Precision measurement of the natural line width of the $D^*$

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ORATION — We measure the total width of the $D^*(2010)^+$ in the transition $D^* \rightarrow D^0 \pi^+$, where the $D^0$ is reconstructed in the decay modes $D^0 \rightarrow K^- \pi^+$, $D^0 \rightarrow K^- \pi^+ \pi^0$, $D^0 \rightarrow K_S^0 \pi^- \pi^+$, and $D^0 \rightarrow K^- \pi^+ \pi^- \pi^+$. Our data sample corresponds to an integrated luminosity of 487 fb$^{-1}$, more than 50 times greater than for the current best measurement of the $D^*$ width. The data were recorded at center-of-mass energies 10.58 and 10.54 GeV with the BABAR detector at the PEP II asymmetric energy $e^+e^-$ collider. We use simulated events to model the resolution in $\Delta m$, the difference between the reconstructed invariant masses of the $D^*$ and $D^0$ candidates. We obtain the $D^*$ width by fitting the measured $\Delta m$ distribution to a Breit-Wigner lineshape convolved with the resolution function.

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