Strangeness production in Fixed target experiment at STAR

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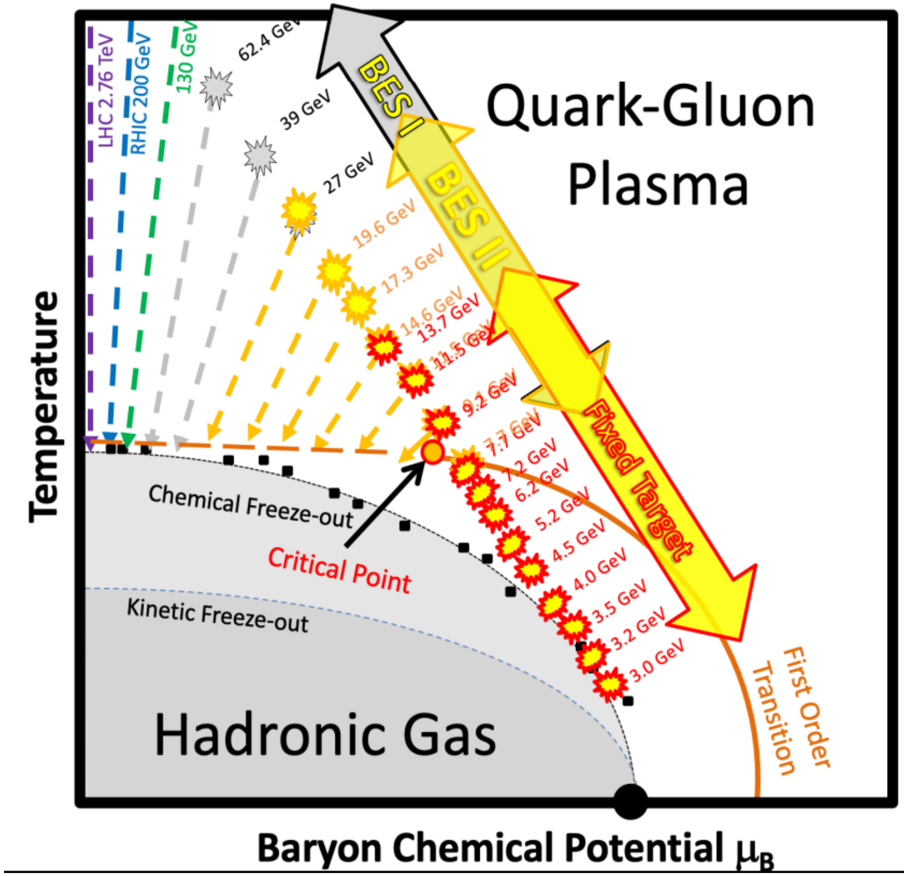
Outline

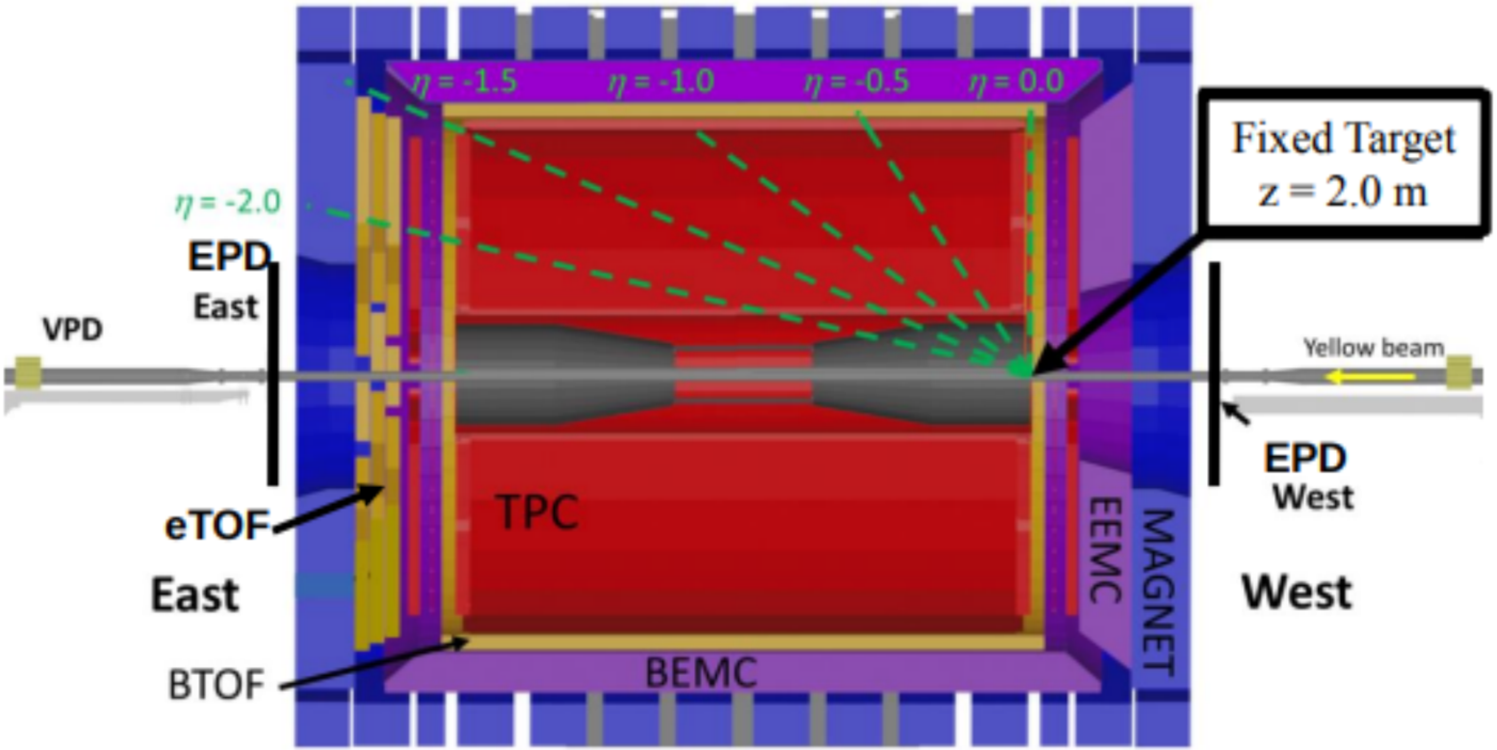
- Motivation
- Dataset and Event Selection
- QA Plots
- Topological cuts
- Efficiency*Acceptance
- Corrected Spectra
- Summary

