

# Overview of Approved Photonuclear EMC-SRC Program

Or Hen - MIT

March 22 - 26, 2021



*and  
the*





Tried to be inclusive. Apologies  
if activities were left out!

This is a personal (i.e. biased)  
perspective



For Next gen. Experiments



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NN Interaction:

- Precision studies of few-body systems



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- Precision studies of few-body systems

## 3N-SRCs:

- Discovery!
- Abundances
- Where they appear in the many-body wave function
- Kinematics (coplanar vs. star)
- Relation to 3N forces



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## EMC Effect:

- $F_2$  dependence on nuclear wave function
- Form factor modification
- Spin EMC
- Flavor dependent EMC
- Modification of GPDs / TMDs



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## 2N-SRCs:

- Dependence on nuclear asymmetry
- Precision measurements & reaction dynamics

# BiG QUESTIONS

## For Next gen. Experiments

NN Inp. data & Calculations

While great progress was made  
(and continues), we still don't  
have cross-section calculations  
for most measurements!

This has to change  
[and is being changed]

Wherever possible, must make strong  
and direct connection with frontier  
theory to maximize data impact!

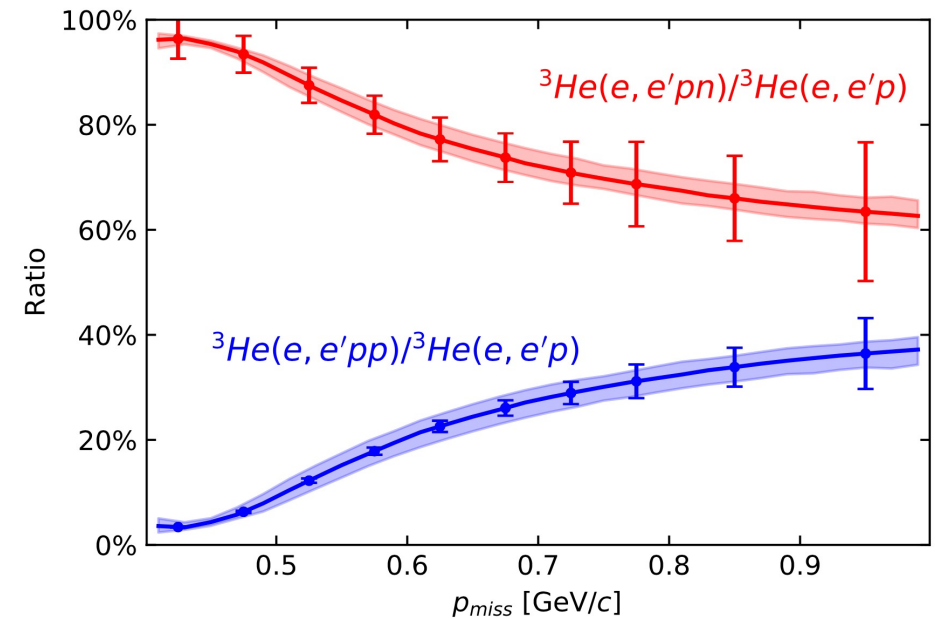
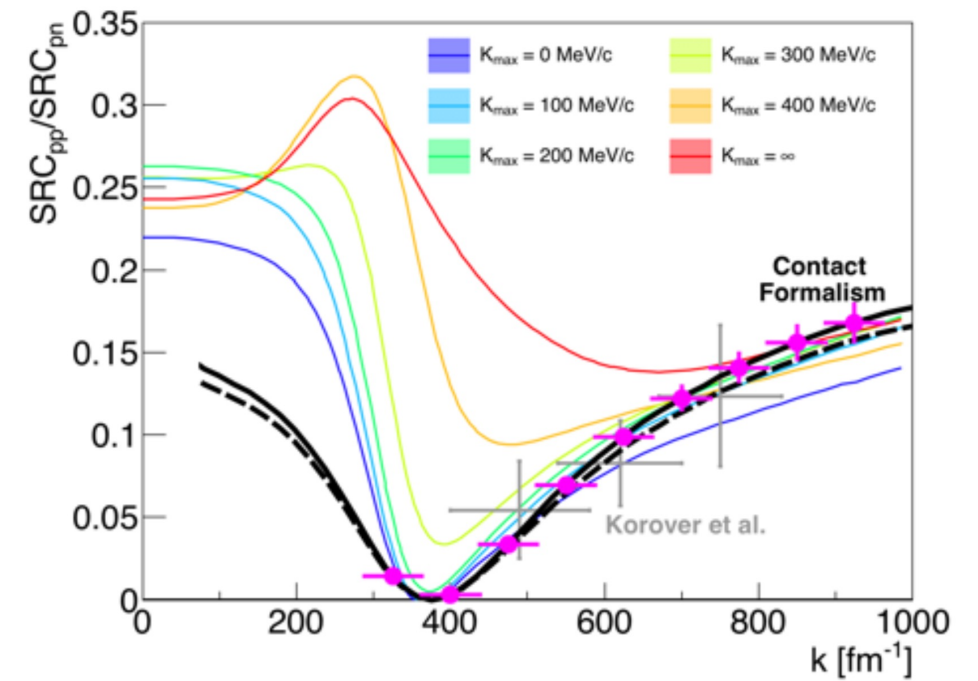
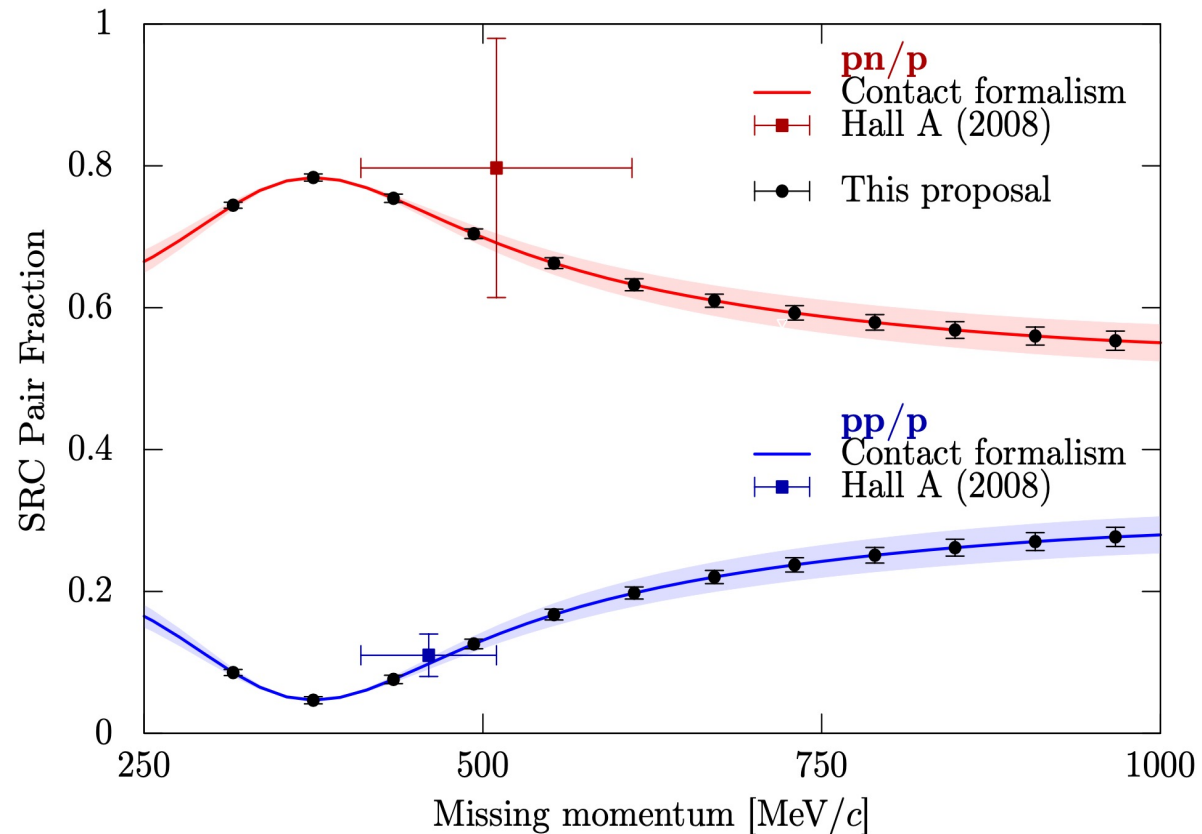
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2N-SRCs:

