# Short-Range Correlations In $^{12}C(e, e'pn)$

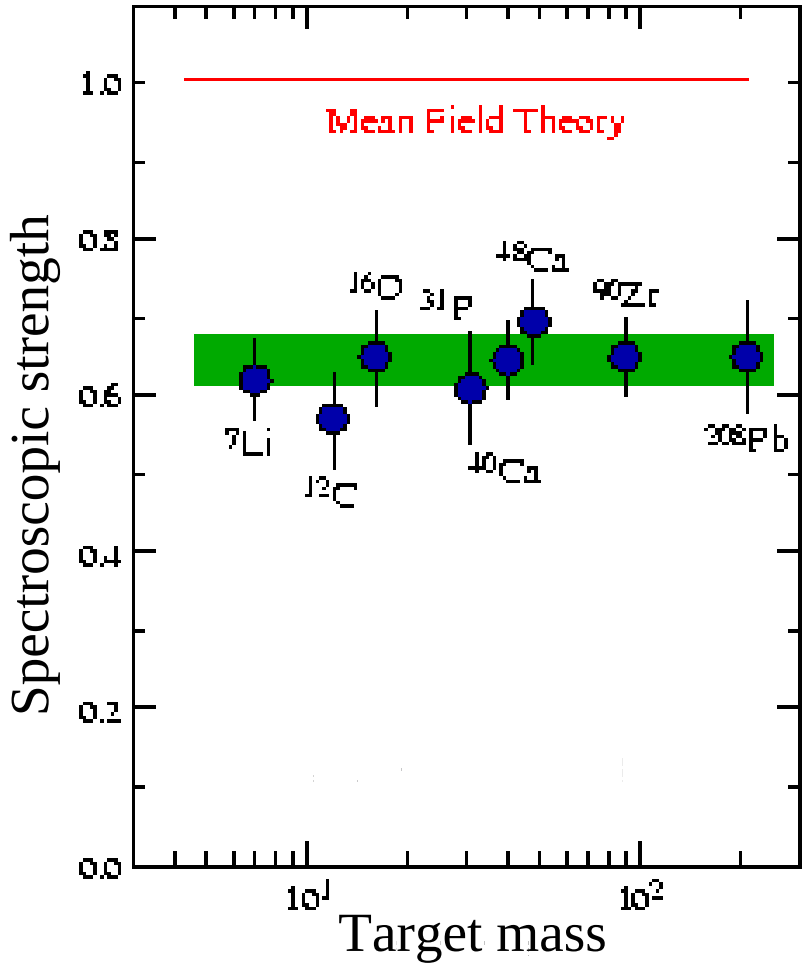
Ramesh Raj Subedi
(For E01-015 and Hall A collaborations)
Kent State University
Kent, OH 44242

DNP Meeting
(Oct 25-28, 2006)
Nashville, TN

Correlations account for deviations from mean field behavior of nucleons.

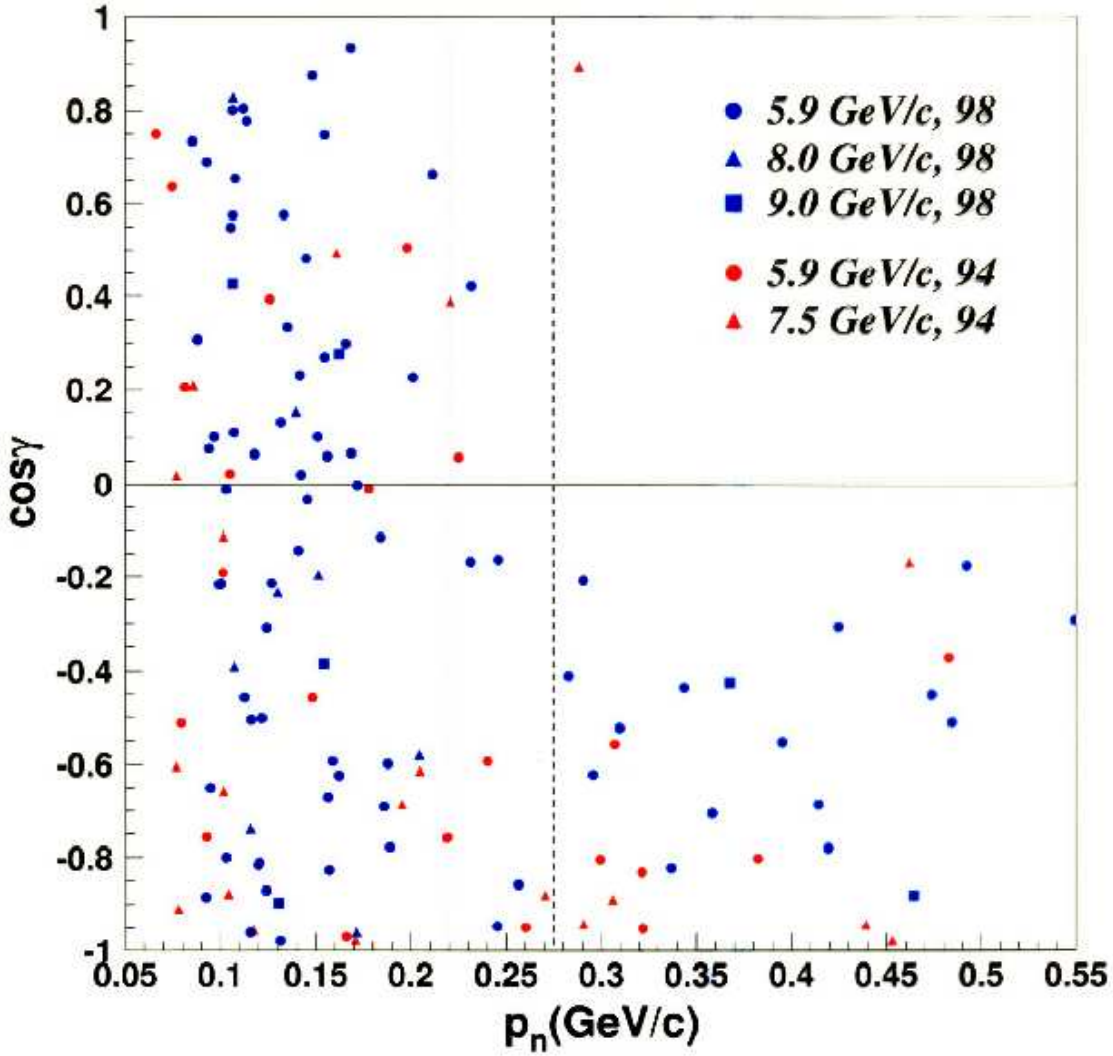
- 100% occupancy from shell model.
- ∼60-75% occupancy from $(e, e'p)$ studies.
- Short-range and long-range correlations may account for the descripency.
- Major contribution from short-range correlations.

