Major goals:

There are 4 major goals of the project within two Jefferson Lab collaborations: Polarimetry (GlueX); Search for hybrid mesons decaying to $K^* K$ mesons (GlueX); Analysis of excited Ξ baryons (GlueX); Assist in the identification of strangeness containing baryons from data coming from the newly built detector in Hall-B of Jefferson Lab (CLAS12).

Goals for year 2 with current status:

- TPOL (GlueX):
  - By January 2021, software will have been written for the determination of polarization that takes into account the new angular resolution capabilities of the TPOL device. **Status**: The TPOL device has not been upgraded because of ASU and JLAB Covid-19 restrictions.
- Hybrid meson analysis (GlueX):
  - By the end of the Spring semester of 2021, Sebastian Cole will have successfully defended his dissertation on the reaction $\gamma p \rightarrow p K^* K$. **Status**: This goal has been delayed slightly. Sebastian Cole is expected to defend in July of this year.
  - By Sept 2021, a new graduate student will have entered the group to work on $K^* K$ data that includes DIRC data. **Status**: The new student (Alan Gardner) entered the group in January, and has assisted Sebastian Cole with the K^*K partial-wave analysis. We have yet to start analyzing data that includes the DIRC.
- Cascade analysis (GlueX):
  - By January 2021 Brandon Sumner will have cross section data for all of the Ξ^* decay chains and started his PWA analysis. **Status**: The cross sections work is ongoing. On the PWA front, Brandon has started to familiarize himself with the tools used by the other graduate students. The actual utilization of the PWA to isolate fixed angular momentum values in the Ξ^* decay is expected later this summer.
- Search for strangeness (CLAS12)
  - The PI will continue to assist in analysis issues that arise regarding strangeness production using CLAS12 and will help coordinate the efforts of the Very Strange Group. **Status**: Ongoing. The ASU group has utilized the undergraduate participants Patrick Walker, Rebecca Osar and Emily Lamagna to work on CLAS12 data. Mr. Walker has analyzed K^*K final states, successfully defended his honors thesis, graduated with his B.S degree and won the ASU Department of Physics Research Award. Ms. Osar has been analyzing the photoproduction of $K\Lambda$ states from the proton. Ms. Lamagna is in the process of analyzing the reaction $e p \rightarrow e p \varphi\pi$. Additionally, undergraduate student Anna Costelle won the ASU Women in Physics Award for Undergraduate Research for her presentation describing the development of an event generator for strangeness states.

Training and professional development:

Students within the ASU Meson Physics Group are trained in the creation and use of software required for the analysis of experimental data, and are given guidance on how to present results to fellow collaborators and the wider scientific community.

Dissemination of results to communities of interest:

Students often present their latest experimental finding to fellow researchers within the GlueX and CLAS12 collaborations during video conferences and in-person when on site at Jefferson Lab.

Outside of the collaborations, results have been shared to the wider community through a virtual poster session held at the Polytechnic campus of Arizona State University [1-3], the 17th Annual Undergraduate Physics Symposium held at the Tempe campus of Arizona State University [4-7], a talk given at an APS meeting [8] and an Undergraduate Honors Thesis [9].

Goals for next reporting period (year 3):

- TPOL (GlueX):
  - The TPOL device will be upgraded by Alan Gardner and the PI.
  - Software will have been written for the determination of polarization that takes into account the new angular resolution capabilities of the TPOL device.
- Hybrid meson analysis (GlueX):
  - Alan Gardner will improve the current PWA used by the group to include more sources of background to the reaction $\gamma\, p \rightarrow p\, K^*\, K$ and also extend the analysis to K* K masses above 1.6 GeV.
- Cascade analysis (GlueX):
  - Brandon Sumner, having finished his work on cross section data for all of the Ξ^* decay chains and PWA analysis, will have successfully defended his dissertation.
- Search for strangeness (CLAS12)
  - The PI will continue to assist in analysis issues that arise regarding strangeness production using CLAS12 and will help coordinate the efforts of the Very Strange Group.

[1] S. Cole, *K* K* in GlueX, presentation at the College of Integrative Sciences and Arts Virtual Student Research Day, 12-2-2020, Polytechnic Campus, Arizona State University, http://meson.hldsite.com/presentations/CISAFall20/SebastianCole_CISA_Fall_2020.pdf

[2] R. Osar, *Event generator for γ p → p K K events*, presentation at the College of Integrative Sciences and Arts Virtual Student Research Day, 12-2-2020, Polytechnic Campus, Arizona State University, http://meson.hldsite.com/presentations/CISAFall20/RebeccaOsar_CISA_Fall_2020.pdf

[3] P. Walker, *Isolation of the φ-meson from ep → ep K+ K- events*, presentation at the College of Integrative Sciences and Arts Virtual Student Research Day, 12-2-2020, Polytechnic Campus, Arizona State University, http://meson.hldsite.com/presentations/CISAFall20/PatrickWalker_CISA_Fall_2020.pdf

[4] A. Costelle, *Construction of Event Generators for Strangeness-Containing Final States*, presentation at the 17th Annual Undergraduate Physics Symposium, 4-29-2021, Tempe Campus, Arizona State University, https://youtu.be/tKCB4t_G2yk

[5] E. Lamagna, *On the road to constructing events that decay φ π^0 using electroproduction with a proton target*, presentation at the 17th Annual Undergraduate Physics Symposium, 4-29-2021, Tempe Campus, Arizona State University, https://youtu.be/3AZP9fjStuc

[6] R. Osar, *Search for high-mass resonances decaying to K Λ**, presentation at the 17th Annual Undergraduate Physics Symposium, 4-29-2021, Tempe Campus, Arizona State University, https://youtu.be/Q2YhBCv1riE

[7] P. Walker, *Search for new states that decay K* K*, presentation at the 17th Annual Undergraduate Physics Symposium, 4-29-2021, Tempe Campus, Arizona State University, https://youtu.be/Buu2YDIrUK4

[8] B. Sumner, *Search for excited Ξ^* states and preliminary cross section for Ξ^-*(1530), Presentation at the American Physical Society April meeting, 4-20-2021, Online, http://meson.hldsite.com/presentations/Sumner/APSSumnerApril2021.pdf

[9] P. Walker, Meson decay in $e\,p \rightarrow e\,p\,K^+\,K^-$ and $e\,p \rightarrow e\,p\,K^+\,K^-\,\pi^0$ events, Honors Thesis, 4-7-2021, Arizona State University, http://meson.hldsite.com/theses/Thesis_WalkerPatrick.pdf