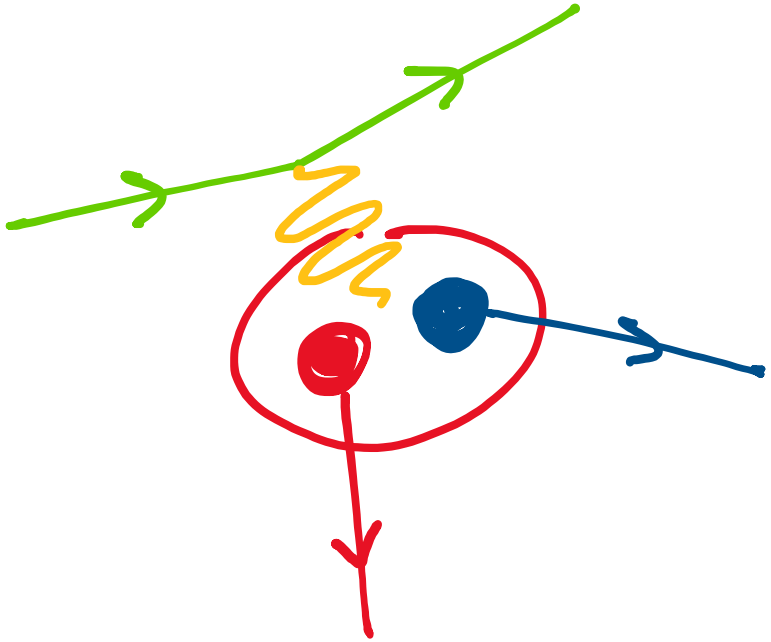
Deuteron electro-Disintegration at very high missing momenta



GHP 2023 10th Workshop

April 12-14, 2023

Spokesperson:
Gema P. Villegas Minyety
Florida International University

APS Topical Group on Hadronic Physics GHP

FIU FLORIDA INTERNATIONAL UNIVERSITY

Jefferson Lab

Outline

1. Motivation
2. Kinematics
3. Previous Works
4. Experiment Run Apr 2018
5. Experiment Run Feb – Mar 2023
6. Summary

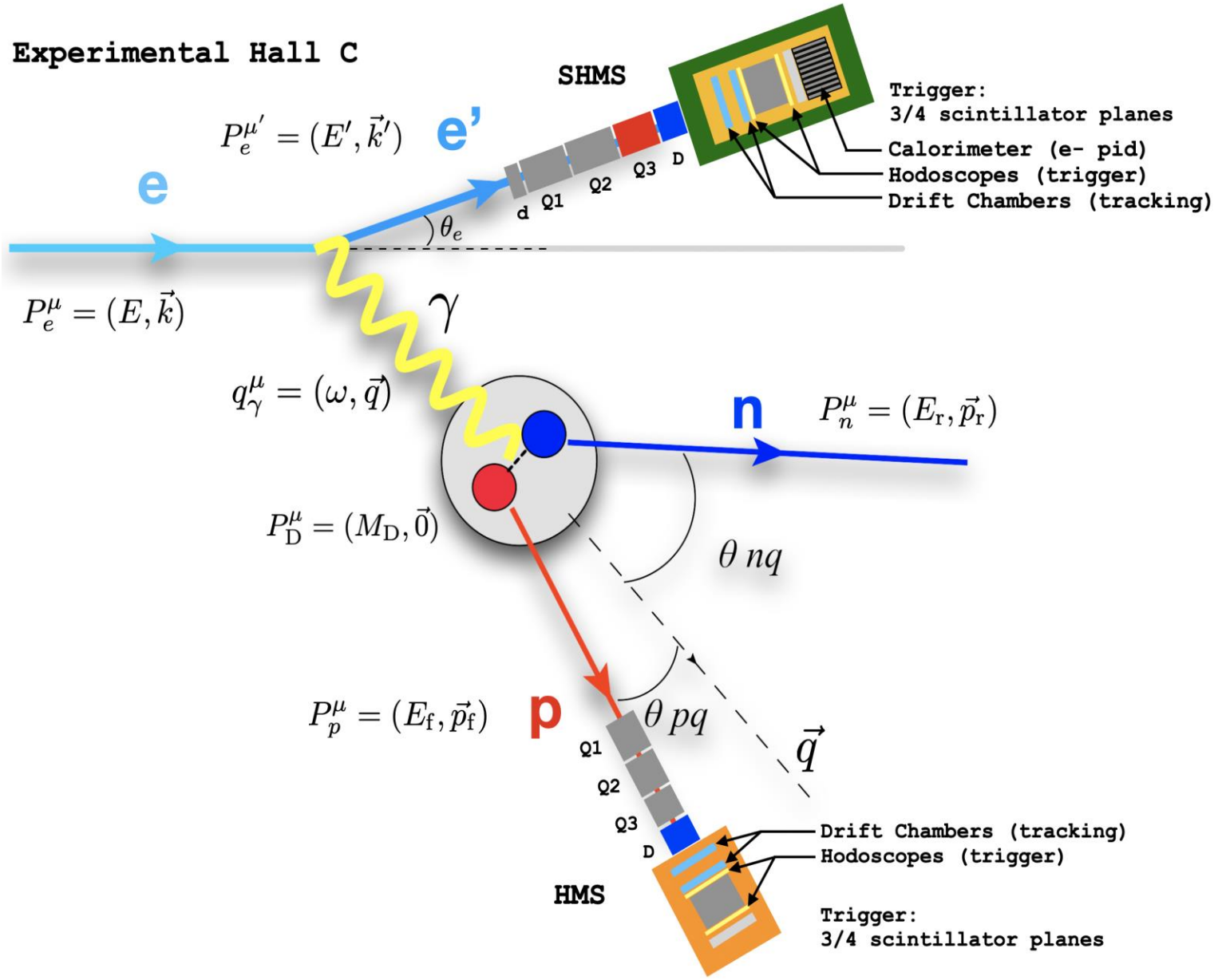
Goal

- Measure *D(e,e'p)n* cross sections at large Q^2 and $x_{Bj} > 1$ for missing momenta $p_m > 600$ MeV/c with a relative statistical error of < 20%.

