



S. Muanza, CPPM Marseille, CNRS-IN2P3
On behalf of the D0 Collaboration

D0 BSM Searches

Outline

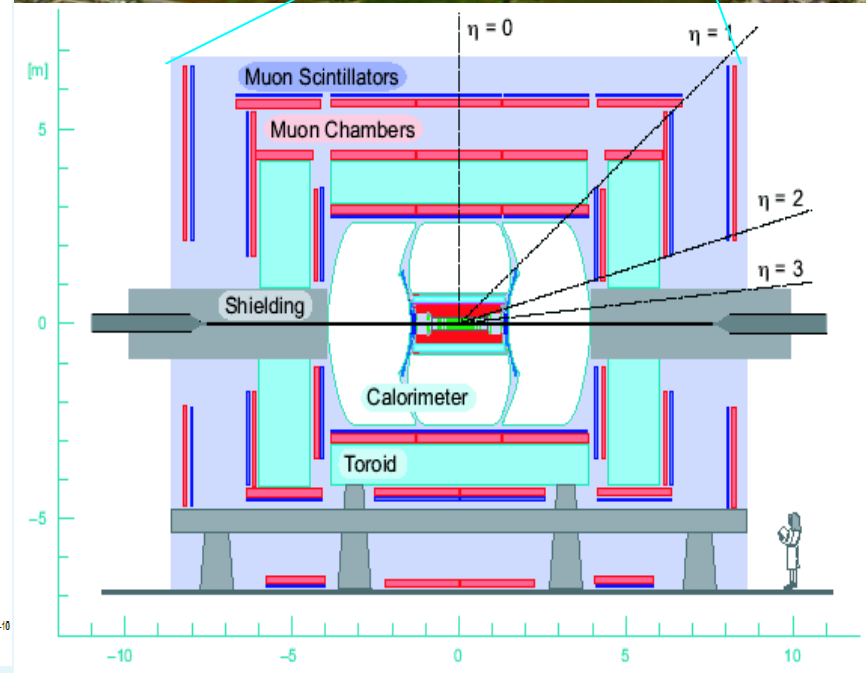
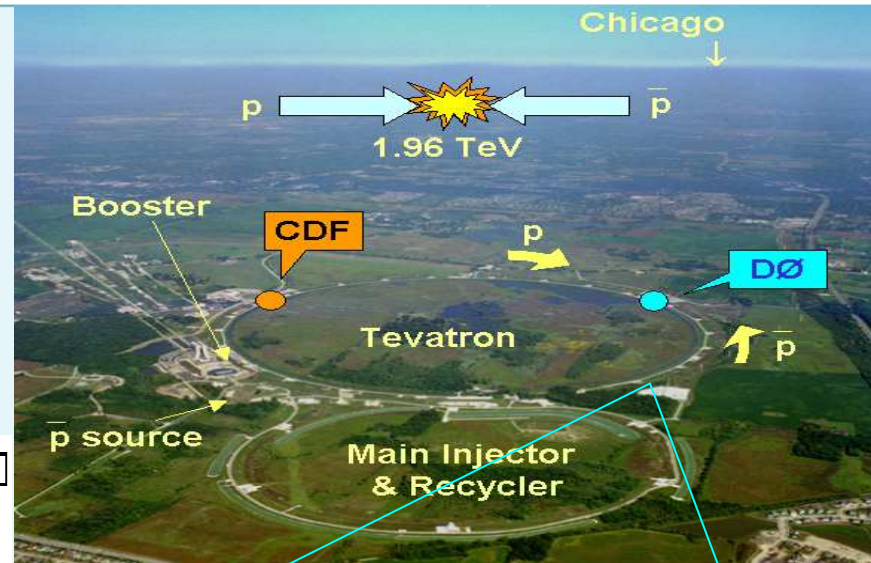
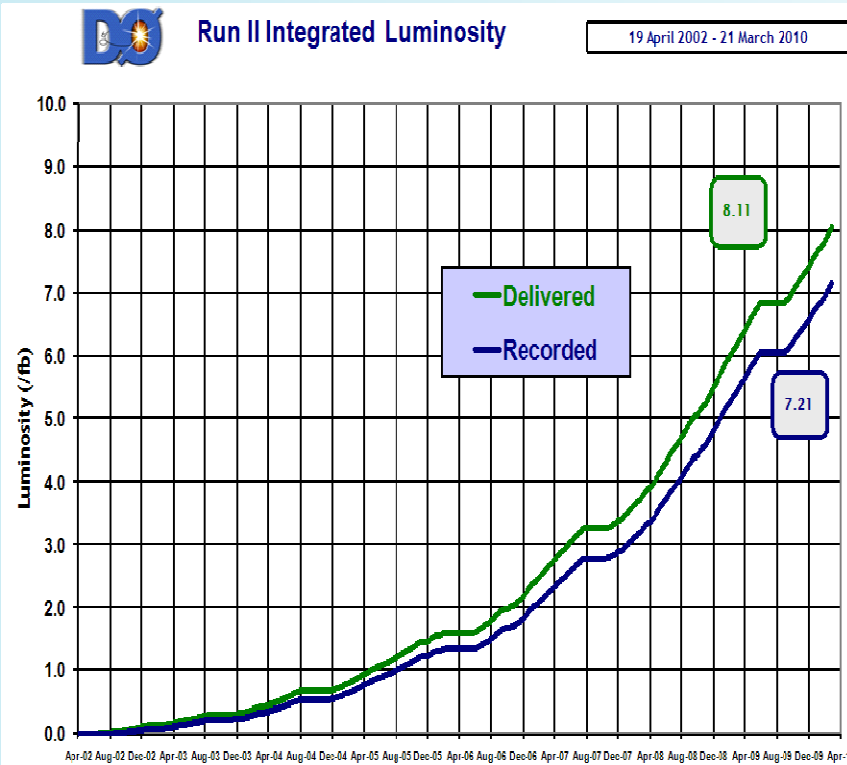
1. Status of the Run II data taking
2. The Monte Carlo simulation chain
3. Model-driven Searches
 - SUSY particles
 - Leptoquarks
4. Signature-based Searches
 - Resonances
 - Dijets angular distributions

NB: Unless otherwise stated all the exclusion limits are at the 95% CL

1. Status of the Run II data taking

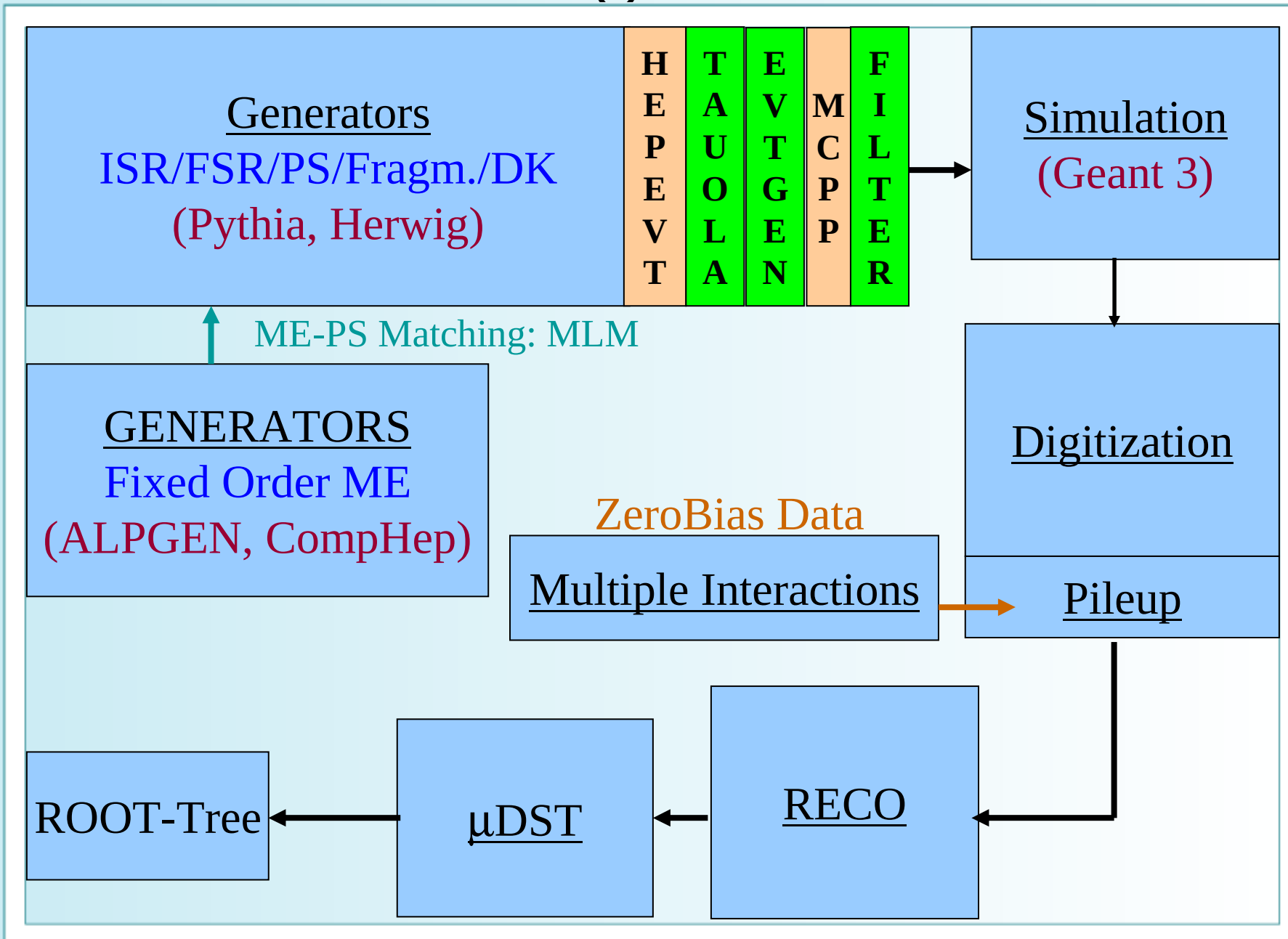
1. Status of the Run II data taking

- $\mathcal{L}$ up to $3.8 \times 10^{32} \text{ cm}^{-2}\text{s}^{-1}$
- Current $\epsilon_{\text{DAQ}} \sim 92\%$
- Delivered: $L=8.11 \text{ fb}^{-1}$
- Recorded: $L=7.21 \text{ fb}^{-1}$
- This talk: L up to 5.4 fb^{-1}



2. The Monte Carlo Simulation Chain

2. The Monte Carlo Simulation Chain (1)



2. The Monte Carlo Simulation Chain (2)

In order to analyze the data:

- BSM signals and generally physics BKGD are modeled using MC
- instrumental BKGD from QCD is measured in data
- Generators:
 - most of the SM processes are generated using **Alpgen+Pythia** (w/ **MLM ME-PS Matching**)
 - top samples:
 - single: **CompHep+Pythia** and **MC@NLO**
 - pairs: **Alpgen+Pythia** and **MC@NLO**
 - di-boson: **Pythia**
 - BSM signals: mainly **Pythia**, except a few w/ **CompHep+Pythia** (**SUSY RPV or stop $\rightarrow \ell + \text{sv} + b$**)
- MC samples:
 - normalized: to the best known theoretical calculation:
 - at least NLO-QCD (in general global K-factor)
 - at most NNLL-QCD, but wo/ NLO-EW
 - corrected for:
 - differences in resolutions and efficiencies wrt data
 - possibly for some kinematical differences as well

