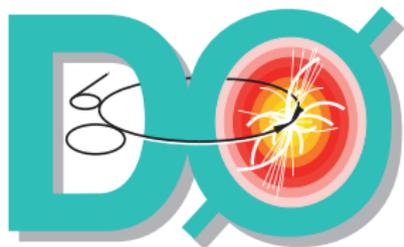


Searches for New Physics in Top Events at the Tevatron

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University of Florida

on behalf of the CDF and DØ Collaborations

Recontres de Moriond
March 18, 2010



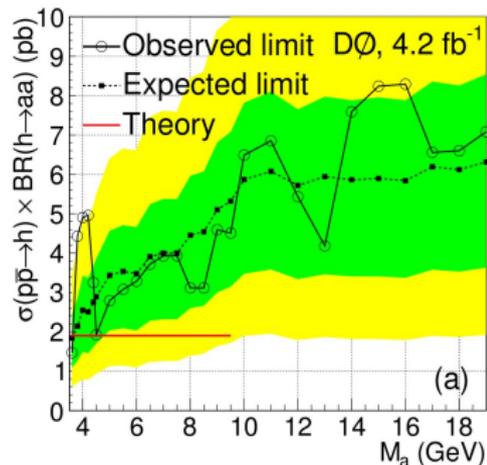
Search for nMSSM H^+ @ CDF

Motivation

- ▶ Search for $t \rightarrow H^+ b$, where $H^+ \rightarrow W^+ A$
- ▶ If $m_A < 2m_b$, $A \rightarrow \tau^+ \tau^-$ will dominate
- ▶ No strong limits on A in this scenario
- ▶ *c.f.* arXiv:0807.2135

Selection

- ▶ Start with standard $t\bar{t}$ lepton+jets selection...
- ▶ ≥ 3 jets, 1 b -tag, $H_T > 250\text{GeV}$
- ▶ Search for isolated track with $3 \leq p_T \leq 20\text{ GeV}$
- ▶ Dominant background from **Underlying Event**

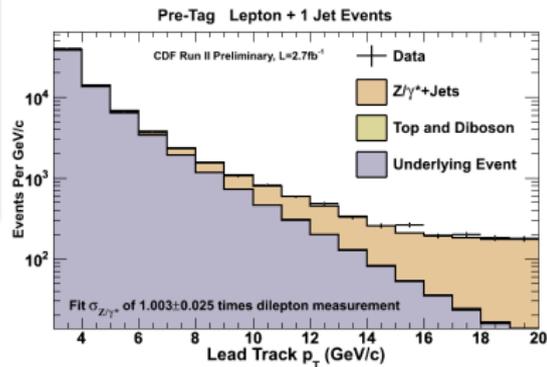
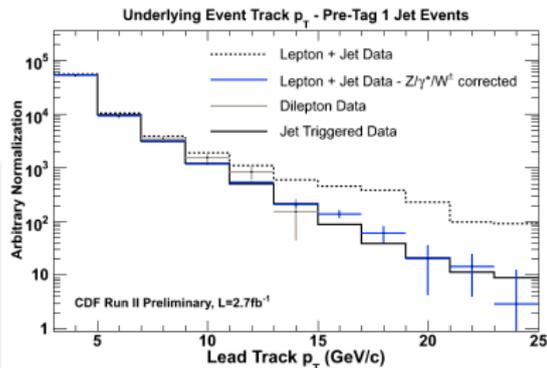


