(Many!) Proton Knockout With CLAS@JLAB

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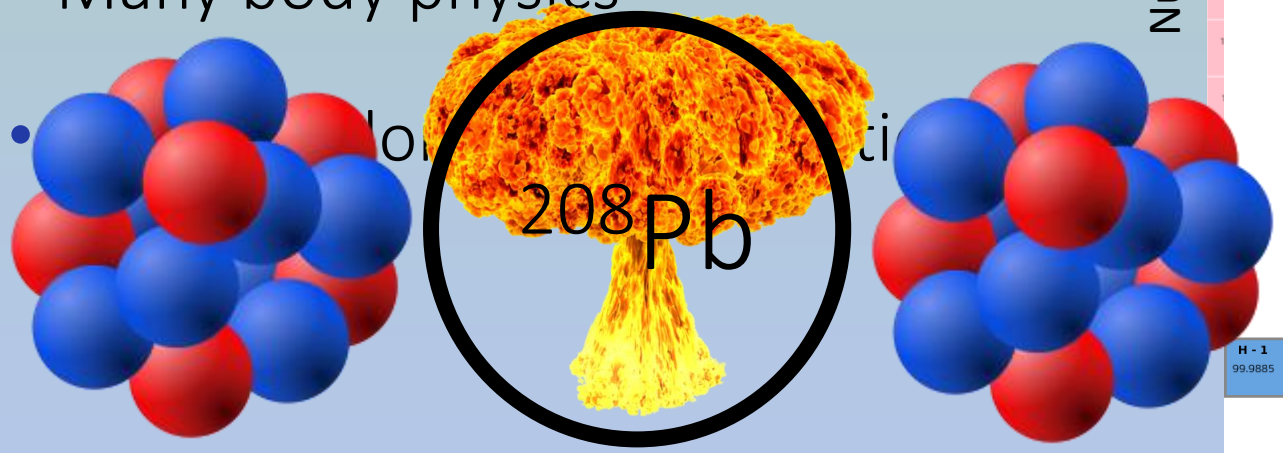
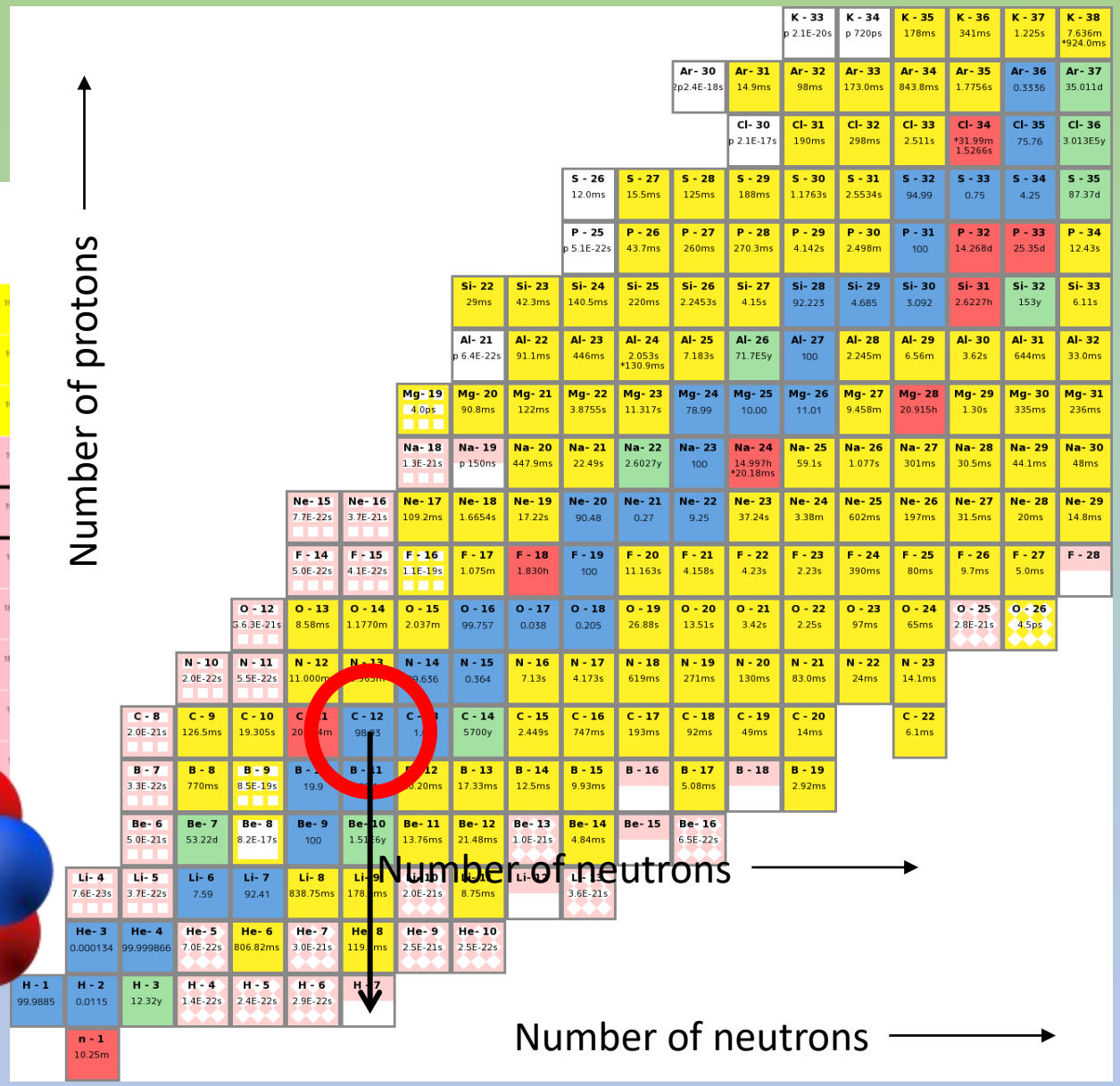
Preview

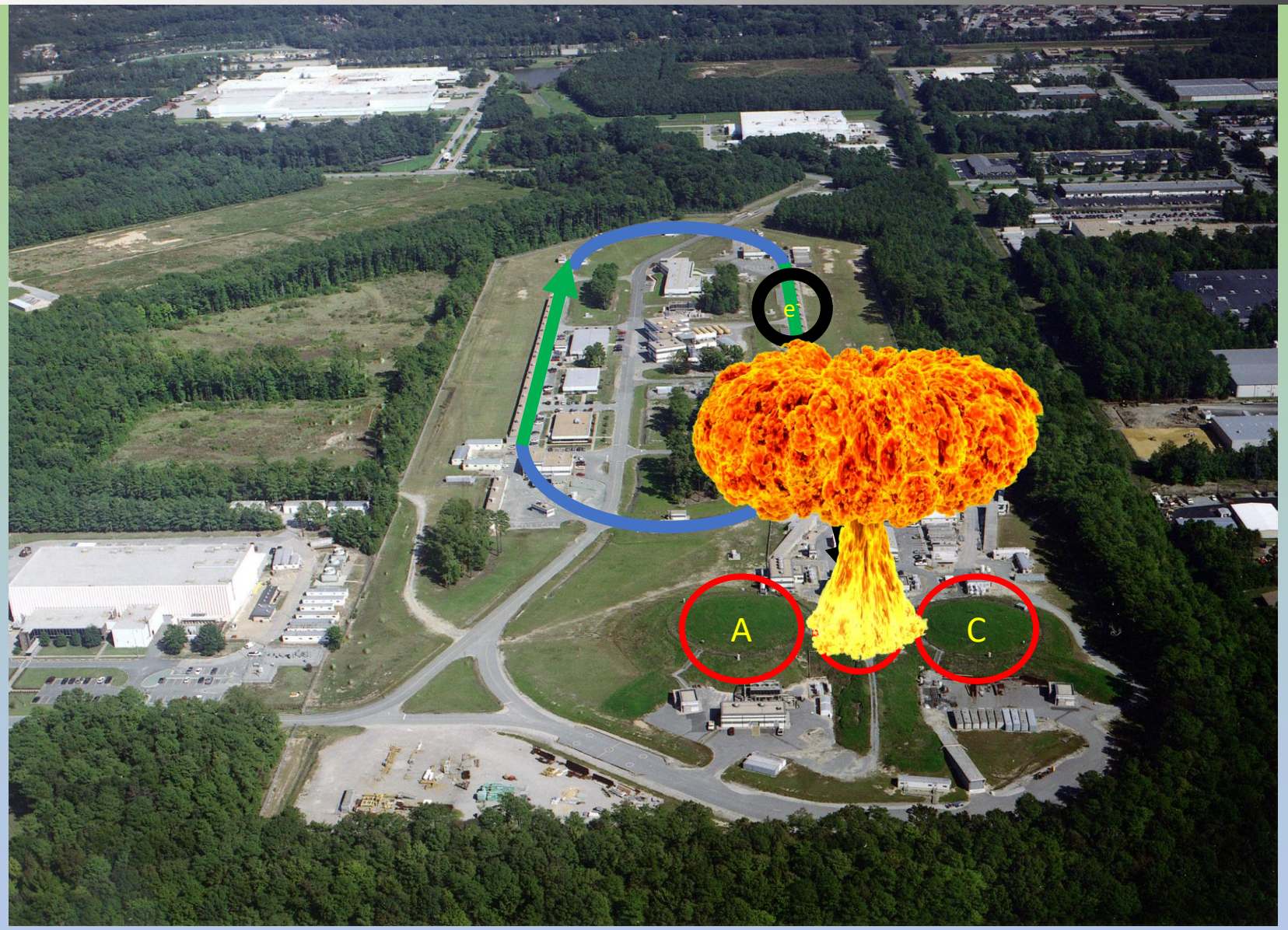
Motivation

- Photon beams as a spallation source
- Reach exotic nuclei
- Comparison with simulation
- Many body physics
- [illegible]





