

# **Status of the KLF and Progress Towards next PAC**

**Sean Dobbs**  
Florida State U.

CPS Collaboration Meeting  
February 4th, 2020

# Next KLF Collaboration Meeting: Feb. 12th, 2020

## TENTATIVE AGENDA

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Wednesday February 12, 2020

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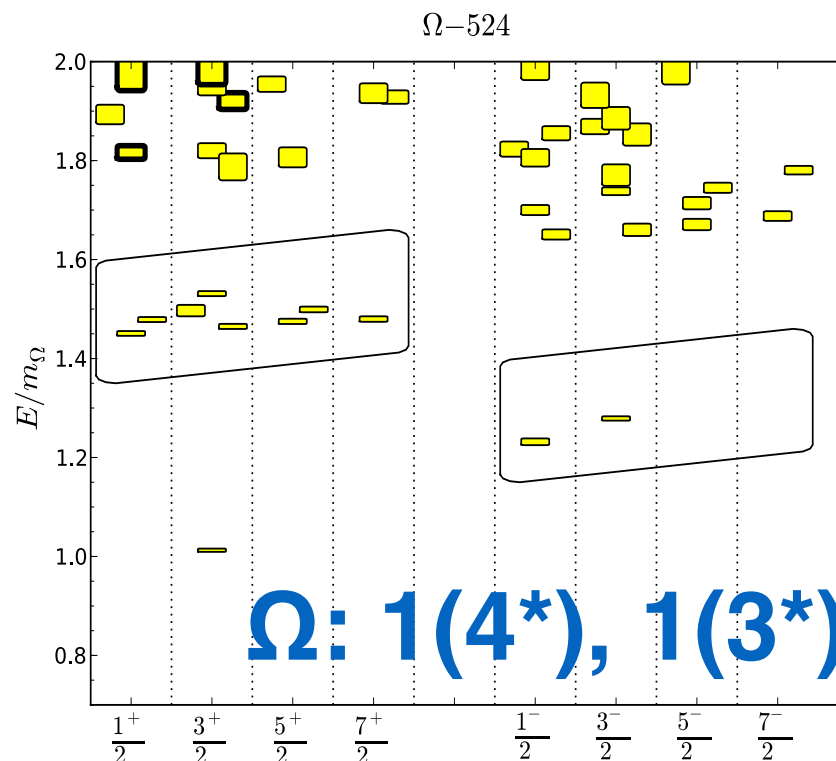
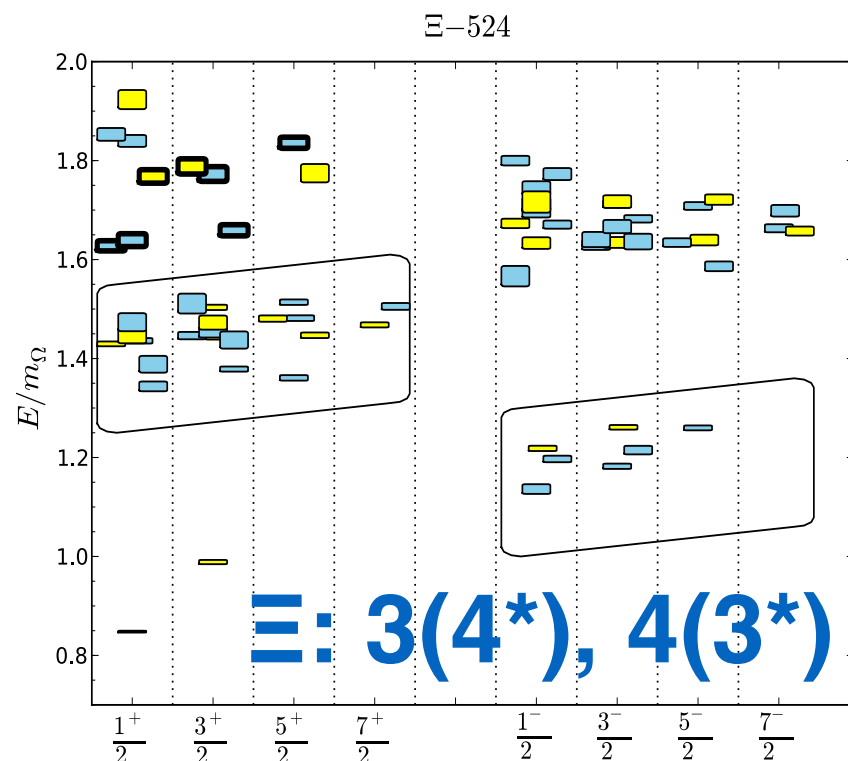
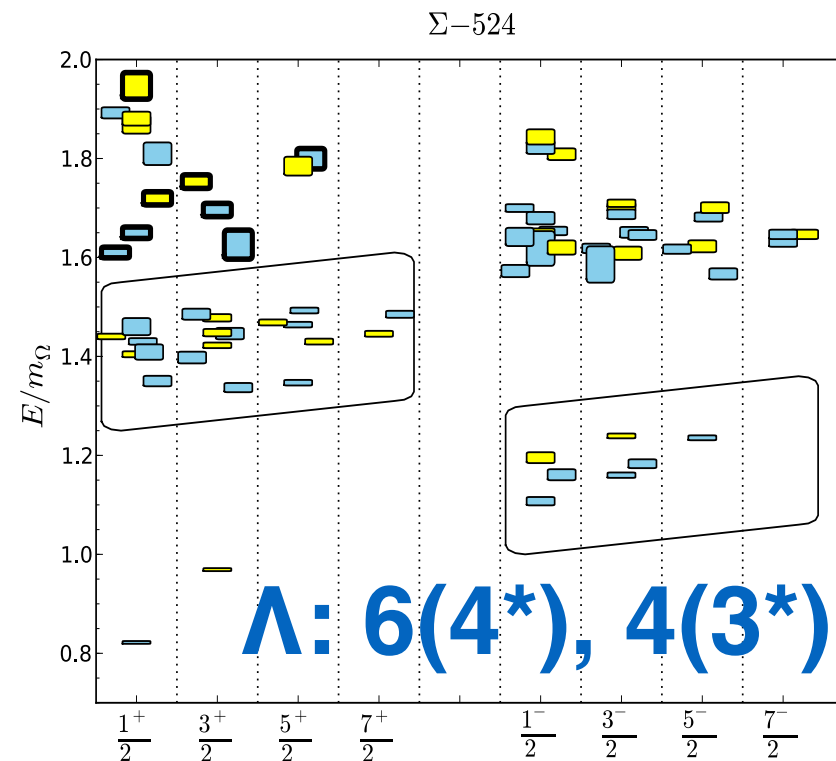
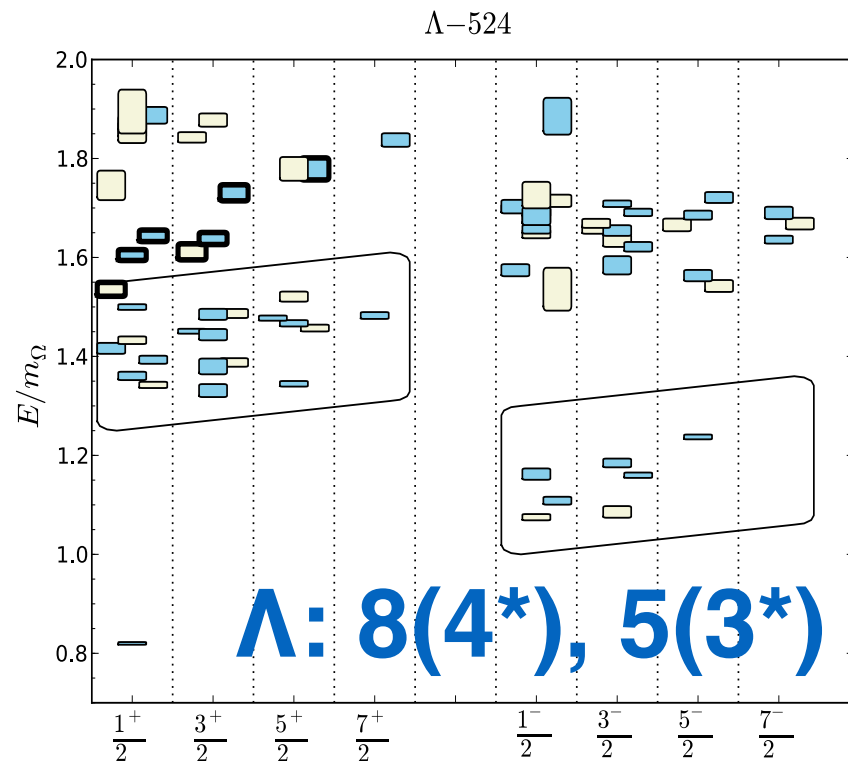
- 08:45 (105) Session I --- Project Status. Chair: **Patrizia Rossi**
  - 08:45 (5) Welcome --- *Eugene Chudakov* []
  - 08:50 (15+5) KLF overview and addressing PAC47 report --- *Moskov Amaryan* []
  - 09:10 (15+5) Compact Photon Source for Hall D: Progress and Plans --- *Sean Dobbs* []
  - 09:30 (15+5) LH2/LD2 cryogenic target: Progress and Plans --- *Chris Keith* []
  - 09:50 (15+5) Be-target assembly conceptual design: Progress and Plans --- *Igor Strakovsky* []
  - 10:10 (15+5) Flux monitor: Progress and Plans --- *Stuart Fegan* []
