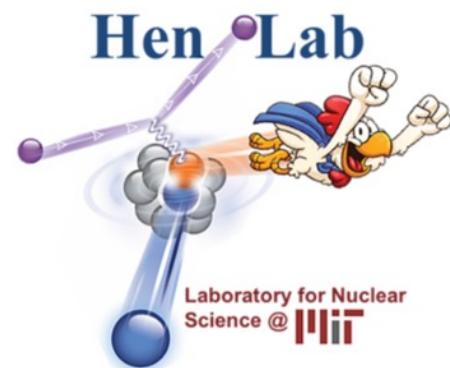


First Analyses on RGM data from CLAS12

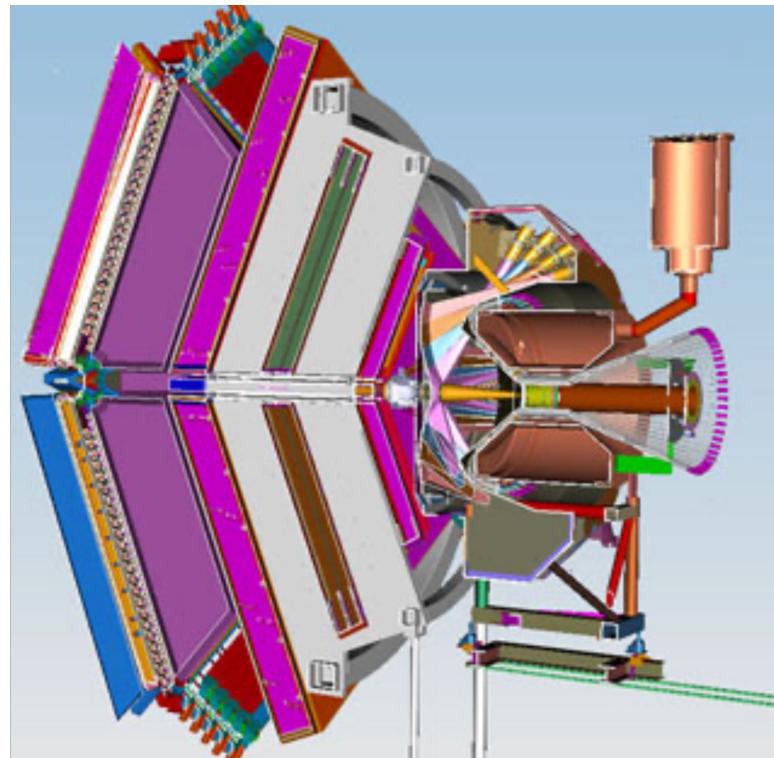
Andrew Denniston

MIT

August 2nd, 2022

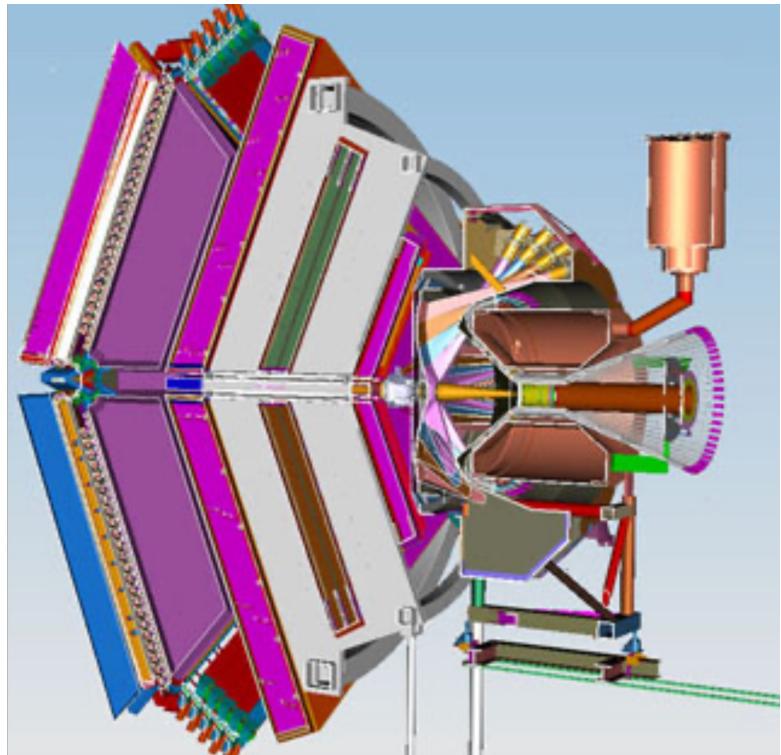


RGM Overview

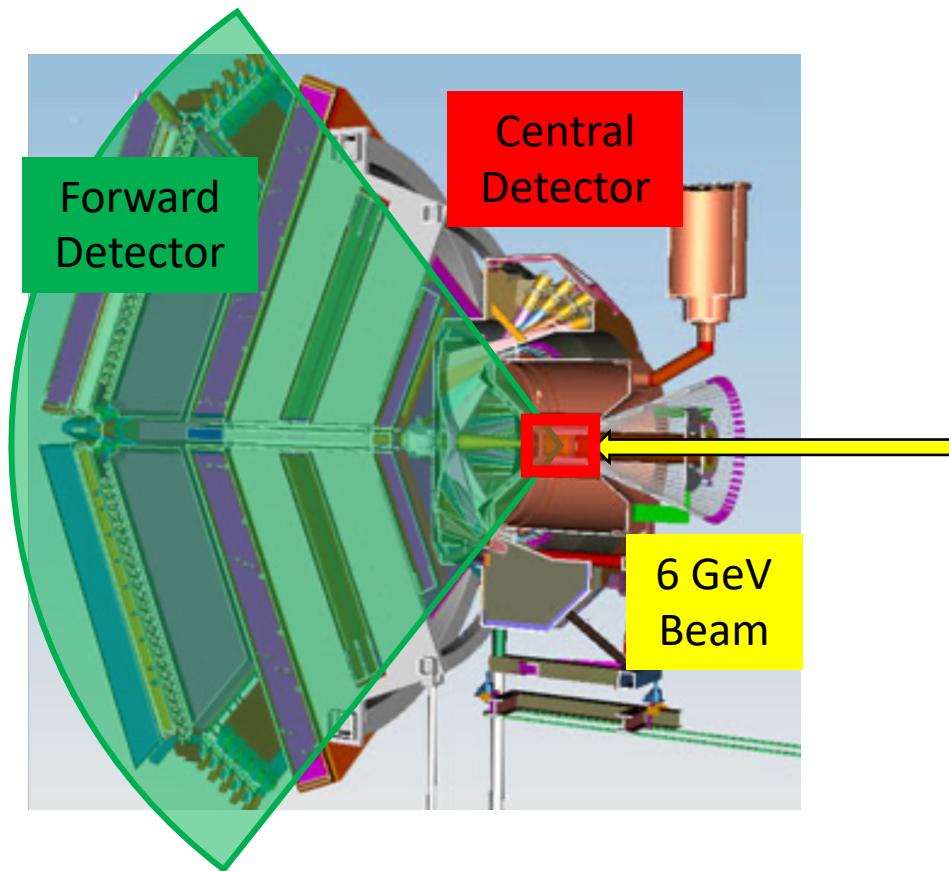


RGM Overview

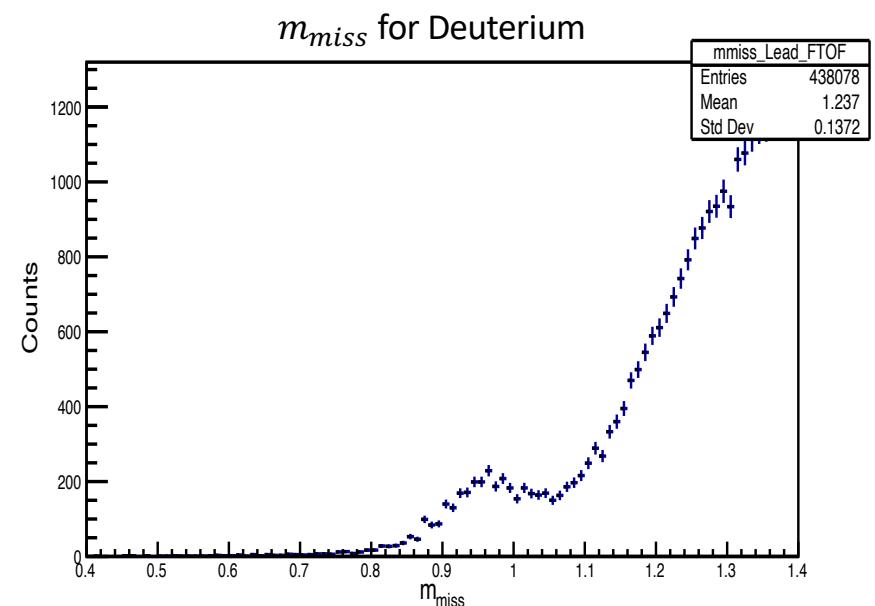
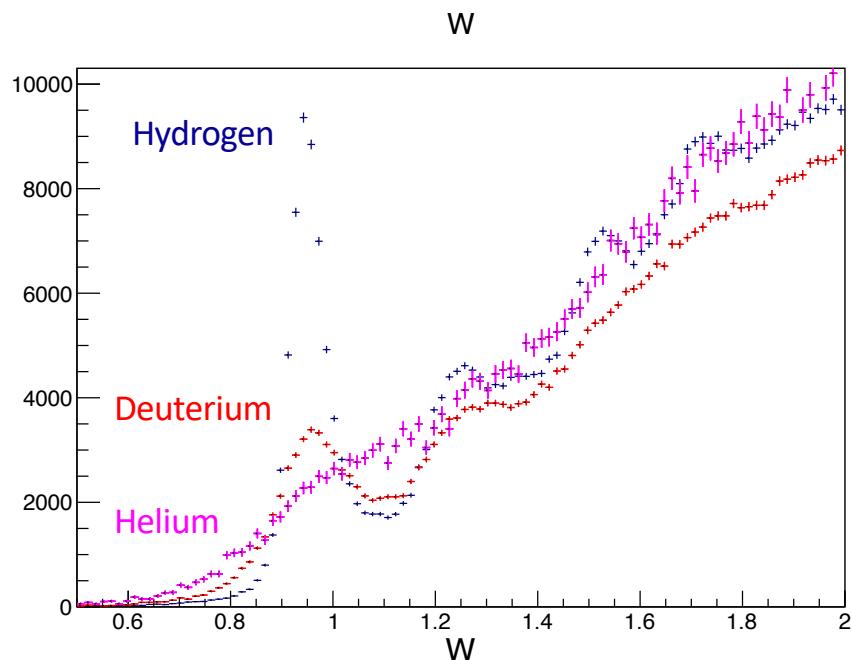
- Electron beam 2, 4, 6 GeV
- $h, d, {}^4He, {}^{12}C, {}^{40}Ar,$
 ${}^{40}Ca, {}^{48}Ca, {}^{120}Sn$
- CLAS12 Detector



