Resonant Slepton Production

Frédéric Déliot, CEA-Saclay

- model: mSUGRA with R-Parity violation
- productions via λ'_{ijk}:
  - resonant sneutrino production: 3 lepton signature analysis (chargino singly produced)
  - resonant slepton production: 2 like sign lepton signature analysis (neutralino singly produced)

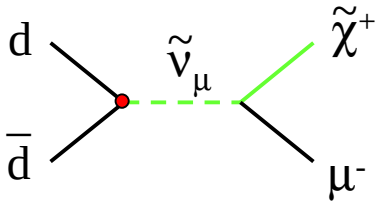
Resonant sneutrino production at Tevatron Run II:
Physics Letters B 475 (2000) 184
F. Déliot, G. Moreau, Ch. Royon, E. Perez, M. Chemtob

Single superpartner production at Tevatron RunII:
European Physical Journal C19 (2001) 155
F. Déliot, G. Moreau, Ch. Royon

Chargino Production Cross Sections

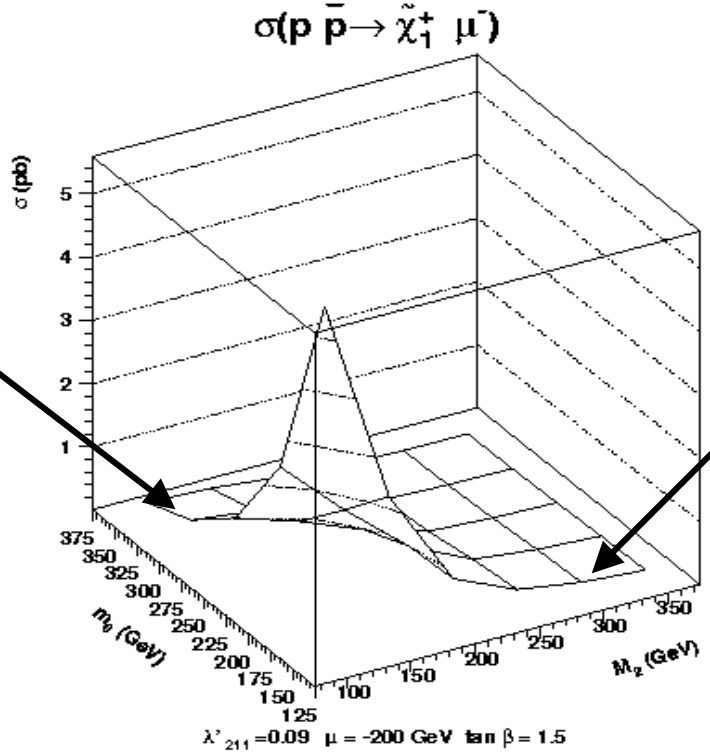
focus on λ'_{2jk}

chargino production cross section as a function of m_0 and M_2:



high sneutrino mass

high chargino mass



Chargino Production Cross Sections (2)

coupling values used: at their low-energy limits

$\sigma(\tilde{\chi}^+_1\mu)$ dominates over $\sigma(\tilde{\chi}^+_2\mu)$

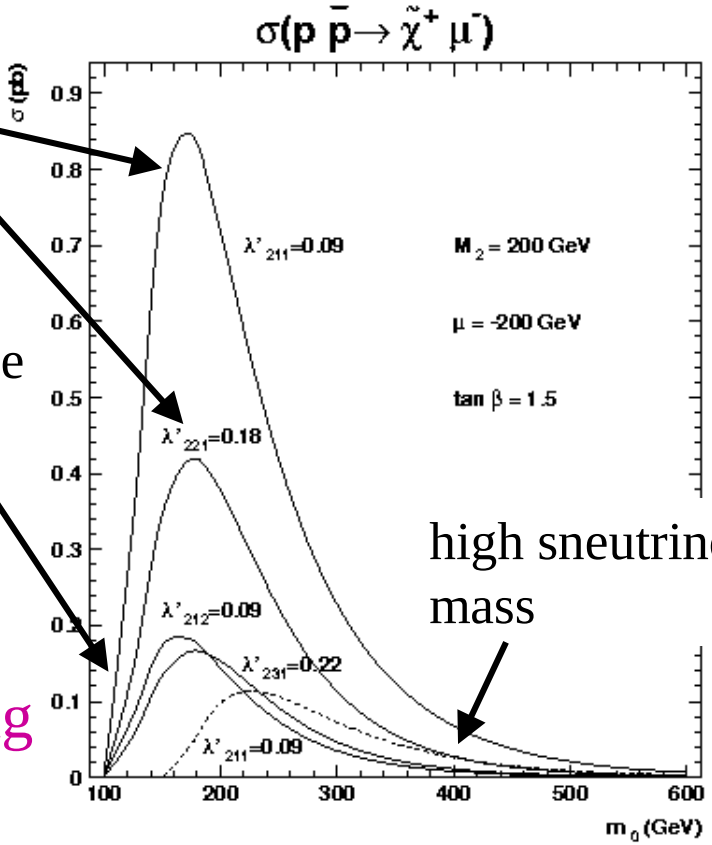
as a function of tanβ:

