Searches for new physics in lepton+jets final states

Marc Stöver

on behalf of the CMS collaboration

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UHH
Universität Hamburg
DER FORSCHUNG I DER LEHRE I DER BILDUNG

CMS

Introduction

$\ell + jets$ signature expected in many scenarios beyond SM

this talk: CMS searches

- 1st, 2nd and 3rd generation leptoquarks
- heavy neutrino and W_R
- heavy compositeness Majorana neutrinos

Full list of CMS results:
http://cms-results.web.cern.ch/cms-results/public-results/publications/

LQ1 and LQ2 in $\ell\ell jj$ final states $(2.6\,\text{fb}^{-1})$

CMS-EXO-16-043

CMS-EXO-16-007
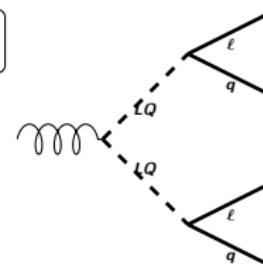
Selection

- 2ℓ at high p_{T}
- 2jets at high p_{T}
- optimization of $M_{\ell\ell}$, S_{T} and $M_{\min}(\ell, \text{jet})$ for each signal mass point

BG estimation

- $t\bar{t}$: from simulation, normalized to data in $e\mu$ CR (LQ1), from data $e\mu$ events (LQ2)
- $Z + jets$: estimated from simulation, normalized to data in Z-peak region
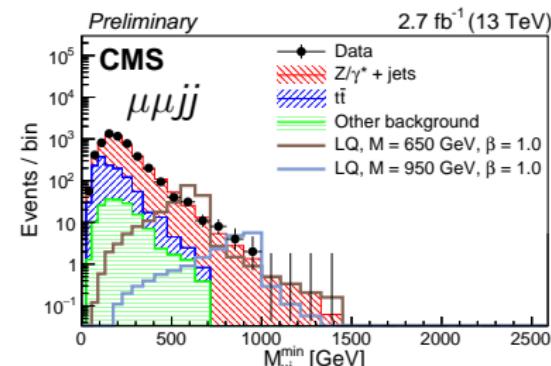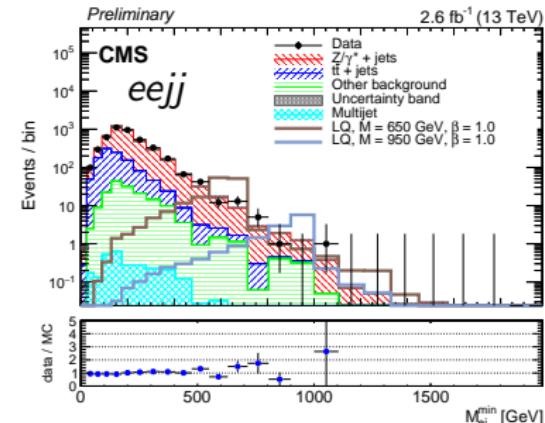
Results for LQ1 and LQ2
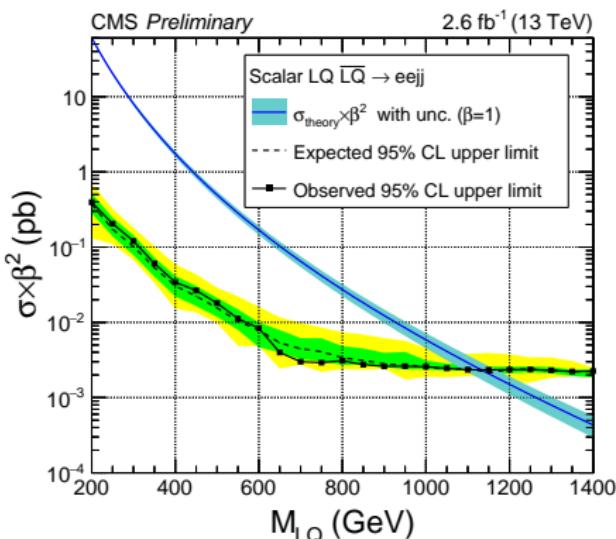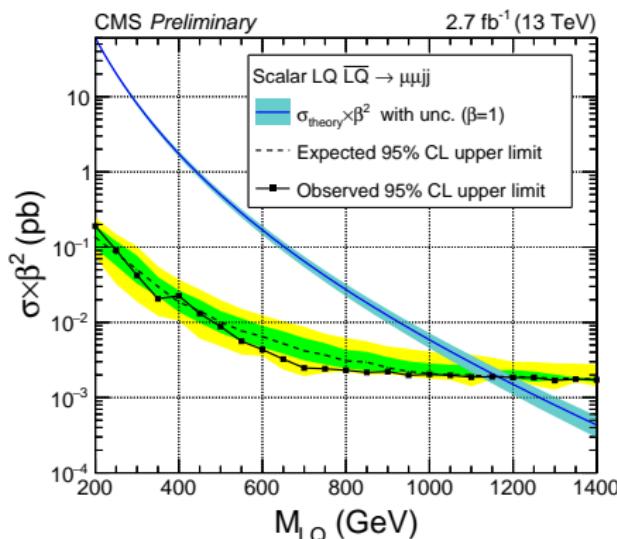
Exclusion limits:
- $M(LQ1) > 1130 \text{GeV}$
- $M(LQ2) > 1165 \text{GeV}$

