

# A tri-muon trigger for pair-production of dark photons with the CMS Experiment at the HL-LHC

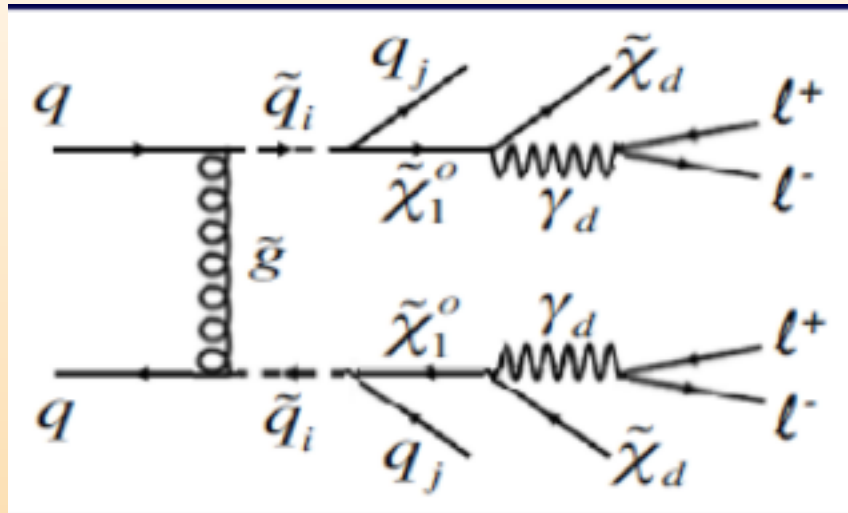
DPF Meeting  
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# Dark Photon Production through the SUSY portal with Decay to Lepton Jet