Motivation

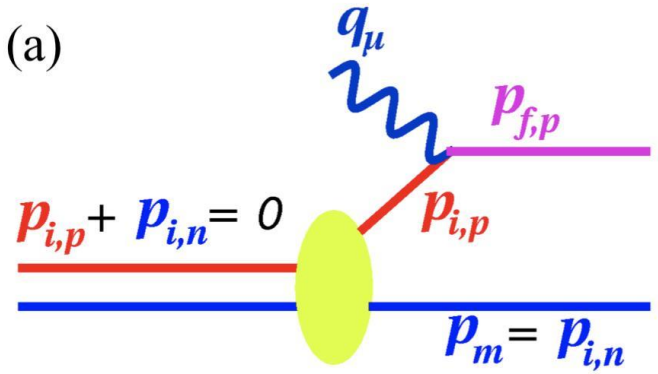
- NN interaction at *< 1 fm* is not well understood
- There is little experimental data for missing momenta beyond *500 MeV/c*
- D(e,e'p)n is ideal for probing the repulsive part of the NN interaction

D(e,e'p)n Reaction Kinematics

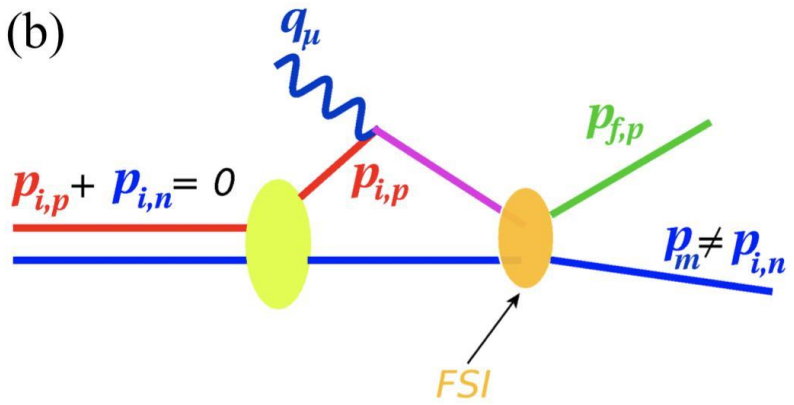


C. Yero. (2020). Thesis

D(e,e'p)n Reaction Kinematics

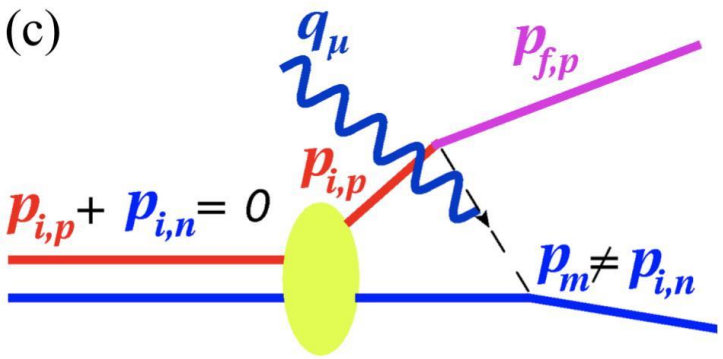


Plane Wave Impulse Approximation (PWIA)



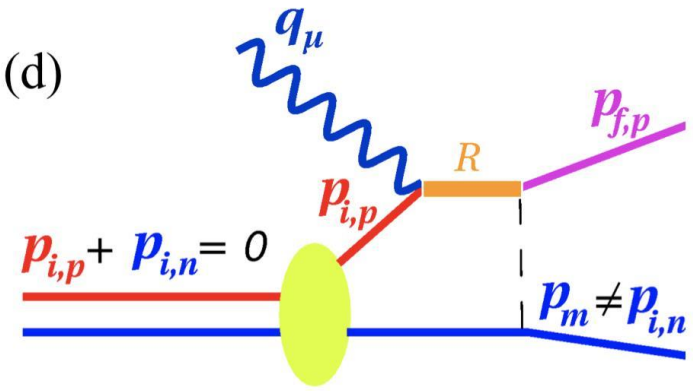
Final State Interactions (FSI)

Suppressed at $\theta_{nq} \approx 35° - 45°$



Meson-Exchange Currents (MEC)

