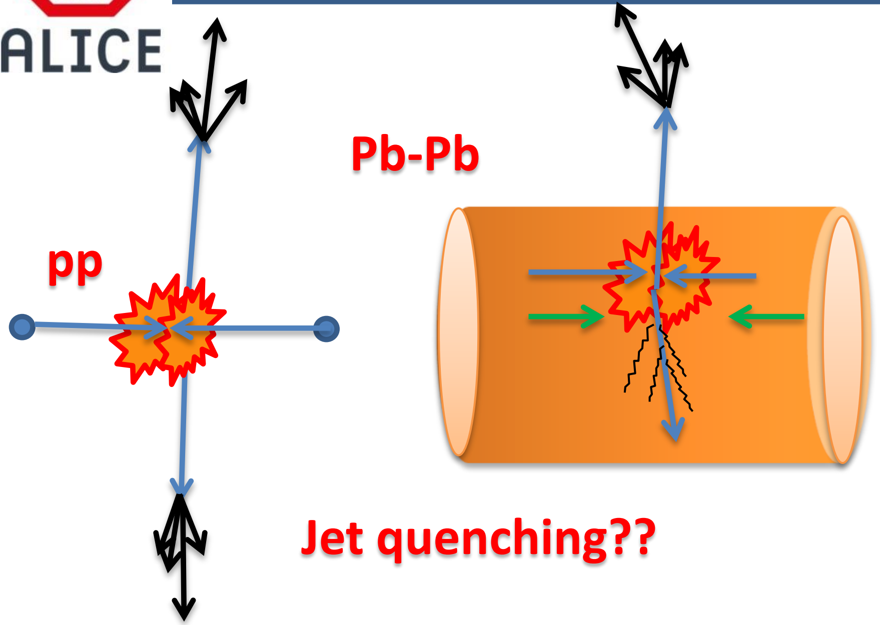
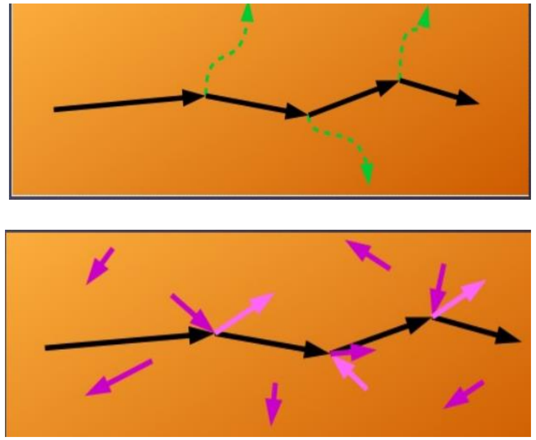
Particle-yield modification in jet-like azimuthal V^0–hadron correlations in Pb–Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with ALICE at the LHC

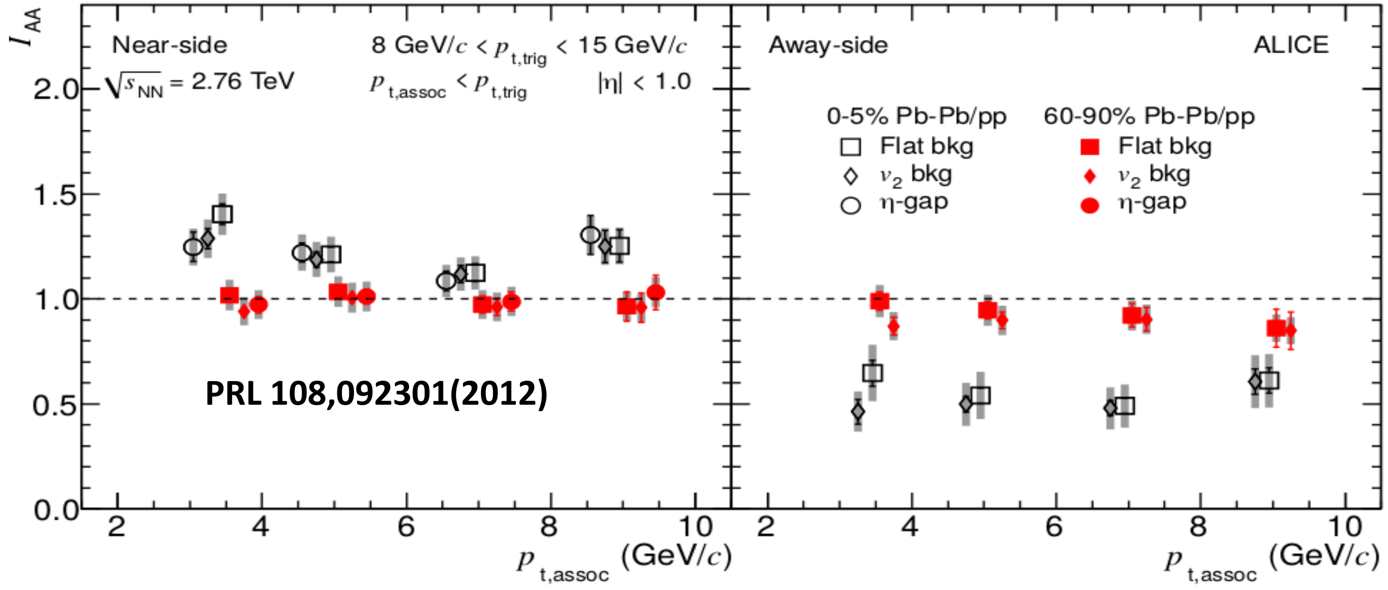
Mustafa Anaam for the ALICE Collaboration