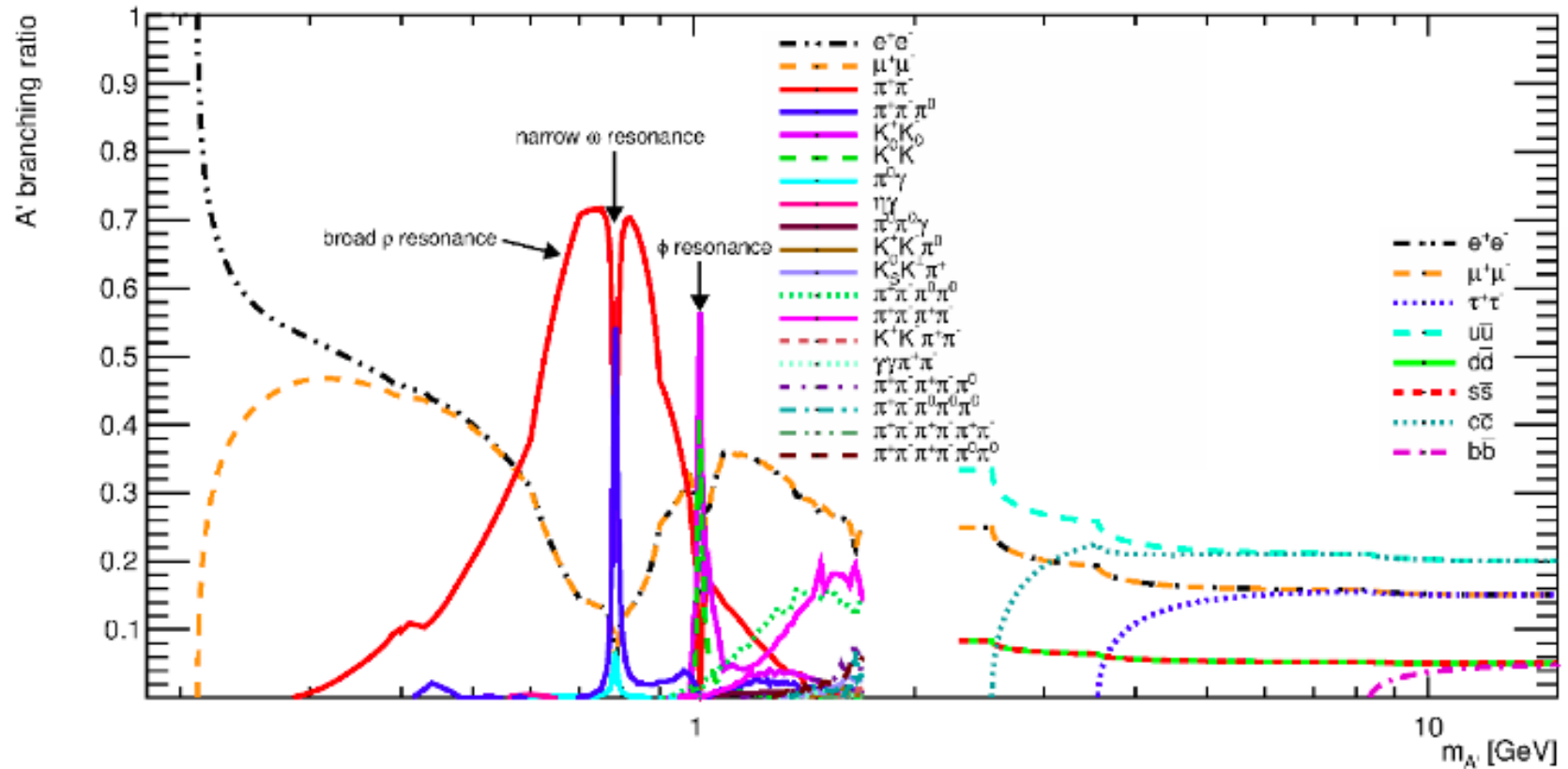


Theoretical model implemented in Pythia:

C. Cheung, J.T. Ruderman, L.-T. Wang and I. Yavin, "Lepton Jets in Supersymmetric Electroweak Processes", JHEP 04 (2010) 116

