New Phenomena :
Etat et Perspectives a haute luminosite

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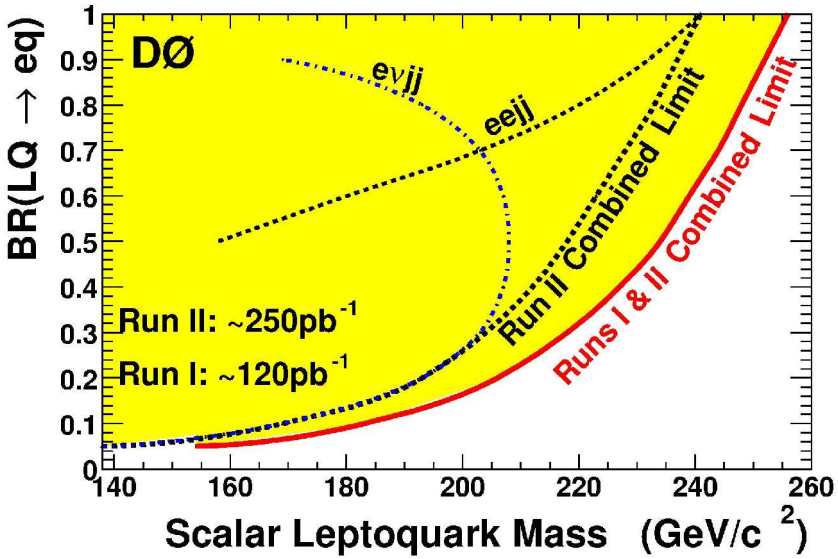
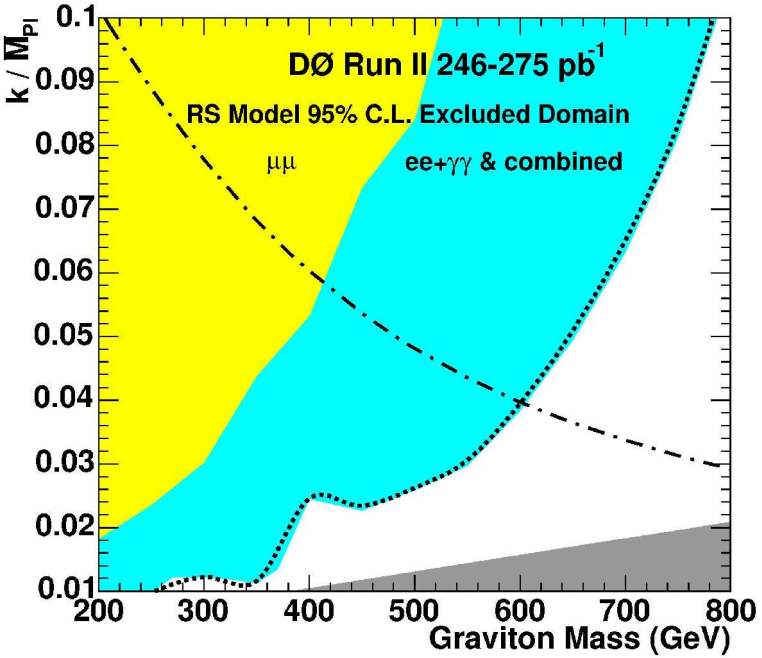
Resultats NP D0-France

- Publication :
- Search for first-generation scalar leptoquarks, 252 pb-1, PRD 71, 071104 (2005) — Alexis, Marie-Claude
- Search for Randall-Sundrum Gravitons in Dilepton and Diphoton Final States, 260 pb-1, PRL 95 091801 (2005) — Emmanuelle





- Resultats preliminaires :
- Search for LED in Jets+MET Topology, 3/19/04, 85 pb-1 — Laurent
- Search for Supersymmetry with R-parity Violation in the eel Final State, 8/4/04, 238 pb-1 — Anne-Marie
- Search for Scalar Leptoquarks in the Acoplanar Jet Topology, 8/25/04, 85 pb-1 — Alexandre
- Search for Supersymmetry with R-parity Violation in the eet Final State, 2/1/05, 200 pb-1 — Anne-Catherine
- Search for Squarks and Gluinos in the Jets+MET Topology, 3/5/05, 310 pb-1 — Patrice
- Search for direct production of scalar bottom quarks, 6/24/05, 310 pb-1 — Arnaud, Eric

RPV λ_{121}

Anne-Marie

- $\int L\,dt \approx 350\ pb^{-1}$, EM+DIEM+EMMU triggers
- **Preselection :** 2 "good" e or 1 e + 1 "good", isolated, $p_T > 15$ and 10 GeV.c^{-1}.

- **Final selection:** ee+e or ee+mu

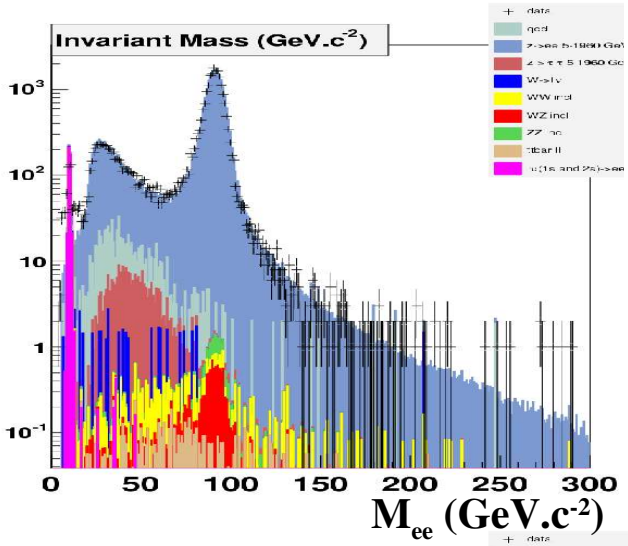
$p_T > 15, 10, 5$ GeV.c^{-1},

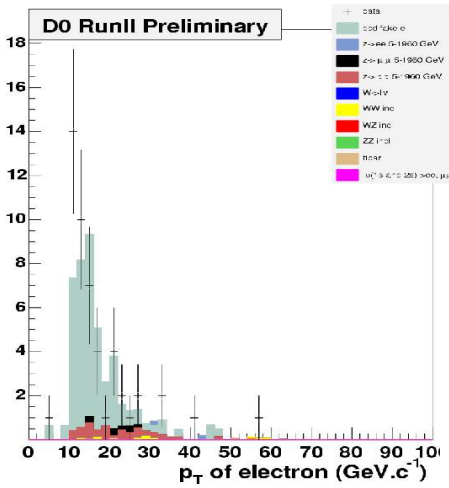
$M_{ee} \notin [80,100]$ GeV.c^{-2}, $ME_T > 15$ GeV.

