

***Strange Quark Spectroscopy with Secondary
Beam of K_L at GlueX***

(progress report)

Moskov Amaryan

Old Dominion University

(on behalf of co-authors)

**GlueX Analysis Meeting
April 17, 2017**

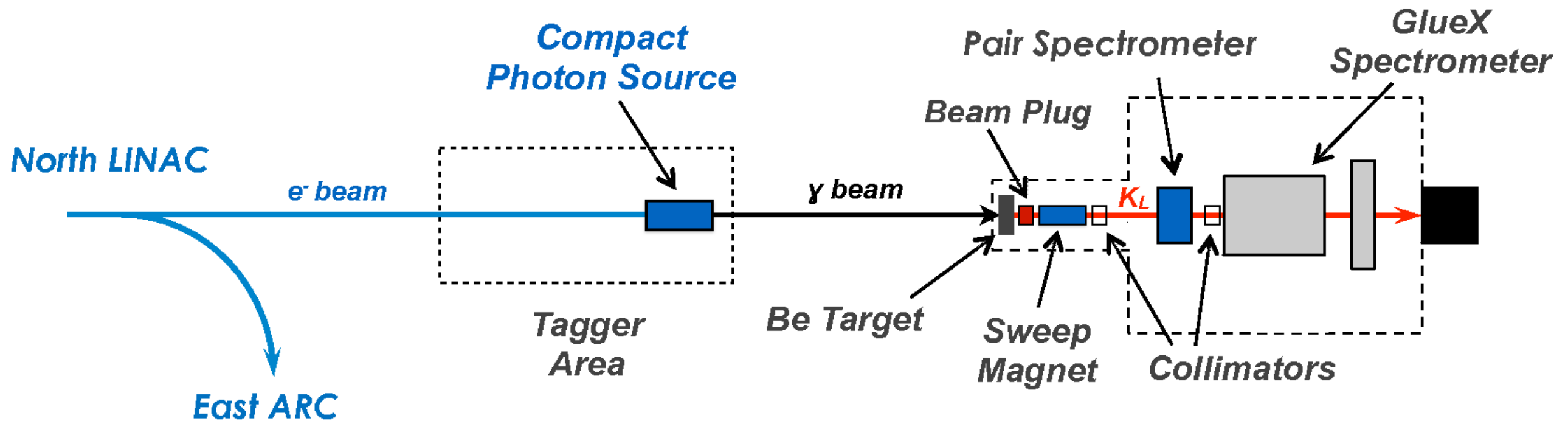
Strange Quark Spectroscopy with a Secondary K_L Beam at GlueX

Shankar Adhikari¹, Moskov J. Amaryan^{2,*†}, Alexey V. Anisovich^{3,4}, Marouen Baalouch²,
Mikhail Bashkanov^{5,†}, Rene Bellwied⁶, William J. Briscoe⁷, William K. Brooks⁸,
Eugene Chudakov⁹, Philip L. Cole¹⁰, Volker Crede¹¹, Pavel Degtyarenko⁹, Gail Dodge²,
Michael Döring^{7,9}, Michael Dugger¹³, Hovanes Egiyan⁹, Stuart Fegan¹⁴, Gagik Gavalian⁹,
Viacheslav Gauzshtein^{15,16}, Derek I. Glazier¹⁷, Jose Goity⁹, Lei Guo¹, Helmut Haberzettl⁷, Mirza
Hadžimehmedović¹⁸, Avetik Hayrapetyan¹⁹, Tanja Horn²⁰, Charles E. Hyde², David Ireland¹⁷,
Benjamin C. Jackson²¹, Christopher D. Keith⁹, Chan W. Kim⁷, Ivan Kuznetsov^{15,16},
Alexander B. Laptev²², Iliya Larin¹², Valery E. Lyubovitskij^{15,16,23,8}, Maxim Mai⁷,
D. Mark Manley²⁴, Vincent Mathieu²⁵, Maxim Matveev⁴, Kanzo Nakayama²¹, Yongseok Oh²⁶,
Hedim Osmanović¹⁸, Rifat Omerović¹⁸, Kijun Park⁹, Ljubomir Pentchev⁹, William Phelps¹,
Eric Pooser⁹, John W. Price²⁷, David Richards⁹, Dan-Olof Riska²⁸, Barry G. Ritchie¹³,
James Ritman^{29,†}, Hui-Young Ryu³⁰, Elena Santopinto³¹, Andrey V. Sarantsev^{3,4},
Andrey Semenov³², Daria Sokhan¹⁷, Alexander Somov⁹, Jugoslav Stahov¹⁸, Justin R. Stevens^{33,†},
Igor I. Strakovsky^{7,†}, Alfred Švarc³⁴, Adam Szczepaniak^{25,9}, Simon Taylor⁹, Daniel Watts⁵,
Nilanga Wickramaarachchi², Ronald L. Workman⁷, Nicholas Zachariou⁵, Bingsong Zou³⁵

Outline

- *K_L beamline*
- *K_L beam characteristics*
- *MC simulation of different reactions*

