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

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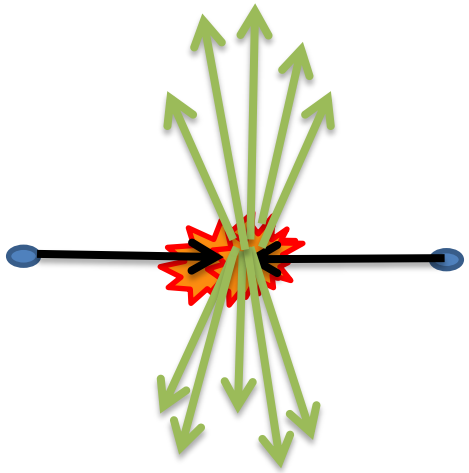
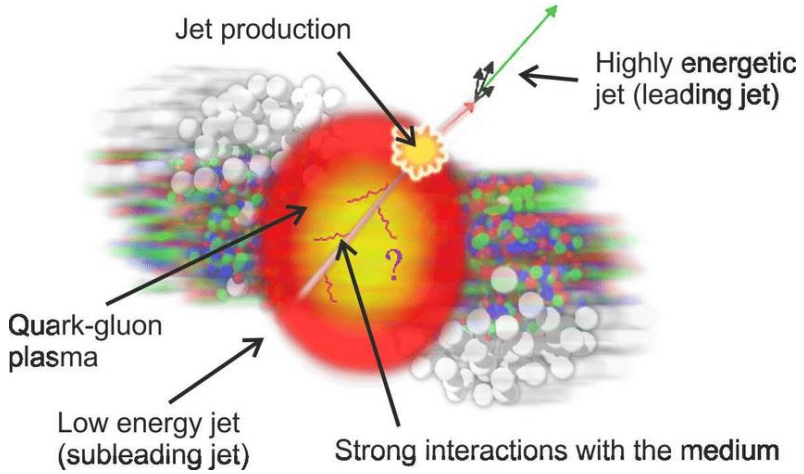
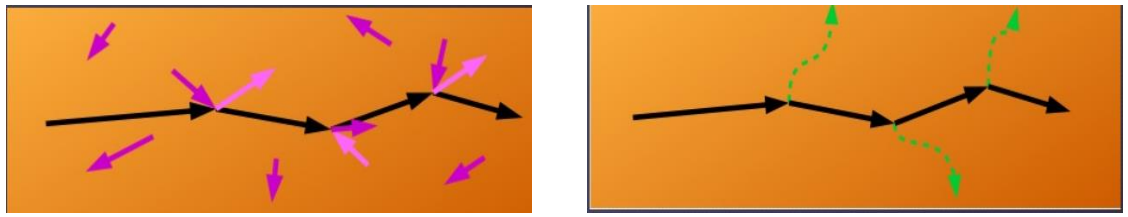
Motivation





pp **Vs** **Pb—Pb**



- near-side jet is more biased to the surface of the QGP - should be more pronounced for gluon jets [1]
- on the away-side:
  The suppression of the yield is due to the energy loss in the QGP
- on the near-side:
  I_{AA} provides information about the fragmenting jet leaving the medium

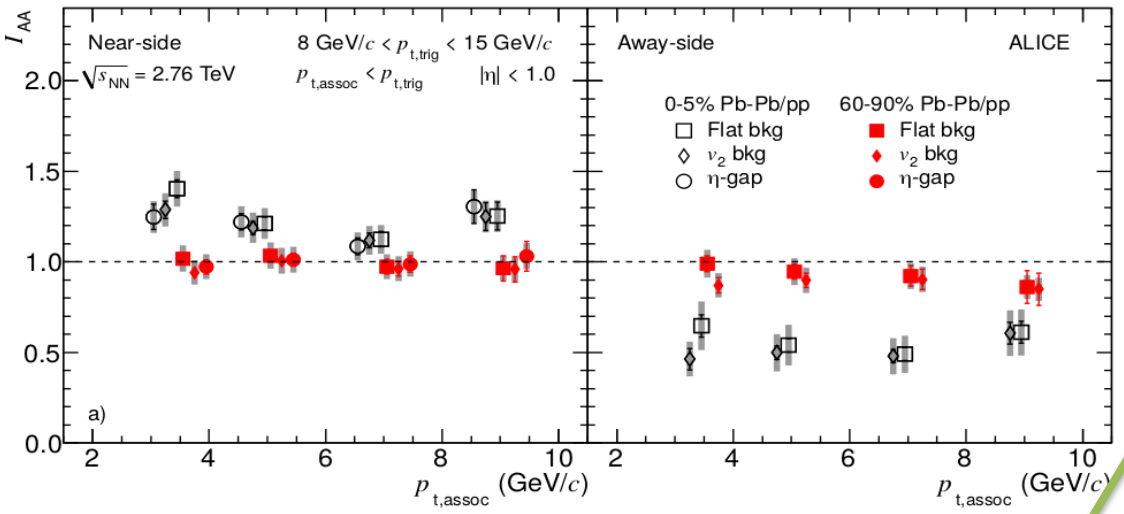
- I_{AA} : probes the interplay between the parton production spectrum, the relative importance of quark– quark, gluon–gluon and quark–gluon final states

$$I_{AA} = \frac{Y_{\Delta\varphi}^{Pb-Pb}}{Y_{\Delta\varphi}^{pp}}$$

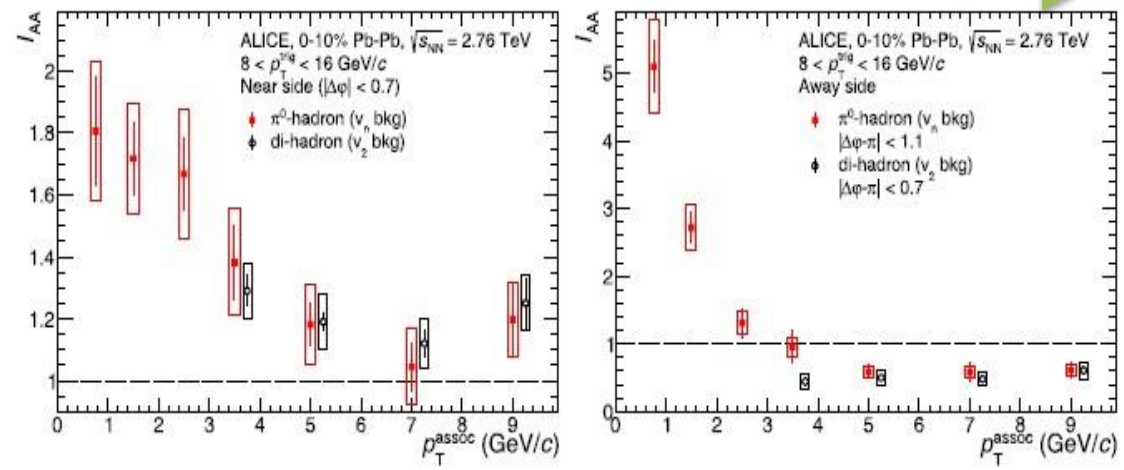
[1] arXiv:nucl-th/0512076

Motivation

PRL 108,092301(2012)



PLB 763, 2016



- Previous measurement of I_{AA} for
  - $h-h$ at $\sqrt{s_{NN}} = 2.76$ TeV
  - π^0-h at $\sqrt{s_{NN}} = 2.76$ TeV
- Why we measure I_{AA} for V0-h?

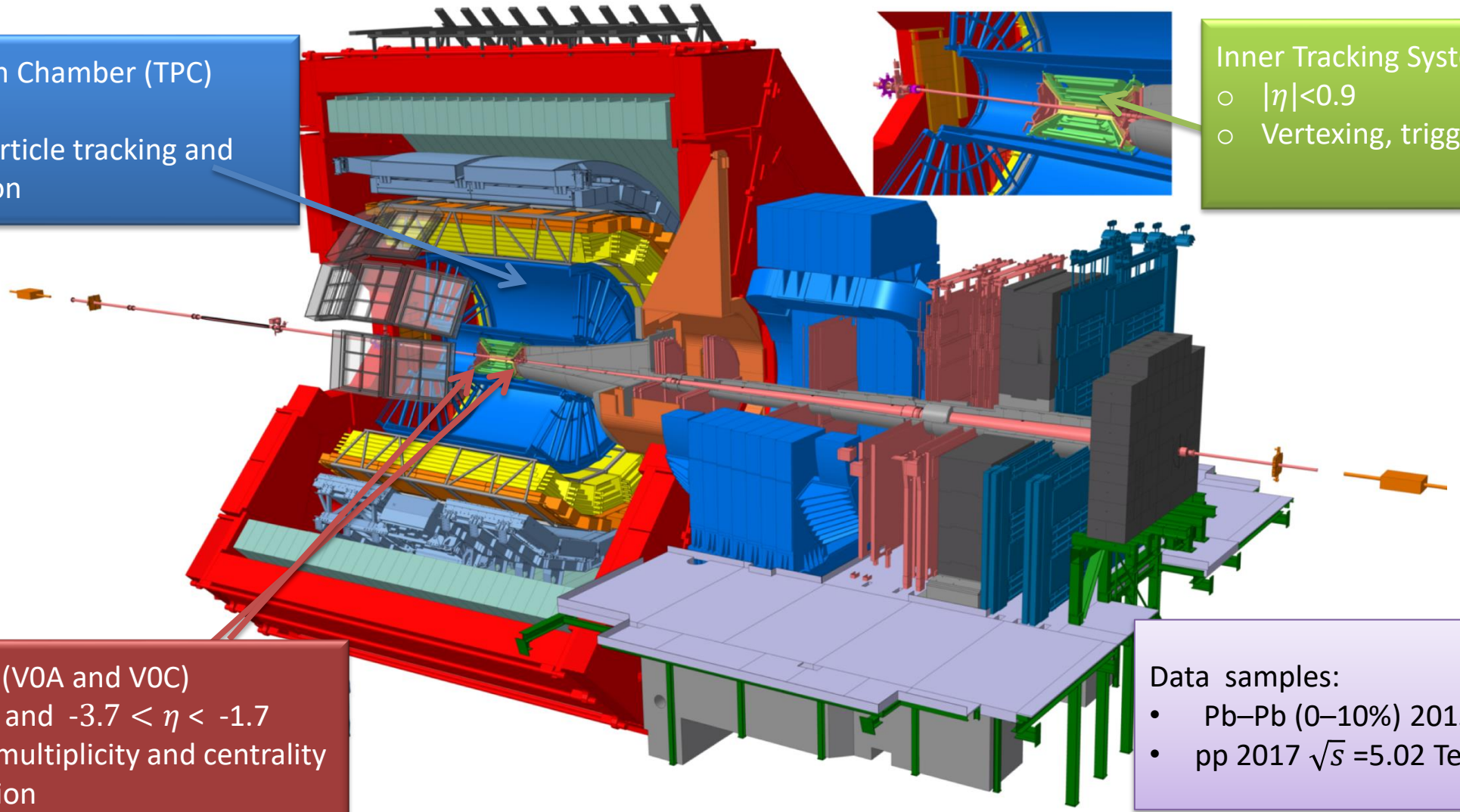
considering K_s^0 and Λ are proxies of quark and gluon jets, we want to investigate :

- the difference of the parton energy loss effects on quark and gluon jets
- the difference in the interaction amplitude with the medium for the 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