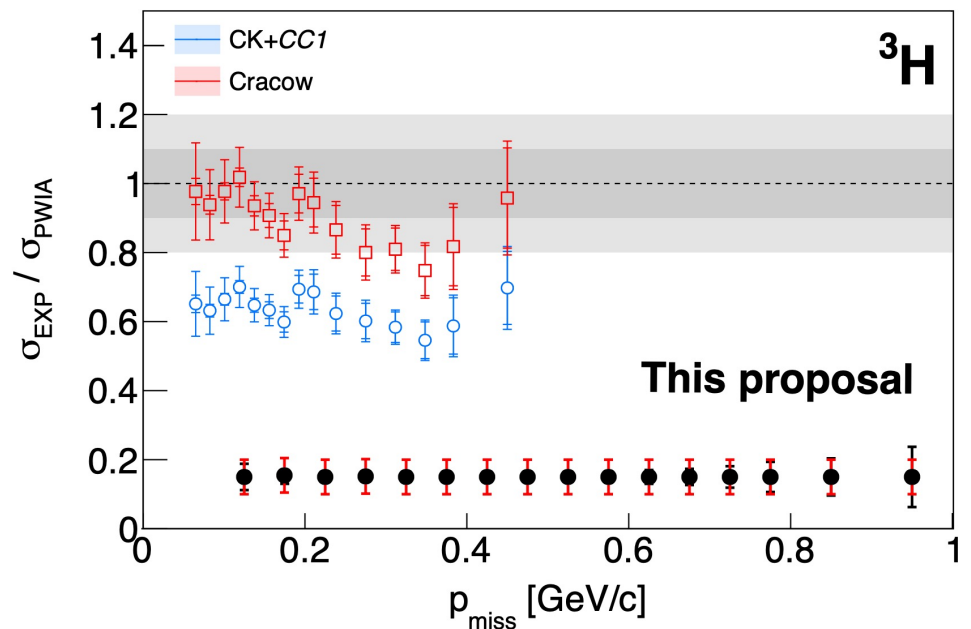
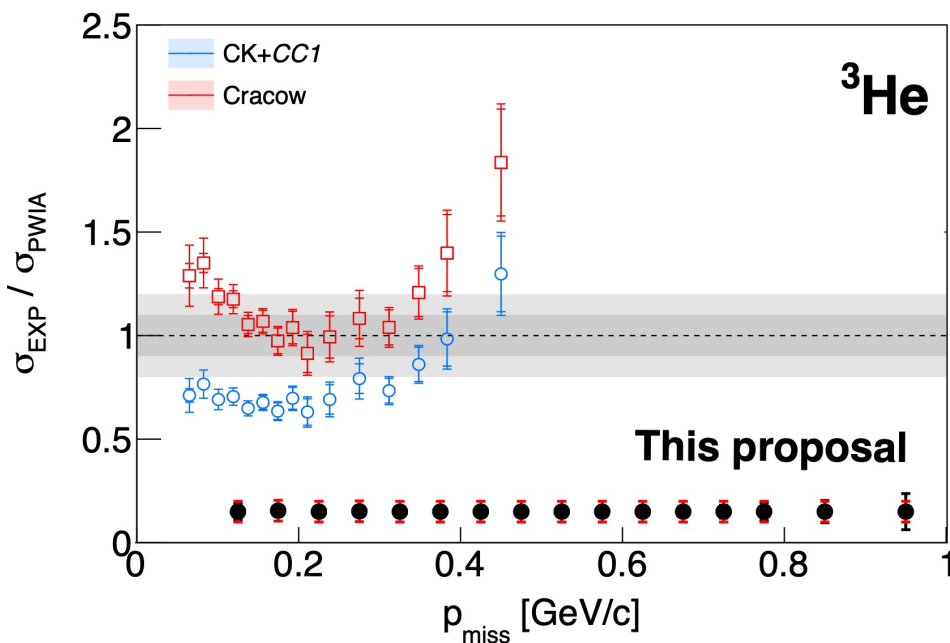
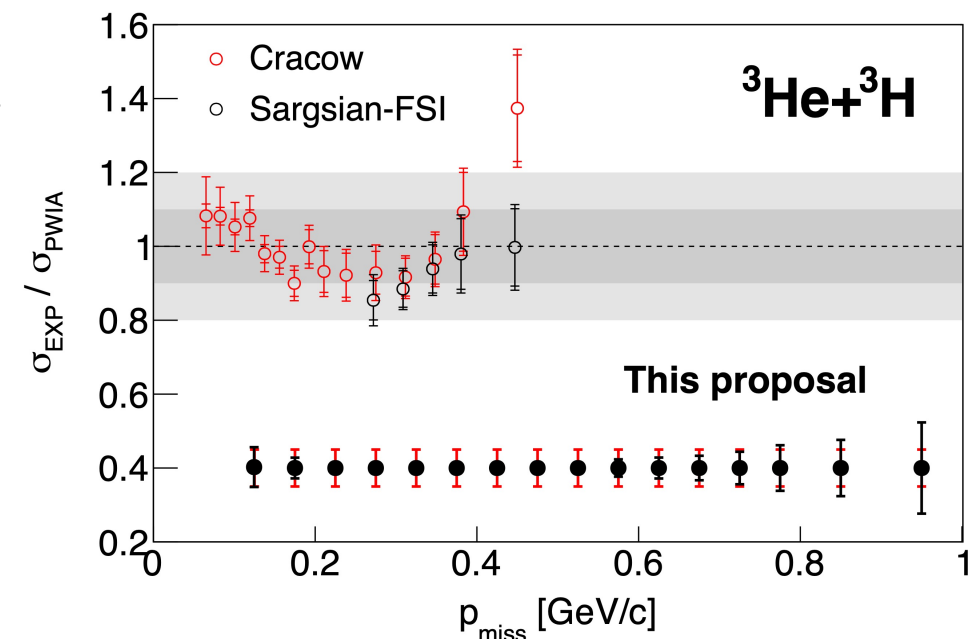
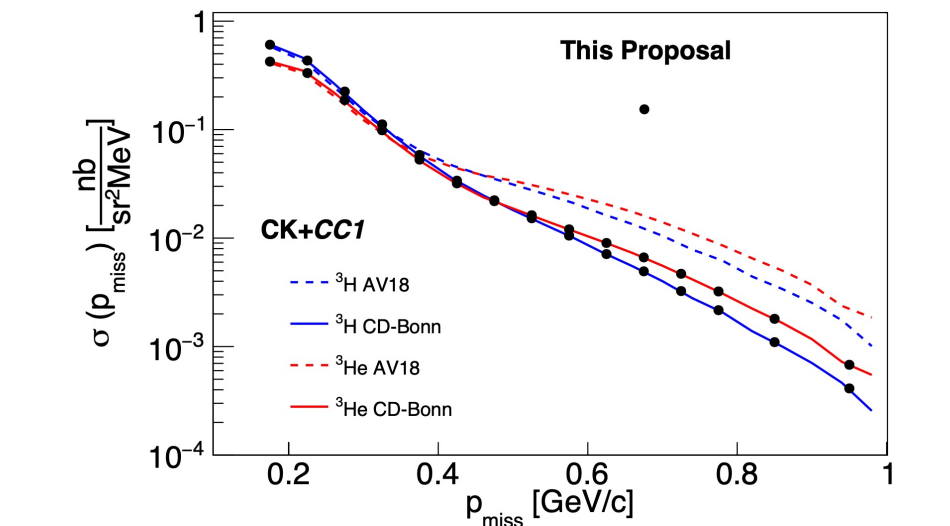