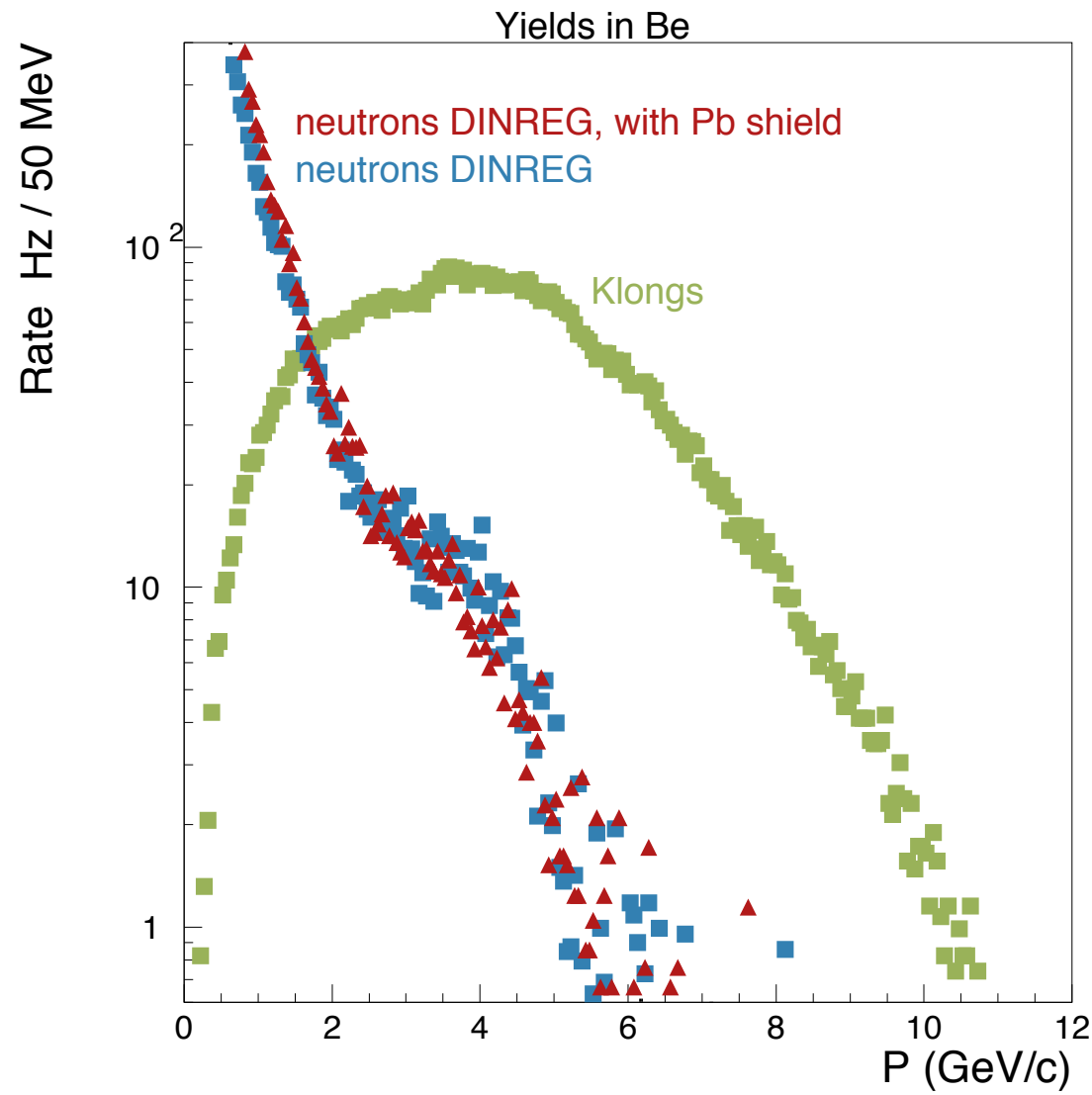
Beamline



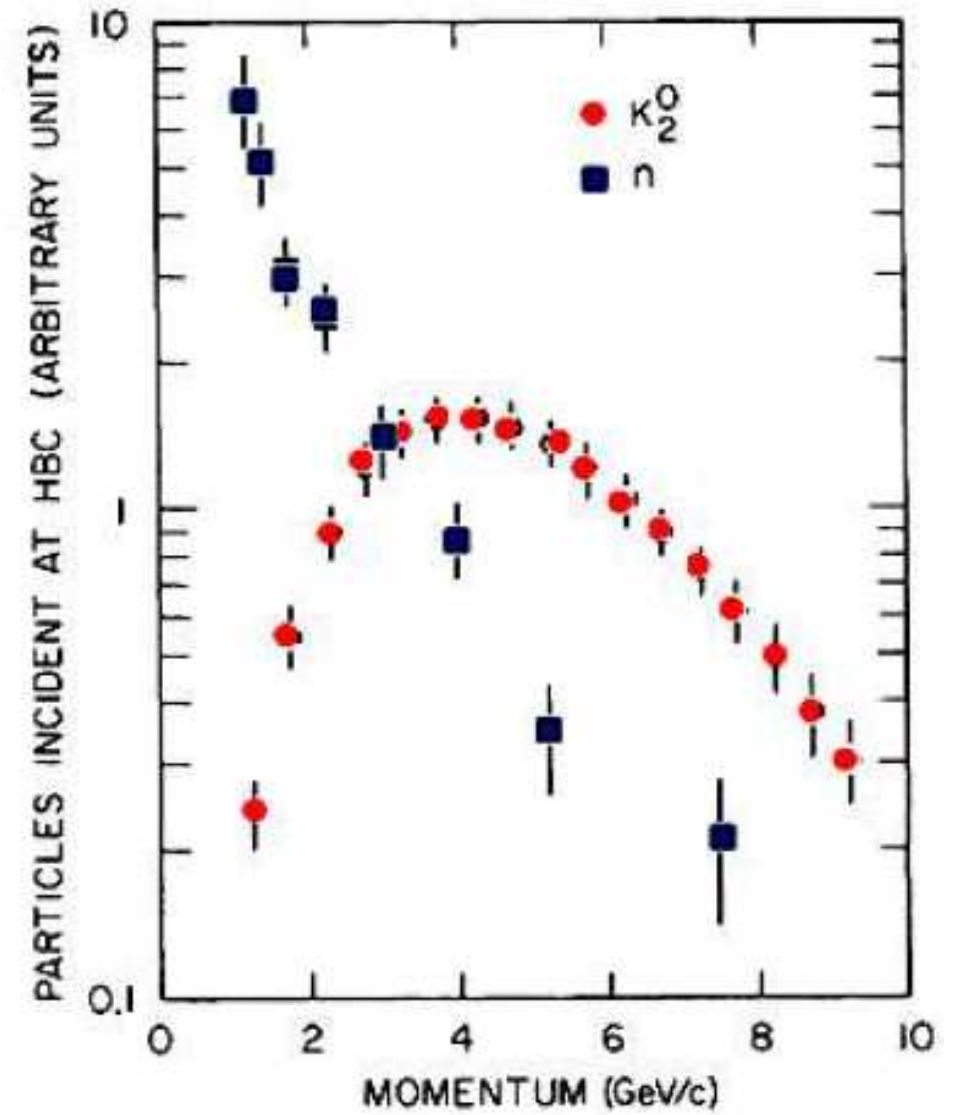
- **Conceptually all components are feasible to install, some already in place**
- **No major issues related to gamma, muon and neutron backgrounds according to detailed simulations *all are tolerable***

