LAPP-EXP-99.03

B/B̄ FLAVOUR TAGGING AND DOUBLY CHARMED B DECAYS IN ALEPH

R. BARATE

LAPP, Chemin de Bellevue, BP110, F74941, Annecy-le-Vieux, CEDEX, France
E-mail: barate@lapp.in2p3.fr

This contribution concerns three contributed papers that share the common feature of analysing fully- (or almost fully-) reconstructed B decays coming from a sample of four million hadronic Z decays collected with the ALEPH detector at LEP. In the first paper [1], 404 charged and neutral B mesons decaying in standard modes are fully reconstructed and used to look for resonant structure in the $B\pi^\pm$ system. In the framework of Heavy Quark Symmetry (HQS), the mass of the B_2^* state and the relative production rate of the B^{**} system are measured. In the same sample of B mesons, significant $B\pi^\pm$ charge-flavour correlations are observed. In the second paper [2], a search for doubly-charmed B decays with both charmed mesons reconstructed is performed. A clear signal is observed in the channels $b \to D_s\bar{D}(X)$ and $b \to D\bar{D}(X)$ providing the first direct evidence for doubly-charmed b decays involving no D_s production. Evidence for associated K_S^0 and $K^\pm$ production in the decays $B \to D\bar{D}(X)$ is also presented and some candidates for completely reconstructed B meson decays $B \to D_s\bar{D}(n\pi)$, $B \to D\bar{D}K_S^0$ and $B \to D\bar{D}K^\pm$ are observed. Furthermore, candidates for the two-body Cabibbo suppressed decays $B^0 \to D^{*-}D^{*+}$ and $B^- \to D^{(*)0}D^{(*)-}$ are also observed. One $B_s^0 \to D_s^+D_s^-$ event is reconstructed, which can be only the short-lived CP even eigenstate. In the third paper [3], the B_s decay to $D_s^{(*)+}D_s^{(*)-}(X)$ is observed, tagging the final state with two ϕ in the same hemisphere. It corresponds mostly to the short-lived CP even eigenstate. A preliminary value of the B_s short lifetime is obtained.

1 Resonant Structure and Flavour Tagging in the $B\pi^\pm$ System

1.1 *Introduction*

Fully reconstructed B meson decays are used to extract a precise mass of the B_2^* state and to obtain the $B/\bar{B}$ signature at the decay point. Using the π from B^{**} decay or the nearest π from fragmentation, direct tagging of the initial B just before it oscillates and decays is possible. It could be used in future CP violation experiments.

1.2 B *meson and associated pion selection*

Charged and neutral B mesons are fully reconstructed in various exclusive modes. Eighty percent are in the mode[a] $B \to \bar{D}^*(X)$, where X is a charged π, ρ or a_1, and 20% are of the form $B \to J/\psi(\psi')X$, where X is a charged K or a neutral K^*. In addition, charged B candidates are reconstructed in the channels $B^- \to D^{*0}\pi^-$ and $D^{*0}a_1^-$, with a missing soft γ or π^0 from the $D^{*0} \to D^0\gamma$ or $D^0\pi^0$ decays. In total, 238 charged and 166 neutral B candidates are reconstructed with purities of $(84 \pm 3)\%$ and $(86 \pm 3)\%$ respectively.

The neighbouring pion is selected using the P_L^{max} algorithm which chooses the track with the highest projected momentum along the B direction (and a $B\pi$ mass below 7.3 GeV/c).

1.3 *Resonant Structure in the* $B\pi^\pm$ *System*

Using the pion selected with the P_L^{max} algorithm, the right sign and wrong sign $B\pi$ mass distributions are made and B^{**} signals are extracted. The gain of one order of magnitude in mass resolution compared to previous inclusive experiments, due to the quality of exclusive B decays, allows a more precise measurement of the masses if one uses the Heavy Quark Symmetry parameters [1]. HQS predicts 4 resonances giving 5 correlated Breit Wigner (3 narrow and 2 wide) in the $B\pi$ mass distributions. Here only the overall mass scale and the total number of signal events are left free. An unbinned likelihood fit (Fig. 1) gives :

$$M(B_2^*) = (5739^{+8}_{-11}(\text{stat})^{+6}_{-4}(\text{syst}))\,\text{MeV}/c^2$$

$$f_{B^{**}} \equiv \frac{\mathcal{B}(b \to B^{**} \to B^{(*)}\pi)}{\mathcal{B}(b \to B_{u,d})} = (31 \pm 9(\text{stat})^{+6}_{-5}(\text{syst}))\%.$$

The result for the mass of the B_2^* state is somewhat low compared to the predicted value of $5771\,\text{MeV}/c^2$.

