Search for New Physics at the Tevatron

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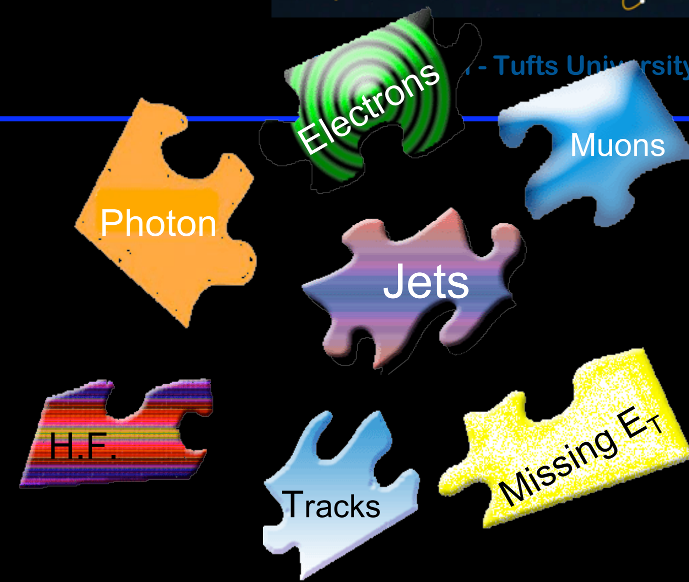
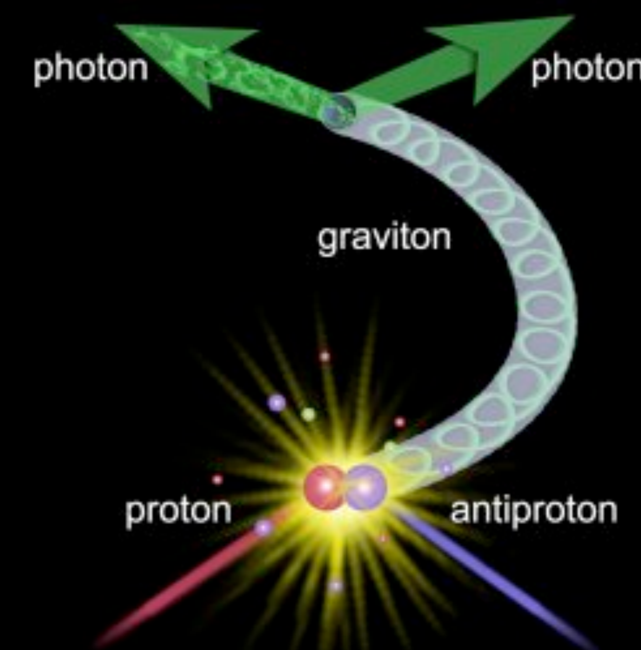
Tufts University
(on behalf of the CDF and D0 Collaborations)

42nd Fermilab Users Meeting
June 3-4, 2009
Ramsey Auditorium, Fermilab
Fermilab UEC

Outline of the talk



- TeVatron status
- Signature-based searches
  - from simple objects to complex final states
    - **leptons-only final states (and isolated tracks)**
    - **… + Missing Energy and Photons**
    - **… + Jets and heavy flavors**
  - Search for SUSY
- Final remarks and conclusions



Tevatron Status

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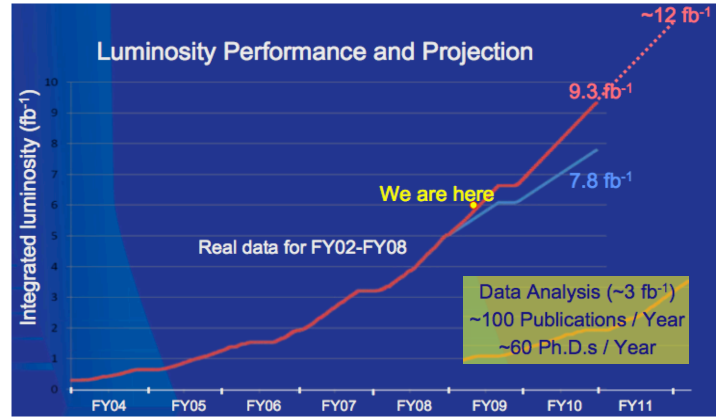
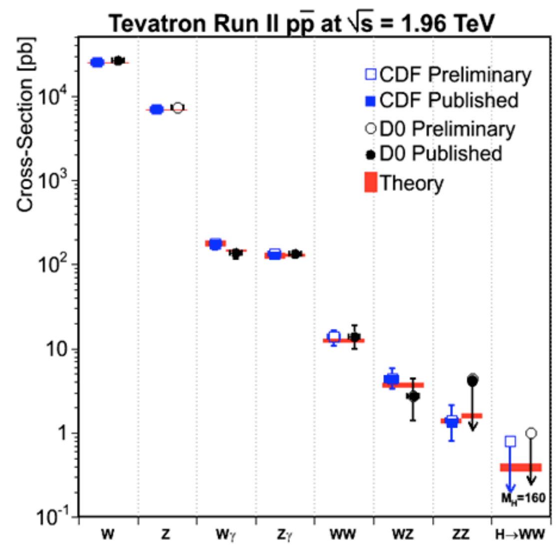
- The TeVatron is currently the highest energy running collider in the world
  - Data are accumulated at fast rate continuously
  - The machine and the detectors (CDF and D0) are performing very well
    - systematic uncertainties are very well under control



- Measurements are becoming very precise
  - Top quark mass known with precision < 2%
- New analyses are now looking for the needle in the hay stack
  - low cross section phenomena



Signatures and Physics Objects

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Many processes: several signatures

Leptons-only final states

- e/μ identification well understood
- τ id a little more complex
- Straightforward and highly efficient approach to search for anomalies

... + Missing Energy and Photons

- Wealth of models and exotic processes
- Need accurate understanding of detector effects

... + Jets and heavy flavors

- More complex signatures
- Maintaining high $S/\sqrt{B}$

When a <u>signature-based</u> approach is advocated, final results are generally interpreted in terms of specific models (typical case dilepton searches, MET + jets)

When the analysis is <u>model driven</u> and results are presented as testing of a specific model, there is always a check on control regions, defined in terms of the process signature (blind analyses)

The two approaches are usually pursued in a balanced and complementary way

Signature-based searches

Open searches, final states are analyzed for anomalies when compared with the SM

- Mass bumps searches
- Multi-objects final state (low background)
- Global Searches

Identification efficiency, detector effects and systematic uncertainties need to be very well understood.

The analysis might not be optimized for the latest theory model available but it might be general enough to exclude several other models.

Dilepton final states

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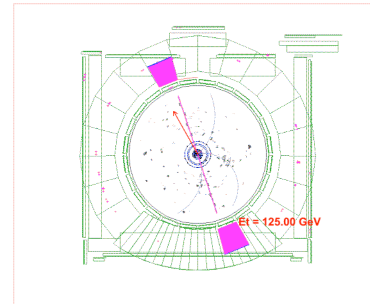
Old-fashioned mass bump hunt..

-Z production and decay into ee/$\mu\mu$ precisely measured
-Lepton ID/Reco and Trigger efficiencies high and very well understood
-Background low and easily determined (QCD fakes)
-Clean events

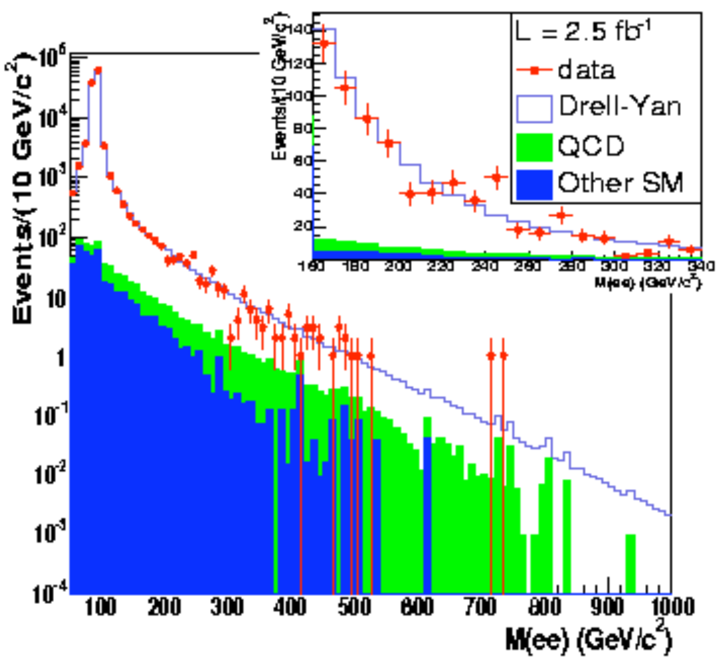


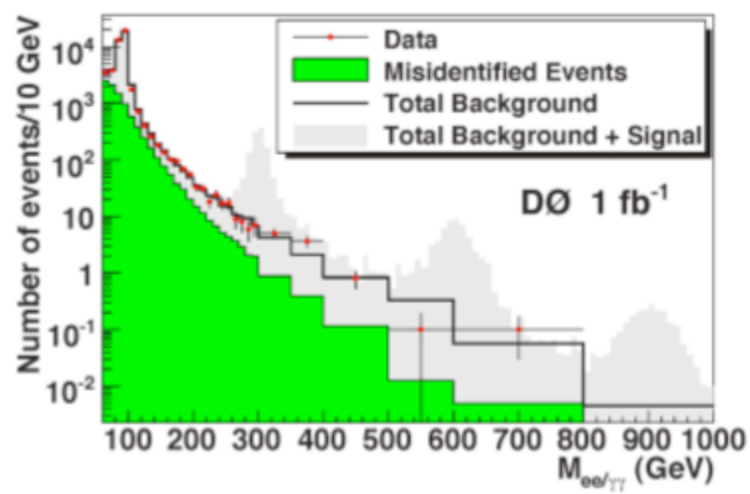
The most significant region of excess for an e^+e^- invariant mass window of 240 GeV/c^2 (CDF)

2.5 standard deviations above the SM prediction

Excess is monitored (data period) Cross-check in muons

D0 does not see any deviation from SM





Testing different models

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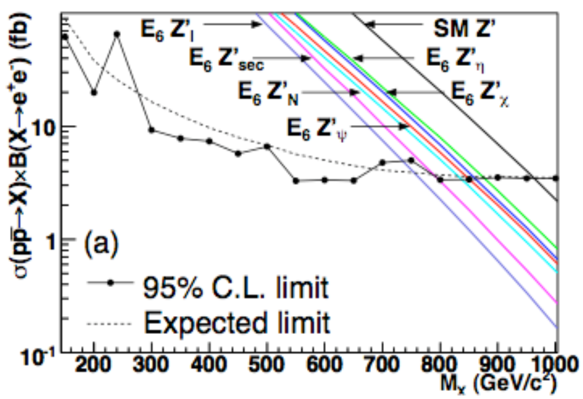
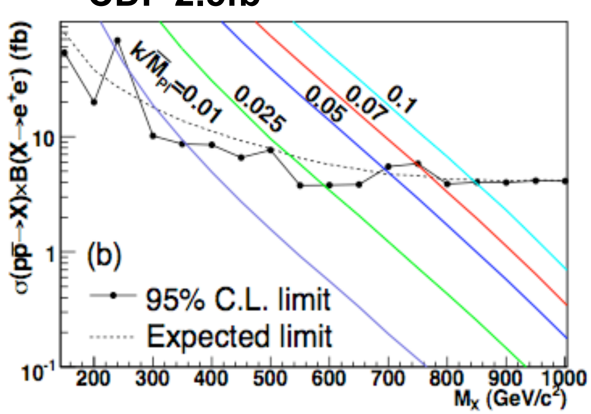
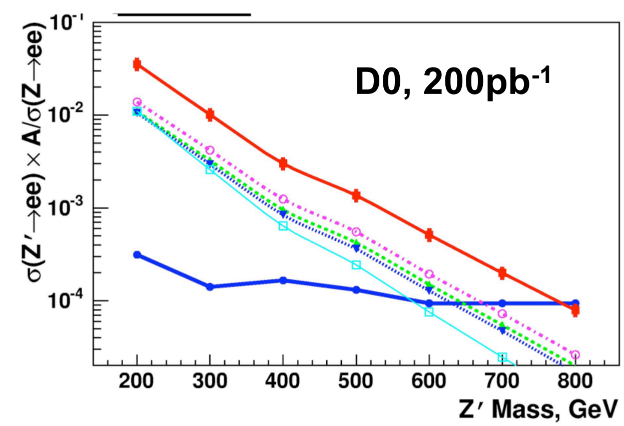
Once the data spectrum is well understood in terms of SM background, from MC, the acceptances for resonant states for different spin particles are derived (Z', RS Graviton) and the expected number of BSM events is calculated.

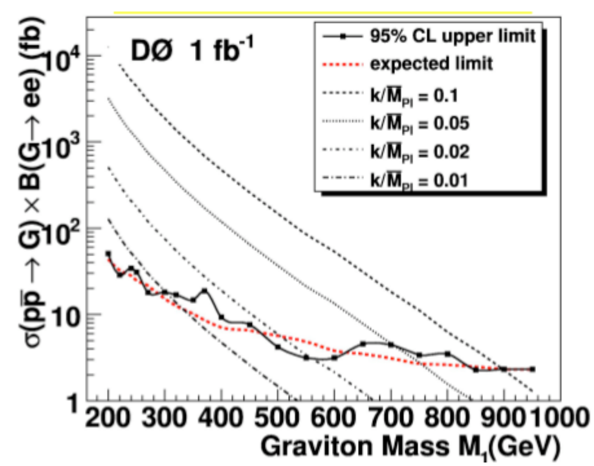
In the absence of an excess of data, 95% CL limits on production cross-sections and mass of the particles are set.



CDF 2.5fb^{-1}







Z’ searches in dimuons

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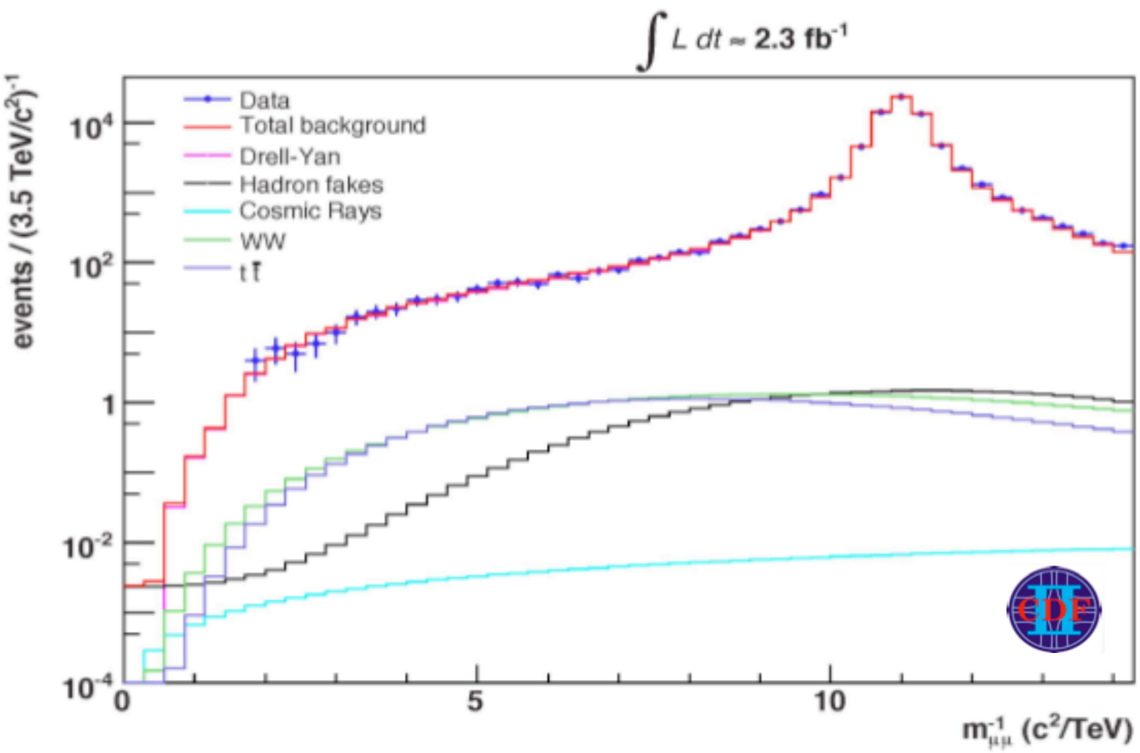
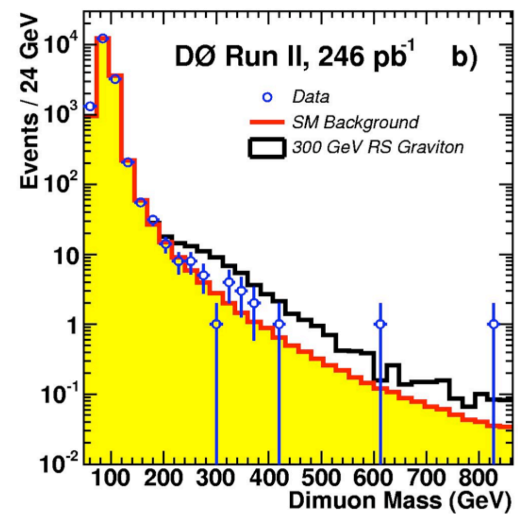
CDF has a new result out searching for bump in the X→μμ final state: no excess is observed.





