Search for low-mass pair-produced dijet resonances using jet substructure techniques in proton-proton collisions at 13 TeV

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**Theory Model**

- **Hadronic RPV SUSY**
  - Pair production of stop decaying via the UDDσ12 RPV coupling into two light quarks

**Physics Motivation**

- **Boosted topologies**
  - Exploit current LHC energy to study this boosted signature and probe lower BSM particle masses

**Analysis Strategy**

- **Search for 2 AK8 jets with high pt and substructure**
  - The average jet mass distribution of the two leading jets using anti-kt jets with cone size R=0.6 is investigated for evidence of a signal consistent with localized deviations from the estimated SM backgrounds

**Substructure Techniques**

- **Event Selection**
  - **Variable** | **Selection**
    - Number of AK8 jets
    - Leading pT jet: $p_T > 150\text{GeV}$
    - jet $p_T > 2.5$
    - $H_T > 900\text{GeV}$
    - $M_{\text{pruned}} > 0.1$
    - $|\eta_j - \eta_{\text{pruned}}| < 1.5$
    - Isolation2ndjet: $\tau_2 < 0.45$

- **Event Results**
  - CMS Preliminary
  - 2.7 fb$^{-1}$ (13 TeV)
  - Events / 5 GeV

- **Systematic Uncertainties**
  - **Signal:**
    - **Source:**
      - Jet Energy Resolution
      - Jet Mass Resolution
      - Jet Energy Scale
      - Jet Mass Scale
      - MC Statistics
      - MC Resonance
      - Systematic Uncertainties
      - Transfer Factor
      - Fit Uncertainty
      - Systematic in MC Backgrounds
    - **Value:**
      - $\pm 5\%$

- **Background Estimation**
  - **Non-resonant backgrounds (QCD):**
    - ABCD method: use background enriched sidebands to estimate the background in the signal region
  - **Resonant backgrounds:**
    - 5% of total background: t\overline{t}, Wjets, Zjets, dibosons
      - Use MC samples, properly validated

**High Level Trigger (HLT)**

- We developed an HLT trigger for this search using the pT sum of AK8 jets (HT) and grooming techniques

**Signal MC Simulations**

- Signal samples were simulated in Madgraph+Pythia
  - On the right, signal shapes are shown after final selection is applied
  - We show the acceptance x efficiency vs. stop mass from the signal MC simulation

**Exclusion Limits**

- Since no excess is observed in data, we set limits on the production cross section ($\sigma$) x branching ratio (B) of stops with the RPV coupling UDDσ12
  - We assume 100% B of stops to light quarks

- CMS Preliminary
  - 2.7 fb$^{-1}$ (13 TeV)
  - 95% CL upper limits
    - Resonance mass [GeV]
    - Yield
    - Expected
    - Observed
    - Limit
  - Expected ± $\sigma$

More information: [http://cern.ch/go/7gGl](http://cern.ch/go/7gGl)