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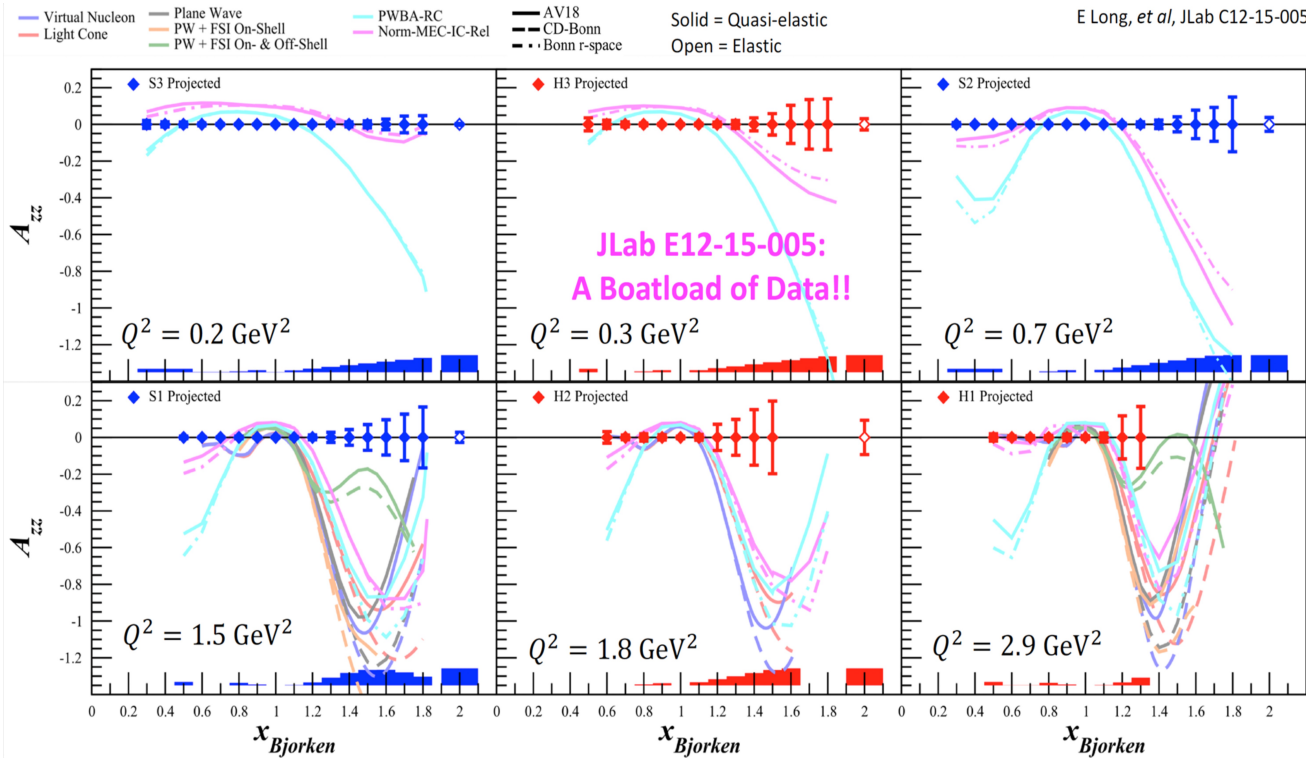
# Few-body dynamics: CLAS12