arXiv:0905.3381

Search for nMSSM H^+ @ CDF

Underlying Event Modeling

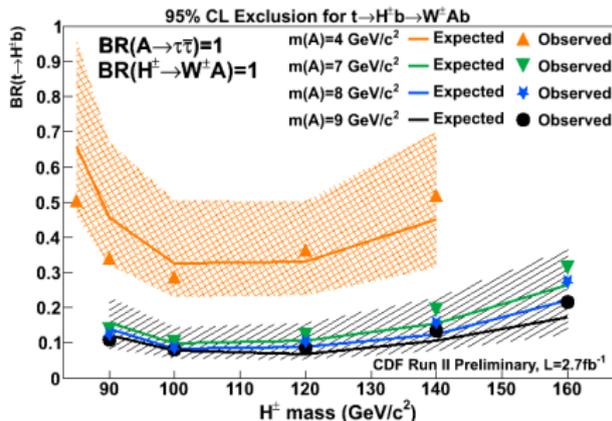
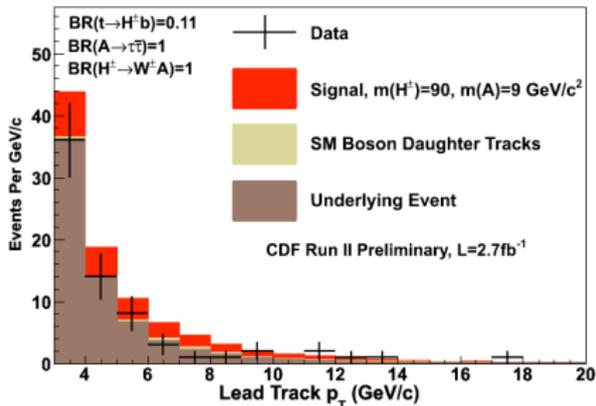
- ▶ Many samples have identical UE p_T spectra
- ▶ Jet-triggered data is used to model the UE p_T spectrum
- ▶ This model is tested by measuring the Z/γ^* cross-section
- ▶ Excellent agreement found with previous measurements



Search for nMSSM H^+ @ CDF

Results

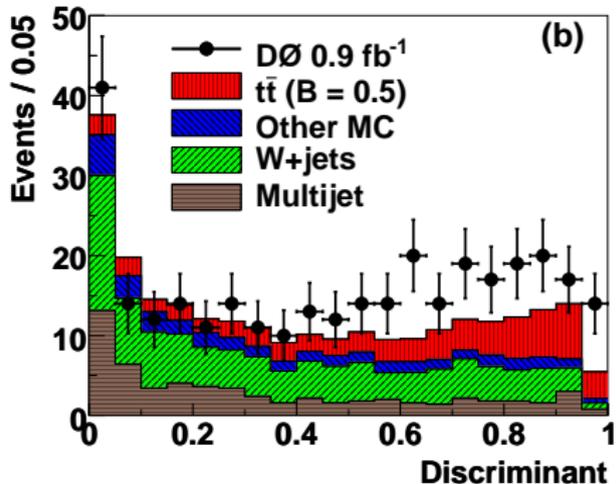
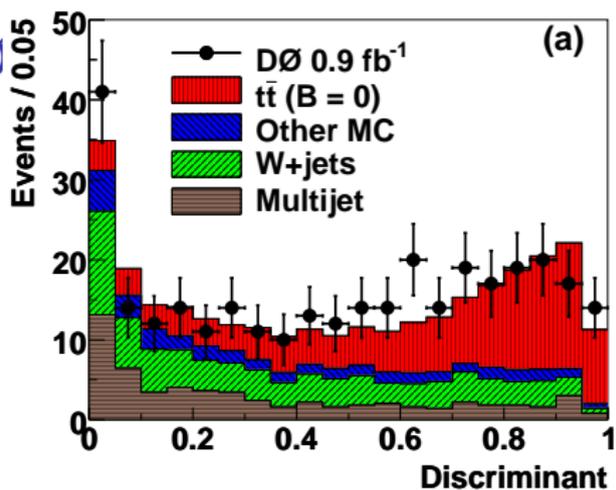
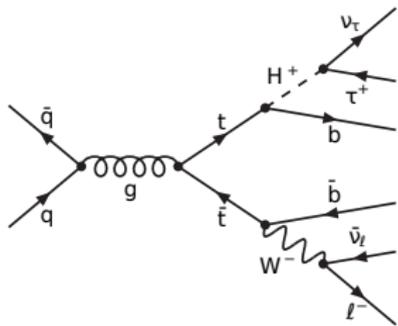
- ▶ The data are consistent with the UE model
- ▶ But, no indication of signal
- ▶ Limits on $BR(t \rightarrow H^+ b)$ vs. m_{H^+} are set for several values of m_A