1.4 $B/\bar{B}$ *Flavour Tagging*

The sign of the neighbouring pion (from B^{**} or fragmentation) tags the $B/\bar{B}$ nature at production : a π^+ right-sign tags a B^0, etc. The P_L^{max} tagging algorithm efficiencies for neutral and charged B's are :

$$\epsilon_{tag}^N = (89 \pm 3(\text{stat}) \pm 2(\text{syst}))\,\%\,,$$

$$\epsilon_{tag}^C = (89 \pm 2(\text{stat}) \pm 1(\text{syst}))\,\%.$$

The asymmetry $\mathcal{A}^N$ between the number of right-sign and wrong-sign tags, $\mathcal{A}^N = (N_{rs} - N_{ws})/(N_{rs} + N_{ws})$, is shown as a function of the B decay proper time, t, in Fig. 2a. The sinusoidal mixing of B^0 into $\bar{B}^0$ gives rise to the excess of wrong-sign tags (negative value of $\mathcal{A}^N$) at high proper times.

[a] Throughout this paper, charge conjugate decay modes are always implied.

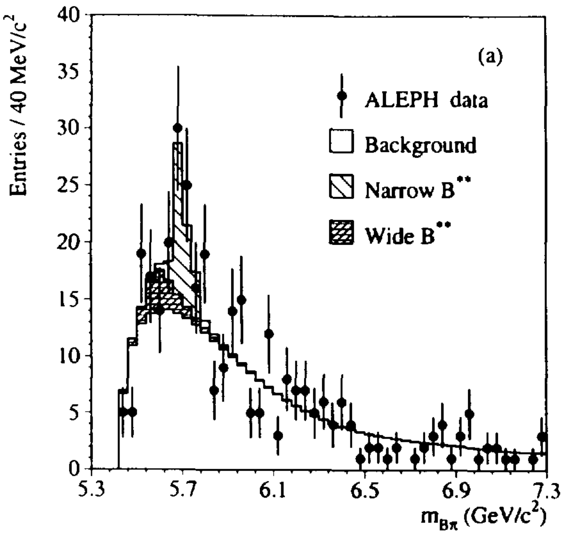

Figure 1: The Bπ mass spectrum from data (points with error bars) and fit (histogram). The fit includes the expected background plus contributions from the narrow and wide B** states.

The mistag rate for neutral B's, ω_{tag}^{N}, is measured from the oscillation amplitude, with Δm_d fixed to the world average of $0.474 \pm 0.031\,\text{ps}^{-1}$. An unbinned likelihood fit gives:

$$\omega_{tag}^{N} = (34.4 \pm 5.5(\text{stat}) \pm 1.0(\text{syst}))\,\%\,;$$

similarly, an unbinned likelihood fit for ω_{tag}^{C}, the mistag rate for charged B's gives :

$$\omega_{tag}^{C} = (26.0 \pm 3.6(\text{stat}) \pm 0.7(\text{syst}))\,\%$$

showing that this method gives good tagging performance, whilst being very efficient. The corresponding fits to the data are displayed in Fig. 2.

2 Doubly charmed B decays

2.1 Introduction

The final states with 2 charm mesons allow a precise study of the b quark decay into $c\bar{c}s$ and give a direct access to the average number of charm quarks per b decay n_c. The study of 3-body B meson decay in $\bar{\text{D}}$DK gives many results on the diagrams, possible resonances and dynamics. Added to the Cabbibo suppressed D$\bar{\text{D}}$, standard $\text{D}_s^+\bar{\text{D}}$, and new $\text{D}_s^+\bar{\text{D}}n\pi^\pm$ decays, one obtains the total double charm contribution to B meson decay.