Motivation



- RHIC BES : Scan the QCD phase diagram and search the critical point to identify features of softening of equation of state.
- BES phase-II (3 to 54.4 GeV) includes both collider and fixed target experiments to probe different regions along the transition boundary of QCD phase diagram especially high μ_B.
- The Fixed-Target Program expands the range of the RHIC Beam Energy Scan (BES) to higher values of μB (baryon chemical potential).
- Strangeness production is considered a sensitive probe to the properties of the medium created in heavy-ion collisions.

STAR: Fxt-Target setup



Gold Target

- 250 µm foil.
- 2 cm below the nominal beam axis.
- 2 m from centre of STAR.

Dataset and Event Selection

Dataset

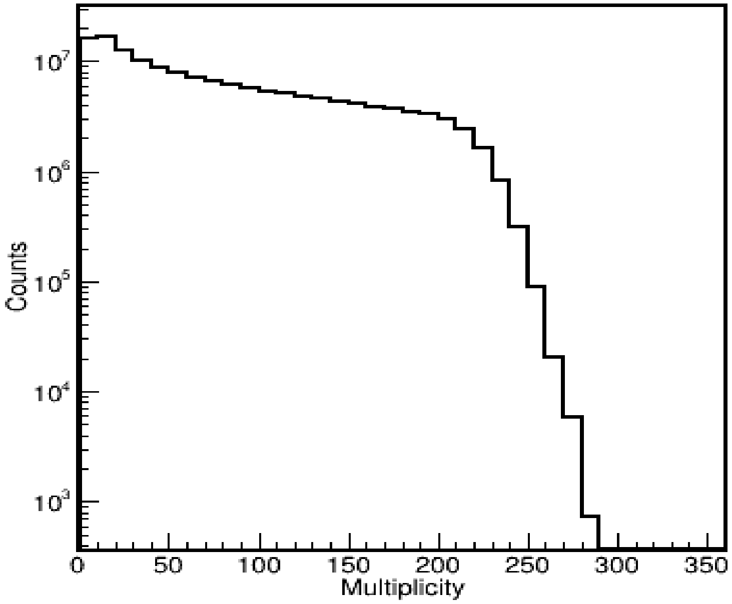
- Au+Au @$\sqrt{s_{NN}}$=7.2 GeV, 26p5fixedTarget_production
- Trigger ID: 630052 (min bias)
- Production tag : P19ie, Run18
- Data file: PicoDST
- Events: 248 Mn (After badruns 149Mn)

