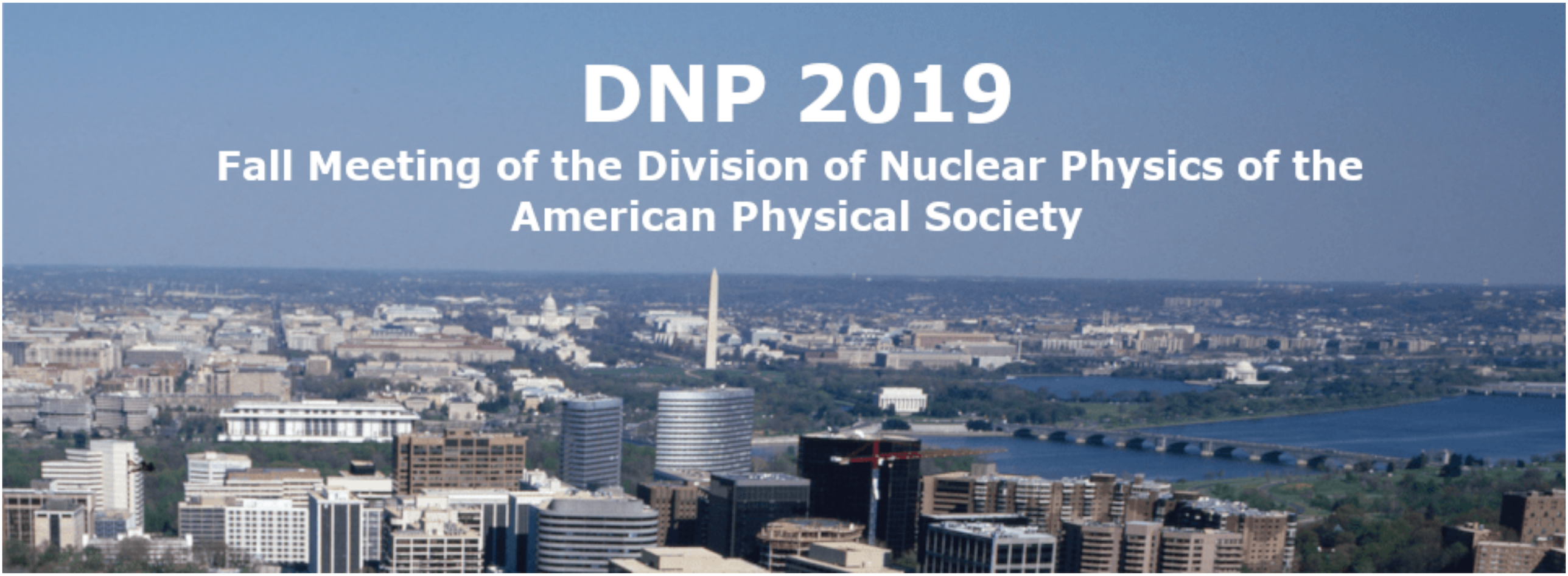
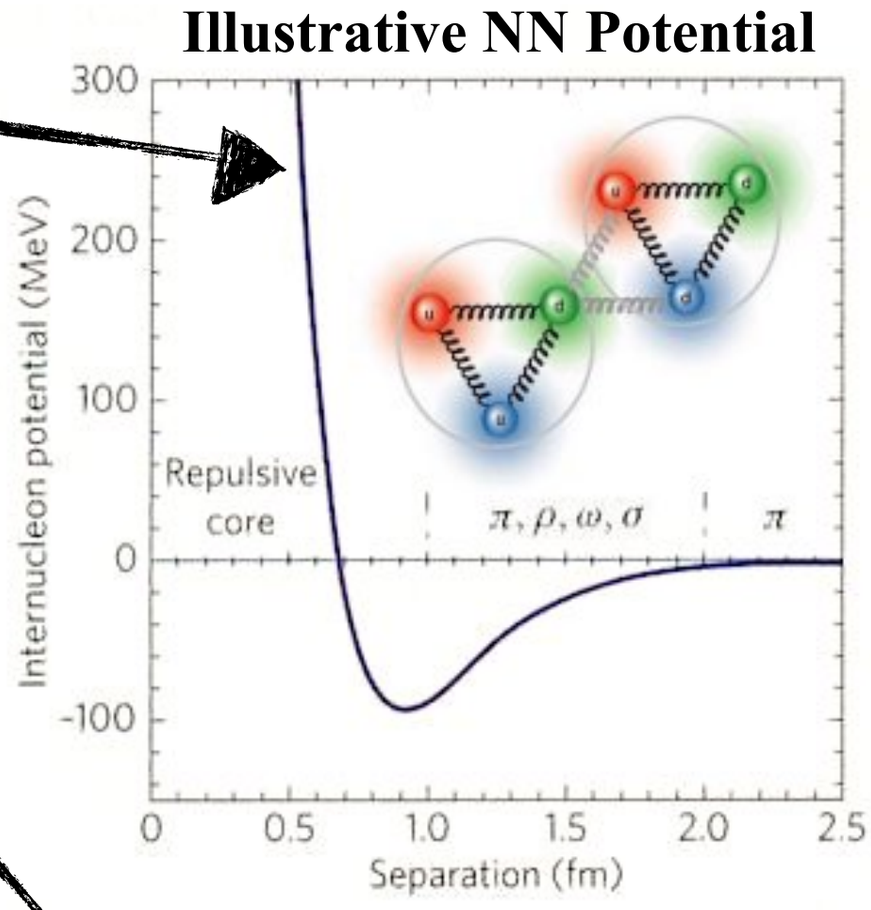


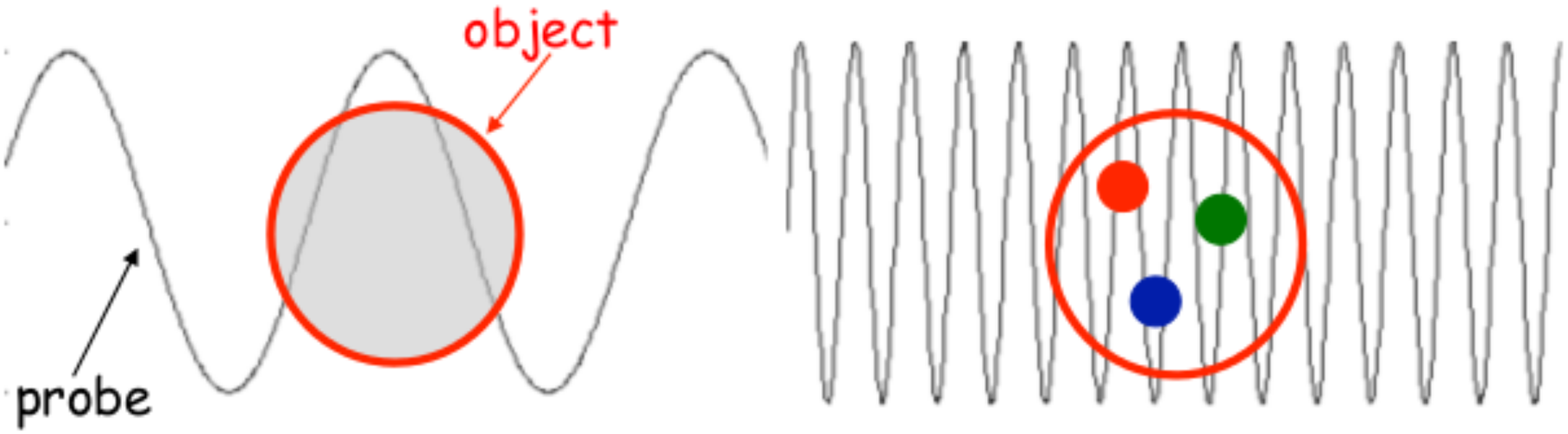
First Cross Section Results of D(e,e'p)n at Very High Recoil Momenta

