

Measurement of y_{CP} in meson D^0 decay at LHCb

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In this thesis analysis the meson mixing observable y_{CP} has been measured via $D^0 \rightarrow K^+ K^-$, $D^0 \rightarrow \pi^+ \pi^-$ and $D^0 \rightarrow K^- \pi^+$ decays, where the D^0 comes from semileptonic decays of B .

Data has been taken by LHCb through pp collisions with center of mass energy of 13 TeV.

The data sample has been split into 18 bins of D^0 decay time and a maximum likelihood fit on the distribution of meson D^0 invariant mass has been performed, in order to obtain signal events for the 18 bins, in each all 3 decay channels.

Starting from those obtained signal events a second fit is performed on the ratio between $D^0 \rightarrow K^+ K^-$ ($D^0 \rightarrow \pi^+ \pi^-$) events with respect to $D^0 \rightarrow K^- \pi^+$ as a function of D^0 decay time.

From this fit the difference between decay amplitude $\Delta_{\Gamma}^{hh} = \Gamma_{h^+ h^-} - \Gamma_{K^- \pi^+} = y_{CP} / \tau_{D^0}$, where h is either a K or a π .

The values of the 2 parameters given by the fit are:

$$\Delta_{\Gamma}^{\text{KK}} = (0.015 \pm 0.002) \text{ ps}^{-1},$$

$$\Delta_{\Gamma}^{\text{pi pi}} = (0.0063 \pm 0.0038) \text{ ps}^{-1}.$$

From those we compute y_{CP} as $\Delta_{\Gamma} \tau_{D^0}$, where $\tau_{D^0} = (0.4103 \pm 0.0010) \text{ ps}$ is the well known value of D^0 mean half life.

$$y_{\text{CP}}^{\text{KK}} = (0.63 \pm 0.10) \%,$$

$$y_{\text{CP}}^{\text{pi pi}} = (0.26 \pm 0.16) \%.$$

Central values of Δ_{Γ} and y_{CP} sono blind , meaning they're shifted by an unknown value comparable with the world average mean values of the parameter's standard deviation, this value is the same for both of the fits. The blind offset is needed to avoid the fact that knowing the final value might lead to some bias on the analysis.

y_{CP} values in the two different channels are consistent with each other between 2.0 standard deviations.

Title

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