ELECTRONICS EXPERIMENTS COMMITTEE

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Letter of Intent

An experiment on $\pi^- p \rightarrow (K\bar{K})^{\pm}\pi^{\mp} n$ using Omega

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We ask the EEC to consider an extension of one week of our presently finished experiment S116. This extension would be used to study a different process with the same trigger system, namely $\pi^- p \to (K\bar{K})^{\pm}\pi^{\mp} n$.

In the period 6 - 21 August 1974 we have taken the data of the experiment S116:

$$K^- p \to \bar{K}^0 \pi^+ \pi^- n \qquad (1)$$

(non-diffractively produced K^*). This experiment uses a topology trigger realized by two proportional chambers of two planes each. The first chamber is placed directly behind the target; the trigger requires two particles crossing it (the $\pi^+\pi^-$ of (1)). The second chamber, about 60 cm downstream of the first, must be hit by 4 particles (two more from $K^0_s \to \pi^+\pi^-$). During the tests and the experiment we found this topology trigger worked very well.

Data taking for reaction (1) does not saturate the Omega data taking system. We considered therefore running a different experiment, namely

$$\begin{aligned} \pi^- p &\to K^0 K^- \pi^+ n && (2) \\ &\to \bar{K}^0 K^+ \pi^- n && (3) \\ &\to K^0 \pi^+ \pi^- \Lambda && (4) \end{aligned}$$

in parallel with (1). After some tests done at the beginning of experiment S116 it turned out, however, that the two different experiments are not compatible. For (2), (3) and (4) identification of at least one of the two charged particles is essential. This can only be achieved by lowering the magnetic field of the Omega magnet since the full field in general sweeps these particles to the sides of the low pressure Cerenkov counter. While we were prepared to accept some loss of momentum resolution due to the lower field also for reaction (1) we could not accept the increased π^- trigger rate at the lower field. Taking data for a meaningful experiment on (2) to (4) under these conditions would have led to a substantial reduction of the time available for (1) and to a large analysis load.

During the run we have studied the nature of the π^- induced triggers and we have taken a number of trigger rate measurements using the counters existing around the Omega. In particular, requiring no hit in a cylindrical counter surrounding the H_2 target reduced the trigger rate by a factor 8. This veto counter suppresses events in which low energy particles go around the first chamber and hit the second one, thus simulating the 2-4 topology.

At the end of our period we worked about 15 hours at 2400 A (instead of 4800) in the Omega magnet. Using the veto counter mentioned, we found a trigger rate of about $4/10^5$ pions. Since this cylindrical counter around the target has an inside diameter of only 5 cm it produces a large bias; the angles of the charged particles with respect to the target axis have to be inside the solid angle of the downstream end of the cylinder seen from the production point.

We have, however, learnt from this run that the sample with the cylindrical veto counter contains about 35% of interesting events and that most of them are identified by the Cerenkov counter. We shall analyse a sample of these events to study their nature and to obtain the resolution at 2400 A magnet current.

For the proposed extension we would construct a veto counter around the target which would not limit the solid angle more than the size of the sensitive area of the first MWPC does. We would lose the events of reaction 4 when the Λ decays in the charged mode. With this larger veto counter the trigger rate may increase by, say, 50%. It is then still so low that the experiment would be very sensitive, with several thousand observed events per μb production cross-section in one week of running time.

$$\begin{aligned} \text{The channels } \pi^- p &\to K^0 K^- \pi^+ n \\ &\to \bar{K}^0 K^+ \pi^- n \end{aligned}$$

in this energy region (10 GeV/c) have not been studied at all so far (the required particle identification was not available for bubble chambers). Several resonances have been seen in $K\bar{K}\pi$, but almost exclusively in the multiparticle final state of $\bar{p}p$ annihilation. It would be interesting to see if these resonances, in particular the D and the E, are also produced in π^-p at high energy. Our few thousand events/μb sensitivity should be able to settle this question (the process is non-exotic). If the presently unknown production cross-section is a few μb we should be able to determine the unknown spin and parity of these objects.