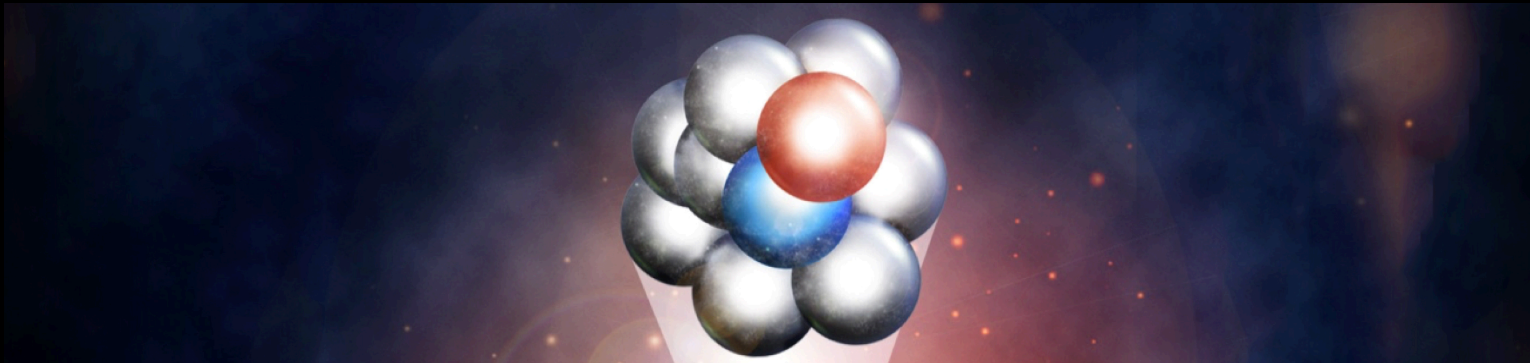


2-Body Momentum Distributions and 2N-SRC

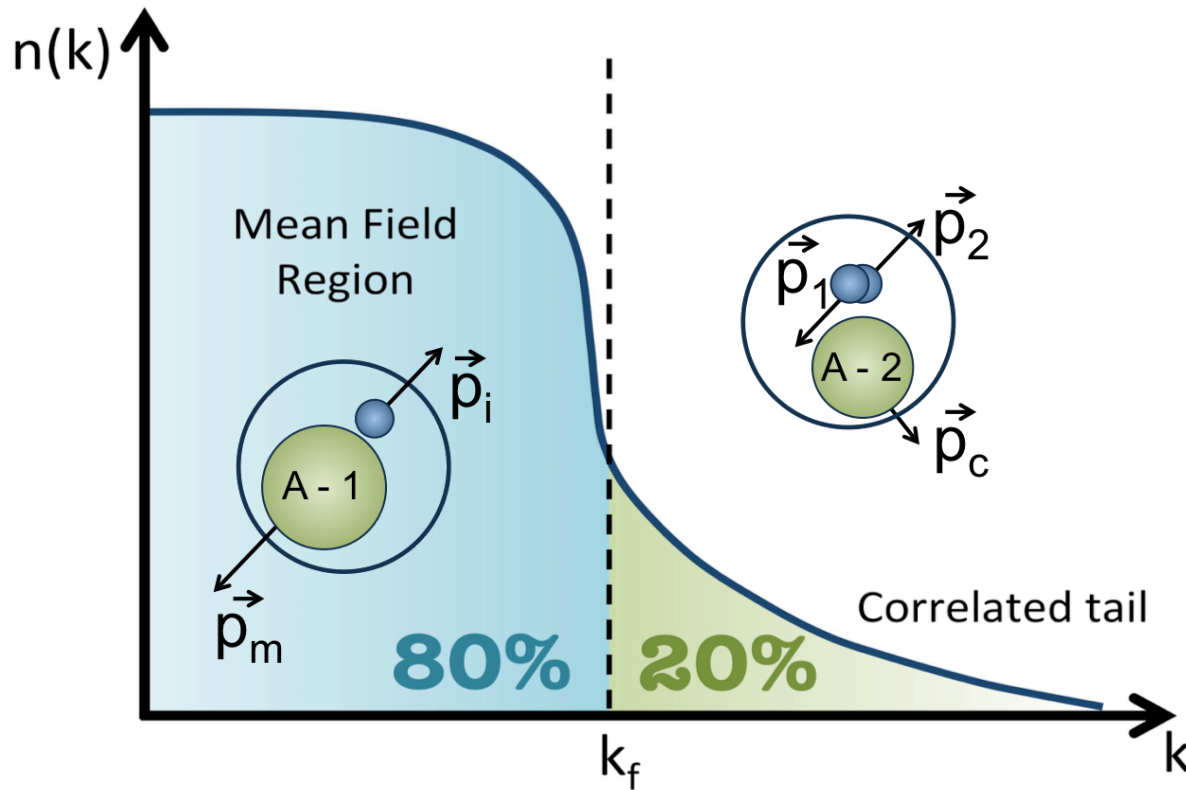


Reynier Cruz Torres

Quantitative challenges in EMC and SRC Research
and Data-Mining

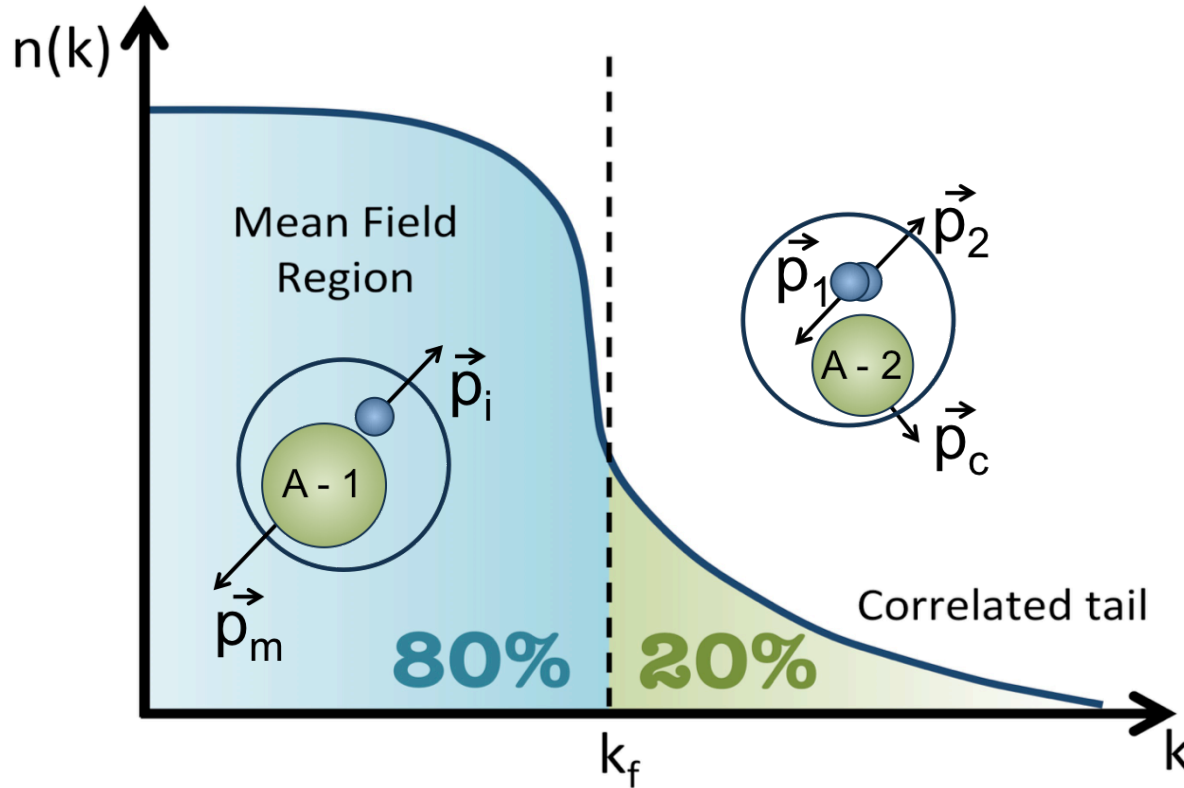
December 2, 2016

2N-SRC



Nucleons in the pair have high relative momentum and low center of mass momentum relative to k_f .

