Reconstructed jets in a multi-phase transport model

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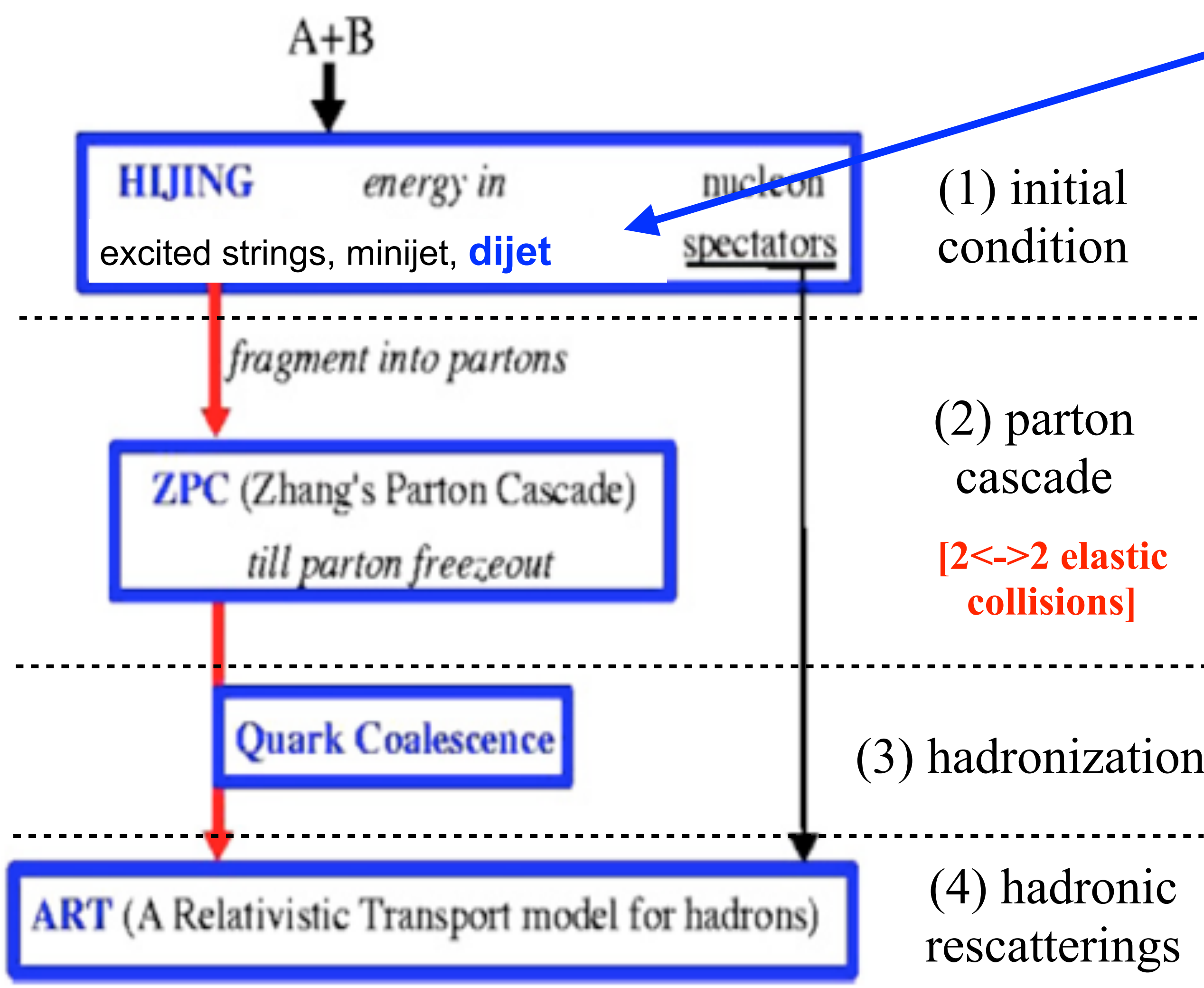
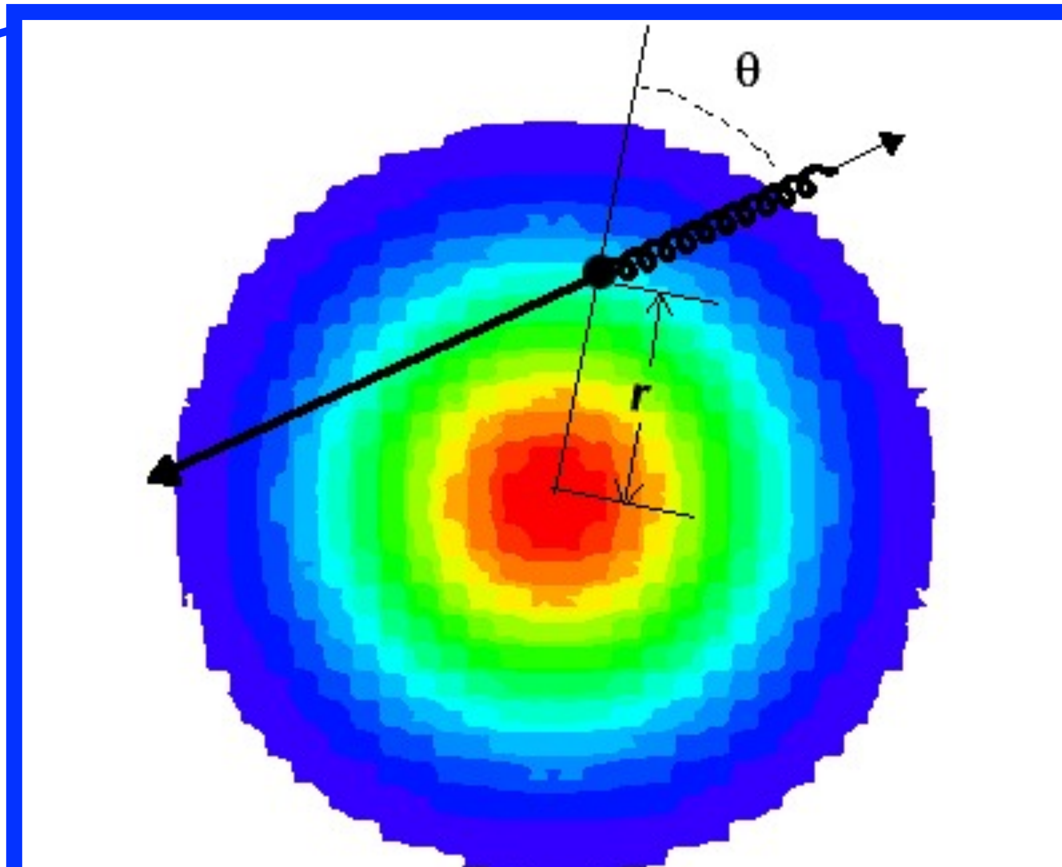
Outline

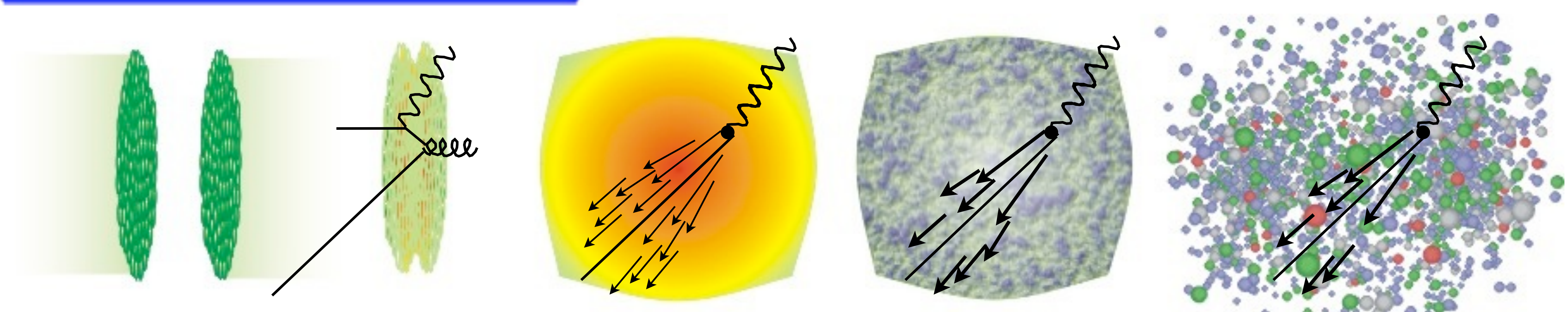
- Model introduction
- Results on reconstructed jets
  - Dijet asymmetry
  - Jet shape
  - Jet fragmentation function
  - Jet vn
  - Overall balance of dijet event
- Summary