Suppressed at $Q^2 > 1$



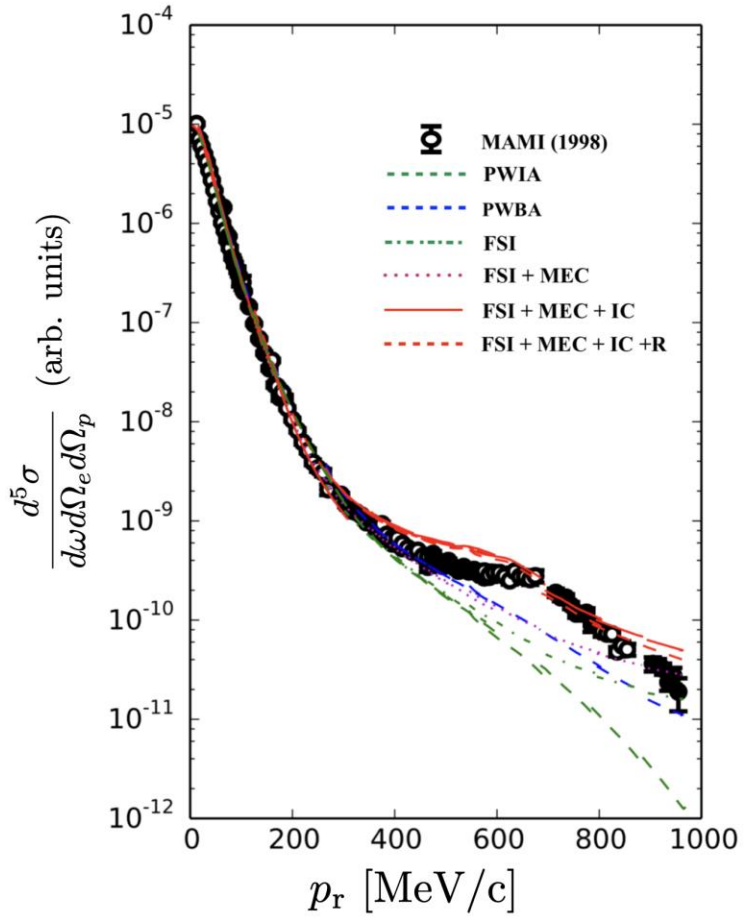
Isobar Configurations (IC)

Suppressed at $x_{Bj} > 1$

C. Yero. (2020)

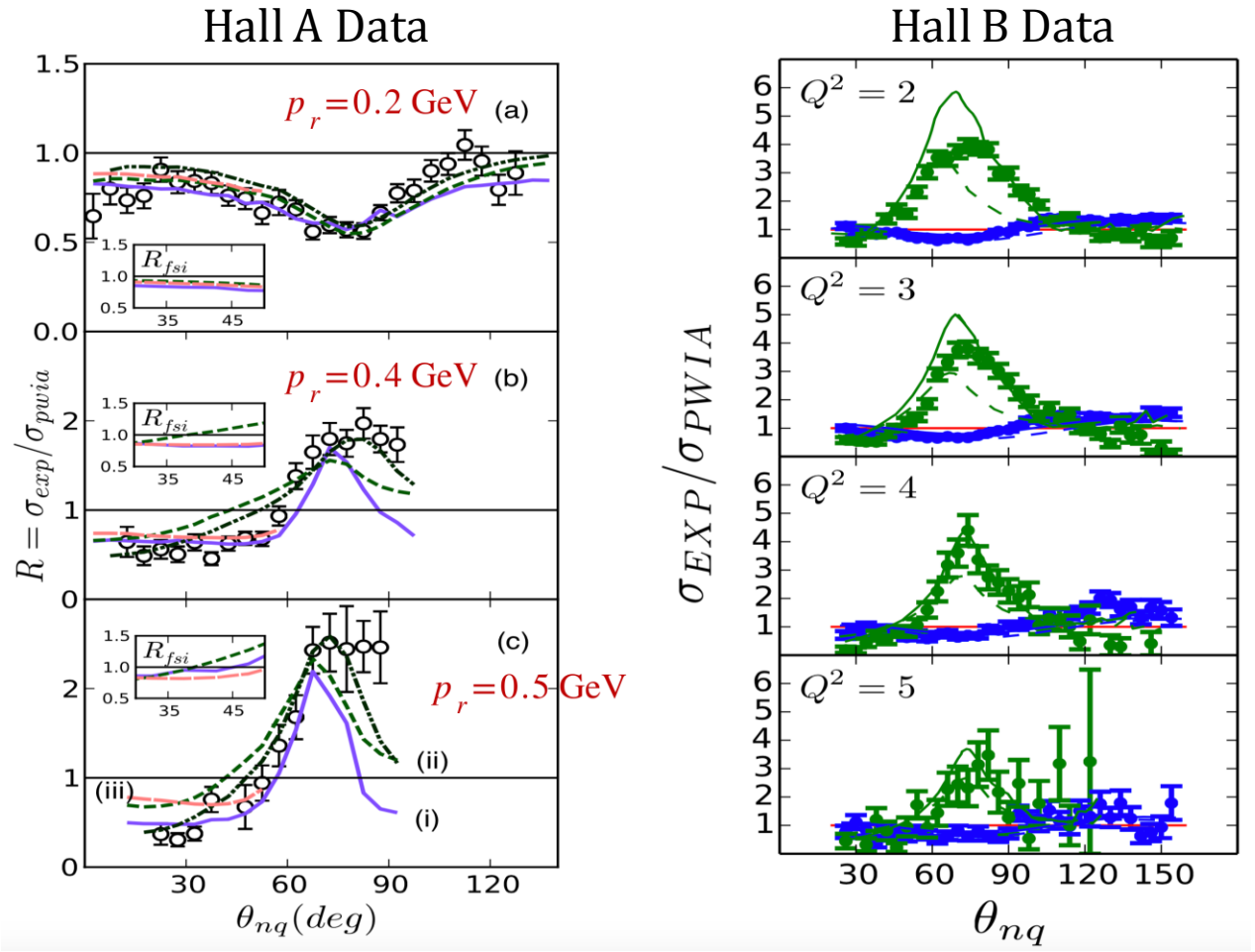
Previous Work

A)



