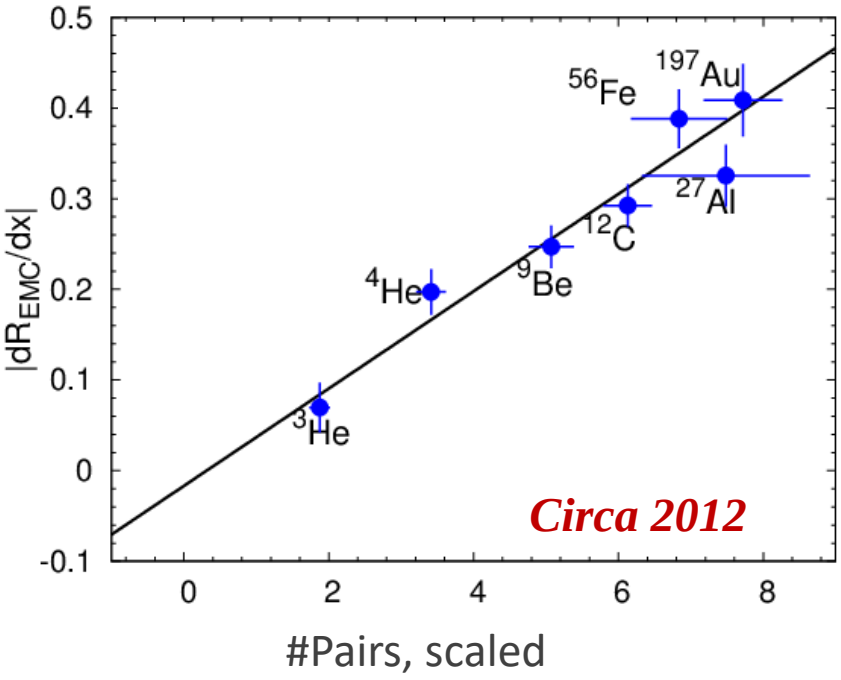
Inclusive Overview

3/20/2019

2nd Workshop on Quantitative Challenges in SRC and EMC research

Nadia Fomin

Inclusive data is the source of a lot of info on SRC/EMC



J. Seely, et al., PRL103, 202301 (2009)

N. Fomin, et al., PRL 108, 092052 (2012)

J. Arringon, A. Daniel, D. Day, N. Fomin, D. Gaskell, P. Solvignon, PRC 86, 065204 (2012)

O. Hen, et al, PRC 85, 047301 (2012)

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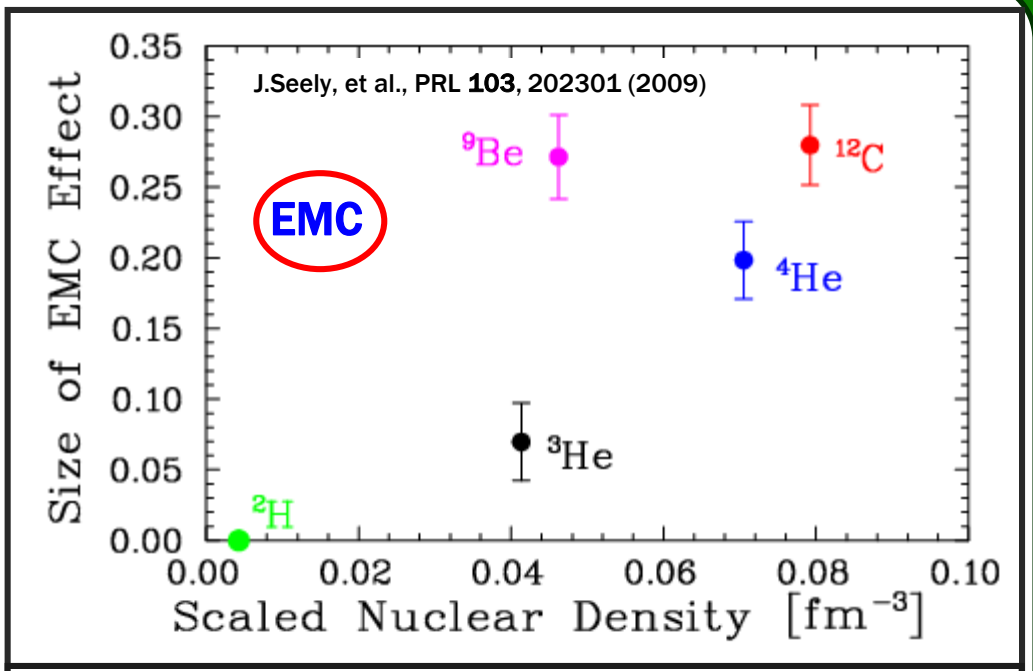
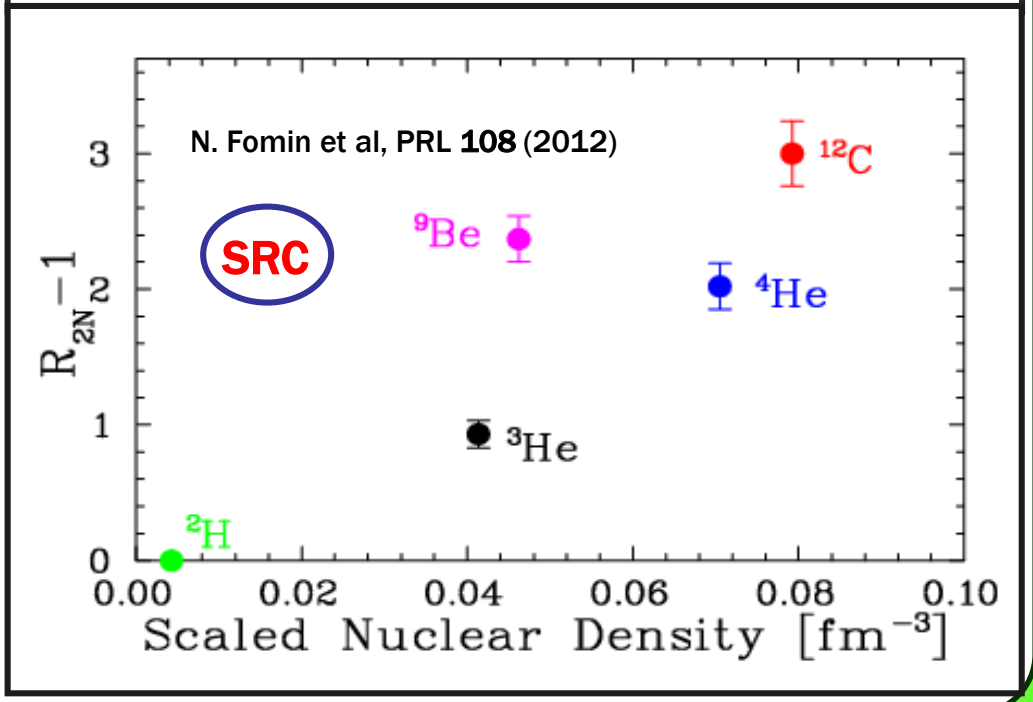




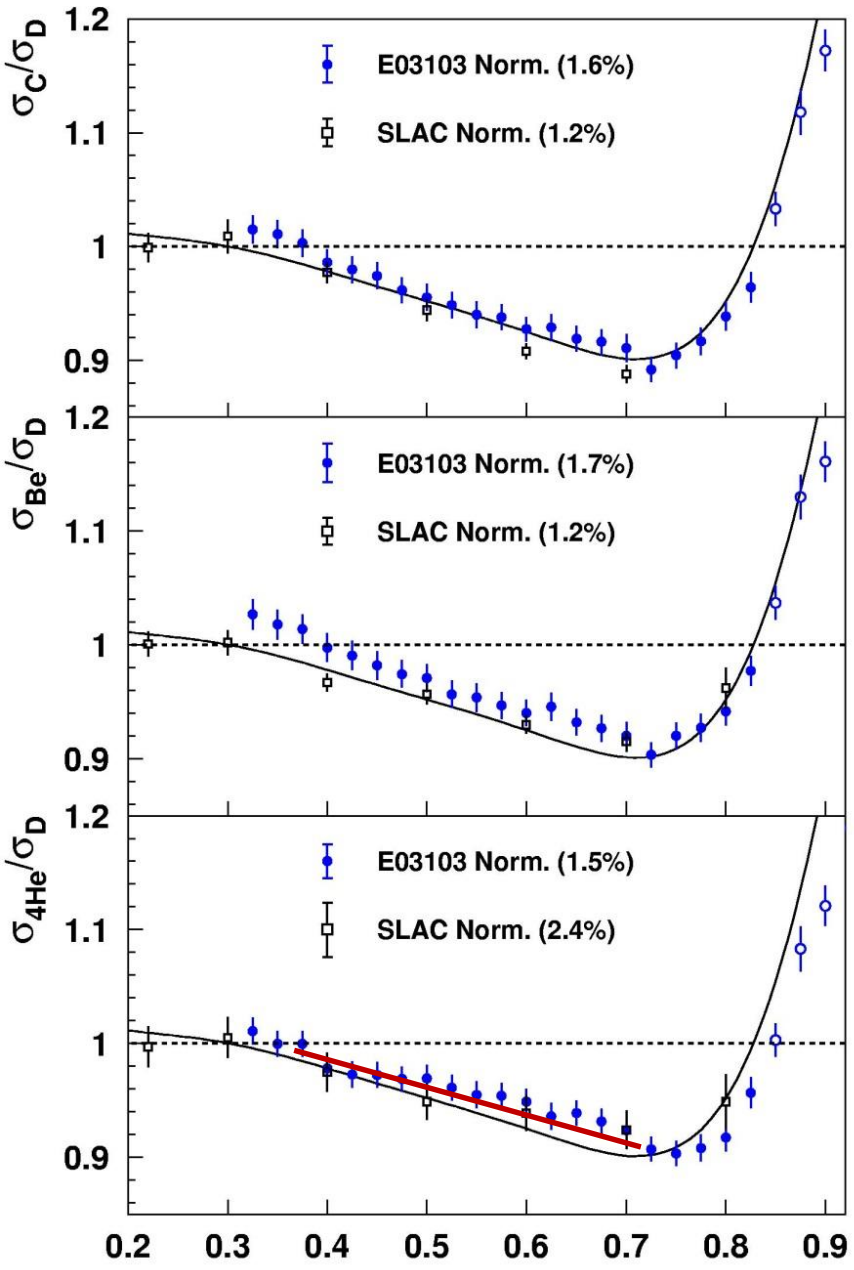
Precision results on light nuclei from JLab E03-103

- ***C/D*** and ***^{4}He/D*** ratios – no isoscalar correction necessary
- Consistent with SLAC results, but much higher precision at high x

- Fit the slope of the ratios for 0.35<x<0.7:

$$\frac{dR_{EMC}}{dx}$$

- Compare across nuclei

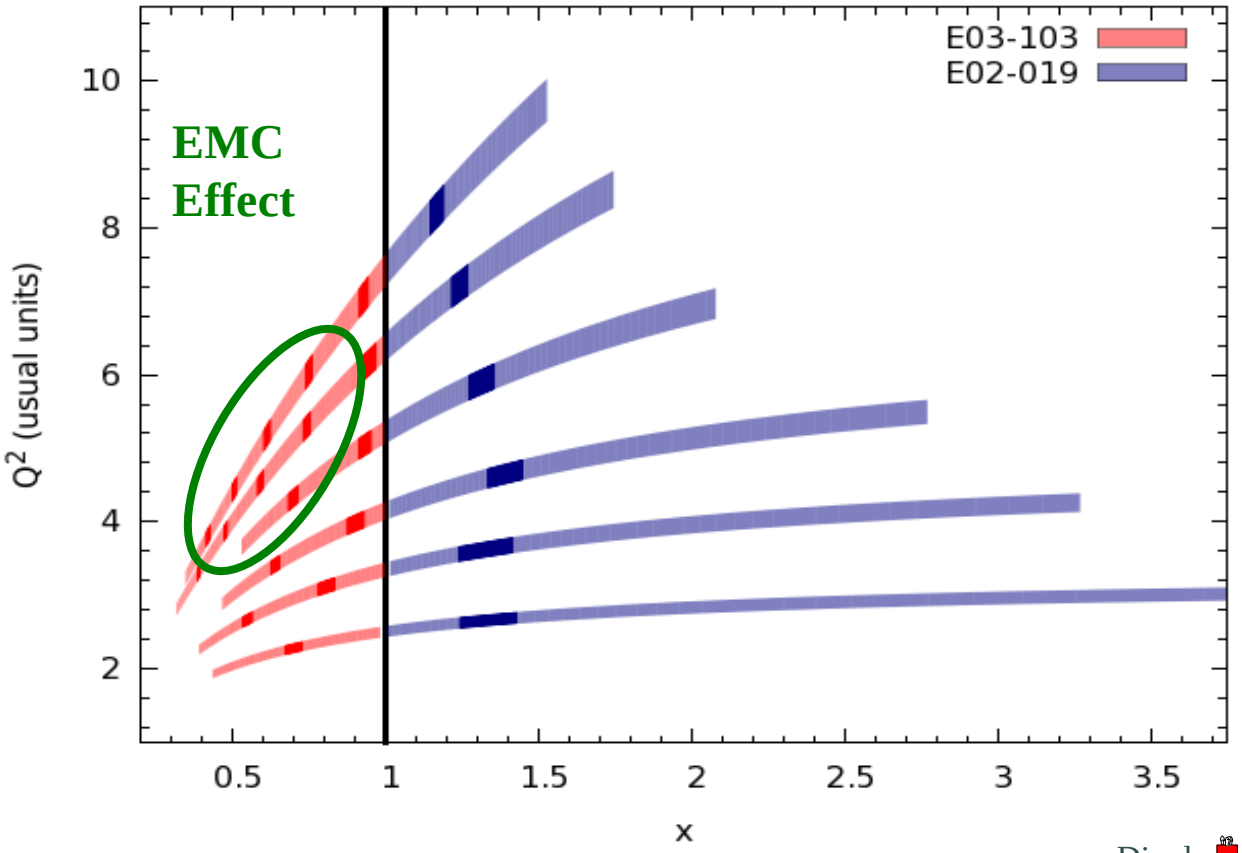


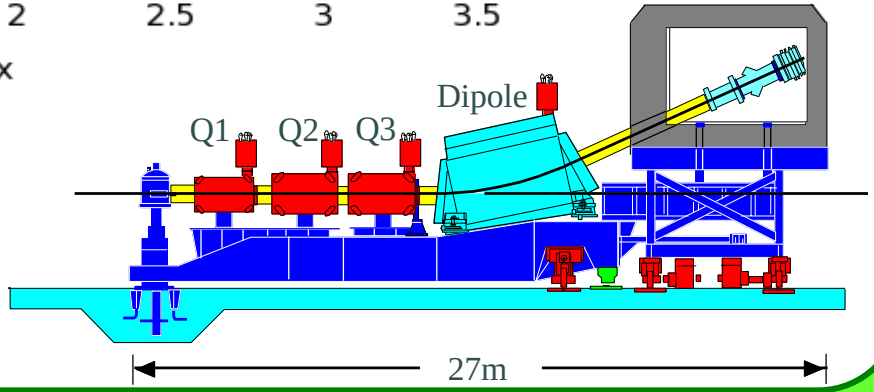
J.Seely, A. Daniel, et al., PRL103, 202301 (2009)

