Measurement with O² at ALICE

Identified Particle Spectra

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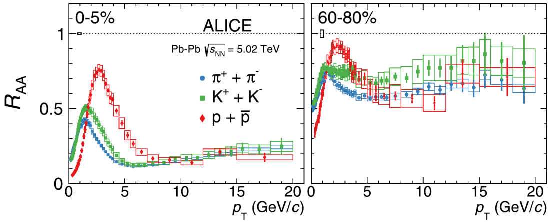
→ *Online-Offline (O²)* computing model for Run 3

→ Standard analysis of identified R_{AA} with new Run 3 software on Run 2 data of Pb-Pb collision

→ Nuclear Modification Factor R_{AA} is defined as

$$R_{\mathrm{AA}} = \frac{\mathrm{d}N^{\mathrm{AA}}/\mathrm{d}p_{\mathrm{T}}}{\langle N_{\mathrm{coll}}\rangle\, \mathrm{d}N^{\mathrm{pp}}/\mathrm{d}p_{\mathrm{T}}} \qquad (1)$$



→ R_{AA} measurement from Ref. [1]

[1]S. Acharya et al. (ALICE), Phys. Rev. C **101**, 044907 (2020)

Analysis Strategy

→ Numerator of R_{AA} equation (1) is high-p_{T} spectrum of $\mathrm{Pb{-}Pb}$ collisions

$$\frac{\mathrm{d}^2 N}{\mathrm{d}p_{\mathrm{T}}\mathrm{d}y} = \frac{1}{N_{Ev}} \cdot \left.\frac{\mathrm{d}^2 N}{\mathrm{d}p_{\mathrm{T}}\mathrm{d}y}\right|_{\mathrm{Raw}} \times \frac{1}{\varepsilon_{\mathrm{Tracking}}} \times \frac{1}{\varepsilon_{\mathrm{Matching}}} \times f_{\mathrm{Primaries}} \times \frac{1}{\varepsilon_{\mathrm{Extra}}}$$

→ Ingredients:

- → $\mathrm{Pb{-}Pb}$ collision data collected by ALICE in 2015 with $\sqrt{s} = 5.02\,\mathrm{TeV}$
- → Run `245064`
- → Simulation `LHC20f6`
- → Data `LHC15o`

Cut-based Selection

→ In the following only primary pions and centrality region $[0.0, 5.0]$

→ Cuts on simulated tracks:

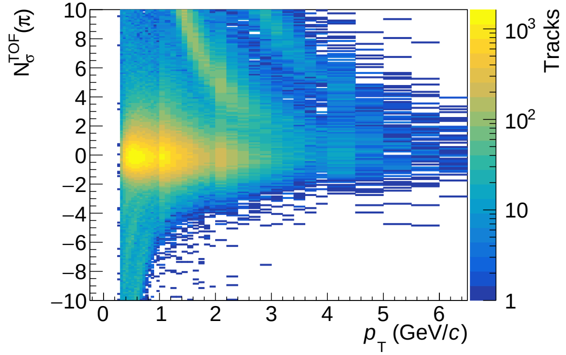
Cut	Description
$\lvert$`Collision.posZ()`$\rvert < 10$	Vertex z-coordinate close to interaction point
$\lvert\eta\rvert < 0.8$	Pseudo-rapidity
$\lvert y\rvert < 0.5$	Rapidity
`isPhysicalPrimary: True`	Select Primaries
`pdgCode` $[\pi^{+/-}, K^{+/-}, p^{+/-}]$	Select Particle Type
`GlobalTracks.isSelected: True`	Standard cuts including condition of 1 SPD hit

