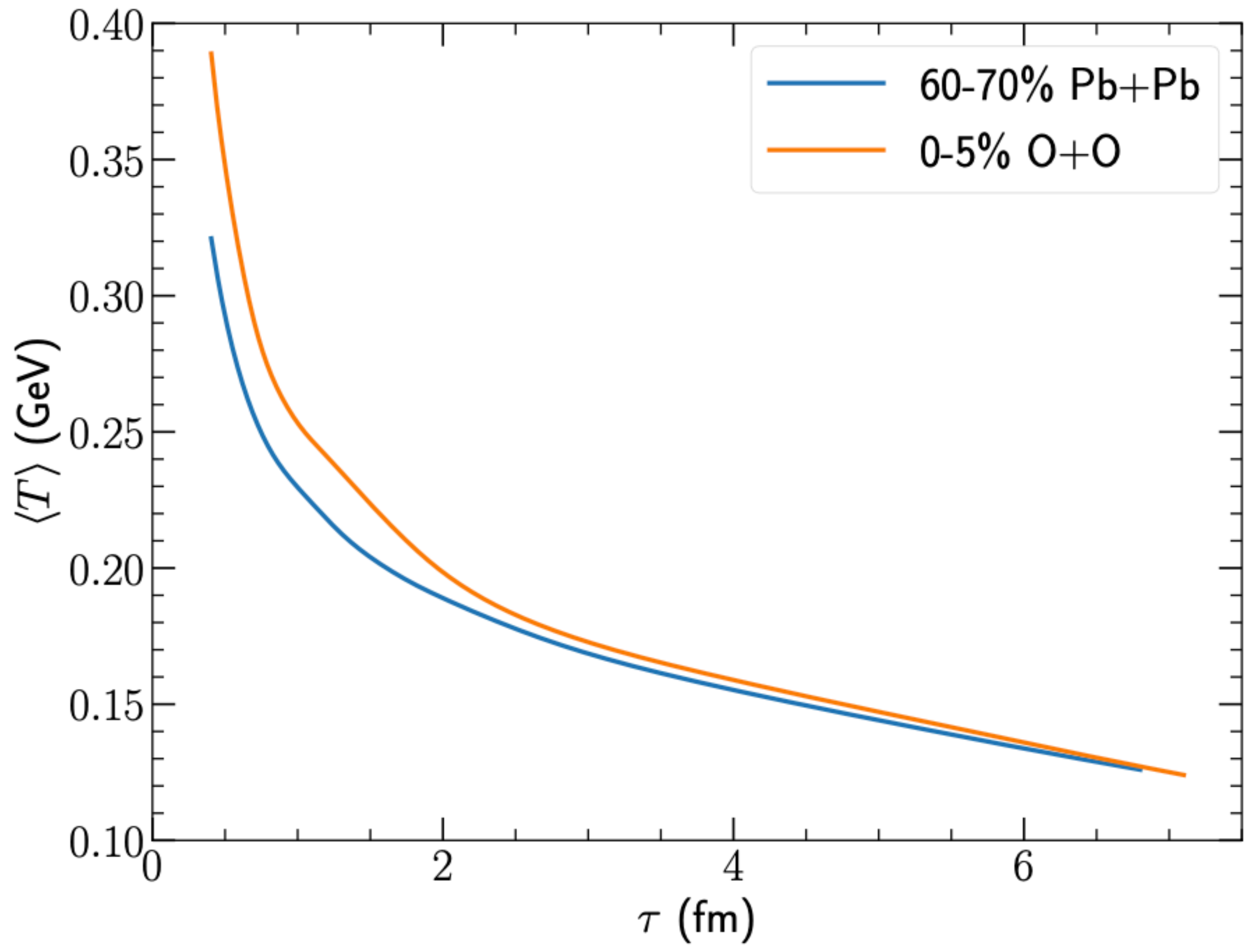
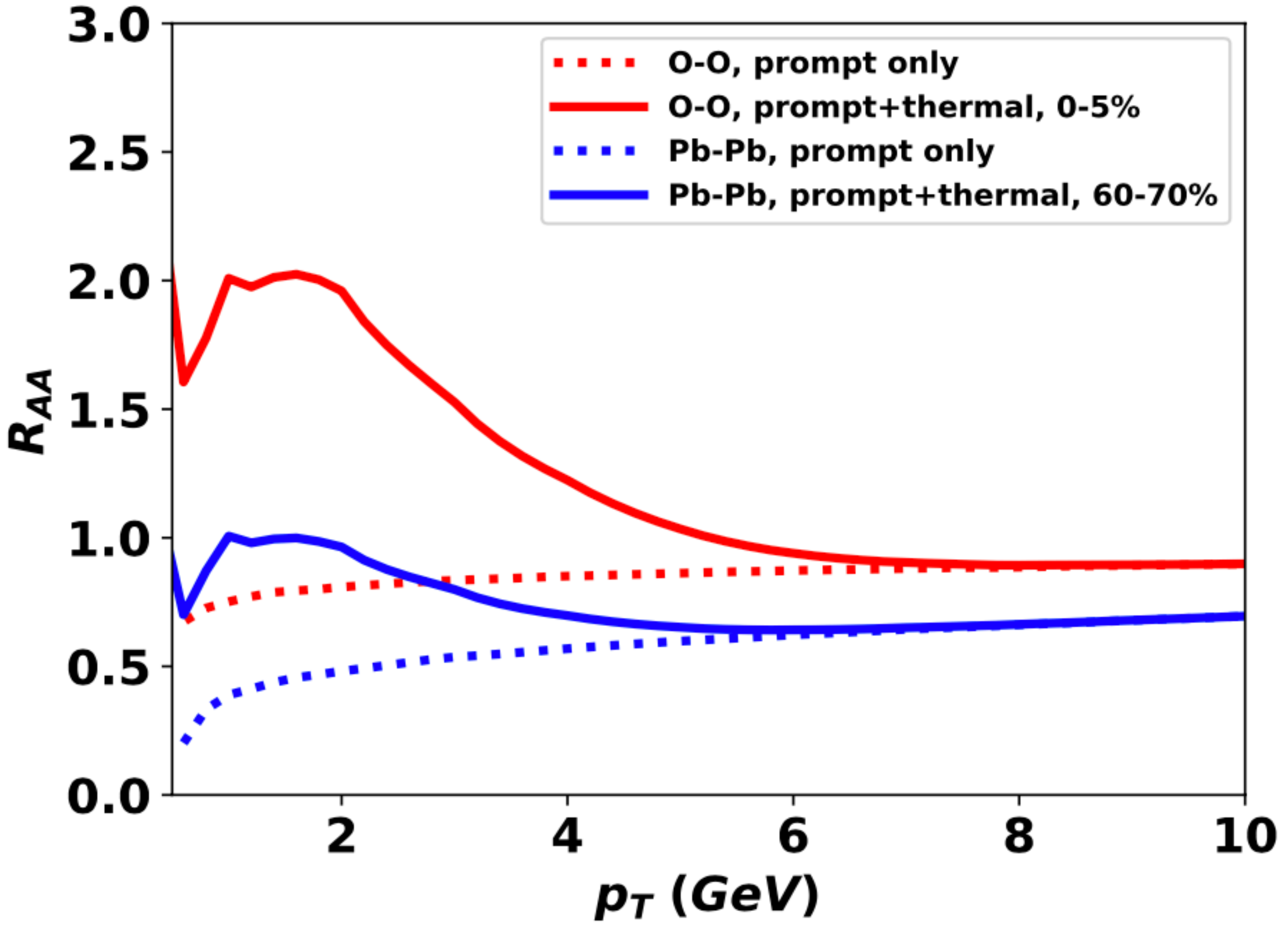
OPPORTUNITIES WITH p+O AND O+O

- O+O provides events that are not present in Pb+Pb (different ecc. at same multiplicity) (Niemi)
- Thermal photon production enhanced (2x) in OO compared to PbPb at same multiplicity (Shen)
- Comparing p+O and p+Pb allows to test what drives the anisotropy (mostly the shape of the proton? (Shen))
- What can pO and OO contribute to constraining models (e.g. initial state, hydro+coalescence, ...)?
  "O+O is in the “sweet spot” multiplicity region that sees transition from hydro to “corona” dominated
  (Kanakubo/Hirano, Zhao)
  Constrain initial state and pre-equilibrium better (slide from Dan Liyanage)
- Parameters can be constrained better in Bayesian analysis including O+O collisions (Nijs)
- Are there (new?) observables that could reveal differences between pO and pPb; make use of the difference between OO and PbPb? (slide on HBT from Christopher Plumberg)
  Is $c_2\{4\}$ negative or positive in pO (OO)? How do we transition to pp? Is NCQ scaling present in OO (pO)? (Zhao)
- Comparing min-bias collisions of different systems removes bias from centrality selection (important for e.g. jet quenching), also multiplicity distribution in OO such that centrality selection (constraining e.g. Ncoll) works better than in p+A. Is the geometry in OO better constrained than in pPb?

TEMPERATURE + EM-PROBES

- O+O hotter than Pb+Pb at ~same multiplicity (see talks by Chun, Harri)