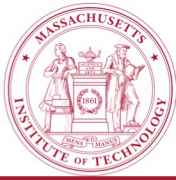
2N-SRC



Each individual nucleon has high momentum

Nucleons are at close proximity in the nucleus

2-Body momentum distributions

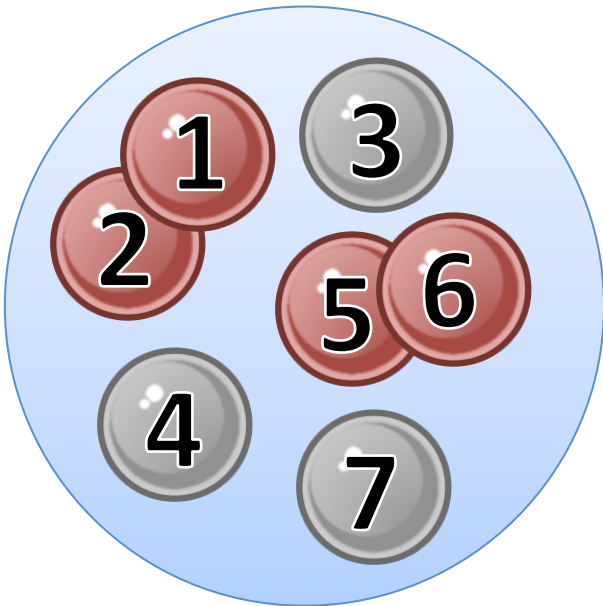
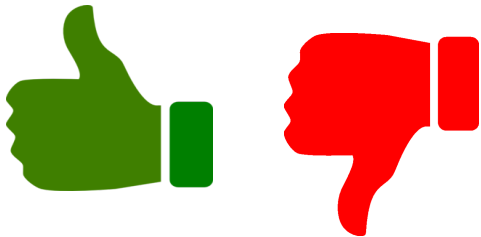


- One Body momentum distribution $[n_N(k)]$:
Probability to find a nucleon, N , in the nucleus with momentum k .
- Two Body momentum distribution $[n_{NN}(q,Q)]$:
Probability to find a NN pair in the nucleus with relative momentum q , and c.m. momentum Q .

$n_{NN}(q,Q)$ – computational Frontier!

2-Body momentum distributions

- $n_{NN}(q, Q)$ – Mathematical object that counts all possible NN pairs, regardless of their state:



Consider all NN pairs:

1-2	5-6			
3-4	3-7	4-7		
1-5	1-6	2-5	2-6	
1-3	1-4	1-7	2-3	
2-4	2-7	3-5	4-5	
5-7	3-6	4-6	6-7	

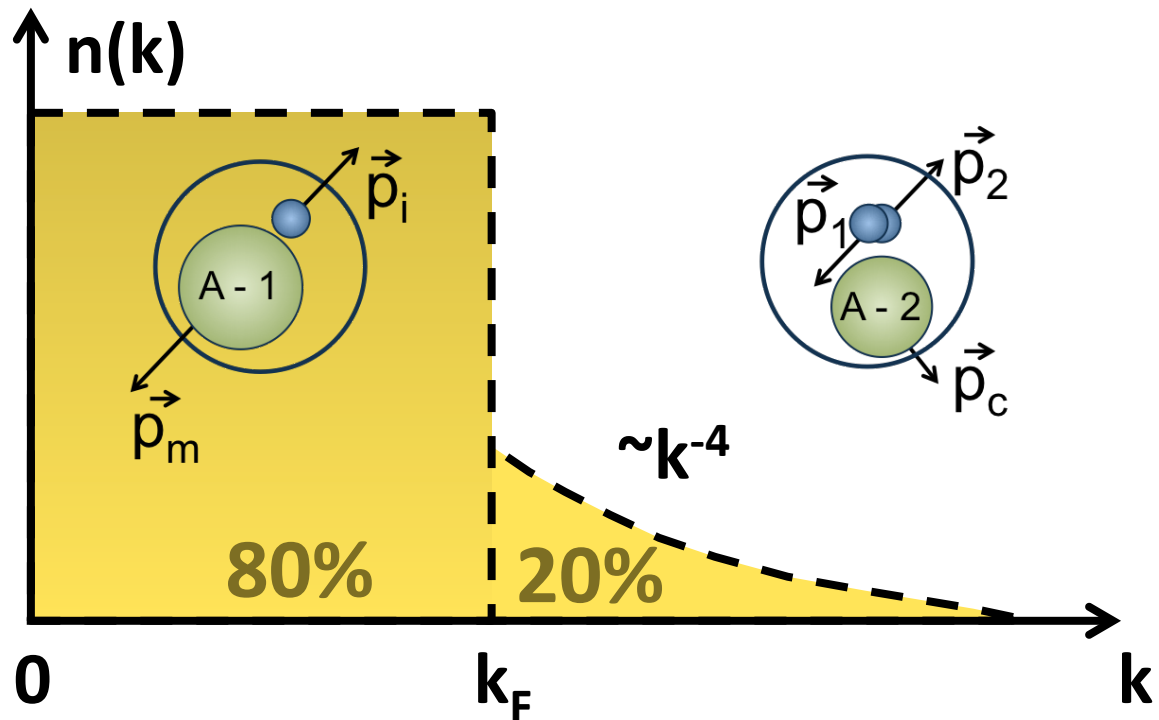
$n_{NN}(q, Q)$

Toy model to the rescue

Build an ideal “contact interaction” system:

- Free Fermi Gas for $k < k_F$
- 2N Correlations with $n_{rel} \sim 1/k^4$ and $n_Q \sim \text{Gaussian}$ for $k > k_F$

Correlated
Fermi Gas
Model





Toy model to the rescue

Build an ideal “contact interaction” system:

Free Fermi Gas for $k < k_F$

2N Correlations with $n_{\text{rel}} \sim 1/k^4$ and $n_Q \sim \text{Gaussian}$ for $k > k_F$

Use Monte Carlo to raffle nucleons and pairs,
and construct the one body and two body
momentum distributions



Toy model to the rescue

Build an ideal “contact interaction” system:

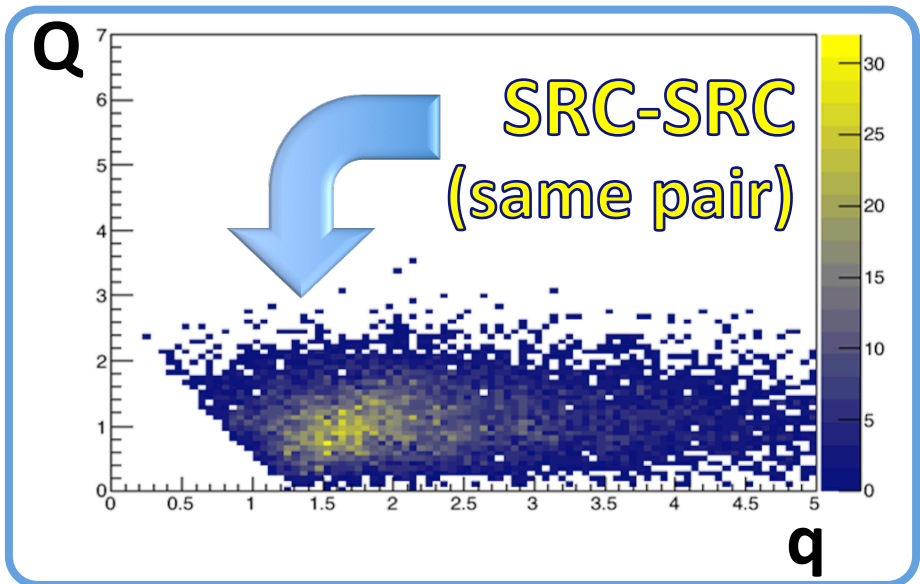
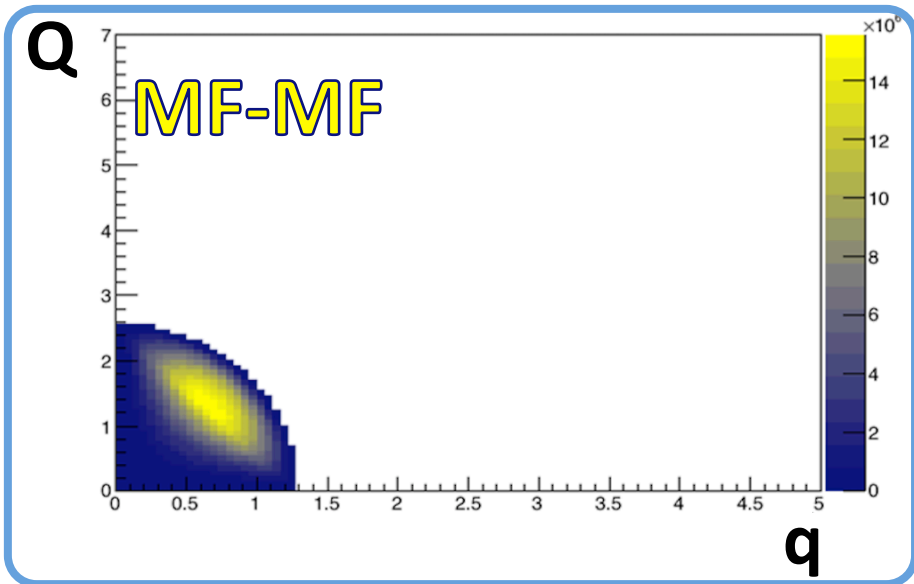
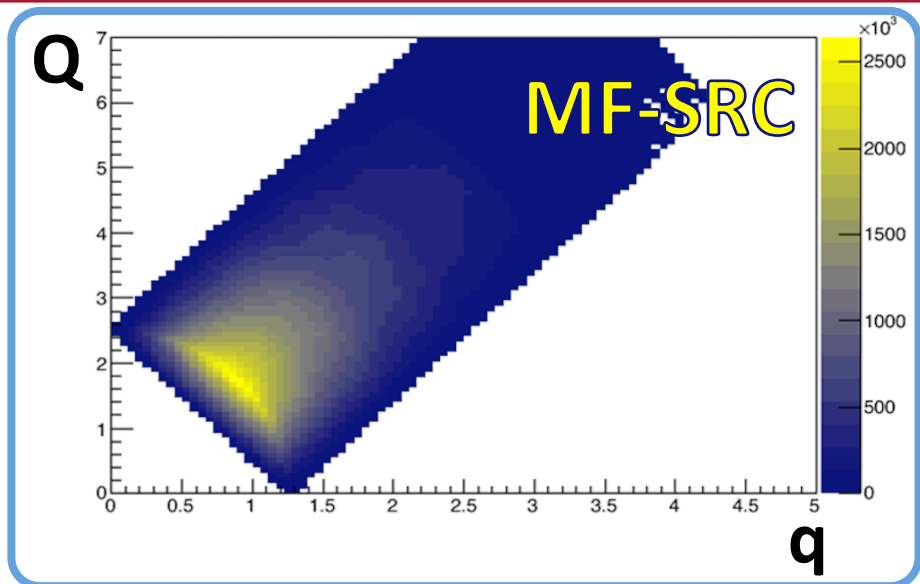
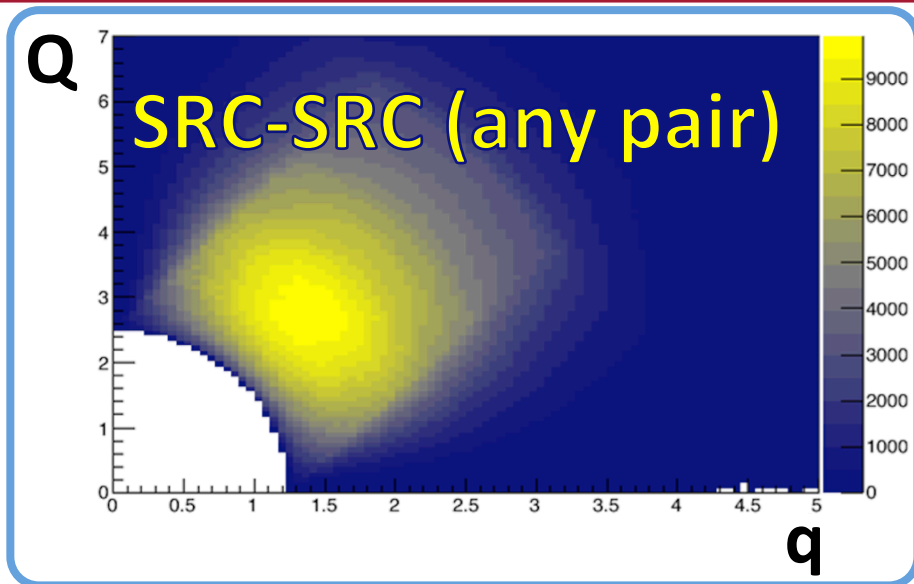
Free Fermi Gas for $k < k_F$

