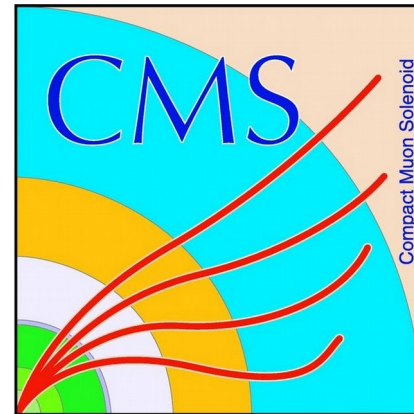


Searches for dark matter at CMS

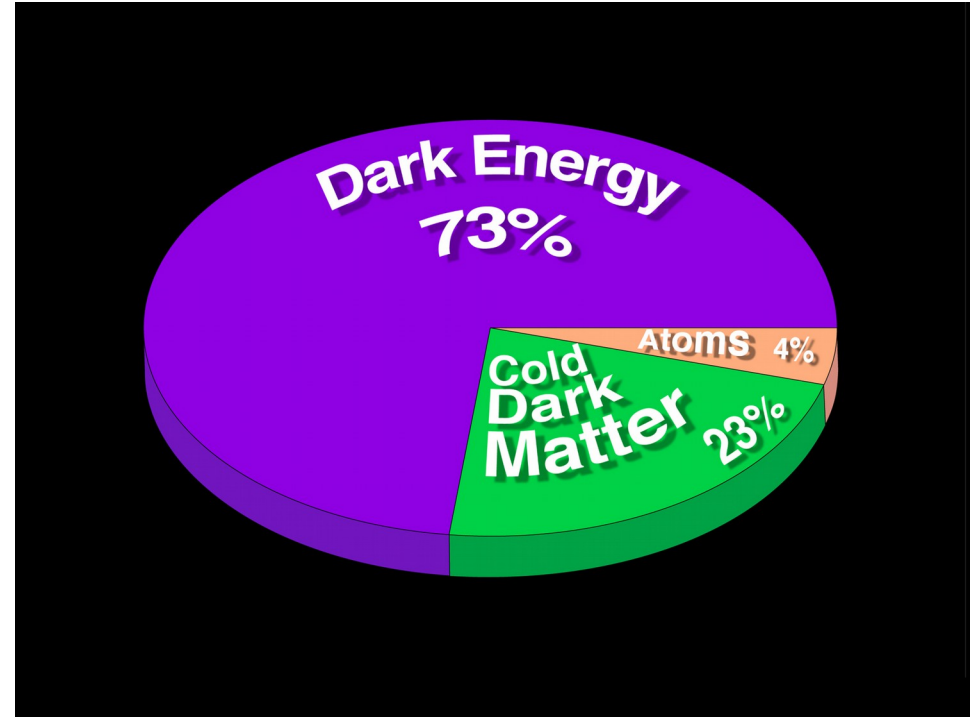
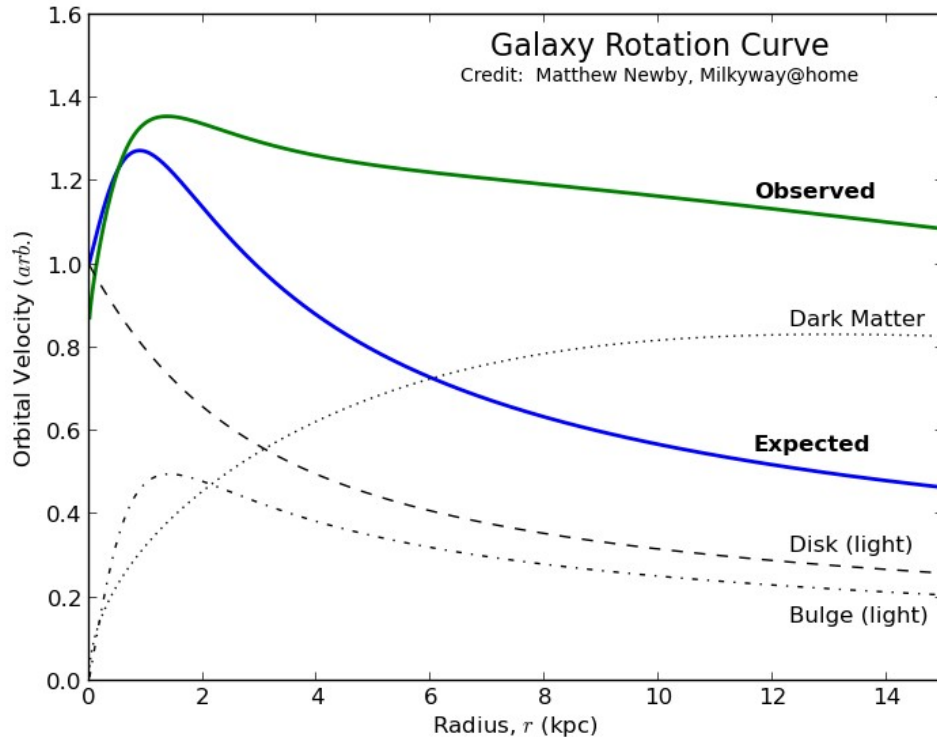
XII SILAFAE

