High-p_T suppression of Λ and K^0_s in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with ALICE

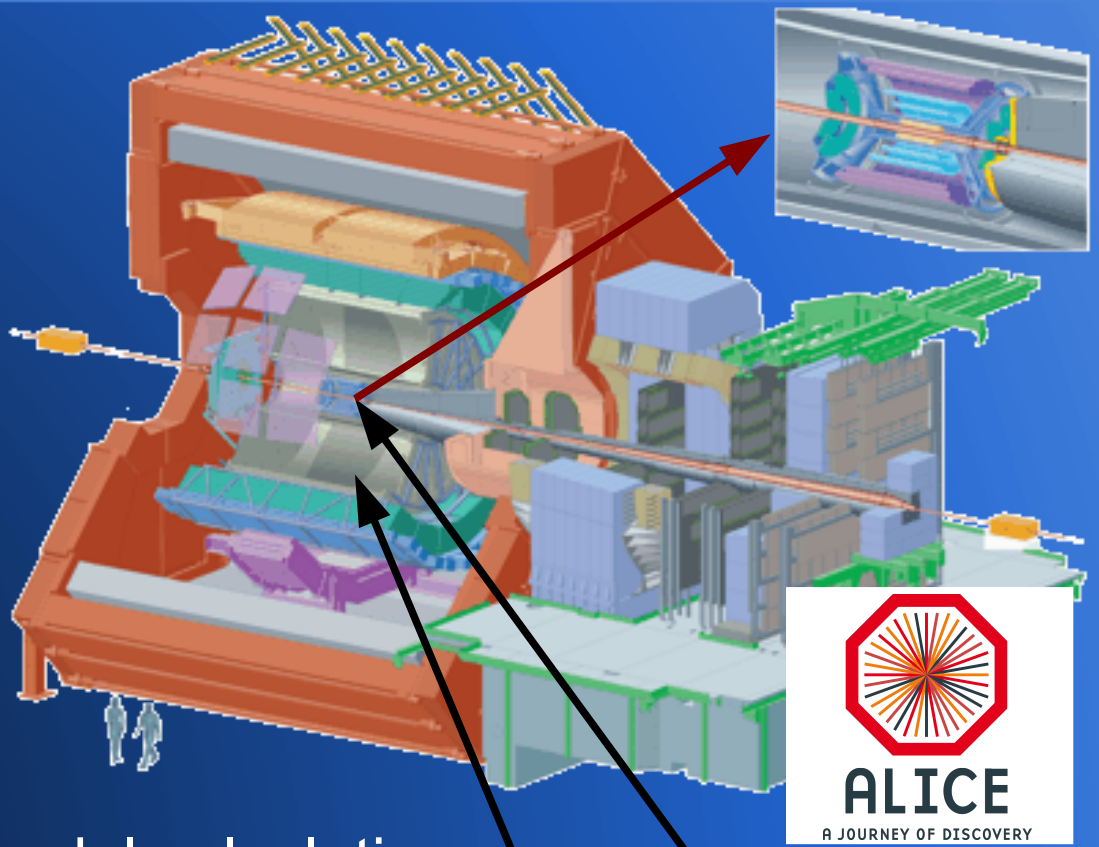
Simone Schuchmann
Goethe-University of Frankfurt

Outline

- Motivation
- Λ and K^0_s reconstruction
- Nuclear modification factors:
  - R_{CP}
  - R_{AA}
- Comparison to RHIC results
- Comparison to HIJING/$B\bar{B}$ model calculations

Outline

- Motivation
- Λ and K^0_s reconstruction
- Nuclear modification factors:
  - R_{CP}
  - R_{AA}
- Comparison to RHIC results
- Comparison to HIJING/$B\bar{B}$ model calculations



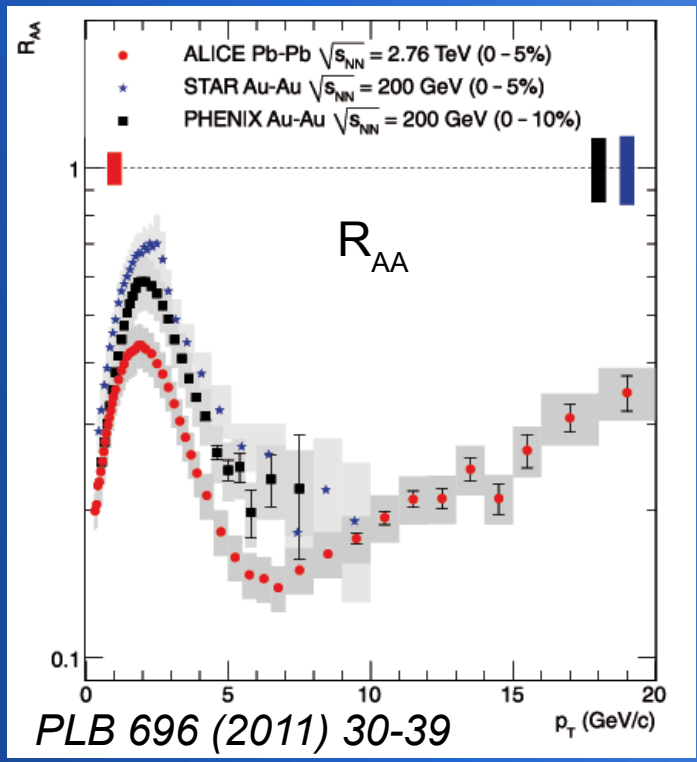
Sub-detectors of interest in this talk: ALICE TPC and ITS

Motivation I

- **Why looking at high p_T?**
  - Diagnostic potential to probe the created medium via
    - the measurement of yields and particle ratios
    - comparison between AA and *pp* collisions

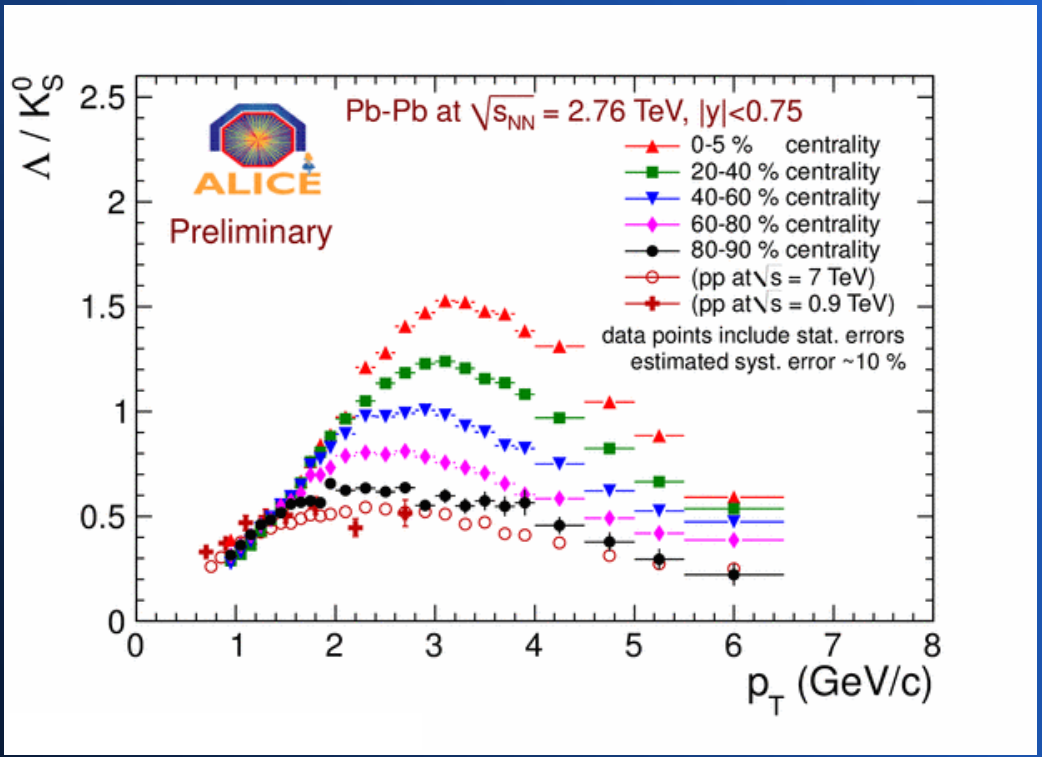
→ Parton energy loss as probe of the medium

- **Charged particle R_{AA}:**
  - Strong suppression in Pb-Pb collisions compared to *pp* around p_T = 6-8 GeV/c
    - Rise towards high p_T
- **Identified particles?**
- **Baryons vs mesons?**



Motivation II

- Baryon to meson enhancement for strange particles



- What is the effect on R_{CP} and R_{AA}?

