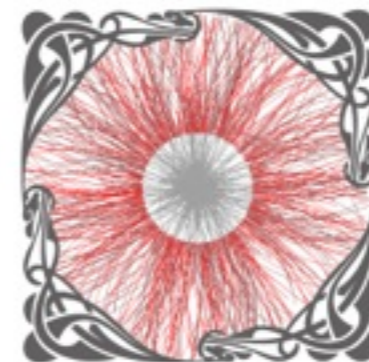


K_S^0 and Λ Production in Charged Jets in p–Pb Collisions at $\sqrt{s_{NN}}=5.02$ TeV with ALICE

Xiaoming Zhang
for the ALICE Collaboration

Quark Matter 2014, May 19–24, 2014, Darmstadt, Germany

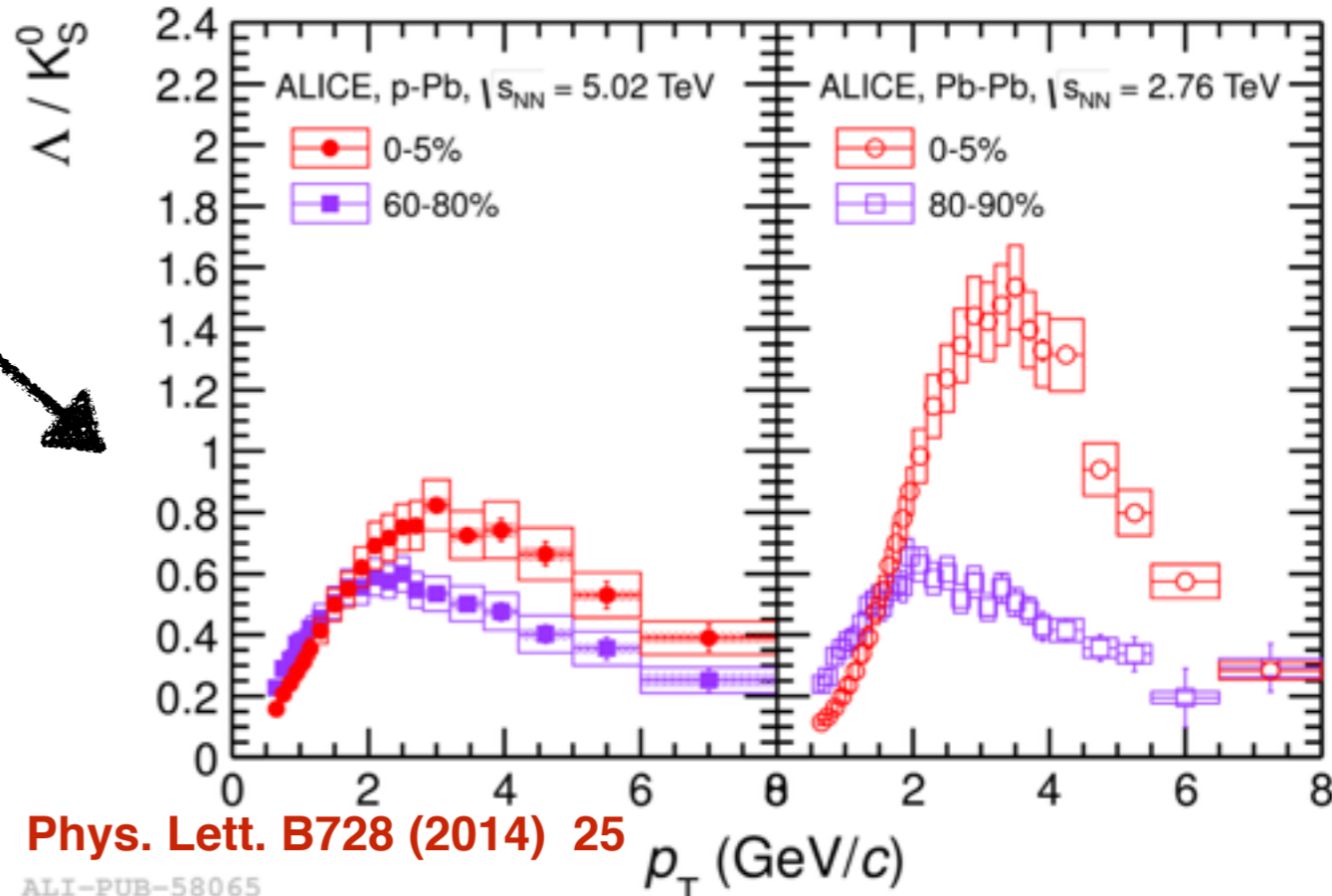
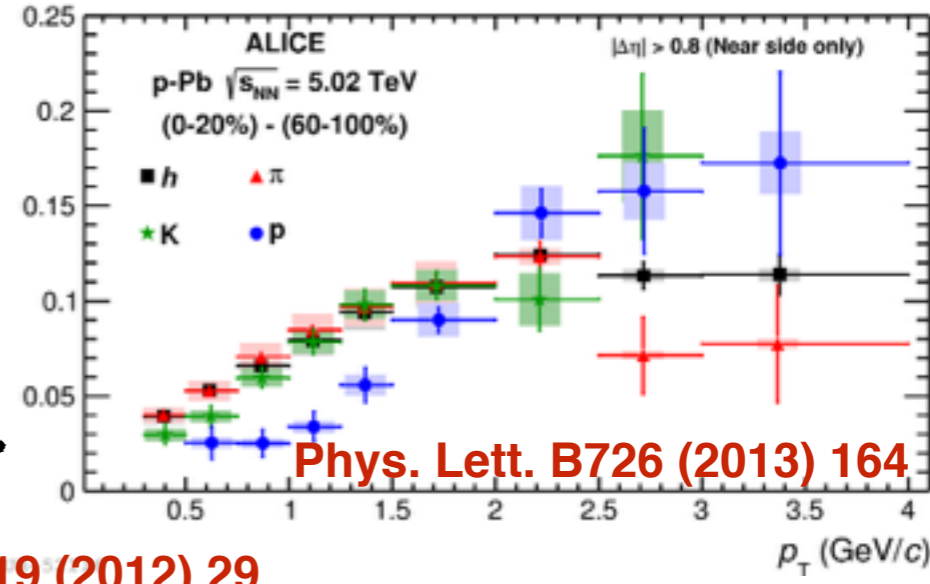
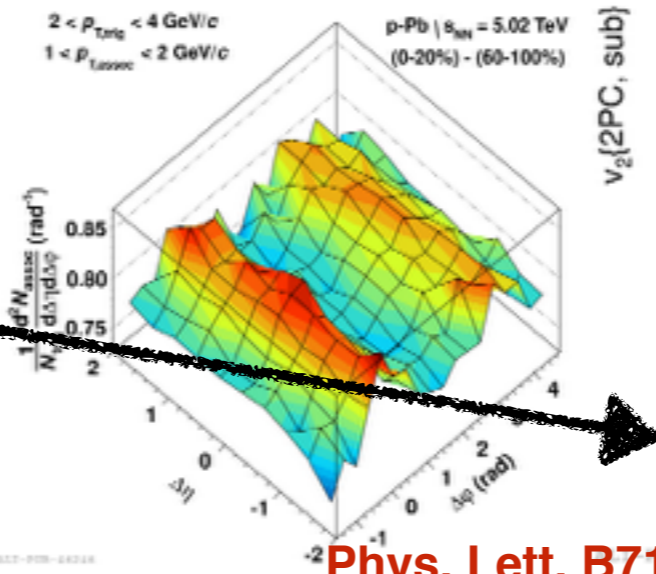


XXIV
QUARK
MATTER
DARMSTADT
2014

Physics Motivation

High multiplicity p-Pb and Pb-Pb collisions - similarities

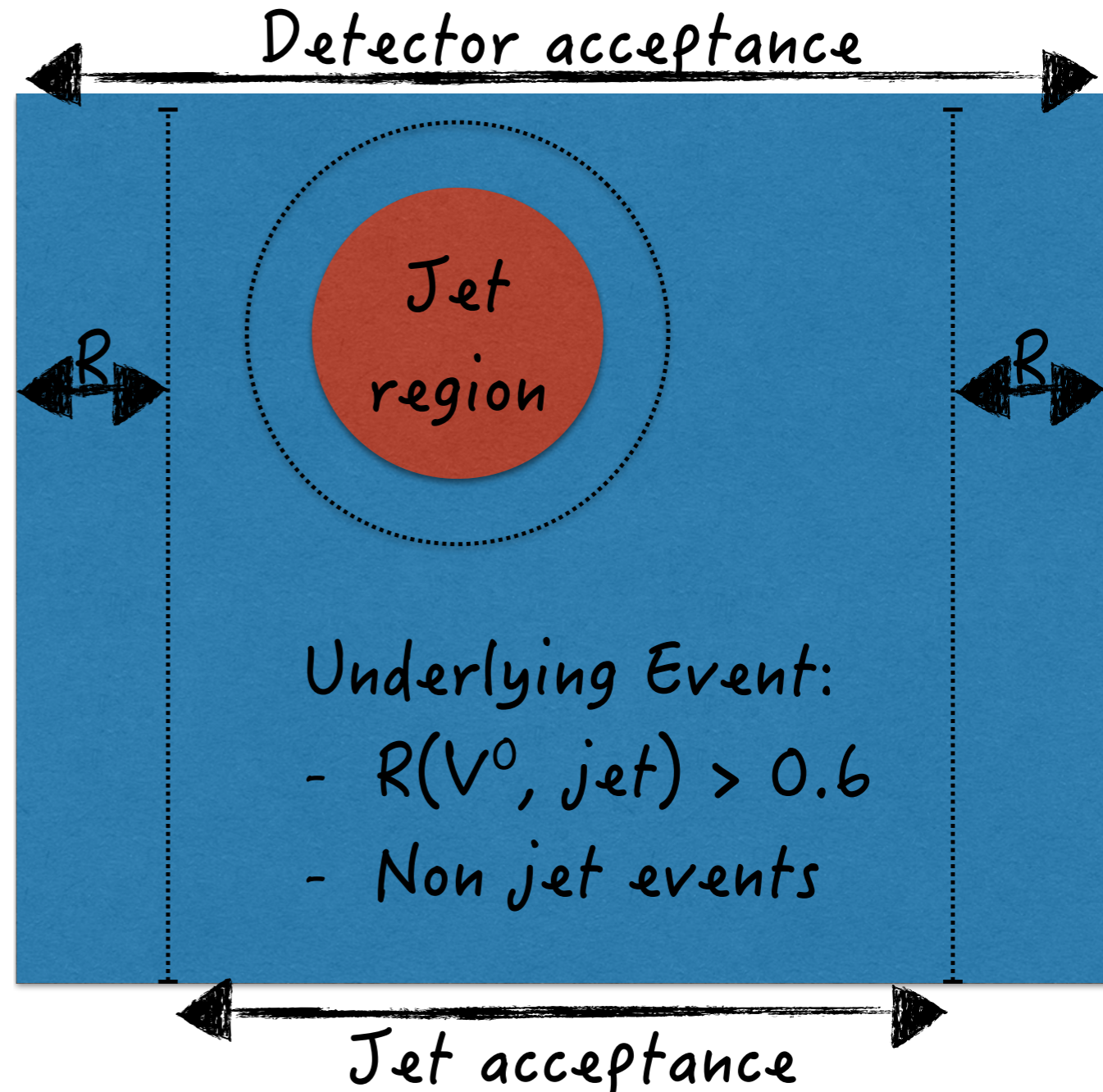
- double ridge structure
- $v_2 > 0$ and PID dependent
- enhanced Λ/K_S^0 ratio
 - ➔ involving several phenomena:
 - ➔ radial flow
 - ➔ coalescence/recombination
 - ➔ jet fragmentation...



This analysis: Λ/K_S^0 ratio in jets in p-Pb
 ➔ separation of soft and hard processes

Analysis Strategy

- Tag the hard scattering with charged particle jets
(in $p_{T,jet}^{ch} > 10$ and 20 GeV/c)
- Reconstruct Λ and K_S^0 (V^0 s) within the “jet region”:
 $R(V^0, jet) < jet\ radius\ R$
- Reconstruct Λ and K_S^0 within the UE region
 - several methods, variation included in the systematic uncertainty
- Subtract the UE contribution from the jet measurement



ALICE Setup and Data Sample

Inner Tracking System (ITS)

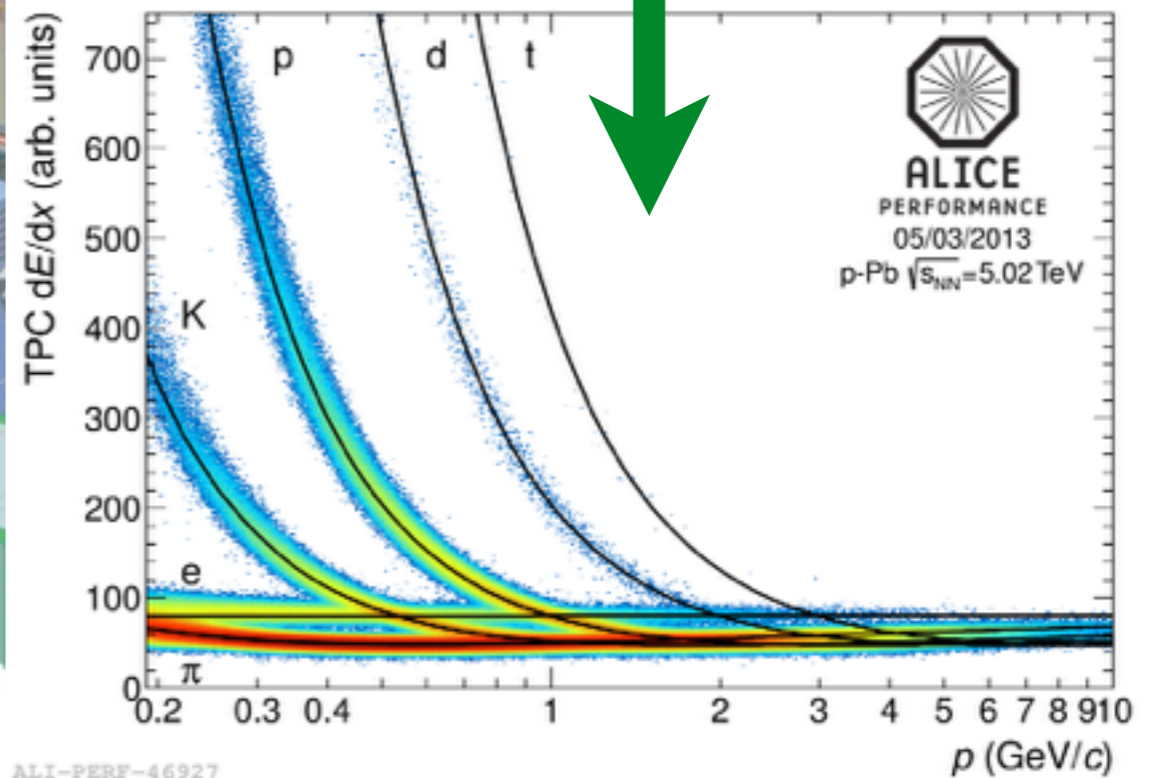
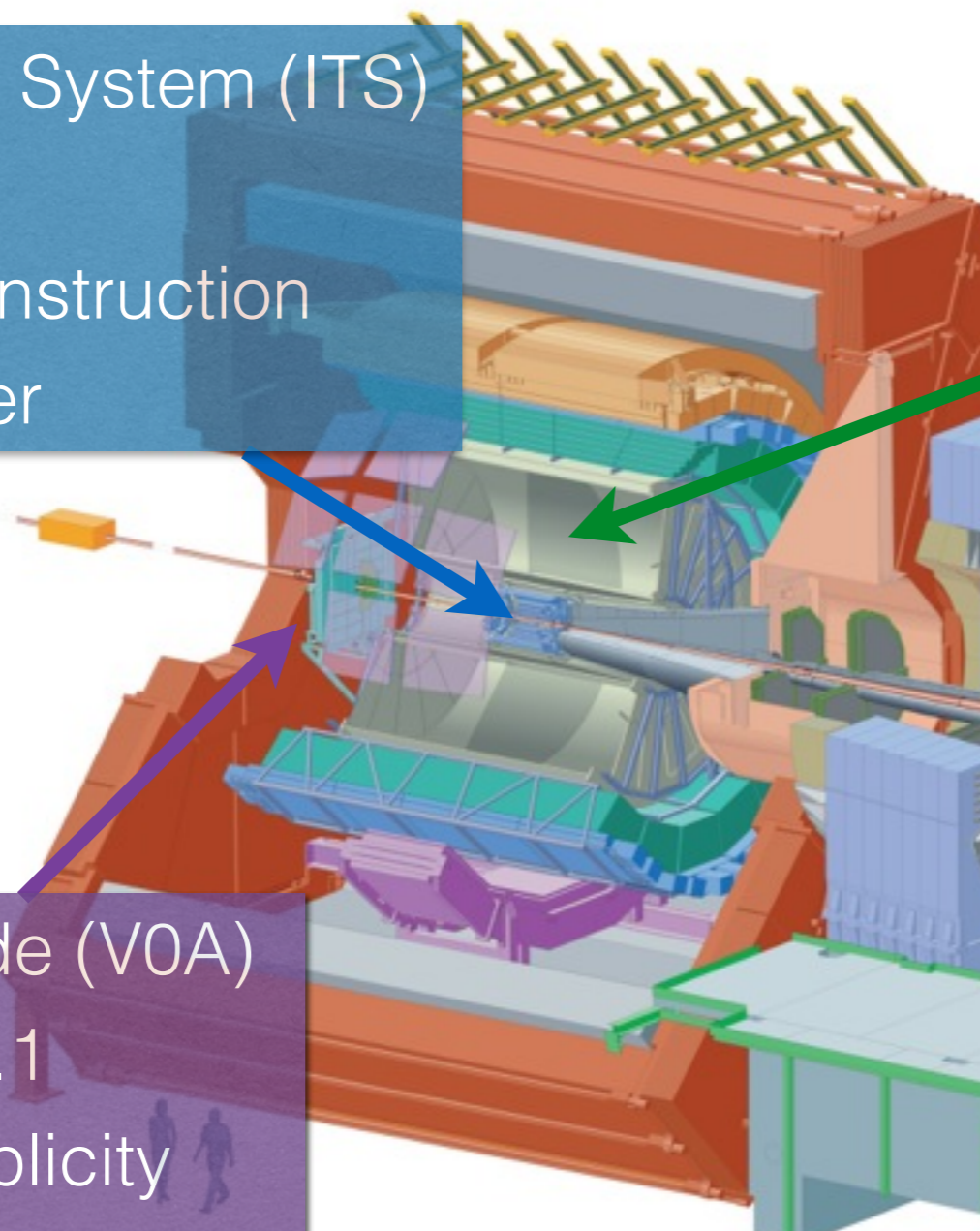
- $|\eta| < 0.9$
- vertex reconstruction
- event trigger

