

Leptoquarks, Dark Matter & the SM Higgs boson at the CMS experiment

Mareike Meyer

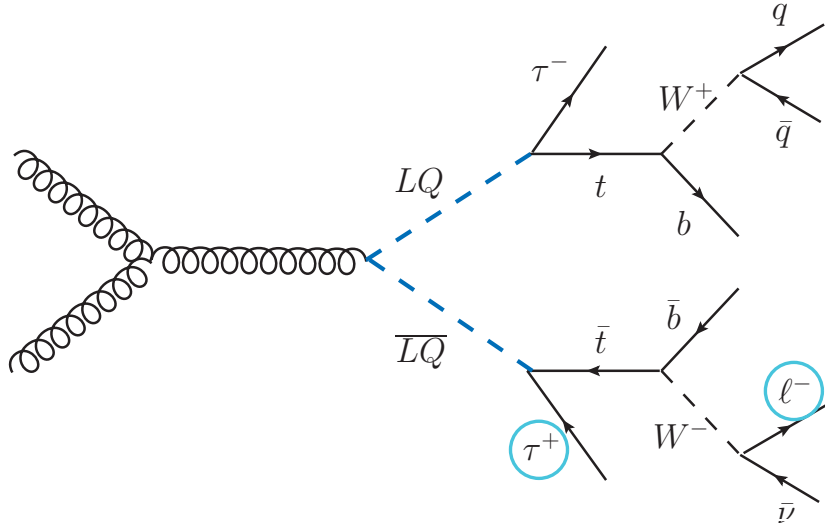
FH Fellow meeting, Feb. 27th 2018



From searches for BSM physics in top quark final states...

My Background & past activities: Leptoquarks

PhD thesis at UHH until 07/17,
data analysis at the CMS exp.



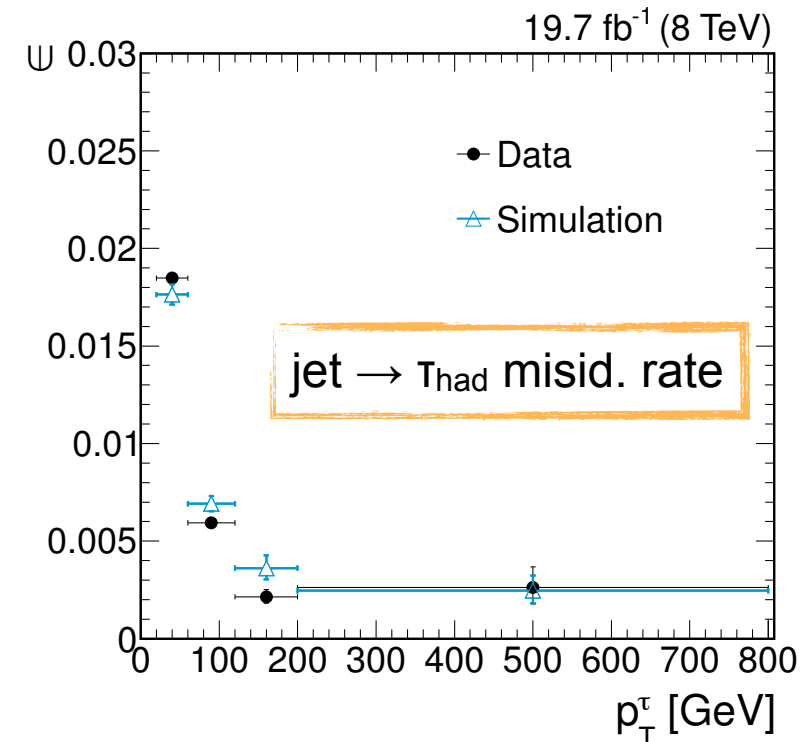
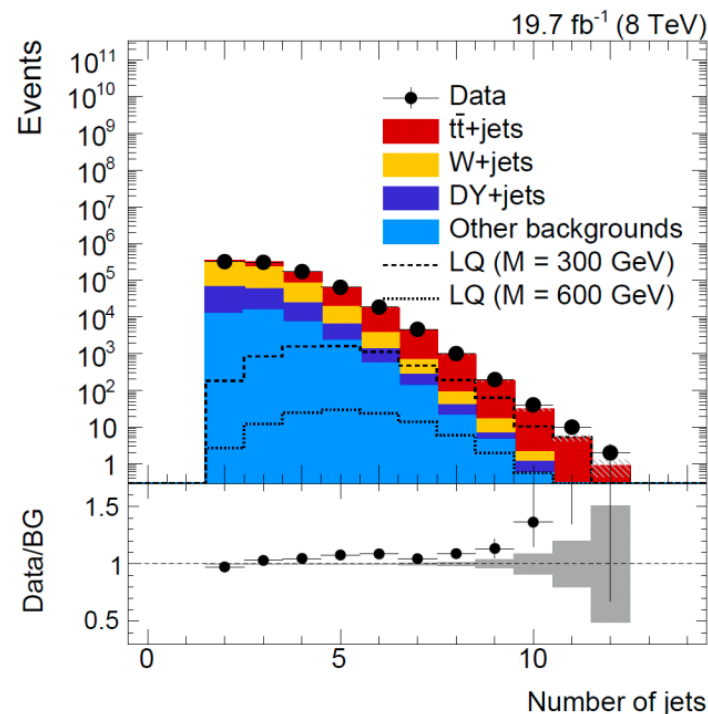
motivation:

- predicted by BSM theories to connect SM lepton & quark sectors
- explain tensions with SM measured in B meson decays?

- **LQLQ \rightarrow tt tt \rightarrow μ T_{had} / eT_{had} + 3 jets**

main SM backgrounds:

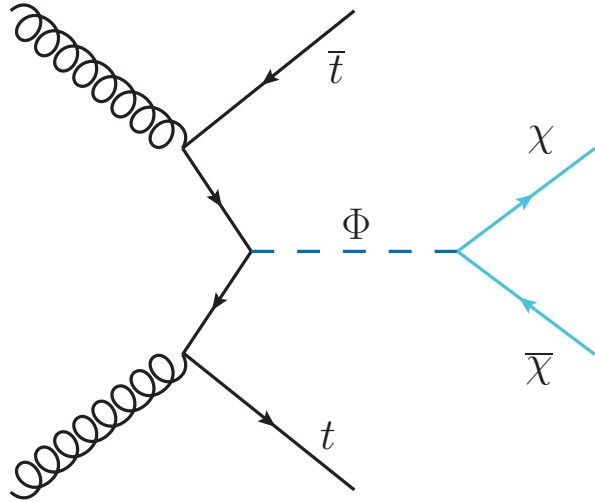
- tt + jets
 - W + jets
- jets misidentified as tau leptons (~50%)



From searches for BSM physics in top quark final states...

My Background & past activities : Dark Matter

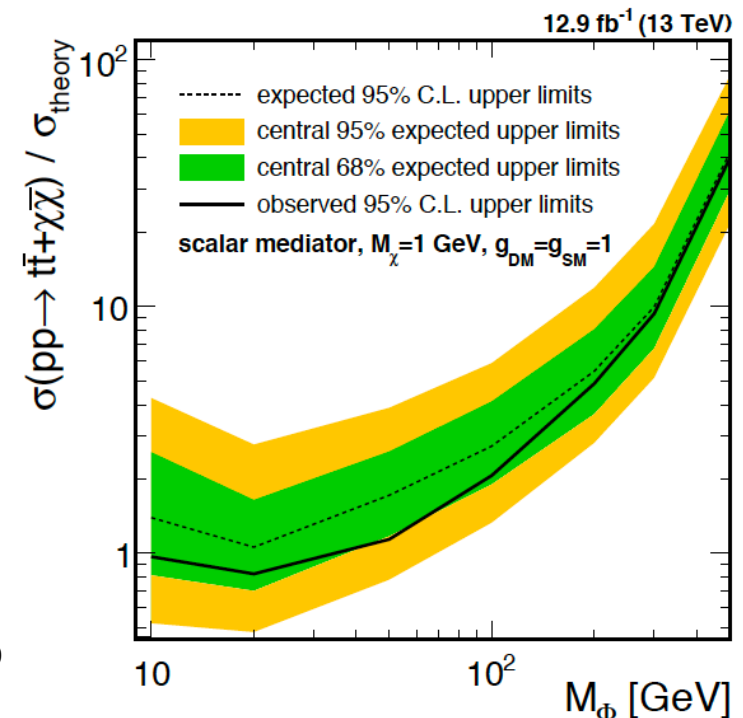
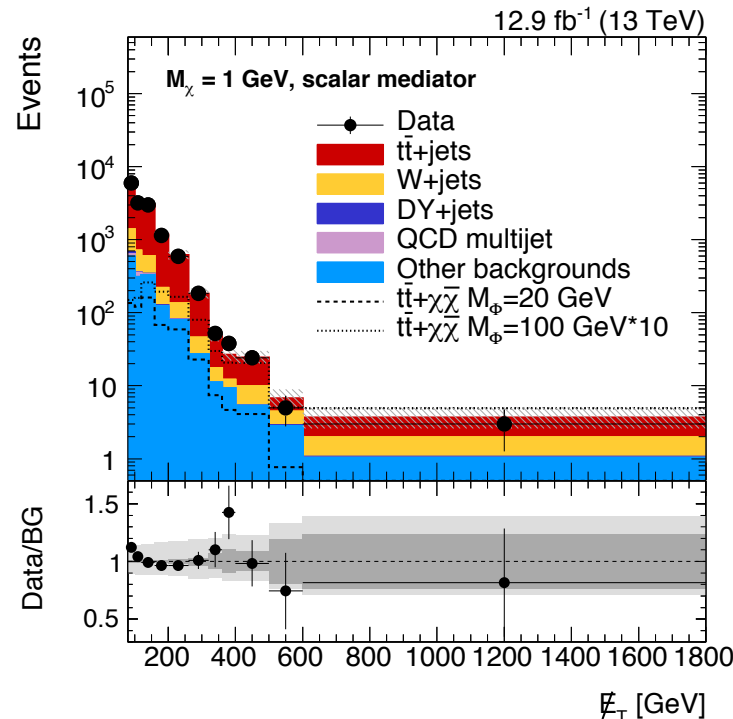
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motivation:

- Yukawa-type couplings, enhanced couplings to heavy quarks?
- pseudoscalar mediators can be probed

- $tt + E_T^{\text{miss}}$
- first search in boosted final state (non-isolated leptons & top tagging)
- novel reconstruction technique for neutrinos in tt events \rightarrow better discriminating variable than E_T^{miss} ?



...to studies of Higgs physics in di-tau final states

My current work: Activities and challenges

DESY Fellow since 10/17,
joined $H \rightarrow \tau\tau$ in DESY
CMS group

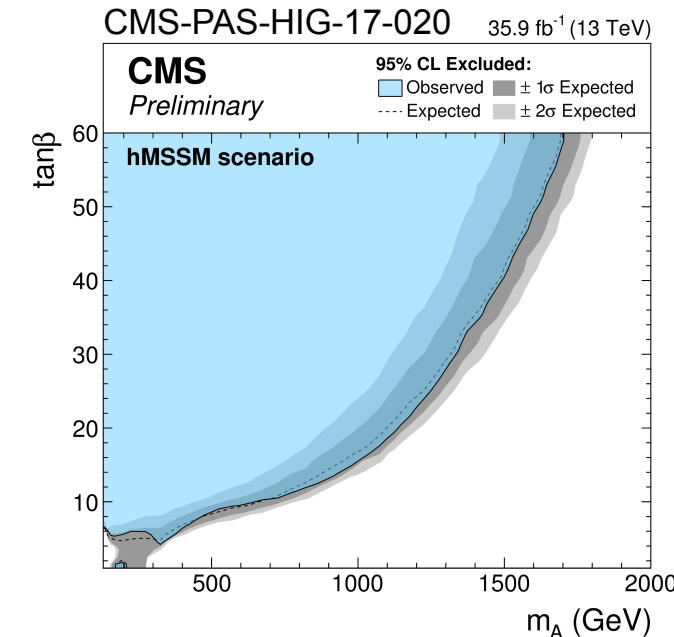
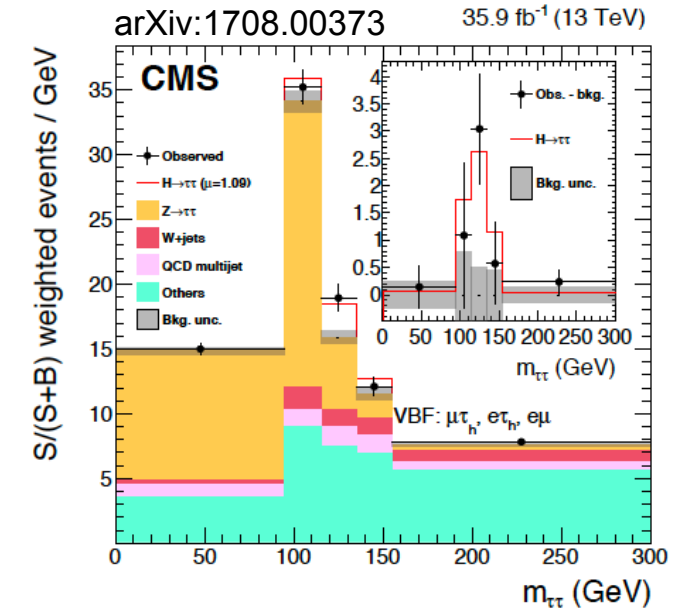
SM $H \rightarrow \tau\tau$ decay:

- established with 5.9σ by CMS experiment
- goals: precise measurements of the couplings, measure differential cross sections & simplified template cross sections ...