AMPT model with triggered jet



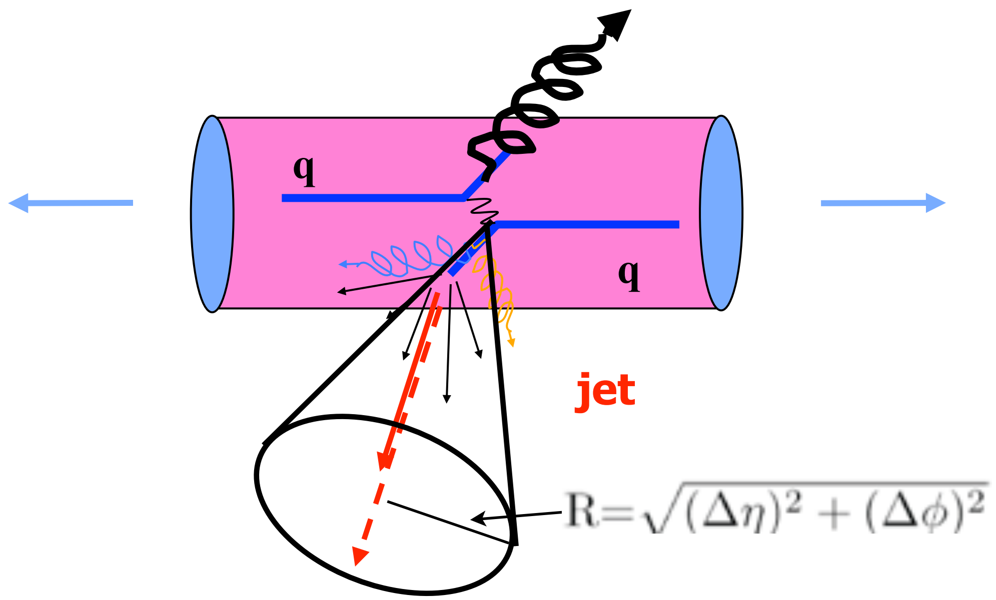


a triggered dijet/γ-jet with known momentum and production position (r,θ)



- Dijet events for Pb+Pb 2.76-TeV collisions.
- String-melting AMPT simulations: **1.5 mb / 0 mb** to turn **on/off** jet-QGP interactions.

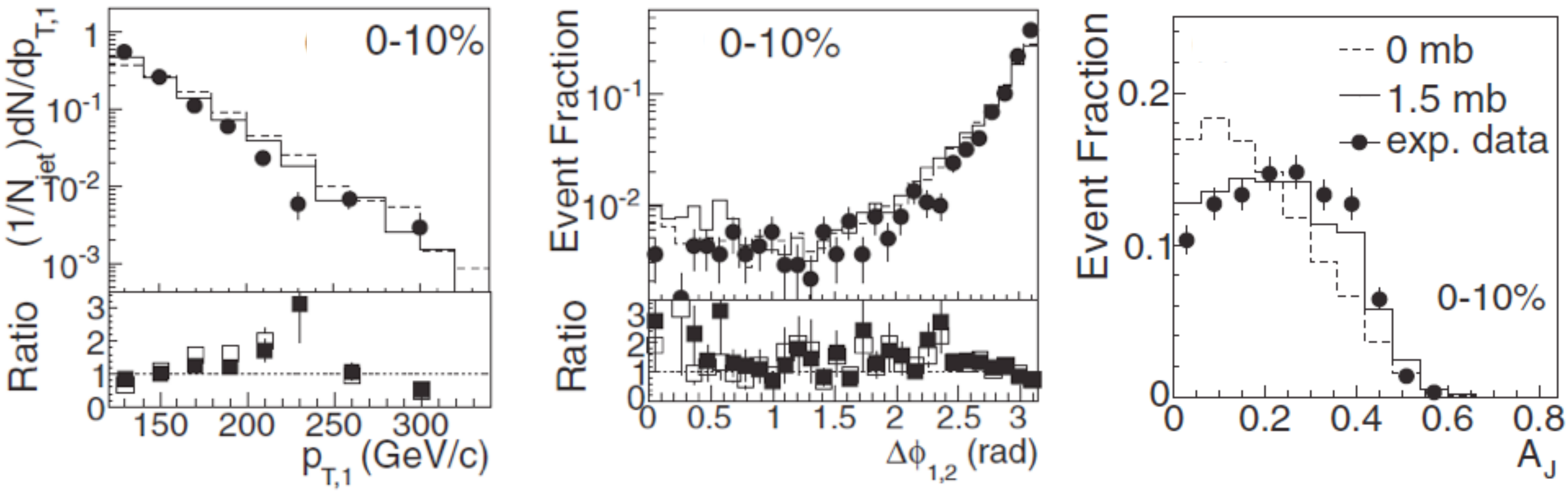
Jet reconstruction



- Jet reconstruction: anti-kt algorithm, [Fastjet package, background subtraction, jet energy scale correction, jet efficiency correction]
- Dijet asymmetry: R=0.5, $p_{T,1}$>120 GeV/c, $p_{T,2}$>50 GeV/c, $|\eta_{1,2}|<2$, $\Delta\phi_{12}>2\pi/3$
- Jet fragmentation function and shape: R=0.3, p_T^{jet}>100 GeV/c, $0.3<|\eta^{jet}|<2$, p_T^{ch}>1 GeV/c
- Jet v_n: R=0.2, p_T^{jet}>45 GeV/c, $|\eta^{jet}|<2$

