

The BAND Experiment

The EMC Effect in Highly-Virtual Nucleons

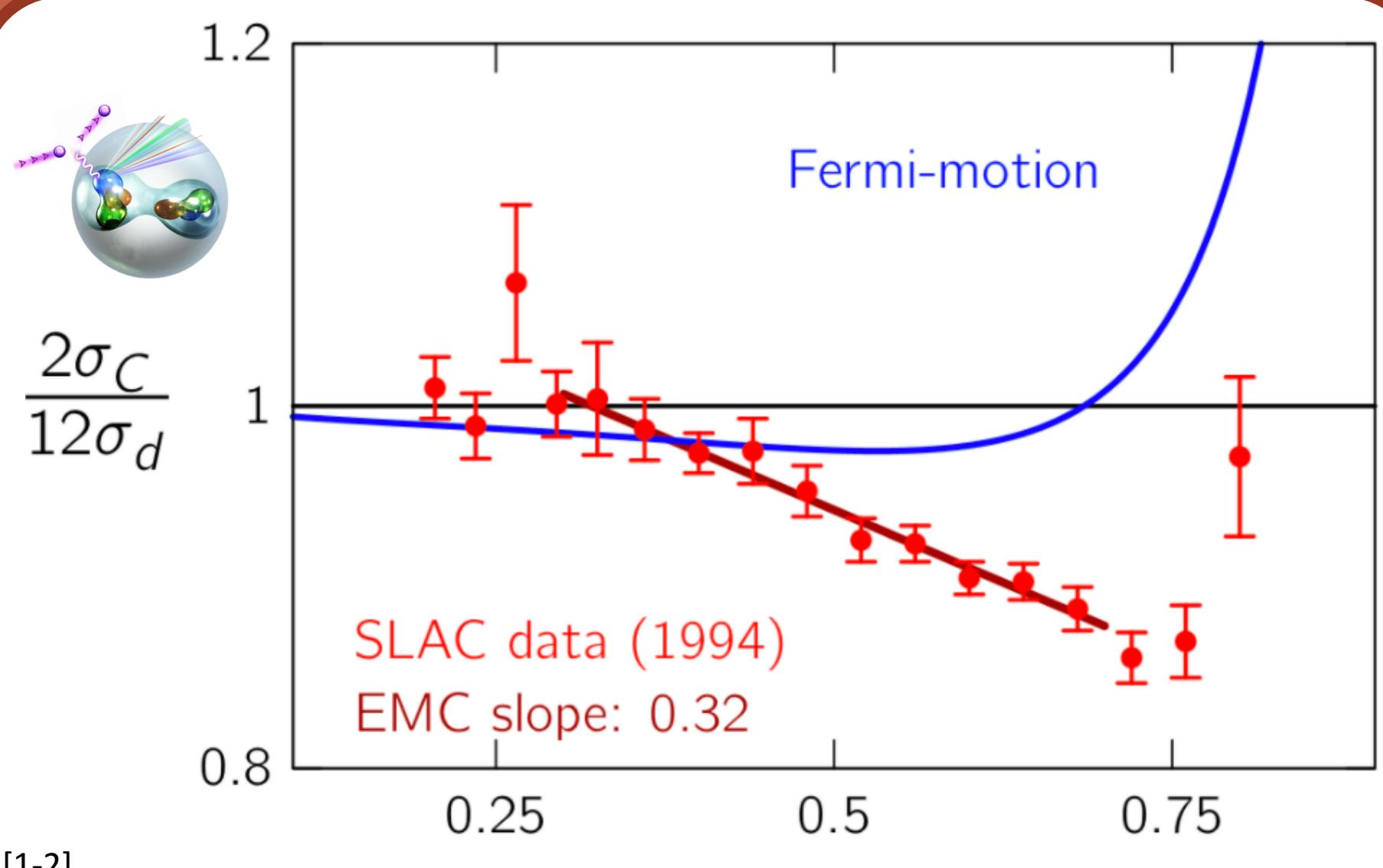
Efrain Segarra, Massachusetts Institute of Technology



