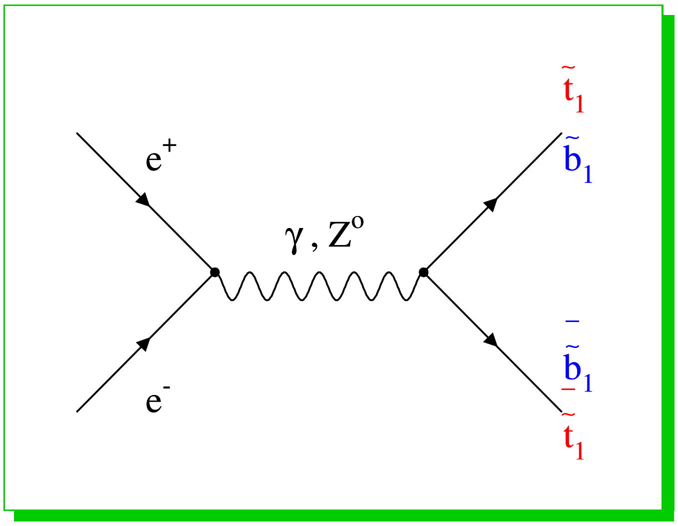
Introduction

Squark Searches from $\sqrt{s} = 189$ to 208 GeV



$$\tilde{t}_1 \longrightarrow c\tilde{\chi}_1^0$$
$$\tilde{b}_1 \longrightarrow b\tilde{\chi}_1^0$$

2 acoplanar jets + missing energy

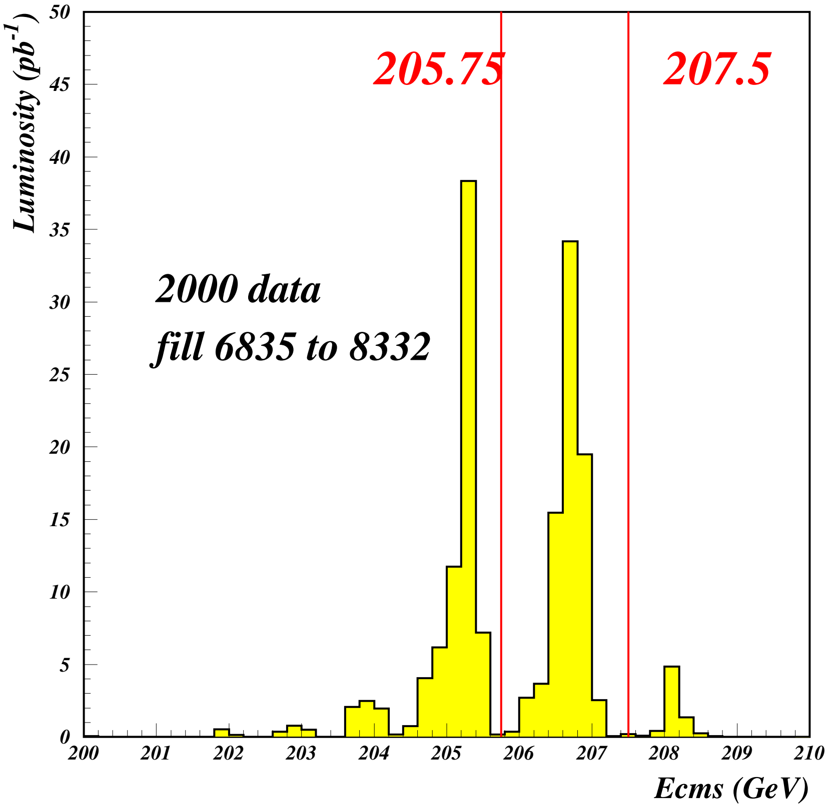
Outline :

- **Final results with systematics**
- **First look at 2000 data without S6**

2000 data

2000 Data with processing C1

- Centre-of-mass energy versus luminosity : (from STILUM00.31OCT00)



$\Longrightarrow$ 3 Ecms analysis windows :

	$\sqrt{s}$	$\mathcal{L}$	$\langle\sqrt{s}\rangle$	MC samples
window 1	≤ 205.75	78.08	204.8	204
window 2	$\in]205.75,207.5]$	78.49	206.6	206
window 3	> 207.5	7.28	208.1	208

Systematics

- **Where are the problems:**

- **In the signal simulation:**
  - **The stop hadronisation model (important for $\Delta M < 10$)**

	$\Delta M \geq 10$	$\Delta M < 10$
Stop simulation	**5%**	**10%**
Sbottom simulation	**5%**	**5%**

- **In the background simulation:**
  - **Problem of shape : (local disagreements, shifts)**
  - **Problem of normalisation**

- **Problem of normalisation :**

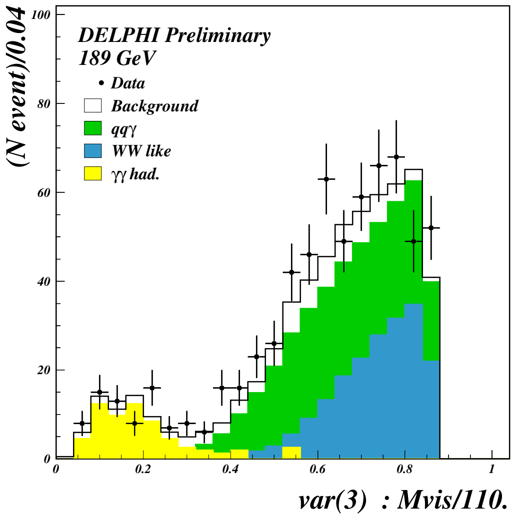
- **Global deficit of MC event at the pre-selection level**
- $\Longrightarrow$ **To propagate the effect of this deficit on the final selection**

$$\mathbf{N}_{\mathbf{mc}}^{\mathbf{Norm.}} = \mathbf{N}_{\mathbf{mc}}^{\mathbf{ana}} * \mathbf{N}_{\mathbf{data}}^{\mathbf{presel.}} / \mathbf{N}_{\mathbf{mc}}^{\mathbf{presel.}}$$
$$\epsilon_{\mathbf{Norm.}} = \mathbf{N}_{\mathbf{mc}}^{\mathbf{Norm.}} - \mathbf{N}_{\mathbf{mc}}$$

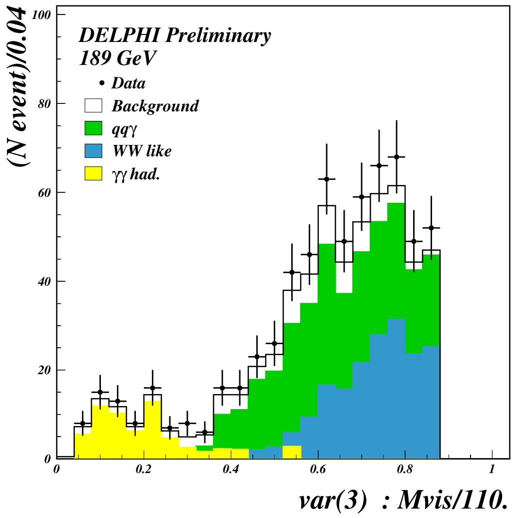
Systematics

- **Problem of shape**

- **After the normalisation procedure, each input variable is separated into 25 bins**
- **For each variable in turn:**
  - **1.-Ndata/Nmc is calculated for each bin after the normalisation procedure. The weight of the event is multiplied by the ratio 1.-Ndata/Nmc of the bin to which it belongs**