Plot from: L. Lapikas, Nucl. Phys. A553(1993) 297c.



## Brookhaven EVA Collaboration result

- BNL experiment in $^{12}C(p, ppn)$ reaction showed a clear back-to-back nature of correlated np-pairs inspiring the present experiment.

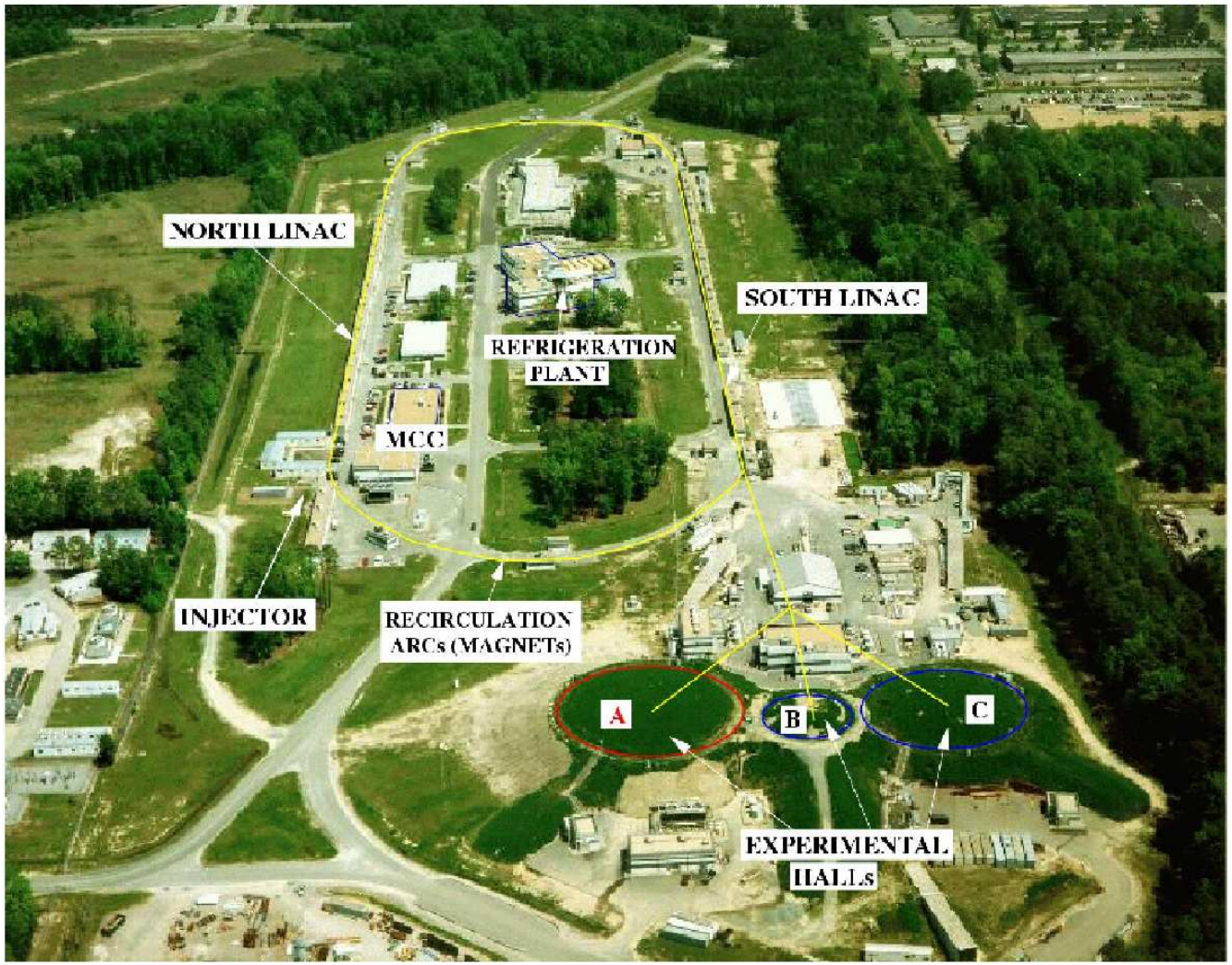



A. Tang et al., Phys. Rev. Lett. 90 (2003) 042301.

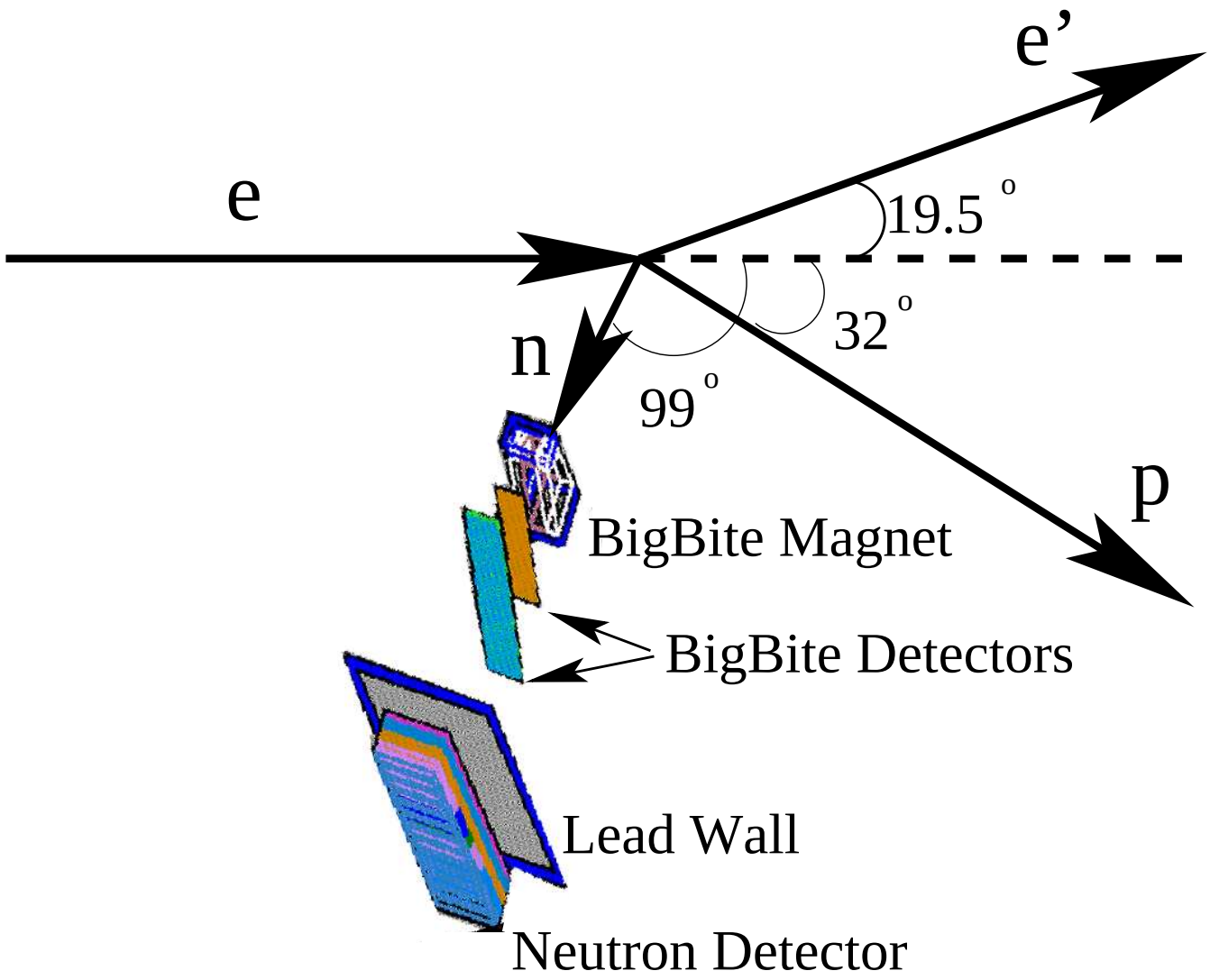
## Jefferson Lab Hall A Short-Range Correlations Experiment: E01-015

- Studying semi-exclusive $^{12}C(e, e'p)$ and exclusive $^{12}C(e, e'NN)$ reactions at $Q^2 = 2$ $(\mathrm{GeV/c})^2$ and $x_B = 1.2$ in anti-parallel kinematics.
- Extracting $\frac{^{12}C(e,e'pp)}{^{12}C(e,e'p)}$ and $\frac{^{12}C(e,e'pn)}{^{12}C(e,e'p)}$ cross section ratios.
- Extracting $\frac{^{12}C(e,e'pn)}{^{12}C(e,e'pp)}$ cross section super-ratio.
- This talk concentrates only in $^{12}C(e, e'pn)$ analysis.

