Nuclear Physics Working Group Summary Report

M. H. Wood, Canisius College

March 8, 2018

Working Group Business

Since January 2018 meeting, there were 18 presentations.
Invited – 1 (approved) , Contributed – 1 (notified), General – 1 (3 notified),
Poster – 1 (1 notified)
Seminars - 14

Continuing Analysis Reviews: 4

New reviews

Article	Author	Status
Inclusive (e,e') Cross-Section Measurements of the EMC Effect and the a_2 Plateau	B. Scmookler et al.	Fast track review; submitted to Science
PROBING 2N-SRC in 12C, 27Al, 56Fe, and 208Pb using the A(e,e'n) and A(e,e'p) reactions	M. Duer et al.	Submitted to Nature
Extracting the center-of-mass momentum distribution and the relative fraction of pp-SRC pairs in 12C, 27Al, 56Fe, and 208Pb	E. O. Cohen et al.	Ad hoc review

Nuclear Physics DC Day

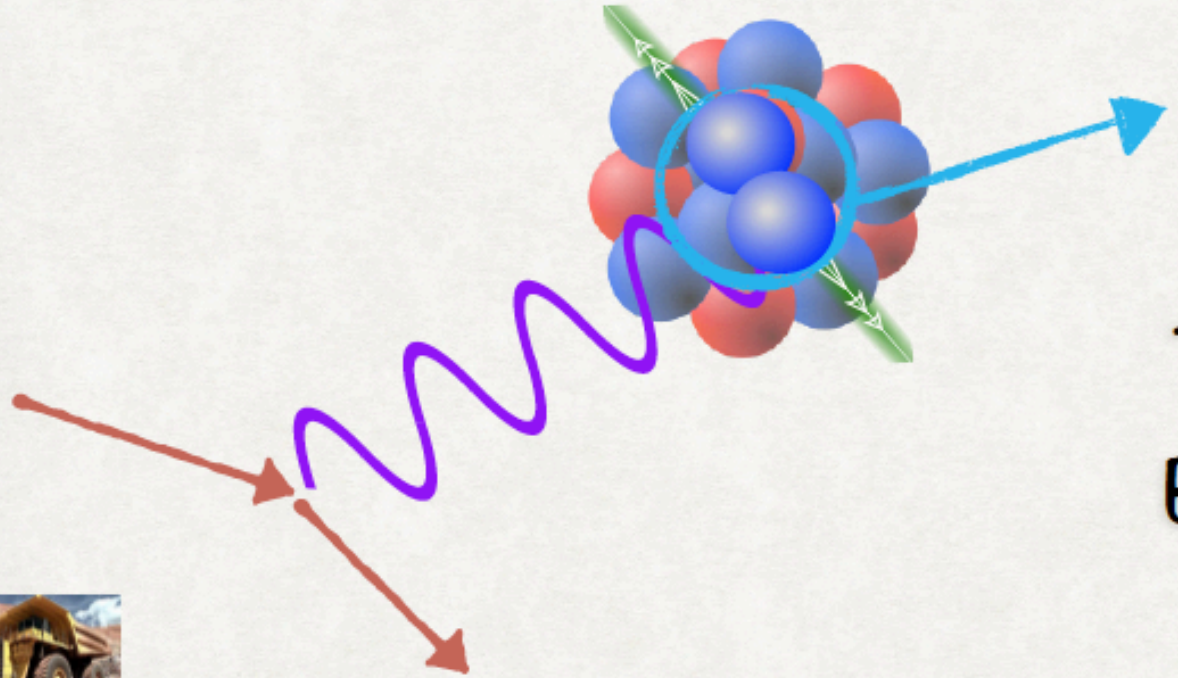
"The goal of this event is for the user community to convey the importance of continued (and increased) funding for nuclear physics research to their elected officials, and meetings with the offices of representatives and senators are set up for this purpose."

When: April 9, 2018
Where: Washington, D.C.
More information: http://nuclearphysicsdcday.com

Many thanks to Lamiaa El Fassi

3/8/18

2N-SRC c.m. momentum distribution extracted from A(e,e'pp)