CLAS12 Overview

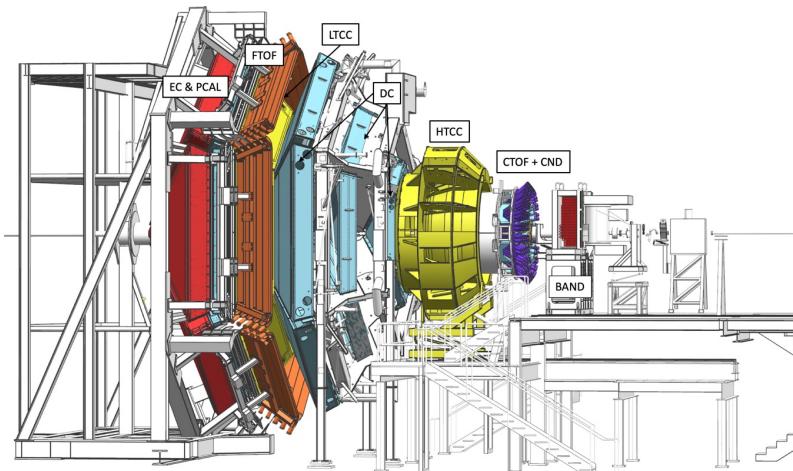


Online analysis of RGM produced great results



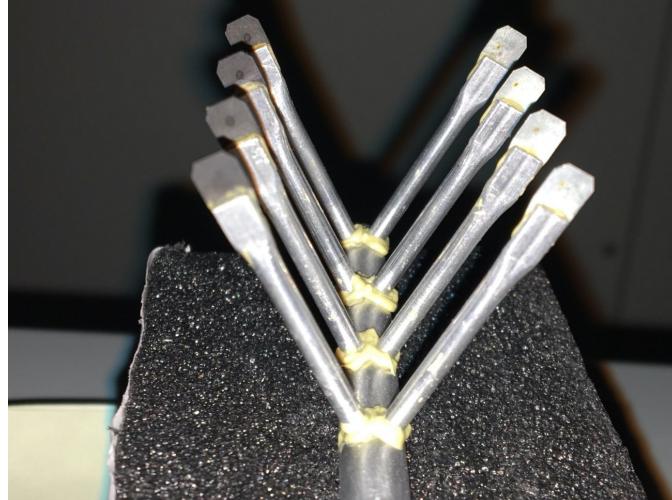
CLAS12 Data Offers

- High statistics for SRC data



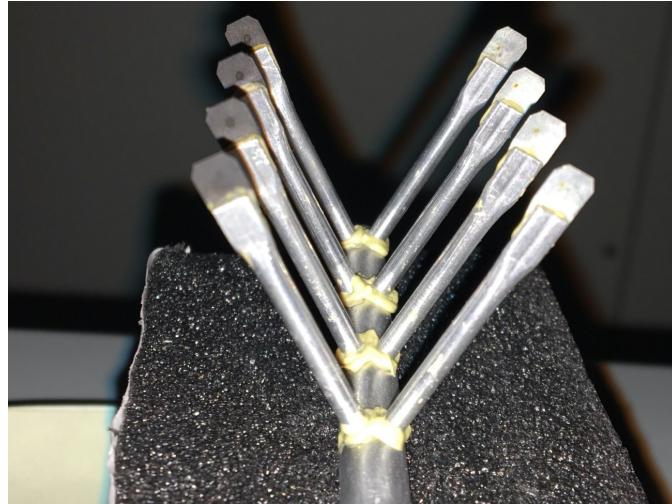
CLAS12 Data Offers

- High statistics for SRC data
- Helium and Carbon Targets for 3N SRC studies



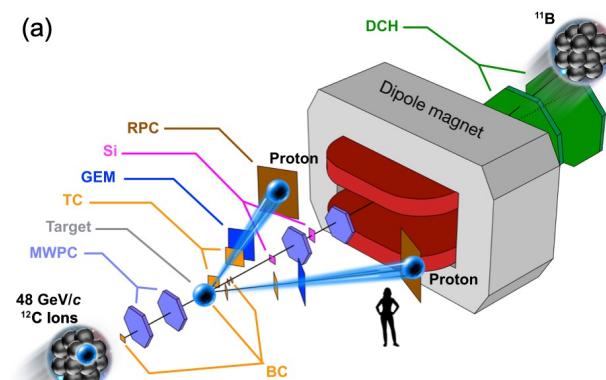
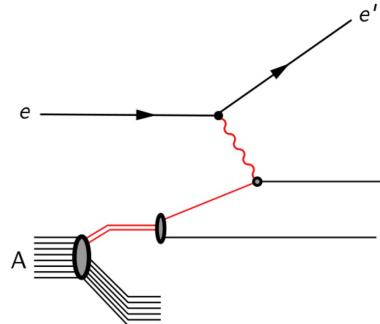
CLAS12 Data Offers

- High statistics for SRC data
- Helium and Carbon Targets for 3N SRC studies
- ^{40}Ar , ^{40}Ca , ^{48}Ca , ^{120}Sn Targets for separating effects of size and asymmetry.



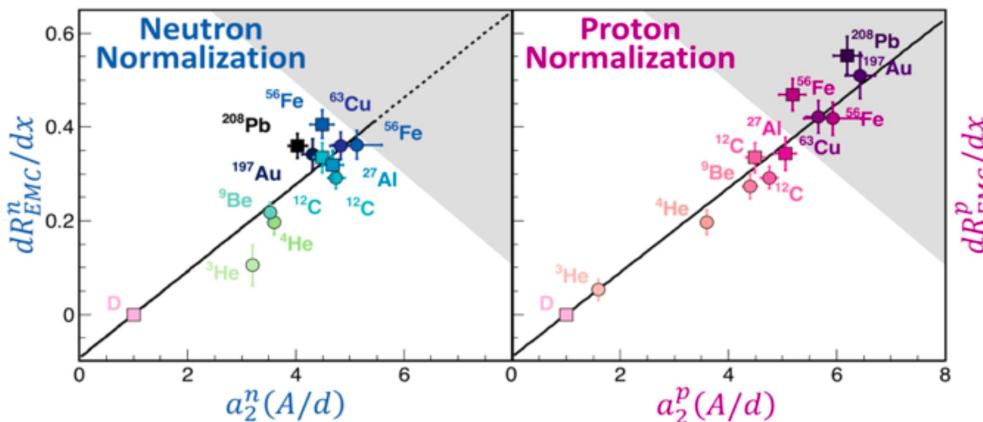
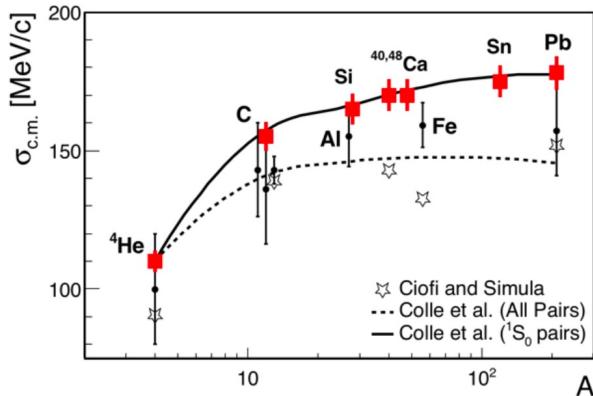
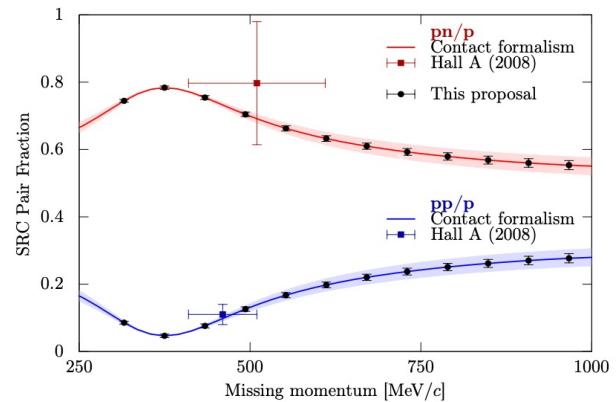
CLAS12 Data Offers

- High statistics for SRC data
- Helium and Carbon Targets for 3N SRC studies
- ^{40}Ar , ^{40}Ca , ^{48}Ca , ^{120}Sn Targets for separating effects of size and asymmetry.
- New theory and data to compare



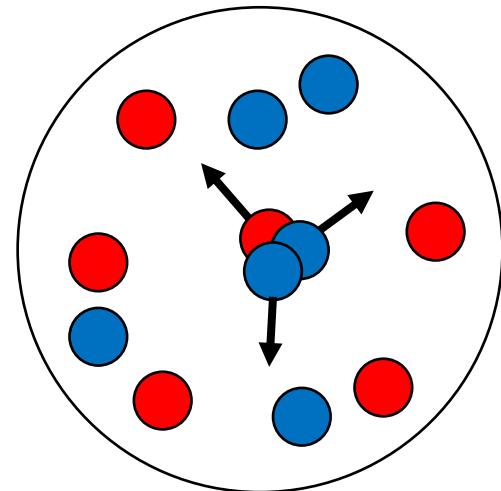
Physics Goals of RGM

- Short Range Correlations
 - NN-interaction
 - SRC pair formation
 - EMC/SRC Relation
 - SRC Scale Universality



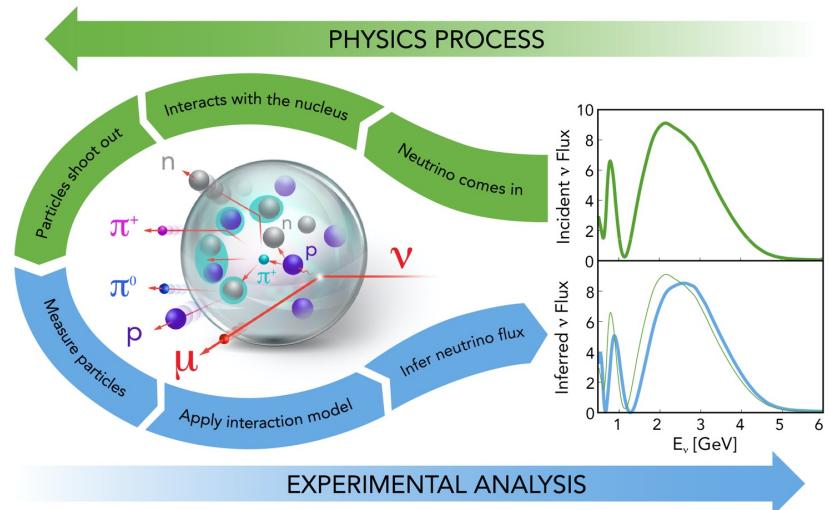
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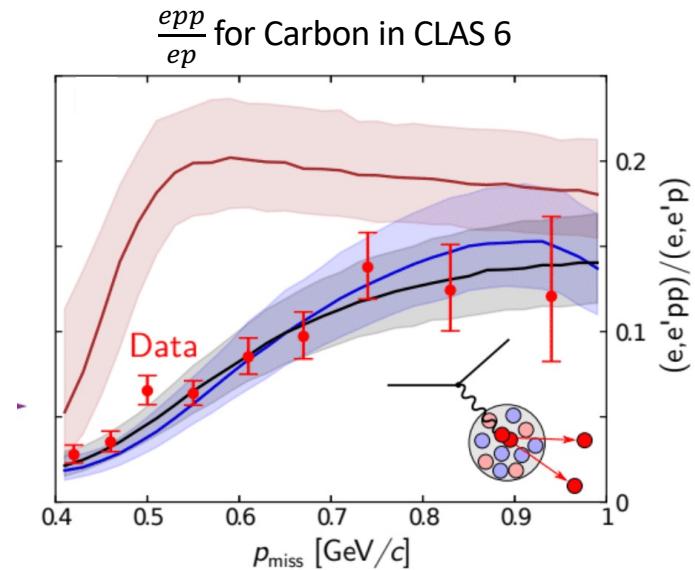
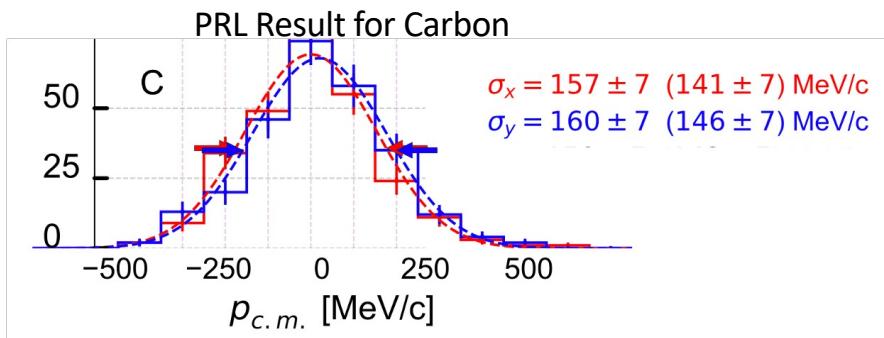


