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HEAVY FLAVOUR RESULTS FROM LEP AND SLC EXPERIMENTS *

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New experimental results on heavy flavour physics obtained in the study of Z^0 decays by the four LEP experiments and SLD are presented. These include production, spectroscopy, lifetimes, $\bar{B}$-mixing and decay properties.

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1. Introduction

An enormous amount of work has been devoted to heavy flavour physics at LEP and SLD. The outcome is much larger than anticipated in the Yellow Report at the LEP start up. This report gives an overview over recent achievements in c- and mainly b-physics from the study of Z^0 decays.

2. Heavy quark production

2.1. b and c production in Z decays

There has been lots of excitement recently about possible deviations from the Standard Model in $R_c = B(Z \to c\bar{c})/B(Z \to q\bar{q})$ (1.8σ below the SM) and R_b (about 3σ above the SM). Three updated and five new analyses by ALEPH [2], DELPHI [3] and OPAL [4] on R_c lead to $R_c = 0.1715 \pm 0.0056$, perfectly consistent with the expectation 0.172 within the 3.2% accuracy. New or updated R_b analyses have been presented by the L3 [5], SLD [6], DELPHI [7] and ALEPH [8] Collaborations. All of them lead to smaller values than the previous world average. Especially noteworthy is the new ALEPH analysis with very small errors ($R_b = 0.2161 \pm 0.0009 \pm 0.0011$,

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in perfect agreement with the SM prediction 0.2158), which is less dependent on charm background and has strongly reduced hemisphere correlations. As no "flaws" have been identified in the older analyses (yet) and the $\chi^2/NDF = 5.1/5$ of the mean value determination indicates consistency between the measurements, one may consider the new mean value (still about two standard deviations above the SM) serious. However, before drawing final conclusions one should await high precision analyses from the DELPHI and OPAL Collaborations. The SM is in a better shape than ever, but the minimal supersymmetric model also is consistent with the data. More details may be found in the contribution by Pepe–Altarelli in these proceedings.

2.2. Gluon splitting into $c\bar{c}$ and $b\bar{b}$

The gluon splitting probability into $c\bar{c}$ has been published by OPAL to be $f_g \to c\bar{c} = 2.38 \pm 0.48\%$ [9]. This value is now used in the combination of electroweak experiments by the LEP/SLD electroweak working group [10]. ALEPH has contributed to Warsaw a new measurement [11] $f_g \to c\bar{c} = 2.65 \pm 0.74 \pm 0.51\%$. The ratio $f(g \to b\bar{b})/f(g \to c\bar{c}) = 0.13 \pm 0.04$ is still taken from theory. This number is consistent with the first measurement of $f(g \to b\bar{b}) = 0.22 \pm 0.10 \pm 0.08\%$ by the DELPHI Collaboration [12]. Although the errors are still large, this number is not anomalously large, such that it cannot be responsible for a large R_b value.

2.3. Prompt J/ψ and Υ production

OPAL has found some evidence for prompt (*i.e.* not from b-decays) J/ψ [13] and Υ [14] in Z^0 decays, with branching ratios $B(Z \to J/\psi X) = (1.9 \pm 0.7 \pm 0.5 \pm 0.4) \cdot 10^{-4}$ and $B(Z \to \Upsilon X) = (1.0 \pm 0.4 \pm 0.1 \pm 0.2) \cdot 10^{-4}$. In order to explain the large cross sections, they need to employ in addition to the normal colour singlet also the colour octet production mechanism, which was invented to explain the roughly 50 times too large inclusive J/ψ and ψ' cross sections observed at the Tevatron. However, some caution is necessary: First OPAL states that the colour octet model does not describe all details observed. Most importantly, the signals are still very small (8 events in the Υ region, and ALEPH [15] has contributed an upper limit of $B(Z \to \Upsilon X) < 0.73 \cdot 10^{-4}$, in slight contradiction to the OPAL result. We should wait for confirmation before making too strong conclusions.