- 10:30 (30) Coffee
- 11:00 (100) Session II --- Simulations. Chair: **Paul Eugenio**
  - 11:00 (20+5) Search for missing Sigma-hyperon states --- *Andrey Sarantsev* []
  - 11:25 (20+5) Simulations of Sigma+(1670) -> Lambda pi+ at KLF --- *Kevin Luckas* []
  - 11:50 (20+5) Status of np studies --- *Michail Bashkanov* []
  - 12:15 (20+5) Status of K-pi studies --- *Shankar Adhikari* []
- 12:40 (60) Lunch
- 13:40 (50) Session III --- Theory. Chair: **Jianwei Qiu**
  - 13:40 (20+5) Perspectives in exciting hyperons --- *Jose Goity* []
  - 14:05 (20+5) LQCD for hyperon spectroscopy --- *David Richards* []
- 14:30 (30) Refreshment
- 15:00-16:00 (60) Seminar for Scattering and form factors from lattice QCD --- *Colin Morningstar* [1] [🔗](#)
- 15:30 (30) Coffee
- 16:00 (75) Session IV --- Discussion. Chair: **Simon Taylor**
  - 16:00 (20+5) DAQ for KLF --- *Sergey Furlotov* []
  - 16:25 (20+5) Trigger for KLF --- *Alexander Somov* []
  - 16:50 (20+5) DIRC update --- *Justin Stevens* []
- 17:15 Adjourn