Dijets final state

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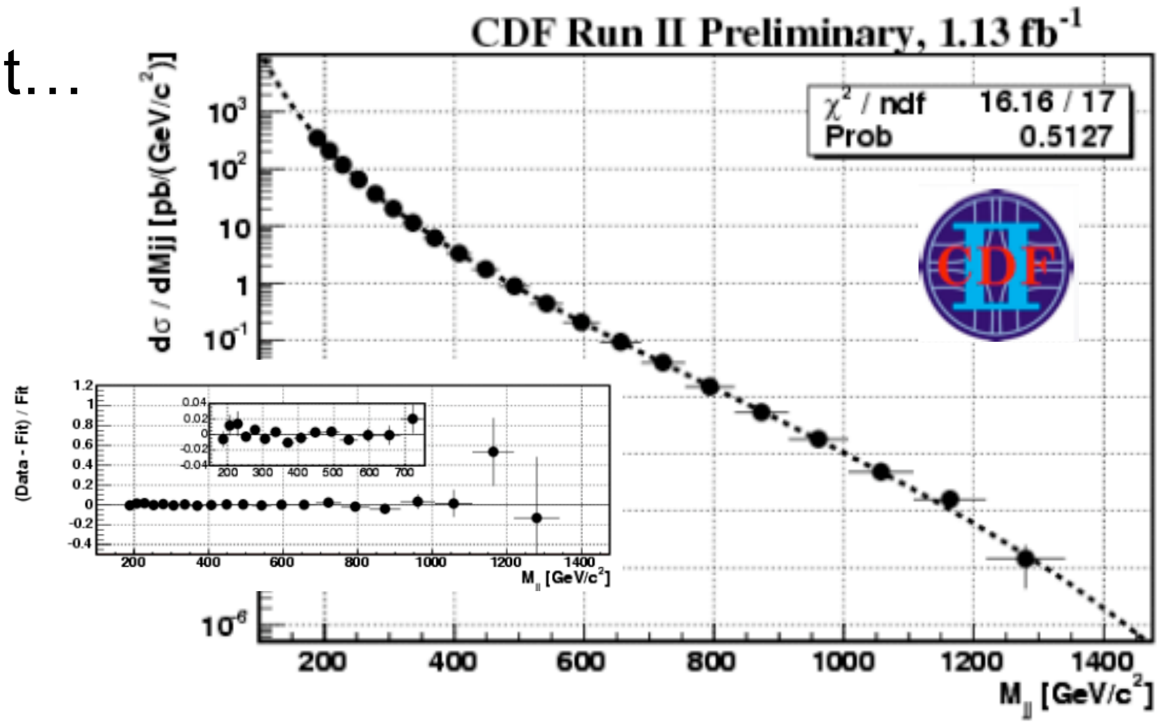
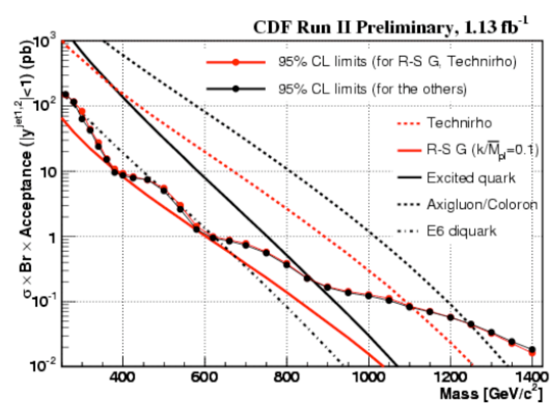
Another mass bump hunt…

- Choose events with two high-p_T jets with rapidity less than 1.0. Look for an excess in the dijet mass spectrum for masses above 180 GeV
- Possible signals include excited quarks, W', Z', and Randall-Sundrum gravitons
- Find functional form of of dijet spectrum in pythia and herwig, fit to data. Look for “bumps” in the data minus fit plot



- No significant resonant structure is observed, so limits are set on various models
- Excludes (at 95% CL) excited quarks from 260-870 GeV, W' from 280-840 GeV, and Z' from 320-740 GeV



Dijets angular distribution

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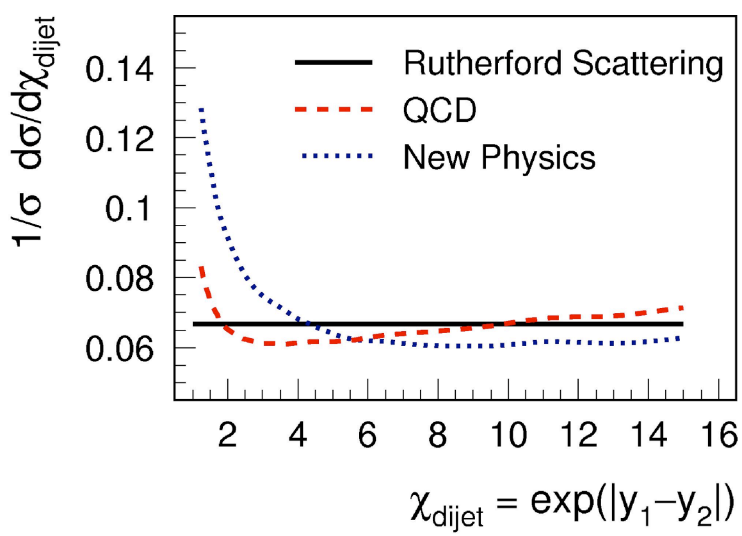
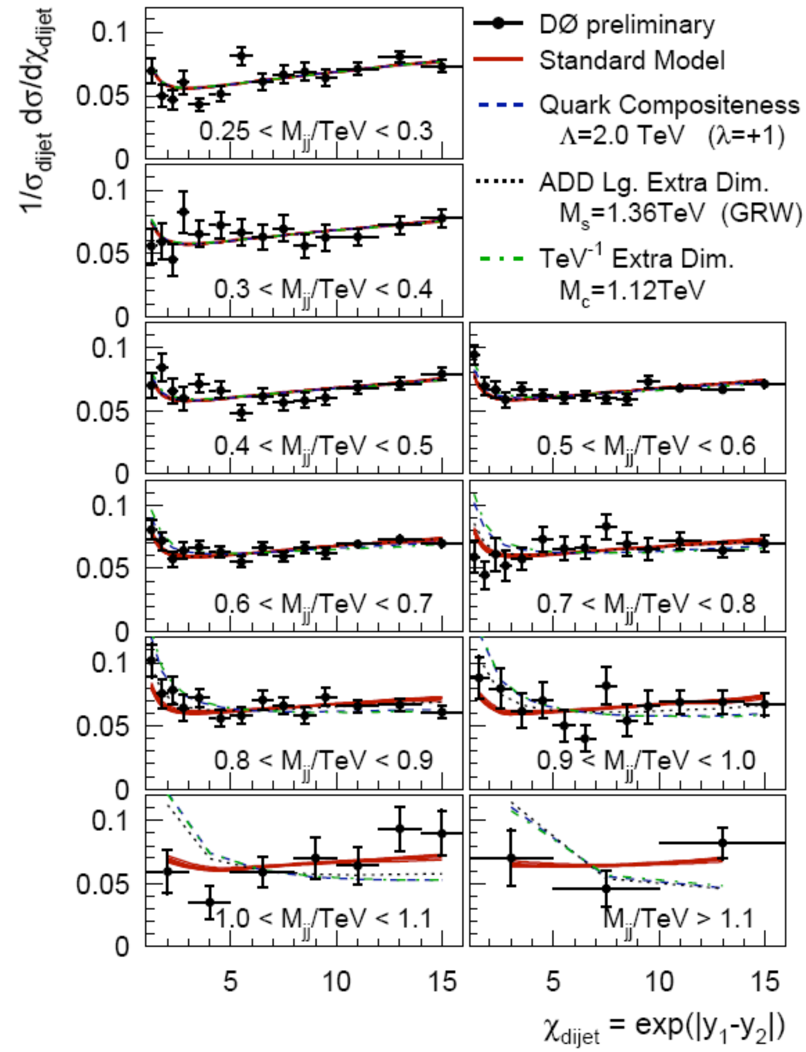
Dijet angular distributions is measured in bins of dijet mass:

- First differential cross section measurement at partonic energies >1 TeV!
- Small experimental and theoretical uncertainties.
- Sensitive to New Physics (95% CL limits):





Lepton+γ final states: Excited leptons

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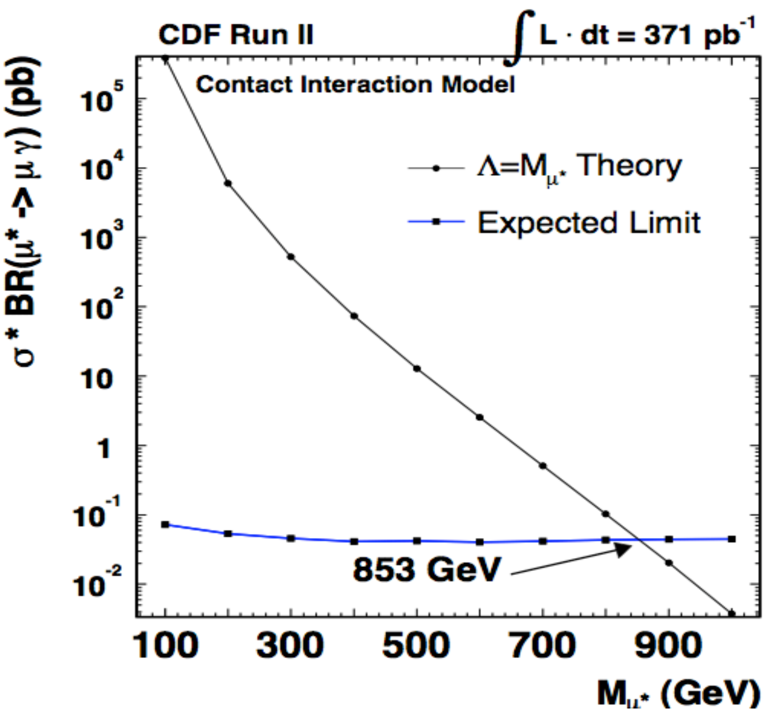
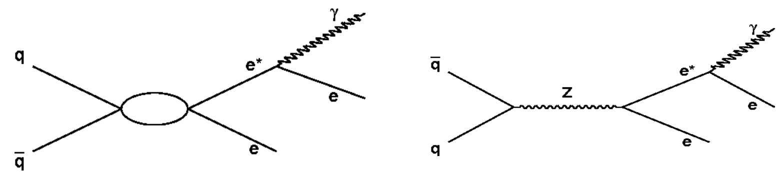
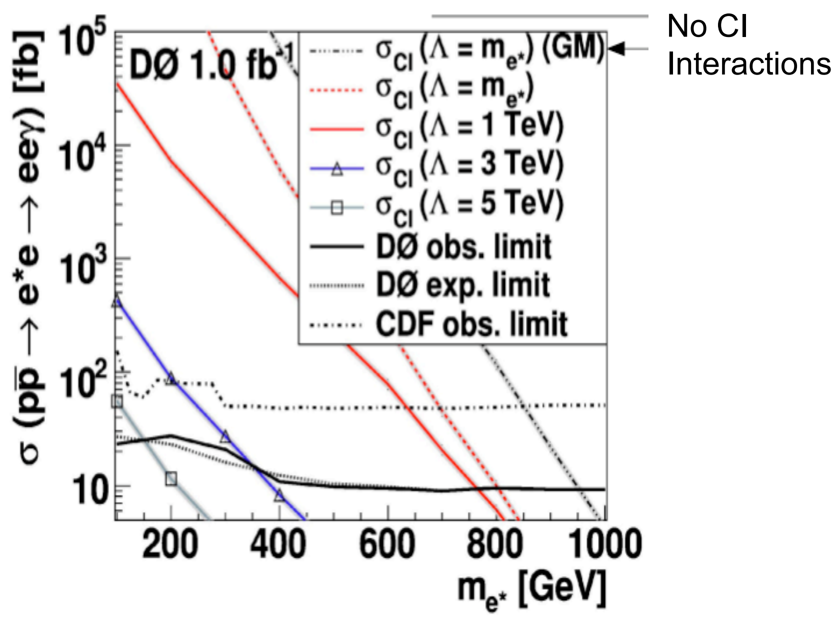
Observation of excited states of quarks and leptons might confirm the hypothesis that they are not elementary particles , but composite states

Select events with eeγ (μμγ) in the final state and look for resonance in M(eγ) or M(μγ)



At Tevatron, e^* /μ^* can be produced via contact interactions or gauge mediated interactions





Diboson resonance searches: Zγ

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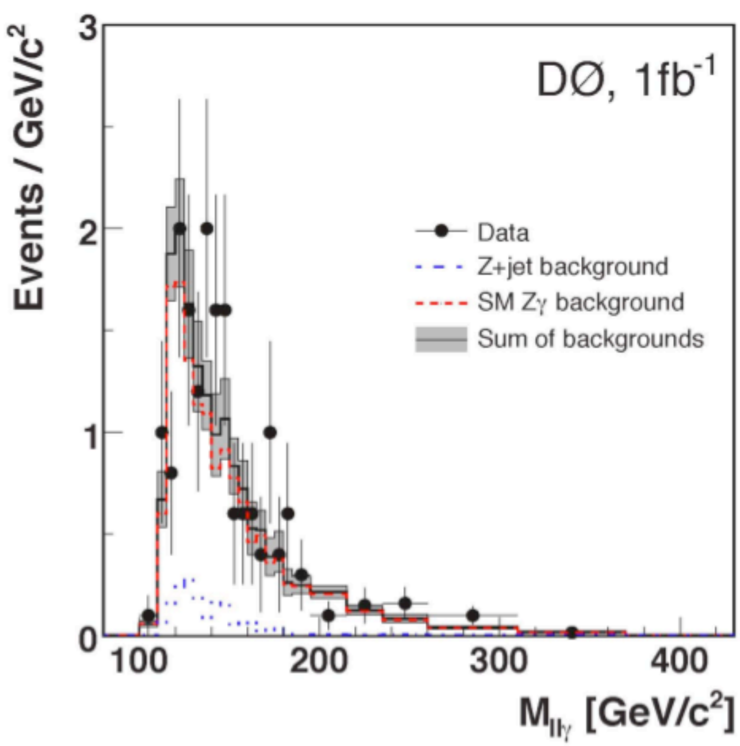
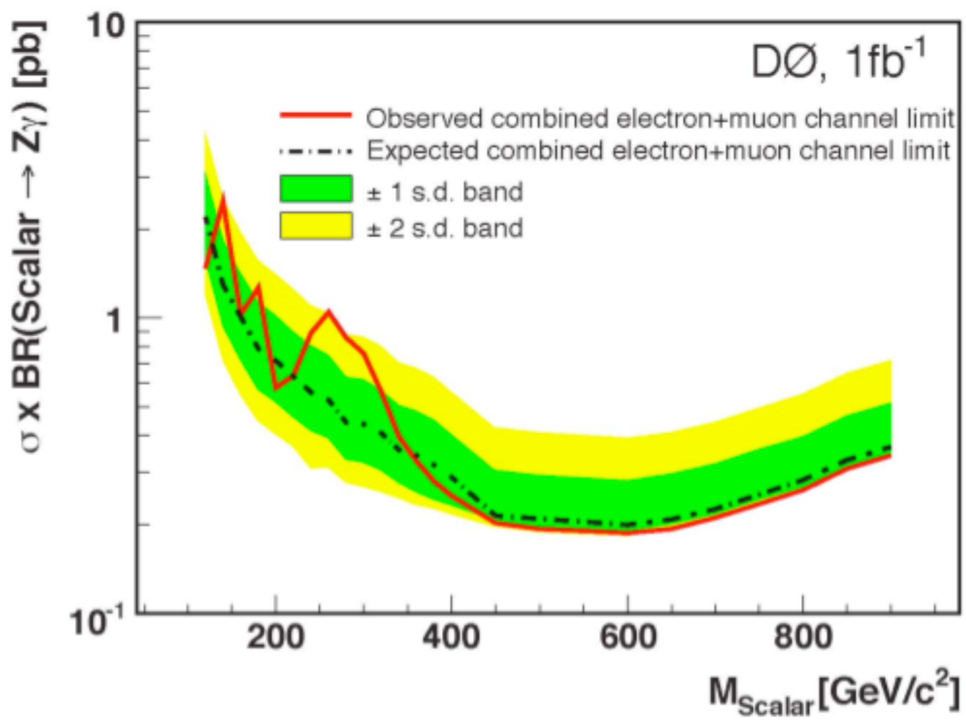
DØ (X → Zγ → ee/μμ γ): no significant excess