$\Longrightarrow$



  - **From events passing the neural network cut, the background is re-estimated with this new set of weigths**

It allows:

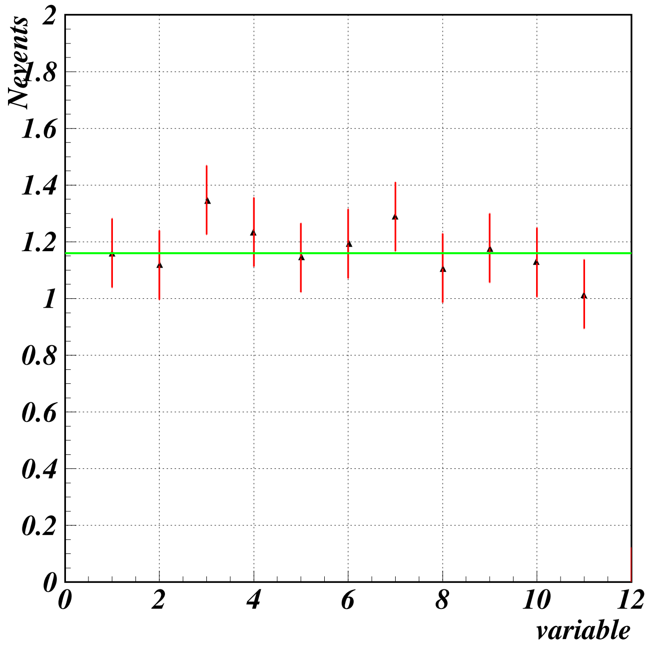
- **to keep exactly the same Monte-Carlo sample and not to introduce new statistical fluctuation**
- **to study the variable independantly**
- **The neural network outputs have not to be re-calculated**

Systematics

- **Example** Sbottom analysis at 189 GeV for $\Delta M \geq 20$

Final numbers: $N_{data} = \mathbf{3}$ $N_{mc} = \mathbf{1.16 \pm 0.12}$ **(stat.)**

Pre-selection: $N_{data}^{presel.} = \mathbf{656}$ $N_{mc}^{presel.} = \mathbf{594. \pm 7.}$



$$\mathbf{N_{mc}^{Norm.} = 1.16 * \frac{N_{data}^{presel.}}{N_{mc}^{presel.}}} \qquad \epsilon_{\mathbf{Norm.}} = \mathbf{N_{mc}^{Norm.} - N_{mc}} \qquad \mathbf{+\ 0.12}$$

$$\mathbf{N_{mc}^{i} \geq N_{mc}} \qquad \epsilon_{+} = \sqrt{\Sigma_{\mathbf{i=1}}^{\mathbf{N+}}(\mathbf{N_{mc}^{i} - N_{mc}})^{2}} \qquad \mathbf{+\ 0.24}$$

$$\mathbf{N_{mc}^{i} \leq N_{mc}} \qquad \epsilon_{-} = \sqrt{\Sigma_{\mathbf{i=1}}^{\mathbf{N-}}(\mathbf{N_{mc}^{i} - N_{mc}})^{2}} \qquad \mathbf{-\ 0.16}$$

$$N_{data} = \mathbf{3} \quad N_{mc} = \mathbf{1.16 \pm 0.12^{+0.27}_{-0.16}}$$

Correlation matrix

Correlation matrix

$$T_{ij} = \sum_{k=1}^{n} \frac{(x_k^i - \bar{x}^i)(x_k^j - \bar{x}^j)}{n}$$

$$C_{ij} = \frac{T_{ij}}{\sqrt{T_{ii}T_{jj}}}$$

	var1	var2	var3	var4	var5	var6	var7	var8	var9	var10
var1	1.000	0.275	-0.043	-0.029	-0.485	0.363	0.585	0.612	-0.469	-0.006
var2	-	1.000	0.888	-0.051	-0.035	0.961	0.185	0.134	-0.235	0.167
var3	-	-	1.000	0.017	0.157	0.811	0.081	-0.128	-0.142	0.158
var4	-	-	-	1.000	0.044	-0.193	0.275	-0.351	-0.252	-0.010
var5	-	-	-	-	1.000	-0.037	-0.467	-0.743	-0.235	-0.042
var6	-	-	-	-	-	1.000	0.108	0.238	-0.225	0.159
var7	-	-	-	-	-	-	1.000	0.182	-0.420	-0.013
var8	-	-	-	-	-	-	-	1.000	0.235	0.020
var9	-	-	-	-	-	-	-	-	1.000	0.037
var10	-	-	-	-	-	-	-	-	-	1.000

- var1=P_t^{mis}/E_{vis}
- var2=E_t
- var3=M_{vis}
- var4=$M_{j1}/E_{j1} + M_{j2}/E_{j2}$
- var5=acolinearity
- var6=$\sqrt{P_{t1}^2 + P_{t2}^2}$
- var7=acoplanarity
- var8=H10+H30
- var9=θ_{Pmis}
- var10=Prob(Z^o) 2 (jets Durham)

Kolmogorov Test

	var1	var2	var3	var4	var5	var6	var7	var8	var9	var10
Presel	0.288	0.056	0.174	0.931	0.410	0.081	0.380	0.936	0.314	0.645
var1	1.000	0.100	0.211	0.870	0.315	0.117	0.910	0.638	0.732	0.767
var2	0.403	1.000	0.998	0.730	0.306	1.000	0.802	0.886	0.523	0.759
var3	0.219	0.486	1.000	0.761	0.701	0.310	0.708	0.998	0.525	0.671
var4	0.240	0.060	0.176	1.000	0.398	0.100	0.241	0.932	0.315	0.635
var5	0.129	0.029	0.157	0.948	1.000	0.044	0.152	0.596	0.466	0.591
var6	0.485	1.000	0.971	0.987	0.245	1.000	0.515	0.645	0.505	0.749
var7	0.605	0.090	0.284	0.483	0.278	0.073	1.000	0.923	0.549	0.708
var8	0.190	0.067	0.242	0.843	0.528	0.084	0.398	1.000	0.352	0.692
var9	0.789	0.140	0.352	0.834	0.770	0.130	0.726	1.000	1.000	0.753
var10	0.269	0.056	0.161	0.926	0.418	0.082	0.318	0.961	0.292	1.000

- The correction of one variable improves most of the time the other variables
- The quadratic sum of the systematic errors overestimates the total systematic error

