II. EXPERIMENTAL TECHNIQUES

The electron detector (Fig. 1) was a right circular cylinder of Plastifluor B,[2] 1-1/2 inches long and 1-1/2 inches in diameter, cemented to a Dumont 6292 photomultiplier.

The fission beta source was located on the axis of the scintillator cylinder, and was sufficiently distant so that all detected electrons traveled in essentially parallel paths. The resultant path in the scintillator, except for scattered electrons, was 4 gms/cm^2, which is about the maximum range of an 8 Mev electron.

The 1.0639 Mev gamma ray of Bi^{207} which converts in both the K and L shells to give an effective electron line of .991 Mev (for the resolution of this system) was adopted as a convenient calibration standard (Fig. 3). An aluminum absorption measurement, using other conversion lines of Bi^{207} (E_γ = .570 Mev) and Cs^{137} (E_γ = .660 Mev) indicated an energy loss of .043 Mev at the .991 line due to the materials present between the source and the detector. The energy scale was checked within 1 percent at 2.526 Mev using the Tl^{208}(Th C'') line. A measurement of the end points of the beta spectra of F^{20} and Al^{28} agreed with the well known values of 5.41 and 2.87 Mev, respectively (maximum uncertainty 2 percent). In the course of the present experiment the Rh^{104} end point was determined as 2.45 Mev.

The resolution (full width at half-maximum) for monoenergetic electrons was 18.5 percent for the 624 kev Cs^{137} line, and 15.3 percent for the 976 kev Bi^{207} line (K-conversion lines only).

The proportional counter of Fig. 1 was made of two parallel subcounters with a square cross section, with .005-inch steel center wires. The common wall between these two subcounters and the two sides in the path of the electrons were .00025-inch aluminized Mylar. This system was chosen because it gave a relatively small spread in pulse heights from monoenergetic electrons of minimum specific ionization, and also gave reasonably small variations in the time of formation of the pulse after the electron had traversed the counter. The counting gas, 97 percent argon and 3 percent ethane, flowed continuously. The electrons traversed 6.9 mg/cm^2 of material in going through the counter. The most probable pulse size produced by a 991 kev electron was 4.2 kev.

The pulses from the photomultiplier were amplified by both a relatively slow (.3 μsec rise time) linear amplifier, and a fast (.1 μsec rise time) amplifier (Fig. 2). The signal from the fast amplifier, together with that from the transmission counter, were fed to a coincidence circuit, the output of which gated a 100-channel analyzer. The signal from the slow amplifier was analyzed in the 100-channel pulse height analyzer. The widths of the pulses in the coincidence circuit (1 μsec total) and the width of the gating signal to the analyzer (4 μsec) were narrow enough so that, with the counting rates employed, not more than .1 percent of the analyzed counts could have been accidental.

Studies made with a pulser on the pulse widths and delays of the two channels of the coincidence circuit proved that the coincidence and gating system was 100 percent efficient. An additional empirical check on the entire