SOLOVIEV: We had several, but we have not been concerned with this particular question in detail.

BERTHELOT: Were all the supposed D particles observed in propane, or were some in hydrogen?

SOLOVIEV: Everything discussed here was done in a propane bubble chamber. The case which was discussed in Kiev did not contain the point of creation in the chamber. Of the remaining cases, one was for sure on hydrogen.

GLASER: Does that mean that you have some information about the production kinematics?

SOLOVIEV: It is difficult to say anything in this case. We make a star with many charged and neutral particles. From this one case we cannot tell much.

ALVAREZ: I'd like to ask for some indication of the degree of confidence one has in the existence of the D particle, as perhaps expressed by the local betting odds in the Dubna Laboratory.

SOLOVIEV: At Kiev it was explained that this event could be the charge exchange of a K meson, the second possibility, since it is coplanar, is that it is the decay of a new particle. To get a final solution of this problem, we have a special experiment under way in a beam of K^+.

ALVAREZ: Is it correct to say that nothing rules out the charge exchange?

SOLOVIEV: Yes, that is one of the possibilities.

VEKSLER: To make a final conclusion we have to have either good statistics for the charge exchange, or have a sufficient number of cases in which the particle would have approximately the same mass. Since there are only four cases, with the mass approximately 800 in three, and there are 12 more cases which are not coplanar, we cannot make any conclusion. It is quite possible that there is no such particle. It would be premature to conclude that no such particle exists.

STRANGE PARTICLE PRODUCTION IN 16 GeV π^--p INTERACTIONS

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(presented by C. Peyrou)

In March of this year the CERN hydrogen bubble chamber (32 cm diameter, 15 cm depth) was exposed to a beam of 16 GeV π^--mesons produced by the CERN Protonsynchrotron; 45,000 pictures were taken.

The π^--mesons were produced by an internal target of aluminium 1 mm thick. They were momentum analyzed by a 2 meters long magnet giving a deflection of 65 mm. There was no other beam optic equipment except three lead collimators. The chamber was located 108 meters from the target.

The beam composition was the following:

$\mu^- = 10\%$ measured and calculated
$K^- \approx 1\%$
$\bar{p} \approx 0.3\%$

the rest being π^--mesons. The proportion of K and $\bar{p}$ was given by a gas Čerenkov counter (v. Dardel et al). The scanning and analysis for the work reported here has been done in collaboration by two groups of CERN (hydrogen bubble chamber and I.E.P.) and by two groups at Pisa and Trieste University. A special analysis of high energy events (jets) is being done by a collaboration of several British groups and will be presented separately.

The results presented here are very preliminary and some work has to be done (for instance on biases) before they can be considered as certainly established.

TOTAL CROSS SECTION

This measurement has been done by counting the number of events in a certain fiducial region of the chamber, and measuring statistically the total path of π^--mesons in the same region. The two prong events were analyzed in order to find the elastic scatterings. They consist of small angle scattering (none has been observed which is larger than 3°). From the distribution of the elastic scattering, the number of scatterings at an angle smaller than 0.5° was computed and added to the number of observed interactions.

With this correction the total cross section is:

$$\sigma_T = 26.5 \pm 1.7 \text{ mb} .$$

The cross section for elastic scattering is about 6 mb.

PRODUCTION OF K^0 AND Λ^0 IN π^--p INTERACTIONS

155 V^0 events correlated with a π^--p interaction inside the chamber were analyzed so far. The identification of the events was done by using two different criteria:

(1) Computation of the Q-values for the different schemes $K^0 \rightarrow \pi^+ + \pi^-$, $\Lambda^0 \rightarrow \pi^- + p$, $\bar{\Lambda}^0 \rightarrow \pi^+ + \bar{p}$ and electron pairs.

(2) A best fit analysis (least squares with constraint) of different interpretations taking the origin into account.

The results are summarized in Table I.

Table I. The observed and corrected number of decays

	Λ^0	K^0	K^0 or Λ^0	K^0 or $\bar{\Lambda}^0$	Electron Pairs
Observed . . .	34	59	12	2	48
Corrected for charged decay outside of the visible region	52	87	18	3	
Produced . . .	91	275			

The first row shows the observed number of particles. In the second row a correction has been applied to take into account the lifetime of the particles and the finite available path length in the chamber for observation of the decay. This correction is computed for each observed event individually.

The third row contains the number of particles produced. This number has been calculated taking into account the neutral decays and the K_2^0 decays which are not observable. Also the 18 ambiguous Λ^0 or K^0 have been distributed in the Λ^0 and K^0, categories by a statistical method.

From the numbers one can calculate the cross sections for production in hydrogen of Λ^0 and K^0 which are $\sigma_{\Lambda^0} \simeq 1$ mb, $\sigma_{K^0} \simeq 3$ mb.

Clearly, the Λ^0 can have been produced as Σ^0.

In order to deduce from the results the cross section for production of (hyperon plus K) and of (K plus $\bar{K}$) one should also know the production cross section for $\Sigma^\pm$. Our analysis of charged decays has not yet progressed far enough for that.

