

Multiplicity dependent π and K production in pp collisions at $\sqrt{s} = 13.6$ TeV

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- * Introduction
- * Analysis Details
- * Results
- * Summary
- * Outlook

- * Prime objective of **ALICE** is to study the deconfined phase of QCD matter termed as **Quark Gluon Plasma (QGP)**.
- * Generally, proton-proton collision are used as reference to study the **fundamental properties** of QGP.
- * This study will be benefited from LHC Run 3 **high luminosity** pp collisions data at $\sqrt{s} = 13.6$ TeV.
- * At this moment we are focusing on the **identification** of light flavour particles mainly pion and kaon to obtain their **SPECTRA** hence to study multiplicity dependent production.

Analysis Details

* **ALICE data:** pp at $\sqrt{s} = 13.6\text{TeV}$

Periods : **LHC22o_apass6_medium**

Run Number: 526641, 526964,
527041, 527240

* **MC data:** pp at $\sqrt{s} = 13.6\text{TeV}$

Periods : **LHC24b1b**

Run Number: 526641, 526964, 527041,
527057, 527109, 527240, 527850,
527871, 527895, 527899, 528292,
528461, 528531

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Event Selections

- * bool sel8 = selection[klsBBT0A]
& selection[klsBBT0C]
- * $|Z_{Vertex}| < 10\text{ cm}$

Track Selection

- * Min TPC crossed Row ≥ 70
- * Min ratio of Crossed rows over findable clusters TPC ≥ 0.8
- * Max $\chi^2/\text{TPC cluster} \leq 4$
- * Max $\chi^2/\text{ITS cluster} \leq 36$
- * TPC Refit & ITS Refit = True
- * DCA to $Z_{Vertex} \leq 2\text{cm}$
- * $|\eta| \leq 0.8$
- * $|y| \leq 0.3$
- * set require hits in ITS layers ≥ 1

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Around **14.5B**
INEL>0
events are selected

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Event Selections

* bool s
& selec

* $|Z_{Ver}$

Track

* Min T

* Min ra
findable

* Max λ

* Max λ

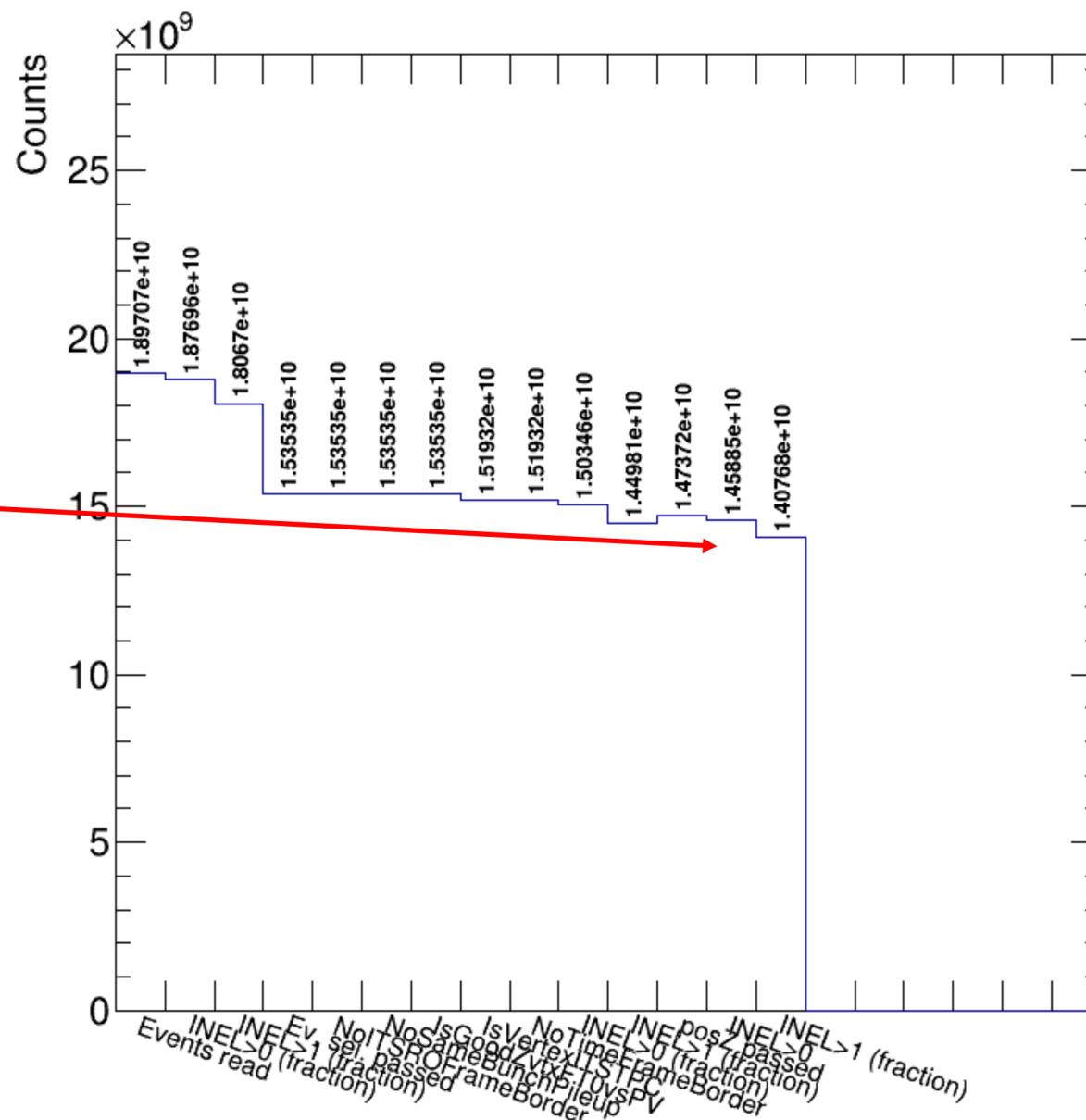
* TPC F

* DCA t

* $|\eta| < 0$

* $|y| < 0$.

* set require hits in ITS layers > 1

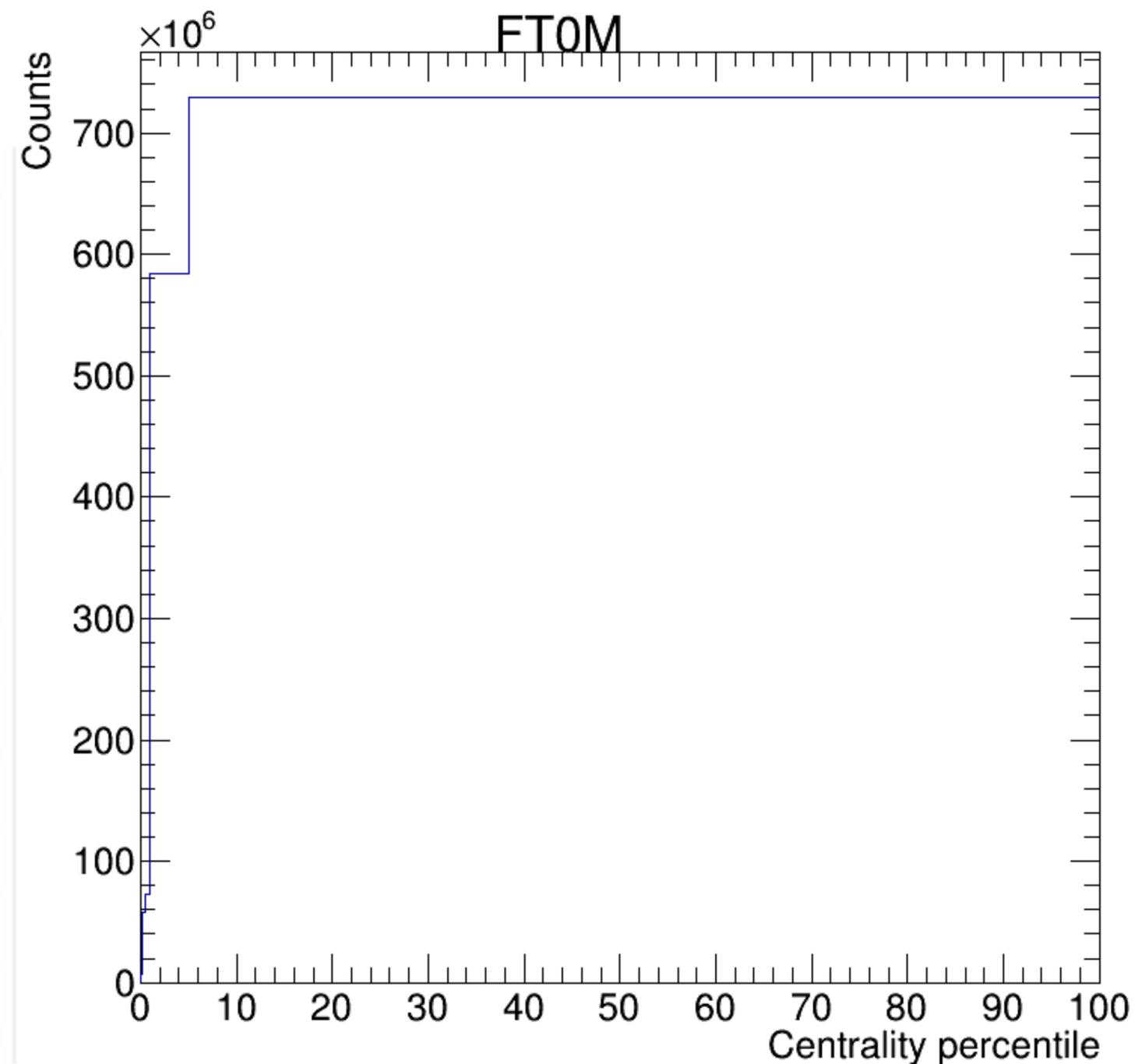


Analysis Details

* Multiplicity bins:

0-1, 1-5, 5-10,
10-15, 15-
20, 20-30, 30-
40, 40-50, 50-70,
70-100

Percentile (%)	13.6 TeV
0-1	$20.07^{+0.42}_{-0.36}$
1-5	$17.28^{+0.27}_{-0.21}$
5-10	$14.88^{+0.24}_{-0.18}$
10-15	$13.19^{+0.21}_{-0.16}$
15-20	$11.88^{+0.19}_{-0.15}$
20-30	$10.30^{+0.19}_{-0.13}$
30-40	$8.62^{+0.16}_{-0.11}$
40-50	$7.24^{+0.13}_{-0.09}$
50-70	$5.58^{+0.10}_{-0.07}$
70-100	$3.52^{+0.07}_{-0.05}$
minimum bias	$7.12^{0.12}_{-0.09}$



[https://indico.cern.ch/event/1401276/contributions/5898065/attachments/2834477/4953080/Multiplicity_distributions_in_pp_collisions\(17\).pdf](https://indico.cern.ch/event/1401276/contributions/5898065/attachments/2834477/4953080/Multiplicity_distributions_in_pp_collisions(17).pdf)

**Detector used : Time Projection Chamber (TPC)
Time of Flight (TOF)**

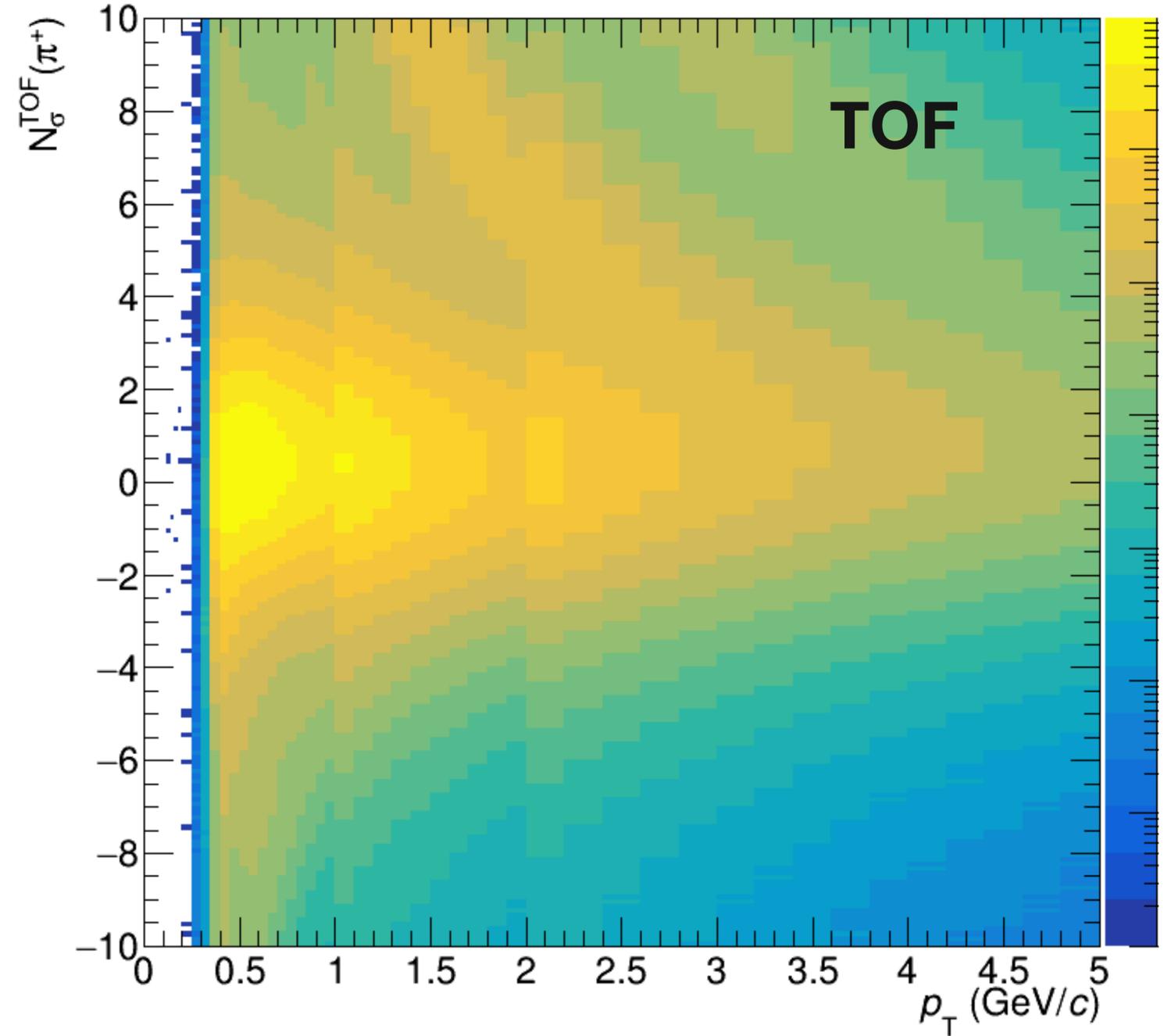
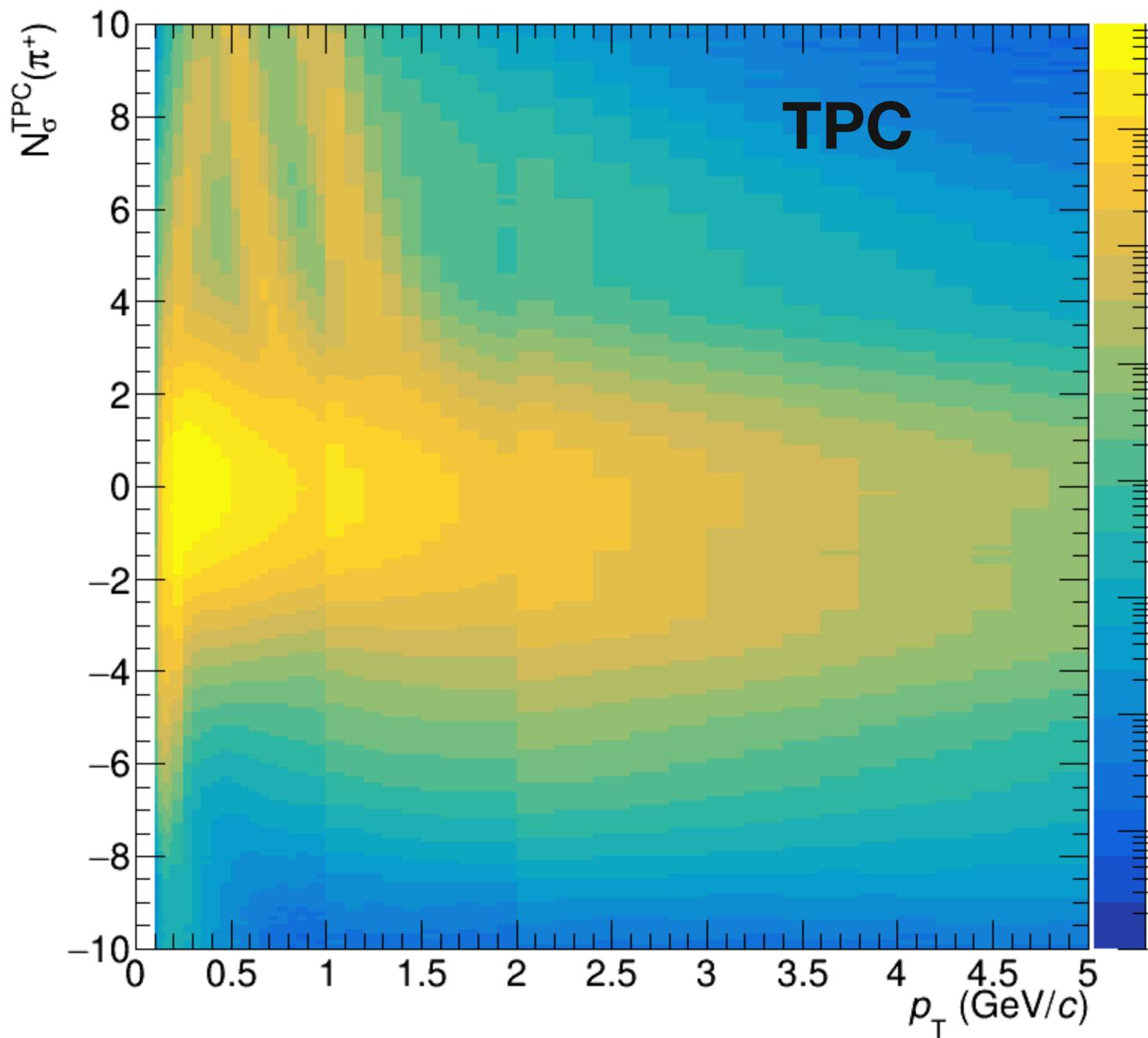
TPC PID p_T range