Physics Goals of RGM

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 - SRC Scale Universality
- Search for 3N SRCs
- Electrons for Neutrinos



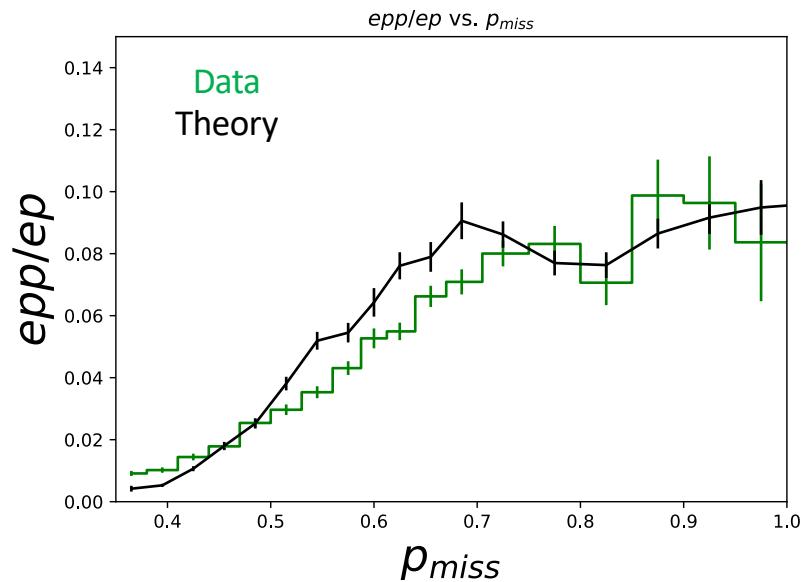
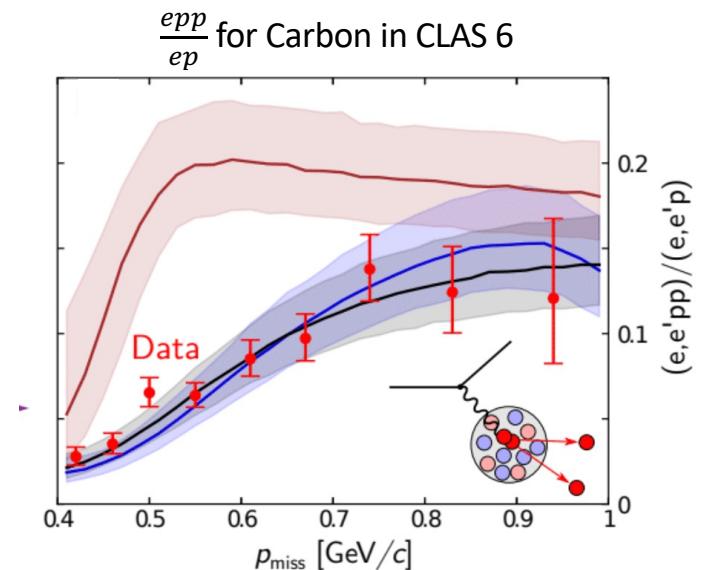
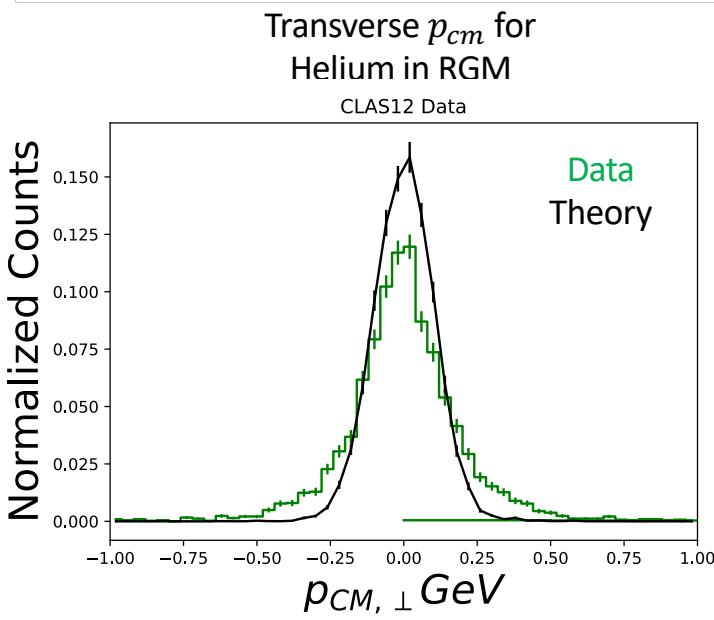
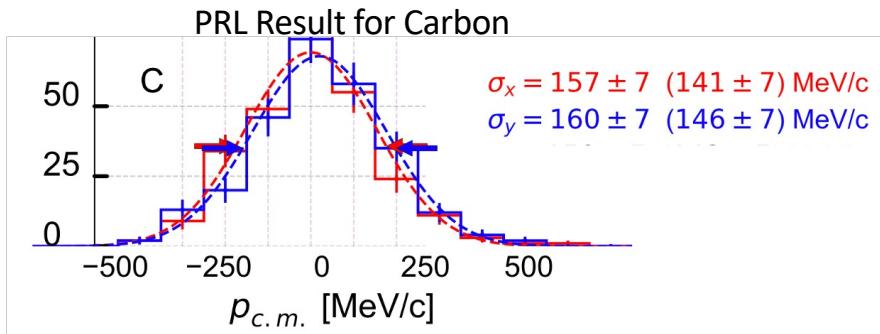
Previous SRC results



List of Event Selection Cuts

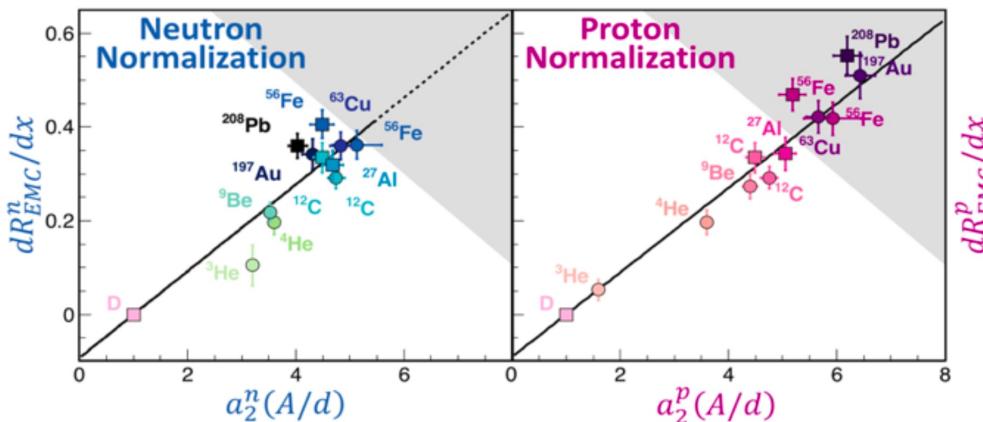
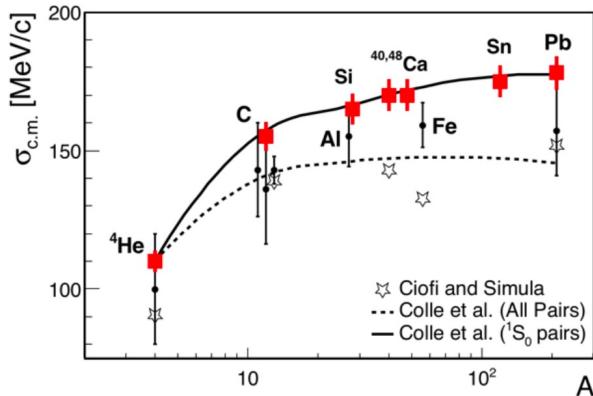
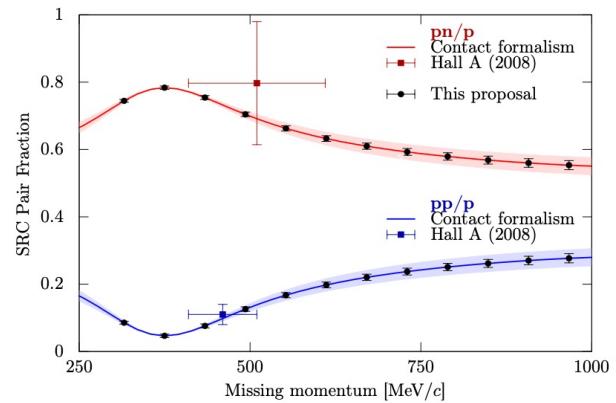
- $1.2 < x_B$
- $1.5 \text{ GeV} < Q^2$
- $\theta_{pq} < 25^\circ$
- $300 \text{ MeV} < p_{miss}$
- $m_{miss} < 1.1 \text{ GeV}$
- $0.62 < \frac{p}{q} < 0.96$

Previous SRC results reproduced by RGM

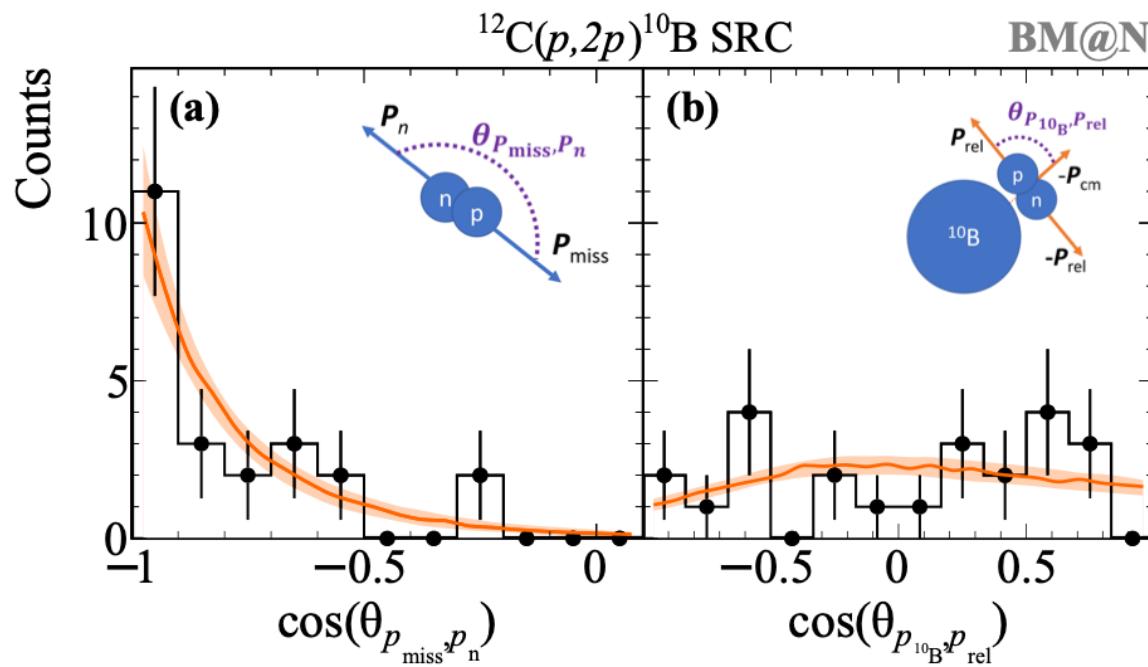
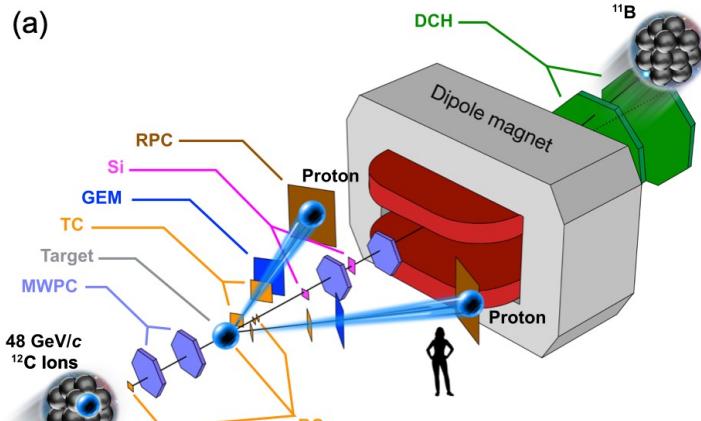