Motivation III

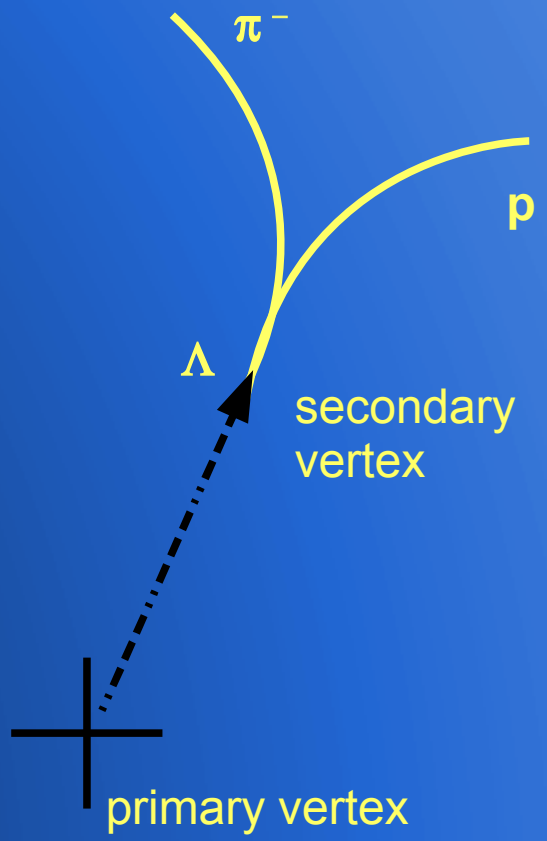
- Measurement of identified particles at high p_T:
  - Λ and K^0_s
  - Reconstruction via weak decay products:

$$K^0_s \rightarrow \pi^+ \pi^- \qquad \Lambda \rightarrow \pi^- p$$

= Invariant mass analysis

→ Identification via topological track reconstruction

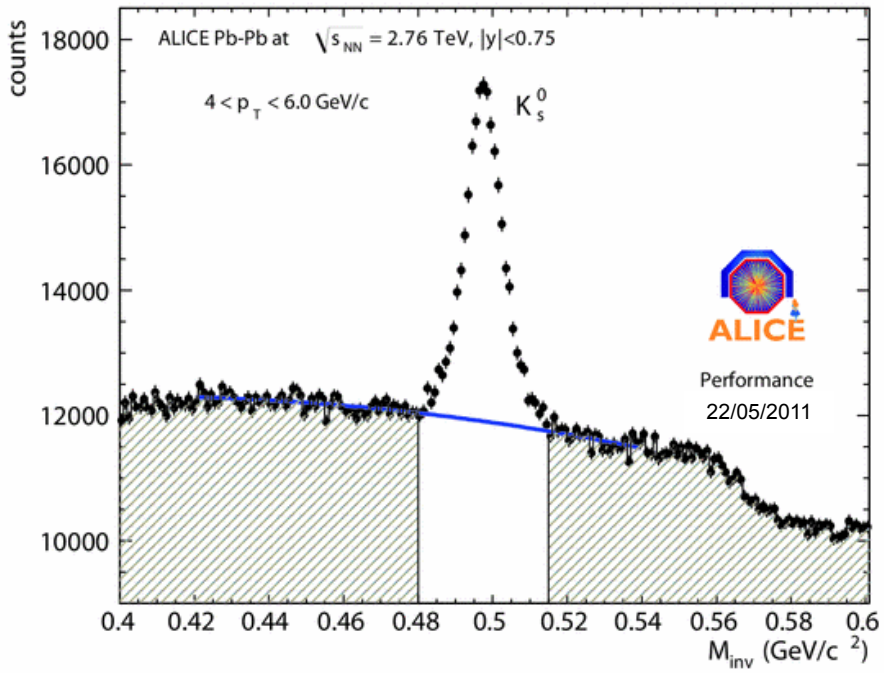
→ no PID necessary



Analysis I

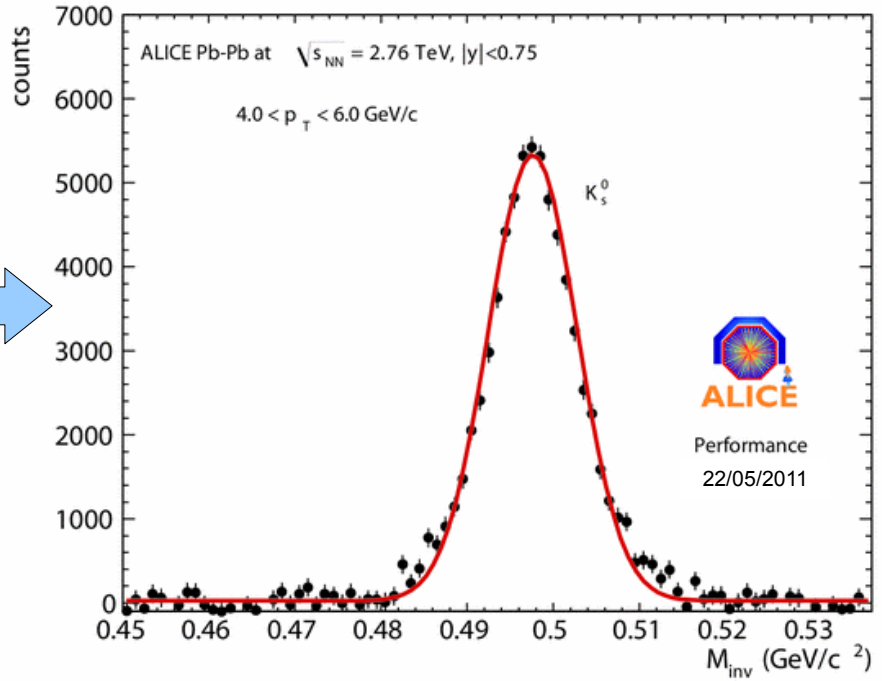
Fit of the background

Function: polynomial of 1st or 2nd order



Fit of the peak for mass and resolution extraction

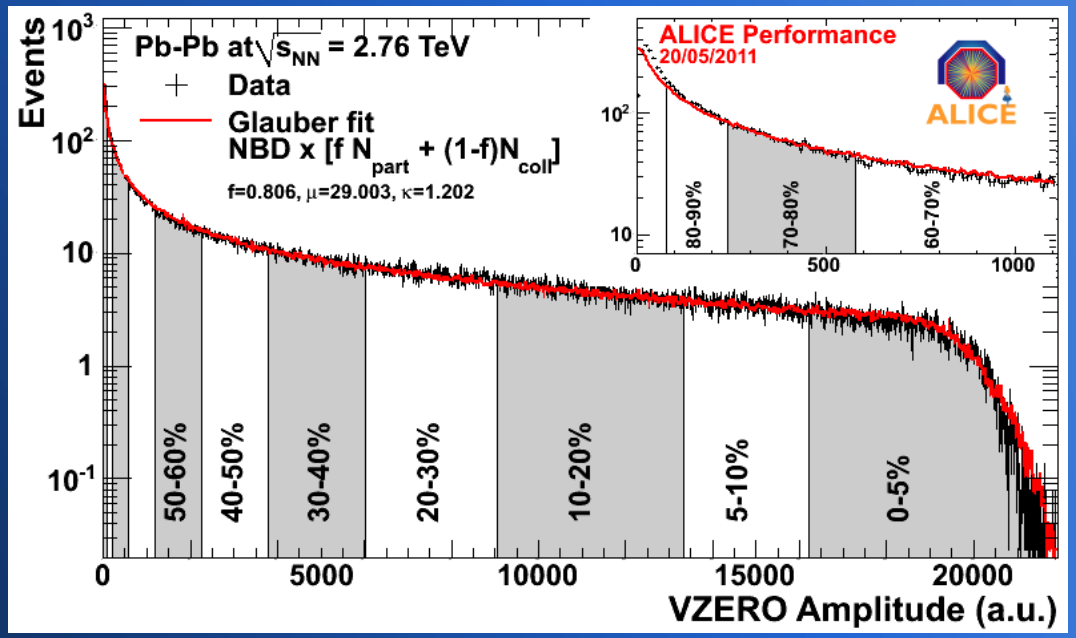
Function: Gaussian + polynomial of 1st order