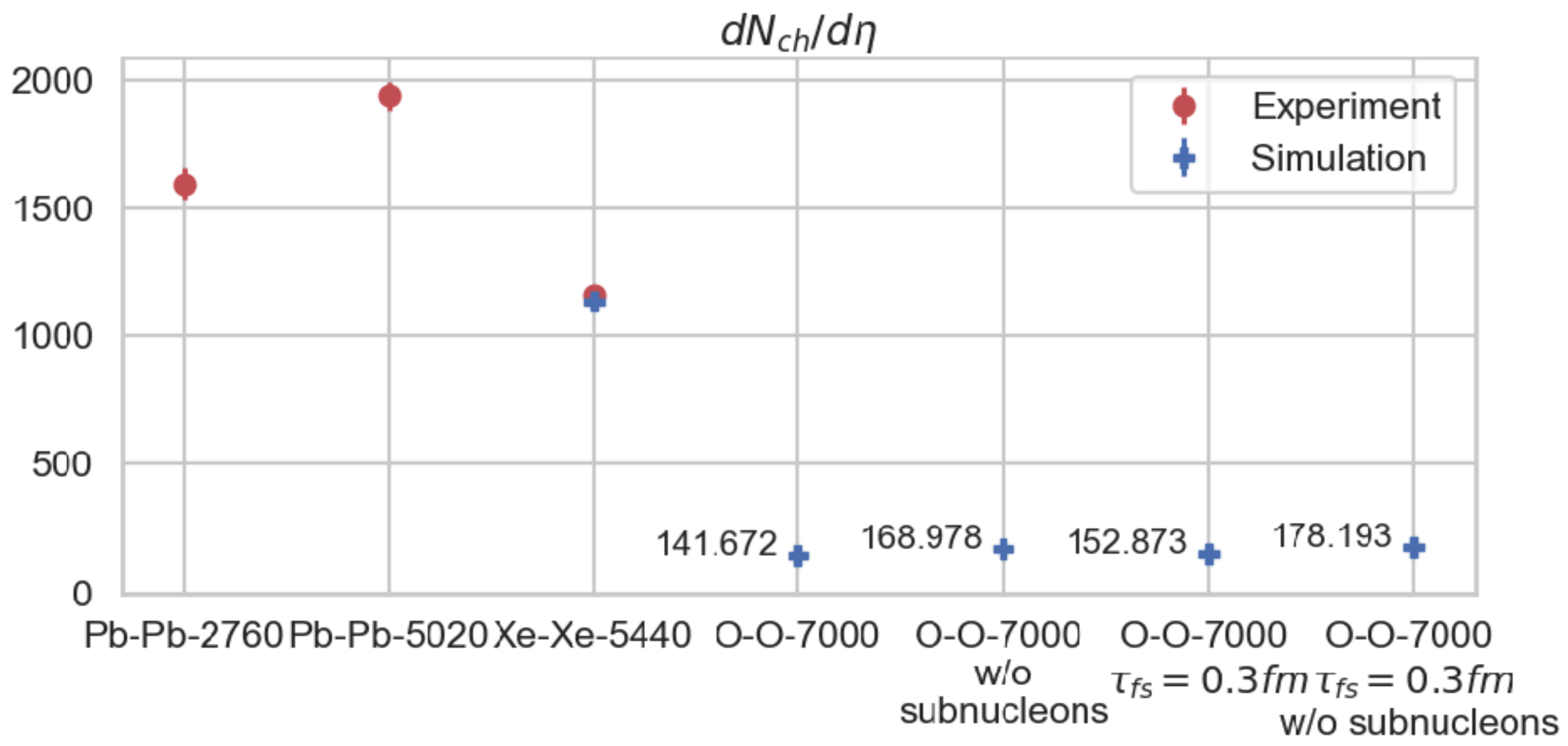


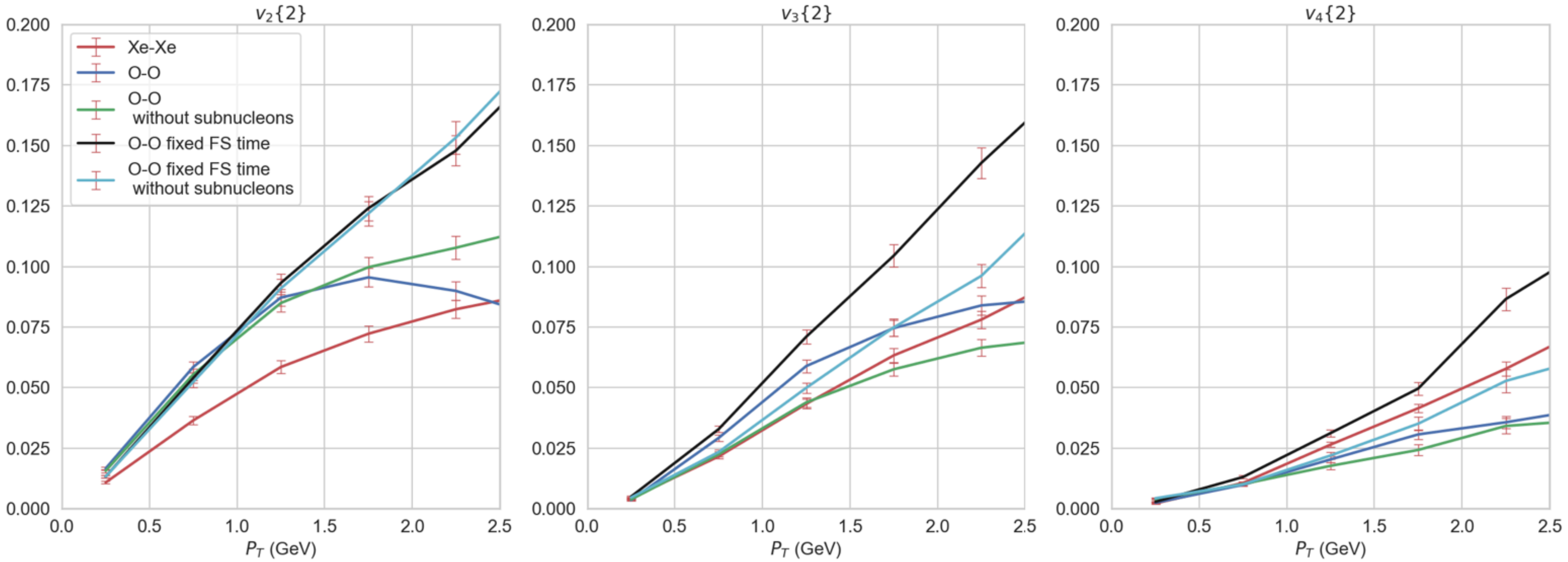


Predictions for 0-5% centrality of O-O collisions at 7 TeV

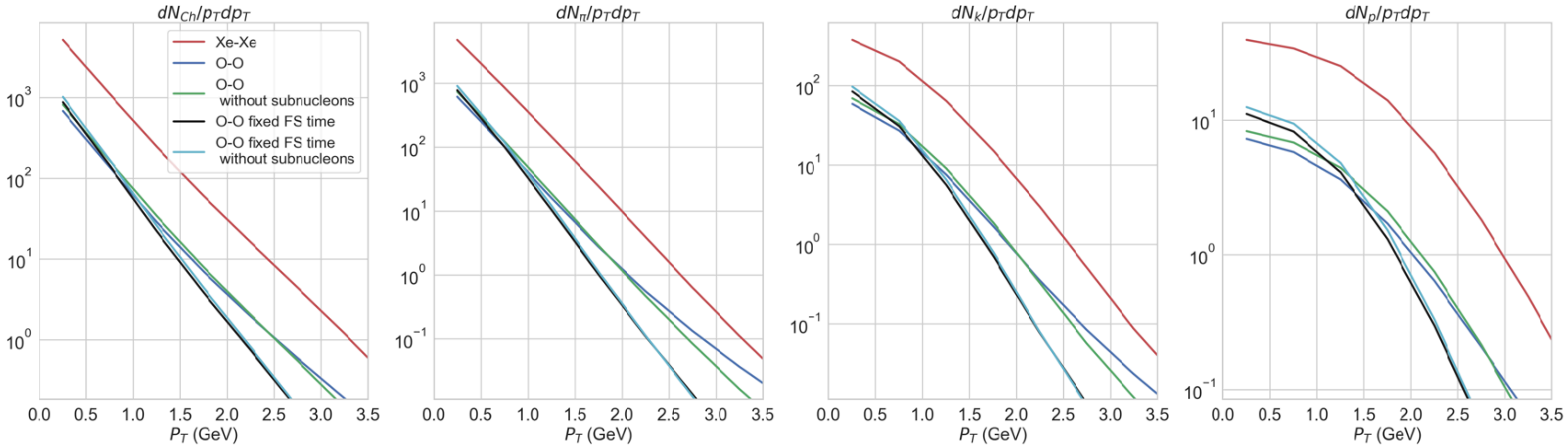
Dan Liyanage, Derek Everett, Ulrich Heinz
The Ohio State University

- ^{16}O configurations from ground state Hamiltonian->Trento with substructure -> Free stream -> MUSIC -> iS3D -> SMASH
- Use JETSCAPE MAP parameters

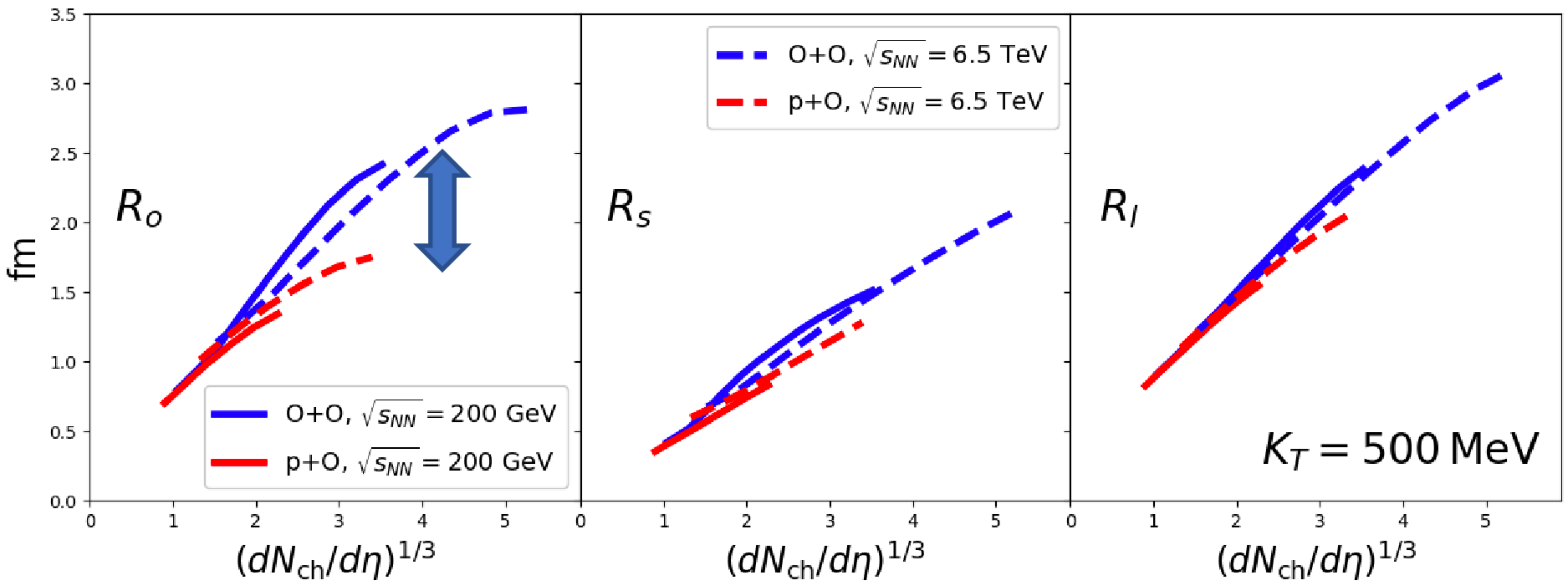




- Using power law for multiplicities we found the O-O multiplicity to be 158.
- Observables are sensitive to nucleon substructure and pre-hydrodynamic.
- OO data can help constrain these model uncertainties.



Small system collectivity: HBT vs. multiplicity



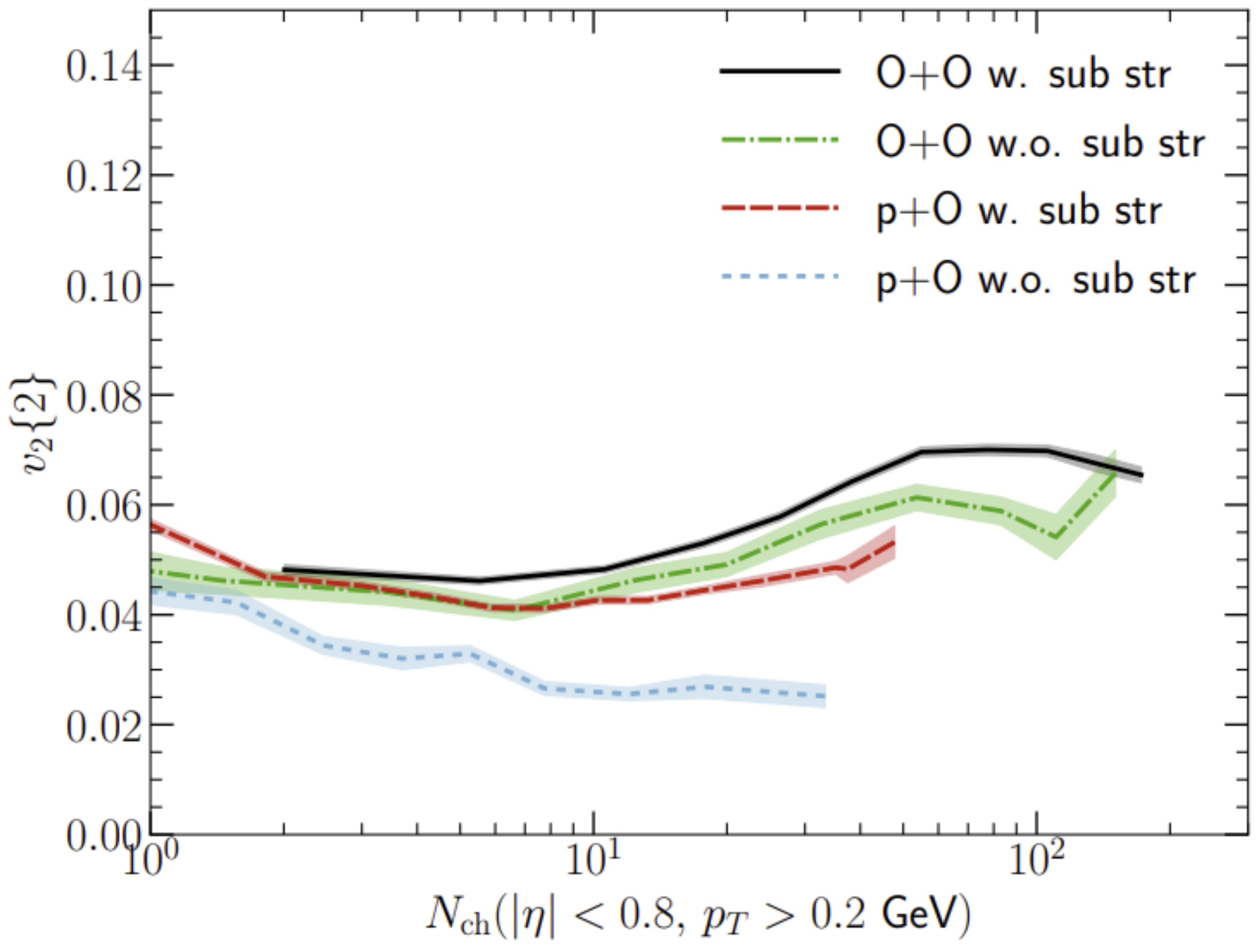
$$R_o^2 \approx \langle x_o^2 \rangle - 2\beta_\perp \langle x_o t \rangle + \beta_\perp^2 \langle t^2 \rangle , \quad R_s^2 \approx \langle x_s^2 \rangle , \quad R_l^2 \approx \langle z^2 \rangle$$

