Experimental Review on η and η' Channels: Recent results and some Open Questions

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I

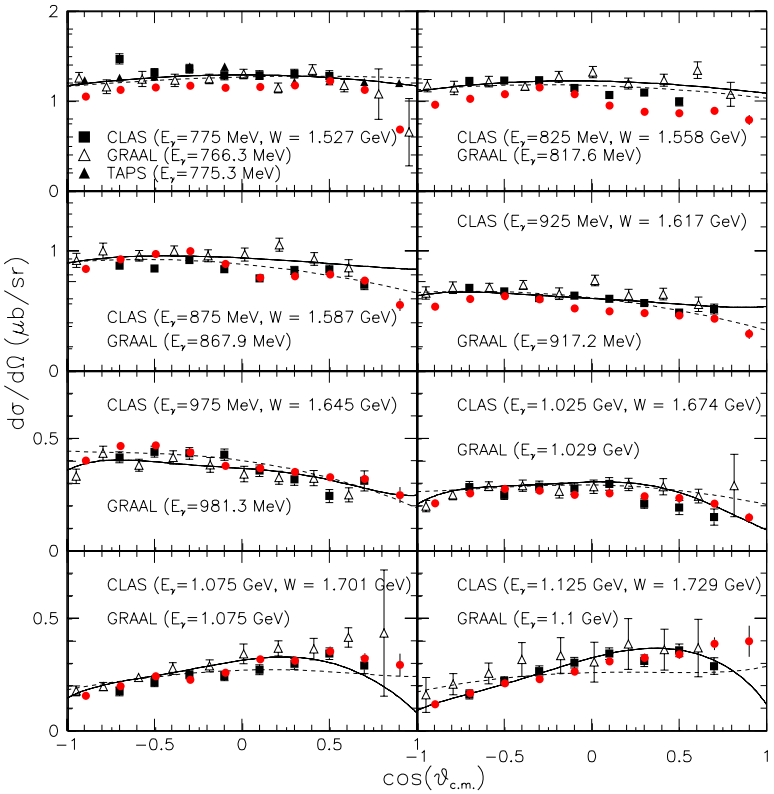
η CHANNEL

Differential Cross Section

(TAPS+GRAAL+CLAS)

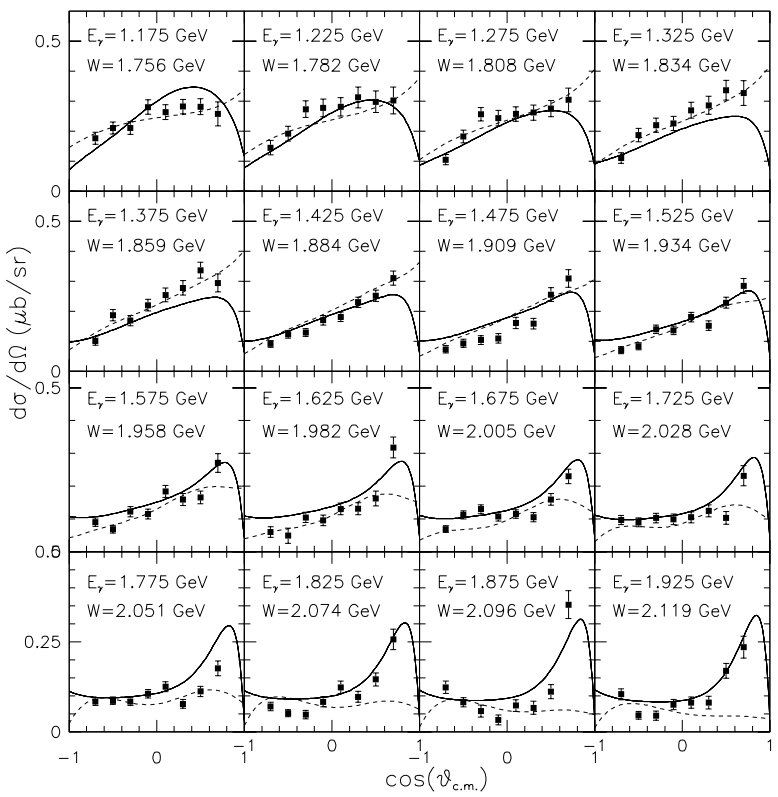
(Q^2=0, E_γ=700-1200 MeV)