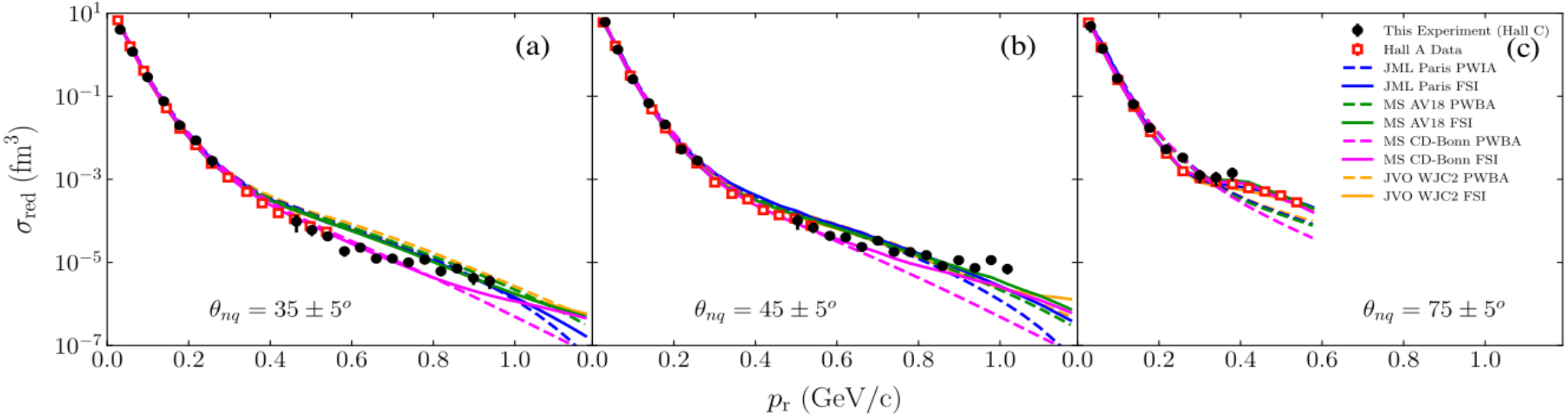
MAMI (1995)

B)