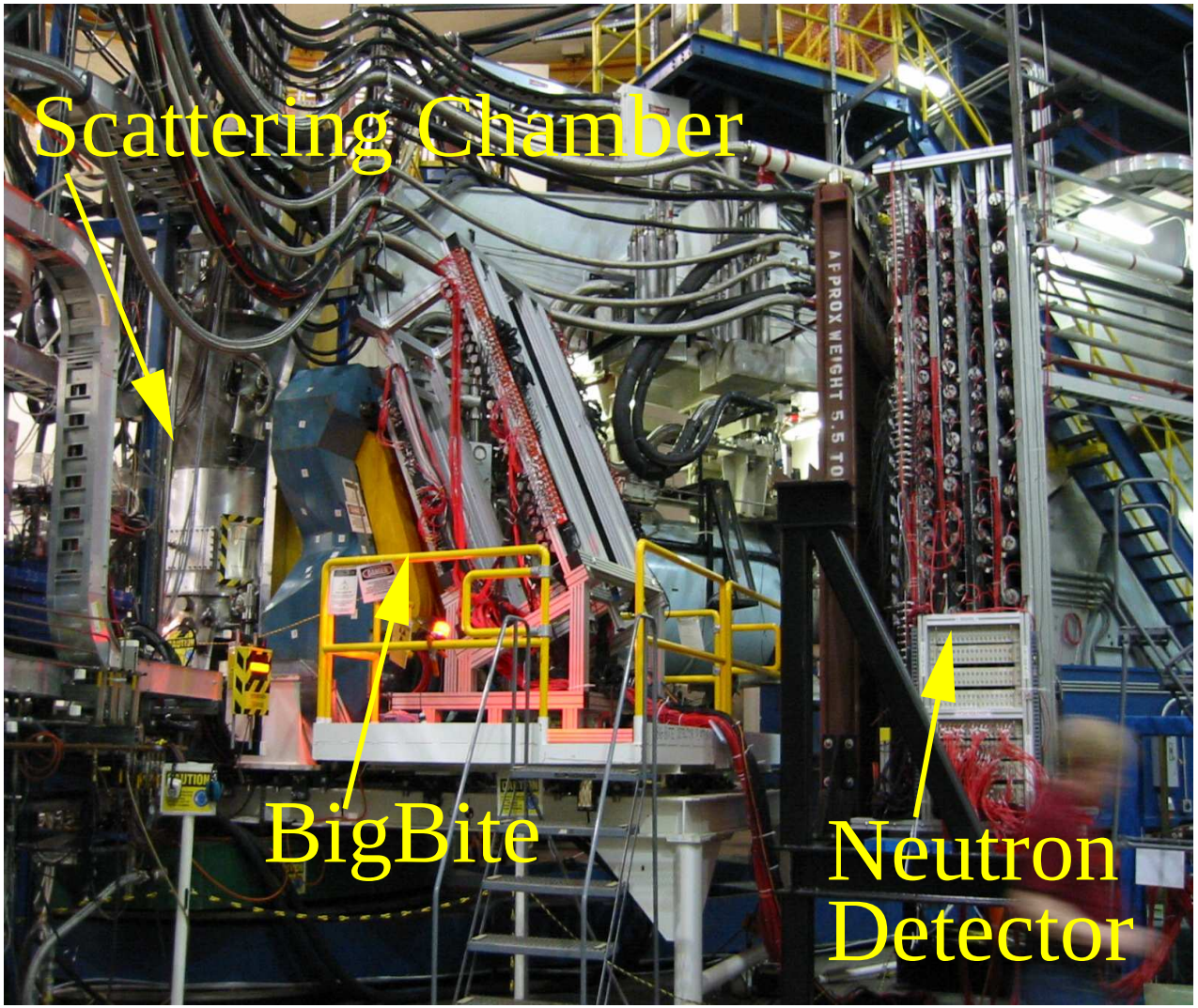
# Bird's Eye View of Jefferson Lab Accelerator Site



