RAPID COMMUNICATIONS

PHYSICAL REVIEW D **73,** 051105(R) (2006)

Measurement of CP observables for the decays $B^{\pm} \rightarrow D^{0}_{CP}K^{\pm}$

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1550-7998/2006/73(5)/051105(8)$23.00

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(Received 27 December 2005; published 15 March 2006)

We present a study of the decay $B^- \to D^0_{(CP)} K^-$ and its charge conjugate, where $D^0_{(CP)}$ is reconstructed in CP-even, CP-odd, and non-CP flavor eigenstates, based on a sample of 232×10^6 $\Upsilon(4S) \to B\bar{B}$ decays collected with the *BABAR* detector at the PEP-II e^+e^- storage ring. We measure the partial-rate charge asymmetries $A_{CP\pm}$ and the ratios $R_{CP\pm}$ of the $B \to D^0 K$ decay branching fractions as measured in $CP\pm$ and non-CP D^0 decays: $A_{CP+} = 0.35 \pm 0.13(\text{stat}) \pm 0.04(\text{syst})$, $A_{CP-} = -0.06 \pm 0.13(\text{stat}) \pm 0.04(\text{syst})$, $R_{CP+} = 0.90 \pm 0.12(\text{stat}) \pm 0.04(\text{syst})$, and $R_{CP-} = 0.86 \pm 0.10(\text{stat}) \pm 0.05(\text{syst})$.

DOI: 10.1103/PhysRevD.73.051105 PACS numbers: 11.30.Er, 13.25.Hw, 14.40.Nd

A theoretically clean measurement of the angle $\gamma = \arg(-V_{ud}V^*_{ub}/V_{cd}V^*_{cb})$ of the Cabibbo-Kobayashi-Maskawa matrix V can be obtained from the study of $B^- \to D^{(*)0}K^{(*)-}$ decays [1] by exploiting the interference between the $b \to c\bar{u}s$ and $b \to u\bar{c}s$ decay amplitudes [2,3]. Among the proposed methods, the one originally suggested by Gronau, London, and Wyler (GLW) exploits the interference between $B^- \to D^0K^-$ and $B^- \to \bar{D}^0K^-$ when the D^0 and $\bar{D}^0$ mesons decay to the same CP eigenstate.

The results of the GLW analyses are usually expressed in terms of the ratios $R_{CP\pm}$ of charge-averaged partial rates and of the partial-rate charge asymmetries $A_{CP\pm}$,

$$R_{CP\pm} = \frac{\Gamma(B^- \to D^0_{CP\pm}K^-) + \Gamma(B^+ \to D^0_{CP\pm}K^+)}{[\Gamma(B^- \to D^0K^-) + \Gamma(B^+ \to \bar{D}^0K^+)]/2}, \quad (1)$$

$$A_{CP\pm} = \frac{\Gamma(B^- \to D^0_{CP\pm}K^-) - \Gamma(B^+ \to D^0_{CP\pm}K^+)}{\Gamma(B^- \to D^0_{CP\pm}K^-) + \Gamma(B^+ \to D^0_{CP\pm}K^+)}. \quad (2)$$

Here, $D^0_{CP\pm} = (D^0 \pm \bar{D}^0)/\sqrt{2}$ are the CP eigenstates of the neutral D meson system, and we have followed the notation used in [4]. Neglecting $D^0 - \bar{D}^0$ mixing [5], the observables $R_{CP\pm}$ and $A_{CP\pm}$ are related to the angle γ, the magnitude r of the ratio of the amplitudes for the processes $B^- \to \bar{D}^0K^-$ and $B^- \to D^0K^-$, and the relative strong phase δ between these two amplitudes, through the relations $R_{CP\pm} = 1 + r^2 \pm 2r\cos\delta\cos\gamma$ and $A_{CP\pm} = \pm 2r\sin\delta\sin\gamma/R_{CP\pm}$ [2]. Theoretical expectations for r are in the range ≈ 0.1–0.2 [2,6], in agreement with the 90% C.L. upper limits on r set by *BABAR* ($r < 0.23$) and Belle ($r < 0.18$) through the study of $B^- \to DK^-$, $D \to K^+\pi^-$ decays [7].