2N Correlations with $n_{\text{rel}} \sim 1/k^4$ and $n_Q \sim \text{Gaussian}$ for $k > k_F$

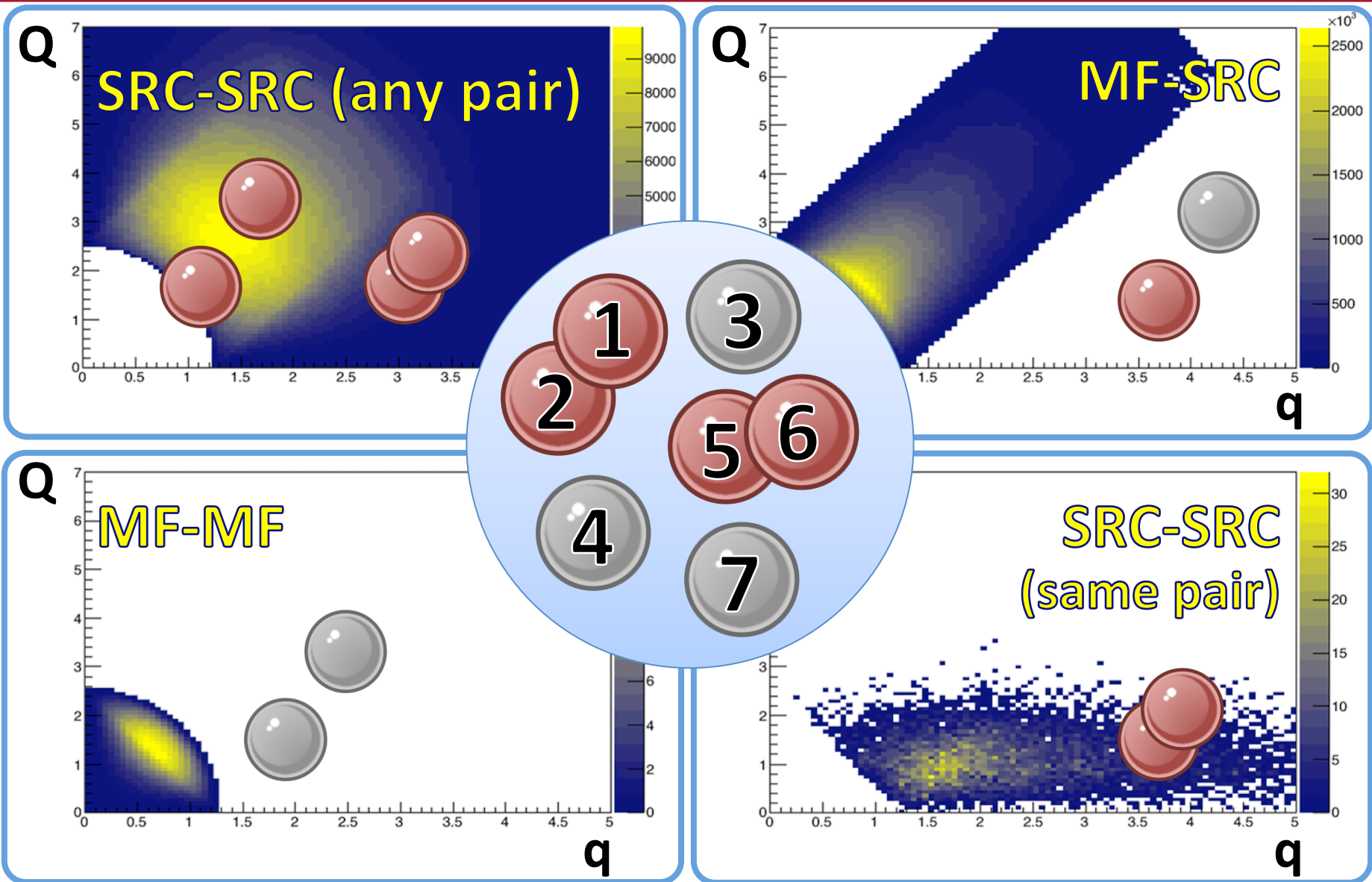
Use Monte Carlo to raffle nucleons and pairs, and construct the one body and two body momentum distributions

Separate different pairs based on their ‘origin’ (mean-field vs. SRC)

