Collectivity in p+p, p+A and A+A collisions from parton scatterings

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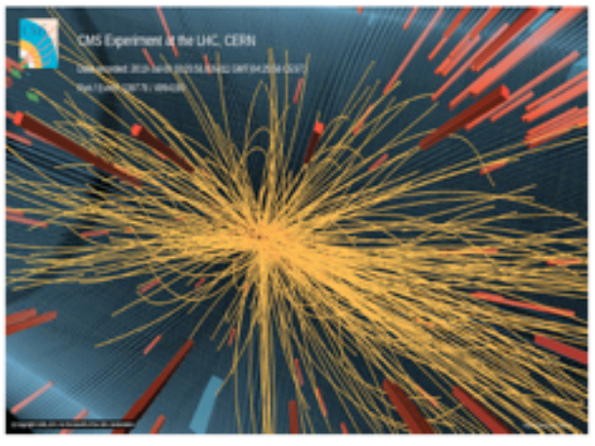
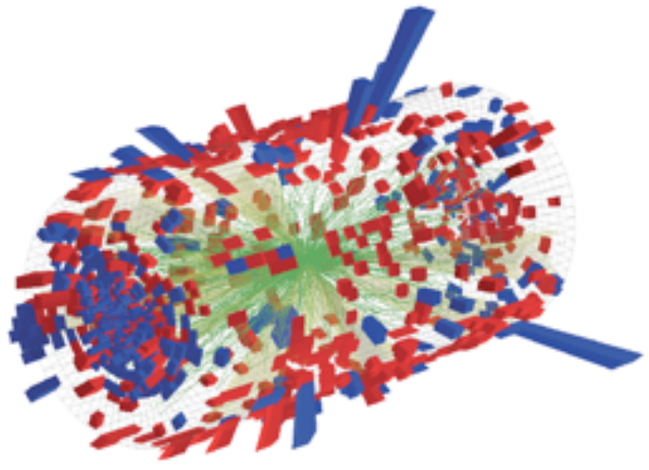
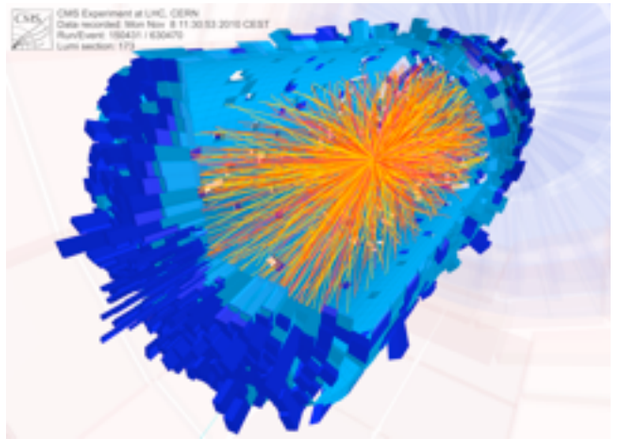
This work is in collaboration with Adam Bzdak (RBRC, BNL), arXiv: 1404.4129 and 1406.2804.







Outline

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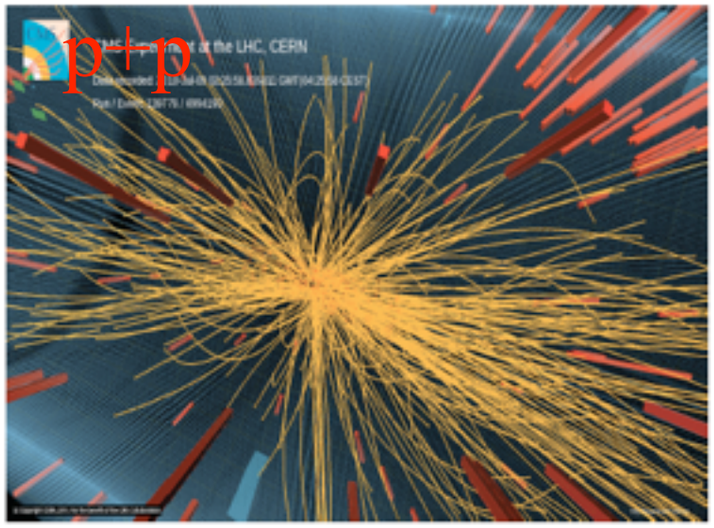
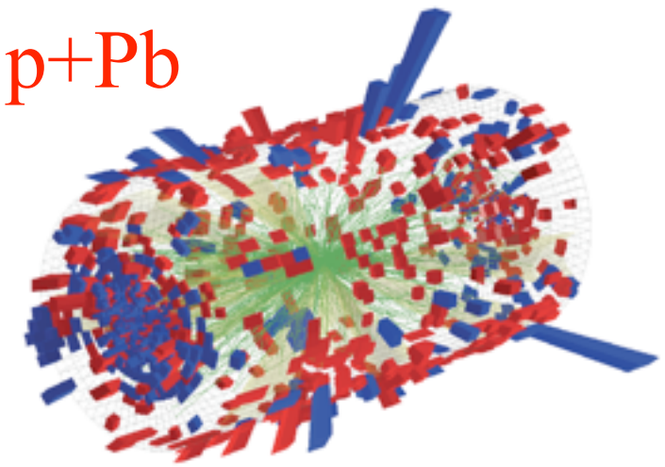
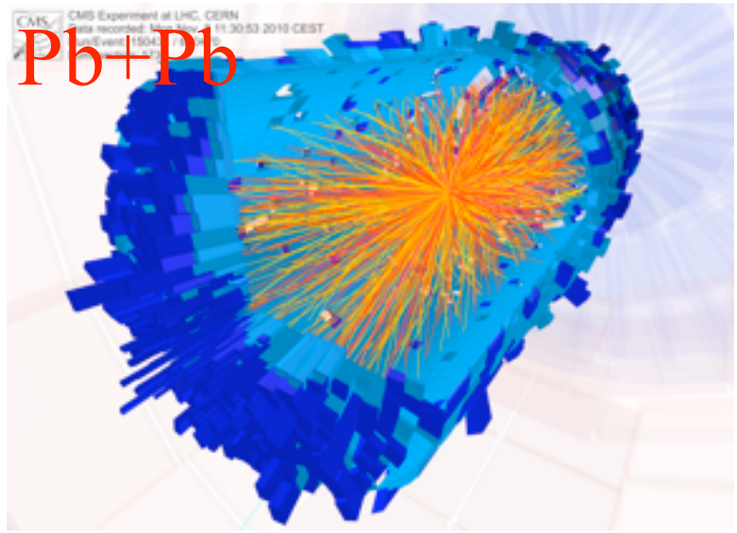
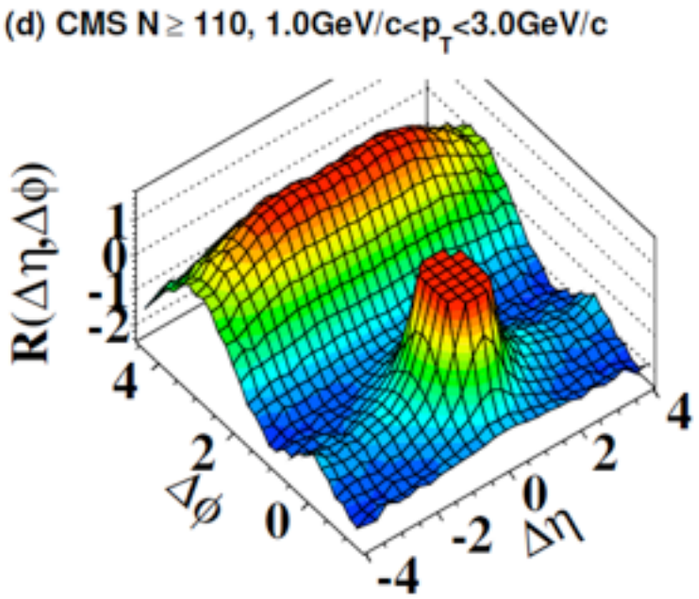
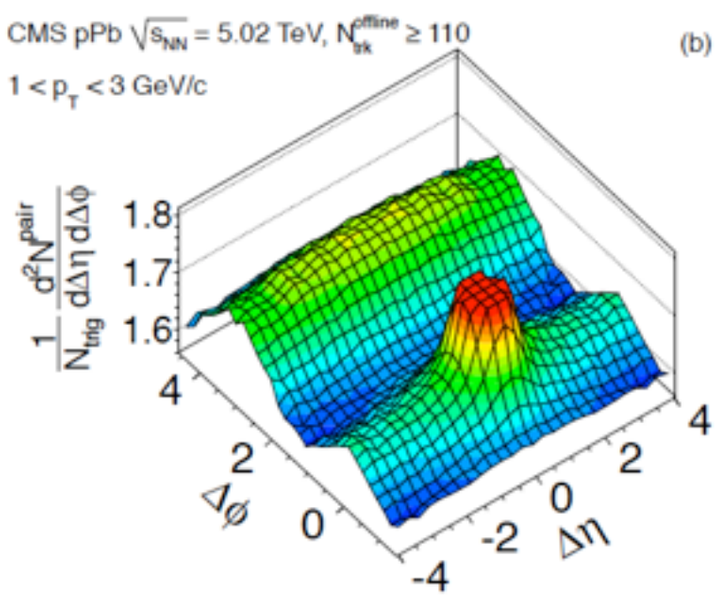
Long-range correlations in p+p, p+Pb, and Pb+Pb

