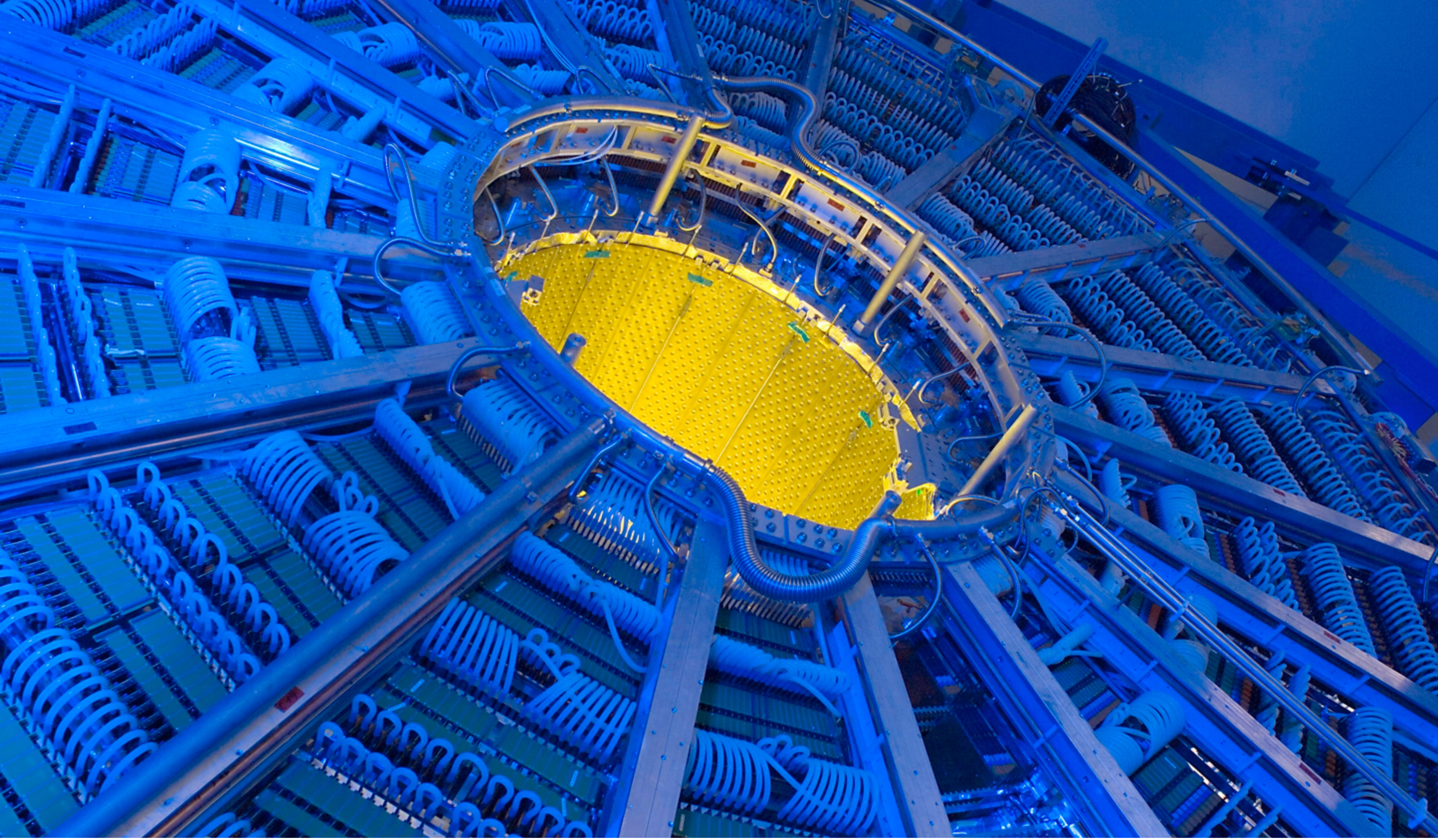

# Light Flavor Production in the ALICE Experiment

Michele Floris (CERN)
for the ALICE Collaboration
Kruger, December 4th, 2014


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## pp Collisions

- (Soft) QCD
- Monte Carlo tuning
- Pb–Pb reference

## Pb-Pb Collisions

- Bulk properties
- Collective behavior
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A rich "Zoo"

$\pi$ $K^{\pm}$ p

d He

$K^0$ $\Lambda$ $\Xi$

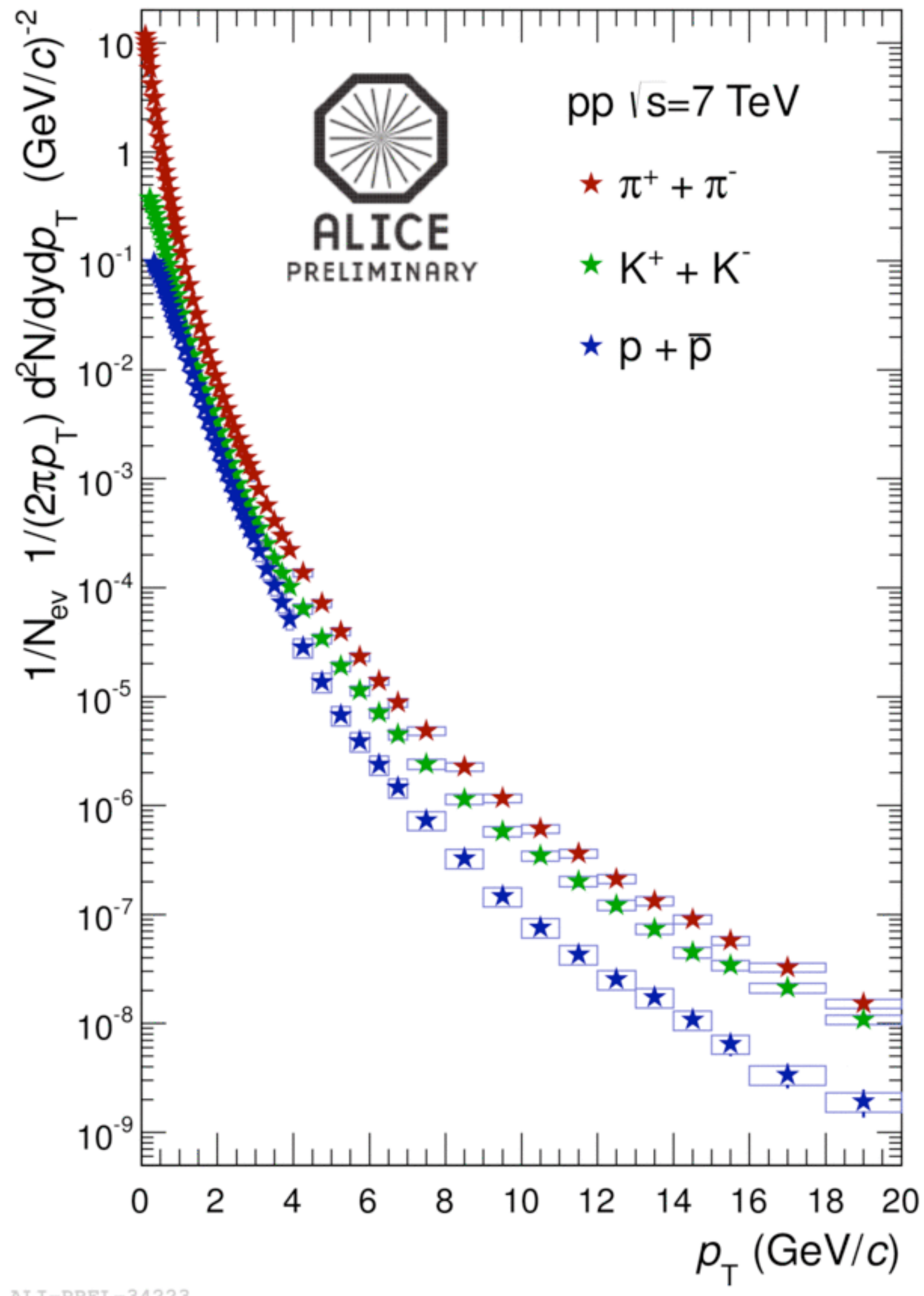
$\Omega$ $^{3}_{\Lambda}H$

$K^*$ $\phi$ $\Sigma^*$

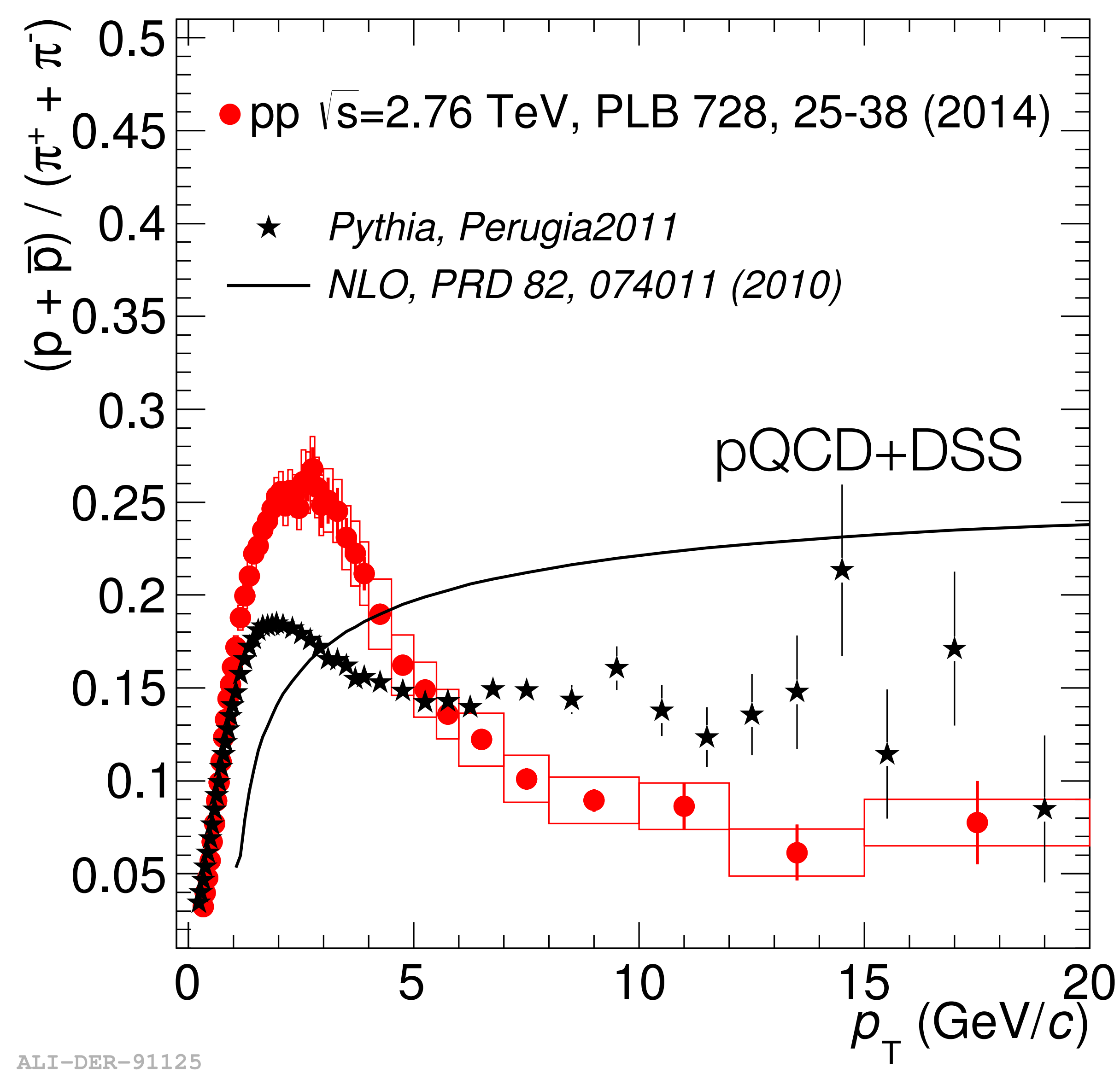
$\Lambda^*$

- PID
- Low mass tracker
- Vertexing

# π, K, p transverse momentum distributions

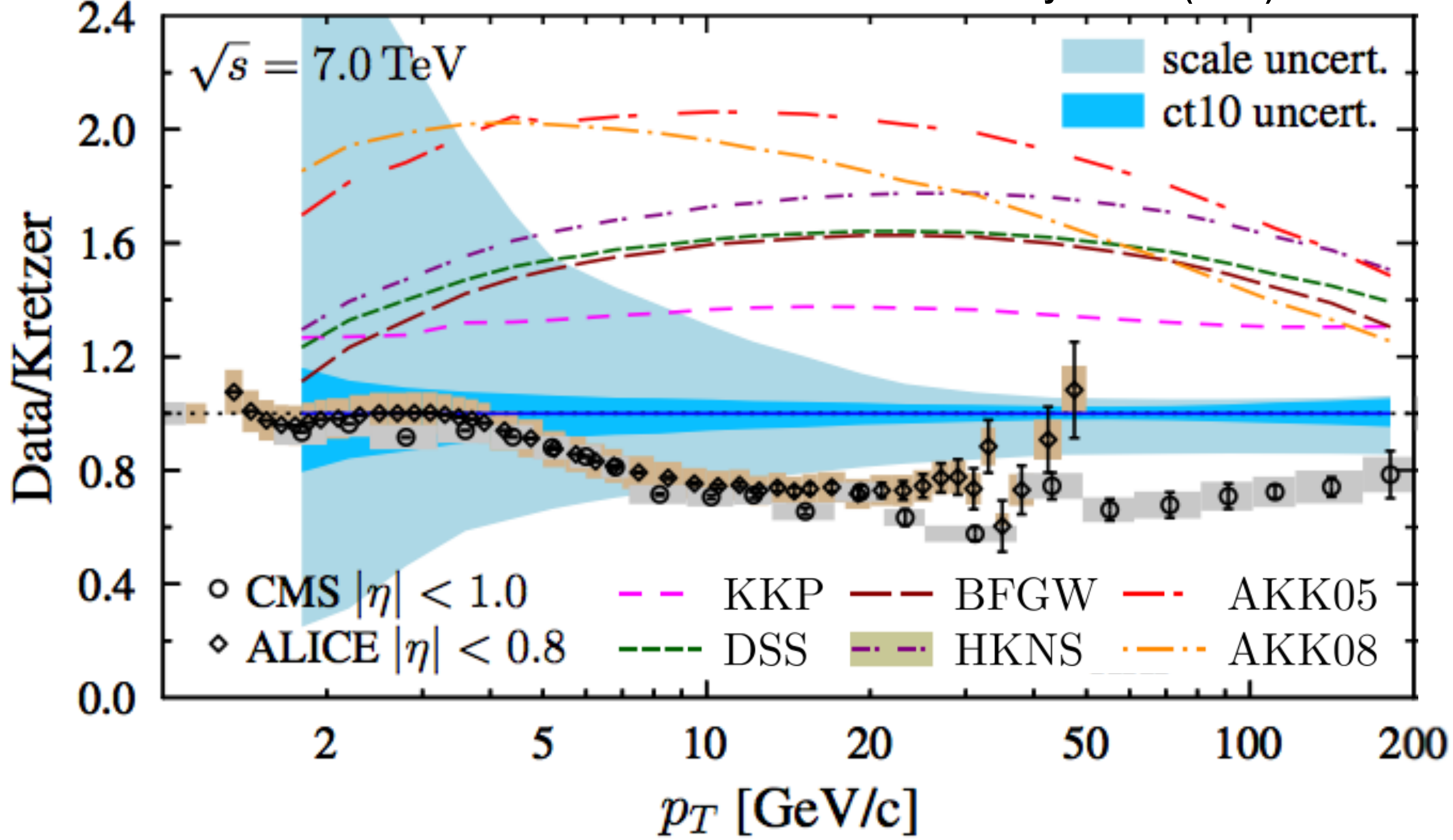



- Wide $p_T$ range: ~100 MeV < $p_T$ < 20 GeV/$c$
- Reference for energy loss studies in Pb-Pb
- Monte Carlo tuning
- pQCD studies and constraints for Fragmentation Functions



# Fragmentation Functions

Nucl.Phys. B883 (2014) 615-628




Large differences between different sets of FF

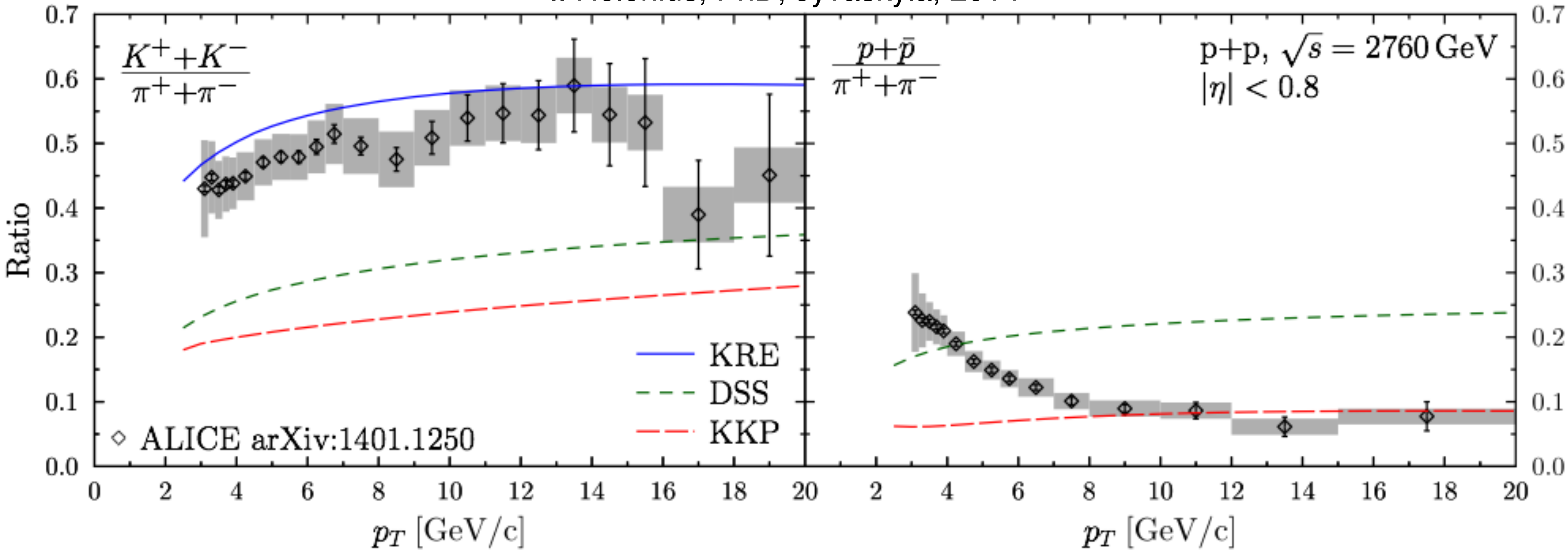
Gluon-to-hadron too hard?

**Identified particles**: stronger constraints

⇒ Calls for a global reanalysis of FF

(see e.g. arXiv:1410.6027)

I. Helenius, PhD, Jyvaskyla, 2014

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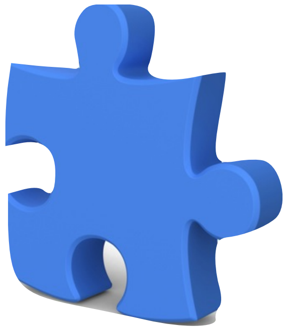
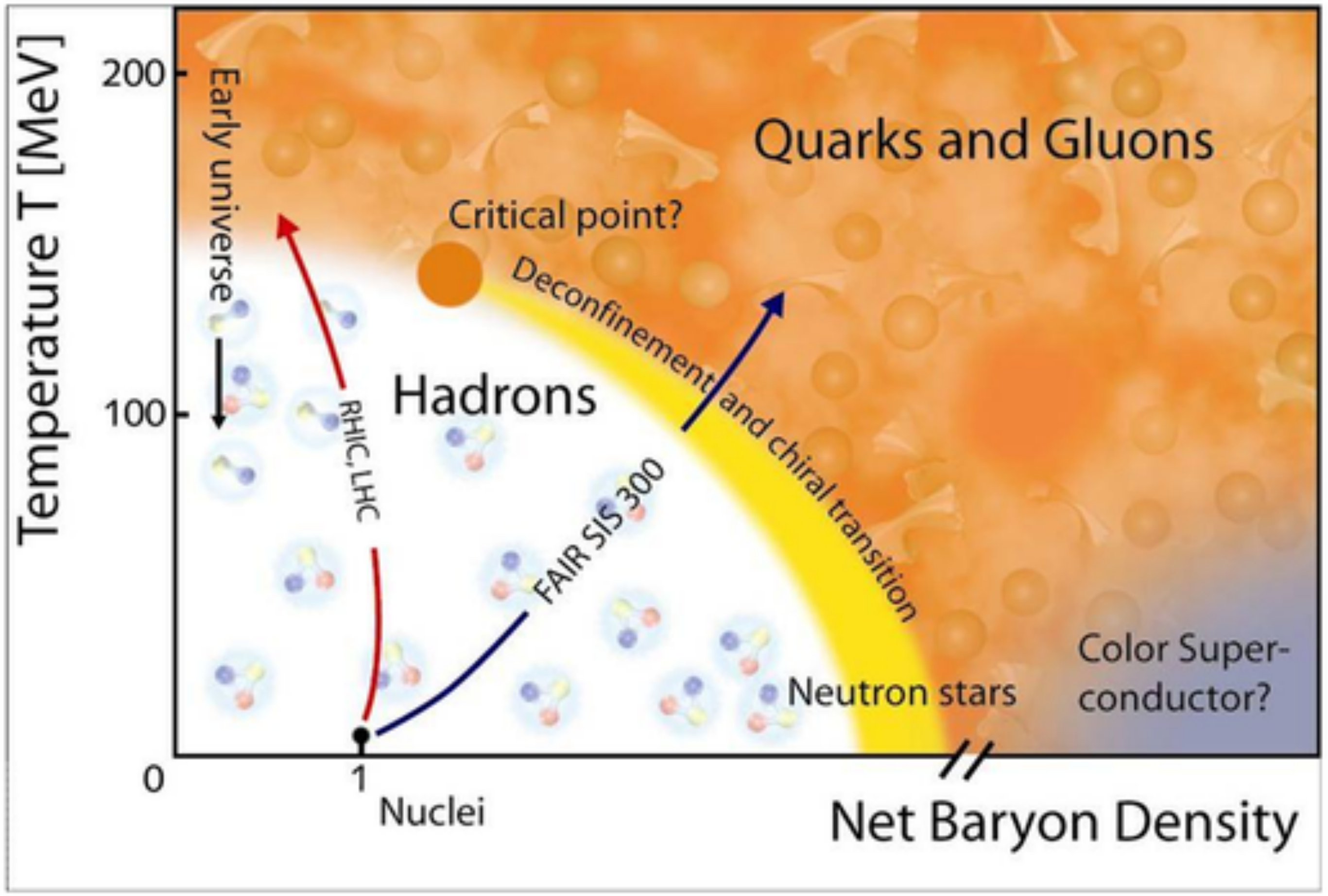


# Heavy-Ion Collisions Evolution



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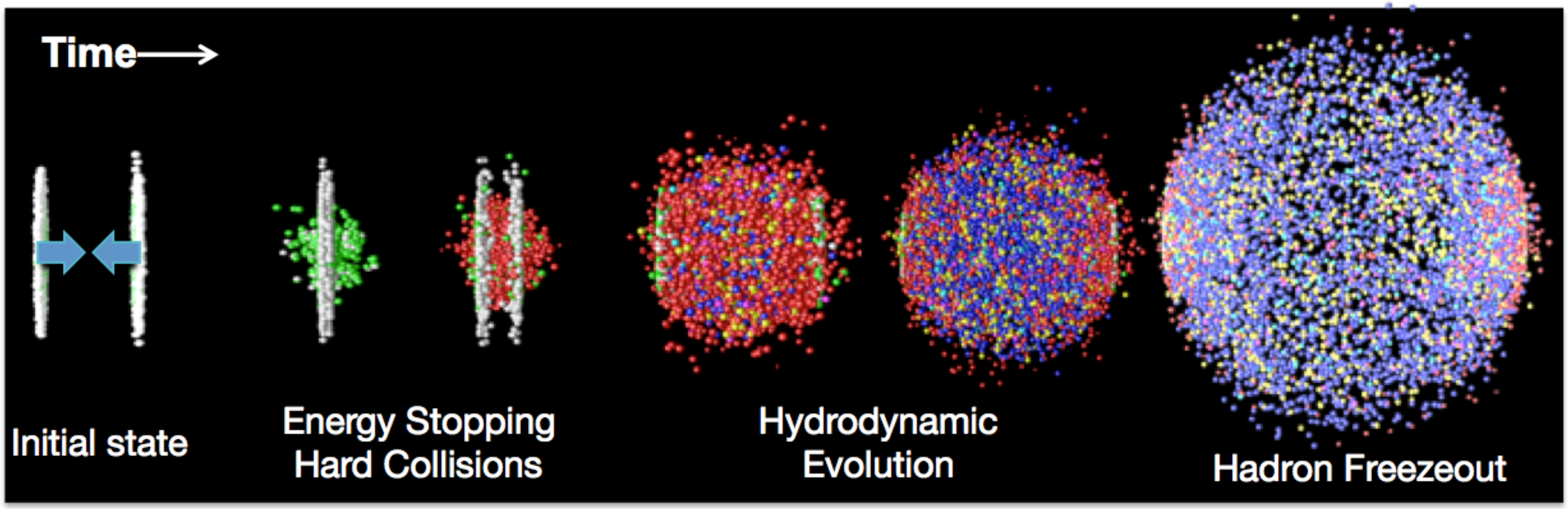


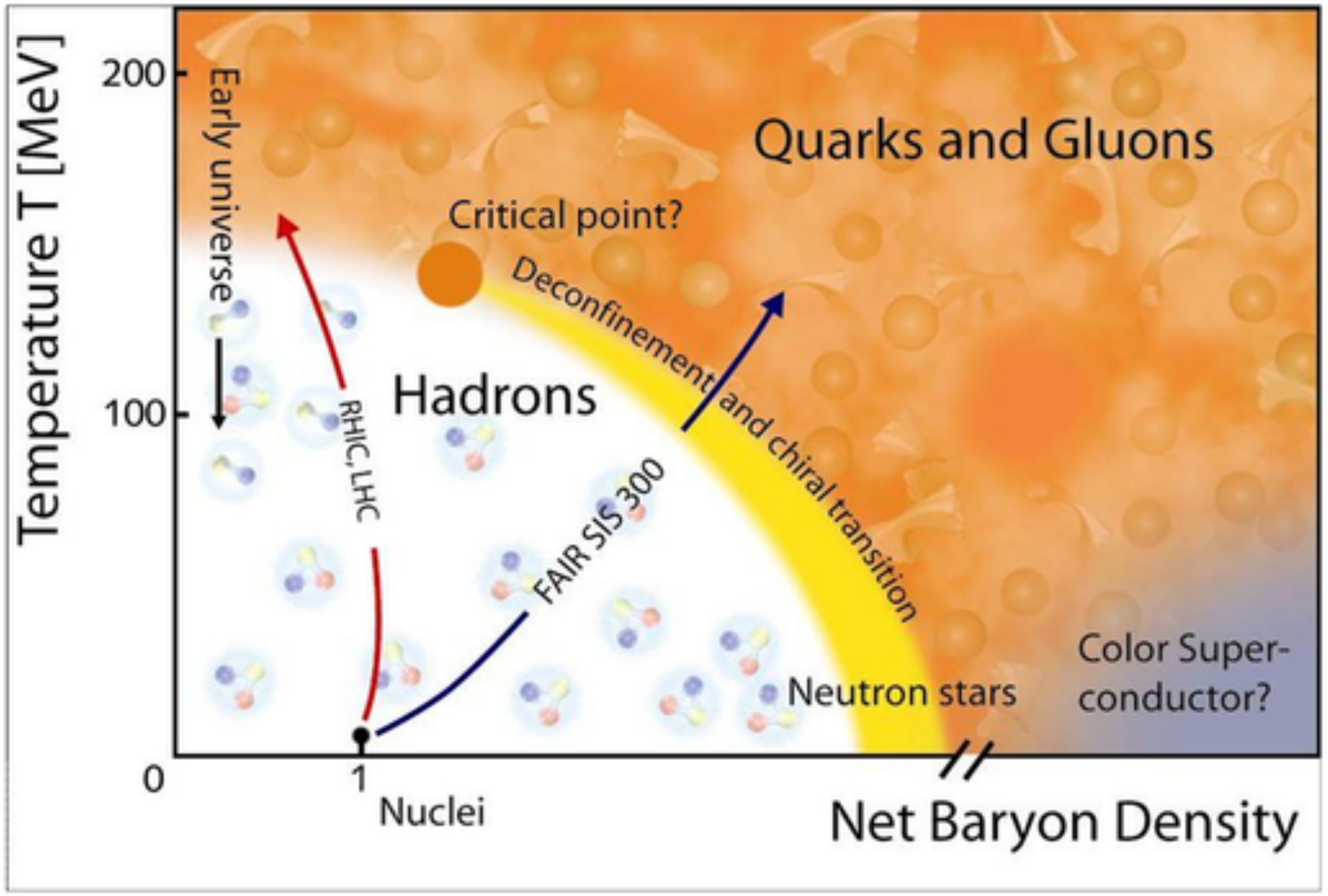

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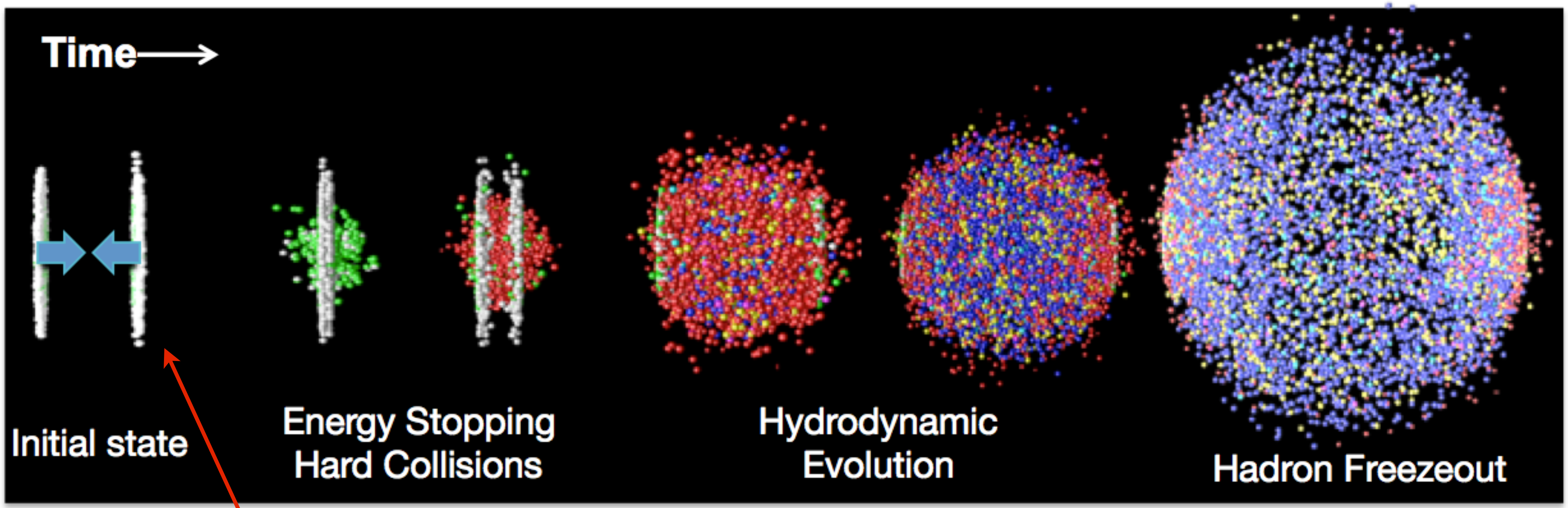


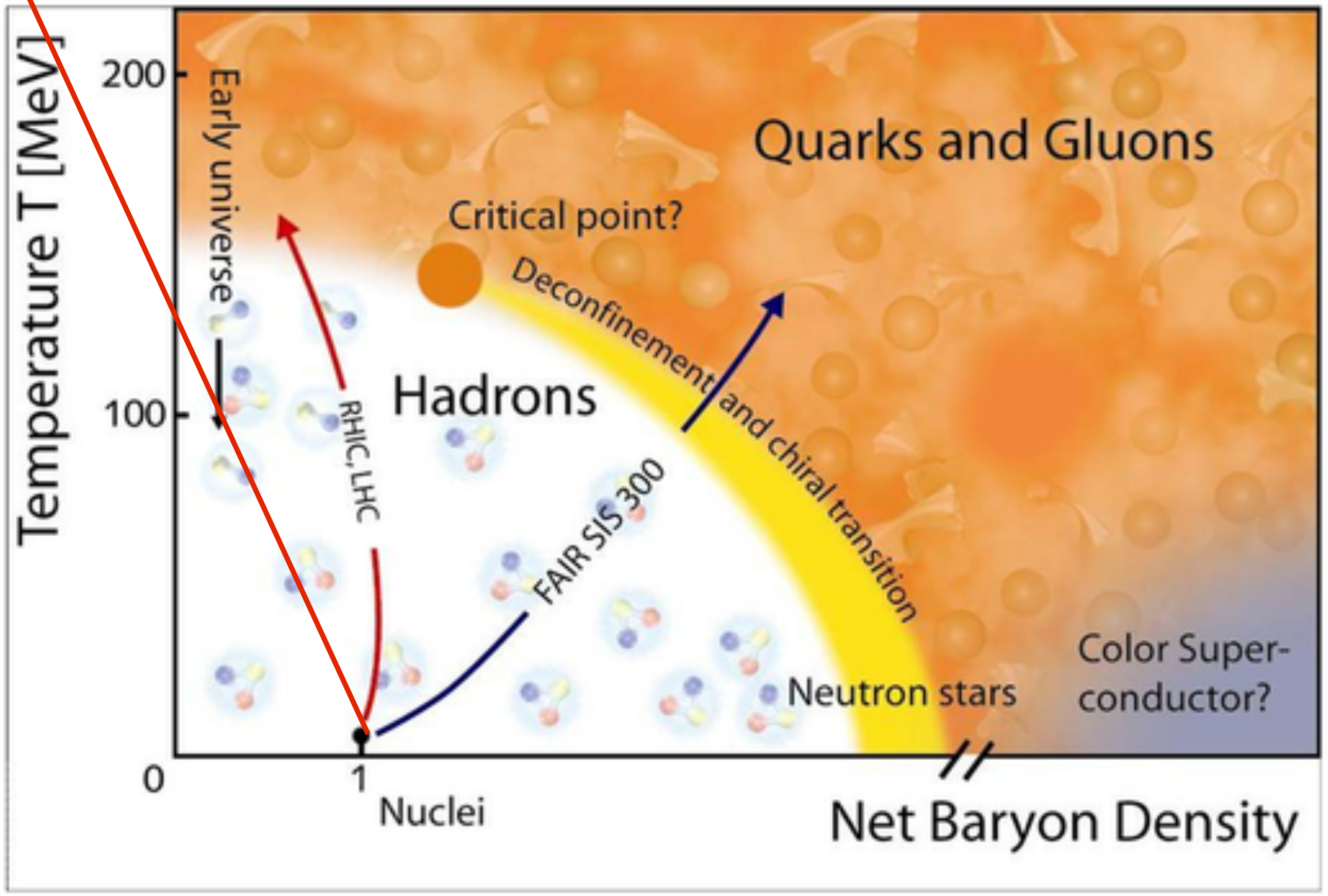

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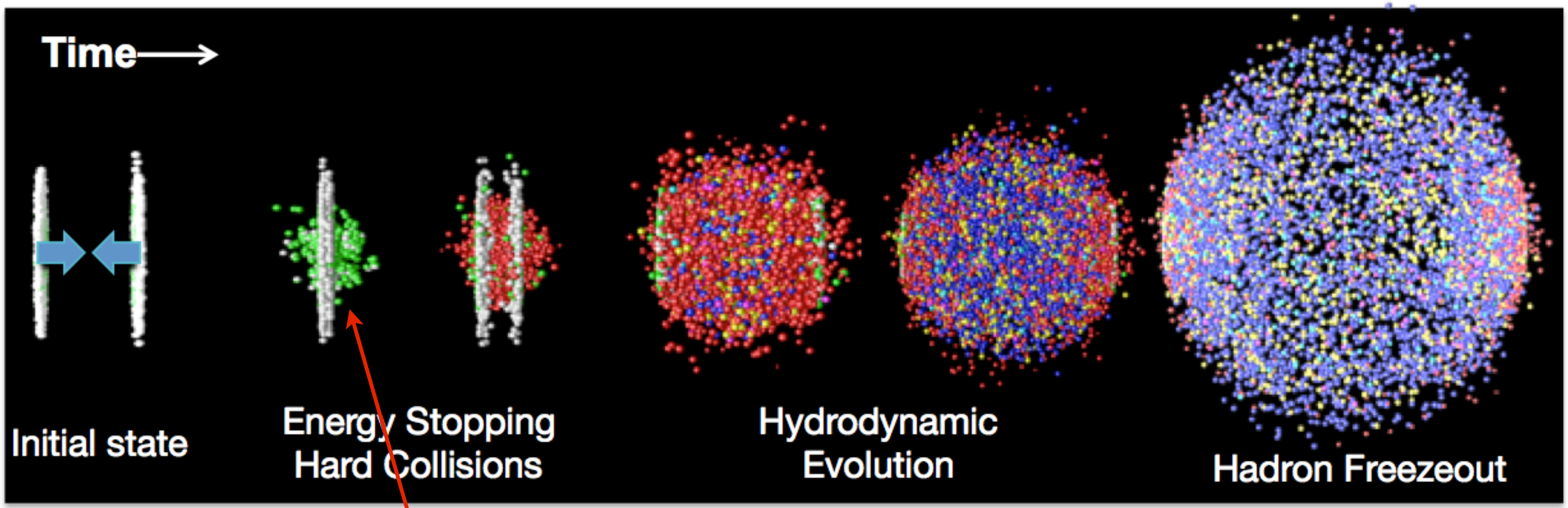
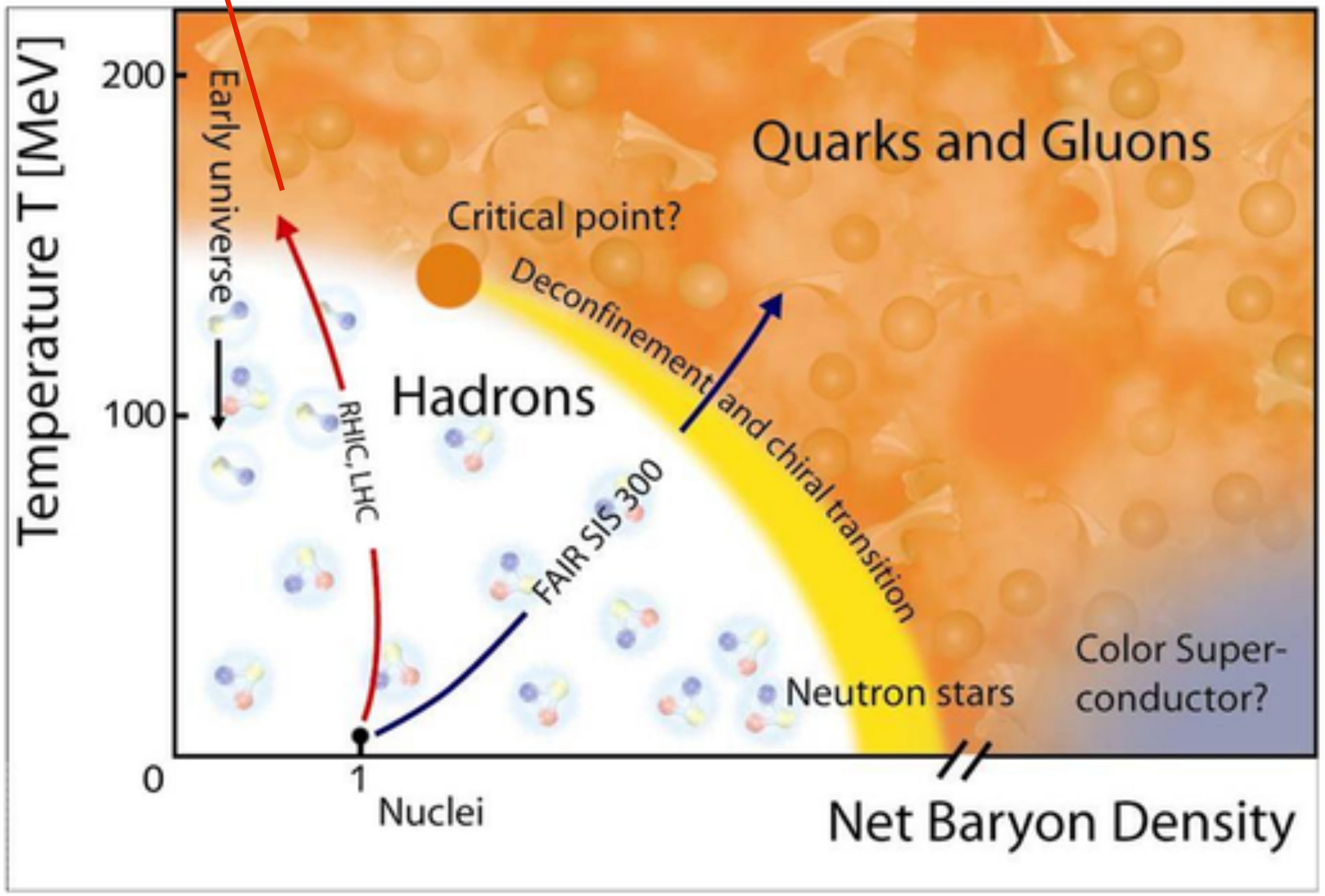



hard scattering



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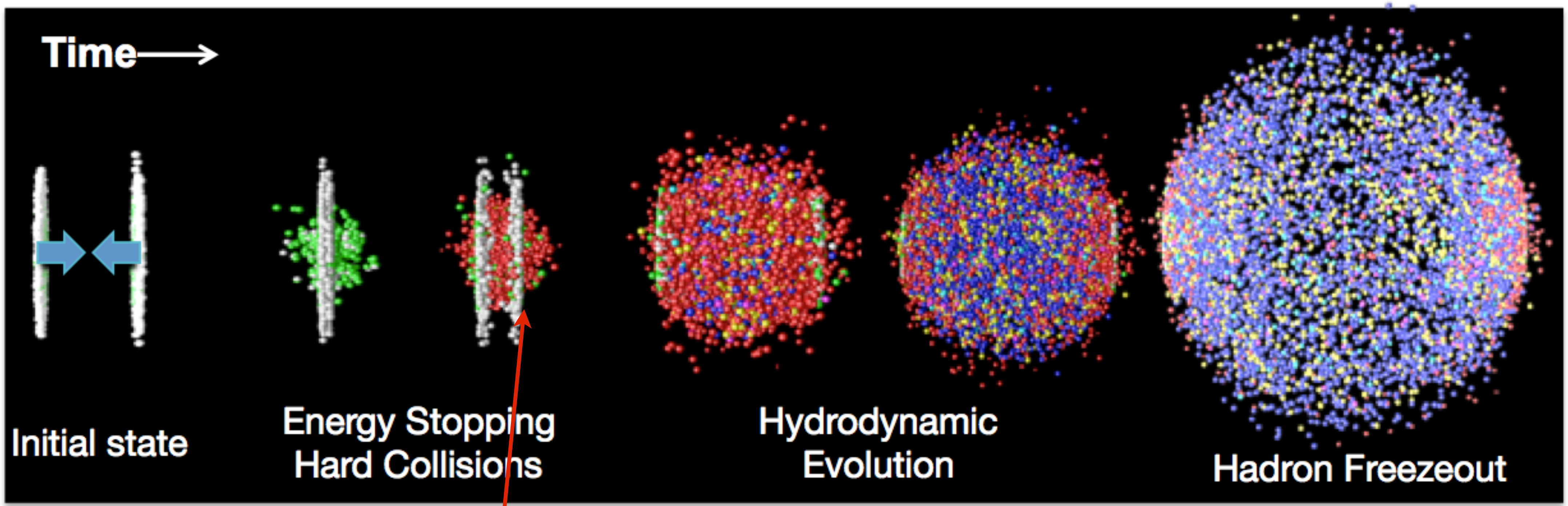
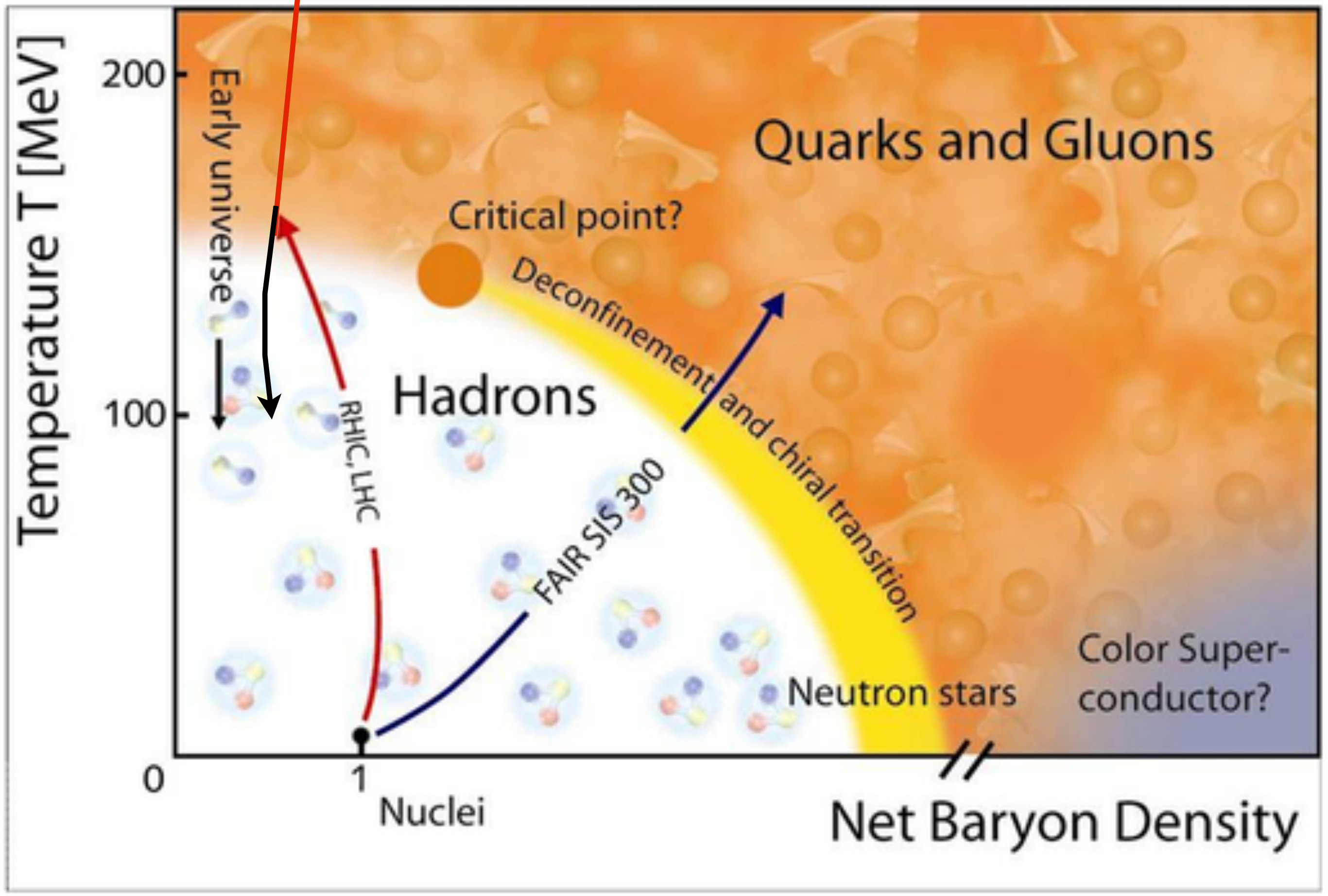



hard scattering

thermalization



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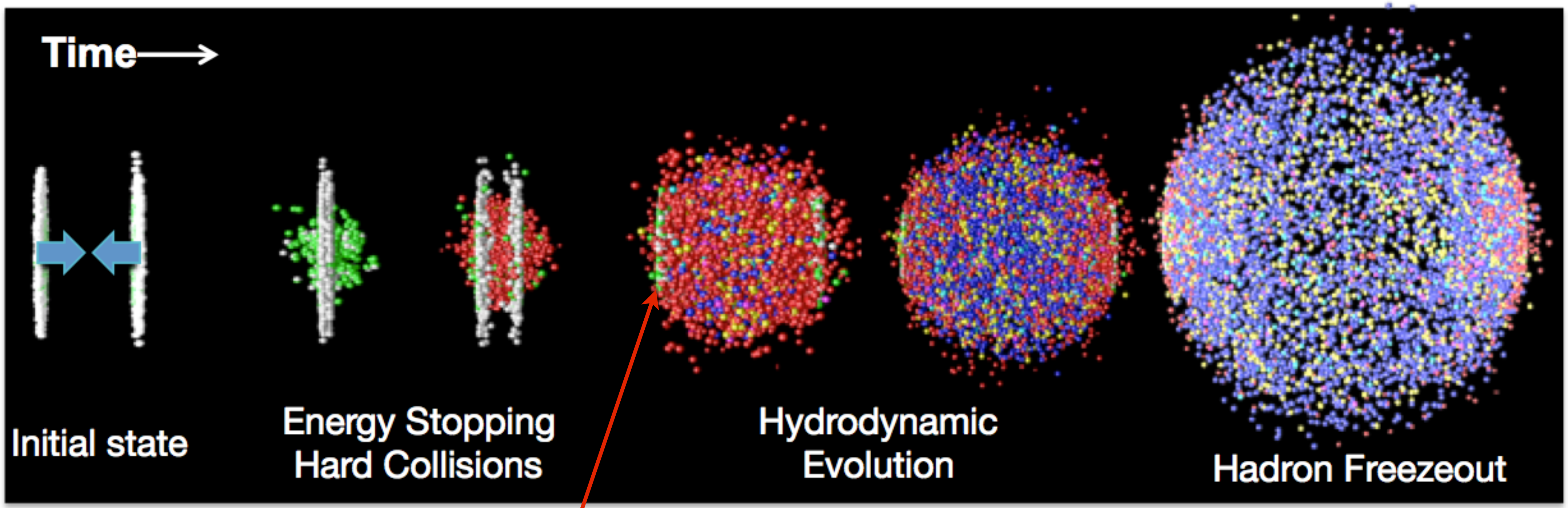
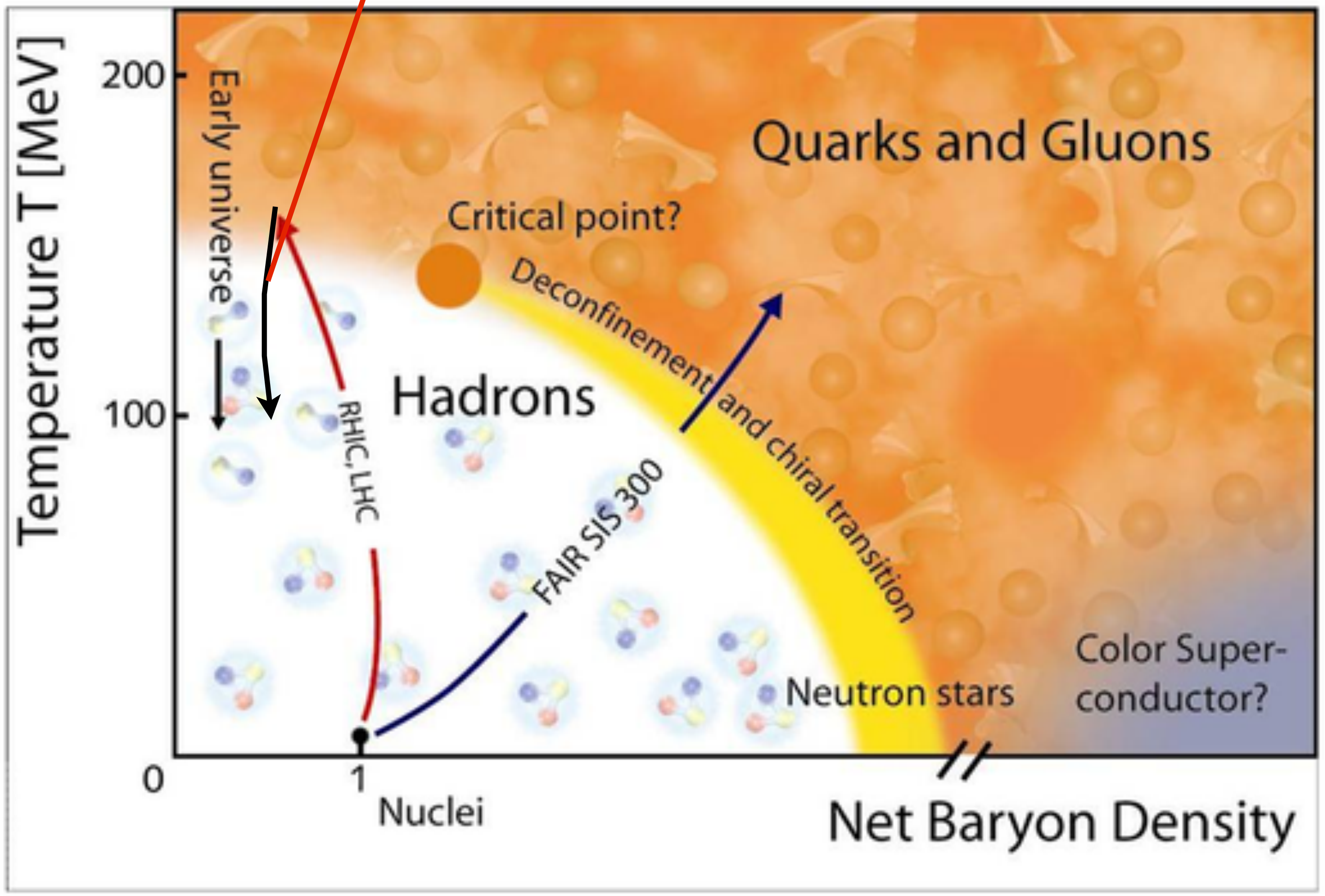



hard scattering

thermalization

hydrodynamic
flow



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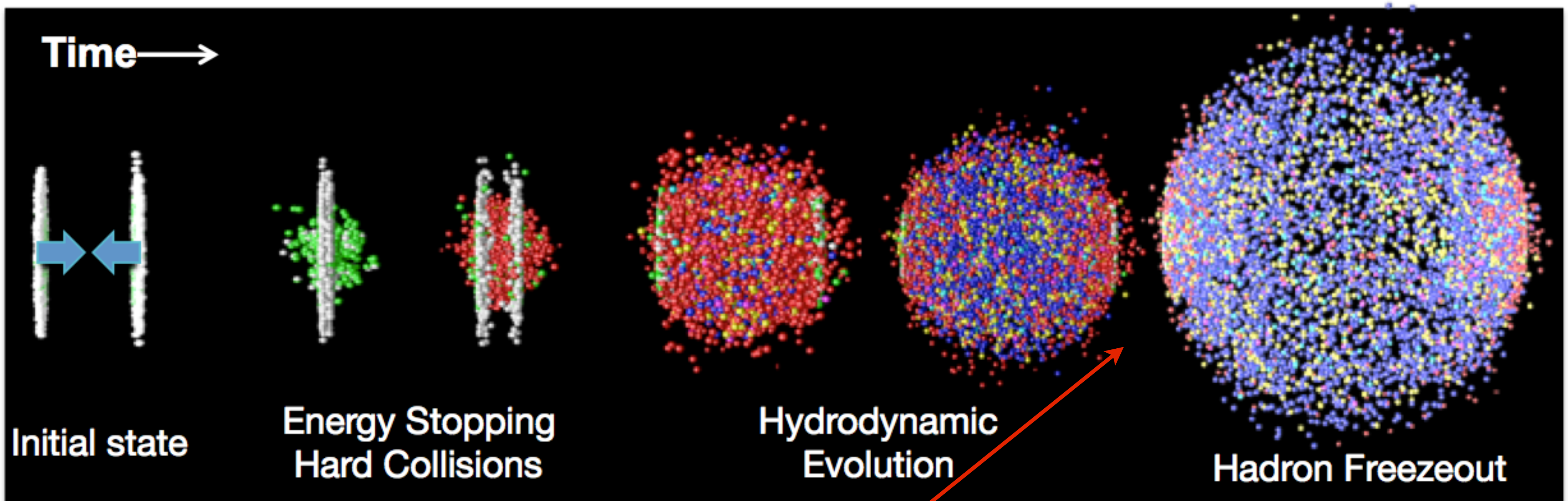


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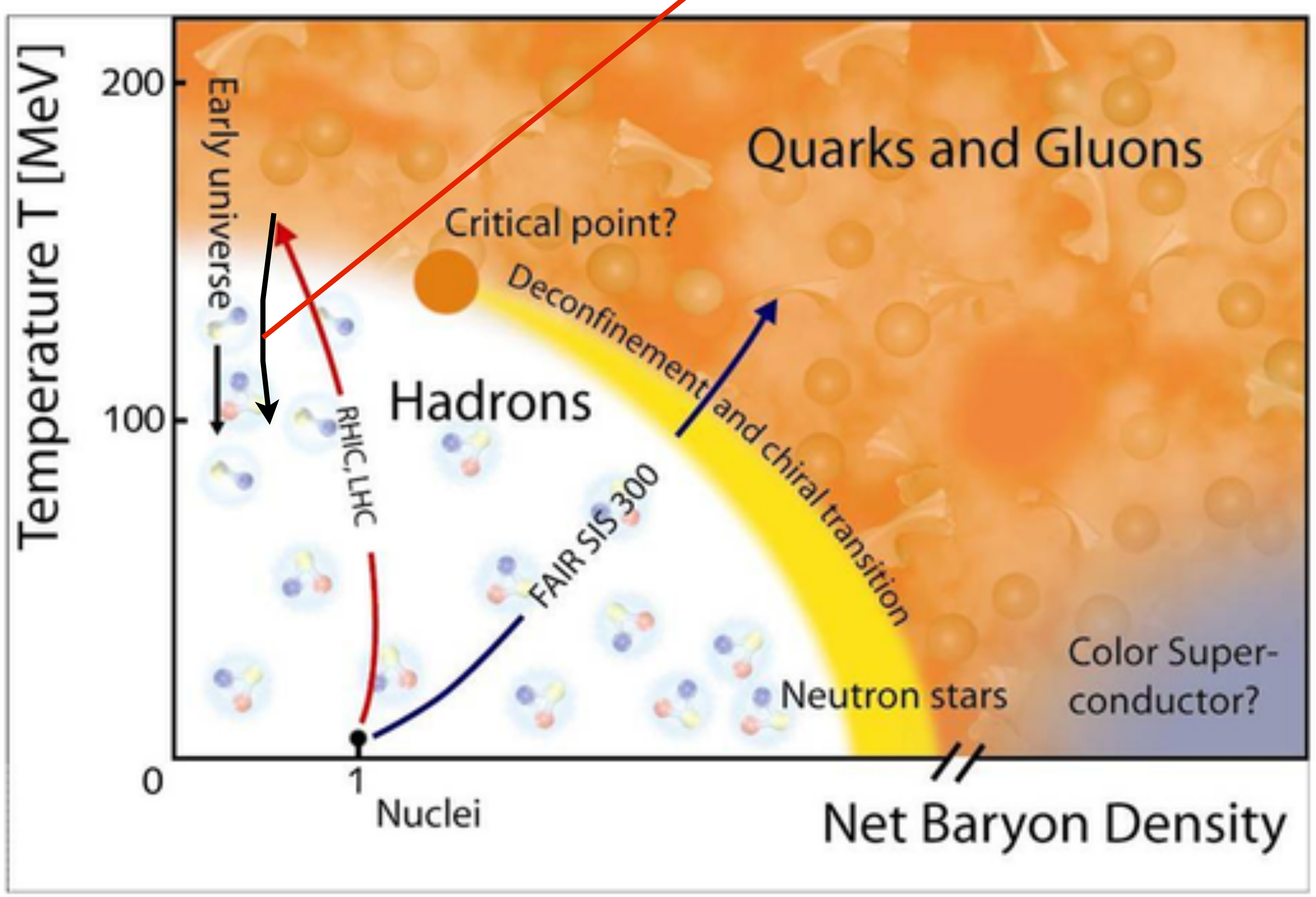


chemical
freezeout
(particle ratios)

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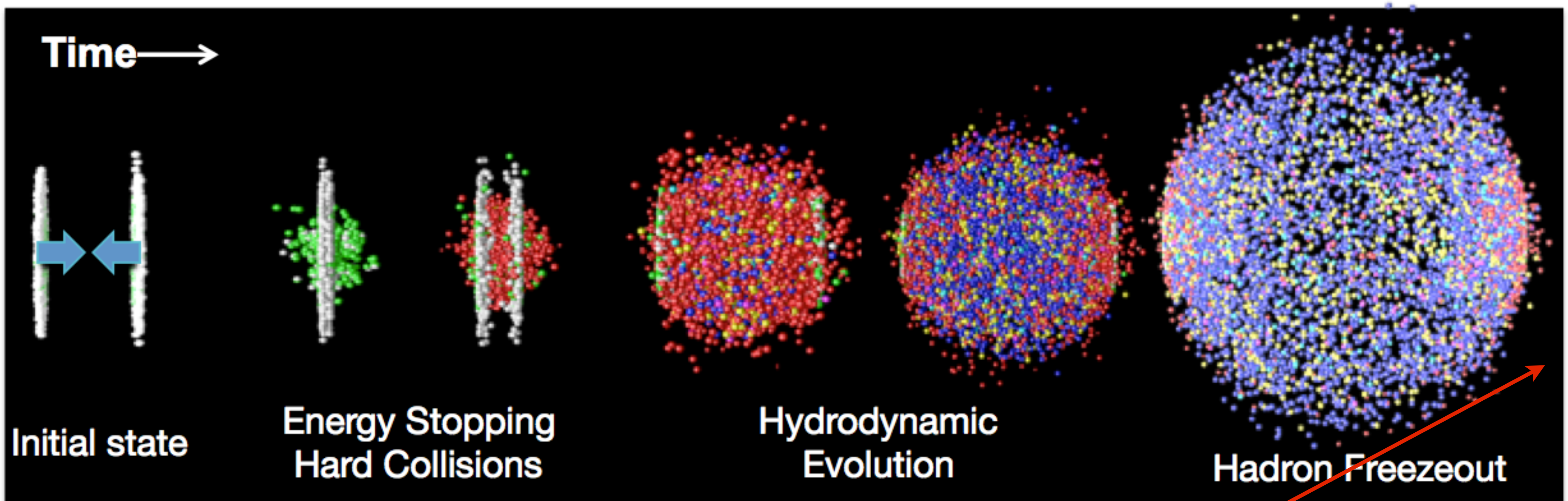
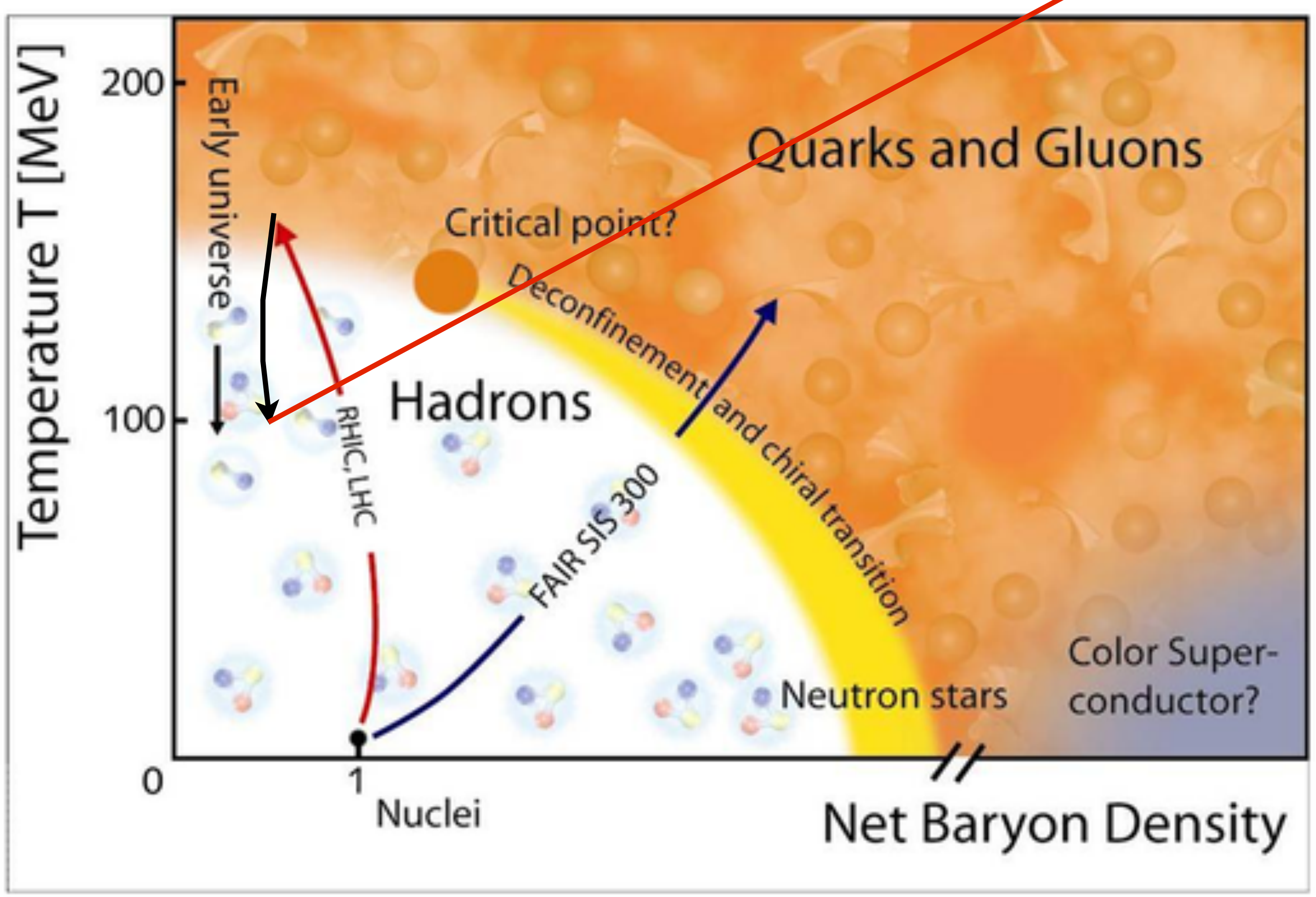



hard scattering

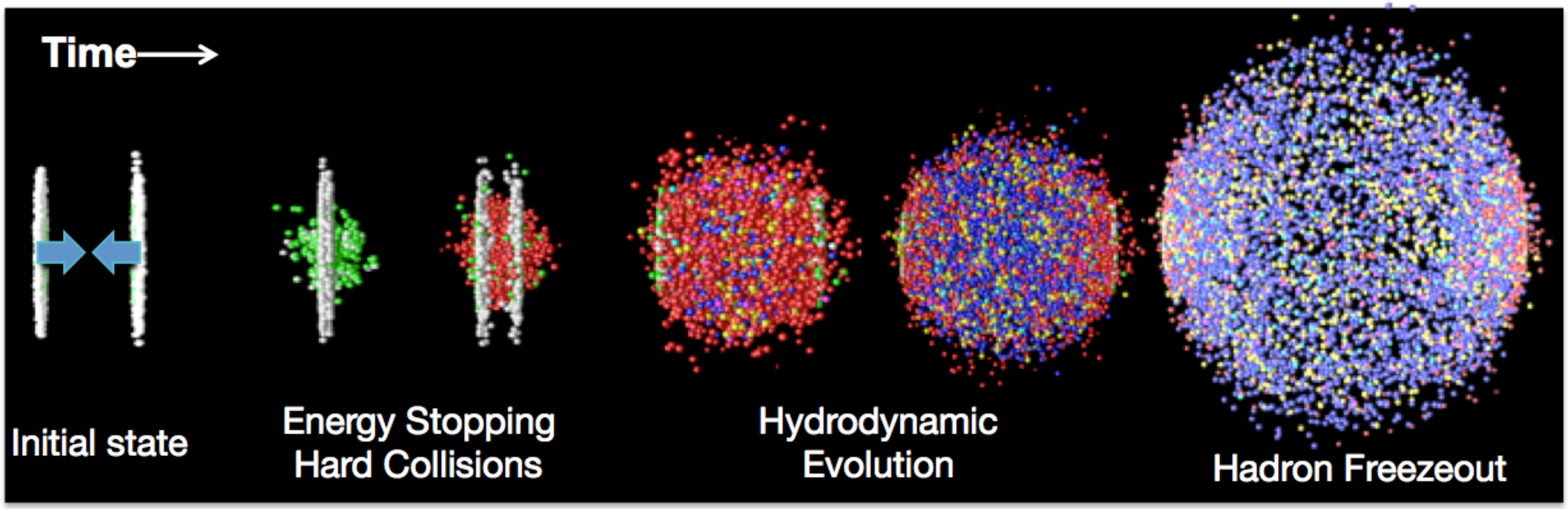
thermalization

hydrodynamic flow




chemical freezeout
(particle ratios)

kinetic freezeout
(momentum distribution)

