π—p-ELASTIC SCATTERING IN THE ENERGY REGION 750-1450 MeV

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Differential cross-sections for π^+p and π^-p elastic scattering have been measured at the different incident pion laboratory momenta (in MeV/c) (see Table).

A secondary pion beam was produced from a beryllium target in the vacuum chamber of the 8 GeV proton synchrotron, Nimrod. A conventional beam transport system was used to focus the beam on a liquid hydrogen target. Interactions occurring in this target were detected by an array of scintillation counters (see Fig. 1). Elastic events were selected by requiring the correct angular relationship between the scattered pion and the recoil proton detected in coincidence. The eighteen counters to the right of the beam defined the solid angles for

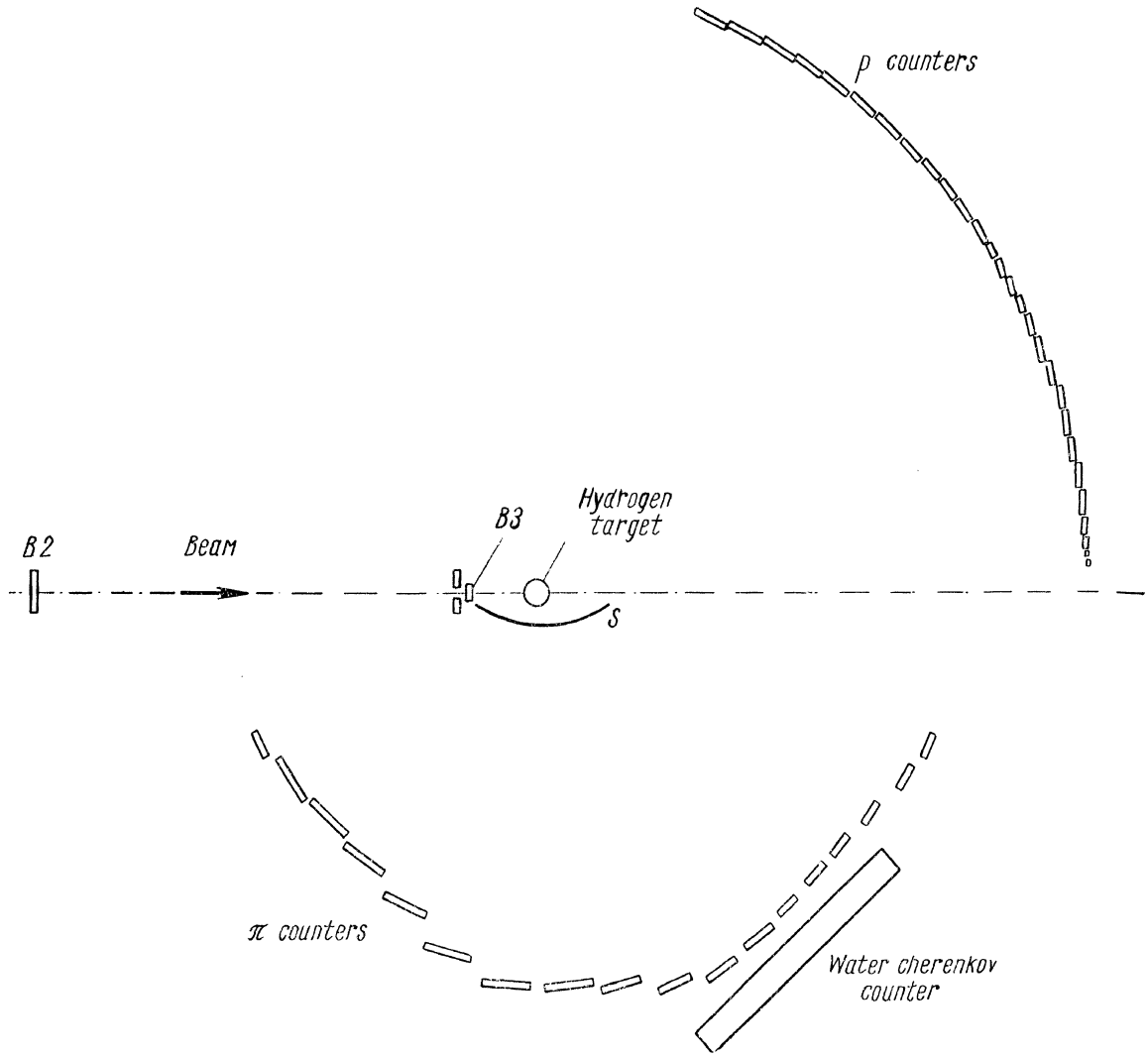

Fig. 1. Experimental layout.