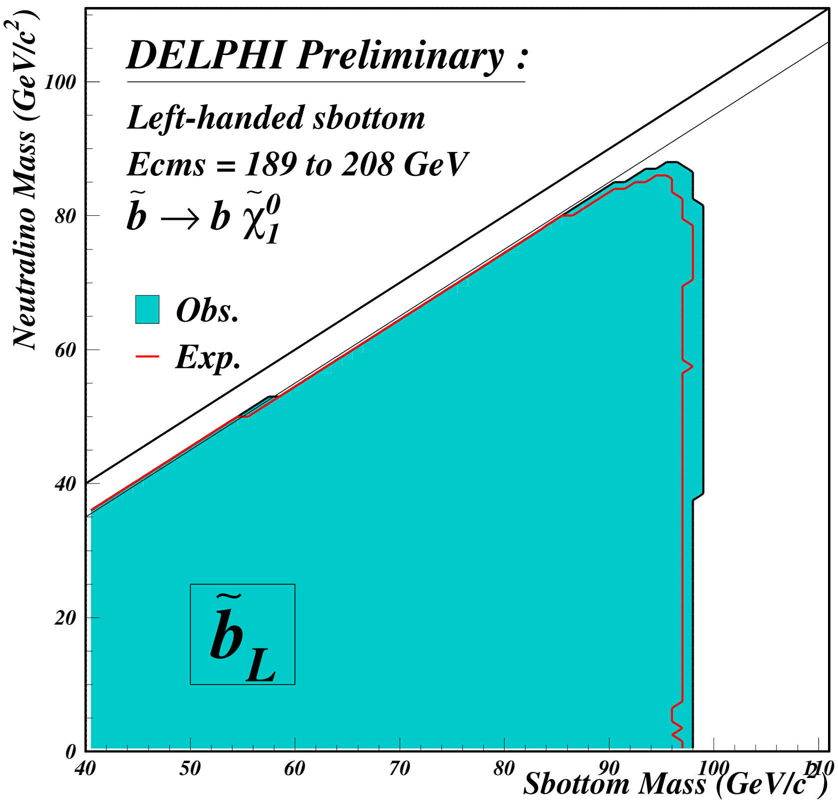
Results

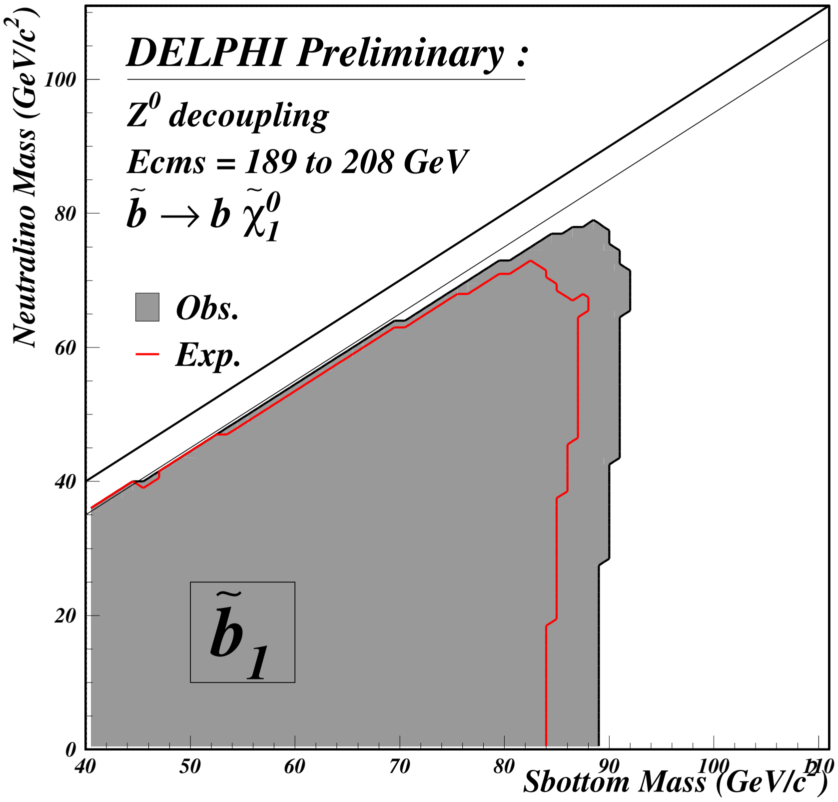
Sbottom analysis				
	$\Delta M \geq 20 GeV/c^2$		$\Delta M < 20 GeV/c^2$	
	data	MC	data	MC
188.7	3	$1.16 \pm 0.12^{+0.27}_{-0.16}$	0	$1.72 \pm 0.93^{+0.57}_{-0.03}$
191.6	0	$0.18 \pm 0.02^{+0.06}_{-0.06}$	0	$0.29 \pm 0.07^{+0.09}_{-0.09}$
195.6	0	$0.66 \pm 0.08^{+0.09}_{-0.05}$	1	$0.92 \pm 0.23^{+0.08}_{-0.32}$
199.6	0	$0.57 \pm 0.07^{+0.06}_{-0.07}$	0	$1.05 \pm 0.25^{+0.56}_{-0.20}$
201.7	0	$0.28 \pm 0.04^{+0.08}_{-0.08}$	1	$0.52 \pm 0.12^{+0.11}_{-0.13}$
204.8	0	$0.70 \pm 0.07^{+0.06}_{-0.12}$	0	$0.60 \pm 0.24^{+0.08}_{-0.30}$
206.6	0	$0.53 \pm 0.05^{+0.06}_{-0.04}$	0	$0.48 \pm 0.21^{+0.21}_{-0.17}$
208.1	0	$0.060 \pm 0.007^{+0.019}_{-0.040}$	0	$0.054 \pm 0.023^{+0.044}_{-0.049}$
Tot.	3	$4.14 \pm 0.19^{+0.32}_{-0.25}$	2	$5.63 \pm 1.05^{+0.85}_{-0.54}$

Stop analysis				
	$\Delta M \geq 20 GeV/c^2$		$\Delta M < 20 GeV/c^2$	
	data	MC	data	MC
188.7	3	$3.92 \pm 0.29^{+0.83}_{-0.40}$	2	$3.64 \pm 1.17^{+1.07}_{-0.33}$
191.6	2	$1.03 \pm 0.11^{+0.38}_{-0.35}$	0	$0.47 \pm 0.09^{+0.12}_{-0.16}$
195.6	2	$2.95 \pm 0.24^{+0.45}_{-0.31}$	2	$1.37 \pm 0.25^{+0.07}_{-0.37}$
199.6	1	$2.71 \pm 0.15^{+0.37}_{-0.36}$	0	$1.59 \pm 0.27^{+0.72}_{-0.18}$
201.7	1	$1.51 \pm 0.08^{+0.49}_{-0.21}$	0	$0.83 \pm 0.13^{+0.29}_{-0.24}$
204.8	5	$2.38 \pm 0.13^{+0.32}_{-0.38}$	0	$1.19 \pm 0.32^{+0.05}_{-0.59}$
206.6	2	$2.71 \pm 0.13^{+0.32}_{-0.23}$	2	$1.25 \pm 0.29^{+0.20}_{-0.41}$
208.1	0	$0.208 \pm 0.014^{+0.066}_{-0.101}$	0	$0.117 \pm 0.030^{+0.088}_{-0.080}$
Tot.	16	$17.4 \pm 0.47^{+1.27}_{-0.87}$	6	$10.5 \pm 1.31^{+1.35}_{-0.94}$