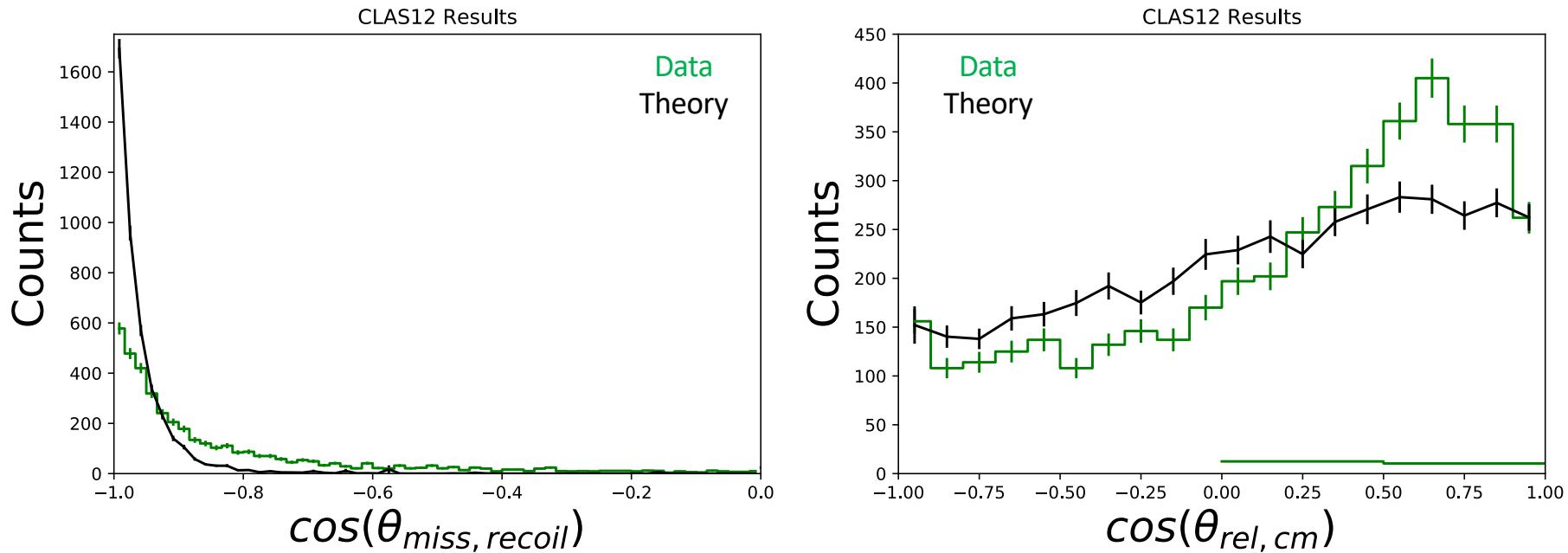
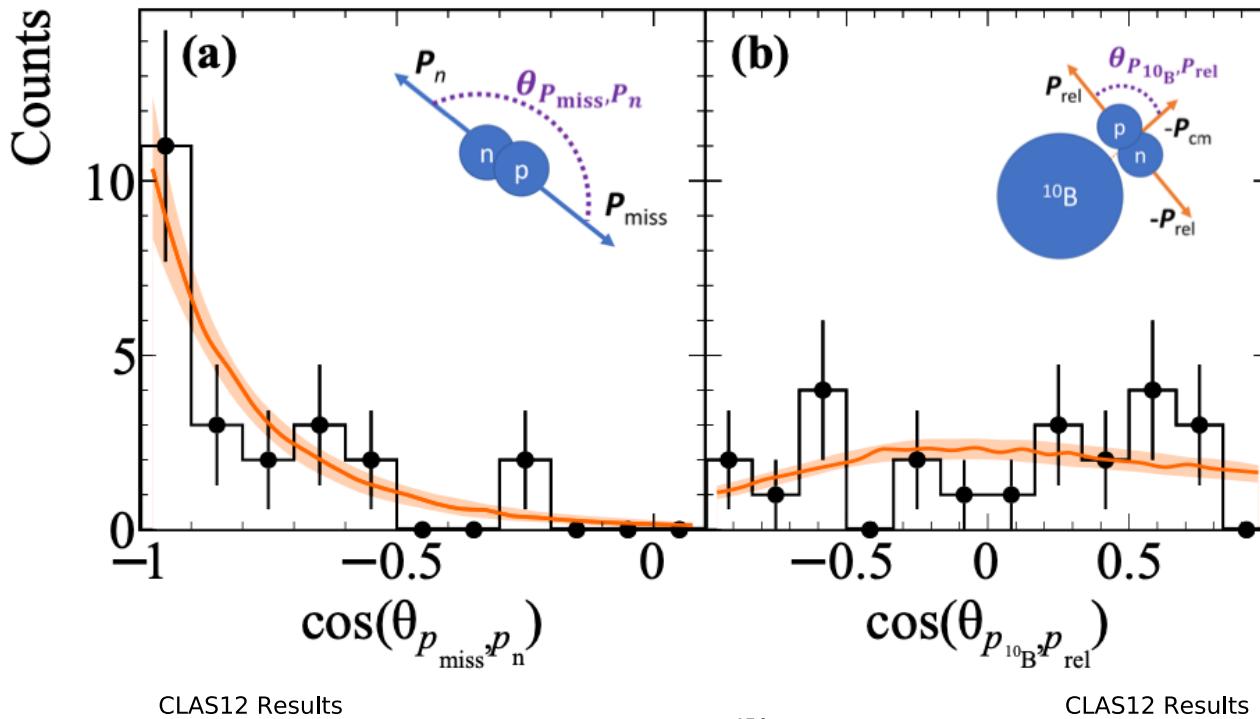
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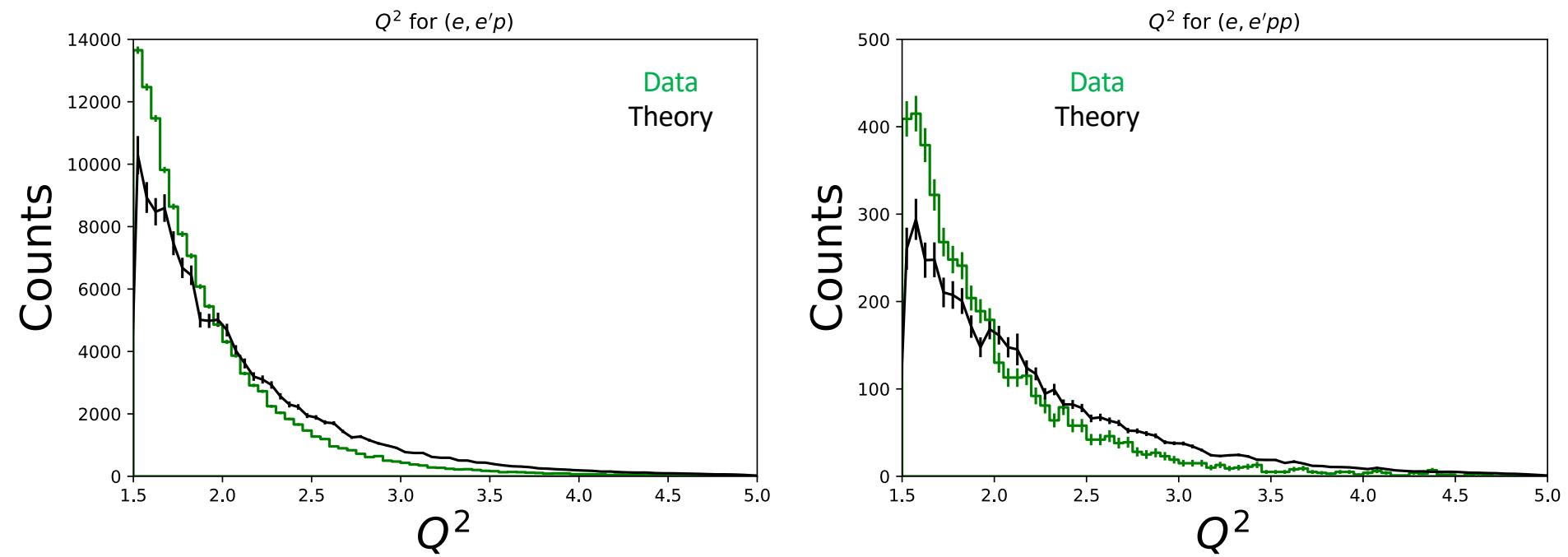


