The STOPGEN Generator

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- The stop hadronisation
- Summary
- The four body decay channel

FORTRAN code :

$\Longrightarrow$ http://home.cern.ch/verdier/

The stop Hadronisation

Hard gluon emission :

- introduced at the matrix element level
- 2 X-sections are calculated : $e^+e^- \to \tilde{\mathrm{t}}_1\tilde{\mathrm{t}}_1$ and $e^+e^- \to \tilde{\mathrm{t}}_1\tilde{\mathrm{t}}_1 g$

Hadronisation :

- Non-pertubative hadronisation model
- Using the Peterson function distribution

Fragmented and spectator quarks :

- They are all treated as u and ū quarks

Fermi motion :

- Using a gaussian distribution to get transverse momentum w.r.t the stop direction

The STOPGEN program

Input card :

```
C#################################################################
C##            GENERAL VARIABLES                                ##
C#################################################################
C --- SEED FOR RANDOM NUMBER GENERATOR
SEED   230575
C --- STEERING MODE :
C ---     mode 1 : stop -> c,x01
C ---     mode 2 : stop -> c,gluino
C ---     mode 3 : stop -> b,tau    (RPV)
MODES 1
C---- INCLUDE OR NOT RADIATIVE CORRECTIONS
ISR  0
C --- INPUT FOR PROCESS 1 = ALL
C ---                   2 = Stop-Stop
C ---                   3 = Stop-Stop Gluon
IJOIN  1
C---- CM ENERGY
ECM     200.
C---- STOP AND LSP MASS (LSP mass not used in mode 3)
MSTOP    50.
MNEUT    45.
C---- SQUARK MIXING ANGLES ( !!IN DEGREES!!)
STOM    0.
```

The STOPGEN program

```
C#################################################################
C##            DREES INPUT CARD                                ##
C#################################################################
C---- MINIMUM GLUON ENERGY
EGLUMIN   1.
C---- FRAGMENTATION PARAMETER ACCORDING TO PETERSON (FOR STOPS)
FRAGFAC   0.5
C---- FRAGMENTATION PARAMETER FOR GLUINOS (for mode 2)
FGLU      0.1
C---- EXPO PARAMETER ACCORDING TO DREES
EXPO      0.1
C---- FERMI MOMENTUM
PFERMI    0.35
C---- NUMBER OF EVENTS FOR THE MC INTEGRATION
MCEVT    10000
C#################################################################
C##           GENERATION PARAMETERS                            ##
C#################################################################
C--- GENERATE EVENTS OR NOT
GENER      1
C--- # EVENTS REQUESTED
EVENTS     1000
C--- Debug or not
DEBUG      0
C--- write out events or not
LUWRIT     TRUE
C--- output format : all event history (0) - DELSIM (1)
LUFOR  0
```

Decay channels

- 3 decay modes are available :
  - Mode 1 : $\tilde{t}_1 \to c\widetilde{\chi}_1^0$
  - Mode 2 : $\tilde{t}_1 \to c\widetilde{g}$
  - Mode 3 : $\tilde{t}_1 \to b\tau$(RPV)
- Coming soon : Mode 4 : 4 body decay $\tilde{t}_1 \to b\widetilde{\chi}_1^0$ff'

Conclusion :

- The hadronisation mechanism can be easily applied to other stop decay
- STOPGEN is ready
- Future :
  - The four body decay will be included, so new analysis are coming
  - STOPGEN will calculate all the Branching-Ratio of the stop decay
  - A "scan mode" will be introduced to perform exclusion with all these BR's

