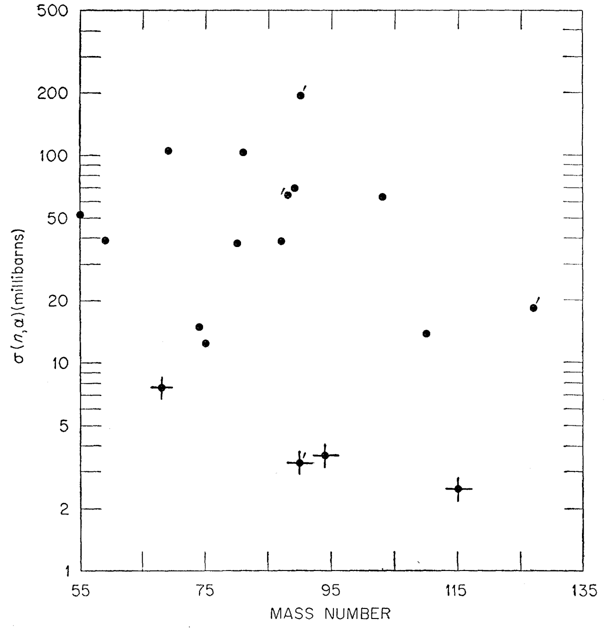

FIG. 1. (n,α) cross sections in millibarns. + —(n,α) cross sections observed in present experiment; ●—(n,α) cross sections observed in reference 1 for this mass region; ′—partial (n,α) cross section leading to an isomeric state.

of atomic number $Z-1$ were removed from the sample by radiochemical techniques. Samples were then counted under end-window Geiger counters and the induced (n,α) activities were determined by analysis of decay curves. In the case of zirconium, the decay curves were analyzed with the Oracle, the Laboratory's digital computer.

The cross section values obtained were: Zn^{68}, 7.6±0.8 mb; Zr^{90}, 3.3±0.6 mb; Zr^{94}, 3.6±0.5 mb; and In^{115}, 2.5±0.4 mb. In Fig. 1, these results are plotted along with the results from reference 1 for this mass region; the distinct difference between these results and the trend indicated by reference 1 may be seen. Zr^{90} is the only isotope included in both sets of measurements. For this isotope reference 1 reports a cross section of 194±107 mb. It should be noted that our value for the cross section on this isotope is in agreement with the results of recent measurements at Los Alamos by Brolley *et al.*[5] In view of the fact that chemical separations were not performed in the work of reference 1, it seems quite likely that the reported large (n,α) cross section on Zr^{90} is in considerable measure a result of (n,p) reaction on Zr^{92} which leads to a similar half-life. Examination of the (n,α) cross sections reported in that work indicates the possibility of a similar error in a number of the measurements so that the indicated trend is perhaps also in error. It is hoped that additional measurements now being undertaken will clarify this situation.

The authors which to express their deep indebtedness to Dr. B. L. Cohen for suggesting this experiment and for much useful discussion. The Cockcroft-Walton accelerator of the ORNL Biology Division provided the neutron source for these experiments.

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Mass Values of the *K* Mesons*

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ADDITIONAL data have been obtained from the stack of emulsions[1] exposed to 114-Mev *K* mesons at the Bevatron and from another stack exposed to 170-Mev *K* mesons. Both exposures were made with the use of the strong-focusing magnetic spectrometer.[2]

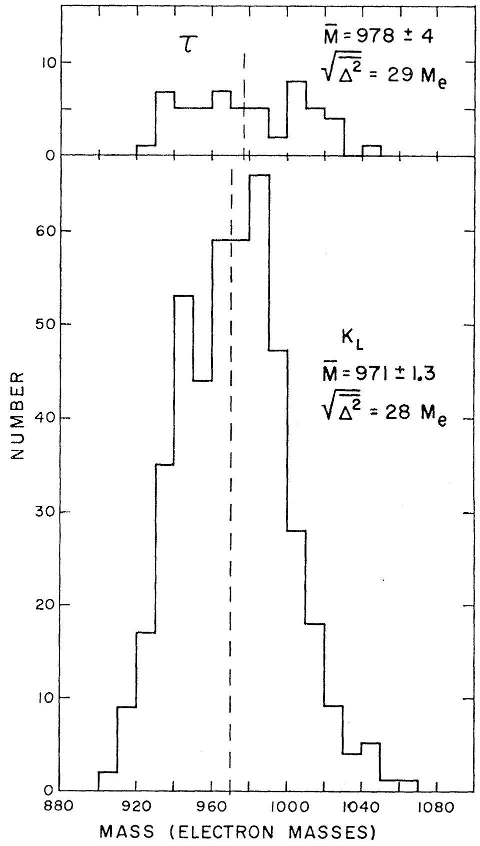

FIG. 1. Masses of 459 K_L and 55 τ mesons found in stack 16.