Universality of SRCs



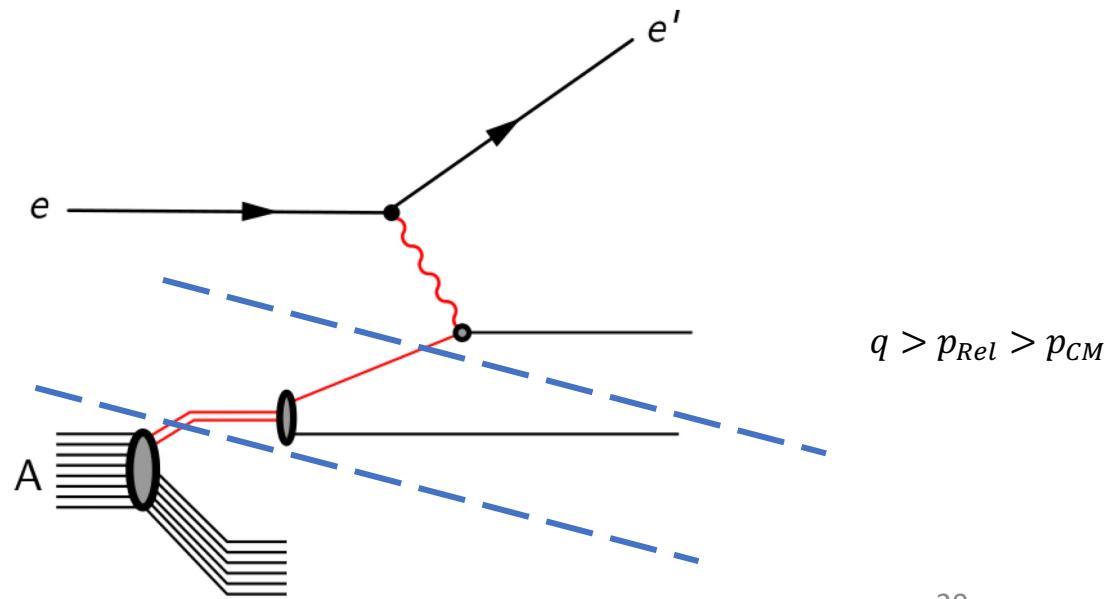


Universality of Scale



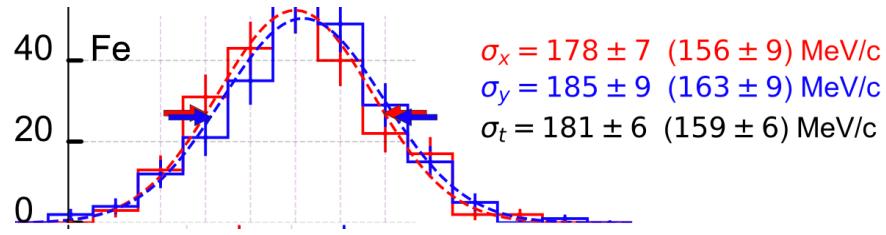
Generalized Contact Formalism

$$\frac{d^8\sigma}{d\phi_k dQ^2 dx_B d^3\vec{p}_{CM} d\Omega_{p2}} = \mathcal{J}\sigma_{e,N} \sum_{\alpha} |\tilde{\varphi}^{\alpha}(|\vec{p}_{Rel}|)|^2 C^{\alpha} n^{\alpha}(\vec{p}_{CM})$$

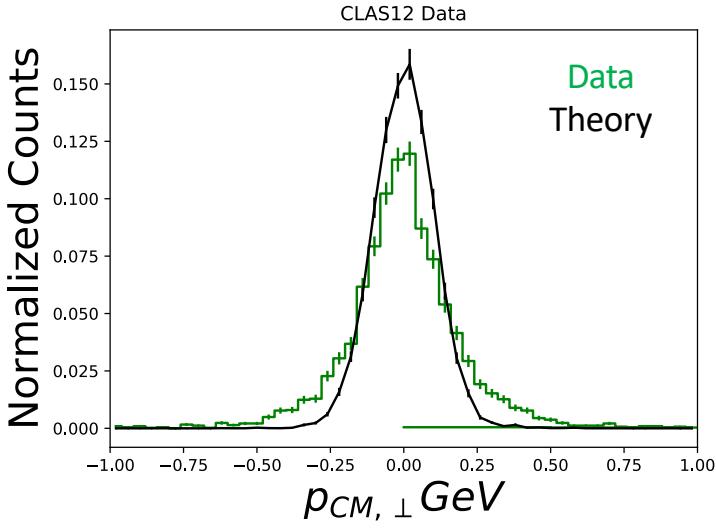


Previous SRC results reproduced by RGM

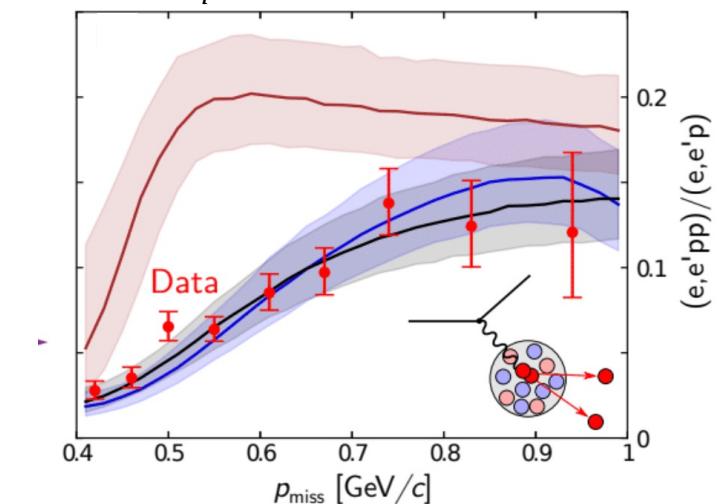
PRL Result for Iron



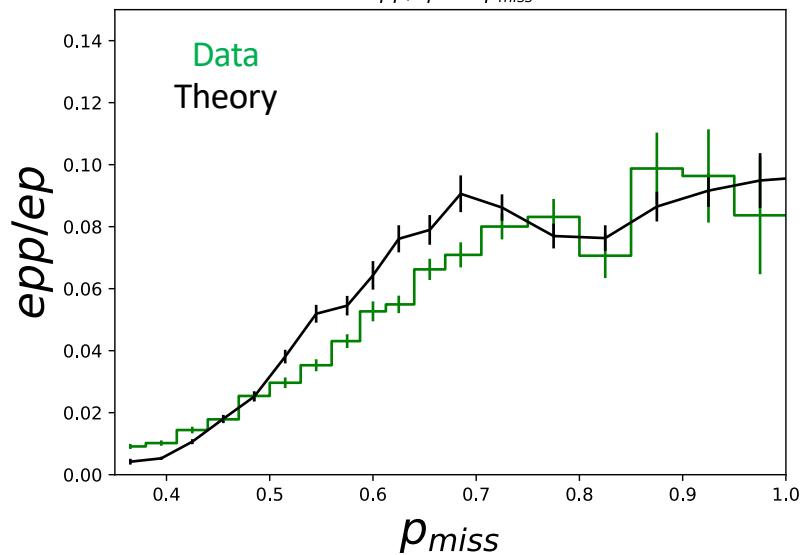
Transverse p_{cm} for Helium in RGM



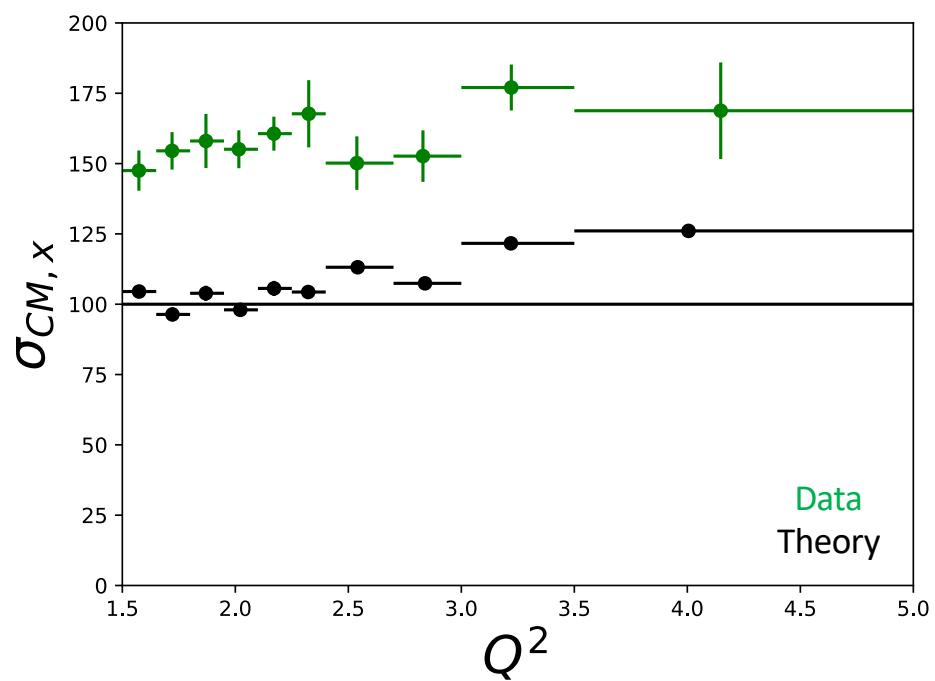
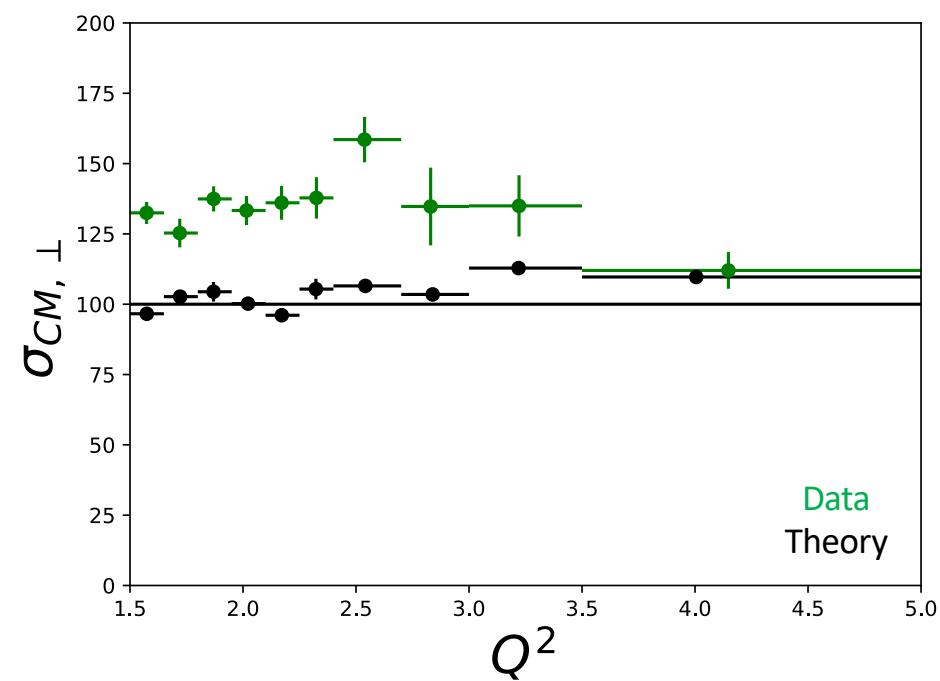
$\frac{epp}{ep}$ for Carbon in CLAS 6