Scalar [Vector] X

σ·Br(X→Zγ) < 0.19[0.20] pb (M_X = 600 GeV)   < 2.5[3.1] pb (M_X = 140 GeV)





Diboson resonance searches: WW/WZ

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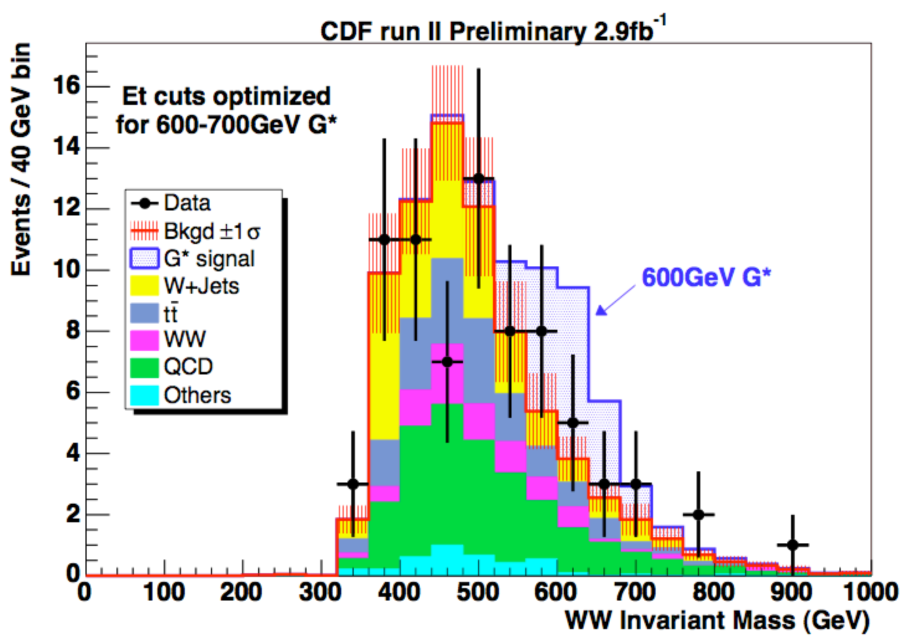
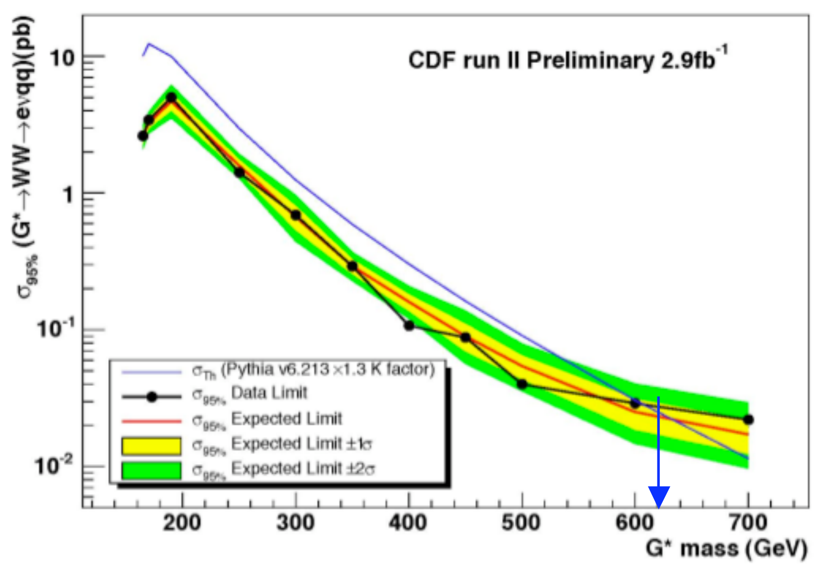
CDF ($X \to WW/WZ \to e\nu jj$): no significant excess
$\Rightarrow$ set limits on W′, Z′, RS graviton

$M_{W'} \notin (284,515)$ GeV $\quad M_{Z'} \notin (247,545)$ GeV $\quad M_G > 607$ GeV ($k/M_p = 0.1$)





Diboson resonance searches: ZZ

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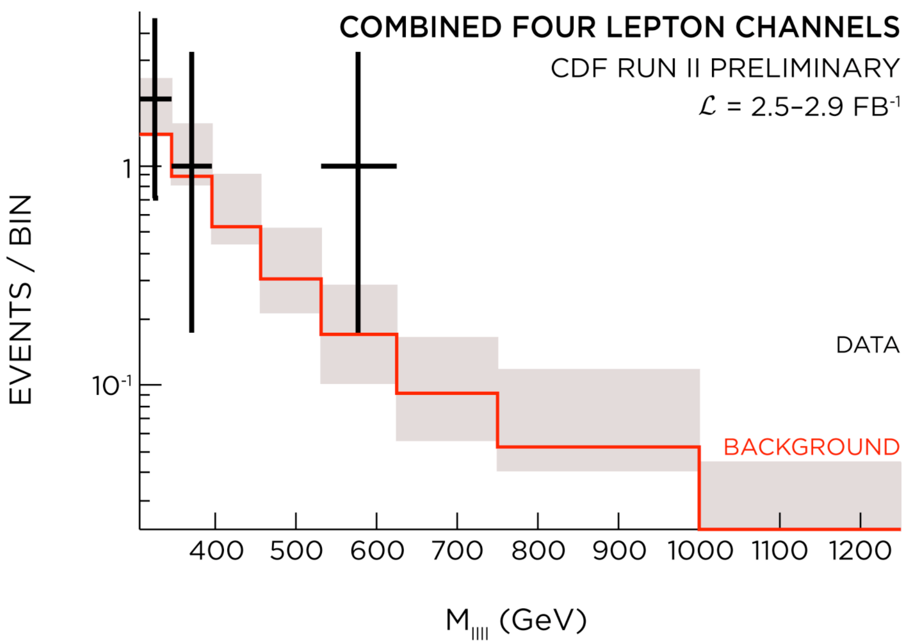
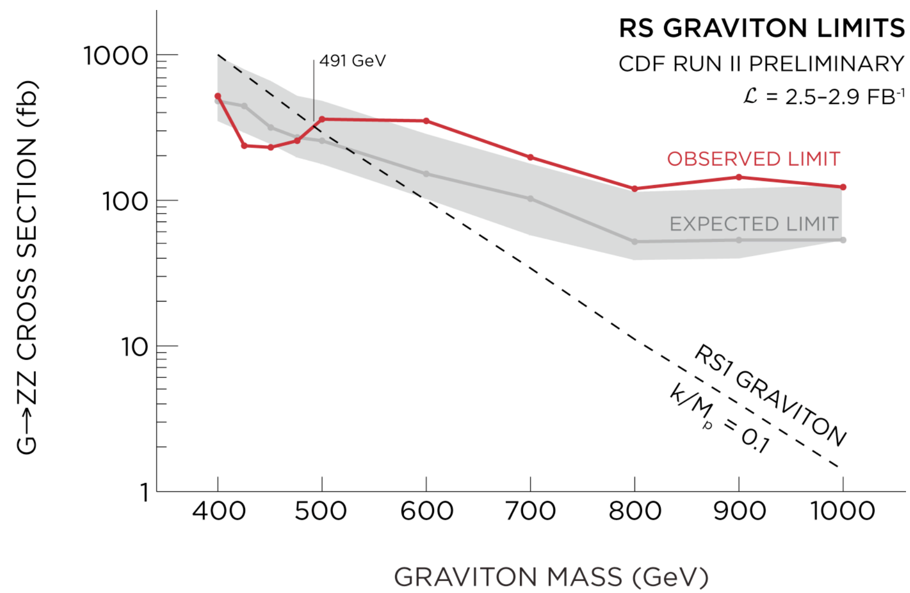
CDF ($X \rightarrow ZZ \rightarrow llll, lljj$; $l=e,\mu$):

newly-improved forward track reconstruction
more efficient muon identification
no significant excess





RS (spin 2) $G \rightarrow ZZ$

$M > 491$ GeV (2.5–2.9 fb^{-1}, $k/M_p = 0.1$)

Diphoton+X

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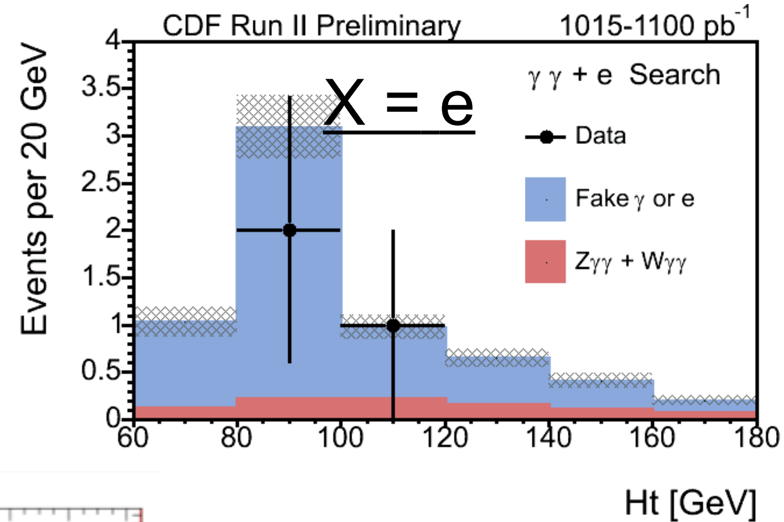
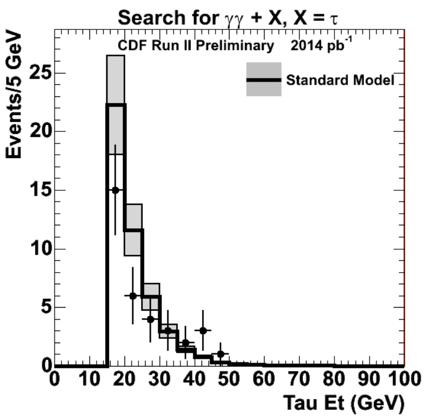
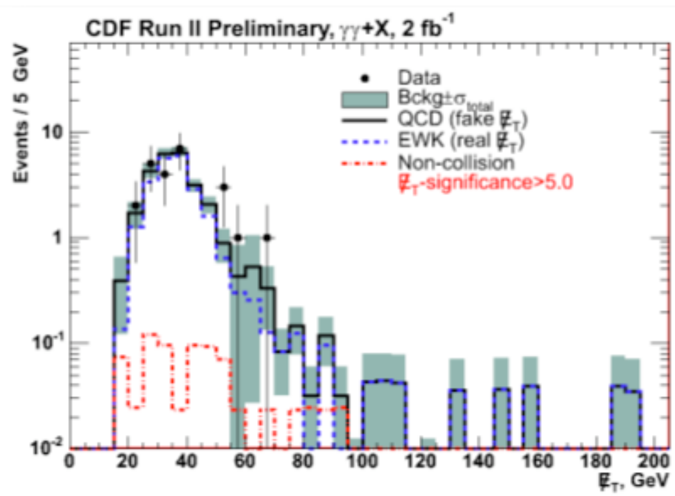
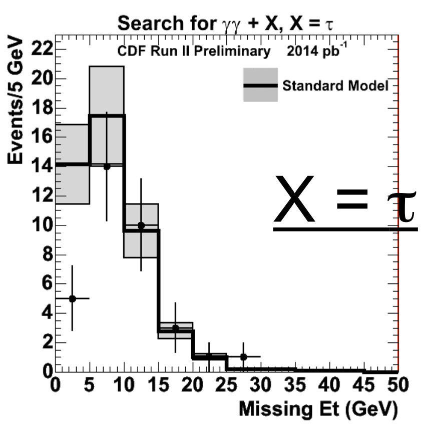
Nominal high E_T object identification and kinematic selections are used.
The observed event counts is reported as well as SM prediction for various kinematic distributions

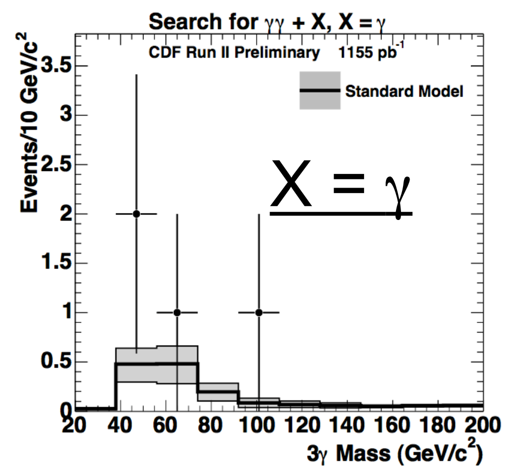




X=MET







Good agreement between data and SM predictions

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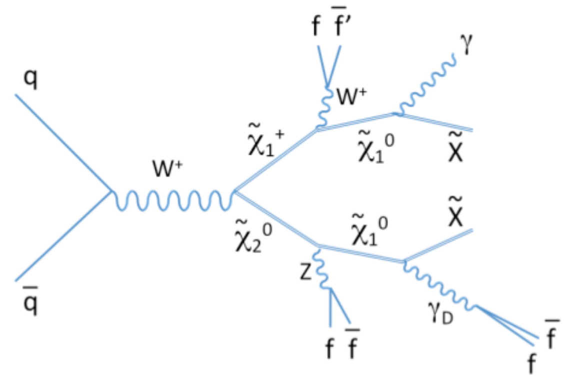
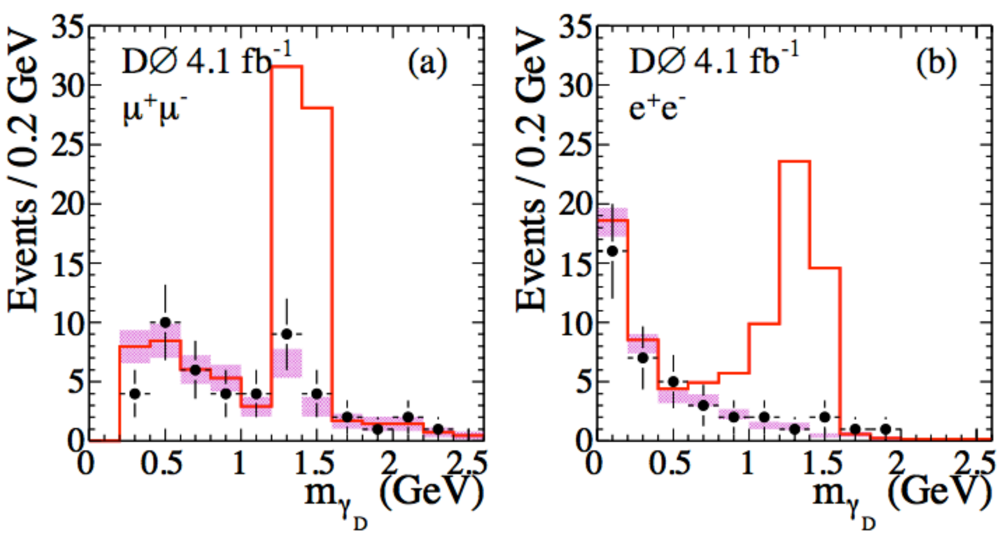
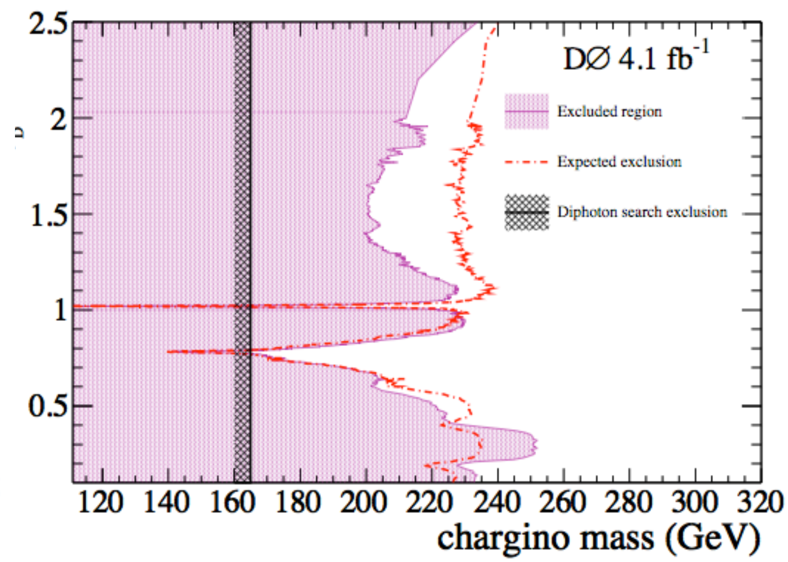
γ+MET+ll