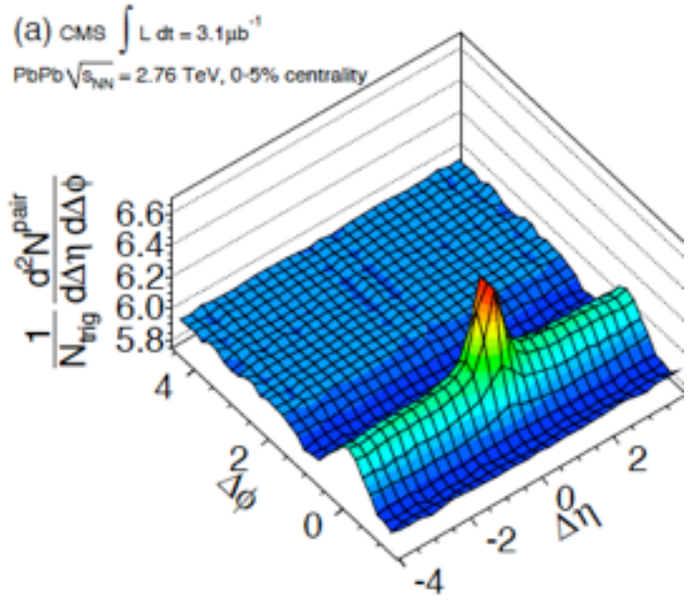












- Are the ‘ridges’ due to the same origin in p+p, p+Pb and Pb+Pb?

