Categorizing and examining excluded and non-excluded pMSSM models for 13TeV runs

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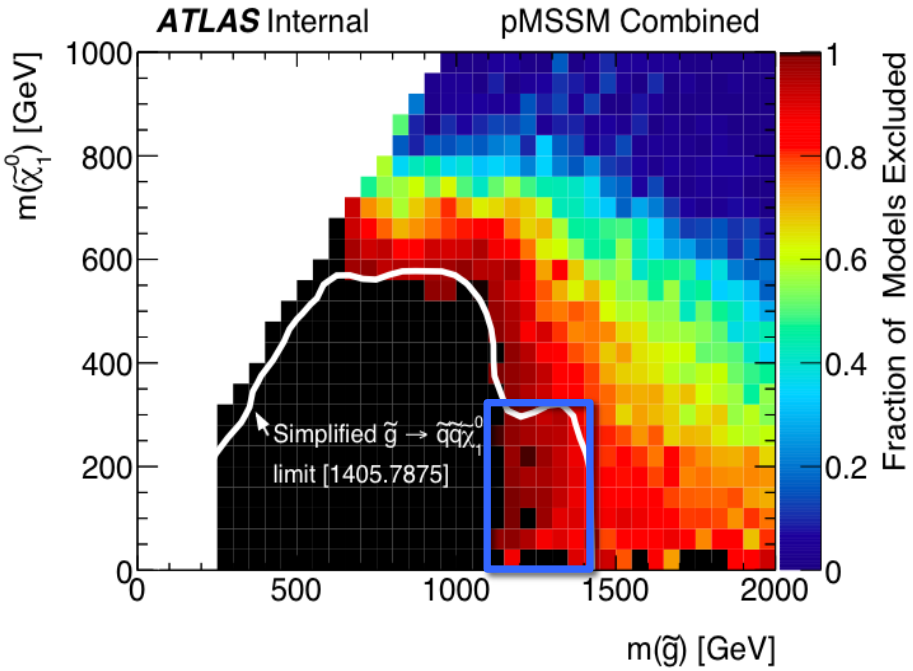
pMSSM

- phenomenological Minimal Supersymmetric Standard Model
  - Includes minimum number of new particle states and interactions
  - phenomenological reduces >100 parameters to 19
- Model assumptions
  - R-parity conserved
  - Lightest neutralino (~chi_10) as LSP

Parameter	Description
tan(β)	Ratio of vacuum expectation value of the Higgs doublets
M_A	Mass of the pseudoscalar Higgs boson
μ	Higgsino mass parameter
M_1	Bino mass parameter
M_2	Wino mass parameter
M_3	Gluino mass parameter
m_q, m_{uR}, m_{dR}	1st and 2nd generation squark masses
m_l, m_{eR}	1st and 2nd generation slepton masses
m_Q, m_{tR}, m_{bR}	3rd generation squark masses
m_L, $m_{\tau R}$,	3rd generation slepton masses
A_t, A_b, A_τ	3rd generation trilinear couplings