Graduate Student: Carlos Yero
Spokespeople: Drs. Werner Boeglin and Mark Jones

Motivation

- ☑ **Short-range structure of the deuteron is currently not well understood.**
- ☑ **Most direct way to study the short-range structure of the deuteron is by probing its high momentum tails via D(e,e'p)n reaction at large momentum and energy transfers**
- ☑ **Extract momentum distributions from measured cross sections beyond 500 MeV/c recoil momentum at PWIA kinematics**





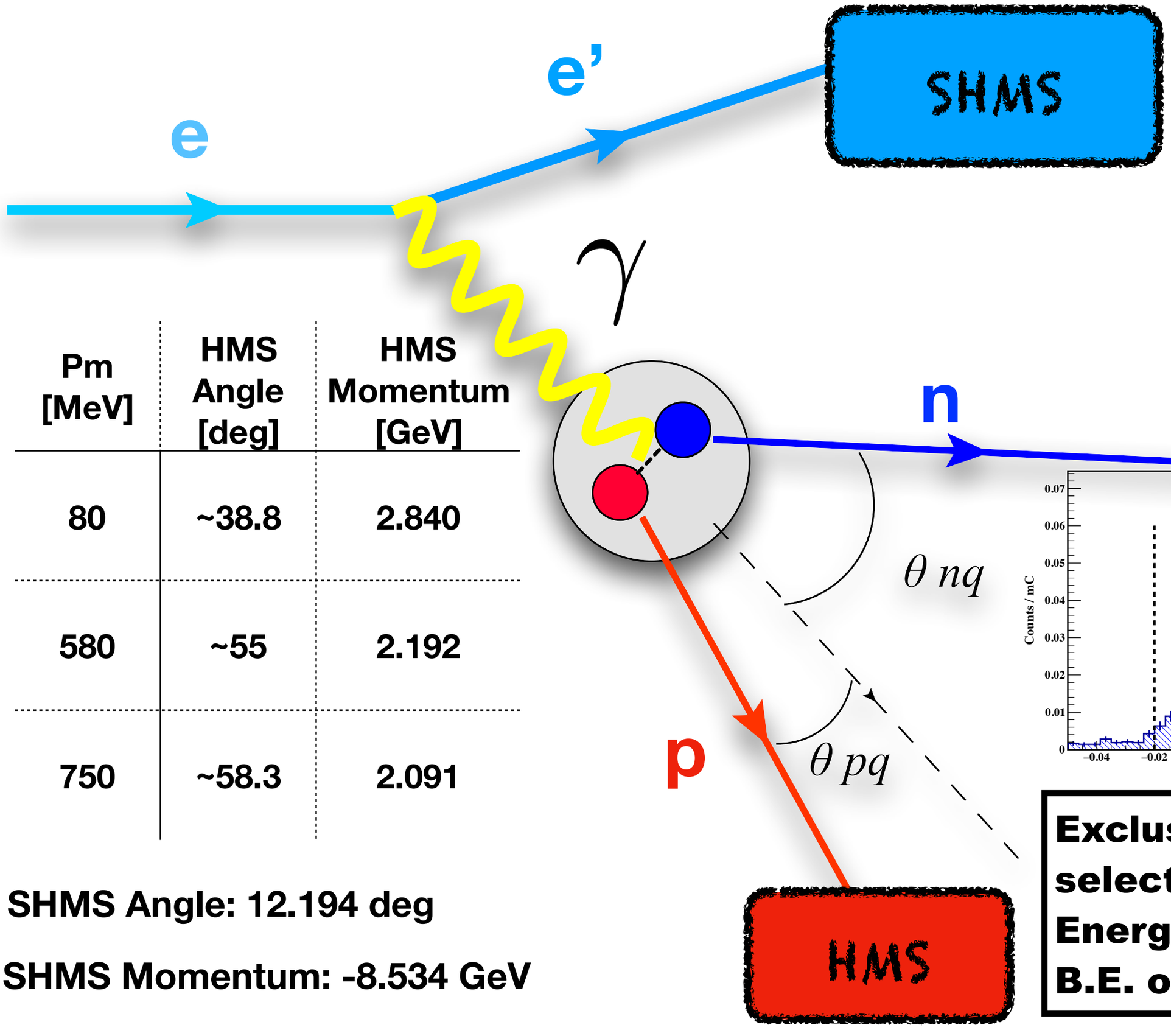
Illustrative figure of low and high energy probe on an object

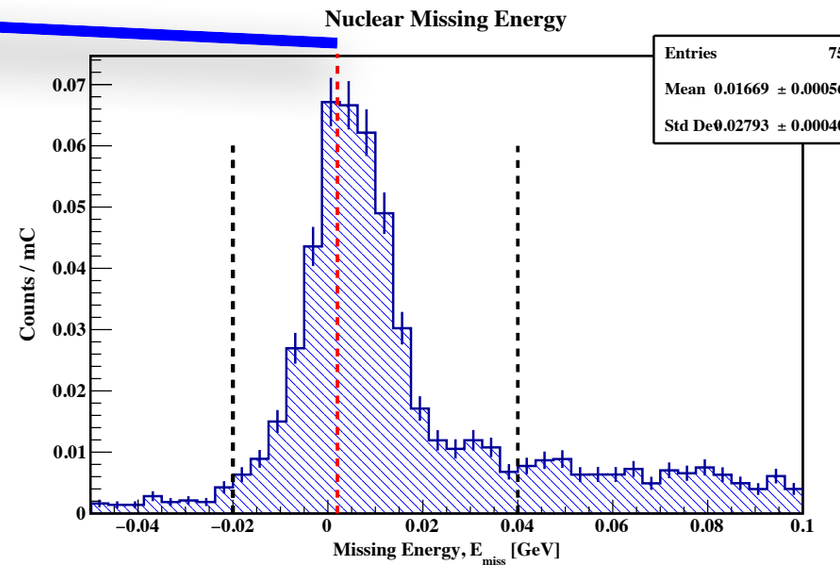
D(e,e'p)n Kinematics

Pm [MeV]	HMS Angle [deg]	HMS Momentum [GeV]
80	~38.8	2.840
580	~55	2.192
750	~58.3	2.091