2.2 D$\bar{\text{D}}$ *selection*

The charmed mesons are searched for in the decay modes $\text{D}^0 \to \text{K}^-\pi^+$, $\text{D}^0 \to \text{K}^-\pi^+\pi^-\pi^+$,

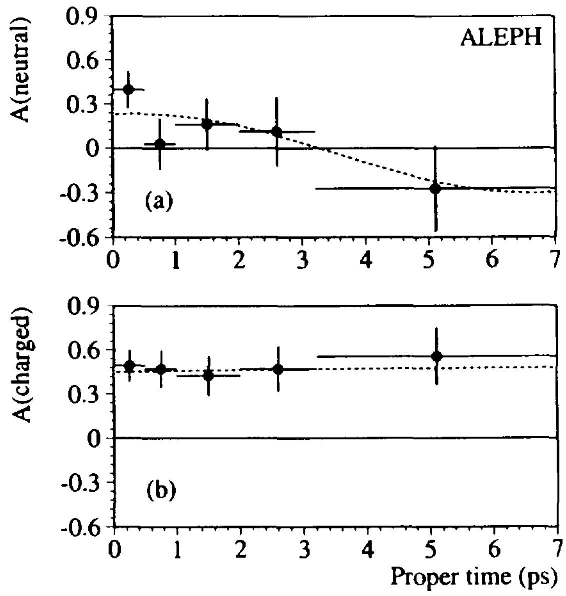

Figure 2: The right-sign/wrong-sign asymmetries in the data as a function of the proper decay time. The dashed curves display the charge asymmetries determined from the unbinned likelihood fits.

$\text{D}^+ \to \text{K}^-\pi^+\pi^+$, $\text{D}^{*+} \to \text{D}^0\pi^+$, $\text{D}_s^+ \to \phi\pi^+(\phi \to \text{K}^-\text{K}^+)$ and $\text{D}_s^+ \to \bar{\text{K}}^{*0}\text{K}^+$ ($\bar{\text{K}}^{*0} \to \text{K}^-\pi^+$). For D^0 mesons from D^{*+} decay, the decay mode $\text{D}^0 \to \text{K}^-\pi^+\pi^0$ is also used.

The pairs of D candidates must be in the same hemisphere and the two D candidates are required to form a vertex with a probability of at least 0.1%. To maintain a good acceptance for the B $\to$ D$\bar{\text{D}}X$ signal whilst rejecting the backgrounds and minimizing the model dependence of the selection efficiencies, a cut $d_{\text{BD}}/\sigma_{\text{BD}} > -2$ (>0) is applied on the D^0, D_s^+ (D^+) decay length significance (defined in Fig. 3). The decay length significance of the D$\bar{\text{D}}$ vertex is also required to satisfy the condition $d_{\text{B}}/\sigma_{\text{B}} > -2$.

To obtain the number of real D$\bar{\text{D}}$ events, standard tables are made (for instance $m(K\pi)_1/m(K\pi)_2$) and the combinatorial background is subtracted linearly.

2.3 Inclusive b quark decays in $\text{D}_s\bar{\text{D}}(X)$ *or* $\text{D}\bar{\text{D}}(X)$

After acceptance corrections, the different branching fractions obtained are given in Table 1.

The inclusive branching fraction of b quarks to $\text{D}_s\text{D}(X)$ is measured to be

$$\mathcal{B}(\text{b} \to \text{D}_s\text{D}^0, \text{D}_s\text{D}^\pm(X)) = (13.1^{+2.6}_{-2.2}(\text{st})^{+1.8}_{-1.6}(\text{sy})^{+4.4}_{-2.7}(\mathcal{B}_\text{D}))\%,$$

in good agreement with previous measurements of the inclusive branching fraction of the B mesons to D_s .