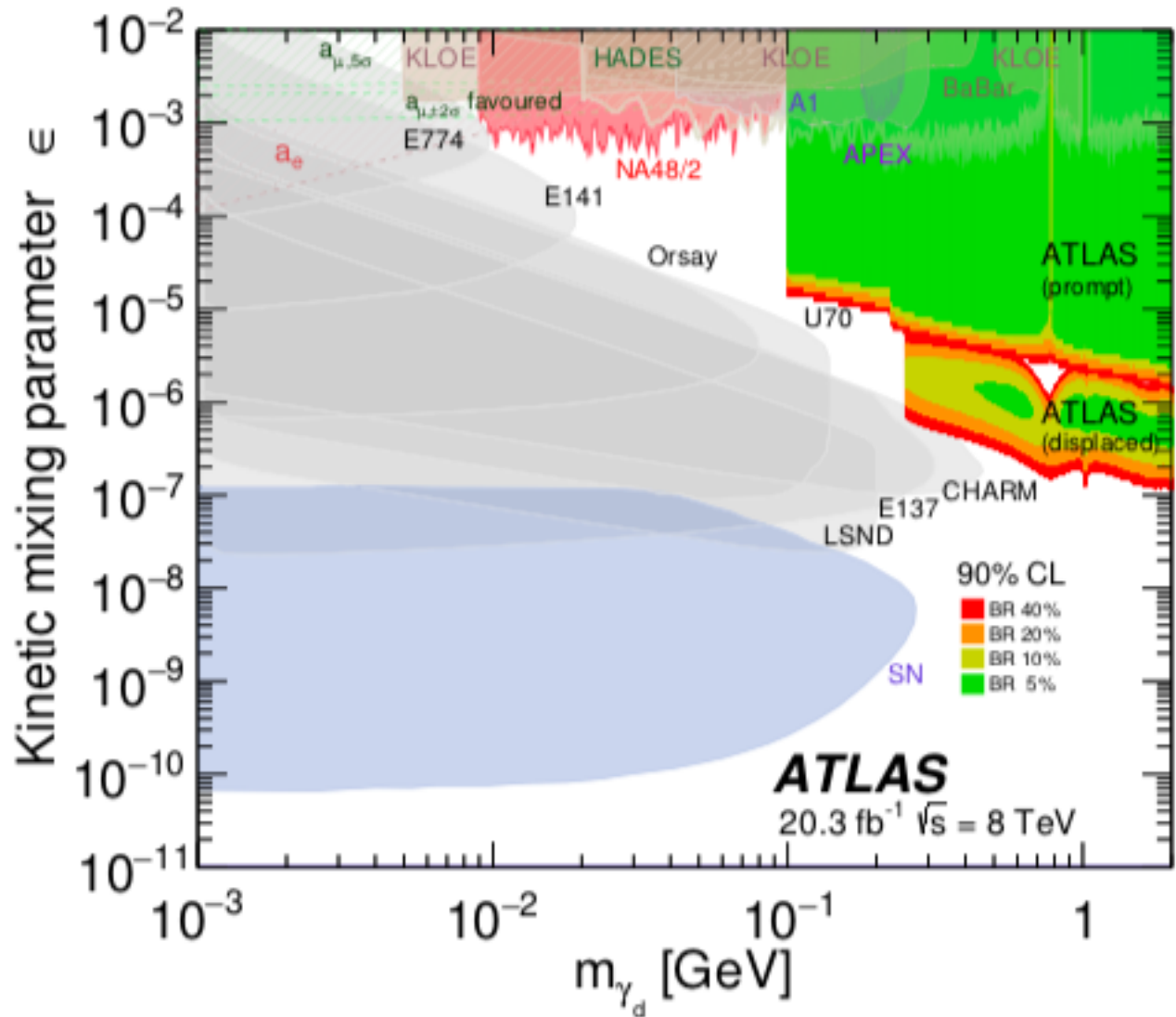
# Dark photon branching fractions

Malte Buschmann, Joachim Kopp, Jia Liu, Pedro