Tuning of EPOS in Pb+Pb collision at 30A GeV/c

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Event and track selection in MC_{rec}

Path: `/eos/experiment/na61/data/Simulation/Pb_Pb_30_16_Luminance/EPOS_053_v1r21p2_nanoSHOE/`

Event cuts

1. Event has main vertex
2. Has fitted vertex
3. Perfect fit of vertex
4. Vertex z position:
   -592.9< z < -590.9 cm
5. $0 - 7.2\%$ Central events

Track cut

1. Track status
2. $|b_x| < 4$ cm, $|b_y| < 2$ cm
3. Right side tracks
4. All clusters > 30
5. VTPC clusters > 15
6. $p > 5$ GeV/c
7. $|\phi| < 30^\circ$

EPOS tuning

The method to tune EPOS MC is defined as follows,

- Obtain the list of particles that may decay in pions, kaons, protons and anti-protons. Calculate the mean multiplicities of those parent particles from pure generated rapidity distributions and compare the calculated values with published results.
- Draw the $y - p_T$ of pions, kaons, protons, and anti-protons produced in the decay of heavy particles, separately for all parent particles, and scale those distributions with the factors calculated by the comparison of MC-generated multiplicities and published data.
- Add all the contributions of pions, kaons, protons, and anti-protons and use them for the additive corrections.

List of parent particles with flag eDecay

Following is the list of parent particles obtained by using eDecay flag that might decay into pions, kaons, protons, and anti-protons.

- $\mu^+, \mu^-, \pi^0, \pi^+, \pi^-, \eta, \eta', \omega, \phi$
- $\rho(770)^0, \rho(770)^+, \rho(770)^-$
- $K^+, K^-, K_S^0, K_L^0, K_0^*, \overline{K_0^*}, K^{*+}, K^{*-}$
- $D^0, \overline{D^0}, D^+, D^-$
- $\Delta^0, \overline{\Delta^0}, \Delta^+, \overline{\Delta^+}, \Delta^-, \overline{\Delta^-}, \Delta^{++}$
- $\Sigma^-, \overline{\Sigma^-}, \Sigma^+, \overline{\Sigma^+}, \Sigma^{*-}, \Sigma^{*0}, \Sigma^{*+}$
- Ω^-, Ω^+
- $\Lambda, \overline{\Lambda}, \Lambda_c^+$
- $\Xi^-, \overline{\Xi^-}$

List of parent particles with flag eGeneratorIntermediate

Following is the list of parent particles obtained by using eGeneratorIntermediate flag that might decay into pions, kaons, protons and anti-protons.

- $\rho(770)^0, \rho(770)^+, \rho(770)^-$
- $\eta, \eta', \omega, \phi$
- $K_0^*, \overline{K_0^*}, K^{*+}, K^{*-}$
- $\Delta^0, \overline{\Delta^0}, \Delta^+, \overline{\Delta^+}, \Delta^-, \overline{\Delta^-}, \Delta^{++}$
- Σ^{*-}, Σ^{*0}

List of parent particles with flag eGeneratorFinal

Following is the list of parent particles obtained by using eGeneratorFinal flag that might decay into pions, kaons, protons and anti-protons.