In this paper we present the measurements of $R_{CP\pm}$ and $A_{CP\pm}$. The ratios $R_{CP\pm}$ are computed using the relations $R_{CP\pm} \approx R_\pm/R$, where the quantities $R_{(\pm)}$ are defined as

$$R_{(\pm)} = \frac{\mathcal{B}(B^- \to D^0_{(CP\pm)}K^-) + \mathcal{B}(B^+ \to \bar{D}^0_{(CP\pm)}K^+)}{\mathcal{B}(B^- \to D^0_{(CP\pm)}\pi^-) + \mathcal{B}(B^+ \to \bar{D}^0_{(CP\pm)}\pi^+)}. \quad (3)$$

Several systematic uncertainties cancel out in the measurement of these double ratios. We also express the CP-sensitive observables in terms of three independent quantities:

$$x_\pm = \frac{R_{CP+}(1 \mp A_{CP+}) - R_{CP-}(1 \mp A_{CP-})}{4}, \quad (4)$$

$$r^2 = x^2_\pm + y^2_\pm = \frac{R_{CP+} + R_{CP-} - 2}{2}, \quad (5)$$

where $x_\pm = r\cos(\delta \pm \gamma)$ and $y_\pm = r\sin(\delta \pm \gamma)$ are the same CP parameters as were measured by the *BABAR* Collaboration with $B^- \to DK^-$, $D \to K^0_S\pi^-\pi^+$ decays [8]. This choice allows the results of the two measurements to be expressed in a consistent manner.

The measurements use a sample of 232 million $\Upsilon(4S)$ decays into $B\bar{B}$ pairs collected with the *BABAR* detector at the PEP-II asymmetric-energy B factory. Since the *BABAR* detector is described in detail elsewhere [9], only the components that are crucial to this analysis are summarized here. Charged-particle tracking is provided by a five-layer silicon vertex tracker (SVT) and a 40-layer drift chamber (DCH). For charged-particle identification, ionization energy loss in the DCH and SVT, and Cherenkov radiation detected in a ring-imaging device (DIRC) are used. Photons are identified by the electromagnetic calorimeter (EMC), which comprises 6580 thallium-doped CsI crystals. These systems are mounted inside a 1.5-T solenoidal superconducting magnet. We use the GEANT [10] software to simulate interactions of particles traversing the detector, taking into account the varying accelerator and detector conditions.

We reconstruct $B^- \to D^0h^-$ decays, where the prompt track h^- is a kaon or a pion. D^0 candidates are reconstructed in the CP-even eigenstates $\pi^-\pi^+$ and K^-K^+ (D^0_{CP+}), in the CP-odd eigenstates $K^0_S\pi^0$, $K^0_S\phi$ and $K^0_S\omega$ (D^0_{CP-}), and in the non-CP, flavor eigenstate $K^-\pi^+$. ϕ candidates are reconstructed in the K^-K^+ channel and ω candidates in the $\pi^-\pi^+\pi^0$ channel. We optimize our event selection to minimize the statistical error on the $B^- \to D^0_{(CP)}K^-$ signal yield, determined for each D^0 decay channel using simulated signal and background events.

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The prompt particle h is required to have a momentum greater than 1.4 GeV$/c$ and the number of photons associated to its Cherenkov ring is required to be greater than four to improve the quality of the reconstruction. We reject a candidate track if its Cherenkov angle does not agree within 4 standard deviations (σ) with either the pion or kaon hypothesis, or if it is identified as an electron by the DCH and the EMC. Particle identification (PID) information from the drift chamber and, when available, from the DIRC, must be consistent with the kaon hypothesis for the K meson candidate in $D^0 \rightarrow K^-\pi^+$, $D^0 \rightarrow K^-K^+$, and $\phi \rightarrow K^-K^+$ decays and with the pion hypothesis for the $\pi^{\pm}$ meson candidates in $D^0 \rightarrow \pi^-\pi^+$ and $\omega \rightarrow \pi^+\pi^-\pi^0$ decays.

Neutral pions are reconstructed by combining pairs of photon candidates with energy deposits larger than 70 MeV that are not matched to charged tracks. The $\gamma\gamma$ invariant mass is required to be in the range 115–150 MeV$/c^2$ and the total π^0 energy must be greater than 200 MeV. To improve momentum resolution, the invariant mass of the two photons from candidate π^0's used in the B meson reconstruction is constrained to the nominal π^0 mass [11].