SHMS Angle: 12.194 deg

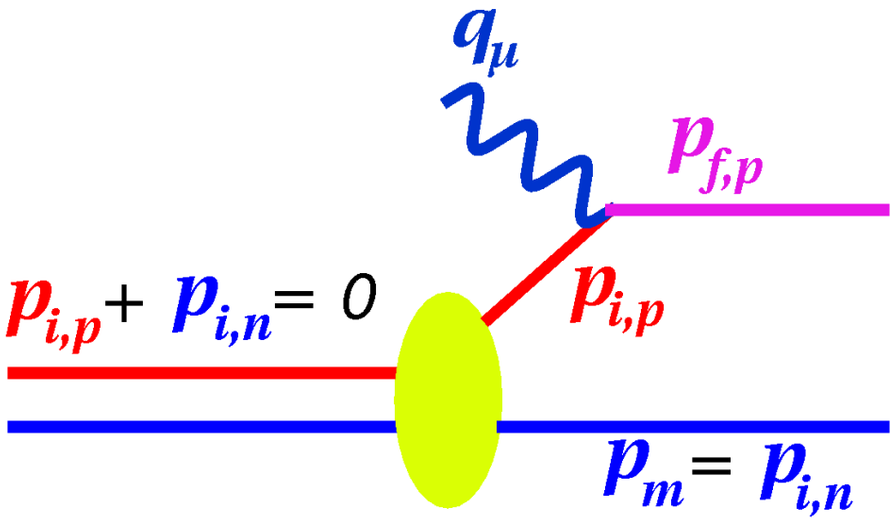
SHMS Momentum: -8.534 GeV



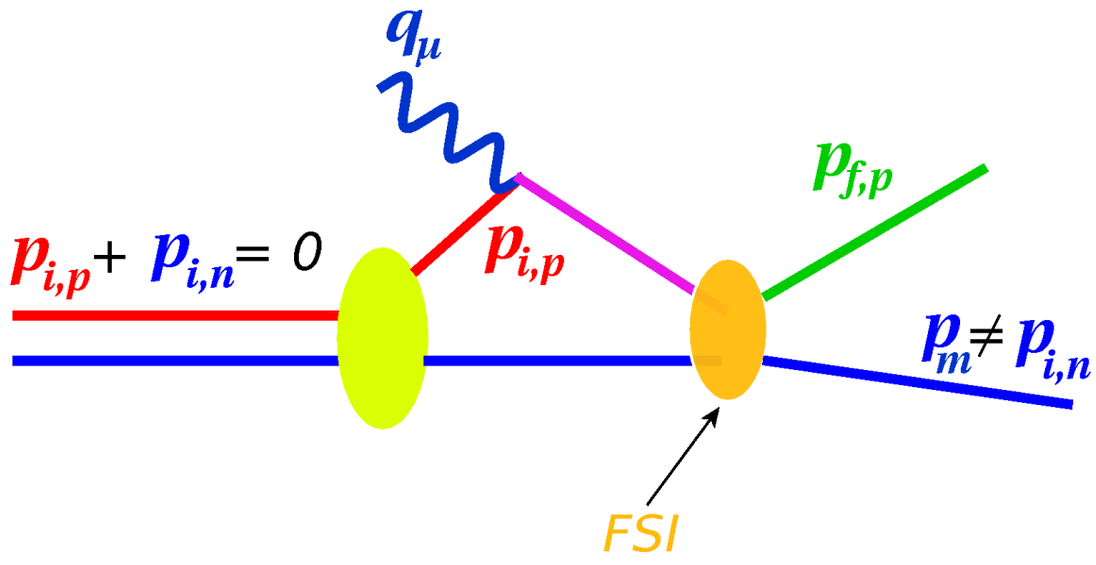


Exclusive reaction selected via Missing Energy Cut around the B.E. of the Deuteron

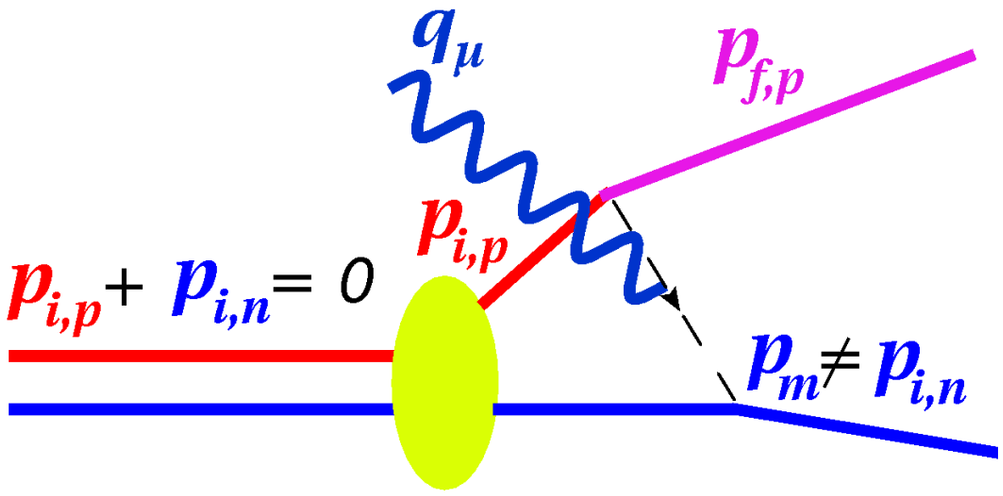
D(e,e'p)n Feynman Diagrams



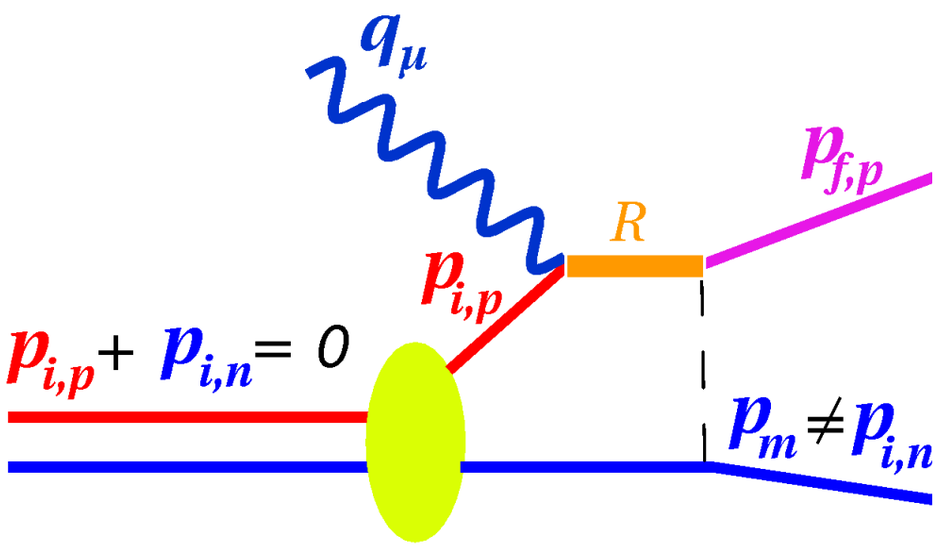
Plane Wave Impulse Approximation (PWIA)



Final State Interactions (FSI)

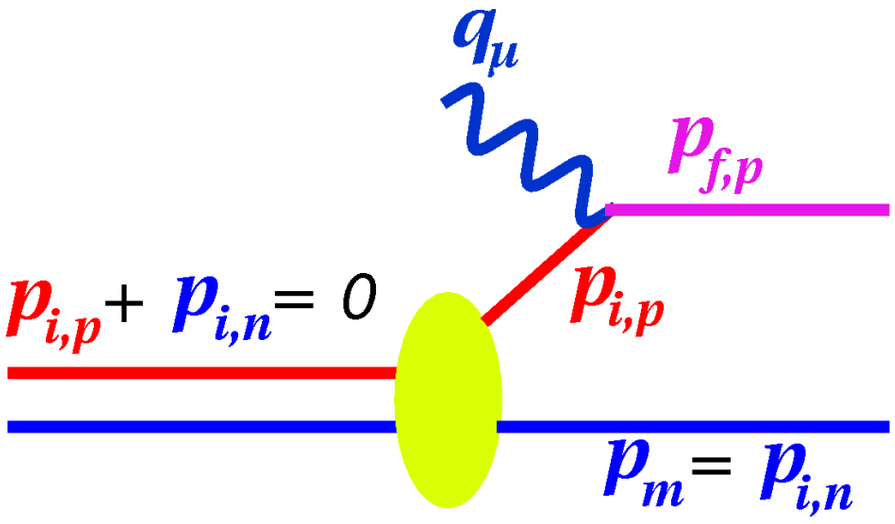


Meson-Exchange Currents (MEC)

