

Search for squarks and gluinos at DØ

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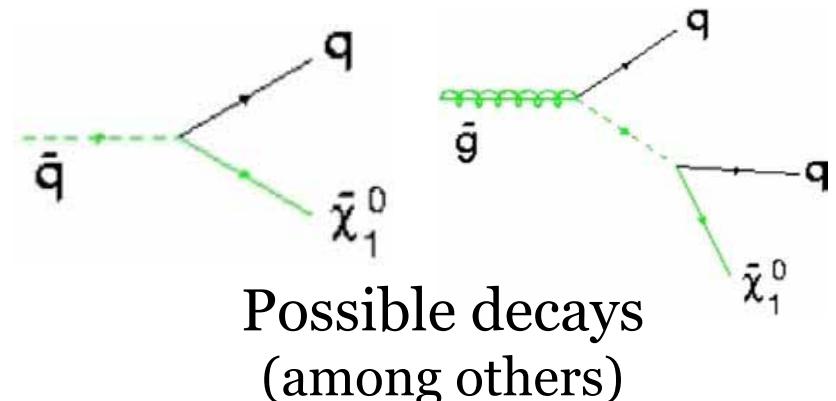
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for the DØ Collaboration

Squarks and gluinos production

◆ Pair production in mSUGRA

- ▶ R-parity is conserved
- ▶ Lightest neutralino χ_1^0 is the LSP
- ▶ $\tan(\beta)=3$, $A=0$, $\mu < 0$
- ▶ Topology: jets + missing energy (MET)

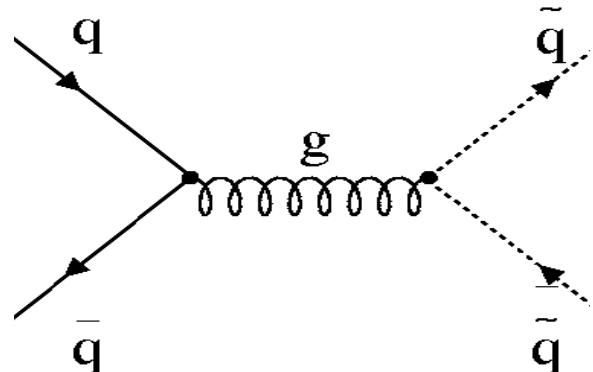


◆ 3 analyses for 3 signal benchmarks:

► Low m_0 : $m(\tilde{q}) < m(\tilde{g})$

- ◆ $m_0 = 25$, $m_{1/2} = 165$
- ◆ At least 2 jets

→ “dijet” analysis

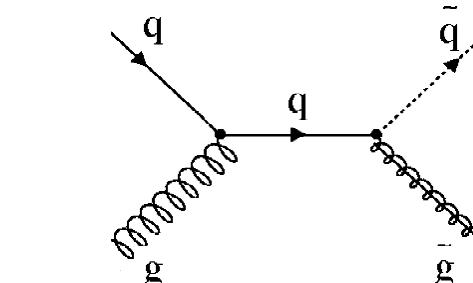


► Intermediate m_0 :