- Discussion of experimental and theoretical aspects of KLF.
- All are welcome!

# JLab $K_L$ Facility

- Primary Physics Goals:
  - Hyperon Spectroscopy

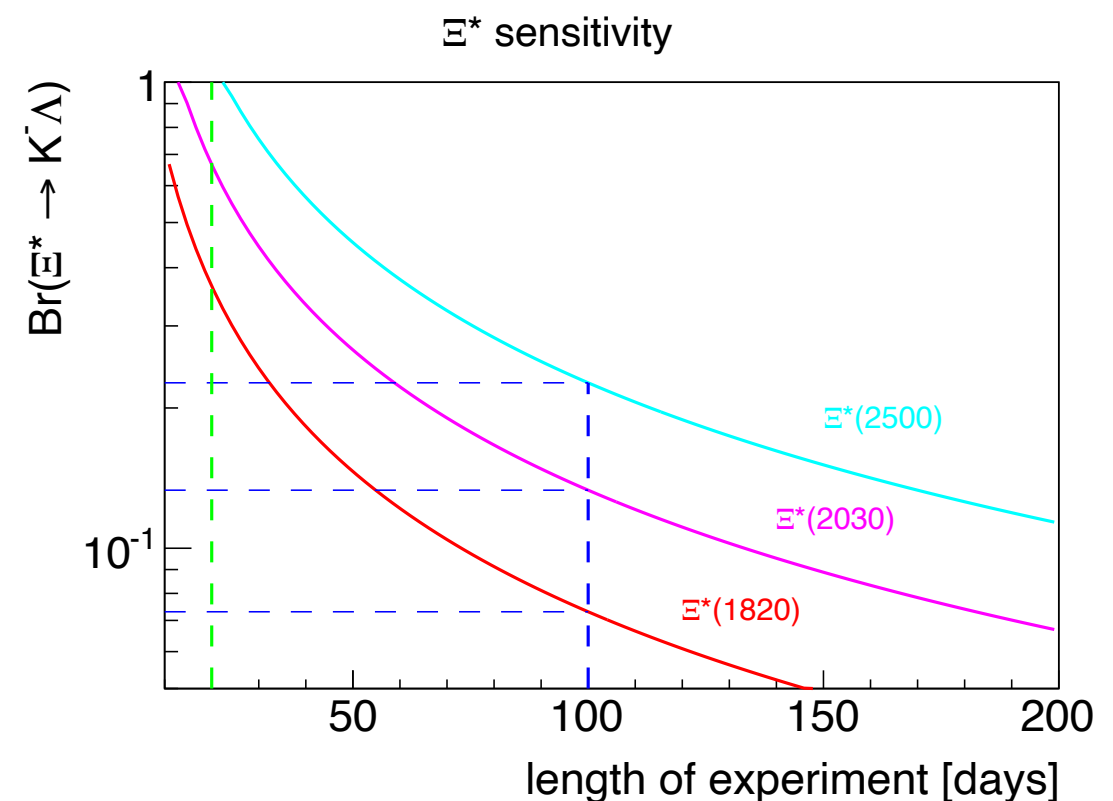
# JLab $K_L$ Facility



Identify missing states, measure mass splittings

# JLab $K_L$ Facility

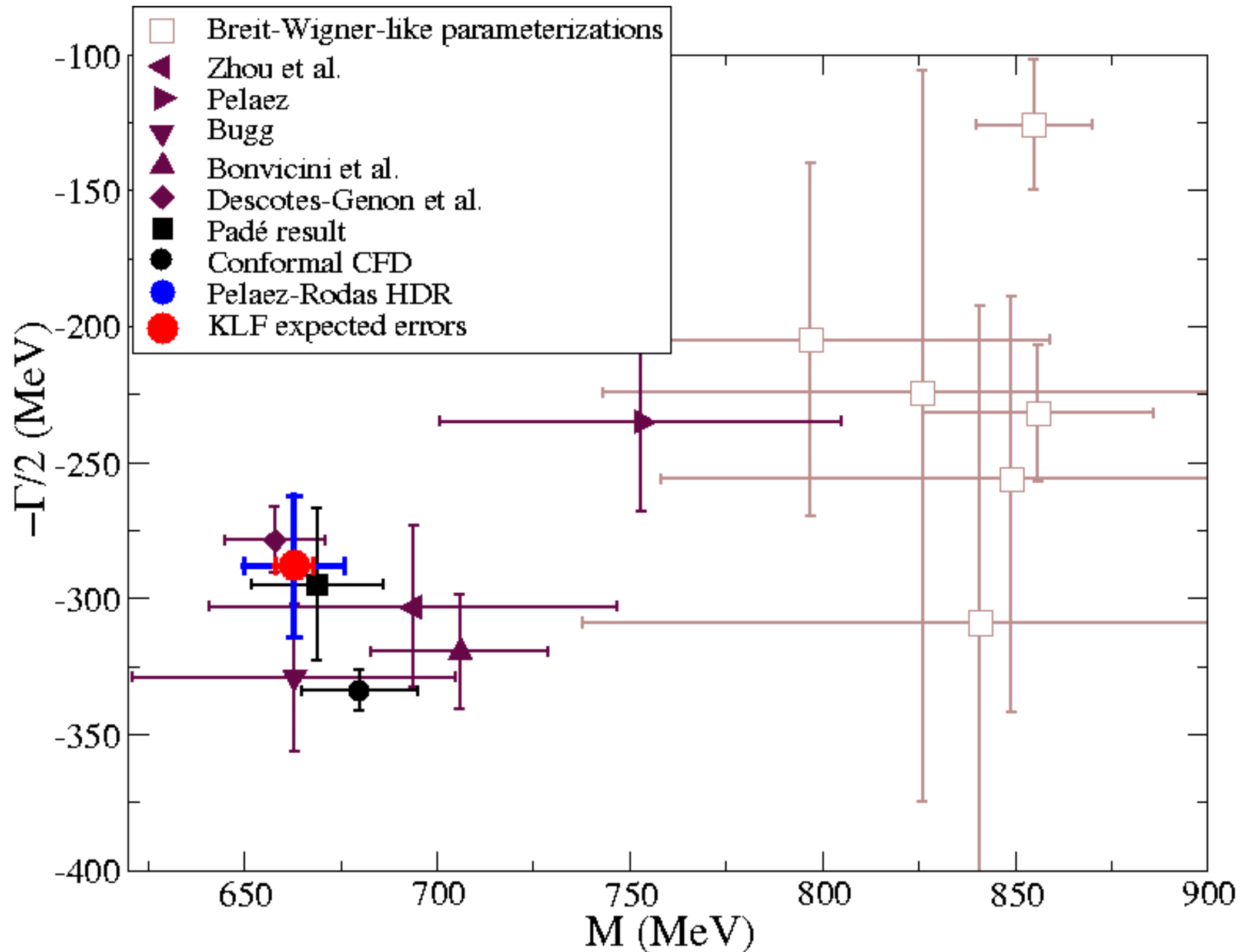
- Primary Physics Goals:
  - Hyperon Spectroscopy
    - Measure differential cross sections and hyperon self-polarization
    - Perform coupled channel PWA for pole parameters
    - Mass reach up to 2400 MeV



# JLab $K_L$ Facility

- Primary Physics Goals:
  - Hyperon Spectroscopy
    - Measure differential cross sections and hyperon self-polarization
    - Perform coupled channel PWA for pole parameters
    - Mass reach up to 2400 MeV
  - Kaon Spectroscopy
    - Studies of  $K\pi$  S-wave and D-wave
    - Excited Kaon Resonances

# JLab $K_L$ Facility



**Identification  
of kappa  
parameters**

# PAC47 Report

**PR12-19-001**

**Scientific Rating:** N/A

**Recommendation:** C2

**Title:** “Strange Hadron Spectroscopy with a Secondary KL Beam in Hall D”

**Spokespersons:** M. Amaryan (contact), M. Bashkanov, S. Dobbs, J. Ritman, J. Stevens, I. Strakovsky

**Motivation:** The spectroscopy of strange baryons and mesons, including their fundamental strong interactions, is the focus of this proposal. New and unique data can be obtained with an intense KL beam aimed at a hydrogen/deuterium target, using the GlueX apparatus to detect final state particles.

[...]

**Summary:** The collaboration should return to the PAC with a well documented proposal. Simulations addressing backgrounds and the low  $l_{\text{t}}$  region are necessary. Also, a well-formed plan is needed to build the beamline and prepare for data taking with GlueX.



