Squark Searches

R-parity Conservation

$$\tilde{q} \longrightarrow q\tilde{\chi}_1^o$$

Non-degenerate mass case : $\Delta M \ > 10$:

Results combining :

- 189 GeV (D2)
- 183 GeV (E3)

First look at the 192 GeV data

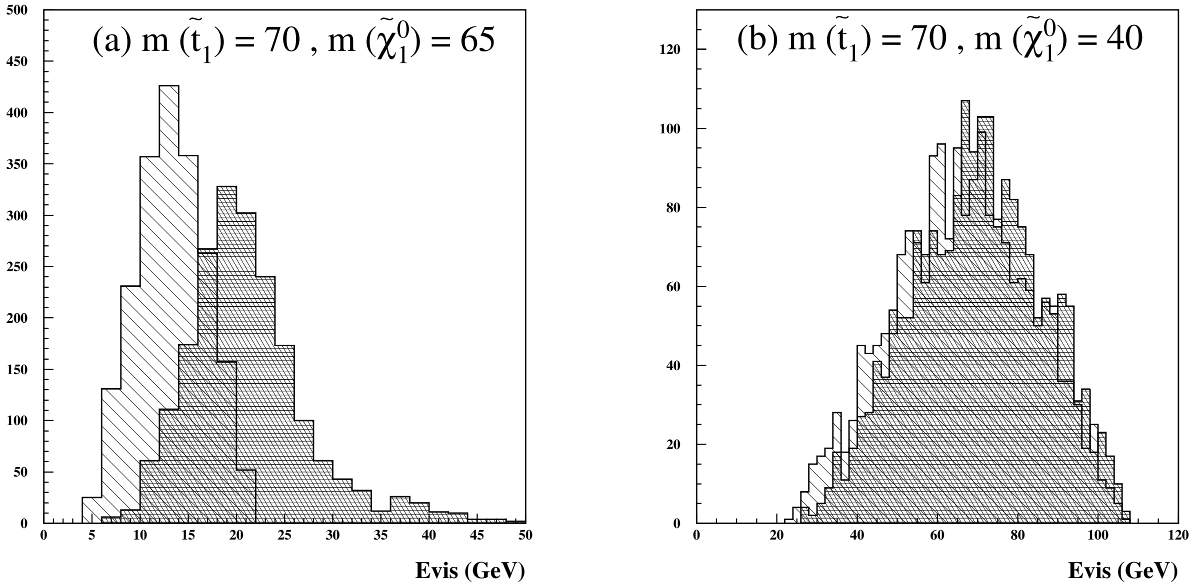
Status on squark generator :

First comparisons.

- Mass analysis windows :

$\Delta m > 30$
$10 < \Delta m \leq 30$
$\Delta m \leq 10$ (Paris)

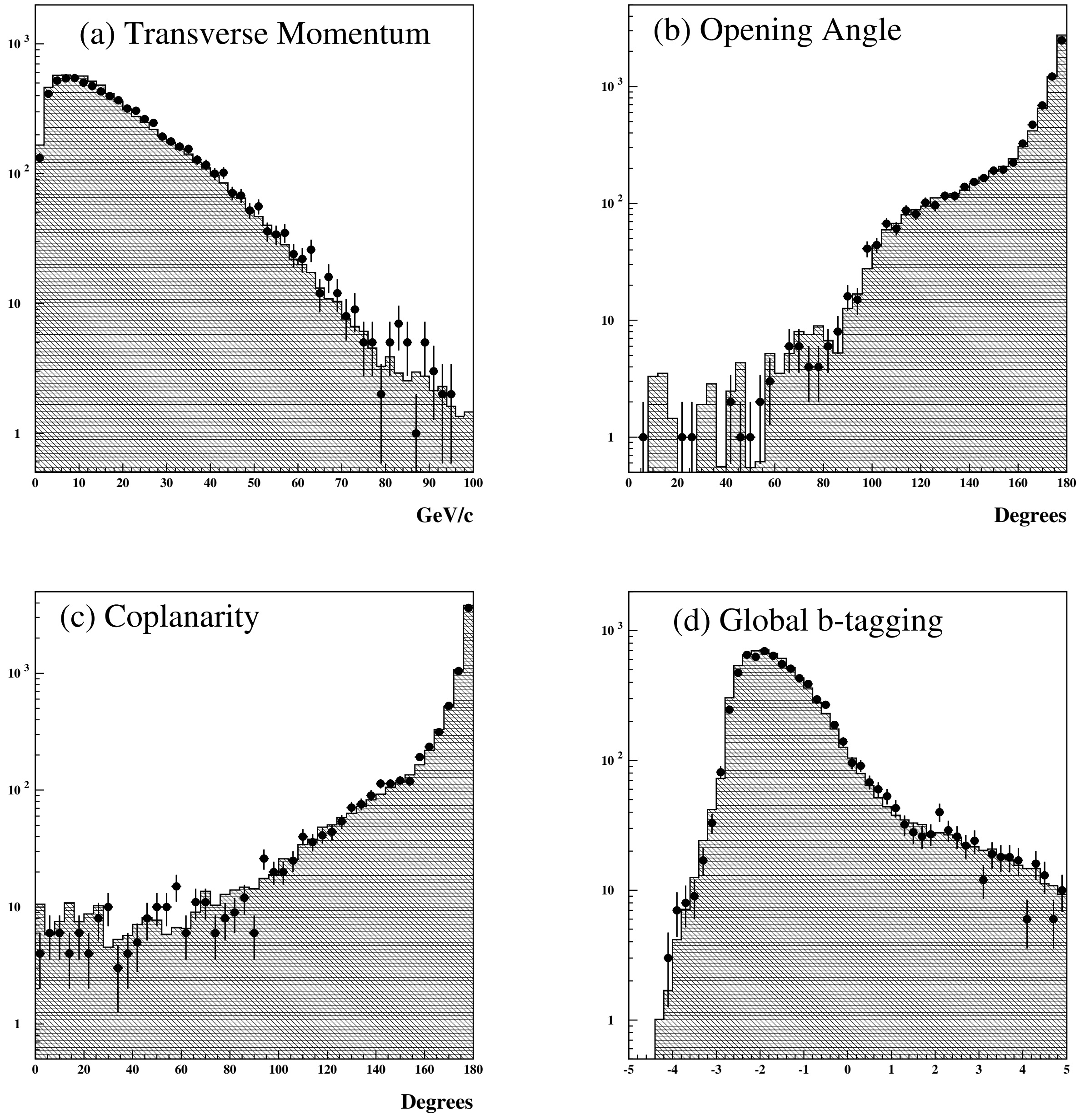
- Hadronisation effects :