- Very exotic SUSY models :
  - hidden valley dark photons..
  - Axions decaying into muons
  - Hidden-state Y cascadying to dark photons
- Signature:Two spatially closed leptons (no Iso), MET and γ







Single jet/photon + MET: LED

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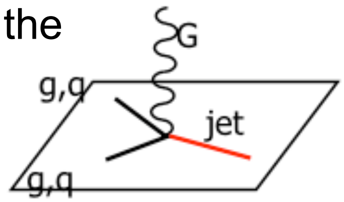
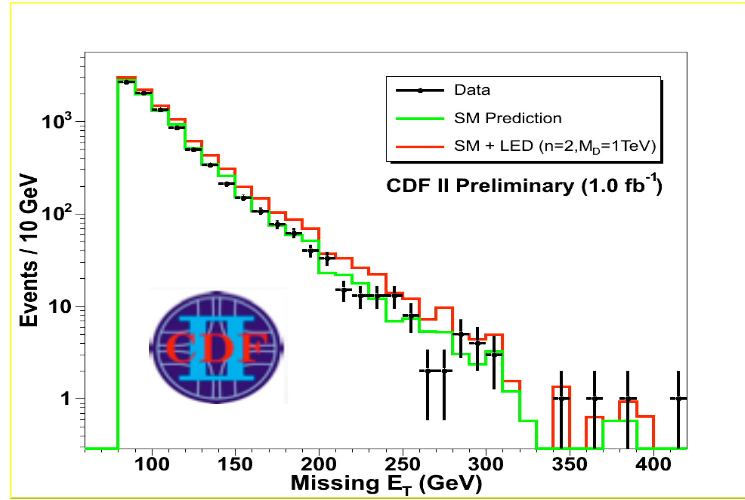
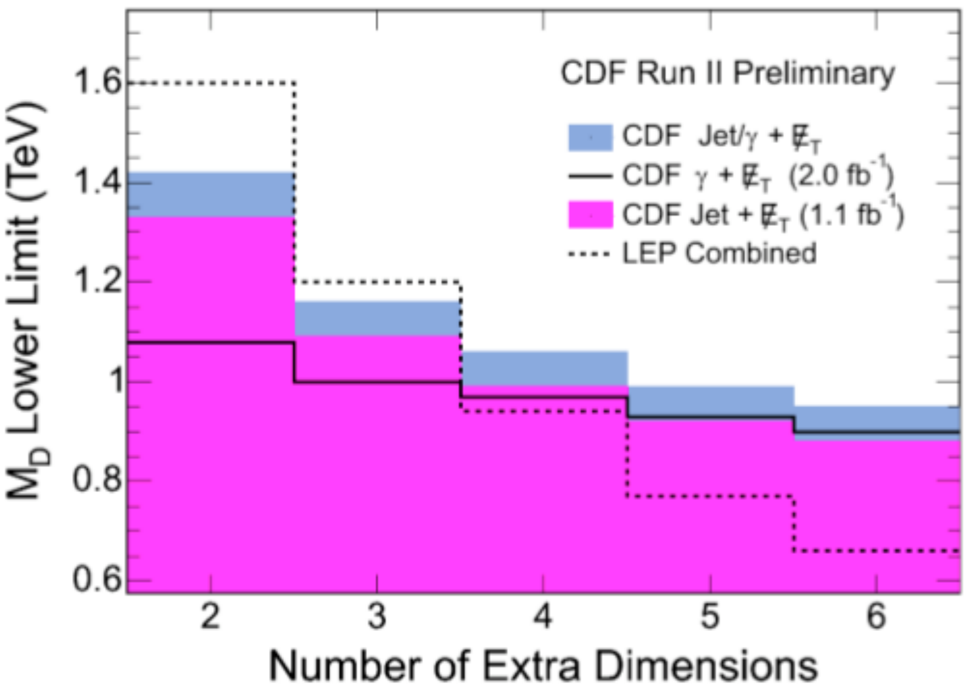
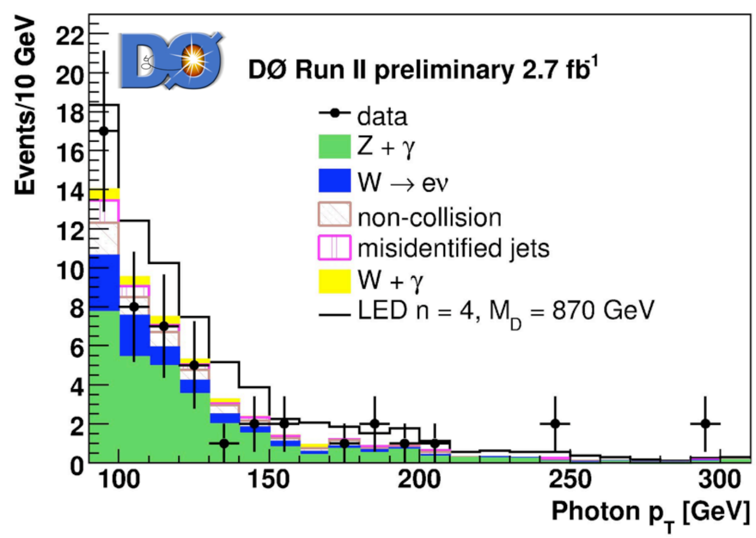
A Kaluza-Klein graviton is produced in association with a jet (or photon). The graviton escapes detection, leaving a monojet (monophoton) signature in the detector









Jets+MET final state:Leptoquarks

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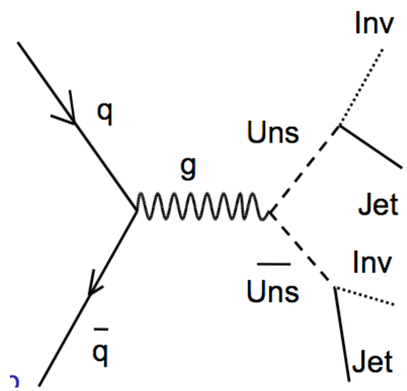
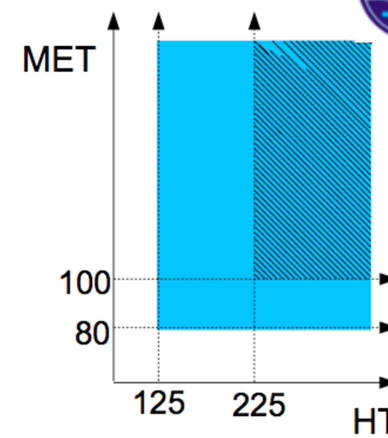


The analysis is a counting experiment examining two different kinematic regions (each region being more sensitive to different models). Cuts are not optimized for a specific model.

Main backgrounds:

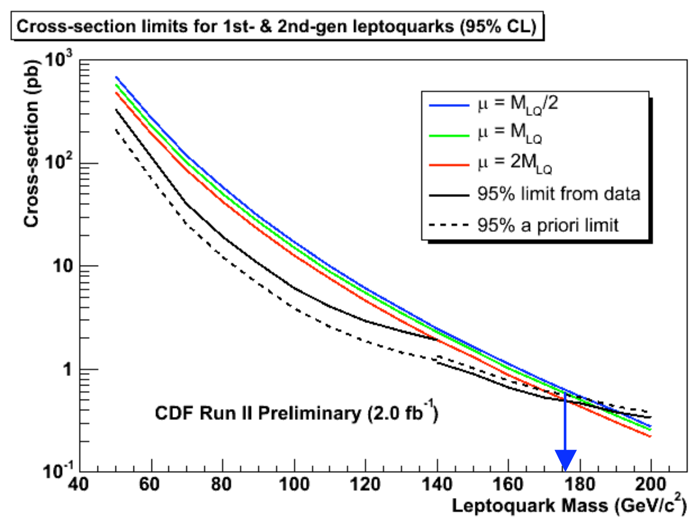
- Z → ν ν + jets (irreducible background)
- W → *l* ν + jets (with charged lepton lost)
- Residual QCD and non-collision backgrounds.

Data driven prediction



CDF Run II Preliminary, 2fb^{-1}

Background	125/80	225/100
Z → νν	777 ± 49	71 ± 12
W → τν	669 ± 42	50 ± 8
W → μν	399 ± 25	33 ± 5
W → eν	256 ± 16	14 ± 2
Z → ll	29 ± 4	2 ± 0
QCD	49 ± 30	9 ± 9
γ + jets	55 ± 13	5 ± 3
top	74 ± 9	11 ± 2
non-collision	4 ± 4	1 ± 1
Total	2312 ± 140	196 ± 29
Observed	2506	186



Other Leptoquarks Results

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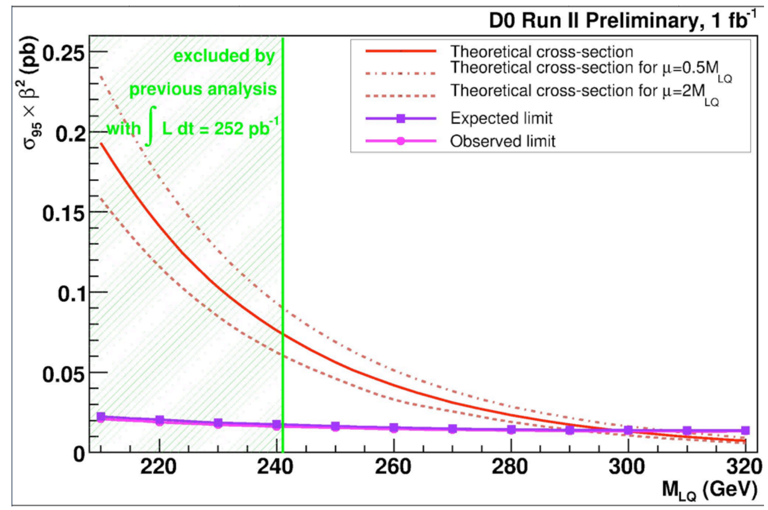
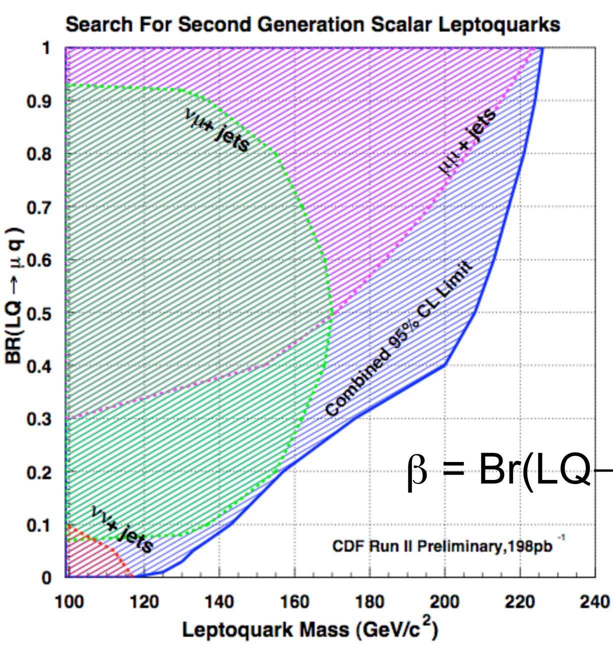
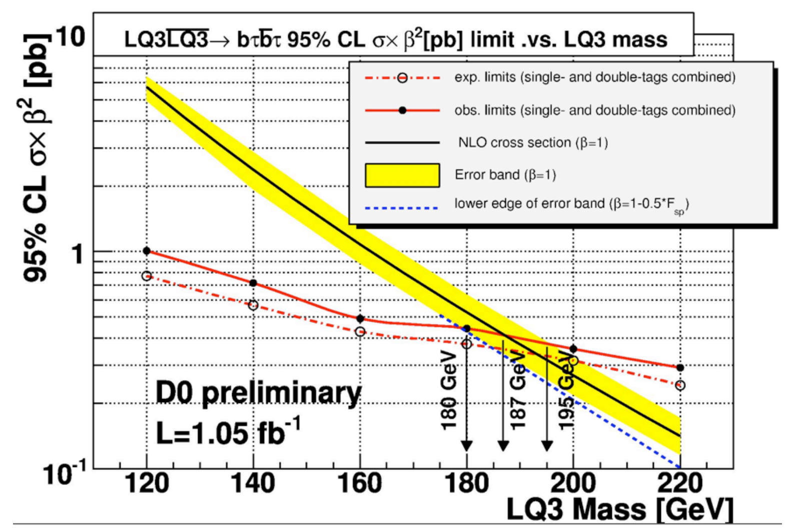
1st Generation	2nd Generation	3rd Generation
$LQ\,\overline{LQ} \to e^-e^+ q\bar{q}$	$LQ\,\overline{LQ} \to \mu^+\mu^- q\bar{q}$	$LQ\,\overline{LQ} \to \tau^+\tau^- q\bar{q}$
$LQ\,\overline{LQ} \to e^{\pm}\nu_e q_i q_j$	$LQ\,\overline{LQ} \to \mu^{\pm}\nu_\mu q_i q_j$	$LQ\,\overline{LQ} \to \tau^{\pm}\nu\, q_i q_j$
$LQ\,\overline{LQ} \to \nu_e\nu_e q\bar{q}$	$LQ\,\overline{LQ} \to \nu_\mu\nu_\mu q\bar{q}$	$LQ\,\overline{LQ} \to \nu_\tau\nu_\tau q\bar{q}$





$\beta = Br(LQ \to lq)$



Search for Supersymmetry

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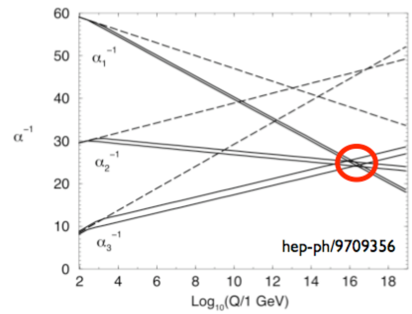
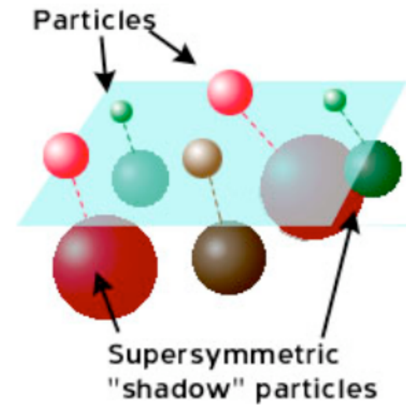
- SUSY is a very popular extension of the SM…
  - It solves several open issues and provide an elegant description of bosons and fermions





- On the other hand…
  - Full set of new particles with constraints on their masses (TeV scale)
- Various signatures with access to a wide phase space
  - Multileptons final states
  - Jets and MET
  - MET and γ
  - Heavy flavors

Names	spin	R_P	Gauge eigenstates	Mass eigenstates
Higgs bosons	0	+1	$H_u^0\ H_d^0\ H_u^+\ H_d^-$	$h^0\ H^0\ A^0\ H^\pm$
squarks	0	-1	$\tilde{u}_L\ \tilde{u}_R\ \tilde{d}_L\ \tilde{d}_R$	same
			$\tilde{c}_L\ \tilde{c}_R\ \tilde{s}_L\ \tilde{s}_R$	same
			$\tilde{t}_L\ \tilde{t}_R\ \tilde{b}_L\ \tilde{b}_R$	$\tilde{t}_1\ \tilde{t}_2\ \tilde{b}_1\ \tilde{b}_2$
sleptons	0	-1	$\tilde{e}_L\ \tilde{e}_R\ \tilde{\nu}_e$	same
			$\tilde{\mu}_L\ \tilde{\mu}_R\ \tilde{\nu}_\mu$	same
			$\tilde{\tau}_L\ \tilde{\tau}_R\ \tilde{\nu}_\tau$	$\tilde{\tau}_1\ \tilde{\tau}_2\ \tilde{\nu}_\tau$
neutralinos	1/2	-1	$\tilde{B}^0\ \tilde{W}^0\ \tilde{H}_u^0\ \tilde{H}_d^0$	$\chi_1^0\ \chi_2^0\ \chi_3^0\ \chi_4^0$
charginos	1/2	-1	$\tilde{W}^\pm\ \tilde{H}_u^+\ \tilde{H}_d^-$	$\chi_1^\pm\ \chi_2^\pm$
gluino	1/2	-1	$\tilde{g}$	same
goldstino	1/2	-1	$\tilde{G}$	same

