

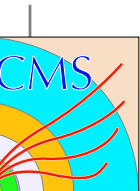
# Stop search @ LM1: background studies

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# LM1 masses and branching ratios

LM1 is gluino dominated:  $\sigma_{\text{tot}}(\tilde{g}) = 49.66 \text{ pb}$

$$m(\tilde{g}) = 611 \text{ GeV}; \quad m(\tilde{t}_1) = 411 \text{ GeV}$$

$$m(\tilde{\chi}_1^+) = 180 \text{ GeV}$$

$$m(\tilde{\chi}_2^0) = 180 \text{ GeV}; \quad m(\tilde{\chi}_1^0) = 95 \text{ GeV}; \quad \tilde{\chi}_2^0 \rightarrow \tilde{\chi}_1^0 Z$$

$$BR(\tilde{g} \rightarrow \tilde{t}_1 \bar{t} + \tilde{t}_1 t) = 2 \times 3.21\%; \quad BR(\tilde{t}_1 \rightarrow b \tilde{\chi}_1^+) = 63\%$$

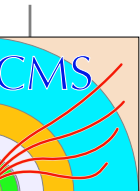
$$BR(\tilde{\chi}_1^+ \rightarrow \tilde{\nu}_{\ell L} \ell) = 3 \times 18\%; \quad BR(\tilde{\nu} \rightarrow \tilde{\chi}_1^0 \nu) \approx 100\%$$

$$BR(\tilde{\chi}_1^+ \rightarrow \tilde{t}_1 \nu_\tau) = 41\%; \quad BR(\tilde{t}_1 \rightarrow \tilde{\chi}_1^0 \tau) = 100\%$$

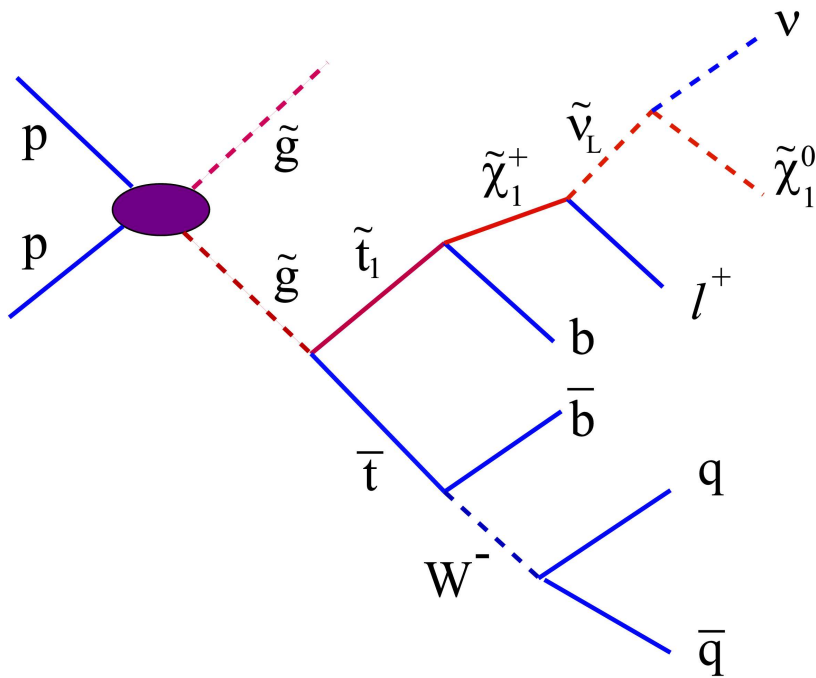
## My search channel:

$$\tilde{g} \rightarrow \tilde{t}_1 \bar{t} \quad \bar{t} \rightarrow \bar{b} W \rightarrow b q \bar{q}' \quad \tilde{t}_1 \rightarrow b \tilde{\chi}_1^+ \rightarrow b \ell^+ + E_{\text{miss}}$$

$$BR(\tilde{g} \rightarrow \text{signal}) = 1.5\%$$



# The search channel



Stop final state:

$b\text{-jet} + \ell^\pm + E_{\text{miss}}$

Stop signature:

$M_{\text{inv}}(\ell^\pm b)$  cutoff at  $E_{\text{miss}} < 180 \text{ GeV}$

tagged by:  $t \rightarrow 3 \text{ jets}$

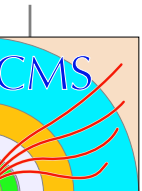
Signal: Saeid's LM1 stop MC 6630  $\tilde{t}_1$  events

PYTHIA-6.20  $\rightarrow$  ISAJET-7.69  $\rightarrow$  OSCAR\_3\_6\_0

Background: jm03b\_TTbar\_inclusive,  $2 \times 10^{33}$  PU

Reconstruction: ORCA\_8\_7\_1/ExProduction/writeDST

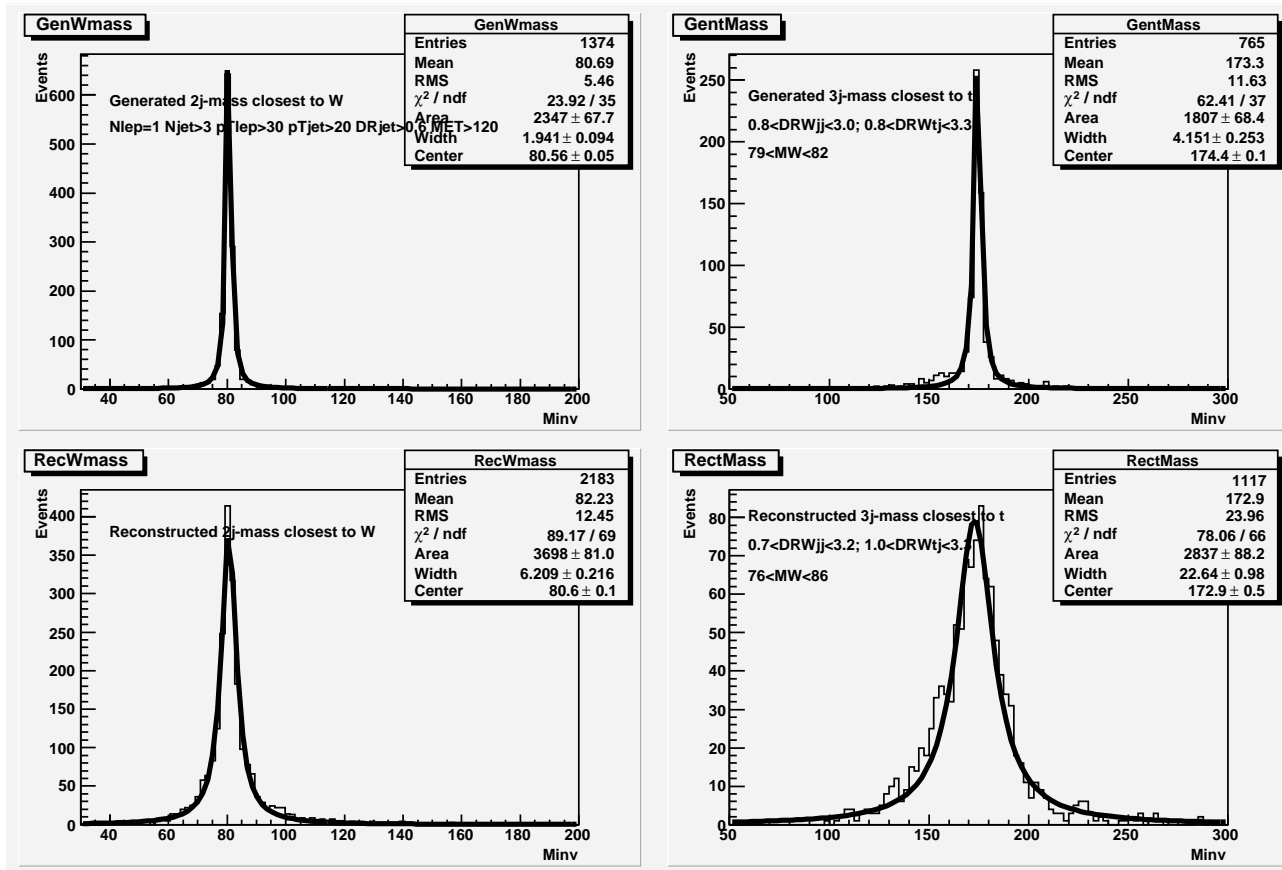
$BR(\tilde{t}\tilde{t}_1 \rightarrow \text{signal}) = 23\% \sim 1500 \text{ good events}$



