Jet-shape modification in $\sqrt{s_{NN}}$ = 2.76 TeV Pb-Pb and pp collisions

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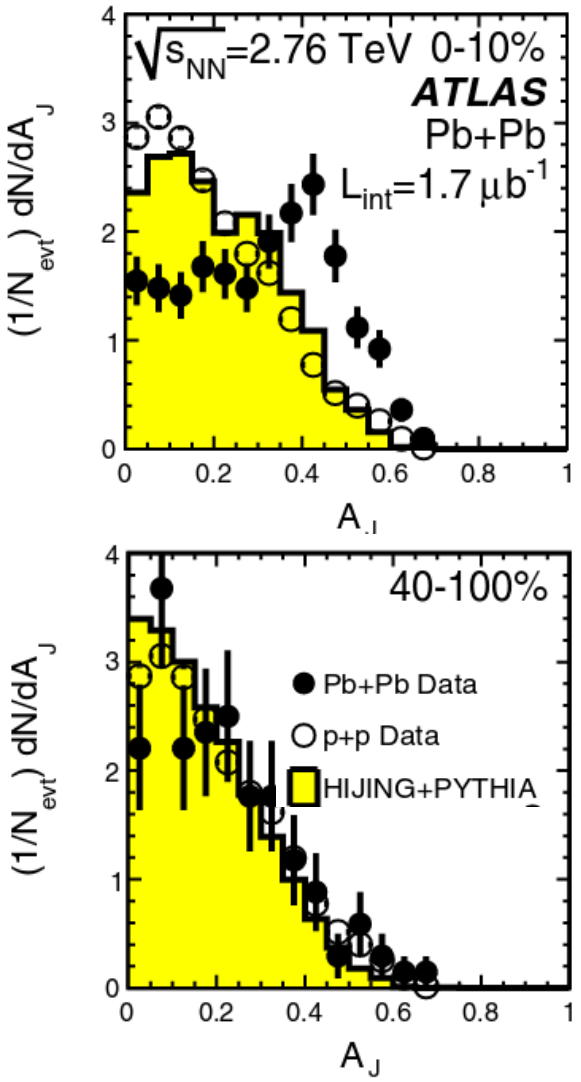
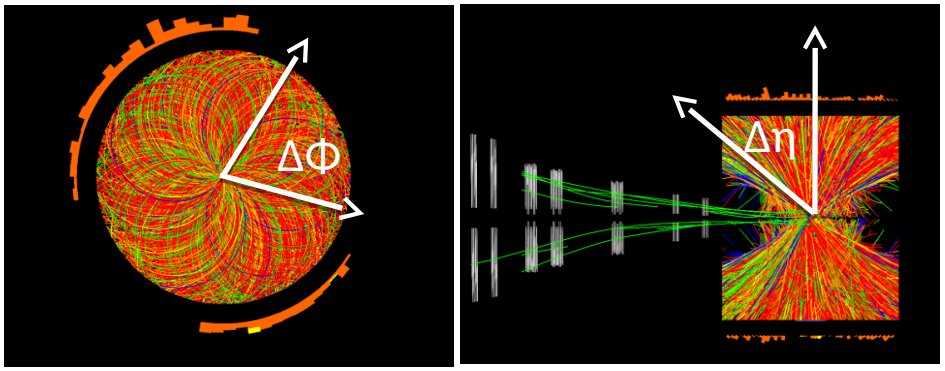
Jet energy loss (w/ jet reconstruction)

- Strong jet quenching is observed in HIC
- Analyses based on fully reconstructed jets:
  - strong di-jet energy asymmetry
    [ATLAS PRL 105(2010) 252303, CMS, PRC 84, 024906 (2011)]
  - centrality dependence of jet fragmentation
    [CMS arXiv:1406.0932]
  - quenched energy reappears at low p_T,
    also outside the jet cone
    [CMS, PRC 84, 024906 (2011)]