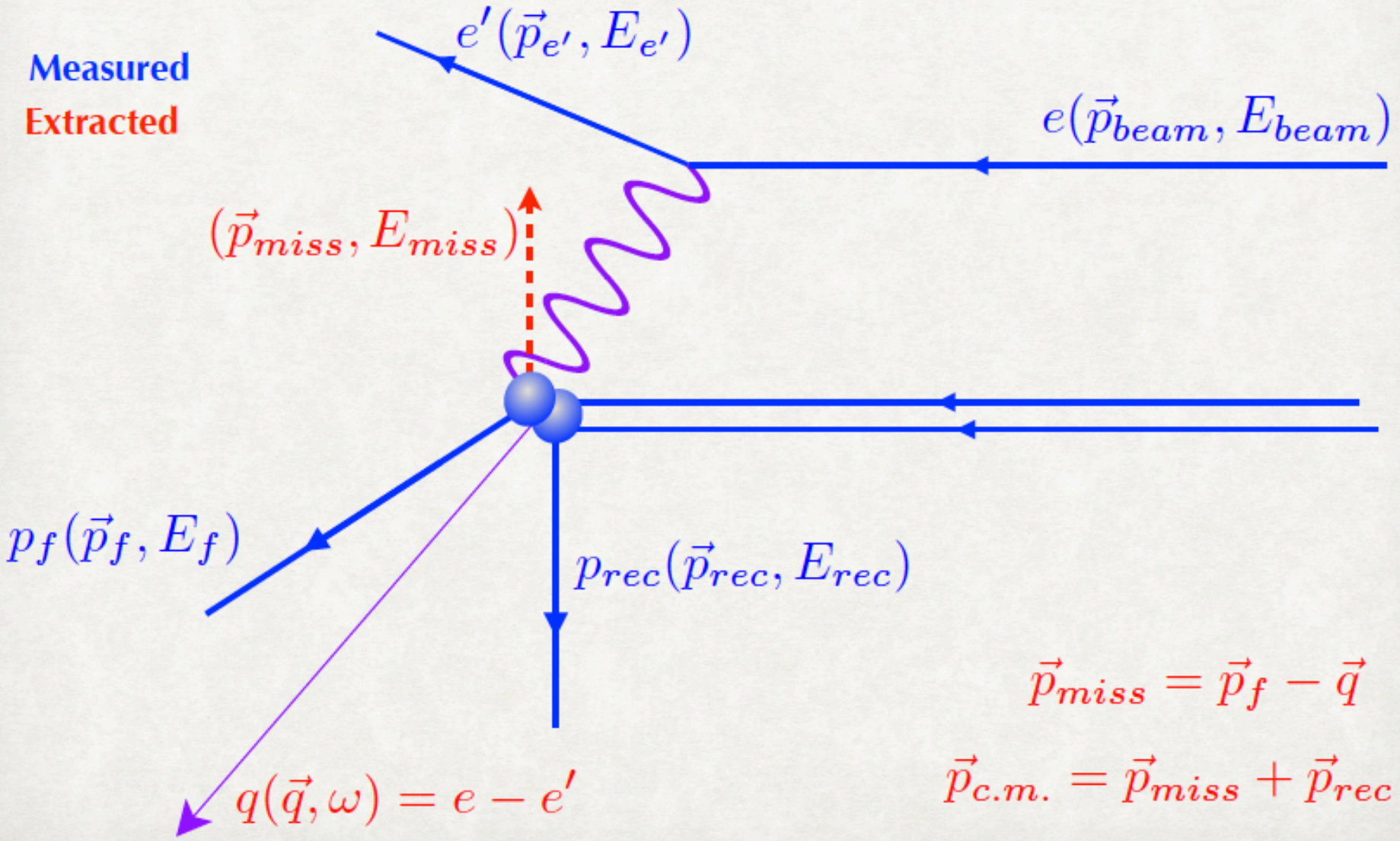


Erez. O. Cohen
Tel Aviv University
E. Piasetzky group

EG2 data-mining

CLAS col. meeting, March 2018

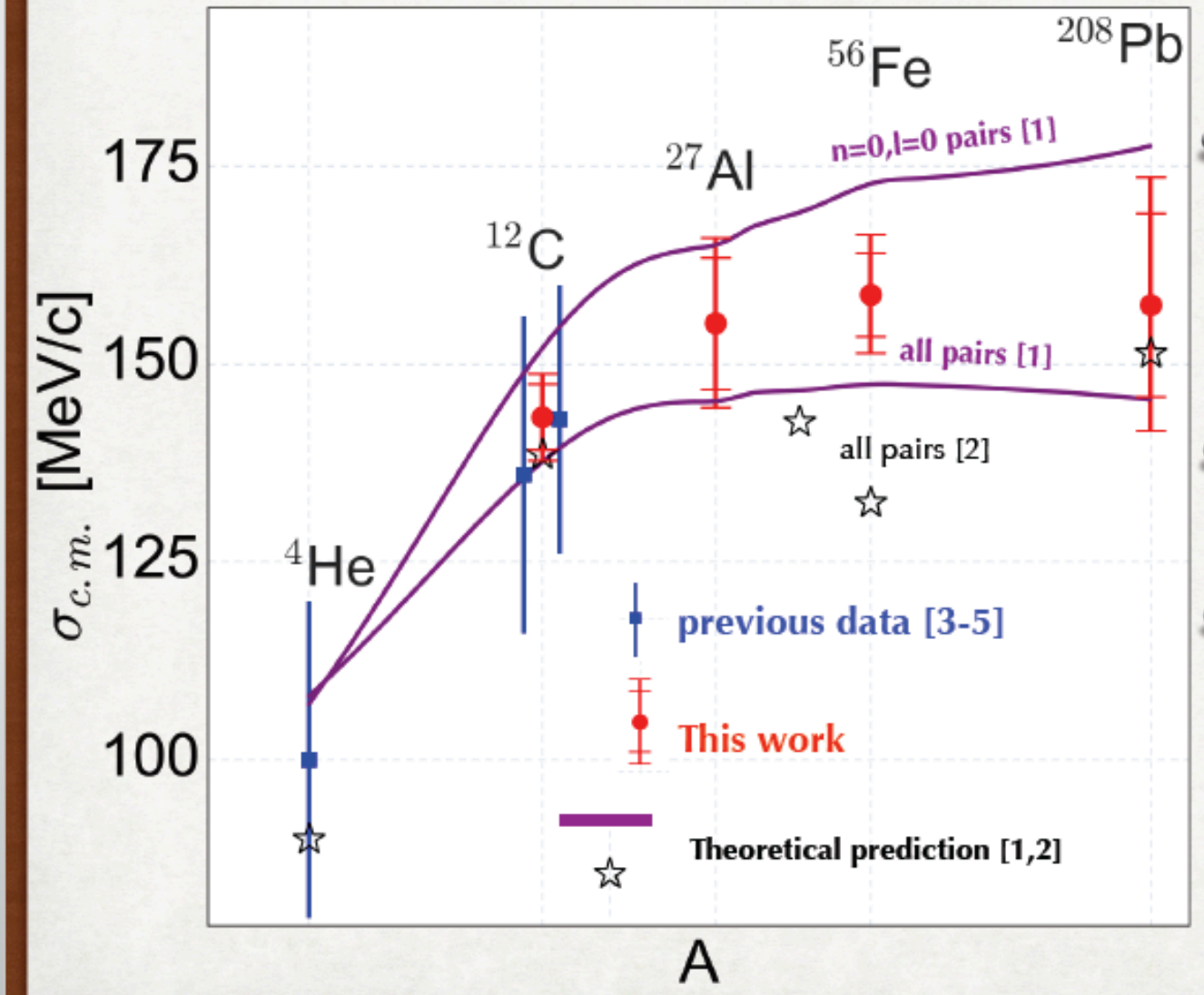
How do we extract p_{cm} from data



$$\vec{p}_{miss} = \vec{p}_f - \vec{q}$$

$$\vec{p}_{c.m.} = \vec{p}_{miss} + \vec{p}_{rec}$$

results - A dependence



The data show:

- The width of the SRC-pair c.m. momentum is small w.r.t. the Fermi momentum.
- c.m. width saturates with mass number A.
- Selective pair matching.

[1] R. Weiss et al. arXiv:1612.00923.
[2] Colle et al. PRC 89.024603.
[3] Ciofi, Simula, PRC 53, 1689.
[4] Korover et al., PRL 113,022501.
[5] Shneor et al., PRL 99, 072501.
[6] Tang et al., PRL 90 ,042301.

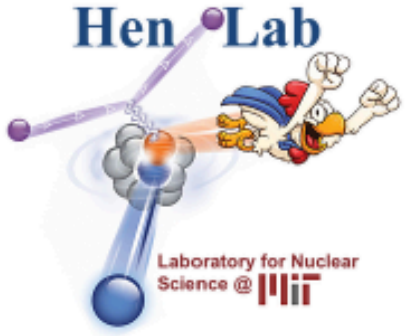
Probing the repulsive core of the NN interaction from $\frac{A(e,e'pp)}{A(e,e'p)}$ measurements.