→ Hydrodynamics predicts splitting in multiplicity scaling of R_o between p+O and O+O at LHC

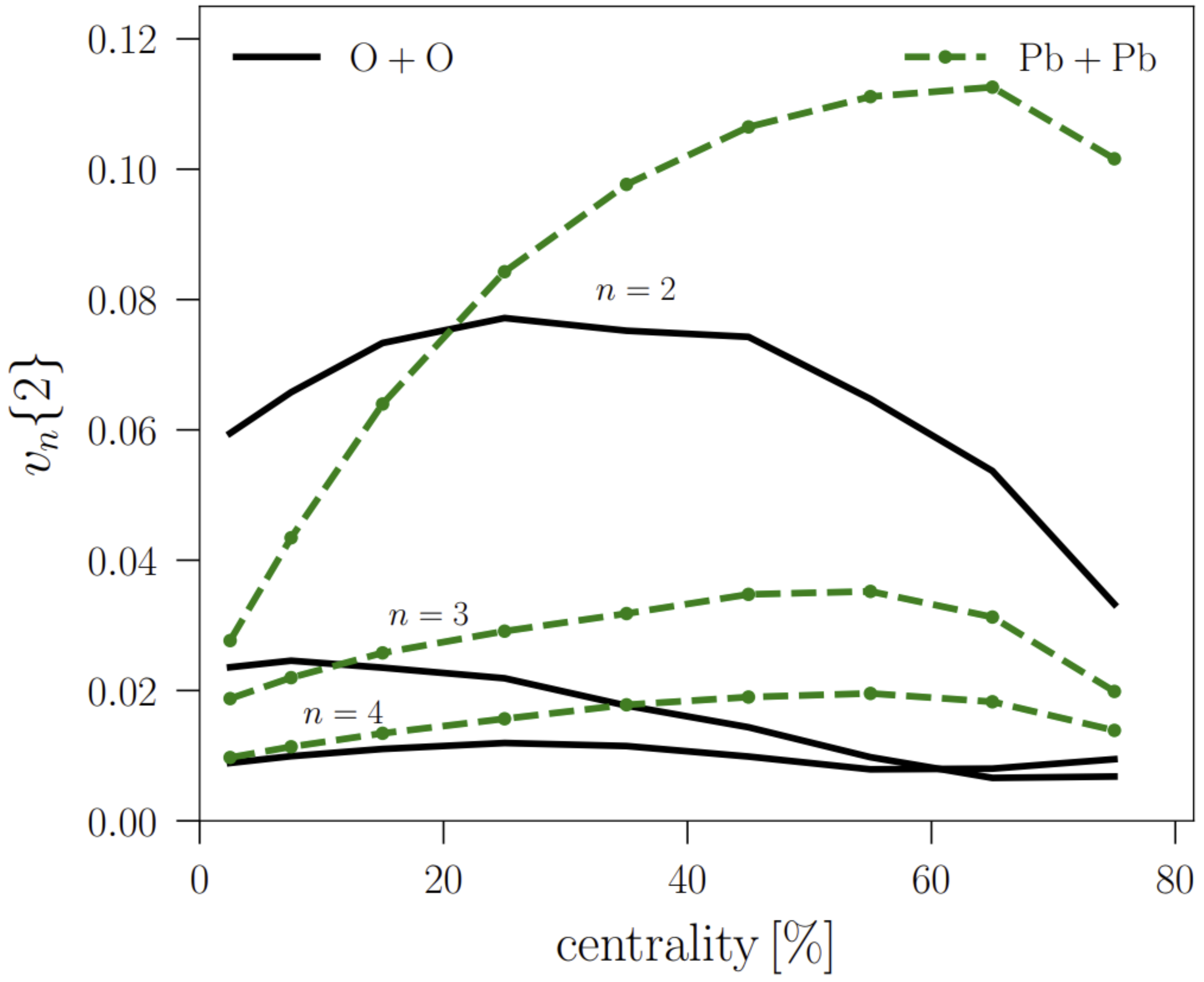
→ Consequence of strong transverse flow, final-state effects