Two-particle correlations provide additional information

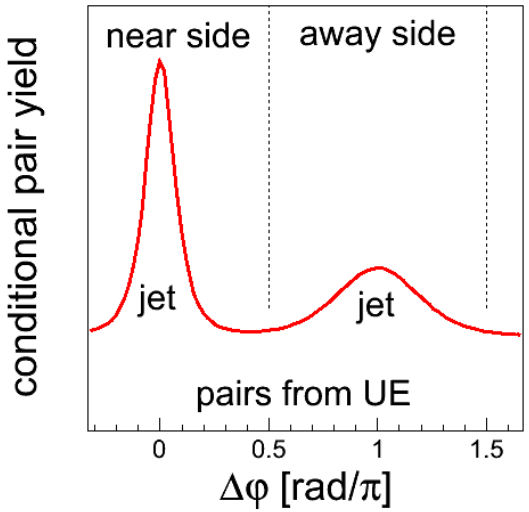


Di-hadron correlations



- Studying lower energy jets
- Statistical treatment
- Basic quantities

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



Near side (intra jet) :
Single jet properties

jet fragmentation in the transverse plane

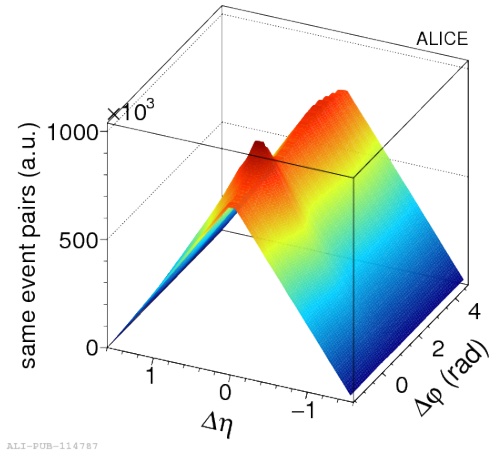
Away side (inter jet) :
Di-jet properties

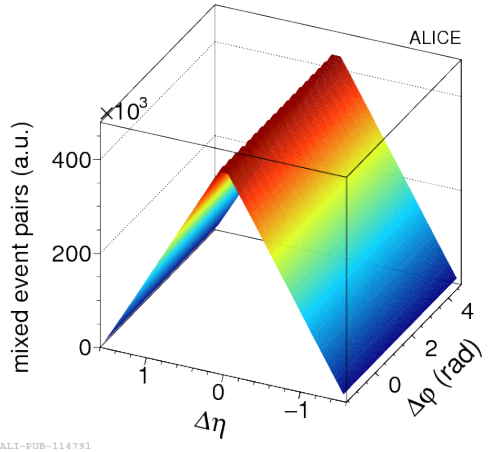
accoplanarity + momentum imbalance due to k_T

Analysis details

- Analyze per-trigger yield
  (positive and negative Δη symmeterized)

$$Y(|\Delta\eta|) = \frac{1}{N_{\mathrm{trigg.}}} \frac{dN}{d|\Delta\eta|}$$





- Event mixing corrects for experimental effects

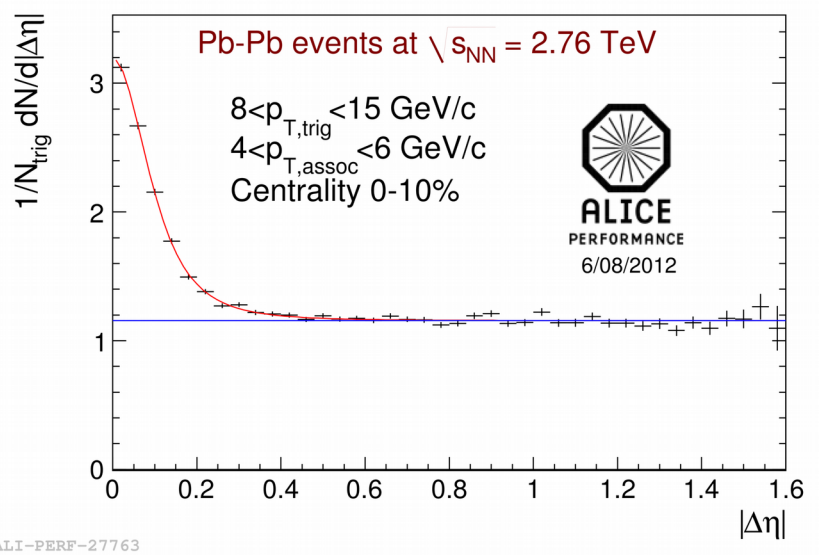
- Background level estimated by fit:

  Kaplan function plus constant $f(|\Delta\eta|) = A(1 + b|\Delta\eta|^2)^{-n} + k$