MSSM particle spectrum

SUSY in Trileptons

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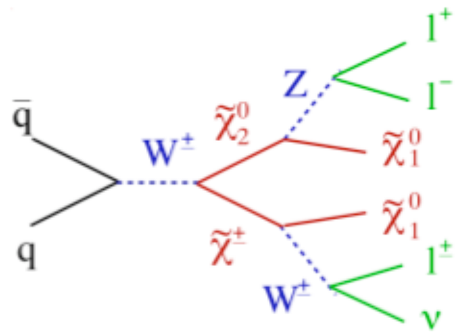
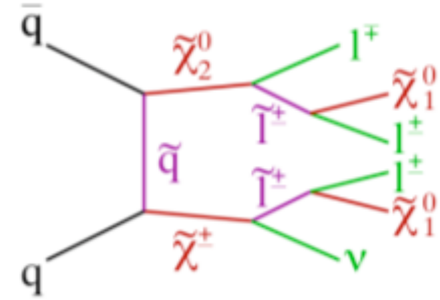
Very clean signature:

- 3 isolated leptons
- $\not{E}_T$ due to undetected $\tilde{\chi}_1^0$ and ν





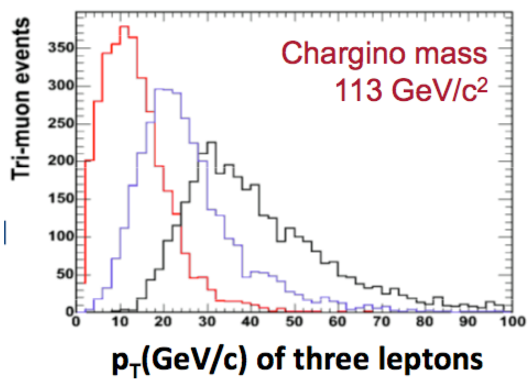
Challenge:

- low cross section:
  $\sigma \times \mathcal{B}r < 0.5$ pb
- very soft 3rd lepton p_T

Search Strategies

CDF: 2.0 fb^{-1}
- 3 identified leptons (e, μ)
- 2 identified leptons + track (ℓ)

DØ: 2.3 fb^{-1}
- 2 identified leptons (e, μ) + ℓ
- μτ + ℓ and μτ + τ (τ had decay)
- "low"-pT vs "high"-pT search



Background is reduced with several set of kinematical cuts: inv-mass cut, lepton (track) p_T cut, $\not{E}_T$, M_T, $\Delta\Phi$ between leptons, number of jets...

diboson (WW,WZ)
Drell-Yan $W \to l\nu$, $t\bar{t}$

SUSY in Trileptons (cont'd)

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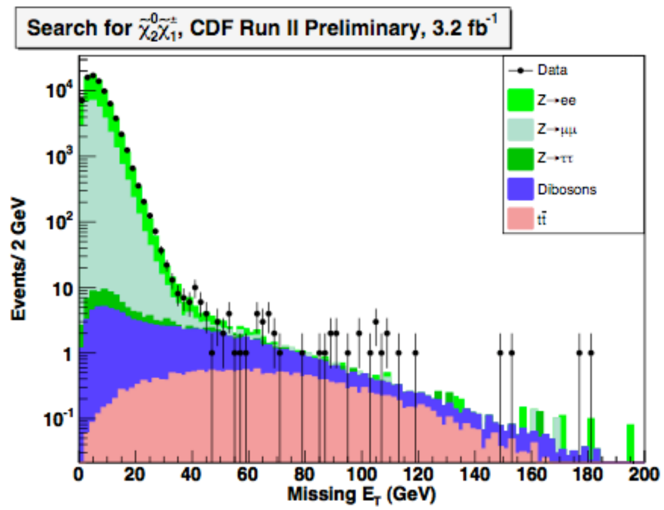


Control regions in MET vs $M_{\ell\ell}$ phase-space

- Signal region is investigated only after validating backgrounds in control regions (a blind analysis)

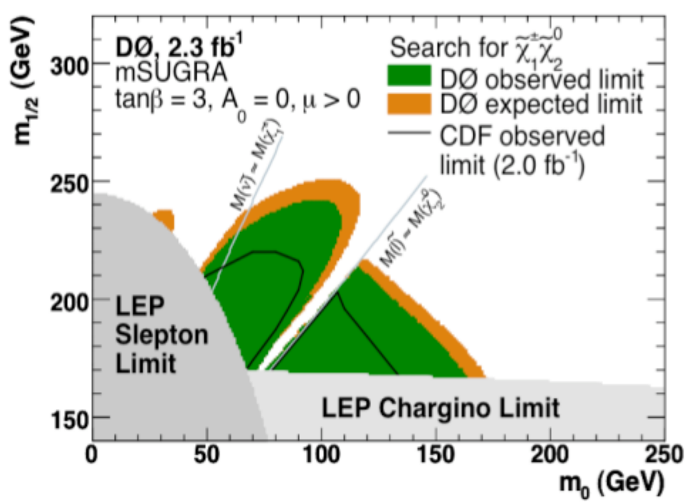
- Good agreement with SM background

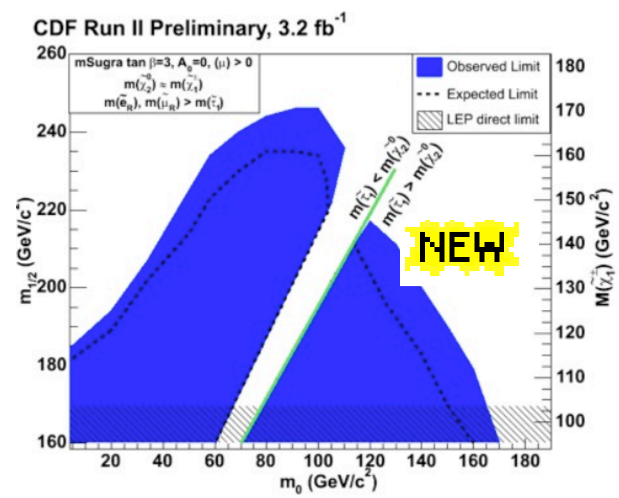
DØ $\int \mathcal{L}dt = 2.3\ \mathrm{fb}^{-1}$	Background	Data	CDF $\int \mathcal{L}dt = 2.0\ \mathrm{fb}^{-1}$	Background	Data
low p_T	5.4±0.6	9	Trilepton	1.47± 0.21	1
high p_T	3.3±0.4	4	Lepton+track	9.38±1.44	6

Data compatible with SM

Set limits in the mSUGRA model

Benchmark scenario:
A^0=0, tanβ=3, μ > 0





Sneutrinos in e+μ/τ final states

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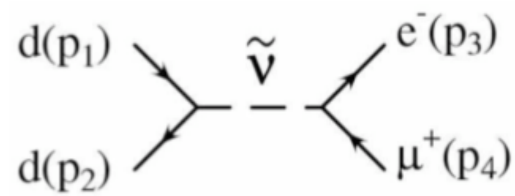
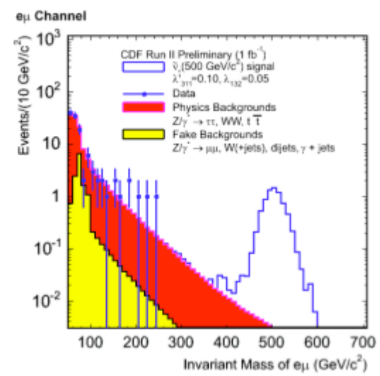
R-parity: $R_P = (-1)^{2S}(-1)^{3(B-L)}$

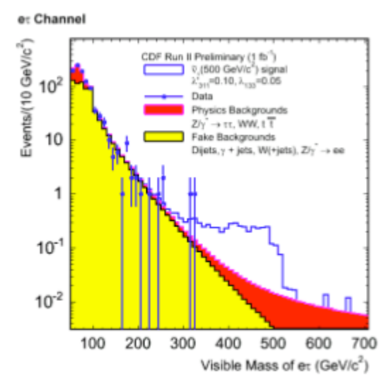
- R-parity violation: automatic generation of neutrino masses and mixing... single sparticle can be produced



Very clean signature:

- 2 hard isolated leptons
- typical signal acceptance: 5 to 15%

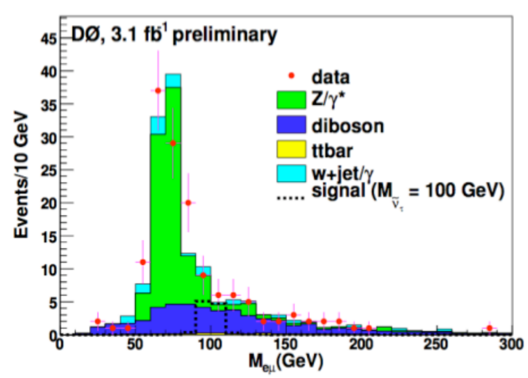




Search Strategies

CDF: • 1.0 fb^{-1}
• 3 channels: eμ; μτ; eτ

DØ: • 4.1 fb^{-1}
• only one channel: eμ



DØ places limits on λ'_{311} for several values of λ_{321} depending on the stau mass.
CDF places limits on the stau mass. Updated limits underway (using more accurate theo. predictions).

GMSB SUSY

Simona Rolli - Tufts University

In gauge mediated SUSY breaking models, SUSY is broken in a hidden sector. The breaking is communicated to (s)quarks, (s)leptons and Higgs(ino) via gauge bosons and gaugino interactions.

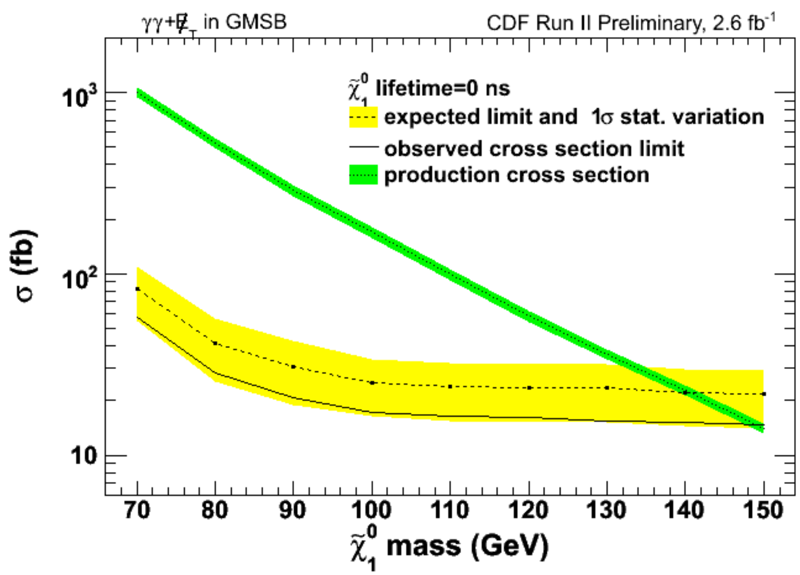
Special features:

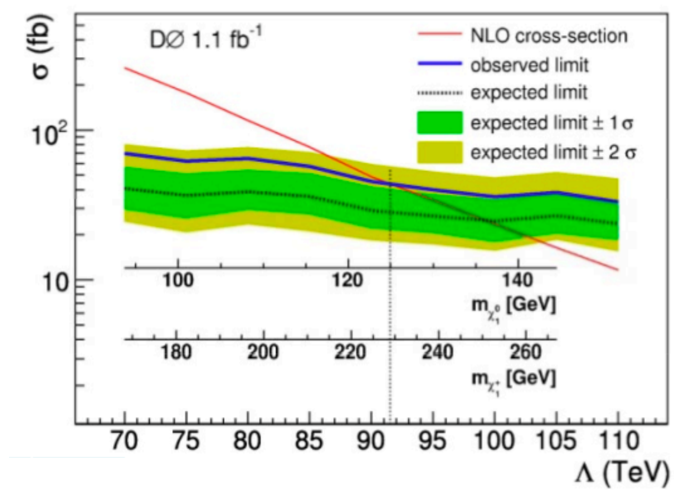
- gravitino is the LSP
- NLSP is a neutralino or a slepton

$p\bar{p} \rightarrow (X \rightarrow) \chi^0_1 \chi^0_1$ → $2\gamma + \not{E}_T$

- NLSP can decay early enough to occur in the detector volume

- If NLSP = neutralino, one has: $\tilde{\chi}^0_1 \rightarrow \tilde{G}\gamma$





Squarks and gluinos: jets +MET

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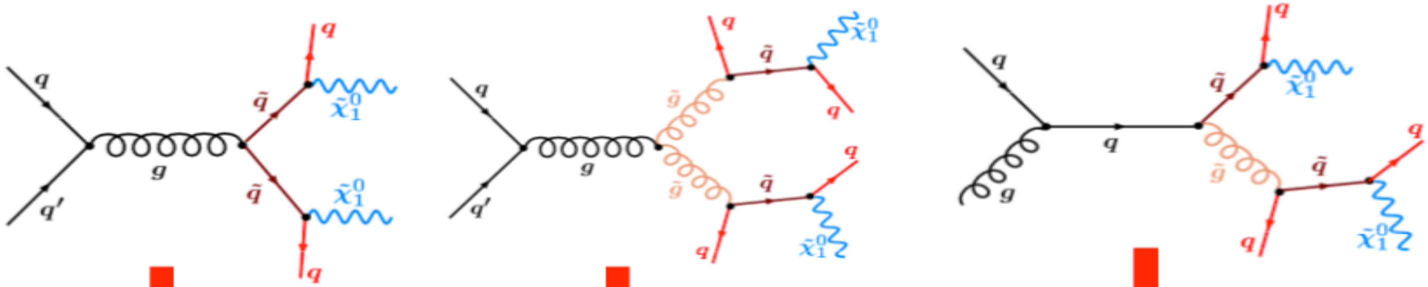
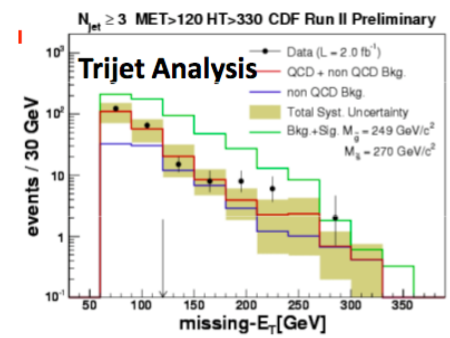


Result: 2 jets and MET

Result: 4 jets and MET

Result: 3 jets and MET

- Although the production is strong, the analyses are challenging due to QCD-multijet and W/Z+jet backgrounds
  - Solution: break-down analyses in jet-multiplicity bins and optimize separately (using MET and HT←Sum of jet E_T)



D0,PLB 660, 449 (2008), $\mathcal{L}$=2.1fb^{-1}

Analysis	HT cut (GeV)	MET cut (GeV)	Jet Et (GeV)	Bckg.	DATA
Dijet	325	225	35,35	11 ± 1 +3/-2	11
Trijet	375	175	35,35,35	11 ± 1 +3/-2	9
4-jet	400	100	35,35,35,20	18± 1 +6/-3	20

CDF Run II Preliminary, $\mathcal{L}$ = 2.0 fb^{-1}

Analysis	HT cut (GeV)	MET cut (GeV)	Jet Et (GeV)	Bckg.	DATA
Dijet	330	180	165,100	16 ± 5	18
Trijet	330	120	140,100,25	37± 12	38
4-jet	280	90	95,55,55,25	48 ± 17	45

