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UNIVERSITY OF CALIFORNIA

Radiation Laboratory

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SUMMARY OF THE RESEARCH PROGRESS MEETING OF NOVEMBER 30, 1950

Margaret Foss Folden

April 6, 1951

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Berkeley, California

SUMMARY OF THE RESEARCH PROGRESS MEETING OF NOVEMBER 30, 1950

Margaret Foss Folden

Radiation Laboratory, Department of Physics
University of California, Berkeley, California

April 6, 1951

Protons Scattered Out of Nuclei at High Energy - John B. Cladis.

The 35 channel magnetic particle spectrometer as shown schematically in Figure 1 has been used in the 'cave' of the 184-inch cyclotron to obtain energy spectra of protons scattered at 22 degrees from hydrogen, deuterium, carbon and oxygen. The scattered protons enter the slit counter, traverse three large proportional counters and the bank of 35 GM tubes. The slit counter and the GM tubes define the paths of the protons.

Curves were exhibited for oxygen, carbon, deuterium and hydrogen. All of the peaks fall at nearly the same energy as is shown in Figures 2 and 3, the energy expected for proton-proton collision. The half-widths of the curves are 70 Mev for hydrogen, 110 Mev for deuterium and 130 Mev for carbon and oxygen. The spreads in the curves are partly accounted for by internal momenta of nuclei.

The energy resolution is poor at high energies. By inclusion of the now completed coincidence circuit in the overlap channel, the first 16 GM tubes in the high energy sector of the magnet are staggered so that neighboring tubes overlap one-third of a GM tube. By connecting the coincidence circuit to identify particles in the overlap channel the energy resolution has been improved by a factor of 3 in these high energy channels. The net energy resolution can be further improved by narrowing the slit entrance to the magnet and by reducing the target thicknesses.

Proton Helium Scattering - Thomas M. Putnam.

This experiment was done at the 60-inch cyclotron with the Los Alamos multi-plate camera designed by Curtis, Rosen and Fowler. The work was completed in 36 hours with this equipment which was devised to obtain a great deal of data with a small amount of running time. A schematic of the camera and the cyclotron are shown in Figure 4, and the scattering chamber is shown in Figures 5 and 6.

The chamber is filled with helium. When the run is about to begin the plates are loaded into the chamber and it is outgassed from 4 to 6 hours. The runs themselves take about 1 hour, during which very little change in temperature and pressure occurs. The beam current is measured accurately with a Faraday Cup and a precision capacitor. Every effort was made to eliminate leakage count current and the cup was surrounded with two bar magnets to cut out stray charged particles. One hundred or two hundred μ plates were used. The scattering results are shown in Figure 7. Five hundred tracks were used for each point on the graph. The statistical error is ± 4 percent.

The differential cross section was calculated from the following equation:

$$\frac{d\sigma(\theta)}{d\omega} = \frac{y}{\omega} \frac{\ell L \sin \theta}{N_b n_o ab}$$

