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.

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

\[
[D_{\mu}, J^{\mu}] = 0 \quad \text{Current conservation equation}
\]

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

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

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

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

\[
T(x, y, z) = \sum_i A_i T_i(x, y, z)
\]

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

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.

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