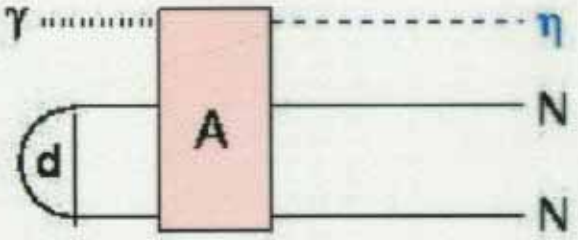
MESON PRODUCTION IN THE VICINITY OF THE ROPER

- ETA PRODUCTION
  $\gamma d \to np\eta$
  } $\Rightarrow a_{\eta N}$

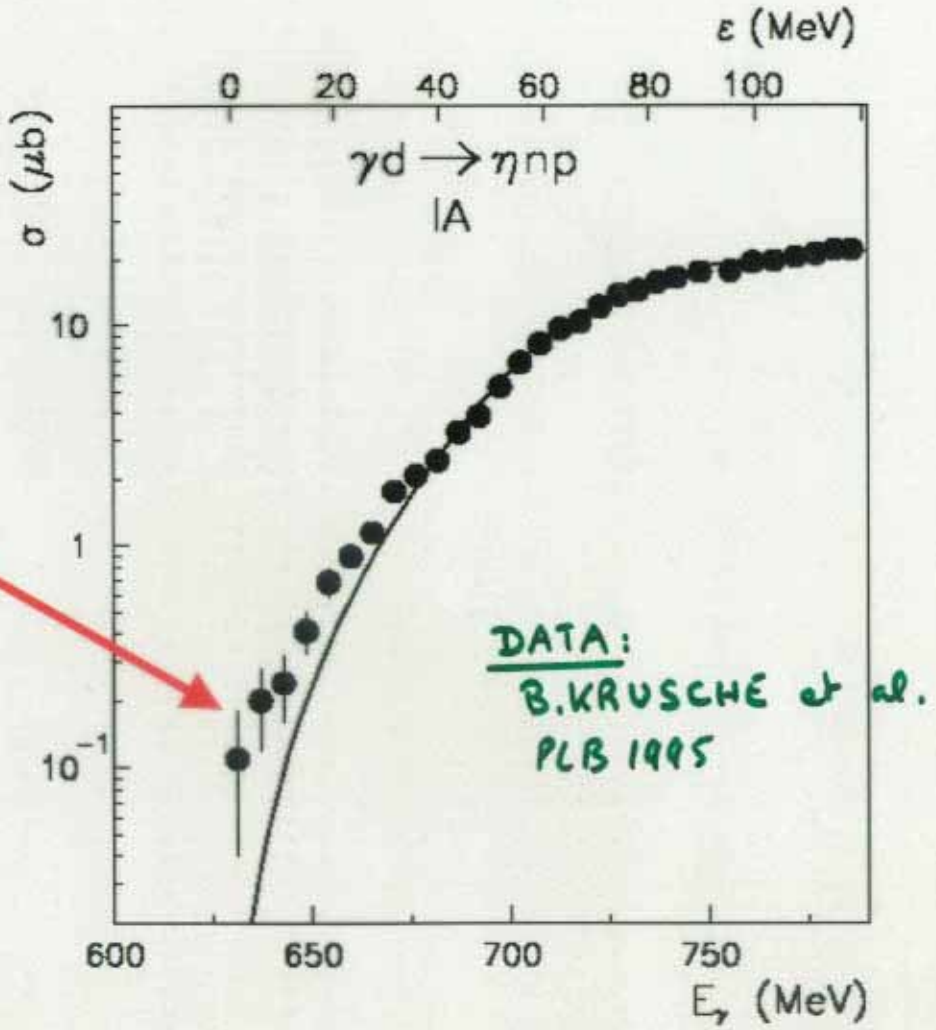
- PION PRODUCTION
  ELECTRO PRODUCTION

S. Schneider
A. Sibirtsev
J. Haidenbauer
Ch. Elster
J. Speth

Total cross section for $\gamma d \rightarrow np\eta$

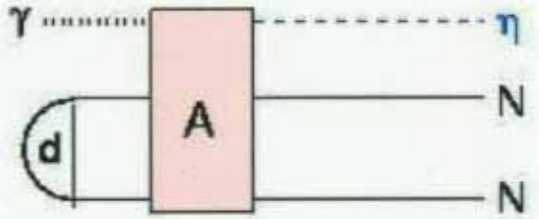


Threshold enhancement

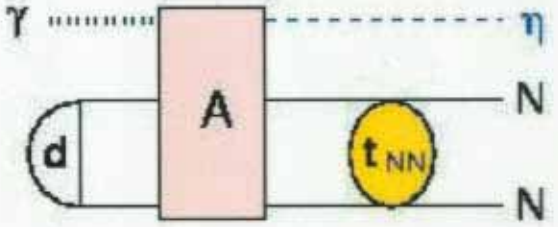


Incoherent η-photoproduction from deuterium

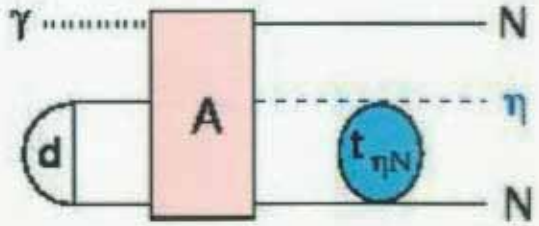
$$\left\langle k_\gamma \varphi_d \left| \mathrm{A} \right| \Psi_{NN\eta} \right\rangle$$



Impulse Approximation (IA)



