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# A novel method to measure the relative strong phase between $D^0$ and $\bar{D}^0$ in the $K^0_S\pi^+\pi^-$ decay mode from correlated $\psi(3770) \to D^0\bar{D}^0$ decays, and an application to measuring the CKM angle $\gamma$ in $B^\pm \to D(\to K^0_S\pi^+\pi^-)K^\pm$ decays.

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We present a novel method that measures the relative strong phase, $\Delta\delta_D$, between $D^0$ and $\bar{D}^0$ amplitudes decaying to the $K^0_S\pi^+\pi^-$ final state measured from correlated $D\bar{D}$ pairs produced at the charm threshold, and its application to the measurement of $CP$ violating observables in $B^\pm \to DK^\pm$ decays which includes the measurement of the CKM angle, $\gamma$, from $B^\pm \to D(\to K^0_S\pi^+\pi^-)K^\pm$ decays.
We test this method using simulated correlated $\psi(3770) \to D^0\bar{D}^0$ decays with at least one $D$ decaying to the $K^0_S\pi^+\pi^-$ final state and simulated $B^\pm \to D(\to K^0_S\pi^+\pi^-)K^\pm$ decays, we perform simultaneous fits to the correcting polynomial to $\Delta\delta_D$ and the CKM parameters, $x_\pm = r_B\cos(\delta_B \pm \gamma)$, $y_\pm = r_B\sin(\delta_B \pm \gamma)$. This method has better statistical precision than the binned measurement of $\gamma$ using the binned measurements of $\Delta\delta_D$ from charm threshold data. We test the ability of our method against mis-modelling $\Delta\delta_D$ by performing pull studies with a predetermined bias applied to $\Delta\delta_D$, we show that our method is able to recover the original $\Delta\delta_D$ and avoid biasing the CKM parameters $x_\pm, y_\pm$ in contrast to the unbinned model dependent measurement.

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