2.4. Λ_b polarization

The SM predicts a large b–quark polarization of -0.94 in Z decays, which is reduced by QCD to -0.91. Given that the Λ_b contains a b-quark and a spin 0-diquark with orbital angular momentum $L = 0$, the helicity of the b-quark is expected to be transferred to the Λ_b. The Λ_b polarization can be measured by measuring the ratio $\langle E_\nu \rangle / \langle E_l \rangle$. ALEPH [16] has updated the first determination to $\mathcal{P}(\Lambda_b) = -0.30^{+0.19}_{-0.16} \pm 0.06$, and DELPHI [17] has measured $\mathcal{P}(\Lambda_b) = -0.08^{+0.35}_{-0.29}{}^{+0.18}_{-0.16}$. Thus the $b \to \Lambda_b$ helicity transfer is small (or, unlikely, the Standard Model prediction is wrong). A possible explanation is that a large fraction of the Λ_b is not primary, but a decay product of excited states, as supported by the evidence for Σ_b and Σ_b^* production observed by DELPHI[18].

2.5. Search for the B_c meson

The $\bar{b}c$ meson B_c, a meson with two different heavy quarks, has not yet been observed experimentally. The prime signature would be its decay into J/ψ and a W, *i.e.* a lepton neutrino pair, a single charged pion or 3 pions. The cross section is expected to be small, since it requires the production of 4 heavy quarks, in addition two of them must be so near in phase space that they can end up in the same meson. ALEPH [19], DELPHI [20], L3 [21] and OPAL [22] have established limits in the order of 10^{-4} for the quantities $B(Z \to B_c X)/B(Z \to q\bar{q}) \cdot B(B_c \to J/\psi\pi, J/\psi 3\pi, J/\psi l\nu)$. ALEPH has found one serious B_c candidate event in the semileptonic channel, with estimated mass $5.96^{+0.25}_{-0.19}$ GeV and an observed decay length of 2.5 mm (see Fig. 1).

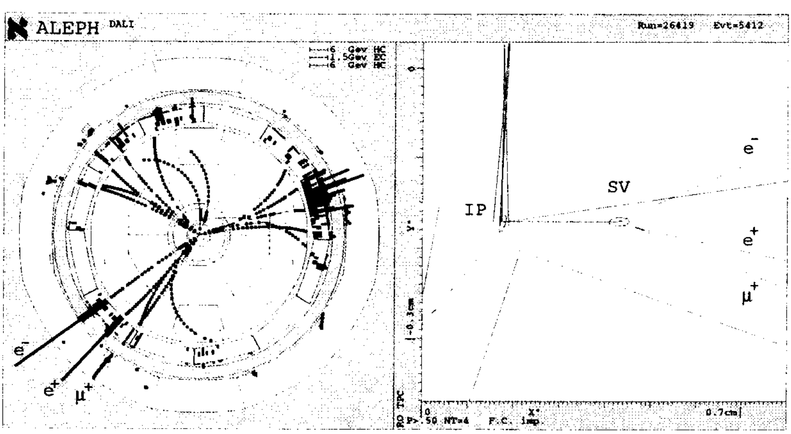

Fig. 1. The ALEPH B_c candidate

3. Heavy quark spectroscopy

3.1. Introduction

The large $b\bar{b}$ cross section, silicon vertex detectors and lifetime b-tagging methods, as well as the development of inclusive b-hadron reconstruction

