

π, K, P spectra in Au+Au collisions at $\sqrt{s_{NN}} = 19.6$ GeV

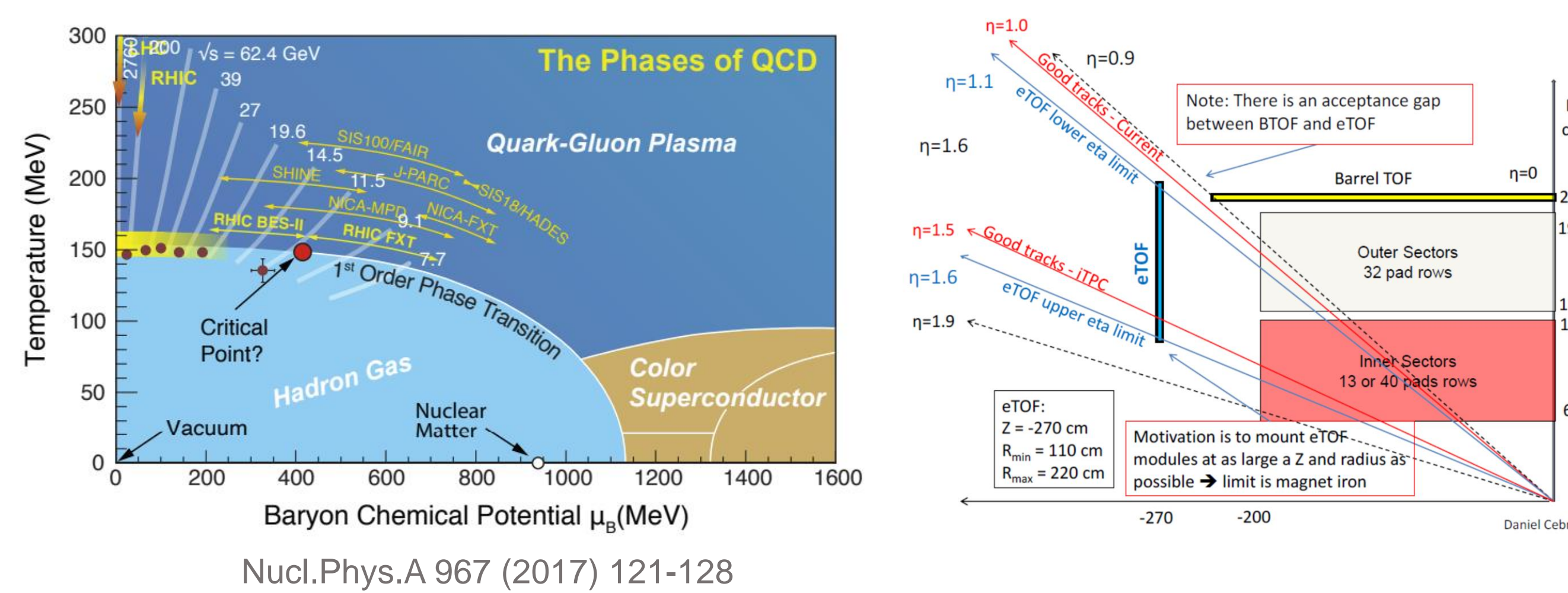
from the STAR experiment

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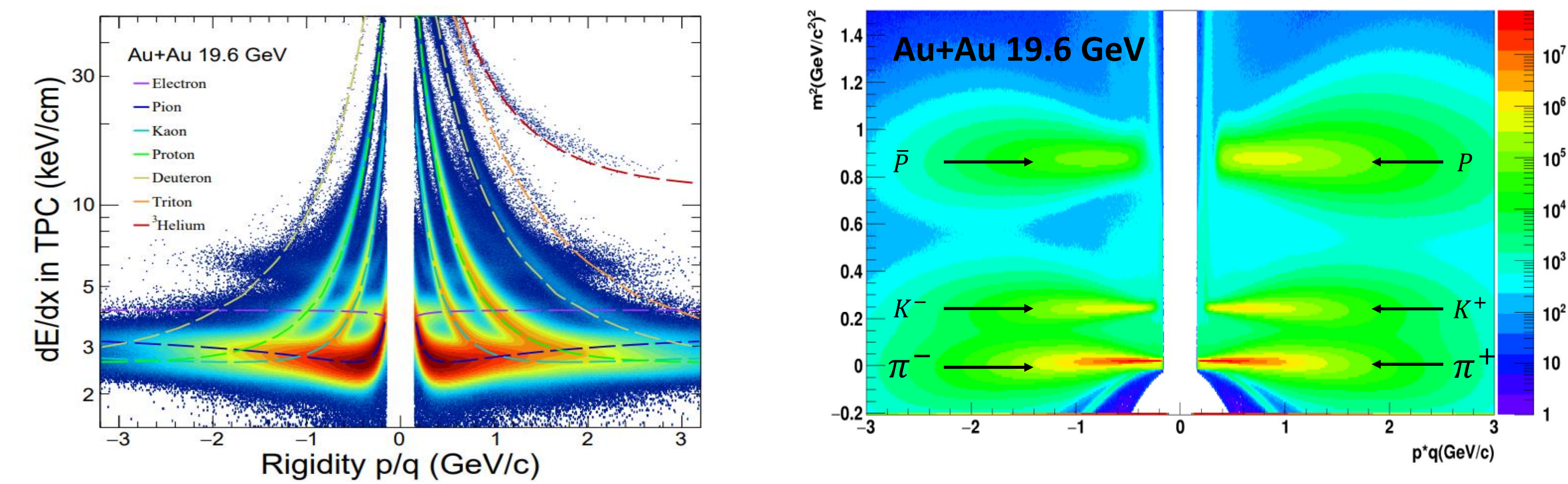


Motivation

- Transverse momentum distributions of identified hadrons contain information of transverse expansion of the system and reveal the freeze-out properties of the matter created in relativistic heavy ion collisions
- The eTOF(endcap Time of Flight detector) upgrade to the STAR detector complements the iTPC upgrade and extends PID capability to forward rapidity region