A. N. Machado, "Lepton Jets from Radiating Dark Matter," JHEP 07 (2015) 045



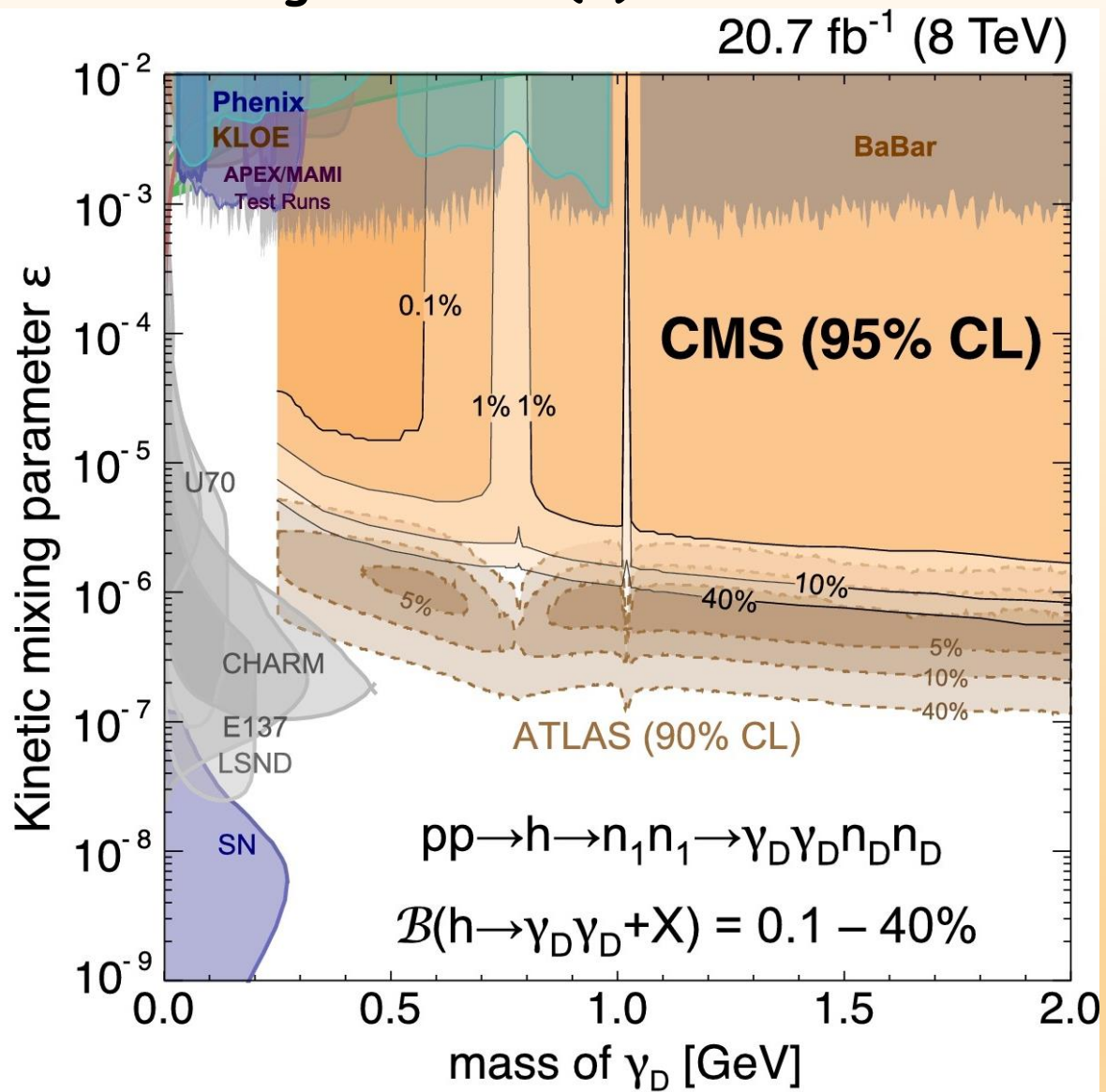
# Existing searches (1)