y = yield

a, b = slit widths

n_o = scattering center

ℓ = distance between slits a and b

L = distance to plate from scattering center

θ = scattering angle

Production of Positive Mesons by Protons as a Function of Z * - Mark Jakobson

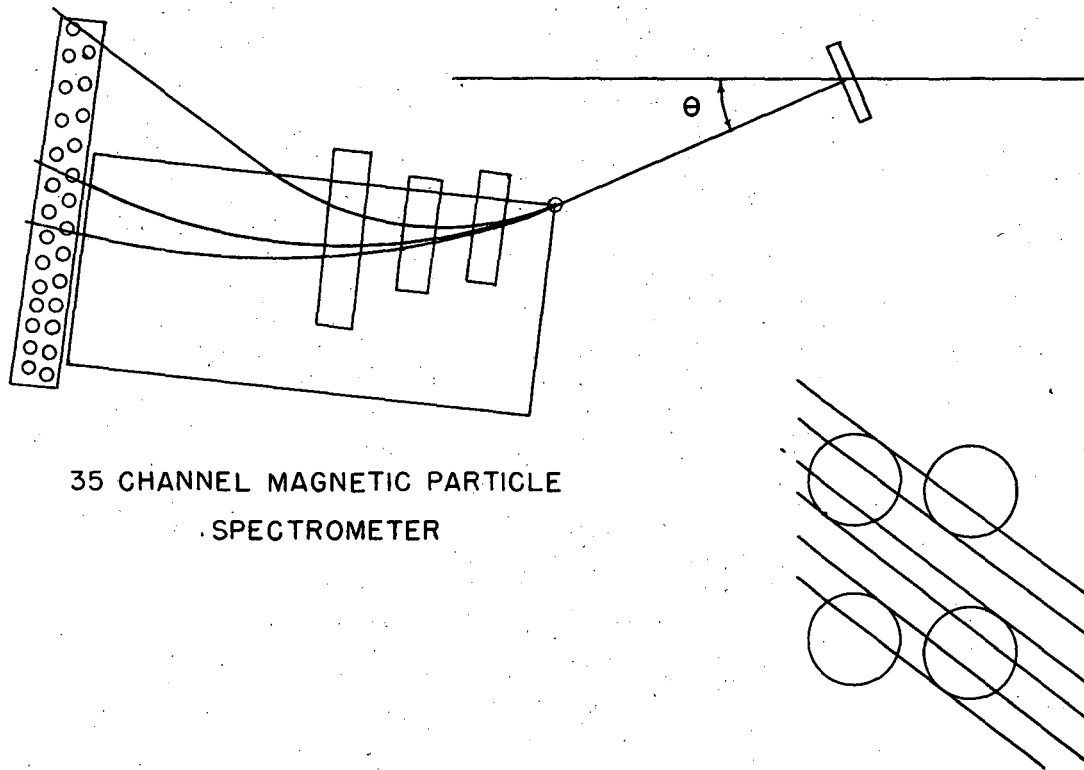
Relative cross sections for production of 53 ± 4 Mev mesons at $0^\circ \pm 7^\circ$ by 340 Mev protons have been measured for C, Al, Fe, Cu, Ag, and Pb. Mesons were produced by the external scattered beam of the 184-in. cyclotron. To separate the mesons from the proton beam, the mesons were turned through approximately 90° by means of a magnetic field (Fig. 8). The mesons were detected by trans-stilbene crystals and electronic circuits. A coincidence of the pulses caused by a π^+ meson passing through one crystal and stopping in a second generates a delayed gate which is put in coincidence with the μ^+ pulse resulting from the decay of the stopped π^+ meson.

Fig. 10 shows the measured relative cross sections. Standard deviations indicated include only statistical deviations arising from counting. A curve is given for σ/A as well as σ per nucleus to indicate the effective cross section per nucleon. σ/A is a decreasing of (A) similar to that measured by Mozley for production of π^+ mesons by photons. The A dependence agrees with that obtained by Brueckner, et al, in an analysis based on absorption of π mesons in nuclear matter.

The differential production cross sections for 20 Mev mesons at $150^\circ \pm 15^\circ$ made by 240 Mev protons has been previously reported. Results here are in qualitative agreement and give the same general functional relation for the production cross section as of (A).

To compare counter detection of π^+ mesons with plate techniques, the peak spectrum for the reaction $p + p \rightarrow D + \pi^+$ was investigated. Fig. 9 shows the spectrum which was obtained with a 2 inch polyethylene target. The peak occurs at the energy expected from the thick p production target which was used. The peak obtained by counters is considerably broader than that obtained by plates because of the greater energy width of the crystal detectors.