SUSY in MET + jets

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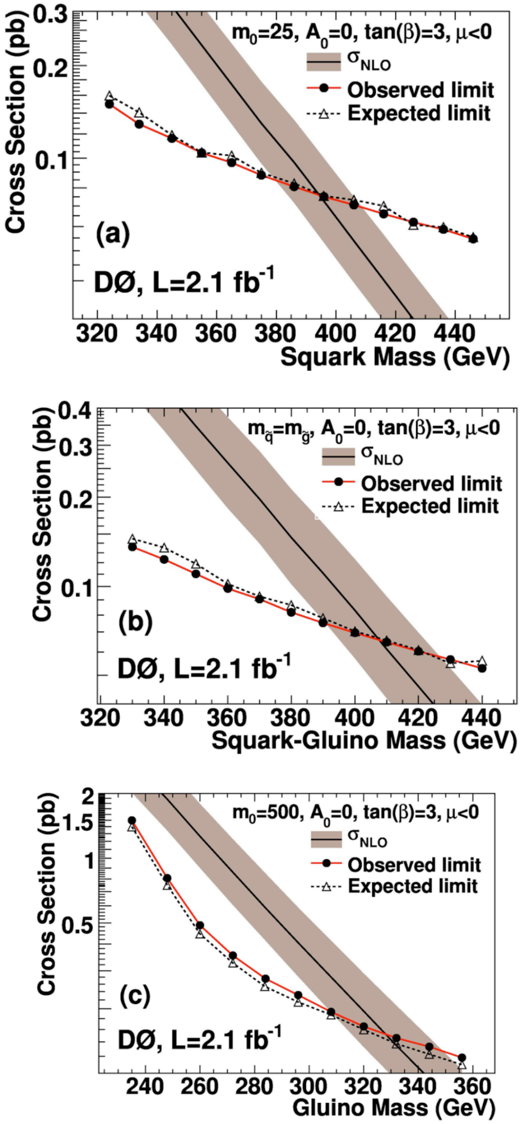

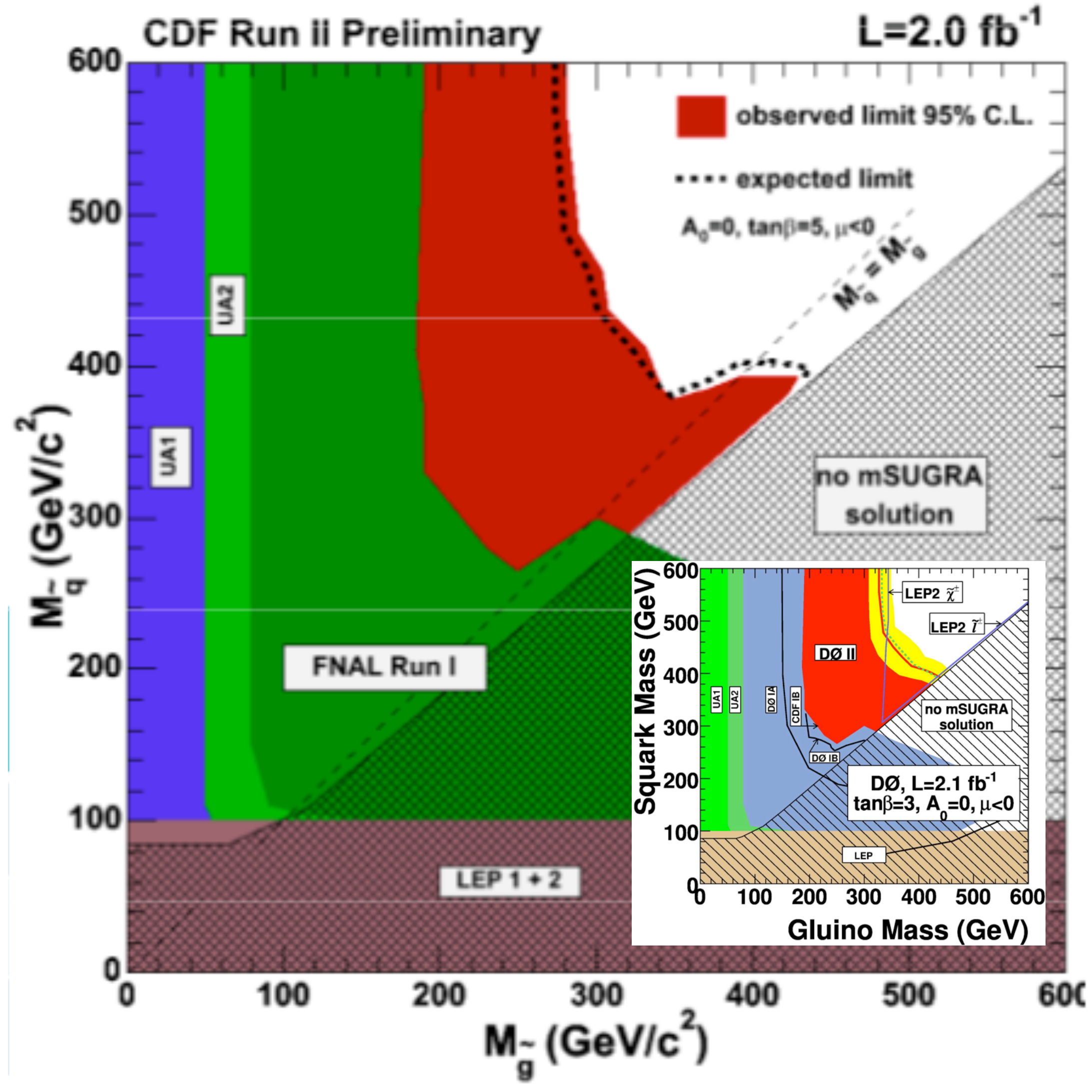

Squarks into taus

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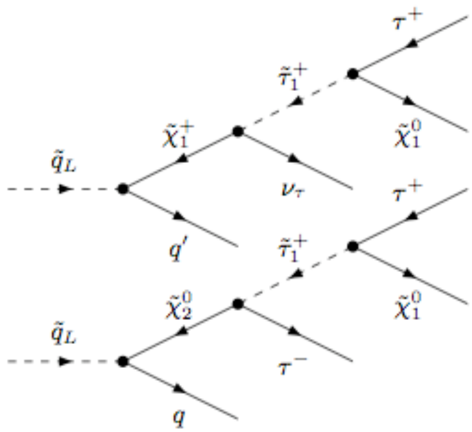
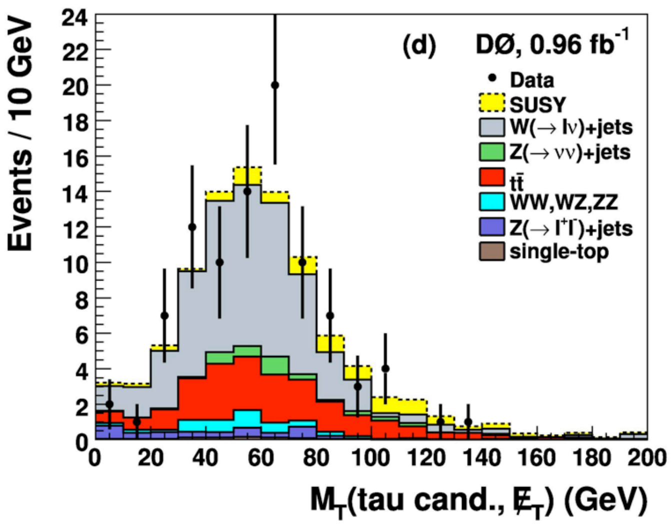
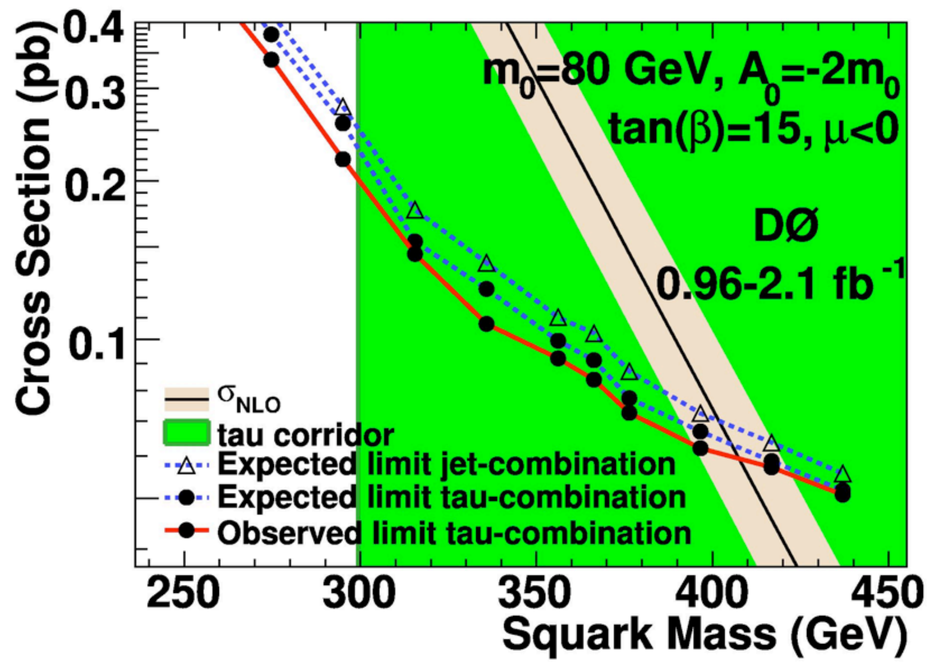


-In some regions of the space parameters squarks and gluinos decay into final state with leptons
-Tau corridor: the stau is the lightest slepton and lighter than chargino/neutralino
-Signature: ≥2jets, large MET and at least 1 τ

First time such channel is used

$m_0, m_{1/2}$ (100,150)





Search for sbottom from gluino decay

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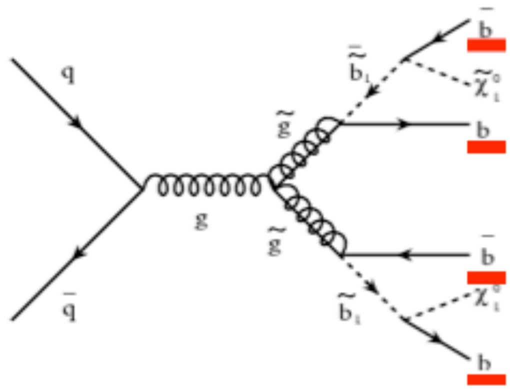
If the sbottom is significantly lighter than the other squarks, the two body decay of gluino into bottom/sbottom is kinematically allowed

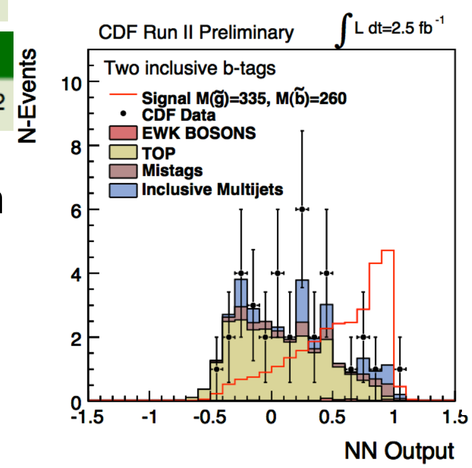


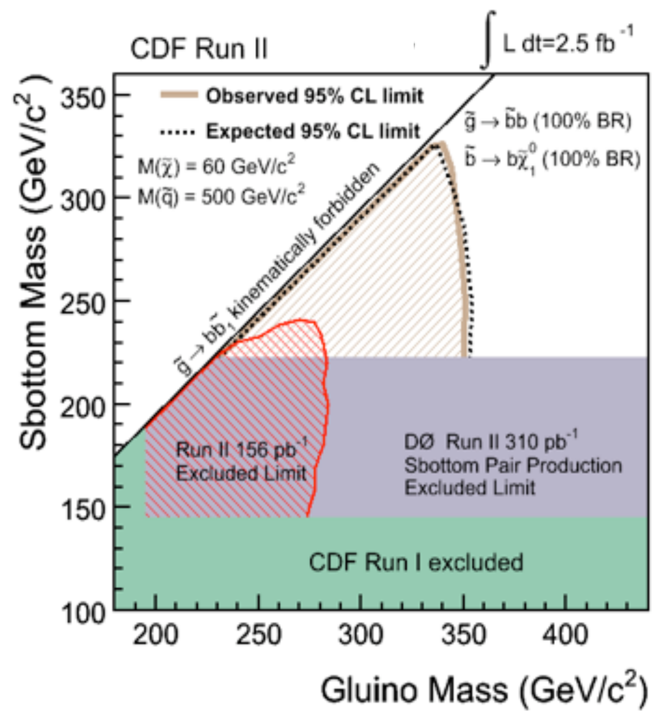
The sbottom decays into a bottom and LSP, giving rise to a final state with 4 b-jets and missing energy

The analysis is optimized for 2 points in the SUSY parameter space:

Large Δm between $\tilde{g}$ and $\tilde{b}$
$M(\tilde{g})$ = 320 GeV/c^2, $M(\tilde{b})$ = 250 GeV/c^2, $M(\tilde{\chi})$ = 60 GeV/c^2
Small Δm between $\tilde{g}$ and $\tilde{b}$
$M(\tilde{g})$ = 300 GeV/c^2, $M(\tilde{b})$ = 280 GeV/c^2, $M(\tilde{\chi})$ = 60 GeV/c^2

In the signal region a further optimization is performed using a neural network output





Stop Searches

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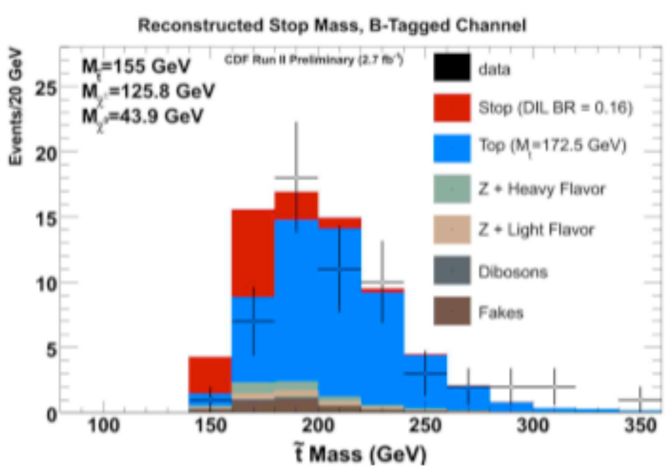
If stop light enough, $m[\tilde{t}] < m[t]$, several interesting decays, depending on the sparticles spectrum:

1. $\tilde{t} \rightarrow b\tilde{\chi}_1^+ \rightarrow b\,l\,\nu\tilde{\chi}_1^0 \quad (m_{\tilde{\chi}_1^+} < m_{\tilde{t}})$
2. $\tilde{t} \rightarrow b\,\tilde{\nu}\,l \quad (m_{\tilde{\chi}_1^+} > m_{\tilde{t}})$
3. $\tilde{t} \rightarrow c\,\tilde{\chi}_1^0$

1. **CDF 2.7 fb^{-1}:** dileptons (e/μ) with one isolated lepton, $\not\!E_T$, high p_T jets, b-tagging. reconstruct the stop mass with a kinematic fit.