Central China Normal University

Motivation: search for jet quenching effects $I_{AA} = \frac{Y_{AA}}{Y_{pp}}$







❖ **Nuclear-modification factor I_{AA} :**
probes the interplay between the parton production spectrum, the relative importance of quark– quark, gluon–gluon and quark–gluon final states, and energy loss in the medium.

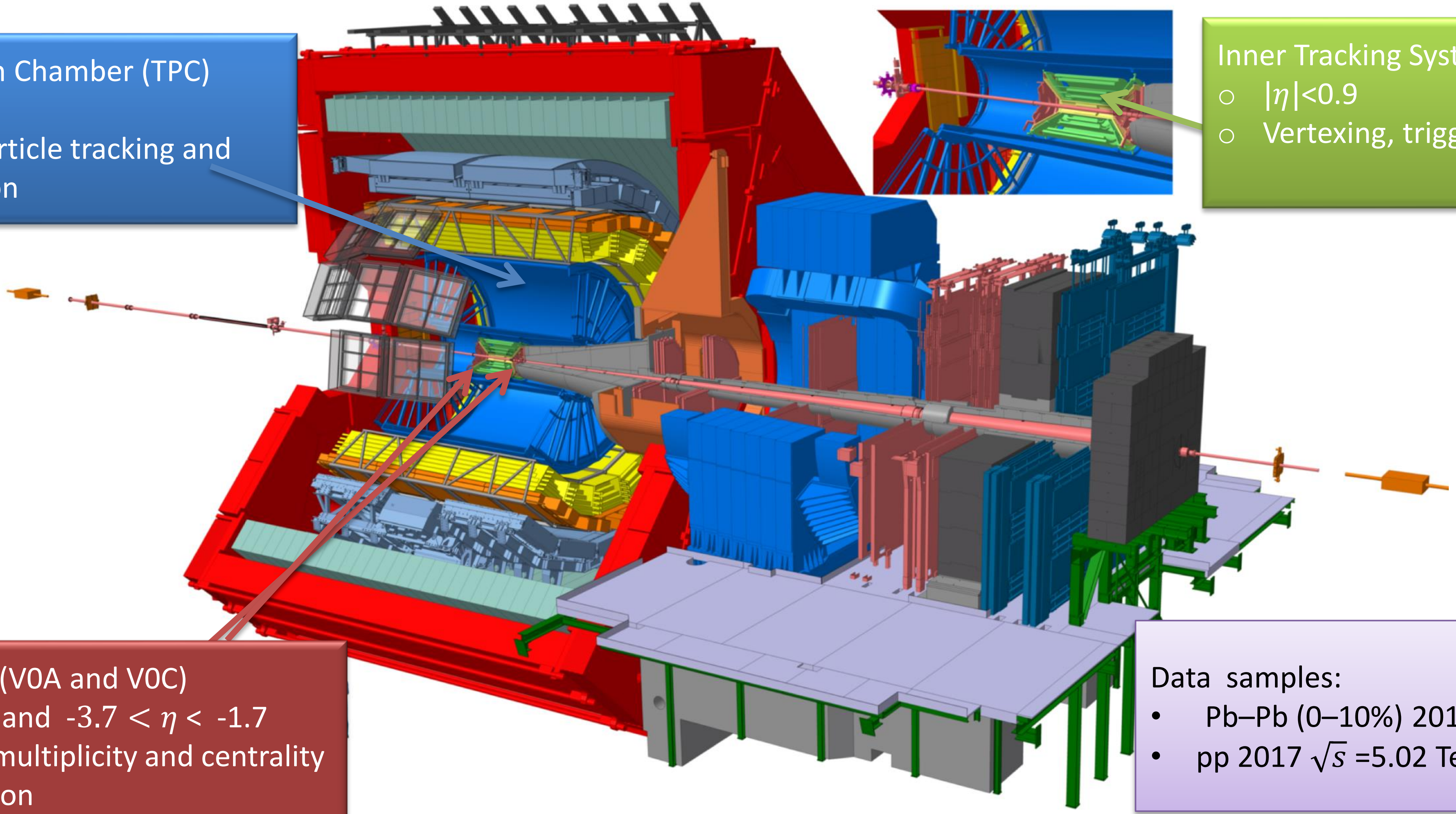
- **Enhancement on the near-side:**
  I_{AA} provides information about the fragmenting jet leaving the medium and this enhancement suggests that the near-side parton is also subject to medium effects.

