Update on C12+23-003: Measurement of Deep Inelastic Scattering from Nuclei with Electron and Positron Beams to Constrain the Impact of Coulomb Corrections in DIS

Spokespersons: N. Fomin (UTK),
D. Gaskell* (JLab), W. Henry (JLab)

Jefferson Lab Positron Working Group Meeting

March 24-26

C12+23-003: Coulomb Corrections in DIS

Goal: Directly measure the impact of Coulomb acceleration in heavy nuclei in DIS

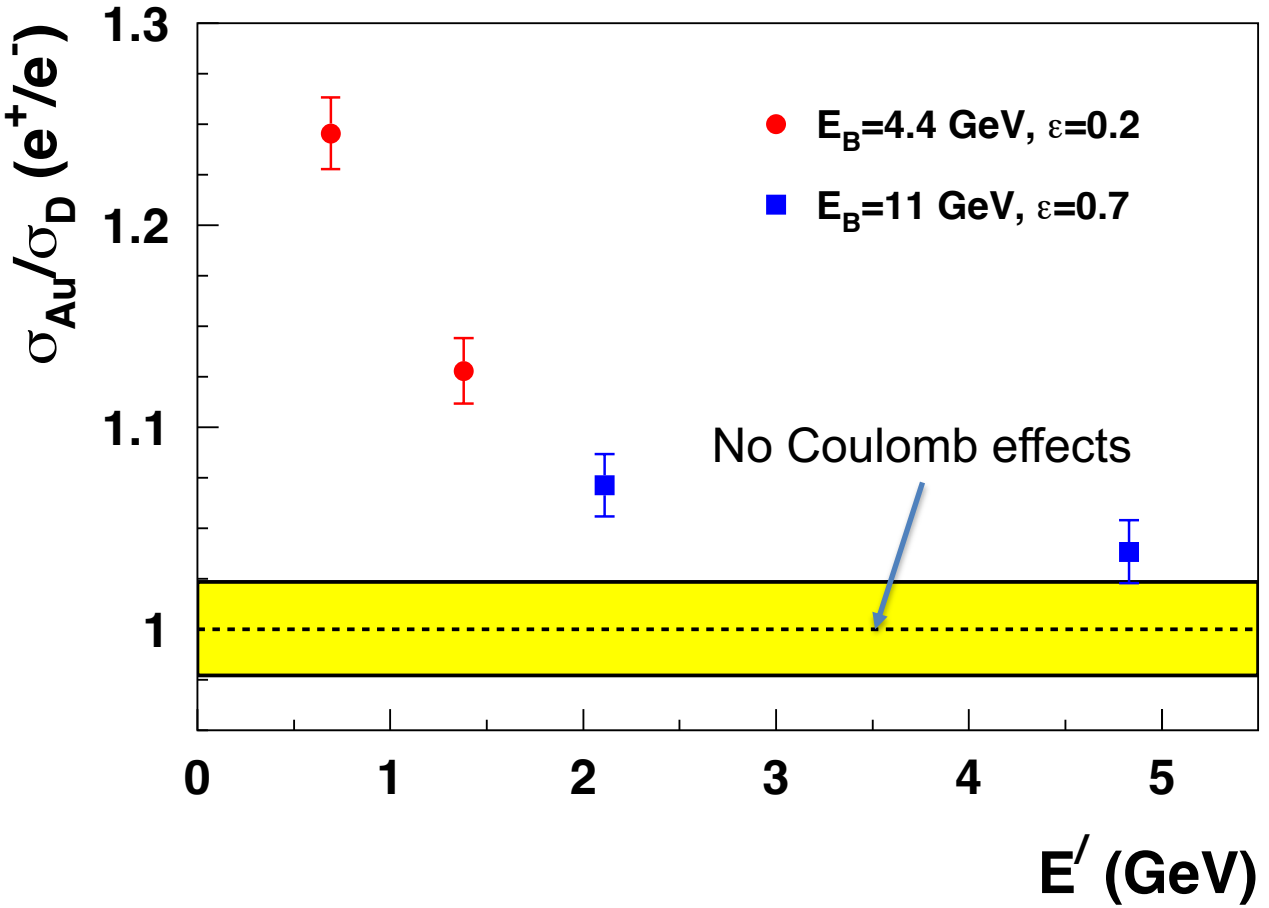
→ Well-known effect in QE scattering

→ Little theoretical guidance for DIS

→ Potential impact on measurements of the EMC effect and nuclear dependence of $R=\sigma_L/\sigma_T$