# Event selection

$MET > 120$  GeV against  $t\bar{t}$

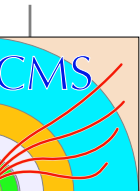
1 isolated  $e^\pm$  or  $\mu^\pm$  ( $p_T > 30$  GeV)  $\geq 4$  isolated jets ( $p_T > 20$  GeV,  $\Delta R > 0.6$ )  
 $j_1 + j_2$  closest to  $M_{inv}^{jj} = 80.6$  GeV,  $j_3$  to  $M_{inv}^{3j} = 174.4$  GeV



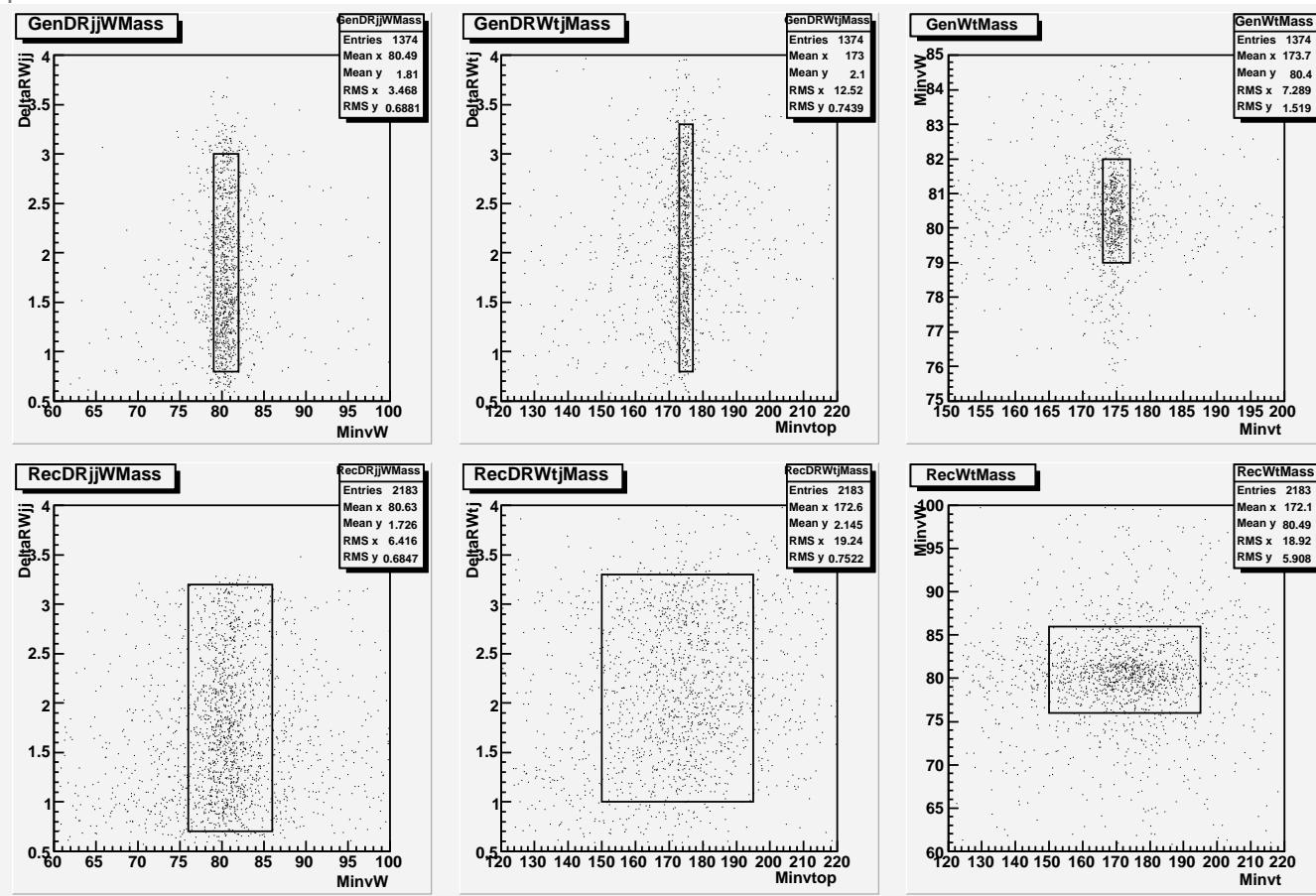
Generated events

Reconstructed events

Lorentz fits:  $M_{rec}^{jj} = 80.6$        $M_{rec}^{3j} = 172.9$