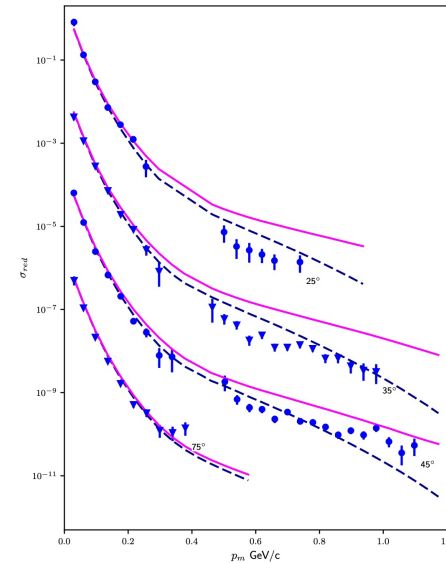
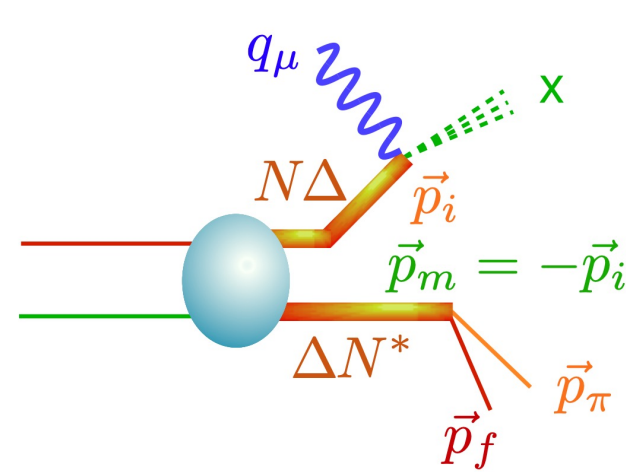
# Few-body dynamics: CLAS12