→ Same cuts on simulated particles for tracking efficiency

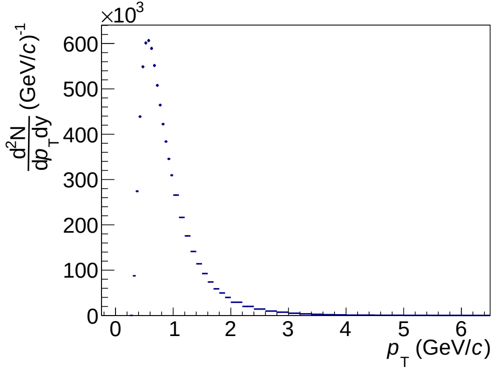
→ Additional trigger and centrality cuts for data in backup slides

→ $N_{\sigma}^{\mathrm{TOF}}(\pi)$ vs. p_{T}

$$N_{\sigma}^{i} = \frac{\text{signal} - \langle \text{signal} \rangle_{i}}{\sigma_{i}}$$



→ $N_{\sigma}^{\mathrm{TOF}}(\pi)$ projection in range $[-3, +3]$ on p_{T}

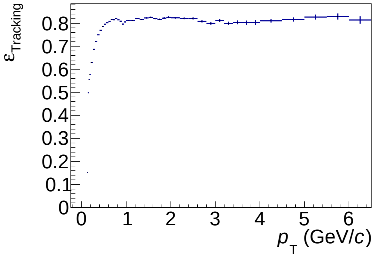


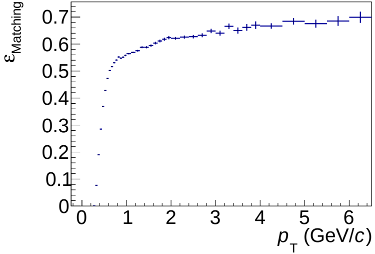
→ Based on simulation of track reconstruction and particle production

$$\varepsilon_{\text{Tracking}} = \frac{\text{\# Reconstructed tracks}}{\text{\# Created particles}}$$

→ Based on simulation of tracks with TOF information and all reconstructed tracks as above

$$\varepsilon_{\text{Matching}} = \frac{\text{\# Tracks with TOF information}}{\text{\# Reconstructed tracks}}$$



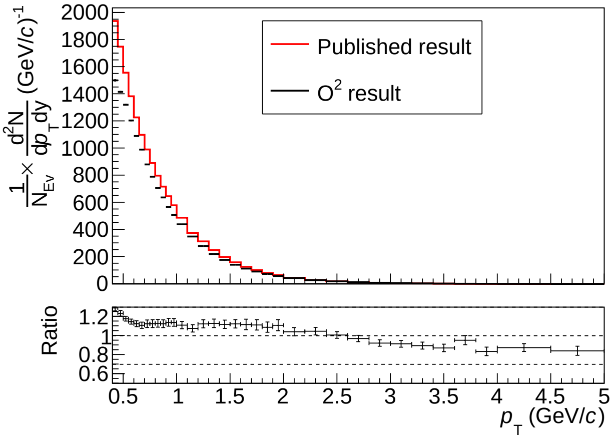


Comparison with Published Results

- Here are corrected spectra of π^+ and π^- combined
- $N_{\mathrm{Events}} = 2601$

$$\frac{\mathrm{d}^2 N}{\mathrm{d}p_{\mathrm{T}}\mathrm{d}y} = \frac{1}{N_{Ev}} \cdot \left.\frac{\mathrm{d}^2 N}{\mathrm{d}p_{\mathrm{T}}\mathrm{d}y}\right|_{\mathrm{Raw}} \times \frac{1}{\varepsilon_{\mathrm{Tracking}}} \times \frac{1}{\varepsilon_{\mathrm{Matching}}} \times \frac{1}{\varepsilon_{\mathrm{PID}}} \times \varepsilon_{\mathrm{Purity}} \times f_{\mathrm{Primaries}}$$

- Comparison with published results from Ref. [1]
- Discrepancy of about 10 %



[1]S. Acharya et al. (ALICE), Phys. Rev. C **101**, 044907 (2020)

Outlook

- → Finish correction of $\mathrm{Pb{-}Pb}$ spectrum
- → Extend analysis on $\mathrm{p{-}p}$ spectrum
- → Find $\langle N_{\mathrm{coll}} \rangle$
- → Build R_{AA}