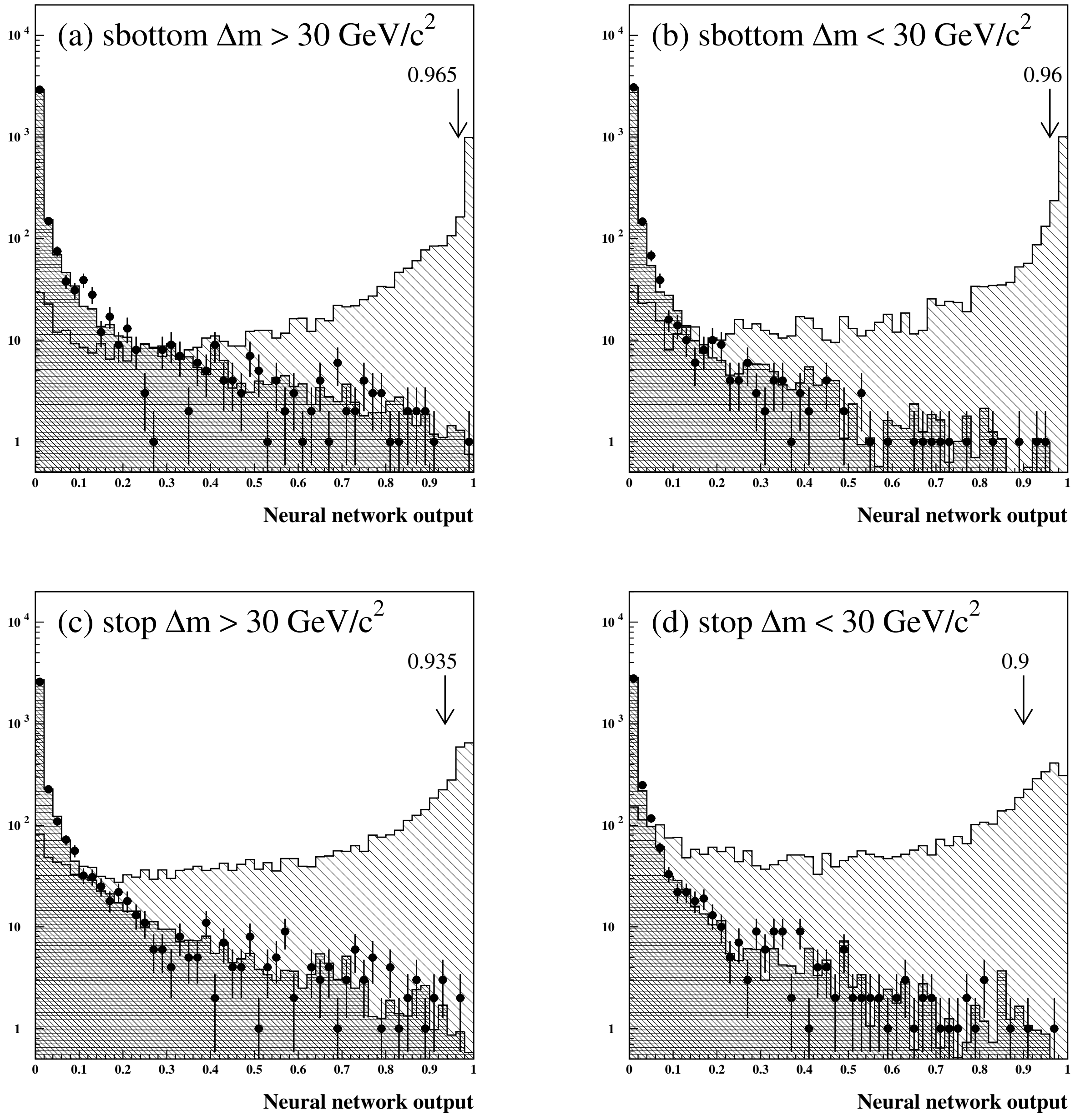


- Neural network method :

16 input nodes, 16 hidden and 3 outputs (signal, $q\bar{q}\gamma$ and 4-fermions together, $\gamma\gamma$ QCD and QPM).
A neural network is trained for each mass window of the stop and sbottom analysis.

Monte-Carlo agreement with data at 189 GeV





(a) sbottom Δm > 30 GeV/c²
0.965
Neural network output
(b) sbottom Δm < 30 GeV/c²
0.96
Neural network output
(c) stop Δm > 30 GeV/c²
0.935
Neural network output
(d) stop Δm < 30 GeV/c²
0.9
Neural network output

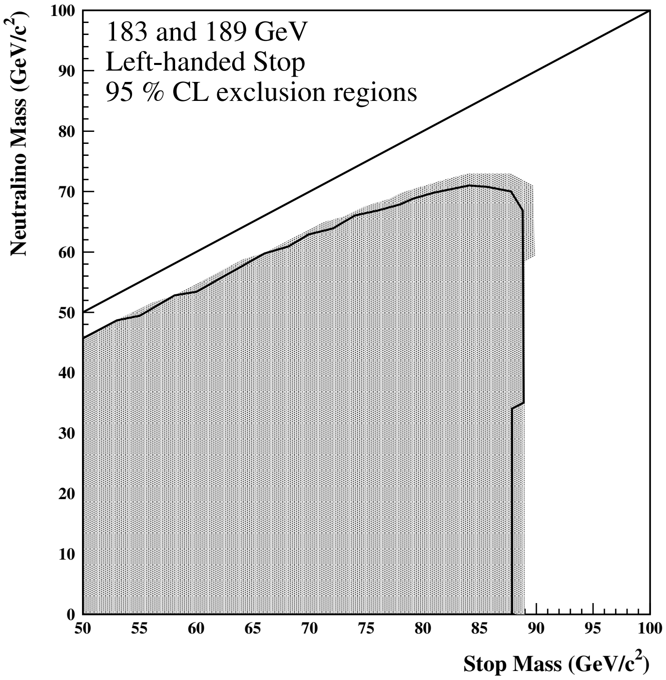
	183 GeV		189 GeV	
	Ndata	Nmc	Ndata	Nmc
Preselection + $E_t > 15$	1998	1944 ± 8	7525	7421 ± 29
$\sqrt{s'} < 170$ and 180	917	836 ± 6	4169	4138 ± 26
Herm. Veto	749	708 ± 6	3463	3487 ± 21

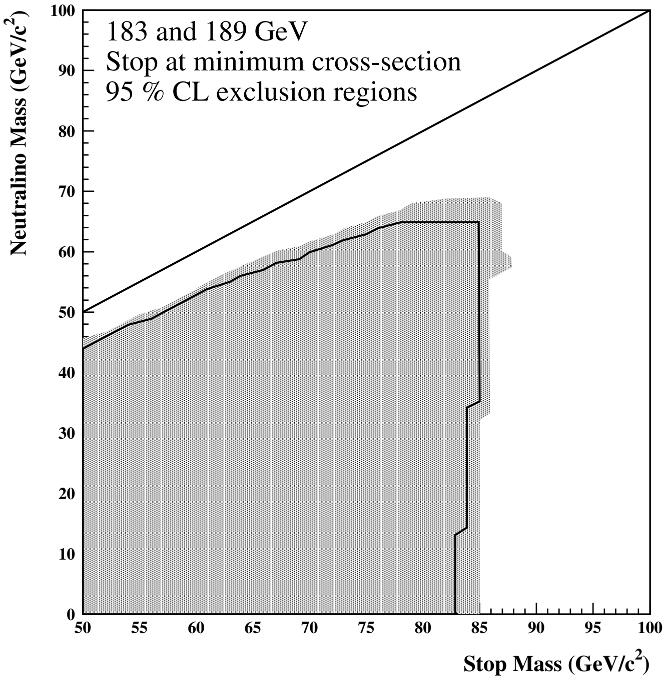
	183 GeV		189 GeV	
	Ndata	Nmc	Ndata	Nmc
sbottom : $\Delta m > 30$	0	0.48 ± 0.09	1	1.26 ± 0.18
sbottom : $\Delta m \leq 30$	0	0.25 ± 0.07	0	0.51 ± 0.11
total sbottom :	0	0.63 ± 0.10	1	1.41 ± 0.19
stop : $\Delta m > 30$	1	1.23 ± 0.26	3	2.84 ± 0.28
stop : $\Delta m \leq 30$	0	0.73 ± 0.25	2	3.10 ± 1.18
total stop :	1	1.88 ± 0.36	5	5.70 ± 1.21