Time Projection Chamber (TPC)

- $|\eta| < 0.9$
- charged particle tracking and identification

VZERO Pb-Side (V0A)

- $2.8 < \eta < 5.1$
- event multiplicity class determination
- event trigger



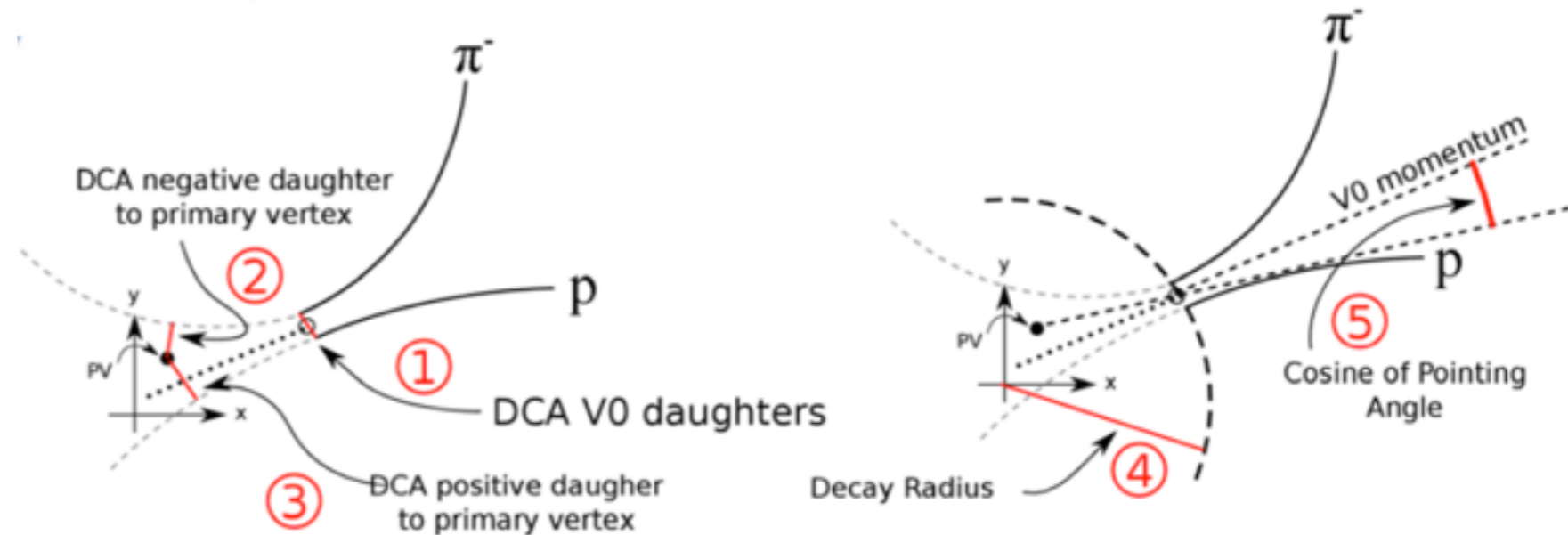
This analysis:

- p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV
- about 100M minimum bias events

K_S^0 and Λ Signal Extraction

Candidate selection

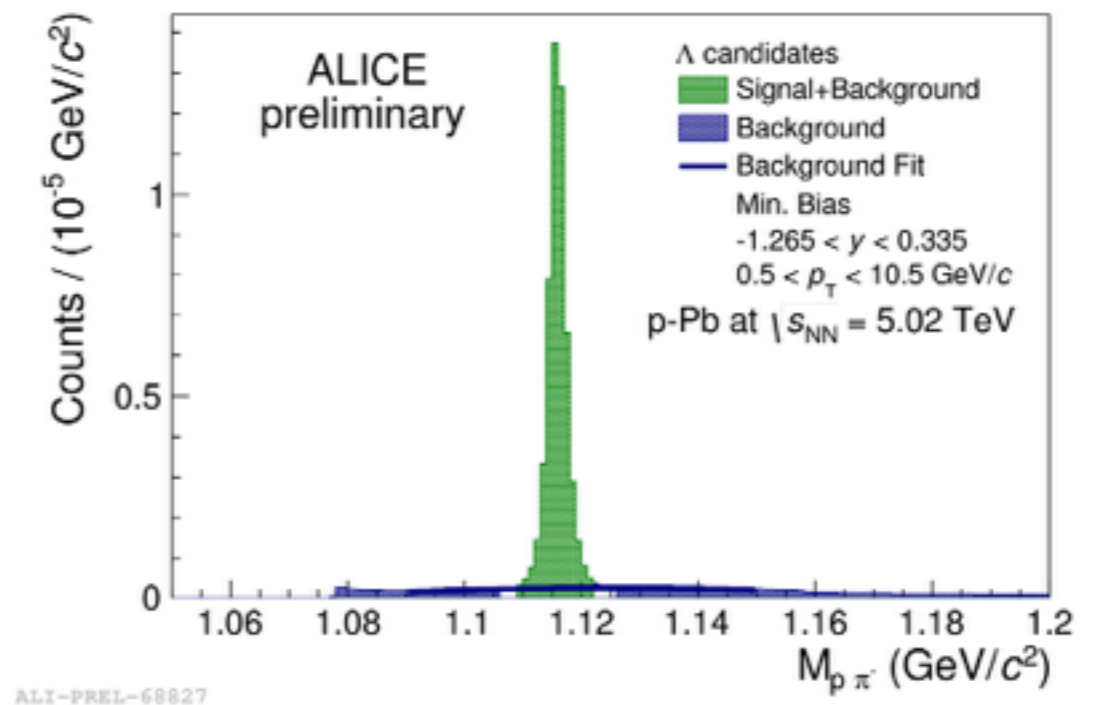
- K_S^0 and Λ candidates are selected via decay topology based on five variables



- V^0 daughters (protons and pions) are identified via dE/dx in TPC

Signal extraction

- fit the invariant mass distribution of V^0 candidates with Gaussian to define the **signal window** and **side bands**
- combinatorial background subtraction,
 - interpolated from the side bands



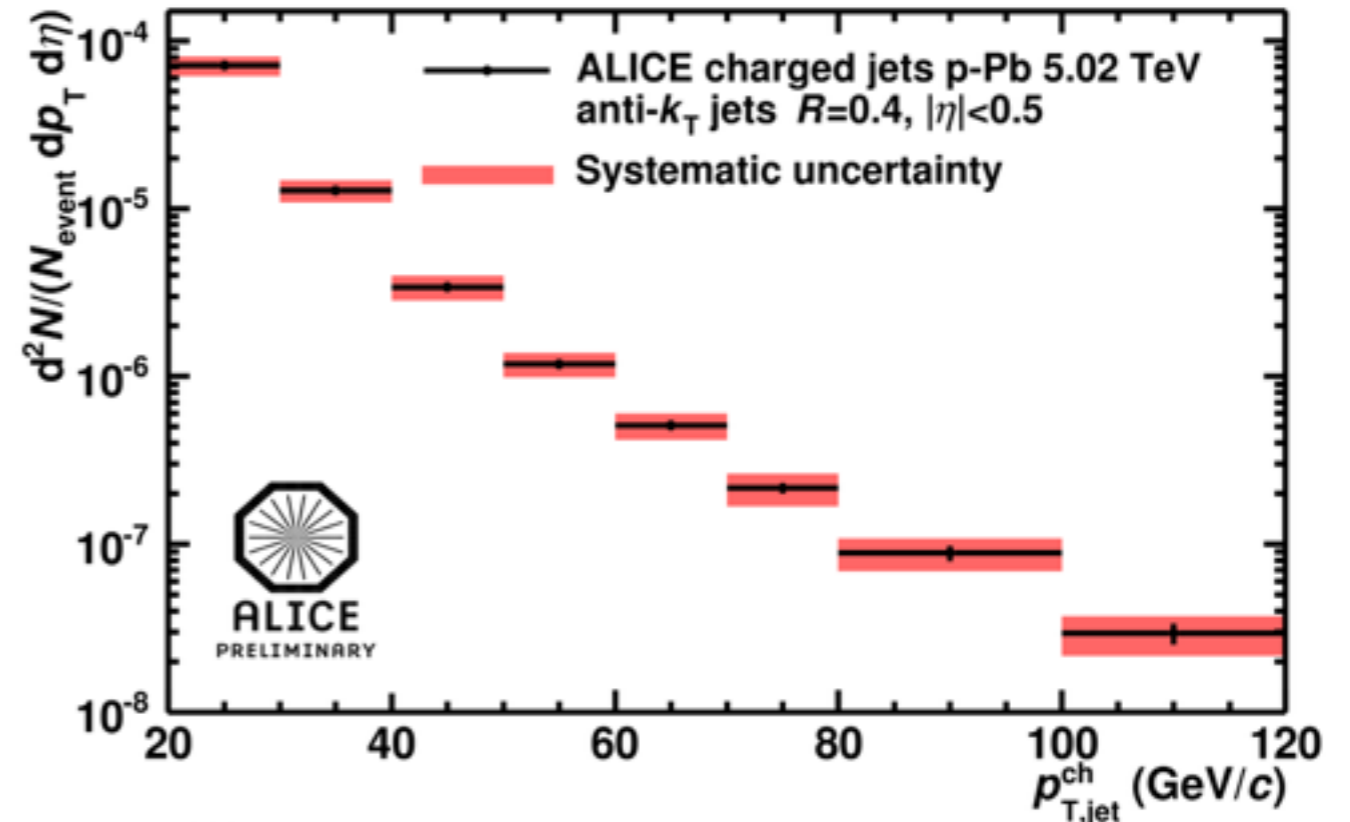
ALI-PREL-68827

Charged Jet Reconstruction

poster: R. Haake, Tue. May 20th, 16:30, QM2014

Charged jet definition

- anti- k_T , $R = 0.2, 0.3$ and 0.4
- $p_{T,track} > 0.15$ GeV/c
- $|\eta_{track}| < 0.9$
- includes only charged tracks

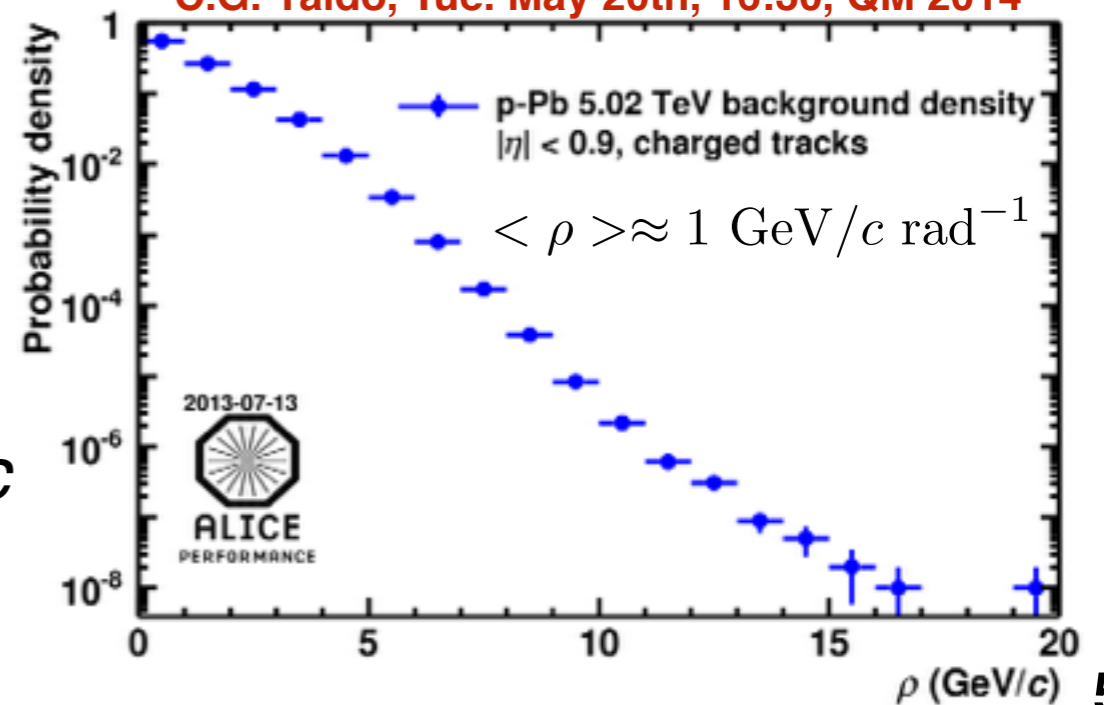


ALI-PREL-53825

poster: J. Kral, Tue. May 20th, 16:30, QM2014
M. E. Connors, Tue. May 20th, 16:30, QM2014
C.G. Yaldo, Tue. May 20th, 16:30, QM 2014

