From a sample of 232 million $\Upsilon(4S) \to B\bar{B}$ events collected with the BABAR detector at the PEP-II $B$ Factory in 1999–2004, we measure the $B^- \to D^0 K^{*-}(892)$ decay branching fraction using events where the $K^{*-}$ is reconstructed in the $K_S^0 \pi^-$ mode and the $D^0$ in the $K^-\pi^+, K^-\pi^+\pi^0$, and $K^-\pi^+\pi^+\pi^-$ channels: $\mathcal{B}(B^- \to D^0 K^{*-}(892)) = (5.29 \pm 0.30 \text{ (stat)} \pm 0.34 \text{ (syst)}) \times 10^{-4}$. 
Measurement of the $B^- \to D^0 K^{*-}$ branching fraction

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From a sample of 232 million \( T(4S) \rightarrow B\bar{B} \) events collected with the BABAR detector at the PEP-II B Factory in 1999–2004, we measure the \( B^- \rightarrow D^0 K^{*-} \) decay branching fraction using events where the \( K^{*-} \) is reconstructed in the \( K_S^0 \pi^- \) mode and the \( D^0 \) in the \( K^- \pi^+ \), \( K^- \pi^+ \pi^0 \), and \( K^- \pi^+ \pi^- \) channels: \( B(B^- \rightarrow D^0 K^{*-}(892)) = (5.29 \pm 0.30 \text{ (stat)} \pm 0.34 \text{ (syst)}) \times 10^{-4} \).

This analysis uses data collected with the BABAR detector at the PEP-II e^+e^− storage ring. The data correspond to an integrated luminosity of 211 fb^{-1} at the \( T(4S) \) peak (232 million \( B\bar{B} \) pairs) and 16 fb^{-1} at center-of-mass energy 40 MeV below the resonance.

The BABAR detector is described in detail in [8]. In this paper we present a new measurement of the branching fraction \( B(B^- \rightarrow D^0 K^{*-}) \) obtained with 2.7 times more data than used for the previous BABAR measurement.

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tion. We also use global event shape variables to distinguish between continuum events which have a two-jet topology in the $\Upsilon(4S)$ rest frame and $B\overline{B}$ events which are more spherical. We require $|\cos \theta^*_T| \leq 0.9$ where $\theta^*_T$ is the angle between the thrust axes of the $B$ candidate and that of the rest of the event. We construct a linear (Fisher) discriminant \cite{12} from $\cos \theta^*_T$ and the $L_0$, $L_3$ monomials (see below) describing the energy flow in the rest of the event, as in \cite{13}. In the center-of-mass frame (CM) we define $L_j = \Sigma_ip^*_i[\cos \theta^*_T]^j$, where $i$ indexes the charged and neutral particles in the event once those from the $B$ candidate are removed, and $\theta^*_T$ is the angle of the CM-momentum $p^*_i$ with the thrust axis of the $B$ meson candidate.

We identify $B$ candidates using two nearly independent kinematic variables: the beam-energy-substituted mass $m_{ES} = \sqrt{s/2 + \mathbf{p}_B \cdot \mathbf{p}_0}^2/E_B - \mathbf{p}_0^2$ and the energy difference $\Delta E = E_B - \sqrt{s}/2$, where $E$ and $p$ are energy and momentum, the subscripts 0 and $B$ refer to the $e^+e^-$-beam-system and the $B$ candidate in the lab frame, respectively; $s$ is the square of the CM energy, and the asterisk labels the CM frame.

In those events where we find more than one acceptable $B$ candidate (less than 25% of selected events depending on the $D^0$ mode), we choose the one with the smallest $\chi^2$ formed from the differences of the measured and world average $D^0$ and $K^{*-}$ masses scaled by the mass resolution which includes the experimental resolution and, for the $K^{*-}$, its natural width. Simulations show that no bias is introduced by this choice and the correct candidate is picked at least 80% of the time. According to simulation of signal events, the total reconstruction efficiencies are: 13.3%, 4.6%, and 9.0% for the $D^0 \to K^{*-}$, $K_{-}^{*} \pi^0$, and $K_{-}^{*} \pi^+ \pi^- \pi^0$ modes, respectively.