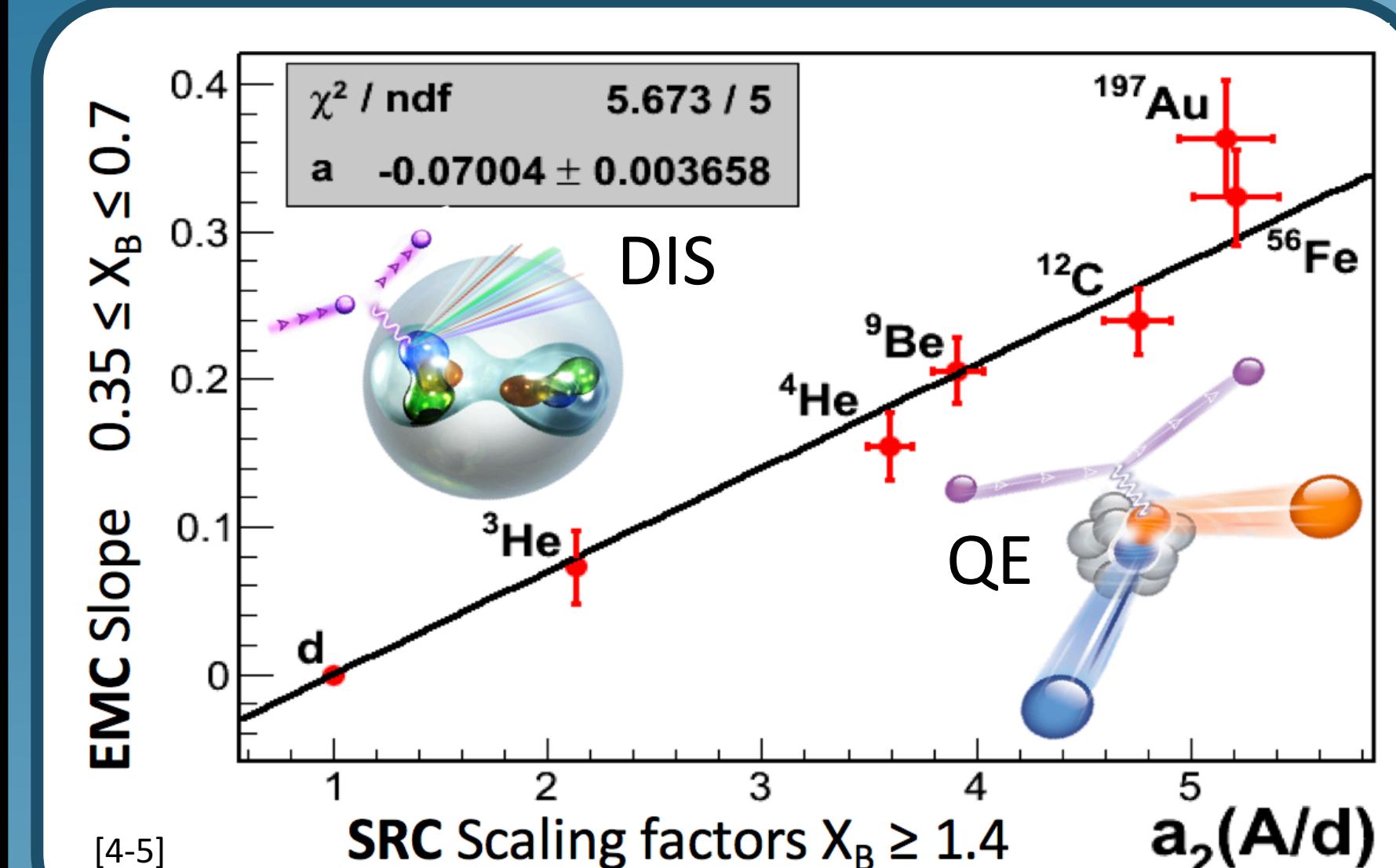
The EMC Effect

Deep-Inelastic Scattering off Quarks in Nuclei:

- Quarks in bound nucleons behave differently than in free nucleons
- No accepted theoretical explanation

