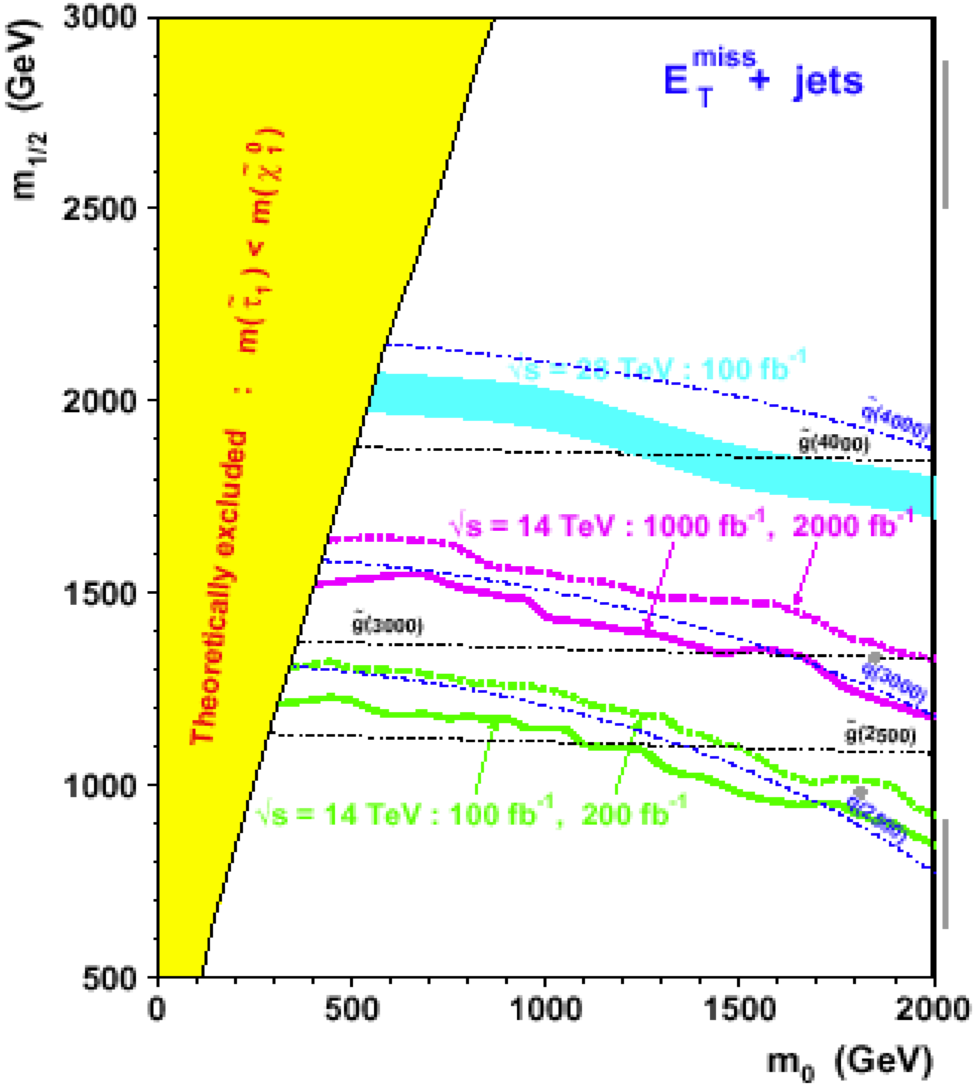
Squark and gluino mass determinations

Massimiliano Chiorboli & Alessia Tricomi
CMS Collaboration
Dipartimento di Fisica and INFN Catania

Mass reach @ 14 TeV vs 28 TeV



- Expected squark-gluino mass reach with CMS
  - 1.5 – 1.8 TeV with 10 fb^{-1}
  - 2.3 – 2.5 TeV with 100 fb^{-1}
  - 3.7 – 4.2 Tev with 100 fb^{-1} @28 TeV
  - 2.6 – 3.0 Tev with 300 fb^{-1}
  - 2.8 – 3.2 TeV with 1000 fb^{-1}

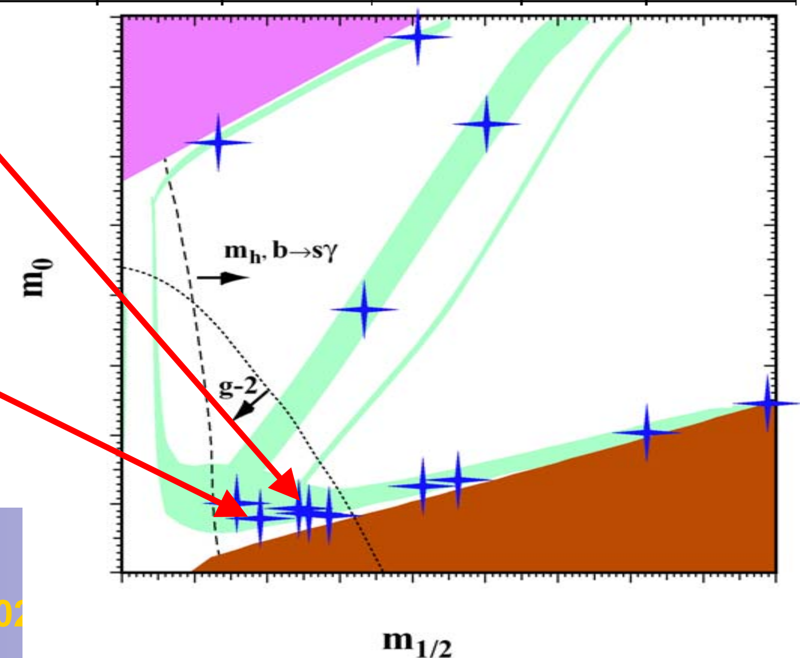
Sparticle's reconstruction

- Look at a particular decay chain and try to reconstruct sparticles for some set of mSUGRA parameters

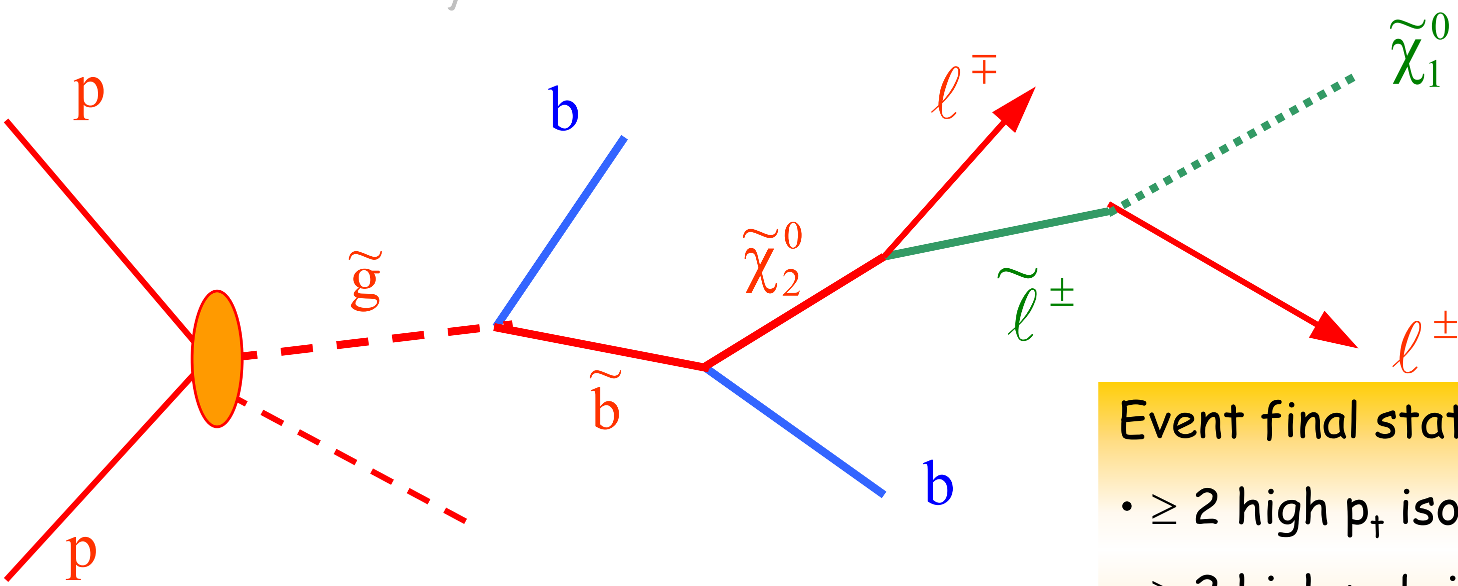
Proposed Post-LEP Benchmarks for Supersymmetry (hep-ph/0106204)

Model	A	B	C	D	E	F	G	H	I	J	K	L	M
$m_{1/2}$	600	250	400	525	300	1000	375	1500	350	750	1150	450	1900
m_0	140	100	90	125	1500	3450	120	419	180	300	1000	350	1500
$\tan\beta$	5	10	10	10	10	10	20	20	35	35	35	50	50
sign(μ)	+	+	+	−	+	+	+	+	+	+	−	+	+
$\alpha_s(m_Z)$	120	123	121	121	123	120	122	117	122	119	117	121	116
m_t	175	175	175	175	171	171	175	175	175	175	175	175	175

Chose point B & G as working points



Decay chain



Event final state:

- $\geq$ 2 high p_t isolated leptons OS
- $\geq$ 2 high p_t b jets
- missing E_t

• $\geq$ 2 isolated leptons, p_T>15 GeV, $|\eta|$<2.4

• $\geq$ 2 b-jets, p_T>20 GeV, $|\eta|$<2

SM bkg: tt, Z+jet, W+jet, ZZ, WW, ZW

Point B spectra

$m_{1/2} = 250$ $\quad sign(\mu) = +$

$m_0 = 100$ $\quad A_0 = 0$

$\tan\beta = 10$

Point B

$\sigma^{TOT}_{SUSY} = 57.77$ pb

g	595.1	t_L	392.9
b_L	496.0	t_R	575.9
b_R	524.0	χ_4^0	361.1
q_L	559	χ_3^0	339.9
q_R	520	χ_2^0	174.4
l_L	196.5	$\chi_2^\pm$	361.6
l_R	136.2	$\chi_1^\pm$	173.8
		χ_1^0 = LSP	95.6

$pp \rightarrow \tilde{g} \rightarrow \tilde{b}b$ (17% b_L, 10% b_R)

$\quad \rightarrow \tilde{\chi}_2^0 b$ (37 % b_L, 25% b_R)

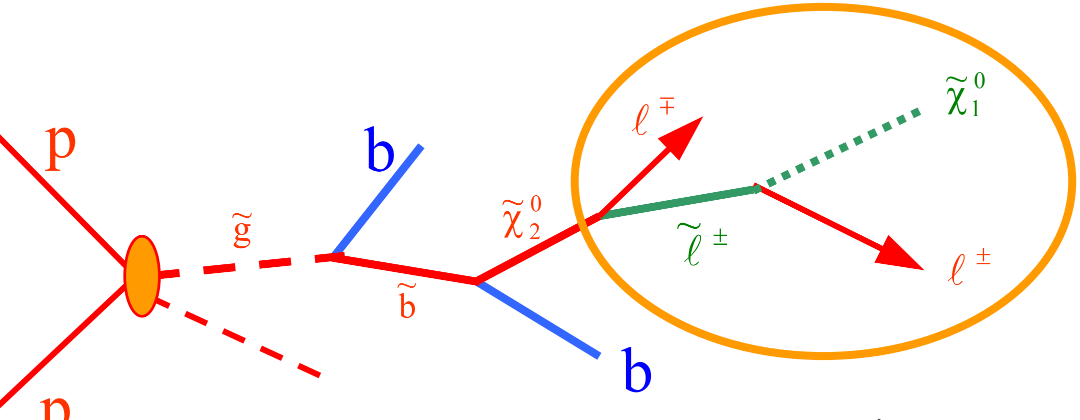
$\qquad \rightarrow \tilde{\chi}_1^0 \ell^+ \ell^-$ (0.04 %)

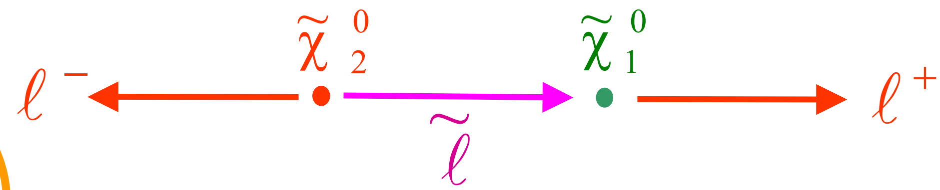
$\qquad \rightarrow \tilde{\ell}^\pm \ell^\mp \rightarrow \tilde{\chi}_1^0 \ell^+ \ell^-$ (16.4 %)

$\qquad \rightarrow \tilde{\tau}^\pm \tau^\mp \rightarrow \tilde{\chi}_1^0 \tau^+ \tau^-$ (83.2 %)

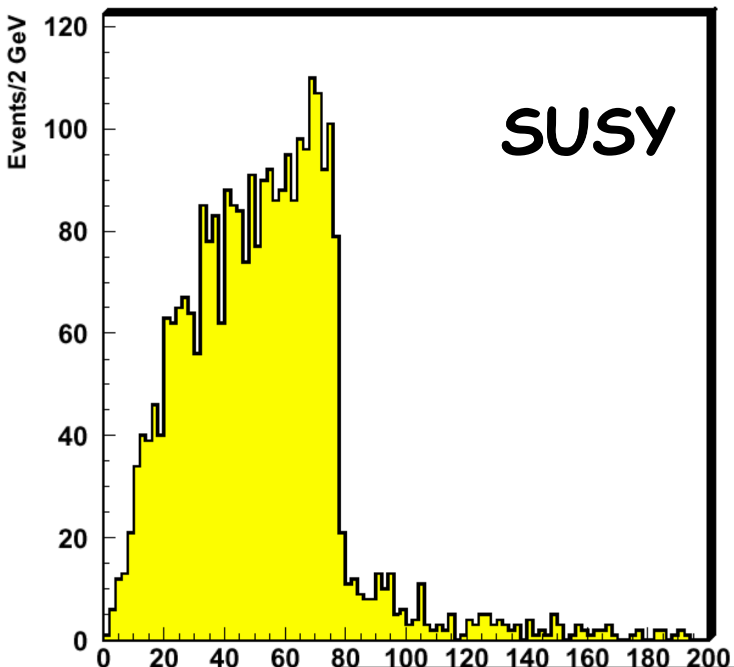
ISAJET 7.58
PYTHIA 6.152

First step: $\chi_2^0 \to l^+l^- \chi_1^0$





$$M_{\ell^+\ell^-}^{max} = \frac{\sqrt{(M^2_{\tilde{\chi}_2^0} - M^2_{\tilde{\ell}})(M^2_{\tilde{\ell}} - M^2_{\tilde{\chi}_1^0})}}{M_{\tilde{\ell}}}$$

