THE PHOTOPRODUCTION OF π^0 MESONS IN HYDROGEN

D. B. Miller and E. H. Bellamy

University of Glasgow, Glasgow.

(presented by E. H. Bellamy)

The cross-section for π^0 photoproduction at hydrogen at 90° cm has been measured, using the apparatus indicated in Fig. 1. Protons emitted at $36° \pm 1.5°$ and $40.5° \pm 1.5°$ from the 1 cm thick flat liquid hydrogen target [1)] were detected in the plastic scintillation counter telescope. Protons between 20 MeV and 40 MeV were identified by time-of-flight over the 1 m distance between the thin counter 1 (20 mil. thick) and counter 2, and energy loss in counter 2. Protons between 40 and 55 MeV were identified by pulse heights in counters 2 and 3. The solid angle for both sets of protons was defined by the 12.5 cm $\times$ 7.5 cm $\times$ $\times$ 1.27 cm counter 2. Corrections were made for the non-linear response of the scintillators. Allowance was also made for energy loss in the finite target thickness. The measured background from the empty target was corrected for additional energy loss when full, by appropriate adjustment of the background proton energy spectrum. The results were corrected to 90° cm using previous measurements of angular distributions [2, 8)]. These corrections were usually less

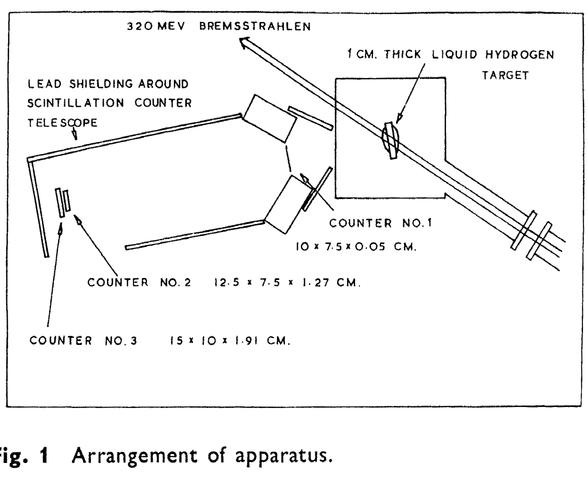

Fig. 1 Arrangement of apparatus.

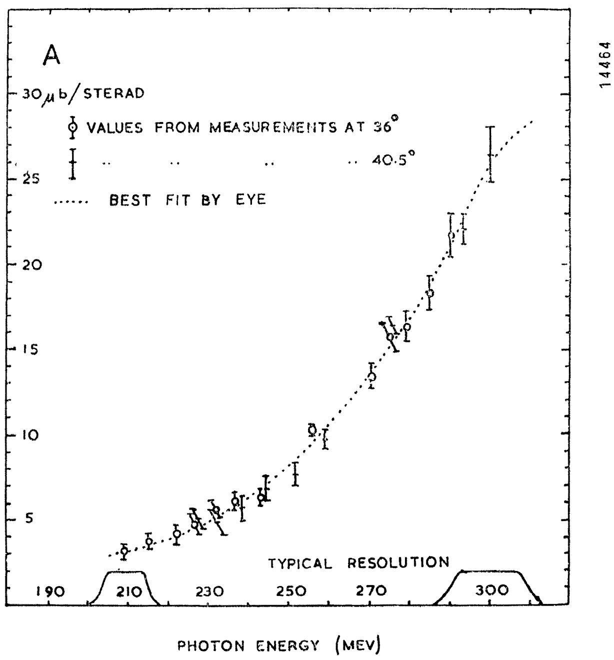

Fig. 2 New results.

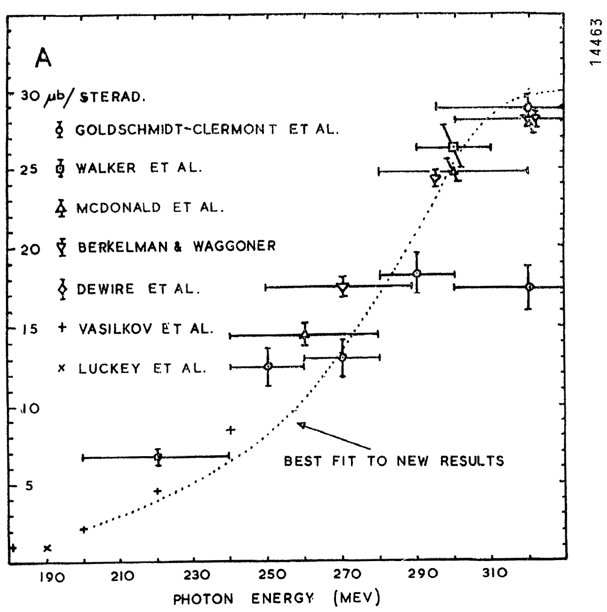

Fig. 3 Comparison with previous results.

than 2%, but amounted to about 8% (±4% assumed) for the lowest energy point at 40° in the laboratory.