Neutral kaons are reconstructed from pairs of oppositely charged tracks with invariant mass within 7.8 MeV$/c^2$ ($\sim 3\sigma$) of the nominal K^0 mass. We also require that the ratio between the flight length in the plane transverse to the beam direction and its error be greater than 2. The ϕ mesons are reconstructed from two oppositely charged kaons with invariant mass in the range $1.008 < M(K^+K^-) < 1.032$ GeV$/c^2$. We also require $|\cos\theta_{\rm hel}(\phi)| > 0.4$, where $\theta_{\rm hel}(\phi)$ is the angle between the flight direction of one of the ϕ daughters and the D^0 flight direction, in the ϕ rest frame. The ω mesons are reconstructed from $\pi^+\pi^-\pi^0$ combinations with invariant mass in the range $0.763 < M(\pi^+\pi^-\pi^0) < 0.799$ GeV$/c^2$. We define θ_N as the angle between the normal to the ω decay plane and the D^0 momentum in the ω rest frame, and $\theta_{\pi\pi}$ as the angle between the flight direction of one of the three pions in the ω rest frame and the flight direction of one of the other two pions in their center-of-mass (CM) frame. The quantities $\cos\theta_N$ and $\cos\theta_{\pi\pi}$ follow $\cos^2\theta_N$ and $\sin^2\theta_{\pi\pi}$ distributions for the signal and are almost flat for wrongly reconstructed or false ω candidates. We require the product $\cos^2\theta_N\sin^2\theta_{\pi\pi} > 0.08$. The invariant mass of a D^0 candidate, $M(D^0)$, must be within 2.5σ of the mean fitted mass, with resolution σ ranging from 4 to 20 MeV$/c^2$ depending on the D^0 decay mode. For $D^0 \rightarrow \pi^-\pi^+$, the invariant mass of the $(h^-\pi^+)$ system, where π^+ is the pion from D^0, and h^- is the prompt track from B^- taken with the kaon mass hypothesis, must be greater than 1.9 GeV$/c^2$ to reject background from $B^- \rightarrow D^0\pi^-$, $D^0 \rightarrow K^-\pi^+$ and $B^- \rightarrow K^{*0}\pi^-$, $K^{*0} \rightarrow K^-\pi^+$ decays. To improve the D^0 momentum resolution, for all the D^0 decay channels the candidate invariant mass is constrained to the nominal D^0 mass [11].

We reconstruct B meson candidates by combining a D^0 candidate with a track h. For the $D^0 \rightarrow K^-\pi^+$ mode, the charge of the track h must match that of the kaon from the D^0 meson decay. We select B meson candidates using the beam-energy-substituted mass $m_{\rm ES} = \sqrt{(E_i^{*2}/2 + \mathbf{p}_i \cdot \mathbf{p}_B)^2/E_i^2 - p_B^2}$ and the energy difference $\Delta E = E_B^* - E_i^*/2$, where the subscripts i and B refer to the initial e^+e^- system and the B candidate, respectively, and the asterisk denotes the CM [$\Upsilon(4S)$] frame. The $m_{\rm ES}$ distributions for $B^- \rightarrow D^0h^-$ signals are Gaussian functions centered at the B mass with a resolution of 2.6 MeV$/c^2$, which do not depend on the decay mode or on the nature of the prompt track. In contrast, the ΔE distributions depend on the mass assigned to the prompt track and on the D^0 momentum resolution. We evaluate ΔE with the kaon mass hypothesis so that the distributions are Gaussian and centered near zero for $B^- \rightarrow D^0K^-$ events and shifted by approximately 50 MeV for $B^- \rightarrow D^0\pi^-$ events. The $B^- \rightarrow D^0K^-$ ΔE resolution is about 17 MeV for all the D^0 decay modes. All B candidates are selected with $m_{\rm ES}$ within 3σ of the mean value and with ΔE in the range $-0.16 < \Delta E < 0.23$ GeV.

To reduce background from continuum production of light quarks, we construct a linear Fisher discriminant [12] based on the following quantities: (i) $L_0 = \sum_i p_i$ and $L_2 = \sum_i p_i \cos^2\theta_i$, evaluated in the CM frame, where p_i is the momentum, and θ_i is the angle with respect to the thrust axis of the B candidate of charged tracks and neutral clusters not used to reconstruct the B; (ii) $|\cos\theta_T|$, where θ_T is the angle between the thrust axes of the B candidate and of the remaining tracks and clusters, evaluated in the CM frame; (iii) $|\cos\theta_B|$, where θ_B is the polar angle of the B candidate in the CM frame.