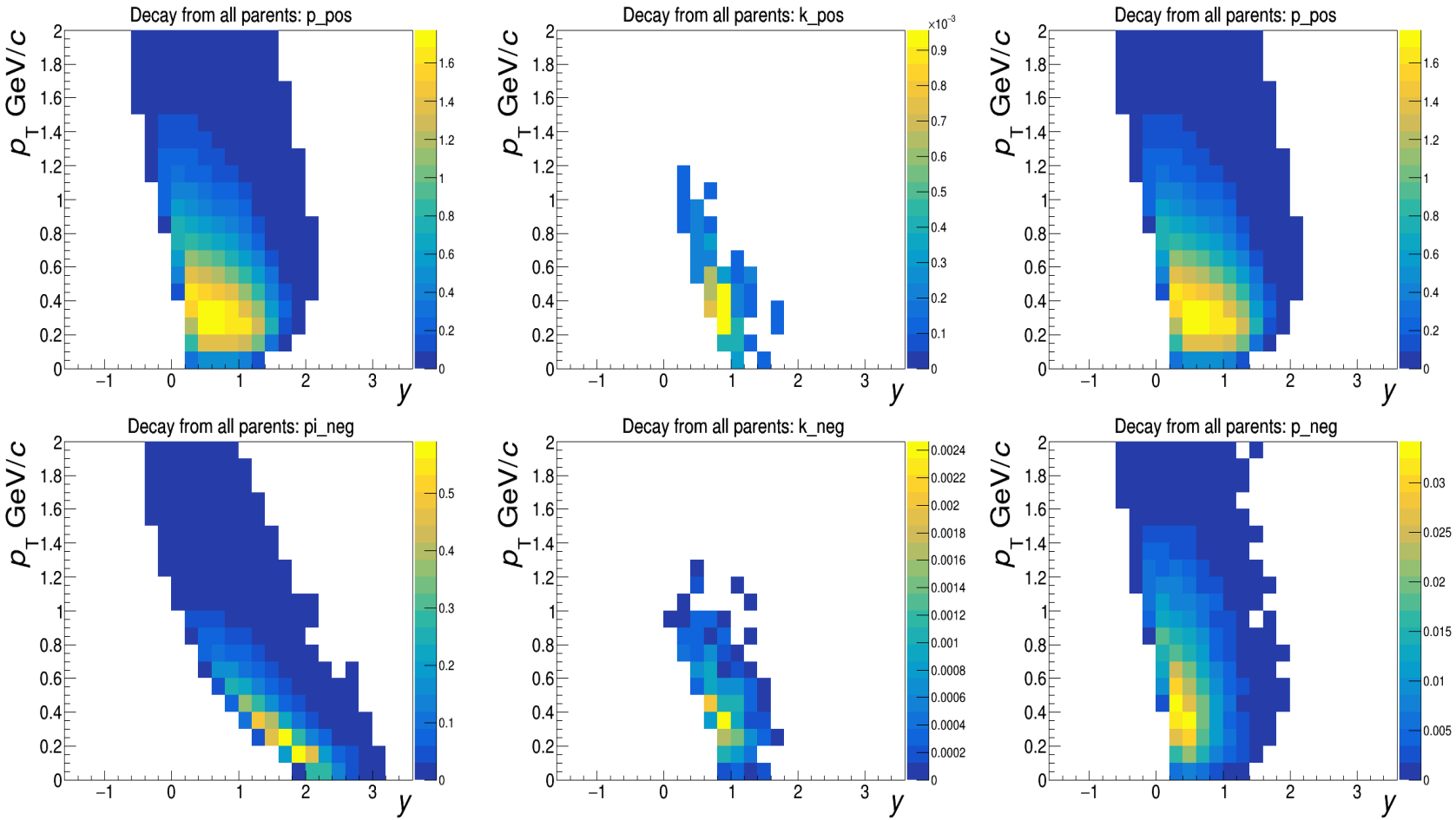
- K_S^0, K_L^0
- $\Sigma^-, \overline{\Sigma^-}, \Sigma^+, \overline{\Sigma^+}$
- Ω^-, Ω^+
- $\Lambda, \overline{\Lambda}$
- $\Xi^-, \overline{\Xi^-}$