- Evaluate ratio:

$$I_{\mathrm{AA}}(|\Delta\eta|) = \frac{\mathrm{Y}^{\mathrm{Pb-Pb}}(|\Delta\eta|)}{\mathrm{Y}^{\mathrm{pp}}(|\Delta\eta|)}$$

(in R<0.2, $R = \sqrt{\Delta\varphi^2 + \Delta\eta^2}$



Energy loss in di-hadron correlations

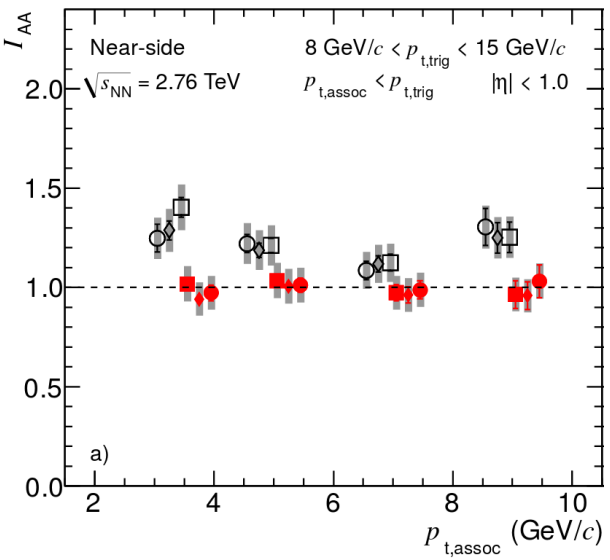
- I_{AA} measurements by ALICE for

  $8<p_{T,trig}<15$ GeV/c & 3 GeV/c < $p_{T,assoc}$< $p_{T,trig}$

  near side parton is sensitive to medium

  - modification of jet fragmentation (softening)?
  - modification of quark/gluon jet ratio?
  - bias of the parton p_T spectrum after energy loss due to trigger selection ?

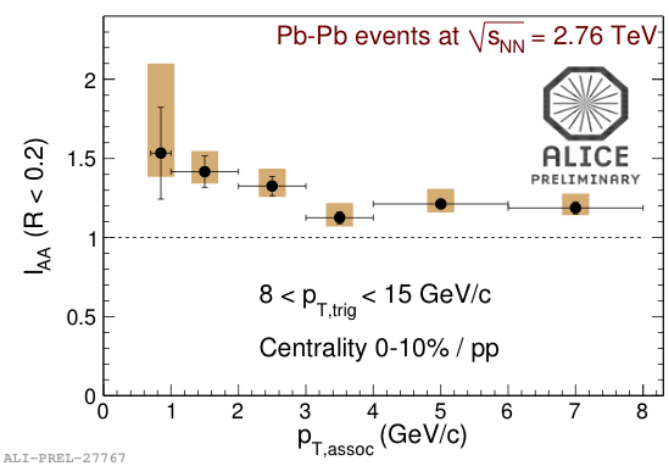
ALICE, PRL108, 092301



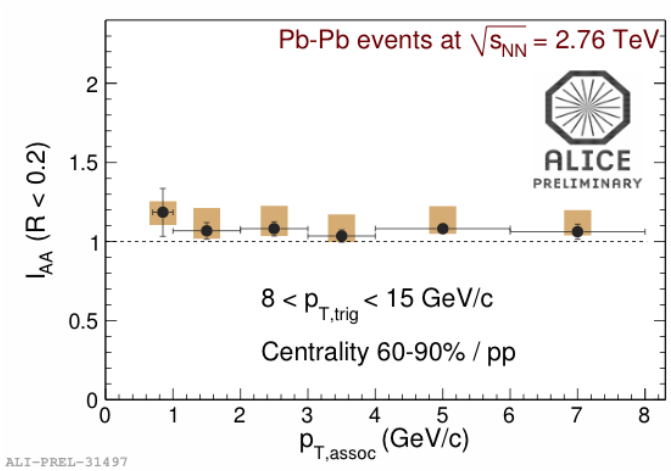
- Near side I_{AA} at lower $p_{T,assoc}$?
- Near side modification in transverse jet shape?