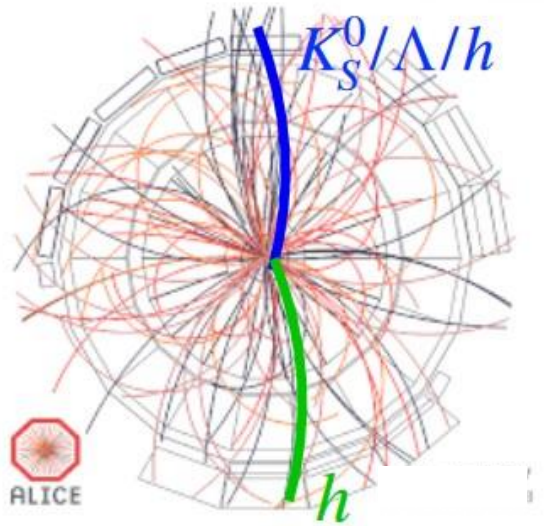


V0 scintillators (V0A and V0C)
- 2.8< η<5.1 and -3.7 < η < -1.7
- Triggering, multiplicity and centrality determination

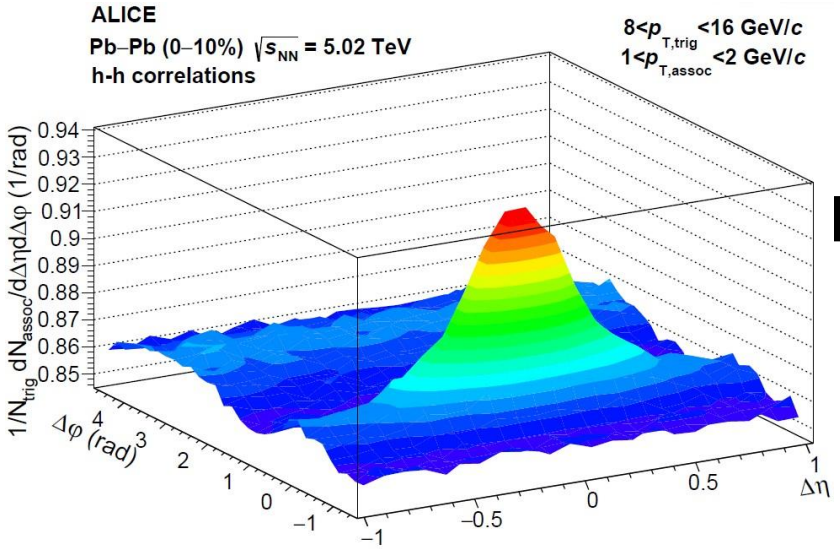
Data samples:
- Pb–Pb (0–10%) 2015 $\sqrt{s_{\mathrm{NN}}}$ =5.02 TeV
- pp 2017 $\sqrt{s}$ =5.02 TeV

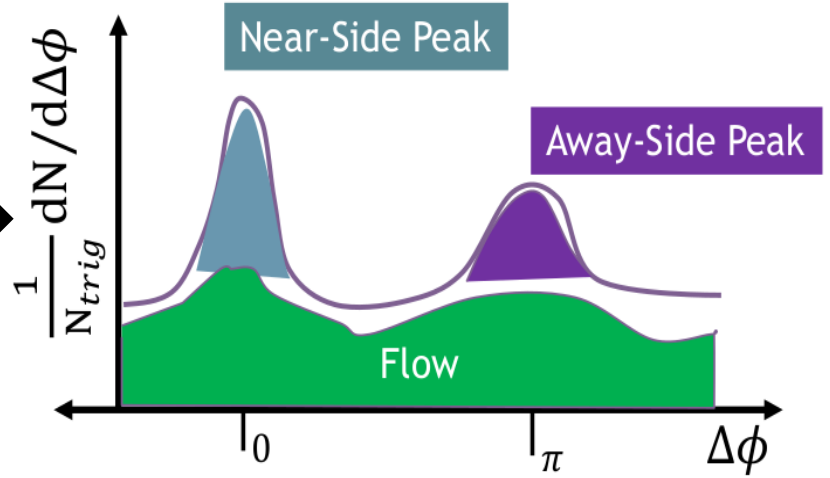
Strange- hadrons Correlations

$8 < p_{T,trig} < 16$ GeV/c



$1 < p_{T,assoc} < 10$ GeV/c





1. Agular *correlation is* mesured

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

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

2. Background contribution is subtracted:

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

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

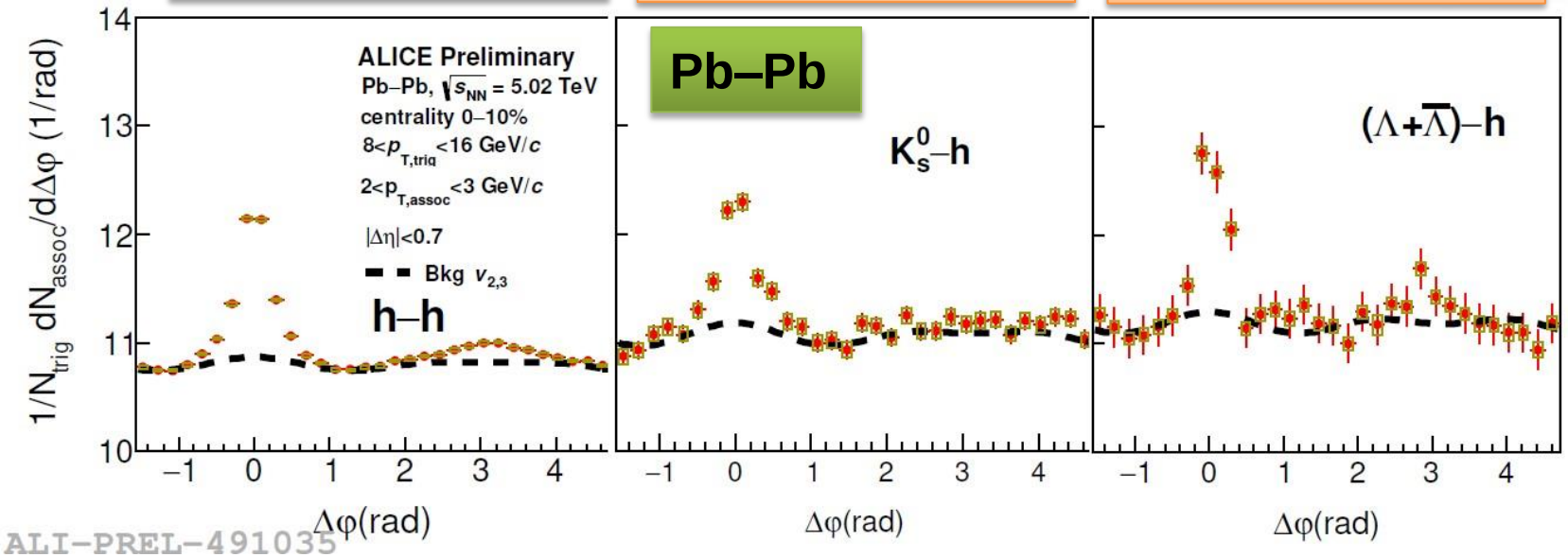
3. *Jet is calculated*

$$\boldsymbol{J(\Delta\varphi) = C(\Delta\varphi) - B(\Delta\varphi)}$$

$\Delta\varphi$ projections

$h-h$ | K^0_s-h | $(\Lambda+\bar{\Lambda})-h$

New



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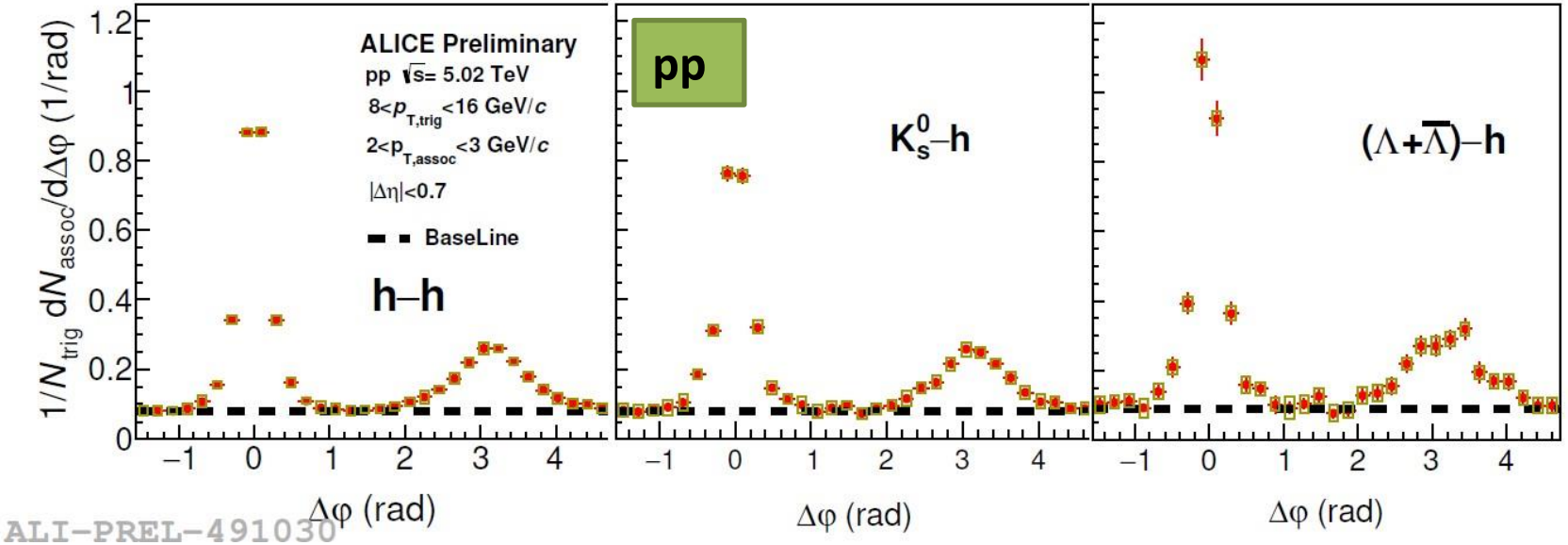

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- the near-side peak size is slightly larger for the Pb–Pb collisions
- away-side peak strongly suppressed in the Pb–Pb collisions in contrast to the pp