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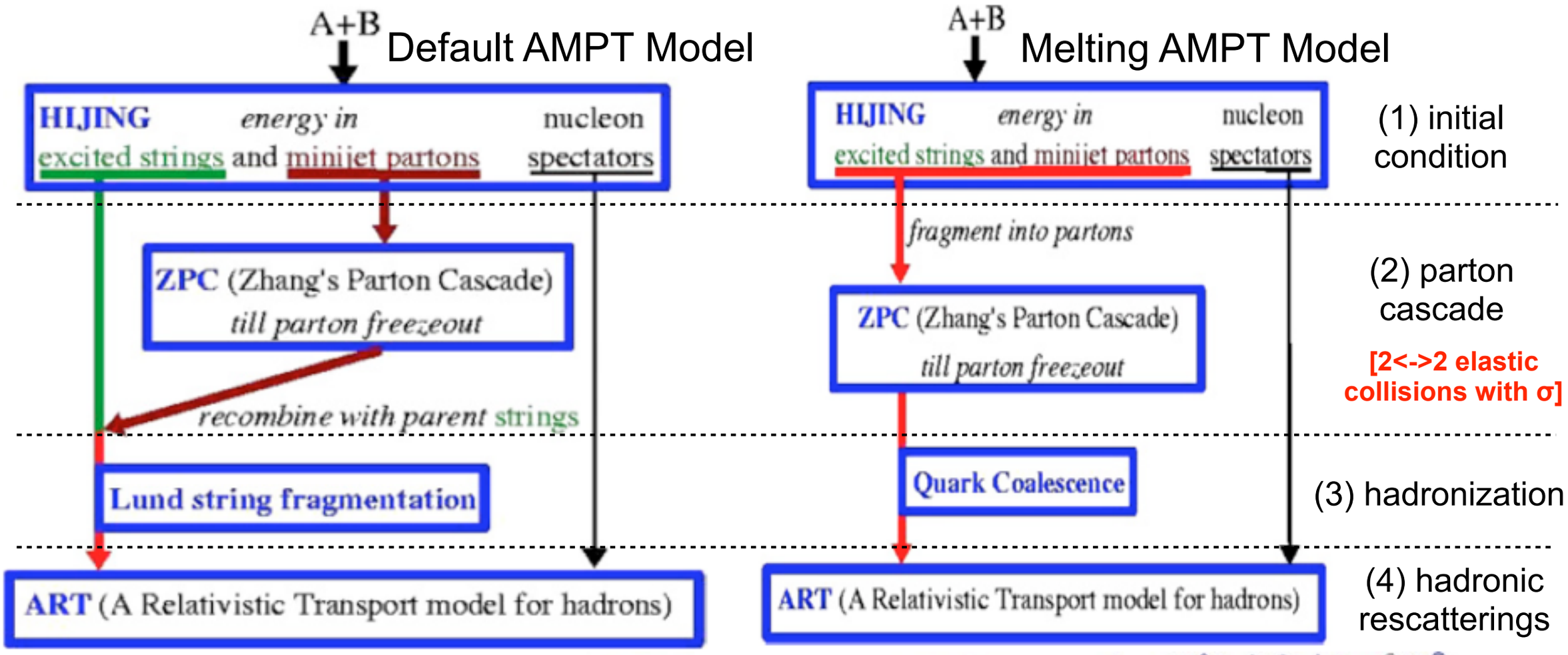
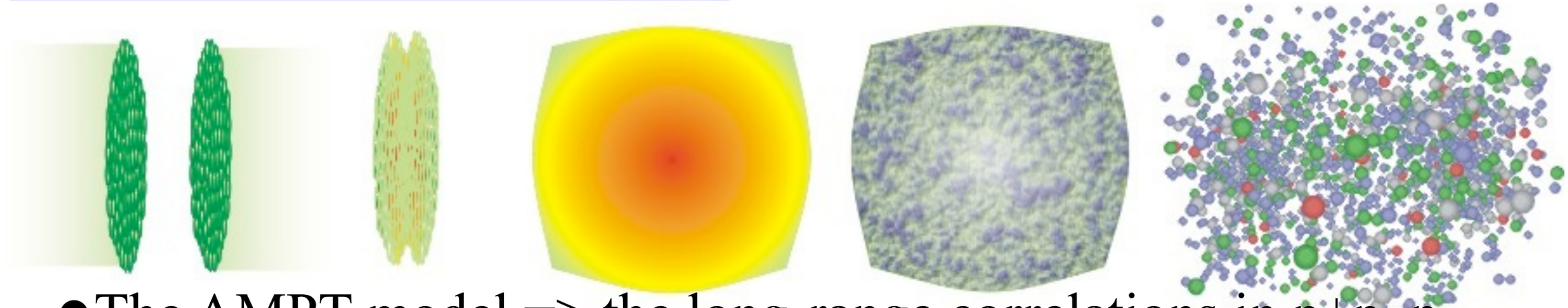
A multiphase transport (AMPT) model

