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To the EEC

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INFORMATION ON THE EXPERIMENT

ON THE β DECAY OF THE Λ

I. The latest estimates on the rate of β-decay events in the present experimental set-up yield approx. 25 good β-decay events per day (or 6 per shift). There will be at least one trigger per burst. Thus the 25 good events per day will occur in at least 40 000 pictures. The estimated trigger of one per machine pulse is a lower limit. From experience in other similar experiments one should be prepared for a considerable higher trigger rate. The estimate is based on an assumed beam intensity of $8.\ 10^4$ negative pions per burst and running in parasitic shifts only (i.e. approx. 40 000 pulses per day). Carbon events are included. The earlier estimates gave a total number of 390 β-decay events per day in less than 11 600 pictures. The reduction in the rate of β-decay events is due to :

a) a reduction of the cross section for $\Lambda^o - K^o$ production by a factor of 0.6 as compared to previously published data (reported during the 1962 Conference on High Energy Physics at CERN)

b) a reduction of the branching ratio for the leptonic decay mode of the Λ^o-particle by a factor of two from 2.10^{-3} to approx. 1.10^{-3} (reported during the 1962 Conference on High Energy Physics at CERN).

c) originally it was assumed that one would be able to run with a beam intensity of 2.10^5 negative pions per burst. Experience from other experiments has shown that under our conditions it would be difficult to run with a beam intensity above approx. 8.10^4 negative pions per burst. This reduces the rate of expected β-decay events by another factor of 0.4.

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d) a number of modifications which had to be introduced in the experimental arrangement and a more detailed consideration of the problems connected to this experiment resulted in another reduction factor of 0.5 in the expected rate of β -decay events. This factor is made up of several factors, each of which is of order of magnitude 0.9 (e.g. loss of protons due to inelastic scattering or nuclear absorption; stopping of low energy protons in the windows of a gas Cerenkov counter or inside a water Cerenkov counter; discrimination against K_2^o β -decay events; elimination of possible ambiguities in the $e-\nu$ correlation; detection efficiency of the gas Cerenkov counter for electrons; etc).

Thus one can only expect only about 6% of the originally expected number of β -decay events, i.e. approx. 25 events per day (or 6 per shift).

II. At present three groups can already extract some information on the leptonic decay of the Λ^o out of their existing data, namely: -

a) Roberts et al. : From scanning a small part of their 5000 000 pictures which were taken during the $\Sigma^o - \Lambda^o$ parity experiment the Argonne group deduced that they should expect to find approx. a total number of 150 leptonic decas of polarized Λ 's.

b) Lagarrigue et al. : Until now approx. 30% of the 250 000 pictures which were taken during the T-8 run late in April this year (1.5 GeV/c K^--beam in the heavy liquid bubble chamber filled with C_2F_5 Cl, X_o = 25 cm) have been scanned. From their present knowledge the group expects to find a total number of approx. 350 β -decay events of unpolarized Λ -particles. Among the 350 events approx. 150 - 200 are likely to be useful to evalutate the $e - \nu$ correlation parameter.

c) Gidal et al. (Berkeley) : This group expect to find approx. 150 - 200 good β -decay events of unpolarized Λ -particles which were produced by stopping a K^- - beam in a heavy liquid bubble chamber at Berkeley. The group is working to extract the

e - ν correlation parameter out of their data.

Since in the proposed experiment one triggers specifically on the leptonic decay mode, scanning of the pictures should be easier than in the other mentioned experiments.

From the Argonne group data is should be possible to extract about the same information we were hoping to get in our experiment. Therefore, the proposed experiment makes sense only if the precision can be improved considerably. This would mean that one should aim at about 1000 good β -decay events. This would require at least 170 parasitic shifts (or eight weeks of parasitic running in the q_1 - beam). The time for setting up and testing the quipment is not included in this estimate.

The experiment would require taking more than 1.7 million pictures.

III. As a result of a study of possible experimental biases in our arrangement we came to the conclusion that there certainly will be some bias favouring a negative e - ν correlation, i.e. e - ν emission angles above 90°. This bias is due to the fact that low energy protons are rejected. However, the bias seems not to be exceedingly serious and can be corrected.

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