SUSY RPV searches in CMS

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The supersymmetric extension of Standard Model (SM) allows to solve several problems as the hierachy problem, the unification of gauge couplings at the GUT scale or also provide a candidate for the dark matter. These models have traditionally several assumptions on the sfermions and gauginos mass unification, as well as on the trilinear couplings. The searches in the case of the not conserved R-parity are presented. The RPV final state searched for contains typically between one to four leptons with a low missing tranverse momentum. The data of Run1 at 8 TeV, representing a total of 19.8 /fb recorded by the CMS detector, have been analyzed and no deviation from SM background was found. An upper limit on several RPV parameters is set, improving the previous limits in SUSY RPV case.
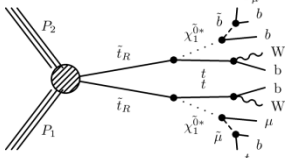
R-parity : $R=(-1)^{3B+L+2S}$

R=+1/-1 Standard Model/SUSY fields

$$W_{RPV} = \frac{1}{2}\lambda_{ijk}L_iL_j\overline{E}_k + \lambda'_{ijk}L_iQ_j\overline{D}_k + \frac{1}{2}\lambda''_{ijk}\overline{U}_i\overline{D}_j\overline{D}_k.$$

L — B

If B and L are not violated together, the constraints arising from the proton lifetime can be avoided

Stop analysis :

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Light top squarks production with RPV decays of the lightest supersymmetric particle (LSP). For these signatures with three or more isolated leptons and at least one bottom-quark jet produced, the missing transverse energy (E_T^{miss}) is expected to be low. As a consequence, another variable S_T combining the scalar sum of E_T^{miss} and the transverse energy of jets and charged leptons discriminates the SM backgrounds from the signal.

Several upper limits on the cross-section are presented, in the case of Stop-RPV with non-zero couplings λ_{122} λ_{233} and λ'_{233}
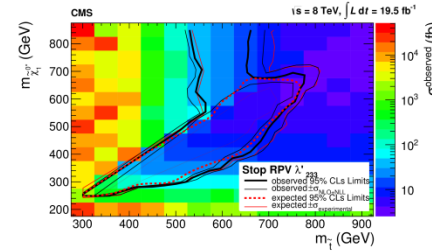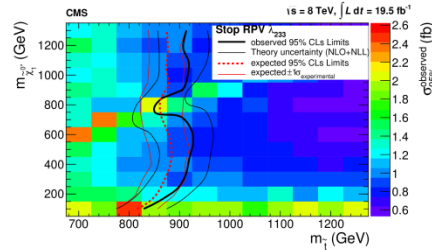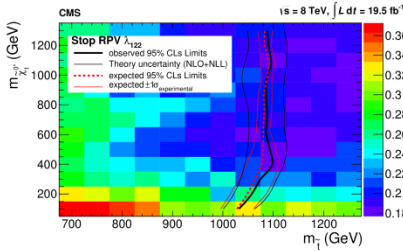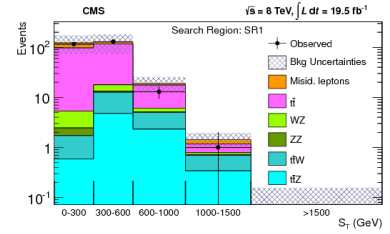
4 leptons analysis :

CMS PAS-SUS-13-010
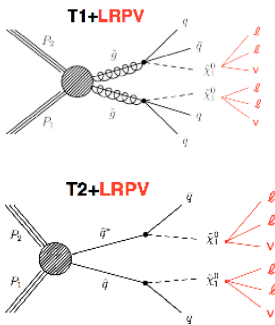
A search for anomalous production of events with four isolated leptons allows to set upper limits on the cross-sections of leptonic RPV SUSY models. As SUSY particles are produced by pairs, the decay of the LSP into two charged leptons and a neutrino gives this final state, assuming an extension of the Simplified Models (R-conserved, T1 is the gluino pair production while T2 is the squark pair production).
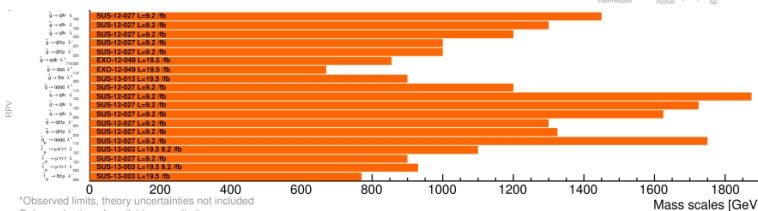
A 95% C.L. upper limit on total cross-section for generic SUSY models is obtained (left), the bands corresponding to the efficiency uncertainty. Using this generic inclusive RPV SUSY cross-section limit, mass exclusions limits are obtained for several production mechanisms (right)
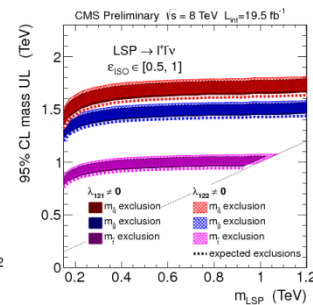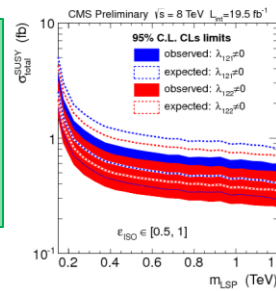
Summary of CMS SUSY RPV results :

The best exclusion limits for the masses of the mother particles are presented using the assumption m(LSP)= 0 GeV.
The branching ratios are assumed to be one and these values should be interpreted as the upper bound on the mass limits.