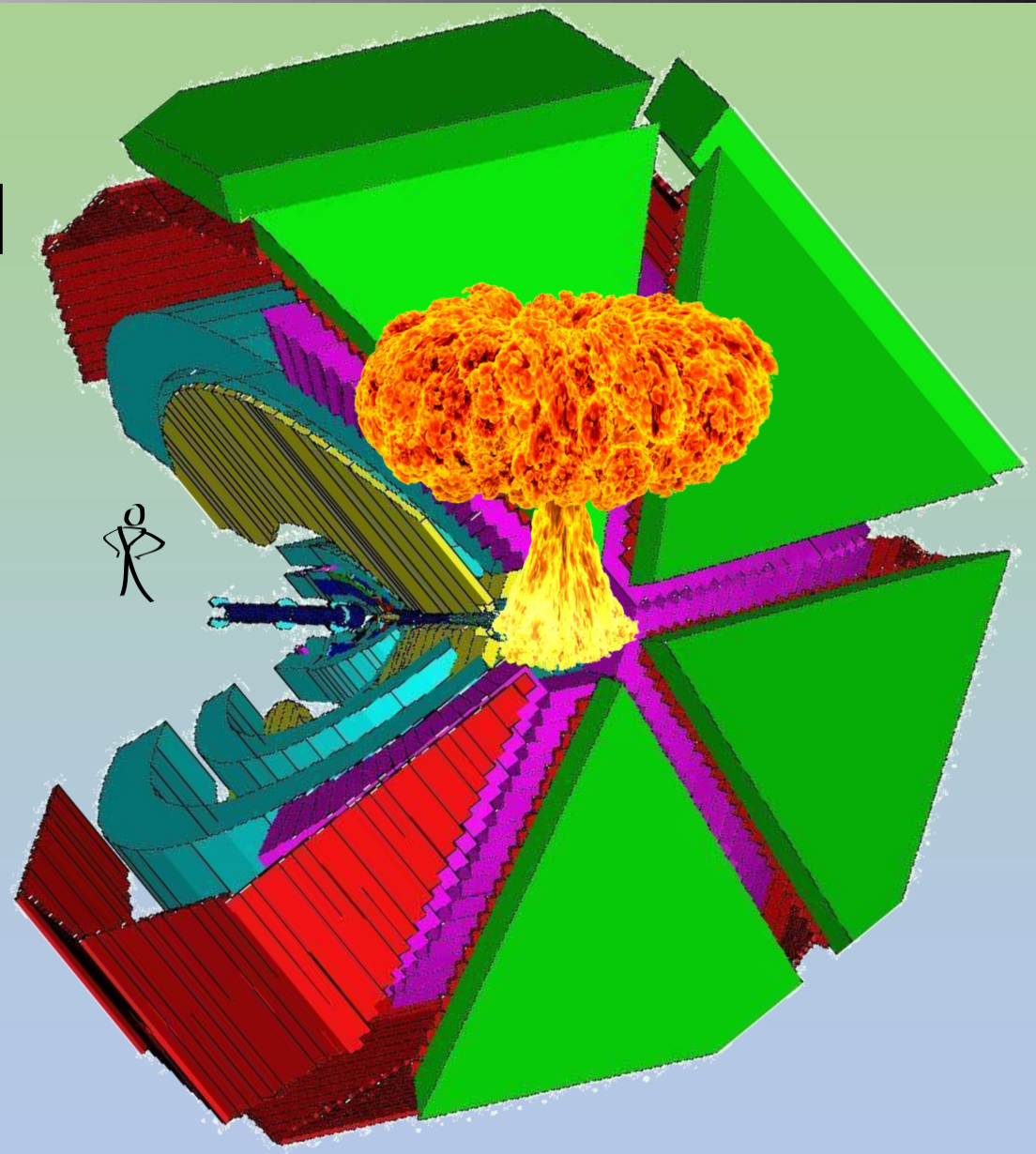
Thomas Jefferson National Laboratory



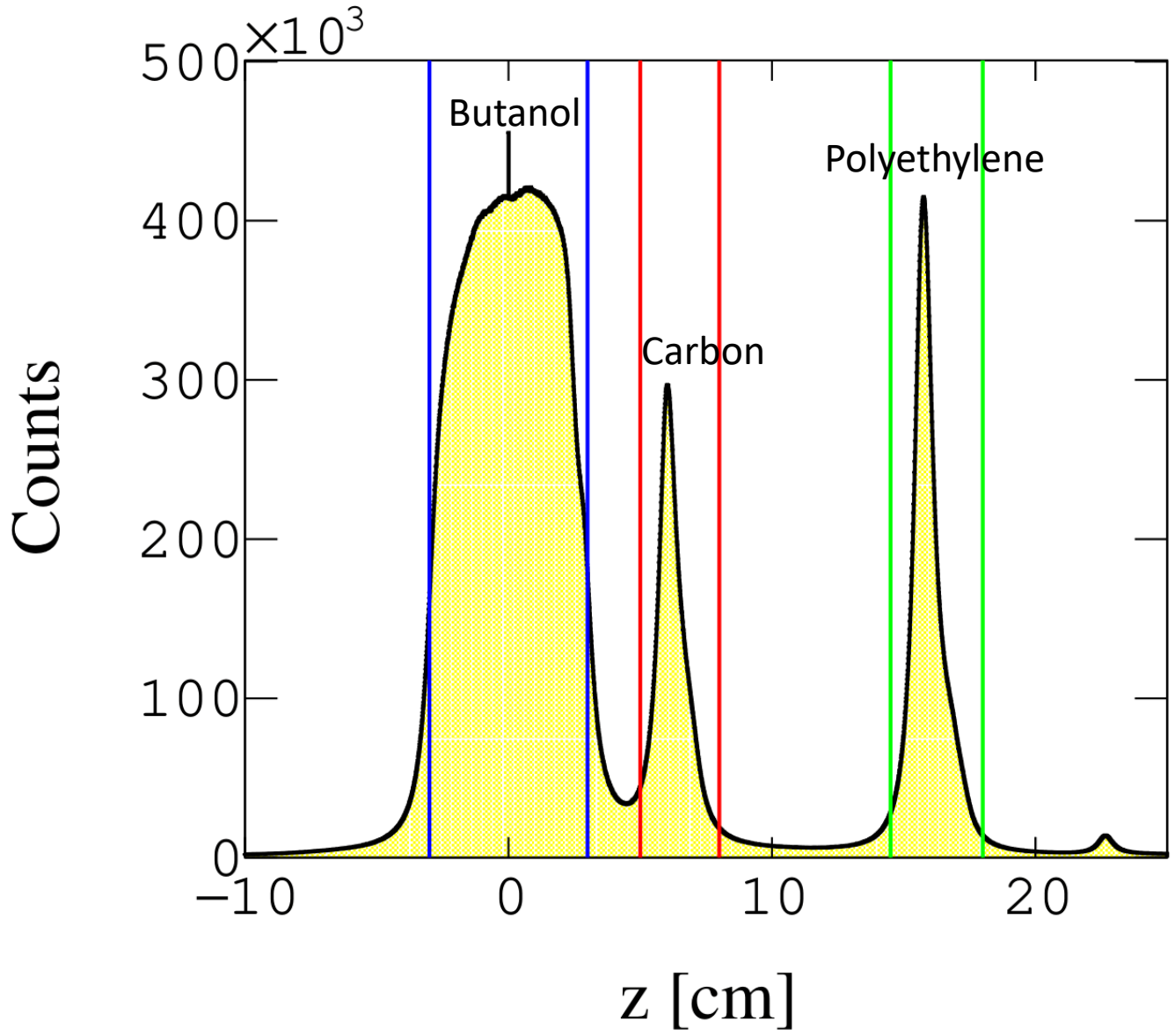
Experimental Details – FROST

Tagging Spectrometer

- Tagged real photons
- 0.6 – 4.3 GeV beams
- Nuclear targets



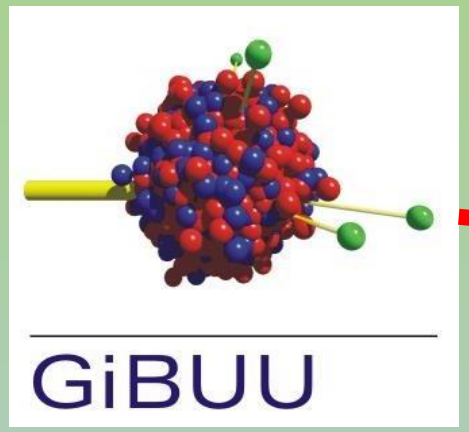
Targets

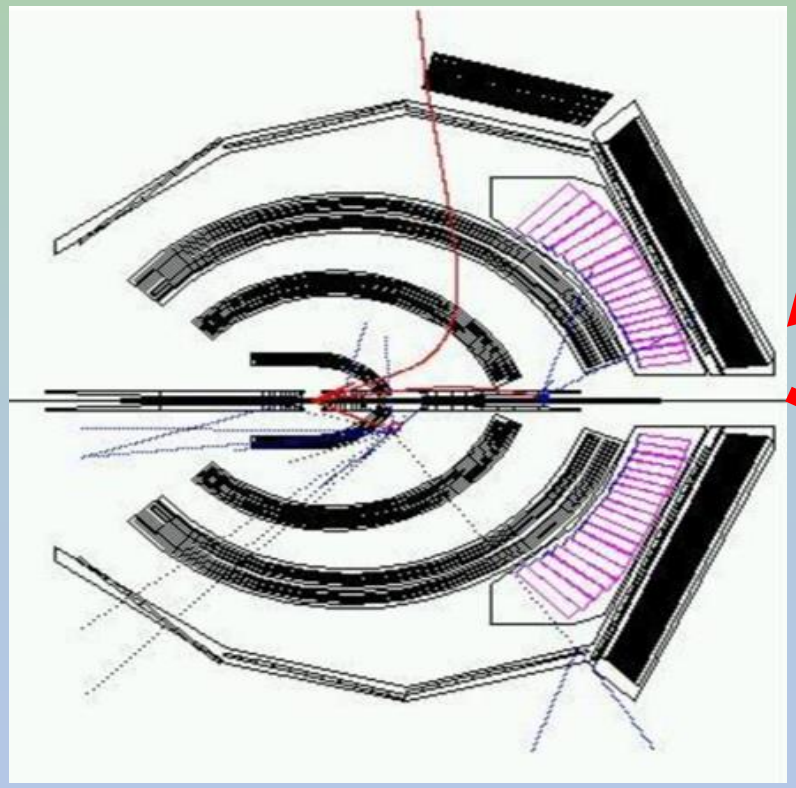