2018 CLAS Nuclear Physics Working Group Meeting

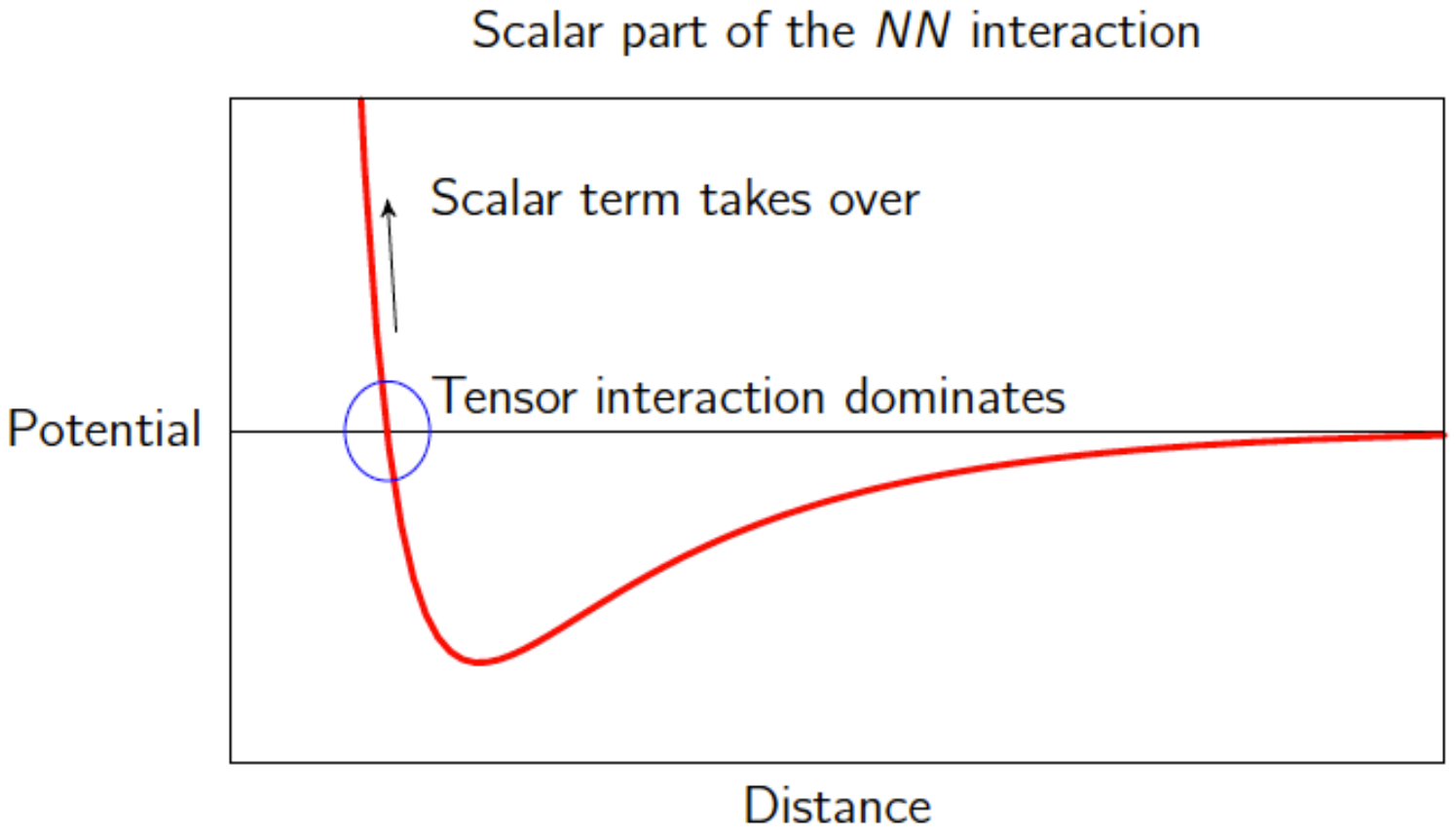
Axel Schmidt

MIT

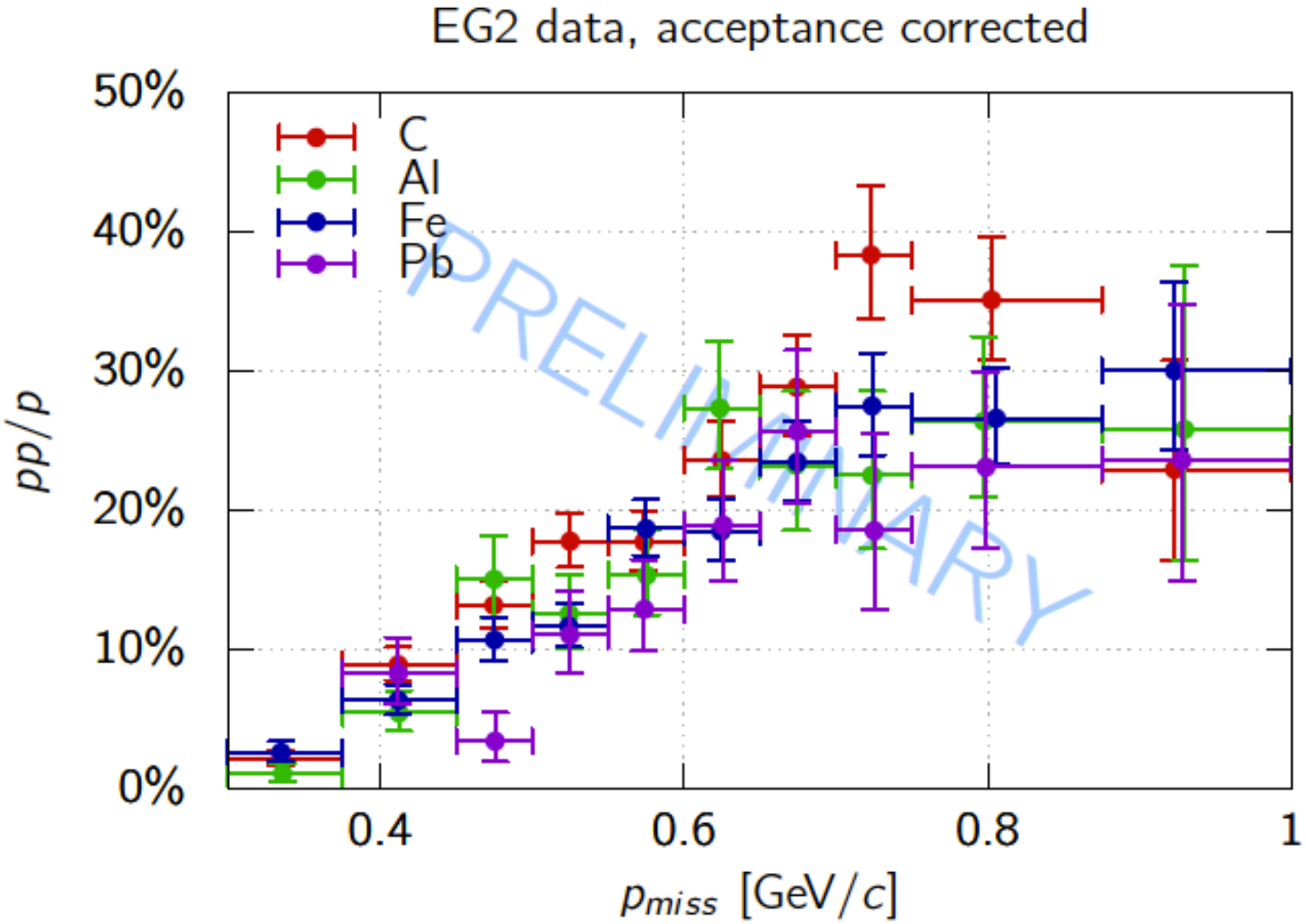
March 8, 2018



How does *np*-dominance evolve with momentum?



We can apply this correction to our pp/p yields.



Probing 2N-SRC via (e,e'N) reactions off ^{3,4}He and ^{12}C targets

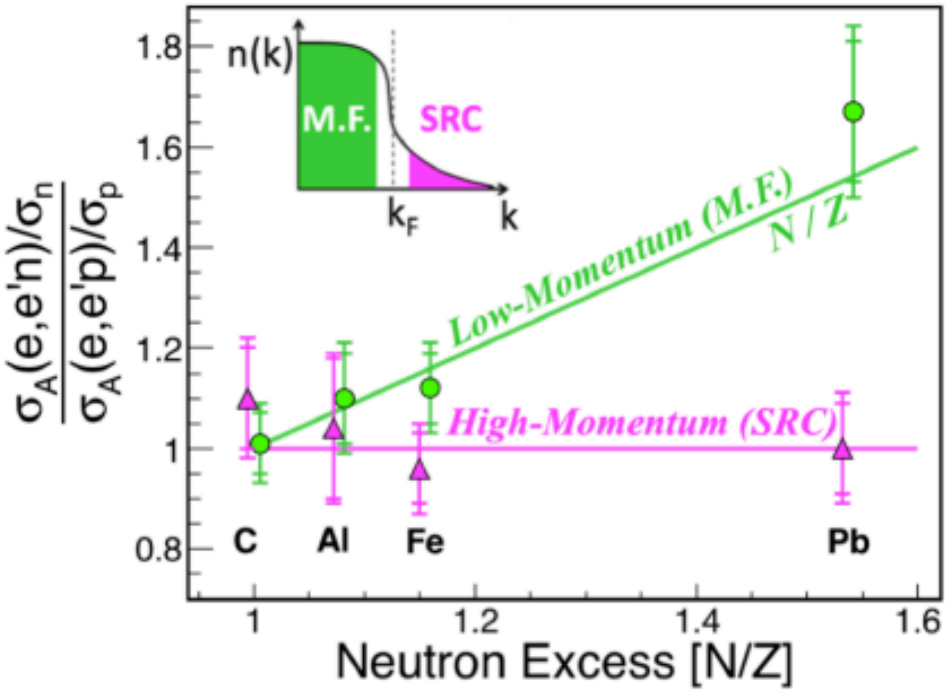
Reynier Cruz Torres

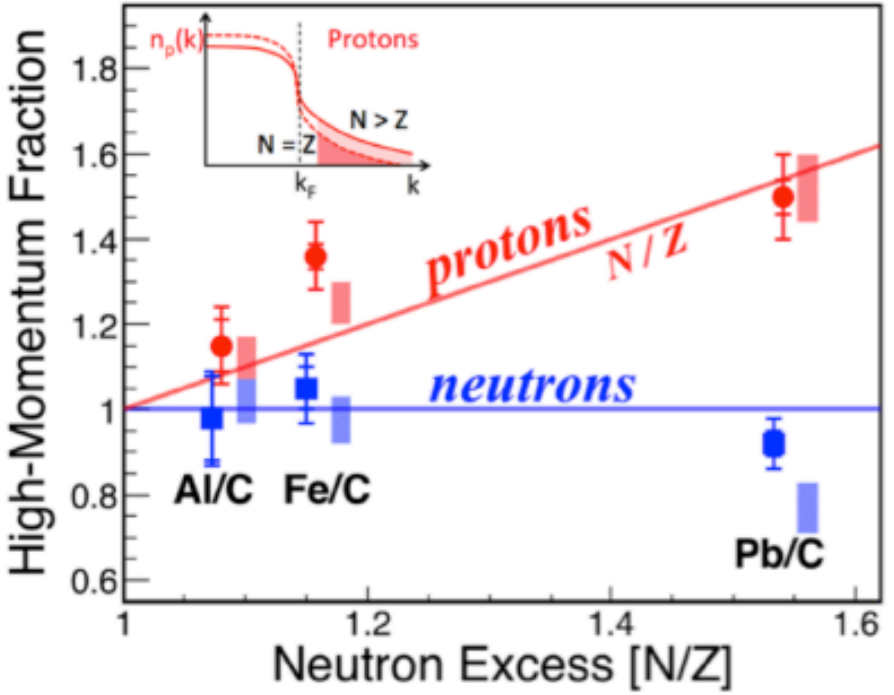
CLAS Collaboration Meeting

March 8, 2018

Results in heavy nuclei

Analysis by Meytal Duer (EG2 data)