Analysis II

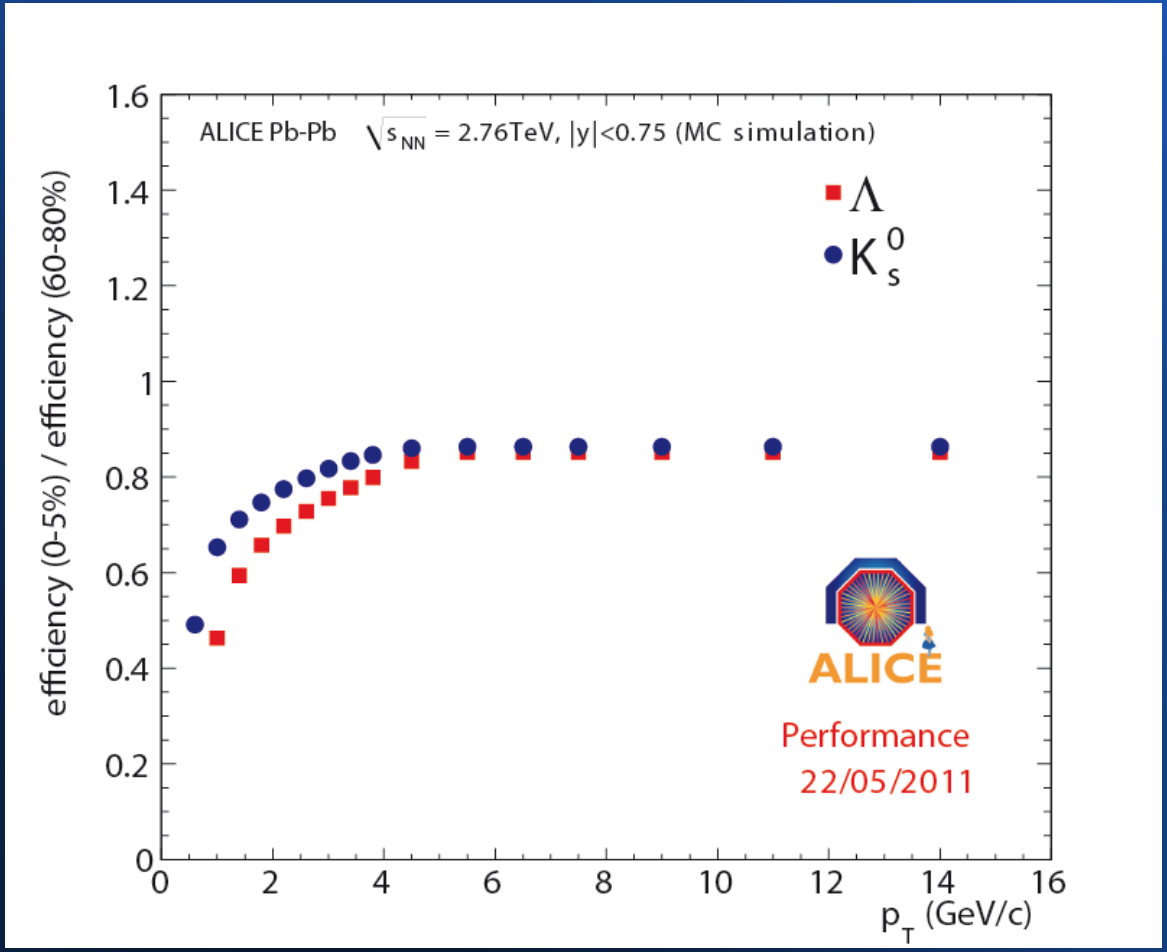
- Data sets:

Centrality bin	Number of events
0 - 5%	876,896
60 - 80%	3,478,958
pp	16,627,679



- Acceptance cuts:
  - mother rapidity < 0.75
  - daughters |η| < 0.8

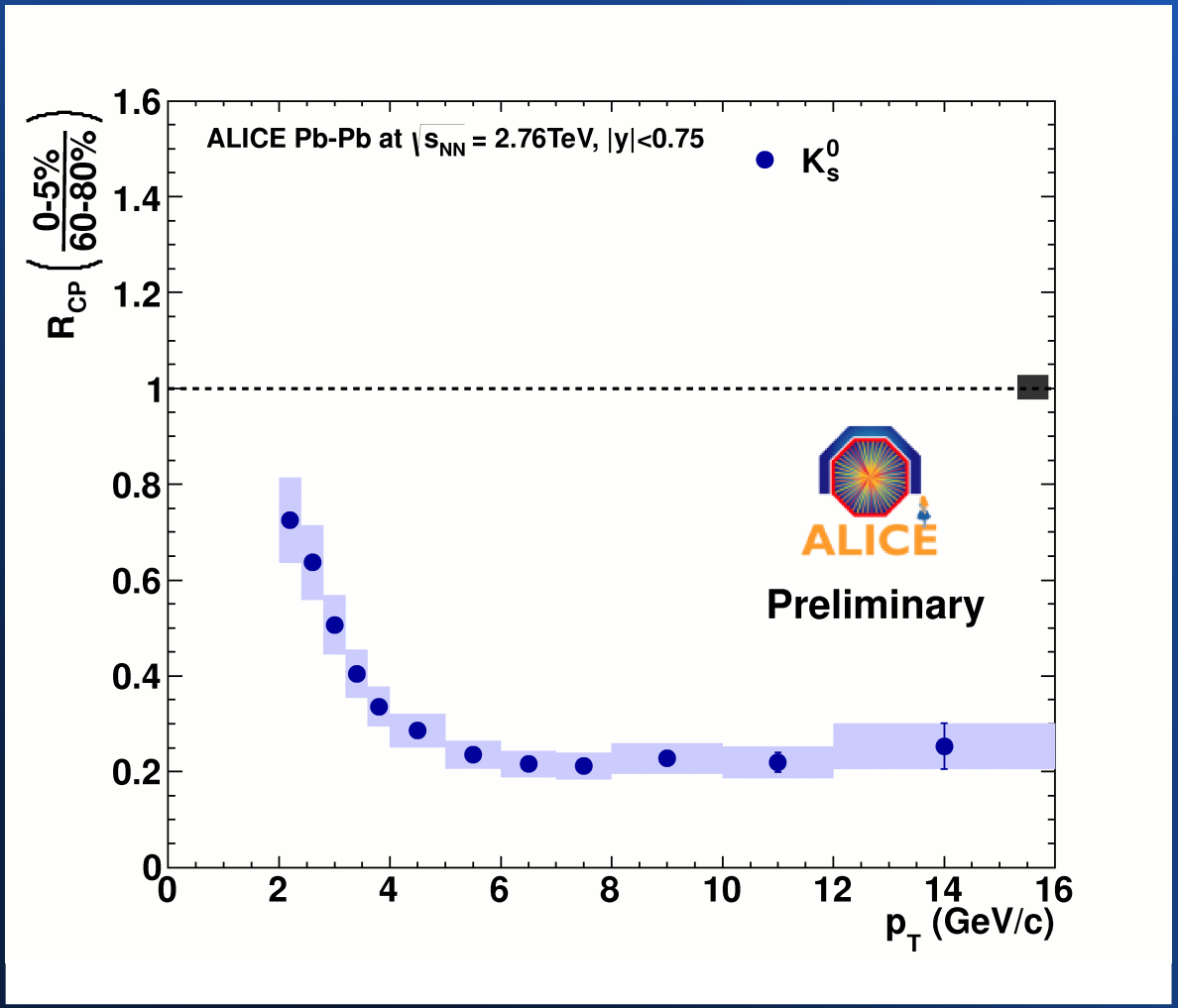
Efficiency and systematics



- Most of the systematics cancel in spectra ratios
- Ratio of efficiencies for centrality 0-5% and 60-80% enters into the systematic errors of R_{CP} and R_{AA}
- Feed down correction is applied for Λ

