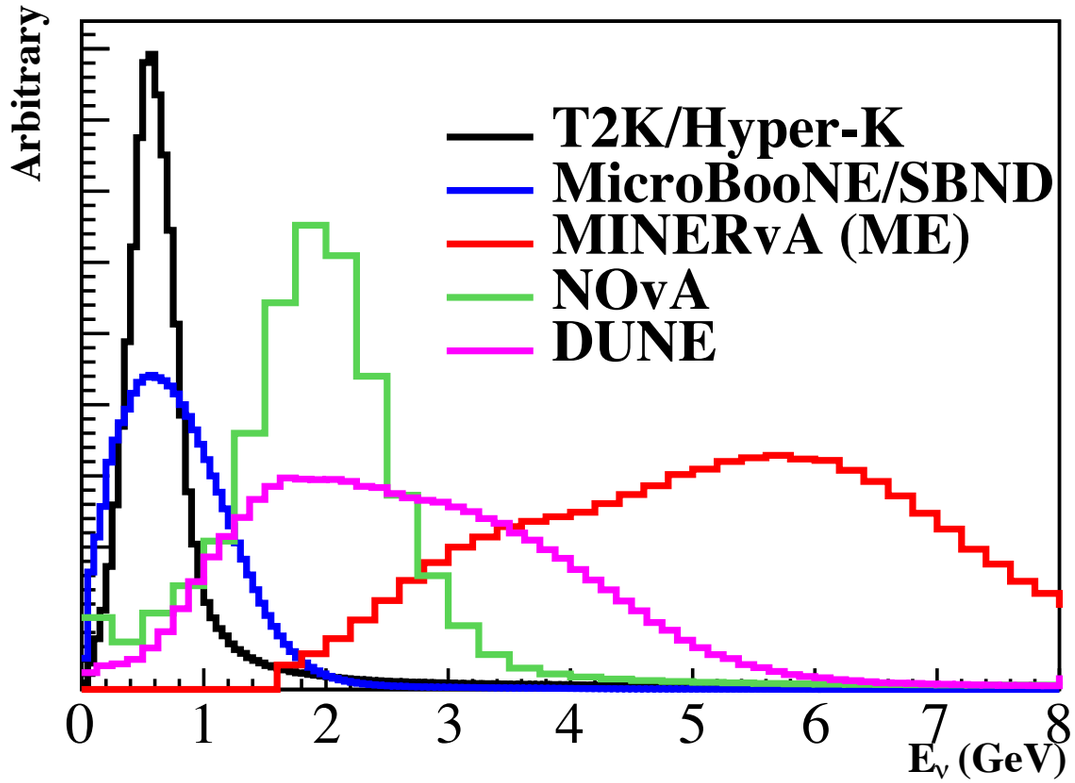
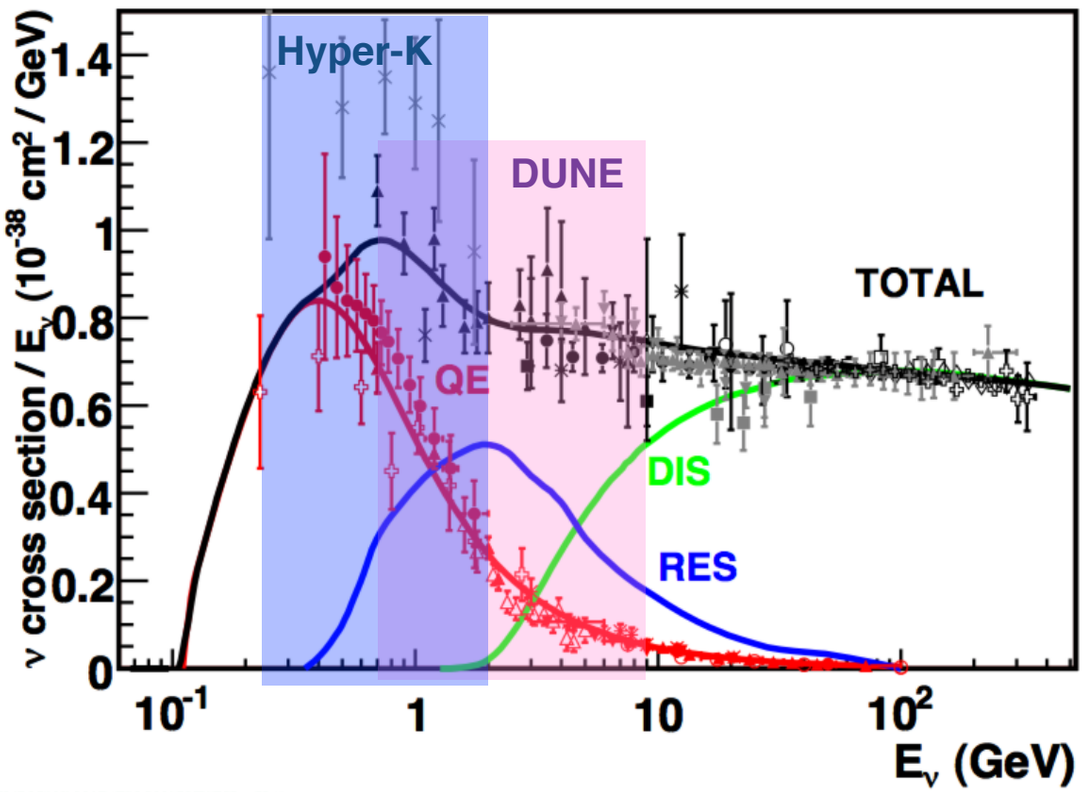
