The Importance of a New Forward p+A(A+A) Program at RHIC and Its Impacts on Future e+A Physics

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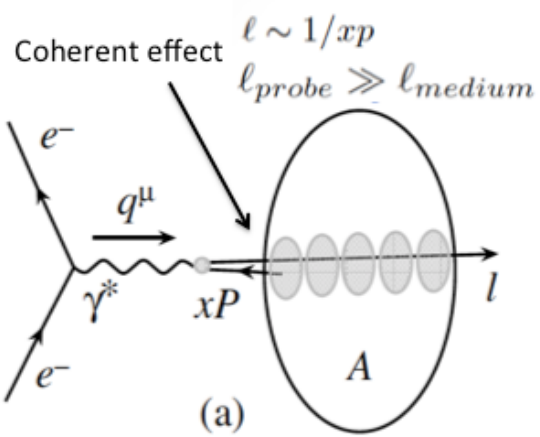
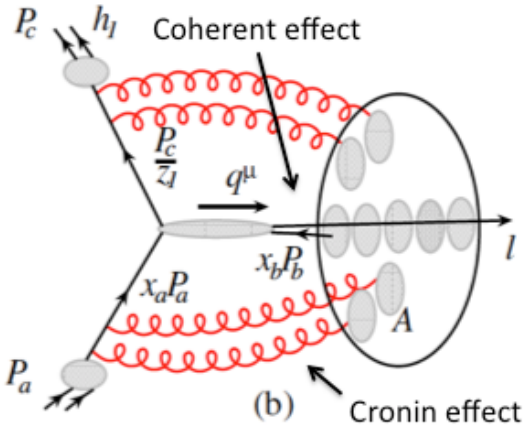
- Key Physics Questions
  - Parton propagation, energy loss and hadronization in CNM
  - CNM and QGP effects in Forward rapidity in p+A and A+A
  - Modification of parton distributions inside the nucleus

DIS



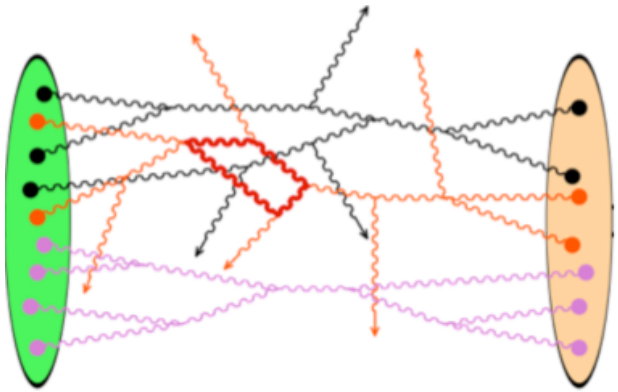
CNM: final state

p+A



CNM: initial (and final)