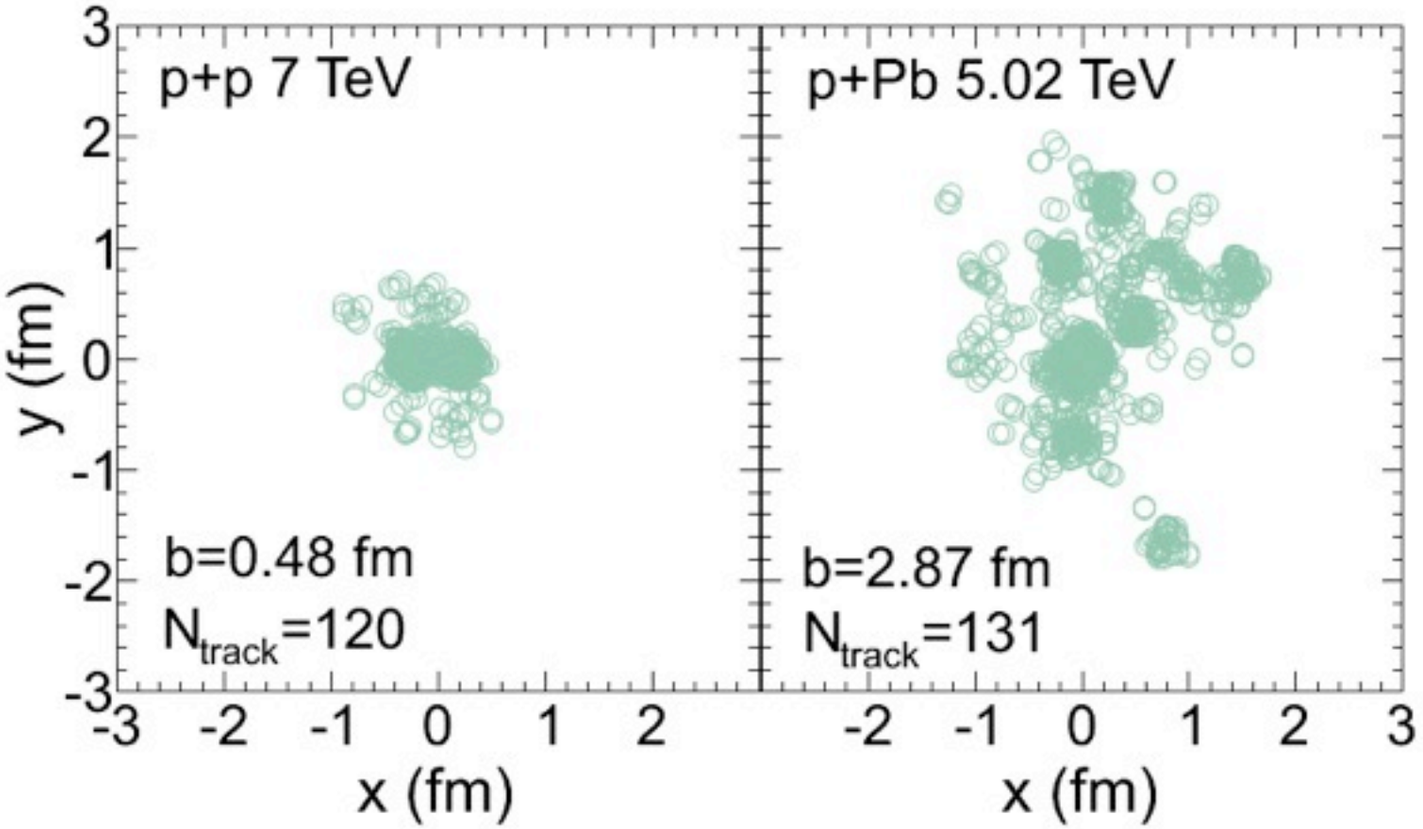


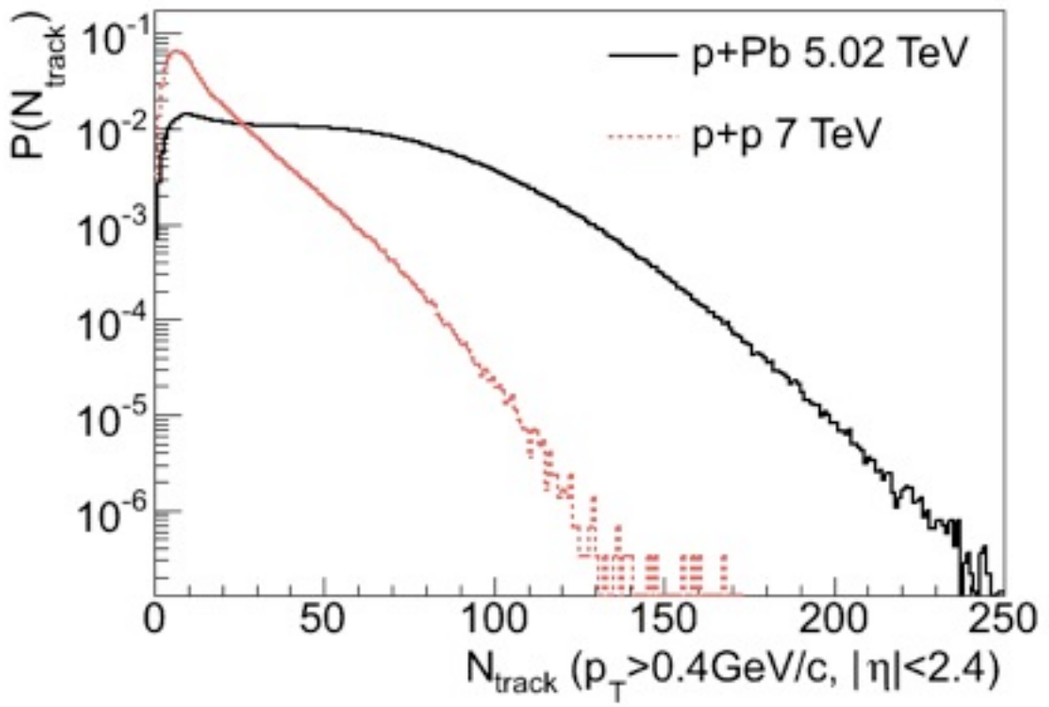


- The AMPT model => the long-range correlations in p+p, p+Pb and Pb+Pb.

