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Observations of π-B charge-flavor correlations and resonant Bπ and BK production

The OPAL Collaboration

Abstract

Evidence is presented for kinematic and charge correlations of B mesons with charged pions and kaons. Using a new technique, a sample of over 80 000 partially reconstructed B mesons is obtained in $3.5 \cdot 10^6$ hadronic Z^0 decays recorded using the OPAL detector at LEP. The invariant mass distributions of $B^+\pi^-$ and B^+K^- combinations show enhancements consistent with the decays of P-wave resonances of a b antiquark and a light quark. We observe an excess of $1\,738 \pm 195$ $B^+\pi^-$ pairs with invariant masses in the range 5.60-5.85 GeV and an excess of 149 ± 31 B^+K^- pairs with invariant masses in the range 5.80-6.00 GeV. Labeling the observed enhancements generically as B^{**} we find

$$\frac{BR(Z^0 \to \bar{b} \to B^{**0} \to B^{(*)+}\pi^-)}{BR(Z^0 \to \bar{b} \to B^+)} = 0.18 \pm 0.04\,,$$

$$\frac{BR(Z^0 \to \bar{b} \to B_s^{**0} \to B^{(*)+}K^-)}{BR(Z^0 \to \bar{b} \to B^+)} = 0.026 \pm 0.008\,,$$

where $B^{(*)+}$ indicates the sum of B^+ and B^{*+} and the errors include statistical and systematic contributions. From a study of π-B charge-flavor correlations we conclude that the production flavor of a B meson can be tagged with the charge of a pion in an appropriately chosen kinematic region, and that the performance of this flavor tag compares favorably in the $Z^0 \to q\bar{q}$ environment with lepton-based tags.

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