Cut-based Selection - Data

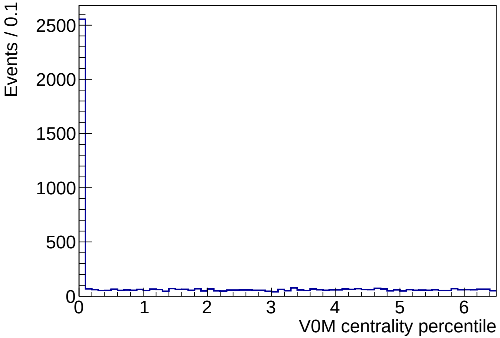
→ Cuts on data:

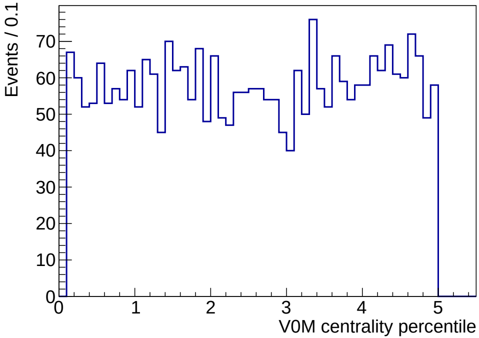
Cut	Description
$\|$`Collision.posZ()`$\| < 10$	Vertex z-coordinate close to interaction point
$\|\eta\| < 0.8$	Pseudo-rapidity
$\|y\| < 0.5$	Rapidity
`GlobalTracks.isSelected: True`	Standard cuts including condition of 1 SPD hit

→ Additional trigger cuts (need to be included on simulation as well at some point):

Cut	Description
`KINT7`	Trigger
$0.1 < \|$`centV0M`$\| < 5$	Centrality

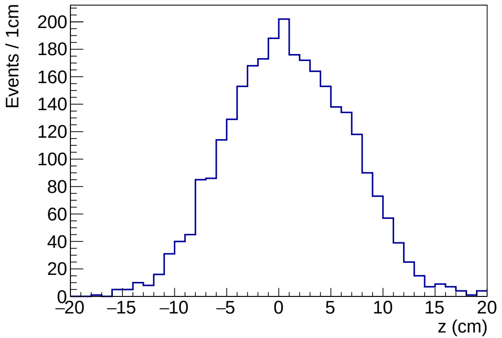
→ Centrality before and after cut on $0.1 < |\texttt{centV0M}| < 5$





Vertex Location

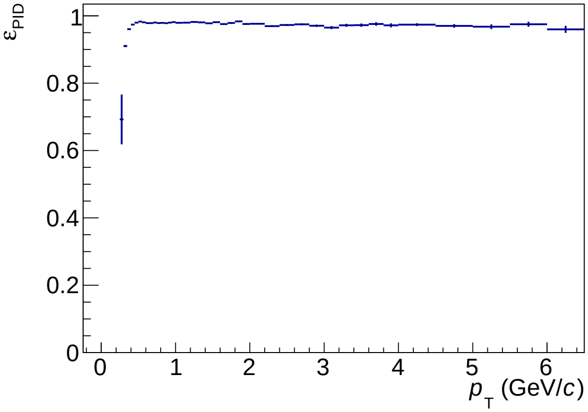
→ Corresponding plot of z-position collision for $|$`Collision.posZ()`$| < 10$ cut



PID Efficiency

- → Based on simulation of $N_{\sigma}^{\mathrm{TOF}}(\pi)$ projection in range $[-3,+3]$ on p_{T} and projection on full range

