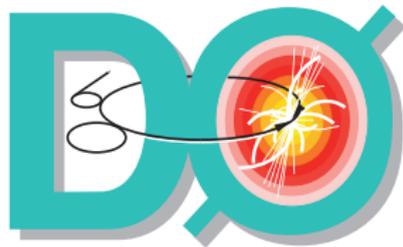


# Searches for $t\bar{t}$ Resonances at the Tevatron

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ICHEP  
July 23, 2010



# Motivation

- ▶ Top is the heaviest fundamental particle
- ▶ While its mass is known with great precision, there are plenty of questions to be answered about Top
- ▶ How are  $t\bar{t}$  pairs produced? Only by SM QCD?
- ▶ Or is there New Physics? Are  $t\bar{t}$  produced by massive resonances?
- ▶ At the Tevatron, we investigate these questions.

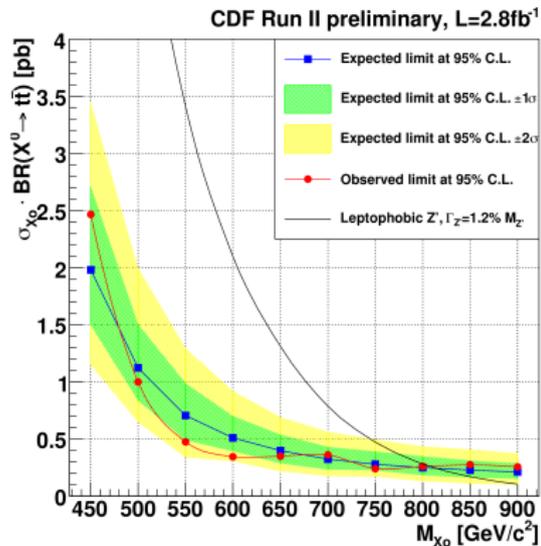
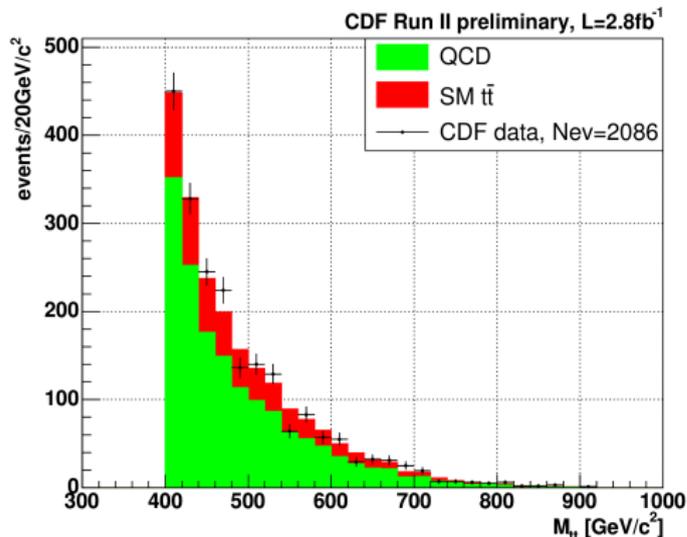
# Search for resonant $t\bar{t}$ production in the all-hadronic channel @ CDF

- ▶ Why all-hadronic? It's difficult with so much QCD multijet background to isolate  $t\bar{t}$
- ▶ It does offer the highest **branching ratio** of  $t\bar{t}$  decay channels
- ▶ (Resonance) mass **resolution** is much improved over lepton+jets
- ▶ It provides opportunity for a **cross-check in an independent sample** (useful in the case of discovery!)

# Search for resonant $t\bar{t}$ production in the all-hadronic channel @ CDF

- ▶ Events are selected with preselection cuts, then a Neural Net selection (very similar to  $m_t$  analyses)
- ▶ The multijet background is modeled using control regions from data
- ▶ The  $t\bar{t}$  invariant mass is estimated using a Matrix Element reconstruction
- ▶ 95 CL limit on top-color-assisted technicolor  $Z'$ :  
 $m_{Z'} > 805 \text{ GeV}$  for  $\Gamma_{Z'} = 0.012M_{Z'}$