$$m(\tilde{q}) = m(\tilde{g})$$

- ◆ $m_0 = 188$, $m_{1/2} = 145$
- ◆ At least 3 jets

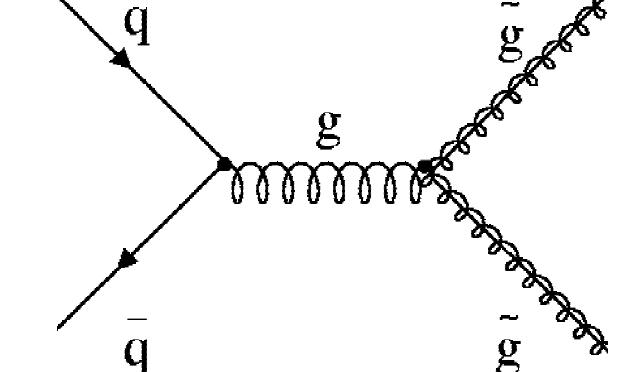
→ “3-jet” analysis



► High m_0 : $m(\tilde{q}) > m(\tilde{g})$

- ◆ $m_0 = 500$, $m_{1/2} = 100$
- ◆ At least 4 jets

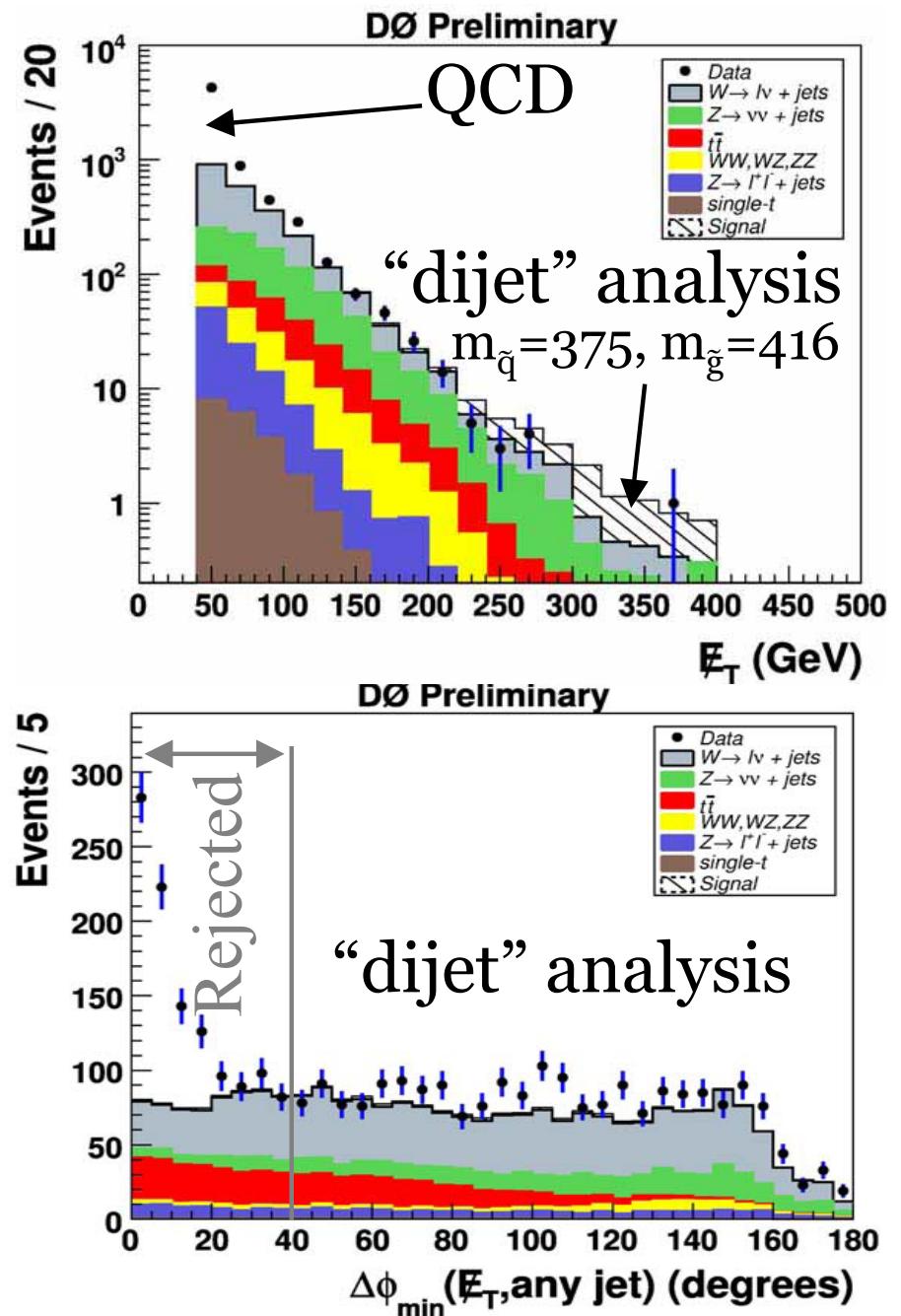
→ “gluino” analysis



Common part for the 3 analyses

- ◆ All RunII data: $L = 0.96 \text{ fb}^{-1}$
- ◆ Main backgrounds: $Z \rightarrow vv$, $t\bar{t}$, $W+jets$
- ◆ After all the selections cuts QCD is negligible