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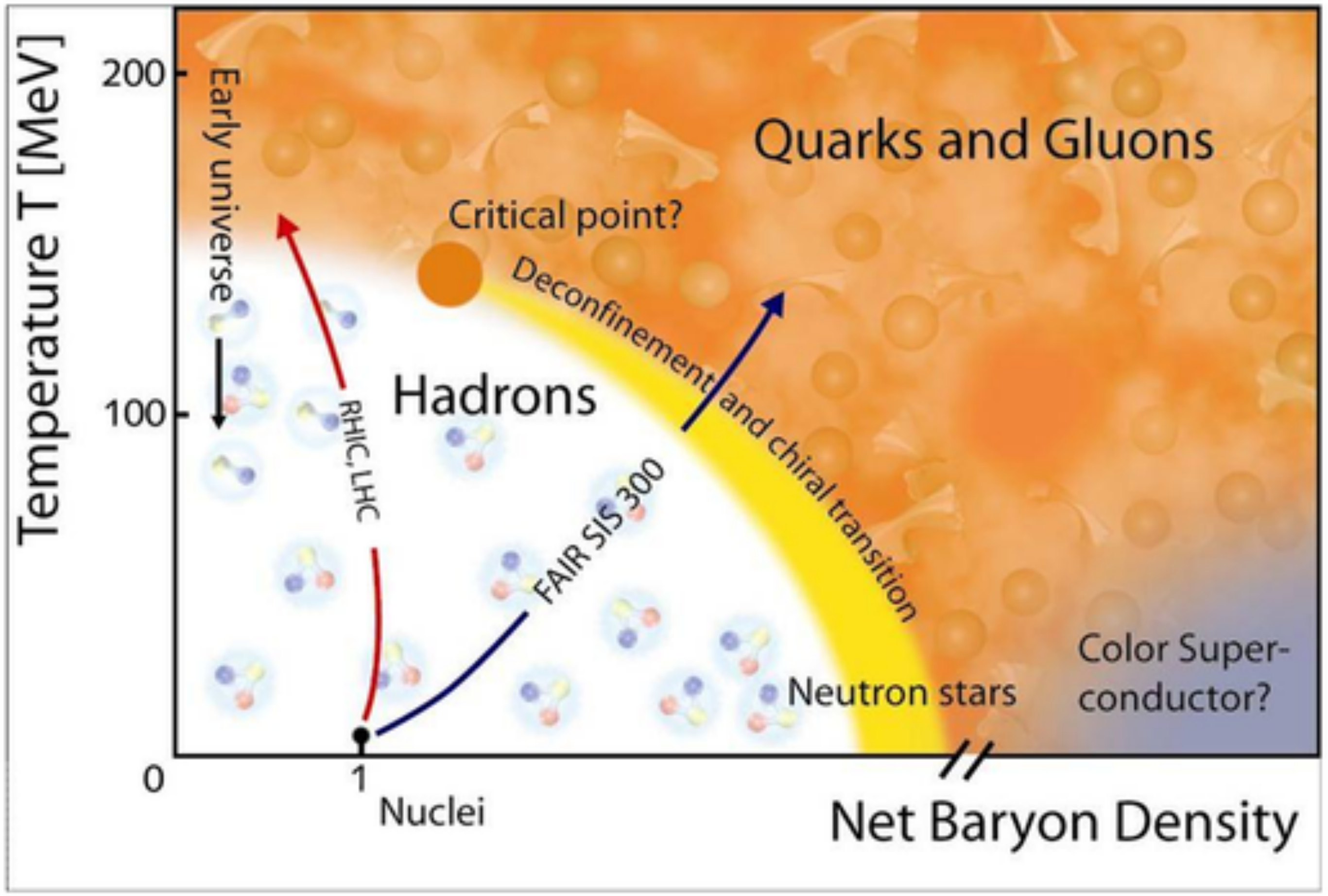


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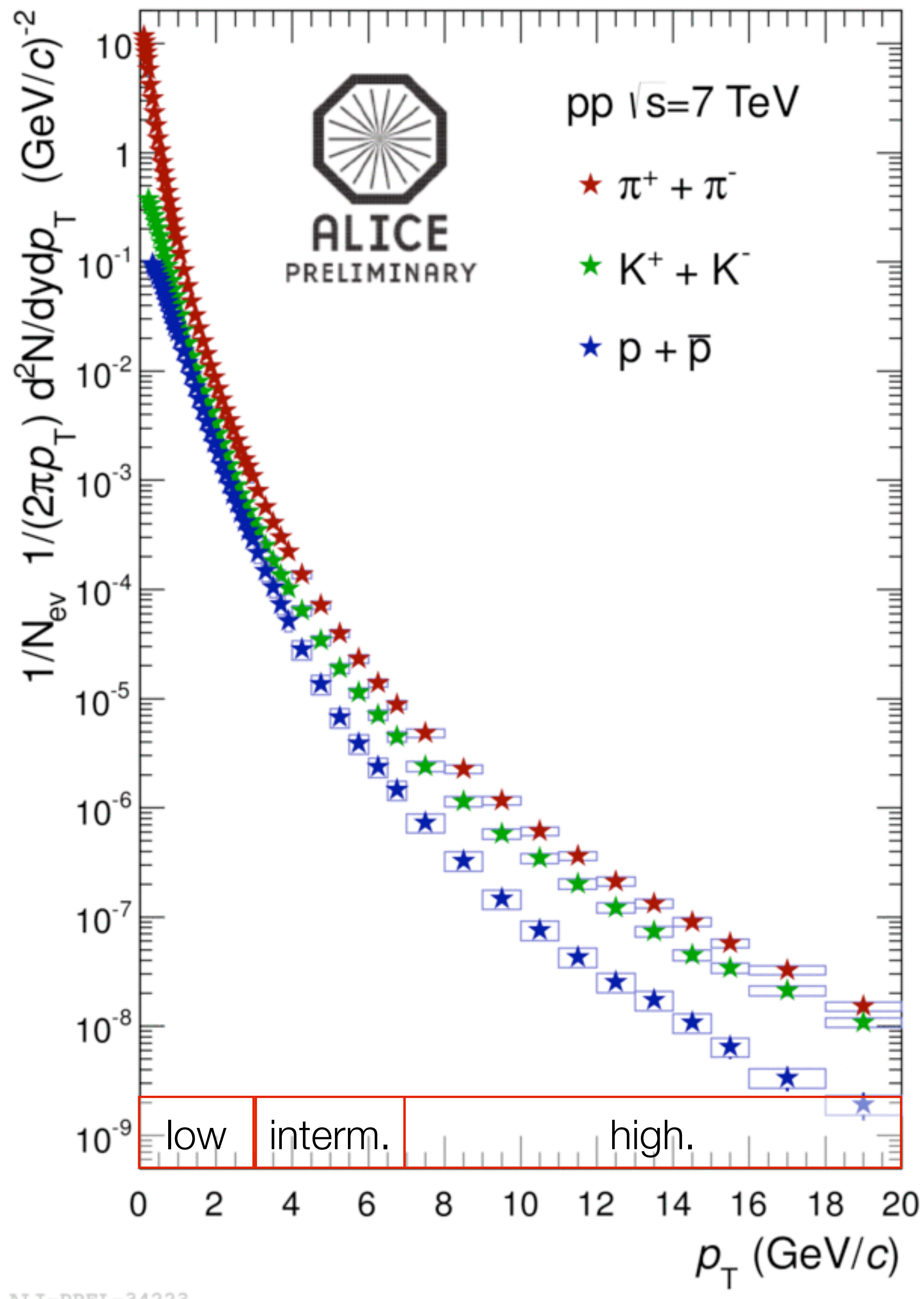
# Transverse momentum regimes




## Low: $p_T < 3$ GeV/c

Bulk properties and collective expansion, hadrochemistry

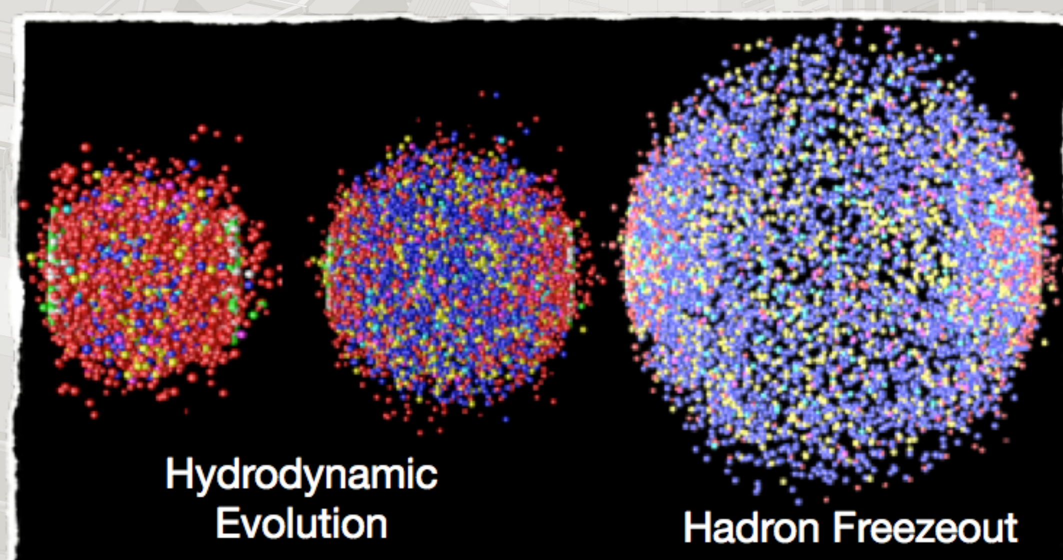
## Intermediate: $3 < p_T < 7$ GeV/c

Coalescence and anomalous baryon enhancement

## High: $p_T > 7$ GeV/c

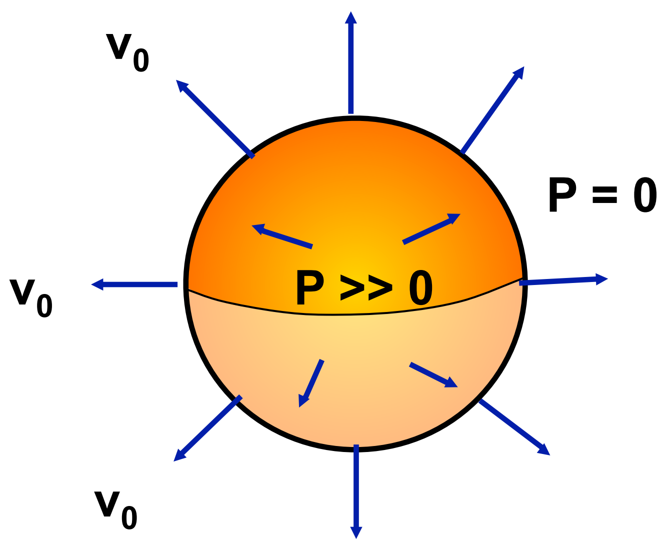
"Jet Quenching": Search for medium modification of fragmentation functions

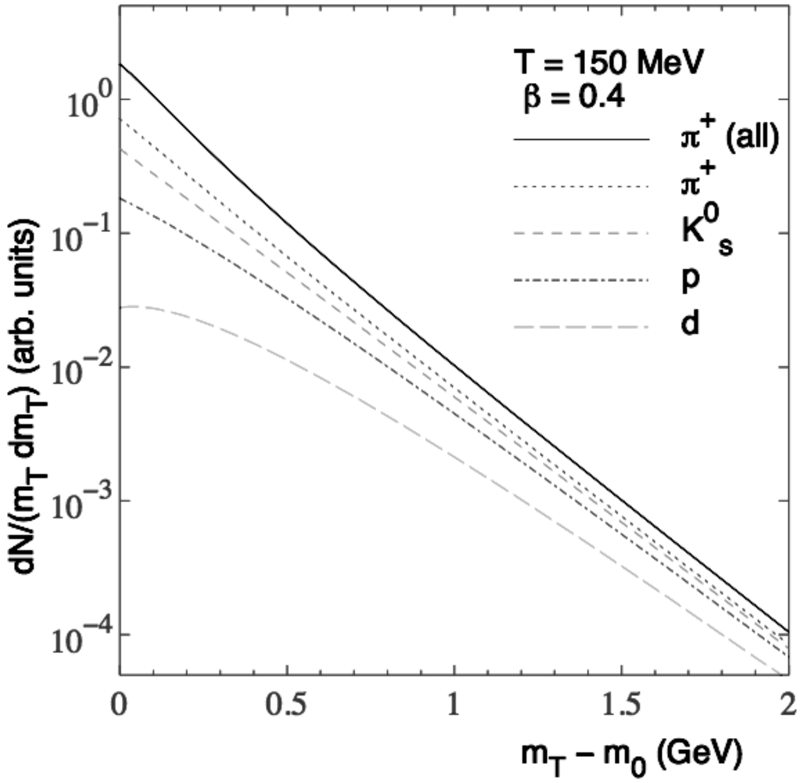
# Low $p_T$

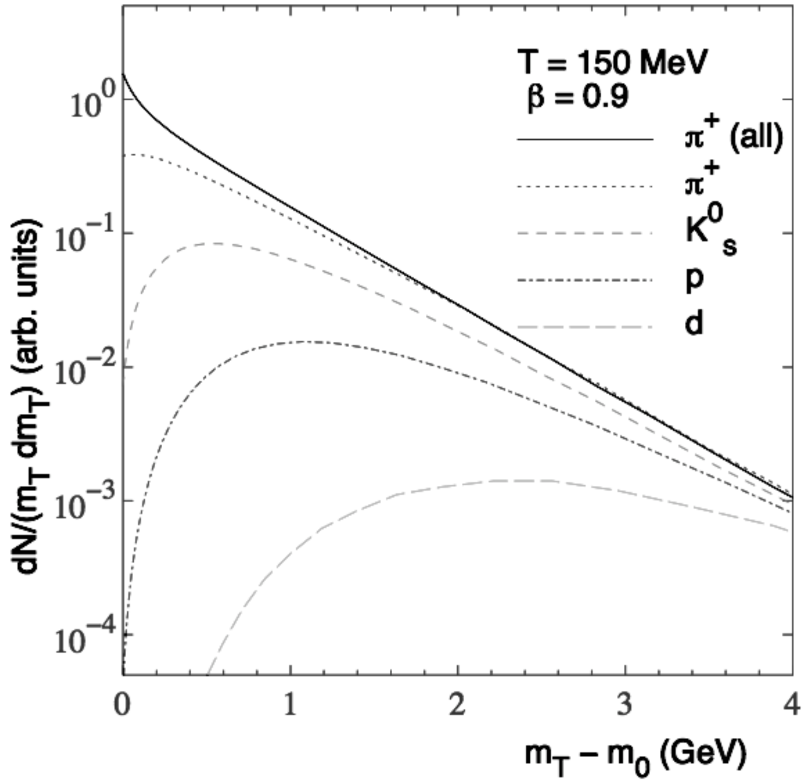


# Isotropic (radial) flow

hep-ph/0407360



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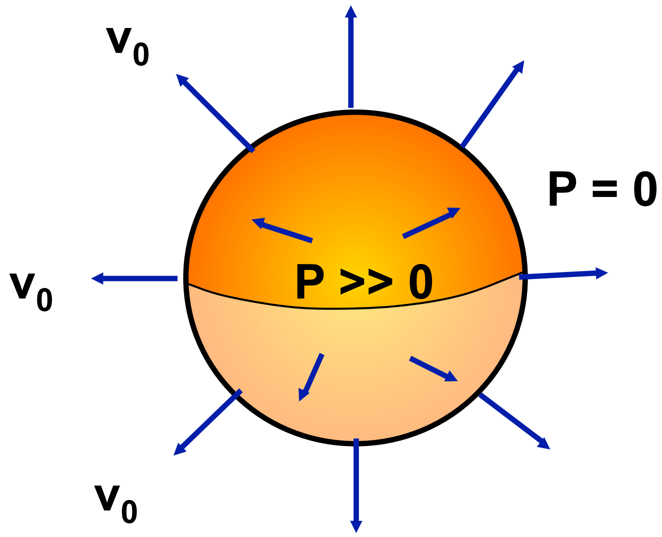
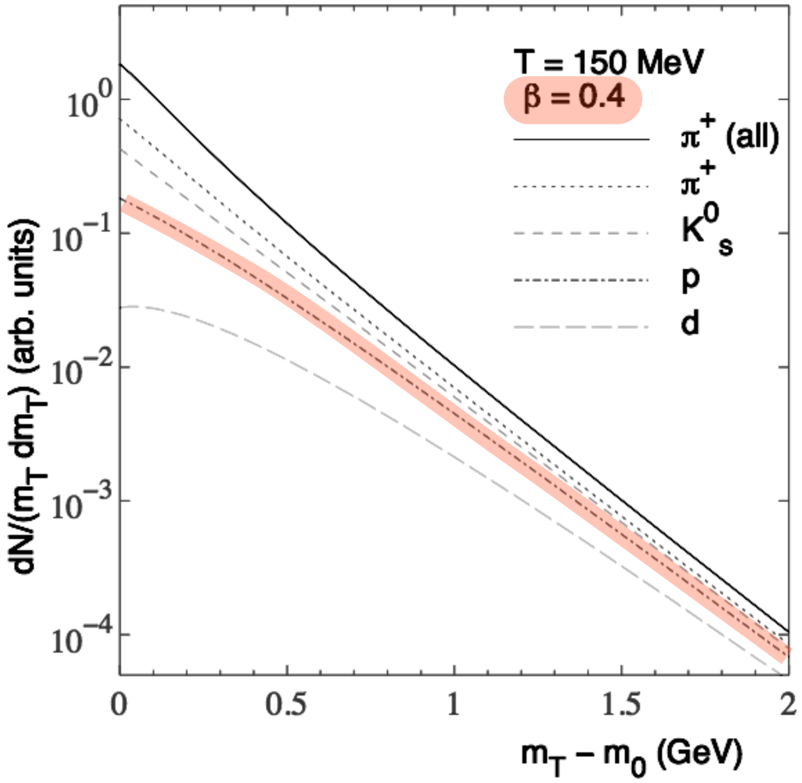
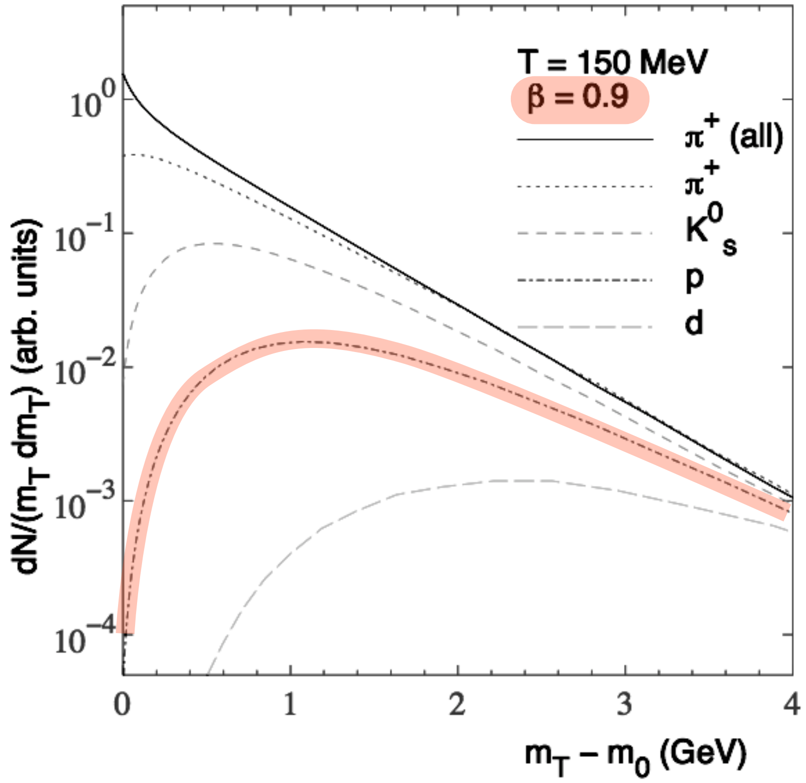


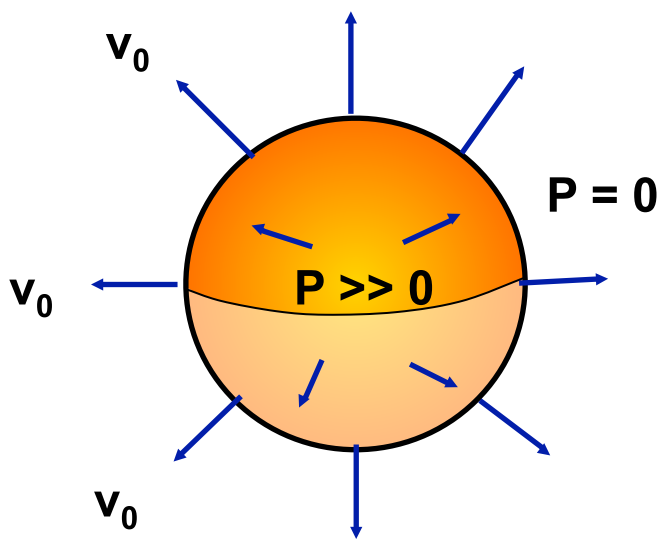



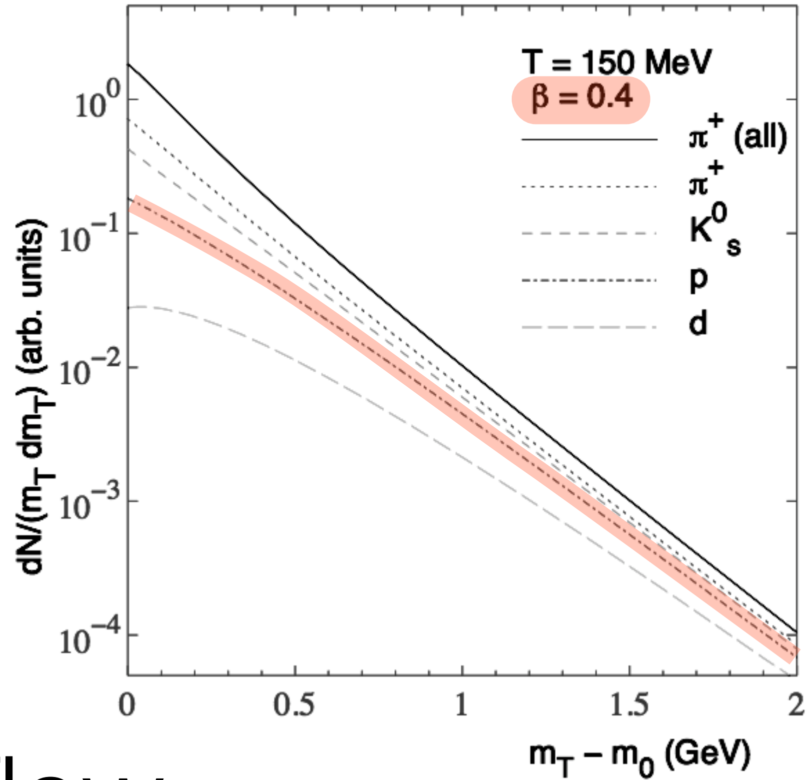



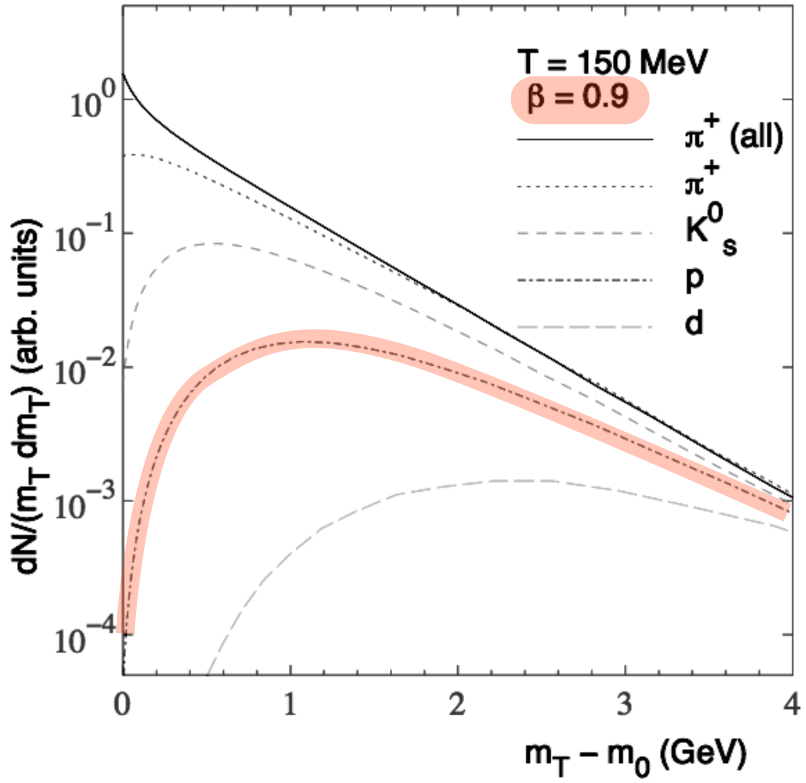
# Radial and Elliptic Flow

## Isotropic (radial) flow

hep-ph/0407360

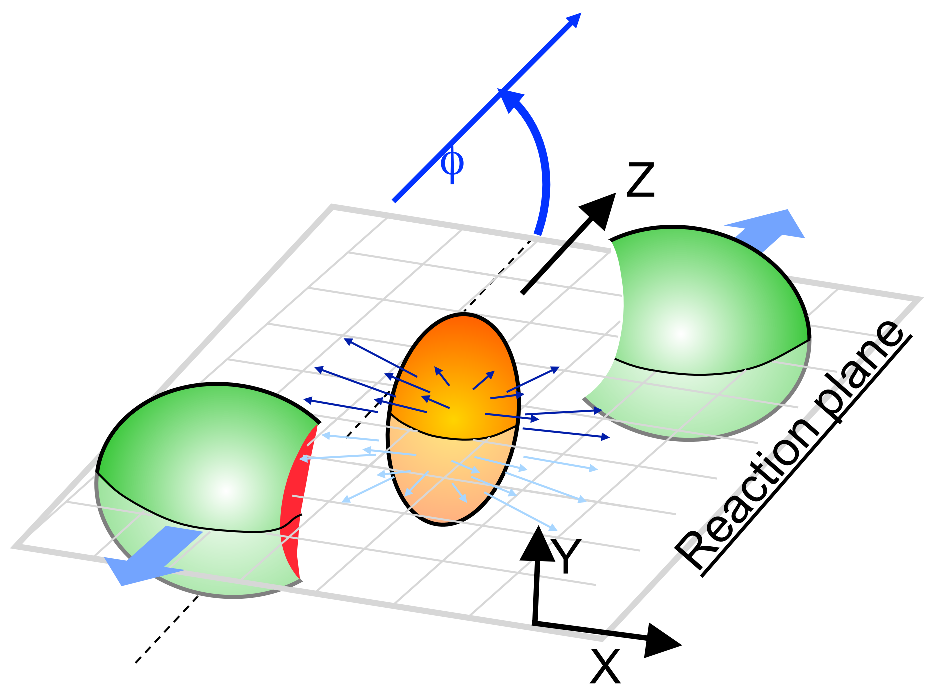


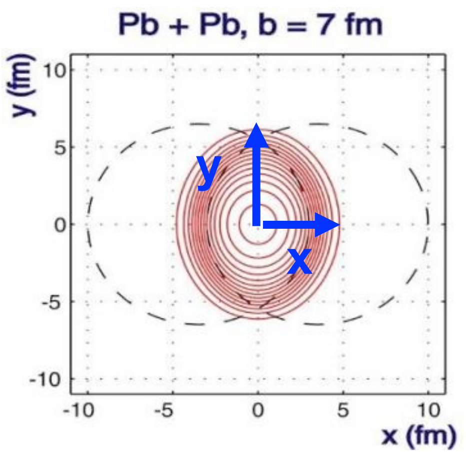




## Anisotropic (elliptic) flow

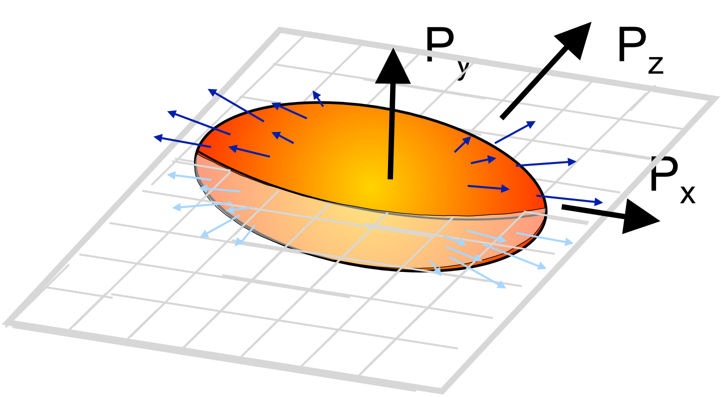
Spatial deformation




Azimuthal (ϕ) pressure gradients




Anisotropic particle density

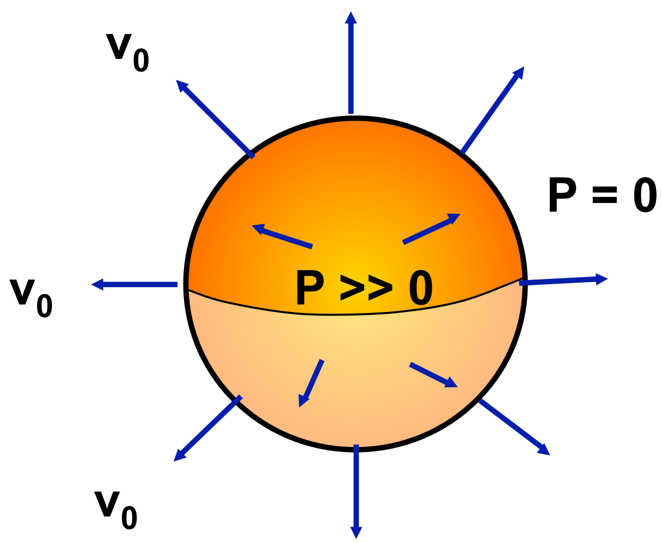


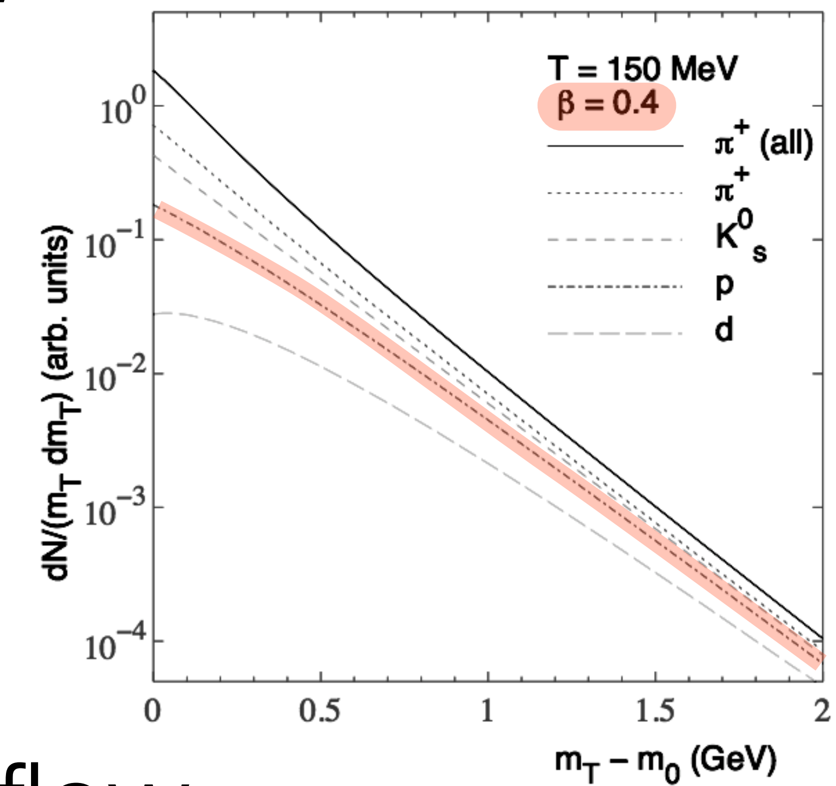

$$\frac{dN}{d\varphi} \propto 1 + 2v_1\cos[\varphi - \Psi_1] + 2v_2\cos[2(\varphi - \Psi_2)] + 2v_3\cos[3(\varphi - \Psi_3)] + ..$$

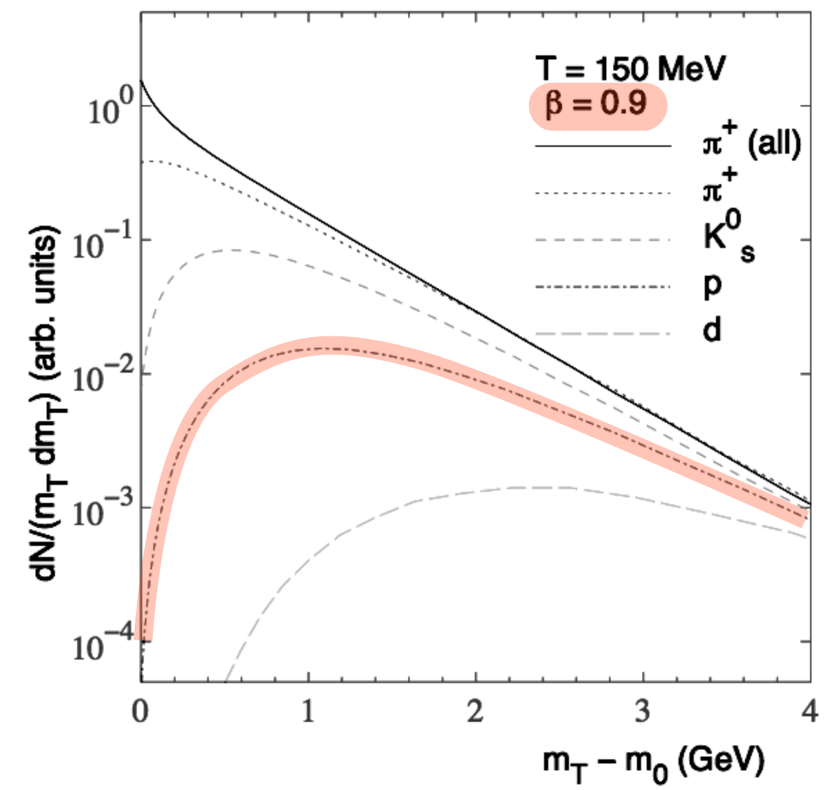
# Radial and Elliptic Flow

## Isotropic (radial) flow

hep-ph/0407360

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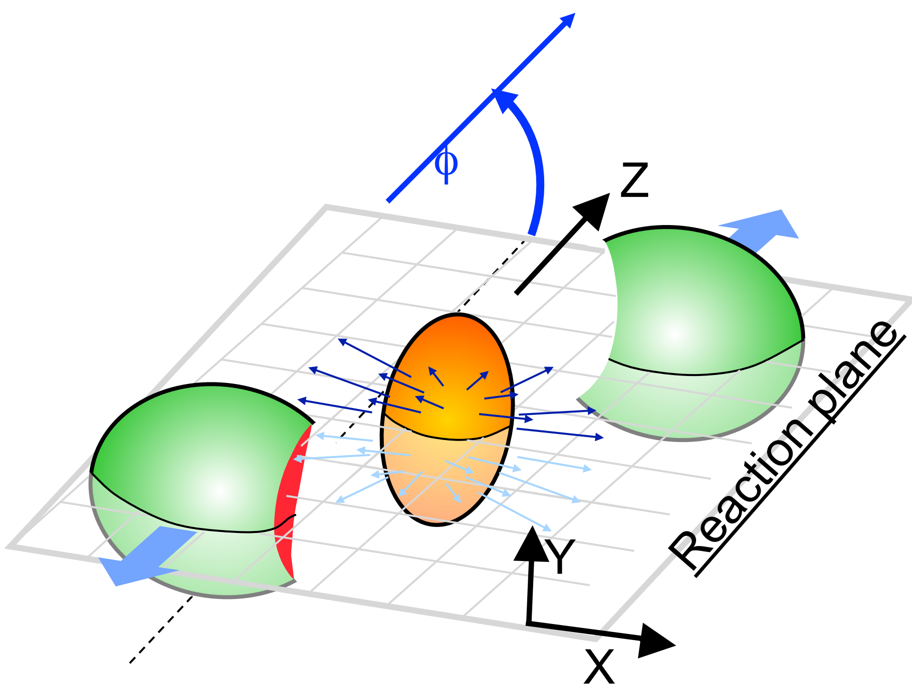


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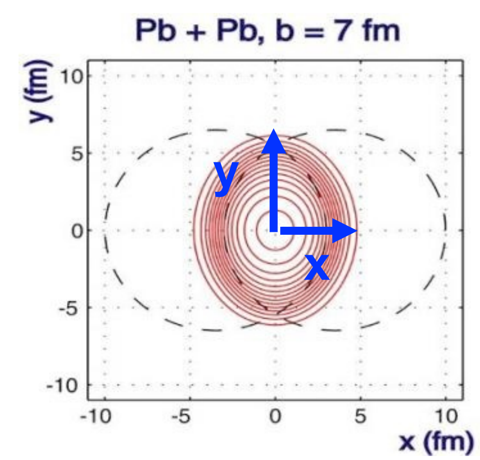


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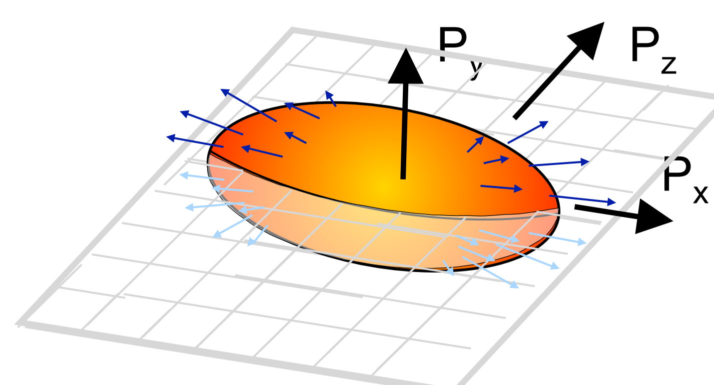


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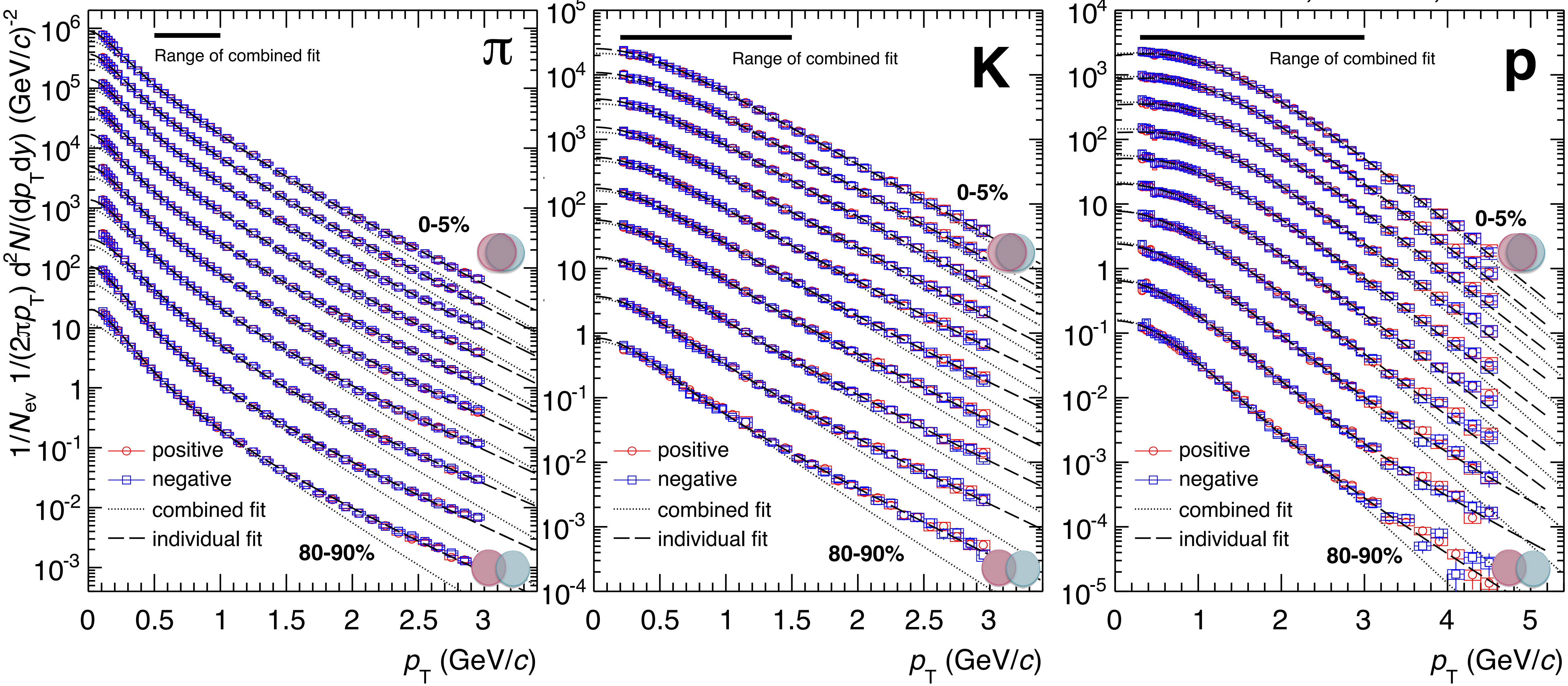
# Transverse momentum distributions

ALICE, PRC 88, 044910

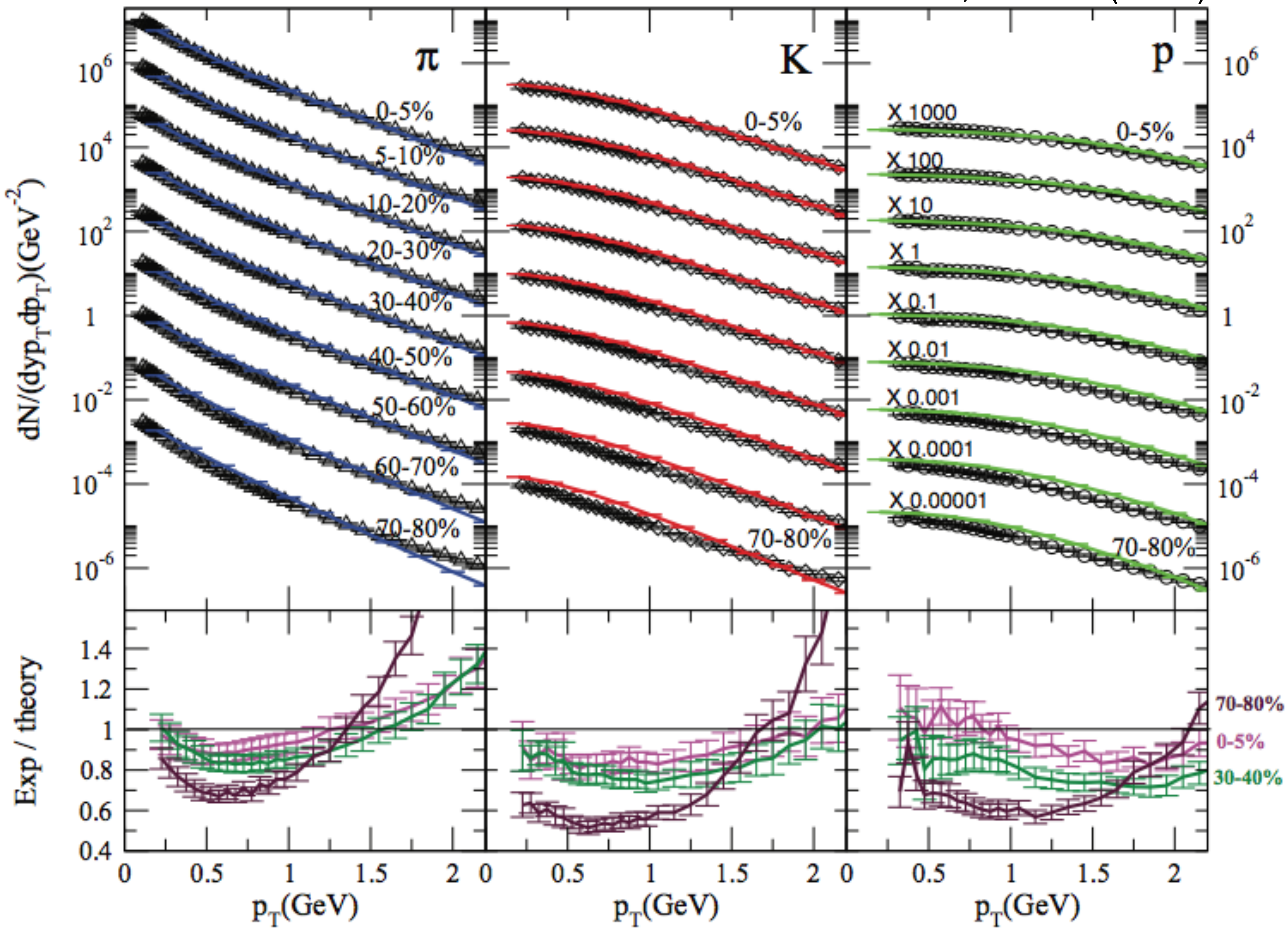



- Clear evolution of spectra with centrality.
- Central collisions: flat at low $p_T$, nearly exponential at high $p_T$
  - Indication for collective radial expansion

→ S. Bufalino, Tue 2nd

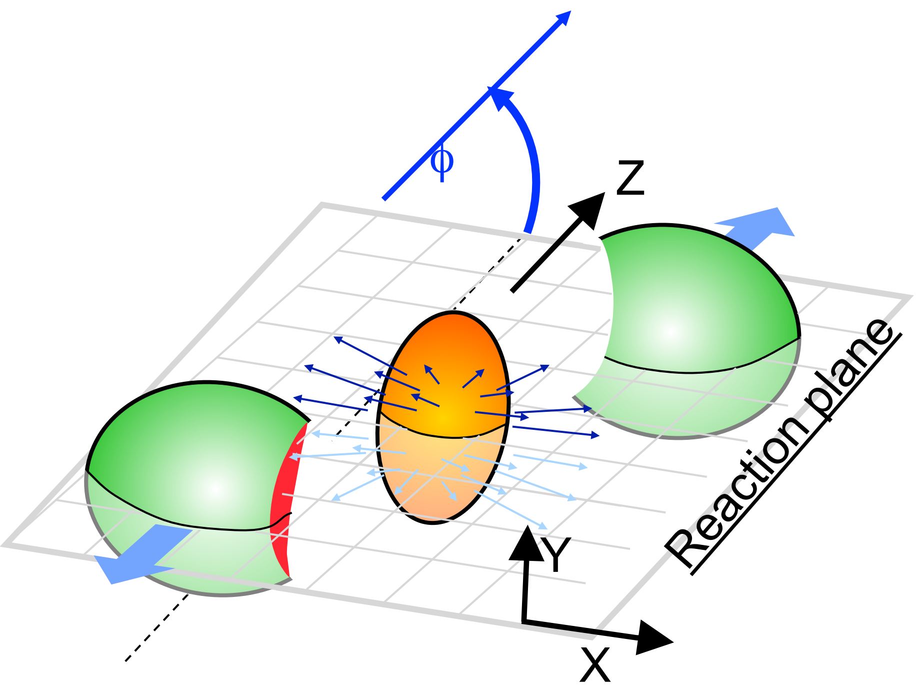
# Comparison to Hydro Models

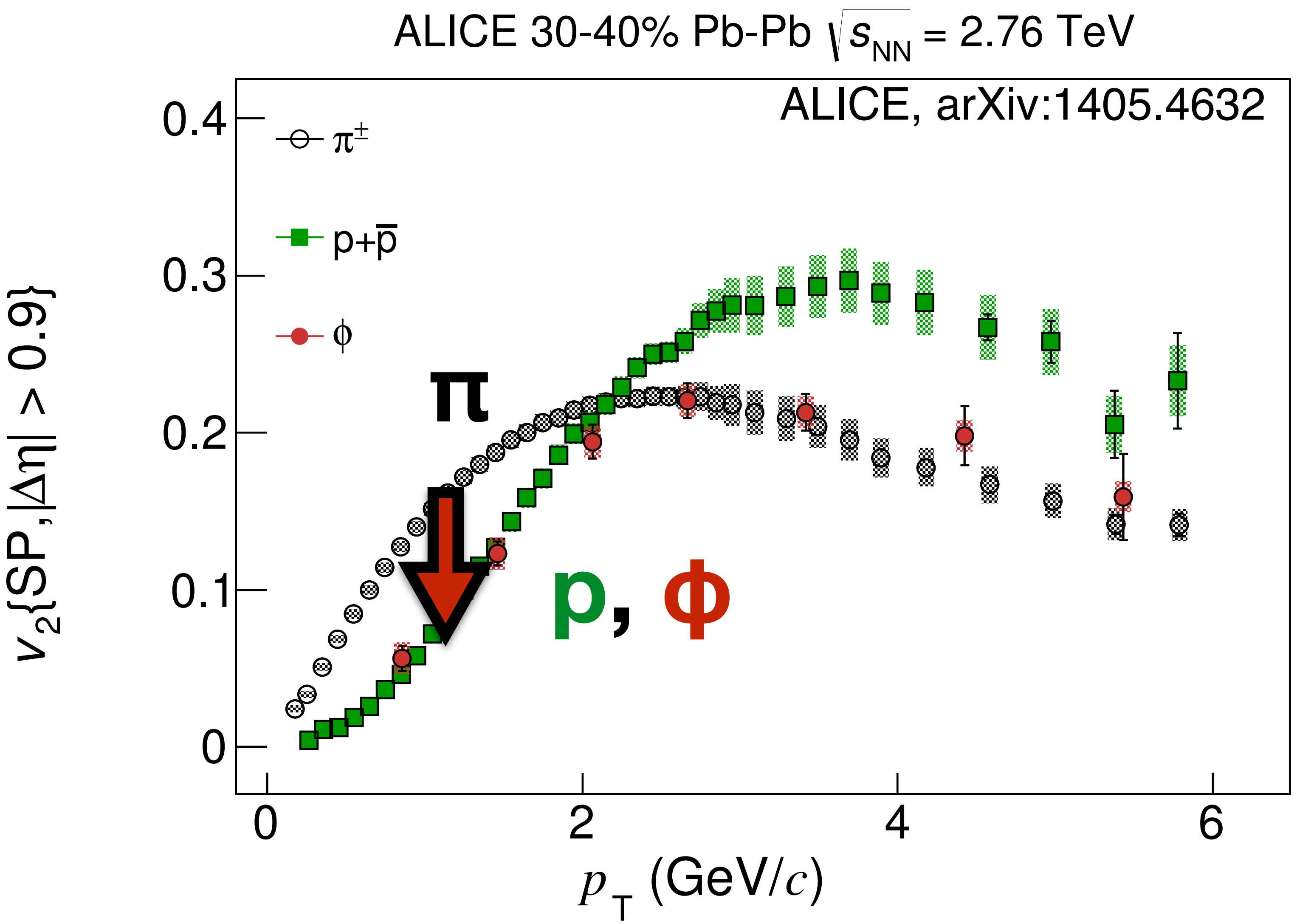
PRC 89, 034919 (2014)




Hydro models give a very satisfactory description!
Requires interactions in the hadronic phase?

→ U. Heinz, Wed 3rd



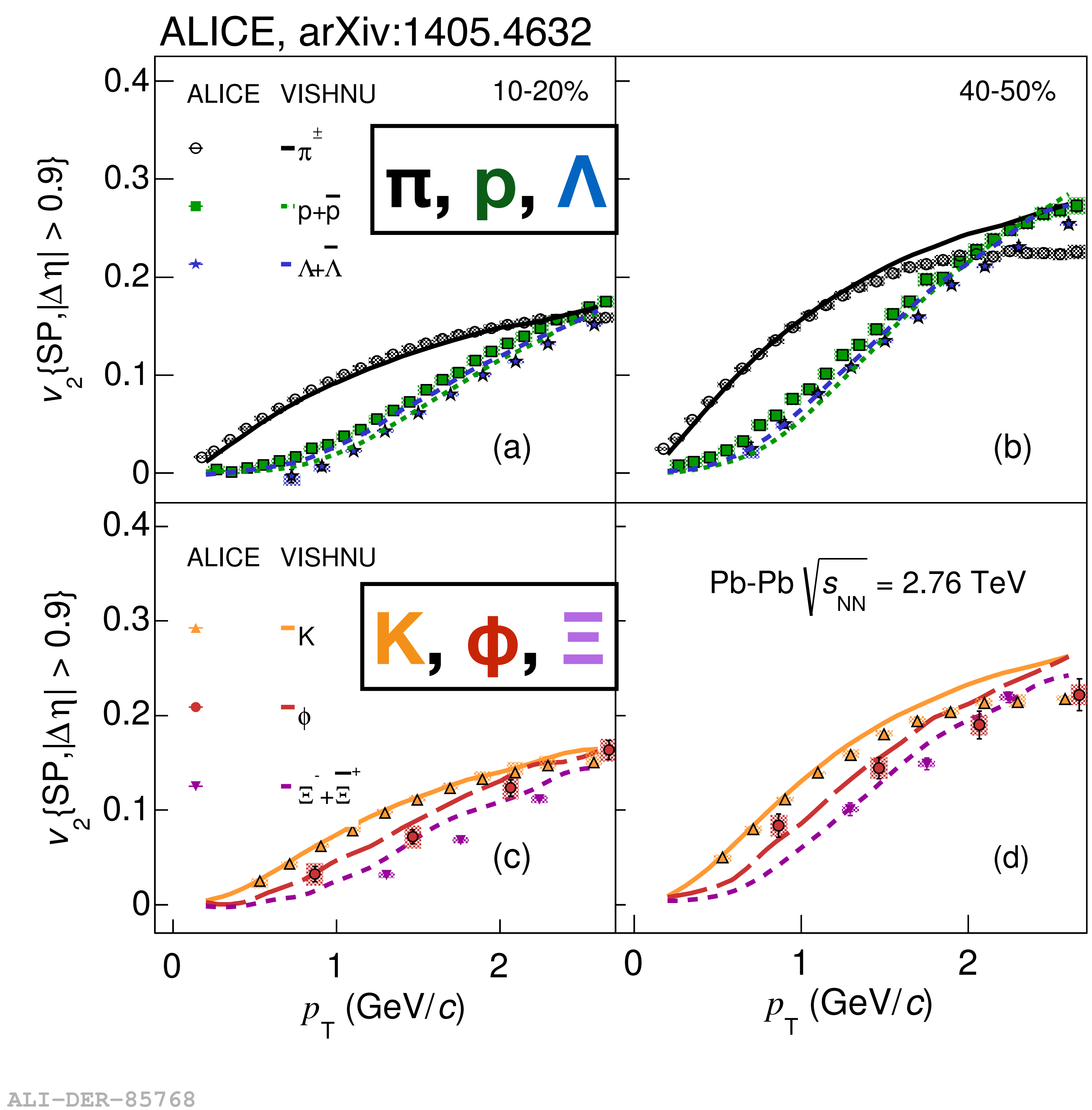

ALI-PUB-85247

**Azimuthal anisotropy**: early thermalization

**Mass ordering**: occurs naturally in hydro

**Details**: interactions in hadronic medium, hadronization mechanism

# Anisotropic flow vs Hydro




Alice results:

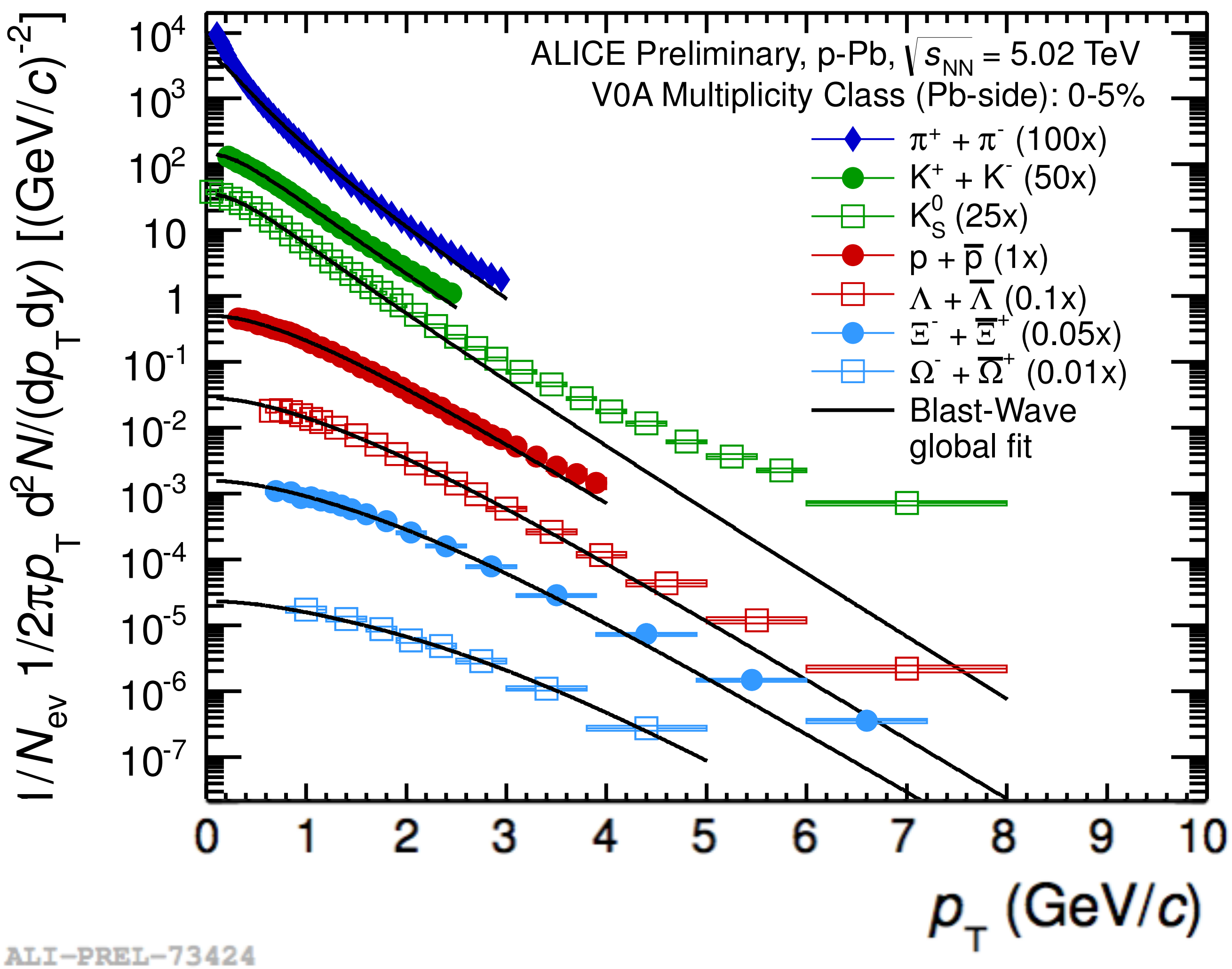
π, K, p, ϕ, Λ, Ξ, Ω

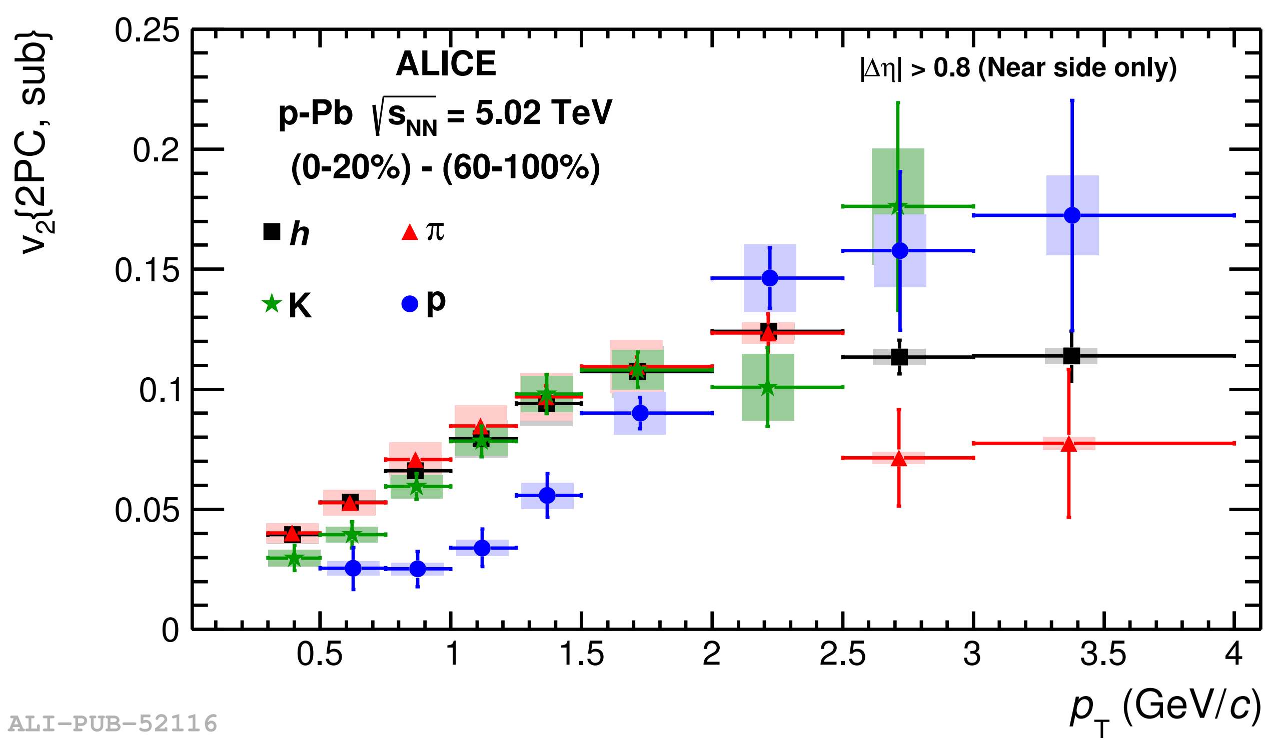
Overall features reproduced by Hydro+ Hadronic cascade

Role of hadronic phase?