PREDICTIONS: $v_n\{2\}$

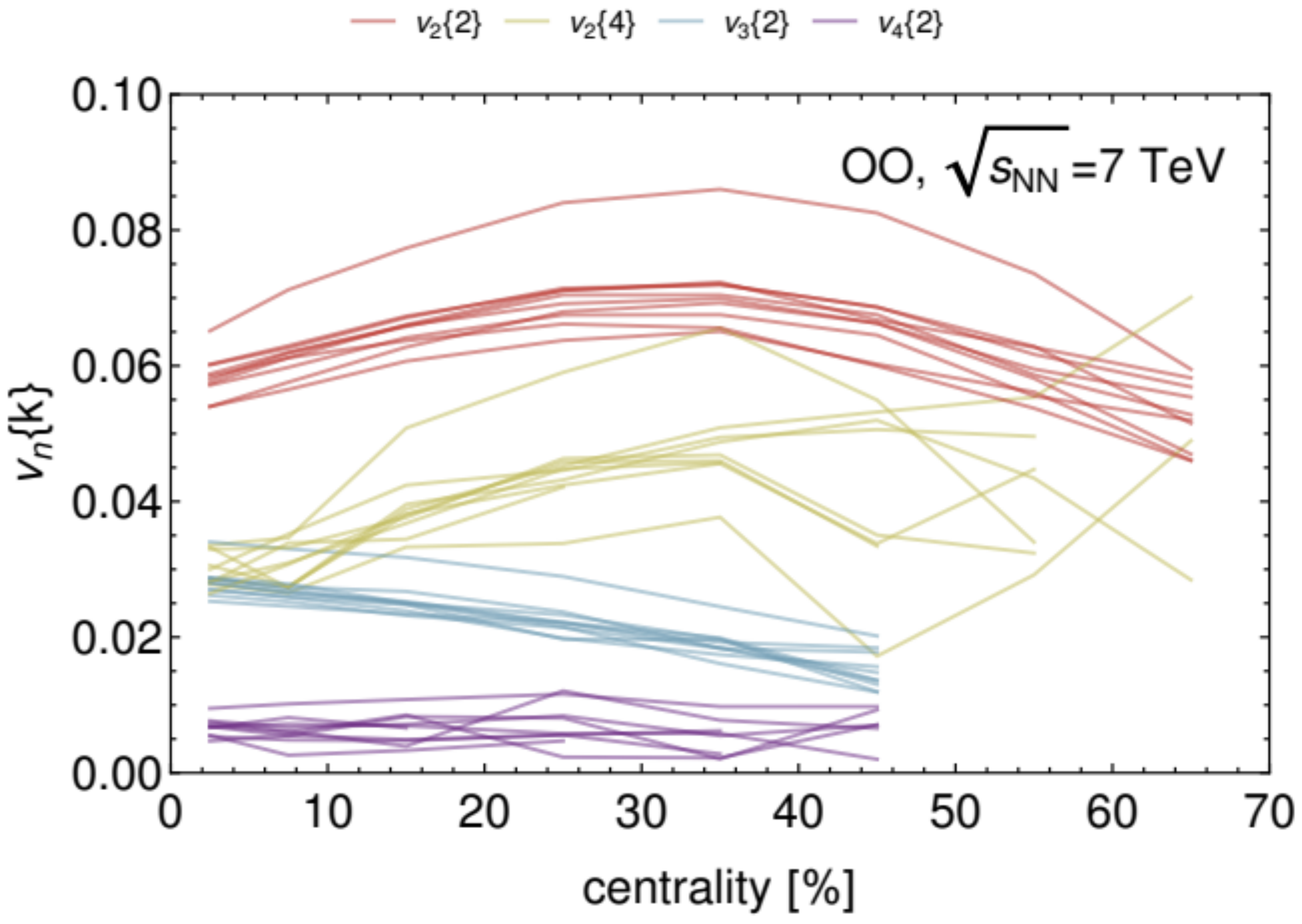
IP-Glasma+MUSIC+UrQMD



EKRT



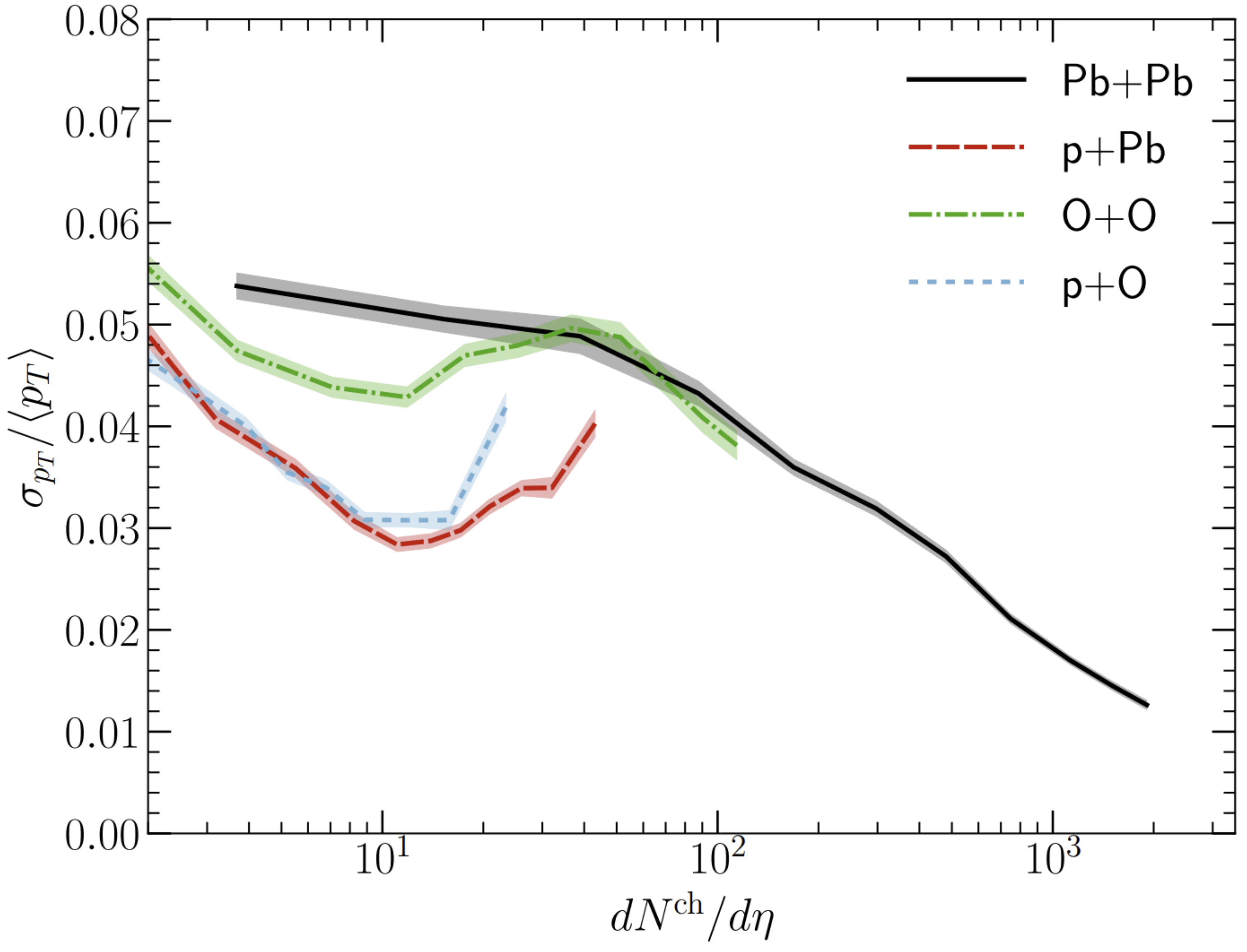
Trajectum



COLLECTED BY WILKE

PREDICTIONS: $\langle p_T \rangle$ FLUCTUATIONS

IP-Glasma+MUSIC+UrQMD



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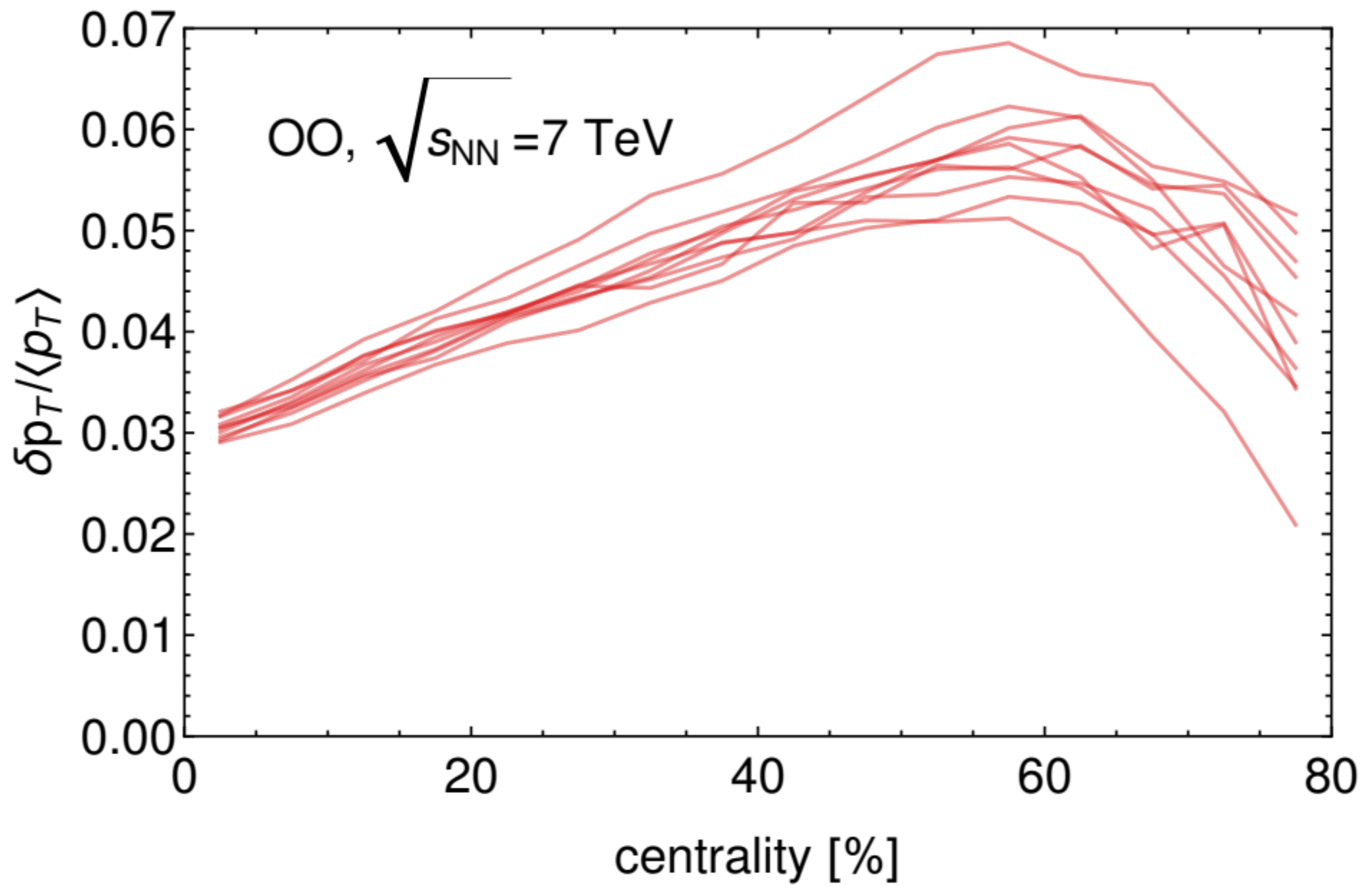
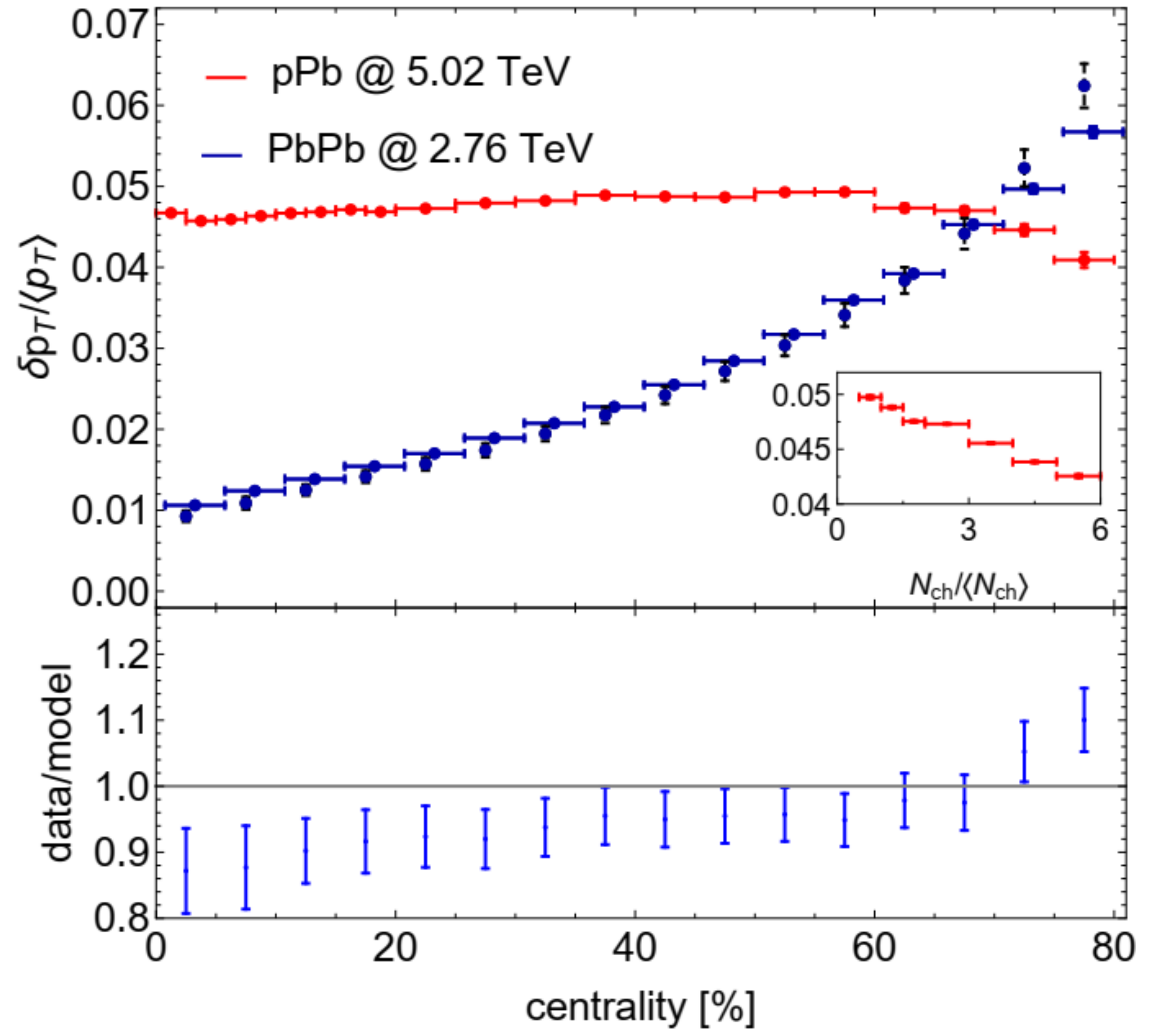
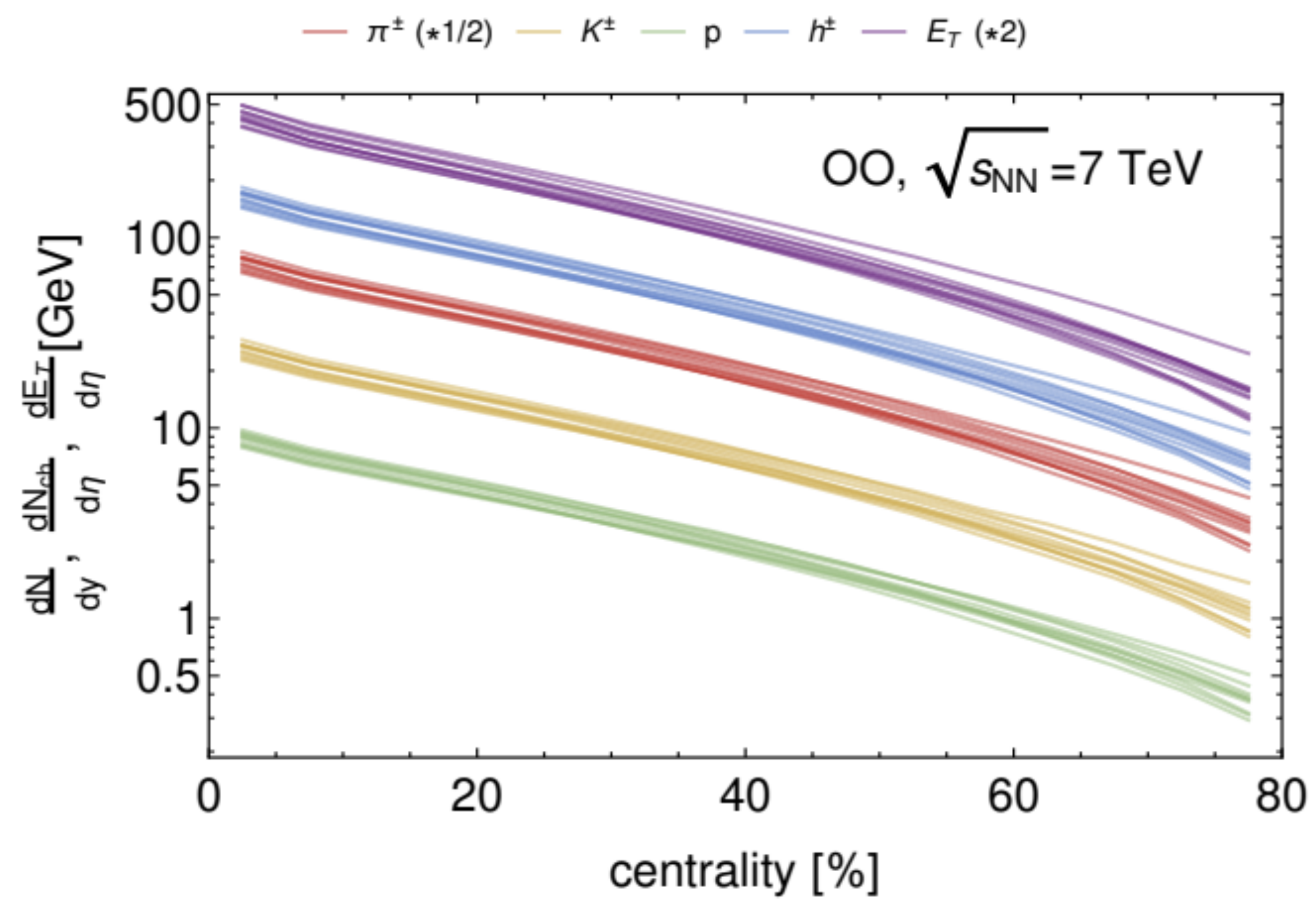