PhD theses: J. Seely, A. Daniel

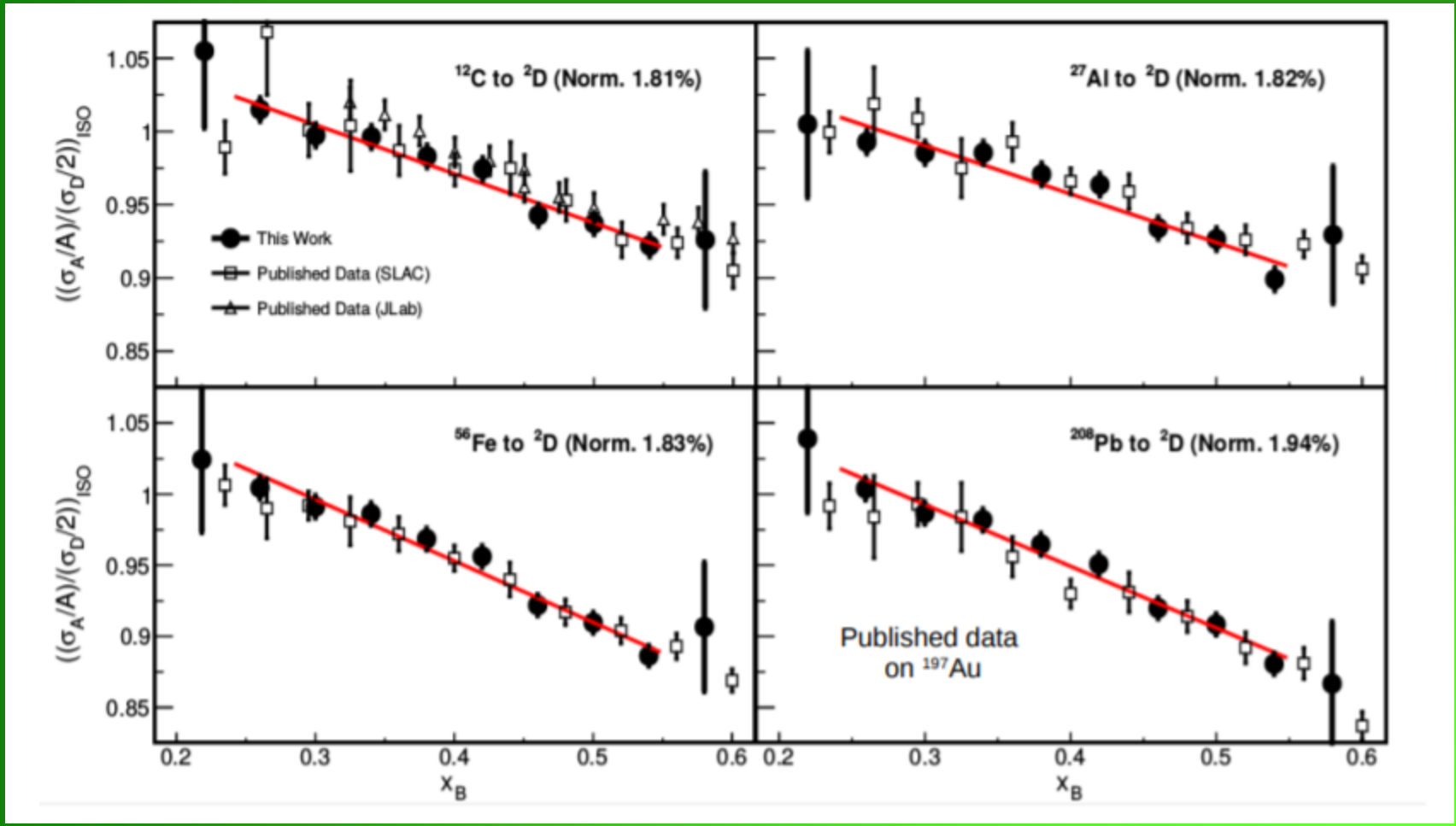
Hall C, high-precision inclusive program at 6GeV

- ^{2}H
- ^{3}He
- ^{4}He
- ^{9}Be
- ^{12}C
- $^{27}Al^{*}$
- ^{63}Cu
- ^{197}Au



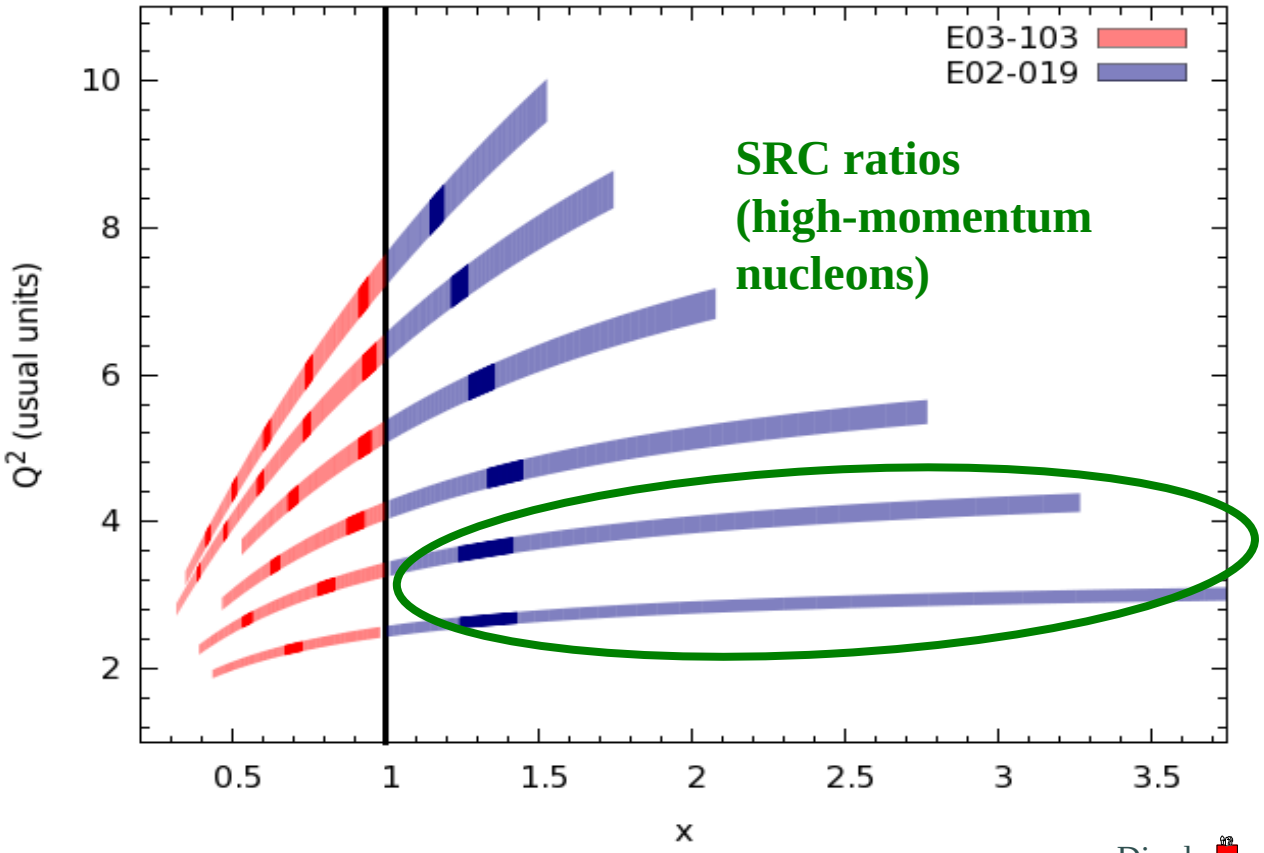


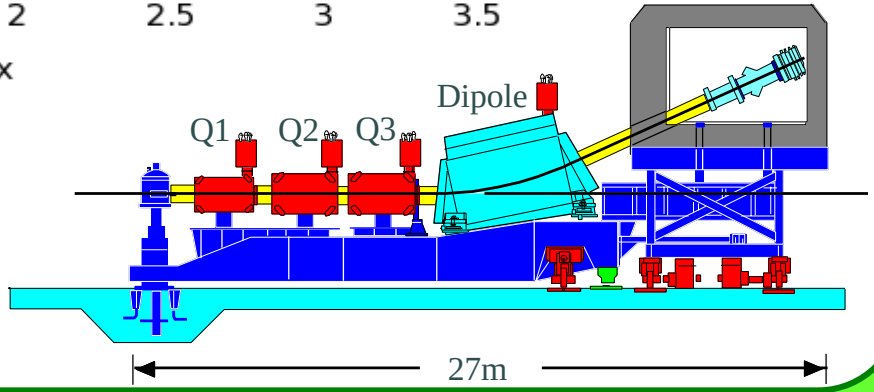
New EMC Ratios from CLAS data mining project



Hall C, high-precision inclusive program at 6GeV

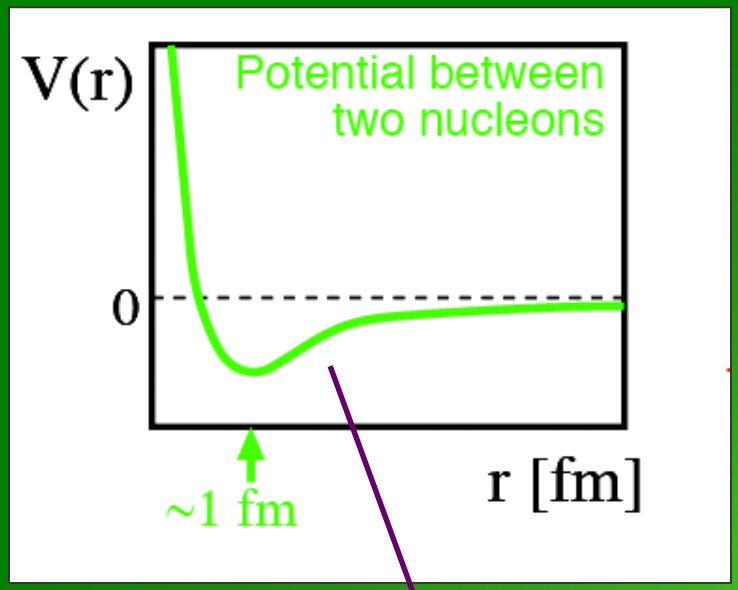
^{2}H
^{3}He
^{4}He
^{9}Be
^{12}C
^{27}Al*
^{63}Cu
^{197}Au