GRAAL 02 PRELIMINARY



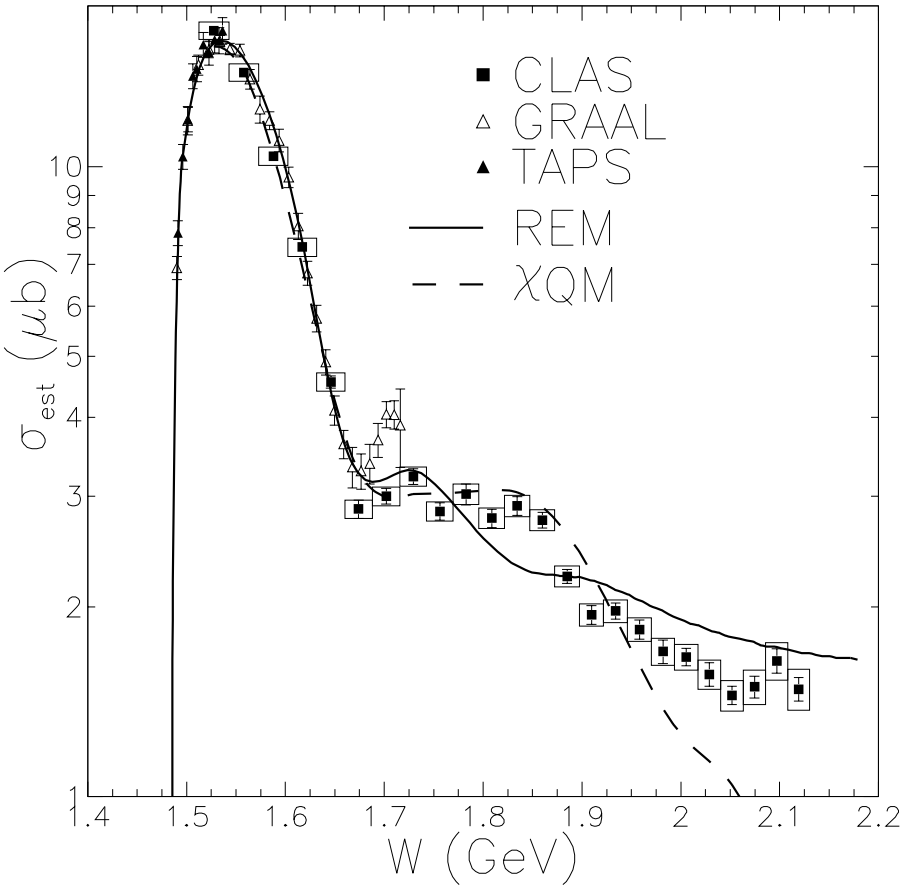
(Q^2=0, E_γ=1200-1950 MeV)

GRAAL 02 PRELIMINARY



Total Cross Section

(Q^2=0, E_γ=700-1950 MeV)