Search for MSSM H^+ @ $D\bar{D}$

Results

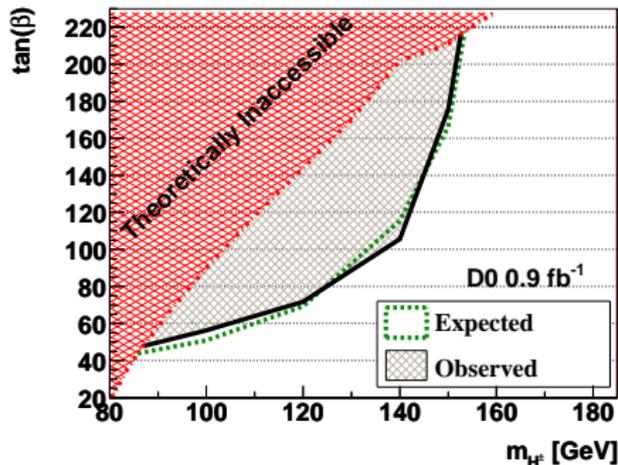
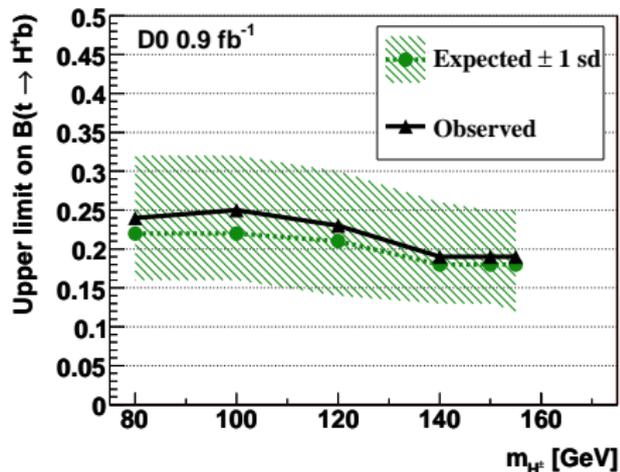
- ▶ For large $\tan(\beta)$, $BR(H^+ \rightarrow \tau^+ \nu_\tau) \sim 1$
- ▶ Neural Net analysis to separate $t\bar{t} \rightarrow W^+ b W^- \bar{b}$ from W +jets



Search for H^+ @ DØ

Results

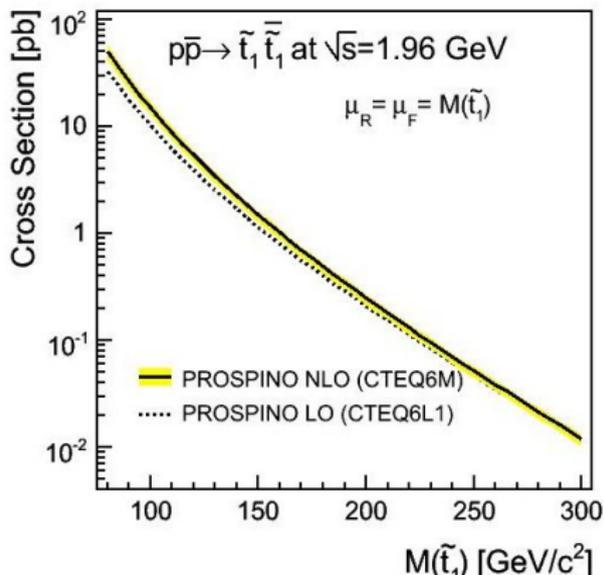
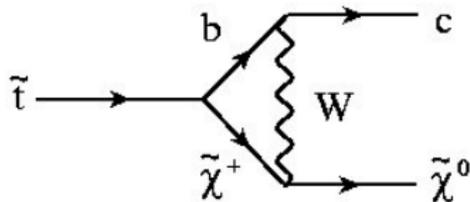
- ▶ Limits on branching-ratio, m_{H^+} vs. $\tan(\beta)$



Search for $\tilde{t} \rightarrow c\tilde{\chi}^0$ in $\cancel{E}_T + \text{jets}$ @ CDF

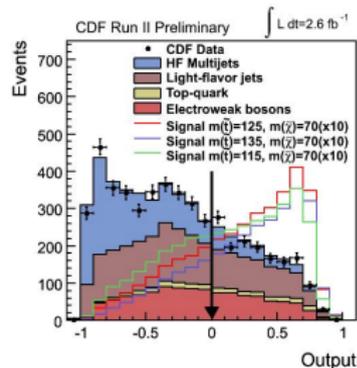
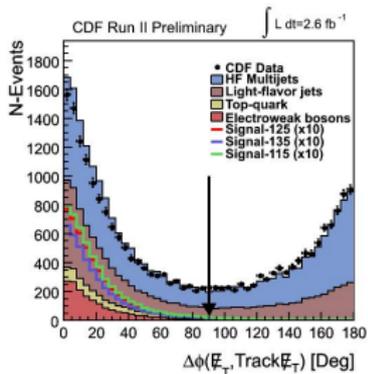
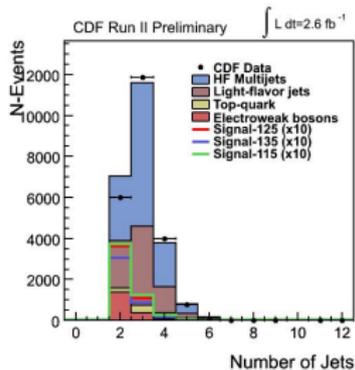
A search for light \tilde{t}