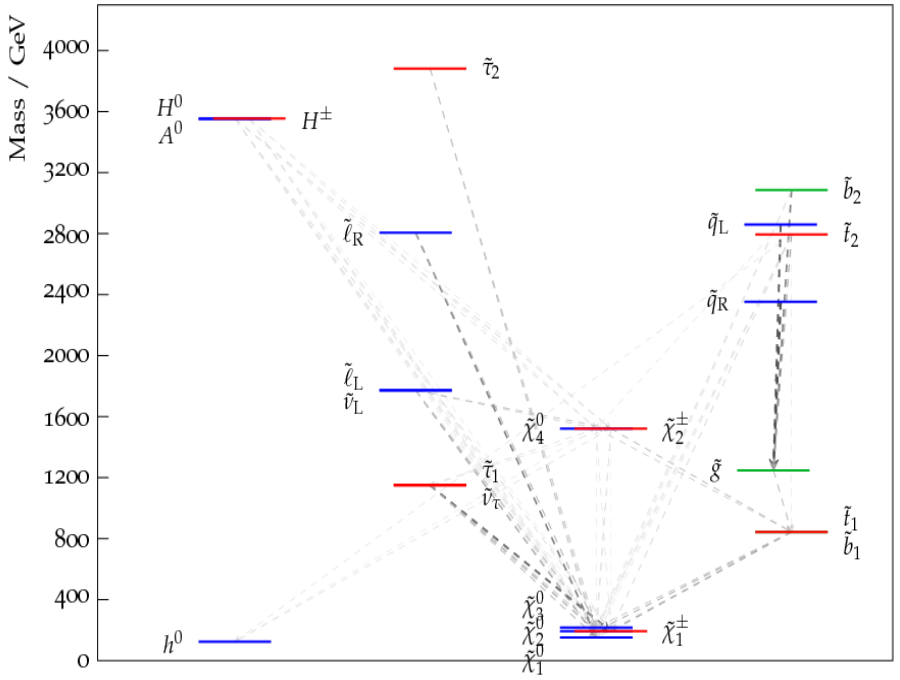
Types of models

- Gluino (~g) mass of 1.1-1.4 TeV, LSP mass < 300 GeV
- Examined for strong production
  - Decay through squarks, neutralinos, or charginos with SM particles
  - Final state includes ~chi_10, which shows up as MET
- Excluded/non-excluded models based on previous experimental measurements and simulations

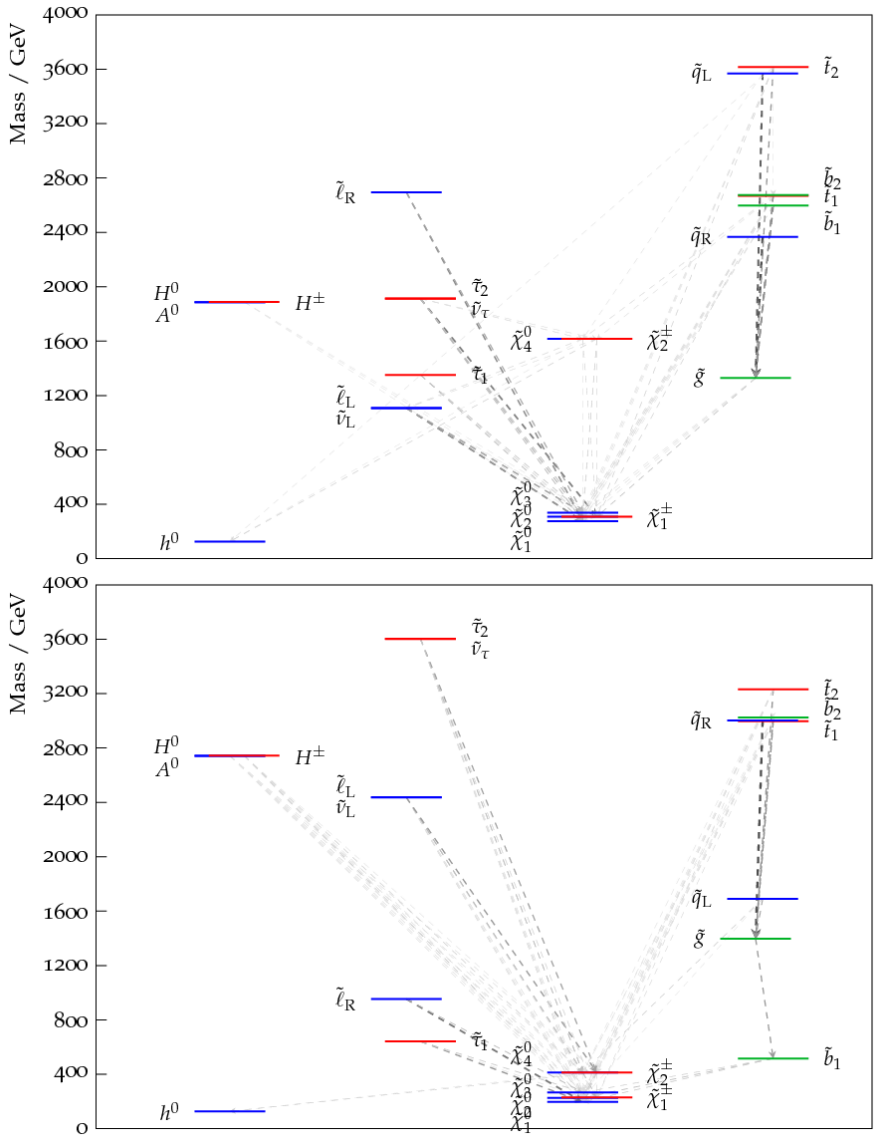


Model categorization

- Categorization based on gluino decay
  - First SSM decay product
  - Mass splits between sequential particles in the decay chain
  - Specific branching ratios
- Looking for differences that would affect final state characteristics