- ◆ Triggers:
 - ▶ A trigger for acoplanar dijet+MET
 - ▶ A trigger for multijet+MET
- ◆ 2 acoplanar ($\Delta\phi < 165^\circ$) jets with:
 - ▶ $E_T > 35 \text{ GeV}$,
 - ▶ $|\eta| < 0.8$
 - ▶ confirmed by tracks
- ◆ MET $> 75 \text{ GeV}$
- ◆ MET isolated from jets
- ◆ Electron and muon veto



Final cuts

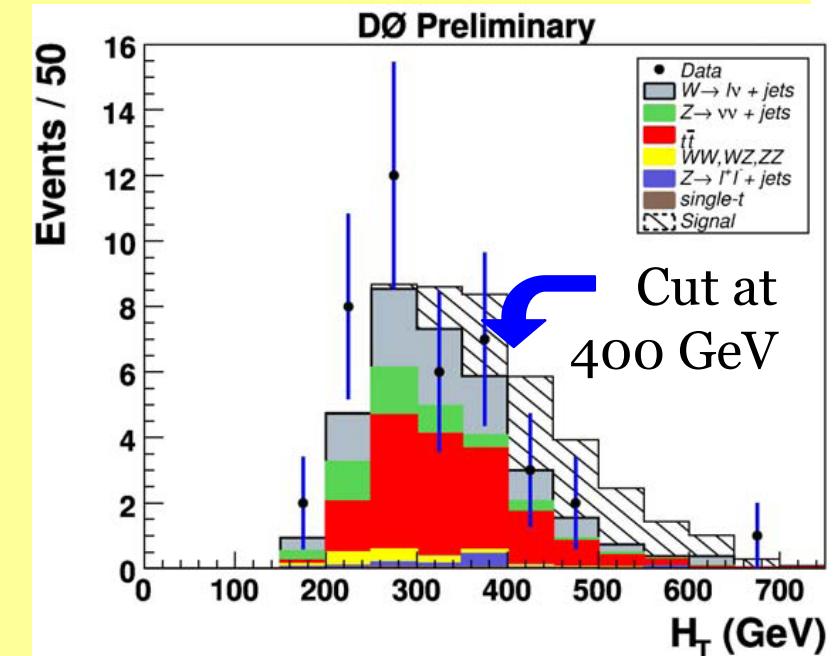
- ◆ Optimization of final cuts : MET and $H_T = \sum E_T(jets)$

- ▶ “dijet” : MET > 225GeV, $H_T > 300$ GeV
- ▶ “3-jets” : MET > 150GeV, $H_T > 400$ GeV
- ▶ “gluino” : MET > 100GeV, $H_T > 300$ GeV

- ◆ No excess observed:

	data	background
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- | | | |
|--------------|----|------------------------------------------|
| ▶ “dijet” : | 5 | 7.5 ± 1.1 (stat) $+1.3 -1.0$ (syst) |
| ▶ “3-jets” : | 6 | 6.1 ± 0.4 (stat) $+1.3 -1.2$ (syst) |
| ▶ “gluino” : | 34 | 33.4 ± 0.8 (stat) $+5.6 -4.9$ (syst) |