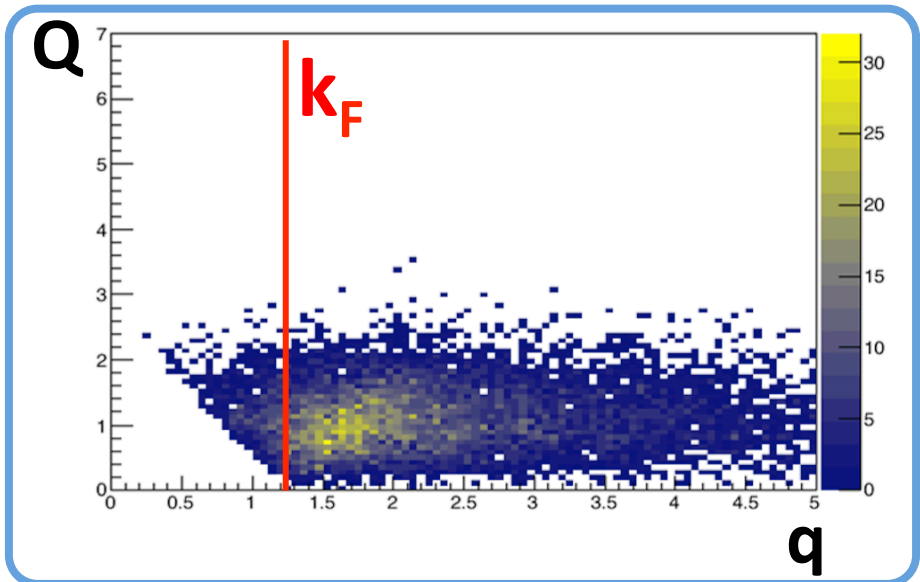
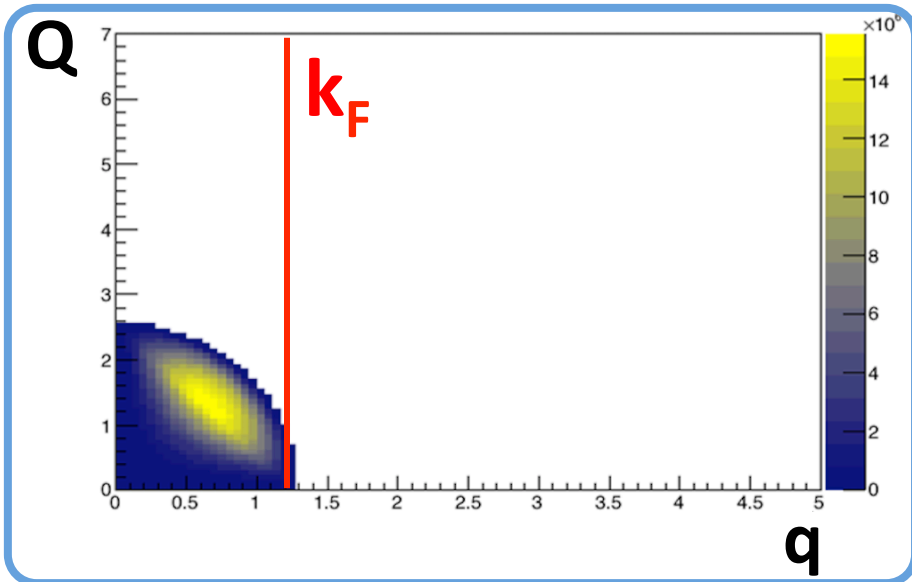
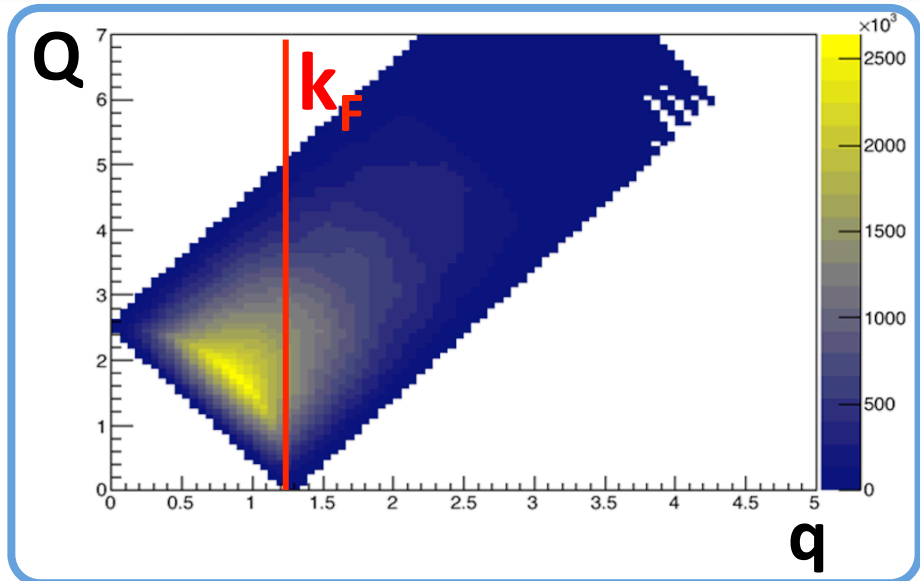
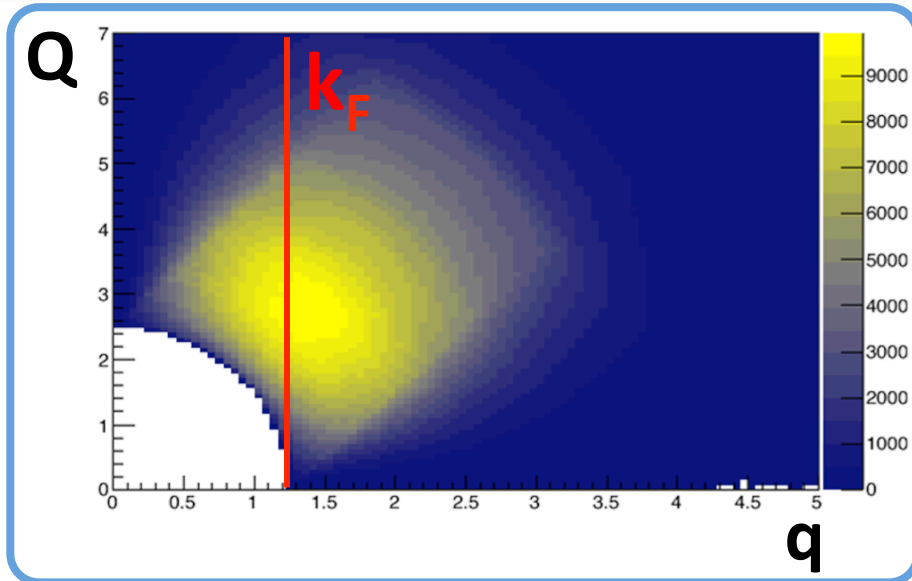
Toy model results



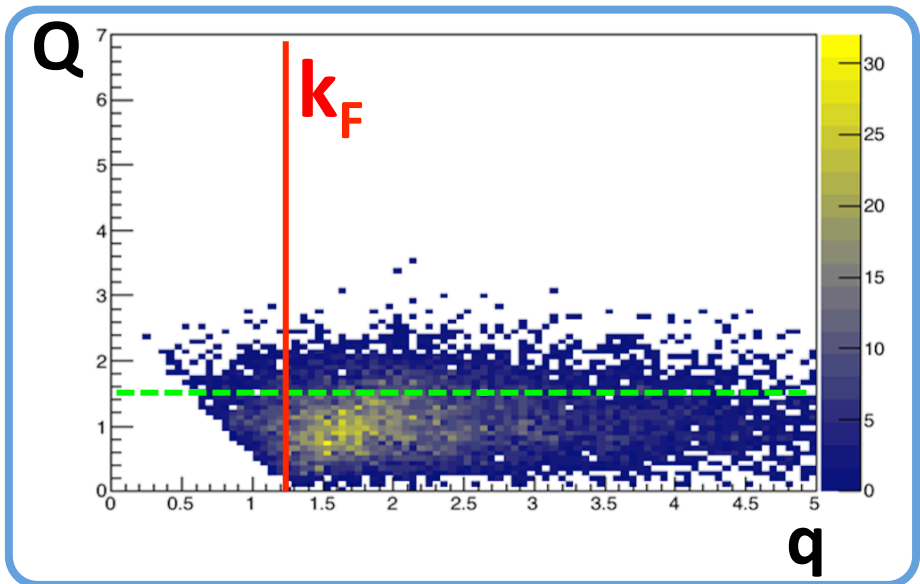
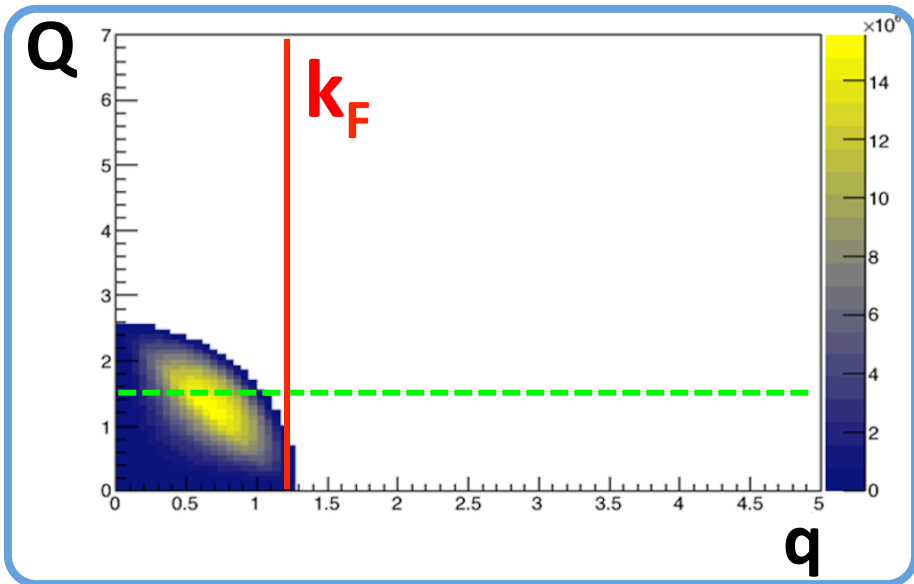
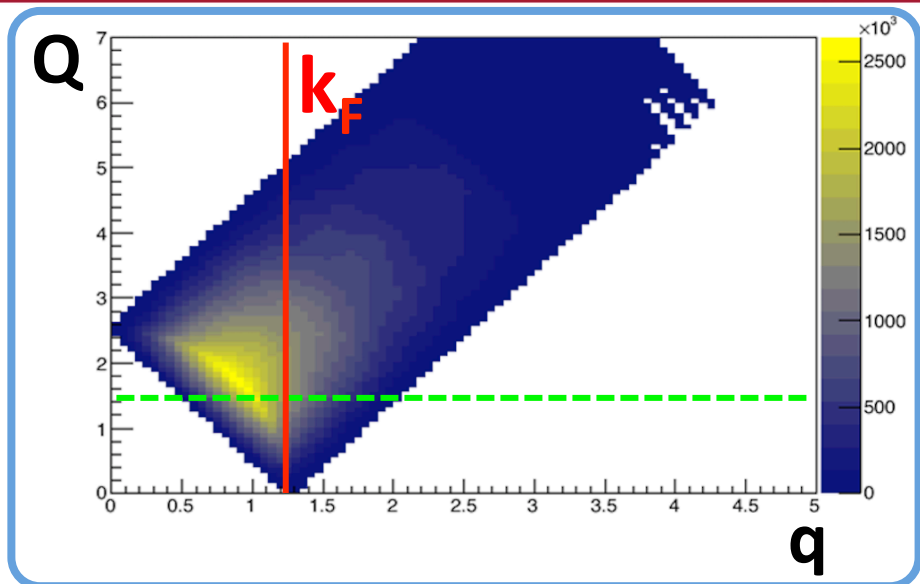
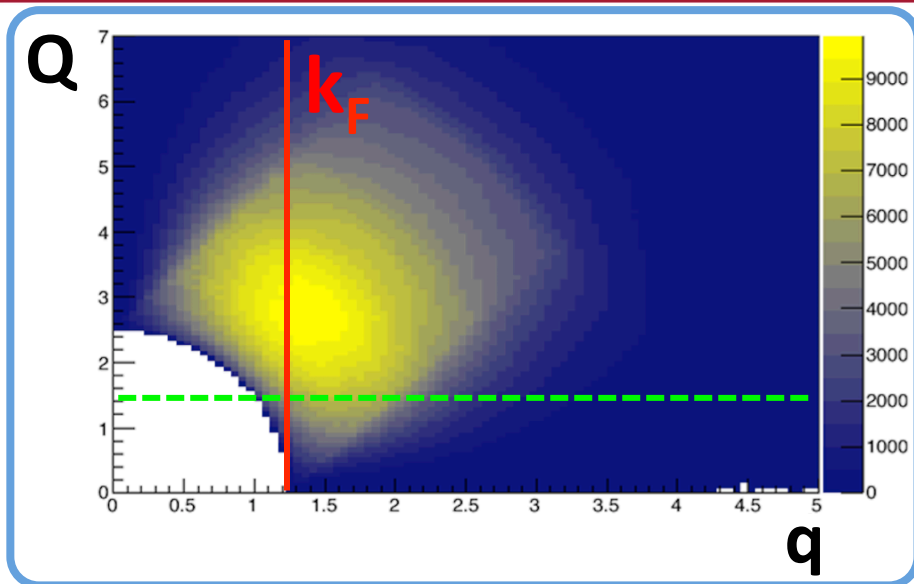
Toy model results