2. The Monte Carlo Simulation Chain (3)

- PDF:
 - Library: **LHAPDF**
 - LO: **CTEQ6L1** → **Pythia**, **Alpgen**, **CompHep**
 - NLO: **CTEQ6M1** → **MC@NLO**, **MCFM**, **PROSPINO**
→ PDF uncertainties (**CTEQ asymmetric prescript.**)
- UE & min.bias Tune: ersatz of **Tune A** using **CTEQ6L1**
- SM K-factors:
 - NLO-QCD from **MCFM**
 - NNLO for incl. V production: **R. Hamberg, W. L. van Neerven and T. Matsuura, Nucl. Phys. B 359 (1991) 343**
 - NLO+NLL for top pair production: arXiv.org:0804.2800; **JHEP 09**, 127 (2008)
 - ~NNLO for top pair production: arXiv.org:0804.1476; **PRD 78**, 034003 (2008)
 - ~NNLO for single top production: hep-ph/0609287; **PRD 74**, 114012 (2006)
- BSM K-factors:
 - NLO-QCD from **PROSPINO** (**SUSY, LQ**)
- Scale uncertainties:
 - choose a central scale: $\mu_0 = \mu_R = \mu_F$
 - vary w/ factors $\frac{1}{2}$ and 2

3. Model-driven Direct Searches

3. Model-driven Direct Searches – SUSY (1)

SUSY

- Introduction $Q_\alpha |S\rangle = |S \pm 1/2\rangle$

S=1	S=1/2	S=0
	$\ell^\pm$	$\tilde{\ell}_R^\pm$ $\tilde{\ell}_L^\pm$
	$\tau^\pm$	$\tilde{\tau}_1^\pm$ $\tilde{\tau}_2^\pm$
	ν_L	$\tilde{\nu}_L$
	q	$\tilde{q}_R$ $\tilde{q}_L$
	b	$\tilde{b}_1$ $\tilde{b}_2$
	t	$\tilde{t}_1$ $\tilde{t}_2$
g	$\tilde{g}$	
$W^\pm$	$\tilde{\chi}_1^\pm$ $\tilde{\chi}_2^\pm$	ϕ_1^+ ϕ_2^-
γ	$\tilde{\chi}_3^0$ $\tilde{\chi}_4^0$	
Z	$\tilde{\chi}_1^0$ $\tilde{\chi}_2^0$	ϕ_1^0 ϕ_2^0

- S=2: $G_{\mu\nu}$ S=3/2: $\tilde{G}_{\mu\alpha}$

$$M_t^2 = \begin{pmatrix} m_{t_L}^2 + m_t^2 & m_t(A_t - \mu/\tan\beta) \\ m_t(A_t - \mu/\tan\beta) & m_{t_R}^2 + m_t^2 \end{pmatrix}$$

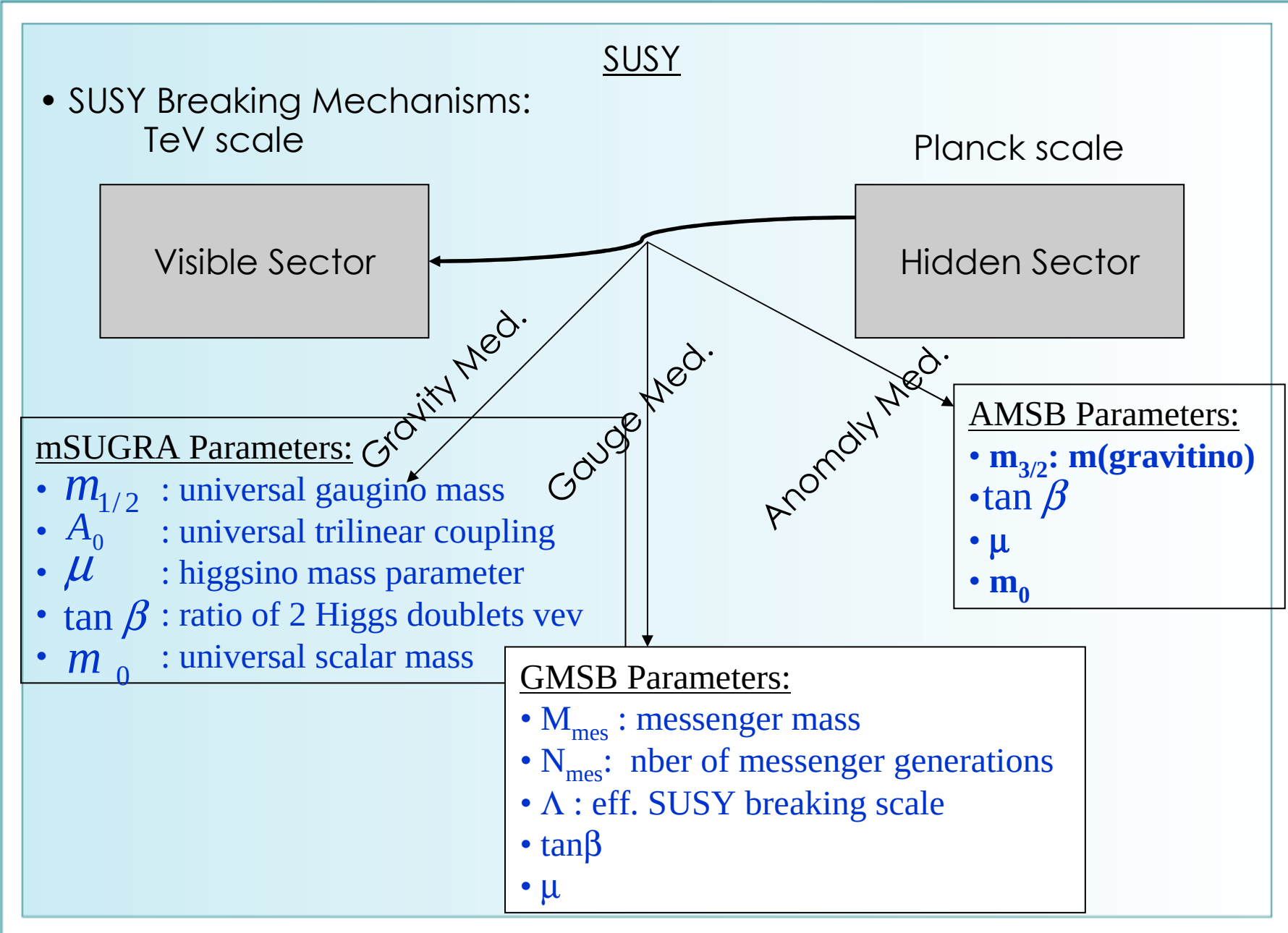
$$M_b^2 = \begin{pmatrix} m_{b_L}^2 + m_b^2 & m_b(A_b - \mu\tan\beta) \\ m_b(A_b - \mu\tan\beta) & m_{b_R}^2 + m_b^2 \end{pmatrix}$$

R Parity:

Conservation:

- Sparticles pair production
- LSP $\tilde{\chi}_1^0$ or $\tilde{G}_{\mu\alpha}$ stable $\Rightarrow E_T$ signature

3. Model-driven Direct Searches – SUSY (2)



3. Model-driven Direct Searches – SUSY (3)

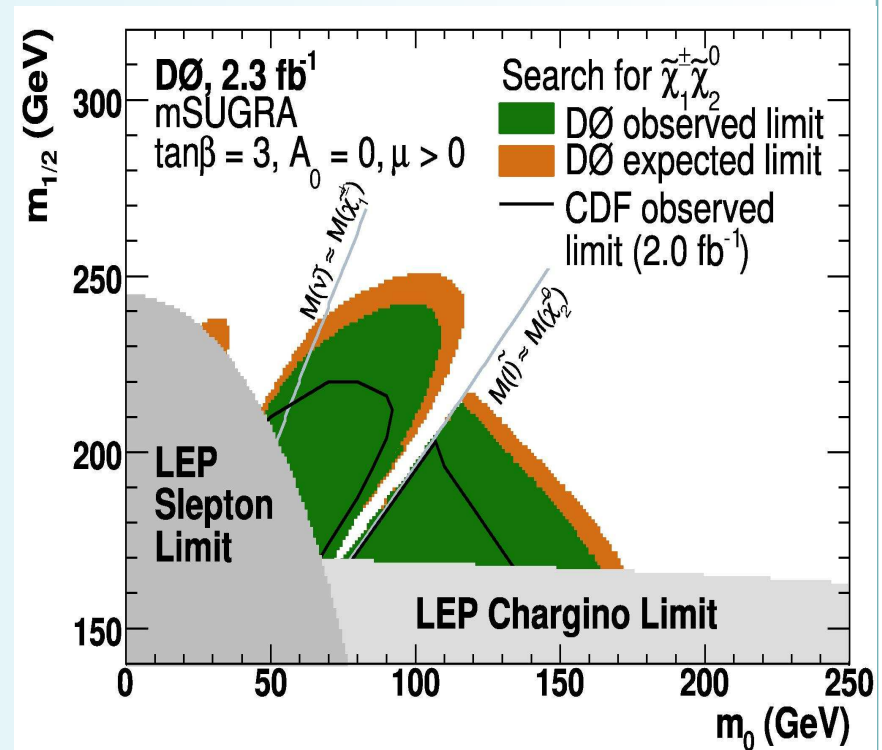
SUSY

- Gravity mediated (RPC):
 - Process: $p + \bar{p} \rightarrow \tilde{\chi}_1^\pm + \tilde{\chi}_2^0 \rightarrow 3\ell^\pm + E_T$
 - Small σ , but low SM background
 - Combine several topologies:
 - $\mu\mu\ell$, $e\ell\ell$, $e\mu\ell$, $\mu\tau\ell$, $\mu\tau\tau$
 - where τ stands for hadronic tau and ℓ for a charged track

Channel	N_{obs}	N_{exp}
Low p_T	9	5.4 ± 0.6
High p_T	4	3.3 ± 0.4

$$\int \mathcal{L} dt = 2.3 \text{ fb}^{-1}$$

Phys.Lett.B680:34-43,2009



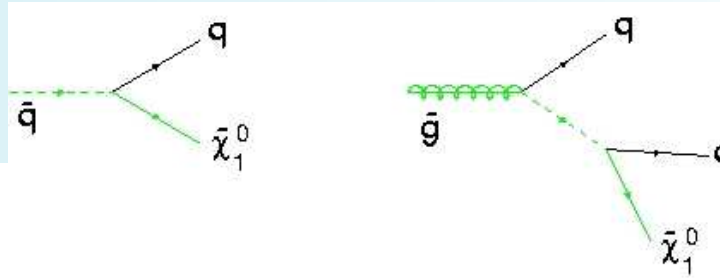
3. Model-driven Direct Searches – SUSY (4)

SUSY

- Gravity mediated (RPC):

