I would like to thank the JSA/JLab Graduate Fellowship Program executive committee for awarding me the fellowship during the 2017-2018 academic year. This support has significantly contributed to my attainments in my PhD study and research. Below, I provide a report on the accomplishments achieved during the fellowship period.

**PhD Study and Research**

I am currently approaching the final stage of the physics PhD program at the University of South Carolina. Recently I have successfully accomplished the course program and now is fully concentrated on my research, which aims on the investigation of the exclusive charged double-pion electroproduction off the proton bound in the deuteron via the analysis of the CLAS data from the “e1e” run period. The research goal is to extract for the first time the integrated and single-differential cross sections of this exclusive channel and to compare them with the corresponding cross sections of the same reaction off the free proton, which have been recently extracted from CLAS data [1].

The research is approaching the concluding phase with the preliminary cross sections obtained and the CLAS analysis note and the PhD thesis being prepared. However, an important portion of work still needs to be done that includes corrections of the extracted cross section (unfolding the effects of the target motion, corrections for binning effects, etc.), evaluation of the cross section’s statistical and systematical uncertainties. Beside that, the comparison of the extracted cross sections with the corresponding cross sections of the same reaction off the free proton [1] needs to be performed and the difference between them should be further investigated.

**Accomplishments and Results**

- Considerable progress has been achieved in my PhD research project, i.e.
  - the methods of selecting exclusive reaction events in the presence of Fermi smearing and final state interactions were finally established and implemented into the analysis,
  - the particle detection efficiency was accounted for using a completely new event generator TWOPEG-D [2],
  - the preliminary cross sections were obtained and are now in the stage of finalization,
  - the radiative corrections for the extracted cross sections were established and applied,
  - the procedure of filling the cells with zero acceptance was established and used to correct the extracted cross sections,
  - the preparation of the PhD thesis and CLAS Analysis Note was initiated and is currently underway.
• The development of TWOPEG-D [2], which is the event generator for double-pion electroproduction off a moving proton, was successfully completed with the release of CLAS12-Note-2017-014. This event generator is now used for the Monte-Carlo simulation in my analysis and will also be used for future CLAS12 experiments. It represents an essential milestone of my PhD research, since such studies of experimental data off deuterons were never performed before and therefore no appropriate tools for the Monte-Carlo simulation previously existed.

• As one of the lead-authors, I was deeply involved in the preparation of the paper [1], which has been submitted for publication and is undergoing PRC review. This paper reports the cross section measurements, which are especially important for my PhD research, since the comparison of these results with those of my analysis will provide insight into the processes that happen in the deuteron. The work on this paper has also provided me an indispensable experience of presenting the results and paper writing, which I will employ in the stage of publishing the results of my analysis.

• I was also participating in investigating the prospect for studying a new promising exclusive channel $\gamma_np \rightarrow n\pi^+\pi^0$ with CLAS12 [3] (it has not yet been investigated using the CLAS detector due to the limited angular coverage for $\pi^0$ detection). This study includes an adaptation of the experimental analysis tools and the phenomenological reaction model that were previously established for the conventional $\gamma_vp \rightarrow p'\pi^+\pi^-$ channel (which is the focus of my PhD research). This activity is significant for me as a young scientist with a strong aspiration to be a part of CLAS12 scientific program and to contribute to the future CLAS12 experiments and data analysis.

Talks and Presentations


• APS April Meeting 2018, “The prospect for studying $n\pi^+\pi^0$ electroproduction off protons with CLAS12”, 15 April 2018 (co-author of the talk).

Publications


• G. V. Fedotov, Iu. Skorodumina et al. [CLAS Collaboration], “Measurements of $\gamma_vp \rightarrow p'\pi^+\pi^-$ cross section with the CLAS detector for $0.4 \text{ GeV}^2 < Q^2 < 1.0 \text{ GeV}^2$ and $1.3 \text{ GeV} < W < 1.825 \text{ GeV}”$, arXiv:1804.05136, under the PRC review, (2018).
The Use of Travel Funds

I was attending the APS April Meeting 2018 in Columbus OH, being a co-author of the following talk: “The prospect for studying $n\pi^+\pi^0$ electroproduction off protons with CLAS12” by Gleb Fedotov [3].

For this travel I requested and received a reimbursement in the amount of $ 794.52.

References

[1] G. V. Fedotov, Iu. Skorodumina et al. [CLAS Collaboration], “Measurements of $\gamma p \rightarrow p'\pi^+\pi^-$ cross section with the CLAS detector for $0.4 \text{ GeV}^2 < Q^2 < 1.0 \text{ GeV}^2$ and $1.3 \text{ GeV} < W < 1.825 \text{ GeV}”$, arXiv:1804.05136, under the PRC review, (2018).
[see also CLAS-Analysis-2017-101 (CLAS-Note-2018-001)]