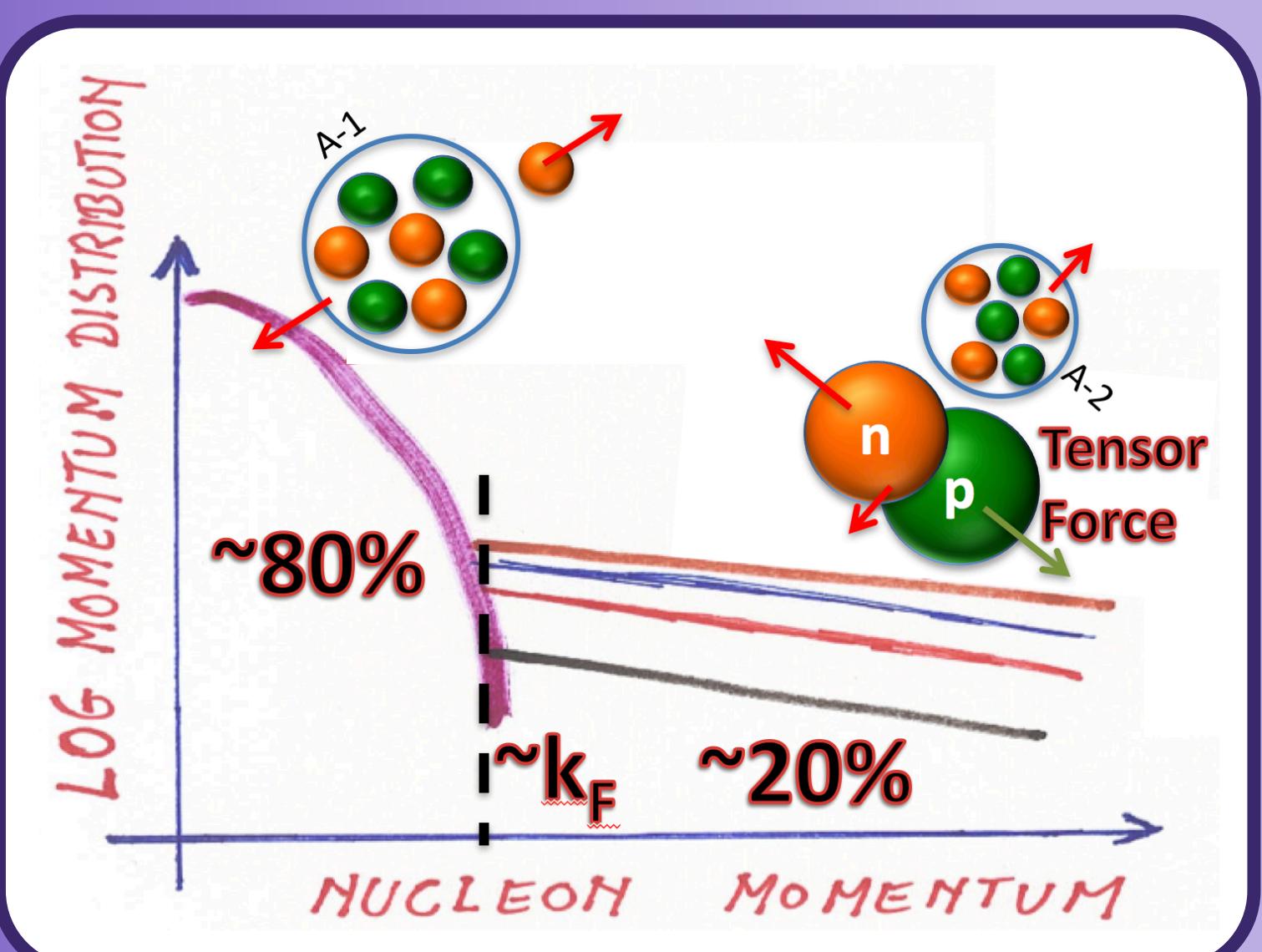


EMC Effect & Short Range Correlations

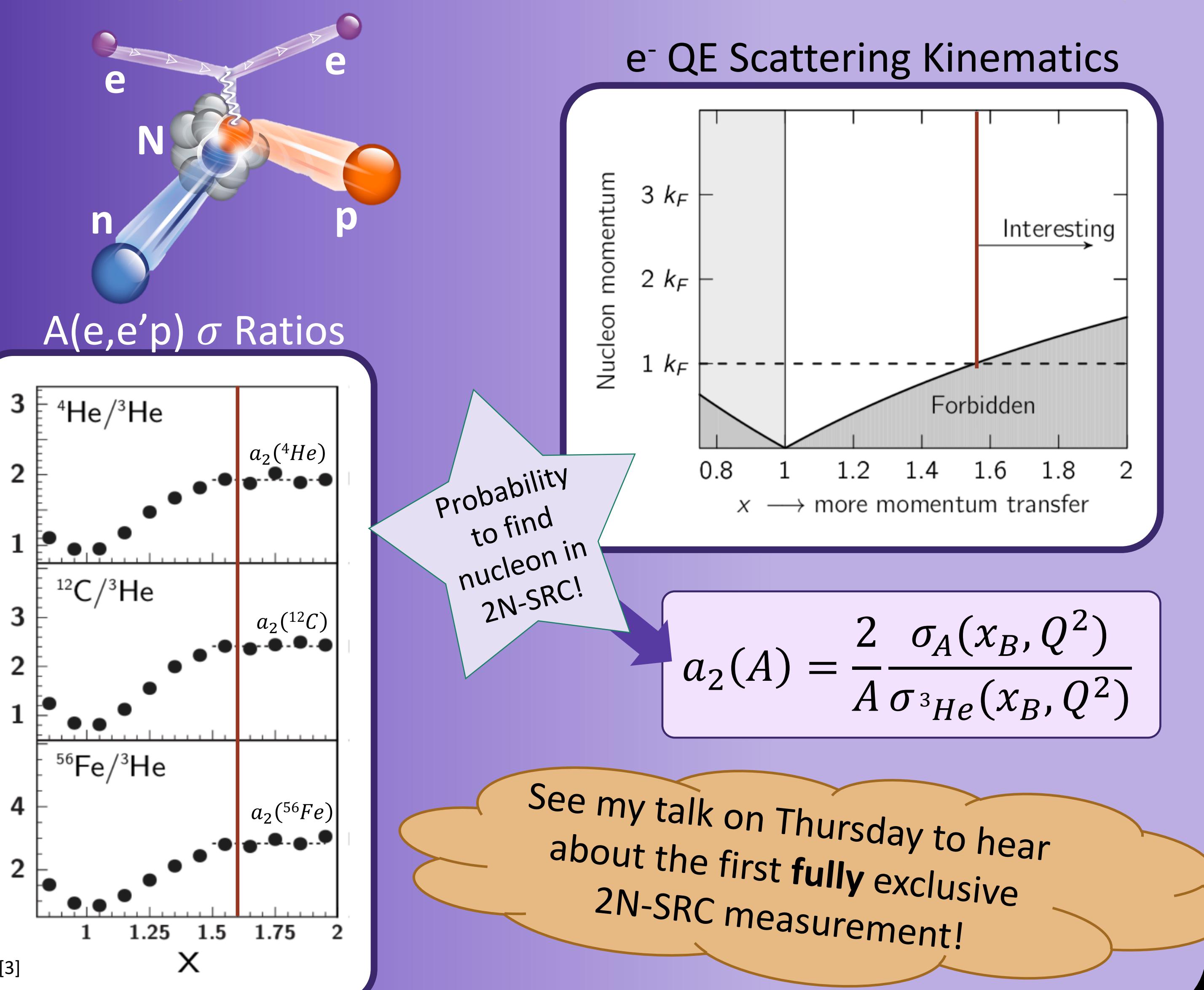


Suggests EMC effect follows local nuclear density (SRCs!)