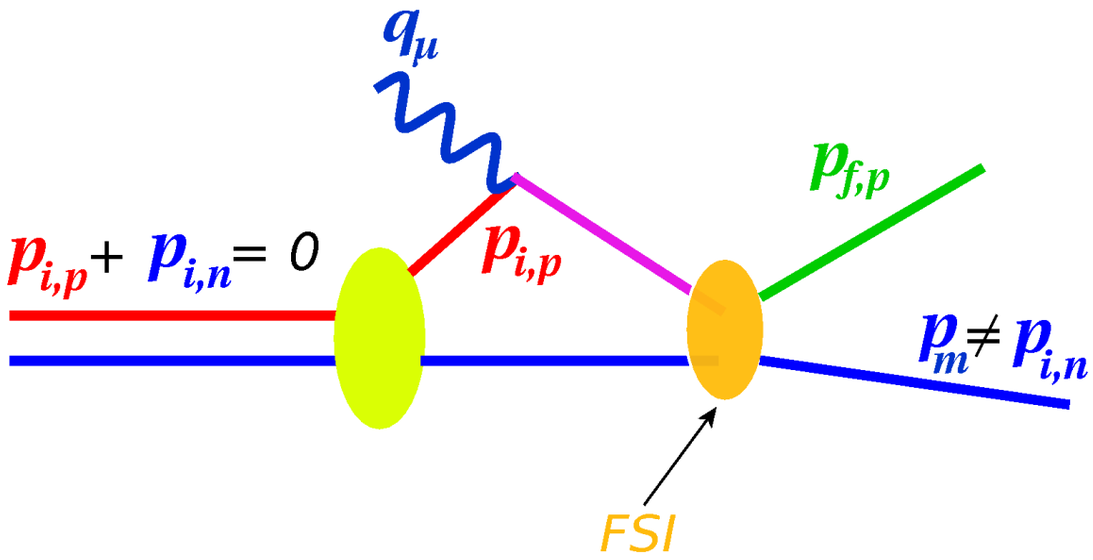


Isobar Configurations (IC)

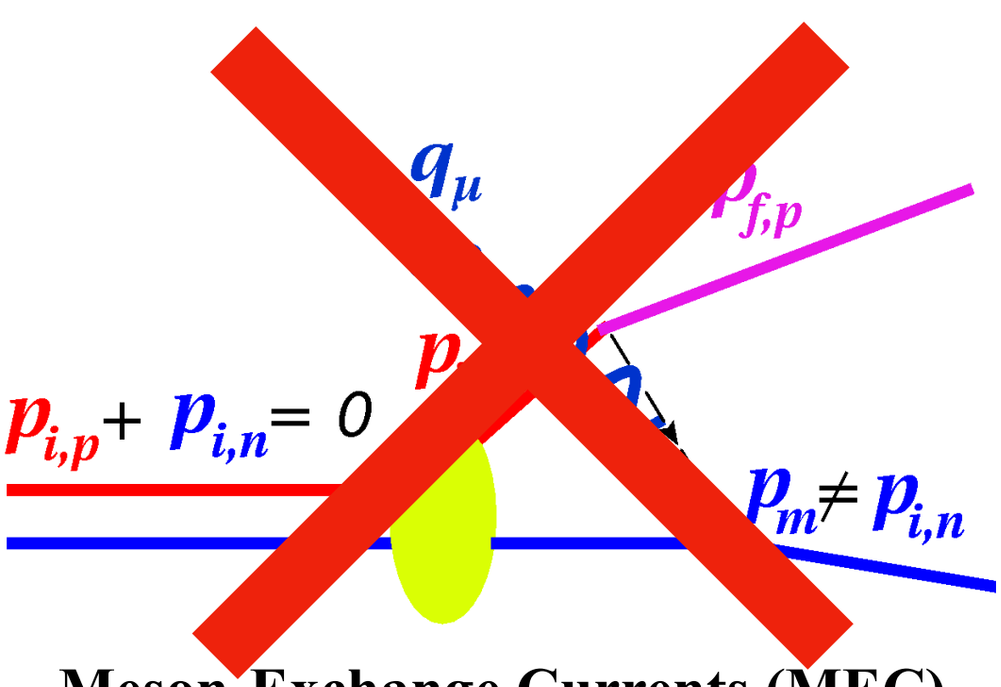
D(e,e'p)n Feynman Diagrams



Plane Wave Impulse Approximation (PWIA)

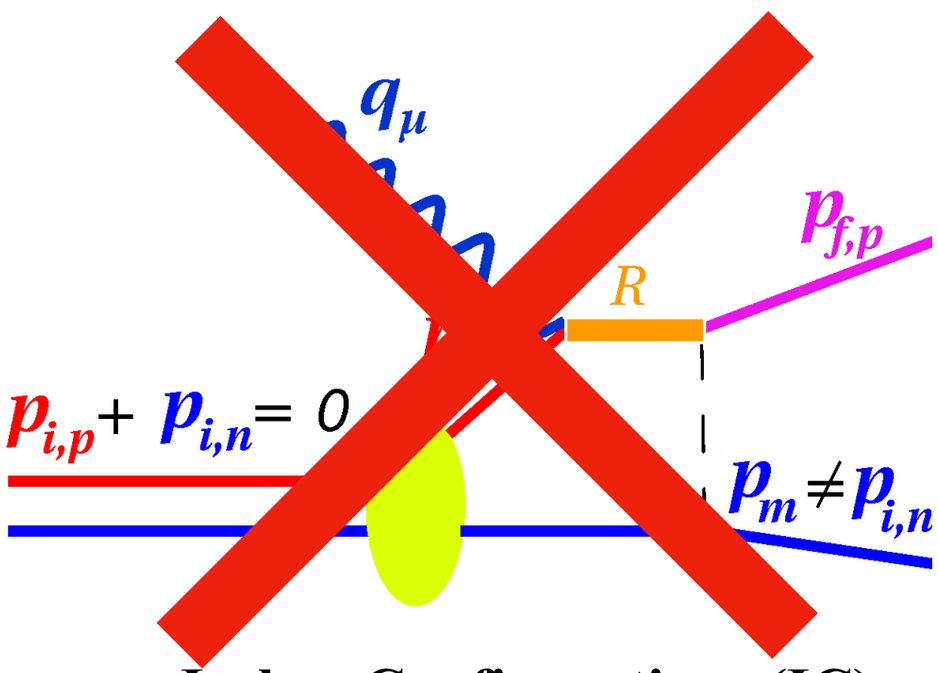


Final State Interactions (FSI)



Meson-Exchange Currents (MEC)

Suppressed at Large Q2



Isobar Configurations (IC)