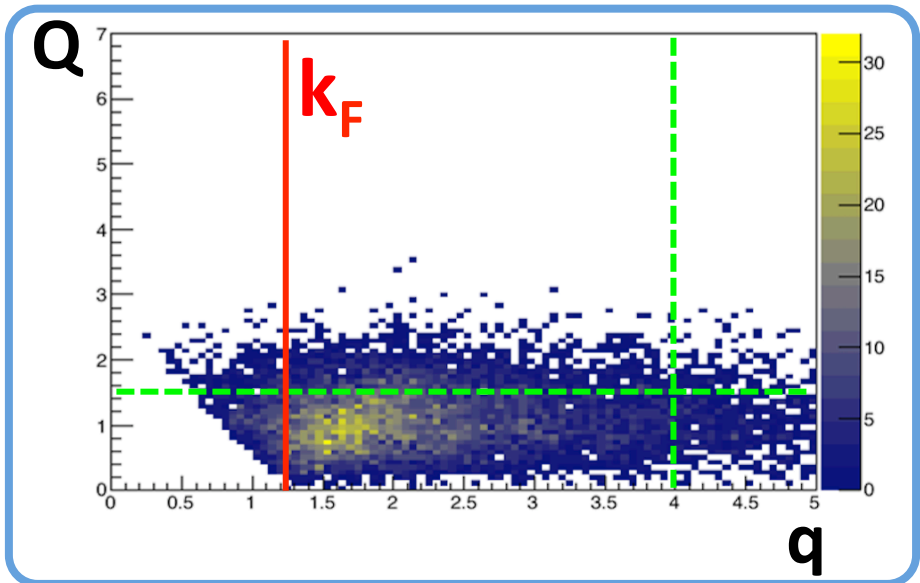
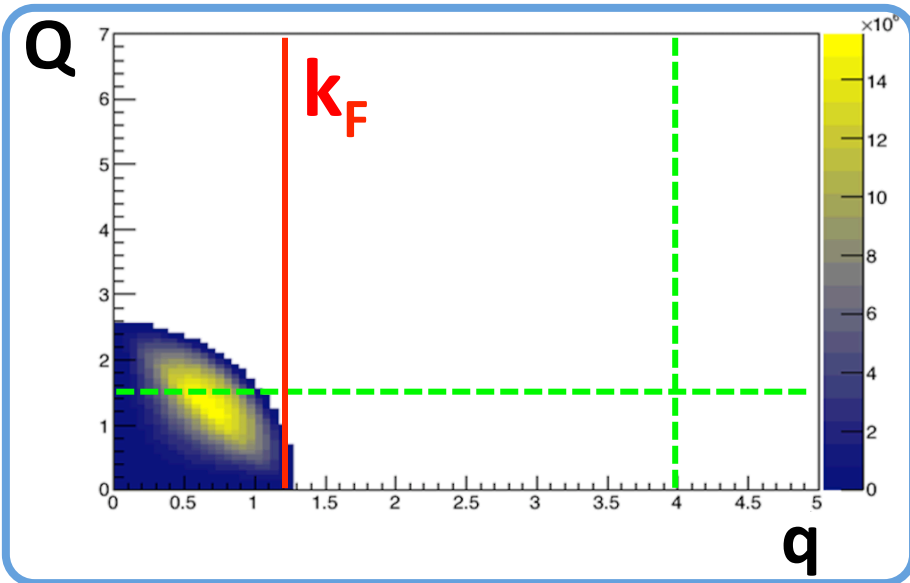
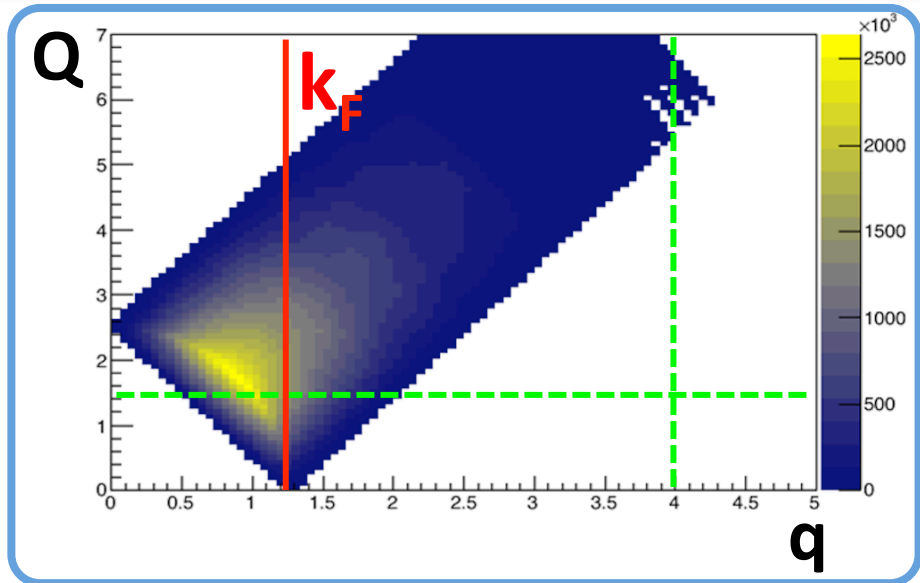
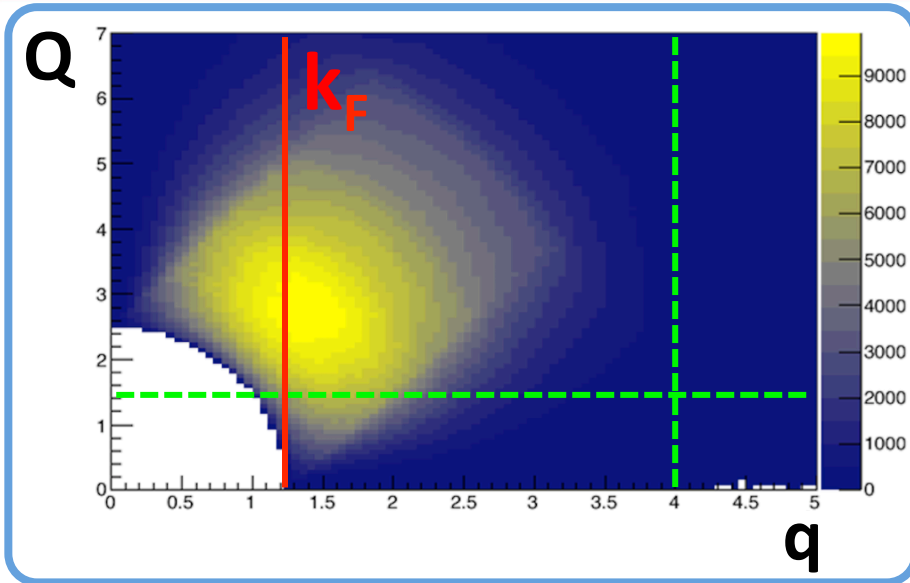
Toy model results