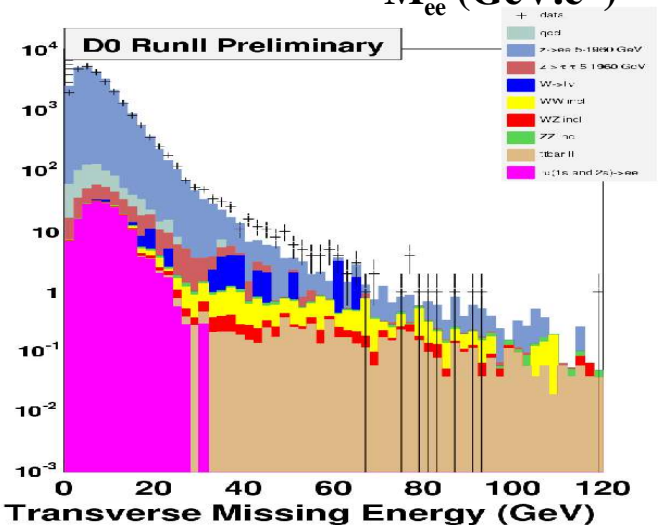
ε (Signal) ≈ 10% – 15%

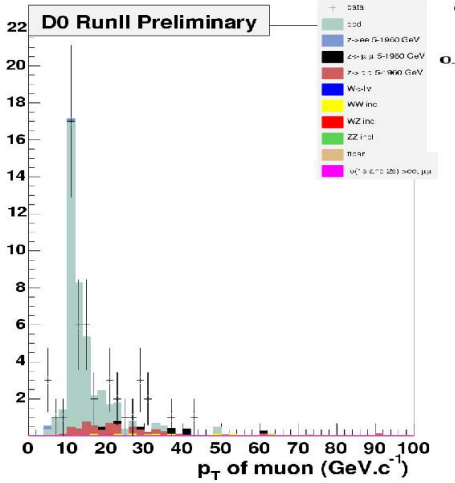
Bkgs : 0.61 ± 0.47 (stat) **± 0.04** (sys),

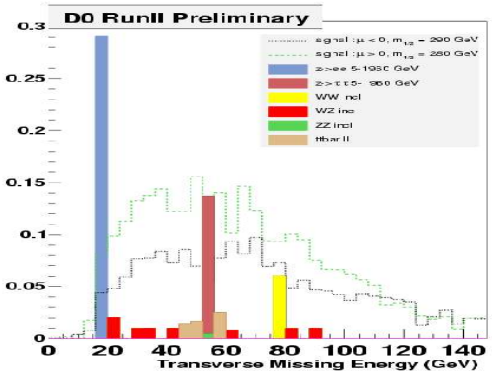
data: 0

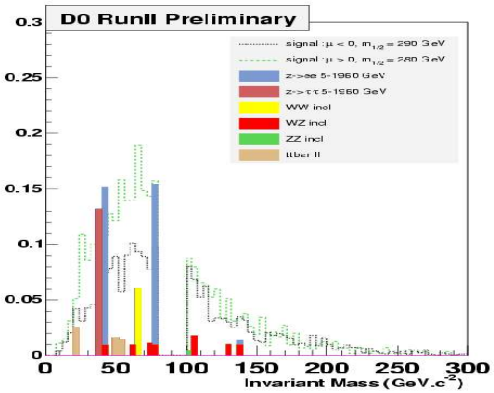












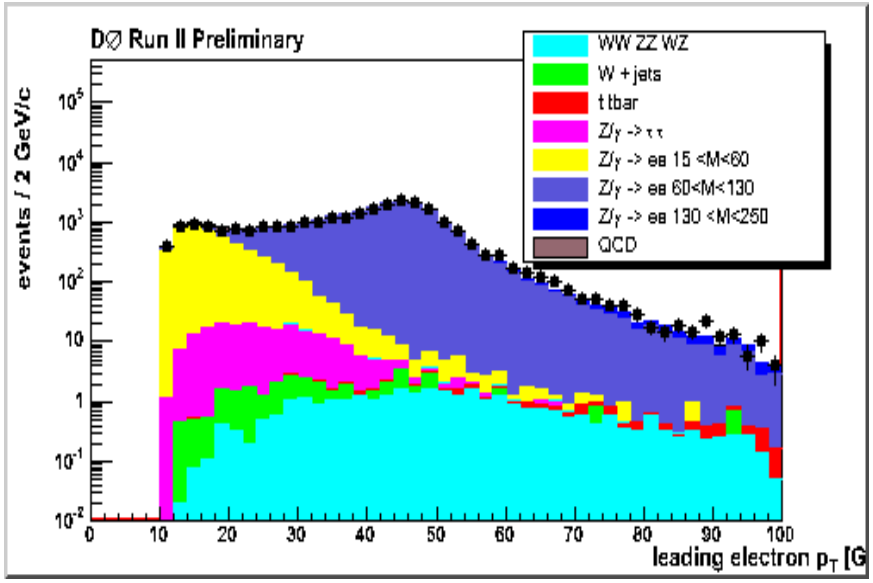
- mSUGRA:
  - M(neutralino1) > 110
  - M(chargino1) > 225