- * **Pion 0.3 – 6.0 (GeV/c)**
- * **Kaon 0.3-7.0 (GeV/c)**

TOF PID p_T range

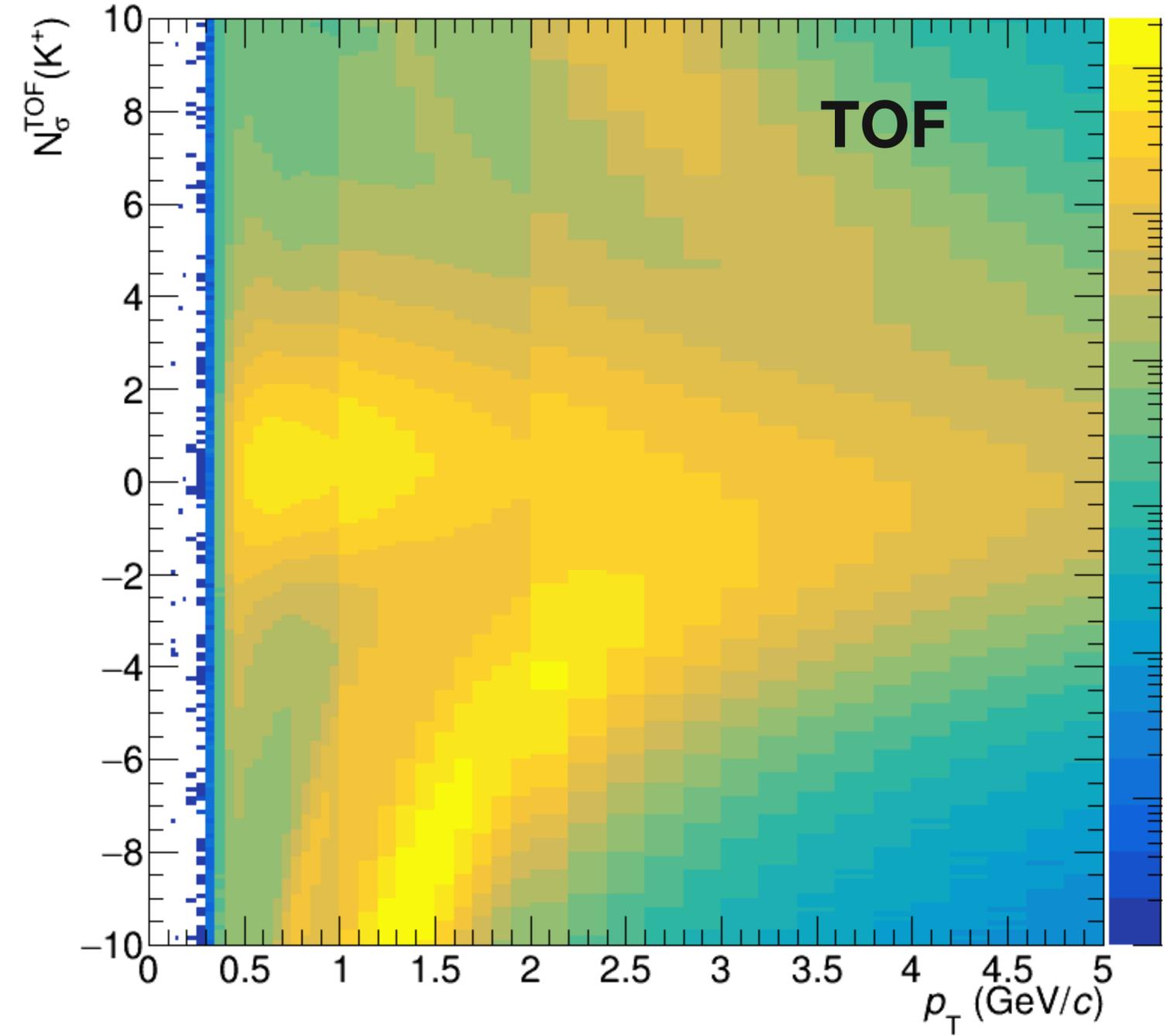
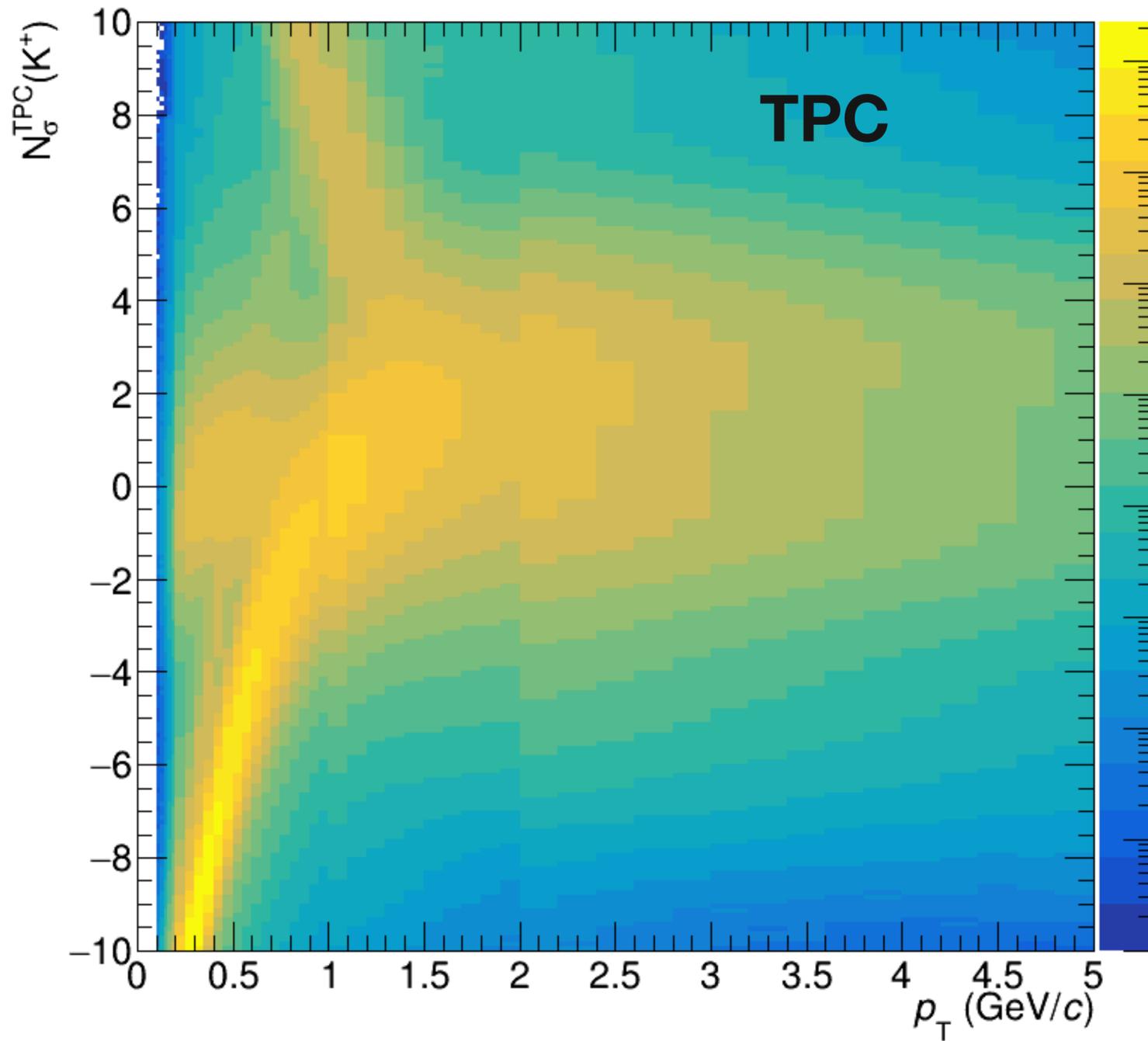
- * **Pion 0.5 – 3.0 (GeV/c)**
- * **Kaon 0.5-2.4 (GeV/c)**

Results



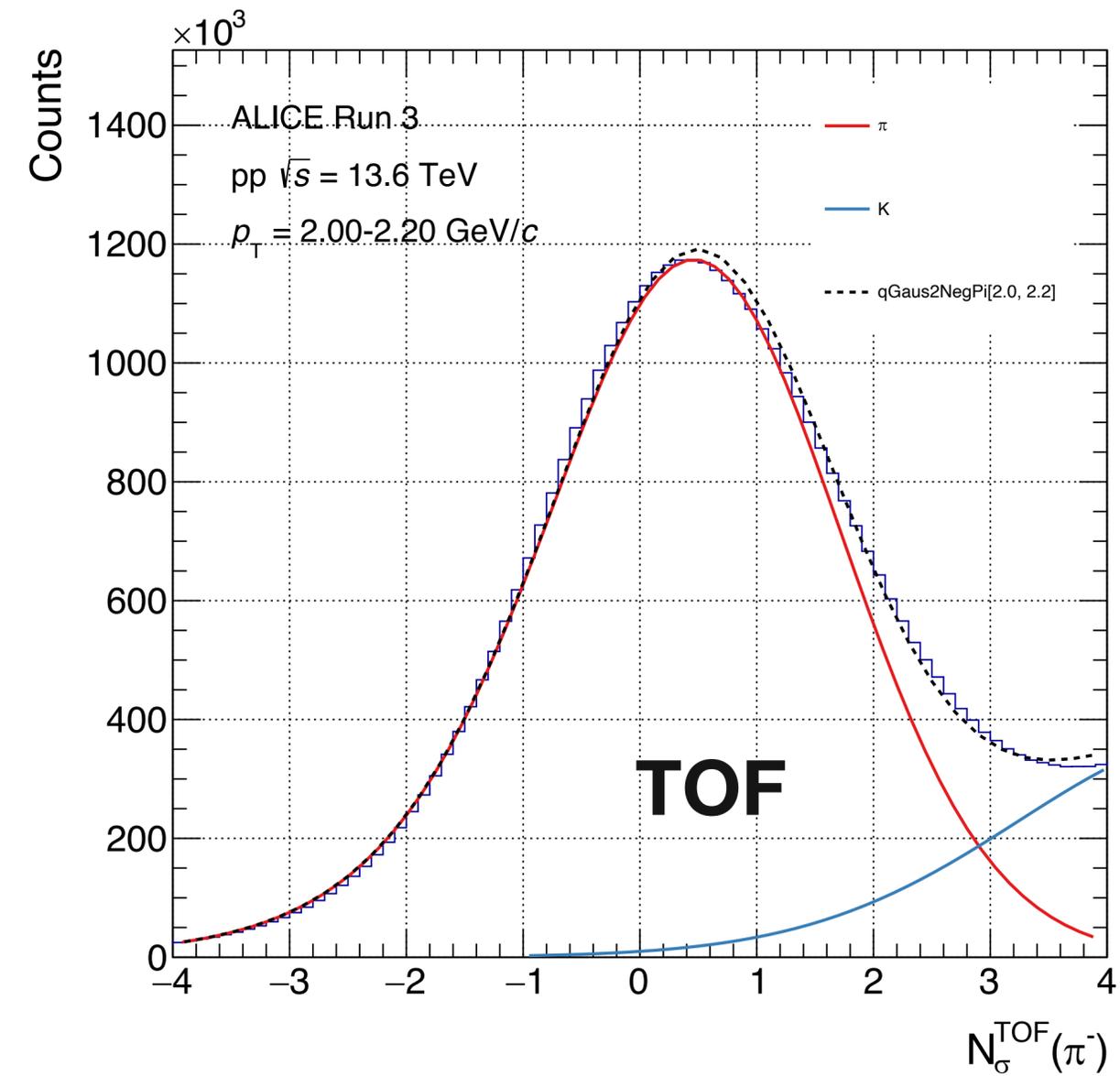
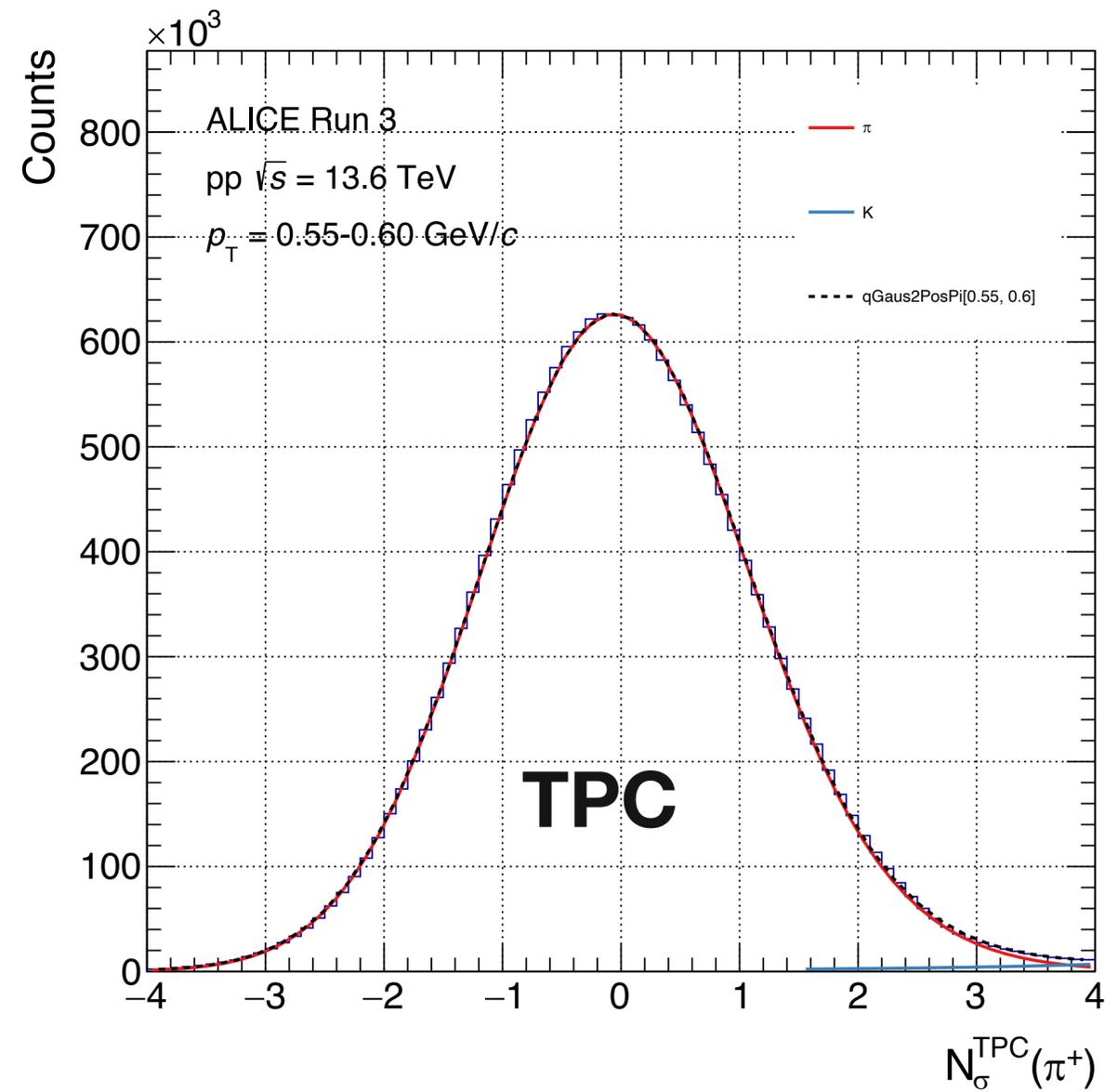
Looks Fine