DYNAMICS OF THE PRODUCTION IN THE π^--p CENTER OF MASS SYSTEM

Figs. 1, 2, 3 and 4 show the c.m.s. momentum spectrum and angular distribution for K^0 and Λ^0. The dot-

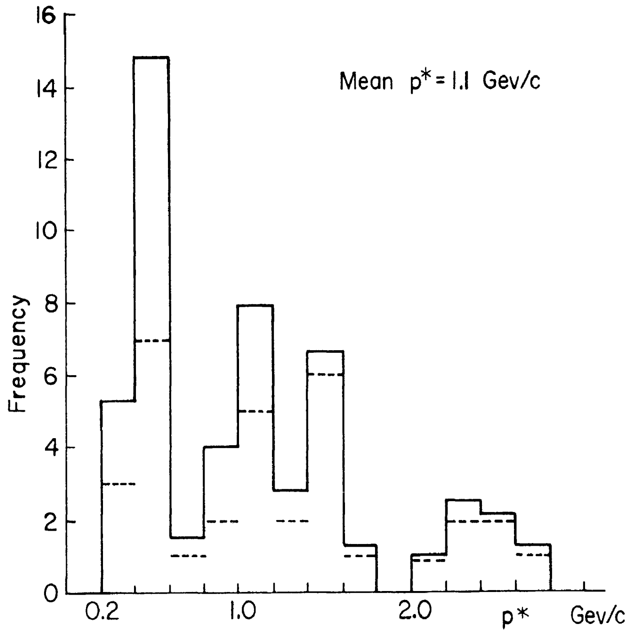

Fig. 1 The c.m.s. momentum distribution for the Λ^0.

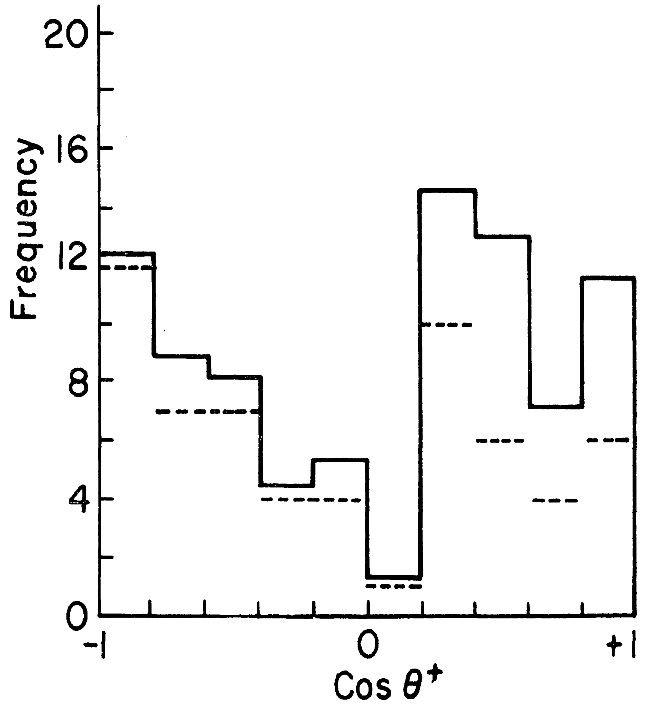

Fig. 3 The c.m.s. angular distribution for the K^0.

ted line indicates the number observed, the solid line the numbers after correction for the finite observable path.

The most striking feature is certainly the sharp peak in the backward direction for the Λ^0. It is clear that Λ^0 emitted more forward will have a larger energy in the lab system and escape detection more easily. However, one finds that the variation of detection probability between $\cos\theta^*_\Lambda = -0.9$ and, for instance, $\cos\theta^* = 0.6$ is not large enough to account for the observed effect, independent of the momentum of the Λ^0 in the c.m.s. Furthermore, if the distribution were anisotropic, but symmetric, we should have observed about 12 Λ^0 of high energies

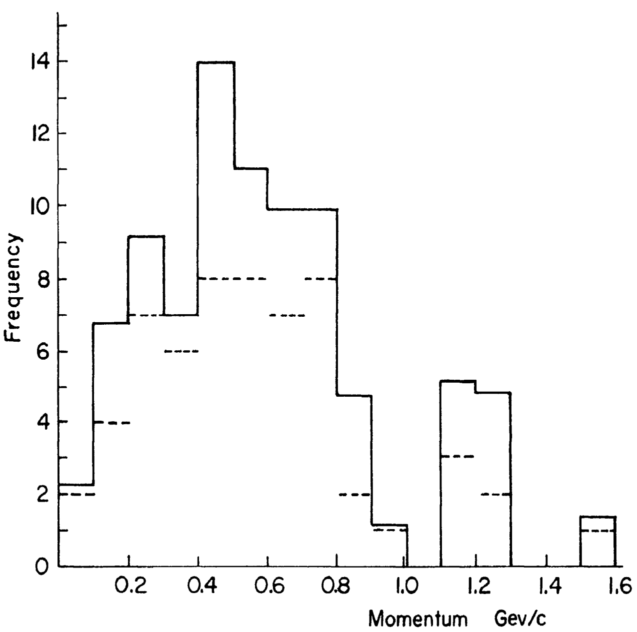

Fig. 2 The c.m.s. momentum distribution for the K^0.