• Process: $\tilde{q} + \tilde{\bar{q}} / \tilde{q} + \tilde{g} / \tilde{g} + \tilde{g} \rightarrow jets + E_T$

- Decay modes:



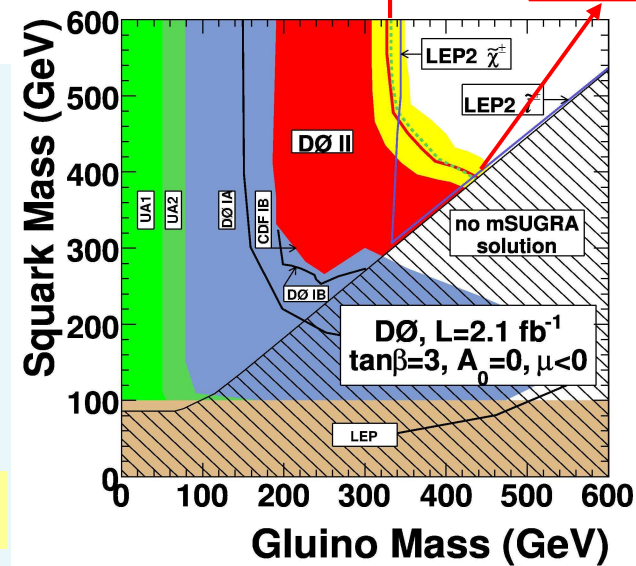
$m_{\tilde{g}} > 308 \text{ GeV}$

$m_{\tilde{q}} > 390 \text{ GeV}$

Top. $\geq$	$2j + E_T$	$3j + E_T$	$4j + E_T$
N_{obs}	11	9	20
N_{exp}	$11.1 \pm 1.2^{+2.9}_{-2.3}$	$10.7 \pm 0.9^{+3.1}_{-2.1}$	$17.7 \pm 1.1^{+5.5}_{-3.3}$

$$\int \mathcal{L} dt = 2.1 \text{ fb}^{-1}$$

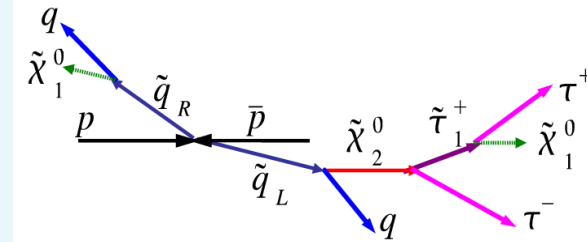
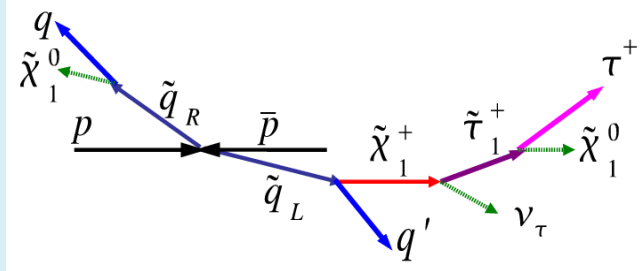
Phys. Lett. B 660, 449 (2008)



3. Model-driven Direct Searches – SUSY (5)

SUSY

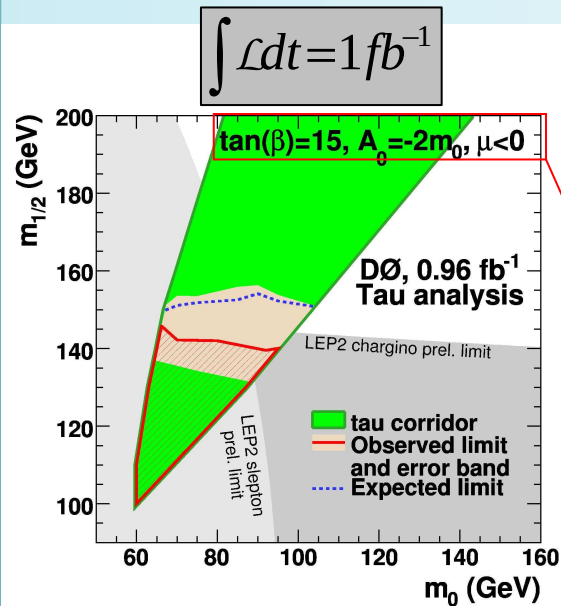
- Gravity mediated (RPC):
- Process:



$$N_{obs} = 3$$

$$N_{exp} = 2.3 \pm 0.4 \pm 0.7$$

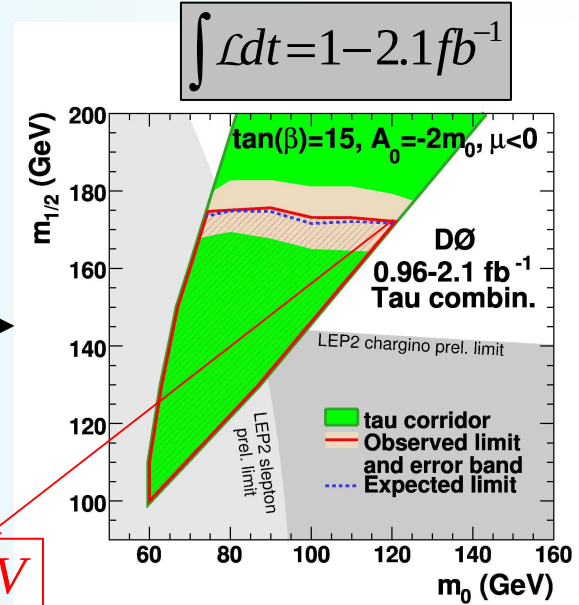
Phys.Lett.B680:24-33,2009



Comb. w/ sq/gl analysis

$$m_{\tilde{q}} > 410 GeV$$

$$m_{1/2} > 172 GeV$$



3. Model-driven Direct Searches – SUSY (6)

SUSY

- Gravity mediated (RPC):
 - Process: $p + \bar{p} \rightarrow \tilde{t}_1 + \tilde{t}_1^*$

Topology	Int. Lumi. (fb ⁻¹)	N _{obs} N _{exp}	Lower Limit (GeV)	Ref.
$2c + E_T$	1	66 $66.6 \pm 1.1^{+9.6}_{-10.0}$	$m_{\tilde{t}_1} > 150 \text{ GeV}$ ($m_{\tilde{\chi}_1^0} = 65 \text{ GeV}$)	Phys. Lett. B 665, 1 (2008)
$e^\pm + \mu^\mp + 2b + E_T$	3.1	288 303^{+16}_{-20}	$m_{\tilde{t}_1} > 200 \text{ GeV}$ ($m_{\tilde{\nu}} < 100 \text{ GeV}, \Delta m > 30 \text{ GeV}$)	D0 Preliminary

$$BR(\tilde{t}_1 \rightarrow b + \ell^\pm + \tilde{\nu}) = 1$$

$$BR(\tilde{t}_1 \rightarrow c + \tilde{\chi}_1^0) = 1$$

3. Model-driven Direct Searches – SUSY (7)

SUSY

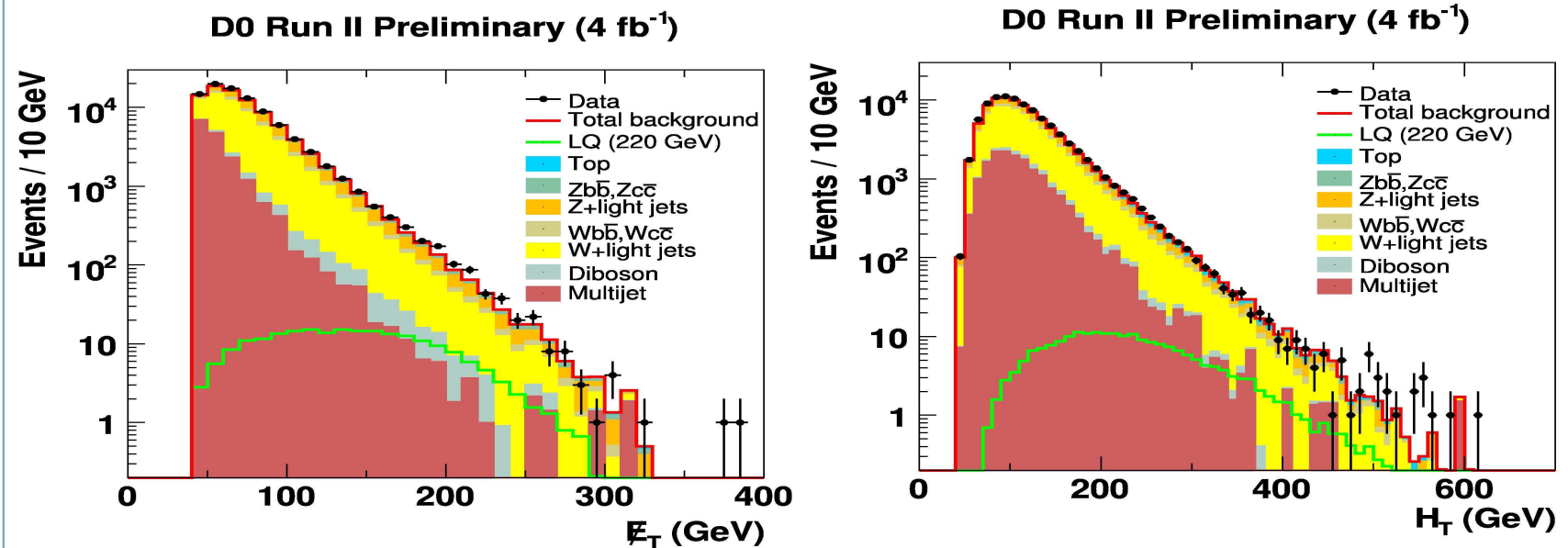
- Gravity mediated (RPC):
 - Process:
$$p + \bar{p} \rightarrow \tilde{t}_1 + \tilde{t}_1 \rightarrow e^\pm + \mu^\mp + 2b + E_T$$
- Steps in generating the signal samples:
 - **Mass spectrum:**
 - even grid in $(m_{\tilde{t}_1}, m_{\tilde{\nu}})$
 - **SuSpect v2.3** in **SLHA** format
 - Decay BRs: **Sdecay**
 - ME and parton LVL evts generation:
 - PDF: **CTEQ6M1**
 - generator: **Madgraph/Madevent v4.413**
 - PS, ISR, FSR, fragmentation,...: feed the **Madgraph** evts into a stand-alone version of **Pythia v6.409**
 - Normalization: NLO
 - PDF: **CTEQ6M1**
 - xsect integrator: **Prospino v2.0** (qq and gg separately)
 - store **Pythia** output into **SAM** (FNAL equivalent of **CASTOR** or **HPSS** + DB)
 - Full Simulation, Digitization and Reconstruction: use the official D0 chain