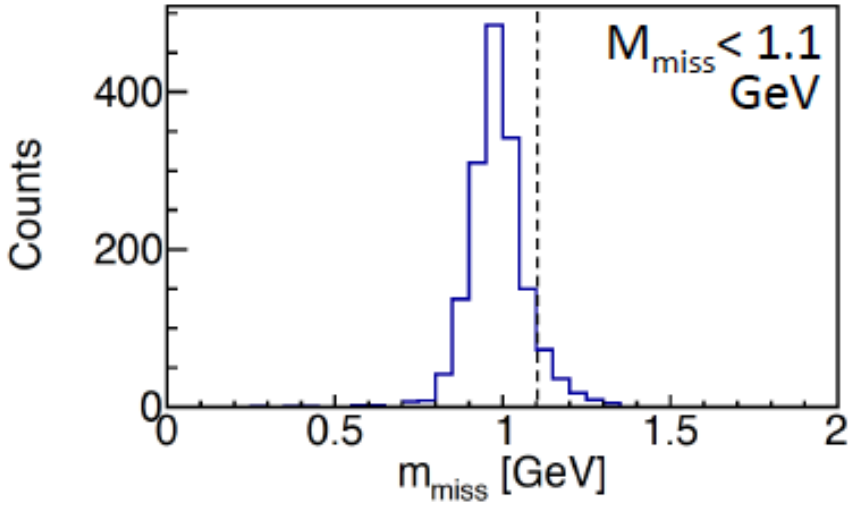


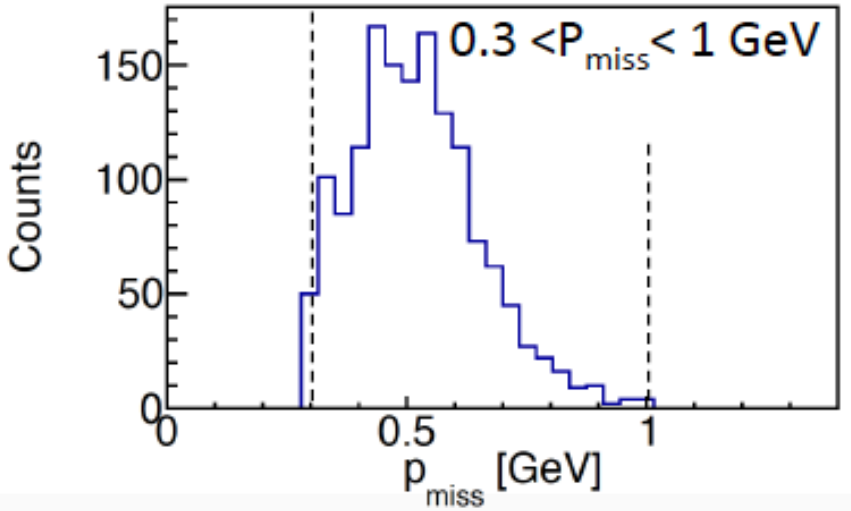
Minority moves faster than majority in heavy nuclei!

Same goal for this analysis, this time on ^{3,4}He and ^{12}C, E_{beam} = 4.4 GeV (*i.e.* e2a data)

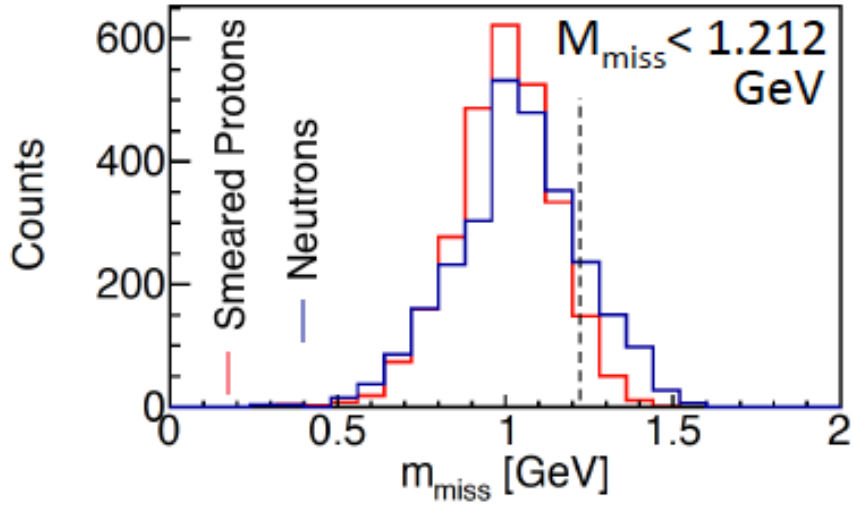
Identifying SRC QE events

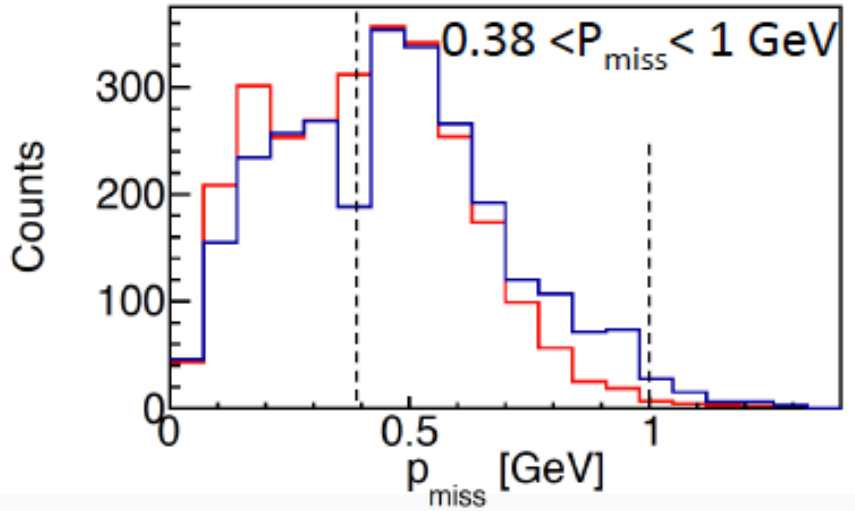
Protons





Smeared protons/neutrons





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By: Igor Korover

Tel Aviv University

Study of SRC with recoil neutron detection in CLAS6 – Data Mining

On going analysis

Hall B, NPWG – Jefferson Lab, Newport News

A(e,e'pn) analysis on eg2a - Motivation

Complete the A(e,e'pp) analysis

Extend A(e,e'pn) measurements to heavier nuclei (Fe, Pb).

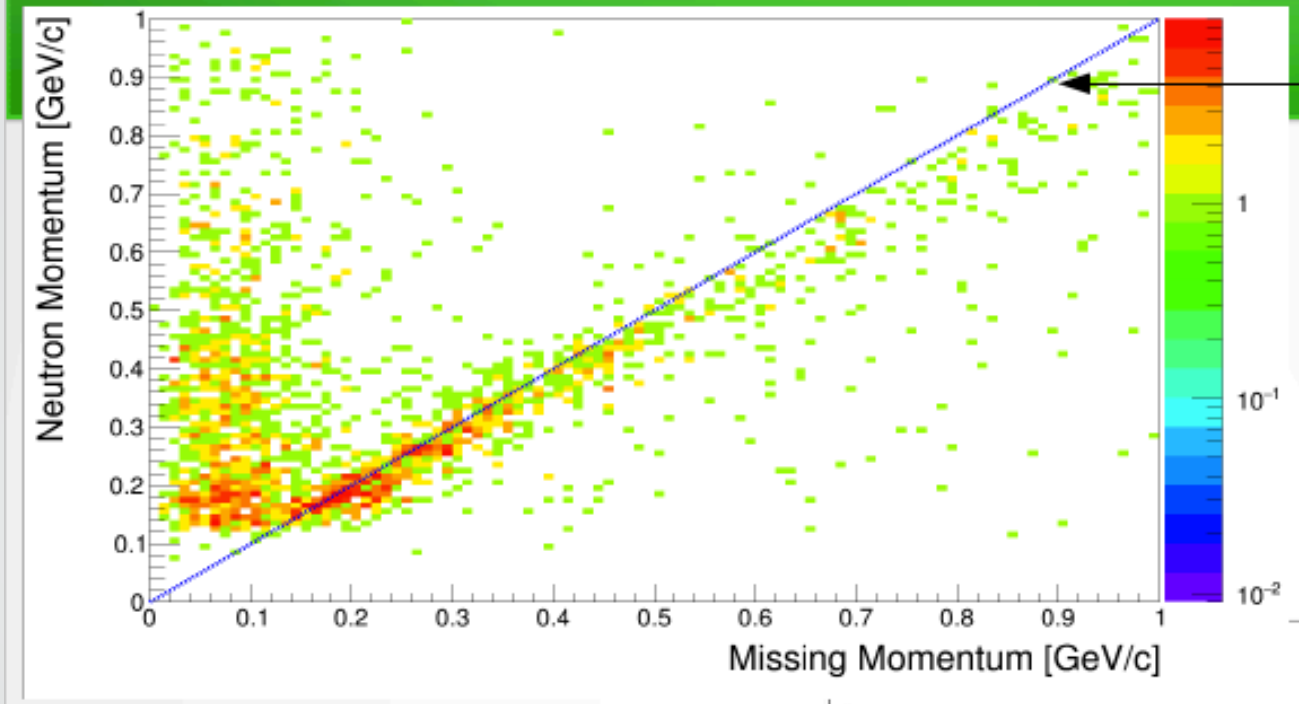
Compare to Meytal Duer analysis in case of **A(e,e'np)** reaction