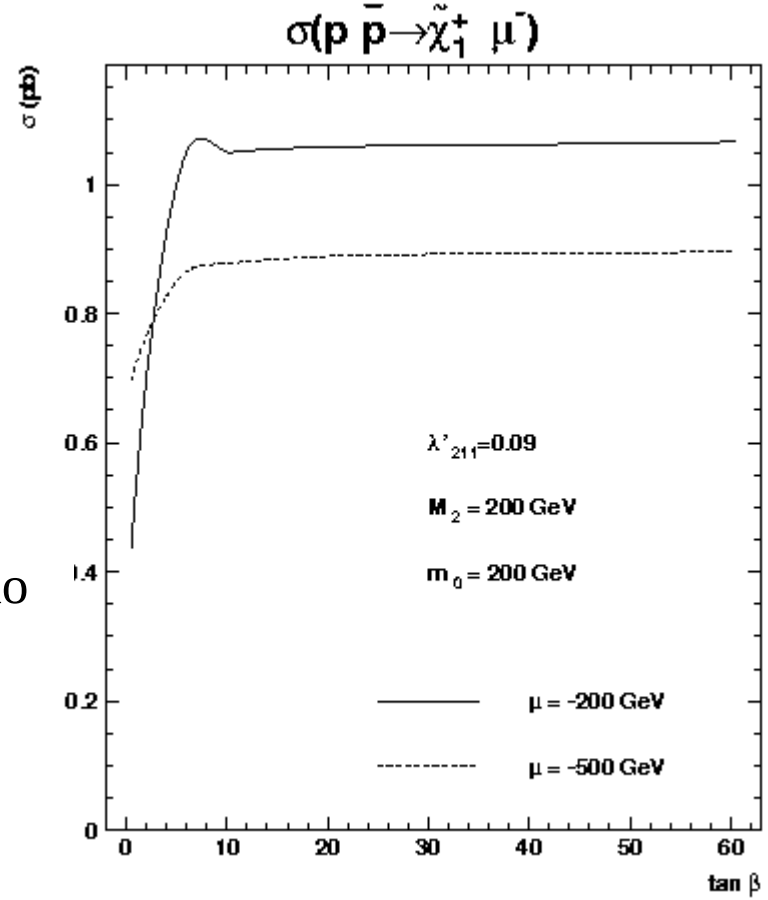
no strong dependency for tan β >10

different partonic densities

sneutrino mass close to chargino mass

high sneutrino mass



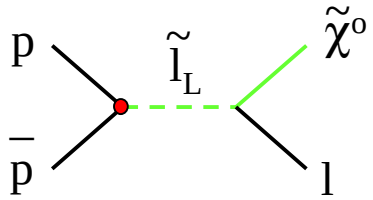


Conclusion:

many interesting couplings

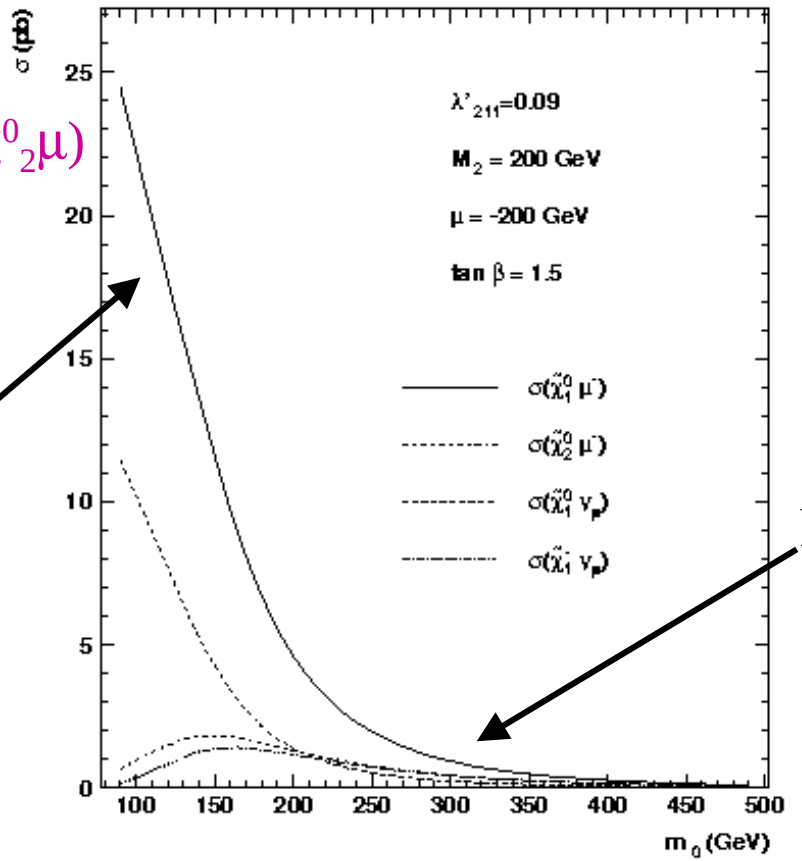
Neutralino Production Cross Sections

same dependency in tanβ and in M_2 as chargino production



as a function of m_0:

$\sigma(\tilde{\chi}^0_1\mu)$ dominates over $\sigma(\tilde{\chi}^0_2\mu)$



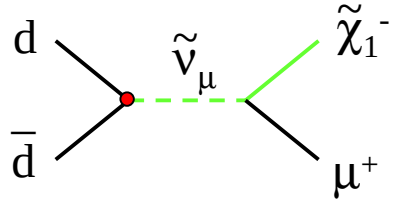
no decreasing because in mSUGRA mass of L slepton mass never close enough to neutralino 1 mass

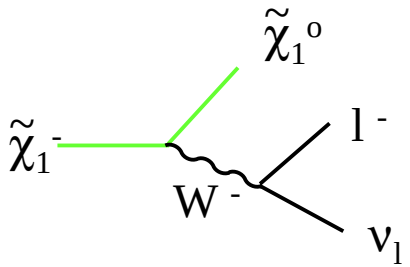
high slepton mass

3 lepton signature analysis

- signature with λ'_{211} :

  2 muons + lepton + 2 jets





- main standard model background:

  $t\bar{t}$, WZ, ZZ

- supersymmetric background:

  ex: pair production, cascade decays to LSP (1 lepton), LSP decays (2 leptons)