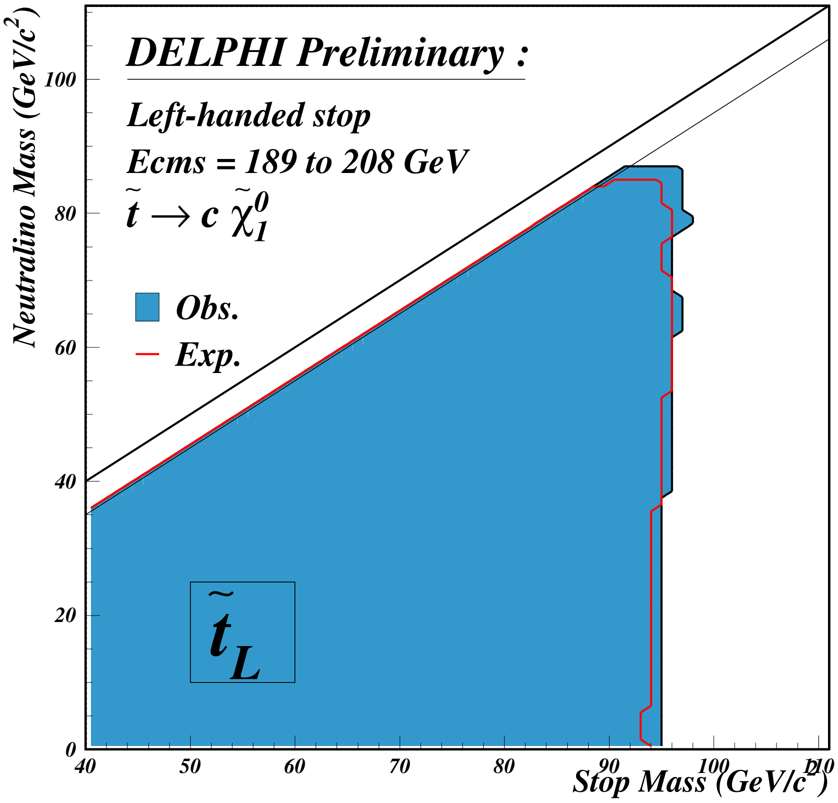
- The highest systematic error is given to exclusion program (ALRMC)
- It is combined quadratically with the statistical error

