Observation of $\bar{B}^0 \rightarrow D^0 \bar{K}^0$ and $\bar{B}^0 \rightarrow D^0 \bar{K}^*$ decays

P. Krokovny, A. Abe, T. Abe, I. Adachi, H. Aihara, M. Akatsu, Y. Asano, T. Aso, V. Aulchenko, T. Aushov, A. M. Bakich, Y. Ban, A. Bay, I. Bedny, A. Bondar, A. Bozek, M. Bracko, J. Brodzicka, T. E. Browder, B. C. K. Casey, P. Chang, Y. Chao, K.-F. Chen, B. G. Cheon, R. Chistov, S.-K. Choi, Y. Choi, Y. K. Choi, M. Danilov, A. Drutskoy, S. Eidelman, V. Eigas, Y. Enari, C. Fukunaga, N. Gabyashev, A. Garmash, T. Gershon, J. Haba, T. Hara, H. Kasuko, H. Hayashi, M. Hazumi, I. Higuchi, T. Higuchi, T. Hojo, H. Hoshi, W.-S. Hou, H.-C. Huang, Y. Igarashi, T. Iijima, K. Inami, A. Ishikawa, R. Itoh, H. Iwasaki, S. Ishikawa, M. Nakao, H. Nakazawa, J. W. Nam, Z. Natkaniec, S. Nishida, O. Nitoh, S. Ogawa, T. Ohshima, T. Okabe, S. Okuno, S. L. Olsen, Y. Onuki, W. Ostrowicz, H. Ozaki, P. Pakhlov, H. Palka, C. W. Park, H. Park, M. Peters, L. E. Piilonen, M. Rozanska, K. Rybicki, H. Sagawa, Y. Sakai, M. Satapathy, A. Satpathy, O. Schneider, J. Schümann, S. Semenov, K. Senyo, R. Seuster, M. E. Sevior, H. Shibuya, B. Shwartz, V. Sidorov, J. B. Singh, M. Stanić, A. Sugi, K. Sunisawa, T. Sumiyoshi, S. Suzuki, S. Y. Suzuki, S. K. Swain, T. Takahashi, F. Takasaki, K. Tamai, N. Tamura, J. Tanaka, M. Tanaka, G. N. Taylor, Y. Teramoto, H. Tomoda, T. Tomura, T. Tsuboyama, T. Tsukamoto, S. Uehara, Y. Unno, S. Uno, G. Varner, K. E. Varvell, C. C. Wang, C. H. Wang, J. G. Wang, E. Won, B. D. Yabsley, Y. Yamada, A. Yamaguchi, Y. Yamashita, M. Yamauchi, H. Yanai, Y. Yusa, C. C. Zhang, Z. P. Zhang, V. Zhilich, D. Žontar

(The Belle Collaboration)

1 Budker Institute of Nuclear Physics, Novosibirsk
2 Chiba University, Chiba
3 Chiao University, Tokyo
4 University of Cincinnati, Cincinnati, Ohio 45221
5 University of Frankfurt, Frankfurt
6 Gyeongsang National University, Chinju
7 University of Hawaii, Honolulu, Hawaii 96822
8 High Energy Accelerator Research Organization (KEK), Tsukuba
9 Hiroshima Institute of Technology, Hiroshima
10 Institute of High Energy Physics, Chinese Academy of Sciences, Beijing
11 Institute of High Energy Physics, Vienna
12 Institute for Theoretical and Experimental Physics, Moscow
13 J. Stefan Institute, Ljubljana
14 Kagawa University, Kagoshima
15 Korea University, Seoul
16 Kyoto University, Kyoto
17 Kyungpook National University, Taegu
18 Institut de Physique des Hautes Énergies, Université de Lausanne, Lausanne
19 University of Ljubljana, Ljubljana
20 University of Maribor, Maribor
21 University of Melbourne, Victoria
22 Nagoya University, Nagoya
23 Nara Women’s University, Nara
24 National Lien-Ho Institute of Technology, Miaoli
25 National Taiwan University, Taipei
26 H. Niewodniczanski Institute of Nuclear Physics, Krakow
27 Nihon Dental College, Niigata
28 Niigata University, Niigata
29 Osaka City University, Osaka
30 Osaka University, Osaka
31 Panjab University, Chandigarh
32 Peking University, Beijing
RIKEN BNL Research Center, Upton, New York 11973
Saga University, Saga
University of Science and Technology of China, Hefei
Seoul National University, Seoul
Sungkyunkwan University, Suwon
University of Sydney, Sydney NSW
Tata Institute of Fundamental Research, Bombay
Toho University, Funabashi
Tohoku Gakuin University, Tagajo
Tohoku University, Sendai
University of Tokyo, Tokyo
Tokyo Institute of Technology, Tokyo
Tokyo Metropolitan University, Tokyo
Tokyo University of Agriculture and Technology, Tokyo
Toyama National College of Maritime Technology, Toyama
University of Tsukuba, Tsukuba
Utkal University, Bhubaneswer
Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061
Yokkaichi University, Yokkaichi
Yonsei University, Seoul