For the first time, doubly-charmed B decays involving no D_s production are observed. The corresponding

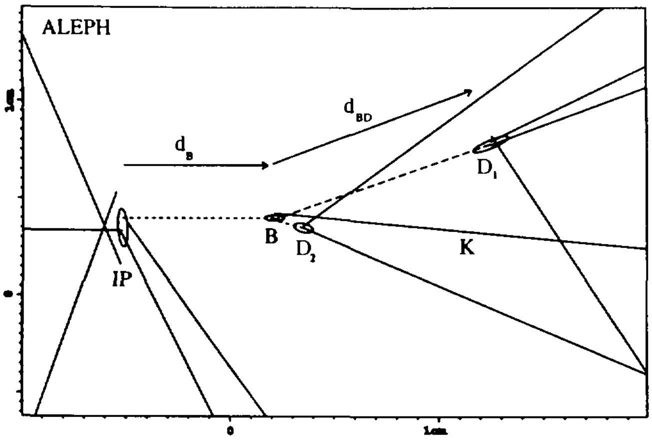

Figure 3: Display of a decay $B^0 \to D^- D^0 K^+$ reconstructed in the ALEPH detector (real data).

Table 1: Summary of the different branching fractions measured in this analysis. The modes involving a D^{*+} (lowest part of the table) are also included in the upper part results as a subsample of the modes involving a D^0 or a D^+.

Channel	$\mathcal{B}(\%)$
$b \to D^0 D_s^-(X)$	$9.1^{+2.0\,+1.3\,+3.1}_{-1.8\,-1.2\,-1.9}$
$b \to D^+ D_s^-(X)$	$4.0^{+1.7}_{-1.4} \pm 0.7\,^{+1.4}_{-0.9}$
Sum $b \to D^0 D_s^-, D^+ D_s^-(X)$	$13.1^{+2.6\,+1.8\,+4.4}_{-2.2\,-1.6\,-2.7}$
$b \to D^0 \bar{D}^0(X)$	$5.1^{+1.6\,+1.2}_{-1.4\,-1.1} \pm 0.3$
$b \to D^0 D^-, D^+ \bar{D}^0(X)$	$2.7^{+1.5\,+1.0}_{-1.3\,-0.9} \pm 0.2$
$b \to D^+ D^-(X)$	$< 0.9\%$ at 90%C.L.
Sum $b \to D^0 \bar{D}^0, D^0 D^-, D^+ \bar{D}^0(X)$	$7.8^{+2.0\,+1.7\,+0.5}_{-1.8\,-1.5\,-0.4}$
$b \to D^{*+} D_s^-(X)$	$3.3^{+1.0}_{-0.9} \pm 0.6\,^{+1.1}_{-0.7}$
$b \to D^{*+} \bar{D}^0, D^0 D^{*-}(X)$	$3.0^{+0.9\,+0.7}_{-0.8\,-0.5} \pm 0.2$
$b \to D^{*+} D^-, D^+ D^{*-}(X)$	$2.5^{+1.0\,+0.6}_{-0.9\,-0.5} \pm 0.2$
$b \to D^{*+} D^{*-}(X)$	$1.2^{+0.4}_{-0.3} \pm 0.2 \pm 0.1$

inclusive branching fractions are

$$\mathcal{B}(b \to D^0 \bar{D}^0, D^0 D^\pm(X)) = (7.8^{+2.0}_{-1.8}(st)^{+1.7}_{-1.5}(sy)^{+0.5}_{-0.4}(\mathcal{B}_D))\%$$

Hence a significant fraction of the doubly-charmed B decays leads to no D_s production. For the average mixture of b hadrons produced at LEP, the sum over all the decay modes above yields:

$$\mathcal{B}(b \to D_s D^0, D_s D^\pm, D^0 \bar{D}^0, D^0 D^\pm(X)) =$$
$$(20.9^{+3.2}_{-2.8}(\text{stat})^{+2.5}_{-2.2}(\text{syst})^{+4.5}_{-2.8}(\mathcal{B}_D))\%.$$

Adding the small hidden charm and charmed baryon contributions, this measurement is in good agreement with the recent ALEPH measurement of the average number of charm quarks per b decay :

$n_c = 1.230 \pm 0.036(\text{stat}) \pm 0.038(\text{syst}) \pm 0.053(\mathcal{B}_D)$.