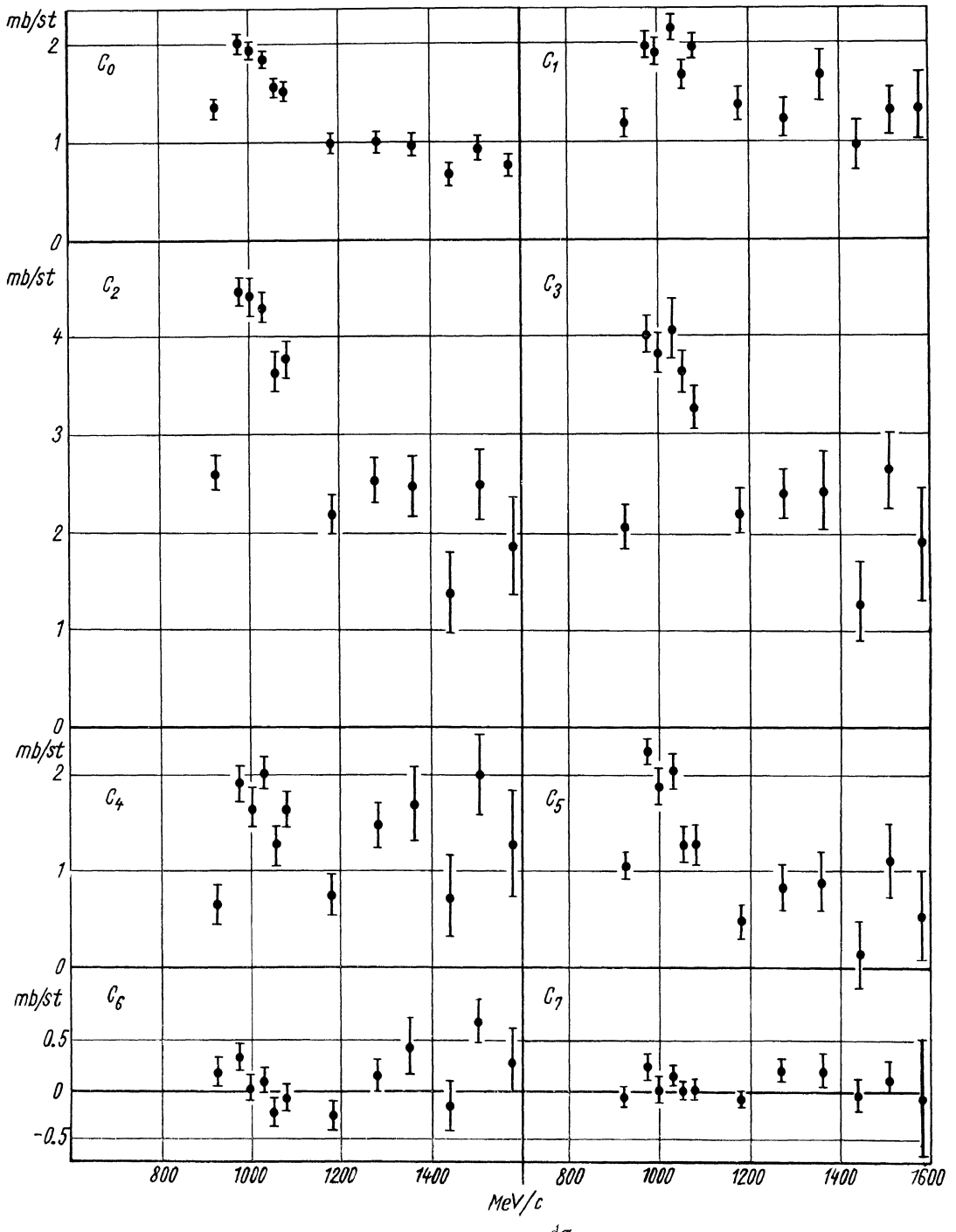

Fig. 2. π^--p elastic scattering $\frac{d\sigma}{d\omega} = \Sigma C_l P_l (\cos\theta^*)$.

detection of the scattered pions. In the energy region in question it was possible at most angles to discriminate between events in which a pion was scattered to the right of the beam, and events in which a proton was scattered to the right. In the range of laboratory angles from 35° to 65°, however, the angular correlation did not resolve pions from protons. The ambiguity was resolved by requiring that the particle scattered to the right should also count in the water Cherenkov counter in coincidence with the relevant array counter.