- Needed to describe protons
- Spoils mass ordering

# Hints for flow in p-A collisions?




**Spectra** and **correlation** measurements show hints of collective behavior in p-Pb collisions

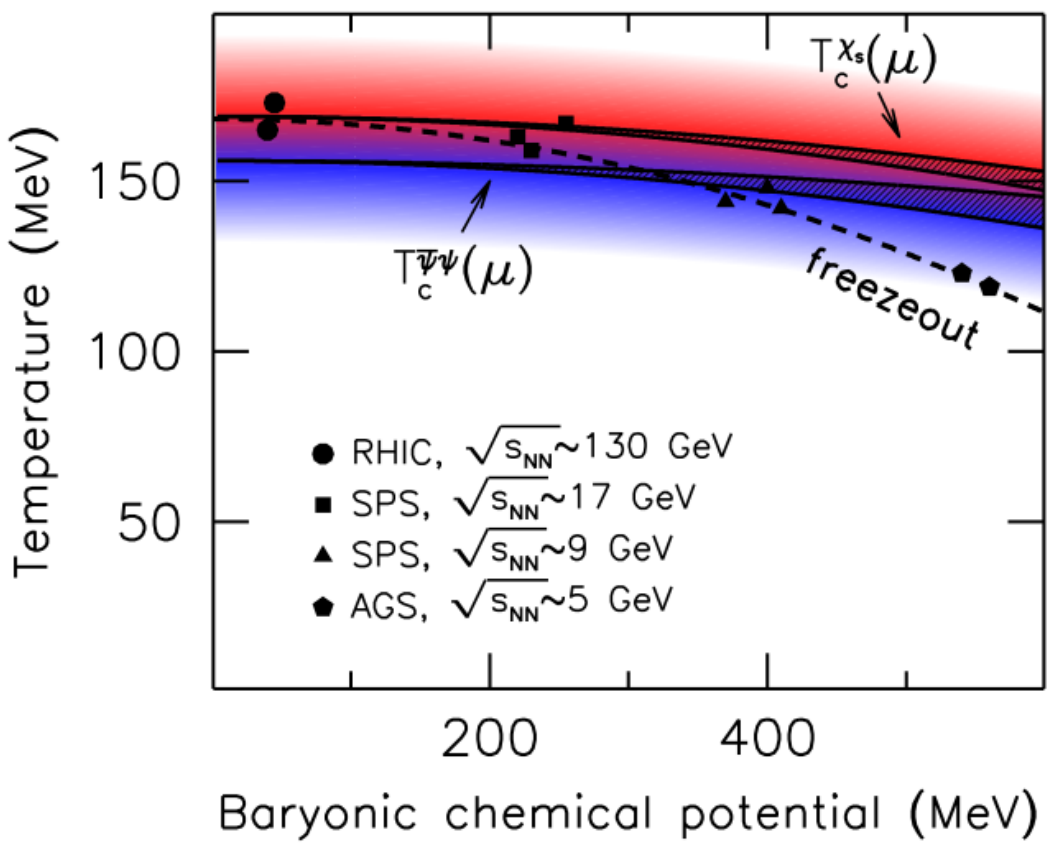
- Evolution with multiplicity
- Azimuthal anisotropy
- Mass ordering

→ S. Bufalino, Tue 2nd

ALICE, PLB 728 25 (2014)
ALICE, PLB 726 164 (2013)

# Hadron abundances

JP Conf. Ser. **316** (2011) 012020




- Hadrons produced in apparent thermal equilibrium
  - In the simplest case: $N(m) \propto e^{-m/T}$
- Measurements at different $\sqrt{s}$ line up in a hadron freeze-out curve
- Key Questions:
  - What is the relation to the critical temperature (154 ± 9 MeV)?
  - How is this apparent equilibrium reached?

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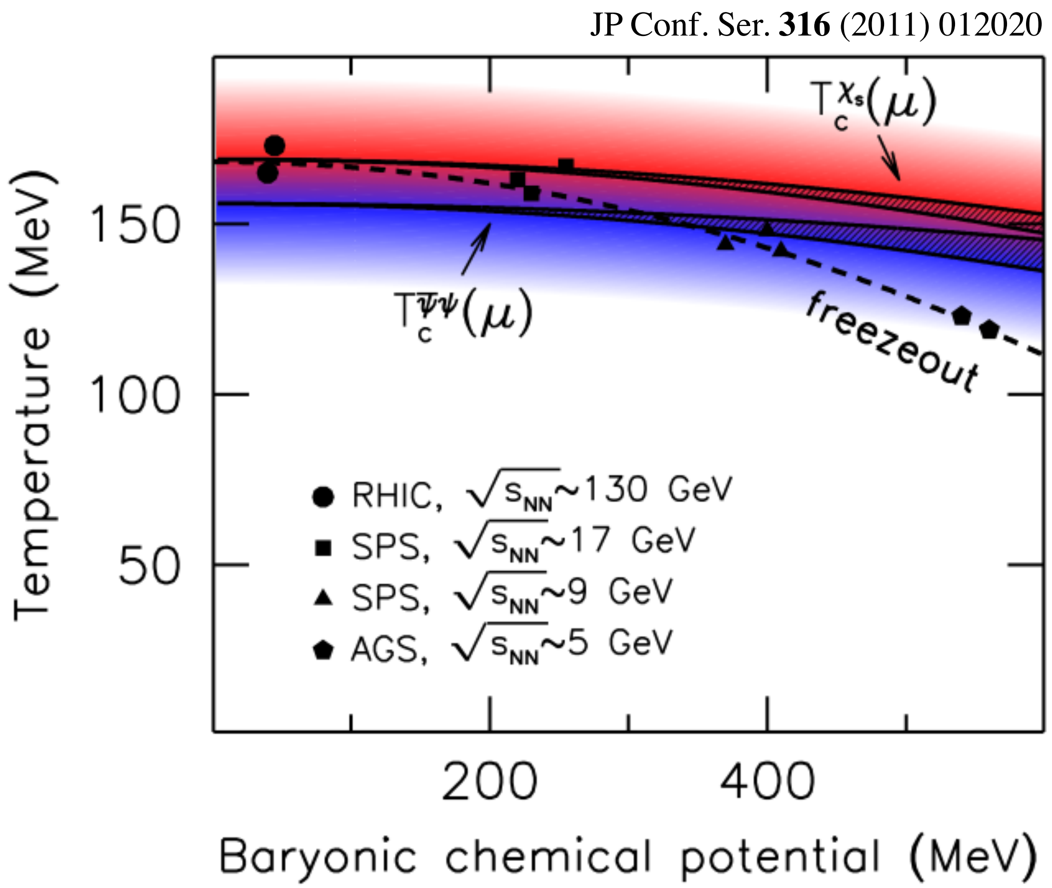


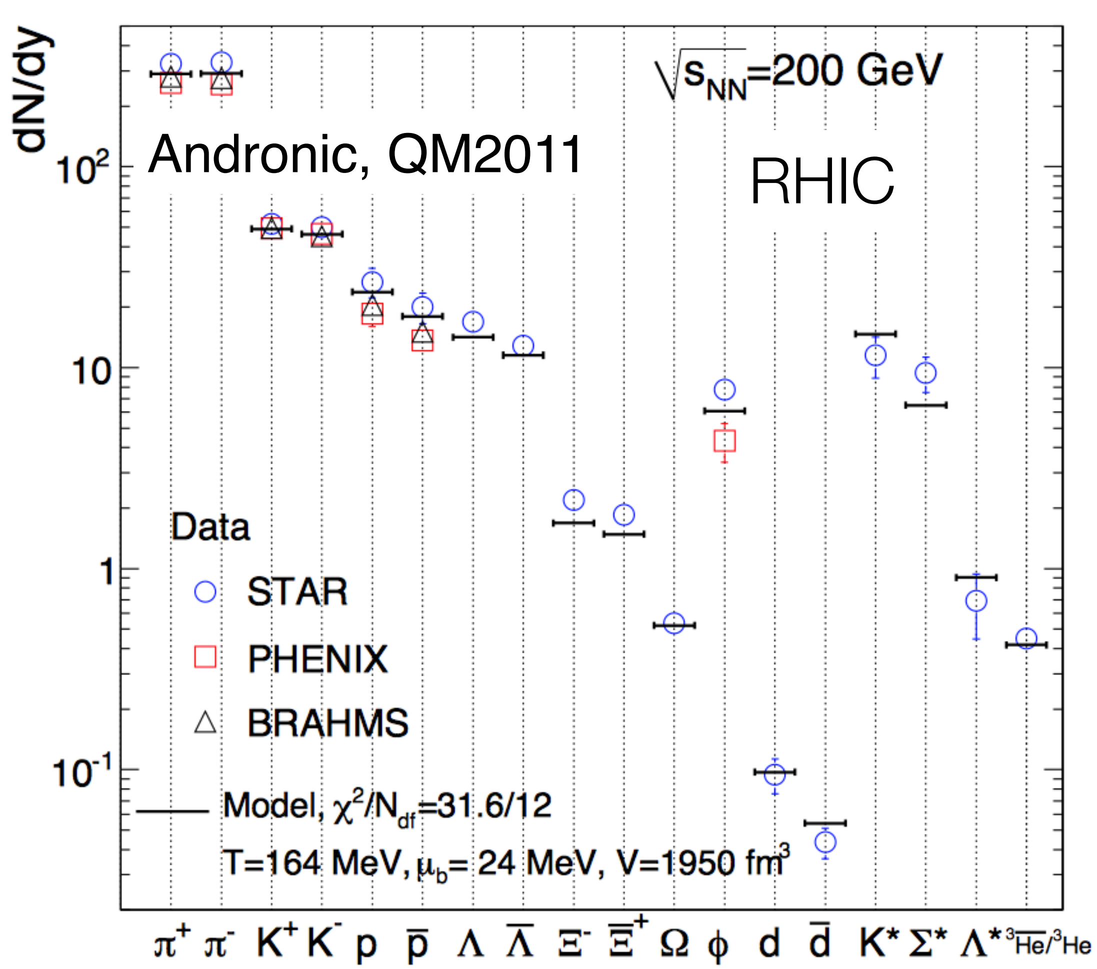


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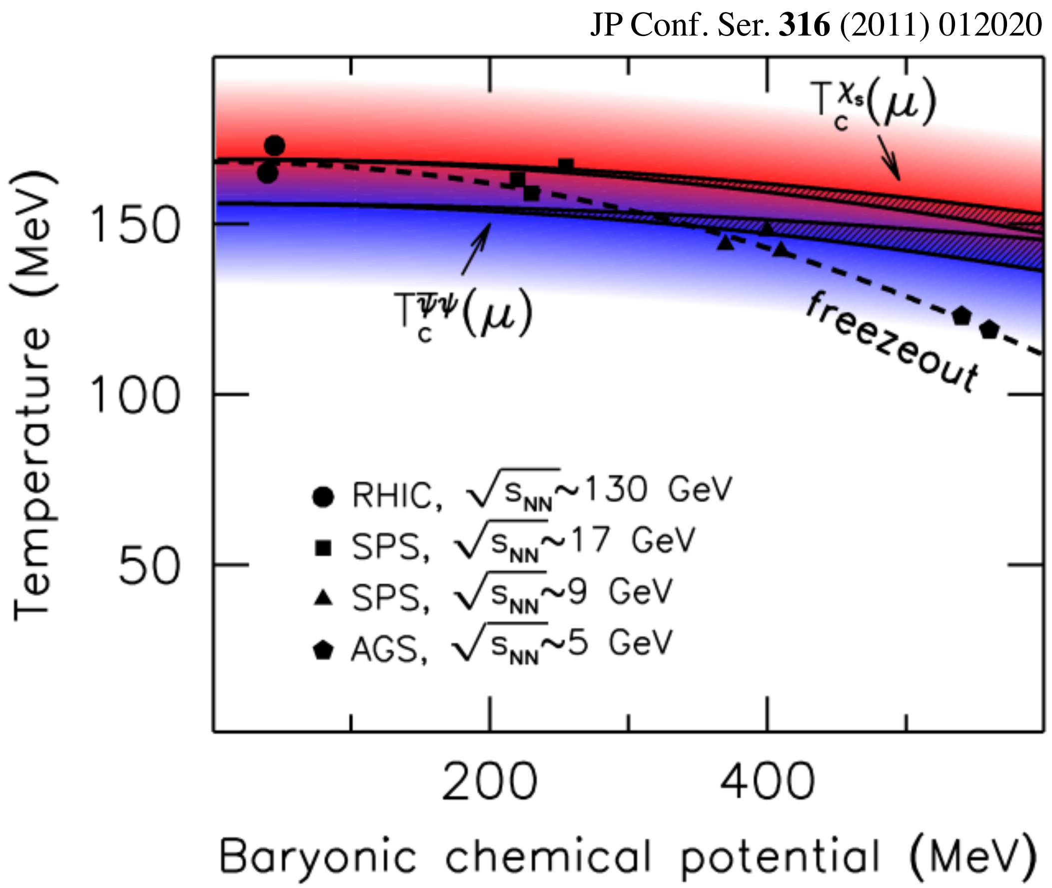


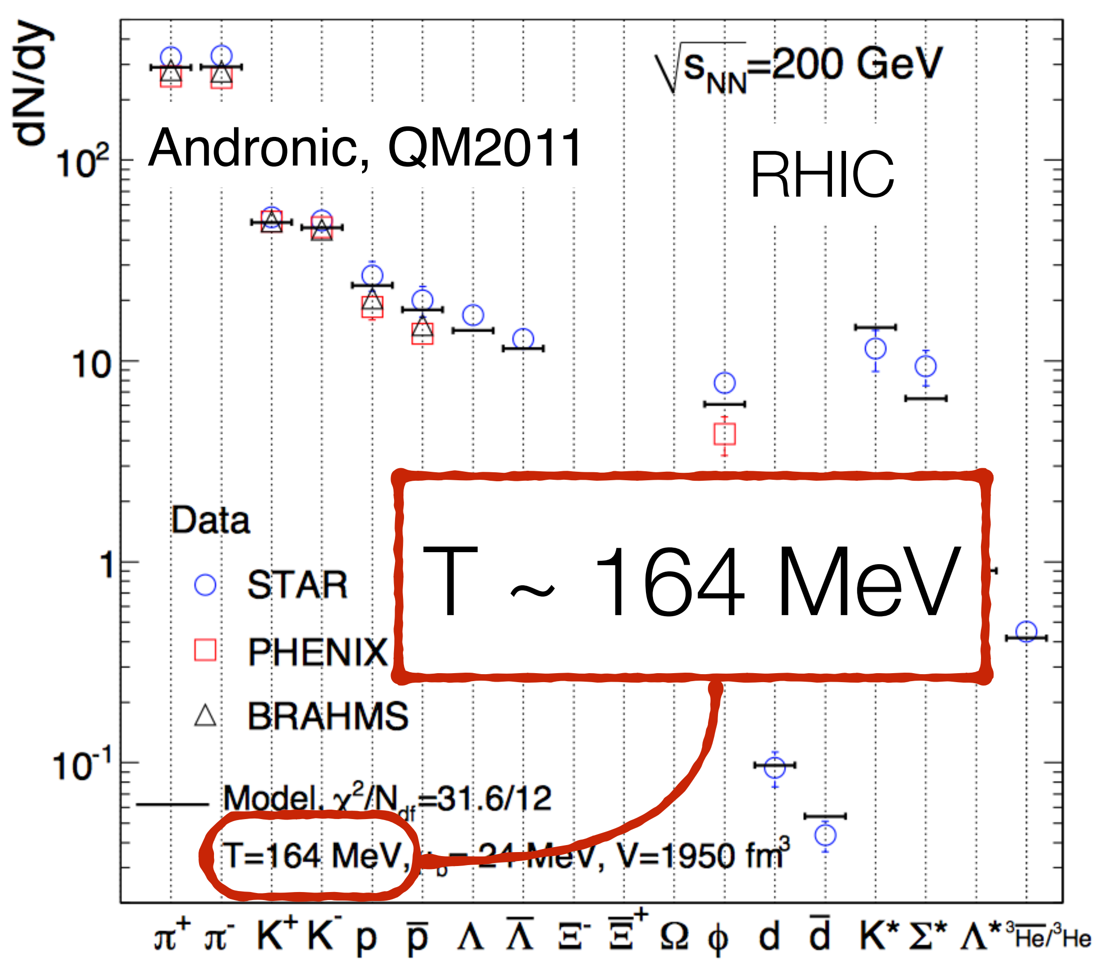


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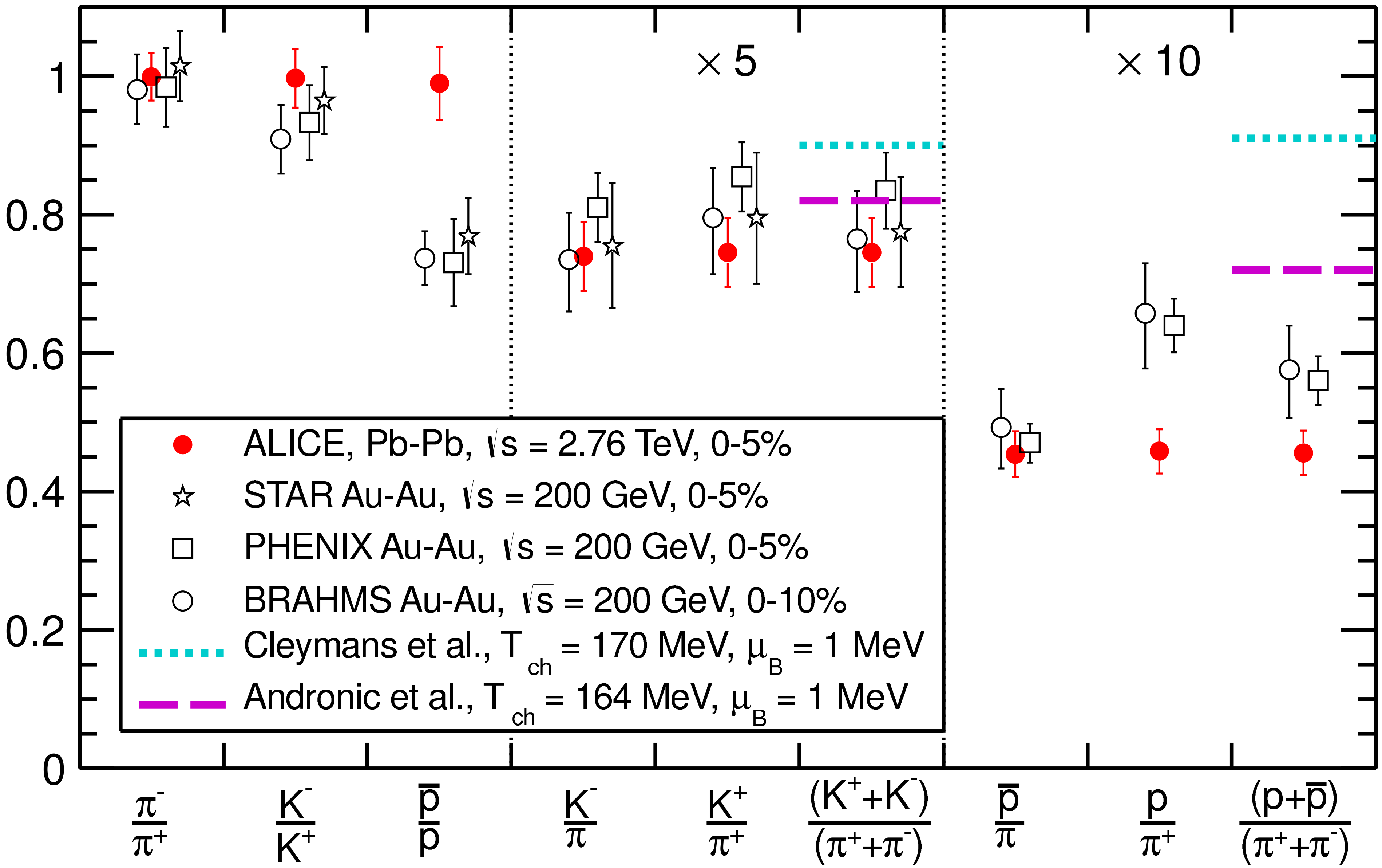
# Anomalous p/π ratio at the LHC

PRL 109 252301 (2012)




ALICE, QM11

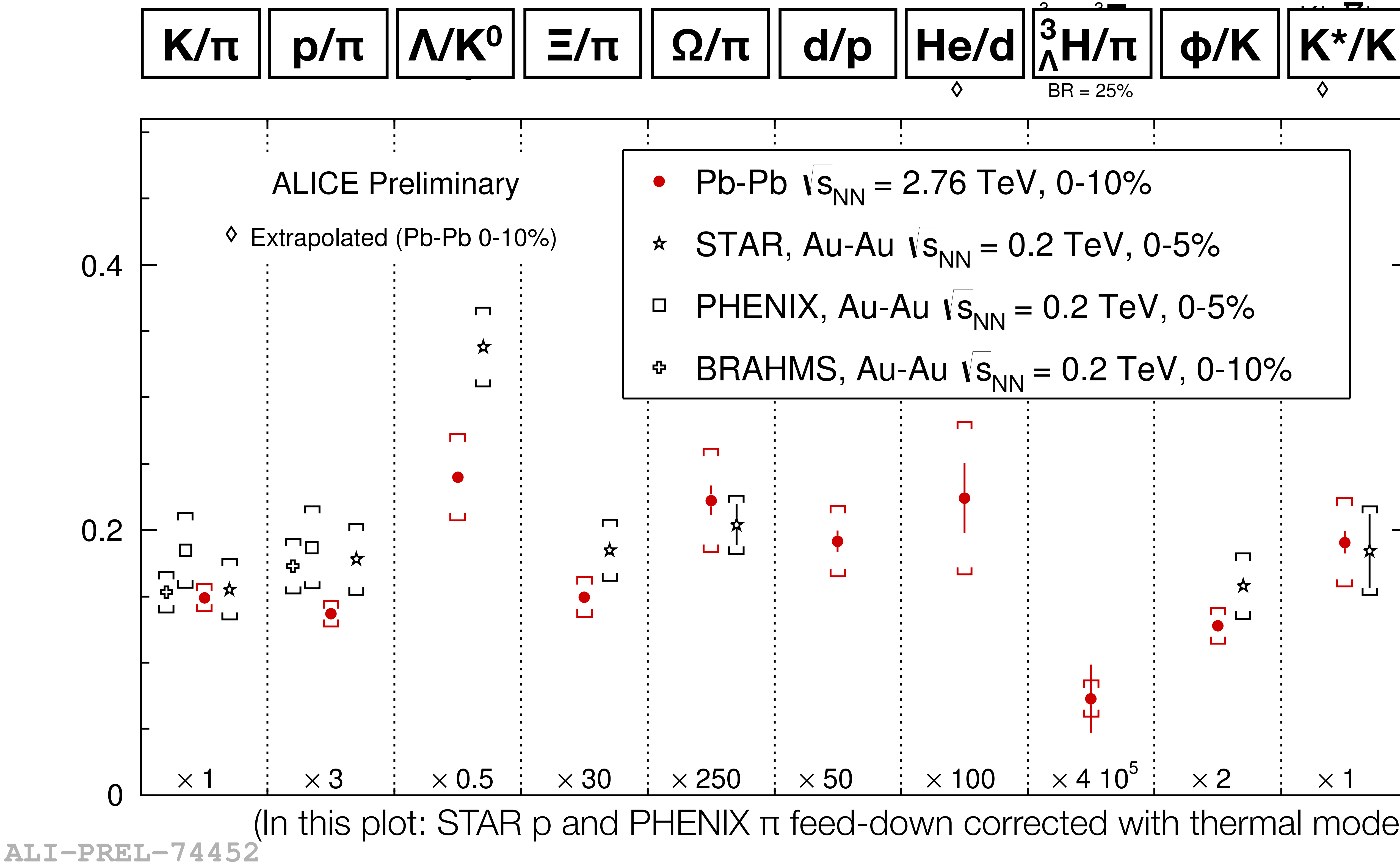
p/π: 1.5 smaller than expectations

Is it only protons or all baryons?

Why?!

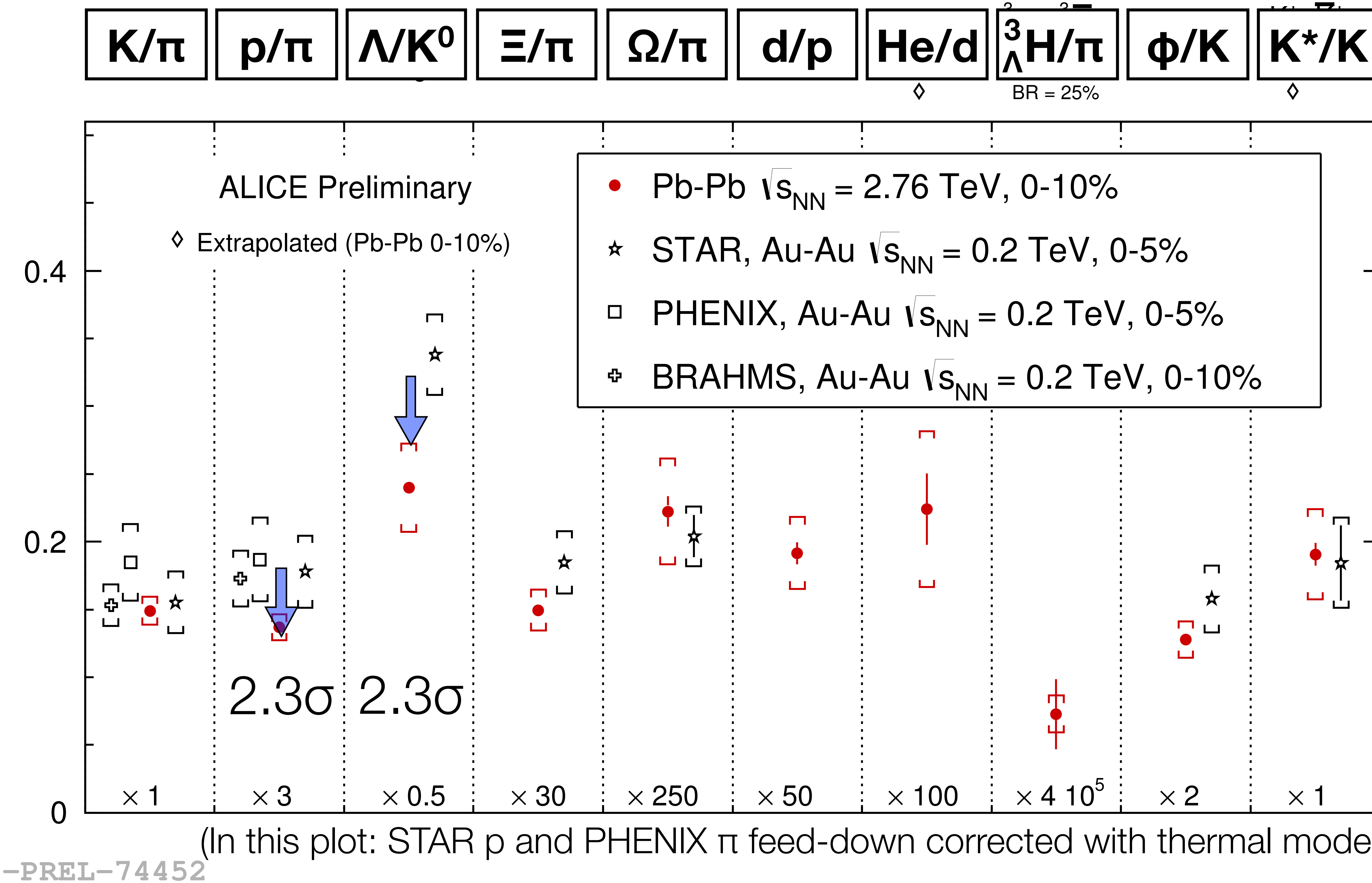
(NB with these 3 species, it would be enough to lower T ~ 140 MeV)

# Ratios, Comparison to RHIC (AA)




(In this plot: STAR p and PHENIX π feed-down corrected with thermal model)

# Ratios, Comparison to RHIC (AA)

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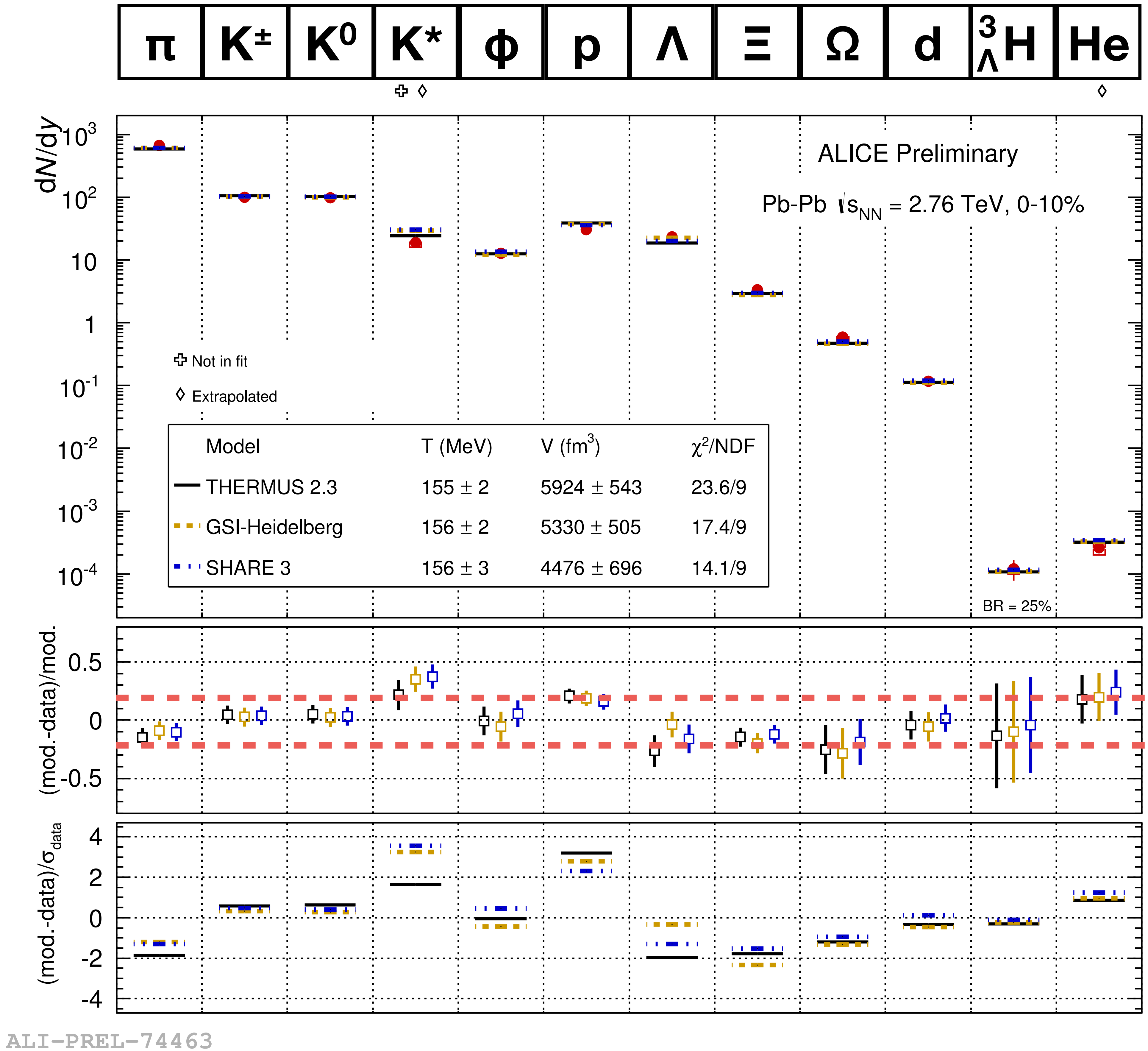
# Equilibrium SHM Fits




N.B.
RHIC
$\sqrt{s}$ = 200 STAR
$\chi^2$/NDF~1

Better fit in
60-80%

**Petran et al, arXiv:1310.5108**
**Wheaton et al, Comput.Phys.Commun, 180 84**
**Andronic et al, PLB 673 142**

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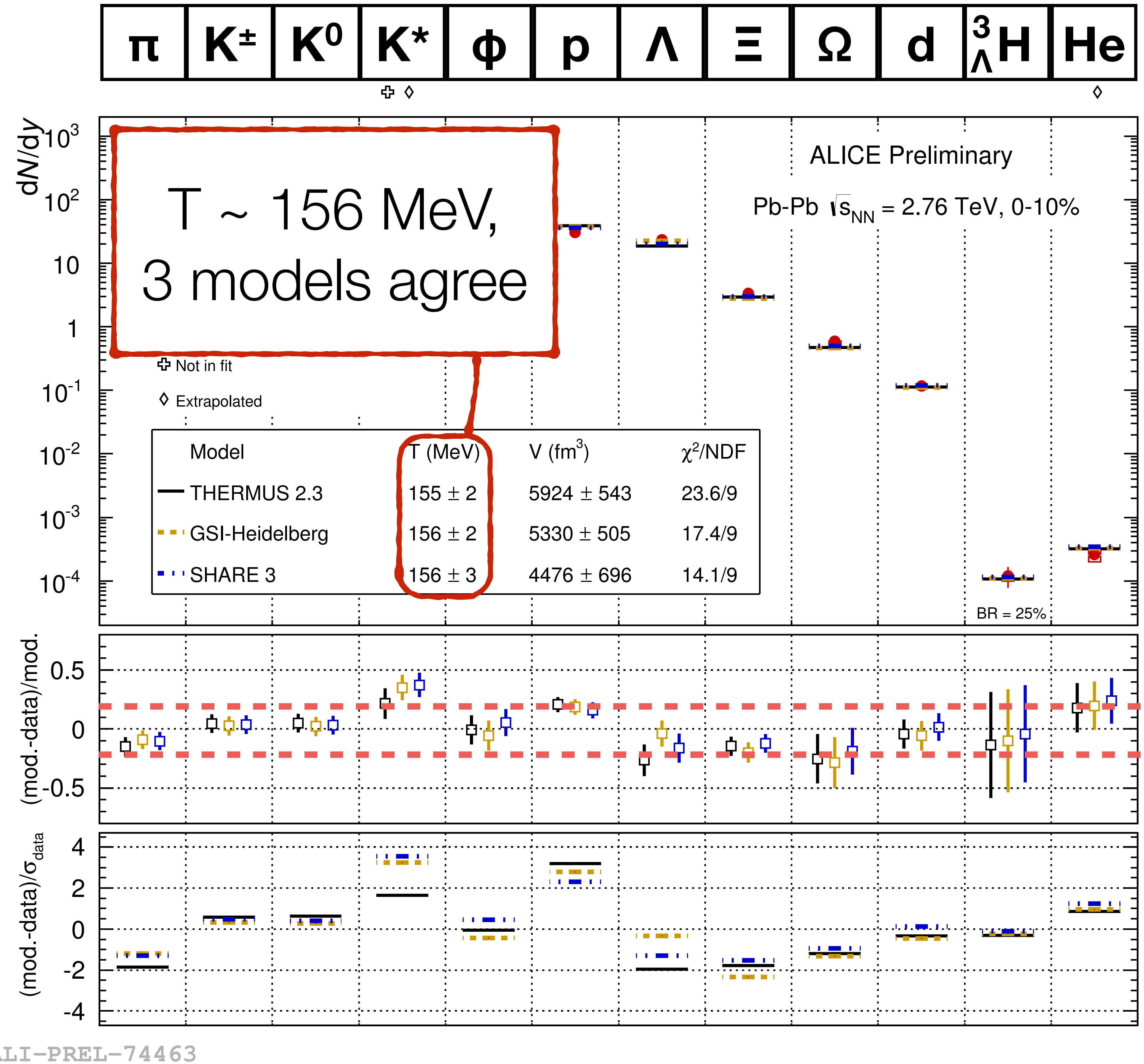


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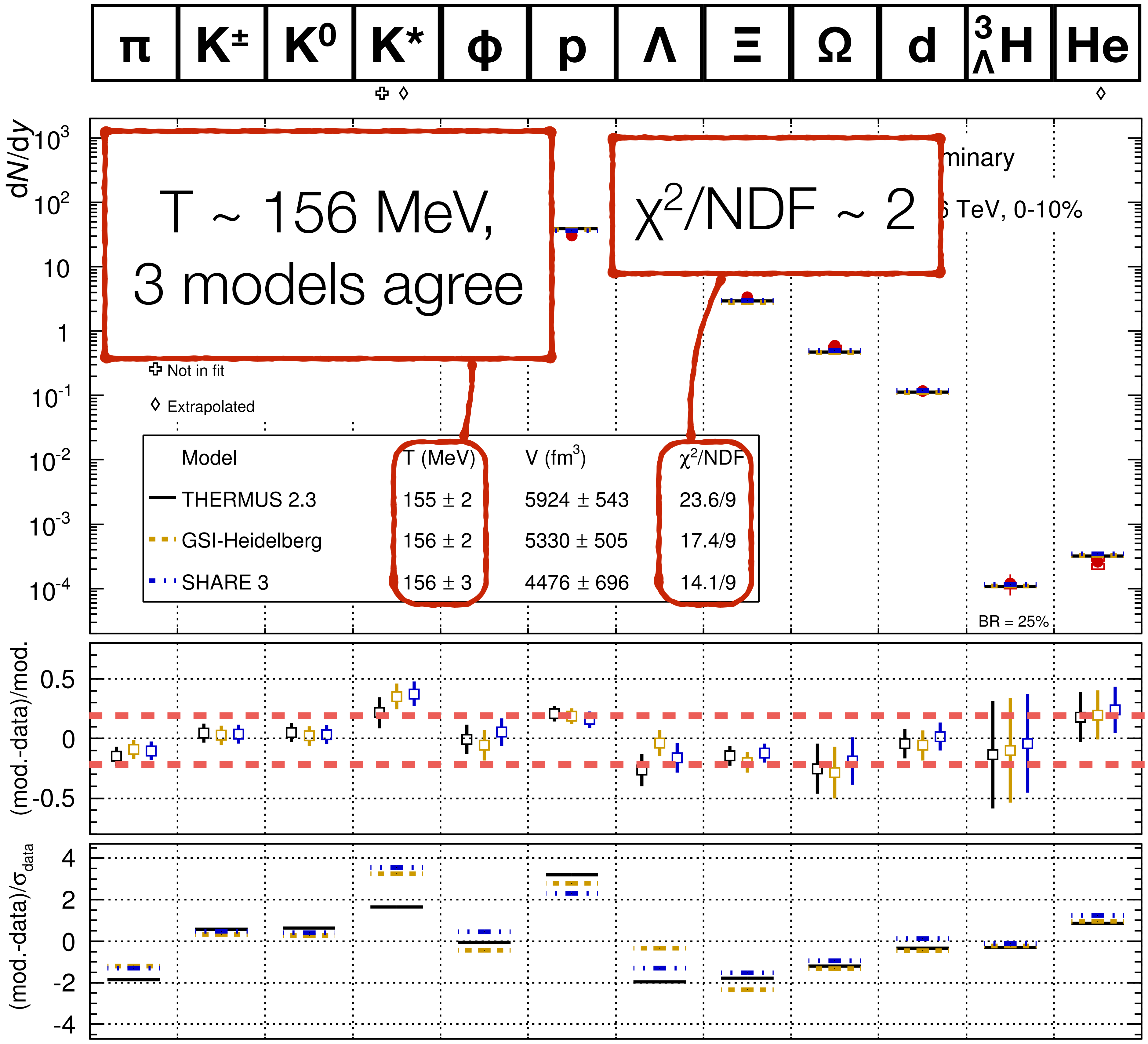


ALI-PREL-74463

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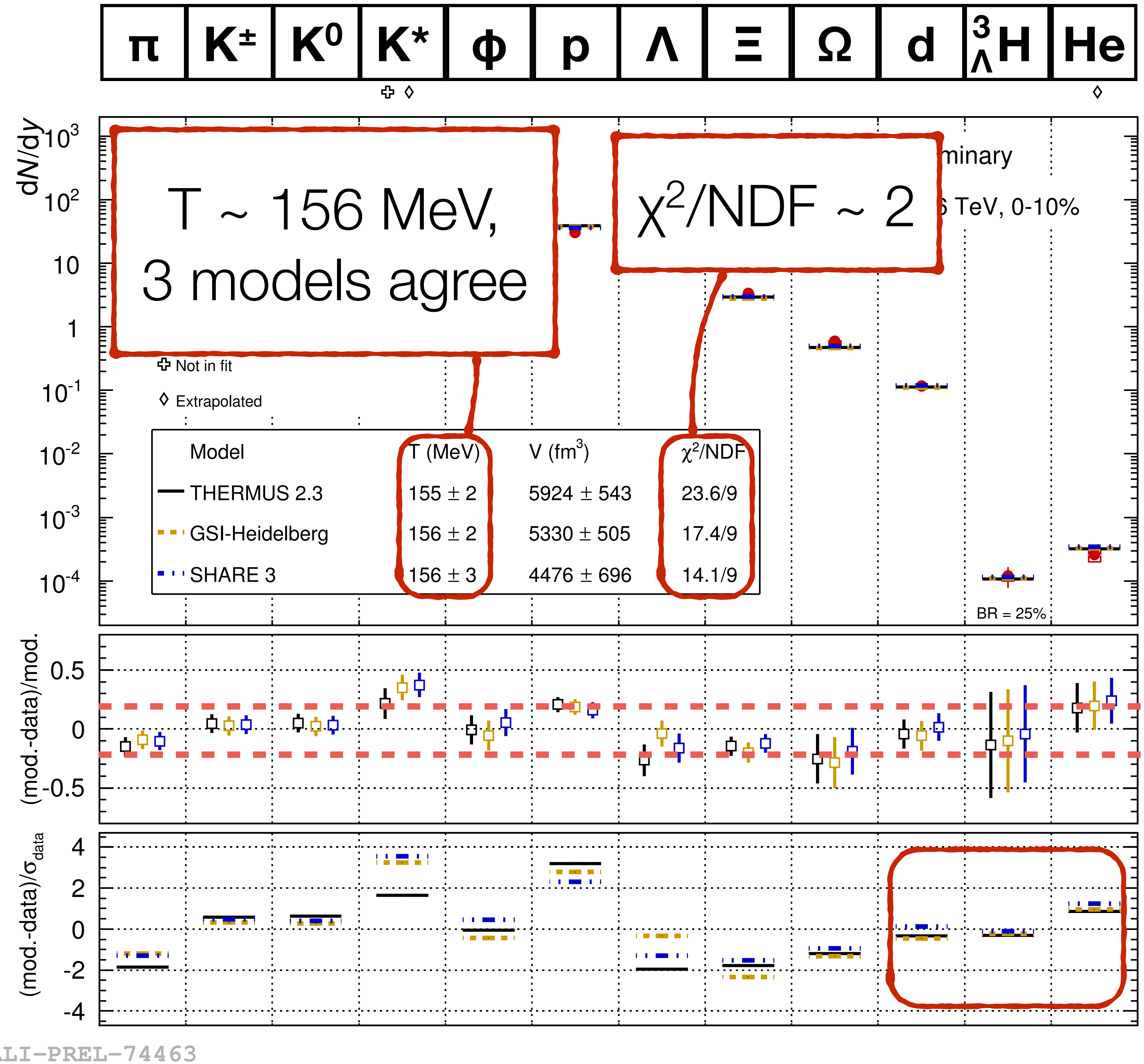


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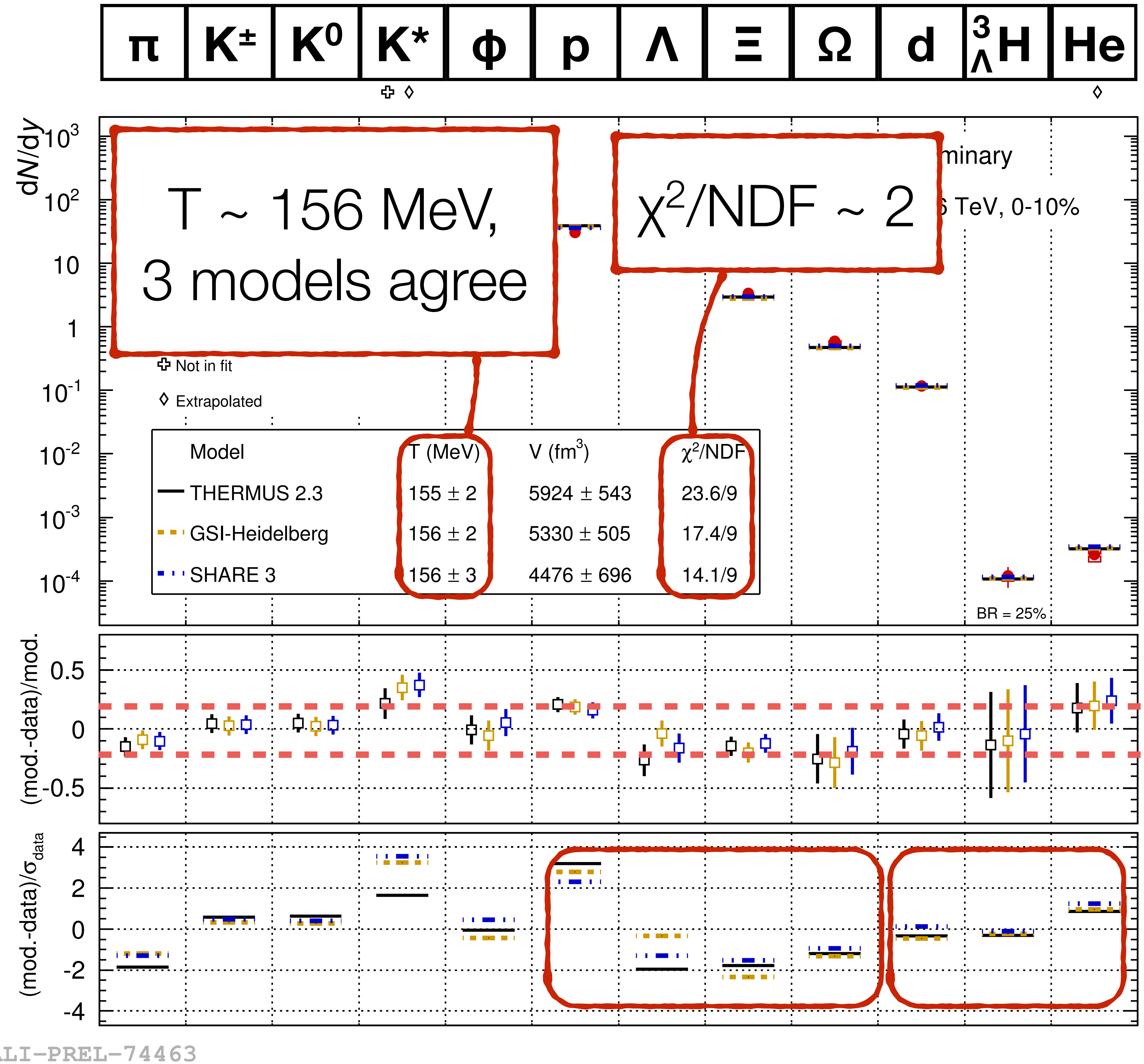


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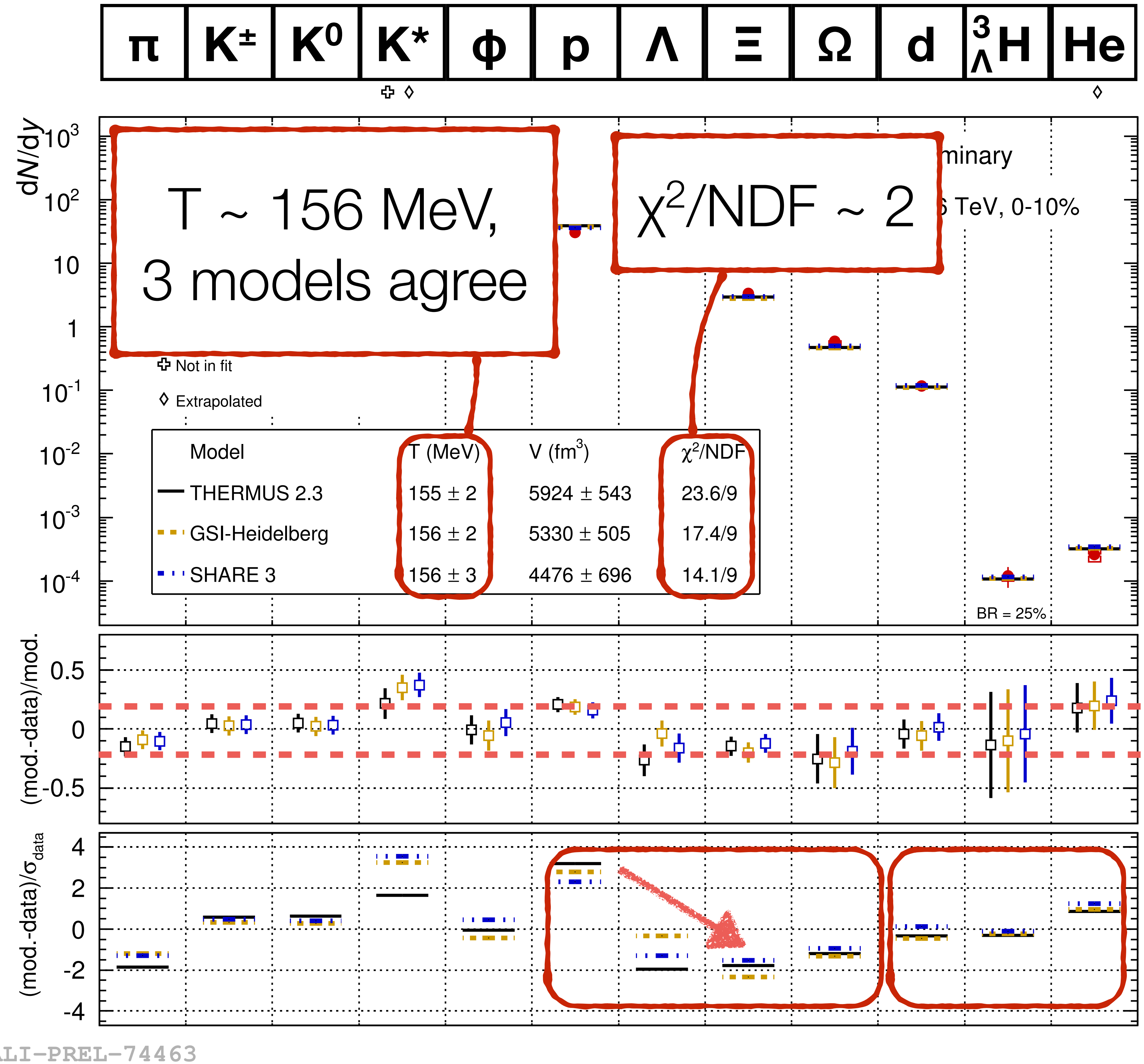


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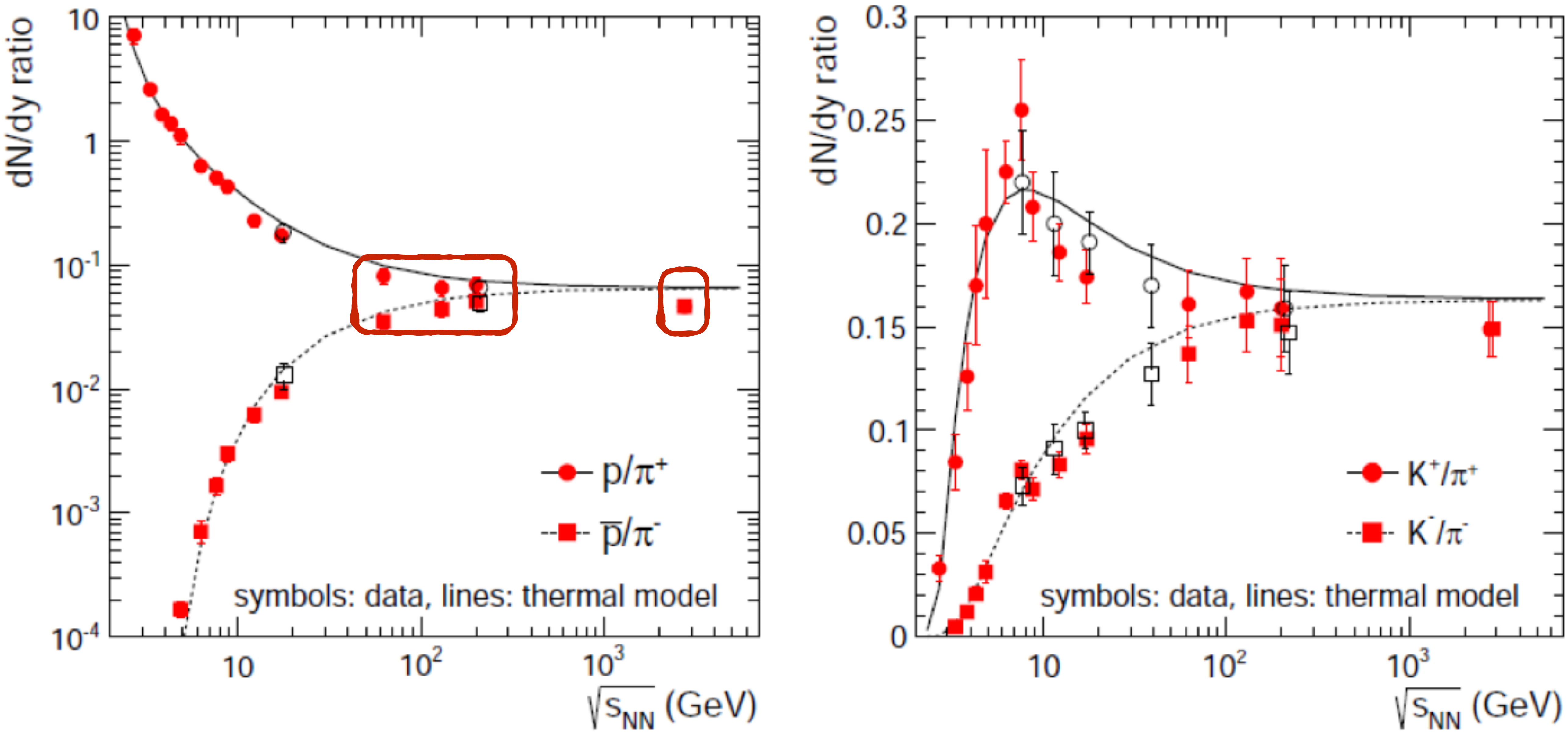
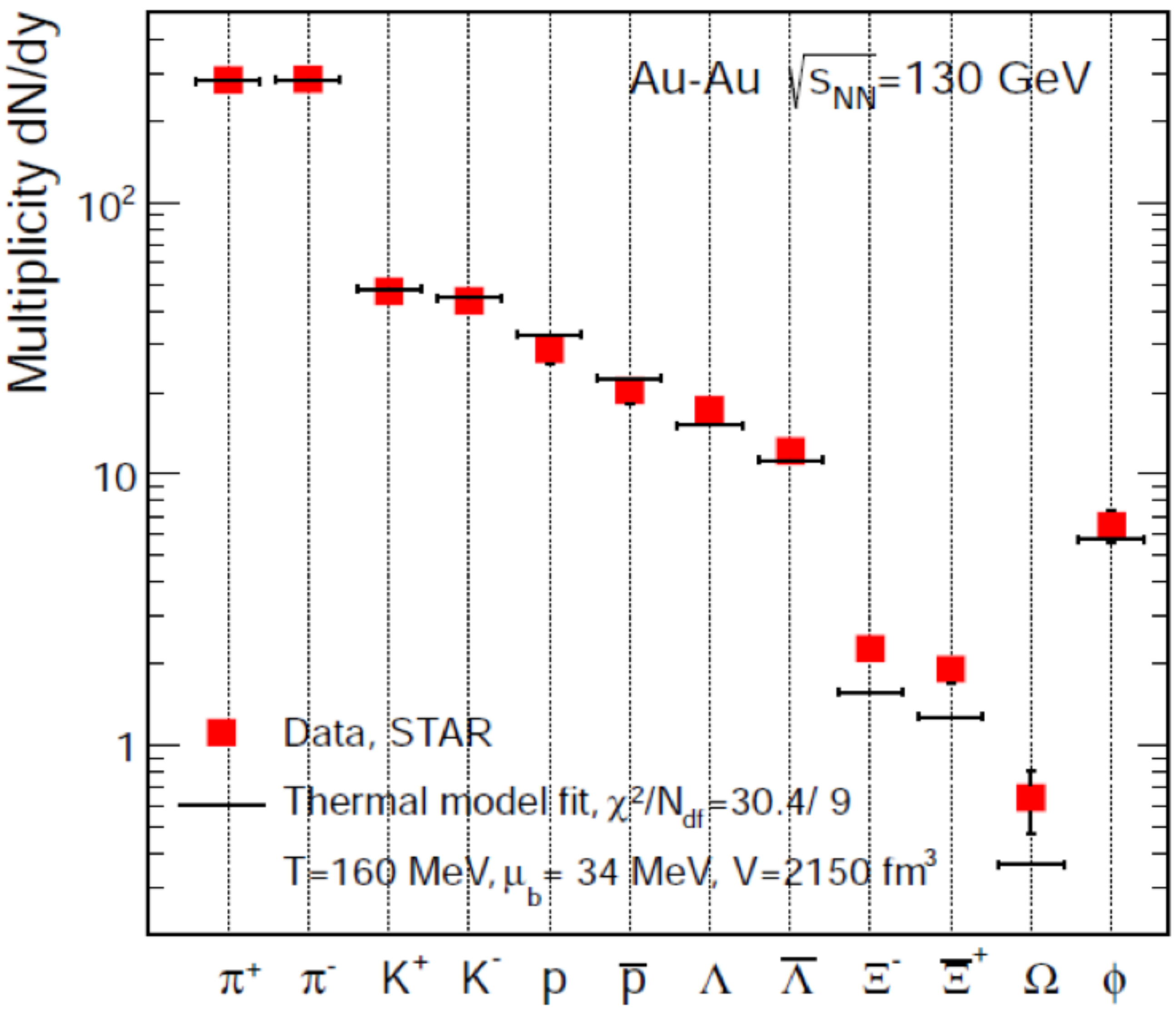
**Wheaton et al, Comput.Phys.Commun, 180 84**
**Andronic et al, PLB 673 142**

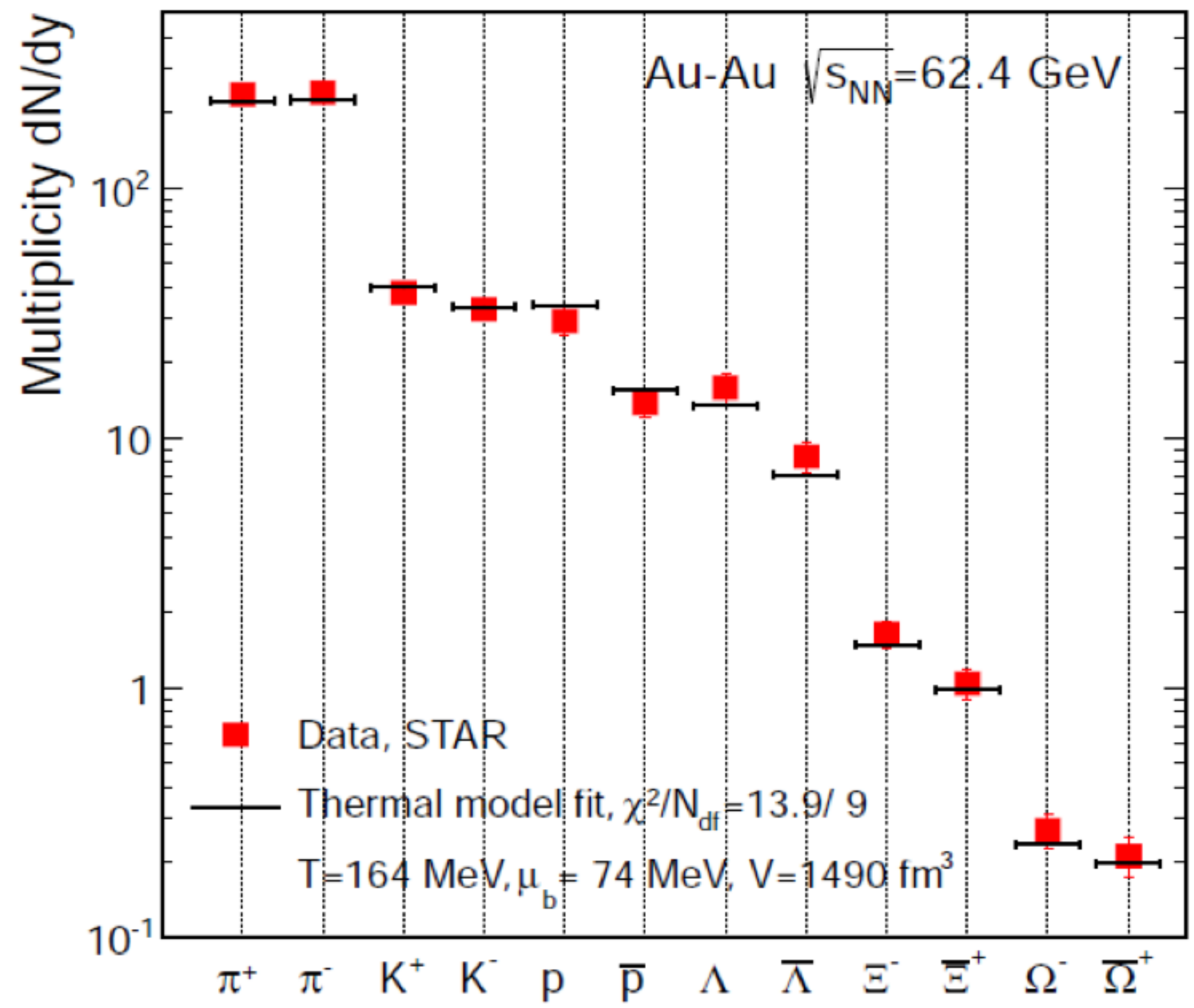
# Re-establishing the baseline: RHIC and SPS




$T_{lim} \simeq 159$ MeV (post-LHC)

**P Braun-Munziger et al, QM2012**

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# Origin of tension Thermal Model / Data?

One of the most discussed features of HI results at the LHC!

