New Heavy Boson searches at HL-LHC with CMS

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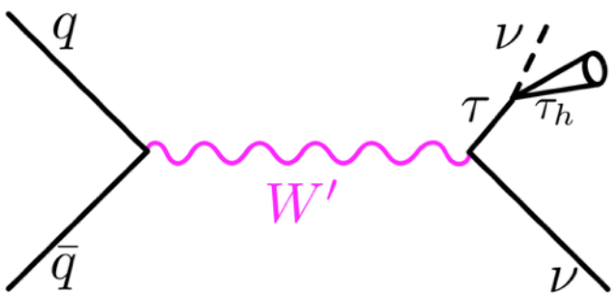
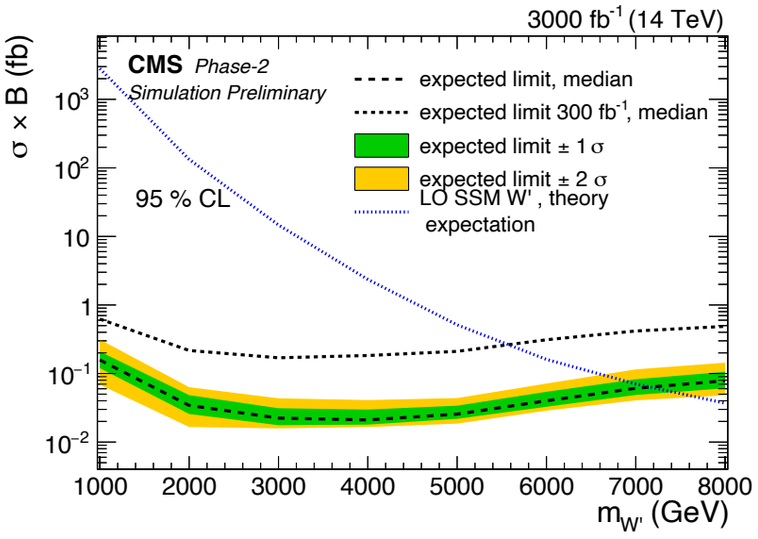
Public projections at a glance

CMS-FTR-18-030

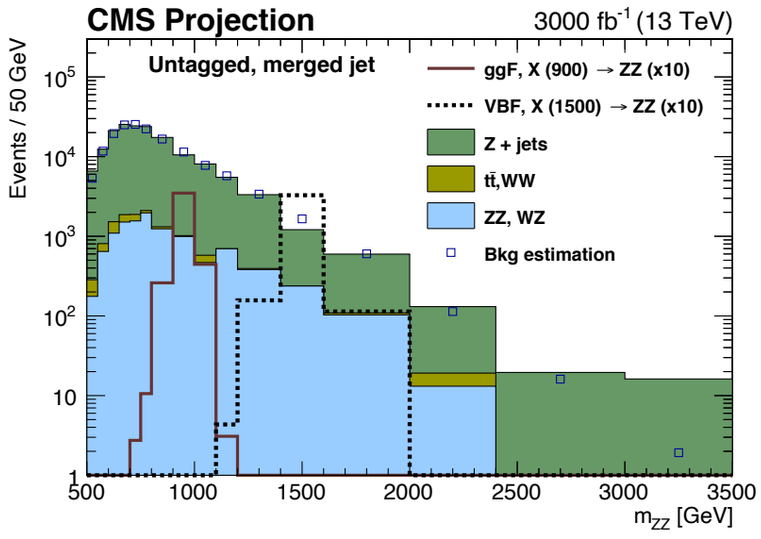
- W' → τ ν search using hadronic tau leptons
- Limits up to 7 TeV for HL-LHC