- **On the away-side:**
  It additionally reflects the probability that the recoiling parton survives the passage through the medium.

❖ **Why to measure I_{AA} for V0-h?**
Considering K^0_S and Λ are proxies of quark and gluon jets, we want to see:

- the difference of the parton energy loss effects on quark and gluon jets.
- the medium response to quark and gluon jets.

ALICE detector setup



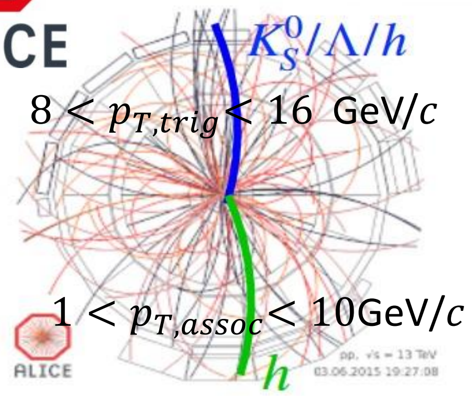
Time Projection Chamber (TPC)
- $|\eta|<0.9$
- Charged-particle tracking and identification

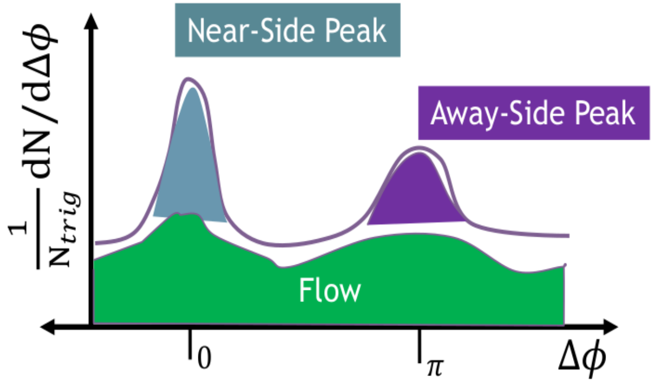
Inner Tracking System (ITS)
- $|\eta|<0.9$
- Vertexing, triggering