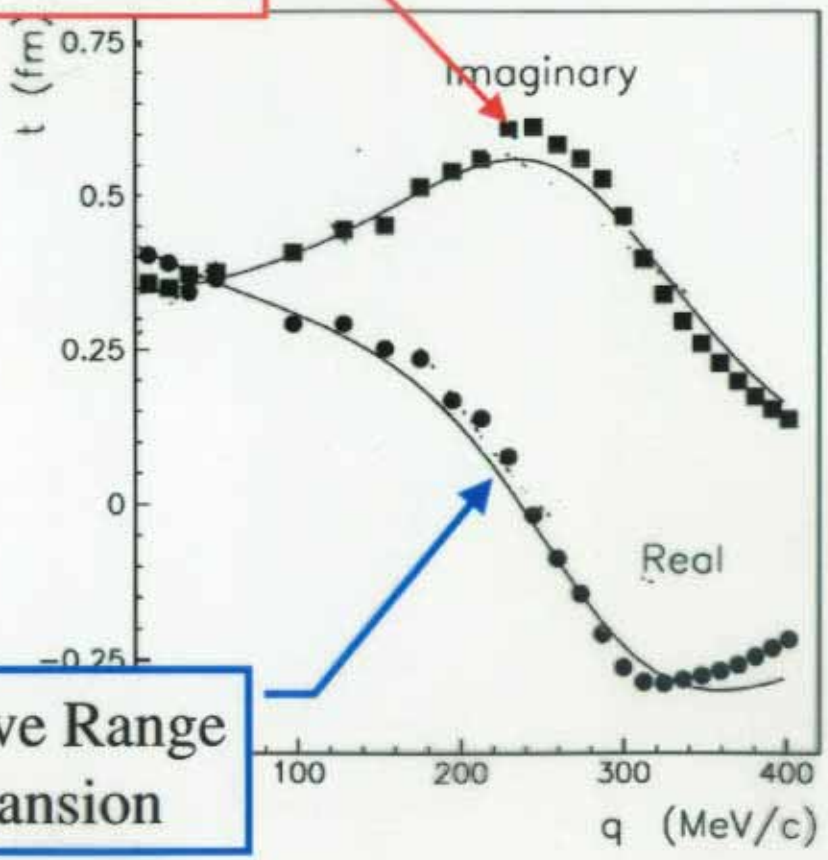
NN FSI (final state interaction)