Tuning factors for parent particles

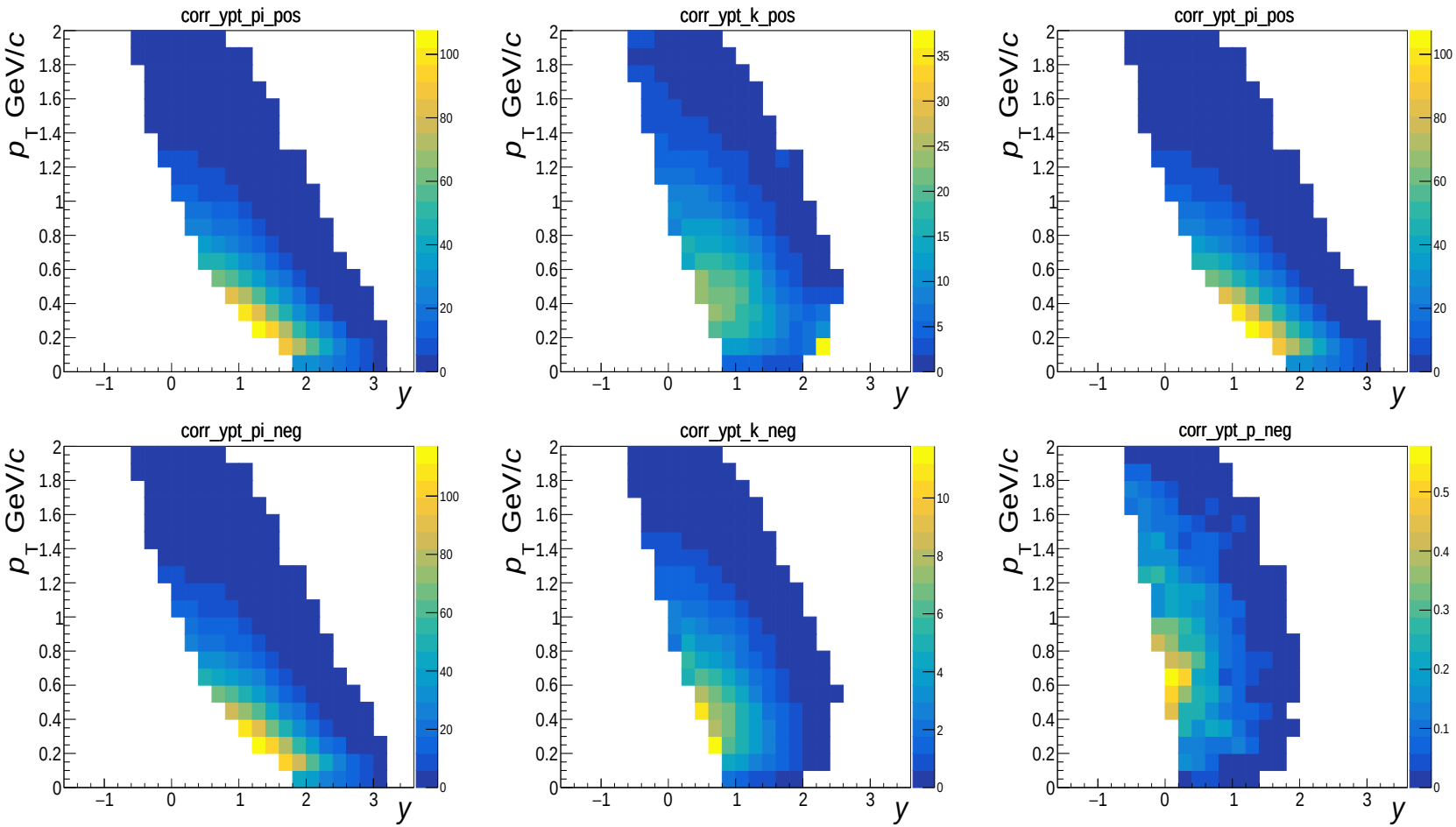
The global tuning factor is obtained by comparing published data with MC-generated multiplicities. For

- K^0_S and K^0_L form $(K^+ + K^-)/(2 \times 1.1)$ is 1.33.
  divided with 1.1 because of charged to neutral kaons asymmetry.
- Ω^- is 1.69 and Ω^+ is 1.45.
  tuning factor for Ωs are obtained by extrapolating Ωs from beam momenta 40 and 158A GeV/c
- Ξ^- is 2.73 and $\overline{\Xi}^+$ is 1.71.
- Λ is 1.42 and $\overline{\Lambda}$ is 0.58.
- Σ^- and Σ^+, using same tuning factor as Λ because they have one strange quark.
- What factor should be used for $\overline{\Sigma^-}$ and $\overline{\Sigma^+}$?

