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ASYMMETRY IN SINGLE π^o PHOTOPRODUCTION BY POLARIZED γ-RAYS ON PROTONS. -

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(Submitted to the Kiev International Conference on High Energy Physics, August 1970).

ABSTRACT.-

The asymmetry ratio for the process $\gamma + p \to \pi^0 + p$ by linearly polarized γ-rays is reported for $E_\gamma = 280 \div 600$ MeV and for a π^0 production angle in the c.m. system $\theta^x = 90^o$.

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We report here some preliminary results of a new measurement of the asymmetry ratio

$$A = \frac{d\sigma_\perp - d\sigma_\parallel}{d\sigma_\perp + d\sigma_\parallel} \tag{1}$$

for single π^0 photoproduction on protons by linearly polarized γ-rays at 90^o in the c.m. system and for $E_\gamma = 280 \div 600$ MeV (for the preceeding measurement see ref. (1)). In eq. (1) $d\sigma_{\parallel}$ and $d\sigma_{\perp}$ represent the photoproduction cross sections by photons with a polarization vector parallel or perpendicular to the production plane, respectively.

A sistematic investigation of this process is now in progress at the Frascati 1 GeV - electronsynchrotron. Further data at 65^o, 105^o, 120^o, 135^o c.m., in the same energy interval, will be analyzed and published in the near future.

The purpose of our investigation is to increase the amount of experimental information, so that a conclusive answer about the elementary photoproduction amplitudes can be obtained by means of a purely phenomenological approach (see ref. (2)). Some informations will be obtained directly from our data on some interesting feature such as the multipole E_{1+} around the first resonance and the multipole M_{1-} in the P_{11} region. From the angular distribution of the asymmetry, $A(\theta^x)$, we can also decide if the contribution of waves higher than S and P is relevant.

The experimental apparatus detects the proton by means of a magnetic spectrometer equipped with a time-of-flight hodoscope(x), operated in coincidence with a lead-glass total-absorption Cerenkov counter which detects one of the photons from π^0 decay. The polarized γ-ray beam is obtained by coherent bremsstrahlung in a diamond crystal.(This technique has been previously reported in ref. (1)).

The results, as shown in Table I and Fig. 1, are corrected for empty-target background, yet not for the contribution of double- π^0 photoproduction (the contribution of other concurrent processes is negligible). The indicated errors are standard deviations and include the uncertainty in the polarization. A least-squares fitting procedure of the experimental coherent bremsstrahlung spectra made it possible to treat statistically also the error in the polarization and in the normalization among different γ-ray spectra.

The comparison between the present data and the previous experiments (refs. (1, 3)) gives a very good agreement in the overlapping energy range (see Fig. 1). For $E_\gamma > 500$ MeV, where precise theoretical predic-

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(x) - Strictly speaking, the time-of-flight distribution of the events, which enables a discrimination against spourious events has not as yet been analyzed. This will be done soon and published in the final paper. In this report only results deduced by scaler counts are given. The hodoscope was prepared and calibrated by V. Kuznezov during his leave of absence from Engineering Institute, Tomsk (U.S.S.R.).