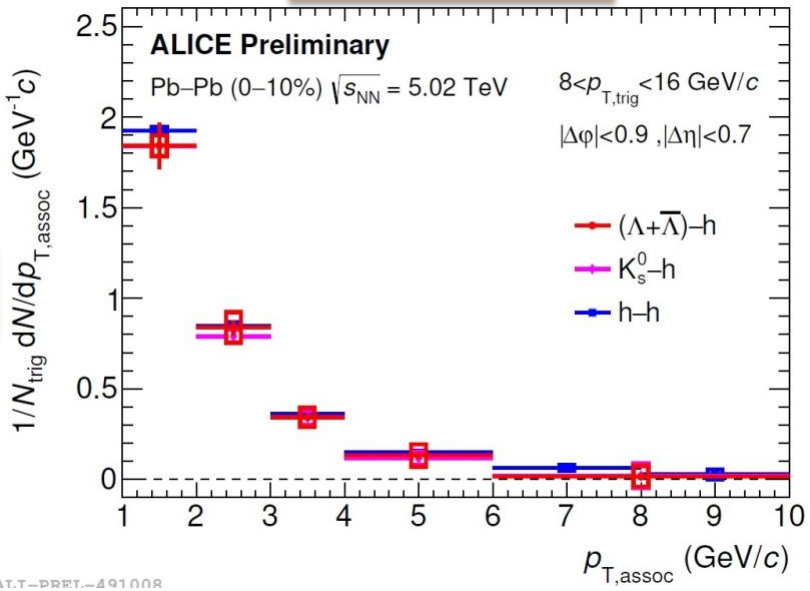
Jet−like yield

New

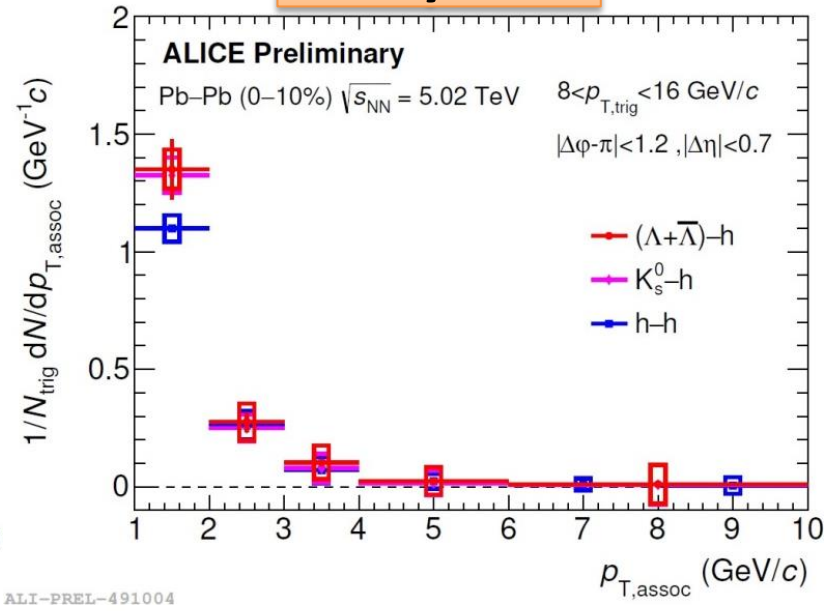
Pb–Pb

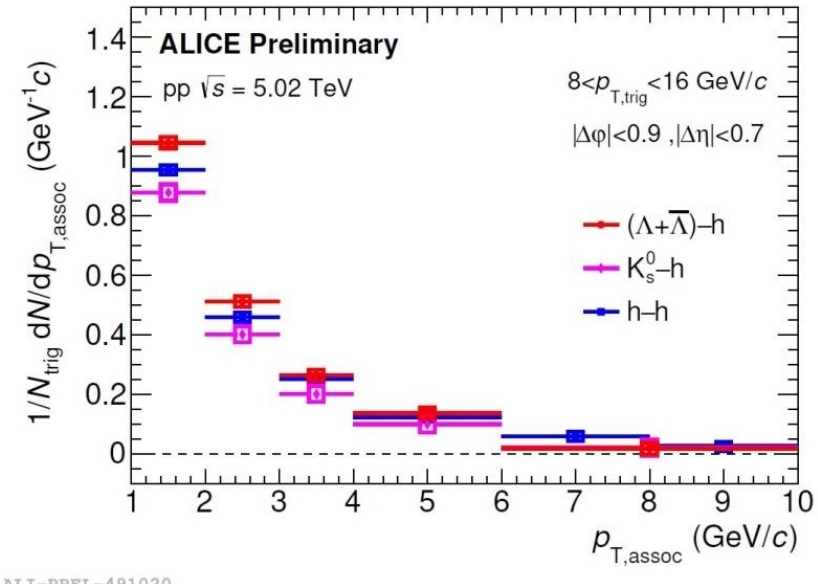
pp

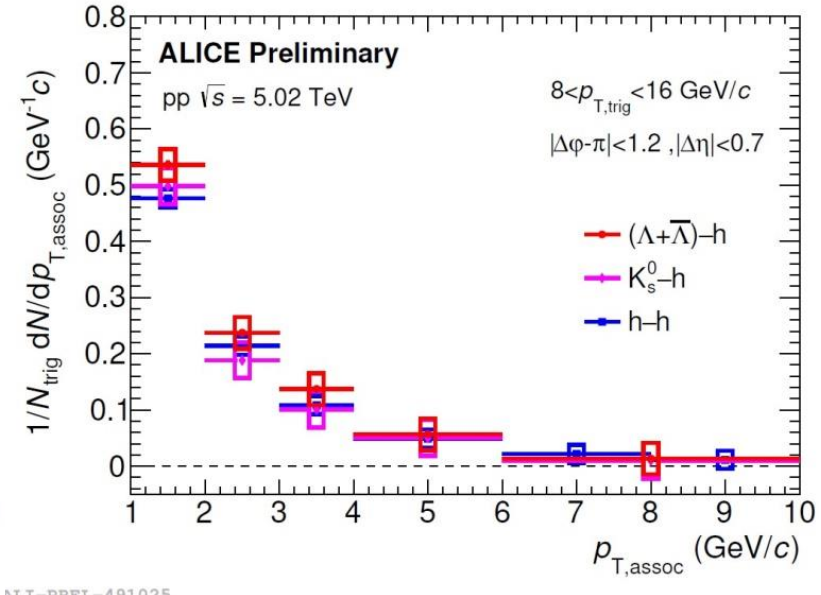
Near-side



Away-side





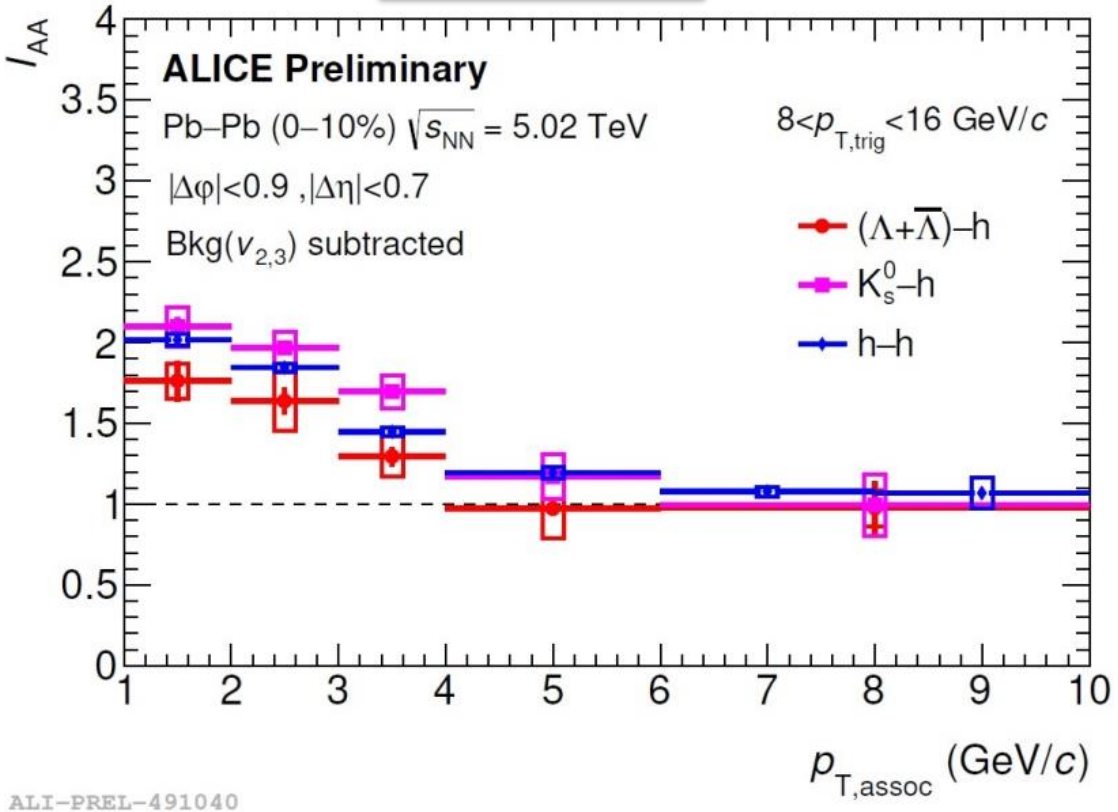


- no strong trigger particle dependence in Pb–Pb
- clear ordering on the near-side in pp