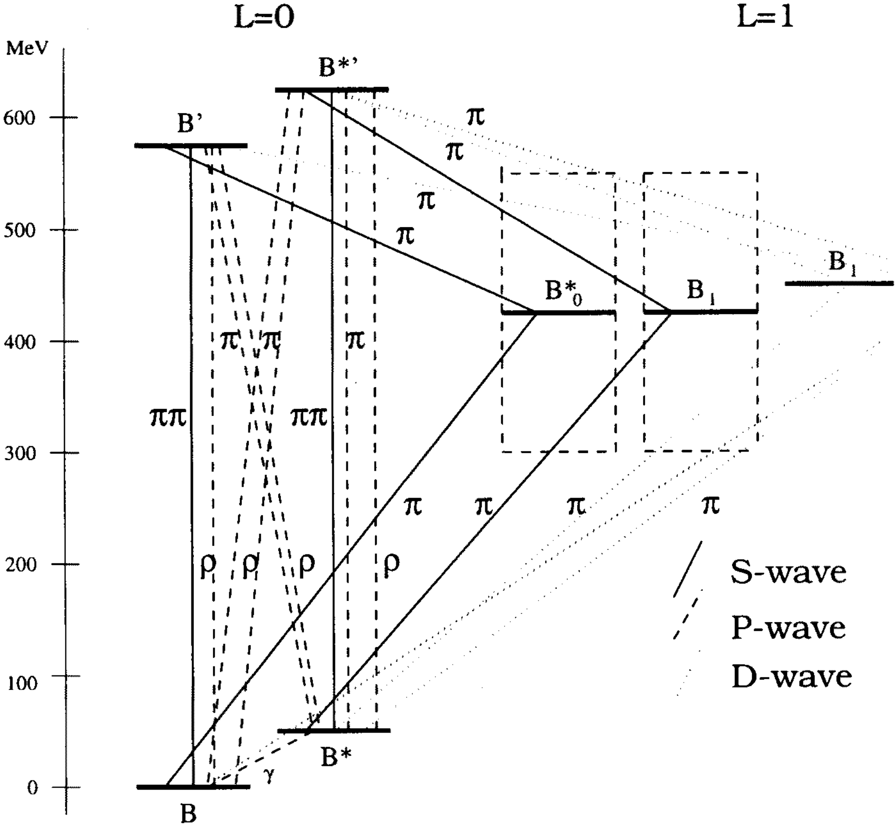

Fig. 2. Quark model prediction of the low lying levels of the B meson mass spectrum and γ, π and $\pi\pi$ transitions

algorithms have led to the possibility to perform B spectroscopy at LEP. The expected spectrum for each of the flavour states is shown in Fig 2. In 1994 the $B^* \rightarrow B\gamma$ transitions have been observed by L3 [23], DELPHI [24] and ALEPH [25], in 1994/95 signals of orbitally excited B^{**} mesons have been found in $B^{(*)}\pi$ by OPAL [26] DELPHI [27, 28] and ALEPH [25]. OPAL [26] and DELPHI [28] have observed evidence for B_s^{**}, and DELPHI [18] evidence for Σ_b and Σ_b^* decays into $\Lambda_b\pi$. These results are summarized *e.g.* in [29, 30]. At the Warsaw conference OPAL presented a B^* analysis [31], in agreement with the earlier B^* results from the other experiments, and DELPHI the first analyses of the Be^+e^- [32] and $B^{(*)}\pi^+\pi^-$ [33] final states showing evidence for the B^* Dalitz decay and a narrow orbital and radial excitation, respectively. These new results have been presented for the first time in [34] and are shortly summarized here.

3.2. B^* Dalitz decay

The development of an algorithm reconstructing low energetic tracks from unassociated hits in the DELPHI silicon micro vertex detector allows to reconstruct low energetic Dalitz pair electrons down to transverse momenta of 30 MeV/c. Combining these with inclusively reconstructed B-mesons showed clear evidence for the B^* Dalitz decay. The preliminary result [32] is $\Gamma(B^* \to Be^+e^-)/\Gamma(B^* \to B\gamma) = 0.00554 \pm 0.00129 \pm 0.00072$, in agreement with QED expectations.

3.3. Orbital and radial excitations in $B^{(*)}\pi^+\pi^-$

The DELPHI experiment has announced the discovery of radially excited B mesons [33]. A search for resonances in the final state $B^{(*)}\pi^+\pi^-$ resulted

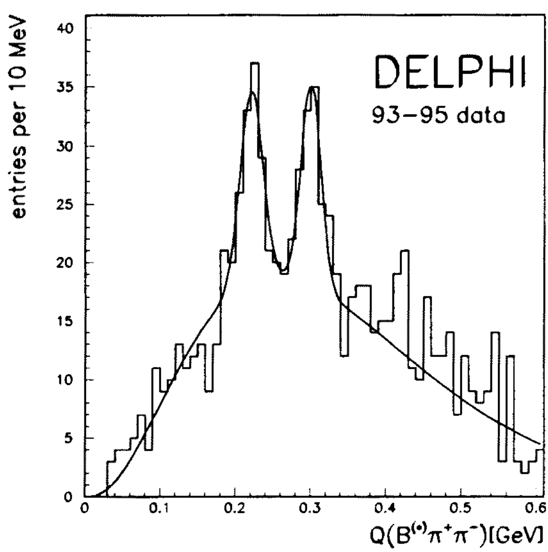

Fig. 3. $B^{(*)}\pi^+\pi^-$ Q-value spectrum as measured by DELPHI. The lower peak is interpreted as stemming from orbitally excited B^{**} state, and the upper from a radial excitation.

in the observation of two narrow peaks, see Fig. 3. The first peak with a mean Q value of $220 \pm 4 \pm 10$ MeV is interpreted as being due to the decay of the orbitally excited B meson $B_1 \to B\pi^+\pi^-$. The peak at $301 \pm 4 \pm 10$ MeV is likely to stem from the decay of radially excited B' or $B^{*'}$ mesons.

