Charged-particle jet properties in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE

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Motivation

- Jets are collimated shower of particles produced from fragmentation and hadronization of hard-scattered partons
- Jets in p-Pb collisions:
  - Provide a baseline measurement for heavy-ion studies
  - Test the impact of cold nuclear matter (CNM) effects [1]
  - Offer possibility to address and understand the possible medium formation in small collision systems

Charged-particle leading jet properties

- Mean charged-particle multiplicity within a leading charged-particle jet [2]

$$\langle N_{\mathrm{ch}} \rangle (p_{\mathrm{T,jet}}^{\mathrm{ch}}) = \frac{1}{N_{\mathrm{jets}}} \sum_{i=1}^{N_{\mathrm{jets}}} N_{\mathrm{ch}}^{i} (p_{\mathrm{T,jet}}^{\mathrm{ch}})$$

- Charged-particle jet fragmentation function [2]:

$$z^{\mathrm{ch}} = p_{\mathrm{T,track}} / p_{\mathrm{T,jet}}^{\mathrm{ch}}$$

where $p_{\mathrm{T,track}} = p_{\mathrm{T}}$ of jet constituent

Analysis details

Collision system: p-Pb

Center-of-mass energy ($\sqrt{s_{NN}}$): 5.02 TeV

No. of events (minimum bias):

Data: 515 M

Simulation: 312 M

DPMJET [3] (GRV94 [4])

Track selection: $p_{T,track} > 0.15$ GeV/c, $|\eta_{track}| < 0.9$

Jet reconstruction: FastJet anti-k_T algorithm [5], jet radius $R = 0.4$, leading jet $p_{T,jet}^{ch} = 10\text{-}100$ GeV/c, $|\eta_{jet}^{ch}| < 0.5$

Underlying event (UE) estimation: Perpendicular cone method

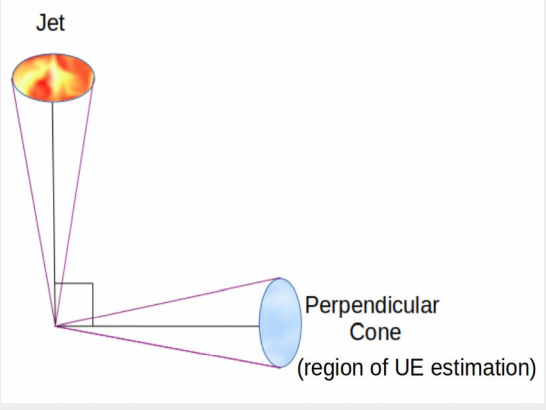
UE subtraction: Performed on a statistical basis [2] after unfolding

Correction for instrumental effects: Unfolding

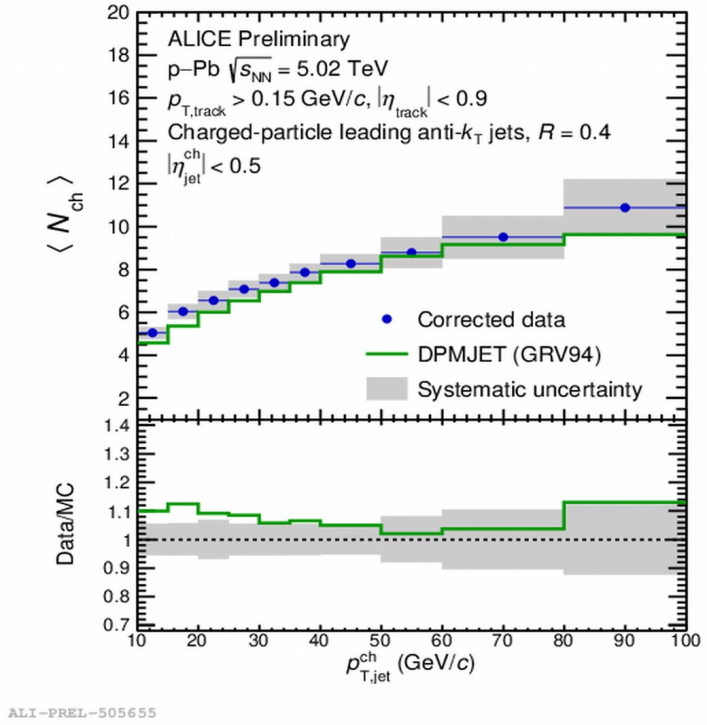
- Performed 2D unfolding
- 4D Response matrix ($p_T^{jet,\ detector}$, $Observable^{detector}$, $p_T^{jet,\ particle}$, $Observable^{particle}$)
- Bayesian method [6] in RooUnfold [7]
- Unfolding parameter (no. of iterations) $\langle N_{ch} \rangle$: 4, z^{ch} : 2