For events with multiple $B^- \rightarrow D^0h^-$ candidates (1%–7% of the selected events, depending on the D^0 decay mode), we choose that with the smallest χ^2 formed from the differences of the measured and true masses of the candidate B, D^0, π^0 (only for $D^0 \rightarrow K^0_S\pi^0, K^0_S\omega$), $\phi(D^0 \rightarrow K^0_S\phi)$, $\omega(D^0 \rightarrow K^0_S\omega)$, scaled by the mass spread. The total reconstruction efficiencies, based on simulated signal events, are 39% ($K^-\pi^+$), 31% (K^-K^+), 30% ($\pi^-\pi^+$), 17% ($K^0_S\pi^0$), 20% ($K^0_S\phi$), and 7% ($K^0_S\omega$).

The main contributions to the background from $B\bar{B}$ events come from the processes $B \rightarrow D^*h$ ($h = \pi, K$), $B^- \rightarrow D^0\rho^-$, misreconstructed $B^- \rightarrow D^0h^-$, and from charmless B decays to the same final state as the signal: for instance, the process $B^- \rightarrow K^-K^+K^-$ is a background for $B^- \rightarrow D^0K^-$, $D^0 \rightarrow K^-K^+$. These charmless backgrounds have similar ΔE and $m_{\rm ES}$ distribution as the D^0K^- signal and we call them "peaking $B\bar{B}$ backgrounds."

For each D^0 decay mode an extended unbinned maximum likelihood fit to the selected data events determines yields for two signal channels, $B^- \rightarrow D^0\pi^-$ and $B^- \rightarrow D^0K^-$, and four kinds of backgrounds: candidates selected either from continuum or from $B\bar{B}$ events, in which the prompt track is either a pion or a kaon.

The fit uses as input ΔE and a particle identification probability for the prompt track based on the Cherenkov angle θ_C, the momentum p, and the polar angle θ of the track.

The extended likelihood function $\mathcal{L}$ is defined as

$$\mathcal{L} = \exp\left(-\sum_{i=1}^{6} n_i\right)\prod_{j=1}^{N}\left[\sum_{i=1}^{6} n_i \mathcal{P}_i(\vec{x}_j;\vec{\alpha}_i)\right], \qquad (6)$$

where N is the total number of observed events and n_i is the yield of the ith event category. The six functions $\mathcal{P}_i(\vec{x}_j;\vec{\alpha}_i)$ are the probability density functions (PDFs) for the variables $\vec{x}_j$, given the set of parameters $\vec{\alpha}_i$. They are evaluated as a product $\mathcal{P}_i = \mathcal{P}_{1i}(\Delta E) \times \mathcal{P}_{2i}(\theta_C)$.

