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Radiation Laboratory

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Summary of the Research Progress Meeting

September 30, 1948

Henry Kramer

Special Review of Declassified Reports

Authorized by USDOE JK Bratton

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**REPORT PROPERLY DECLASSIFIED**

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## Summary of the Research Progress Meeting

September 30, 1948

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Pulse Analyzer Using a Cathode Ray Tube. W. Glenn

In order to identify  $\alpha$ -emitting isotopes produced by the bombardment of an element, the energy spectrum of the resulting radiation is observed. A typical  $\alpha$ -particle spectrum is shown in Fig. 1. A maximum or peak indicates the emission of particles with energies contained within a short range about the "characteristic" energy level of a certain isotope.

In the past, such an energy distribution for  $\alpha$ -particles was found by imposing the pulse which was registered in the counter on a selector consisting of a series of fifty thyratrons which were adjusted to discriminate between the energy levels. As a thyatron was fired, it activated a mechanism whereby the preceding thyatron was extinguished. Each thyatron was connected to a particular channel of a mechanical counter. In this fashion, the number of pulses within discrete energy ranges was recorded.

It was found, however, that false peaks which did not correspond to a particular characteristic energy were sometimes recorded. This was attributed to the tendency of the thyratrons to drift, that is, to fail to contain the discrimination within the prescribed energy range. To correct this failing in the method, the series of thyratrons was replaced by a cathode ray tube selector.

This selector is shown schematically in Fig. 2. The pulse is imposed on the deflector plates of the tube. This results in a corresponding deflection of the electron beam which impinges on the screen. The deflection of the beam can be used as a measure of the energy level of the pulse. For this purpose, a series of fifty electrodes was attached to the inside of the screen. The electrodes were then connected through amplifiers

to the channels of a mechanical counter. Thus, the ladder of electrodes served to discriminate between the energy levels of the pulses. Relative drift was essentially eliminated, since the discrimination depends on physical dimensions (size of electrodes and their position).

In order to assure the activation of none but the appropriate electrode, a pulse shaper was connected to the horizontal deflector of the tube. This resulted in a square pulse picture.

A cathode ray tube in conjunction with a photomultiplier tube will be used to measure very short half-lives. It is expected that it will be possible to measure half-lives of the order of  $1 \mu \text{ sec}$ .

#### High Energy Gamma-rays from the Cyclotron. B. Moyer

It was decided to look for gamma-radiation emanating from the target of the 184" cyclotron. Since it was thought reasonable to suppose that gamma-radiation, if it exists, is isotropic, the apparatus was set up outside the shielding in line with the neutron channel (Fig. 3).

The apparatus consists of a plate of Ta or Pb as a source of electron pairs, a magnet to deflect these pairs, and three proportional counters firing in coincidence. (Fig. 4).

Although the source of the radiation is not known, evidence was obtained which seems to indicate its existence. Speculation as to the source must include consideration of meson decay, bremsstrahlung from the cyclotron target, and nuclear excitation.

The energy spectrum of the electron pairs emitted from the lead shield was found by adjusting the field of the magnet. The results are set down in Table I. Columns 3 and 4 were obtained for bombardment of the cyclotron target with deuterons; column 5 corresponds to bombardment with alpha-particles.

Table I. Electron pair coincidences for different energy ranges.

Table I

Energy range in Mev	Average Energy in Mev	No. of Coincidences N/500 sec. (deuterons)	$N/\Delta E \cdot P$ rel. no. of Counts Corrected for Scatterer	N/1000 $\alpha$ -particles
81-150	116	1	0.12	0
54-95	73	15	3	2.5
27-49	42	19	6	2
16-29	22	27	(27)?	--
8-14	11	~ 40	(200)?	--
0	0	0	0	0

The number of accidental coincidences was found to be negligible since, when the pair-producing shield was removed or the magnet turned off, no counts were observed.

The only conclusion which can be drawn at present is that gamma-radiation is produced in the cyclotron.