- Incomplete hadron spectrum in the model — PRL 113, 072001 (2014) arXiv:1405.7298
  - Affects feed-down and hence final abundances
- Inelastic interactions in the hadronic phase — PRC 90, 054907 (2014)
  - May deplete baryons
- Flavor ordering at freeze-out — PRL 111, 202302 (2013)
  - Different T preferred by *s* and *u-d*
- Non–equilibrium thermal model — PRC, 88, 021901 (2013)
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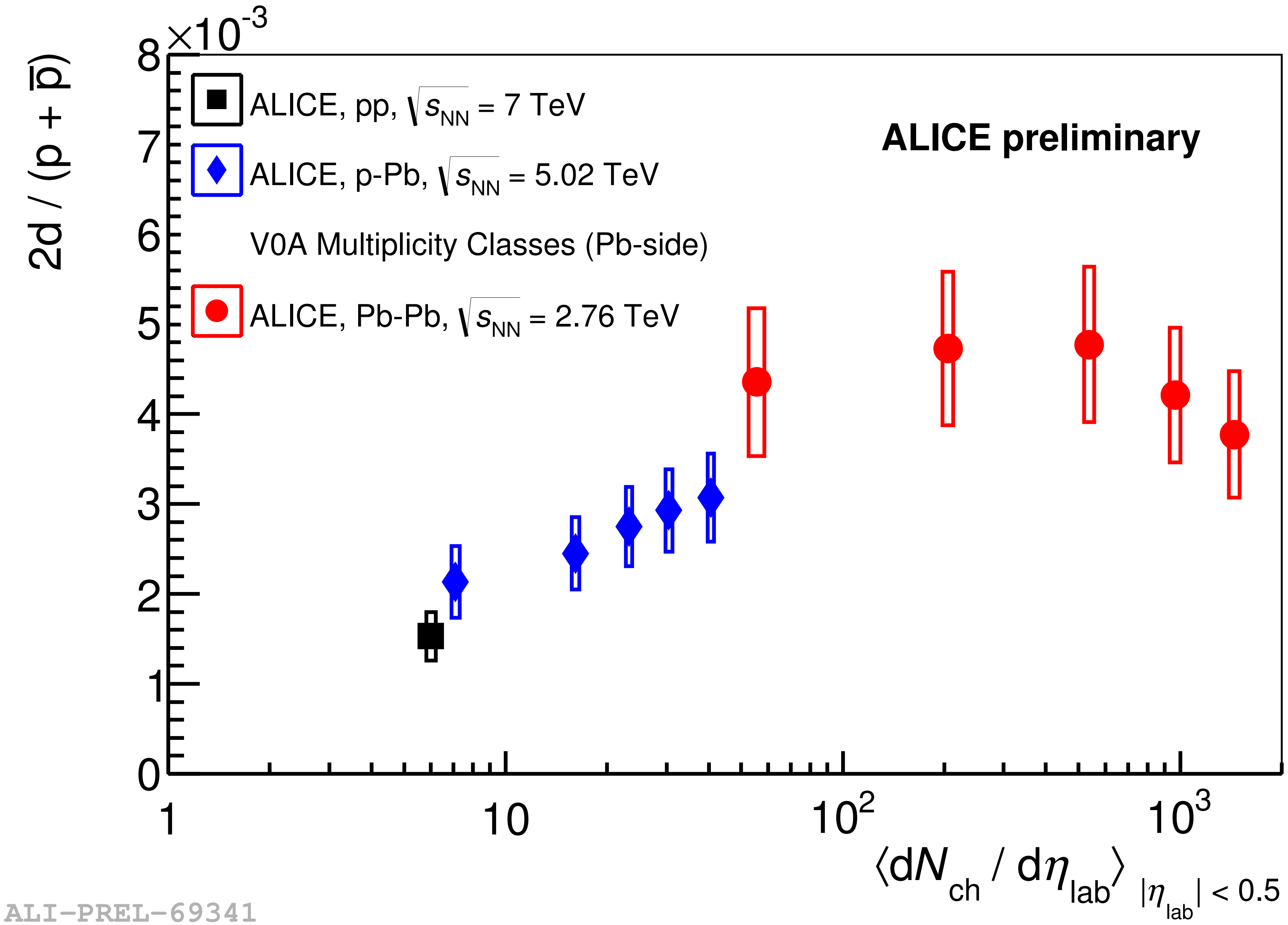
**Crucial** to **distinguish** different scenarios:

⇒ detailed understanding of **collision dynamics**

⇒ window in the **deconfined phase**

# Deuteron in p-Pb



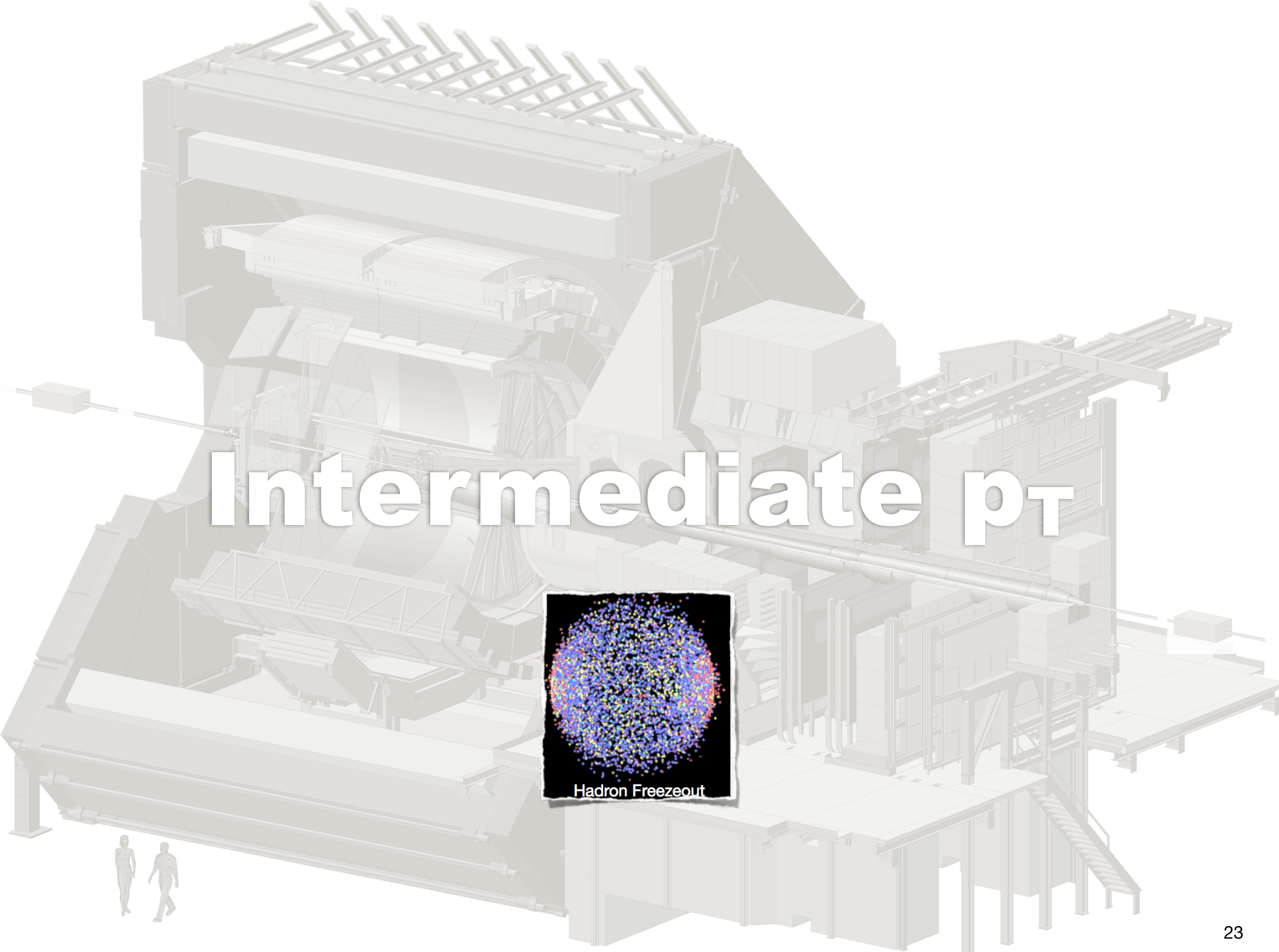

Deuteron enhancement in p-Pb

Production mechanism of Nuclei

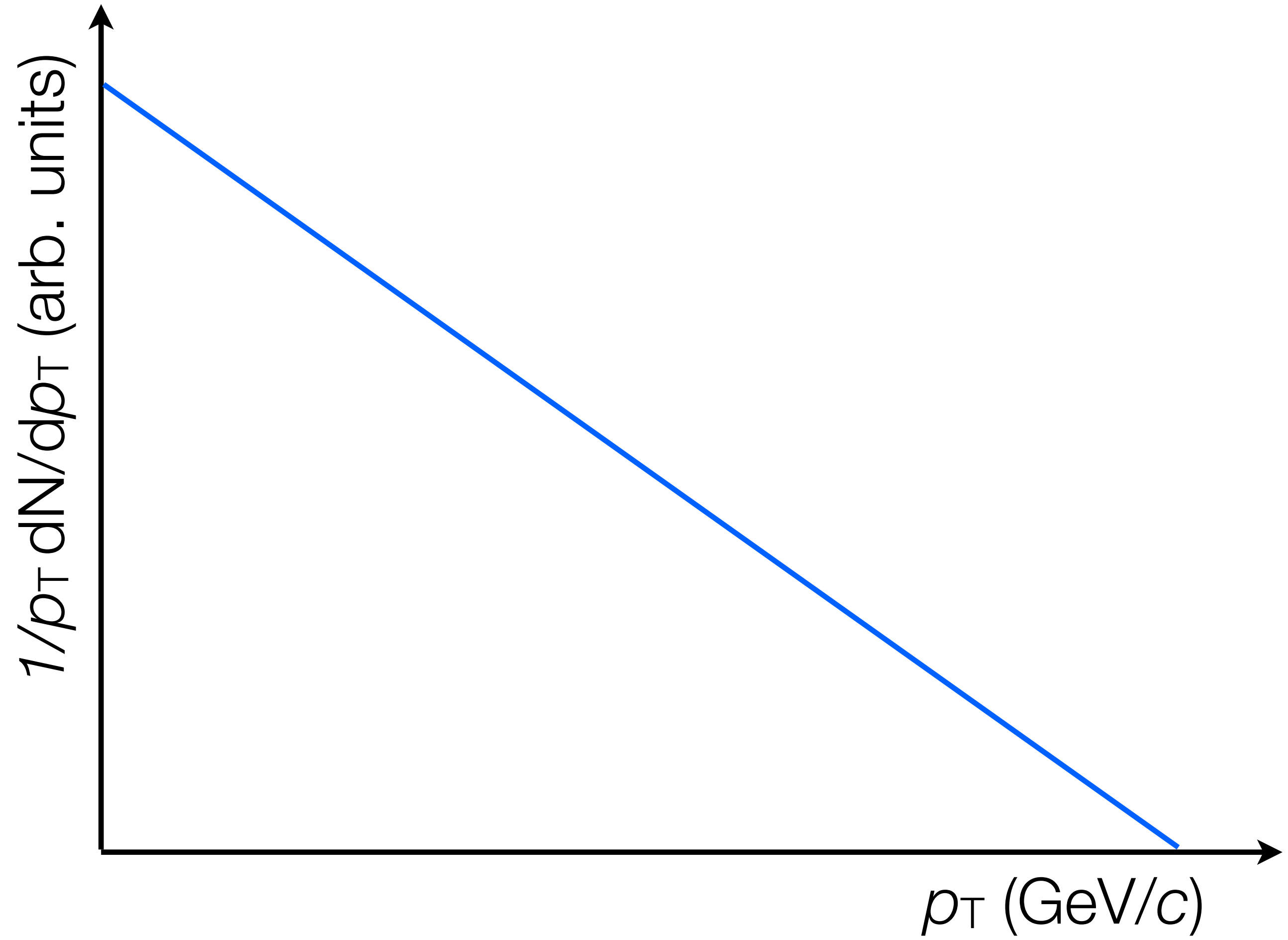
Hint for coalescence?

→ N. Sharma, Tue 2nd

# Intermediate $p_T$



# Quark coalescence




Fragmentation: single parton with $p_T > p_T^{[hadron]}$

Recombination: 2(3) partons with $p_T \sim p_T^{[hadron]}/2(3)$

- Enhances B/M
- Scaling with Number of Constituent Quarks (NCQ)

(In some models: thermal + minijet recombination)

recent review: Greco, Fries, Sorensen, Annu. Rev. Nucl. Part. Sci. 2008.58:177-205.

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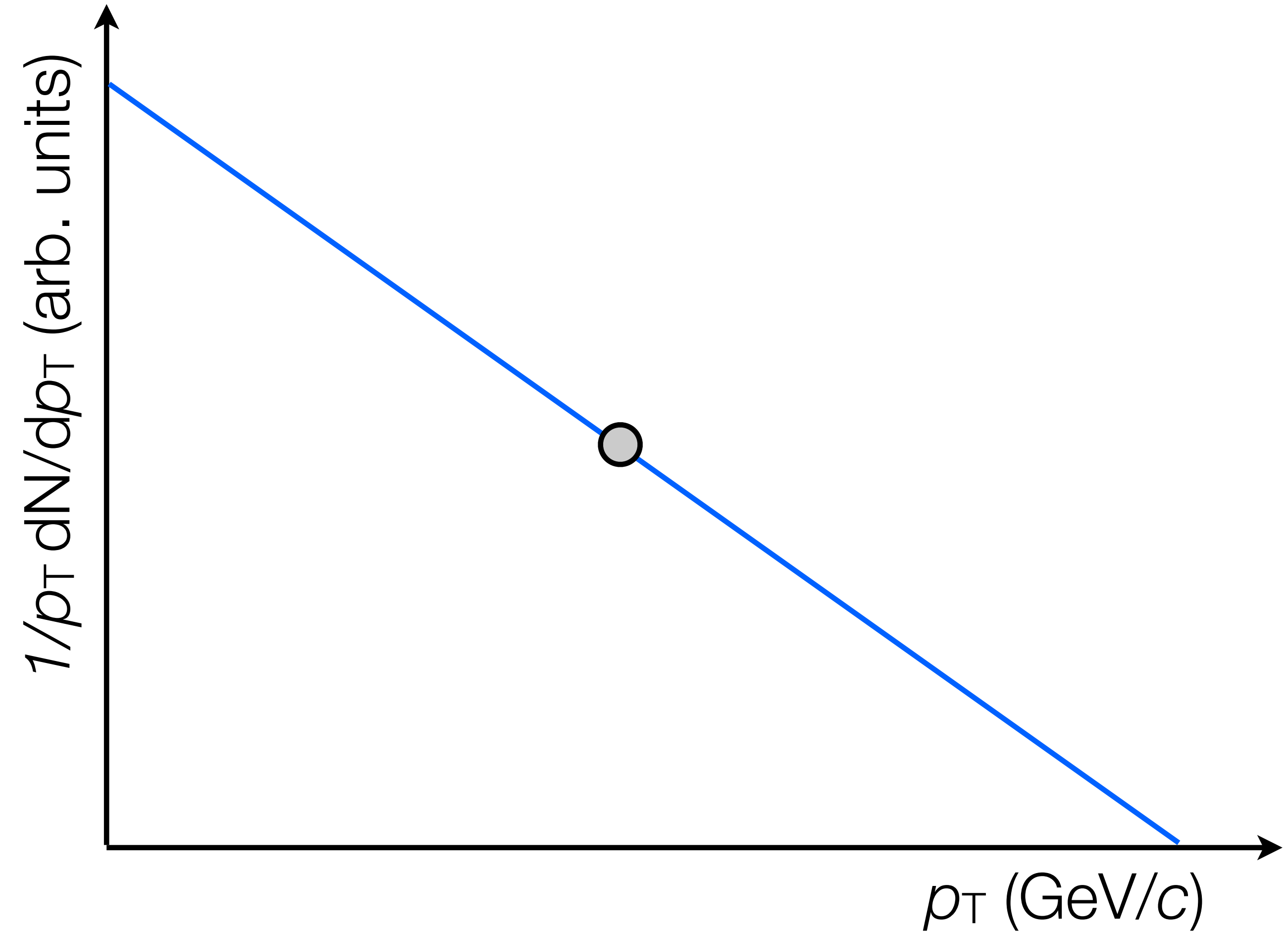


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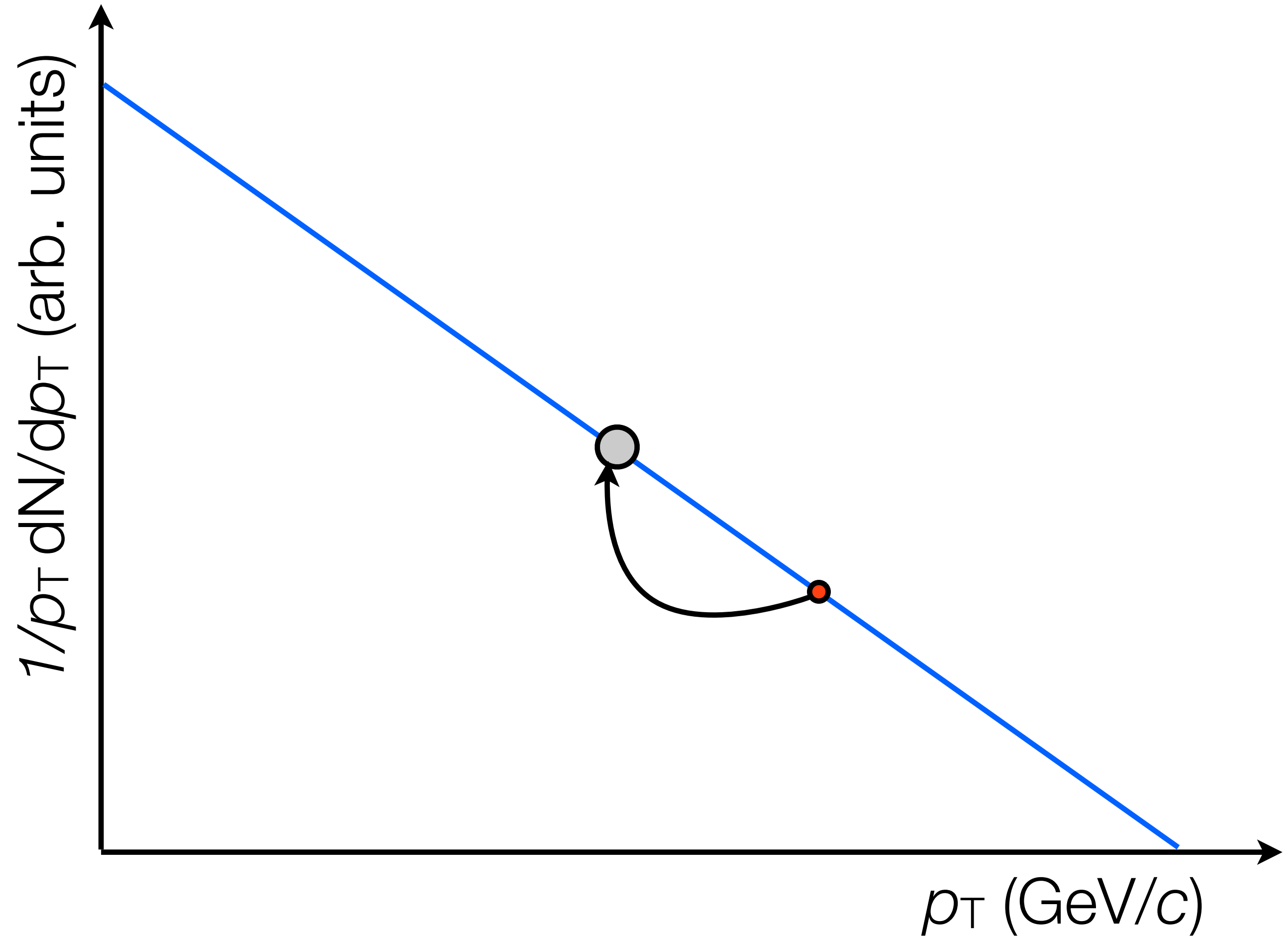


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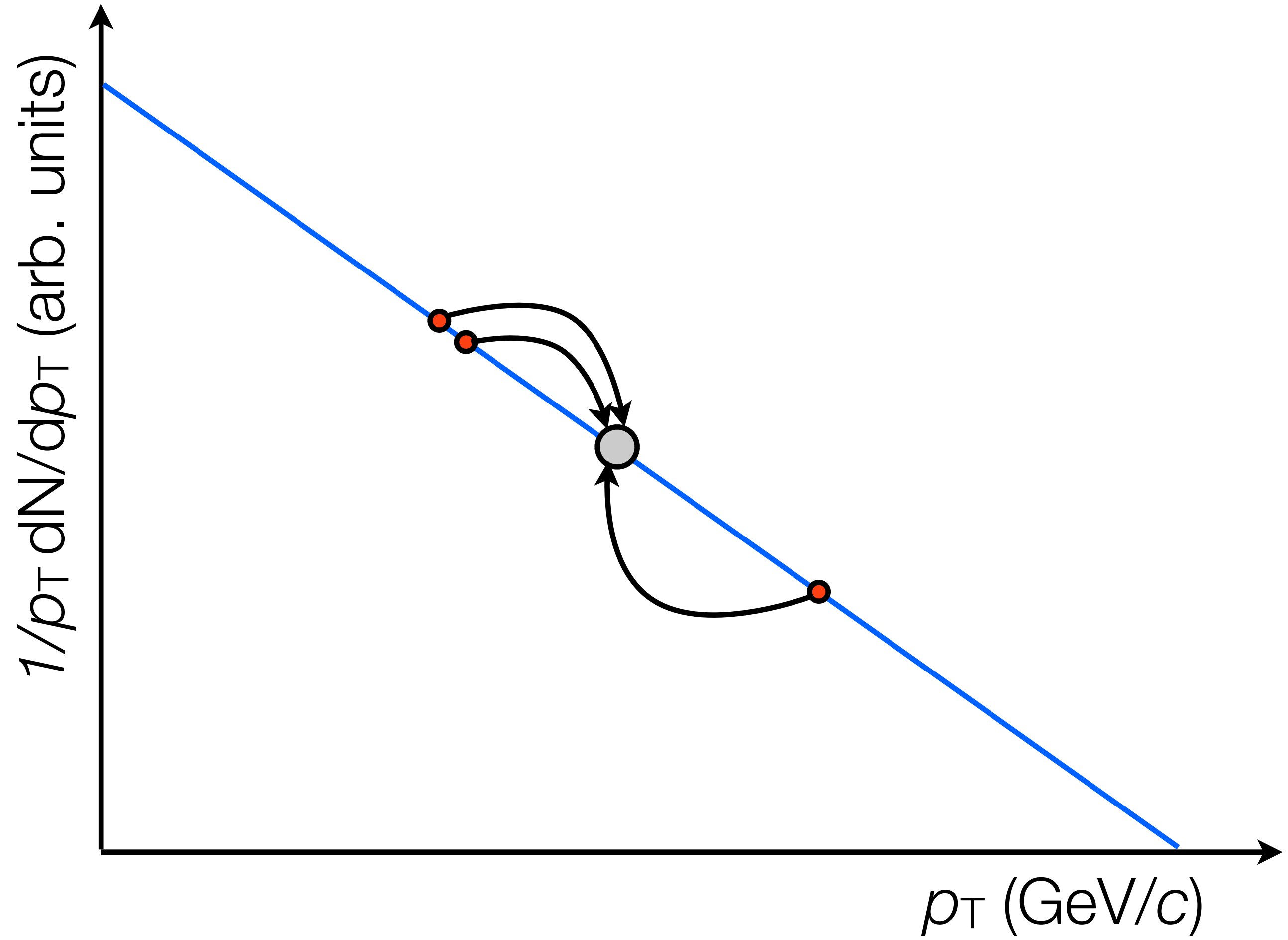


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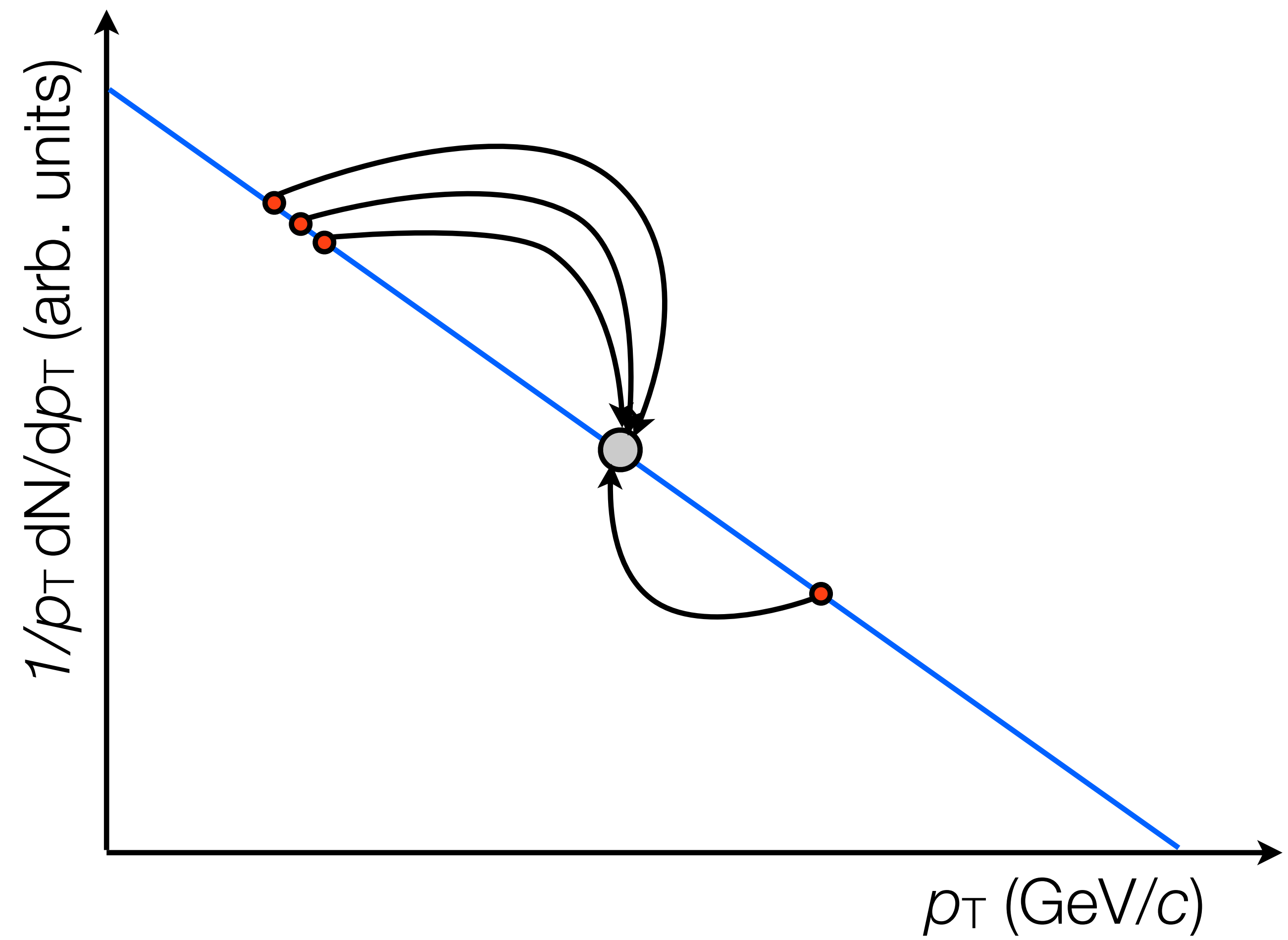


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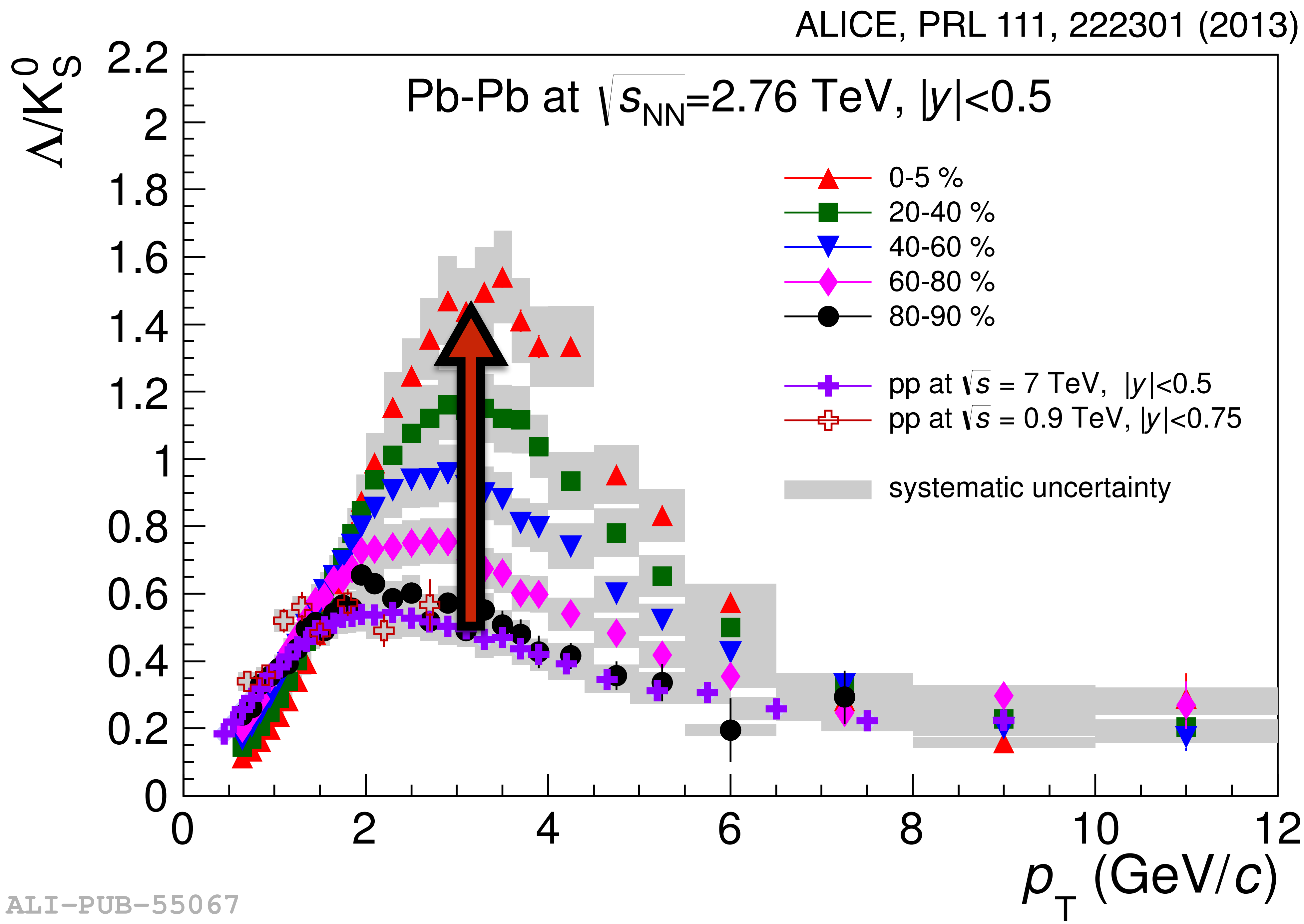
# B/M ratios at intermediate $p_T$

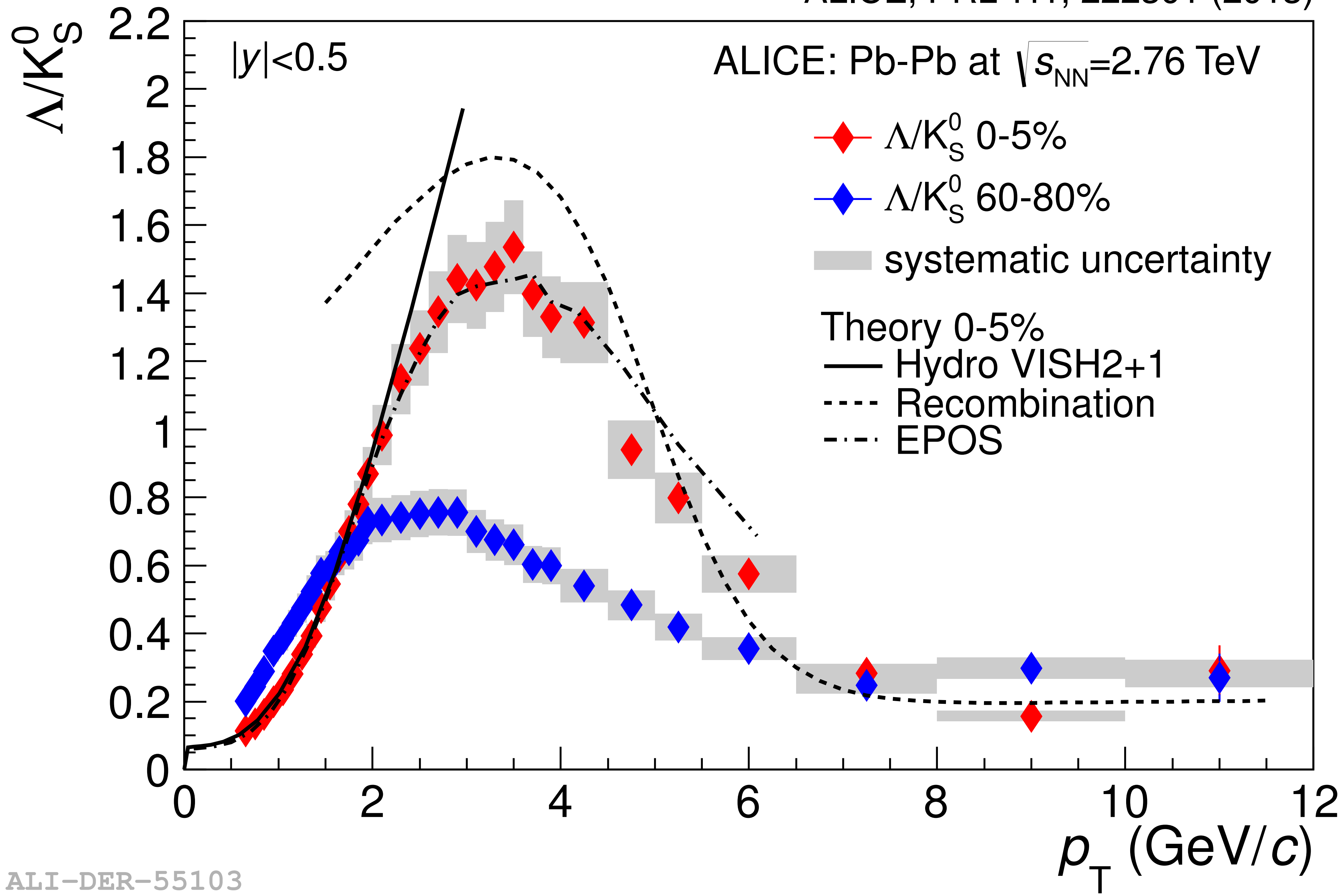



**Radial Flow** explains rise

**Recombination** describes some features of the data

**Interplay** of "bulk" expansion and hard processes?

ALICE, PRL 111, 222301 (2013)

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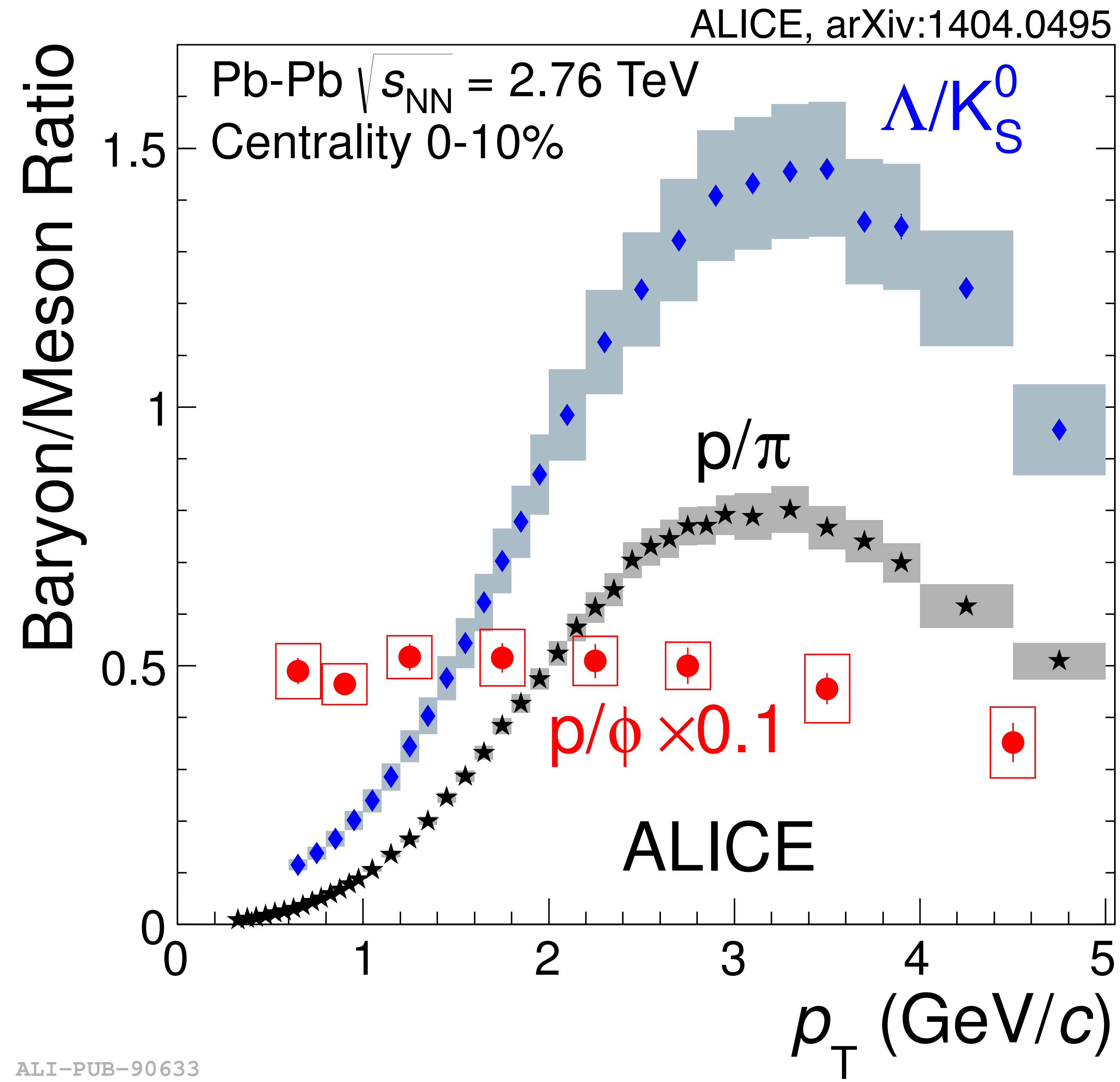
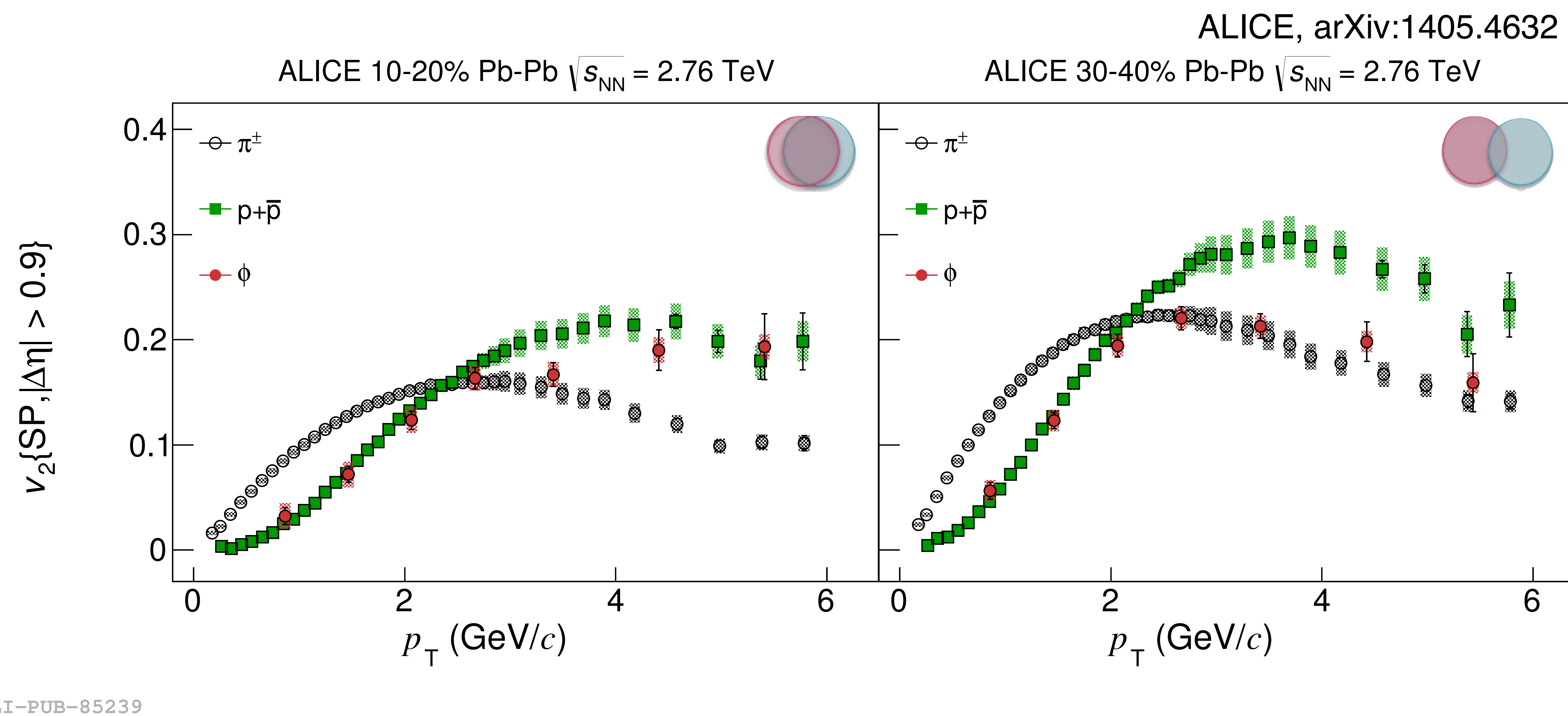
# B/M ratios: ϕ/p




The ϕ meson has the same shape as p: mass ordering (as expected from radial flow)?

# Recombination and anisotropic flow



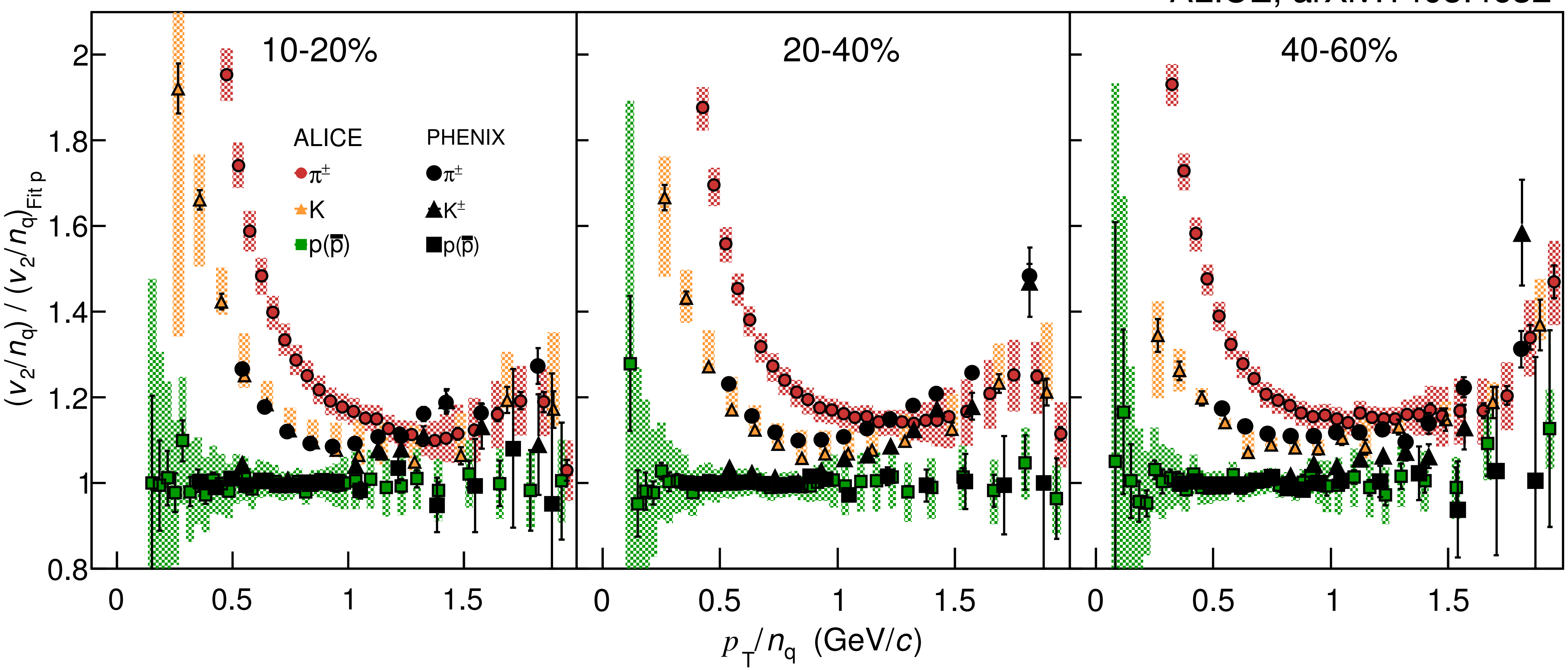

**Recombination and $v_2$** ⇒ B/M ordering + NCQ scaling

**ϕ central**: mass ordering at all $p_T$ (close to p)

**ϕ semi-central**: mass ord. low $p_T$, follows π high $p_T$

# Recombination and anisotropic flow

ALICE, arXiv:1405.4632




ALI-PUB-82622

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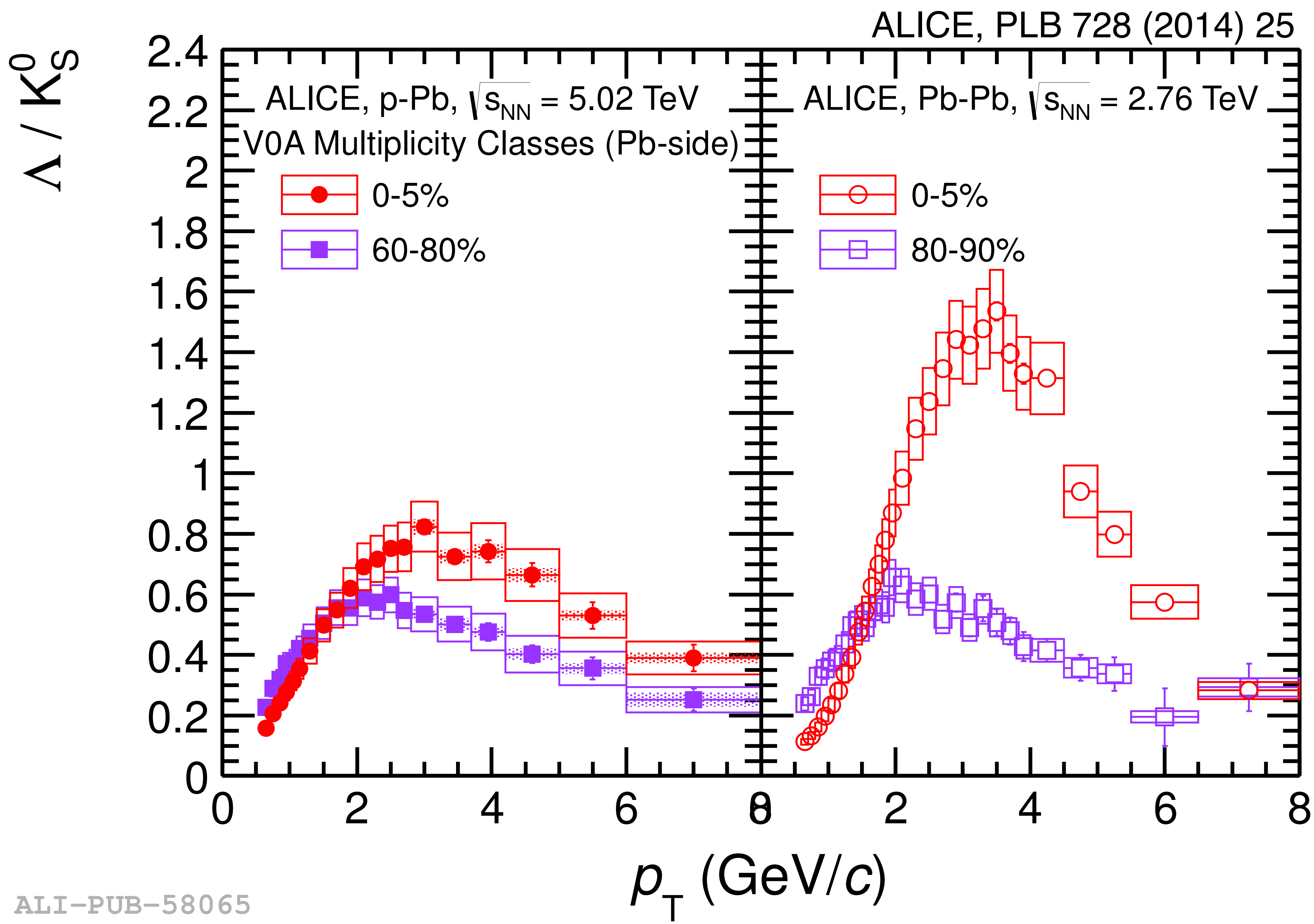
Violation of constituent quark scaling ~ ±20%

# B/M ratios in p–Pb collisions




Similar behavior seen in p-Pb

Disappears if analysis is done only inside jet cones (similar conclusion in Pb-Pb)

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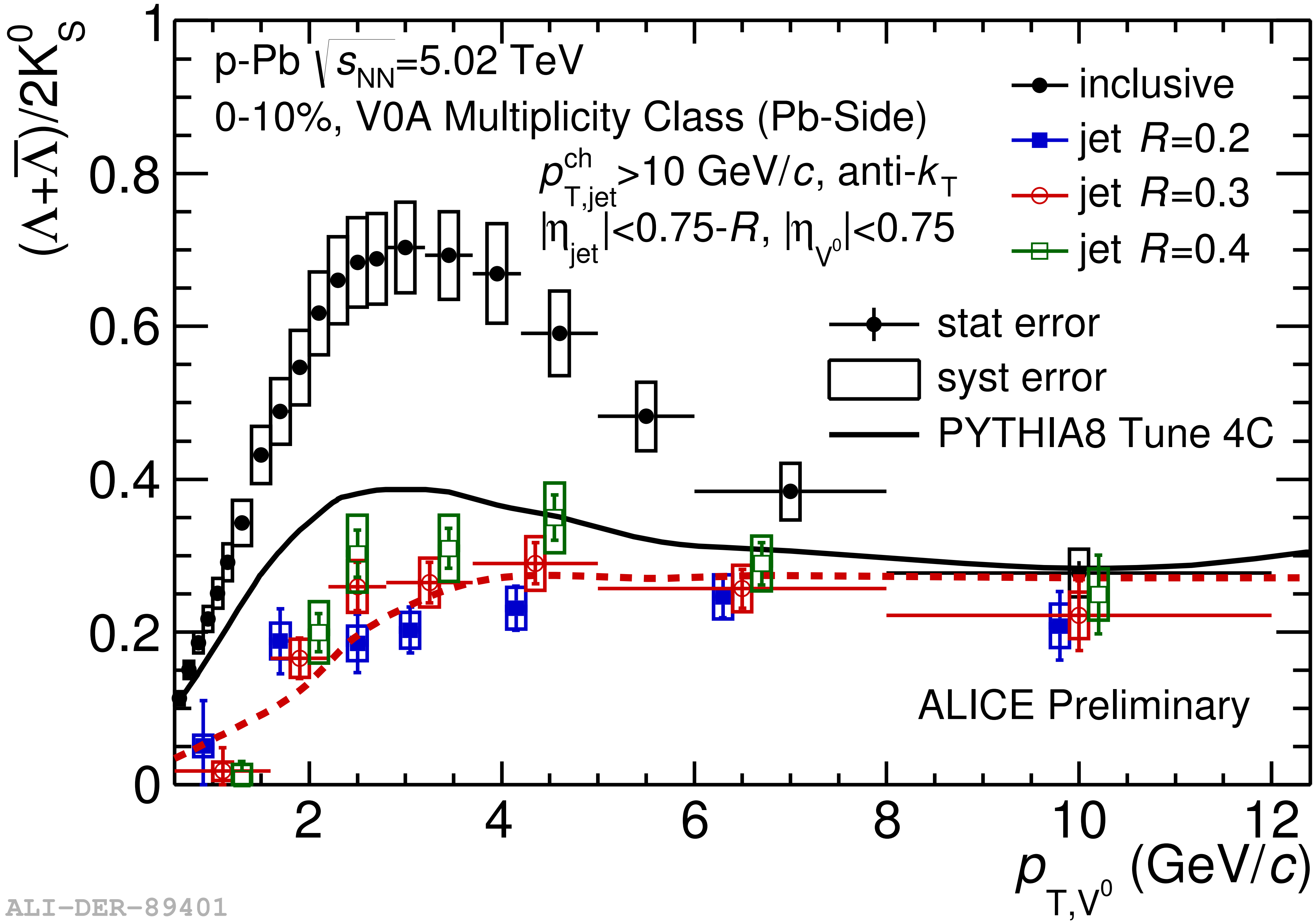


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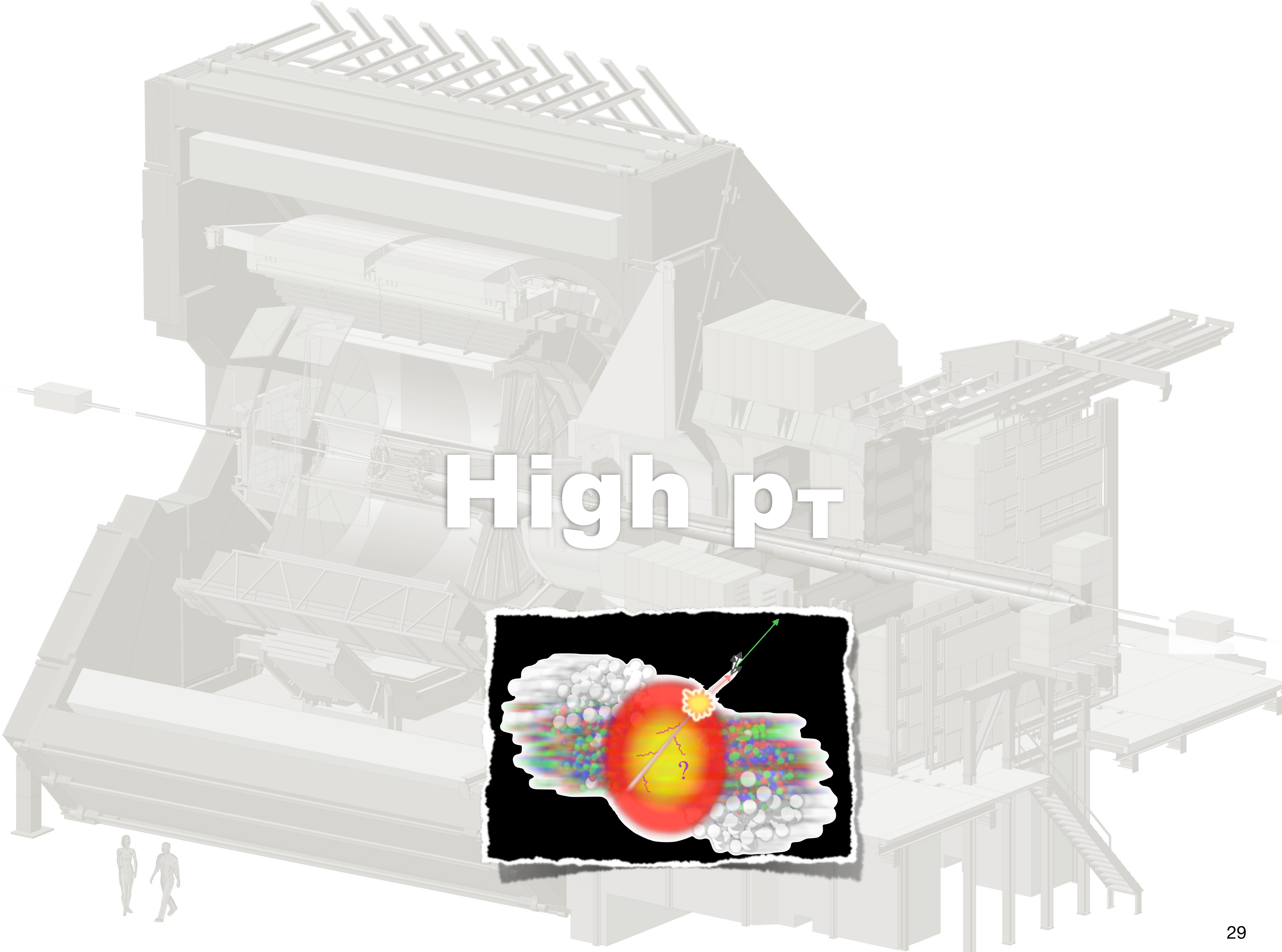
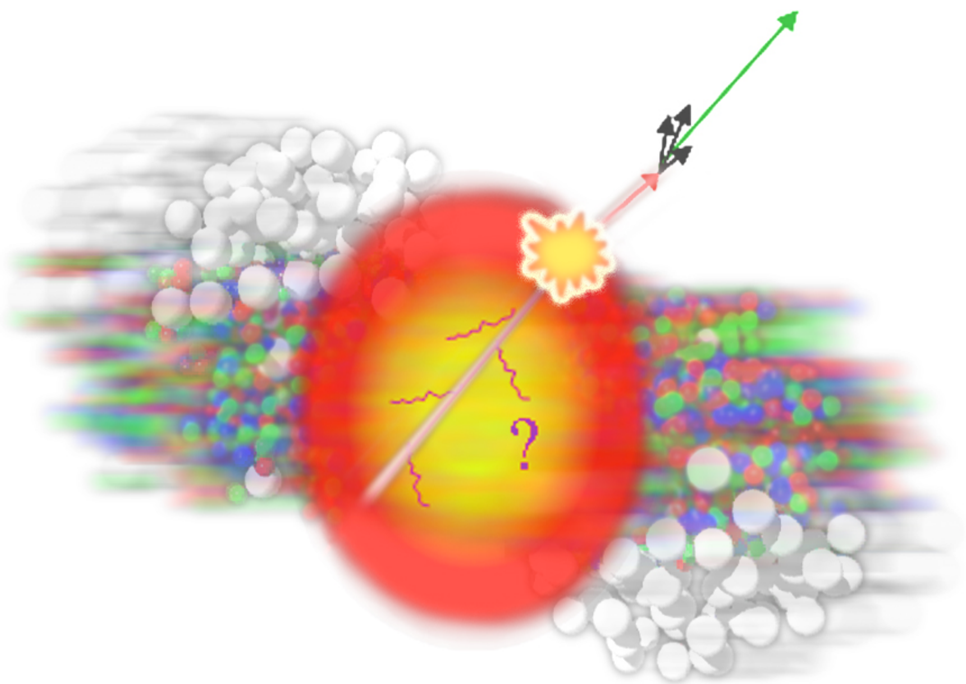
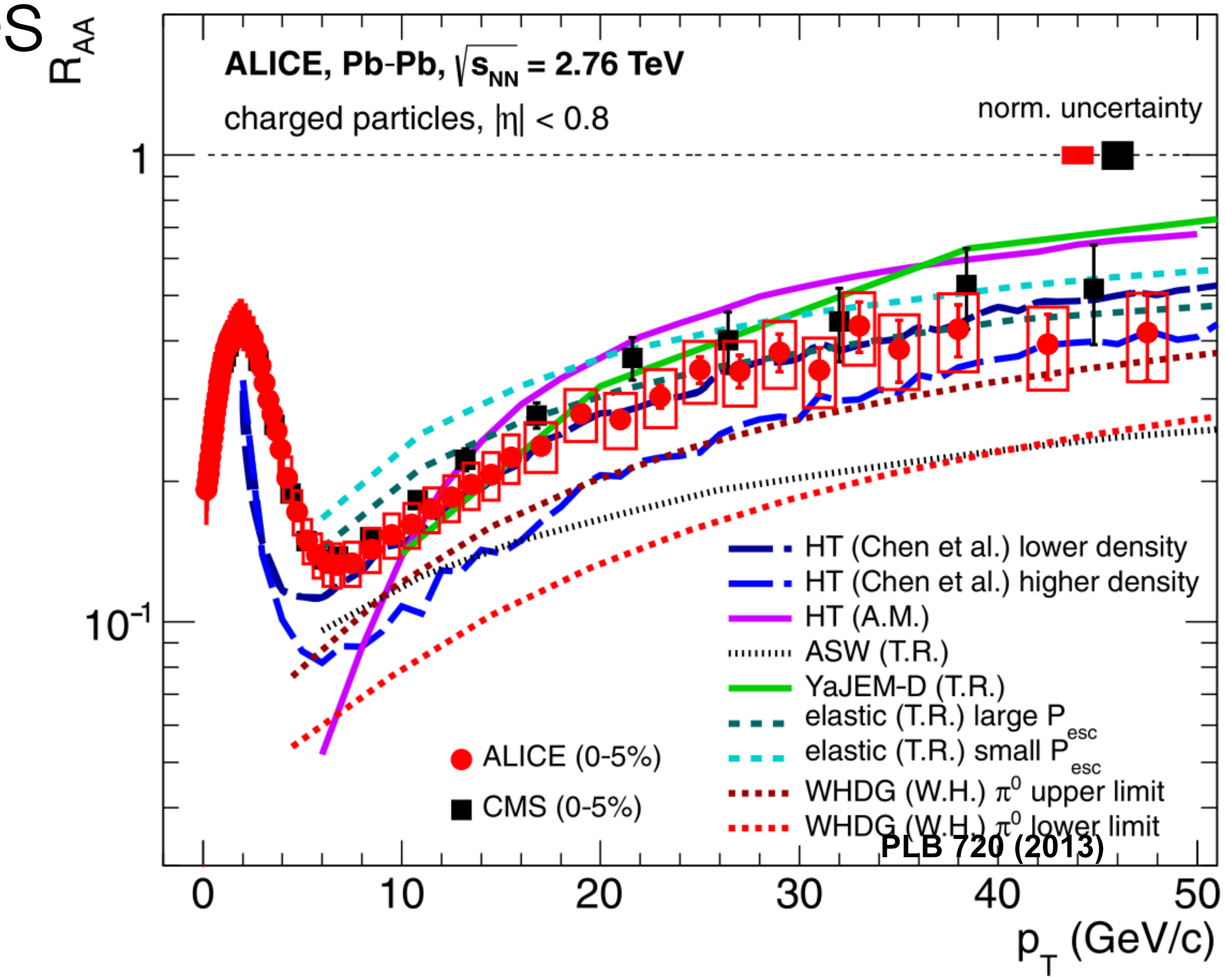
# High $p_T$



# High $p_T$ suppression

**Suppression** of high $p_T$ particles






Studied through "**nuclear modification factor**"

$$R_{AA} = \frac{AA}{\text{rescaled pp}} = \frac{d^2N_{AA}/dp_T dy}{\langle N_{coll}\rangle d^2N_{pp}/dp_T dy}$$

Measured for a variety of LF particles: **reference** for HF studies

ALICE, PLB 720, 52
ALICE, PRL 110, 082302
ALICE, PLB 736,196

→ S. Masciocchi, Tue 2nd
→ K. Reygers, Fri 5th

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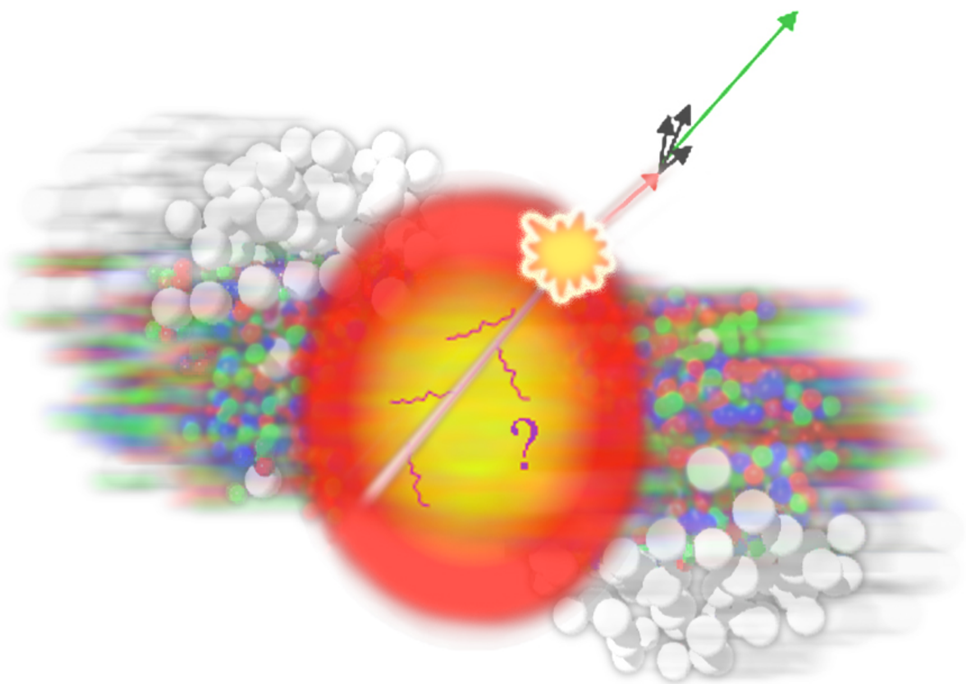

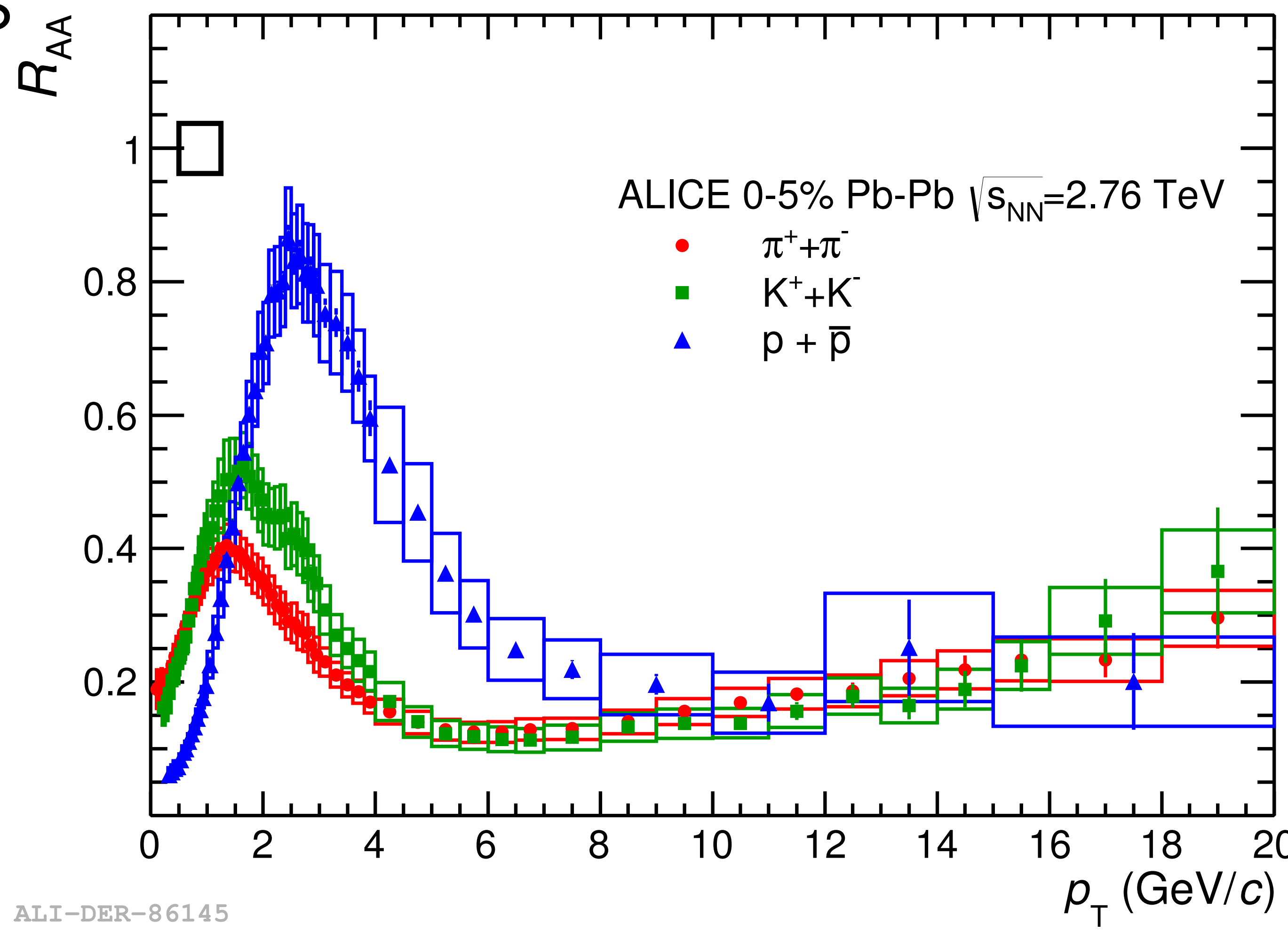


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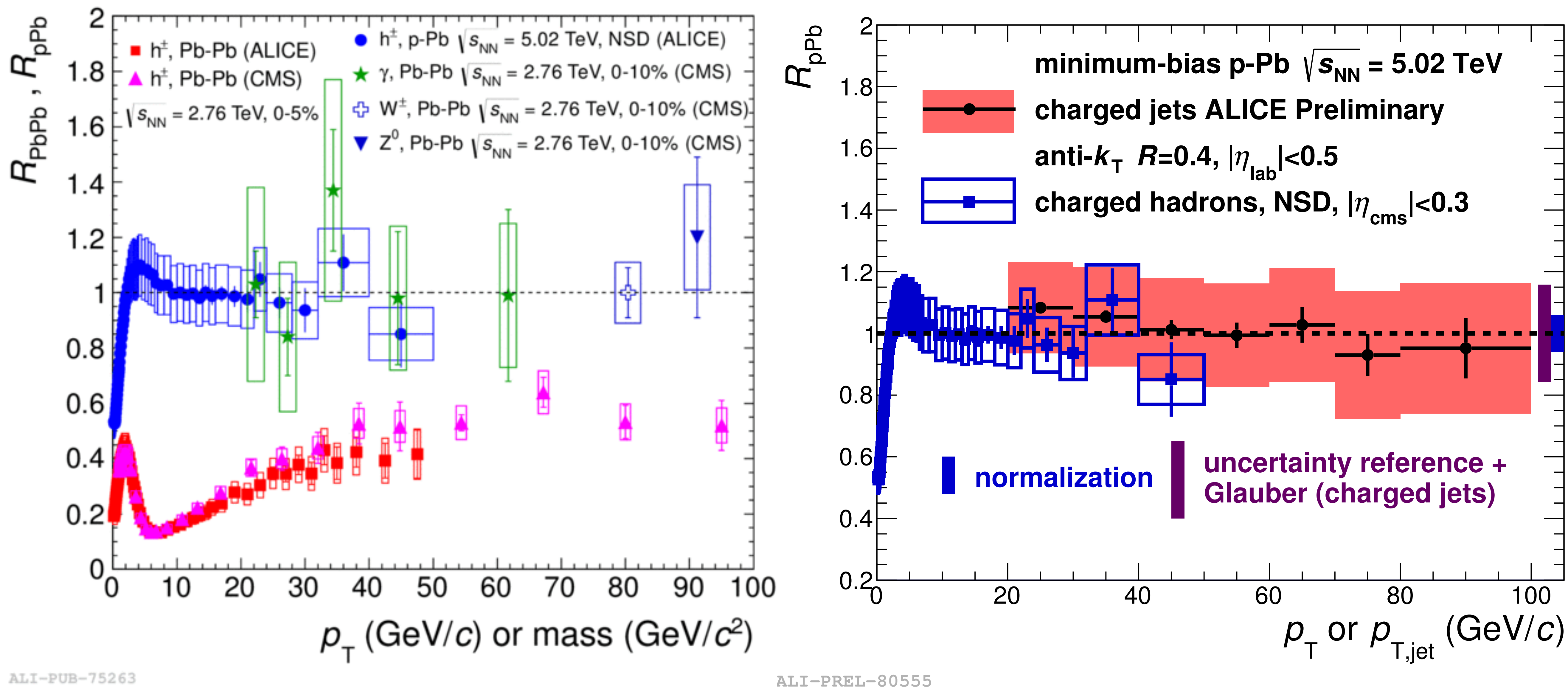
ALICE, PLB 720, 52

ALICE, PRL 110, 082302

ALICE, PLB 736,196

# Control experiment: p-Pb



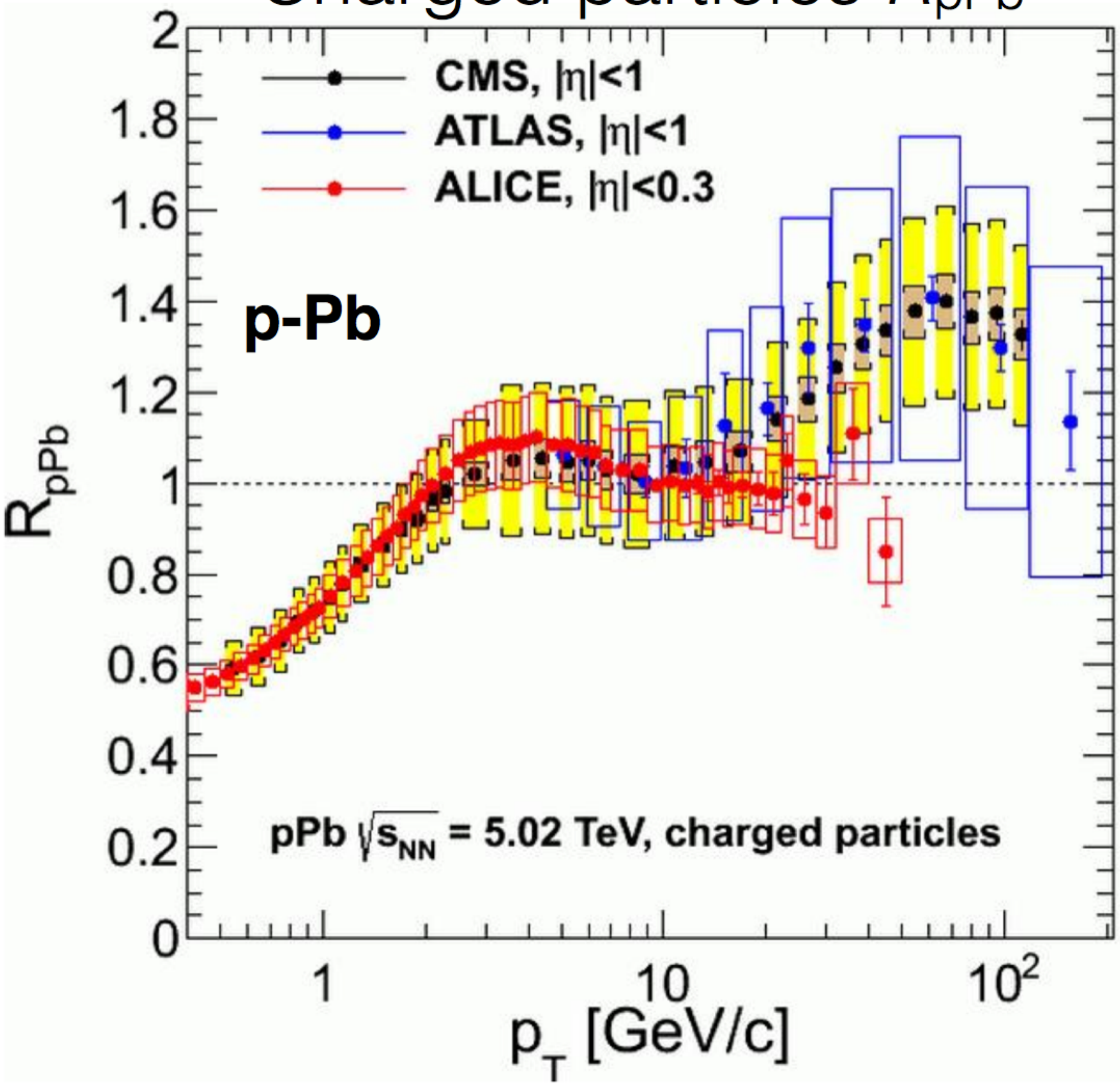

p-Pb results: no modifications at high $p_T$!