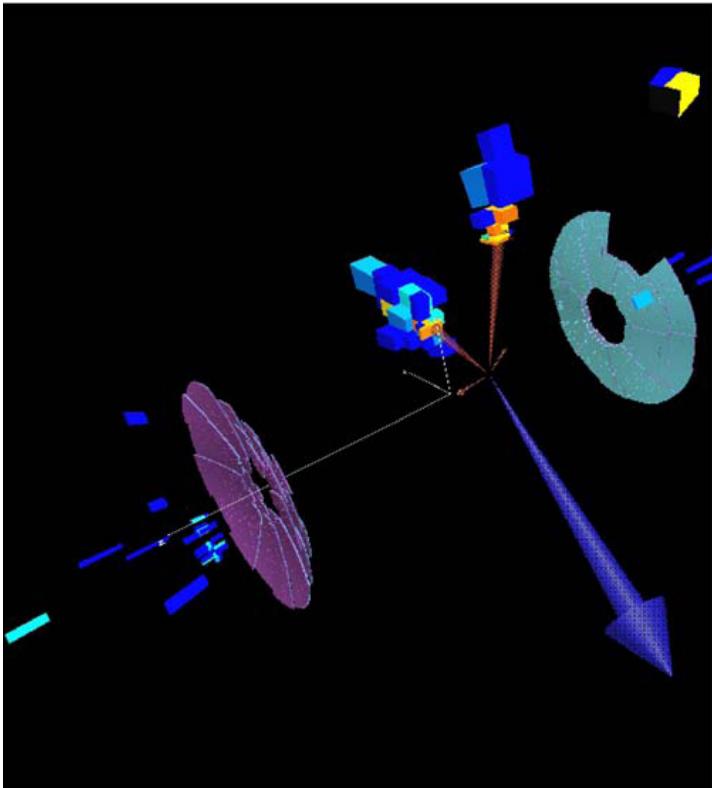


“3-jets” analysis
 $m_{\tilde{q}} = 380$, $m_{\tilde{g}} = 380$

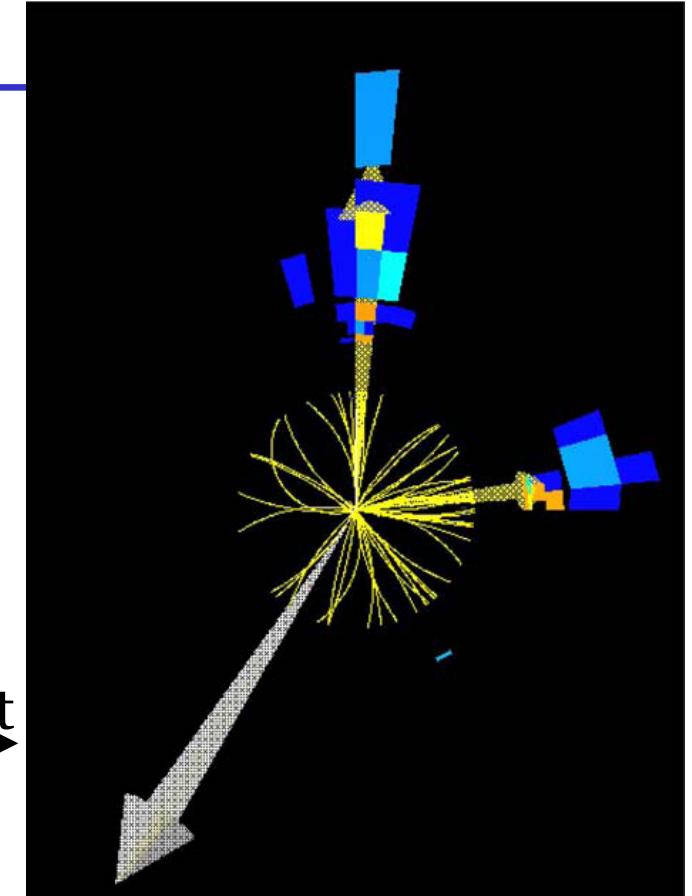
- ◆ → the 3 analysis are combined

Systematic uncertainties

- ◆ Main systematic uncertainties:
 - ▶ Background cross sections: 15%
 - ▶ Jet Energy Scale: 6 to 17%
 - ▶ Track confirmation: 5%
 - ▶ Luminosity: 6.1%
 - ▶ PDF on signal acceptance : 6%