Jet background density

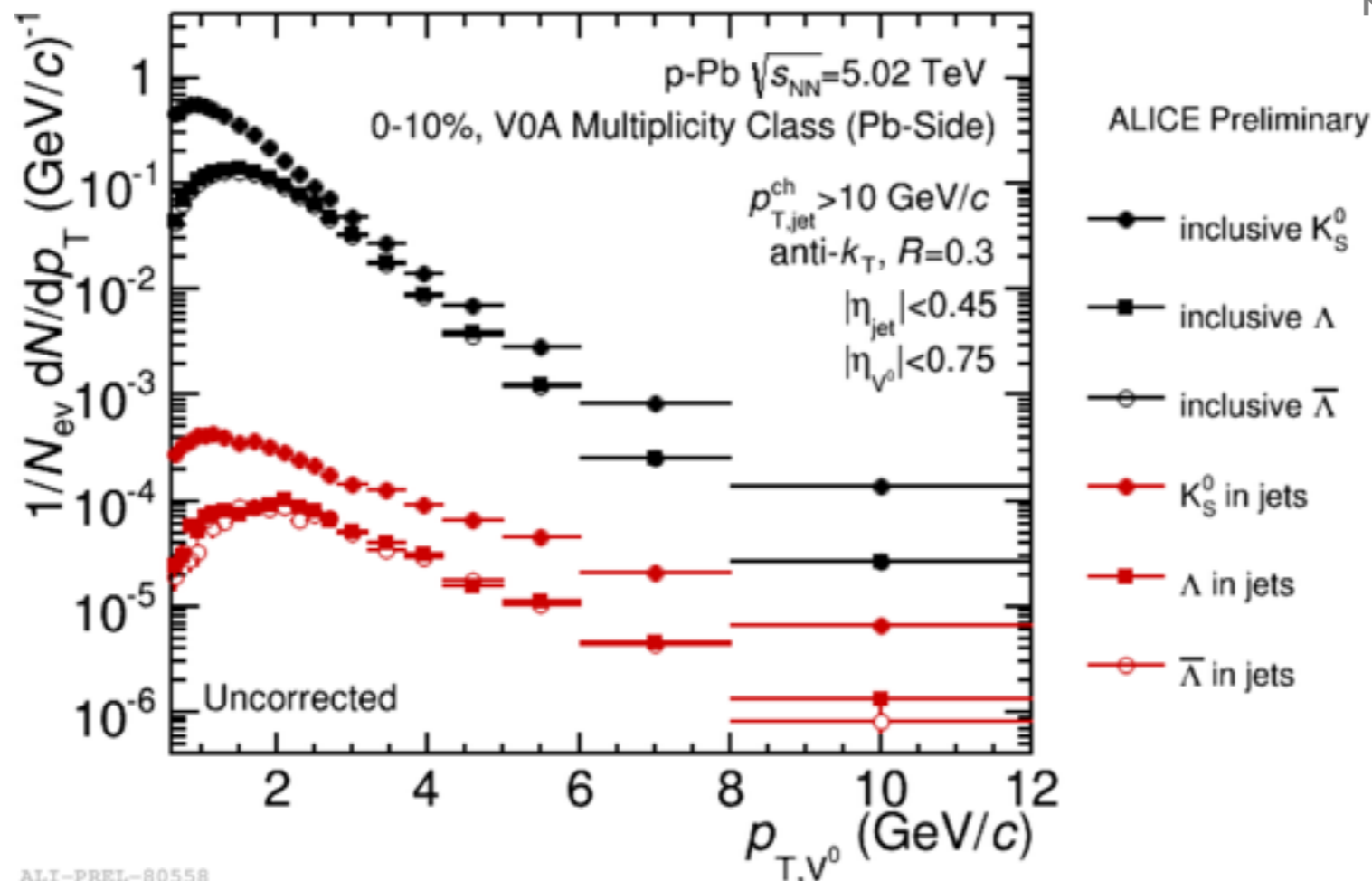
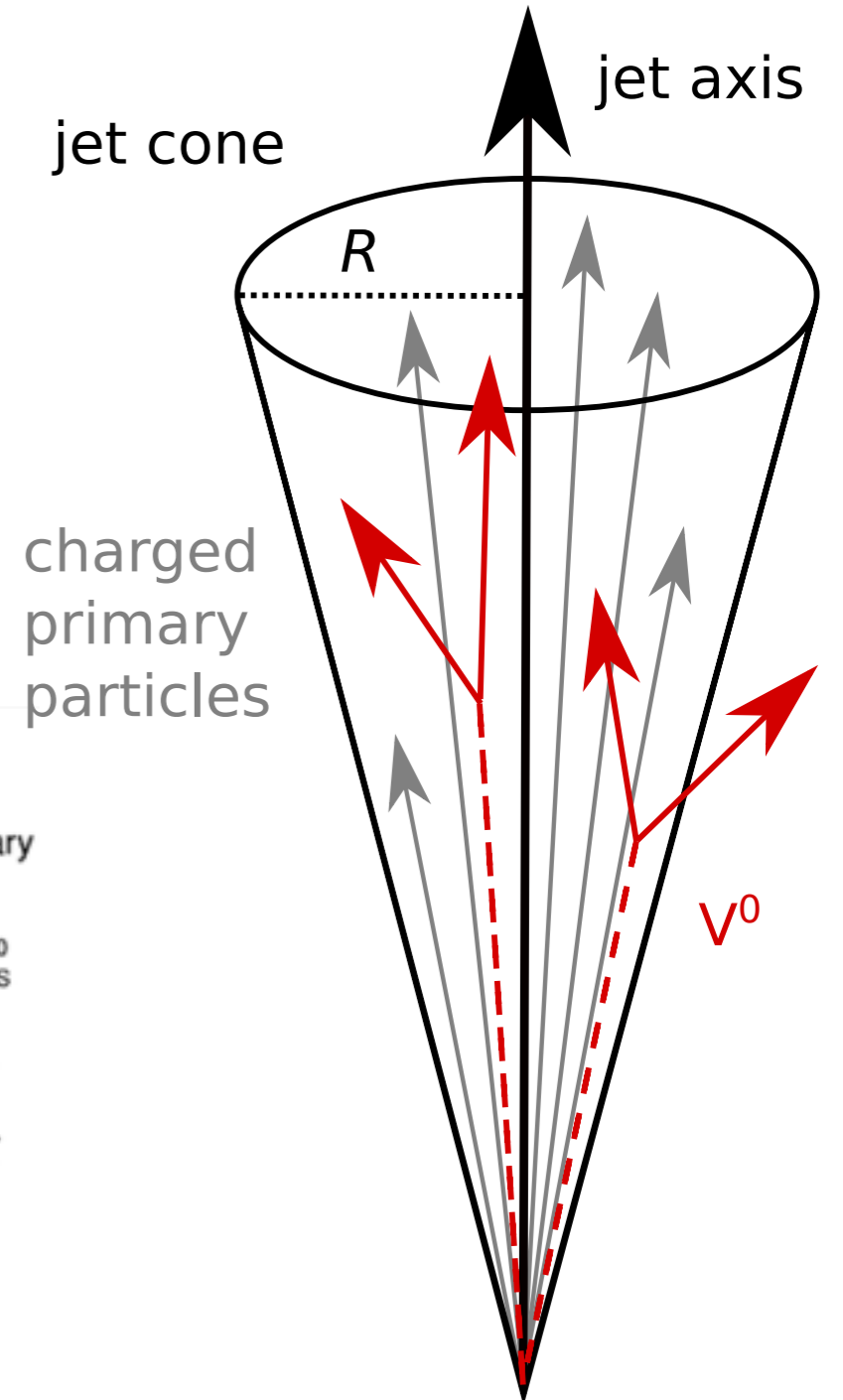
- median p_T density of jets reconstructed by k_T -algorithm for each jet radius
- corrected by the charged track occupancy event-by-event
- background fluctuations: variance ~ 1 GeV/c



ALI-PERF-53829

V^0 -Jet Matching

- V^0 -jet matching
- V^0 s and jets are reconstructed independently
- select V^0 s in the jet cone: $R(V^0, \text{jet}) < R_{\text{jet}}$
- Acceptance
- $|\eta_{V^0}| < 0.75, |\eta_{\text{jet}}| < 0.75 - R_{\text{jet}}$ in the lab. frame

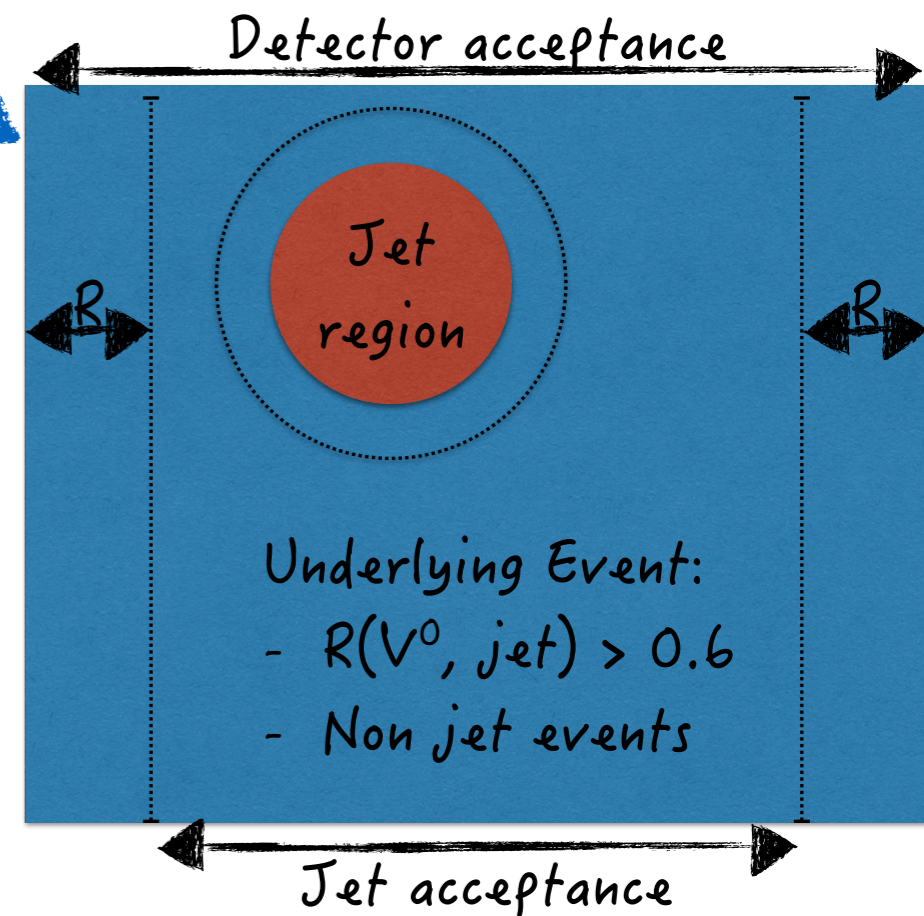
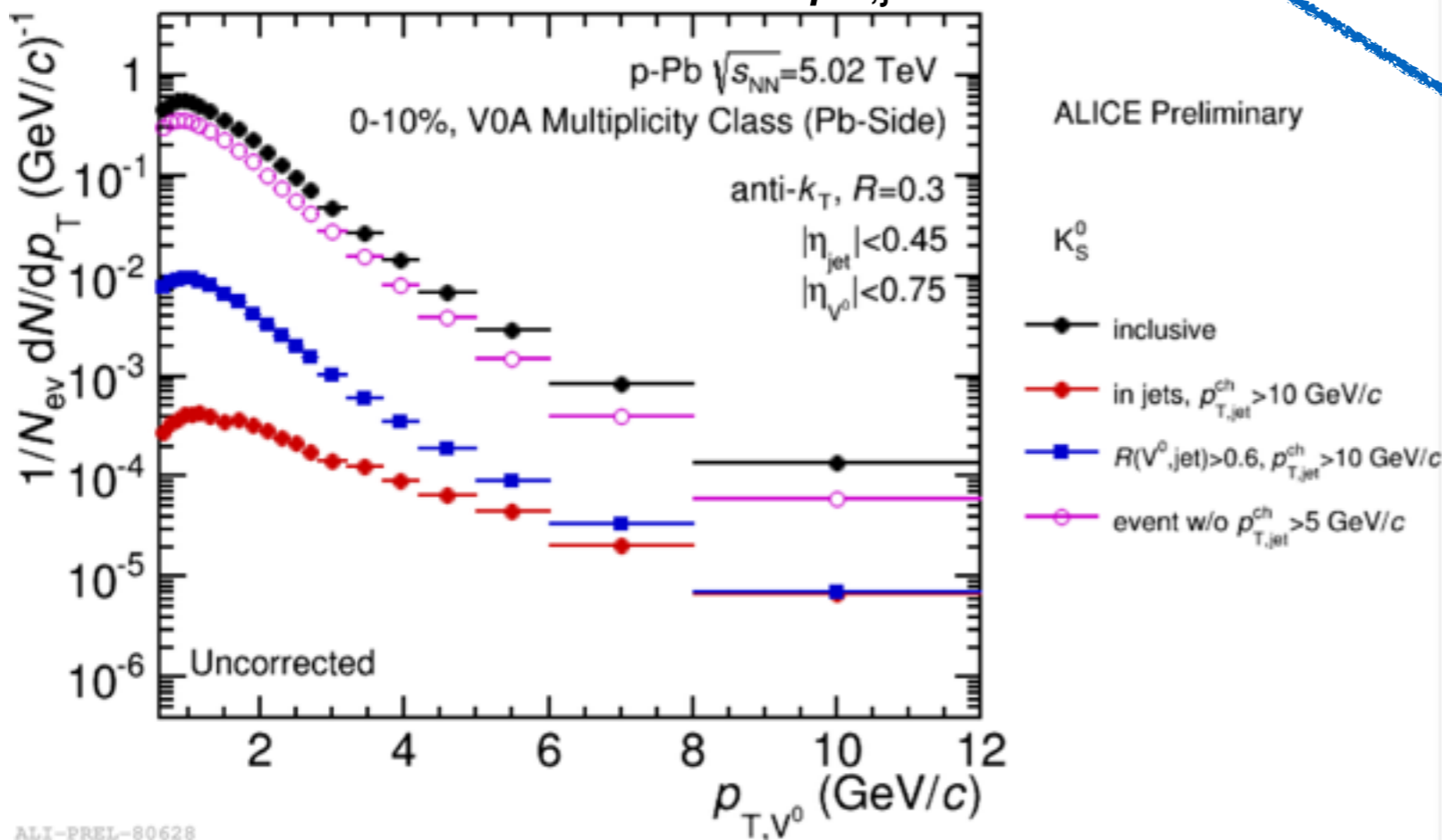


ALI-PREL-80558

Underlying Event Estimation

Two classes of underlying events

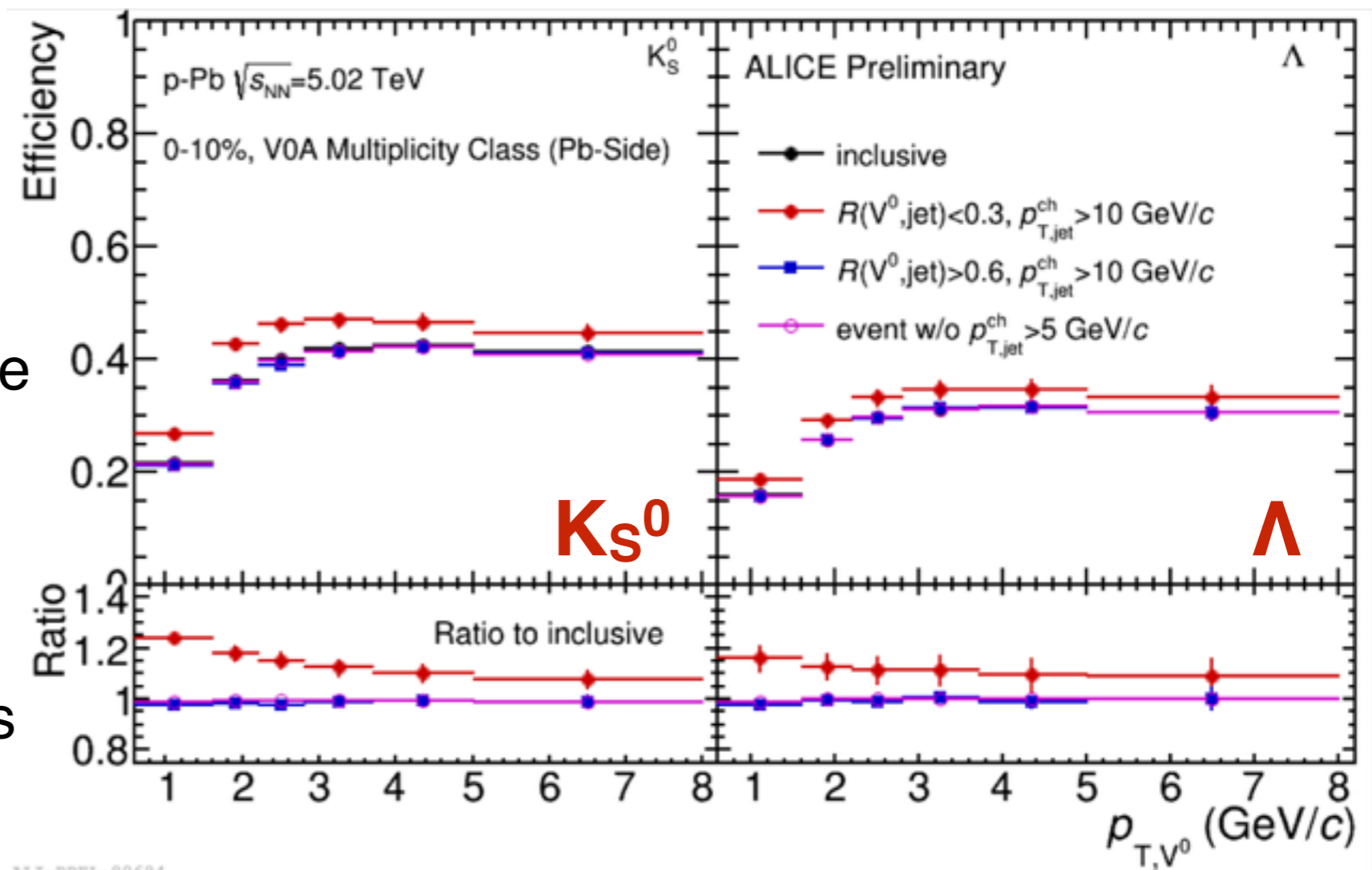
- V^0 s outside jet cone, $R(V^0, \text{jet}) > R_{\text{cut}}$ ($R_{\text{cut}} = 0.4, 0.6, 0.8$, default $R_{\text{cut}} = 0.6$)
- V^0 s in events without with $p_{T,\text{jet}}^{\text{ch}} > 5 \text{ GeV}/c$