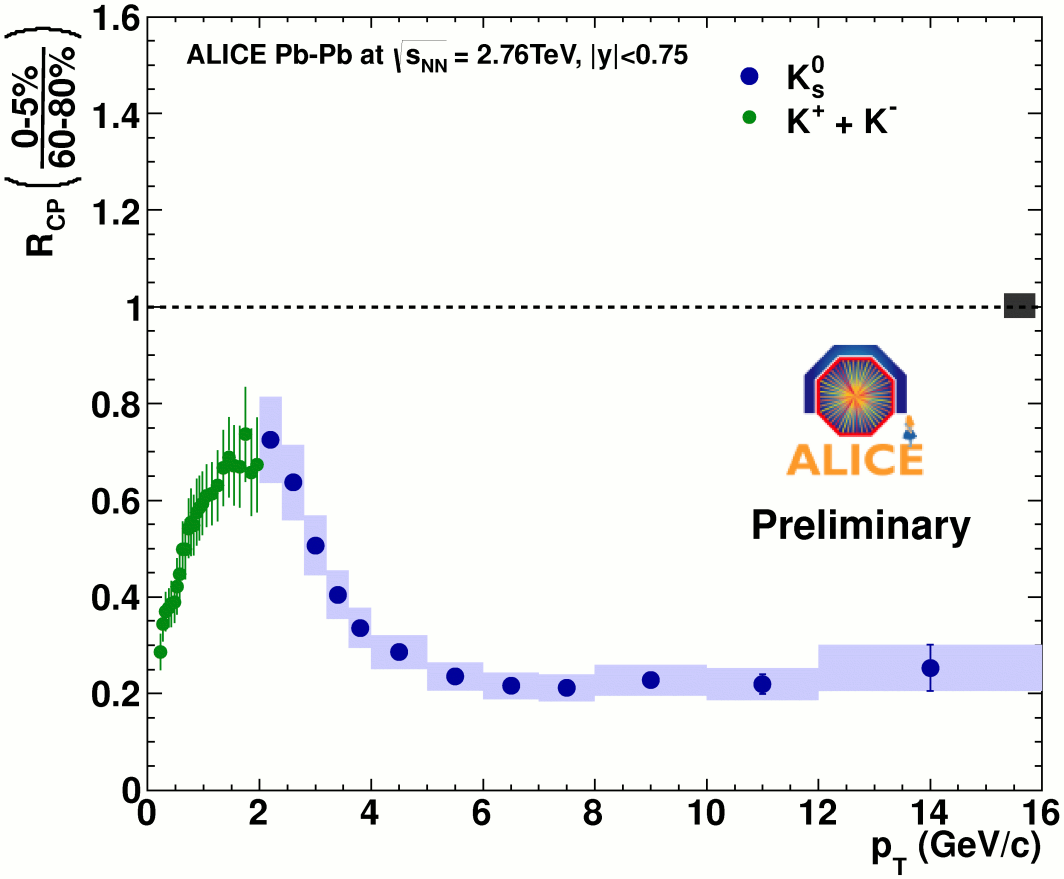
  → contribution to the systematic error at lower p_T

R_{CP}: K^0_s (0-5%)/(60-80%)



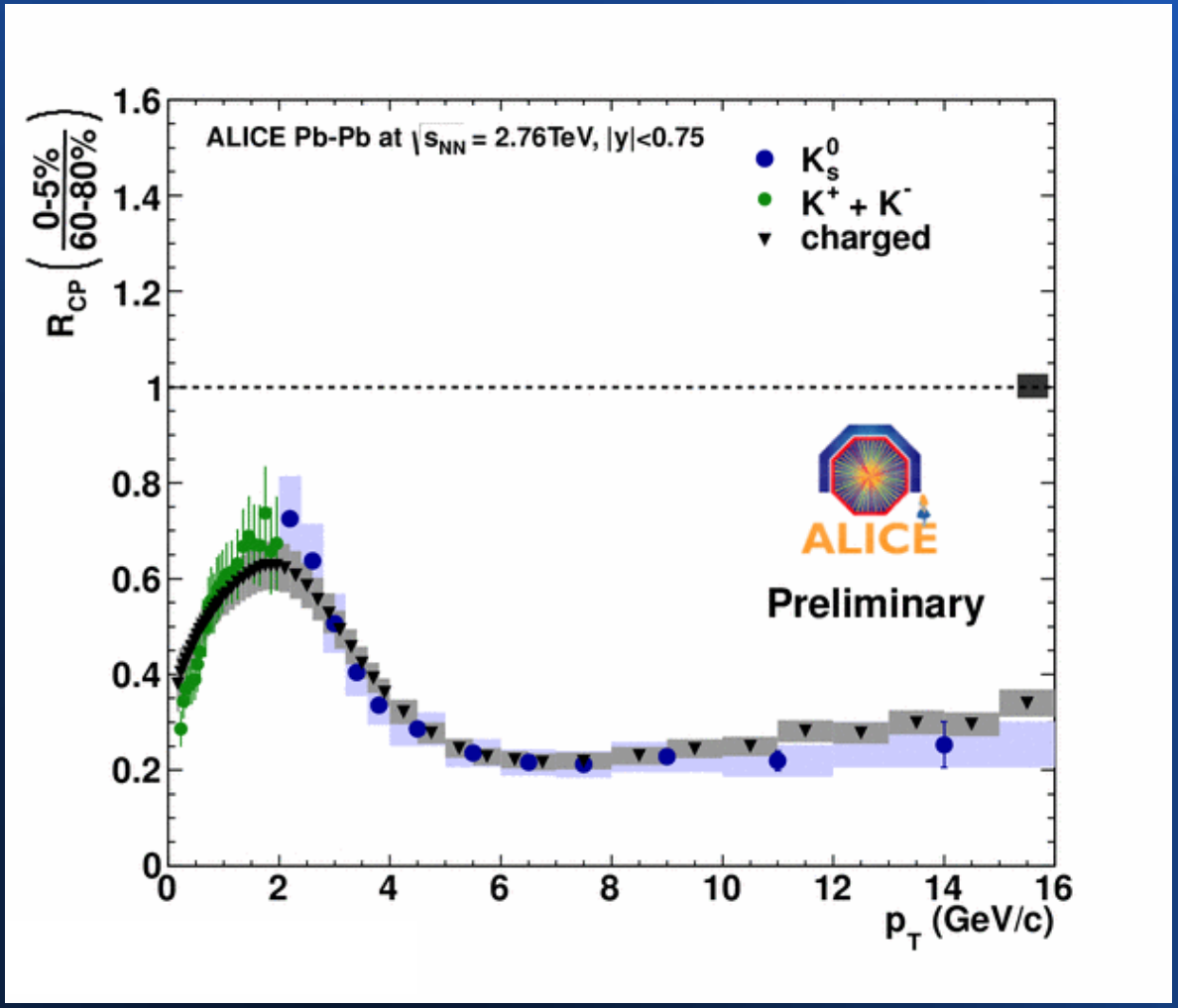
$$R_{CP} = \frac{dN_{central}/dp_T}{dN_{periph}/dp_T} \cdot \frac{\langle N_{coll} \rangle_{periph}}{\langle N_{coll} \rangle_{central}}$$

