

I would like to comment briefly on the interesting discovery of a positively charged V-particle with a secondary heavier than the pi-meson (York et al. (1953)). We have made accurate measurements on 25 V_1^+ -particles and have not found a similar example. The measurements on the primary particles are very incomplete, but there are five cases which could be heavier than the proton (i.e. have secondaries of protonic mass). Now York et al have suggested that their event may be an example of the decay of a V_1^+ -particle according to the scheme:

$$V^+ \rightarrow p^+ + \pi^0 + Q \quad 7.1$$

If the V_1^+ is the charged counterpart of the V_0^+ -particle and if it has the same mass, then $Q = 40$ Mev and the maximum possible value of $p_m = 110$ Mev/c. However, all of the five positively charged V-particles which might be more massive than the proton have values of p_m greater than 110 Mev/c. Thus we consider that only a very small fraction of our events could be V_1^+ -particles (with $Q = 40$ Mev).

DISCUSSION

Peters - Apart from mass values only one event might distinguish a K and a χ - the one where the secondary suffers a large angle scatter in the piston - could this be coulomb scatter of a μ ?

Butler - After scatter the meson has a momentum of $35 \frac{\text{Mev}}{c}$, before scatter the momentum can't be measured but is probably ~ 150 Mev - at such a value coulomb scatter of the μ is unlikely.

Sard - Until the K decay spectrum is known the μ -e curve might be used to find the p_m distribution.

Butler - This is what York has done.

Michel - The theoretical spectrum is not unambiguous, there are other possible curves. In the case of 2 zero mass neutral particles the shape could be very different.

Newth - Event P33 (see figure) differs in its dynamics from the others - in view of the results of the Cal. Tech. who find 2 life times, could you say how long this V lived in the chamber?

Butler - $\sim 5 \times 10^{-10}$. It is of positive charge.

Peyron - In a determination of the momentum in the rest mass system does the biggest error come from the ionization estimate on the secondary momentum?

Butler - Secondary momentum.

? - Can you say anything of the energy of the particles that creates the V?

Butler - Few of our V_1^+ 's come from the plate; of those that do, some are created by high energy particles, some by more moderate energied particles (few Bev.)

D - 2. RECENT MEASUREMENTS ON CHARGED V-PARTICLES AND HEAVY MESONS IN PASADENA

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Most of the observations have been made in 2 chambers separated by a Pb plate and surmounted by a Pb production layer.

Relative frequency of V^+ and V^- - It has been already reported (Phys. Rev.) that for charged V's produced in the production layer there is an excess of negative particles whilst the reverse is true for V's formed in the plate. The latest figures still indicate this. Below the total results to date are given, the bracketted figures being those already published :

	No of V^+	No of V^-
From production layer	14 (8)	25 (18)
From plate	22 (18)	12 (9)
Total	36 (26)	37 (27)

If all charged V-particles are the same, the probability of an asymmetry as great as the above is about 10^{-2} .

Life-Time - The possibility of there being 2 V-types with different positive to negative ratios is supported by the measured life times.

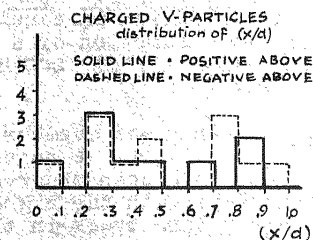


Figure D-2, 1

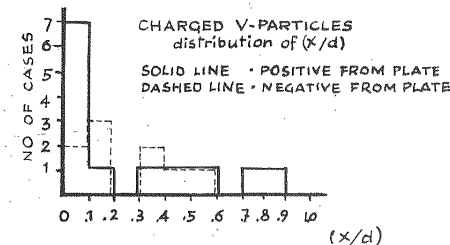


Figure D-2, 2

In the upper chamber the decay of both positive and negative particles is distributed uniformly. In the lower chamber, there is a high proportion of V^+ 's decaying near the plate. (Figure D-2, 1 and 2).

Mass of the V-secondaries - The determined values group about a value approximating to those of the pi and ρ , though a distinction between the two is not possible. (Figures D-2, 3 and 4)

A small number of positive secondaries could be protons.