ηN FSI

t-matrix $t_{\eta N}(q,k)$

calculated t-matrix



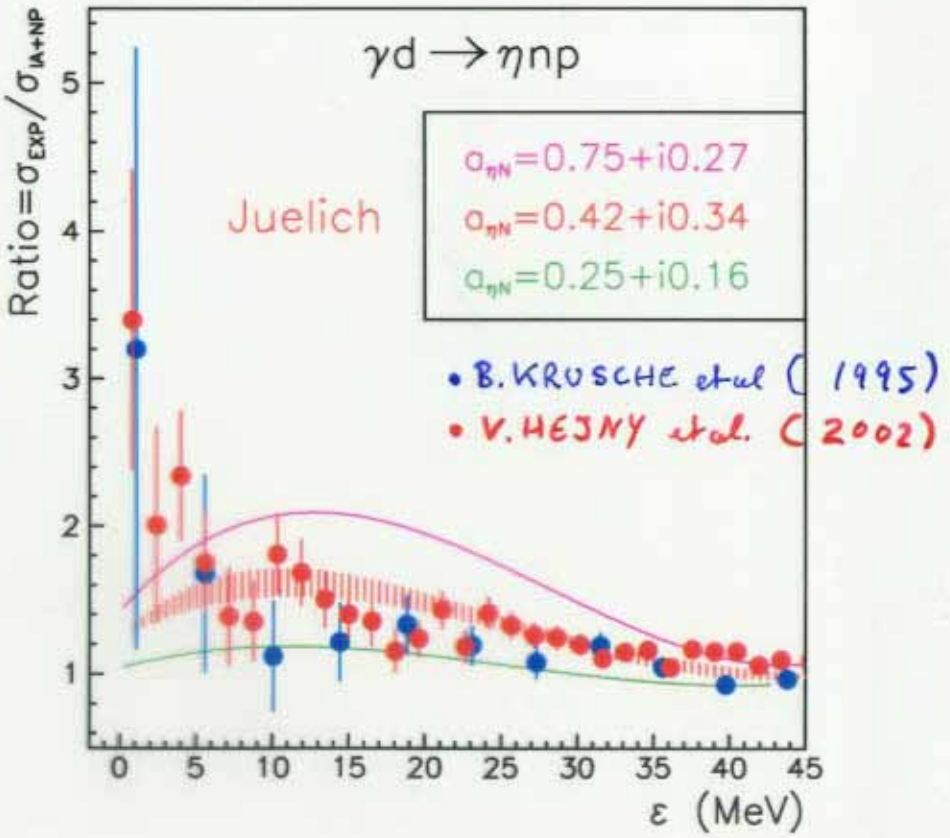
Effective Range Expansion

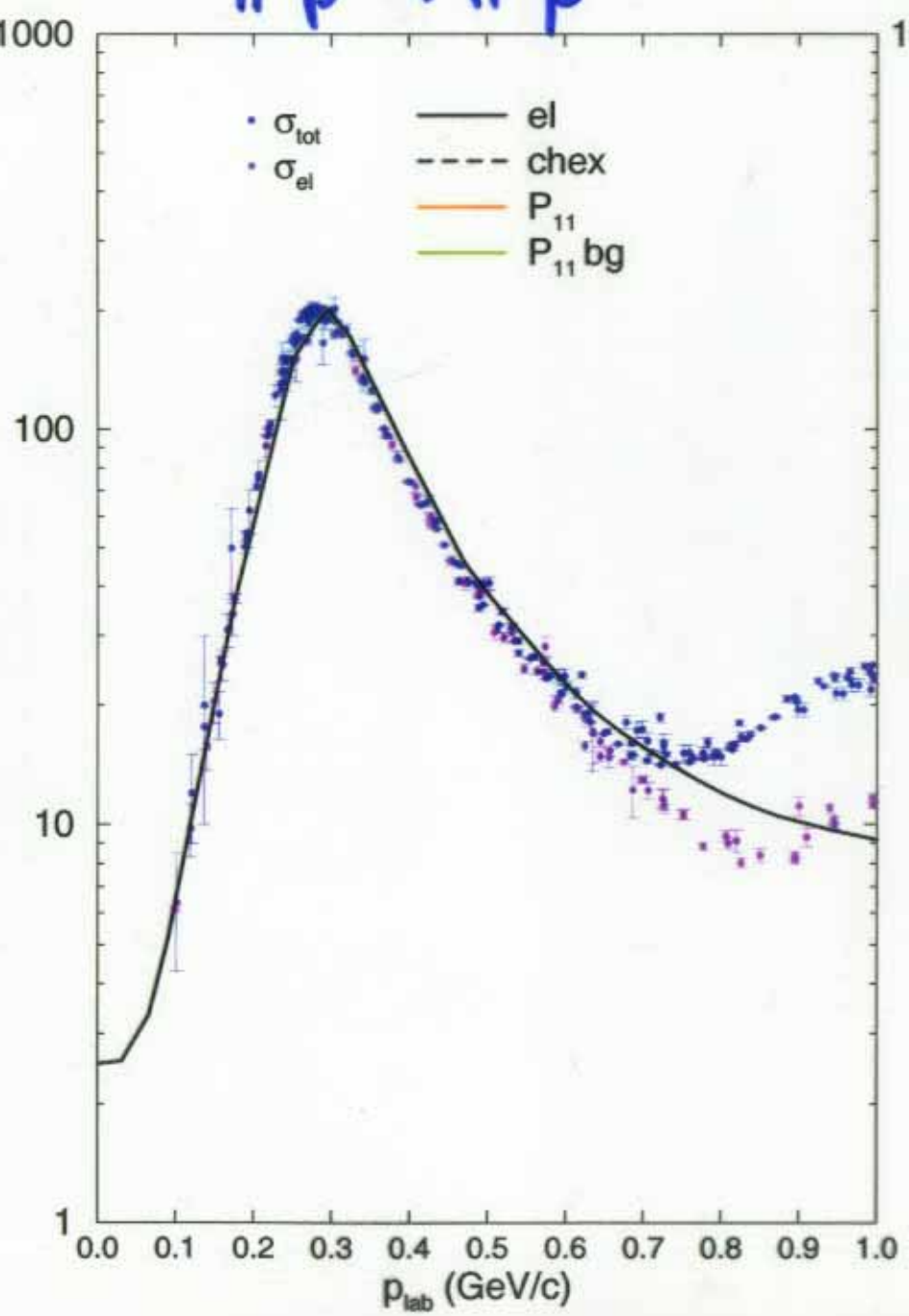
ηN FSI
with **exact t-matrix**
and effective range expansion
give numerically the SAME result