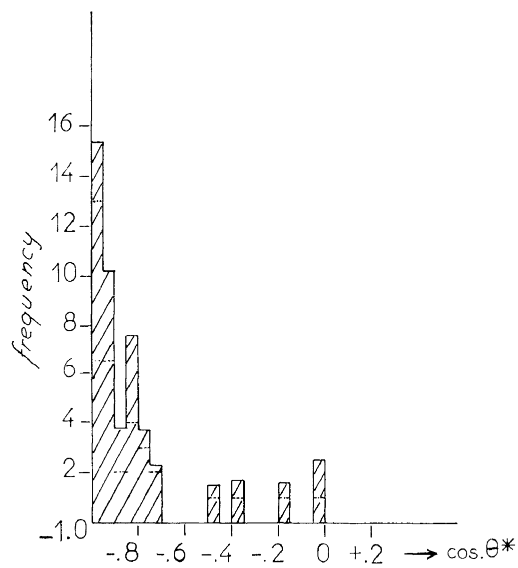

Fig. 4 The c.m.s. angular distribution for the Λ^0.

corresponding to the forward emission in the c.m.s. We have found none. Fig. 5 shows the angular distribution of the ambiguous Λ^0 or K^0 if all were Λ^0. It is seen that they could not greatly affect the distribution.

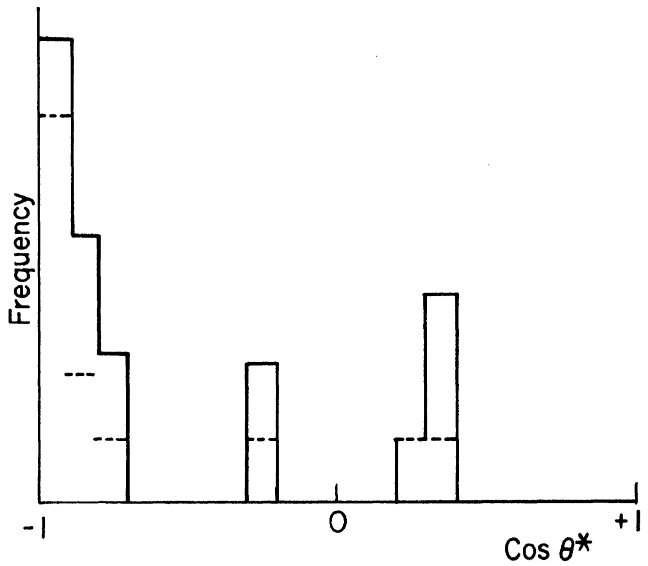

Fig. 5 The c.m.s. angular distribution for the ambiguous cases, if they all are Λ^0.

However, some more work on possible biases is needed before the effect can be considered as certainly established.

The backward peak of the Λ^0 particles can be understood if one assumes a simple and somewhat naive picture of high energy interactions. Since the production of $\overline{\Lambda^0}$ is small, the Λ^0 is made from the proton which, before the interaction, was traveling backward in the c.m.s. We have then to make the following assumption :

In most of the collisions the proton loses an appreciable fraction of its energy to produce mesons but continues more or less in the same direction in the c.m.s. We have also to assume that if among the mesons produced there is one K meson, the proton being transformed into a hyperon, the picture remains valid. Indeed preliminary results indicate that a backward peak is observed for hyperons and also for protons in ordinary collisions.

A symmetric peak in the forward direction would, on the contrary, correspond to a reversal of the momentum in the c.m.s.

It will be very interesting to repeat the same experiment for *p-p* interactions and to see if the same anisotropy exists. (Symmetry should of course exist in this case.) It will be also interesting to compare the rates of production of hyperons in *p-p* and *π-p* interactions.

OTHER RESULTS

So far, as shown in the Table, no certain case of $\overline{\Lambda^0}$ production has been found in hydrogen events. However, we have identified 7 $\overline{\Lambda^0}$ among the V^0's produced in the beam window. Four of them are very certain and in one case the proton makes an annihilation star, identified as such. Only 4Ξ^- were found so far among 4000 decays (neutral and charged), but the result should be checked for scanning efficiency.

DISCUSSION

SELOVE : You said that there were seven anti-lambda events. Were these in hydrogen?

PEYROU : No, all were produced in the beam window.

SELOVE : Were there any other anti-hyperons?

PEYROU : No, but the analysis of the charge decays is not complete.

VEKSLER : Was the transverse momentum of the Λ^0's measured?

PEYROU : The results are similar to those you obtained. The average is about 300 MeV/c.