Suppressed at x-Bjorken > 1

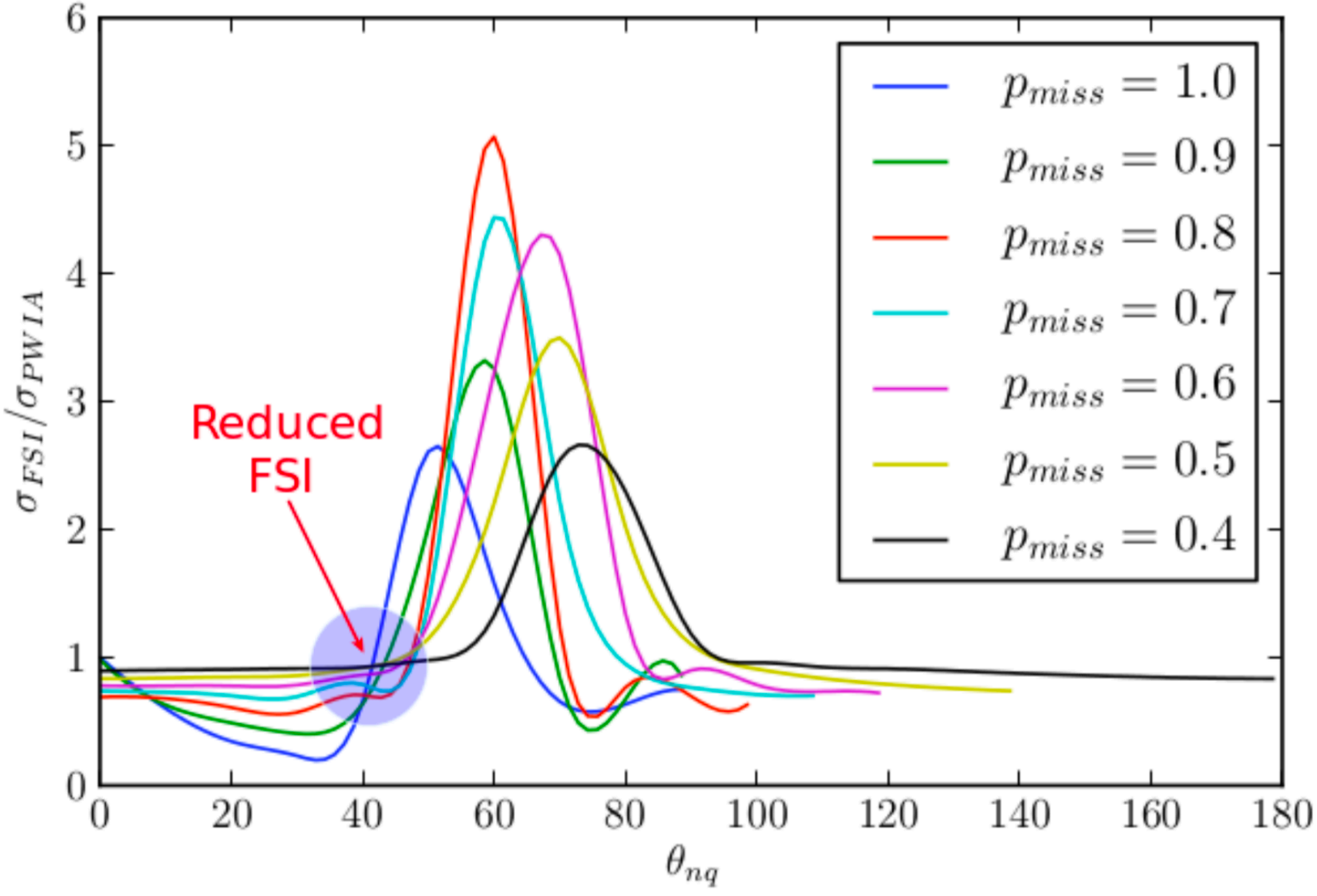
Theoretical Background for D(e,e'p)n

- **The onset of GEA is established at large Q2, which predicts a strong angular dependence of FSI on recoil angles**

- **Kinematical Region where FSI are small was FOUND at ~ 40 deg !**

$\frac{\text{D(e,e'p)n Kinematics}}{E_e = 11 \text{ GeV}}$
$Q^2 = 4.25 \text{ (GeV/c)}^2$
$x_{B_j} = 1.35$
$p_m = 0.5 - 1.0 \text{ GeV/c}$
$\theta_{nq} = 35^\circ - 40^\circ$

W.U. Boeglin *et. al*
Int.J.Mod.Phys. E24
(2015) no.03, 1530003



Theoretical Calculation by: M. Sargsian

Deuteron Momentum Distribution

Experiment

$$\sigma_{exp} \equiv \frac{d^5\sigma}{d\omega d\Omega_e d\Omega_p} = K \cdot \sigma_{ep} \cdot S(p_m)$$

Theory

$$S(p_m) \approx \sigma_{red} \equiv \frac{\sigma_{exp}}{K\sigma_{ep}}$$

Factorization ONLY possible in PWIA

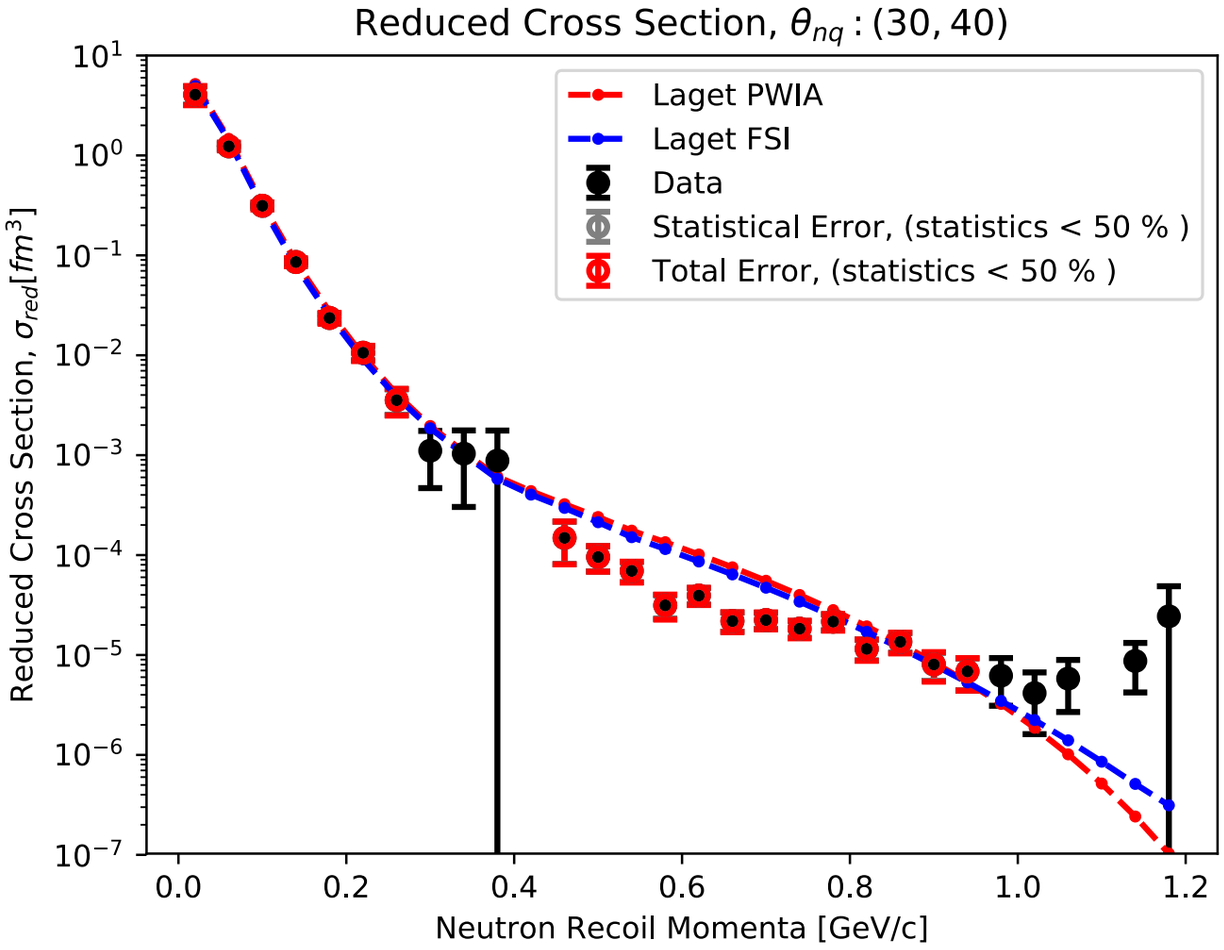
ep off-shell cross section

electron scatters off a bound proton within the nucleus; usually, de Forest σ_{cc1} or σ_{cc2} is prescribed