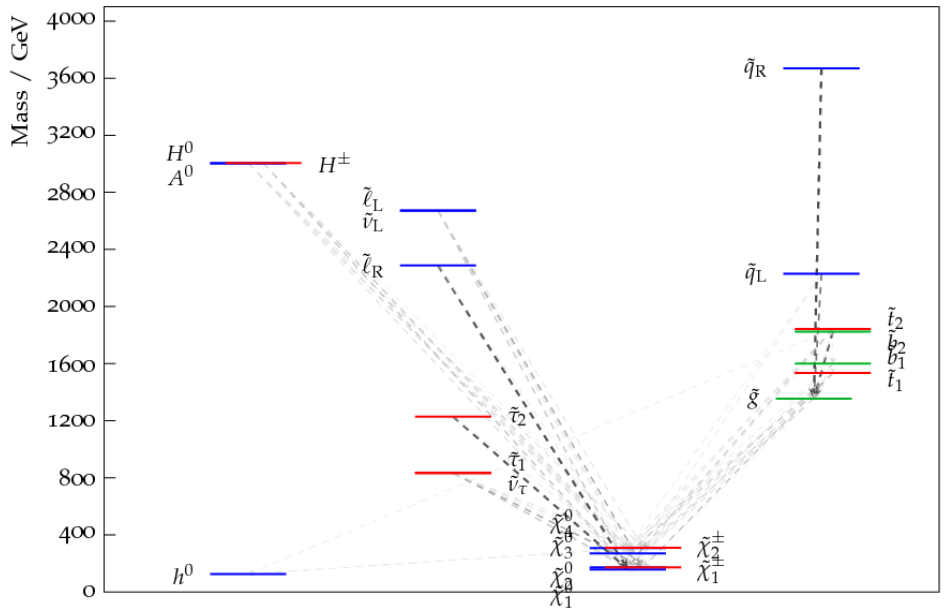
Model categorization

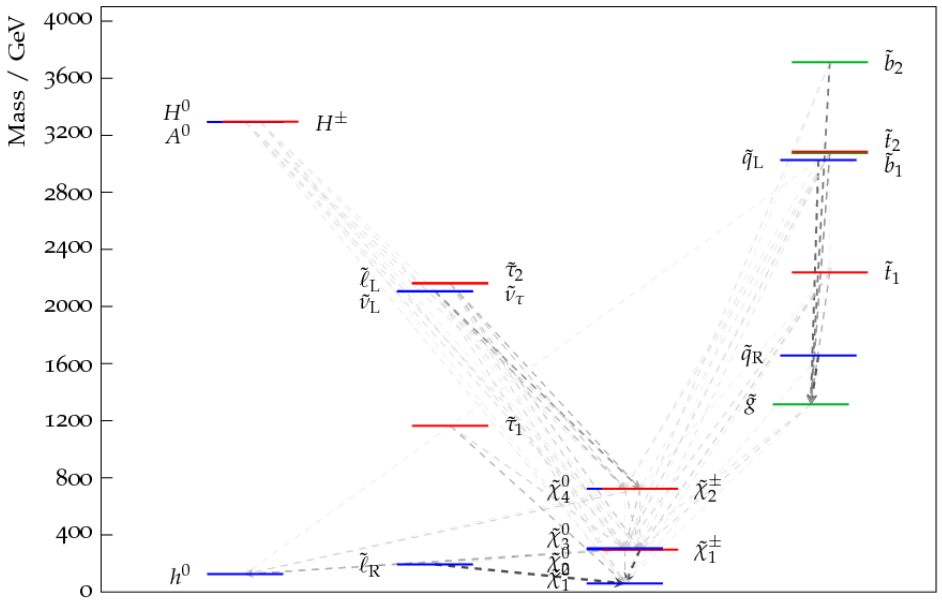


Non-excluded 114		Excluded 1508	
->chi 87	->squark 27	->chi 275	->squark 1233

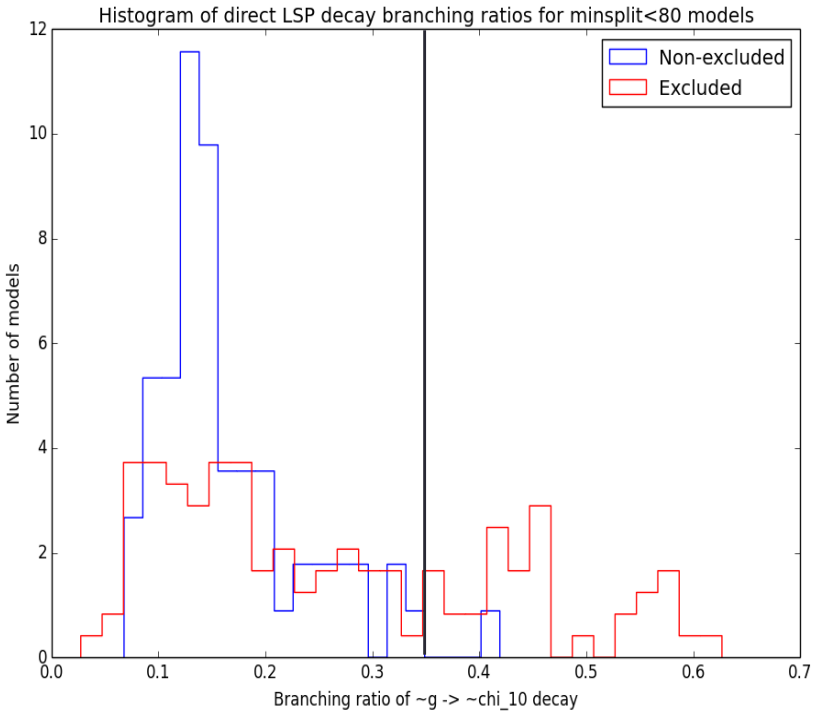
Model categorization

Non-excluded ~g->chi 87			Excluded ~g->chi 275		
Minimum mass split			Minimum mass split		
20 GeV 6	20-80 GeV 64	>80 GeV 17	20 GeV 48	20-80 GeV 124	>80 GeV 103