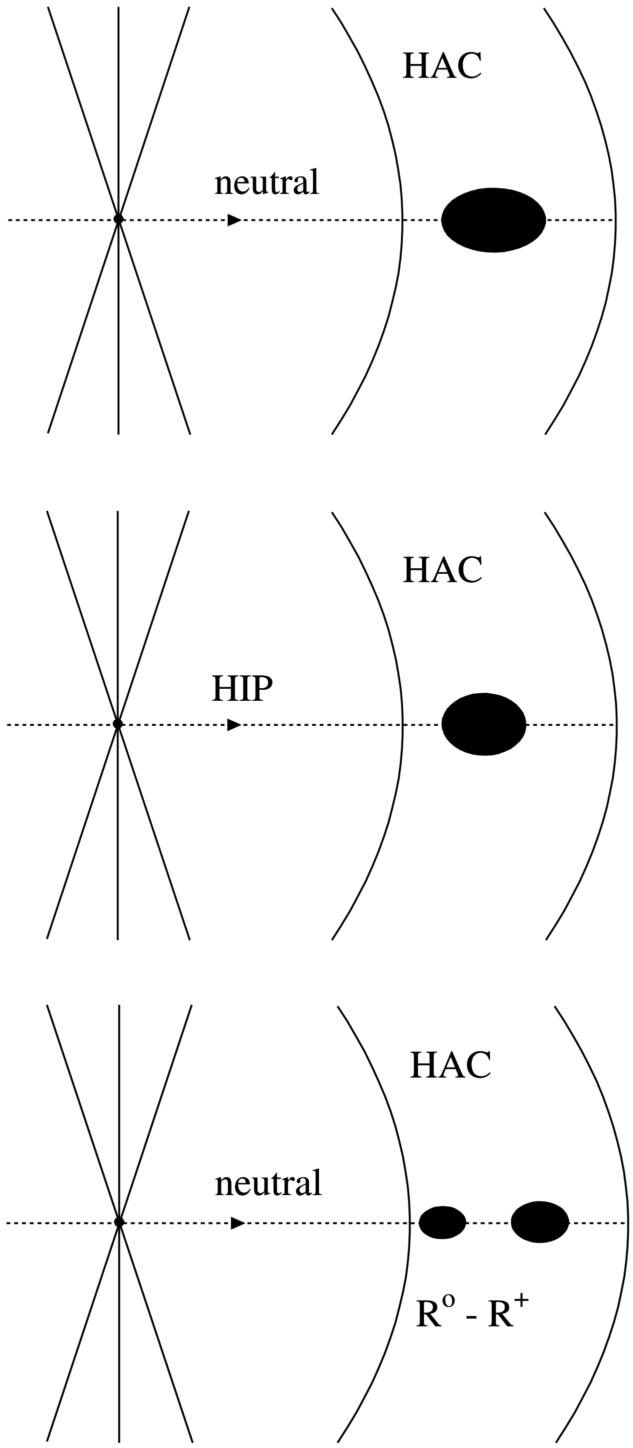
INTRODUCTION

Light gluino search

$\tilde{t}_1 \longrightarrow \mathbf{c}\tilde{g}$

- Generator status
- Gluino simulation :
  - Charged R-hadrons : $R^{\pm}$
  - Neutral R-hadrons : R^{o}
- What can be done for Moriond ?

