Study of Neutron Resonances via Precision γn Measurements

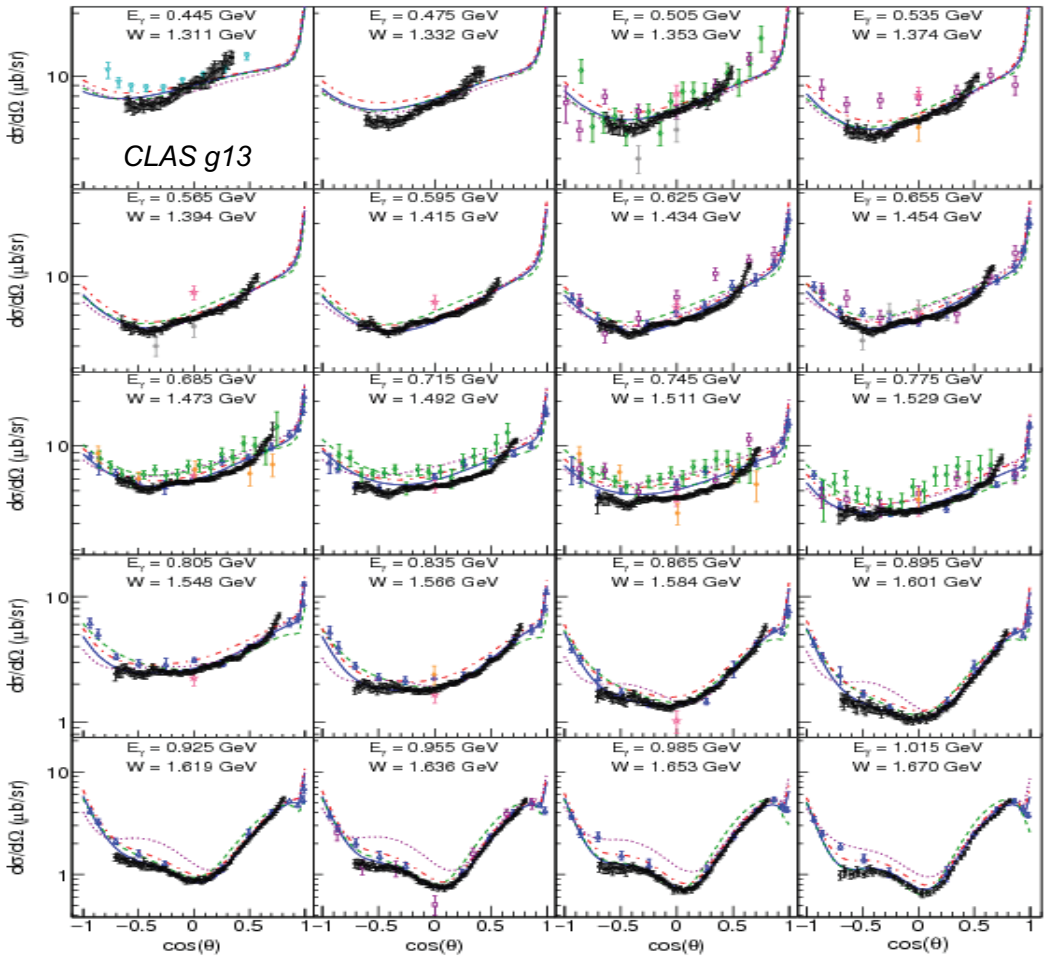
- Measurement goal: Describe excited nucleon states as a means to understand strongly interacting matter
- QCD describes systems of interacting quarks but is challenged by effects that dress the interactions
- Need measurements for both proton and neutron targets to disentangle different isospin contributions

(neutron measurements sorely lacking)

CLAS "g13" experiment: $\gamma d \rightarrow \pi^- p(p)$

8400 bins: E_γ: [0.445 – 2.510 GeV], cos θ_π^{cm}: [-0.72 – 0.92]

FSI corrections applied to extract γn from γd



P.T. Mattione et al. (CLAS Collaboration), arXiv:1706:01963, (2017)

This first determination of neutron couplings at the pole positions significantly improves the world data

g13 increases world data by x3

Resonance	Coupling	SAID Fits Modulus, phase	PDG 2016 BW
N(1440)1/2$^+$	$A_{1/2}$(n)	0.065±0.005, 5°±3°	0.040±0.010
N(1535)1/2$^-$	$A_{1/2}$(n)	-0.055±0.005, 5°±2°	-0.075±0.020
N(1650)1/2$^-$	$A_{1/2}$(n)	0.014±0.002, -30°±10°	-0.050±0.020
N(1720)3/2$^+$	$A_{1/2}$(n)	-0.016±0.006, 10°±5°	-0.080±0.050
N(1720)3/2$^+$	$A_{3/2}$(n)	0.017±0.005, 90°±10°	-0.140±0.065

amplitudes [GeV$^{-1/2}$]