(di)Jet results consistent with this picture

(see also ATLAS and CMS results)

# A puzzle in p-Pb?

Charged particles $R_{pPb}$




Atlas and CMS hint at an **increase at high $p_T$**

Not explained by nPDF modifications (shadowing)

Consistent with jet $R_{pA}$?
**Origin?**

→ J. Harris, Fri 5th

Largest **difference among experiments**: pp reference
Low statistics: need new data in pp at $\sqrt{s}$ = 5 TeV!

# Conclusions

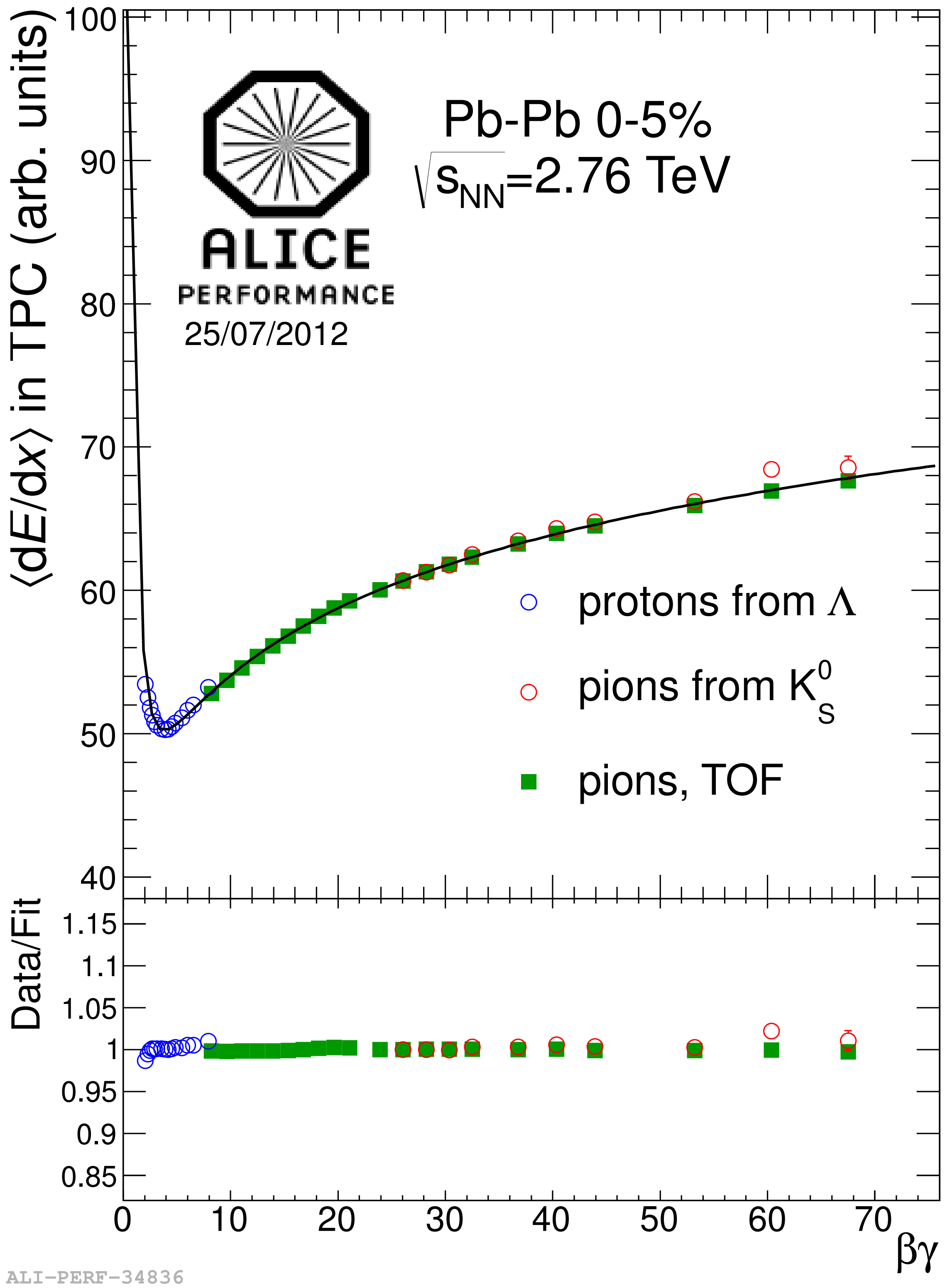
Identified light-flavor measurements crucial to constrain bulk properties of the matter created in HI collisions

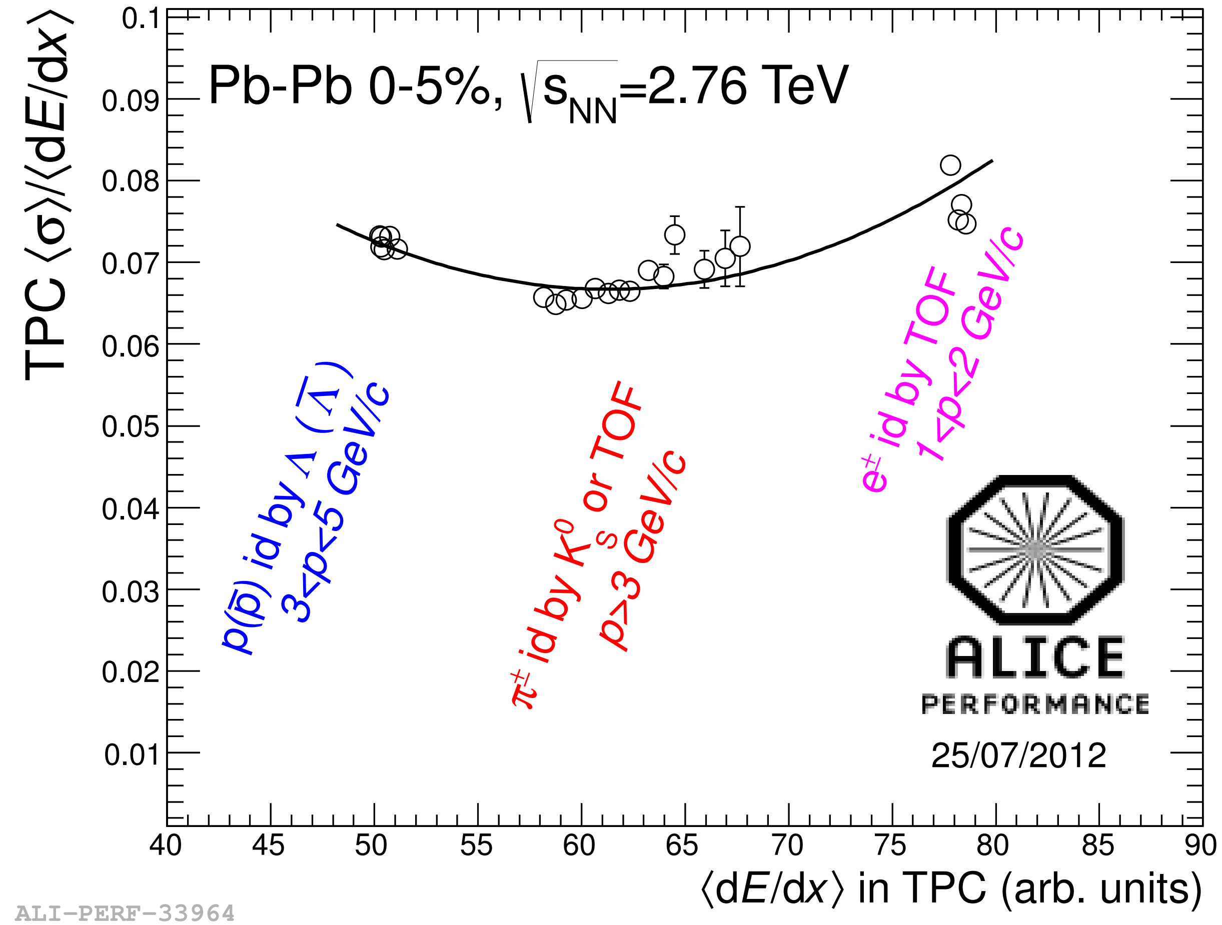
Several observables suggest formation of a "collective medium" already in high multiplicity p-Pb (and pp) collisions

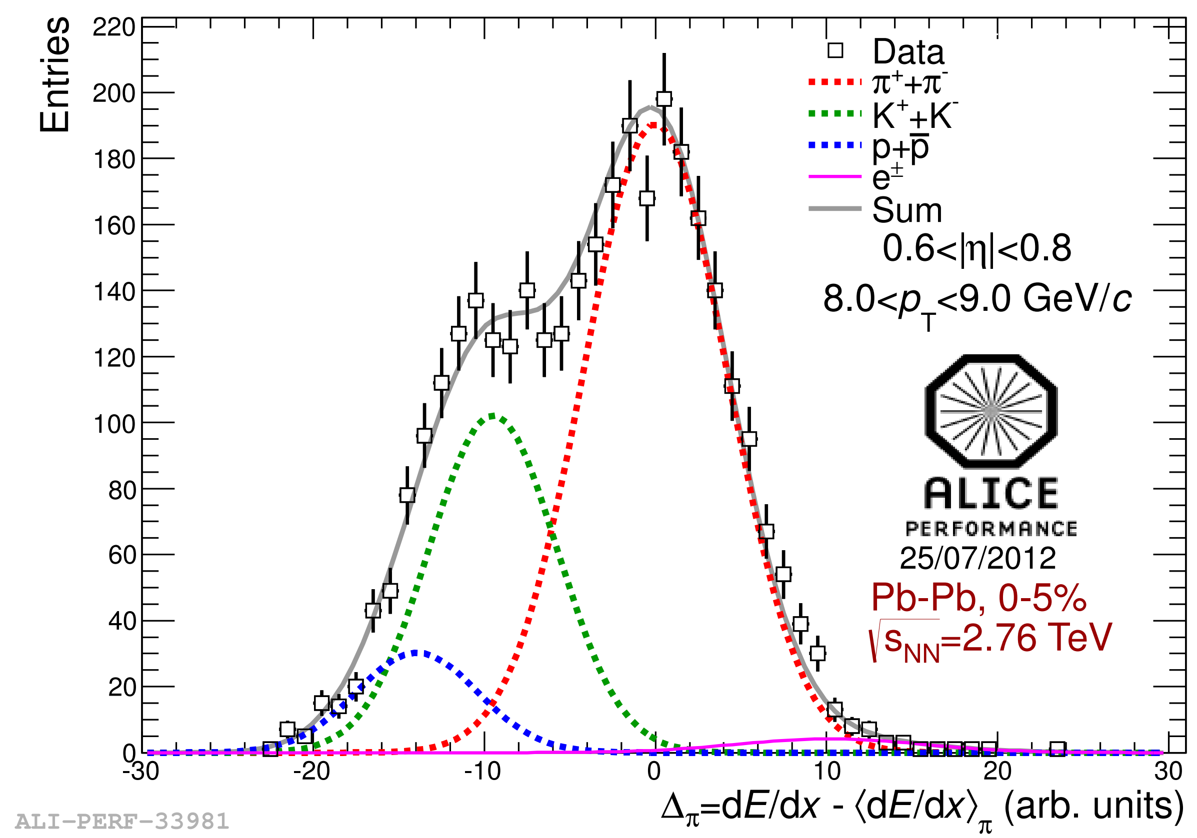
- LHC  still close to **hydrodynamic limit** for (semi) central collisions
  - Very strong **radial and anisotropic flow**,
  - Hydrodynamic models describe data qualitatively
  - **Collective behavior in p-Pb** collisions? → pp studies at high multiplicity
- **Equilibrium thermal model** challenged by the data: puzzle still open
- "**Baryon anomaly**" is a bulk effect, strong constraints for coalescence models
  - Seems to be driven by mass rather than meson/baryon
- No (light) flavor dependence of the $\boldsymbol{R}_{\mathbf{AA}}$ at high $p_T$
- **Enhanced** $\boldsymbol{R}_{\mathbf{pA}}$ at high $p_T$?
  - Need reference data

# Backup

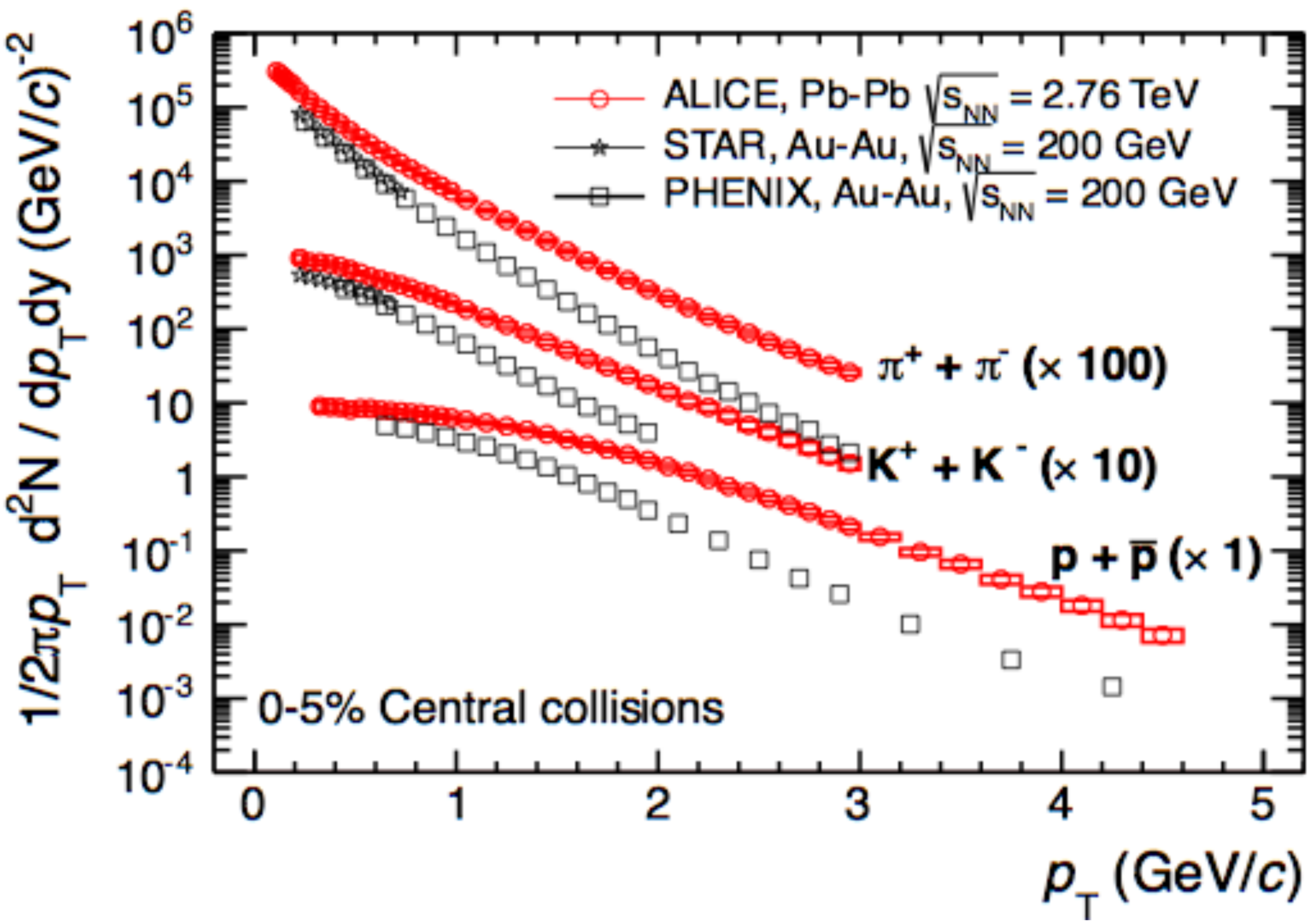
# Analysis in the relativistic rise



# Kinetic freezeout: Blast wave fits



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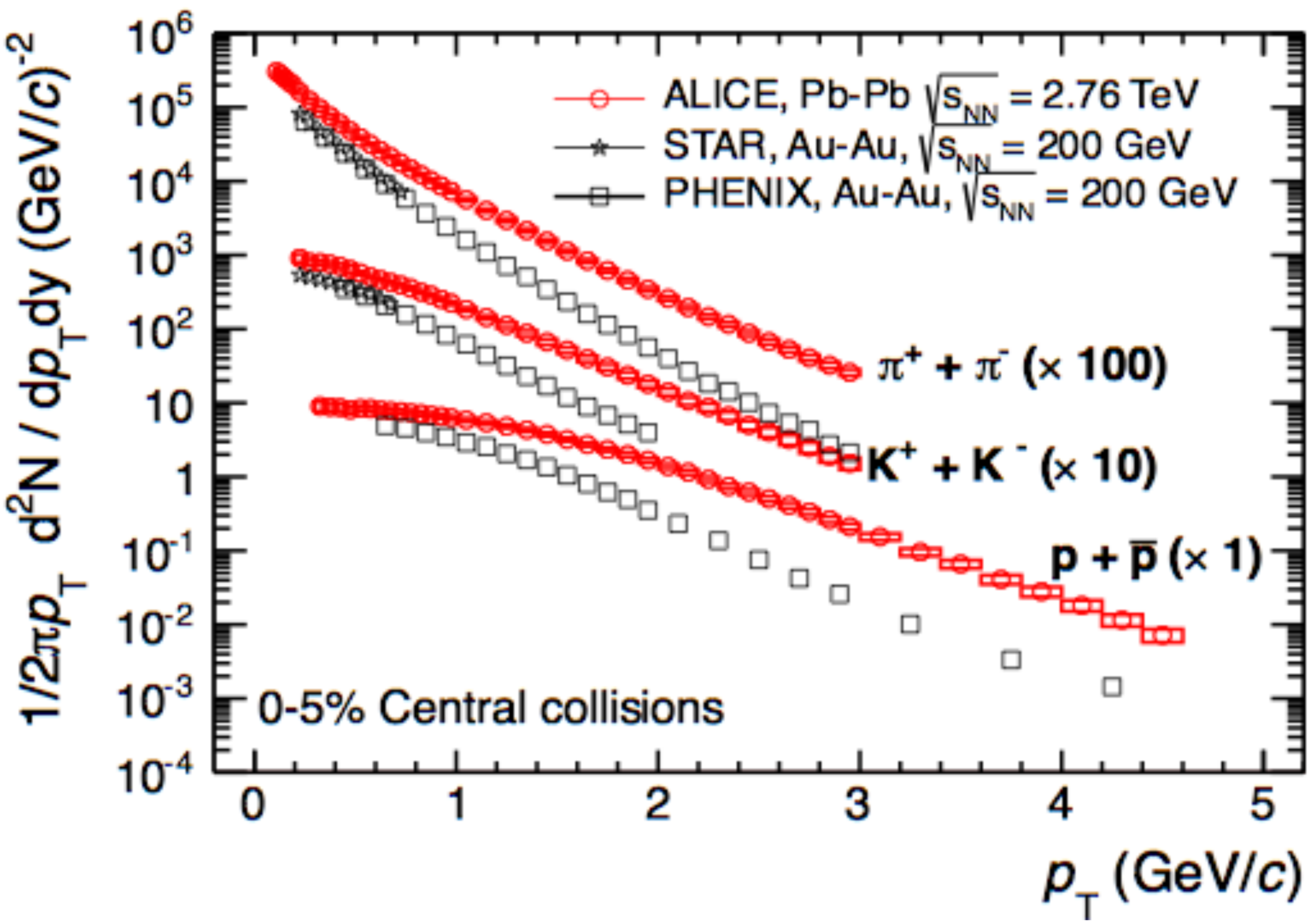


Blast wave model: thermalized volume elements, expanding in a common velocity field

Parameters: $T_{kin}$, $\beta_T = \beta_S \cdot (r/R)^n$

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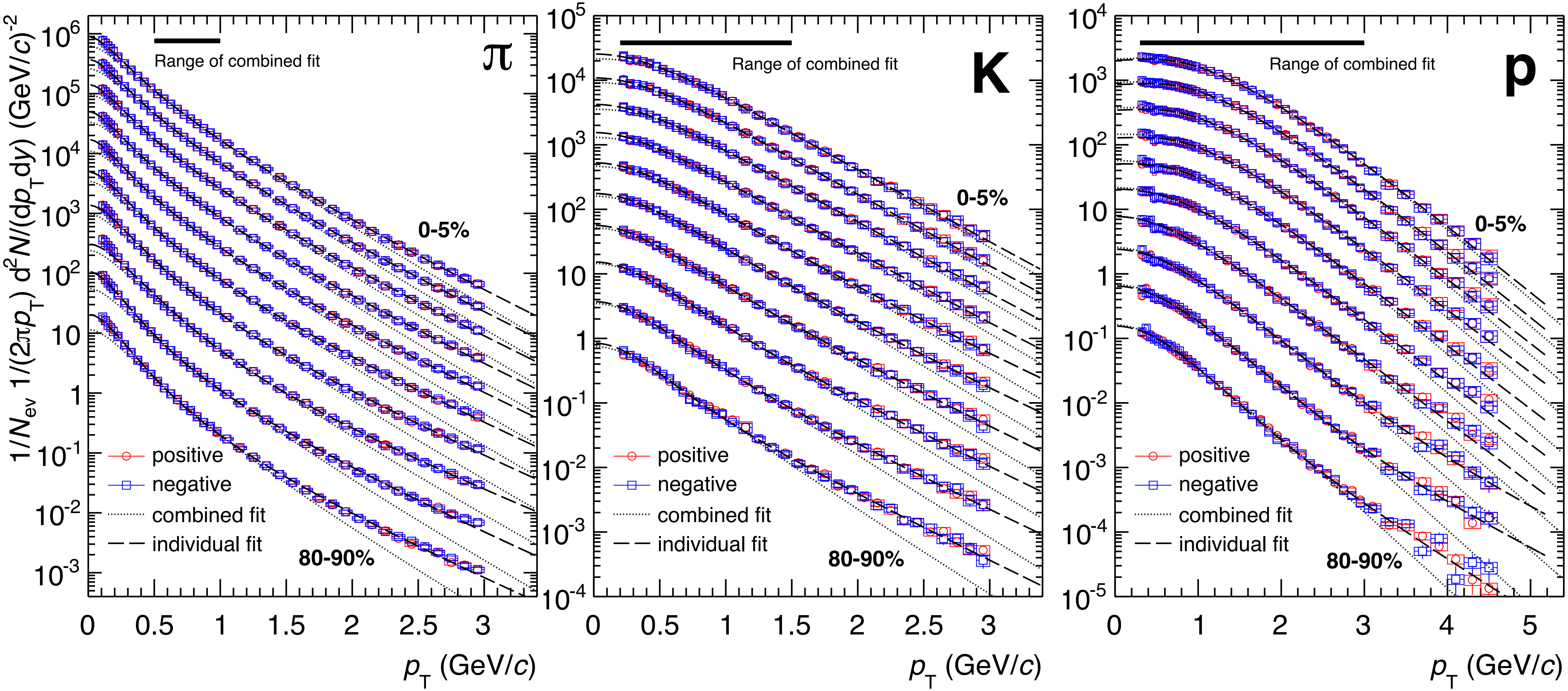


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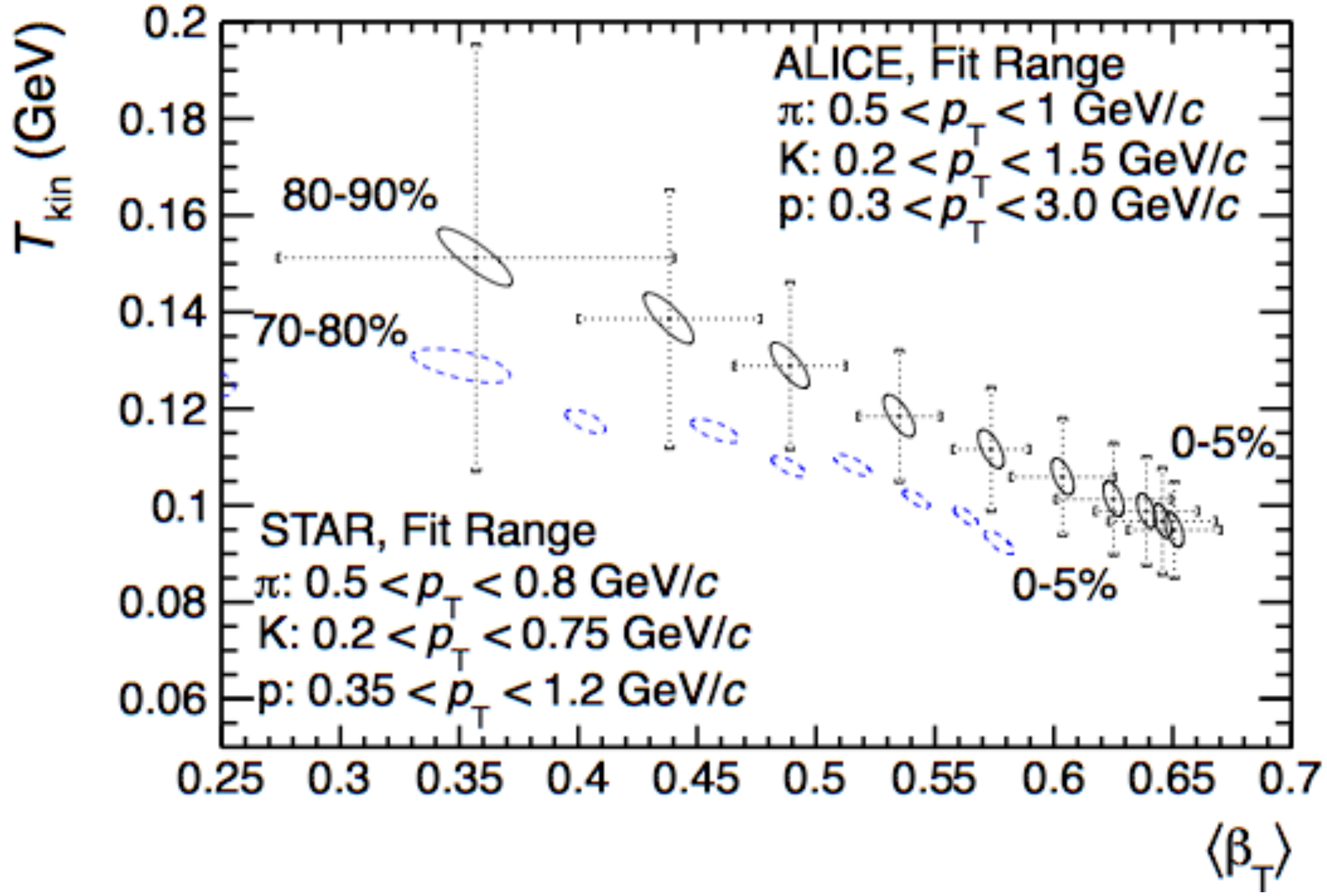


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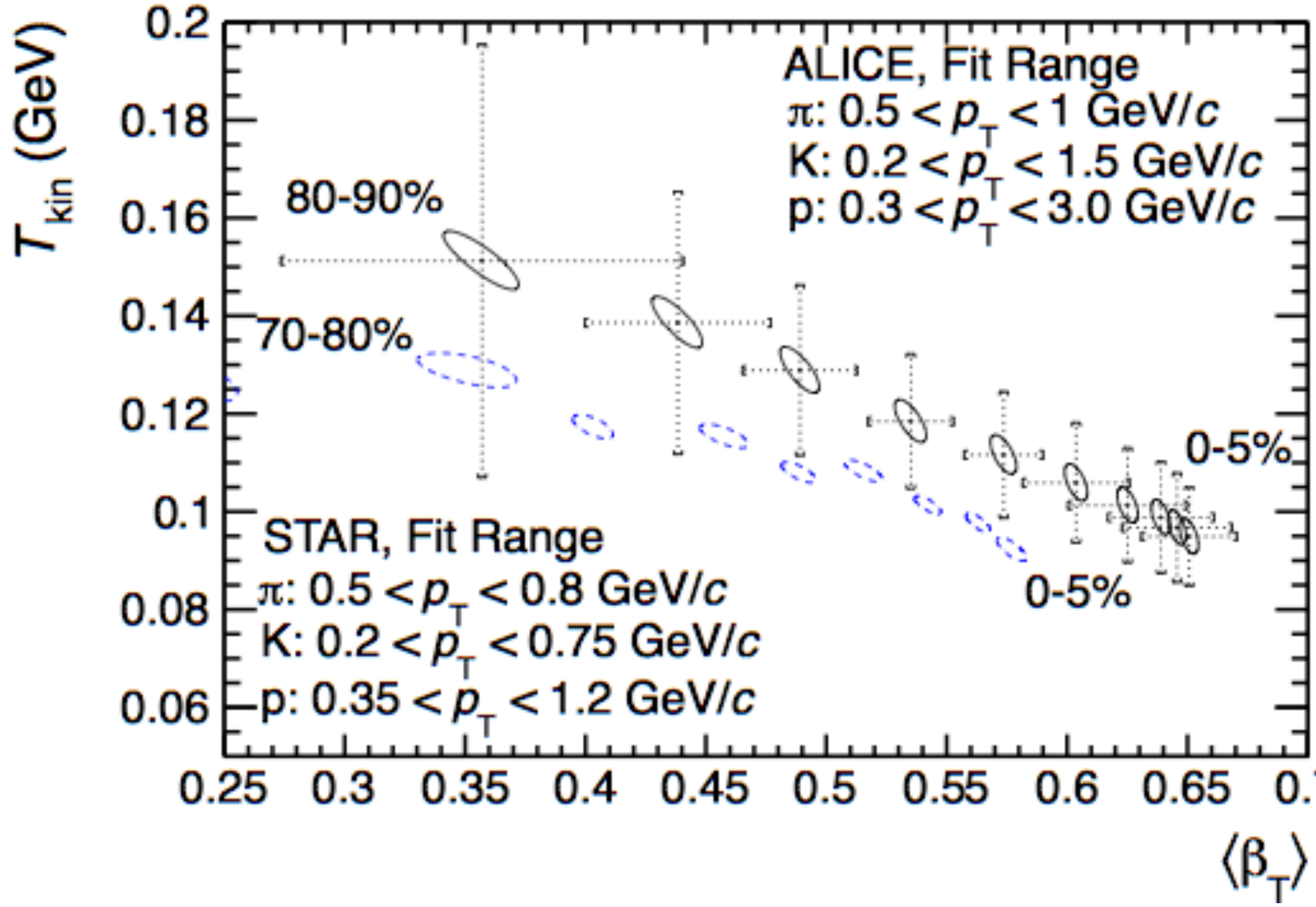


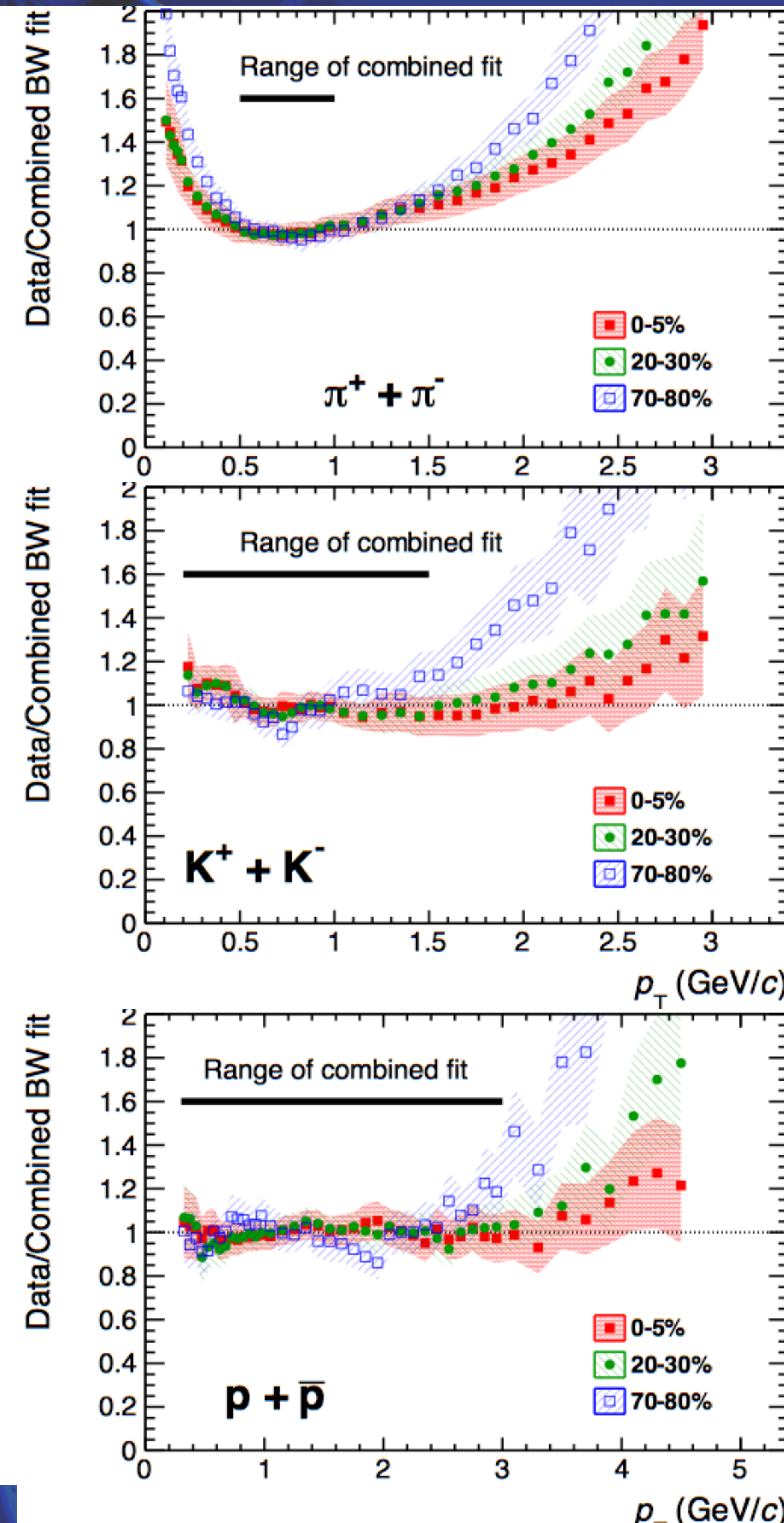


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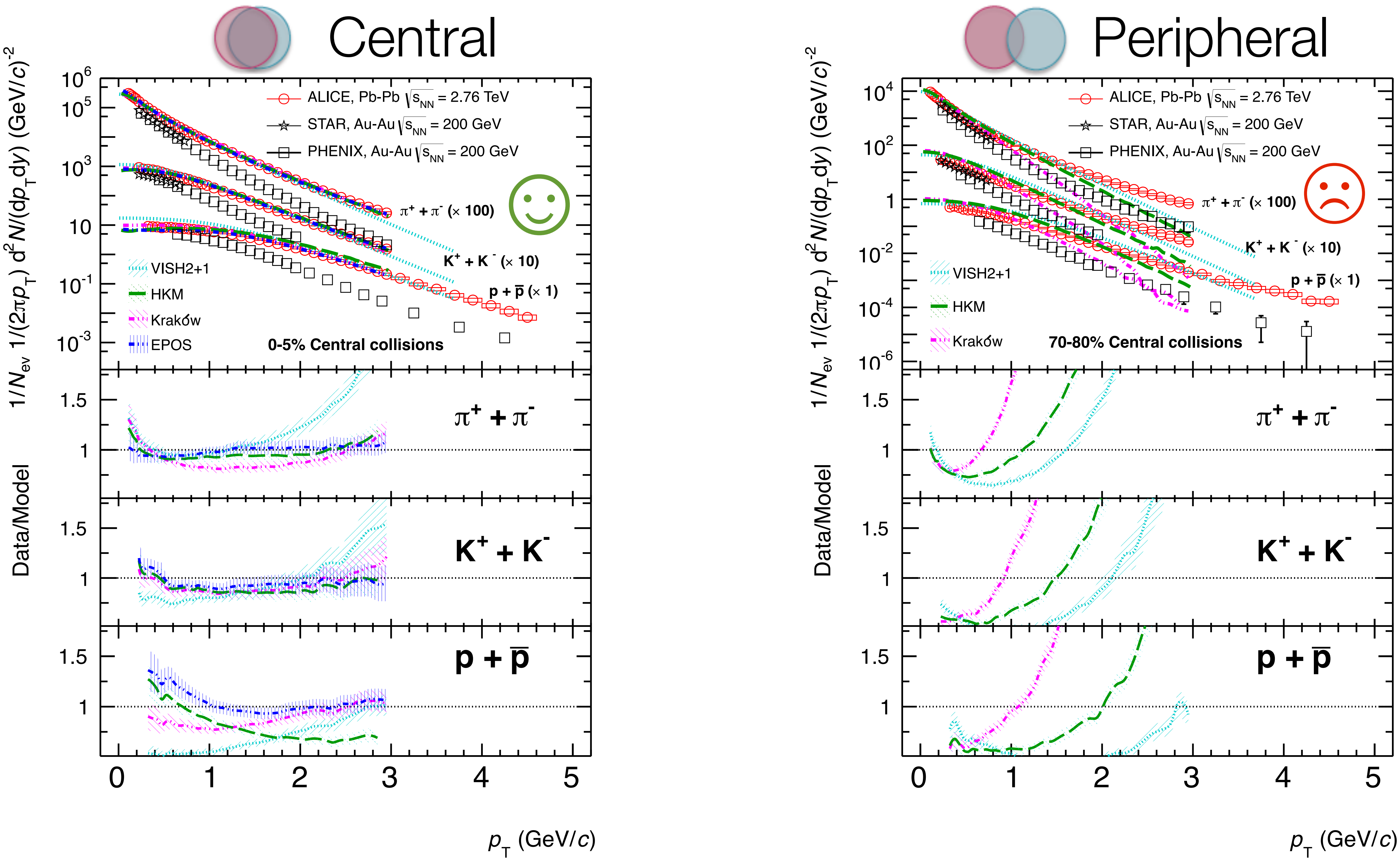
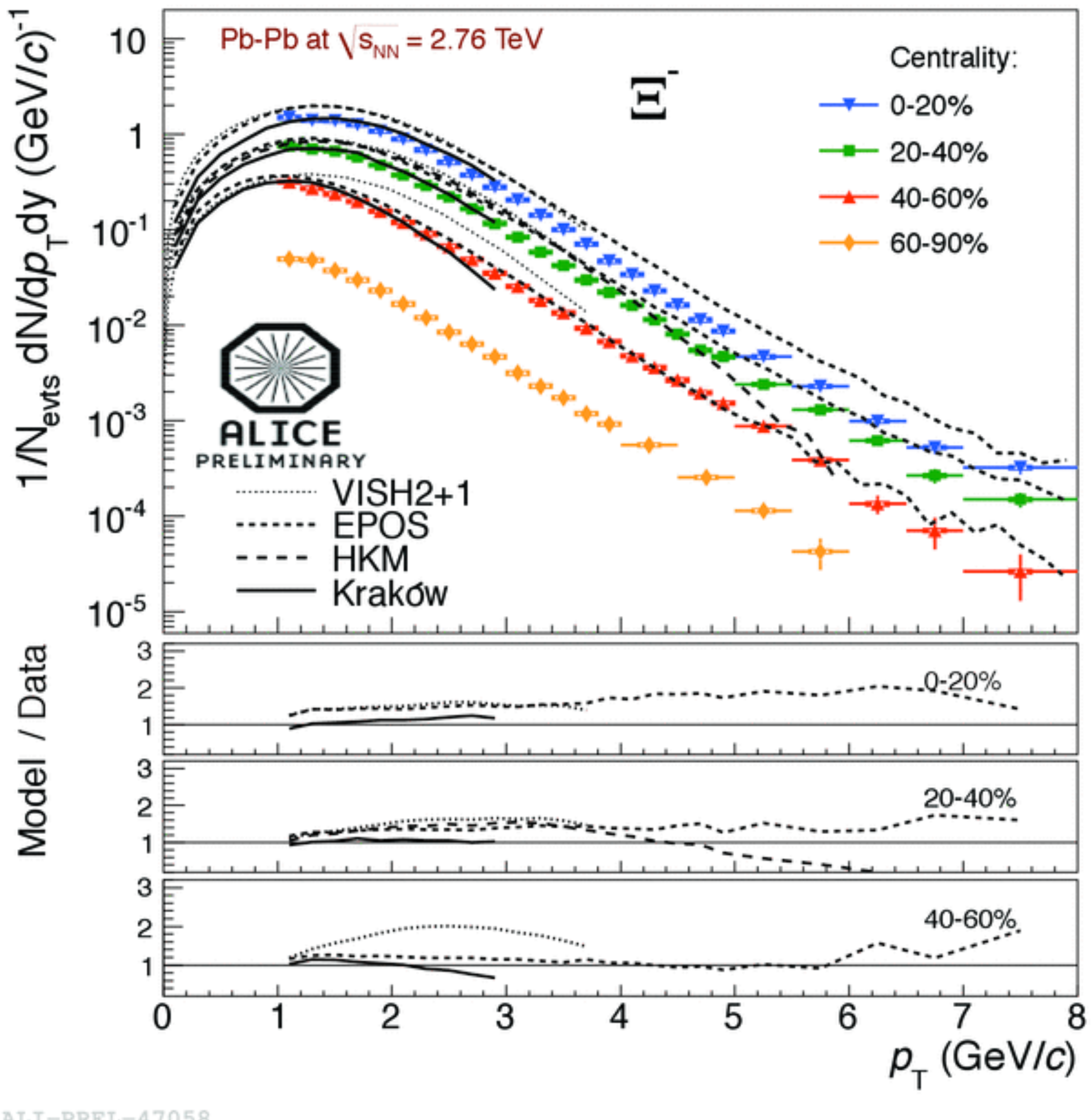
# Comparison to hydro models

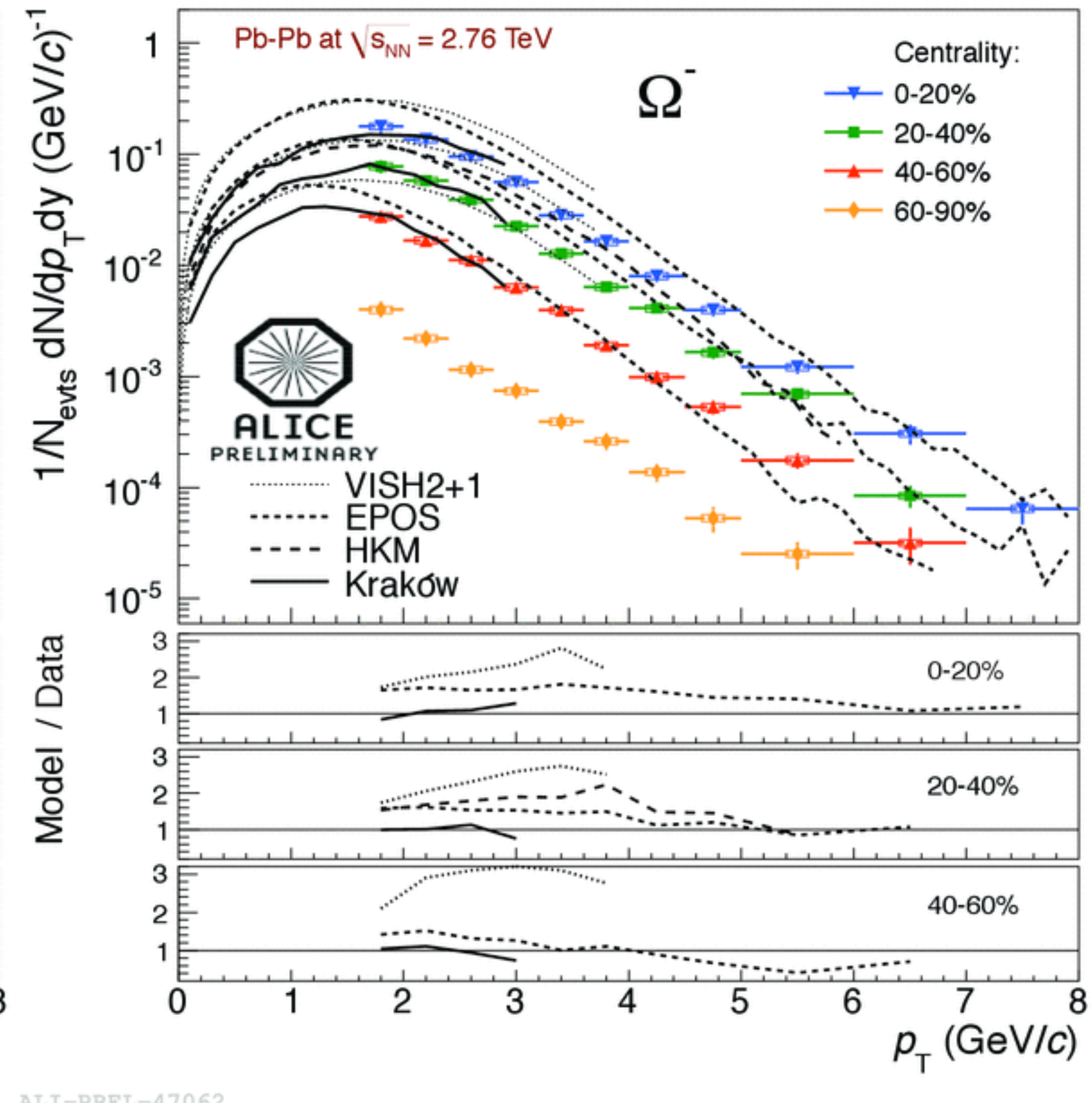



Description of the late stages of the fireball needed?

Not expected to work in peripheral collisions

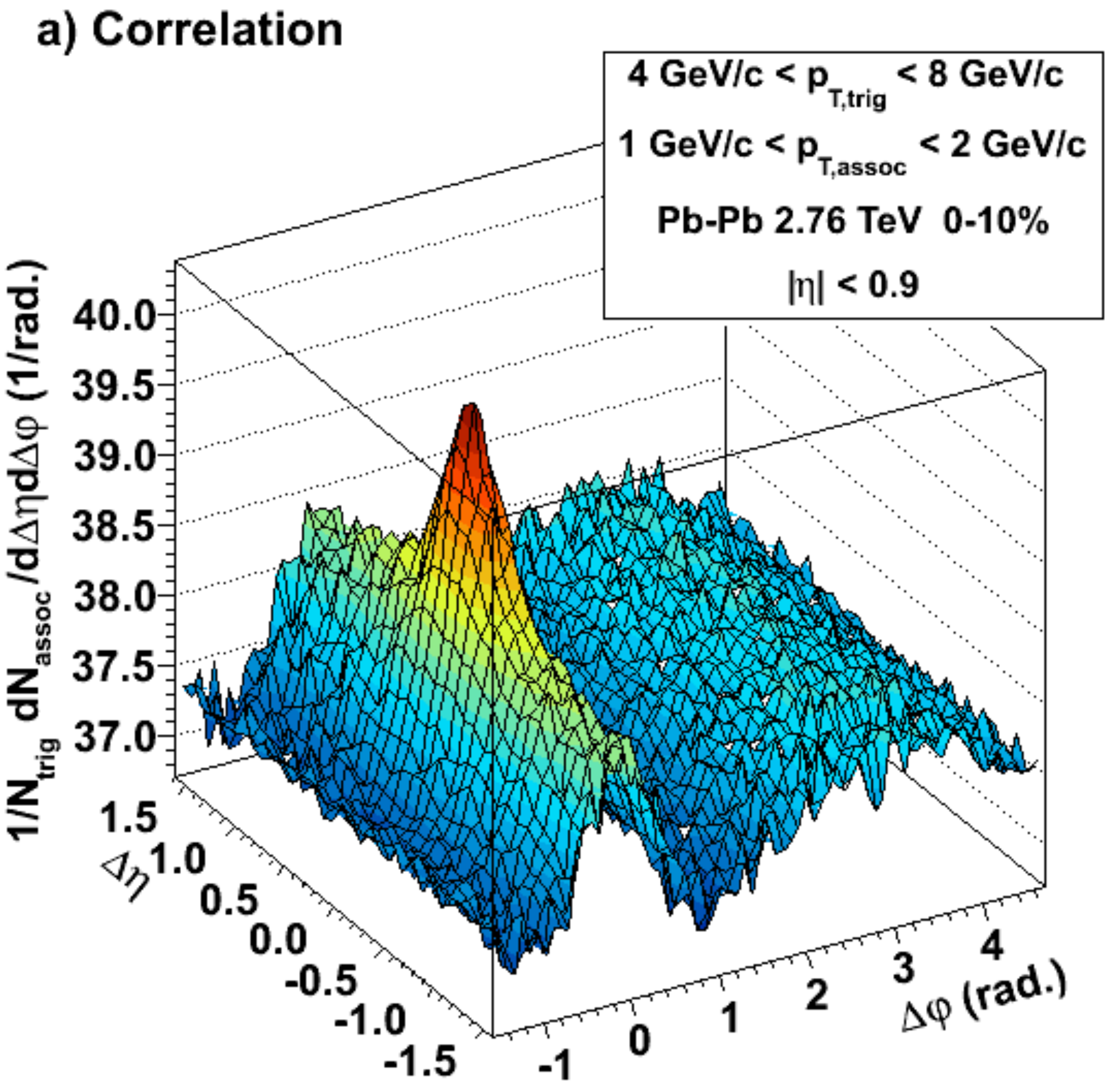
# Early kinetic freezeout of φ, Ξ, Ω?

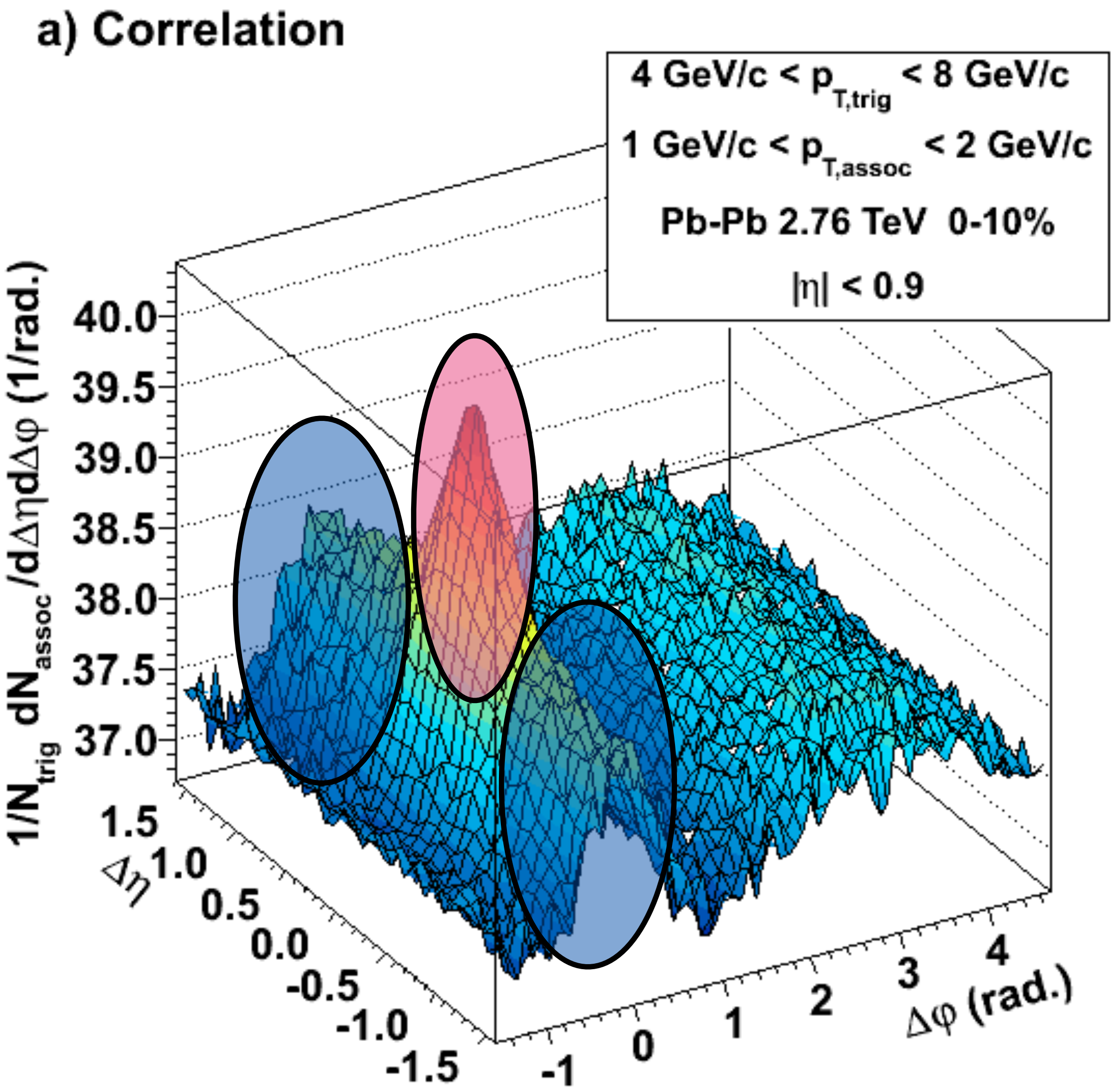


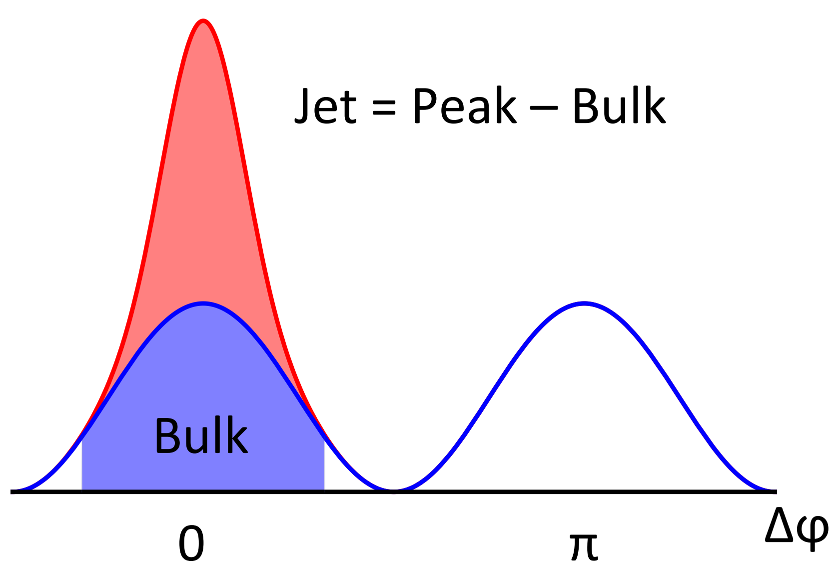




Sequential freezeout (smaller hadronic cross-section)?