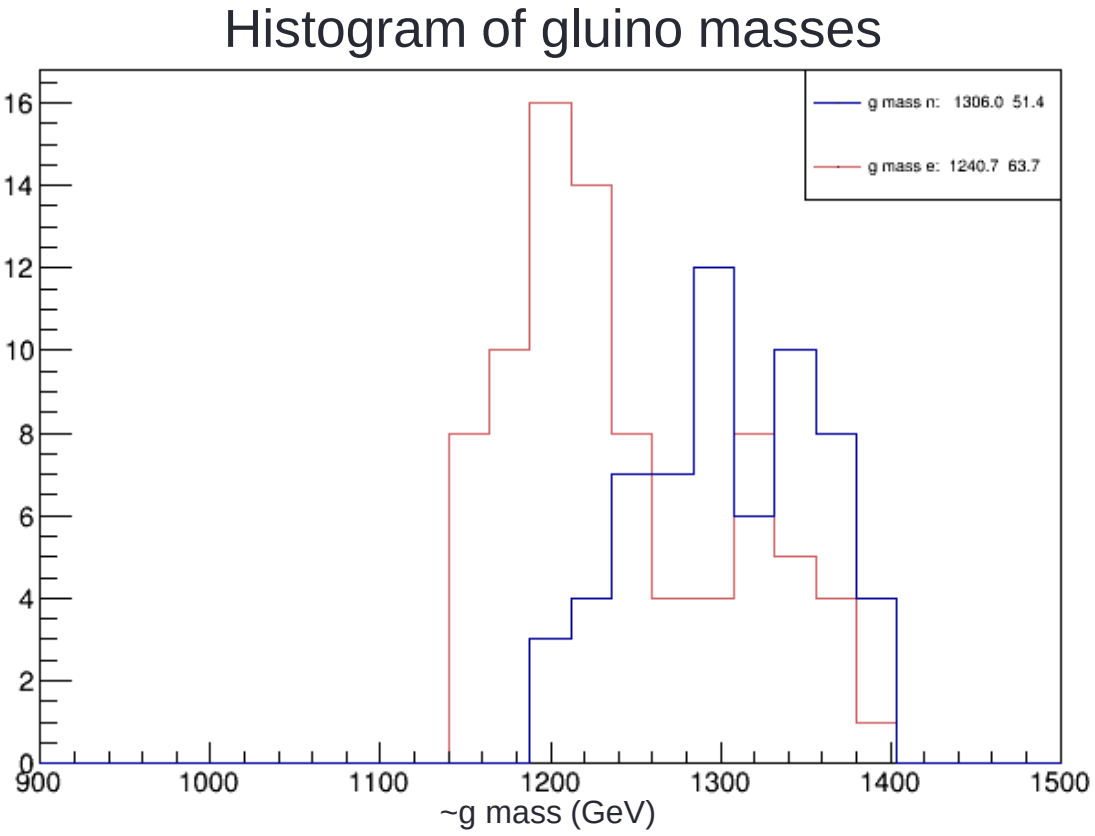
Model categorization



Non-excluded ->chi, 20-80 GeV split 64			Excluded ->chi, 20-80 GeV split 124		
0	<0.35	>0.35	0	<0.35	>0.35
0	63	1	3	84	37