Suggestions were offered from the audience regarding the refinement of the apparatus by the introduction of plates to collimate the electron beams.

#### Meson Half-life. W. Panofsky

In the Research Progress Meeting for August 26, J. R. Richardson reported a method for determining the half-life of a meson by a photographic technique employing a comparison of the number of mesons recorded on plates placed at the  $180^\circ$  and  $540^\circ$  positions in a special holder provided with spiral channels. That is to say, a channel is provided that selects negative mesons spiraling upward from the target. Six photographic plates are exposed at the  $180^\circ$  position. A similar channel is provided for mesons spiraling downward at an equal angle but unobstructed at the  $180^\circ$  position. These mesons spiral downward passing 1 inch below the center of the target through an open channel to the  $540^\circ$  position. The ratio of the number of mesons in these two sets of



plates when corrected for geometry gives the loss of mesons in the time corresponding to one revolution of the magnetic field. In a uniform magnetic field the geometrical correction is simply a factor of three.

In a recent communication Richardson reports that in the interval since August 26 fifty more meson tracks in plates exposed at the  $540^\circ$  position have been measured. On the assumption that the geometry is correct he has derived a revised value of the half-life of the meson of  $7.5 \pm .8 \times 10^{-9}$  seconds. This corresponds to a ratio of approximately 6:1 in the mesons discovered in the  $180^\circ$  and  $540^\circ$  positions.

An attempt has been made here to check the geometric factor in the experiment using the same plate holder and protons arising from the target of the 184" cyclotron. As yet this experiment with protons has not been successful enough to allow any conclusions to be drawn. In addition, the same plate holder has been used with a thick  $\alpha$ -particle source in the magnetic field of the cyclotron but with the cyclotron beam turned off. Tentative results give a geometrical factor of  $3.3 \pm 20$  per cent for the ratio of the number of particles received at the  $180^\circ$  and  $540^\circ$  positions. It thus appears that a factor of 3 used by Richardson in his calculations is not far from correct. It is planned to make a more accurate determination of this factor.

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Number of counts

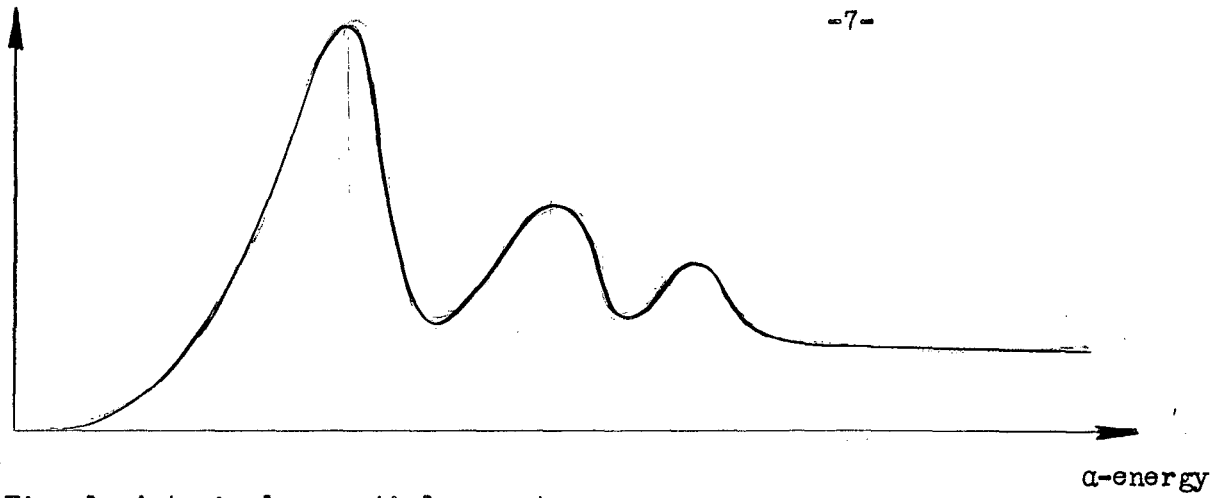


Fig. 1 A typical alpha-particle spectrum.