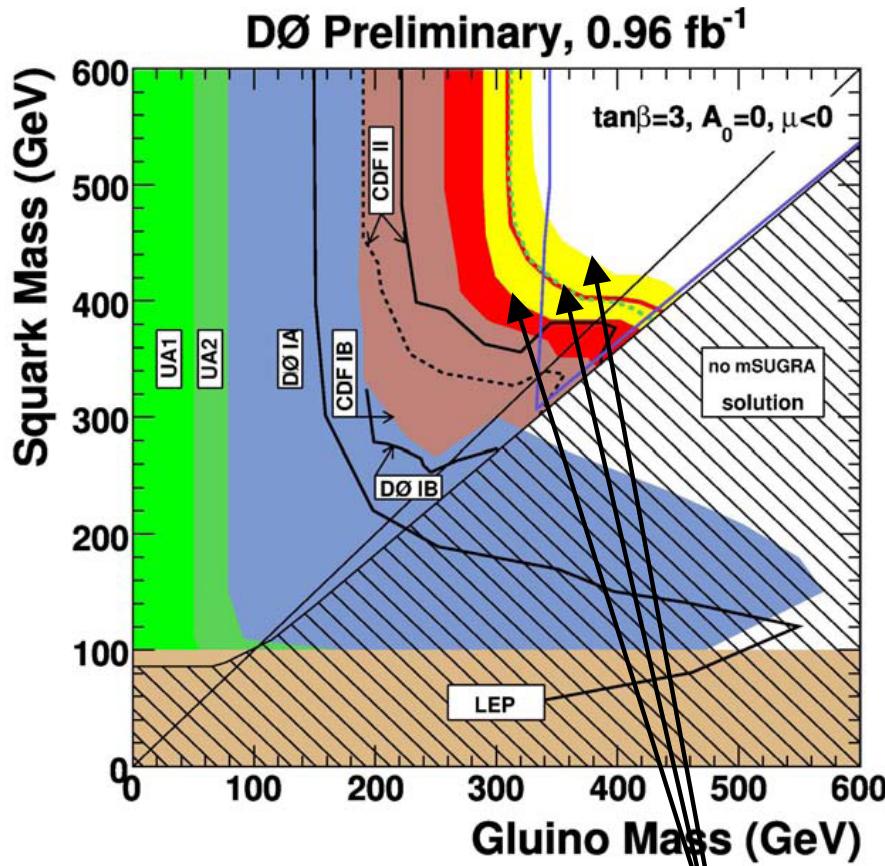


Dijet event with largest
MET = 368GeV



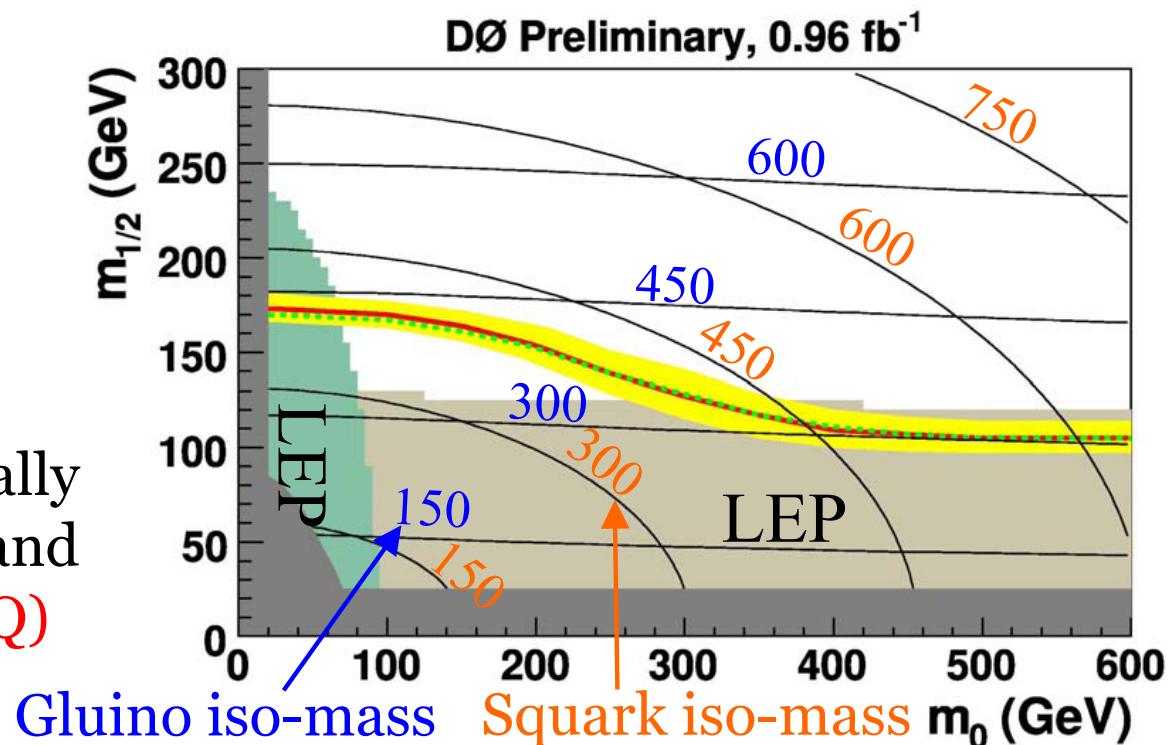
- ◆ Signal cross sections uncertainties:
 - ▶ Using the 41 CTEQ6.1M PDF sets
 - ▶ Lack of knowledge about **gluon at high-x** is responsible for the main uncertainties

