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RECENT RESULTS IN CHARM DECAYS FROM MARK III*

Jonathan F. Labs
Stanford Linear Accelerator Center,
Stanford University, Stanford, CA 94309 USA
Representing the
Mark III Collaboration

ABSTRACT

Measurements of $D^0 \to \bar{K^0}\,\pi^0$, $\bar{K^0}\,\eta$ and $\bar{K^0}\,\eta'$ are reported. Preliminary results of a search for the doubly Cabibbo-suppressed decays $D^+ \to K^+\,\pi^-\,\pi^+$ and $K^+\,\pi^0$ are also given. Both analyses used $9.3 \pm 0.47\mathrm{pb}^{-1}$ of data collected near the $\psi(3770)$ at SPEAR.

ANALYSIS OF $D^0 \to \bar{K^0}\,\pi^0$, $\bar{K^0}\,\eta$ AND $\bar{K^0}\,\eta'$

The decays, $D^0 \to \bar{K^0}\,\pi^0$, $\bar{K^0}\,\eta$ and $\bar{K^0}\,\eta'$ are interesting first in that they are color-suppressed. Secondly, the standard spectator diagrams only produce $\bar{K^0}\,\eta$ and $\bar{K^0}\,\eta'$ through non-$s\bar{s}$ components in their wave functions; hence they should be produced with roughly equal strength. Non-spectator processes, such as W-exchange or final state interactions, can generate these channels via the $s\bar{s}$ components; these processes would cause an excess of $\bar{K^0}\,\eta'$ over $\bar{K^0}\,\eta$.[1]

Table I.[2]

Mode	ARGUS	CLEO	MARKIII
$D^0 \to \bar{K^0}\,\pi^0$	$1.7 \pm 0.4 \pm 0.3$	$2.3 \pm 0.4 \pm 0.5$	$1.8 \pm 0.2 \pm 0.2$
$D^0 \to \bar{K^0}\,\eta$	$1.4 \pm 0.5 \pm 0.3$		$1.6 \pm 0.6 \pm 0.4$
$D^0 \to \bar{K^0}\,\eta'$	$1.9 \pm 0.4 \pm 0.3$		$3.3 \pm 0.3 \pm 1.0$

Table 1. lists our measurements for each of these channels, together with ARGUS and CLEO measurements. None of the color-suppressed channels are greatly suppressed. Taking the Mark III and Argus numbers, the ratio $\mathrm{BR}(D^0 \to \bar{K^0}\,\eta')/\mathrm{BR}(D^0 \to \bar{K^0}\,\eta)$ is found to be 1.8 ± 0.5 (weighted average). Factoring out the phase space contributions, the ratio of matrix elements squared is 2.5 ± 0.7. That this number deviates from unity is an indication that non-spectator processes may play a role in hadronic charm decays.

ANALYSIS OF DOUBLY CABIBBO-SUPPRESSED DECAYS

Naively, the spectator model predicts doubly Cabibbo-suppressed decays (DCSD) to be suppressed relative to Cabibbo-allowed decays (CAD) by a factor of $(\rho^2 \simeq 1)\tan^4\theta_C$. Weak decay phenomenology, however, predicts $\rho^2 > 1$ for many DCSD channels.[3] The D^+ DCSD are interesting first because $\rho^2 \gg 1$ is predicted. This enhancement arises from Pauli interference

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affecting CAD's but not DCSD's. Secondly, the D^+ DCSD produce unique final states, unlike the D^0 DCSD which generate final states identical to those produced by $D^0\bar{D}^0$ mixing. Reported here are the *preliminary* results of the first search for $D^+ \to K^+\pi^-\pi^+$ and $K^+\pi^0$.

For the $K^+\pi^-\pi^+$ analysis, proper track selection and anti-background requirements are first imposed. A scatter plot of the invariant mass vs. beam constrained mass is then formed from the resulting $K^+\pi^-\pi^+$ candidates. The beam constrained mass depends upon the correct track combination, while the invariant mass requires the right particle identification. Figure 1 shows the resulting plot where three events remain in the signal region. Monte Carlo studies estimate the background to be $0.8 \pm 0.3 \pm 0.3$ events in the signal region. The calculation of Ref. 3 predicts the number of expected events to be between 0.5 and 0.8.

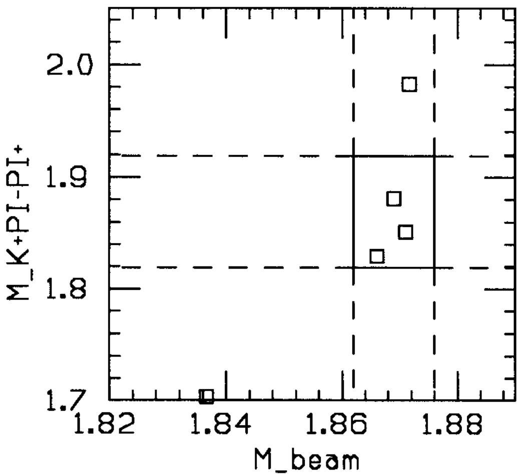

Fig. 1. $D^+ \to K^+\pi^-\pi^+$ candidates.

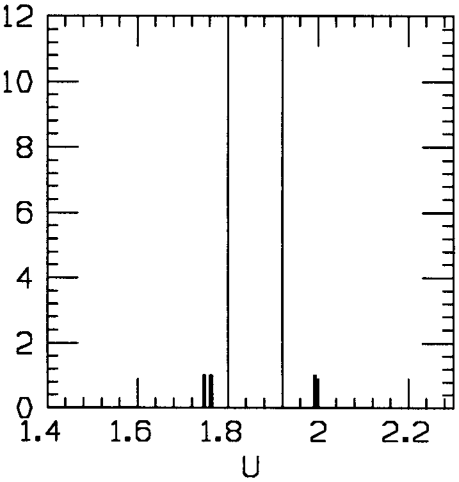

Fig. 2. $D^+ \to K^+\pi^0$ candidates.

For the $K^+\pi^0$ analysis, proper track selection and anti-background requirements are imposed. A histogram of $U \equiv P^{\mu}_{recoil}P_{K\mu}$ is then made from the resulting $K^+\pi^0$ candidates. The U variable depends upon the correct track identification of the charged track. Figure 2 shows the resulting plot with no events remaining in the signal region. Monte Carlo studies estimate the level of background to be < 0.2 at 90% CL. The number of real events expected[3] is ~ 0.2.

A previous analysis of $D^0\bar{D}^0$ mixing and D^0 DCSD suggests that ρ^2 for the D^0 is larger than theoretical predictions[4]. The results for $D^+ \to K^+\pi^-\pi^+$ suggests a similar trend in the D^+ DCSD.

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