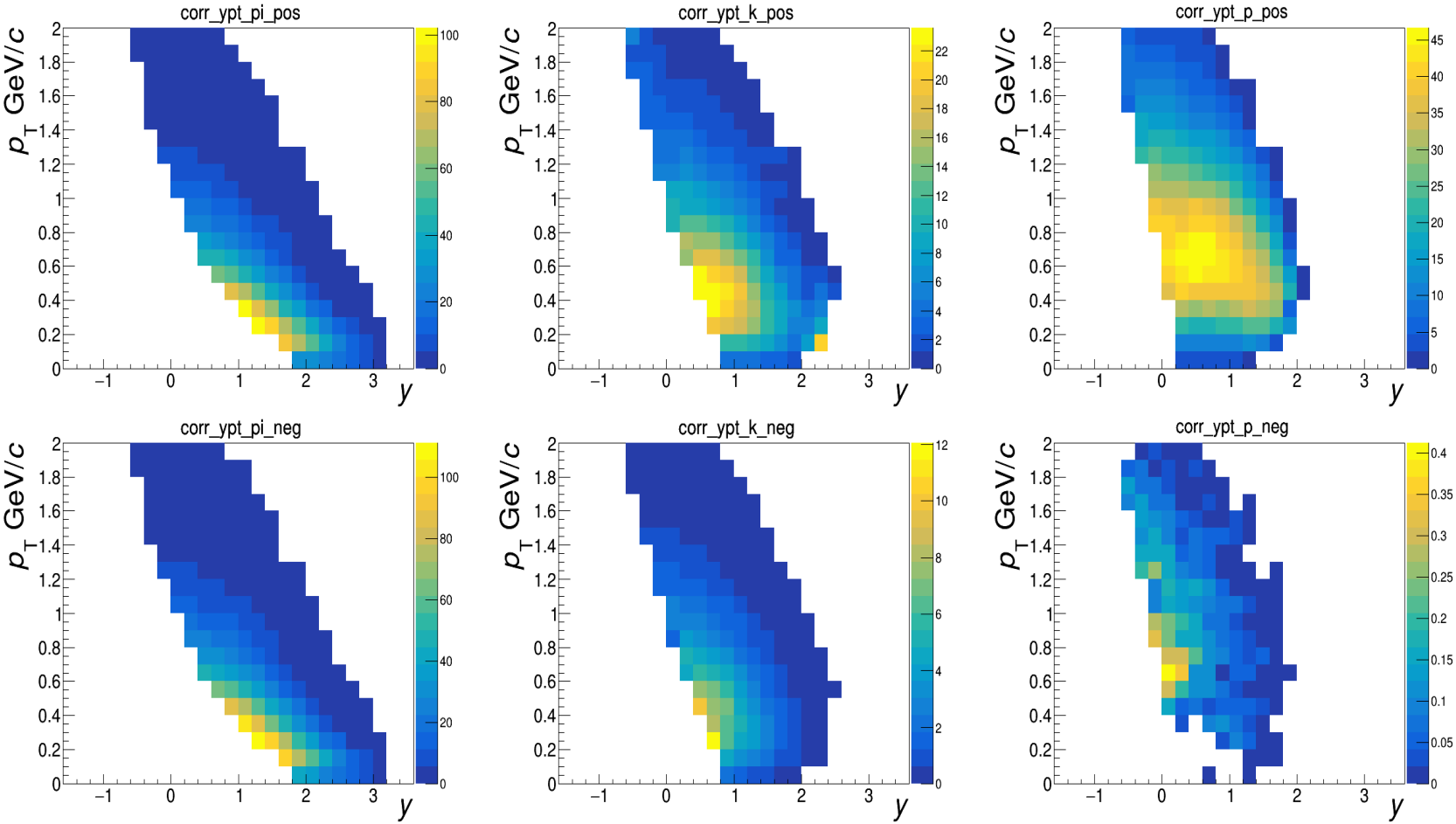
Spectra of the all contributions form weak deacys