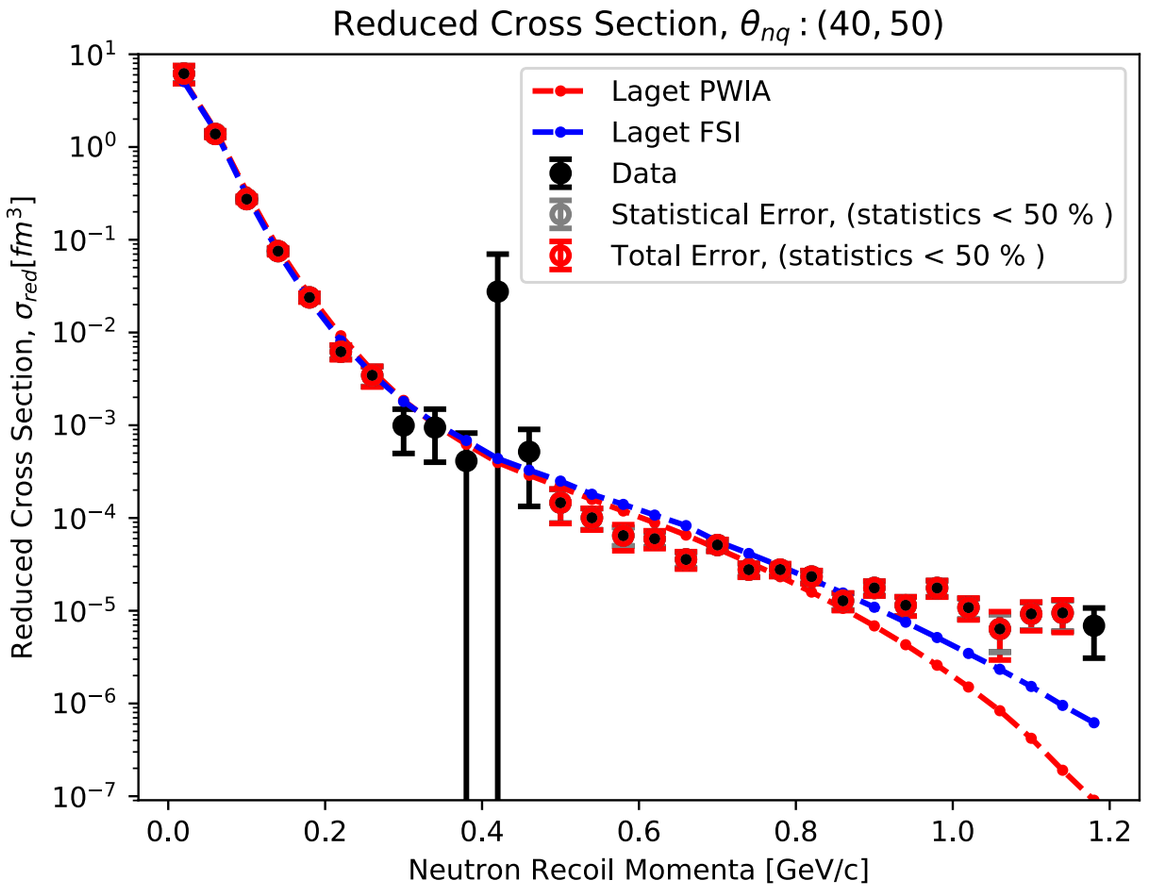
Spectral Function, $S(p_m)$

the momentum distribution inside the deuteron is interpreted as the probability density of finding a bound proton with momentum p_i

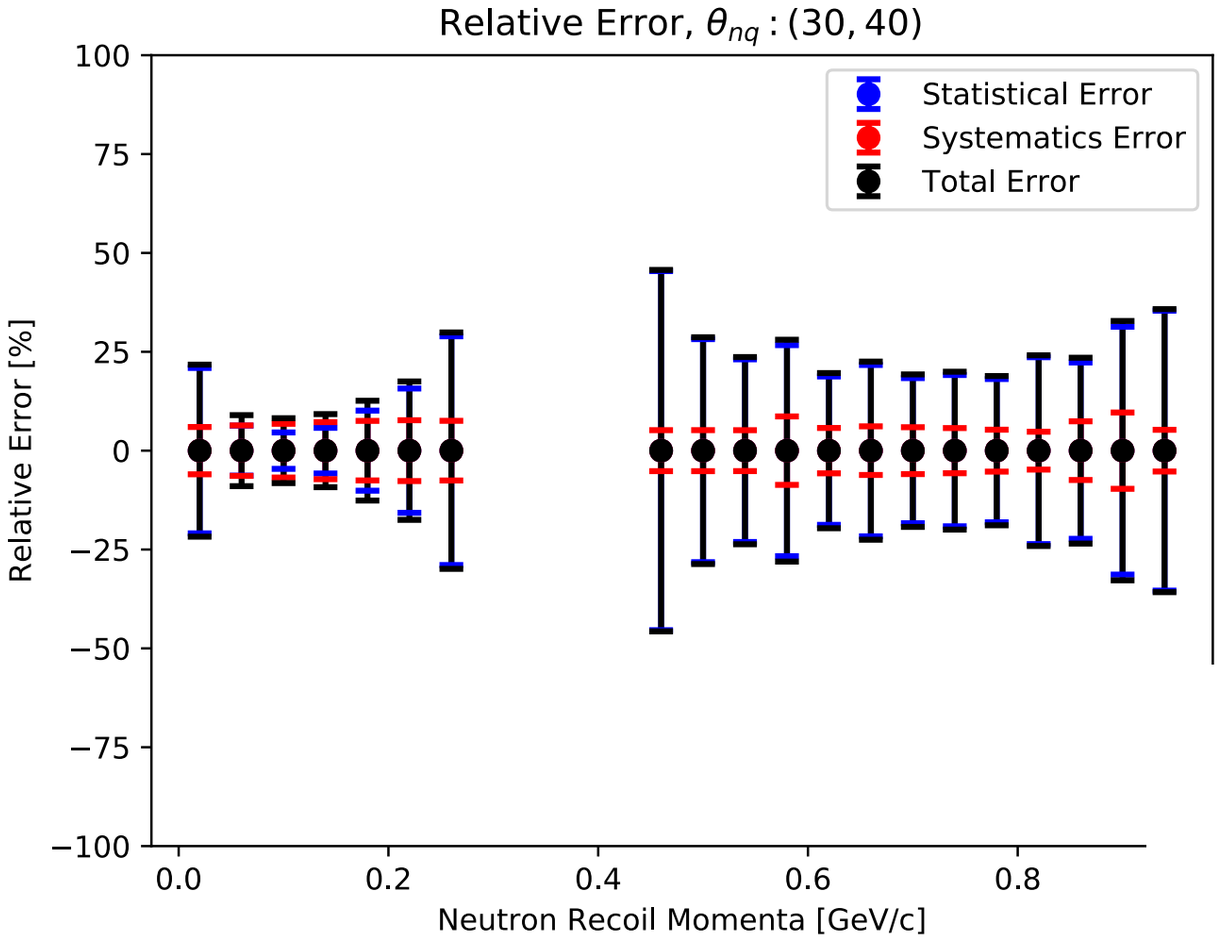
PLOTS SHOWING REDUCED CROSS SECTIONS AT 35 AND 45 DEG.