Limits



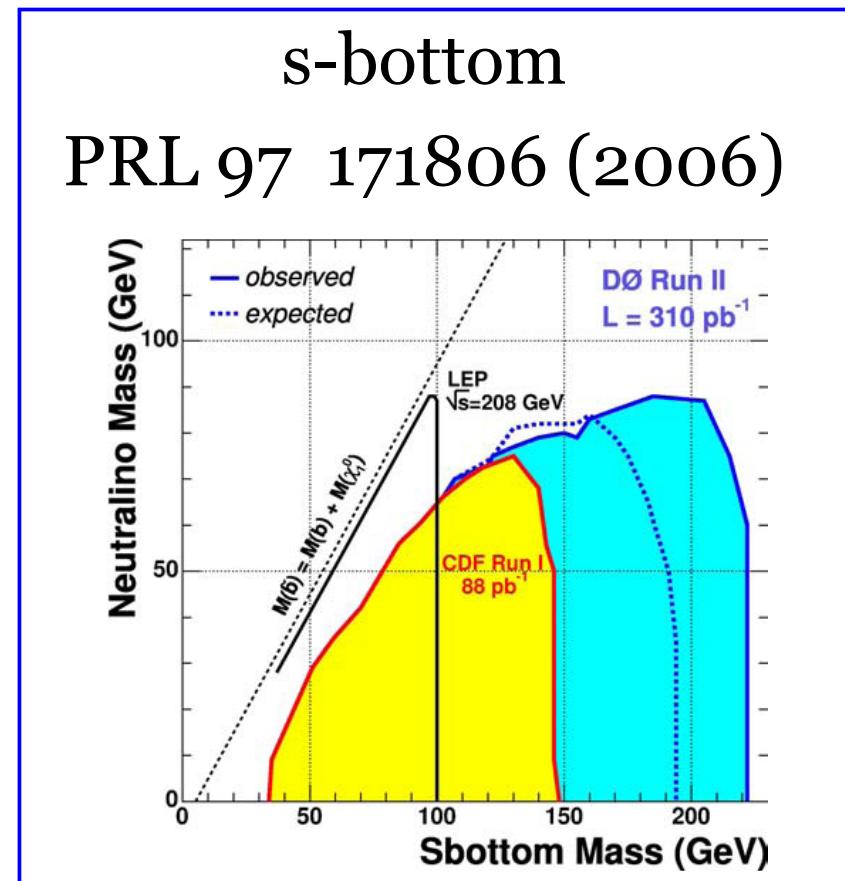
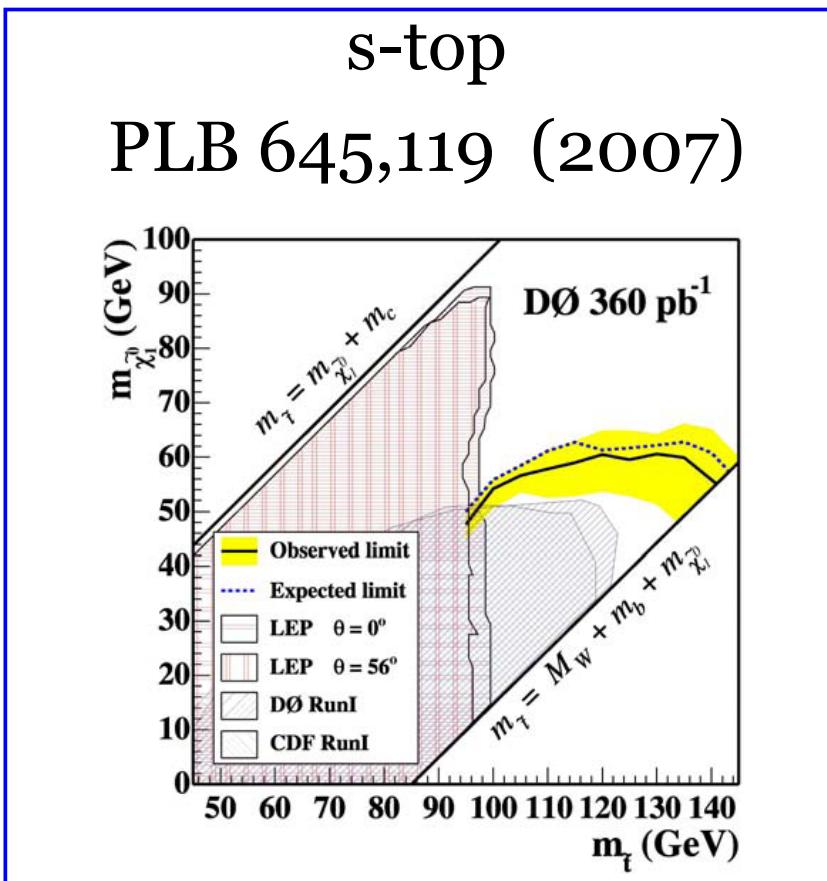
- ◆ pdf effect combined quadratically with effect of the renormalization and factorization scales ($\mu = Q/2, Q, 2Q$)