Results

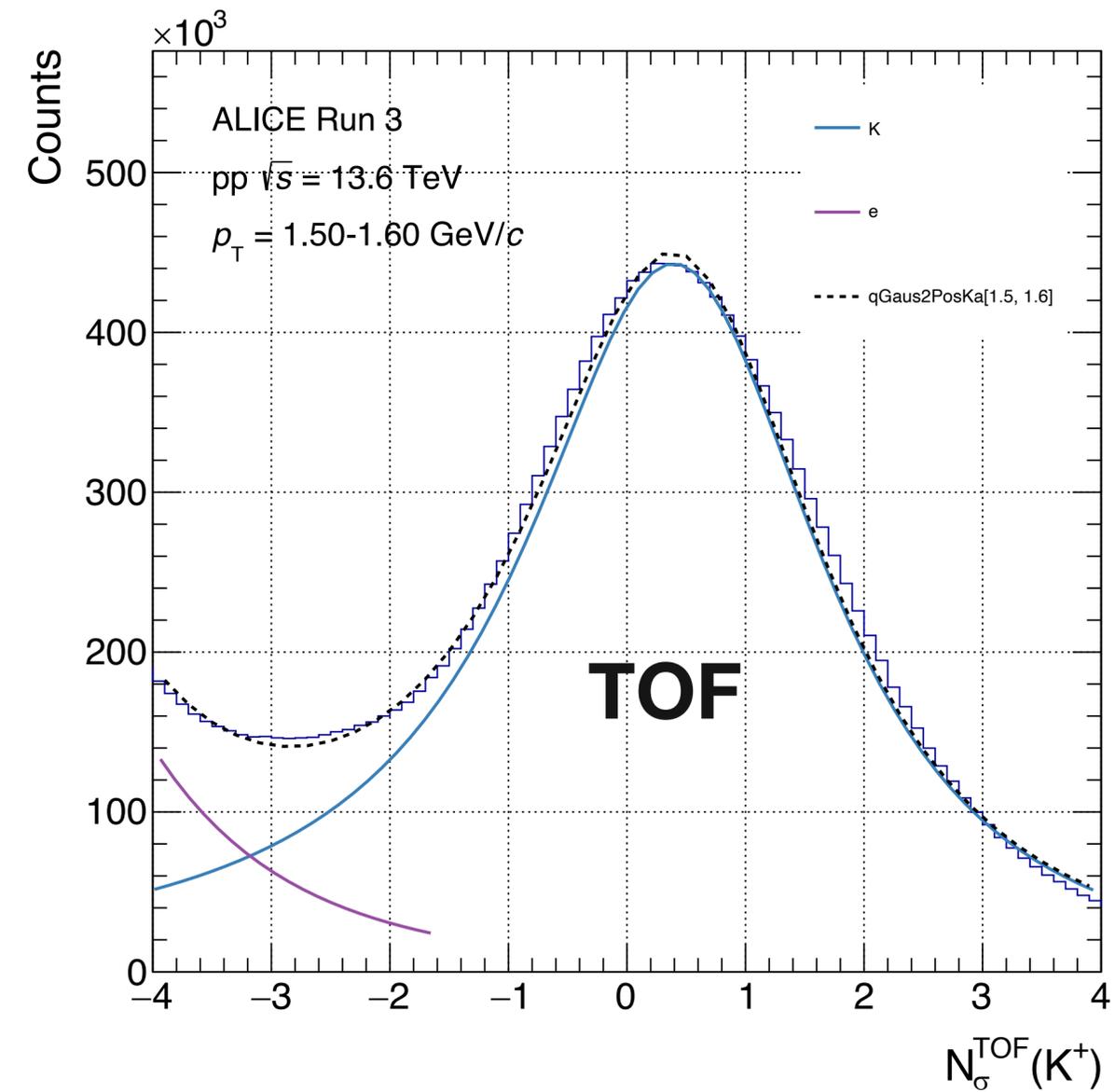
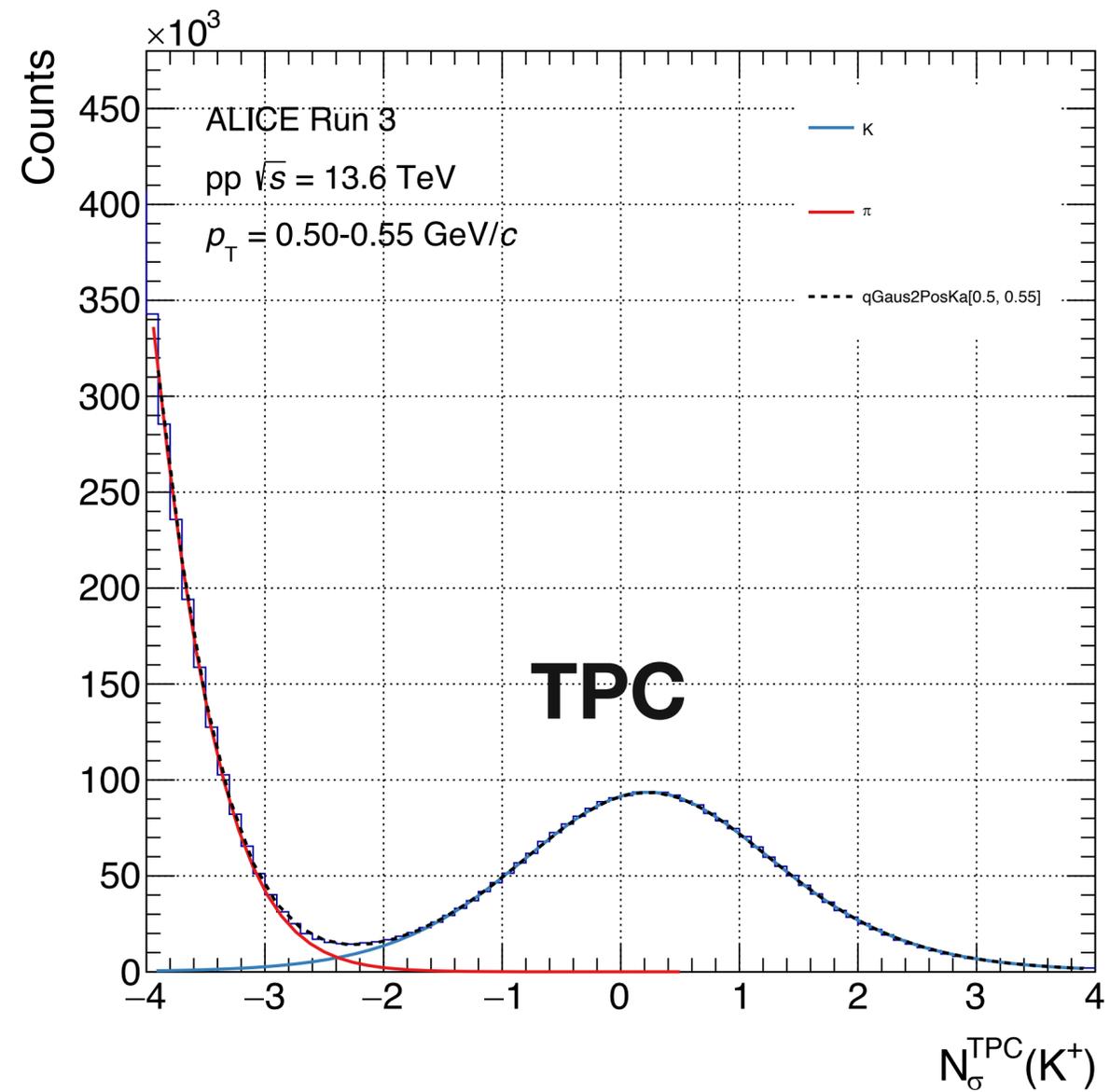


Looks Fine

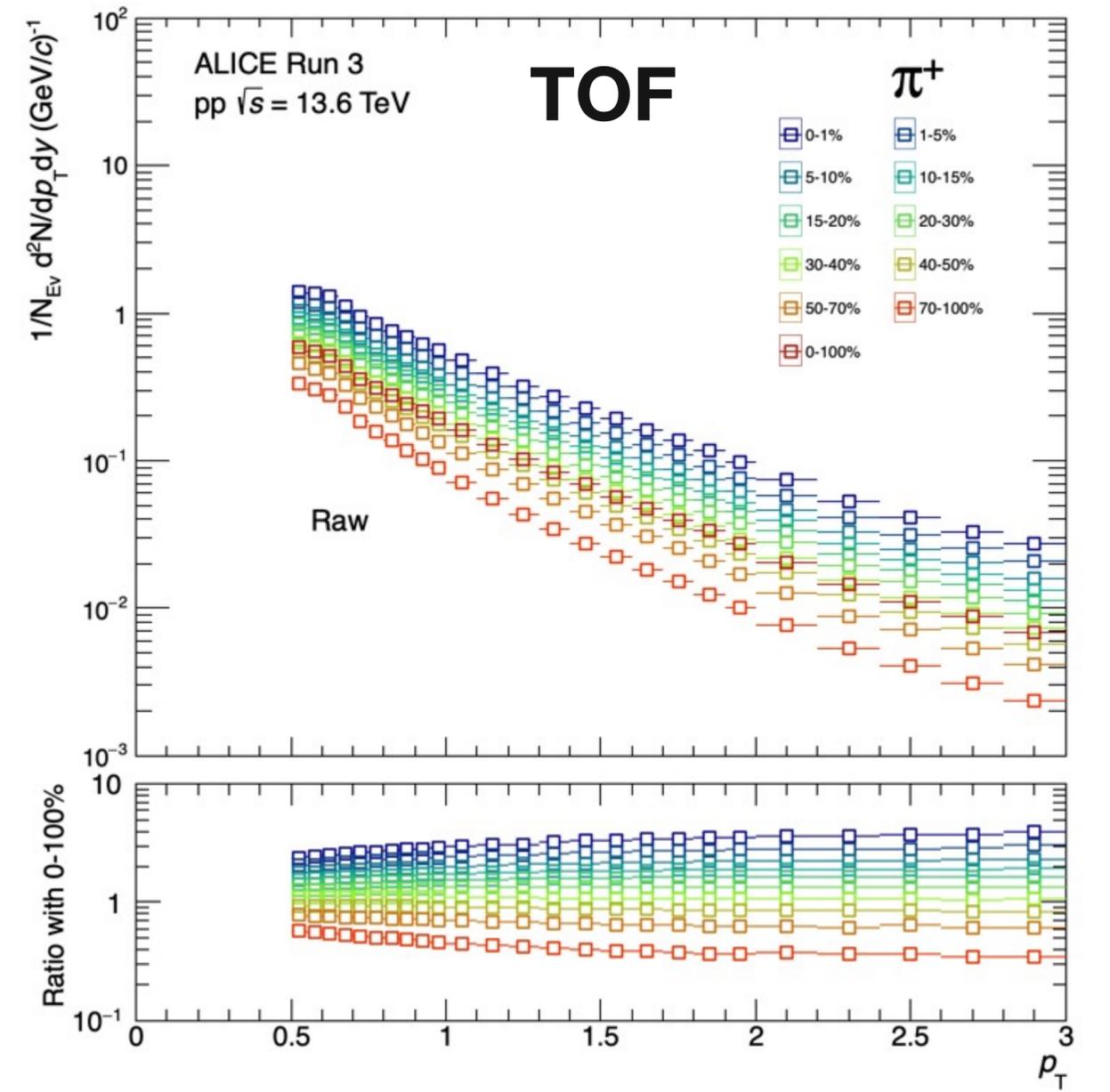
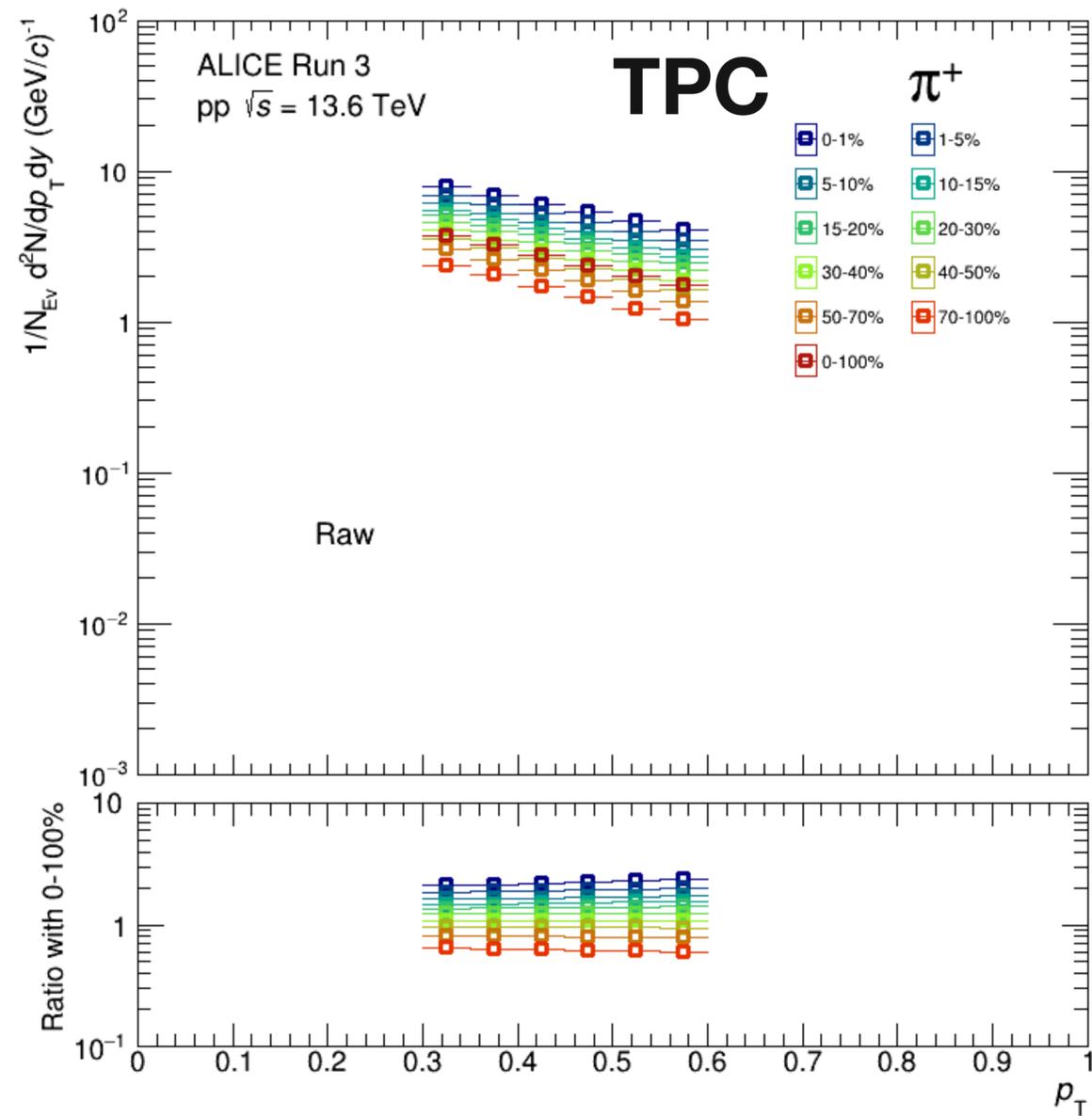
Fitting of nSigma signal for π^+