RPV λ_{133}

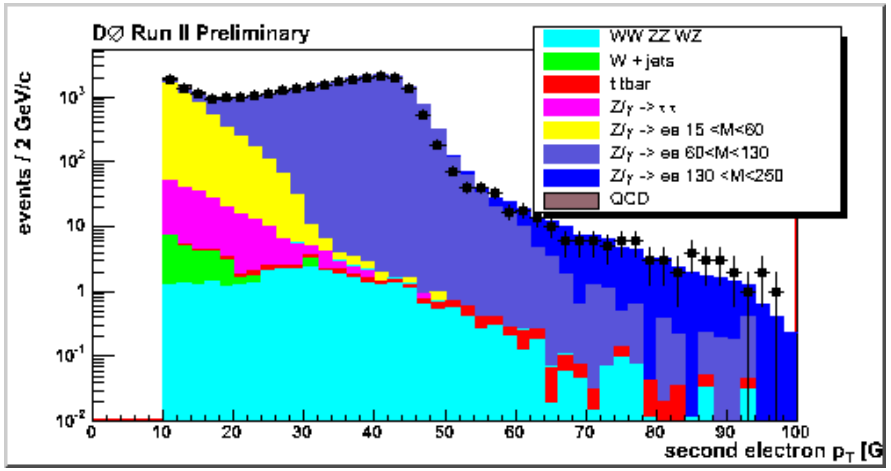
Anne-Catherine

• $\int$ **L dt ≈ 352 pb^{-1}**, EM+DIEM triggers.
Selection cuts : **2 isolated electrons** pT>10 GeV/c ($M_{ee} \in$ [18-80] GeV/c^2), **at least 1 hadronic tau** (isolated narrow jet) E_T>8 GeV, missig E_T $ME_T/\sqrt{(SE_T)}$>1.5

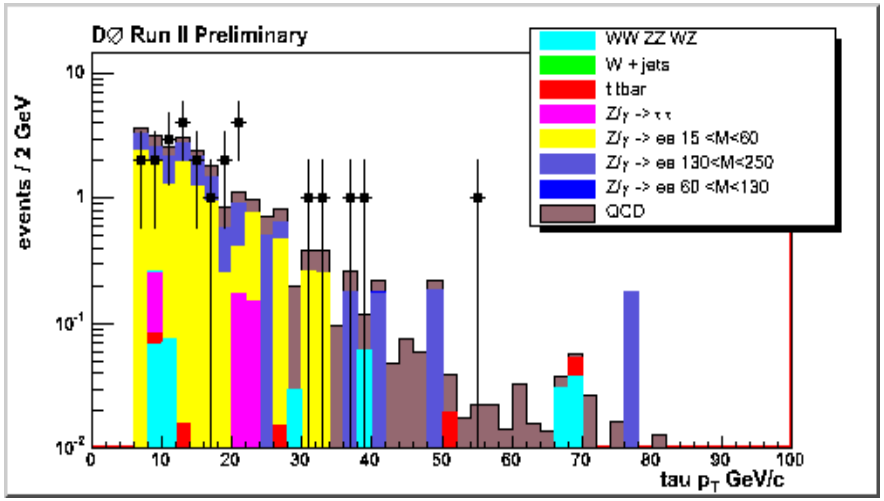
leading e- p_T



next to leading e- p_T



selected tau E_T



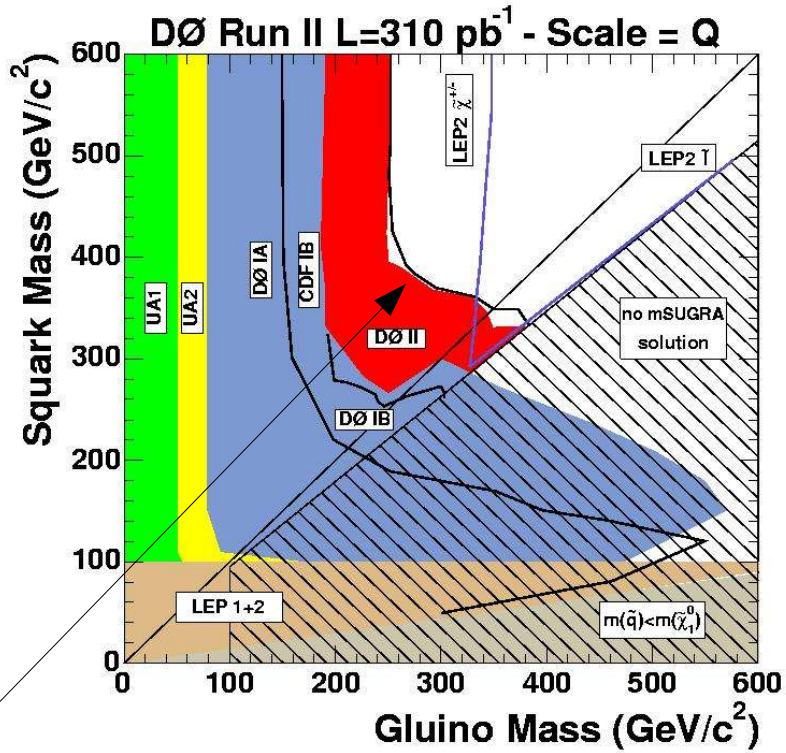
data : 1 event
Bkgs : 2.09 ± 0.8 (sys) ± 1.68 (stat)

- Analyses RPV envoyees a l'EB (032)
- Publications tres prochainement

- mSUGRA:
  - M(neutralino1) > 87
  - M(chargino1) > 168

Squarks and Gluino in Jets + MET Topology

- Summer 2005 : 310 pb-1
- Use JES eta corrections for data and MC, and data/MC relative JES correction for the MC
  - Lower JES systematic uncertainties
- More MC statistics, especially W+3 and 4 jets
- Detailed studies on the Z->ee +>= 2 jets events
- Treatment of data/MC differences for :
  - The bad jet cut
  - Jet reconstruction and identification efficiencies
  - Efficiency of the jet track confirmation
- CLs program : now use TLimit everywhere (We cross-checked that the program we used gives the same result)
- Re-optimization of the final cuts using the expected Cls
- Combine the 3 analyses (black contour)