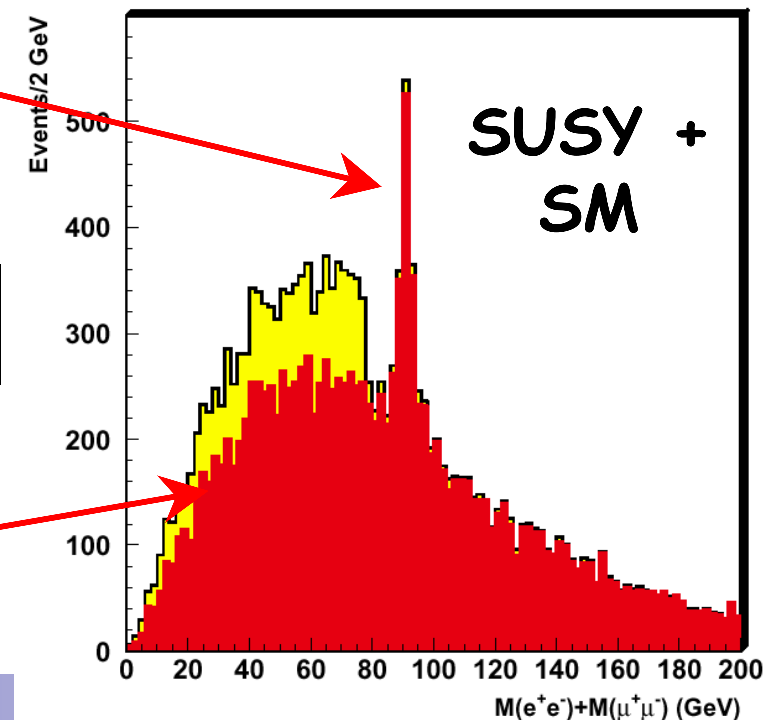


$M(e^+e^-) + M(\mu^+\mu^-)$

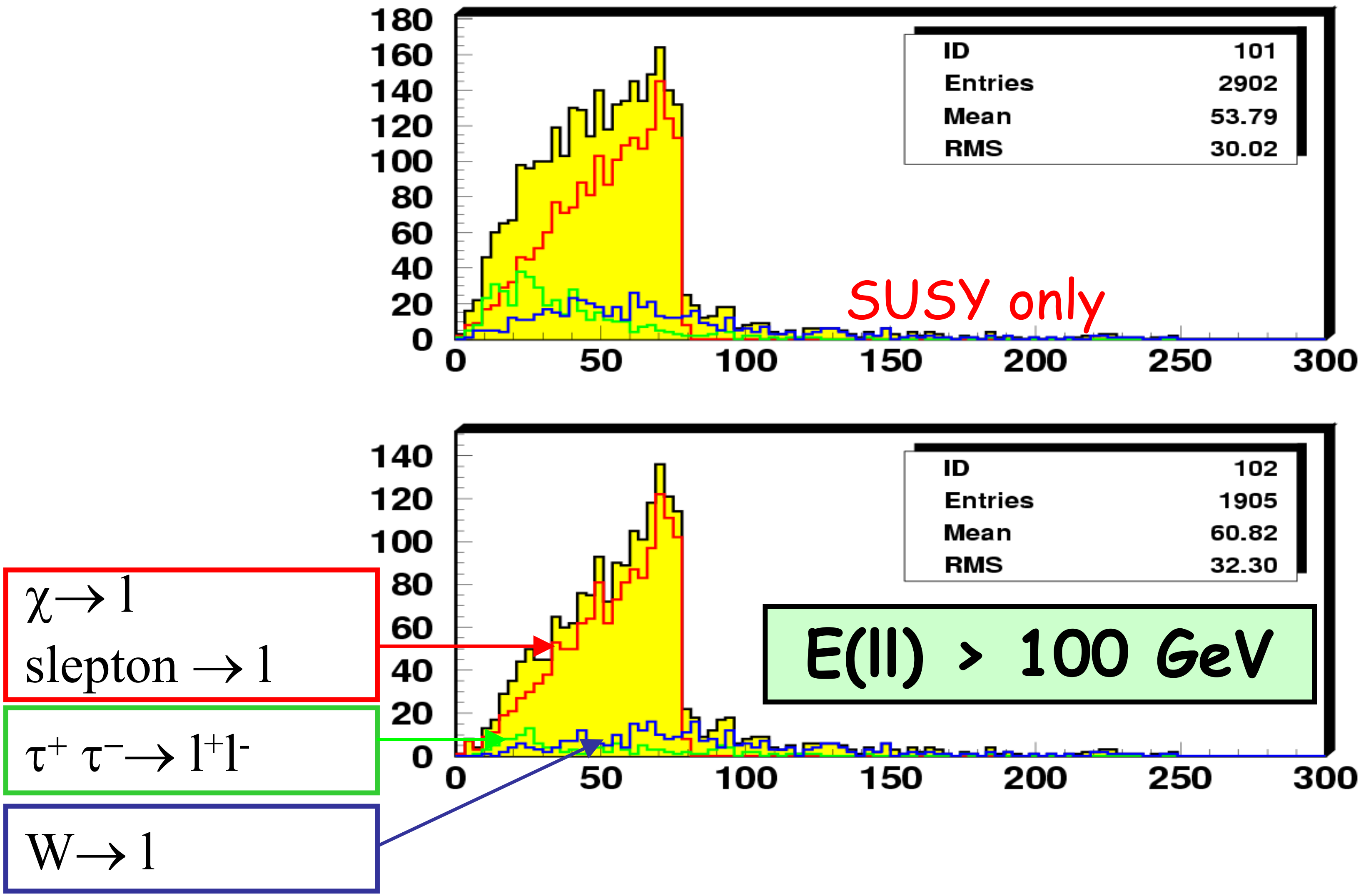
10 fb^{-1}

Z+jet

tt

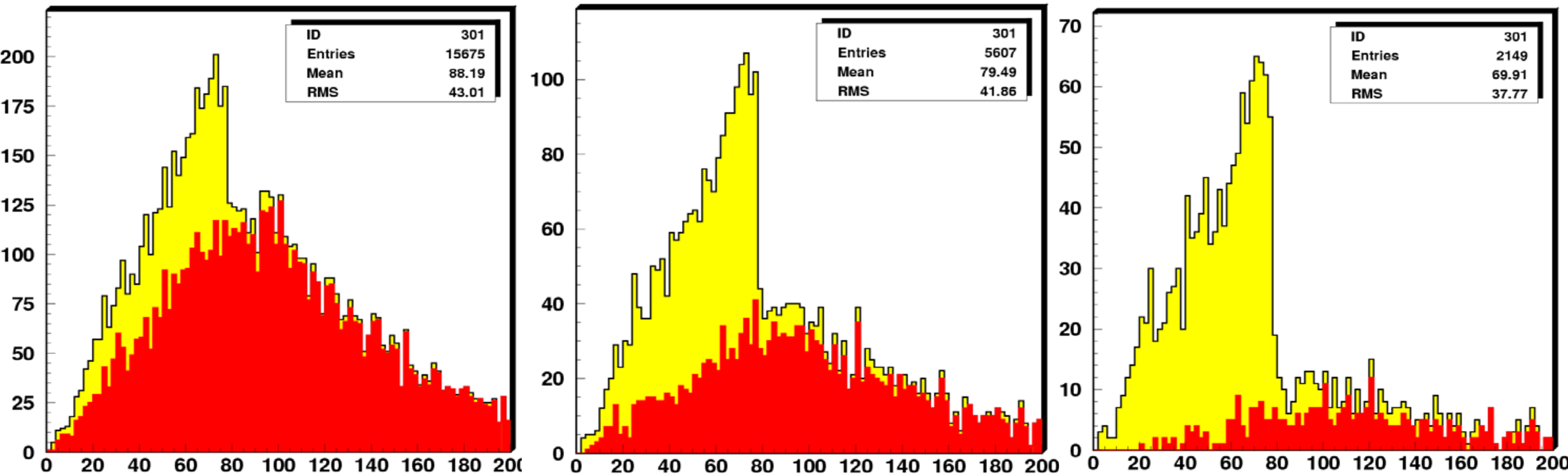


Dilepton edge



Dilepton edge

E(ll) > 100 GeV

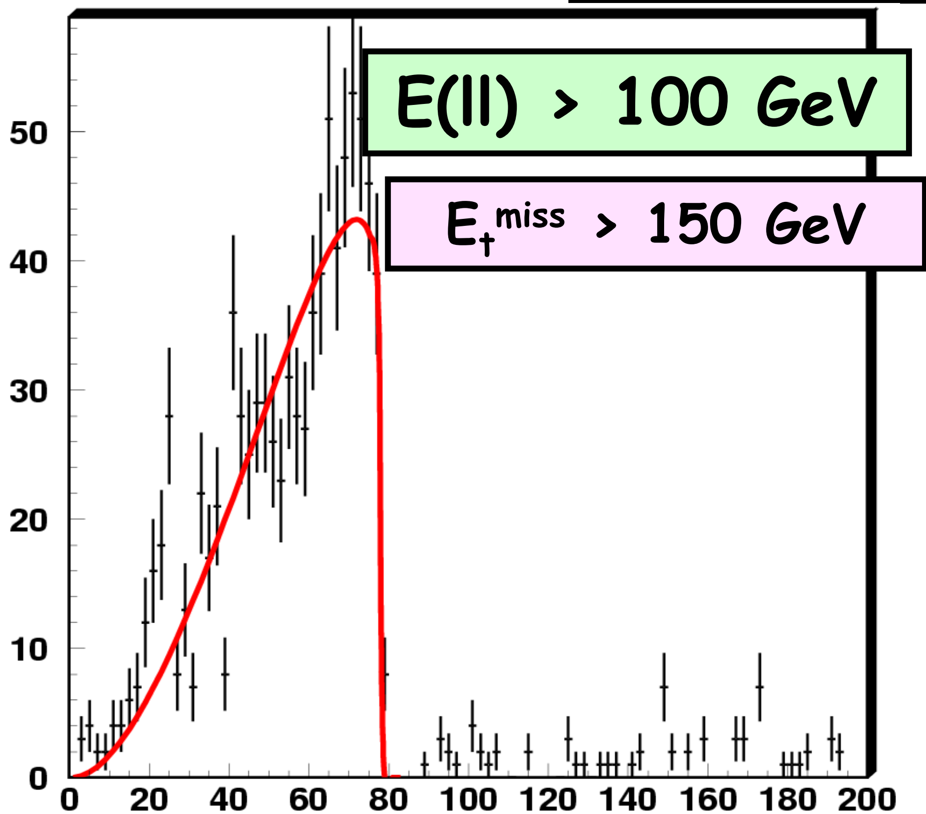


E_t^{miss} > 50 GeV | **E_t^{miss} > 100 GeV** | **E_t^{miss} > 150 GeV**

Working point

Dilepton edge fit

$M(e^+e^-) + M(\mu^+\mu^-) - M(e^+\mu^-) - M(e^+\mu^-)$

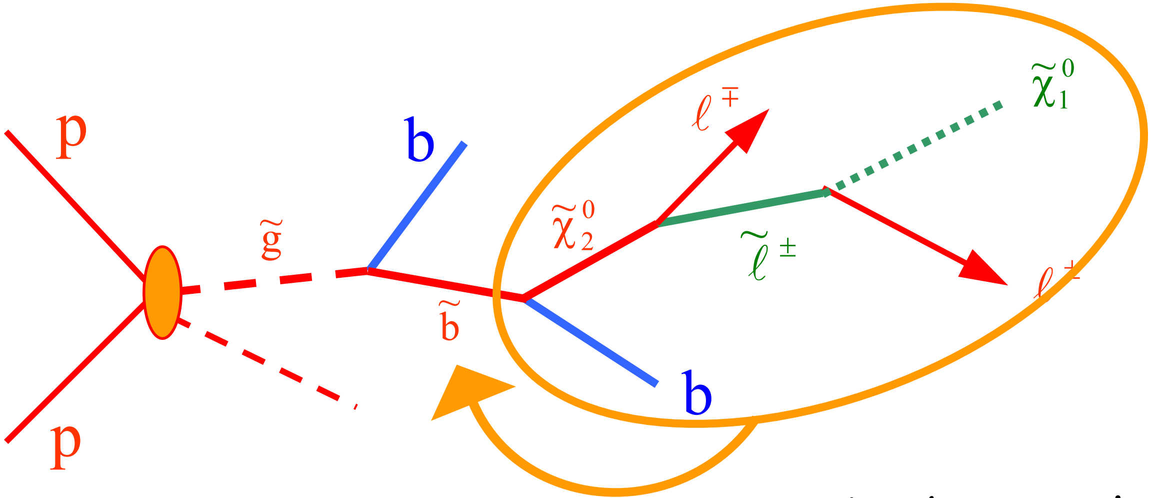


$$M^{max}_{\ell^+\ell^-} = \frac{\sqrt{(M^2_{\tilde{\chi}^0_2} - M^2_{\tilde{\ell}})(M^2_{\tilde{\ell}} - M^2_{\tilde{\chi}^0_1})}}{M_{\tilde{\ell}}} = 78.16\ \text{GeV}$$

Fit result:

$$M^{max}_{\ell^+\ell^-} = 85.48 \pm 0.91\ \text{GeV}$$

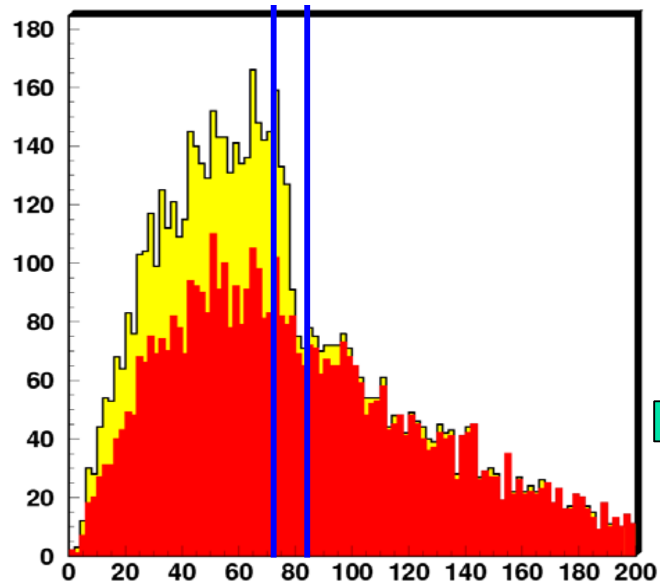
Sbottom reconstruction



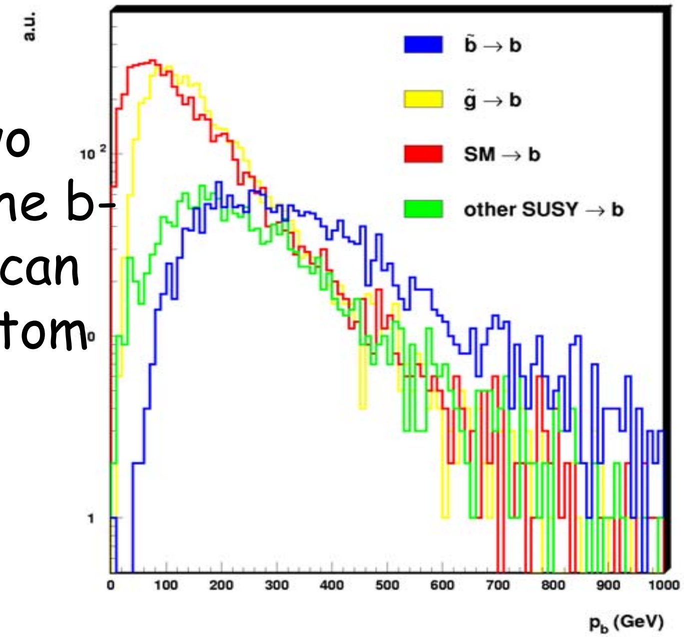
Assuming $M(\chi_1^0)$ known!

$$\vec{p}_{\tilde{\chi}_2^0} = \left(1 + \frac{M_{\tilde{\chi}_1^0}}{M_{\ell^+\ell^-}}\right)\vec{p}_{\ell^+\ell^-}$$

Combining the χ_2^0 obtained from the two leptons with one of the b-jets of the event we can reconstruct the sbottom



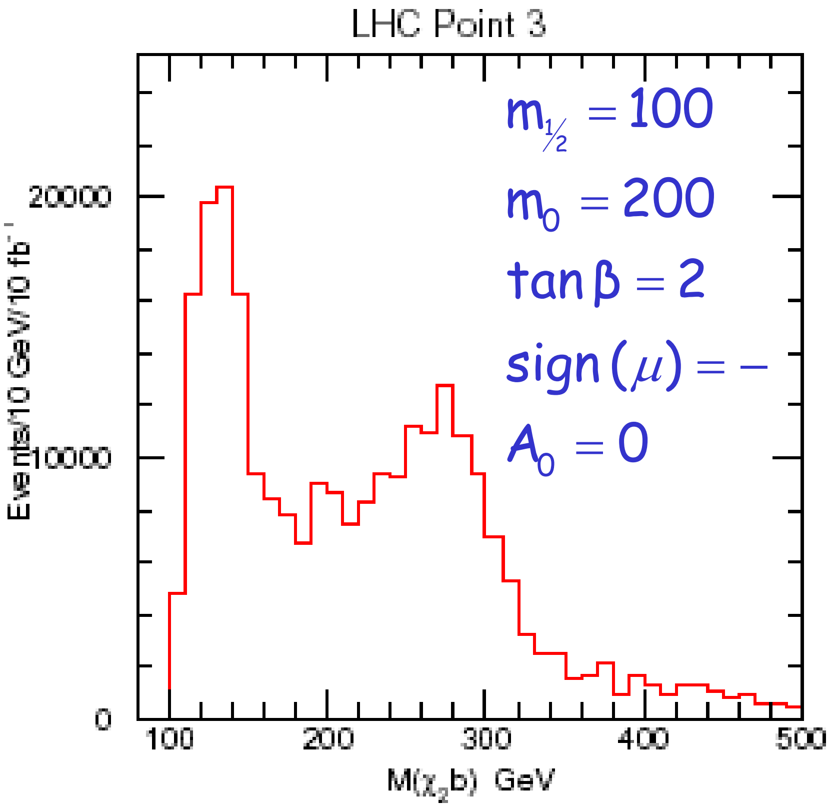
$65\ GeV < M_{\ell^+\ell^-} < 81\ GeV$

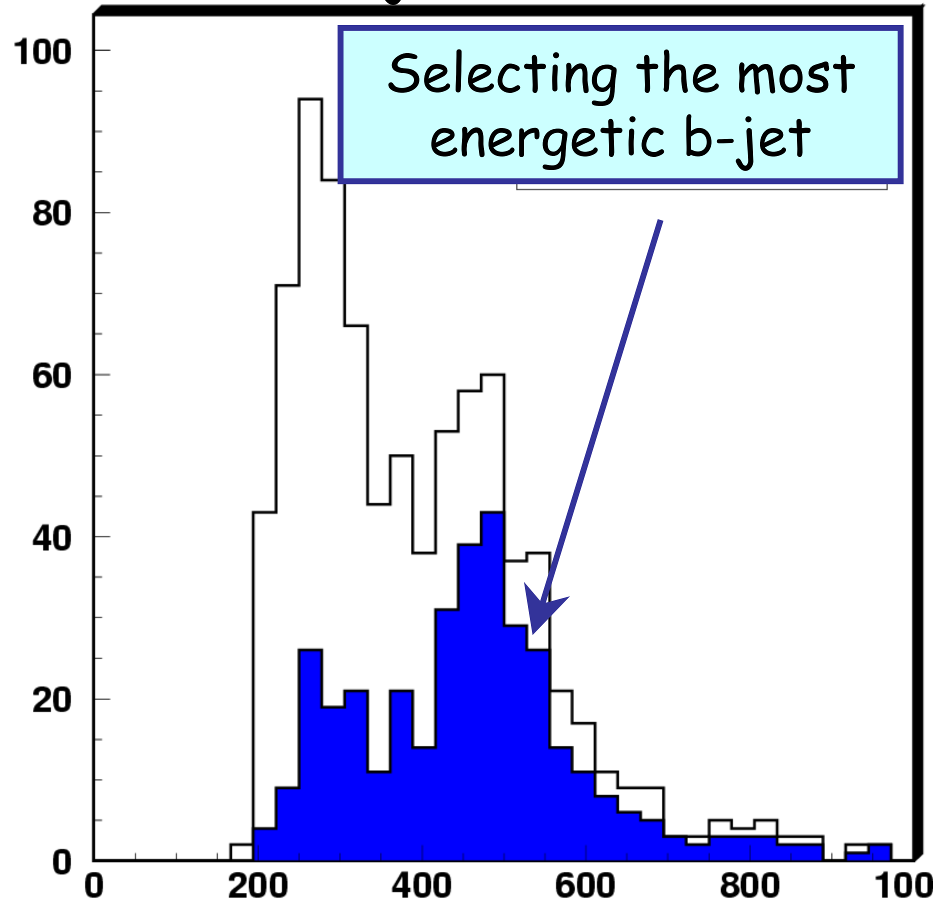


The ATLAS method

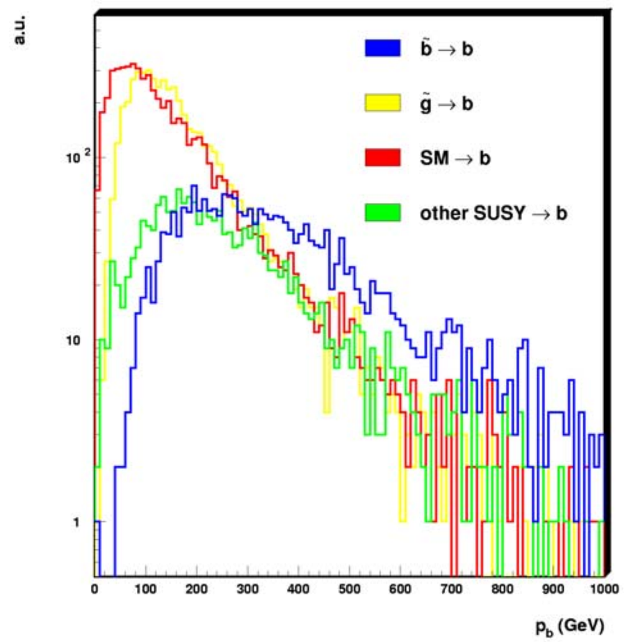
ATLAS Note Phys-109 (Hinchliffe, Paige...)