	Or	Meytal	Current	Hall A
^{4}He	-	-	-	(e,e'pN)
^{12}C	(e,e'pp)	(e,e'**np**)	(e,e'p**n**)	(e,e'pN)
^{27}Al	(e,e'pp)	(e,e'**np**)	(e,e'p**n**)	-
^{56}Fe	(e,e'pp)	(e,e'**np**)	(e,e'p**n**)	-
^{208}Pb	(e,e'pp)	(e,e'**np**)	(e,e'p**n**)	-

Measure the fraction of np – SRC as function of A

Combine with pp-SRC estimate the total amount of 2N-SRC in the nuclei (C, Al, Fe, Pb)

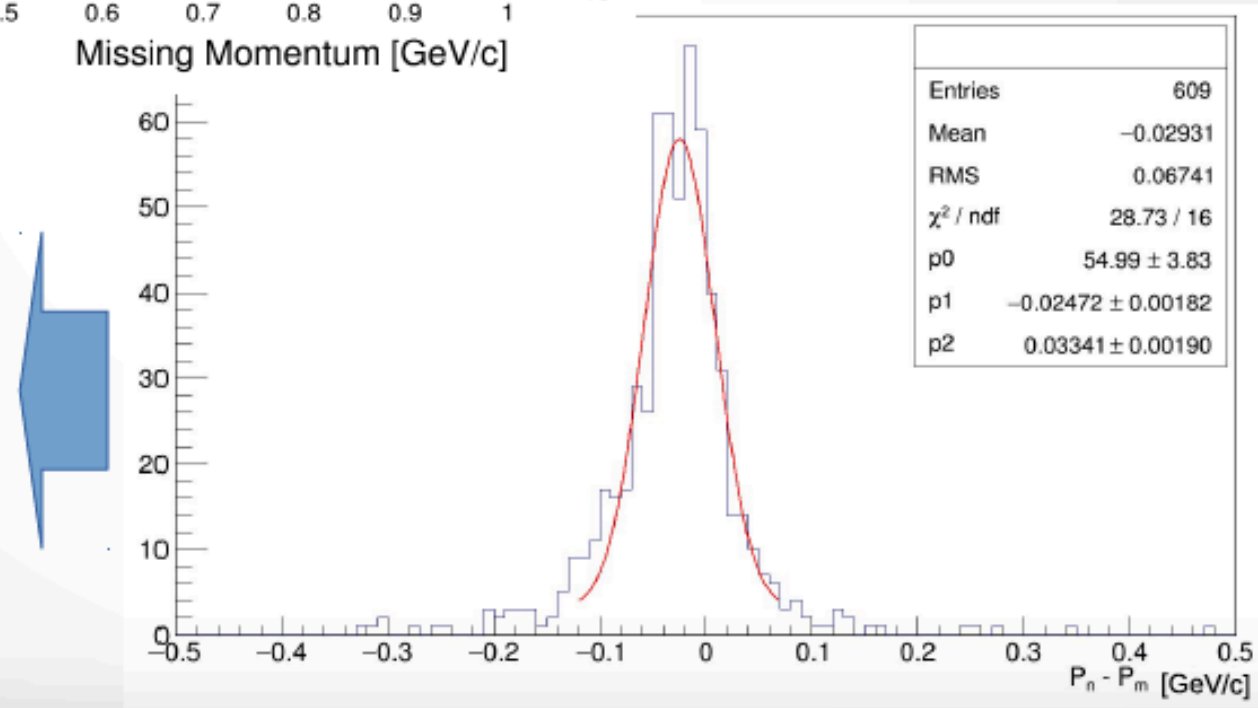
Identification of neutrons from D(e,e'pn) Events