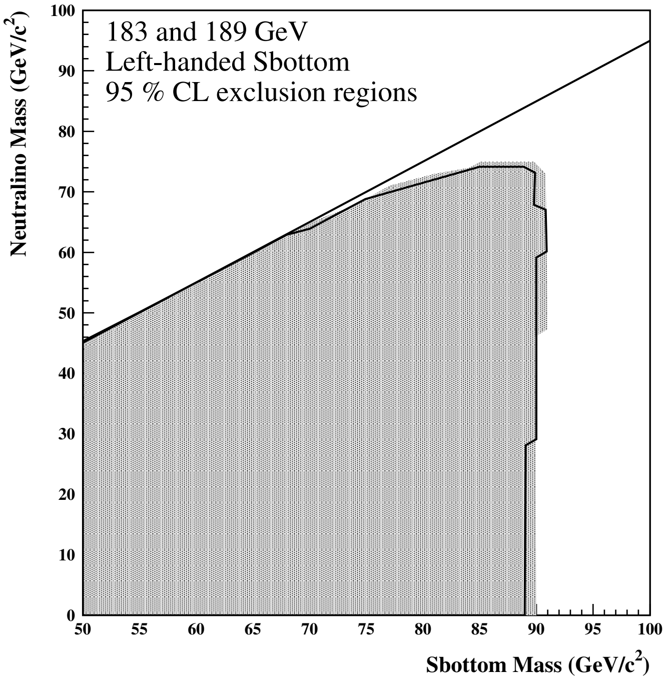
- Signal efficiencies :

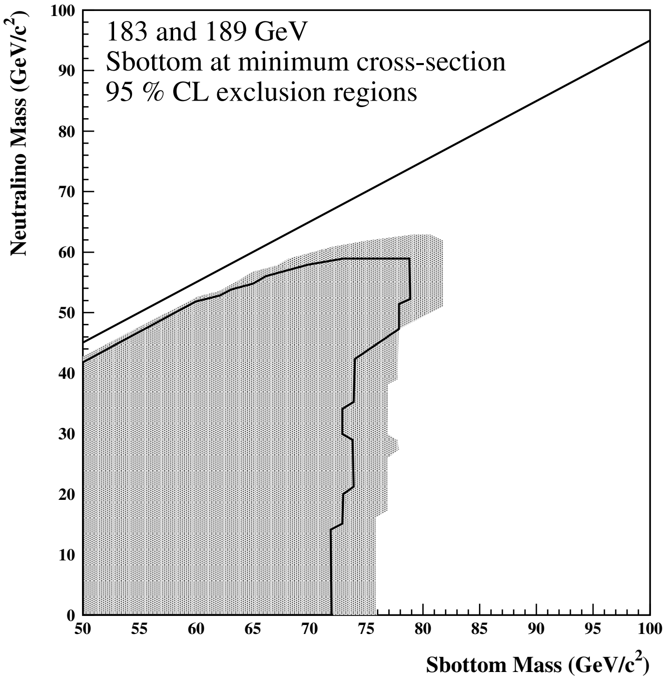
From 10 to 60 %. (Signal MC events used for the training are not taken into account to compute the efficiency)

Stop excluded region





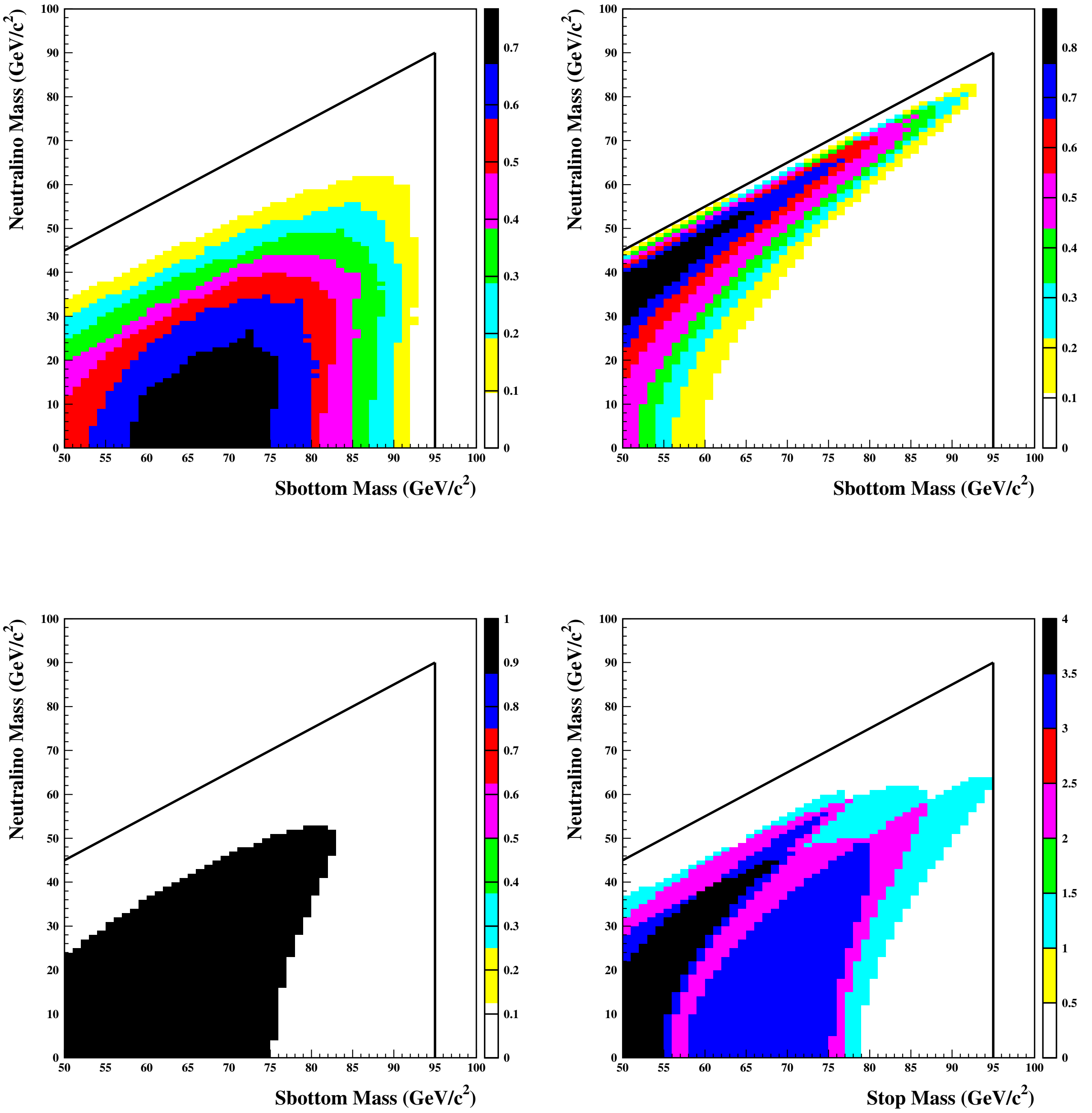

183 and 189 GeV
Left-handed Sbottom
95 % CL exclusion regions
Neutralino Mass (GeV/c^2)
Sbottom Mass (GeV/c^2)
0
10
20
30
40
50
60
70
80
90
100
50
55
60
65
70
75
80
85
90
95
100


