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RESEARCH PROGRESS MEETING

June 3, 1948

Margaret Foss Folden

Special Review of Declassified Reports
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RESEARCH PROGRESS MEETING

June 3, 1948

Margaret Foss Folden

Photomultipliers. L. Wouters.

Investigations have continued on the origin of the large pulses shown on the oscilloscope even when the anthracene has been removed. Experiments have been made with a 50 Mev and a 100 Mev beam and with an RA-BE source. Results indicate that neutrons striking the photomultiplier tube cause the pulses. This may occur when a neutron strikes the nucleus, sharing its energy with nucleons and then recoiling. This is a plausible explanation if the surface layer is at least 10,000 molecules deep.

Under gamma ray bombardment these large pulses were also obtained. Temperature effect was offered as a possible explanation, and a discussion concerning tube cooling resulted in this regard.

Positive Mesons. C. M. G. Lattes.

The first evidence for the heavy meson was the observation of the π, μ decay by the group at the University of Bristol. The π, or heavy meson, slows down and stops in the emulsion giving rise to the μ, or light meson. The range of the light mesons in the emulsion was found to be very close to 600 microns for all light mesons which stopped in the emulsion, as illustrated in Figure 1.

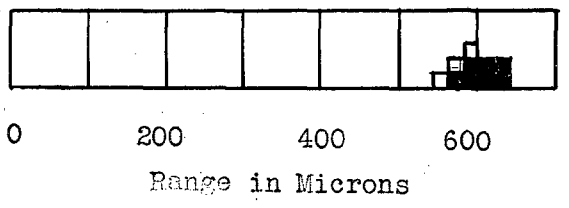

Figure 1

Distribution in range of ten secondary mesons.

■ - stop in the emulsion.

□ - leave emulsion near end of their range.

An example has been found at this laboratory of a similar event. On a photographic plate (Eastman NTB Plate, emulsion thickness 90 microns) which had been exposed to positive mesons in the 184-inch cyclotron, and using the arrangement shown in Figure 2, a secondary meson which stopped in the emulsion was found. The range was 630 microns, in agreement with the observations of Lattes, Occhialini, and Powell.

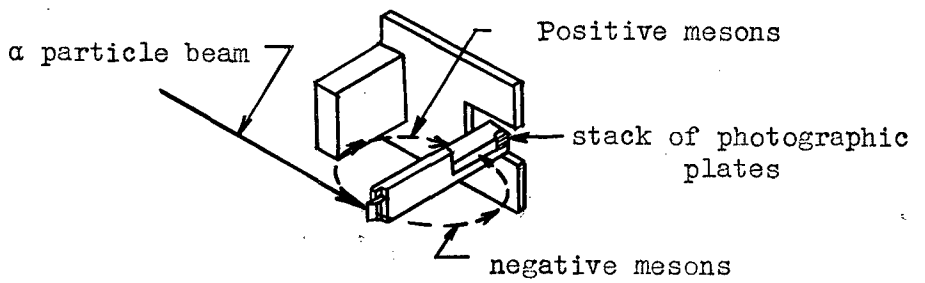

Figure 2

It is planned to expose a set of plates to obtain the excitation functions for heavy and light mesons.

Background Work in 184-inch Program. W. Panofsky.

Improvements in background in the 184-inch cyclotron have been attempted in connection with meson experiments and work in the "doghouse." Various factors in cyclotron operation were investigated.

An instrument has been built to monitor directly the deuteron and alpha current. In addition a pair of tandem ionization chambers were used for this

purpose. Even when the tank had been operating with deuterons it was possible to get ratios of 50-100/1 of alpha's to deuteron currents; however the background with deuterons is larger than it is with alpha's.

Sources of scattering inthe chamber were also investigated. As the beam travels in a circle, it becomes scattered and hits the dee, producing neutron flux. Even without a target, scattering is obtained. According to measurements, less than 1 per cent of the beam lies more than 2" from the median plane.

Investigations into limiting the vertical amplitude of the beam were carried out. A beam clipper of 1-1/4" width was installed and the beam current studied as a function of distance between tank center line and clipper center line as illustrated in Figure 3.