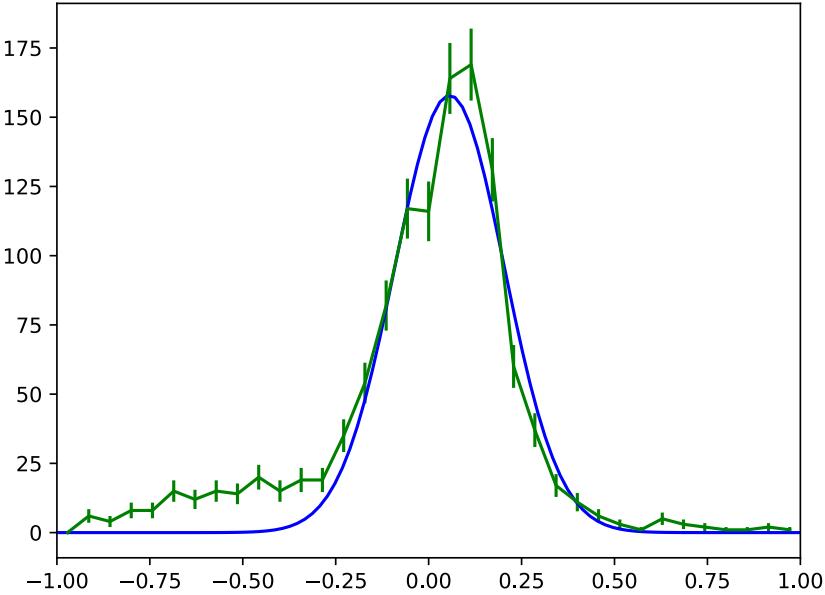
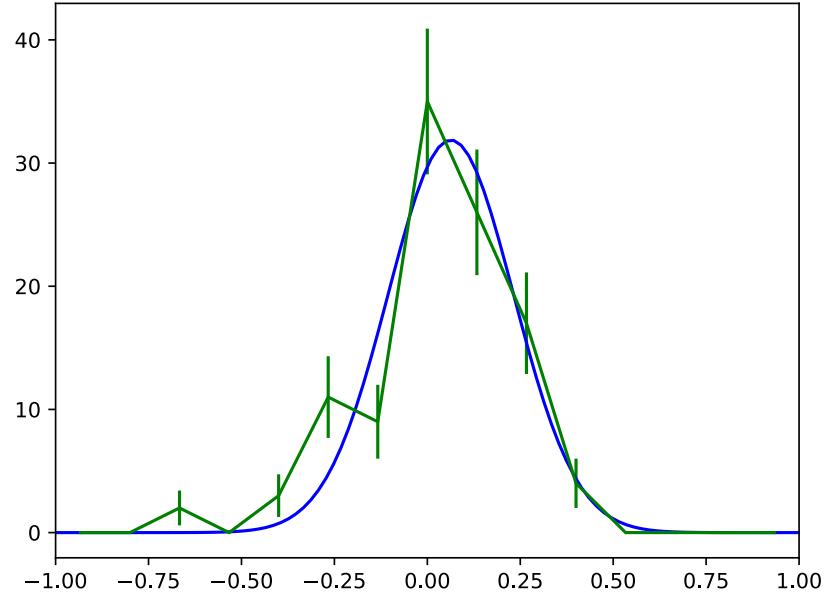
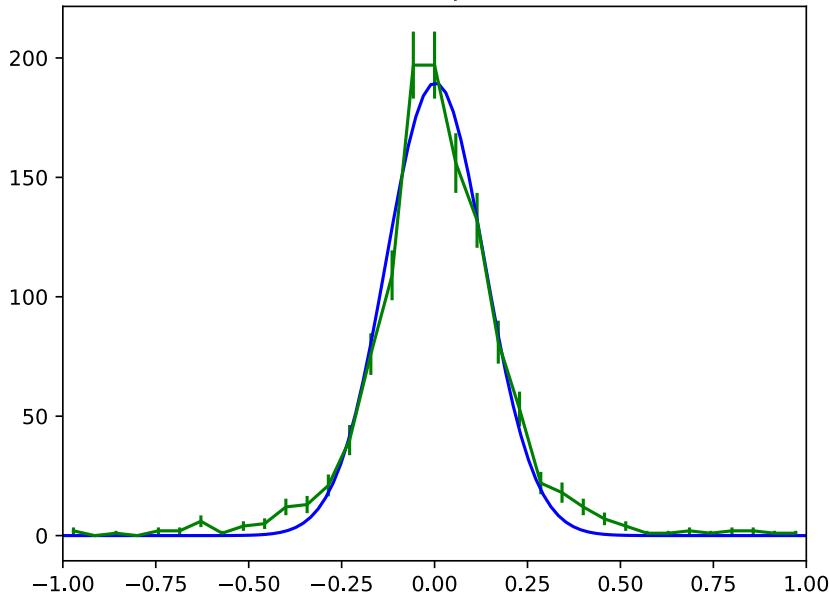
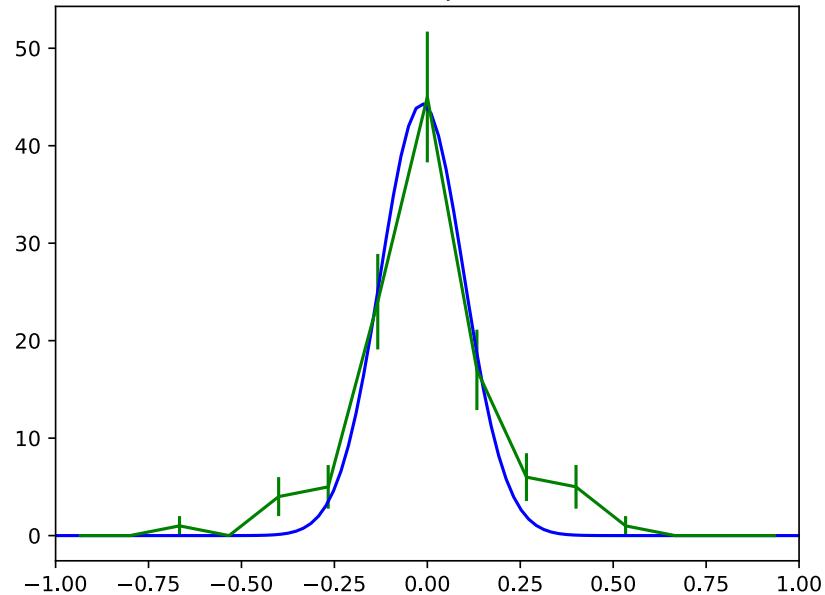


epp/ep vs. p_{miss}

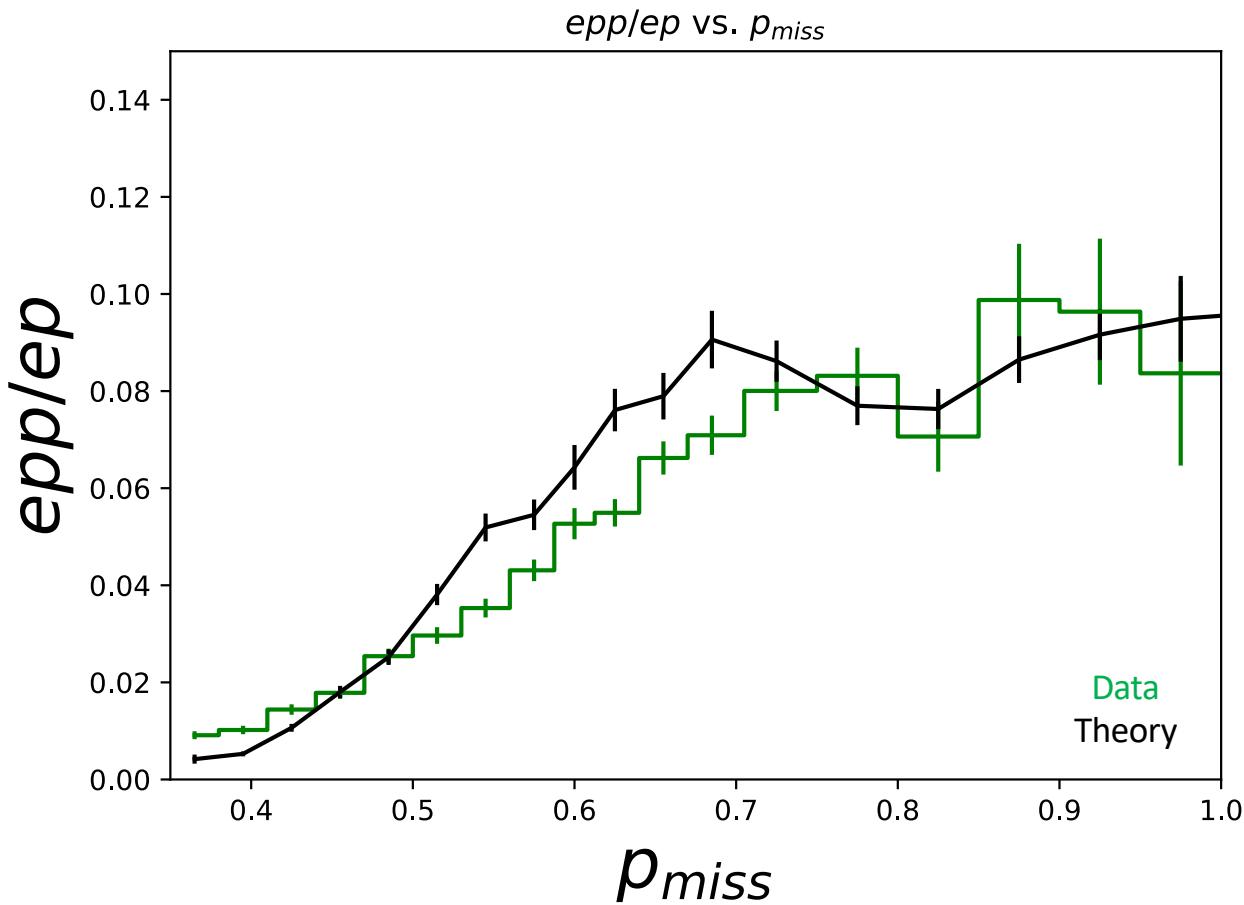


σ_{CM} is overall flat in Q^2

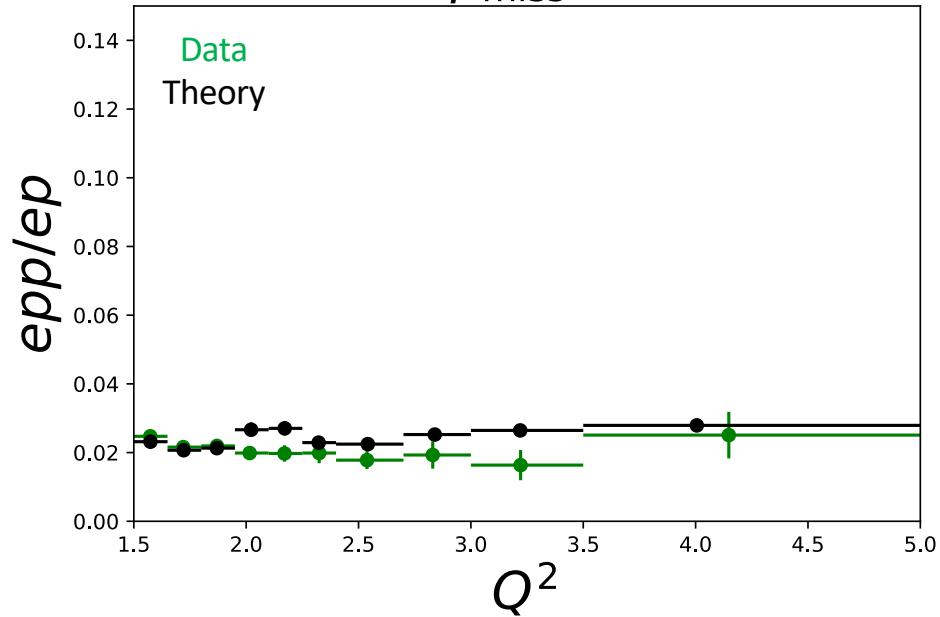


$\sigma_{CM, x}$  $\sigma_{CM, x}$  $\sigma_{CM, y}$  $\sigma_{CM, y}$ 

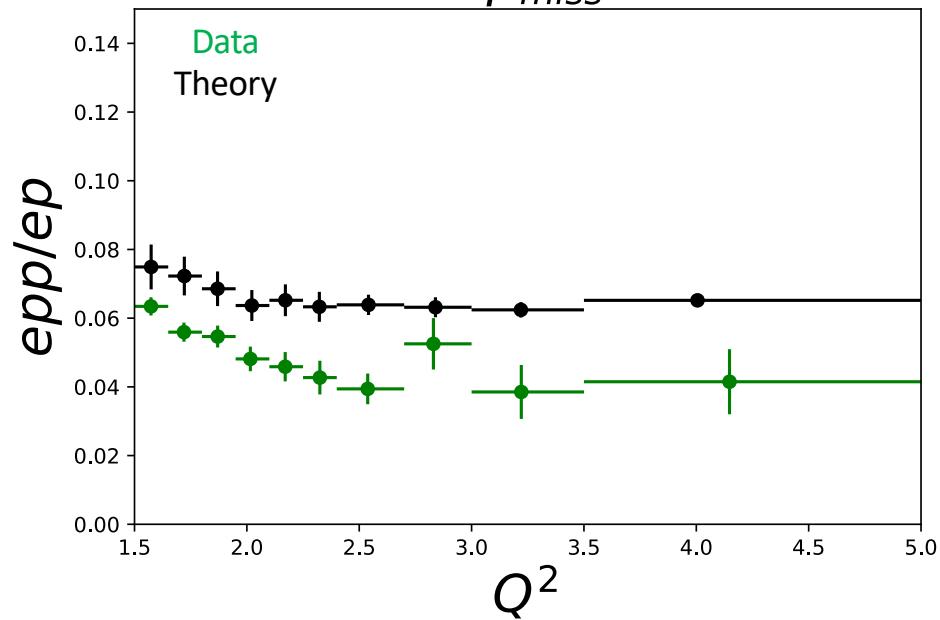
How does epp/ep change over Q^2 ?



