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

13th International Workshop on Top Quark Physics (TOP2020) – Virtual conference – September 2020
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**Motivation**

- 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".
- **Lepton + jets**: JHEP 05 (2020) 052

**Event selection and strategy**

- **2016 dataset** is used, corresponding to an integrated luminosity of 35.9 fb⁻¹.
- Opposite-sign eµ pair, \(N_\ell \geq 2\) and \(N_\ell \geq 1\).
- Search for degenerate stop pair production in 3 diagonals:
  \[
  \Delta m(t, \bar{t}) = m_t, m_{\tilde{t}} \pm 7.5\text{ GeV}
  \]
- Main discriminating variable: \(M_{T2}(e\mu)\)
  \[
  M_{T2}(e\mu) = \min_{\pm} \left( \max(\Delta m(T^1, \tilde{t}^1), m_T, m_{\tilde{t}}) \right)
  \]

The \(M_{T2}\) variable has an endpoint at \(t\tilde{t}\) at the W boson mass, so signal events are expected to populate the tails of the distribution.

**Backgrounds**

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 to have sensitivity.

**Methodology**

- **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.

**Results**

- No excess is 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:
  - \(m(t) > 208\text{ GeV for } m = 175\text{ GeV}\).
  - \(m(t) > 235\text{ GeV for } m = 175 - 7.5\text{ GeV}\).
  - \(m(t) > 242\text{ GeV for } m = 175 + 7.5\text{ GeV}\).

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.

**References**