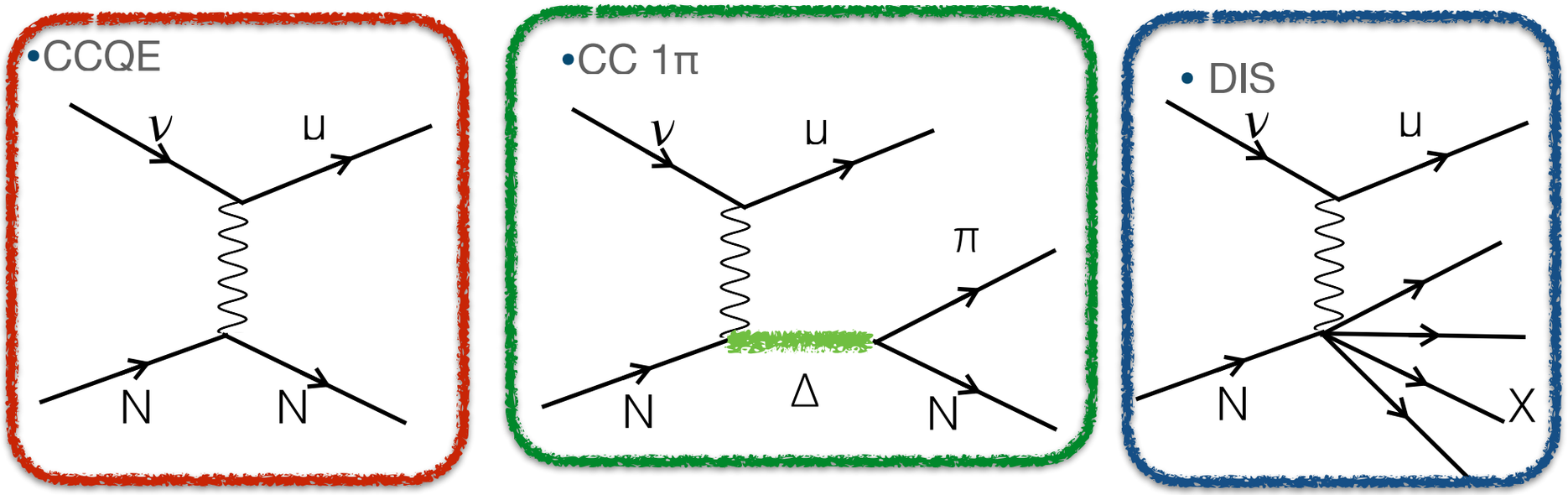
Addressing future precision experiments