# Few-body dynamics: Deuteron



Outlook: More statistics and explore NN interaction core using inelastic channels: Jlab, EIC



- Backwards  $\Delta$  or  $N^*$
- Large momentum  $\sim 1 \text{ GeV/c}$

# 3N-SRC

Not much to show!

No observation of 3N plateau @  $x > 2$ . Most likely just due to data taken at too low  $Q^2$ . Some plans to search for a plateau @ higher  $Q^2$ .

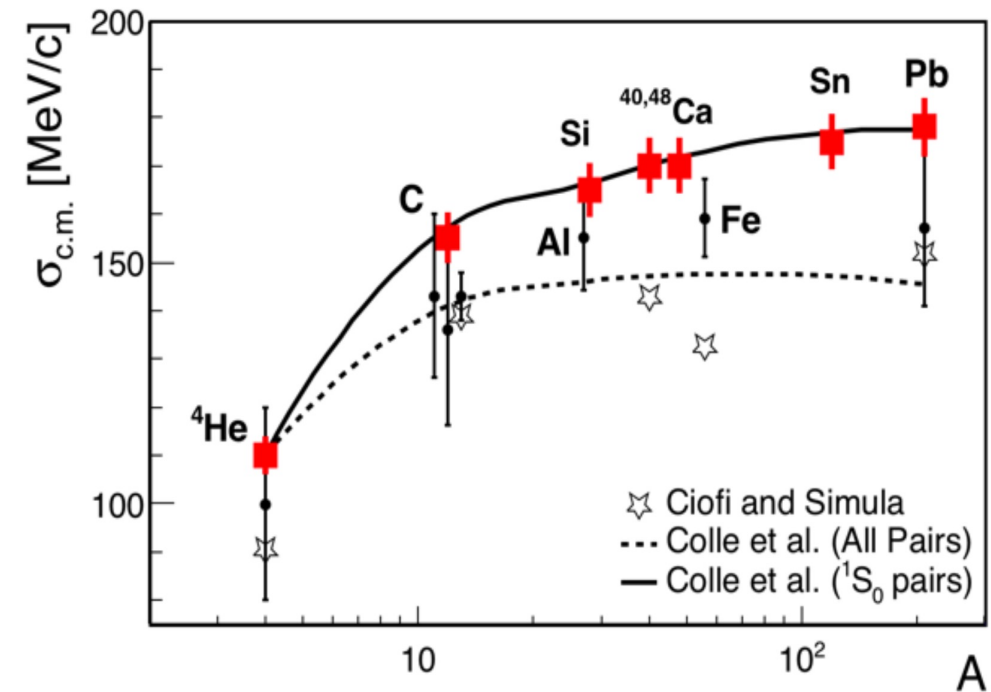
Approved CLAS12 exclusive measurement will search for 3N-SRC in nucleon knockout reactions.