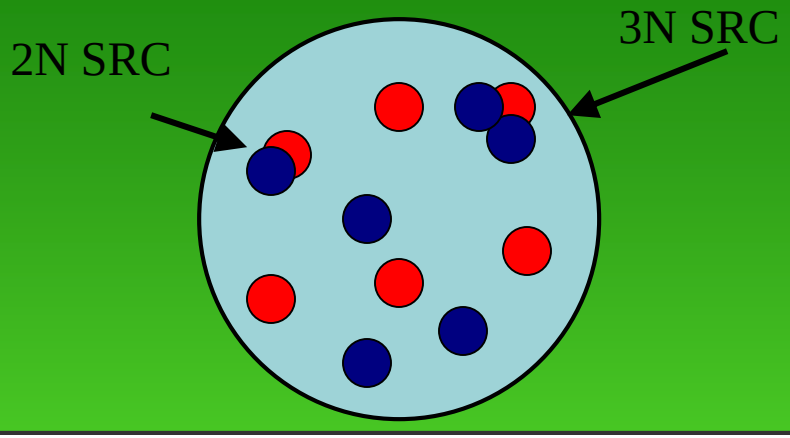


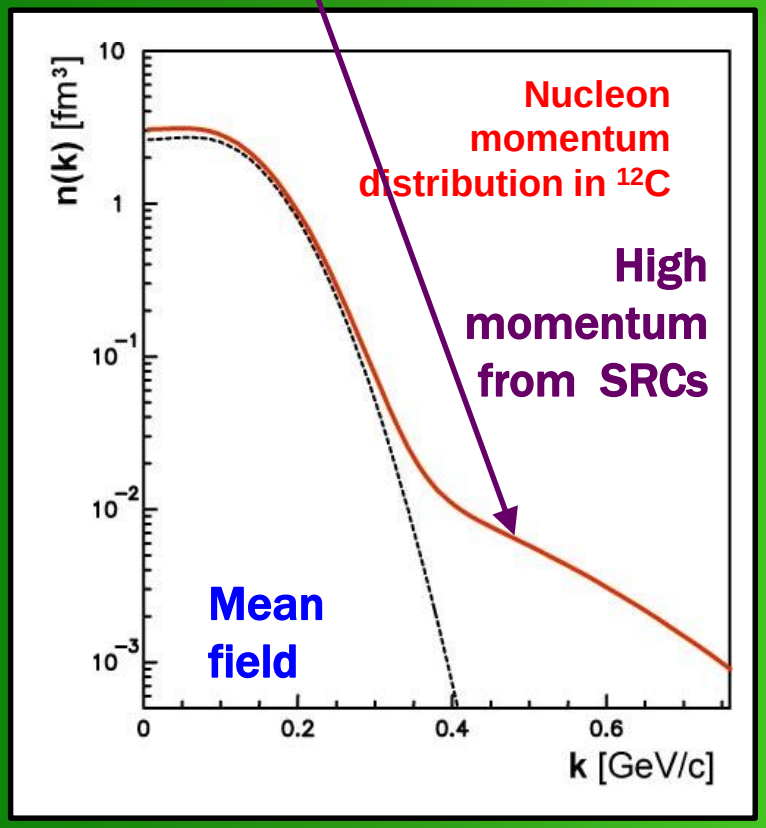


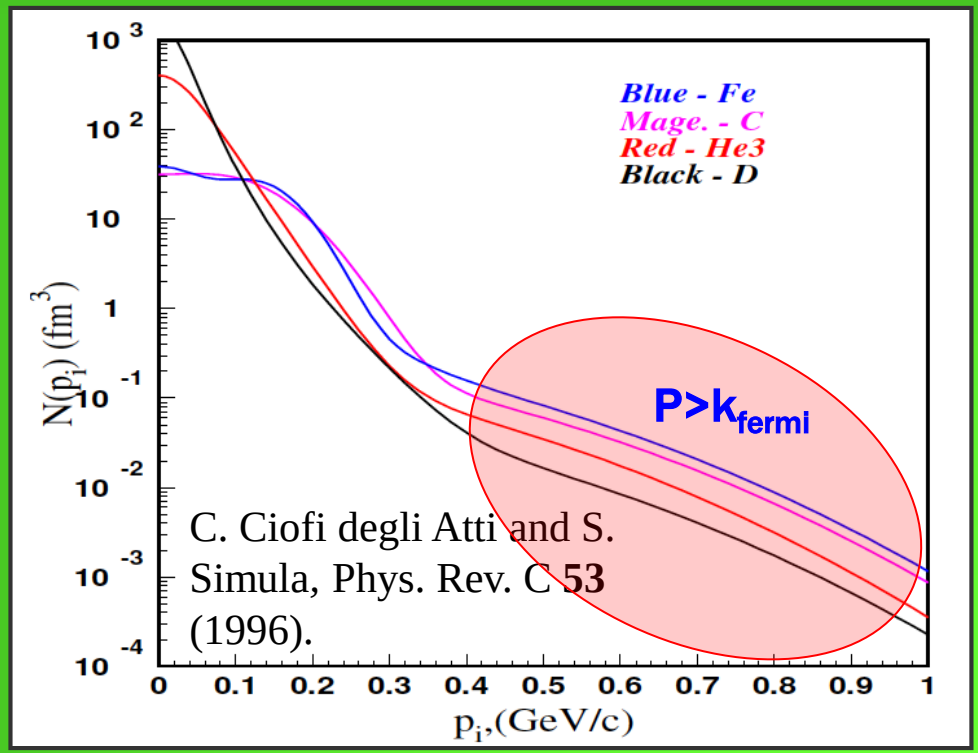
High momentum nucleons

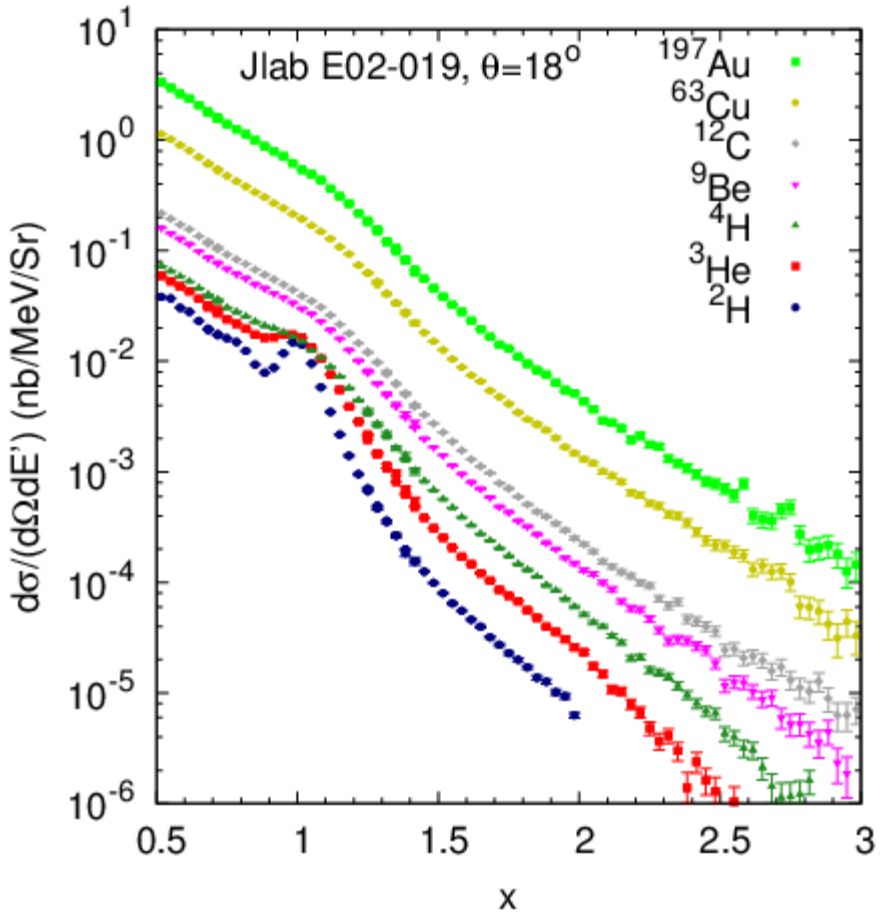
- Short Range Correlations

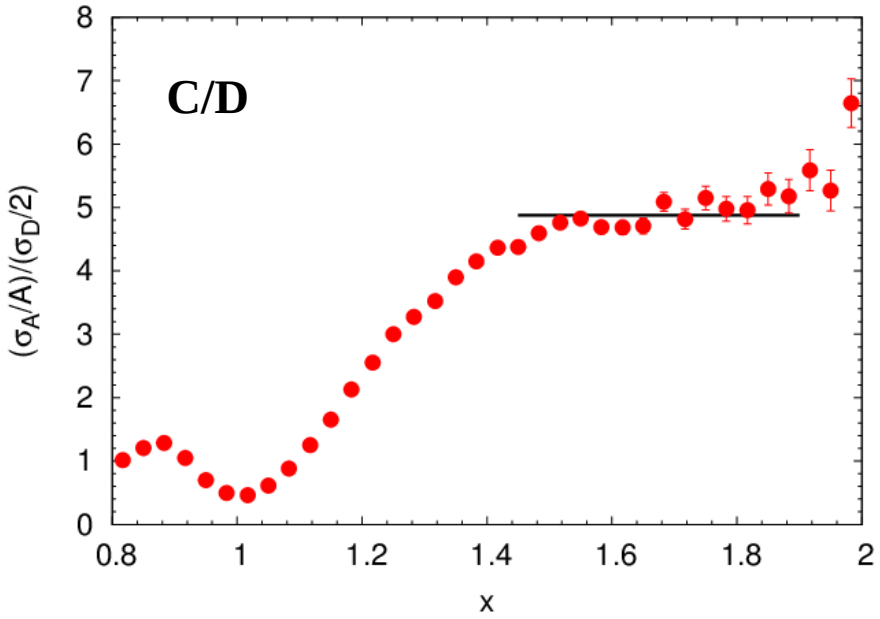


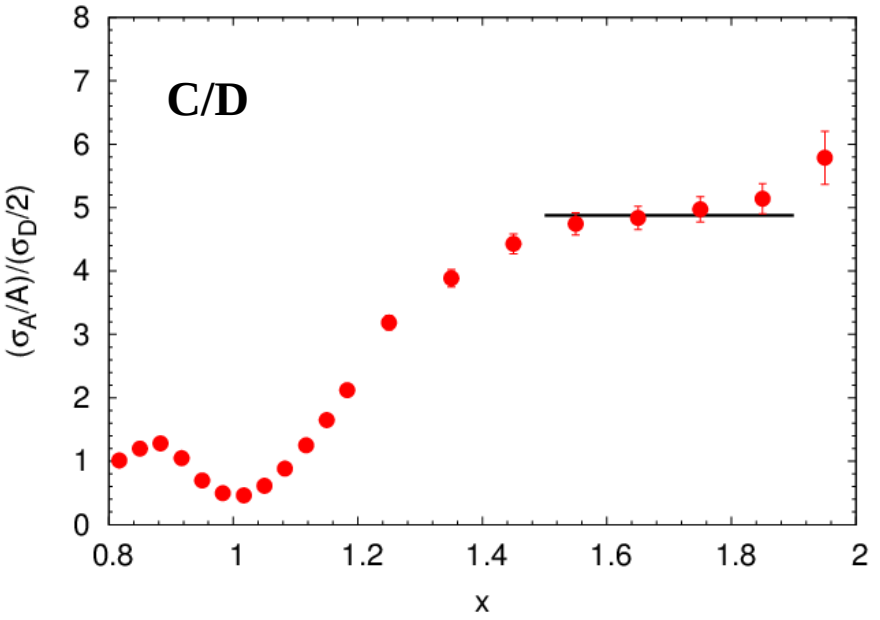










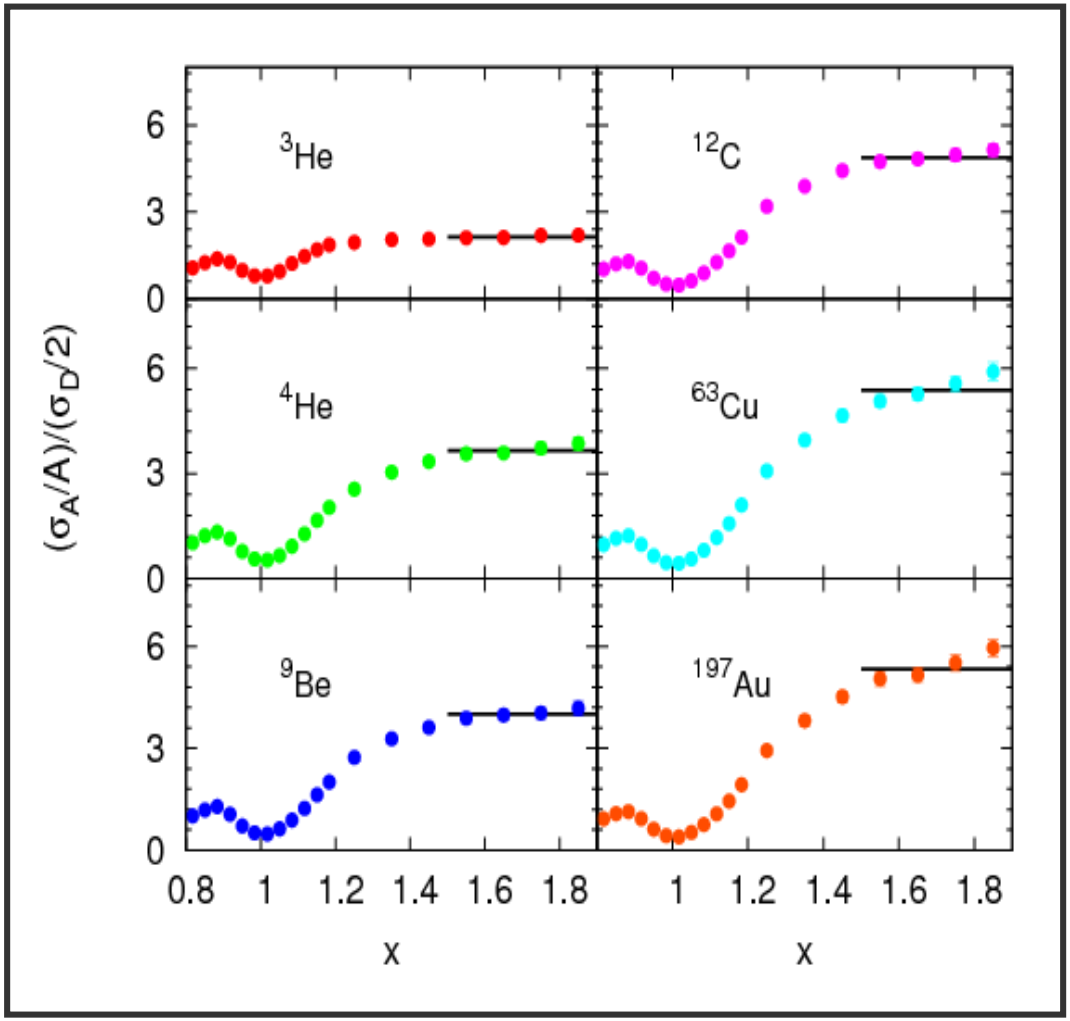


Cross section binning: xbinsize=0.033

Ratios rebinned starting at x=1.2

E02-019: 2N correlations in A/D ratios

A	θ_e=18°
^{3}He	2.14±0.04
^{4}He	3.66±0.07
Be	4.00±0.08
C	4.88±0.10
Cu	5.37±0.11
Au	5.34±0.11
$\langle Q^2 \rangle$	2.7 GeV^2
x_{min}	1.5