Track cuts

- nhitsFit>15
- p_{T}>0.1

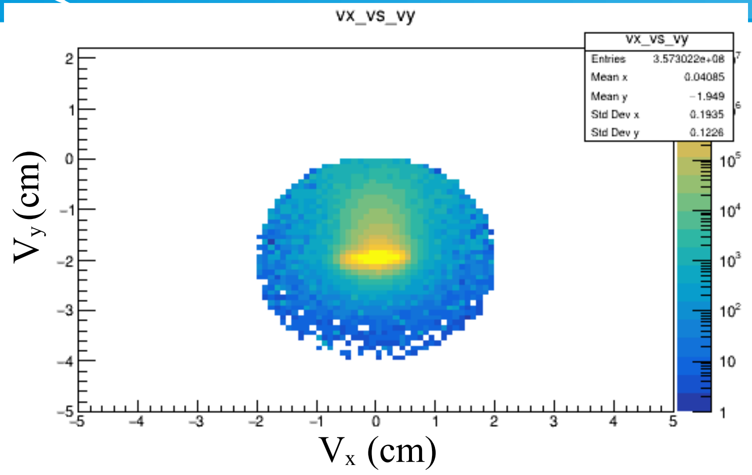
Event Cuts

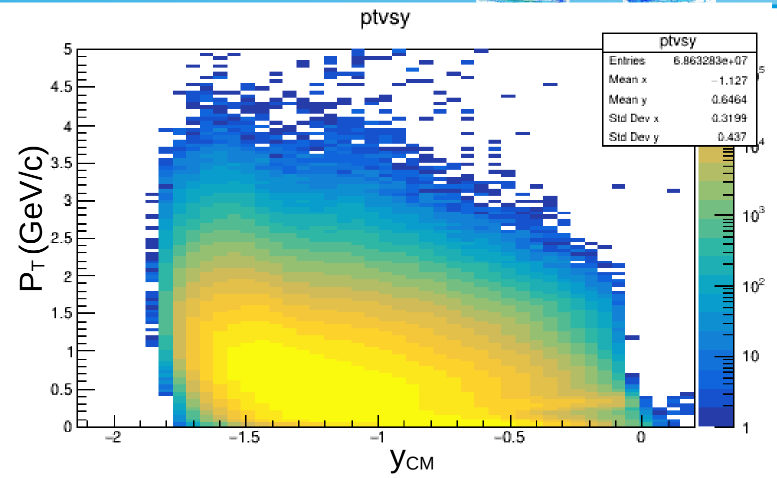
- V_Z -> (198,202)
- V_r < 2cm

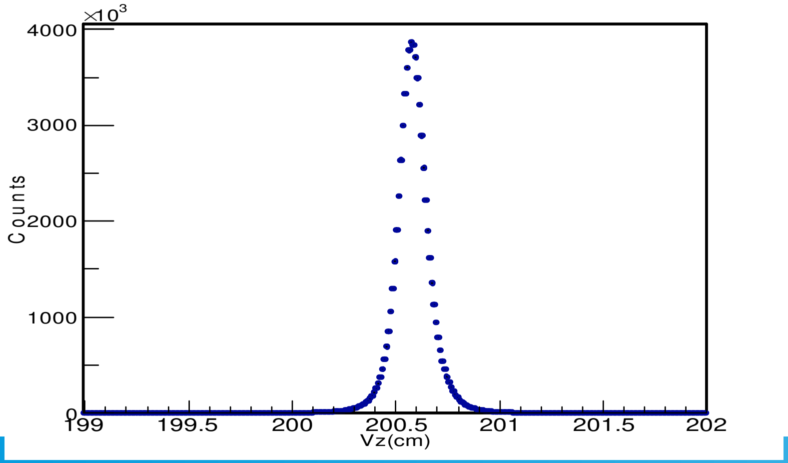


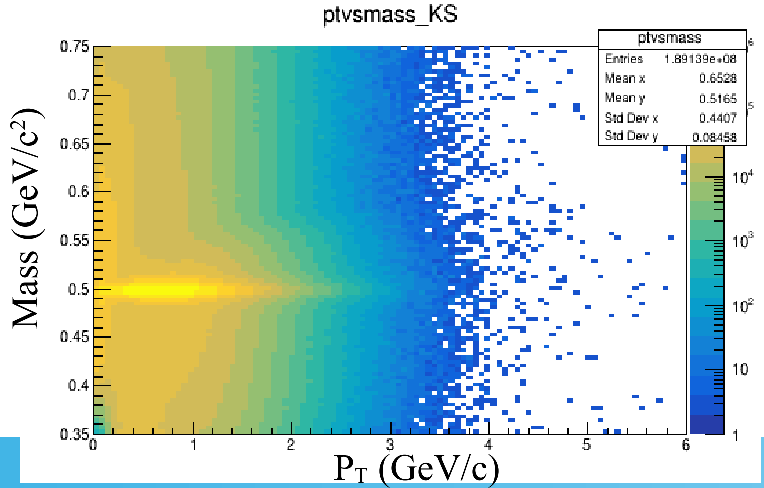
- Badruns: removed
- Centrality: not official

QA Plots for K^0_s









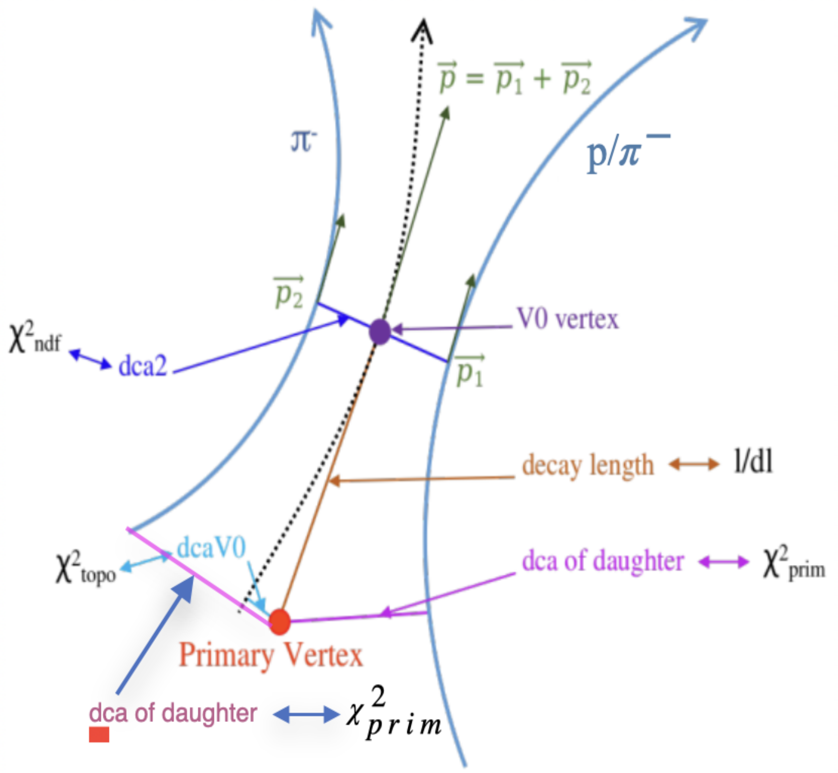
KFParticle : Topological cuts

- KFParticle : reconstruction package for short lived particles

Cuts Applied	
➢ Chi2primary_A	> 10
➢ Chi2primary_B	> 10
➢ Chi2topo	< 5
➢ Chi2ndf	< 5
➢ L	> 1
➢ L/dl	> 5

- **Decay mode (BR) :**

➢ $K^0_s \rightarrow \pi^- + \pi^+$ (69.2%)
➢ BR:(69.05 ± 0.05) %
➢ $c\tau$ = 2.68 cm



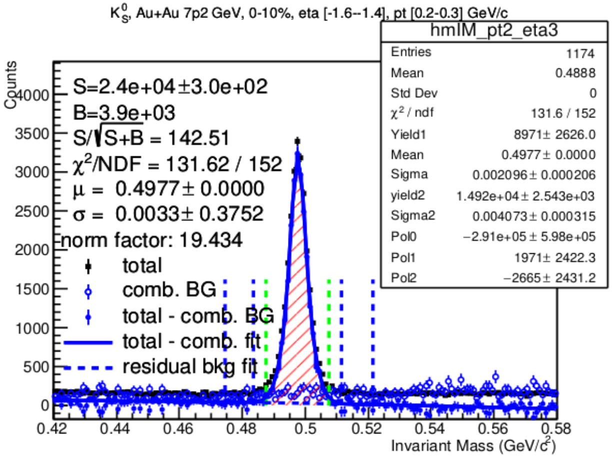
KF Particle Finder: M. Zyzak, Dissertation thesis, Goethe University of Frankfurt, 2016