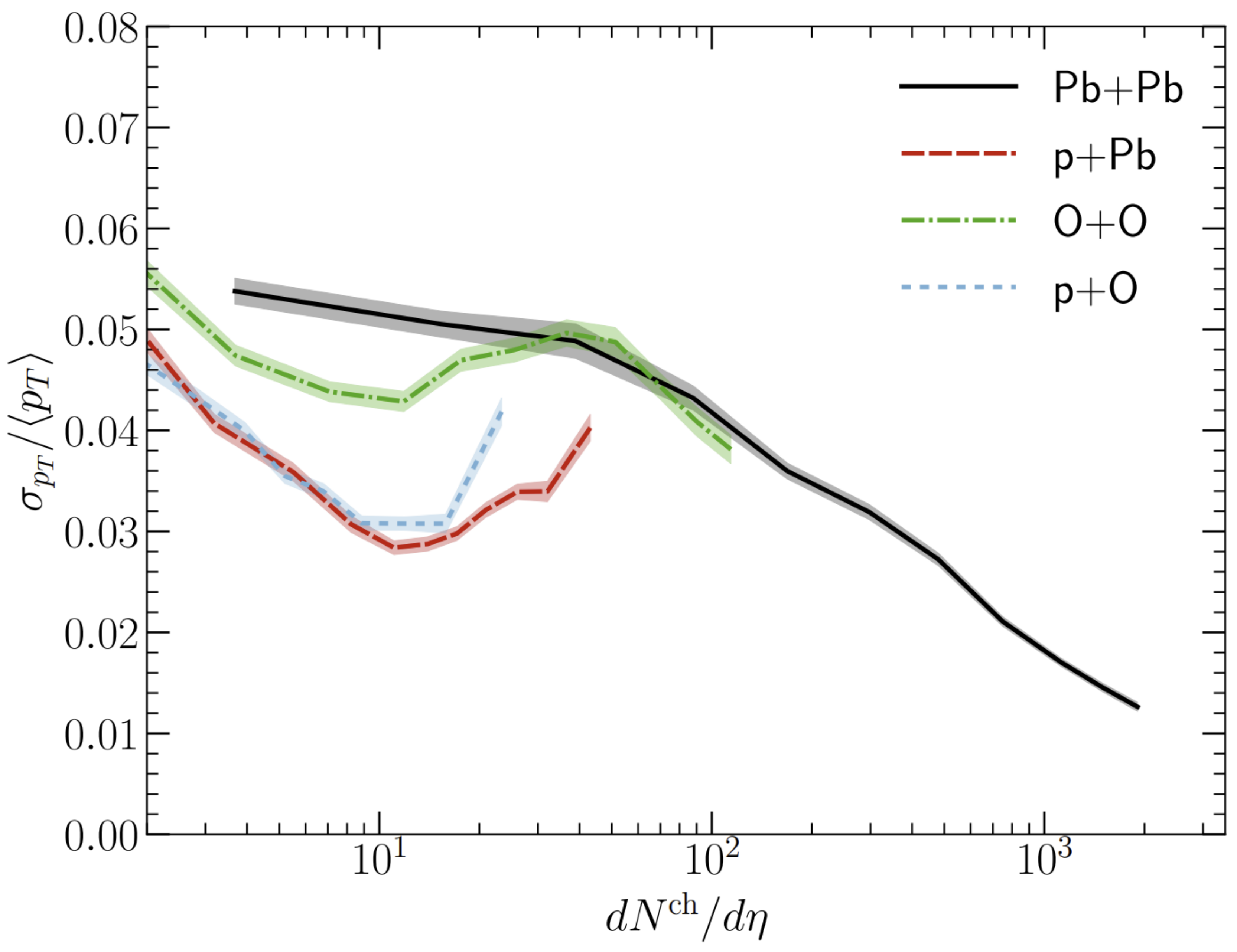


COLLECTED BY WILKE

Predictions: p_T fluctuations



IP-Glasma+MUSIC+UrQMD



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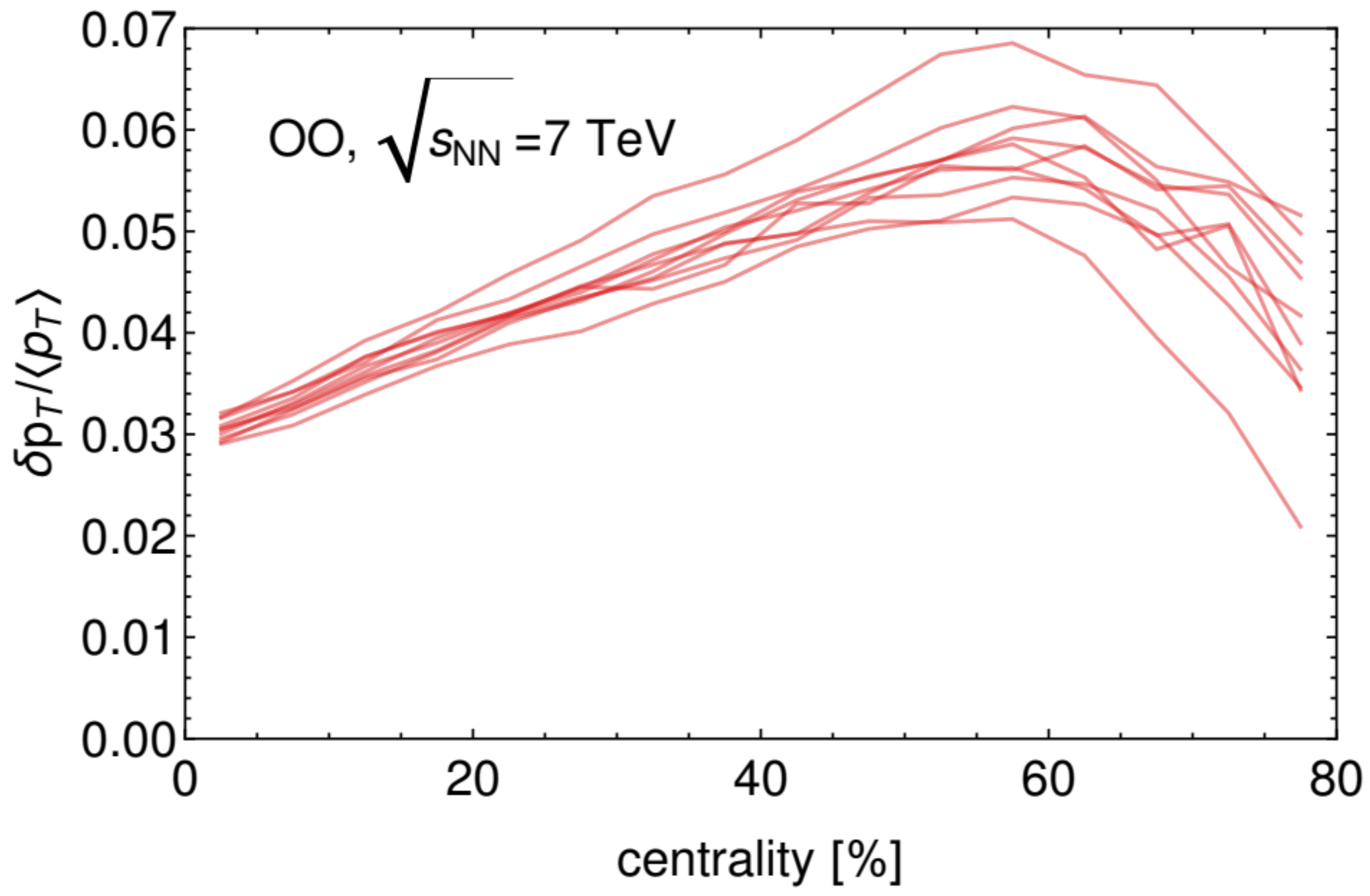
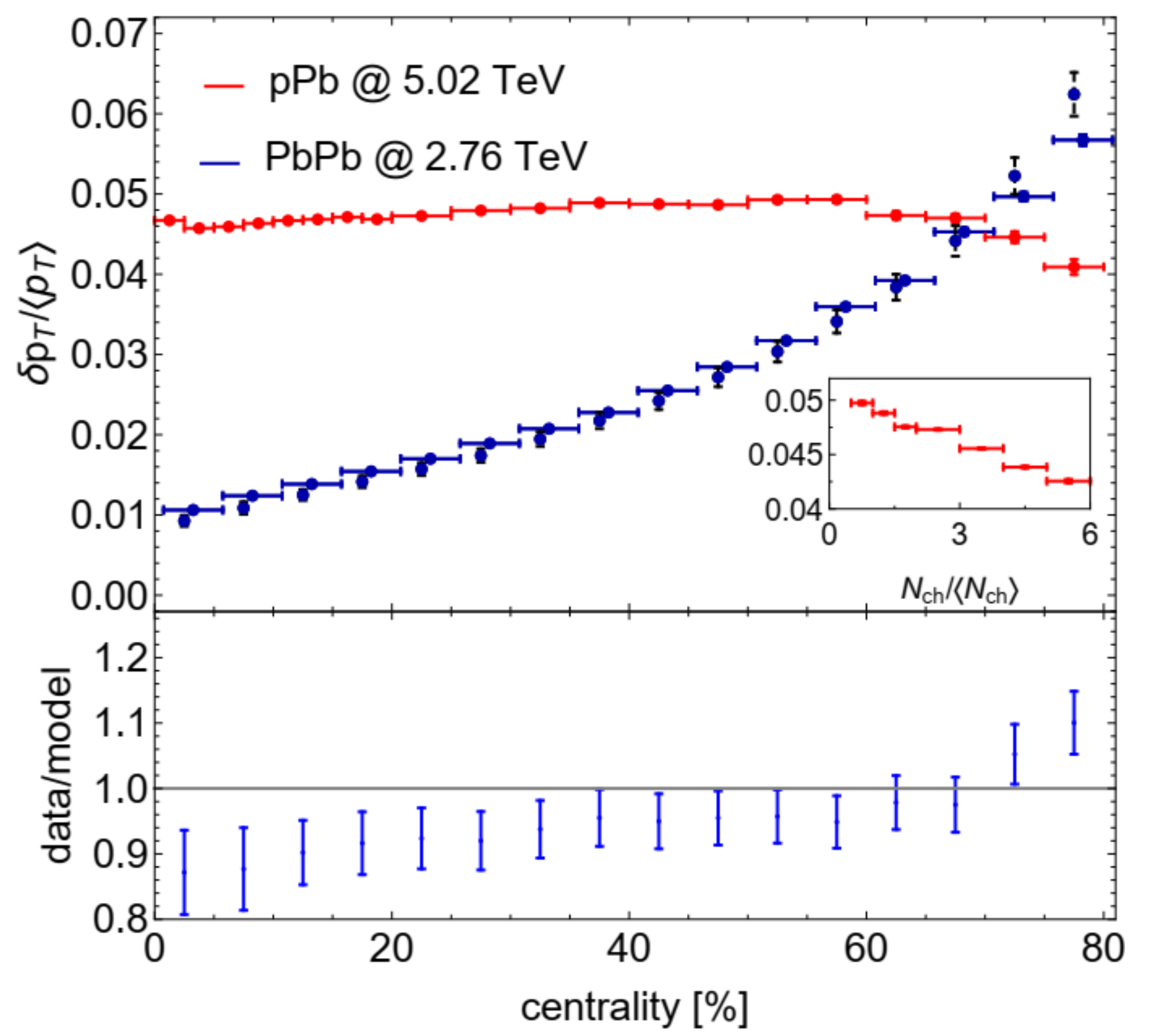
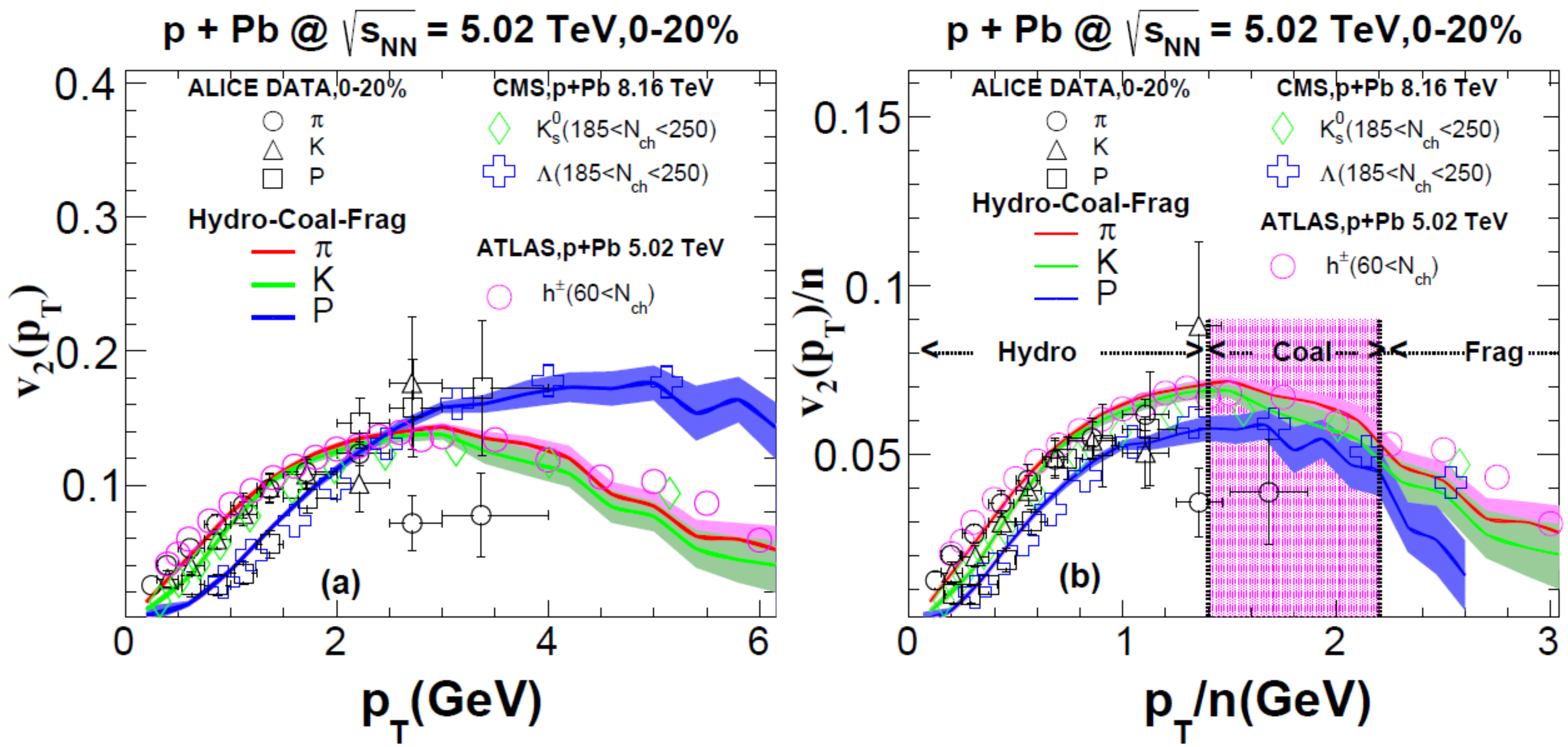