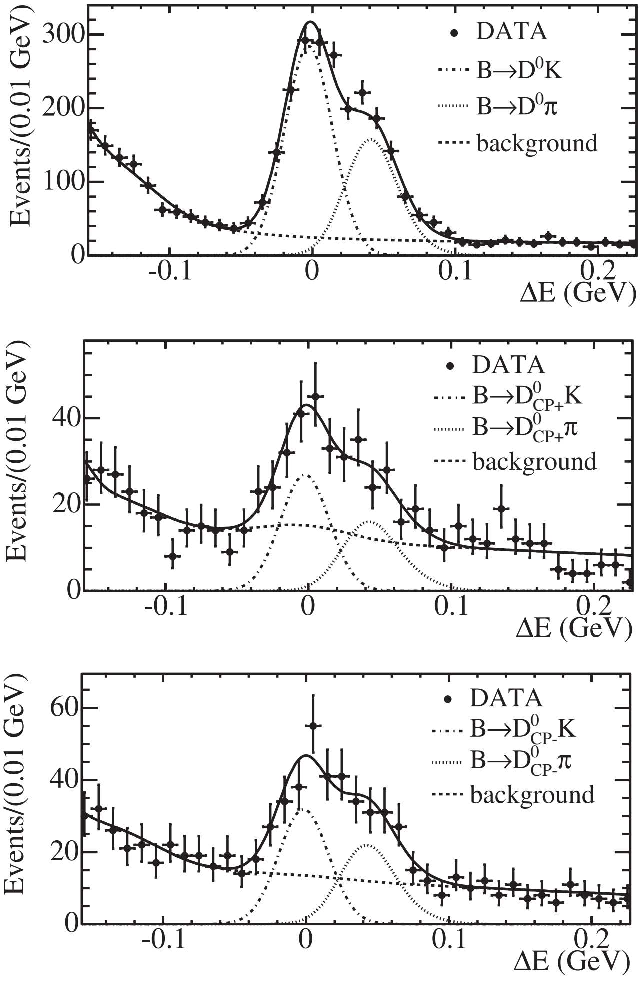

FIG. 1. Distributions of ΔE for events enhanced in the $B \to D^0 K$ signal. Top: $B^- \to D^0 K^-$, $D^0 \to K^-\pi^+$; middle: $B^- \to D^0_{CP+}K^-$; bottom: $B^- \to D^0_{CP-}K^-$. Solid curves represent projections of the maximum likelihood fit; dashed, dash-dotted and dotted curves represent the $B \to D^0 K$, $B \to D^0\pi$ and background contributions.

TABLE I. Yields from the maximum likelihood fit. The quoted uncertainties are statistical.

D^0 mode	$N(D\pi^+)$	$N(D\pi^-)$	$N(DK^+)$	$N(DK^-)$
$K^-\pi^+$	8151 ± 95	7899 ± 93	649 ± 29	611 ± 28
K^-K^+	705 ± 28	690 ± 28	26 ± 9	70 ± 10
$\pi^-\pi^+$	256 ± 18	219 ± 17	18 ± 7	17 ± 7
$K^0_S\pi^0$	707 ± 29	677 ± 29	39 ± 9	42 ± 9
$K^0_S\phi$	176 ± 14	157 ± 13	15 ± 5	13 ± 4
$K^0_S\omega$	235 ± 17	230 ± 17	25 ± 7	14 ± 6

The ΔE distribution for $B^- \to D^0 K^-$ signal events is parametrized with a Gaussian function. The ΔE distribution for $B^- \to D^0\pi^-$ is parametrized with the same Gaussian function used for $B^- \to D^0 K^-$ with an additional shift, computed event by event as a function of the prompt track momentum, arising from the wrong mass assignment to the prompt track. The offset and width of the Gaussian functions are determined from data together with the yields.

The ΔE distribution for the continuum background is parametrized with a linear function whose slope is determined from off-resonance data. The ΔE distribution for the nonpeaking $B\bar{B}$ background is empirically parametrized with the sum of a Gaussian function and an exponential function when the prompt track is a pion, and with an exponential function when the prompt track is a kaon. The parameters are determined from simulated events. The ΔE distribution for the peaking charmless $B\bar{B}$ background is parametrized with the same Gaussian function used for the $B^- \to D^0 K^-$ signal. The yield of the $B\bar{B}$ peaking background is estimated from the sidebands of the D^0 invariant mass distribution and fixed in the fit.

The parametrization of the particle identification PDF is performed by fitting with two Gaussian functions the background-subtracted distribution of the difference between the reconstructed and expected Cherenkov angles of kaon and pion samples. The parametrization is performed as a function of the momentum and polar angle of the track. Pions and kaons are selected from a pure $D^{*+} \to D^0\pi^+$, $D^0 \to K^-\pi^+$ control sample.

The results of the fit are summarized in Table I. Figure 1 shows the distributions of ΔE for the $K^-\pi^+$, $CP+$ and $CP-$ modes after enhancing the $B \to D^0 K$ purity by requiring that the prompt track be consistent with the kaon hypothesis. The total PDF, normalized by the fitted signal

TABLE II. Measured ratios $R_{CP\pm}$ and $A_{CP\pm}$ for CP-even and CP-odd D decay modes. The first error is statistical, the second is systematic. R_{CP-} and A_{CP-} are corrected for the CP-even dilution described in the text.

D^0 mode	R_{CP}	A_{CP}
$CP+$	$0.90 \pm 0.12 \pm 0.04$	$0.35 \pm 0.13 \pm 0.04$
$CP-$	$0.86 \pm 0.10 \pm 0.05$	$-0.06 \pm 0.13 \pm 0.04$

and background yields, integrated over the Cherenkov angle variable and modified to take into account the tighter selection criteria, is overlaid in the figure.

