Chapter 6

Conclusions

Combining the results obtained in chapter 4 with the systematic uncertainties of chapter 5, the $B^{**}_{u,d}$ mass for the charged-pion channel is : $M_{B^{**}_{u,d}}$ = (5.712 ± 0.010 +0.034 -0.023) GeV and that for the neutral-pion channel is : $M_{B^{**}_{u,d}}$ = (5.604 ± 0.019 +0.041 -0.048) GeV. In figure 6.1 the values for the $B^{**}_{u,d}$ mass obtained in this analysis are compared to those obtained by the other LEP experiments. The results from the charged-pion channel are compatible with the results of the other LEP experiments. For the first time, the π^0-channel (not measured by the other experiments) can now be compared to the results of the $\pi^{\pm}$-channel. The $B^{**}_{u,d}$ mass obtained from the π^0-channel lies 2.3 standard deviations below the average mass of the $\pi^{\pm}$-channel. Heavy Quark Effective Theory predicts a mass of 5.767 and 5.755 GeV for the narrow states B_2^* and B_1, respectively. The masses of the broad states can not (yet) be well predicted, but have been assumed to lie about 100 MeV lower.

The widths of (0.079 ± 0.006 +0.015 - 0.016) and (0.082 ± 0.026 +0.045 - 0.051) obtained in the charged and neutral-pion channels, respectively, are compatible within errors (deviation is 0.05 σ). In both cases, the width is too large to be due only to the two narrow $B^{**}_{u,d}$ states. For the charged-pion channel, this is in agreement with the results obtained by the other LEP experiments.

In the charged-pion channel a relative production rate of (14.8 ± 1.2 +3.5 -3.0)% was measured, in the neutral-pion channel of (8.9 ± 2.5 +5.6 -5.8) %. When both rates are added, a total $B^{**}_{u,d}$ production rate BR($b \rightarrow B^{**}_{u,d} \rightarrow B\pi$) of (23.7 ± 2.8 ± 6.5) % is obtained. With about 10 % of the b-events being due to baryons and about 12 % due to B_s, a total production rate $\frac{BR(b\rightarrow B^{**}_{u,d}\rightarrow B\pi)}{BR(b\rightarrow B_{u,d})}$ of (29.9 ± 3.5 ± 8.2) % is obtained. As can be seen in figure 6.2, this value compares well to that of the other LEP experiments

Assuming isospin symmetry, a total production rate BR($b \rightarrow B^{**}_{u,d} \rightarrow B\pi$) of (22.4 ± 1.8 ± 6.3)% is obtained. This compares well with the value obtained by the sum of the charged- and the neutral-pion channel.

Since the different states of the $B^{**}_{u,d}$ cannot be separated, no conclusion can be drawn on their relative production rates.

For completeness, also the B^* signal was measured. A $B^* - B$ mass splitting of (46.5 ± 0.7) MeV was obtained, which is in agreement with the values obtained by other experiments as can be seen in figure 6.3. A production rate BR($b \rightarrow B^* \rightarrow B\gamma$) of (72.7 ± 3.3) % is measured, also in agreement with other measurements, as can be seen in figure 6.4.

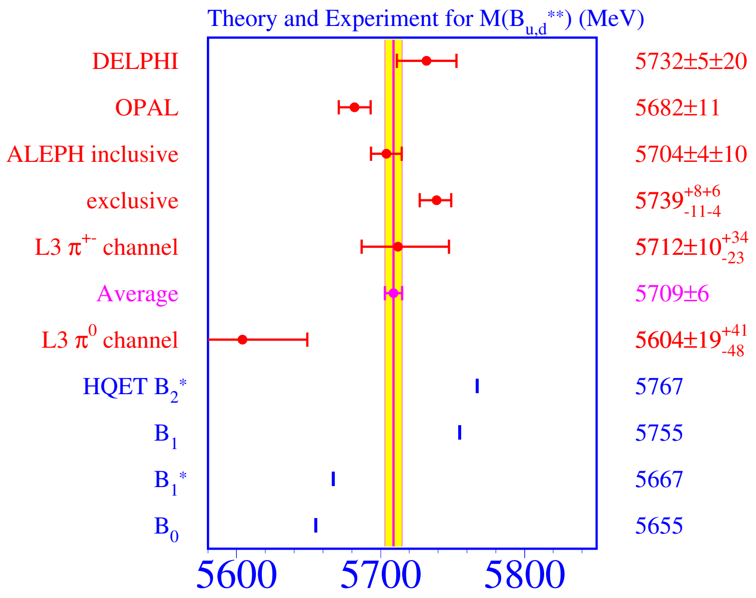

Figure 6.1: *A comparison between the* LEP *measurements of the* $\mathrm{B}^{**}_{\mathrm{u,d}}$ *mass.*