R_{CP}: comparison K^0_s – K^{+-}



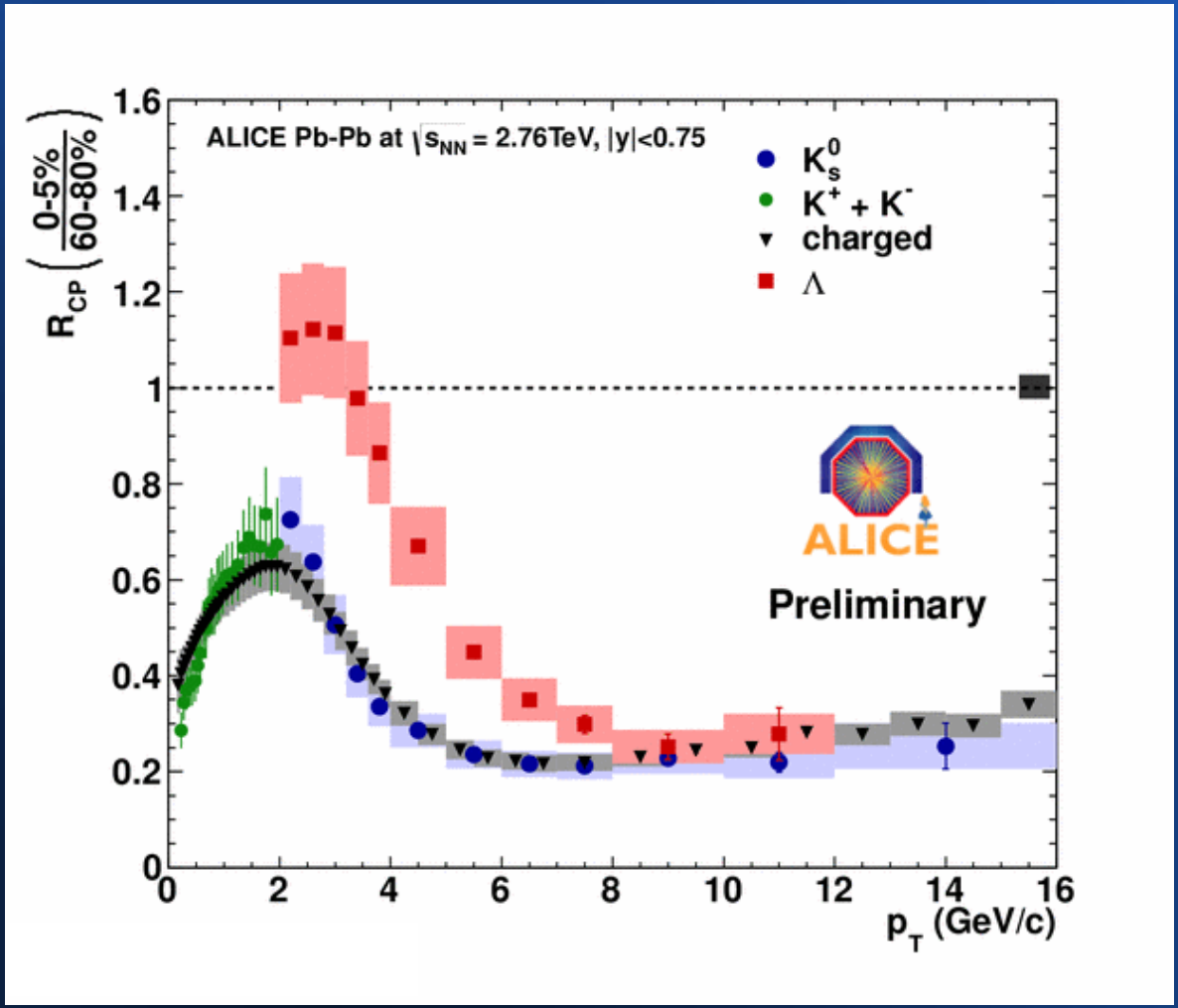
- R_{CP} of charged kaons match the K^0_s R_{CP} at low p_T

R_{CP}: comparison K^0_s – charged



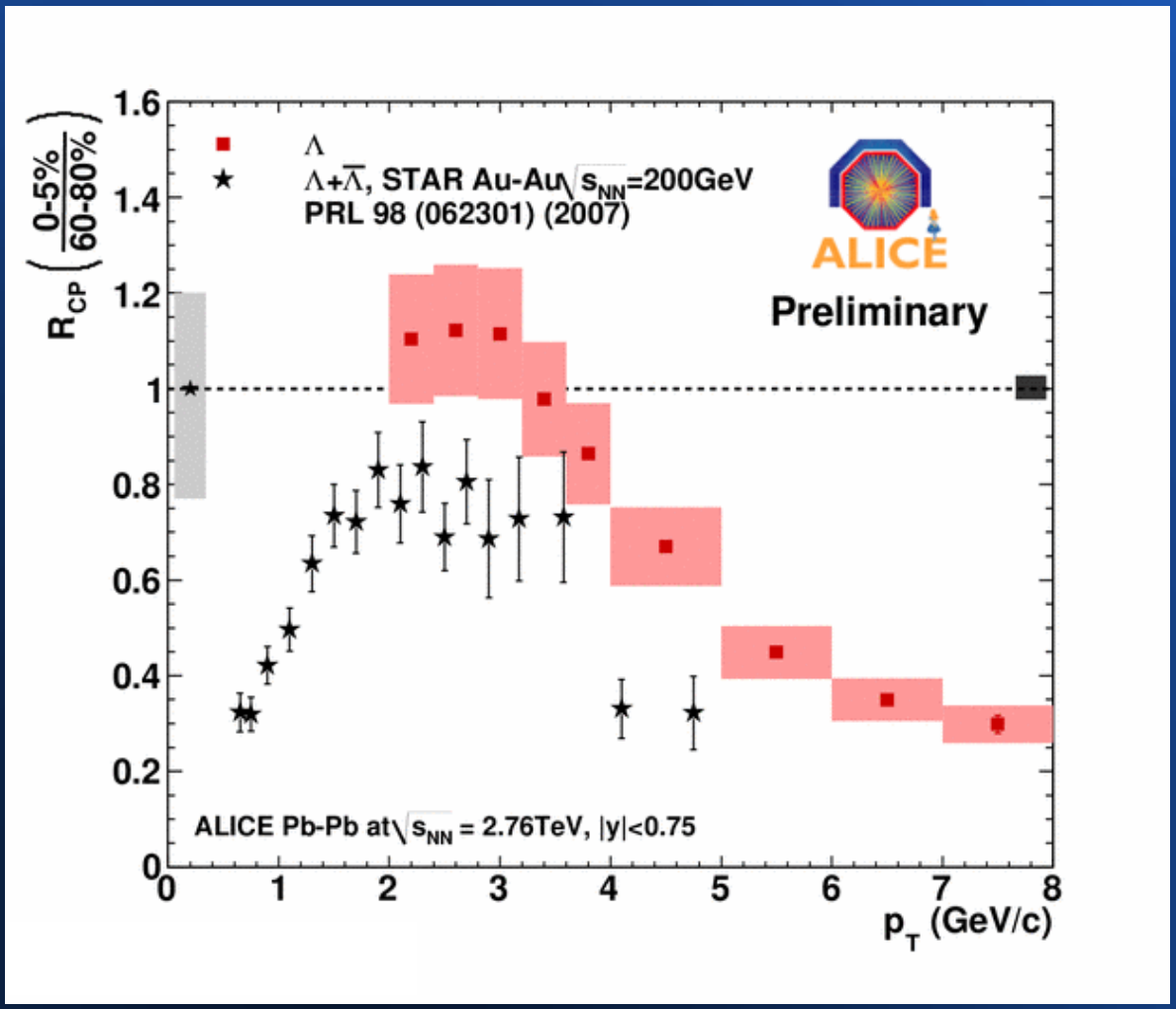
- R_{CP} of charged kaons match the K^0_s R_{CP} at low p_T
- R_{CP} similar for charged particles and K^0_s
- Strong suppression of K^0_s at high p_T