# Cuts in $M_{inv}$ and $\Delta R$



## Generated events

$$0.8 < \Delta R(j_1 - j_2) < 3.0$$

$$0.8 < \Delta R(W - j_3) < 3.3$$

$$79 < M_{inv}^{2j} < 82 \text{ GeV}$$

$$173 < M_{inv}^{3j} < 177 \text{ GeV}$$

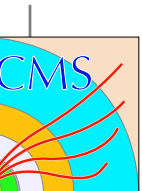
## Reconstructed events

$$0.7 < \Delta R(j_1 - j_2) < 3.2$$

$$1.0 < \Delta R(W - j_3) < 3.3$$

$$76 < M_{inv}^{2j} < 86 \text{ GeV}$$

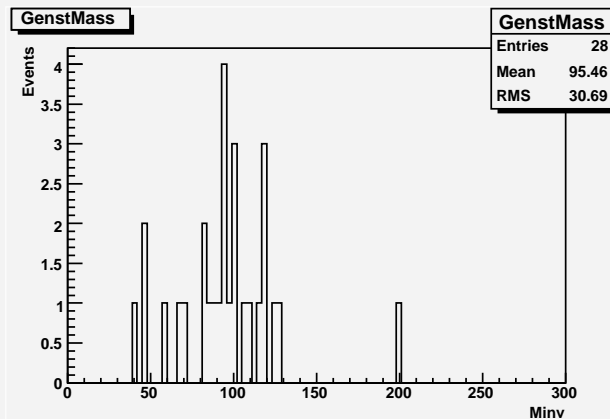
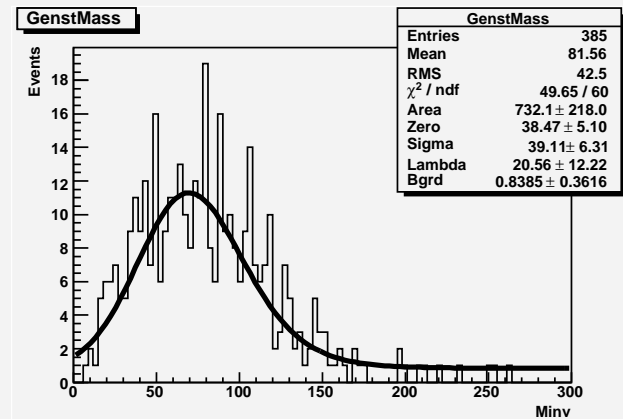
$$150 < M_{inv}^{3j} < 195 \text{ GeV}$$



