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RESEARCH PROGRESS MEETING
Margaret Folden
October 23, 1947

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RESEARCH PROGRESS MEETING

October 23, 1947

By Margaret Folden

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184-inch Deflector. D. Sewell

Another 14 inches of the outside channel bar of the magnetic deflector was cut off in order to get some of the beam which was being intercepted by one of the bars. Probe measurements were then made since some of the beam still appeared to be cut off. The probe head consisted of a copper block covered with aluminum foil. The following results were noted.

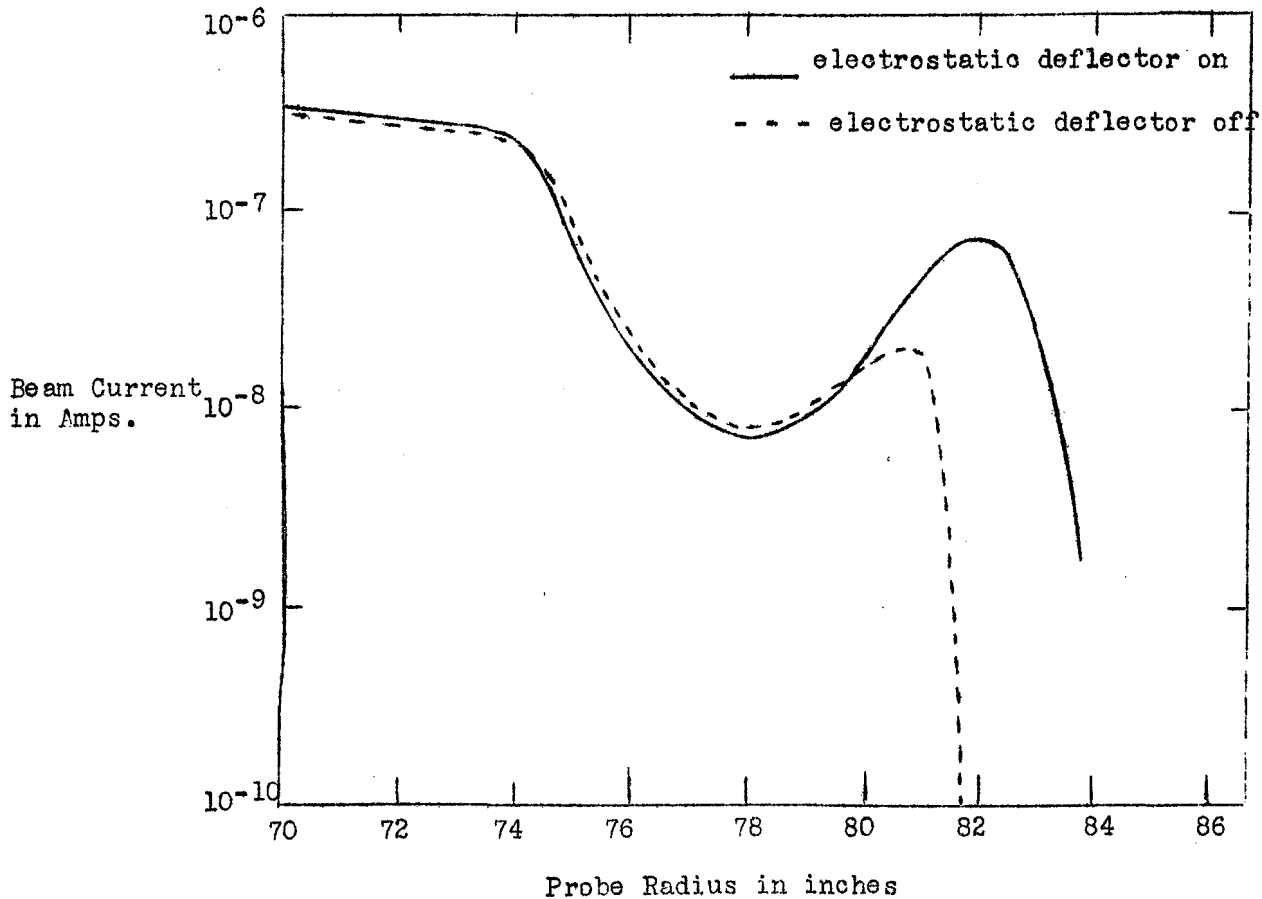


FIG. 1

When a gap in the aluminum foil on the probe was made, the curve of Fig. 2 resulted.