- V^0 spectrum outside jet cone harder than in events w/o a tagged jet
- V^0 outside jets for different radii equal within $\sim 10\%$
- Uncertainty on underlying event: $\sim 10\%$ ($\sim 2\%$) at low (high) p_T

Efficiency of V^0 s

- no difference in the efficiency of single V^0 s inside and outside jet cone
- η -dependence accounted for by reweighing with η -distributions of V^0 in jets



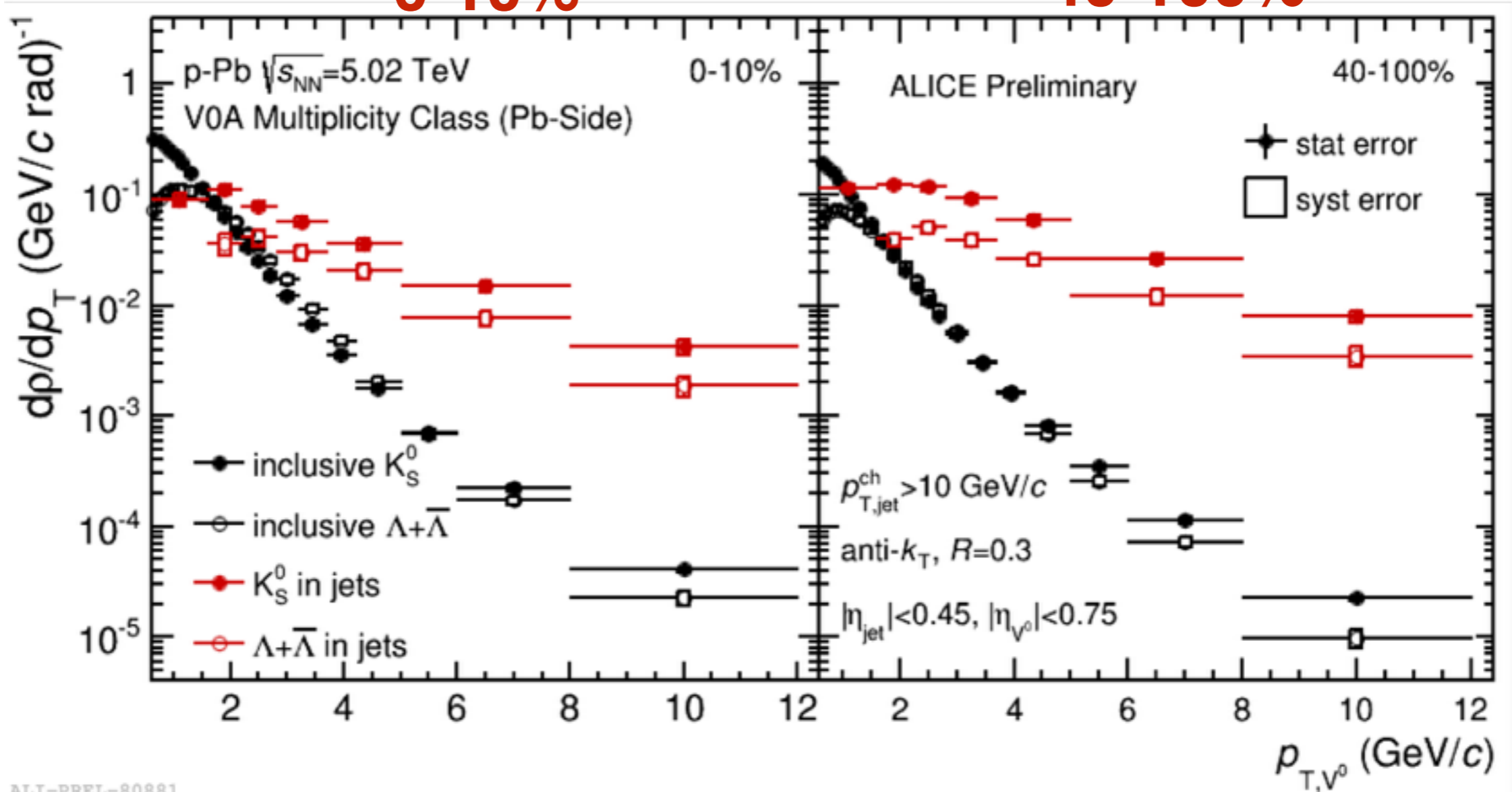
Feed-down correction for Λ from Ξ decays

- secondary V^0 s in jet cone are corrected after underlying event subtraction
- difference between the feed-down fraction of inclusive V^0 s in data and that of V^0 s in jets from MC is taken as uncertainty (5%)

p_T -differential Density of V^0 s in Jets

$$\frac{d\rho}{dp_T} = \frac{1}{N_{ev}} \times \frac{1}{\langle \text{Area} \rangle} \times \frac{dN}{dp_T}$$

0-10%
40-100%

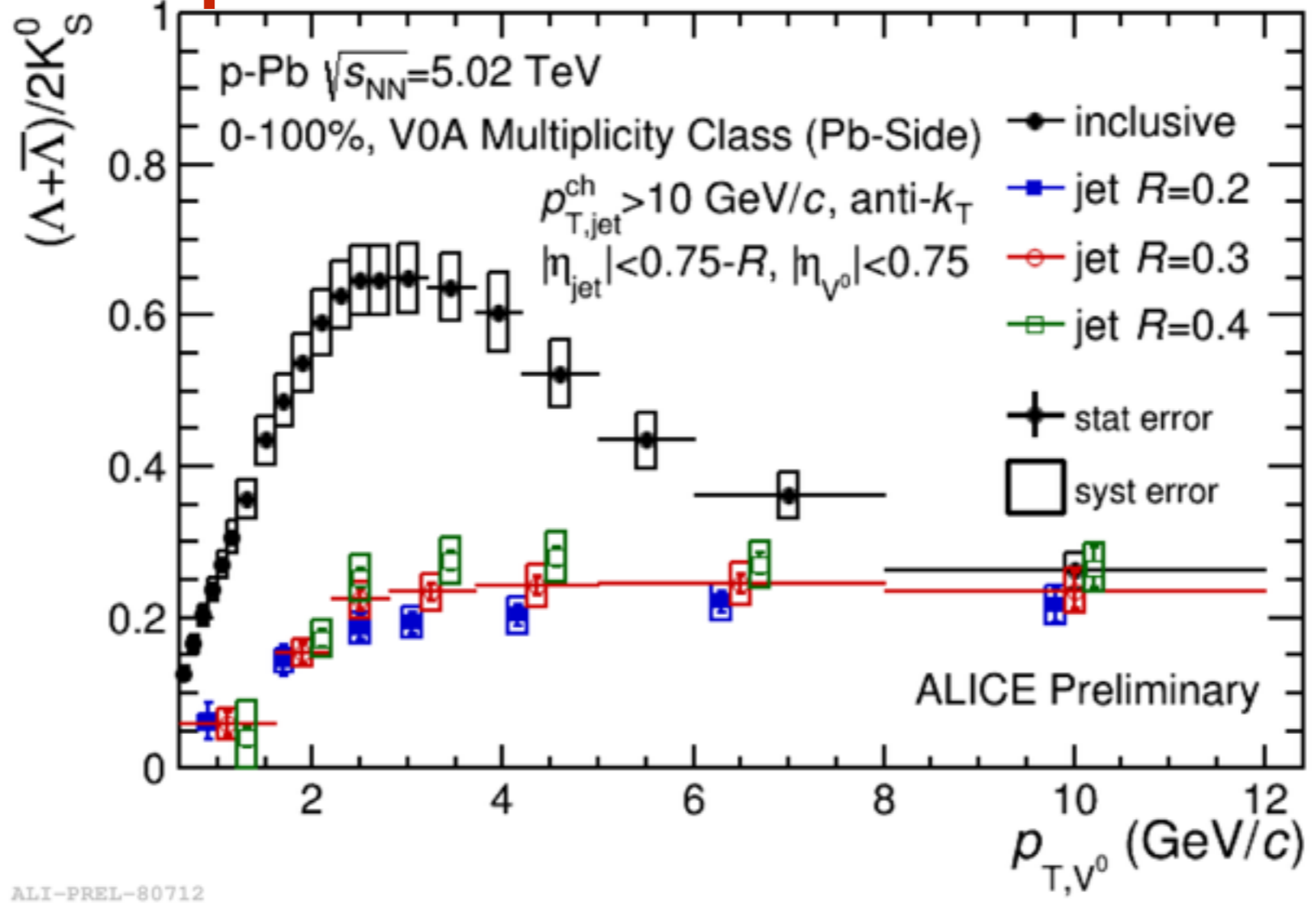


ALI-PREL-80881

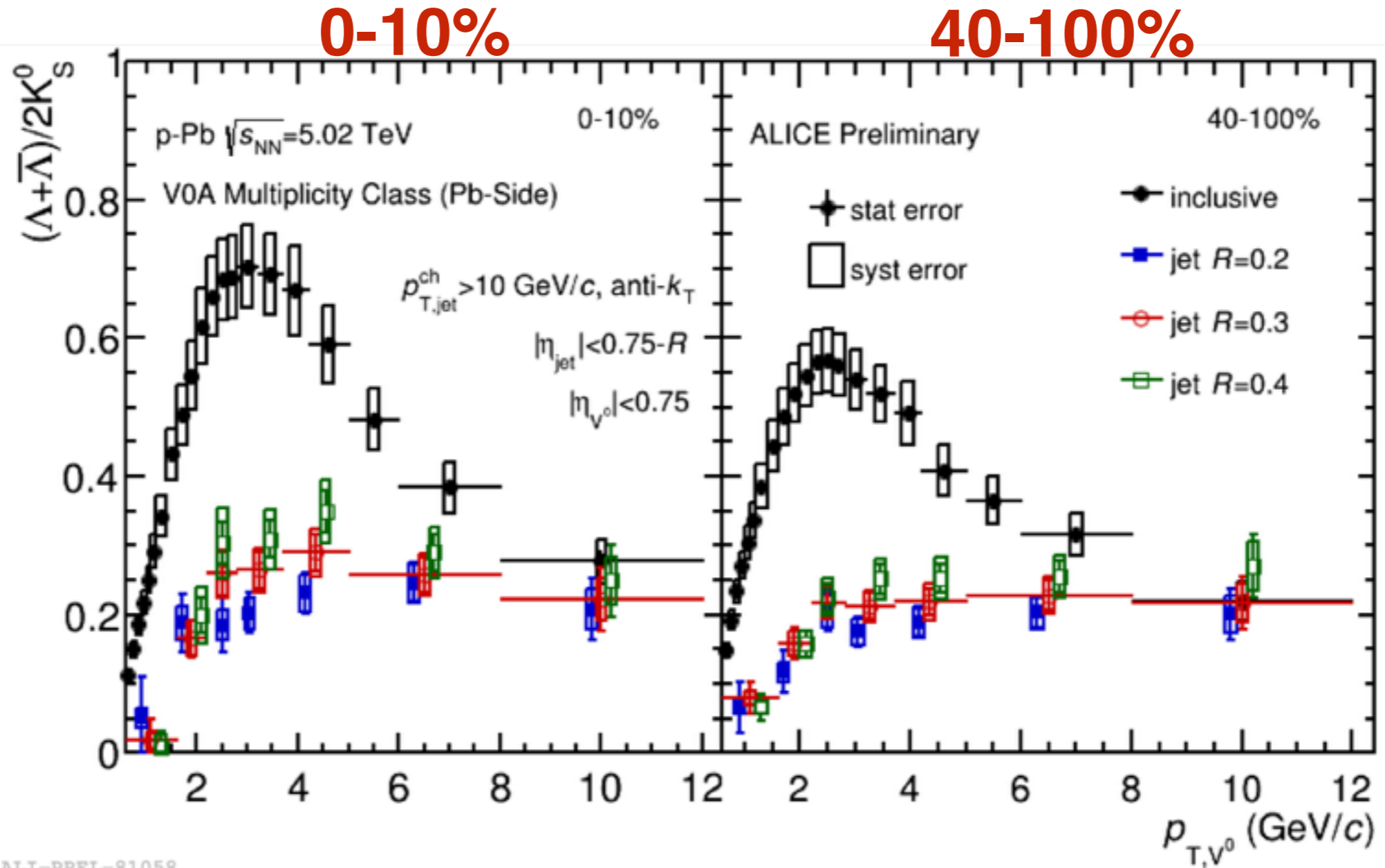
- p_T -differential density: spectra per event and unit acceptance ($\Delta\phi \times \Delta\eta$)
- Much harder distribution as compared to the inclusive - next: Λ/K_S^0 ratio

Λ/K_S^0 Ratio in Jets

p-Pb minimum-bias collisions

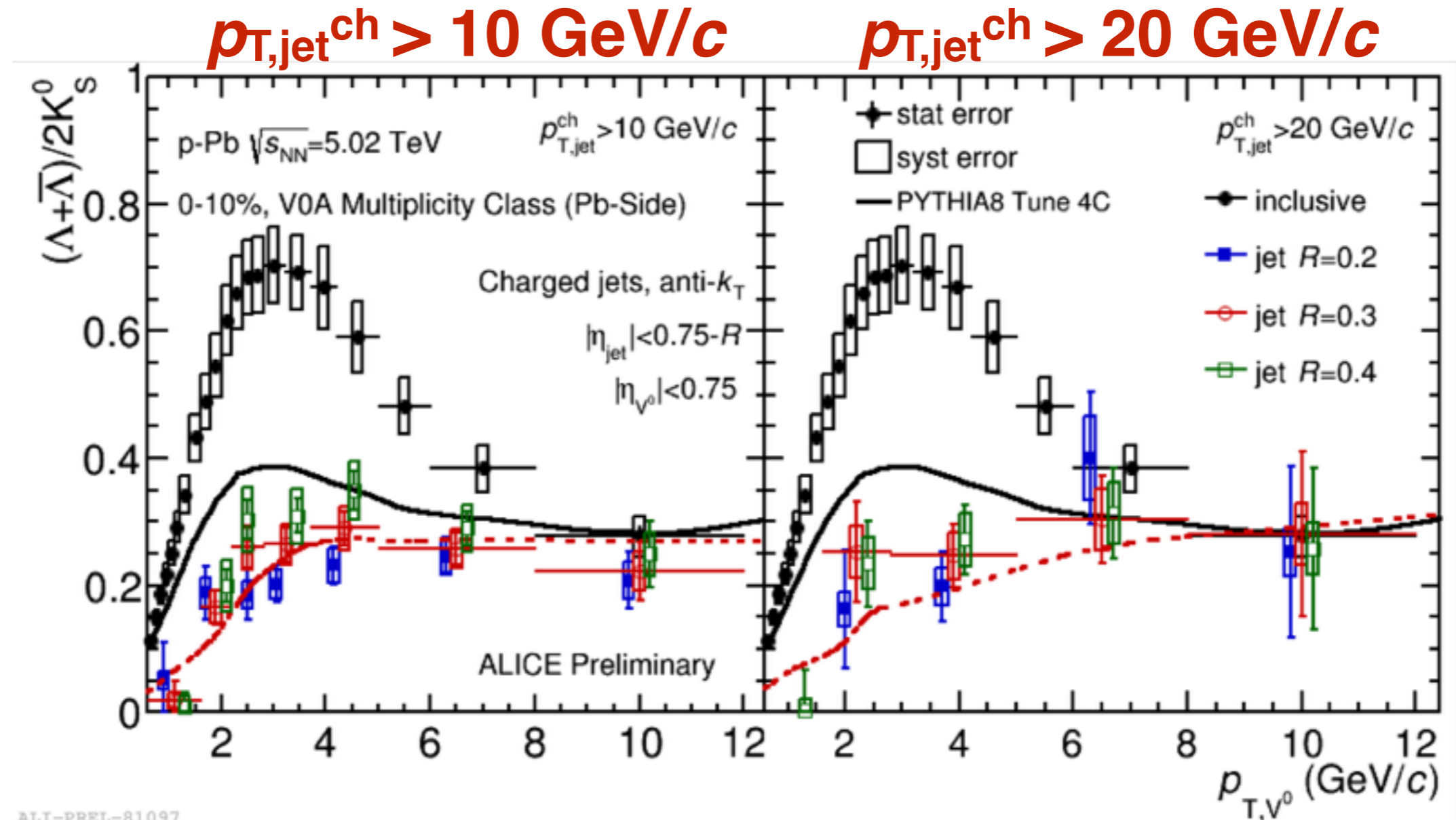


Λ/K_S^0 Ratio in Jets



- Λ/K_S^0 ratio significantly lower in jets than inclusive
- Ratio for different radii is the same within uncertainties
- Similar observation within uncertainties for high and low multiplicity events