3. Model-driven Direct Searches – SUSY (8)

SUSY

- Gravity mediated (RPC):
 - Production Process: $p + \bar{p} \rightarrow \tilde{b}_1 + \bar{\tilde{b}}_1 \rightarrow 2b + E_T$
 - Trigger: $jets + E_T$
 - Offline selection:
 - Preselection
 - PV: $|z| < 40$ cm, w/ > 2 tracks
 - Jets:
 - $N_{jets} = 2 \text{ or } 3$; $p_T > 20 \text{ GeV}$; $|\eta_{det}| < 2.4$
 - w/ > 1 track from PV for j_0, j_1
 - $\Delta\phi(j_0, j_1) < 165^\circ$
 - reject evts w/ bad jets of $p_T > 15 \text{ GeV}$
 - Missing E_T :
 - $E_T > 40 \text{ GeV}$
 - $E_T > 80 - 40 \cdot \Delta\phi_{min}(E_T, jets)$
 - $\Delta\phi(E_T^{cal}, E_T^{trk}) < \pi / 2$
 - Leptons:
 - Reject isolated EM and m w/ $p_T > 15 \text{ GeV}$
 - $\Delta R(\ell, jet) > 0.5$

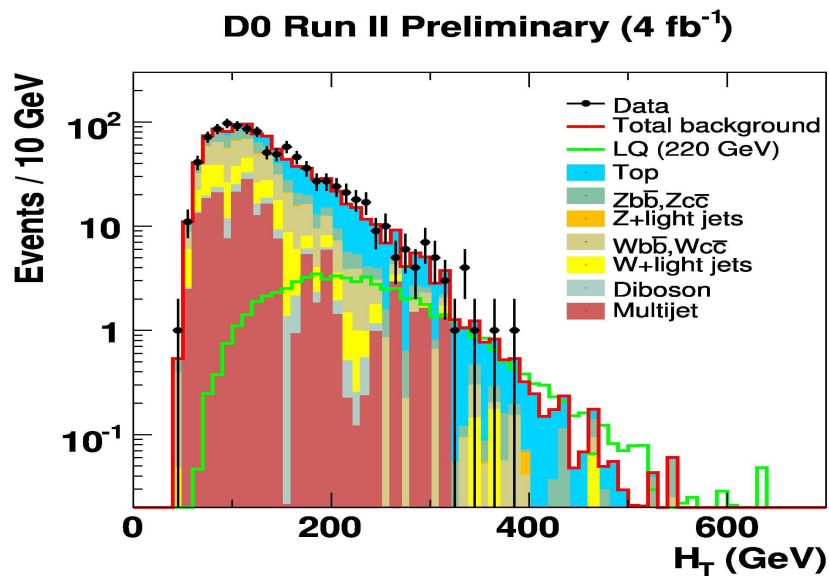
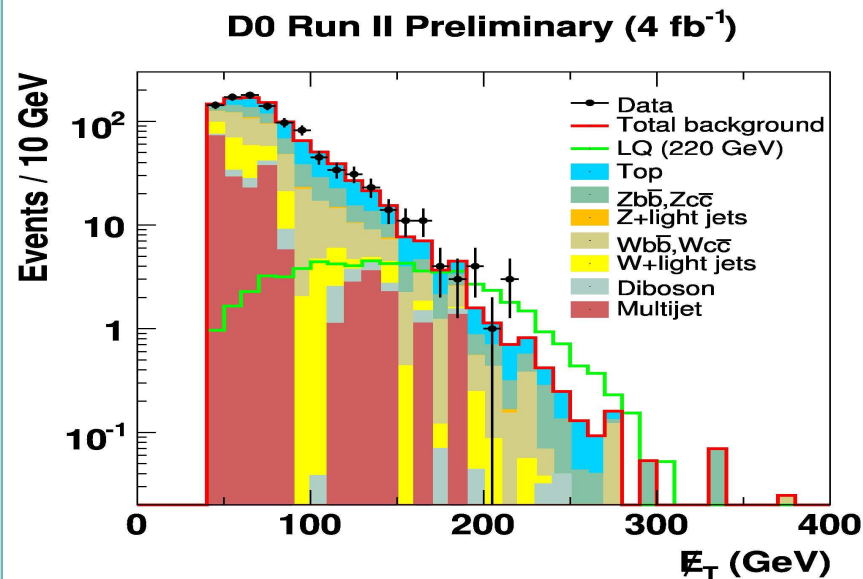
3. Model-driven Direct Searches – SUSY (9)



3. Model-driven Direct Searches – SUSY (10)

SUSY

- Offline selection (cont'd):
 - B-tagging:
 - 1 tight ($\epsilon_b = 45\%$, $R_{LF} = 200$)
 - 1 loose ($\epsilon_b = 70\%$, $R_{LF} = 20$)



3. Model-driven Direct Searches – SUSY (11)

SUSY

- Offline selection (cont'd):
 - Reduction of the QCD instr. BKGD:
 - reject evts w/ mis-measured mE_T :
 - $-0.1 < \frac{(E_T^{cal} - E_T^{jets})}{(E_T^{cal} + E_T^{jets})} < 0.2$
 - $\Delta\phi_{\min}(E_T, jets) > 0.6$
 - Final Selection:
 - Reject top BKGD: $X_{jj} = \frac{p_T(j_0) + p_T(j_1)}{H_T^{jets}} > 0.9$
 - Optimize wrt m_{LQ3} : for 220 GeV
 - $p_T(j_0) > 50 \text{ GeV}$
 - $E_T > 130 \text{ GeV}$
 - $H_T > 230 \text{ GeV}$

3. Model-driven Direct Searches – SUSY (12)

SUSY

- Offline selection (summary):

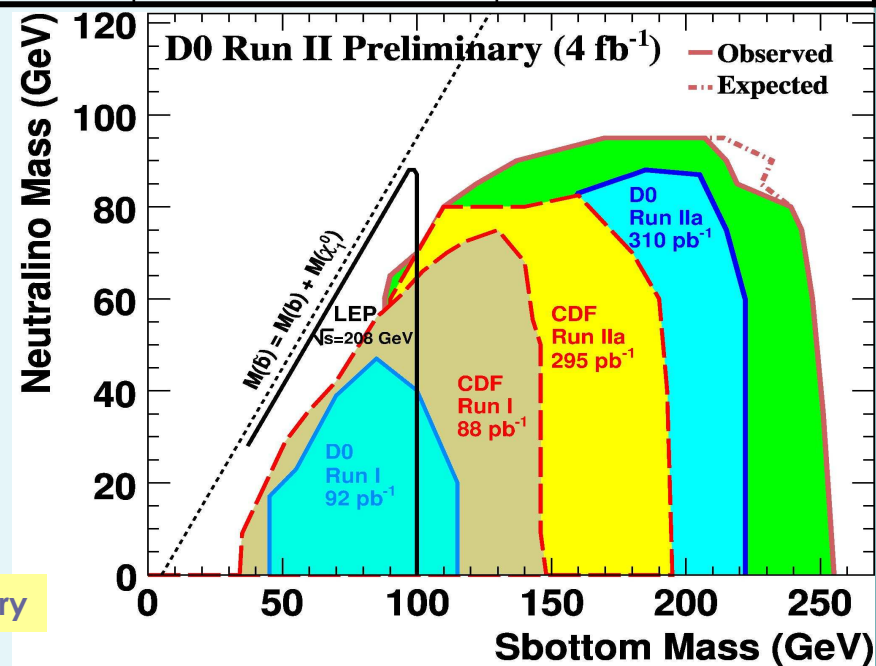
Selection Level	N_{obs}	N_{exp}	Dominant BKGD	$\epsilon(\text{Signal})$ $m_{LQ}=220 \text{ GeV}$
Preselection	221k	221k	QCD multijets	42.3%
B-tagging	1814	1699	$t\bar{t}$ bar	12.0%
QCD Rej.	998	981	W+QQ	11.2%
Final Sel.	7	7.1	$t\bar{t}$ bar	3.0%

- Systematic Uncertainties:

- SM xsect: 10%
- $\epsilon(\text{b-tag})$: 7%
- $\epsilon(\text{jet reco})$: 7%
- Int.Lumi: 6.1%

$$\int \mathcal{L} dt = 4 \text{ fb}^{-1}$$

D0 Preliminary

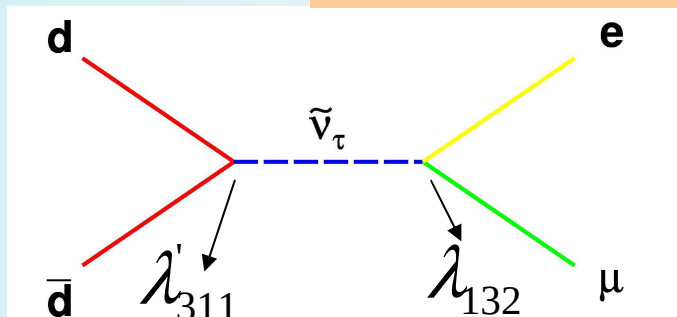


3. Model-driven Direct Searches – SUSY (13)

- Gravity mediated (RPV):

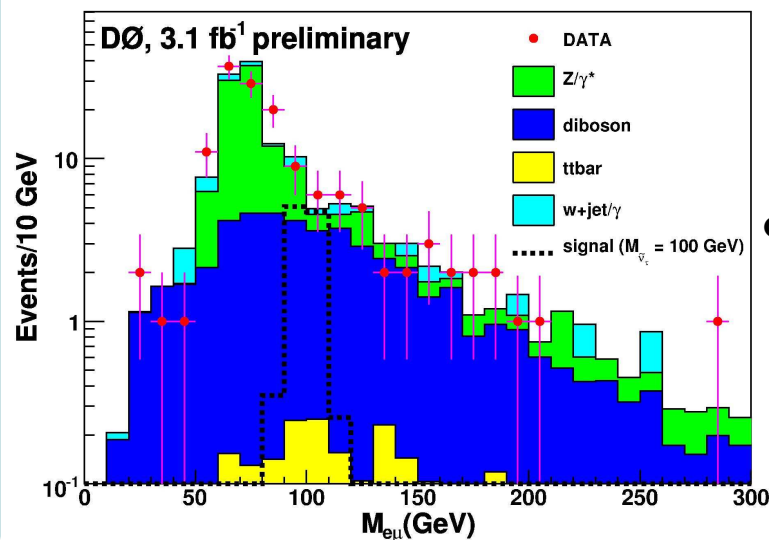
- Introduction:

- Process:



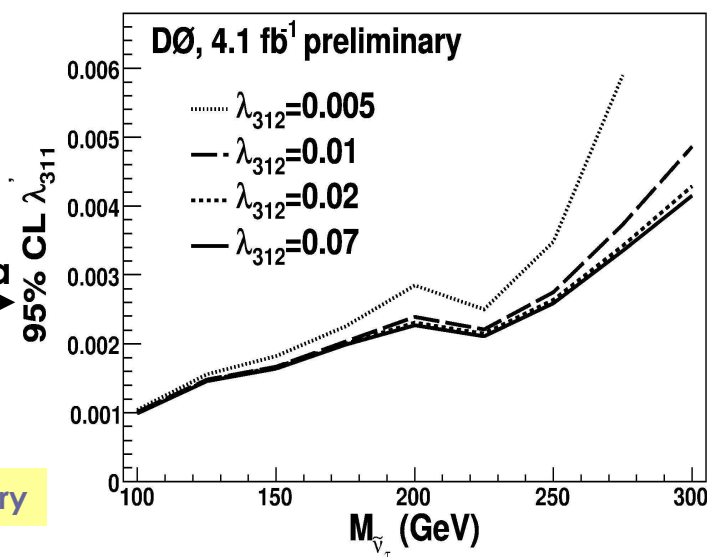
Generator: CompHep+Pythia

- Search for a peak in $m(e\mu)$ distribution



comb. Run IIa

D0 Preliminary

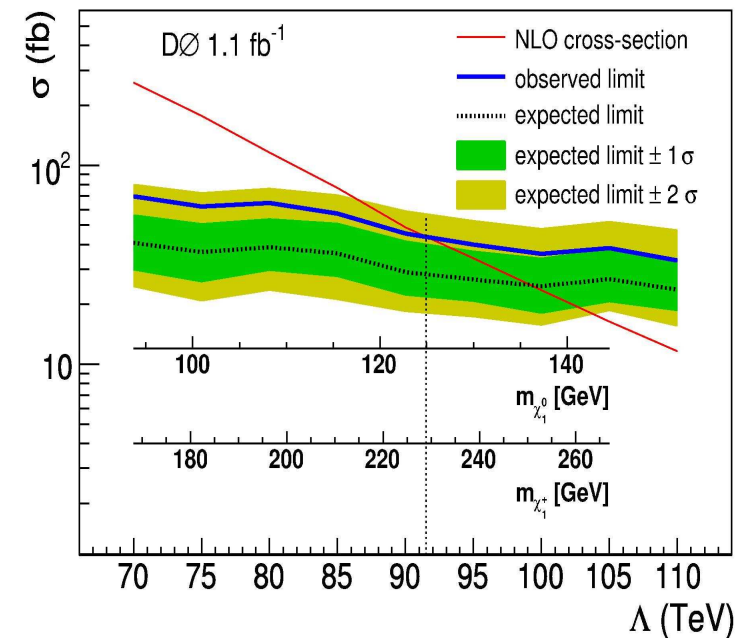
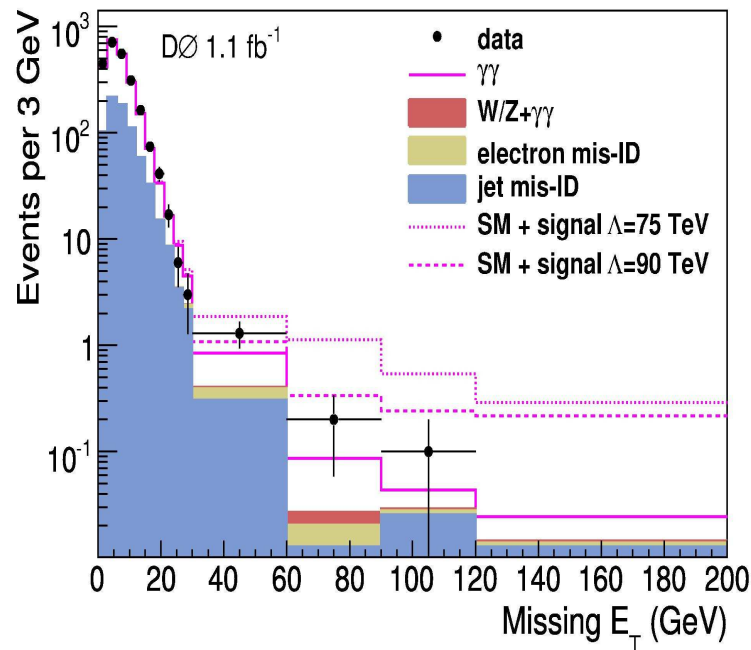


3. Model-driven Direct Searches – SUSY (14)

SUSY

- Gauge mediated (RPC):
 - Production Process: $p + \bar{p} \rightarrow \tilde{\chi}_1^+ + \tilde{\chi}_1^- / \tilde{\chi}_1^+ + \tilde{\chi}_2^0$
 - Decay end: $\tilde{\chi}_1^0 \rightarrow \gamma + \tilde{G}_{\mu\alpha}$

$$\int \mathcal{L} dt = 1.1 \text{ fb}^{-1}$$



Phys. Lett. B 659 , 856 (2008)

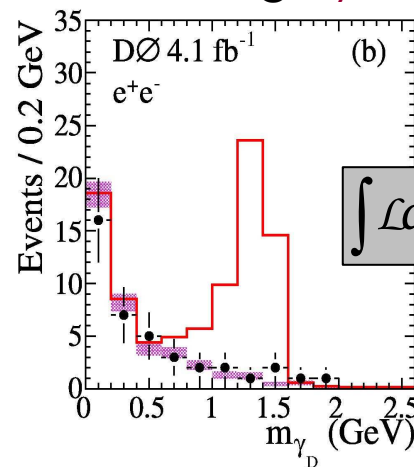
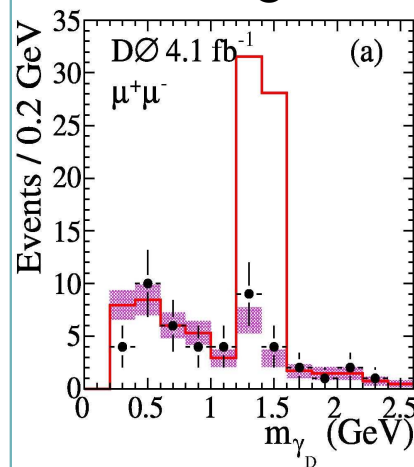
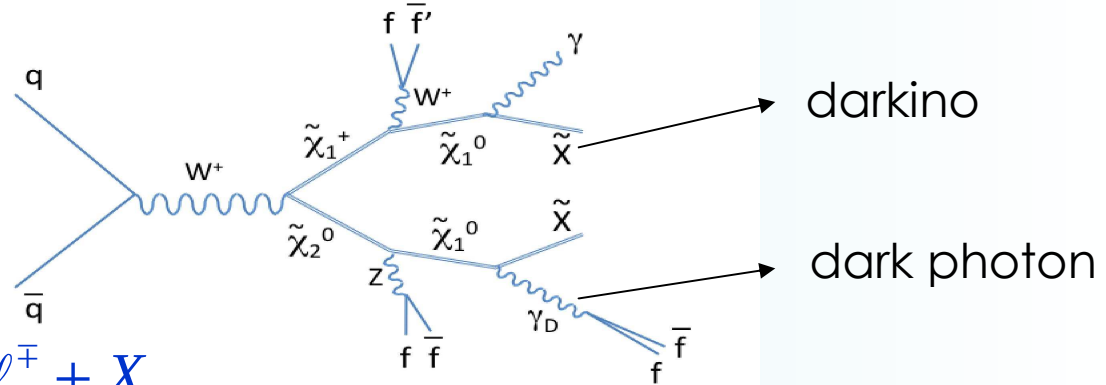
3. Model-driven Direct Searches – SUSY (15)

- Hidden Valleys (RPC):
 - Process:

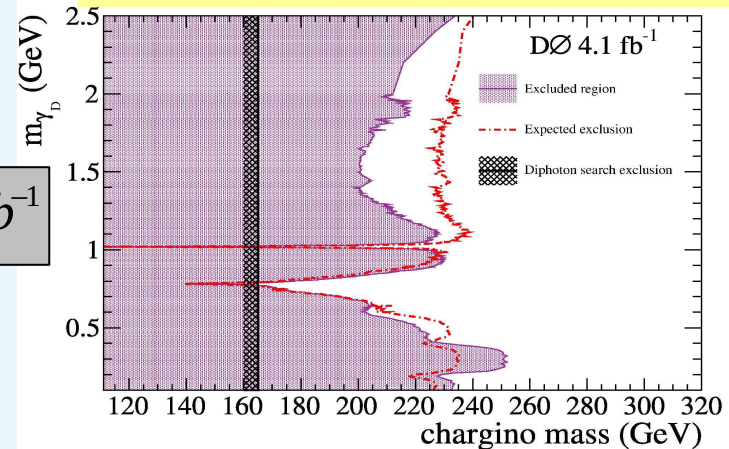
- Topology: $\gamma + \ell^\pm + \ell^\mp + X$
- Look for narrow resonances
- Tools:

- **SUSYHIT**: GMSB mass spectrum and decay BR
- mod. this **SLHA** file to introduce γ_D decay
- generate evts using **Pythia**

SUSY



$$\int \mathcal{L} dt = 4.1 \text{ fb}^{-1}$$



Phys. Rev. Lett. 103 , 081802 (2009)

3. Model-driven Direct Searches – LQ (1)

LEPTOQUARKS

- Introduction

- particles bearing electric charge and both L, B quantum nbers
- conjectured in some GUT, TC or compositeness models
- suppose no inter-generation mixing

PRODUCTION:

- $q + \bar{q} \rightarrow LQ_i + \bar{LQ}_i$
- $g + g \rightarrow LQ_i + \bar{LQ}_i$
- $q + g \rightarrow LQ_i + \ell^\mp$ (smaller σ)
($0 < i < 4$: generation index)
- σ independent of λ for SLQ
(except for single LQ)
 $\Rightarrow \sigma(\alpha_s, M_{\text{SLQ}})$
- σ depends on +2 parameters κ_G
and λ_G for VLQ
 $\Rightarrow \sigma(\alpha_s, M_{\text{VLQ}}, \kappa_G, \lambda_G)$

DECAY MODES:

$$BR(LQ \rightarrow \ell^\pm q) = \beta$$

- Channels:

$$LQ_i + \bar{LQ}_i \rightarrow \ell_i^\pm \ell_i^\mp q_i \bar{q}_i \quad \beta^2$$

$$LQ_i + \bar{LQ}_i \rightarrow \ell_i^\pm \nu_i q_i \bar{q}_i \quad 2\beta(1 - \beta)$$

$$LQ_i + \bar{LQ}_i \rightarrow \nu_i \bar{\nu}_i q_i \bar{q}_i \quad (1 - \beta)^2$$