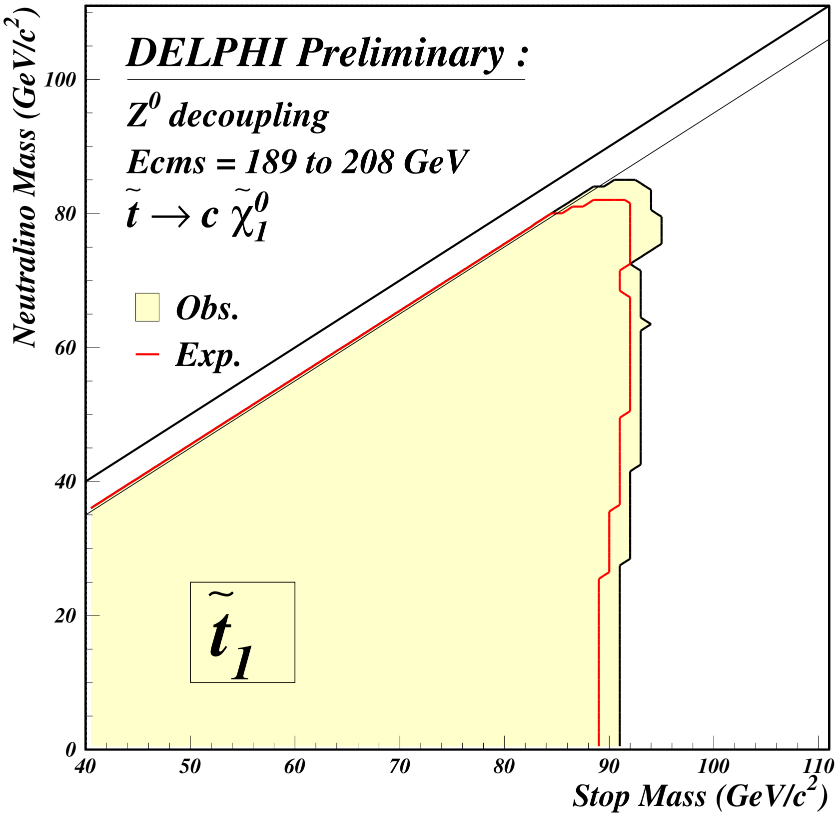
Excluded region





Excluded region





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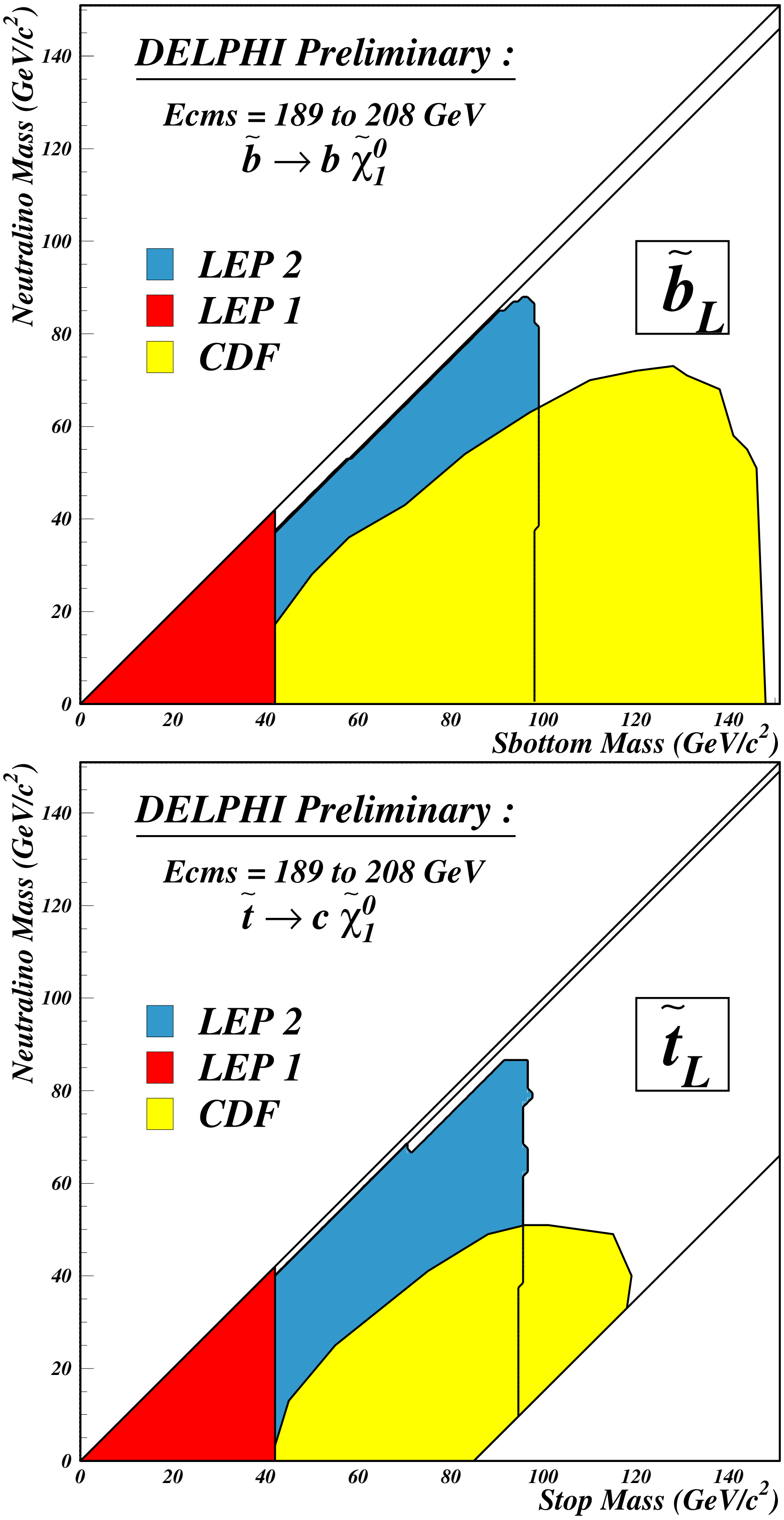
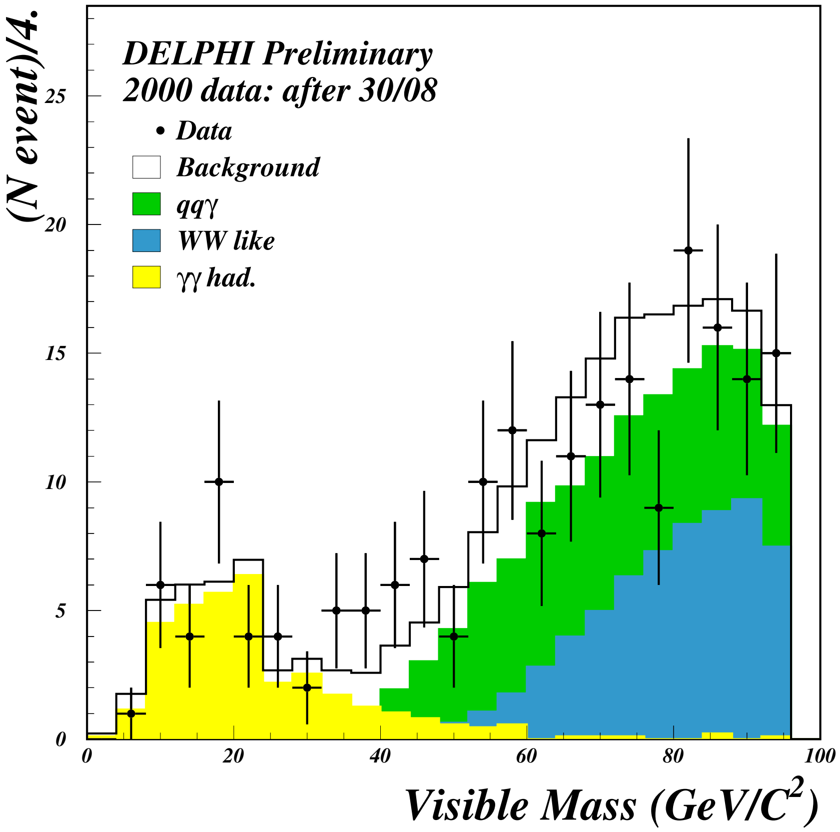
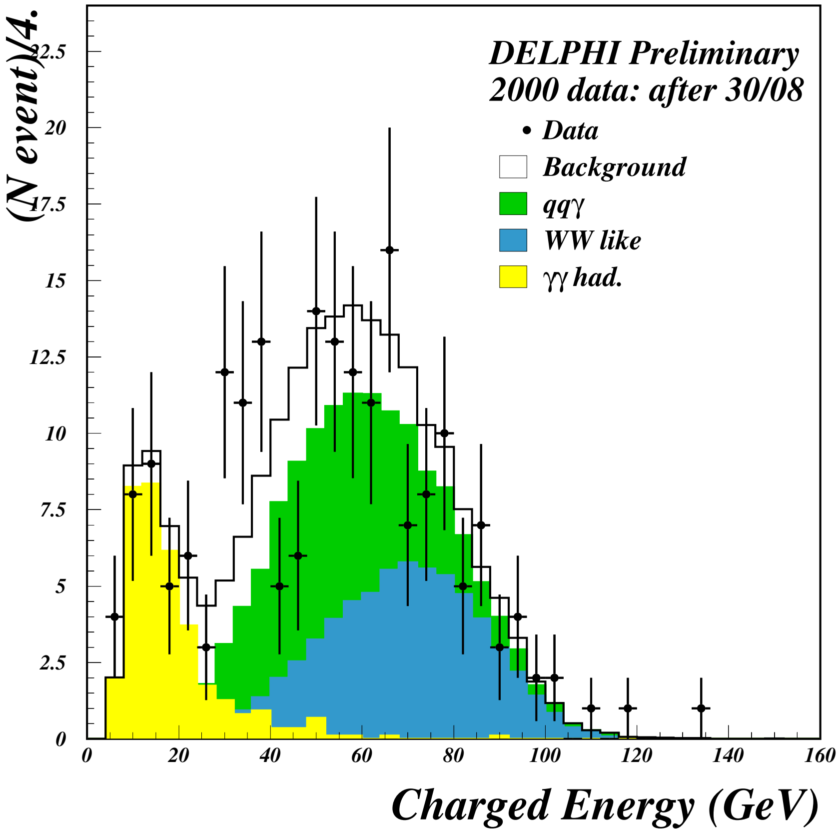