Comparison with PYTHIA



ALI-PREL-81097

- PYTHIA8 pp collisions in jets: similar to p–Pb data
- Consistent picture for $p_{T,jet}^{ch} > 10 \text{ GeV}/c$ and $p_{T,jet}^{ch} > 20 \text{ GeV}/c$
 - no significant variation of the Λ/K_S^0 ratio in jets observed

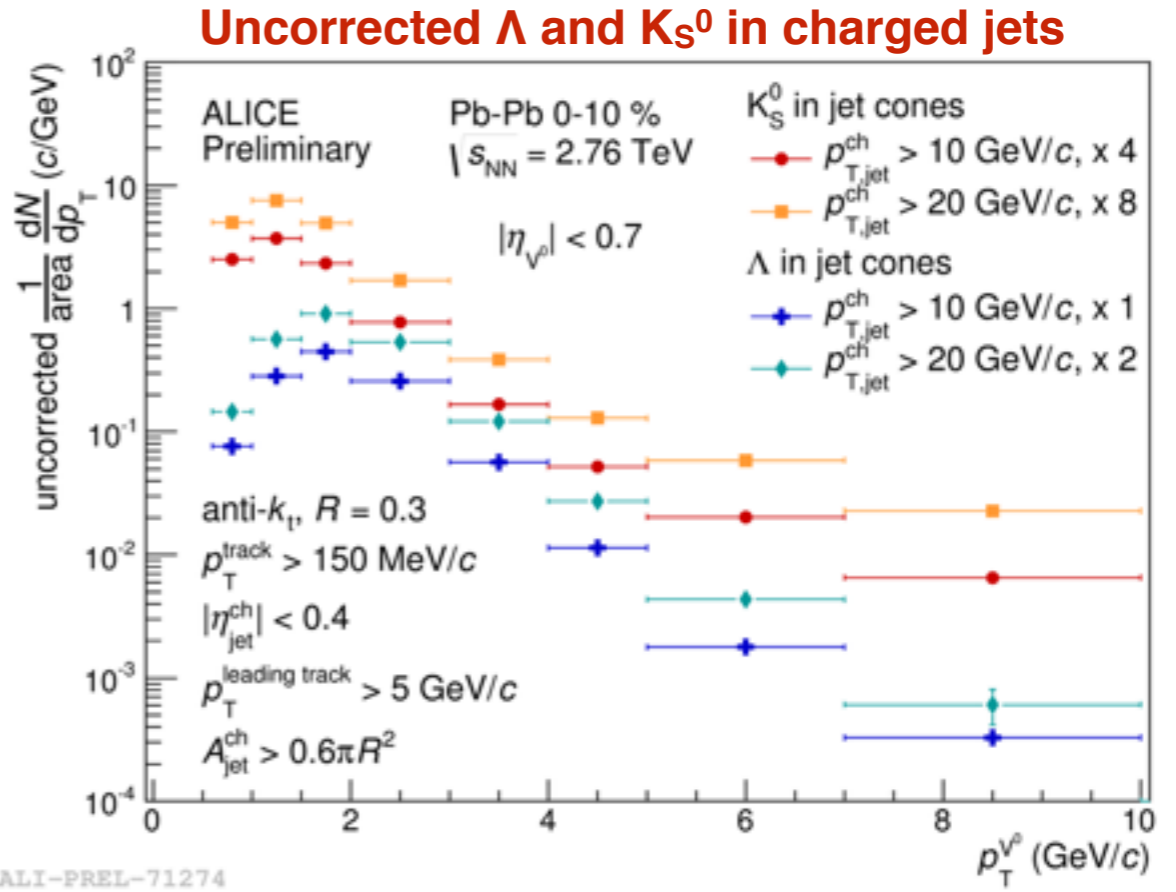
Conclusion

- The first measurement of strange particle production in jets in p–Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV
- Baryon/meson ratio of Λ and K_S^0 well separated into a jet region and the underlying event at intermediate p_T .
- The enhanced ratio of Λ/K_S^0 in p–Pb collisions relative to pp collisions is not present within the jet region
 - It is clearly a feature of the “underlying event” dominated by soft particle production
 - Similar observations for different jet radii and event multiplicity classes
 - Underlying event: an interplay of radial flow and jets with little room for coalescence/recombination mechanism (?)

Outlook

- Measurement with full/charged jets in Pb–Pb collisions

poster: V. Kucera and A. Zimmermann, Tue. May 20th, 16:30, QM2014

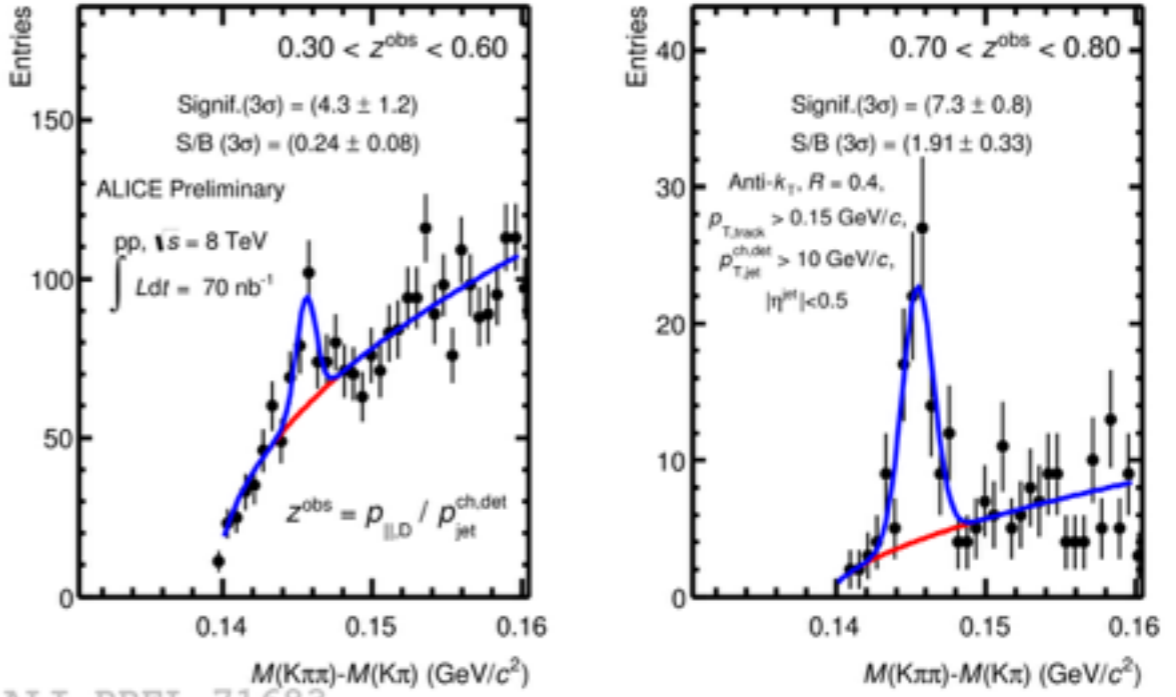


ALI-PREL-71274

- Long term: Baryon/meson ratio in the heavy-flavour sector...

poster: C. Bianchin, Tue. May 20th, 16:30, QM2014

D* candidates in charged jets in pp collisions

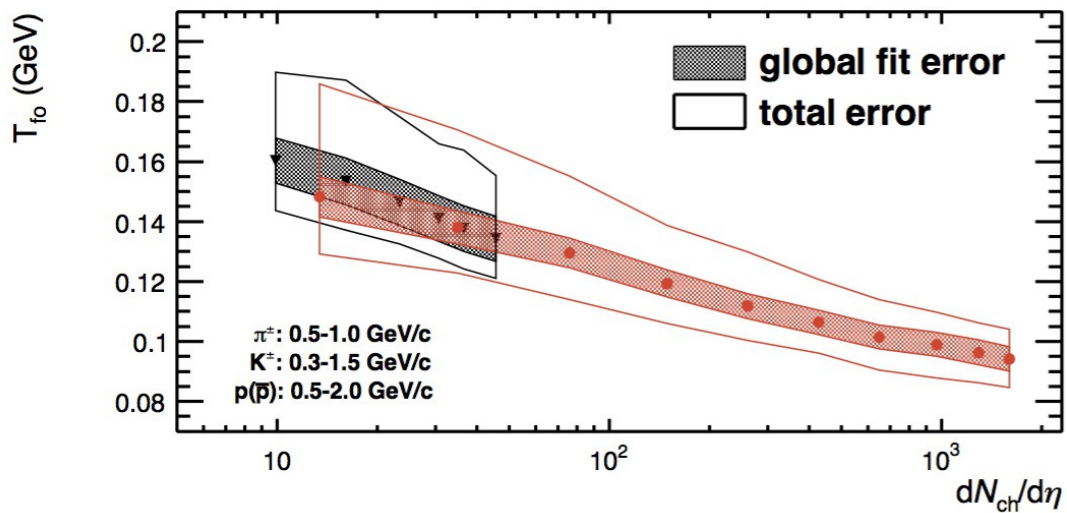
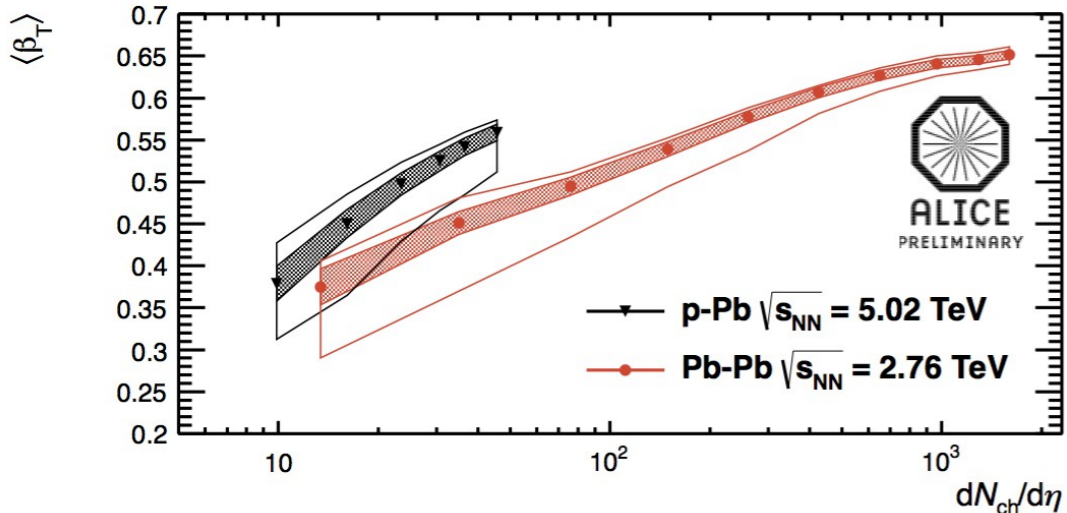