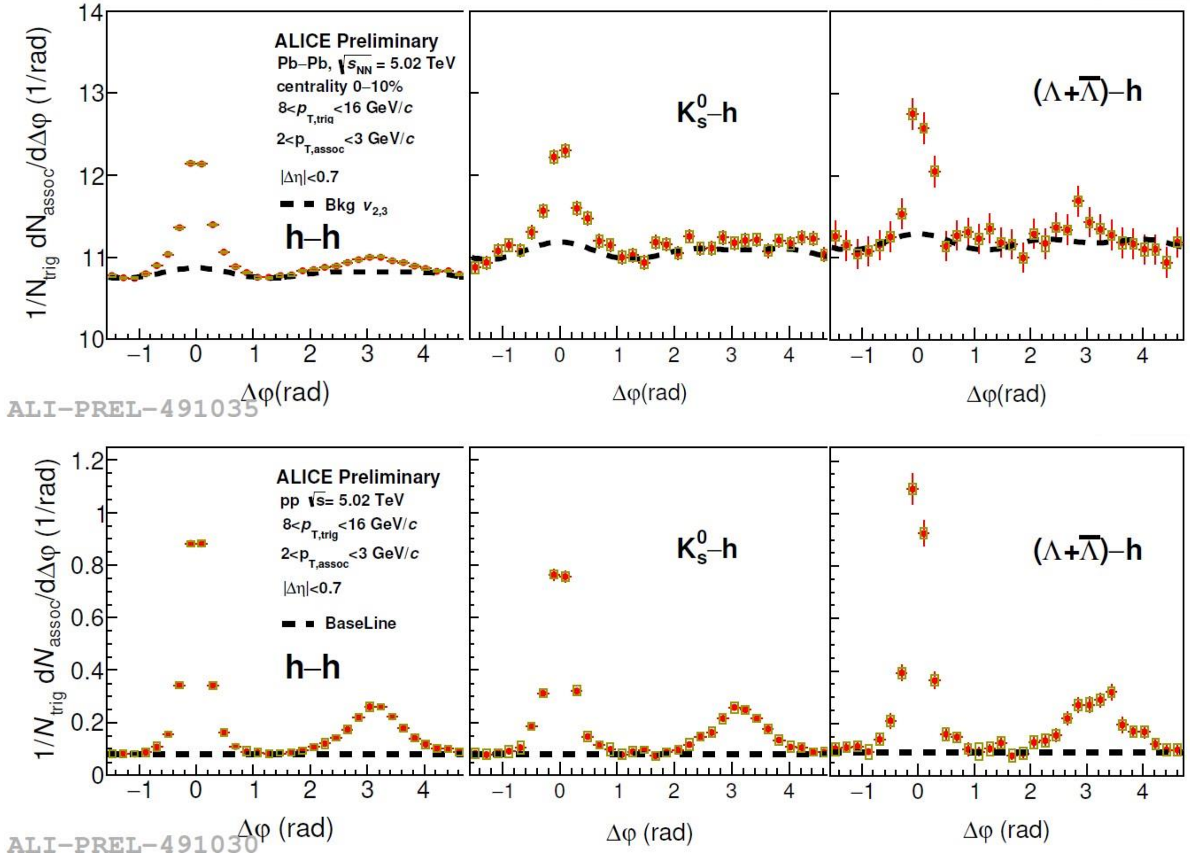
V0 scintillators (V0A and V0C)
- $2.8<\eta<5.1$ and $-3.7<\eta<-1.7$
- Triggering, multiplicity and centrality determination

Data samples:
- Pb–Pb (0–10%) 2015 $\sqrt{s_{\mathrm{NN}}}$ =5.02 TeV
- pp 2017 $\sqrt{s}$ =5.02 TeV

Di-hadron correlations (analysis strategy)







1. Angular correlation between trigger and associated particles is mesured:

$$C(\Delta\varphi,\Delta\eta) = \frac{1}{N_{trig}}\frac{d^2N_{assoc}}{d\Delta\varphi d\Delta\eta} = \frac{S(\Delta\varphi,\Delta\eta)}{M(\Delta\varphi,\Delta\eta)}$$

$$\Delta\varphi = \varphi_{trig} - \varphi_{assoc}\,, \Delta\eta = \eta_{trig} - \eta_{assoc}$$

2. Background contribution is subtracted:

$$B(\Delta\varphi) = B_0\left(1 + 2\sum_n V_n\cos(n\Delta\varphi)\right)$$

where $V_n \approx v_n^{trig}.v_n^{assoc}$, n=2,3.

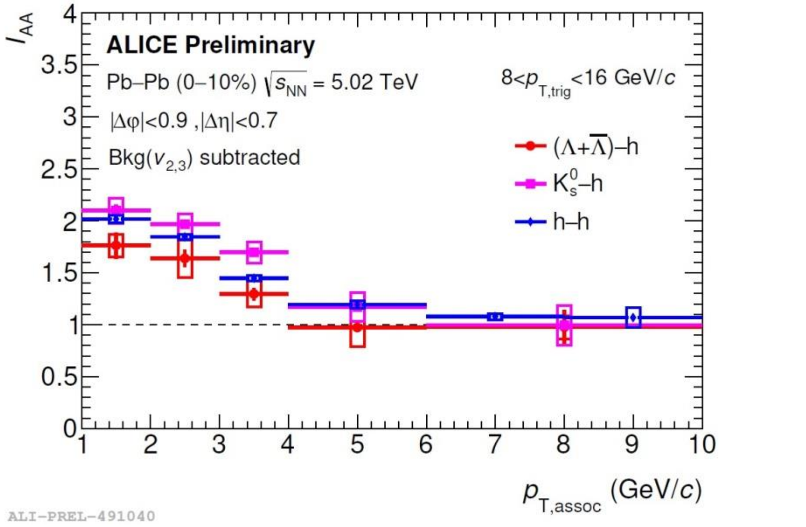
$$J(\Delta\varphi) = C(\Delta\varphi) - B(\Delta\varphi)$$

