VARIATION OF M-SUGRA PARAMETERS IN THE CHANNEL OF DECAY OF A SQUARK AND A GLUINO, WHICH DECAY VIA NEUTRALINOS IN A PAIR MUON-ANTIMUON.

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Overview

The simulation of one of the experimental signals of the production of s-quarks and gluinos in proton-proton collisions at center of mass energy of 7 TeV will be presented.

The signal that will be analyzed, results from the decay of a s-quark and gluinos via neutralinos and Z bosons, where the Z bosons decay in opposite sign muons.

Was simulated the decay channel using Pythia 6 event generator, where was included the characteristics of the channel and the variation of the Minimal Supergravity Model (M-Sugra) parameters.

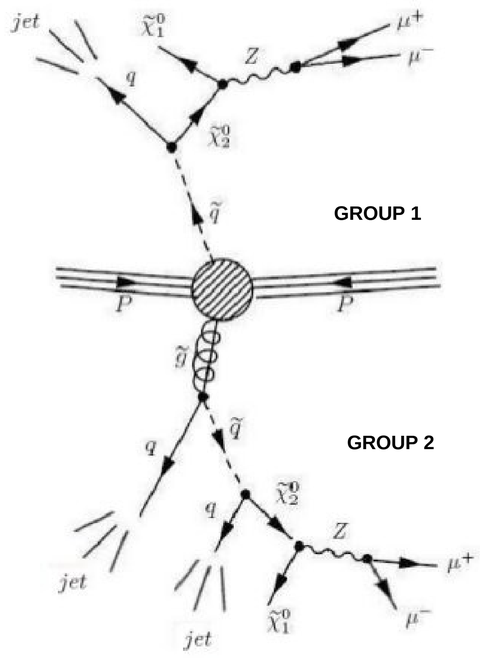


Figure 1

MSUGRA PARAMETERS

The minimal extension of Standard Model that includes supersymmetry is known like Minimal supersymmetric standard model (MSSM).

Minimal supergravity Model (M-Sugra) is a model in the universality of the different soft parameters at the Grand Unified Theory (GUT) sacale $M_{GUT} \approx 2 \times 10^{16}$ GeV is postulated.

The equations for the determination of no trivial minimum of electroweak potential are used to decrease the number of the unknown parameters, so the M-Sugra model depends on five unknown parameters:

- M_0 and $M_{1/2}$, in SUGRA all scalar s-particles have a common mass at M_{SUSY}, as do all gauginos, M_0 is the common scalar mass and $M_{1/2}$ is the common gaugino mass.
- A_0: Soft trilinear interaction parameter

Tanβ and sign(μ): Tanβ is the ratio of the Higgs vacuum expectation values.

POINT OF REFERENCE FOR SUSY PRODUCTION

To search for supersymmetry in the M-Sugra parameters space, is fixed a set of parameters (benchmarks), they are classified in two classes: *low mass* (LM) wich purpose is made a proff of the sensitivity of the CMS experiment in the detecction of supersymmetry in the early years, and *high mass* (HM) designed to search supersymmetry in the post years with high luminosity.

Table of parameters LM

Punto	m_0(GeV)	$m_{1/2}$(GeV)	tan β	sign (μ)	A_0
LM_0	200	160	10	+	-400
LM_1	60	250	10	+	0
LM_2	185	350	35	+	0
LM_3	330	240	20	+	0
LM_4	210	285	10	+	0
LM_5	230	360	10	+	0
LM_6	85	400	10	+	0
LM_7	3000	230	10	+	0
LM_8	500	300	10	+	-300
LM_9	1450	175	50	+	0

Table 1

SIMULATION DETAILS

The coupling constants and cross sections in the leading order approximation for SUSY processes were calculated with PYTHIA 6.

Different set of M-Sugra parameters were used for the study of decay channel (LM2, LM4, LM5, LM6, LM8). See Table 1.

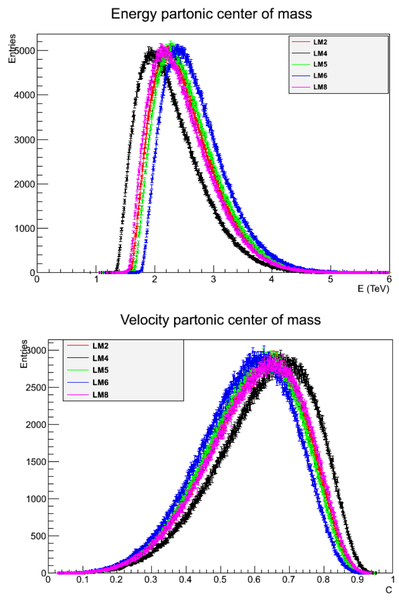


Figure 2

FINAL STATE RESULTS

We can obtain the mass of the Zo using the information of the muons in the final state of our analyzed channel. Using the definition given by:

$$M_{\mu\mu} = \sqrt{(E_{\mu^+} + E_{\mu^-})^2 - (p_{\mu^+} + p_{\mu^-})^2}$$

We determine then if the muons were produced from the Zo decay or not.