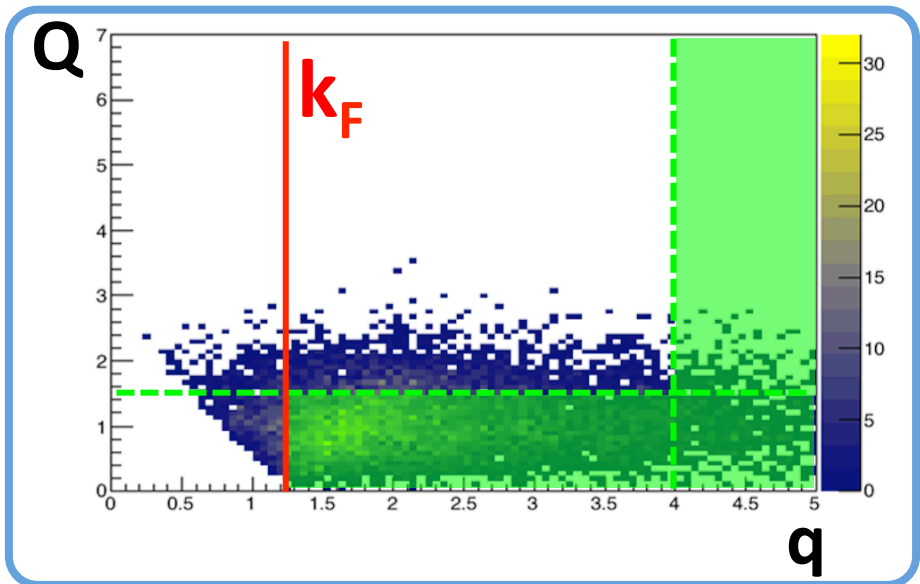
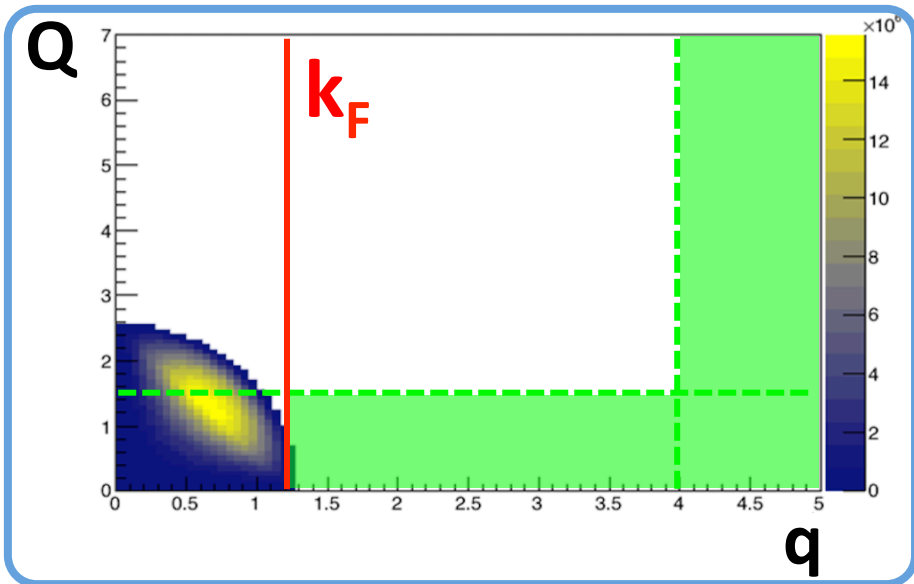
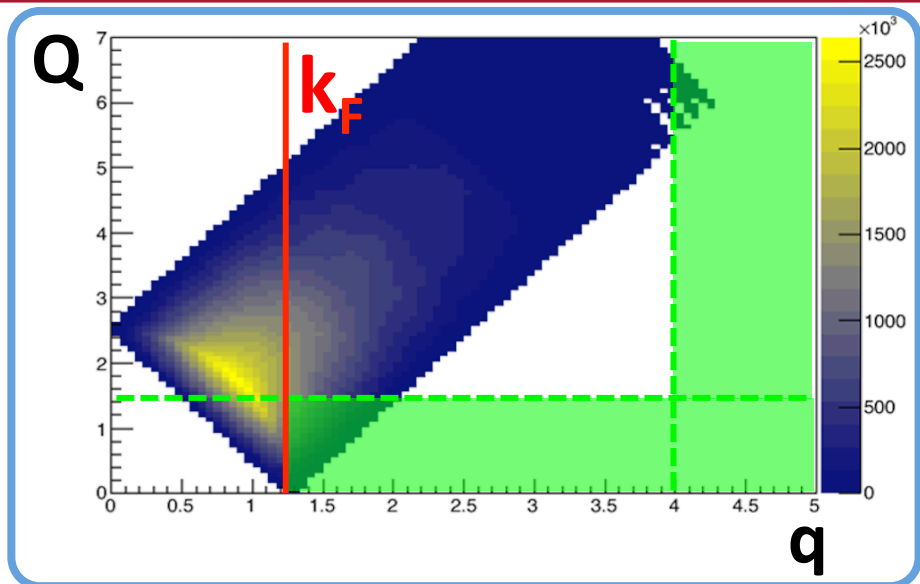
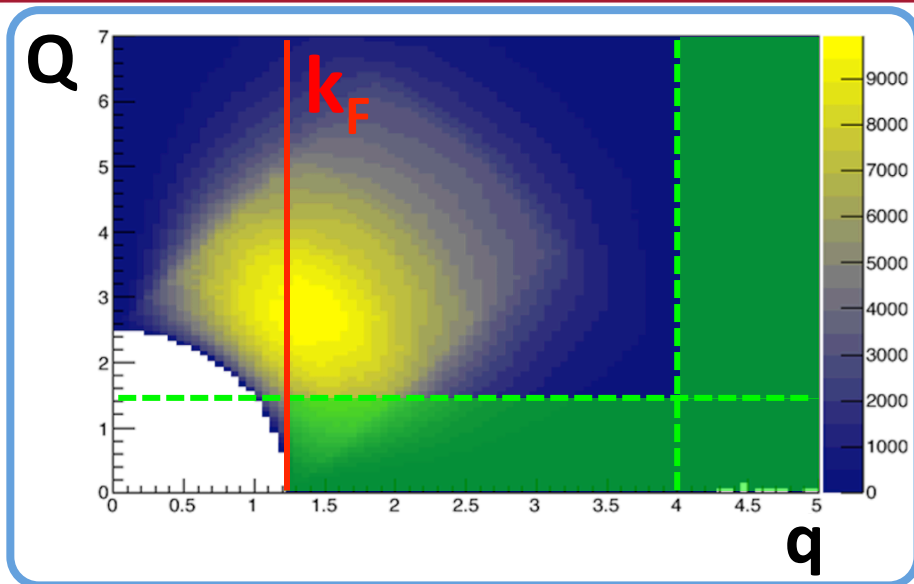
Toy model results



Toy model results

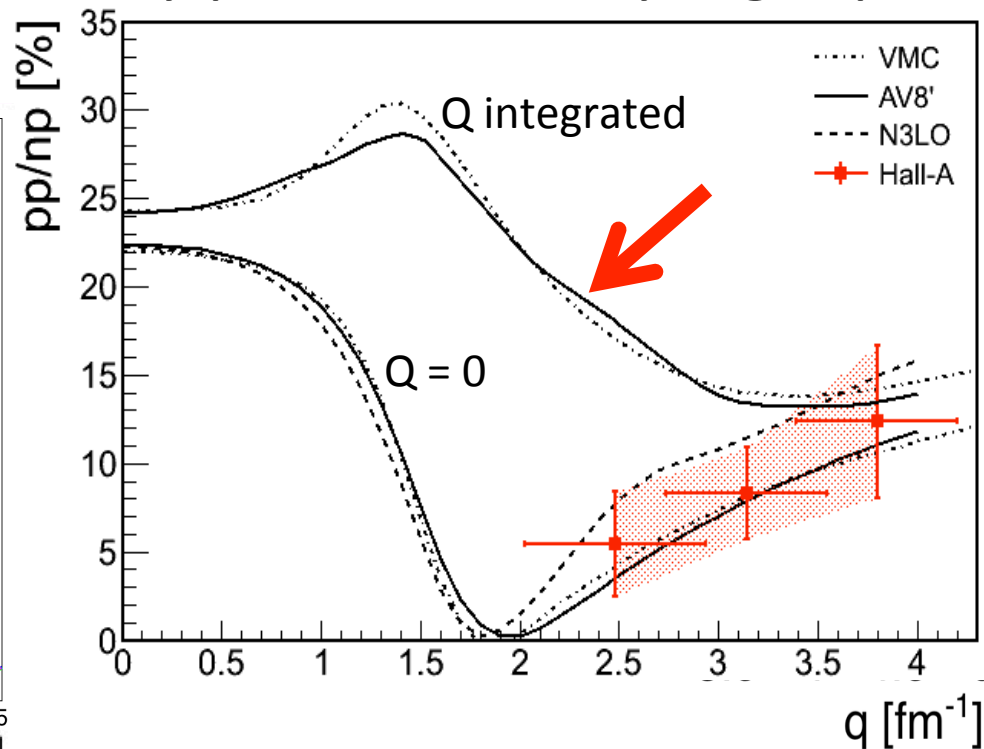
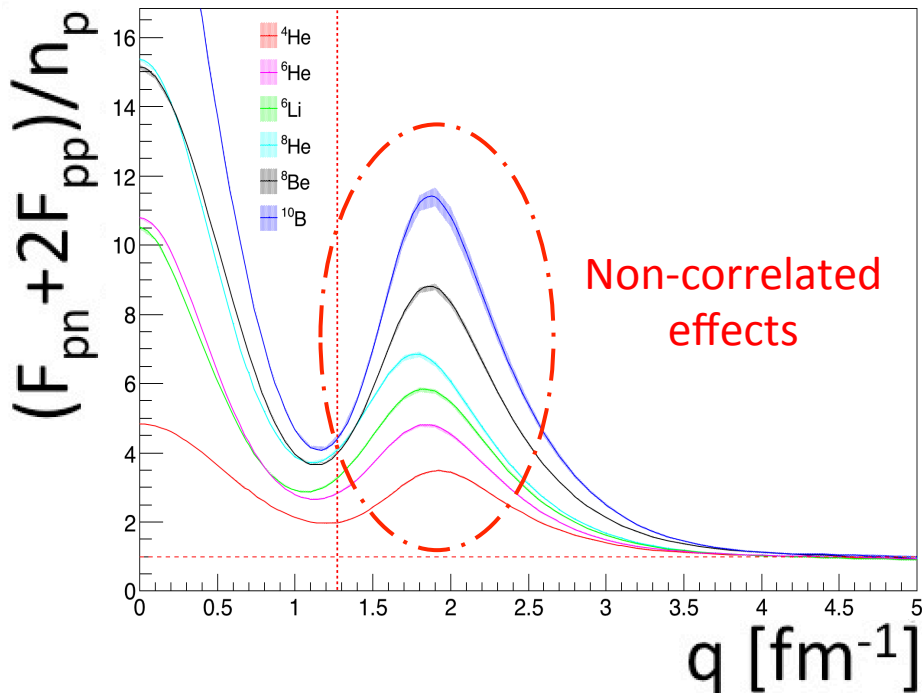


