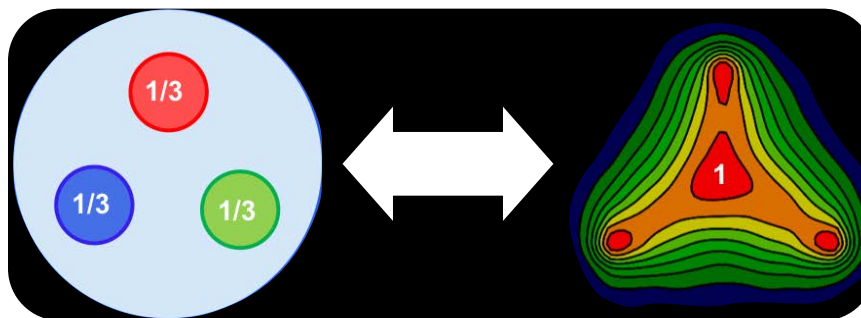


Search for baryon junctions in isobar collisions at EIC

Niseem Magdy, Prithwish Tribedy, Zhangbu Xu,
Roy Lacey, Wenliang Li, Abhay Deshpande

What carries the baryon quantum number?

Valence **Quarks**?
Stop the quarks to stop
a baryon.

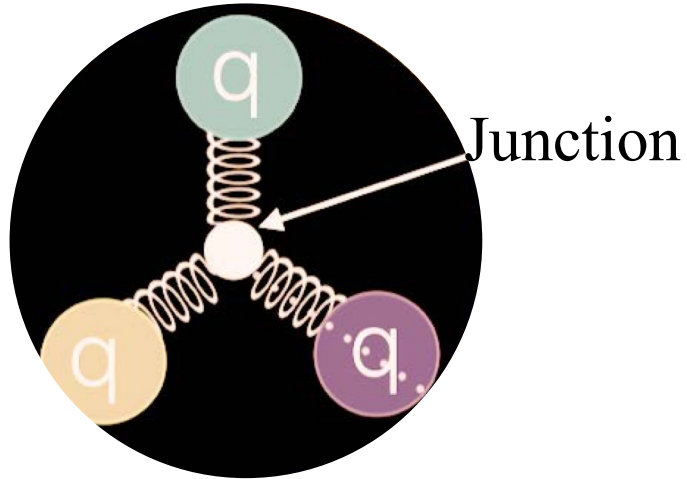


Gluons?
Stop the junction to stop
a baryon.

Tracking the origin of baryon number with the EIC
Zhangbu Xu, May 19, 2023, 8:55 AM

Can gluons carry the flow of baryon number?

P. Tribedy, CETHNEP, VECC, Nov 15, 2022



- Baryon-junction will be stopped at $y \sim 0$ (low pT)
- ✓ Large N_{Baryon} at midrapidity

How do we set an experimental test

J. Brandenburg, N. Lewis, P. Tribedy, Z. Xu, arXiv: 2205.05685

- Valence quarks carry electric charge; do they also carry a baryon number?
- Electric Charge (Q) vs. baryon (B) stopping in e+A collisions
- ✓ Naive expectations:

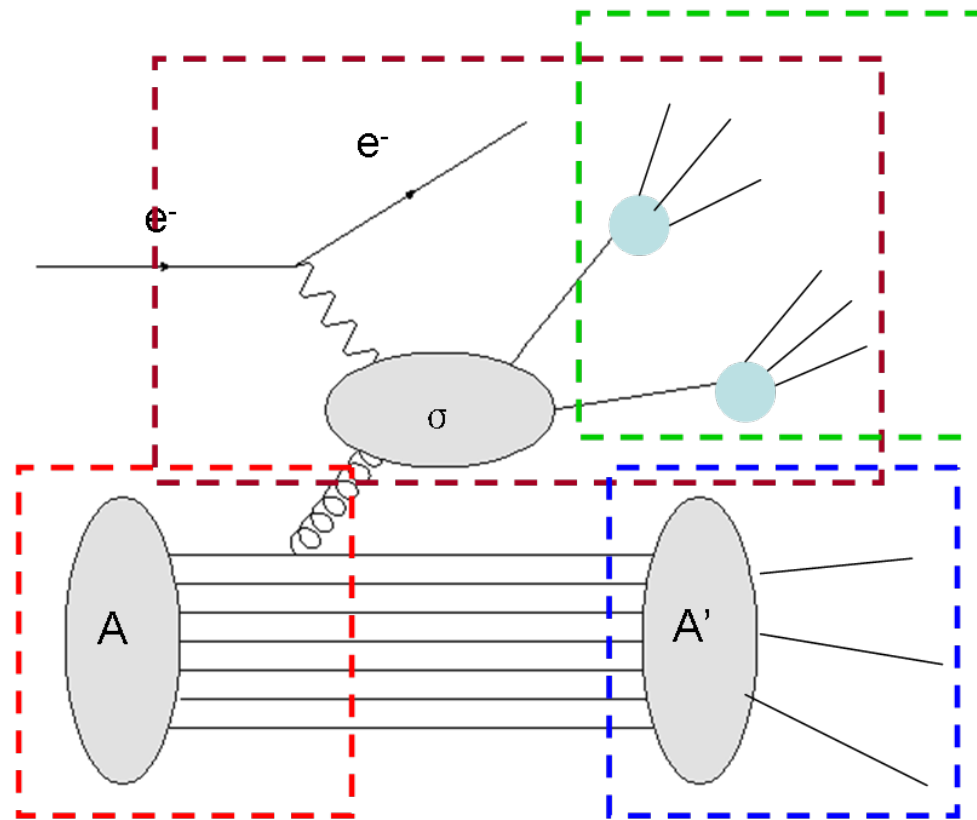
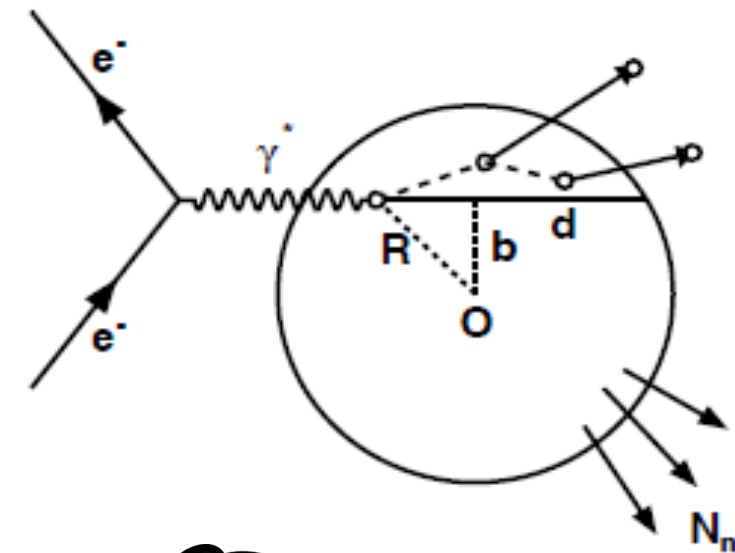
$$R = \frac{B}{Q} \times \frac{Z}{A}$$

> 1; gluons carry the flow of baryon number

< 1; quarks carry the flow of baryon number

The BeAGLE model

PRD 106, 012007 (2022)



A hybrid model consisting of DPMJet and PYTHIA with nPDF EPS09.

Nuclear geometry by DPMJet and nPDF provided by EPS09.

Parton level interaction and jet fragmentation completed in PYTHIA.

Nuclear evaporation (gamma deexcitation/nuclear fission/fermi break up) treated by DPMJet

Energy loss effect from routine by Salgado&Wiedemann to simulate the nuclear fragmentation effect in cold nuclear matter



In BeAGLE, quarks carry the flow of baryon number.

