EXPERIMENTS ON DOUBLE SCATTERING OF PROTONS AT HIGH ENERGY †

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In a first experiment, the relative intensities of protons scattered near the vertical and near the horizontal planes at the second event of a double scattering process have been studied, the first scattering having taken place in the horizontal plane. Protons of kinetic energy 980 MeV were scattered first from carbon at 4° and then from either carbon or polyethylene at 14°. They were detected by an array of scintillation counters which could be rotated about an axis along the flight path of the protons between the two scatterers, and which was arranged so as to detect preferentially the elastic proton-proton scattering from the polyethylene. The ratio of horizontal to vertical scattering was found to be 0.940 ± 0.056, in proton-proton collisions.

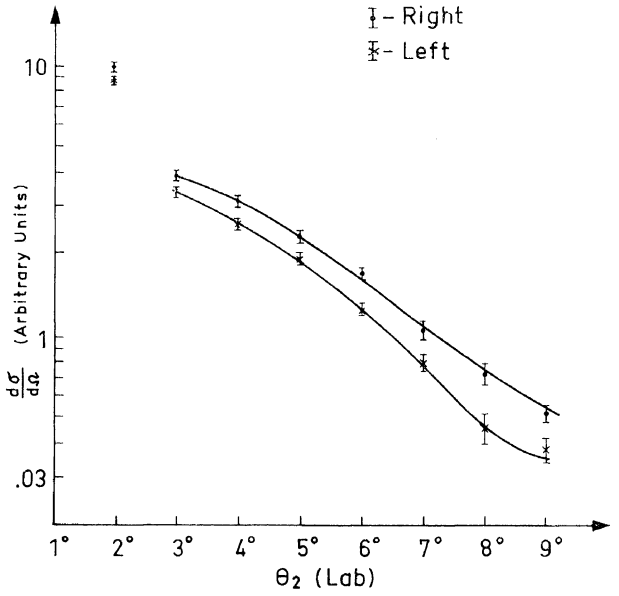

Fig. 1.

This result confirms the idea that the large effect found in previous plates and diffusion chamber work is due to geometrical loss of events near the vertical plane.

The other experiments are concerned with the polarization of protons scattered from carbon at 700 and 950 MeV.

Preliminary studies have been made of right-left asymmetry in double scattering of protons in carbon using scintillation and Cherenkov counters to define the direction and energy of the particles.

† Appendix to Session 2. — Experimental I.

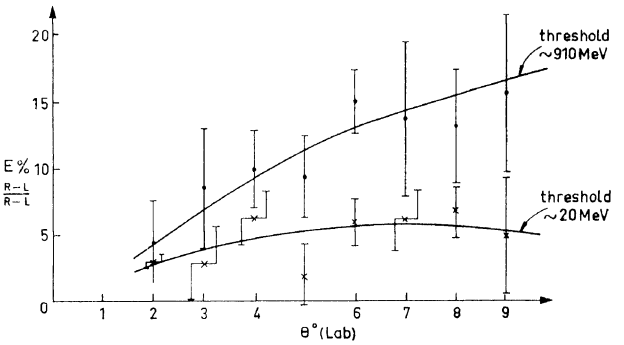

Fig. 2. *Asymmetry in proton-carbon double scattering : 950 MeV. (1st scattering at 4°).*

In the first experiment the only energy selection was by a threshold detector counting all protons of energy greater than about 500 MeV (Fig. 1). No evidence was found for an asymmetry at either energy and for angles of first scatter of 4° and $5\frac{1}{2}$°. The results for the 4° first scatter are shown in Fig. 2 and indicate only small asymmetry ($R-L/R+L = +0.02$). For first and second scatters both at $5\frac{1}{2}$° the asymmetries, $R-L/R+L$, were

-0.016 ± 0.030 at 700 MeV and
-0.024 ± 0.024 at 950 MeV.

Thus this experiment suggests polarization near to zero.

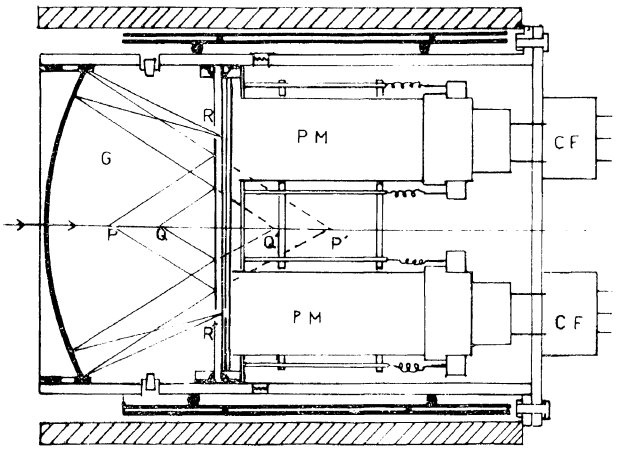

Fig. 3. *Second scattering of protons from carbon. E = 950 MeV. Detection > 910 MeV.*

In the second experiment the doubly scattered particles were detected *a*) by scintillation counters with no effective energy selection and *b*) by these in coincidence with a focusing Cherenkov detector designed to reject protons of energy more than 40 MeV lower than that of the doubly elastically scattered protons. The results are shown in Fig. 3. The energy selective counter shows a definite asymmetry rising to the order of 0.15 at about 8° for the second scattering angle, while in the absence of energy selection the asymmetry is small but significant. The first scattering angle was 4° and the energy 950 MeV.

The beam collimation conditions were different in the two experiments. It is probable that in the second experiment elastic first scattering events were more selectively focused by the fringing field of the synchrotron.

The results are compatible with a reasonable extrapolation of the lower energy data from other laboratories. They are not in agreement with the larger asymmetries found in preliminary photographic plate measurements published from this laboratory by Batty and Goldsack, but later plate experiments from Birmingham give results in satisfactory agreement with those reported here.