183 and 189 GeV
Sbottom at minimum cross-section
95 % CL exclusion regions
Neutralino Mass (GeV/c^2)
Sbottom Mass (GeV/c^2)
0
10
20
30
40
50
60
70
80
90
100
50
55
60
65
70
75
80
85
90
95
100

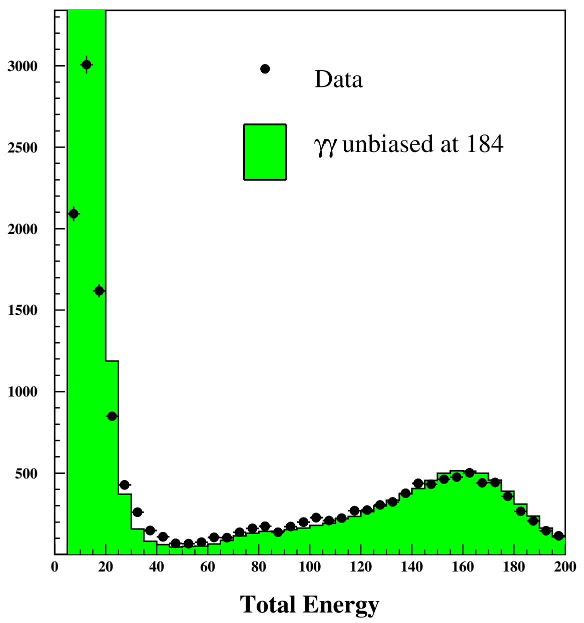
- Results : Combining 183 and 189, $\Delta M \geq 15.$

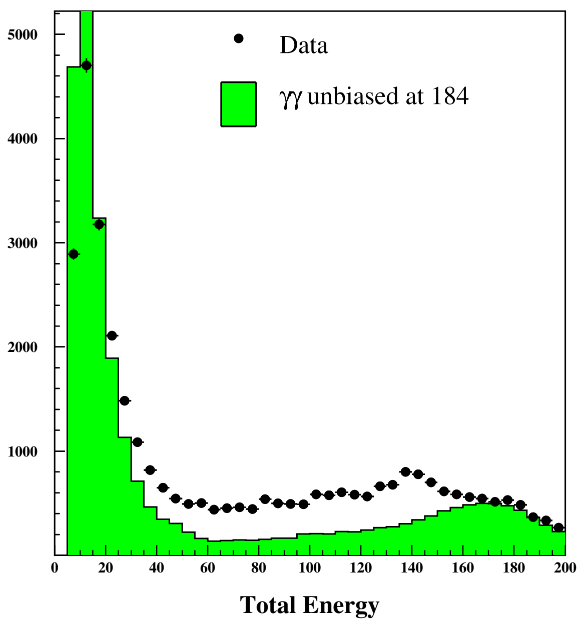
	No mixing	Max. mixing
$\mathbf{m}(\widetilde{b}_1)$	$\geq 90.$	$\geq 76.$
$\mathbf{m}(\tilde{t}_1)$	$\geq 88.$	$\geq 84.$

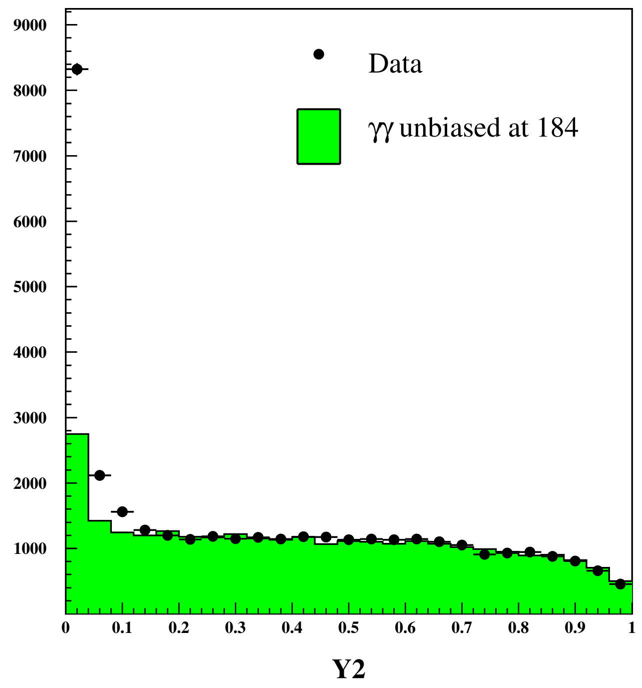
Mass hypotheses

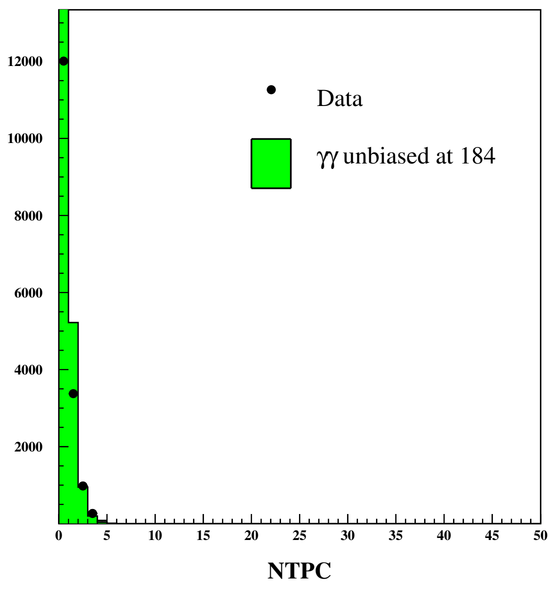


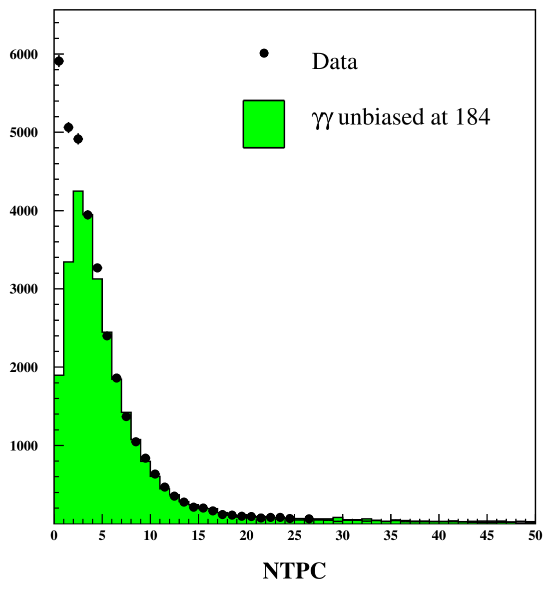
Comparison : Chris Parkes and Team B track selections.

