

Bs decays at Belle

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Using fully reconstructed B_s mesons, we measure the branching fractions for the decays of $B_s \rightarrow D_s^{(*)+} D_s^{(*)-}$ exclusively. Assuming these decay modes saturate decays to CP-even final states, the branching fraction determines the relative width difference between the CP-odd and CP-even B_s states.

We study the decay $B_s^0 \rightarrow J/\psi \phi$, $\phi \rightarrow K^+ K^-$. In this sample B_s^0 mesons are produced in three $\Upsilon(5S)$ decays:

$\Upsilon(5S) \rightarrow B_s^* \bar{B}_s^*$, $B_s^* \bar{B}_s$ and

$B_s \bar{B}_s$, where the B_s^* mesons decay to $B_s \gamma$.

We determine the absolute branching fraction of the decay

$B_s^0 \rightarrow J/\psi \phi$, which is an important mode for measuring the CP violating phase β_s in the $B_s \bar{B}_s$ mixing.

The latter is of particular interest as it is sensitive to physics beyond the Standard Model.

We also report the first observation of $B_s^0 \rightarrow J/\psi f_0(980)$ and first evidence for $B_s^0 \rightarrow J/\psi f_0(1370)$, which are CP-eigenstate decay modes. We measure the branching fractions

$\mathcal{B}(B_s^0 \rightarrow J/\psi f_0(980); f_0(980) \rightarrow \pi^+ \pi^-) = (1.16_{-0.19}^{+0.31}(\text{stat.})_{-0.17}^{+0.15}(\text{syst.})_{-0.18}^{+0.26}(N_{B_s^{(*)} \bar{B}_s^{(*)}})) \times 10^{-4}$ with a significance of

8.4σ ,

and $\mathcal{B}(B_s^0 \rightarrow J/\psi f_0(1370); f_0(1370) \rightarrow \pi^+ \pi^-) = (0.34_{-0.14}^{+0.11}(\text{stat.})_{-0.02}^{+0.03}(\text{syst.})_{-0.05}^{+0.08}(N_{B_s^{(*)} \bar{B}_s^{(*)}})) \times 10^{-4}$ with a

significance of 4.2σ .

The last error listed is due to uncertainty in the number of produced $B_s^{(*)} \bar{B}_s^{(*)}$ pairs.

We have also performed the first search for charmed baryonic B_s^0 decay, $\bar{B}_s^0 \rightarrow \Lambda_c^+ \pi^- \bar{\Lambda}$.

The measurement precision of the B_s^0 branching fraction at Belle is limited by the poor knowledge of the B_s^0 production fraction,

$f_s = \sigma(B_s^{(*)} \bar{B}_s^{(*)})/\sigma(b\bar{b})$.

We present the status of the current measurements and discuss their main limitations. Using dilepton events, a new independent measurement of f_s is presented, together with its impact on the precision of Belle's B_s^0 measurements.

We present a measurement of the CP violation parameter $\sin 2\phi_1$ at the $\Upsilon(5S)$ resonance using a new tagging method called the B- π tagging. This method in general uses a $\Upsilon(5S)$ decay to a charged B meson, a neutral B meson, and a charged pion. The neutral B meson decays to a CP eigenstate, and the charged B meson is reconstructed

as missing mass of the neutral B meson and the charged pion. The initial flavor of the neutral B meson is determined by the charge of the pion at the moment of the $\Upsilon(5S)$ decay. CP violating parameters can be derived from asymmetry of the number of $BB\pi^+$ and $BB\pi^-$ events without measuring decay time. Since the B- π tagging method have different systematic errors from the analyses on the $\Upsilon(4S)$ resonance and thus complementary. In this analysis, the neutral B meson is reconstructed as $J/\psi K_S$.

All these results are based on a data sample collected with the Belle detector at the $\Upsilon(5S)$ resonance

with an integrated luminosity of 121.4 fb^{-1} at the KEKB asymmetric-energy e^+e^- collider.

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