Dijet characters

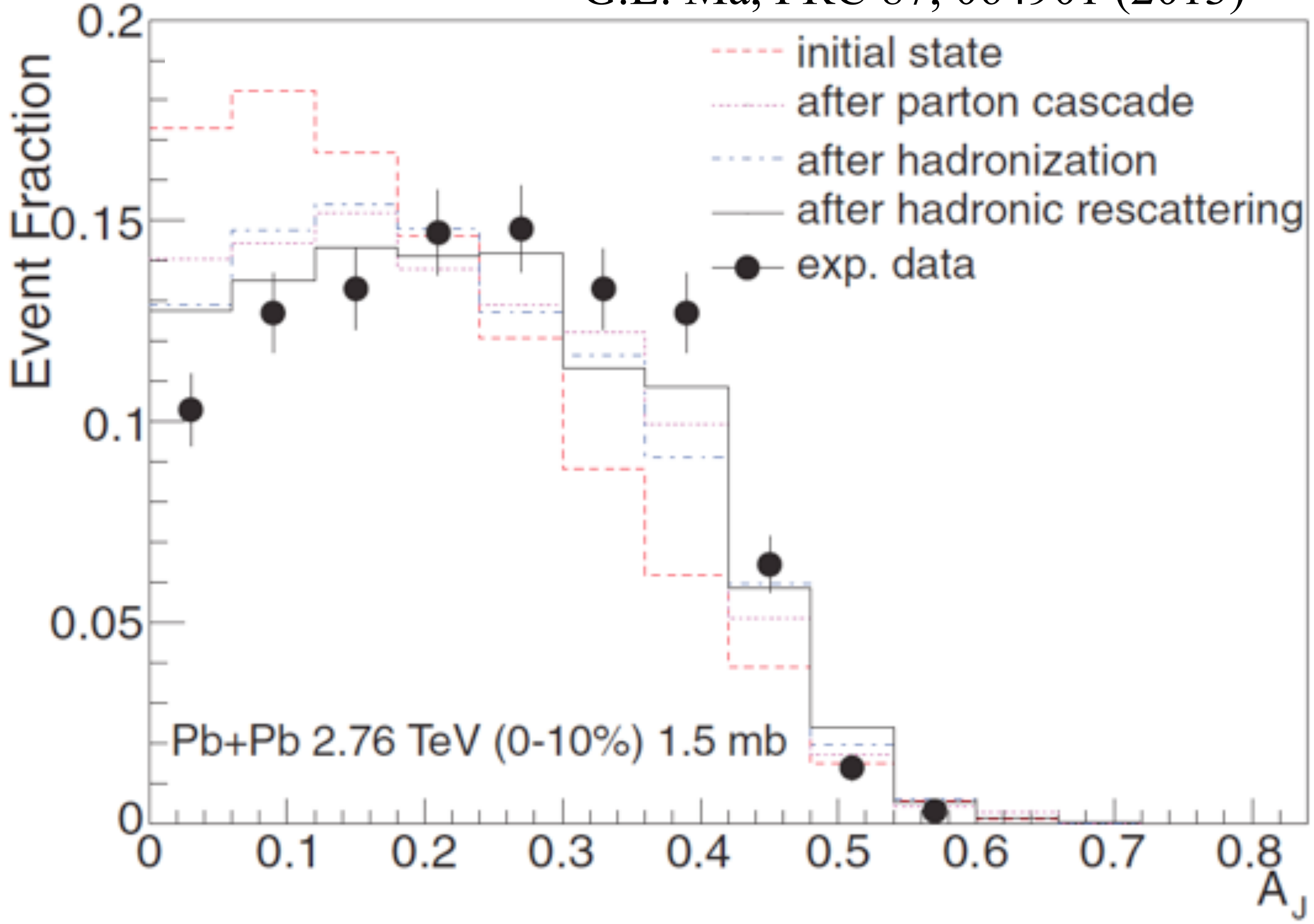
G.L. Ma, PRC 87, 064901 (2013)



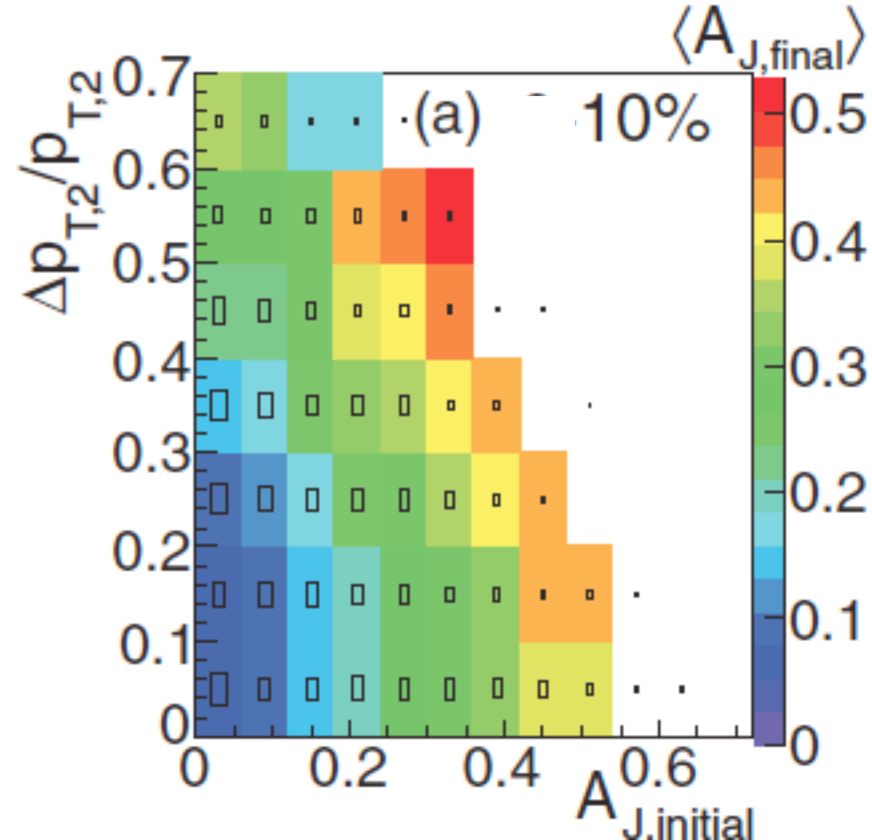
- Dijet p_T spectra and back-to-back azimuthal correlation are not sensitive to if partonic phase exists.
- Dijet asymmetry is enchanced due to strong parton cascade.

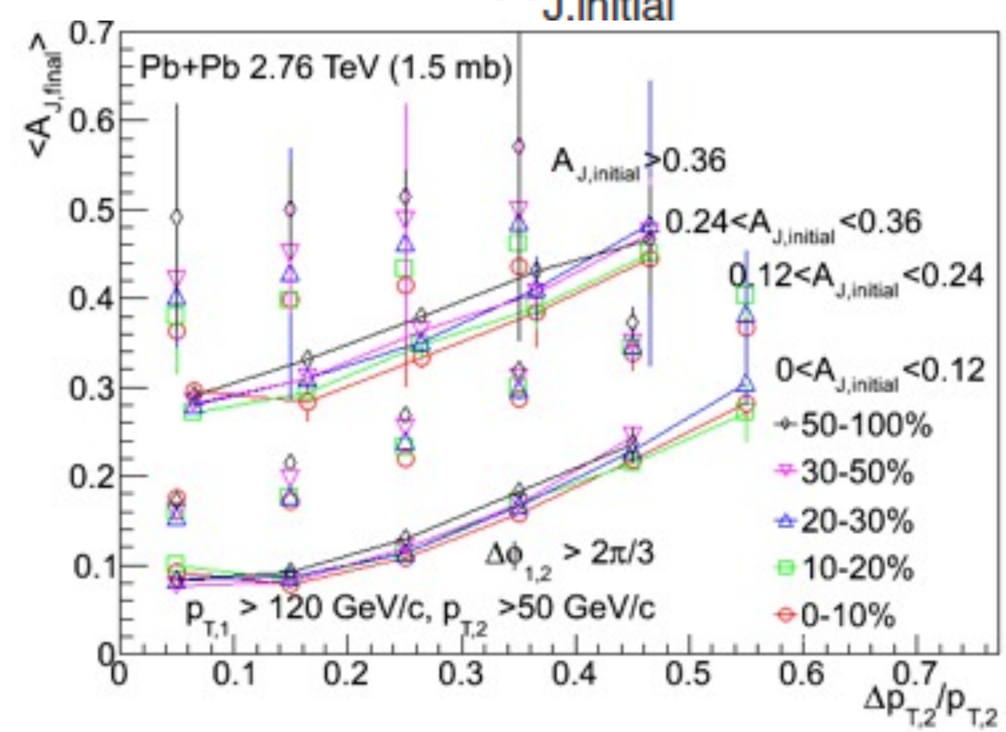
Dijet asymmetry

G.L. Ma, PRC 87, 064901 (2013)