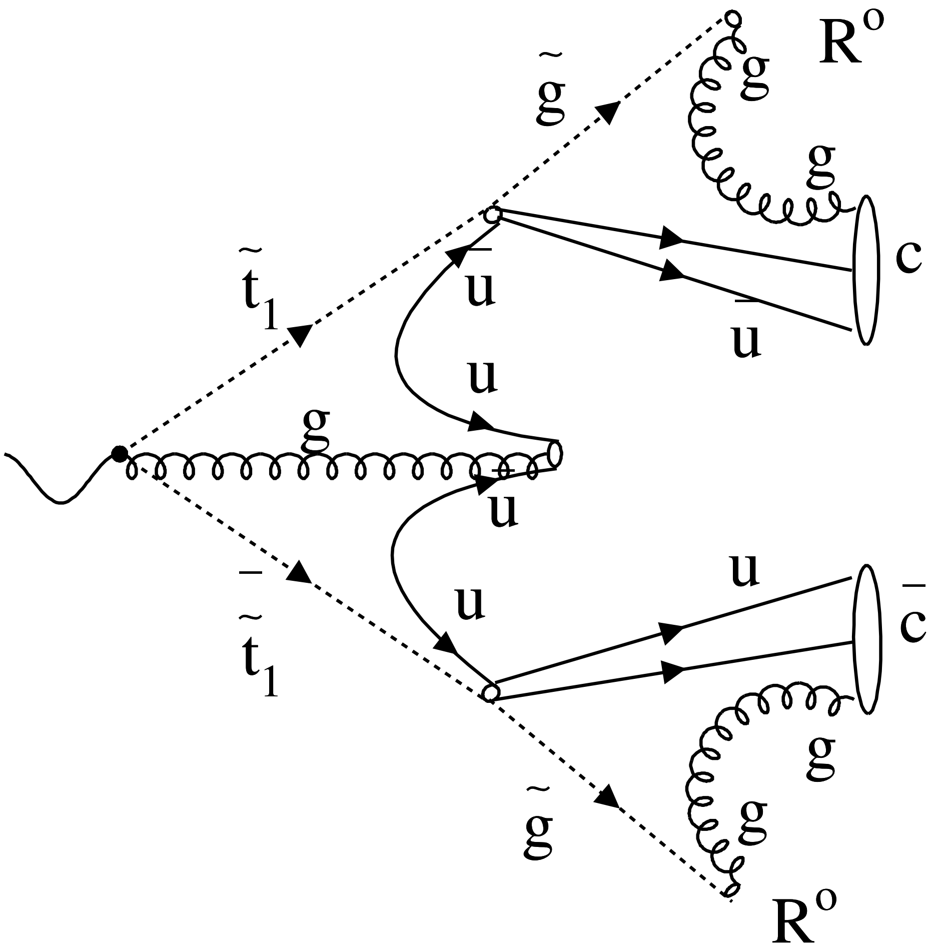
Scenario



Generator Status

"Parton" level

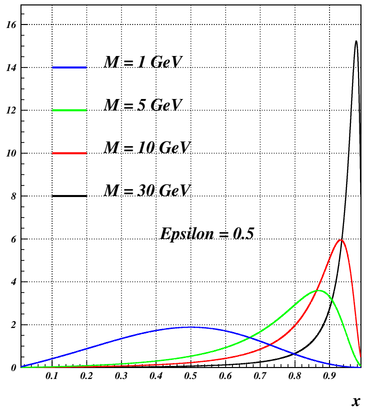
- The generator is ready
- Mode 2 in STOPGEN
- Example of R^o pair production : $(R^o \equiv \tilde{g}g)$

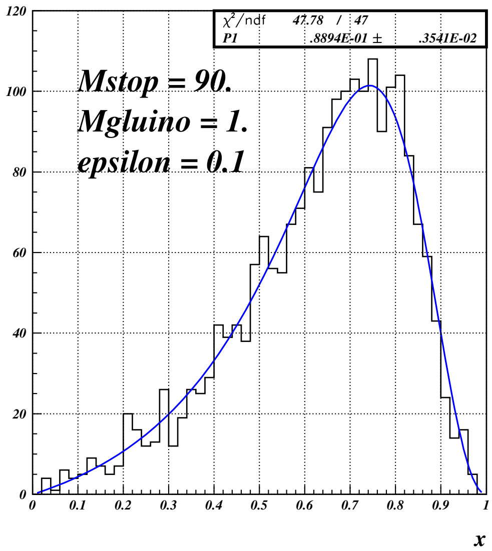


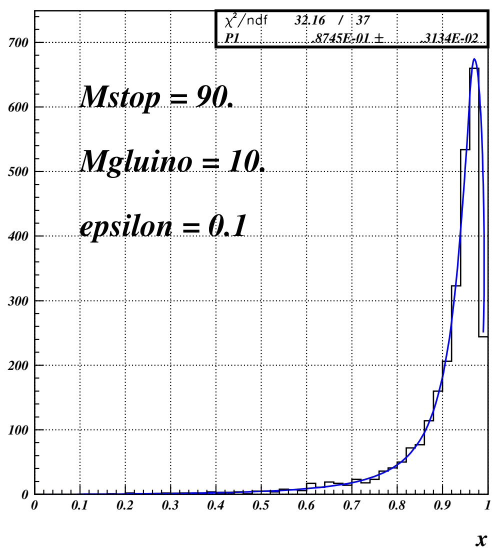
JETSET interface

Fragmentation step :

- Using a Peterson function to calculate the fraction of energy from the initial gluino, taken by the R-hadron state.







Generator Status

Parton shower evolution :

