

# Three-body decays of quarkonium states at BABAR

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We report about recent results obtained at BABAR on three-body decays of charmonium and bottomonium states.

We present Dalitz plot analyses of  $J/\psi$  three-body hadronic decays to  $\pi^+\pi^-\pi^0$ ,  $K^+K^-\pi^0$  and  $K_S K^\pm \pi^\mp$  using the isobar and Veneziano models. The  $J/\psi$  is produced through the Initial-State-Radiation process. We also perform Dalitz plot analyses of  $\eta_c$  three-body hadronic decays to  $K^+K^-\pi^0$  and  $K_S K^\pm \pi^\mp$ , where the  $\eta_c$  is produced in two-photon interactions. An isobar model is used, as well as a Model Independent Partial Wave Analysis which allows to extract the amplitude and phase of the  $K\pi$   $S$ -wave up to a mass of 2.5 GeV. Finally, we present a study of the reactions  $\Upsilon(1S) \rightarrow \gamma\pi^+\pi^-$  and  $\Upsilon(1S) \rightarrow \gamma K^+K^-$ . The  $\Upsilon(1S)$  candidates are obtained from the data samples collected at the peak of the  $\Upsilon(2S)$  and  $\Upsilon(3S)$  selecting the decays  $\Upsilon(2S, 3S) \rightarrow \pi^+\pi^-\Upsilon(1S)$ .

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