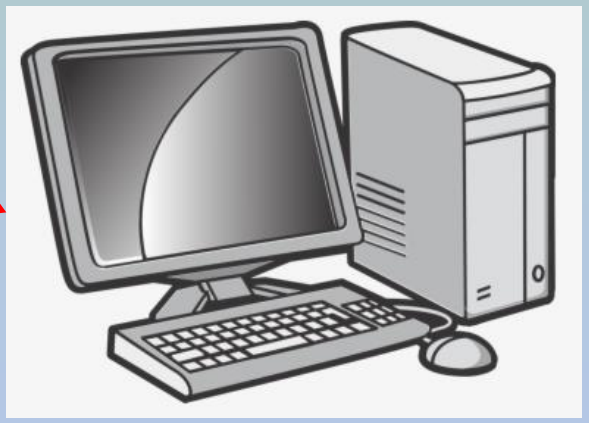
- All targets contain carbon
- Scale to carbon target

$$N = \frac{N_A \rho L}{m_{mol}}$$

Simulation

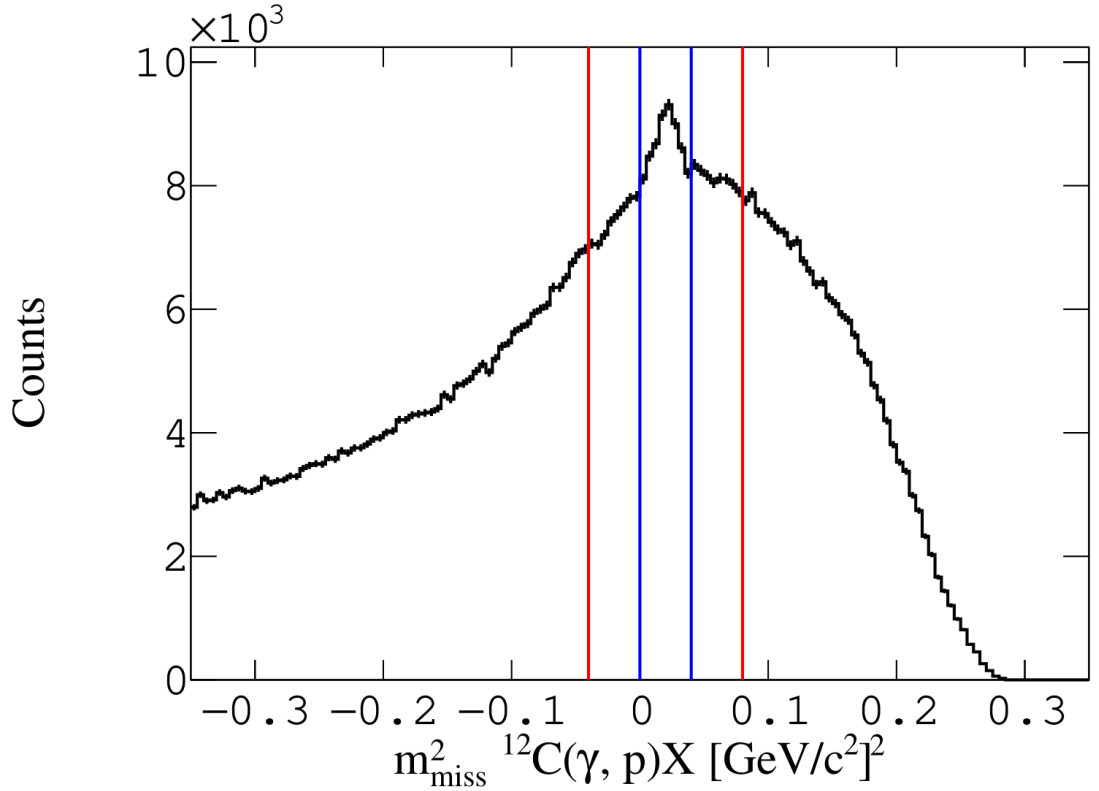


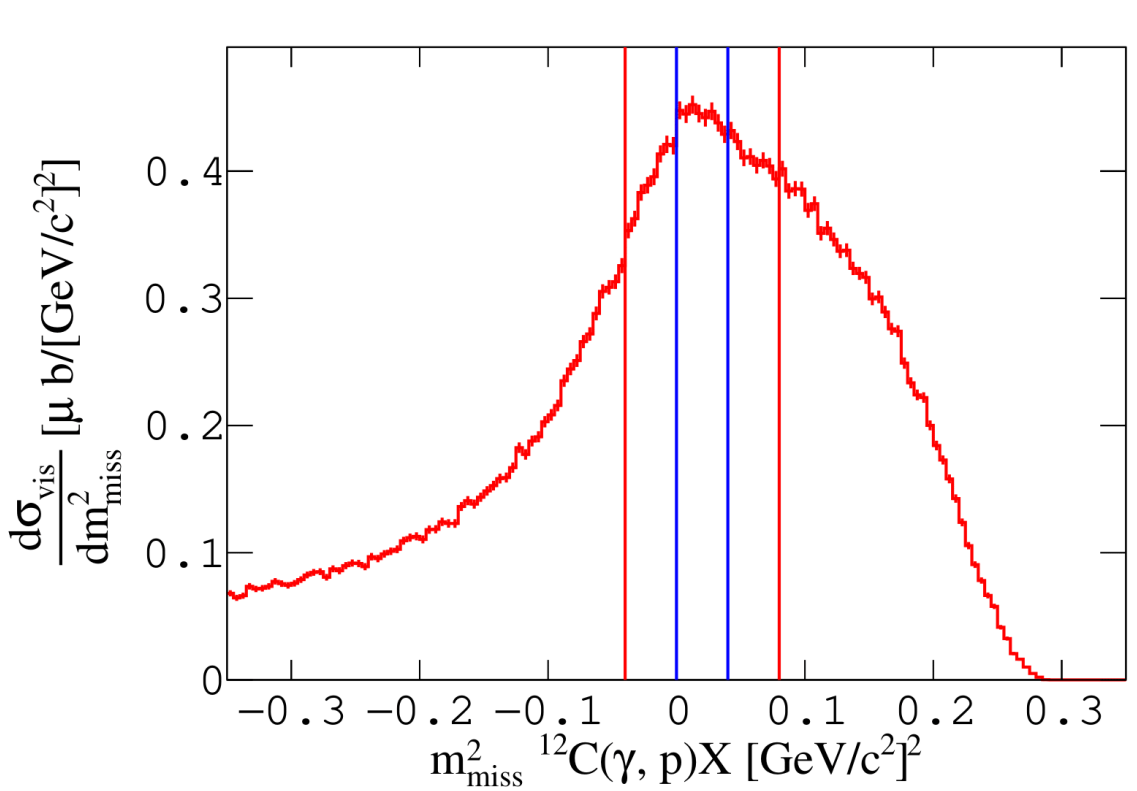




Normalisation

Assume GiBUU models $\gamma^{12}C \rightarrow p\pi^0$ well for $E_\gamma = (0.6, 0.7)$ GeV