## Typical Kinematic Setup

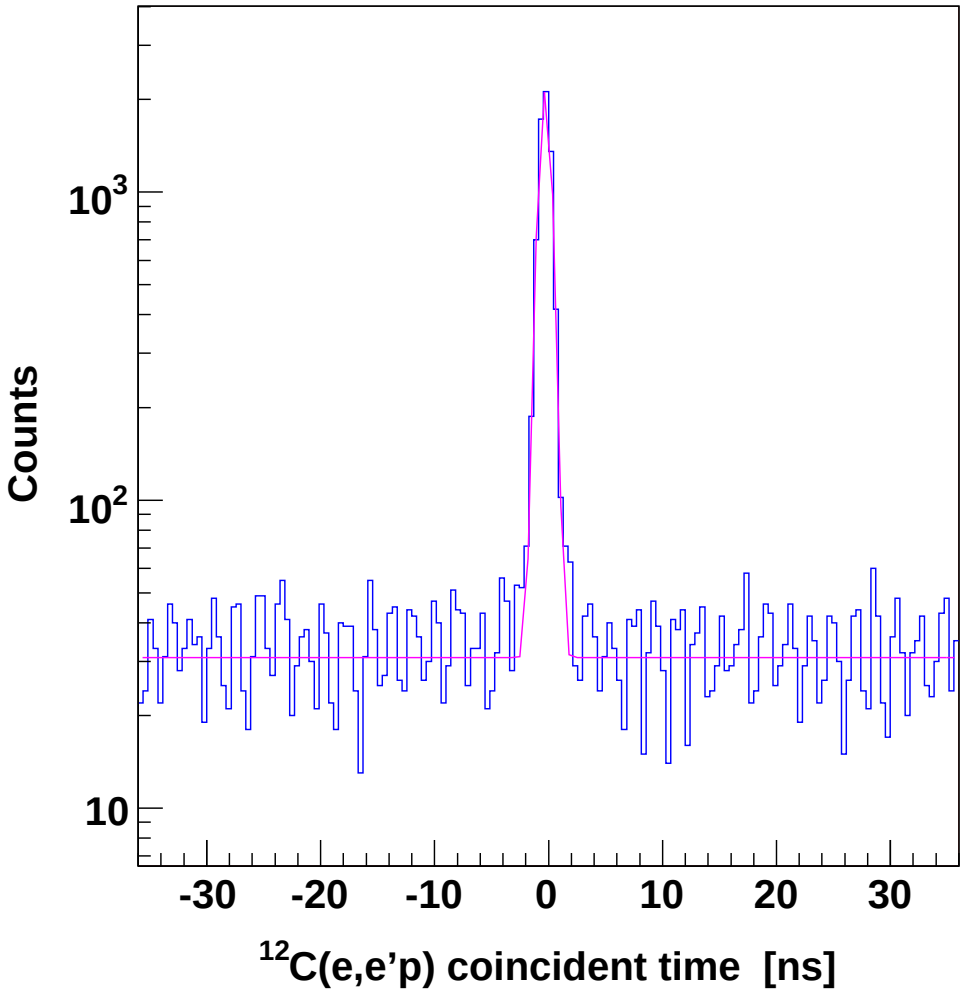


# Detectors in real life



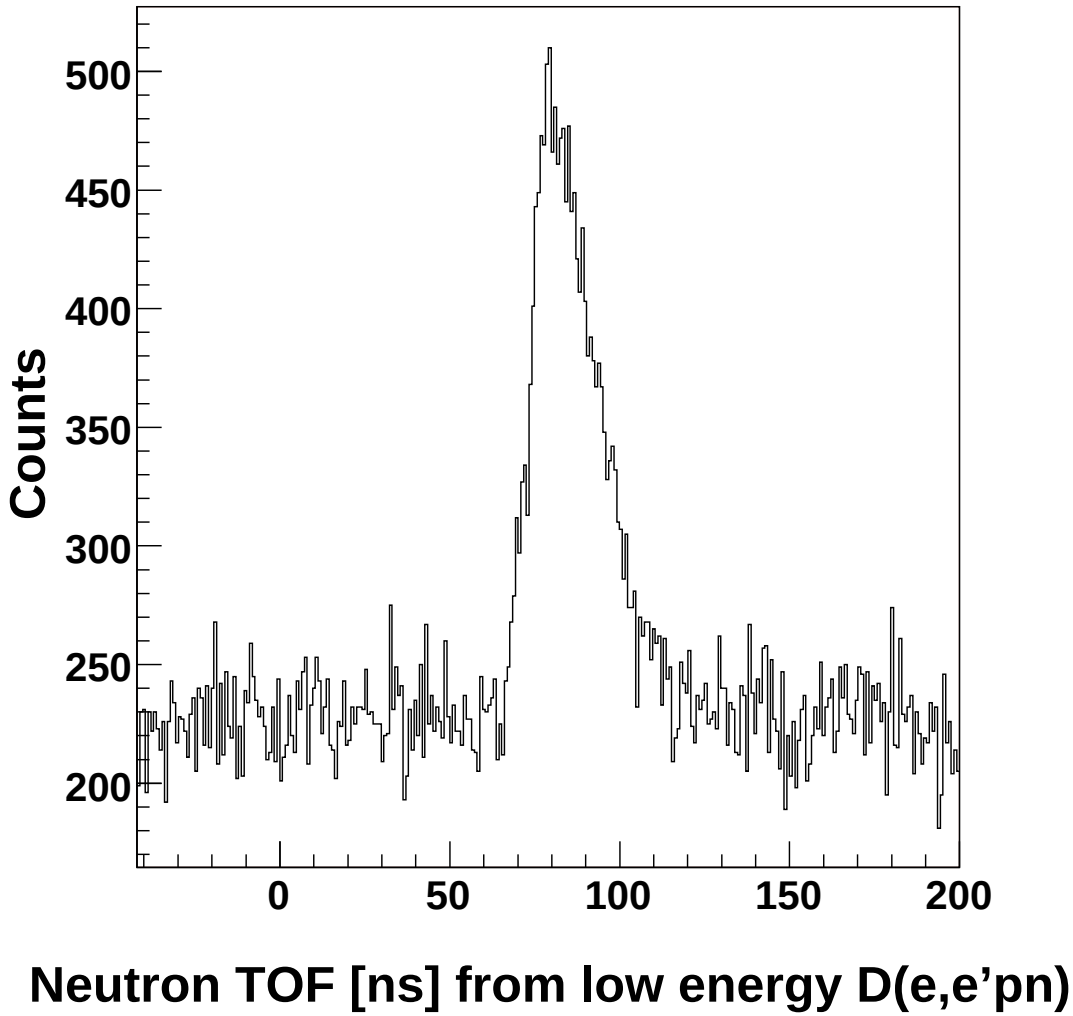
## Hall A high resolution spectrometers (HRS) response

- Coincident time between two HRS's: the signal is almost background free and has $\sigma$ about 0.5 ns.
- 2ns beam structure is also seen.