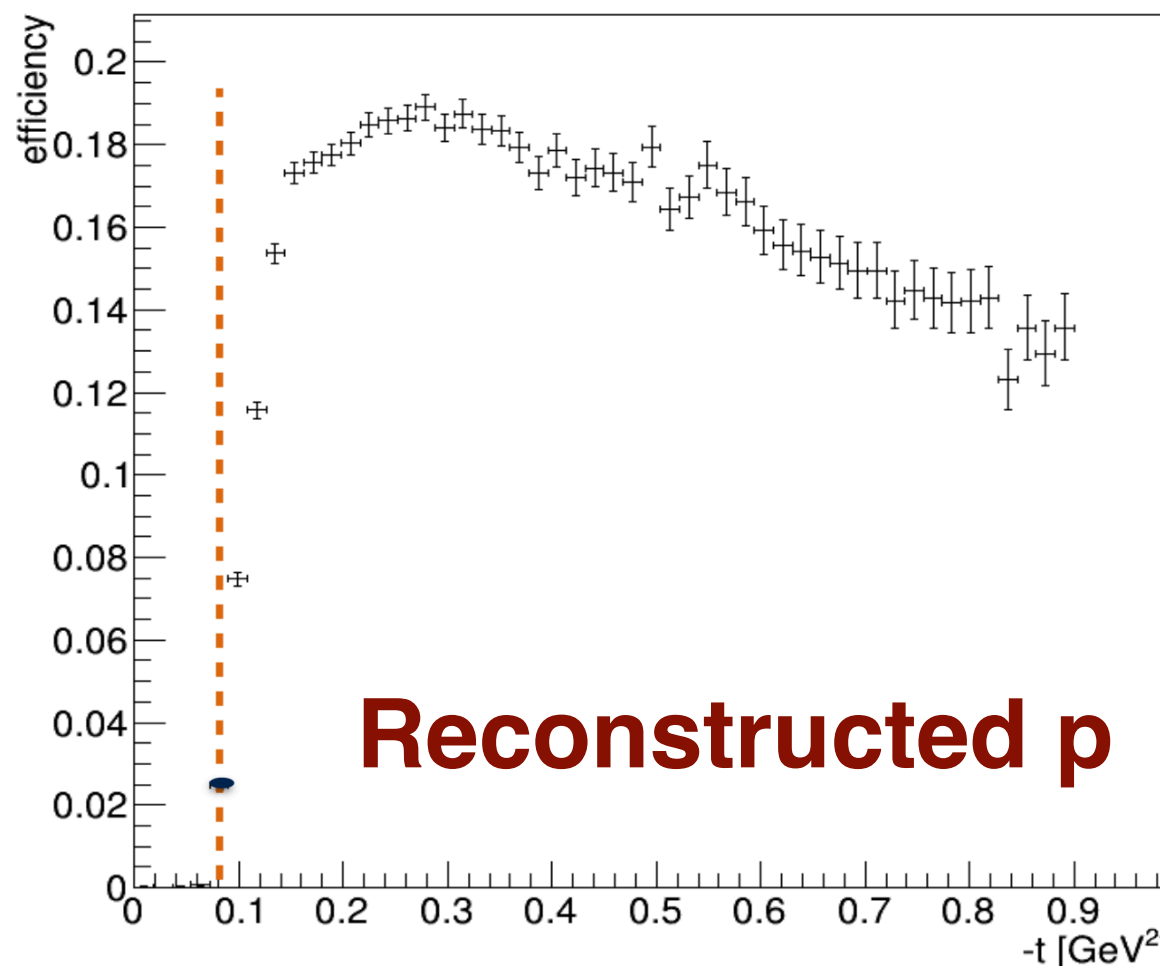
# KL Missing Mass and $K\pi$ at low $|t|$ — PAC47

- PAC: “A) the missing mass technique to replace the direct proton detection at very low values of  $|t|$  was only presented in the open session and the details of the underlying simulations should be clarified”

