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Proposal for a large statistics K^-p exposure at 8.25 GeV/c in the CERN 2 meter HBC

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This is a proposal for a 5×10^6 pictures exposure of the CERN 200 HBC to an R.F. separated K^- beam at 8.25 GeV/c. Assuming 12 beam tracks per picture, 1 meter fiducial length and a 10% μ-contamination, such an exposure will yield 180 events/μb and consequently bring to ∿200 ev/μb the total statistic available at this momentum[1].

In effect, we are essentially asking to transfer to the 200 HBC our already approved K^- exposure of 10^6 pictures (∿200 ev/μb) in BEBC[2]. This has become necessary because, due to a delay in the chamber operation, it is unlikely that any substantial fraction of our planned BEBC exposure will be obtained before the West Hall shut-down in 1975.

Exposure and Analysis

We intend to use the U5 beam ($\Delta p/p$ ∿0.2%, μ-contamination ∿10%) to provide the 200 HBC with a flux of 12 beam tracks per picture: such a flux being considered as suitable for the automatic measurement of the events. The choice of a chamber fiducial length of 1 meter allows the fast secondary tracks to be always long enough to ensure a momentum error $\delta p \lesssim 140$ MeV/c which is considered as necessary to isolate those events with one missing neutral from the multineutral ones[3]. The smaller dimensions of the 200 HBC, as compared to BEBC, affect appreciably the detection of the three-step (two-step) decay of the Ω (Ξ) particles; the resulting losses, however, are expected to be smaller than 30% and 20% for the Ω and Ξ respectively[5].

As in the original BEBC proposal[2], we plan to scan and measure, at first, only the events with at least one associated V^o decay, i.e.: 0.8×10^6 events. Each of the four groups will devote to this experiment a measurement capability of 10^5 events year: three groups are ready to start the measurements immediately, while the CERN group will only start in 1975. This being the case it will take us 2-3 years to complete the measurements and consequently the film taking could be spread over this period. However, to avoid further delays in this experiment, it would be desirable that a moderate amount of film (∿3×10^5 pictures) should be taken before the end of the U5 operation in August 1974.

Physics

The physics interest of this experiment has already been discussed, in some detail, in ref. 2, and we will here try to look at its relevance in the context of a coherent programme of K^-p exposures at P.S. energies.

Fig.1 shows an up to date summary[4] of the microbarn equivalent for the K^-p exposures done at CERN; one notices that only three exposures yield more than 50 ev/μb, i.e.: at 4.2, 14.3 and 16.0 Gev/c. The picture does not change substantially when one takes into account the largest exposures performed, up to now, in the U.S.A., i.e.: ∿30 ev/μb spread between 3.9, 4.6 and 5.0 GeV/c and ∿ 25 ev/μb at 7.3 GeV/c[5].

A first remark is that, although most of the known bosons are produced in the K^-p interactions, the statistics available above 5 GeV/c is generally not sufficient for a detailed study of the non-diffractive production mechanisms, because the production cross sections decrease rapidly as a function of p_{lab} $(p^{-2} \div p^{-3})$.

In the proposed experiment at 8.25 GeV/c we expect, for each reaction, a statistics comparable to that obtained by the ∿30 ev/μb BNL experiment[6], which has, up to now, produced the most significant results concerning the production of the strange and non-strange bosons at ∿4 GeV/c.

The comparison of these two set of results, taken at values of s which differ by almost a factor 2, should allow a better understanding of the production mechanism. Such a comparison can be particularly interesting for those final states such as $\Lambda\rho$, $\Lambda\omega$, $\Lambda\phi$ where the presence of the Λ facilitates an amplitude analysis of the reactions; an analysis of this kind has been performed by the BNL group[7] with ∿ 500 events per each final state, i.e. about half the number of events that we expect at 8.25 GeV/c.

Such a high statistics experiment will also permit a search for new boson states up to a mass of ∿ 2.4 GeV/c^2; therefore, as compared to the other high statistics experiment now in progress at 4.2 GeV/c^2[8], it

will extend well above 1.6-1.7 GeV/c^2 the mass region that can be investigated.

A search for Ξ^* will also be attempted up to a mass of $\sim$3 GeV/c^2. We expect 10'000 events of the type $K^-p \to \Xi^- K\, n\pi$ plus a comparable number of fitted events from the reaction $K^-p \to Y\bar{K}K\, n\pi$; with such a statistics we can attempt to improve the Ξ^* situation, especially in the mass region between 2 and 3 GeV/c^2 where 17 new Ξ states are predicted on the basis of SU(3).

Finally, we would like to mention that all the present knowledge of the Ω^- particles comes from 41 published events[9] from different K^-p bubble chamber exposure, and we expect that the proposed experiment will contribute 200 new Ω^- events.

References

1) At 8.25 GeV/c exist already 4.8×10^5 pictures taken, in the 200 HBC, by an Athens, Bologne, Liverpool, Vienna collaboration.