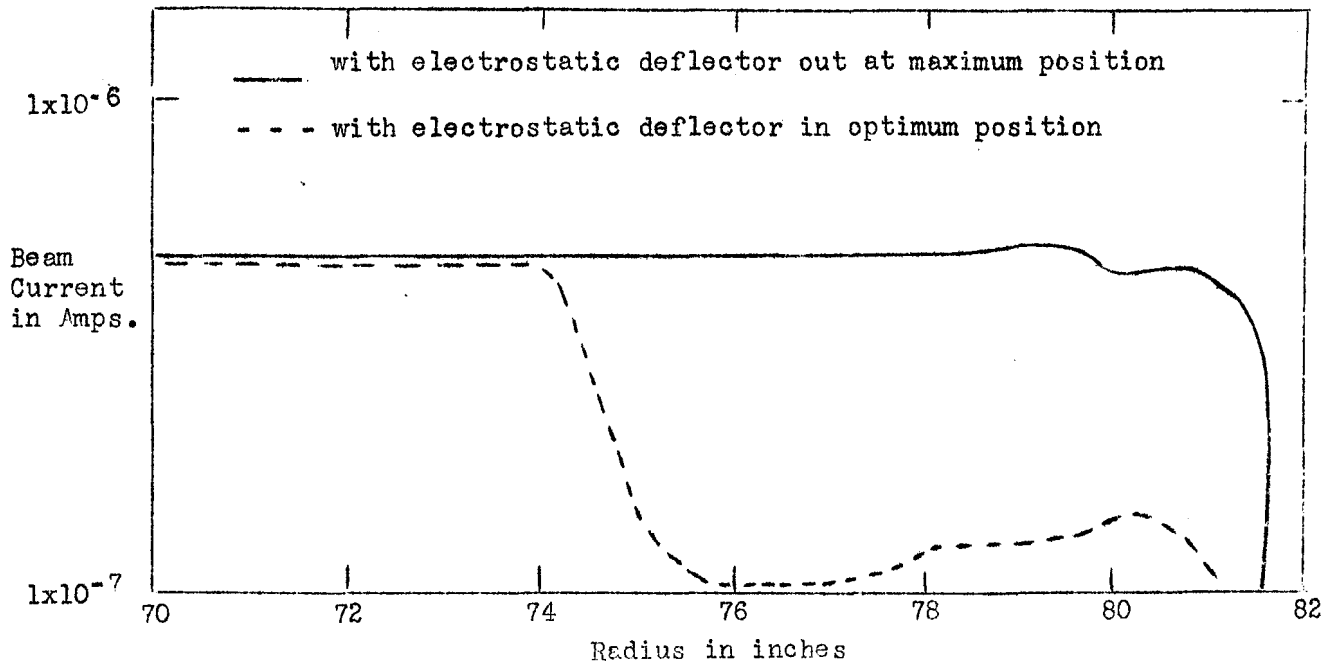


FIG. 2

An improved beam pattern was obtained by moving the electrostatic deflector down.

The circulating beam is of the magnitude of 5×10^{-7} amp., the electrostatically deflected beam 1×10^{-7} amp., and the magnetically deflected beam 3×10^{-9} amp., outside the tank with +22 1/2 v. on the collector and a 3/4" copper plate.

Experiments have now been begun to determine the angular spread of the beam. The experimental arrangement is shown in Fig. 3.