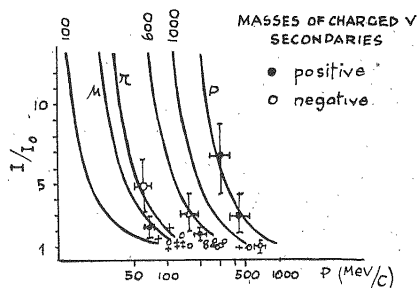


Figure D-2, 3

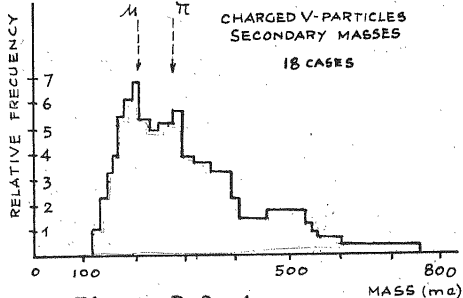


Figure D-2, 4

Mass of the V⁺ - Those charged V's of greater than minimum ionization whose momenta can be measured have a distribution of determined masses about 1000 m_e. (Figures D-2, 5 and 6)

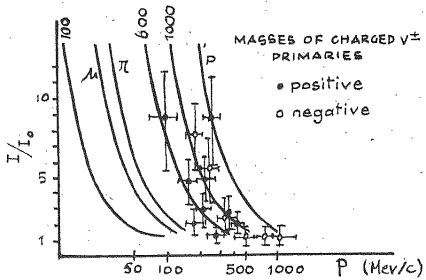


Figure D-2, 5

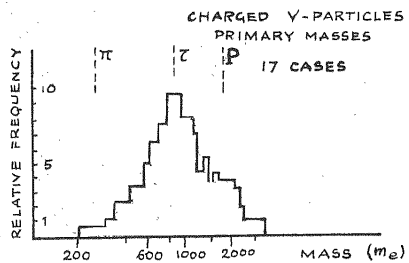


Figure D-2, 6

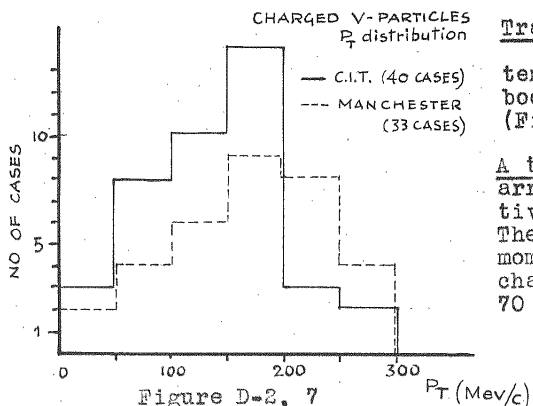


Figure D-2, 7

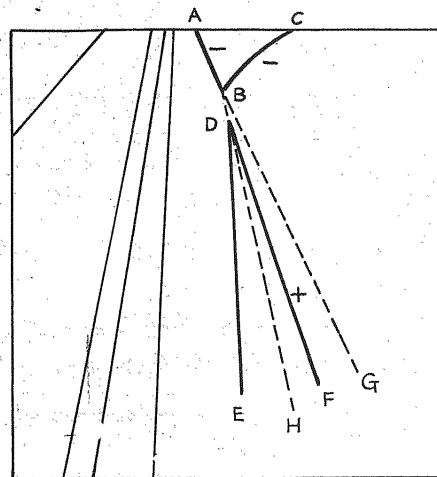
Transverse momentum, P_T distribution

The distribution is consistent with the assumption of a 2-body decay with a P* of 200 Mev/c. (Figure D-2, 7)

A tau-meson - In a new chamber arrangement a negative tau-meson has been observed. The secondary-pi with the highest momentum has a long track in the chamber and an accurate Q of 70 ± 3 Mev is obtained.

Cascade events - 3 cases of V⁰'s apparently coming from the disintegration of a charged V have been found; two of these are from the double chamber and one from that of Cowan.

In every case the geometry is consistent with two 2-body decays.



#1: Momenta : (Approximate)

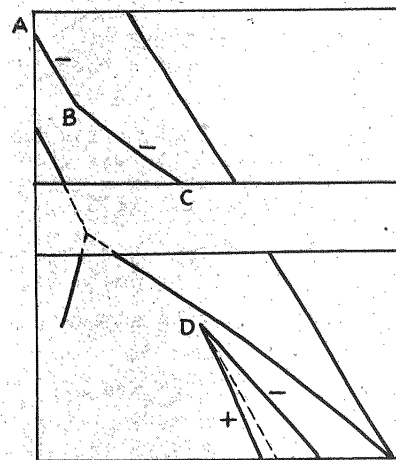
P_{bc} = 0.2 Bev/c

P_{df} = 1 Bev/c

P_{de} = 4 Bev/c (from P_t balance)

Coplanarity of ABC with point D is good.
Coplanarity of DEF with point B is good.

Cascade Decay 2. (Found by Dr. E.W.Cowan)



#2: Momenta : (Approximate)

P_{bc} = 0.11 Bev/c

P_{de} = 0.4 Bev/c

P_{df} = 0.7 Bev/c

Masses:

BC is \bar{K}^0 or ρ^0
DF is > 1000 m_e, and is consistent with proton.
DE is < ~ 600

Ionizations (Approximate)

I_{bc} = 2 I₀

I_{df} = 1.5 - 2 I₀

(All others ~ I₀)

Coplanarity of DEF with point B is good.
Coplanarity of ABC with point D is good.