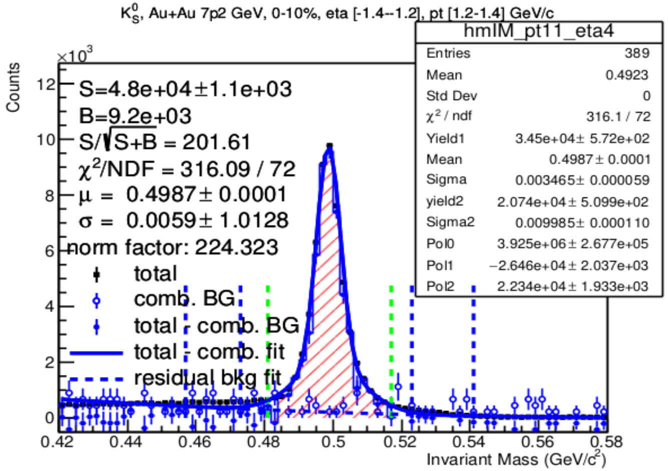
Analysis details: particle reconstruction

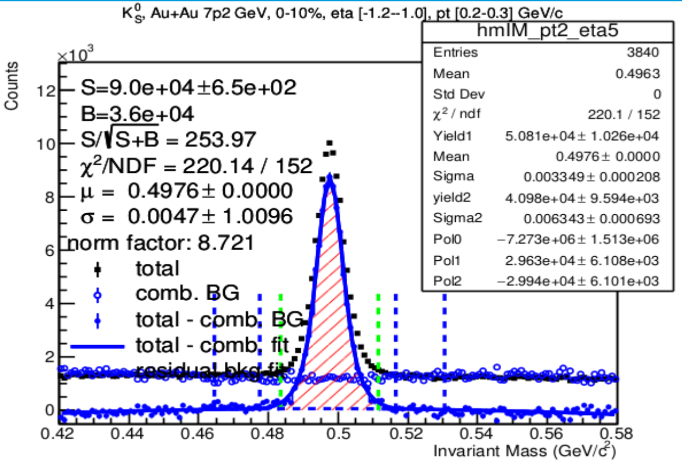
- Invariant mass method: Mother reconstructed by their decay products, adding their 4-momenta.
- Combinatorial background: Removed using rotation method
- Residual background: Misidentified decay products removed by fitting with second order polynomial function.
- Signal: Fit with double Gaussian function, yield calculated by Bin counting method.

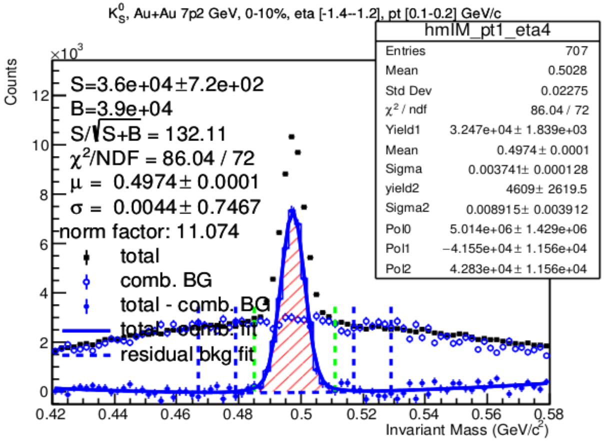
$$a_0 + a_1 m^1 + a_2 m^2 + \frac{Y_1}{\sqrt{2\pi}\,\sigma_1} \exp \frac{(-(m - m_0)^2)}{2\sigma_1^2} + \frac{Y_2}{\sqrt{2\pi}\,\sigma_2} \exp \frac{(-(m - m_0)^2)}{2\sigma_2^2}$$

