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PRELIMINARY REPORT ON MASSES, DECAY MODES, ABUNDANCES, AND ENERGY SPECTRA OF K⁺ MESONS

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UNIVERSITY OF
CALIFORNIA

*Radiation
Laboratory*

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UNIVERSITY OF CALIFORNIA

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Marian N. Whitehead, Donald H. Stork, James R. Peterson,
Donald H. Perkins, and Robert W. Birge

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The analysis of the data from our large emulsion stack, 95 9-by-17-inch 600- μ pellicles, has been substantially completed. K-particle secondaries whose direction indicated that they would stop in the stack were they 21 cm. long were followed. The secondaries were chosen from 2000 total in the stack. Out of 96 secondaries followed, 24 π 's from $K_{\pi 2}$ decay, and 20 μ 's from $K_{\mu 2}$ decay have been stopped. Another 185 have been identified by "blob" counting at the decay point, of which 42 are common with the above 96. These data allow one to calculate ratios of the various type of K particles and to measure the primary mass of identified K's. The percentages of all K's are given in Table I.

The spectrum of $K_{\mu 3}$ secondaries and the spectrum from the alternate mode of decay of the τ 's have been corrected for scanning efficiency and the results are shown in Figs. 1 and 2. For comparison we have included the data of other recent studies¹ with our data and plotted these in Figs. 3 and 4.

The masses of the various types of K mesons have been measured by the primary range-momentum method and by the range of secondaries. These values are given in Table I. Statistical errors only are shown.

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

Table I

Results of Meson Measurements			
Type	Percentages of all K particles	Primary mass	Secondary mass
τ	4.8 ± 0.5	966.3 ± 1.9	965.8 ± 1.0
τ^0	2.1 ± 0.6		
$K_{\mu 2}$	$57.2 \pm \overset{5.0}{\cancel{2.5}}$	967.5 ± 2.2	964.8 ± 2.8
$K_{\pi 2}$	$31.2 \pm \overset{3.5}{\cancel{3.0}}$	966.5 ± 2.0	$\overset{964.2}{\cancel{960.8}} \pm 2.0$
$K_{\mu 3}$	2.6 ± 1.1	967.3 ± 5.5	
K_{β}	2.1 ± 1.5	963 ± 10	

- Ritson et al. (to be published);
Barkas et al. private communication;
article on "G-stack Collaboration" in *Il Nuovo Cimento* 2, 1063 (1955);
J. Crussard et al. (to be published).

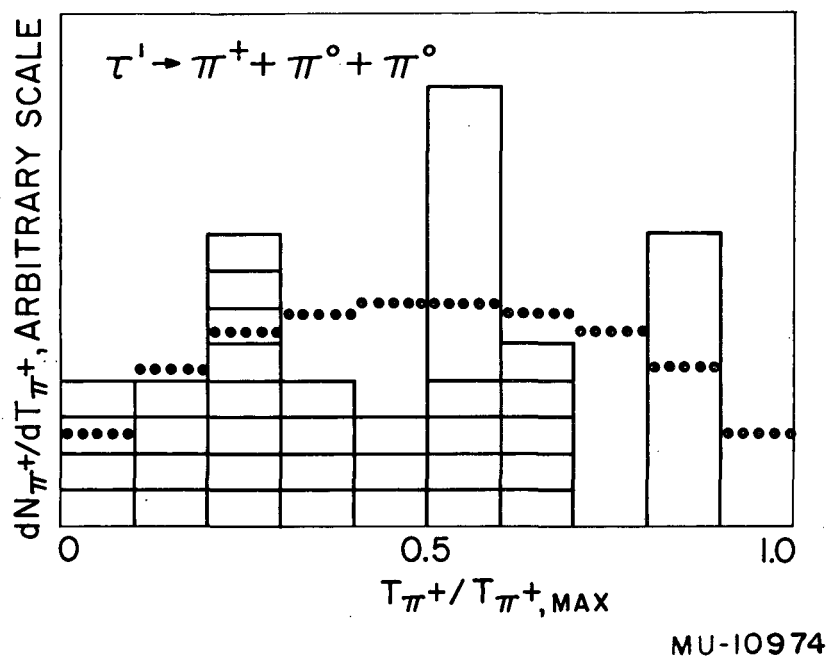
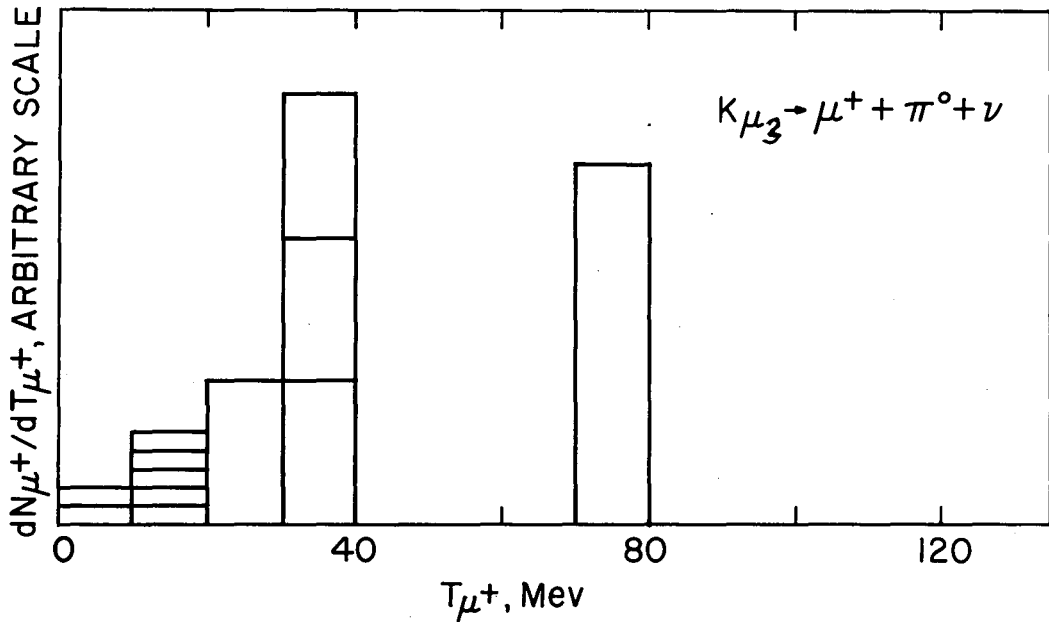
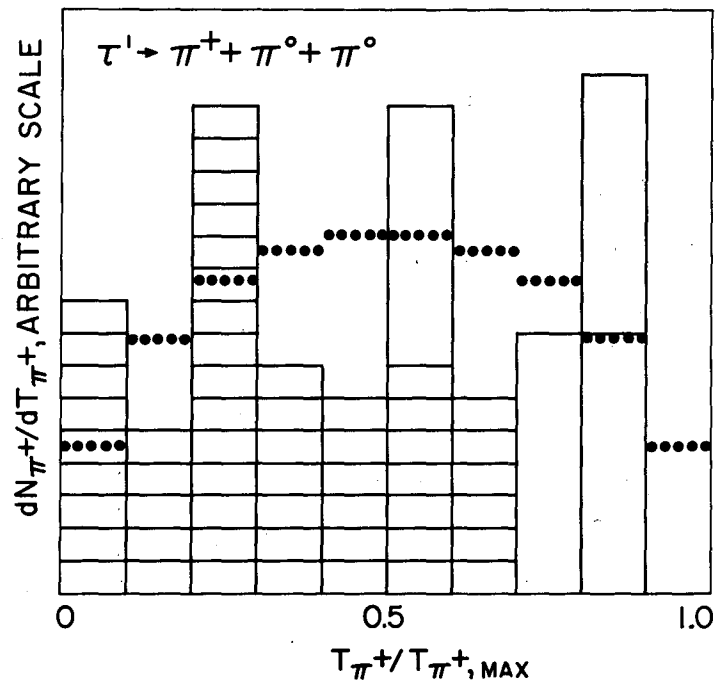