# Stop signature: $M_{\text{inv}}(\ell^{\pm} j_4)$ slope

Signal: 6629  $\tilde{t}_1$

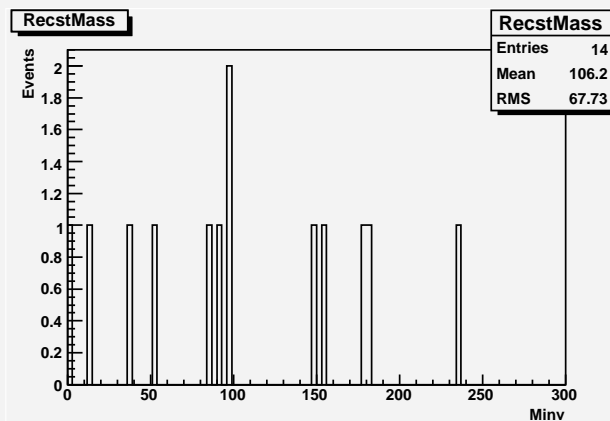
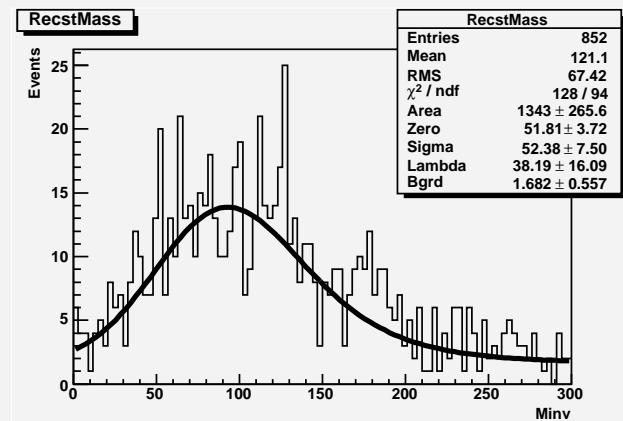
Background: 10000  $t\bar{t}$



Generated lep+jet mass (stop?)

Nlep=1 Njet>3 pTlep>30 pTjet>20 DRjet>0.6 MET>120  
 0.8<DRWjj<3.0; 0.8<DRWtj<3.3  
 79<MW<82; 173<Mtop<177

2005-09-05 19:01:57



Reconstructed lep+jet mass (stop?)

Nlep=1 Njet>3 pTlep>30 pTjet>20 DRjet>0.6 MET>120  
 0.7<DRWjj<3.2; 1.0<DRWtj<3.3  
 76<MW<86; 150<Mtop<195

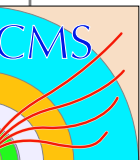
2005-09-05 19:01:57

Fitting Gauss & exponential convolution

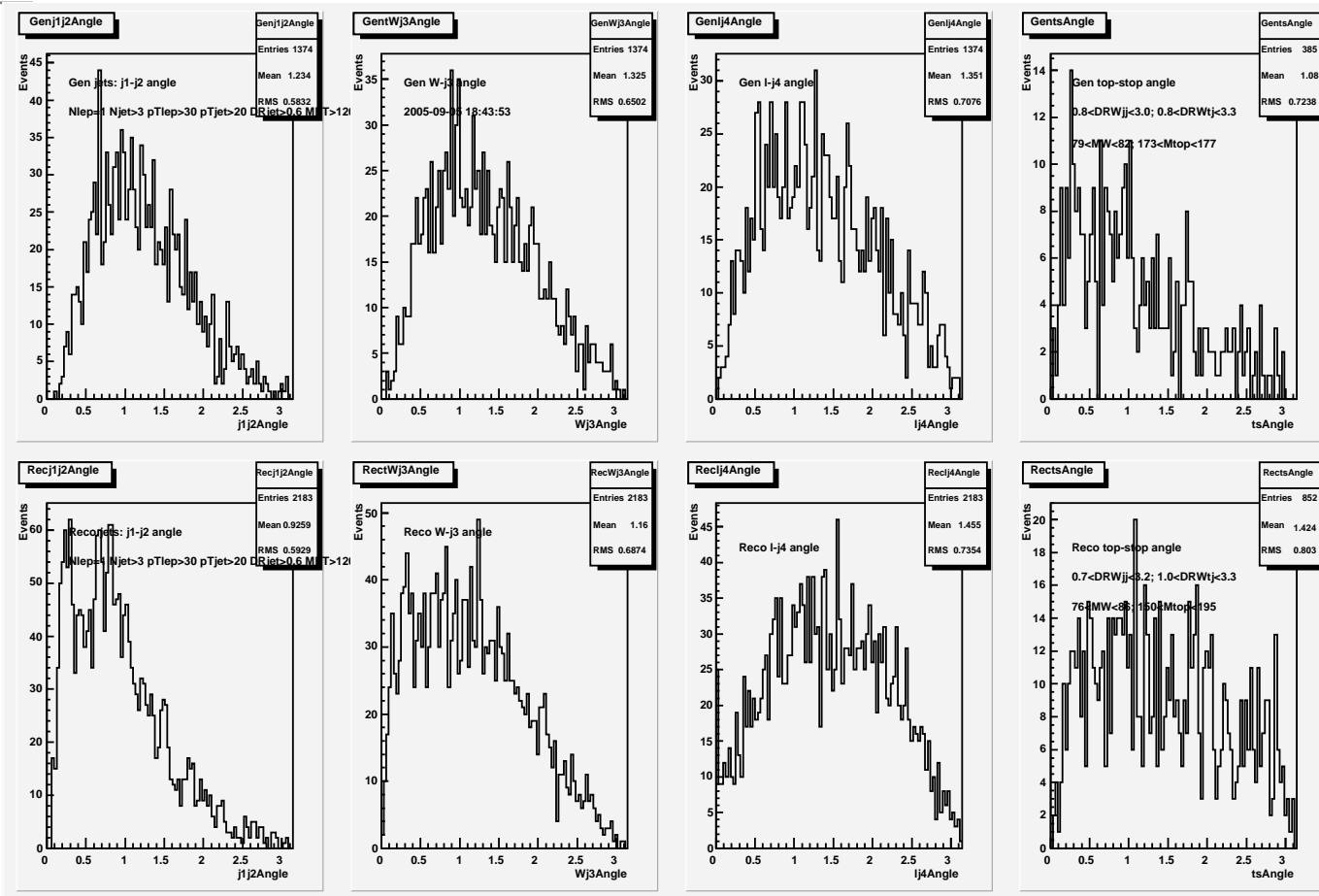
$$\frac{1}{2}A\lambda \exp\left(\frac{1}{2}\lambda^2\sigma^2 - \lambda t\right) \left[1 + \text{erf}\left(\frac{t/\sigma - \lambda\sigma}{\sqrt{2}}\right)\right] \text{ where } t = M_{\text{inv}} - M_0$$