* See also UCRL-1433



35 CHANNEL MAGNETIC PARTICLE
SPECTROMETER

MU 2049

Fig. 1

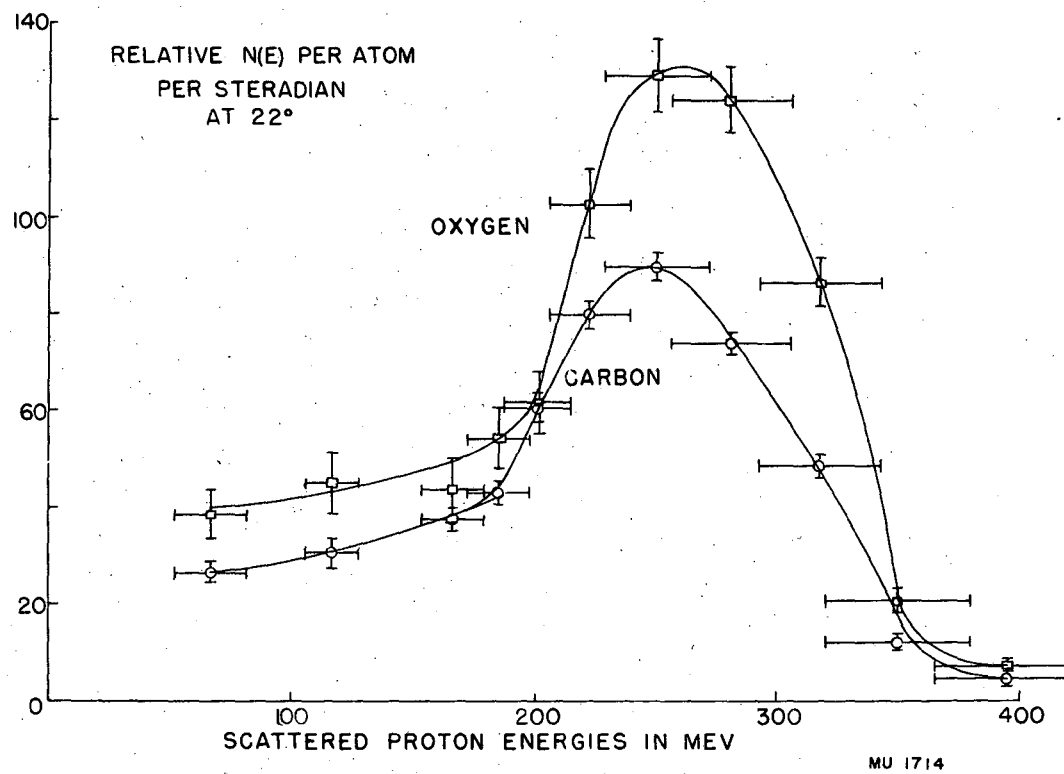