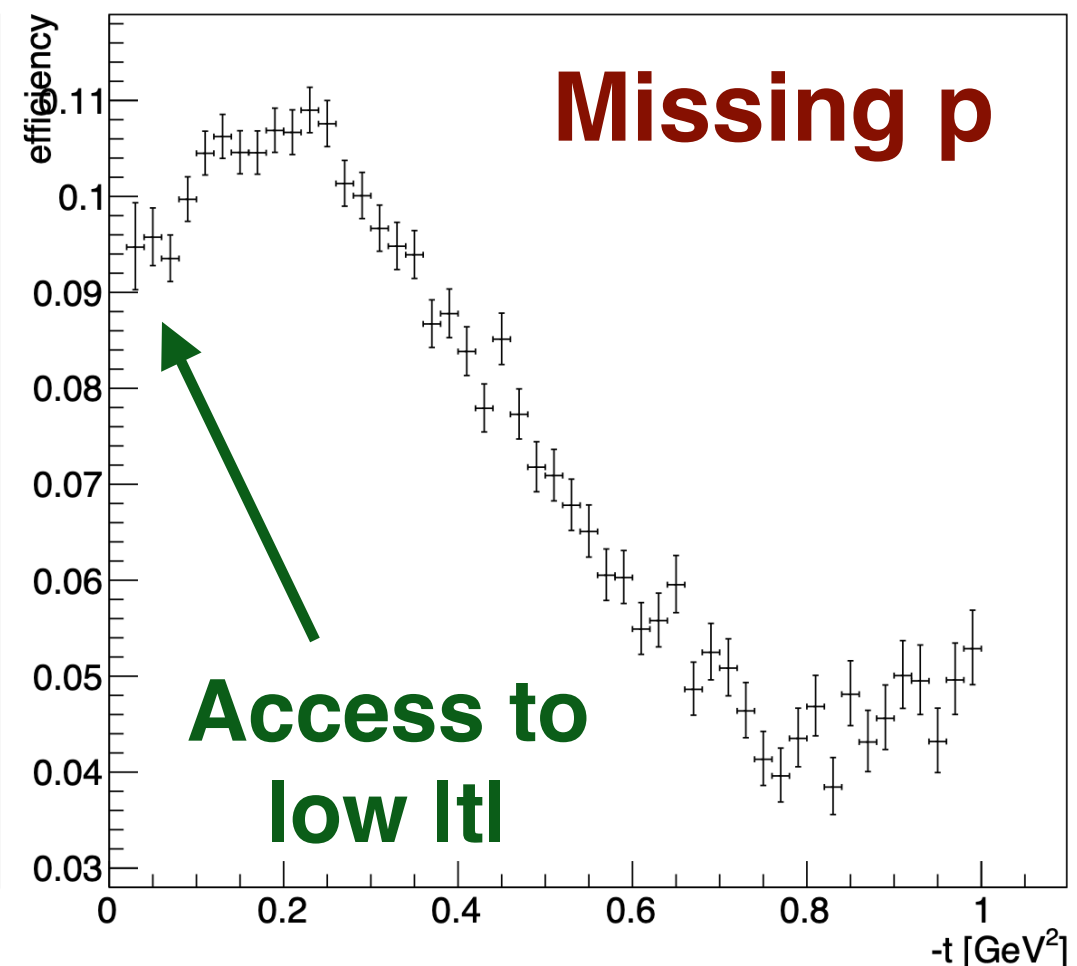
$$K_L p \rightarrow K^+ \pi^- p$$

PAC47

Transfer Four Momentum Efficiency



Transfer Four Momentum Efficiency



# $K_L$ Missing Mass and $K\pi$ at low $|t|$ — Next Steps

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*D. Aston et al. /  $K^- \pi^+$  scattering*