R_{CP}: K^0_s and Λ



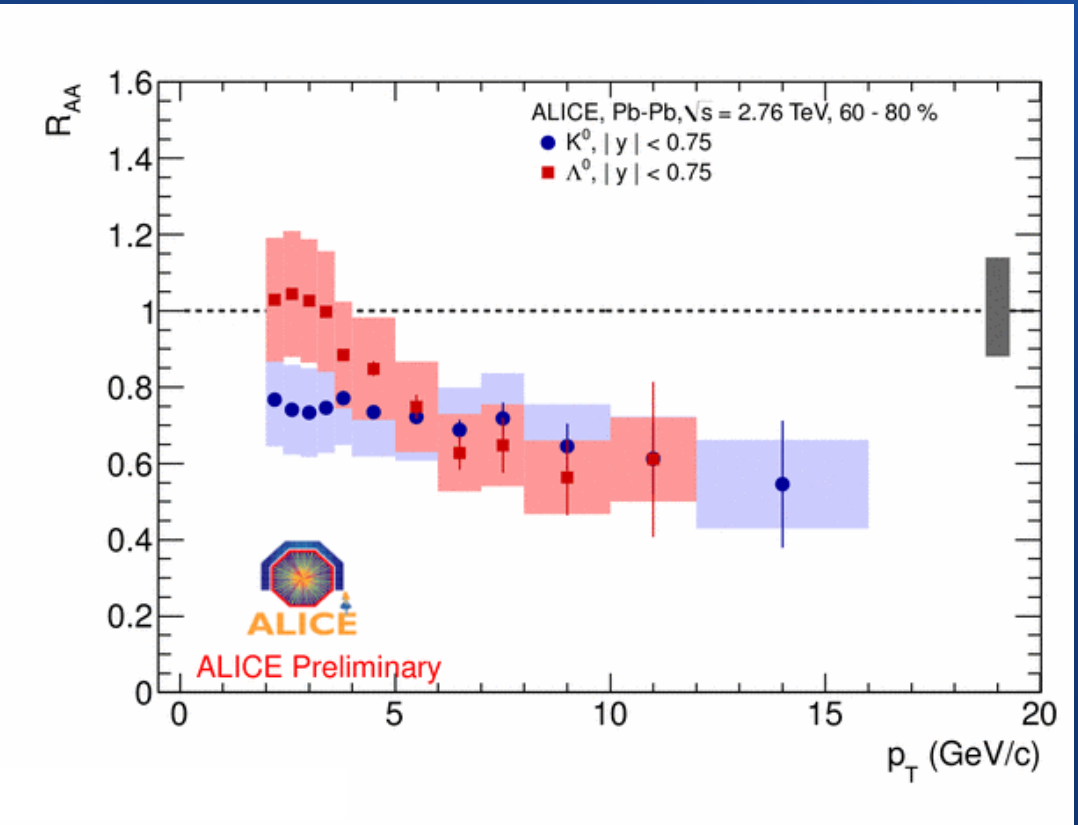
- Low p_T: Λ enhanced over K^0_s (baryon to meson enhance-ment) up to p_T = 8 GeV/c
- High p_T :
  - R_{CP} for Λ and K^0_s compatible
  - Similar to R_{CP} of charged particles

R_{CP}: comparison to STAR ($\Lambda+\bar{\Lambda}$)



- R_{CP} comparable to STAR measurement up to p_T = 3.5 GeV/c
- Λ enhancement extends to higher p_T

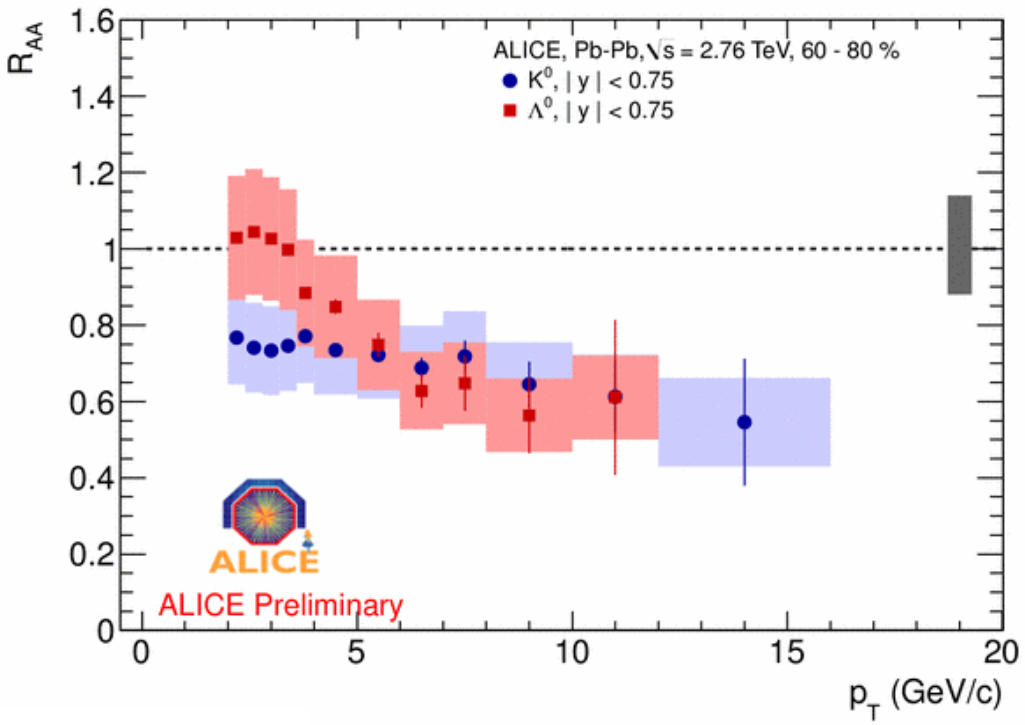
R_{AA}: peripheral Λ and K^0_s

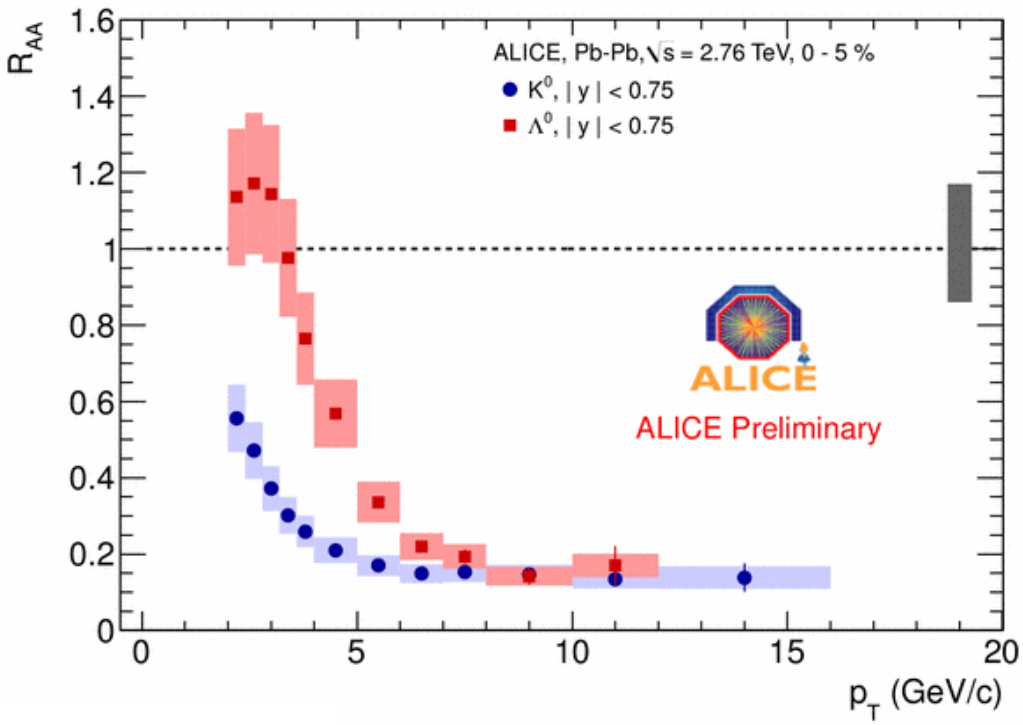


$$R_{AA} = \frac{dN_{AA}/dp_T}{dN_{pp}/dp_T} \cdot \frac{1}{\langle N_{coll} \rangle_{AA}}$$