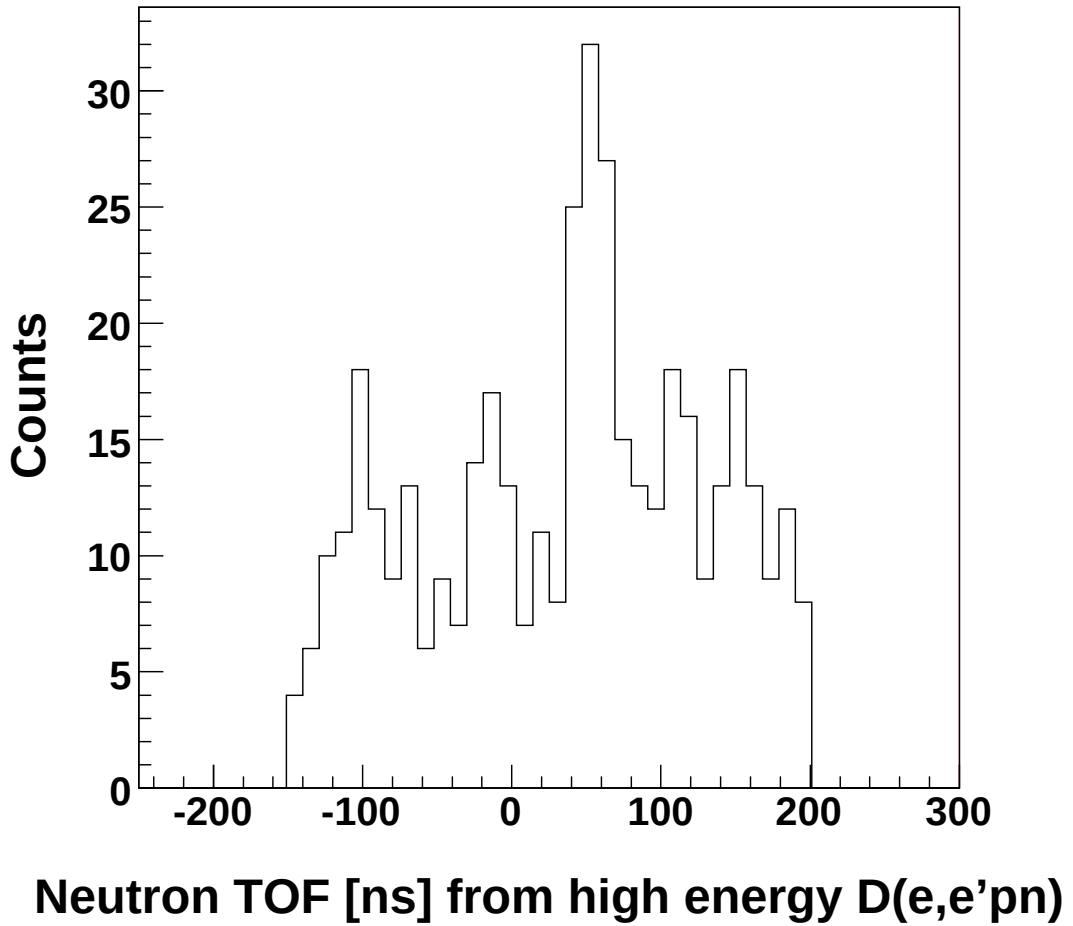
## Neutron Detector check

- Detector check for $D(e, e'pn)$ using low energy (2.345 GeV) beam.