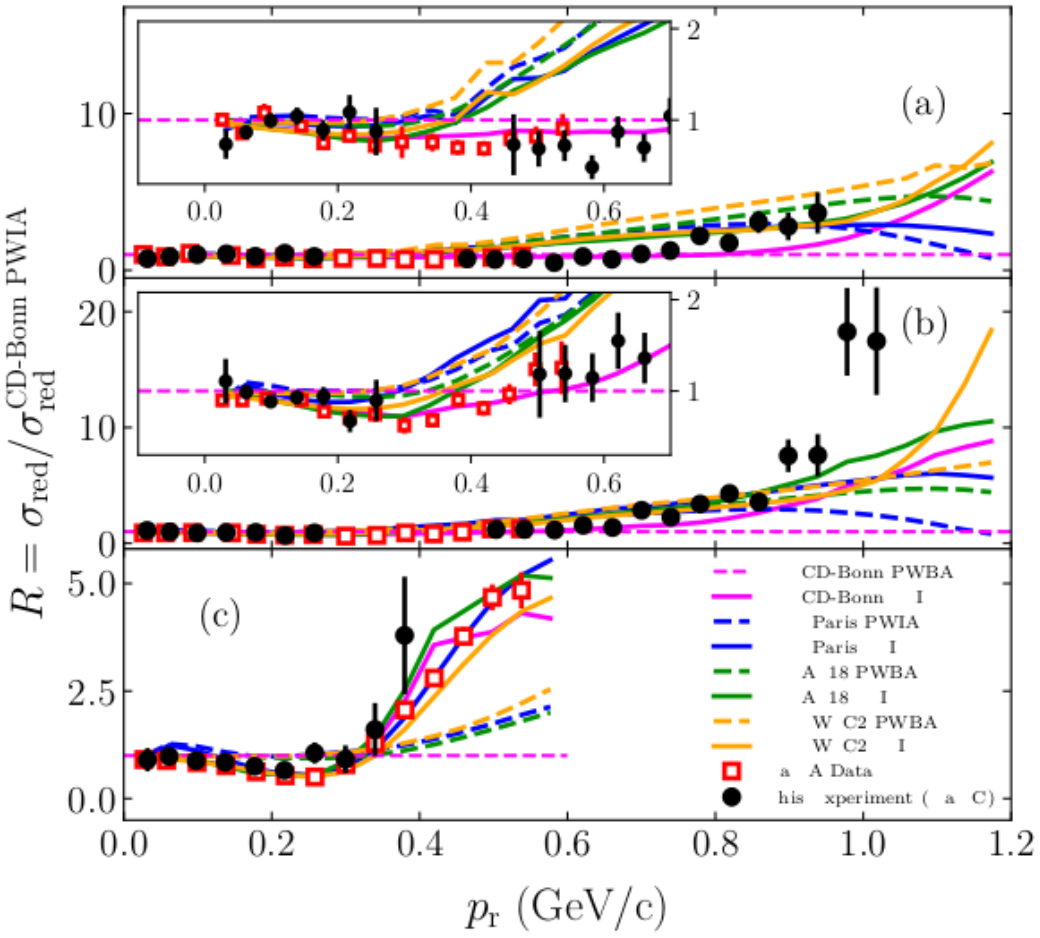
W. Boeglin and M. Sargsian. (2015). DOI

Experiment Run Apr 3-9, 2018



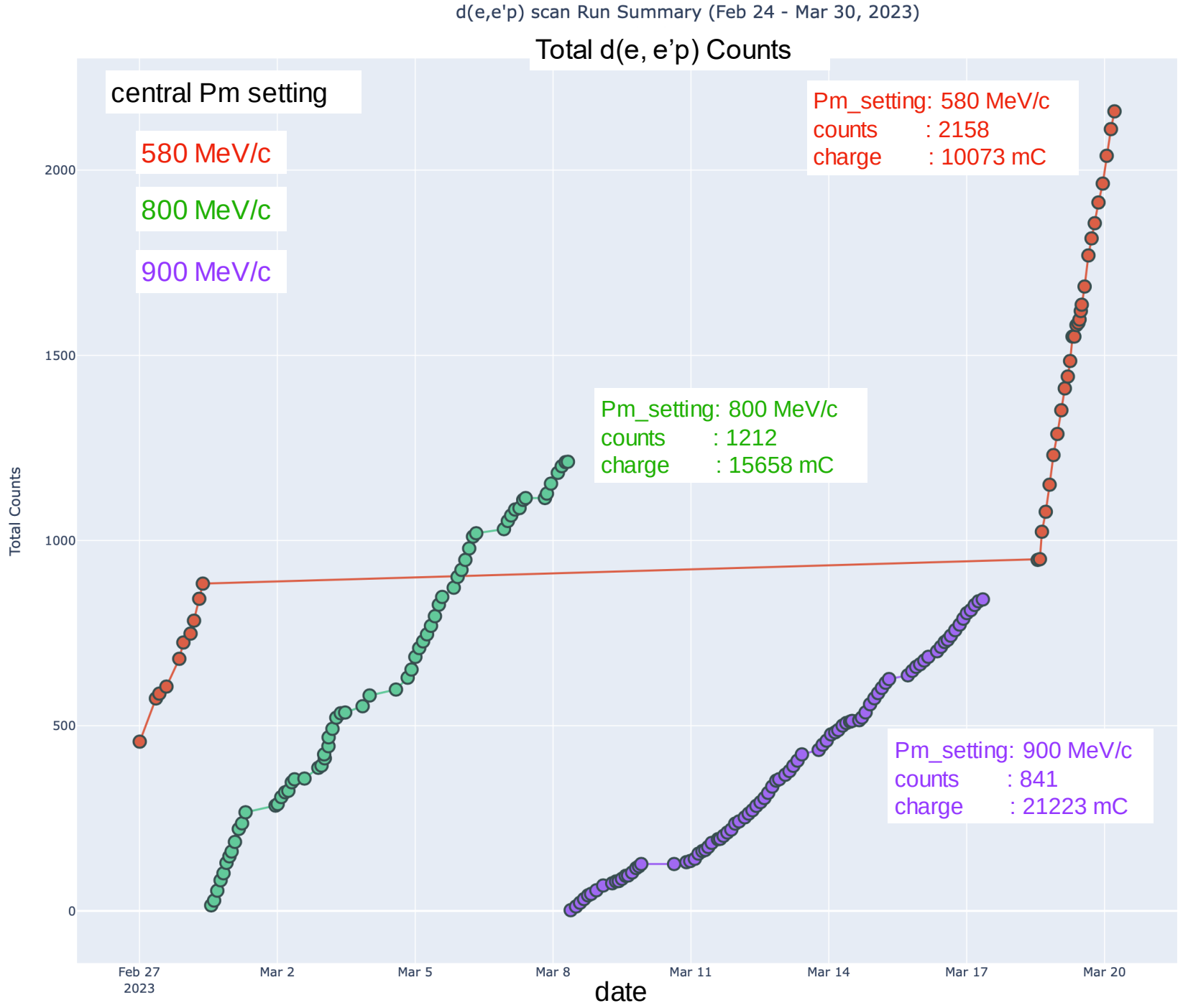
C. Yero et al. [Hall C]. (2020). DOI

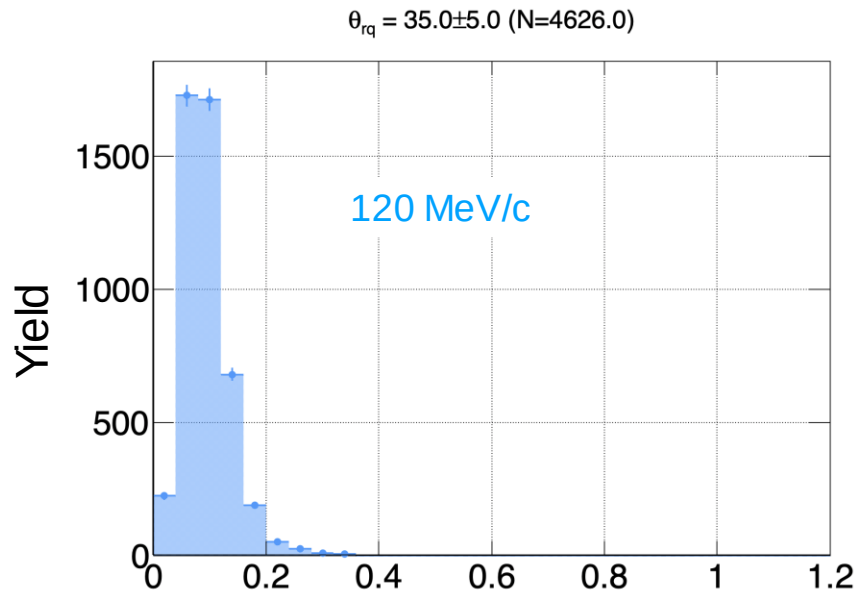
Experiment Run Apr 3-9, 2018