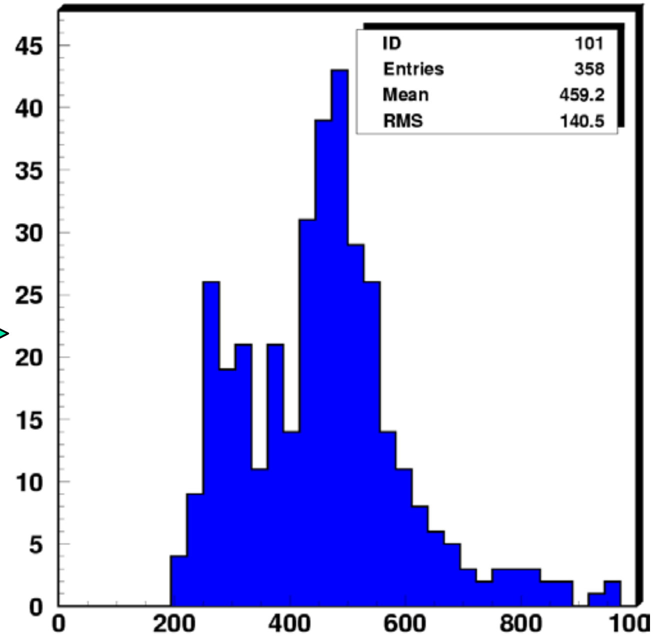
Combination of the dilepton pair with all the b-jets in the event

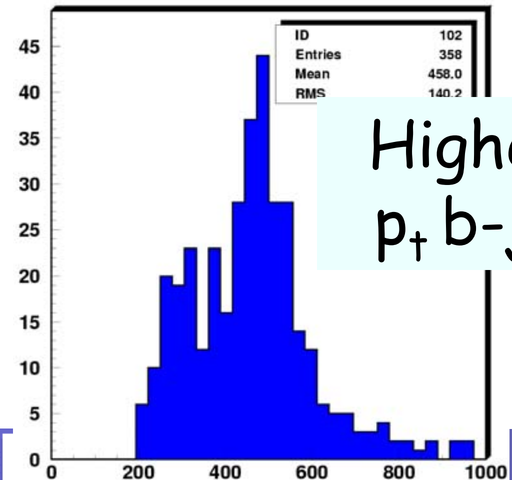




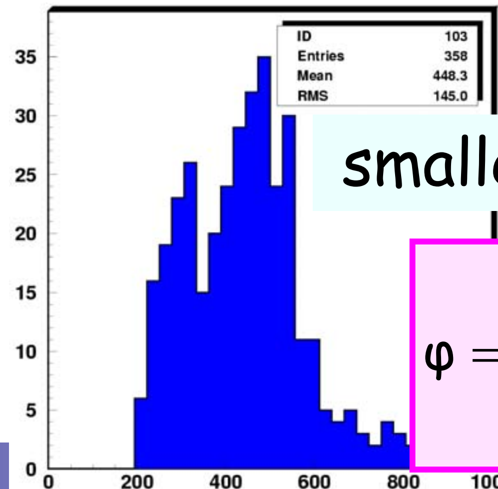
Sbottom reconstruction



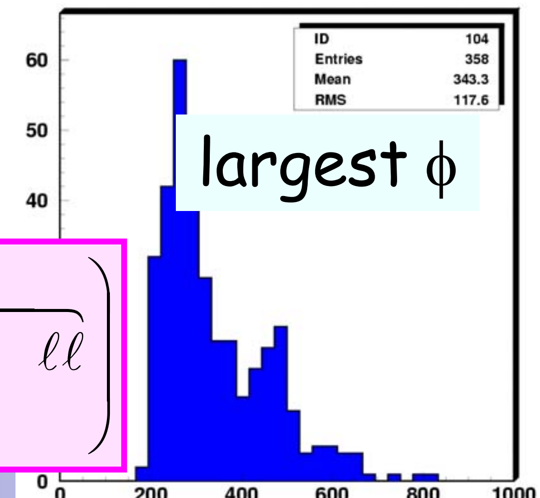




Highest p_t b-jet



smallest ϕ



largest ϕ

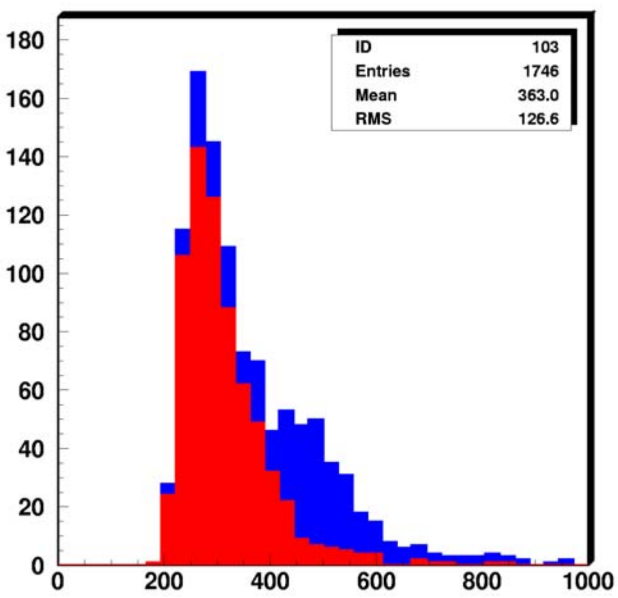
$$\varphi = \text{angle}\left(\overbrace{b-\text{jet} \quad \ell\ell}\right)$$

Sbottom reconstruction

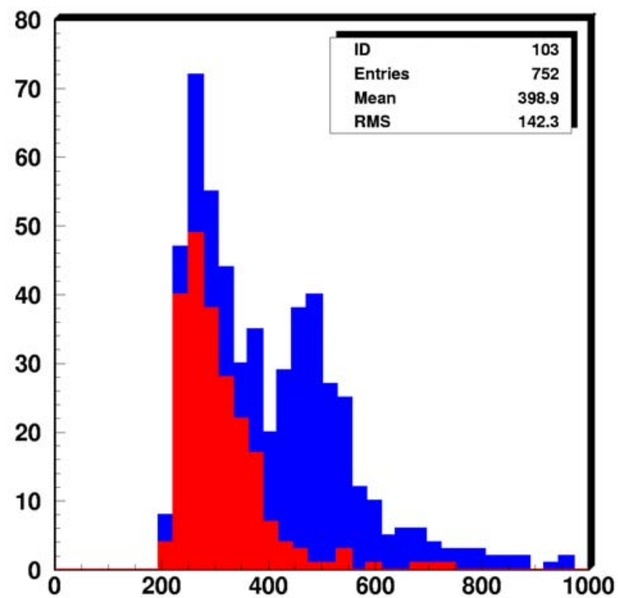
Chose the most energetic b-jet

$$\vec{p}_{\tilde{\chi}_2^0} = \left(1 + \frac{M_{\tilde{\chi}_1^0}}{M_{\ell^+\ell^-}}\right)\vec{p}_{\ell^+\ell^-}$$

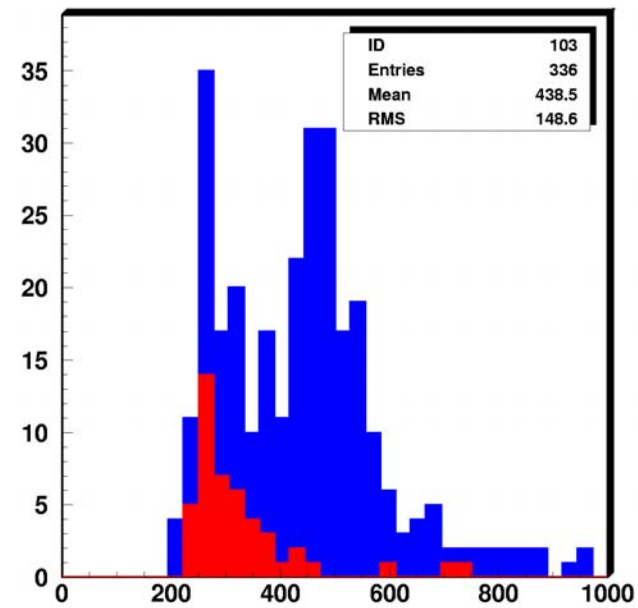
MC true



$E_t^{miss} > 50$ GeV



$E_t^{miss} > 100$ GeV



$E_t^{miss} > 150$ GeV

Combinatorial suppression

$\tilde{g} \rightarrow \tilde{t}_1 t$ (3%)

$\quad \hookrightarrow \tilde{\chi}_1^+ b$ (69%), $\tilde{\chi}_2^+ b$, $\tilde{\chi}_2^0 t$

$M(\tilde{g}) - M(\tilde{t}\,t) \approx 27$ GeV

$M(\tilde{t}) - M(\tilde{\chi}^+ b) \approx 184$ GeV

$\tilde{b}_1 \rightarrow \tilde{\chi}_1^+ t$ (46%)

$\tilde{b}_1 \rightarrow \tilde{t}_1 W$ (9%)

$\quad \hookrightarrow \tilde{\chi}_1^+ b$ (69%), $\tilde{\chi}_2^+ b$, $\tilde{\chi}_2^0 t$

$\tilde{b}_2 \rightarrow \tilde{\chi}_1^+ t$ (34%)

$\tilde{b}_2 \rightarrow \tilde{t}_1 W$ (22%)

$\quad \hookrightarrow \tilde{\chi}_1^+ b$ (69%), $\tilde{\chi}_2^+ b$, $\tilde{\chi}_2^0 t$

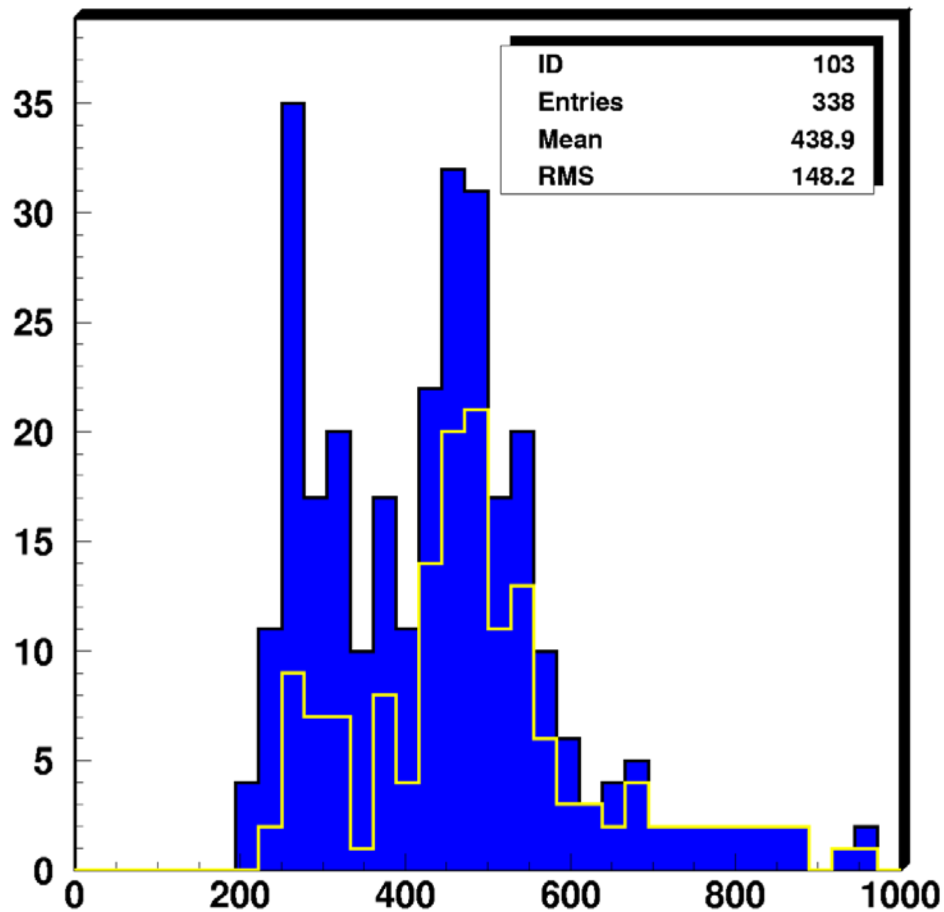
$M(\tilde{b}) - M(\tilde{\chi}^+ t) \approx 147$ GeV

$M(\tilde{b}) - M(\tilde{t}\,W) \approx 23$ GeV

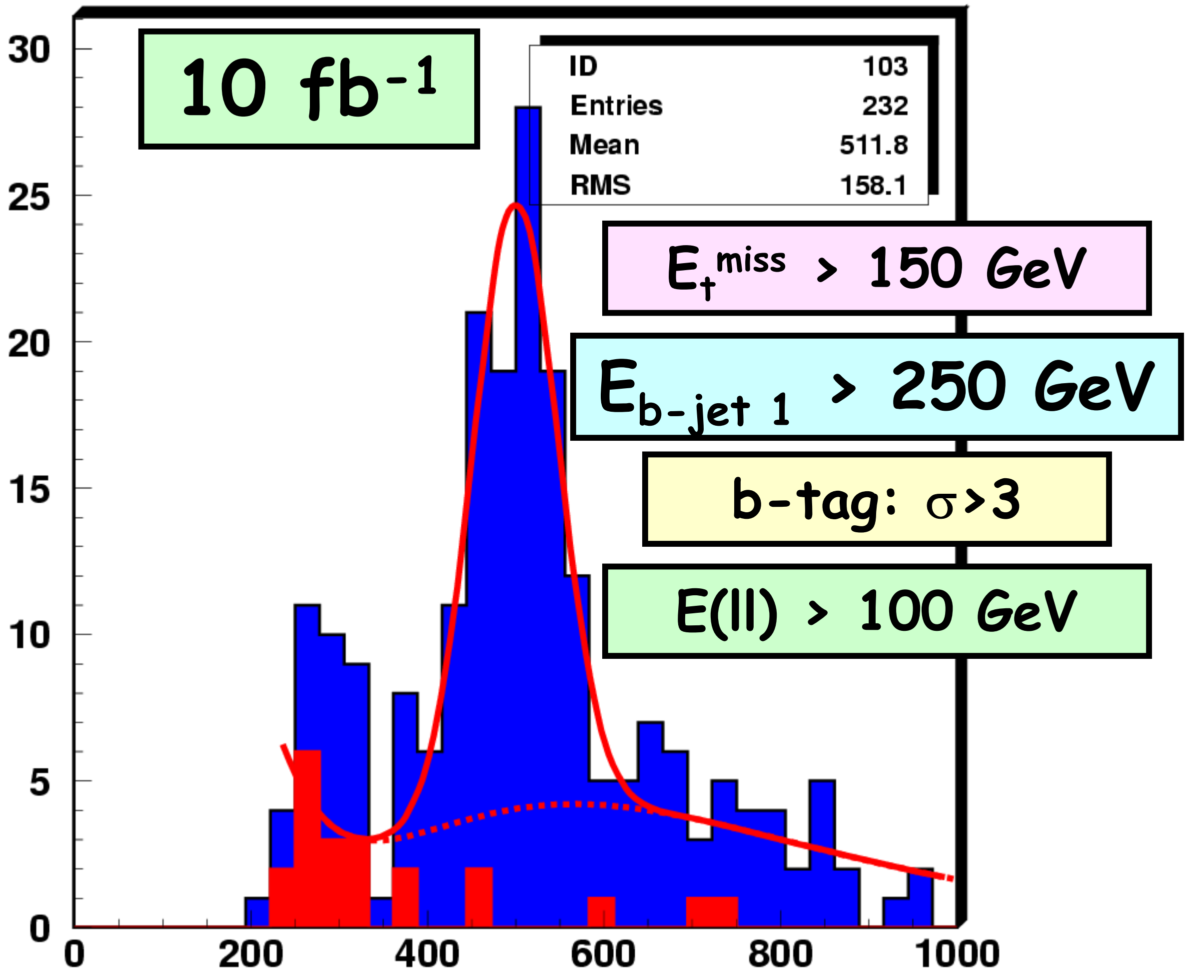
$M(\tilde{b}) - M(\tilde{\chi}_2^0 b) \approx 317$ GeV

Combinatorial suppression

$E_{b\text{-}jet\ 1} > 250$ GeV



Sbottom mass



Result of fit:

$M(\tilde{\chi}_2^0 b) = 499.4 \pm 6.6\ \text{GeV}$

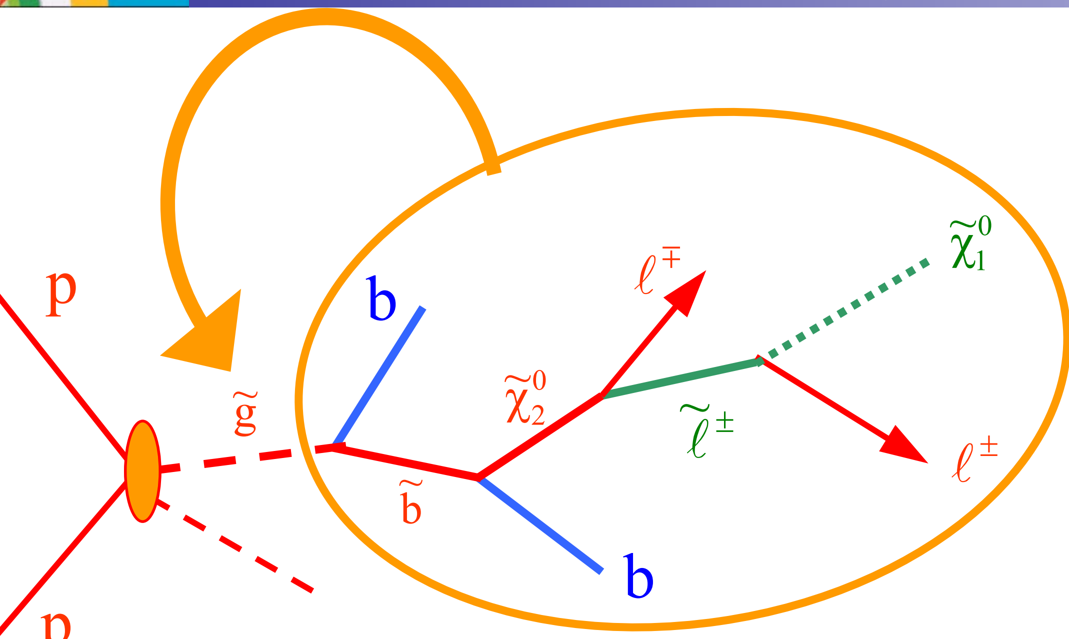
$\sigma = 47.6$

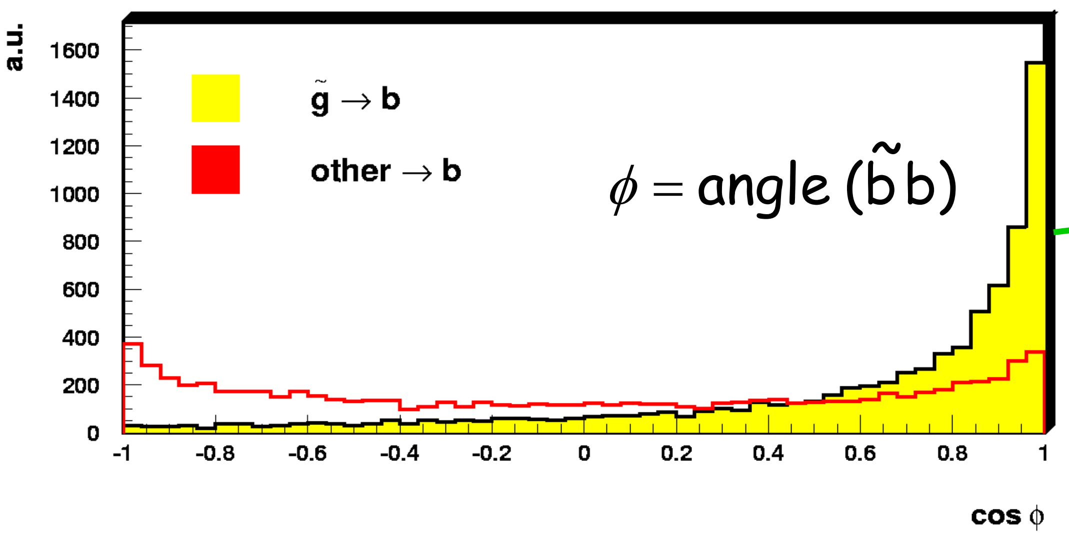
Generated masses:

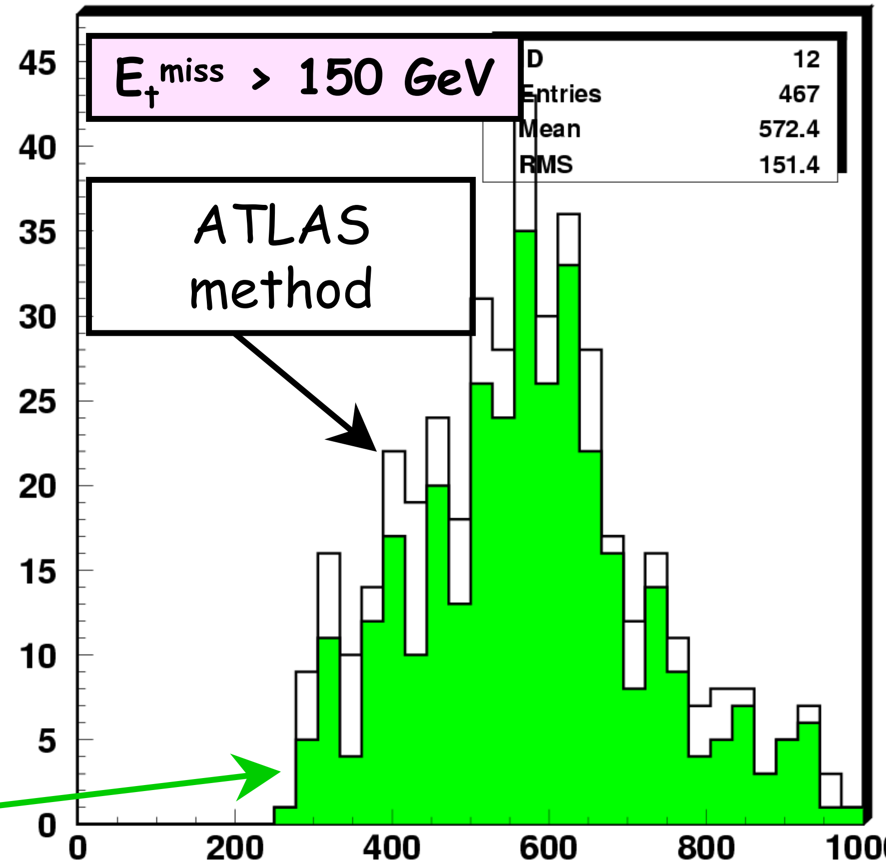
$M(\tilde{b}_L) = 496.0\ \text{GeV}$

$M(\tilde{b}_R) = 524.0\ \text{GeV}$

Gluino reconstruction

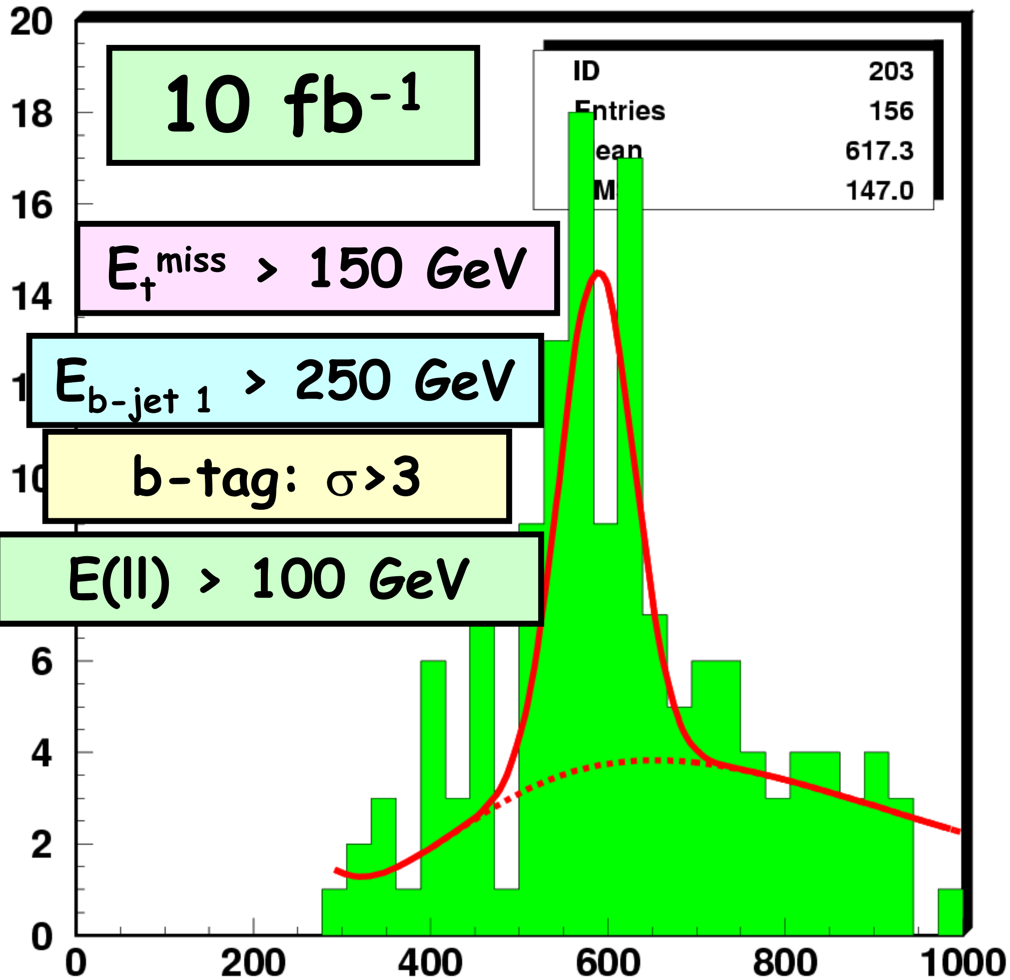






b-jet closest in angle to the reconstructed sbottom

Gluino mass



Result of fit:

$$M(\tilde{\chi}_2^0 bb) = 585.1 \pm 11.1\ \text{GeV}$$

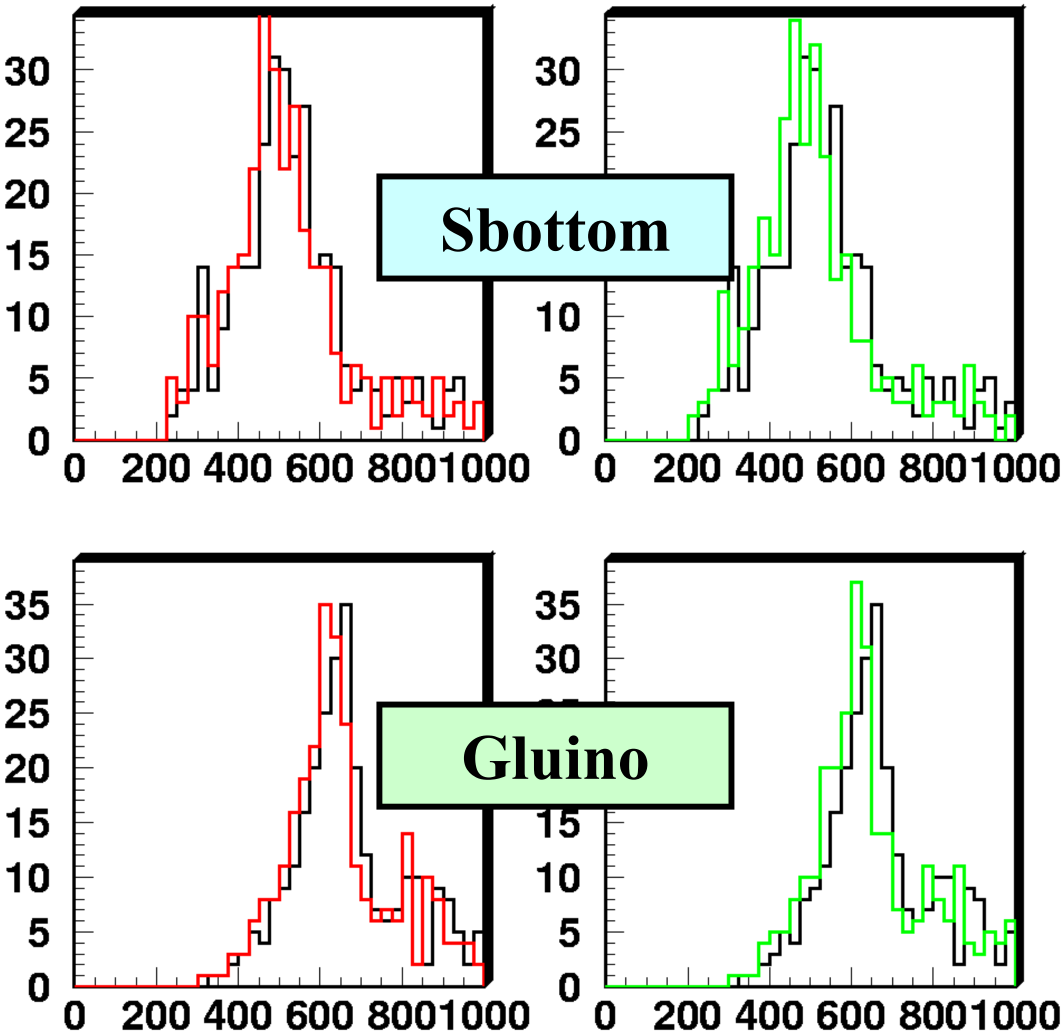
$$\sigma = 50.1$$

Generated mass:

$$M(\tilde{g}) = 595.1\ \text{GeV}$$

Dependance on $M(\chi_1^0)$

We assume $M(\chi_1^0)$ known but… we cannot detect the neutralinos!



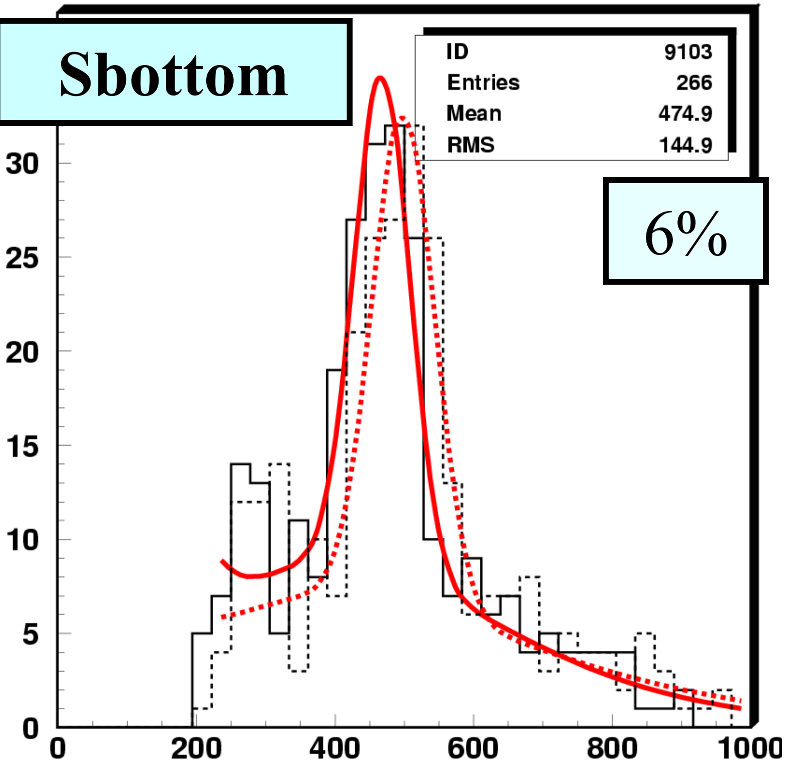
— $M(\chi_1^0)$ true

— $M(\chi_1^0)$ = M edge

— $M(\chi_1^0)$ = M(ll)

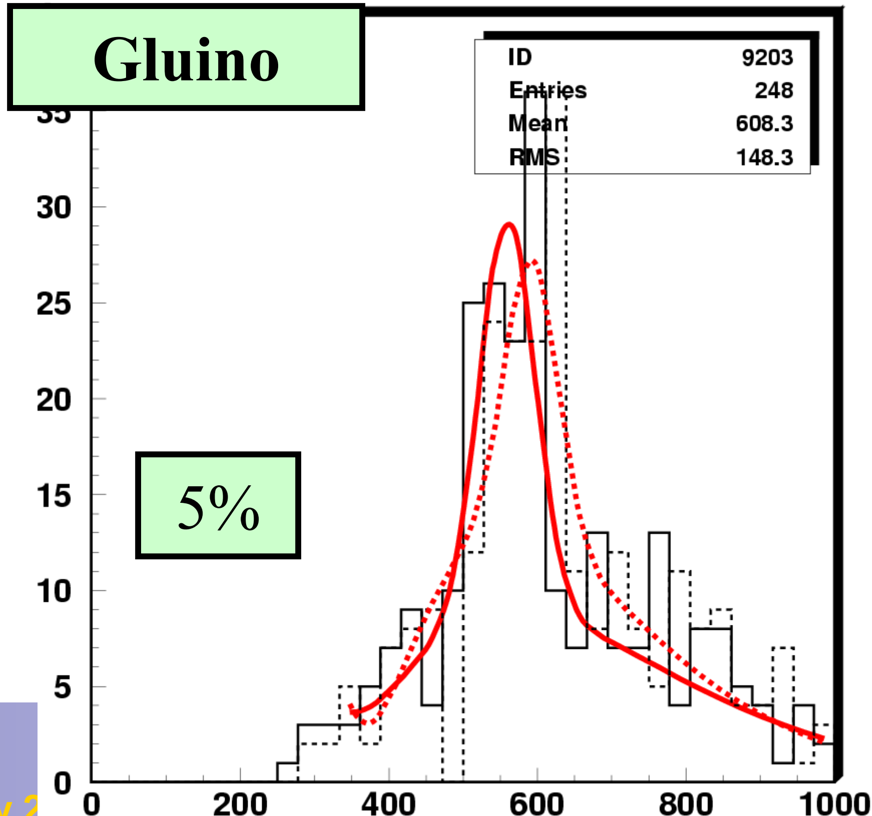
$$\vec{p}_{\tilde{\chi}_2^0} = \left(1 + \frac{M_{\tilde{\chi}_1^0}}{M_{\ell^+\ell^-}}\right)\vec{p}_{\ell^+\ell^-} = 2\vec{p}_{\ell^+\ell^-}$$

Dependance on M(χ_1^0): a more realistic situation...



$M(\tilde{\chi}_1^0) = M(\tilde{\chi}_1^0 true) \Rightarrow M(\tilde{b}) = 499.4\ GeV$

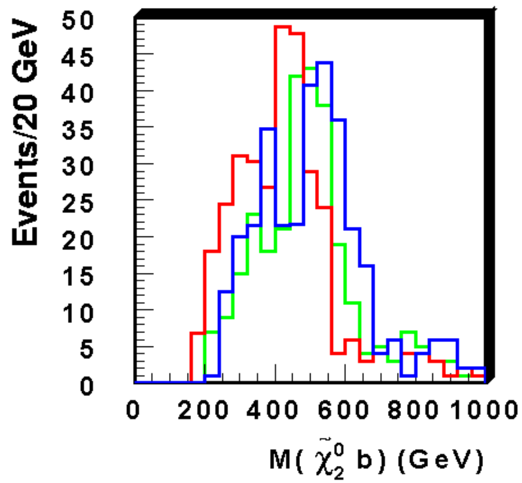
$M(\tilde{\chi}_1^0) = M_{\ell\ell}^{max} \Rightarrow M(\tilde{b}) = 467.8\ GeV$

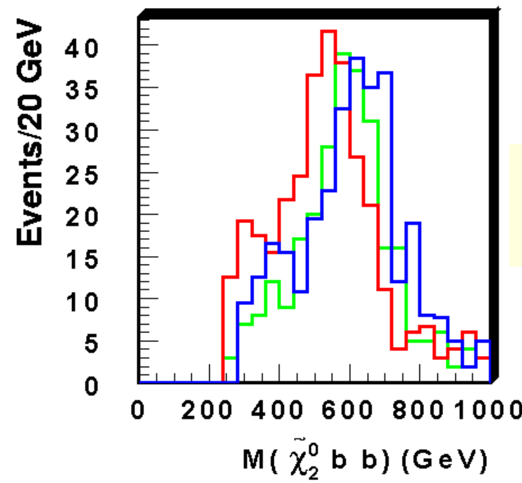


$M(\tilde{\chi}_1^0) = M(\tilde{\chi}_1^0 true) \Rightarrow M(\tilde{g}) = 585.1 GeV$

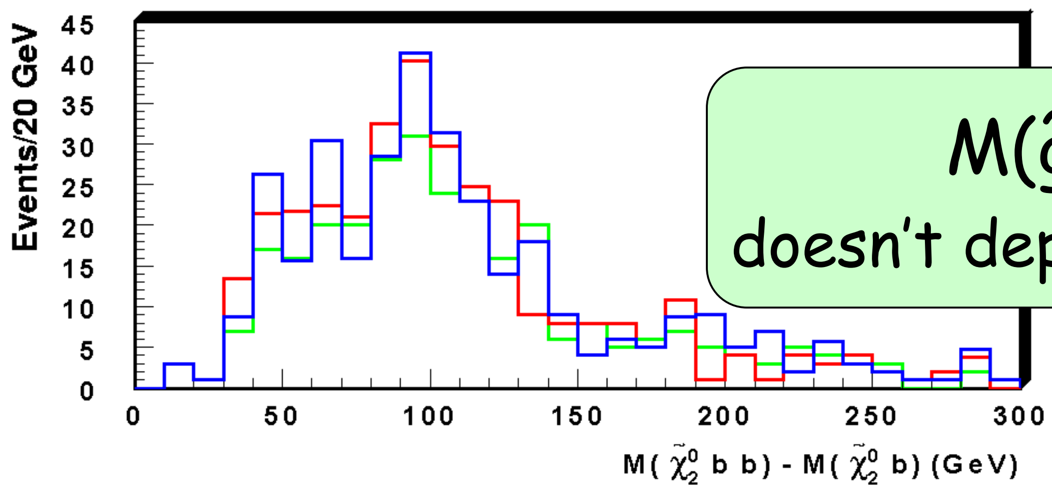
$M(\tilde{\chi}_1^0) = M_{\ell\ell}^{max} \Rightarrow M(\tilde{g}) = 559.3 GeV$

$M(\tilde{g}) - M(\tilde{b})$ estimation





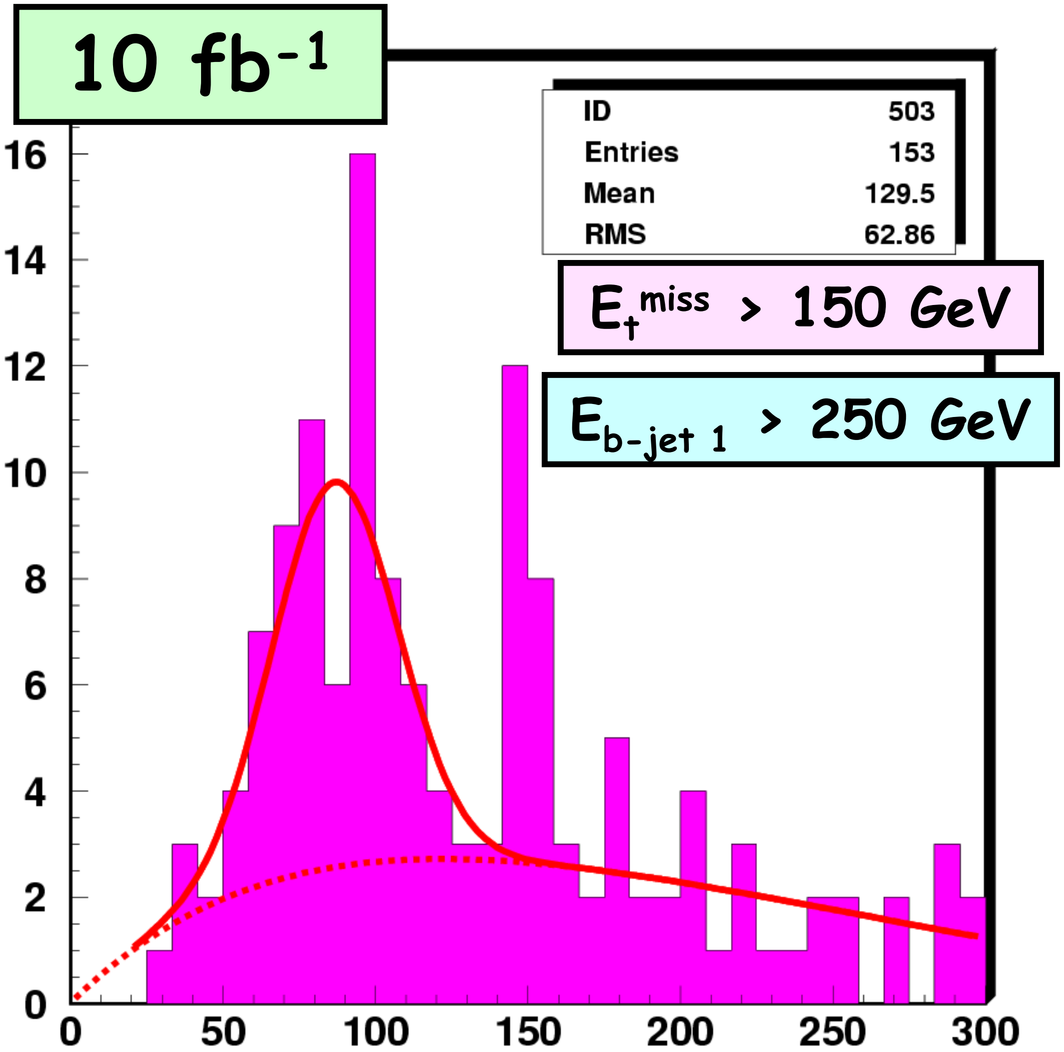
$M(\tilde{\chi}_1^0) \pm 30$ GeV



$M(\tilde{g}) - M(\tilde{b})$

doesn't depend on $M(\chi_1^0)$!