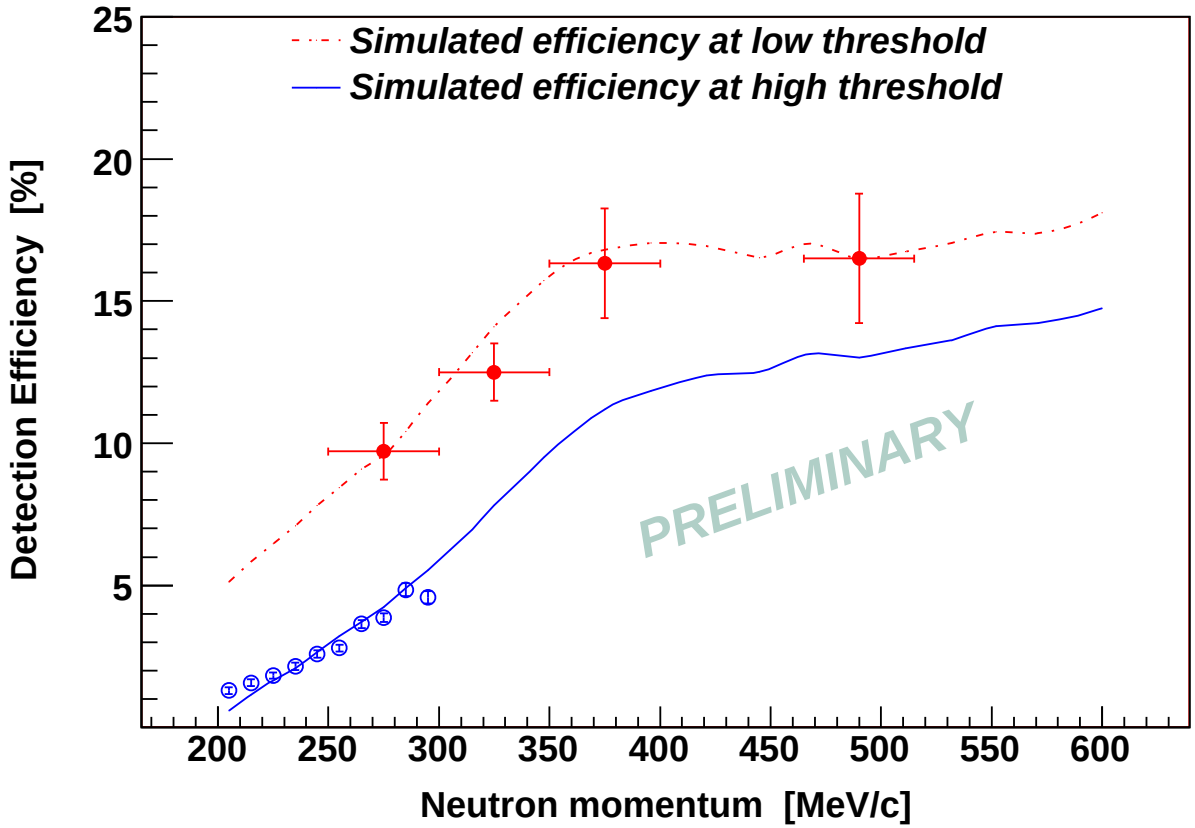


## Neutron Detector check

- Detector check with high energy (4.6275 GeV) beam for $D(e, e'pn)$.

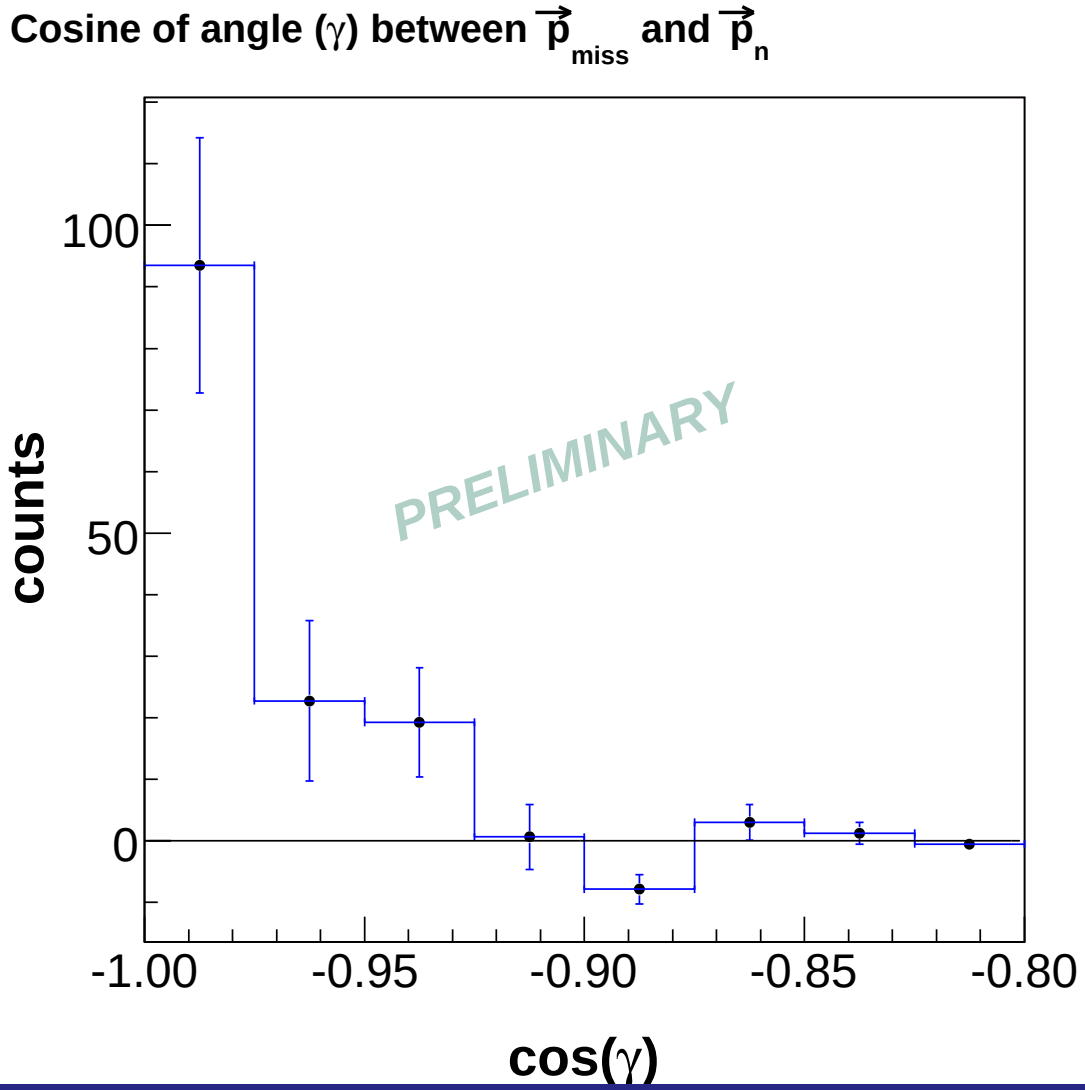


- Neutron detection efficiency using a monte-carlo code and compared with data as well.