p+p and p+Pb in the AMPT model

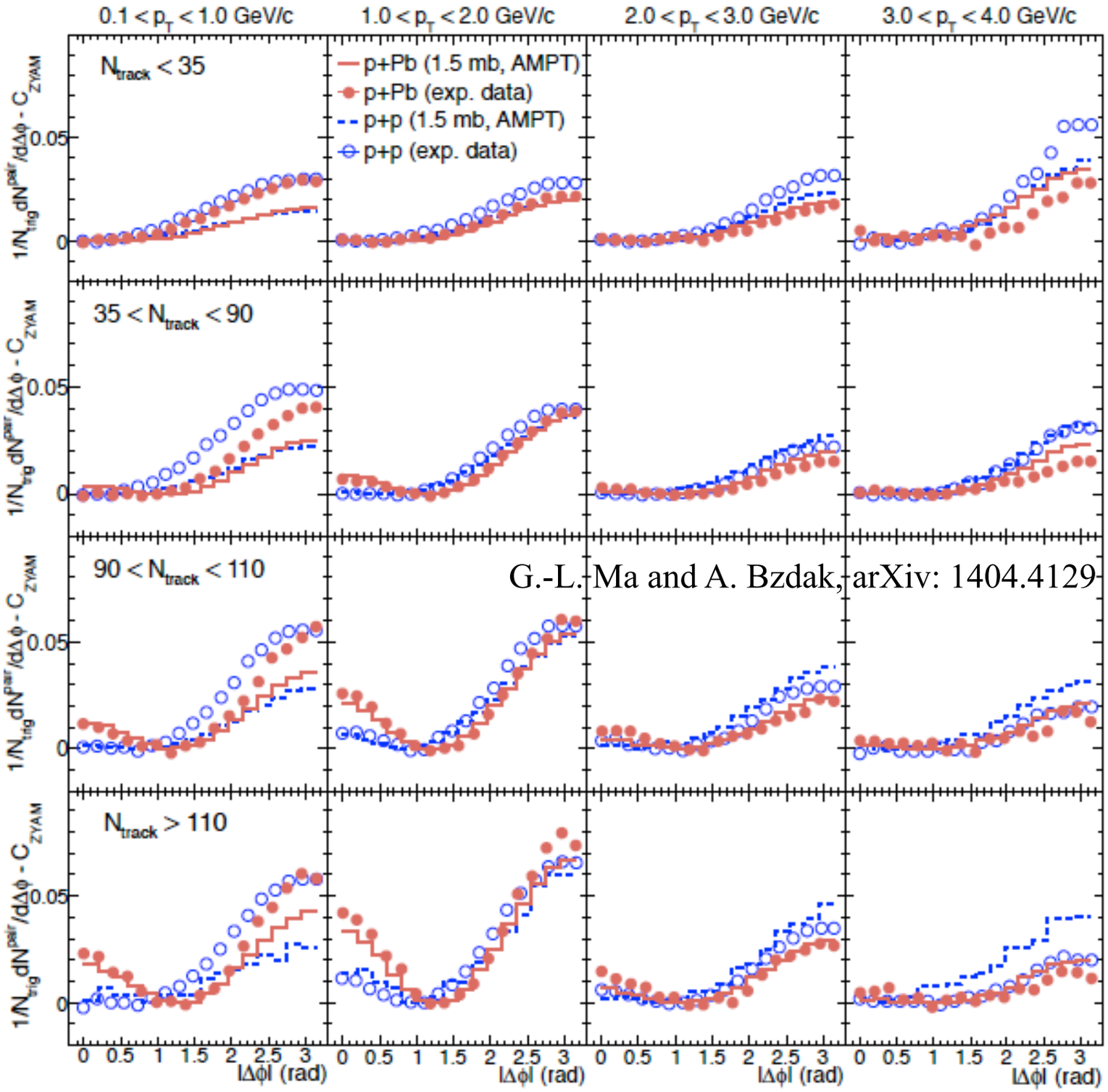
G.-L. Ma and A. Bzdak, arXiv: 1404.4129

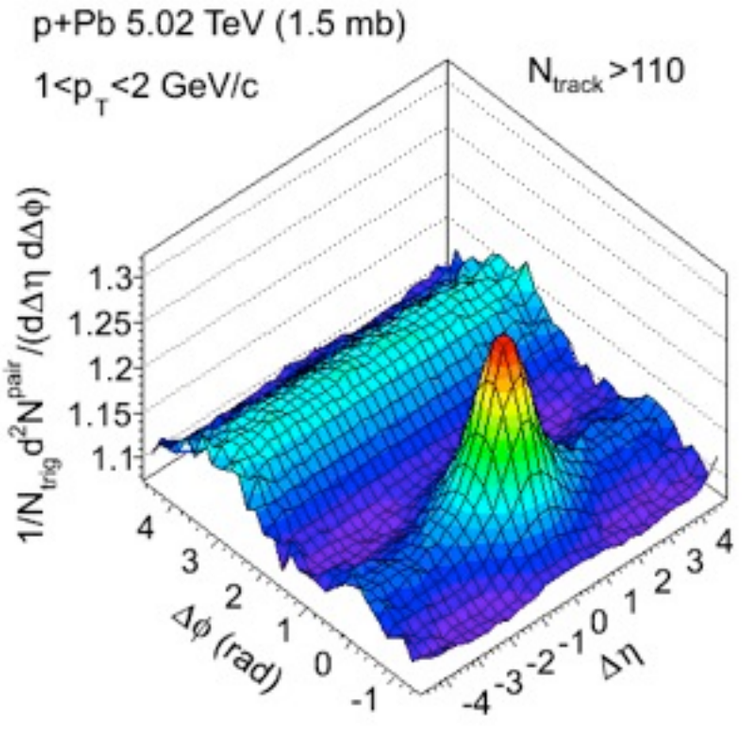




- One hot spot in p+p vs Several hot spots in p+Pb.
- 'Centrality' defined by using N_track distributions as the CMS.

AMPT results on long-range correlations in p+p and p+Pb

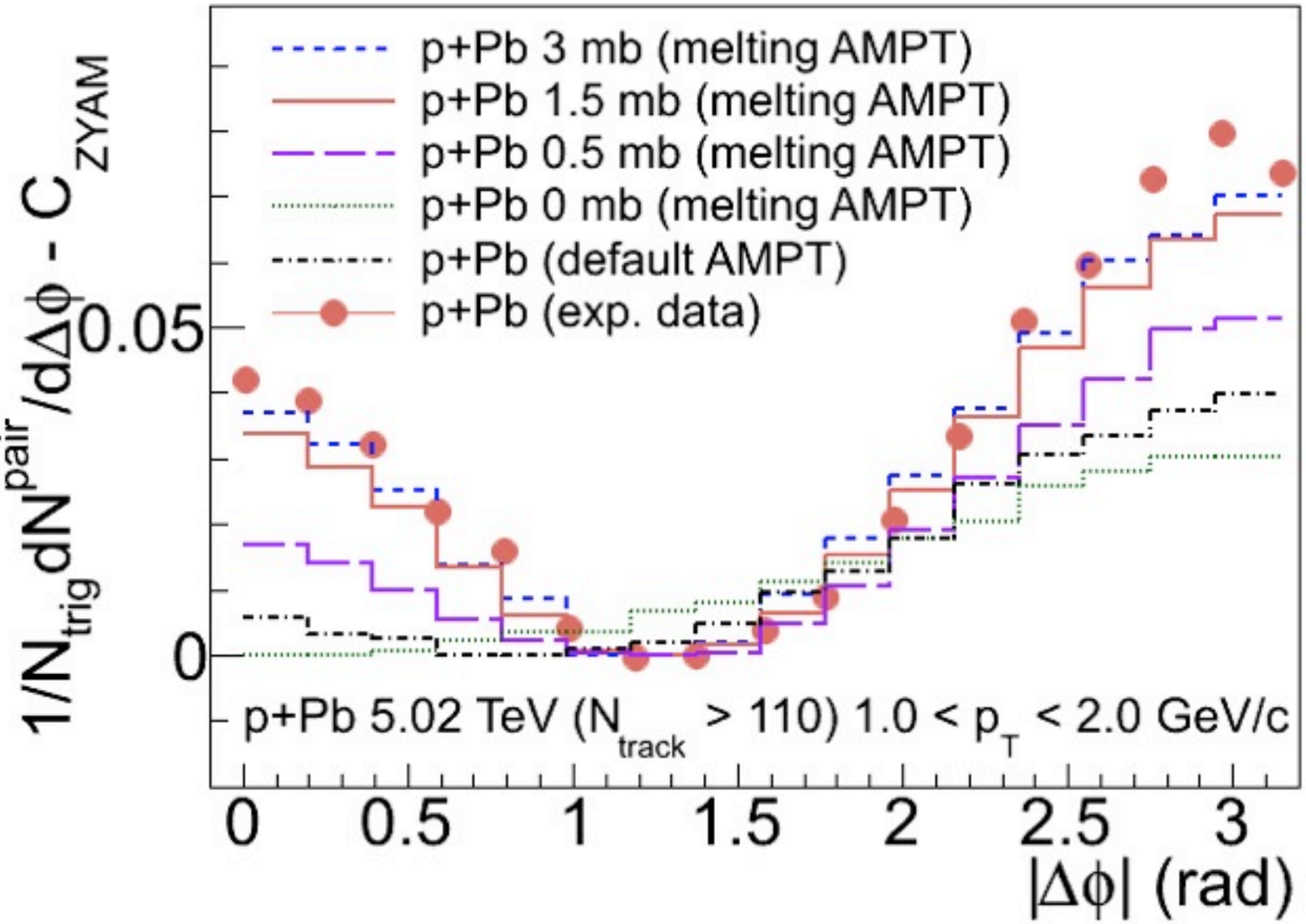




- The two-particle correlations in p+p and p+Pb are well reproduced by AMPT model (1.5mb).
- Long-range correlation appears in high-multiplicity p+p and p +Pb.
- For signal strength, p+p <p+Pb.

