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Search for scalar top quark pair production in the top corridor region with CMS

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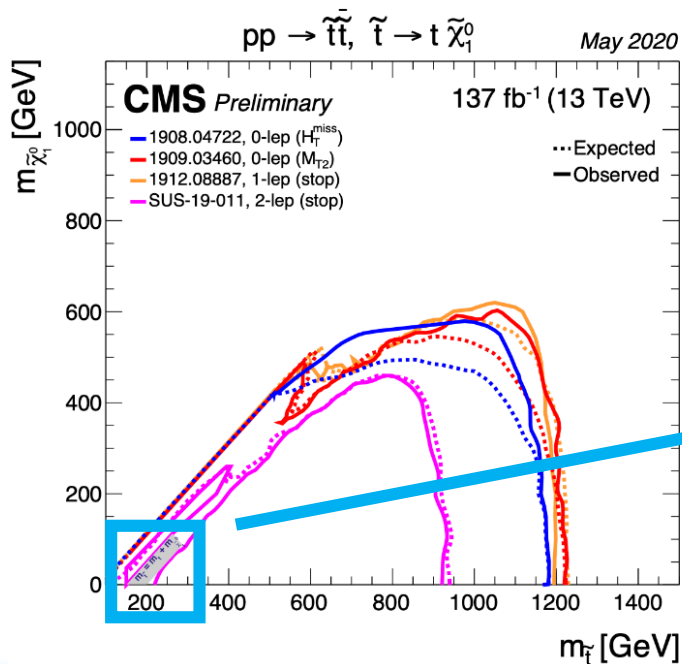
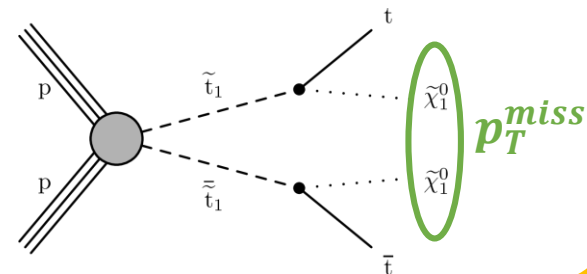
On behalf of the CMS Collaboration

— ICHEP 2020 —

TOP SQUARK SEARCHES

- The stop quark plays an essential role in understanding the SUSY models.
- Several searches with the full **Run 2 dataset** have been performed by the CMS Collaboration excluding stop masses up to 1.2 TeV, but most of these searches are not sensitive in the so-called “top corridor”.
- Final states include **0, 1** and **2** leptons:
 - **All jets:** [Eur. Phys. J. C 80 \(2020\) 3](#), [JHEP 10 \(2019\) 244](#)
 - **Lepton + jets:** [JHEP 05 \(2020\) 032](#)
 - **Dileptons:** [CMS-PAS-SUS-19-011](#), [JHEP 03 \(2019\) 101](#)* (top corridor)

Simplified Model Spectra “T2tt”



TOP CORRIDOR

- The mass difference between stop and neutralino is close to the **top mass**.
- Signal and $t\bar{t}$ background have **similar kinematics**, especially at low neutralino masses.
- Signal events can only be detected as an **excess on the $t\bar{t}$ cross section**.
- The **accurate estimation of $t\bar{t}$** process is very important to have sensitivity.

JHEP 03 (2019) 101

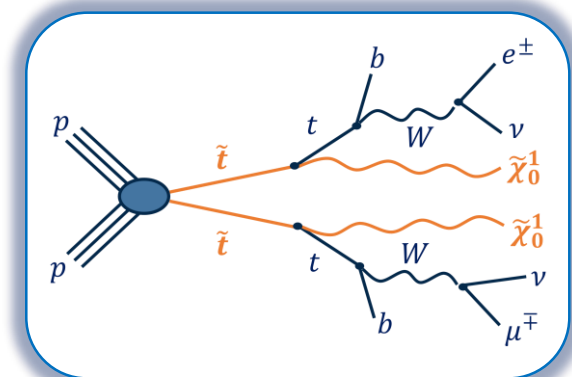
➤ Event selection and strategy

- **2016 dataset** used, 36 fb^{-1} .
- OS $e\mu$ pair, $N_j \geq 2$ and $N_b \geq 1$.
- Search for degenerate stop pair production in 3 diagonals:

$$\Delta m(\tilde{t}, \tilde{\chi}_0^1) = m_t, m_t \pm 7.5 \text{ GeV}$$

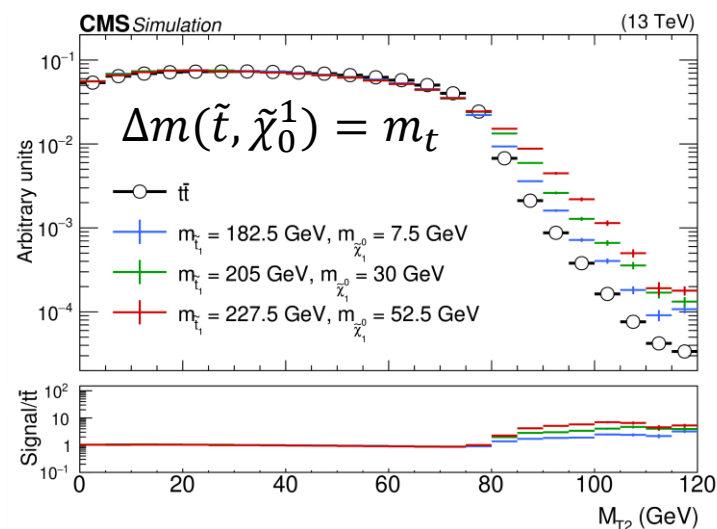
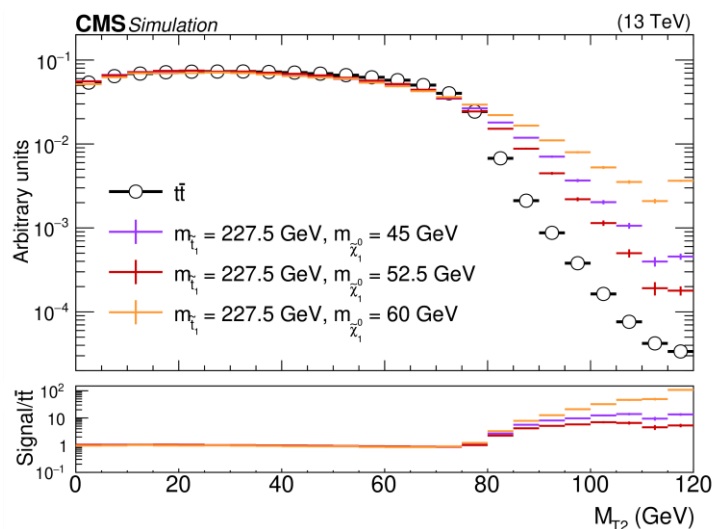
- Main discriminating variable: $M_{T2}(e\mu)$