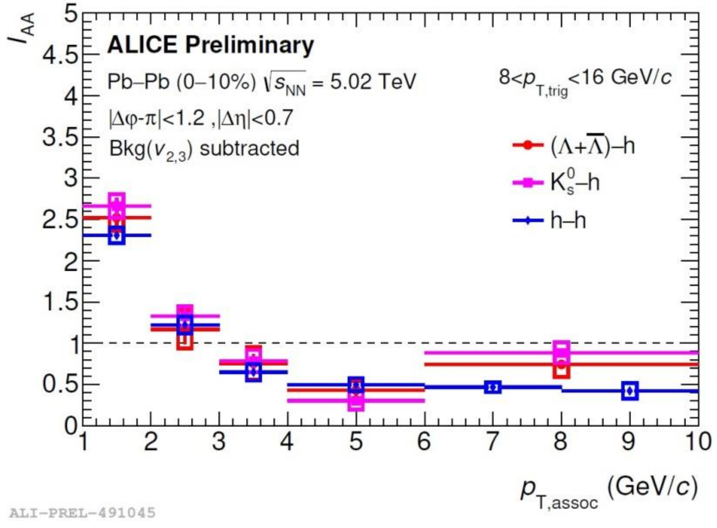
3. Yield and I_{AA} are calculated:

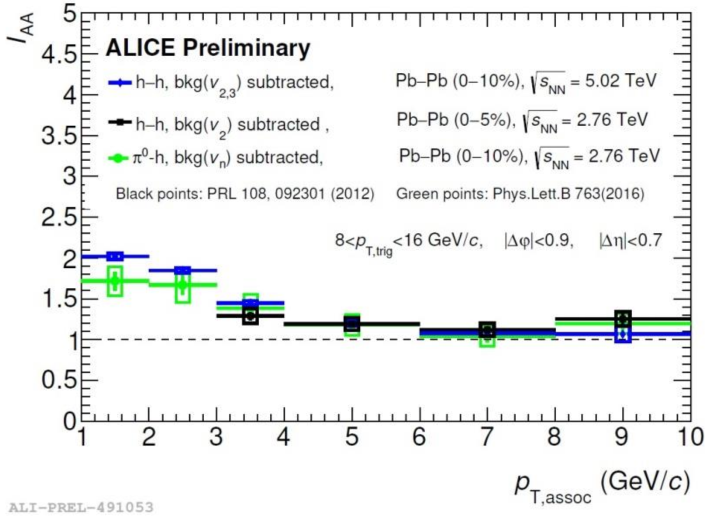
$$I_{AA} = \int J_{AA}(\Delta\varphi)d\Delta\varphi \Big/ \int J_{pp}(\Delta\varphi)d\Delta\varphi$$

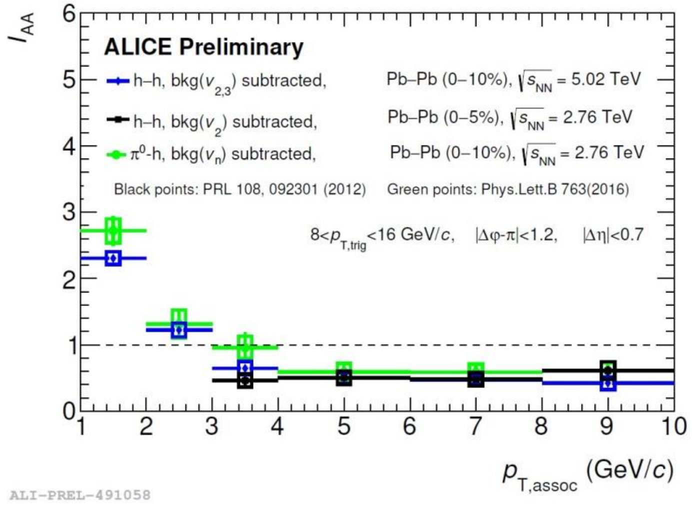
Nuclear modification factors (I_{AA}) Pb–Pb (0–10%)

Near-Side | **Away-Side**









- **low $p_{T,assoc}$**:
  strong enhancement in near-side and away-side for all particles species
- **high $p_{T,assoc}$**:
  suppression in away-side,
  no modifications in near-side for all particles species
- no significant specie-dependence in I_{AA} within uncertainties specially in away-side
- new measurement consistent with previous ones at $\sqrt{s_{NN}} = 2.76$ TeV