J.A. Formaggio and G.P. Zeller, Rev. Mod. Phys. 84 (2012)



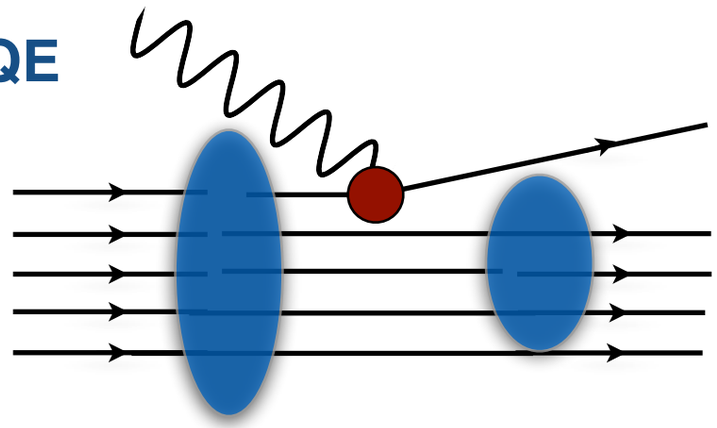


• The dominant reaction mechanism changes dramatically over the region of interest to oscillation experiment

Factorization Scheme and Spectral Function

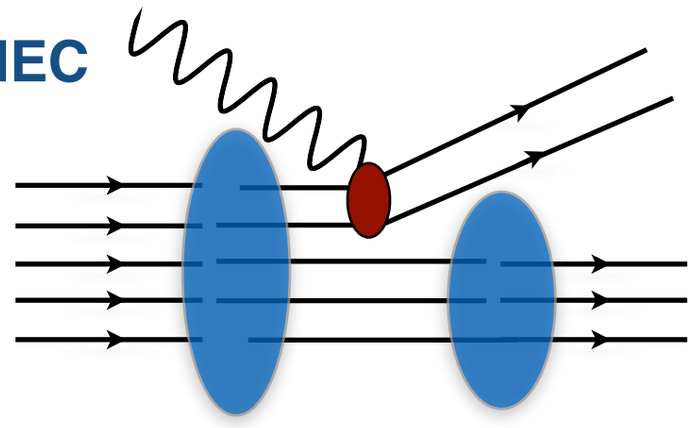
For sufficiently large values of |**q**|, the **factorization scheme** can be applied

QE



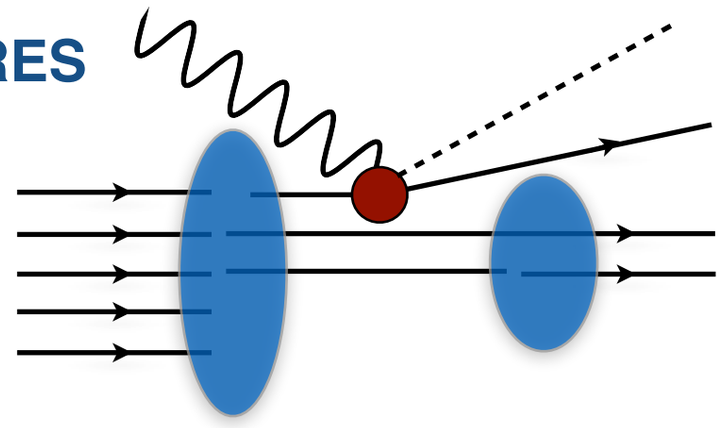
$$|f\rangle \rightarrow |p\rangle \otimes |f_{A-1}\rangle$$