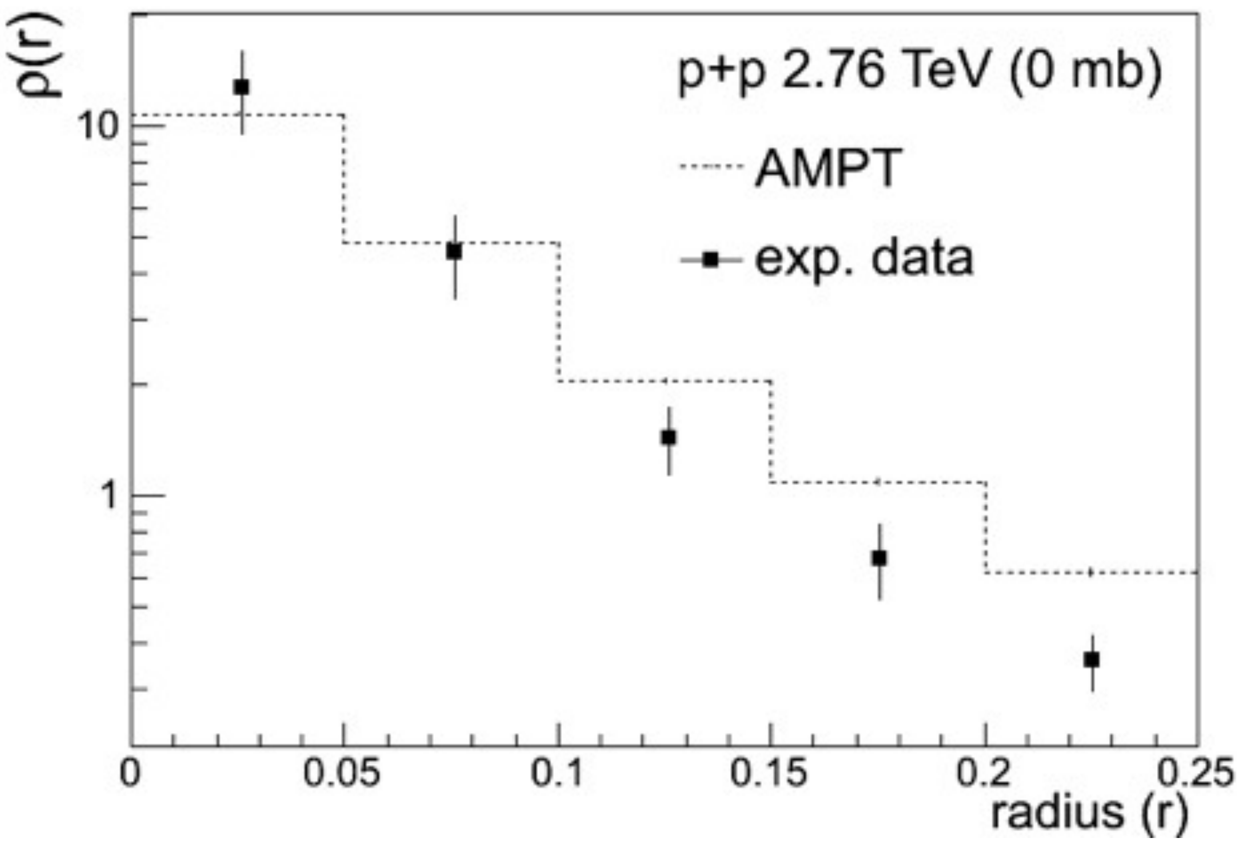
$A_{J,final} = f(A_{J,initial}, \Delta p_T/p_T)$



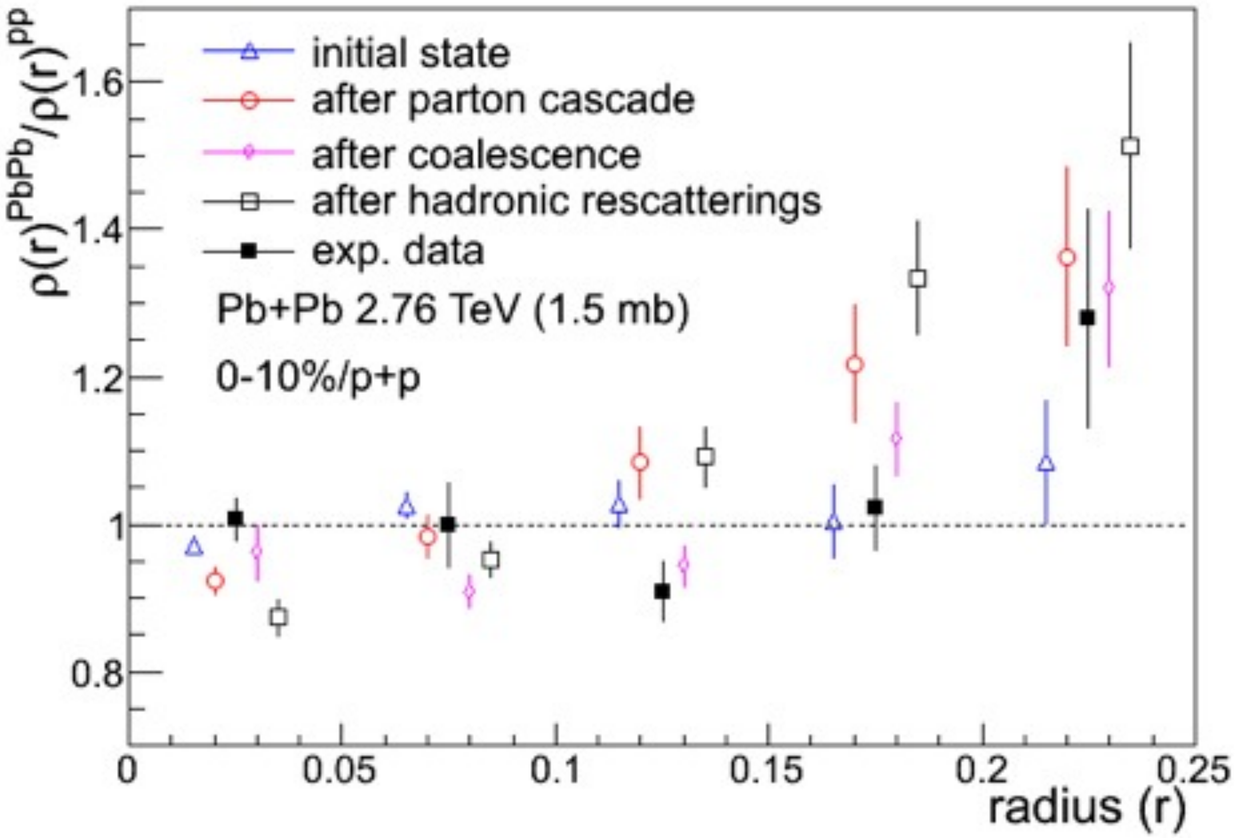


- A large dijet asymmetry (A_J) is produced by strong interactions between jets and partonic matter.
- The final A_J is driven by both initial A_J and partonic jet energy loss.

Jet shape

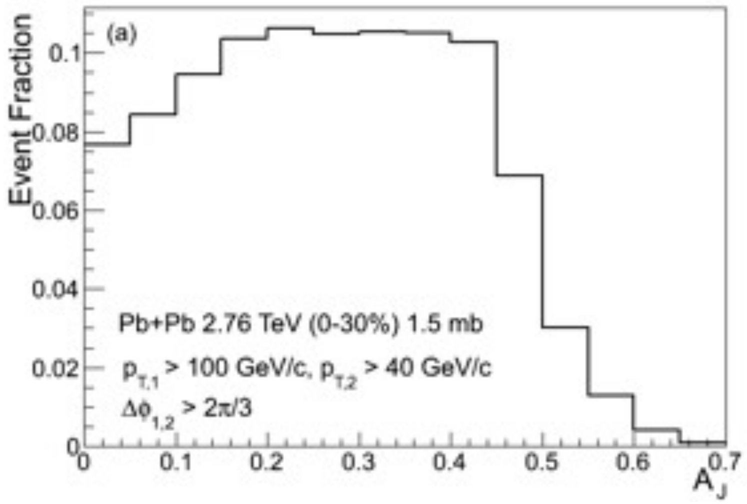


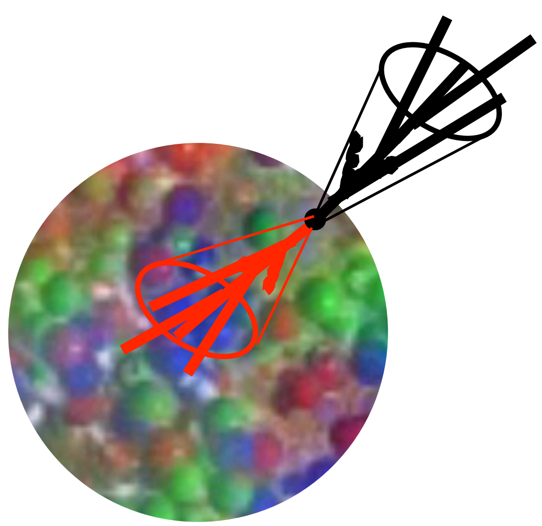
G.L. Ma, PRC 89, 024902 (2014)