NCQ scaling of v2 & hint partonic degree of freedom

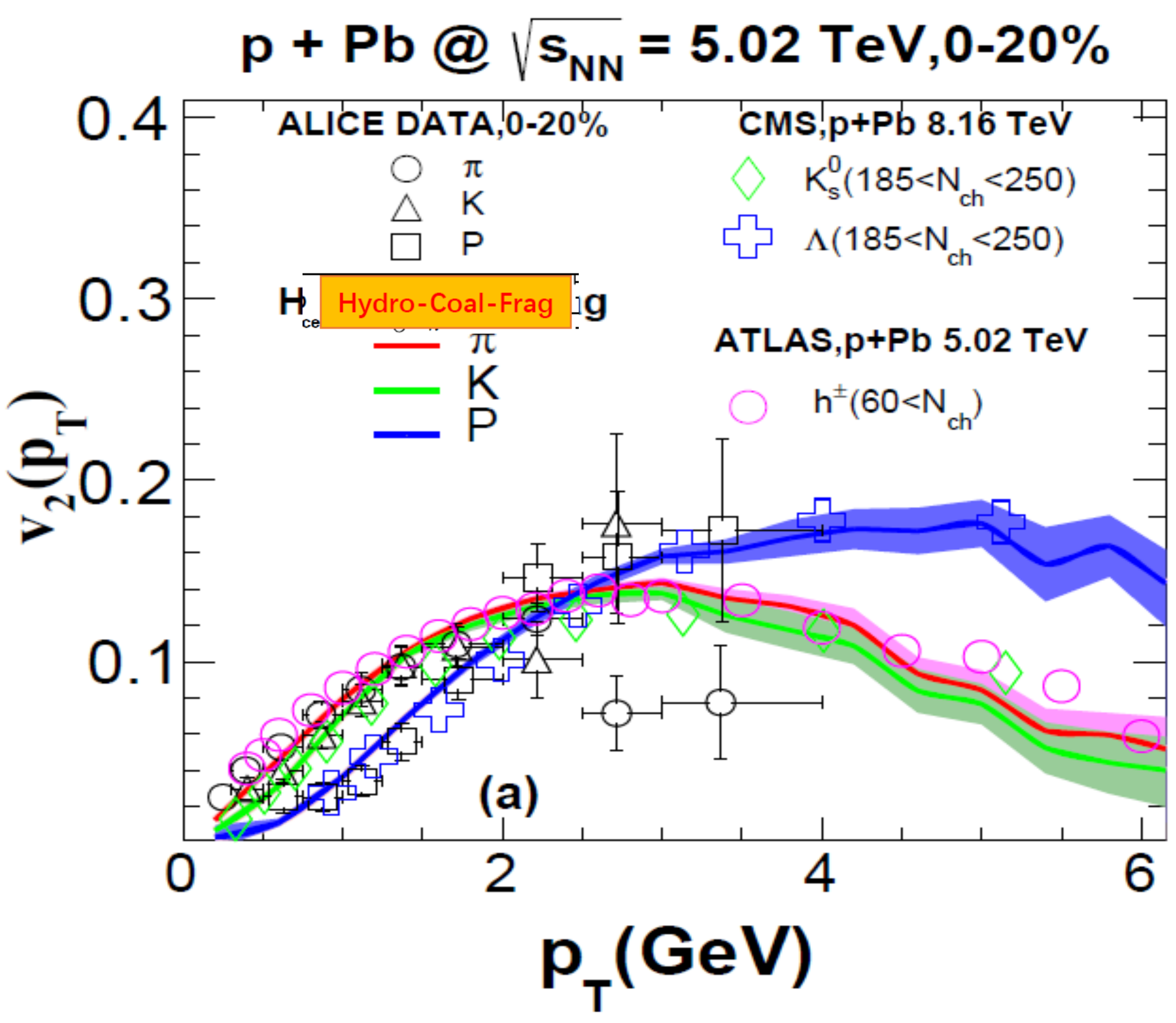


-Hydro-Coal-Frag model gives a nice description of $v_2(p_T)$ of pion, kaon and proton over p_T from 0 to 6 GeV.

-At intermediate p_T, Hydro-Coal-Frag model obtains an approximate NCQ scaling as shown by the data.

Strongly hint partonic degree of freedom in small systems.

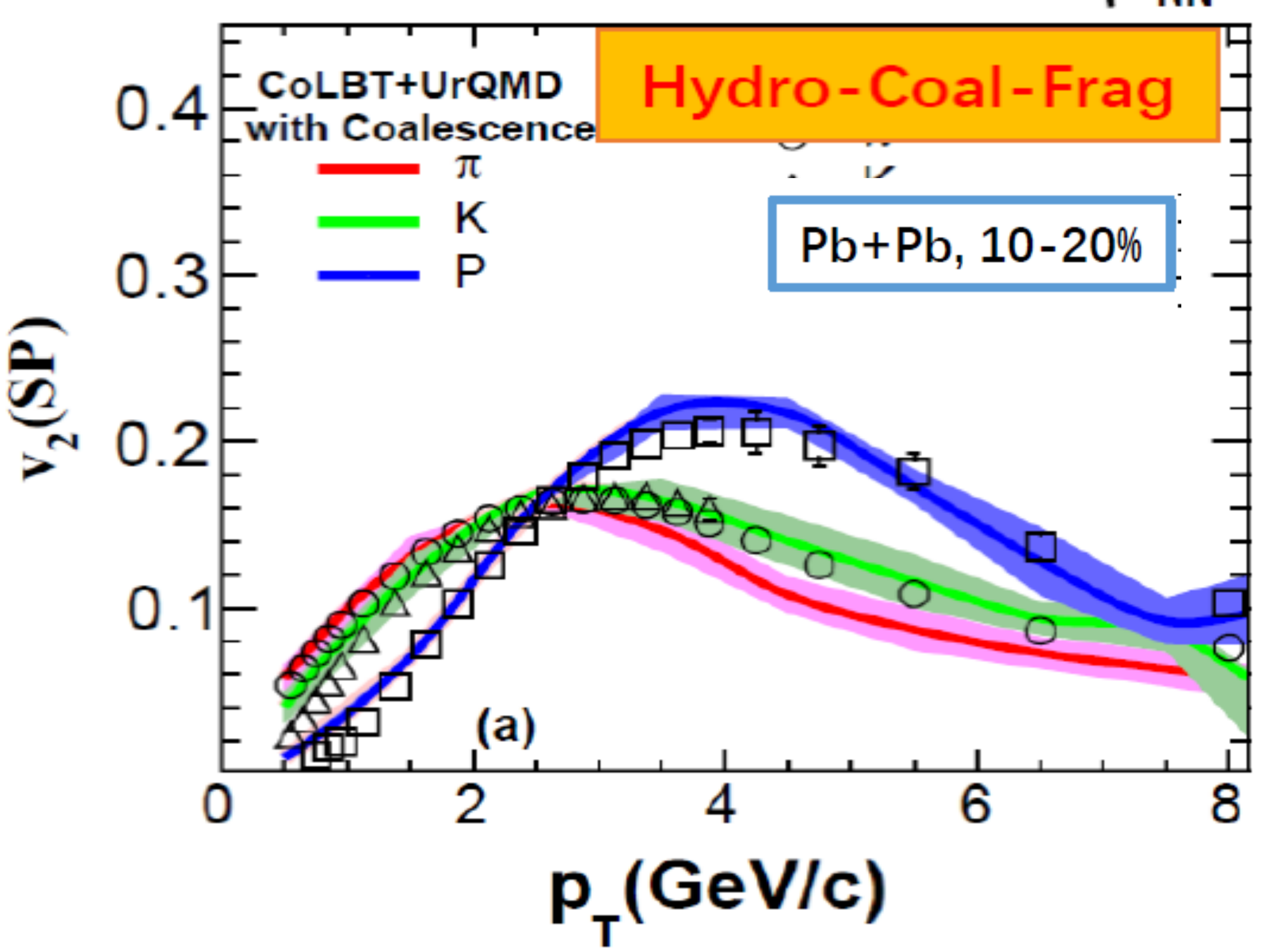
Zhao, Ko, Liu, Qin & Song, Phys. Rev. Lett. 125 7 072301 (2020).