- ▶ We consider $m_{\tilde{t}} \sim 150$ GeV
- ▶ $\tilde{t} \rightarrow c\tilde{\chi}^0$ dominant
- ▶ Signature: two charm jets + \cancel{E}_T
- ▶ The Tevatron is a great place to test such a scenario



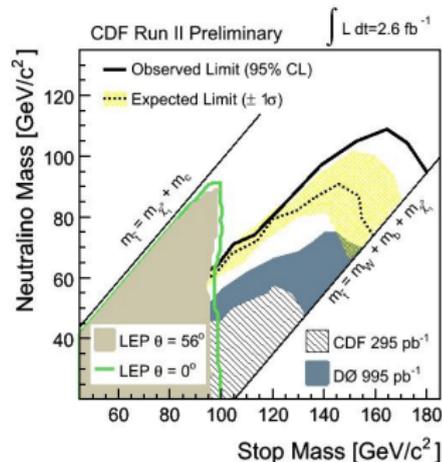
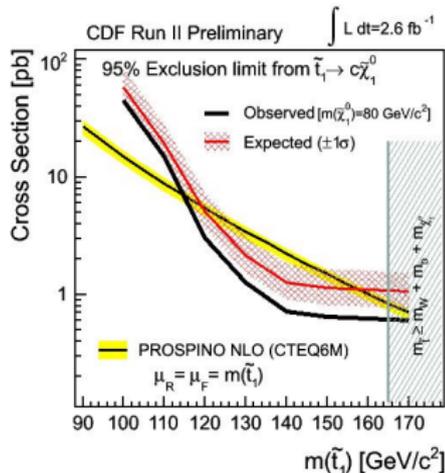
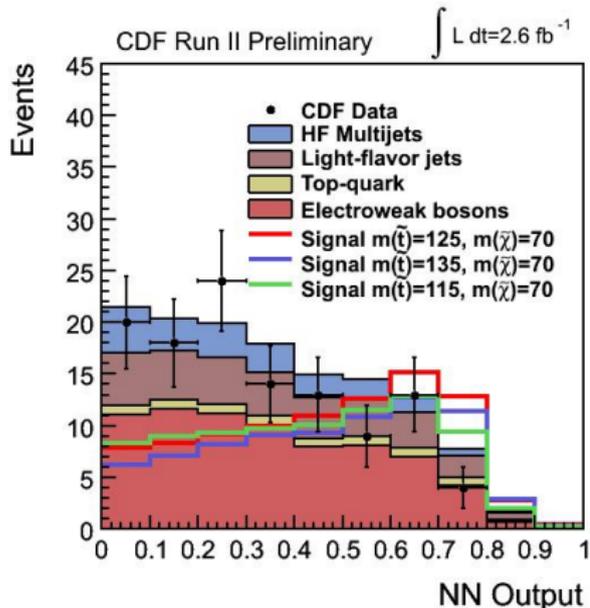
Search for $\tilde{t} \rightarrow c\tilde{\chi}^0$ in $E_T + \text{jets}$ @ CDF

- ▶ To isolate this signal, a **flavor separator** was developed
 - ▶ A Neural Network is trained to distinguish charm from light jets and bottom
-
- ▶ Backgrounds are controlled and are reduced using cuts and a NN trained to reject QCD