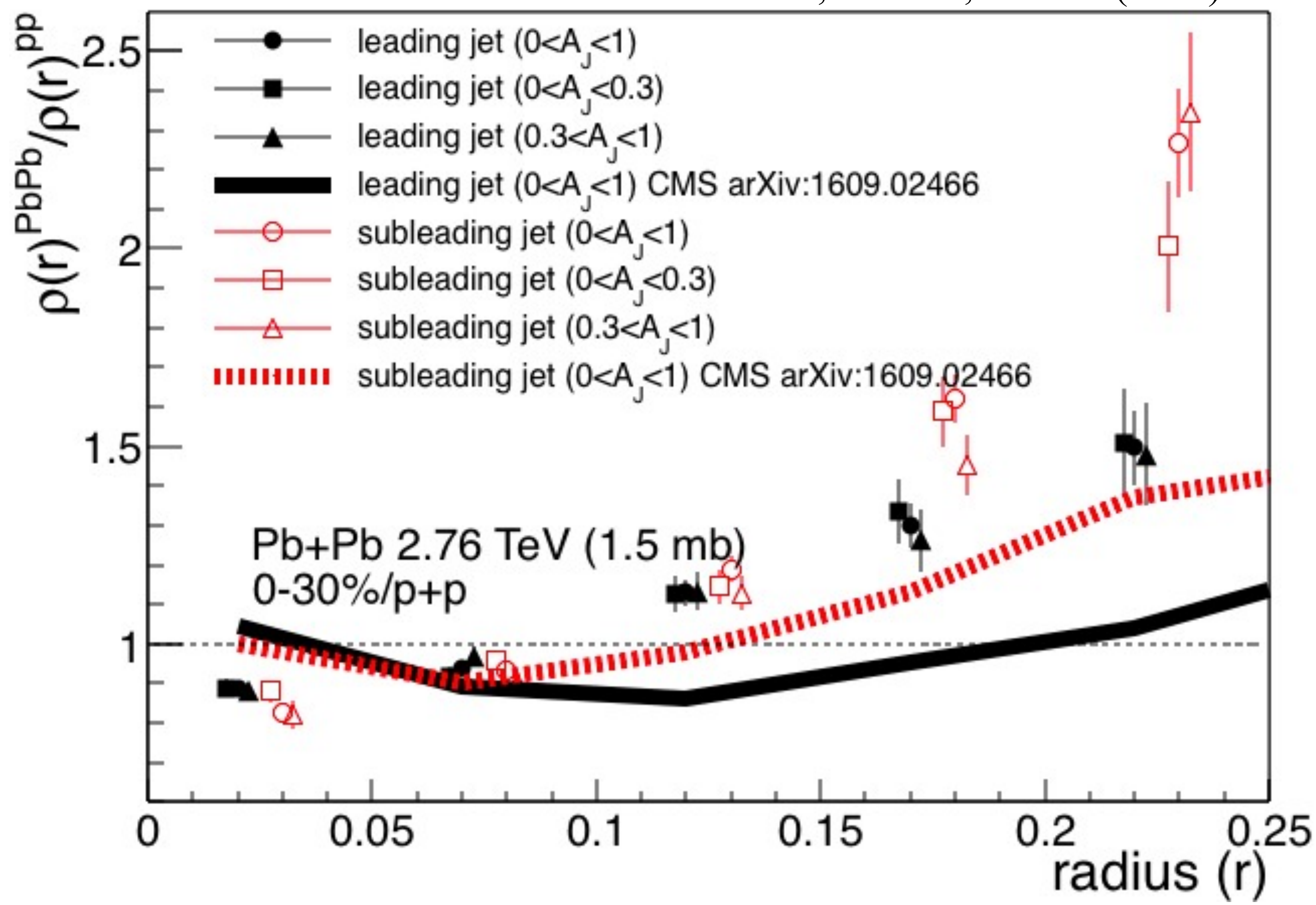
- **A dynamical evolution of jet shape modifications in A+A:**
  - **Parton cascade** :Jet energy is redistributed towards larger radius.
  - **Coalescence:** weaken the jet modification (a qualitative feature).
  - **Hadron rescatterings**: futher modification by pushing the jet energy outwards further.

Leading vs subleading jet shapes





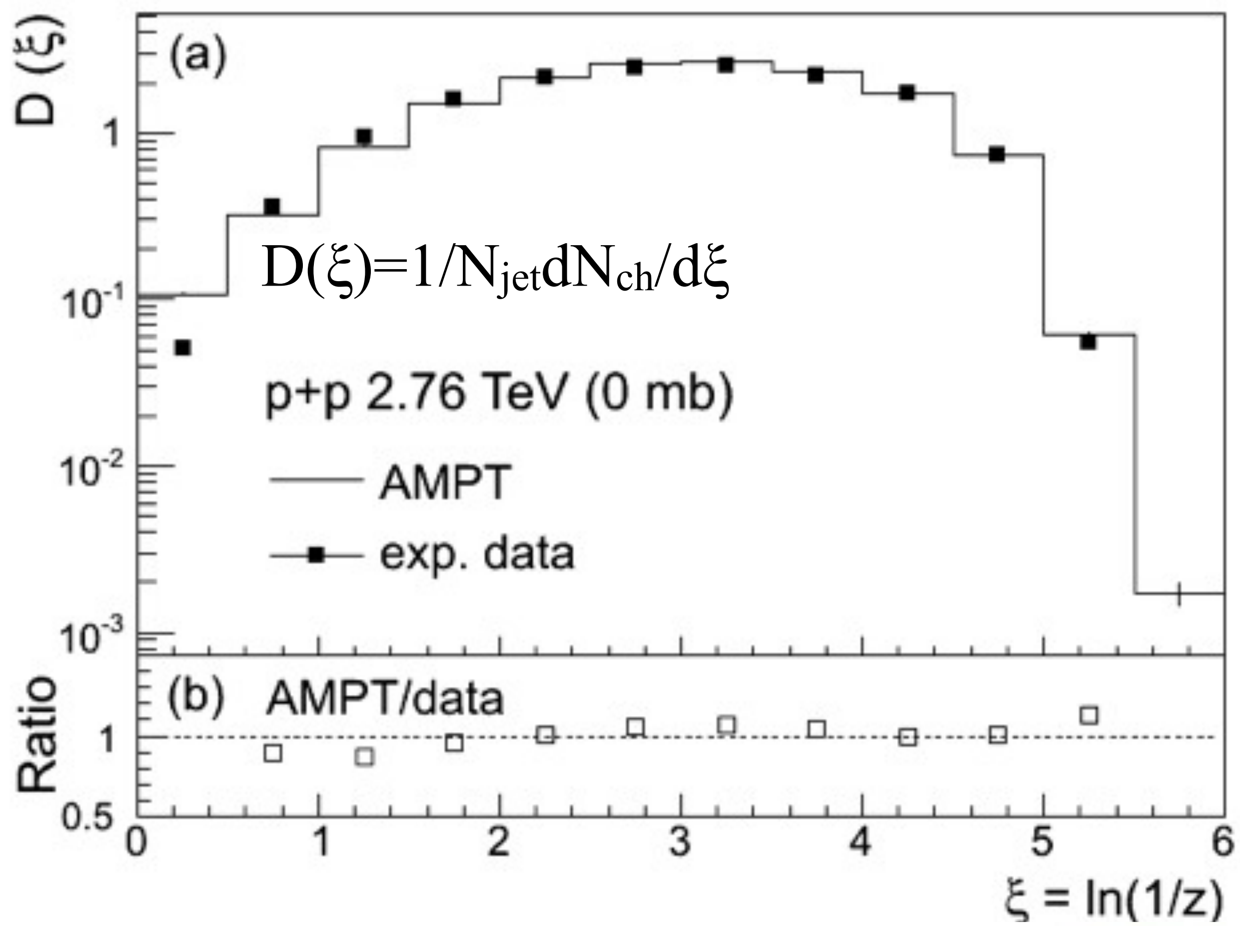
G.L. Ma, PRC 89, 024902 (2014)