To study $B\overline{B}$ backgrounds we look at sideband regions away from the signal region in $\Delta E$ and $m_{D^0}$. The $\Delta E$ distributions are centered around zero for signal with a resolution between 11 and 13 MeV for all three channels. We define a signal region $|\Delta E| < 25$ MeV. We also define a $\Delta E$ sideband in the intervals $-100 \leq \Delta E \leq -60$ MeV and $60 \leq \Delta E \leq 200$ MeV. The lower limit ($-100$ MeV) is chosen to avoid selecting a region of high background coming from $B^- \to D^0 K^{*-}$. In this $\Delta E$ sideband we see no significant evidence of a background peaking near the $B$ mass in $m_{ES}$ which could leak into the signal region. The sideband region in $m_{D^0}$ is defined by requiring that this quantity differs from the $D^0$ mass peak by more than four standard deviations. It provides sensitivity to doubly-peaking background sources that mimic signal both in $\Delta E$ and $m_{ES}$. This pollution comes from either charmed or charmless $B$ meson decays that do not contain a true $D^0$. Since many of the possible contributions to this background are not well known, we attempt to measure its size by including the $m_{D^0}$ sideband in the fit described below.

An unbinned extended maximum likelihood fit to $m_{ES}$ distributions in the range $5.2 \leq m_{ES} \leq 5.3$ GeV/$c^2$ is used to determine the event yields. For signal modes, the $m_{ES}$ distributions are described by a Gaussian function $G$ centered at the $B$ mass with resolution ($\sigma$), averaged over the three $D^0$ decay modes, of 2.7 MeV/$c^2$. For each $D^0$ decay mode $k$ ($=1, 2, 3$) we determine the mean and sigma of the Gaussian $\xi_k$ by fitting to the data. The combinatorial background in the $m_{ES}$ distribution is modeled with a threshold function $A_k$ \cite{14}. Its shape is governed by one parameter $\xi_k$ that is left free in the fit for each $D^0$ decay mode. We fit simultaneously $m_{ES}$ distributions of nine samples: the $K^{*}\pi^+$, $K^{*-}\pi^0\pi^0$ and $K^{*-}\pi^+\pi^-\pi^+$ samples for $i$ the $\Delta E$ signal region, $ii$ the $D_{ES}$ sideband and $iii$ the $\Delta E$ sideband. We fit three probability density functions (PDF) weighted by the unknown event yields. For the $\Delta E$ sideband, we use $A_k$. For the $D_{ES}$ sideband we use $N_{sig}^k \cdot A_k + N_{DP}^k \cdot \xi_k$, where $\xi_k$ accounts for the doubly-peaking $B$ decays. For the signal region PDF we use $N_{sig}^k \cdot A_k + \kappa N_{DP}^k \cdot G_k + N_{sig}^k \cdot \xi_k$, where $\kappa$ is the ratio of the $D_{ES}$ signal-window to sideband widths and $N_{sig}^k$ is the number of $B^- \to D^0 K^{*-}$ signal events. The $\Delta E$ sideband sample helps define the shape of the background function $A_k$. We assume that the $B$ decays found in the $D_{ES}$ sideband have the same final states as the signal so we use the same Gaussian shape for the doubly-peaking $B$ background.

| $K^{*-}\pi^+$ | $K^{-}\pi^+\pi^0$ | $K^{*+}\pi^-\pi^+$ |
|----------------|----------------|----------------|
| Yield | $144 \pm 13$ | $185 \pm 19$ | $195 \pm 18$ |
| Efficiency | $13.30\%$ | $4.60\%$ | $8.99\%$ |
| $B(B^- \to D^0 K^{*-})$ | $5.15\pm0.47$ | $5.65\pm0.57$ | $5.24\pm0.49$ |

The fit results are shown graphically in Fig.\textbf{1} and numerically in Table\textbf{1}. For each channel $k$, a measurement $B_k$ of the branching fraction $B(B^- \to D^0 K^{*-})$ is derived as follows:

$$B_k = \frac{N(D^0 \to X_k) \cdot f}{N_{B^{\pm}} \cdot \xi_k \cdot B_{K^{*-}} \cdot B(D^0 \to X_k)}, \quad (1)$$

where $N(D^0 \to X_k)$ is the event yield from the fit, $f$ the fraction of $K^{*-}$’s in the sample (discussed below), $N_{B^{\pm}}$ is the number of charged $B$ mesons in the data sample, $\xi_k$ is the efficiency to reconstruct $B^- \to D^0 K^{*-}$ when $D^0 \to X_k$, $B_{K^{*-}} \equiv B(K^{*-} \to K^{*0}_\pi \cdot B(K^{*0}_\pi \to \pi^+\pi^-)$ and $B(D^0 \to X_k)$ are the branching fractions of the $K^{*-}$ and the $D^0$. We have assumed equal production of pairs of neutral and charged $B$ mesons in $\Upsilon(4S)$ decay.