KL Beam Profile

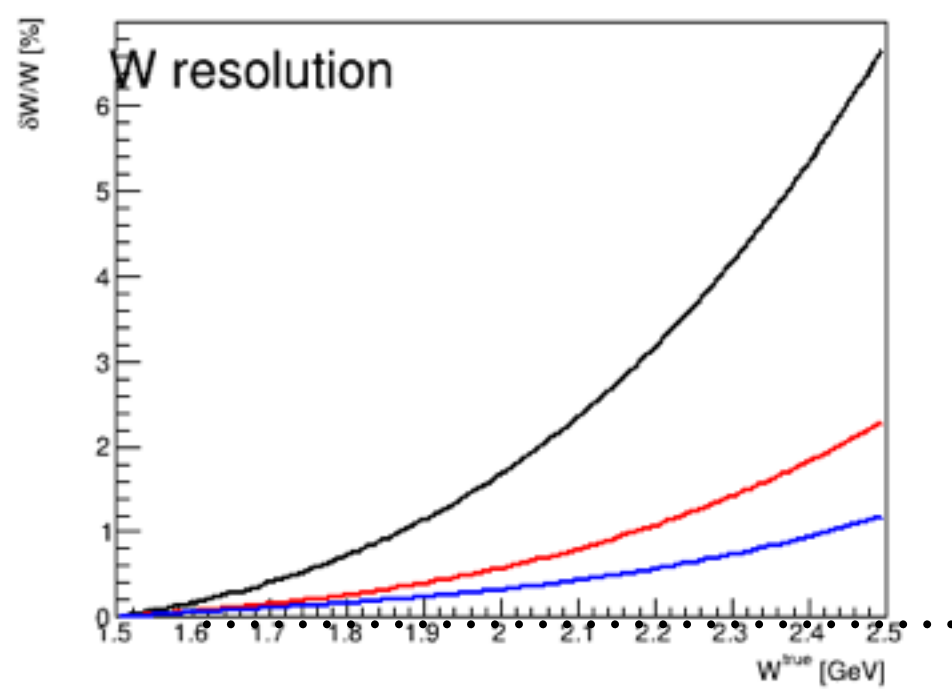
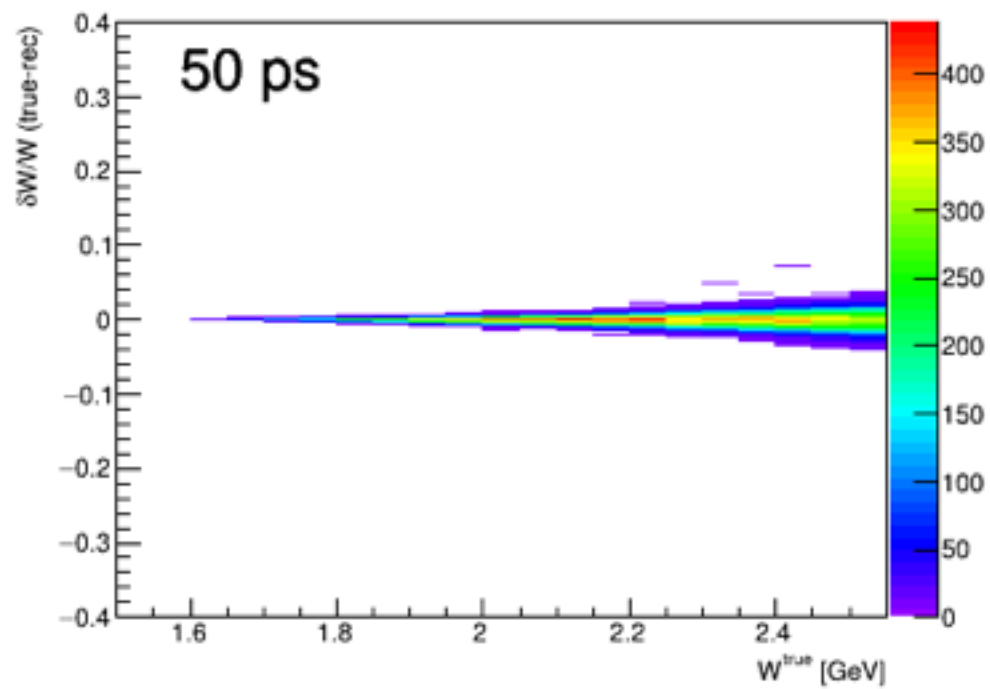
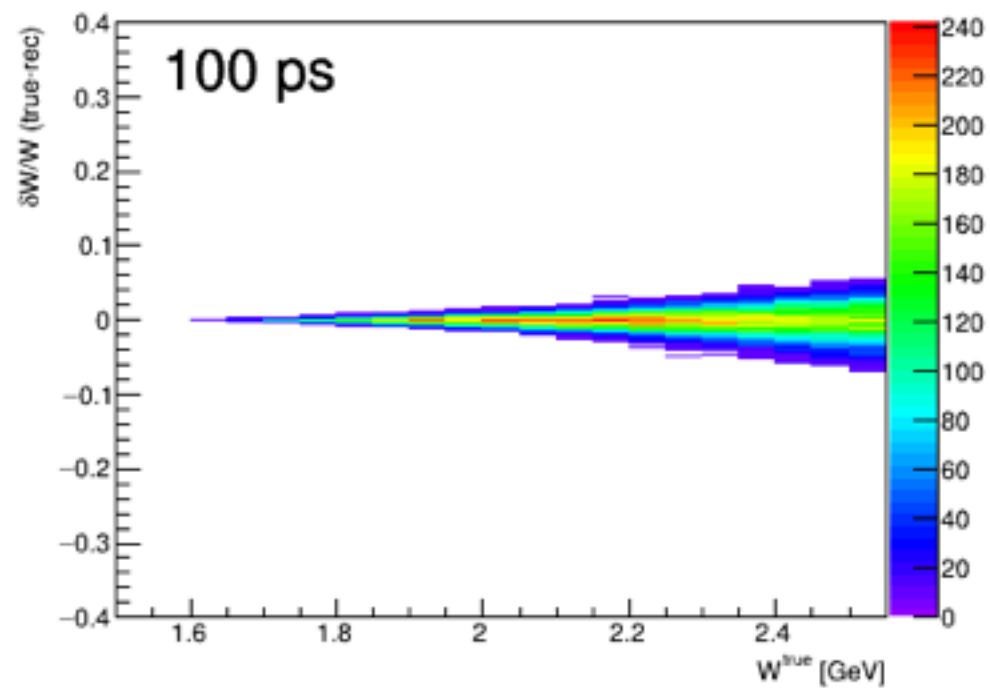
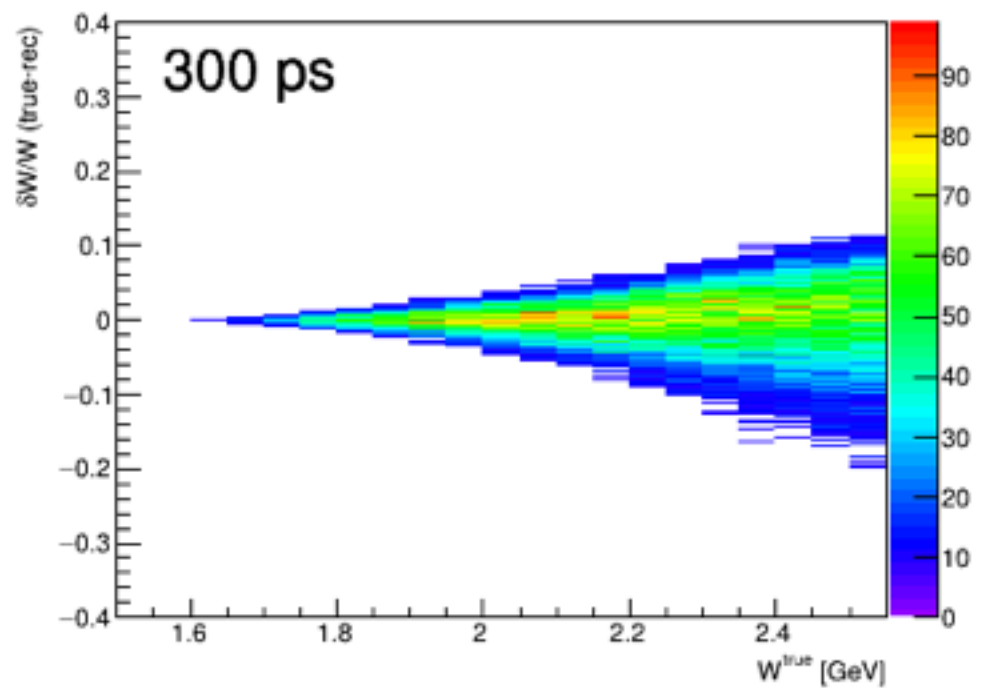
Proposed at GlueX