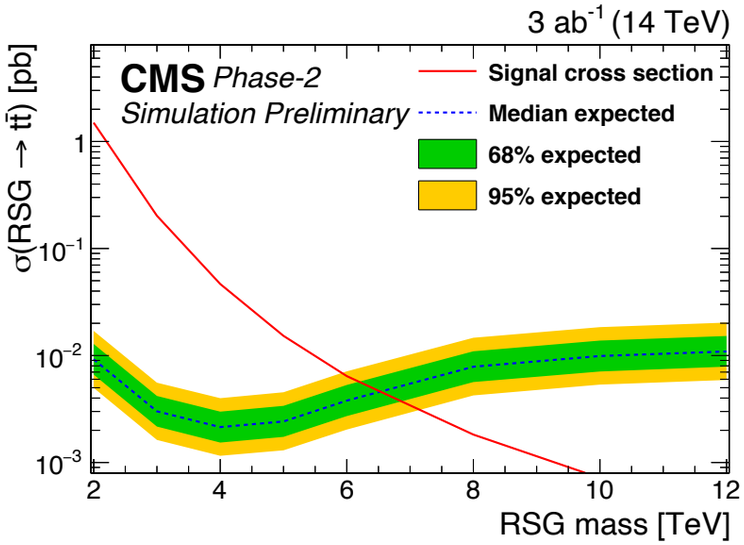
CMS-FTR-18-040

- Heavy scalar→ZZ→2l 2q
- Search over mass range 550-3000 GeV
- Cross section limits improved by factor of 10 wrt 2016 analysis



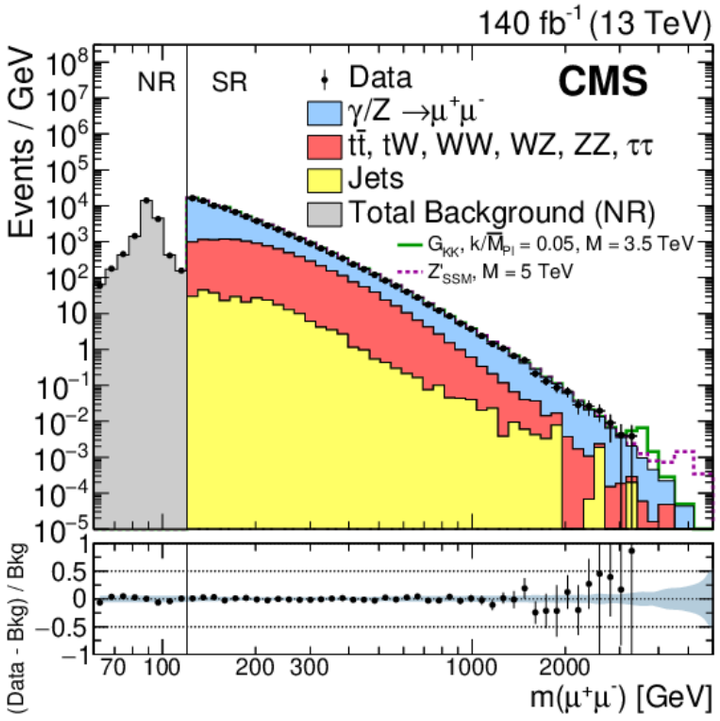
CMS-FTR-18-009

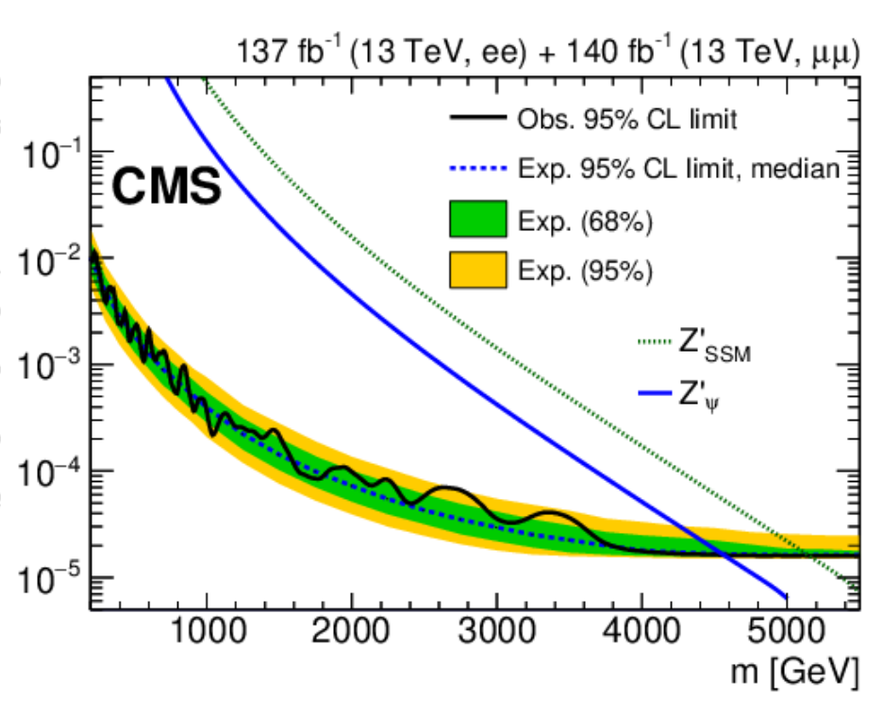
- ttbar resonance (RS gluon)
- Single lepton and all hadronic final states
- Jet substructure tagging for high-p_T top quarks
- Limits up to 6.6 TeV for HL-LHC