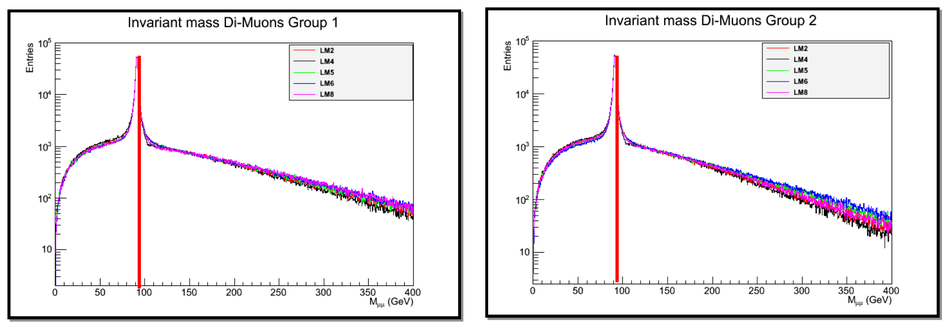


Figure 3

The red line in the Figure 3 shows the invariant mass obtained from the pair of muons in the final state. The peak is around the mass of the Zo.
The table 2 shows the mean values of the distributions for the different M-Sugra parameters.

Point LM	Group 1	Group 2
LM_2	111.4	106
LM_4	108.6	103.4
LM_5	112.2	108.3
LM_6	113.4	110.1
LM_8	113.6	106.3

Table 2

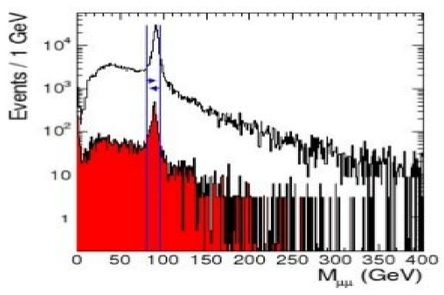


Figure 4 Physical Desing CMS Report

The angular separation of the muons in the final state that were obtained from the Zo decay is showed in the Figure 5.

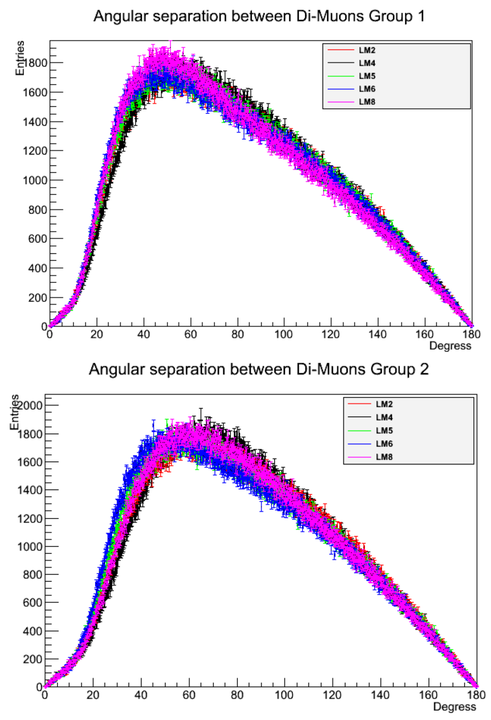
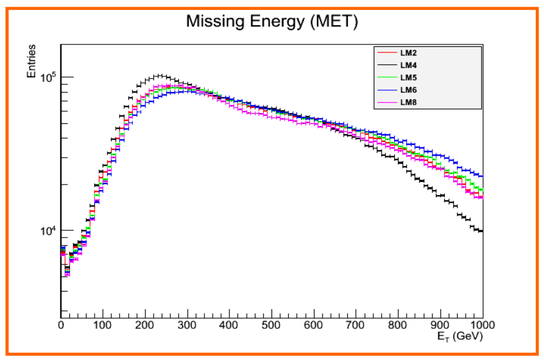


Figure 5

Finally is presented the distribution of missing transverse energy (Etmiss), for the ligthest particle, the neutralino. The equation is given by:

$$\vec{E}_T^{miss} = -\sum_n \{E_n \sin\theta_n \cos\phi_n \hat{i} + E_n \sin\theta_n \sin\phi_n \hat{j}\}$$



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