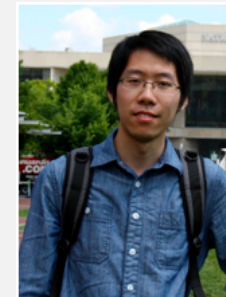


# Investigating high energy pp collisions with a multi-phase transport model coupled with PYTHIA8 initial conditions

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Initial Stages 2023, Copenhagen

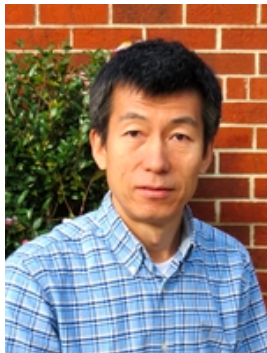


# Motivation

- Collectivity in high multiplicity pp collisions has been experimentally observed
- Understand the role of the parton degrees of freedom in collectivity observables
- Investigate the interplay of parton and hadron interactions at initial and final states

## AMPT

- Extensively applied to interpret the spectra and correlations in AA collisions



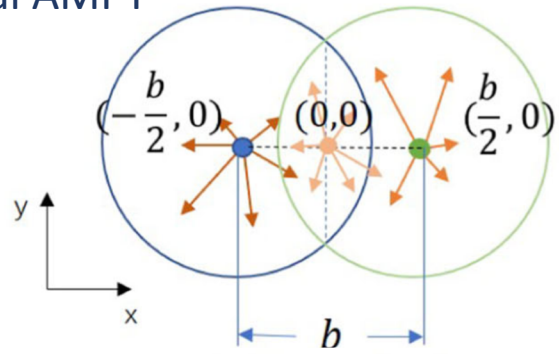
## PYTHIA

- String fragmentation model succeeding in pp collisions (impact parameter dependent string system)