Some corresponding $D^{(*)}\bar{D}^{(*)}$ mass spectra are given in Fig. 4.

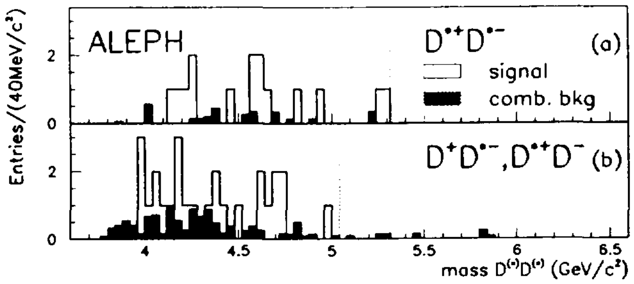

Figure 4: Unshaded histogram: the $D\bar{D}$ mass spectra of the selected $b \to D\bar{D}(X)$ candidates (a) $D^{*+}D^{*-}$ (b) $D^\pm D^{*\mp}$. The channels are mutually exclusive. Shaded histogram: the $D\bar{D}$ mass distribution of the events in the sidebands of the D_1 or D_2 mass spectra, normalised to the expected number of combinatorial background events.

2.4 *Cabbibo suppressed* $B \to \bar{D}D$ *decays*

As can be seen in Fig. 4a, two candidates for the Cabibbo suppressed decay $B^0_d \to D^{*+}D^{*-}$ are observed. Asking for no charged track at the $D\bar{D}$ vertex, the background is reduced to 0.10 ± 0.03 event. The corresponding branching fraction is measured to be

$$\mathcal{B}(\bar{B}^0_d \to D^{*+}D^{*-}) = (0.23^{+0.19}_{-0.12} \pm 0.04 \pm 0.02(\mathcal{B}_D))\,\%.$$

One candidate for the Cabibbo suppressed decay $B^- \to D^{*-}D^0$, with both D vertices well separated from the reconstructed B decay point, is also observed [4] and limits on branching fractions are obtained [2].

2.5 *Semi inclusive* $B \to \bar{D}DK(X)$ *decays*

Reconstructing a K^0_S and $K^\pm$ compatible with the $D\bar{D}$ vertex, and making the $\bar{D}DK$ invariant mass (without using the soft pion from a D^*), 3 peaks separated by about 150 MeV/c^2 appear, corresponding to the three 3-body B meson decay modes (Fig. 5). At a lower mass, the events correspond to more than 3-body decay modes (mainly $D^{(*)}\bar{D}^{(*)}K\pi$). After background subtraction, the total number of events is 32.2±7.9, and in the 3-body region 21.2±5.5. Hence, one sees that the three-body decays $B \to \bar{D}^{(*)}D^{(*)}K$ are a large part (about 70%) of the inclusive doubly-charmed $B \to \bar{D}^{(*)}D^{(*)}K(X)$ decays.

2.6 *Exclusive* $B \to \bar{D}DK$ *decays*

Asking now for no other charged track at the $\bar{D}DK$ vertex (and using the soft pion from a D^* when available), a clear B signal appear (Fig. 6) with 9 $\bar{D}^{(*)}D^{(*)}K^0_S$ events and 9 $\bar{D}^{(*)}D^{(*)}K^\pm$ events above 5.04 GeV/c^2. One of these events [4] was displayed in Fig. 3.

No evidence for resonant decays $B \to \bar{D}^{(*)}D^+_{s1}(2535)$ is found.