A+A



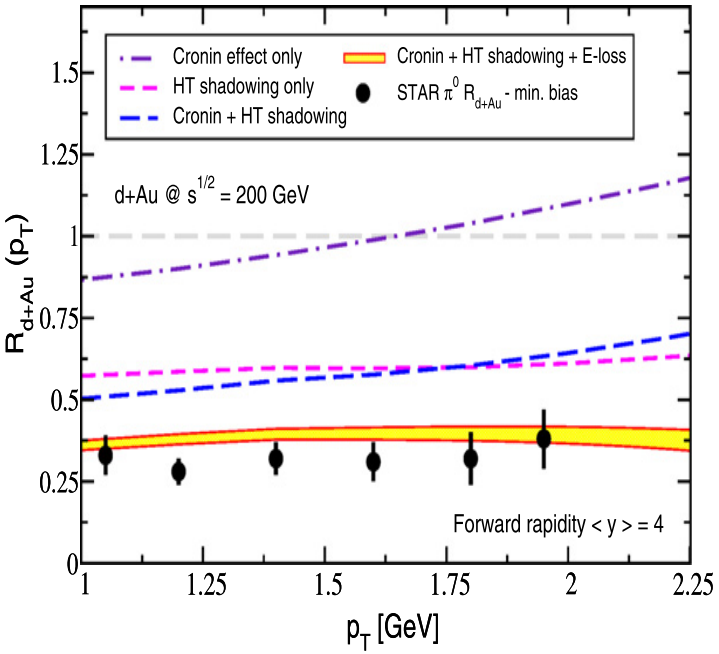
CNM more complicated

Rich Forward CNM Physics in p+A: p+A ≠ e+A

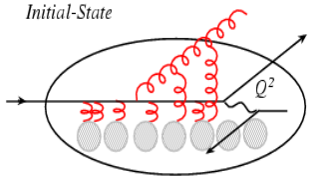
Significant competing CNM effects in the forward rapidity particle productions:

1) Cronin; 2)High-Twist shadowing; 3)E-Loss; 4) Saturation

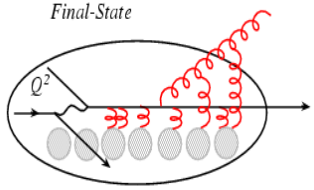
R.B. Neufeld et al. / Physics Letters B 704 (2011) 590–595



Drell-Yan: p+A



DIS: e+A



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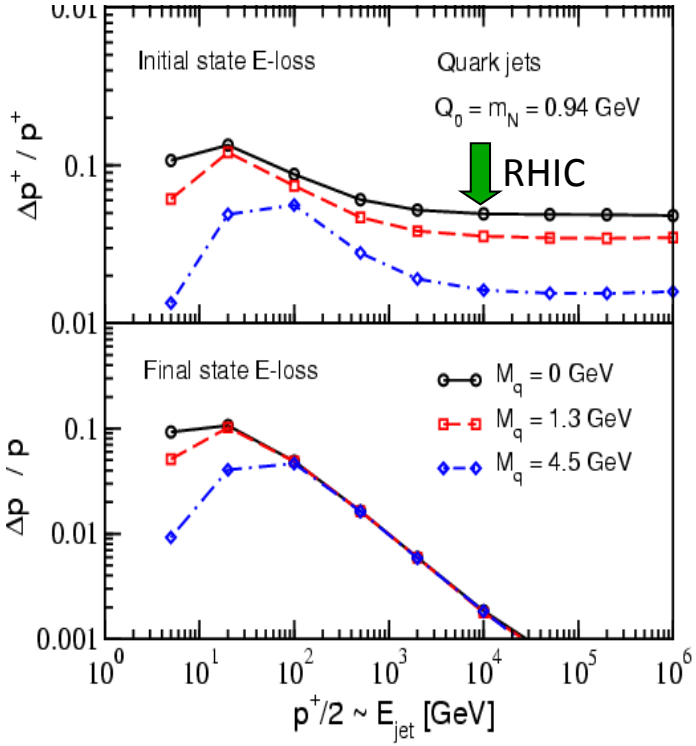
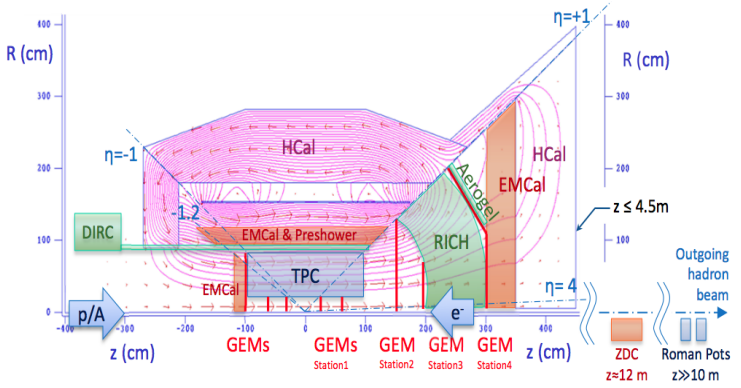