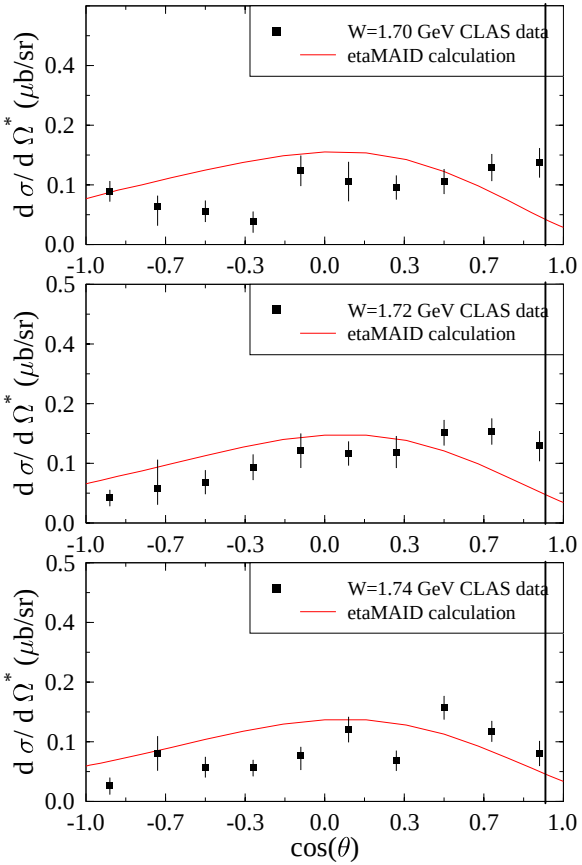


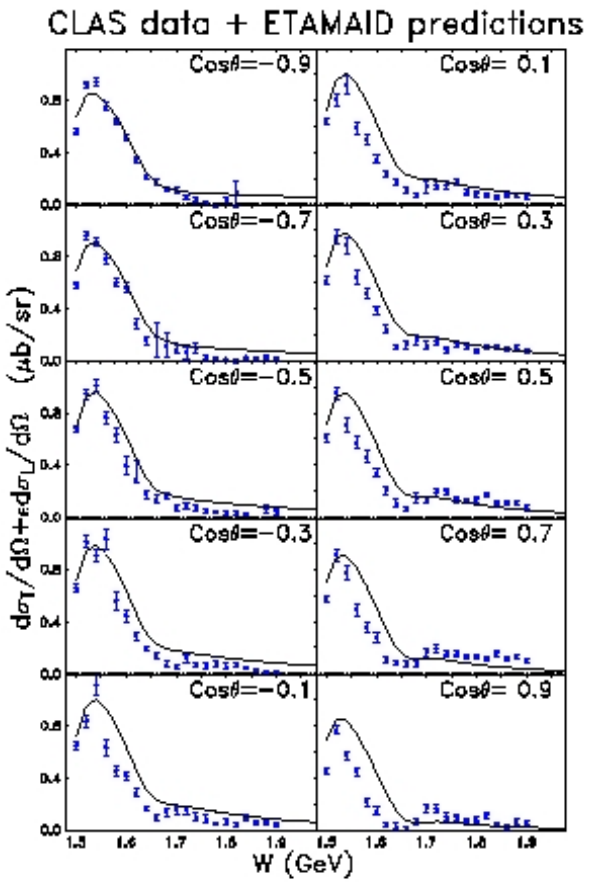
CLAS Electroproduction

New data (Statistics x 10)

.7<W<1.9 GeV, 0.17< Q^2 <3.1 GeV^2

Q^2=0.8 GeV^2





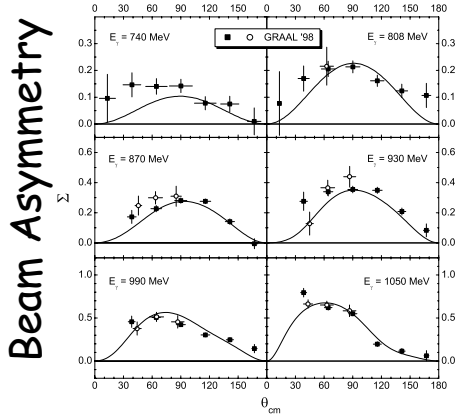
Polarization Observables

ETA-MAID

χQM

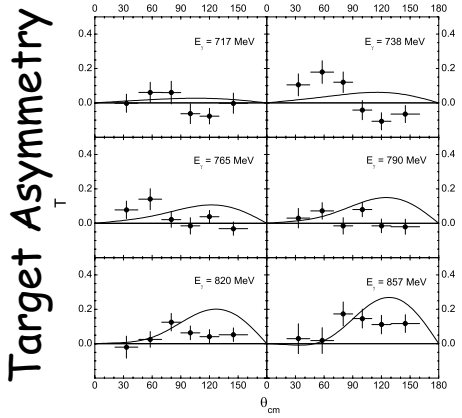
GRAAL

(PRL 98)