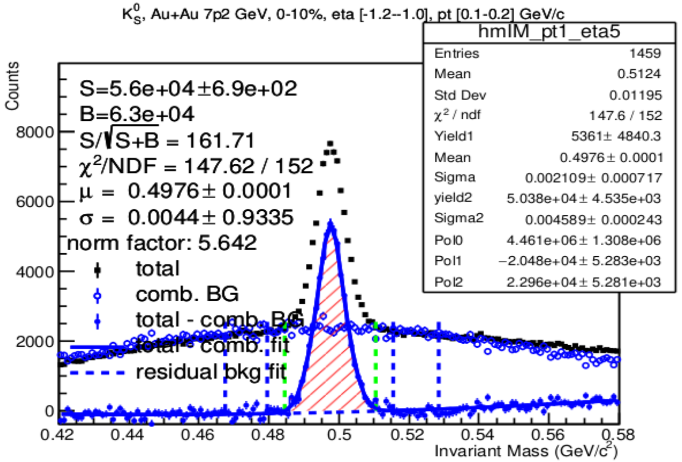
K^o_s signal for 0-10% centrality

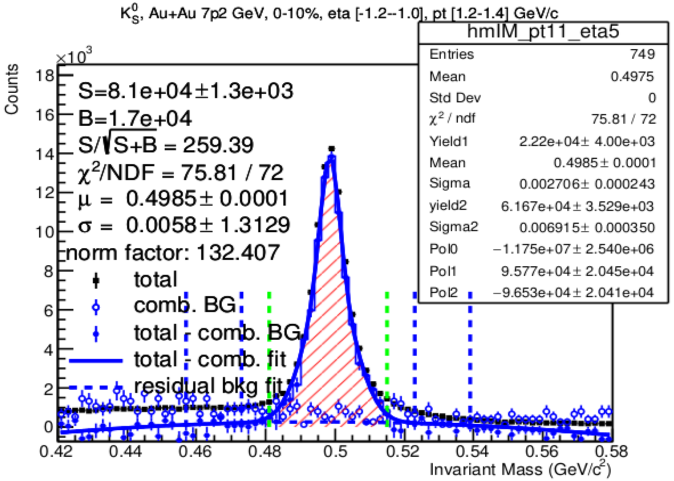




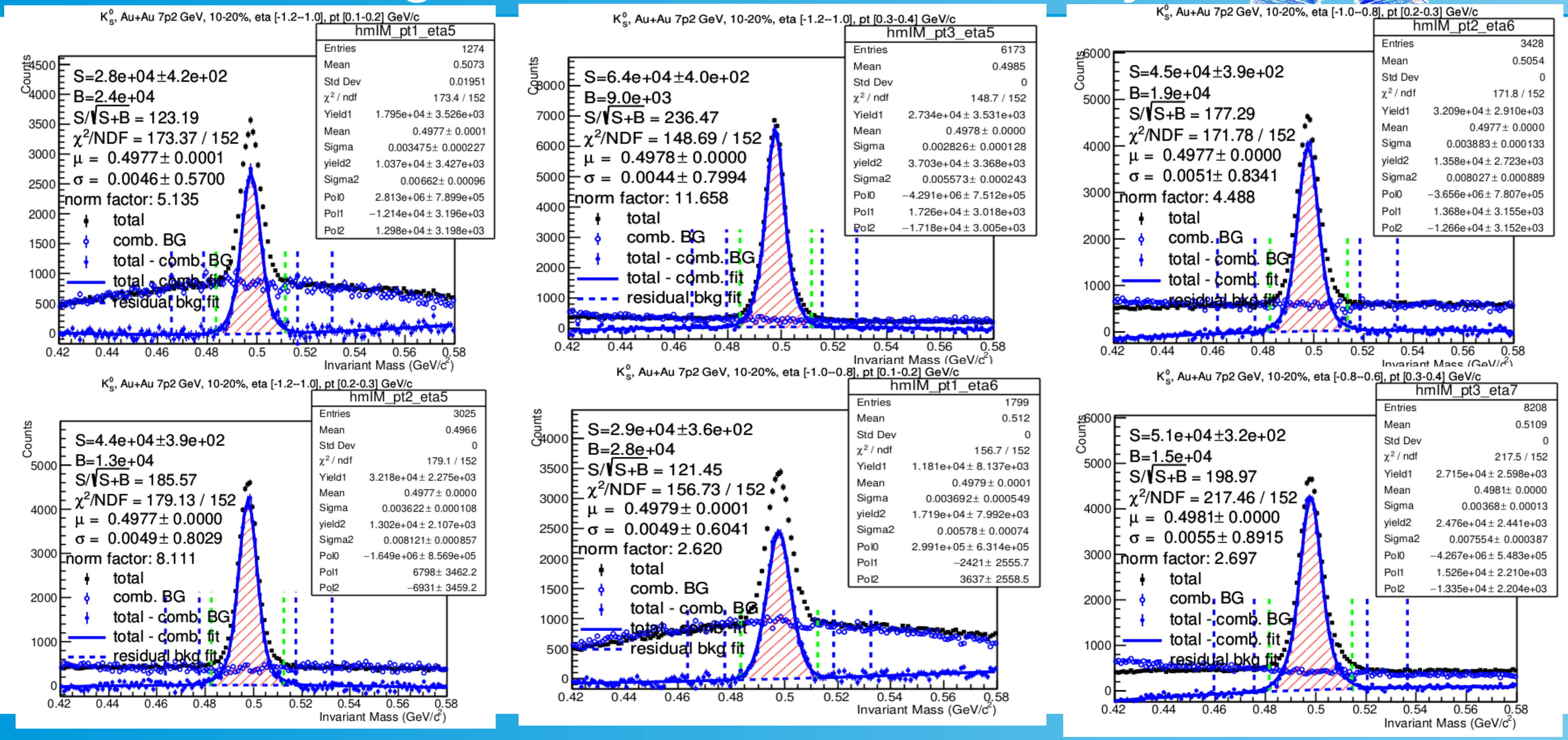




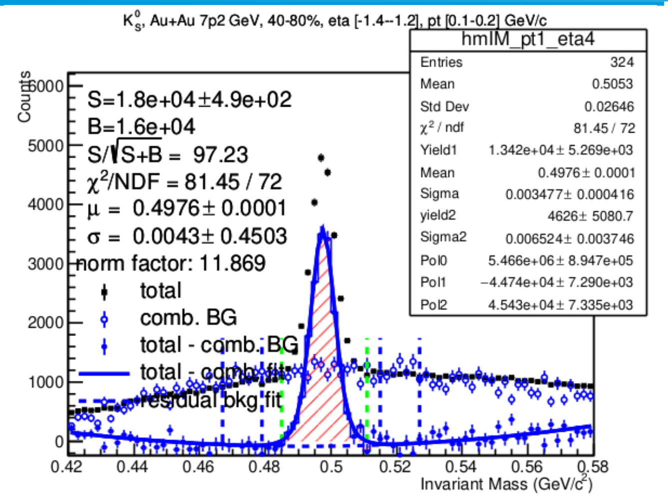


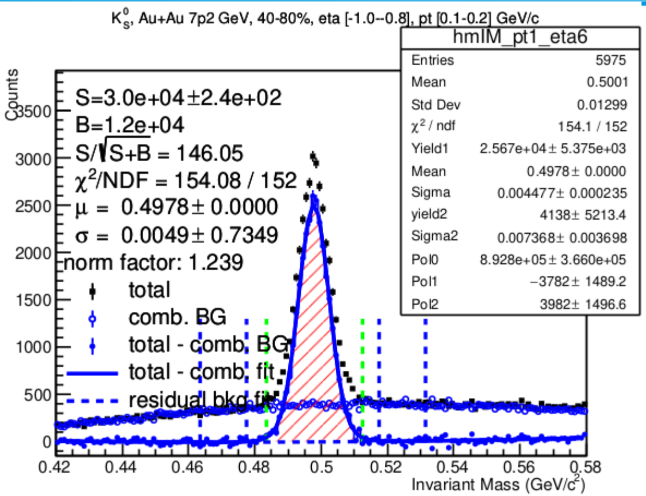


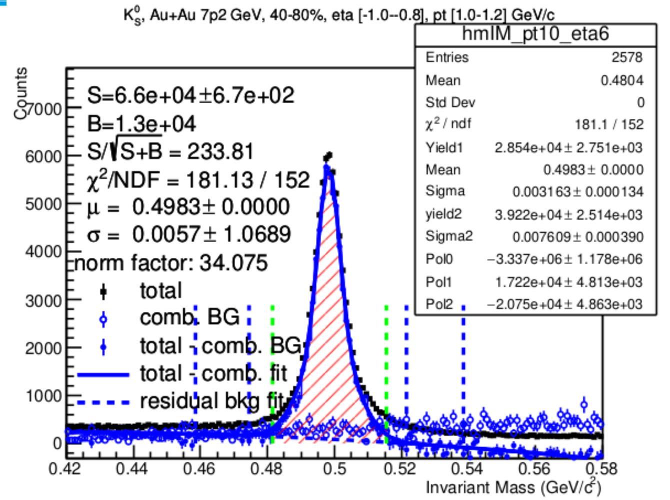