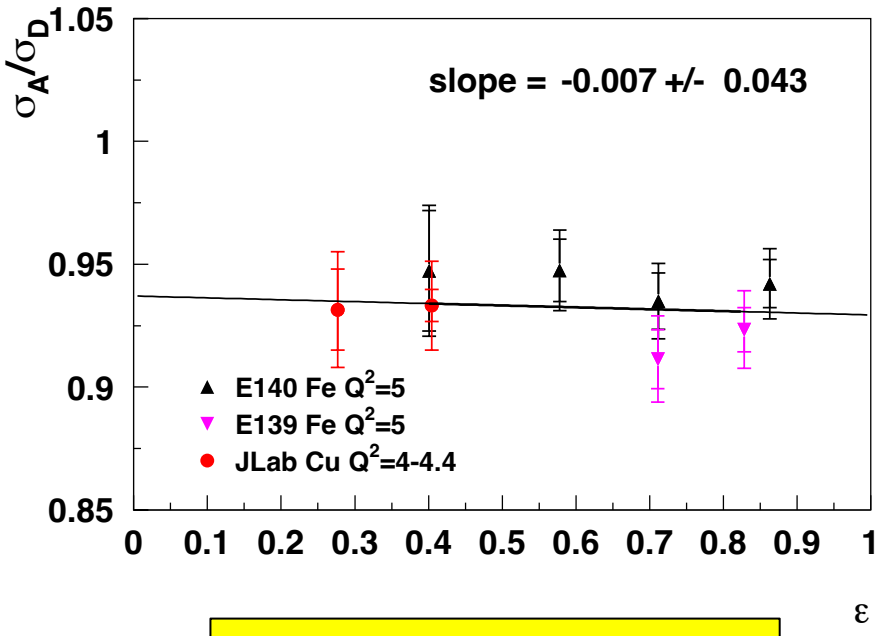
Experiment: Measure cross section ratios for Au/D at with positron beam at 2 beam energies