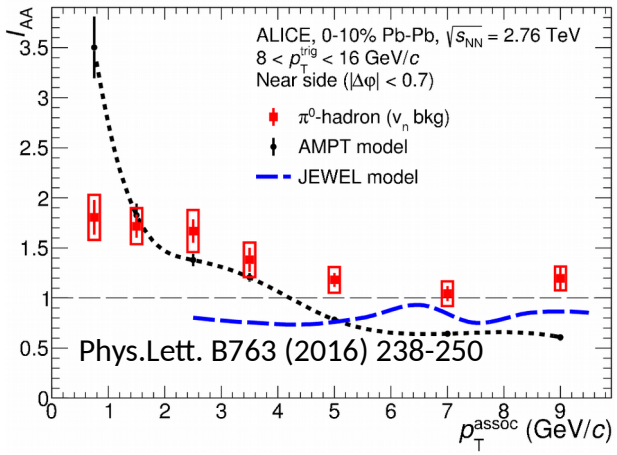
I_{AA} at low p_T

Near side I_{AA} in 0-10%: moderate enhancement by ~ 20-50%



60-90%: less enhancement, no p_T-dependence



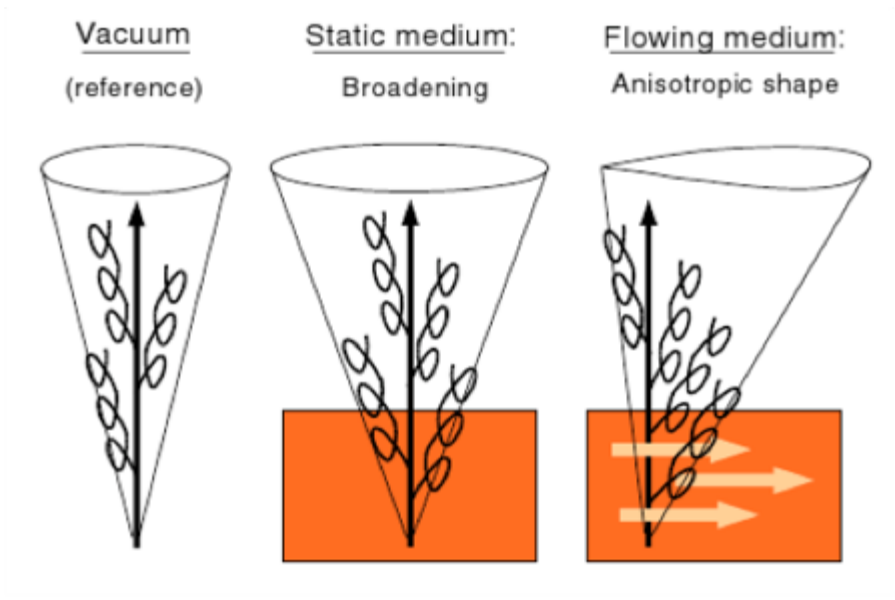


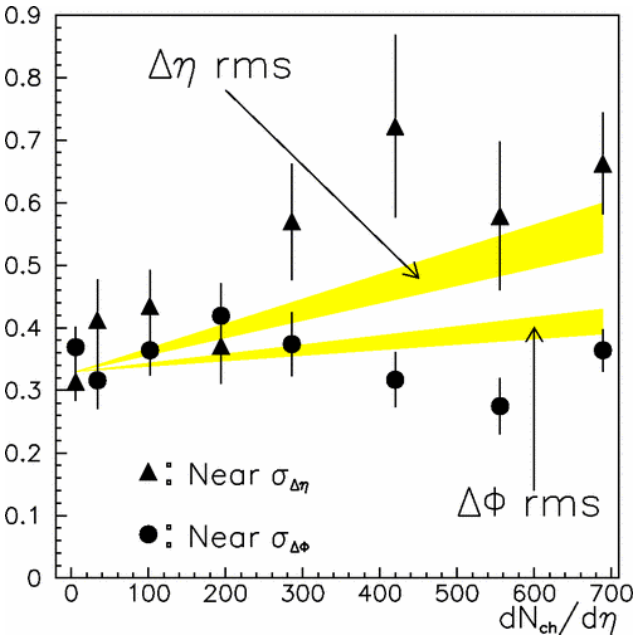
Same with identified (π^0) trigger