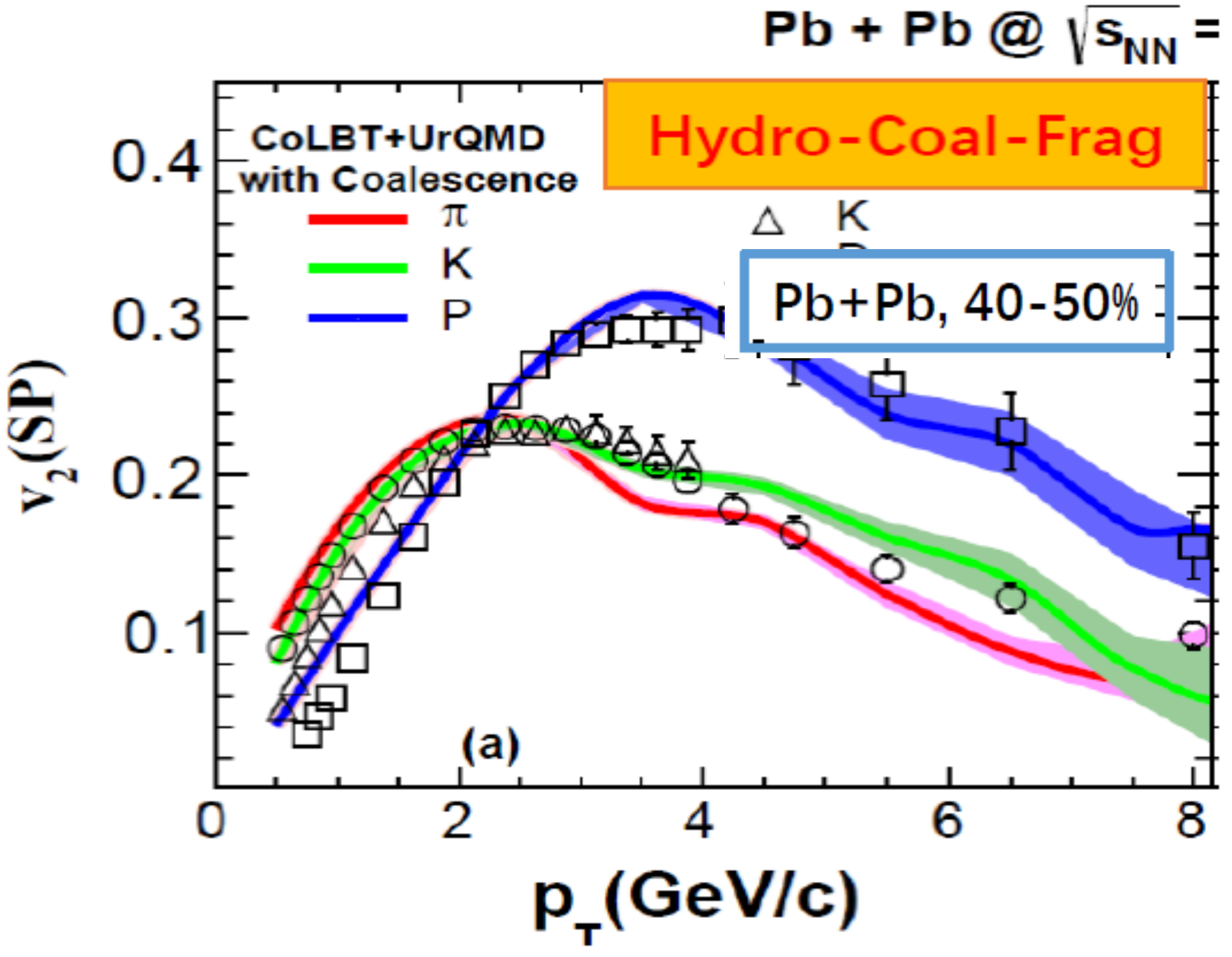


W.Zhao,C. Ko, Y. Liu,G. Qin & H. Song, Phys. Rev. Lett. 125 7 072301 (2020).

At intermediate p_T , <u>Hydro-Coal-Frag model</u> nicely describe PID v2 ,obtains an approximate NCQ scaling in p-Pb collisions– indication Partonic degree of freedom in small system .

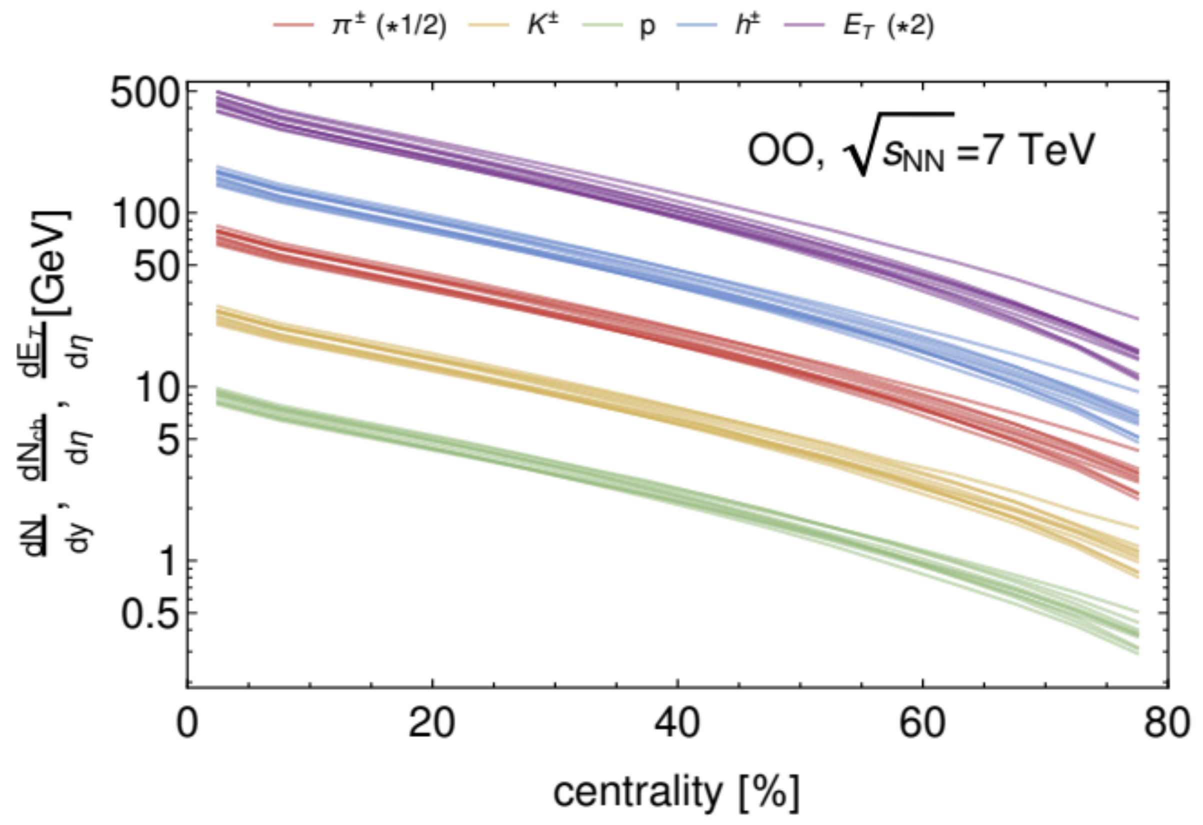
At intermediate p_T , <u>Hydro-Coal-Frag model</u> nicely describe PID v2 in Pb+Pb collisions, also explained NCQ scaling breaking in Pb+Pb collisions .



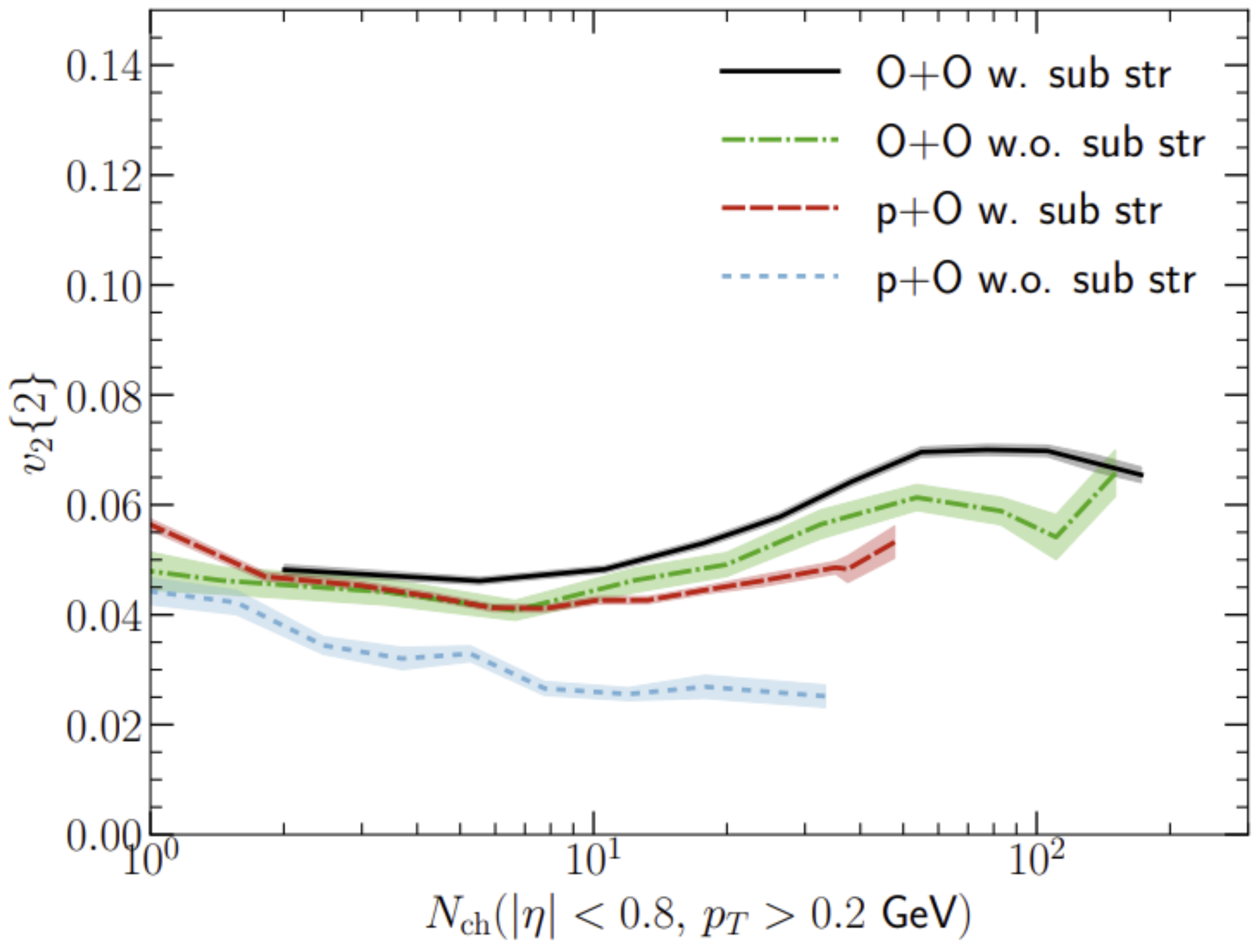


W.Zhao, W. Chen, T. Luo, W. Ke& X.-N. Wang, in preparation.