3.4. Σ_c^* from CLEO

Not from LEP, but interesting in the framework of heavy quark spectroscopy, is a new measurement from CLEO, who find unambiguous signals for Σ_c^{*0} and Σ_c^{*++} in the $\Lambda_c^+\pi^-$ and $\Lambda_c^+\pi^+$ invariant mass spectra [35]. The $\Sigma_c^* - \Lambda_c$ mass differences are measured to be around 233 MeV. Simple scaling laws for mass splittings then let the preliminary DELPHI result [18] on the Σ_b^* mass appear to be higher than expected. About 13% of all Λ_c baryons at CLEO come from the decay of a Σ_c^*. Such a large fraction is in good agreement with the findings of DELPHI in the b-sector.

4. *B* lifetimes

To measure B lifetimes, one exploits the good resolution of silicon vertex detectors for a decay length measurement, mainly using partially or fully inclusively reconstructed vertices. Various energy reconstruction methods have been developed to estimate the Lorentz boost necessary to measure the proper time of the decay. Apart of the measurement of the inclusive B lifetime [36], one needs in addition methods to separate the different B-hadron species B^+ [37], B^0 [38, 37], B_s [39], Λ_b [40, 41] and Ξ_b [42]. Many new and updated measurements are available. As an example Fig. 4 shows the lifetime distributions obtained by the SLD Collaboration using a topological vertexing method to distinguish charged and neutral B hadrons.

The new world averages (also containing CDF data) determined from the LEP/CDF lifetime working group [43] and presented by Shepard-Themistocleous and Ratoff in Warsaw are:

$$\begin{aligned} \text{inclusive } \tau(b) &= 1.549 \pm 0.020\text{ps}, \\ \tau(B^+) &= 1.65 \pm 0.04\text{ps}, \\ \tau(B^0) &= 1.55 \pm 0.04\text{ps}, \\ \tau(B_s) &= 1.52 \pm 0.07\text{ps}, \\ \tau(\Lambda_b) &= 1.27 \pm 0.06\text{ps}, \\ \tau(\Xi_b) &= 1.38^{+0.36}_{-0.29}\text{ps} . \end{aligned}$$

Thus the observed lifetime hierarchy is as expected in Heavy Quark Effective Theory, however the observed Λ_b lifetime is much smaller than expected.

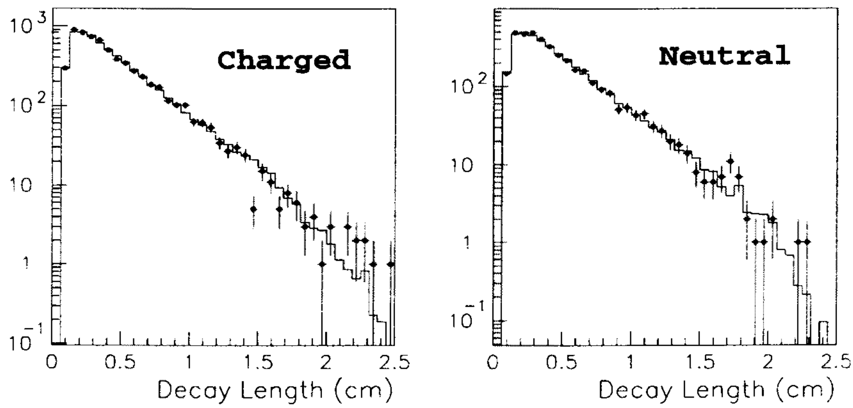

Fig. 4. Lifetime distributions for neutral and charged topological b-vertices as measured by the SLD Collaboration

5. B mixing

In the Standard Model second order weak interactions give rise to $B-\bar{B}$ oscillations. Time-dependent $B_0-\bar{B}_0$ oscillations now have been clearly established in a number of analyses from different experiments. $B_s-\bar{B}_s$ oscillations proceed too fast to have been detected yet, but lower limits on the frequency are derived. A LEP working group is being built to optimally combine the different measurements, taking correlated systematics into account. New measurements of the integrated mixing probability at LEP are available from OPAL [44], ALEPH [45] and L3 [46], the new mean value being $\bar{\chi}=0.12200\pm0.0046$ [10].