Toy model results



2-Body scaling for Q integrated

- Integrating over Q introduces non-correlated effects above k_F and thus, scaling is only present at very high q (4 fm^{-1}).



R. Weiss, R. Cruz-Torres et al., In-Preparation (2016)

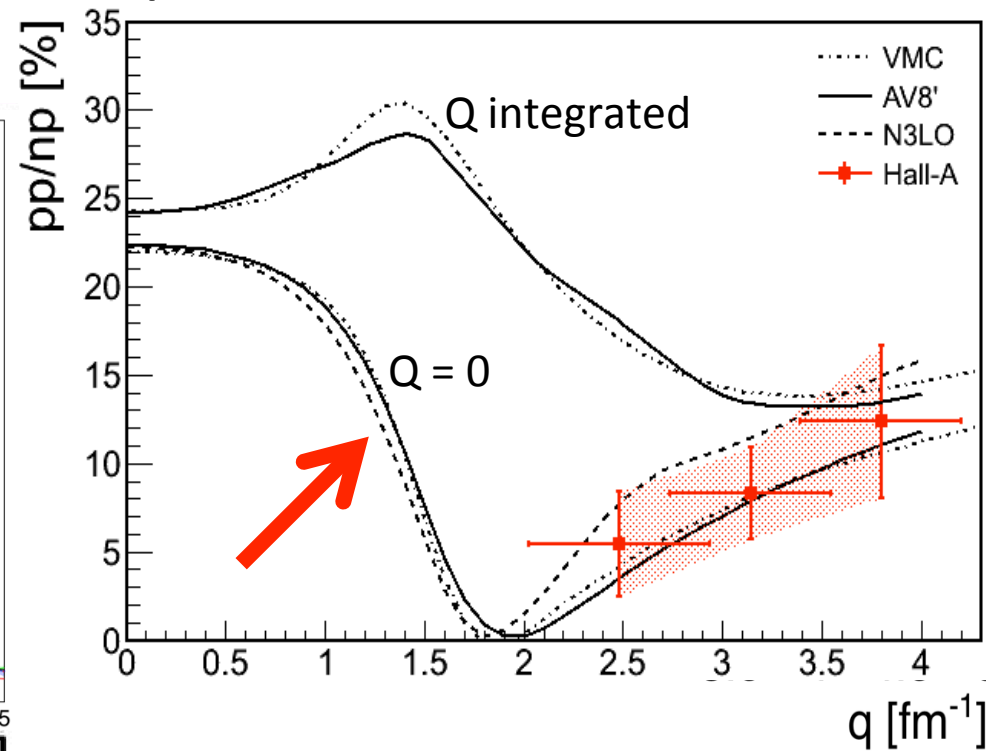
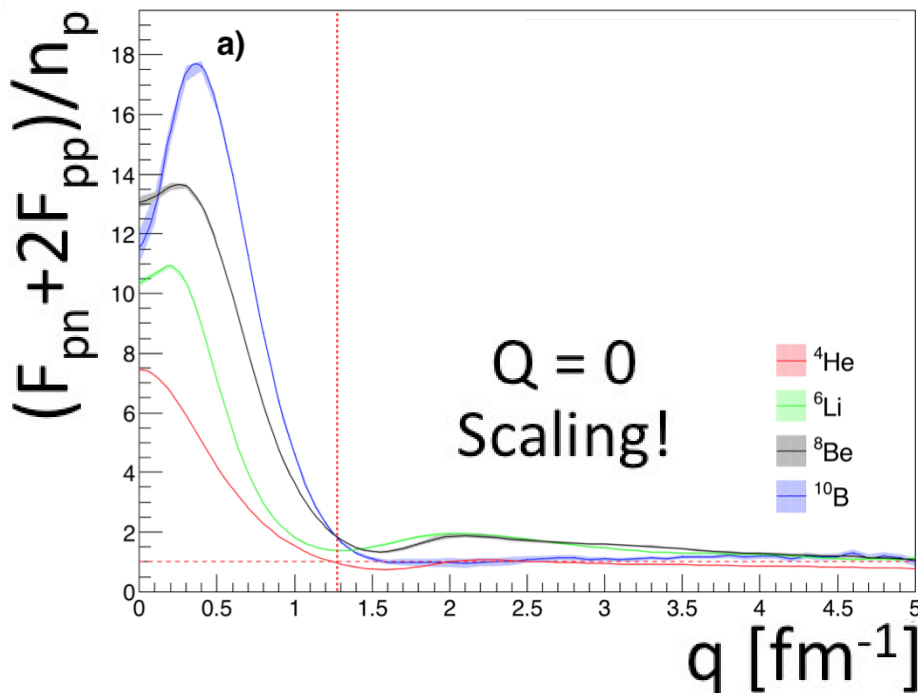
R. Wiringa et al., Phys. Rev. C 89, 024305 (2014).

T. Neff, H. Feldmeier and W. Horiuchi, Phys. Rev. C 92, 024003 (2015).

I. Korover, N. Muangma, and O. Hen et al., Phys. Rev. Lett 113, 022501 (2014).

2-Body scaling for $Q=0$

- Restricting $Q=0$ restores scaling starting from $k > k_F$ AND gives consistent results with experimental data!