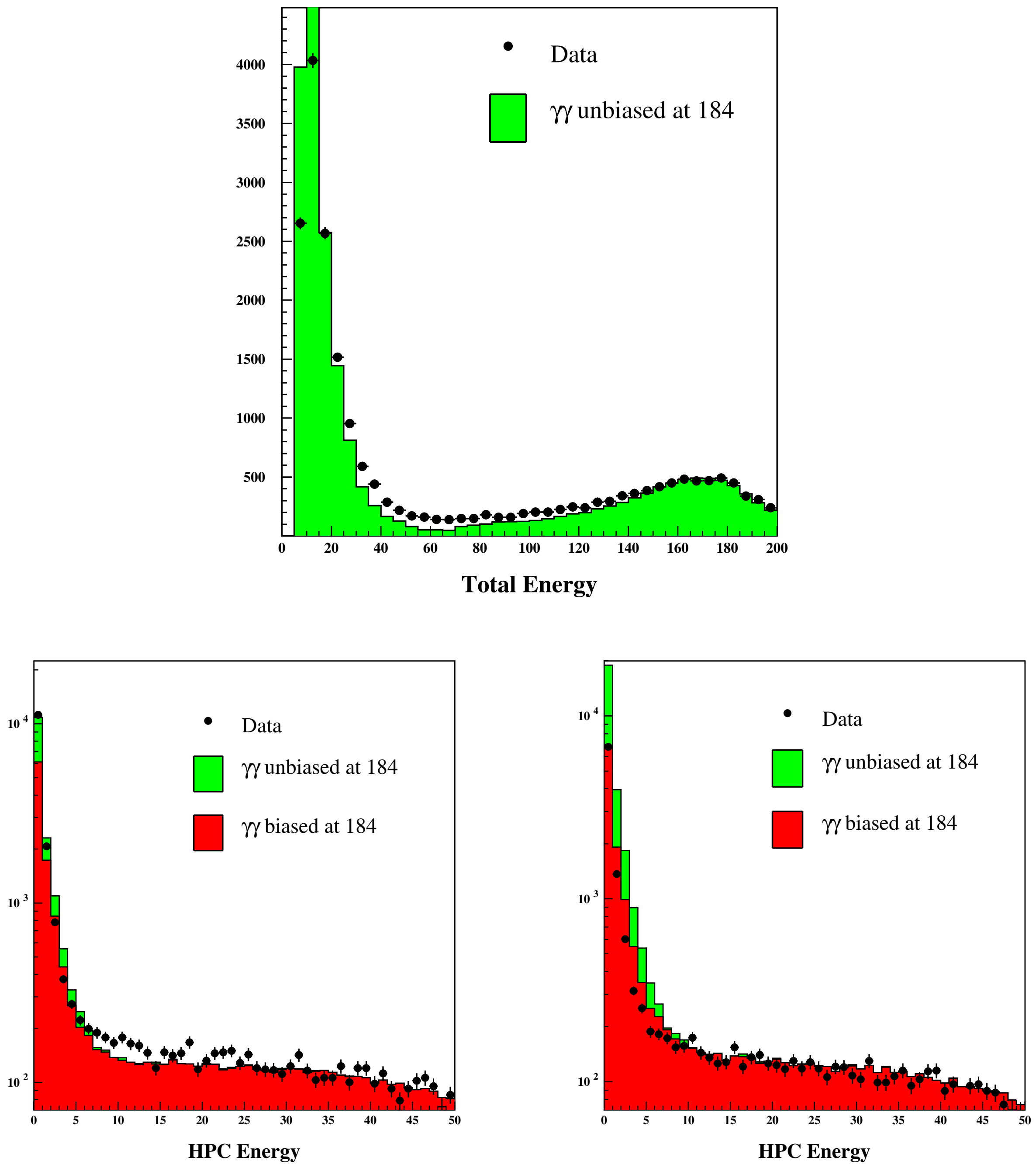


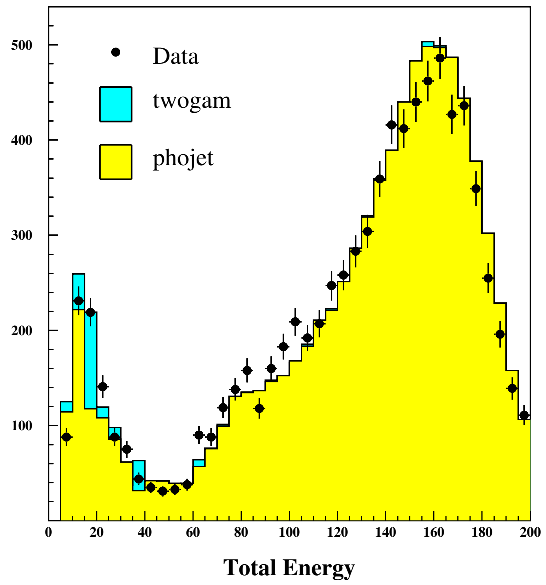


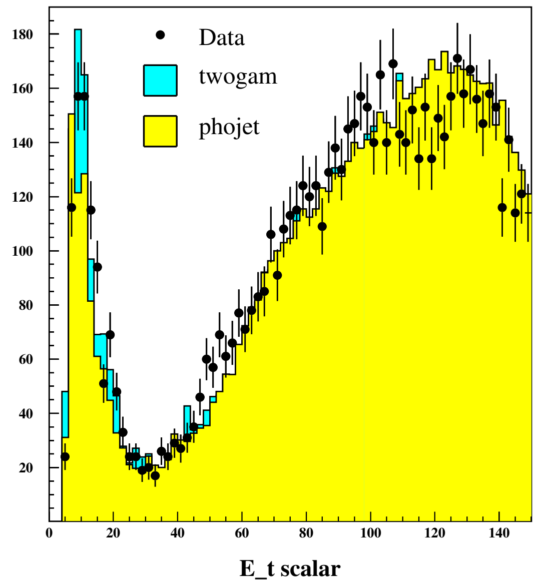

Data
γγ unbiased at 184
Y2

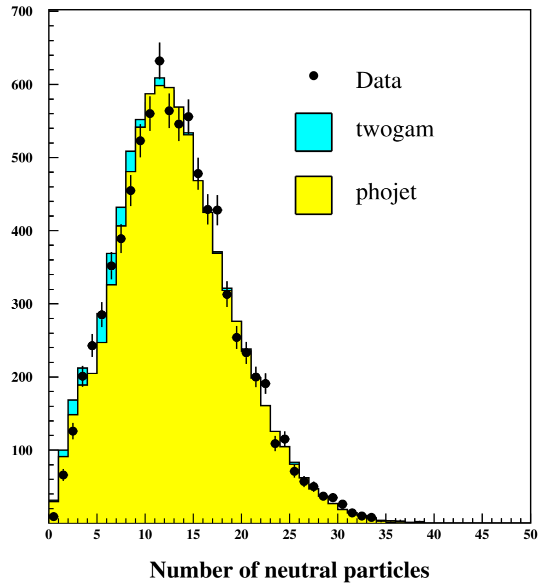

Data
γγ unbiased at 184
NTPC

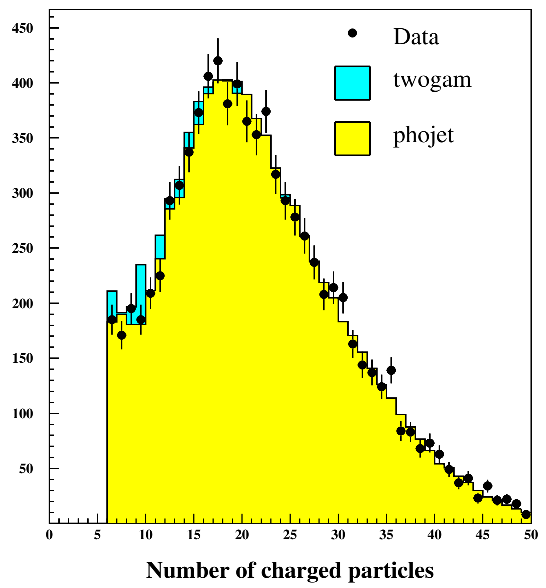

Data
γγ unbiased at 184
NTPC


Data
γγ unbiased at 184
4000
3500
3000
2500
2000
1500
1000
500
0
20
40
60
80
100
120
140
160
180
200
Total Energy
Data
γγ unbiased at 184
γγ biased at 184
10 4
10 3
10 2
0
5
10
15
20
25
30
35
40
45
50
HPC Energy
Data
γγ unbiased at 184
γγ biased at 184
10 4
10 3
10 2
0
5
10
15
20
25
30
35
40
45
50
HPC Energy


Data
twogam
phojet