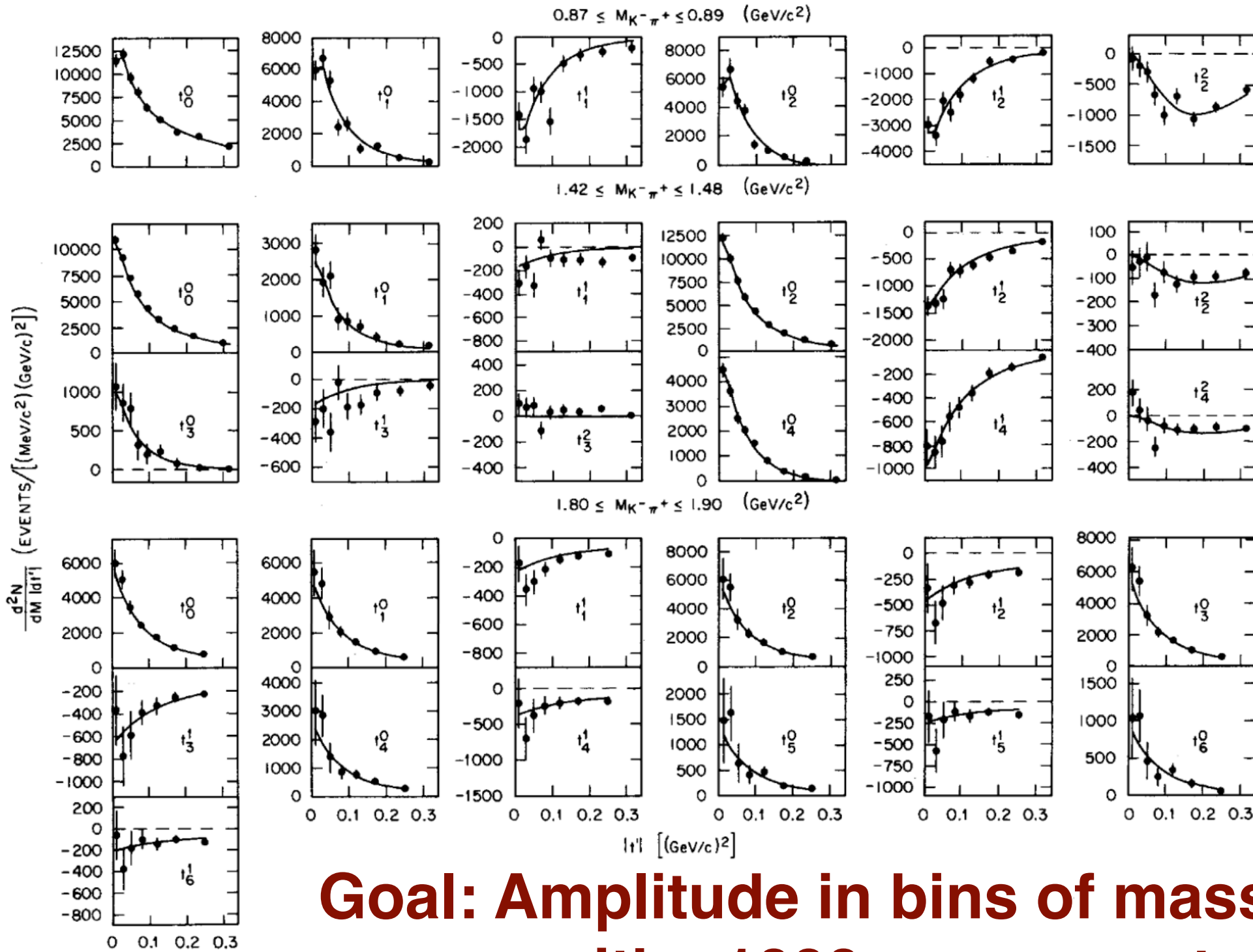
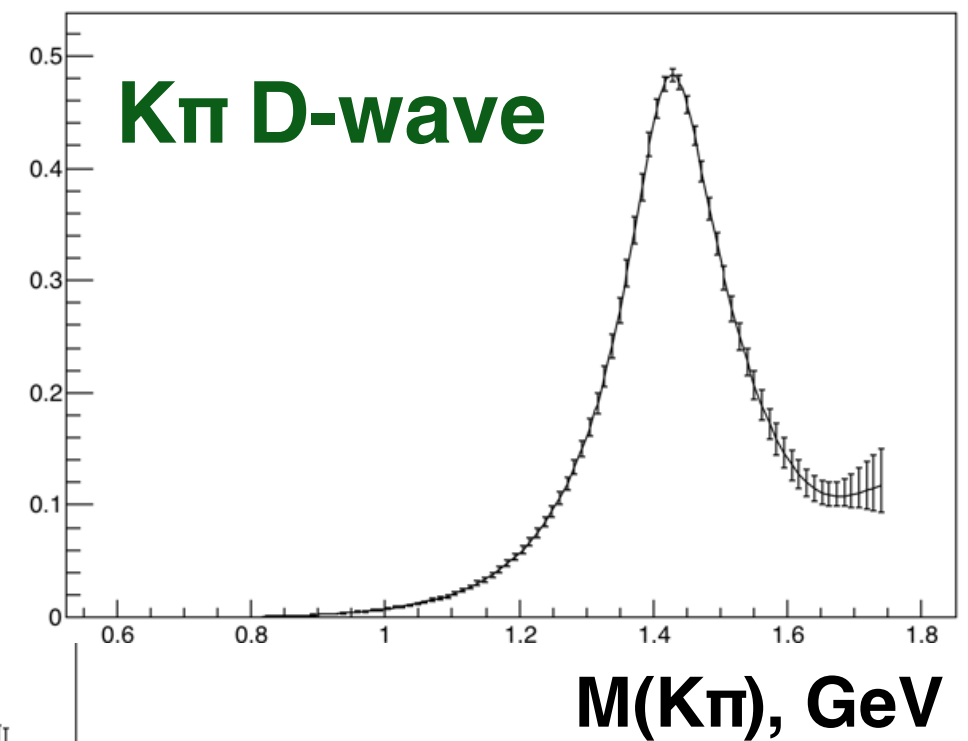
