final states involving 6 quark jets suffer an enormous background from QCD multijet production, with estimates of intrinsic signal-to-noise of $< 10^{-4}$. Because of these large backgrounds, this channel has not been the focus of most of the effort, and I will ignore it here also.

With these considerations, there are five final states that are experimentally accessible:

$$\begin{aligned} t\bar{t} &\rightarrow e^+\nu_e b\, e^-\bar{\nu}_e\bar{b} \quad (1/81) \\ t\bar{t} &\rightarrow \mu^+\nu_\mu b\, \mu^-\bar{\nu}_\mu\bar{b} \quad (1/81) \\ t\bar{t} &\rightarrow e^\pm\nu_e b\, \mu^\mp\nu_\mu\bar{b} \quad (2/81) \\ t\bar{t} &\rightarrow e^\pm\nu_e b\, q\bar{q}'\bar{b} \quad (12/81) \\ t\bar{t} &\rightarrow \mu^\pm\nu_\mu b\, q\bar{q}'\bar{b} \quad (12/81), \end{aligned} \tag{4}$$

where I have also listed the expected standard model branching ratios for each channel. The first three dilepton channels turn out to be the cleanest final states, as the requirement of two energetic charged leptons and neutrinos virtually eliminate all backgrounds. They suffer from rather small branching fractions and are therefore the most statistically limited. The last two lepton + jets final states together correspond to approximately 30% of the $t\bar{t}$ branching fraction. However, these channels face the largest potential backgrounds.

3 Backgrounds to a Standard Model Top Quark Search

Top quark production is an extremely rare process in $\bar{p}p$ collisions; its cross section of less than 100 pb can be compared with the total $\bar{p}p$ cross section of over 50 mb (almost nine orders of magnitude difference). Since the total cross section is dominated by "soft" QCD interactions, the top quark cross section can be more fairly compared with the cross section for other high Q^2 production processes, such as inclusive W production (20 nb), Z production (2 nb) and WW and WZ production (10 and 5 pb, respectively). These higher Q^2 processes are the sources of the most severe background to $t\bar{t}$ production.

It is necessary to control these backgrounds so that one can be sensitive to a top quark signal. All the channels listed in (4) involve an energetic charged electron or muon, and one or more energetic neutrinos. The requirement of these two signatures in the final state using the DØ and CDF lepton identification systems are sufficient to adequately control the backgrounds associated with jets that might satisfy the lepton ID criteria. The remaining backgrounds are dominated by physics processes that generate real leptons in the final state.

In the case of the dielectron and dimuon modes, the single largest background comes from Drell-Yan production (including $Z \rightarrow e^+e^-$ and $Z \rightarrow \mu^+\mu^-$). This is controlled by requiring a neutrino signature as well as additional jet activity. The single largest physics background in the $e^\pm\mu^\mp$ final state comes from $Z \rightarrow \tau^+\tau^-$