ALI-PREL-71683

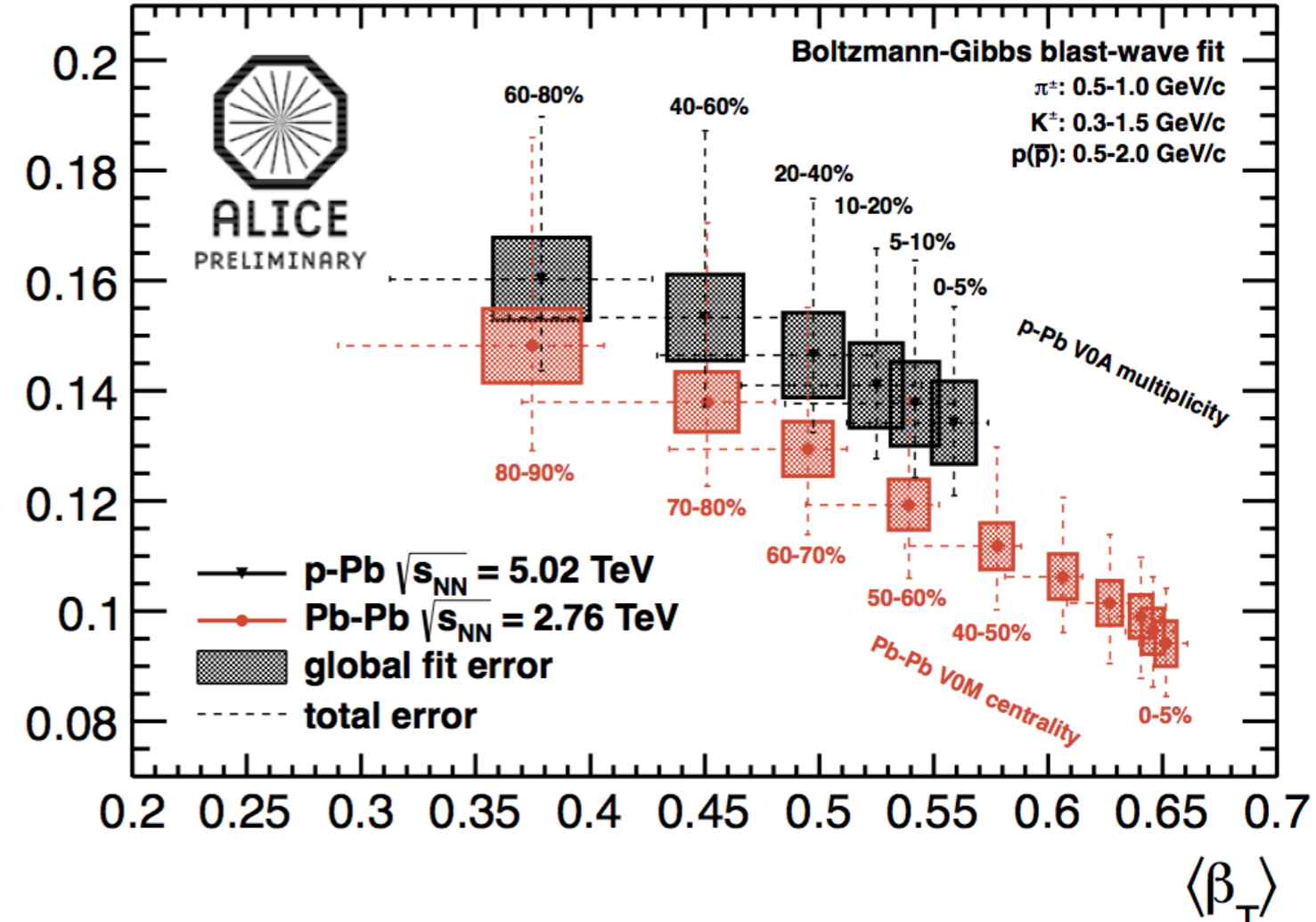


Backup

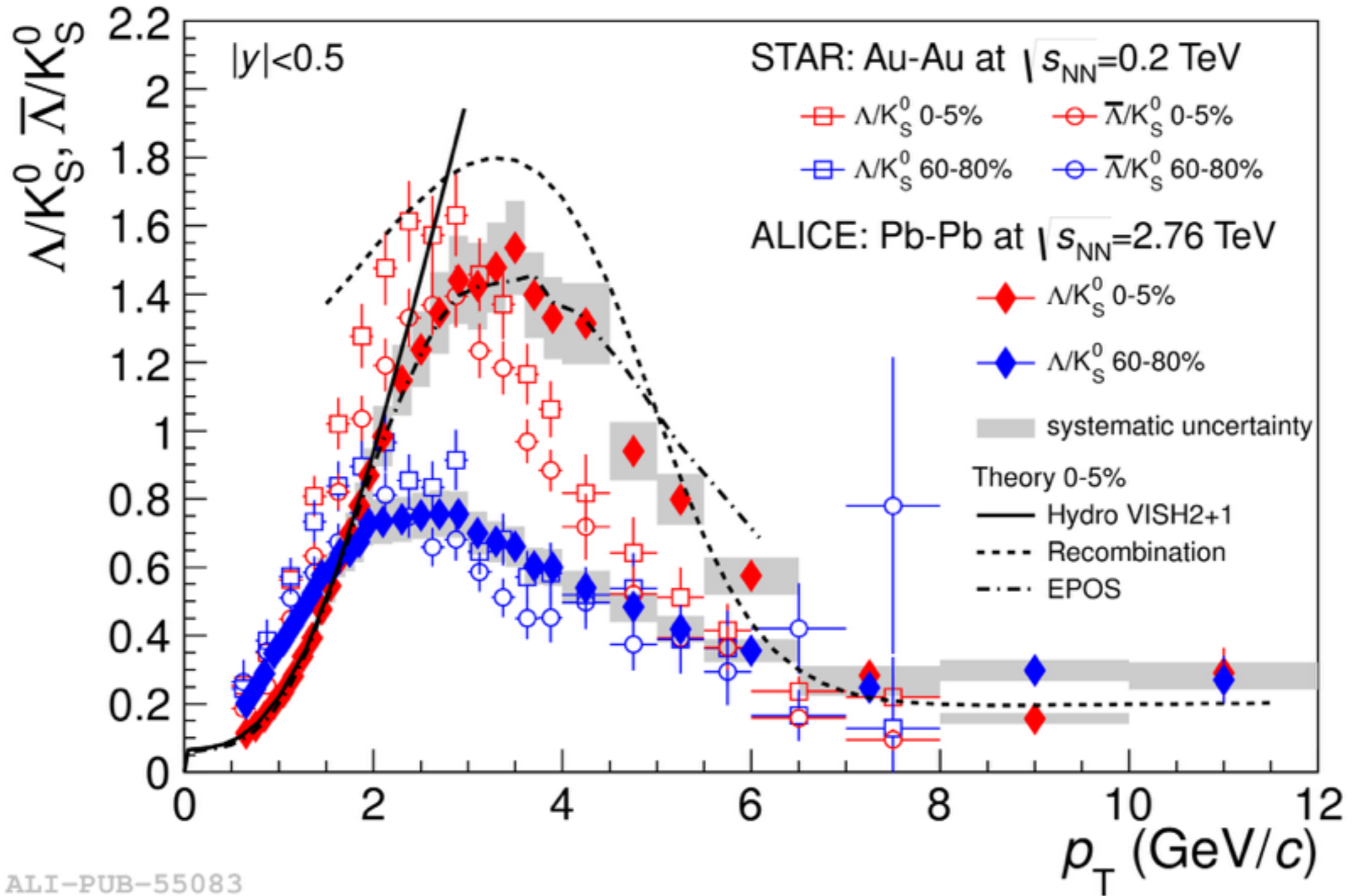
Physics Motivation



T_{fo} (GeV)



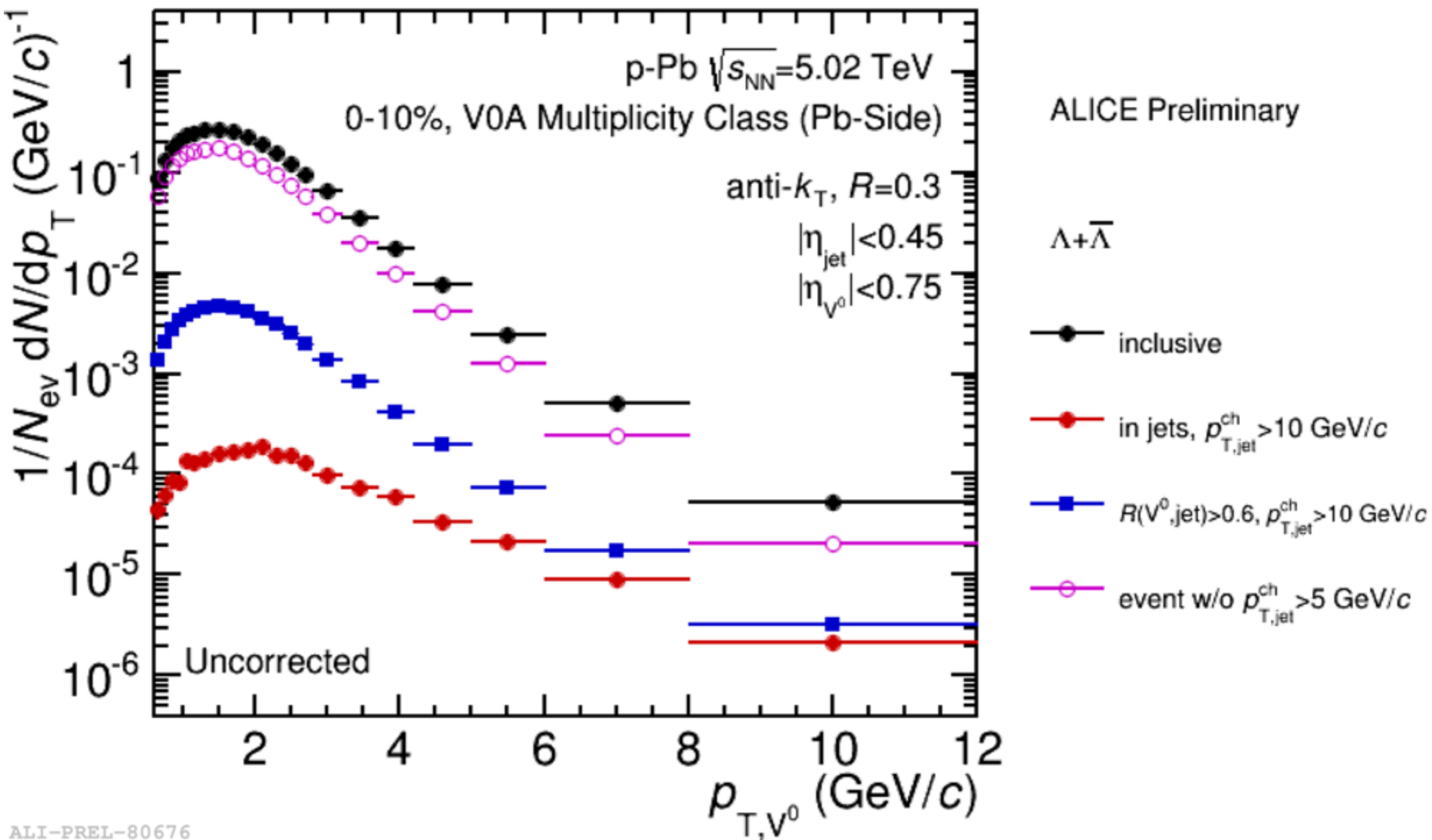
Physics Motivation



Systematic Uncertainty

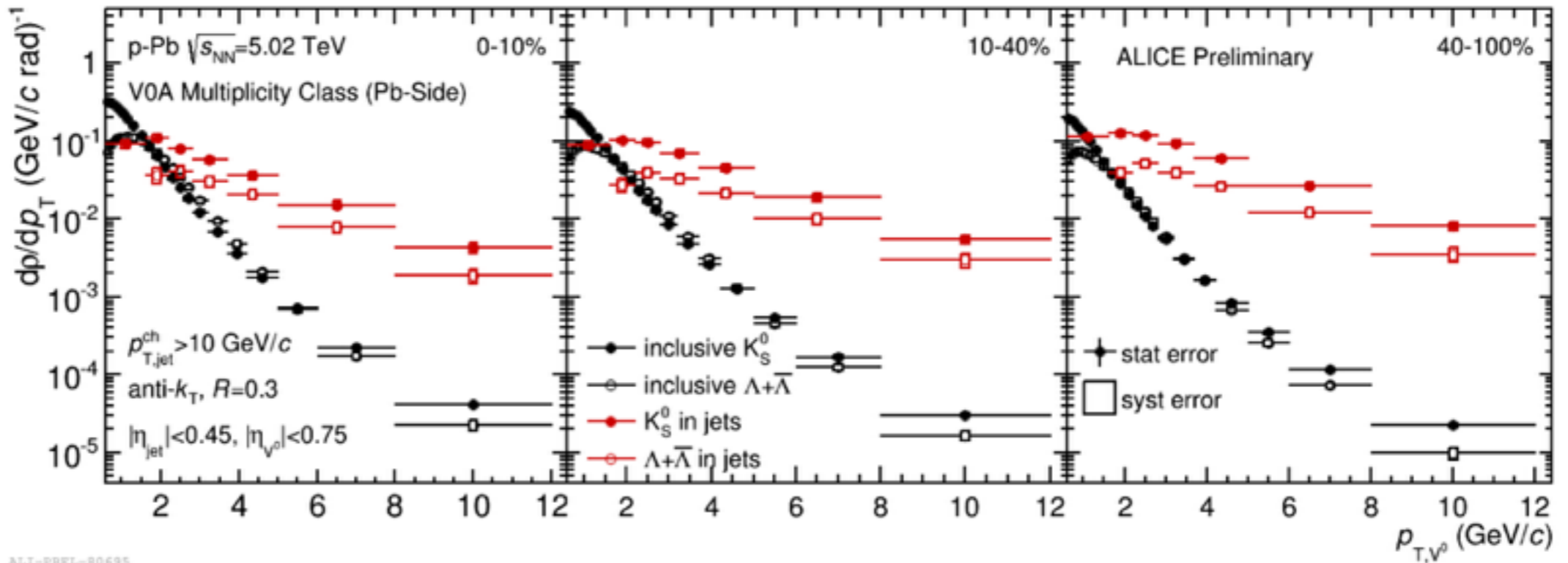
- **Uncertainty on V^0 candidates selection:**
 - by varying the decay topology cut in data and MC simultaneously
 - 2–5% for K_S^0 and 3–6% for Λ
- **Uncertainty on V^0 signal extraction:** 6% (10%) in $p_{T,jet} > 10$ GeV/c (20 GeV/c)
- **Uncertainty on underlying event selection:** $\sim 10\%$ ($\sim 2\%$) at low (high) p_T
- **Uncertainty from jet p_T scale (affected by the jet background fluctuations):**
 - obtained by spectra variations when jet p_T varied within 20%
 - $\sim 1\%$ at low- p_T GeV/c; 10% at high- p_T
 - correlated with jet p_T , almost cancels in Λ/K_S^0 ratio
- **Uncertainty on feed-down correction:** $\sim 5\%$
 - correlated with Λ the production

Underlying Event Estimation

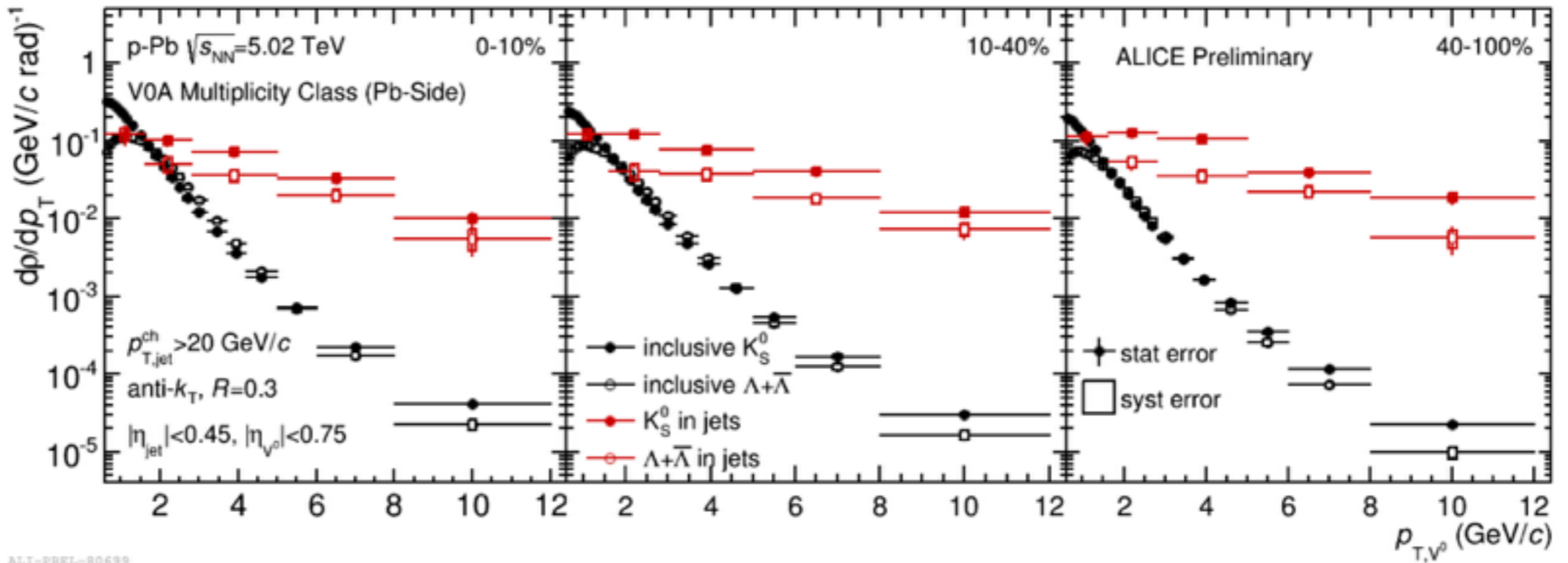


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p_T -differential Density of V^0 s in Jets