We report on a search for $\bar{B}^0 \to D^{(*)0}\bar{K}^{(*)0}$ decays based on $85 \times 10^6 \bar{B}\bar{B}$ events collected with the Belle detector at KEKB. The $\bar{B}^0 \to D^0\bar{K}^0$ and $\bar{B}^0 \to D^{*0}\bar{K}^0$ decays have been observed for the first time with the branching fractions $\mathcal{B}(\bar{B}^0 \to D^0\bar{K}^0) = (5.0^{+1.3}_{-1.2} \pm 0.6) \times 10^{-5}$ and $\mathcal{B}(\bar{B}^0 \to D^{*0}\bar{K}^0) = (4.8^{+1.1}_{-1.0} \pm 0.5) \times 10^{-5}$. No significant signal has been found for the $\bar{B}^0 \to D^{*0}\bar{K}^{(*)0}$ and $\bar{B}^0 \to D^{(*)0}\bar{K}^{(*)0}$ decay modes, and upper limits at 90% CL are presented.

PACS numbers: 13.25.Hw, 14.40.Nd
Since the recent discovery of CP violation in the B meson system, through the measurement of non-zero values for \(\sin 2\phi_1\), attention has turned towards the measurement of the other Unitary Triangle angles. Such measurements will allow tests of the Kobayashi-Maskawa ansatz and of the Standard Model. Precise measurements of the branching fraction for \(B^0 \to D^0 \bar{K}^0\), \(B^0 \to D^0 \bar{K}^0\) and \(B^0 \to D^*_{CP} \bar{K}^0\) decays, where \(D^*_{CP}\) denotes \(D^0\) or \(D^0\) decay to a CP eigenstate, will allow a measurement of the system, through the measurement of non-zero values at large momenta (\(\text{BR}\)).

The decay \(B^0 \to D^0 \bar{K}^0\) can also be used to measure time-dependent CP asymmetry in \(B\) decays. So far no experimental information is available for any of these decays.

In this Letter we report on a search for the \(B^0 \to D^{(*)0} \bar{K}^0\), \(B^0 \to D^{(*)0} \bar{K}^0\) and \(B^0 \to D^{(*)0} \bar{K}^0\) decays with the Belle detector at the KEKB asymmetric energy \(\gamma(4\pi)\) collider. The results are based on a 78 fb\(^{-1}\) data sample collected at the center-of-mass (CM) energy of the \(\Upsilon(4S)\) resonance, which contains \(5 \times 10^6\) produced \(B\) meson pairs.

The Belle detector has been described elsewhere. Charged tracks are selected with a set of requirements based on the average hit residual and impact parameter relative to the interaction point (IP). We also require that the transverse momentum of the tracks be greater than 0.1 GeV/c in order to reduce the low momentum combinatorial background.

For charged particle identification (PID), the combined information from specific ionization in the central drift chamber (\(dE/dx\), time-of-flight scintillation counters (TOF) and aerogel \(\bar{\text{C}}\)erenkov counters (ACC) is used. At large momenta (> 2.5 GeV/c) only the ACC and \(dE/dx\) are used. Charged kaons are selected with PID criteria that have an efficiency of 88%, a pion misidentification probability of 8%, and negligible contamination from protons. All charged tracks having PID consistent with the pion hypothesis that are not identified as electrons are considered as pion candidates.

