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ON THE BRANCHING RATIO OF THE π^+ MESON

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January 4, 1951

Berkeley, California

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Early experiments on π^+ mesons, using photographic emulsions as detectors, have seemed to show[1] that some of the π^+ mesons, upon stopping in matter, do not decay into μ^+ mesons.

These studies were concerned with mesons of fairly low energy so that the emulsion would be the only stopping material. Ilford C_2 and C_3 emulsions were used in order to facilitate the identification of the mesons. In many cases the processed emulsions showed an apparent non-uniformity in sensitivity and since the μ-meson track is rather tenuous in the region of the terminus of the π track, there is a chance of missing the decay. For a more intensive study of the decay scheme, a much more sensitive emulsion is required. Ilford G_5 and Eastman NTB_3 emulsions were chosen for the present study.

The apparatus used in this study consisted of a brass chamber for holding the plates and the target, as shown in the figure. The target was 0.036-inch carbon. This assembly was mounted on a probe and inserted into the vacuum chamber of the 184-inch cyclotron. The circulating beam of 345 Mev protons irradiated the target. Mesons emitted in the backward direction entered a channel cut into the brass holder. This channel was of such dimensions that π^+ mesons from the target with energies between 6 and 8 Mev only will enter the emulsion after a turn of 180°. No μ mesons from decay of the π stopping in

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1 J. Burfening, E. Gardner, and C.M.G. Lattes, Phys. Rev. 75, 383-4 (1949)

the target can get into the plate chamber. μ mesons from decay in flight of the π mesons could get into the emulsion only if they were emitted in a narrow cone in the forward or backward direction. These would not be confusable with π mesons from the target as their ranges in the emulsion would be too great or too small to have the correct energy.

The plates were studied using a high power microscope. Only those mesons which stopped in the emulsion at a distance greater than 10 microns from either surface of the undeveloped emulsion were counted.

Meson scattering from the channel walls gave a background fairly uniformly distributed with respect to range in the emulsion.

Analysis of results consisted of calculating the number of background μ mesons expected to fall in the main distribution. This number was subtracted from the number of mesons showing no decay found in the main distribution.

A preliminary estimate of the percentage of π mesons from the target which do not decay into μ mesons is: $R = 0.3 \pm 0.4\%$. This indicates that the brancing ratio of the π^+ mesons is less than 1 percent and probably zero. A more complete account of this work will be published at a later date.

I wish to thank Dr. L. W. Alvarez for his many helpful suggestions in this study. I wish also to thank J. Vale and the cyclotron crew for their help in the use of the cyclotron and J. Willat for microscope work.

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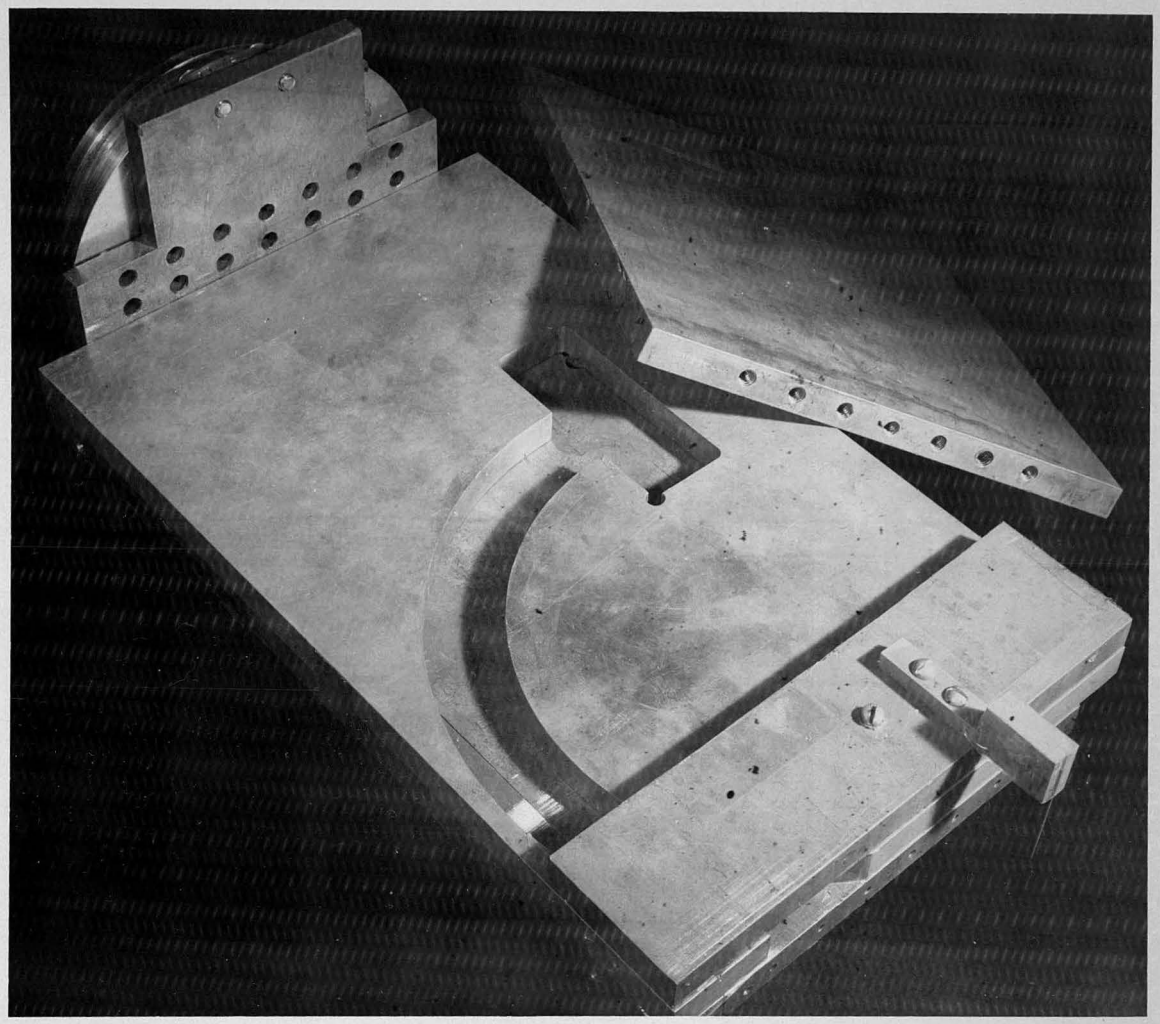

FIG. 1

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