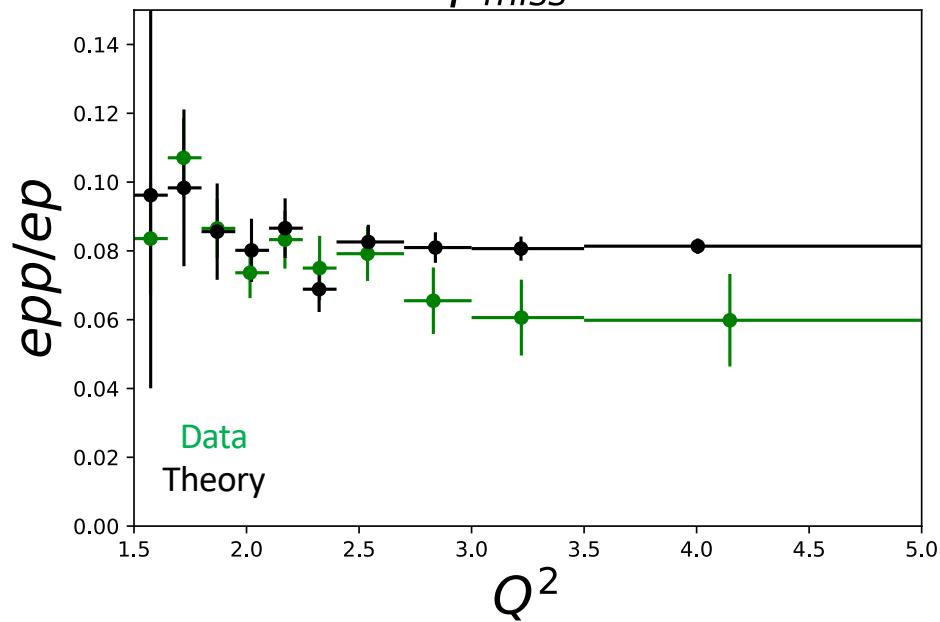
$0.4\text{GeV} < p_{miss} < 0.55\text{GeV}$



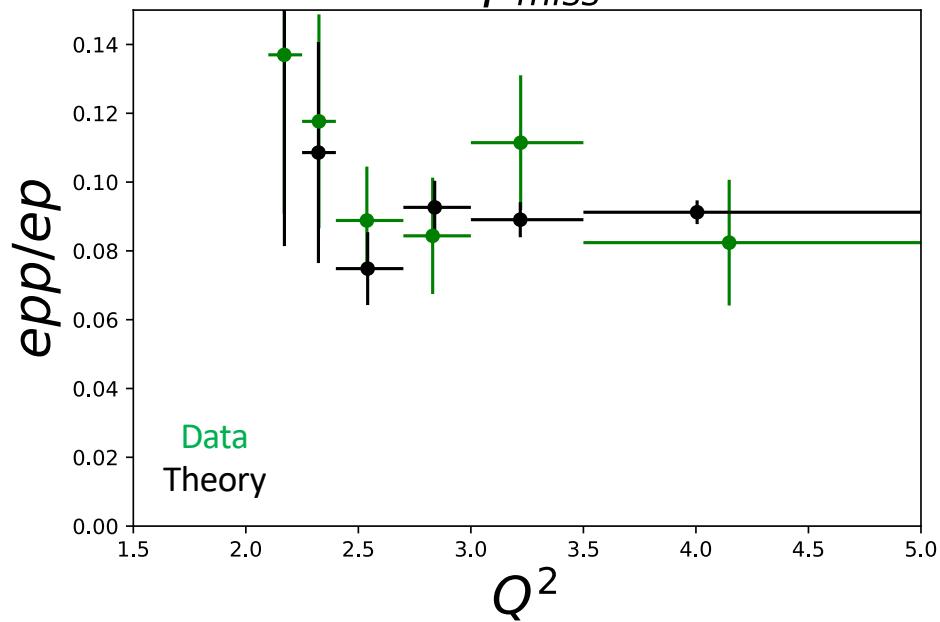
$0.55\text{GeV} < p_{miss} < 0.7\text{GeV}$



$0.7\text{GeV} < p_{miss} < 0.85\text{GeV}$

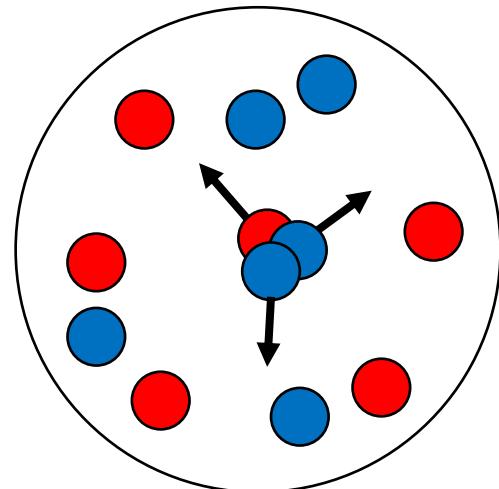


$0.85\text{GeV} < p_{miss} < 1.0\text{GeV}$



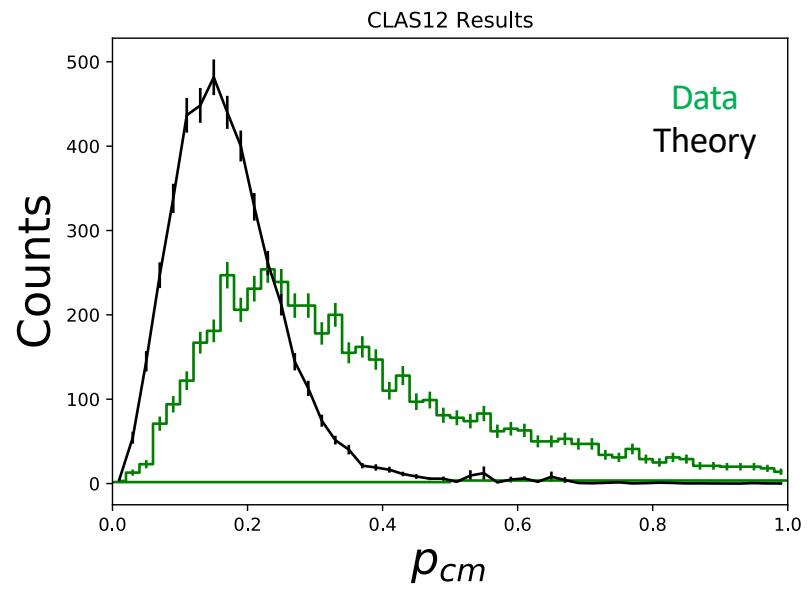
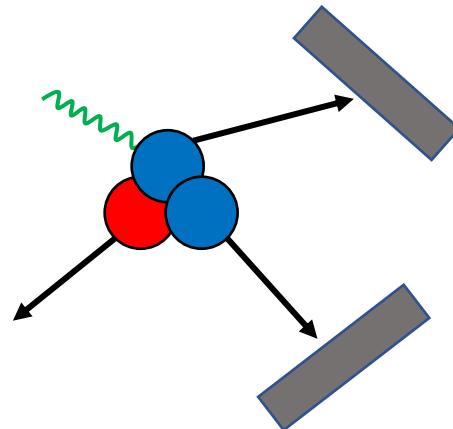
Physics Goals of RGM

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- Search for 3N SRCs



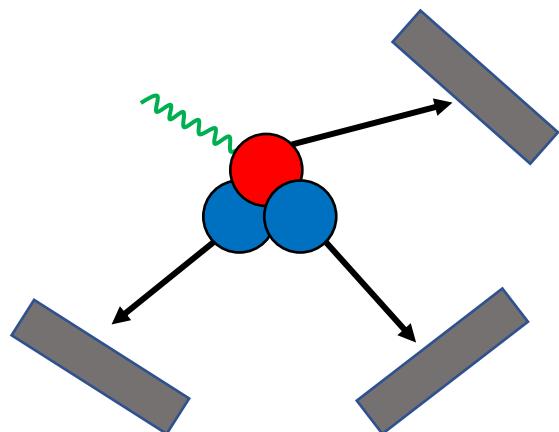
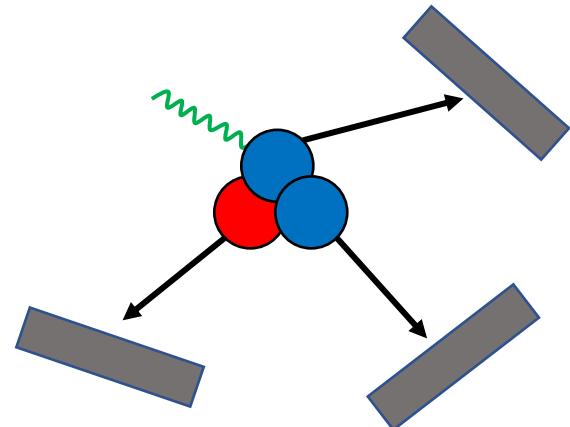
Searching for 3N SRCs