Fig. 1. Energy distribution of the odd pion in the decay $\tau' \rightarrow \pi^+ + \pi^0 + \pi^0$. Each open block represents one event. The events were found either by studying those K-meson secondaries recognized visibly as having an ionization greater than minimum or by systematically following or blob-counting the secondaries of a selected portion of the K mesons. The treatment of the data in determining the energy distribution was such as to remove all selection bias. For comparison the theoretical distribution for (0, -) τ spin and parity is shown and good agreement is to be noted.



MU-10975

Fig. 2. Energy distribution of the muon in the decay ($K_{\mu_3} \rightarrow \mu^+ + 2$ neutral particles). Each open block represents one event. The events in the region $0 < T_{\mu^+} < 60$ Mev were found either by studying those K-meson secondaries recognized visibly as having an ionization greater than minimum or by systematically following or blob-counting the secondaries of a selected portion of the K mesons. The events in the energy interval $T_{\mu^+} > 60$ Mev were found only by systematically following a selected group of K-meson secondaries. The treatment of the data in determining the energy spectrum was such as to remove all selection bias.



MU-10976

Fig. 3. Energy distribution of the odd pion in the decay $\tau' \rightarrow \pi^+ + \pi^0 + \pi^0$ in which other data (see text) are combined with those of Fig. 1.

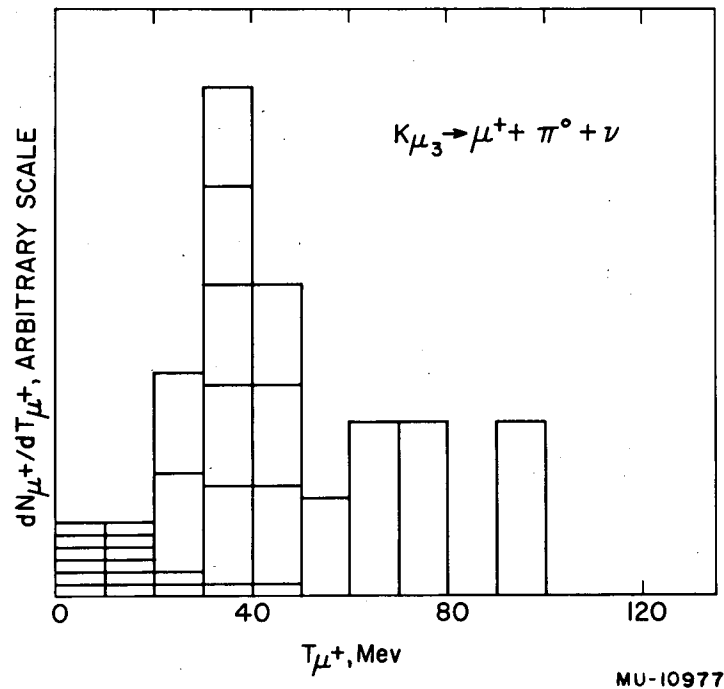


Fig. 4. Energy distribution of the muon for the K_{μ_3} decay in which other data (see text) are combined with those of Fig. 2.