- ◆ Using minimal cross-section:
 - $M(\tilde{g}) > 289 \text{ GeV}$
 - $M(\tilde{q}) > 375 \text{ GeV}$
 - If $M(\tilde{g}) = M(\tilde{q})$
then $M(\tilde{g}), M(\tilde{q}) > 383 \text{ GeV}$



Susy searches in jets+MET topologies at DØ

- ◆ Supersymmetry searches recently published with $\sim 300 \text{ pb}^{-1}$ are continued with 1 fb^{-1}

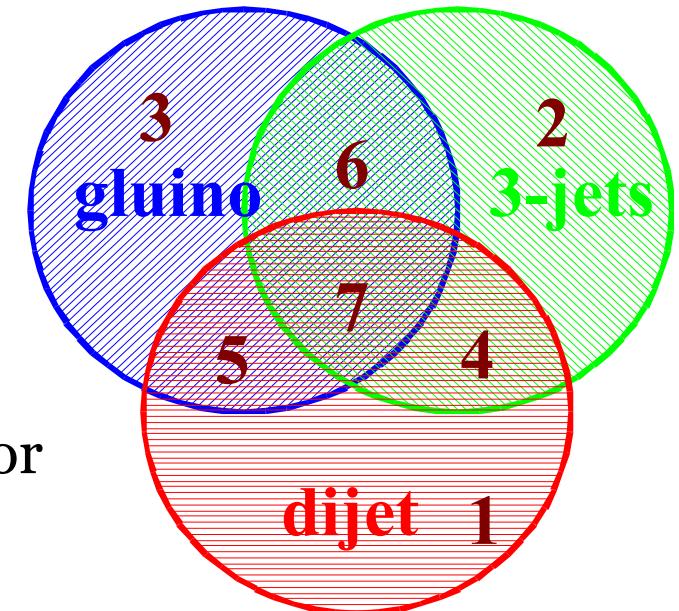


- ◆ New search in progress: gluino \rightarrow b + s-bottom ($\rightarrow 4$ b-jets+MET)

Backup

Combining the analyses

- The 3 analyses are combined
 - 7 independent event selections
 - Good agreement between data and Standard Model expectations
 - Systematic uncertainties are re-computed for each combinations



Name	“dijet”	“3-jets”	“gluino”	Data	SM events expected	
“dijet”	yes	-	-	5	7.47 ± 1.06 (stat.)	$+1.32_{-1.02}$ (syst.)
“3-jets”	-	yes	-	6	6.10 ± 0.37 (stat.)	$+1.26_{-1.16}$ (syst.)
“gluino”	-	-	yes	34	33.35 ± 0.81 (stat.)	$+5.56_{-4.92}$ (syst.)
combination 1	yes	no	no	5	6.10 ± 1.04 (stat.)	$+1.17_{-0.73}$ (syst.)
combination 2	no	yes	yes	1	1.09 ± 0.14 (stat.)	$+0.17_{-0.22}$ (syst.)
combination 3	no	no	yes	29	27.78 ± 0.73 (stat.)	$+4.39_{-3.84}$ (syst.)
combination 4	yes	yes	no	0	0.22 ± 0.07 (stat.)	$+0.02_{-0.06}$ (syst.)
combination 5	yes	no	yes	0	0.78 ± 0.14 (stat.)	$+0.12_{-0.16}$ (syst.)
combination 6	no	yes	yes	5	4.42 ± 0.32 (stat.)	$+1.01_{-0.83}$ (syst.)
combination 7	yes	yes	yes	0	0.37 ± 0.11 (stat.)	$+0.07_{-0.13}$ (syst.)
global “OR”	-	-	-	40	40.76 ± 1.33 (stat.)	$+6.91_{-5.88}$ (syst.)