SLAC

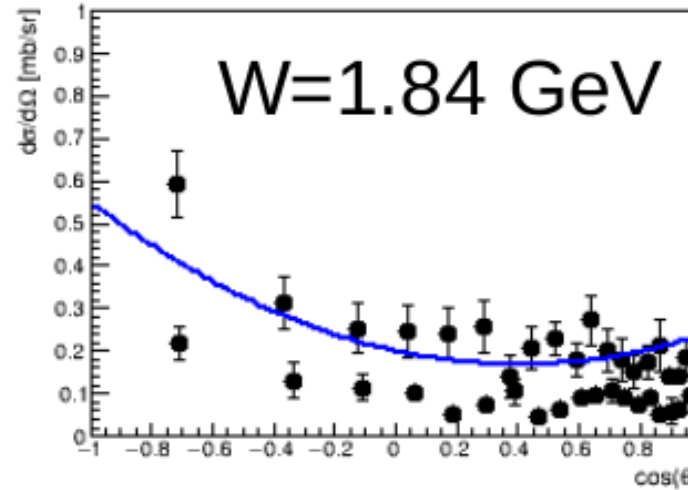
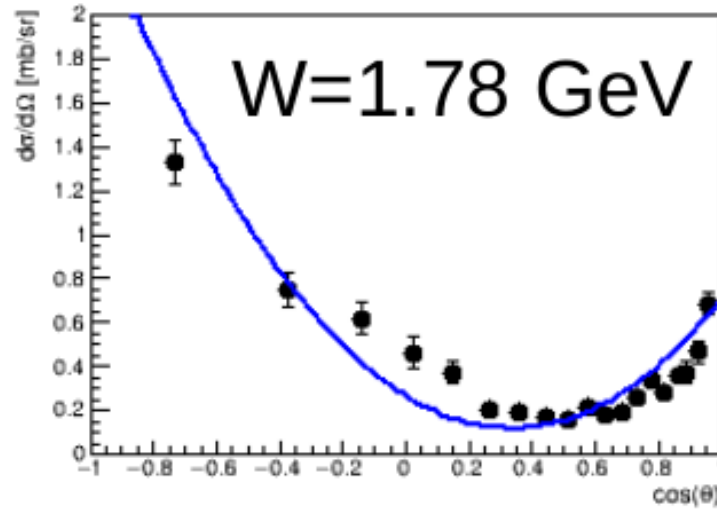
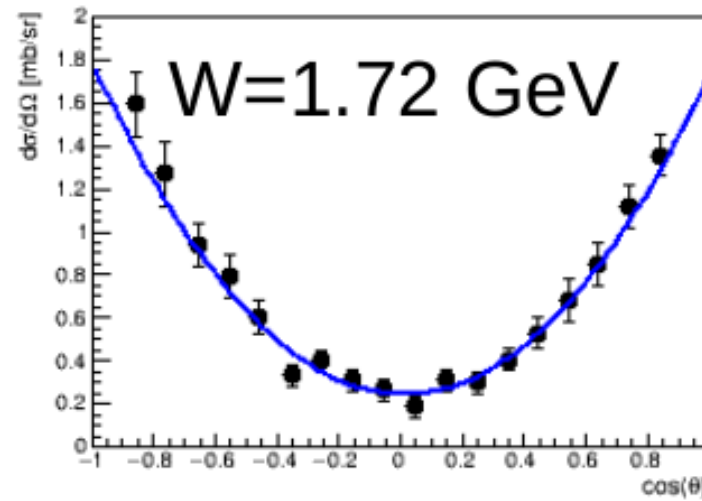
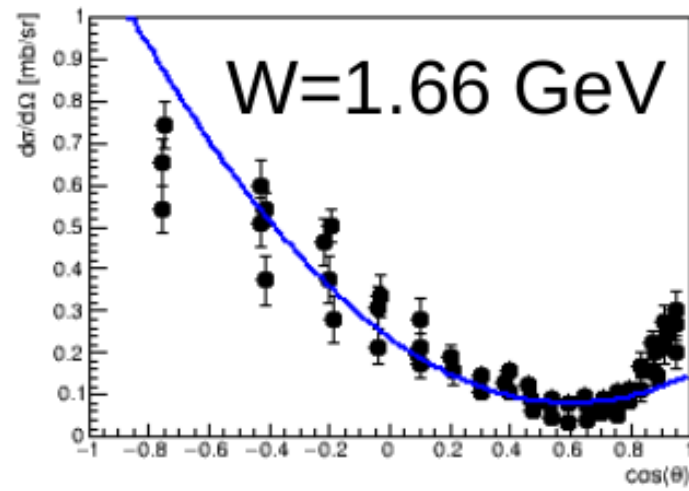