Cross section dependence of long-range correlation in p+Pb

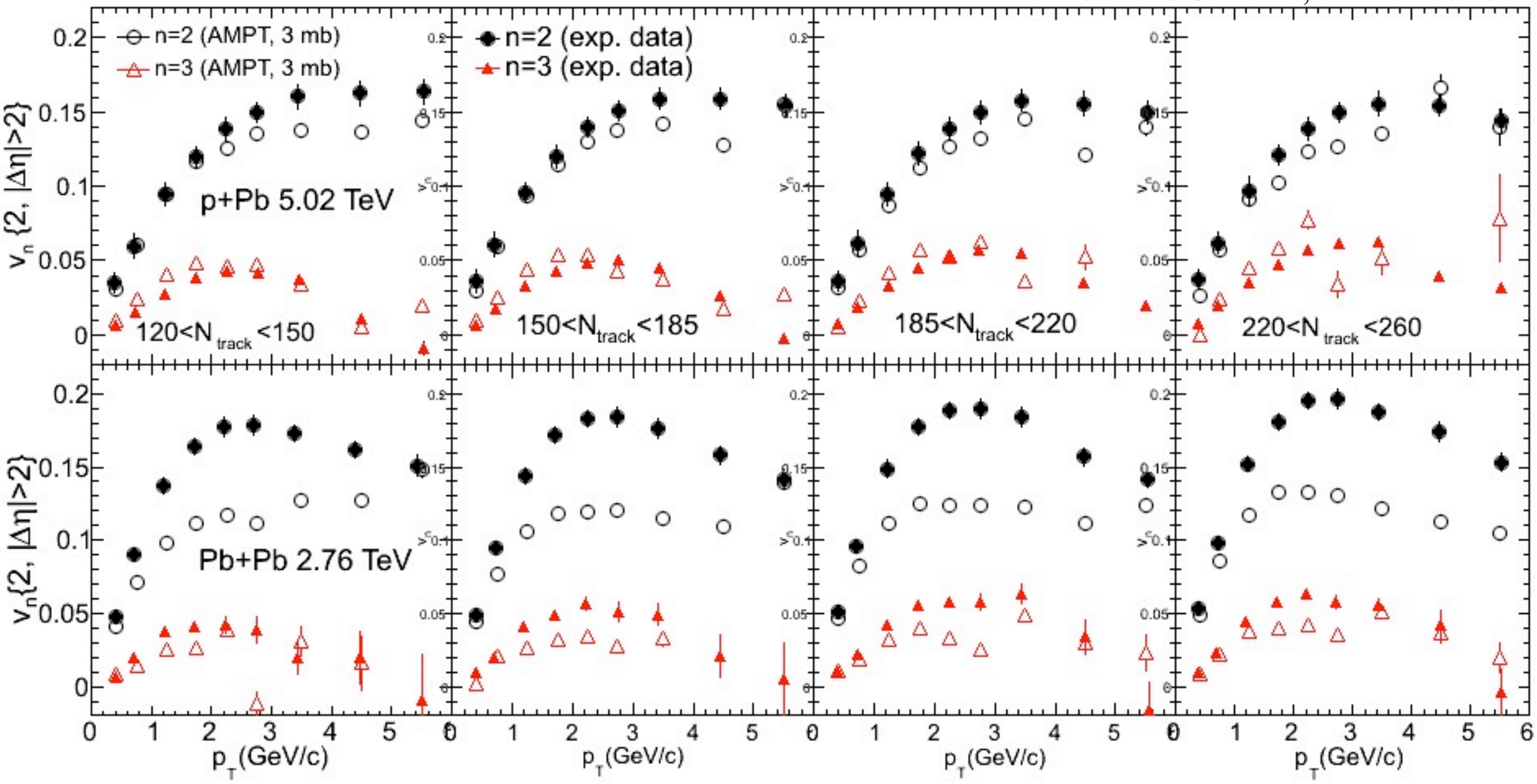
G.-L. Ma and A. Bzdak, arXiv: 1404.4129



- The two-particle correlations in p+Pb can be well described by σ=1.5-3 mb.
- The strength of the signal gradually increases with growing σ and the signal vanishes completely for σ = 0 mb.
- No visible long-range signal in the default AMPT model.

AMPT results on vn(pT) in p+Pb vs Pb+Pb

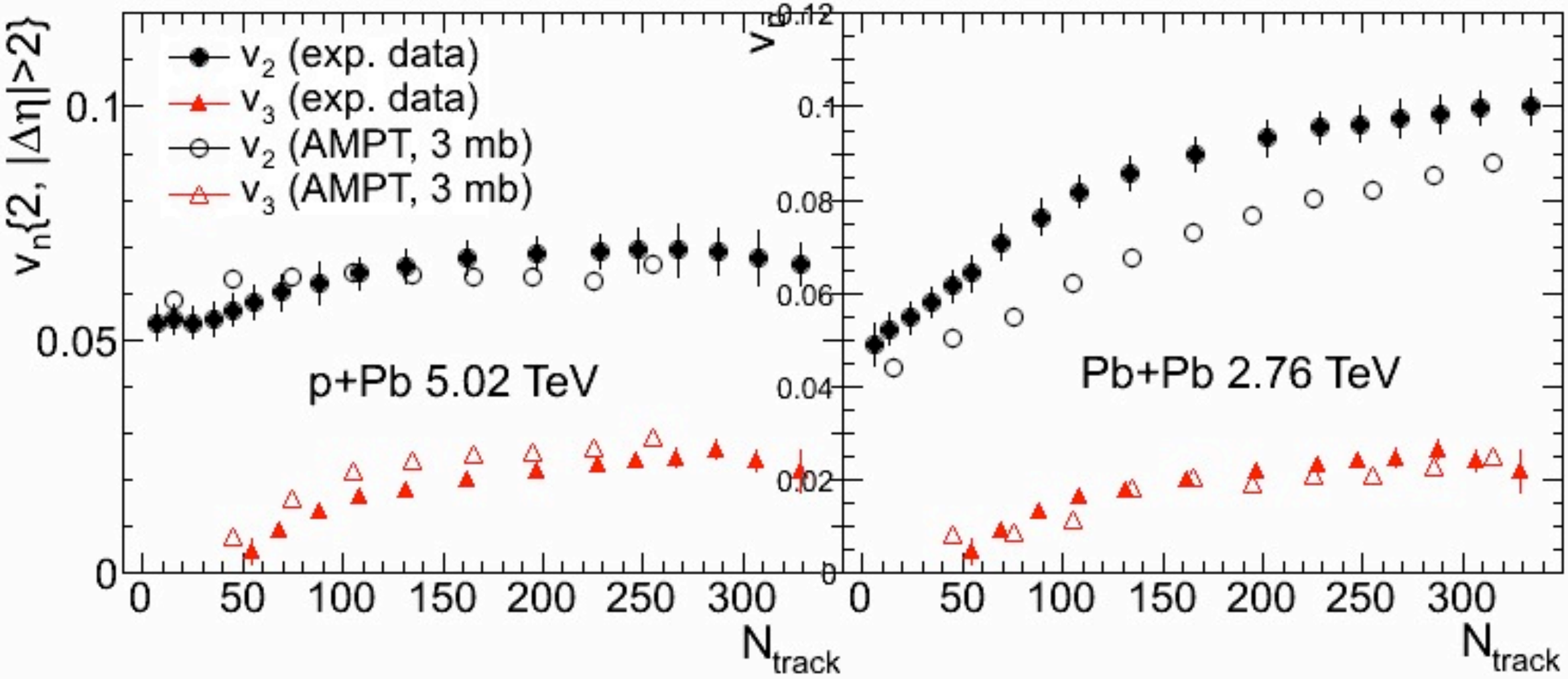
A. Bzdak and G.-L. Ma, arXiv:1406.2804



- For p+Pb, AMPT (3 mb) reproduces the measured v2 and v3.
- For Pb+Pb, AMPT (3 mb) reproduces the measured v3 for all pT, but underestimates v2 especially for high pT.