Neutral kaons are reconstructed via the decay \(K_S^0 \to \pi^+ \pi^-\) with no PID requirements for these pions. The two-pion invariant mass is required to be within 6 MeV/\(c^2\) (~ 2.5\(\sigma\)) of the nominal \(K^0\) mass and the displacement of the \(\pi^+ \pi^-\) vertex from the IP in the transverse \((r-\phi)\) plane is required to be between 0.2 cm and 20 cm. The direction from the IP to the \(\pi^+ \pi^-\) vertex is required to agree within 0.2 radians in the \(r-\phi\) plane with the combined momentum of the two pions. A pair of calorimeter showers not associated with charged tracks, with an invariant mass within 15 MeV/\(c^2\) of the nominal \(\pi^0\) mass is considered as a \(\pi^0\) candidate. An energy deposition of at least 30 MeV and a photon-like shape are required for each shower. \(K^0\) candidates are reconstructed from \(K^- \pi^+\) pairs with an invariant mass within 50 MeV/\(c^2\) of the nominal \(K^-\) mass. We reconstruct \(D^0\) mesons in the decay channels: \(K^- \pi^+, K^- \pi^- \pi^- \pi^+\) and \(K^- \pi^+ \pi^0\), using a requirement that the invariant mass be within 20 MeV/\(c^2\), 15 MeV/\(c^2\) and 25 MeV/\(c^2\) of the nominal \(D^0\) mass, respectively. In each channel we further define a \(D^0\) mass sideband region, with width twice that of the signal region. For the \(\pi^0\) from the \(D^0 \to K^- \pi^- \pi^0\) decay, we require that its momentum in the CM frame be greater than 0.4 GeV/c in order to reduce combinatorial background. \(D^{(*)}\) mesons are reconstructed in the \(D^{(*)} \to D^0 \rho^0\) decay mode. The mass difference between \(D^{(*)}\) and \(D^0\) candidates is required to be within 4 MeV/\(c^2\) of the expected value (~ 4\(\sigma\)).

We combine \(D^{(*)}\) candidates with \(K_S^0\) or \(K^-\) to form B mesons. Candidate events are identified by their CM energy difference, \(\Delta E = (\sum_i E_i) - E_b\), and the beam constrained mass, \(M_{bc} = \sqrt{E_b^2 - (\sum_i p_i)^2}\), where \(E_b\) is the beam energy and \(p_i\) and \(E_i\) are the momenta and energies of the B meson decay products in the CM frame. We select events with \(M_{bc} > 5.2\) GeV/\(c^2\) and \(|\Delta E| < 0.2\) GeV, and define a B signal region of 5.272 GeV/\(c^2\) < \(M_{bc}\) < 5.288 GeV/\(c^2\) and \(|\Delta E| < 0.03\) GeV. In the rare cases where there is more than one candidate in an event, the candidate with the \(D^{(*)}\) and \(K^{(*)}\) masses closest to their nominal values is chosen. We use Monte Carlo (MC) simulation to model the response of the detector and determine the efficiency.

To suppress the large combinatorial background dominated by the two-jet-like \(e^+e^- \to q\bar{q}\) continuum process, variables that characterize the event topology are used. We require \(|\cos \theta_{b+}\| < 0.80\), where \(\theta_{b+}\) is the angle between the thrust axis of the B candidate and that of the rest of the event. This requirement eliminates 77% of the continuum background and retains 78% of the signal events. We also construct a Fisher discriminant, \(F\), which is based on the production angle of the B candidate, the angle of the B candidate thrust axis with respect to the beam axis, and nine parameters that characterize the momentum flow in the event relative to the B candidate thrust axis in the CM frame. We impose a requirement on \(F\) that rejects 67% of the remaining continuum background and retains 83% of the signal.

Among other B decays, the most serious background comes from \(B^0 \to D^- \pi^+, D^- \to K^{(*)0} K^-, K^{(*)0} K^- \pi^0, K^{(*)0} K^- \pi^- \pi^+,\) and \(B^0 \to D^- K^+, D^- \to K^{(*)-} \pi^+, K^{(*)-} \pi^- \pi^0, K^{(*)-} \pi^- \pi^- \pi^+\). These decays produce the same final state as the \(B^0 \to D^{(*)0} K^{(*)0}\) signal, and their product branching fractions are up to ten times higher than those expected for the signal. To suppress this type of background, we exclude candidates if the invariant mass of the combinations listed above is consistent with the \(D^-\) hypothesis within 25 MeV/\(c^2\) (~ 3\(\sigma\)). The \(B^0 \to D^{(*)} K^- D^{(*)} \pi^0\) can also produce the same final state as the \(B^0 \to D^{(*)0} K^{(*)0}\) decay. But this decay is kinematically separated from the signal; the invariant mass selection criteria for \(K^{(*)}\) candidates completely eliminates this background. Another potential \(B\bar{B}\) background comes from \(B^0 \to D^{(*)0} \rho^0\) decay channel with one pion from \(\rho^0\) decay misidentified as
FIG. 1: △E (left) and Mbc (right) distributions for the \( \bar{B}^0 \to D^0 K^{(*)0} \) candidates. Points with errors represent the experimental data, hatched histograms show the \( D^0 \) mass sidebands and curves are the results of the fits.