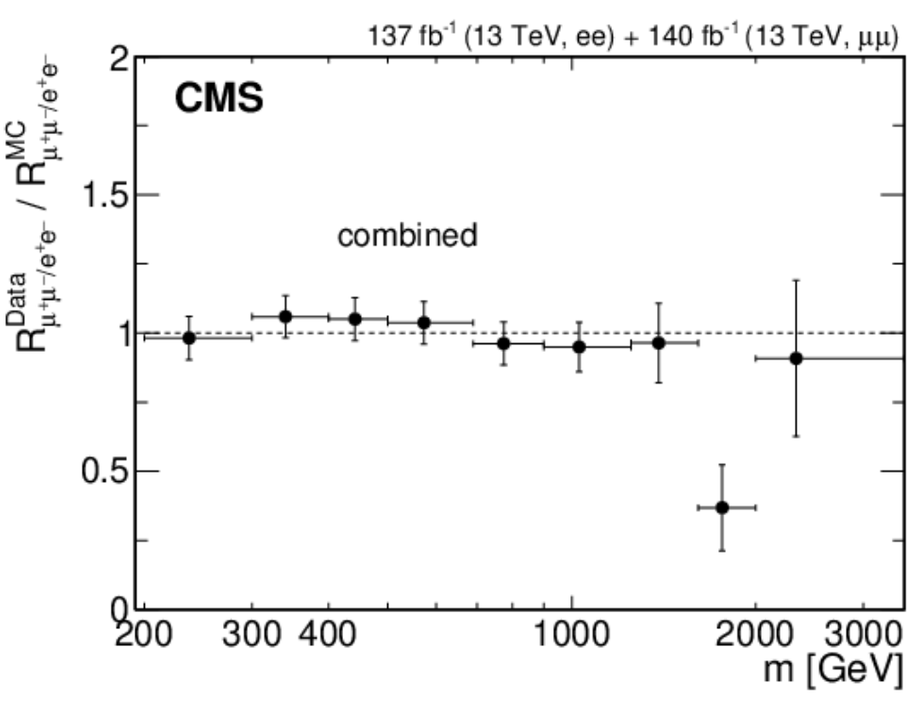


Z’ → dilepton

- Run 2 result 2103.02708:
  - Z’(SSM) exclusion up to 5.2 TeV
  - dimuon to dielectron flavor ratio
- Currently planning / working on extrapolations for both
  - With full HL-LHC dataset of 3/ab, lower mass limit of ~6.7 TeV expected
  - Exclusive searches could profit more from the larger dataset

