DØ's Top Quark Physics Abstracts submitted to the XXXIII International Conference on High Energy Physics Moscow, Russia, July 26 – August 2, 2006

Session: Electroweak Physics

1. Measurement of the Top Quark Mass at DØ Using Lepton+Jets Events

We report on the measurement of the top quark mass using $t\bar{t}$ candidates in the lepton+jets final states. For each event, a matrix element probability is calculated as a function of the top mass and the overall jet energy scale. The top mass and jet energy scale are extracted by maximizing a likelihood constructed as the product of the single event probabilities. The overall jet energy scale is constraint by the two hadronic jets forming a W boson. This reduces the large uncertainty due to the jet energy scale.

2. Measurement of the Top Quark Mass at DØ Using Dilepton Events

We report on the measurement of the top quark mass using $t\bar{t}$ candidates in the dilepton final states. The kinematics of these events are solved for a range of assumed top quark masses, and the relative likelihood of each solution is assessed. Information from the complete set of events is combined in a maximum likelihood fit to extract the top quark mass and its uncertainty.

3. Measurement of the W Boson Helicity in Top Quark Decay at DØ

We report on a measurement of the fraction of right-handed W bosons in top quark decay. In the Standard Model, this fraction is too small to measure with the current data sample, so a non-zero value would be a clear sign of new physics. The measurement uses $t\bar{t}$ events in both the lepton+jets and dilepton decay channels, and is based upon the helicity angle θ^* between the charged lepton and top quark directions in the W boson rest frame.

4. Single Top Quark Production at the DØ Experiment

Protons and antiprotons are collided in Run II at the Fermilab Tevatron at a center of mass energy of 1.96 TeV. We present results of an improved search for single top quark production in these collisions using a dataset of approximately 360 pb^{-1} collected with the DØ detector. This analysis considers both production modes, s-channel tb and t-channel tqb, and makes use of secondary-vertex tagging to identify jets originating from b quarks as well as neural networks to separate the expected signals from backgrounds.

Session: Heavy Quarks

5. Measurement of the Top Quark Charge at DØ

We report on a measurement of the charge of the top quark by resolving the kinematic ambiguity between the standard model scenario of a charge 2/3 quark decaying to W^+b and an exotic scenario of a charge –4/3 quark decaying to W^-b. We distinguish between the two scenarios by measuring the charge of the b jet that is kinematically most consistent with arising from the same top quark as the charged lepton.

6. Measurement of the $t\bar{t}$ Production Cross Section at DØ Using b Tagging

We report on the measurement of the $t\bar{t}$ production cross section using candidate events in the lepton+jets final state. The $t\bar{t}$ signal is discriminated from background processes by the requirement of one or more identified b jets.

7. Measurement of the $t\bar{t}$ Production Cross Section at DØ Using Kinematic Information

We report on the measurement of the $t\bar{t}$ production cross section using candidate events in the lepton+jets final state. The $t\bar{t}$ signal is discriminated from background processes using kinematic information. Several kinematic variables are combined into a multivariate discriminant to maximize the separation between signal and background.

8. Measurement of the $t\bar{t}$ Production Cross Section at DØ Using Dilepton Events

We report on the measurement of the $t\bar{t}$ production cross section with candidate events in the dilepton final state. The $t\bar{t}$ signal is discriminated from background processes by requiring two identified leptons and by using kinematic criteria that exploit the presence of neutrinos and energetic jets in $t\bar{t}$ events.

9. Measurement of the $t\bar{t}$ Production Cross Section at DØ Using Lepton + Track Events

We report on the measurement of the $t\bar{t}$ production cross section with candidate events in the dilepton final state in which only one of the leptons satisfies our usual identification criteria, while the other appears as an isolated charged track. The $t\bar{t}$ signal is discriminated from background processes by requiring at least one b-tagged jet and by using kinematic criteria that exploit the presence of neutrinos and energetic jets in $t\bar{t}$ events.

10. Measurement of the $t\bar{t}$ Production Cross Section at DØ Using All-Hadronic Events

We report on the measurement of the $t\bar{t}$ production cross section with candidate events in the all-hadronic final state. The $t\bar{t}$ signal is discriminated from the QCD multijet background process by requiring identified *b*-tagged jets and W bosons reconstructed from dijets. A data-derived background sample is normalized to the candidate sample using the dijet mass spectrum in the region below the W mass. The all-hadronic mass spectrum is then fit to derive the $t\bar{t}$ production cross section.

11. Measurement of $B(t \to Wb)/B(t \to Wq)$ at DØ

We report on a measurement of the ratio $R = B(t \to Wb)/B(t \to Wq)$. In the standard model this ratio is > 0.998 at the 95% confidence level. Experimentally, we measure the ratio by fitting the fraction of candidate events that have 0, 1, or 2 *b*-tagged jets.

12. Investigation of Spin Correlations in $t\bar{t}$ Production with the DØ Detector at the Tevatron

One of the most striking properties of the top quark is its very short lifetime, which does not allow it to form bound states. Therefore, the spin properties of top quarks are transferred to their decay products without being diluted by hadronization. Due to angular momentum conservation, top quarks pair-produced at threshold have correlated or anti-correlated spins in $q\bar{q}$ or *gg* annihilation. Hence, studies of angular correlations of the $t\bar{t}$ decay products allow sensitive tests of the $t\bar{t}$ spin correlation as well as the top decay dynamics.

We present a measurement of spin correlations of top anti-top pairs using data from proton anti-proton scattering at a center-of-mass energy of $\sqrt{s}$ = 1.96 TeV recorded by the DØ experiment at the Tevatron. Here, top quarks are mainly pair-produced, each decaying into a *W* boson and a *b* quark. In this analysis, the leptonic decays of the *W* bosons are studied. Thus, the final state consists of two or more jets, of two isolated high transverse momentum charged leptons (either two electrons, one electron and one muon, or two muons) and of high missing transverse energy. For instance, double angle distributions of the two leptons are studied.

Session: Beyond the Standard Model

13. A Search for Resonant $t\bar{t}$ Production at DØ

We report on a search for a massive particle that decays to $t\bar{t}$. The search is performed using $t\bar{t}$ candidates in the lepton+jets channel. A constrained kinematic fit, with top quark mass fixed, is used to evaluate the $t\bar{t}$ invariant mass for each candidate. We then search for deviations from the $t\bar{t}$ mass distribution predicted by QCD.

14. Search for Single Top Quarks Produced via Flavor-Changing Neutral-Current Couplings at DØ

The large mass of the top quark, close to the electroweak symmetry-breaking scale, makes it a good candidate for probing physics beyond the Standard Model, including possible anomalous couplings. One form these couplings can take is with flavor-changing neutral currents, which can give rise to a single top quark in the final state through gluon exchange, together with a *c* or *u* quark in the initial or final state. We search for single top quark production through both the *t*-*c*-*g* and *t*-*u*-*g* couplings, using the DØ detector at the Fermilab Tevatron collider, and present limits on the anomalous coupling parameters κ_c / Λ and κ_u / Λ, where Λ defines the scale of new physics and κ_c (κ_u) defines the strength of the *t*-*c*-*g* (*t*-*u*-*g*) couplings.