Fig. 2

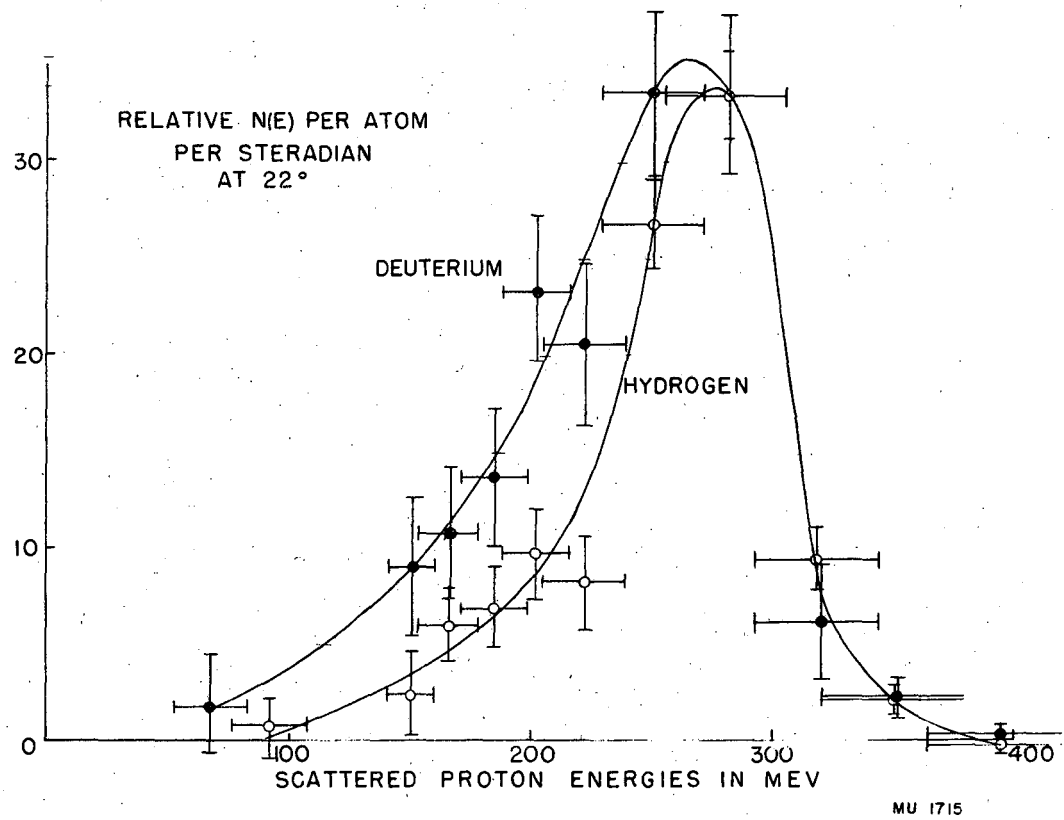
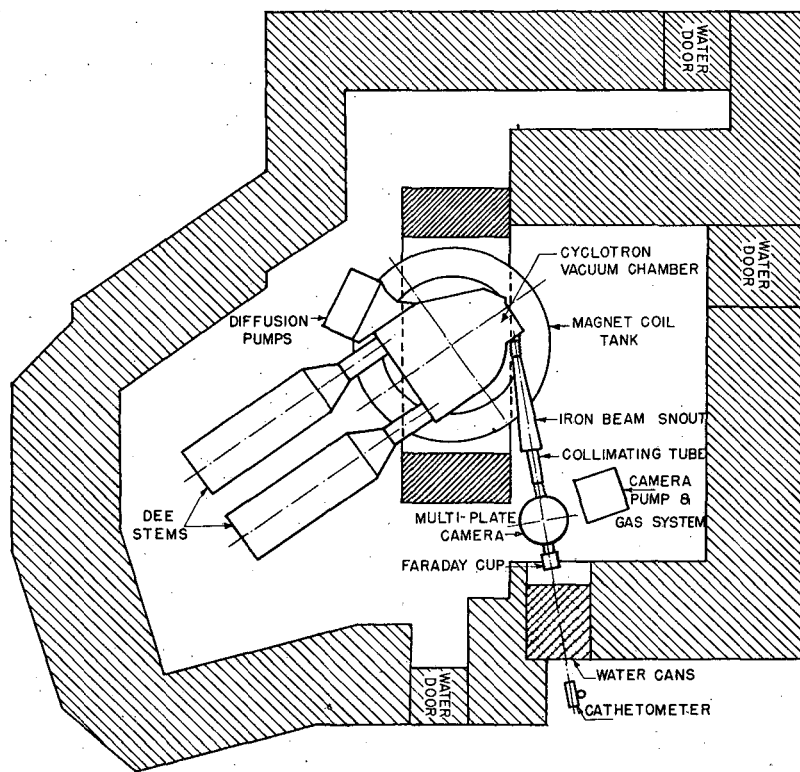