2) "Proposal for a large statistics K^-p exposure at 7 GeV/c in BEBC". CERN/TCC/71-25.

3) See for instance: B. French and L. Mandelli, ECFA Vol.I page 311 (1972).

4) R. Armenteros, CERN/TCC/73-50 updated to the 1.5.1974.

5) Both exposures have been done by the BNL group in the 80" chamber.

6) See for instance: M. Aguilar-Benitez et al., Phys.Rev. D4-2583 (1971). and BNL 16675 (1972).

7) See for instance: R.D. Field et al., BNL 17220 (1972).

8) CERN/TCC/71-27.

9) Compilation done by the ABCLV collaboration - Nucl.Phys. B61, 102 (1973).

Figure Caption

Fig.1 Compilation[4] of the microbarn equivalent for the K^- bubble chamber exposures done at CERN. The full lines correspond to exposures in hydrogen.

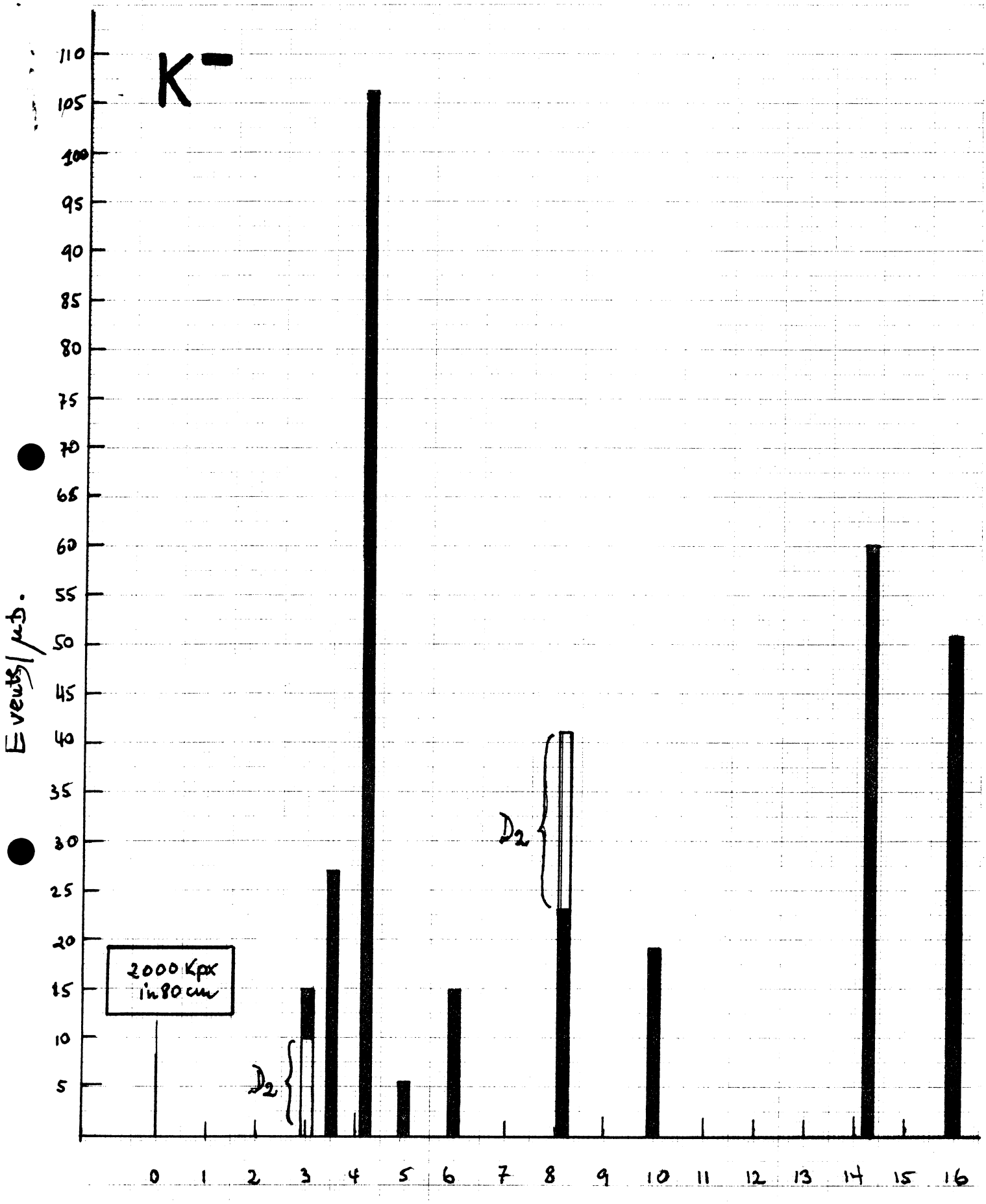
K⁻
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
Events/μb.
2000 Kpx
in 80 cm
D2
D2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Pc (Gev).

fig. 1