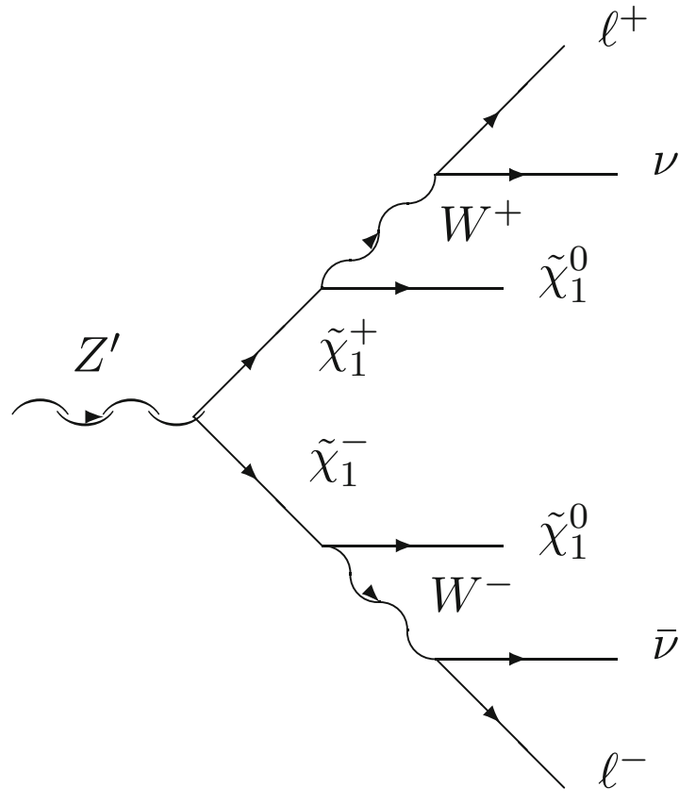






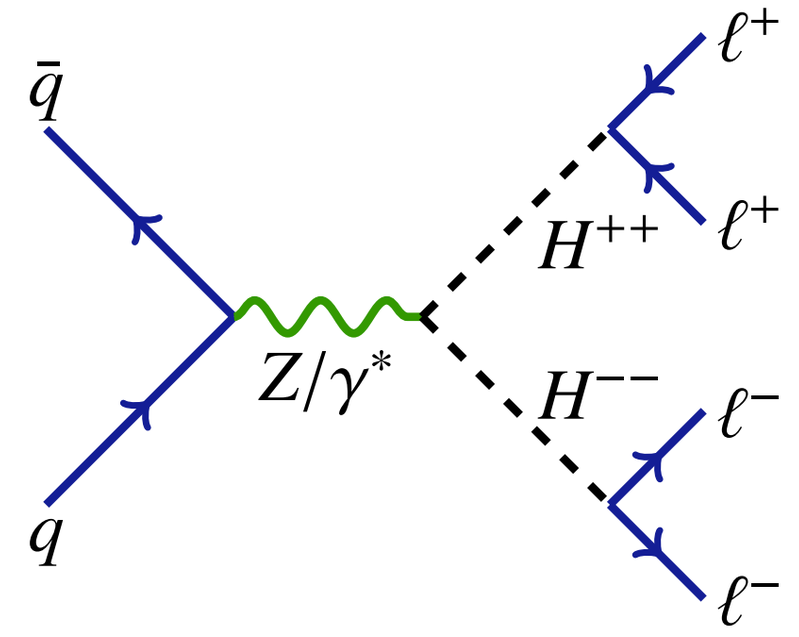
Z’ → dilepton + MET

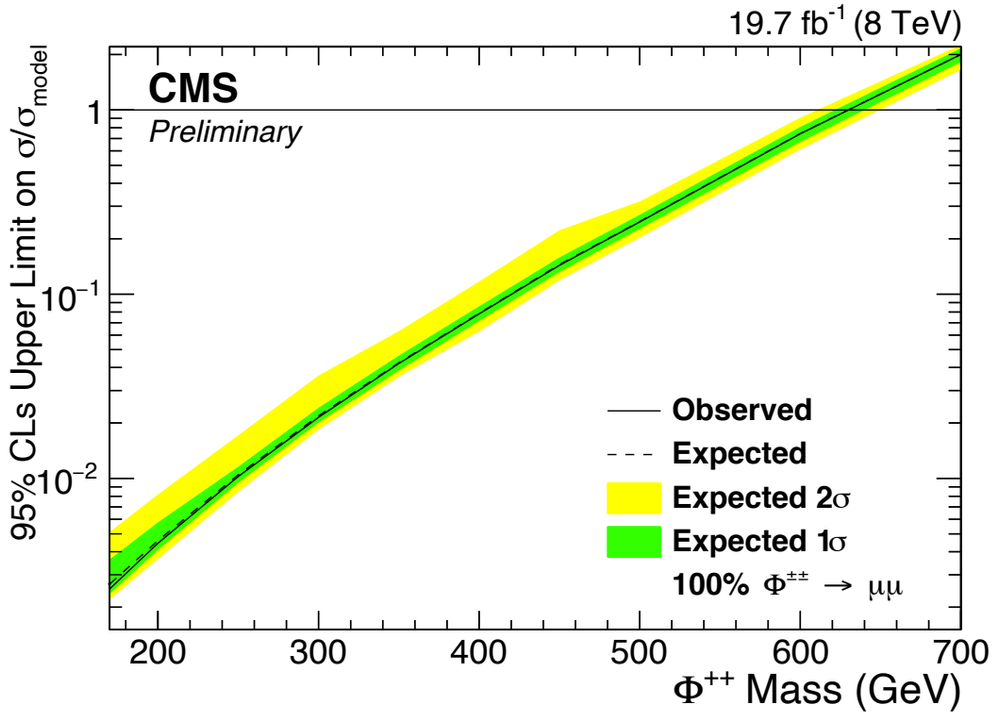
- Limits for Z’ from Run 2 already reach up to several TeV
- Leptophobic Z’ much less constrained, e.g. JHEP02(2018)092, Nucl. Phys. B 866(3) (2013)293–336, Eur. Phys. J. C (2015)75:264
  - Z’ decay to SUSY particles → nonresonant dilepton + MET final state
- DNN can help suppressing dilepton backgrounds (ttbar, DY, tt+X)
- Expect sensitivity up to ~2 TeV, depending on chargino and neutralino masses
- This analysis is currently categorized in EF08 (model specific)



$H^{\pm\pm} \rightarrow$ 4 leptons

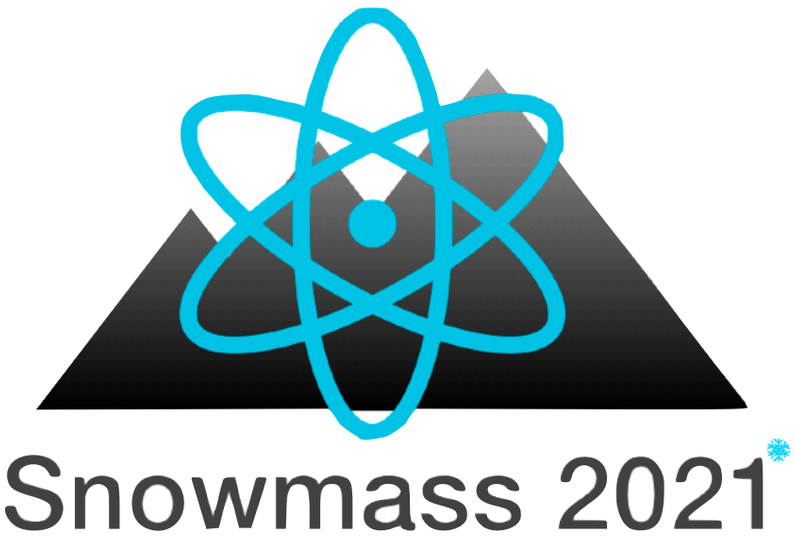
- Doubly-charged Higgs with decays to same-sign lepton pairs
- Predicted in a variety of BSM theories, e.g. left-right symmetric models (LRS)
  - Predominant production via Drell-Yan process
  - Decay to leptons or W bosons, depending on triplet VEV
- Current lower limits on mass:
  - 770 - 870 GeV, ATLAS 13 TeV
  - ~600 GeV, CMS 8 TeV, CMS 7 TeV
- Goal for Snowmass: Analysis in muon channel with estimate on cross section / mass sensitivity for HL-LHC





Summary

- Several contributions for Snowmass are ready (public results from YR)
- Working on new projections for two different Z' and doubly-charged Higgs models
- All public CMS HL-LHC physics projections available here



BACKUP

Dark photons

- Dark matter charged under non-Abelian gauge symmetry (dark sector)
- Dark gauge boson (dark photon) with mass around 1 GeV
  - Leptons from decays very close in $\Delta R \rightarrow$ leptonic jets
- SUSY or Higgs portal models with different decay chains
- ATLAS search at 8 TeV: JHEP 02 (2016) 062, CMS at 8 TeV: Phys. Lett. B752 (2016)