Per-trigger yield ratios to h-h

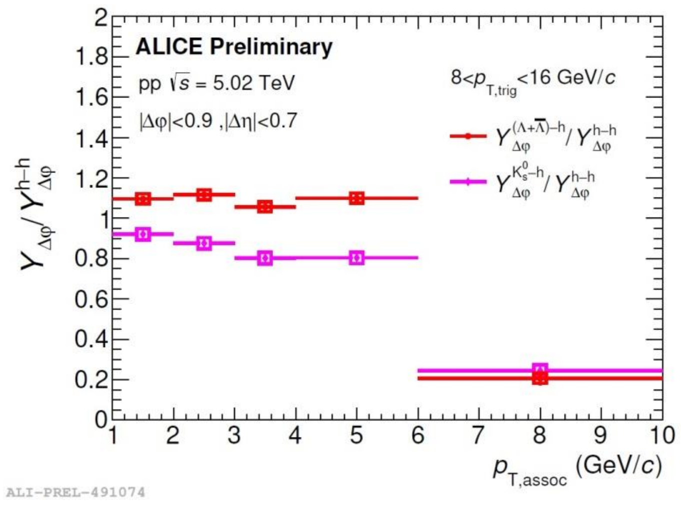
ALICE

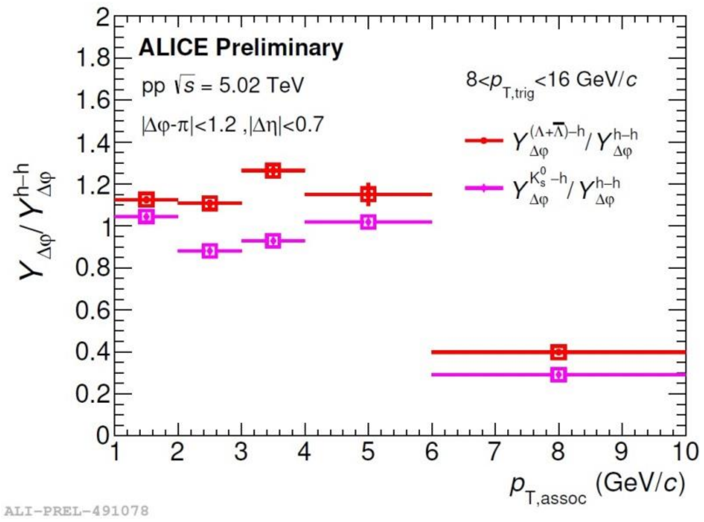
Near-Side **Away-Side**

$Y_{\Delta\varphi}^{(\Lambda+\overline{\Lambda})-h} / Y_{\Delta\varphi}^{h-h}$

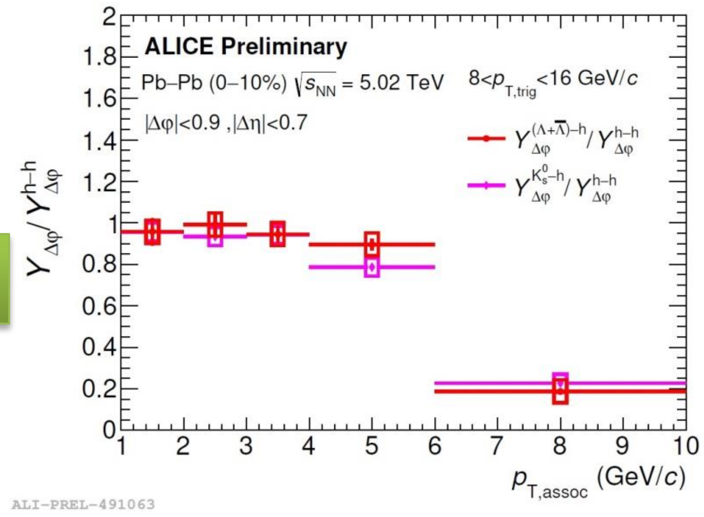
$Y_{\Delta\varphi}^{K_s^0-h} / Y_{\Delta\varphi}^{h-h}$