- Energy dependence probes different phase space regions with STAR BES-II program



Particle identification



- Particle identification at high momentum region is challenging when using dE/dx or m^2 alone
- PID capability could be improved if TPC and TOF information are combined

Combined PID technique

Shift:

$$f_{scale} = \sigma(n\sigma_\pi) / \sigma(m^2(\pi))$$

$$x' = (n\sigma_\pi - \mu(n\sigma_\pi)) / f_{scale}$$

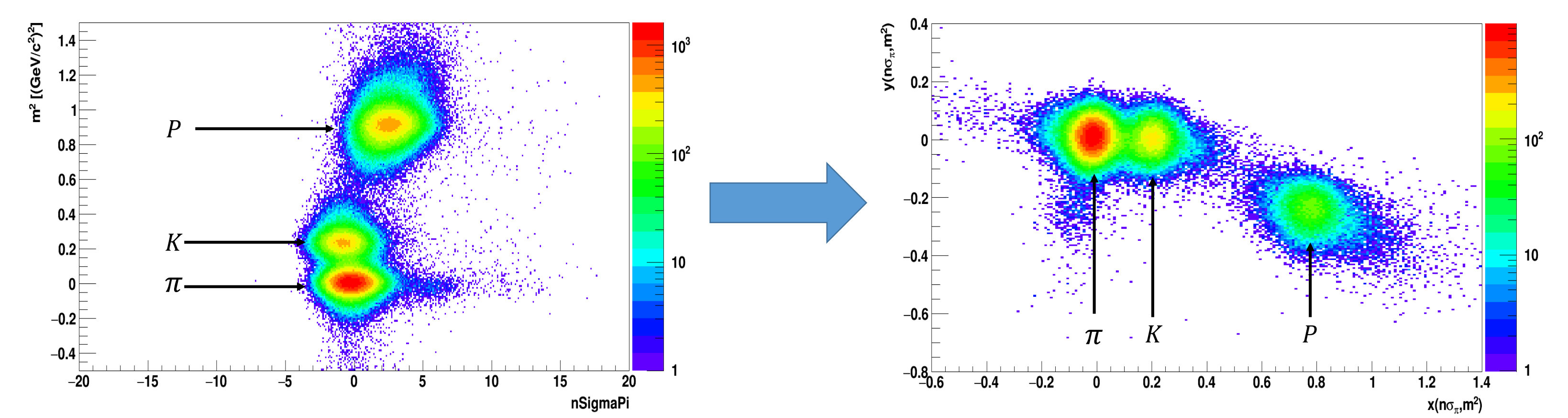
$$y' = m^2 - \mu(m^2(\pi))$$

Rotation:

$$\alpha = \tan^{-1} \left[\frac{\mu(m^2(K)) - \mu(m^2(\pi))}{\mu(n\sigma_K) - \mu(n\sigma_\pi)} \right]$$