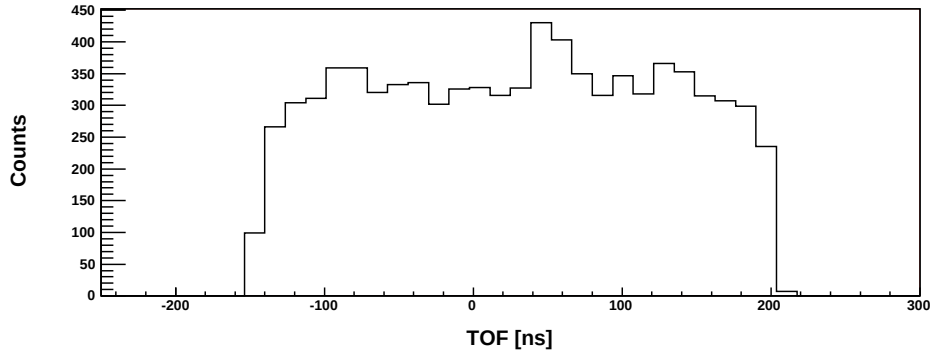
## Back-to-back correlations revisited

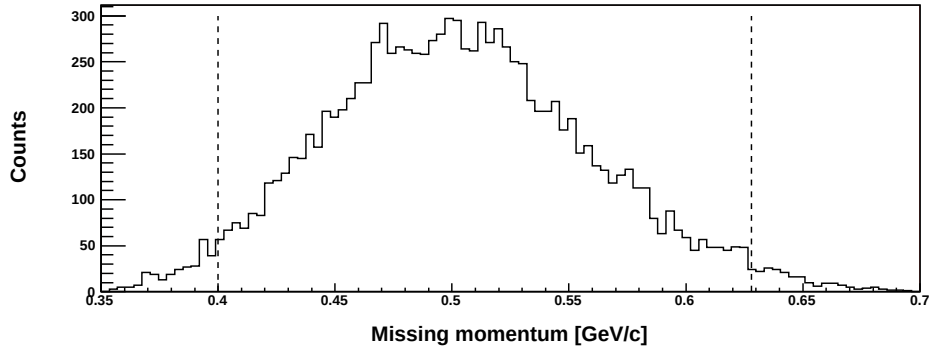
- The correlated np-pairs observed perfectly back-to-back.

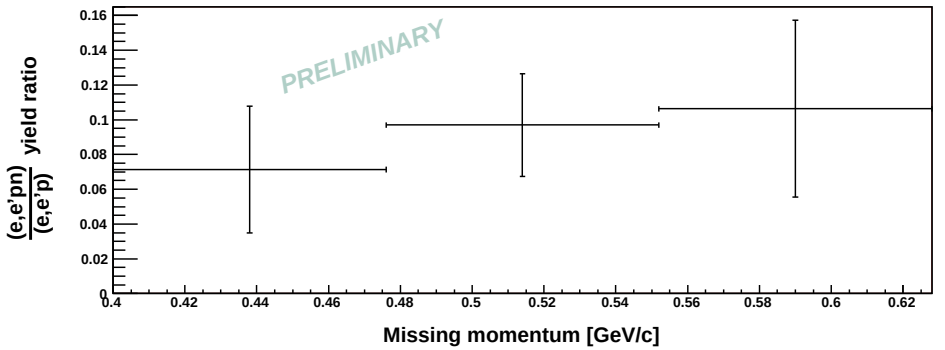


## Main result

- The yield ratio $\frac{^{12}C(e,e'pn)}{^{12}C(e,e'p)}$ has only efficiency correction but not the neutron detector angular acceptance correction.
- Preliminary analysis after angular acceptace correction (not shown) shows the yield ratio as little less than 1.0 indicating that the SRC is np-pair dominating.



# Conclusion I

- First time commissioning of BigBite at Jefferson lab looks successful.
- Newly built large acceptance neutron detector working well.
- Neutron detection efficiency of the neutron detector turns out to be $\backsim$ 17% for the neutrons above 350 MeV/c momenta.

# Conclusion II

- Observed clean back-to-back np-pairs.
- $\frac{^{12}C(e,e'pn)}{^{12}C(e,e'p)}$ yield ratio looks promising.
- In a preliminary analysis, the yield ratio of $\frac{^{12}C(e,e'pn)}{^{12}C(e,e'p)}$ is about 10-times higher than that of $\frac{^{12}C(e,e'pp)}{^{12}C(e,e'p)}$. This shows the dominance of np-pair short-range correlations over pp-pair.