  only important for low m_0 and $m_{1/2}$

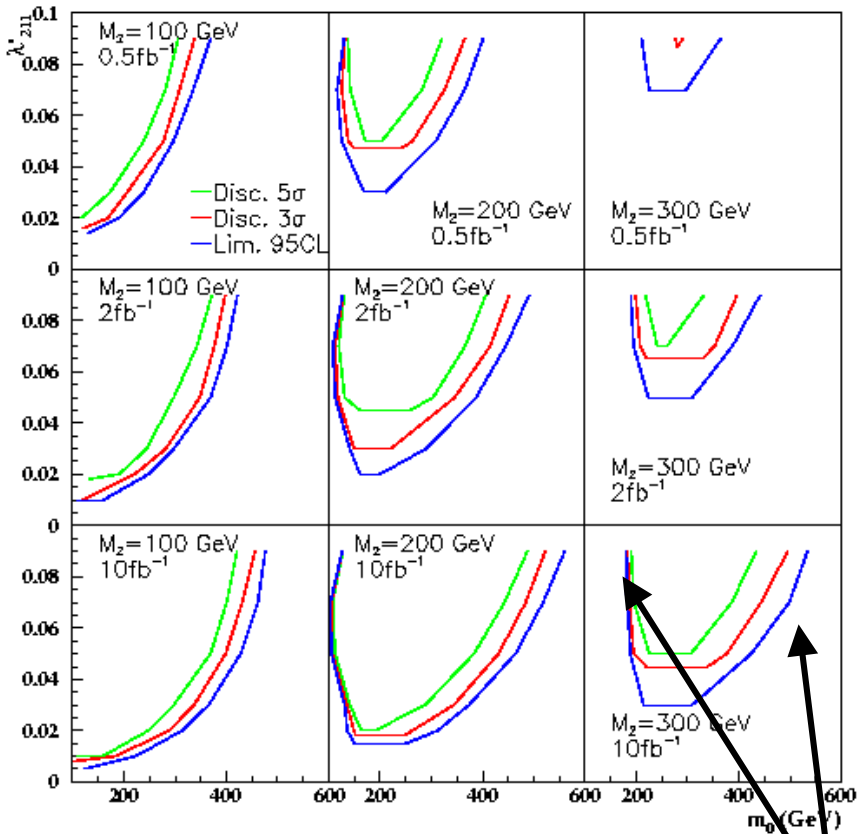
Cuts

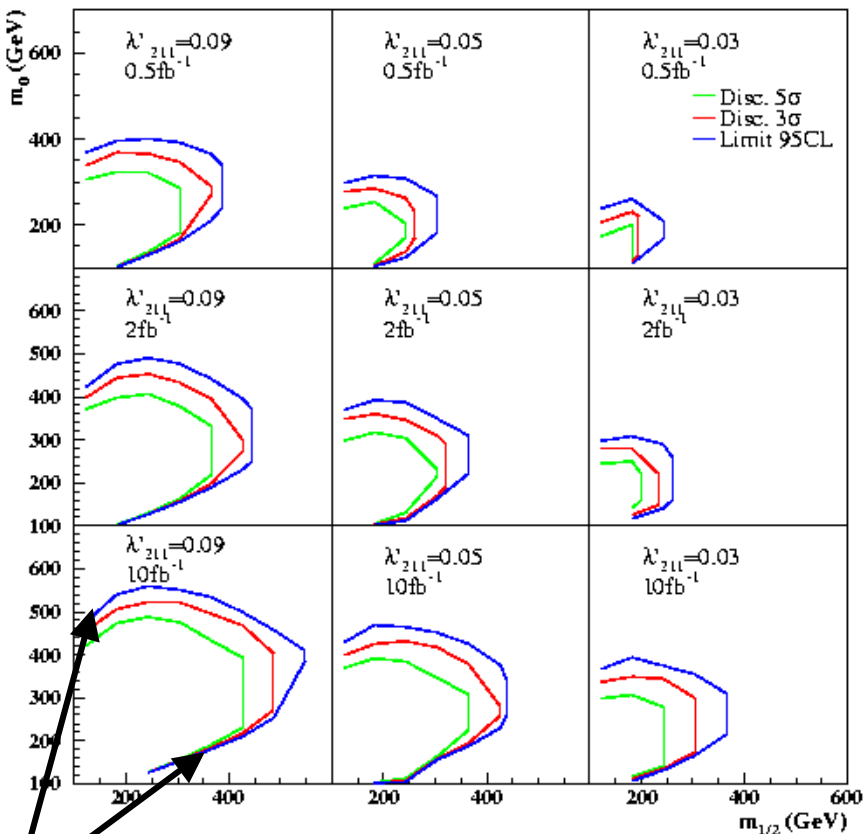
- signal generation: SUSYGEN
- background generation:
  - SM background: PYTHIA
  - SUSY background: HERWIG
- reconstruction: SHW (parametrization of the detector response)
- Cuts:
  - at least 3 leptons:

    with $E(l_1) > 20$ GeV, $E(l_2) > 20$ GeV, $E(l_3) > 10$ GeV
  - at least 2 jets with $P_t > 10$GeV
  - isolation between leptons and jets: $\Delta R = \sqrt{\Delta\theta^2 + \Delta\varphi^2} > 0.4$
  - isolation on leptons in a cone $\Delta R < 0.25$ around each lepton: $E_{jets} < 2$GeV

Results: Discovery Potential

- for λ'_{211}: sign(μ) < 0, tanβ = 1.5



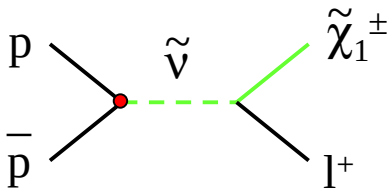


see cross section evolution

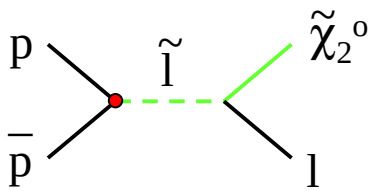
dimuon signature analysis

- signature with λ'_{211} :