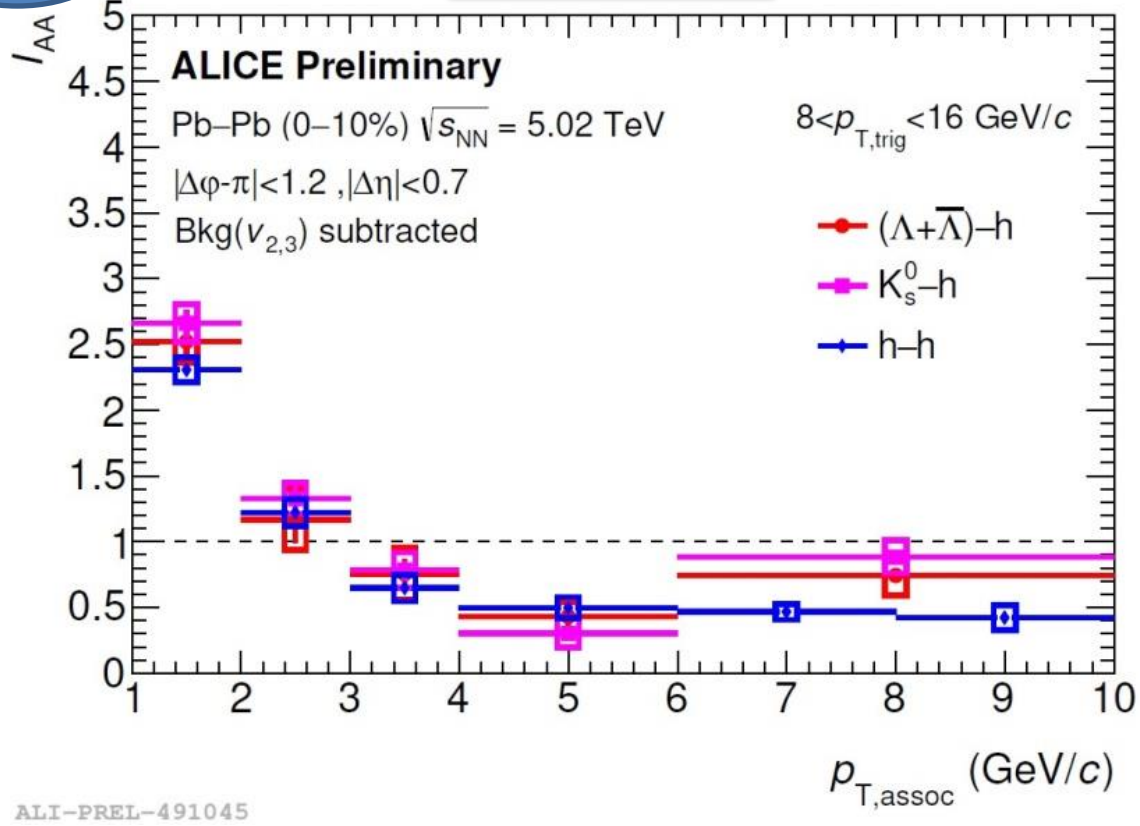
I_{AA}

New

Near-side



Away-side

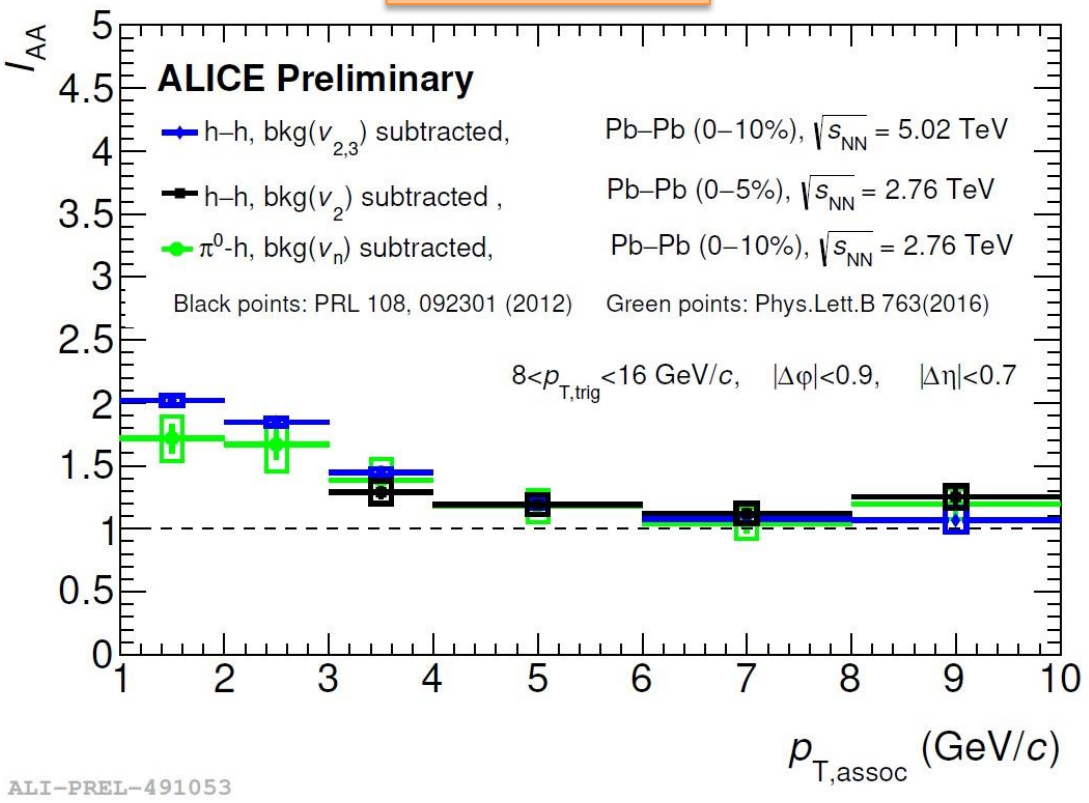


- **low $p_{T,assoc}$**: strong enhancement in near-side and away-side for all particles species
- **high $p_{T,assoc}$**: suppression in away-side, no modifications in near-side for all particles species

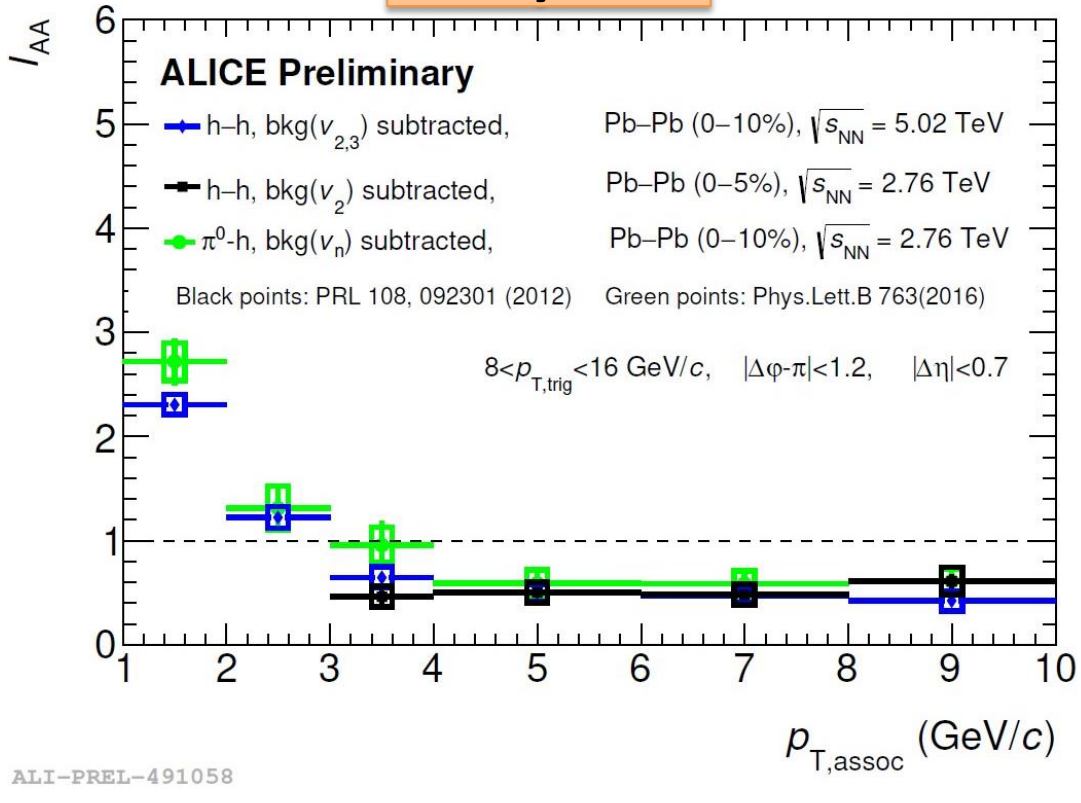
- no significant specie-dependence in I_{AA} within uncertainties specially in away-side

I_{AA}:compare with published

Near-side



Away-side



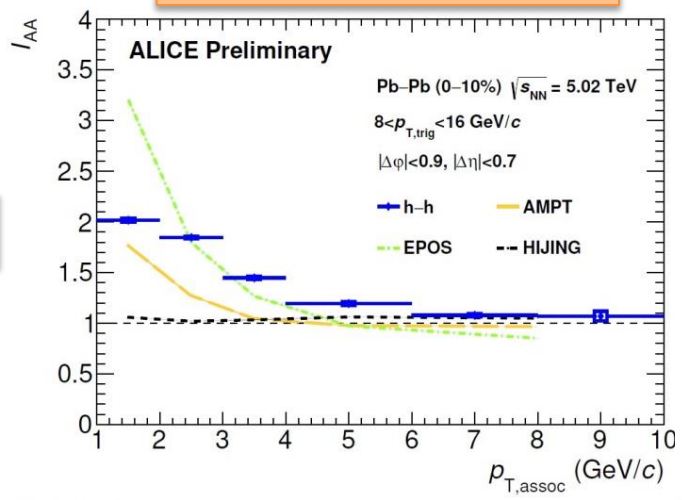
- new measurement consistent with previous ones at $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV

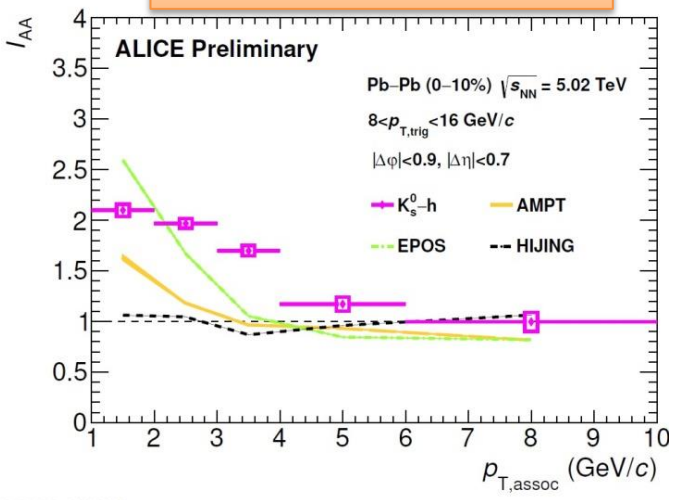
I_{AA}:compare with models

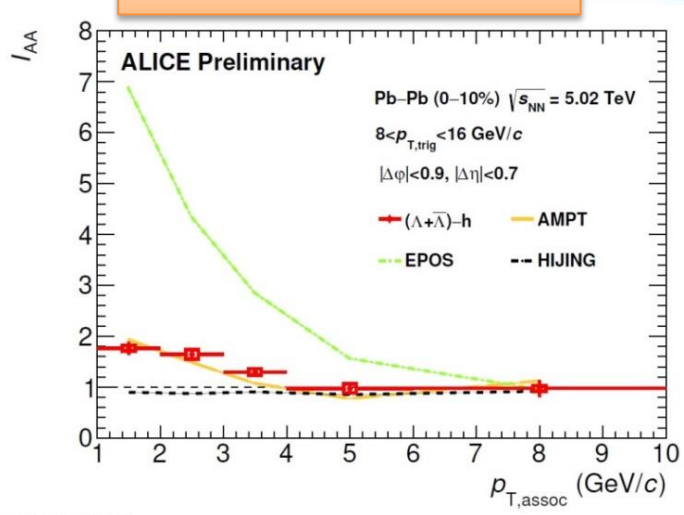
Near-side

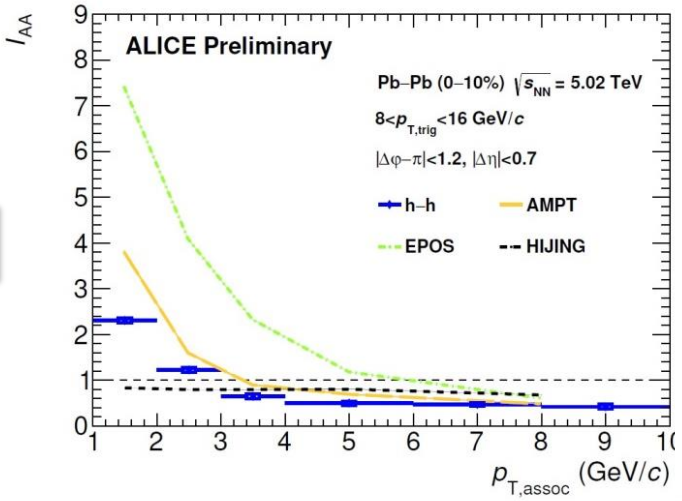
Away-side

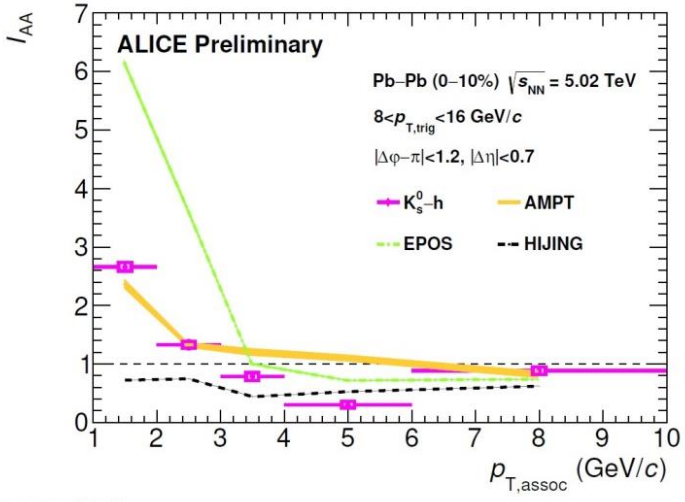
$h-h$	K_s^0-h	$(\Lambda+\bar{\Lambda})-h$

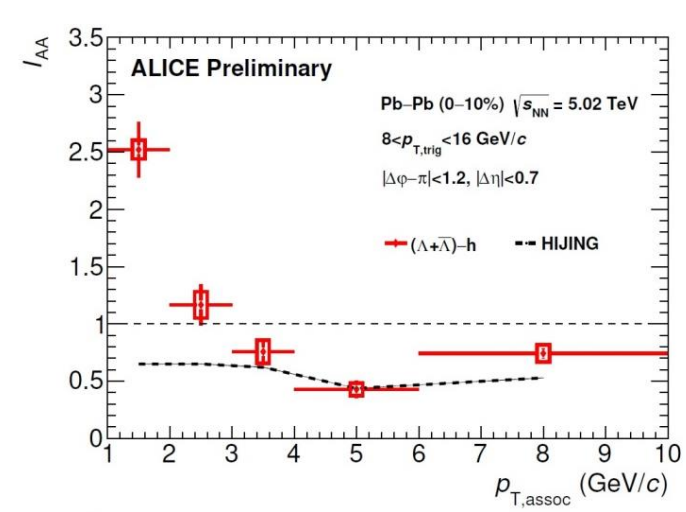












- comparison of I_{AA} with model calculations (EPOS, AMPT and HIJING)
- AMPT qualitatively describes I_{AA} , HIJING shows suppressions on the away-side at high $p_{T,assoc}$ as expected