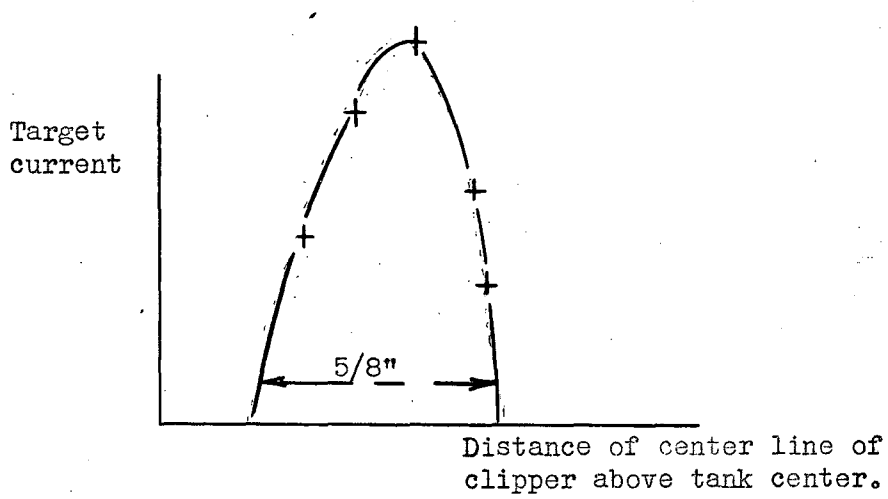

Figure 3

Since the width of this curve is very nearly equal to half the clipper clearance, this indicates that there are some particles in the beam which have negligible vertical oscillations.

The clipper installed in the tank now is 20" long and slopes downward to conform to the variation in beam height as a function of the radius as shown in Figure 4.

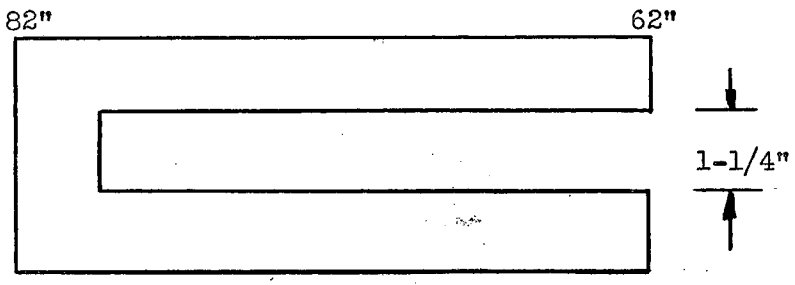

Figure 4.

It was not conclusively established whether the clipper actually reduced the background, and the ratio of background to mesons was not greatly improved.

It was pointed out that the background showed a directional effect. This may be caused by neutrons generated in the shielding or in the target assembly. The effect has a fairly definite increase square dependence on distance from the target.

With some obvious difficulties, a number of targets on the electric deflector and 180° from the probe were exposed to measure the background. Results obtained were:

	Background	
Target on Probe	200	
" " deflector	190	1/2 directional
Thick target on auxiliary probe	85	
Thin target on probe	56	
Thin target on auxiliary probe	16	

These values are corrected for an activity ratio of 1.8. An appreciable fraction of the background comes then from the target.

The factors affecting meson production and the effect of total radiation which the target is receiving were also examined. A 3" target in place of the original 1" target was used. Experiments were also conducted using a set of photographic plates as a thin target. Exposures at various radii were compared and gave results as shown in Figure 5.

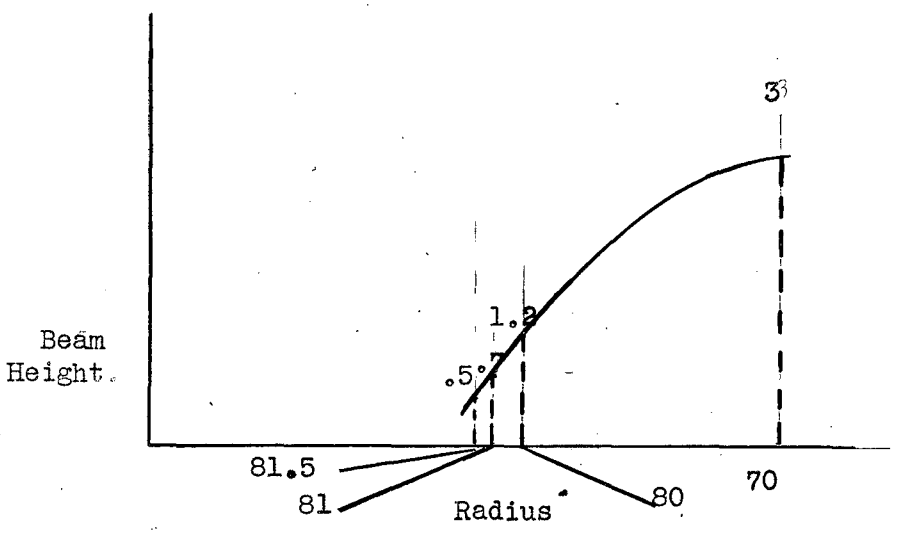

Figure 5

Using a number of elements at an 81" radius with a C monitor, the number of mesons produced were counted and results are listed in Table I.