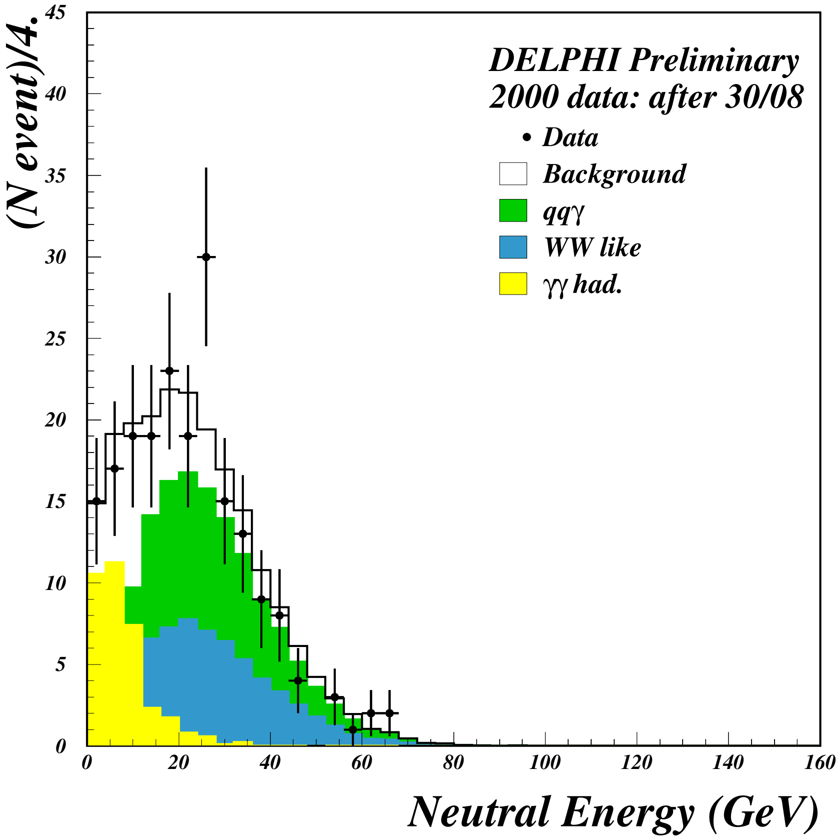
Data without Sector 6

- (Data (S1) comparison with MC at 206 (A1)
- Without any change in the analysis
- Pre-selection level : Ndata= 199 , Nmc= 206. ± 3.