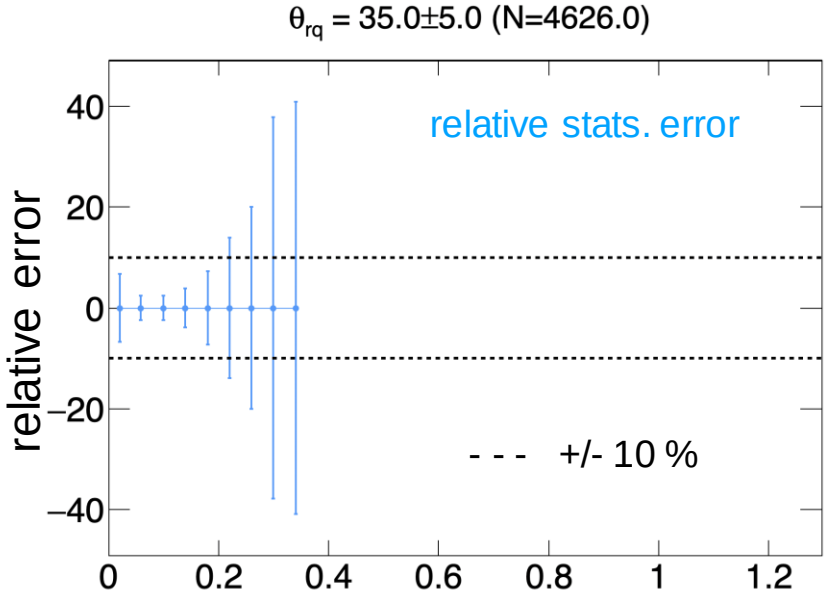


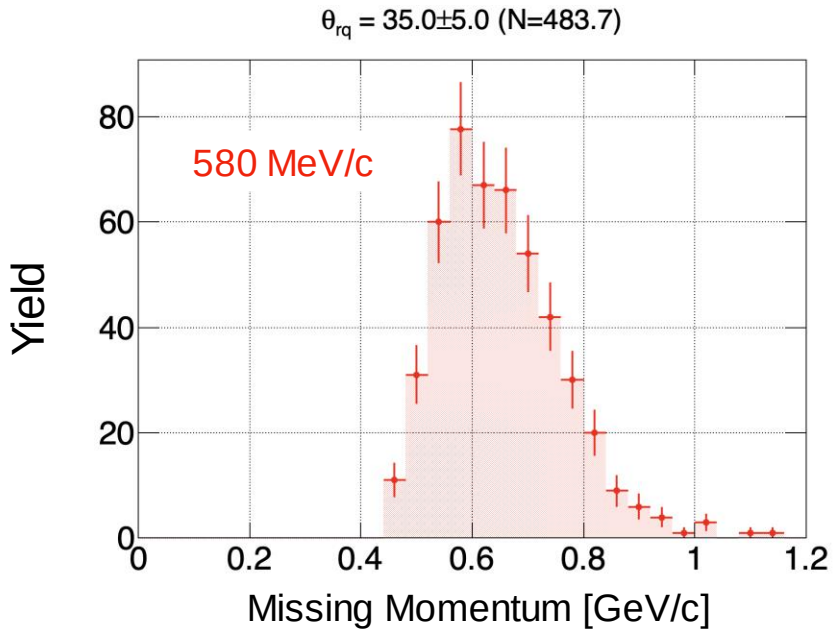
C. Yero et al. [Hall C]. (2020). DOI

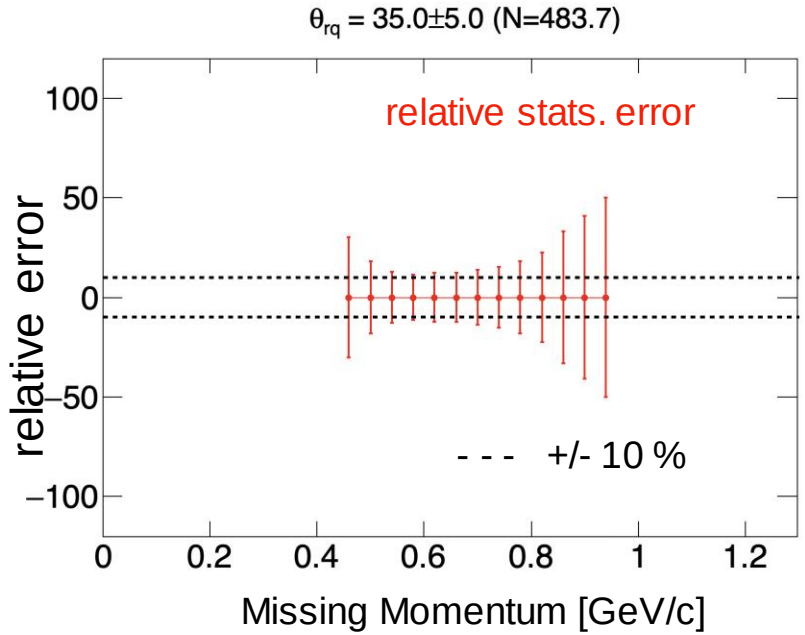
Experiment Run
Feb 25 – Mar 20, 2023

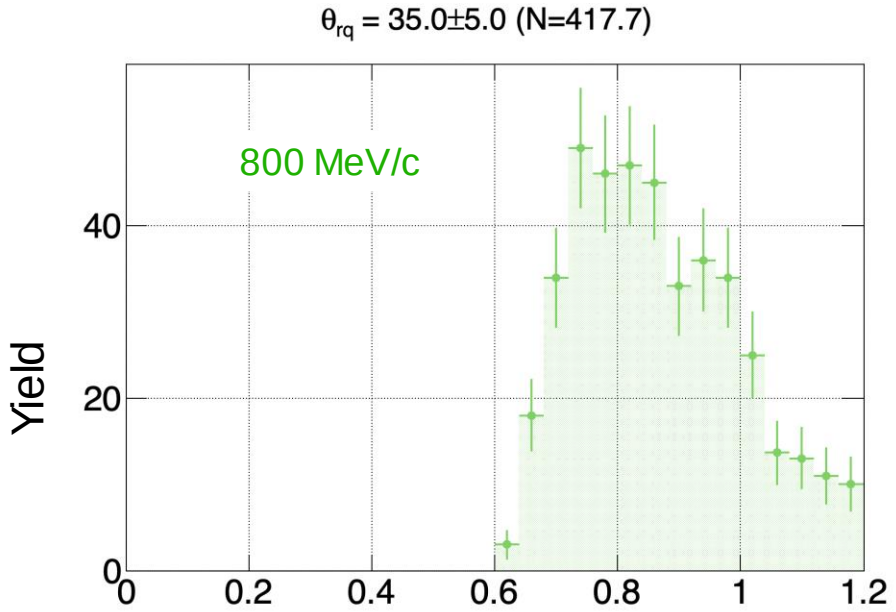


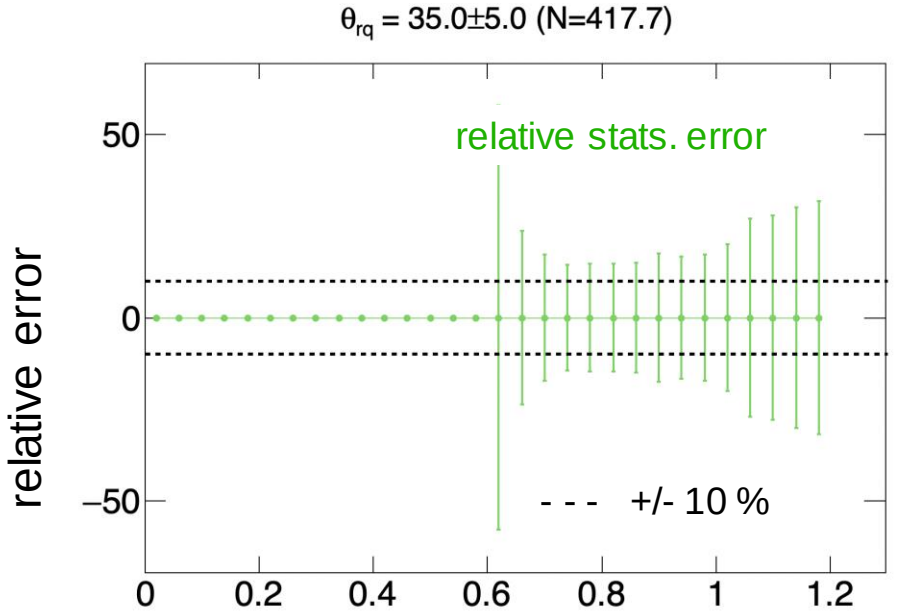