W Resolution

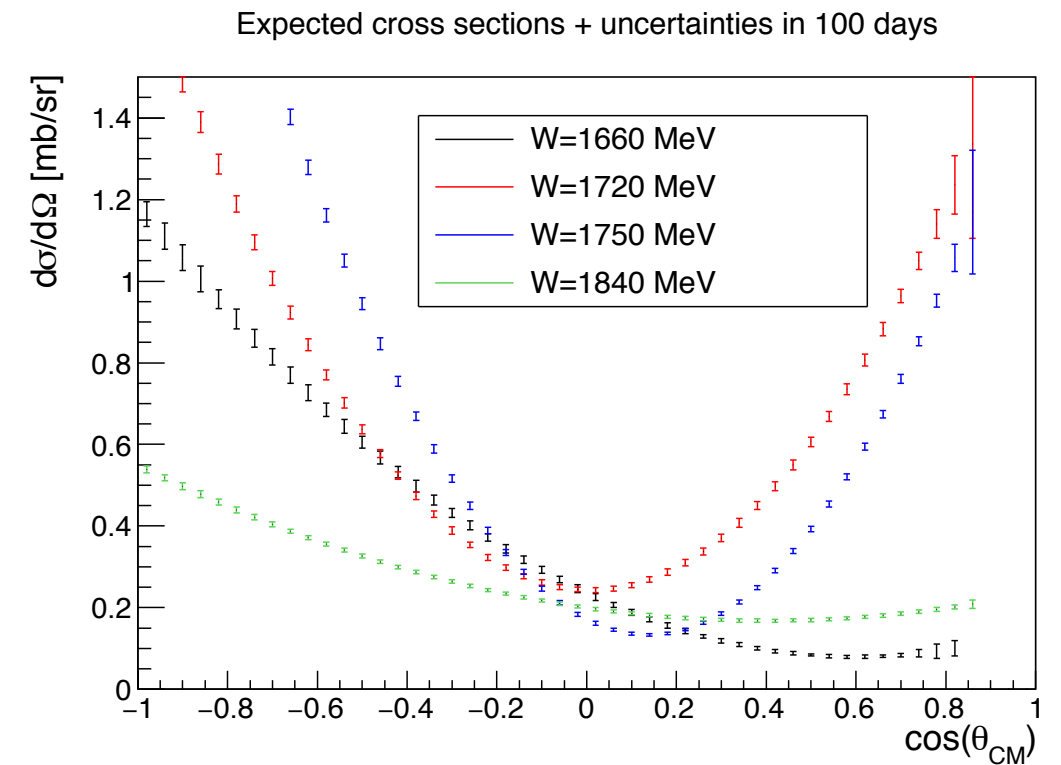


$$K_L p \rightarrow K_S p$$

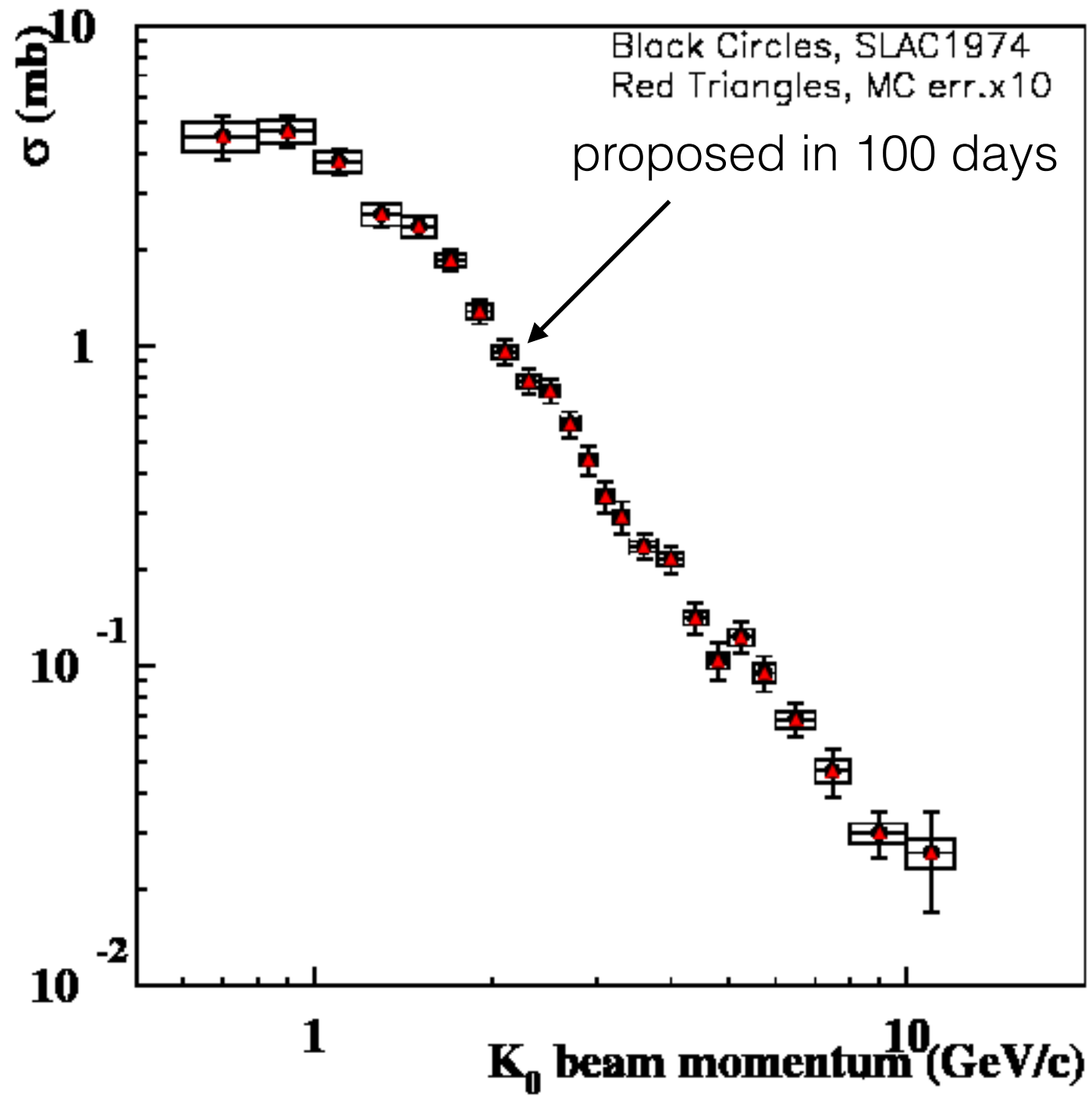
Old Data from SLAC



Proposed measurement



$$K_L p \rightarrow \pi^+ \Lambda$$



$$K_L p \rightarrow K^+ X$$

blue points: 100 days of running

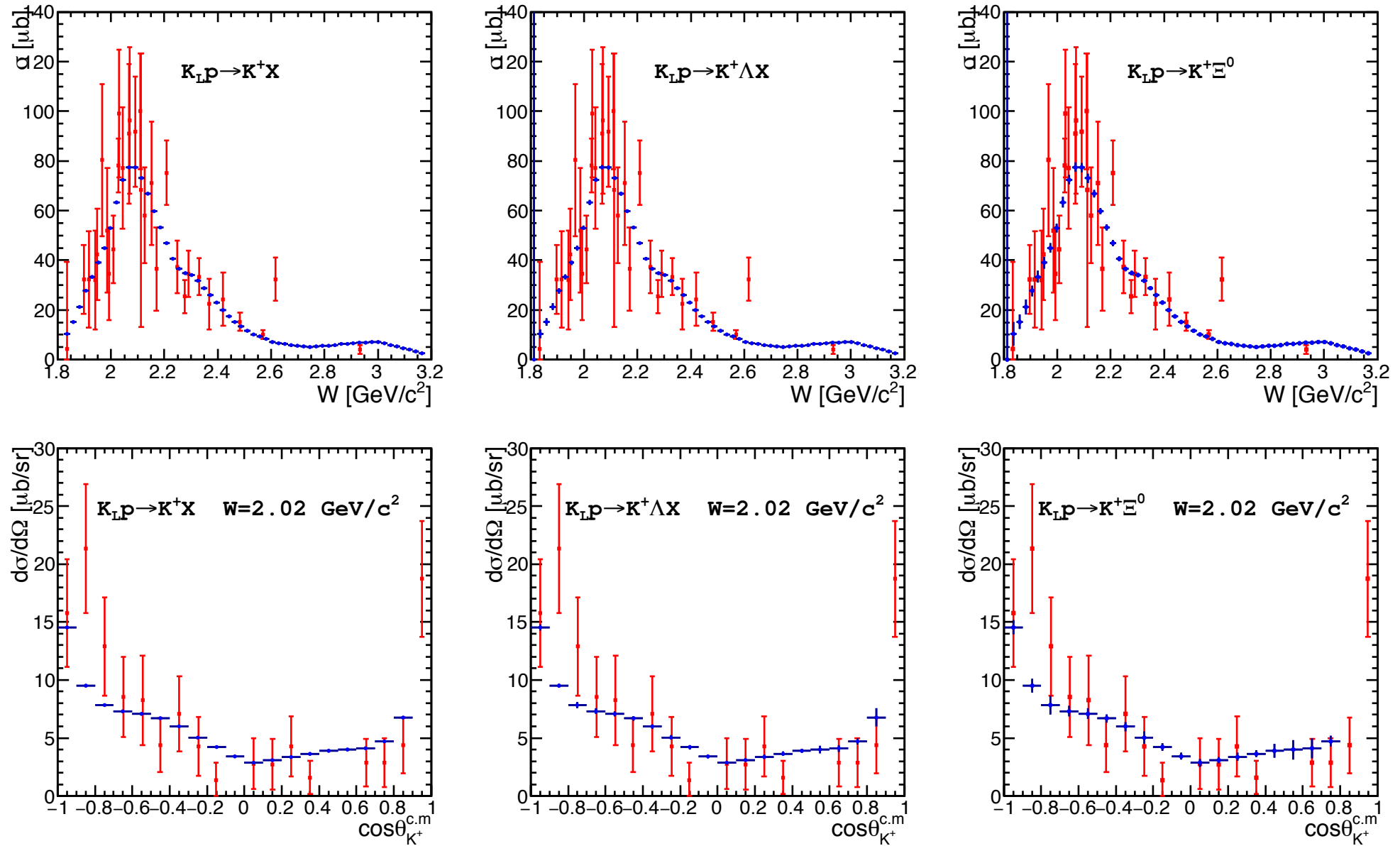


Figure 43: Total and differential cross section statistical uncertainty estimates (blue points) for the three topologies (column 1: only K^+ reconstructed, column 2: $K^+ \Lambda$ reconstructed, and column 3: $K^+ \Xi^0$ reconstructed) in comparison with data taken from Ref. [175] (red points).