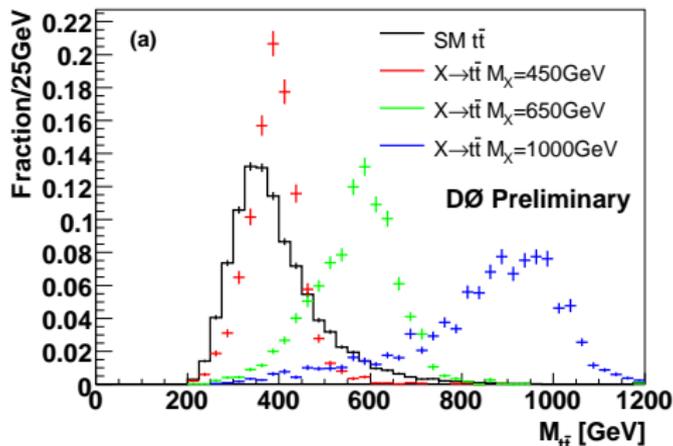
# Search for resonant $t\bar{t}$ production in the all-hadronic channel @ CDF



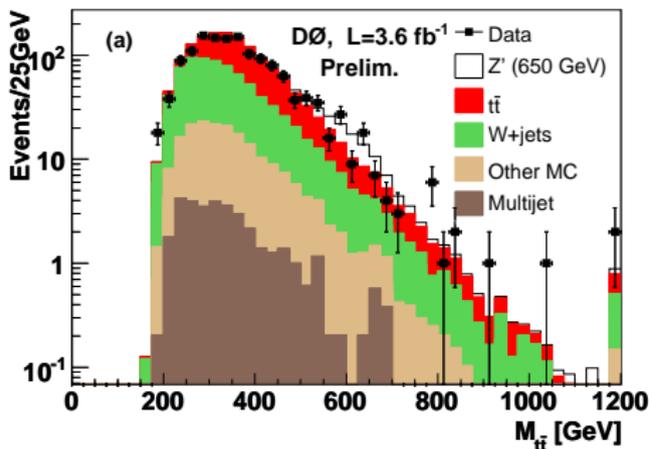
## Search for resonant $t\bar{t}$ production in lepton+jets @ DØ

- ▶ Here we consider the case where one  $W$  decays to an electron or muon
- ▶ Backgrounds are further reduced by requiring one jet be “tagged” according to DØ’s Neural Network tagger
- ▶ Events are reconstructed by simply solving for the neutrino  $z$ -component of momentum
- ▶ This allows 3-jet events to be included as well
- ▶ 95 CL limit on top-color-assisted technicolor  $Z'$ :  
 $m_{Z'} > 820 \text{ GeV}$  for  $\Gamma_{Z'} = 0.012M_{Z'}$

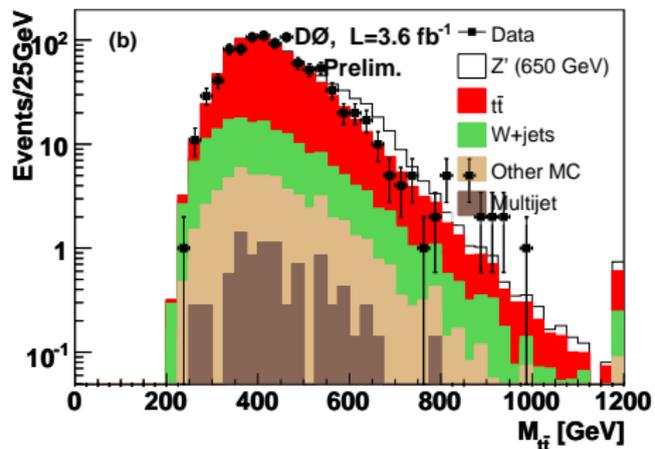
# Search for resonant $t\bar{t}$ production in lepton+jets @ DØ