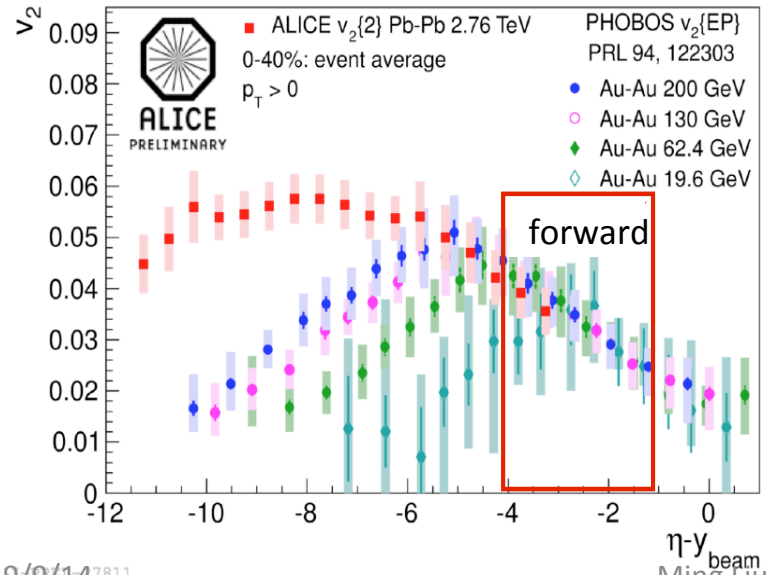
Critical to have p+A, better kinematics and precision. With e+A, fully explore the initial and final state dE/dx and other CNM contributions to QGP effects in A+A

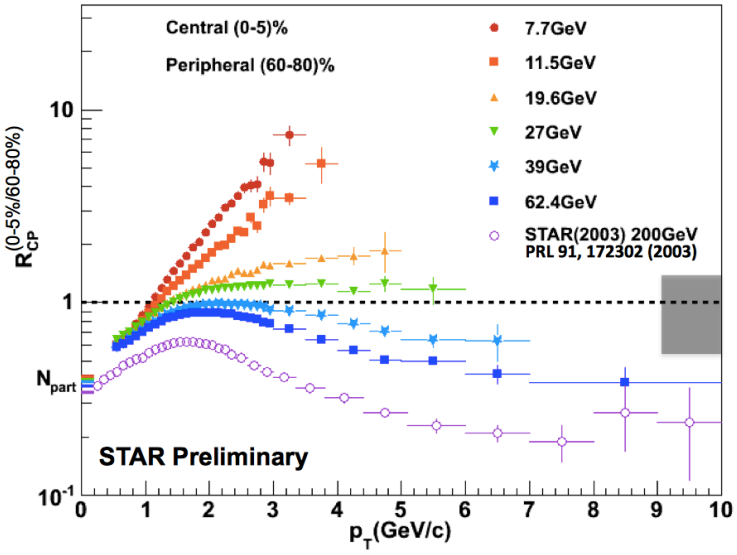
Why Explore QGP in Forward Rapidity?

- Longitudinal expansion of QGP, least explored
  - Expect different mix of CNM and QGP
  - Hadrons, Drell-Yan, Jets etc. in eta up to ~ 4.
  - R_{AA}, Vn, Correlations in large rapidity
  - Many interesting puzzles in forward rapidity pA & AA
- Scaling of "v_2" in the forward rapidity, why?
  - Little energy dependence, from 20GeV to 2.8 TeV
  - Is Hydro flow the only source of V_n? Other physics?
- Strong energy dependence of R_{cp}
  - Believed due to different mix of CNM and QGP effects, same at large rapidity?
  - Important for QCD Critical point search