Only AMPT describes data qualitatively

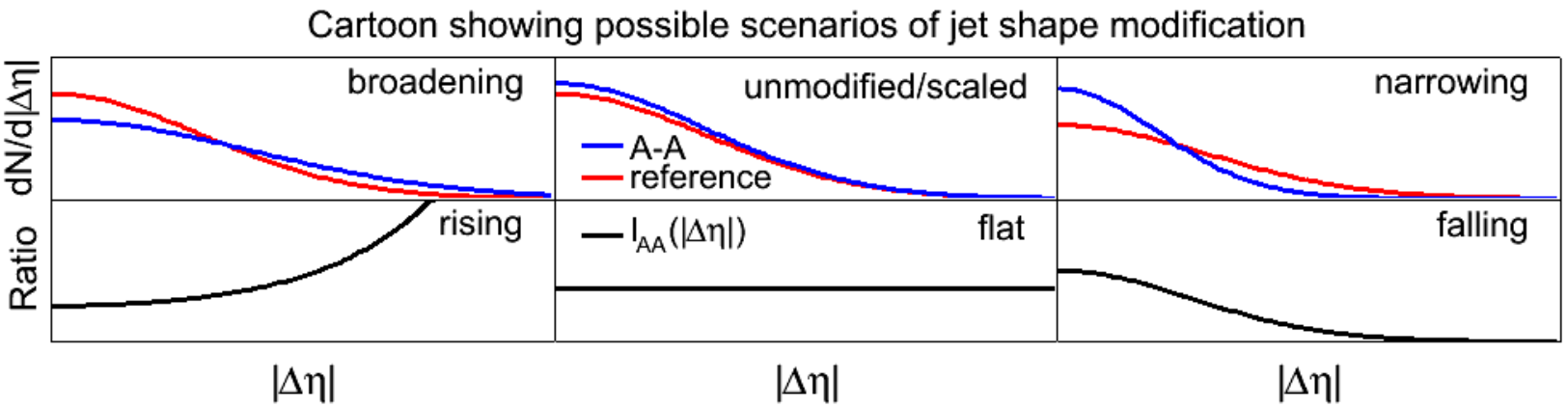
Can flow deform the peak?

- Armesto, Salgado, Wiedemann suggested that longitudinal flow can deform the conical jet shape (PRL 93,242301 (2004))
- Interplay between jet and flow
- Study I_{AA} as a function of $\Delta\eta$