MEC



$$|f\rangle \rightarrow |pp'\rangle_a \otimes |f_{A-2}\rangle$$

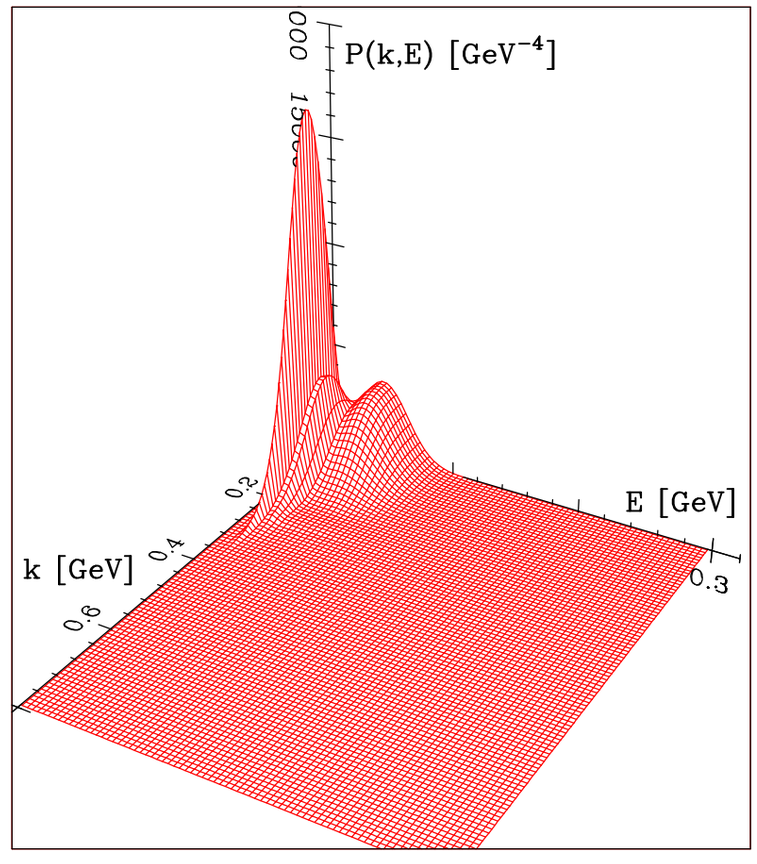
RES



$$|f\rangle \rightarrow |p_\pi p\rangle \otimes |f_{A-1}\rangle$$

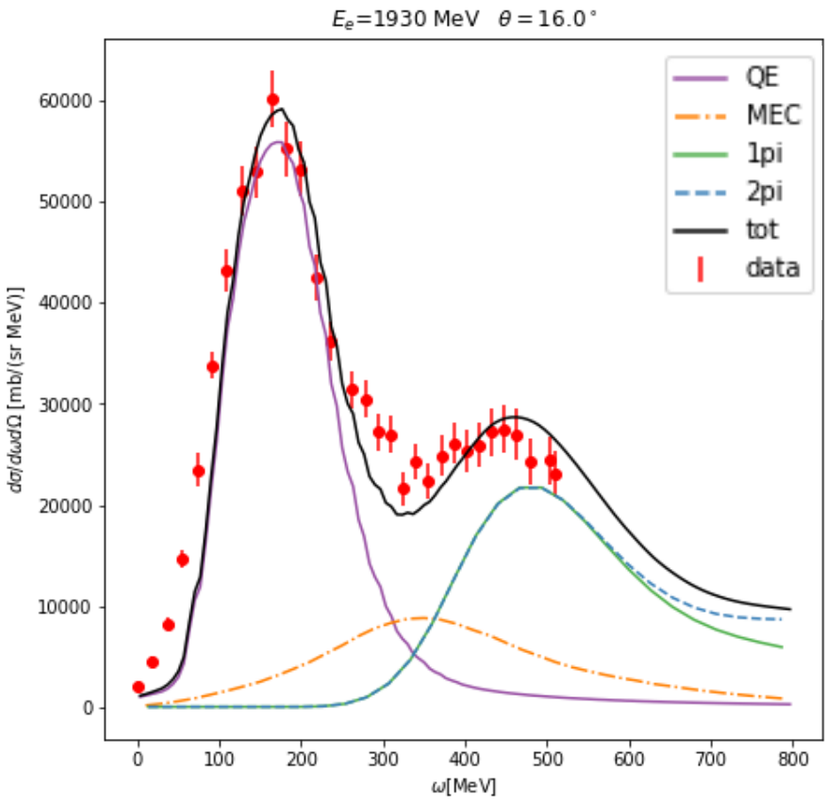
The intrinsic properties of the nucleus are described by the **Spectral Function**→ effective field theory and nuclear many-body methods