Total Energy


Data
twogam
phojet
E_t scalar


Data
twogam
phojet
Number of neutral particles


Data
twogam
phojet
Number of charged particles

First look at 192 GeV data

- DATA : Luminosity = 17.3 pb^{-1}

- Monte-Carlo and cross-section :
  - MC at 189 GeV, with the D2 processing.
  - cross-section at 189 GeV.

- Analysis at 189 GeV :

Hadronic preselection :

- more than 5 charged particles.
- one particle (charged or neutral) with $P_t > 1.2$ GeV/c
- $E_{cone30}/Evis < 0.7$
- $|\cos(\theta_{Pmiss})| < 0.95$ (relaxed)
- $|\cos(\theta_{Jet1})| < 0.95$
- $E_t > 15$ GeV

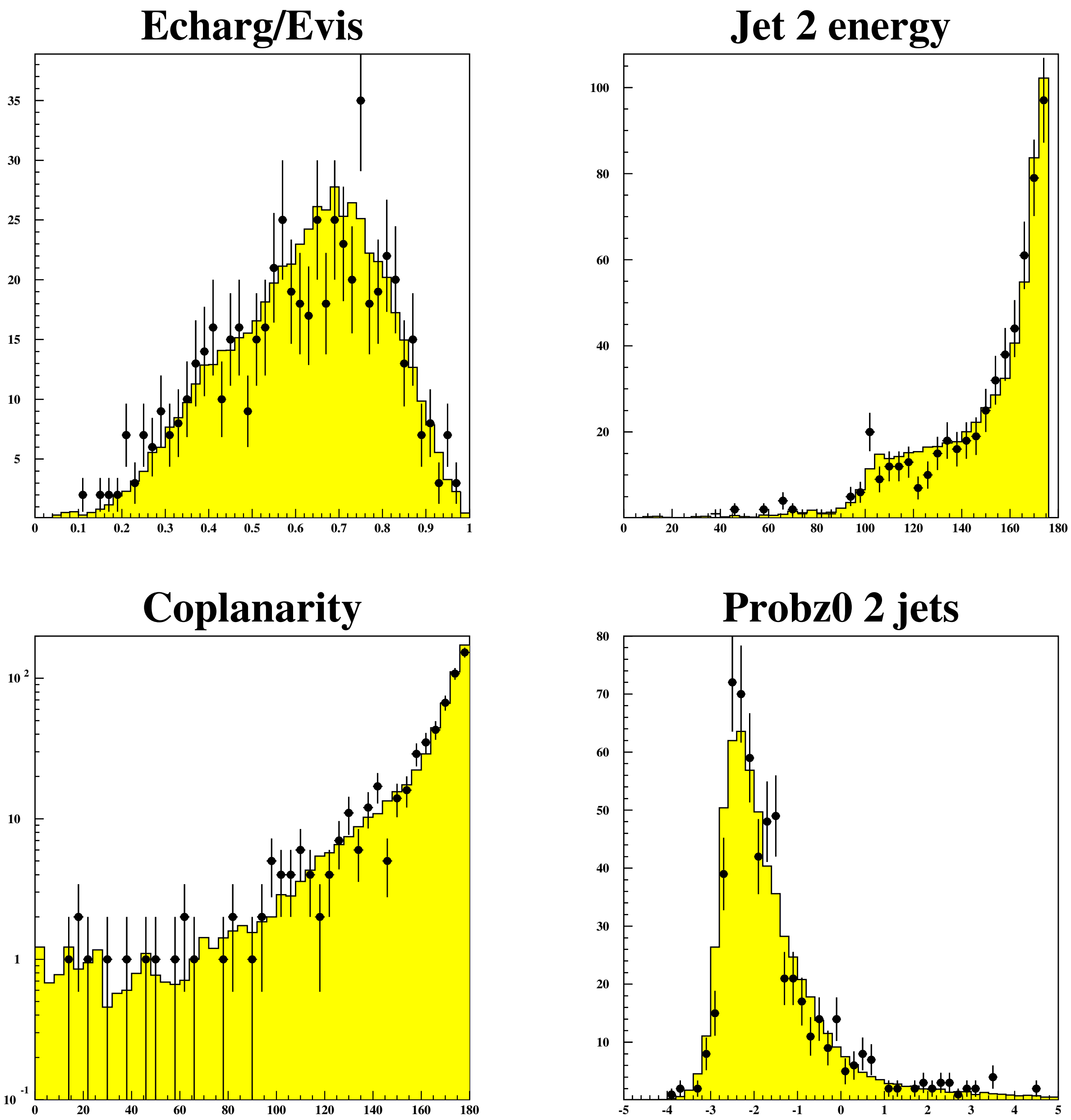
Acolinear events :