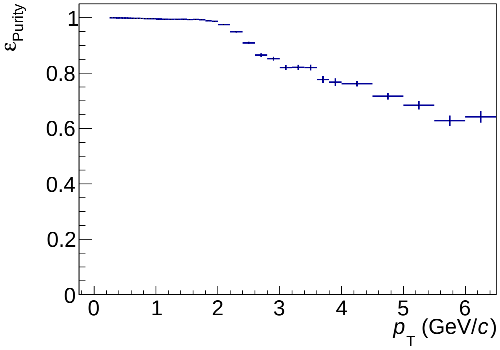
$$\varepsilon_{\mathrm{PID}} = \frac{\text{\# pions in } N_{\sigma}^{\mathrm{TOF}}(\pi)[-3,+3]\text{-range}}{\text{\# pions in } N_{\sigma}^{\mathrm{TOF}}(\pi)\text{ full range}}$$

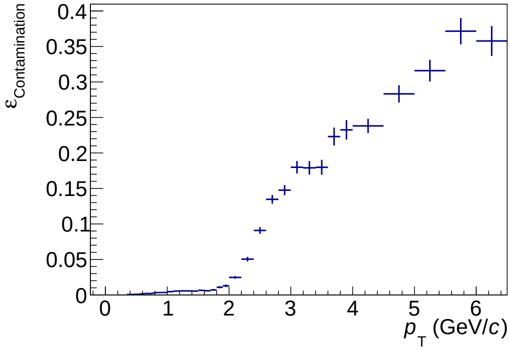


Purity and Contamination

→ Based on simulation of $N_\sigma^{\mathrm{TOF}}(\pi)$ projection in range $[-3, 3]$ on p_{T} of pions and non-pions

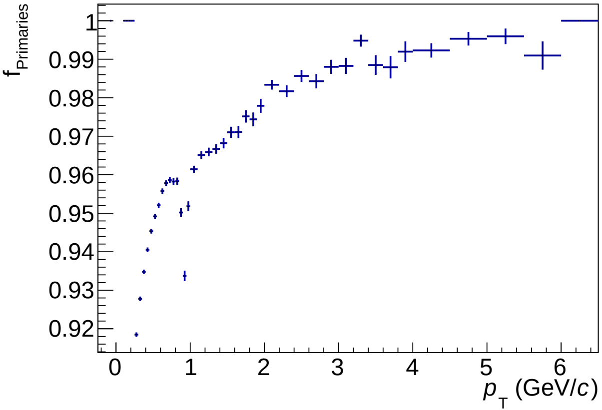
$$\varepsilon_{\mathrm{Purity}} = \frac{\text{\# pions in } N_\sigma^{\mathrm{TOF}}(\pi)\text{-range}}{\text{\# pions and \# non-pions in } N_\sigma^{\mathrm{TOF}}(\pi)\text{-range}} \qquad \varepsilon_{\mathrm{Cont.}} = \frac{\text{\# non-pions in } N_\sigma^{\mathrm{TOF}}(\pi)\text{-range}}{\text{\# pions and \# non-pions in } N_\sigma^{\mathrm{TOF}}(\pi)\text{-range}}$$





$f_{\mathrm{Primaries}}$

- Data-driven approach to find primaries with DCA_{xy} (distance of closest approach in xy-plane)
- Fit of simulated DCA_{xy} projection on p_{T} for secondary and primary particles to DCA_{xy} projection on p_{T} of data
- Fraction of primaries on the right for each bin



Corrected Spectrum

- Raw spectrum divided by number of events and applied corrections
- $N_{\text{Events}} = 2601$

$$\frac{\mathrm{d}^2 N}{\mathrm{d}p_{\mathrm{T}}\mathrm{d}y} = \frac{1}{N_{Ev}} \cdot \left.\frac{\mathrm{d}^2 N}{\mathrm{d}p_{\mathrm{T}}\mathrm{d}y}\right|_{\text{Raw}} \times \frac{1}{\varepsilon_{\text{Tracking}}} \times \frac{1}{\varepsilon_{\text{Matching}}} \times \frac{1}{\varepsilon_{\text{PID}}} \times \varepsilon_{\text{Purity}} \times f_{\text{Primaries}}$$