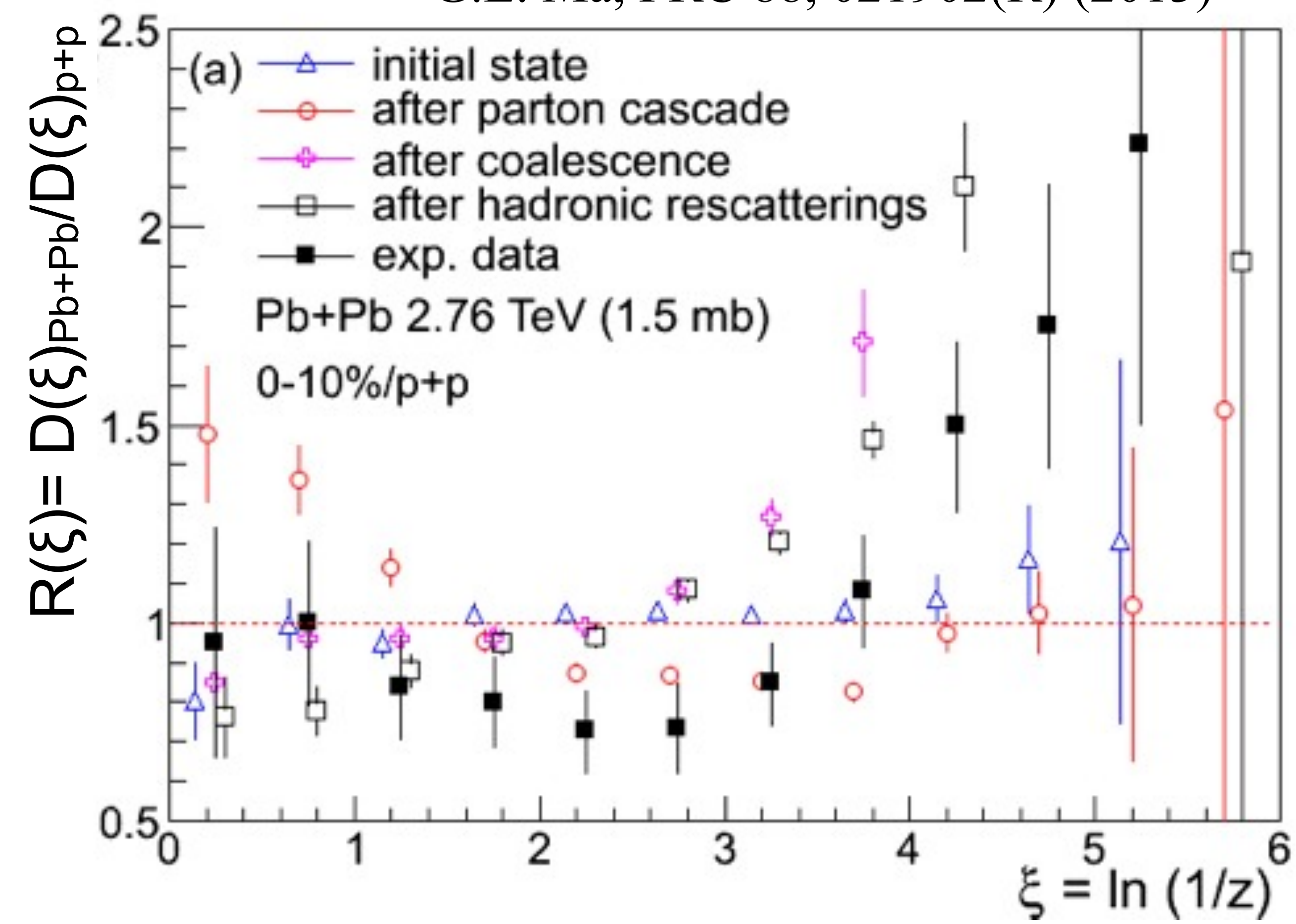


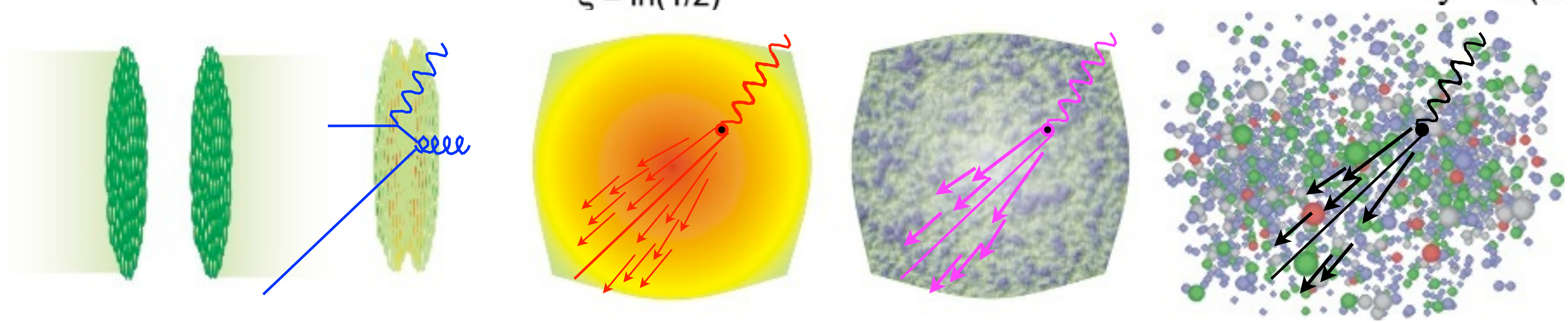
- Subleading jet has a larger medium modification than leading jet. This ordering is consistent with the new CMS measurement.
- The jet shape slightly depends on the dijet asymmetry Aj, consistent with the new CMS data.

Jet fragmentation function

G.L. Ma, PRC 88, 021902(R) (2013)