The ratios $R_{CP\pm}$ are computed for the five CP modes using the relations in Eq. (3). A number of systematic uncertainties, as the uncertainty associated to the tracking efficiency and the uncertainty on the D^0 decay branching fractions, cancel out in the measurement of the double ratio. The relations $R_{CP\pm} = R_{\pm}/R$ hold neglecting the magnitude r_π of the ratio of the amplitudes of the $B^- \to \bar{D}^0\pi^-$ and $B^- \to D^0\pi^-$ processes [6] ($r_\pi \sim r\frac{\lambda^2}{1-\lambda^2} \lesssim 0.012$, where $\lambda \approx 0.22$ [11] is the sine of the Cabibbo angle). This assumption is considered further when we discuss the systematic uncertainties. The quantities $R_{\pm}/R$ are computed from the ratios of the $B \to DK$ and $B \to D\pi$ yields in Table I, scaled by correction factors taking into account small differences in the selection efficiency between $B \to DK$ and $B \to D\pi$. These correction factors are evaluated from simulated events and range between 0.982 ± 0.018 and 1.020 ± 0.031 depending on the D^0 decay mode. The results for the CP-even and CP-odd combinations are listed in Table II.

The partial-rate charge asymmetries $A_{CP\pm}$ are calculated from the measured yields of positive and negative $B \to DK$ decays in Table I. The results for the CP-even and CP-odd combinations are reported in Table II.

In the case of $D^0 \to K^0_S\phi$, $\phi \to K^+K^-$, and $D^0 \to K^0_S\omega$, $\omega \to \pi^+\pi^-\pi^0$, the values of R_{CP-} and A_{CP-} quoted in Table II are obtained after correcting the measured values to take into account the dilution from a CP-even background arising from $B^- \to D^0h^-$, $D^0 \to K^0_S(K^-K^+)_{\text{non-}\phi}$ and $D^0 \to K^0_S(\pi^-\pi^+\pi^0)_{\text{non-}\omega}$ decays. For the $K^0_S\phi$ channel we exploit the investigation performed by *BABAR* of the $D^0 \to K^0_SK^+K^-$ Dalitz plot [13] to estimate the level of the CP-even background (0.160 ± 0.006 relative to the $K^0_S\phi$ signal) and the corresponding R_{CP-} and A_{CP-} dilution. For the $K^0_S\omega$ channel there is little information on this background. We estimate the amount of $D^0 \to K^0_S(\pi^+\pi^-\pi^0)_{\text{non-}\omega}$ background (0.25 ± 0.05 relative to the $K^0_S\omega$ signal) from the $\cos\theta_N$ distribution of $B^- \to D^0\pi^-$, $D^0 \to K^0_S\pi^+\pi^-\pi^0$ candidates, and assume the CP-even content of this background to be $(50 \pm 29)\%$.

Systematic uncertainties in the ratios $R_{CP\pm}$ and in the CP asymmetries $A_{CP\pm}$ are listed in Table III. They arise both from the uncertainties on the signal yields, extracted through the unbinned maximum likelihood fit, and from the assumptions used to compute $R_{CP\pm}$ and $A_{CP\pm}$. The correlations between the different sources of systematic errors, when non-negligible, are considered when combining the two CP-even or the three CP-odd modes.

The uncertainties on the fitted signal yields are due to the imperfect knowledge of the ΔE and PID PDFs and of the peaking background yields, and are evaluated by varying the parameters of the PDFs and the peaking background yields by $\pm 1\sigma$ and taking the difference in the signal yields. The uncertainties in the branching fractions used in the simulation of the B decays that contribute to the $B\bar{B}$ background are also taken into account. The yields of the $B\bar{B}$ and continuum backgrounds found in data are consistent with what is expected from the simulation. In the $K^0_S\phi$ and $K^0_S\omega$ channels we also take into account the uncertainties in the dilution factors due to the imperfect knowledge of the levels of the CP-even backgrounds from $B^- \to D^0K^-$, $D^0 \to K^0_S(K^-K^+)_{\text{non-}\phi}$ and $D^0 \to K^0_S(\pi^-\pi^+\pi^0)_{\text{non-}\omega}$ decays.

A possible bias in the measured $A_{CP\pm}$ may come from an intrinsic detector charge asymmetry due to asymmetries in acceptance or tracking and particle identification efficiencies. An upper limit on this bias has been obtained from the measured asymmetries in the processes $B^- \to D^0h^-$, $D^0 \to K^-\pi^+$ and $B^- \to D^0_{CP\pm}\pi^-$, where CP violation is expected to be negligible. From the average asymmetry, $(-1.8 \pm 0.9)\%$, we obtain the limit $\pm 2.7\%$ for the bias. This has been added in quadrature to the total systematic uncertainty on the CP asymmetry.