$M(\tilde{g}) - M(\tilde{b})$ estimation



Result of fit:

$$M(\tilde{\chi}_2^0 bb) - M(\tilde{\chi}_2^0 b) = 86.7 \pm 4.7 \text{ GeV}$$

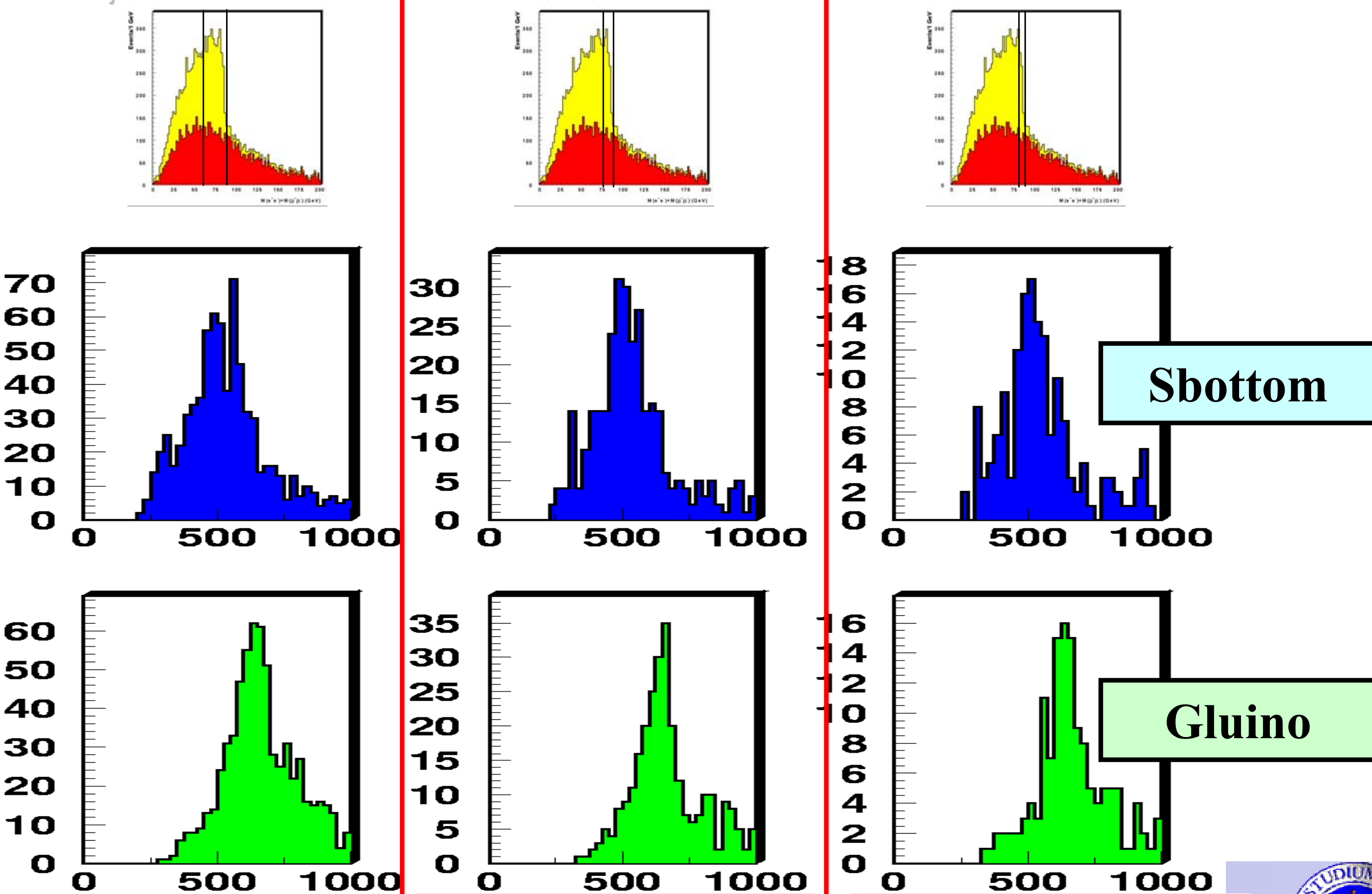
$$\sigma = 20.5$$

Generated mass:

$$M(\tilde{g}) - M(\tilde{b}_L) = 99.1 \text{ GeV}$$

$$M(\tilde{g}) - M(\tilde{b}_R) = 71.1 \text{ GeV}$$

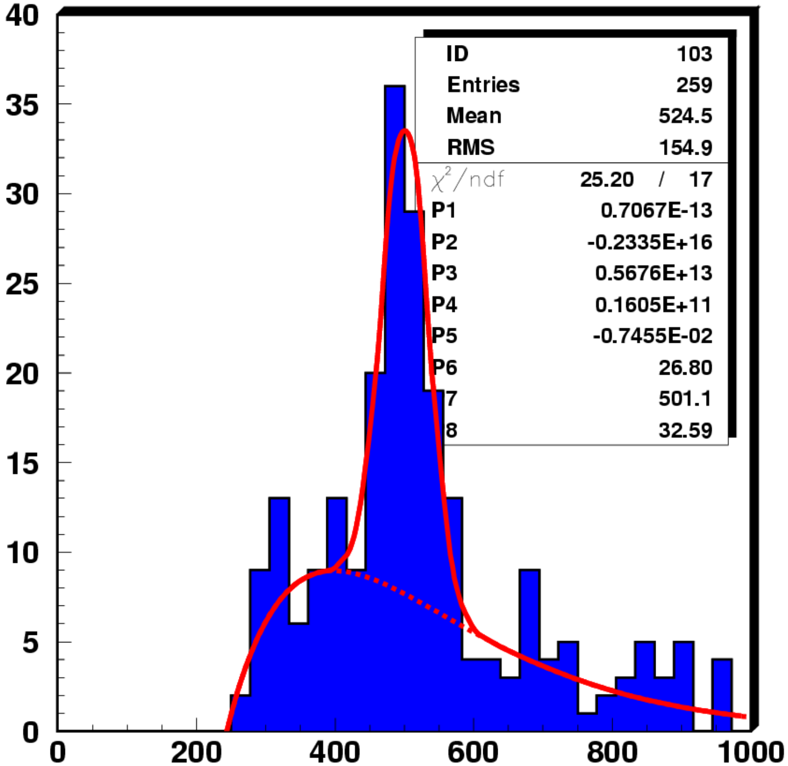
Dependance on M(ll)



60 GeV < $M_{\ell^+\ell^-}$ < 92 GeV | 75 GeV < $M_{\ell^+\ell^-}$ < 92 GeV | 80 GeV < $M_{\ell^+\ell^-}$ < 92 GeV

Results for 60 fb^{-1}

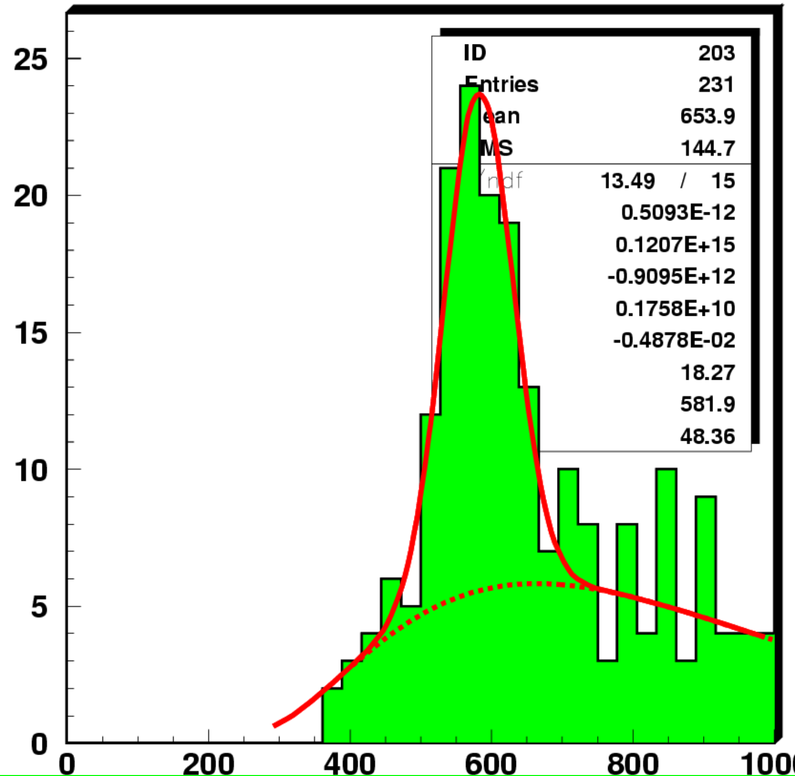
$$75\ \text{GeV} < M_{\ell^+\ell^-} < 81\ \text{GeV}$$



$$M(\tilde{\chi}_2^0 b) = 501.1 \pm 5.5\ \text{GeV}$$

$$\sigma = 32.6$$

Point B



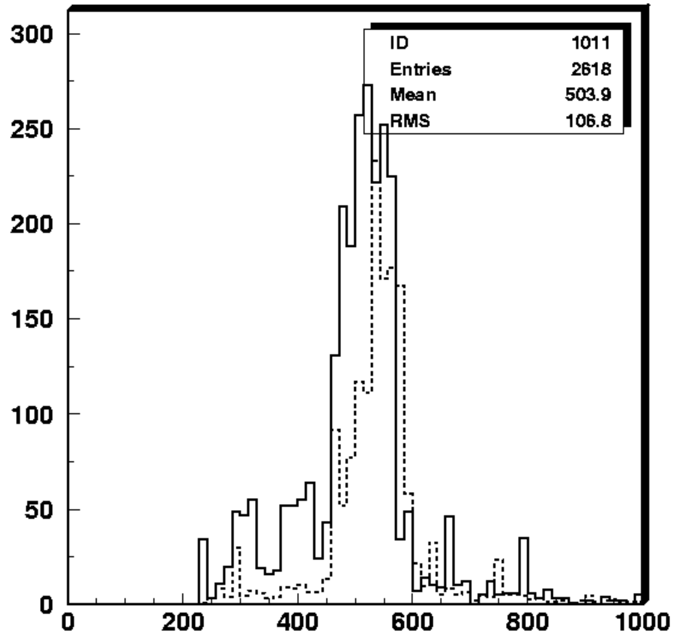
$$M(\tilde{\chi}_2^0 bb) = 581.9 \pm 7.5\ \text{GeV}$$

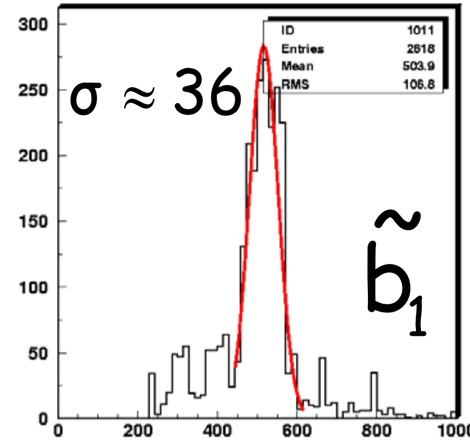
$$\sigma = 48.4$$

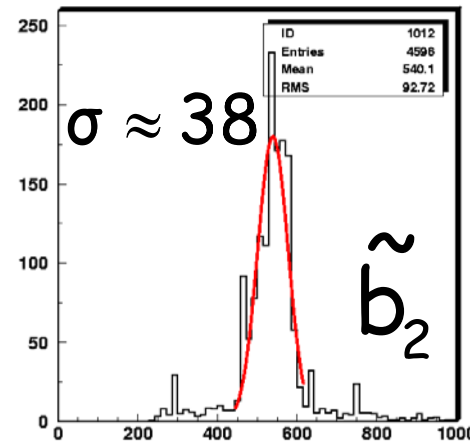
Sbottom separation

$$10^6\ \tilde{q}\tilde{g},\quad \tilde{g} \to \tilde{b}_1 b \to \tilde{\chi}_2^0 bb \to \tilde{\chi}_1^0 \ell^+\ell^- bb$$

$$10^6\ \tilde{q}\tilde{g},\quad \tilde{g} \to \tilde{b}_2 b \to \tilde{\chi}_2^0 bb \to \tilde{\chi}_1^0 \ell^+\ell^- bb$$





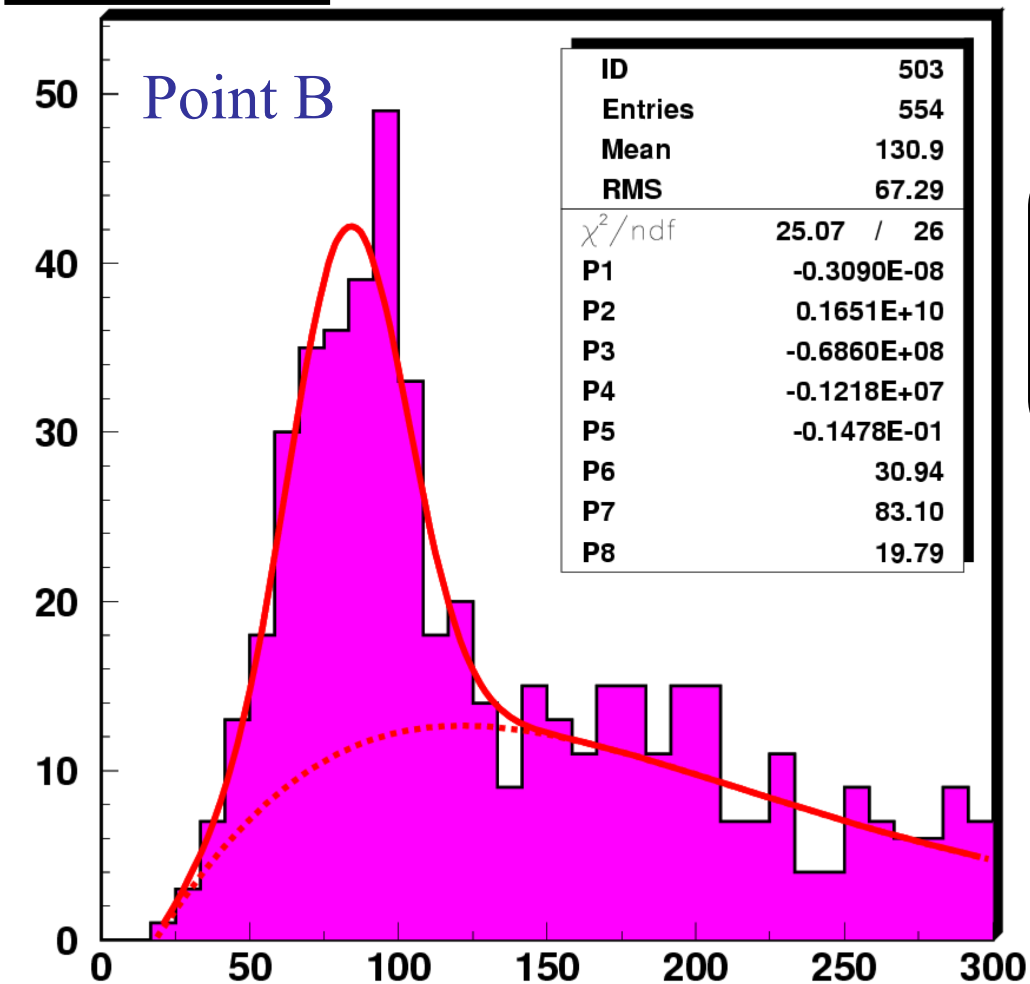


Detector resolution seems to prevent sbottom separation

Full detailed simulation needed!

$M(\tilde{g}) - M(\tilde{b})$ for 60 fb^{-1}

60 fb^{-1}



Result of fit:

$$M(\tilde{\chi}_2^0 bb) - M(\tilde{\chi}_2^0 b) = 83.1 \pm 2.4 \text{ GeV}$$

$$\sigma = 19.8$$

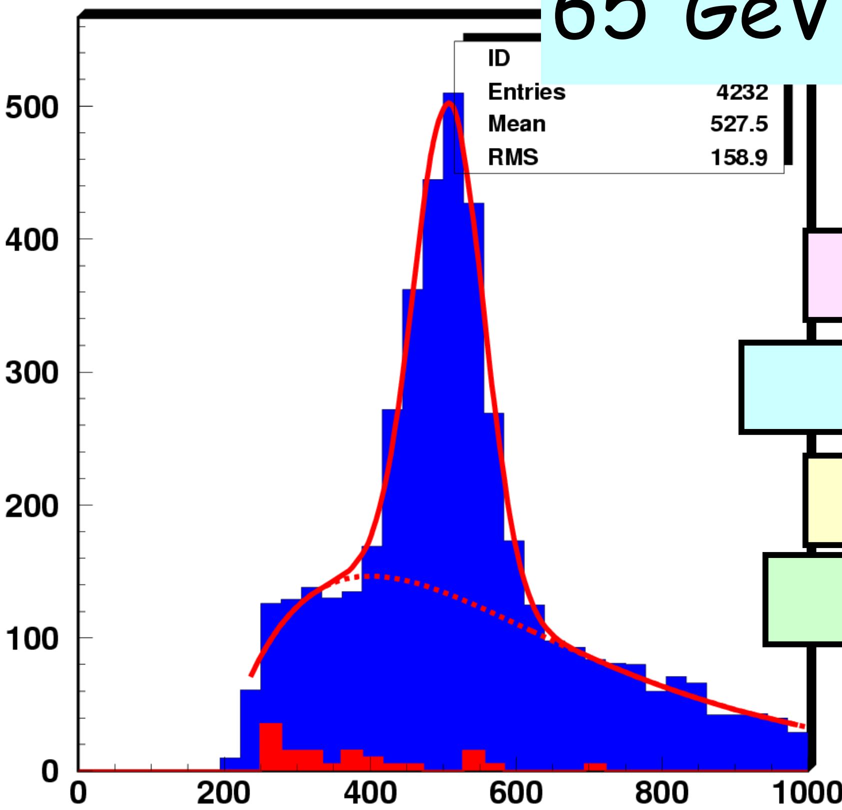
Generated values:

$$M(\tilde{g}) - M(\tilde{b}_L) = 99.1 \text{ GeV}$$

$$M(\tilde{g}) - M(\tilde{b}_R) = 71.1 \text{ GeV}$$

Results for 300 fb^{-1}

$65\ GeV < M_{\ell^+\ell^-} < 81\ GeV$



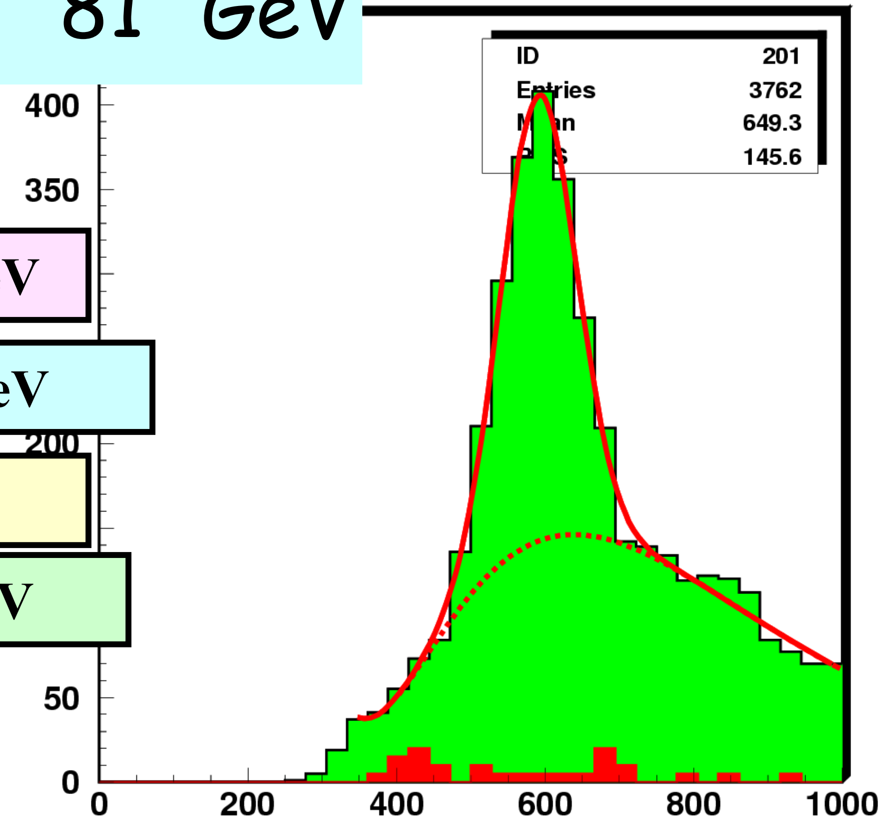
300 fb^{-1}

$E_t^{miss} > 200$ GeV

$E_{b\text{-jet }1} > 250$ GeV

b-tag: σ>3

E(ll) > 100 GeV



$M(\tilde{\chi}_2^0 b) = 507.6 \pm 1.5\ GeV$

$\sigma = 47.6$

$M(\tilde{\chi}_2^0 bb) = 590.9 \pm 2.4\ GeV$

$\sigma = 50.8$

Generated masses

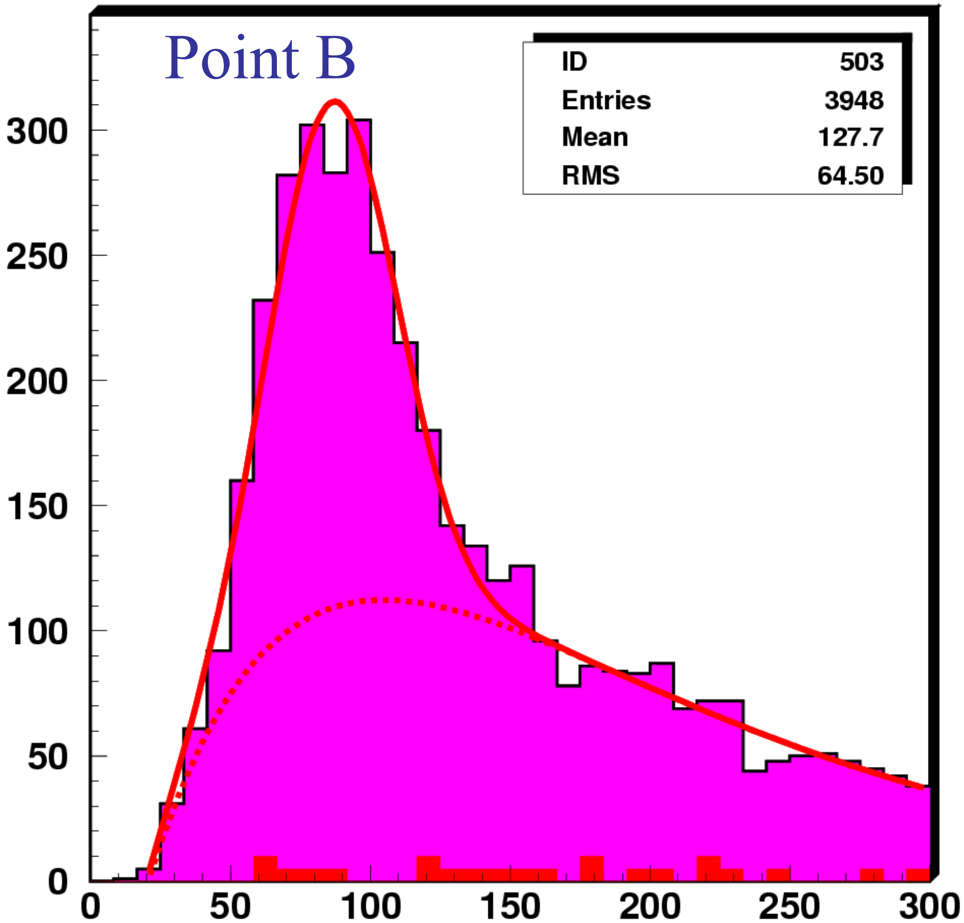
$M(\tilde{b}_L) = 496.0\ GeV$

$M(\tilde{b}_R) = 524.0\ GeV$

$M(\tilde{g}) = 595.1\ GeV$

$M(\tilde{g}) - M(\tilde{b})$ for 300 fb^{-1}

300 fb^{-1}



Result of fit:

$$M(\tilde{\chi}_2^0 bb) - M(\tilde{\chi}_2^0 b) = 86.4 \pm 1.0 \ \text{GeV}$$

$$\sigma = 22.7$$

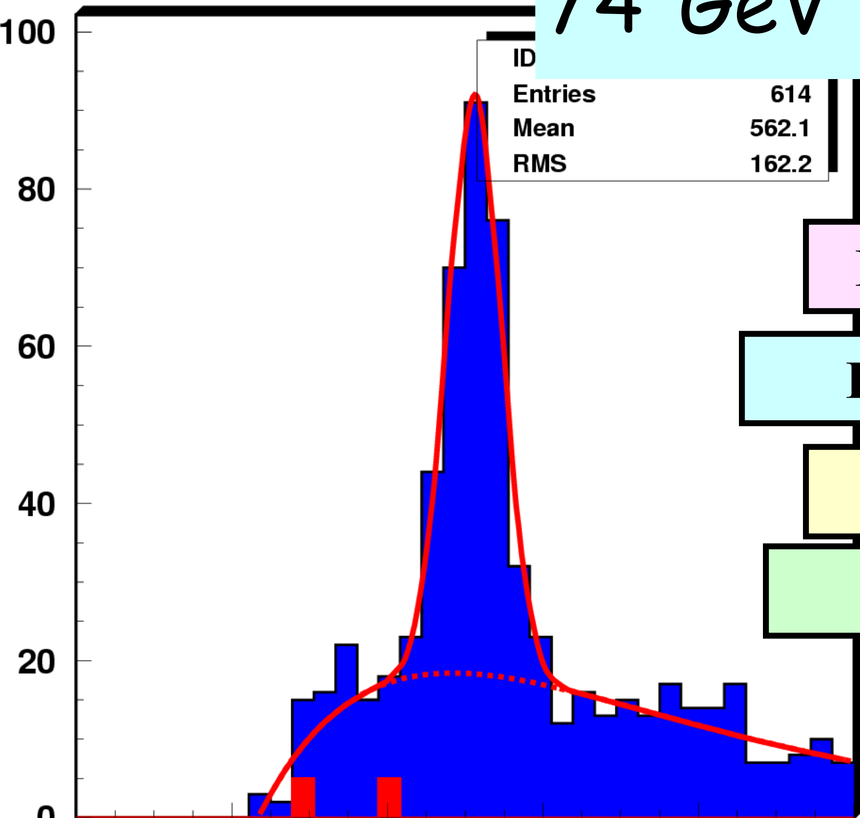
Generated values:

$$M(\tilde{g}) - M(\tilde{b}_L) = 99.1 \ \text{GeV}$$

$$M(\tilde{g}) - M(\tilde{b}_R) = 71.1 \ \text{GeV}$$

Results for 300 fb^{-1} (harder cuts)

$$74\ GeV < M_{\ell^+\ell^-} < 80\ GeV$$



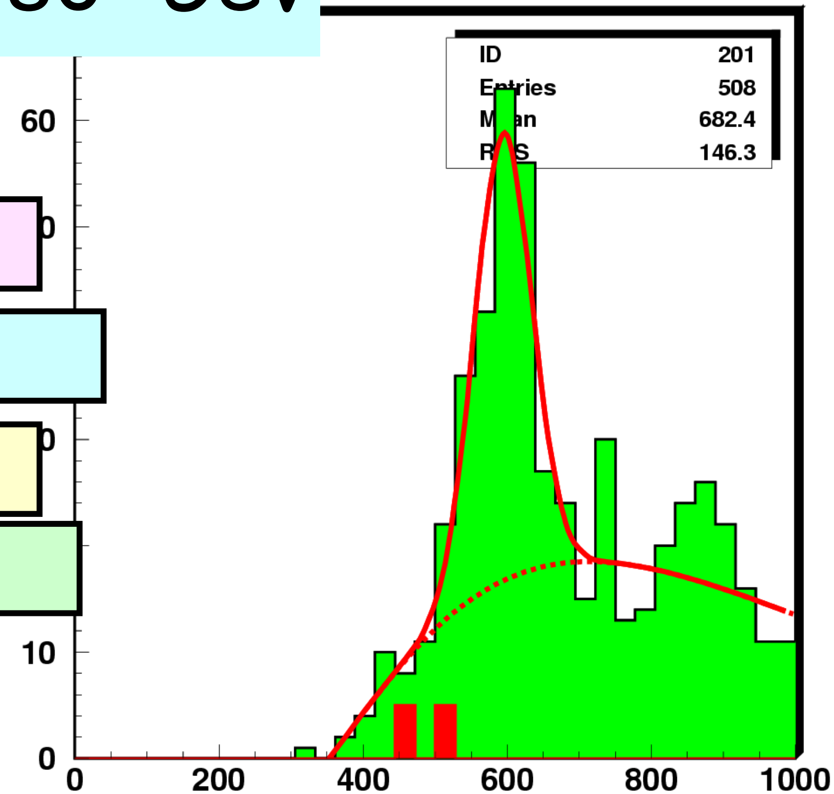
300 fb^{-1}

$E_t^{miss} > 200$ GeV

$E_{b\text{-jet } 1} > 400$ GeV

b-tag: $\sigma > 3$

E(ll) > 100 GeV



$$M(\tilde{\chi}_2^0 b) = 512.0 \pm 1.4\ GeV \quad \sigma = 34.7$$

$$M(\tilde{\chi}_2^0 bb) = 594.2 \pm 5.1\ GeV \quad \sigma = 39.5$$

Generated masses

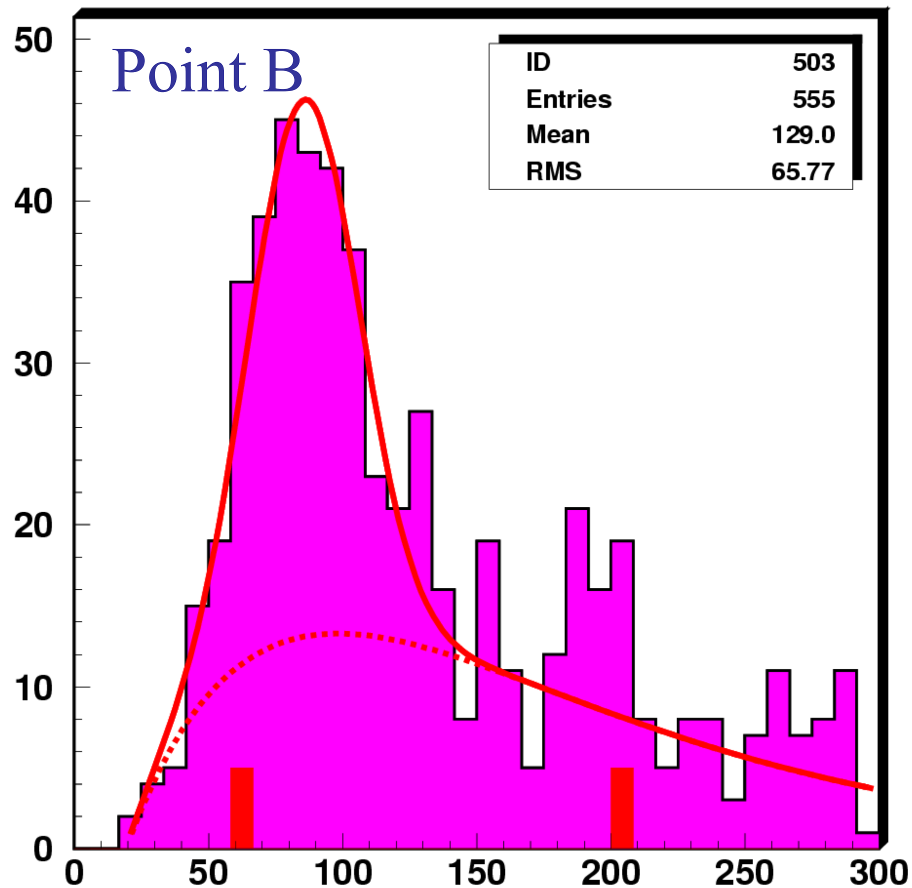
$$M(\tilde{b}_L) = 496.0\ GeV$$

$$M(\tilde{b}_R) = 524.0\ GeV$$

$$M(\tilde{g}) = 595.1\ GeV$$

$M(\tilde{g}) - M(\tilde{b})$ for 300 fb^{-1}

300 fb^{-1}



Result of fit:

$$M(\tilde{\chi}_2^0 bb) - M(\tilde{\chi}_2^0 b) = 85.7 \pm 2.4 \text{ GeV}$$

$$\sigma = 20.4$$

Generated values:

$$M(\tilde{g}) - M(\tilde{b}_L) = 99.1 \text{ GeV}$$

$$M(\tilde{g}) - M(\tilde{b}_R) = 71.1 \text{ GeV}$$

Summary of results @ Point B

- Sbottom and gluino reconstruction possible even at low integrated luminosity (10 fb^{-1}) with
  - Resolution <10%
  - Errors on mass determination of 1-2% (if we assume $M(\chi_1^0)$ known)
  - Errors ~ 5-6% if we approximate $M(\chi_1^0) \sim M(ll_{max})$ (this approximation is valid only in a mSUGRA scenario for which $M(\chi_2^0) \sim 2M(\chi_1^0)$, if we want a model independent analysis, we have to find other solutions)
- At 60 fb^{-1} improvements of ~ few percent but still no sbottom separation
  - Maybe detector resolution prevents it
  - Detailed simulation needed at higher integrated luminosity to understand if possible
- At 300 fb^{-1} and assuming $M(\chi_1^0)$ measured from a LC, we can have errors of ~ 0.5%

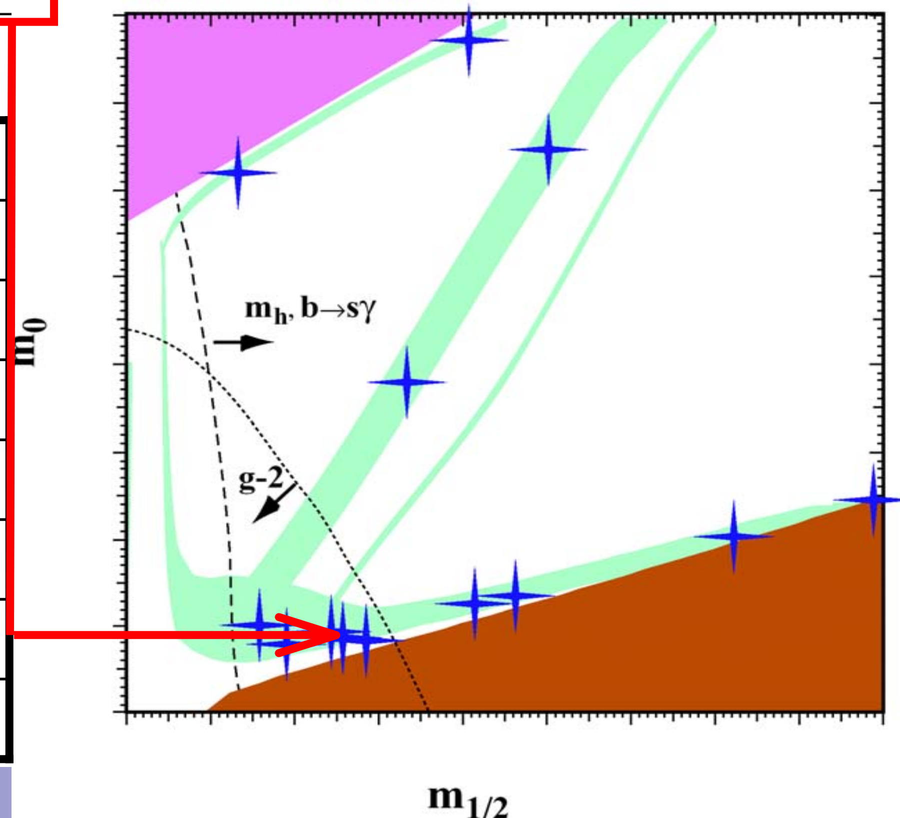
Point G

Model	A	B	C	D	E	F	G	H	I	J	K	L	M
$m_{1/2}$	600	250	400	525	300	1000	375	1500	350	750	1150	450	1900
m_0	140	100	90	125	1500	3450	120	419	180	300	1000	350	1500
$\tan\beta$	5	10	10	10	10	10	20	20	35	35	35	50	50
sign(μ)	+	+	+	−	+	+	+	+	+	+	−	+	+
$\alpha_s(m_Z)$	120	123	121	121	123	120	122	117	122	119	117	121	116
m_t	175	175	175	175	171	171	175	175	175	175	175	175	175

PYTHIA 6.152

g	919.8	t_L	589.4
b_L	723.0	t_R	800.8
b_R	771.3	χ_4^0	545.3
q_L	814	χ_3^0	532.4
q_R	780	χ_2^0	294.8
l_L	299.6	$\chi_2^\pm$	546.1
l_R	193.4	$\chi_1^\pm$	294.5
		χ_1^0 = LSP	152.5

$\sigma^{TOT}_{SUSY} = 6.00$ pb



Decay chain

$$pp \to \tilde{g} \to \tilde{b}b \quad (16\%\ b_L,\ 10\%\ b_R)$$

$$\hookrightarrow \tilde{\chi}_2^0 b \quad (15\ \%\ b_L,\ 28\%\ b_R)$$

$$\hookrightarrow \tilde{\ell}^{\pm}\ell^{\mp} \to \tilde{\chi}_1^0 \ell^+\ell^- (8\ \%) \quad (60\ \%) \quad (16\%)$$

Less good events

$$\tilde{g} \to \tilde{t}_1 t \quad (16\%)\ (8\ \%)$$

$$\hookrightarrow \tilde{\chi}_1^+ b\ (8.5\%)(2.7\%),\quad \tilde{\chi}_2^+ b,\quad \tilde{\chi}_2^0 t$$