Proposing: the collision of isobars (same baryon B, different charge Q) to achieve best precision

$$R(\text{Isobar}) = \left(\frac{B_{Ru}}{\Delta Q}\right) \left(\frac{\Delta Z}{A}\right) \quad \Delta Q = Q_{Ru} - Q_{Zr}$$

$R(\text{Isobar}) > 1$;

Gluons carry the flow of baryon number

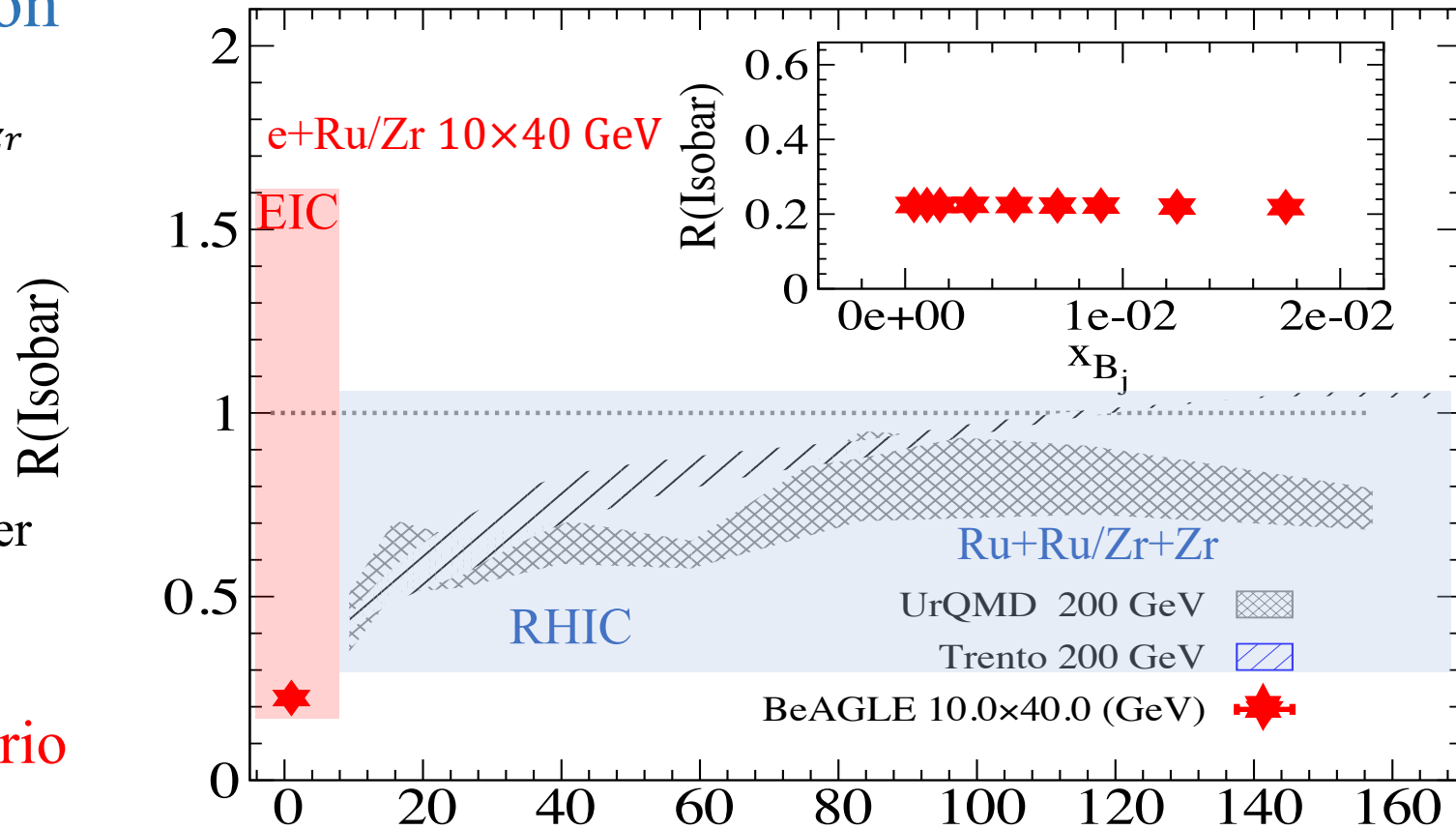
$R(\text{Isobar}) < 1$;

Valence quarks carry the flow of baryon number

➤ $R(\text{Isobar})$ is independent of x_{B_j}

✓ Consistent with the quark's scenario

BeAGLE shows value consistent with the quark's scenario



Thank You

$\langle N_{part} \rangle$

UrQMD and Trento taking from, N.Lewis DIS 2023