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Measurement of the Time Dependence of $B_d^0 \leftrightarrow \overline{B_d^0}$ Mixing Using a Jet Charge Technique

The OPAL Collaboration

Abstract

The observation and measurement of the time-dependence of $B_d^0 \leftrightarrow \overline{B_d^0}$ mixing are described. The B_d^0 meson is reconstructed in final states that contain a D^{*-} and an ℓ^+, where the b flavour of the B_d^0 at decay time is tagged by the electric charge of the lepton. A new and efficient method, using a jet charge technique, is developed for identifying the b flavour of the produced B_d^0. From a sample of 556 $D^{*\pm}\ell^{\mp}$ candidates reconstructed in the OPAL data collected during 1990–1993, the $B_d^0 \leftrightarrow \overline{B_d^0}$ oscillation frequency is measured to be $\Delta m_d = 0.508 \pm 0.075(\mathrm{stat})$ $\pm 0.025(\mathrm{syst})$ ps^{-1} giving an oscillation parameter of $x_d = 0.73 \pm 0.11(\mathrm{stat})$ $\pm 0.08(\mathrm{syst})$, where 0.076 of the systematic error on x_d arises from the uncertainty on the B_d^0 lifetime.

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