Squark Searches

R-parity Conservation

$\tilde{q} \rightarrow q\widetilde{\chi}_1^o$

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

- Analysis at 189 GeV (D2).
- Analysis at 183 GeV (E3).

New squark generator

M. Drees, O. Eboli, S. Katsanevas, P. Verdier.

- Stop fragmentation and hadronisation.
- Hard gluon emission.

- PROCESSING : D2 at 189 GeV, E3 at 183 GeV.

- Track selection : Skelana (Chris Parkes).

- 4-fermion backgrounds : Excalibur.

- Mass Windows : $\Delta m > 30$,
  $10 < \Delta m \leq 30$
  $\Delta m \leq 10$ (still to do)

- Neural network analysis :
  - Number of inputs : 16
  - Number of hidden nodes : 16
  - Number of Outputs : 3

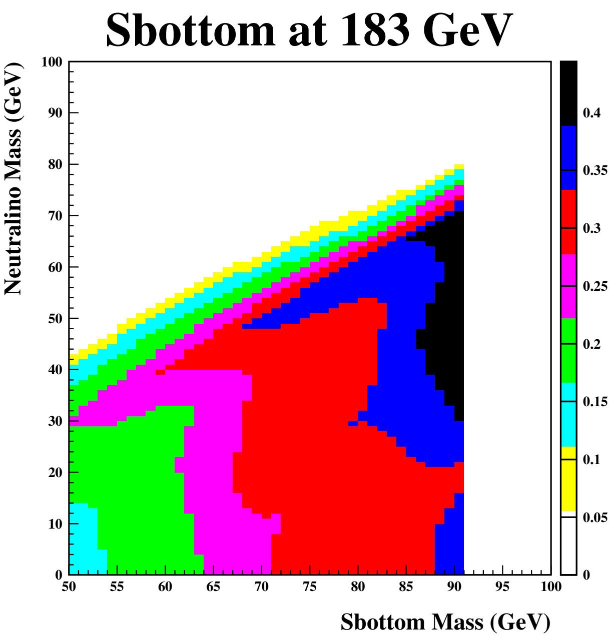
Output node	node 1	node 2	node 3
Signal	1	0	0
$q\bar{q}\gamma$ 4-fermions	0	1	0
$\gamma\gamma QCD$ $\gamma\gamma QPM$	0	0	1

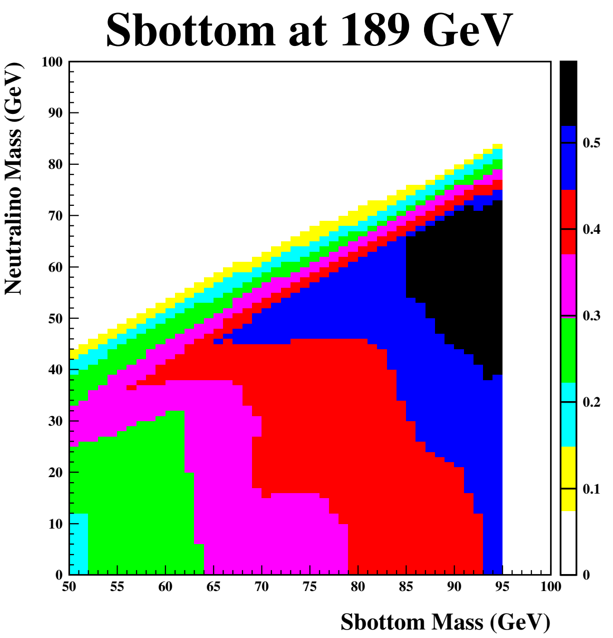
- Optimisation : CUTOPTIM on the SNNS output.