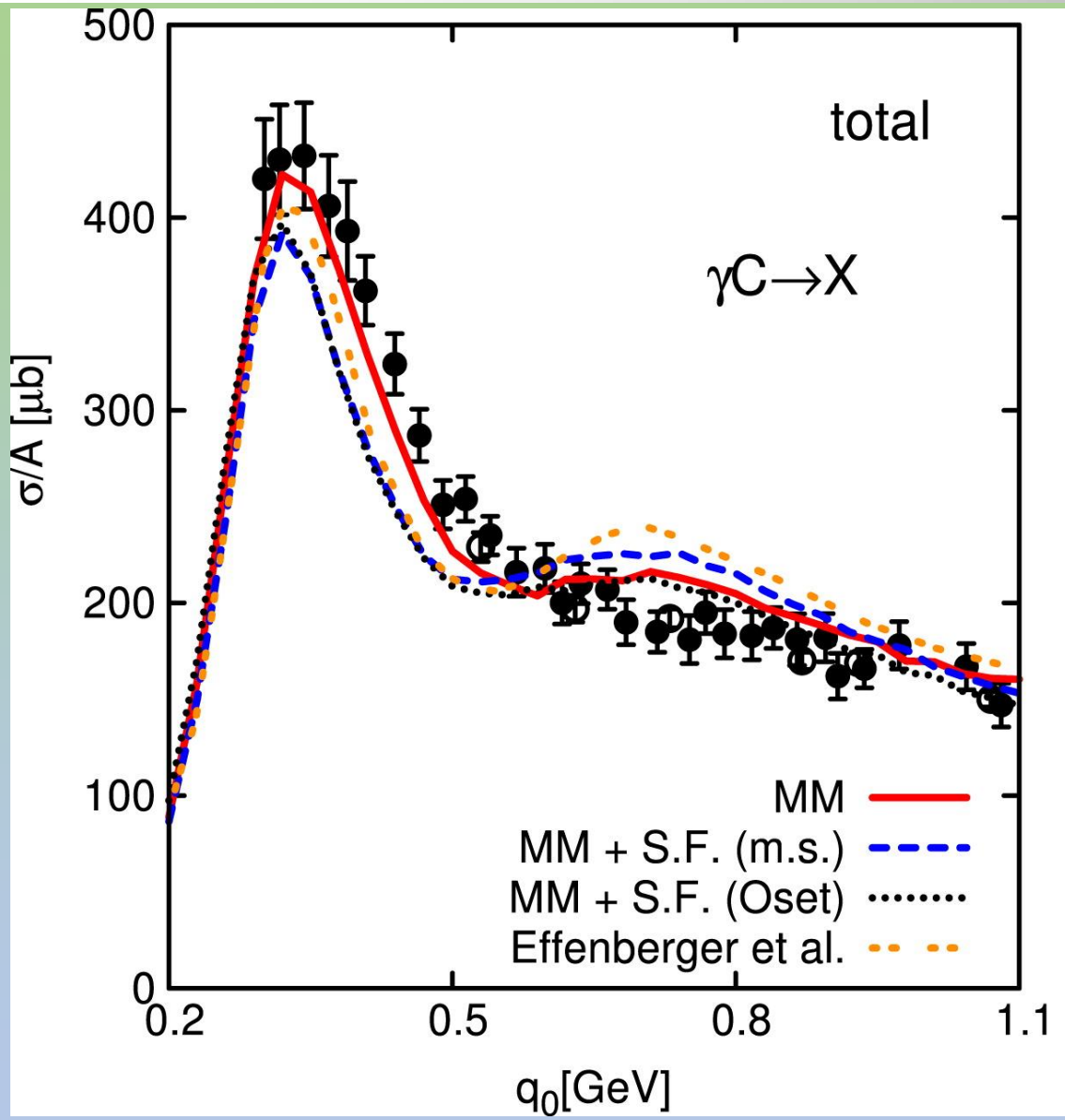


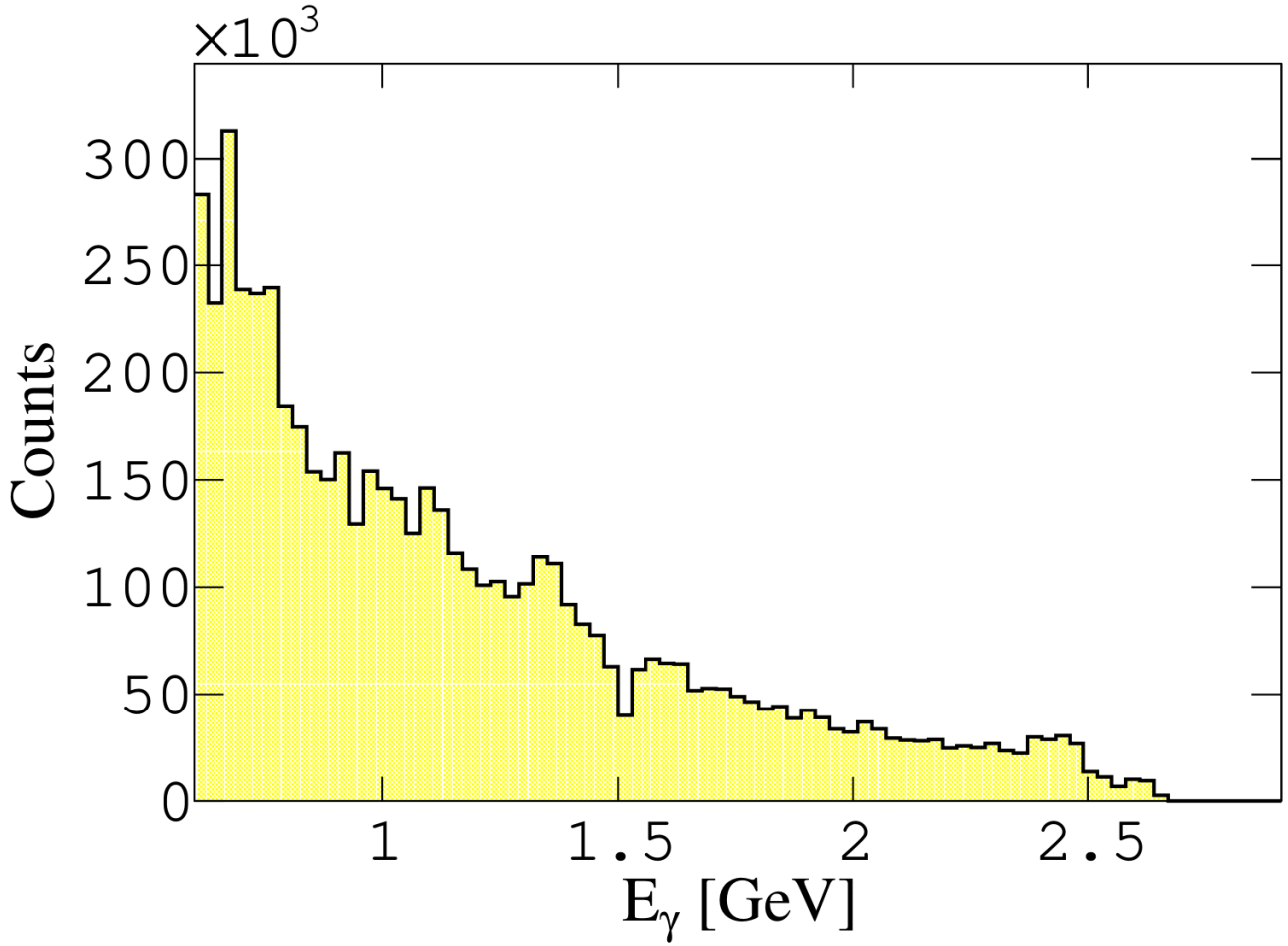


$$P_{Miss} = P_{Beam} + P_{C_{12}} - \sum_{i=1}^{n} P_{p_i}$$

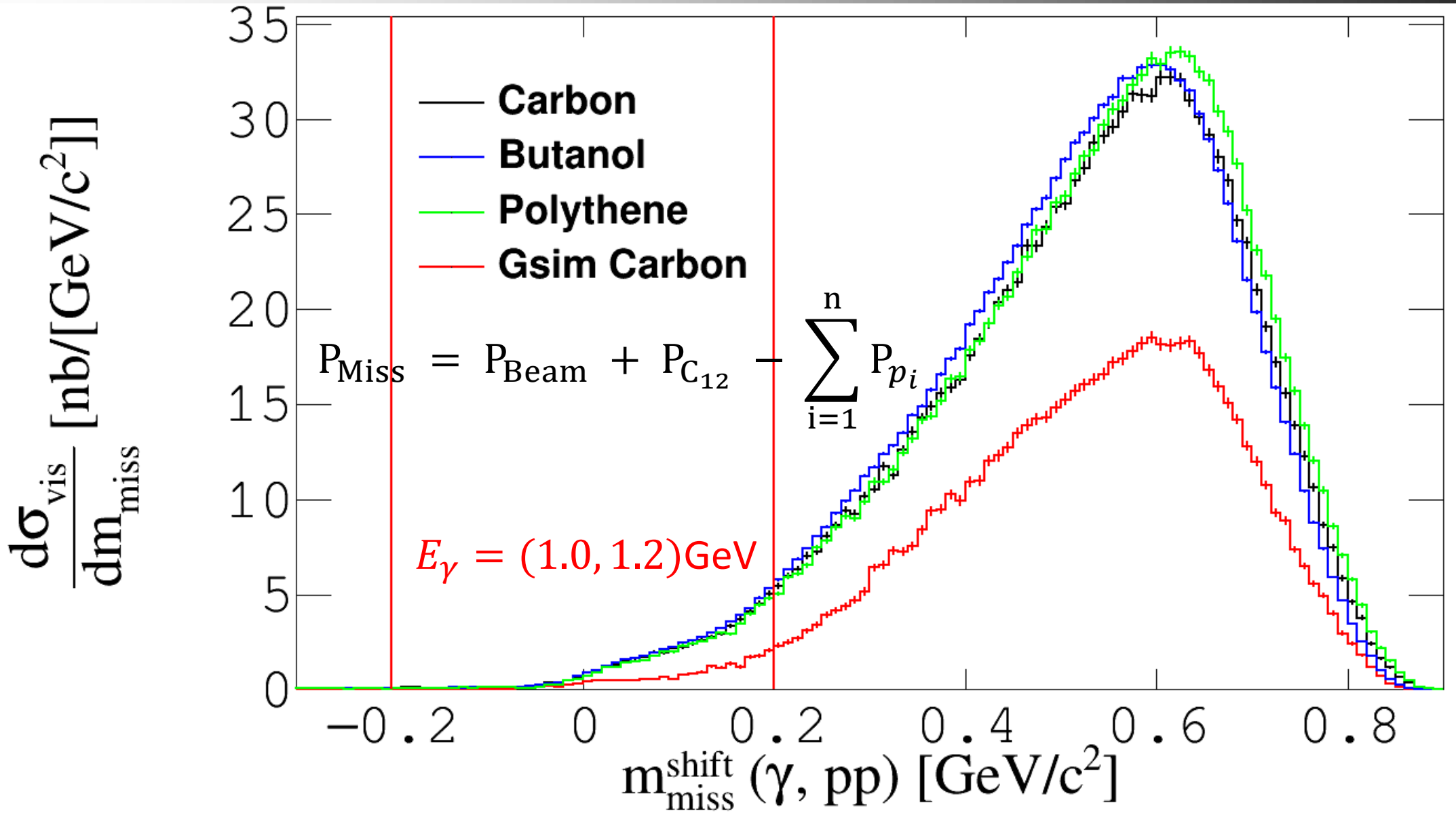
$$Scale\ Factor = \frac{\sigma_{p\pi}^{GiBUU}}{Yield_{p\pi}^{Data}}$$