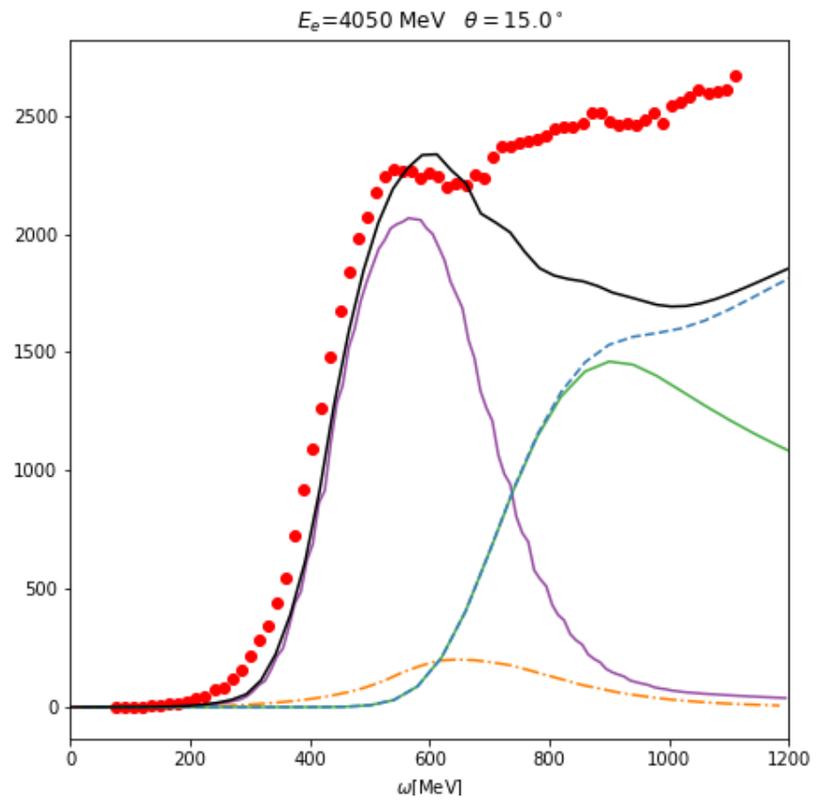
$$d\sigma_A = \int dE d^3k \; d\sigma_N P(\mathbf{k}, E)$$



O. Benhar, A. Fabrocini, and S. Fantoni, Nucl. Phys. A505, 267 (1989).

Factorization Scheme and Spectral Function





- We included the DCC predictions for two π production
- We plan to tackle the DIS further extending the convolution approach: spectral function+nucleon pdf
- In collaboration with J. Isaacson, H. Haider, and **S. English**

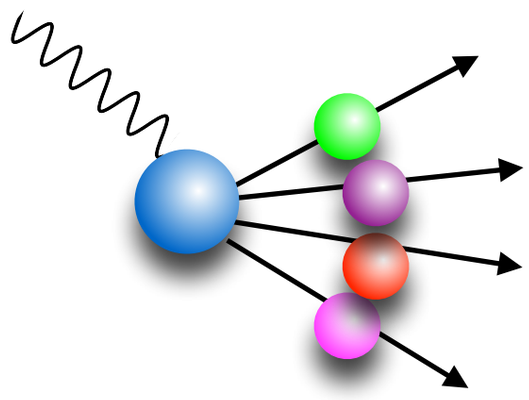
$$d\sigma_A = \int dE\, d^3k\, d\sigma_N\, P(\mathbf{k}, E)$$

$$d\sigma_N \propto W_2(\omega, q^2) cos^2\frac{\theta}{2} + 2W_1(\omega, q^2) sin^2\frac{\theta}{2}$$