Heavy neutrinos and W_R in $\ell\ell jj$ final state (2.6fb^{-1})

CMS-EXO-16-045

LQ analyses can be interpreted in left-right handed SM
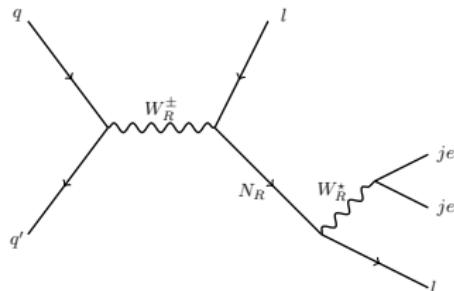
Selection

- 2ℓ at high p_T
- 2jets at high p_T
- requirements on $M_{\ell\ell}$ and $M_{\ell\ell jj}$

BG estimation

- $t\bar{t}$: from data in $e\mu$ CR extrapolated to SR
- $Z+jets$: estimated from simulation normalized data in Z-peak region
- Others taken from simulation
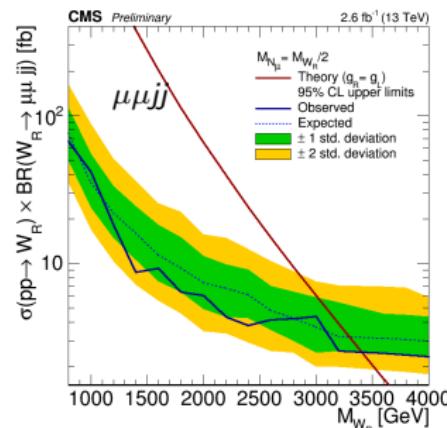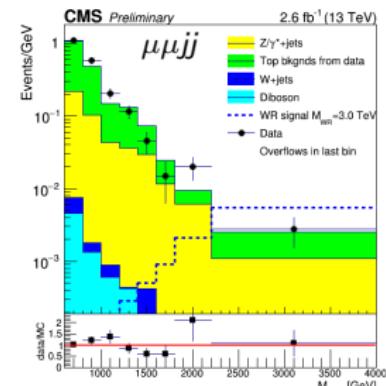
# Searches with 2 taus and 2 jets (2.1fb^{-1})

JHEP 03 (2017) 077

Selection

- $2\tau_h$ at high p_T
- 2jets at high p_T
- requirements on $\not{E}_T$ and $M_{\tau\tau}$