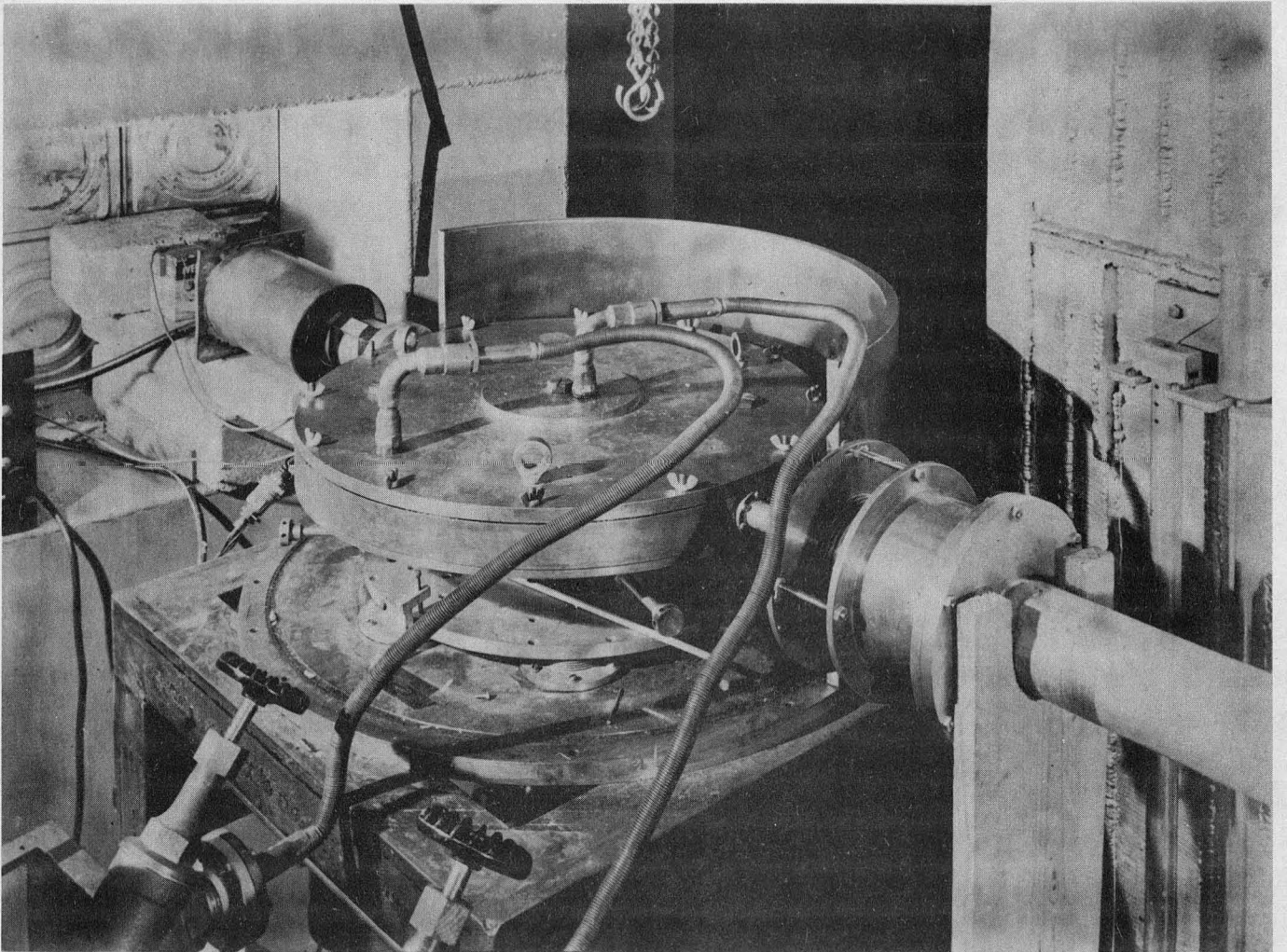
Fig. 3



CYCLOTRON & CAMERA
SCHEMATIC