For each \( D^0 \) decay mode, the △E distribution is fitted with a Gaussian for signal and a linear function for background. The Gaussian mean value and width are fixed to the values from MC simulation of the signal events. The region \( △E < -0.1 \) GeV is excluded from the fit to avoid contributions from other \( B \) decays, such as \( B \to D^{(*)0} K^{(*)0}(\pi) \) where \( (\pi) \) denotes a possible additional pion. For the \( M_{bc} \) distribution fit we use the sum of a signal Gaussian and an empirical background function with a kinematic threshold \( m \), with a parameter fixed from the analysis of the off-resonance data. For the calculation of branching fractions, we use the signal yields determined from the fit to the △E distribution. This minimizes a possible bias from other \( B \) meson decays, which tend to peak in \( M_{bc} \) but not in △E. The fit results are presented in Table I, where the listed efficiencies include intermediate branching fractions. The statistical significance of the signal quoted in Table I is defined as \( \sqrt{-2 \ln(L_i/L_{max})} \), where \( L_{max} \) and \( L_i \) denote the maximum likelihood with the nominal signal yield and the signal yield fixed at zero, respectively.

For the final result we use a simultaneous fit to the △E distributions for the three \( D^0 \) decay channels taking into account the corresponding detection efficiencies. The normalization of the background in each \( D^0 \) sub-mode is allowed to float while the signal yields are required to satisfy the constraint \( N_i = N_{BB} \cdot B(\bar{B}^0 \to D^{(*)0} K^{(*)0}) \cdot \varepsilon_i \), where the branching fraction \( B(\bar{B}^0 \to D^{(*)0} K^{(*)0}) \) is a fit parameter; \( N_{BB} \) is the number of \( BB \) pairs and \( \varepsilon_i \) is the efficiency, which includes all intermediate branching fractions.

The statistical significances for the \( \bar{B}^0 \to D^0 \bar{K}^0 \) and \( \bar{B}^0 \to D^0 \bar{K}^{(*)0} \) signals are higher than 5σ. The signals in the \( \bar{B}^0 \to D^{(*)0} \bar{K}^{(*)0} \) channels are not significant.
FIG. 2: From left to right: \( K_B^0 \) candidates’ invariant mass and flight distance for the \( \bar{B}^0 \to D^0 K^0 \) channel, \( \bar{K}^0 \) candidates’ invariant mass and helicity distributions for the \( \bar{B}^0 \to D^0 \bar{K}^0 \) channel.

TABLE I: Fit results, efficiencies, branching fractions and statistical significances for \( \bar{B}^0 \to D^{(*)0} \bar{K}^{(*)0} \) decays.