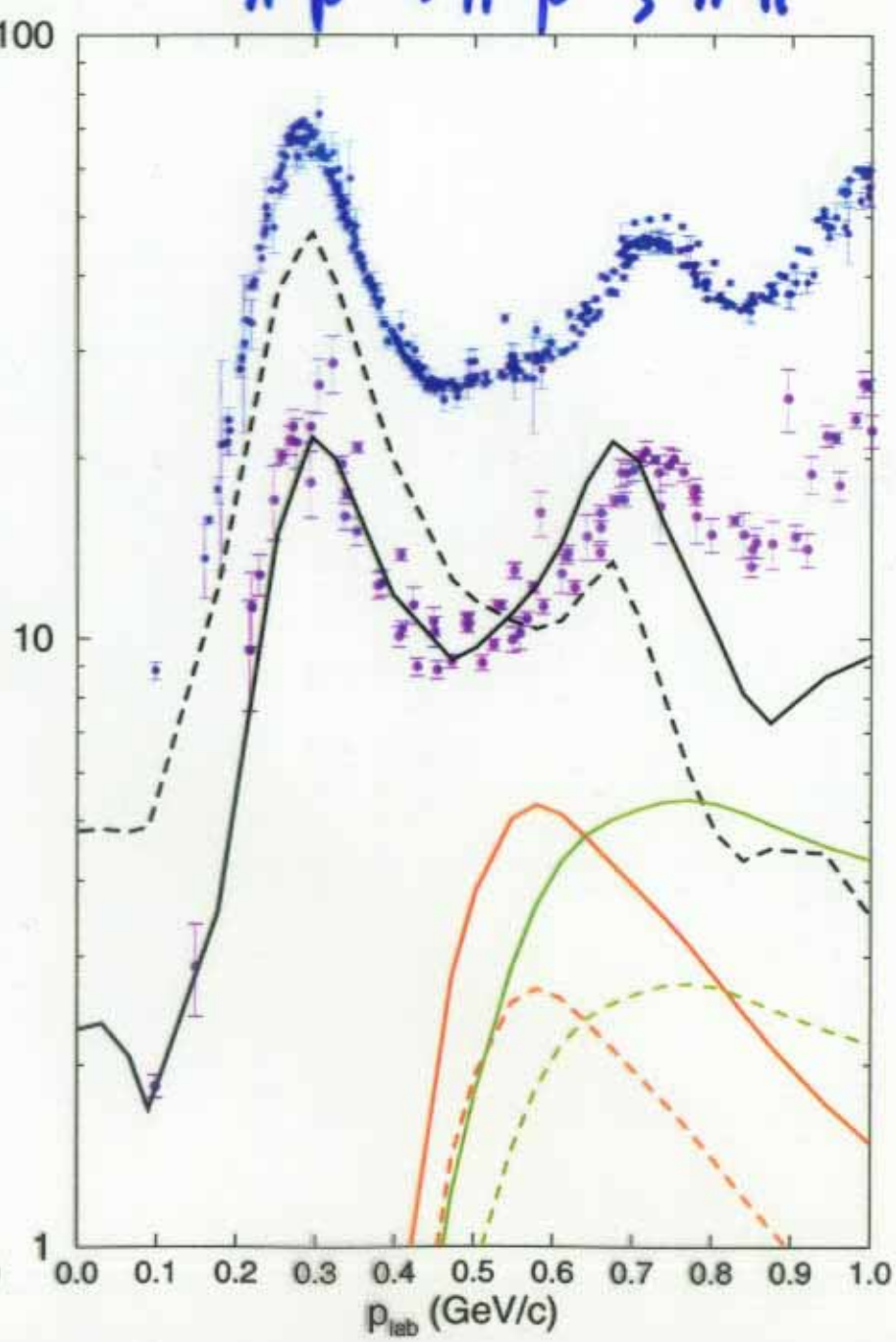
we can test $a_{\eta N}$

Linear scale for ηN enhancement

- Divide data through our calculation IA + NN-FSI

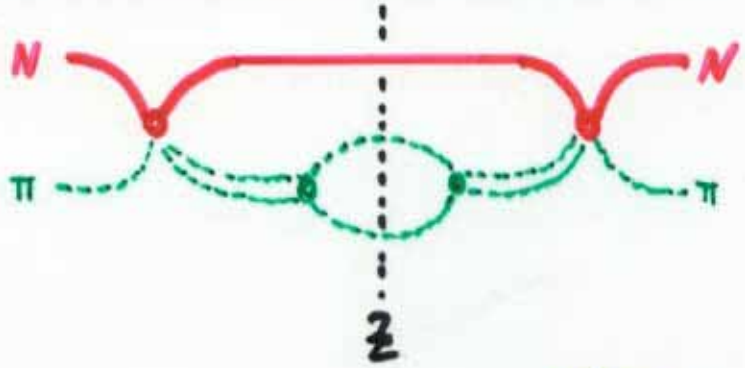






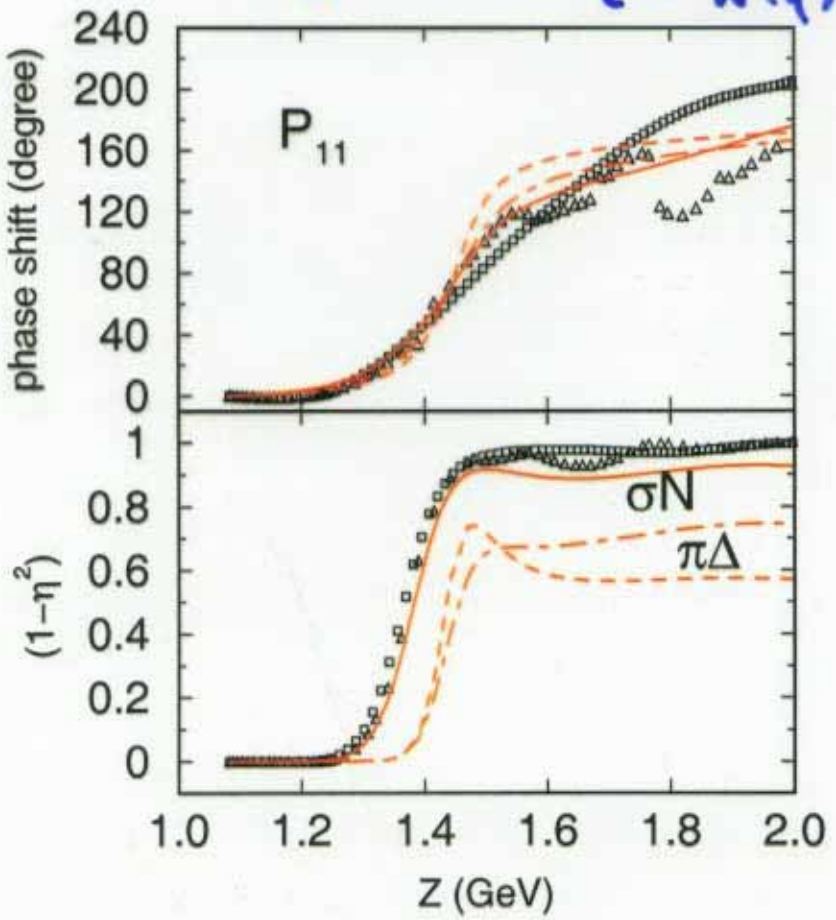
WHY EARLY ONSET OF INELASTICITY?

SIMPLIFIED MODEL:



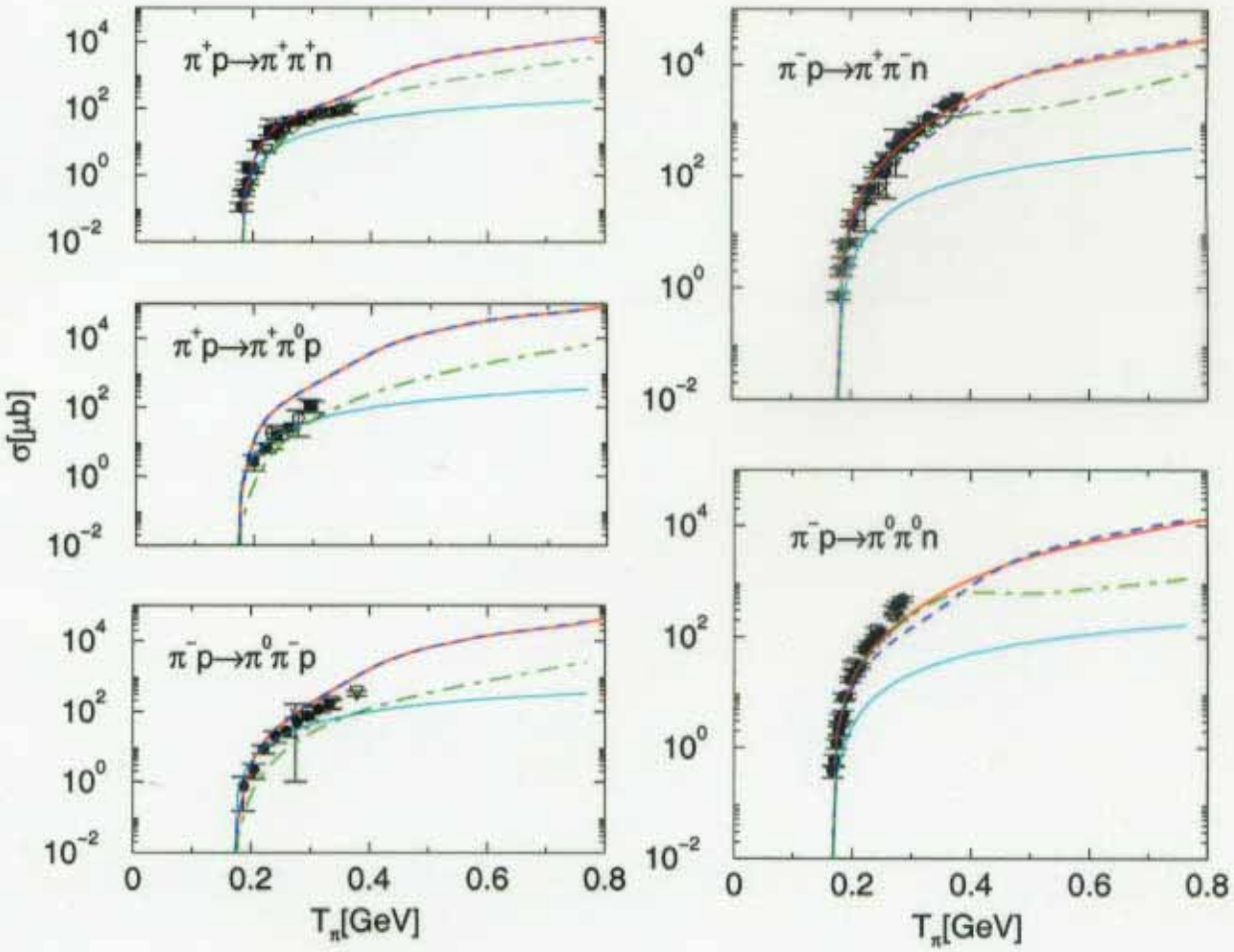
$$T(z) = \frac{f^\dagger f}{z - m_0 - \Sigma(z)}$$