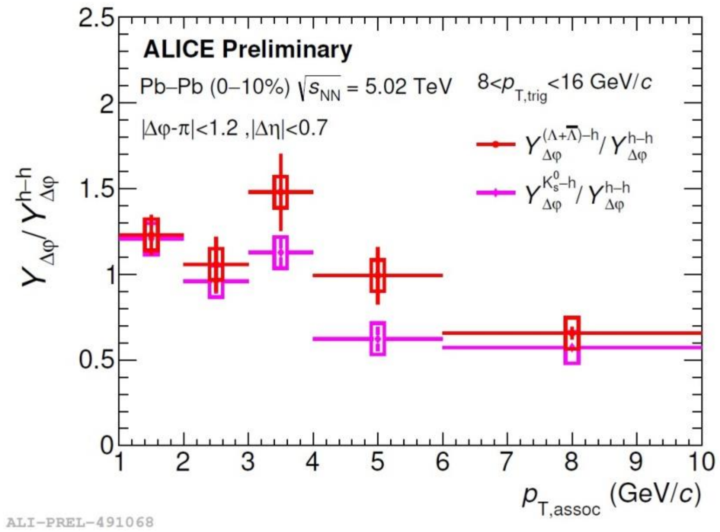
pp





Pb–Pb



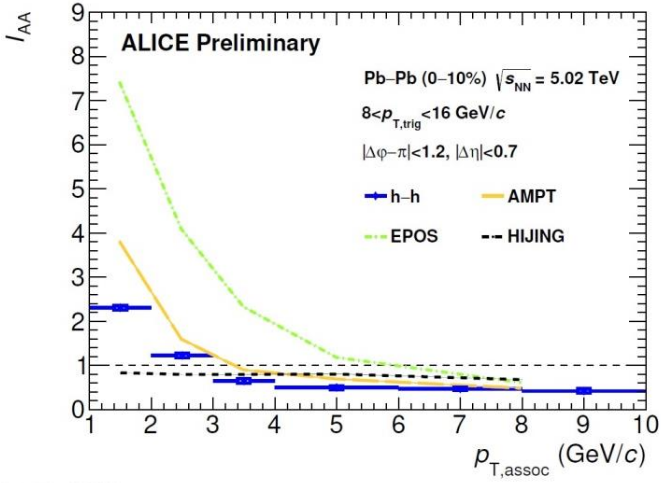


- per-trigger yields associated with Λ are higher than those with K_s^0 in pp
- in the Pb–Pb collisions, the difference is almost not visible

