Search for Top-Squark Pair Production in the Single-Lepton Final State at 8 TeV

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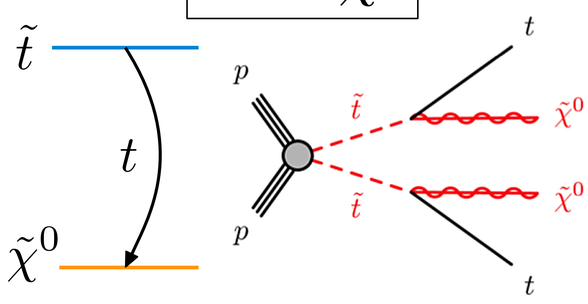
Context

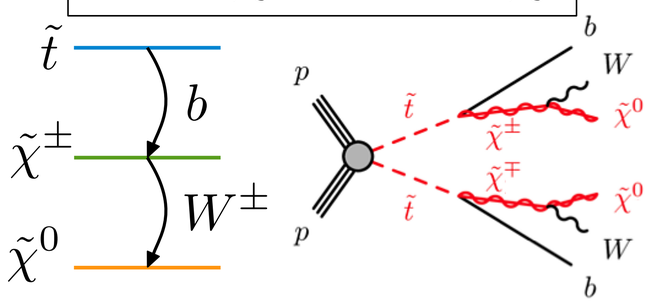
Searching for a **super-partner of the top quark (stop)**

- Predicted by Super-Symmetric models
- Light mass (~1 TeV) motivated by naturalness
- Two types of decays are considered

