UNIVERSITÄT BIELEFELD

Longitudinal structure of the initial state from 3+1D CGC simulations[1]

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IS2021 The VI[th] International Conference on the INITIAL STAGES OF HIGH-ENERGY NUCLEAR COLLISIONS

CRC-TR 211 Strong-interaction matter under extreme conditions

Overview

We perform classical Yang-Mills simulations of the 3+1D structure of the initial state, based on the CGC framework beyond the boost-invariant approximation.

General Formalism for 3+1D Collisions

Idea: Superimpose the fields coming from individual nuclei which then evolves to produce glasma.

The evolution of the fields and the currents are given by:

$[D_\mu, F^{\mu\nu}] = J^\nu$ Yang-Mills equation

$[D_\mu, J^\mu] = 0$ Current conservation equation

Model for realistic color charge distribution

Plan: Connect the color charge distribution to the measurements of hadronic structure function from DIS experiments.

Assumption: Position and momentum dependence can be factorised as

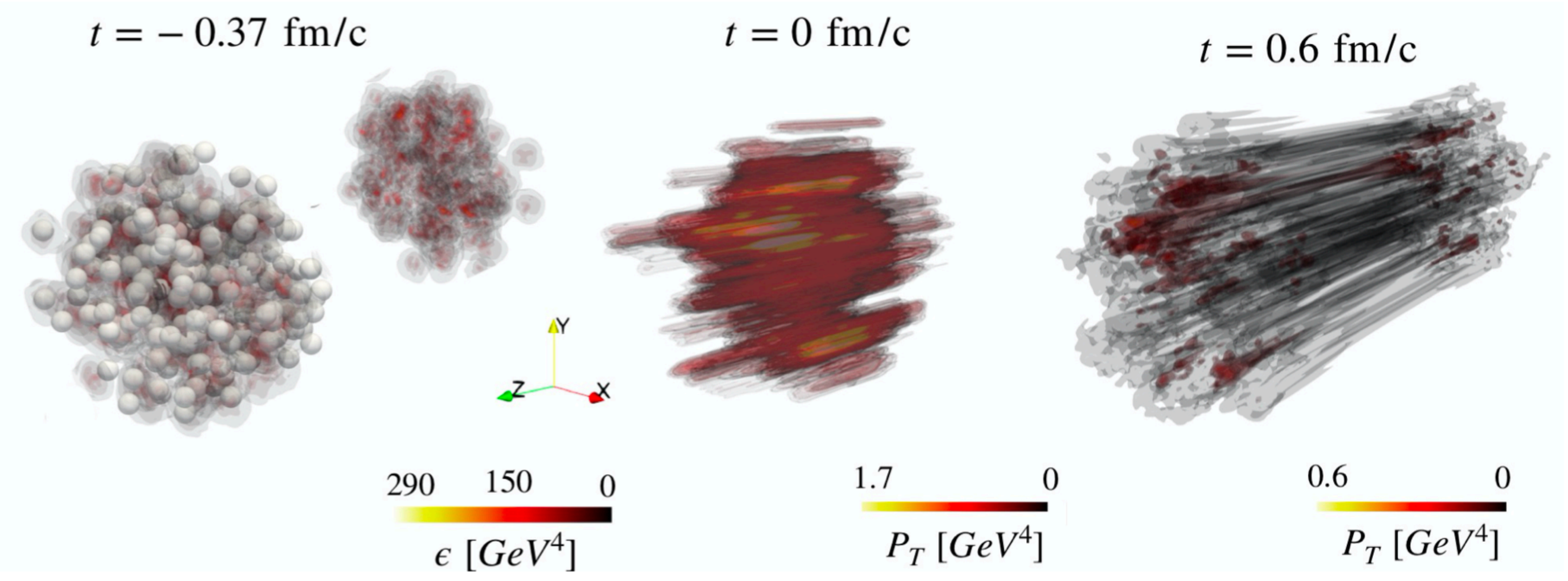
$$\left\langle \rho^a(x)\rho^b(y) \right\rangle = \delta^{ab} T\left(\frac{x+y}{2}\right)\Gamma(x-y)$$

$\Gamma(x-y)$ constrained by parametrising small-x TMDs in dilute limit with GBW model.