  2 muons + 2 jets

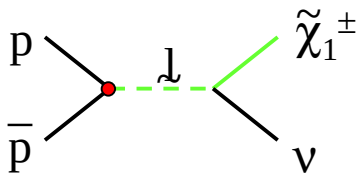


$\tilde{\chi}_1^{\pm} \longrightarrow \tilde{\chi}_1^{o}\ qq$

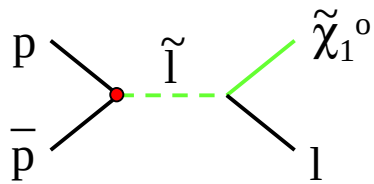


$\tilde{\chi}_2^{o} \longrightarrow \tilde{\chi}_1^{o} + X$

$\tilde{\chi}_1^{o} \longrightarrow l\ u\ d$



$\tilde{\chi}_1^{\pm} \longrightarrow \tilde{\chi}_1^{o}\ l^{\pm}\ \nu$



main contribution

- main standard model background:

  $t\bar{t}$, $b\bar{b}$, $t\bar{b}/\bar{t}b$, WW, WZ, ZZ

- supersymmetric background:

  ex: pair production, cascade decays to LSP, LSP decays (2 leptons)

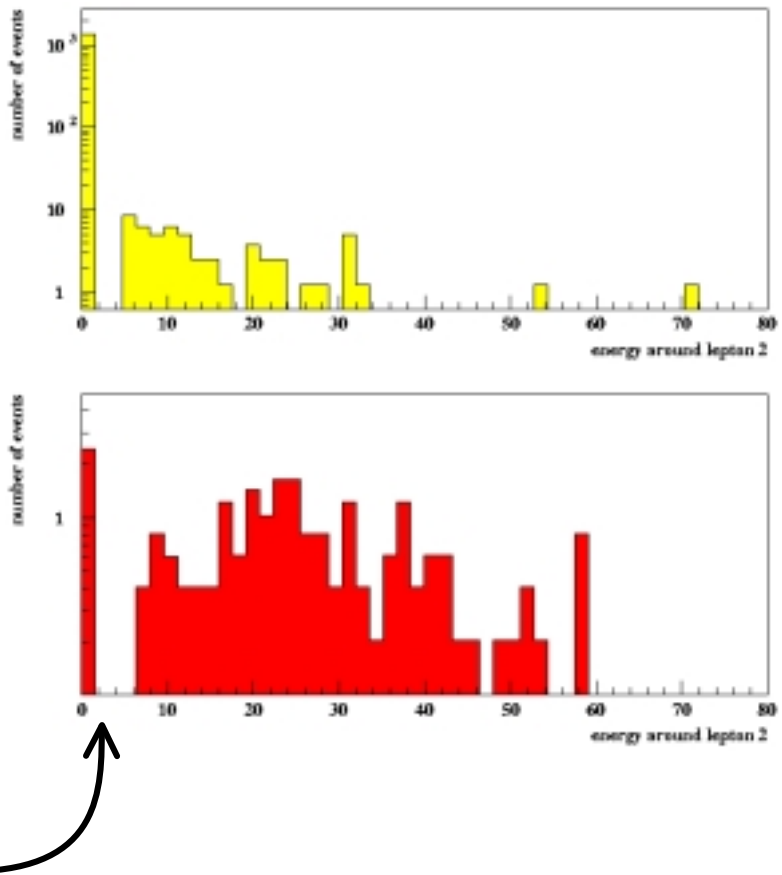
Cuts

- Cuts:
  - 2 like sign muons:

    with $E(l_1) > 20$ GeV, $E(l_2) > 20$ GeV
  - at least 2 jets with $P_t > 10$GeV
  - isolation between leptons and jets:

$$\Delta R = \sqrt{\Delta\theta^2 + \Delta\varphi^2} > 0.4$$

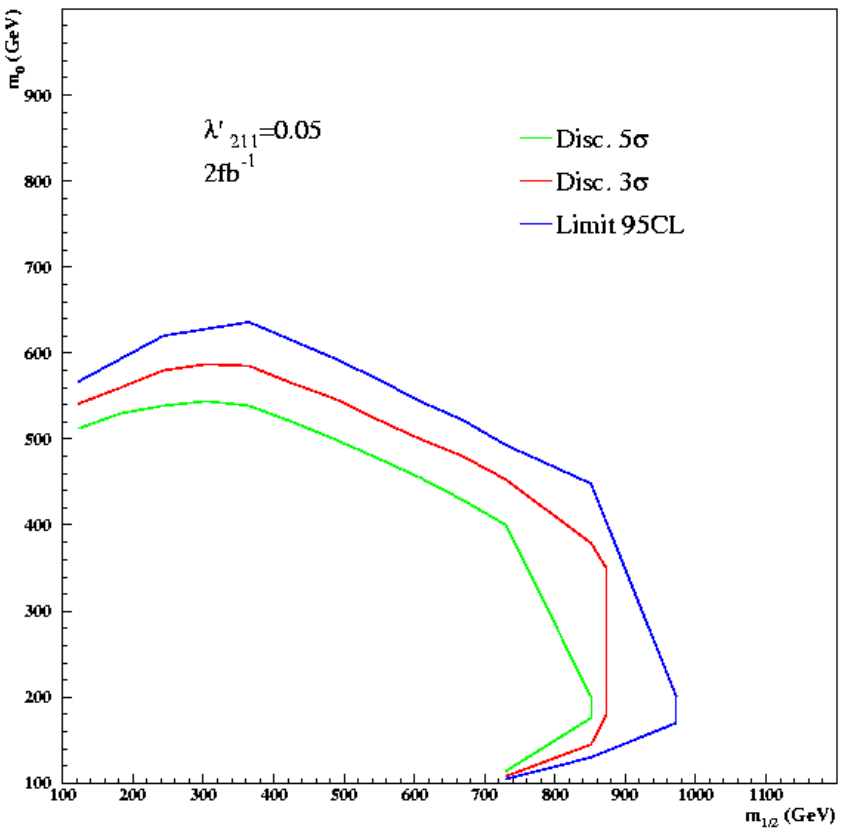
  - isolation on muons: in a cone $\Delta R < 0.25$ around each muon: $E_{jets} < 2$GeV



Results

- for λ'_{211}= 0.05, sign(μ) < 0, tanβ = 1.5

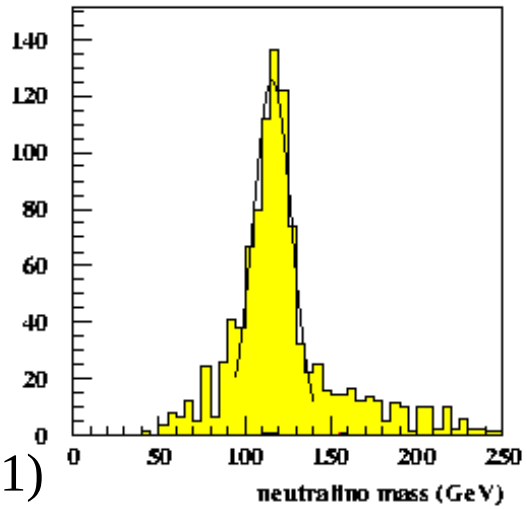
Higher sensitivity than the trilepton channel



simulation:

$m(\tilde{\chi}^0_1)$ = 127.1GeV

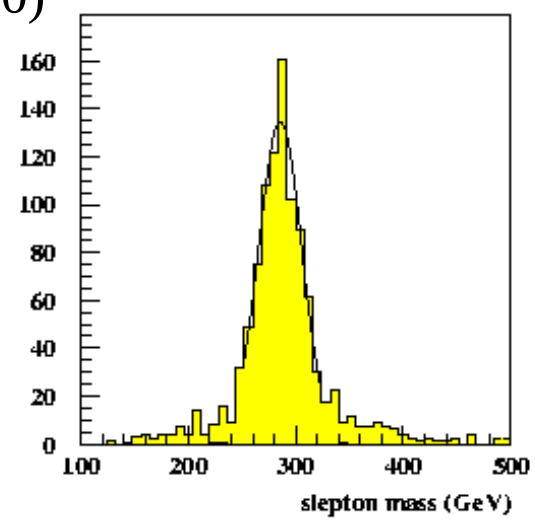
$m(\tilde{\mu})$ = 298GeV



$m(\tilde{\chi}^0_1)$ = 116 GeV (±11)

$m(\tilde{\mu})$ = 285 GeV (±20)

L = 10 fb^{-1}



Plans

- comparison fast/full simulation
- scan the plan $m_{1/2}$, m_0 with fast simulation (200 pb^{-1})
- full simulation/reconstruction for points around the expected CL contours
- data analysis before the october shutdown:
  - efficiency of high Pt muon and dimuon trigger
  - muon chamber efficiency
  - muon reconstruction efficiency (hit/segment/track)
- people involved: Christophe Royon, Frédéric Déliot (+ another person from Saclay?)