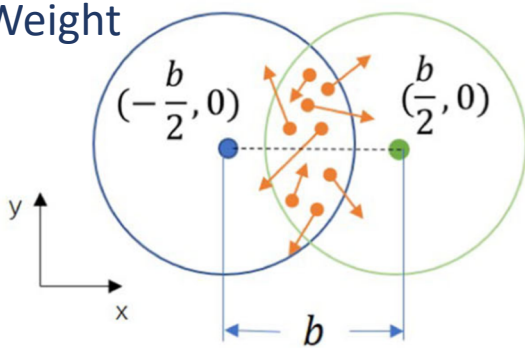


# Model setup

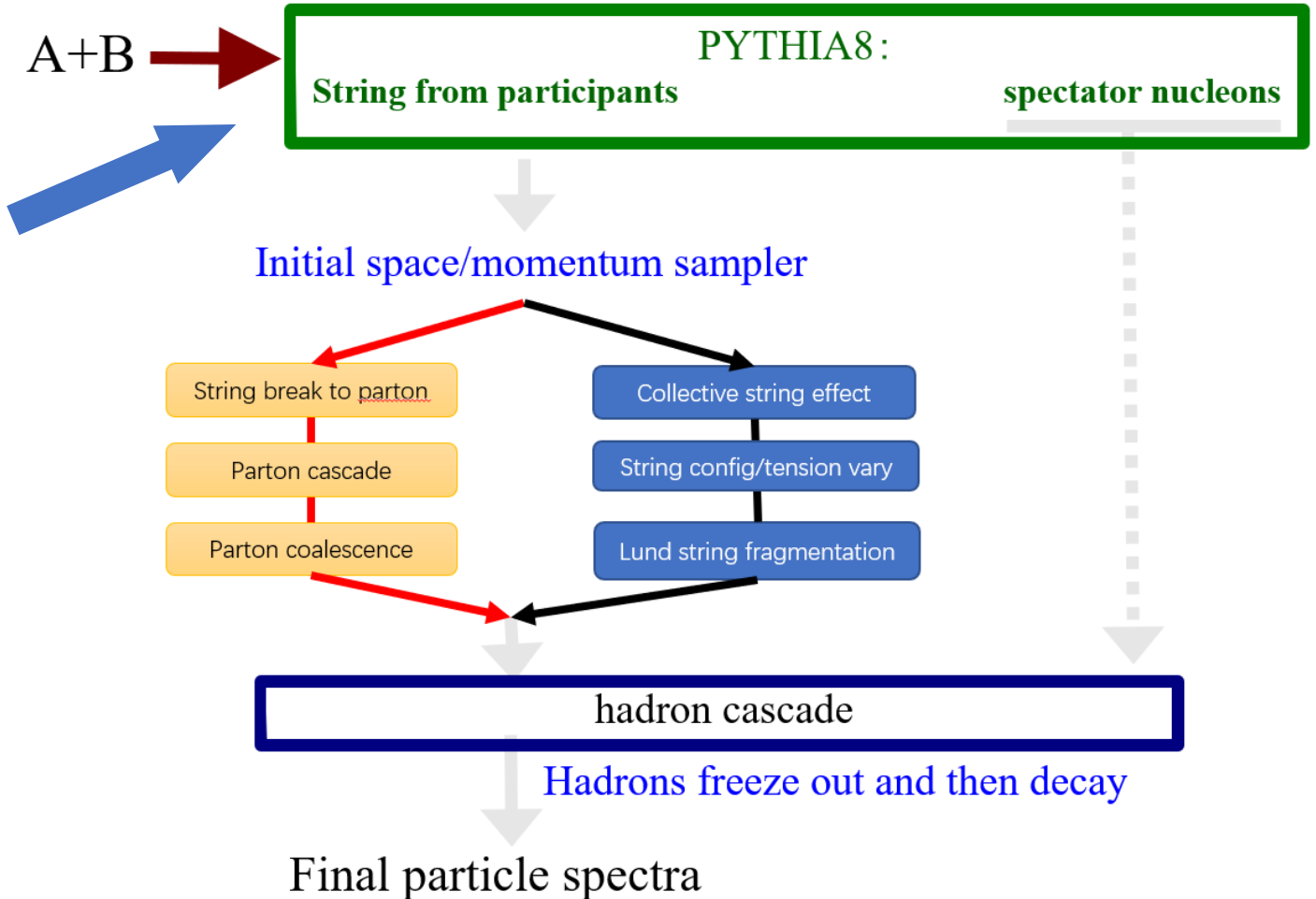
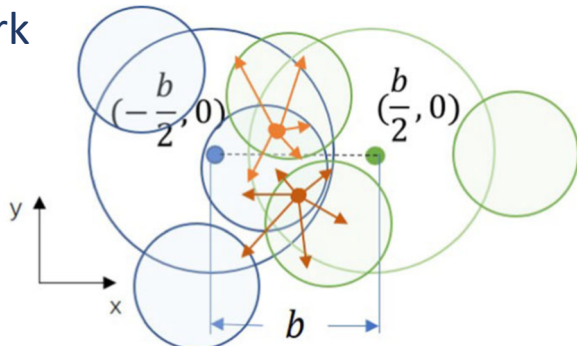
Original AMPT