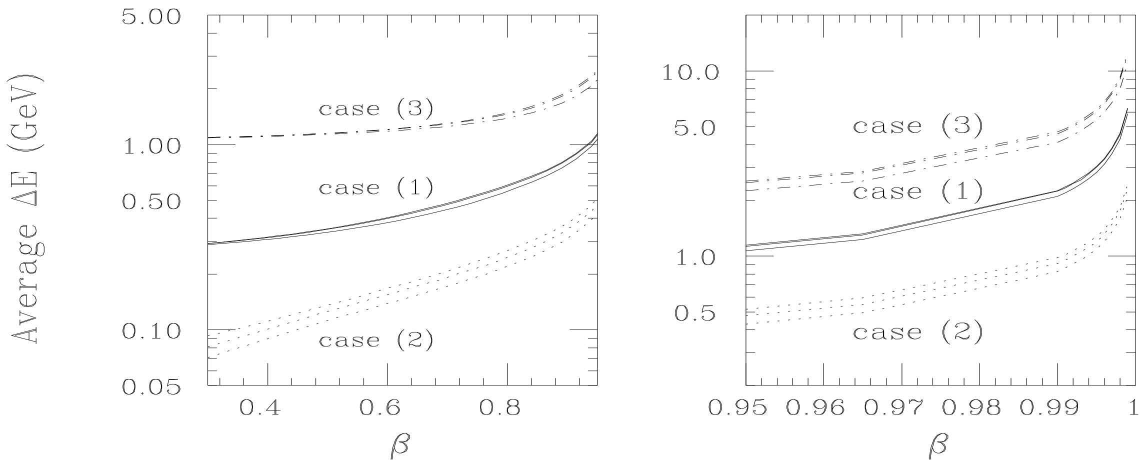
Problems when JETSET perfoms the Parton shower evolution (SUBROUTINE LUSHOW) :

- The 3 body parton shower evolution often fails in JETSET

$\Longrightarrow$ I have chosen to re-generate the event when LUSHOW fails, instead of doing independant hadronisation (to have energy-momentum conservation).

Gluino simulation

Average energy loss in a collision :



$\Longrightarrow$ for $\beta < 0.99, < \Delta E > < 2\,GeV$

DELPHI :

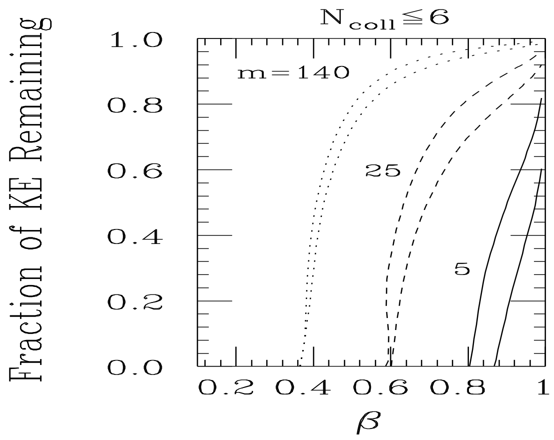
Electromagnetic Calorimeters : $\sim 1\ \Lambda_T$

Hadronic Calorimeters : $6.6\ \Lambda_T$

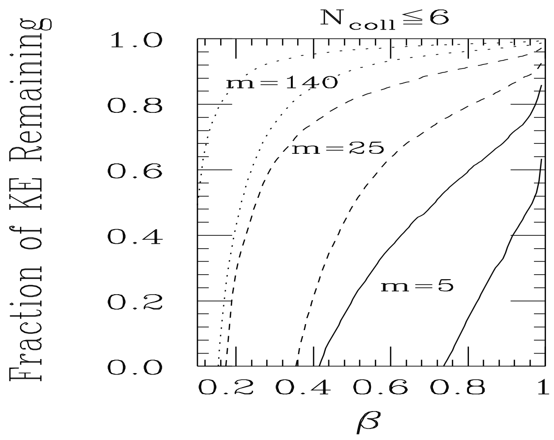
- corrections for R-hadrons : $\sigma^T_{R^oN} \sim (9/16)\sigma^T_{\pi N}$
- $\Longrightarrow (9/16) \times 7.6\Lambda_T = 4$ collisions

Deposited energy: (CDF)

- Charged R-hadrons : $R^{\pm}$



- Neutral R-hadrons : R^{o}



- To obtain the same kind of plots for DELPHI.

Gluino simulation

Choice of particles

We will simulate the R-hadrons as :