NN Short Range Correlations (SRC)

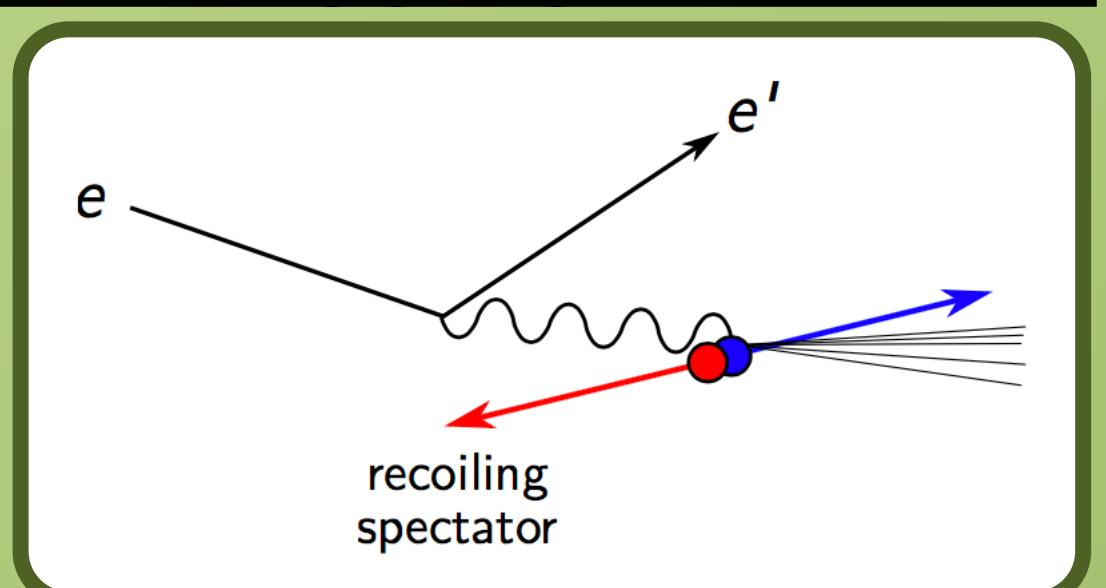


Finding SRC Pairs in Nuclei in e⁻ QE Scattering

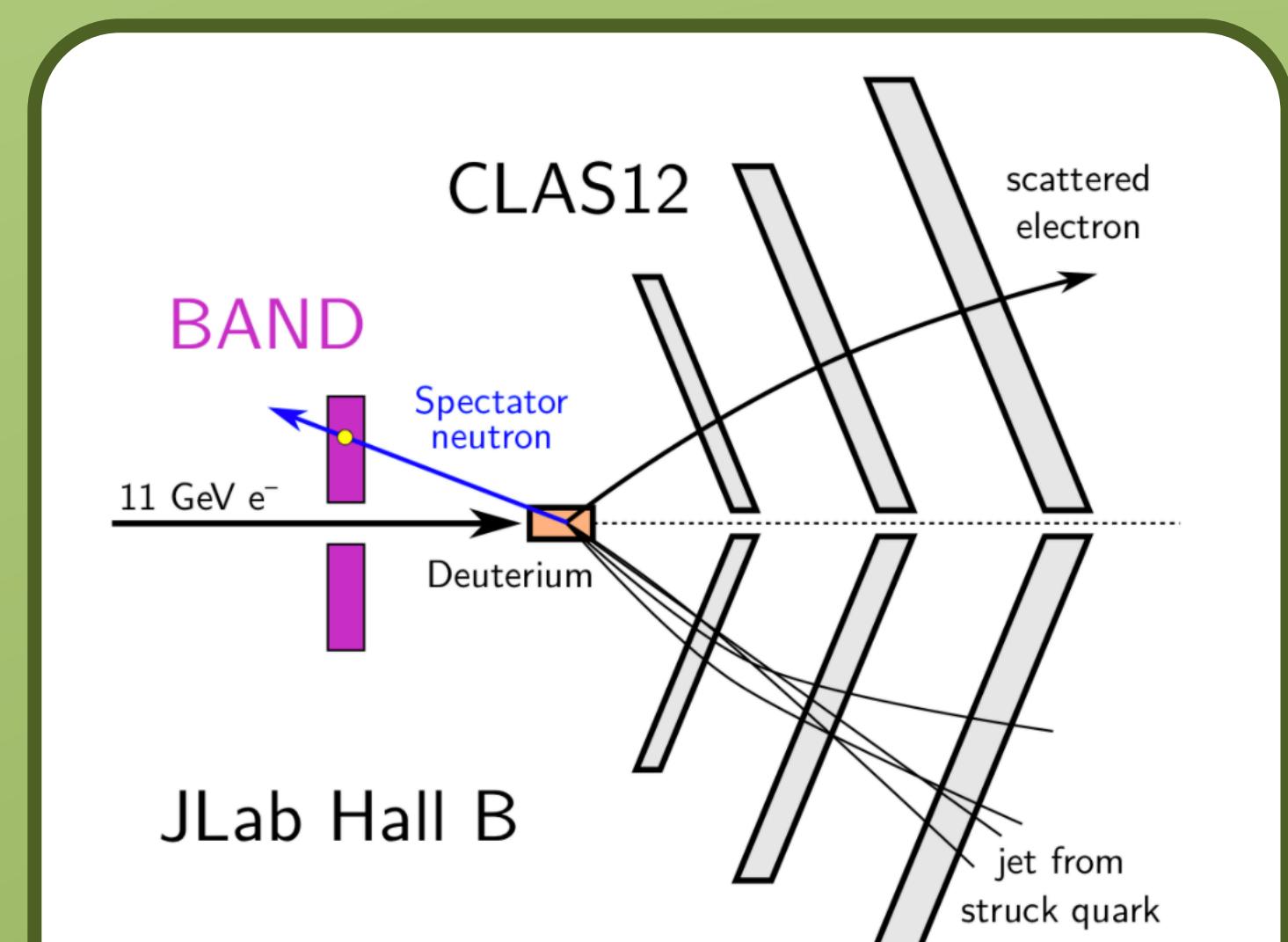


The Backward Angle Neutron Detector (BAND)