Final cuts

- Gluino mass >1.2 TeV
  - **61** non-excluded models, **38** excluded models

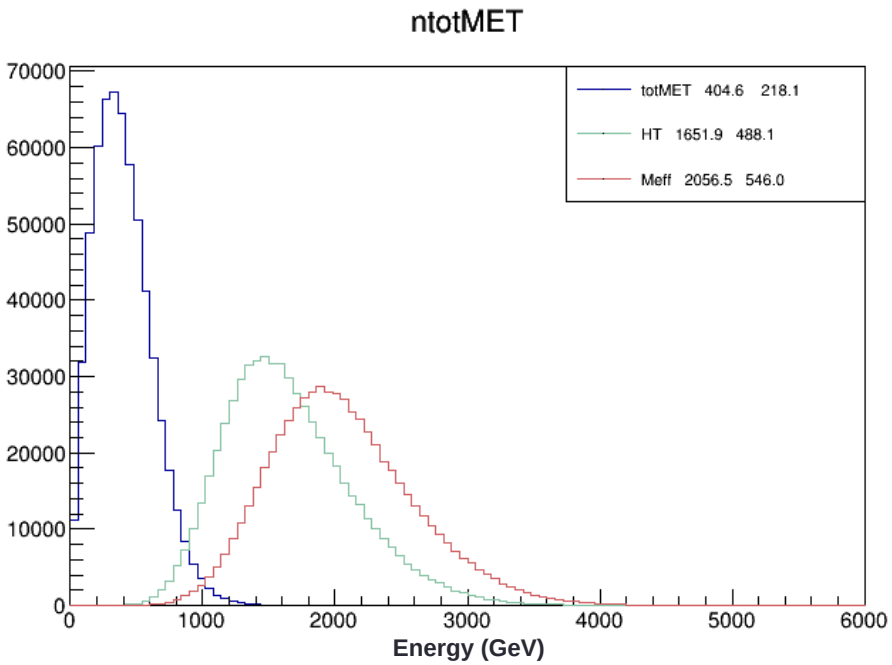


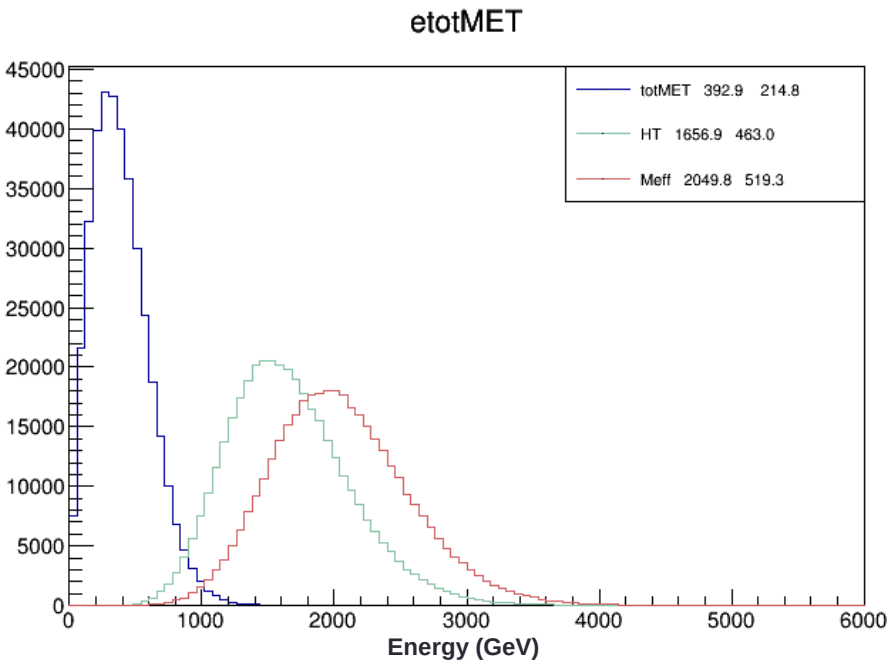
Analysis of simulation files

- ROOT files of event simulation data
- Strong production: gluino pair production events
- Truth variables analyzed:
  - Missing transverse energy (MET)
  - Scalar sum of transverse momentum (HT)
  - Effective mass (sum of MET and HT)
  - Number and P_t of jets and b jets
  - Number and P_t of leptons (electrons and muons)