#3: Momenta: (Approximate)

$$P_{bc} = 188 \pm 15 \text{ Mev/c}$$

$P_{df} = 195 \pm 25 \text{ Mev/c}$ (but track appears to have a small single scattering)

$$P_{ij} = 170 \pm 12 \text{ Mev/c}$$

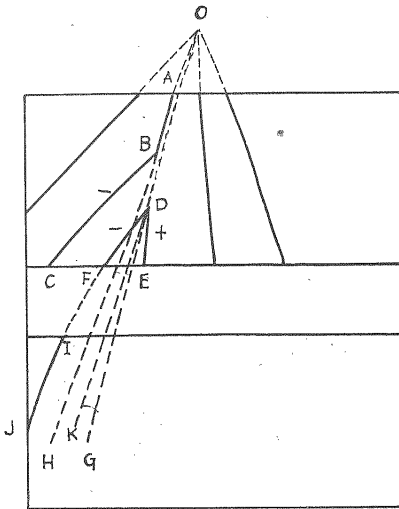
($P_{df} = 265 \pm 20 \text{ Mev/c}$ using P_{ij} and energy loss through plates for pi-meson)

Ionizations: All $< 1.5 I_0$.

Coplanarity of FED with B is good

Coplanarity of FED with O is good

Coplanarity of ABC with D is good

Cascade Decay 3.

(Found By V.A.J. Van Lint)

The chances are more than 10^4 to 1 against these 3 and the Manchester event being due to a fortuitous association of a charged and neutral V^0 .

In all 3 cases the positive secondary of the V^0 lies nearer the line of flight of V^0 than does the negative, (this is probably also true of the Manchester example.) and in the case of Cowan's example a mass determination of the positive V^0 secondary gives $\sim 1800 m_e$.

It appears, therefore, that the positive secondary has a larger mass than the negative.

If the V^0 is a V_1^0 , the mass of the charged V must be super-protonic.

All four of the charged V -particles decaying into V^0 are of negative sign.

DISCUSSION

Peters - The possibility of a fortuitous association of a V^0 and a V_1^+ will be underestimated if there is a tendency for the two types of V to be produced simultaneously. We have a number of cases where 2 V^0 's appear from a single interaction.

Leighton - Such an explanation of the phenomena would also require a directional relationship in the emission of the 2 V 's. It would be noted too that the V^0 always decays after the V^- .

Reynolds - With reference to the simultaneous production of V^0 's it appears this is more common for V_1^0 's than V_1^+ 's.

Leighton - No evidence on this point.

Reynolds - If the events are due to chance association, one would expect more cases where there was no geometric correlation between the two V 's. - We get only 1 such spurious event.

Leighton - We have a few.

? - What can be said of the distance of the V^0 from the V_1^+ knowing the V^0 life time?

Leighton - If every V_1^+ underwent this type of decay, we should see many more than we do - less than 5% can be of this type.

D - 3. QUELQUES RESULTATS SUR LES V CHARGES

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Avant de vous donner quelques résultats sur les mésons-V chargés, je vais vous décrire brièvement notre expérience du Pic-du-Midi.

L'installation est représentée sur la Figure D-3, 1 (page suivante). Vous voyez qu'elle comporte essentiellement deux grandes chambres de Wilson, situées à 109 cm l'une au-dessous de l'autre, et de dimensions utiles 64 x 68 x 30 pour la chambre du haut, et 64 x 68 x 40 pour la chambre du bas. La chambre du haut est dans un champ magnétique de 2600 gauss, la chambre du bas comporte 14 écrans alternés de C et de Pb comme l'indique la figure. Chaque chambre est photographiée par 3 appareils, l'angle extrême de stéréoscopie étant d'environ 17° .

Le système de déclenchement exige une coïncidence triple dans le banc de compteurs B au-dessus de la chambre du haut accompagnée d'une coïncidence simple dans les compteurs C entre les 2 chambres. Il n'y a aucun compteur au-dessous de la chambre du bas de façon à ne pas introduire de sélection. Les anticoincidences A protègent les gerbes électroniques ou nucléaires qui pourraient se produire dans la bobine. On obtient ainsi environ 60% de gerbes pénétrantes, la plupart de grande énergie.

Je passe maintenant aux résultats sur les V chargés,

Dans un dépouillement rapide d'environ 7.000 photos, on a trouvé dans la chambre du haut 14 V_1^+ (ce que l'on peut comparer avec les