ATLAS, "A search for prompt lepton-jets in pp collisions at  $\sqrt{s} = 8$  TeV with the ATLAS detector," JHEP 02 (2016) 062.



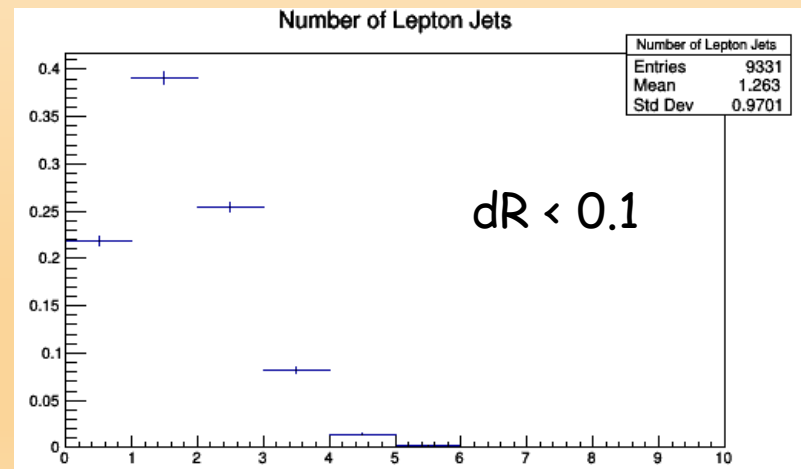
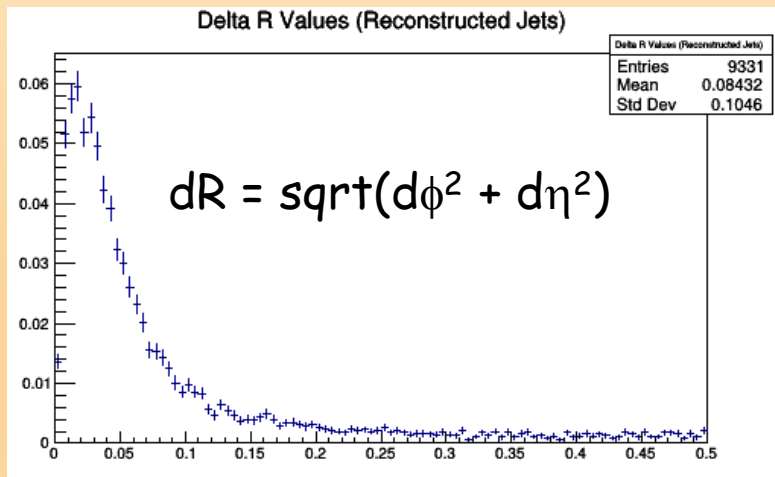
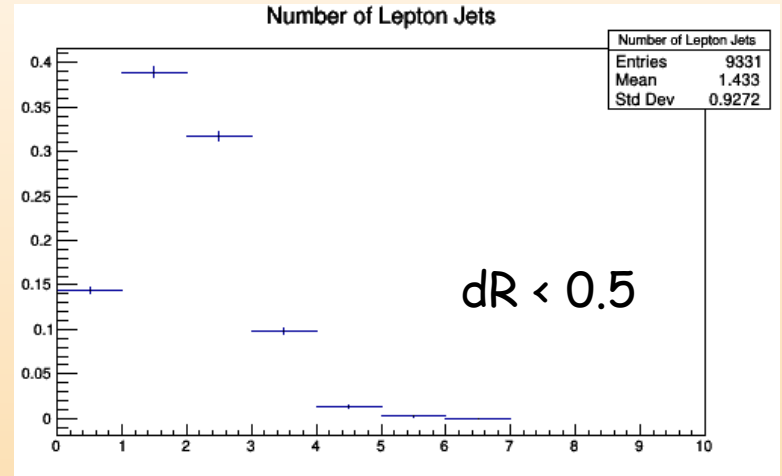
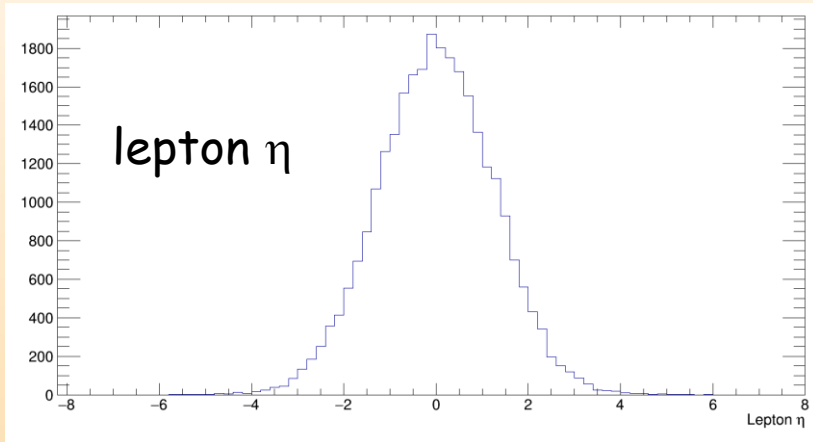
## Existing searches (2)

CMS, "A search for pair production of new light bosons decaying into muons," PLB 752, (2016), p. 146-168