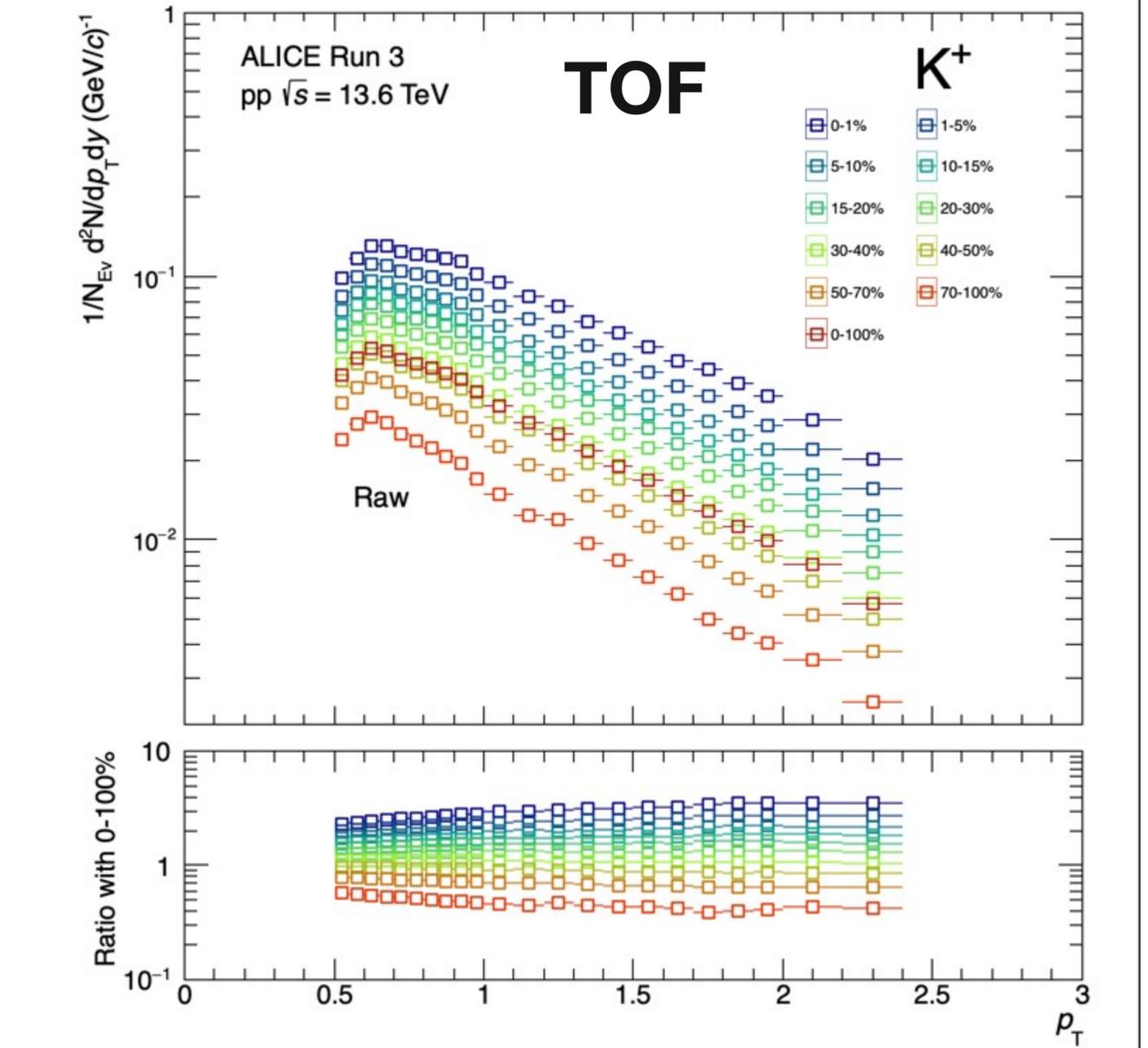
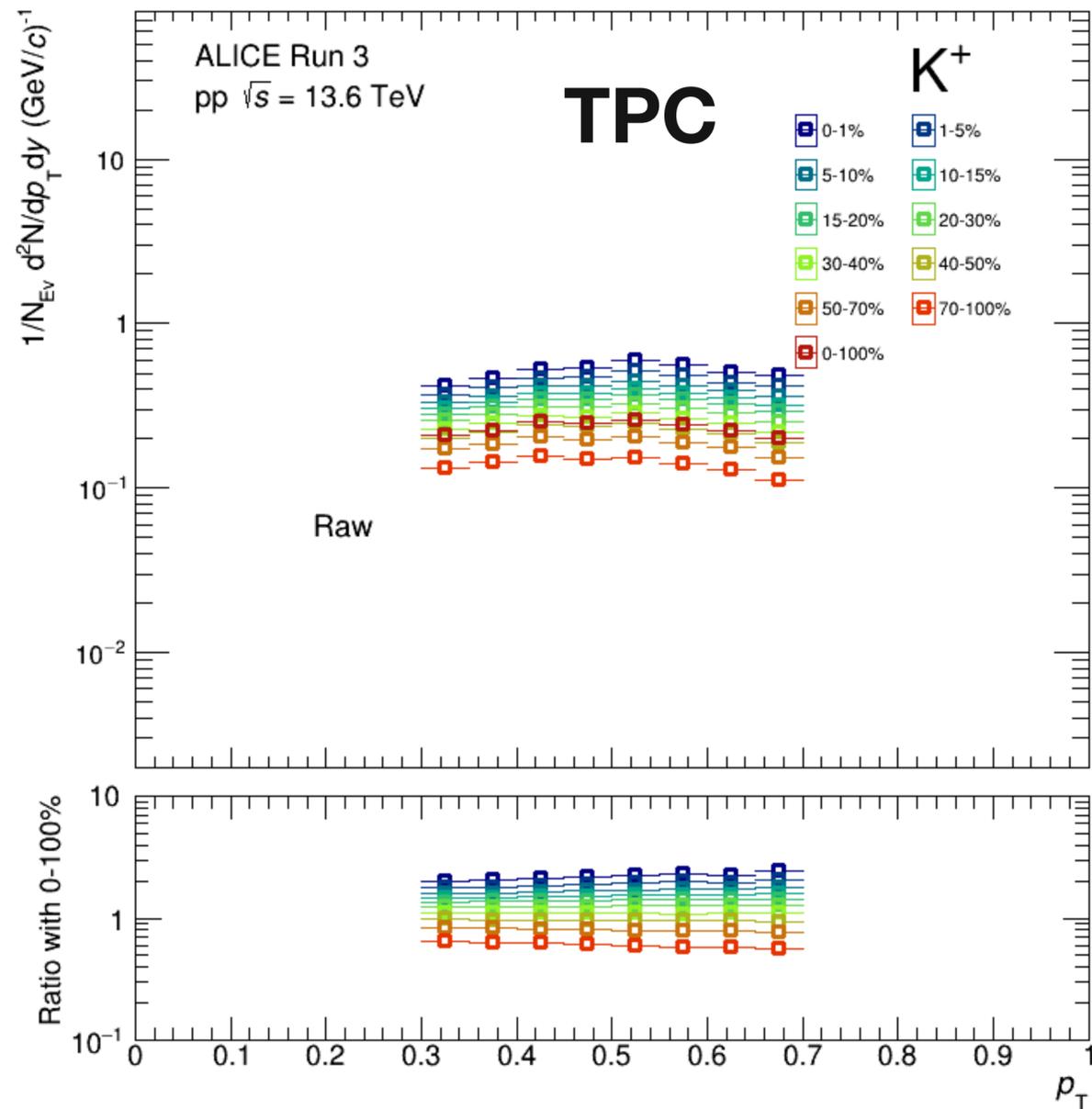
Fitting of nSigma signal for K^+



Raw spectra after yield extraction for π^+

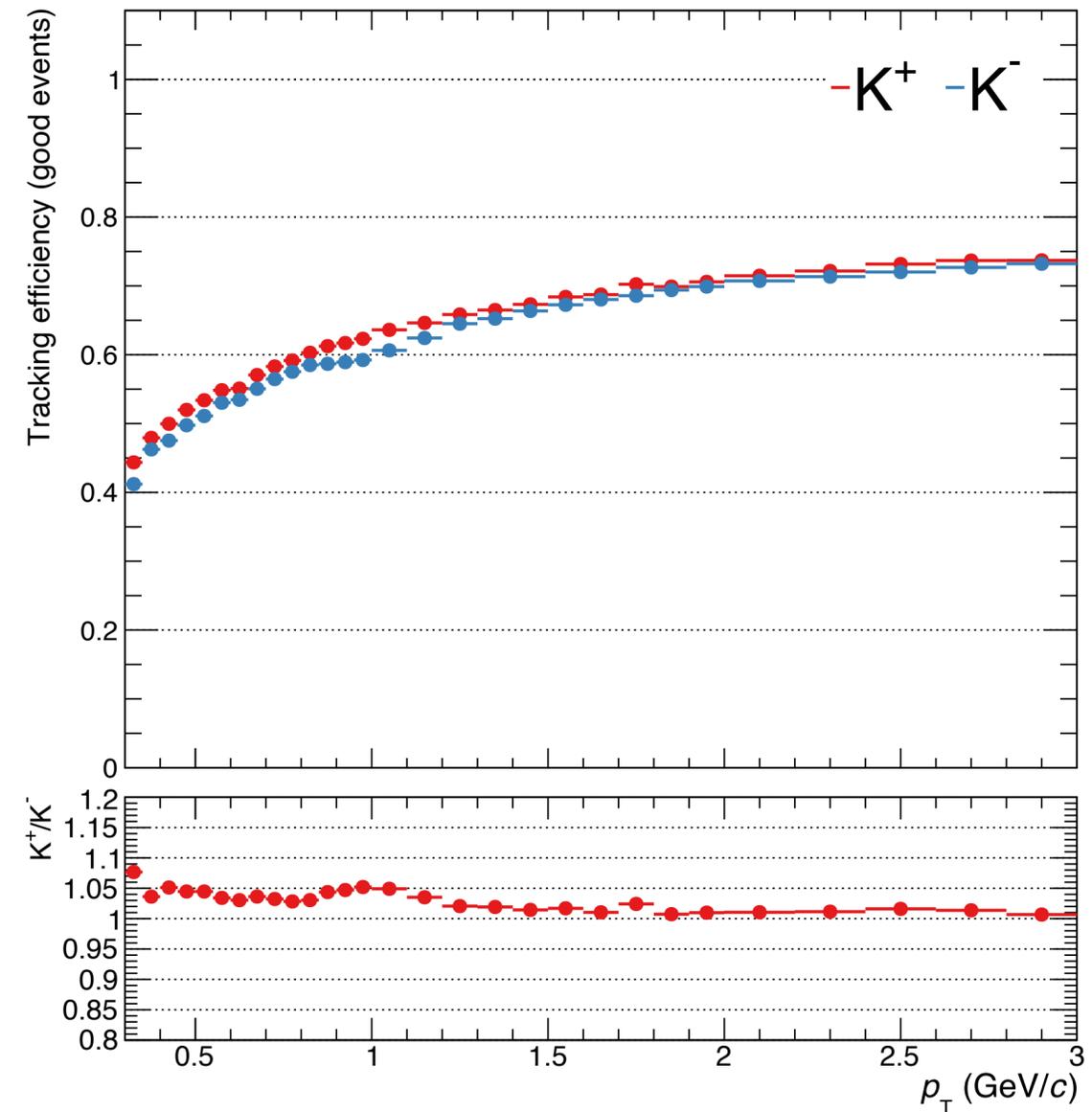
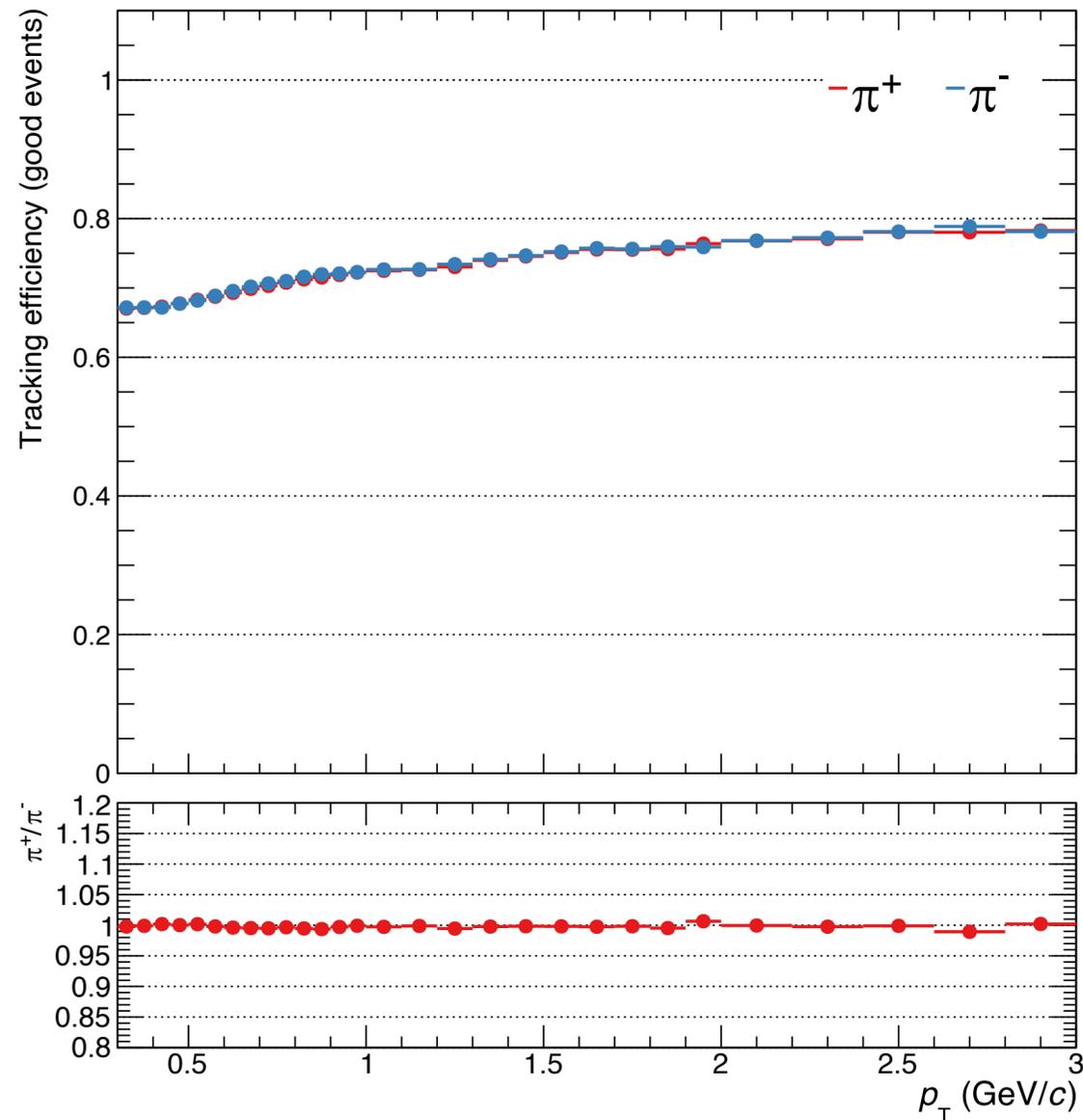