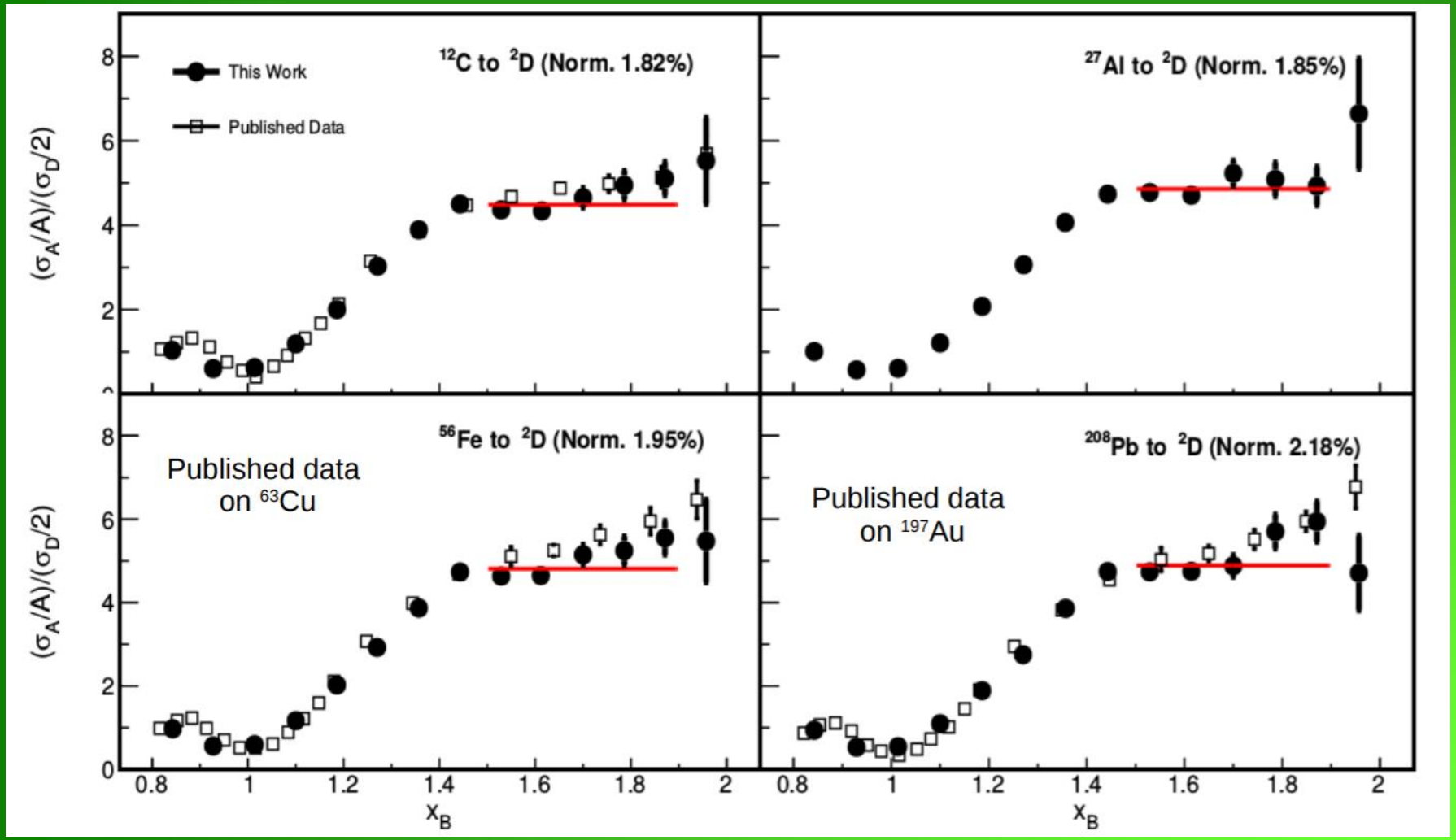


- *5% of strength in high momentum tail (calculated)*
- *20% of nucleons spend time in SRC configurations*

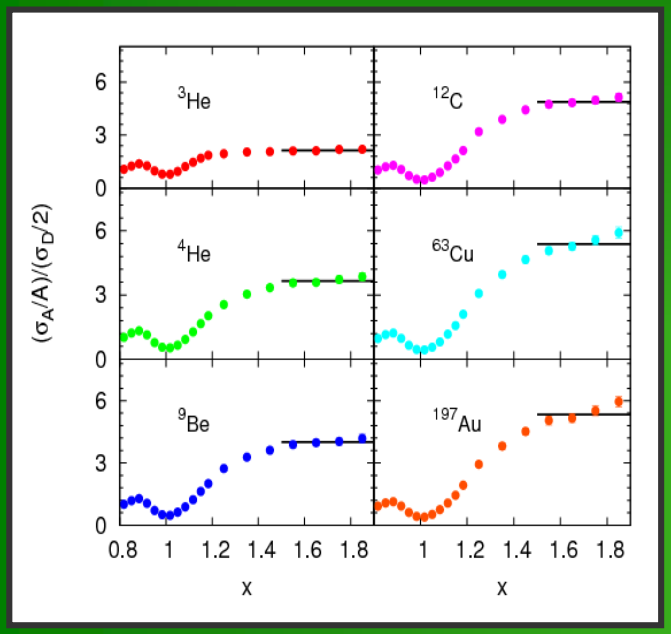
<Q^2>=2.7 GeV^2

Fomin et al, PRL 108 (2012) Jlab E02-019

New Inclusive Ratios from CLAS data mining project



Look at nuclear dependence of NN SRCs



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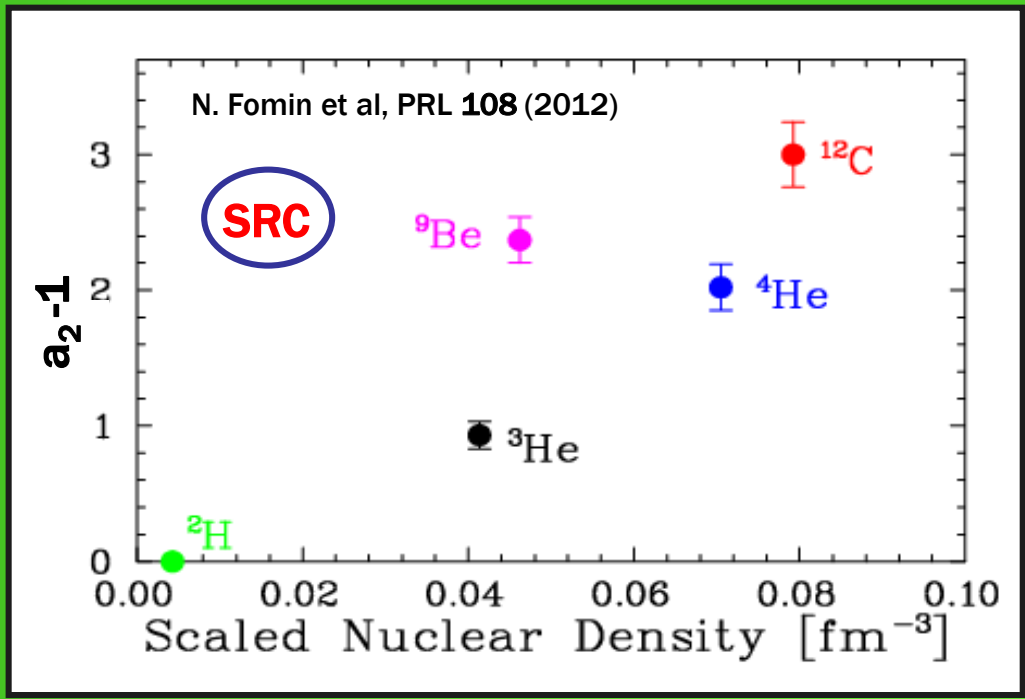
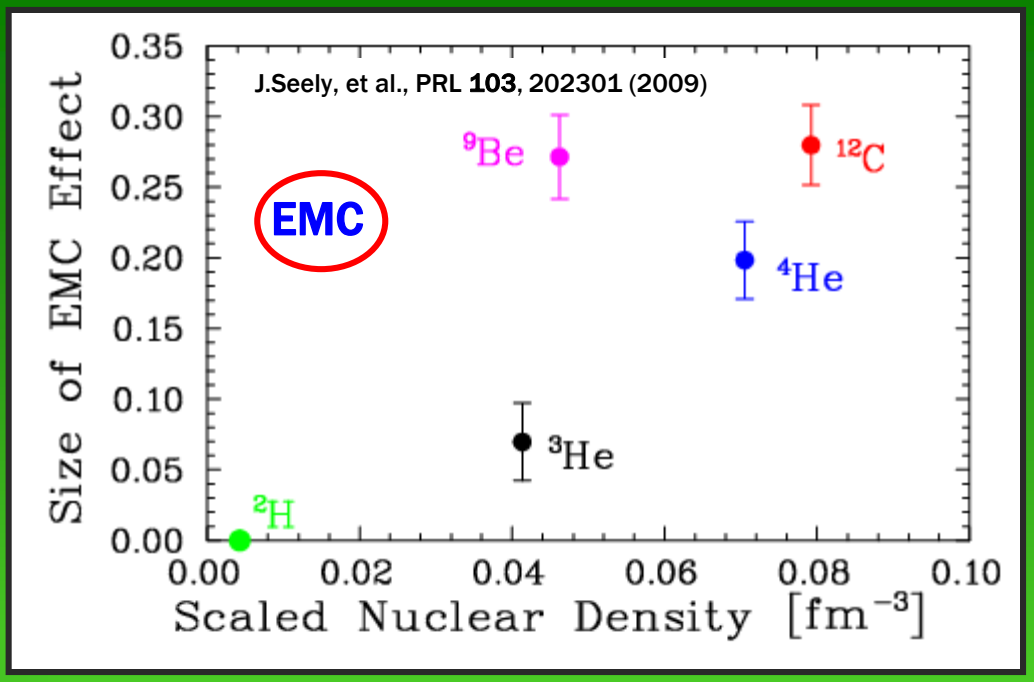
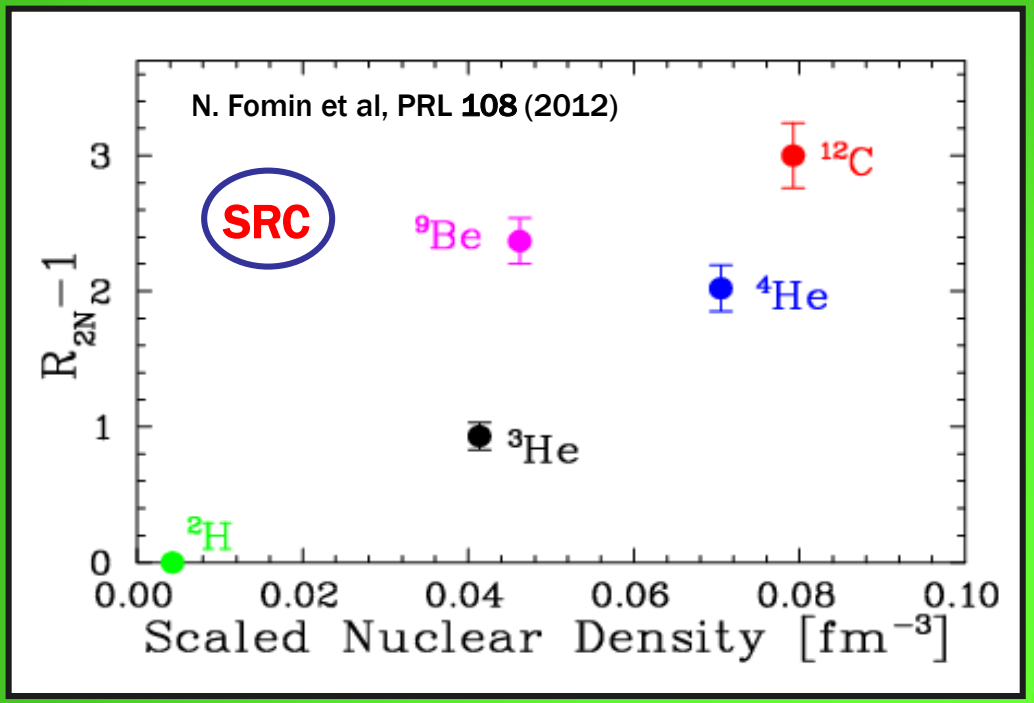
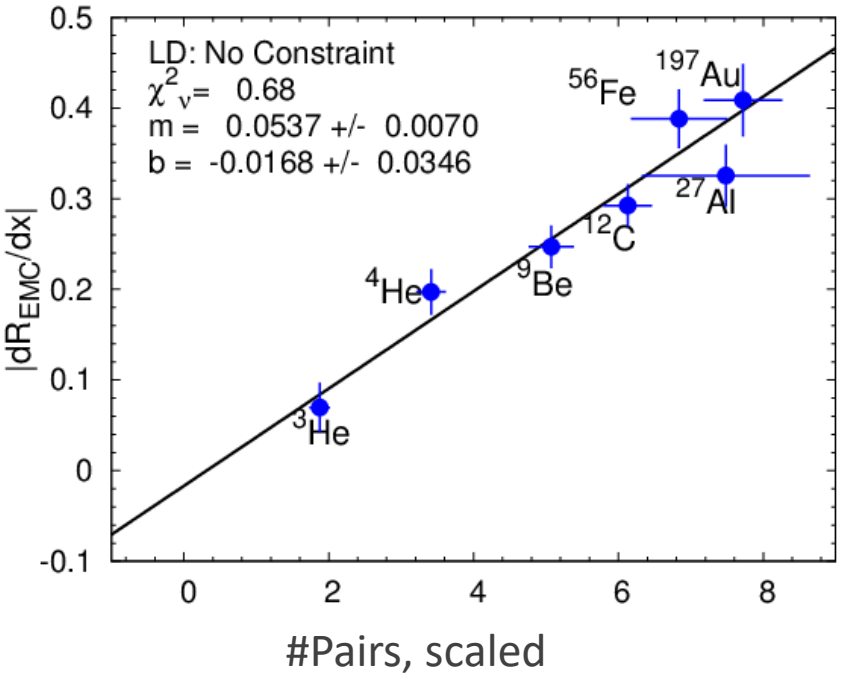
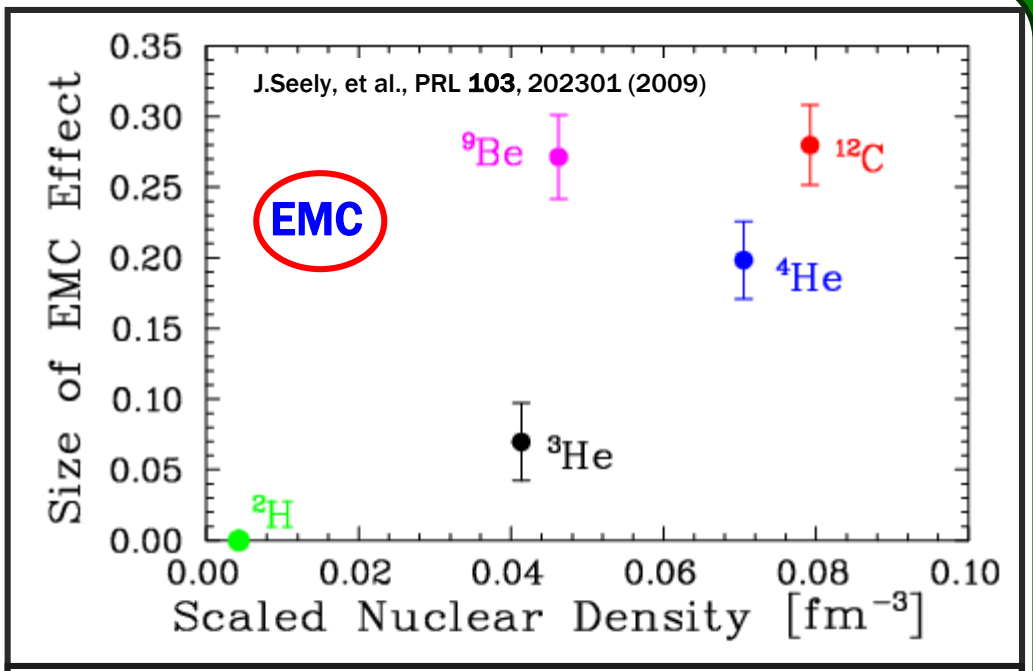