After background subtraction, corrections were made for absorption of particles in the

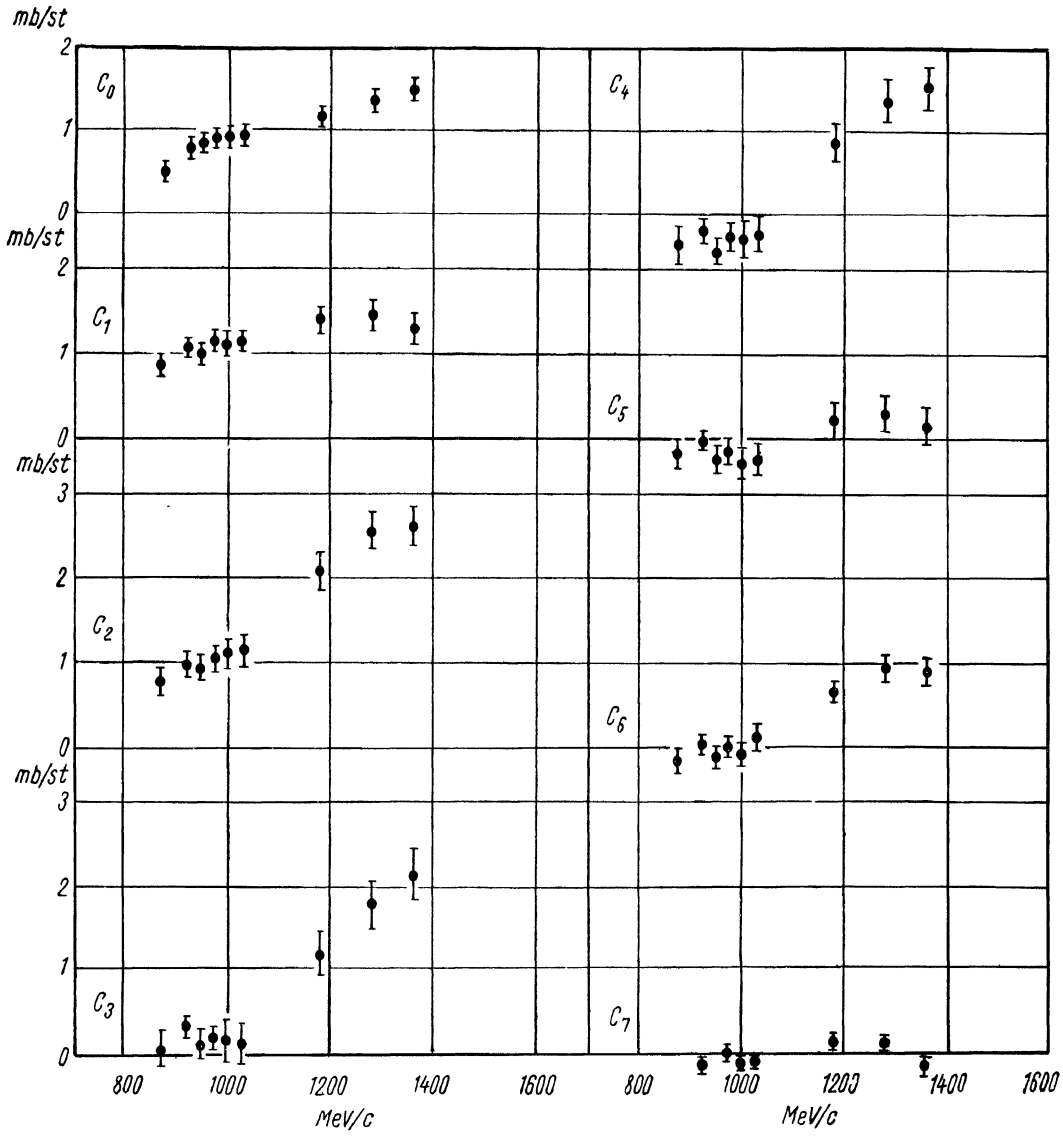

Fig. 3. π^+-p elastic scattering $\frac{d\sigma}{d\omega} = \Sigma C_l P_l(\cos\theta^*)$.

π^-	π^+	π^-	π^+
875	875	1080	1080
925	925	1180	1180
—	950	1280	1280
975	975	1360	1360
1000	1000	1440	—
1030	1030	1505	1505
1055	—	1579	1579

hydrogen target, muon and electron contamination of the beam and Cherenkov counter efficiency. A least squares fit was made to the resulting differential cross-sections in terms of Legendre polynomials:

$$\frac{d\sigma}{d\Omega} = \sum_l C_l P_l(\cos\theta^*)$$

The expansion coefficients C_l obtained from this analysis are shown below (see Fig. 2,3).