$Q^2 \to \infty,\ \omega \to \infty$

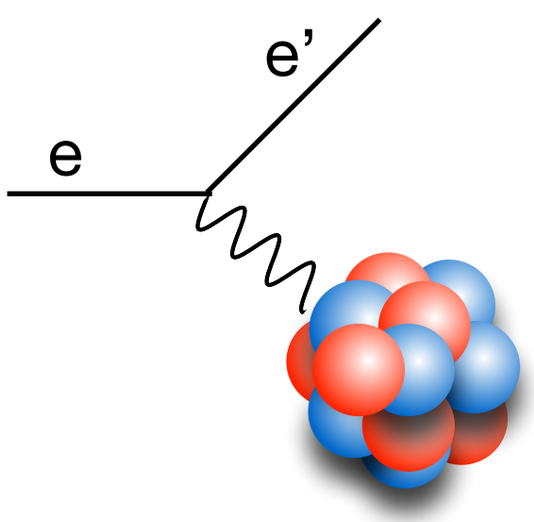
$$\omega W_2(\omega, q^2) \to F_2(x) = \sum_i e_i^2 x f_i(x)$$

$$mW_1(\omega, q^2) \to F_1(x) = \frac{1}{2x} F_2(x)$$

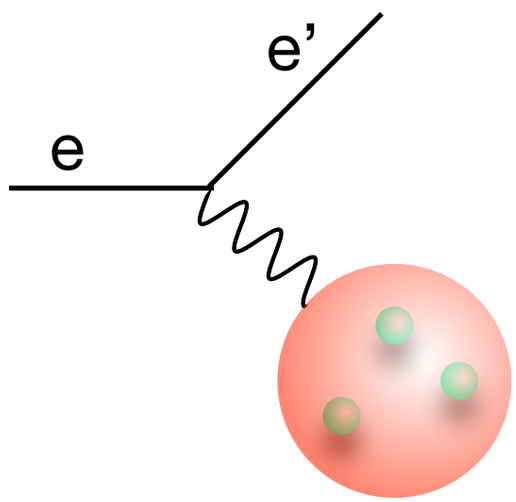


- Use different sets of PDF using the LHAPDF library and comparing with nuclear nCTEQ pdf

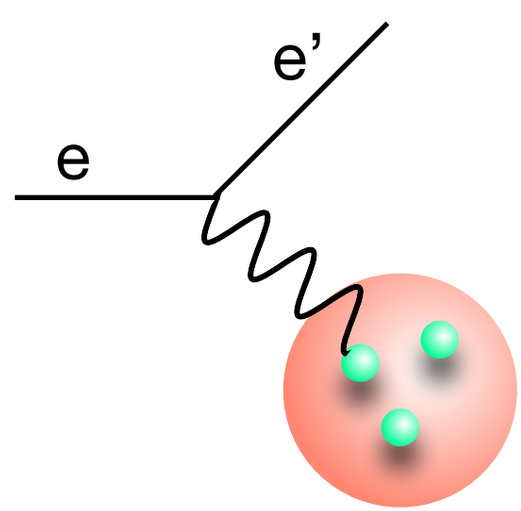
Extension to Deep Inelastic Scattering



- Nuclear level



- Nucleon level



- Quark level

$$d\sigma_N \propto W_2(\omega, q^2)cos^2\frac{\theta}{2} + 2W_1(\omega, q^2)sin^2\frac{\theta}{2}$$

$$W_1^A = \int d^3p dE\, P(p,E)\left(\frac{m}{E_p}\right)\left[W_1^N + \frac{1}{2}\frac{W_2^N}{m_N^2}|\vec{p}\times\hat{q}|^2\right]$$

$$W_2^A = \int d^3p dE\, P(p,E)\left(\frac{m}{E_p}\right)\left[W_1^N\frac{Q^2}{q^2}\left(1-\frac{Q^2}{\tilde{Q}^2}\right) + \frac{W_2^N}{m_N^2}\left[\frac{Q^4}{q^4}\left(E_p + \frac{\tilde{\omega}(\tilde{Q}p)}{\tilde{Q}^2}\right)^2 + \frac{1}{2}\frac{Q^2}{q^2}|\vec{p}\times\hat{q}|^2\right]\right.$$

$$\omega W_2(\omega, q^2) \to F_2(x) = \sum_i e_i^2 x f_i(x) \qquad mW_1(\omega, q^2) \to F_1(x) = \frac{1}{2x}F_2(x)$$