Photon Energy Spectrum

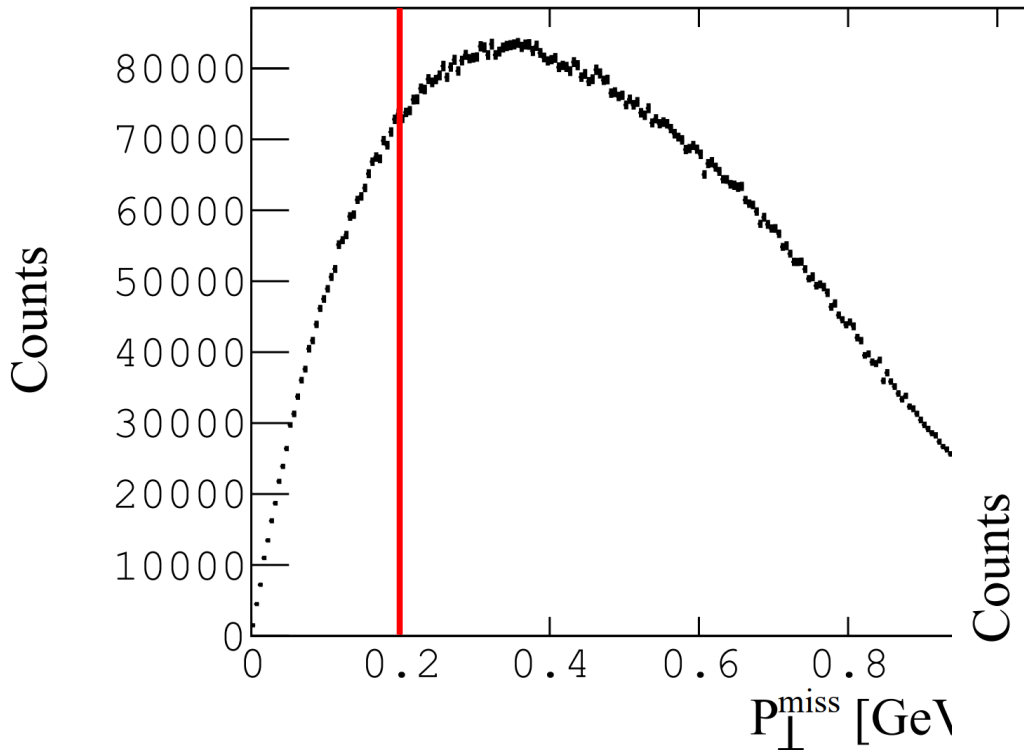


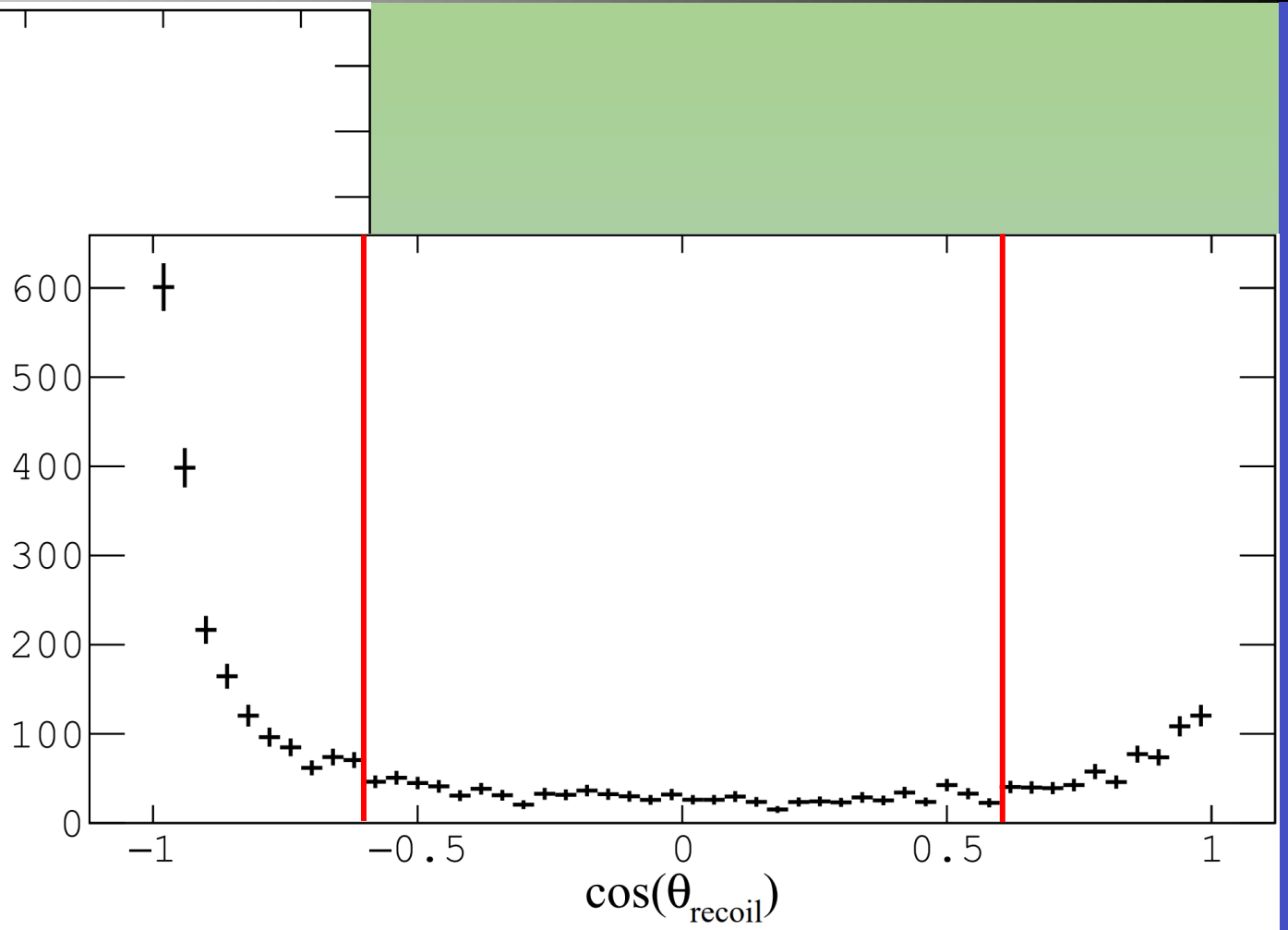


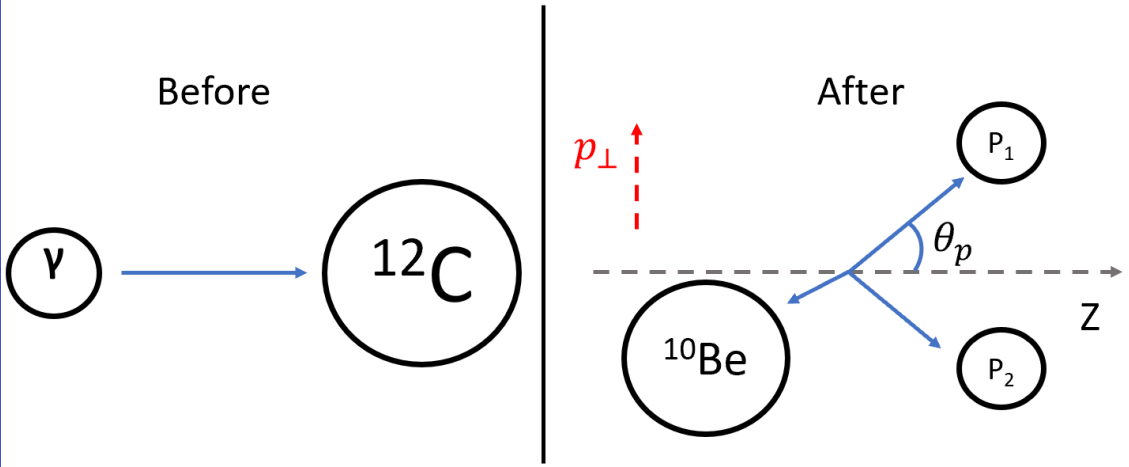
Scaled Missing Mass 2 Proton Knock-Out



Can We Isolate/Enhance Direct Knock-Outs?