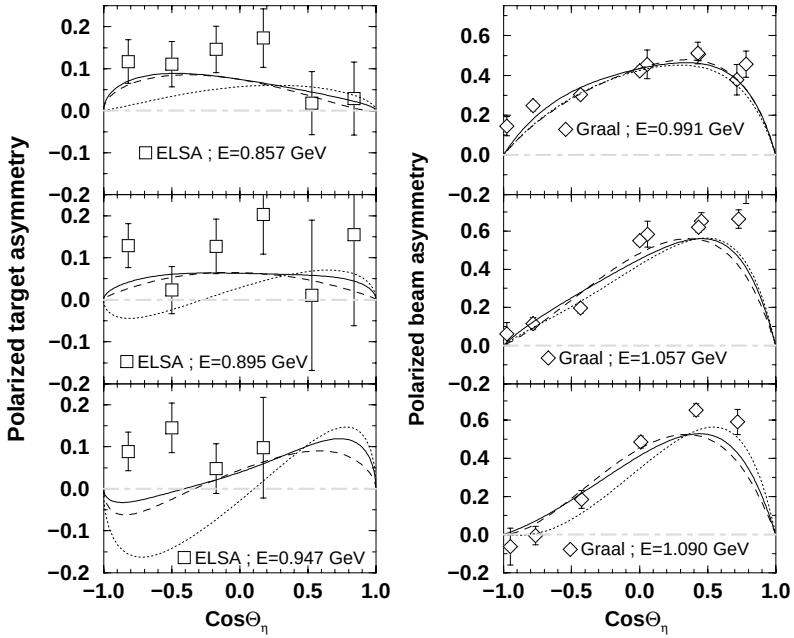
ELSA

(PRL 98)