Raw spectra after yield extraction for κ^+

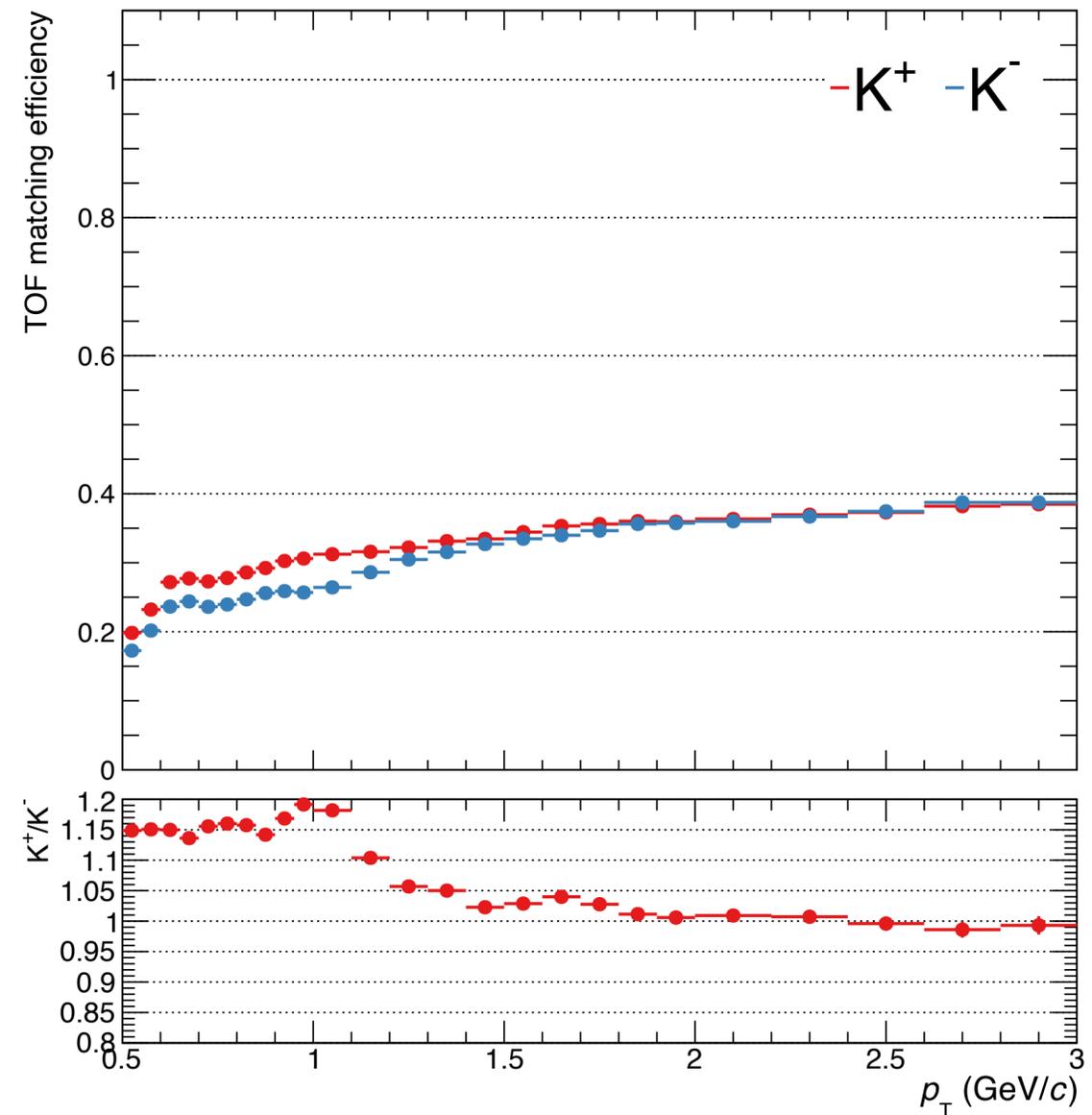
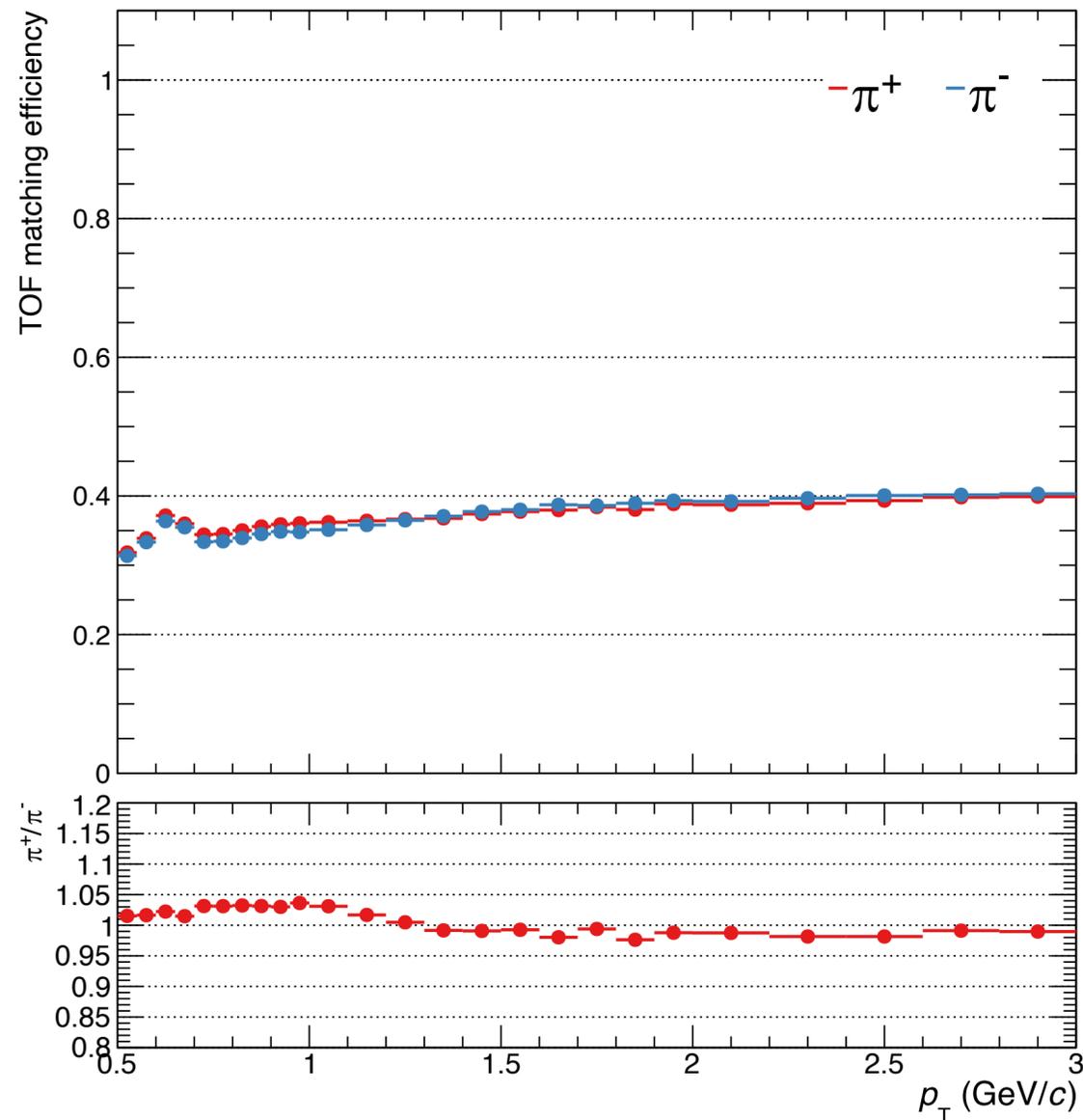


Tracking Efficiency =

Reconstructed particles
Generated particles in reconstructed events



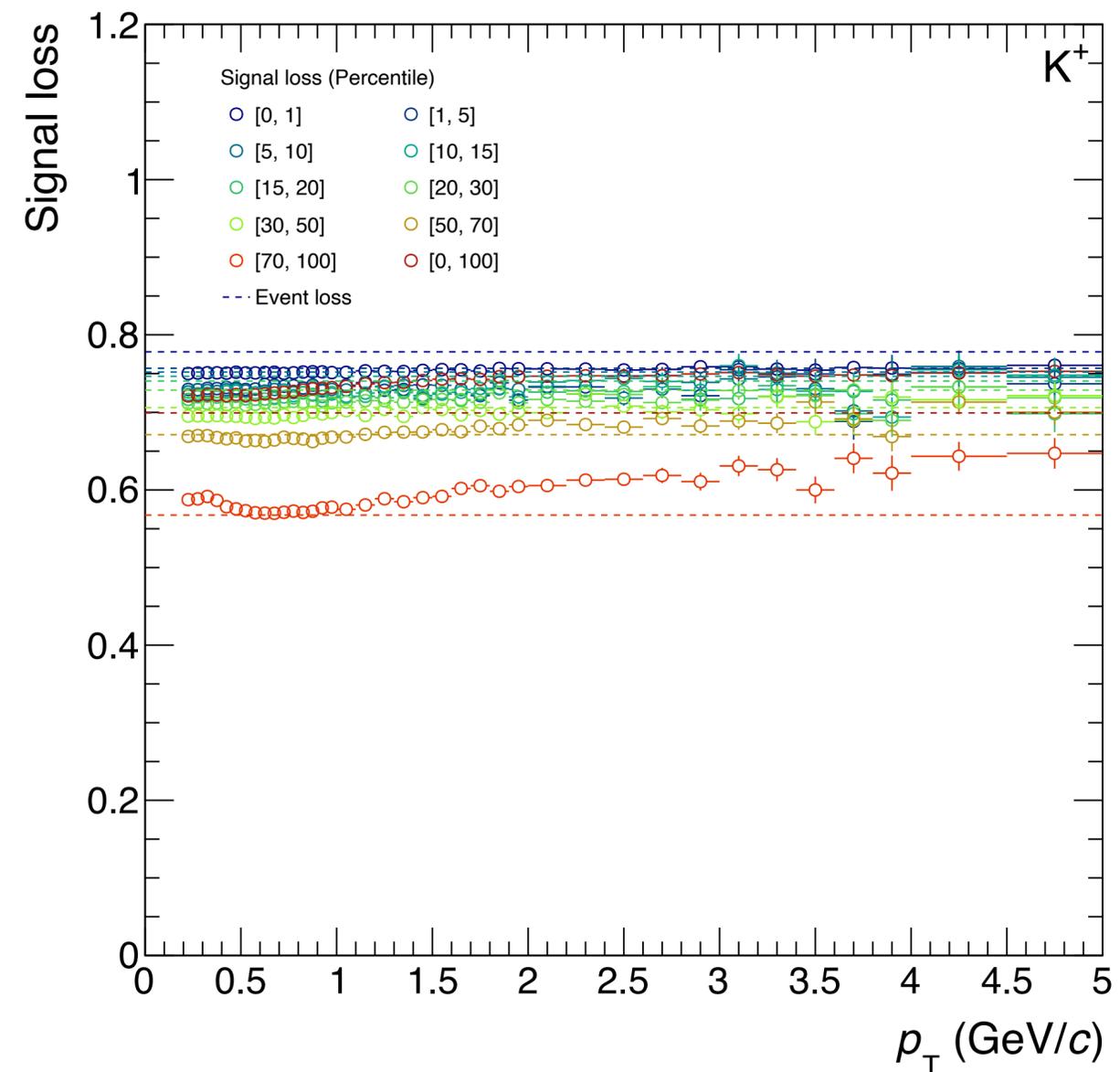
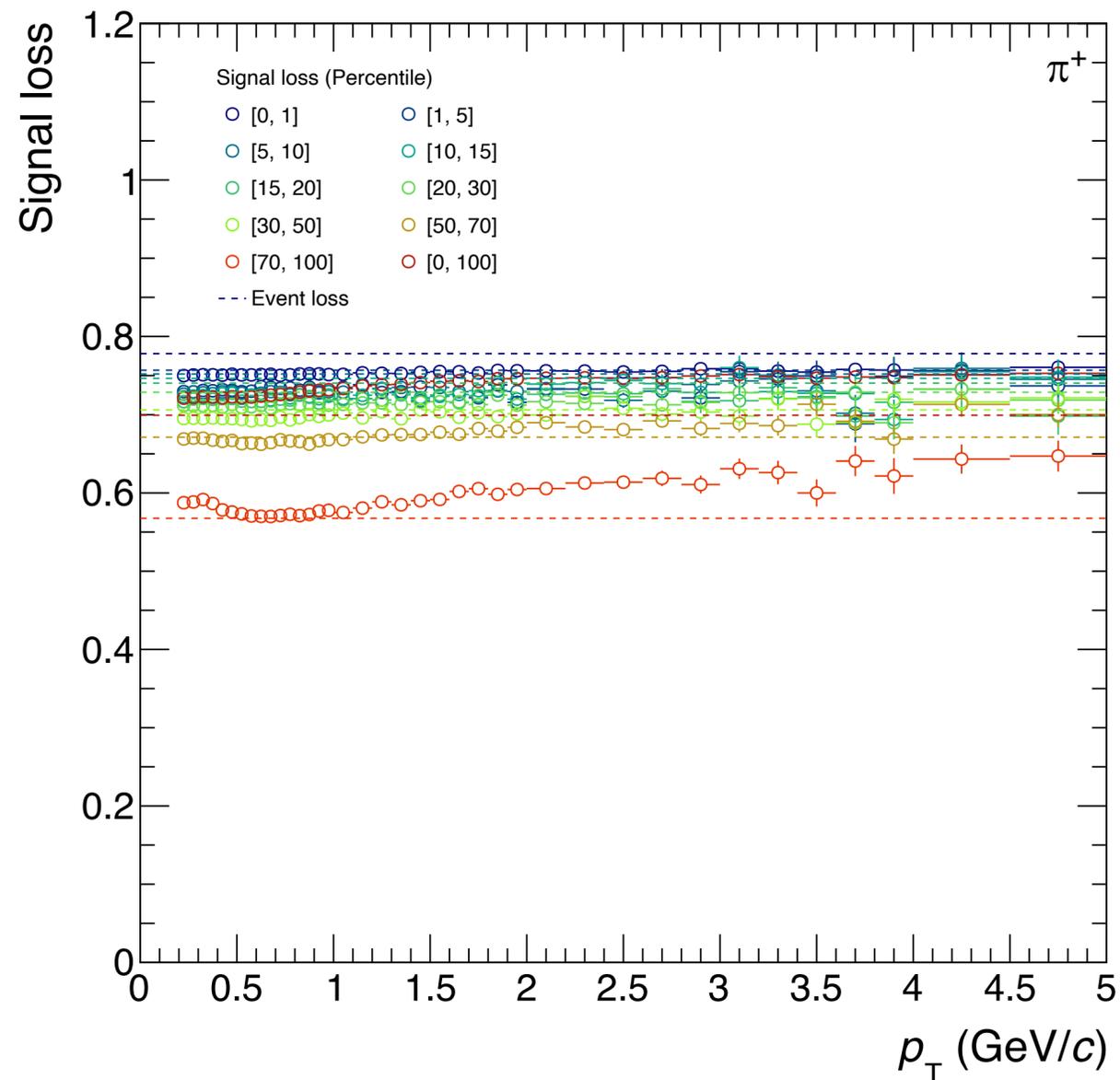
Matching Efficiency = $\frac{\text{Reconstructed particles with TOF}}{\text{Reconstructed particles}}$



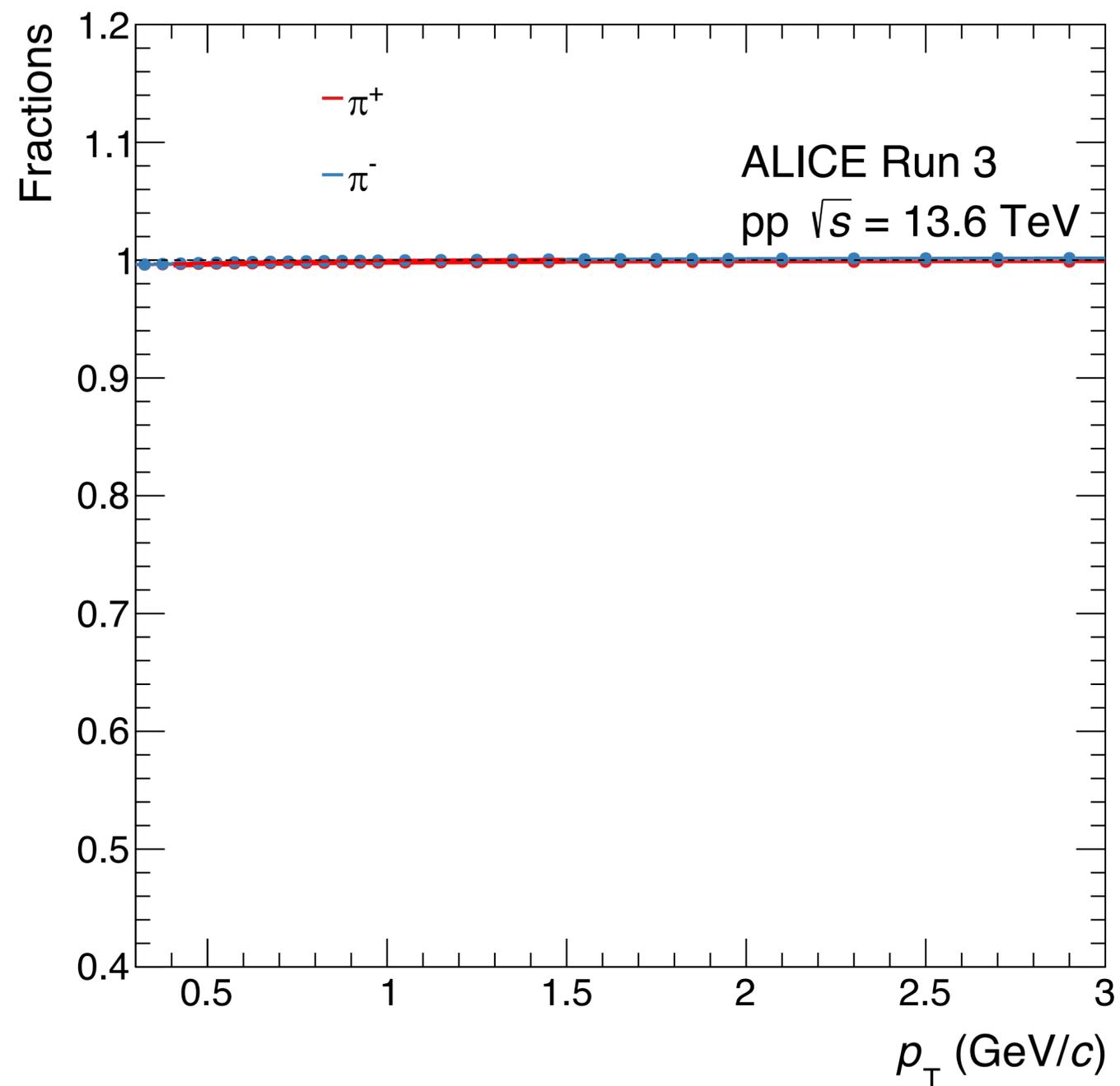
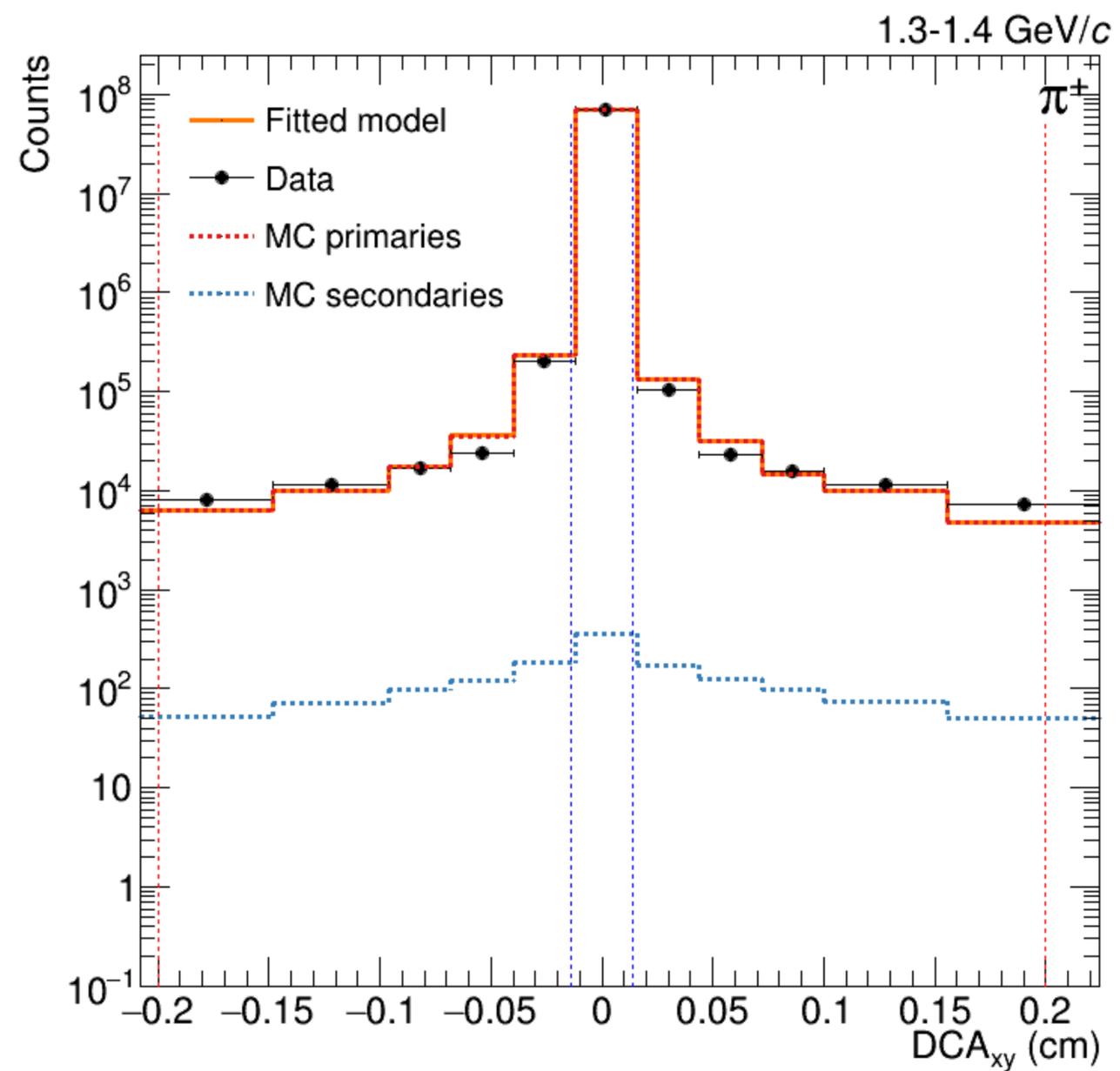
Results