K^o_s signal for 10-20% centrality

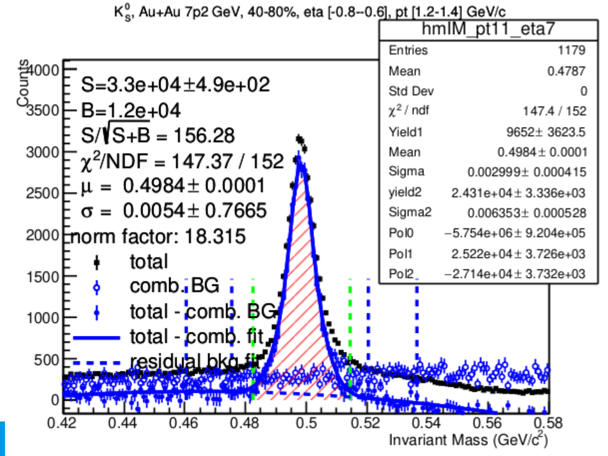


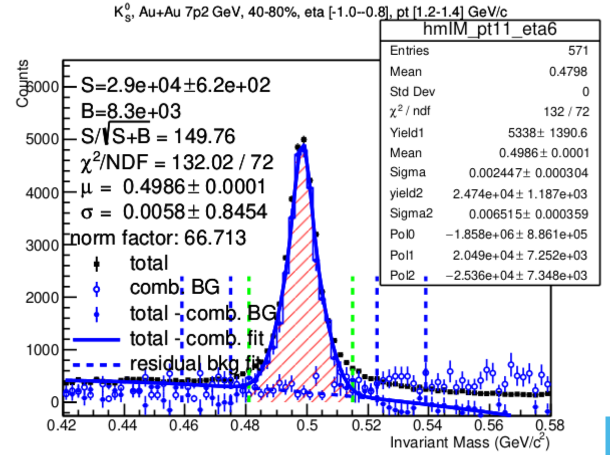
K^o_s signal for 40-80% centrality

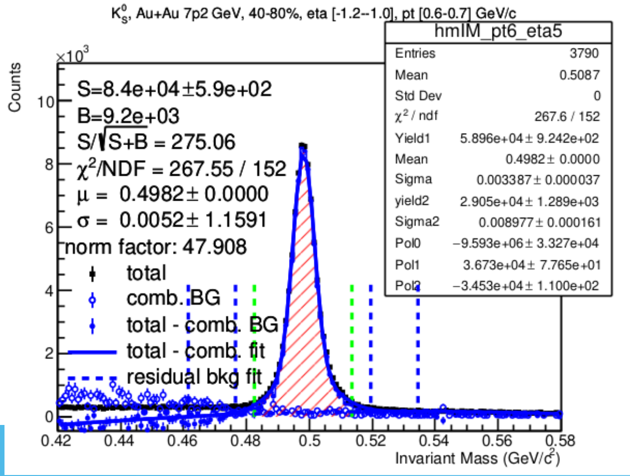




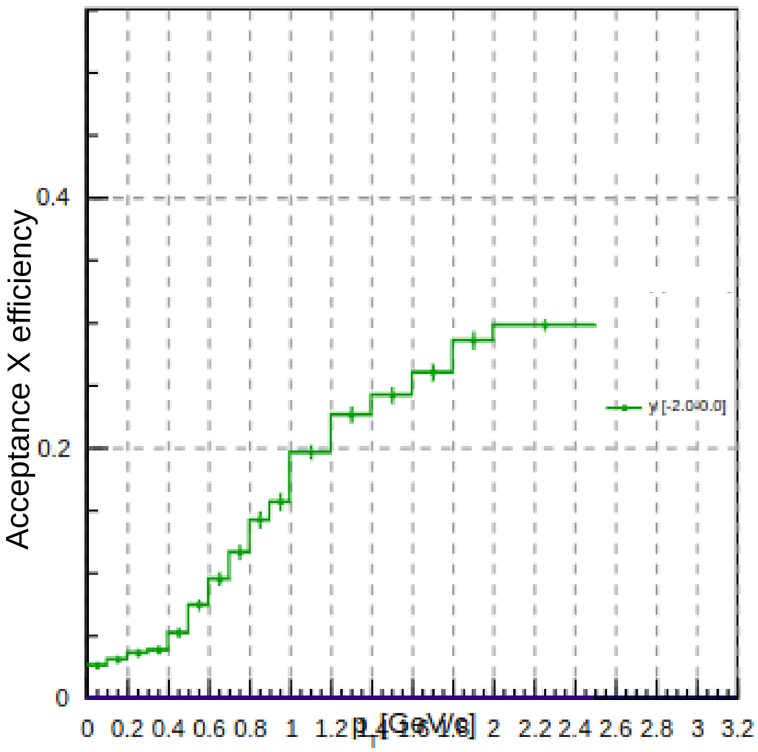






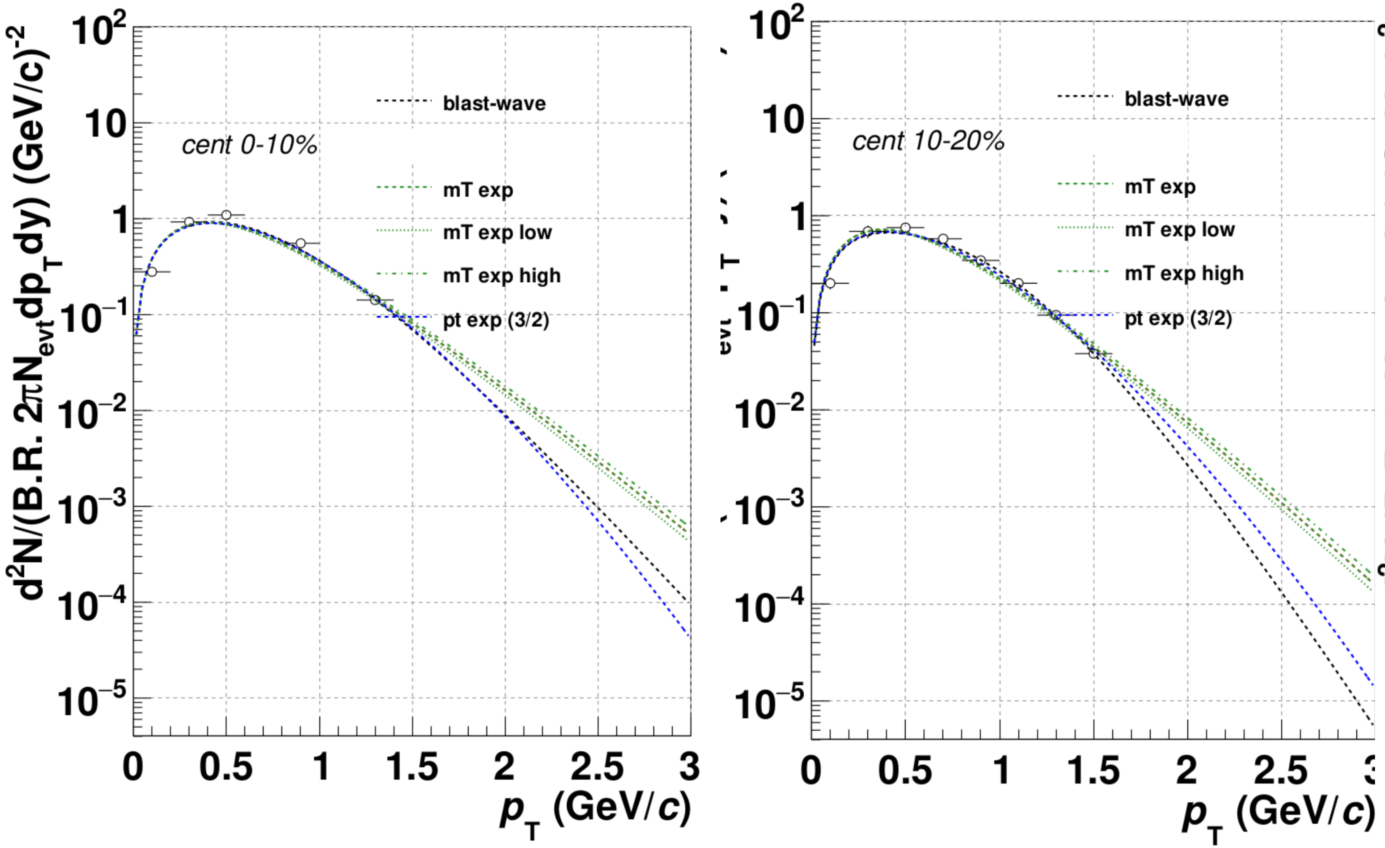


Efficiency corrections