Jet−like yield ratios to h−h yields

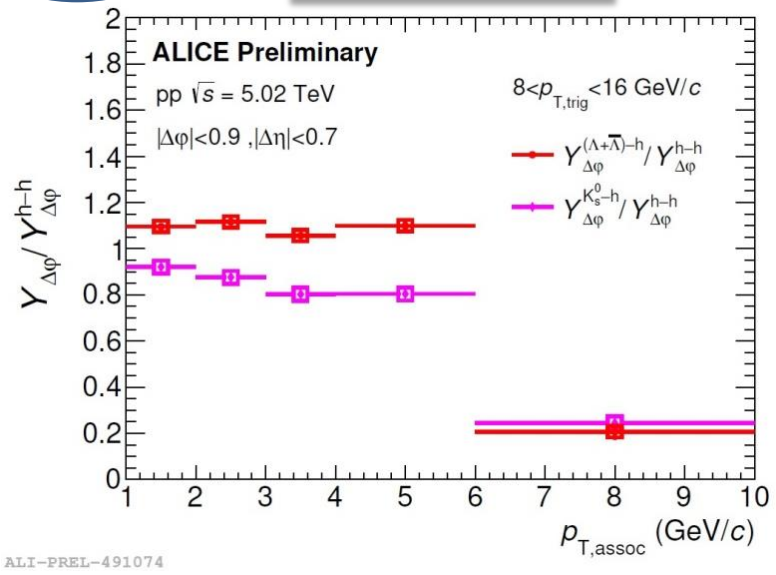
New

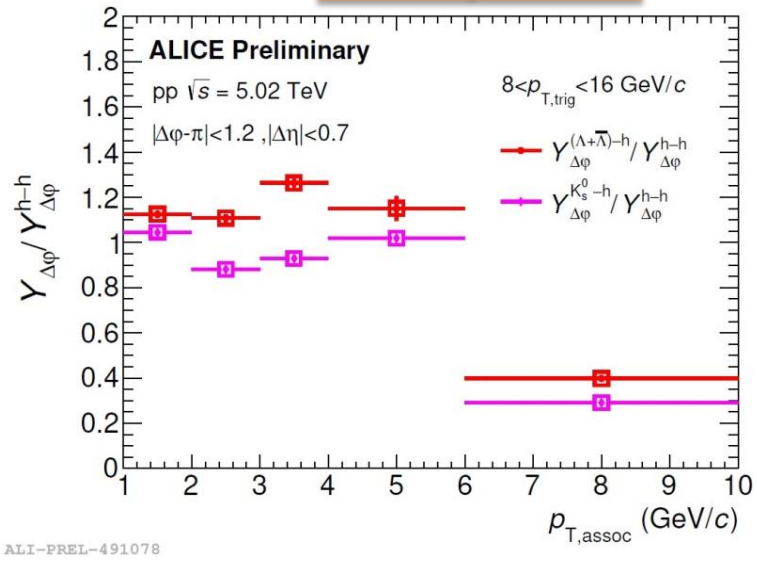
pp

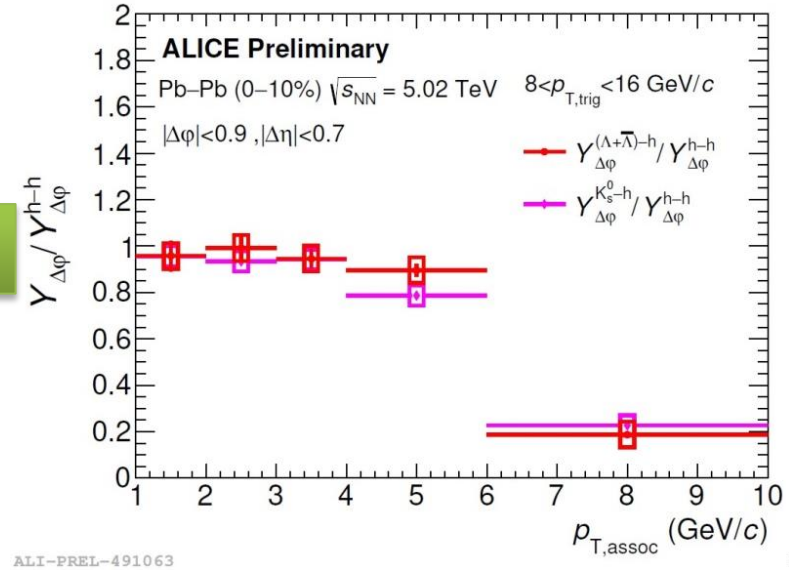
Pb–Pb

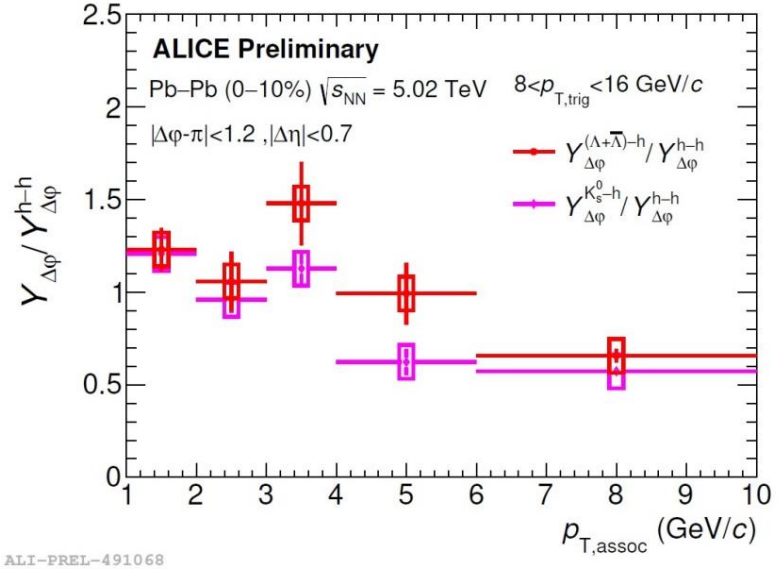
Near-side

Away-side









$Y^{(\Lambda+\bar{\Lambda})-h}_{\Delta\varphi}/Y^{h-h}_{\Delta\varphi}$

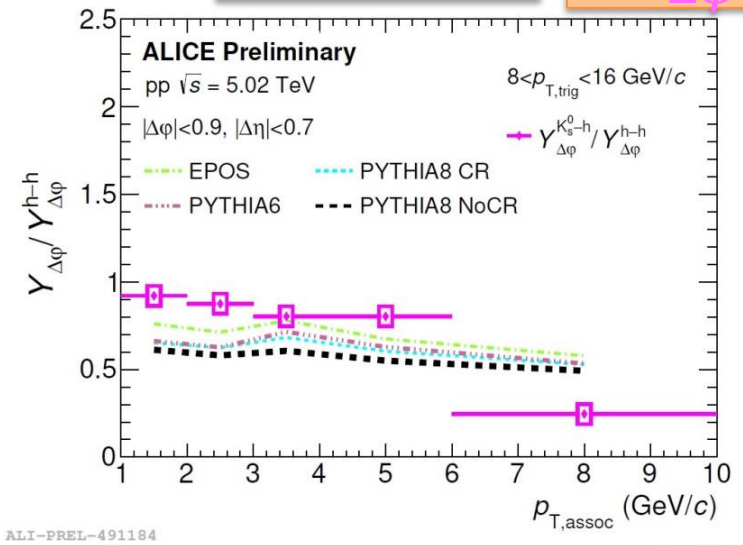
$Y^{K^0_s-h}_{\Delta\varphi}/Y^{h-h}_{\Delta\varphi}$

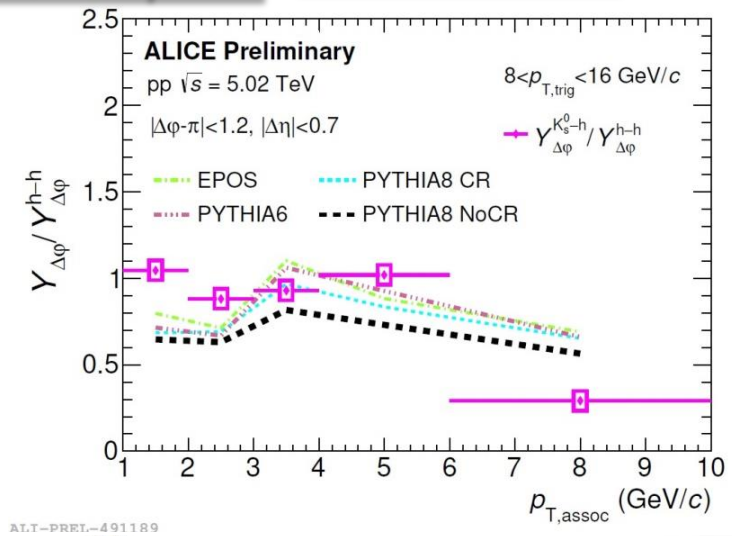
- per-trigger yields associated with Λ are higher than those with K^0_s in pp
- in the Pb–Pb collisions, the difference is almost not visible

Jet−like yield ratios to h−h yields(model comparison)

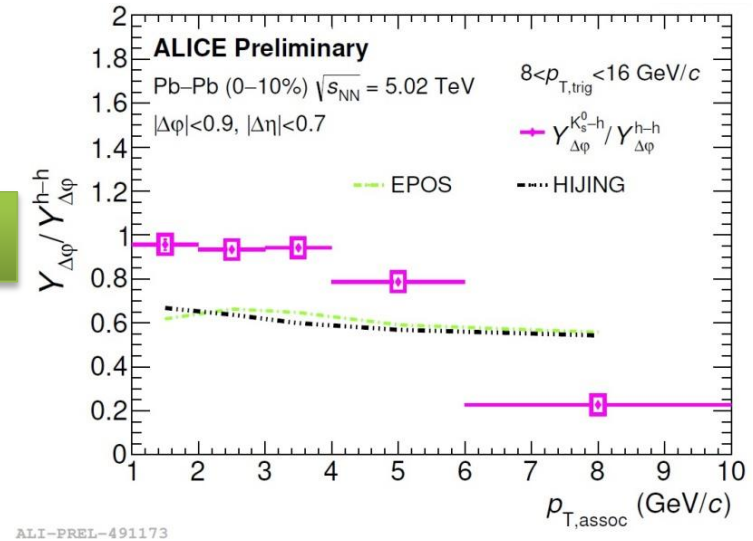
Near-side $Y^{K_s^0-h}_{\Delta\varphi} / Y^{h-h}_{\Delta\varphi}$ **Away-side**

