A Forward-Backward Asymmetry in $t\bar{t}$ Production

The CDF Collaboration

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Early measurements of the forward-backward $t\bar{t}$ production asymmetry at CDF and D0 suggested significant asymmetries that have been interpreted as evidence for exotic gluon partners or new t-channel interactions. We present new measurements performed with 5.3 fb^{-1} of $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV. Significant inclusive asymmetries are observed in both the lepton+jets and the dilepton decay modes of the $t\bar{t}$ pair. In the dilepton mode, the asymmetry is also observed in the lepton rapidity difference, independent of any top reconstruction. In the lepton plus jets sample, the asymmetry is found to be consistent with CP conservation under interchange of t and $\bar{t}$. The full reconstruction of the top kinematics in lepton+jets is used to measure the dependence of the asymmetry on the $t\bar{t}$ rapidity difference Δy and invariant mass $M_{t\bar{t}}$, and the asymmetry is found to be most significant at large values of those variables. For $M_{t\bar{t}} > 450$ GeV/c^2, the parton-level asymmetry in the $t\bar{t}$ rest frame is $A_{fb} = 0.475 \pm 0.114$ compared to the NLO QCD prediction of 0.088 ± 0.013.