$$\text{Event loss} = \frac{\text{Reconstructed events}}{\text{Generated events}}$$

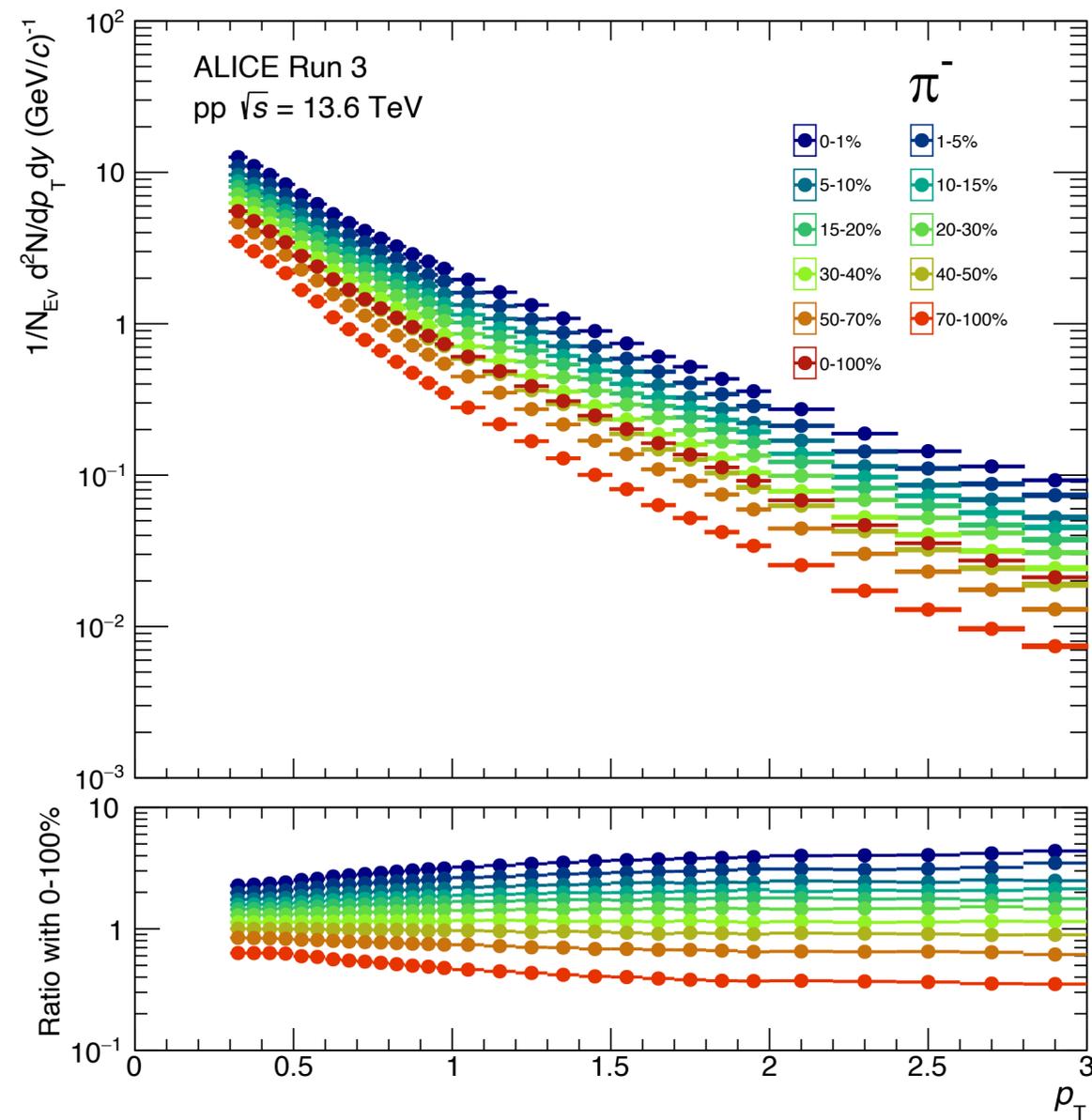
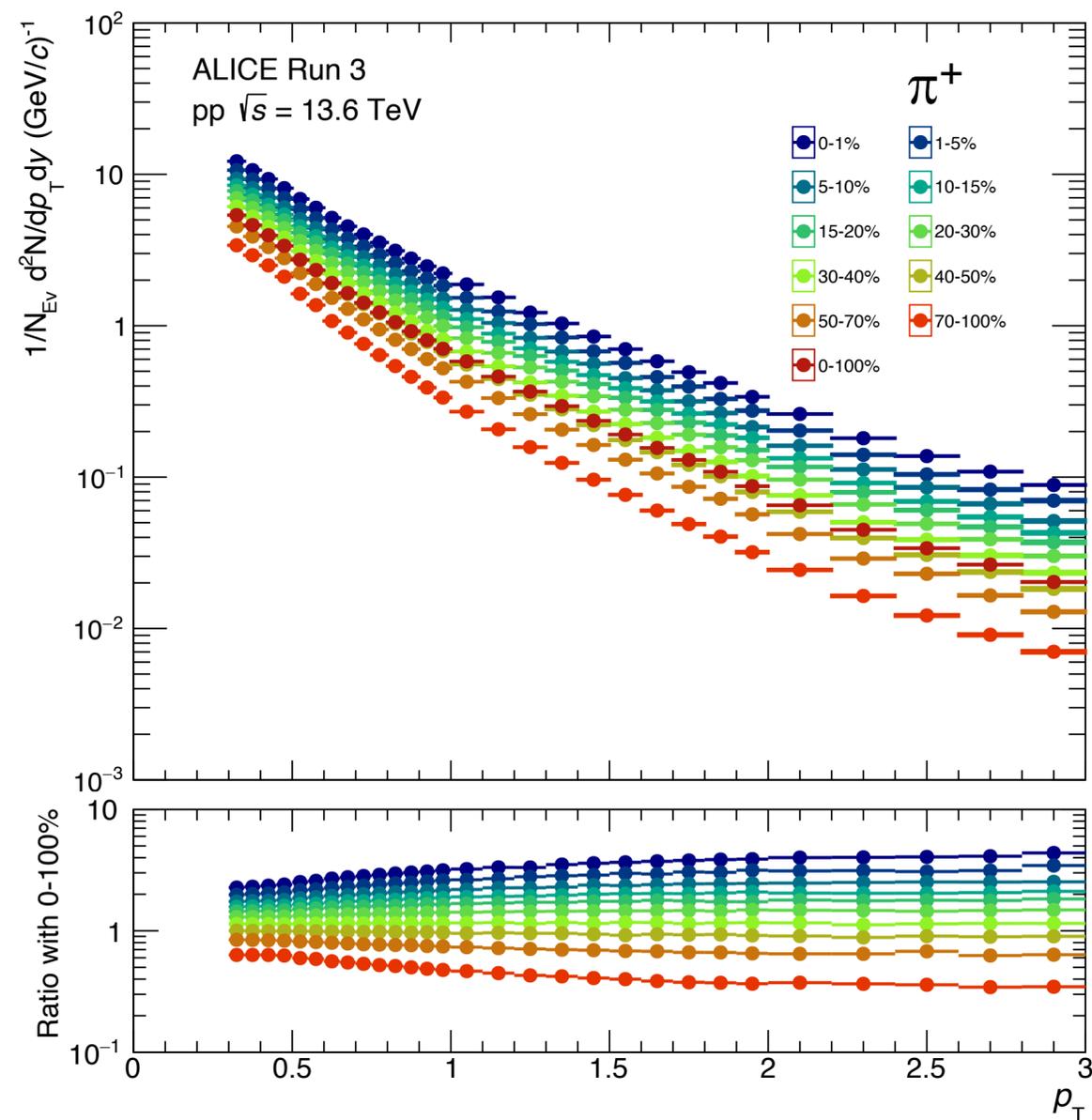
$$\text{signal loss} = \frac{\text{Generated particle in reco event}}{\text{Generated particle}}$$



Primary Fraction correction

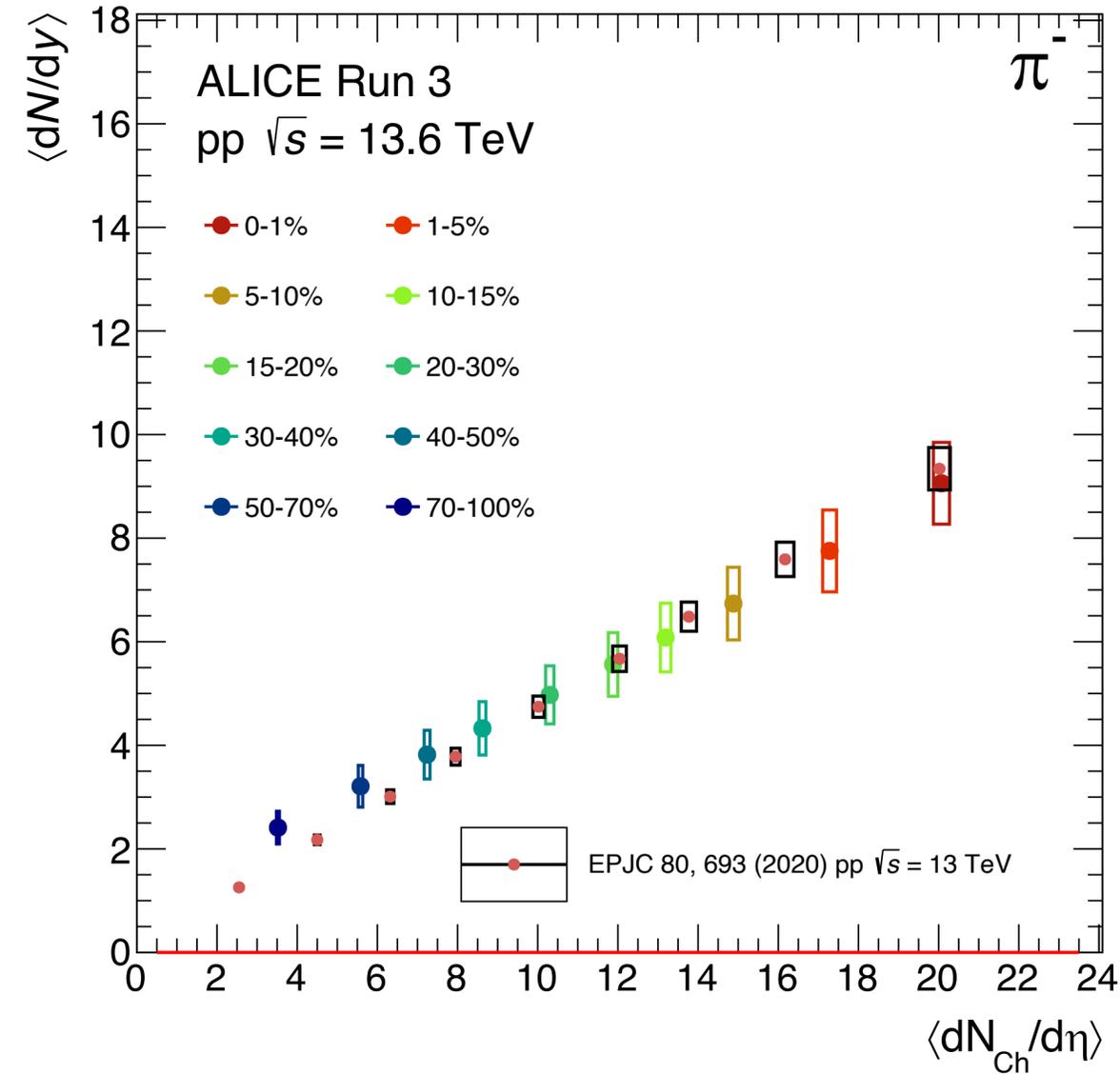
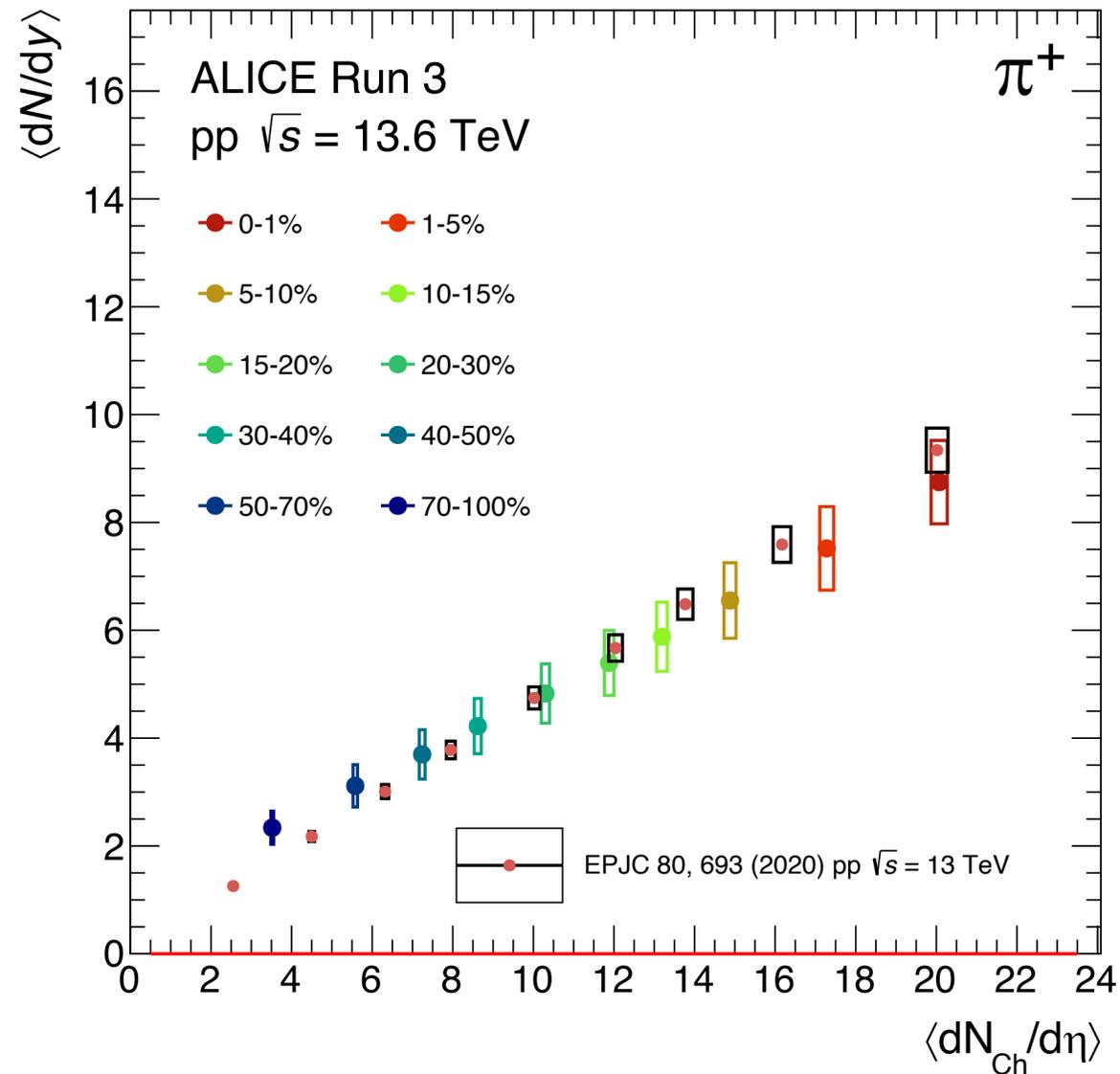