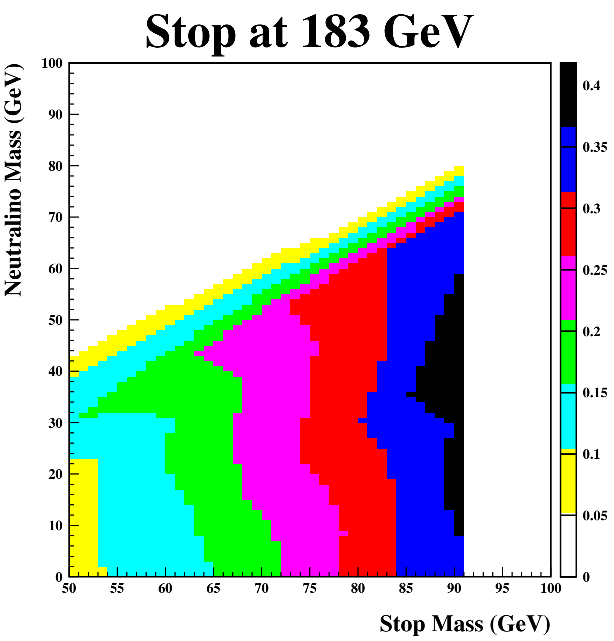
	183 GeV		189 GeV	
	Ndata	Nmc	Ndata	Nmc
Preselection + $E_t > 15$	1998	1944 ± 8	7525	7421 ± 29
$\sqrt{s'} < 170$ and 180	917	836 ± 6	4169	4138 ± 26
Herm. Veto	749	708 ± 6	3463	3487 ± 21

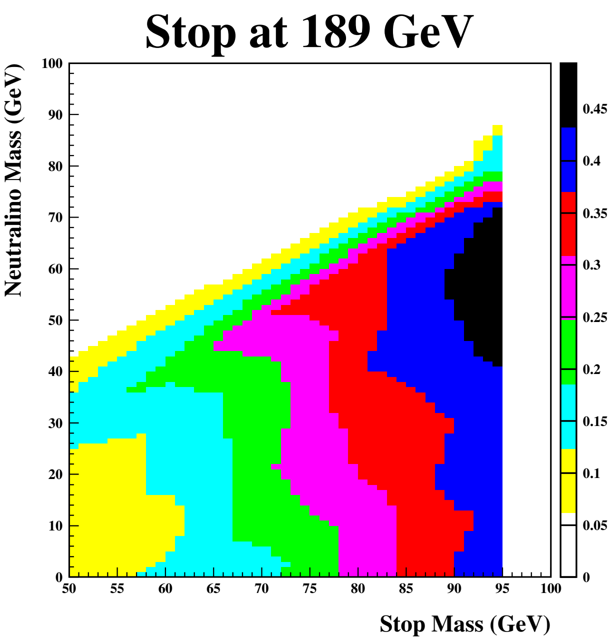
	183 GeV		189 GeV	
	Ndata	Nmc	Ndata	Nmc
sbottom : $\Delta m > 30$	0	0.48 ± 0.09	1	1.26 ± 0.18
sbottom : $\Delta m \leq 30$	0	0.25 ± 0.07	0	0.51 ± 0.11
stop : $\Delta m > 30$	1	1.23 ± 0.26	3	2.84 ± 0.28
stop : $\Delta m \leq 30$	0	0.73 ± 0.25	2	3.10 ± 1.18