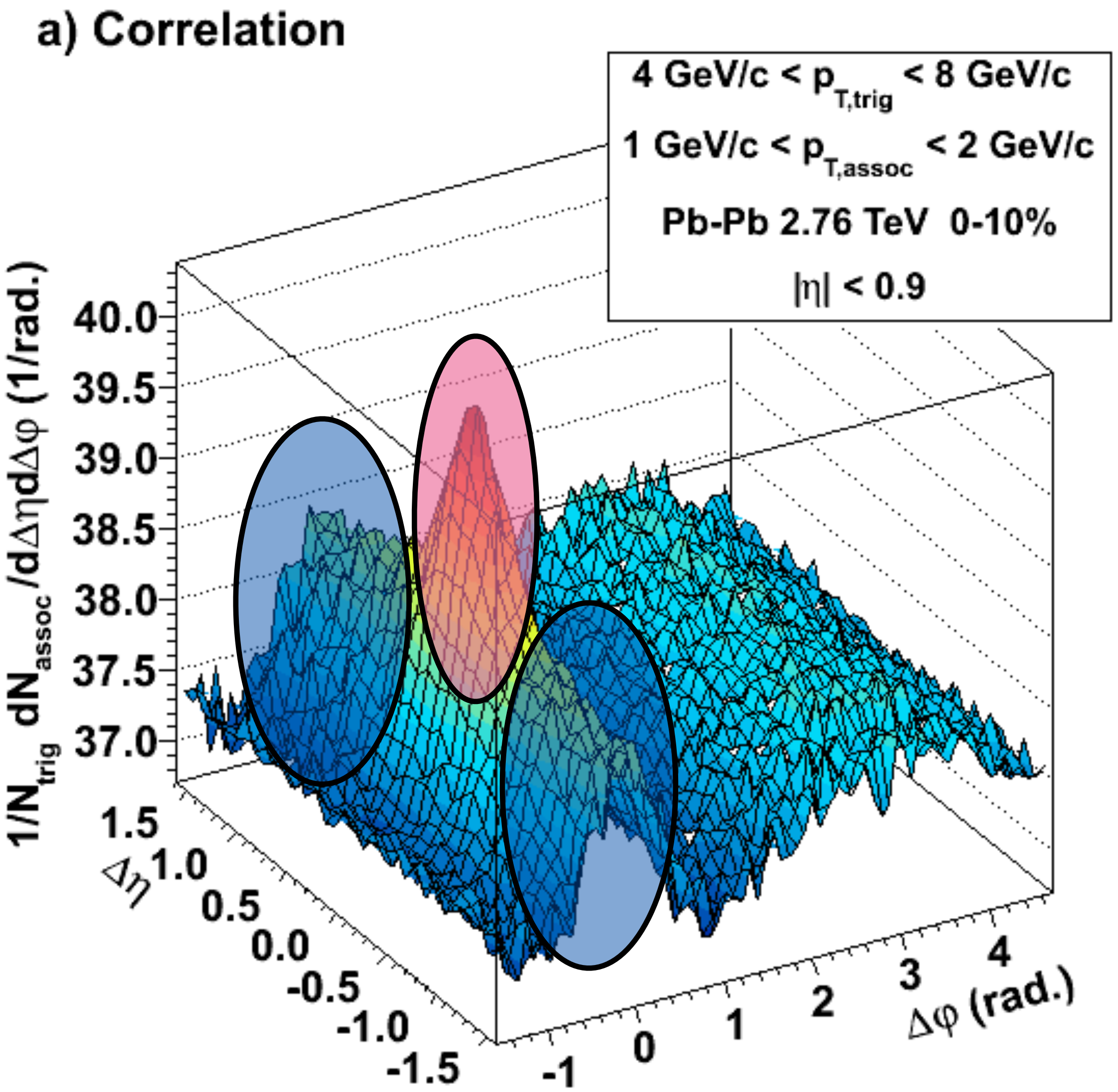
# Intermediate $p_T$ in the bulk and in the jet

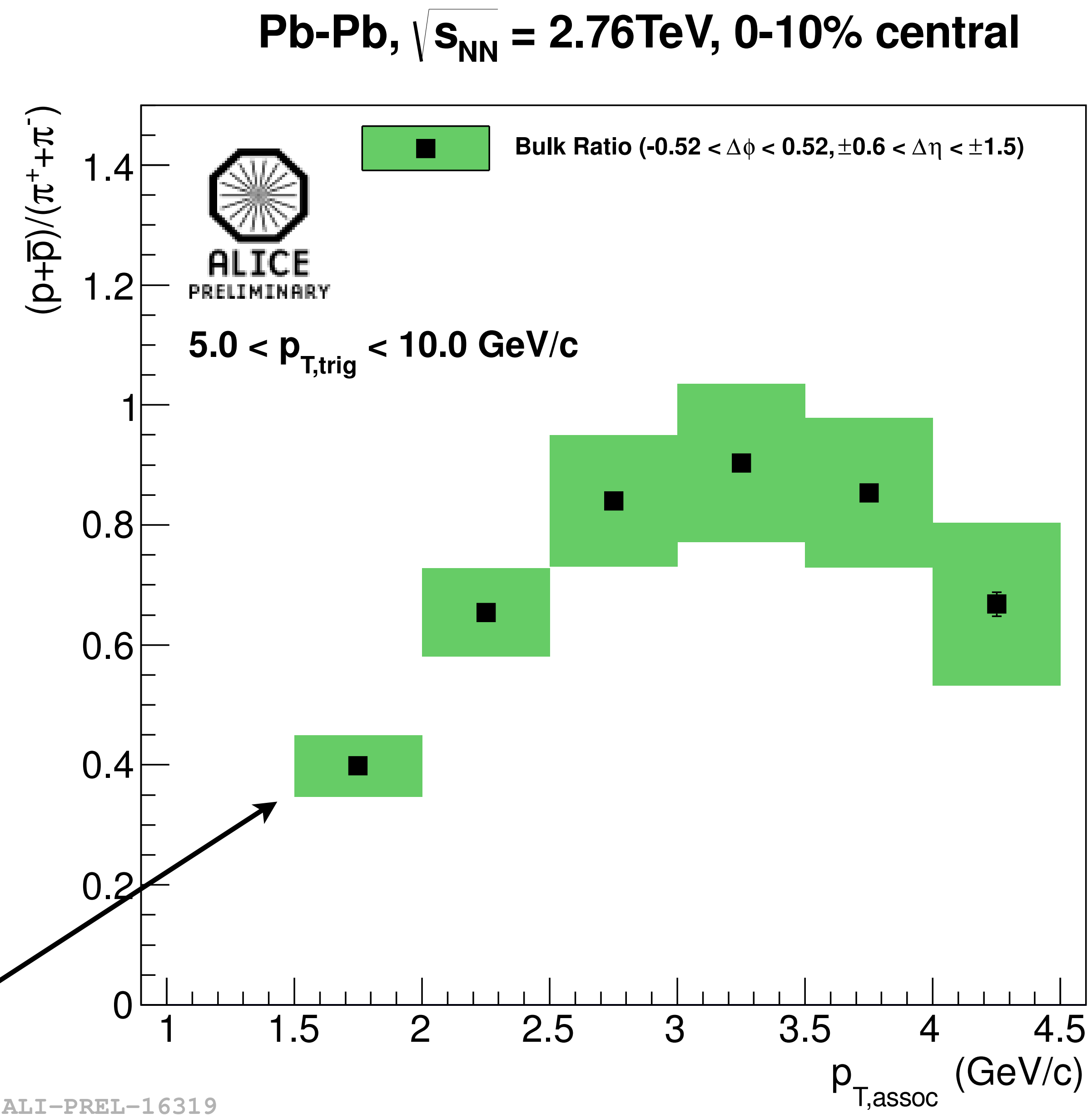


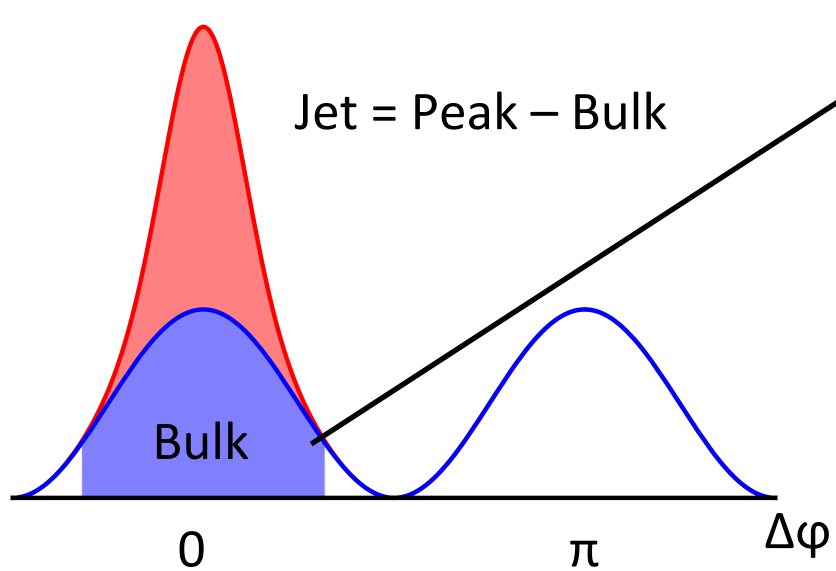

a) Correlation
4 GeV/c < p_T,trig < 8 GeV/c
1 GeV/c < p_T,assoc < 2 GeV/c
Pb-Pb 2.76 TeV 0-10%
|η| < 0.9
1/N_trig dN_assoc/dΔηdΔφ (1/rad.)
40.0
39.5
39.0
38.5
38.0
37.5
37.0
Δη
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1
0
1
2
3
4
Δφ (rad.)


Jet = Peak – Bulk
Bulk
0
π
Δφ

# Intermediate $p_T$ in the bulk and in the jet



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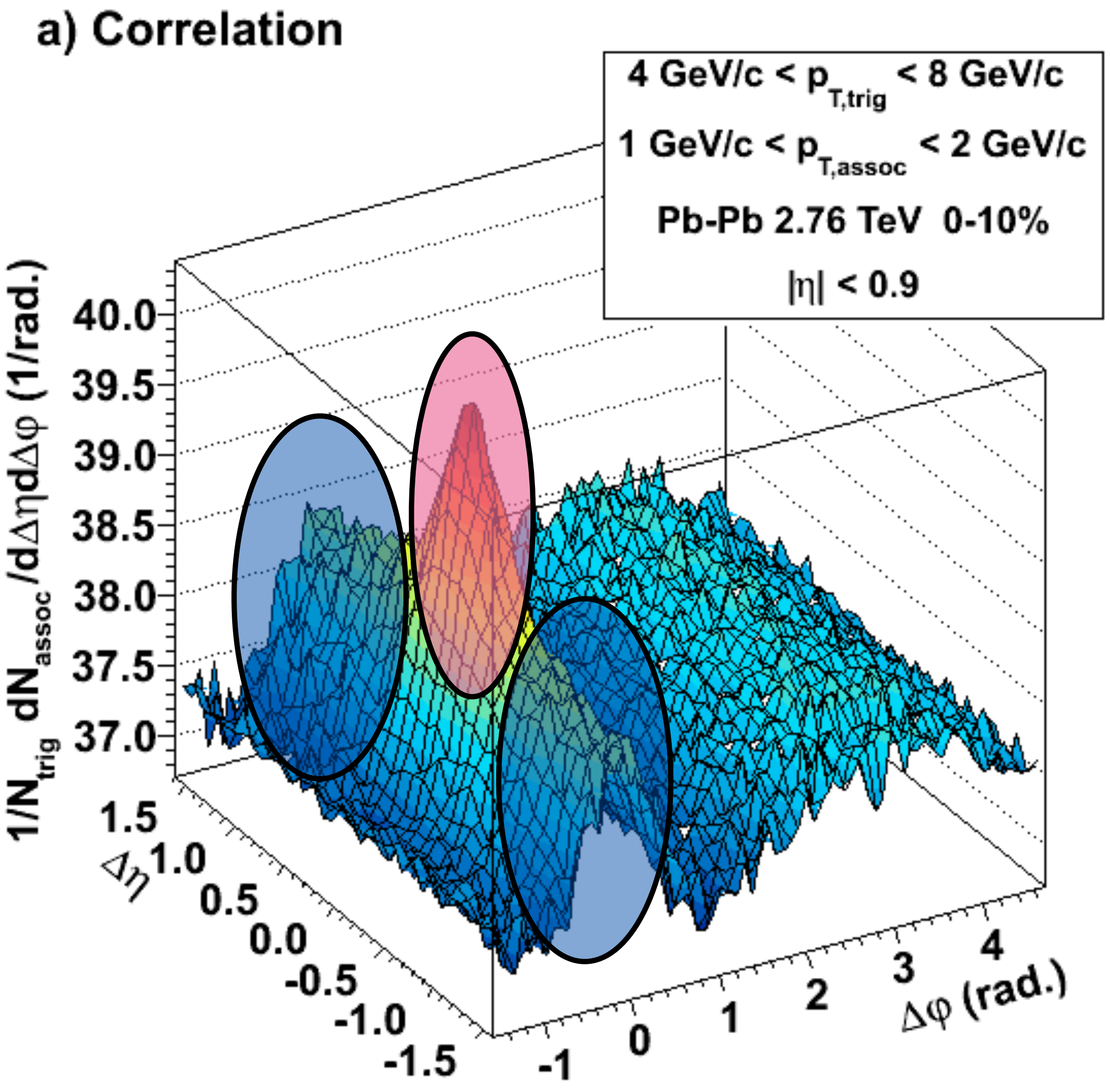


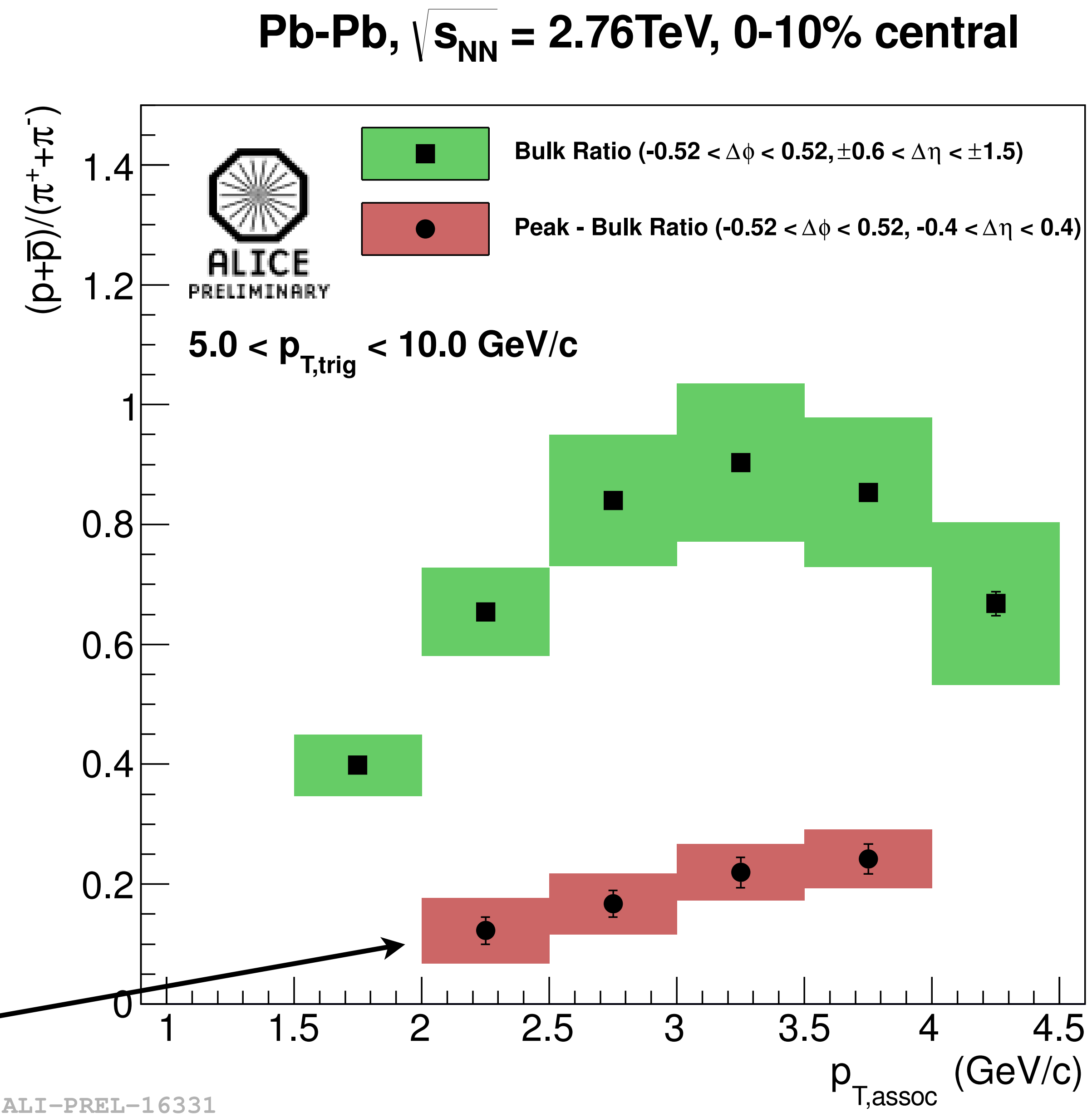


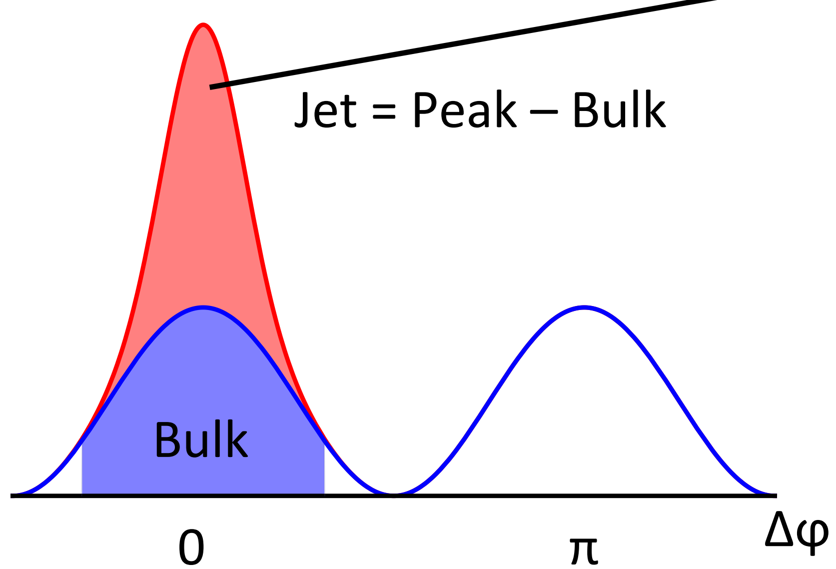

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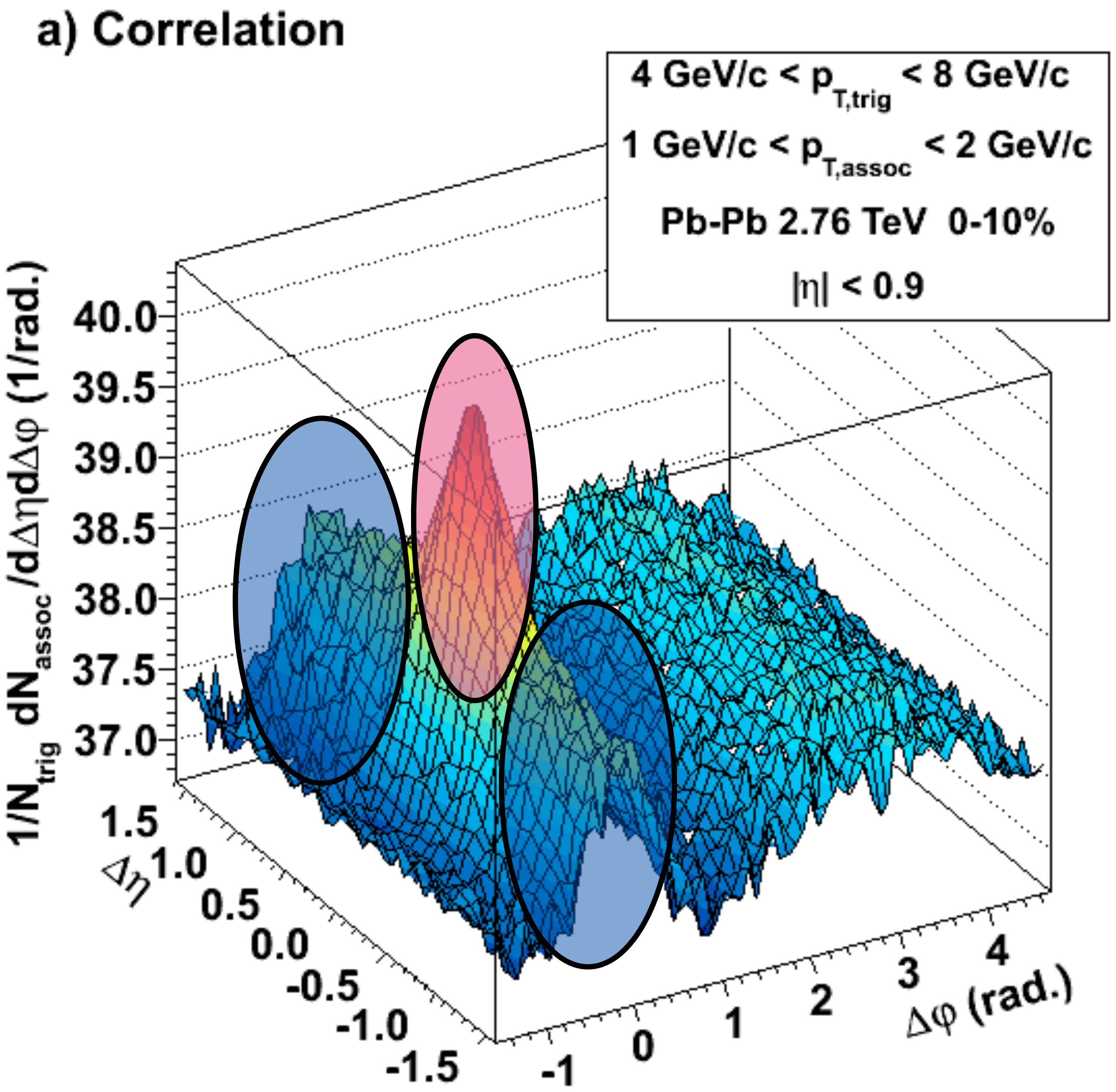


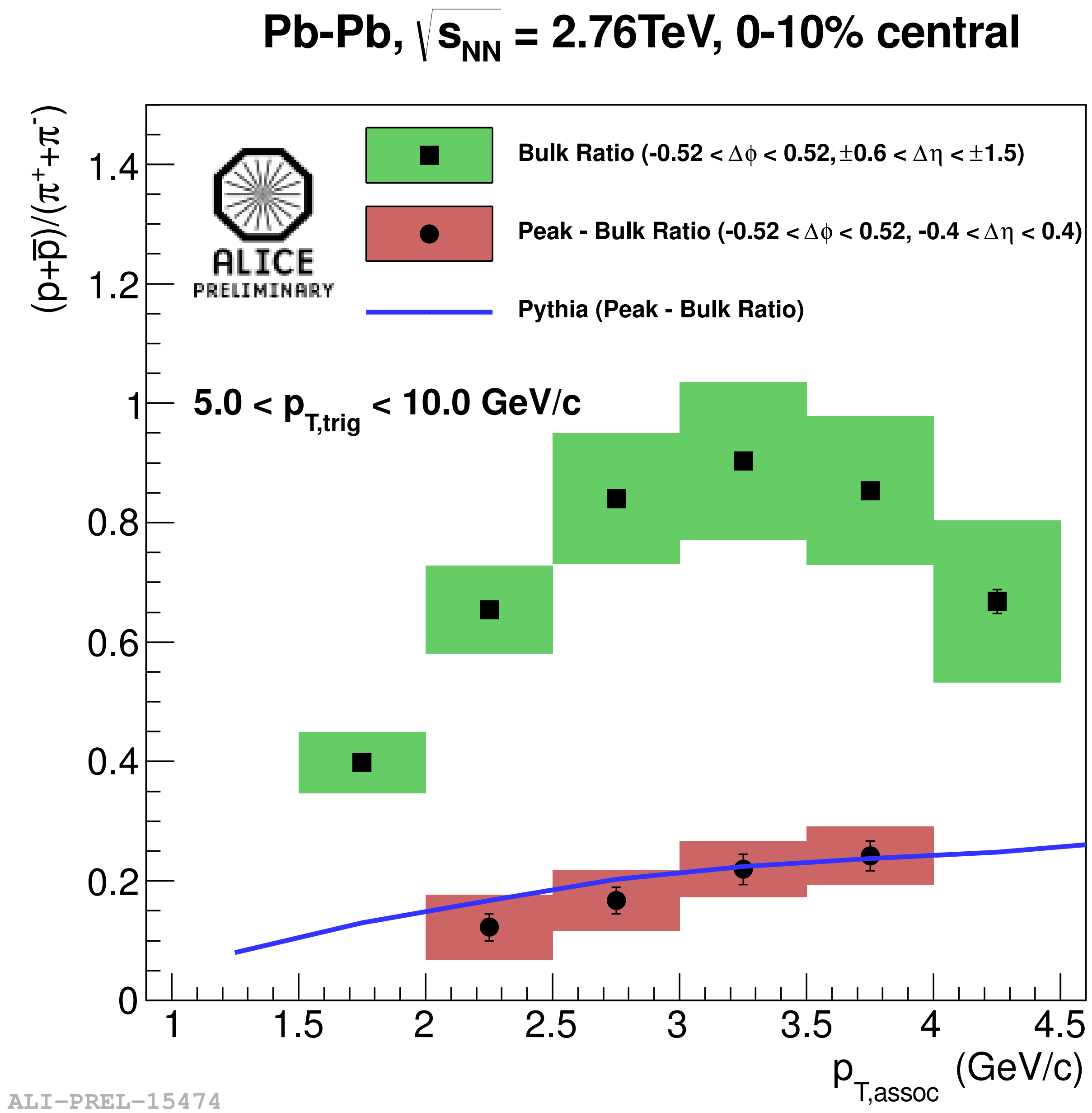


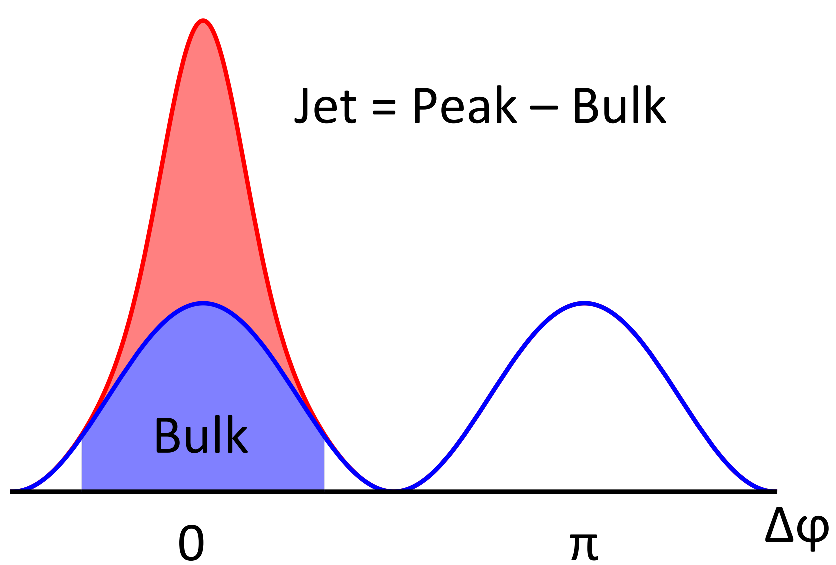

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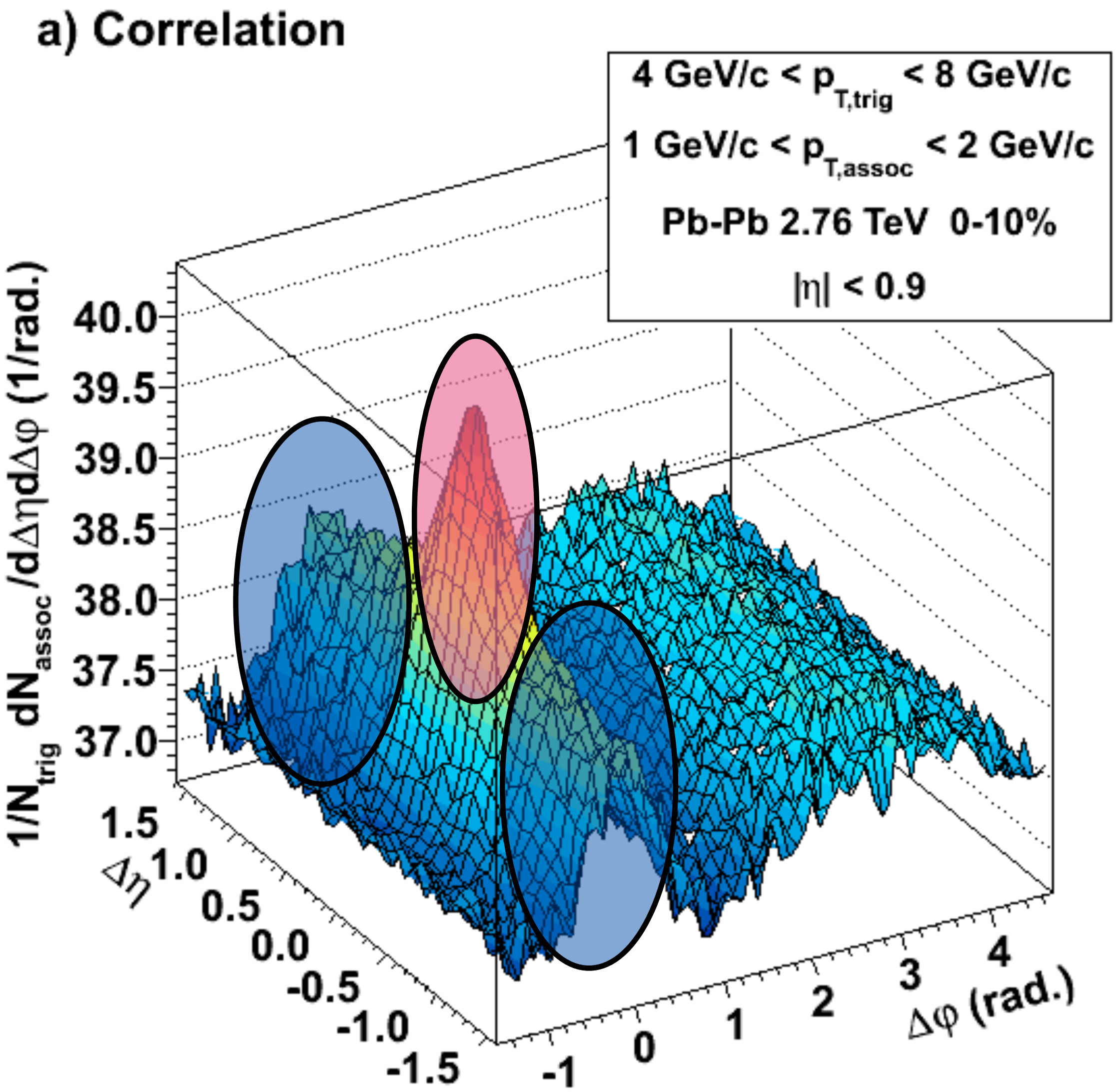
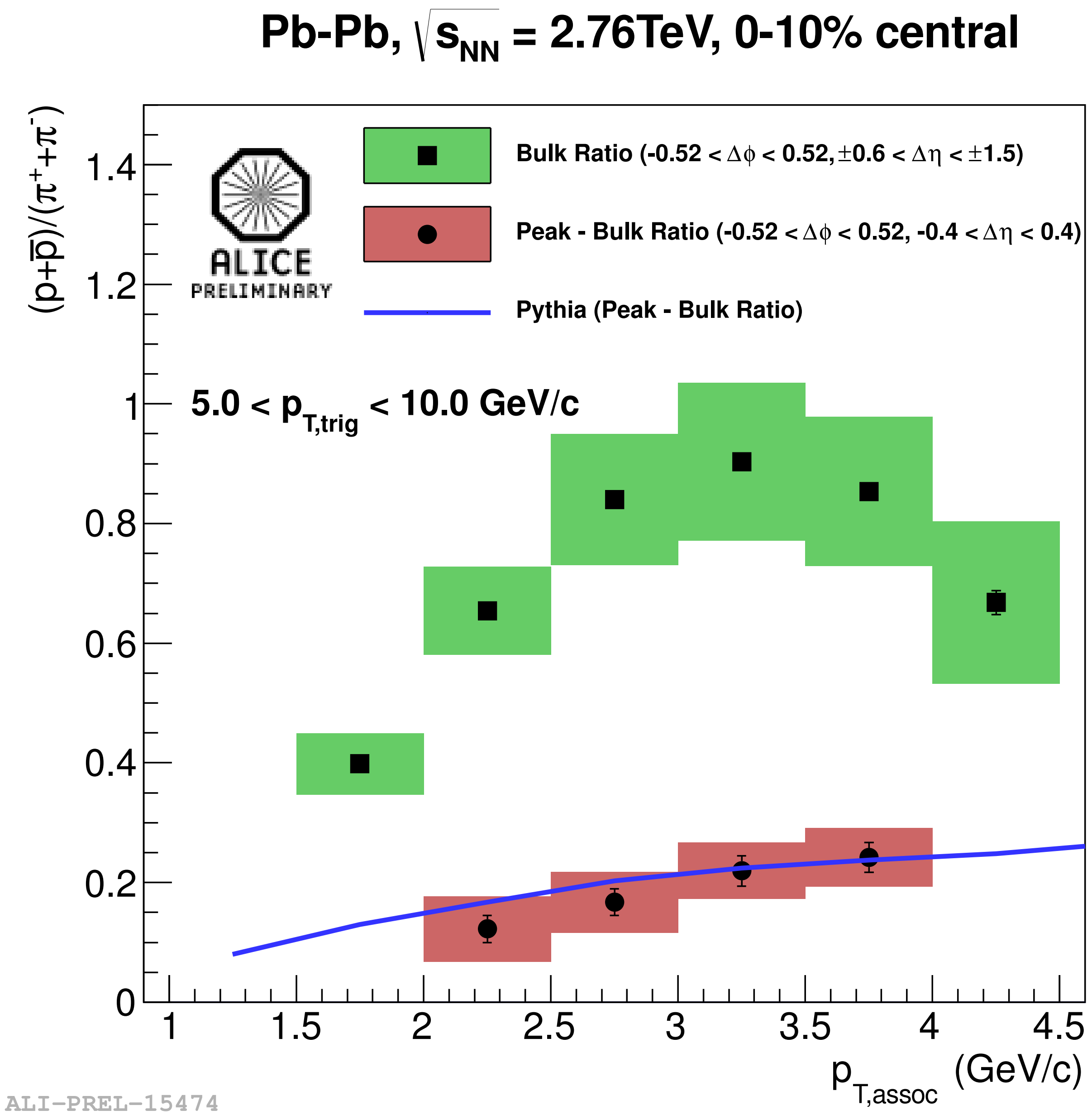
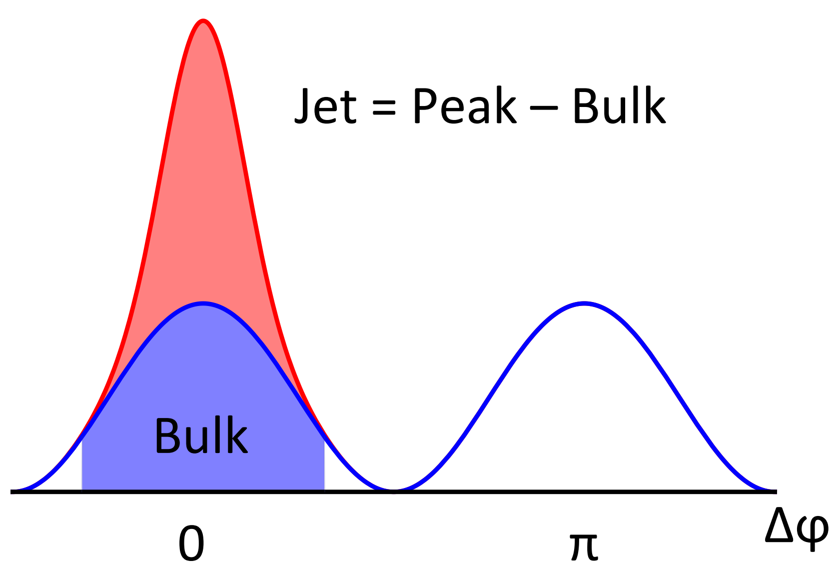


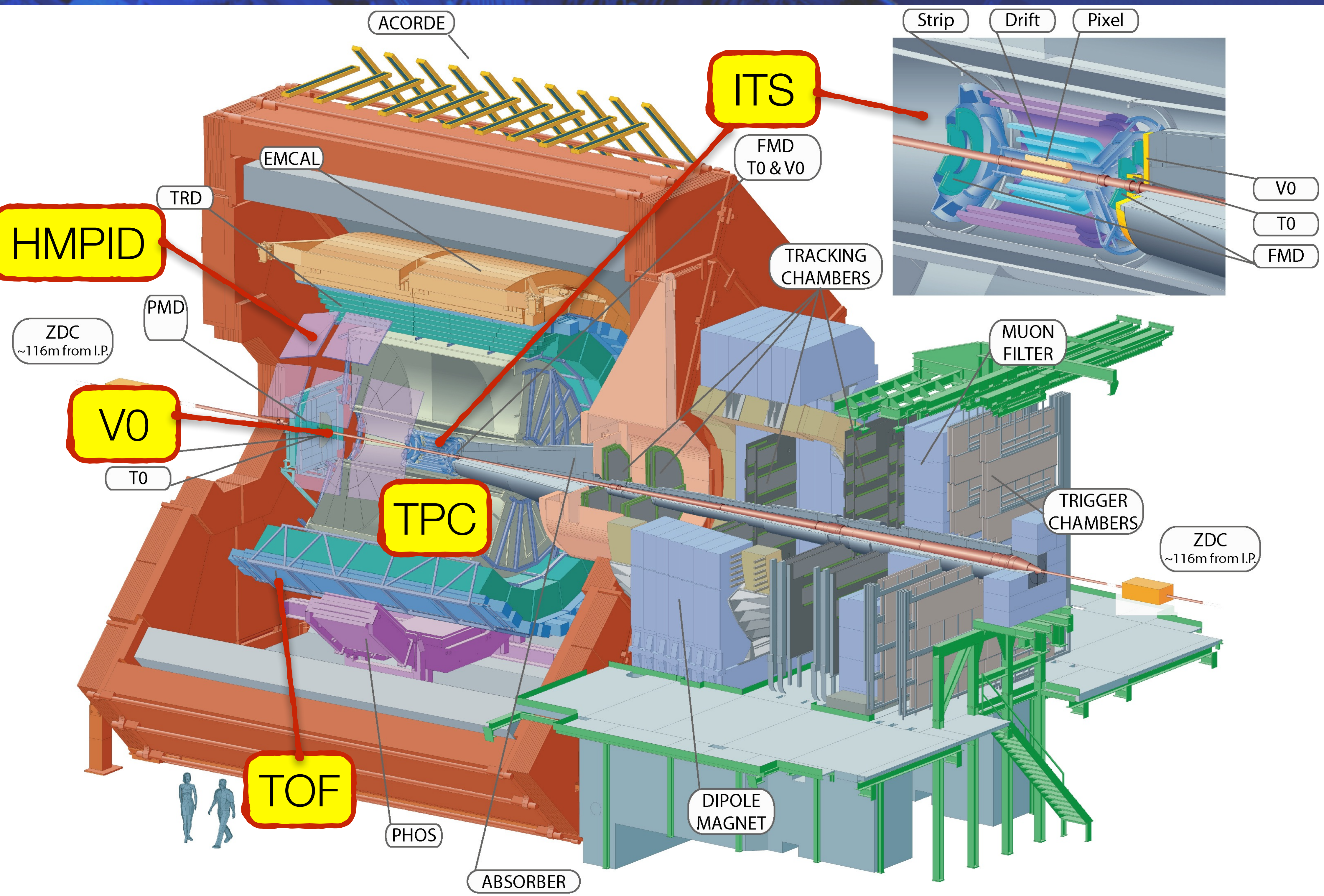




The "baryon anomaly" is a bulk effect!

Surface bias, effect on the away side?

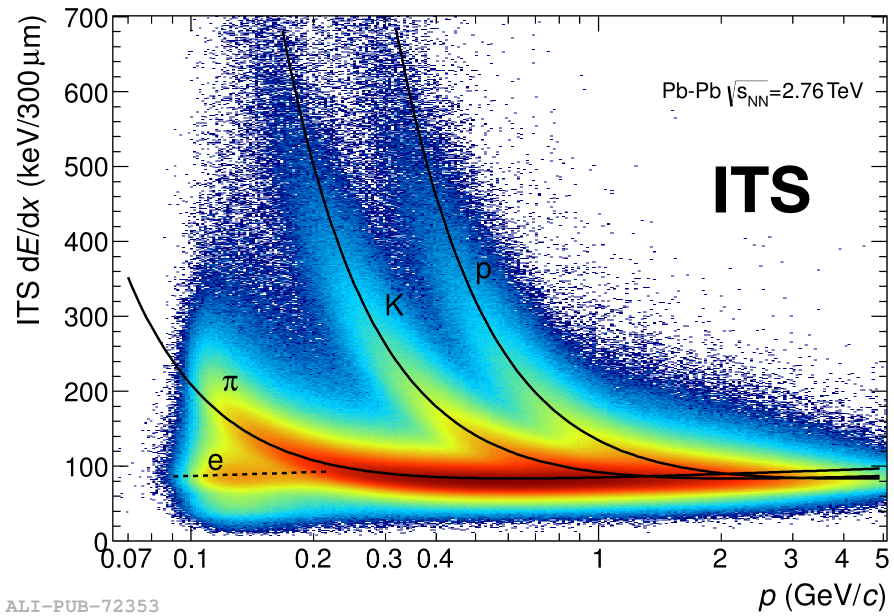
# The ALICE detector

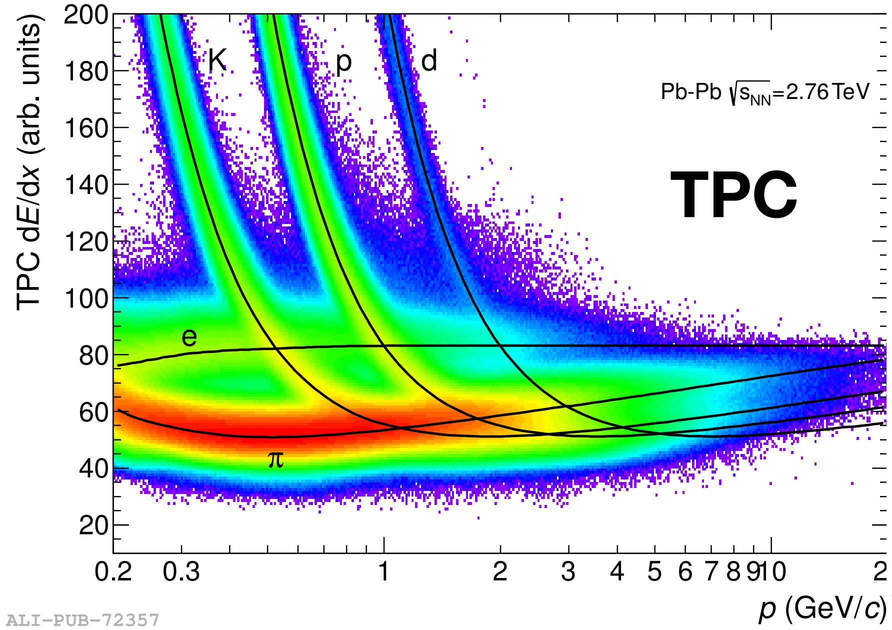


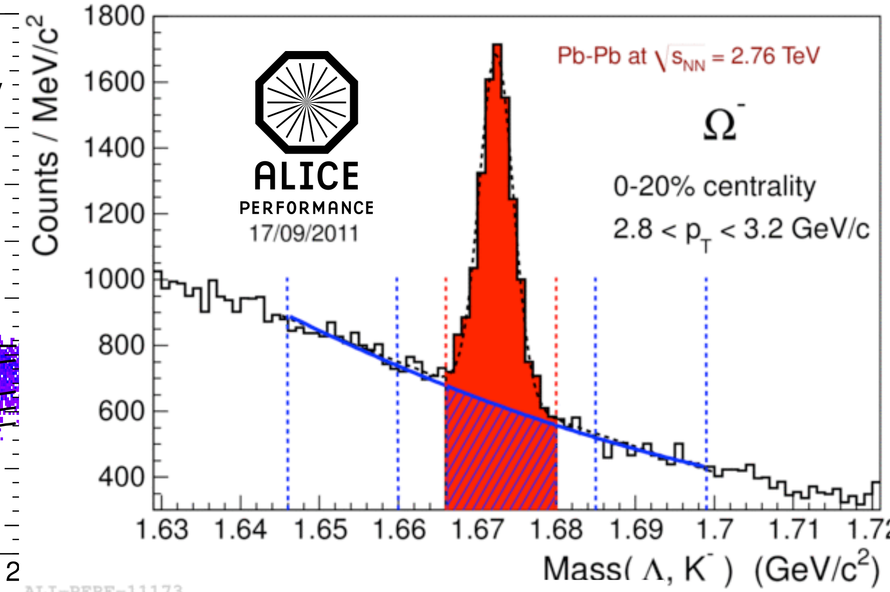

**Barrel** PID & Tracking **$|\eta|<0.8$**

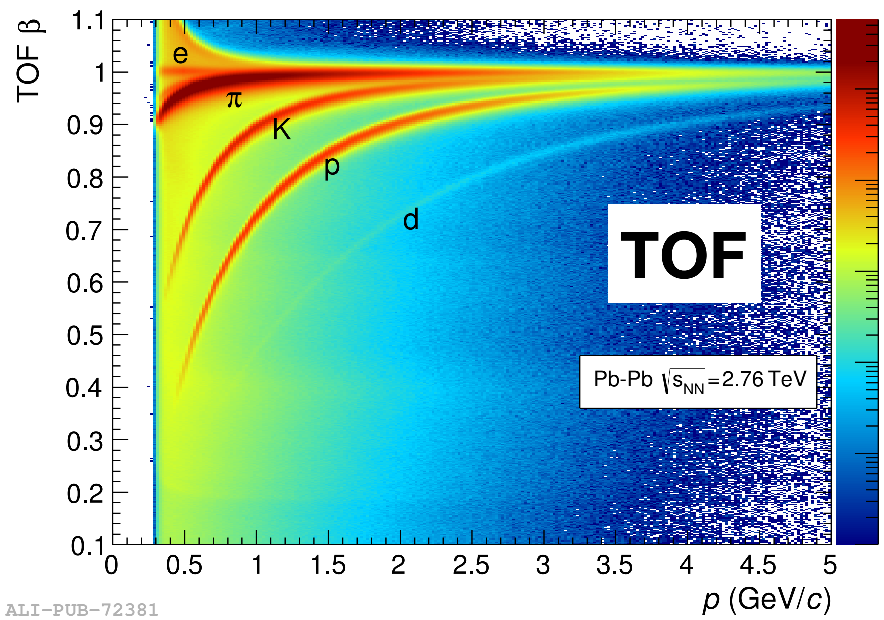
**Forward** (V0) event activity selection, **2.8(-3.7) $\lesssim \eta \lesssim$ 5.1(-1.7)**

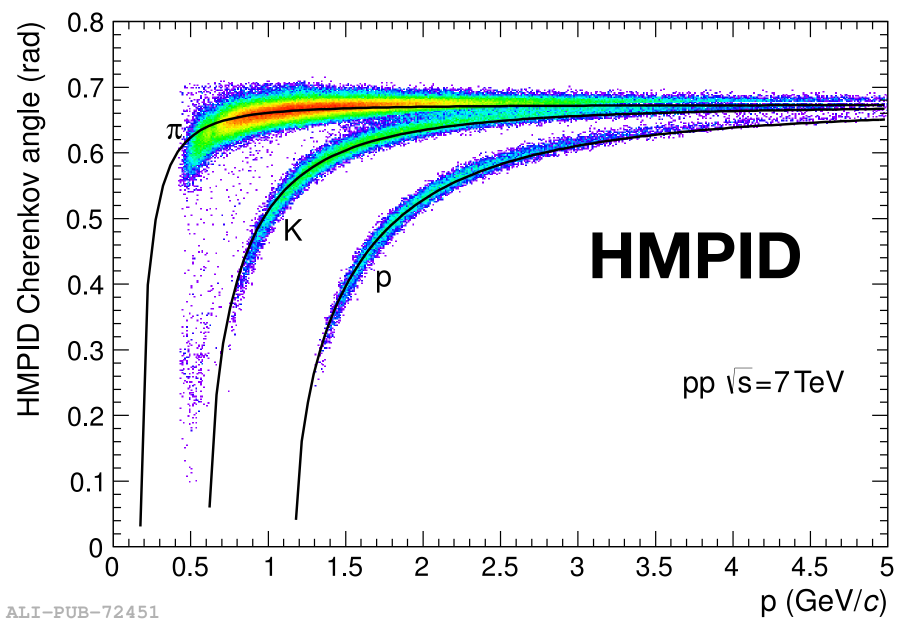
# Tracking and Particle Identification



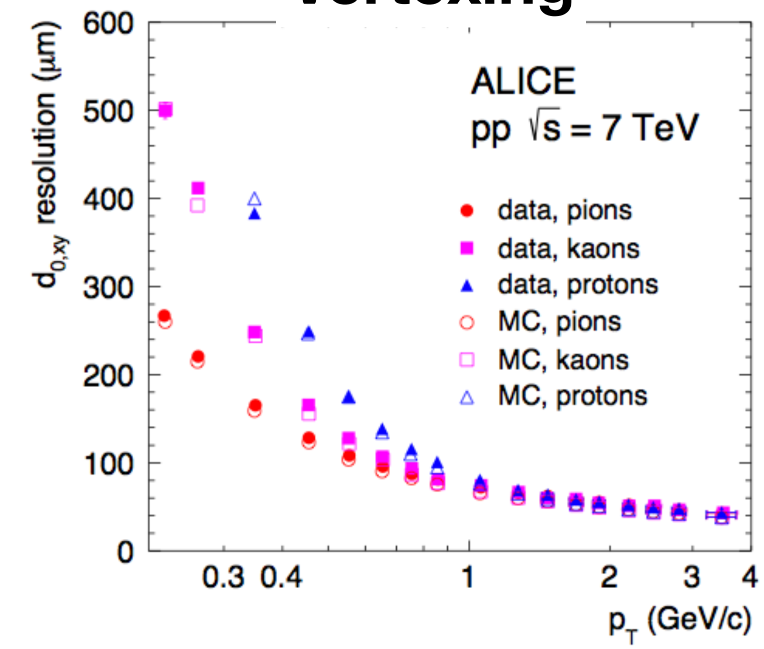




## Vertexing




Particle identification (many different techniques)

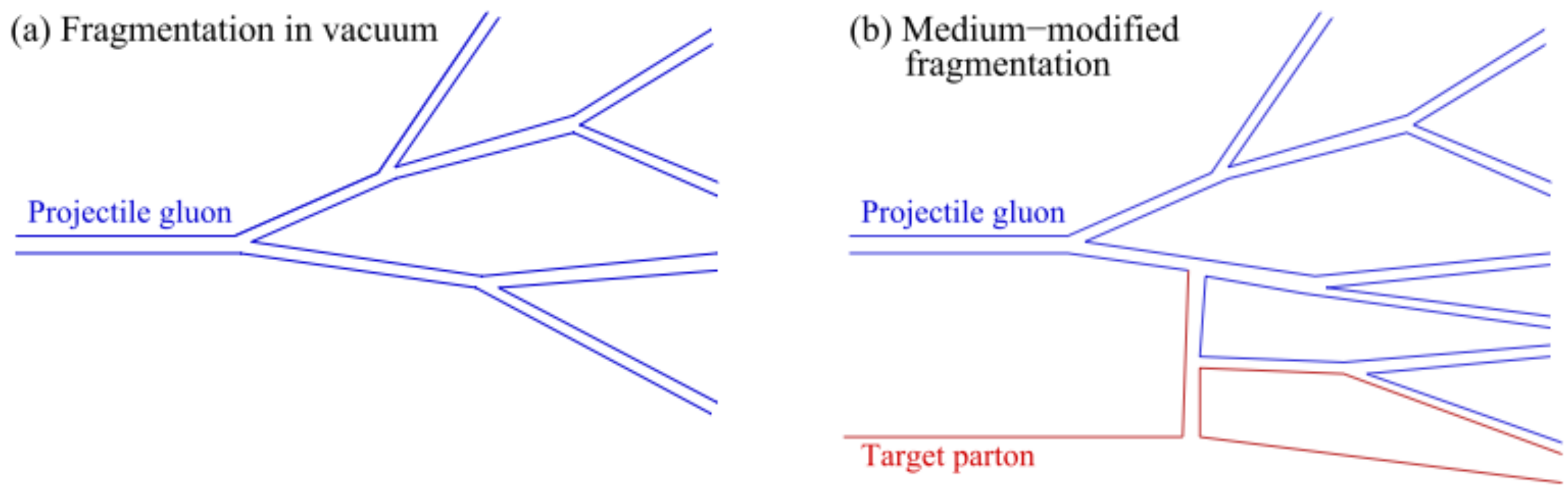
Extremely low-mass tracker ~ 10% of $X_0$

Excellent vertexing capability

Efficient low-momentum tracking – down to ~ 100 MeV/c

# Flavor dependence of $R_{AA}$?

- Quark jets vs gluon jets
- Color exchange with the medium

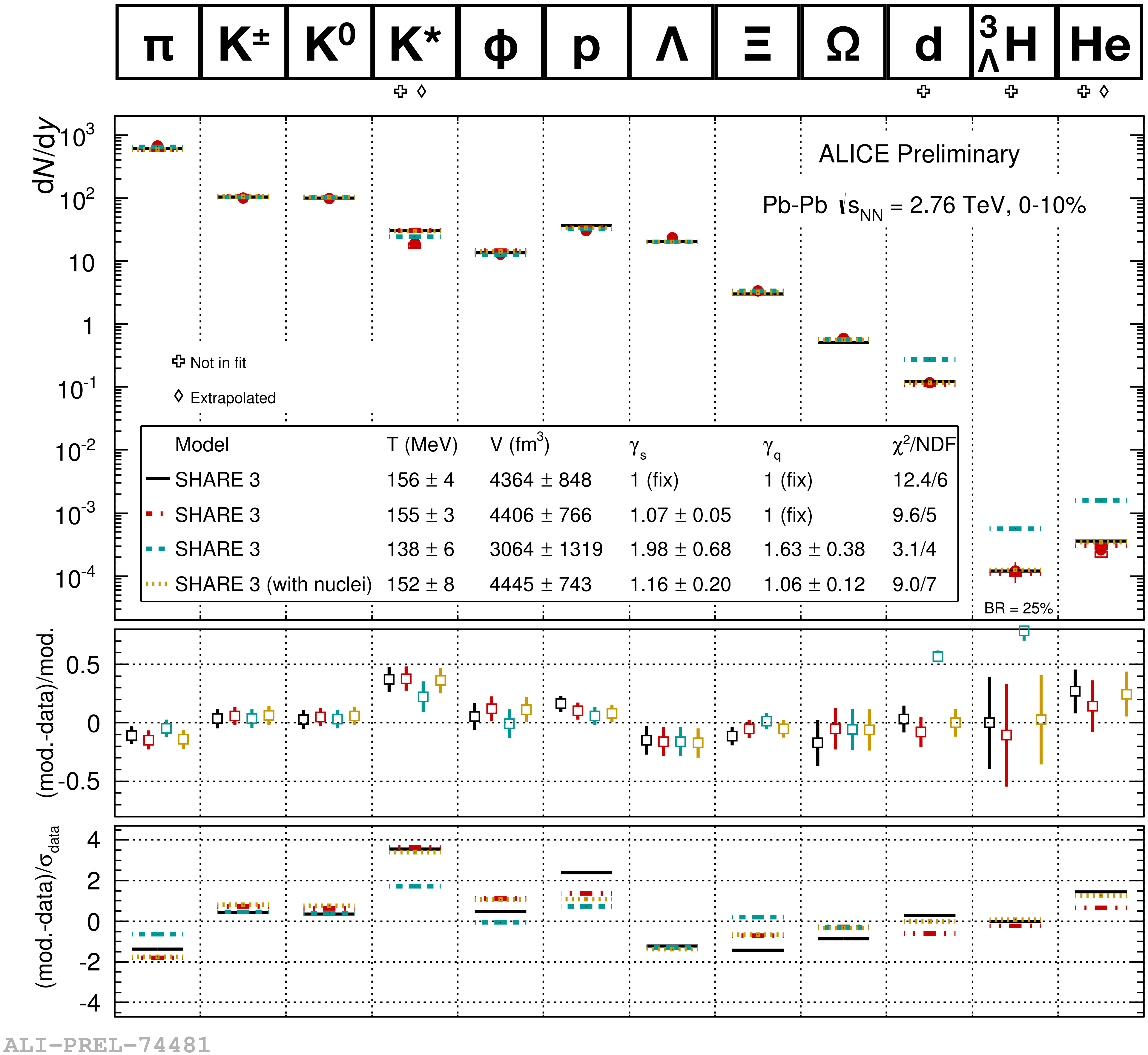



- Heavy flavor? (dead cone effect)

$$\Delta E_{quark} < \Delta E_{gluon} \quad , \quad \Delta E_{massive\ quark} < \Delta E_{light\ quark}$$
$$\Downarrow$$
$$R_{AA}(B) > R_{AA}(D) > R_{AA}(\pi)$$

Wiedemann et al, EPJC 55, 293–302

# Non equilibrium SHM: Fits




Very good if not including nuclei (similar to Refs)

Nuclei prediction off by factor ~ 5
Try to include nuclei in fit $\gamma_q \rightarrow 1$


**Petran et al PRC 88 021901**
**Petran et al, arXiv:1303.2098**
**Petran et al, arXiv:1310.2551**
**Petran et al, J. Phys. G 509 012018**

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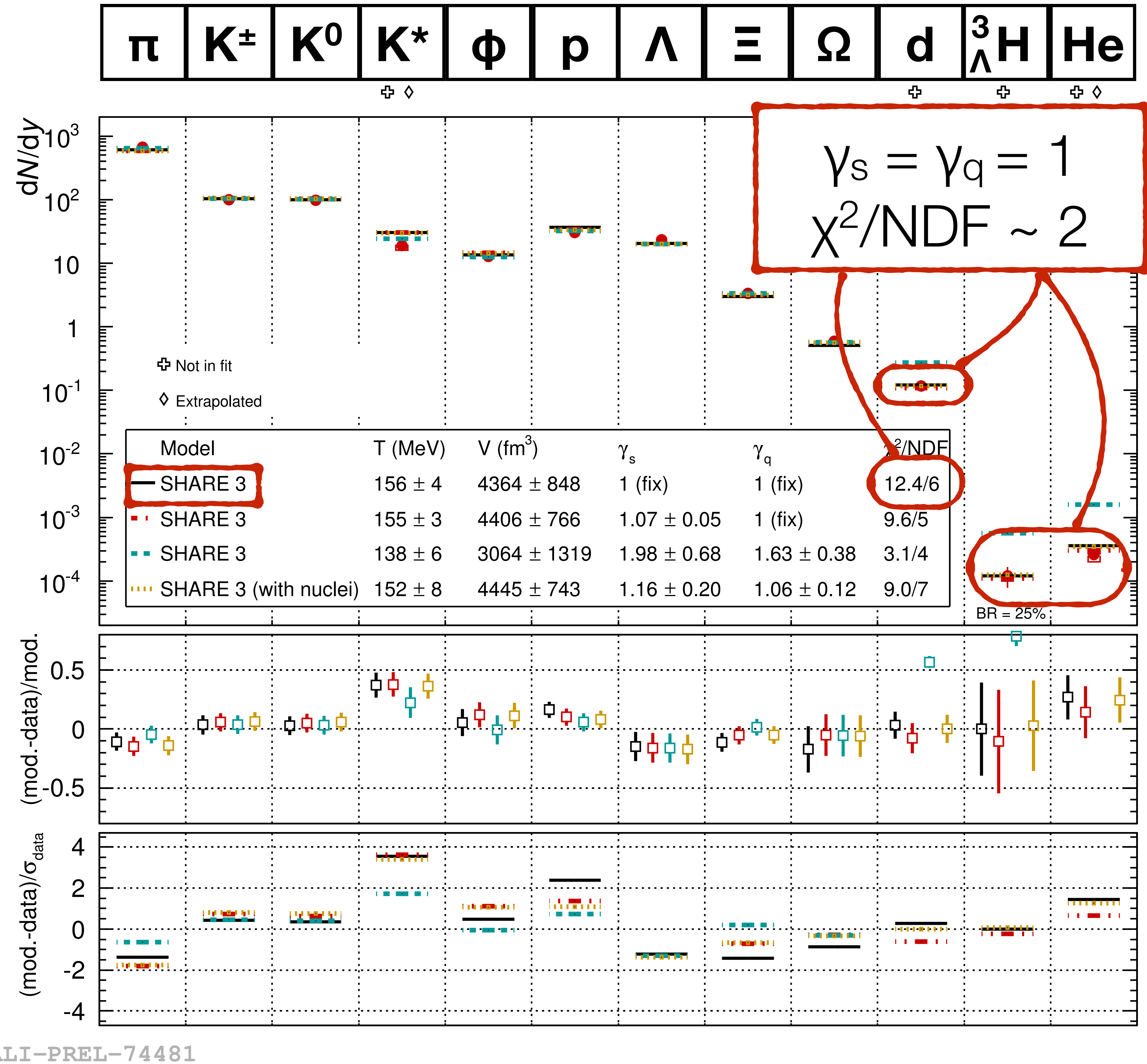


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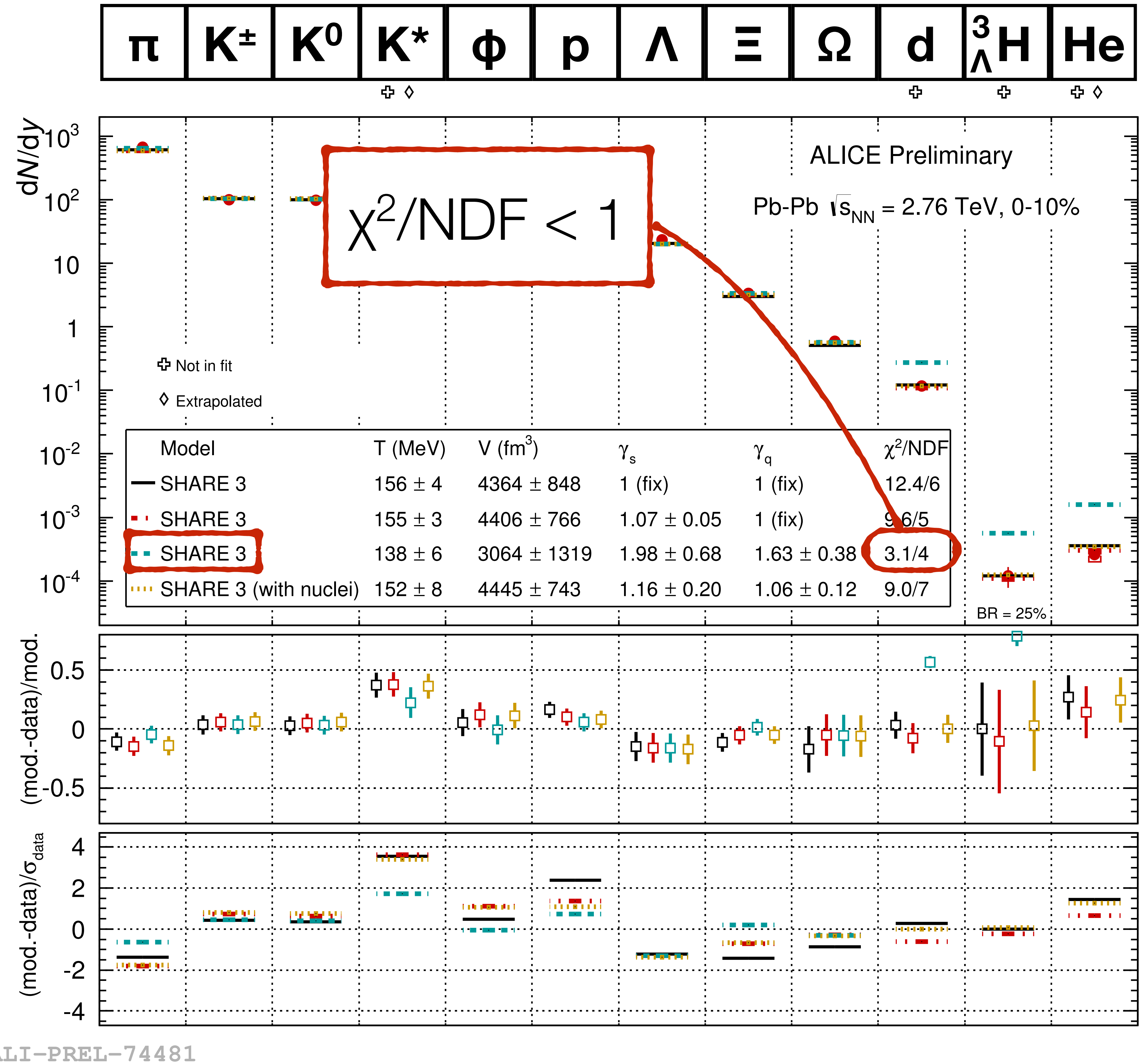