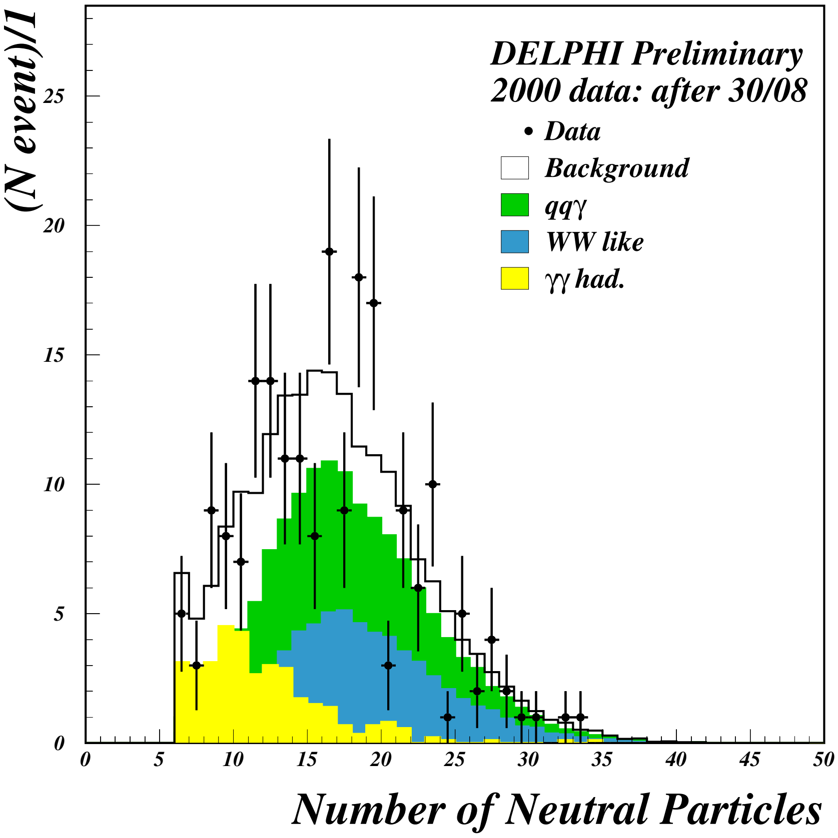


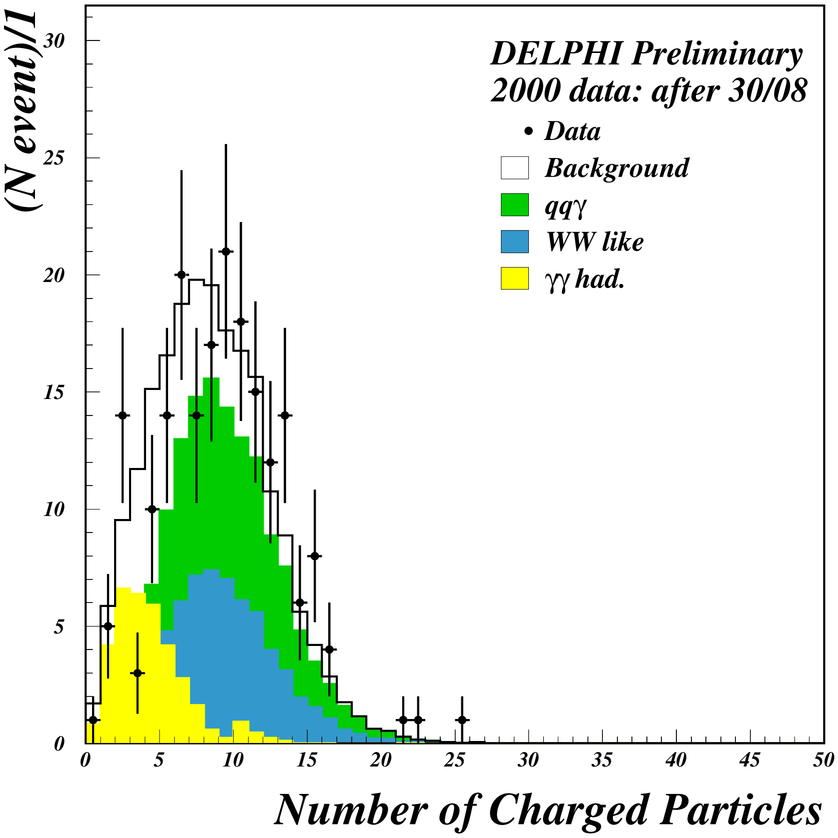
Data without Sector 6





Data without Sector 6





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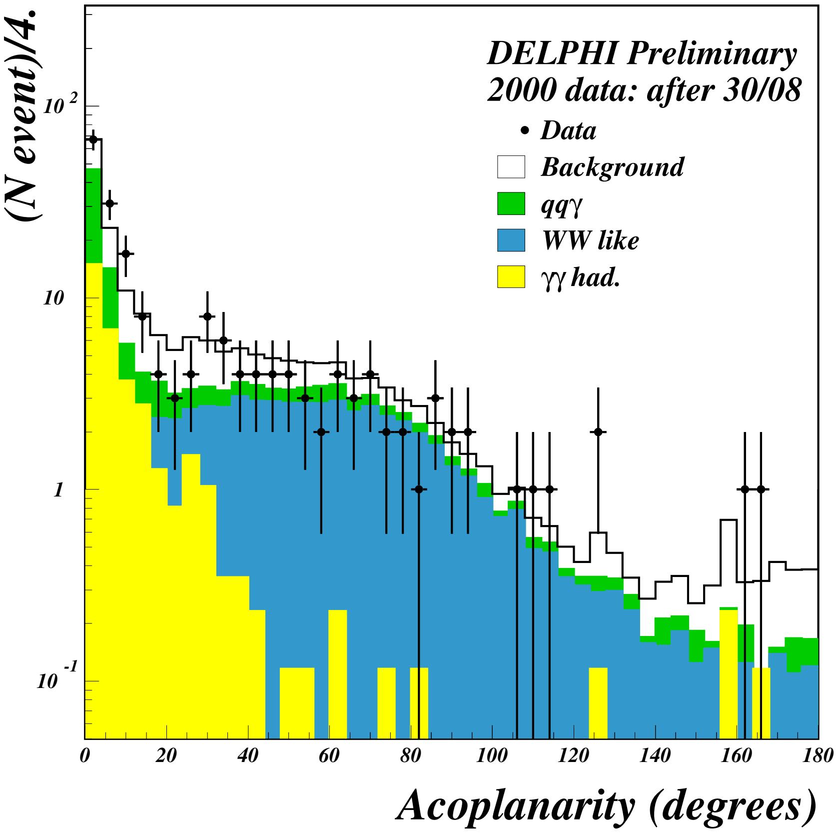

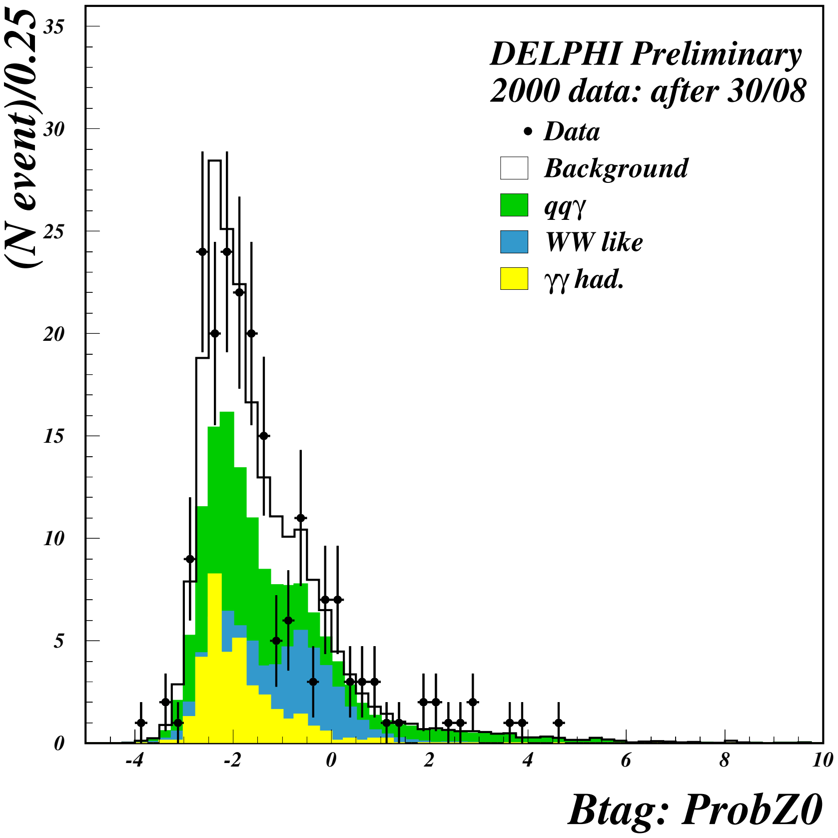

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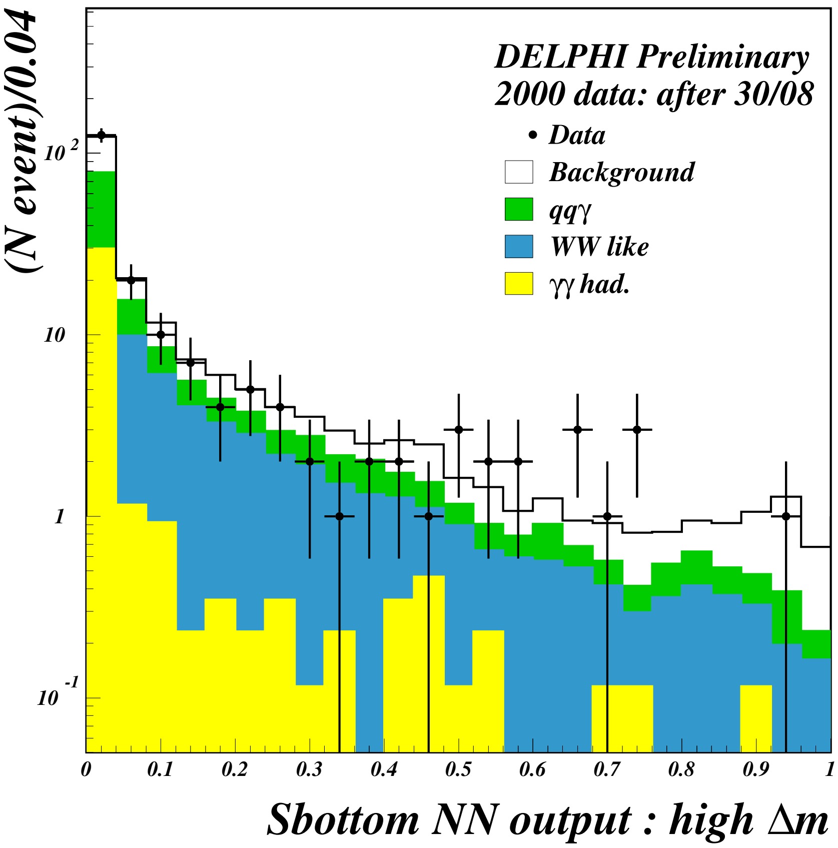