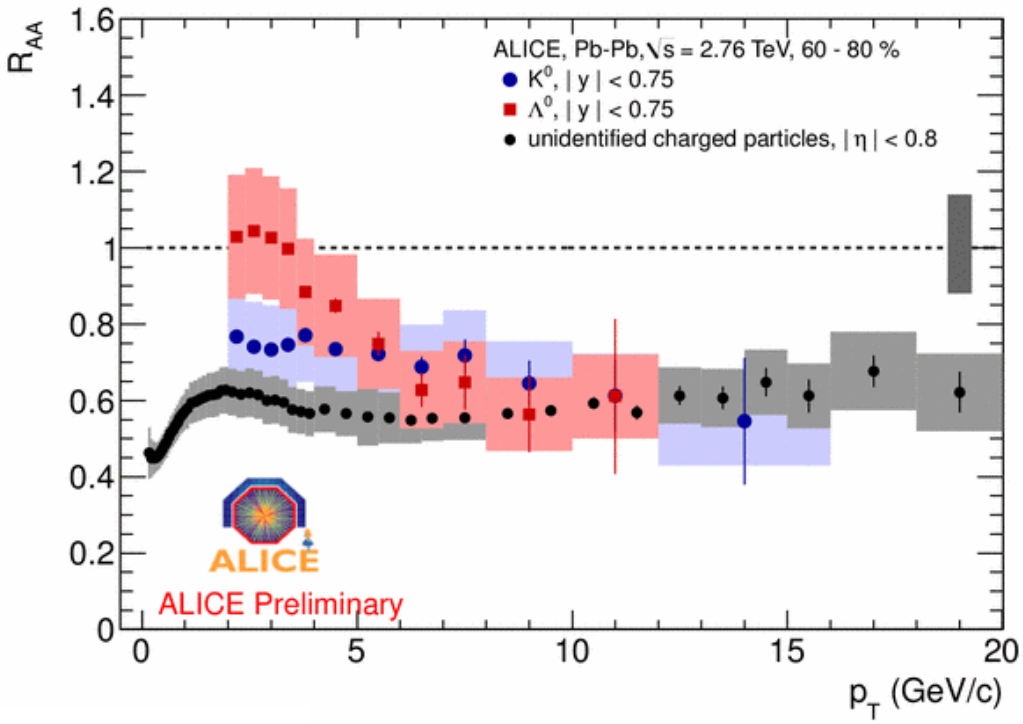
- Low p_T:
  - Λ enhanced over suppressed K^0_s
- High p_T :
  - Λ and K^0_s are suppressed similarly