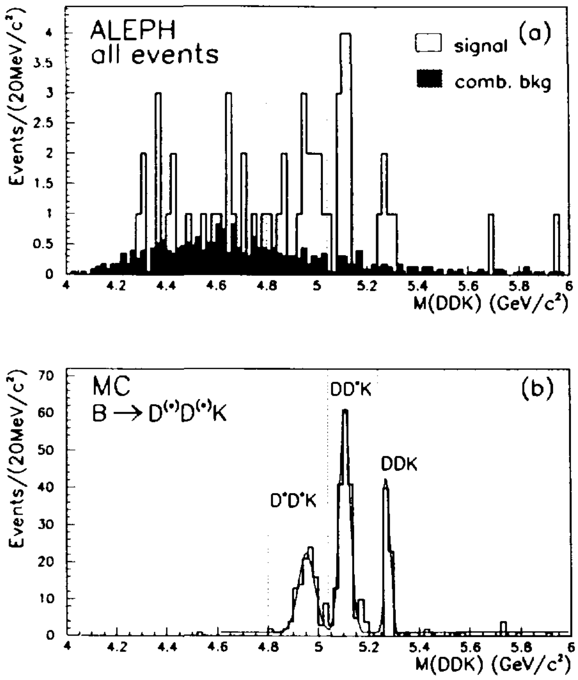

Figure 5: The $D^0\bar{D}^0K$, D^0D^-K or D^+D^-K mass of $D\bar{D}$ events with a reconstructed K^0_S or a $K^\pm$ for (a) ALEPH data (b) simulated three-body decays $B \to D^{(*)}\bar{D}^{(*)}K$. The π^+ from $D^{*+} \to D^0\pi^+$, even if reconstructed, are not used in the mass.

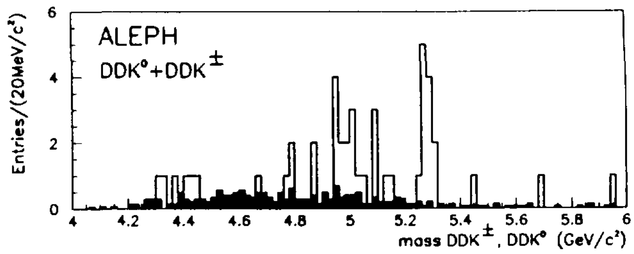

Figure 6: Invariant mass $m(D\bar{D}K)$ for events with one identified K and no other additional track from the $D\bar{D}K$ vertex. D can be either a D^0, a D^+ or a D^{*+}.

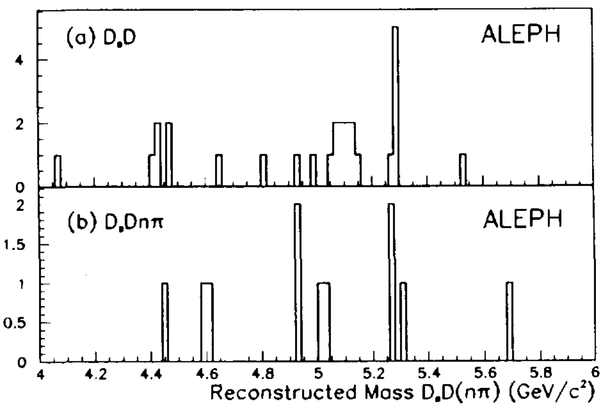

Figure 7: Invariant mass $m(D_s^+\bar{D}(n\pi^\pm))$ reconstructed for ALEPH data (a) $D_s^+\bar{D}$ (b) $D_s^+\bar{D}n\pi^\pm$, $n \geq 1$. The peak close to 5.1 GeV/c^2 is due to events with one missing neutral from decays $D^* \to D\pi^0, \gamma$ or or $D_s^{*+} \to D_s^+\gamma$.

B and $\bar{B}$ decays give different final states and, for instance in a $\bar{B}$ decay, the D coming from the b quark decay (called D_b) can be distinguished from the $\bar{D}$ coming from the W decay (D_W): in most of the events, the invariant mass $m(D_bK)$ tend to be higher than $m(D_WK)$ (and hence the momentum $p(D_b)$ in the B rest frame is higher than $p(D_W)$).

The diagrams contributing to these decays can be divided into 3 classes (Table 2): External W (E), Internal W (I) or color suppressed (cf $B \to J/\psi K$) and interference (EI); as can be seen in Table 2, some I type events are also observed.