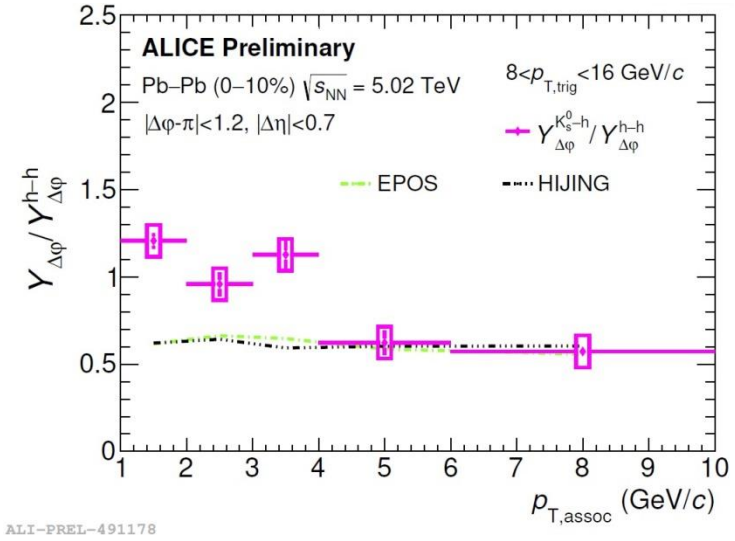
pp





Pb–Pb



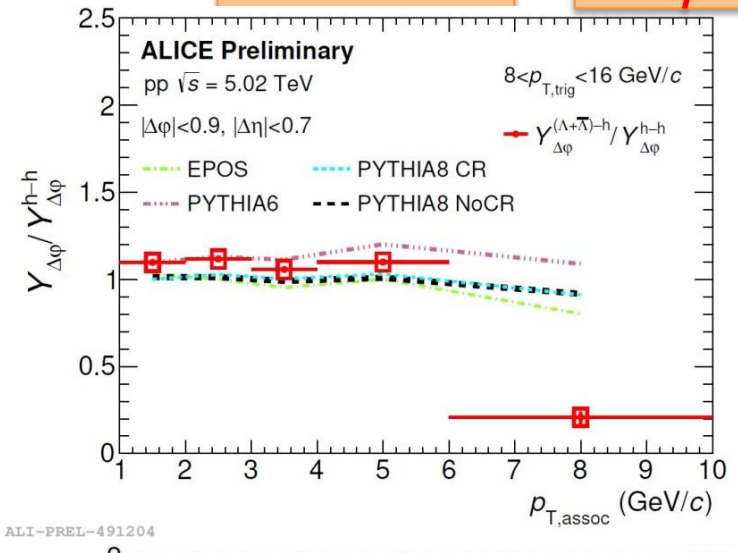


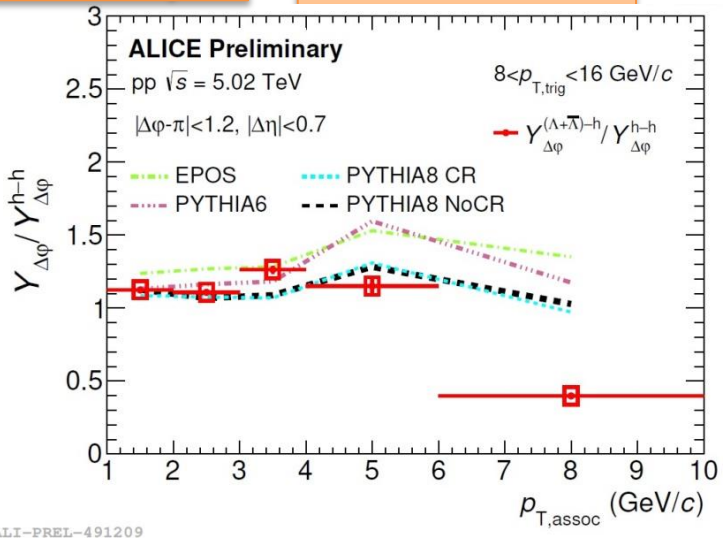
- EPOS, PYTHIA qualitatively describes the ratios in pp
- EPOS, HIJING qualitatively describes the ratios at high p_T in Pb–Pb

Jet−like yield ratios to h−h yields(model comparison)

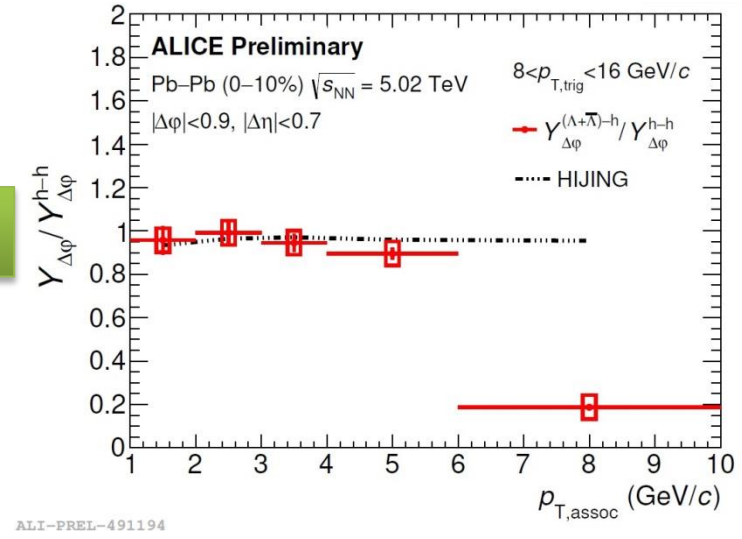
Near-side $Y^{(\Lambda+\bar{\Lambda})-h}_{\Delta\varphi} / Y^{h-h}_{\Delta\varphi}$ **Away-side**

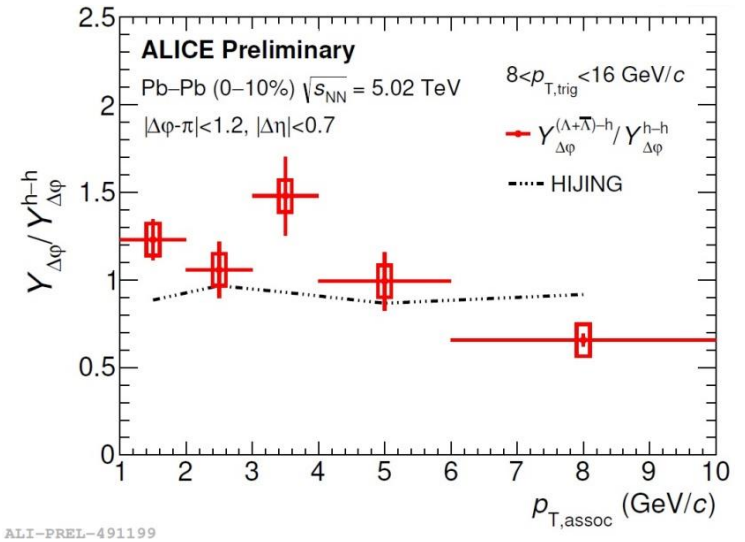
pp





Pb–Pb

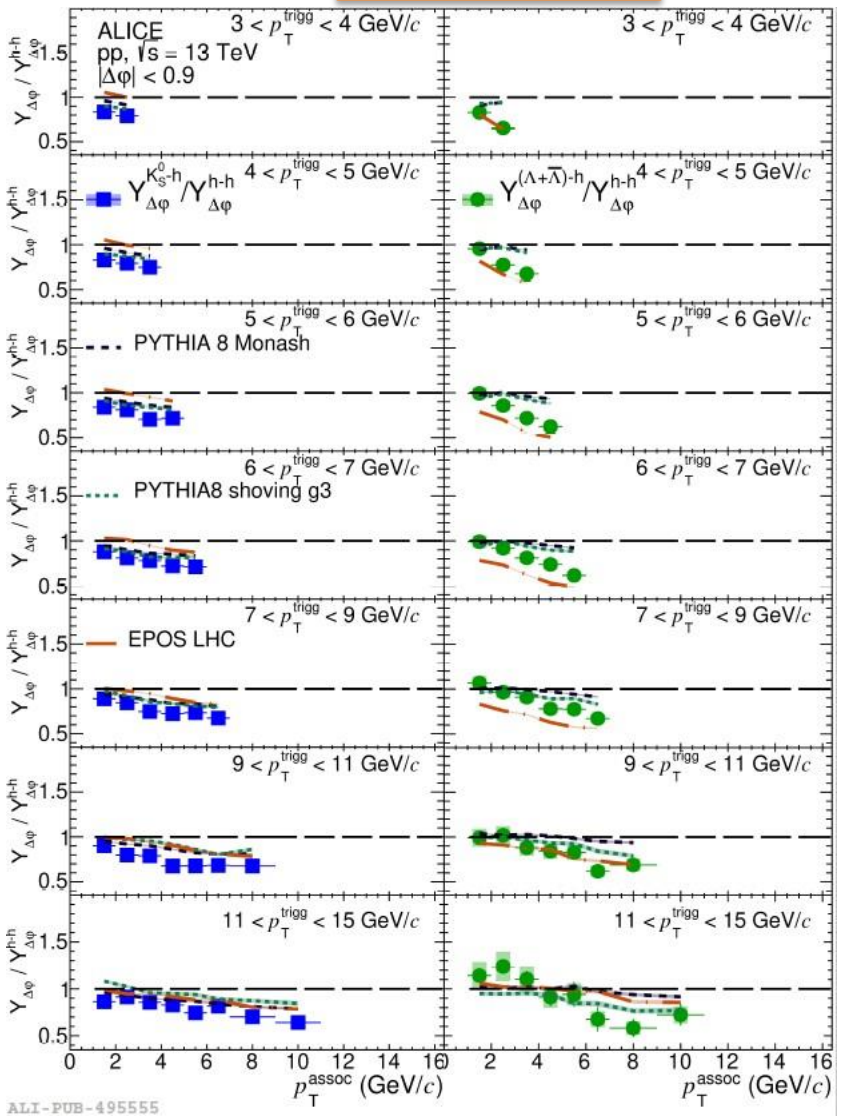




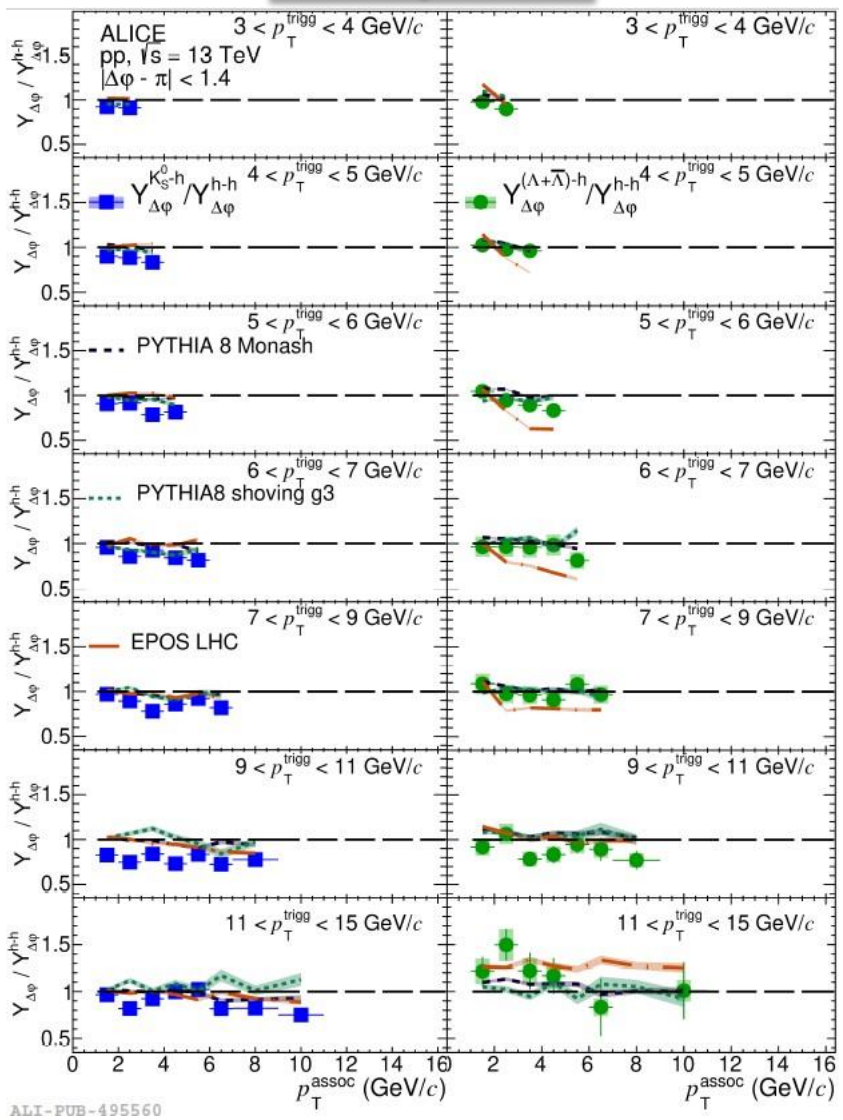
- EPOS, PYTHIA qualitatively describes the ratios in pp
- HIJING qualitatively describes the ratios in Pb–Pb