Jose Ruiz

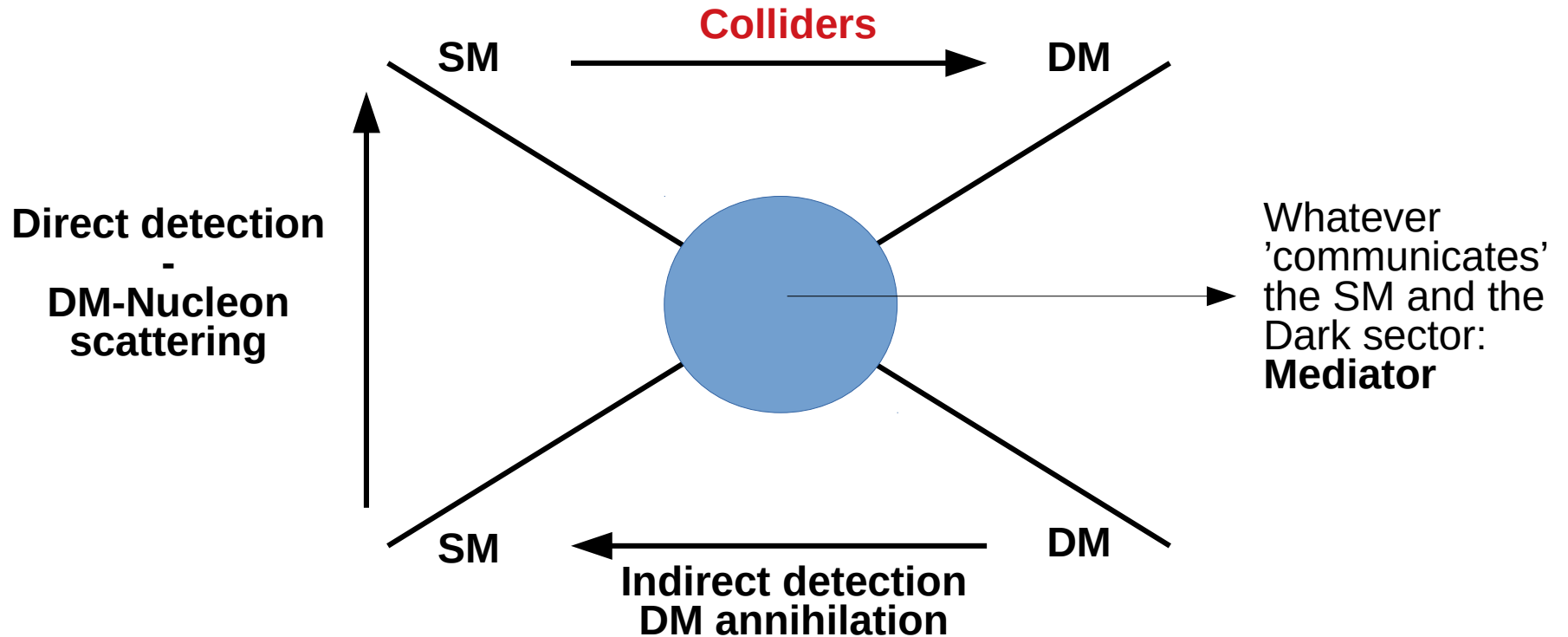
on behalf of the CMS collaboration



The Dark Matter problem



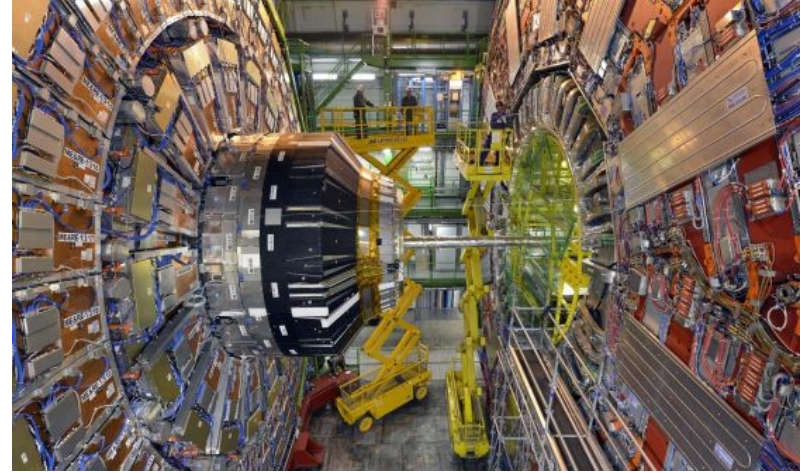
Dark Matter detection



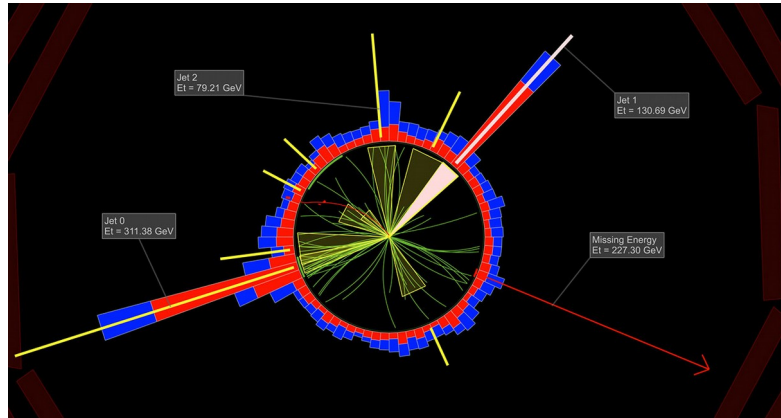
CMS experiment and LHC



LHC provides pp collisions



CMS records the products of LHC collisions

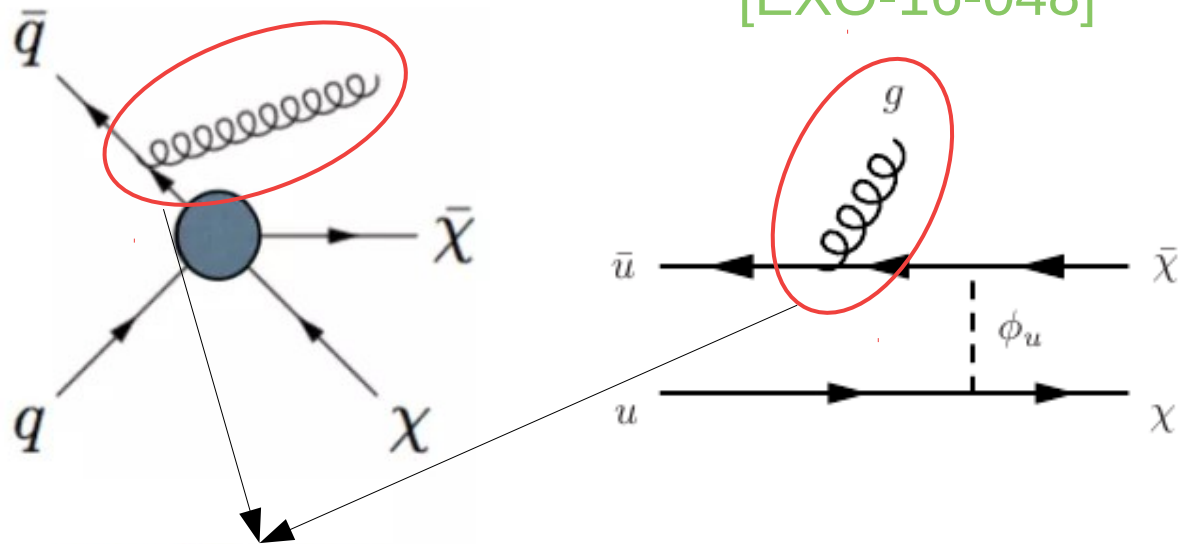


Non-interacting particles
cause momentum imbalance
in the transverse plane
of the beam