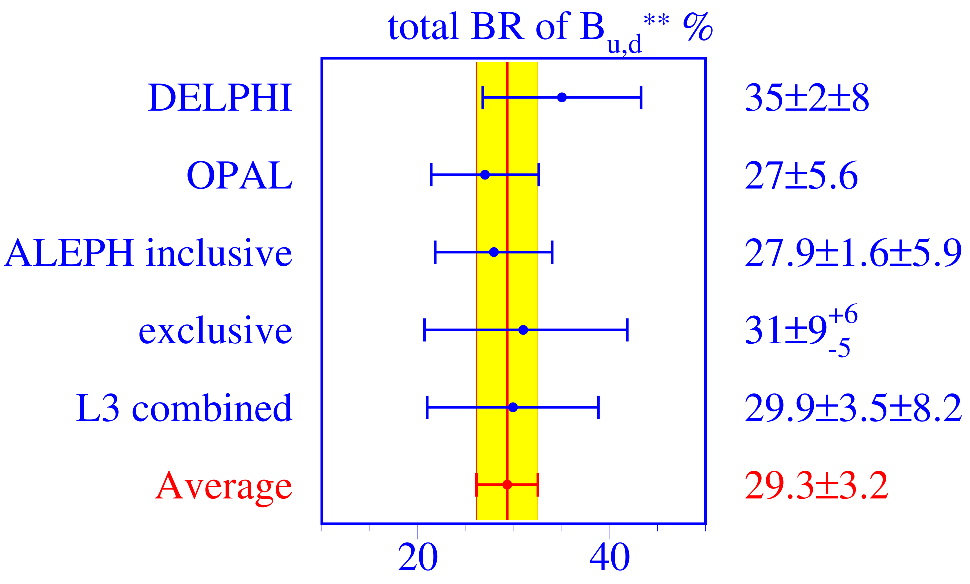

Figure 6.2: *A comparison between the* LEP *measurements of the* $\mathrm{B}^{**}_{\mathrm{u,d}}$ *total production rate* $\frac{\mathrm{B}^{**}_{\mathrm{u,d}}}{\mathrm{B}_{\mathrm{u,d}}}$.

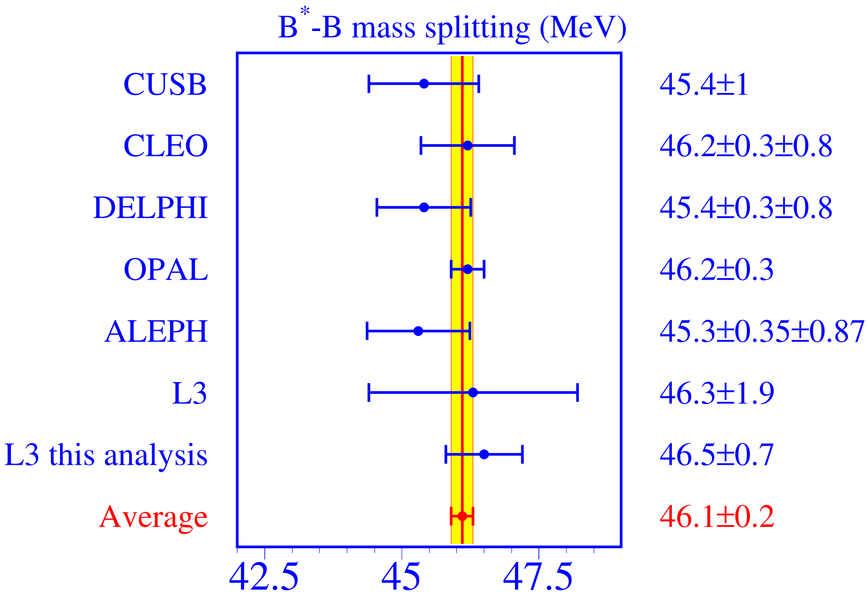

Figure 6.3: *A comparison between the* LEP *measurements of the* B^*-B *mass splitting.*

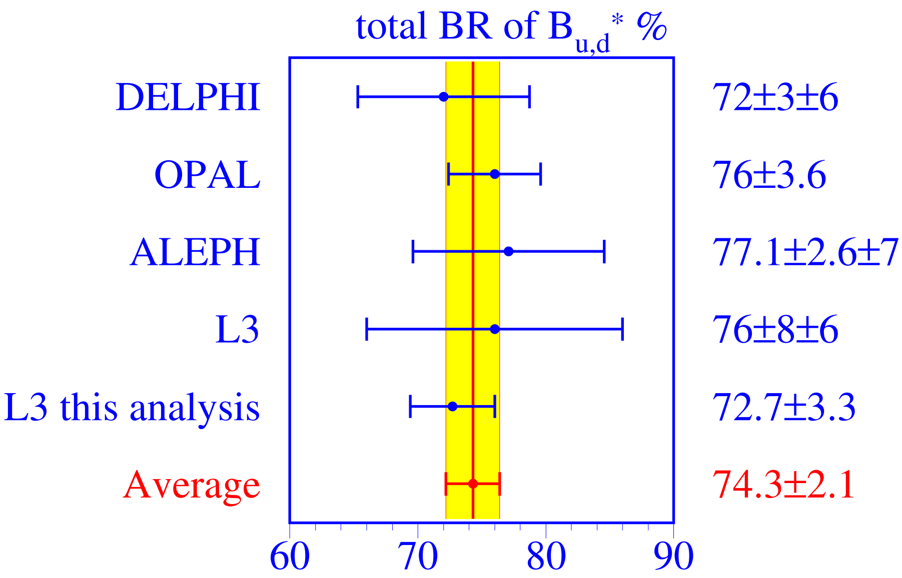

Figure 6.4: *A comparison between the* LEP *measurements of the* B^* *production rate.*