Proposal : π^-d ∿100 GeV 15' BC
Proposal : π^-d ∿360 GeV 15' BC
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PROPOSAL

TO STUDY ∿100 GeV π^-d INTERACTIONS IN CONJUNCTION WITH A CORRESPONDING $\bar{p}$d EXPOSURE; ALSO TO STUDY ∿360 GeV π^-d INTERACTIONS

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Abstract

We propose that the 15' BC flash be triggered also for those pulses where the beam contains only a π^- rather than only for the $\bar{p}$ required by the UCD proposal (P). For a modest Fermilab investment of film only over what is required for the $\bar{p}$d exposure, the π^- data will permit interesting $\bar{p}$d and π^-d comparisons under precisely the same experimental conditions. The statistics (∿2 to 4 times the $\bar{p}$d proposal of ∿150 Kpix yielding a comparable number of events) will be several times larger than previous 30" DBC exposures sofar at various Fermilab momenta. The 15' BC will permit also far better track measurement precision than the 30" hybrid systems over much of the central region in the πd CMS and far better detection of neutral particles, especially in the forward direction. Addition of an exposure at ∿360 GeV will permit as well, study of s dependent processes under the same experimental conditions and useful comparisons with existing ∿360 GeV π^-p data (E384).

Introduction. We point out here some of the interesting physics results which can be obtained at very little extra cost to Fermilab as a byproduct of the $\bar{p}d$ exposure of the 15' DBC proposed by the UCD group (R. Lander, spokesman); these $\bar{p}d$ exposures are themselves proposed to parasite on the $\overset{(-)}{\nu}d$ exposures planned for Fall 1977 in the 15' DBC, in multipulsing mode. The $\pi^- d$ film scanning and measuring could be done together with the $\bar{p}d$ frames on the same rolls and could be processed thru the same analysis system. (LBL Cicero (Cobweb), used for several previous Fermilab BC hadron experiments.)

Physics Justification. We make here only some preliminary remarks. Further details will be appended later in cooperation with the UCD group.

1. Comparison of $\pi^- d$ and $\bar{p}d$ at the same beam momenta ($\sim$100 GeV) and under the same experimental conditions

Such comparisons will yield interesting tests, for example, of quark model predictions of charge ratios ($\pi^-:\pi^o:\pi^+$) separately in the beam, central and target regions; of cluster model predictions of charge structure, particle-particle correlations, etc.; and in general of any detailed predictions of any serious model of high energy strong interactions.

2. Comparison of $\pi^- d$ with $\pi^- p$ at 360 GeV.

Again, tests can be made of various model predictions for comparison of neutron and proton targets with the same beam particle.

3. Study of s Dependence.

Analysis by the same group of $\sim$100 GeV and $\sim$360 GeV $\pi^- d$ data taken under the same experimental conditions (also of our 15 GeV $\pi^- d$ experiment, SLAC BC43) will permit direct analysis of s dependent processes. Among those of interest, which are specific to deuterium are

a) Coherent diffractive processes ($\pi \to A_1$, A_3, (etc?)). Are they really independent of s? In what sense? How does $\pi \to 5\pi$ depend on s? Is there significant $\pi \to 7\pi$ at high s?

b) Other coherent processes. Is there significant $\pi \to \pi\, \omega^o$ coherent production at high energies? What is its s dependence? Is it consistent with ω^o exchange? Are there other $\pi \to 2n\pi$ (G exchange) coherent processes?

c) Rescattering in the deuteron. Is the rescattering indeed energy dependent, i.e., a mixture of single-outgoing-particle-like (at high energies, low outgoing multiplicities) and cascade-like (at low energies and high outgoing multiplicities)? Detailed data under precisely controlled experimental conditions appears necessary to extract meaningful tests of Gottfried et al. vs Cascade models.

d) Other d effects. Does the apparent Δ-Δ component of the deuteron depend on s?

e) Neutral particles. Is forward and central production of $\pi^o(\gamma)$, K^o, Λ, $\bar{\Lambda}$ independent of p or d target? How does backward neutral production depend on target? Are various charged-neutral correlations (e.g. $\pi^+ - \Lambda^o$) target dependent? How is strangeness distributed and correlated along the multiperipheral chain, etc.?

Analysis and Priority. We propose to analyse this experiment, in close cooperation with the UCD group and with W. Michael of LBL, using the LBL Cicero system. (Cicero is a system improved from the cobweb system we used so successfully for E137 - π^-p 200 GeV, 30" HBC. We are currently using it again to help with the analysis of charged current events produced by $\bar{\nu}$ interactions

in the 15' BC filled with 2/3 Ne-1/3 H, E172.) We have in addition an image plane digitizer suitable for 15' BC measurements.

This experiment would have (for the UCB group) priority comparable to E89 (π^- light neon $\sim$360 GeV). We expect it will come after E172 measurements are finished. We would regard our contributions to measurement of E460 (triplet beam - 2 plane EMI - 15' heavy mix) and E383 (dichromatic ν and $\bar{\nu}$) as higher priority than this experiment, if they should happen to conflict. We hope to have sufficient support to get the competing measurements done fast enough not to conflict significantly.

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