More “fake” events

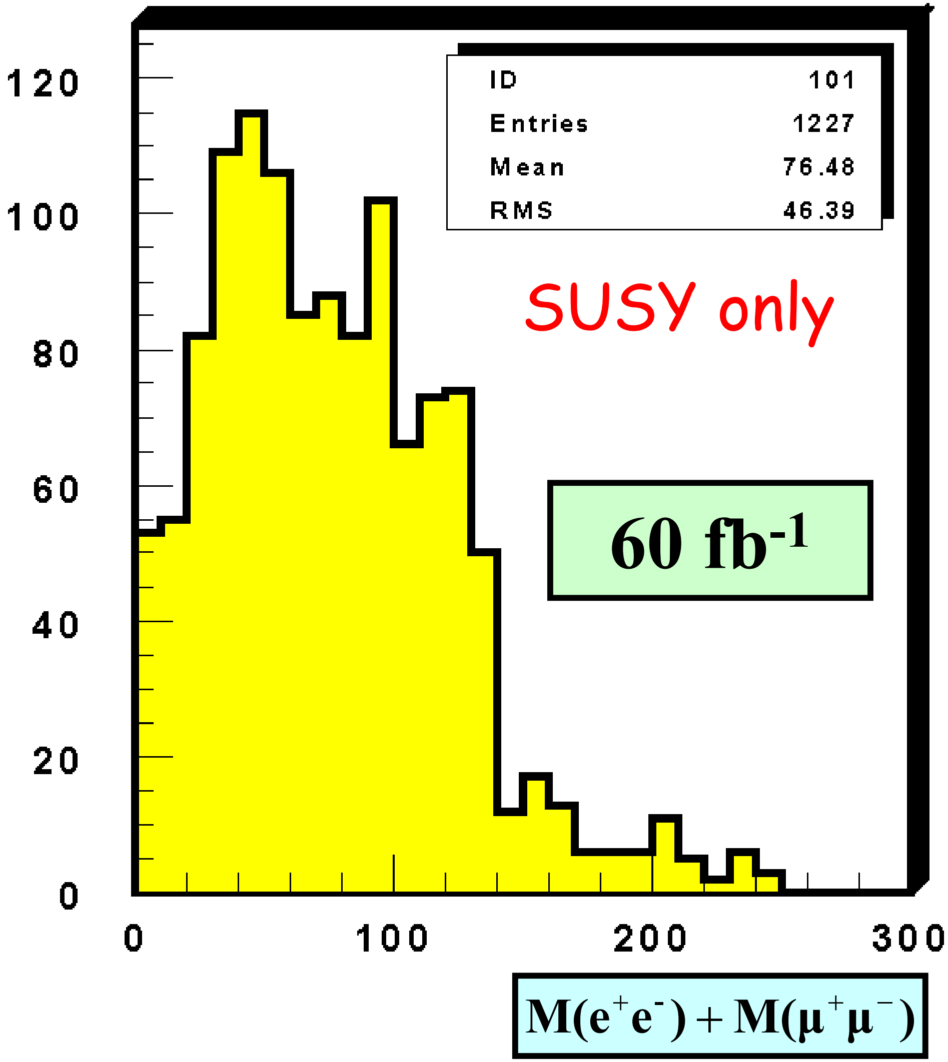
$$\tilde{b}_1 \to \tilde{\chi}_1^+ t\ (7\%)(3.5\%)$$

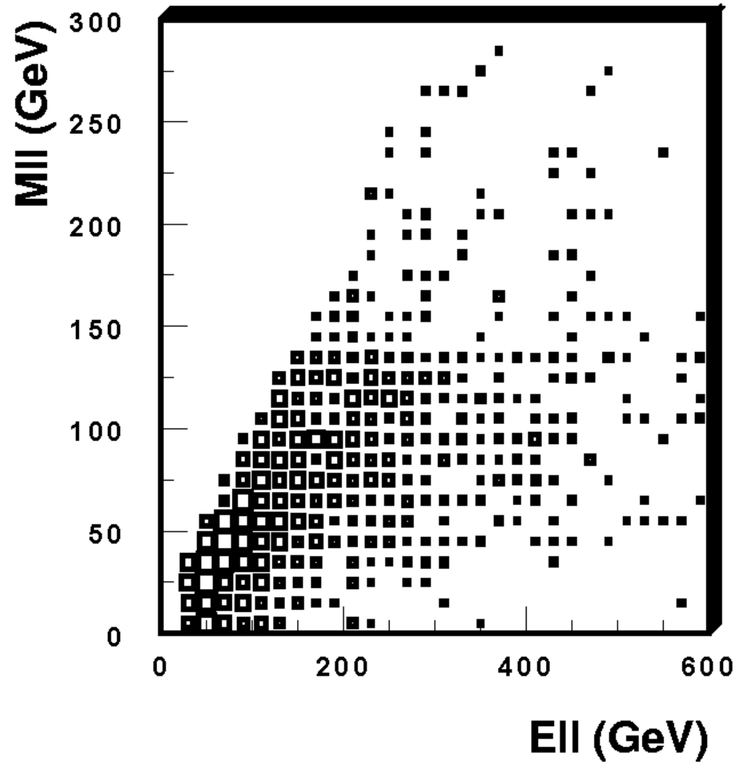
$$\tilde{b}_1 \to \tilde{t}_1 W\ (3\%)(1\%)$$

$$\tilde{b}_2 \to \tilde{\chi}_1^+ t\ (2.6\%)(1.6\%)$$

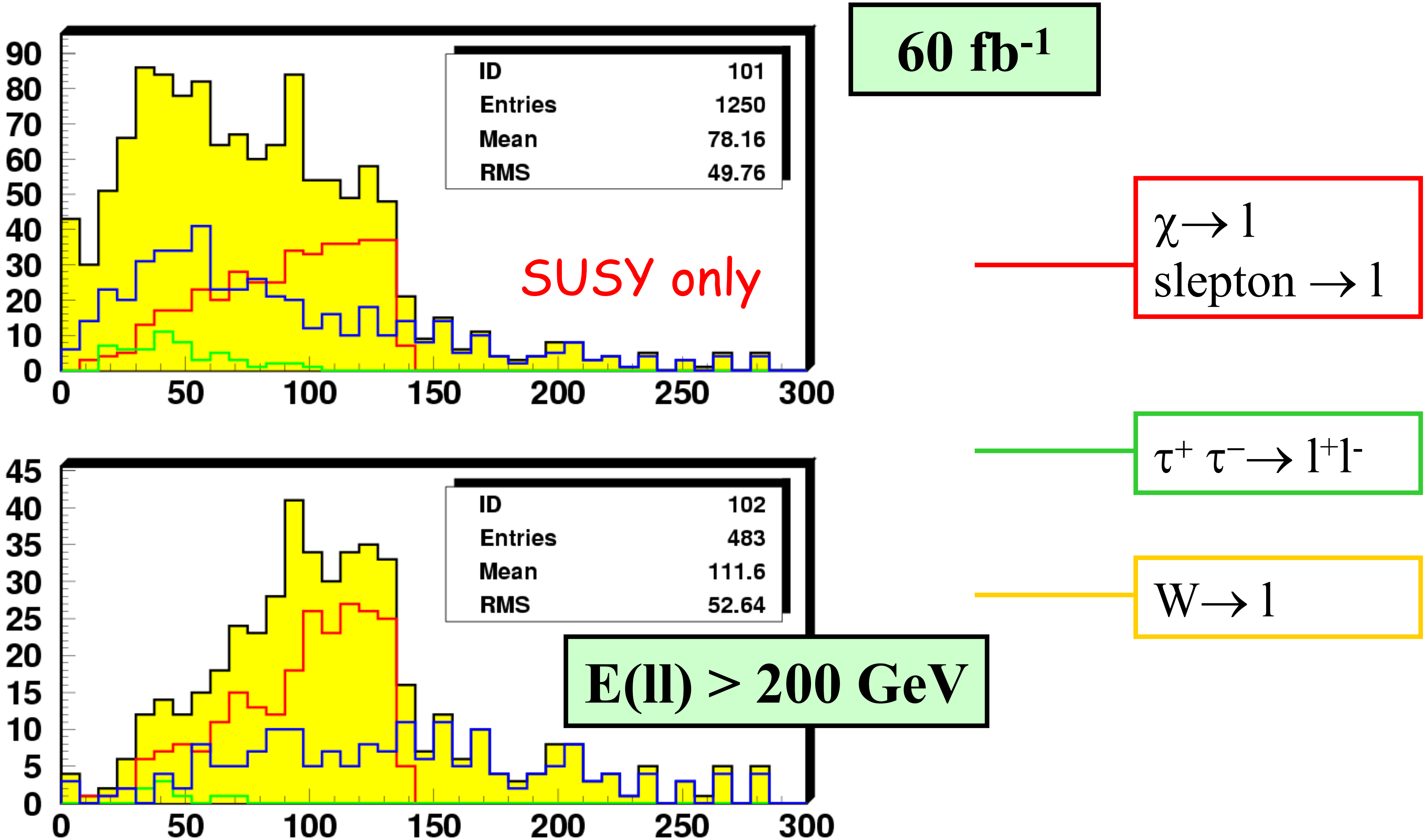
$$\tilde{b}_2 \to \tilde{t}_1 W\ (3.2\%)(1.2\%)$$