Corrected TOF is not included

Momentum Resolution

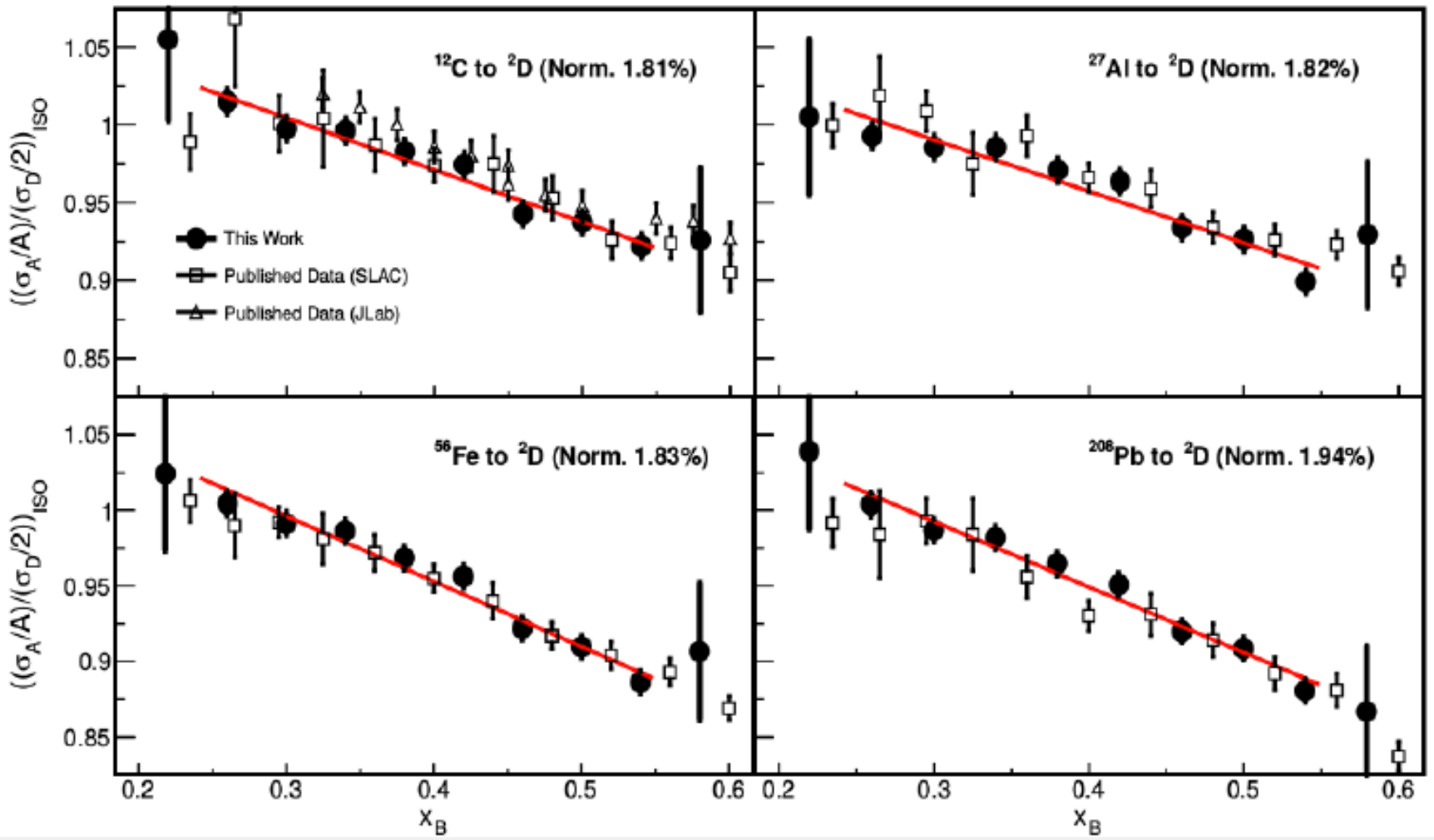
$$\frac{\Delta p}{p} \approx 10\,\%$$



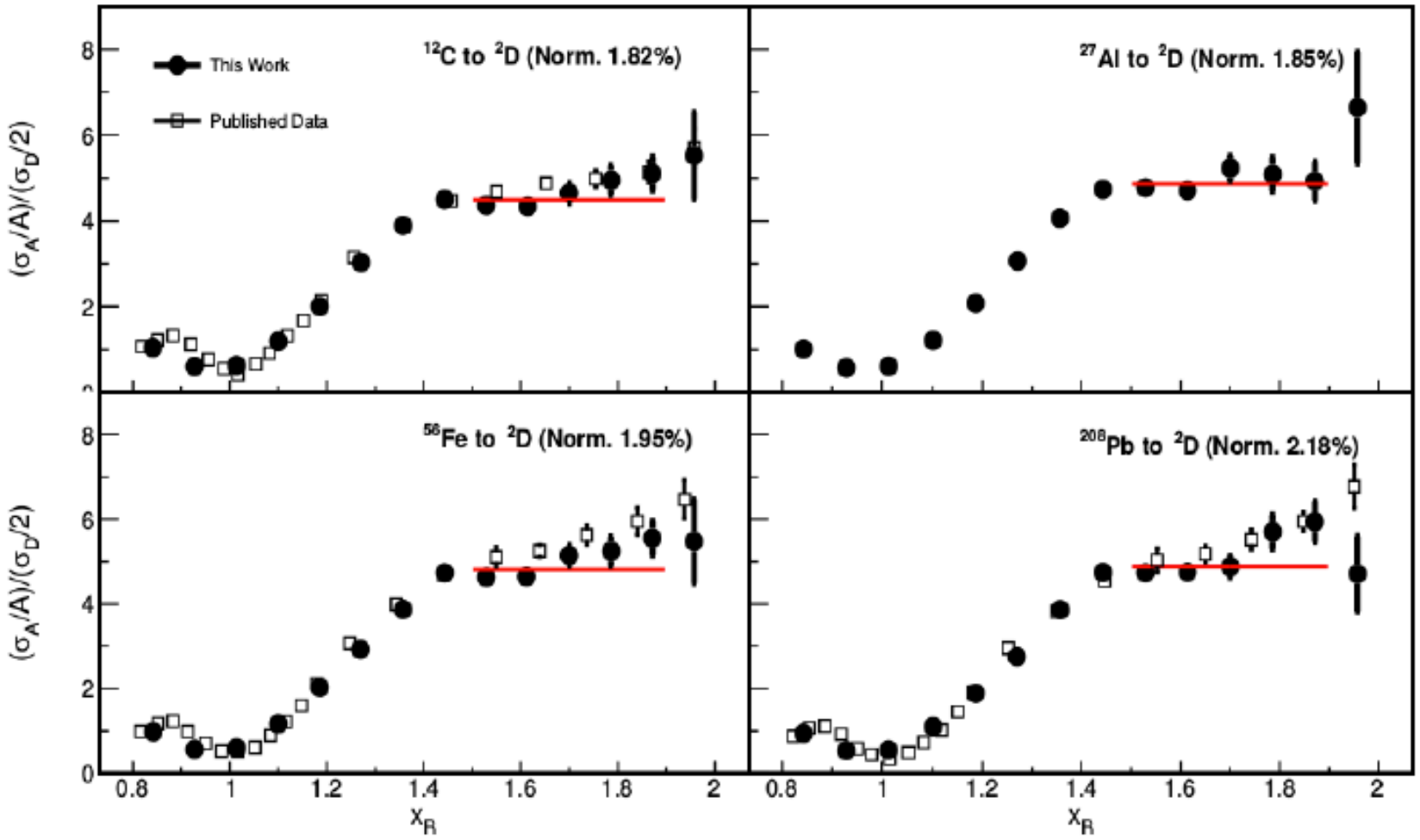
Analysis of (e,e') and (e,e'p_{Recoil}) Reactions from ^{2}D, ^{12}C, ^{56}Fe, and ^{208}Pb using the EG2c Dataset

Barak Schmookler

Final DIS Cross-Section Ratios



Final QE Cross-Section Ratios



Validation of neutrino energy estimation using electron scattering data

Student: Mariana Khachatryan Supervisor:Lawrence Weinstein

1.First use of electron data to test neutrino energy reconstruction algorithms

- use zero-pion cuts to enhance quasi-elastic event selection
- just scattered lepton (E_{kin})
  - ✧ used in Cherenkov-type neutrino detectors
- total energy of electron plus proton ($E_{Calorimetric}$)
  - ✧ used in calorimetric neutrino detectors
- improved by a transverse momentum cut to better select QE events

2.Only 0.09-0.55 fraction of events reconstruct to within 5% of the beam energy at 2GeV

- better for lighter nuclei

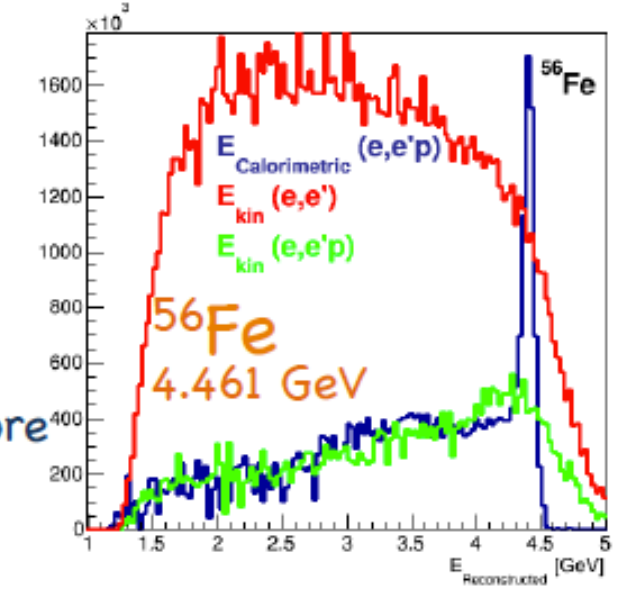
3. Serious implications for neutrino oscillation Measurements

4.Tremendous interest in the neutrino community

5.Analysis note in preparation, aiming for PRL

6.Future work

- extend analysis to other kinematic regions, more targets and energies
- Identify regions with good and bad energy reconstruction and GENIE modeling.
- Proposal "Electrons for Neutrinos" conditionally approved by PAC 45.



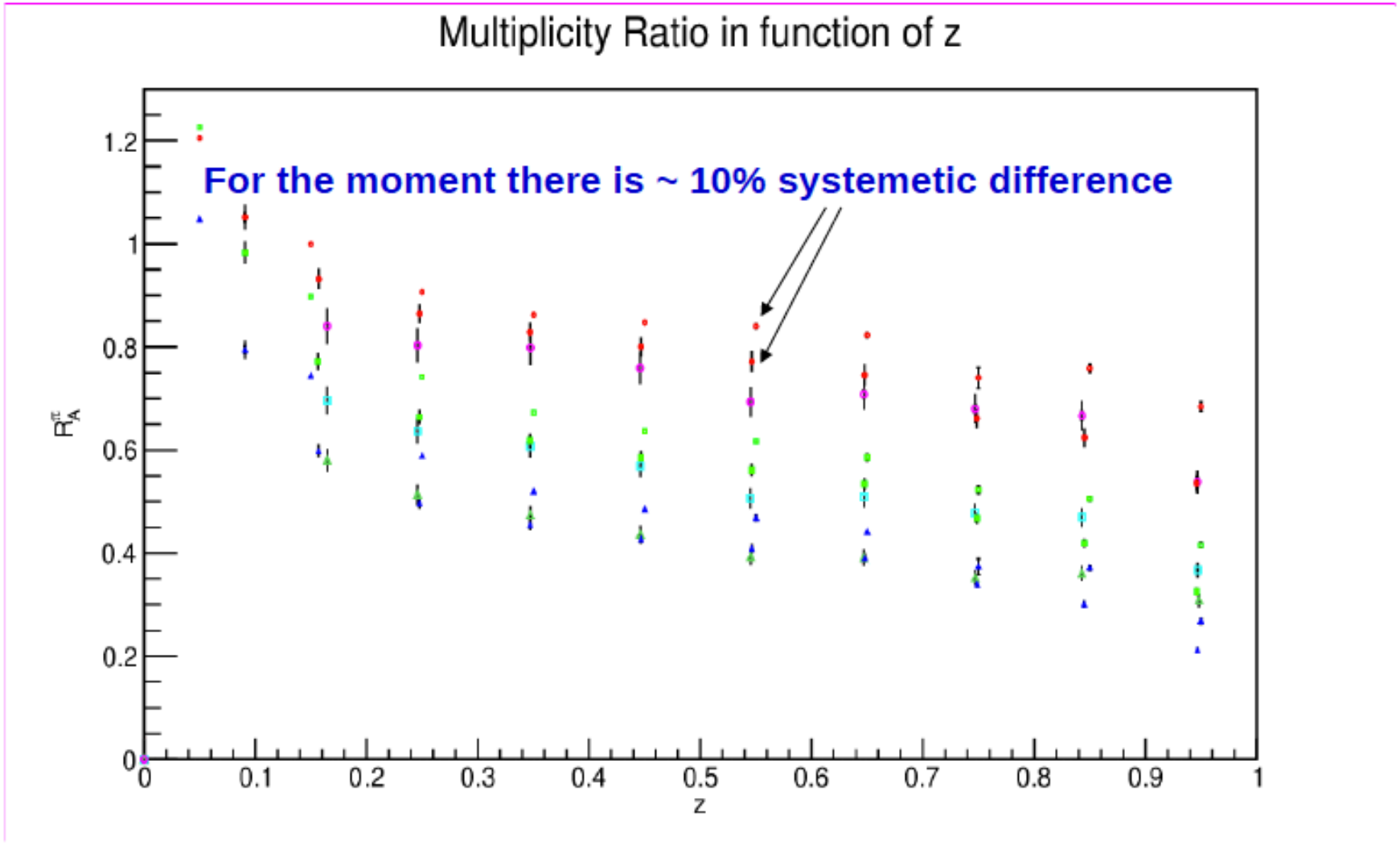
Quark propagation and hadron formation in the nucleus