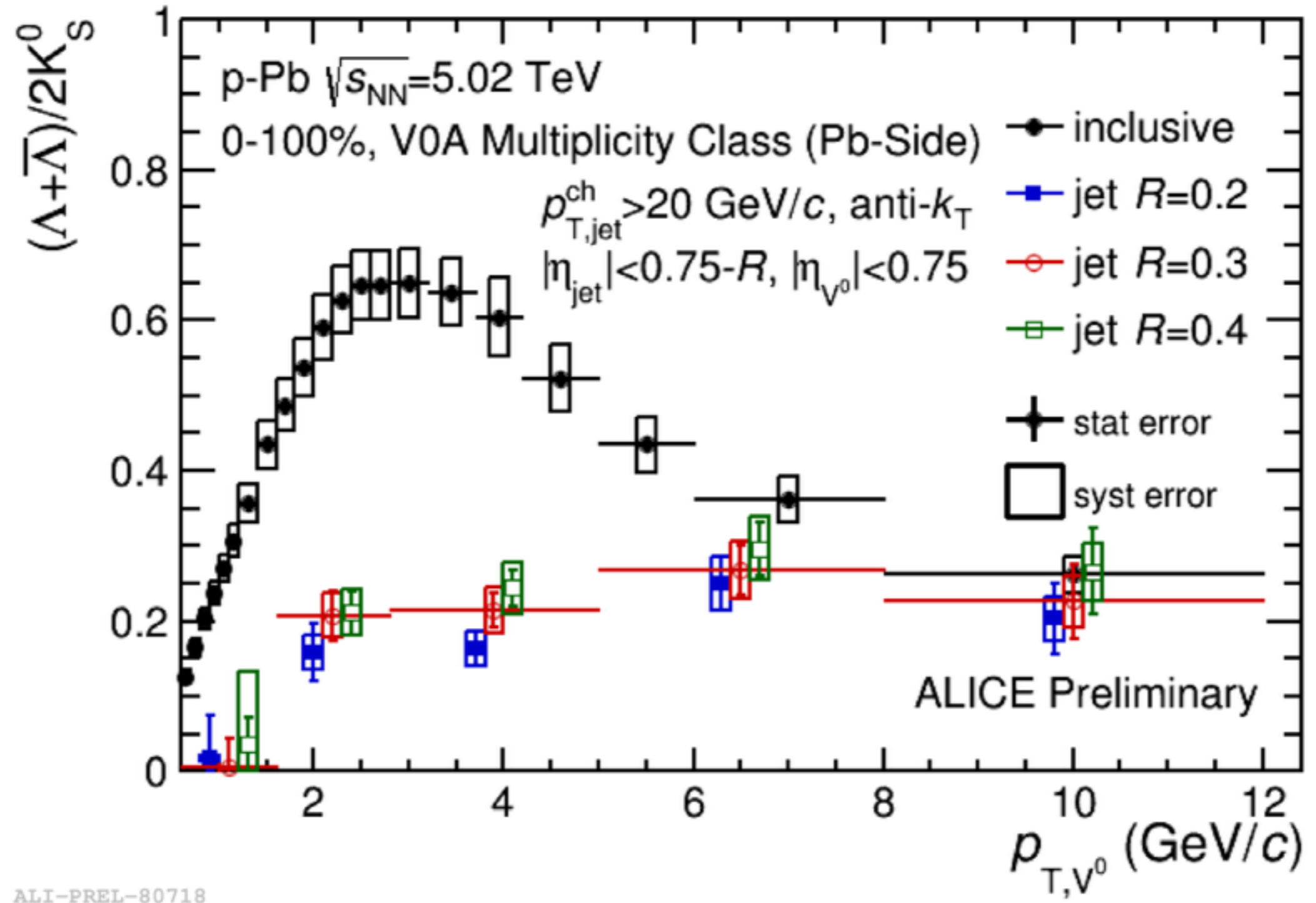


ALI-PREL-80695



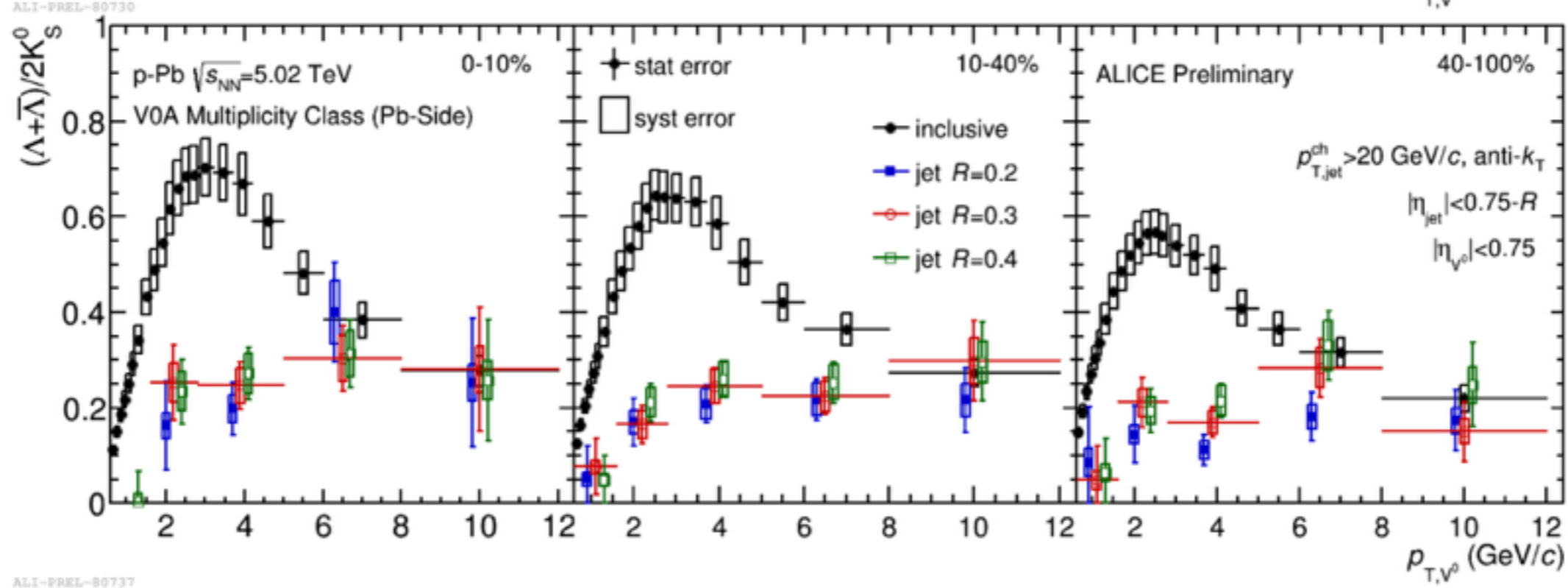
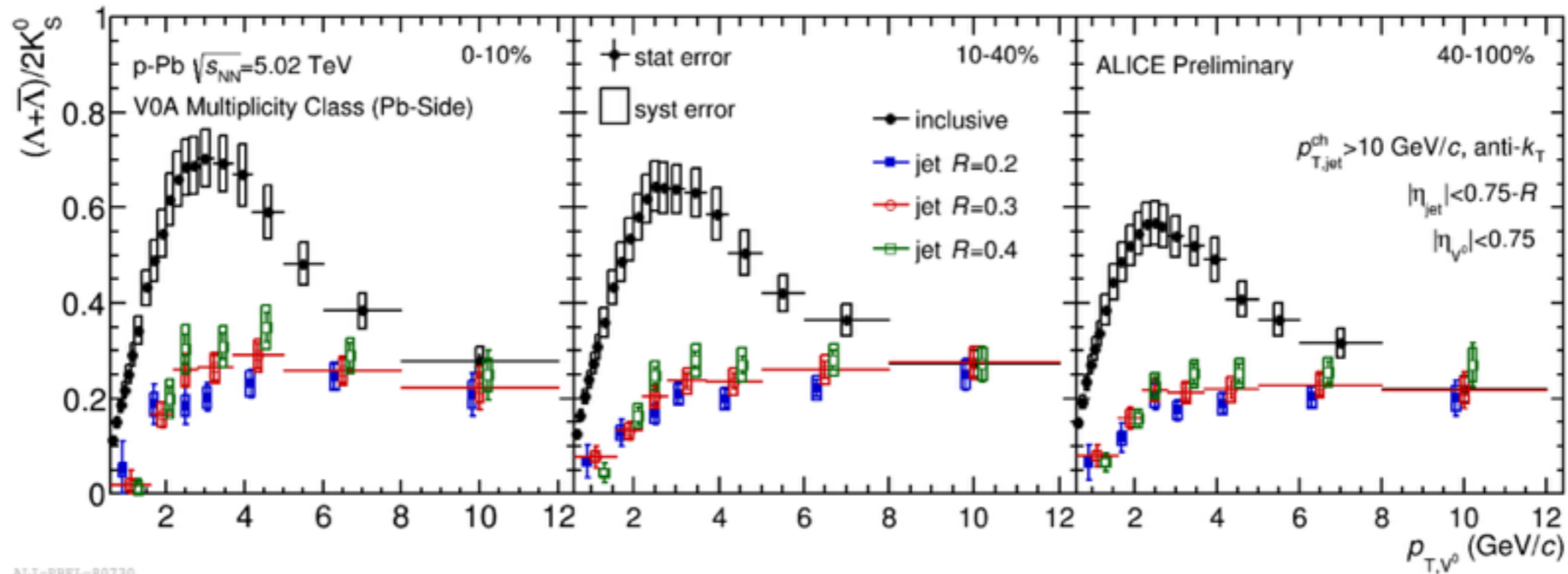
ALI-PREL-80699