Using isospin symmetry, the different branching fractions are given in Table 2 and the sum is :

$$\mathcal{B}(B \to \bar{D}^{(*)}D^{(*)}K) = (7.1^{+2.5}_{-1.5}(st)^{+0.9}_{-0.8}(sy) \pm 0.5(\mathcal{B}_D))\%.$$

2.7 $B \to \bar{D}DKX$ decays

Compared to the semi-inclusive result of Sec. 2.5 or to the inclusive b results of Sec. 2.3 , scaled by a factor $1/2f_{B^0_d} = 1.3$ to account for $b \to \bar{B}^0, B^-$, one sees that $\mathcal{B}(B \to \bar{D}^{(*)}D^{(*)}KX)$ should be about 3%.

2.8 $B \to D_s^+\bar{D}(n\pi^\pm)$ decays

Using the events with a $D_s^+\bar{D}$ mass above 5.04 GeV/c^2 in Fig. 7a, the branching fraction of B^0 and B^+ mesons into doubly-charmed two-body decay modes is also measured and gives

$$\mathcal{B}(B \to D_s^{(*)+}\bar{D}^{(*)}) = (5.6^{+2.1}_{-1.5}(st)\ ^{+0.9}_{-0.8}(sy)\ ^{+1.9}_{-1.1}(\mathcal{B}_D))\%,$$

in good agreement with previous measurements of the same quantity .

For the first time, some candidates for completely reconstructed decays $B^0, B^+ \to \bar{D}^{(*)}D_s^+n\pi^\pm$ ($n \geq 1$) are also observed (Fig. 7b). A measurement of the branching fraction for many-body decays $B^0, B^+ \to \bar{D}^{(*)}D_s^+X$ is performed, leading to

$$\mathcal{B}(B \to D_s^{(*)\pm}D^{(*)}X) = (9.4^{+4.0}_{-3.1}(st)^{+2.2}_{-1.8}(sy)^{+2.6}_{-1.6}(\mathcal{B}_D))\%.$$

Table 2: Summary of the various branching fractions $B \to D\bar{D}K$ measured in this analysis.

Diagram	Channel (B^0, B^+)	Number of candidates	$\mathcal{B}(B \to D^{(*)}\bar{D}^{(*)}K)$ (B^0/B^+ average)
E	$D^-D^0K^+$, $\bar{D}^0D^+K^0$	3	$1.7^{+1.2}_{-0.8} \pm 0.2 \pm 0.1\%$
E	$(D^{*-}D^0 + D^-D^{*0})K^+$, $(\bar{D}^{*0}D^+ + \bar{D}^0D^{*+})K^0$	5	$1.8^{+1.0}_{-0.8} \pm 0.3 \pm 0.1\%$
E	$D^{*-}D^{*0}K^+$, $\bar{D}^{*0}D^{*+}K^0$	1	$< 1.3\%$
I	$\bar{D}^0D^0K^0$, $D^+D^-K^+$	1	$< 2.0\%$
I	$(\bar{D}^0D^{*0} + \bar{D}^{*0}D^0)K^0$, $(D^{*+}D^- + D^+D^{*-})K^+$	1	$< 1.6\%$
I	$\bar{D}^{*0}D^{*0}K^0$, $D^{*+}D^{*-}K^+$	1	$< 1.5\%$
EI	$D^+D^-K^0$, $\bar{D}^0D^0K^+$	1	$< 1.9\%$
EI	$(D^{*+}D^- + D^+D^{*-})K^0$, $(\bar{D}^{*0}D^0 + \bar{D}^0D^{*0})K^+$	4	$1.6^{+1.0}_{-0.7} \pm 0.2 \pm 0.1\%$
EI	$D^{*+}D^{*-}K^0$, $\bar{D}^{*0}D^{*0}K^+$	1	$< 3.0\%$
Sum E	$D^{(*)-}D^{(*)0}K^+$, $\bar{D}^{(*)0}D^{(*)+}K^0$	9	$3.5^{+1.7}_{-1.1}{}^{+0.5}_{-0.4} \pm 0.2\%$
Sum I	$\bar{D}^{(*)0}D^{(*)0}K^0$, $D^{(*)+}D^{(*)-}K^+$	3	$0.8^{+1.0}_{-0.4}{}^{+0.2}_{-0.1} \pm 0.1\%$
Sum EI	$D^{(*)+}D^{(*)-}K^0$, $\bar{D}^{(*)0}D^{(*)0}K^+$	6	$2.8^{+1.6}_{-1.0}{}^{+0.4}_{-0.3} \pm 0.2\%$
E+I+EI	Sum $D\bar{D}K$	5	$2.3^{+1.5}_{-0.9}{}^{+0.3}_{-0.3} \pm 0.2\%$
E+I+EI	Sum $D\bar{D}^*K + D^*\bar{D}K$	10	$3.8^{+1.6}_{-1.1}{}^{+0.5}_{-0.4} \pm 0.2\%$
E+I+EI	Sum $D^*\bar{D}^*K$	3	$1.0^{+1.3}_{-0.6}{}^{+0.2}_{-0.2} \pm 0.1\%$
E+I+EI	Sum $D^{(*)}\bar{D}^{(*)}K$	18	$7.1^{+2.5}_{-1.5}{}^{+0.9}_{-0.8} \pm 0.5\%$