→ Make direct comparison with electron data from E12-14-002

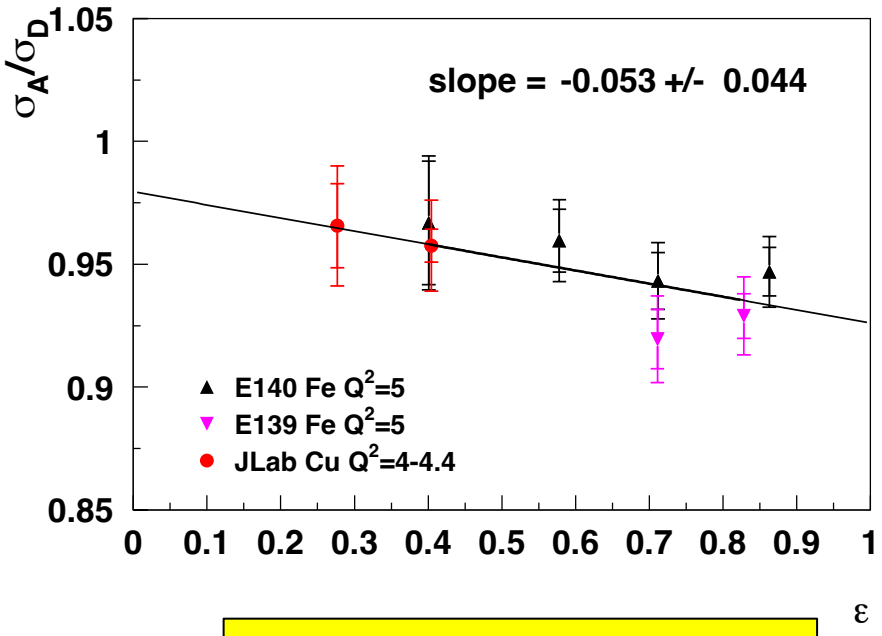


Conditionally approved for 9.3 days

Impact of CC in DIS: Nuclear Dependence of R



No Coulomb Corrections



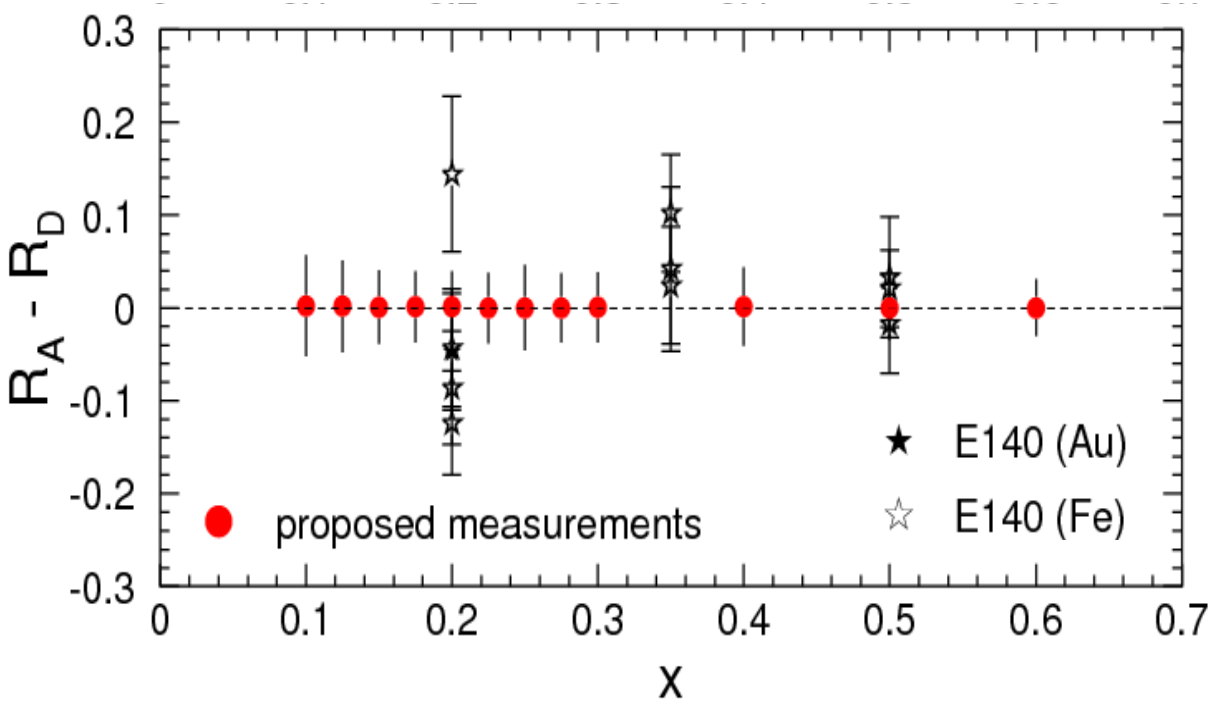
with Coulomb Corrections

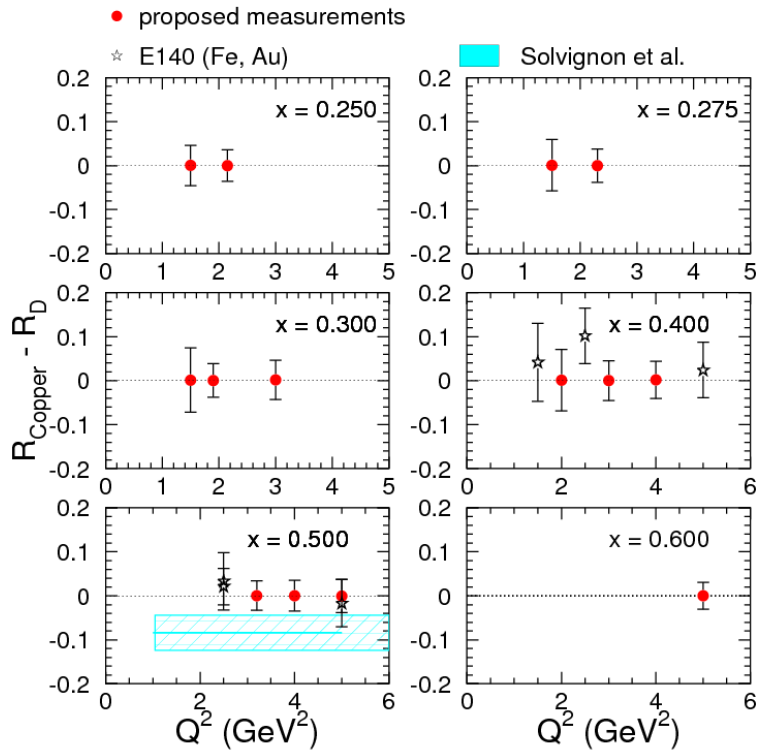
PRC 104(6):065203, 2021

Combined analysis of SLAC E139, E140 and JLab 6 GeV data for Fe/Cu at *x=0.5*, Q^2~*5 GeV*^{2}