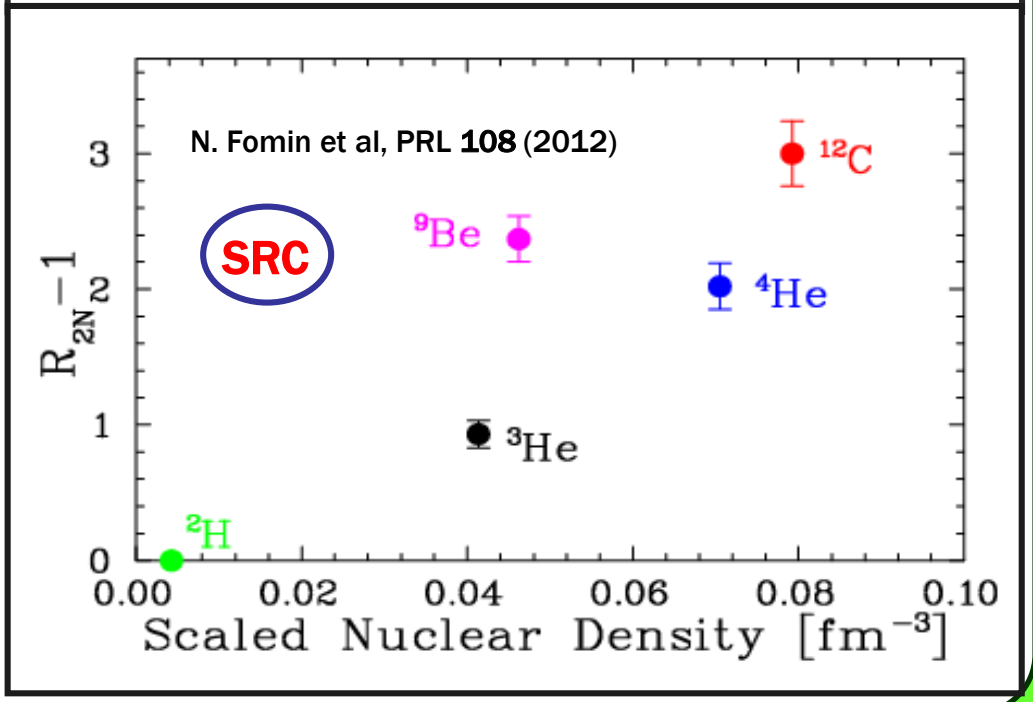

J.Seely, et al., PRL 103, 202301 (2009)
EMC
Size of EMC Effect
Scaled Nuclear Density [fm^{-3}]
^{9}Be
^{12}C
^{4}He
^{3}He
^{2}H
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.00
0.02
0.04
0.06
0.08
0.10


N. Fomin et al, PRL 108 (2012)
SRC
$R_{2N} - 1$
Scaled Nuclear Density [fm^{-3}]
^{12}C
^{9}Be
^{4}He
^{3}He
^{2}H
0
1
2
3
0.00
0.02
0.04
0.06
0.08
0.10

Thanks, ^{9}Be!







J. Seely, et al., PRL103, 202301 (2009)

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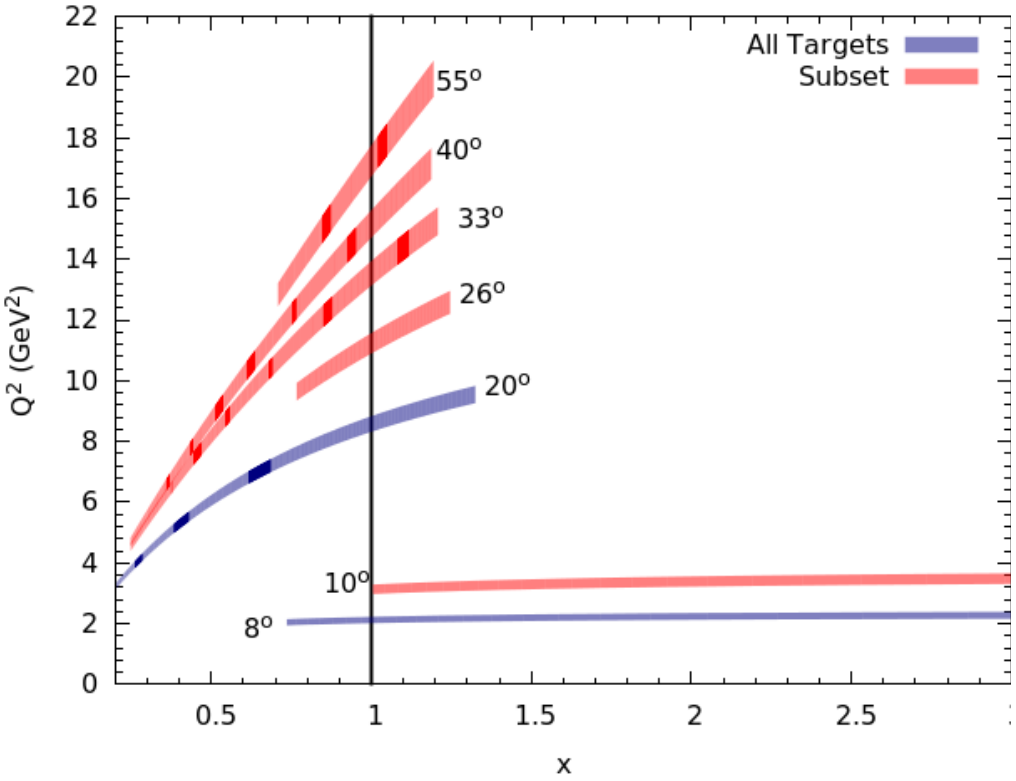
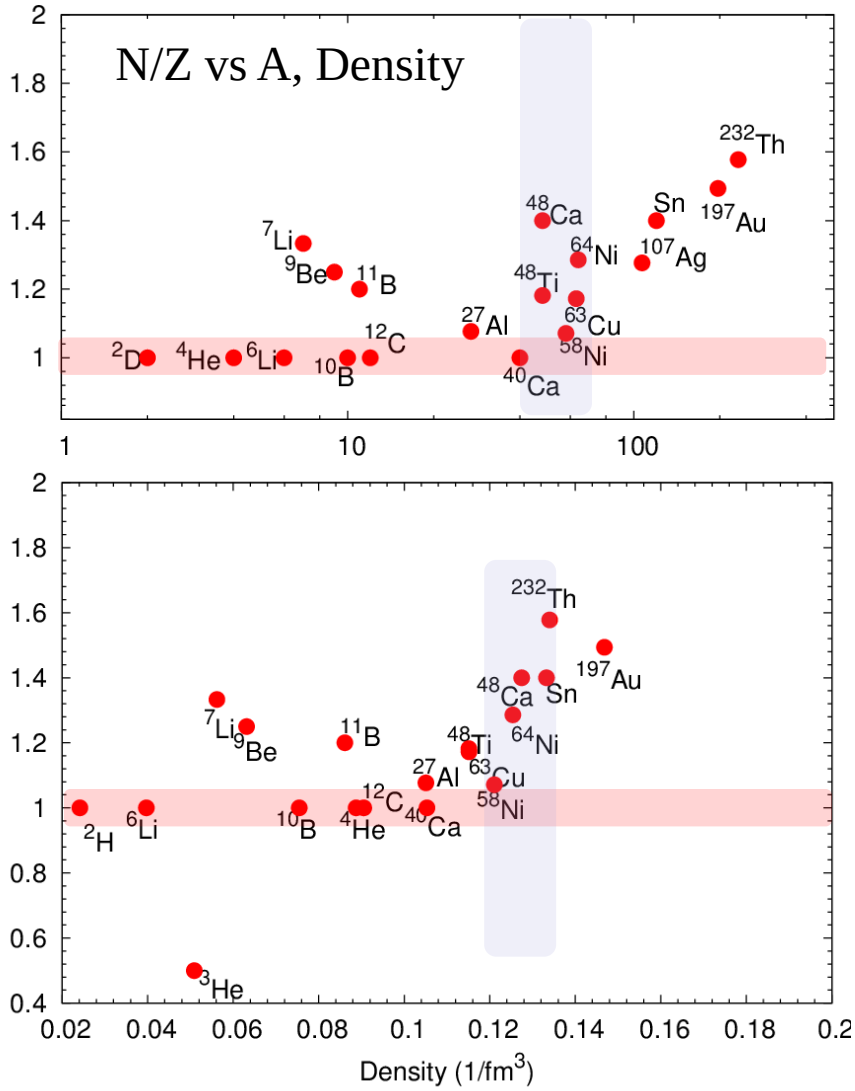
O. Hen, et al, PRC 85, 047301 (2012)

L. Weinstein, et al., PRL 106, 052301 (2011)

12 GeV: The next inclusive generation

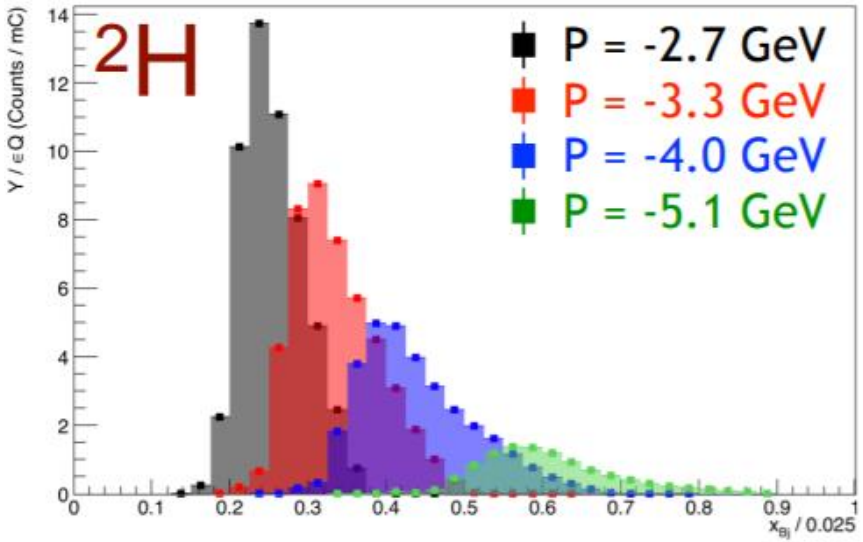
Target Choice motivated by physics impact