AMPT results on integrated vn

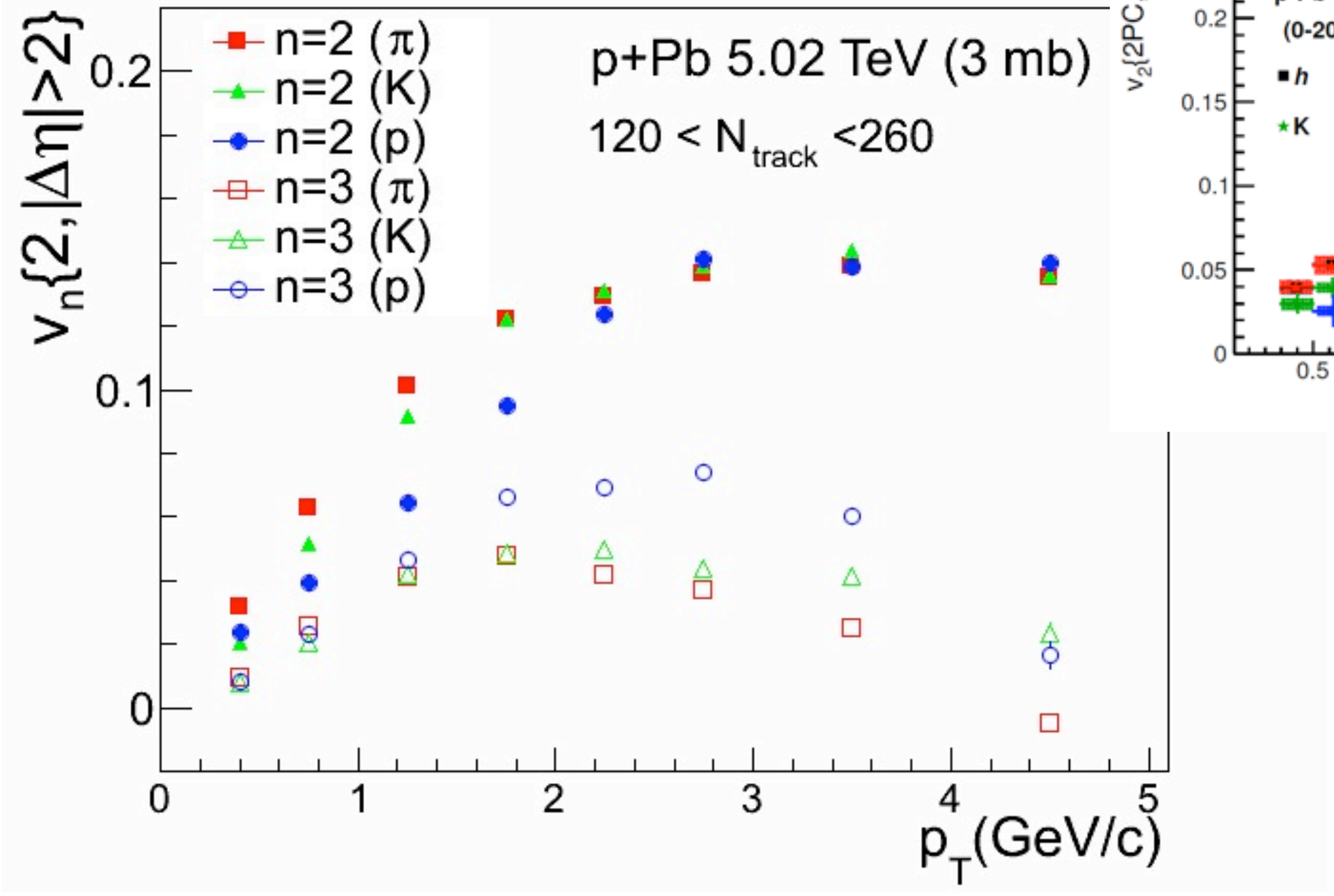
A. Bzdak and G.-L. Ma, arXiv:1406.2804

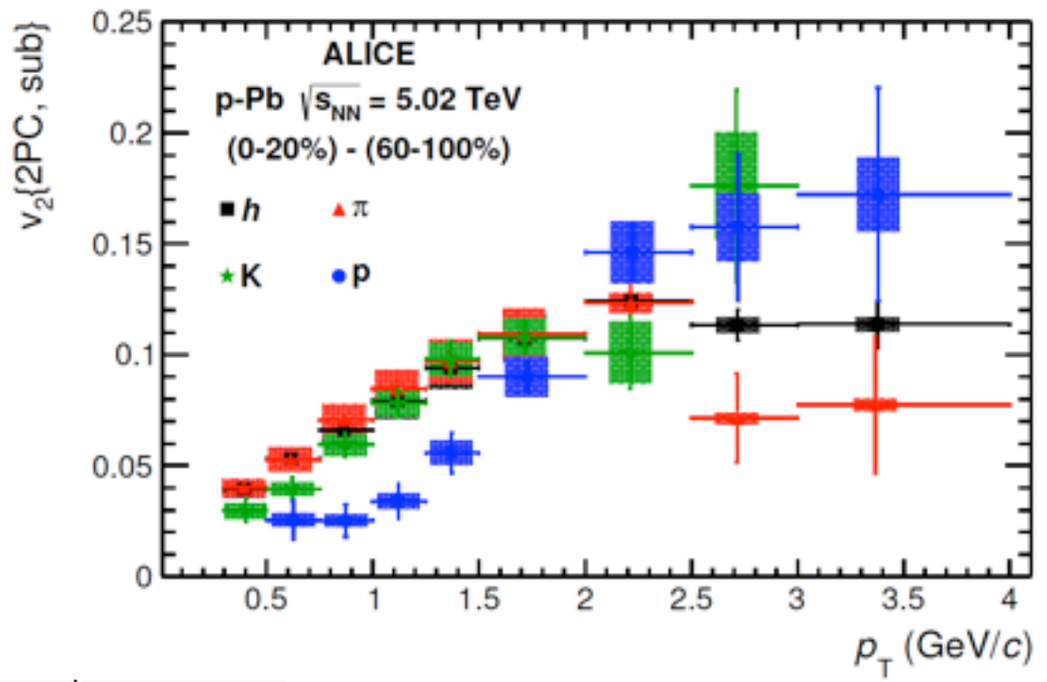


- For p+Pb, AMPT (3 mb) reproduces the integrated v2 and v3.
- For Pb+Pb, AMPT (3 mb) reproduces the integrated v3, but underestimates the integrated v2 by ~20%.
- AMPT (3 mb) shows similar v3 between p+Pb and Pb+Pb.