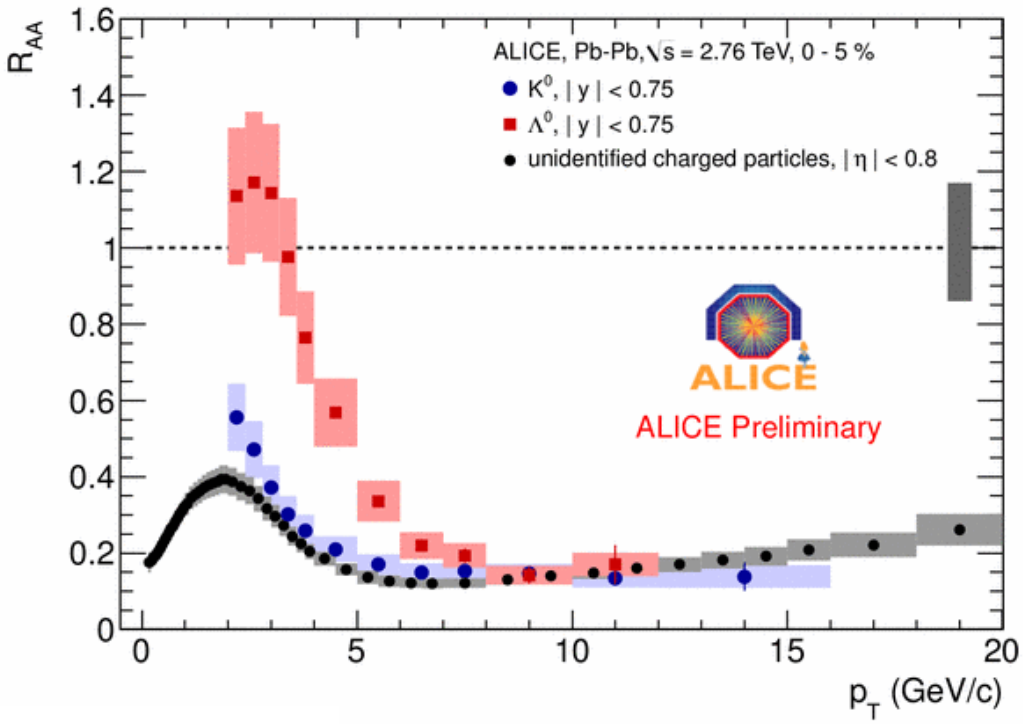
R_{AA}: central vs peripheral



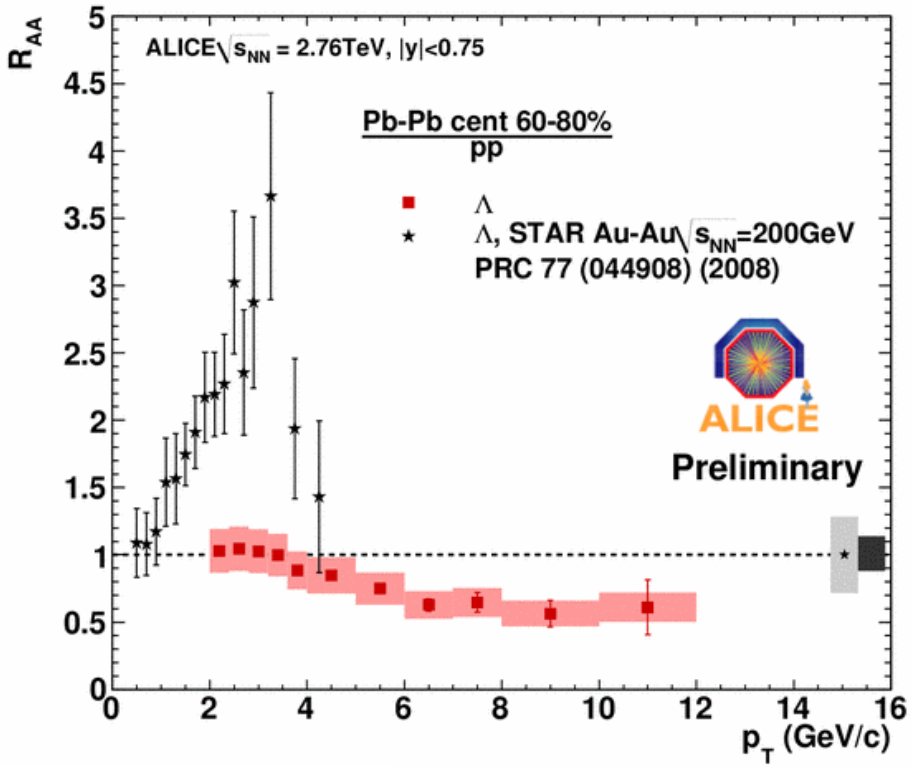


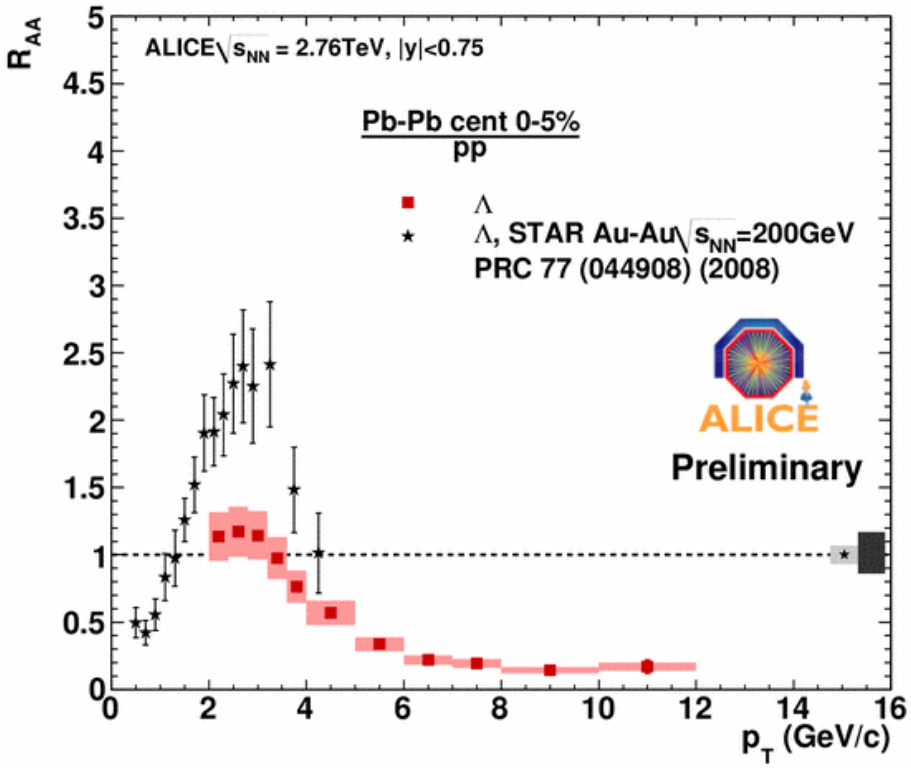
R_{AA}: comparison to charged



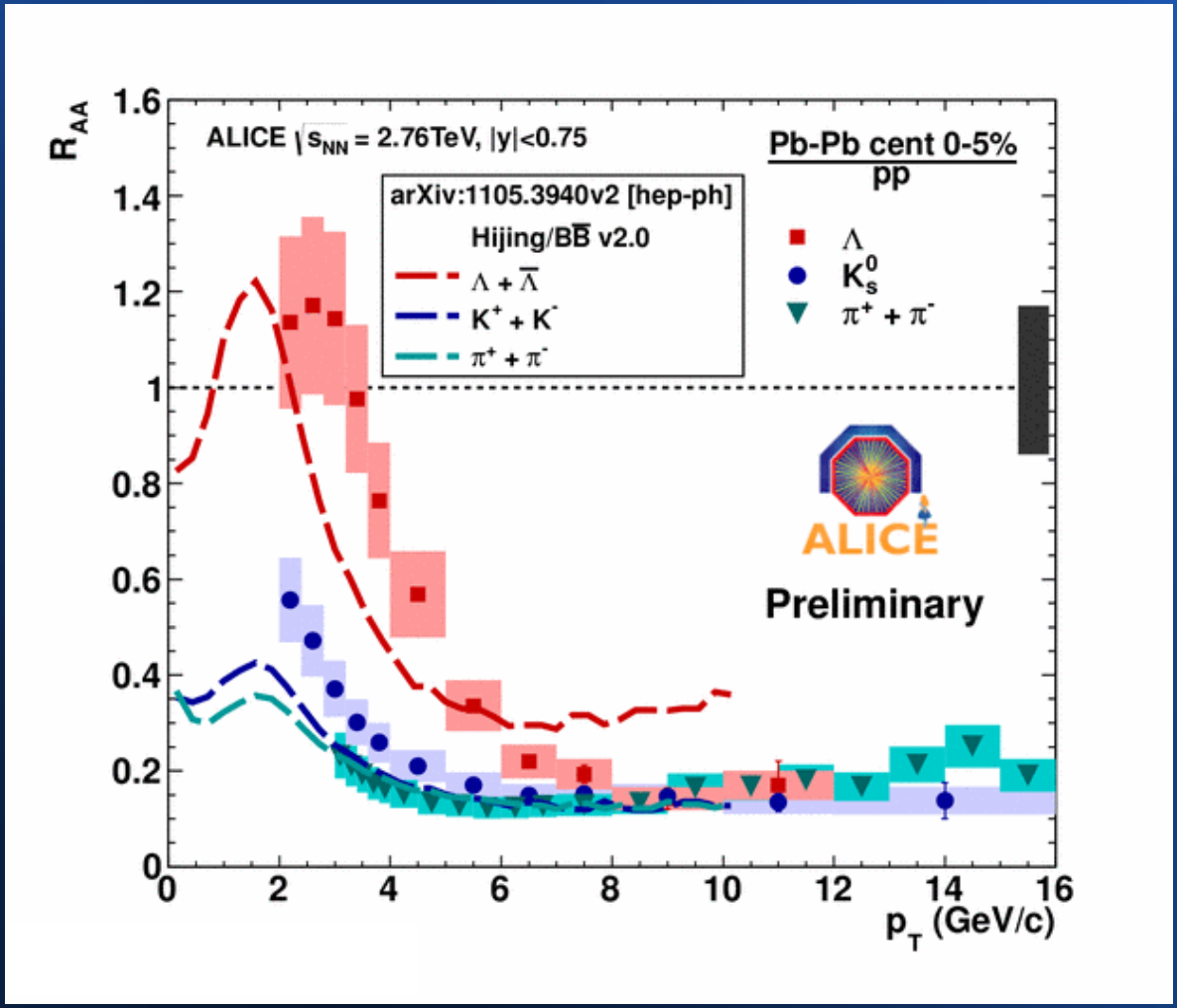


R_{AA}: comparison to STAR (Λ)





R_{AA}: comparison to theory



Predictions from HIJING/B$\bar{B}$ v2.0 model for R_{AA} of identified particles at $|\eta| < 0.8$ in central (0 – 5%) Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV.

V. Topor Pop, M. Gyulassy, J. Barrette, C. Gale
arXiv:1105.3940v2 [hep-ph]

- $\pi^{+/-}$ and K^0_s R_{AA}: well described from intermediate to high p_T
- Λ less suppressed than K^0_s over whole p_T range
- Above p_T = 3 GeV/c constant difference in suppression

Summary

- Λ and K^0_s R_{CP}, R_{AA} measured in Pb-Pb and *pp* at $\sqrt{s_{NN}}$ = 2.76 TeV up to p_T = 16 GeV/c.
- Strong suppression observed at high p_T (p_T > 8 GeV/c):
  - Λ and K^0_s compatible
  - Similar to charged particles
- At lower p_T (p_T < 5 GeV/c):
  - Λ and K^0_s different in R_{CP} and R_{AA}: Baryon to meson enhancement
  - ALICE Λ R_{CP} comparable to STAR results
  - ALICE Λ R_{AA} at maximum much smaller than STAR measurements
- HIJING/BB v2.0 reproduces the results for $\pi^{+/-}$ and K^0_s R_{AA} but fails for Λ R_{AA}.