For the branching fraction ratios $R_{CP\pm}$ two additional sources of uncertainty are the correction factors used to scale the yield ratios, and the assumption that $R_{CP\pm} = R_{\pm}/R$. The scaling factor, estimated from simulated events, is a double ratio of efficiencies, $\varepsilon^{K/\pi}_{\pm}/\varepsilon^{K/\pi}$, where

TABLE III. Systematic uncertainties on the observables $R_{CP\pm}$ and $A_{CP\pm}$ after combination of the two CP-even and the three CP-odd D^0 decay modes.

Source	ΔR_{CP+} (%)	ΔR_{CP-} (%)	ΔA_{CP+} (%)	ΔA_{CP-} (%)
Background ΔE PDF	1.3	1.1	1.1	0.4
PID PDF	0.1	0.1	0.2	0.2
Peaking background yields	3.0	4.2	2.6	2.2
Opposite-CP background	···	1.3	···	1.0
Detector charge asymmetry	···	···	2.7	2.7
$\varepsilon^{K/\pi}_{\pm}/\varepsilon^{K/\pi}$	1.0	1.1	···	···
r_π	2.2	2.1	···	···
Total	4.1	5.1	3.9	3.7

$\varepsilon^{K/\pi}_{(\pm)}$ denotes the ratio between the selection efficiencies of $B \to D^0_{(CP\pm)}K$ and $B \to D^0_{(CP\pm)}\pi$. In the double ratio the systematic uncertainties arising from possible discrepancies between data and simulation are negligible, and only the contribution from the limited statistics of the simulated samples remains. The assumption $R_{CP\pm} = R_\pm/R$ introduces a relative uncertainty $\pm 2r_\pi \cos\delta_\pi \cos\gamma$ on $R_{CP\pm}$, where δ_π is the relative strong phase between the amplitudes $A(B^- \to \bar{D}^0\pi^-)$ and $A(B^- \to D^0\pi^-)$. Since $|\cos\delta_\pi \cos\gamma| \leq 1$ and $r_\pi \lesssim 0.012$, we assign a relative uncertainty $\pm 2.4\%$ to $R_{CP\pm}$, which is completely anticorrelated between R_{CP+} and R_{CP-}.

We quote the measurements in terms of $x_\pm$ and r^2,

$$x_+ = -0.082 \pm 0.053(\text{stat}) \pm 0.018(\text{syst}), \tag{7}$$

$$x_- = +0.102 \pm 0.062(\text{stat}) \pm 0.022(\text{syst}), \tag{8}$$

$$r^2 = -0.12 \pm 0.08(\text{stat}) \pm 0.03(\text{syst}). \tag{9}$$

The measured values of $x_\pm$ are consistent with those found, on a slightly smaller data sample, with the $B^- \to DK^-$, $D \to K^0_S\pi^-\pi^+$ decays, and the precision is comparable [8].

In conclusion, we have reconstructed $B^- \to D^0K^-$ decays with D^0 mesons decaying to non-CP, CP-even and CP-odd eigenstates. We have improved the measurements of $R_{CP\pm}$ and $A_{CP\pm}$ [14,15], and we have also expressed the results in terms of the same $x_\pm$ parameters as were measured with $B^- \to DK^-$, $D \to K^0_S\pi^-\pi^+$ through a Dalitz plot analysis of the D final state [8], with a comparable precision. These measurements, combined with the existing measurements of the $B \to DK$ decays, will improve the knowledge of the angle γ and the parameter r.

We are grateful for the excellent luminosity and machine conditions provided by our PEP-II colleagues, and for the substantial dedicated effort from the computing organizations that support *BABAR*. The collaborating institutions wish to thank SLAC for its support and kind hospitality. This work is supported by DOE and NSF (U.S.A.), NSERC (Canada), IHEP (China), CEA and CNRS-IN2P3 (France), BMBF and DFG (Germany), INFN (Italy), FOM (the Netherlands), NFR (Norway), MIST (Russia), and PPARC (United Kingdom). Individuals have received support from the A. P. Sloan Foundation, Research Corporation, and Alexander von Humboldt Foundation.

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