Efficiency corrected spectra for π



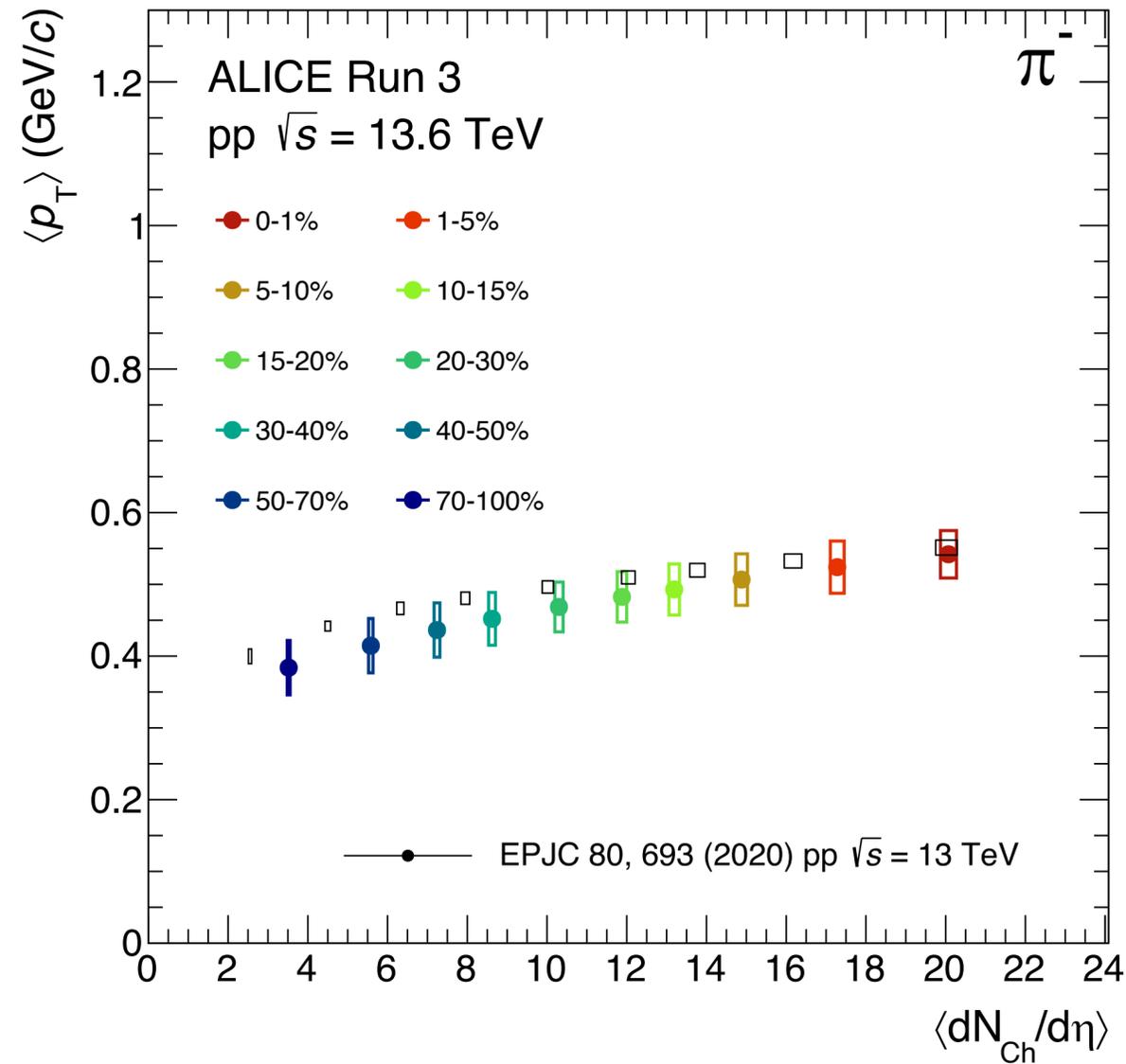
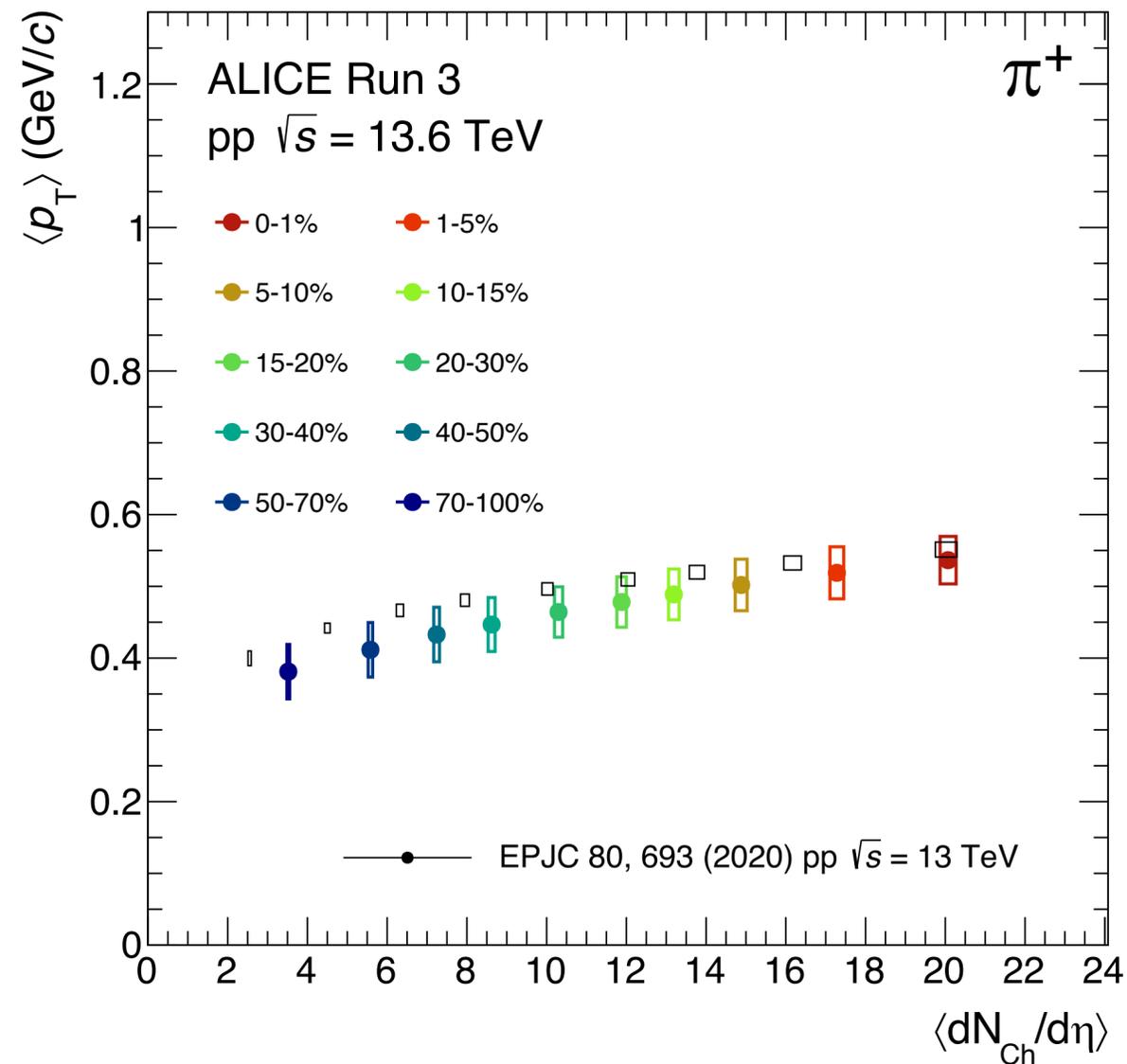
1. p_T -differential TPC TOF spectra for pion.
2. Measured p_T spectra become harder with increasing $\langle dN_{ch}/d\eta \rangle$.

The p_T -integrated Yield for π^+ and π^-



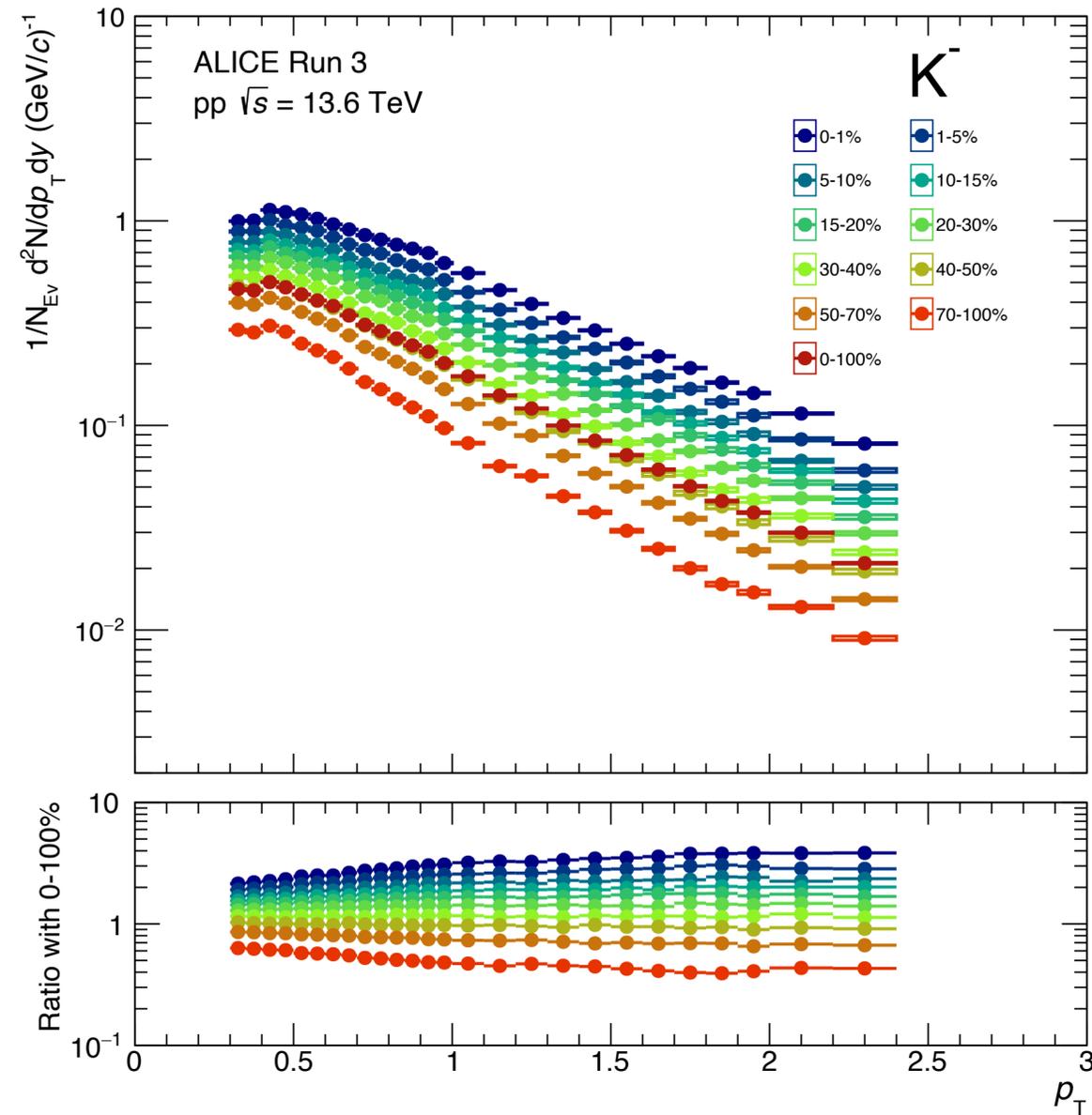
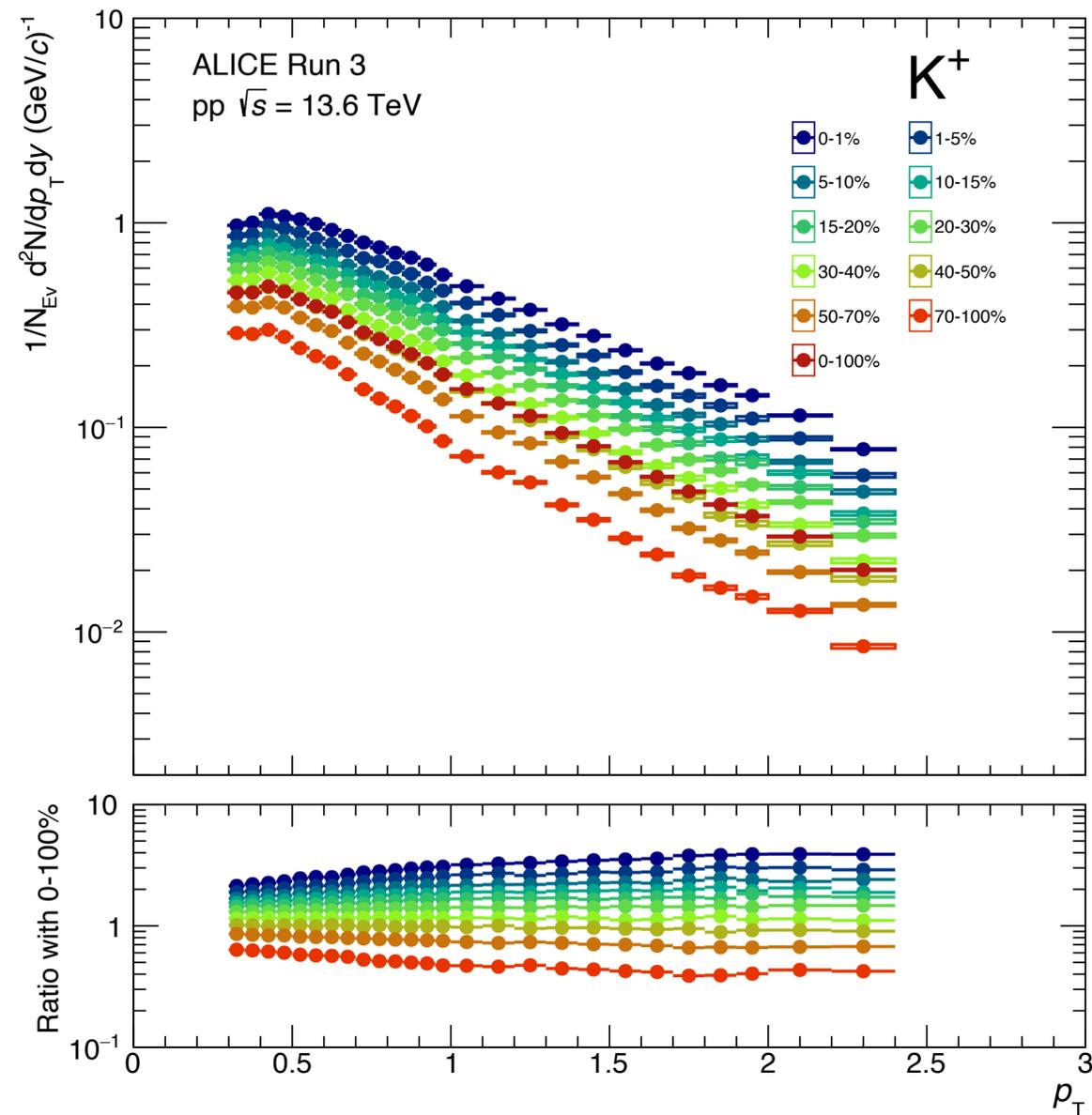
1. The results are compared with the measurement available at RUN2 energy pp collisions
2. The yields of the particles increase linearly with increasing charged-particle multiplicity