$V_n\{2\}$



IP-Glasma+MUSIC+UrQMD



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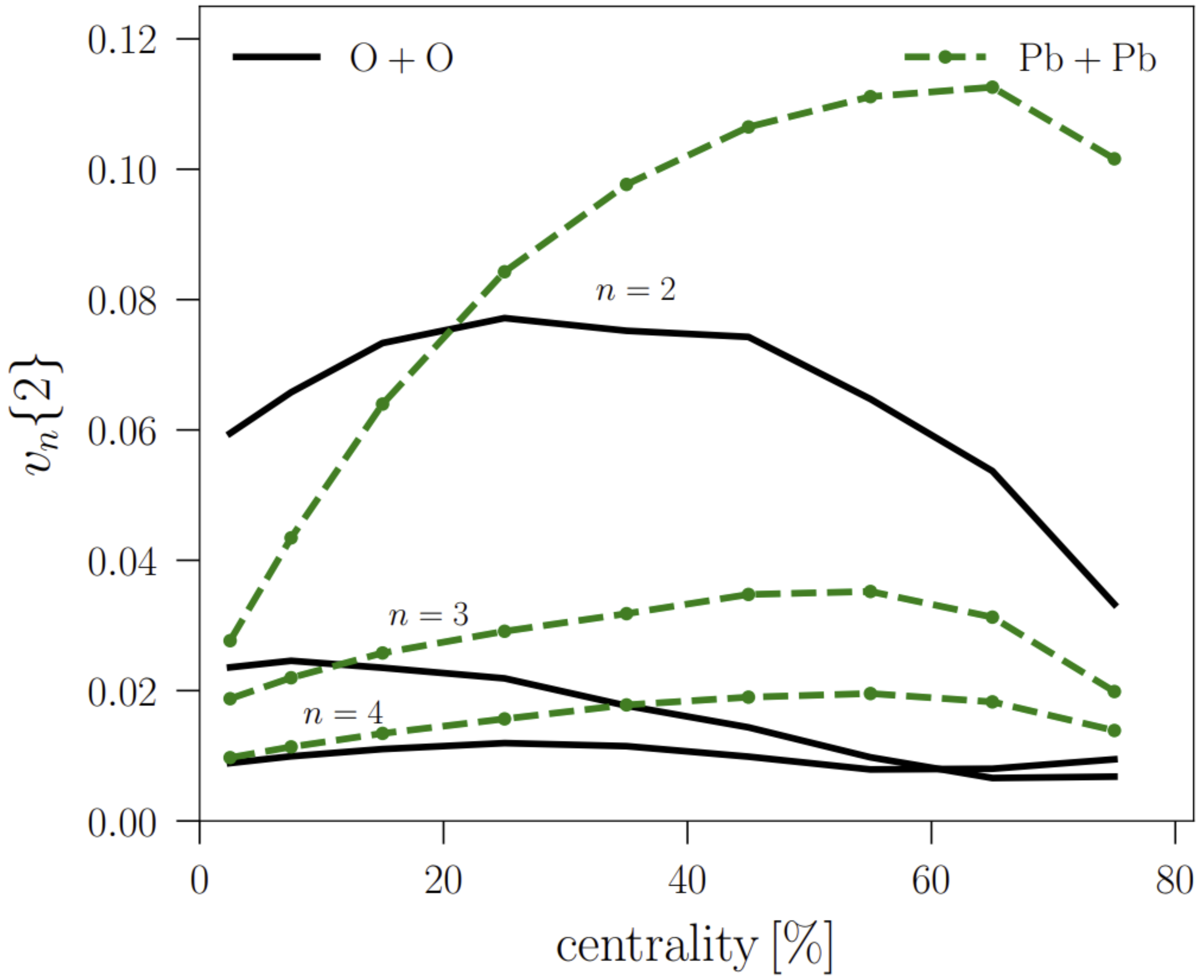
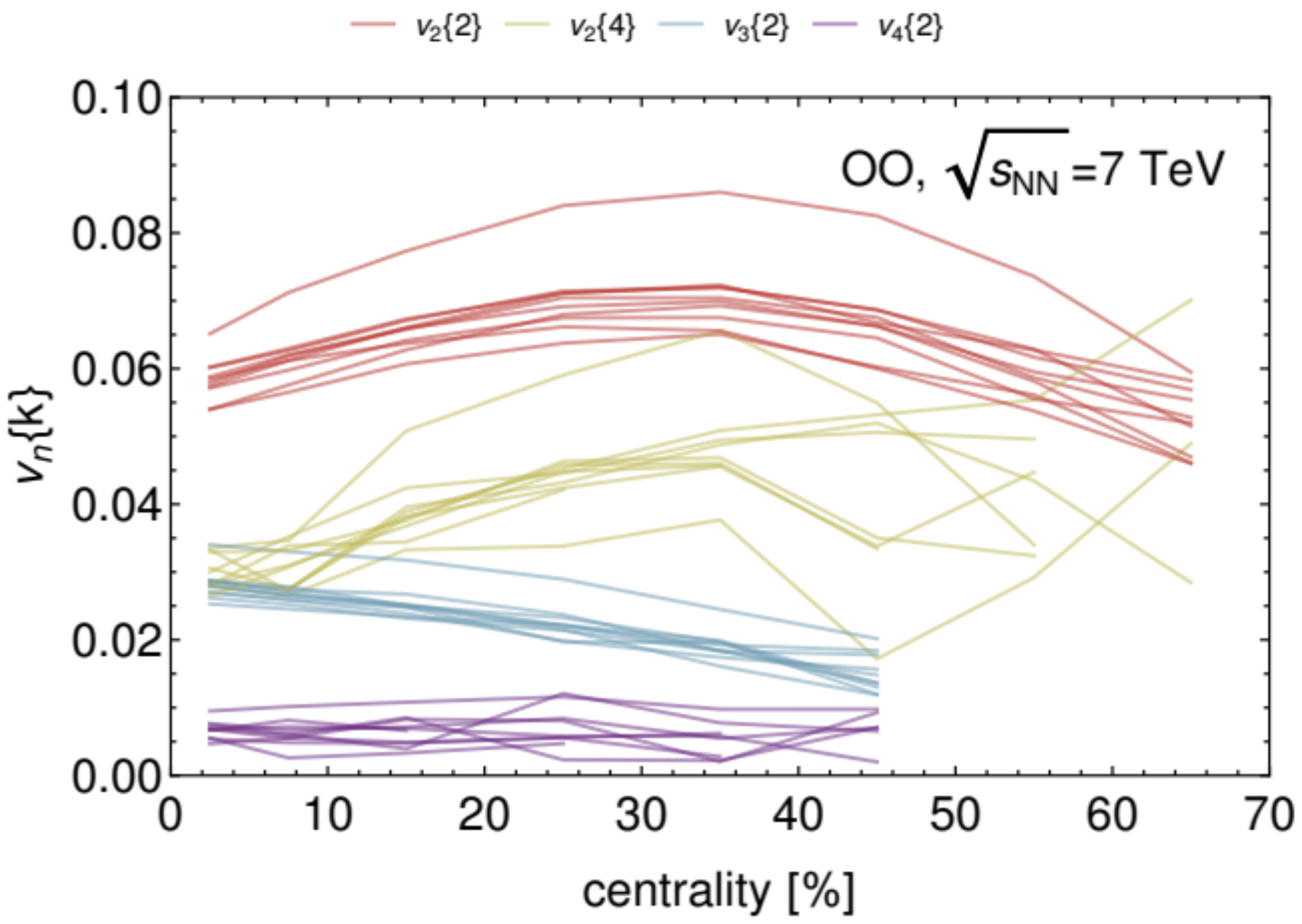
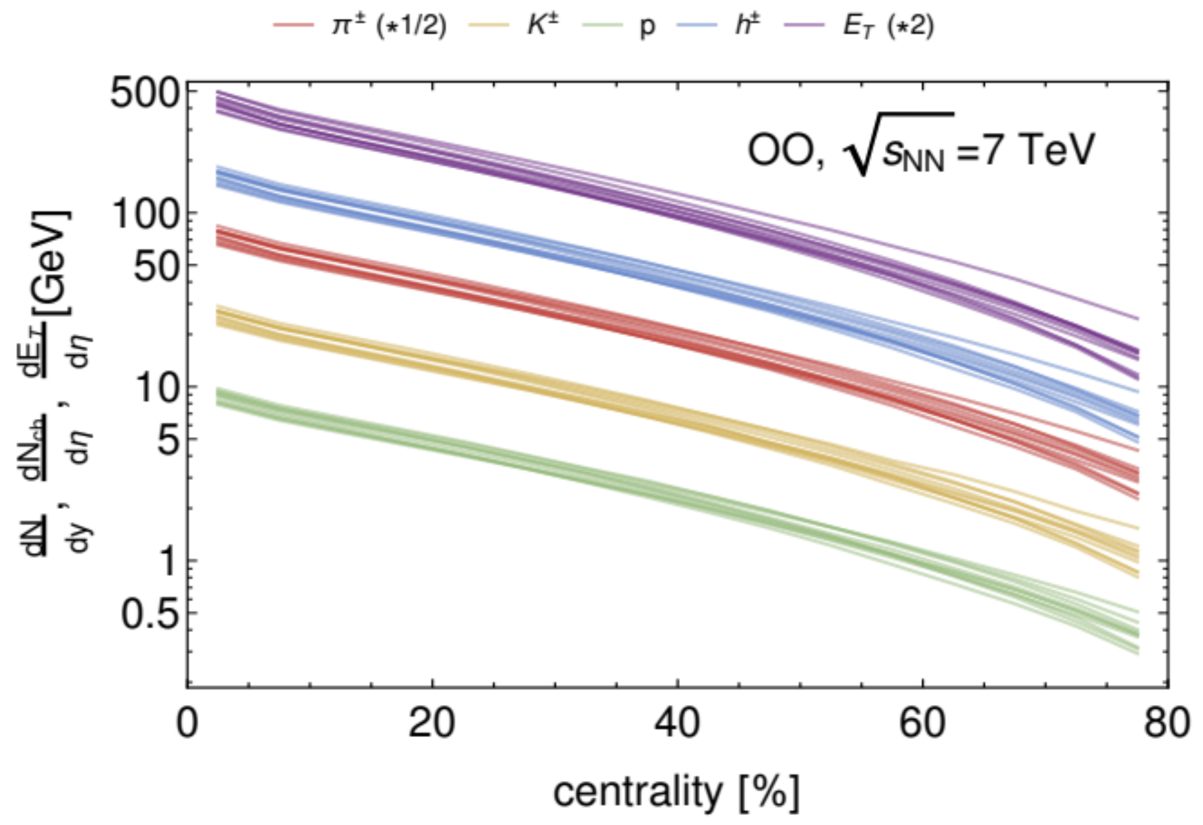


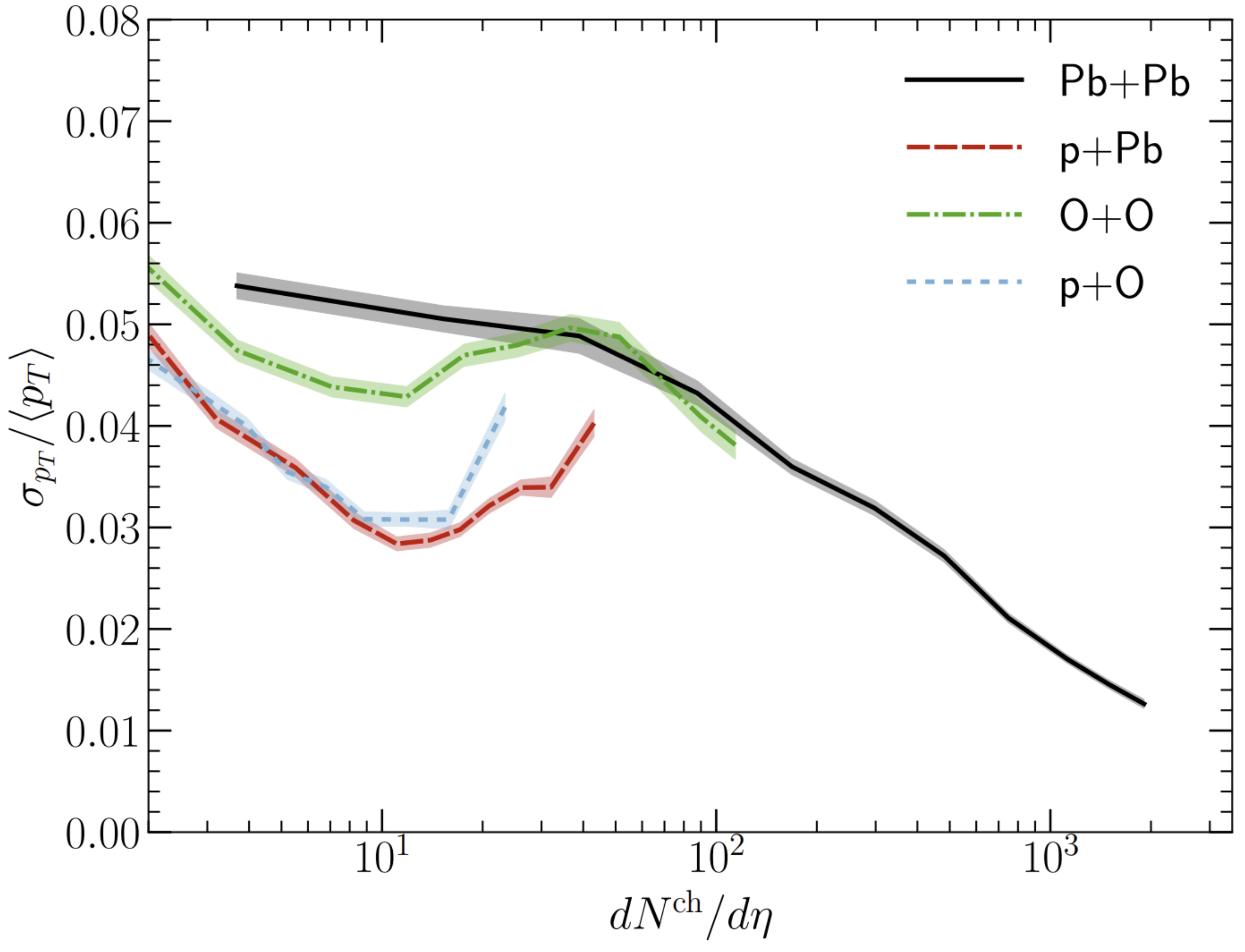
Trajectum



p_T fluct



IP-Glasma+MUSIC+UrQMD



Trajectum