Search for $\tilde{t} \rightarrow c\tilde{\chi}^0$ in $E_T + \text{jets}$

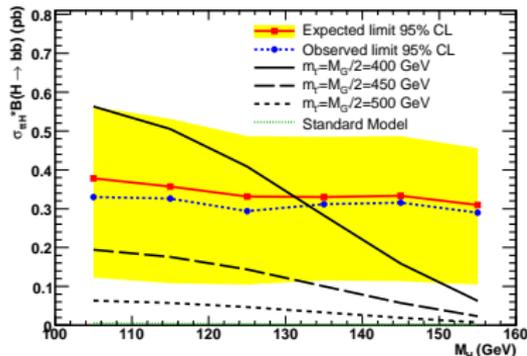
► No signal observed



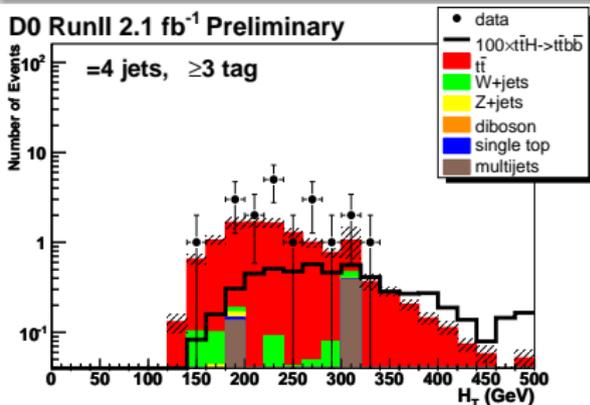
Search for $t\bar{t}H$ @ $D\bar{O}$

- ▶ Simultaneous estimation of $t\bar{t}$ and $t\bar{t}H$ cross-sections
- ▶ $\sigma_{t\bar{t}} = 8.36_{0.98}^{1.08} (\text{stat} + \text{syst}) \pm 0.51 (\text{lumi}) \text{ pb}$
- ▶ Limits also set in context of heavy color-octet production of $t'\bar{t}'$

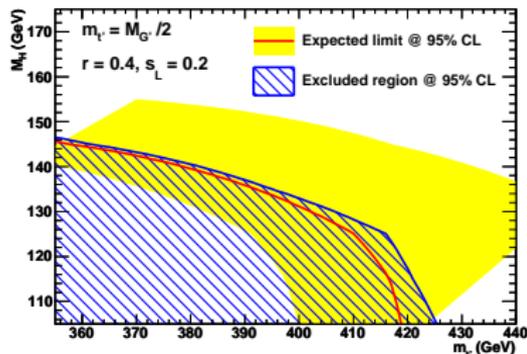
DØ Run II Preliminary (1fb⁻¹)



DØ RunII 2.1 fb⁻¹ Preliminary

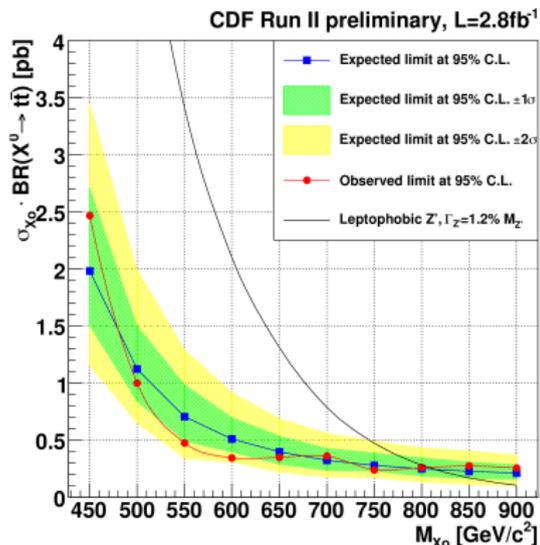
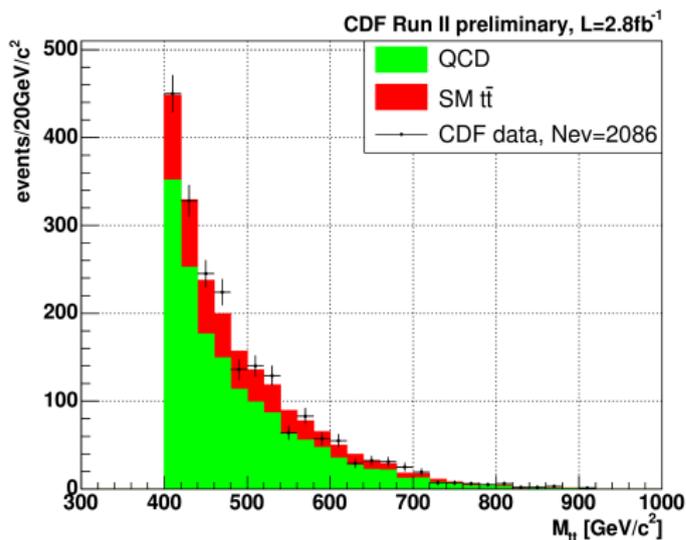


