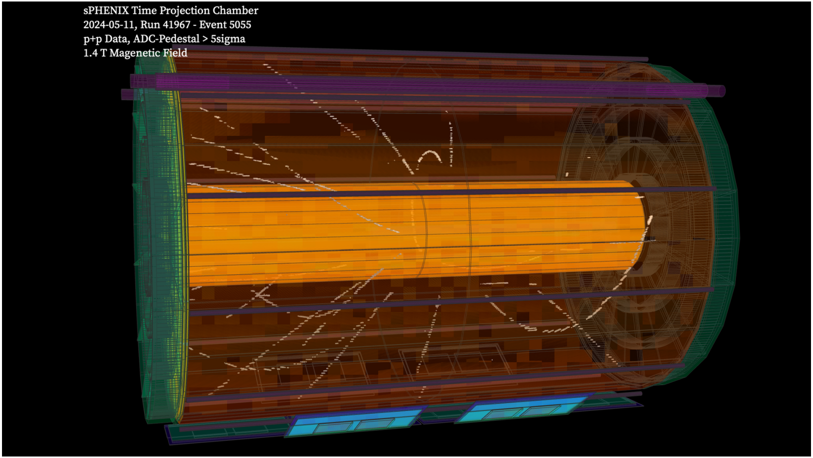




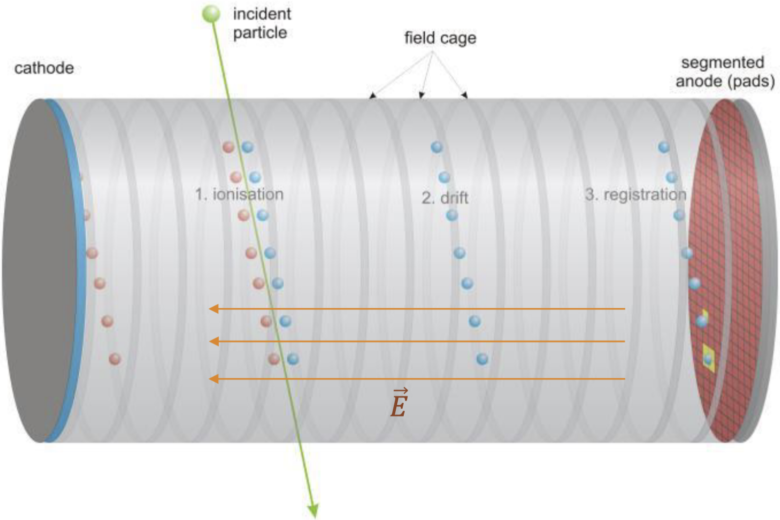

ICX17-00-00
СЕЧЕНИЕ А-А
ICX17-00-00
Полная сборка
ИФТ




cryogenic chimney
SC magnet
flux return door
INTT
MVTX
outer HCal
inner HCal
EMCal
TPC
support carriage


sPHENIX Time Projection Chamber
2024-05-11, Run 41967 - Event 5055
p+p Data, ADC-Pedestal > 5sigma
1.4 T Magenetic Field

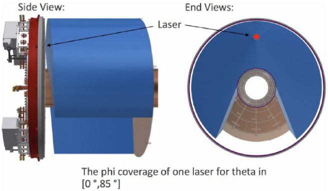
TPC

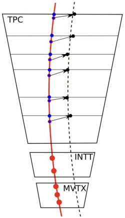

incident particle
field cage
cathode
segmented anode (pads)
1. ionisation
2. drift
3. registration
$\vec{E}$

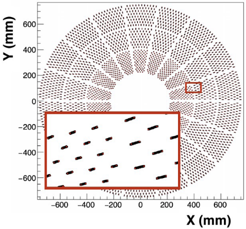
A Common Tracking Software (ACTS)

- Build the ACTS geometry and translate the sPHENIX measurement objects into ACTS measurement objects
- Clusters are found in each subsystem individually
- Clusters are used to seed tracklets in the TPC and silicon subsystems, + INTT to find additional measurements (a set of 3-5 measurement silicon seeds)
- Assign silicon seeds a vertex position
- Track seeds in silicon and TPC are matched to one another with ϕ/η windows
- KalmanFitter tool to fit fully assembled track seeds

- Static distortions due to E, B field inhomogeneities, alignment etc. Length scale: O(1cm). Directed lasers
- Beam-induced distortions due to charges from primary ionization and IBF in drift volume, that create an additional position and time-dependent E field. Length scale: O(1mm). Track extrapolation to the TPC.
- Event-by-event fluctuations of the beam-induced distortions due to multiplicity/centrality fluctuations Length scale: $< 100\ \mu$m. Diffuse laser (and digital currents)

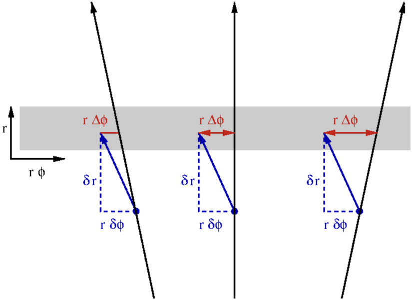


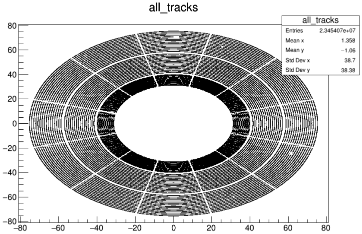


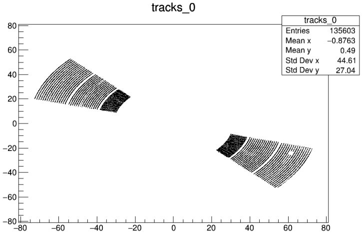


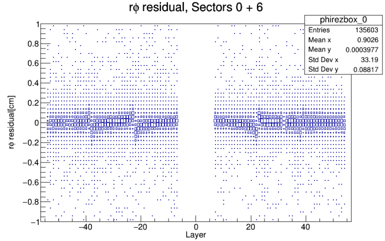
Reconstructing distortions using tracks

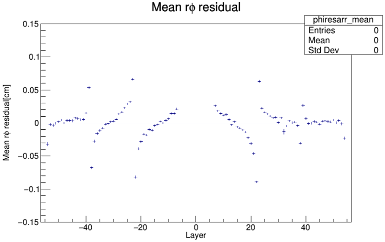
- Find tracks using all detectors and large search windows
- Fit tracks using the detectors outside of the TPC
- Form residuals (cluster - track) in the TPC along ϕ and z
- In each volume element, derive distortions along ϕ, r and z from $\Delta\phi$ and Δz residuals




all_tracks
all_tracks
Entries 2.345407e+07
Mean x 1.358
Mean y −1.06
Std Dev x 38.7
Std Dev y 38.38


tracks_0
tracks_0
Entries 135603
Mean x −0.8763
Mean y 0.49
Std Dev x 44.61
Std Dev y 27.04


rϕ residual, Sectors 0 + 6
phirezbox_0
Entries 135603
Mean x 0.9026
Mean y 0.0003977
Std Dev x 33.19
Std Dev y 0.08817
rϕ residual[cm]
Layer


Mean rϕ residual
phiresarr_mean
Entries 0
Mean 0
Std Dev 0
Mean rϕ residual[cm]
Layer

Thank you for attention!