Λ/K_S^0 Ratio in Jets

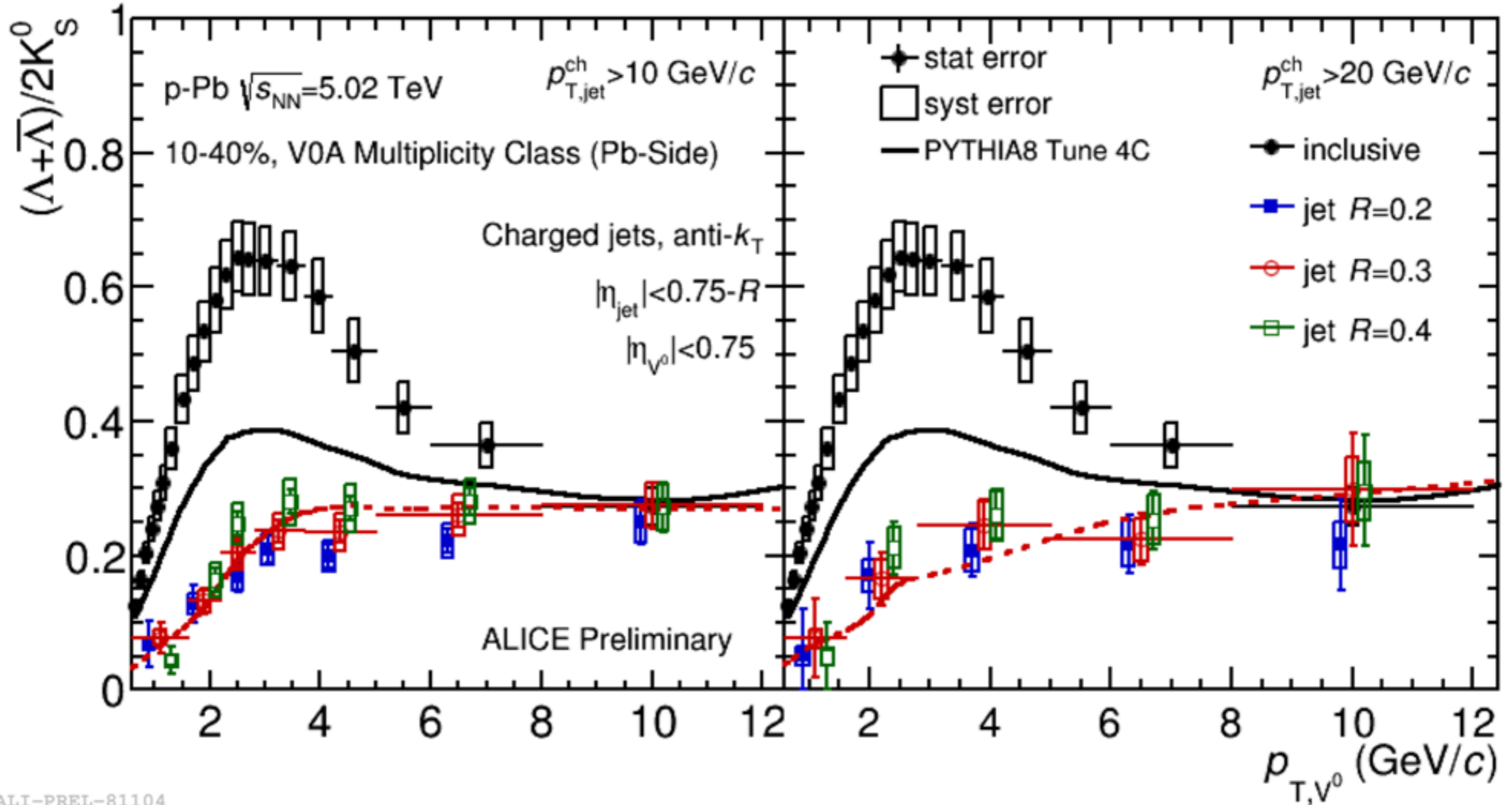


ALI-PREL-80718

Λ/K_S^0 Ratio in Jets

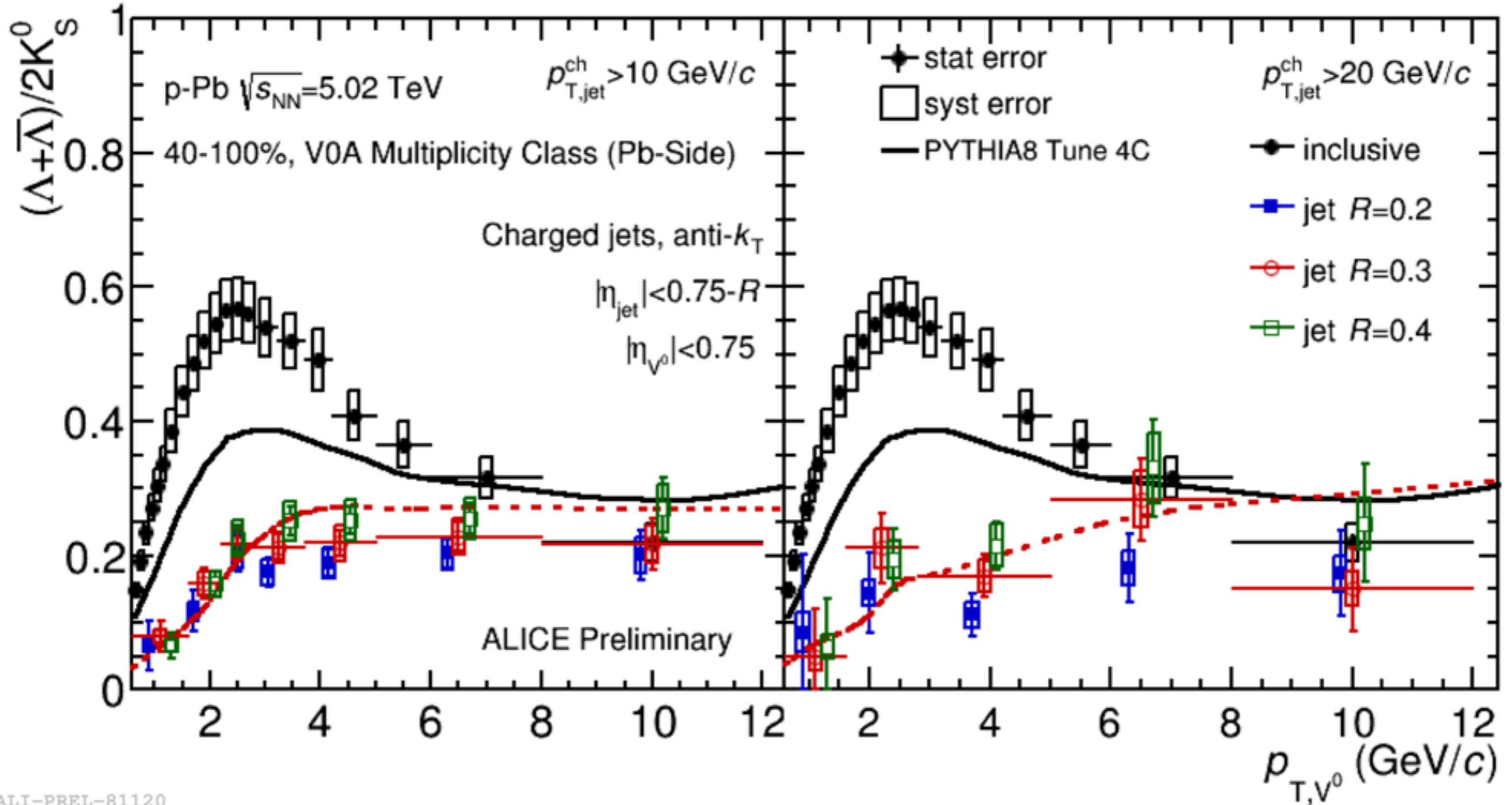


Comparison with PYTHIA



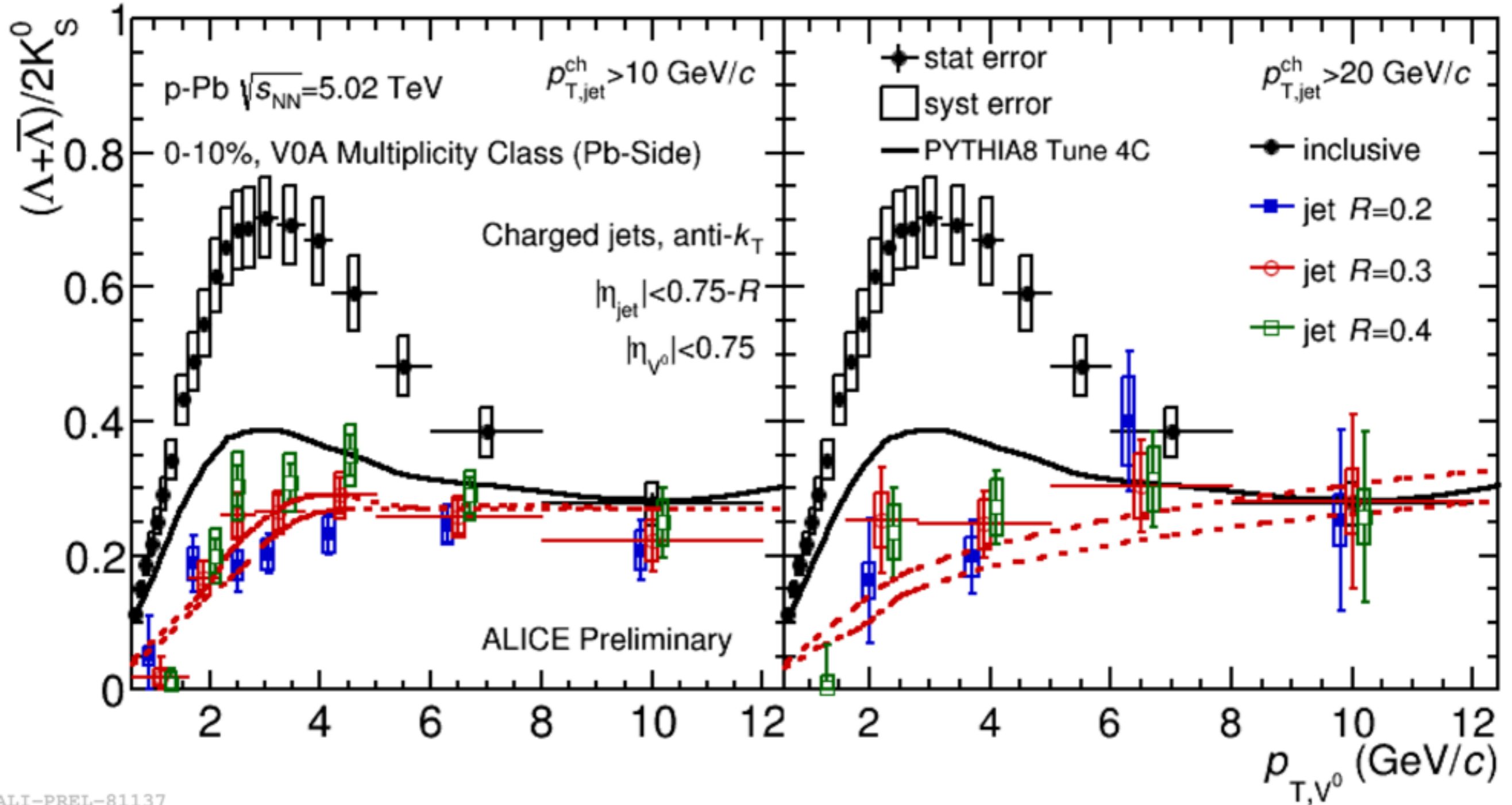
ALI-PREL-81104

Comparison with PYTHIA



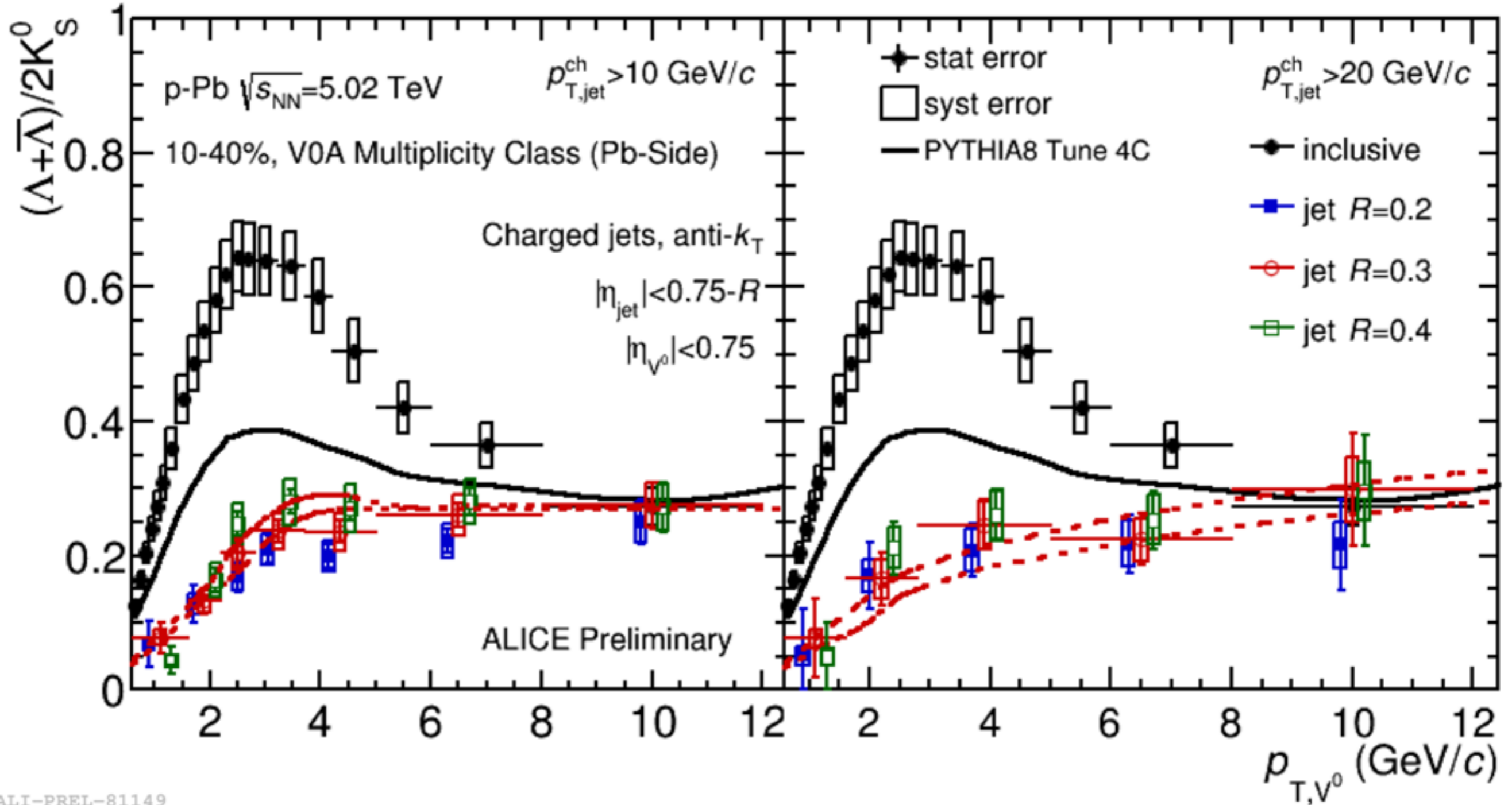
ALI-PREL-81120

Comparison with PYTHIA



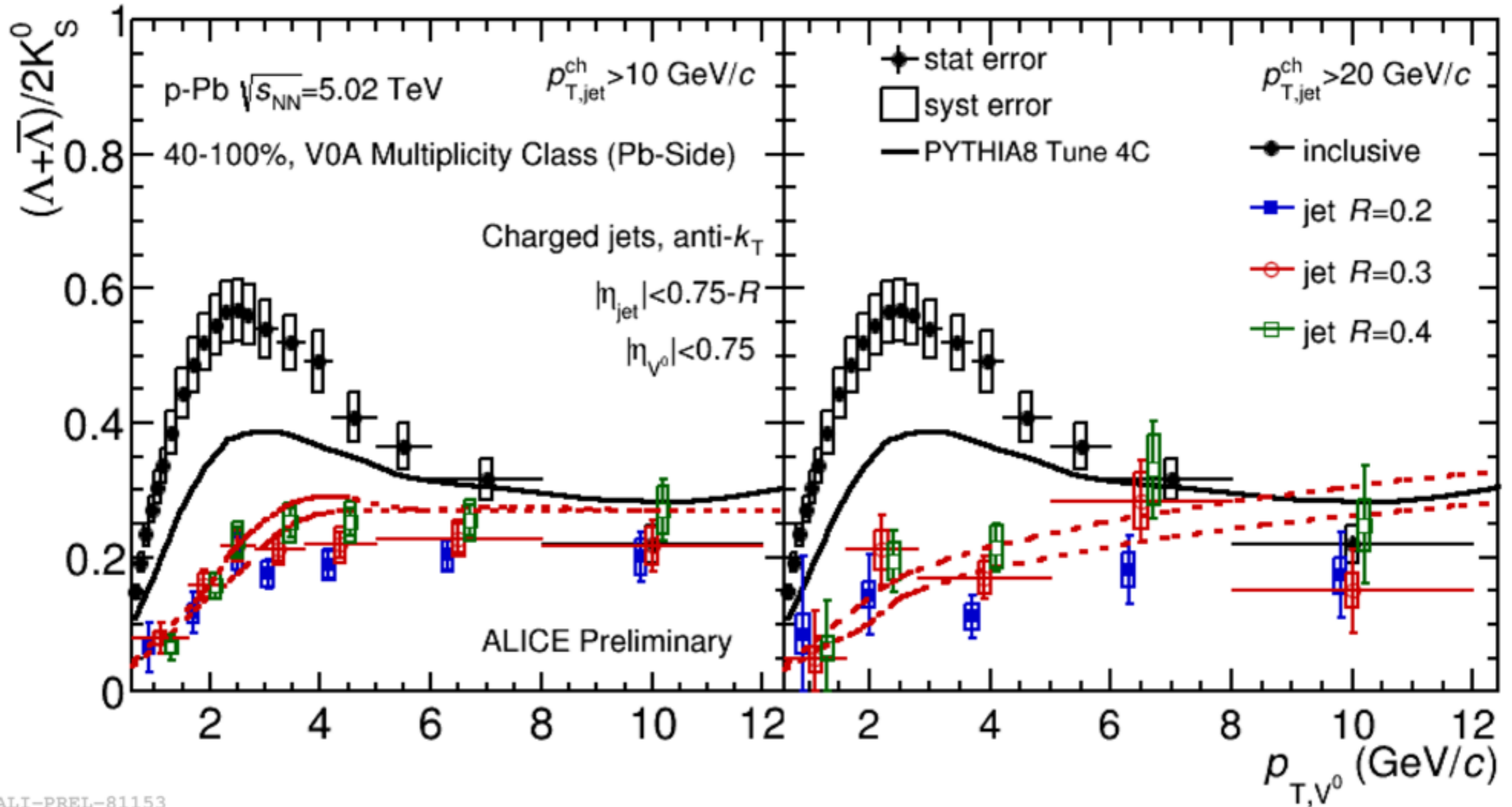
ALI-PREL-81137

Comparison with PYTHIA



ALI-PREL-81149

Comparison with PYTHIA



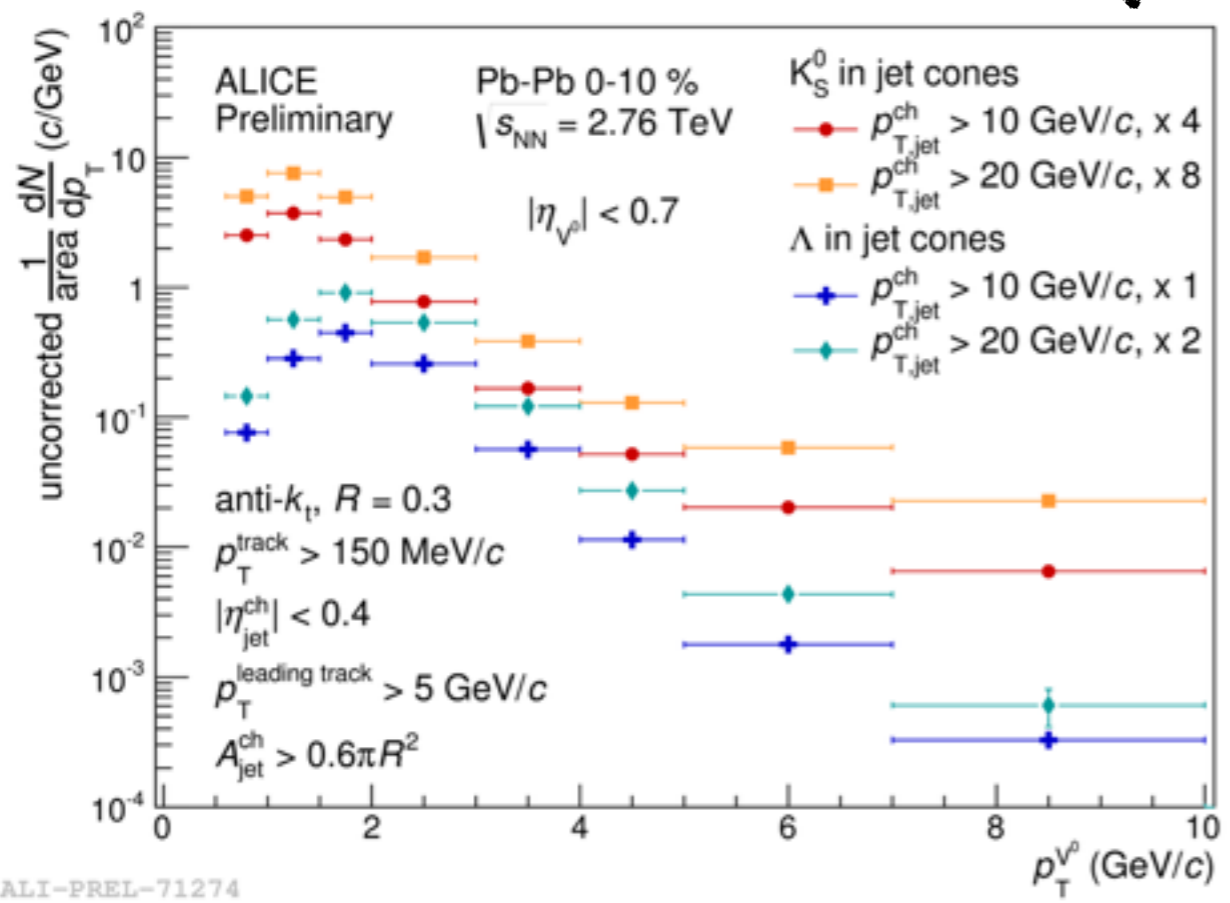
ALI-PREL-81153

Outlook

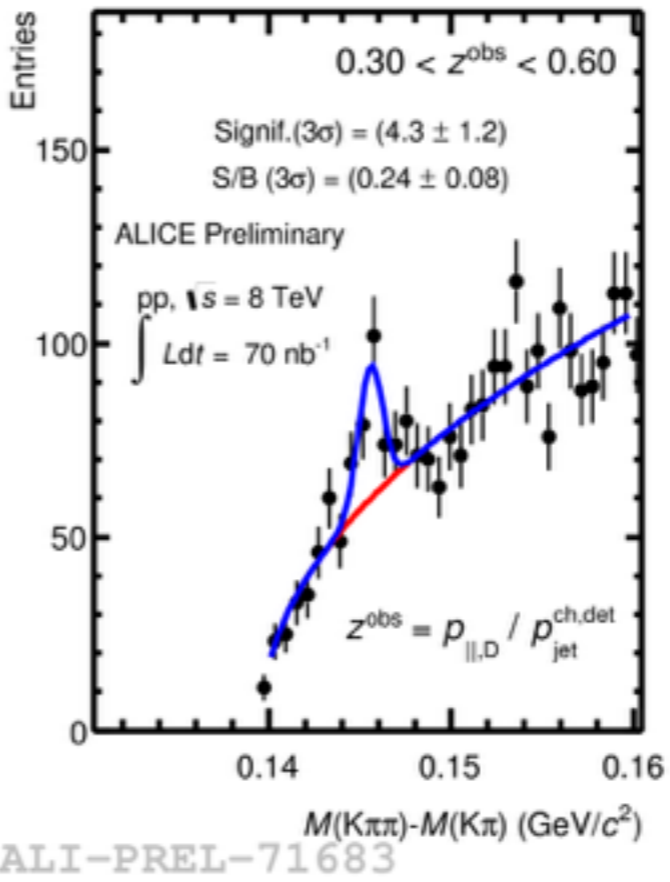
- Measurement with full/charged jets in Pb–Pb collisions
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- Long term: Baryon/meson ratio in the heavy-flavour sector...
 poster: C. Bianchin, Tue. May 20th, 16:30, QM2014

Uncorrected Λ and K_S^0 in charged jets

D^* candidates in charged jets in pp collisions



ALI-PREL-71274



ALI-PREL-71683