Efficiencies

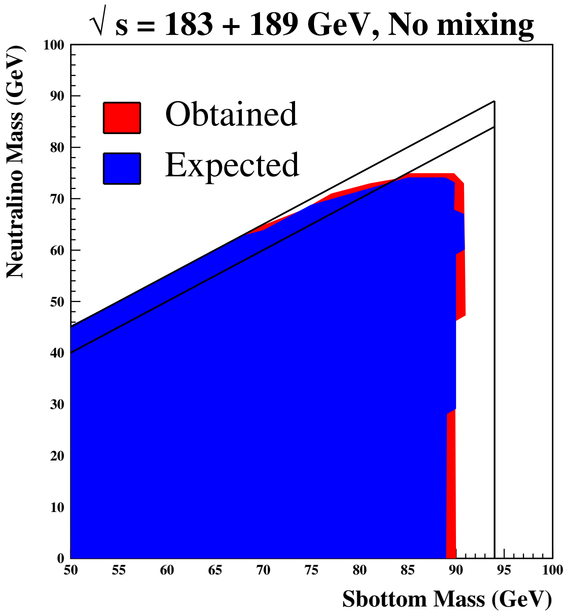


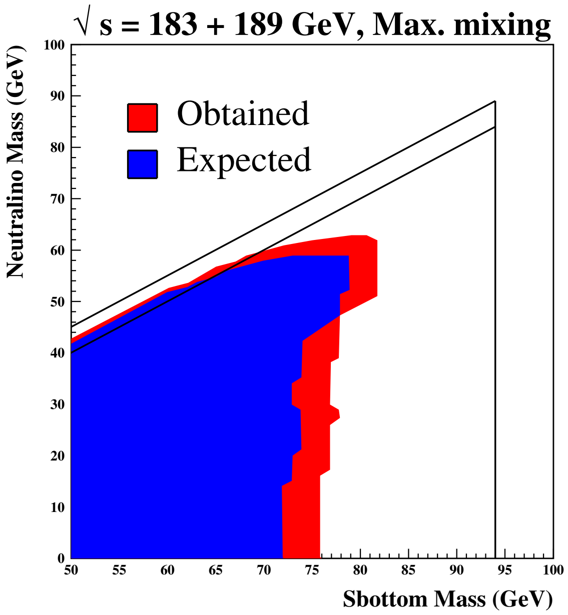


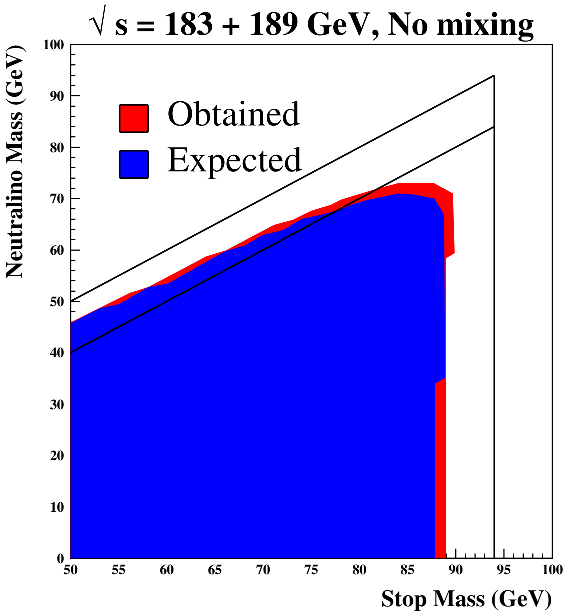


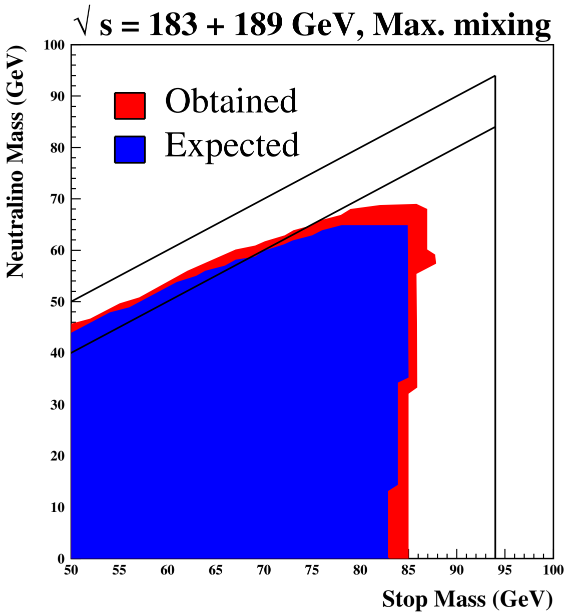


Exclusion


√ s = 183 + 189 GeV, No mixing
Obtained
Expected
Neutralino Mass (GeV)
Sbottom Mass (GeV)


√ s = 183 + 189 GeV, Max. mixing
Obtained
Expected
Neutralino Mass (GeV)
Sbottom Mass (GeV)


√ s = 183 + 189 GeV, No mixing
Obtained
Expected
Neutralino Mass (GeV)
Stop Mass (GeV)


√ s = 183 + 189 GeV, Max. mixing
Obtained
Expected
Neutralino Mass (GeV)
Stop Mass (GeV)

- Results : Combining 183 and 189, $\Delta M \geq 20.$

	No mixing	Max. mixing
$\mathbf{m}(\tilde{b}_1)$ expected	$\geq 90.$ ($\geq 89.$)	$\geq 76.$ ($\geq 72.$)
$\mathbf{m}(\tilde{t}_1)$ expected	$\geq 89.$ ($\geq 88.$)	$\geq 85.$ ($\geq 83.$)

- A study of the degenerate mass case $\Delta M \leq 10.$
- Understanding the gama-gamma backgrounds.