$\langle p_T \rangle$ for π^+ and π^-



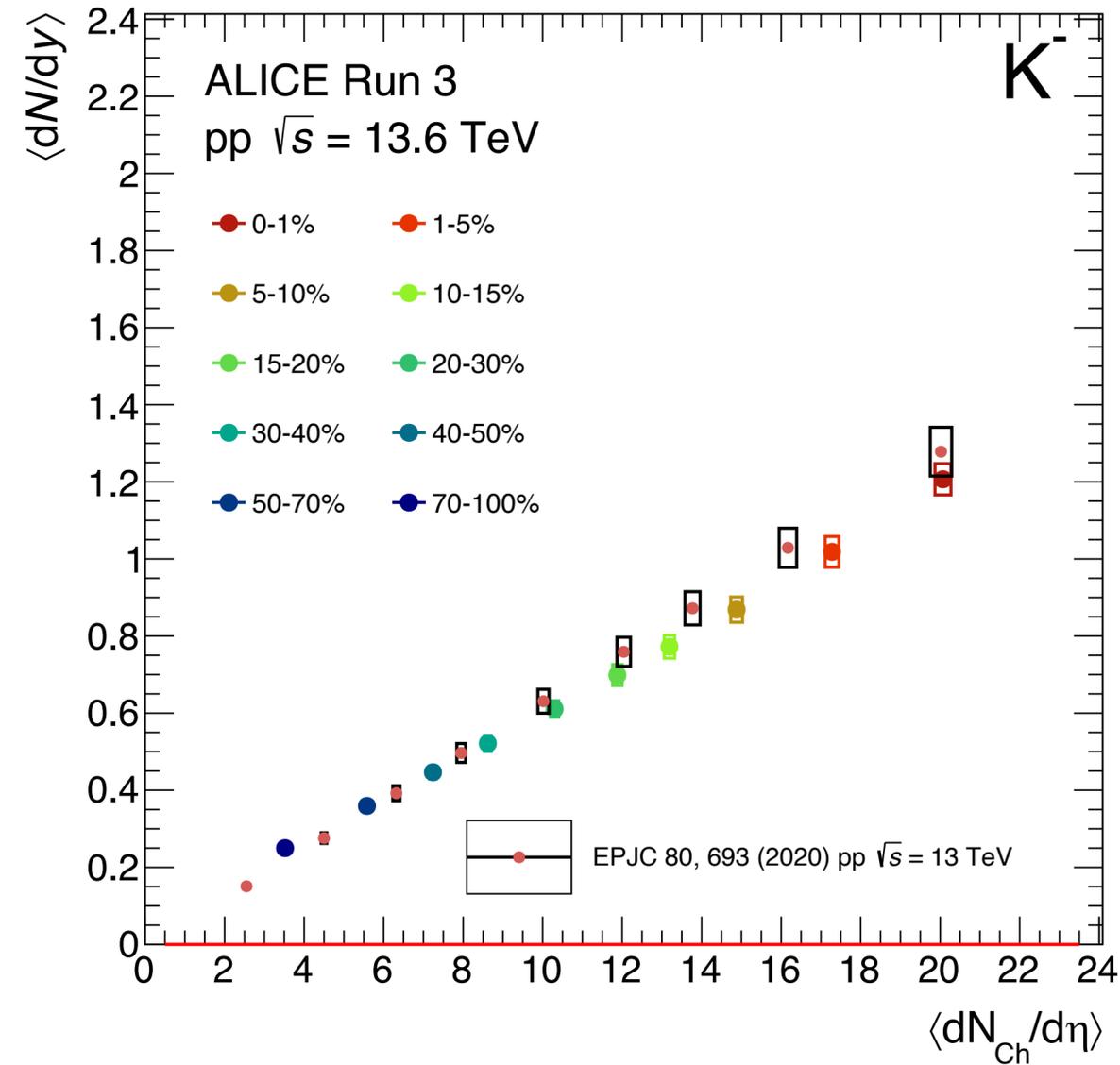
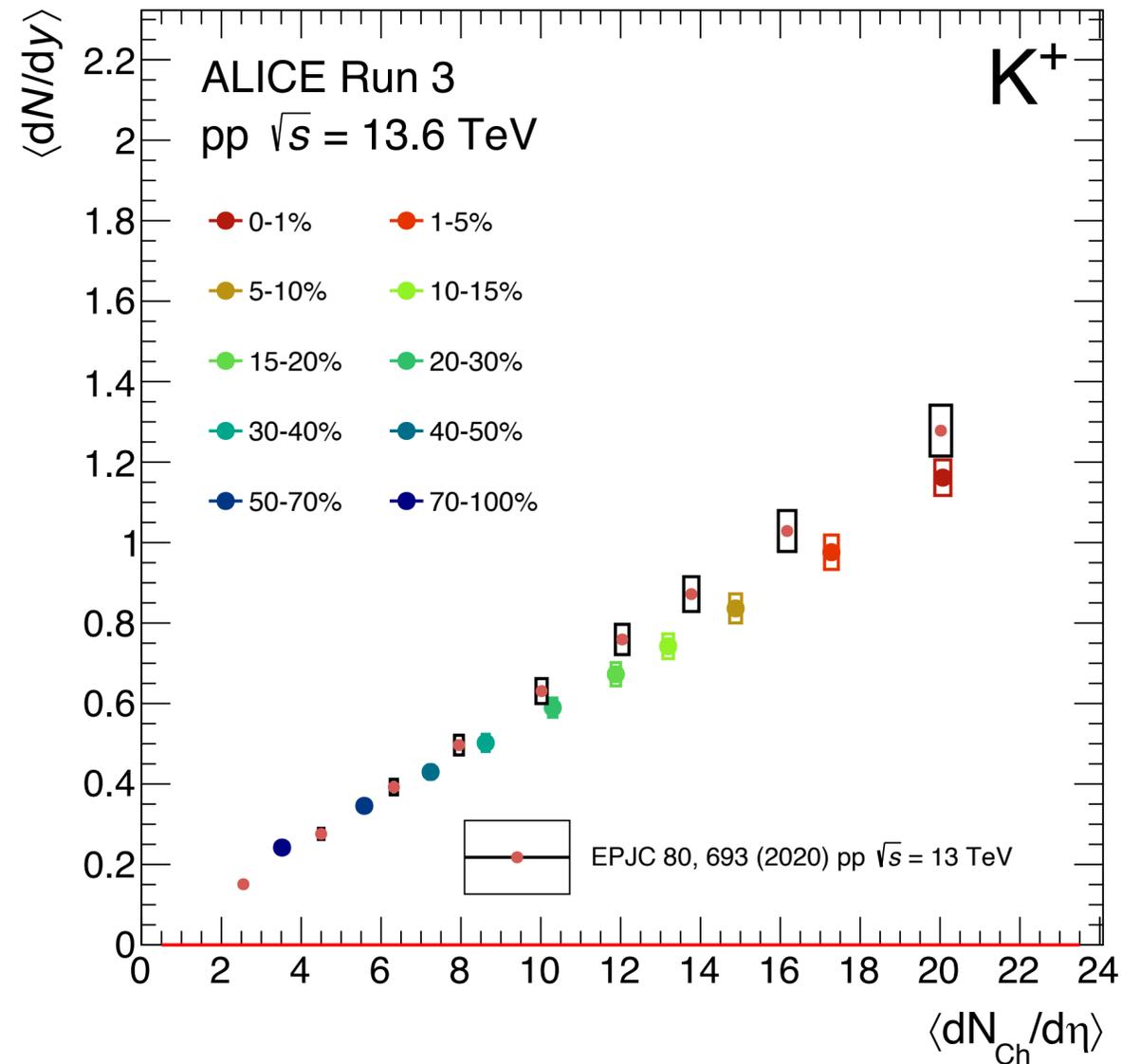
1. The results are compared with the measurement available at RUN2 energy pp
2. It could be observed that the $\langle p_T \rangle$ increases with increasing charged-particle multiplicity

Efficiency corrected spectra for K



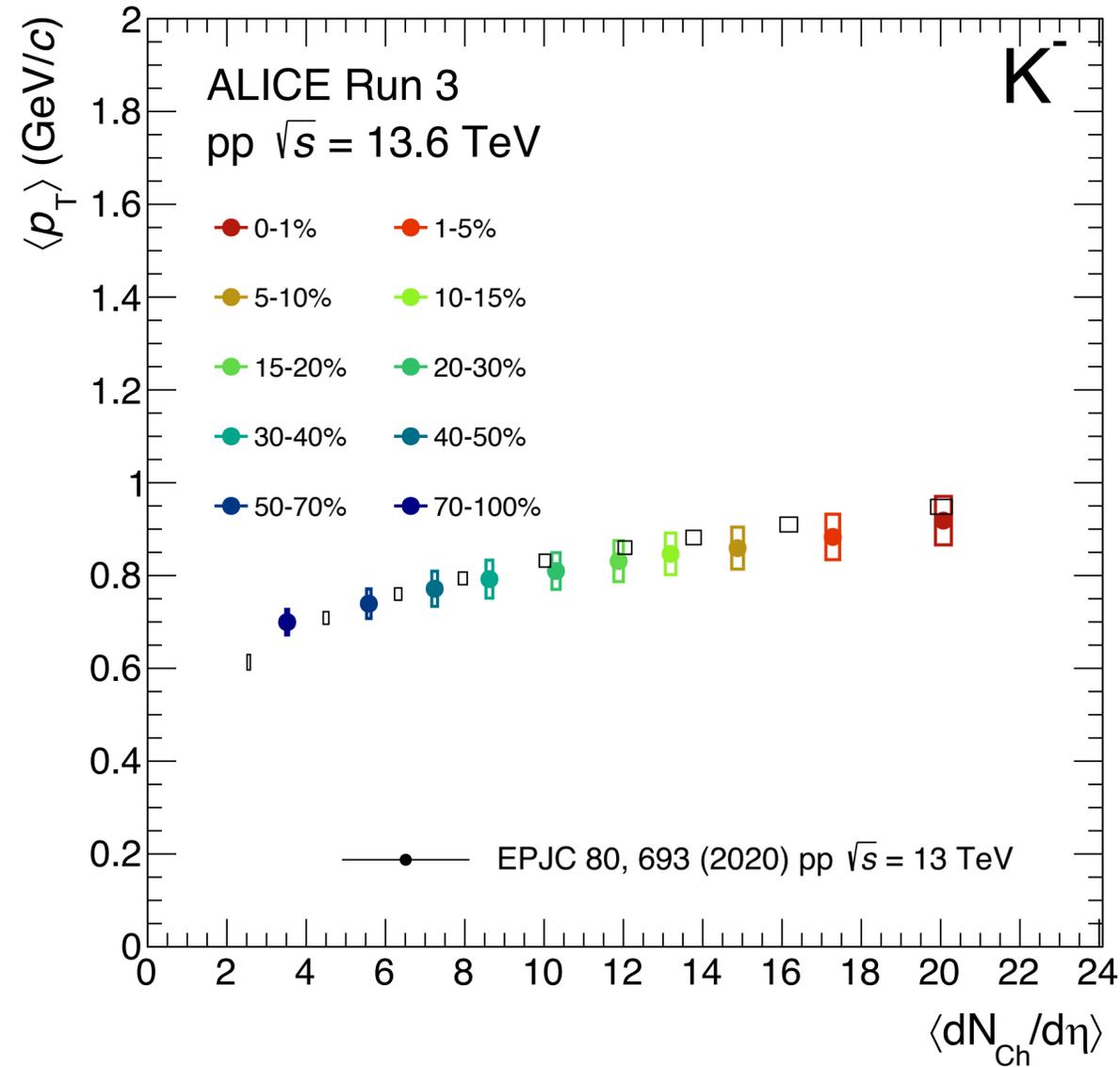
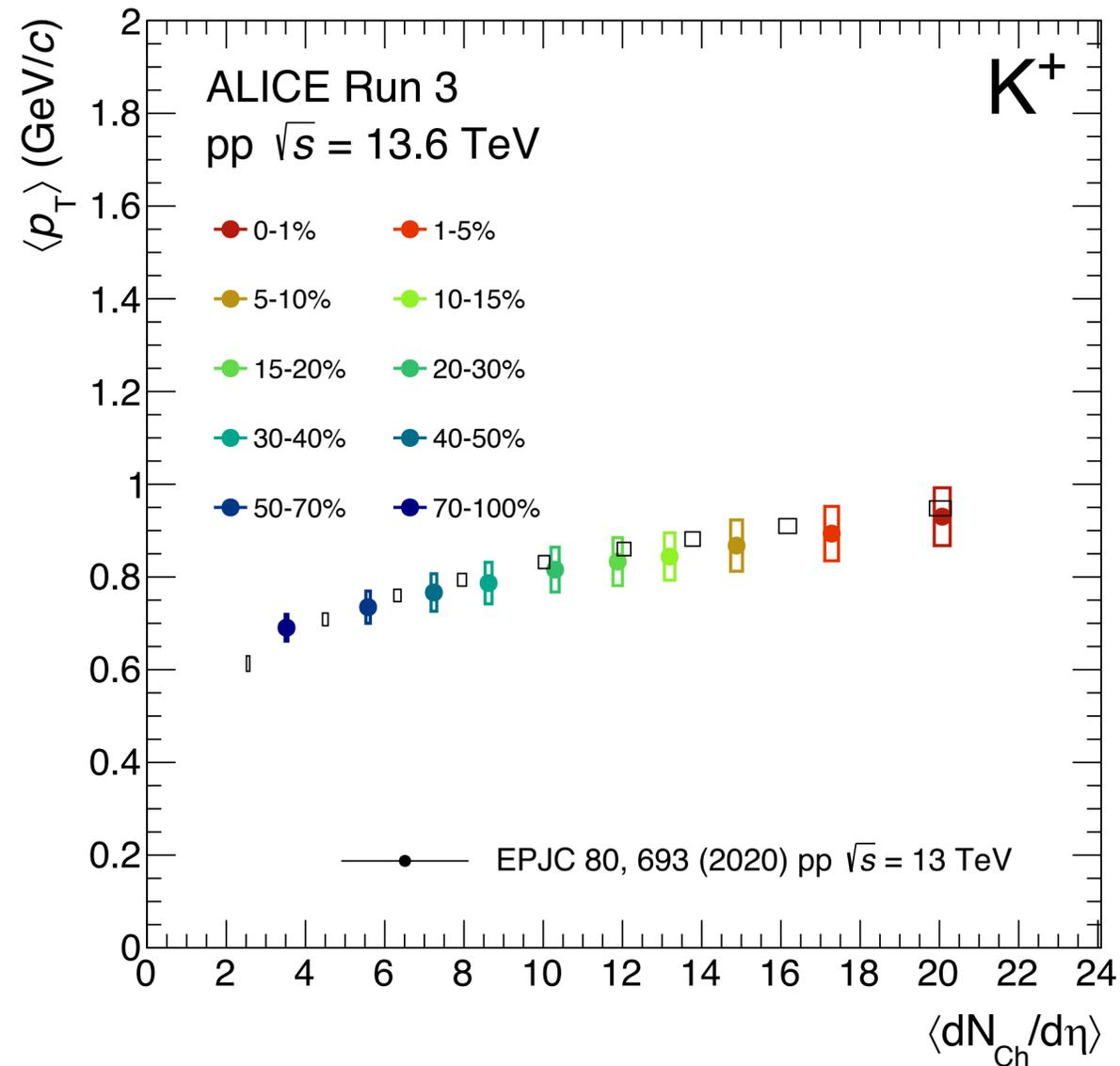
1. p_T – differential TPC TOF spectra for kaon.
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Integrated Yield for K^+ and K^-



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$\langle p_T \rangle$ for K^+ and K^-



1. The results are compared with the measurement available at RUN2 energy pp
2. It could be observed that the $\langle p_T \rangle$ increases with increasing charged-particle multiplicity

- * Shown multiplicity dependent spectra for pions and kaons.
- * Shown p_T integrated yield and $\langle p_T \rangle$ as a function of multiplicity which is near to RUN2 results.

- * To do the same analysis for proton once pass7 is available for the same period.

Acknowledgement

1. I want to acknowledge, Department of Science and Technology, govt. of India for financial assistance through a project entitled “Indian Participation in the ALICE Experiment at CERN” by No. SR/MF/PS-02/2021-GU (E-37122).
2. I want to acknowledge organisers of IOPB for organising ALICE-STAR India Collaboration meeting.

**THANK YOU FOR
YOUR PATIENCE**