# Search for resonant $t\bar{t}$ production in lepton+jets @ DØ

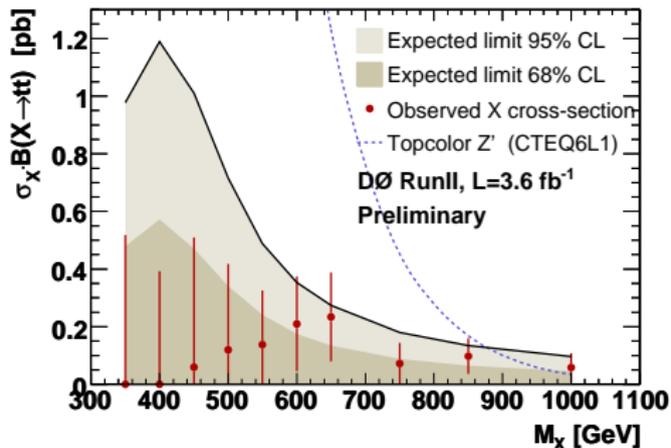
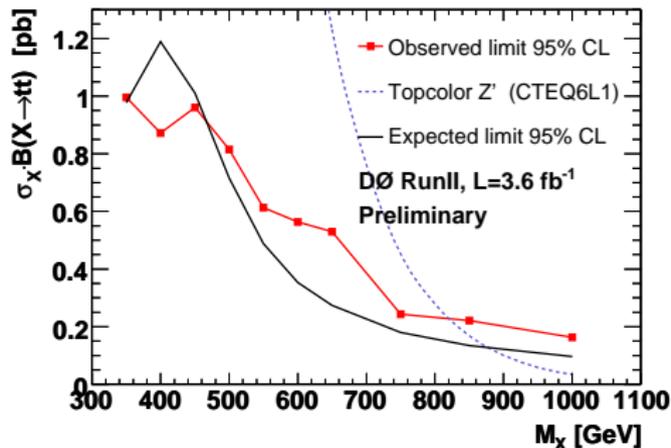


3 jets



$\geq 4$  jets

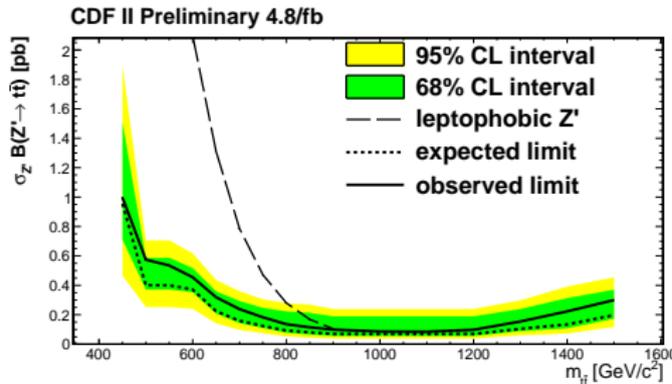
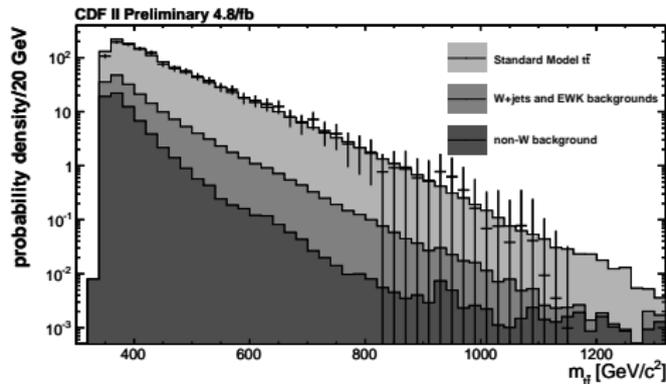
# Search for resonant $t\bar{t}$ production in lepton+jets @ DØ



# Search for resonant $t\bar{t}$ production in lepton+jets @ CDF

- ▶ Full Matrix Element reconstruction
- ▶ For each event, observe PDF of  $m_{t\bar{t}}$ , not a single value
- ▶ Require  $\geq 4$  jets, one  $b$ -tag
- ▶ 95 CL limit on top-color-assisted technicolor  $Z'$ :  
 $m_{Z'} > 900$  GeV for  $\Gamma_{Z'} = 0.012M_{Z'}$

# Search for resonant $t\bar{t}$ production in lepton+jets @ CDF



# Conclusions

- ▶ No evidence for resonant production of  $t\bar{t}$  at the Tevatron
- ▶ Limits set at the level of a few percent of SM  $t\bar{t}$  cross-section
- ▶ CDF lepton+jets result sets limits for resonance masses above 1 TeV for the first time

Thank You