AMPT results on PID vn

A. Bzdak and G.-L. Ma, arXiv:1406.2804

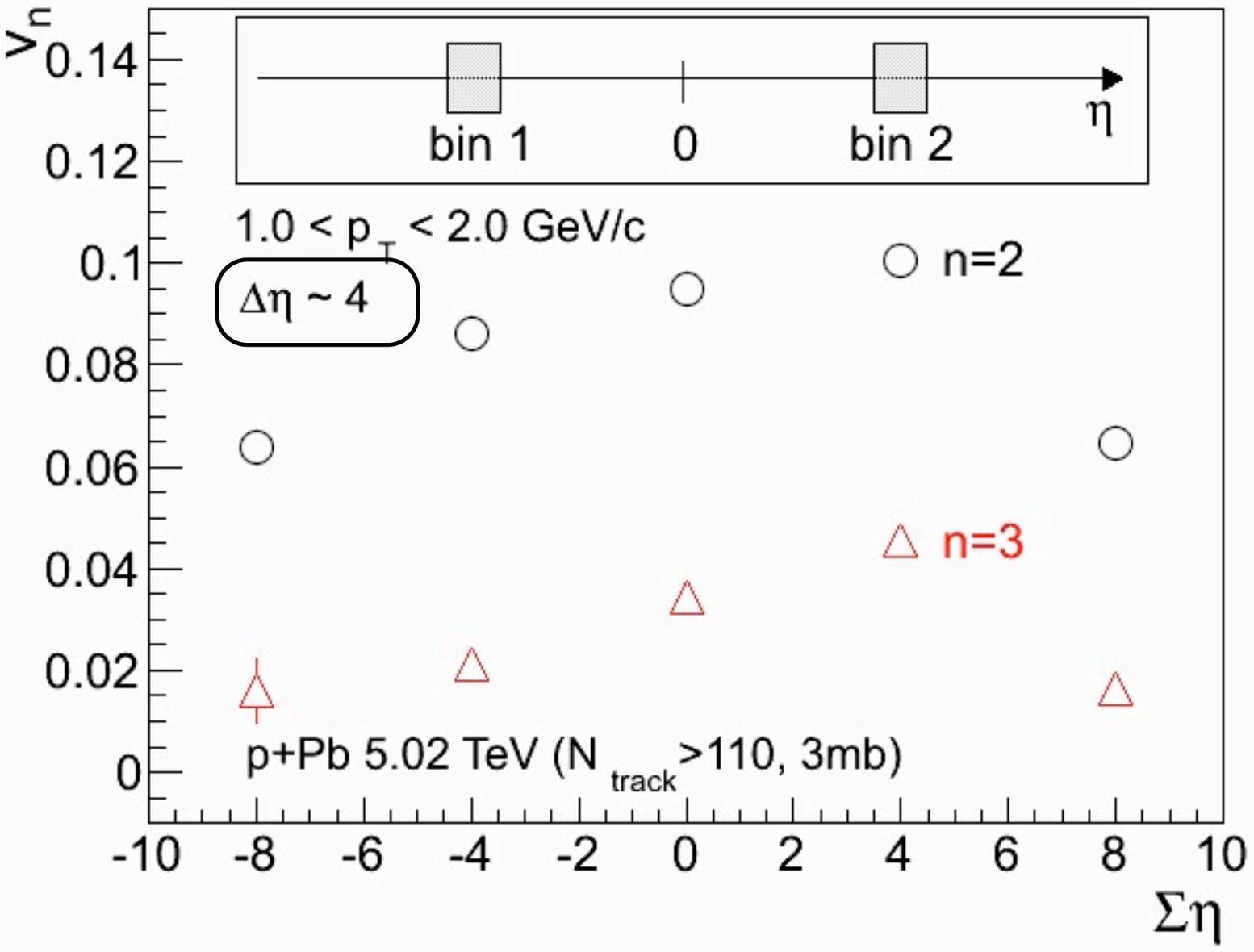


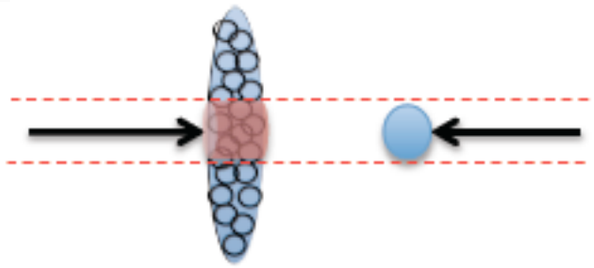


- The mass ordering of v2 is observed in p+Pb.
- No such a mass ordering of v3 in p+Pb.

A proposed observable

A. Bzdak and G.-L. Ma, arXiv:1406.2804





$$C(\Delta\phi) \equiv \frac{Y_{\text{Same}}(\Delta\phi)}{Y_{\text{Mixed}}(\Delta\phi)} \times \frac{\int Y_{\text{Mixed}}(\Delta\phi)d\Delta\phi}{\int Y_{\text{Same}}(\Delta\phi)d\Delta\phi}$$

$$C(\Delta\phi) = 1 + \sum_n 2v_n^2 \cos(n\Delta\phi)$$

∑η	bin 1	bin 2
-8	[−6.2, −5.8]	[−2.2, −1.8]
-4	[−4.2, −3.8]	[−0.2, 0.2]
0	[−2.2, −1.8]	[1.8, 2.2]
4	[−0.2, 0.2]	[3.8, 4.2]
8	[1.8, 2.2]	[5.8, 6.2]

- v2 and v3 increase when going from a proton side to a Pb-nucleus side.

Summary

- The incoherent elastic scattering of partons, with σ =1.5-3mb, naturally explains the long-range two-particle azimuthal correlations in p+p, p+Pb, and Pb+Pb.

- v3 are in a good agreement with the CMS data. v2 is very well described in p+Pb and underestimated for higher pT in Pb+Pb.

- The mass ordering of v2 is reproduced whereas for v3 such ordering is not observed in p+Pb.

- v2 and v3 are gradually growing when going from a proton side to a Pb-nucleus side.

- The long-range correlations in p+p, p+Pb and Pb+Pb could be due to a same origin, i.e. the collectivity from parton scatterings.

Thanks!