BG estimation

- QCD: data-driven ABCD method ($\not{E}_T$, isolation of τ_h)
- Others from simulation
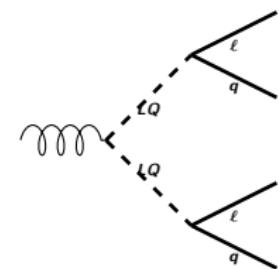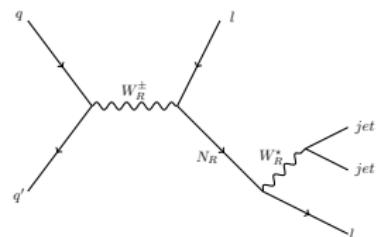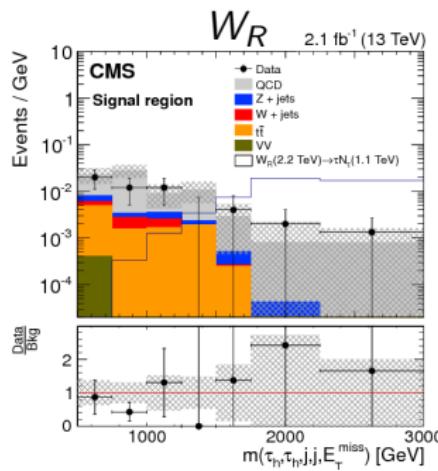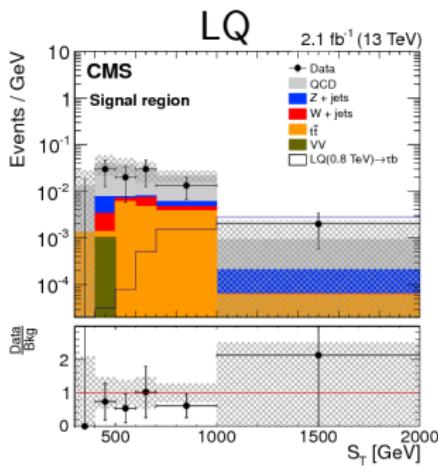
Results on W_R/LQ3: $\tau_h\tau_h bb$
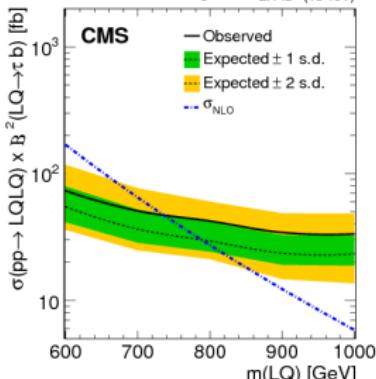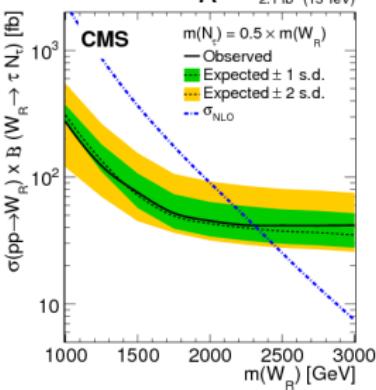
- limit LQ3 > 740 GeV
- limit $W_R > 2.31$ TeV for $M(N_\tau) = 0.5 M(W_R)$
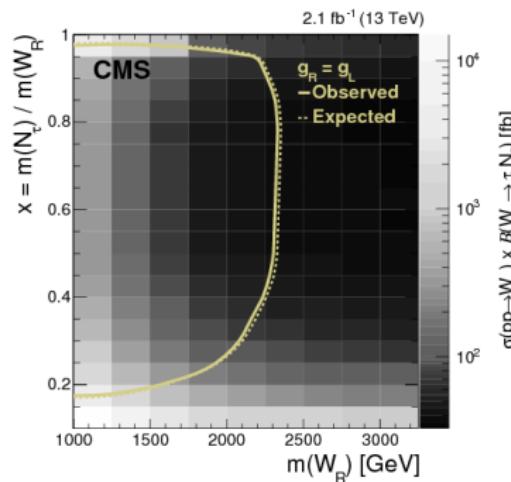
$W_R/LQ3$: $\tau_h \ell bb$ (12.9fb^{-1})

CERN-EP-2017-025

Selection

- $1\tau_h$, 1ℓ, OS charge
- $n_{jets} \geq 2$, at least one b-tag
- requirements on $M(\tau_h, j)$, $\not{E}_T$ and $M(\tau_h, \ell)$