- $(e, e' pp)N$
 - High statistics
 - Low information



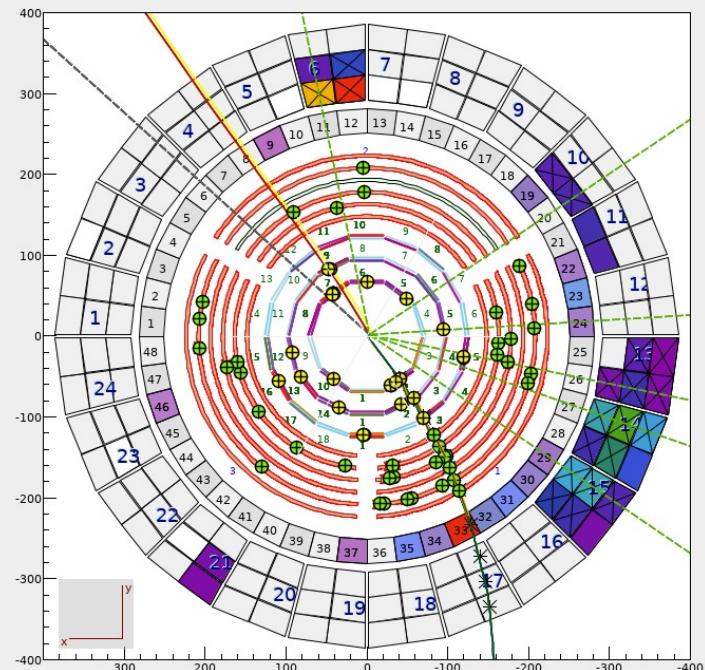
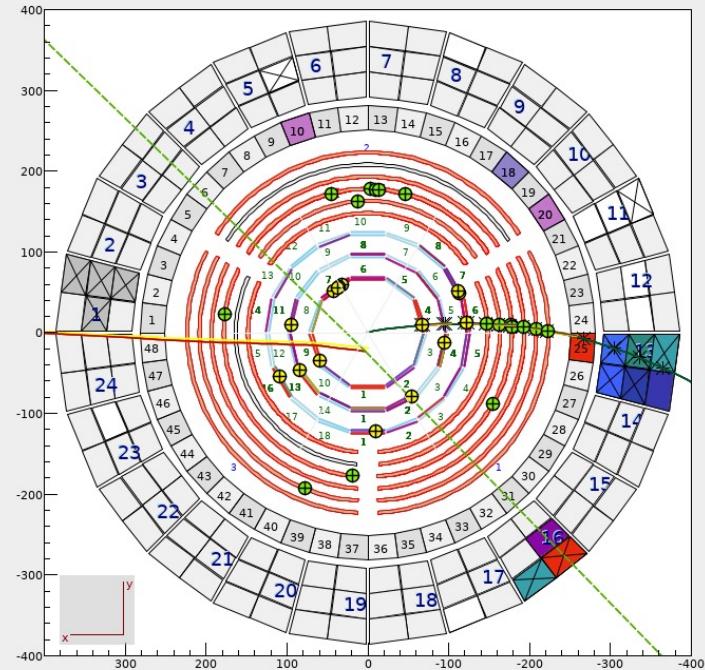
Searching for 3N SRCs

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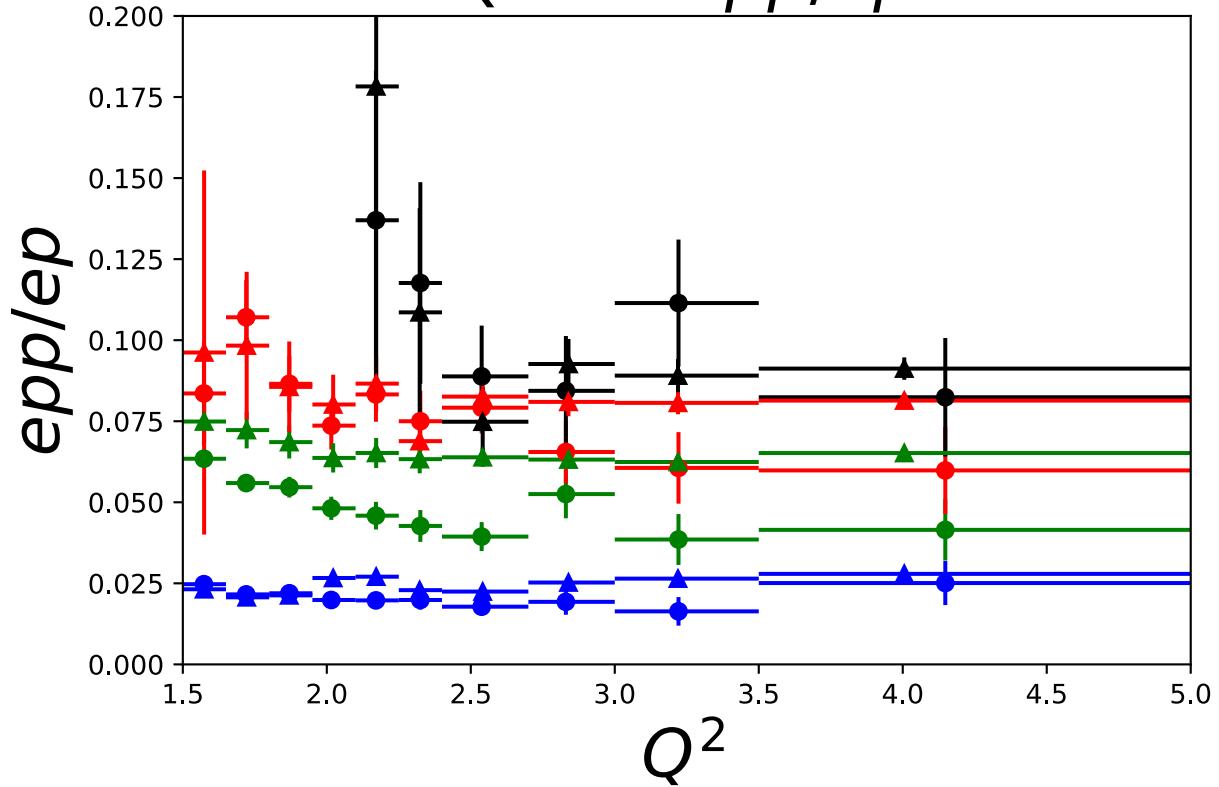
Some of my questions:

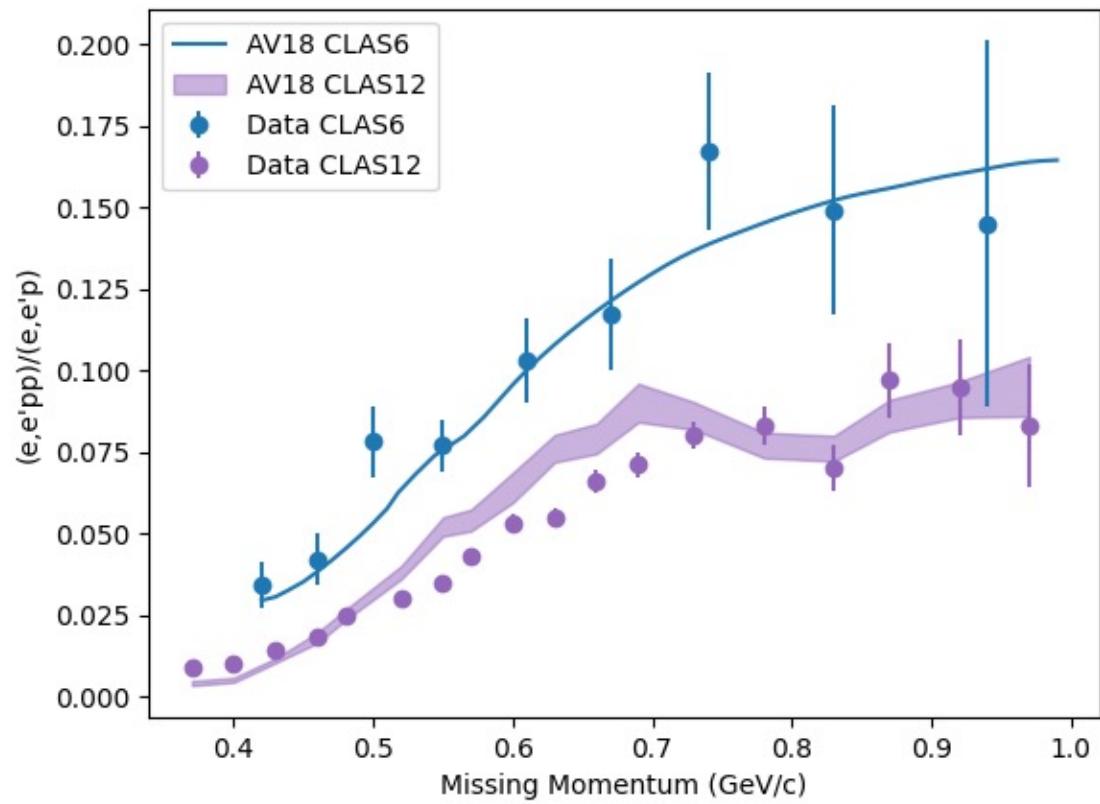
- What are the ideal reaction mechanisms?
- What observables can help us isolate 3N SRCs?
- How do we reduce the effects of Inelastic and FSI contributions with event selection cuts?
- Can we develop a 3N spectral function to do full cross section calculations?

Conclusions

- RGM was setup to address several SRC topics and will fulfill those goals.
- Preliminary helium data shows that SRC variables are largely independent of scale.
- The search for 3N SRCs is an imminent project on RGM which will need guidance from theory.

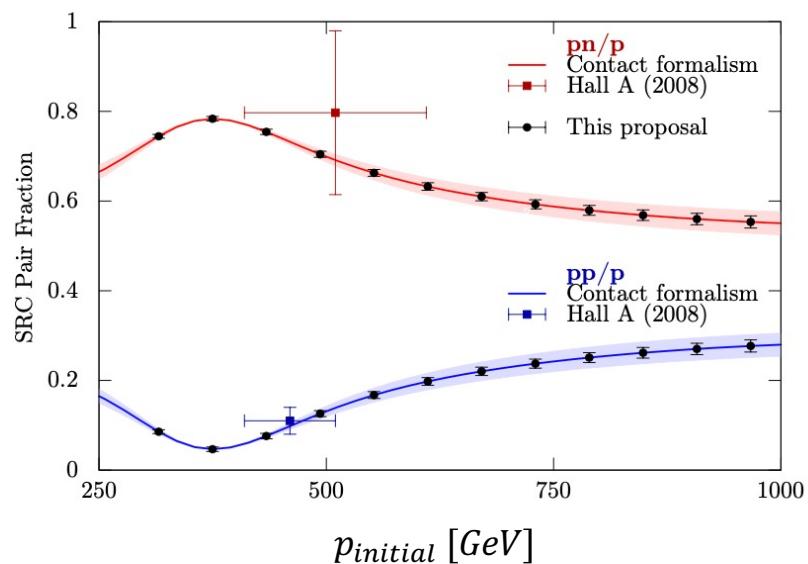
Q^2 vs. epp/ep





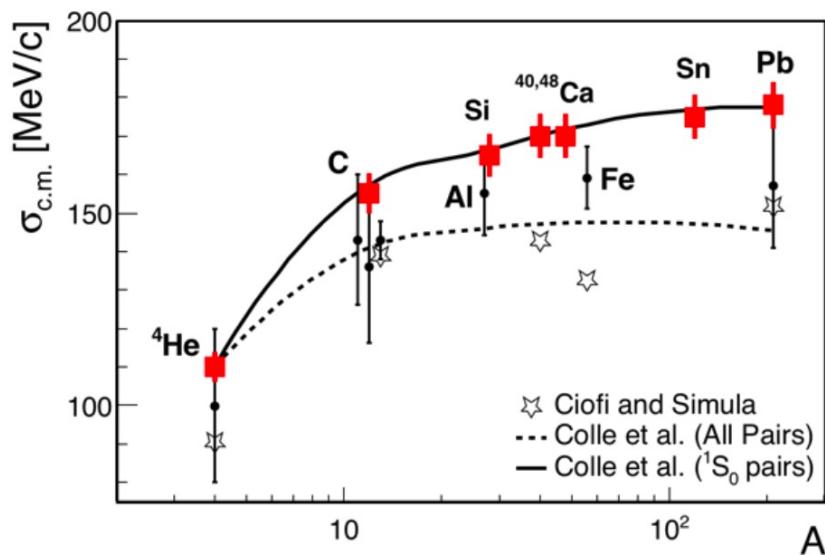
Physics Goals of RGM

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- Short Range Correlations
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 - SRC pair formation



Physics Goals of RGM

- Short Range Correlations

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