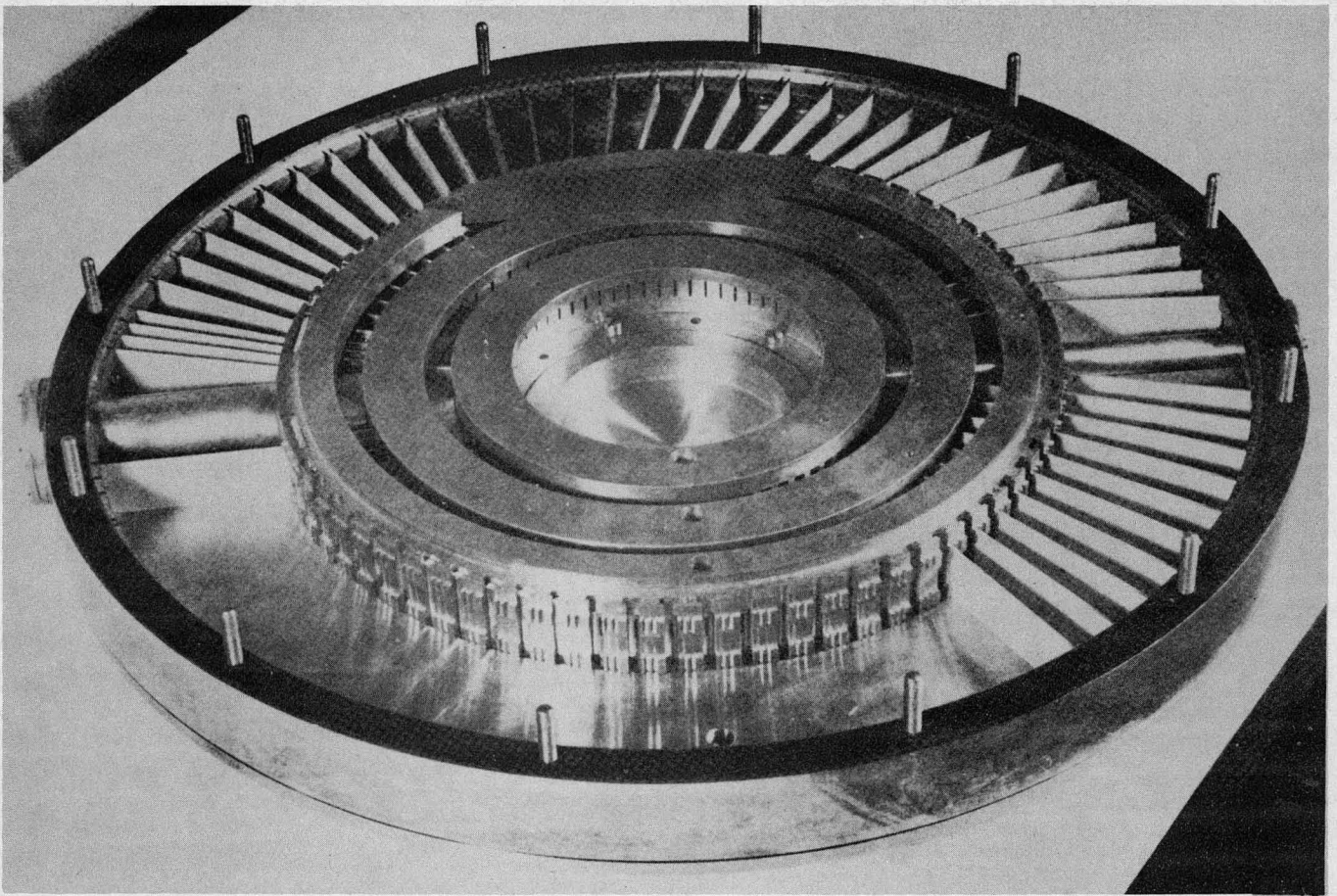
MU 1015

Fig. 4



ZN61

Fig. 5



ZN 62

Fig. 6