Heavy Higgs boson searches in di-tau final states

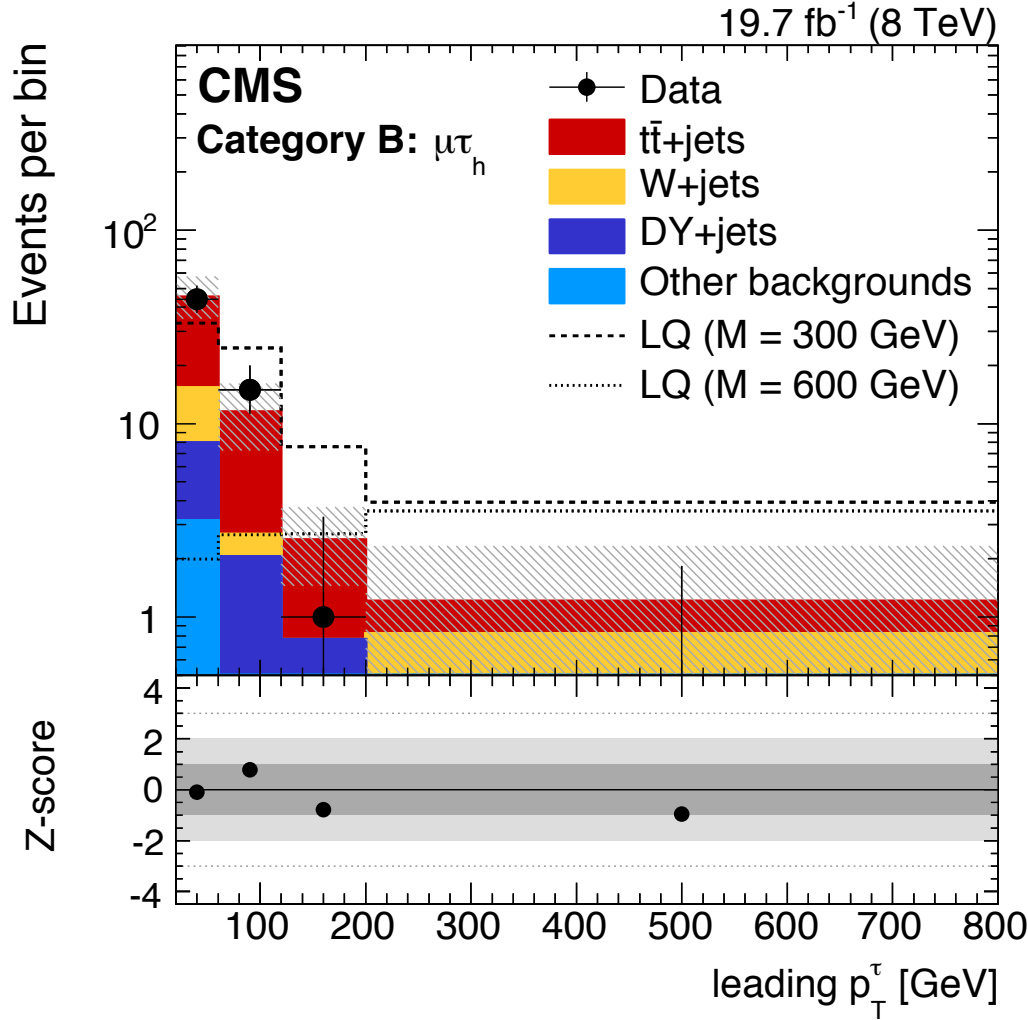
Reconstruction and identification of tau leptons:

- BR of 65% into hadrons, have to be distinguished from quark & gluon initiated jets
- measurements of identification efficiency and energy scale of high (intermediate) p_T tau leptons & jet \rightarrow T_{had} misidentification rate ...



My Favourite Plot

Result of the Leptoquark search:



- SM prediction describes the data well
- ➔ LQ $\rightarrow t\tau$ (BR=1) below 685 GeV excluded
- ➔ LQ below 560 GeV excluded for arbitrary BR
- results also applicable to RPV SUSY models

First result in $t\tau$ -channel
 (CMS PAS-EXO-13-010, JHEP1 507 (2015) 042)