$\tilde{t} \to t\tilde{\chi}^0$

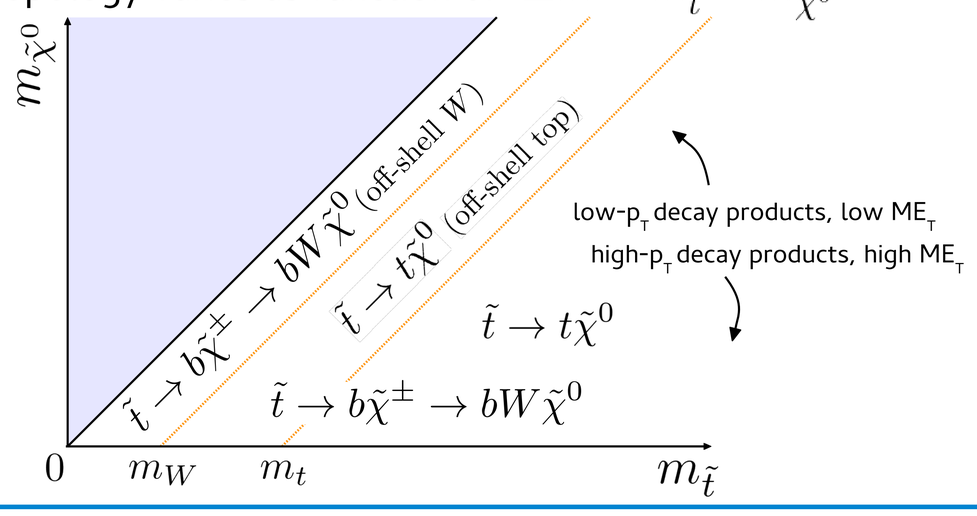


$\tilde{t} \to b\tilde{\chi}^{\pm} \to bW\tilde{\chi}^0$

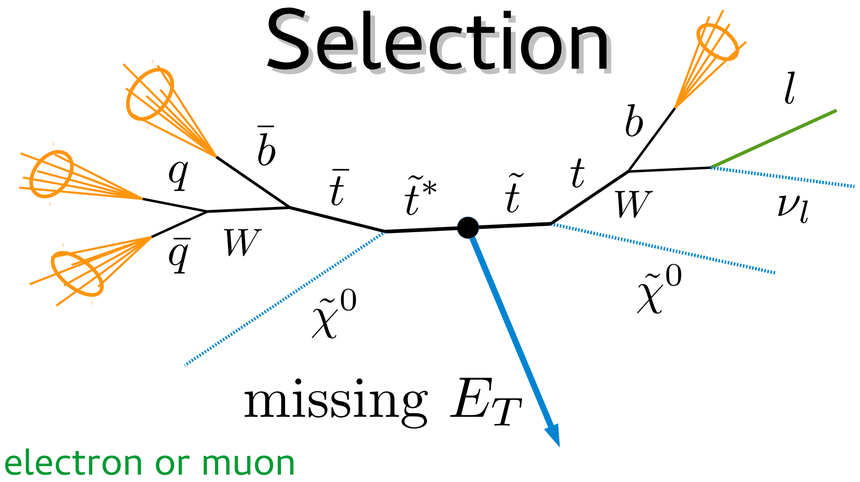


Phenomenology

- Neutralinos ($\tilde{\chi}^0$) leading to large missing transverse energy
- Topology varies as function of $\Delta m = m_{\tilde{t}} - m_{\tilde{\chi}^0}$



Selection



- 1 electron or muon
- ≥ 4 jets, ≥ 1 b-tag
- missing E_T > 100 GeV

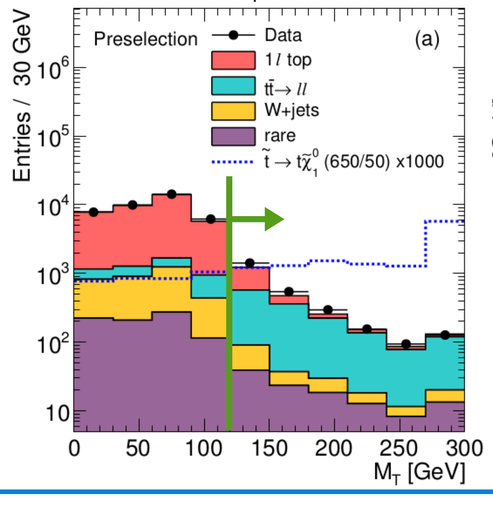
} match signal topology

- second lepton vetos (isolated track, hadronic τ)

} aim to reject tt → ll background

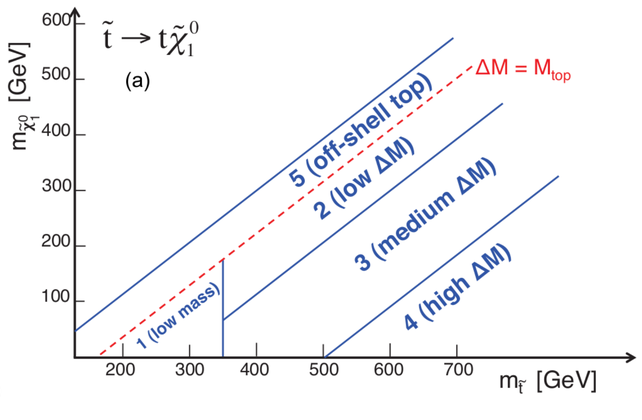
M_T-based signal region

- $M_T = m_T(\ell, M\vec{E}T)$
- Large values sign several sources of ME_T
- Require M_T > 120 GeV



Further optimization using Boosted Decision Trees

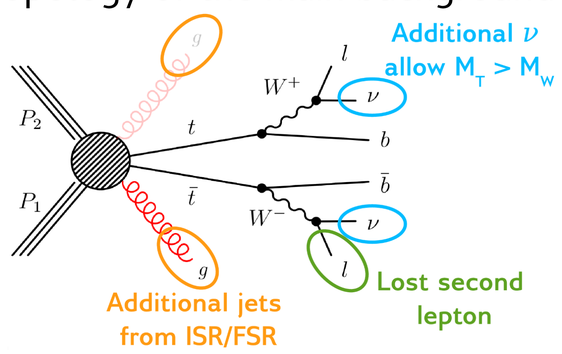
- Up to 7 discriminating variables used in input
- Different trainings according to Δm regimes



Backgrounds

- Dileptonic $t\bar{t}$ (main background)
- Semileptonic $t\bar{t}$
- W + jets
- Others (single-top, tt+V, diboson, ..)