2.9 Conclusion on B meson decays

Summing the results of Sec. 2.4, 2.6, 2.7 and 2.8, one sees that $B \to D\bar{D}(X)$ and $B \to D_s^+\bar{D}(X)$ are a big part (about 25%) of B mesons decays.

2.10 $B_s^0 \to D_s^+D_s^-$ decay

One event [4] is reconstructed with a $D_s^+D_s^-$ mass at the B_s^0 mass, on a negligible background, with $D_s^+ \to \bar{K}^{*0}K^+$ and $D_s^- \to \phi\pi^-$. This can be only the pure CP even B_s^0 short state as explained in Sec. 3.1 below.

3 Width difference in the $B_s - \bar{B}_s$ system

3.1 Introduction

Most of the channels common to B_s and $\bar{B}_s$ are CP even (cf $D_s^+D_s^-$ ...). Hence the B_s short is the CP even state. Here a direct measurement of the B_s short lifetime is made using the mostly CP even decay modes $B_s^0 \to D_s^{(*)+}D_s^{(*)-}(X)$ with $D_s^+ \to \phi X$, that is a $\phi\phi X$ final state [5] .

3.2 $\phi\phi$ selection

The same method as for double charm (Sec. 2.2) is applied (table $m(K^+K^-)_1/m(K^+K^-)_2$). The number of $\phi\phi$ events measured in this way is $N_{\phi\phi} = 50 \pm 15$, taking into account the non linear background shape near the K^+K^- threshold. In these events, 20% of charm contamination is expected from Monte Carlo; the contribution of $\phi\phi$ coming from B_d and B_u decays is evaluated using $\mathcal{B}(B \to D_s^{(*)\pm}D^{(*)}(X))$ measured in Sec. 2.8. After subtracting these events, the number of $B_s^0 \to D_s^{(*)+}D_s^{(*)-}(X)$ found is $N_{sig} = 32 \pm 17$ (over a background of 78%). This number corresponds to a $B_s^0 \to D_s^{(*)+}D_s^{(*)-}(X)$ branching ratio of approximately 10%.

3.3 B_s short lifetime

The $\phi\phi$ vertex (which has a resolution of about $200\mu m$) is a good approximation of the B_s vertex due to the short D_s lifetime. An unbinned maximum likelihood fit using background parametrisation from the sidebands gives a preliminary lifetime $\tau_s = 1.42 \pm 0.23 \pm 0.16$ ps for this eigenstate. Using the world average B_s lifetime, $\bar{\tau} = 1.61 \pm 0.10$ ps, it would correspond [5] to $\Delta\Gamma/\Gamma = (24 \pm 35)\%$ where the statistical and systematic errors are combined.

References

1. Paper # 946, Preprint CERN EP/98-017, submitted to *Phys. Lett.* B.
2. Paper # 941, Preprint CERN EP/98-037, submitted to *The European Physical Journal* C.
3. Paper # 1054, Preprint ALEPH 98-064.
4. Color displays of the events shown during the talk can be found in http://alephwww.cern.ch/.
5. See also A. Ribon, Talk # 802, these proceedings.