$$\Sigma(z) = \sum_\gamma \int d^3q \; \frac{f_\gamma(q)\, f_\gamma(q)}{z - W(q)}$$



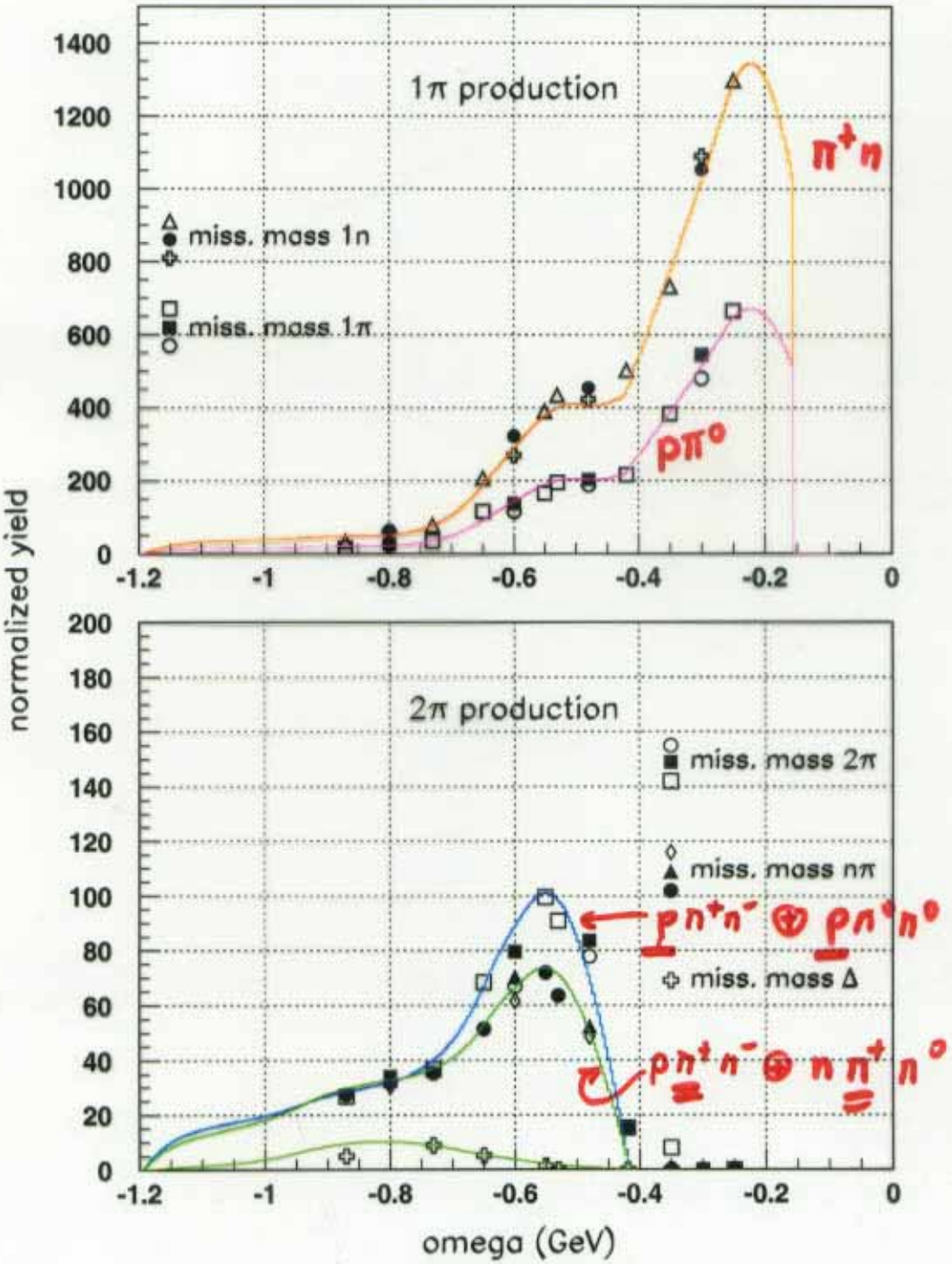
$\pi N \to \pi\pi N$

Total cross sections



EXP. → B. NEFKENS, J. COMFORT, M. SADLER, ...