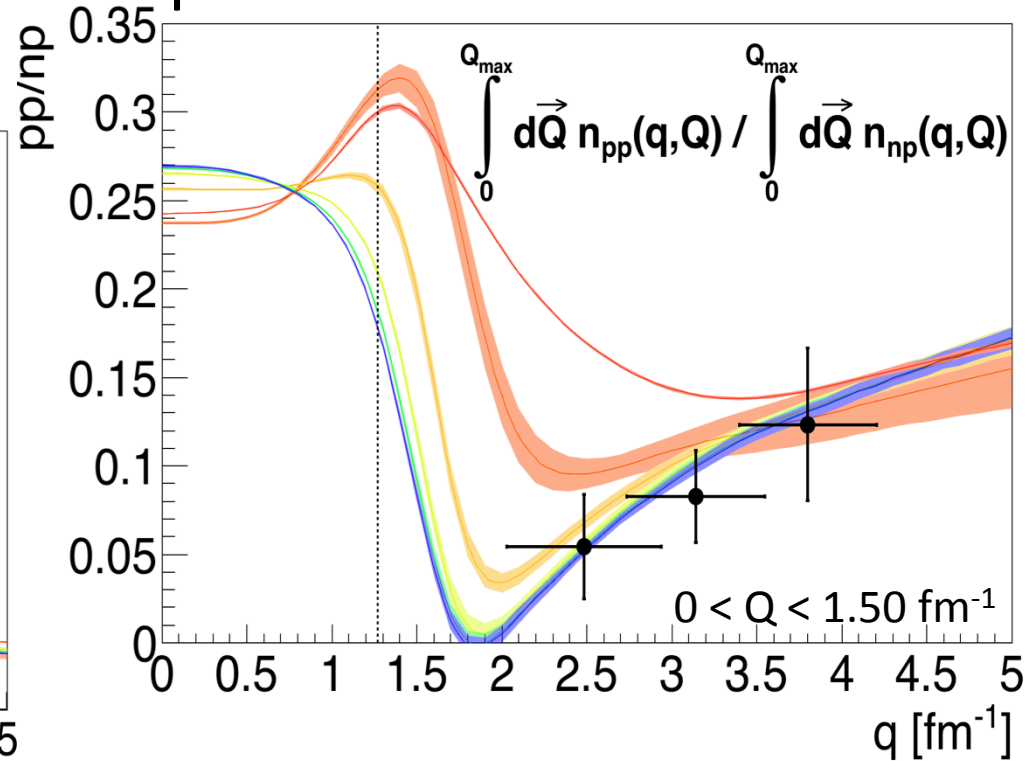
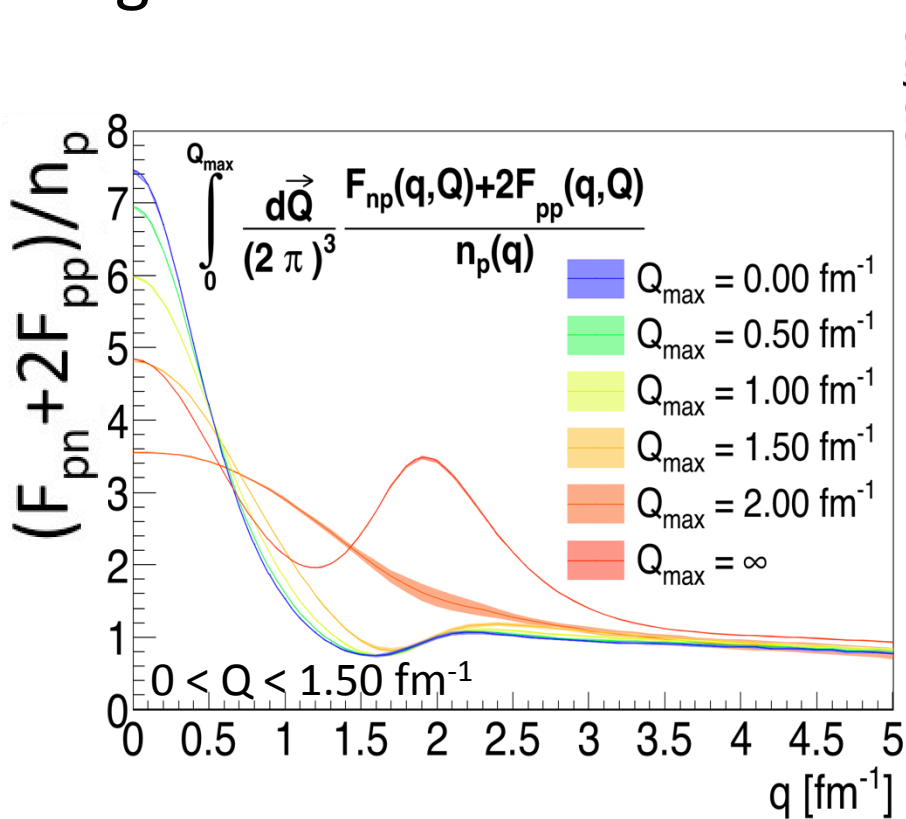


SRC pairs are consistent with $Q=0$ *back-to-back* pairs

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2-Body scaling: Q dependence

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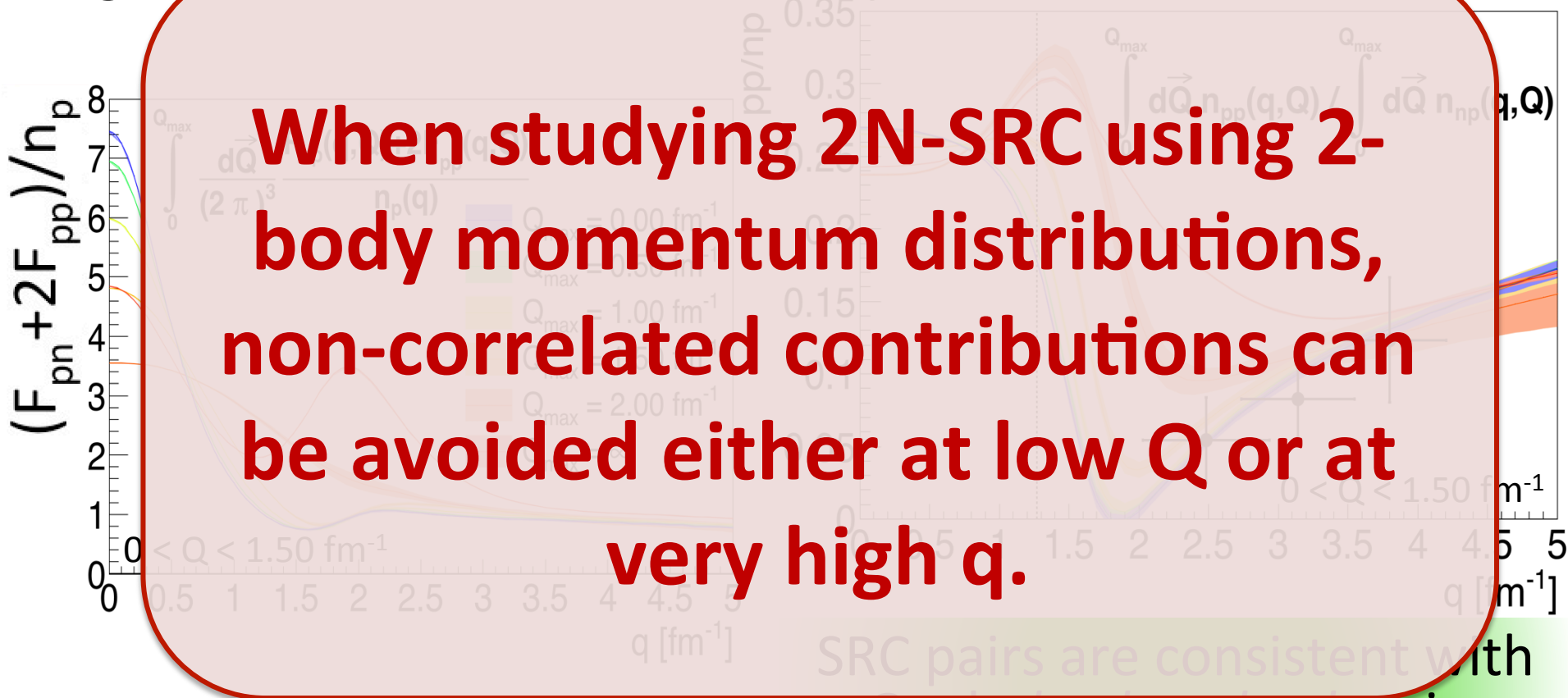
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2-Body scaling: Q dependence

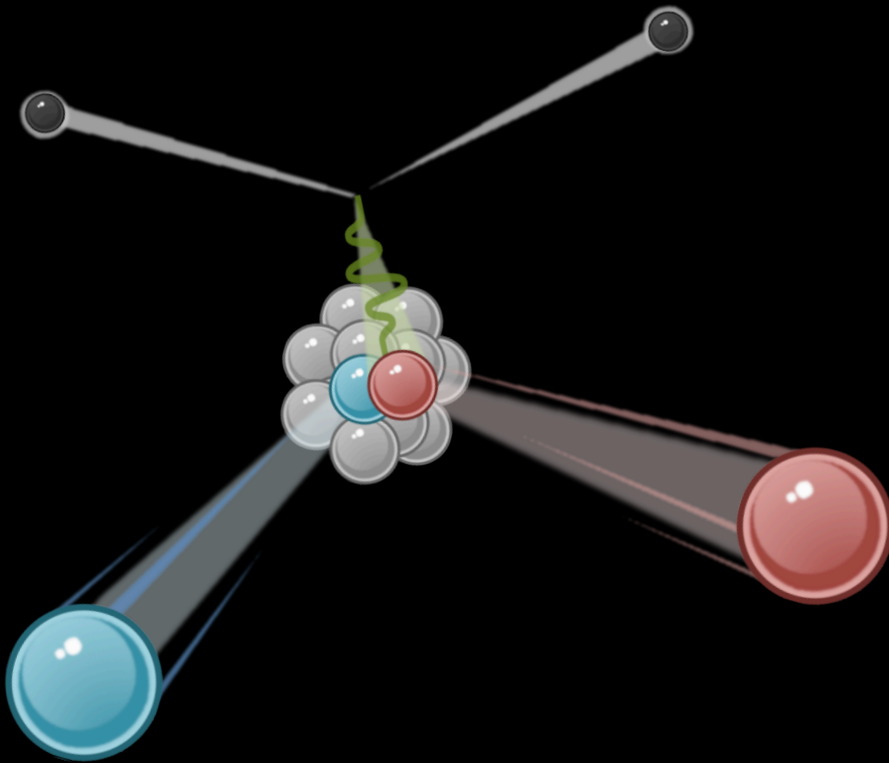
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Thank you!



Questions?

Collaborators:

E. Piasetzky (Tel Aviv University)

N. Barnea (Hebrew University)

R. Weiss (Hebrew University)

O. Hen (MIT)