Recoil Tagging d(e,e'n)X

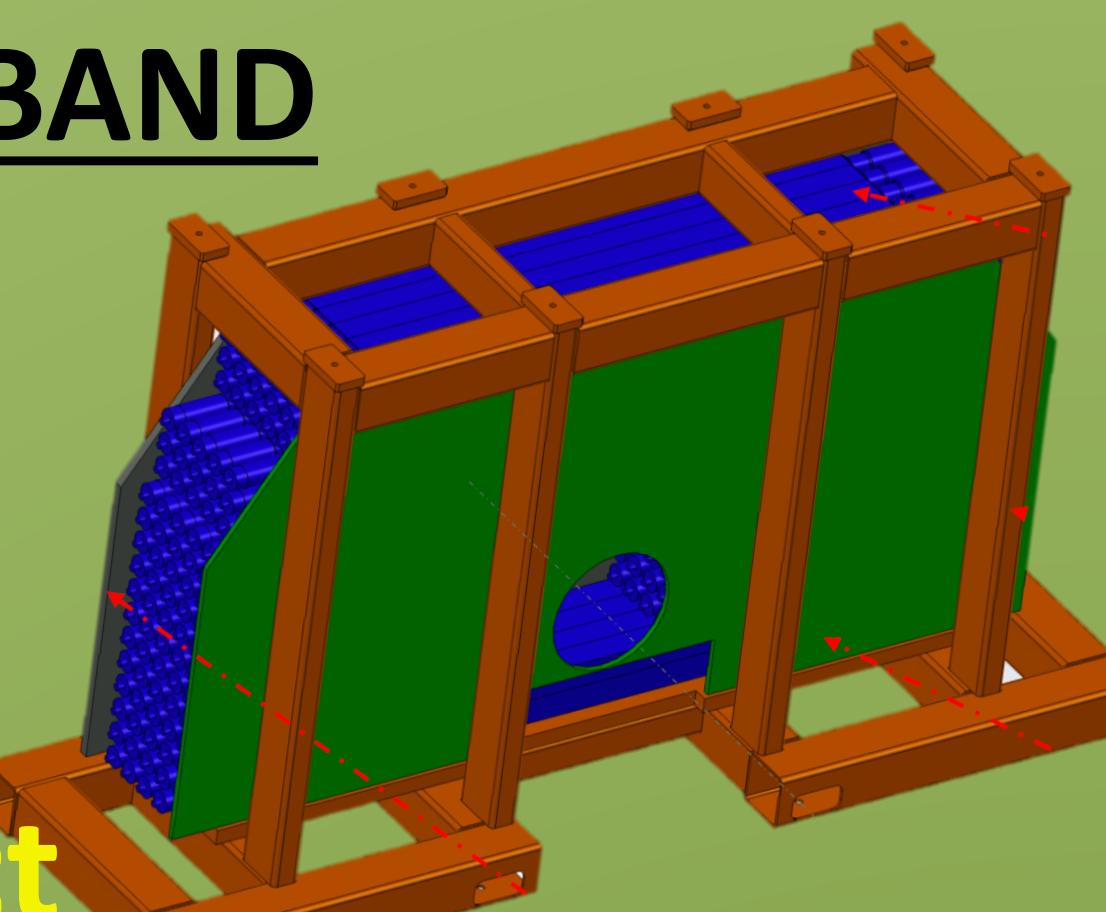


- Minimizes final state interactions
- No residual system
- Recoil has exact opposite momentum of struck