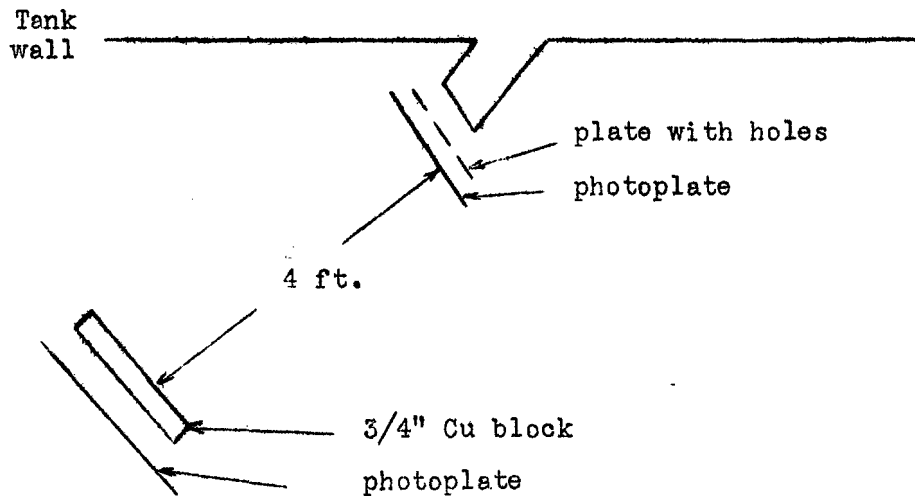


FIG. 3

A spread of 1" in 50" has been noted. Further work on the deflector will follow to improve the beam pattern.

Linear Accelerator. H. Bradner

On Thursday evening, October 16, the linear accelerator operated for the first time to give 32 Mev protons.

During operation, some difficulty was encountered in achieving full r.f. power and only barely enough was available for phase stability. The power level was brought up slowly due to trouble with the oscillators.

Improvements are being made in the focus of the Van de Graaff and additional oscillators are being coupled into the 40 ft. section to make it possible to operate them at lower power to avoid some of the breakdowns.

The arc pulsing system for the Van de Graaff has been completed. It will offer some improvement and will prevent burning out the grids.

Operation is expected by the middle of next week.

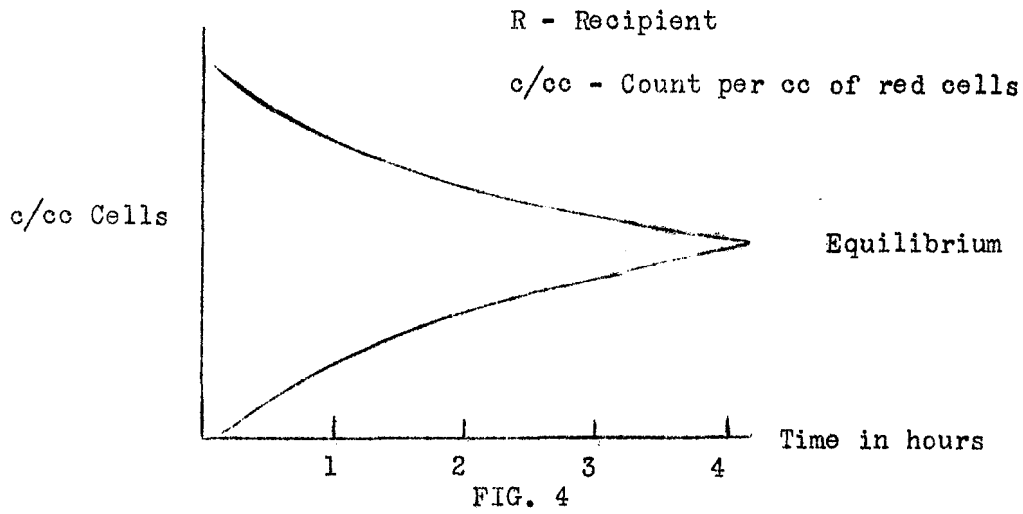
Para-Biotic Experiments with Radioactive Iron. R. Huff

In order to study the problems of common circulation, para-biotic animals or artificial Siamese twins are produced in two ways: first, by placing cutaneous layers in juxtaposition and suturing, and second; by achieving open coelomic unions. The latter has usually been done. Best results are obtained with embryonic tissue at which time a circulating physiologically active substance is present..

Circulation or passage of a substance between the pairs, such as that encountered with fluorescein, Congo red or colloidal substances, may be due to one of several possibilities. First, at the line of incision, capillaries may grow back in loops and anastomose. This would have to occur by intercirculation to be a reality. Second, if not an anastomosis, osmosis or capillaries in juxtaposition would also accomplish inter-circulation. Third, diapodesis which is the passage of cells through cellular walls is feasible but this process would be extremely slow.

After considering these possibilities, the obvious answer was to tag the red cells with radioactive iron. The iron enters the hemoglobin and then goes into the cell and remains, for rats, about 120 days.

The donor animal may be prepared by injecting intraperitoneally or intravenously. Yield of beta activity in both animals of each of two pairs gave the following results.