CHARGE EXCHANGE AND η PRODUCTION IN THE REGION BETWEEN THE SECOND AND THIRD π—N RESONANCES

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Using pictures from the 35 and 50 cm deuterium bubble chambers of Saclay, the reaction

$$\pi^+ + D \rightarrow p + p + \text{neutrals} \qquad (1)$$

has been studied with incident pions of 600, 650, 750, 800, 850 Mev kinetic energies.

Kinematic fits for reactions

$$\pi^+ + D \rightarrow p + p + \pi^0; \qquad (2)$$

$$\pi^+ + D \rightarrow p + p + \eta \qquad (3)$$

were applied to events which had two recognizable protons, one of which had a small momentum (1), in order to approximate the reactions

$$\pi^+ + n \rightarrow p + \pi^0; \qquad (4)$$

$$\pi^+ + n \rightarrow p + \eta \qquad (5)$$

25% of the original sample were discarded as possiblly non impulse model events.

The missing mass distribution is shown on Fig. 1, most events are clearly of type (2) or (3) where η decays through its neutral modes. The center of mass energy and production angle are calculated in the $p\pi^\circ$ and $p\eta$ systems for events in the two peaks of Fig. 1.

Impulse model events giving no fit for reactions (2) and (3) are considered examples of the reaction

$$\pi^+ + n + (p_s) \rightarrow \pi^0 + \pi^0 + p + (p_s). \qquad (6)$$

Normalizing to the total neutral cross section $\pi^- p \rightarrow$ neutrals measured with counters (2) we obtain the cross-sections for reactions (4), (5) and (6) as a function of the c. m. energy as shown in Fig. 2. Contamination from reaction (6) in reaction (5) is evaluated at each energy and cross-section for η production is corrected for η charged decay mode.

The angular distribution of reaction (5) integrated over all energies (30% background events of reaction (6) are included) is shown to be compatible with isotropy.

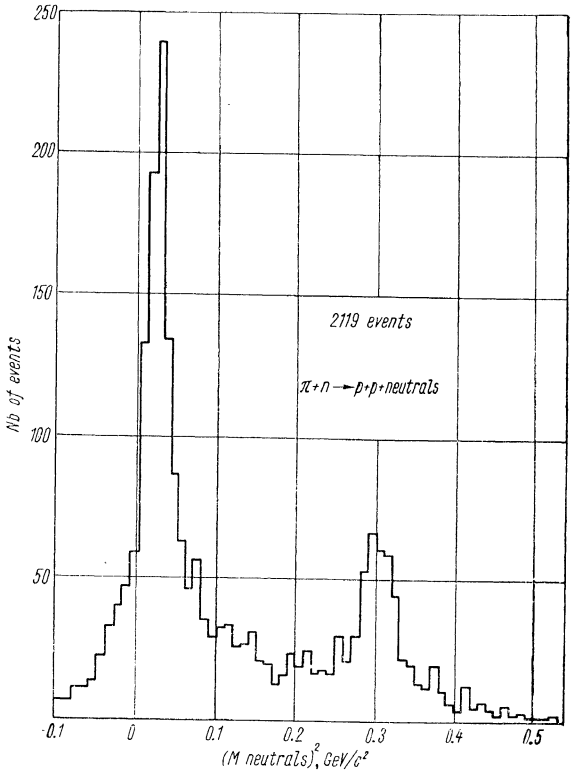

Fig. 1.

Differential cross-sections for reaction (4) and coefficients in the expansion $\frac{d\sigma}{d\omega} = \sum a_n \cos^n \theta$ are given respectively in Fig. 3 and Table. The dominant effect is the rising of a backward bump at higher energies which is reflected by the large decrease of a_3 and strong

