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shift of the $t\bar{t}$ production cross section as well as the appearance of a resonance. On the other hand, the t-channel exchange of our Z' in $p\bar{p} \rightarrow t\bar{t}$ interferes with QCD. It is possible then to have smaller modifications to the cross section while having a large contribution to A_{FB}^r . There is no resonance present in the $M_{t\bar{t}}$ spectrum. We use MadGraph/MadEvent 4.4.17 [19] with CTEQ6.6M parton distribution functions [20] to generate event samples, and BRIDGE 2.0 [21] to decay unstable particles. We do not carry out parton showering or detailed detector simulation. We assume $m_t=175$ GeV, and apply everywhere a QCD K-factor K=1.31 to match the SM prediction for $\sigma(t\bar{t})$, we fix renormalization and factorization scales at $\mu_{R}=\mu_{F}=m_{t}.$

We plot cross section and A_{FB}^{rev} in Fig. 2 as a function of α_X for three Z' masses. A_{FB}^{rev} indicates the A_{FB}^{rev} induced only in the $t\bar{t}$ final state. The SM NLO contribution (5%) is not included. Similarly, the "new" in $\sigma(p\bar{p} \rightarrow t\bar{t})^{new}$ emphasizes that other (reducible) contributions that might enter the $t\bar{t}$ sample are not included. They are discussed below.

Comparing the two panels of Fig. 2 indicates a potential simultaneous fit to a large A_{FB}^i and the correct cross-section. However, new physics can contribute to final states that fake the $t\bar{t}$ final state. This could pollute both the cross-section and the A_{FB}^i measurement. Reducible backgrounds that contaminate the sample arise, e.g., from tt/\bar{t} , $tZ'/(\bar{t}Z')$ events, and modify the results of Fig. 2 by δA_{FB}^{fake} , $\delta \sigma(t\bar{t})^{fake}$. If $M_{Z'} < m_t$, it is also important to include effects of exotic top decays $t \to uZ'$ which can take events away from the registered $t\bar{t}$ crosssection. Assuming Z' decays are completely hadronic, they reduce the dilepton top cross section relative to the lepton+jets channel. At CDF and D0, $t\bar{t}$ production is defined by specific final state topologies with at least one b quark tag, several hard jets, and one ("l+i sample") or two ("dilepton sample") charged leptons. CDF has measured $\sigma(t\bar{t}) = 7.2 \pm 0.75$ pb from the l + i sample [22], and 6.7 ± 0.98 pb from the dilepton sample [23]. To avoid a too large discrepancy between these two channels, Fig. 3 shows that a light $Z'(M_{Z'} \leq 120 \text{ GeV})$ is to be avoided. For our "best point" we show comparisons with these cross sections in Table I. Our simulation method is to construct event samples based on cuts detailed in [22, 23], and rescale the result by the inverse of the SM event selection efficiency (again using our simulation) to approximate their unfolding procedure.

For our best point (the red star in Fig. 3), the total asymmetry is about 18%, see Table I. This includes the SM α_s^3 contribution, the Z' tree contribution, and contributions due to δA_{FB}^{rake} . The last is negative largely due to anti-correlation of t direction with that of u in $gu \rightarrow tZ'$ production. We estimate $|\delta A_{FB}^{rake}|$ at a few percent, not quite canceling with the 45% SM contribution. There is a small uncertainty in this estimate, as the kinematics of these events are not identical to those analyzed in the $t\bar{t}$ events.

Table I shows the top quark asymmetry and the inferred $t\bar{t}$ cross section of our best point in the l + j and dilepton channels. The asymmetry is high, and the cross東京大学







selection	N events	all $M_{t\bar{t}}$	$M_{t\bar{t}} < 450 \text{ GeV}/c^2$	$M_{t\bar{t}} > 450 \text{ GeV}/c$
standard	1260	$0.057 {\pm} 0.028$	-0.016 ± 0.034	0.212±0.049
electrons	735	0.026 ± 0.037	-0.020 ± 0.045	0.120 ± 0.063
muons	525	$0.105 {\pm} 0.043$	-0.012 ± 0.054	$0.348 {\pm} 0.080$
data $\chi^2 < 3.0$	338	$0.030 {\pm} 0.054$	-0.033 ± 0.065	0.180 ± 0.099
data no-b-fit	1260	$0.062 {\pm} 0.028$	0.006 ± 0.034	0.190 ± 0.050
data single b-tag	979	$0.058 {\pm} 0.031$	-0.015 ± 0.038	0.224 ± 0.056
data double b-tag	281	$0.053 {\pm} 0.059$	-0.023 ± 0.076	$0.178 {\pm} 0.095$
data anti-tag	3019	$0.033 {\pm} 0.018$	0.029 ± 0.021	0.044 ± 0.035
pred anti-tag	-	$0.010 {\pm} 0.007$	$0.013 {\pm} 0.008$	$0.001 {\pm} 0.014$
pre-tag	4279	$0.040 {\pm} 0.015$	0.017 ± 0.018	0.100 ± 0.029
pre-tag no-b-fit	4279	$0.042 {\pm} 0.015$	$0.023 {\pm} 0.018$	0.092 ± 0.029