Jet−like yield ratios to h−h yields @$\sqrt{s}$ =13 TeV model comparison

Near-side



Away-side



arxiv/2107.11209

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

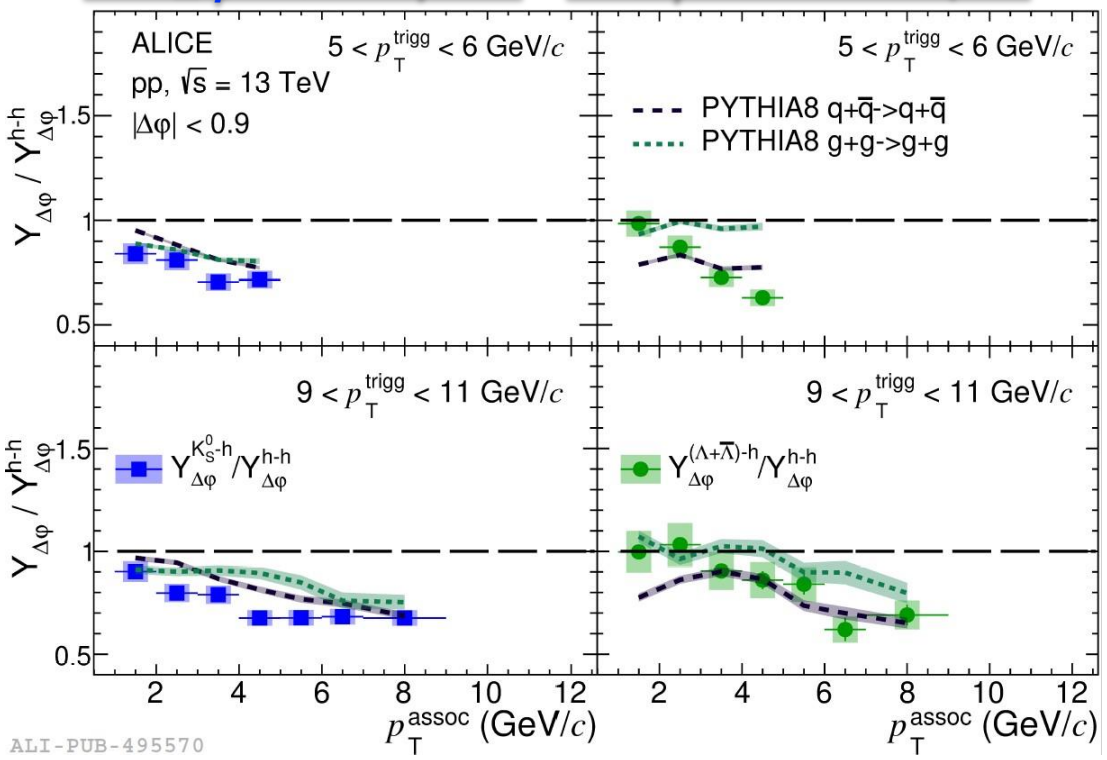
$Y_{\Delta\varphi}^{K_S^0-h} / Y_{\Delta\varphi}^{h-h}$

- the ratios of different $p_{T,\mathrm{trig}}$ with $p_{T,assoc}$ compared with EPOS,PYTHIA8-Monash and PYTHIA8 shoving g3
- Similar trend in pp $\sqrt{s} = 5$ TeV at high $p_{T,\mathrm{trig}}$

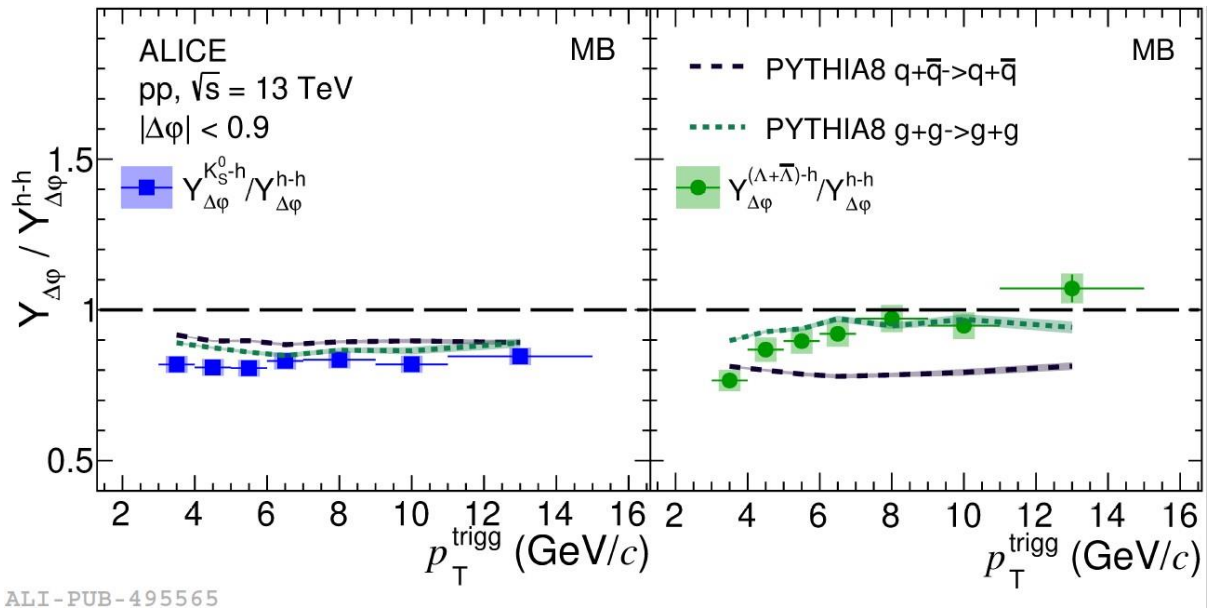
Near−side Jet−like yield ratios to h−h yields @ $\sqrt{s}$ =13 TeV model comparison

arxiv/2107.11209

$Y_{\Delta\varphi}^{K_s^0-h}/Y_{\Delta\varphi}^{h-h}$ $Y_{\Delta\varphi}^{(\Lambda+\bar{\Lambda})-h}/Y_{\Delta\varphi}^{h-h}$



$p_{\mathrm{T},trig}$ dependence



- ratio with PYTHIA8 exclusive hard processes containing only : $q + \bar{q} \rightarrow q + \bar{q}$ or $g + g \rightarrow g + g$.
- the ratio in case K_s^0 -triggered yields is almost identical for both quark and gluon jets.
- the ratio in case$(\Lambda + \bar{\Lambda})$-triggered yields from gluon jets is significantly higher than the one from quark jets.
- the difference in the ratio caused by the bias towards gluon jets through triggering with Λ or $\bar{\Lambda}$.

Summary

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

- Clear ordering on the near-side yield in pp and no strong trigger particle dependence in Pb–Pb
- I_{AA} shows strong enhancement at low $p_{T,assoc}$ in near-side and away-side for all particles species
- I_{AA} shows strong suppression at high $p_{T,assoc}$ 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 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 in Pb–Pb while PYTHIA and EPOS perform better than other models for pp
- Similar trends of jet-like yields triggered ratios of K_s^0 and Λ to h-h has been observed at 13 TeV.
- triggering with $(\Lambda+\overline{\Lambda})$ caused a bias towards gluon jets .

Back-up

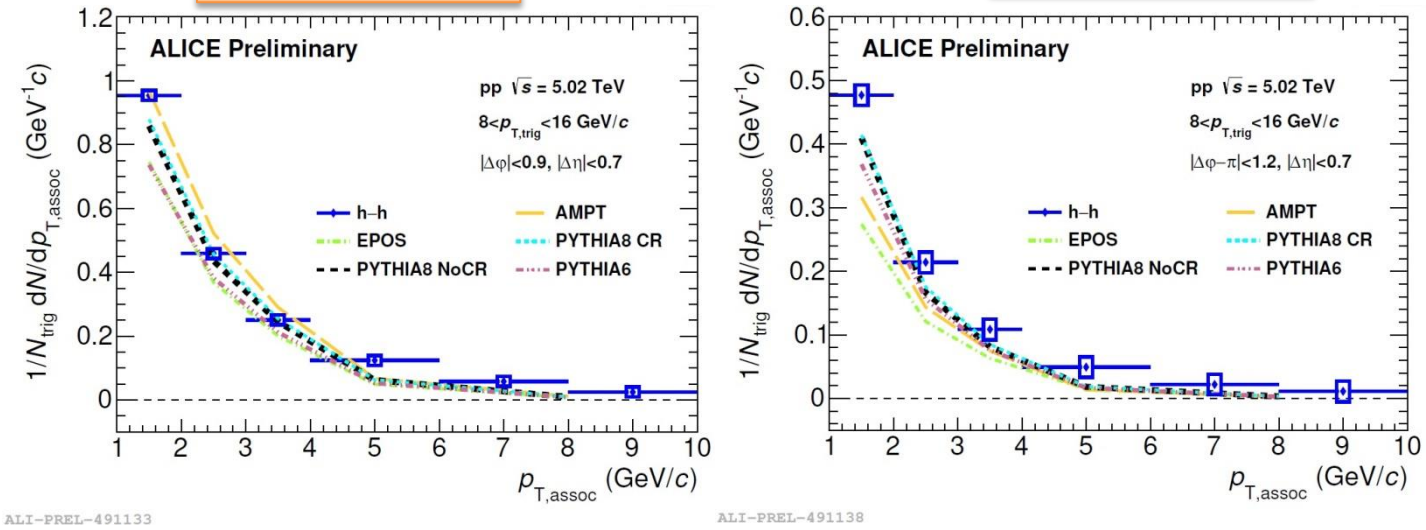
Jet–like yield Model comparison

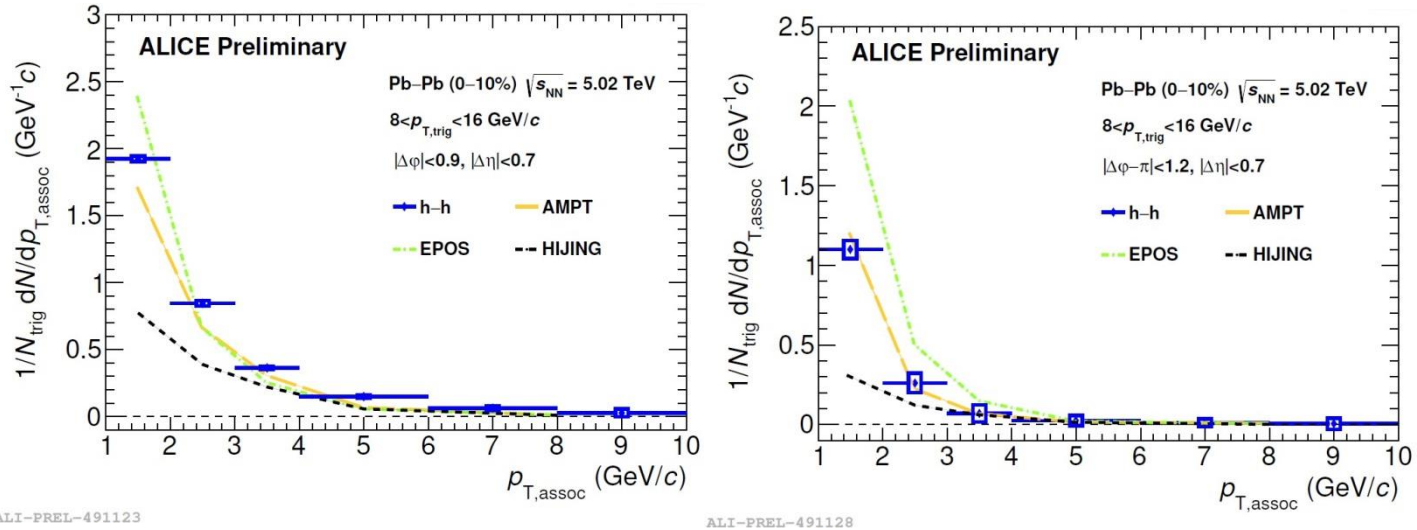
New

pp

Pb–Pb

Near-side $(h-h)$ Away-side





- AMPT,EPOS and PYTHIA qualitatively describes the yield in pp except lowest p_T
- AMPT and EPOS qualitatively describes the yield in Pb–Pb