5.1. B^0 oscillations

Many different techniques are used to tag the B flavour at production time and decay time. Most often the production tag is taken from the opposite hemisphere. The sign of fully reconstructed D^* mesons, very low p_T spectator pions (π^*) of $D^*\to D\pi^*$ high p_T leptons, and jet charge techniques are used to enrich B- or $\bar{B}$ mesons. The SLD Collaboration [47] can exploit the large SLC electron beam polarization that induces a strong forward-backward asymmetry of b-quarks to define a production tag. This is either used on its own or in combination with jet charge. ALEPH [48] also has made first measurements with same side tagging using the charge of the leading fragmentation pion in hemispheres with fully reconstructed B-mesons. Further new results have been presented by DELPHI [49], L3

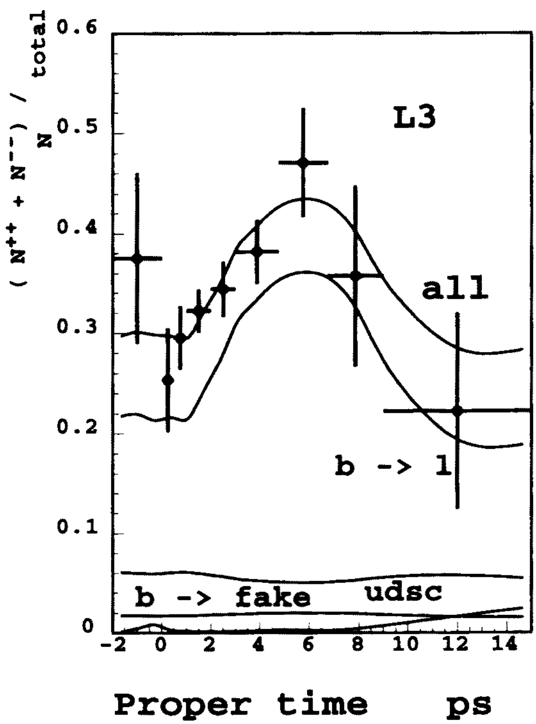

Fig. 5. B_d oscillation signal from dilepton events measured by the L3 Collaboration

[50] (see Fig. 5) and OPAL [51]. The mean value presented by Gibbons in Warsaw is $\Delta m_d = 0.464 \pm 0.012 \pm 0.013\ \mathrm{ps}^{-1}$.

5.2. B_s oscillations

Updated limits on B_s mixing have been provided by the ALEPH [52], DELPHI [53] and OPAL [54] Collaborations, using a variety of methods: leptons, jet charge, leading fragmentation kaons, D_s+ lepton, D_s+ hadron, ϕ+ lepton in many different combinations. To establish limits, OPAL is looking at the fit likelihood as a function of the frequency. ALEPH and DELPHI now employ the so-called amplitude method, fitting the amplitude A of a possible oscillation as a function of frequency. If $A = 1$ for a given frequency, the data is consistent with a $B_s - \bar{B}_s$ oscillation of that frequency, for all other values not. This is a sort of Fourier transform. The advantage is that with the amplitude method it is easy to combine different experiments. A signal would show up as a narrow peak of height 1 in the A vs. $\Delta(m_s)$ plot, outside the peak A should be consistent with 0. Upper limits can be placed at the Δm_s, where $A + 1.645\sigma_A$ reaches 1. The combined limit of ALEPH is 7.8 ps^{-1}, of DELPHI 6.5 ps^{-1}, and of OPAL 4.6 ps^{-1}. Combining the two amplitude method results of ALEPH and DELPHI leads to $\Delta m_s > 9.2\,ps^{-1}$.