ELSA

GRAAL

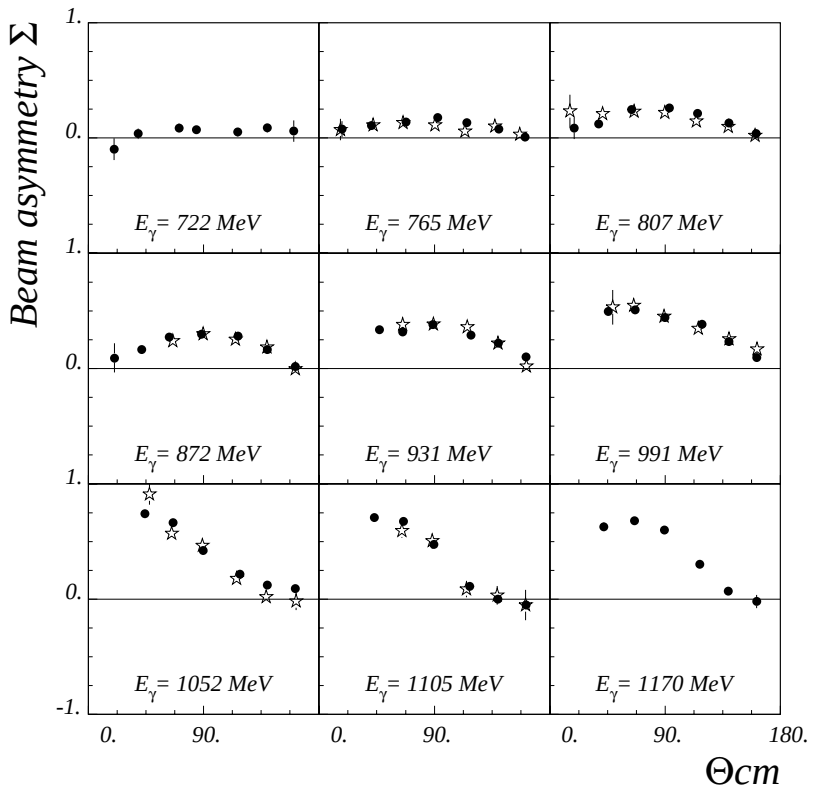


Beam Asymmetry

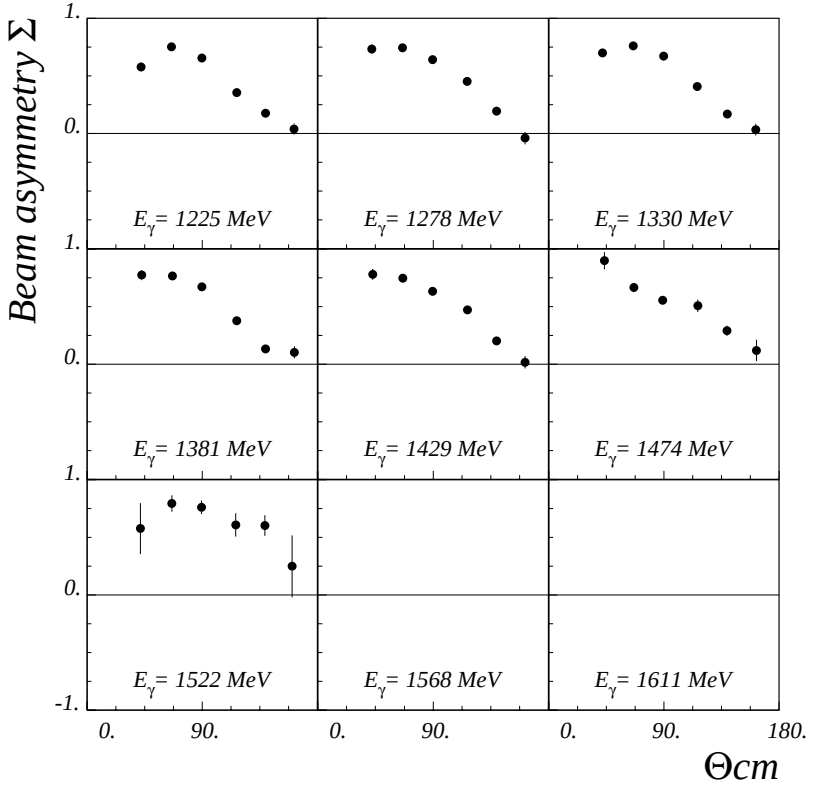
E_γ=700-1550 MeV

☆ GRAAL PRL '98

● GRAAL '02 PRELIMINARY



● GRAAL '02 PRELIMINARY



" Established " results

- $S_{11}(1535)$ dominance
  - Behaviour of σ_T at threshold
  - Isotropy of $d\sigma/d\Omega$ close to threshold
- $D_{13}(1520)$ contribution
  - S-D interference seen in Σ ($\sin^2(\theta)$ shape)
- Resonant P-wave contribution: $P_{11}(1710)$, $P_{13}(1720)$?
  - Rapid evolution of S-P interference in $d\sigma/d\Omega$ for W>1.6 GeV ($E\gamma$>1 GeV)

$S_{11}(1535)$ Width ?

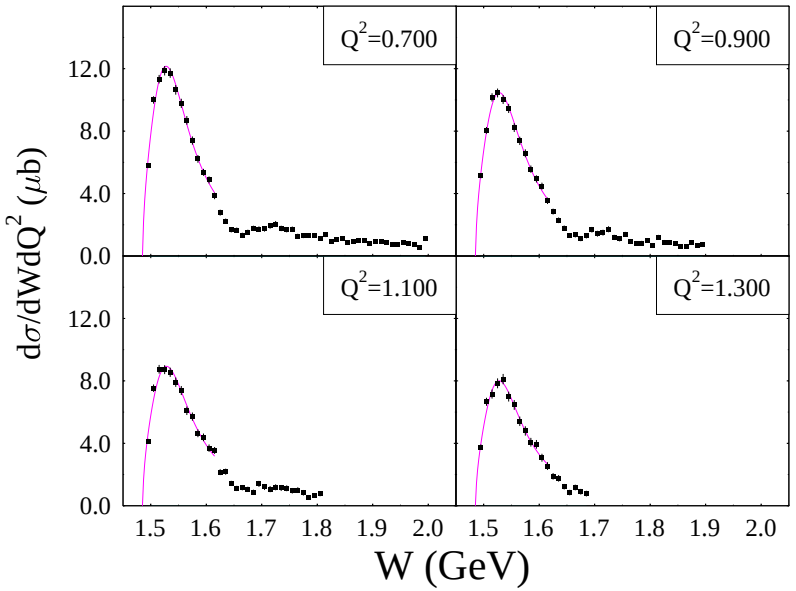
• PDG 2000:	100 to 250 MeV, est.=150 MeV
• Single BW fit CLAS (PRL 01):	143+- 18 MeV
• Single BW fit GRAAL(PLB 01):	174+- 20 MeV
• Vrana *et al.*, Multichannel analysis	112 MeV
• Waluyo *et al.*, Multichannel "	252 MeV
• Li-Saghai, χQM	162 MeV
• Chiang *et al.*, ETA-MAID	191 MeV