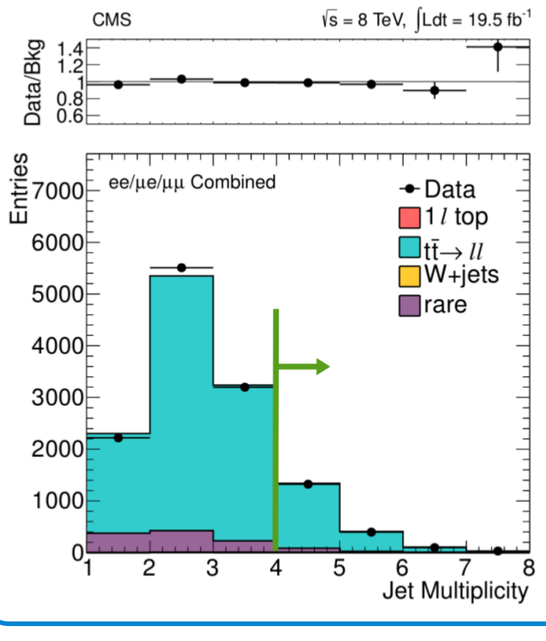
Topology of the main background



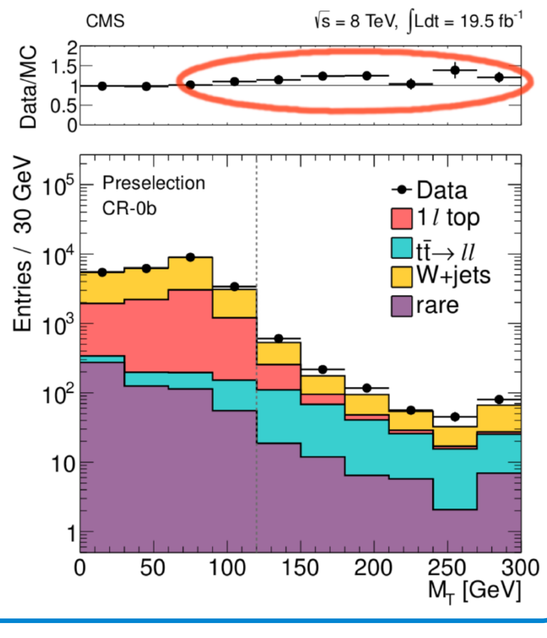
Selection criteria	1ℓ	≥2ℓ
0 b-jet	W+jets dominated	-
≥1 b-jet	**Signal region**	tt → $\ell\ell$ dominated

Control regions are designed to check and correct when needed the Monte-Carlo prediction.

Tail of the jet multiplicity distribution for dileptonic $t\bar{t}$ is well-modeled