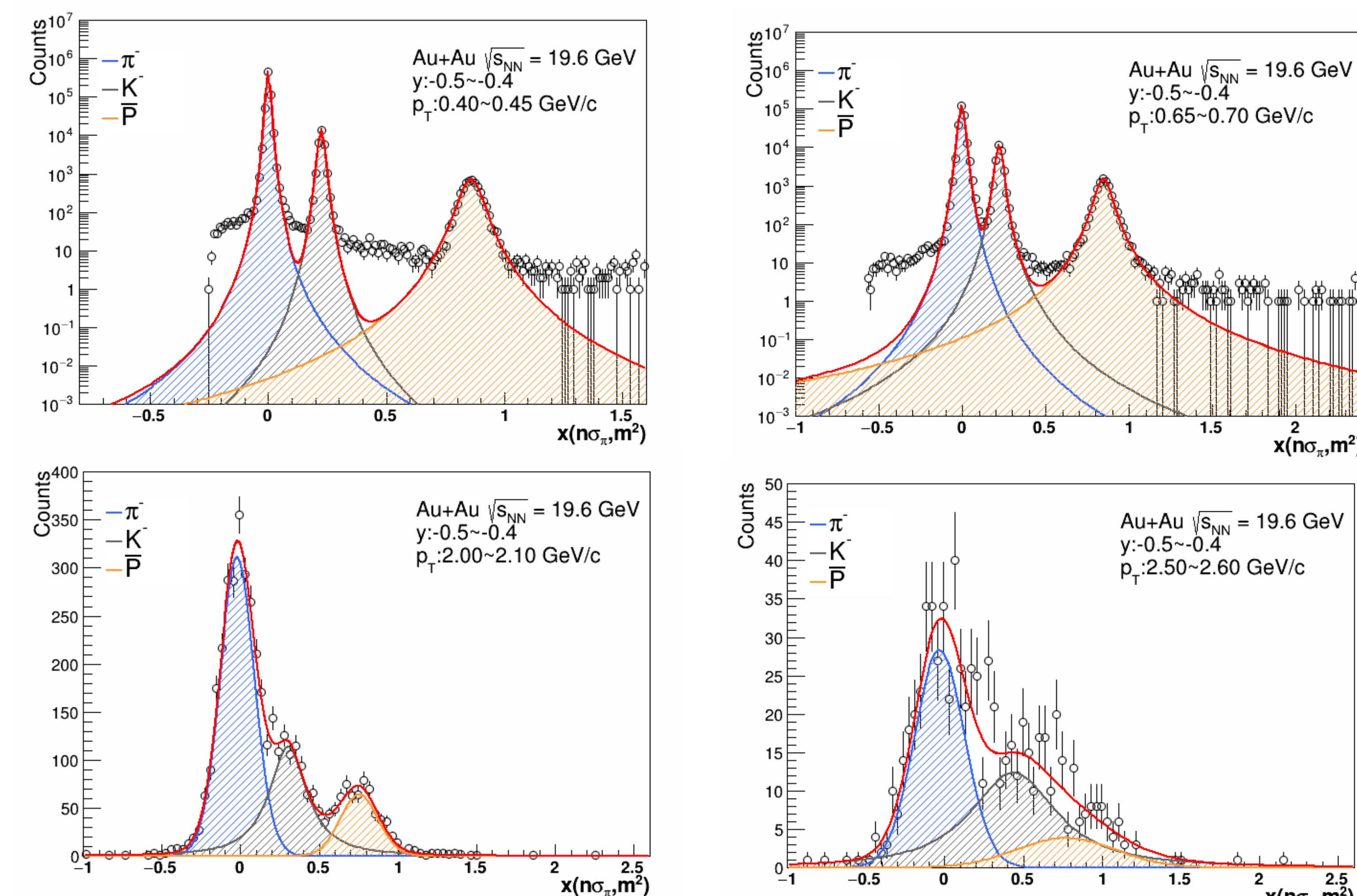
$$\begin{pmatrix} x(n\sigma_\pi, m^2) \\ y(n\sigma_\pi, m^2) \end{pmatrix} = \begin{pmatrix} \cos(\alpha) & -\sin(\alpha) \\ \sin(\alpha) & \cos(\alpha) \end{pmatrix} \begin{pmatrix} x' \\ y' \end{pmatrix}$$

Rotated distribution using Run19 $\sqrt{s_{NN}} = 19.6$ GeV data ($1.2 < p_T < 1.4$ GeV/c, $-0.2 < \eta < 0$)