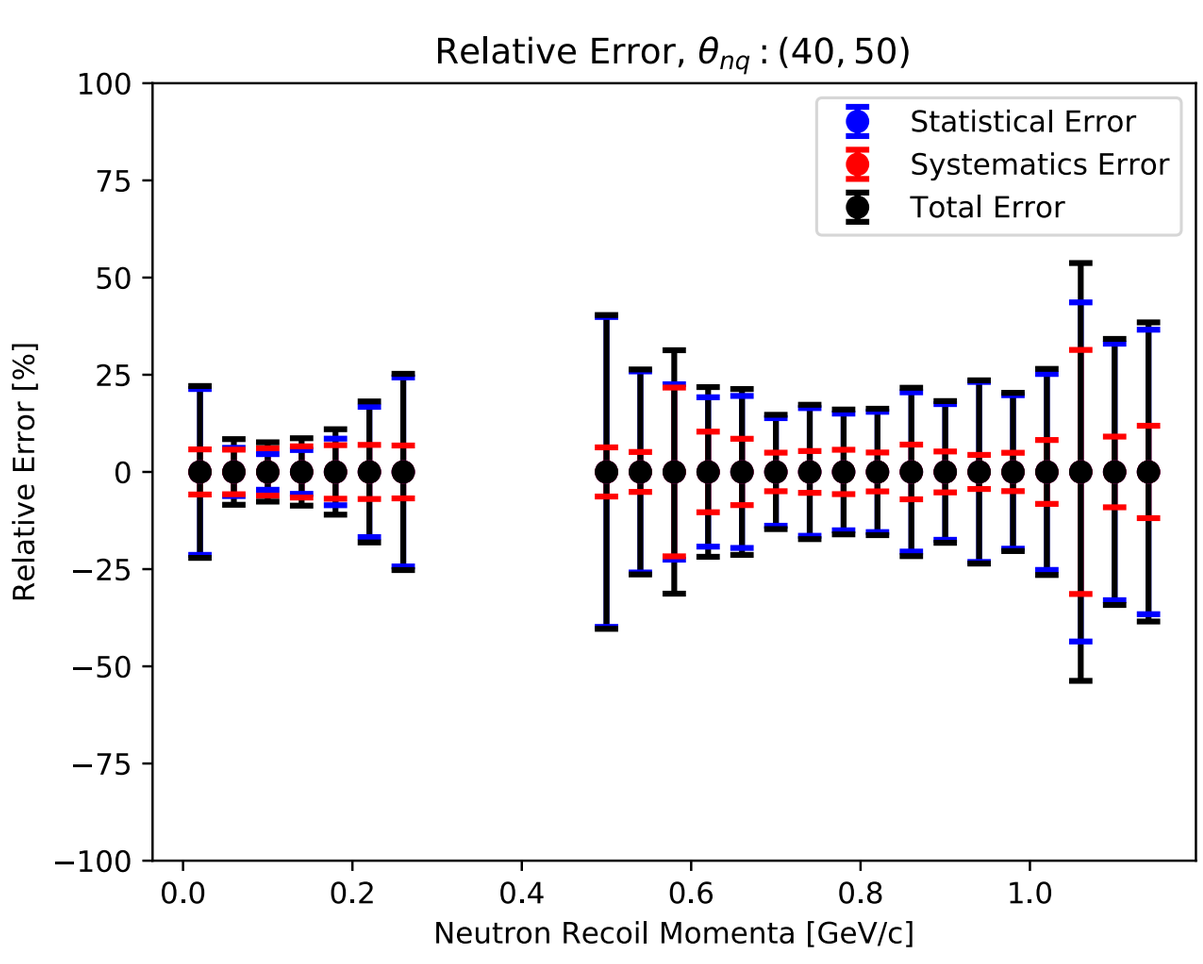


Need to be updated to show comparison with additional models

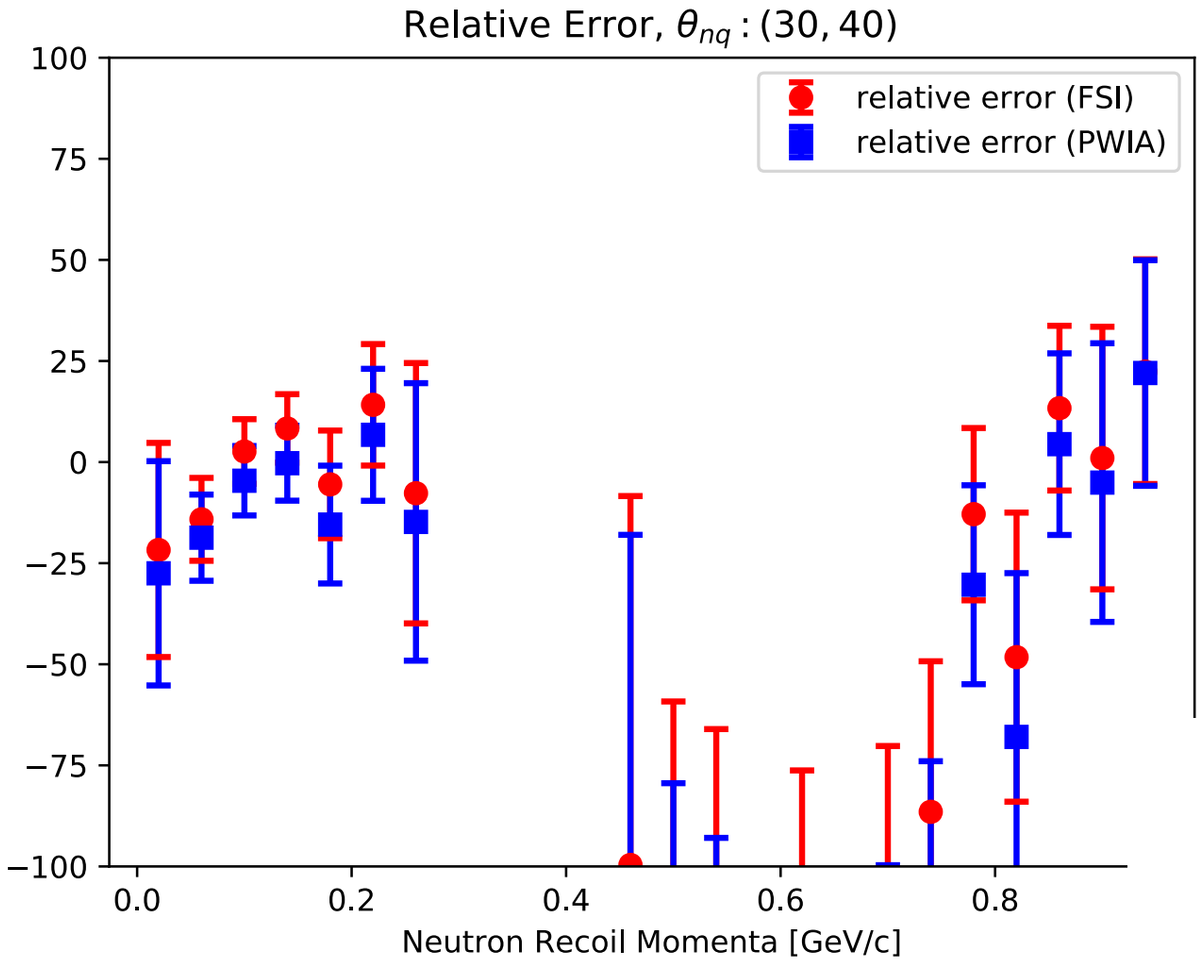


PLOTS SHOWING ERROR CONTRIBUTIONS TO DATA REDUCED CROSS SECTION





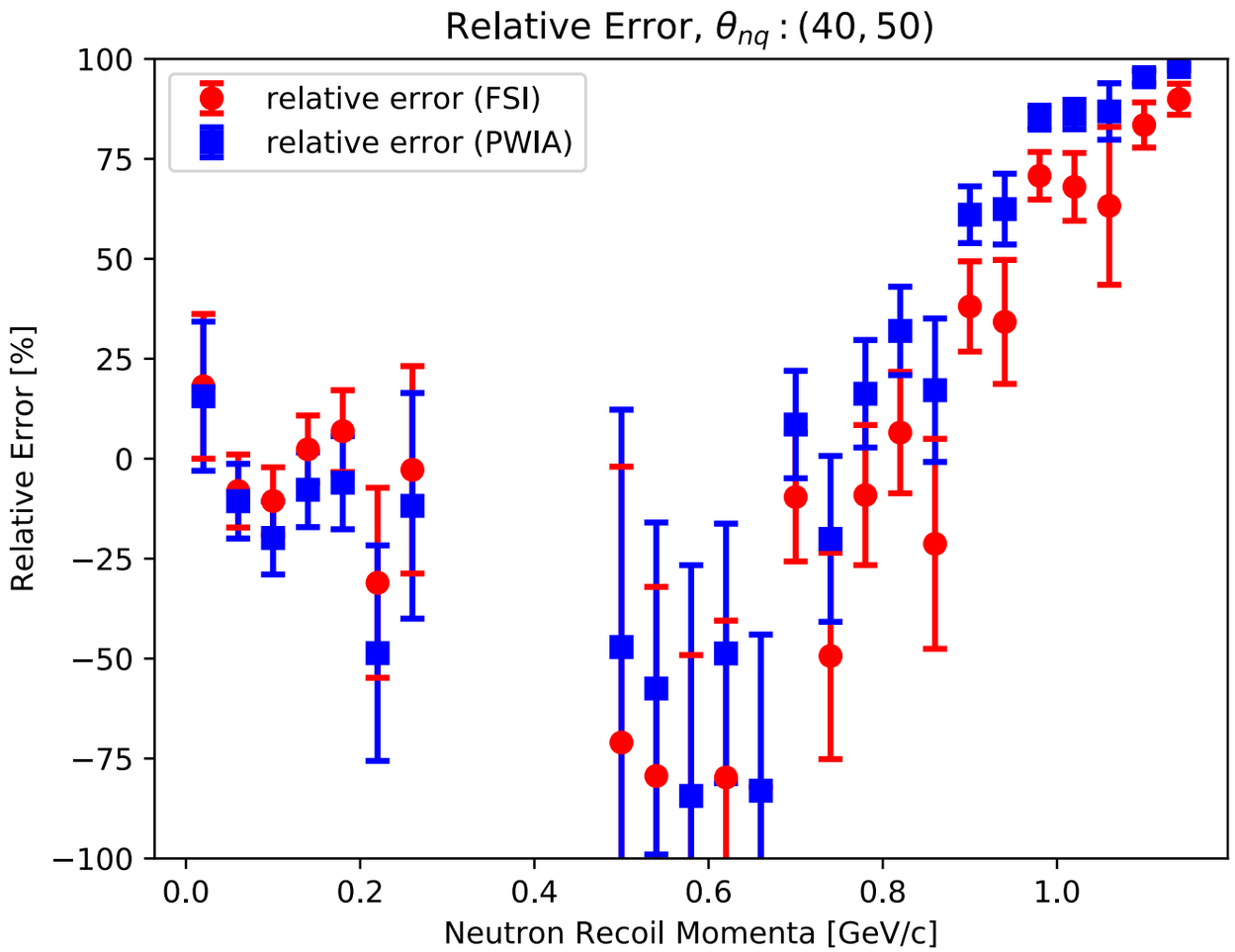
PLOTS SHOWING RELATIVE ERROR BETWEEN DATA AND MODEL