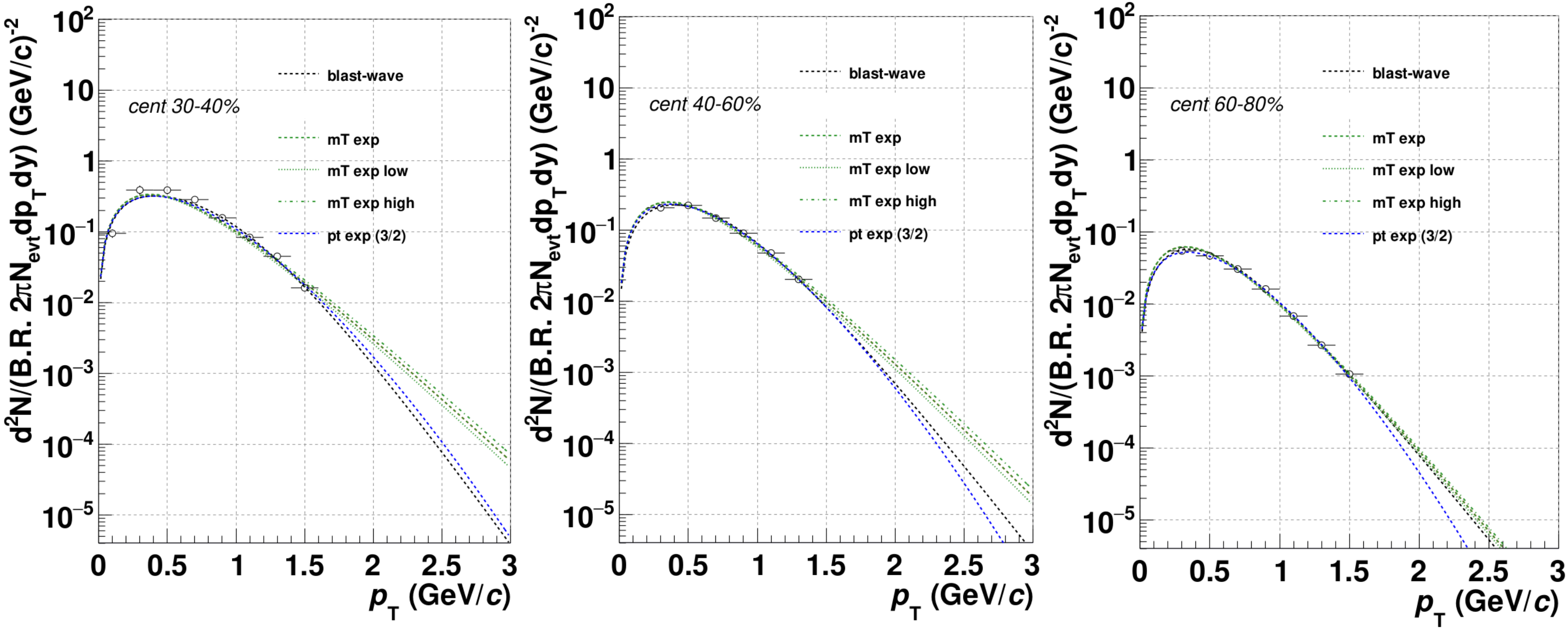


- To caluclate efficiency, embedding data is used where simulated events are embedded into the real data.
- The acceptance and efficiency are calculated by dividing the number of reconstructed Monte Carlo (MC) K^0_s by that of input MC events.

