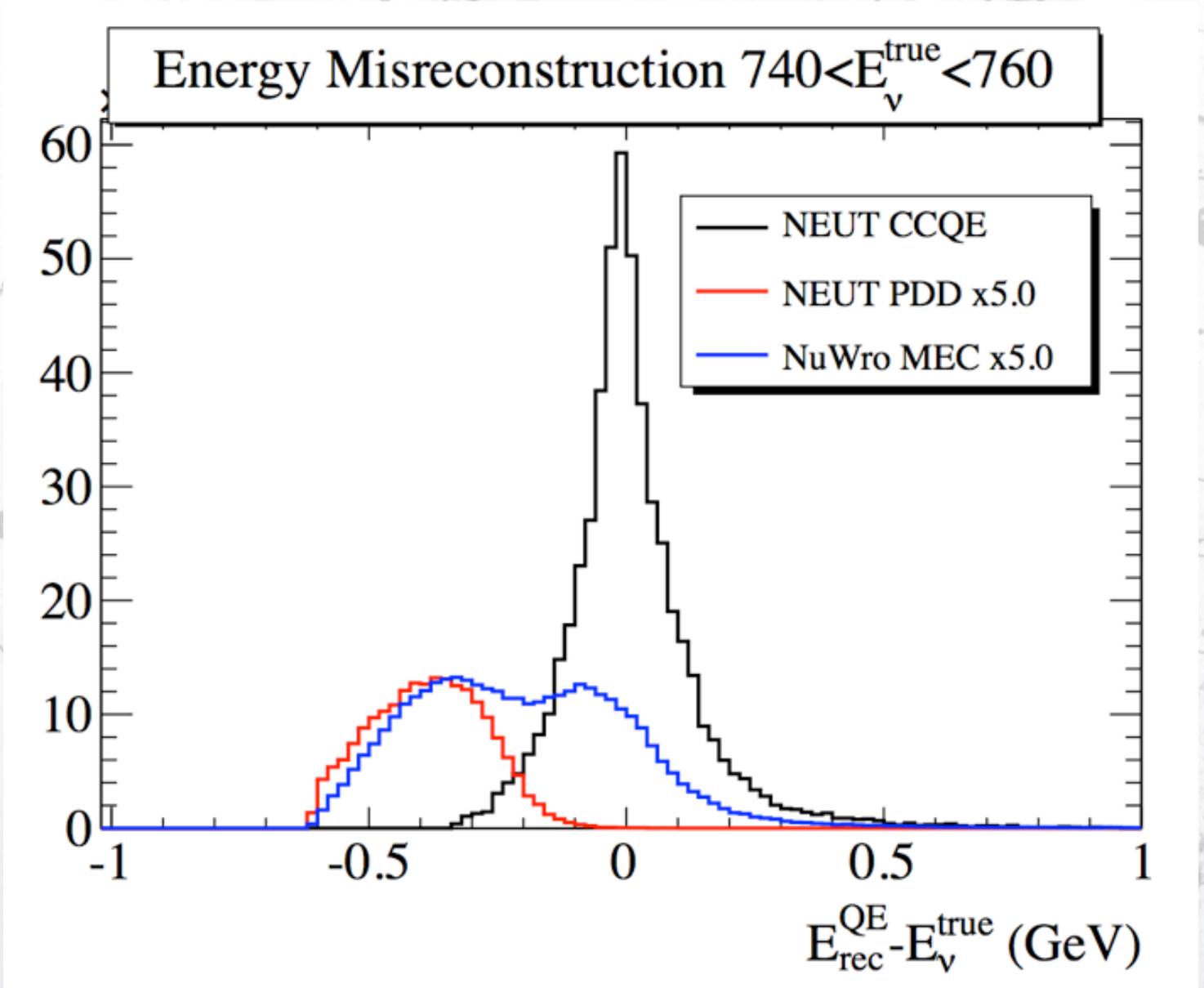
Interplay between 2p2h & π prod. for MC simulations

F.Sánchez

NEUT Model

- Neut had included since a long time the pion-less Δ decay.
- This was implemented in a simple manner:
  - Produce a Δ
  - 20% decays without pions.
  - 80% decays in the usual manner.

Check



- Actually the 20% πless decay corresponds more or less to the equivalent Δ contribution to 2p2h, but:
  - Is it also the kinematics of final states ?

NEUT Model

- The Δ production cross-section can be scaled up by two methods:
  - Change of the Resonant axial mass.
  - Change of the absolute cross-section.
- This scale up is done by comparing predictions to the ND data.

Is this reasonable ?