$p_{T,miss} \rightarrow$ “Missing energy”

The mono-jet paradigm

[EXO-16-048]



At least one jet in the detector:
Mono-jet + missing energy

The “mono-X” family:

1) Mono-jet + MET

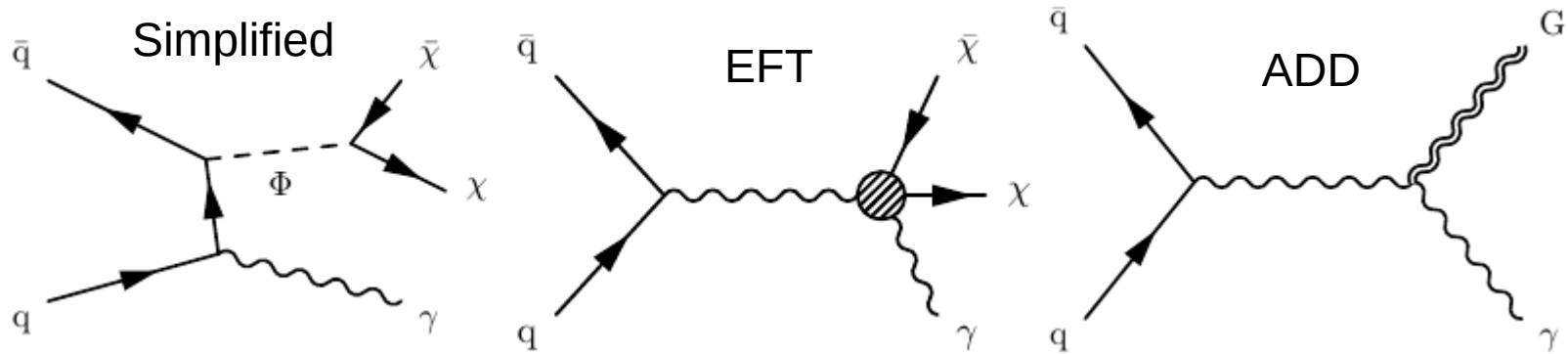
2) Mono-V + MET

3) Mono-H + MET

4) Mono-photon + MET

Mono-photon

[EXO-16-053]



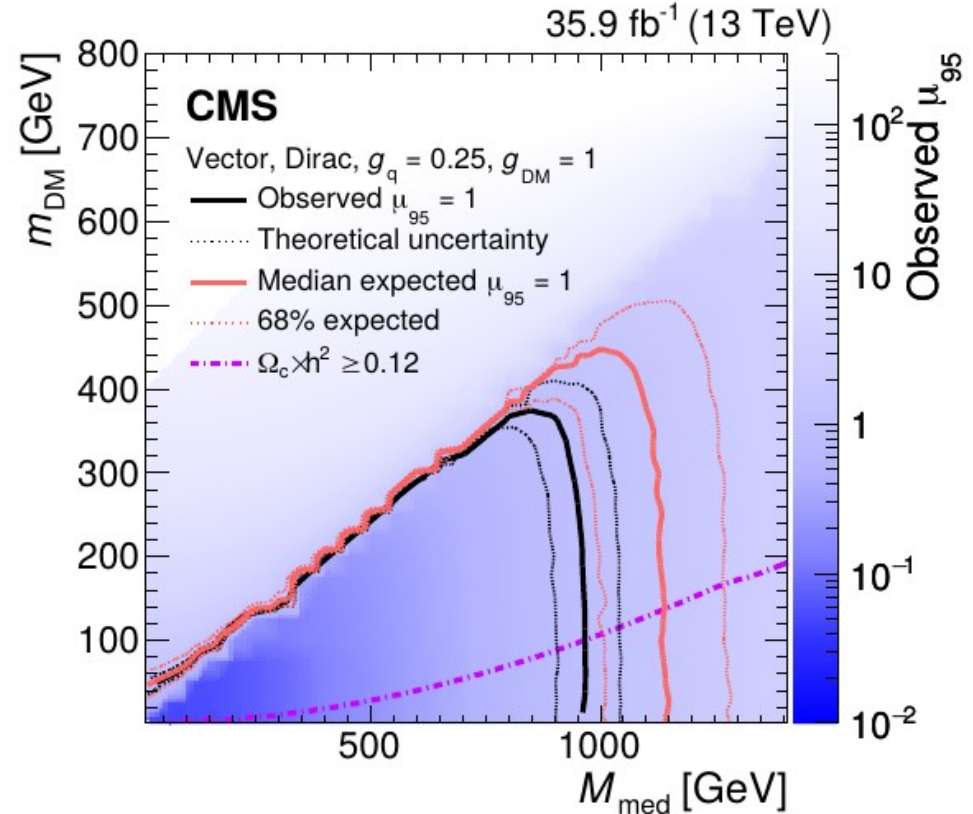
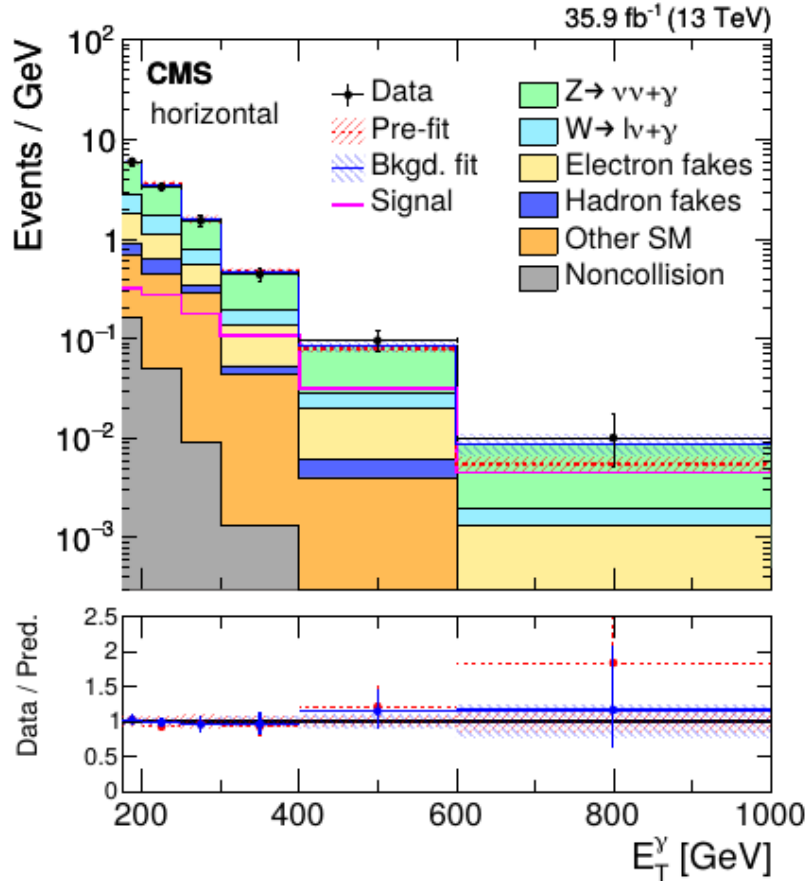
Selection:

$p_{T, \text{miss}} > 170 \text{ GeV}$
 $E_T(\text{photon}) > 175 \text{ GeV}$

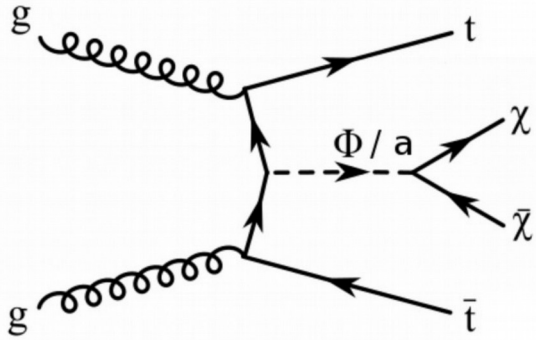
Main backgrounds:

$Z(\rightarrow \text{inv}) + \text{photon}$ 50%
 $W(\rightarrow \text{lost } l, \text{nu}) + \text{photon}$ 20%
 $W(\rightarrow e, \text{nu})$ e fakes a photon

Mono-photon \rightarrow Results



Top-pair+DM



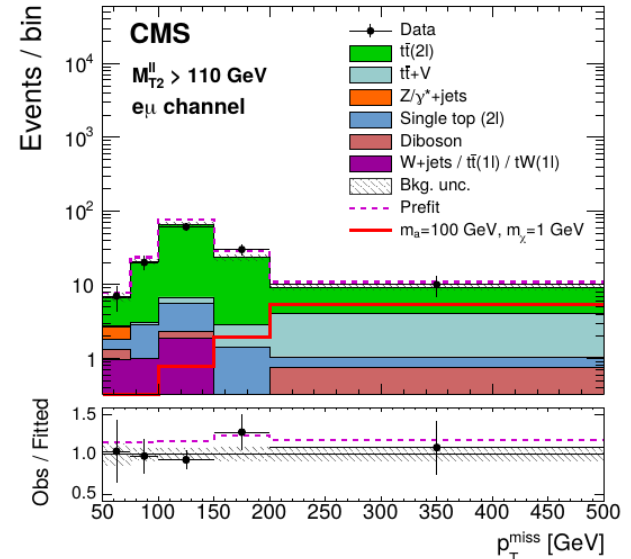
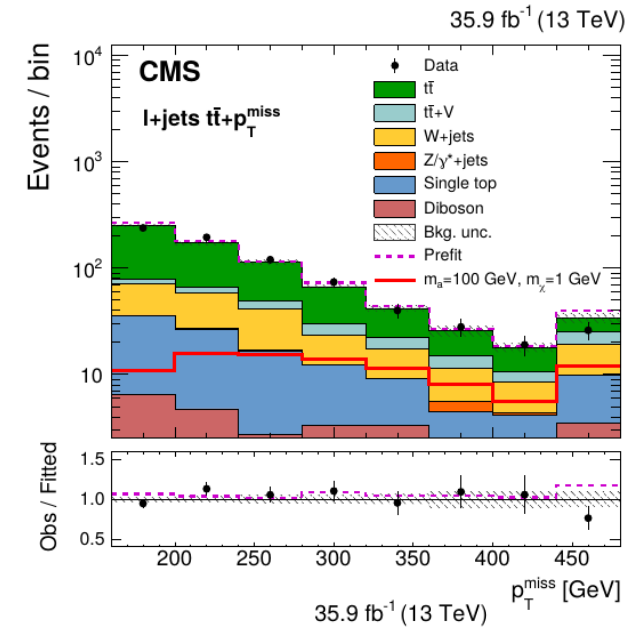
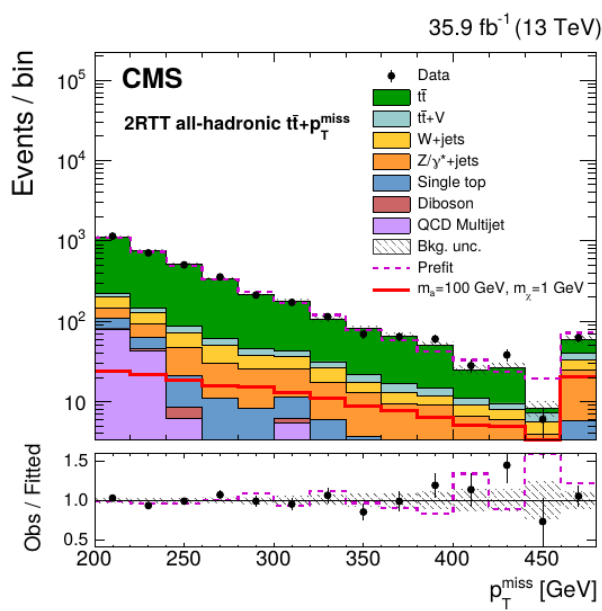
Simultaneous search in three channels:

All hadronic, semileptonic and dilepton
Selection based on number of jets,
 B-tagged jets, number of leptons and
 high missing p_T

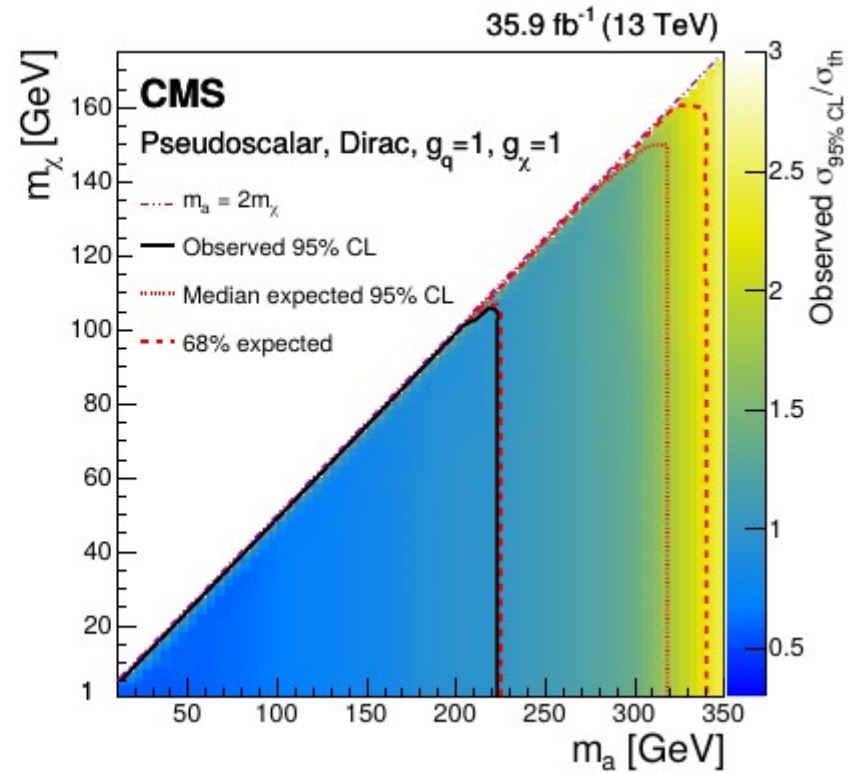
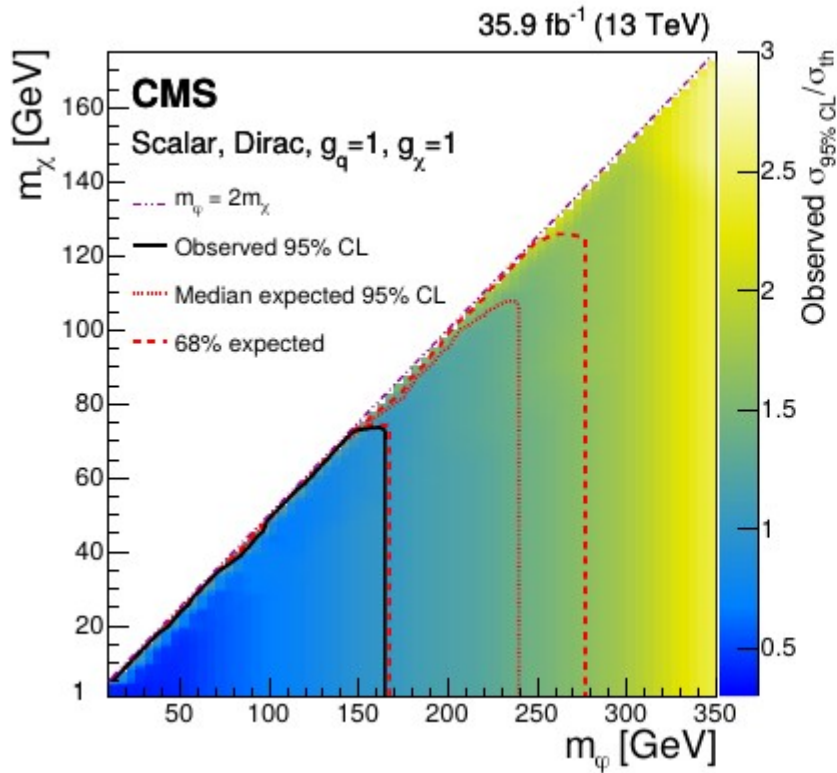
Signal extraction from $p_{T,miss}$ fit

[EXO-16-049]