Connection to E12-14-002

- Precision Measurements and Studies of a Possible Nuclear Dependence of $R=\sigma_L/\sigma_T$
  [S. Alsalmi, M.E. Christy, D. Gaskell, W. Henry, S. Malace, D. Nguyen, T.J. Hague, P. Solvignon]
- Measurements of nuclear dependence of structure functions, R_A-R_D via direct L-T separations





Depends critically on correct application of Coulomb Corrections

New Developments

Near future Hall C schedule

- FY26 assume 25 weeks and start in Nov 2025-May 2026. **(guess work for dates)**
  - Run HMS/SHMS experiments on the draft beam schedule
  - E12-06-107 Complete Pion Color Transparency
  - E12-14-002 Run standard beam energies for NucR
  - E12-22-001 N-Delta at low Q^2, Special beam energy to match Hall B.
  - E12-23-001 VCS at low Q^2, Special beam energy to match Hall B.
- FY27 assume 30 weeks and start in Sept 2026. Not scheduled, speculation
  - Run standard HMS/SHMS experiments Sept –Dec 2026. Possibilities:
    - Complete NucR and KaonLT non-standard beam energies
    - Complete VCS experiment
    - E12-23-010 Color Transparency in Maximal Rescattering Kinematics
    - E12-20-007 Backward-angle Exclusive pi0 Production above the Resonance Region
  - Hypernuclear installation in Jan 2027 – Aug 2027 (8 months)
  - Start Hypernuclear experiments in Sept 2027

E12-14-002 running planned for FY26 and FY27

Follow-on Proposal

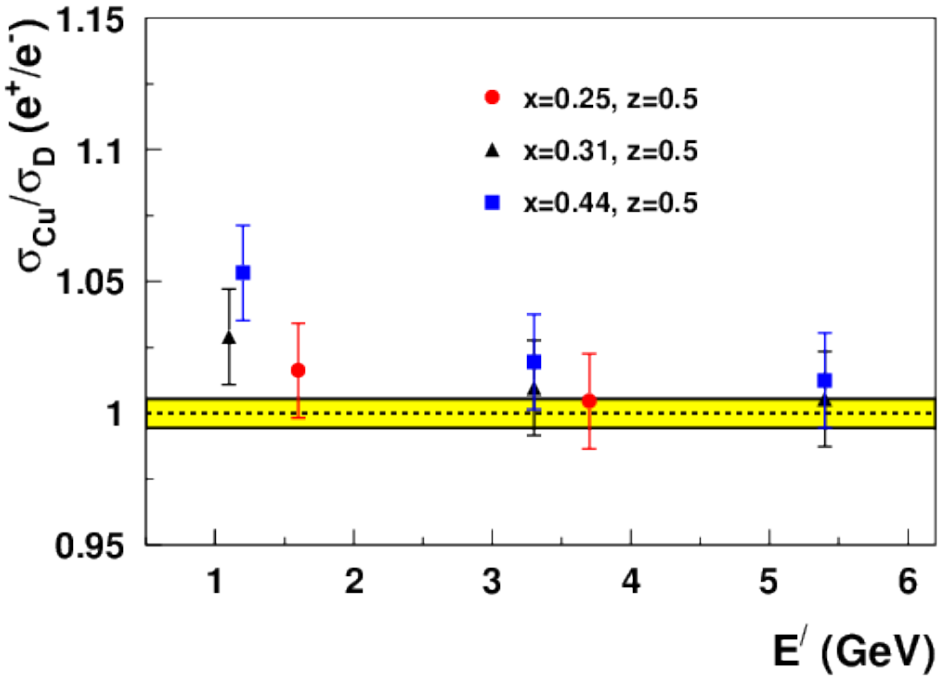
Working underway on new proposal to explore 2-photon exchange effects in DIS and SIDIS and Coulomb Corrections in SIDIS, *Tyler Hague (JLab), Mike Nycz (UVa), DG*

Two talks at this week's meeting:

<u>Tuesday, March 25</u>

11:30 am	Coulomb Corrections in SIDIS	Tyler Hague
12:00 pm	Two-Photon Exchange in DIS and SIDIS	Mike Nycz

Estimated precision for possible Coulomb Corrections test in SIDIS



Summary

- Since initial proposal, no new developments in calculation of Coulomb Corrections in DIS
- E12-14-002 is planned to take some (or all) of proposed data in the next couple years
  - Relies crucially on Coulomb Corrections
  - Data from R-SIDIS experiment (run starts June 2025) can also be used to measure R_A-R_D
- Extending studies of multi-photon effects with new proposal to investigate 2-photon exchange in DIS and SIDIS and Coulomb Corrections in SIDIS