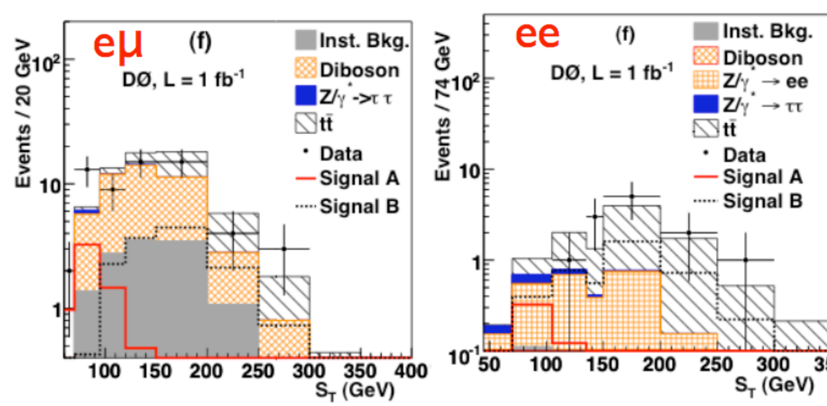
$$\tilde{t}_1\bar{\tilde{t}}_1 \rightarrow b\,b\,l\,l'\,\nu\,\bar{\nu}\,\tilde{\chi}_1^0\,\tilde{\chi}_1^0$$



2. **DØ 1.0 fb^{-1}:** ee, eμ.

require hight p_T isolated leptons, $\not\!E_T$, use kinematics and b-tagging (for ee) to disentangle signal from background.
Signal efficiency ranges from 0.1 to 10% depending on $\Delta m = m_{\tilde{t}_1} - m_{\tilde{\nu}}$

$$\tilde{t}_1\bar{\tilde{t}}_1 \rightarrow b\,b\,l\,l'\,\tilde{\nu}\,\bar{\tilde{\nu}}$$



Stop Searches (cont'd)

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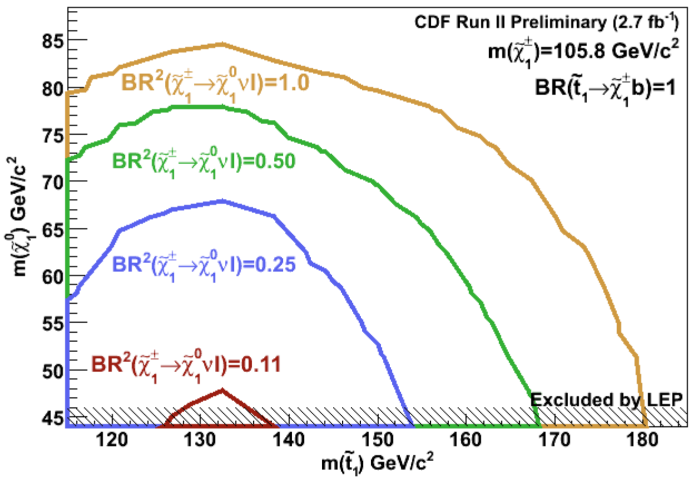
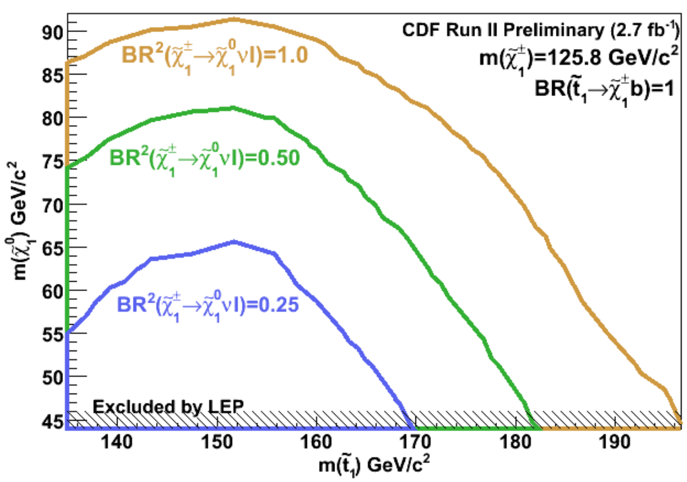
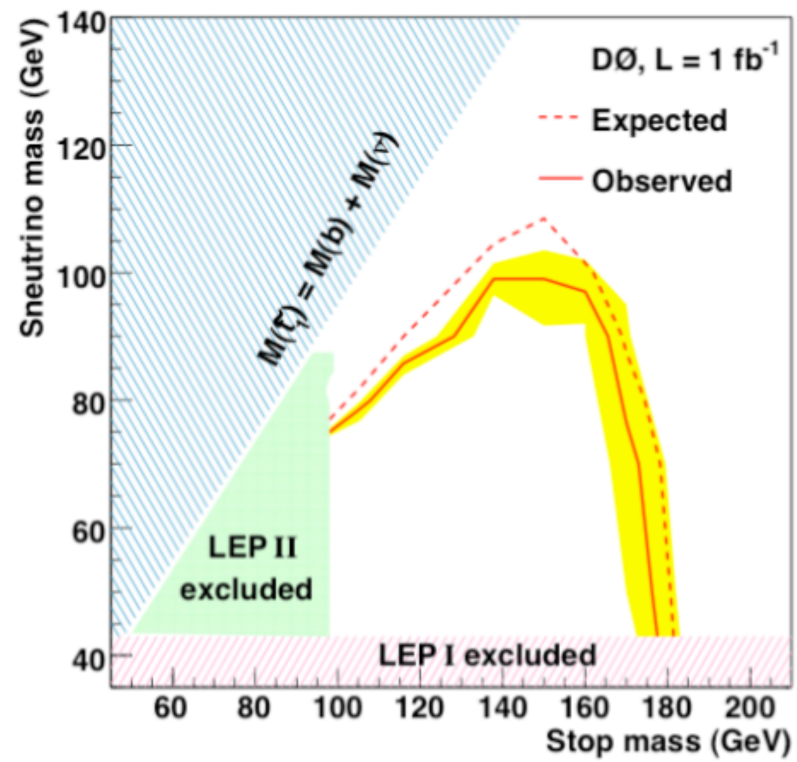
$$\tilde{t}_1 \bar{\tilde{t}}_1 \rightarrow b\, b\, l\, l'\, \nu\, \bar{\nu}\, \tilde{\chi}_1^0\, \tilde{\chi}_1^0$$

Observed 95% CL





$$\tilde{t}_1 \bar{\tilde{t}}_1 \rightarrow b\, b\, l\, l'\, \tilde{\nu}\, \bar{\tilde{\nu}}$$



Stop searches (cont'd)

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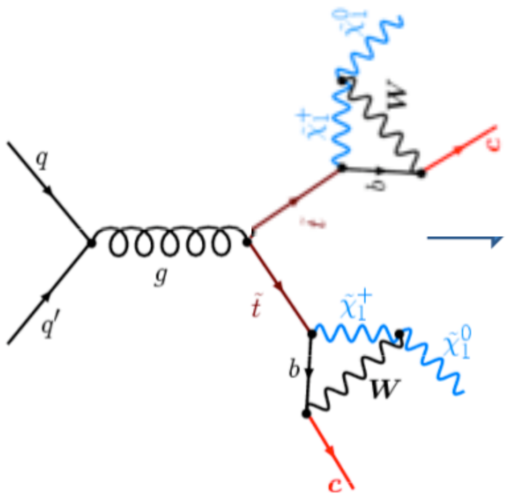
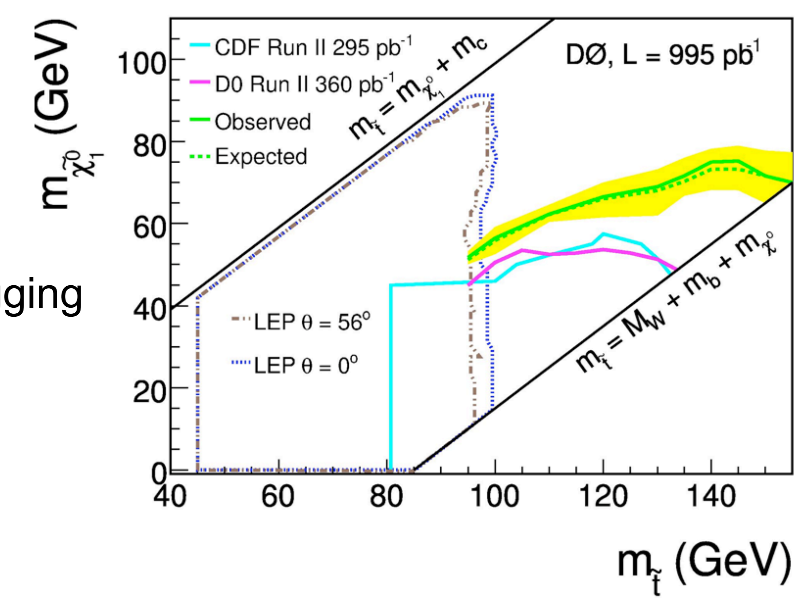


Stops to charm

$$\tilde{t} \to c\tilde{\chi}_1^0$$

Exactly 2 jets (E_T > 15 GeV)
MET > 40 GeV

Jets are tagged using a NN tagging tool



Final selection is optimized for Stop and neutralino masses

$m_{\tilde{t}}$	H_T	S	Observed	Predicted
$95-130$	>100	<260	83	$85.3 \pm 1.8^{+12.8}_{-13.0}$
$135-145$	>140	<300	57	$59.0 \pm 1.6^{+8.5}_{-8.8}$
$150-160$	>140	<320	66	$66.6 \pm 1.1^{+9.6}_{-10.0}$

Exclusion: stop mass <149 GeV/c^2 for neutralino mass of 63 GeV/c^2

Searches for CHAMPS

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Charge Massive Stable Particles (CHAMPS) are predicted by several extension of the SM. The could be stau and/or charginos (GMSB, AMSM) or stop.

CHAMPS may appear as “slow” moving highly ionizing and highly penetrating particles (muons).

Striking signature: isolated high PT muons, with possible calorimeter deposition

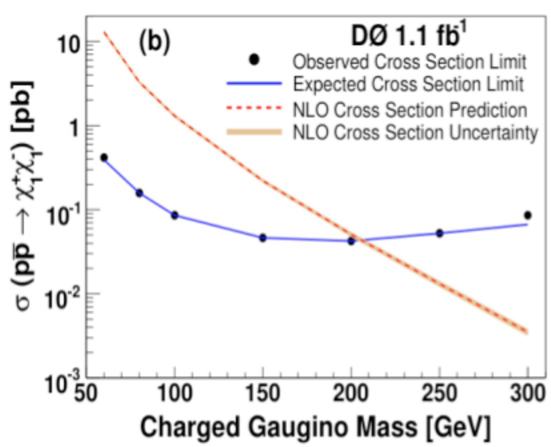
- -D0 ($1.1 fb^{-1}$) uses timing in the muon system to measure the speed while the dimuon mass provides discrimination
- -CDF ($1.03 fb^{-1}$) uses the TOF detector to measure the mass and sets a limit on the stop mass - long TOF and large dE/dx

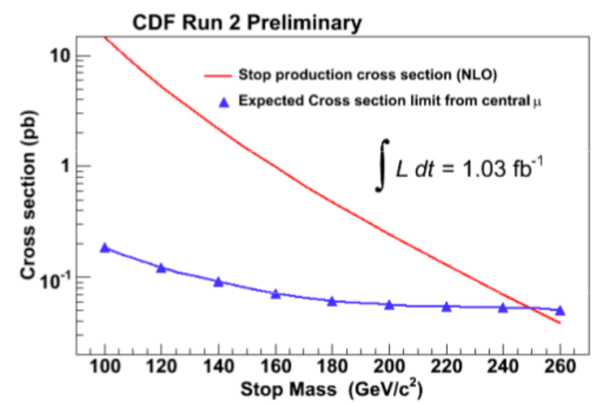
Limits: (D0)

- $\tilde{\tau}$: no sensitivity
- $\tilde{\chi}_1^+$, $\tilde{h}$-like

  $m_{\tilde{\chi}_1^+} > 171\ GeV$
- $\tilde{\chi}_1^+$, gaugino-like

  $m_{\tilde{\chi}_1^+} > 206\ GeV$





Limits: (CDF)

$m_{\tilde{t}} > 249\ GeV$

Conclusions

Many exciting results are continuously produced at the Tevatron!

The search for physics beyond the SM is carried on through a careful analysis of various final states using model driven as well as signature based approaches.

A bump can be around the corner before the LHC turns on….

References

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- http://www-cdf.fnal.gov/physics/exotic/exotic.html
- http://www-d0.fnal.gov/Run2Physics/WWW/results/np.htm

Backup

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TeVatron Status

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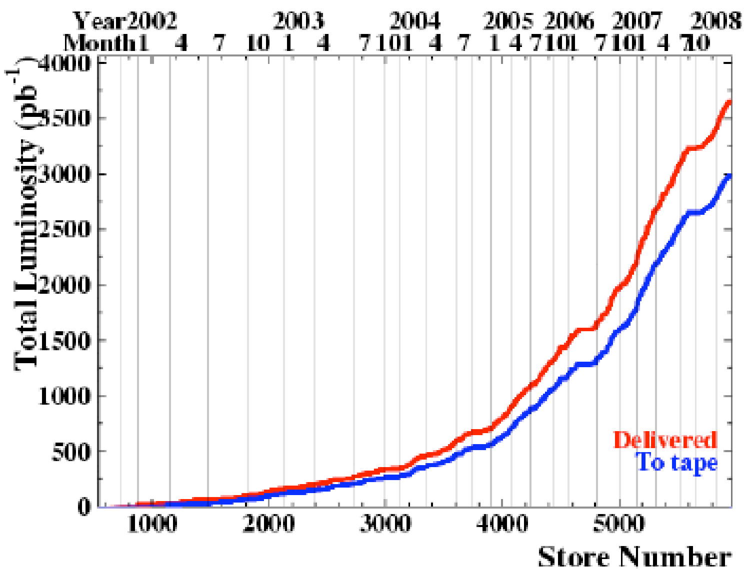
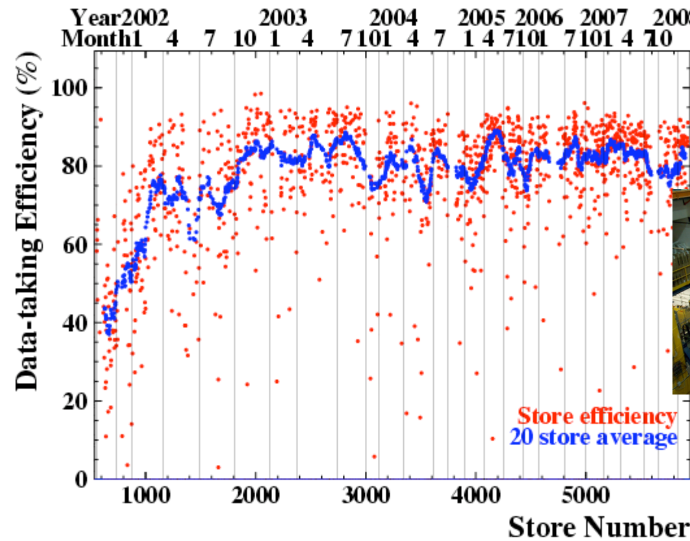
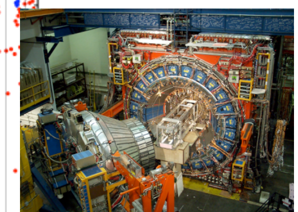
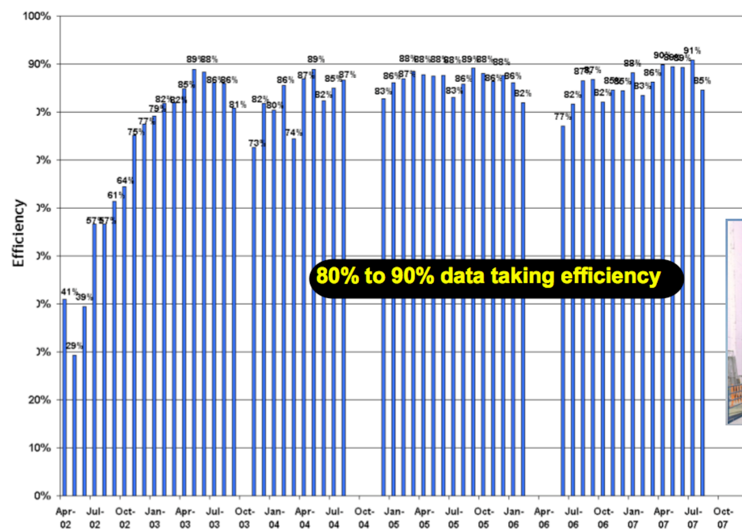
The TeVatron is doing very well!

Luminosity Profile









Delivered Lumi. > 3.6 fb^{-1}
Good for analysis ~ 3. fb^{-1}

Lepton Efficiencies

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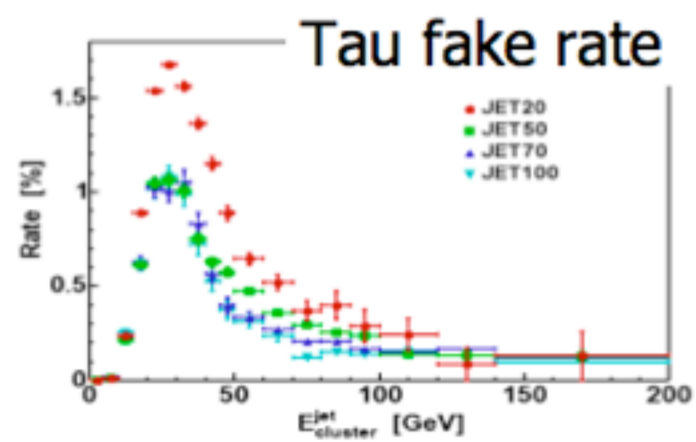
- Compare "typical" high-pt (>20 GeV) isolated lepton efficiency and fake rates

Lepton	Efficiency	Fake Rate
electron	~80%	~0.01%
muon	~85%	~0.01%
tau (box cuts)	~45%	~1-0.1%
tau (neural net)	~80%	~5-1%



Jets and Heavy Flavor

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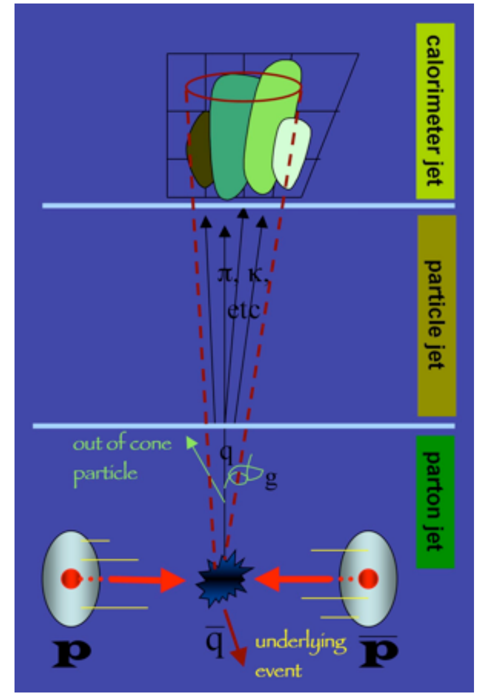
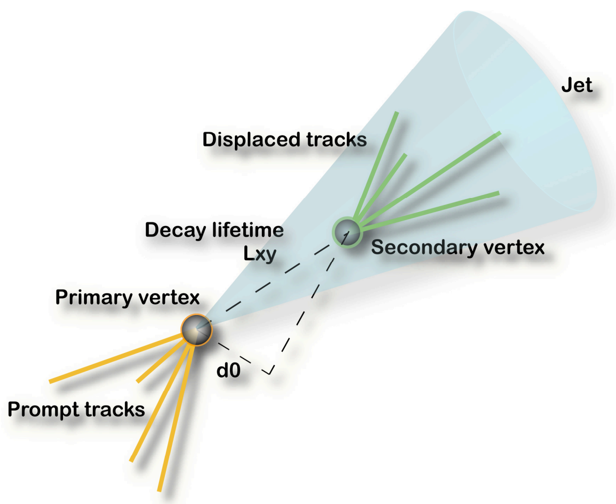
Hadronic jets are reconstructed using several algorithms: Cone,Midpoint, KT etc..

