Measurement of the Chiral-Odd Generalized Parton Distribution Functions and Non-Parametric Analysis of the Deeply Virtual Neutral Pion Electroproduction Cross Section at the Thomas Jefferson National Accelerator Facility at 10.6 GeV

by

Robert Johnston

Submitted to the Department of Physics
in partial fulfillment of the requirements for the degree of

Interdisciplinary PhD in Physics and Statistics

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2023

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Abstract

Deeply virtual exclusive reactions provide unique channels to study both transverse and longitudinal properties of the nucleon simultaneously, allowing for a 3D image of nucleon substructure. This presentation will discuss work towards extracting an absolute cross section for one such exclusive process, deeply virtual neutral pion production, using 10.6 GeV electron scattering data off a proton target from the CLAS12 experiment in Jefferson Lab Hall B . This measurement is important as exclusive meson production has unique access to the chiral odd GPDs, and is also a background for other exclusive processes such as DVCS, making the determination of this cross section crucial for other exclusive analyses.

Thesis Supervisor: Richard Milner
Title: Professor of Physics

Acknowledgments

To Be Completed. Currently this will serve as a to-do list:

input list of figures

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Hi (Bedlinskiy et al., 2014) see more in section 1.1 just a test

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Methods General analysis technique event selection Configuration and kinematics region Cross section extraction Simulation pipeline acceptance correction Radiative corrections Monte carlo estimators

Data post processing energy loss correction for charged particles electron energy loss detector regions for proton energy loss correction details of the two band issue proton energy loss correction biases for higher momentum protons benehmarks for corrections Resolution matching kinematics correction of experimental data smearing the simulation data

Results CLAS12 qality assurance Event selection revisted multidimentsional binning signal yields and acceptance corrections radiative corrections normalizatinon and the modified cross section error analysys unpolarized corss sections plarized cross sections conclusions

References

Bedlinskiy, I., Kubarovsky, V., Niccolai, S., Stoler, P., Adhikari, K. P., Anderson, M. D., ... Zonta, I. (2014). Exclusive π^0 electroproduction at w>2 gev with clas. *Physical Review C - Nuclear Physics*, *90*. Retrieved from https://arxiv.org/pdf/1405.0988.pdf doi: 10.1103/PhysRevC.90.025205

Appendix A

A.1 Full Cross Section Data

To be completed

Appendix B

B.1 Cross check between Andrey Kim and Bobby Johnston

As an additional cross check, Bobby calculated a $DV\pi^0P$ beam spin asymmetry and compared to Andrey Kim's results. This check will not comment on any acceptance, luminosity, or virtual photon flux factor calculations, but does validate exclusive event selection criteria. By examining figure B-1 we can see that agreement is reasonable, especially considering Bobby's calculation does not have sideband subtraction included.

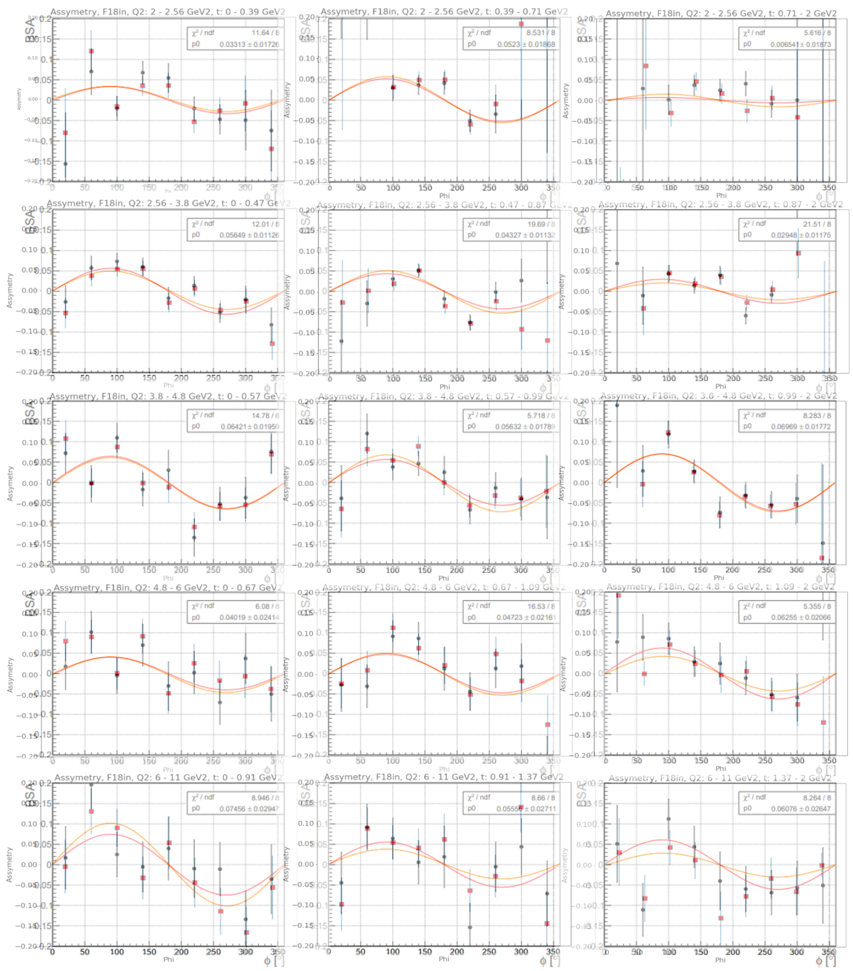

Figure B-1: Overlay comparison of Andrey Kim's results (black datapoints, red fit line) and Bobby's results (red datapoints, orange fit line).