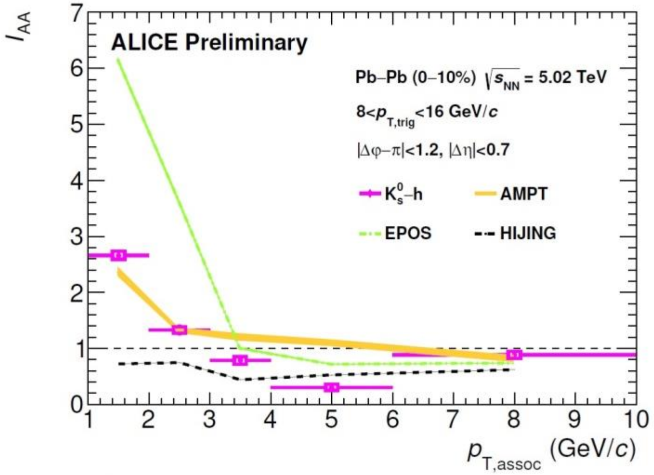
I_{AA} compared with model calculations

h − h | **K_s^0 − h** | **($\Lambda + \bar{\Lambda}$) − h**

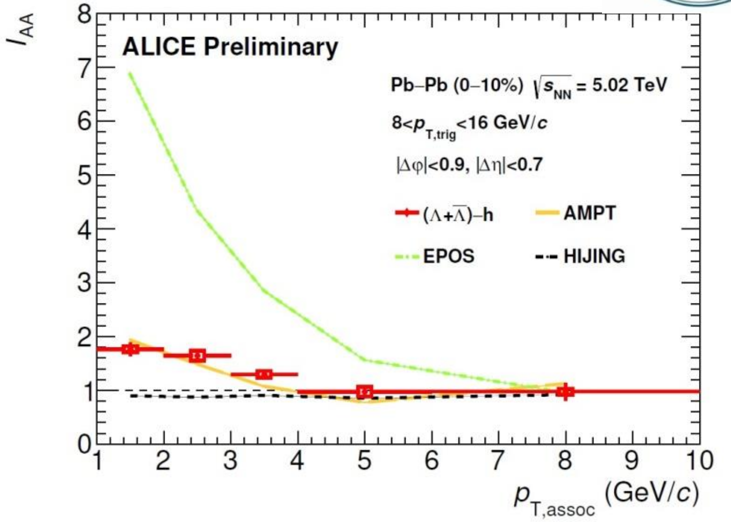
Near-Side



ALI-PREL-491168

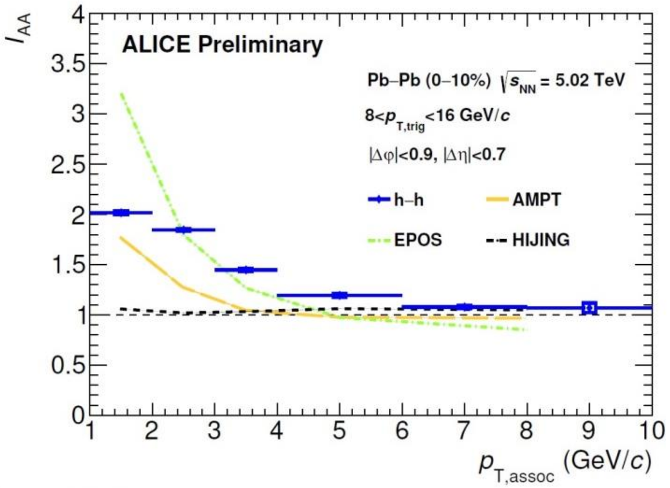


ALI-PREL-491148

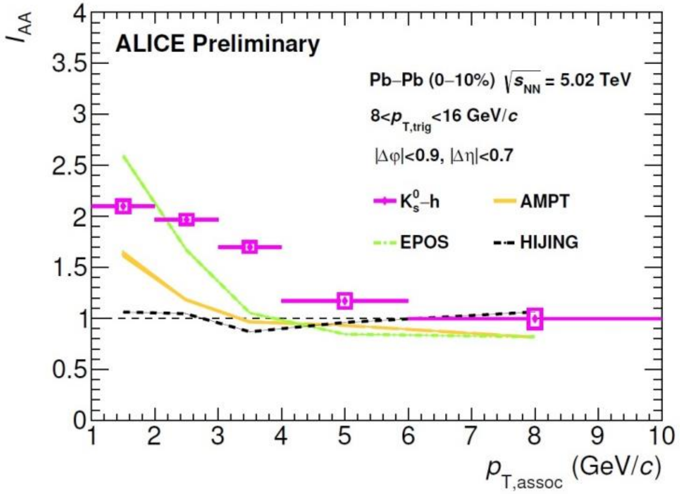


ALI-PREL-491153

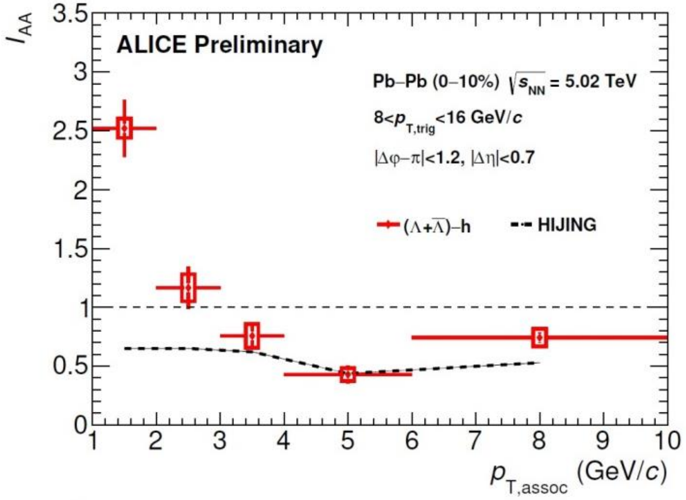
Away-Side



ALI-PREL-491163



ALI-PREL-491143



ALI-PREL-491158

- comparison of I_{AA} with model calculations (EPOS, AMPT and HIJING)
- AMPT qualitatively describes I_{AA} , HIJING shows suppressions on the away-side at high $p_{T,assoc}$

Summary

❖ We studied near-side and away-side yield, yield ratio to h-h and I_{AA} for $(\mathrm{K_S^0}-\mathrm{h})$, $(\Lambda+\overline{\Lambda})-\mathrm{h}$ and $(\mathrm{h}-\mathrm{h})$ in pp and Pb–Pb (0–10%)

- I_{AA} shows strong enhancement at low $\mathrm{p_{T,assoc}}$ in near-side and away-side for all particles species
- I_{AA} shows strong suppression at high $\mathrm{p_{T,assoc}}$ in away-side for all particles species
- I_{AA} shows no significant specie-dependence specially in away-side.
- A difference between jet-like yields triggered with $\mathrm{K_S^0}$ and Λ with respect to charged hadron was observed in pp collisions while in Pb Pb collisions the difference is almost not visible

❖ We compared the result with published and model calculations.

- I_{AA} shows good agreements with published result from $\sqrt{s_{NN}} = 2.76$ TeV
- AMPT performs better than other models.