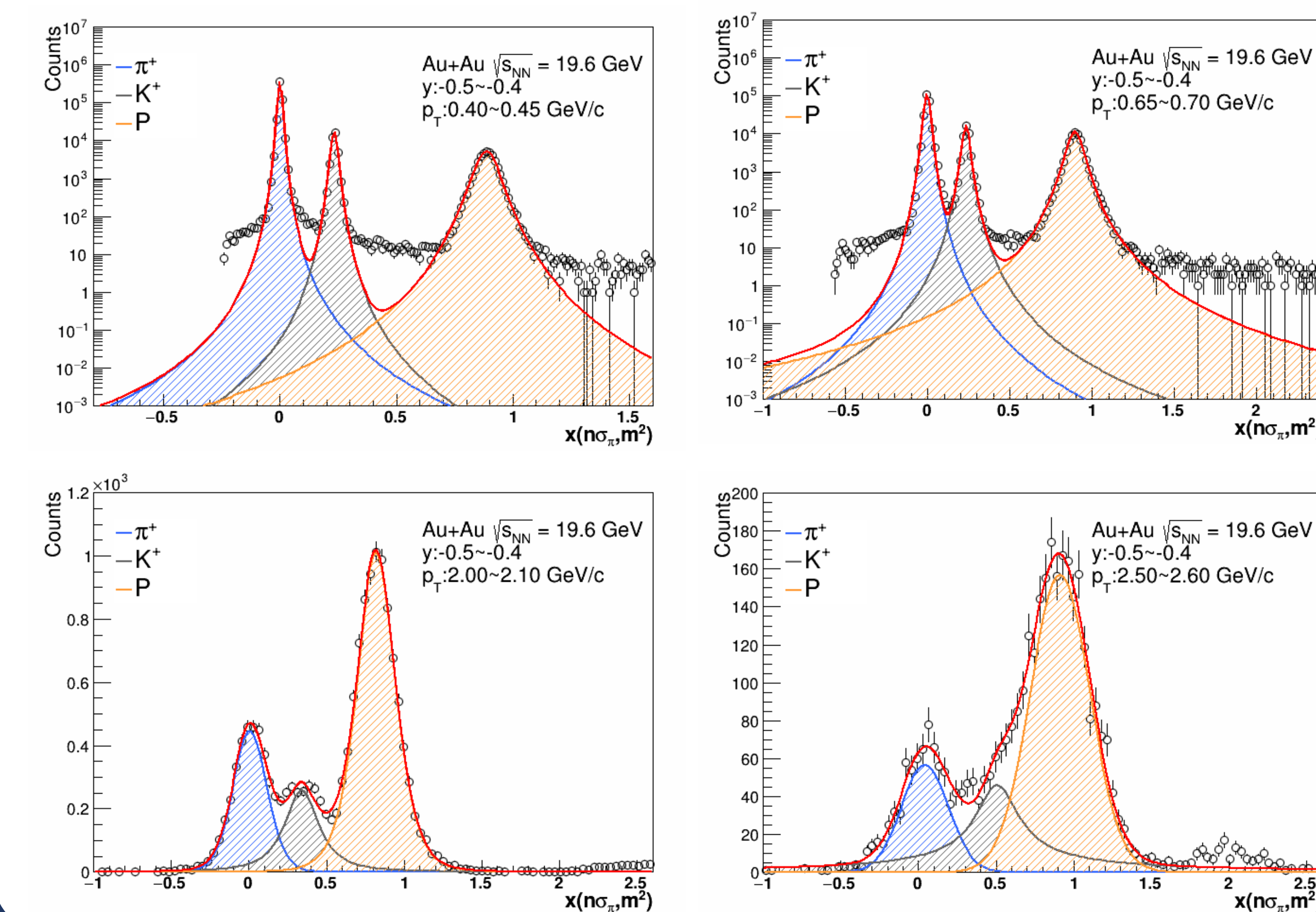


Yield extraction

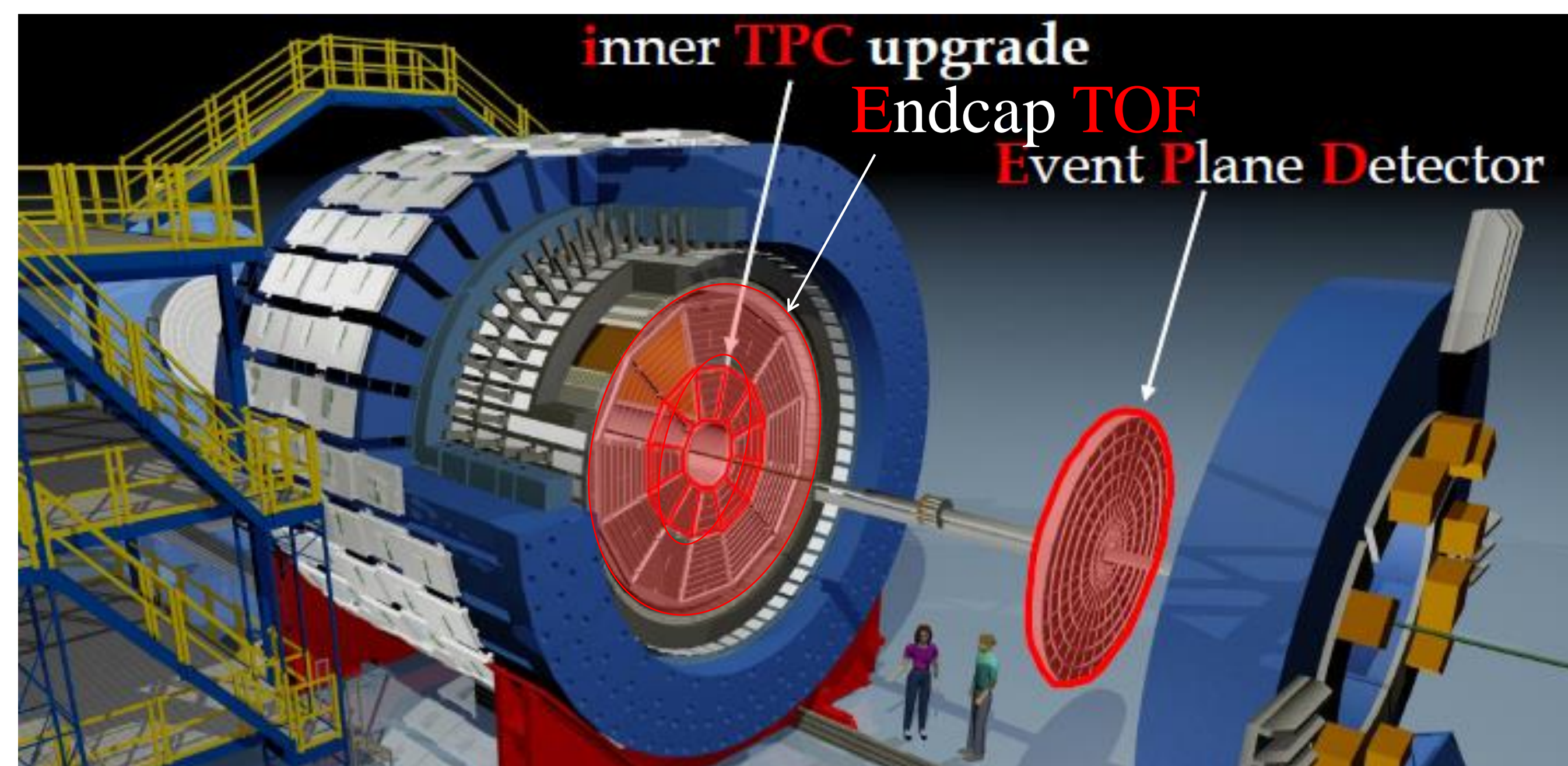
Project the rotated distribution to X axis, then fit with student's t function



Yield extraction



STAR experiment and dataset



Dataset: Run19 19.6 GeV fast offline data, 0.6% of recorded statistics(582M good events)

- * Without final calibration
- * eTOF results are not shown
- * No centrality selection

Trigger: Minbias trigger (Trigger id: 640001, 640011, 640021, 640031, 640041, 640051)