A proposed new EIC detector at RHIC with forward physics capability





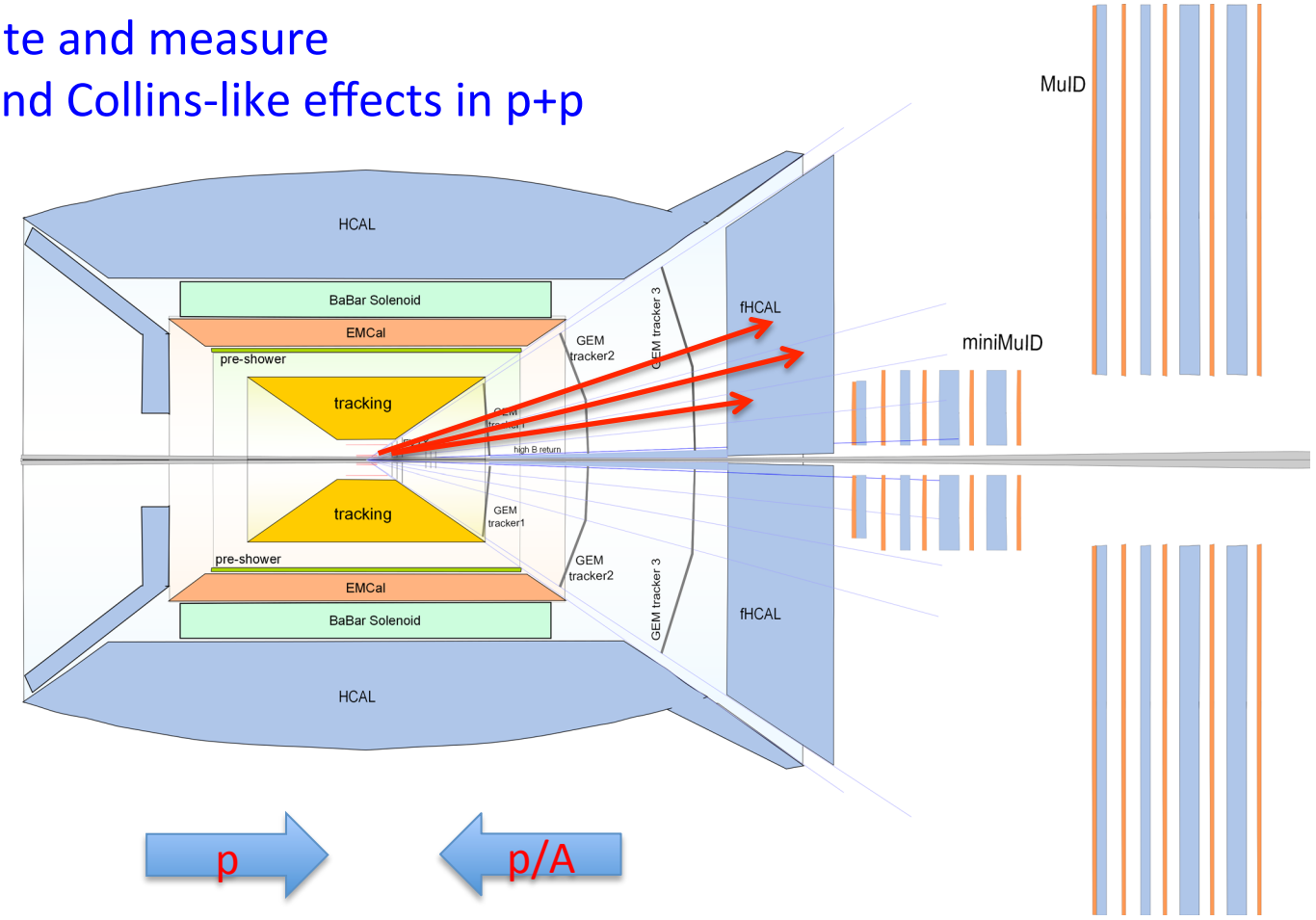


Backup slides

Forward Transverse Spin Physics Proposal at RHIC

-1 < eta < 4

Clearly isolate and measure
Sivers-like and Collins-like effects in p+p



Key capabilities:
- Jet with Cal.
- Tracking