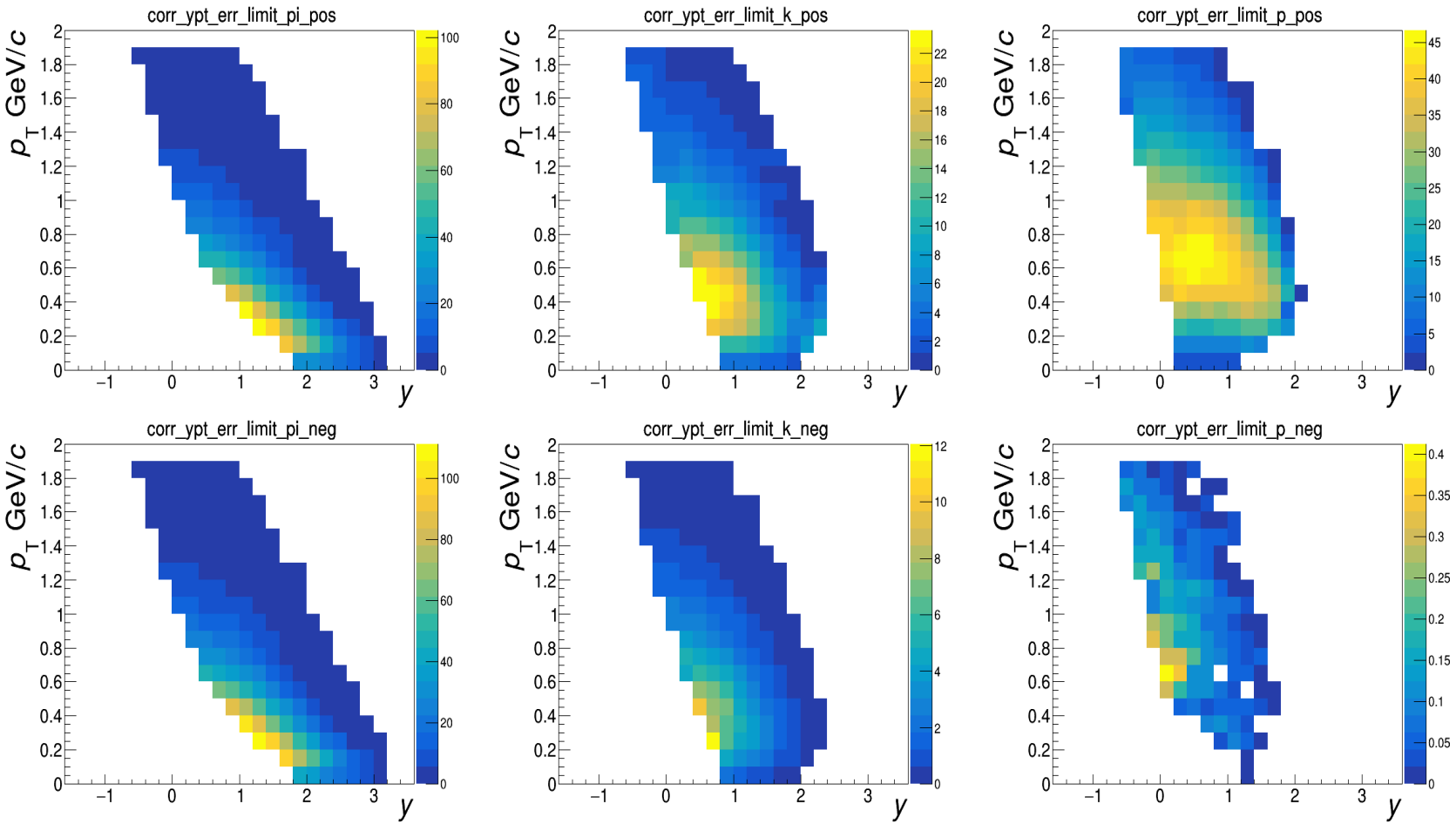
Corrected spectra (multiplicative tuning)



Corrected spectra (multiplicative + additive tuning) after tuning of EPOS

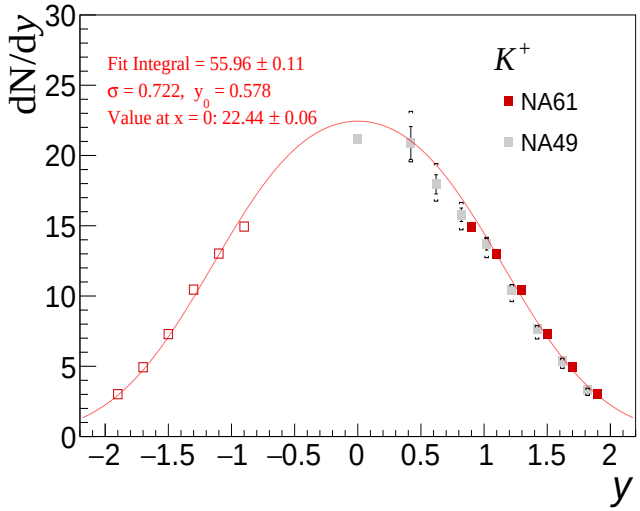


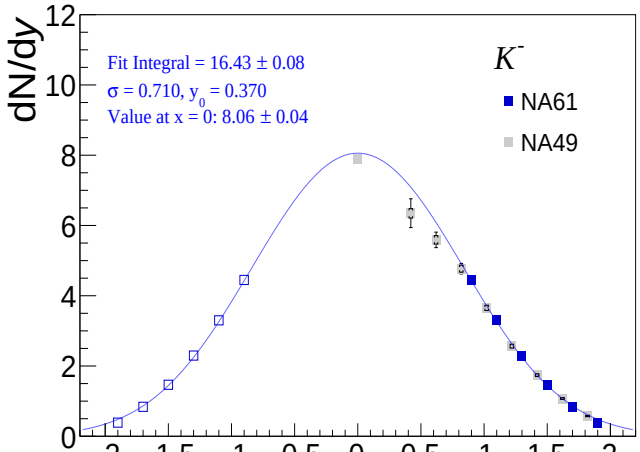
Corrected spectra after tuning of EPOS with statistical uncertainties less than 50% of bin content



Comparison of kaons rapidity distributions before and after EPOS tuning

Data corrected before EPOS tuning





Data corrected after EPOS tuning