6. *B* decays

6.1. Determination of V_{cb}

The Cabibbo–Kobayashi–Maskawa (CKM) matrix element V_{cb} has been determined from the ω (recoil velocity) spectrum in $B \to D^* l\nu$ [55, 56, 57]

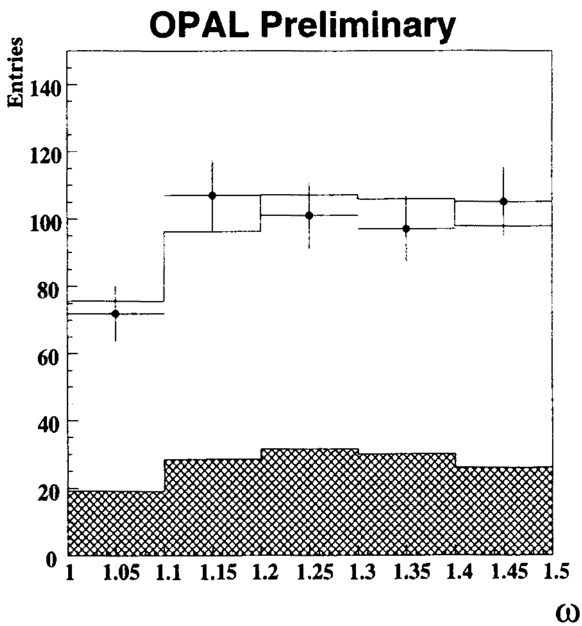

Fig. 6. The ω spectrum as measured by OPAL in the $|V_{cb}|$ analysis

(see *e.g.* Fig. 6) and $B \to Dl\nu$ [55]. According to HQET the spectra are given by a universal form factor $F(\omega)$, and the form factor at zero recoil $F(1)$ can be related model-independently to V_{cb}. The experiments simultaneously fit the intercept and the slope of the form factor. They agree well on the intercept, but show quite some scattering in the slope. The mean value determined from the D^* analyses (including the CLEO result) reported by Gibbons in Warsaw is $\langle F(1)|V_{cb}|\rangle = 0.0348 \pm 0.0016$. Using a 2-loop calculation of $F(1) = 0.91 \pm 0.02$ this corresponds to $|V_{cb}| = 0.0392 \pm 0.0027$ (experimental) ± 0.0013 (theoretical).

6.2. D^{**} production in c- fragmentation and semileptonic B decays

There is a large number of analyses looking for excited D states in c-quark fragmentation and inclusive and semileptonic B-decays by ALEPH [58], DELPHI [59] and OPAL [60]. Indications of the "narrow" $j_l = 3/2$ orbitally excited $c\bar{u}$ mesons D_1 and D_2^* and $c\bar{s}$ mesons D_{s1} and D_{s2}^* have been observed, as well as evidence for "broad" D^{**} resonances or non-resonant $D^*\pi$ states in semileptonic B decays. Unfortunately all measurements still are based on small statistics. About one third of all D-mesons stem from a decay of an orbitally excited D-meson state, both in c-fragmentation as well as in B decays.

These observations are also important inputs for the correct interpretation of form factor measurements in the V_{cb} determinations mentioned above.

As pointed out by Zalewski in the discussion, it would be interesting to study the ω dependence of D^{**} production in semileptonic B decays. In the heavy quark limit one expects no D^{**} at zero recoil, since at that point the light quark wave function of initial and final state mesons should be identical.

6.3. Double charm production and charm counting in B decays

The quark diagram $b \to c\bar{c}s$ leads to final states with charm and anticharm. These can either manifest itself as hidden charm (J/ψ,χ_c, ψ') or as a $D\bar{D}$ pair. First experimental signs for double charmed meson production has now been established by ALEPH [61]

$$B(B^0, B^- \to D_s D^0 X, D_s D^- X) = 12.5 \pm 2.9 \pm 2.6\%,$$
$$B(B^0, B^- \to D^0 \bar{D}^0 X, D^0 D^- X, \bar{D}^0 D^+ X) = 12.8 \pm 2.7 \pm 2.6\%$$

and DELPHI [62]

$$B(B^0, B^- \to D^{*+} D^{*-} X) = 1.0 \pm 0.2 \pm 0.3\%$$

at a surprisingly high rate.

A similar conclusion has been drawn by a recent CLEO 2 analysis [63] (see also the talk by Bowler in these proceedings) of lepton-D correlations: in addition to the dominating $B \to \bar{D}X$ the inclusive branching fraction of D mesons in B decays is determined to be $B(B \to DX) = 8.1 \pm 2.6\%$.

This is surprising since in $b \to c\bar{c}s$ B^- and B^0 decays into $D\bar{D}$ the strange quark has to end up in an extra K meson, and the phase space is not very large. In fact, in present (tuned) Monte Carlo programs used by the CLEO and also the LEP Collaborations the double charmed meson production rate is very small. The JETSET 7.4 default decay routines, however, predict a sizable branching ratio for this decay.