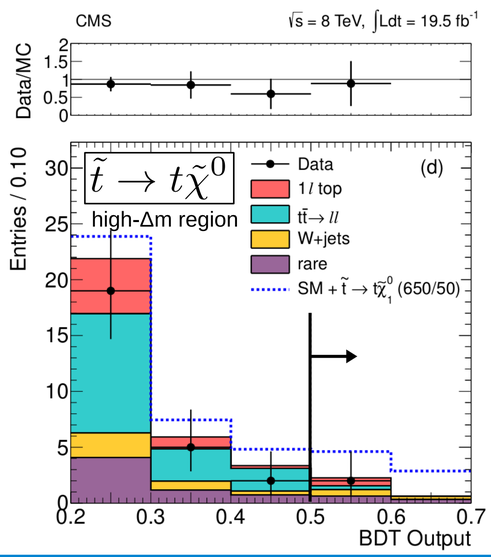


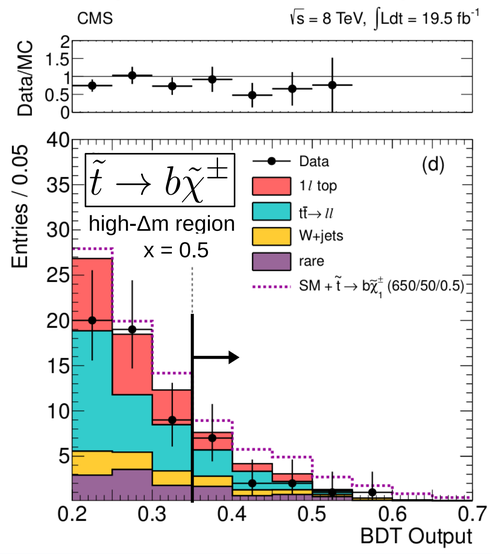
Tail of the M_T distribution for W+jets needs to be corrected



Results

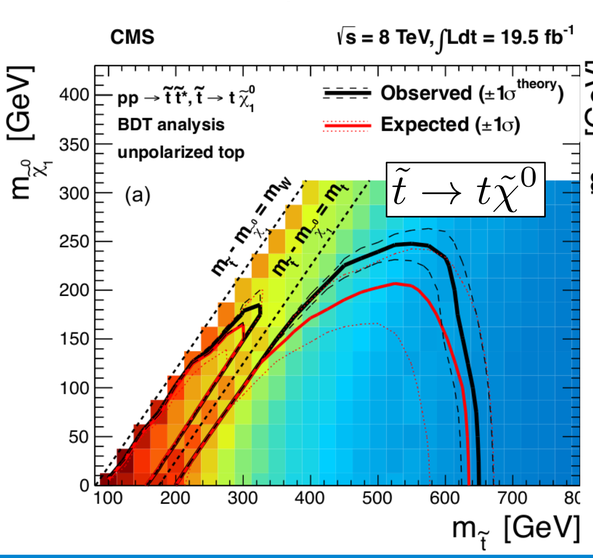
- Perform a counting experiment in the tail of BDT output
- So far, no excess observed with respect to the S.M. prediction

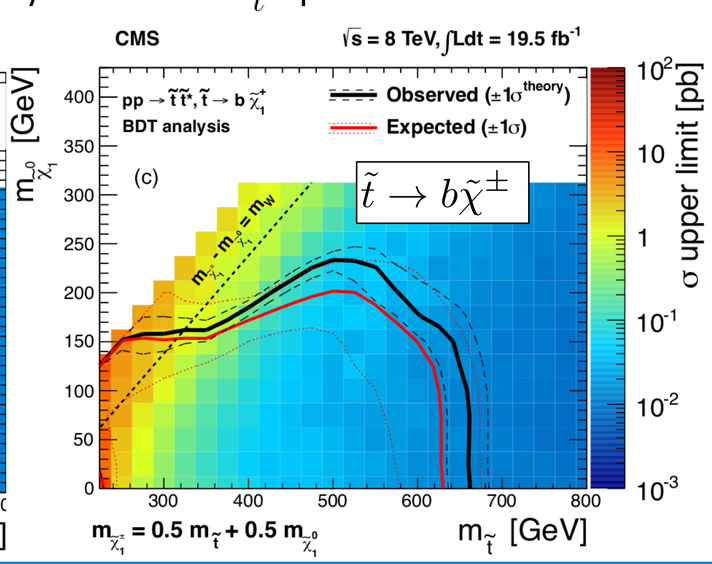




Interpretation

- Upper limits on the production cross section are derived
- Comparison with theory excludes $m_{\tilde{t}}$ up to 650 GeV





Reference — **Search for top-squark pair production in the single-lepton final state in pp collisions at sqrt(s) = 8 TeV**
The CMS Collaboration / SUS-13-011 Eur. Phys. J. C 73 (2013) 2677, arXiv : 1308.1586