Systematic effects arise from the difference between the actual detector response for the data and the simulation model for the Monte Carlo. Here the main effects stem
from the modeling of the tracking efficiency (1.2-1.3% per track), the \(K^0\) reconstruction efficiency (2% per \(K^0\)), the \(\pi^0\) reconstruction efficiency for the \(K^-\pi^+\pi^0\) channel (3%) and the efficiency and misidentification probabilities from the particle identification (2% per kaon. A study of a high-statistics \(B^-\rightarrow D^0\pi^-\) control sample shows excellent agreement between the data and Monte Carlo sample except for the distributions of \(\Delta E\) and the continuum-suppression Fisher discriminant. For these variables, differences of up to (2.5 ± 1.1)% are measured between the data and Monte Carlo. Suitable corrections to the efficiencies are therefore applied and systematic errors assigned. The \(K^{*-}\) helicity angle distributions differ significantly between data and simulation because of the non-resonant background under the \(K^{*-}\) peak. We describe below how we subtract this background. For the pure \(K^{*-}\) events, we estimate that the residual discrepancy between data and simulation in the helicity to be less than 1.6%. We determine using simulations that the \(m_{ES}\) signal PDFs deviate from the single Gaussian shape by less than 0.1%. Substantial systematic uncertainties come from the measured \(D^0\) branching fractions \(^{10}\) and the number of \(B^\pm\) pairs in the sample.

The observed number of signal events must be corrected for the non-resonant \(K_S^{0}\pi^-\) pairs under the \(K^{*-}\).

When we remove the requirement on the \(K^{*-}\) helicity angle, we see that the \(K^{*-}\) helicity distribution (Fig. 2) of the selected events manifests a forward-backward asymmetry that indicates an interference with a \(K^{0}\pi^-\) background \(^3\). We model the \(K^{0}\pi^-\) system with a P-wave and an S-wave component. The P-wave mass dependence is described by a relativistic Breit-Wigner while the S-wave piece is assumed to be a complex constant. This model is fitted to the data and shown in Fig. 2 along with an estimate of the combinatorial background. Neglecting higher resonances, the number of \(K^{0}\pi^-\) peaking background events is \((4 \pm 1)\%\) of the total measured number of signal events. We do not quote a systematic error on the contributions of the neglected partial waves (non-\(K^*\) P-wave and higher order waves) since their expected rates in the \(K\pi\) mass window are far below that of the S-wave \(^{12}\). In Fig. 3 we see that a relativistic Breit-Wigner gives a fair description of the resonance structure in the \(K^{0}\pi^-\) mass spectrum (\(\chi^2=26.8\) for 20 degrees of freedom).

| Source                      | \(K^0\pi^-\) | \(K^0\pi^+\pi^-\) | \(K^0\pi^+\pi^0\) |
|-----------------------------|--------------|--------------------|-------------------|
| Tracking efficiency         | 3.8%         | 3.8%               | 6.3%              |
| \(\pi^0\) efficiency       | -            | 3.1%               | -                 |
| Particle Identification     | 2.0%         | 2.0%               | 2.0%              |
| \(K^0\) efficiency         | 1.6%         | 1.9%               | 1.8%              |
| \(\cos \theta_H (K^{*-})\) | 1.6%         | 1.6%               | 1.6%              |
| Fisher                      | 1.1%         | 1.1%               | 1.1%              |
| \(\Delta E\)               | 1.9%         | 1.8%               | 2.0%              |
| \(m_{ES}\) PDF shape       | 0.1%         | 0.1%               | 0.1%              |
| Number of \(B^\pm\)         | 1.1%         | 1.1%               | 1.1%              |
| Simulation statistics       | 0.9%         | 1.4%               | 1.0%              |
| \(B_K^{*-}\) \(^{10}\)     | 0.2%         | 0.2%               | 0.2%              |
| \(B(D^0\rightarrow X_k)\) \(^{10}\) | 2.4%   | 6.2%               | 4.2%              |
| \(K_S^0\pi^-\) S-wave subtraction | 1.1%     | 1.1%               | 1.1%              |

All sources of systematic uncertainties are listed for each mode in Table II. With the exception of \(\Delta E\) and simulation statistics the systematic error sources listed in Table II are correlated among the different \(D^0\) modes. We use the procedure discussed in \(^{10}\) to form a weighted average of the three \(D^0\) decay modes and determine:

\[
B(B^-\rightarrow D^0K^{*-}) = (5.29\pm0.30\pm0.34) \times 10^{-4}.
\]

The first error is statistical and the second is systematic. We have compared the results from this analysis using the same data set as in our previously published analysis \(^{0}\). The two analyses use different selection criteria and therefore find different numbers of events. The results from the two analyses are consistent to within a half of a (statistical) standard deviation. We have also

![FIG. 1: Distributions of \(m_{ES}\) in the signal region for \(B^-\rightarrow D^0K^{*-}\) decays where \(D^0\rightarrow K^-\pi^+\) (top), \(K^-\pi^+\pi^0\) (middle), and \(K^-\pi^+\pi^-\) (bottom). The dashed curve indicates the contribution from the combinatorial background and the peaking \(B\)-background which is estimated from a simultaneous fit to the \(D^0\) sideband (not shown).](image-url)
and observed the interference of the \( K^0 \) background as estimated from the data. The dotted line shows the combinatorial background. The solid line is a fit to a model which includes P-wave and S-wave interference.