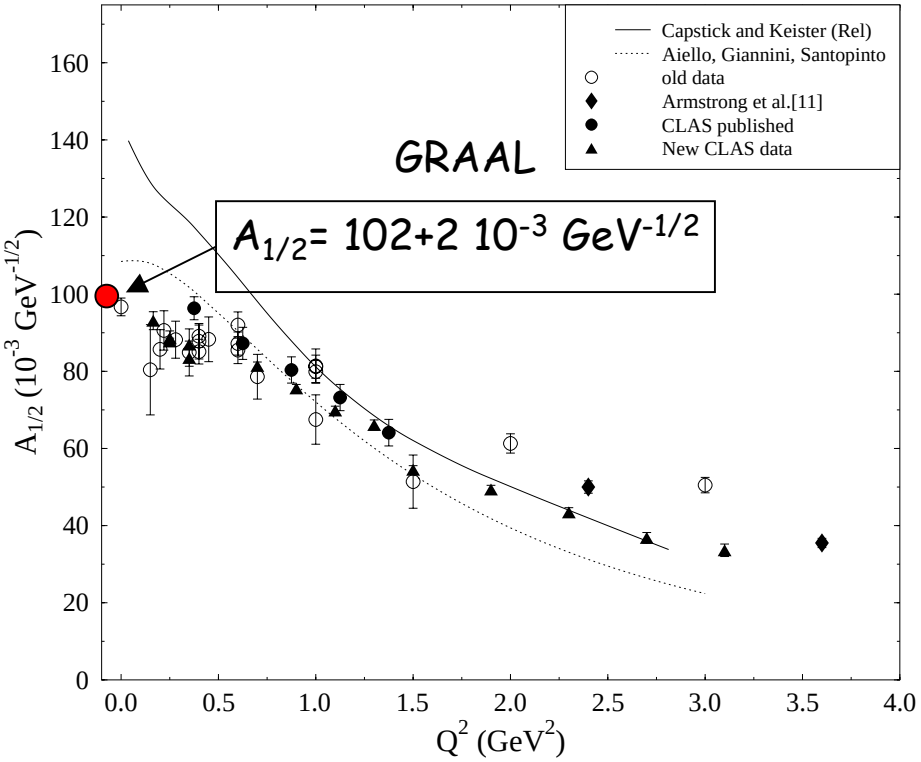
Despite good Data Base, still large uncertainties on the width due to the presence of other contributions:

- $S_{11}(1650)$,...
- Third S_{11} resonance ?

$A_{1/2}(\gamma p \rightarrow S_{11}(1535))$

New CLAS Data





- $A_{1/2}$ extracted with Single BW fit
- Normalization model dependent but shape well determined