3. Model-driven Direct Searches – LQ (2)

LEPTOQUARKS

- First generation

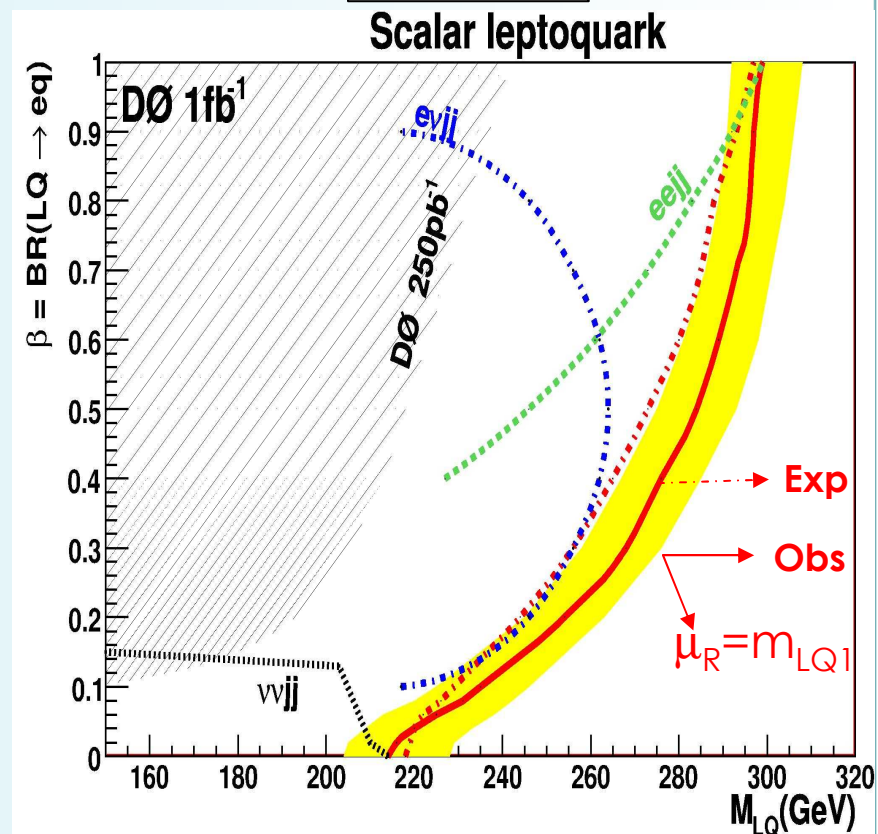
Scalar LQ₁

β	Lower limit (GeV)
1	299
0.5	284
0.02	216

Vector LQ₁

β	Lower limit (GeV)
0.5	357-464

$$\int \mathcal{L} dt = 1 \text{ fb}^{-1}$$



[Phys.Lett.B681:224-232,2009](#)

3. Model-driven Direct Searches – LQ (3)

LEPTOQUARKS

- Second generation

- Pair production:

$$\int \mathcal{L} dt = 1 \text{ fb}^{-1}$$

[Phys. Lett. B 671, 224 \(2009\)](#)

Scalar LQ₂

β	Lower limit (GeV)
1	316
0.5	270

- Single production:

$$\int \mathcal{L} dt = 0.3 \text{ fb}^{-1}$$

[Phys. Lett. B 647 \(2007\) 74-81](#)

Scalar LQ₂

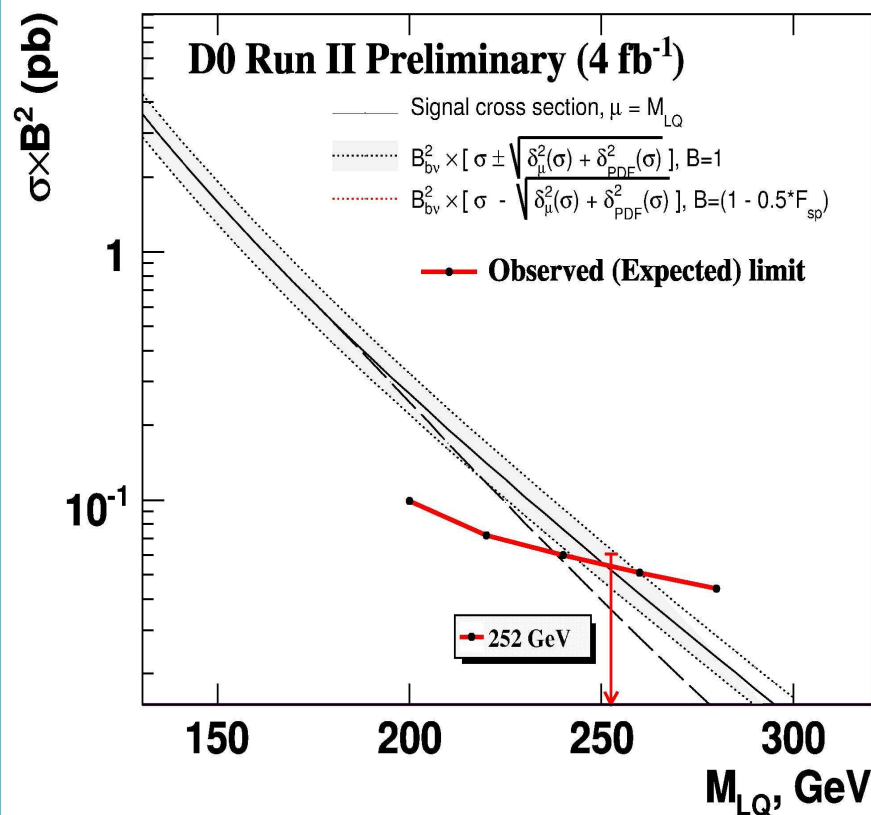
β	Lower limit (GeV)
1	274
0.5	226

3. Model-driven Direct Searches – LQ (4)

LEPTOQUARKS

- Third generation:
 - $p + \bar{p} \rightarrow LQ_3 + \overline{LQ_3} \rightarrow b\bar{b} + \nu_\tau \bar{\nu}_\tau$
- same analysis as sbottom pairs search

High m_{LQ} mass sel. : 3 events for $3.2 \pm 0.3 \pm 0.6$



Scalar LQ₃

β	Lower limit (GeV)
1	210
0	252

$$\int \mathcal{L} dt = 4 \text{ fb}^{-1}$$

D0 Preliminary

$$\int \mathcal{L} dt = 1.05 \text{ fb}^{-1}$$

[10.1103/PhysRevLett.101.241802](https://arxiv.org/abs/10.1103/PhysRevLett.101.241802)

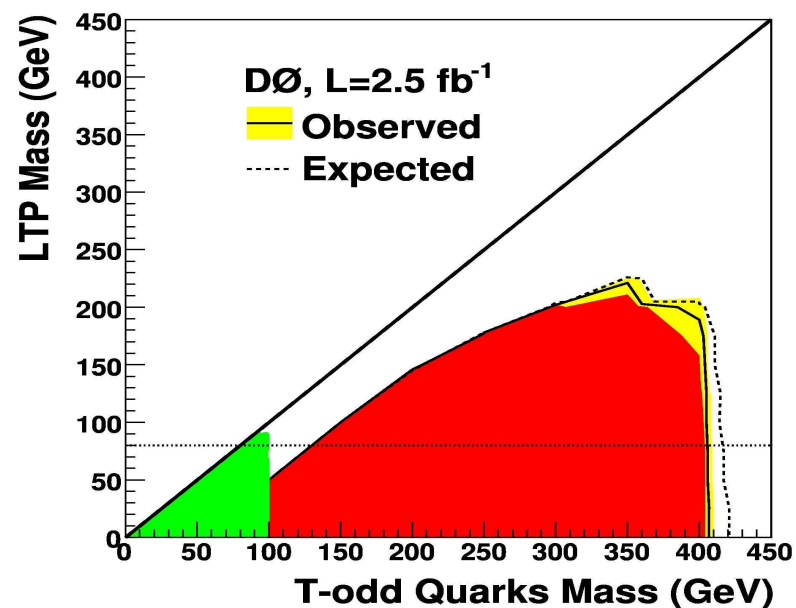
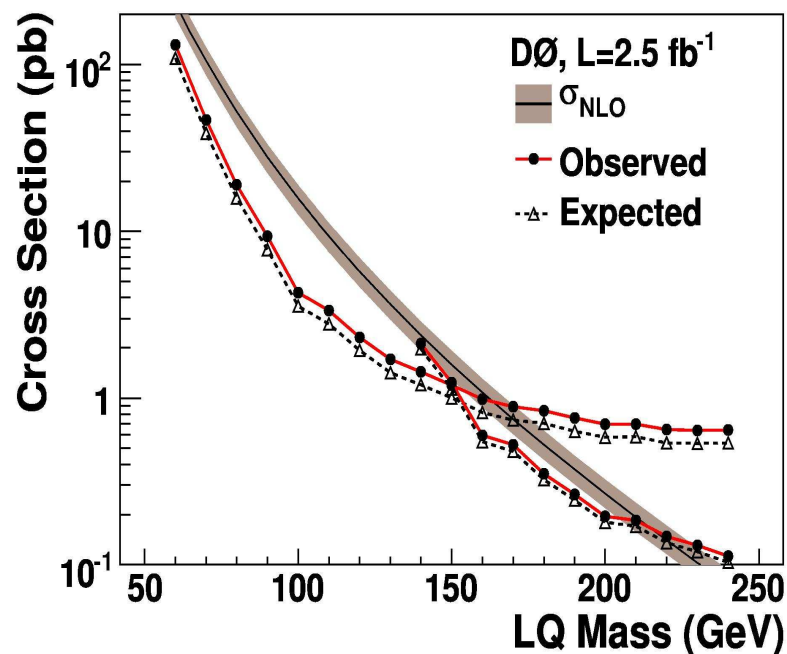
3. Model-driven Direct Searches – LQ+LH

LEPTOQUARKS & LITTLE HIGGS

- Little Higgs models w/ T-parity predict T-odd quarks that can be searched for in the jets+mE_T topology
 - Same applies for $\beta=0$ LQ₁ searches
- => Recycle a SUSY analysis on squarks/gluinos → jets+mE_T to test these models

$$\int \mathcal{L} dt = 2.5 \text{ fb}^{-1}$$

Phys. Lett. B 668 , 357 (2008)



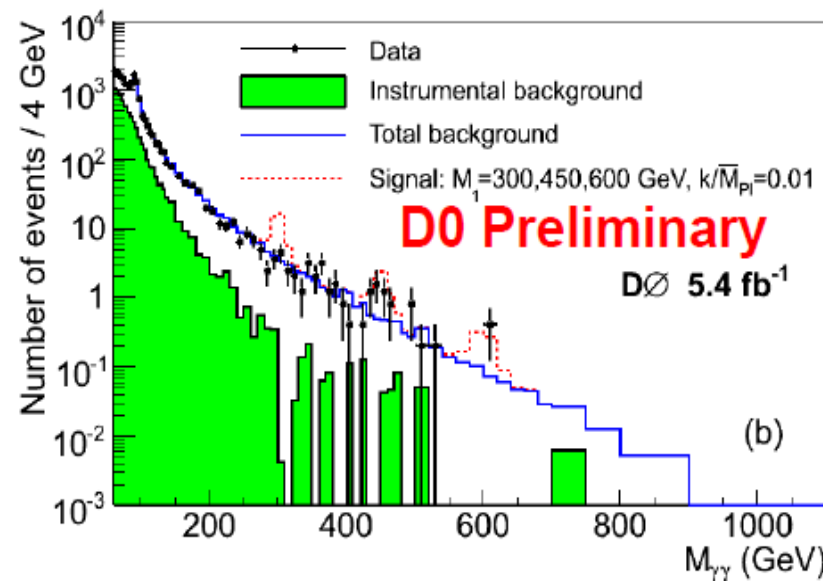
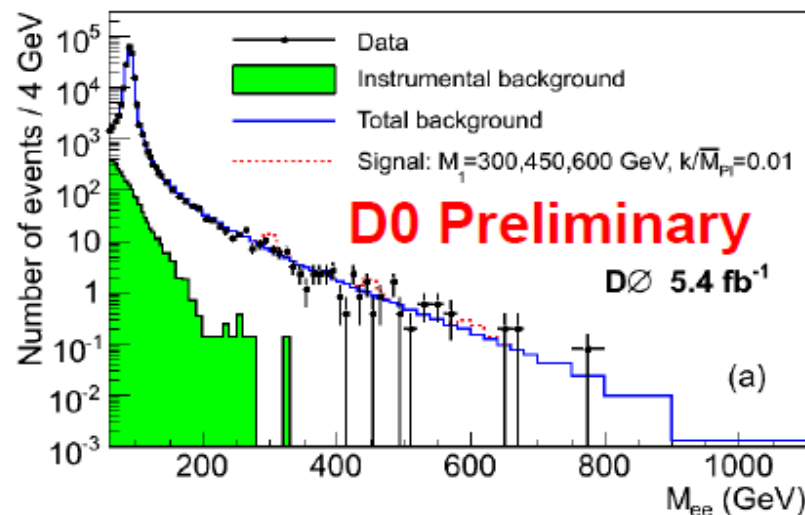
4. Signature-based Direct Searches