$$M_{T2}(e\mu) = \min_{\vec{p}_{T,1}^{miss} + \vec{p}_{T,2}^{miss} = \vec{p}_T^{miss}} (\max[m_T(\vec{p}_T^{l1}, \vec{p}_{T,1}^{miss}), m_T(\vec{p}_T^{l2}, \vec{p}_{T,1}^{miss})])$$

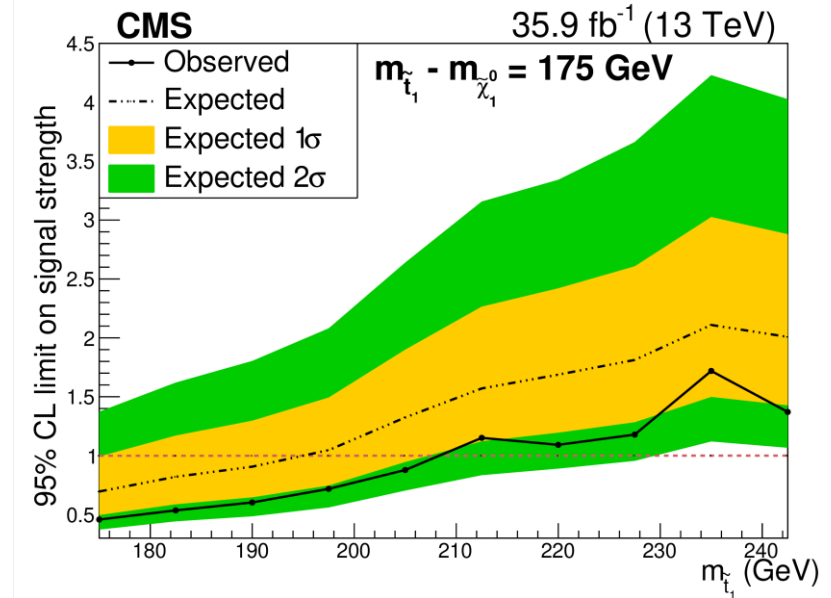
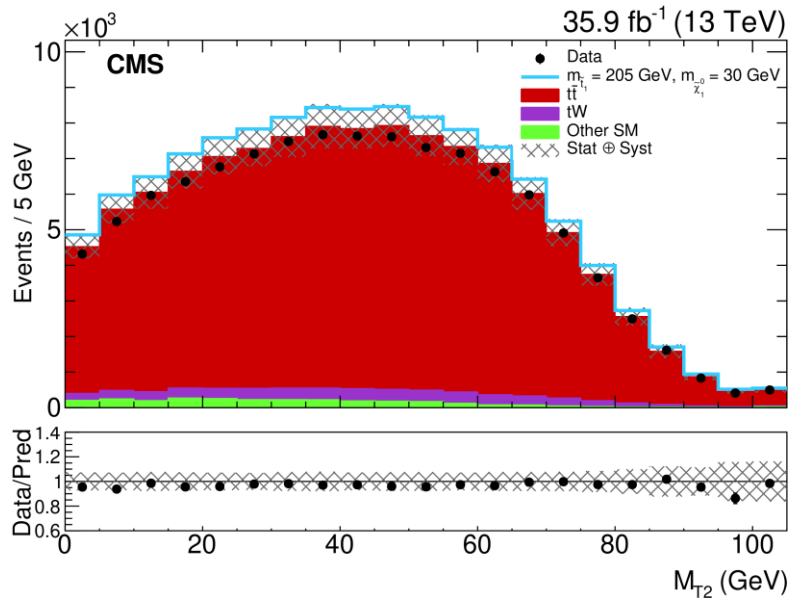


➤ Backgrounds

- The main background is $t\bar{t}$ due to the similar kinematics with the signal process in this region. It is estimated from MC with an accurate knowledge.



- **No excess** was observed and for the signal extraction the M_{T2} **distribution** is used.
- Results are presented in terms of **exclusion limits** at 95% confident level for stop quark pair production on simplified models of SUSY.



Stop masses excluded up to:
208 GeV in $\Delta m(\tilde{t}, \tilde{\chi}_0^1) = m_{\tilde{t}}$
235 GeV in $\Delta m(\tilde{t}, \tilde{\chi}_0^1) = m_{\tilde{t}} - 7.5$ GeV
242 GeV in $\Delta m(\tilde{t}, \tilde{\chi}_0^1) = m_{\tilde{t}} + 7.5$ GeV

This result significantly extends the exclusion limits of stop quark searches at the LHC to higher stop masses in this region, that was previously unexplored.