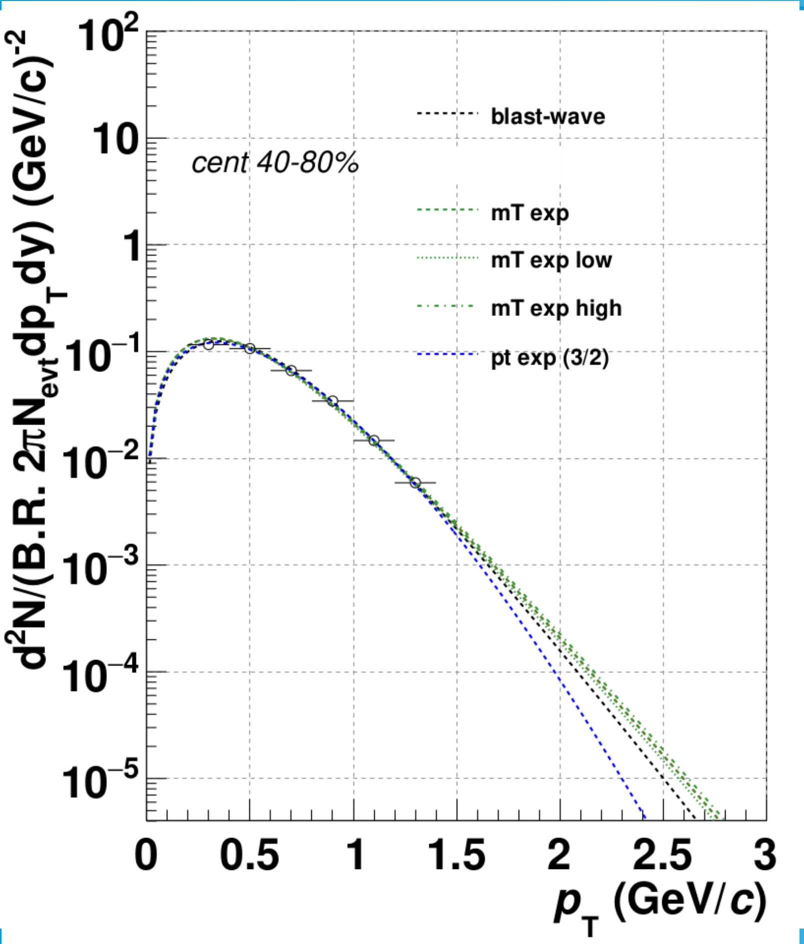
Corrected p_T spectra for K^0_s



Corrected pT spectra for K^0_s



Corrected p_T spectra for K^0_s



- The spectra after efficiency corrections shows a pt dependence.
- However the fittings for lower centralities need to be further improved.

Summary

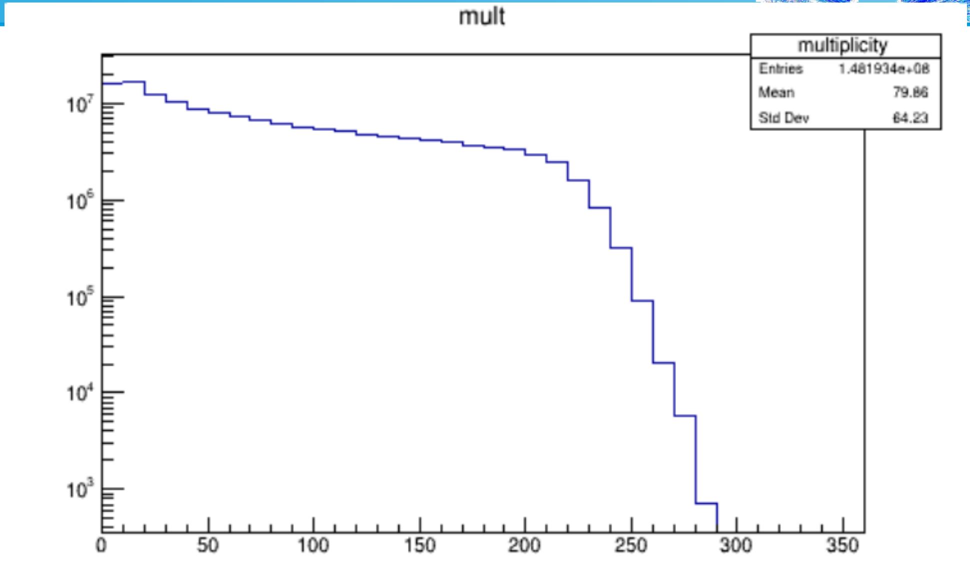
- We presented efficiency corrected spectra for K^0_s.
- The analysis is done using the Kalman filter package for reconstruction of K^0_s in run 18, 26p5fixedTarget production.
- **Also Submitted the embedding** request for Λ^0.
- **To do:** RCP, rapidity density, $\langle p_T \rangle$ & other physics results.

Thank You

Backup

Centrality

- Centrality definition my own.
- Integration the multiplicity curve and then putting a 10% cut on X-axis



Multiplicity	163-289	129-163	101-129	78-101	58-78	41-58	27-41	17-27
Centrality	0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%