Reference

"Strong Interaction Effects in Stop Pair Production at e^+e^- Colliders"
hep-ph/9902391.
Manuel Drees and Oscar J.P. Eboli.

- QCD corrections for the process $e^+e^- \longrightarrow \tilde{t}_1\tilde{t}_1$, and adding the $e^+e^- \longrightarrow \tilde{t}_1\tilde{t}_1{}^*g$ process.
- Non-perturbative stop fragmentation a la Peterson et al.
- stop decay in-to a massless quark and a neutralino.

- Fragmentation : stop (and gluon) 4-momenta are generated, assuming all particles to be on-shell.

A virtuality for the squarks :

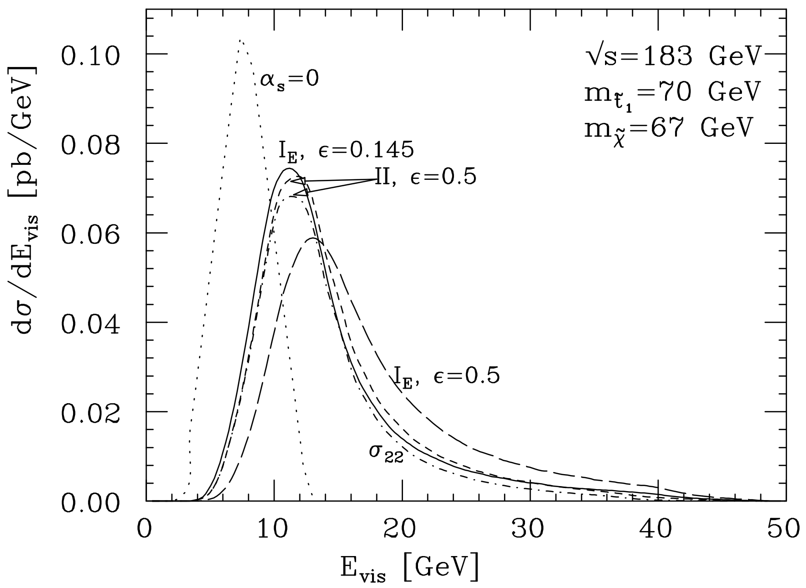
$$m^2 = m^2_{stop} + 2E^0(1-x)(E^0 - k^0)$$