For tan beta =3 , A = 0 , mu<0 in mSUGRA

Absolute limit on squark-gluino masses for the most conservative case

(lowest signal cross-section : mu = 2*Q)

M gluino > 234 GeV

M squark > 325 GeV

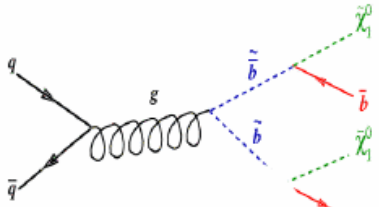
- Draft 1.1 of the analysis note sent to EB19 and available on :
  - http://www-d0.fnal.gov/~pverdier/d0_private/sqgl_summer2005/sqgl_analysisNote_v1.0.ps.gz

Recherche du sbottom: 2b+MET

Arnaud et Eric (transparent Marie-Claude)

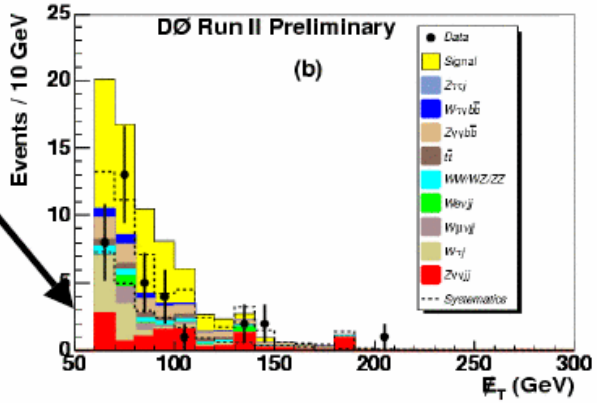
Samuel Calvet pour p17

Direct Production of $\tilde{b}\bar{\tilde{b}}$ decaying in $b\bar{b}\tilde{\chi}_1^0\bar{\tilde{\chi}}_1^0$



$BR(\tilde{b} \rightarrow b\chi_1^0) = 100\ \%$

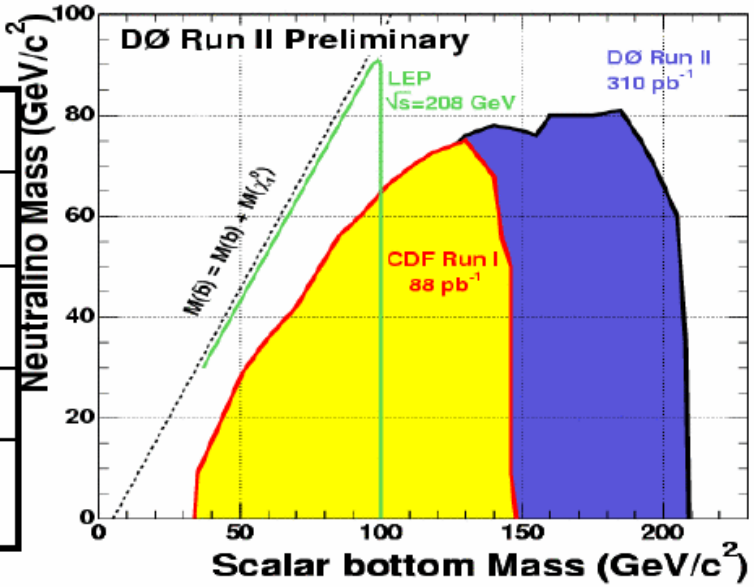
2 b-jets + $\not{E}_T$



Selection:

2 jets acoplanars (+3rd jet) + E_T^{miss} cut + single b-tag + lepton veto

$M(\tilde{b})$	Low val.	Med.val.	High val.
E_T(j1,j2) (GeV)	>(40,15)	>(40,15)	>(70,40)
E_T^{miss} (GeV)	>60	>80	>100
Data	36	15	2
SM exp.	38.6±2.8	19.6±1.7	4.4±0.4



Planning 2006

- Previsions contribution francaise:
  - conveners meeting 28 octobre

p17 Analyses for Moriond

RWTHAACHEN

Advertised last month as possible p17 results for Moriond '06:

Large extra dimensions in di-EM	(challenging)
SUSY trileptons	(challenging)
GMSB in $\gamma\gamma$+MET	(challenging)
LQ1 in eeqq	(challenging)
LQ1 in nunuqq / stop in c chi	(moved to p14 now)

Additional possible results:

- LED in Monojets
- W' in e nu
- LED / Z' in di-muons

Prime concerns voiced unanimously:

- (non-) availability of skimmed data sets
- high statistics MC (Pythia and V+jets)
- (object ID / JES / b-tagging certification)

p17 Analyses for Moriond

RWTHAACHEN

Large extra dimensions in di-EM

Understanding of data and MC (PMCS)

SUSY trileptons

High statistics W, Z as well as low-mass DY samples

Due to tau-ID problems at low pt, very challenging to get a large tan(β) result

GMSB in $\gamma\gamma$+MET

Most important: expect certified photon ID by mid-November

Certified b-tagging, fixed CAF data, and data quality information

Due to bug in D0 COMPHEP version, all backgrounds (W+γ, ...) need to be regenerated

Plan to set limits on $\gamma\gamma$ + X, $\gamma\gamma$ + b-jet, $\gamma\gamma$ + lepton

LED in Monojets

Monte Carlo availability (Z→nunu) and understanding

LQ1 in eeqq, W' in e nu, LED/Z' in di-muons: very hard for Moriond, analyses at early stage

Summer 2006

RWTHAACHEN

- Squarks/gluinos in jets+MET
- RS gravitons in dileptons and gammagamma
- Z', TC in dileptons
- Stopping gluinos
- LQ1 in enuqq
- LQ2 in mumu/munu qq
- LQ3 in tautauqq
- Gluinos in 4b+MET
- stop in c chi / sbottom in b chi
- RPV in e mu