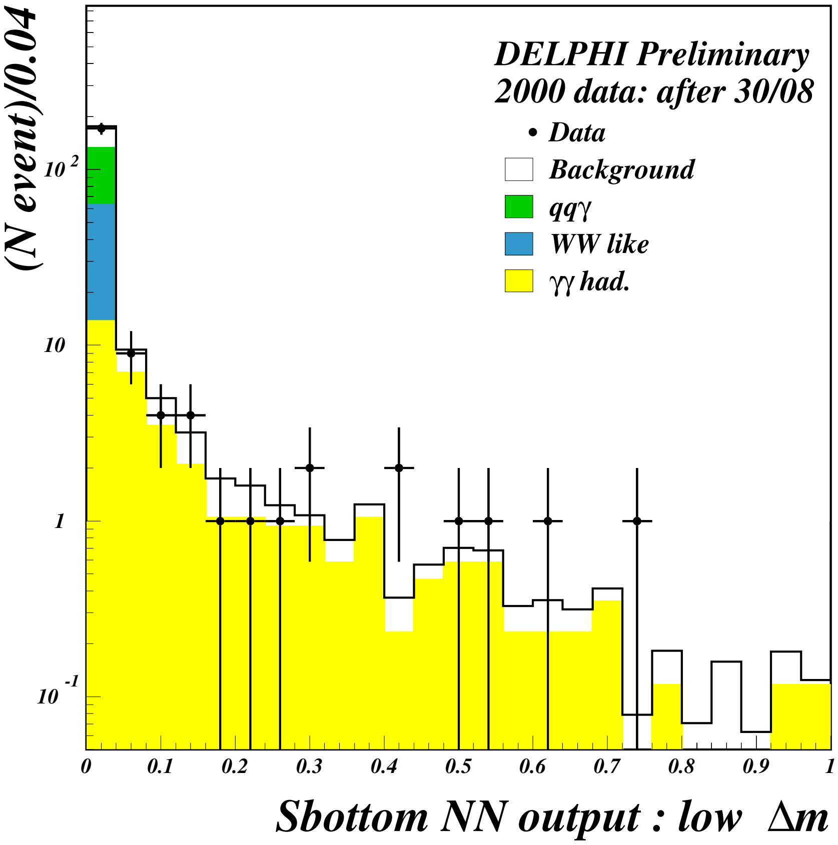

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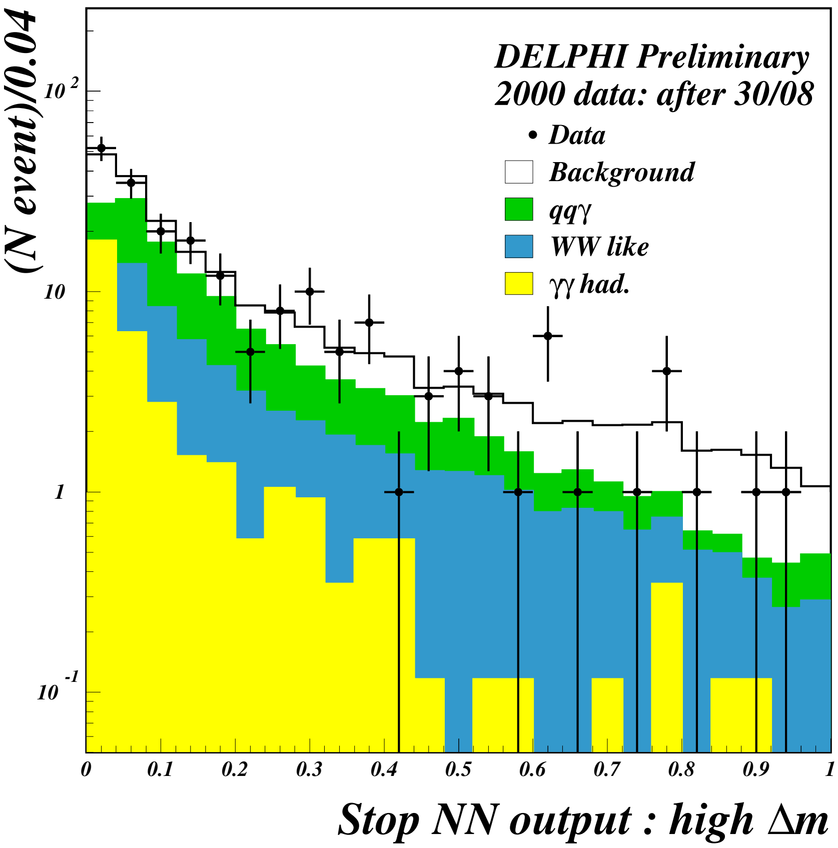

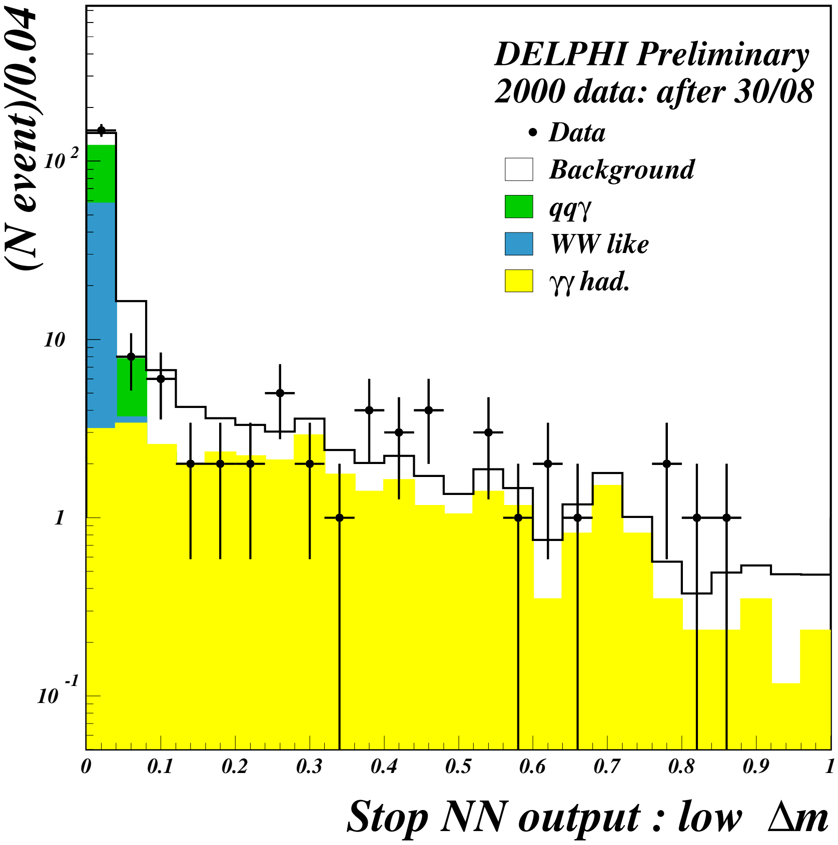

Conclusion

- **Data without S6:** 60.6 pb^{-1}

Sbottom analysis				
	$\Delta M \geq 20 GeV/c^2$		$\Delta M < 20 GeV/c^2$	
	data	MC	data	MC
206.5	0	0.41 ± 0.04	0	0.72 ± 0.19

Stop analysis				
	$\Delta M \geq 20 GeV/c^2$		$\Delta M < 20 GeV/c^2$	
	data	MC	data	MC
206.5	1	2.1 ± 0.10	0	1.26 ± 0.22

- Waiting for the next full SUSANA ntuple production to have S1 MC

- **Systematics**

- The systematic study is performed by varying the weight of the MC
- The introduction of the errors has a limited effect on the limits given at 95 % CL

	Sbottom		Stop	
	a=0.	a=68.	a=0.	a=56.
$\Delta M \geq 7$	94. (=)	80. (=)	94. (-1.)	91. (=)
$\Delta M \geq 10$	97. (=)	89. (=)	95. (=)	91. (=)
$\Delta M \geq 15$	98. (=)	89. (=)	95. (=)	91. (=)