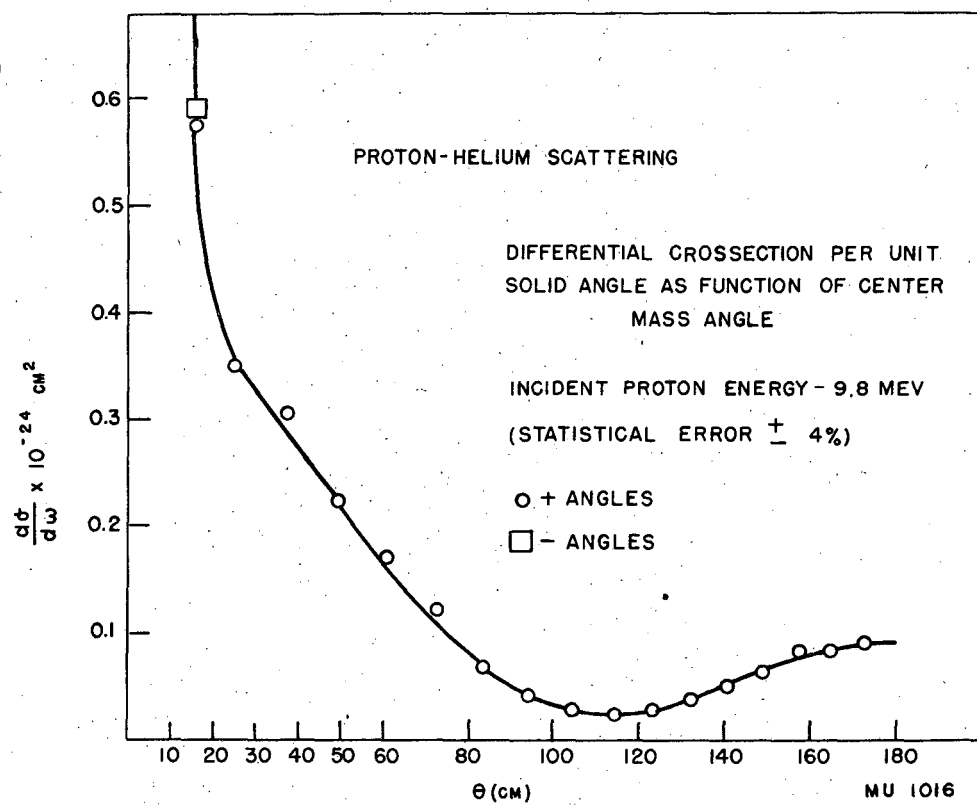
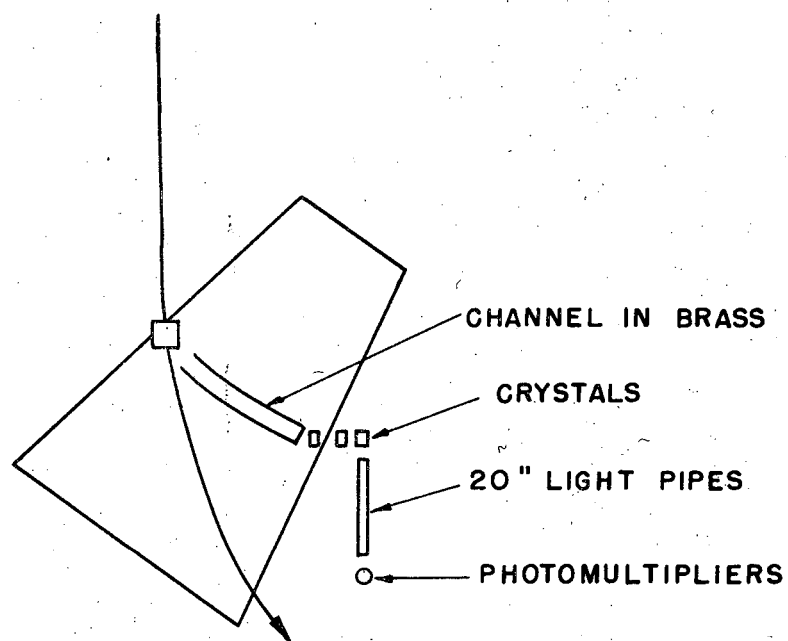