H.P. MORSCH ($\alpha p \to \alpha' p X$ / $\to \alpha' \pi^+ X$)



WASA-PROMICE: $pp \to pp\pi^+\pi^-$

PRL 88, 2002

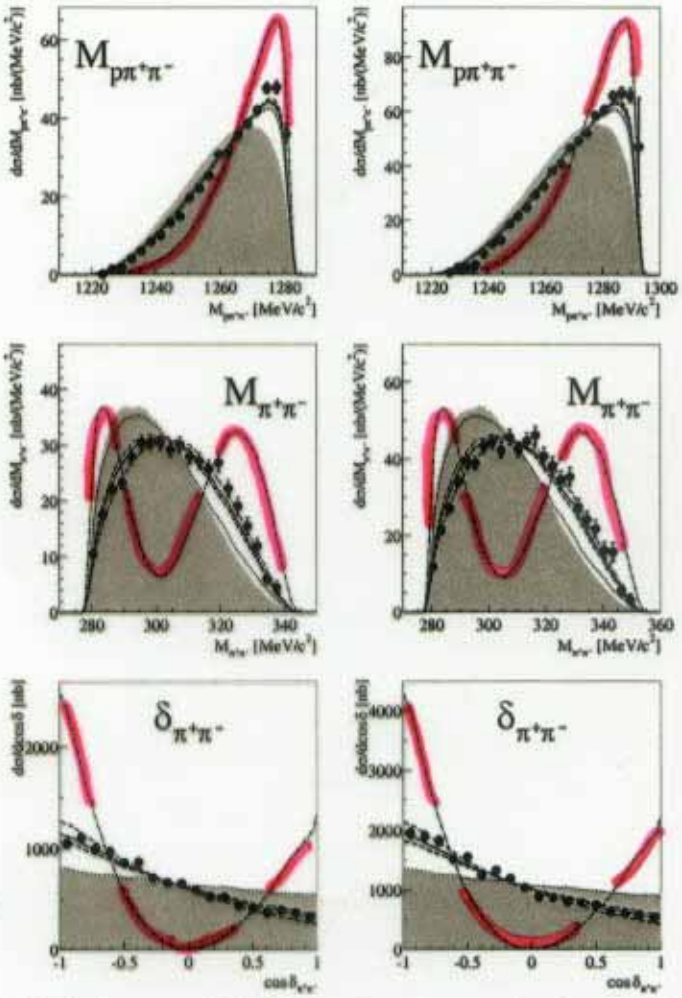
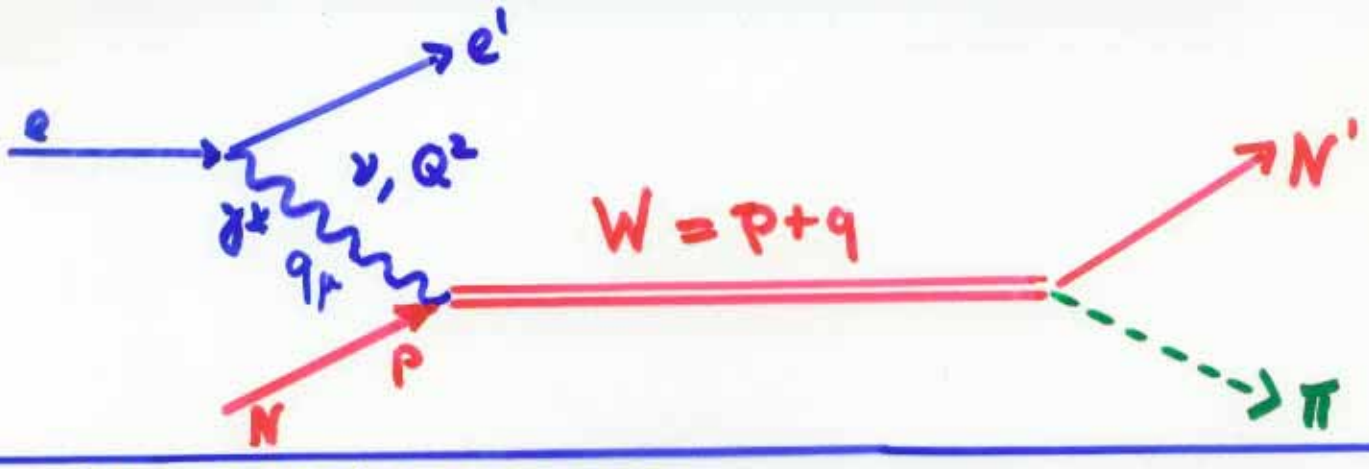


Fig. 2: Influence of the Roper resonance decay onto the differential cross sections for the invariant masses $M_{p\pi^+\pi^-}$ and $M_{\pi^+\pi^-}$ as well as for the opening angle $\delta_{\pi^+\pi^-}$ between both pions in the reaction $pp \to pp\pi^+\pi^-$ at $T_p = 750$ MeV (left) and $T_p = 775$ MeV (right). Pure phase space calculations are shown by the shaded area, dotted lines show the case of a pure $N^* \to N\sigma \to N(\pi^+\pi^-)_{I=\ell=0}$ decay, whereas the dash-dotted lines exhibit the scenario for a pure $N^* \to \Delta\pi \to N(\pi^+\pi^-)_{I=\ell=0}$ decay. Solid and dashed curves finally show calcualtions assuming interference from both decay routes and having an admixture of 20%, 25% and 33% of the $\Delta\pi$ route in the total decay amplitude [20].