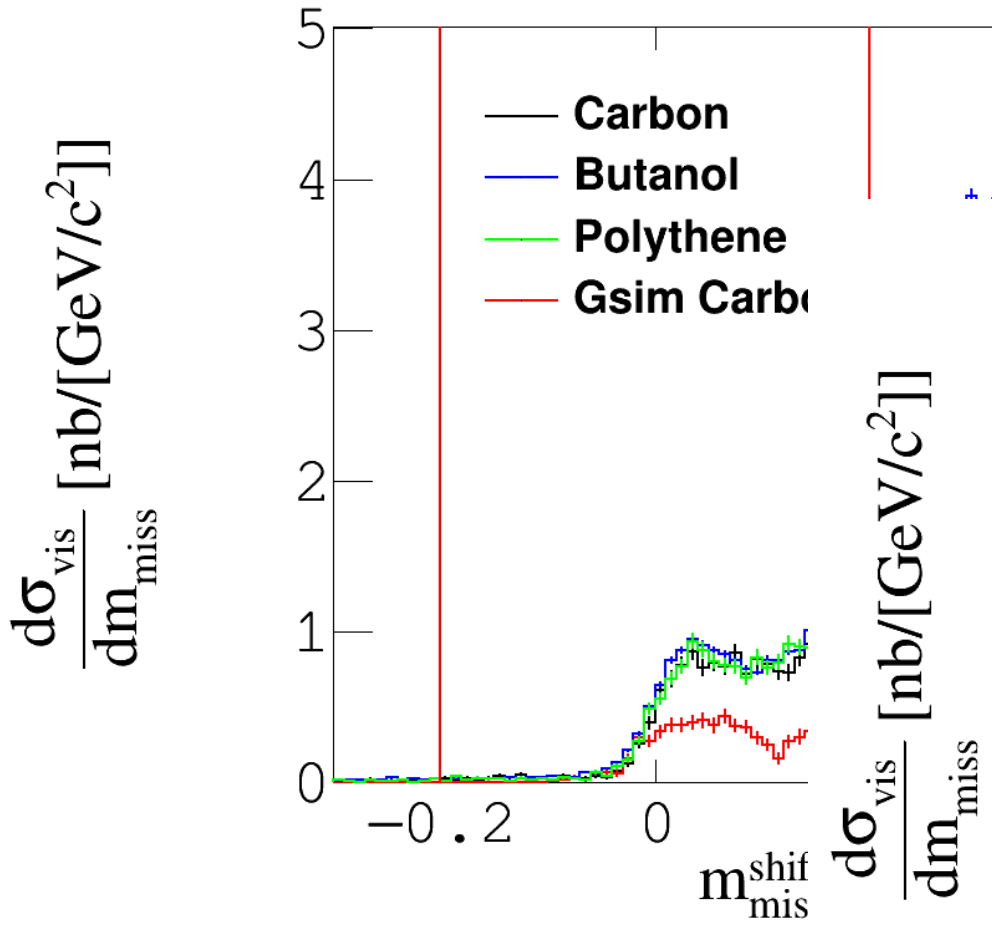


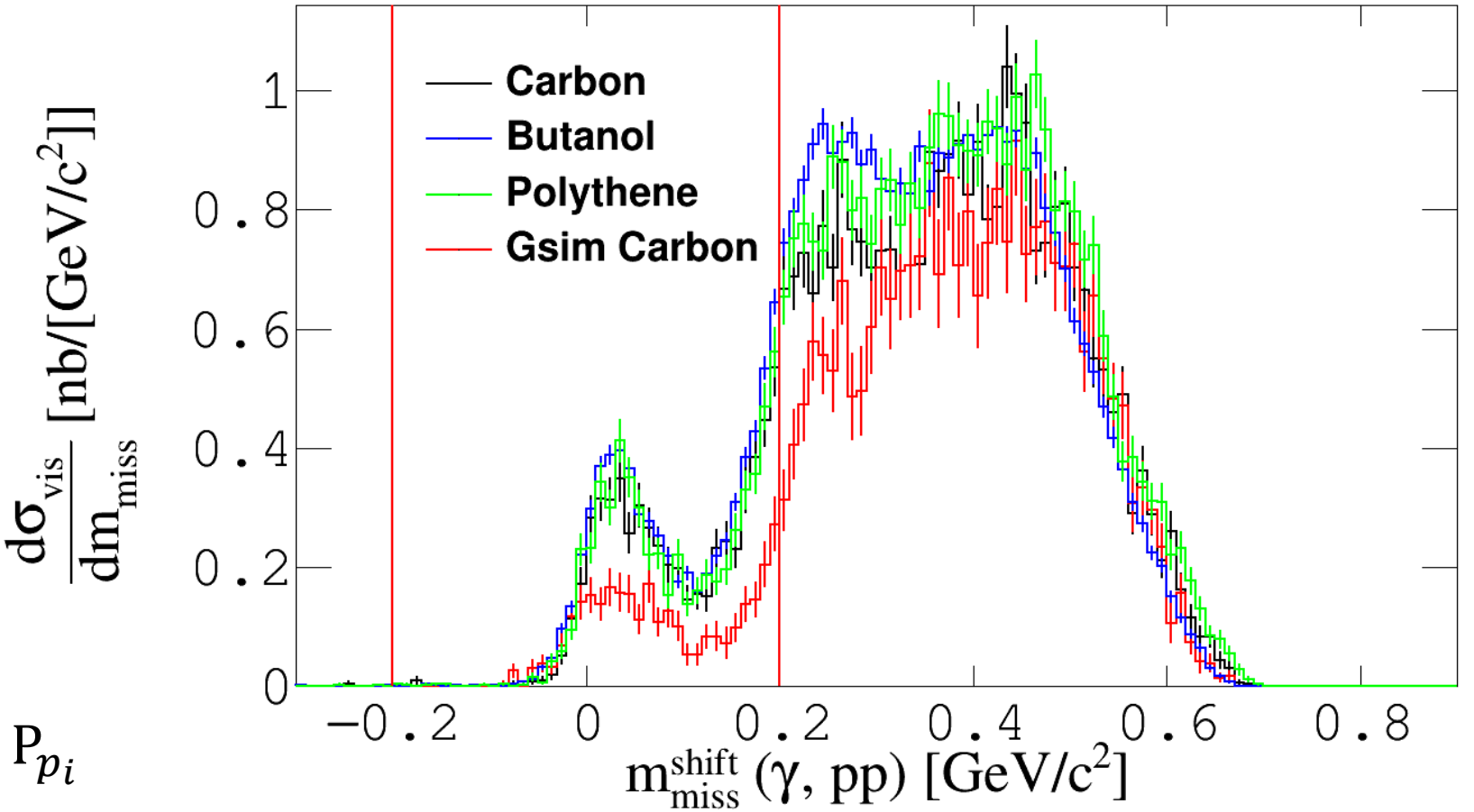




Answer: Yes!