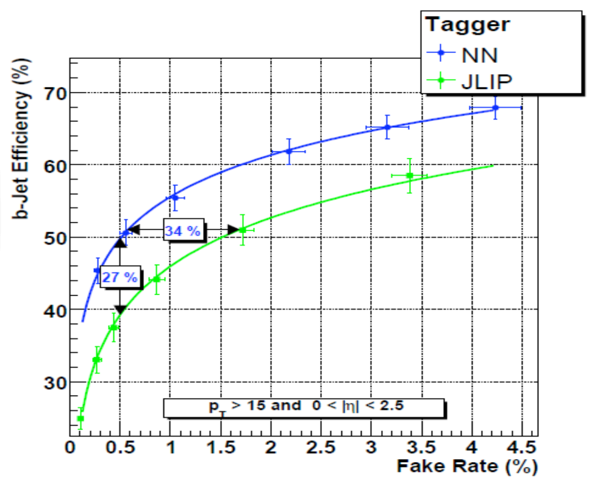
Measured jet energies are corrected to scale them back to the final state particle level jet . Additionally there are corrections to associate the measured jet energy to the parent parton energy, so that direct comparison to the theory can be made. Currently the jet energy scale is the major source of uncertainty in the measurement of the top quark mass and inclusive jet cross section

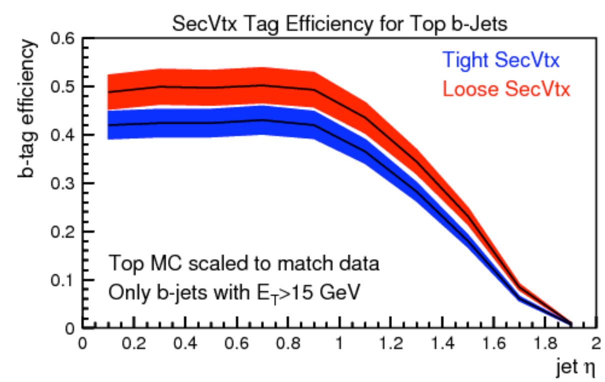


B-jet identification is implemented via:

- -displaced vertices with L_{xy}/σ cut (CDF)
- -Vertex mass separation (CDF)
- -combining vertex properties and displaced track info with NN (D0)
  - -Tag to η beyond 2







Btagging Mistag Rate (CDF)

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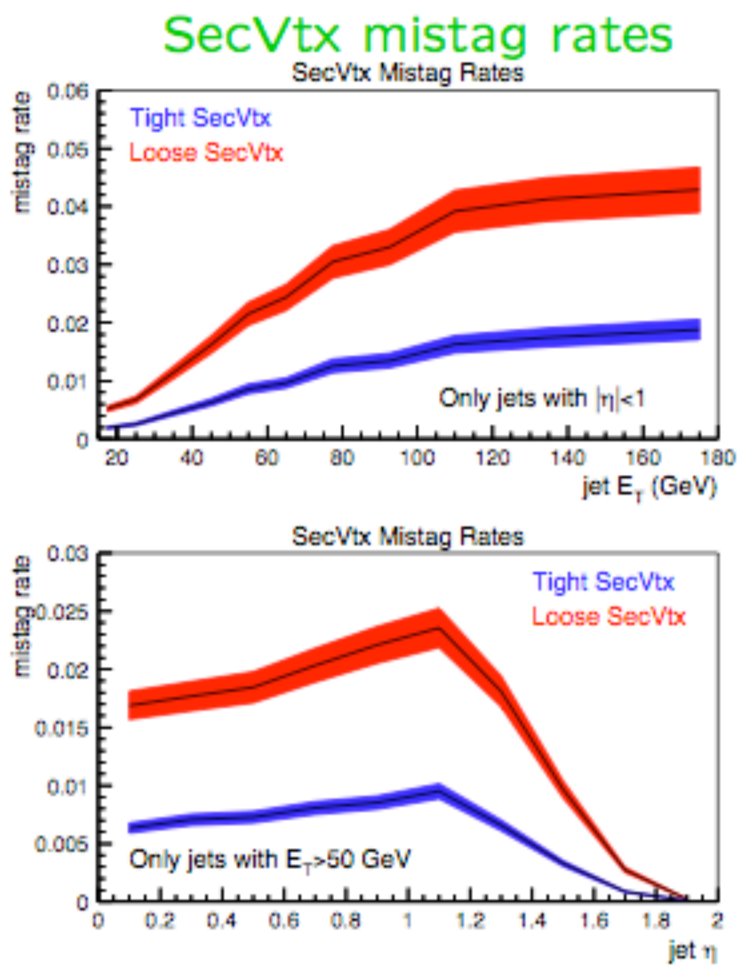

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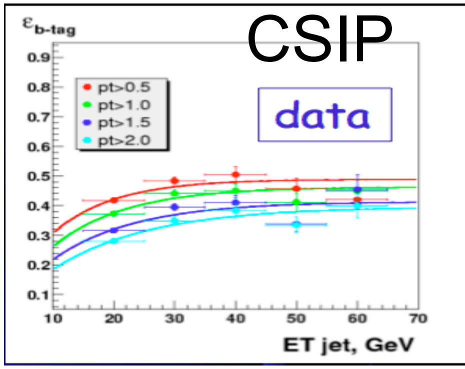
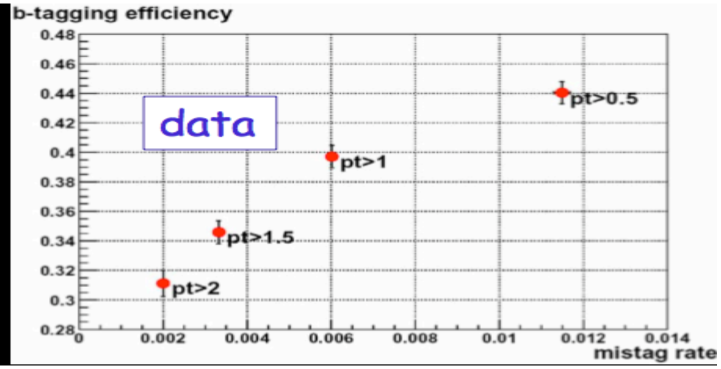
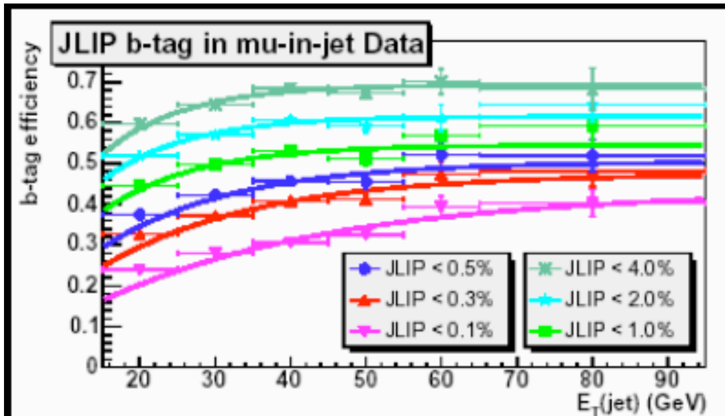
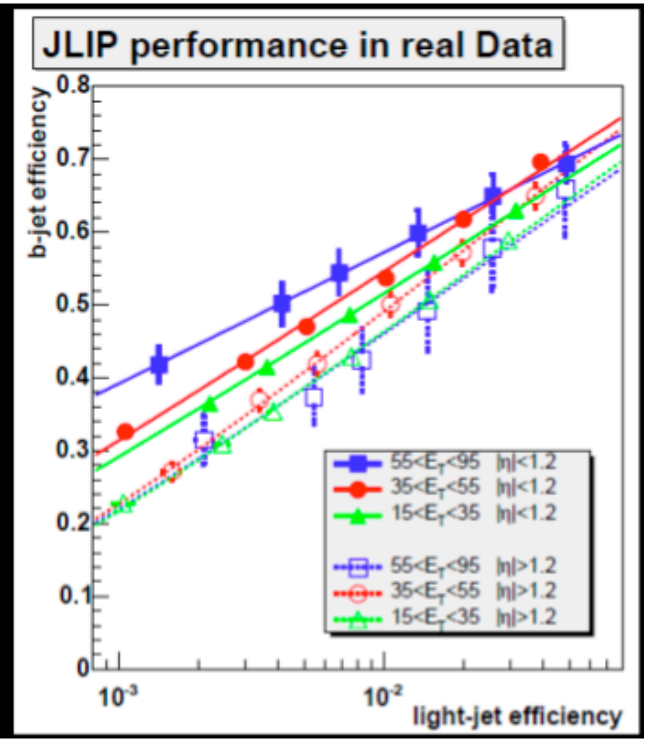
D0 btagging







- 6 operating points



$B_s \to \mu\mu$

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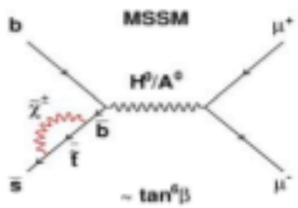
Sensitive to new physics: if no observation, it can strongly constraint SUSY models



SM prediction:
BR = 3.42×10^{-9}

SUSY enhancement
~$(\tan\beta)^6$

- Data sample dominated by random combinatorial background
- Extract signal with Neural Net based discrimina

B_s and B_d considered separately:

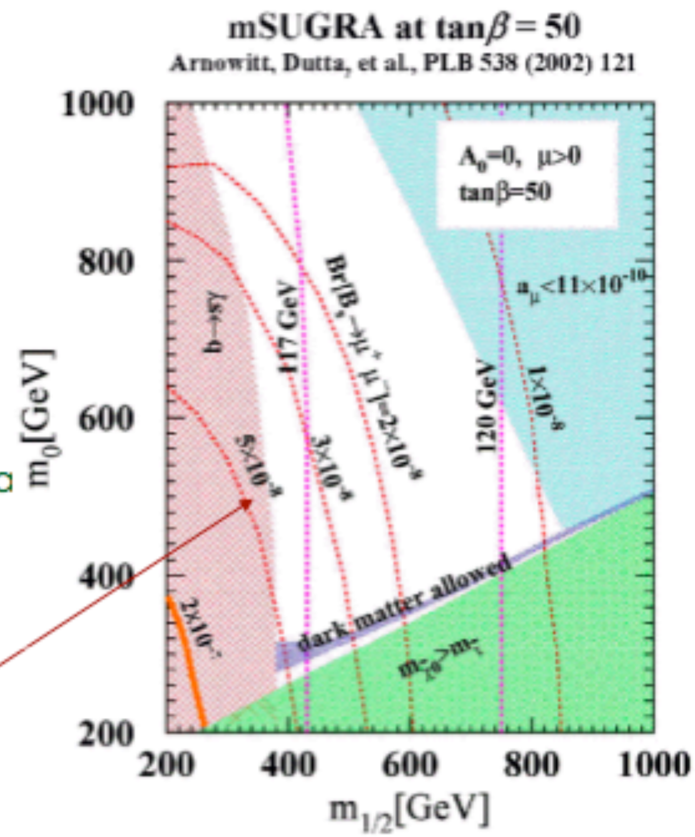
$B_s \to \mu\mu$ 3 observed events (3.6+/-0.3 exp.bkg.)

$B_d \to \mu\mu$ 6 observed events (4.3+/-0.3 exp.bkg.)

No significant excess → exclusion limit

$Br(B_s \to \mu\mu) < 5.8 \times 10^{-8}$ @ 95% CL
$Br(B_d \to \mu\mu) < 1.8 \times 10^{-8}$ @ 95%CL

Comb CDF/D0



BR($B_s \to \mu\mu$) <
1.5×10^{-7} @95% CL

hep-ex/0508058

Global Searches at CDF

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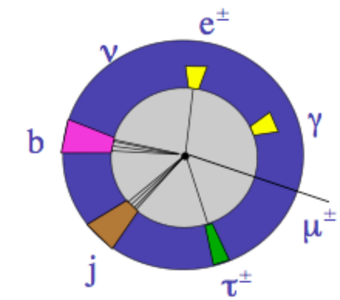
Fermilab UEC

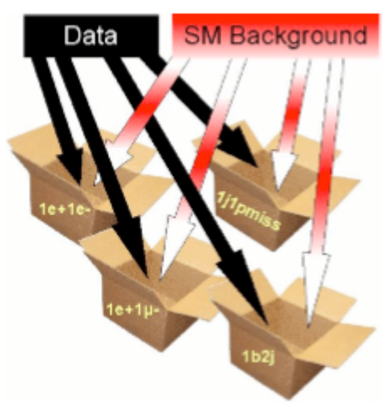
Simona Rolli - Tufts University

The goal is to perform a model-independent global search of high P_T data:

- -study bulk features of high P_T data;
- -search for resonances invariant mass distributions
- -search for significant excesses at high sum-p_T



Physics objects are categorized and events selected and partitioned into ~400 exclusive final states



The whole high P_T region is monitored at once

Pythia and MadEvent are used to implement the SM theoretical prediction (CdfSim emulates the detector response)

Many correction factors are used to obtain the *true* SM predictions (shouldn't a global search work globally?)

- theory k-factors etc
- experimental efficiencies and Scale Factors, fake rates etc

Currently observed discrepancies are explained in terms of incorrect MC modeling

42nd Fermilab Users Meeting
June 3-4, 2009
Ramsey Auditorium, Fermilab
Fermilab UEC

Global Searches at D0

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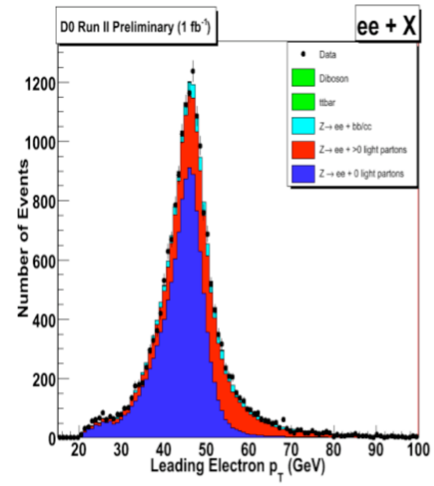
DØ also uses common MC
- PYTHIA and ALPGEN
- Multijets background from data

Apply common collaboration-wide scale factors
- Can be bin-by-bin or several parameter functions
- Use phase space dominated by SM processes

Then fit for normalization factors
- Trigger efficiencies, k-factors, etc
- 7 inclusive final states
- Exclude high-p_T tails

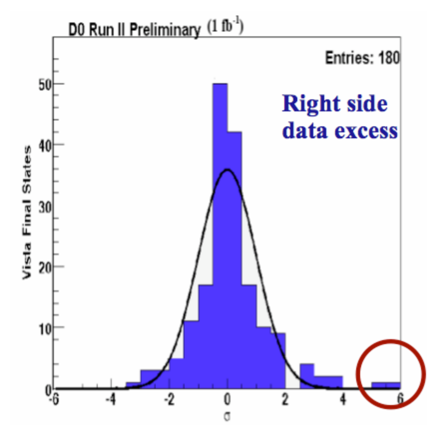


Search limited to final states with leptons
- 3 basic modeling issues

η-dependent trigger efficiency in μ + jets + MET

Muon resolution in $\mu\mu$ + MET

Jets misidentified as photons in γ states



All of the given discrepancies point to modeling difficulties