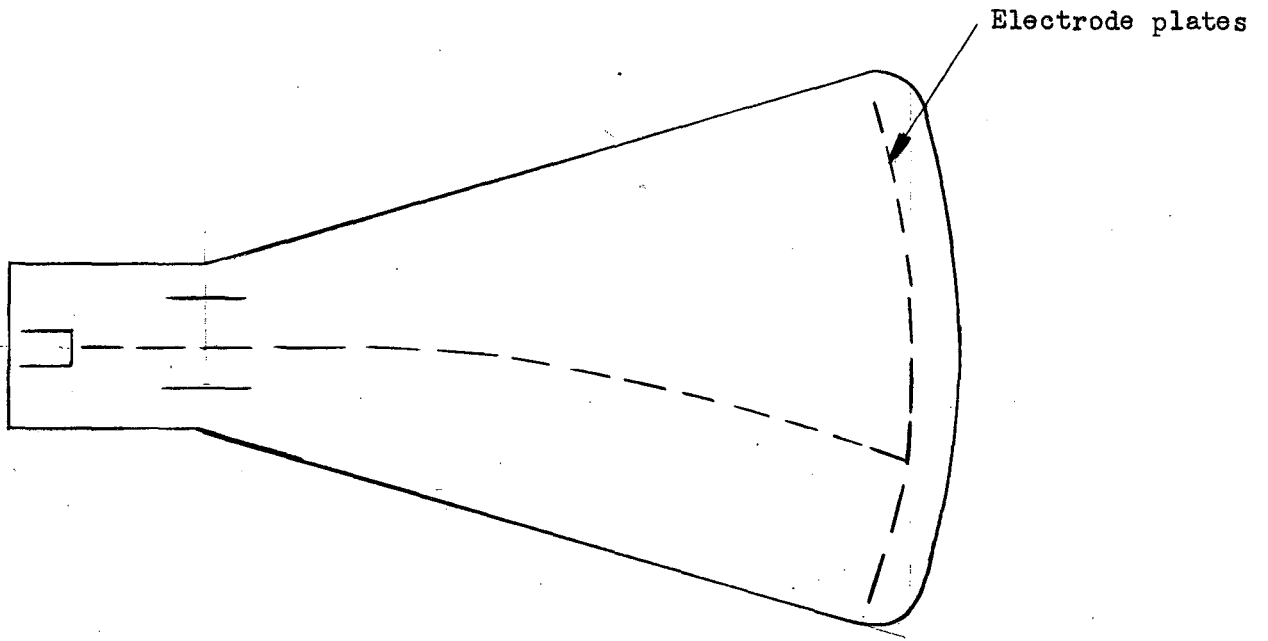


Fig. 2 Cathode ray tube selector.