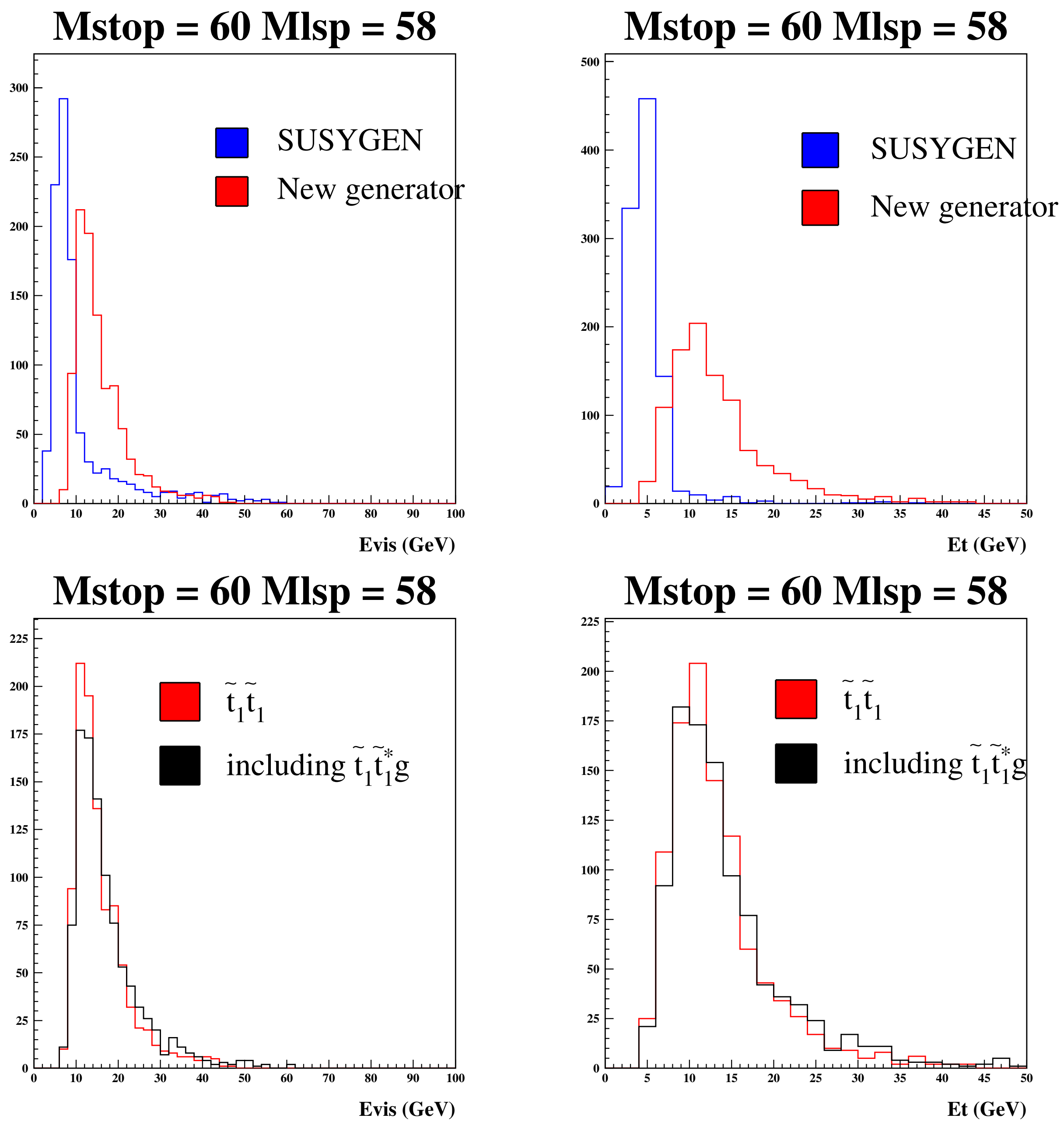
The 4-impulsion of the (now off-shell) stops are recomputed.
The virtual stops are "decayed" into real "stop-mesons" (with mass = m_{stop}) and massless fragmentation jets.

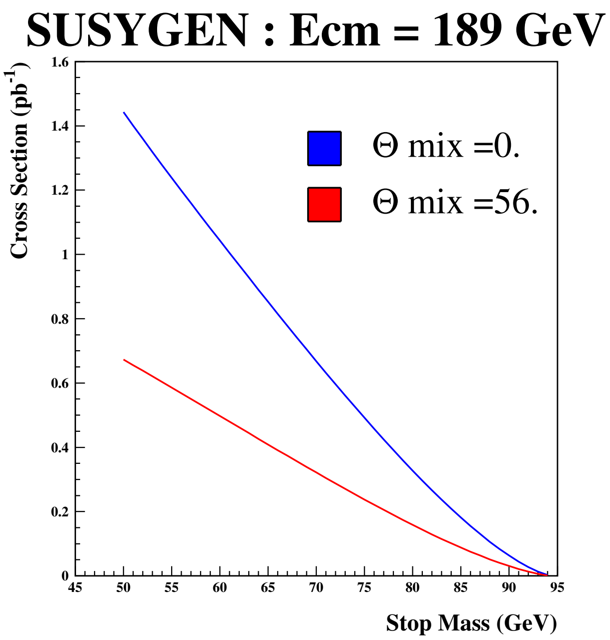
Different ways to compute the fragmentation variable :