⇒ Smooth Q^2 dependence favours 3q state VS K-Σ molecule

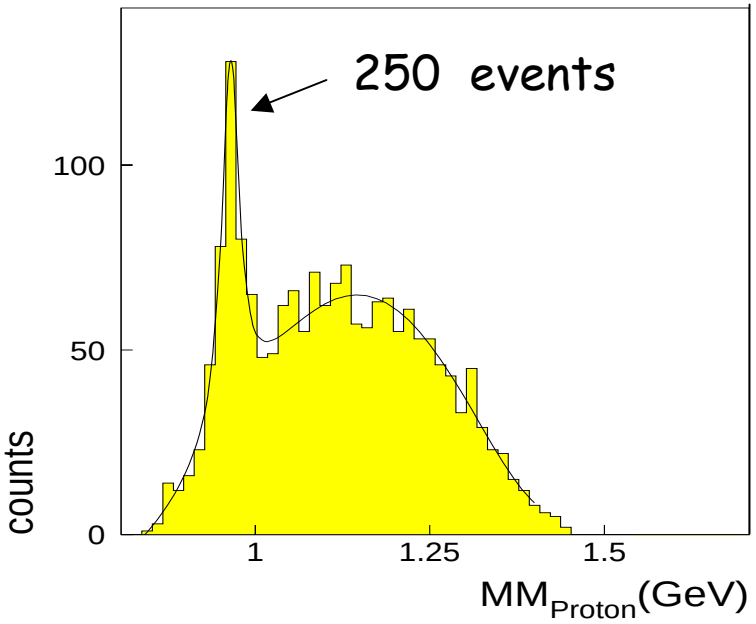
II

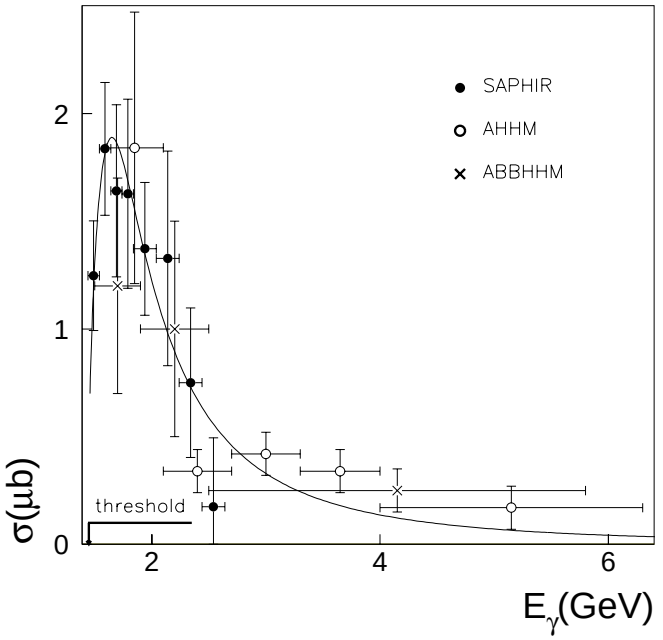
η' CHANNEL

Published Results

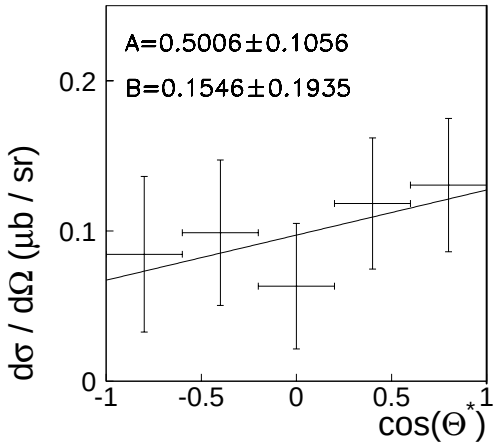
- Photoproduction
  - SAPHIR/ELSA: ($E\gamma$=1.44-2.6 GeV), Plotzke *et al.*, PLB 98

$$\gamma p \longrightarrow \eta' p \longrightarrow \eta\pi^+\pi^- p \longrightarrow 2\pi^+2\pi^-\pi^0 p$$