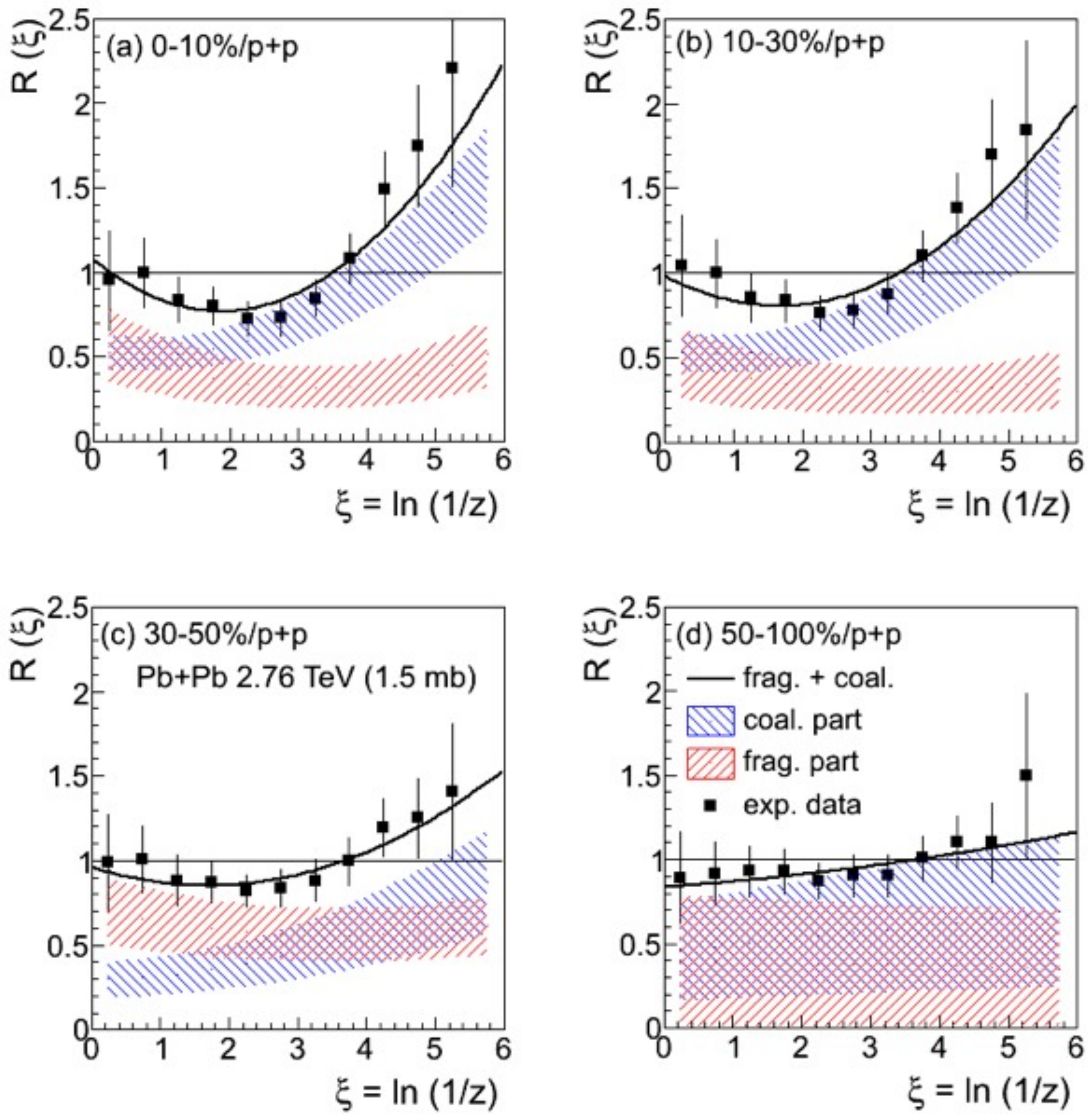




- p+p: good agreement between AMPT results and exp data.
- Pb+Pb: Jet fragmentation function evolves, but none of them can describe exp data.

Decomposition of jet fragmentation function

G.L. Ma, PRC 88, 021902(R) (2013)



$$R(\xi) = \lambda_f R_f(\xi) + \lambda_c R_c(\xi)$$

Fragmentation part

Coalescence part

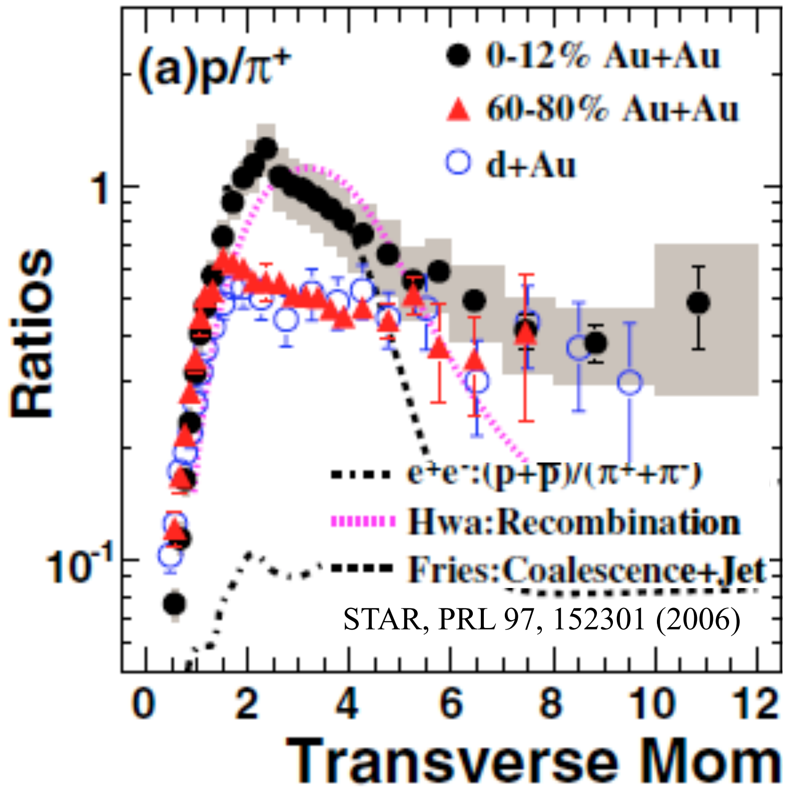
TABLE I: The fitting parameters of λ_f and λ_c for different centrality bins in Pb+Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV.

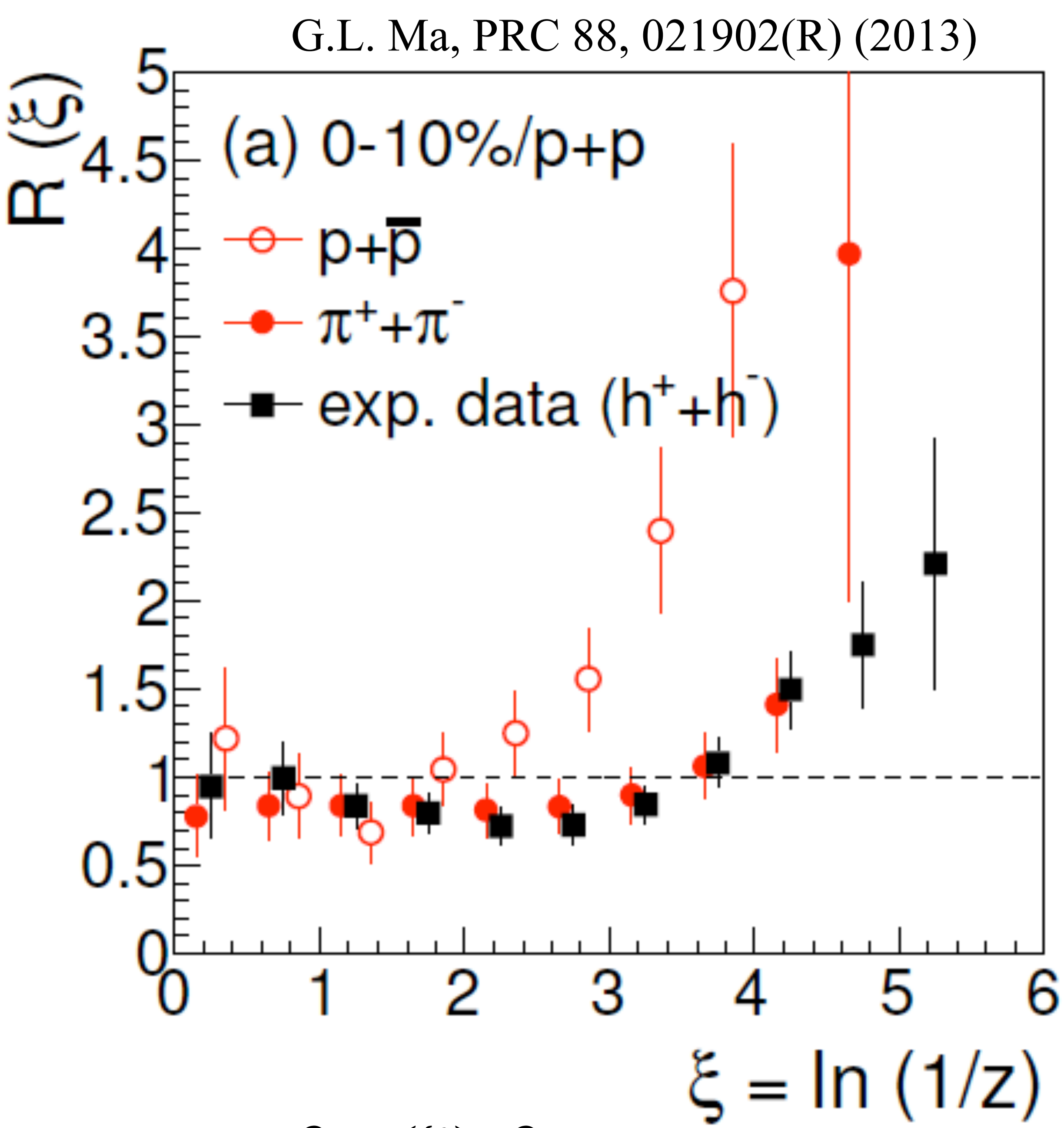
	λ_f	λ_c
0-10%	0.377 ± 0.147	0.612 ± 0.120
10-30%	0.346 ± 0.156	0.616 ± 0.131
30-50%	0.599 ± 0.168	0.386 ± 0.137
50-100%	0.379 ± 0.370	0.527 ± 0.338

- Frag. part [$\lambda_f R_f(\xi)$]: more important for low-ξ range in more peripheral collisions.