Fig. 7



PAIR SPECTROMETER MAGNET

MU 2050

Fig. 8

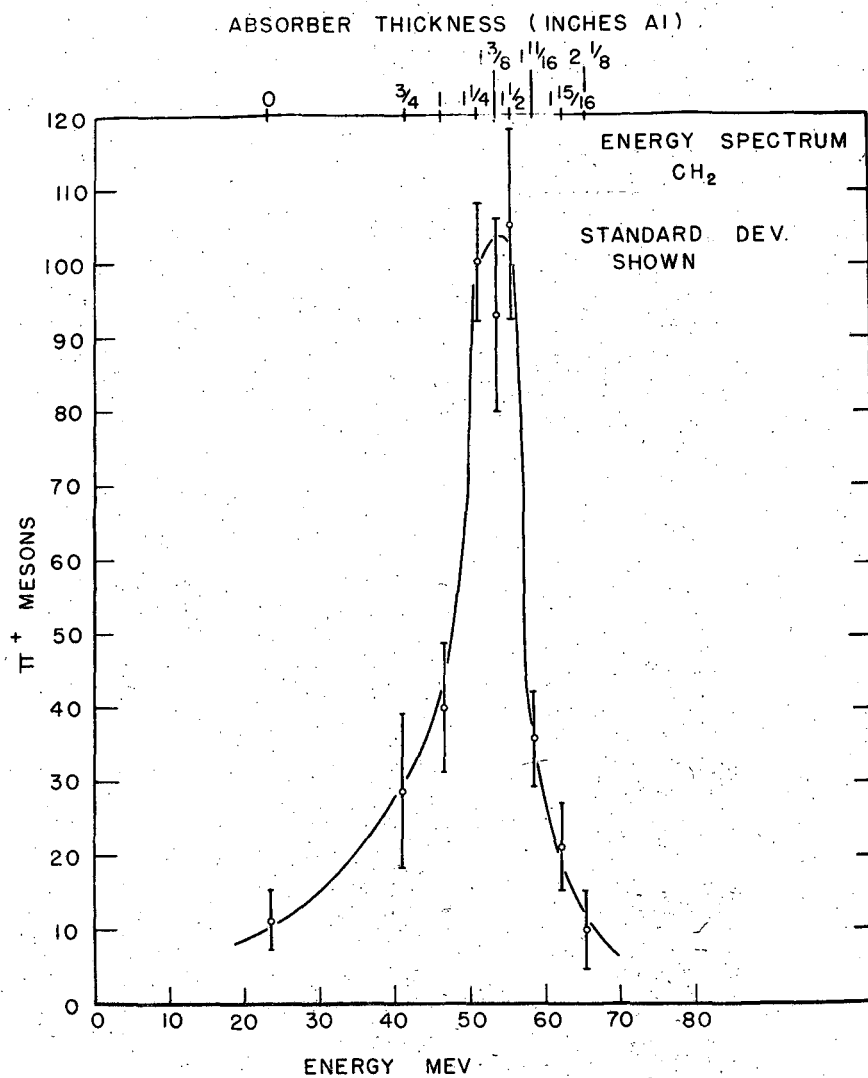


Fig. 9

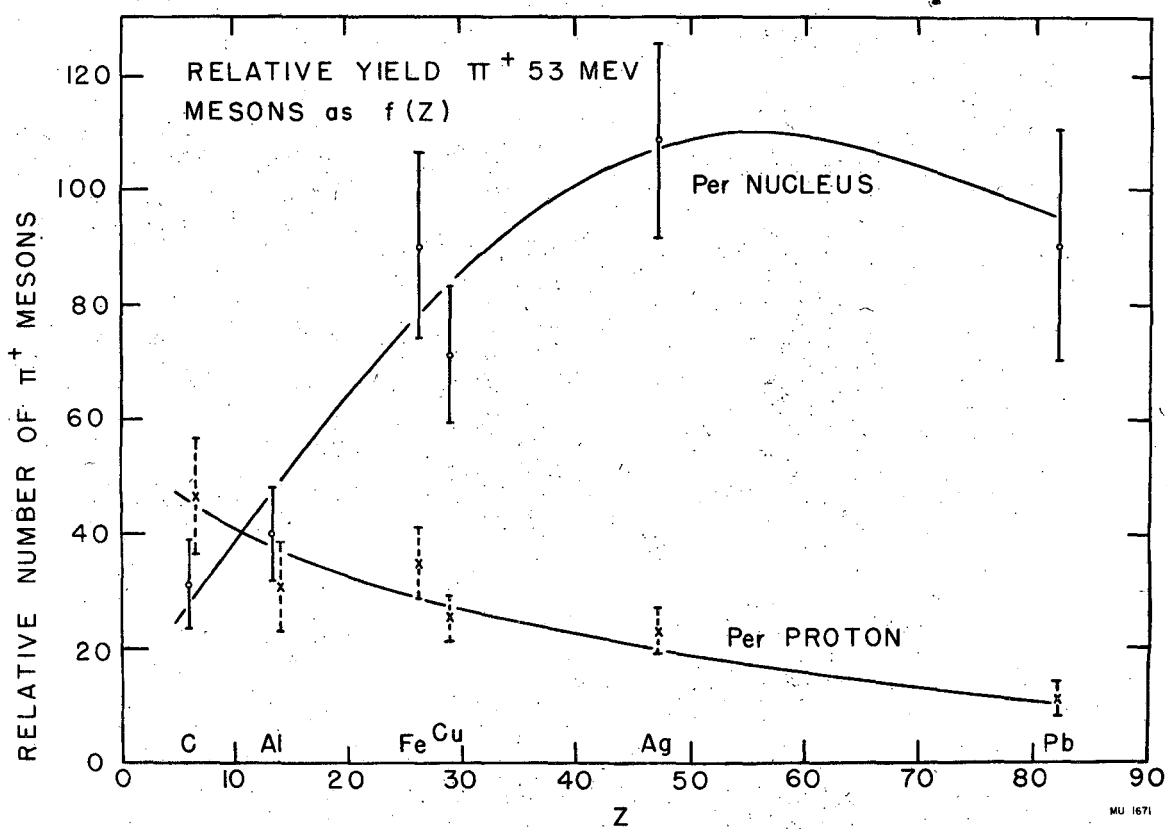


Fig. 10