SLAC

$$K_L p \rightarrow K^+ n$$

blue points: 100 days of running

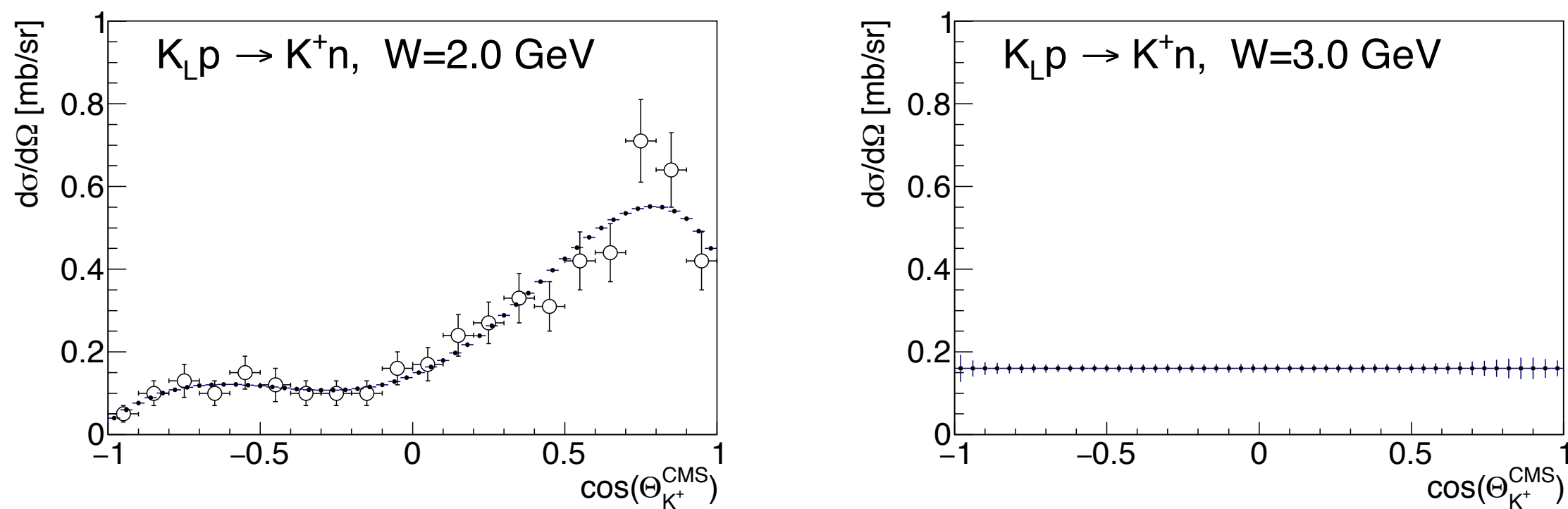
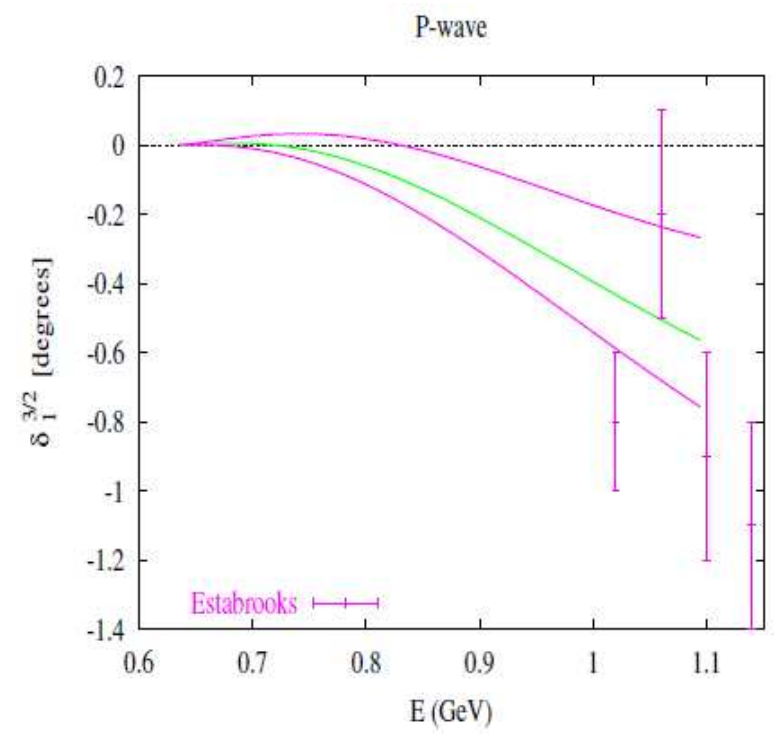
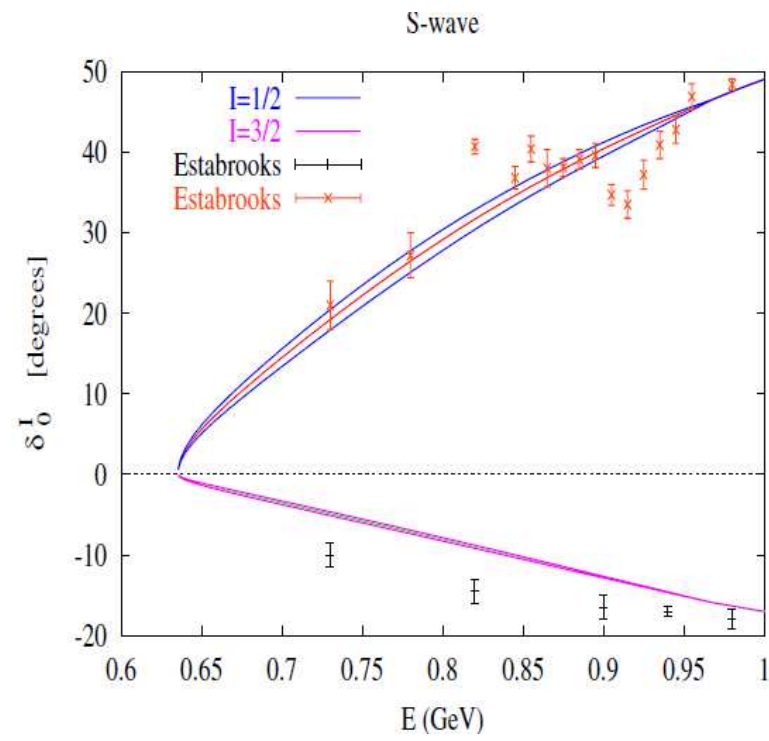
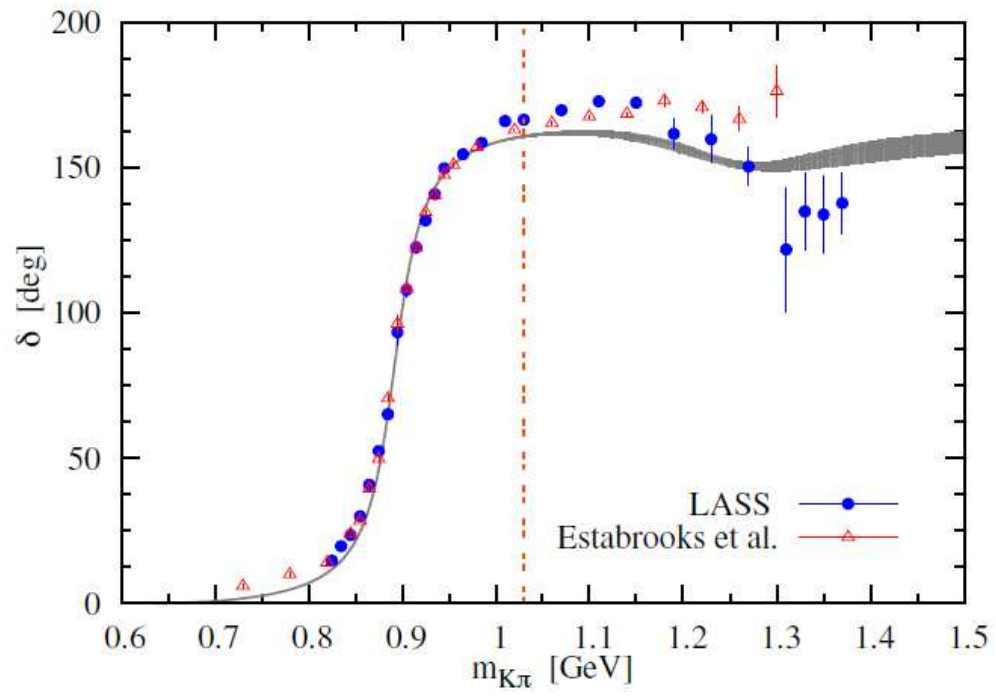


Figure 46: The cross section uncertainty estimates (statistics only) for $K_L p \rightarrow K^+ n$ reaction for the $W = 2$ GeV (left) in comparison with data from Ref. [177] and $W = 3$ GeV (right). The errorbars for the right plot are increased by factor of 10 to make them visible.

$$K_L p \rightarrow K^\pm \pi^\mp p$$



Simulation is in progress

Expected Statistics in 100 days of Running on LH₂

Reaction	Statistics (events)
$K_L p \rightarrow K_S p$	8M
$K_L p \rightarrow \pi^+ \Lambda$	24M
$K_L p \rightarrow K^+ \Xi^0$	4M
$K_L p \rightarrow K^+ n$	200M
$K_L p \rightarrow K \pi X$	under study

Our main goals are:

- to establish KL facility***
- to measure cross sections and self polarization using LH2 and LD2***
- to do PWA and determine resonance parameters (including looking for missed hyperons)***

Outlook

- *Proposal is almost ready to be submitted to the GlueX Collaboration*
- *Simulation of K-pi final state is in progress*
- *Final editing of the proposal after we get comments from collaboration*
- *May 22, submission to PAC45*