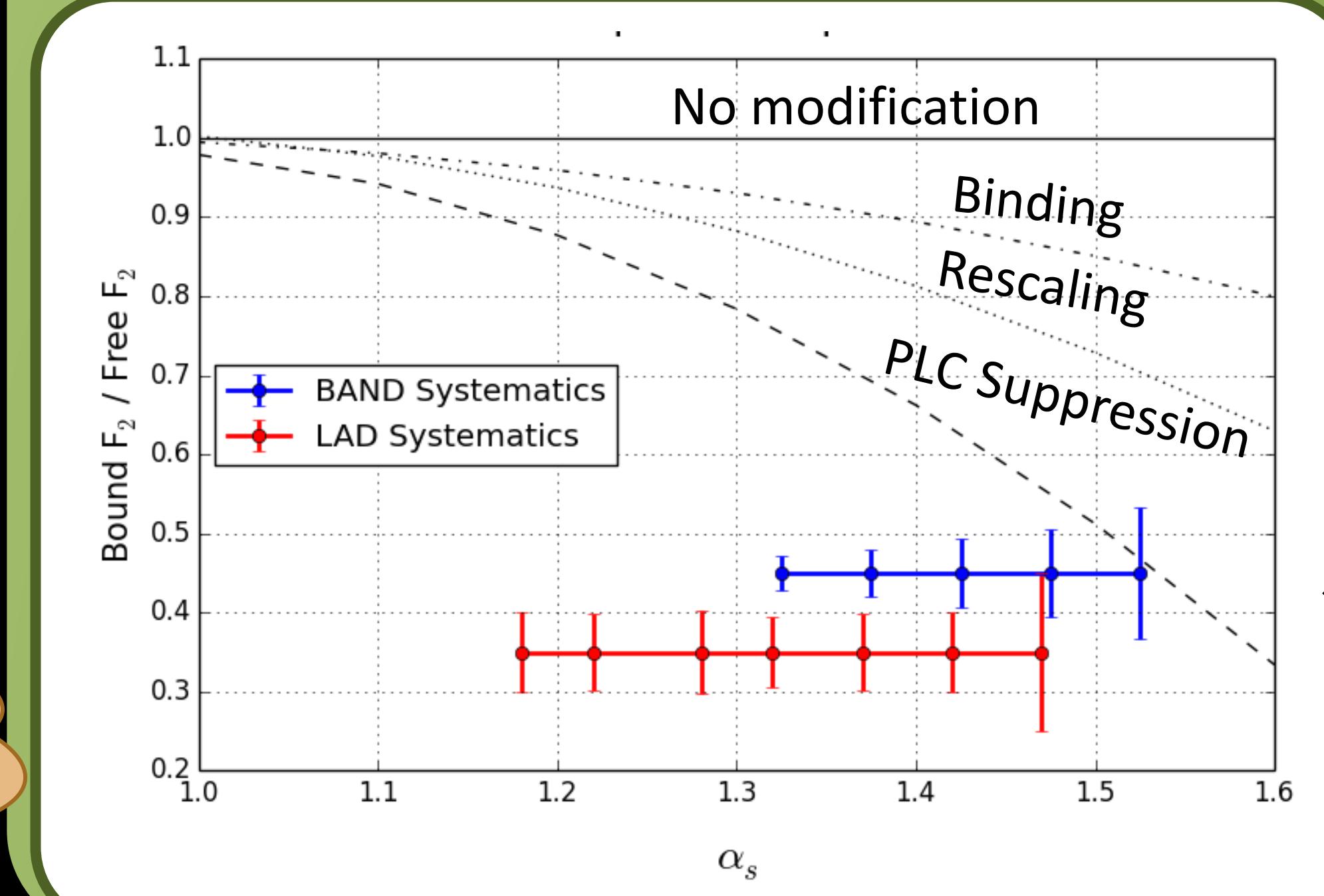
Detecting Recoil Neutrons with BAND

- Covers backward recoil angles 160°-175°
- 5 layers of 24 scintillation bars – 36cm thick
- Veto layer & lead shield to reject background