# Event kinematics

generator-level only, 13 TeV, DP mass 1 GeV



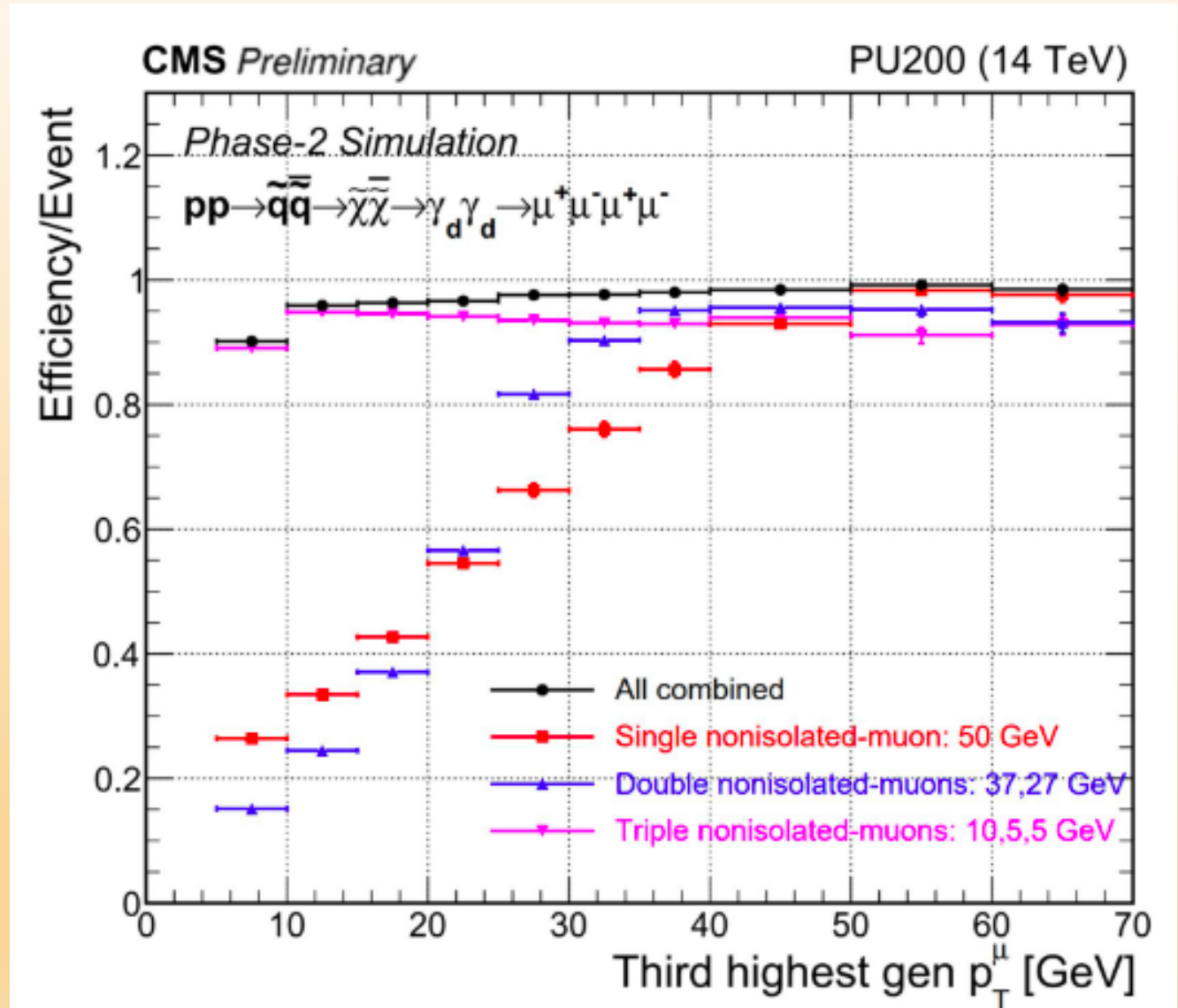
# Full simulation for HL-LHC detector

DP prompt decay  
to  $\mu^+\mu^-$

DP mass 1 GeV

muon  $|\eta| < 2.1$

80k events



## Summary

A tri-muon trigger with low  $p_T$  thresholds (10, 5, 5 GeV) provides a large increase in acceptance for prompt, pair-produced, low mass (1 GeV) dark photons with two or more muons with  $p_T < 40$  GeV.

## Future Plans

- Consider dark photon final states with more than 2-particle jets.
- Allow for long-lived DP decays within the tracker volume.
- Find the acceptance for backgrounds from production of  $ZW$ ,  $ZZ$ , Drell-Yan pairs, and  $b\bar{b}$  pairs.
- Extend the study to electrons.
- Estimate the cross-section sensitivity versus DP mass and lifetime.