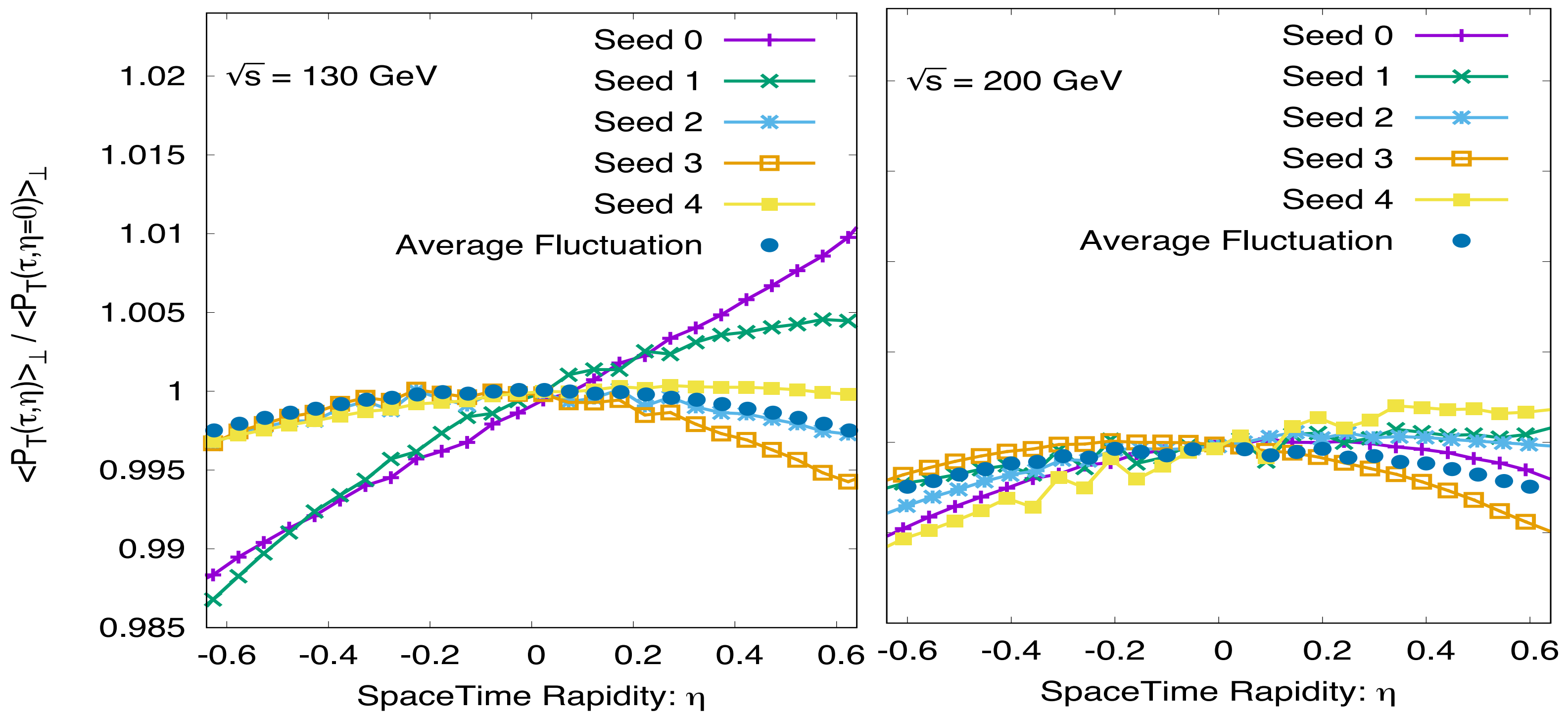
Overall thickness of nucleus obtained by superimposing 3D MC-Glauber profile

$$T(x,y,z) = \sum_i^A T_i(x,y,z)$$

Collision with (semi-) realistic charges



Explore the longitudinal fluctuation which emerge naturally within our framework.