θrq = 35.0±5.0 (N=4626.0)
120 MeV/c
Yield
1500
1000
500
0
0
0.2
0.4
0.6
0.8
1
1.2

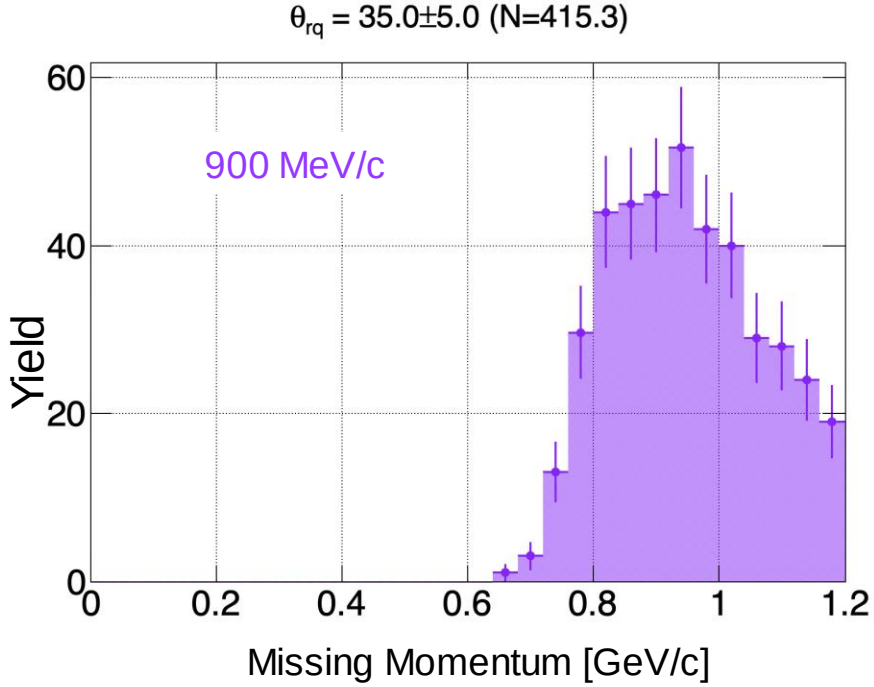

θrq = 35.0±5.0 (N=4626.0)
relative stats. error
- - - +/- 10 %
relative error
40
20
0
−20
−40
0
0.2
0.4
0.6
0.8
1
1.2