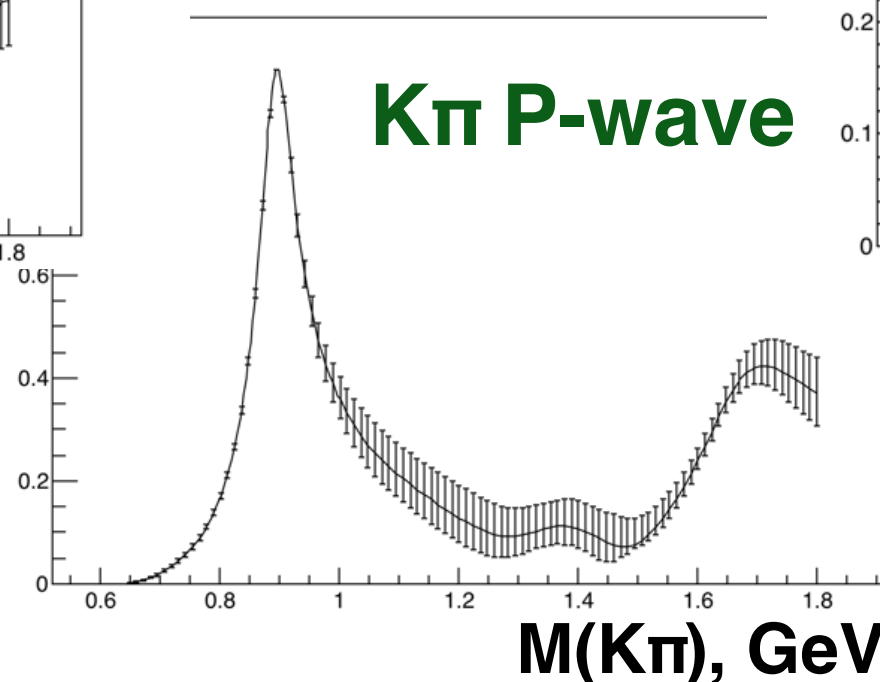
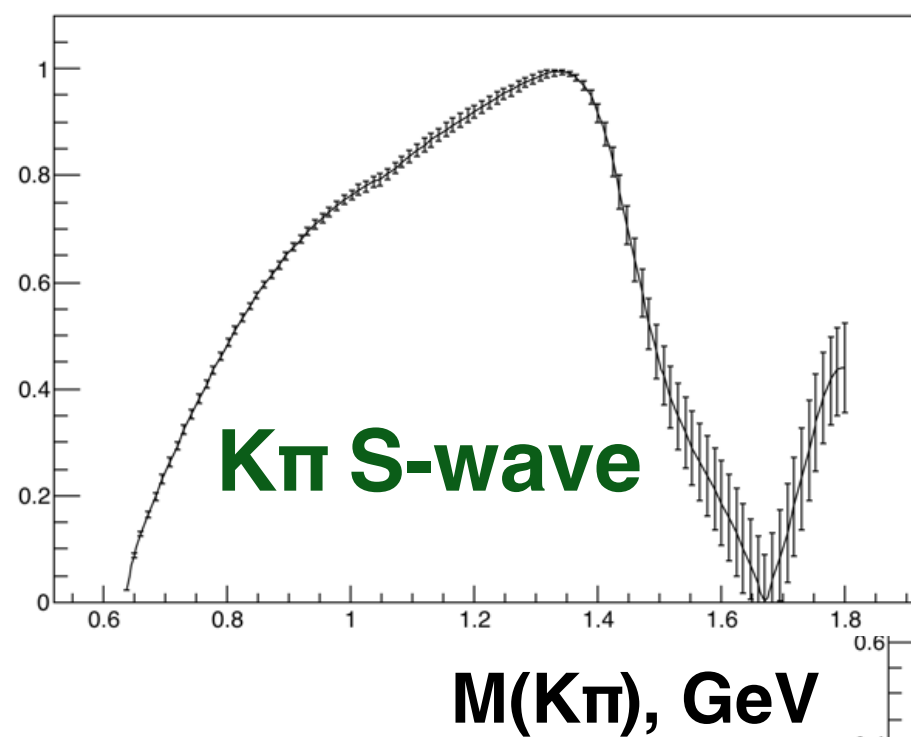