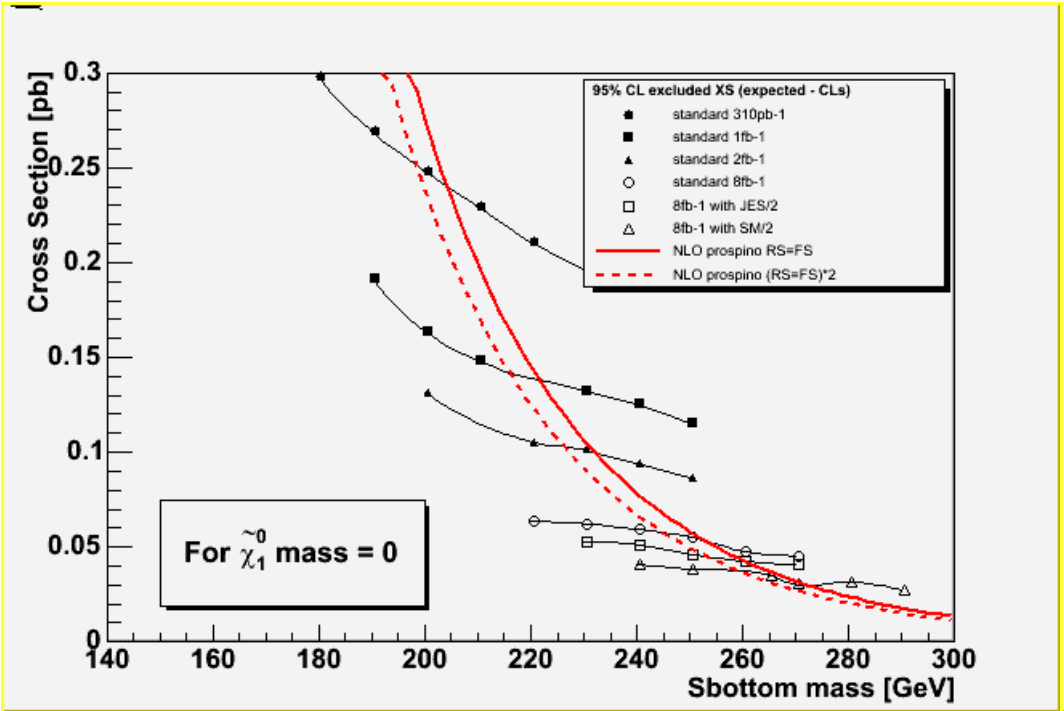
Theses

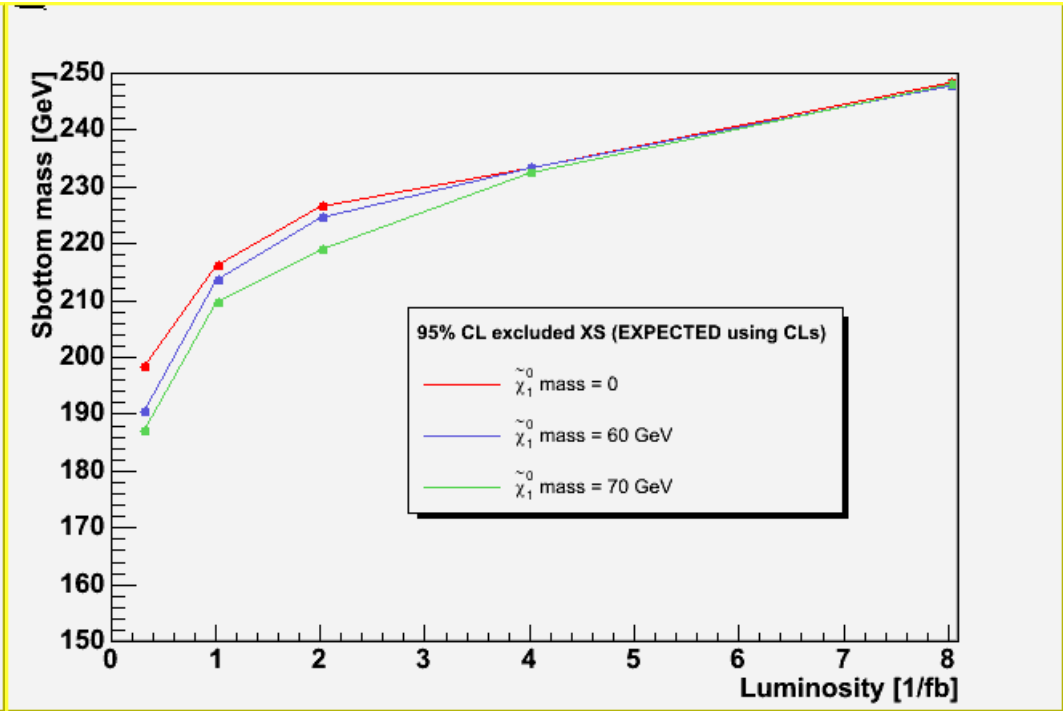
- Arnaud Gay Ires : stop -> btau
- Soutenance en 2006 :
  - Nikola Makovec LAL : LQ1LQ1 -> nunuqq + stop -> c chi10
  - Vincent Lesne LPC : trileptons dans le canal di muon de meme signe
  - Aurelien Mendes CPPM : stop -> blsnu (canal emu)
- Soutenance en 2007 :
  - Thomas Millet IPNL : gluino-gluino -> 4b+MET
  - Samuel Calvet CPPM : sbottom -> b chi10
- Soutenance en 2008 :
  - Bertrand Martin LPSC : squark-gluino-> leptons+jets+MET
  - Anne-Fleur Barfuss CPPM : LQLQ -> eeqq/ enuqq

Perspectives

- Pour la venue a Fermilab du comite P5 en septembre, des perspectives a 1,2,4,8 fb-1 ont ete effectuees. Les resultats sont disponibles sur :
  - http://www-cdf.fnal.gov/physics/projections
- Pour SUSY :
  - trileptons
  - squarks-gluinos
  - sbottoms