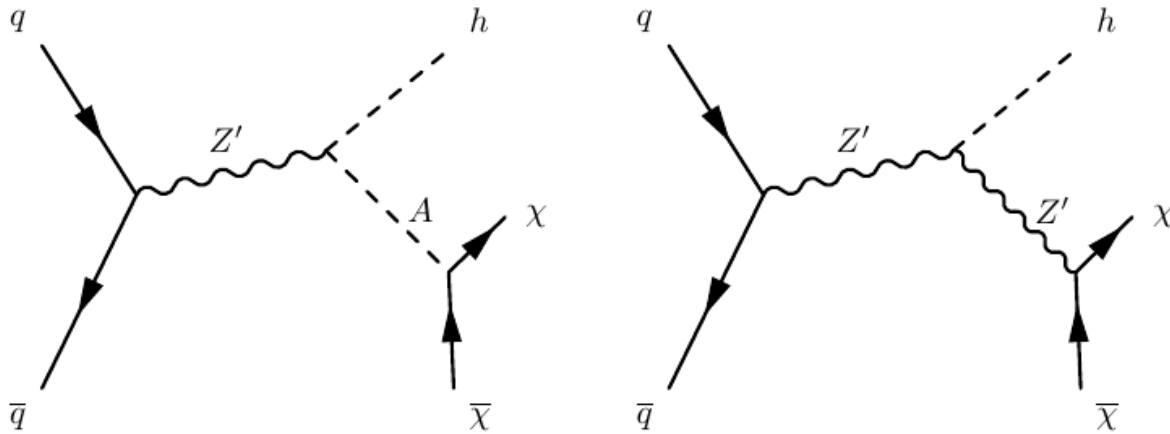
Jose Ruiz - DM @ CMS



Top-pair + DM \rightarrow Results



Mono-Higgs searches

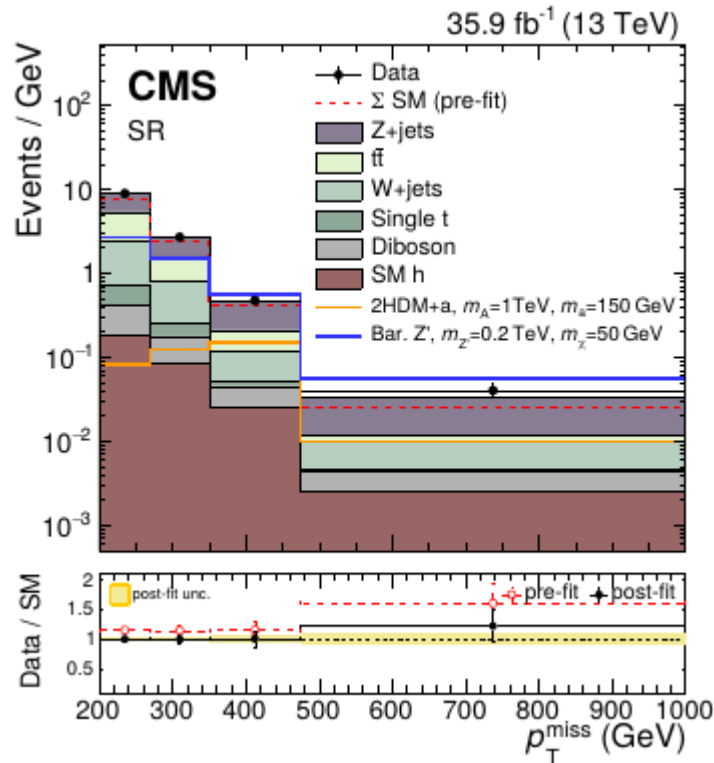


Many possible final states:

- 1) Higgs decay to a b-pair
[EXO-16-050]
- 2) Gamma-Gamma or taut-tau
Higgs decay
[EXO-16-055]