ALEPH [64] and OPAL [65] also have performed so-called charm counting analyses. They measure production rates for D^0, D^+, D_s, Λ_c and charmonium states in $b\bar{b}$-events, and apply models for the small contributions of $\Xi_c^{-,0}$ and Ω_c baryons. The results are $n_c = 120 \pm 4 \pm 4(BRs)\%$ (ALEPH) and $n_c = 110 \pm 5 \pm 6 \pm 4(BRs)\%$ (OPAL) for the mean number of charm quarks and antiquarks produced in a B-hadron decay.

6.4. Semileptonic branching ratios

6.4.1. Inclusive semileptonic decays

The mean inclusive semileptonic b branching ratio measured at LEP is given by the LEP electroweak working group [10] to be $11.22 \pm 0.21\%$. This is in slight contradiction to the CLEO value measured at the $\Upsilon(4S)$ of $10.43 \pm 0.24\%$. The possible explanation that the b-hadron composition in Z^0 and $\Upsilon(4S)$ decays is different, cannot be the correct interpretation, because the only possible large deviation would be from the Λ_b (see next paragraph), and that goes into the wrong direction. Another reason might be the contribution of $\bar{B} \to \bar{D}$, as discussed in Section 6.3. This class has not been taken into account in neither LEP nor CLEO analyses. Both try to disentangle direct $b \to l$ and $b \to c \to l$, but don't know about the third possibility $b \to \bar{c} \to l$. This latter class usually leads to very low energetic $\bar{D}$ mesons and thus low-energetic leptons, which are easier lost at CLEO with the B-mesons at rest than in Z^0 decays, where the B hadrons have a large boost. It seems that a reanalysis of the inclusive lepton spectra is necessary to resolve this discrepancy.

6.4.2. Semileptonic decays of the Λ_b

OPAL [66] has presented the first measurement of a quantity closely related to the Λ_b semileptonic branching ratio. From theory one expects all semileptonic widths of weakly decaying B hadrons to be the same, and all lifetime differences are just created by interference effects in purely hadronic decay modes. Then the low observed Λ_b lifetime must be correlated with a low semileptonic branching ratio.

Selecting hemispheres with a high energy Λ baryon OPAL has determined the ratio $BR(\Lambda_b \to \Lambda l\nu(X))/BR(\Lambda_b \to \Lambda(X)) = 6.8 \pm 1.3 \pm 1.0\%$, which is significantly lower than the inclusive b semileptonic branching ratio and in agreement with the expectation.

6.4.3. Charmless semileptonic decays

ALEPH [67] has presented an analysis of charmless semileptonic B decays, resulting in $B(B \to l\nu X_u) = (1.6 \pm 0.4 \pm 0.4) \cdot 10^{-3}$.

6.5. D^0 and D_s branching ratios

An important auxiliary quantity in many B- and D-physics analyses are the D^0 and D_s branching ratios. ALEPH [68] has contributed the new number $B(D^0 \to K^-\pi^+) = (3.897 \pm 0.094 \pm 0.117)\%$ comparing inclusive $D^* \to \pi^+ D^0$ decays identified by the small Q-value of the pion alone with the exclusively reconstructed decay chain $D^* \to \pi^+ D^0, D^0 \to K^-\pi^+$. This is the most precise single measurement of this quantity, however it strongly depends on a correct modelling of the background under the spectator pion peak at low transverse momenta.

ALEPH also presented two new measurements of the D_s [69]: $B(D_s \to K^0 K)/B(D_s \to \Phi\pi) = 0.80 \pm 0.15 \pm 0.13$ and $B(D_s \to K^0 K^*)/B(D_s \to \Phi\pi) = 1.33 \pm 0.24 \pm 0.18$.

7. Overview over further results

7.1. D^* spin alignment

OPAL [70] has analysed the spin alignment of D^* in $c-$ and $b-$quark fragmentation and has found a small effect in c-quark events.

7.2. Rare decays

DELPHI [71] and ALEPH [72] have observed a few candidates for the rare decays of B hadrons into $\pi\pi$, $K\pi$, $\rho\pi$ and $K^*\pi$, and limits on $b \to s\gamma$, $K^*\nu\nu$, $\Phi\nu\nu$, $K^* l^+ l^-$ and other final states have been established.