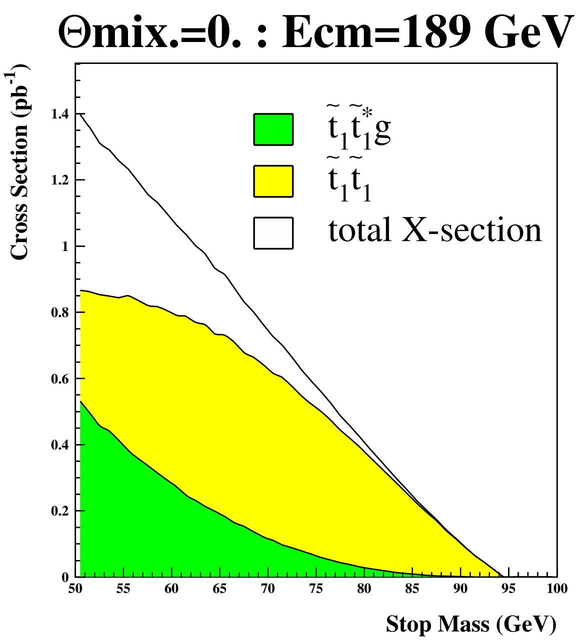
$$x_E = \frac{2E_{\tilde{t}}}{\sqrt{s}}$$

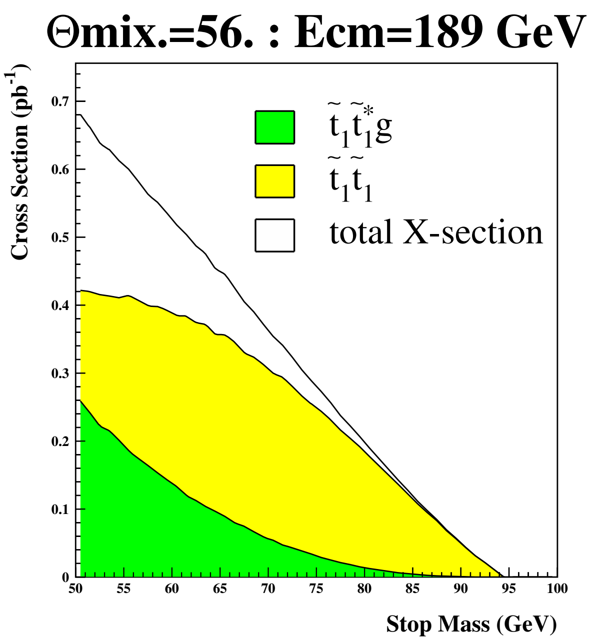
$$x_k = \frac{2\left|\vec{k}_{\tilde{t}_M}\right|}{\beta\sqrt{s}}$$




Mstop = 60 Mlsp = 58
SUSYGEN
New generator
Evis (GeV)
Mstop = 60 Mlsp = 58
SUSYGEN
New generator
Et (GeV)
Mstop = 60 Mlsp = 58
$\tilde{t}_1\tilde{t}_1$
including $\tilde{t}_1\tilde{t}_1^*g$
Evis (GeV)
Mstop = 60 Mlsp = 58
$\tilde{t}_1\tilde{t}_1$
including $\tilde{t}_1\tilde{t}_1^*g$
Et (GeV)


SUSYGEN : Ecm = 189 GeV
Cross Section (pb^{-1})
Θ mix =0.
Θ mix =56.
Stop Mass (GeV)


Θmix.=0. : Ecm=189 GeV
Cross Section (pb^{-1})
$\tilde{t}_1\tilde{t}_1^*g$
$\tilde{t}_1\tilde{t}_1$
total X-section
Stop Mass (GeV)


Θmix.=56. : Ecm=189 GeV
Cross Section (pb^{-1})
$\tilde{t}_1\tilde{t}_1^*g$
$\tilde{t}_1\tilde{t}_1$
total X-section
Stop Mass (GeV)

Conclusion

- A systematic study of the fragmentation and hadronisation effects will be done.
- The stop hadronisation will be included in SUSYGEN.
- The analysis for the degenerate mass case will be performed using neural networks.
- The gamma-gamma backgrounds should be understood to perform this last point.
- A study of neural network stability is in progress.