Conclusion and Outlook

Photoproduction: Total cross section $\mu$

Photo beam asymmetry
Angular distributions

Photoproduction: $\nu$

Experimental setup

Introduction, Motivation and Previous Results
$\mu$ and $\nu$ photoproduction off deuterium
Excited states of the nucleon

Resonances in $\Lambda$ and $\Lambda'$ production

Photorosonon on nucleon

Tagging resonances

Characteristic meson decay

Broad and overlapping resonances
Crystal Barrel: V. Cweba et al., PR1A9 (2005) 012004
McDugger et al., PR1B9 (2002) 220202
F. Renard et al., PLB529 (2002) 175
Grauel et al., PR1C4 (1985) 3736
B. Krusche et al., PR74 (1975) 30

Data:

W [GeV]

2.4 2.2 2.0 1.8 1.6 1.4 1.2 1.0

Resonances coupling to the neutron the only with stronger electromagnetic among known resonances D_{15}(1675) is

- \pi^{+}\eta(960)
- \eta^{'}(1450)
- D_{15}^{+}(1770)
- D_{15}^{+}(1835)
- D_{15}^{+}(1910)
- D_{15}^{+}(1975)
- D_{15}^{+}(2020)
- D_{15}^{+}(2080)
- D_{15}^{+}(2135)
- D_{15}^{+}(2190)

Branching ratios and spin couplings:

$\eta_{11}$ and $\eta_{0}$ pair production off the proton

\eta_{11} \leftrightarrow \eta_{0}$
Neutron: Strong contribution from D_{15}^{+}(1675) 
Proton: Only small contributions from other resonances
Strong cancellation between S_{11}^{+}(1535) and S_{11}^{+}(1650)

Domiance of S_{11}^{+}(1535)

Resonance contributions to \nu N in the MAID model
higher lying resonances
incident photon energy due to
predicted to increase at higher
the dominance of \( S_{11}(1535) \)
The constant ratio shows
Ratio in \( S_{11}(1535) \) region \( \approx 2/3 \)

Previous results for the ratio \( d\sigma/\eta d\Omega \) (TAPS@MAMI)
\[ X = \text{whatever} \]

Incident

\[ \land \rightarrow o \lor o \lor o \rightarrow \lor \]

\[ X \lor \rightarrow N \lor \]

Inclusive measurement

\[ (n \lor p) \rightarrow \text{measured in coincidence} \]

\[ \land \rightarrow o \lor o \lor o \rightarrow \lor \]

Incident

\[ \lor \lor N \rightarrow N \lor \]

Exclusive measurement
Preliminary

normalization arbitrary

quasifree from data

(Crude et al.)

\cos{\theta_{cm}}

\frac{dN}{dy, \sqrt{s}} \quad \text{[GeV/c]}

Quasifree \frac{dN}{dy, \sqrt{s}}: angular distributions

$\pi^0 n \rightarrow p n$ (quasifree from d)
Quasitriee $\gamma n \rightarrow nn$: angular distributions

\[ \cos \theta \]

Normalization arbitrary

$Y_{n n} \leftarrow m_{n n} (\text{quasitriee from } d)$

$Y_{p n} \leftarrow m_{p n} (\text{quasitriee from } d)$
Quasitreee $N \gamma \rightarrow NN_{\text{total and ratio cross sections}}$
Some indication for $D_{15}$ contribution

Very preliminary analysis, but full available statistics!

Preliminary results for photon beam asymmetry.
Agreement with the sensitivity of $\xi$ to $^{15}D^{15}$.

Agreement with $^n - MAID$ model for angular distribution.

Comparison with $^n - MAID$ model.

Angular distribution for $^{15}D^{15}$ at neutron.
Neutron and proton cross sections have the same size.

Total cross section lower than previously measured.

Results: Very Preliminary
Ratios seem to be constant, dominance of \(^{3}\text{He}(2090)\) ?

\[ E_y [\text{MeV}] \]

\[ \gamma [\text{MeV}] \]

\[ \text{results: Very Preliminary} \]
Inclusive $\gamma$-photoproduction from deuterium

Comparison: inclusive data at low energy

Total cross sections $\gamma n$ and $\gamma X$

$X^l l$
Identification of quark in production from \( \bar{u} \) to \( \nu \)