Fig. 9. The acceptance corrected unnormalized  $K^- \pi^+$  moments as a function of  $|t'|$ . Three different mass regions are shown:  $0.87 \leq M_{K^- \pi^+} \leq 0.89 \text{ GeV}/c^2$ ,  $1.42 \leq M_{K^- \pi^+} \leq 1.48 \text{ GeV}/c^2$ , and  $1.80 \leq M_{K^- \pi^+} \leq 1.90 \text{ GeV}/c^2$ . The curves are the result of a fit to the production model described in the text.

**Goal: Amplitude in bins of mass and  $|t|$  with x1000 more events**

# $K_L$ Missing Mass and $K\pi$ at low $|t|$ — Next Steps

- Generated  $K_L p \rightarrow K^+ \pi^- p$  events using realistic model
- Currently optimizing binning and moment extraction
- Final amplitude and model parameters determination performed along with theory collaborators



# Detailed Simulations of Hyperon Production

- PAC: “B) a realistic simulation including beam backgrounds is to be presented with details to be spelled out and documented thoroughly”
  - Detailed simulation of  $K_L p \rightarrow \Lambda \pi$  was performed with full detector simulation and beam backgrounds included
  - Events with estimated systematic uncertainties being analyzed by Bonn-Gatchina group to determine estimated precision of resonance pole parameter uncertainties
  - Full details to be included in next proposal

# KLF Beamline Planning

- PAC: “Also, a well-formed plan is needed to build the beamline and prepare for data taking with GlueX.”
  - Be target: conceptual design in advanced stage, summary document being written
- CPS: See previous talk
- Will continue developing design in consultation with Hall D personnel

# Summary

- The K-Long Facility will provide a unique window into hadron spectroscopy and allow for the study of the properties of the strange-quark hadrons.
  - An active community of experimentalists and theorists are collaborating to bring this project to reality
- Detailed studies are being performed for the next PAC
  - Hyperon spectroscopy with full backgrounds
  - $K\pi$  at small  $|t|$
  - Beamline: CPS + Be-target