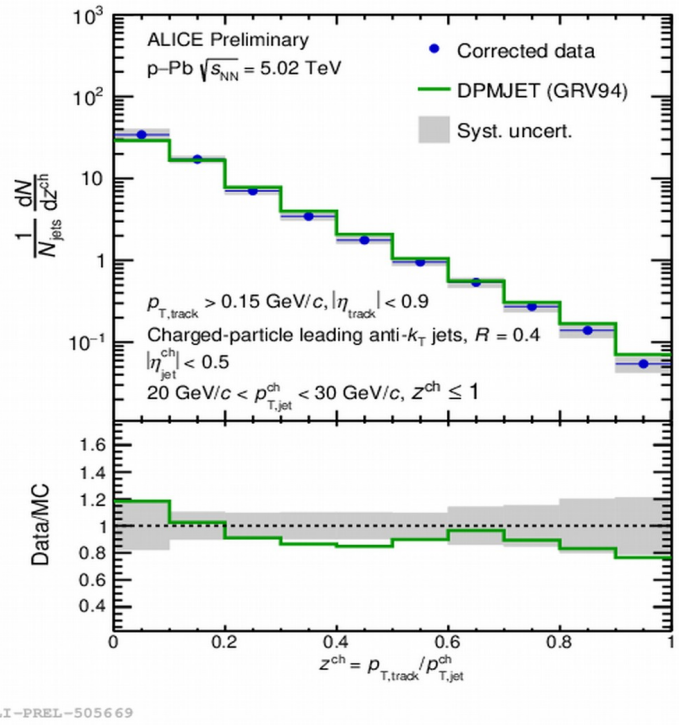
Sources of systematic uncertainties:

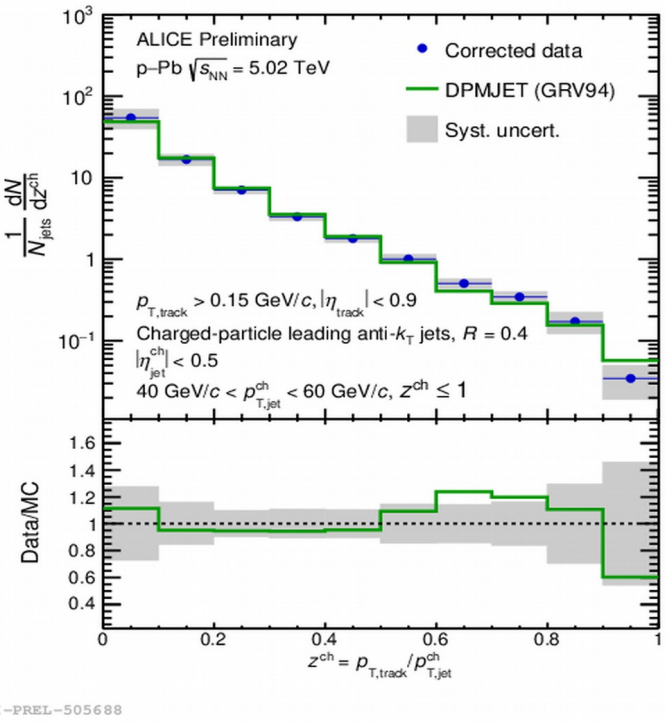
- Uncertainty in tracking efficiency
- MC dependence
- Change in prior
- Choice of number of iterations
- Uncertainty in estimation of UE