| Mode                  | \( \Delta E \) yield | \( M_N \) yield | Efficiency \( (10^{-3}) \) | \( \mathcal{B} \) \( (10^{-3}) \) | Significance |
|-----------------------|----------------------|-----------------|-----------------------------|-----------------------------|--------------|
| \( \bar{B}^0 \to D^0 K^0, D^0 \to K^- \pi^+ \) | 9.3 ± 4.2            | 7.1 ± 3.0       | 2.50                        | 4.4 ± 2.0 ± 0.5            | 3.1σ         |
| \( \bar{B}^0 \to D^0 K^0, D^0 \to K^- \pi^+ \pi^0 \) | 14.9 ± 5.5           | 13.1 ± 5.2      | 2.36                        | 7.4 ± 2.7 ± 0.8            | 3.6σ         |
| \( \bar{B}^0 \to D^0 K^0, D^0 \to K^- \pi^+ \pi^0 \) | 8.7 ± 3.8            | 7.0 ± 4.2       | 2.52                        | 4.0 ± 2.0 ± 0.4            | 1.9σ         |
| \( \bar{B}^0 \to D^0 K^0, \) simultaneous fit | 31.5 ± 8.2           | 27.0 ± 7.6      | 7.38                        | 5.0 ± 1.3 ± 0.6            | 5.1σ         |
| \( \bar{B}^0 \to D^0 K^{*0}, D^0 \to K^- \pi^+ \) | 14.8 ± 4.1           | 11.7 ± 3.9      | 3.47                        | 5.0 ± 1.9 ± 0.6            | 4.3σ         |
| \( \bar{B}^0 \to D^0 K^{*0}, D^0 \to K^- \pi^+ \pi^0 \) | 15.1 ± 5.0           | 13.4 ± 4.8      | 3.34                        | 5.3 ± 1.4 ± 0.6            | 3.6σ         |
| \( \bar{B}^0 \to D^0 K^{*0}, D^0 \to K^- \pi^+ \pi^0 \) | 9.9 ± 4.0            | 16.7 ± 4.9      | 3.34                        | 3.5 ± 1.2 ± 0.4            | 1.7σ         |
| \( \bar{B}^0 \to D^0 K^{*0}, \) simultaneous fit | 41.2 ± 9.0           | 41.0 ± 8.1      | 10.15                       | 4.8 ± 1.3 ± 0.5            | 5.6σ         |
| \( \bar{B}^0 \to D^0 K^{*0}, \) simultaneous fit | 4.2 ± 3.0            | 2.7 ± 3.0       | 1.98                        | < 6.6 90% CL               | 1.4σ         |
| \( \bar{B}^0 \to D^0 K^{*0}, \) simultaneous fit | 6.1 ± 4.2            | 8.6 ± 4.2       | 2.68                        | < 6.9 90% CL               | 1.4σ         |
| \( \bar{B}^0 \to D^0 K^{*0}, \) simultaneous fit | 1.4 ± 3.2            | 9.2 ± 7.7       | 10.15                       | < 1.8 90% CL               | —            |
| \( \bar{B}^0 \to D^0 K^{*0}, \) simultaneous fit | 1.2 ± 3.6            | 0.0 ± 1.2       | 2.68                        | < 4.0 90% CL               | —            |

and we set 90% confidence level (CL) upper limits for these final states. We do not observe a significant signal for the \( \bar{B}^0 \to \bar{D}^{(*)0}\bar{K}^{(*)0} \) decays and also present upper limits for them. Figure 3 shows the \( \Delta E \) distributions for \( \bar{B}^0 \to D^{(*)0} \bar{K}^{(*)0} \) and \( \bar{B}^0 \to \bar{D}^{(*)0} \bar{K}^{(*)0} \) candidates. The upper limit \( N \) is calculated from the relation \( \mathcal{L}(n) = 0.9 \int_0^\infty \mathcal{L}(n)dn \), where \( \mathcal{L}(n) \) is the maximum likelihood with the signal yield equal to \( n \). We take into account the systematic uncertainties in these calculations by reducing the detection efficiency by one standard deviation.

As a check, we apply the same analysis procedure to \( \bar{B}^0 \to D^{\pm} [K_B^0 K^0]^\pm \pi^- \) and \( \bar{B}^0 \to D^{\pm\pm} [D^0 \pi^+ K^- \pi^0] \) decay chains. The estimated branching fractions of \( B(\bar{B}^0 \to D^+ \pi^-) = (2.5 \pm 0.3) \times 10^{-3} \) and \( B(\bar{B}^0 \to D^{++} K^-) = (1.7 \pm 0.2) \times 10^{-4} \) (statistical errors only) are consistent with the world average values.

The following sources of systematic errors are found to be significant: tracking efficiency (2% per track), kaon identification efficiency (2%), \( e^0 \) efficiency (6%), \( K_B^0 \) reconstruction efficiency (6%), efficiency for slow pions from \( D^0 \to D^0 \pi^0 \) decays (8%), \( D^{(*)0} \) branching fraction uncertainties (2% - 6%), signal and background
shape parameterization (4%) and MC statistics (2% – 3%). The tracking efficiency error is estimated using \( \eta \) decays to \( \gamma \gamma \) and \( \pi^+\pi^-\pi^0 \). The kaon identification uncertainty is determined from \( D^{++} \to D^0\pi^+ \), \( D^0 \to K^-\pi^+ \) decays. The \( \pi^0 \) reconstruction uncertainty is obtained using \( D^0 \) decays to \( K^-\pi^+ \) and \( K^-\pi^+\pi^0 \). We assume equal production rates for \( B^0D^0 \) and do not include the uncertainty related to this assumption in the total systematic error. The overall systematic uncertainty is found to be 11% for \( B^0 \to D^0\bar{K}^{(*)0} \) and 14% for \( B^0 \to D^0\bar{K}^{(*)0} \).