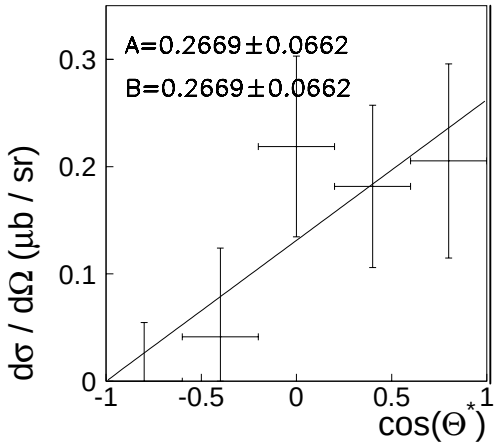




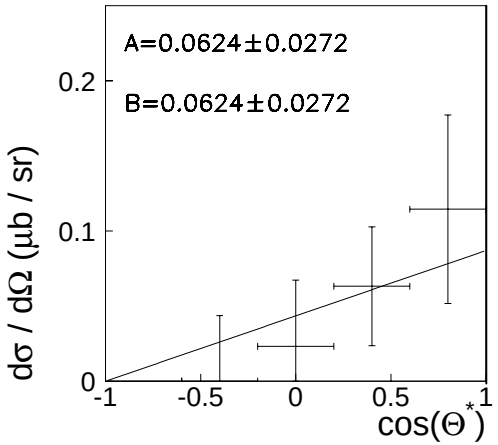
Resonance Interpretation



Eγ=1.44-1.54 GeV



Eγ=1.74-1.84 GeV



Eγ=2.24-2.64 GeV

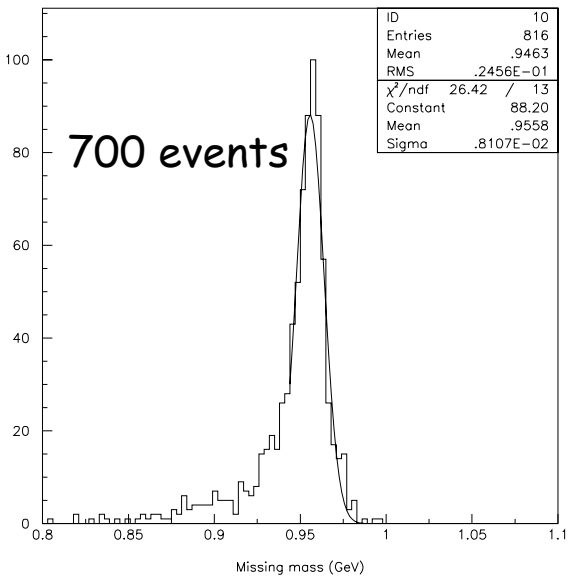
⟹ Data are consistent with 2 resonant partial waves:

- S_{11} M=1900 MeV
- P_{11} M=1986 MeV

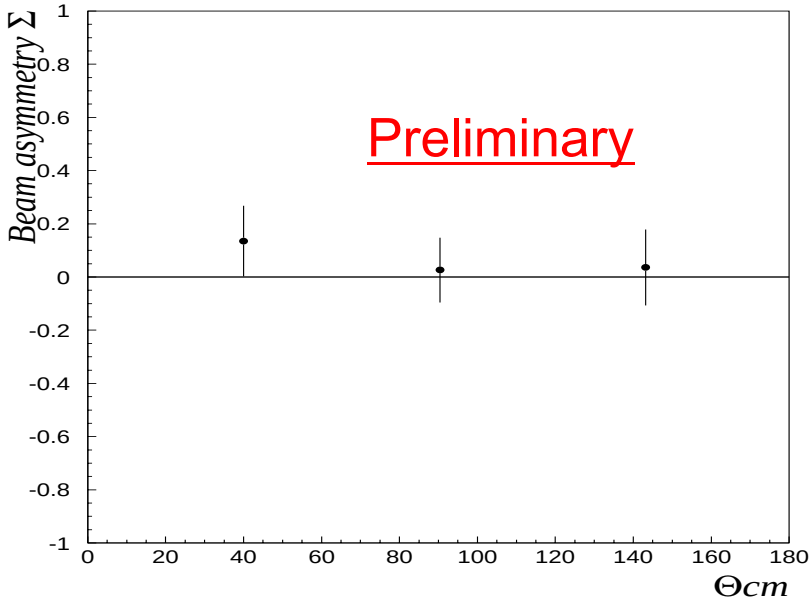
Beam Asymmetry
(Very preliminary)

E_γ=1440-1600 MeV

$\gamma p \longrightarrow \eta' p \longrightarrow \eta\pi^+\pi^- p \longrightarrow \pi^+\pi^- 2\gamma p$



Missing mass



Conclusions/Perspectives

- Eta Channel
  - $d\sigma/d\Omega(Q^2=0)$: Good consistency between TAPS/GRAAL/CLAS
  - Forward angles covered by new GRAAL and CLAS data
  - $d\sigma/d\Omega(Q^2>0)$: High statistics now available
  - Σ measured from 700 to 1500 MeV
  - Interpretation still largely open !!
  - New results on the photoproduction on the neutron from GRAAL are coming ⇒ S. Kouznetsov's talk
- Eta' channel
  - $d\sigma/d\Omega(Q^2=0)$ from Bonn but with very low statistics
  - Results in photoproduction will be available soon from CLAS.
  - Small signal in electroproduction: more work needed