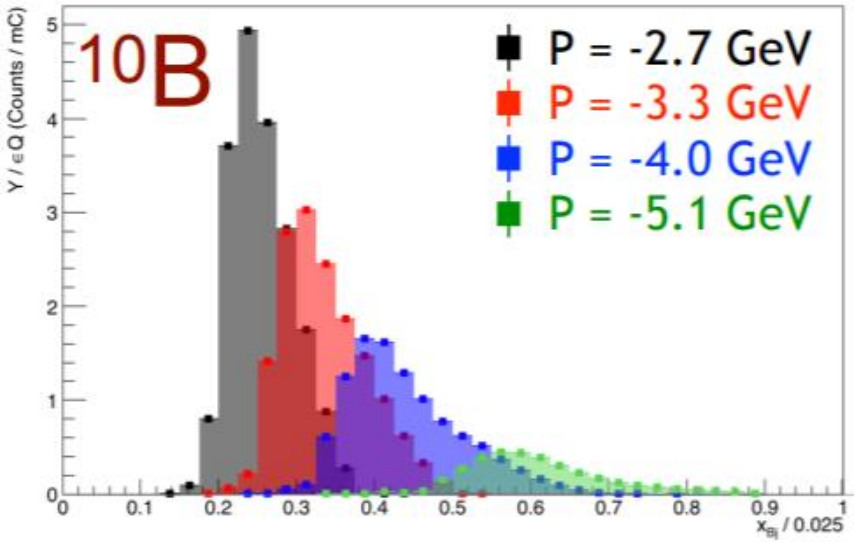


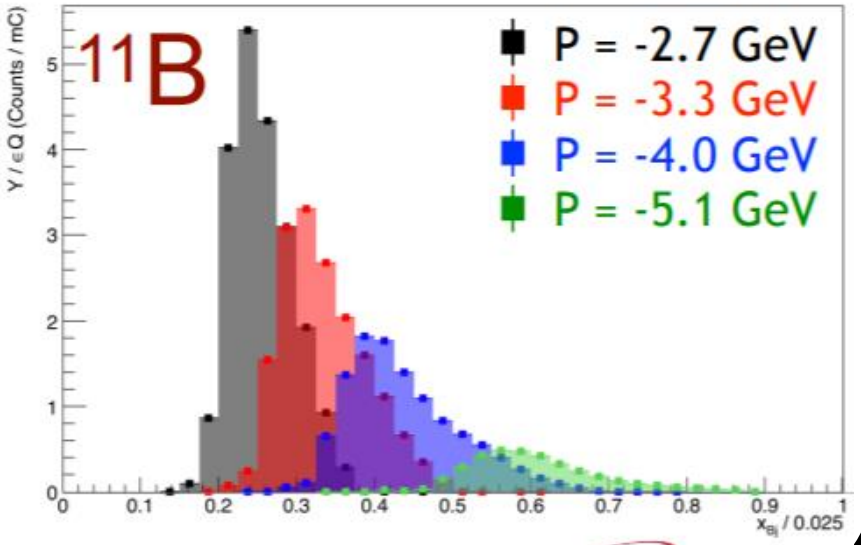


Hall C data on new nuclei!

Hall C data on new nuclei!



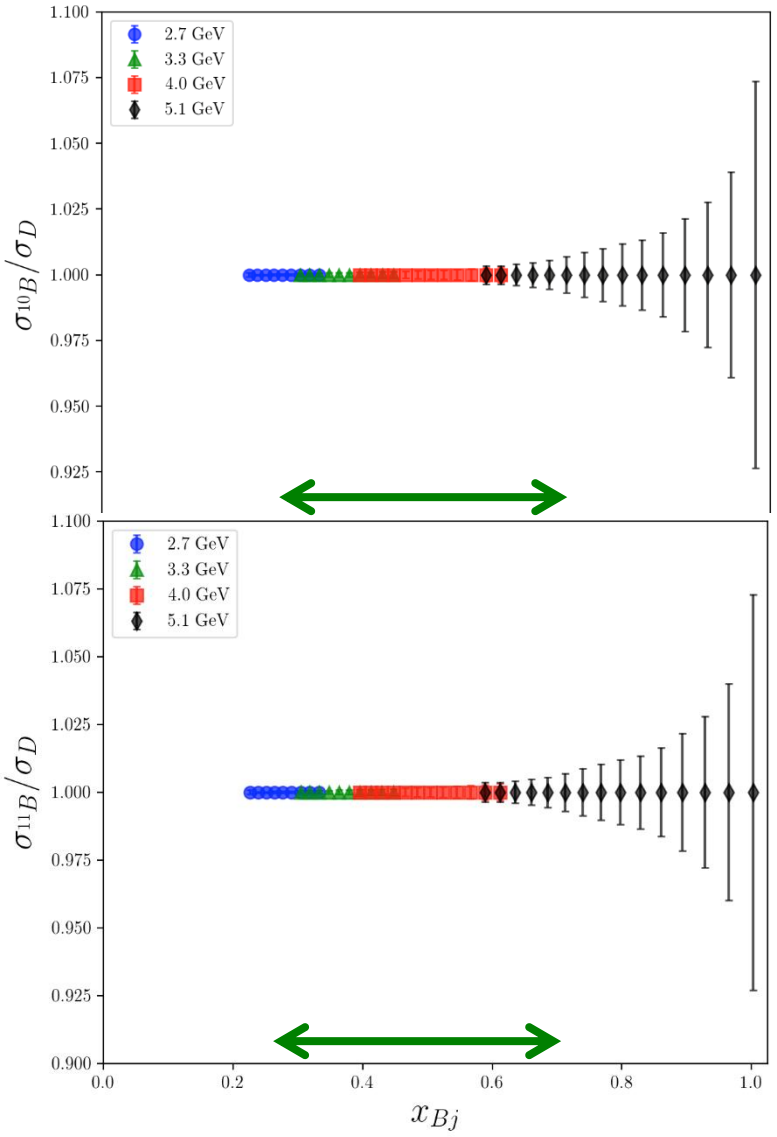


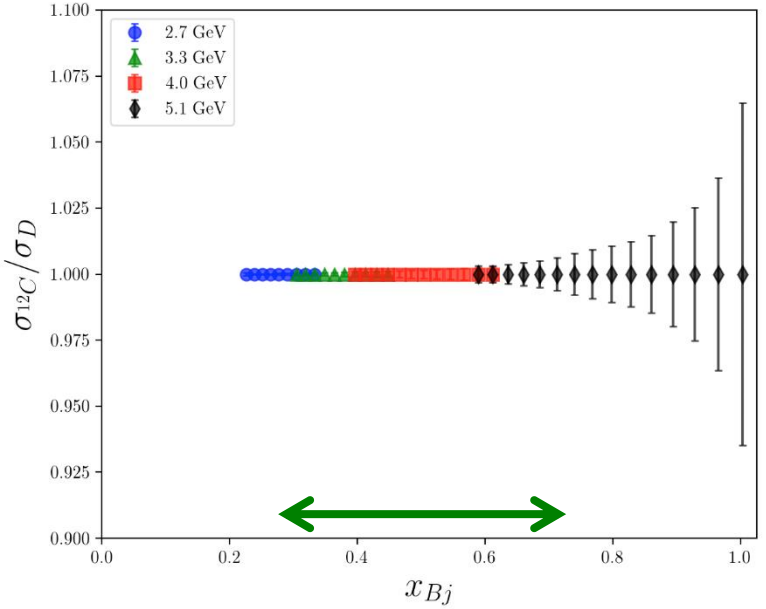


- Good coverage in x (0.15 < x < 0.9)
- Sizable amount of overlap in order to understand the acceptance
- Nominal x binning (0.025) provides good statistics over a wide x range
  - < 1% statistical error

Stolen from E. Pooser

A dream of Spring ....2018 data





New EMC (and SRC) data on

- ^{12}C
- ^{11}B
- ^{10}B
- ^{9}Be

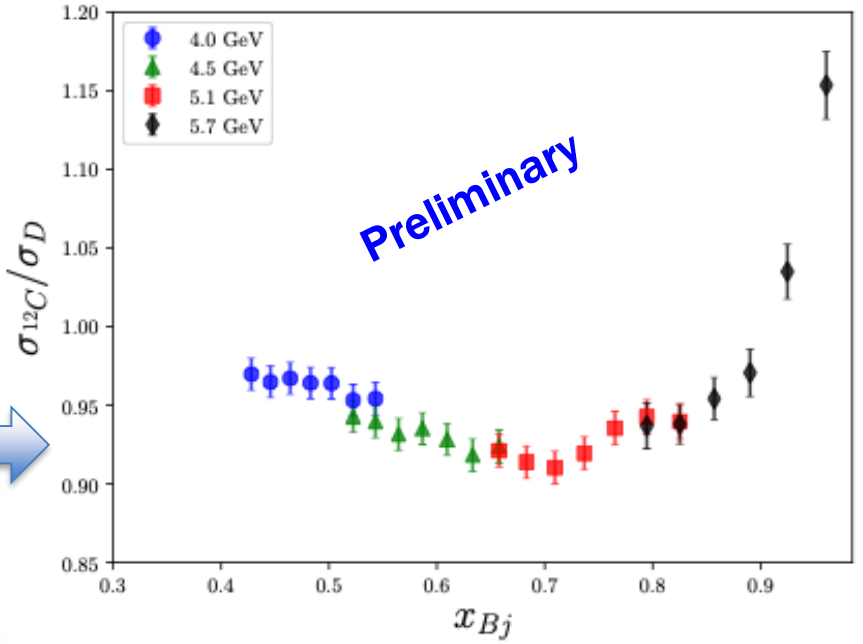
Generously contributed by E. Pooser

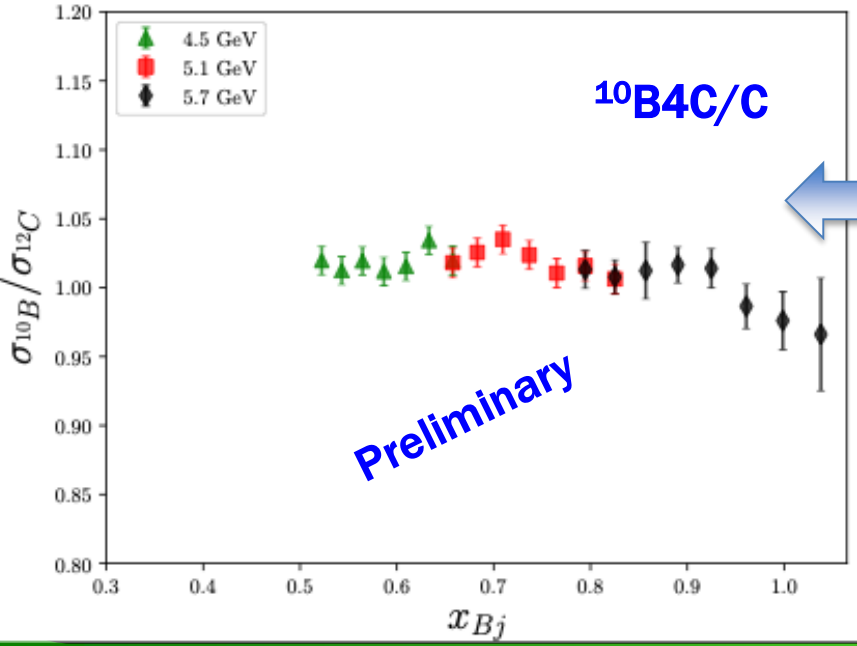
Super-Preliminary Ratios: Spring 2018

Preliminary ratios from HMS

- Larger x coverage and similar statistics in SHMS
- Uncertainties = statistics + ~ 1% systematics

1. No bin-centering
2. First order acceptance correction (long vs. short target)
3. 0^{th} order radiative correction

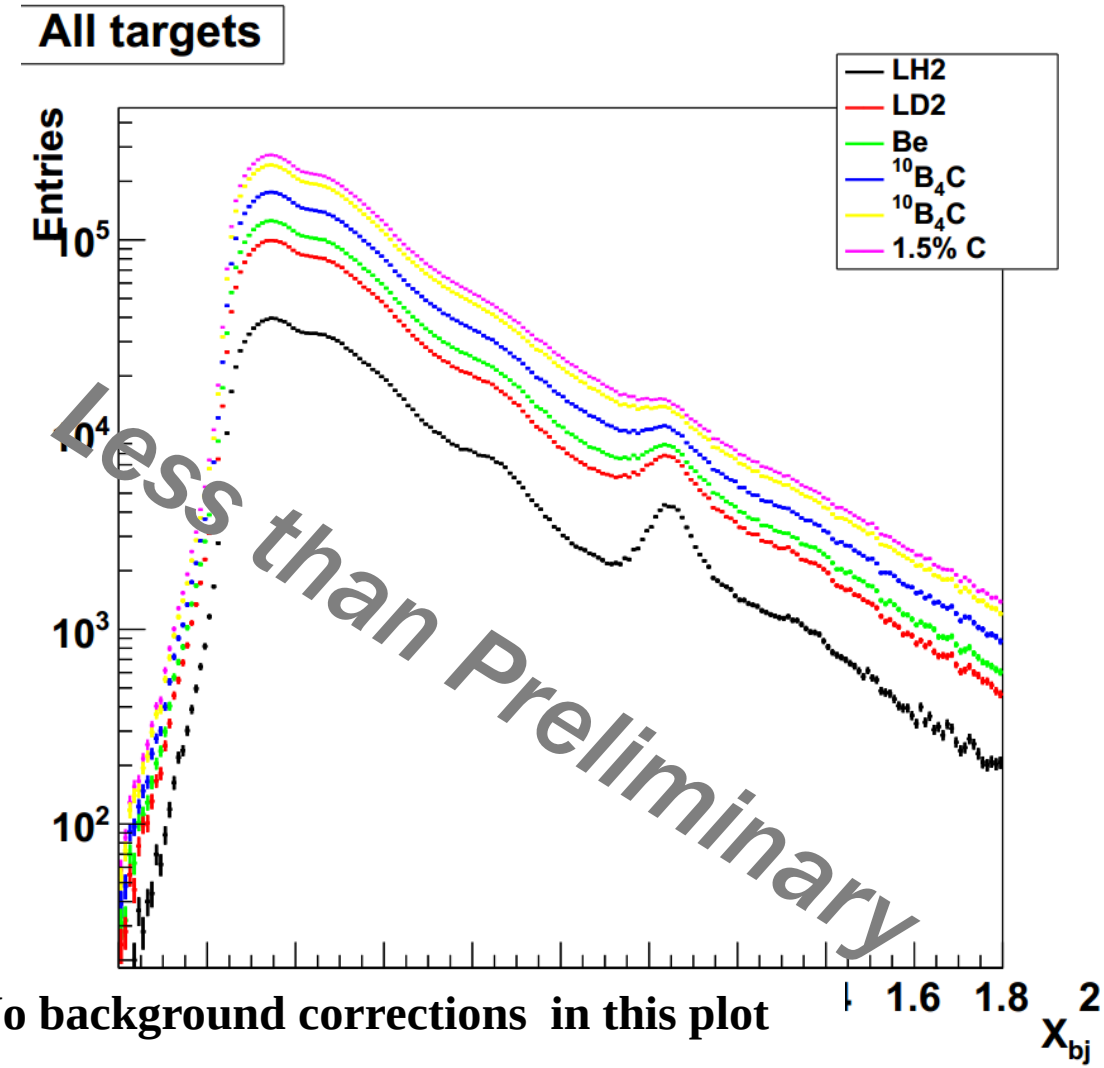




1. Ratio of raw yields (per nucleon)
2. No bin-centering
3. No acceptance correction (both point targets)
4. No radiative corrections