Analysis of simulation files

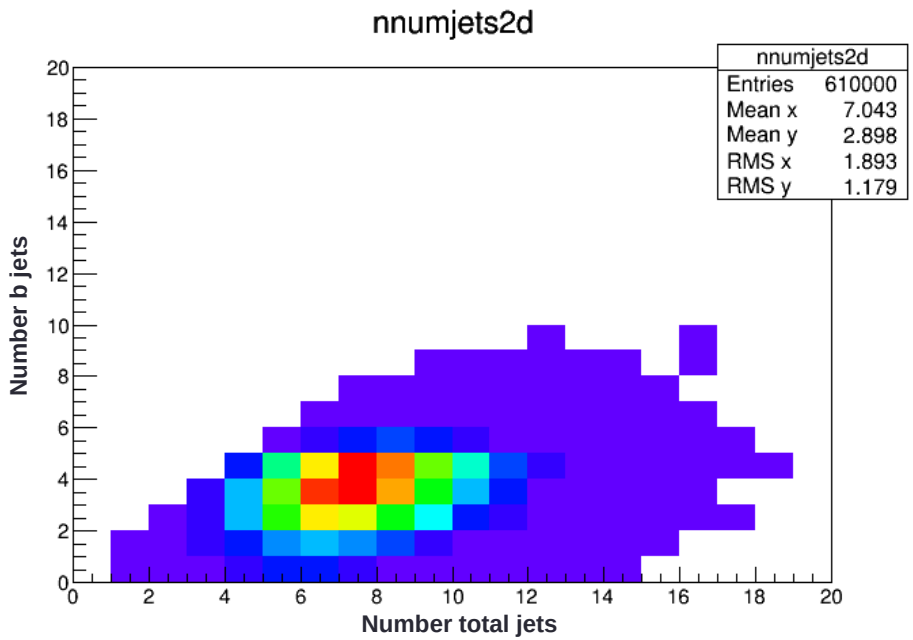
- Histograms of MET, HT, and Meff

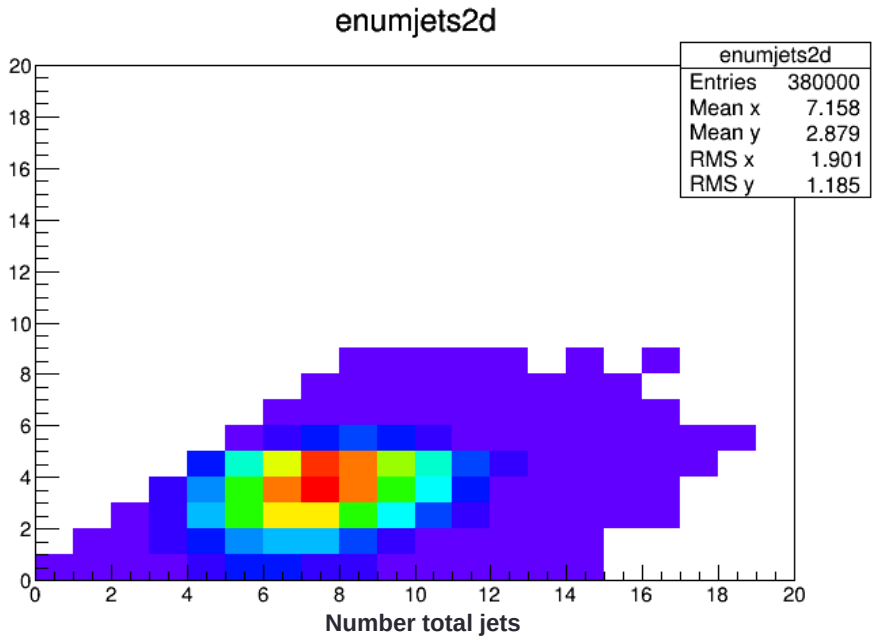




Analysis of simulation files

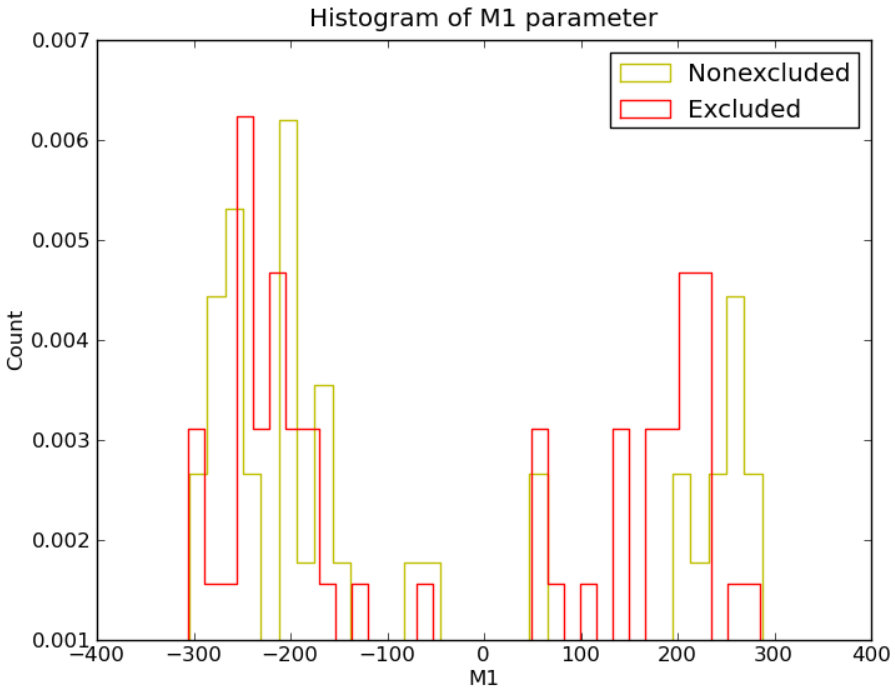
- 2D histogram of total number of jets vs. number of b jets