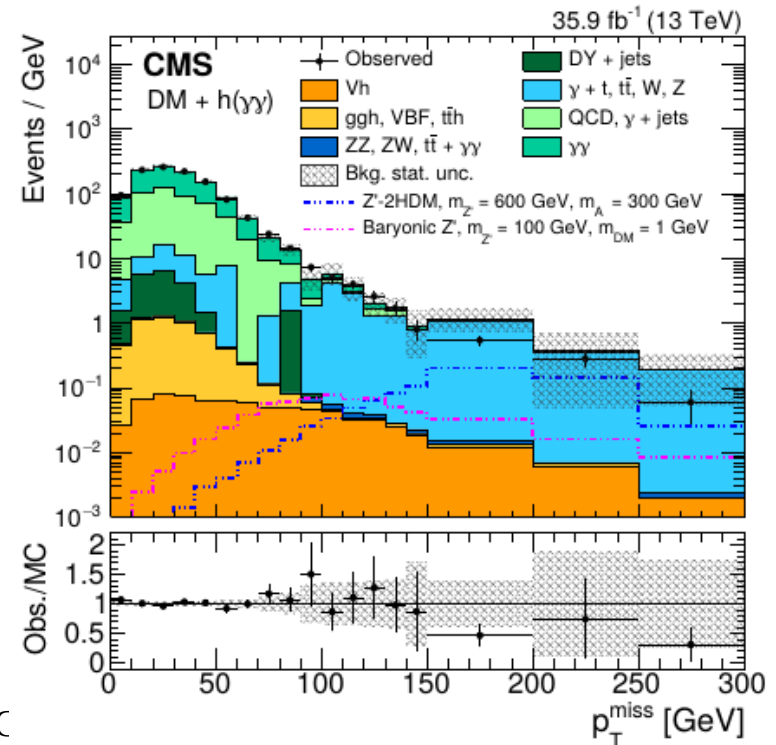
H(→ bb) + DM

- Selection based on high missing p_T , high p_T Higgs-tagged fat jet

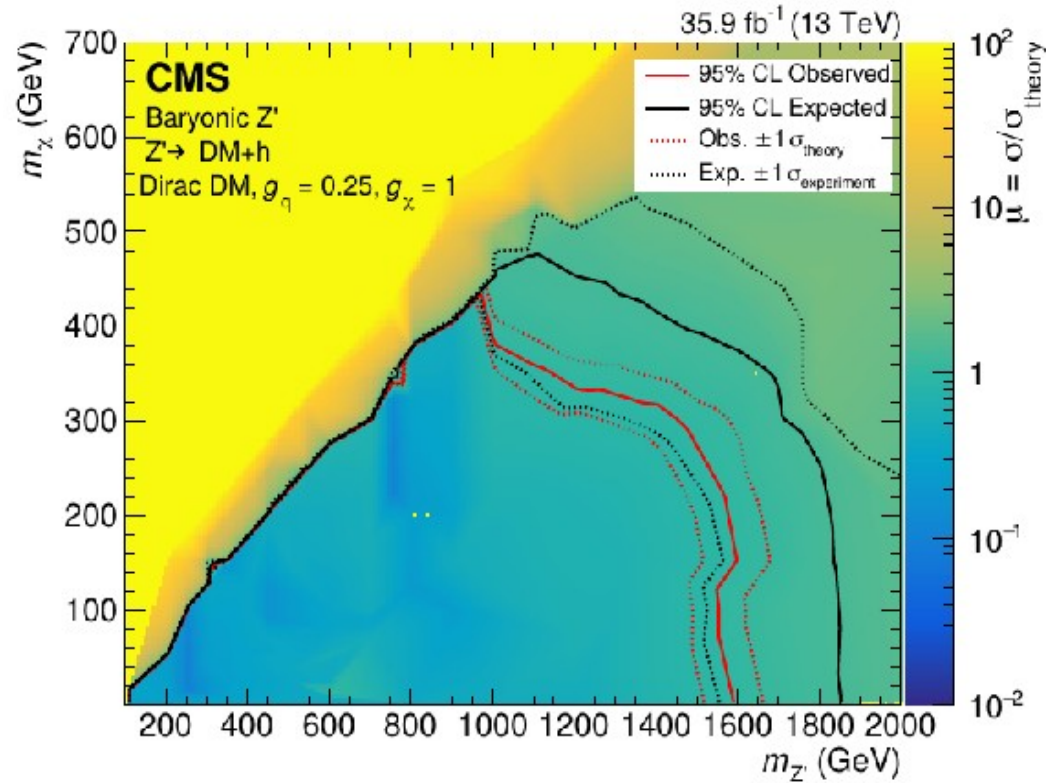


H(→ $\gamma\gamma$)

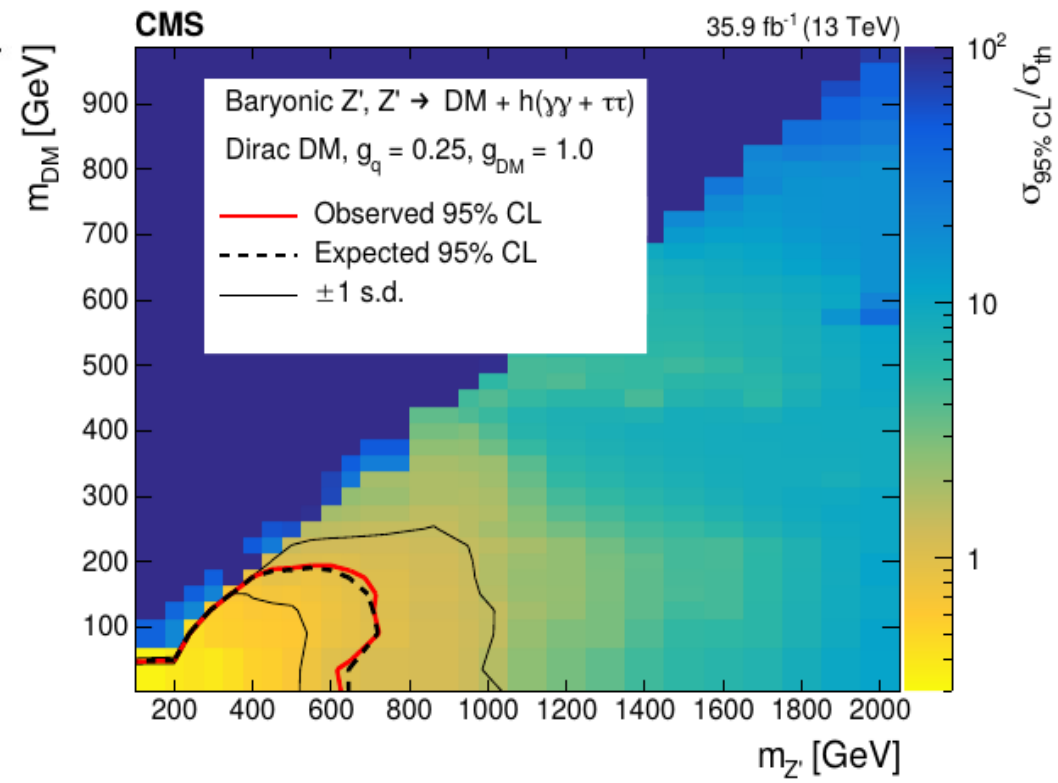
- Selection based on photons p_T , diphoton invariant mass and missing p_T