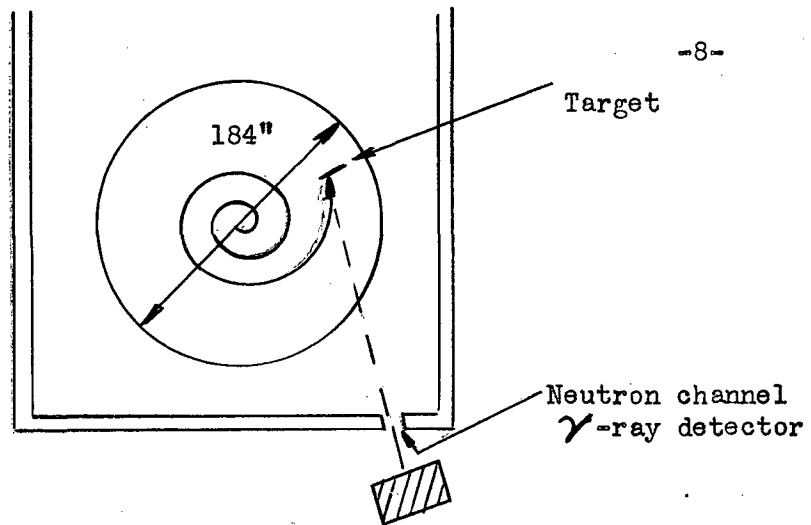


Fig. 3 Position of the apparatus

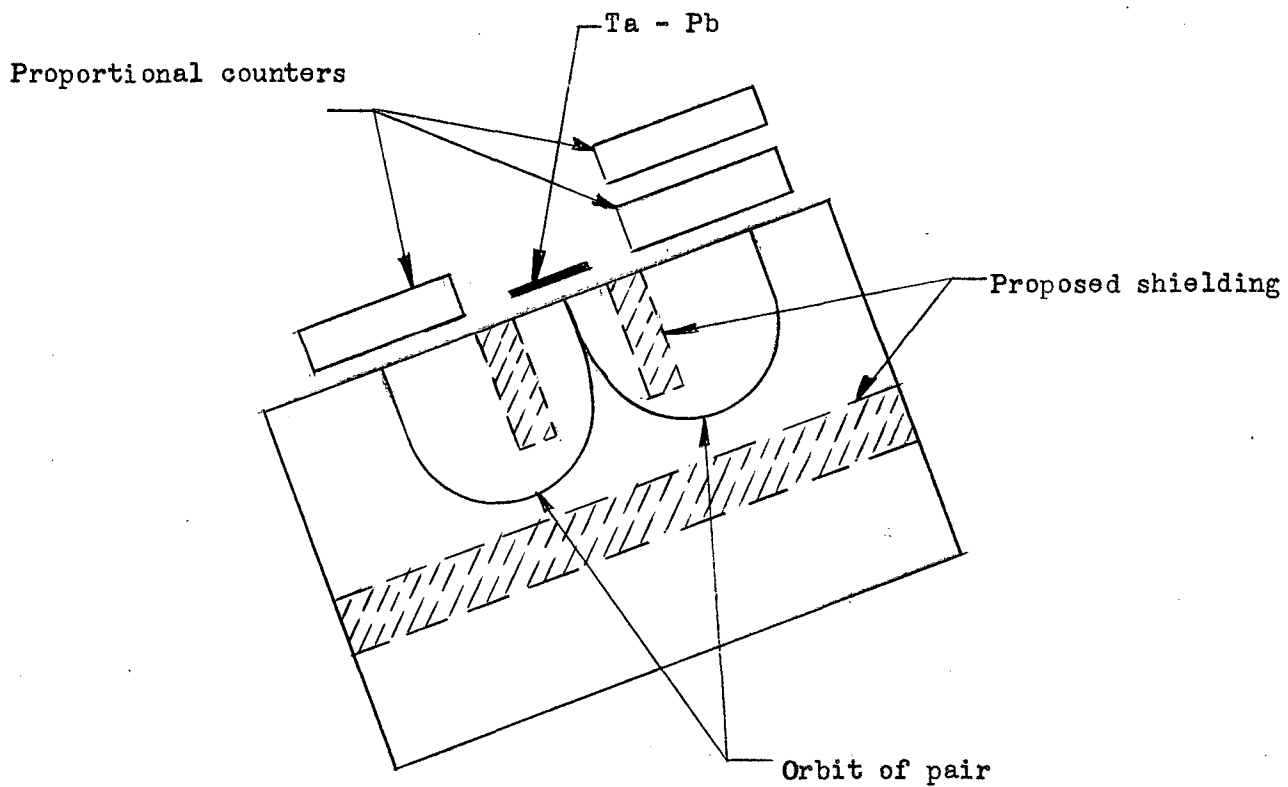


Fig. 4 The  $\gamma$ -ray detector

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