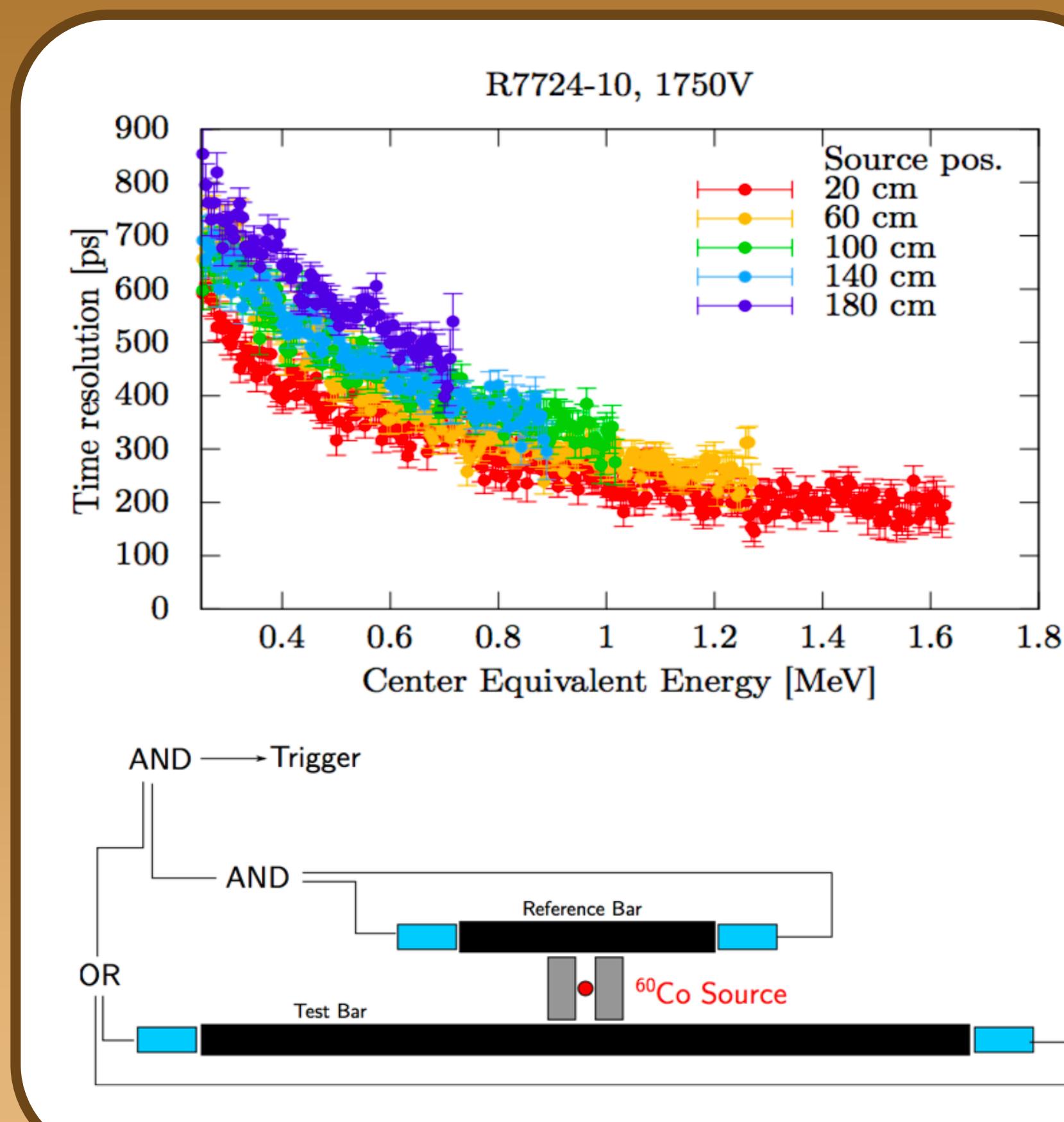
Expected Experimental Impact

$$\frac{F_2(\text{high } x', Q^2, \alpha_s)_{\text{bound}}}{F_2(\text{high } x', Q^2)_{\text{free}}} \approx \frac{\sigma_{\text{DIS}}(\text{high } x', Q^2, \alpha_s)_{\text{bound}}}{\sigma_{\text{DIS}}(\text{low } x', Q^2, \alpha_s)_{\text{bound}}} \times \frac{\sigma_{\text{DIS}}(\text{low } x', Q^2)_{\text{free}}}{\sigma_{\text{DIS}}(\text{high } x', Q^2)_{\text{free}}} \times R_{\text{FSI}}$$



BAND Neutron Detector R&D Work Requirements and Challenges

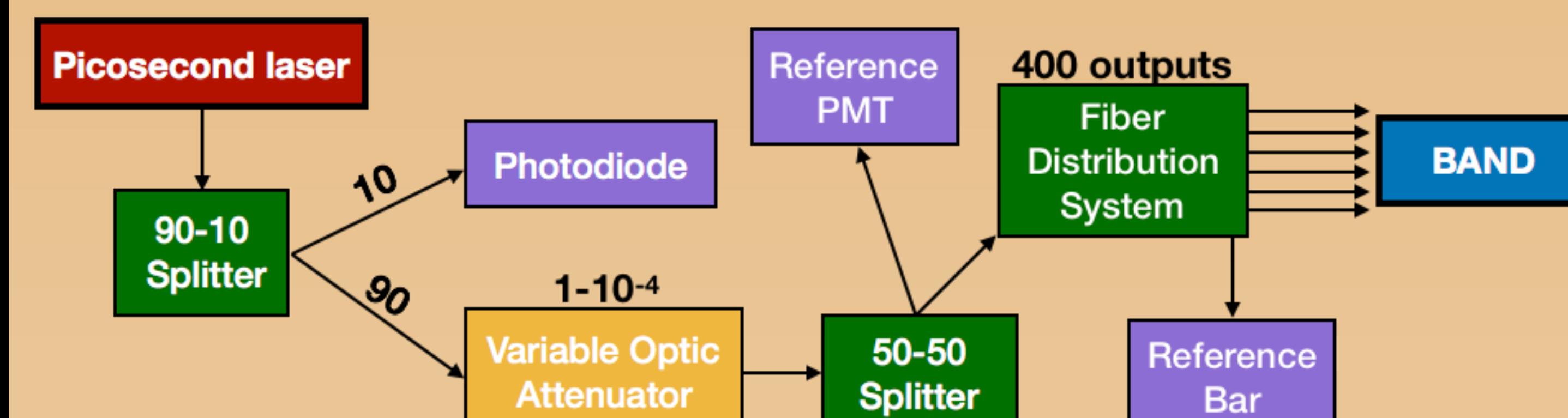
- ~40% efficiency
- 2MeVee threshold
- Large angular coverage
- 200 ps time resolution