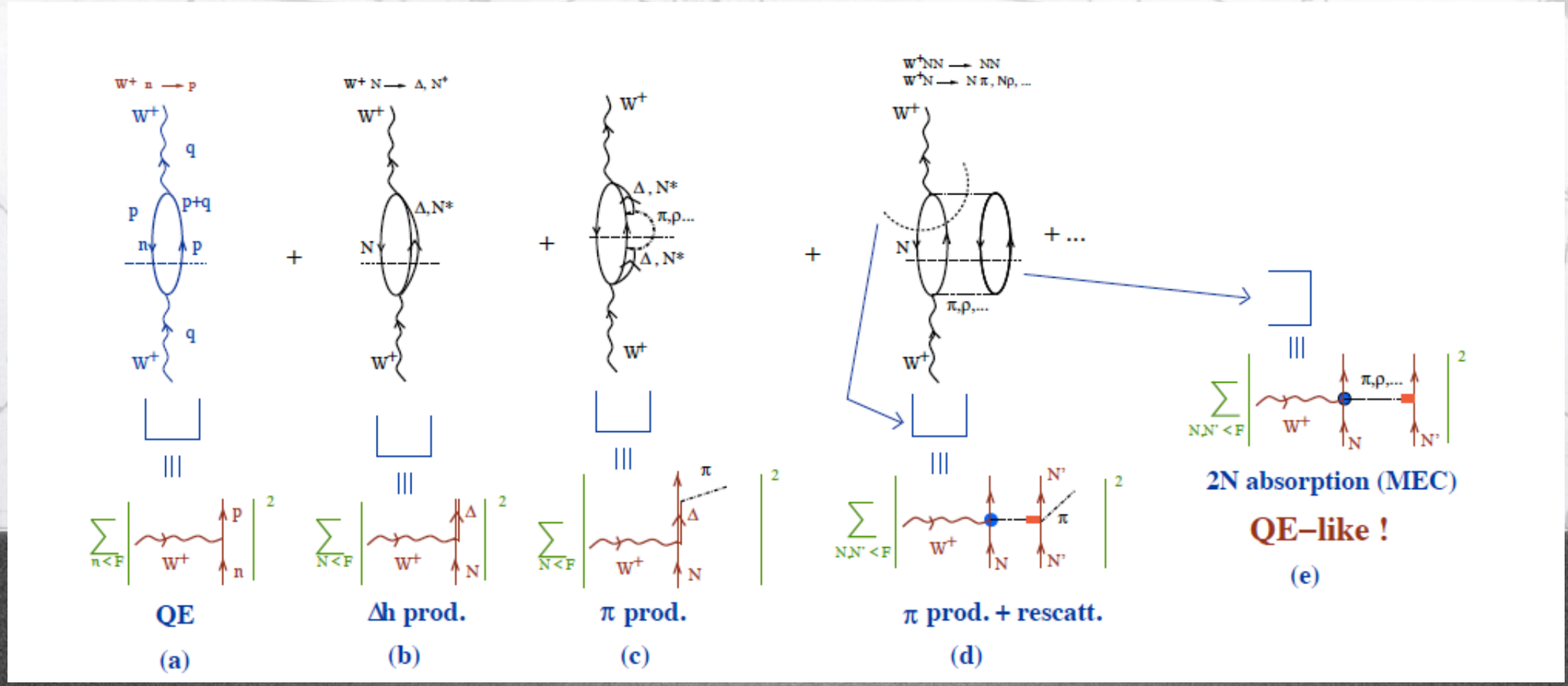
- I have several concerns:
  - The width of the Δ should take this into account:
    - $\Gamma(w) = \Gamma(w) + \Gamma_{\pi\text{-less}}(w)$
    - The 20% can be seen as the application of $\Gamma(w)$ @ the numerator, but the denominator should contain the two.
  - Is it really true that the partial deltas depend only on w ?
    - $\Gamma(w) = \int (\Gamma(w,q_3) + \Gamma_{\pi\text{-less}}(w,q_3)) \, dq_3$

$$\frac{1}{2\pi} \cdot \frac{\Gamma}{(W-M)^2 + \Gamma^2/4}$$

Neut uses a fixed Γ with no w dependency

Is this reasonable ?

- We need to treat consistently the Δ and $\Delta_{\pi less}$
- As J.Nieves mentioned the only consistent method is to be consistent. There are two final states:
  - ν A → μ (A-2) N N
  - ν A → μ (A-1) π N
- and no, Δ, MEC's, 2p2h which will lead to defects, double counting, problems!.



Is this reasonable ?

- We also need to be realistic, we have to continue with our MC for a (long) while:
  - What is the best model to integrate Nieves and Martini's calculation in a model (MC) which already contain Delta's.
  - Is there any expected dependency of the probability of producing pions as function of the mass and momentum transfer ?
  - Are the kinematics of the nucleons produced in the πless decays of the delta different than the ones from other channels ?

Is this reasonable ?

- Should we add the W dependency of the Γ?
- Are the πless decays and π decays competing or adding (regardless the change of the Γ) ?
- should we keep the full Rein Sehgal and add full Nieve's (Martini's) Model ?

Final concerns

- The statement: "we need to have a consistent treatment of Δ and 2p2h" is obvious but rather complex to implement:
  - We need also a consistent treatment of the high mass resonances.
  - and the treatment of the resonance to DIS transition.
- The goal is clear, but we need intermediate states that experimentalists can