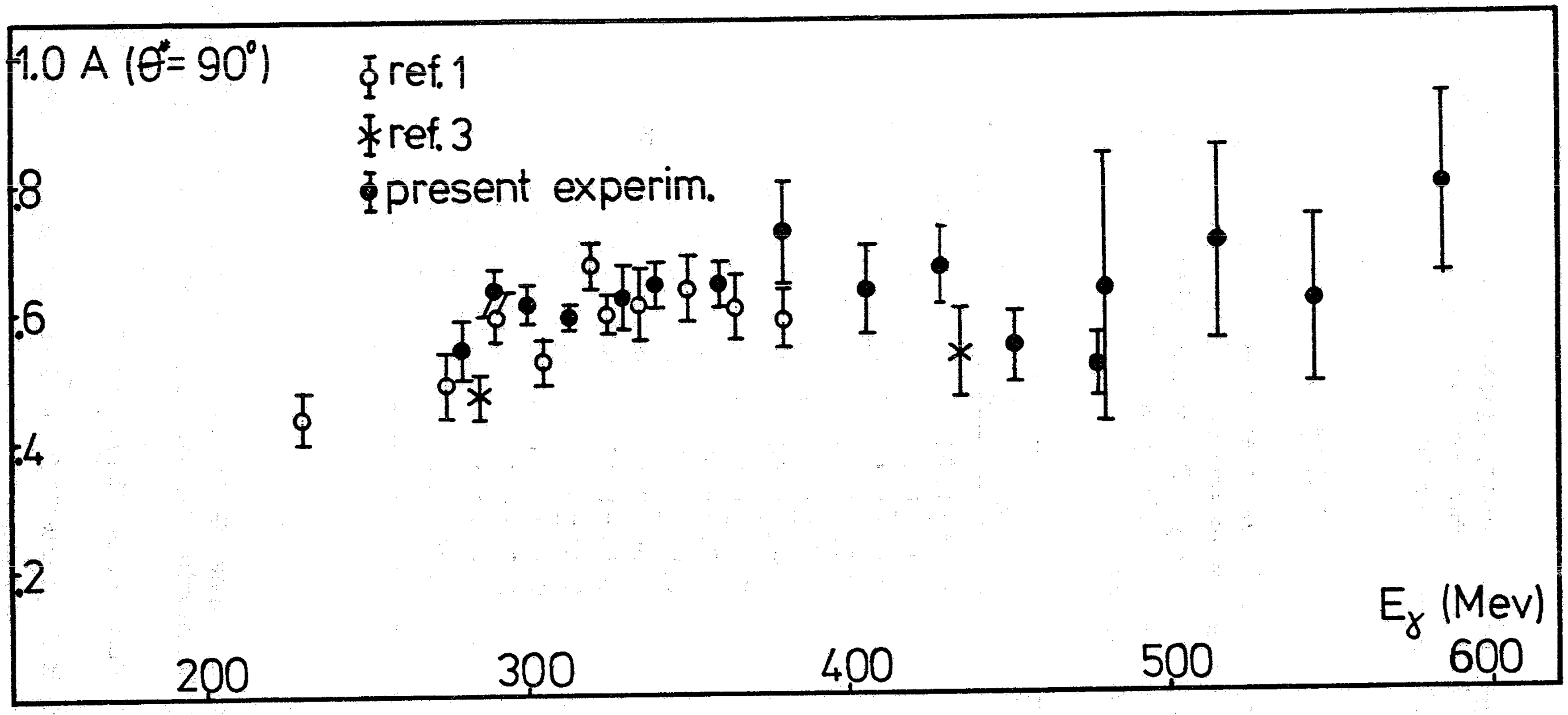

FIG. 1 - Asymmetry ratio, A, at 90° c.m., versus photon energy, E_γ. The errors are standard deviations. For the present experiment the errors include the standard deviation in the polarization.

tions are still lacking, the asymmetry remains almost constant. A complete discussion of the experimental results, together with a phenomenological investigation,will be published later.

TABLE I

Asymmetry ratio, A, as given by eq. (1), for single π^{o} photoproduction on protons, at 90^{o} c.m., versus photon energy, E_{γ}. The values of the beam linear polarization P is also given. The errors are standard deviations.

E_{γ} (MeV)	A	P
280	0.54 ± 0.04	0.296 ± 0.003
290	0.63 ± 0.04	0.324 ± 0.003
300	0.61 ± 0.03	0.352 ± 0.003
313	0.59 ± 0.02	0.389 ± 0.003
330	0.67 ± 0.05	0.242 ± 0.003
346	0.64 ± 0.04	0.265 ± 0.003
360	0.64 ± 0.04	0.311 ± 0.003
380	0.72 ± 0.08	0.112 ± 0.002
406	0.63 ± 0.07	0.144 ± 0.003
430	0.66 ± 0.06	0.179 ± 0.003
452	0.54 ± 0.06	0.214 ± 0.004
478	0.51 ± 0.05	0.256 ± 0.004
480	0.63 ± 0.21	0.071 ± 0.002
515	0.70 ± 0.15	0.098 ± 0.003
545	0.61 ± 0.14	0.126 ± 0.004
585	0.79 ± 0.14	0.166 ± 0.004

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