- heavy muons for $R^{\pm}$ case
- k_L^o for the R^o case

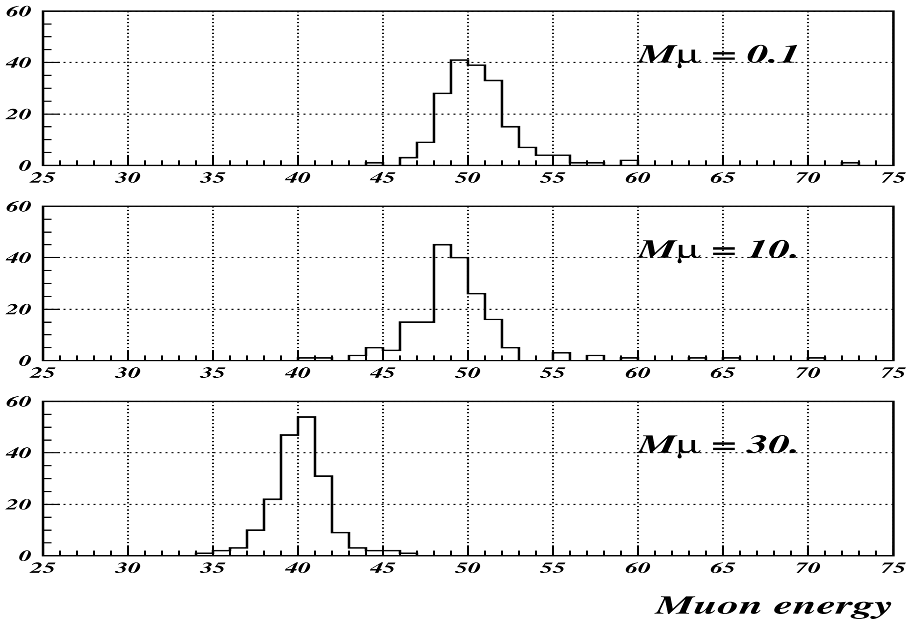
For the R^o case, The energy will be fixed by the average energy loss calculated from previous formula.

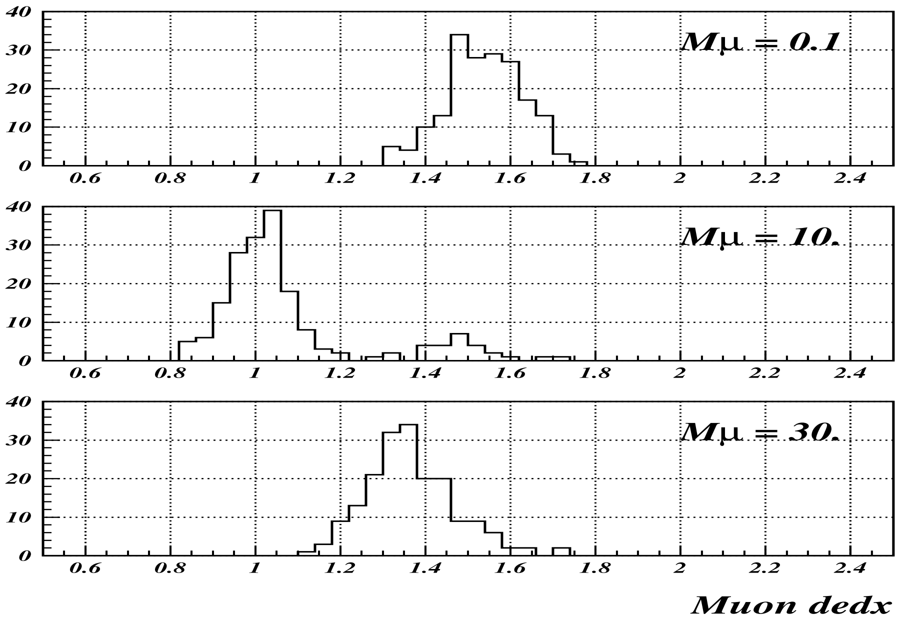
DELSIM and heavy muons

100 muon pairs have been simulated with DELSIM. The energy is fixed at 50 GeV, and three different masses have been tested :

- $M_{\mu} = 0.1$, 10 and 30 GeV

Gluino simulation





- DELSIM+DELANA seem to be able to handel heavy muons

Gluino simulation

DELSIM and k_L^o

- Few Problems have to be solved :
  - The k_L^o can interact in DELPHI before the HAC $\Longrightarrow$ few particles.
  - How a k_L^o of few GeV is identified in DELPHI ?

Gluino analysis

Summary and outlook

- Signal simulation will start next week
- The analysis will be perfomed using the new SKELANA version
  - Ntuples are ready
  - The preselection could be the same as the $\tilde{t}_1 \rightarrow c\tilde{\chi}^0_1$ analysis.
  - A strategy has to be defined to see how many jets we are looking for (2 jet analysis, or 4 jet analysis). It depends on the mass difference between the stop and the gluino, and on the charge of the R-hadrons we are looking for ($R^{\pm}$, R^o)
- Results will be ready for Moriond.