



Meson photoproduction on the neutron

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- Introduction
- Analysis procedure
- Comparison between free and quasi free proton for π^{o} and η photoproduction
- Results on quasi free neutron

 π^0 beam asymmetry

 η beam asymmetry

 $\eta\mathchar`-p$ $\eta\mathchar`-n$ final state invariant mass

• summary



introduction



The GrAAL experiment is based on the use of a tagged and polarised photon beam obtained through the Compton backscattering of laser light from the 6.04 GeV electrons of the ESRF.

- The Lagranye apparatus is optimised for the measurement of neutral final states and its cylindrical symmetry is ideal to measure polarisation observables.
- Many results were obtained on a free proton target: asymmetries and cross sections for π^0 , π^+ , η , 2 π^0 photoproduction were produced, allowing a better understanding of the excited nucleon.
- The natural extension was the use of a deuterium target to study the same processes on the neutron in order to obtain complementary information, toward a full multipole analysis including the isospin structure.









data collection

- Data were collected in different periods with a 6 cm liquid deuterium target and with green ($E\gamma$ max = 1100 MeV <I> ~ 2.5×10⁶ s⁻¹) and uv ($E\gamma$ max = 1500 MeV <I> ~ 1.5×10⁶ s⁻¹) laser lines.
- The γ beam polarisation was rotated by 90° approximately every 20 minutes by changing the laser polarisation direction.
- The trigger for data taking consisted in the coincidence of a signal from the tagging counter and the total energy in the Rugby Ball calorimeter (Etot > 180 MeV).
- ~ 3.5×10^6 and $3.2 \times 10^6 \pi^0 p$ events reconstructed.
- ~ 1.2×10^6 and $1.1 \times 10^6 \pi^0$ n events reconstructed.
- ~ 4.1×10⁵ and 3.9×10⁵ η p events reconstructed.
- ~ 1.3×10^5 and 1.4×10^5 η n events reconstructed







data analysis -preselection









data analysis -bidimensional cuts-1

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data analysis - extraction of the asymmetry







Results - π^0 on quasi free proton





• quasi free proton

• free proton





Results - η on quasi free proton





• quasi free proton

• free proton





Results - π^0 on quasi free neutron (NFN)



Full line :MAID 2003 Dotted line: SAID st.





Results - η on quasi free neutron line



Full line :MAID 2001



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η **qfproton-qfneutron**







η -proton η -neutron invariant mass











summary

- The beam asymmetries Σ for π^0 and η photoproduction from qf proton and qf neutron were measured in the second and third resonance region (first measurement).
- for quasi free proton Σ is virtually the same of the asymmetry measured for free proton in both reactions.
- for π^0 on qf neutron Σ is always positive.
- for η on qfp and qfn Σ is the same up to 1 GeV. At higher energies the asymmetries differ.
- In the total cm energy of the final N- η state a bump appears when the η is detected at backward angles in η -n, though not in η -p.