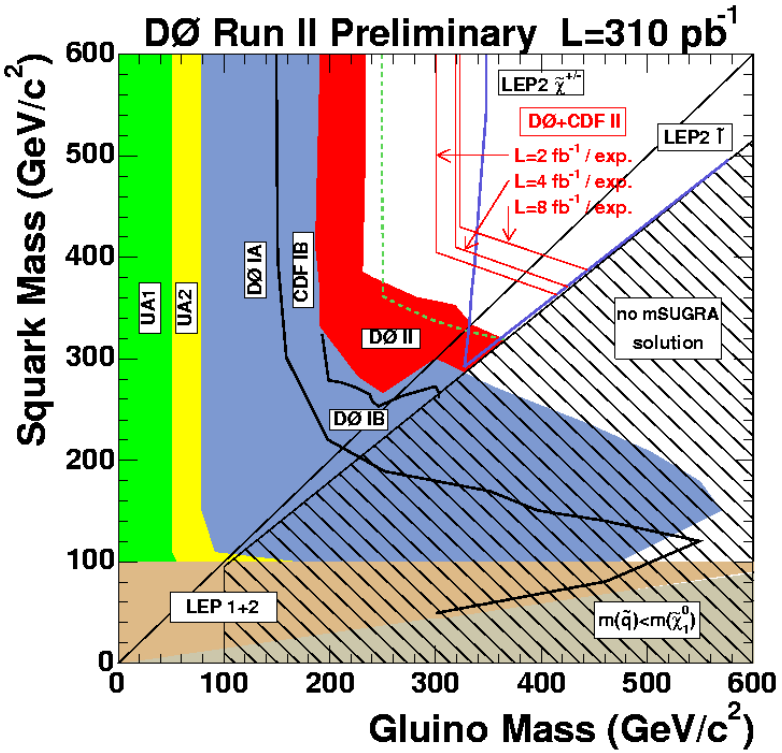
Sbottom -> b chi10

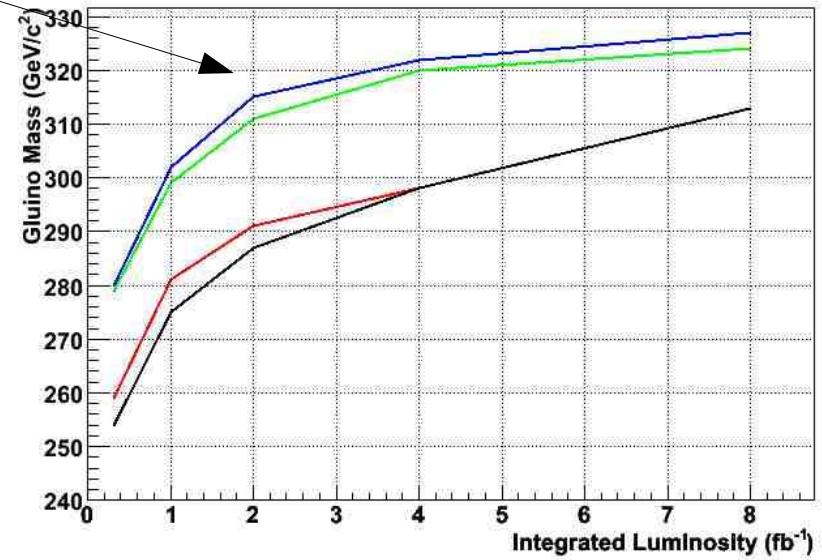




Perspectives squark-gluino

- Tous les resultats pour mu=Q (echelle de renormalisation et factorisation)
- Pour P5:
  - approximation : 2 *D0 ~= D0+CDF
  - analyse squark-gluino du mois de juillet “telle quelle”
- Dans l'analyse “gluino”, les 3 erreurs principales sont :
  - statistique MC
  - JES
  - section efficace SM bkg
- Scenarii pour m0=500 : (gluino-gluino domine)
  - noir : on ne change rien
  - rouge: erreurs JES et xsec back. divisees par 2
  - vert : rouge + back. divise par 2
  - bleu : vert + erreur stat = 5%
- Saturation car fonds irreductibles => ~ 140 evenements selectionnes avec 8 fb-1