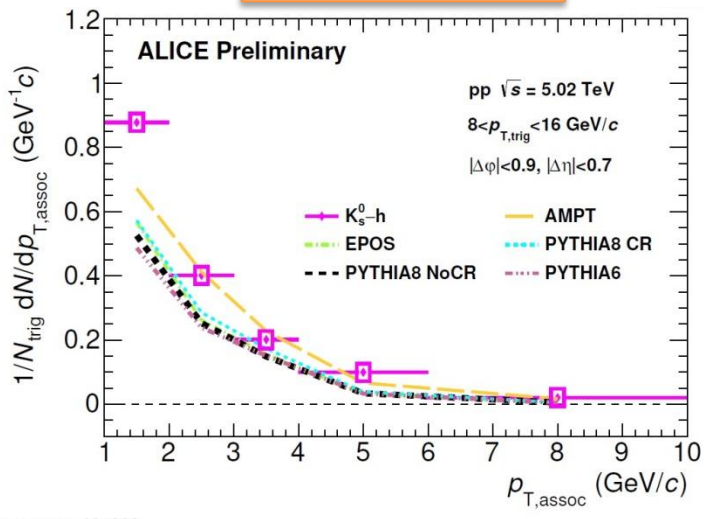
Jet–like yield Model comparison

New

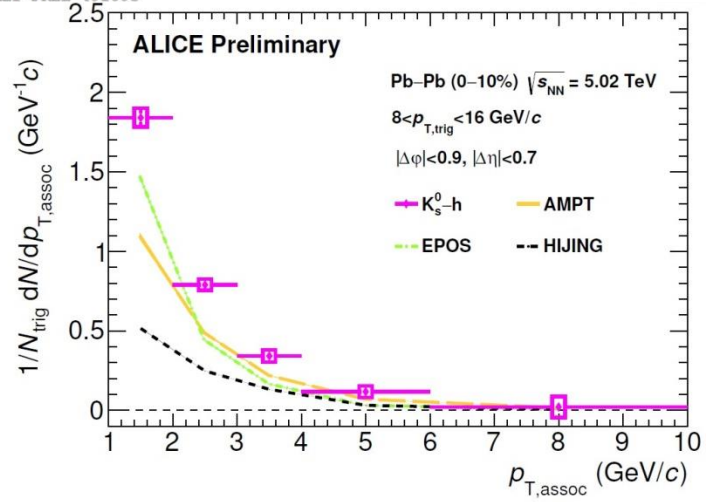
pp

Pb–Pb

Near-side $(K_s^0-\mathrm{h})$

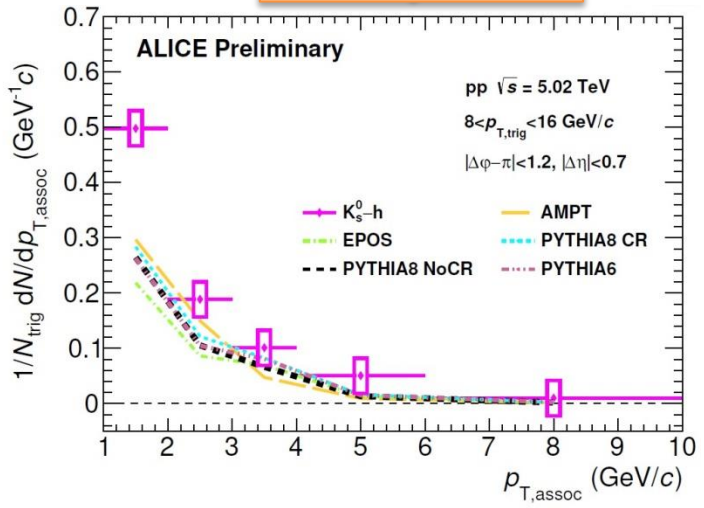


ALI-PREL-491093

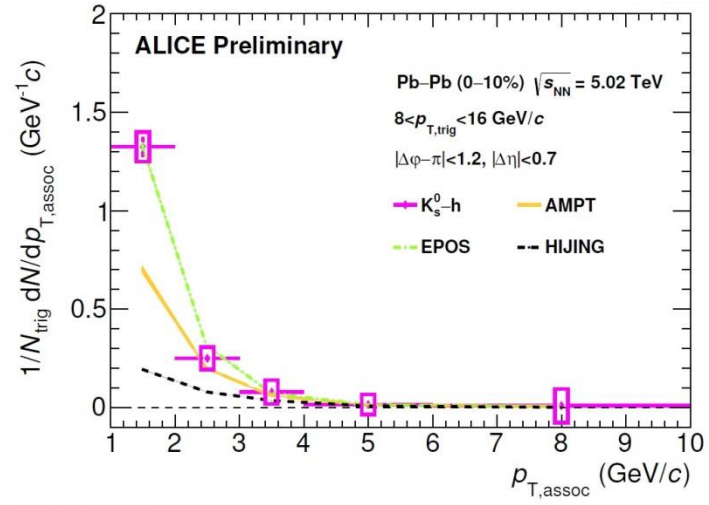


ALI-PREL-491083

Away-side



ALI-PREL-491098



ALI-PREL-491088

- AMPT,EPOS and PYTHIA qualitatively describes the yield in pp except lowest p_T
- AMPT and EPOS qualitatively describes the yield in Pb–Pb except lowest p_T

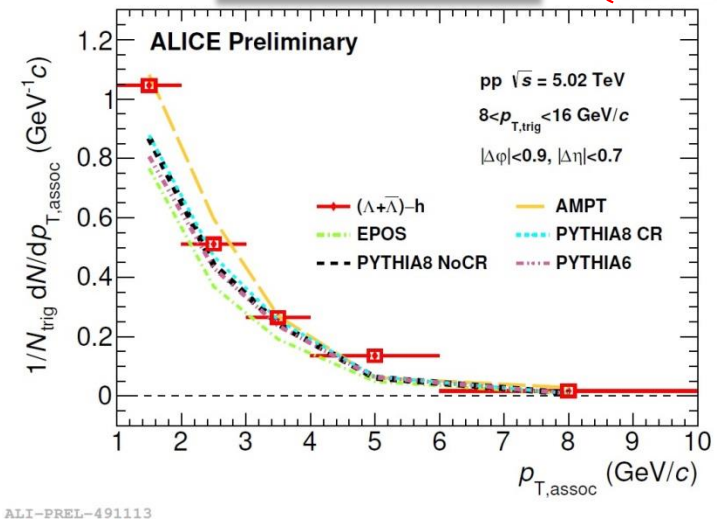
Jet−like yield Model comparison

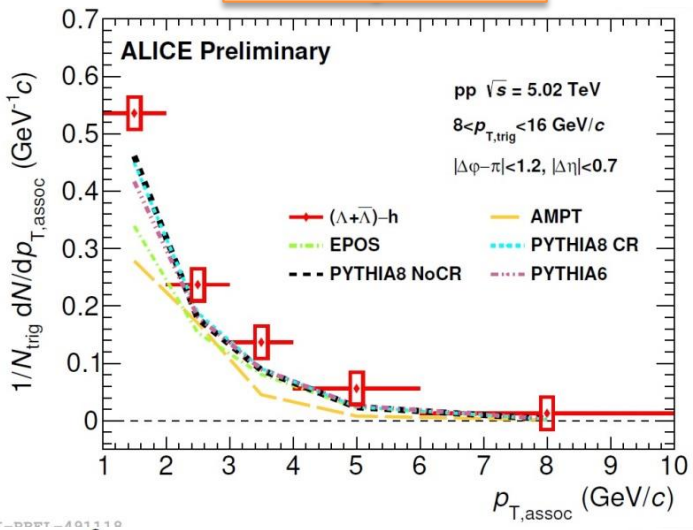
New

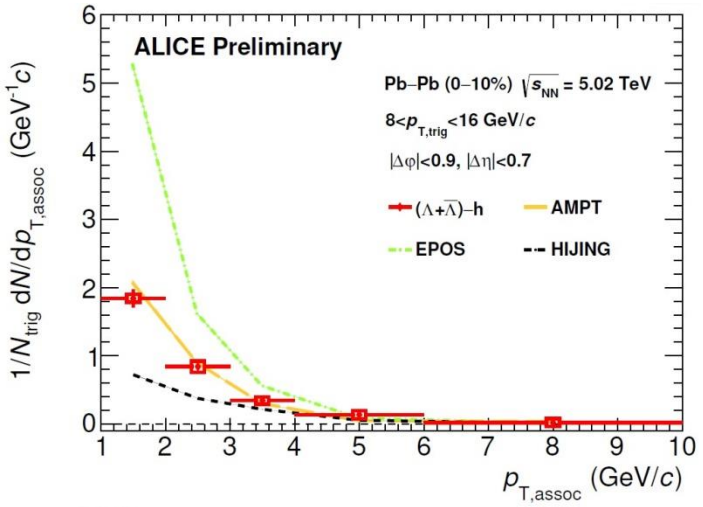
pp

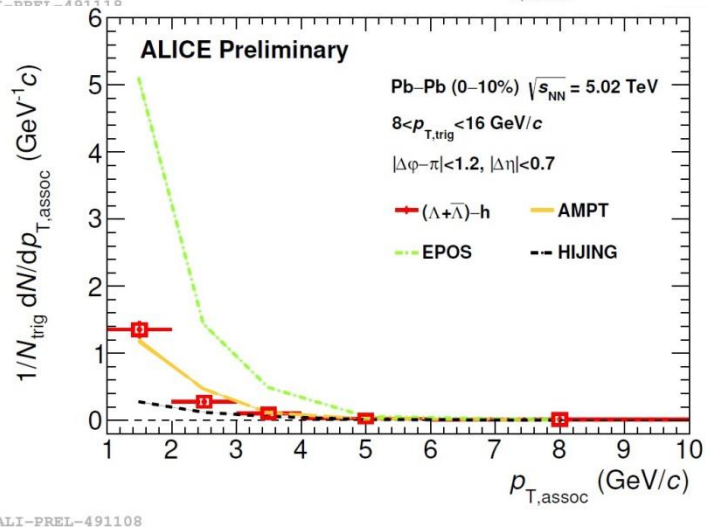
Pb–Pb

Near-side $(\Lambda + \bar{\Lambda}) - h$ Away-side









- AMPT,EPOS and PYTHIA qualitatively describes the yield in pp except lowest p_T
- AMPT qualitatively describes yield in Pb–Pb except lowest p_T.