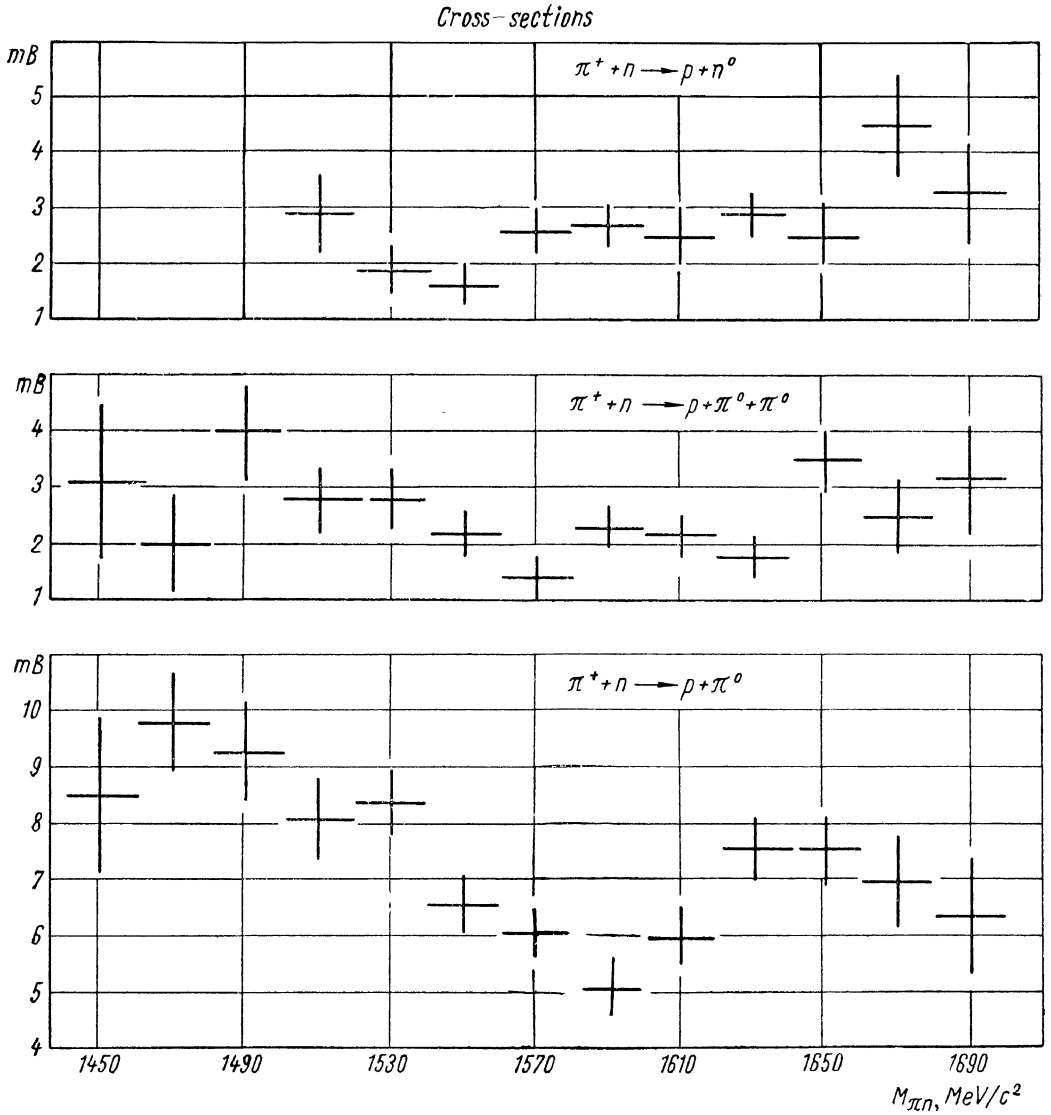

Fig. 2.

E^*, MeV	a_0, mb/ster	a_1, mb/ster	a_2, mb/ster	a_3, mb/ster	a_4, mb/ster	a_5, mb/ster	Total cross-section (mb)
1490—1530	0,31±0,03	0,85±0,11	1,01±0,12	−0,15±0,24	—	—	8,1
1530—1570	0,23±0,06	0,21±0,19	0,89±0,23	0,65±0,36	—	—	6,6
1570—1610	0,12±0,03	0,15±0,19	1,08±0,36	−1,89±0,95	−0,31±0,55	2,47±1,05	5,2
1610—1650	0,16±0,03	0,34±0,15	0,38±0,31	−3,82±0,94	1,58±0,51	4,57±1,17	7,6
1650—1690	0,2±0,05	0,96±0,25	0,11±0,51	−6,43±1,25	1,66±0,8	7,34±1,41	7,2

increase of a_5, which indicates a strong $D_{15}F_{15}$ interference near the third resonance.

The similarity between charge exchange and elastic $\pi^- p$ differential cross-section indicates that $\pi^+ p$ interaction is dominated by the $T = 1/2$ state and that interferences between the 2 isospin states do not play a dominant role.