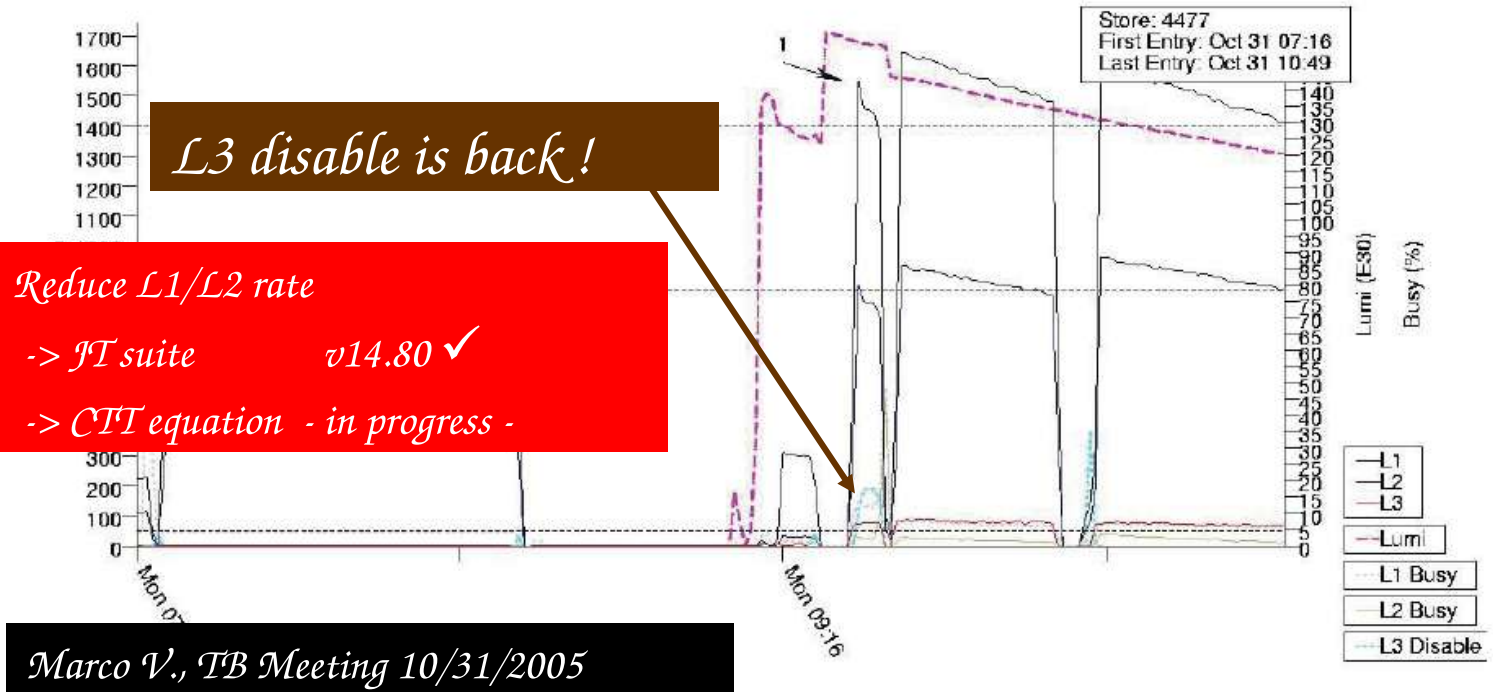
Trigger

- Initialement:
  - La trigger list v14 a ete optimise a 100E30 et devait pouvoir fonctionner jusqu'a 150E30
  - shutdown a l'automne 2005
- Maintenant :
  - Problemes de rate apparaissent a ~125-130E30
  - Grosse augmentation de la luminosite instantanee ces 3 dernieres semaines
  - shutdown au 1er mars 2006 : jusqu'ou la lumi va t-elle augmenter d'ici la ?
  - Tout ca retarde les etudes pour v15 car il faut que v14 marche maintenant

Monsters (today is Halloween)

Record Store 4477

Initial luminosity 157E30, prescale 150-160E30



Marco V., TB Meeting 10/31/2005

Triggers : Jets+MET

Thomas

- Summary of results for HZ :

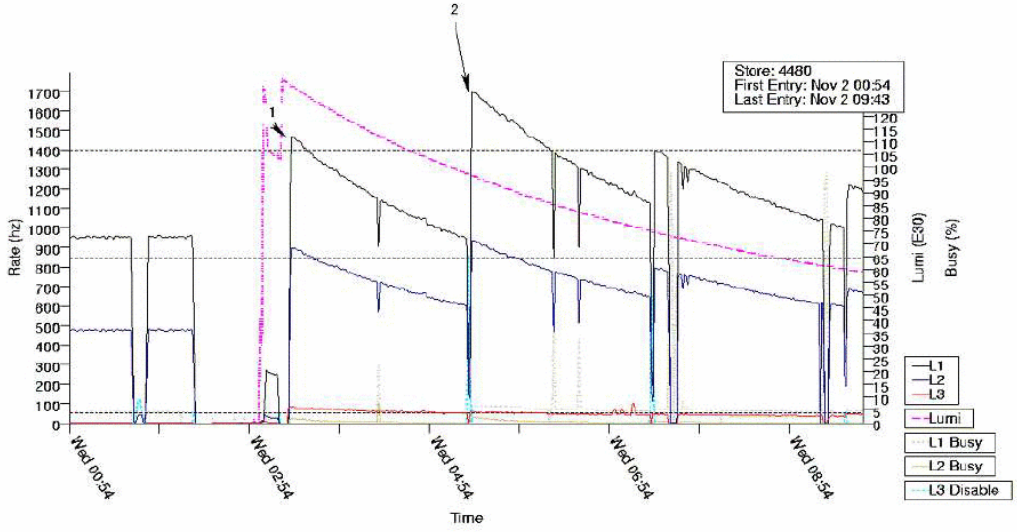
L1 Term	Relative L3 Efficiencies (%)	Relative efficiency loss (%)	L1 rates (Hz) at L=100E30	L1 Relative rate gain (%)
CJT(3,5)	89,1 ± 0,3	0,0	478 ± 10	24
CJT(3,5)CJT(3,4eta26)	89,1 ± 0,3	0,0	386 ± 9	0
CJT(3,5)CJT(2,4eta12)	84,9 ± 0,3	-4,7	305 ± 8	-21
CJT(3,5)CJT(3,4eta16)	85,5 ± 0,3	-4,0	249 ± 8	-35
CJT(3,5)CJT(2,4eta16)	88,1 ± 0,3	-1,0	345 ± 9	-11
CJT(3,5)CJT(3,4eta26)CJT(1,7eta18)	88,4 ± 0,3	-0,7	290 ± 8	-25
CJT(3,5)CJT(3,4eta16)CJT(1,7eta18)	85,3 ± 0,3	-4,3	218 ± 7	-44
CJT(3,5)CJT(2,4eta16)CJT(1,7eta18)	87,7 ± 0,3	-1,6	283 ± 8	-27
CJT(3,5)CJT(2,4eta16)CJT(2,7eta18)	83,5 ± 0,3	-6,3	152 ± 6	-61

After offline cuts

- Le probleme est surout au L1: il faut reduire les rates de nos triggers a ce niveau => Etudes avec :
  - Trigger Rate Tool
  - TrigSim
- Il faut maintenant passer tres rapidement aux etudes pour la trigger list v15

- Final decision : **CJT(3,5)CJT(3,4eta26)CJT(1,7eta18)**
  - Reduction of **25 %** for L1 rate and reduction of **29 %** and **15** for L2 rates (JT1 and JT2)
  - L1 rate at L=150E30 $cm^2.s^{-1}$: 435 Hz (linear approximation), rate : 56 Hz for JT1, 123 Hz for JT2
  - Relative Trigger efficiencies :
    - **89,1 % to 88,4 %** for HZ in ννbb
    - **90,6 % to 90,3 %** for Sbottom/Sbottom
- This tightened L1 Term was implemented in V14.80 Trigger List
- First store : 4480 and first run : 211518 (11/02/05)