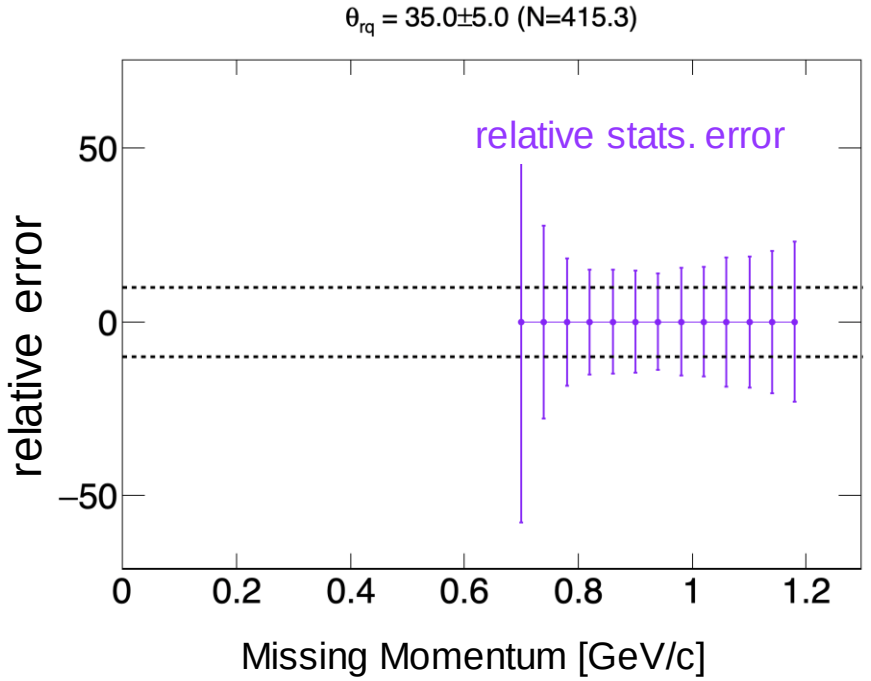

θrq = 35.0±5.0 (N=483.7)
580 MeV/c
Yield
80
60
40
20
0
0
0.2
0.4
0.6
0.8
1
1.2
Missing Momentum [GeV/c]


θrq = 35.0±5.0 (N=483.7)
relative stats. error
- - - +/- 10 %
relative error
100
50
0
−50
−100
0
0.2
0.4
0.6
0.8
1
1.2
Missing Momentum [GeV/c]


θrq = 35.0±5.0 (N=417.7)
800 MeV/c
Yield
0
20
40
0
0.2
0.4
0.6
0.8
1
1.2

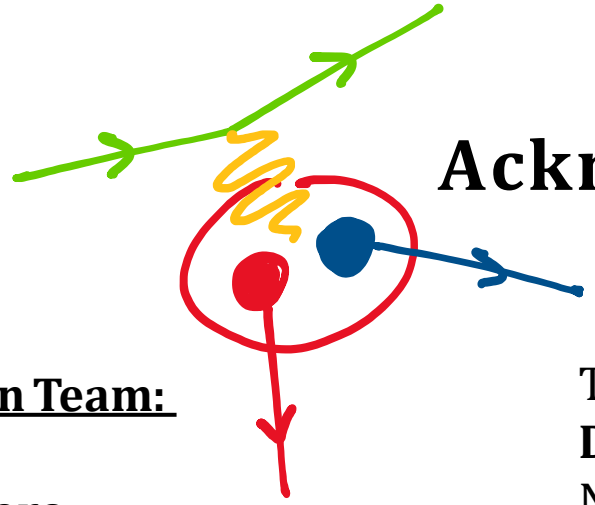

θrq = 35.0±5.0 (N=417.7)
relative stats. error
relative error
50
0
−50
- - - +/- 10 %
0
0.2
0.4
0.6
0.8
1
1.2


θrq = 35.0±5.0 (N=415.3)
900 MeV/c
Yield
0
20
40
60
0
0.2
0.4
0.6
0.8
1
1.2
Missing Momentum [GeV/c]


θrq = 35.0±5.0 (N=415.3)
relative stats. error
relative error
50
0
−50
0
0.2
0.4
0.6
0.8
1
1.2
Missing Momentum [GeV/c]

Summary

- The D(e,e'p)n experiment ran most recently from Feb 25 – Mar 20, 2023, obtaining new data for missing momentum bins of 800 and 900 MeV/c. The data is currently being analyzed.
- We want to probe the repulsive part of the NN interaction below 1 fm
  Theoretical predictions poorly describe the data in this region
- 2018 results of D(e,e'p)n published in PRL (arXiv)
- We want to understand the new behavior found for higher momentum bins in a kinematic region dominated by SRC



Acknowledgements

Deuteron Team:

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Jefferson Lab, ODU, FIU
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Florida International University
Joerg Reinhold
Florida Interntional University
Hall C Collaboration
Jefferson Lab

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