Equilibrium occurred in one pair at 4 hours, 10 minutes, and in the other at 4 hours and 20 minutes. It is therefore believed that there is an open anastomosis between the pair. Further experimentation is indicated.

Other experiments are being carried out by giving one animal radioactive iron and later joining him to a normal animal. No exchange was noted on the first day and very little on the second day but the exchange was almost complete on the third day. It is possible that a practical application of this fact may be made in wound healing where tissues anastomose in about three days.

Deuteron Stars, V.Z. Peterson

A study has been made of the average prong number of deuteron-produced stars. Slides were wrapped in black paper and mounted on probes and exposed to bombardment in the 184-inch cyclotron.

Exposure was made by turning on the dee voltage for about 1/2 second with no source voltage. Ilford type C - 1 photographic emulsion was used.

The results showed first that there is no significant variation of average prong number with incident energy because of transparency of the nucleus and because of a greater proportion of stars formed from heavier nuclei, at higher energies.

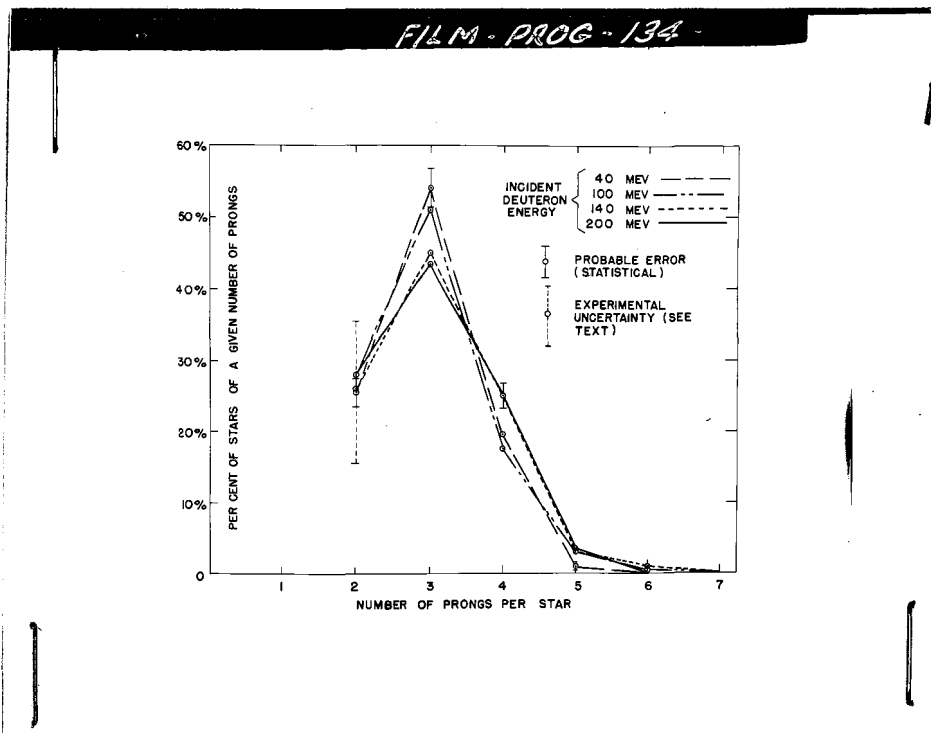


FIG. 5

Theoretical calculations showed an average prong number of 3.0 at low energies and 3.9 at 190 Mev.

Second, the angular distribution of star prongs in the laboratory coordinate system is a function of energy and therefore the angular distribution is essentially constant.