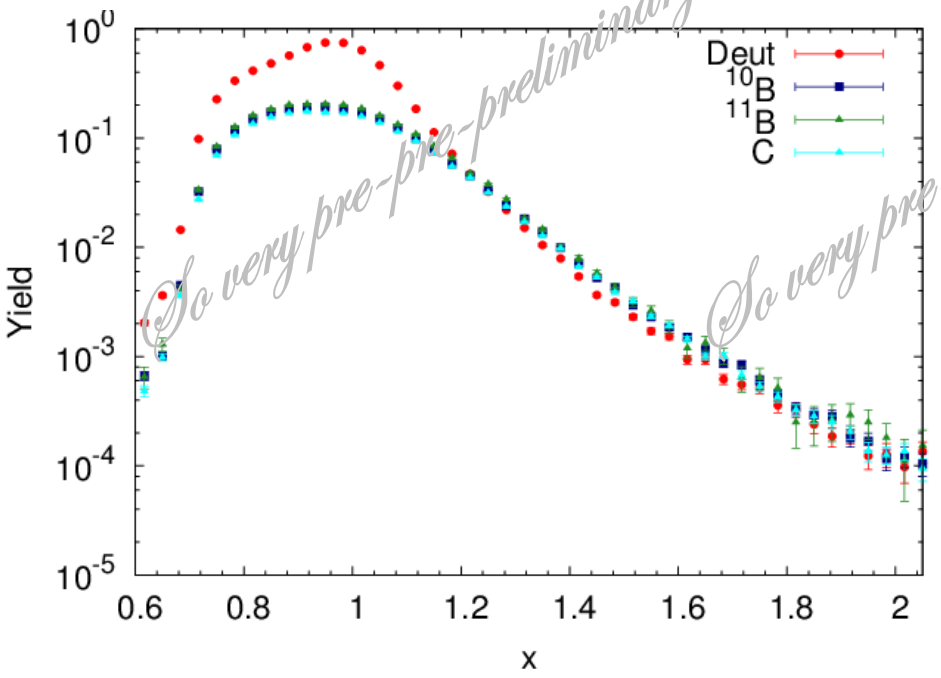
Ratios by Eric Pooser

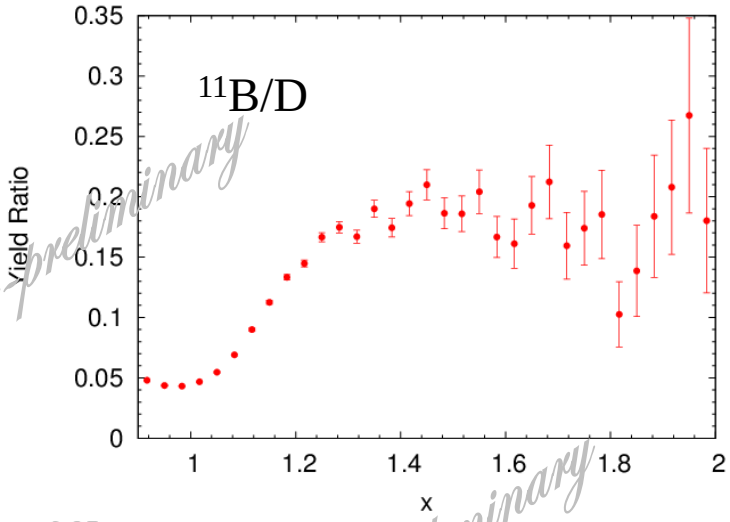
And on the other side of x=1 (2018)

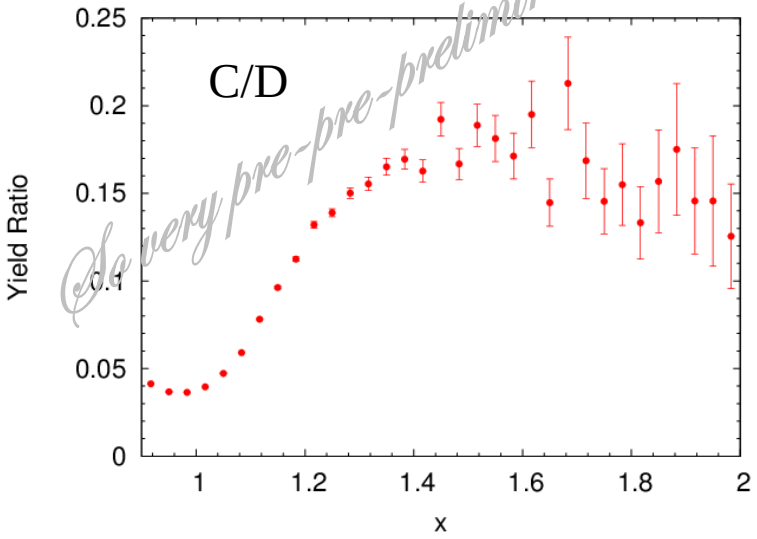


No background corrections in this plot

Tried again in 2019



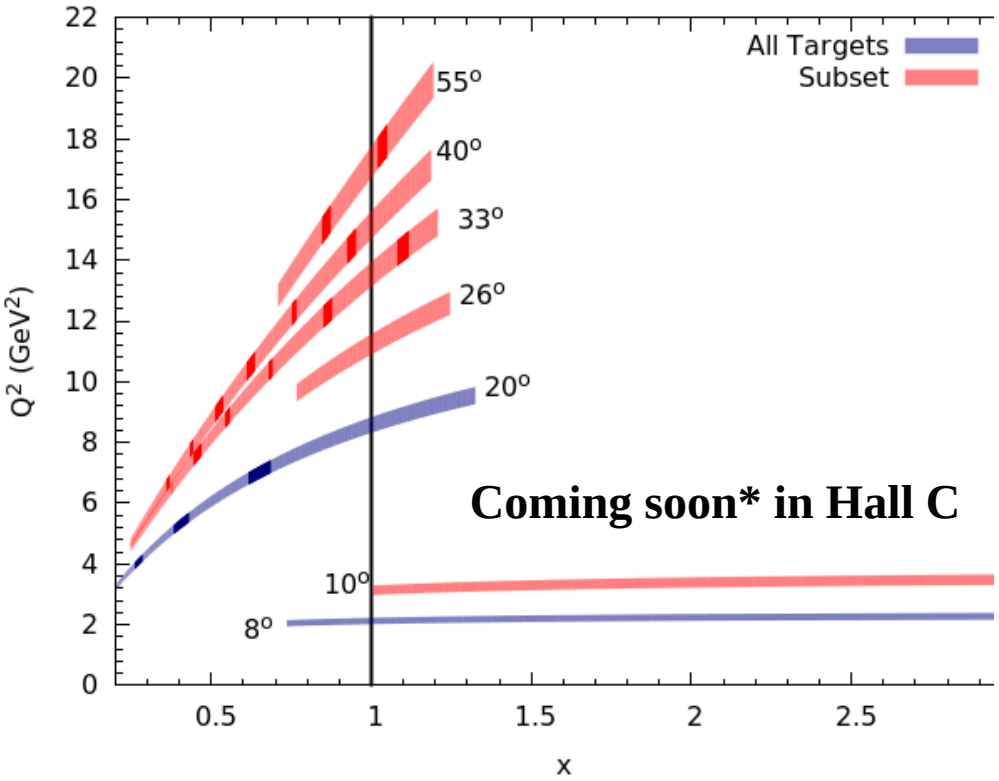


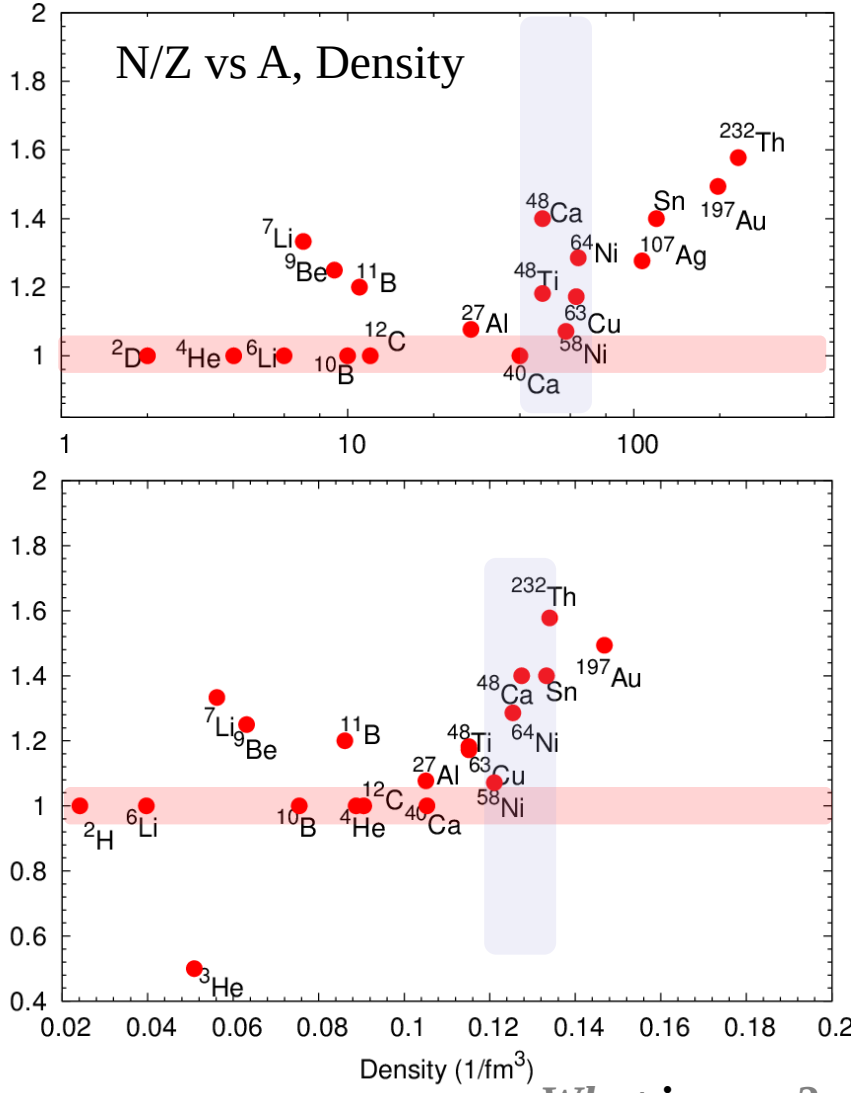


Analysis in progress by Casey Morean

What about all the other targets?

