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Precision measurements of Direct CP violation and D^0 - D^0 bar mixing at CDF

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The CDF experiment has previously reported evidence for D^0 - D^0 bar mixing with a significance equivalent to 3.8 standard deviations based on the time-dependent ratio of the decay rates for $D^0 \rightarrow K^+ \pi^-$ and $D^0 \rightarrow K^- \pi^+$, and charge-conjugates. That measurement was based on an integrated luminosity of 1.5 fb^{-1} and achieved sensitivities of $+0.35 \cdot 10^{-3}$ and $-7.6 \cdot 10^{-3}$ on the mixing parameters x'^2 and y' , respectively. Here we report an updated measurement using the same technique. In addition, we present an analysis that measures CP-violating asymmetries in D^* -tagged $D^0 \rightarrow \pi^+ \pi^-$ decays, where any enhancement from the standard model prediction (of the order of 10^{-3}) would be unambiguous evidence for New Physics. A technique combining asymmetries of $\pi^+ \pi^-$, and $K^- \pi^+$ D^0 decays highly suppresses systematic uncertainties due to detector charge-asymmetric efficiencies allowing a measurement limited only by statistical uncertainties. Both measurements are based on a sample corresponding to an integrated luminosity of 5.2 fb^{-1} .

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