- First results on data to conclude :



No L3 disable, and the L1 & L2 FEBs are back to normal, the triggerlist is doing what it is expected to do => smooth data taking ! (Carsten Magass)

11/03/2005 New Phenomena bi-weekly meeting Thomas Millet, Carsten Magass

Triggers : tau

LPC

- Definition et optimisation des trigger tau au L3:
  - pour v14
  - re-optimisation pour v15

τ triggers in v14.2

- Running τ Triggers in v14.2 – present (Proposed by τ-id + NP/ Higgs/ EW groups)
  - TAU1: single-τ trigger (*e.g.*, W' trigger, high-p_T physics)
    - L1: CJT(1,7.,eta1.8)* TIS(1,10.)
    - L2: L2JETTRK(1,7,10.,TIS)* ACOP(135)
    - L3:
      - TAU_LOOSE_TRACK_NN(p_T15.,NN0.3)* MET(CalMEt_PV3_NLC_N,12.)* TRKISO(p_T15.,L1)
      - TAU_LOOSE_TRACK_NN(p_T20.,NN0.5)* MET(CalMEt_PV3_NLC_N,15.)
      - TAU_LOOSE_TRACK_NN(p_T20.,NN0.0)* MET(CalMEt_PV3_NLC_N,15.)* TRKISO(p_T20.,L1)
      - TAU_LOOSE_TRACK_NN(p_T30.,NN0.3)* MET(CalMEt_PV3_NLC_N,20.)

    L1 and L2 stay same as v13 but L3 conditions are tighter to reduce rates
  - TAU2: single-τ trigger (*e.g.*, W →τν trigger, for luminosity < 50E30 running)
    - L1: CJT(1,7,eta1.8)* TIS(1,10)
    - L2: L2JETTRK(1,7,10,TIS)* ACOP(135)
    - L3: TAU_LOOSE_TRACK_NN(p_T10.,NN0.3)* MET(CalMEt_PV3_NLC_N,10.)

    L3 trigger would like to be run in addition to TAU1 and not 'or' with TAU1 and may require an extra L1-L2 bit
  - TAU3: multi-τ trigger (*e.g.*, H →ττ trigger, SUSY, etc...)
    - L1: TTK(2,10.)* TIS(1,10.)* CJT(2,5.)
    - L2: L2JETTRK(2,5,10,TTK)
    - L3: TAU_LOOSE_TRACK_NN(2τ, p_T10.,NN0.3)* TRK(2,p_T10.)* TRKISO(1,p_T10.,L1)

    L1 and L2 stay same as v13 and L3 condition has 2TRK10 added to cut rate.

Overall rates

		Rates (Hz) @100E30
a) TAU2_b (multi tau)		
	L3TAU10_NN03_TAU10_NN03*2TRK10*ISOTRK3_10_L1	0.32 +/- 0.09
b) TAU1 (single tau)		
TAU1_Low	L3MET(12)*L3TAU15_NN03*ISOTRK3_15_8_L1	0.32 +/- 0.09
TAU1_Medium1	L3MET(15)*L3TAU20_NN05	0.29 +/- 0.08
TAU1_Medium2	L3MET(15)*L3TAU20*ISOTRK3_20_8_L1	0.24 +/- 0.08
TAU1_High	L3MET(20)*L3TAU30_NN03	0.20 +/- 0.07
	Total trigger rate (a)+(b)	0.98 +/- 0.15

TAU1_low_luminosity wants to also run at lower luminosities < ~50E30

Evaluation of efficiency on MC sample

- gg->h->tau+tau-

mh =	120	140	160
TAU2_b	12.46%	15.5%	17.7%
TAU1_Low	22.95%	28.03%	33.3%
TAU1_Medium1	35.06%	41.65%	50.13%
TAU1_MED2	16.68%	21.15%	27.6%
TAU1_High	23.95%	31.51%	39.3%
efficiency	48.87%	56.28%	63.23%

Plans for v15: Revisiting Tau Trigger

Revisiting means understand what was done and test new approaches

- Which variables are discriminant ?
  - What is background?
  - What is signal?
    Which fraction of taus are already kept by other triggers?
- Are those variables robust?
- Limited number of neural networks?
  do not distinguish tau type, but allow flexibility wrt timing question
  - calorimeter based variables
  - calorimeter + tracker based variables
- Training with object really available in L3 online (not RECO)
- Investigate alternative multivariable methods

Conclusion

- Contribution importante de D0-France au groupe NP
- Il faut finaliser les analyses p14 et publier avec 300-350 pb-1
- Beaucoup de resultats sont attendus en 2006 avec ~1fb-1:
  - Moriond 2006 est un but difficile : production MC, certification JES/objects ID
- Les etudes de triggers sont fondamentales et representent actuellement une grosse fraction du travail:
  - Remarque : on travaille sur des donnees vieilles de plus d'un an pour les analyses, et sur la future prise de donnees, mais il y a finalement tres peu de personnes qui regarde les donnees que l'on est en train de prendre => potentiellement tres dangereux ...
- Certaines perspectives pour 1,2,4,8 fb-1 avaient deja ete presentees a la derniere reunion D0-France a Grenoble. Certaines de ces etudes ont ete refaites en septembre:
  - Pour les analyses avec un fond irredutcible important, le gain entre 4 (voir 2) et 8 fb-1 est faible
  - Mais, ce n'est pas le cas pour : RPV, etats finaux avec des b, tri-leptons car le niveau de fonds est faible
- Dans tres peu de temps :
  - donnees (1fb-1) et MC p17 seront disponibles pour les analyses. Il ne faut pas oublier qu'un gros travail a ete fait nottamnet sur le calorimetre et que la qualite et la comprehension des donnees va s'en ressentir.
  - Ce sont de tres bons moments pour l'analyse qui s'annoncent dans les mois qui viennent.