![Graph](image1.png)

**FIG. 2:** Acceptance corrected distribution of \( \cos \theta_H(K^{*-}) \). The solid line is a fit to a model which includes P-wave and S-wave interference. The dotted line shows the combinatorial background as estimated from the data.

In summary, we have measured the branching fraction of the decay \( B^- \rightarrow D^0 K^{*-} \) in the \( D^0 K^0_S \pi^- \) final state and observed the interference of the \( K^{*-} \) with a small non-resonant \( K^0_S \pi^- \) background.

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![Graph](image2.png)

**FIG. 3:** Invariant mass of \( K^0_S \pi^- \) combinations with all other analysis cuts applied. The solid curve is a Breit-Wigner line shape including detector resolution. The dotted line shows the combinatorial background.

calculated the branching fraction for the two data sets obtained since the previous analysis. The measurement in each set is consistent with, although lower than the value obtained in [6]. This result supersedes our previously published result.

In summary, we have measured the branching fraction of the decay \( B^- \rightarrow D^0 K^{*-} \) in the \( D^0 K^0_S \pi^- \) final state and observed the interference of the \( K^{*-} \) with a small non-resonant \( K^0_S \pi^- \) background.

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[1] Reference to a charge conjugate mode is implied throughout the paper unless otherwise stated.
[2] N. Cabibbo, Phys. Rev. Lett. **10**, 531 (1963); M. Kobayashi and T. Maskawa, Prog. Theor. Phys. **49**, 652 (1973).
[3] M. Gronau and D. Wyler, Phys. Lett. B **265**, 172 (1991); I. Dunietz, Phys. Lett. B **270**, 75 (1991). D. Atwood, G. Eilam, M. Gronau and A. Soni, Phys. Lett. B **341**, 372 (1995); D. Atwood, I. Dunietz and A. Soni, Phys. Rev. Lett. **78**, 3257 (1997).
[4] M. Gronau, Phys. Rev. D **58**, 037301 (1998); M. Gronau, Phys. Lett. B **557**, 198 (2003).
[5] CLEO Collaboration, R. Mahapatra et al., Phys. Rev. Lett. **88**, 101803 (2002).
[6] BABAR Collaboration, B. Aubert et al., Phys. Rev. D **69**, 051101 (2004).
[7] BABAR Collaboration, B. Aubert et al., Nucl. Instr. Methods Phys. Res., Sect. A **479**, 1 (2002).
[8] GEANT4 Collaboration, S. Agostinelli et al., Nucl. Instr. Methods Phys. Res., Sect. A **506**, 250 (2003).
[9] BABAR Collaboration, B. Aubert et al., Phys. Rev. D **72**, 071103 (2005).
[10] Particle Data Group, S. Eidelman et al., Phys. Lett. B **592**, 1 (2004).
[11] CLEO Collaboration, S. Kopp et al., Phys. Rev. D **63**, 092001 (2001).
[12] R. A. Fisher, Annals Eugen. **7**, 179 (1936).
[13] BABAR Collaboration, B. Aubert et al., Phys. Rev. Lett. **89**, 281802 (2002).
[14] ARGUS collaboration, H. Albrecht et al., Phys. Lett. B **185**, 218 (1987); ibid. **241**, 278 (1990). The function is \( A(x_{\text{max}}) \propto m_{\text{ES}} \sqrt{1-x^2} \exp[-\xi(1-x^2)] \), where \( x = m_{\text{ES}}/E_{\text{max}} \) and \( \xi \) is a fit parameter.
[15] FOCUS collaboration, J. M. Link et al., Phys. Lett. B **535**, 43 (2002); LASS Collaboration, D. Aston et al., Nucl. Phys. B **296**, 493 (1988); E791 Collaboration, E. M. Aitala et al., Phys. Rev. Lett. **89**, 121801 (2002).
[16] L. Lyons et al., Nucl. Instr. Methods Phys. Res., Sect. A **270**, 110 (1988).