- Coal. part [$\lambda_c R_c(\xi)$]: more dominant for high- ξ range in more central collisions.

Baryon vs meson for jet fragmentation function

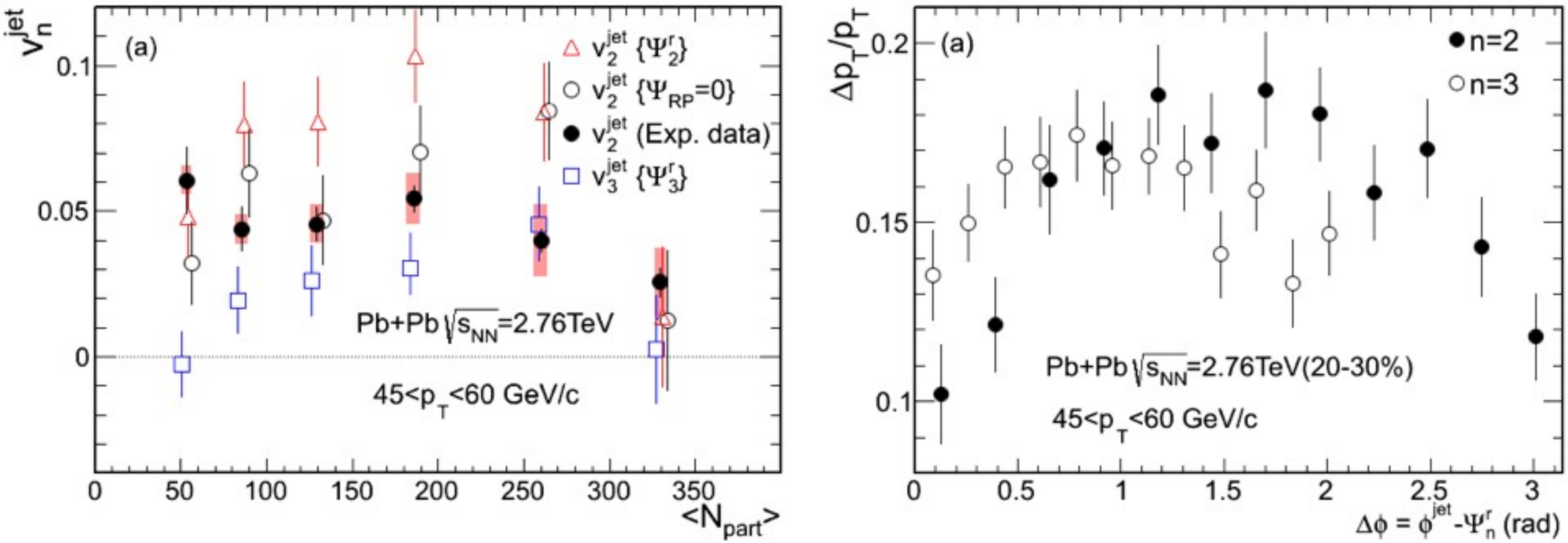




● Large high-ξ enhancement of R(ξ) for protons compared to for pions, if the relative increase of coalescence part in central Pb+Pb collisions.

Jet anisotropy

M. -W. Nie and G.-L. Ma, PRC 90, 014907 (2014)

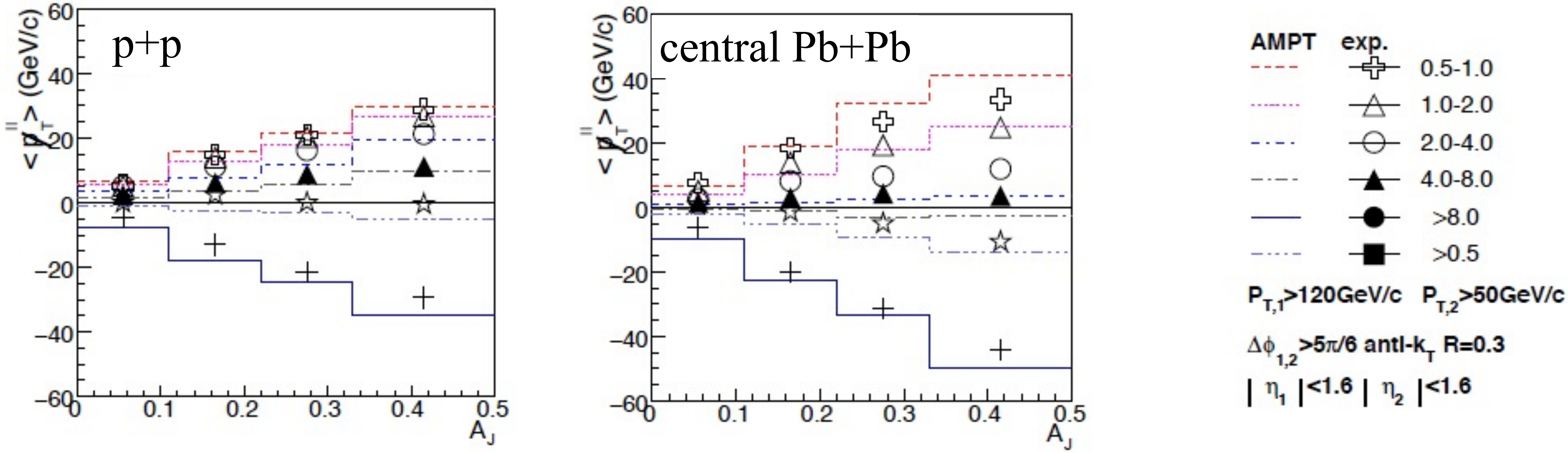


$$\Psi_n^r = \frac{1}{n}\left[arctan\frac{\langle r^n sin(n\varphi)\rangle}{\langle r^n cos(n\varphi)\rangle} + \pi\right], \qquad v_n^{jet} = \langle cos\left[n(\phi^{jet} - \Psi_n^r)\right]\rangle .$$

- Jet $v_2\{\psi_2=0\}$ is consistent with jet $v_2\{\psi_2\}$.
- Jet v_3 is smaller than jet v_2.
- Jet energy loss fraction depends on the azimuthal angles with respect to ψ_n.=>a path-length dependence of jet energy loss.

Overall momentum balance of dijet event

Z. Gao, G.L. Ma, G. Y. Qin, and H. Z. Zhang, in preparation



$$\not{p}_T^{||} = \sum_i -p_T^i \cos(\phi_i - \phi_{leadingjet}),$$

- Good description for p+p (left) and peripheral Pb+Pb(not shown here).
- Overestimation of 0.5<pT<2.0GeV/c may be due to the lack of jet radiation energy loss in central Pb+Pb (right).

Summary

Various aspects are studied through reconstructed jets from the AMPT model with triggered dijet:

- Dijet asymmetries: driven by both initial asymmetries and final partonic jet energy loss.
- Jet shape modification: subleading jet >leading jet, and slightly depends on Aj.
- Jet fragmentation function: fragmentation + coalescence, =>larger high-ξ enhancement for baryon.
- Jet vn: arises from path-length dependence
- Overall balance of dijet events: jet radiation energy loss is more important in central A+A.

Thanks for your attentions!