DØ Run II Preliminary (1fb⁻¹)



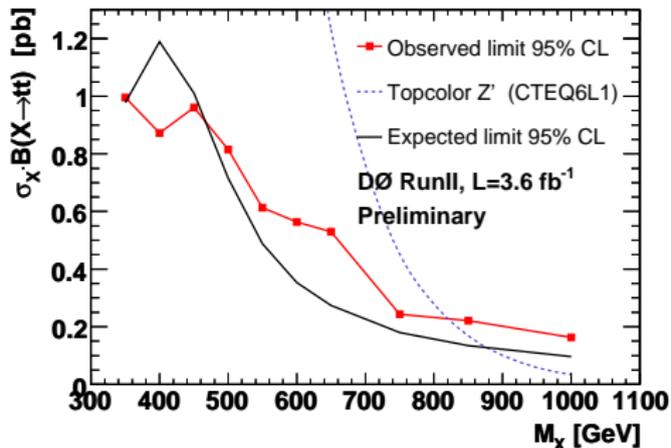
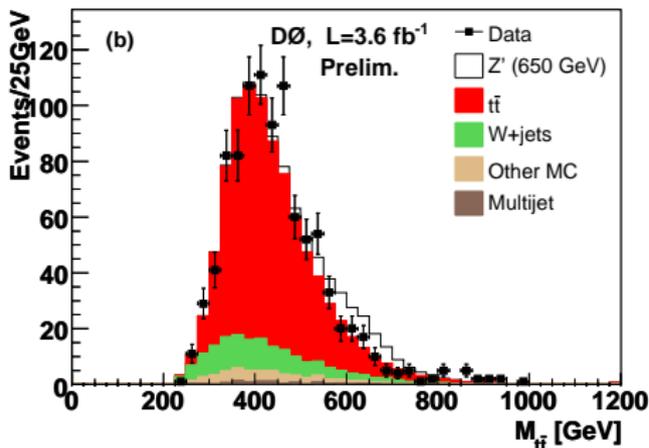
Search for resonant $t\bar{t}$ production in the all-hadronic channel @ CDF

- ▶ Multijet background modeled using data.
- ▶ Event selection by Neural Net



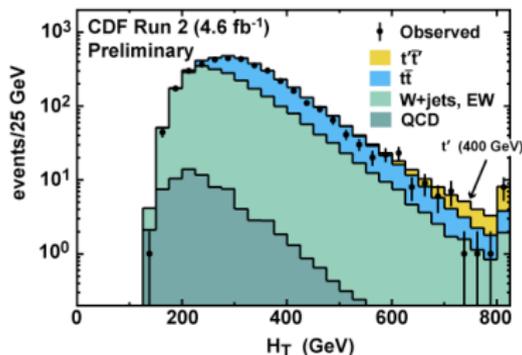
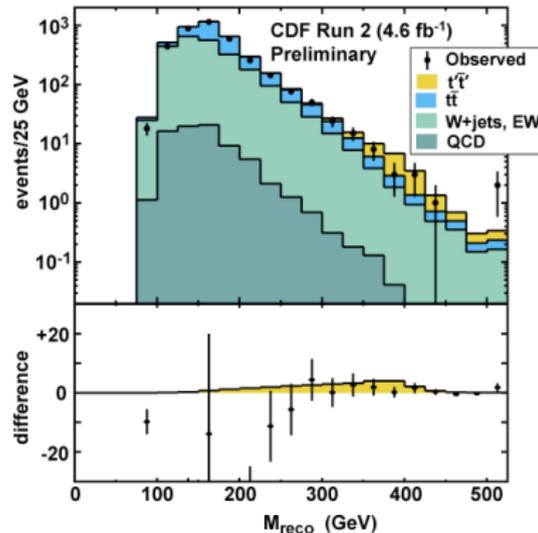
Search for resonant $t\bar{t}$ production in lepton+jets @ DØ