(progress in analysis of experimental data
of CLAS EG2 experiment)

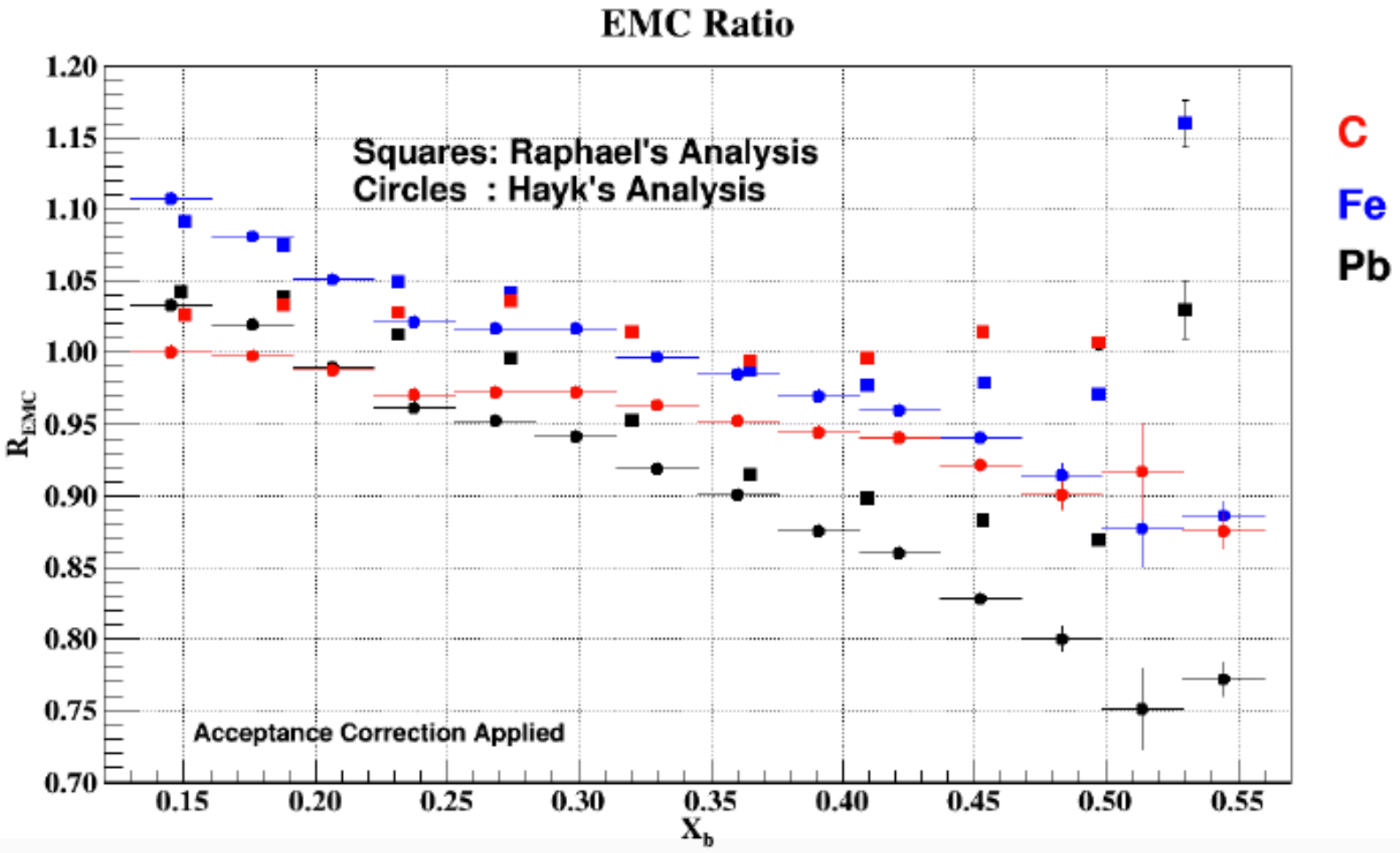
Hayk Hakobyan for UTFSM group

CLAS collaboration meeting
March, 2018

Integrated distribution comparison between Raphael and Hayk analysis



EMC curve from different analysis



Analysis Update for Electroproduction of Lambdas in EG2 Data

Sereres Johnston (ANL), Lamiaa El Fassi (Miss St. U)

- Λ production: window to access fragmentation in current and target region
- Three areas of focus:
  - Multiplicity Ratio
  - Transverse Momentum Broadening
  - Fracture Functions
- Can access hadronization time scales
- Can provide information on spectator target evolution

First hyperon fragmentation study ever!

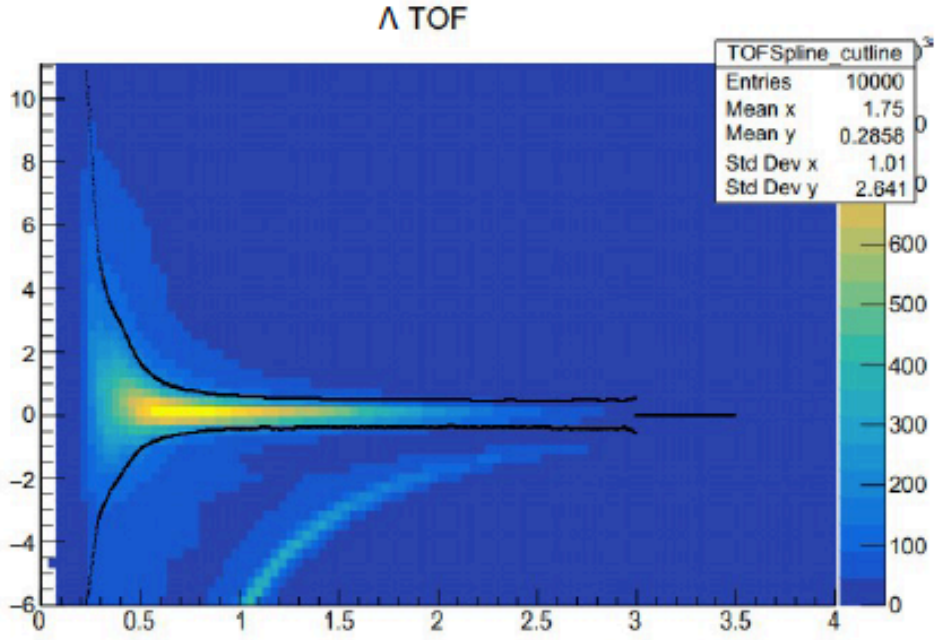
Semi-Inclusive DIS (SIDIS):

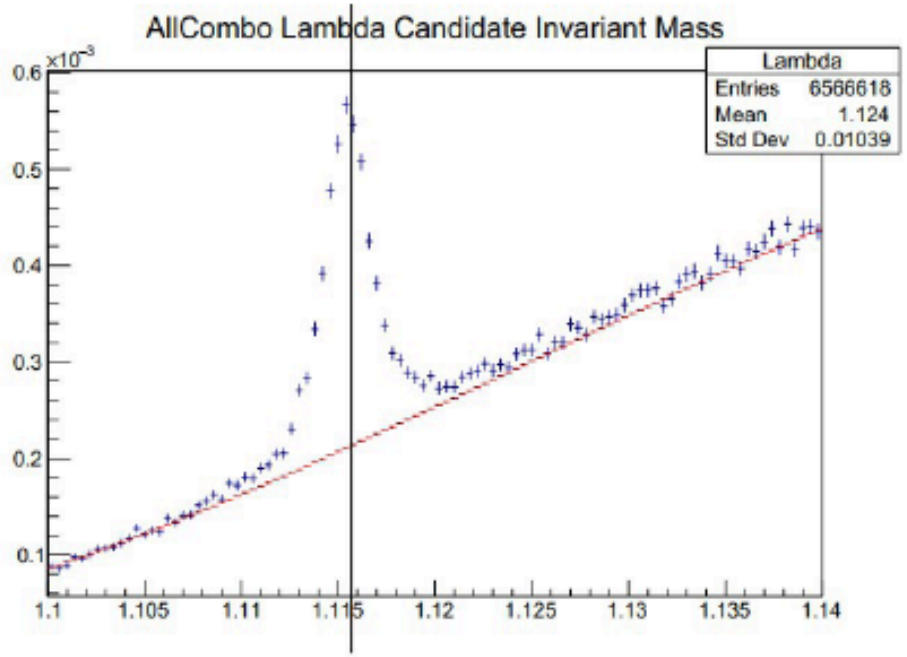
- electron + proton $\rightarrow$ e' + Λ^0 + X
- Identify scattered electron and π^- + proton from Λ decay

Electron and pion identification adapted from approved EG2 CT analysis

New Proton Particle Identification

New Combinatorial Background Model





Stay tuned for Λ fragmentation results!