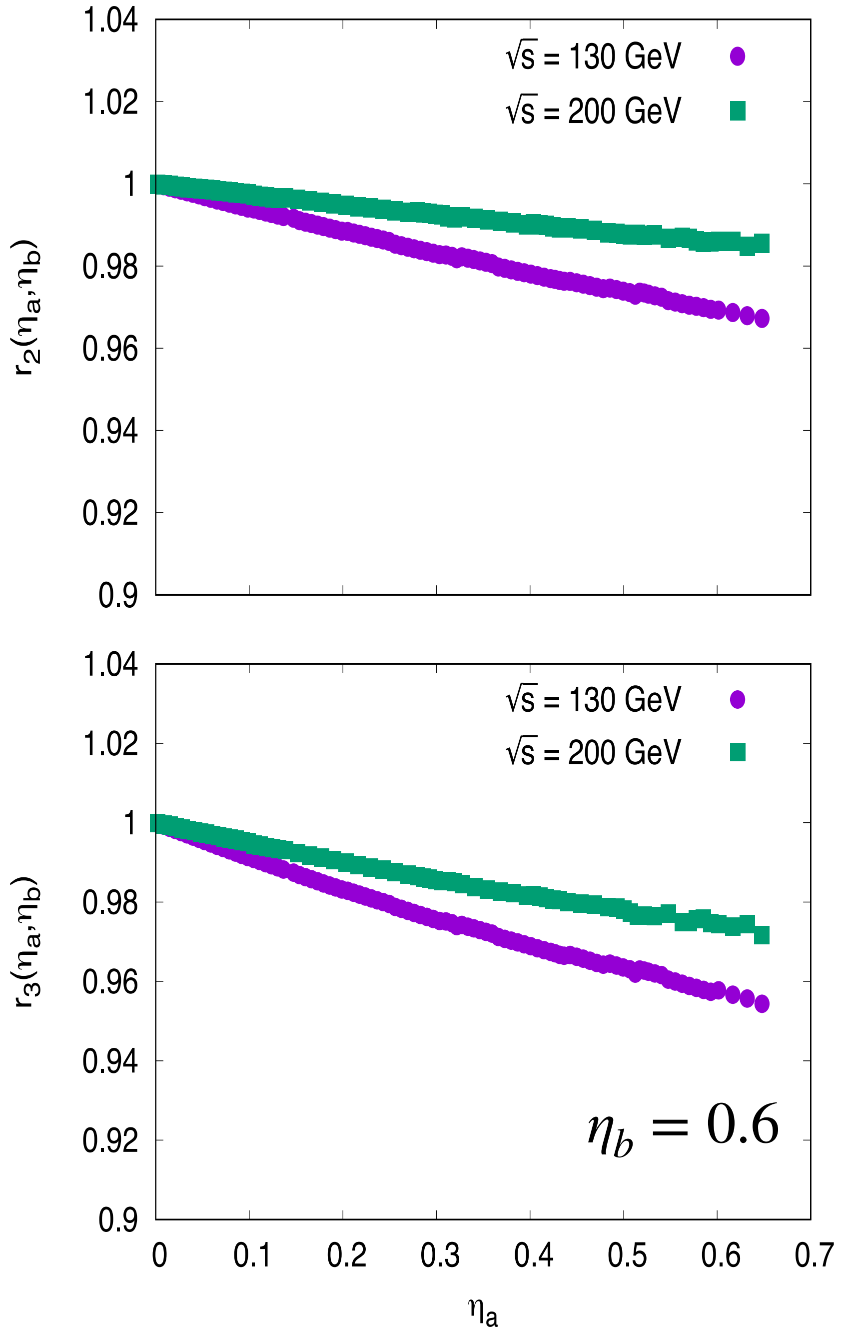


Effects of fluctuations smallish but clearly visible; promising dependence on center of mass energy

Event-plane decorrelation

$$r_n(\eta_a,\eta_b) = \frac{\langle \mathrm{Re}[\epsilon_n(-\eta_a)\cdot\epsilon_n^*(\eta_b)]\rangle}{\langle \mathrm{Re}[\epsilon_n(\eta_a)\cdot\epsilon_n^*(\eta_b)]\rangle}$$

CMS Collaboration PRC 92, 034911



Conclusion & Outlook

Developed a framework to describe 3D profiles of initial energy deposition. Successful results from numerical simulations.

Explore larger rapidity window and get additional insights from analytics.

Acknowledgement

We acknowledge support by the Deutsche Forschungsgemeinschaft (DFG) through the grant CRC-TR 211 "Strong-interaction matter under extreme conditions". Computational resources have been provided by Paderborn Centre for Parallel Computing (PC2) and National energy Research Scientific Computing Center (NERSC)

[1] Based on S. Schlichting and P. Singh Phys. Rev. D 103, 014003 and references within.