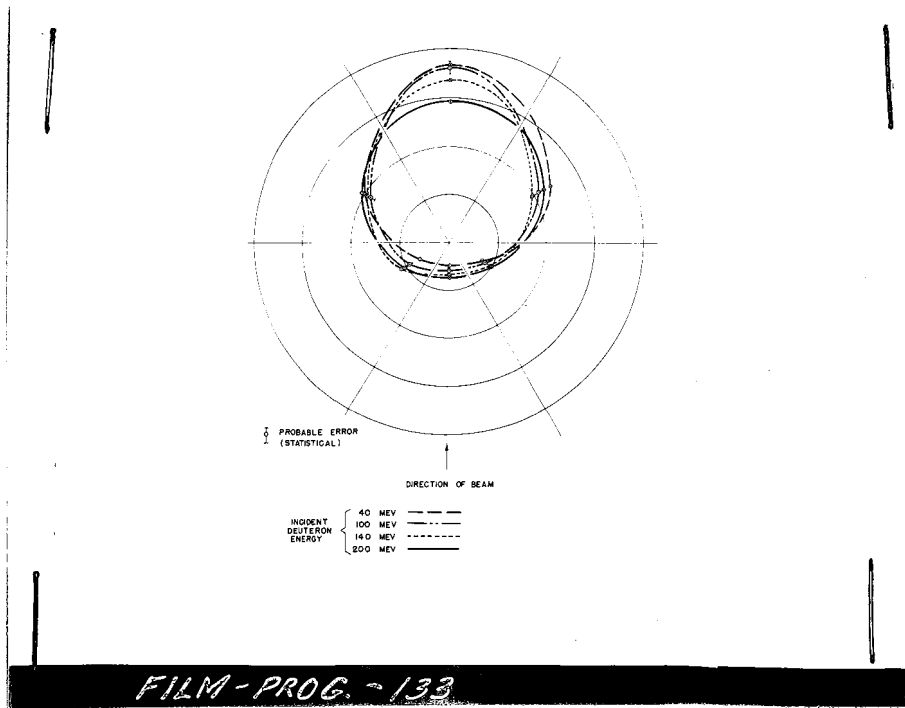


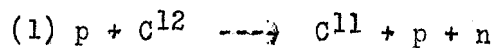
FIG. 6

Third, results obtained on the prong length as a function of energy are summarized below:

| <u>Energy</u> | <u>Average Prong Length in Microns</u> |
|---------------|--|
| 40 Mev | 25 |
| 100 Mev | 100 |
| 140 Mev | 80 |
| 200 Mev | 120 |

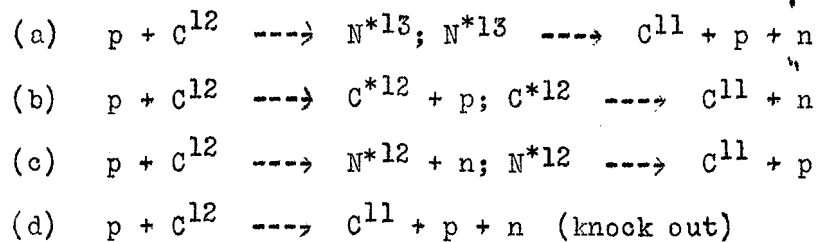
Excitation Function of the Carbon Reaction. W. Heckrotte

Determinations have been made recently on the yields of the reactions



Calculations were made on the basis of 50% and 100% charge exchange.

Reaction (1) can go in four ways:



The part played by each of these separate reactions to give the total reaction is shown in Fig. 7 for 50% charge exchange. Reaction (a) contributes chiefly in the 40 Mev region. Reaction (b) takes place when the incident proton passes through the nucleus and makes few collisions before emerging with most of its original energy. It contributes very little to the total reaction, although somewhat more for the 50% charge exchange since a one collision non-exchange can then contribute. Reaction (c) is made possible by a net charge exchange taking place when the incident proton passes through the nucleus so that it emerges as a neutron. Only a single p - n exchange collision is effective in giving reaction (c) and results in making the reaction practically directly proportional to the amount of charge exchange which exerts a direct influence on the yield of the total reaction at high energies. Reaction (d) is the knock out reaction which is probable only if the incident proton makes just the one collision.

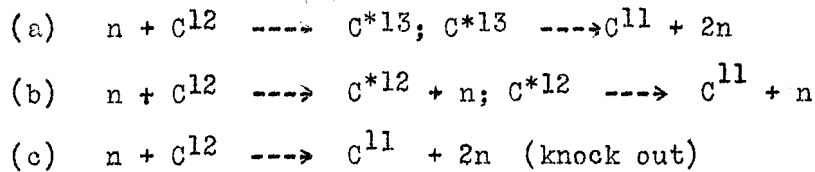
The total reaction for both 50% and 100% charge exchange is produced on a range scale in Fig. 8 assuming 140 Mev protons on a carbon block. These curves may be compared to the experimental curve which is a straight line parallel to the abscissa from 140 to 60 Mev. The 50% charge exchange curve offers a slightly better fit.