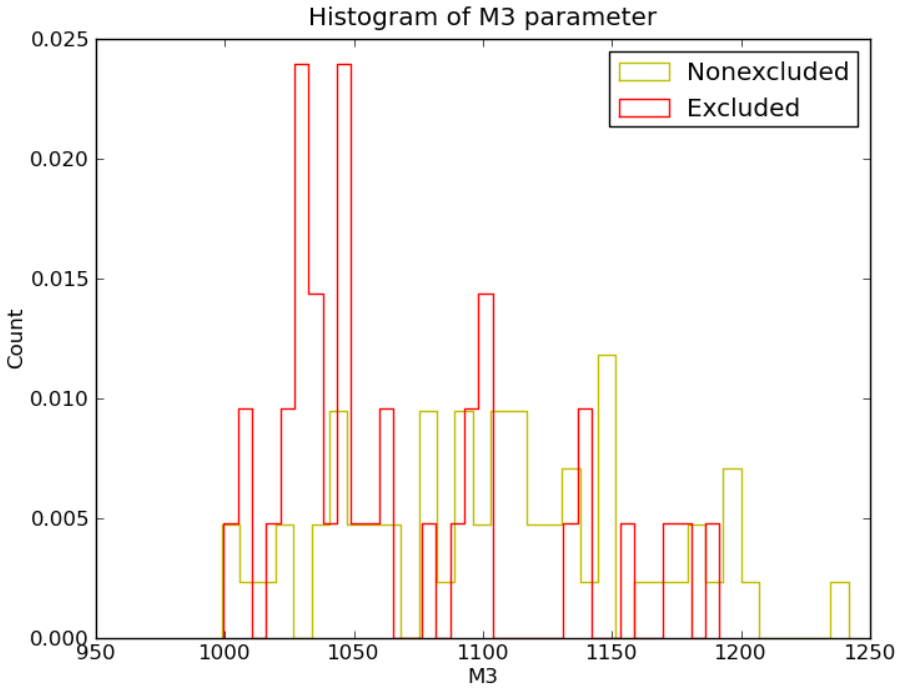




Examination of pMSSM parameters

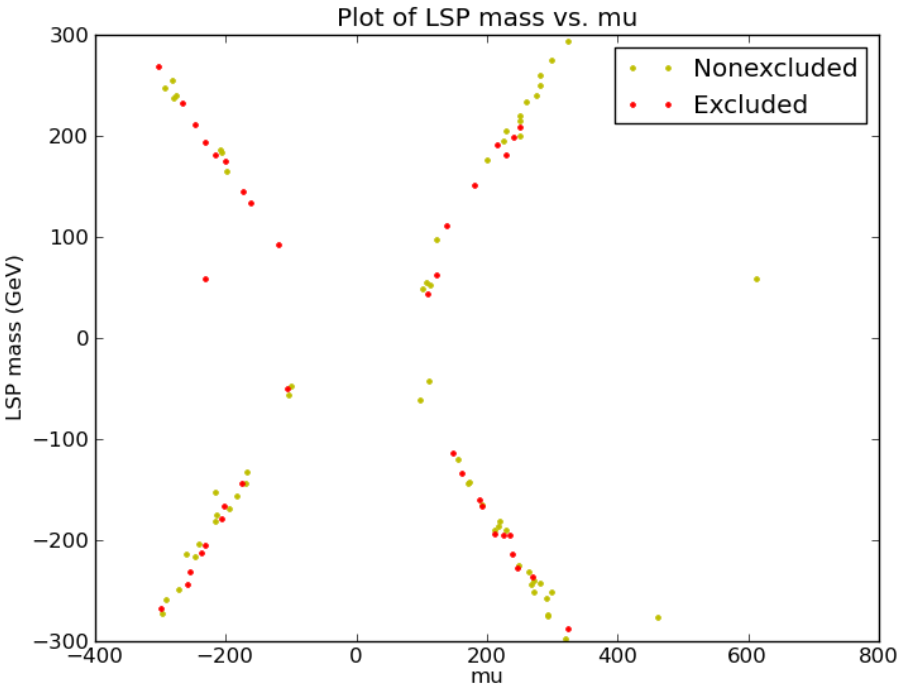
Bino (M1) and gluino (M3) mass parameters

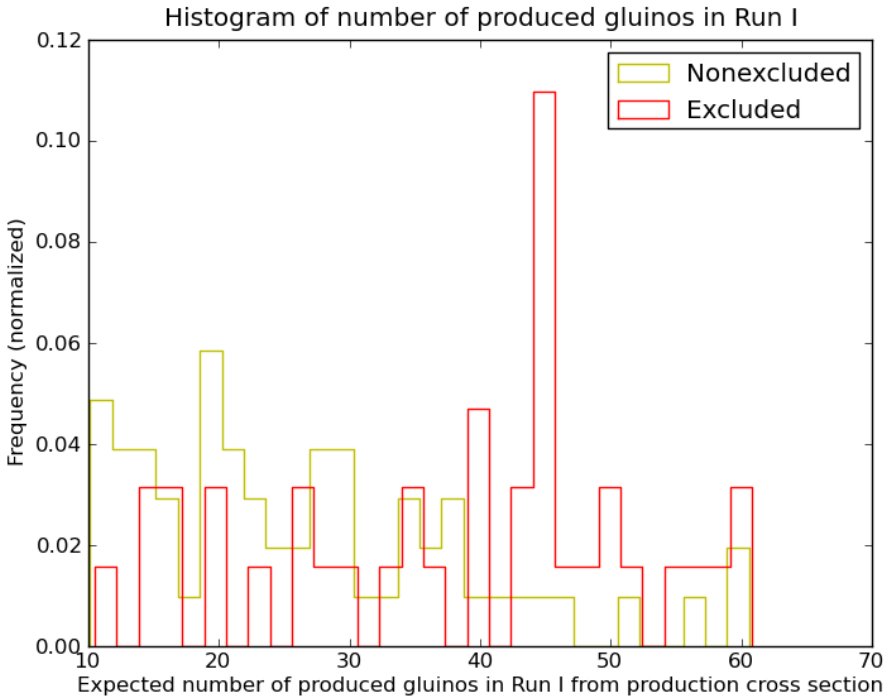




Examination of pMSSM parameters

- LSP mass vs. μ; gluino production cross section





Conclusions

- Further examination of parameters and simulation files is needed to identify the differentiating trait
- Models are of same type with similar decay patterns; exclusion vs. non-exclusion may be very slight
  - May be different across categories

Thank you