Results

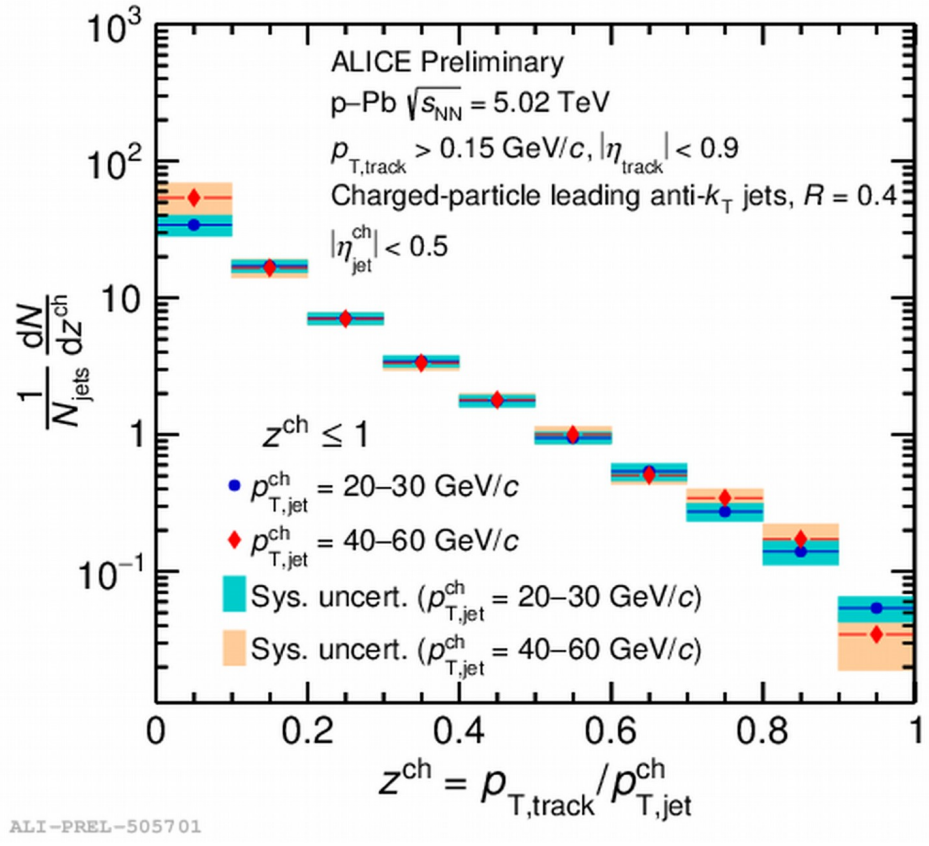






- $\langle N_{ch} \rangle$ increases with $p^{ch}_{T,jet}$
- DPMJET (GRV94) explains $\langle N_{ch} \rangle$ and z^{ch} distributions within uncertainties

Results



- Scaling of jet fragmentation with $p_{T,jet}^{ch}$

Summary

- **Measurement of Charged-particle jet properties ($\langle N_{ch} \rangle$, z^{ch}) in minimum bias p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE**
- **DPMJET (GRV94) explains measured $\langle N_{ch} \rangle$ and z^{ch} distributions within uncertainties**
- **Scaling of charged-particle jet fragmentation with jet transverse momentum observed**

References

[1] EPJ Web of Conferences 171, 11001 (2018)
[2] Phys. Rev. D 91 (2015) 112012
[3] DOI: 10.1007/978-3-642-18211-2_166
[4] arXiv:hep-ph/9507241
[5] Matteo Cacciari et al JHEP04(2008)063
[6] https://doi.org/10.1016/0168-9002(95)00274-X
[7] https://gitlab.cern.ch/RooUnfold/RooUnfold