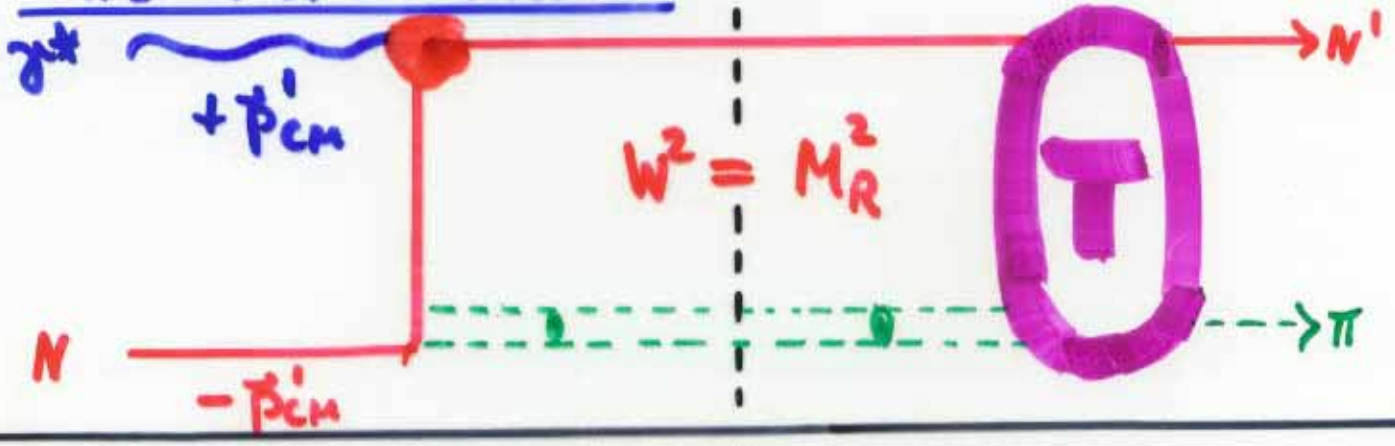
THEORY: L. ALVAREZ-RUSO

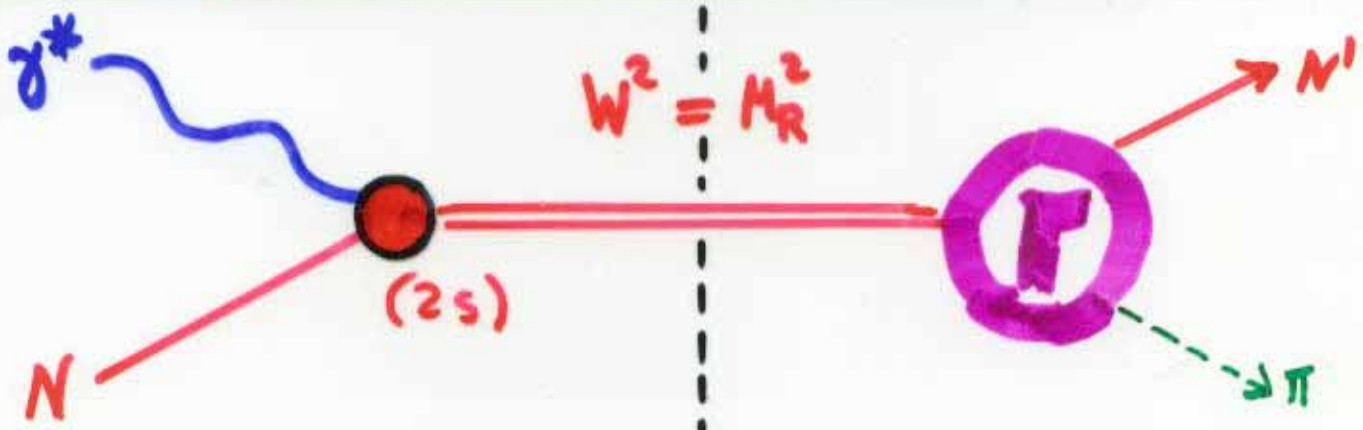
E. OSET

ELECTROPRODUCTION

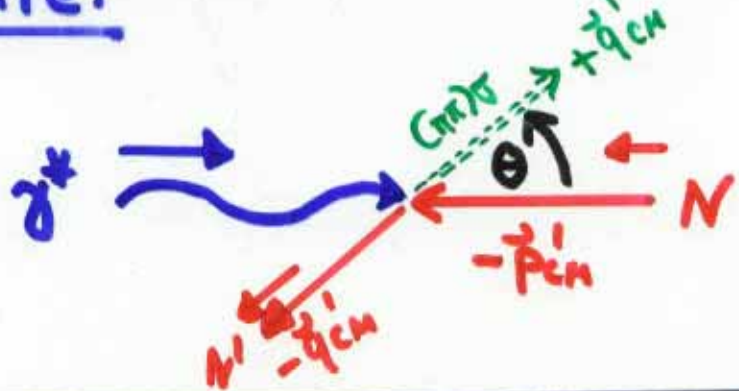


THEORIST'S FRAME:



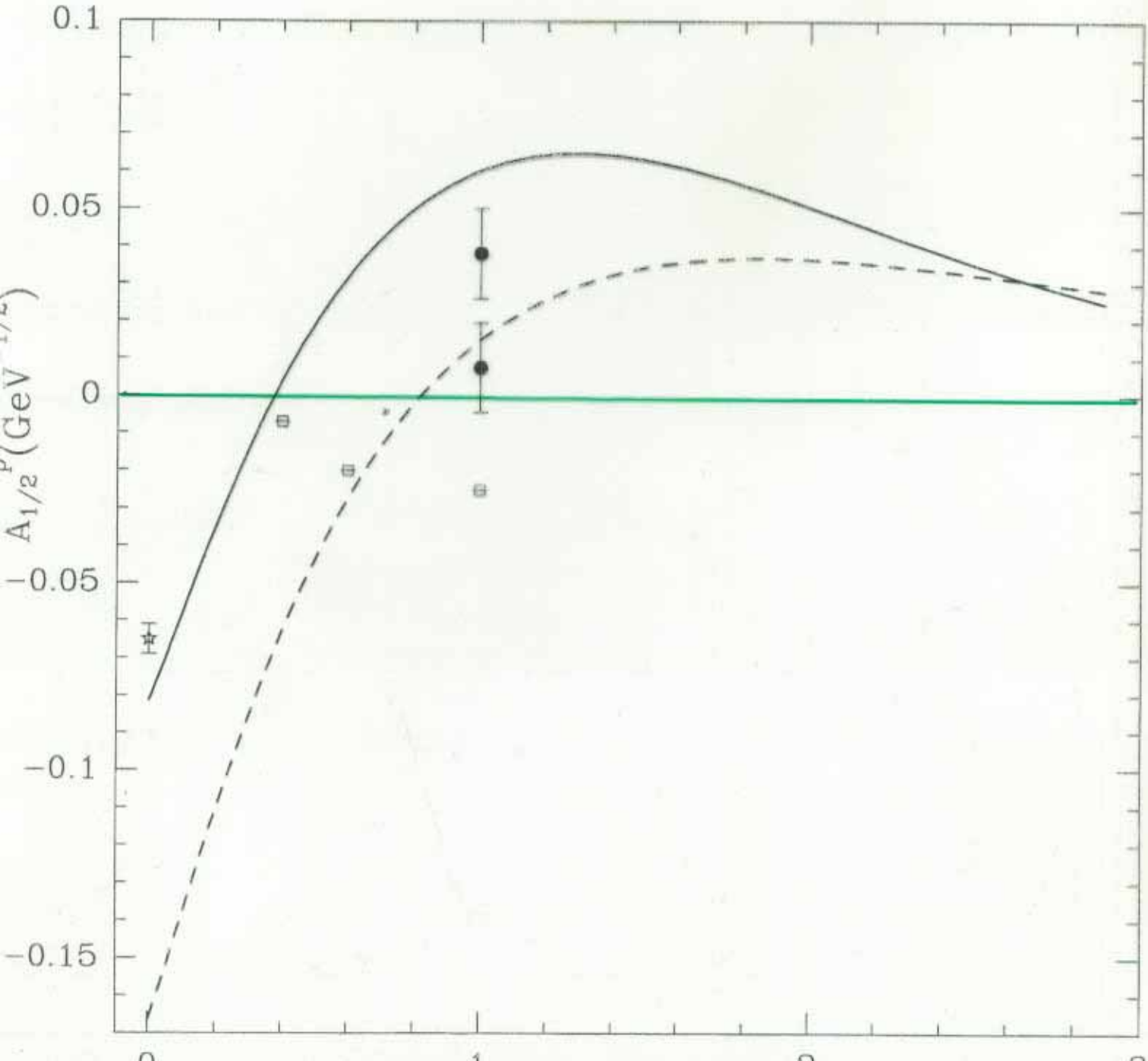


ESTIMATE:



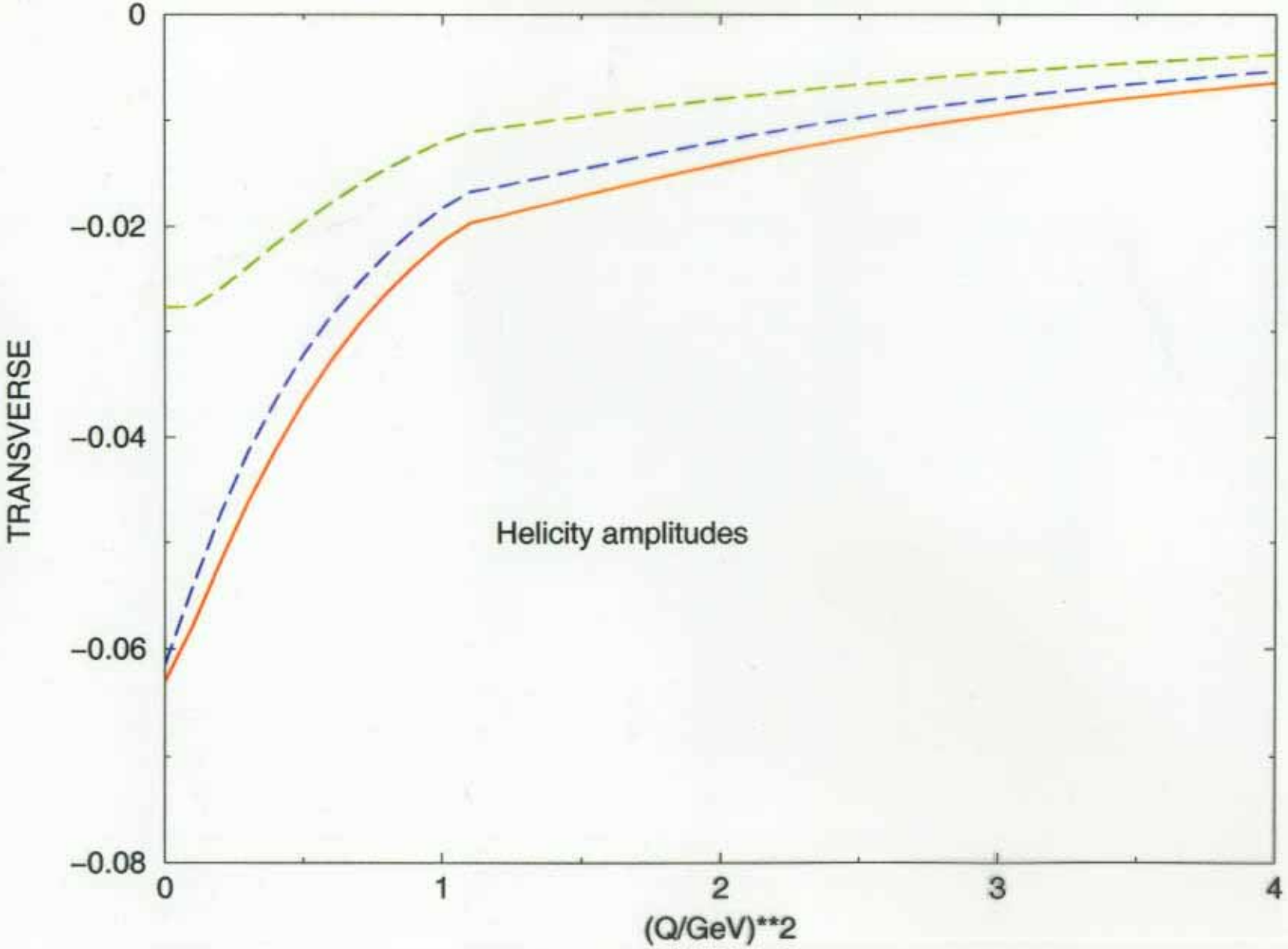
F. Cano, P. González,
PLB 431 (1998) 270 :

Quark model



ELECTROPRODUCTION

preliminary



CONCLUSIONS

- $\gamma d \to pn\eta$
  - THRESHOLD ENHANCEMENT
  - ANALYSIS MODEL INSENSITIVE
  - $a_{\eta N}$
- ROPER:
  - complementary probes are needed!

    $\pi N \to \pi\pi N$

    $\gamma N \to \pi\pi N$

    $pp \to pp\pi^+\pi^-$

    ELECTROPRODUCTION:

    SENSITIVE TO STRUCTURE