The calculated cross section for the reaction at 62 Mev is:

- .049 barns for 50 per cent charge exchange
- .064 barns for 100 per cent charge exchange

The experimental value is $1.067 \pm .007$ barns for 62 Mev incident protons.

Reaction (2) can go in three ways:



The results of the calculations for 50% charge exchange are shown in Fig. 9. The calculated cross section for the reaction at 90 Mev is:

.011 barns for 100 per cent charge exchange

.013 barns for 50 per cent charge exchange

The experimental value is $0.025 \pm .004$ barns.

The ratio of the cross section $C^{12}(p,pn)C^{11}$ to the cross section of reaction (2) at 90 Mev is:

5.8 for 100 per cent charge exchange

3.8 for 50 per cent charge exchange

The experimental ratio is 2.7 at 90 Mev.

This difference in cross sections between the two reactions is established by two factors. First, the part played by charge exchange in reaction (1) leads to excited N^{12} with the subsequent boiling off of a proton whereas a similar exchange process cannot take place for reaction (2). Second, there is the difference between the contributions of the knock out process as a result of the difference in the n - p and the n - n cross sections which favors the p + C^{12} knock out reaction.

The results seem to give a good qualitative picture of the contributing factors affecting the total reactions.

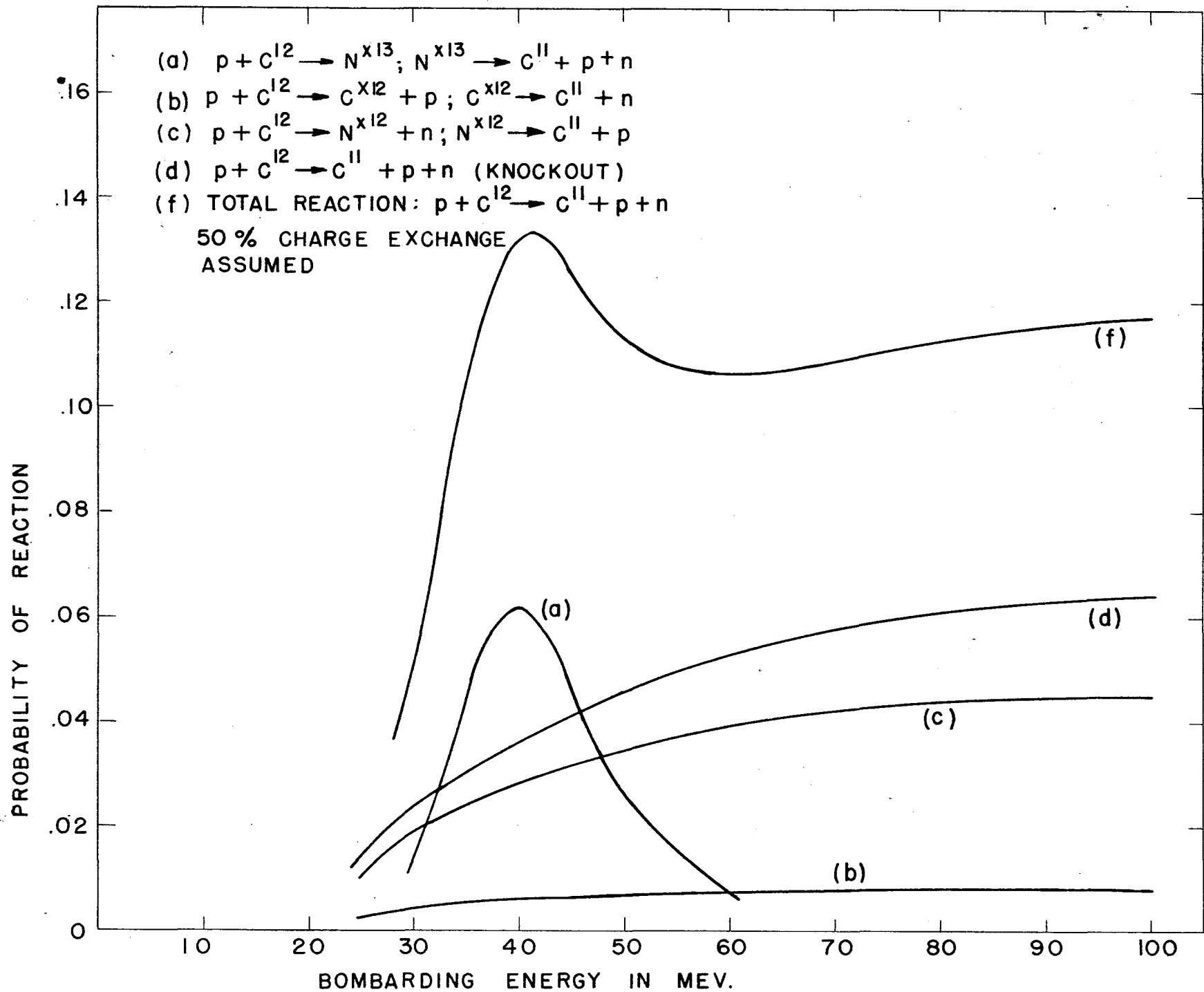


FIG. 7

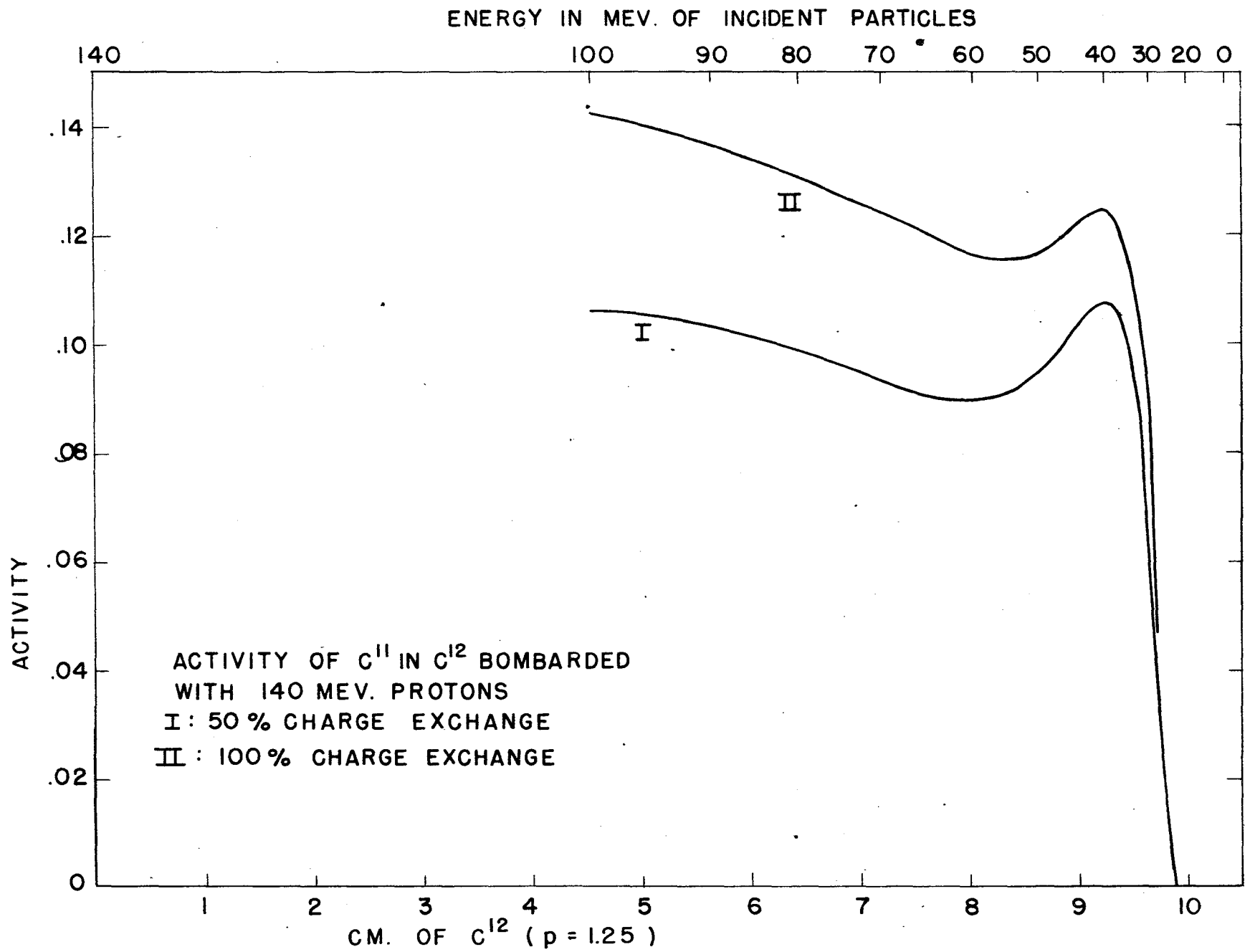


FIG 3

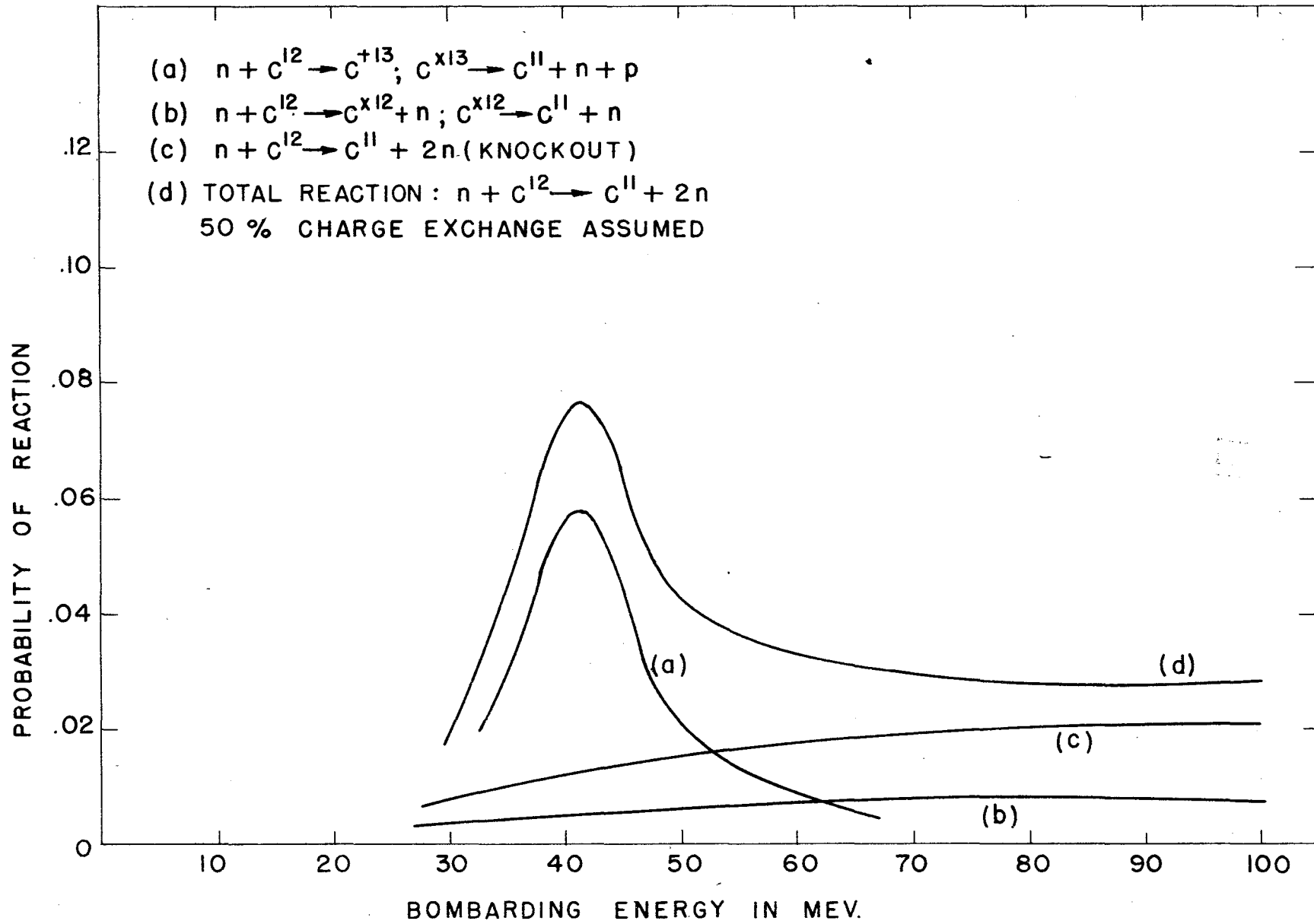


FIG. 7