# 2N-SRC

To a certain extent, a bit 'more of the same' but \w higher precision and more interesting nuclei which is very important!

Exclusive: Higher stat. Better precision.  
Interesting nuclei ( $^{40,48}\text{Ca}$ - $^{54}\text{Fe}$ ).

Inclusive: many light-nuclei isotopes.



To what accuracy do we really understand systematic variations between asymmetric nuclei? **Need theory collaboration to interpret data!**

# EMC

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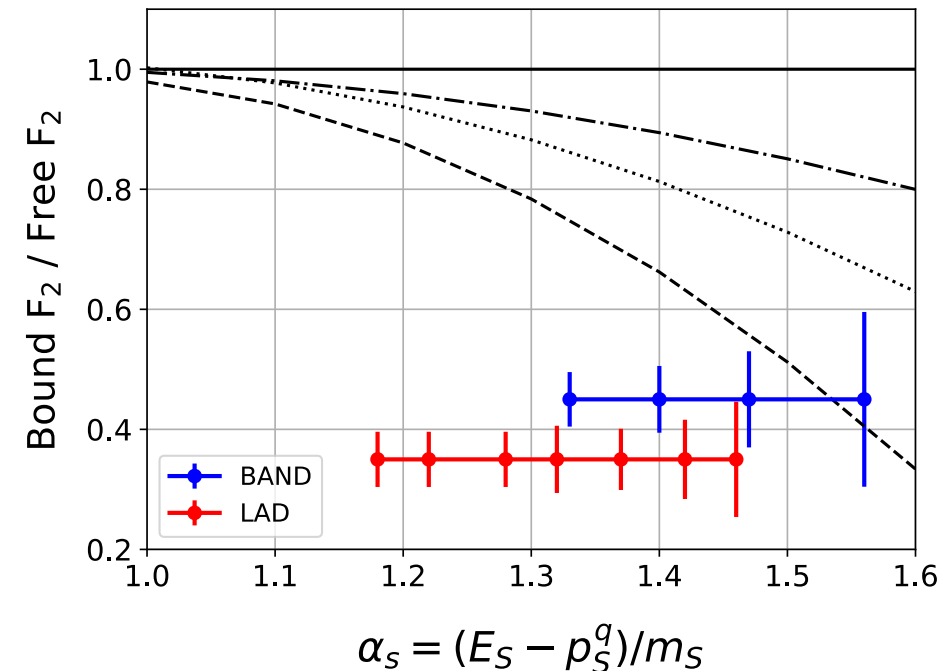
[BAND / LAD / ALERT]

[Hall C / MAINZ]

[CLAS12 pol 7Li]

[CLAS12 A=3?]

[ALERT (?)]



# So... What's approved?

- Inclusive  $x > 1$  on 'all' possible targets
- Tensor pol. d inclusive
- CaFe
- Tritium@CLAS12
- SRC@CLAS12
- SRC@GlueX
- Inclusive  $x < 1$  on 'all' possible targets + super fast quarks
- BAND / LAD
- ALERT
- Spin EMC in  ${}^7\text{Li}$
- In-medium form factor

# So... What's approved?

- Inclusive  $x > 1$  on 'all' possible targets '22
- Tensor pol. d inclusive '23 (?)
- CaFe '22
- Tritium@CLAS12 '24 / '25 (?)
- SRC@CLAS12 Fall '21
- SRC@GlueX Fall '21
- Inclusive  $x < 1$  on 'all' possible targets + super fast quarks '22
- BAND / LAD  
~1/2 done '23 (?)
- ALERT '24 / 25 (?)
- Spin EMC in  $^7\text{Li}$  '24 / 25 (?)
- In-medium form factor '23 (?)