In summary, we report the first observation of \( \bar{B}^0 \to D^0\bar{K}^{(*)0} \) decays. The branching fractions \( \mathcal{B}(\bar{B}^0 \to D^0\bar{K}^0) = (5.0^{+1.3}_{-1.2} \pm 0.6) \times 10^{-5} \) and \( \mathcal{B}(\bar{B}^0 \to D^0\bar{K}^{*0}) = (4.8^{+1.1}_{-1.0} \pm 0.5) \times 10^{-5} \) are measured with 5.1\( \sigma \) and 5.6\( \sigma \) statistical significance, respectively. Note that we ignore the possible contribution of \( \bar{B}^0 \to D^0K^0 \) to the former result, since we do not distinguish between \( \bar{K}^0 \) and \( K^0 \). No significant signal is observed in the \( \bar{B}^0 \to D^0\bar{K}^{(*)0} \) final states. The corresponding upper limits at the 90% CL are \( \mathcal{B}(\bar{B}^0 \to D^0\bar{K}^0) < 6.6 \times 10^{-5} \) and \( \mathcal{B}(\bar{B}^0 \to D^0\bar{K}^{*0}) < 6.9 \times 10^{-5} \). We also set the 90% CL upper limits for the \( V_{ub} \) suppressed \( \bar{B}^0 \to D^{(*)0}\bar{K}^{(*)0} \) decays: \( \mathcal{B}(\bar{B}^0 \to D^{(*)0}\bar{K}^{(*)0}) < 1.8 \times 10^{-5} \) and \( \mathcal{B}(\bar{B}^0 \to D^{(*)0}\bar{K}^{(*)0}) < 4.0 \times 10^{-5} \).

We wish to thank the KEKB accelerator group for the excellent operation of the KEKB accelerator. We acknowledge support from the Ministry of Education, Culture, Sports, Science, and Technology of Japan and the Japan Society for the Promotion of Science; the Australian Research Council and the Australian Department of Industry, Science and Resources; the National Science Foundation of China under contract No. 10175071; the Department of Science and Technology of India; the BK21 program of the Ministry of Education of Korea and the CHEP SRC program of the Korea Science and Engineering Foundation; the Polish State Committee for Scientific Research under contract No. 2P03B 17017; the Ministry of Science and Technology of the Russian Federation; the Ministry of Education, Science and Sport of the Republic of Slovenia; the National Science Council and the Ministry of Education of Taiwan; and the U.S. Department of Energy.

* on leave from Nova Gorica Polytechnic, Nova Gorica

[1] Belle Collaboration, K. Abe et al., Phys. Rev. D 66, 071102 (2002).
[2] BaBar Collaboration, B. Aubert et al., Phys. Rev. Lett. 89, 201802 (2002).
[3] I. Dunietz, Phys. Lett. B 270, 75 (1991). J.H. Jang, P.Ko, Phys. Rev. D 58, 111302 (1998).
[4] M. Gronau, D. London, Phys. Lett. B 253, 483 (1991). B. Kayser, D. London, Phys. Rev. D 61, 116013 (2000).
[5] The inclusion of charge conjugate states is implicit throughout this report. Note that we do not distinguish between final states with \( \bar{K}^0 \) and \( K^0 \).
[6] Belle Collaboration, A. Abashian et al., Nucl. Inst. and Meth. A 479, 117 (2002).
[7] E. Kikutani ed., KEKB Accelerator Papers, KEK Preprint 2001-157 (to be published in Nucl. Inst. and Meth. A).
[8] R. Brun et al., GEANT 3.21, CERN DD/EE/84-1, 1984.
[9] Belle Collaboration, A. Satpathy et al., hep-ex/0211022 to be published in Phys. Lett. B.
[10] ARGUS Collaboration, H. Albrecht et al., Phys. Lett. B 241, 278 (1990).
[11] K. Hagiwara et al. (Particle Data Group), Phys. Rev. D 66, 010001 (2002).