Target Choice motivated by physics impact





- *Light nuclei – sensitivity to some nuclear structure (clusters, halos, etc...)*
- *Heavier nuclei – N/Z isospin lever*

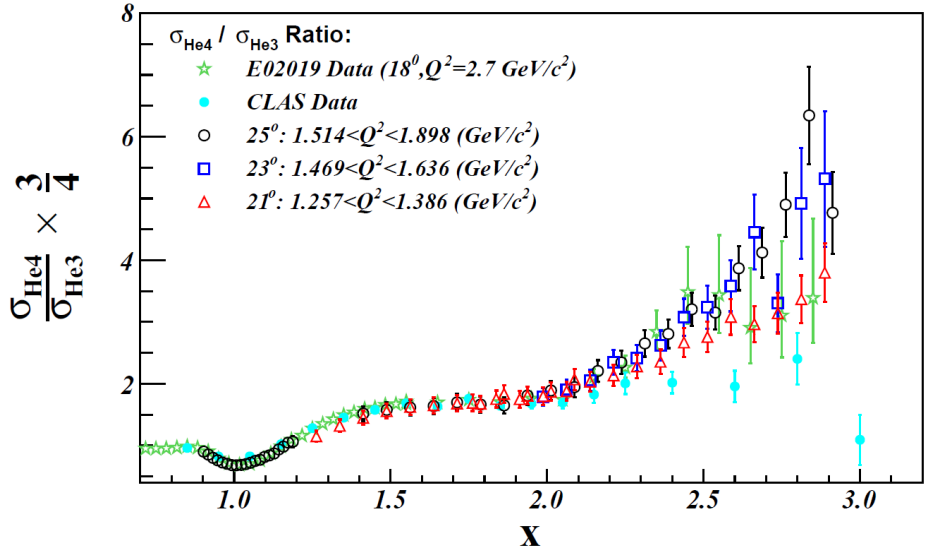
*What **is** soon?*

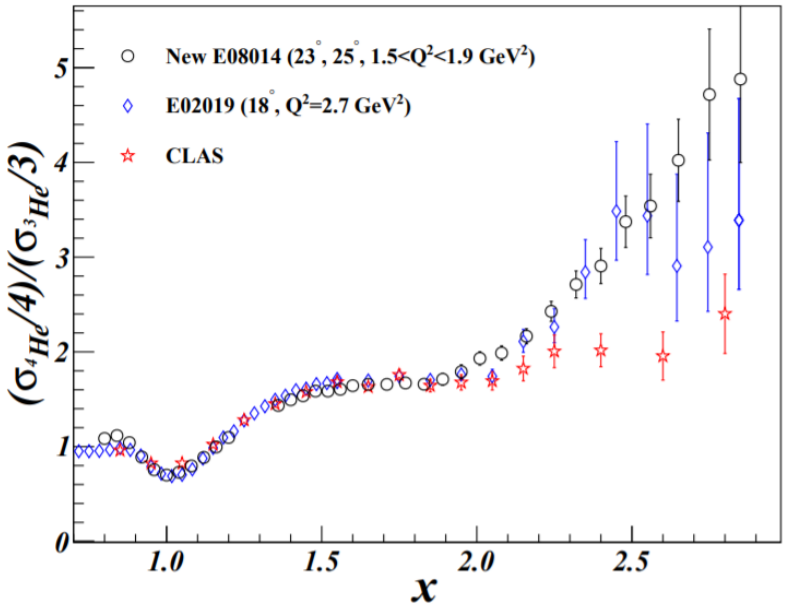
3N correlations - still looking

Search for three-nucleon short-range correlations in light nuclei

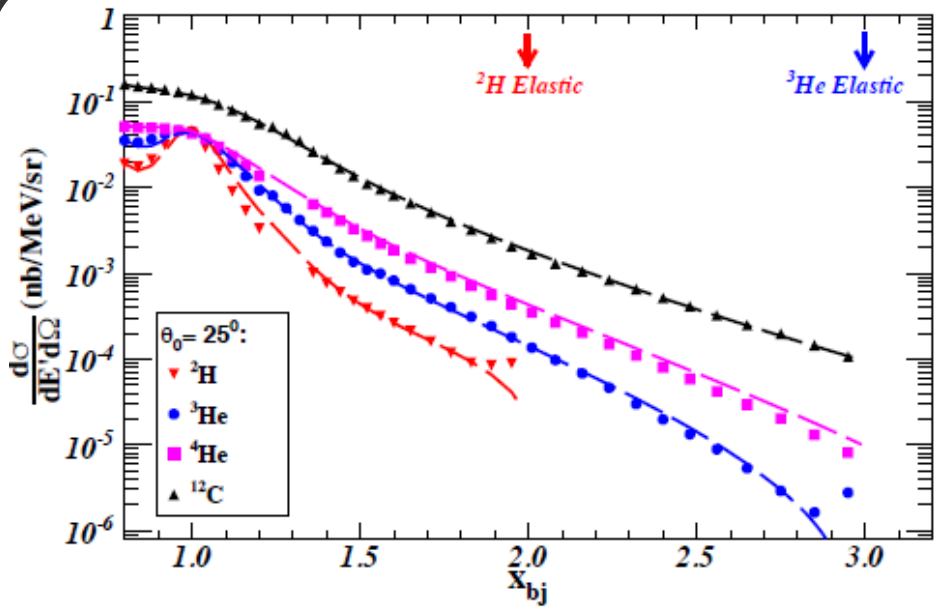
Z. Ye,[1,2,3] P. Solvignon,[4,5,*] D. Nguyen,[2] P. Aguilera,[6] Z. Ahmed,[7] H. Albataineh,[8] K. Allada,[5] B. Anderson,[9] D. Anez,[10] K. Aniol,[11] J. Annand,[12] J. Arrington,[1] T. Averett,[13] H. Baghdasaryan,[2] X. Bai,[14] A. Beck,[15] S. Beck,[15] V. Bellini,[16] F. Benmokhtar,[17] A. Camsonne,[5] C. Chen,[18] J.-P. Chen,[5] K. Chirapatpimol,[2] E. Cisbani,[19] M. M. Dalton,[2,5] A. Daniel,[20] D. Day,[2] W. Deconinck,[21] M. Defurne,[22] D. Flay,[23] N. Fomin,[24] M. Friend,[25] S. Frullani,[19] E. Fuchey,[23] F. Garibaldi,[19] D. Gaskell,[5] S. Gilad,[21] R. Gilman,[26] S. Glamazdin,[27] C. Gu,[2] P. Guèye,[18] C. Hanretty,[2] J.-O. Hansen,[5] M. Hashemi Shabestari,[2] O. Hen,[28] D. W. Higinbotham,[5] M. Huang,[3] S. Iqbal,[11] G. Jin,[2] N. Kalantarians,[2] H. Kang,[29] A. Kelleher,[21] I. Korover,[28] J. LeRose,[5] J. Leckey,[30] R. Lindgren,[2] E. Long,[9] J. Mammei,[31] D. J. Margaziotis,[11] P. Markowitz,[32] D. Meekins,[5] Z. Meziani,[23] R. Michaels,[5] M. Mihovilovic,[33] N. Muangma,[21] C. Munoz Camacho,[34] B. Norum,[2] Nuruzzaman,[35] K. Pan,[21] S. Phillips,[4] E. Piasetzky,[28] I. Pomerantz,[28,36] M. Posik,[23] V. Punjabi,[37] X. Qian,[3] Y. Qiang,[5] X. Qiu,[38] P. E. Reimer,[1] A. Rakhman,[7] S. Riordan,[2,39] G. Ron,[40] O. Rondon-Aramayo,[2] A. Saha,[5,*] L. Selvy,[9] A. Shahinyan,[41] R. Shneor,[28] S. Sirca,[42,33] K. Slifer,[4] N. Sparveris,[23] R. Subedi,[2] V. Sulkosky,[21] D. Wang,[2] J. W. Watson,[9] L. B. Weinstein,[8] B. Wojtsekhowski,[5] S. A. Wood,[5] I. Yaron,[28] X. Zhan,[1] J. Zhang,[5] Y. W. Zhang,[26] B. Zhao,[13] X. Zheng,[2] P. Zhu,[43] and R. Zielinski[4]

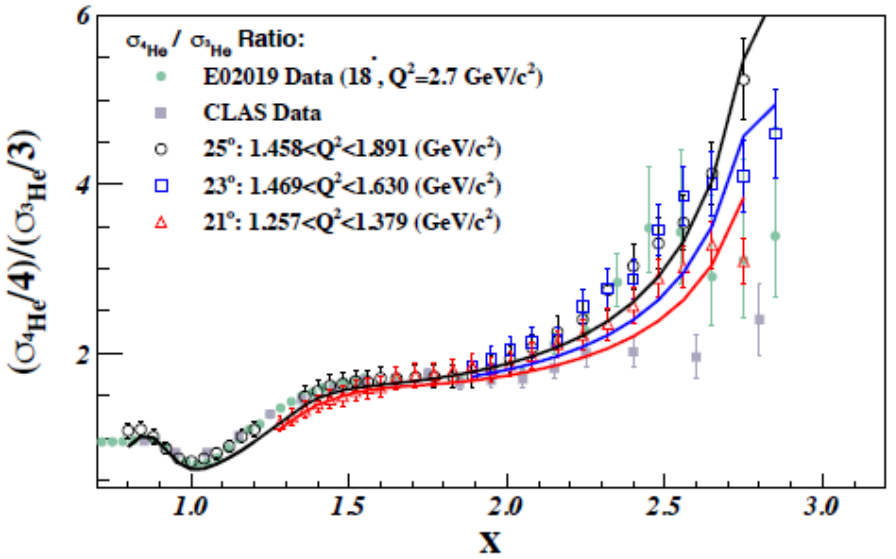
(The Jefferson Lab Hall A Collaboration)

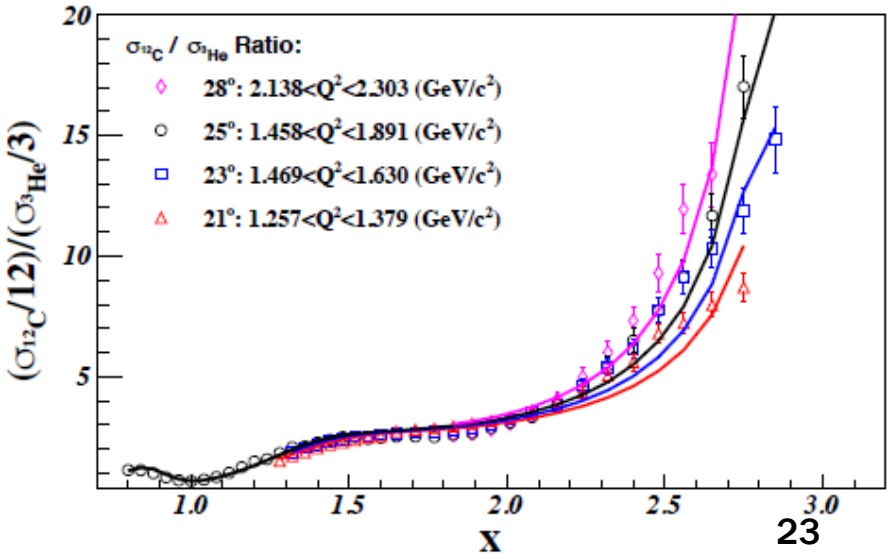




Can we see a second plateau?





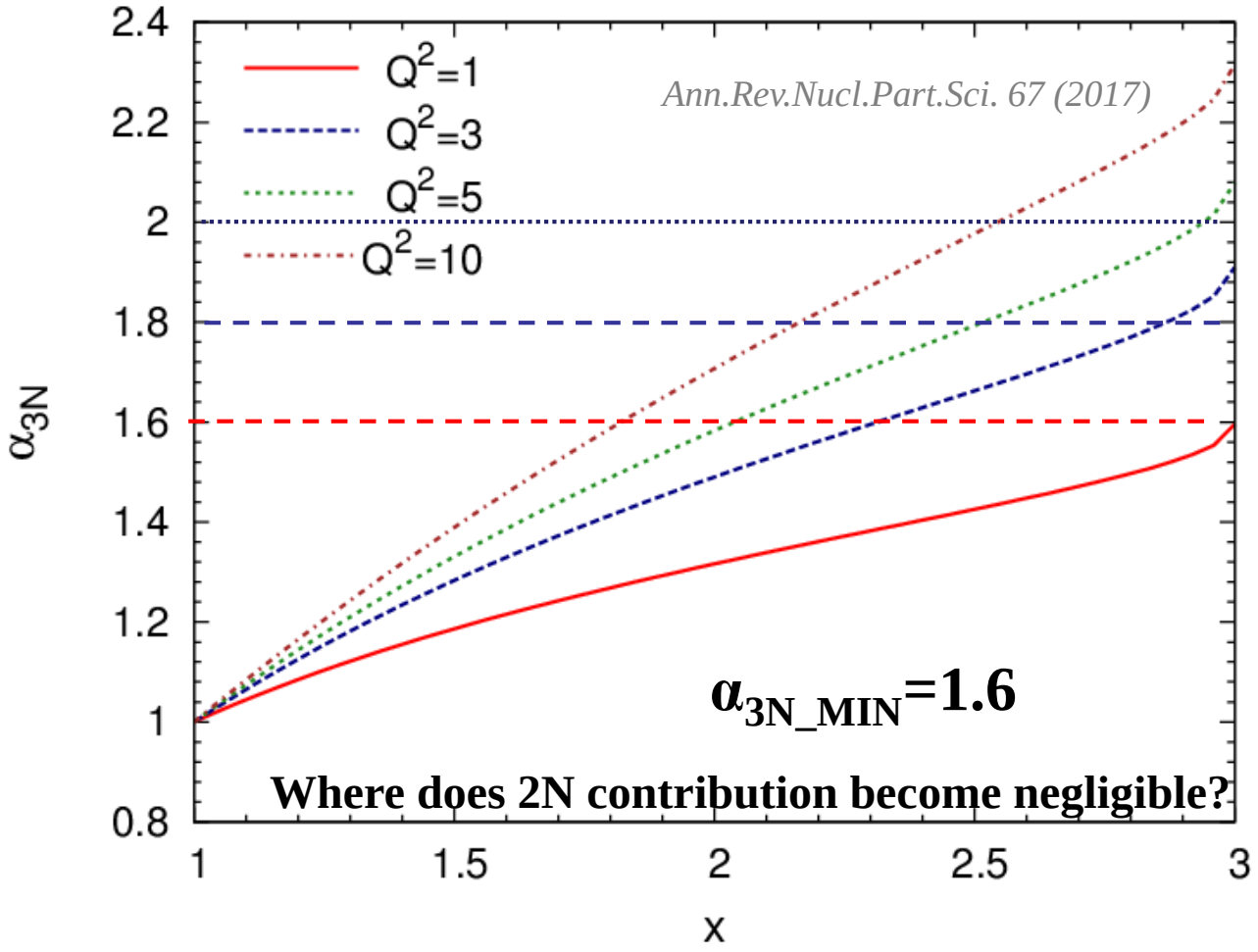


Deuteron: smeared SRC similar to ^{2}H (A/D is ~flat) until x>1.8

^{3}He: cross section of stationary 3N-SRC begins to fall off closer to x=2.6. Sets in EARLIER at high Q^2


I WAS TOLD THERE WOULD BE
3N SRC PLATEAUS
imgflip.com

3N correlations – are we there yet?



α_i represents the light-cone momentum fraction of 3N SRCs carried by the correlated nucleon *i*

Summary

- New inclusive data on EMC effect and SRC ratios at 12 GeV on new nuclei
- Looking forward to data on:
  - Additional light nuclei (extra neutrons!)
  - Scans in n/p at fixed A
  - Pushing to x=3 looking for 3N SRCs
- Results on new nuclei soon*!