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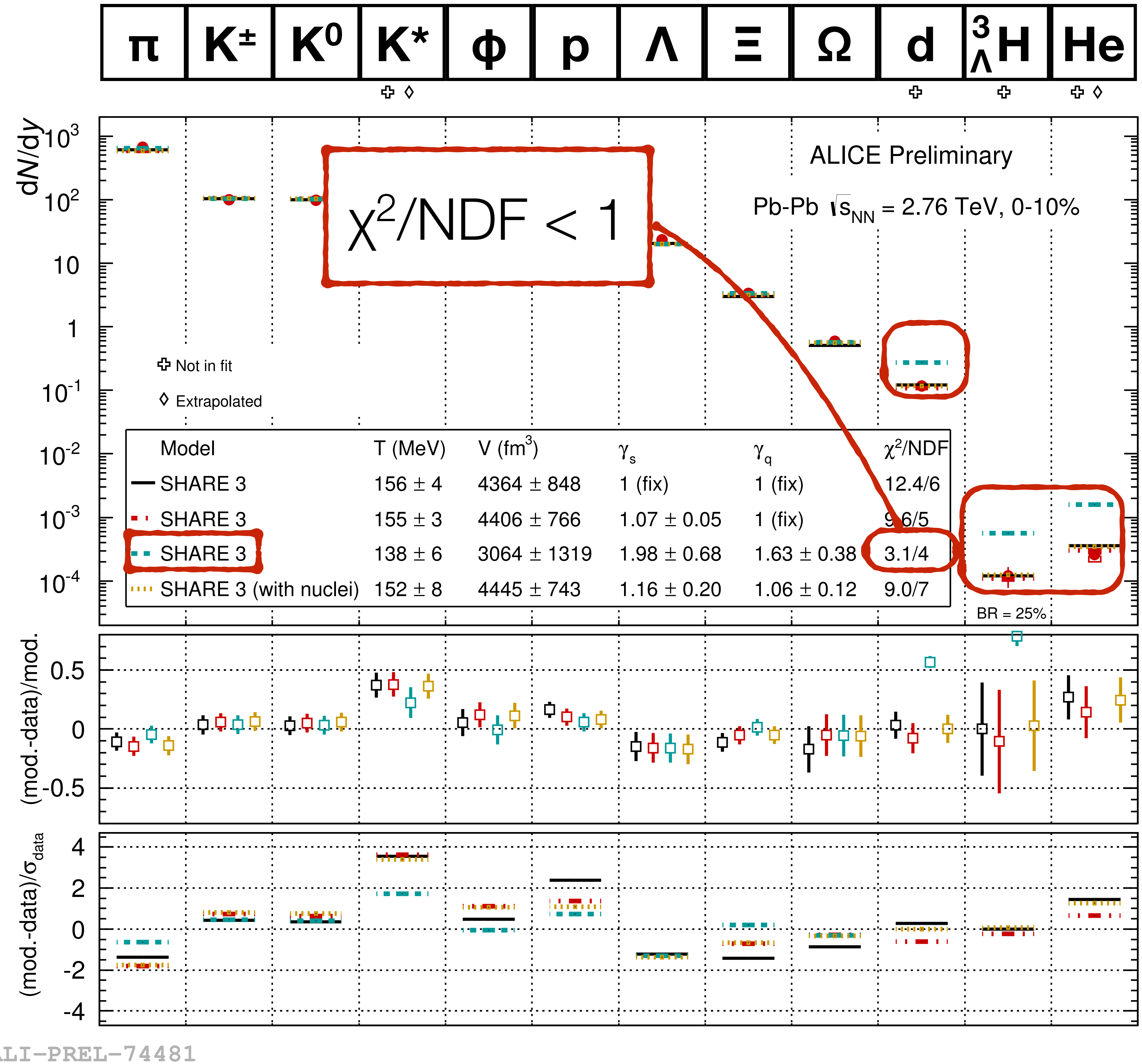


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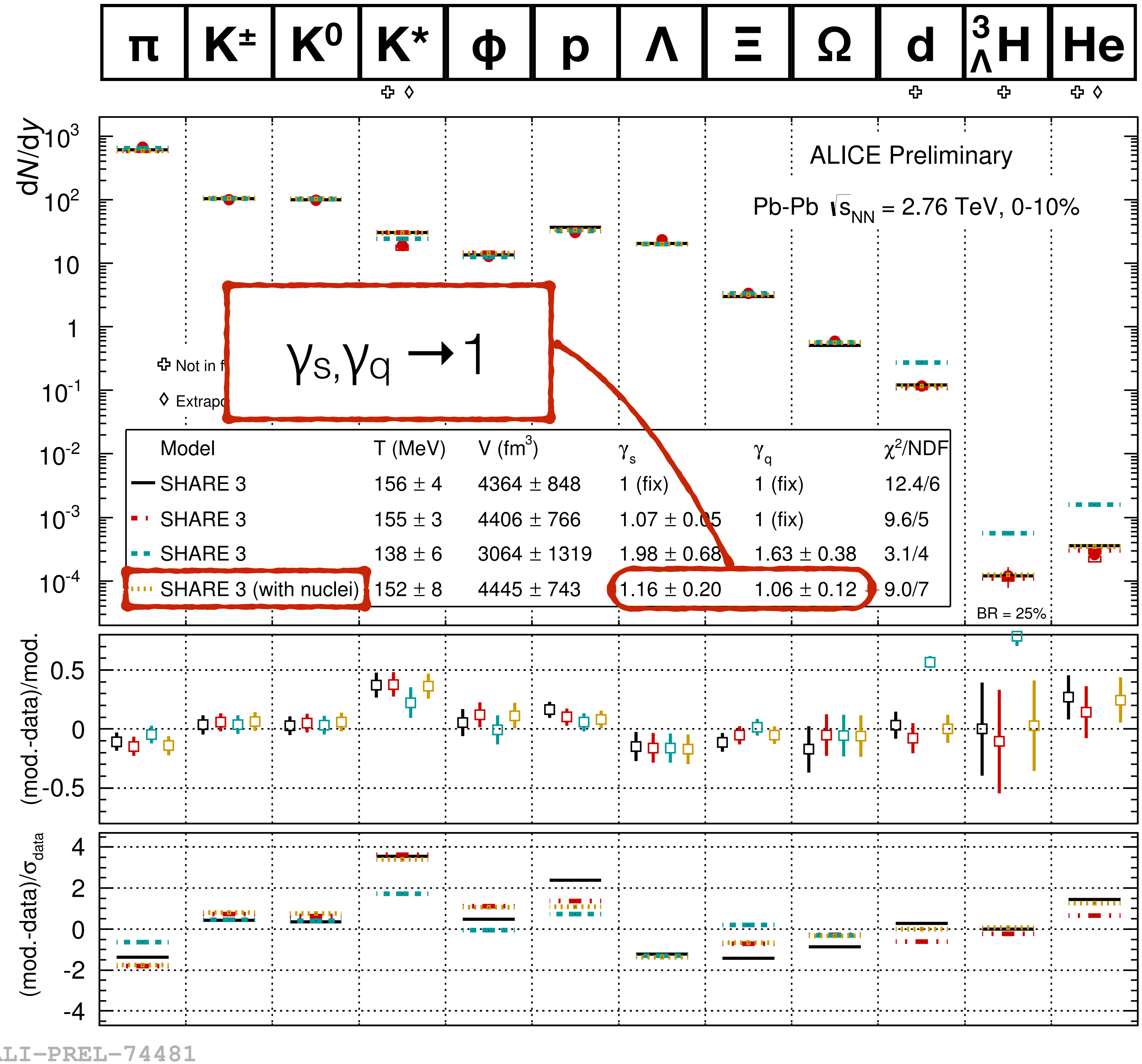


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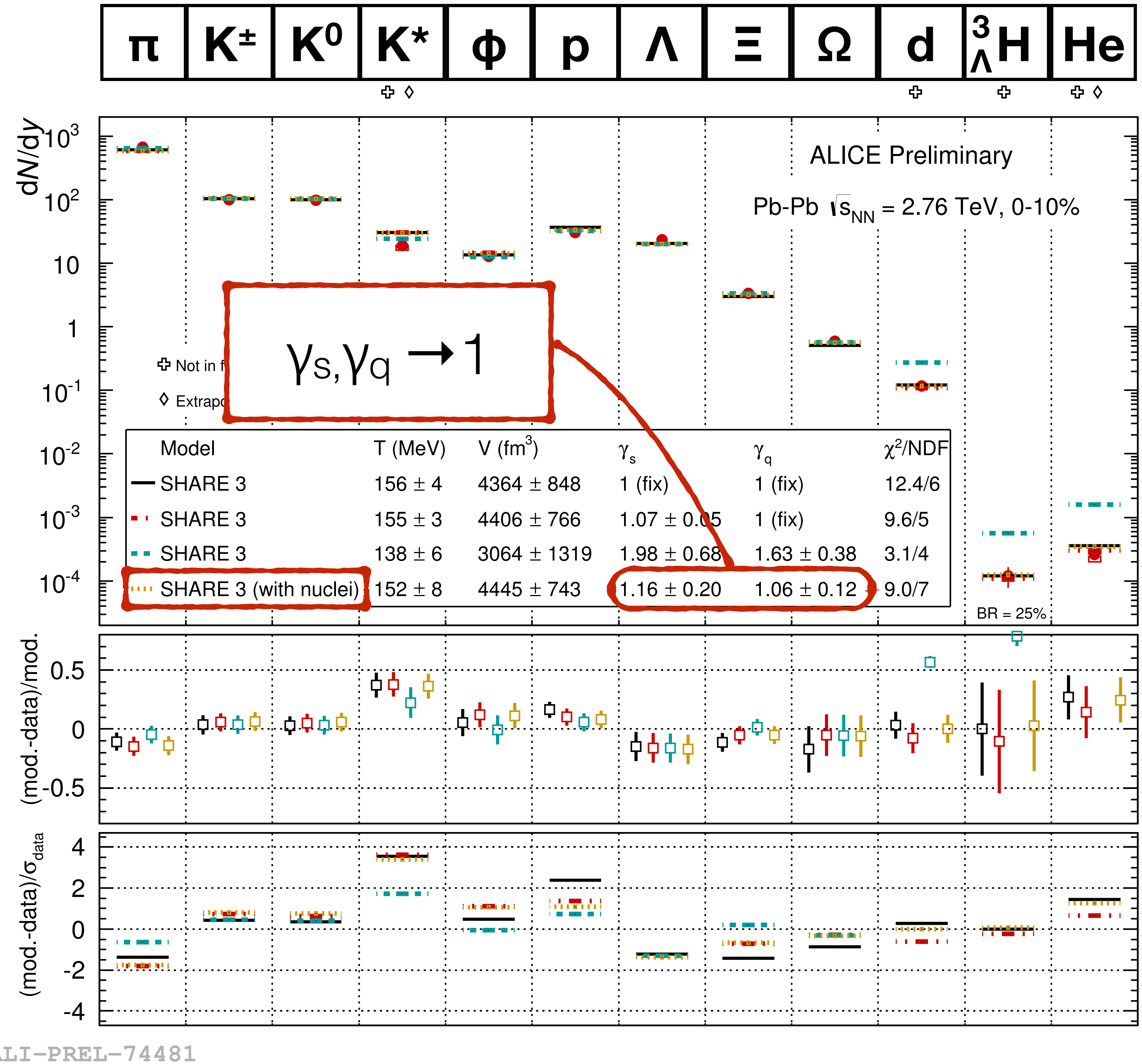


| Model | T (MeV) | V (fm³) | $\gamma_s$ | $\gamma_q$ | $\chi^2$/NDF |
|---|---|---|---|---|---|
| SHARE 3 | 156 ± 4 | 4364 ± 848 | 1 (fix) | 1 (fix) | 12.4/6 |
| SHARE 3 | 155 ± 3 | 4406 ± 766 | 1.07 ± 0.05 | 1 (fix) | 9.6/5 |
| SHARE 3 | 138 ± 6 | 3064 ± 1319 | 1.98 ± 0.68 | 1.63 ± 0.38 | 3.1/4 |
| SHARE 3 (with nuclei) | 152 ± 8 | 4445 ± 743 | 1.16 ± 0.20 | 1.06 ± 0.12 | 9.0/7 |

Very good if not including nuclei (similar to Refs)

Nuclei prediction off by factor ~ 5
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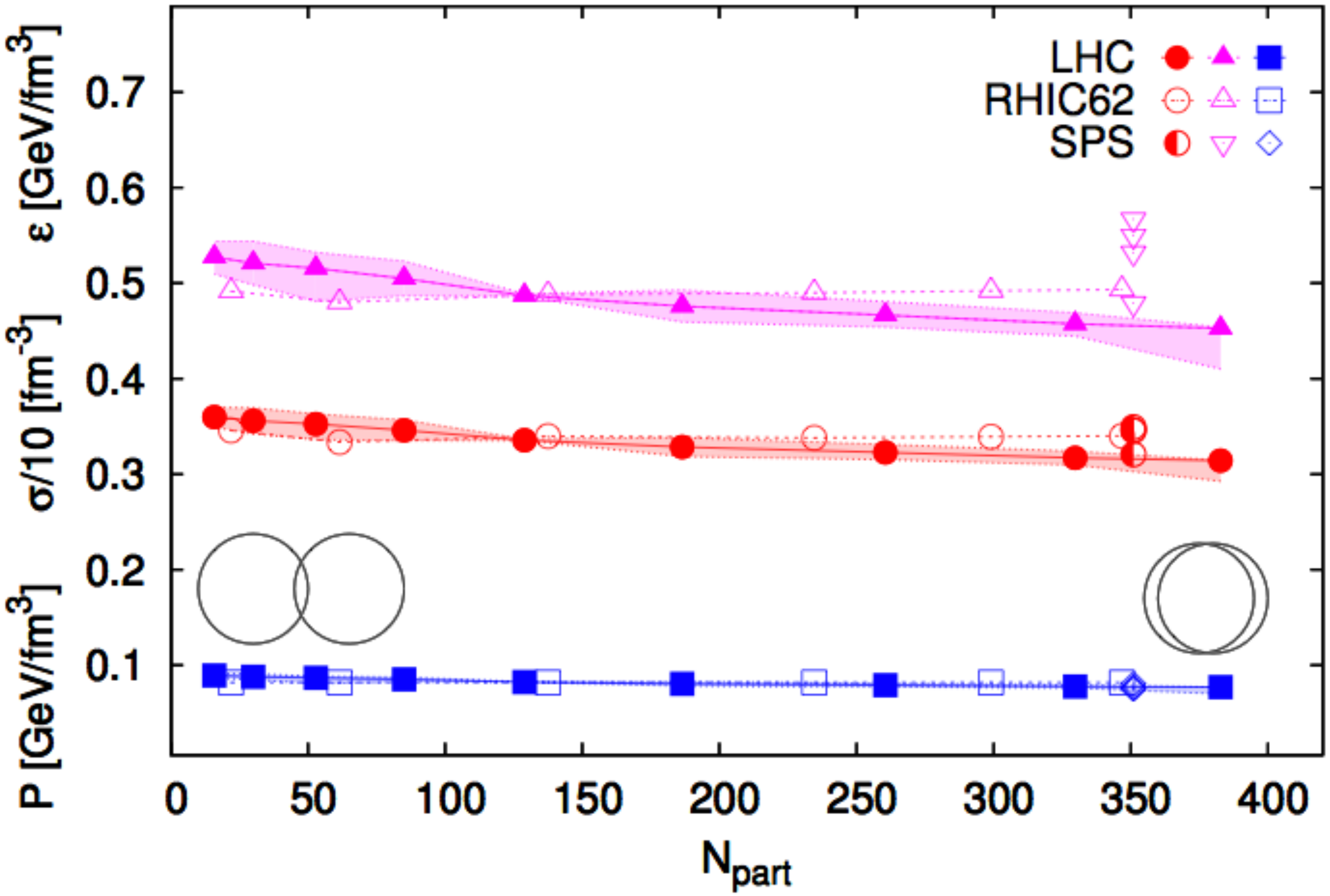
Nuclei $v_2$ in AuAu:

**R. Haque, STAR, Mon 19**

**Petran et al PRC 88 021901**
**Petran et al, arXiv:1303.2098**
**Petran et al, arXiv:1310.2551**
**Petran et al, J. Phys. G 509 012018**

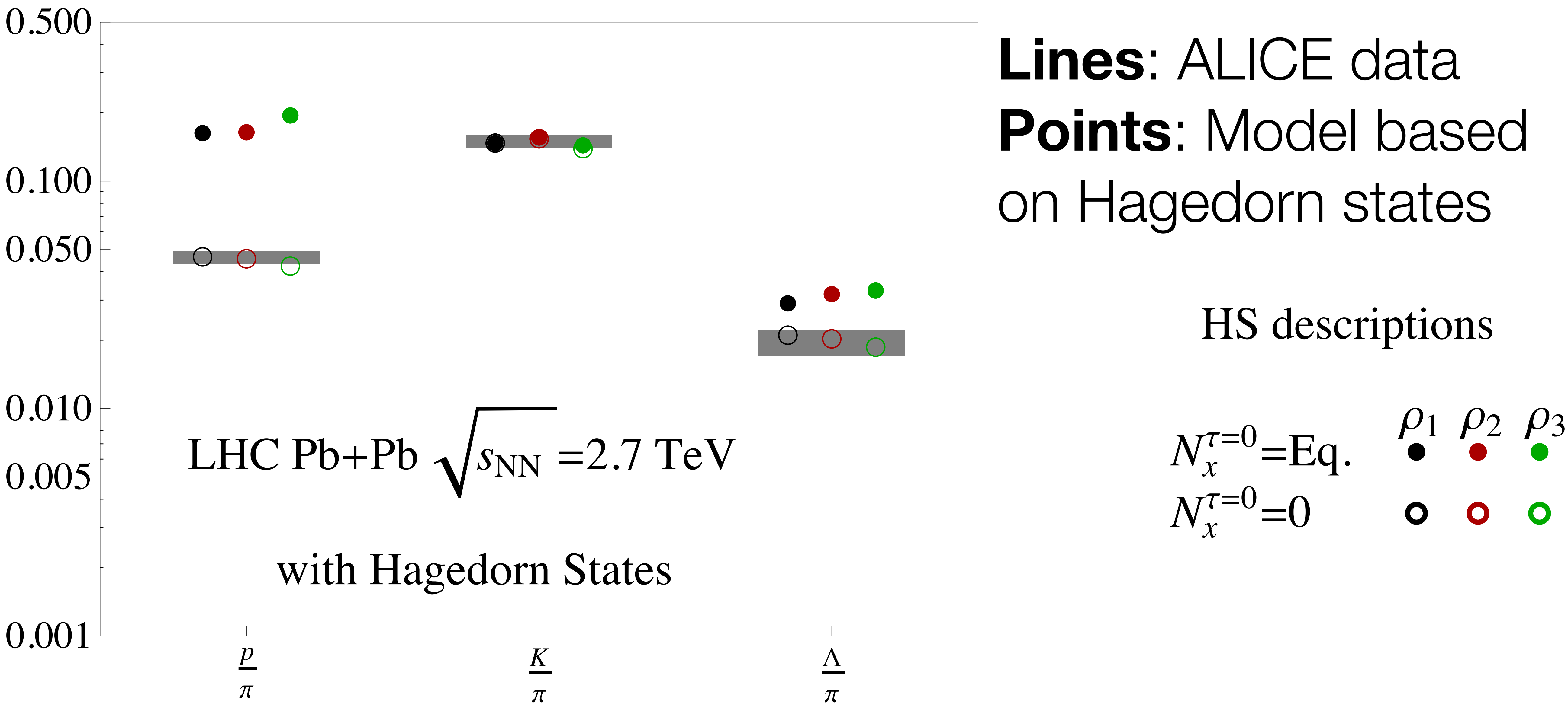
# Non equilibrium fits vs √s and system size




**Uniformity** of fireball freeze-out parameters across energy and centrality

Strangeness/entropy smaller than at RHIC?

**Rafelski, HIF CERN, March 20, 2014**
**Rafelski et al, A. Phys.Pol. B. Supp 7 35**




**Lines**: ALICE data
**Points**: Model based on Hagedorn states

Using assumptions on Hagedorn states, p/π reproduced

J. Noronha-Hostler, arXiv:0906.3960 (RHIC)

# Hadronic phase

**Late freeze-out for protons?**

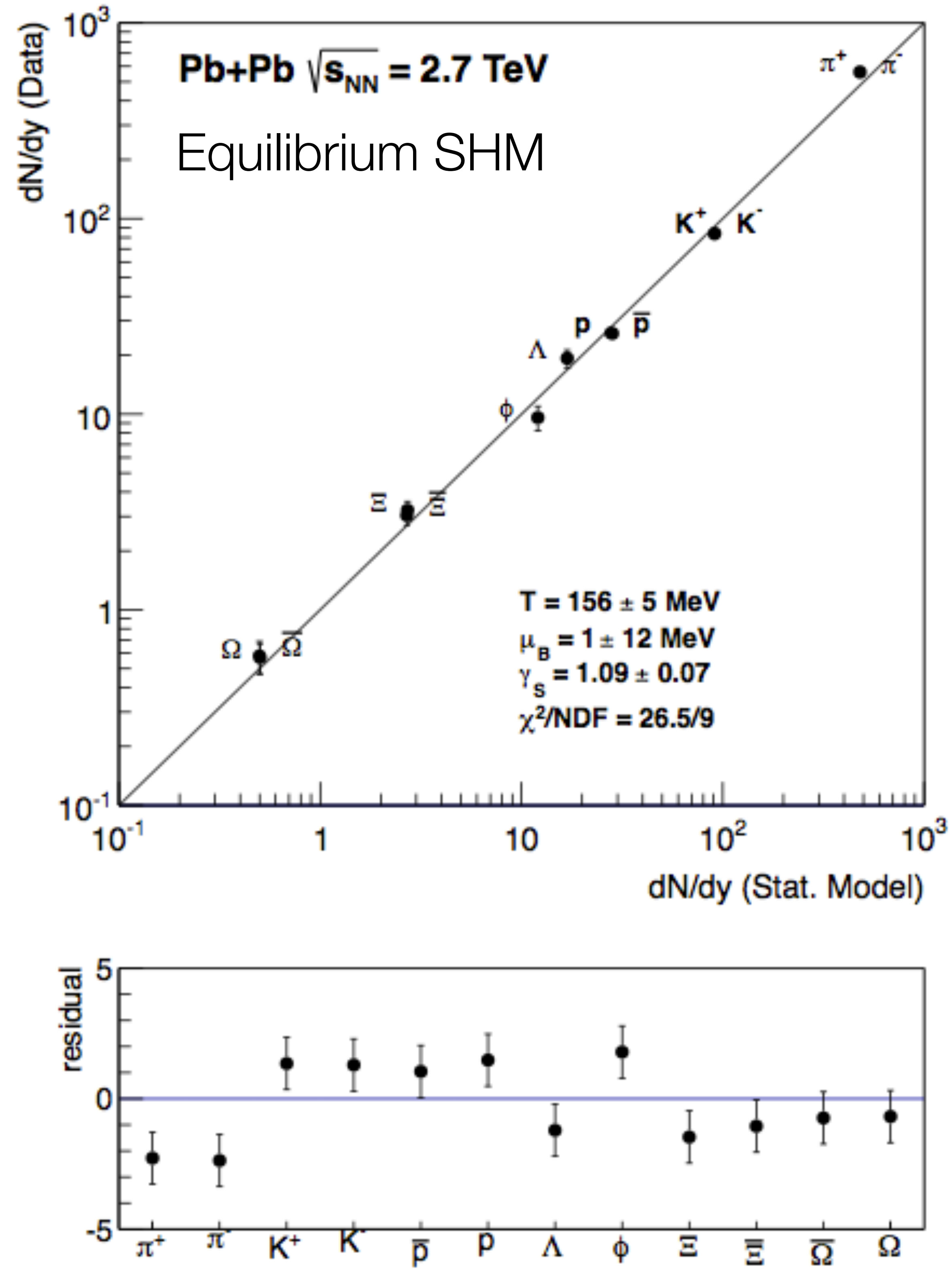
Baryon annihilation ↘ p yield

Unmeasured cross sections?

Inverse reactions

($n\pi \rightarrow p\bar{p}$, heavy meson $\rightarrow p\bar{p}$)?

Centrality dependence?




**Becattini et al, arXiv:1212.2431**

**arXiv:1405.0710**

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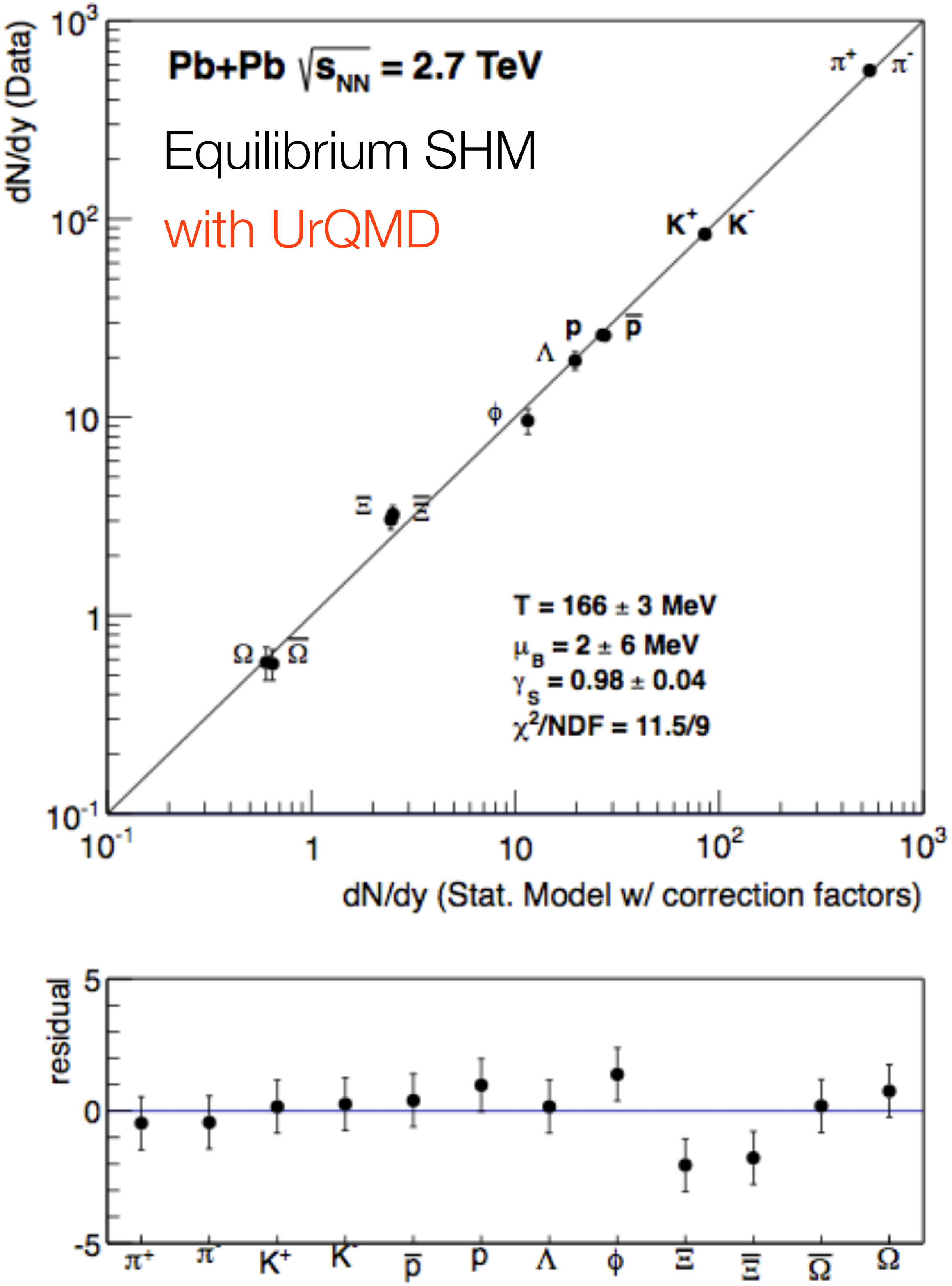


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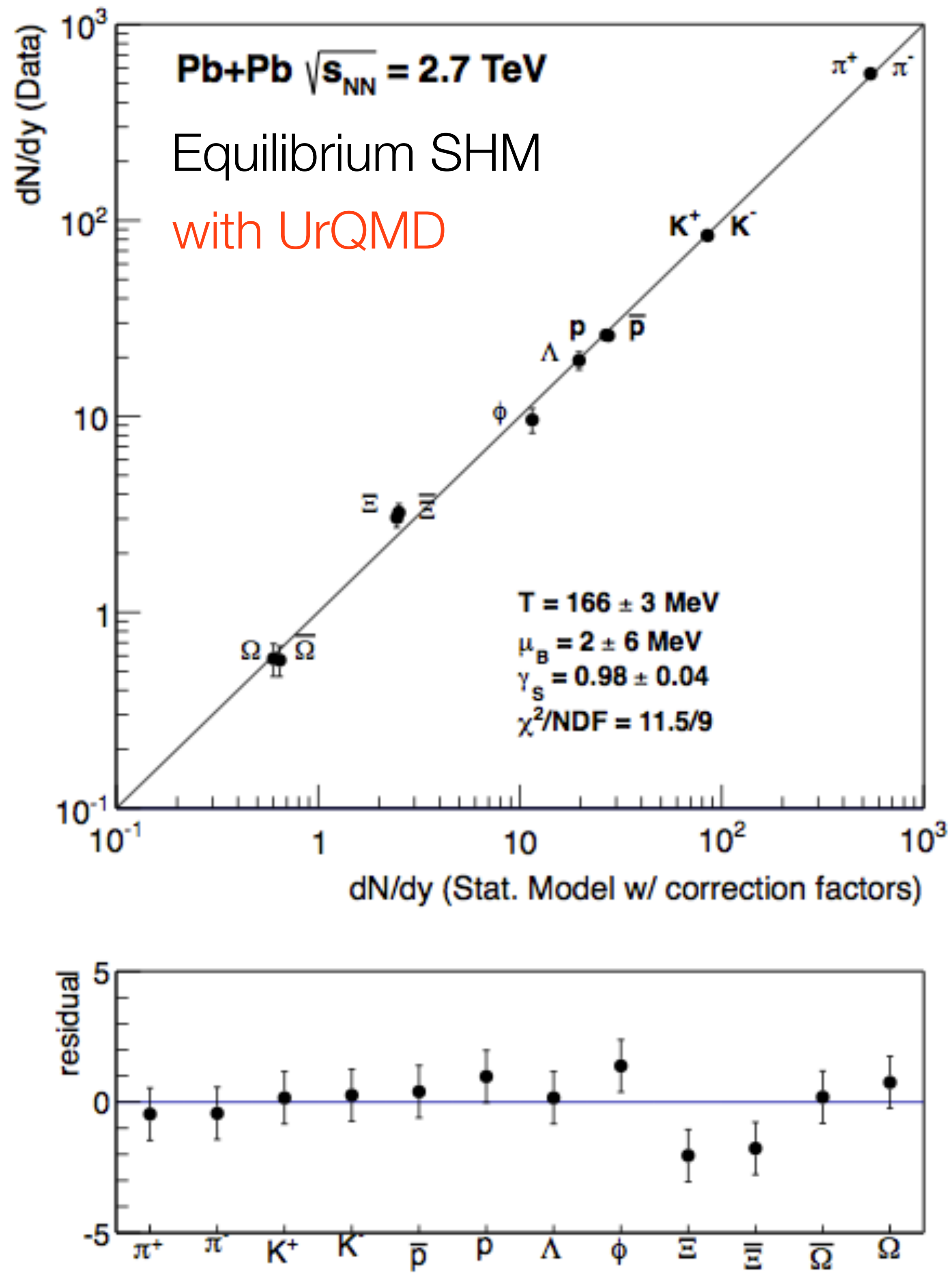


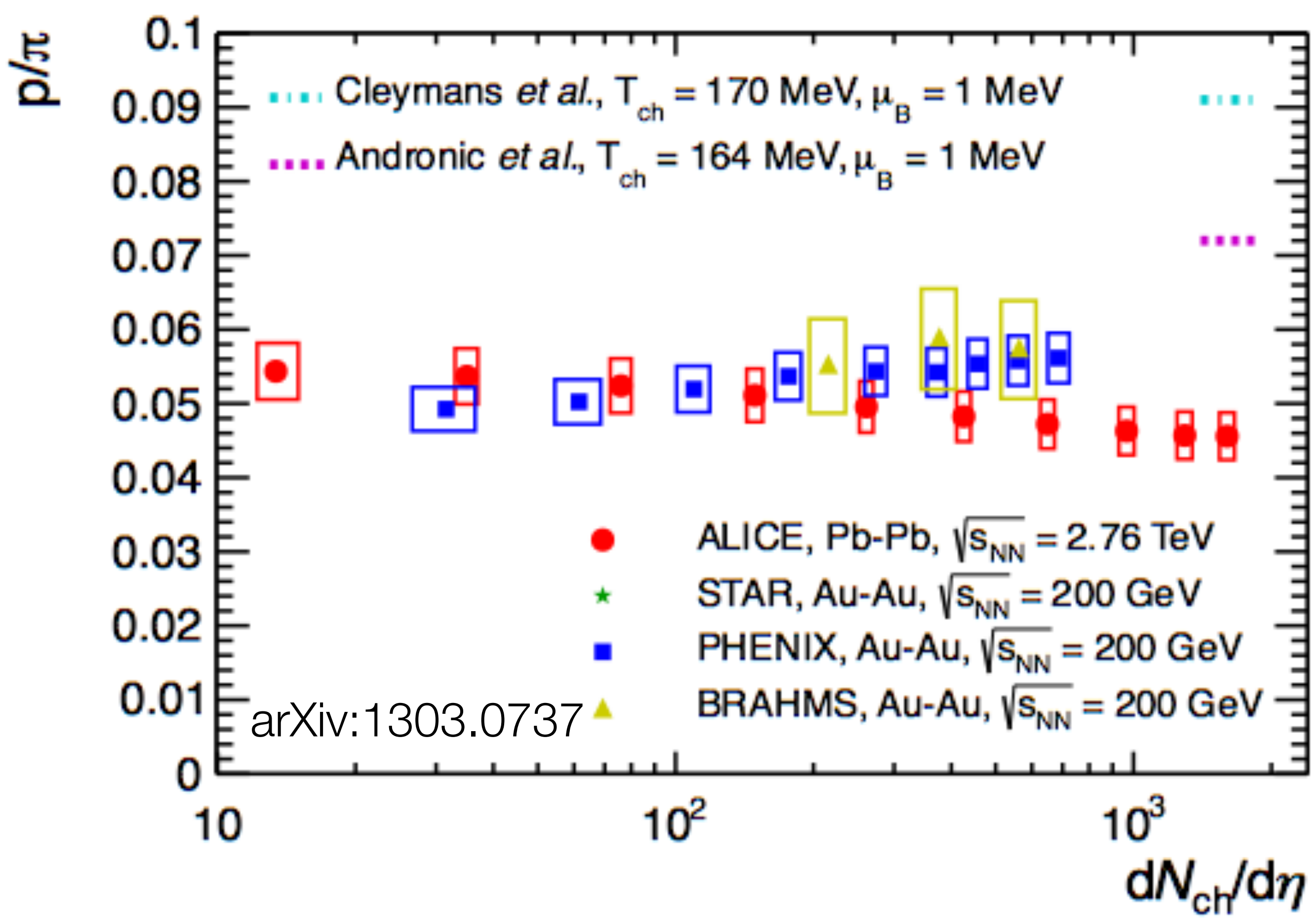


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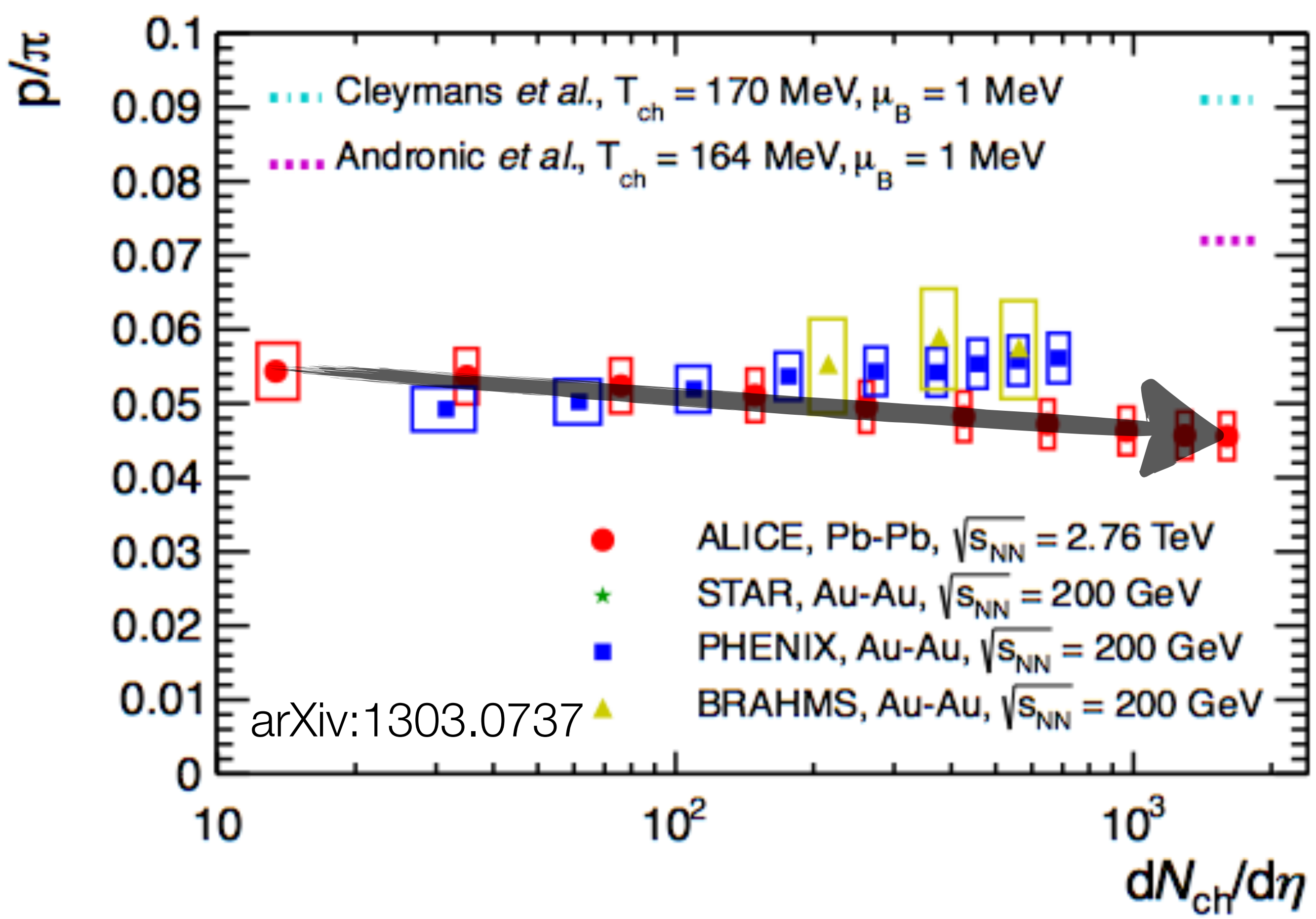


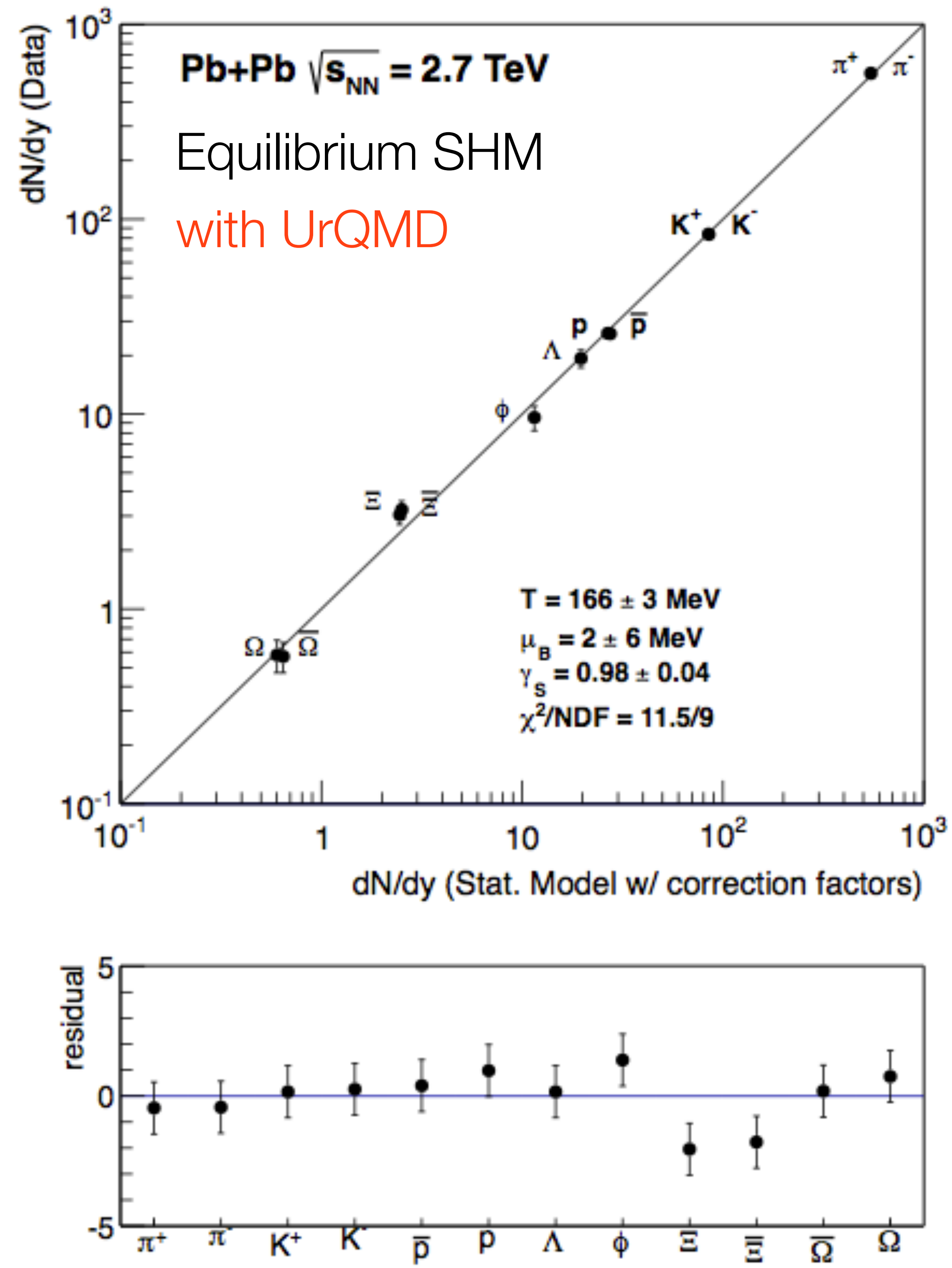


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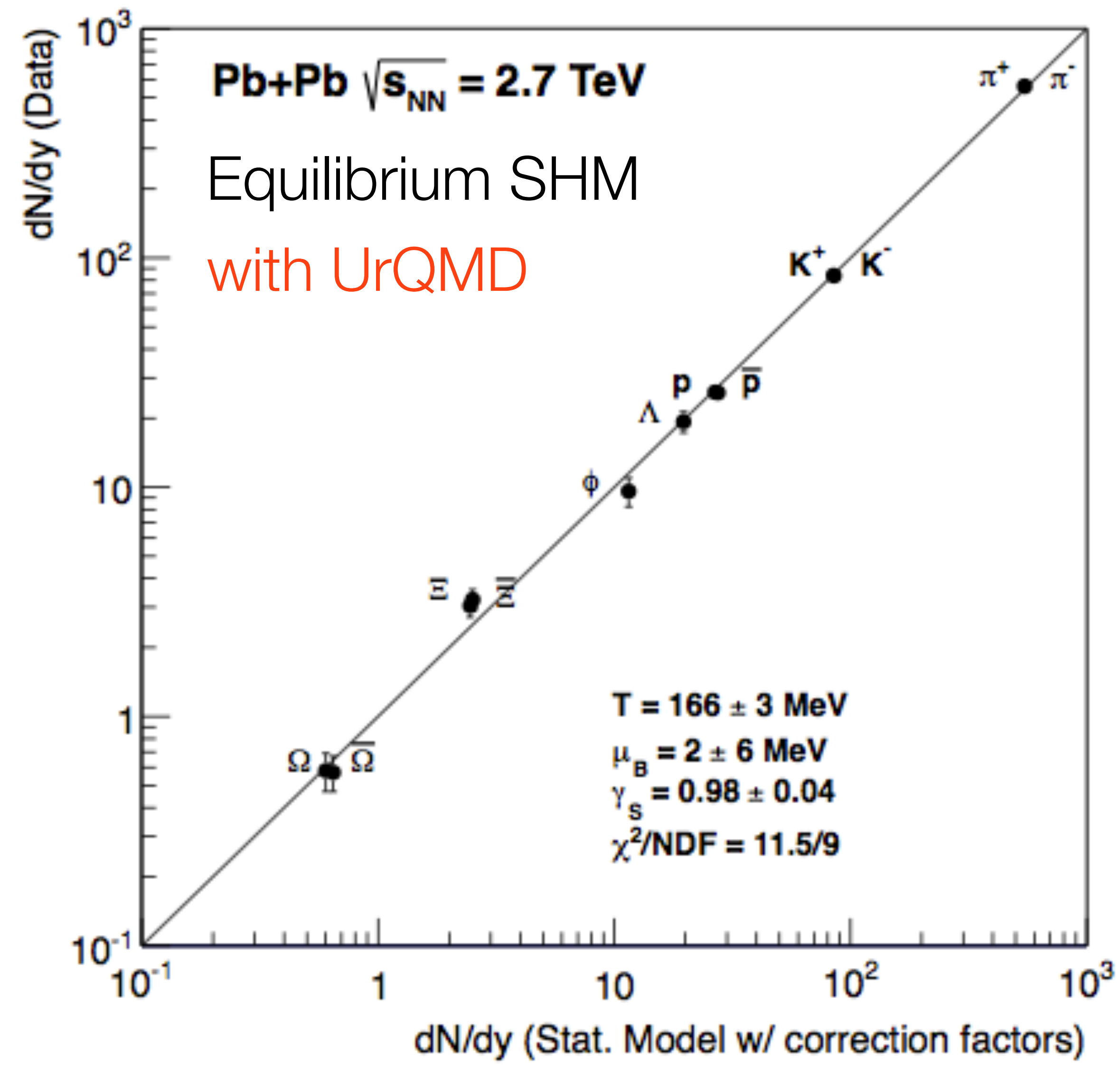
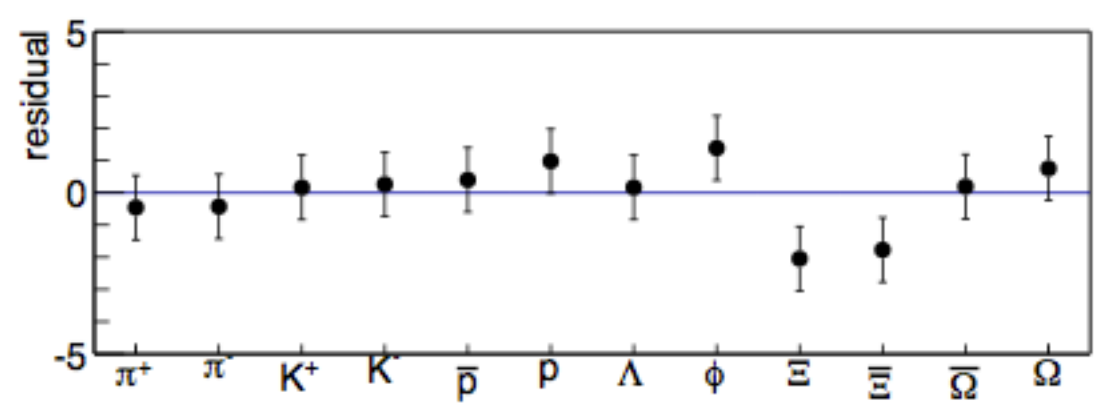
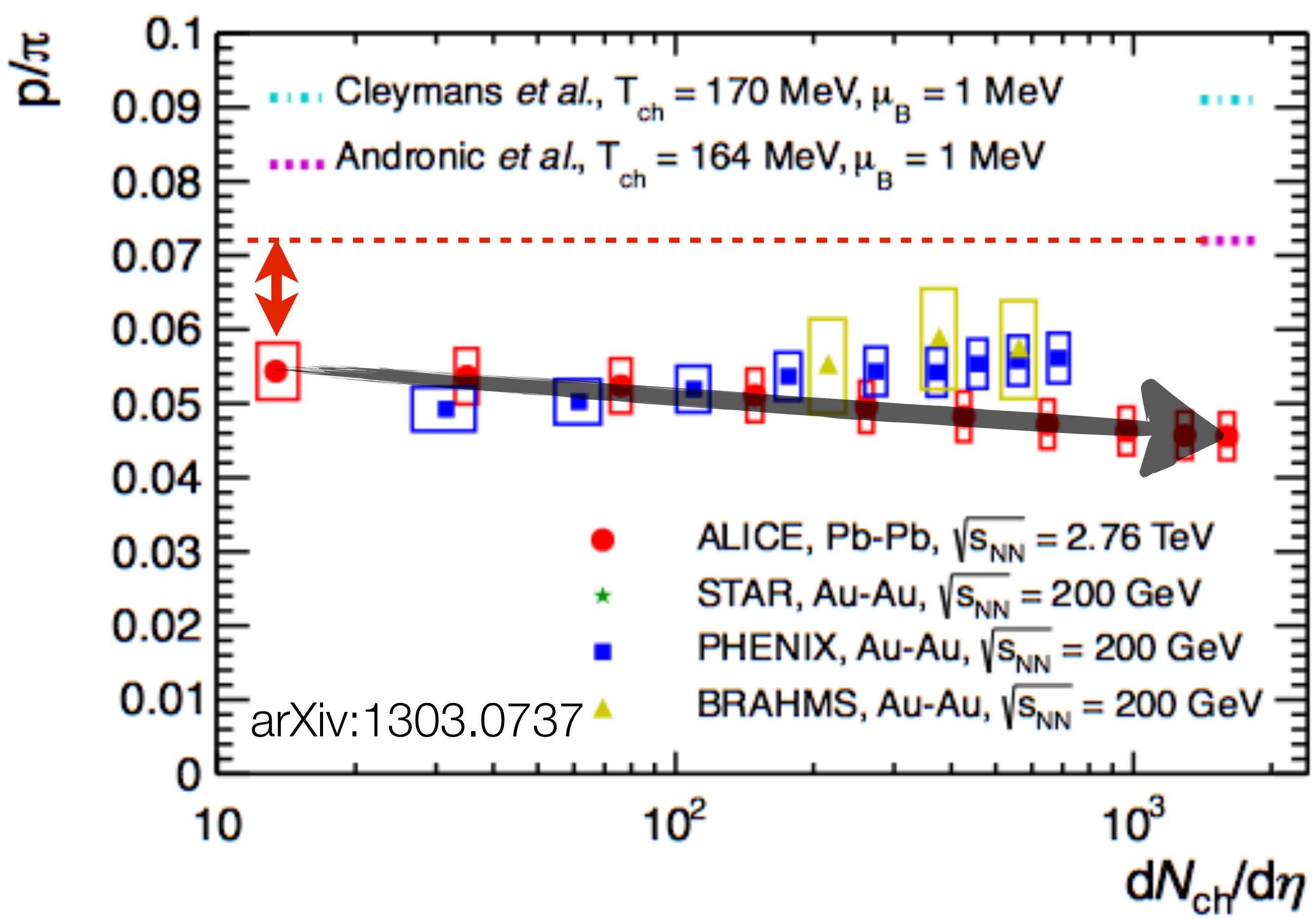


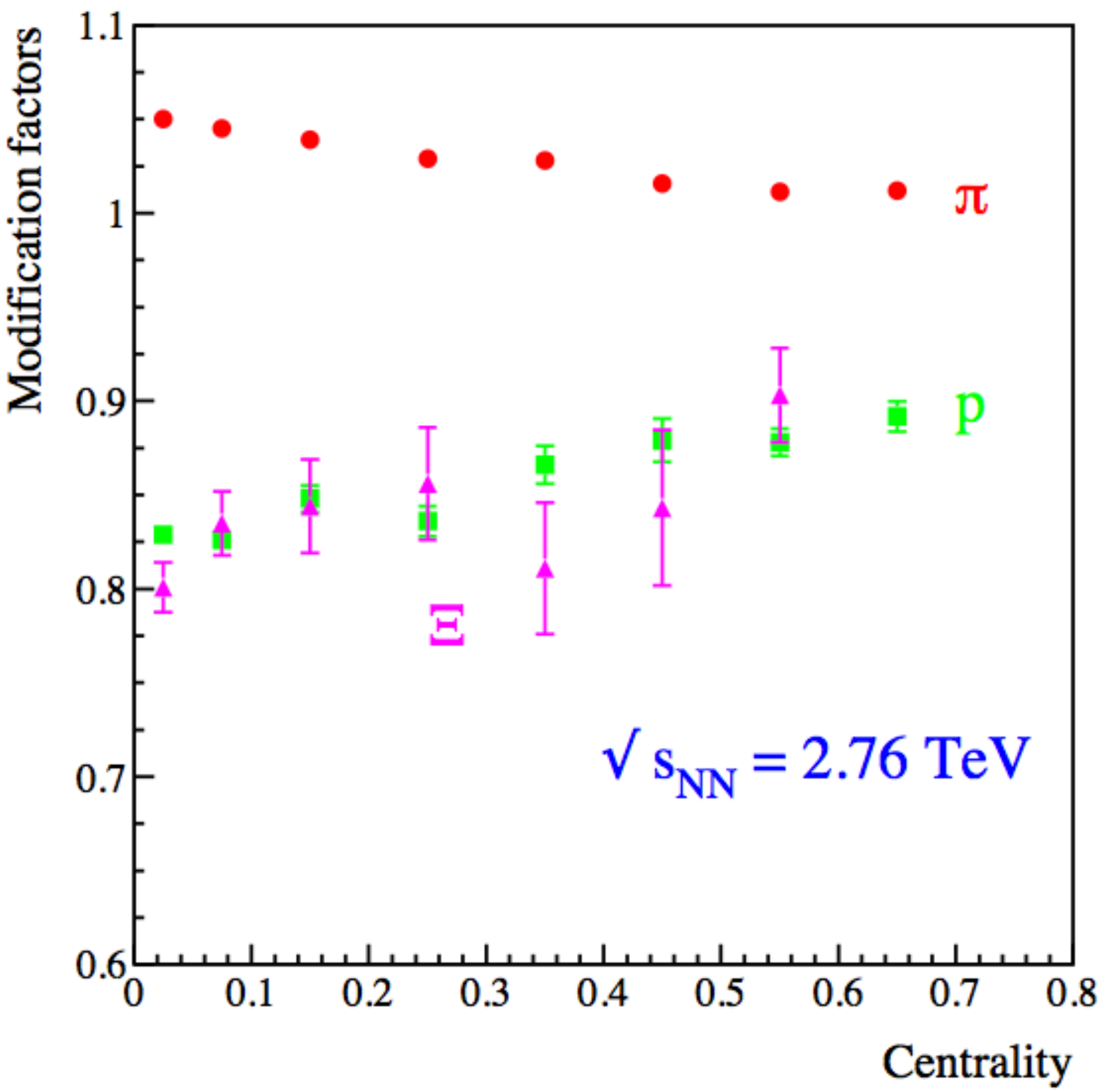



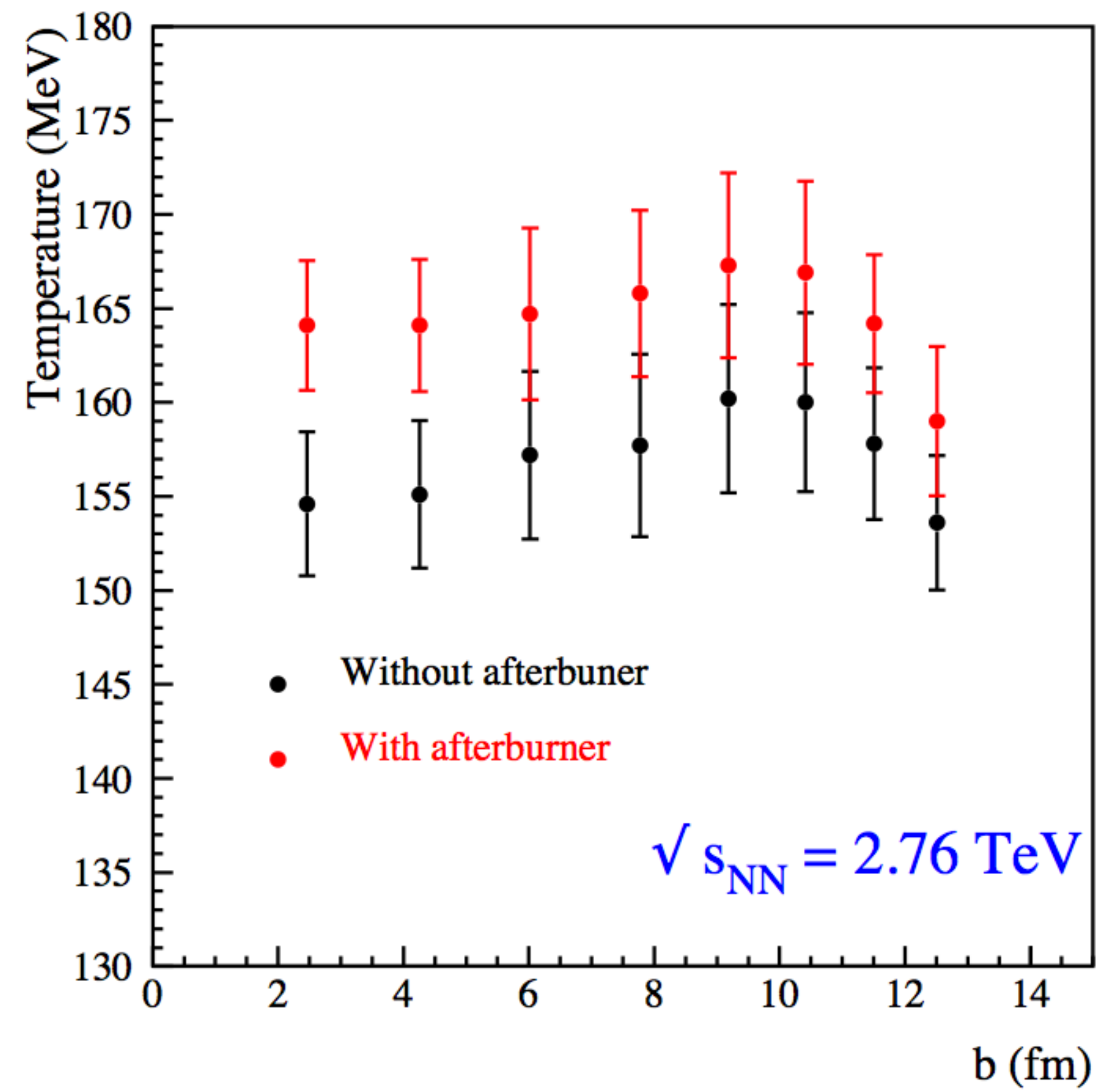




**Becattini et al, arXiv:1212.2431**

**arXiv:1405.0710**

# Centrality dependence calculation

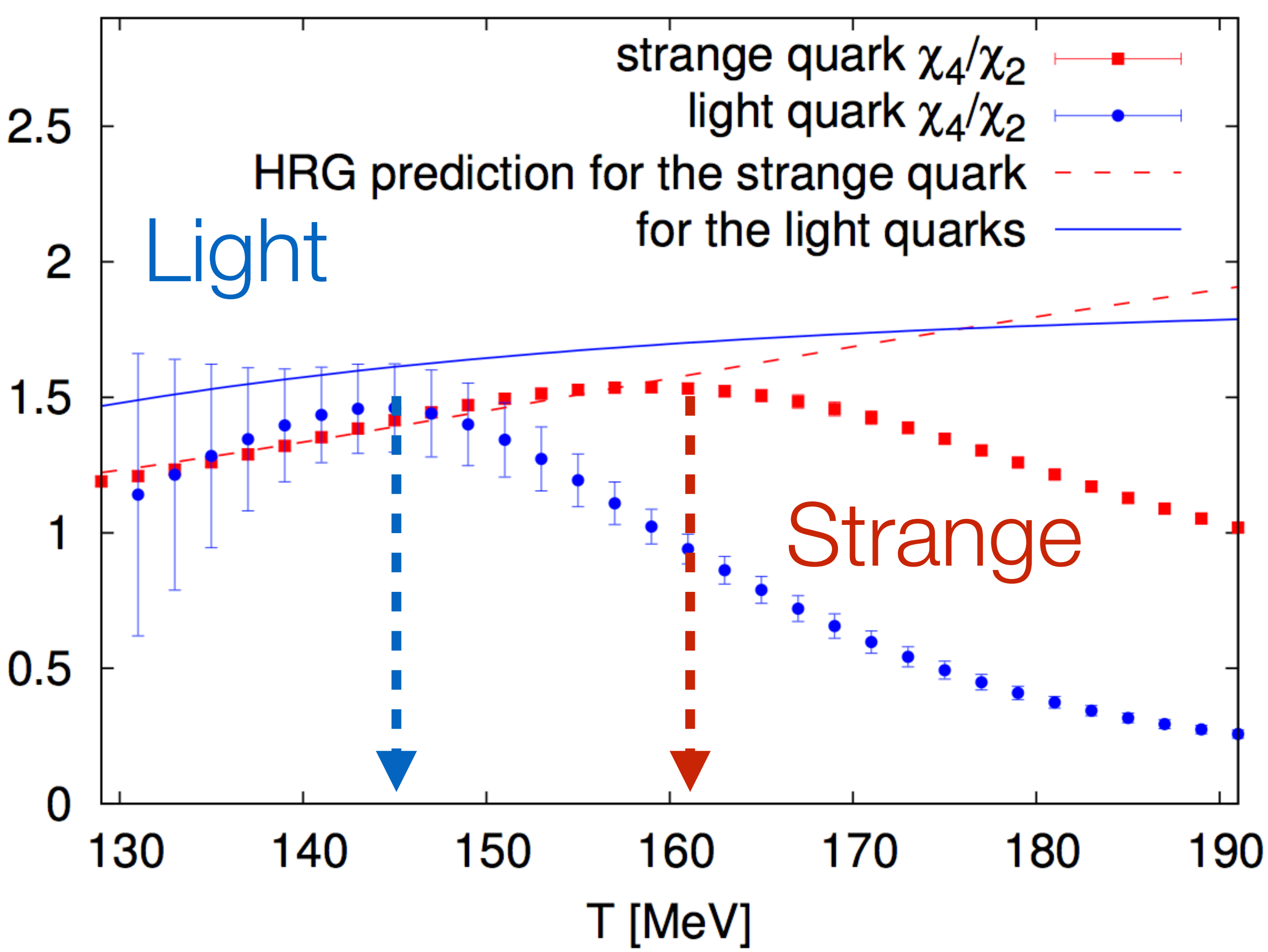



Correction factors now computed for **all centrality bins**
**Back-reaction neglected**, effect estimated to be small (but no rigorous estimate yet)

**Becattini et al, arXiv:1405.0710**

# Flavor hierarchy in the QCD phase transition



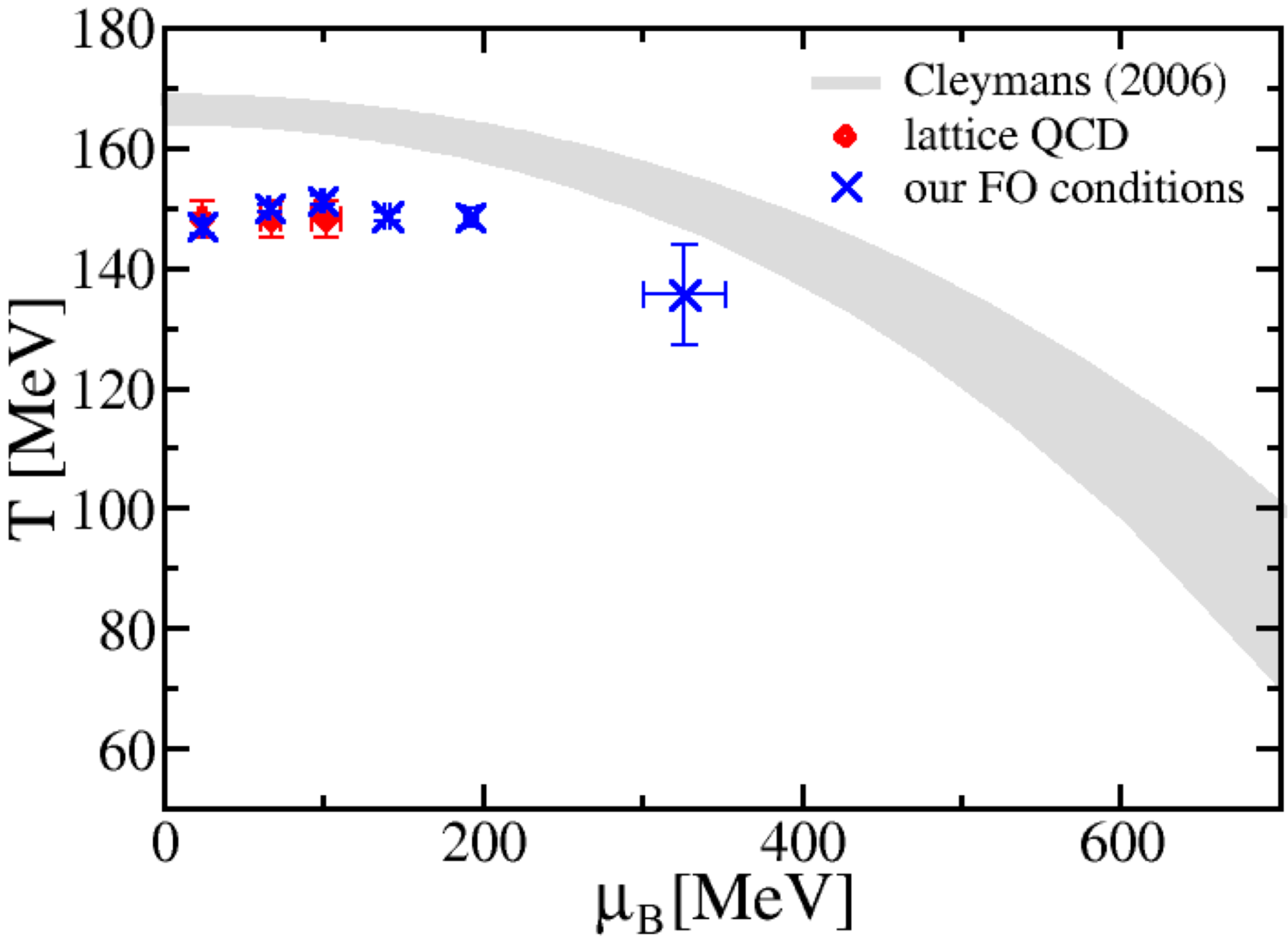

Lattice: indication of a **flavor hierarchy** at freeze-out?