7.3. b decays into τ

ALEPH [73] and OPAL [74] have updated their measurements of the branching ratio $b \to \tau\nu_\tau X$, being in accord with the Standard Model prediction. OPAL also measured $B(b \to \tau\nu_\tau D^*) = 1.04 \pm 0.38 \pm 0.32$. No sign has yet been found for the exclusive decay $B^- \to \tau^-\nu_\tau$, which is directly related to the B decay constant f_B^2, a very important quantity for the interpretation of mixing and CP violation studies.

8. Summary and outlook

The LEP and SLD experiments deliver — in comparison to the classical $\Upsilon(4S)$ experiments — a lot of competitive and complementary heavy flavour results, and it is reasonable to say that a Z^0 factory also is a sort of B factory. The year 1996, with the advent of LEP 2, marks the end of b-physics at LEP. There still are some improvements to be expected, due to better reconstruction algorithms, improved analysis (*e.g.* vertexing) methods, use of all available statistics (especially the 1995 data are not included in all analyses), and a proper combination of all experiments. Both the OPAL and DELPHI experiments are currently reprocessing their data with improved tracking algorithms which in particular optimize the use of the z-measurements of their micro vertex detectors. Large improvements are expected in a variety of analyses. After these relatively modest improvements we will have to wait long for news on B spectroscopy, B_s mixing, the B_c discovery, better B_s and b-baryon lifetime measurements. Depending on the further time schedule at CERN, especially the LHC, one should seriously consider the possibility of an extra high luminosity Z^0 run at the end of the LEP 2 era, which would have a large physics potential, not only for B-physics, but especially also for more stringent Standard Model tests, especially of statistically limited asymmetries and polarizations. The chance to actually observe time dependent $B_s - \bar{B}_s$ oscillations at such a run would be large.

I like to thank the organizers of this workshop for their excellent work creating such a pleasant and creative atmosphere. I further want to thank my colleagues from the DELPHI, ALEPH, OPAL and L3 for providing material and helpful discussions.

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for DELPHI under `http://delwww.cern.ch:8010/physics/ st3/www/-warsaw.html`,
for L3 under `http://hpl3sn02.cern.ch/analysis/Peter Fisher/-ICHEP96.html`,
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[39] DELPHI Coll., ICHEP '96 pa01-042.

[40] ALEPH Coll., ICHEP '96 pa01-068.
[41] DELPHI Coll., ICHEP '96 pa01-045.
[42] ALEPH Coll., ICHEP '96 pa01-071.
[43] LEP B Lifetime Group, DELPHI-Note 46-432 CONF 52.
[44] OPAL Coll., ICHEP '96 pa05-005.
[45] ALEPH Coll., ICHEP '96 pa10-121.
[46] L3 Coll., ICHEP '96 pa07-060.
[47] SLD Coll., ICHEP '96 pa08-26A, pa08-026B, pa08-27/28.
[48] ALEPH Coll., ICHEP '96 pa05-054.
[49] DELPHI Coll., ICHEP '96 pa01-038.
[50] L3 Coll., ICHEP '96 pa05-048.
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[52] ALEPH Coll., ICHEP '96 pa05-054, pa08-020.
[53] DELPHI Coll., ICHEP '96 pa05-039.
[54] OPAL Coll., ICHEP '96 pa08-010, pa08-014.
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[56] DELPHI Coll., ICHEP '96 pa01-048.
[57] OPAL Coll., ICHEP '96 pa08-008.
[58] ALEPH Coll., ICHEP '96 pa01-073.
[59] DELPHI Coll., ICHEP '96 pa01-117.
[60] OPAL Coll., ICHEP '96 pa01-012, pa01-013.
[61] ALEPH Coll., ICHEP '96 pa01-060.
[62] DELPHI Coll., ICHEP '96 pa01-108.
[63] Y. Kwon, talk given at ICHEP '96, Warsaw.
[64] ALEPH Coll., ICHEP '96 pa01-061.
[65] OPAL Coll., ICHEP '96 pa05-013.
[66] OPAL Coll., ICHEP '96 pa05-034.
[67] ALEPH Coll., ICHEP '96 pa05-059.
[68] ALEPH Coll., ICHEP '96 pa05-062.
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[73] ALEPH Coll., ICHEP '96 pa10-019.
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