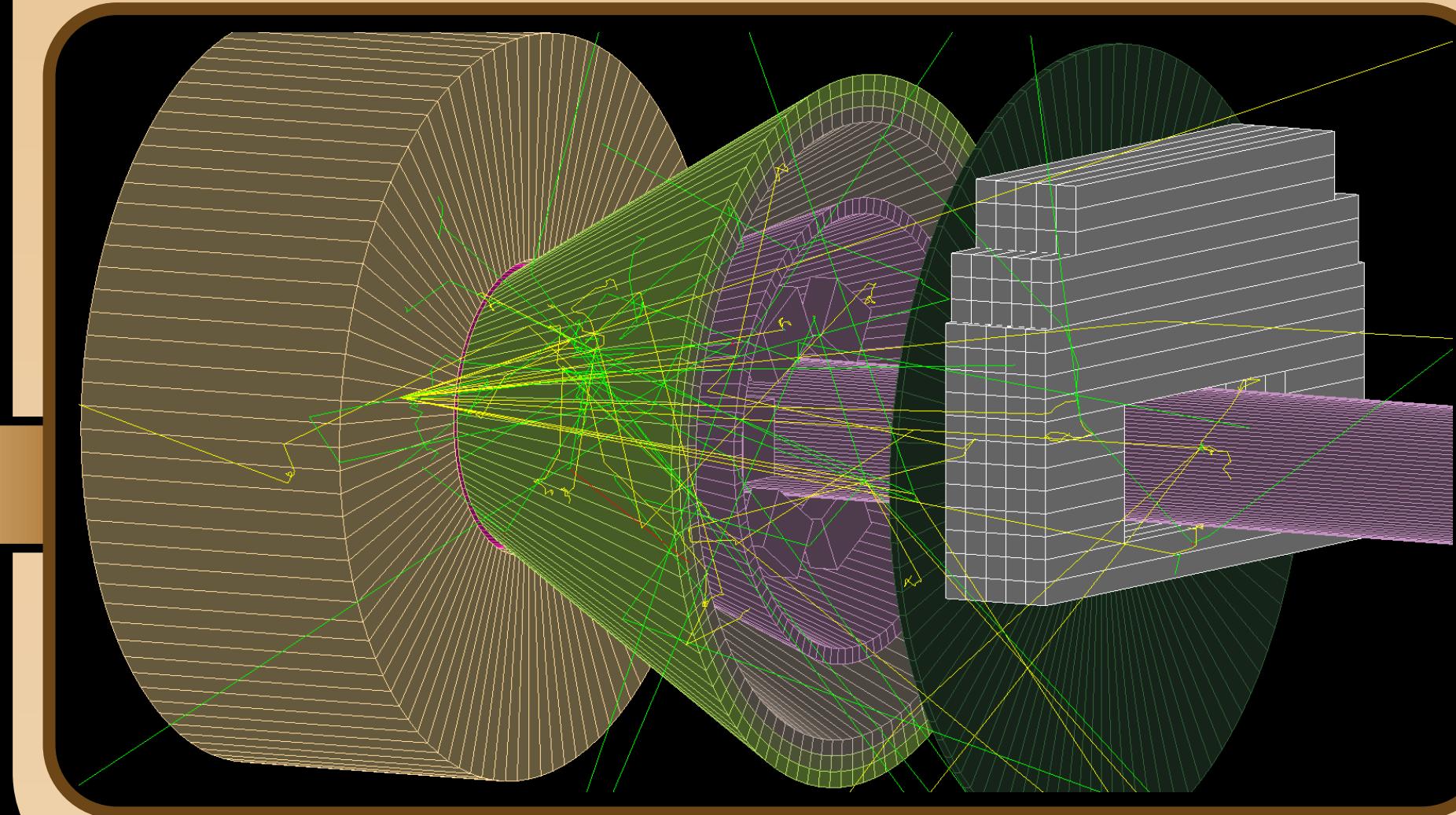
Quality Control

- 250 PMTs
- 125 scintillation bars
- Individual light attenuation and gain curves

Laser Calibration System:



Simulation Efforts in Geant4



- Jefferson Lab Hall B geometry
- Random neutron background