

GiBUU: Future Problems

of all generators, not just GiBUU

General GiBUU Status

- Two venues for improvement
 - Theory: 2p-2h interactions at high Q^2 , ω ?
 - Theory: Consistent treatment of 2p-2h in Transport, Doublecounting problem
- Combination of inclusive X-sections with generator for simulation of full final state

Details of 2p-2h get Flux-smeared

- Model for $\nu + p_1 + p_2 \rightarrow p_3 + p_4 + \mu$ (no recoil)

$$\frac{d^2\sigma}{dE'_l d(\cos\theta')} \propto \frac{k'}{k} \int_{NV} d^3r \int \prod_{j=1}^4 \frac{d^3p_j}{(2\pi)^3 2E_j} f_1 f_2 \overline{|M|^2} (1-f_3)(1-f_4) \delta^4(p)$$

with flux averaged matrixelement

$$\overline{|M|^2} = \int \Phi(E_\nu) L_{\kappa\lambda}(E_\nu, \omega) W^{\kappa\lambda}(Q^2, \omega) dE_\nu$$

Flux smears out details in W

From Inclusive to Semi-Inclusive

$$\frac{d^2\sigma}{dE'_l d(\cos\theta')} \propto \frac{k'}{k} \int_{NV} d^3r \int \prod_{j=1}^4 \frac{d^3p_j}{(2\pi)^3 2E_j} f_1 f_2 \overline{|M|^2} (1-f_3)(1-f_4) \delta^4(p)$$



$$M = M(p_3, p_4)$$

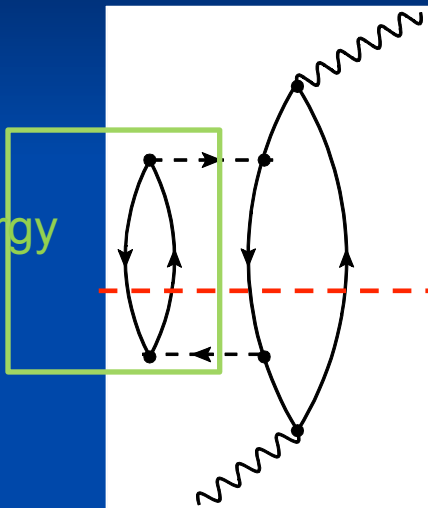
$$\frac{d^2\sigma}{dE'_l d(\cos\theta') d^3p_N} \propto \frac{k'}{k} \int_{NV} d^3r \int \prod_{j=1}^3 \frac{d^3p_j}{(2\pi)^3 2E_j} f_1 f_2 \overline{|M|^2} (1-f_3)(1-f_4) \delta^4(p)$$

Consistent: Same matrixelement! Not just phase-space!

2p-2p excitations and spectral functions

2nd ampl. squared

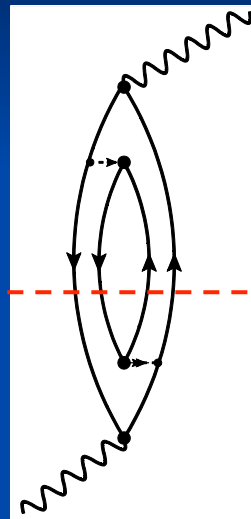
hole
selfenergy
 Σ



Hole Spectral Function

$$\mathcal{A}(x, p) = \frac{1}{\pi} \frac{\sqrt{p^{*2}} \Gamma_{\text{med}}}{[p^{*2} - m^{*2}]^2 + p^{*2} \Gamma_{\text{med}}^2}$$

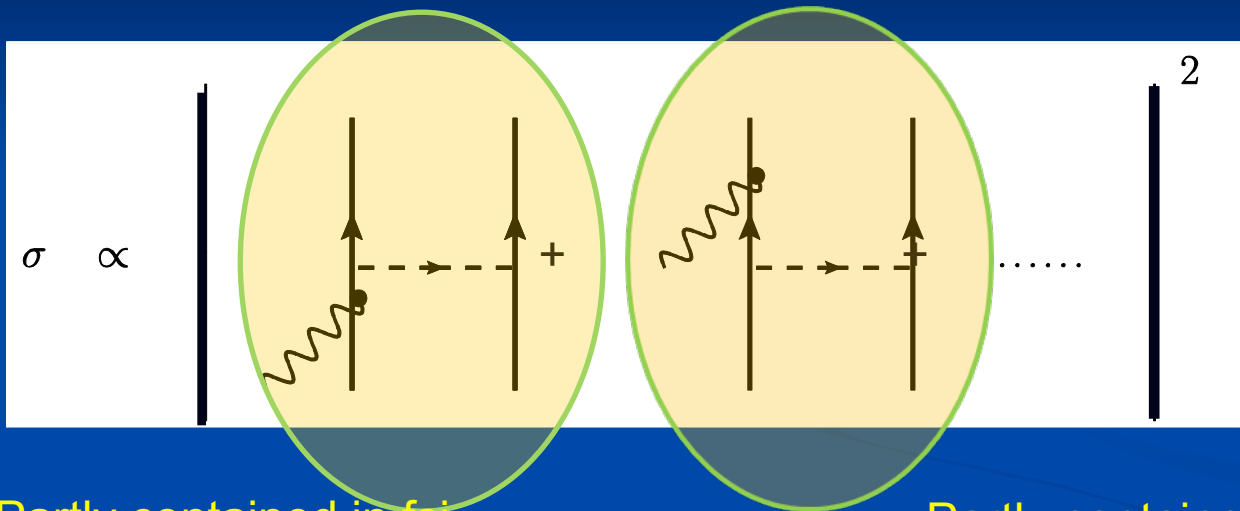
Interference term squared



No selfenergy,
Vertex correction,
not included in spectral
function

Vertex correction
Not contained in spectral function

2p-2p Excitations and Spectral Functions



Partly contained in fsi

Partly contained in SF

Double Counting Problem for 2p2h Implementation in Generators

2p-2h and Spectral Functions

- Go from inclusive to (semi-) exclusive reactions, make consistent contact with theory
- What are good 2p2h models at high energies (MINERvA, LBNE)?
- Double counting problem:
How much of 2p-2h is contained in
 - nucleon spectral functions ??
 - and in final state interactions??