Shape pars not sensitive to mass cuts

b-tagging: no better, less statistics



# Angle distributions (signal)



Generated events

Reconstructed events

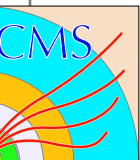
$$0.2 < \Theta(j_1 - j_2) < 1.6$$

$$0.2 < \Theta(\ell - j_4) < 2.5$$

$$0.2 < \Theta(W - j_3) < 2.0$$

$$0.2 < \Theta(t - \tilde{t}_1) < 1.6$$

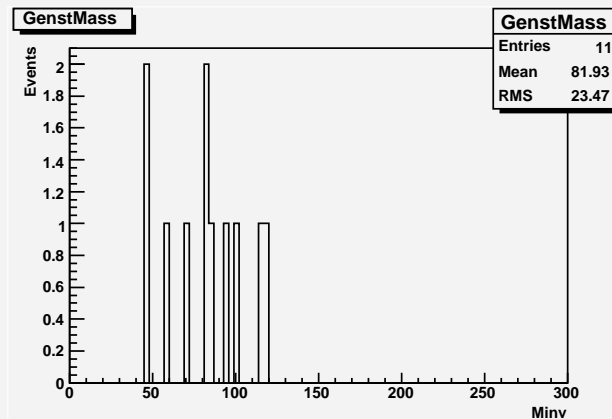
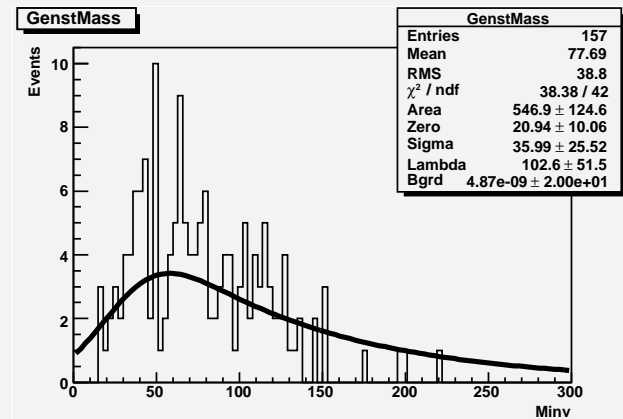
## Cuts on angles