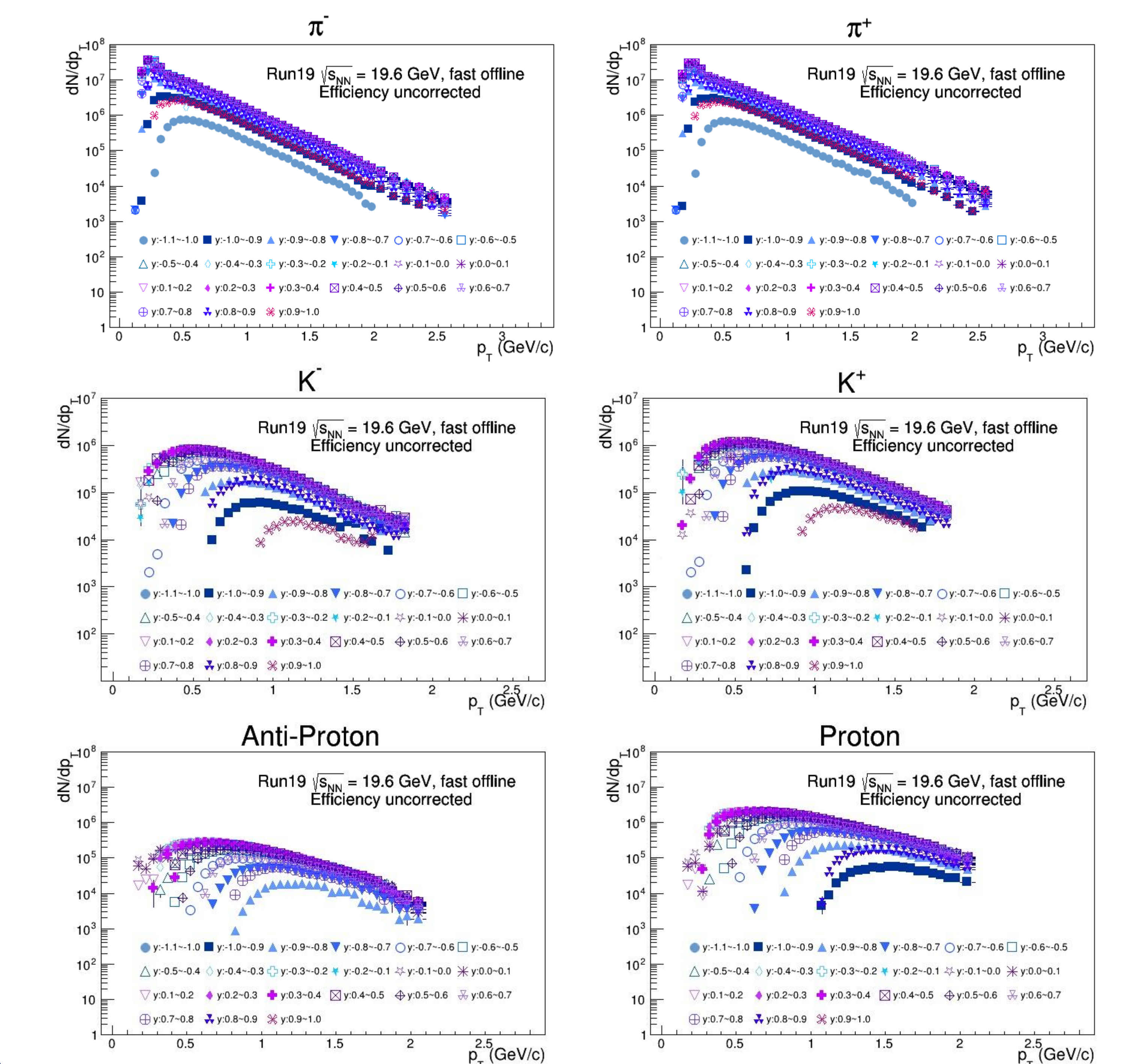
Vertex cuts:

- * $V_r < 1$ cm
- * $|V_z| < 70$ cm

Track quality cuts:

- * Transverse momentum: $p_T > 0.2$ GeV/c
- * Pseudorapidity: $-2 < \eta < 1$
- * Distance of Closest Approach: $DCA < 3$ cm
- * Number of TPC hits used for reconstruction: $nHitsFit > 10$ ($nHitsFit > 15$) for $-2 < \eta < -1$ ($-1 < \eta < 1$)
- * Number of TPC hits used for energy loss: $nHitsDedx > 6$ ($nHitsDedx > 10$) for $-2 < \eta < -1$ ($-1 < \eta < 1$)
- * Number of used to maximum TPC hits: $nHitsFit/nHitsMax > 0.52$
- * Matched to bTOF & valid bTOF information: $btofMatchFlag > 0$ && $btof_beta > 0$ && $|btofLocal| < 1.8$

Raw p_T spectra



Summary

- Combined PID technique can improve pion and kaon separation.
- Plan: use eTOF for forward spectra analysis when official data production is completed.