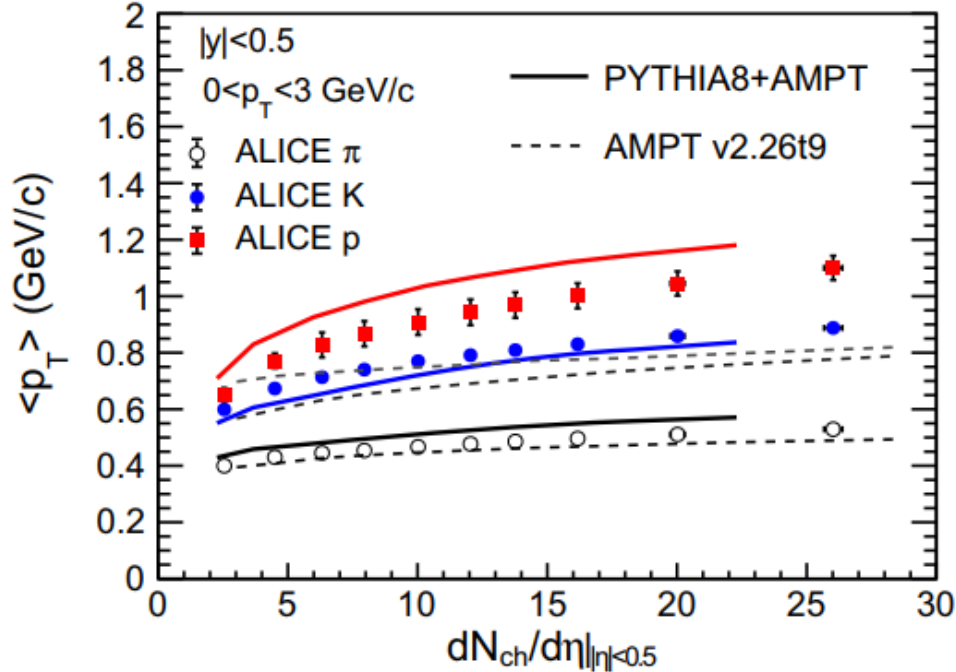
$(x,y,b)$  Weight



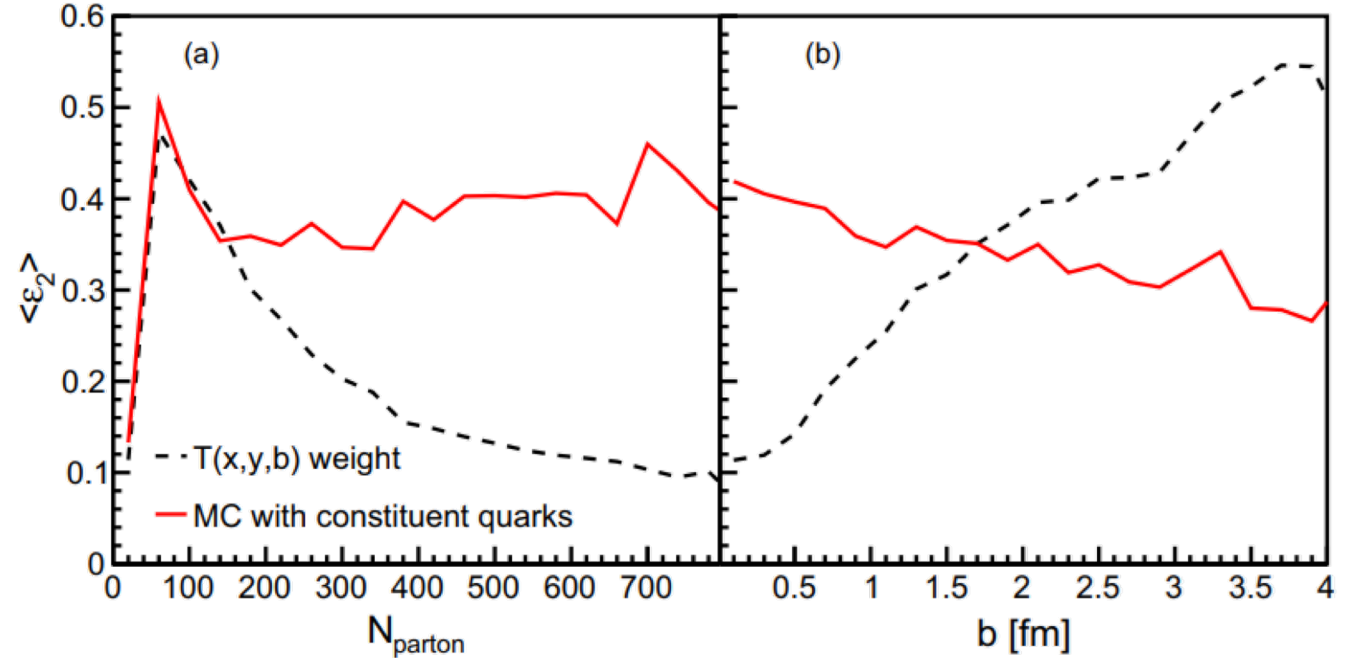
3-quark



# Results: particle spectra and eccentricity

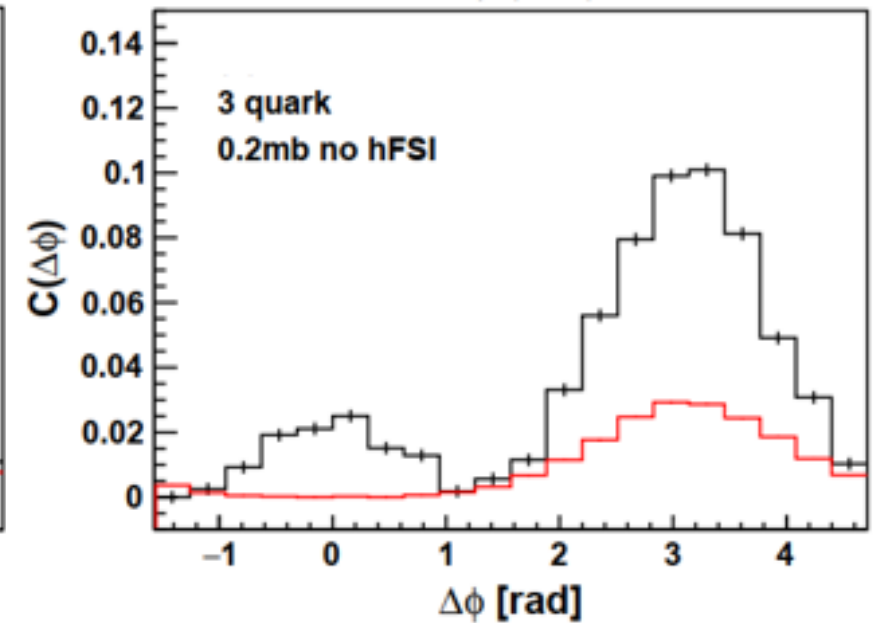
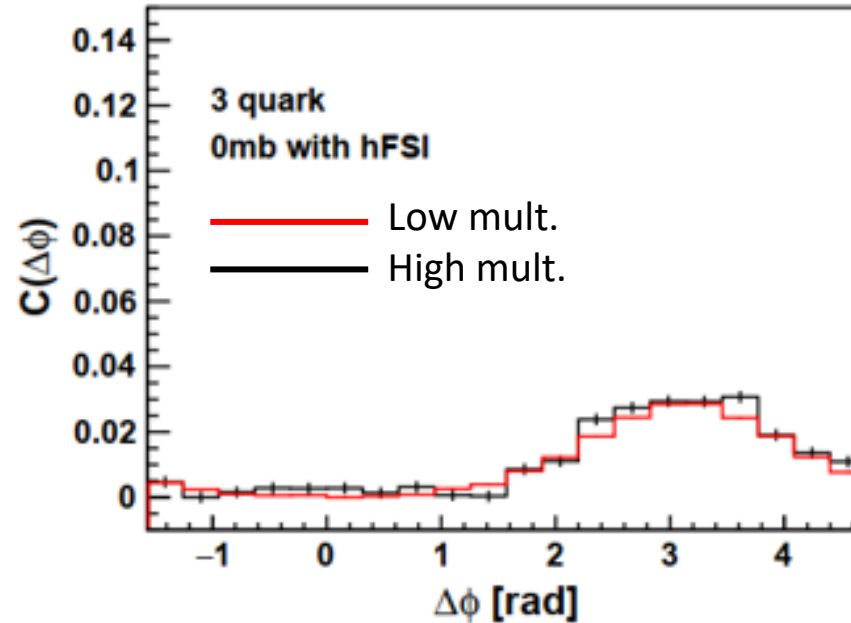
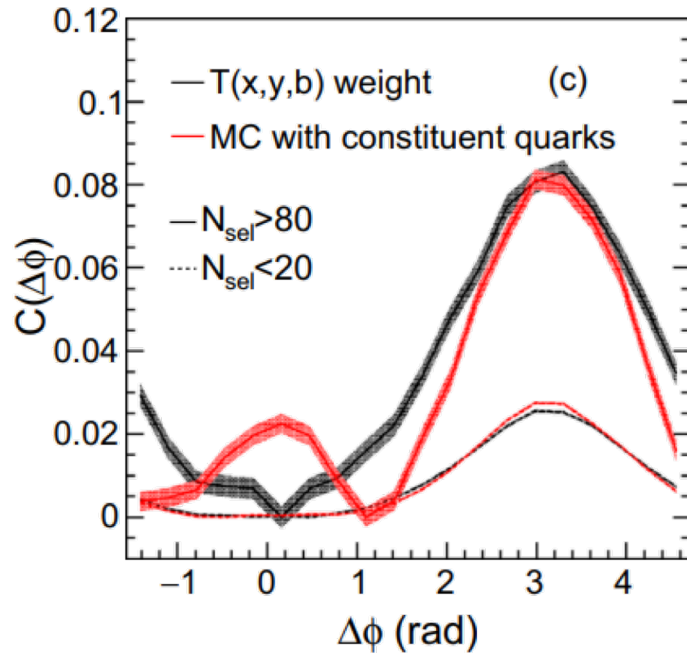


- PYTHIA8+AMPT can better describe the multiplicity dependence of identified hadron productions in pp collisions at LHC



- Sizable spatial eccentricity expected in the high multiplicity or central pp collision events due to the sub-nucleon spatial fluctuations

# Results: long range correlations



- Significant long range correlations can be induced in the scenario considering sub-nucleon constituent quark structure.
- The long range correlation is developed in the parton evolution stage and cannot be generated with only hadron cascade effects.

# Summary

- We implement PYTHIA8 initial conditions in the AMPT model to study multiplicity dependent features in pp collisions
- Near side ridge in pp collisions appears from the response to the large spatial eccentricity in transport model
- Sub-nucleon fluctuation is important in understanding the formation of small system collective behavior

See  
Eur. Phys. J. C 81, 755 (2021)  
Phys. Lett. B 839, 137799 (2023)  
for details

**Thank you for your attention!**