4. Signature-based Direct Searches – Resonances (1)

RESONANCES

- High mass narrow e^+e^- or $\gamma\gamma$ peak:
- Expected from R-S Gravitons in Warped ED, w/ lightest $M_1 = \mathcal{O}(1 \text{ TeV})$
- Trigger: di-EM
- Dominant BKGDs:
 - D-Y
 - SM $\gamma\gamma$

$$\int \mathcal{L} dt = 5.4 \text{ fb}^{-1}$$

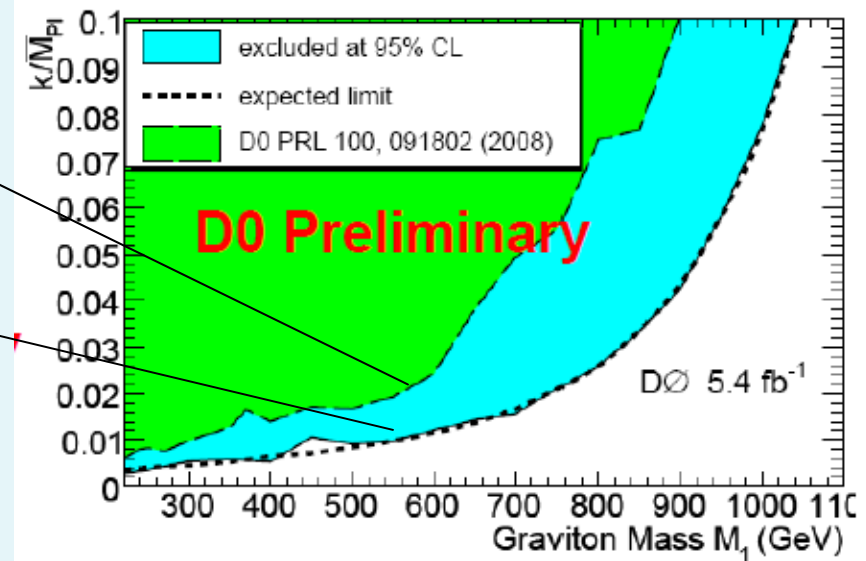
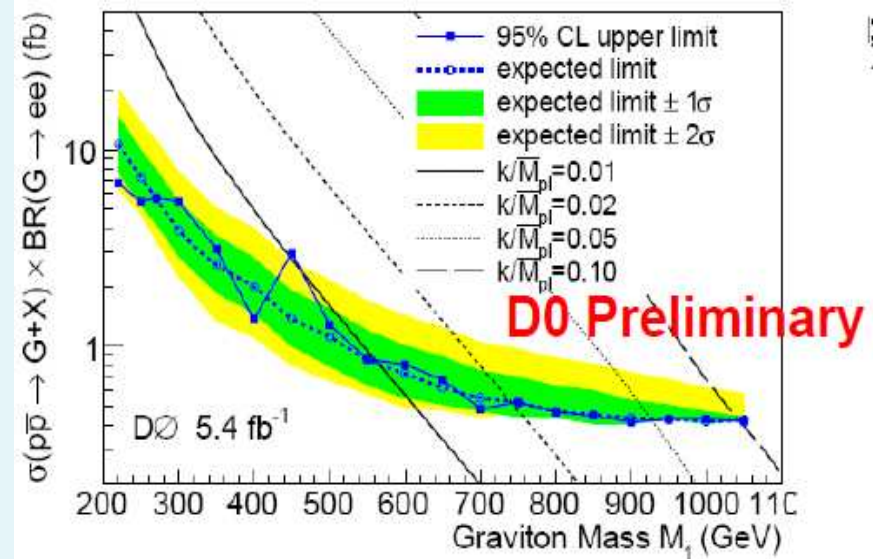


4. Signature-based Direct Searches – Resonances (2)

$$\begin{cases} M_1 > 440 - 1040 \text{ GeV} \\ \kappa/M_{Pl} = 0.01 - 0.1 \end{cases}$$

$$\int \mathcal{L} dt = 1 \text{ fb}^{-1}$$

$$\int \mathcal{L} dt = 5.4 \text{ fb}^{-1}$$



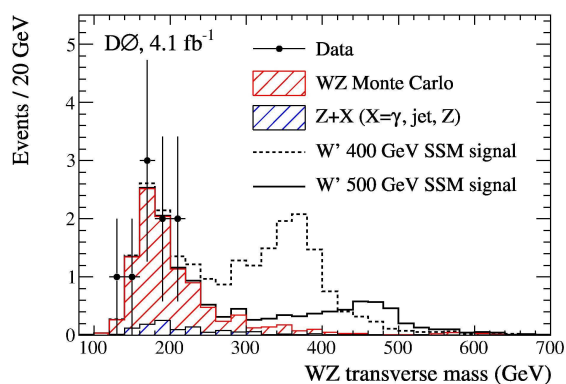
4. Signature-based Direct Searches – Resonances (3)

RESONANCES

• W' :

• Process:

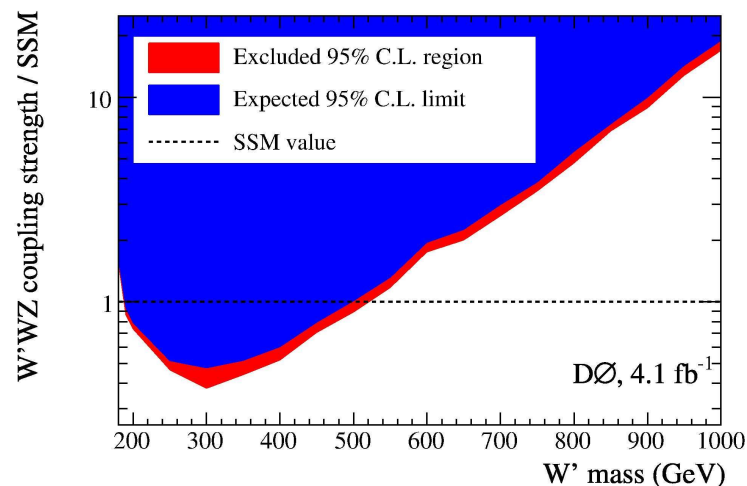
$$p + \bar{p} \rightarrow W'^{\pm} \rightarrow W^{\pm} + Z \rightarrow 3\ell^{\pm} + E_T$$



$$N_{obs} = 9$$

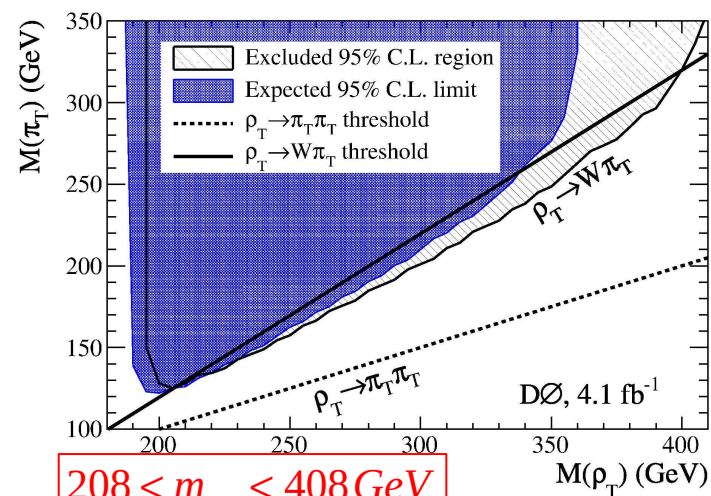
$$N_{exp} = 10.2 \pm 1.6$$

$$p + \bar{p} \rightarrow \rho_T \rightarrow W^{\pm} + Z \rightarrow 3\ell^{\pm} + E_T$$



$$188 < m_{W'} < 520 \text{ GeV}$$

$$\int \mathcal{L} dt = 4.1 \text{ fb}^{-1}$$



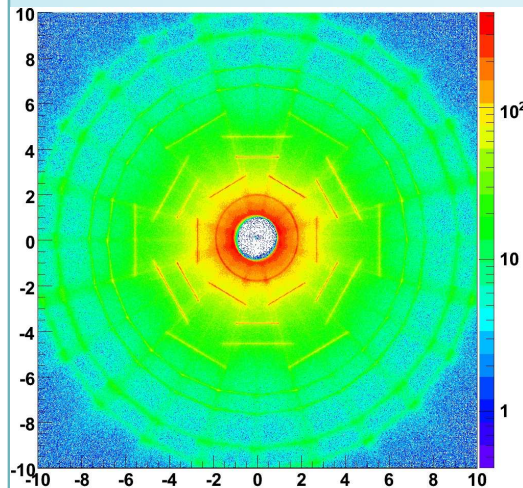
$$208 < m_{\rho_T} < 408 \text{ GeV}$$

Phys. Rev. Lett. 104, 061801 (2010)

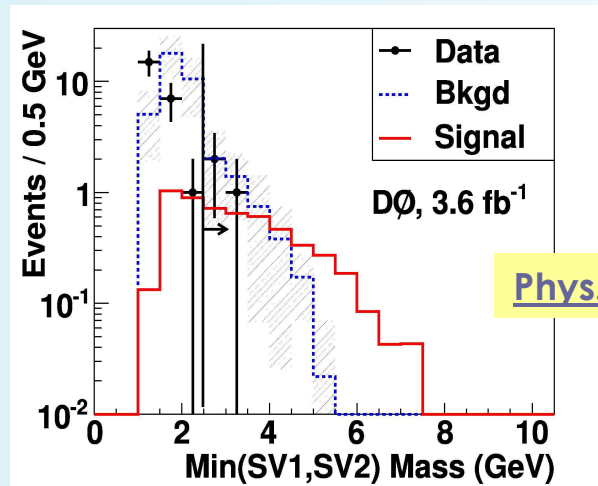
4. Signature-based Direct Searches – Resonances (4)

RESONANCES

- Neutral Long-Lived Particle:
 - Process: $p + \bar{p} \rightarrow NLLP \rightarrow b + \bar{b}$
Inspired by some hidden valley models
 - Trigger: OR of all
 - Offline Selection:
 - 2 b-jets, 1 w/ a muon
 - look for displaced vertices w/ $1.6 < r < 20$ cm in the tracker



SV per 0.0016 cm²



$$\int \mathcal{L} dt = 3.6 \text{ fb}^{-1}$$

Phys. Rev. Lett. 103 , 071801 (2009)

$$\frac{\sigma(H + X) \cdot BR(H \rightarrow H_V + H_V) \cdot BR^2(H_V \rightarrow b\bar{b})}{\sigma_{SM}} < 1-10$$

