Search For High-Mass $t\bar{t}$ Resonances at CMS
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**INTRODUCTION**
- New physics models predict resonances with enhanced couplings to 3rd generation particles
- Search for heavy resonances decaying to $t\bar{t}$
  - Topcolor $Z'$ and RS KK gluon models
- All-hadronic and semileptonic decay channels
- High energies = boosted tops
- Use latest jet substructure identification techniques

**DIJET EVENT SELECTION**
- **All-hadronic:**
  - Event requirement: $2$ AK8 jets, $|\Delta \phi| > 2.1, H_T > 1000$ GeV
  - AK8 jet requirement: $p_T > 400$ GeV, $|y| < 2.4$
- **Semileptonic:** $\mu/e +$ jets selection
  - Muon (electron) selection
    - $p_T > 50$ GeV, $|\eta| < 2.1 (2.5)$
    - $p_T > 150 (250)$ GeV, $H_T > 50$ (70) GeV
    - $1$ AK8, $1$ AK4 jet: $p_T > 30 (500)$ GeV for AK4 (AK8) jet, $|\eta| < 2.4$
    - $\Delta R_{min}(i,j) > 0.4 \ | \ p_{T,\text{min}}(i,j) > 20$ GeV
- $x^2 < 30$

**RESULTS**
- SM backgrounds: $t\bar{t}; W +$ jets, single-top, DY+jets, VV (semileptonic); QCD estimated from top mistag rate in data (all-hadronic)
- Limit setting: Create $t\bar{t}$ invariant mass distributions; rate and shape uncertainties included

**JET SUBSTRUCTURE: TOP-TAGGING**
- New top-tagger for AK8 jets - working point for $\epsilon(B) = 3$
  - Softdrop jet mass = $[110, 210]$ GeV
  - Removes soft and collinear radiation
  - $N$-subjettiness ($\tau_{SD}$) $< 0.69$
  - Distinguishes 3-prong subjet structure (top) from non-top jet

**LIMITS**
- Exclusion limits obtained for each of the physics models
- Already improving upon 8 TeV limits!

**REFERENCES**
- Search for resonant $t\bar{t}$ production in proton-proton collisions at $\sqrt{s} = 8$ TeV, Phys. Rev. D 93 (2016) 012001, arXiv:1506.03062
- Search for $t\bar{t}$ resonances in boosted semileptonic final states in pp collisions at $\sqrt{s} = 13$ TeV, CMS PAS B2G-15-002
- Search for top quark-antiquark resonances in the all-hadronic final state at $\sqrt{s} = 13$ TeV, CMS PAS B2G-15-003
- Top Tagging with new Approaches, CMS PAS JME-15-002

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