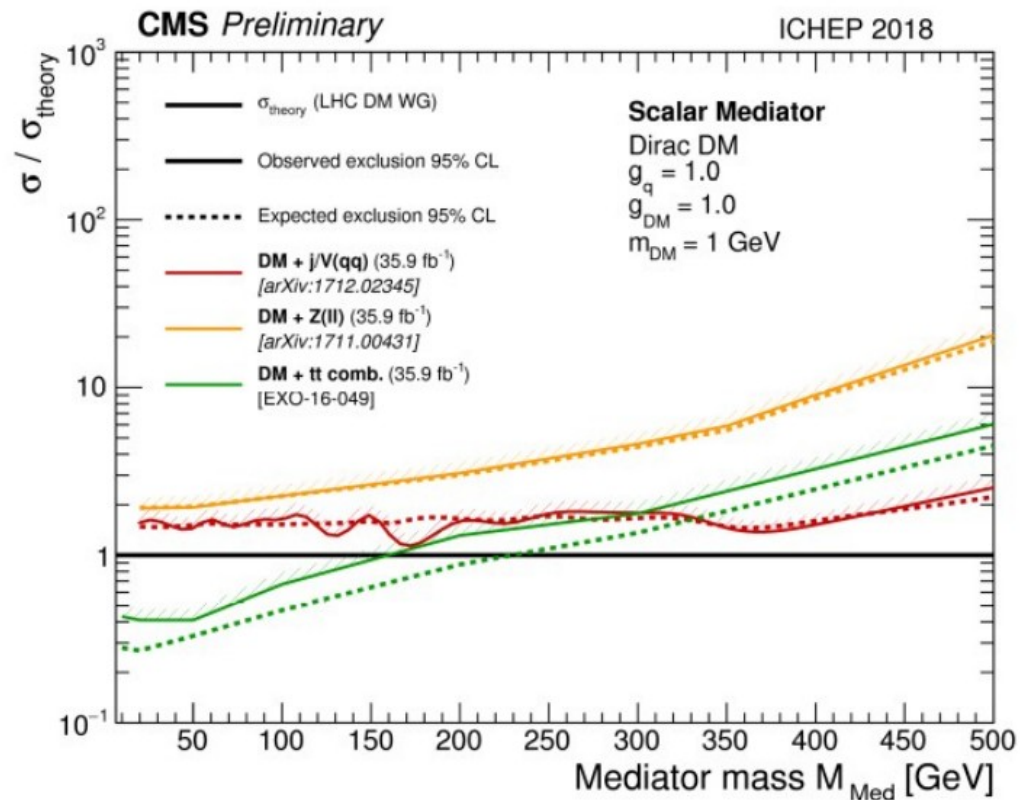
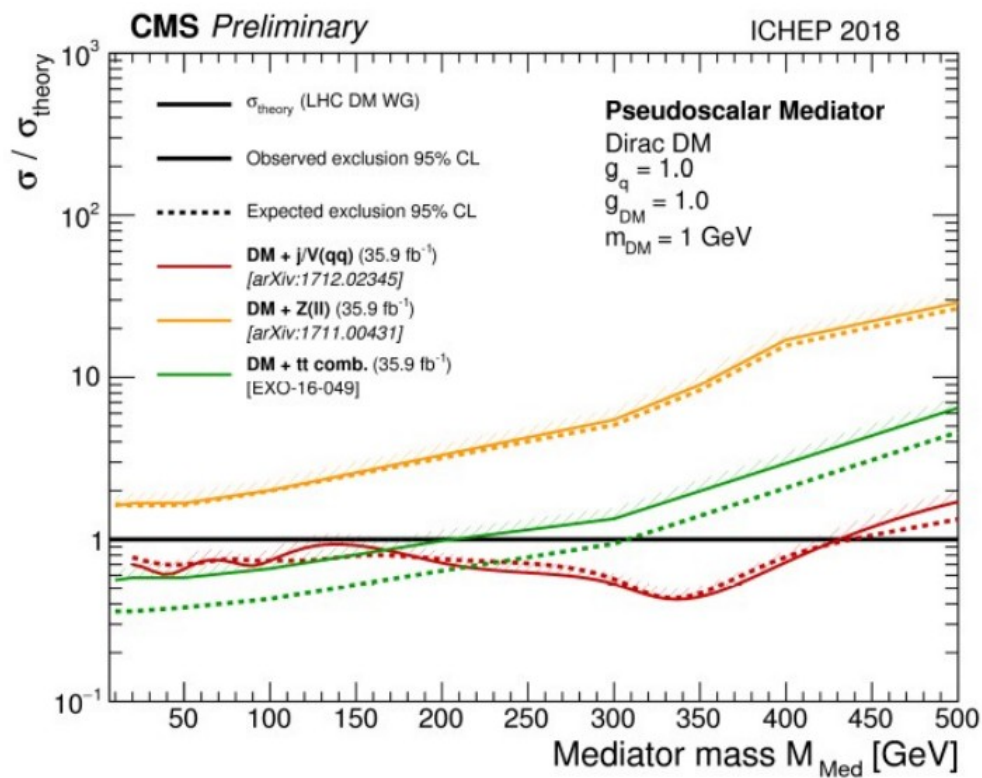
H(→ bb) + DM



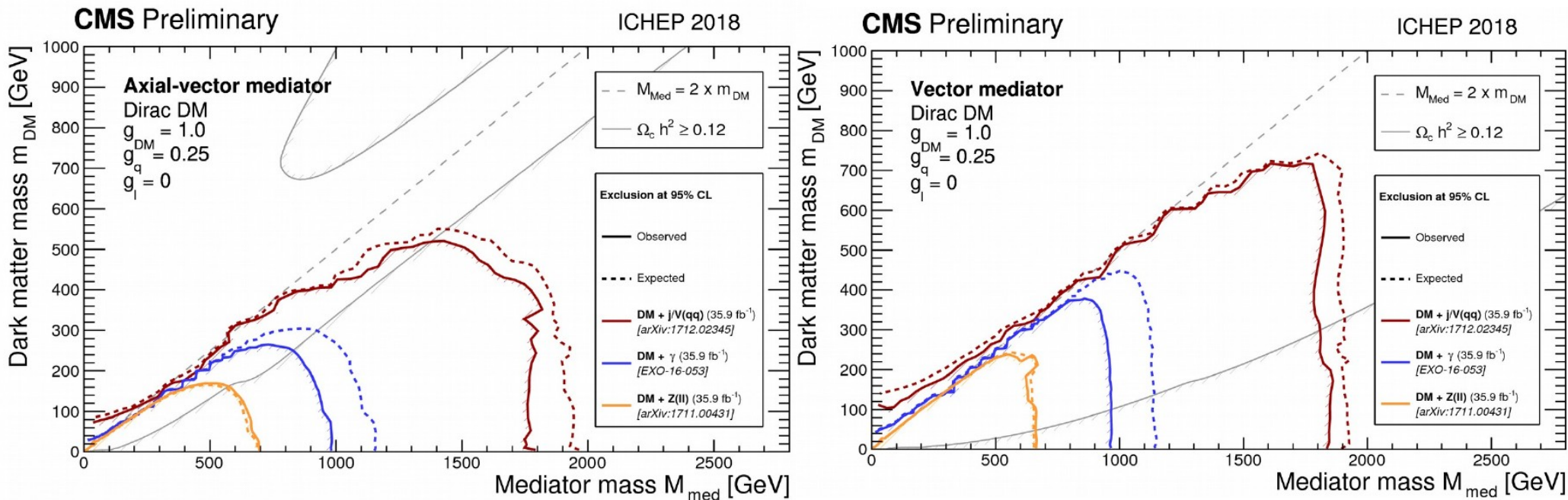
H(→ ττ, γγ) + DM



Spin-0 summary plots



Spin-1 summary plots



Summary and conclusions

- Just glimpse of DM searches at CMS
- Much more already in the literature and even more to come!
- Stay connected for 2019 Full-Run-II results!
- Preliminary public results:

<https://cms-results.web.cern.ch/cms-results/public-results/preliminary-results/EXO/>