4. Signature-based Direct Searches – Dijets

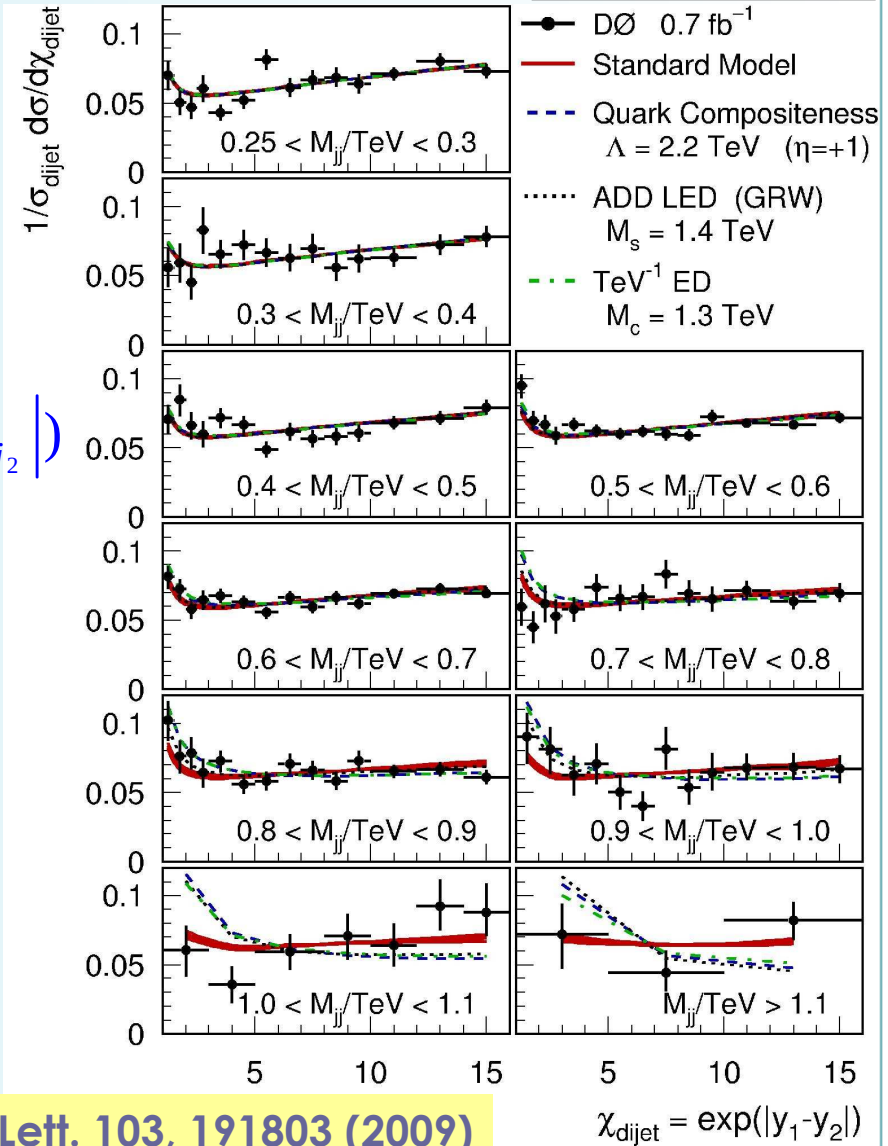
- QCD Dijets:
 - Process: $p + \bar{p} \rightarrow 2j + X$

Use dijets mass bins within:
 $0.25 < M_{j_1, j_2} < 1.1 \text{ TeV}$

to constrain exotic models through $\chi_{j_1, j_2} = \exp(|y_{j_1} - y_{j_2}|)$

Model	Limit (TeV) $\Delta\chi^2 = 3.84$
<u>Quark Composit.</u>	$\eta=+1: \Lambda > 2.92$ $\eta=-1: \Lambda > 2.96$
<u>TeV⁻¹ ED</u>	$M_c > 1.59$
<u>ADD LED</u>	
GRW	$M_s > 1.66$
HLZ n=3	$M_s > 1.97$
HLZ n=4	$M_s > 1.66$
HLZ n=5	$M_s > 1.50$
HLZ n=6	$M_s > 1.39$
HLZ n=7	$M_s > 1.32$

DIJETS ANGULAR DISTRIBUTIONS



Phys. Rev. Lett. 103, 191803 (2009)

5. Conclusions

CONCLUSIONS

- Many models have been tested
 - Many topologies have been studied
 - With large datasets (up to 5.4 fb^{-1})
 - Yet, there are no evidence of New Physics
 - We derived improved or new exclusion limits
-
- Exhaustive list at:
 - <http://www-d0.fnal.gov/Run2Physics/WWW/results/np.htm>
 - http://www-d0.fnal.gov/d0_publications/d0_pubs_list_runII_bytopic.html#np
 - More analyzed data are in the pipeline, stay tuned...

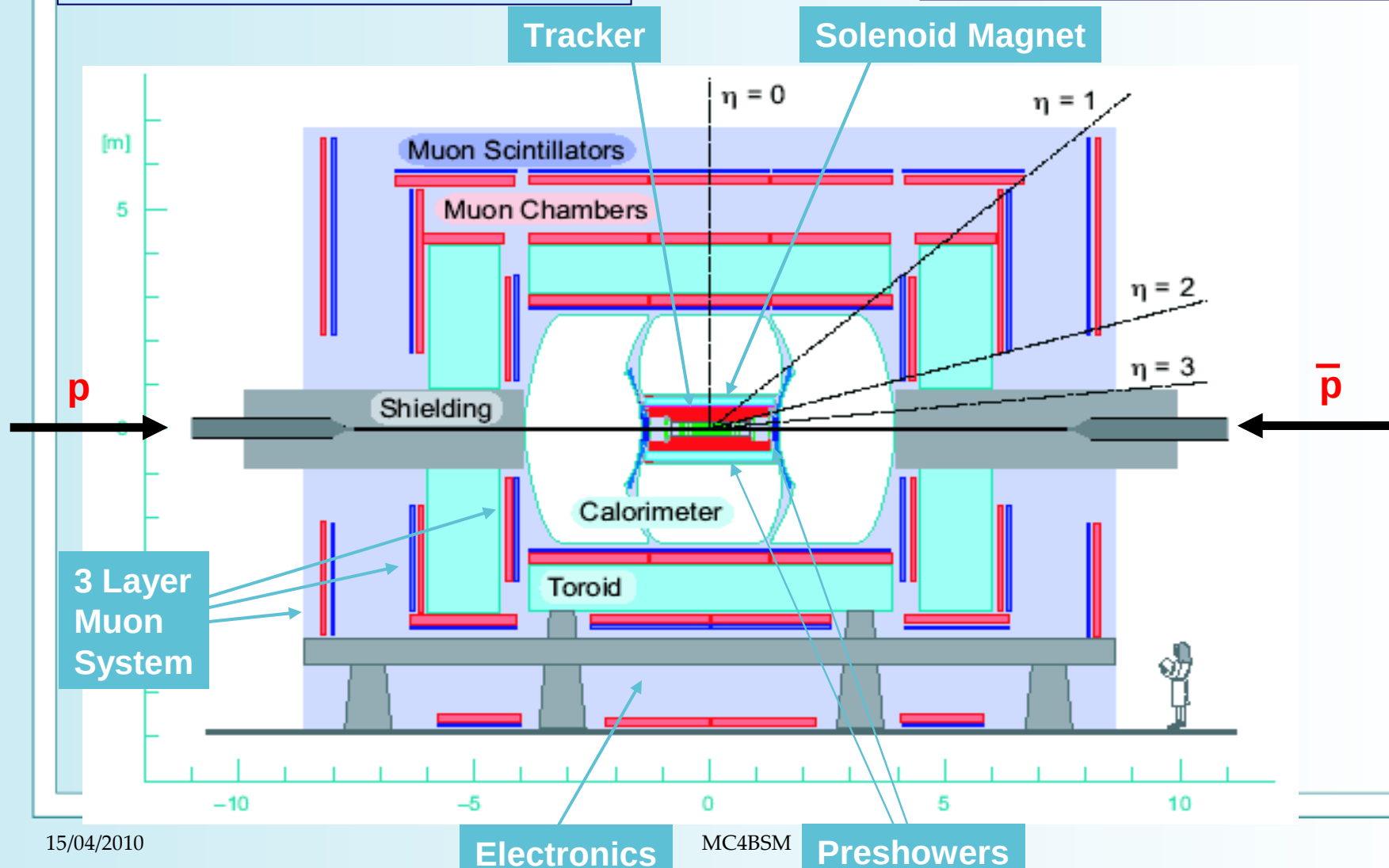
BACK-UP

Upgraded: Run I $\rightarrow$ Run IIa

Muon system, CAL Electronics
DAQ, (track) trigger system
Displaced-vtx trigger

New @ Run IIa

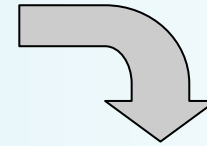
Tracking in B-field
Silicon detector
Fiber tracker, preshowers



Instrumental Context: p+pbar collisions @ 1.96 TeV

Run IIa (2001-06):

- delivered / stored / analyzed
1.6 / 1.4 / 1.1 fb⁻¹
- Peak Inst. $\mathcal{L}$: [3x10³¹, 2x10³²] cm⁻²s⁻¹

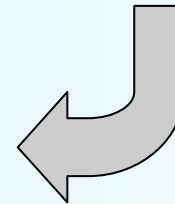


Upgrades (2006):

- TEVATRON
- D0 Detector:
 - Silicon Tracker: « Layer 0 »
 - Trigger: L1 Calo

Run IIb (2006-09/10):

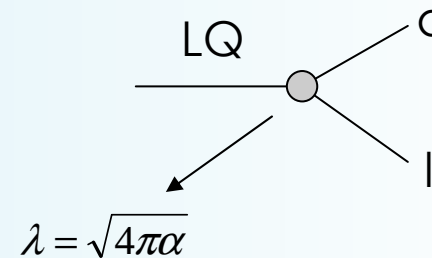
- delivered / stored / analyzed (incl)
8.1 / 7.2 / 5.4 fb⁻¹
- Peak Inst. $\mathcal{L}$: 3.8x10³² cm⁻²s⁻¹
- Current DAQ ϵ : ~90%



VECTOR LEPTOQUARKS

- Generator: **CompHep**
 - Parameters for LO cross section:
 - M_{VLQ} : mass
 - κ_G, Λ_G : anomalous magnetic and quadrupole moments
 - λ : Yukawa coupling, impacts the Γ_{VLQ}
 - α_s : strong coupling

- Minimal couplings: $\kappa_G = 1, \Lambda_G = 0$
- Yan-Mills couplings: $\kappa_G = 0, \Lambda_G = 0$
- Minus-Minus couplings: $\kappa_G = -1, \Lambda_G = -1$



- Ref: A. Belayev et al., « Leptoquark single and pair production at LHC with CalcHEP/CompHEP in the complete model »

<http://iopscience.iop.org/1126-6708/2005/09/005>