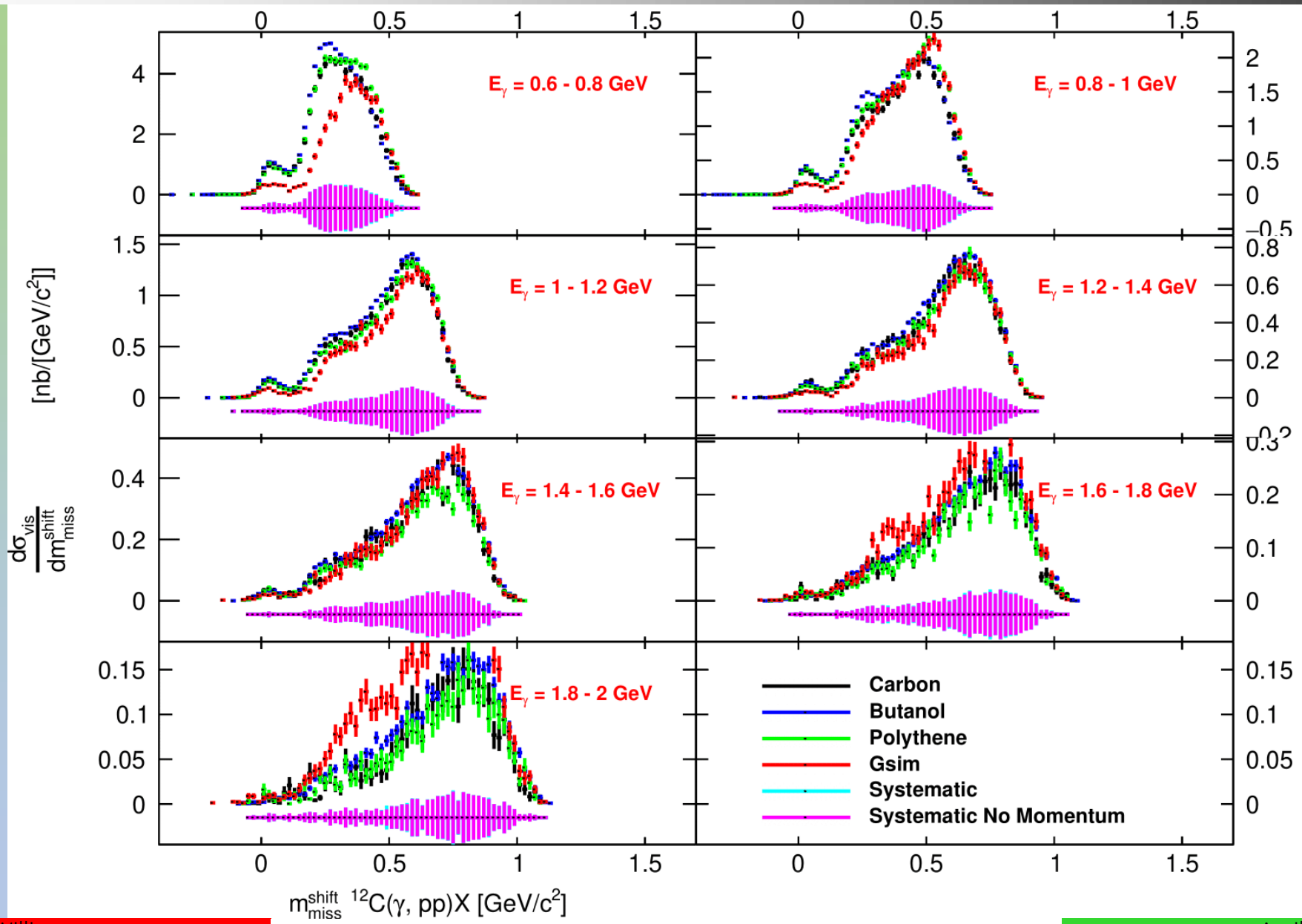
$E_\gamma = (0.8, 1.0)\text{GeV}$



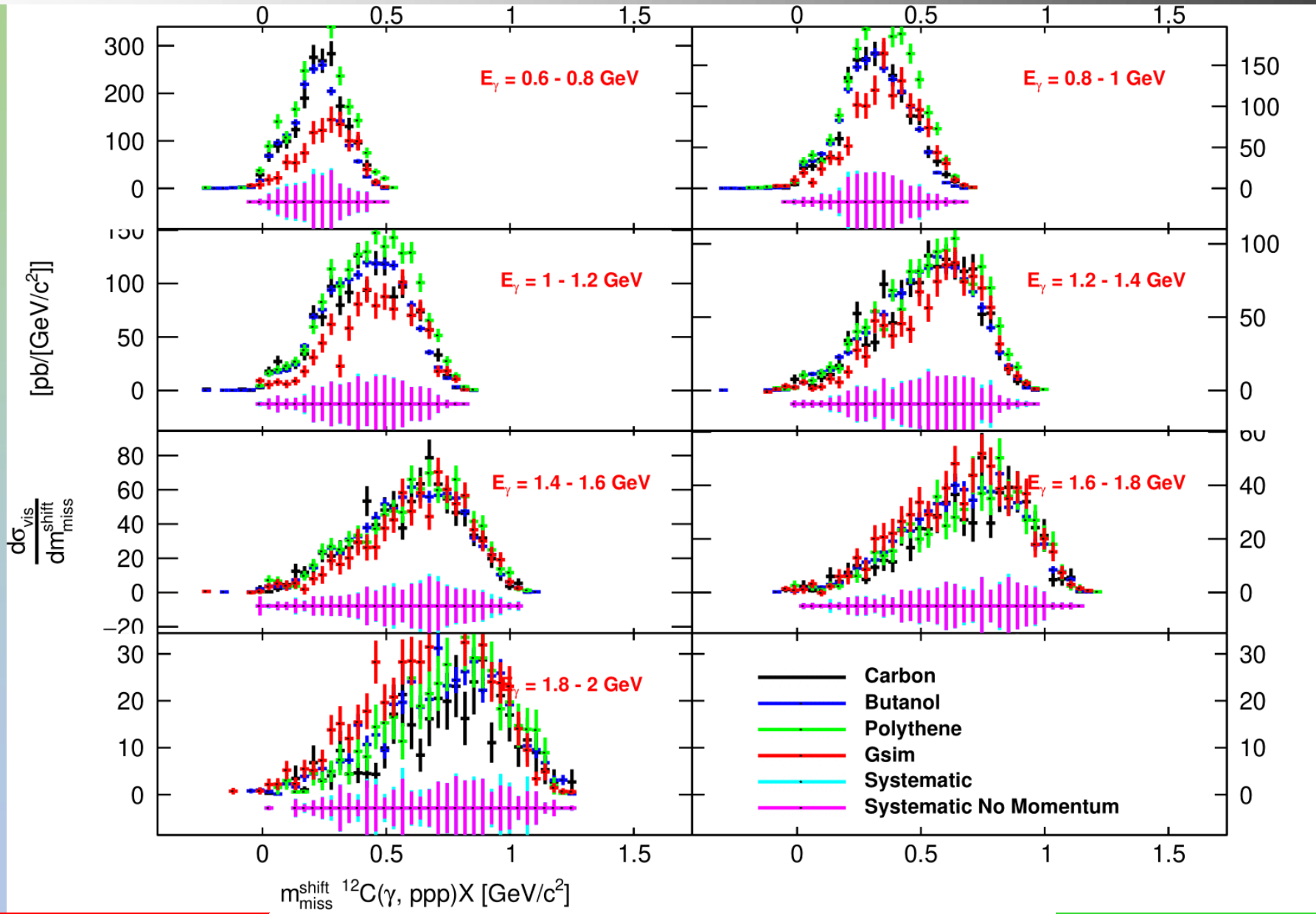


$$P_{Miss} = P_{Beam} + P_{C_{12}} - \sum_{i=1}^{n} P_{p_i}$$

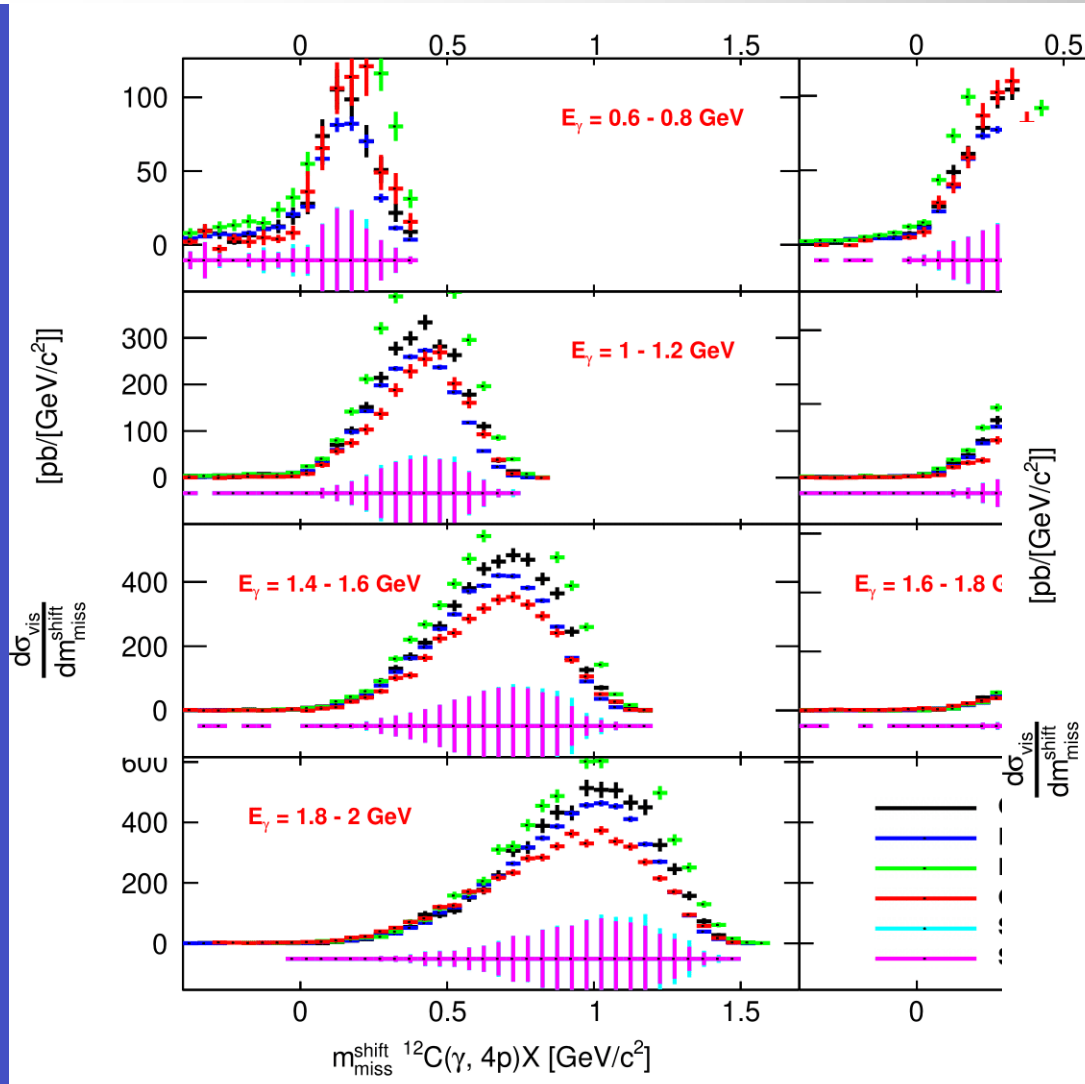
2 Proton Knock-Out

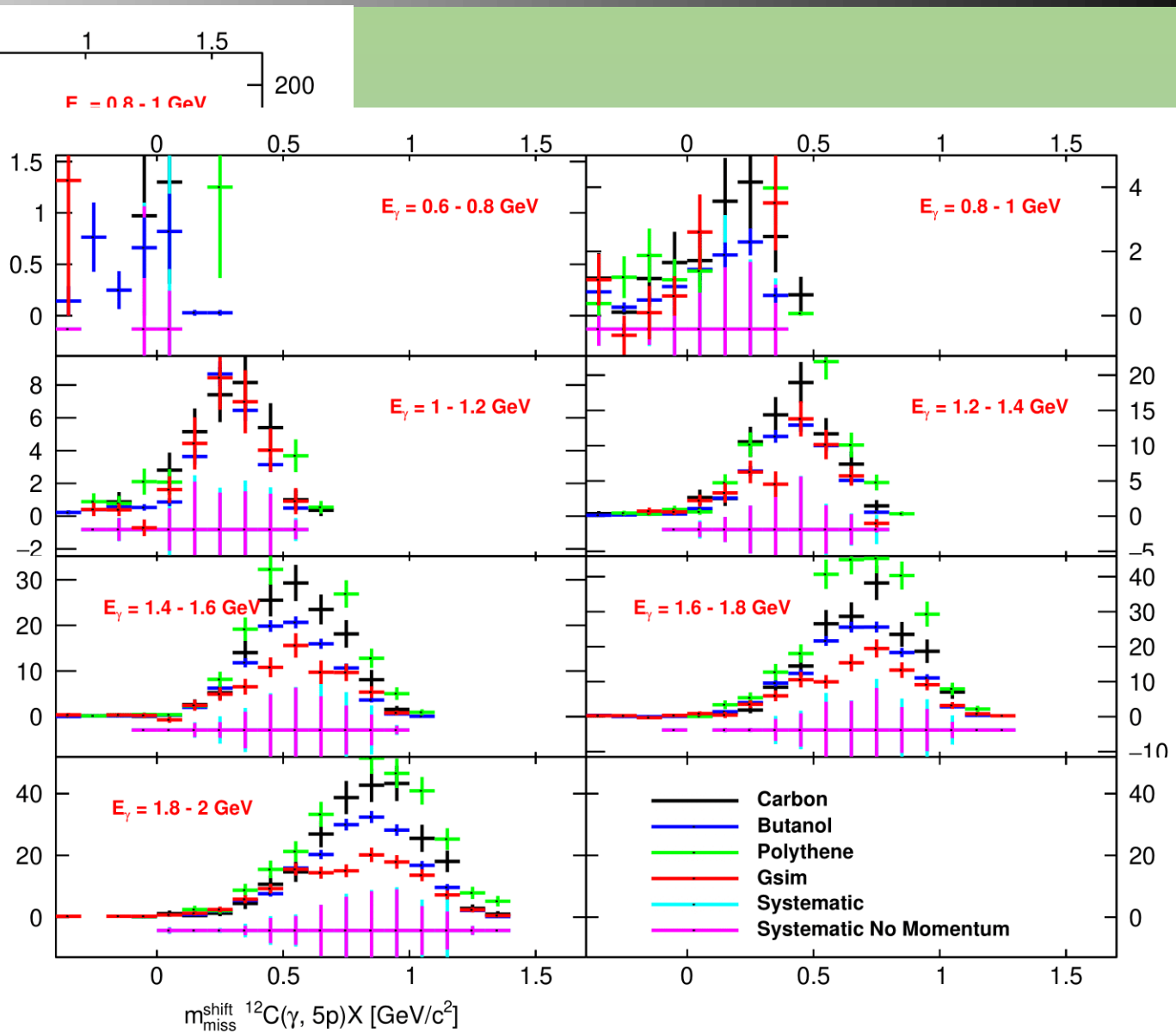


3 Proton Knock-Out

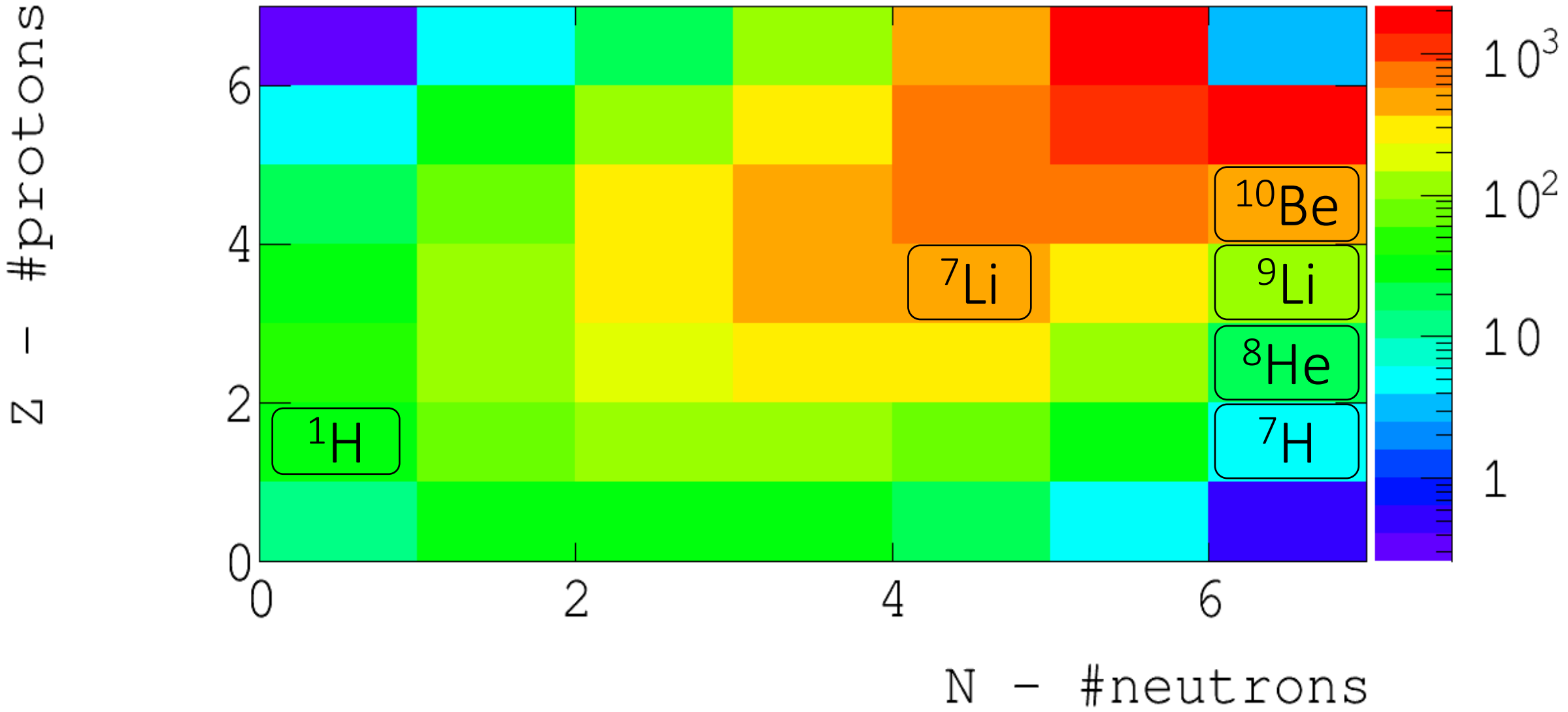


4 and 5 Proton Knock-Out

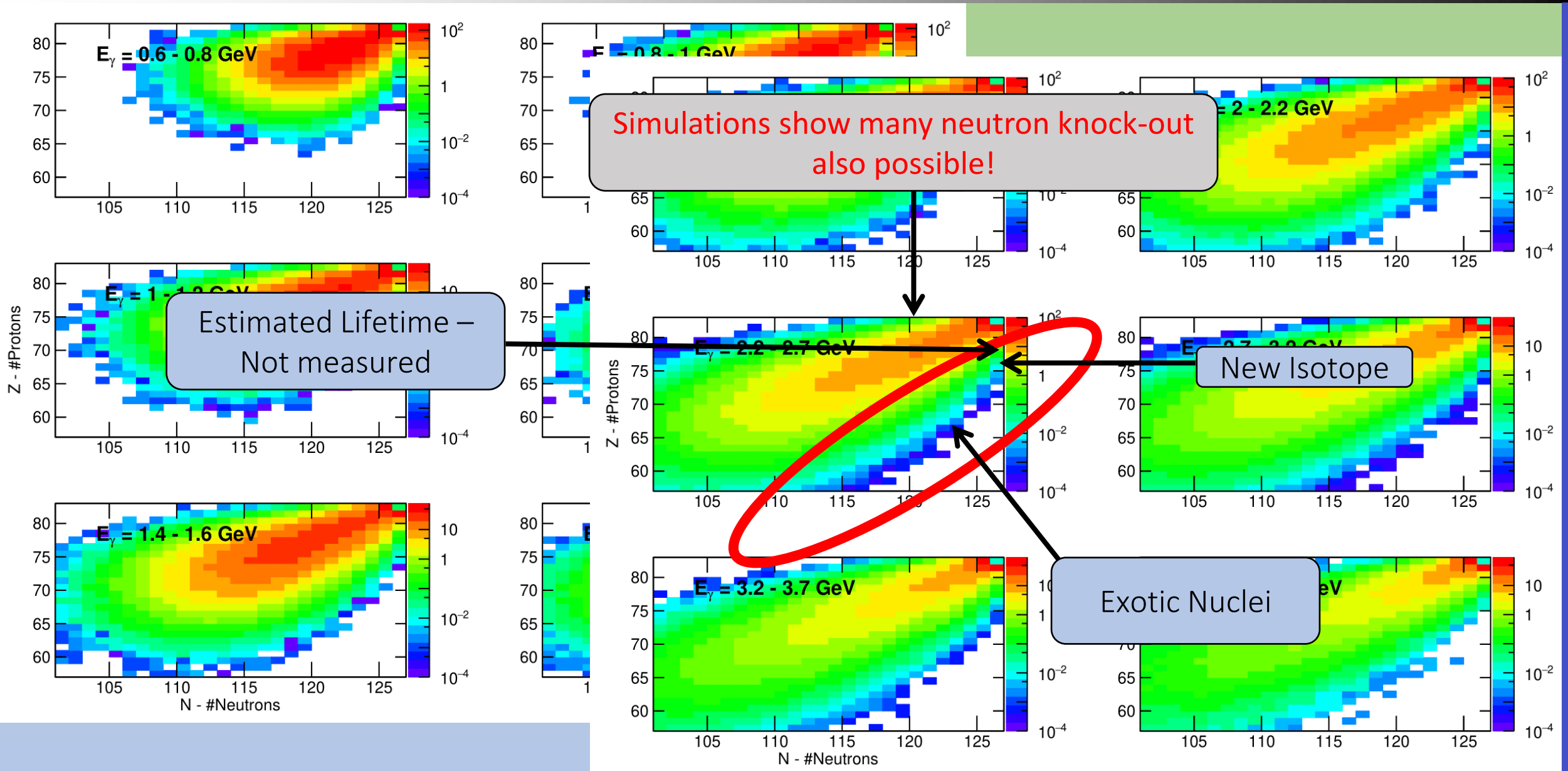




C_{12} Nuclear Chart



Pb_{208} Nuclear Chart



Conclusion + Future Work

- First test of feasibility shows promising results
- Future experiments exploiting mass spectrometers could be used
- Compact photon source
- Theorists adapting model based on our results
- Simulations show method applicable to neutrons
- Nuclear physics community take great interest
- Expand physics learnt to enhance models for photon beam experiments
- Work important for neutrino oscillation community