- ▶ Reconstruction simplified, robust
- ▶ 95 CL limit on top-color-assisted technicolor Z' :
 $m_{Z'} > 820$ GeV for $\Gamma_{Z'} = 0.012M_{Z'}$



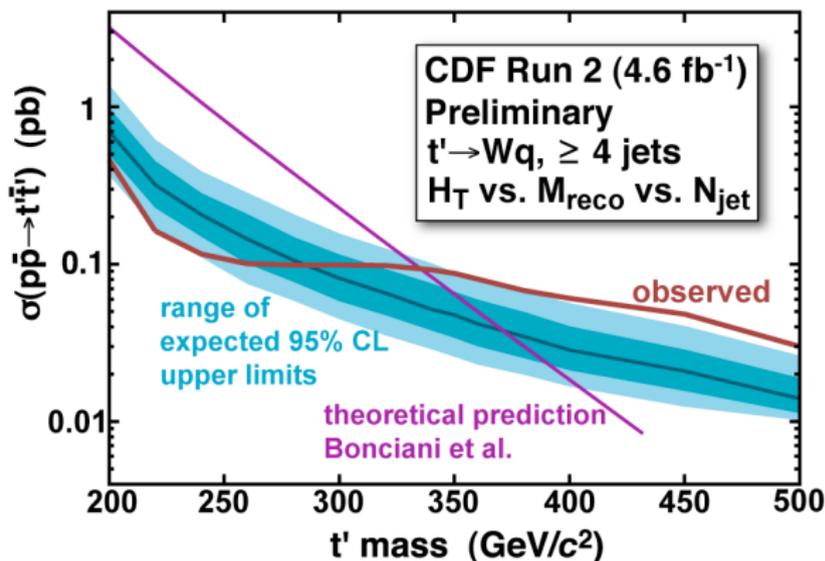
Search for t' @ CDF

- ▶ Search for $t' \rightarrow Wq$ in lepton+jet events
- ▶ t' mass reconstructed using kinematic fit
- ▶ Fit to estimate signal cross-section in multidimensional space: H_T , M_{rec} , N_{jet}



Search for t' @ CDF

- ▶ No statistically significant excess, it's really less than 2 sigma
- ▶ Events with high M_{reco} appear to be clean lepton+jet events

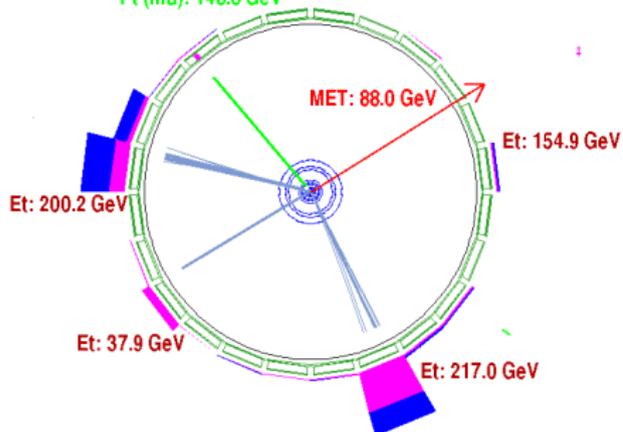


Event Displays of high- M_{reco} events

CDF Run II Preliminary

Run: 194323 Ht: 856.7 GeV
Event: 9830702 Mreco: 449.7 GeV

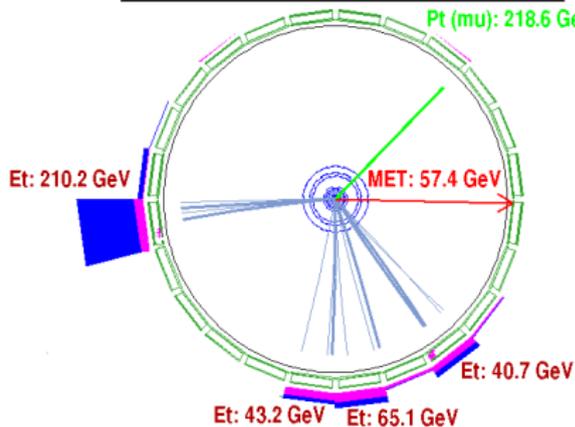
Pt (mu): 148.8 GeV



CDF Run II Preliminary

Run: 192306 Ht: 635.2 GeV
Event: 405574 Mreco: 521.9 GeV

Pt (mu): 218.6 GeV



Thank You