TABLE I

	$\theta 1/2$ (Half value of scattering angle)	μ (Meson Count)	Activity
Pb	.00289	22, 20	16.5
Ag	.00220		16.7
Cu	.00162		~ 13.5
C	.00090	31	27.1
Be	.00086	43, 47	~ 21.1

The limiting angular vertical aperture due to the clipper is .0039 radians.

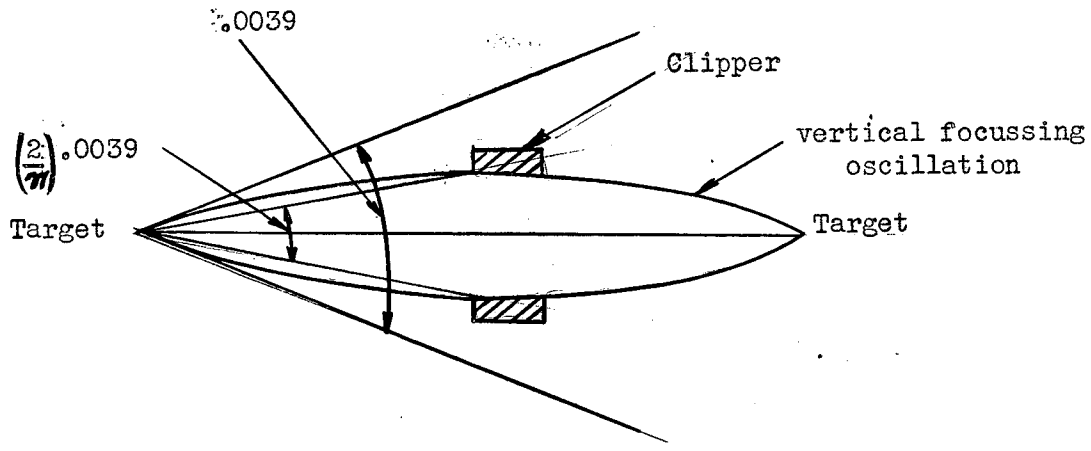

Figure 6

A narrow target loses mesons because vertical oscillations cause the beam to miss part of the target. The largest possible radius must be used with a thin target. The clipper now used has 4 in, clearance mounted on the pole tips with a second clipper sliding into it, which limits the clearance to 1-1/4" if desired.

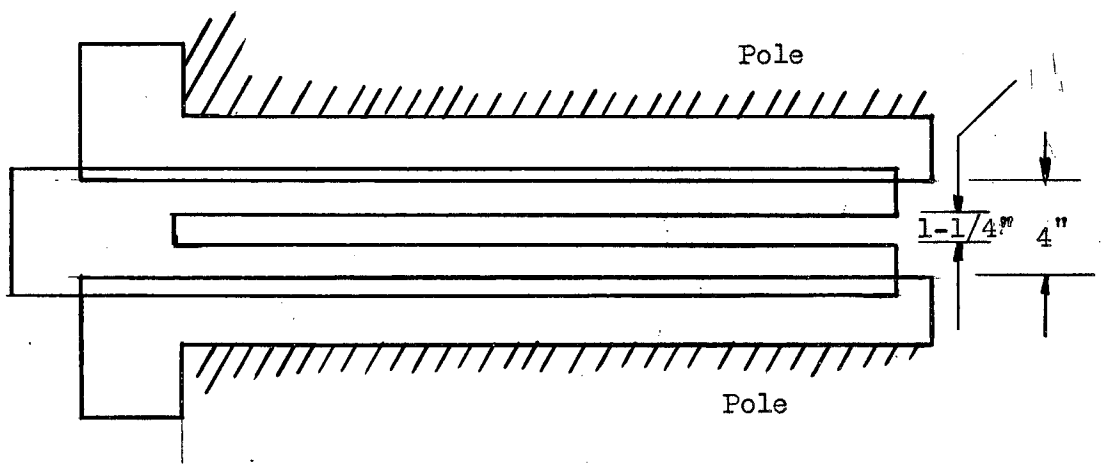

Figure 7

Consideration was also given to making exposures outside the tank in the doghouse. A shield to absorb the slow neutrons was constructed consisting of 8" of Pb, followed by 8" of paraffin and boron carbide. This reduced the background by a factor of 10.

These problems will be investigated further.

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