REFERENCES

1. Muller P. A. et al. Internal report LPCHE 64-10, 1964.
2. Brisson J. C. et al. Proceedings of the International Conference on Elementary Particles, Aix-en, Provence, **1**, p. 45, 1961.

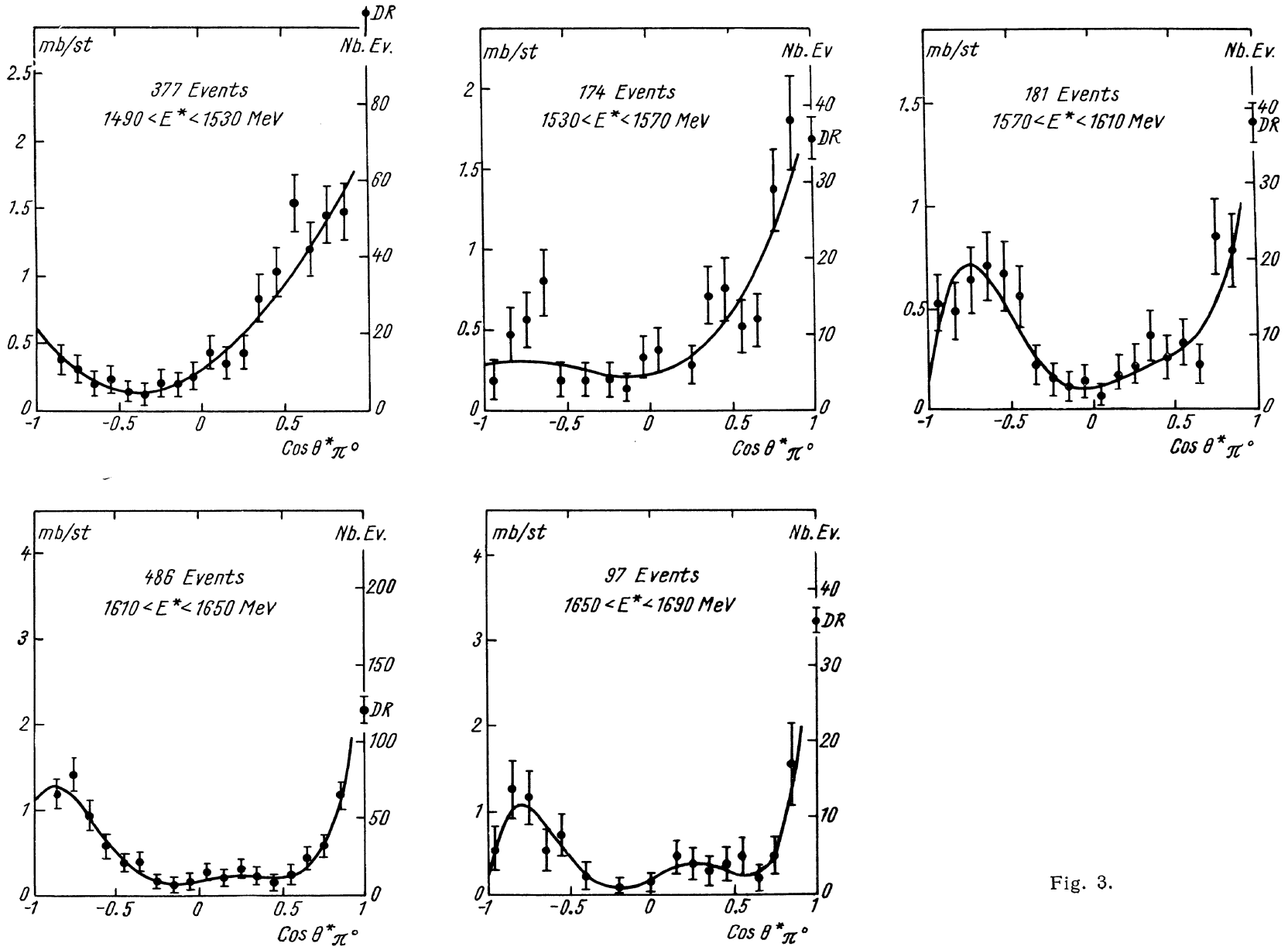
mb/st
Nb. Ev.
DR
377 Events
1490 < E* < 1530 MeV
174 Events
1530 < E* < 1570 MeV
181 Events
1570 < E* < 1610 MeV
486 Events
1610 < E* < 1650 MeV
97 Events
1650 < E* < 1690 MeV
Cos θ* π°

Fig. 3.