Dilepton edge





Dilepton edge

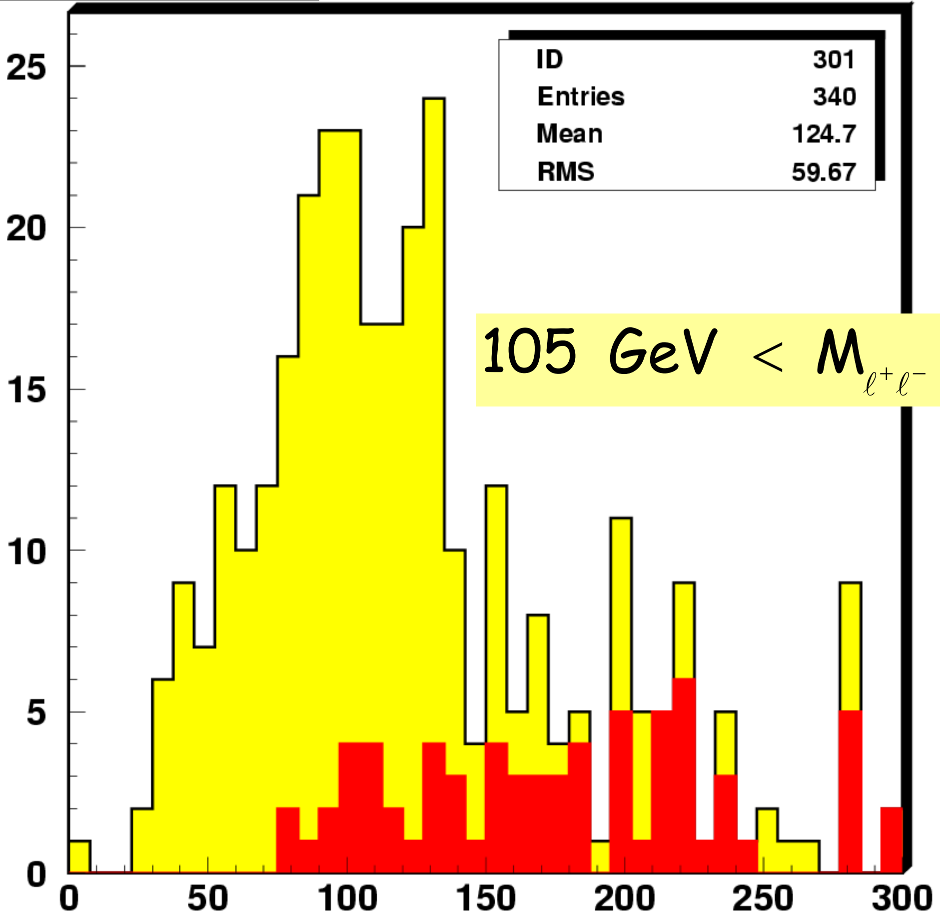


Dilepton edge: harder cuts

60 fb^{-1}

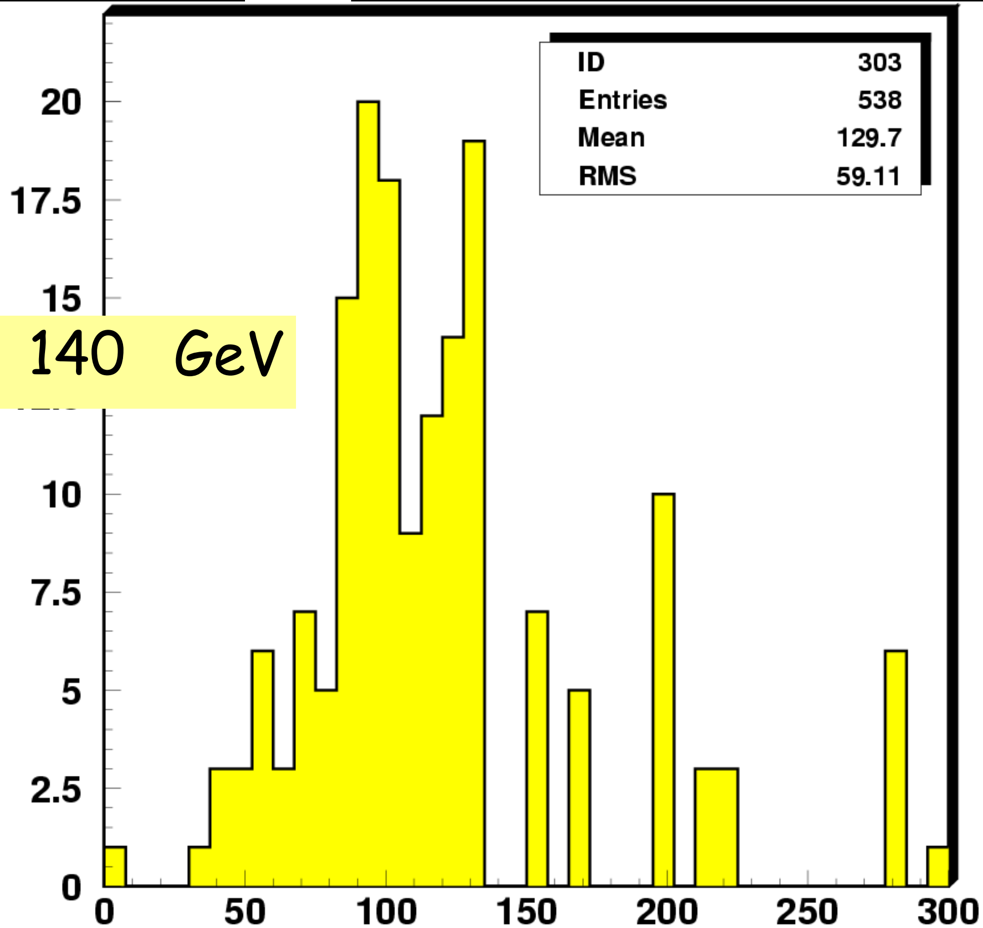
E(ll) > 200 GeV

E_t^{miss} > 250 GeV



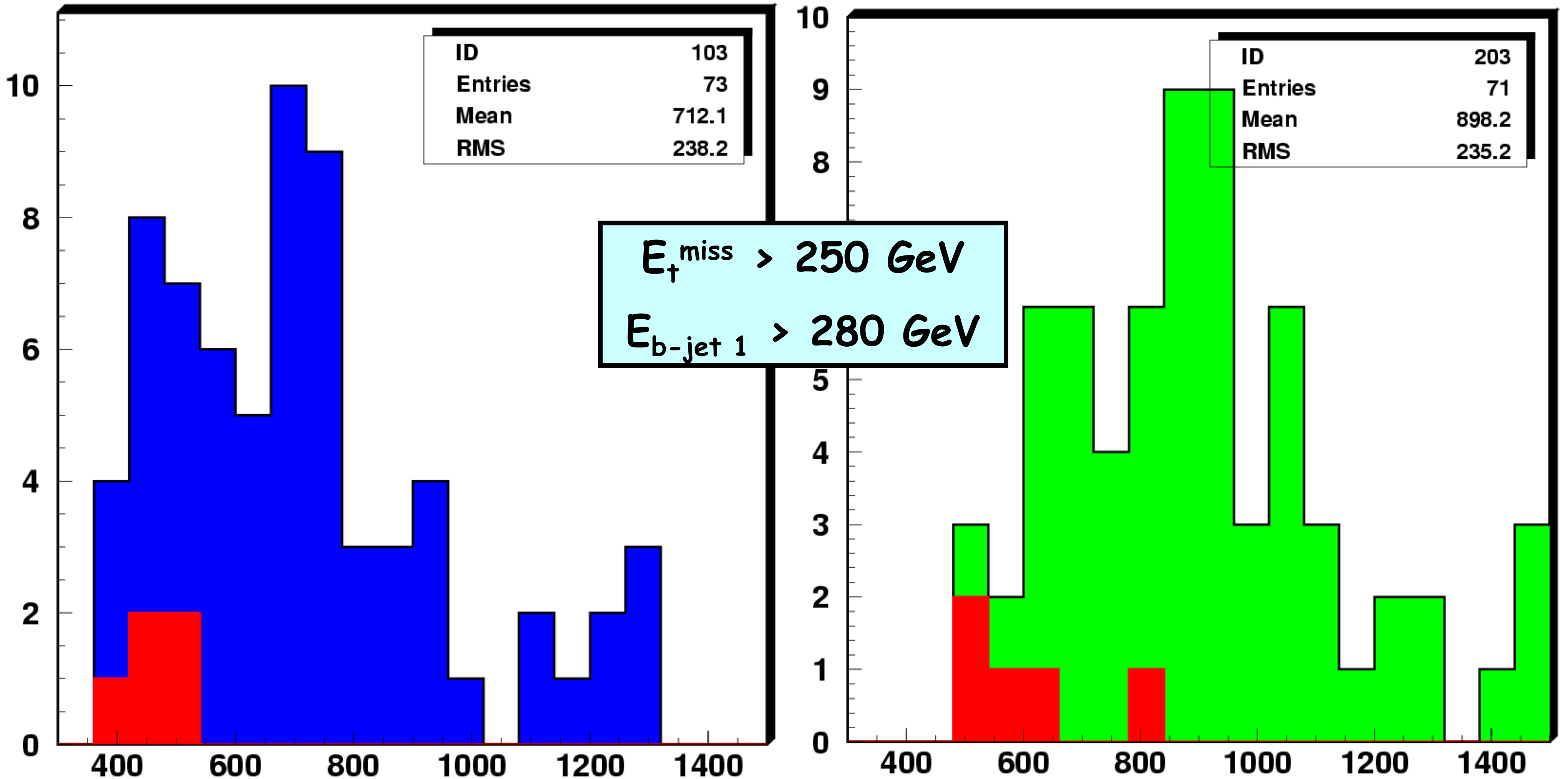
$M(e^+e^-) + M(\mu^+\mu^-)$

105 GeV < $M_{\ell^+\ell^-}$ < 140 GeV



$M(e^+e^-) + M(\mu^+\mu^-) - M(e^+\mu^-) - M(e^+\mu^-)$

Sbottom & gluino mass reconstruction

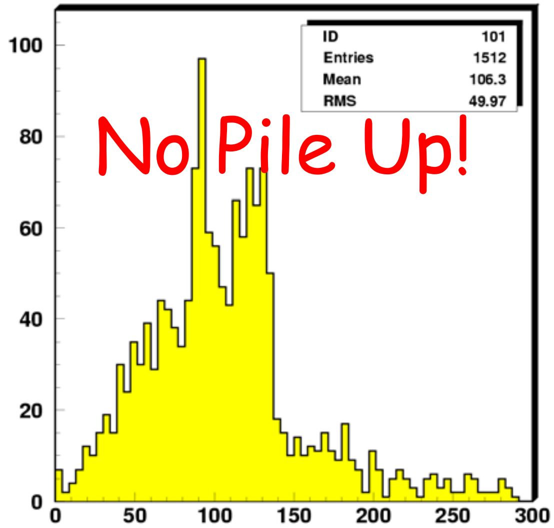


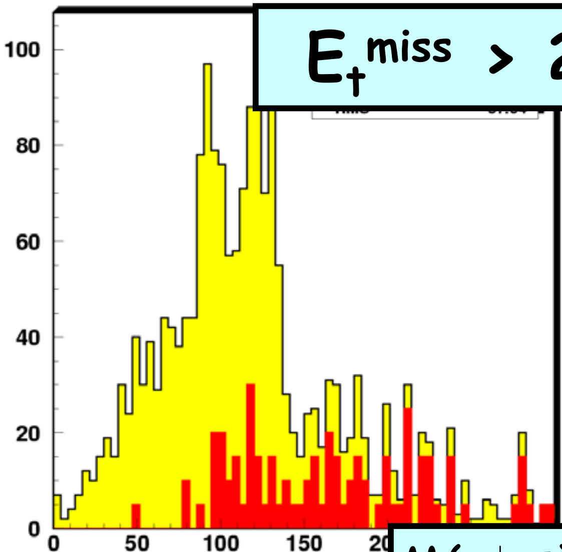
$E_t^{miss} > 250$ GeV

$E_{b\text{-jet }1} > 280$ GeV

Even with harder cuts no good fit possible @ 60 fb^{-1}

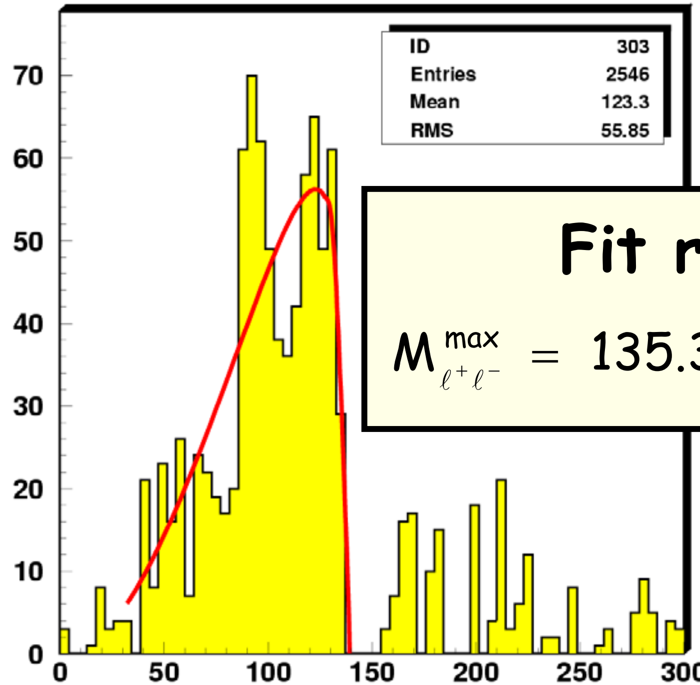
Point G for 300 fb^{-1}





$E_t^{miss} > 250$ GeV

$M(e^+e^-) + M(\mu^+\mu^-)$



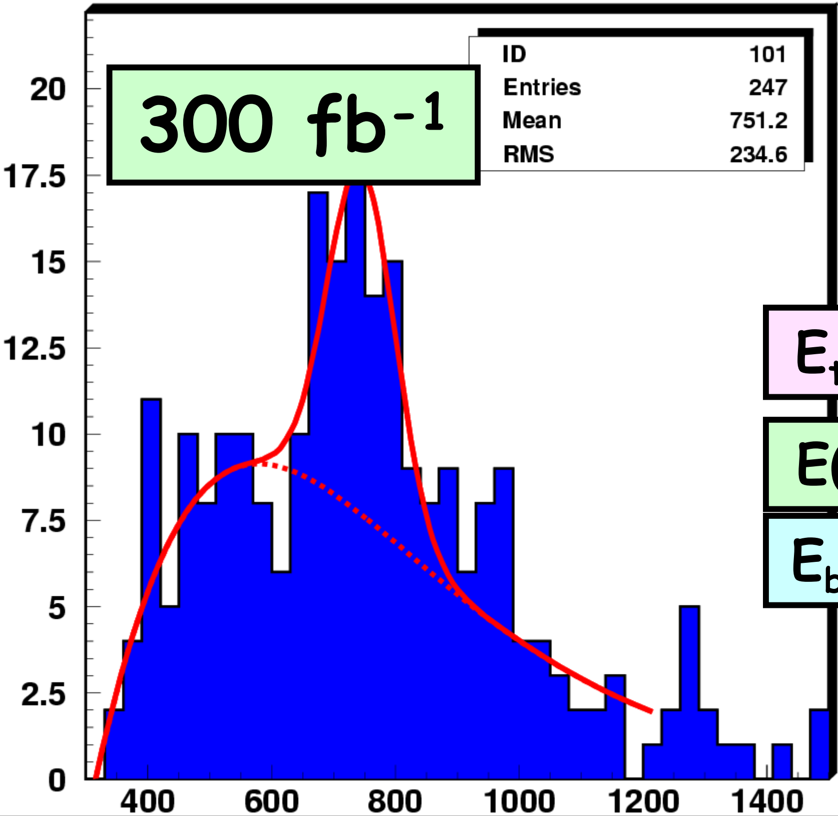
Fit result:

$$M_{\ell^+\ell^-}^{max} = 135.3 \pm 2.5 \text{ GeV}$$

$M(e^+e^-) + M(\mu^+\mu^-) - M(e^+\mu^-) - M(e^+\mu^-)$

$$M_{\ell^+\ell^-}^{max} = \frac{\sqrt{(M^2_{\tilde{\chi}^0_2} - M^2_{\tilde{\ell}})(M^2_{\tilde{\ell}} - M^2_{\tilde{\chi}^0_1})}}{M_{\tilde{\ell}}} = 136.84 \text{ GeV}$$

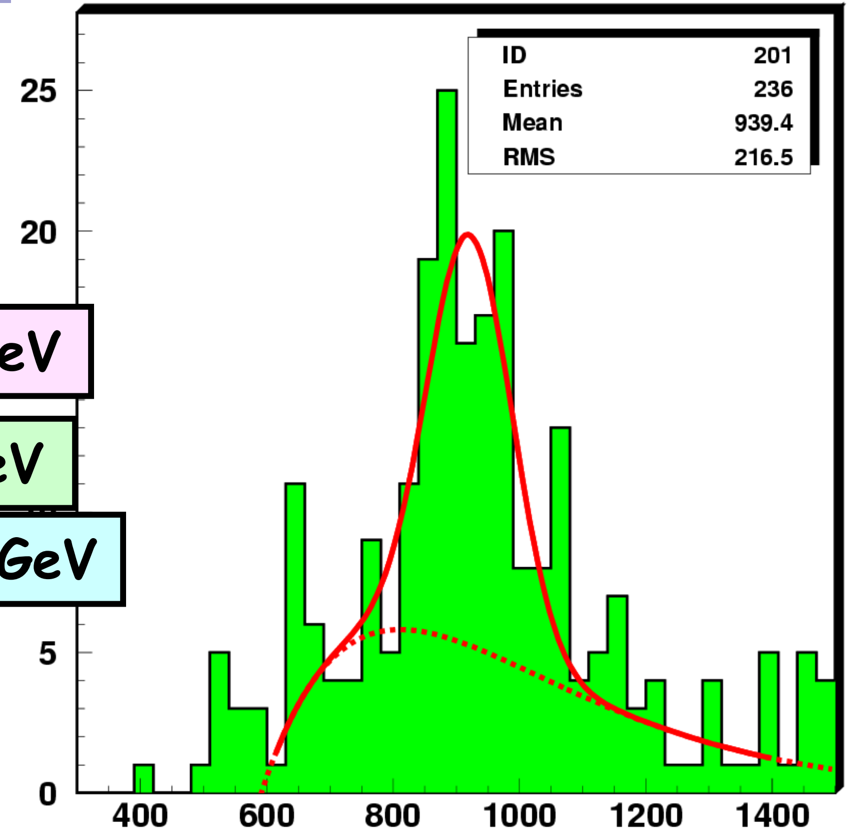
Sbottom and gluino mass reconstruction @ point G



E_t^{miss} > 250 GeV

E(ll) > 180 GeV

$E_{b\text{-}jet\ 1}$ > 280 GeV



Result of fit:

$M(\tilde{\chi}_2^0 b) = 744.2 \pm 17.7$ GeV

$\sigma = 54.2$

Generated masses:

$M(\tilde{b}_L) = 723.0$ GeV

$M(\tilde{b}_R) = 771.3$ GeV

Result of fit:

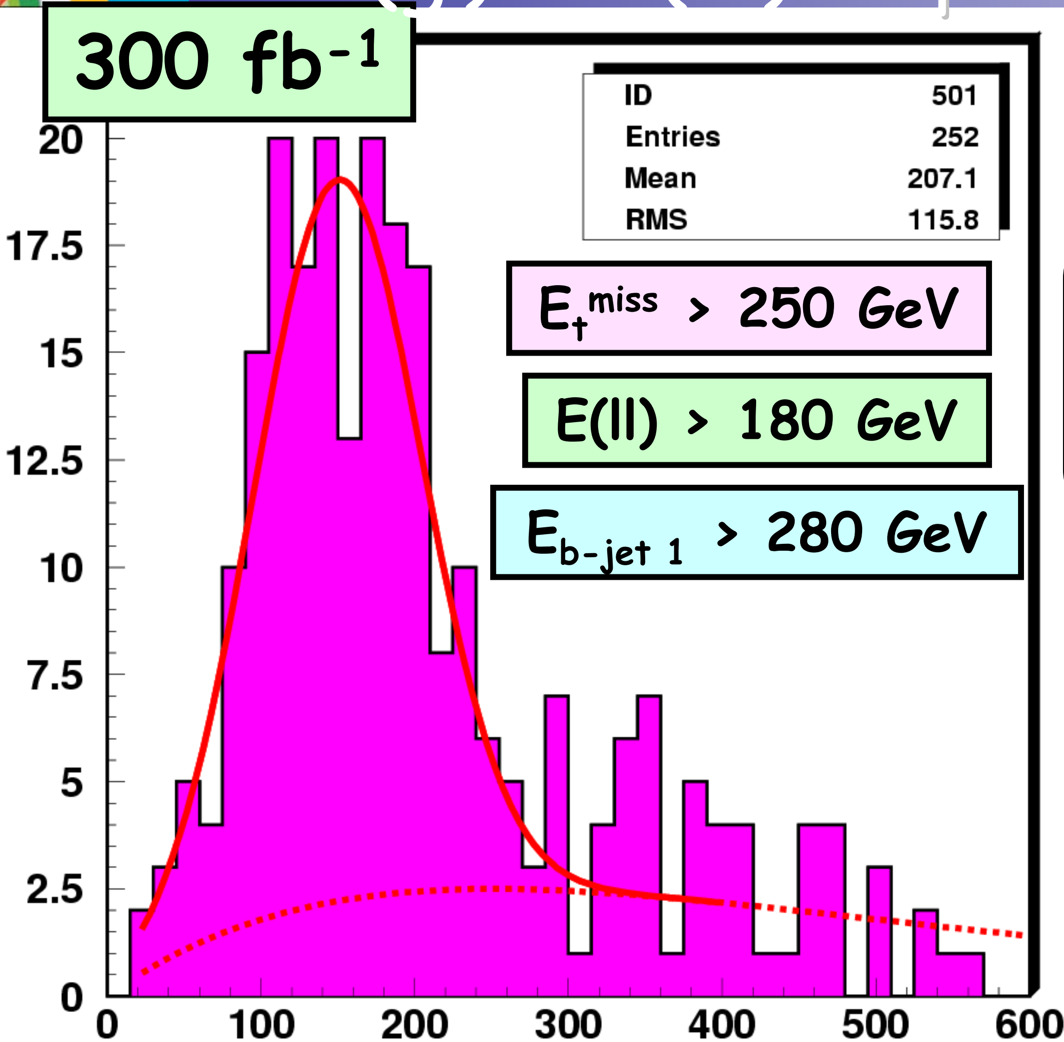
$M(\tilde{\chi}_2^0 bb) = 921.1 \pm 12.3$ GeV

$\sigma = 67.1$

Generated mass:

$M(\tilde{g}) = 919.8$ GeV

$M(\tilde{g}) - M(\tilde{b})$ at point G



Result of fit:

$$M(\tilde{\chi}_2^0 bb) - M(\tilde{\chi}_2^0 b) = 150.3 \pm 6.5 \text{ GeV}$$

$$\sigma = 54.1$$

Generated values:

$$M(\tilde{g}) - M(\tilde{b}_L) = 196.8 \text{ GeV}$$

$$M(\tilde{g}) - M(\tilde{b}_R) = 148.5 \text{ GeV}$$

Squark reconstruction

$pp \rightarrow \tilde{g} \rightarrow \tilde{q}_L q$ (5.2% d_L, 5.6% u_L, 5.2% s_L, 5.6% c_L)

$\hookrightarrow \tilde{\chi}_2^0 q$ (32%)

$\rightarrow \tilde{\ell}^{\pm}\ell^{\mp} \rightarrow \tilde{\chi}_1^0 \ell^+ \ell^-$ (16.4%)

$\rightarrow \tilde{\tau}^{\pm}\tau^{\mp} \rightarrow \tilde{\chi}_1^0 \tau^+ \tau^-$ (22.4%)

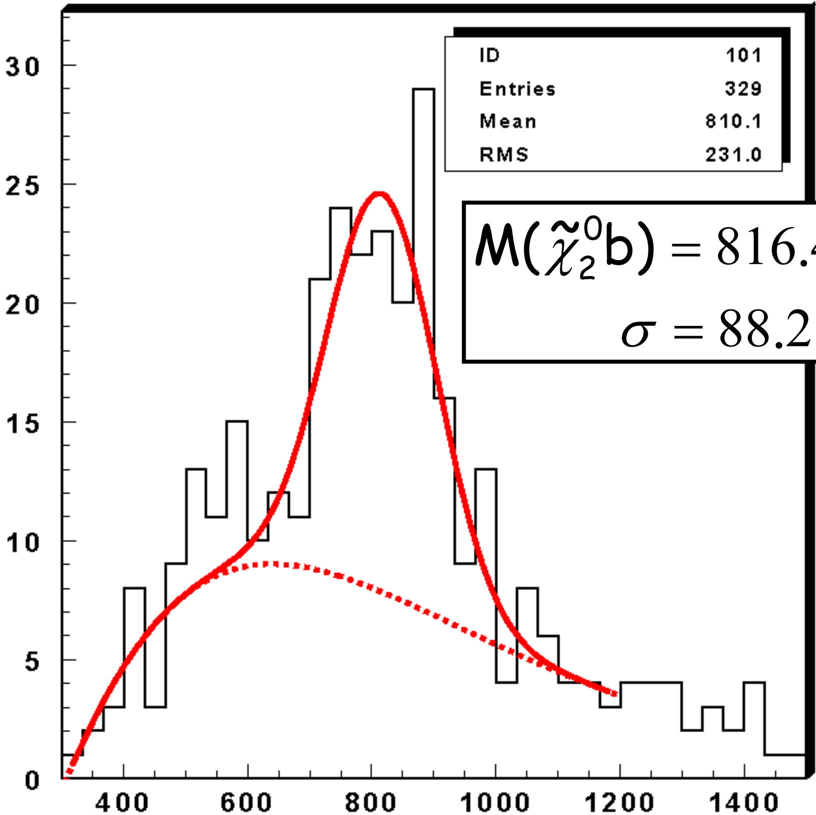
- ≥2 isolated leptons, p_T>15 GeV, $|\eta|$<2.4
- ≥ 2 jets (not b), p_T>20 GeV, $|\eta|$<2.4
- b-jet veto

anti b-tag → $\sigma_{ip} < 1$

No SM bkg: 2 leptons + high E_t^{miss} cut

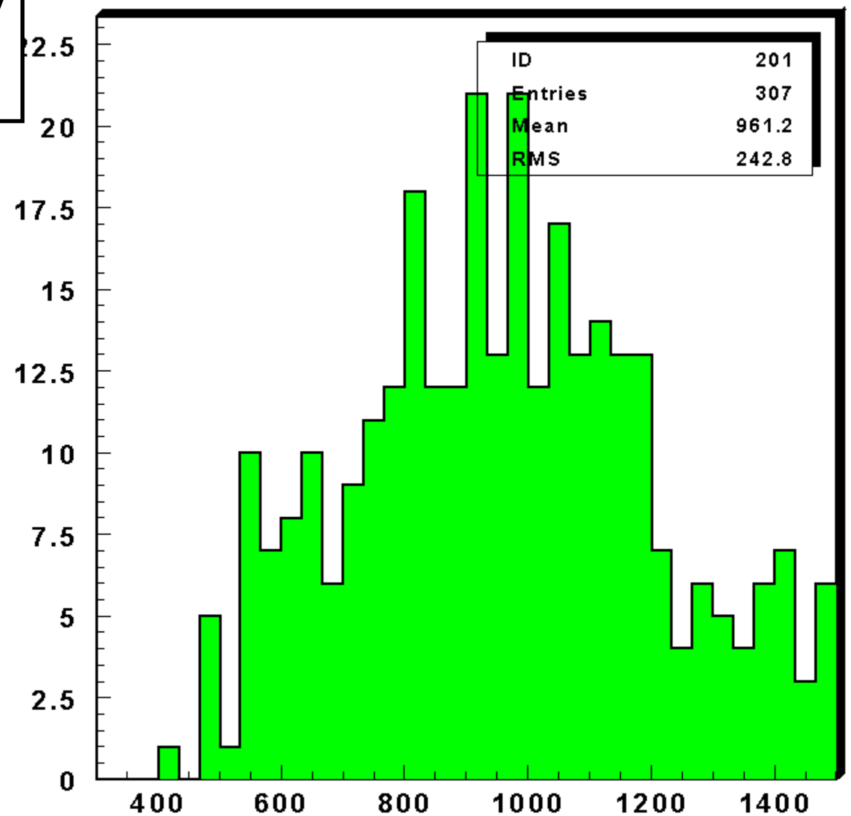
Squark reconstruction

This would need a better understanding of the BKGs



$$M(\tilde{\chi}_2^0 b) = 816.4 \pm 13.9 \text{ GeV}$$

$$\sigma = 88.2$$



$$M(\tilde{d}_L) = M(\tilde{s}_L) = 814.4 \text{ GeV}$$

$$M(\tilde{u}_L) = M(\tilde{c}_L) = 810.8 \text{ GeV}$$

Results at point B and G

Point	Luminosity (fb^{-1})	$M(\tilde{b})(\chi_1^0{}_{true})$ GeV $M(\tilde{b})(\chi_1^0 = M_{\ell^+\ell^-})$	σ (GeV)	$M(\tilde{g})(\chi_1^0{}_{true})$ GeV $M(\tilde{g})(\chi_1^0 = M_{\ell^+\ell^-})$	σ (GeV)	$M(\tilde{g}) - M(\tilde{b})$ GeV	σ (GeV)
B	10	480.5 ±5.4 467.8	43.3	587.1±11.3 559.3	41.4	86.7±4.7	20.5
	60	501.1 ±5.5	32.6	581.9±7.5	48.4	83.1±2.4	19.8
	300	512.0±1.4	34.7	594.2±5.1	39.5	85.7±2.4	20.4
G	60	-	-	-	-		-
	300	744.2±17.7	54.2	921.1±12.3	67.1	150.3±6.5	54.1

Conclusions

@ POINT B

- Sbottom and gluino reconstruction possible even at low integrated luminosity (10 fb^{-1}) with
  - Resolution <10%
  - Errors on mass determination of 1-2% (if we assume $M(\chi_1^0)$ known)
  - Errors ~ 5-6% if we approximate $M(\chi_1^0) \sim M(ll_{max})$ (this approximation is valid only in a mSUGRA scenario for which $M(\chi_2^0) \sim 2M(\chi_1^0)$, if we want a model independent analysis, we have to find other solutions)
- At 60 fb^{-1} improvements of ~few percent but still no sbottom separation
  - Maybe detector resolution prevents it
  - Detailed simulation needed at higher luminosity to understand if possible
- At 300 fb^{-1} and assuming $M(\chi_1^0)$ measured from a LC, we can have errors of ~ 0.5%

@ POINT G

- Sbottom and gluino reconstruction possible only at high luminosity
- At 300 fb^{-1} we can reconstruct sbottoms and gluino with resolution ~7%, errors 1-2%, assuming $M(\chi_1)$ known from a LC
- First attempt to reconstruct other squarks look promising but…

Conclusions

More work in progress…

Still many things to be understood and many tools to be developed and tuned before LHC starts!