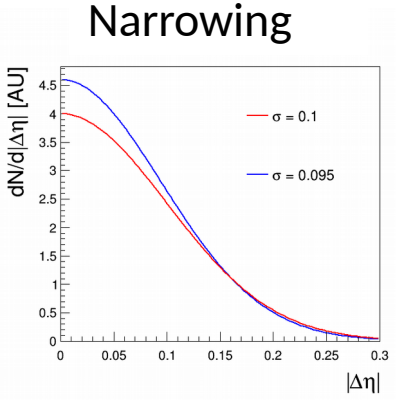


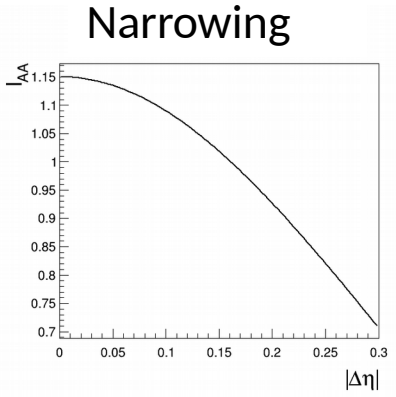
Interpretation of $I_{AA}(\Delta\eta)$



Sensitive tool to study jet shape modification

5% difference in RMS results in significant falling in I_{AA}

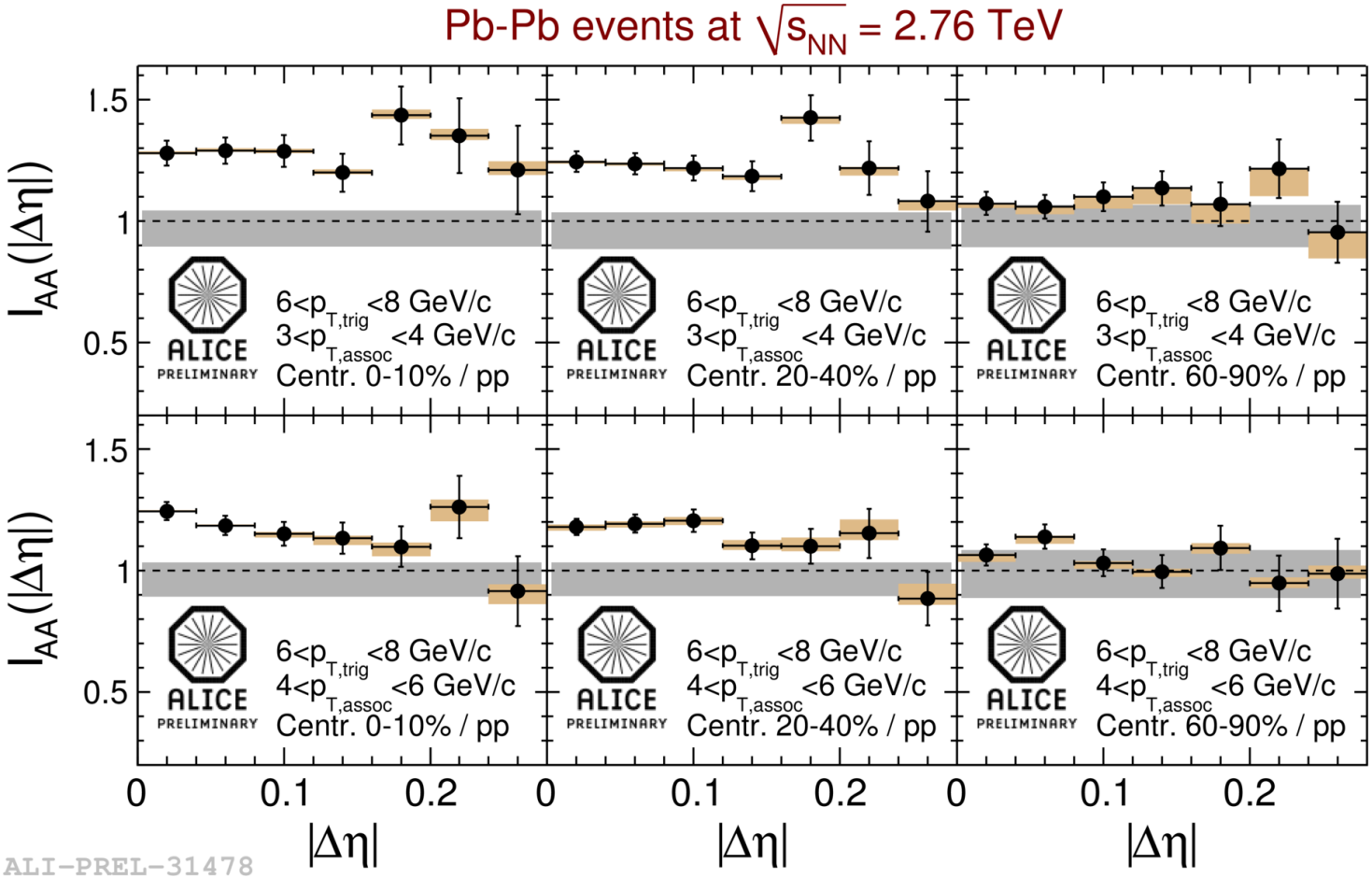




$I_{AA}(|\Delta\eta|)$ at intermediate p_T ($6<p_{T,trig}<8$ GeV/c)

Centrality

$p_{T,assoc}$



Trend of $I_{AA}(|\Delta\eta|)$ is consistent with being flat.