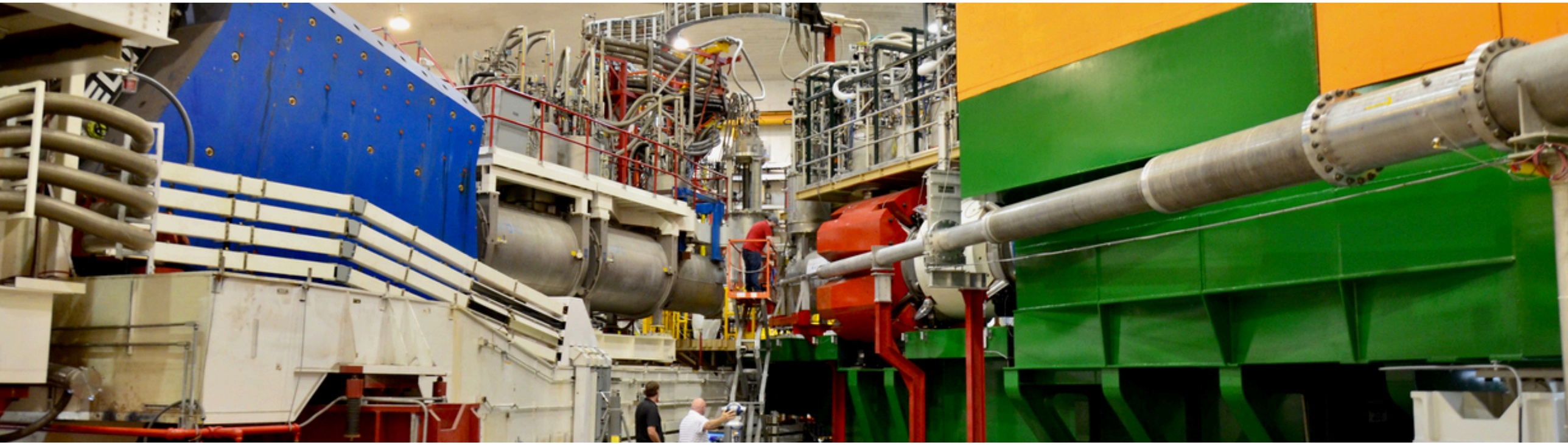


$$R = \frac{\sigma_{red}^{data} - \sigma_{red}^{model}}{\sigma_{red}^{data}} \times 100$$

$$\delta R^2 = \left(\frac{\partial R}{\partial \sigma_{red}^{data}} \right)^2 (\delta \sigma_{red}^{data})^2$$

Need to be updated to show comparison with additional models





THANK YOU !