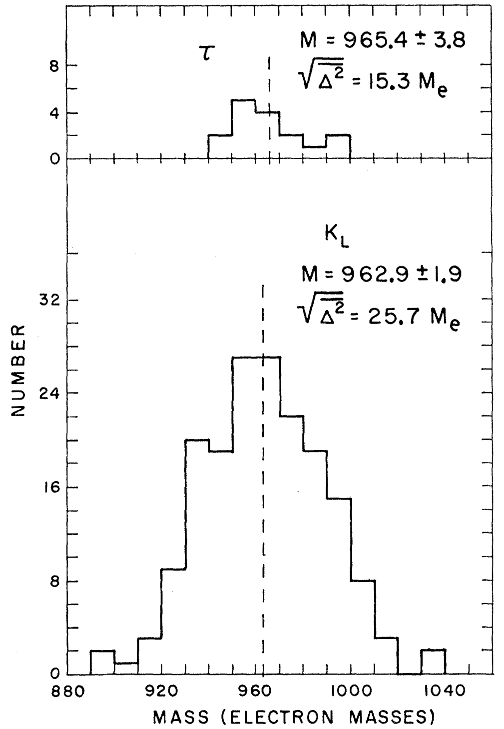

FIG. 2. Masses of 177 K_L and 16 τ mesons found in stack 17.

In the preliminary report, the stopping point of each K meson was used to determine its lateral position, and hence its momentum. We have now calculated the masses of all the K mesons in the first stack (stack 16), using the lateral position where the track was first picked up (about 3 cm from the end) to determine the momentum of the particle. The results plotted separately for K_L and τ mesons are shown in Fig. 1. The distribution includes 459 K_L mesons, 42 τ mesons, and 13 alternate decays of τ mesons into one charged pion.

Of the fifteen τ mesons in the preliminary report, three were found to have large angle scatters causing a large error in the projected range. These few events caused most of the apparent mass difference between the τ and K_L mesons. These events represent a large statistical deviation from the number of scatterings predicted using nuclear area for the interaction cross section. In the much larger sample of K_L mesons, such a fluctuation is unlikely.

In the emulsion exposed to 170-Mev K mesons (stack 17), each K meson track has been followed back to the stopping proton position to determine its momentum. The results shown in Fig. 2 include 177 K_L mesons, 12 τ mesons, and four alternate decays of τ mesons.

The mass values obtained in units of the electron mass are

	Stack 16	Stack 17
K_L	971±1.3	962.9±1.9
τ	978±4	965.4±3.8

The uncertainties given are $\sigma/\sqrt{N}$, where $\sigma = (\langle\Delta^2\rangle_{\text{Av}})^{\frac{1}{2}}$ is the root-mean-square deviation from the average mass and N is the total number of events in the distribution.

The absolute values for the masses include systematic errors due to uncertainties in measurement of the momentum of the K particles, to the errors in the proton range measurement, and to scattering and ionization loss in the air path. In addition, the resolution is somewhat broadened from that expected, by multiple scattering in the window of the Bevatron tank and in the emulsions and by aberrations of the strong focusing lens. Relative masses of the mesons should not be affected by the above errors. However, a different interaction cross section for the τ and K_L particles could cause a range shortening of one with respect to the other and hence an apparent mass shift.

A more complete report of this work will appear in the summary of the International Conference on Elementary Particles held in Pisa, Italy, in June, 1955.

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* This work was performed under the auspices of the U. S. Atomic Energy Commission.

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New Radioactive Isotope Scandium-42†

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THE nuclide Sc^{42} is of interest for several reasons: (1) Because of its probable configuration, Ca^{40} plus one neutron and one proton, a reliable theoretical treatment should be possible. (2) In analogy with three known 0^+-0^+ transitions in the positron decay of Al^{26}, Cl^{34}, and K^{38},[1–3] it may also decay by a 0^+-0^+ transition. (3) From the analogy to Li^6 and F^{18} the lowest $T=0$ state may be expected to have spin 1^+, if one extends the prediction of King and Peaslee.[4]

It cannot be predicted, however, whether the $T=0$ or the $T=1$ state would be the ground state since these states lie very close in neighboring similar nuclides. The separate positron decay of these states, which occurs in Al^{26}, Cl^{34}, and K^{38}, is rather unlikely because of the small spin difference. So the lower level will determine the half-life of the positron decay. If the 0^+ state ($T=1$) is lower, the decay will proceed by a pure Fermi-type super-allowed transition and its half-life will be about 0.6 sec.[2] But if the 1^+ state is lower, the half-life of 0.6 sec is expected only under the assumption of perfect LS coupling which is more or less unrealistic for such a heavy nucleus. Therefore, a somewhat longer half-life is expected from the 1^+ ground state. A $T=0$ state with higher spin is safely rejected since it would