BG estimation

- $t\bar{t}$: from simulation, validated in $e\mu$ data sample
- $W + jets$: from simulation, normalization from CR
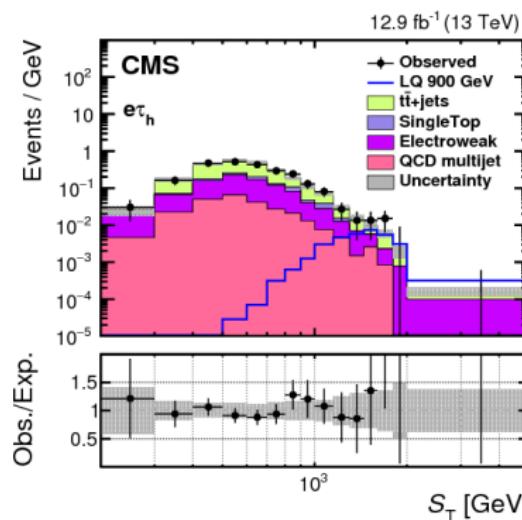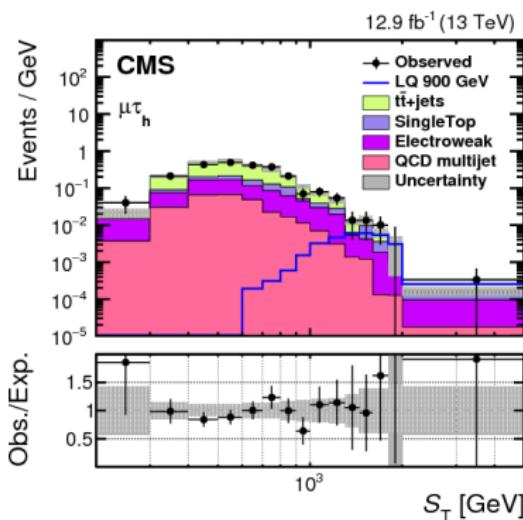
Results on W_R/LQ3: $\tau_h \ell bb$
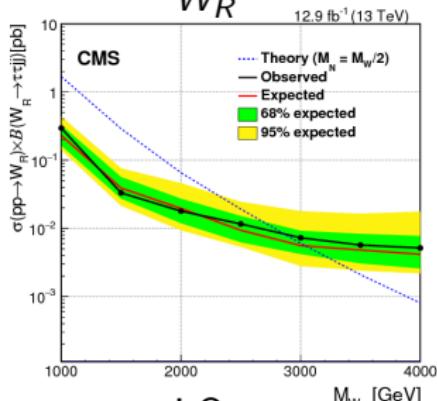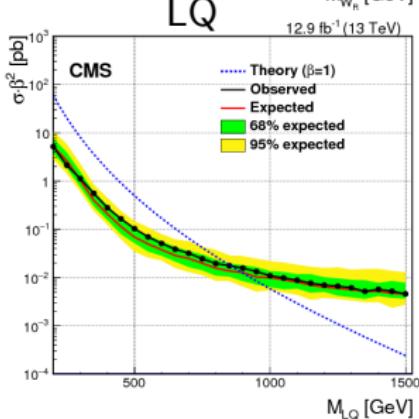
- limit $W_R > 2.9\,\text{TeV}$ for $M(N_\tau) = 0.5 M(W_R)$
- limit LQ3 $> 850\,\text{GeV}$ for $\beta = 1$
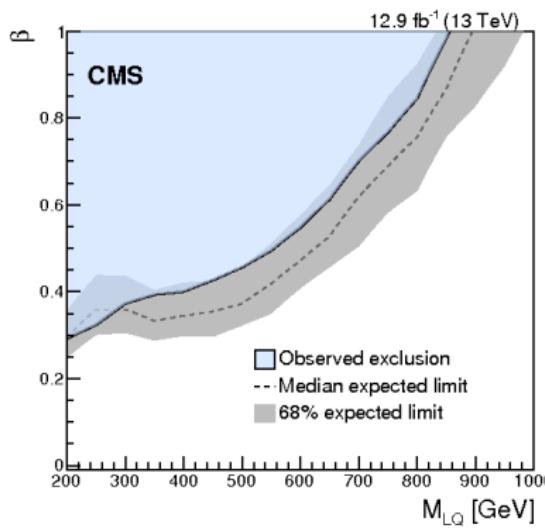
Heavy compositeness Majorana neutrinos in $\ell\ell jj$ final state (2.3fb^{-1})

CERN-EP-2017-125
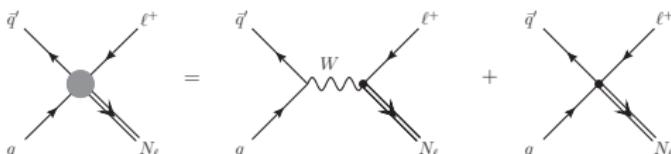
Selection

- 2ℓ at high p_{T}
- 1 large radius jet at high p_{T}
- $M_{\ell\ell} > 300$GeV

BG estimation

- $t\bar{t}$: from $e\mu$ CR in data
- $Z + jets$: from simulation, normalized to data in Z peak region
- Others taken from simulation
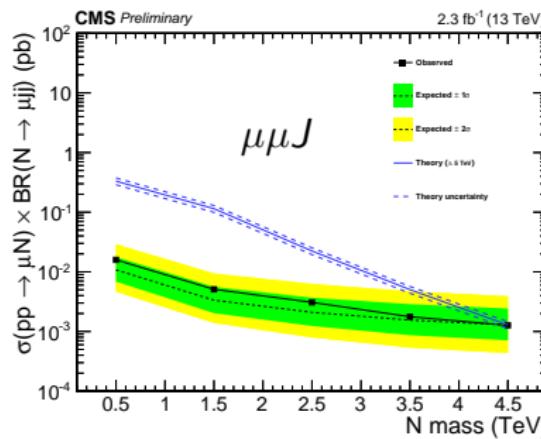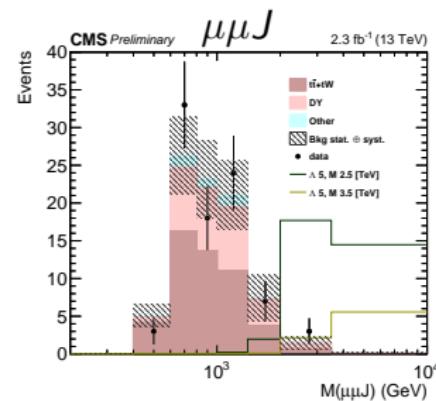
Summary

- CMS covers wide program of searches in $\ell + jets$ final states
  - Here: leptoquark and heavy neutrino searches
- No significant excess found above SM predictions
- Limits are set on benchmark models
- expect results with full 2016 data from all analyses

CMS Integrated Luminosity, pp, 2016, $\sqrt{s} = 13$ TeV