Using Kinematic Fitting in CLAS EG6: Beam-Spin Asymmetry of Exclusive Nuclear DVMP

Frank Thanh Cao

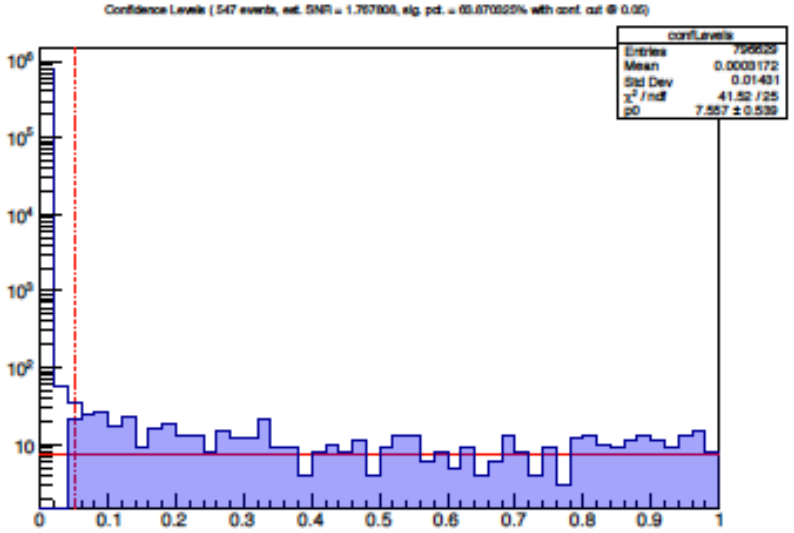
Advisor: K. Joo
Co-Advisor: K. Hafidi

University of Connecticut

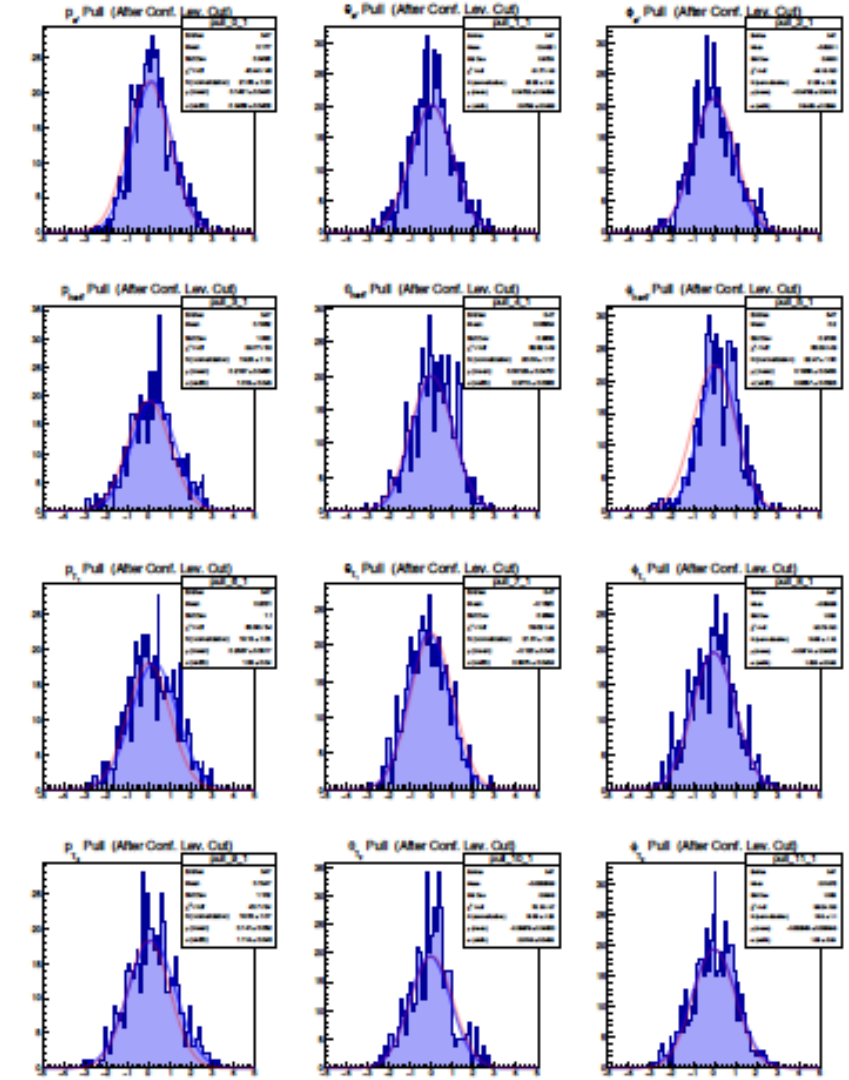
March 2018

Fit Outputs

Confidence Level Distribution



Pull Distributions



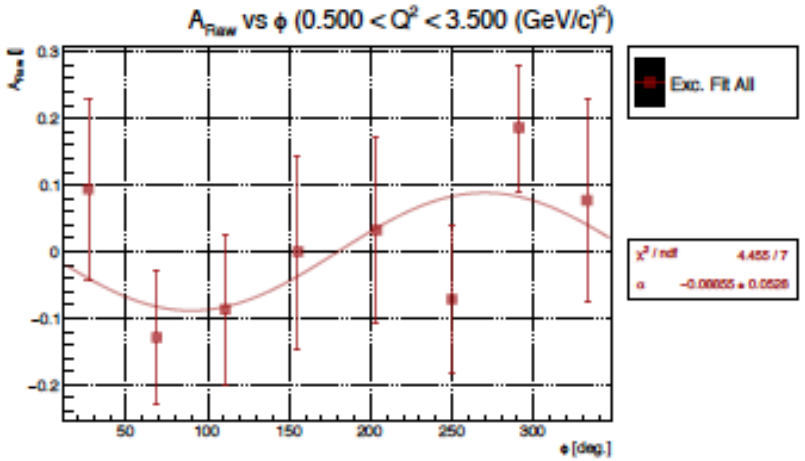
Results

For the EG6 experiment, the BSA for the coherent DVMP process

$$e^4\mathrm{He} \rightarrow e'^4\mathrm{He}'\pi^0 \qquad (1)$$

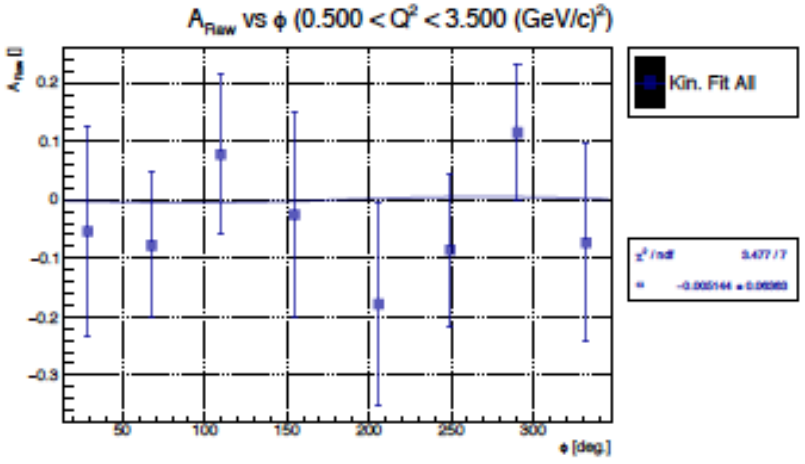
is obtained from two different event selection methods:

Exclusivity Cuts



BSA = -8.9±5.3 %
(800 events)

Kinematic Fit



BSA = -0.5±6.3 %
(537 events)