- Opening angle < 175 degrees

570 events in the data for 589 in the MC

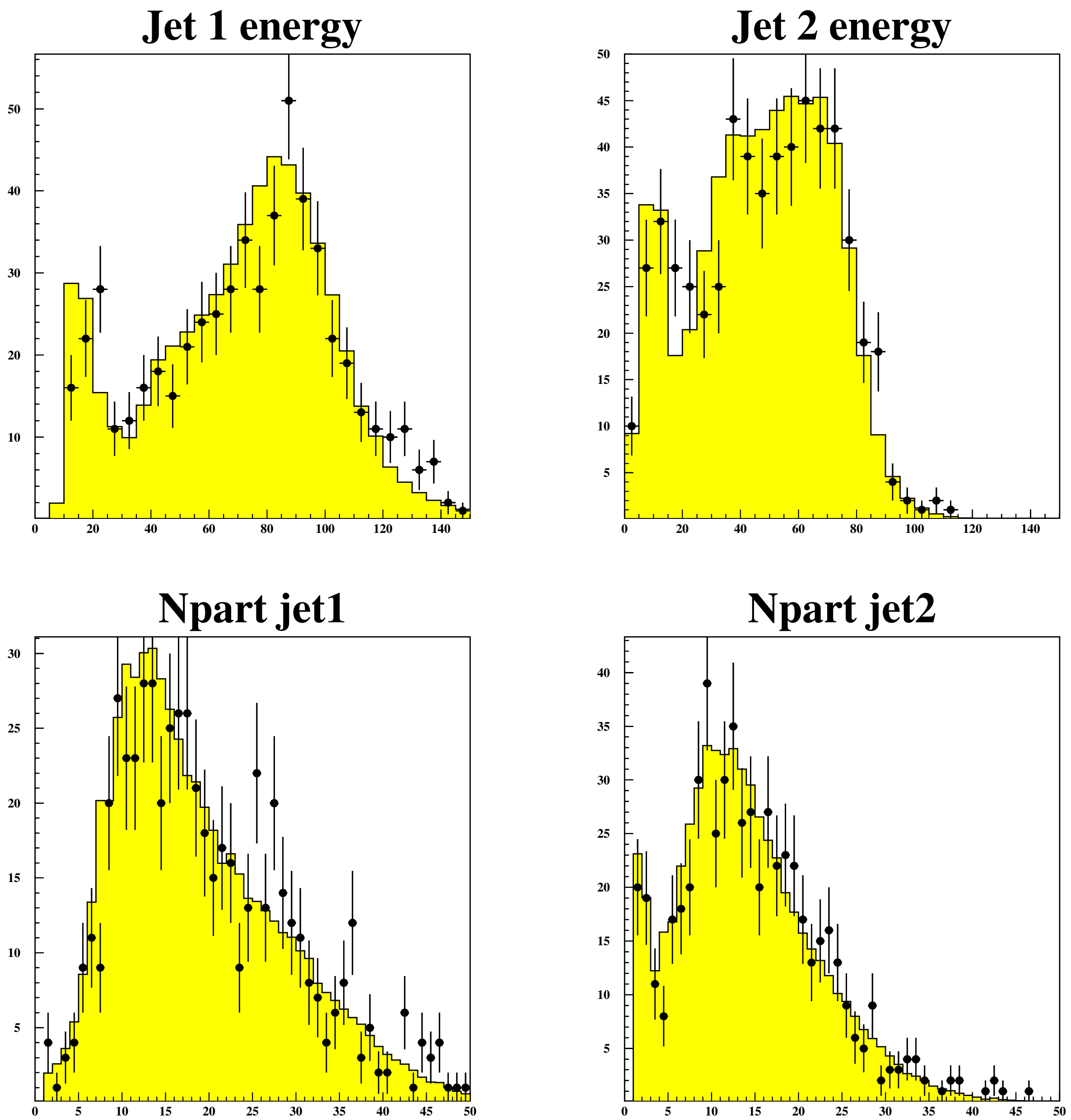
Neural networks :

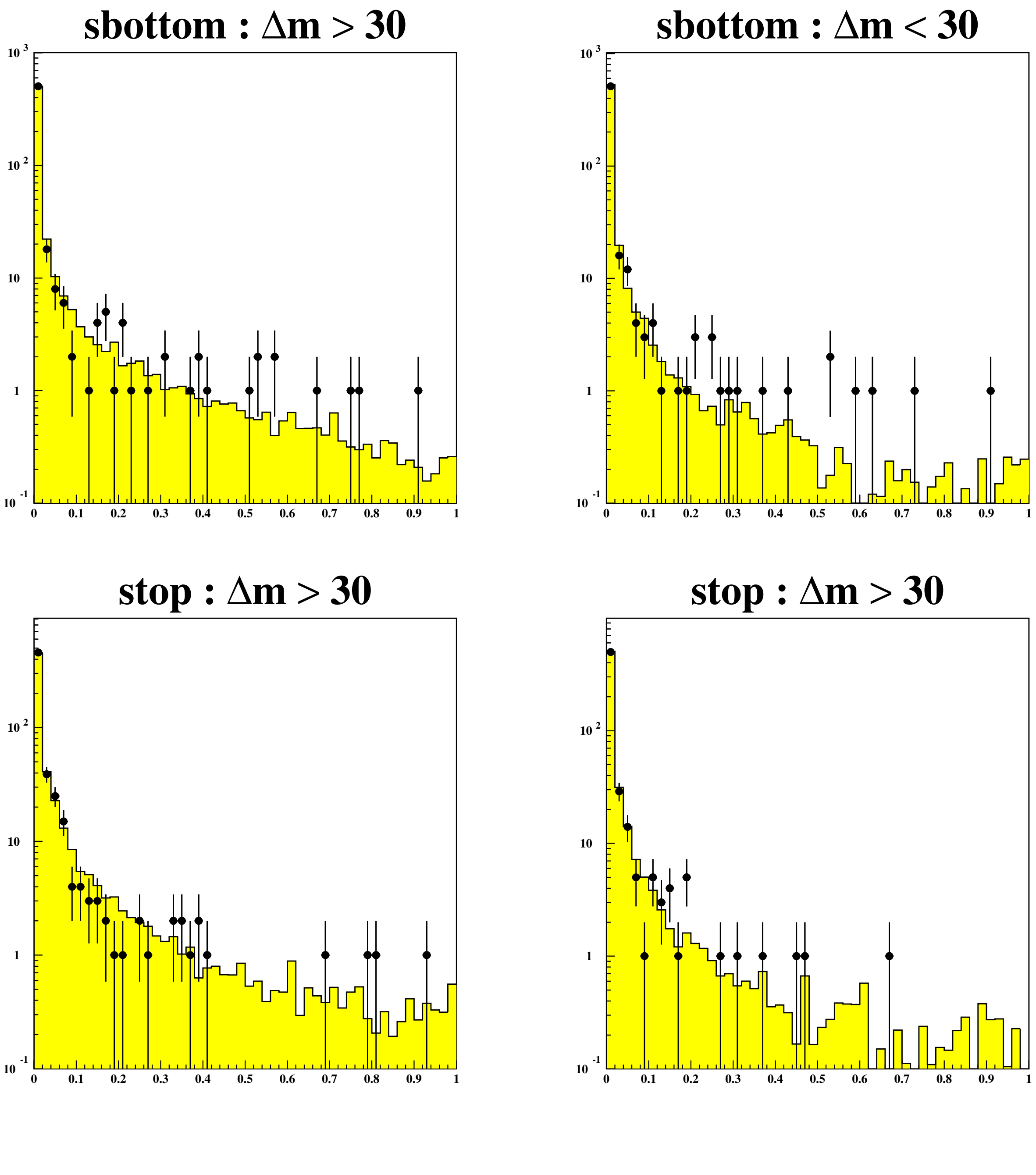
- Trained with the 189 GeV MC.



Echarg/Evis
Jet 2 energy
Coplanarity
Probz0 2 jets

First look at 192 GeV data





sbottom : Δm > 30
sbottom : Δm < 30
stop : Δm > 30
stop : Δm > 30
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

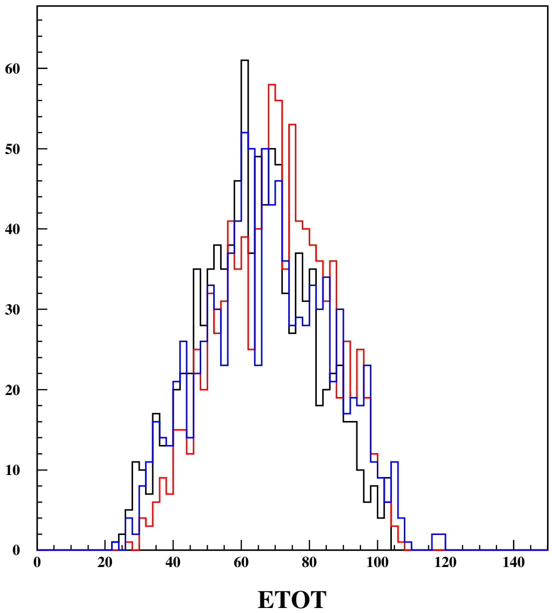
Main difference between the two generators :
the stop fragmentation treatment.