Pre-hadronic bound states: strangeness above $T_C$?

**Connection to experiment**:
higher order moments of net charges?
(related to susceptibilities ratios of conserved charges)
**Caveats**: needs strange baryons, limited phase space, baryons vs protons …

**Bellwied et al, PRL 111 202302**
**Ratti et al PRD85 014004**
**F. Karsh, Cent. Eur. J. Phys., 10 1234**

# Higher moments: HRG and STAR




P.Alba et al, arXiv:1403.4903
S. Borsanyi et al, arxiv.org:1403.4576
STAR arXiv:1402.1558
STAR, PRL, 112 (2014) 032302

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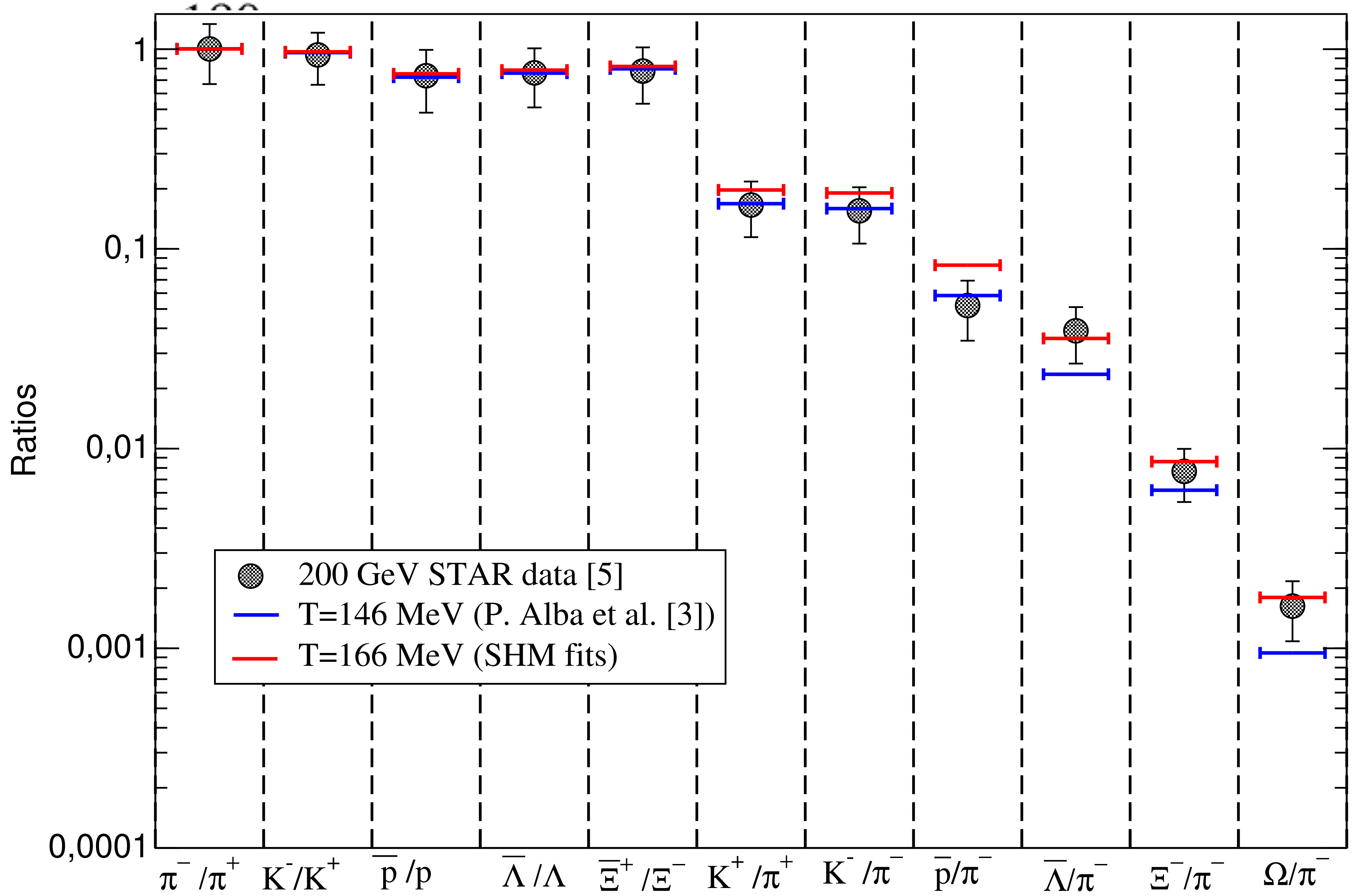
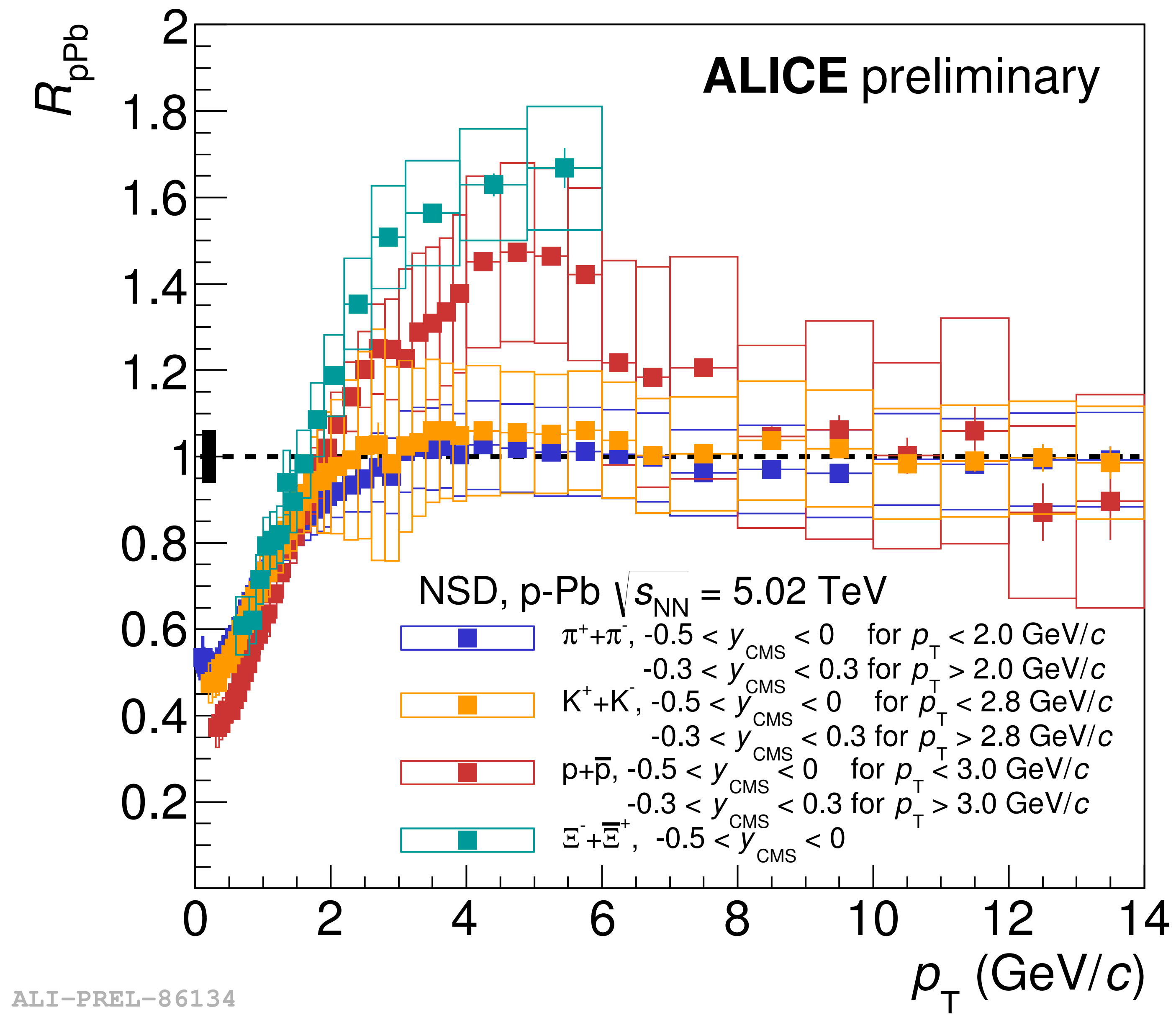



**P.Alba et al, arXiv:1403.4903**
**S. Borsanyi et al, arxiv.org:1403.4576**
**STAR arXiv:1402.1558**
**STAR, PRL, 112 (2014) 032302**



ALICE preliminary
NSD, p-Pb √sNN = 5.02 TeV
π⁺+π⁻, -0.5 < yCMS < 0 for pT < 2.0 GeV/c
-0.3 < yCMS < 0.3 for pT > 2.0 GeV/c
K⁺+K⁻, -0.5 < yCMS < 0 for pT < 2.8 GeV/c
-0.3 < yCMS < 0.3 for pT > 2.8 GeV/c
p+p̄, -0.5 < yCMS < 0 for pT < 3.0 GeV/c
-0.3 < yCMS < 0.3 for pT > 3.0 GeV/c
Ξ⁻+Ξ̄⁺, -0.5 < yCMS < 0
RpPb
pT (GeV/c)
ALI-PREL-86134

# Reminder: what drives a thermal fit

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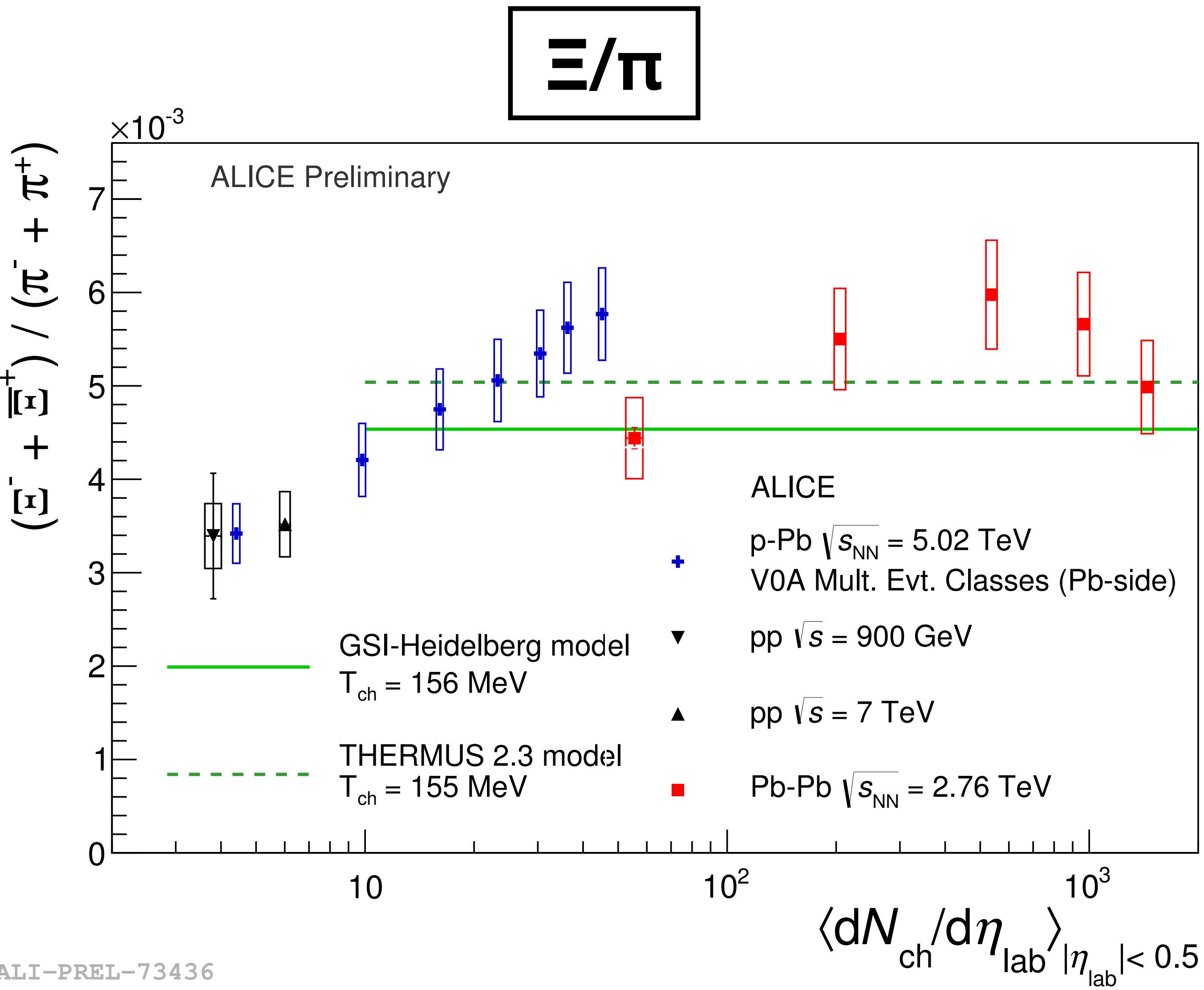
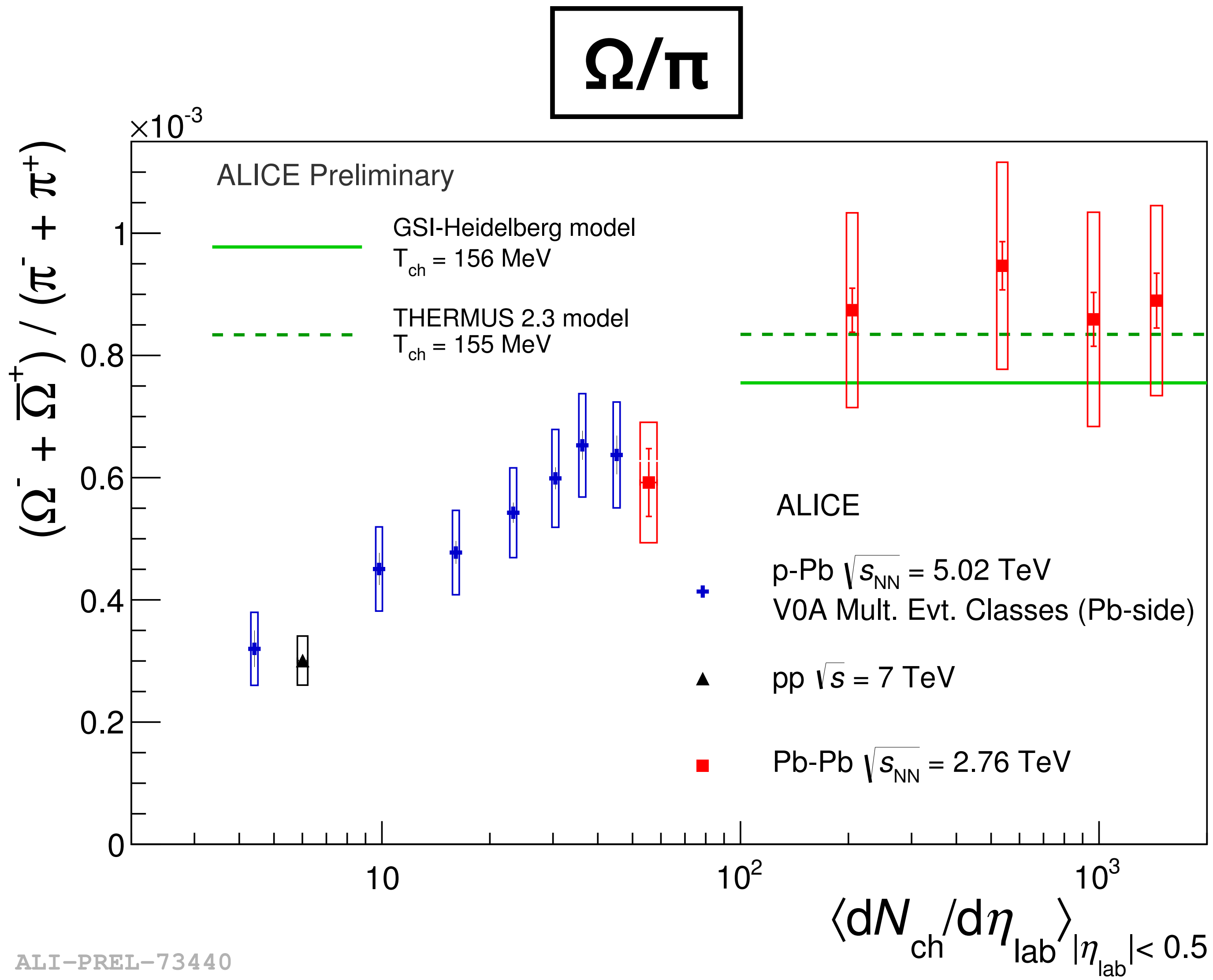
    - Adds a degree of freedom between baryons and mesons
- Physical picture of non-equilibrium models: **supercooled quark-gluon plasma** undergoes **sudden hadronization** → no further re-interaction

# Strangeness production in p-Pb collisions



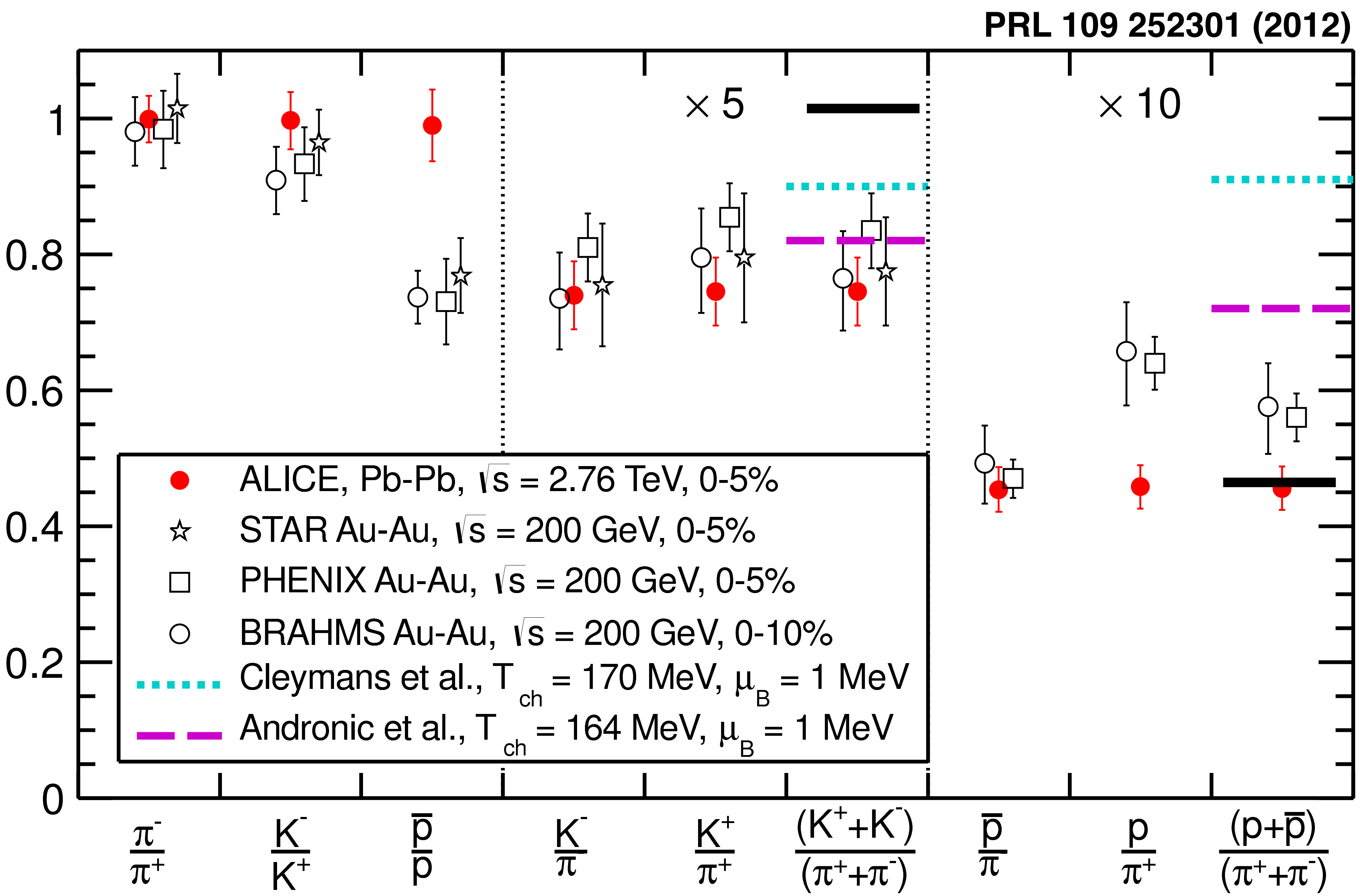




Strangeness enhancement in p-Pb collisions!

- Ξ reaches the Pb-Pb (GC?) value
- Ω not yet

Origin of the tension?

# Anomalous p/π ratio at the LHC

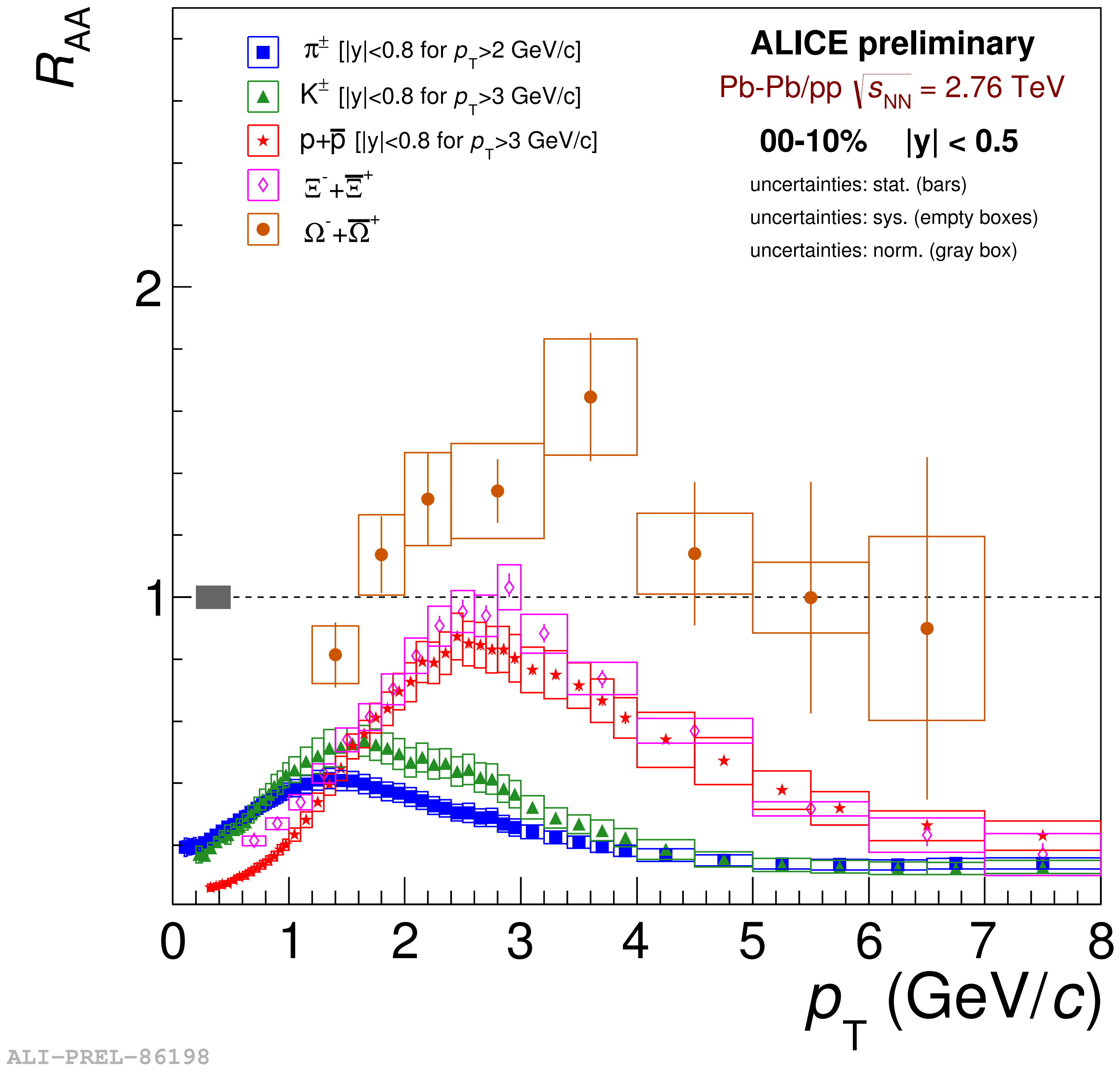



ALICE, QM11

p/π: 1.5 smaller than expectations

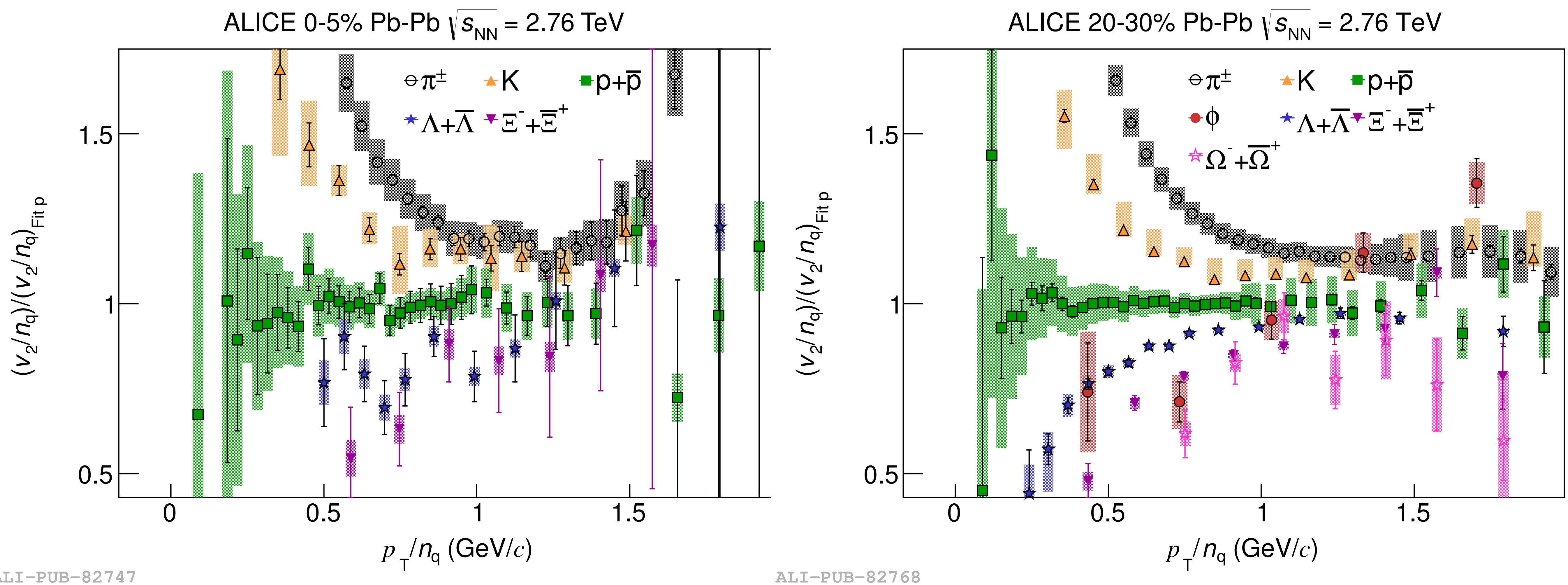
| | |
|---|---|
| | $T = 137.7$ MeV, $\gamma_q \sim 1.6$, $\gamma_s \sim 2.75$ <br> Hadronization pressure $P = 82$ MeV/fm$^3$ <br> **Rafelski, Letessier, PRC 83, 054909 (2011)** |

Non equilibrium model prediction



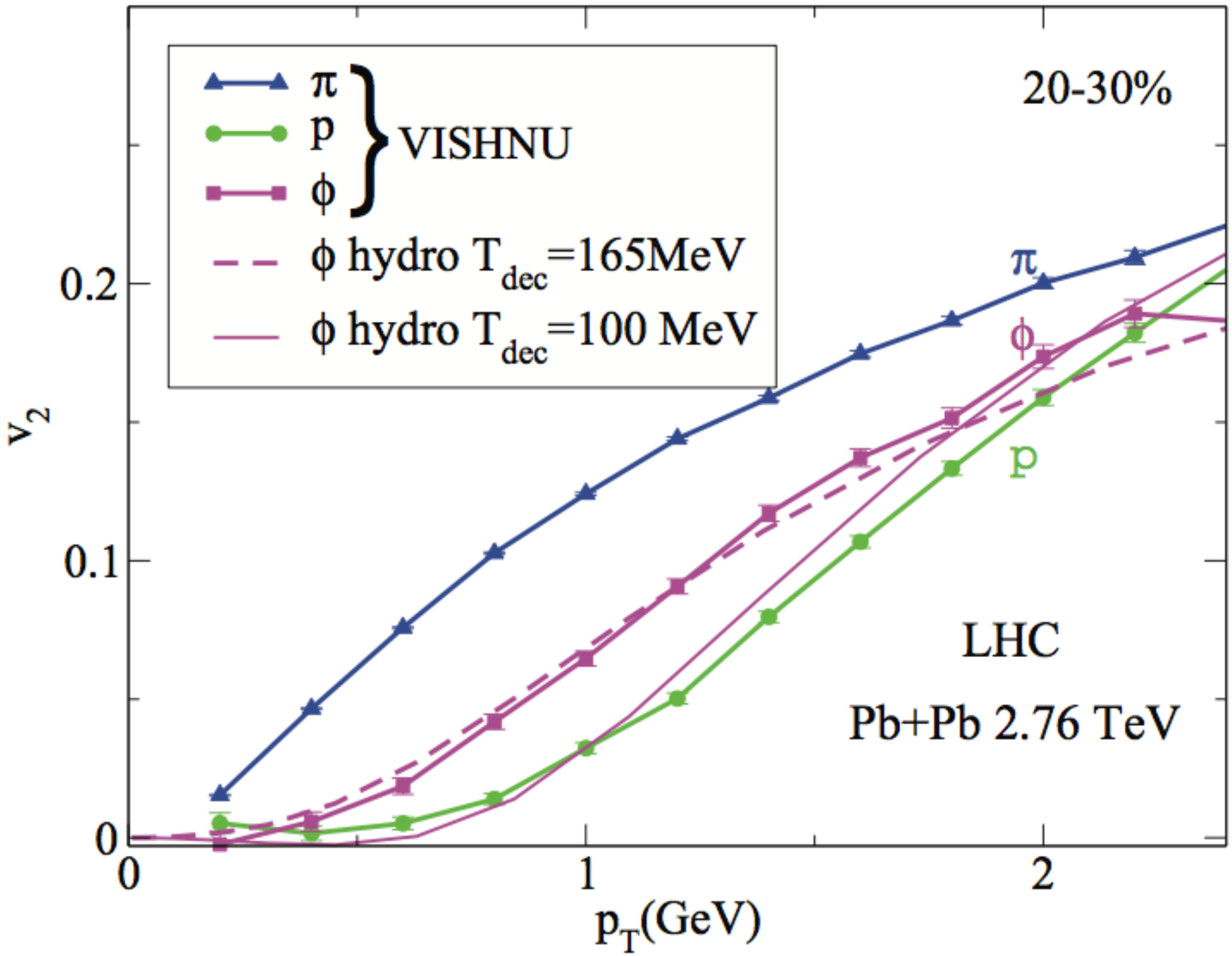
$R_{AA}$
$\pi^{\pm}$ [|y|<0.8 for $p_T$>2 GeV/c]
$K^{\pm}$ [|y|<0.8 for $p_T$>3 GeV/c]
p+p̄ [|y|<0.8 for $p_T$>3 GeV/c]
$\Xi^{-}+\overline{\Xi}^{+}$
$\Omega^{-}+\overline{\Omega}^{+}$
ALICE preliminary
Pb-Pb/pp $\sqrt{s_{NN}}$ = 2.76 TeV
00-10% |y| < 0.5
uncertainties: stat. (bars)
uncertainties: sys. (empty boxes)
uncertainties: norm. (gray box)
$p_T$ (GeV/$c$)
ALI-PREL-86198

# NCQ Scaling

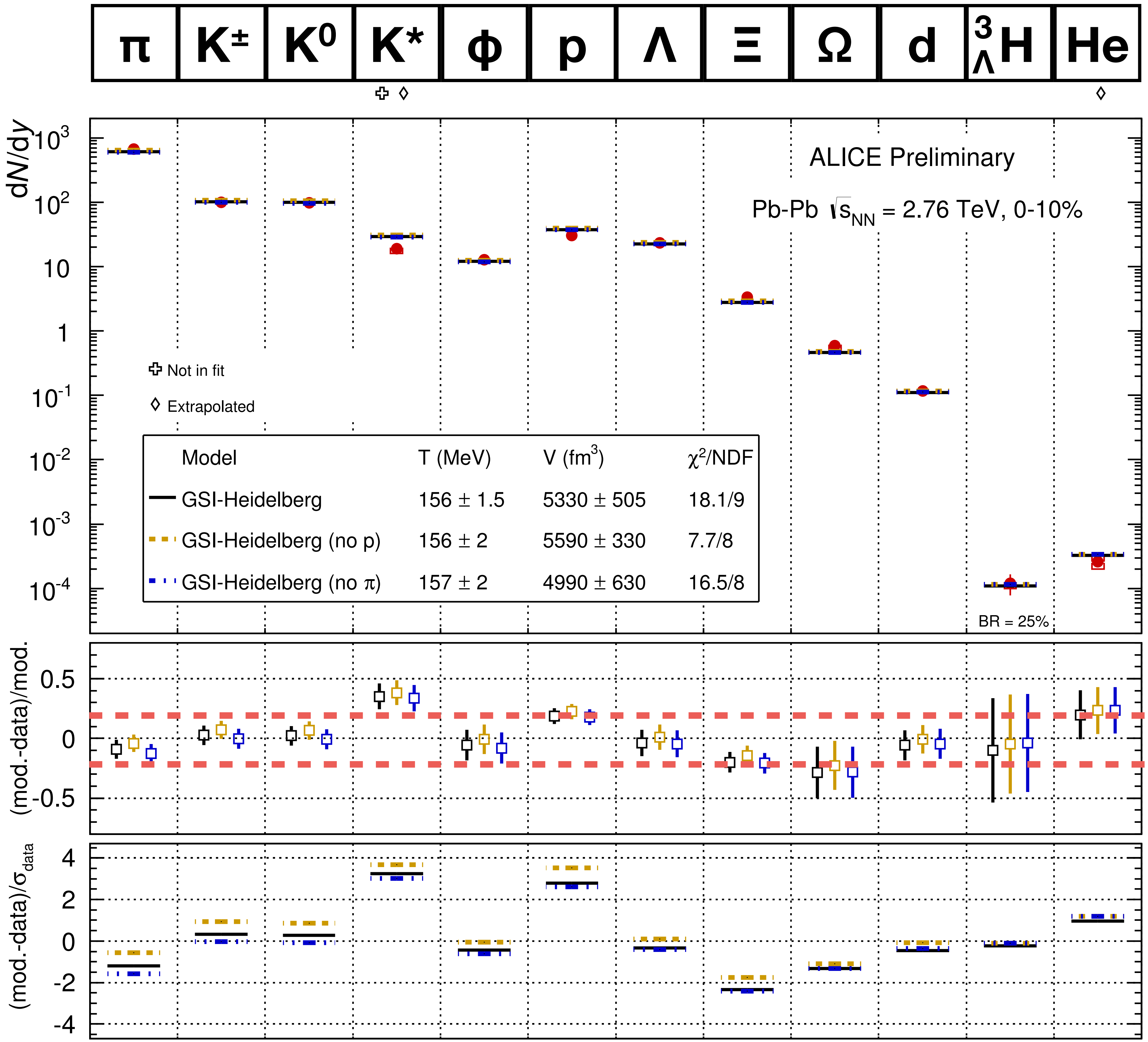


ALICE 0-5% Pb-Pb $\sqrt{s_{NN}}$ = 2.76 TeV
$\pi^{\pm}$
K
$p+\bar{p}$
$\Lambda+\bar{\Lambda}$
$\Xi^{-}+\bar{\Xi}^{+}$
$(v_2/n_q)/(v_2/n_q)_{\text{Fit p}}$
$p_T/n_q$ (GeV/$c$)
ALI-PUB-82747
ALICE 20-30% Pb-Pb $\sqrt{s_{NN}}$ = 2.76 TeV
$\pi^{\pm}$
K
$p+\bar{p}$
$\phi$
$\Lambda+\bar{\Lambda}$
$\Xi^{-}+\bar{\Xi}^{+}$
$\Omega^{-}+\bar{\Omega}^{+}$
$(v_2/n_q)/(v_2/n_q)_{\text{Fit p}}$
$p_T/n_q$ (GeV/$c$)
ALI-PUB-82768

# VISHNU Mass Ordering



# Excluding protons or pions



ALI-PREL-74473

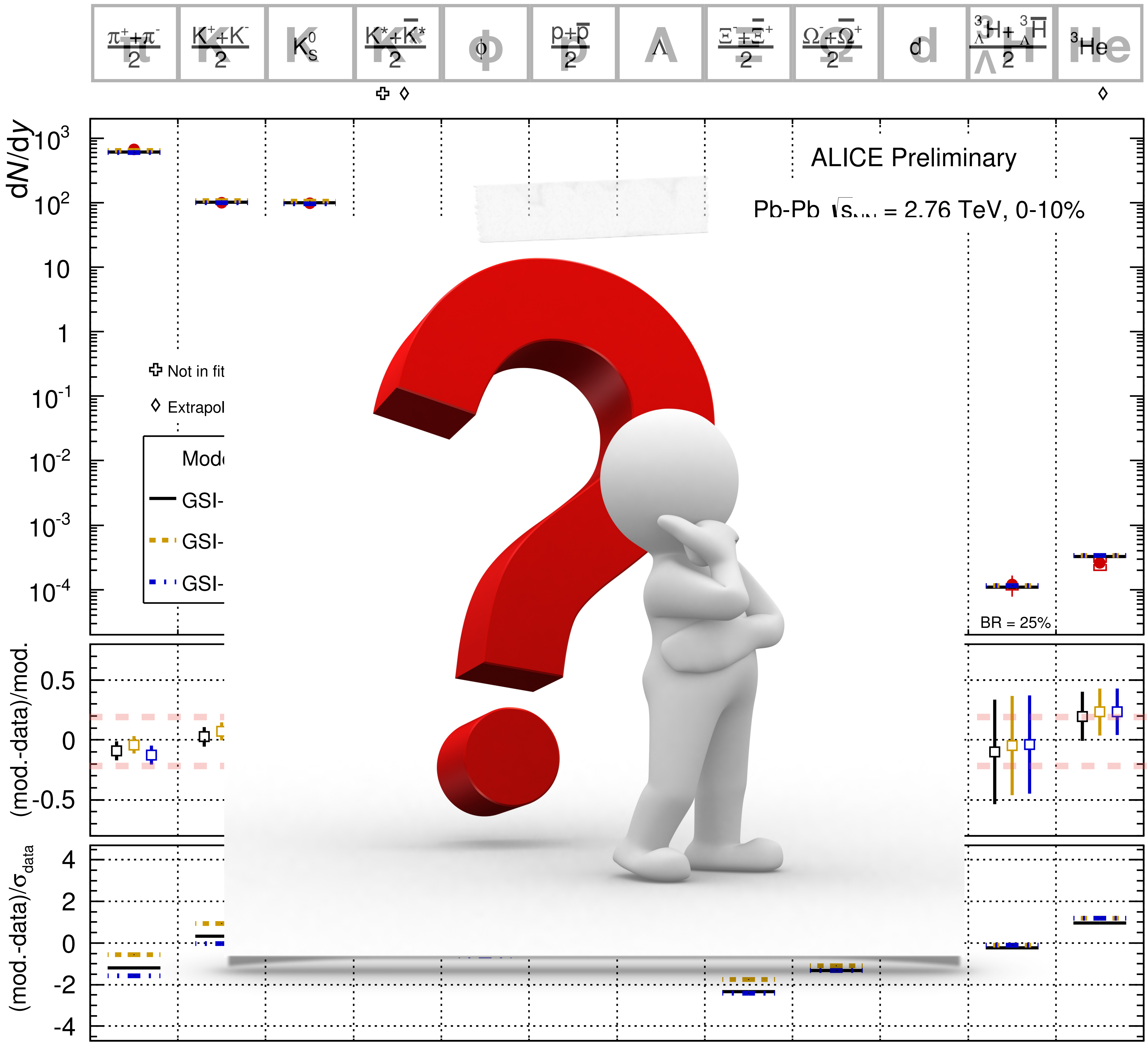
**No π**

Fit quality does not improve (no evidence for pion condensate, as opposed to n.eq. model)

**No p**

Better fit, proton anomaly?

# Excluding protons or pions



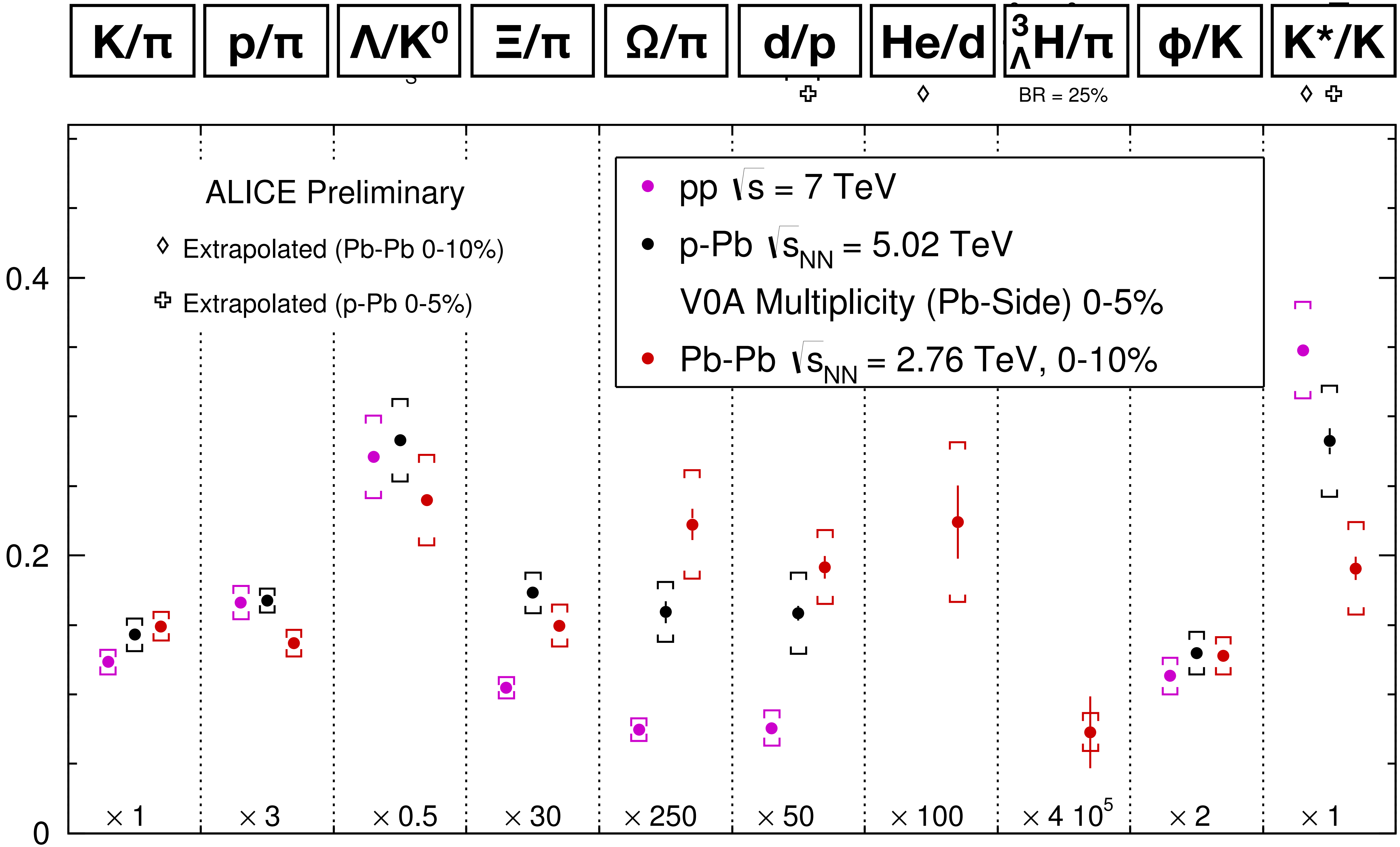

**No π**

Fit quality does not improve (no evidence for pion condensate, as opposed to n.eq. model)

**No p**

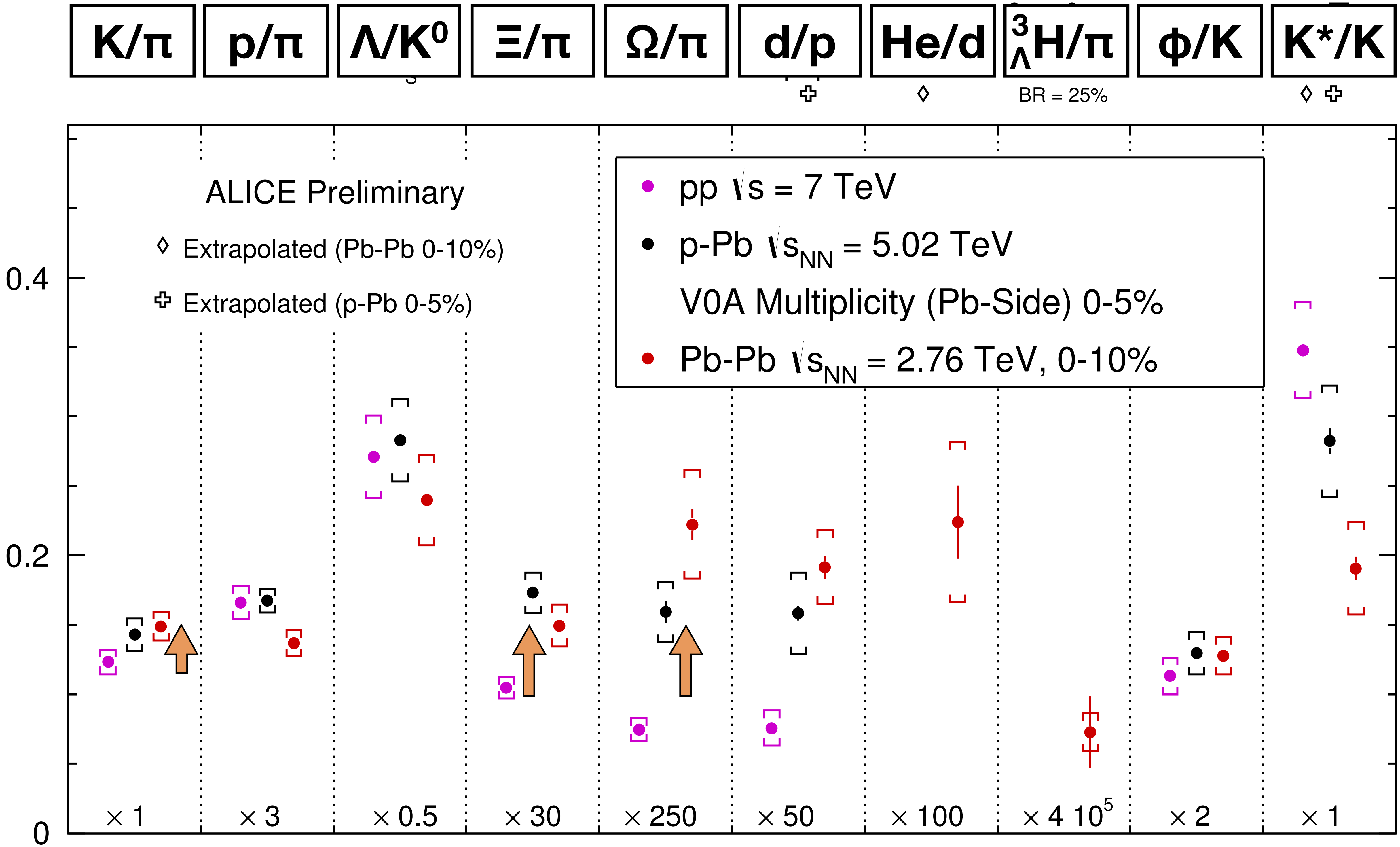
Better fit, proton anomaly?

# Ratios, system size dependence at the LHC




→ H. Oeschler, Mon 1st

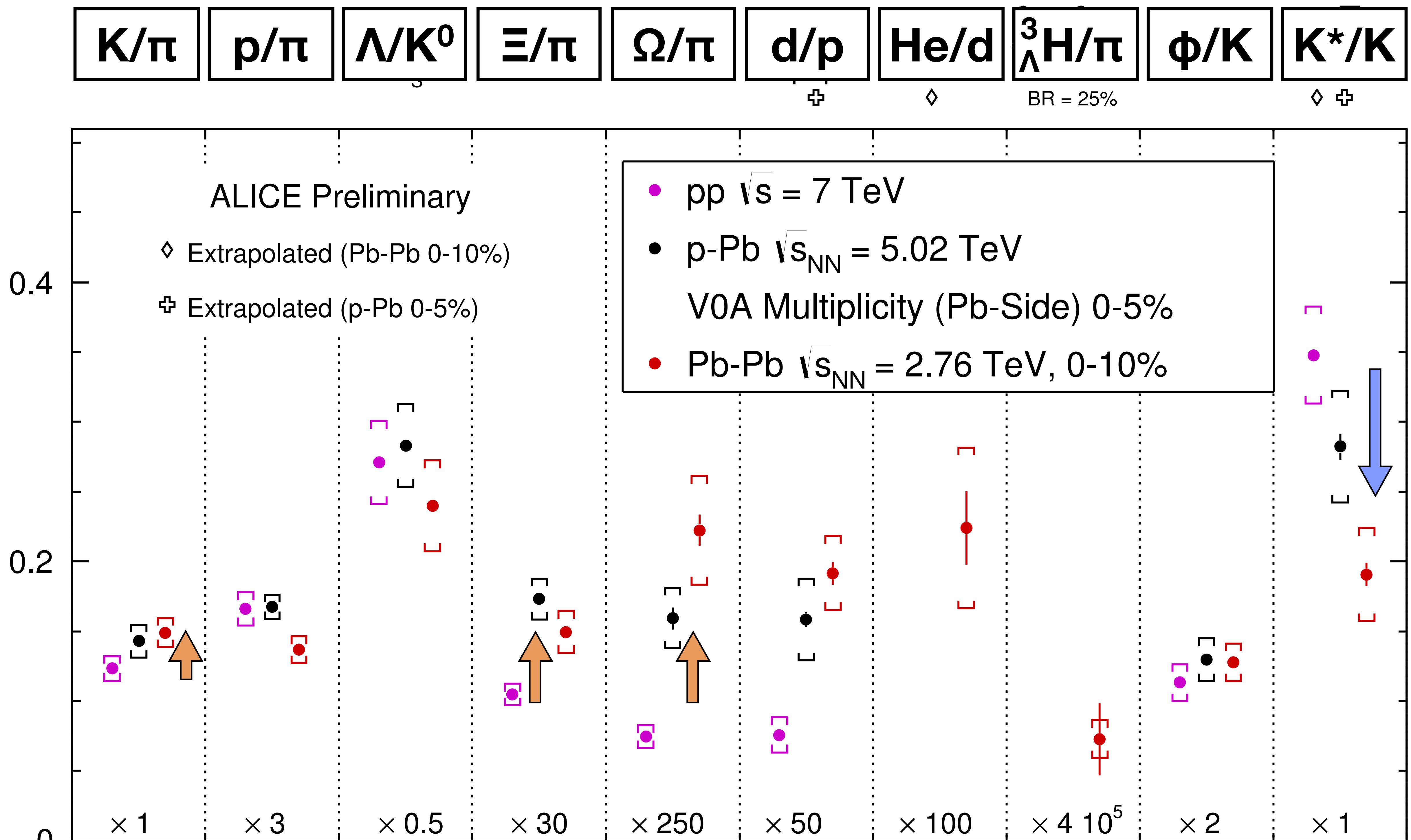
# Ratios, system size dependence at the LHC




Strangeness enhancement

→ H. Oeschler, Mon 1st

# Ratios, system size dependence at the LHC

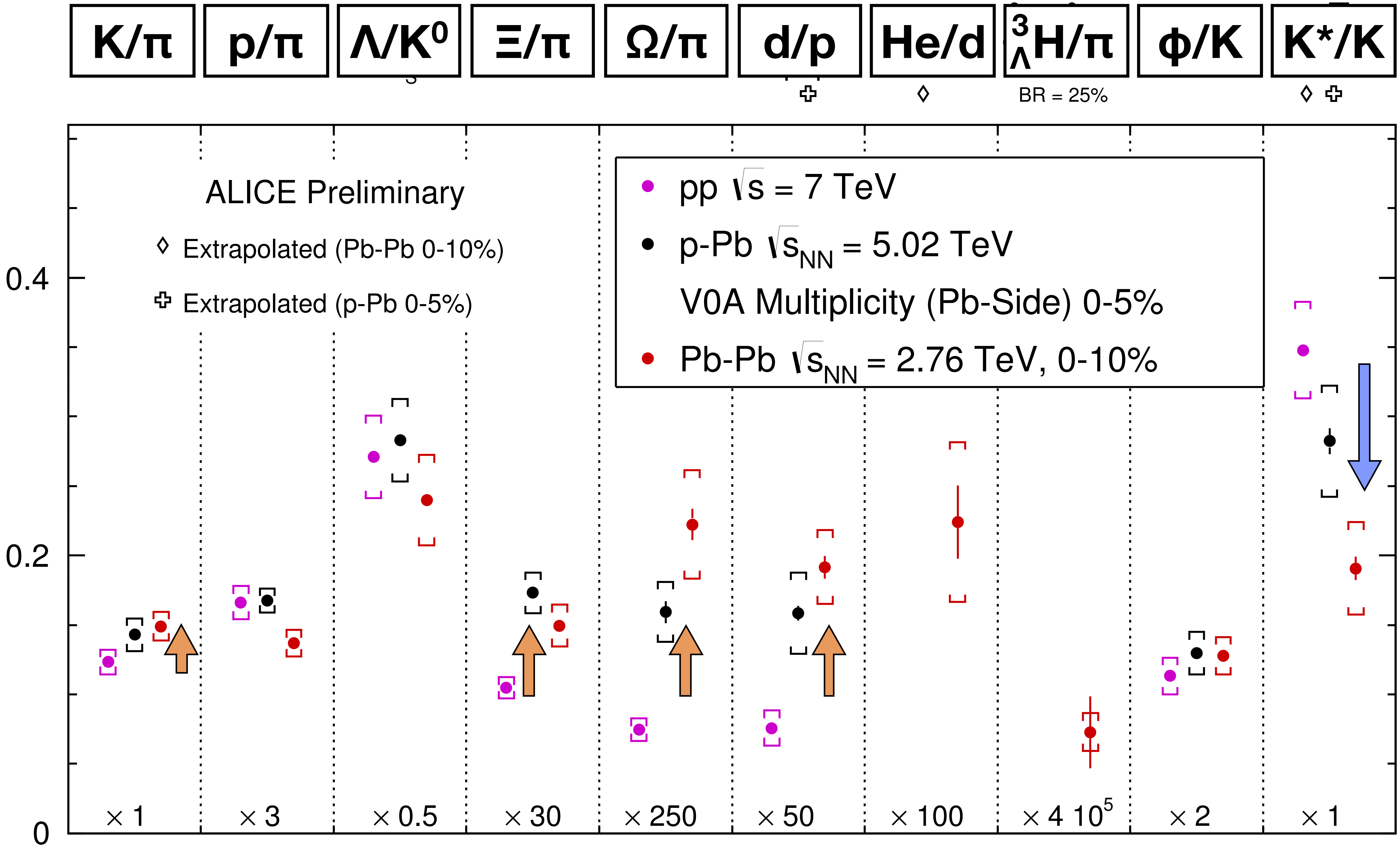



Strangeness enhancement

K* suppression

→ H. Oeschler, Mon 1st

# Ratios, system size dependence at the LHC



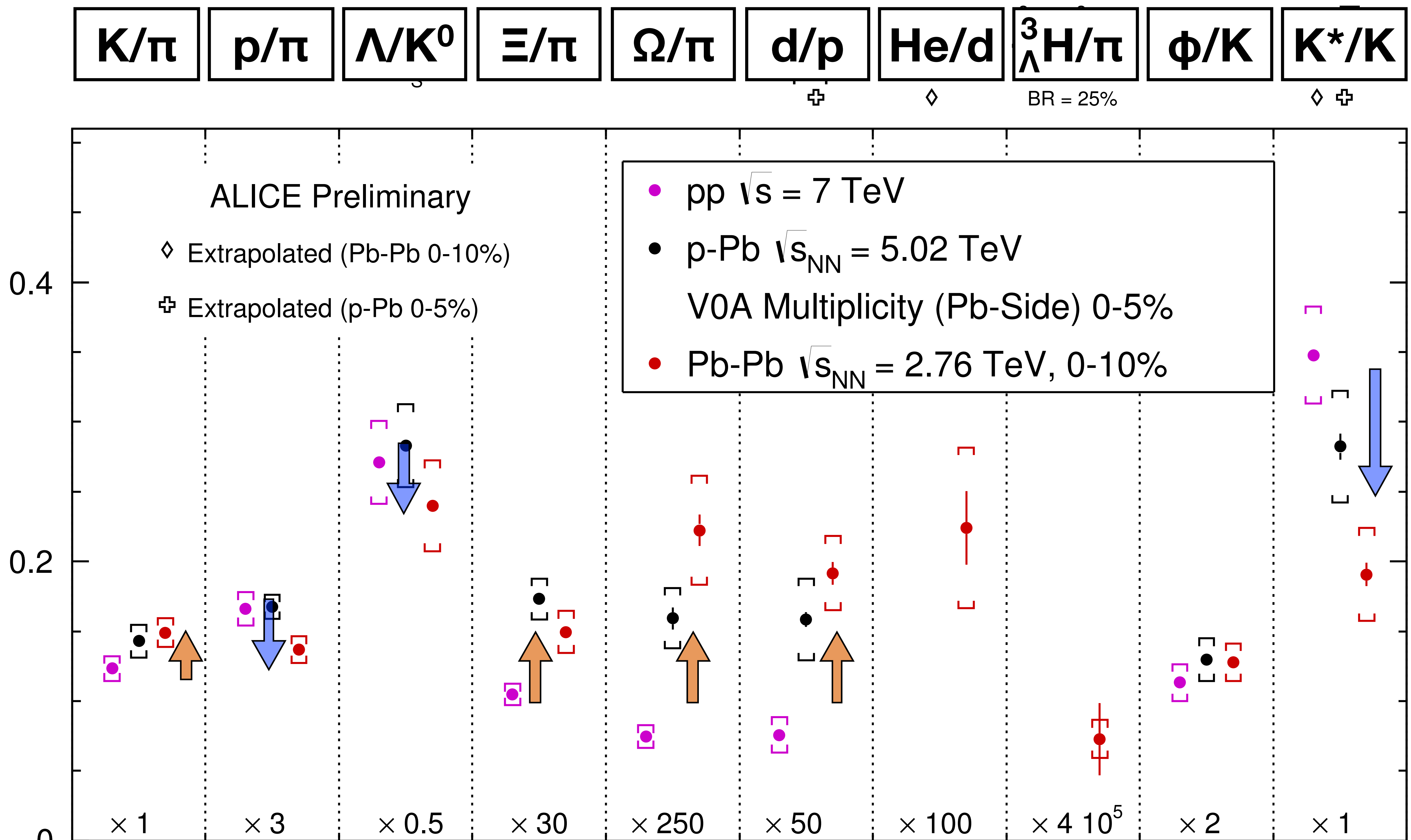

Strangeness enhancement

Deuteron enhancement

K* suppression

→ H. Oeschler, Mon 1st

# Ratios, system size dependence at the LHC



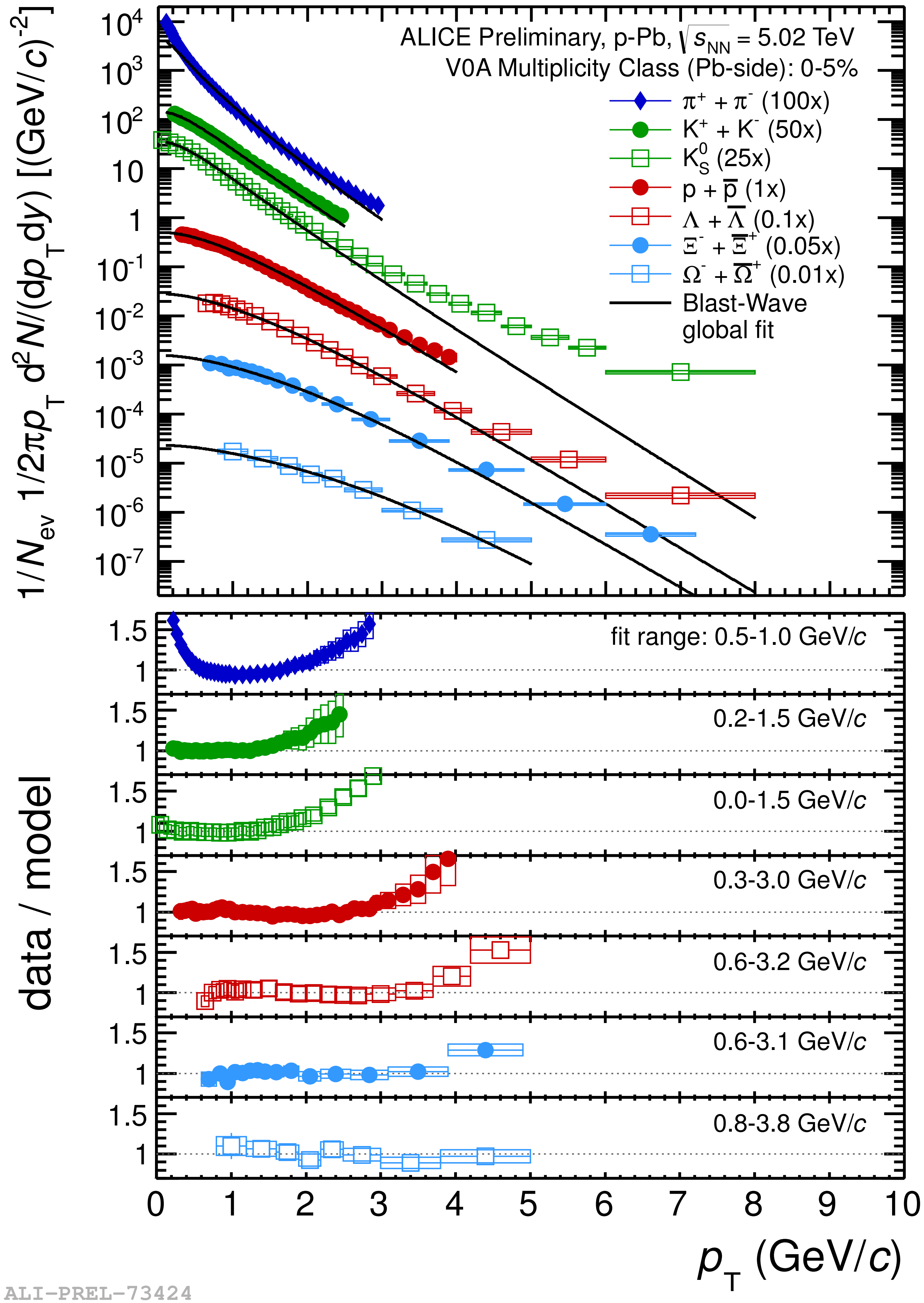

Strangeness enhancement

Deuteron enhancement

$K^*$ suppression

Baryon suppression?

→ H. Oeschler, Mon 1st



ALICE Preliminary, p-Pb, $\sqrt{s_{NN}}$ = 5.02 TeV
V0A Multiplicity Class (Pb-side): 0-5%
$\pi^+ + \pi^-$ (100x)
$K^+ + K^-$ (50x)
$K^0_S$ (25x)
$p + \bar{p}$ (1x)
$\Lambda + \bar{\Lambda}$ (0.1x)
$\Xi^- + \bar{\Xi}^+$ (0.05x)
$\Omega^- + \bar{\Omega}^+$ (0.01x)
Blast-Wave global fit
$1/N_{ev}\ 1/2\pi p_T\ d^2N/(dp_T dy)$ [(GeV/c)$^{-2}$]
data / model
fit range: 0.5-1.0 GeV/c
0.2-1.5 GeV/c
0.0-1.5 GeV/c
0.3-3.0 GeV/c
0.6-3.2 GeV/c
0.6-3.1 GeV/c
0.8-3.8 GeV/c
$p_T$ (GeV/c)
ALI-PREL-73424