The results are shown in Fig. 2. All errors, except an uncertainty of ±3.5% in beam calibration, are included. Fig. 3 and Fig. 4 compare these results with previous measurements [2, 8].

Fig. 5 shows a dispersion relation calculation of Höhler and Müllensiefen [9] using measured values of the α_{33} phase shift. The agreement is seen to be reasonable. J. Kennedy (private communication) has also included the bi-pion and tri-pion interactions. His results with $\Lambda_B = 0.6$ ef and $\Lambda_T = 0.4$ ef (also chosen by De Tollis and Verganelakis [10]) are indicated in Fig. 5. A detailed comparison with theoretical calculations should require inclusion of the effects of the small phase shifts, which unfortunately are not precisely known.

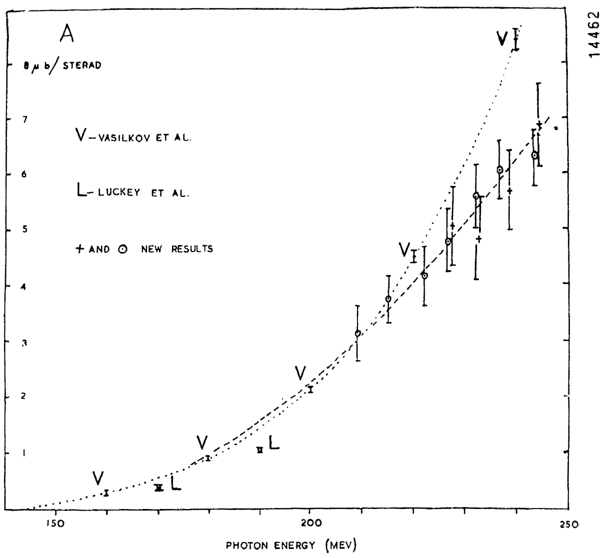

Fig. 4 Low energy results.

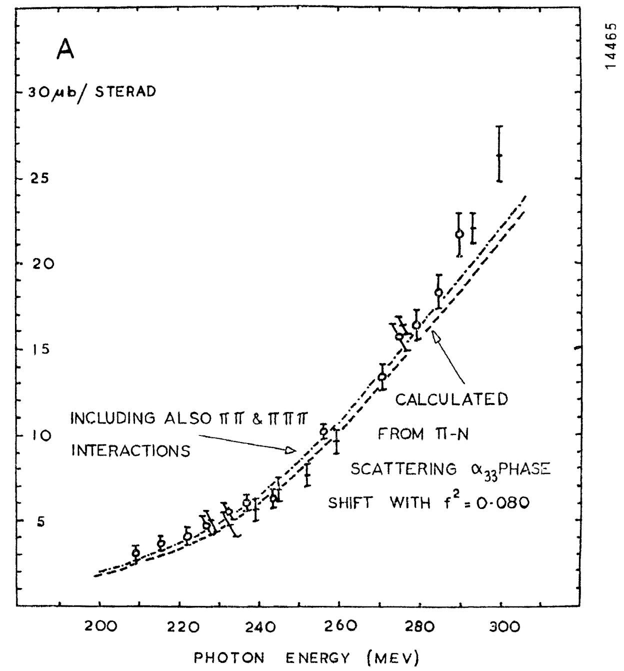

Fig. 5 Comparison with theory.

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DISCUSSION

GOLDWASSER: At what angle did you make these measurements?

BELLAMY: At 90° in the centre of mass. This was about 36° and 40° in the lab. We did two sets of measurements at slightly different angles to allow for the changing kinematics of the transformation from the centre of mass to the lab system.

GOLDWASSER: The $\pi-\pi$ interaction should make a great difference in the angular distributions, I think.

BELLAMY: These measurements are going to be extended by other people in Glasgow, to determine the angular distributions.