- Peterson function :

$$D_{\tilde{t}}(x) = \frac{1}{N} \frac{1}{x(1 - \frac{1}{x} - \frac{\epsilon_{\tilde{t}}}{1-x})} \quad , \quad \epsilon_{\tilde{t}} = \frac{\epsilon}{M_{\tilde{t}_1}^2}$$

$$\epsilon = 0.1 \text{ to } 0.5 \text{ GeV}^2$$

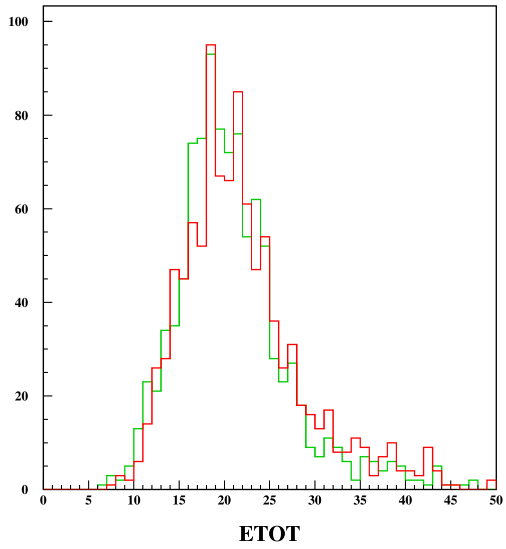
- Comparison for high Δm :



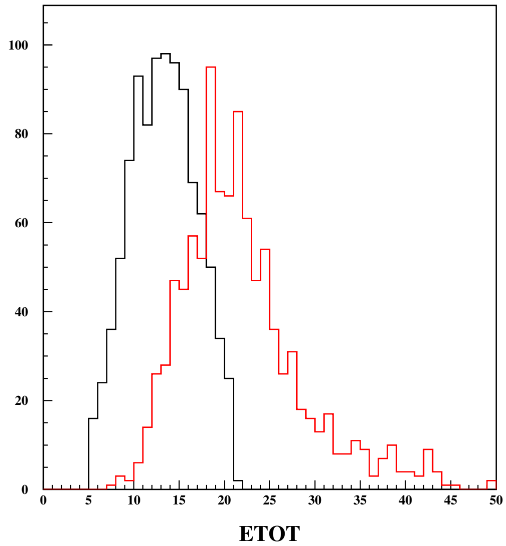
The stop fragmentation has only very low effect for high Δm.

Fragmentation effects for low Δm : $M_{\tilde{t}_1} = 70\,,\ M_{\tilde{\chi}_1^o} = 65$

- QCD correction effects :

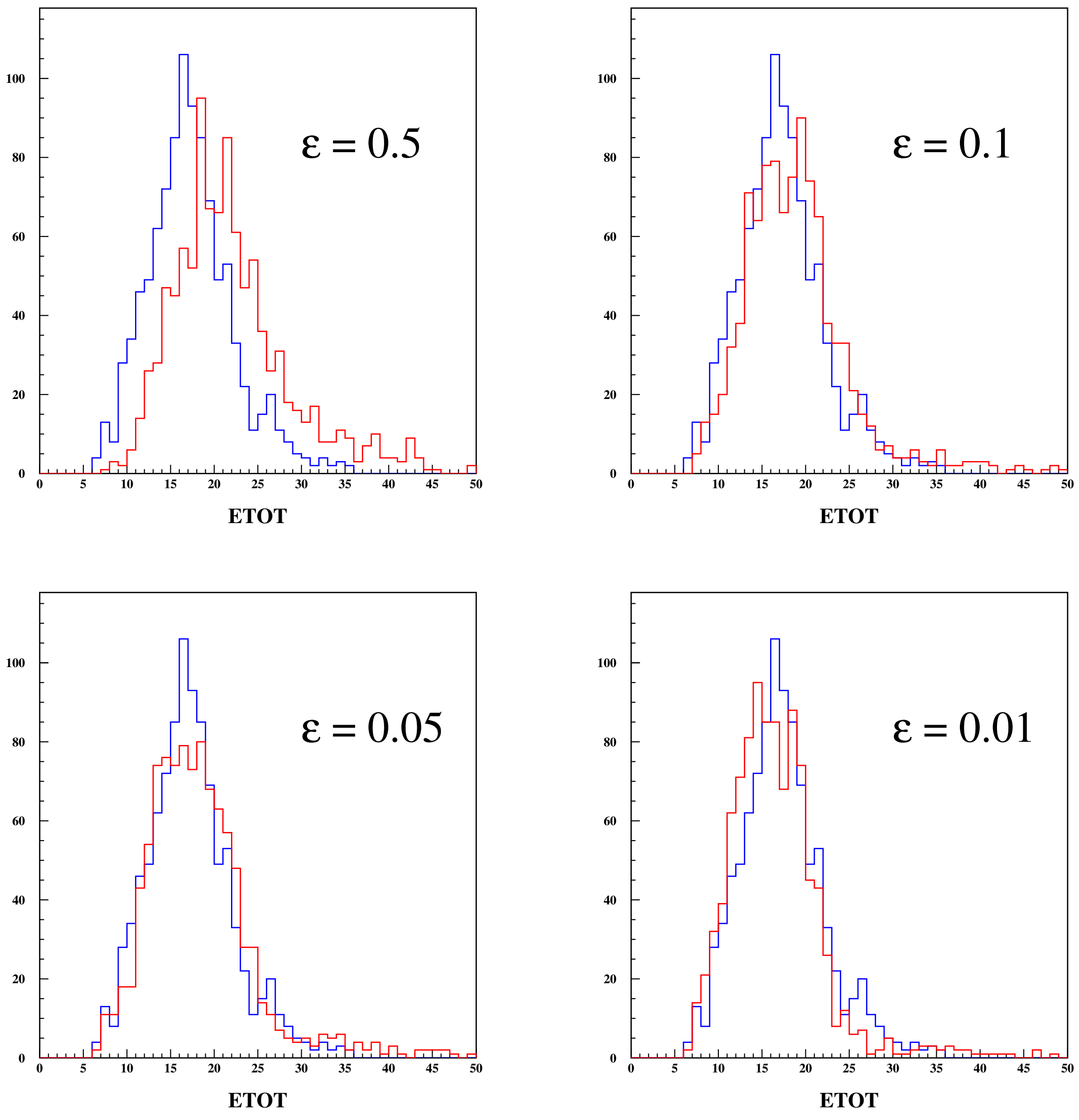


- Stop fragmentation effects :



Stop Generator

- The fragmentation parameter :



Conclusion

- The generator will be published soon.
- The stop hadronisation will be included in SUSYGEN, keeping the fragmentation parameter as input.
- One possibility is to simulate stop signal for two extreme values of the fragmentation parameter.