# Stop signature with angle cuts

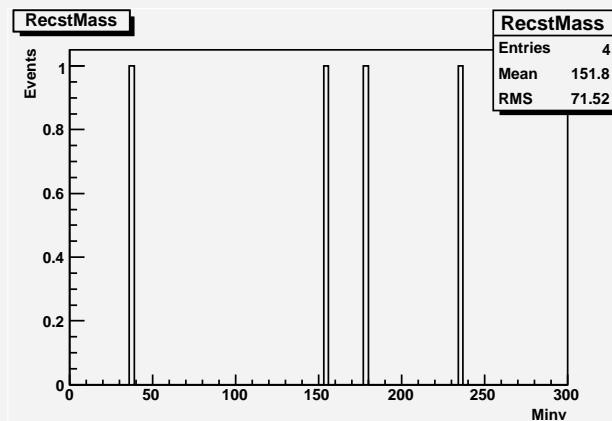
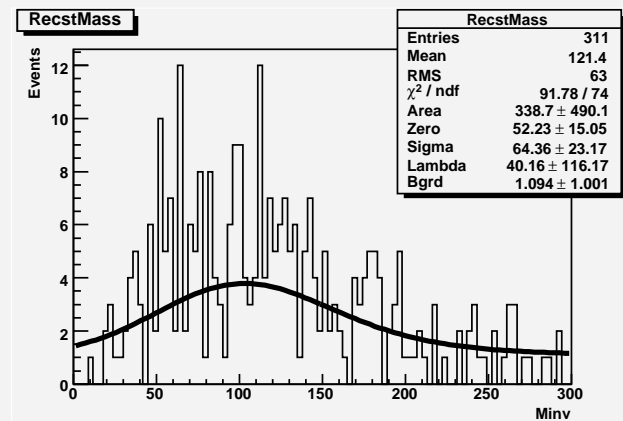
Signal: 6629  $\tilde{t}_1$

Background: 10000  $t\bar{t}$



Generated lep+jet mass (stop?)

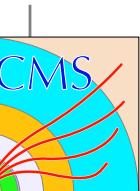
$N_{lep}=1$   $N_{jet}>3$   $p_{Tlep}>30$   $p_{Tjet}>20$   $DR_{jet}>0.6$   $MET>120$   
 $0.8<DR_{Wjj}<3.0$ ;  $0.8<DR_{Wtj}<3.3$   
 $79<MW<82$ ;  $173<M_{top}<177$   
 $Angles>0.2$   $j_1-j_2<1.6$   $W-j_3<2.0$   $l-j_4<2.5$   $t-s<1.6$   
 2005-09-04 09:47:45



Reconstructed lep+jet mass (stop?)

$N_{lep}=1$   $N_{jet}>3$   $p_{Tlep}>30$   $p_{Tjet}>20$   $DR_{jet}>0.6$   $MET>120$   
 $0.7<DR_{Wjj}<3.2$ ;  $1.0<DR_{Wtj}<3.3$   
 $76<MW<86$ ;  $150<M_{top}<195$   
 $Angles>0.2$   $j_1-j_2<1.6$   $W-j_3<2.0$   $l-j_4<2.5$   $t-s<1.6$   
 2005-09-04 09:47:45

~ 30% constant background under signal





# Significance??

No angle cut:  $N(\tilde{t}_1) = 852$ ,  $N(t\bar{t}) = 14$

$L(\text{fb}^{-1})$	0.1	1.0	10	100
signal/ $\sqrt{\text{bgrd}}$	2.1	6.6	21	66
exp signal evs	24	240	2400	24000

With angle cuts:  $N(\tilde{t}_1) = 311$ ,  $N(t\bar{t}) = 4$

$L(\text{fb}^{-1})$	0.1	1.0	10	100
signal/ $\sqrt{\text{bgrd}}$	1.4	4.5	14	45
exp signal evs	9	90	900	9000

Shape fitting needs statistics!

Systematics?

Shape of background?