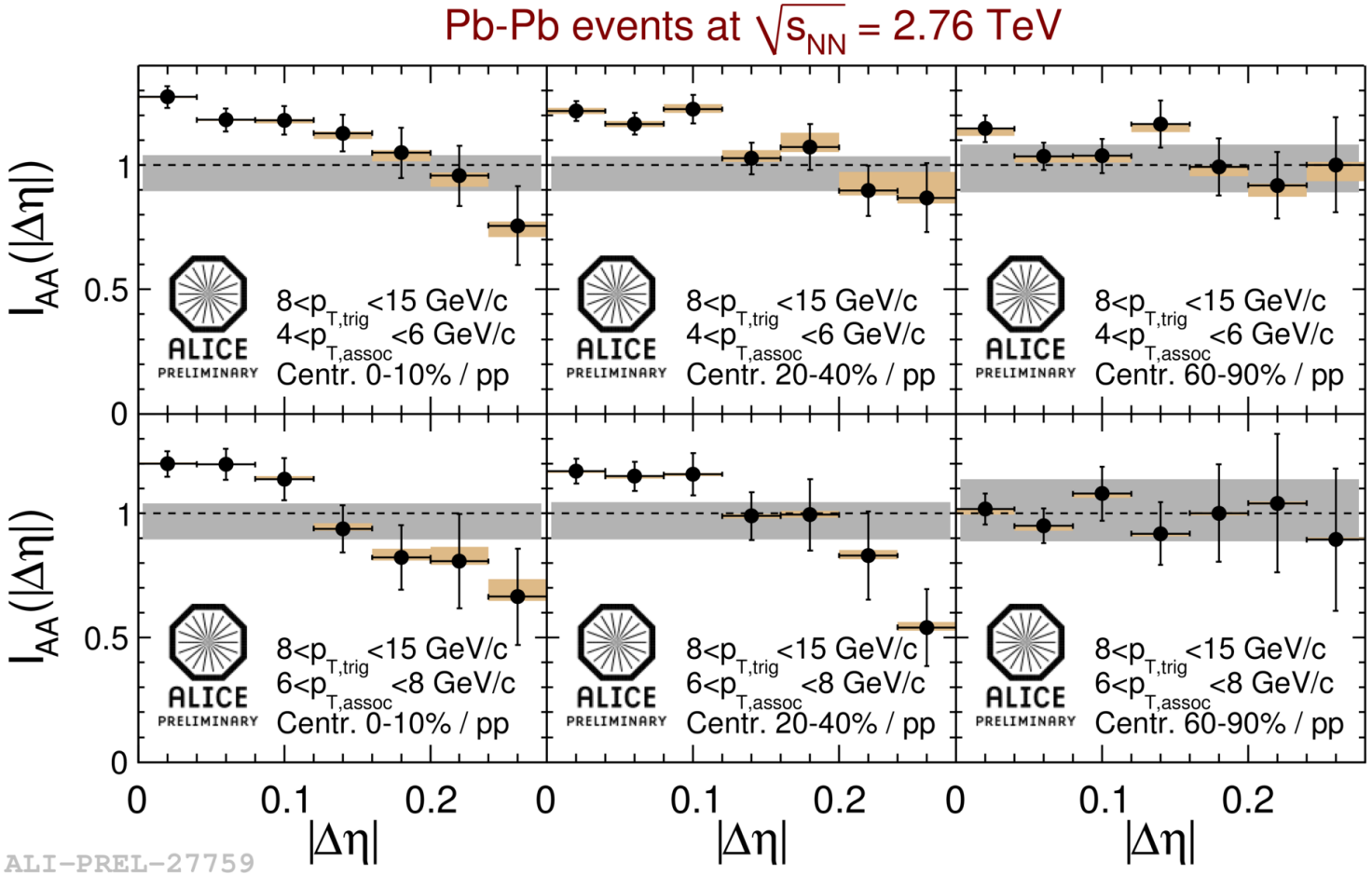
Gray band gives scaling uncert.

Brown boxes show point-to-point variable syst. uncert.

$I_{AA}(|\Delta\eta|)$ at high p_T ($8<p_{T,trig}<15$ GeV/c)

Centrality

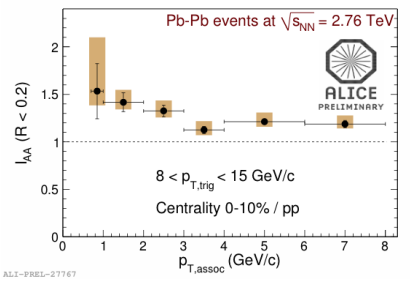
$p_{T,assoc}$



Trend of $I_{AA}(|\Delta\eta|)$ shows a possible onset of jet shape modification in $\Delta\eta$ (narrowing). Only at high p_T.

Summary

- Near side I_{AA} measured in 0-10% most central Pb-Pb collisions in cone with R=0.2 exhibits enhancement of 20-50% down to $p_{T,assoc} = 0.7$ GeV/c



- At high p_T ($8<p_{T,trig}<15$ GeV/c + 4GeV/c < $p_{T,assoc}$ < $p_{T,trig}$) we see a hint for narrowing along $\Delta\eta$

- Lower p_T shows broadening (both $\Delta\eta$ and $\Delta\varphi$)

- Energy loss of high-p_T partons?