An investigation of triboson decays into four-lepton final states

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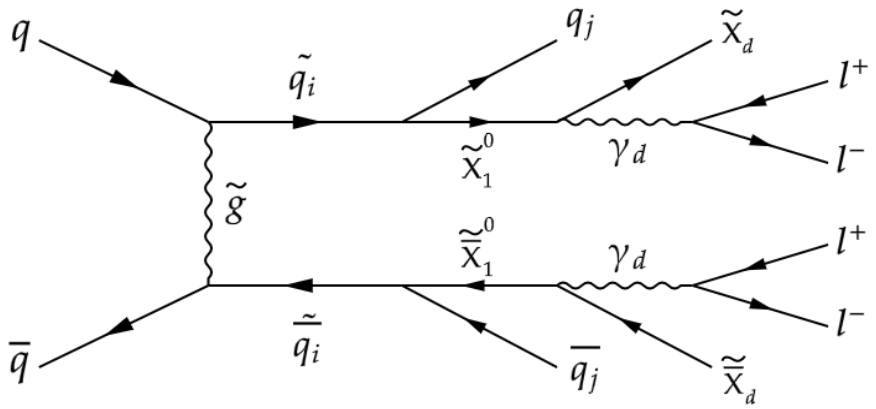
Preface

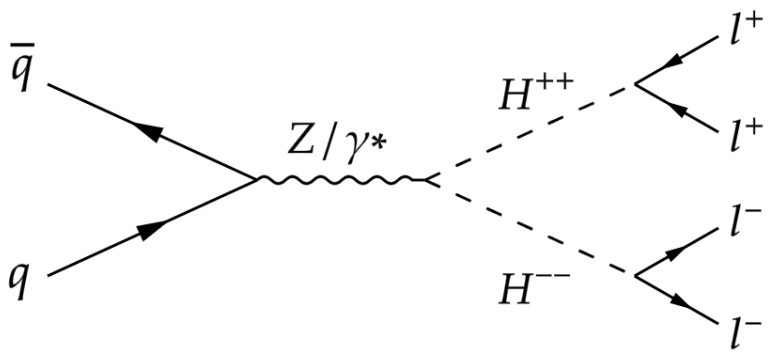
- Doubly charged Higgs boson ($H^{\pm\pm}$) is a theoretical non-Standard Model scalar boson produced via Drell-Yan mechanism
- Dark photon (γ_d) is a theoretical dark matter non-SM gauge boson in the dark sector produced via SUSY portal

$H^{\pm\pm}$ and γ_d Feynman Diagrams



SUSY-Portal Dark Photon production into 4 leptons

Drell-Yan H++ production and its decay into 4 leptons



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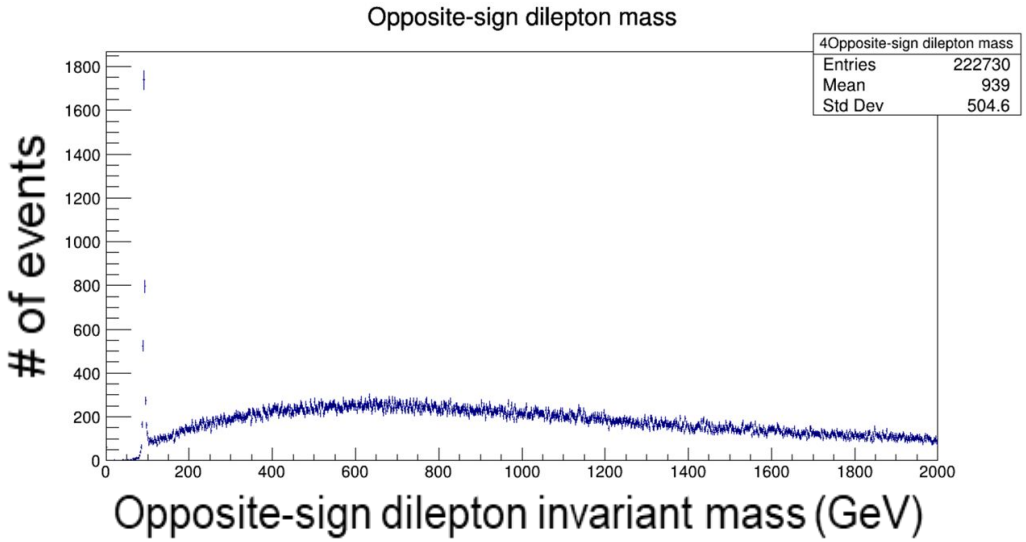
Motivation

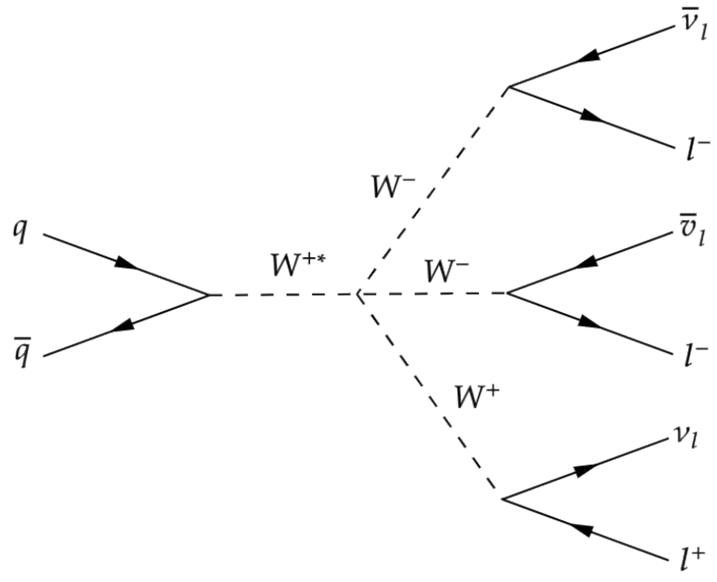


- Triboson background events exhibit a frequency slowly decreasing from its peak over increasing values of p_T
- This displays a different behavior from the other sources of background

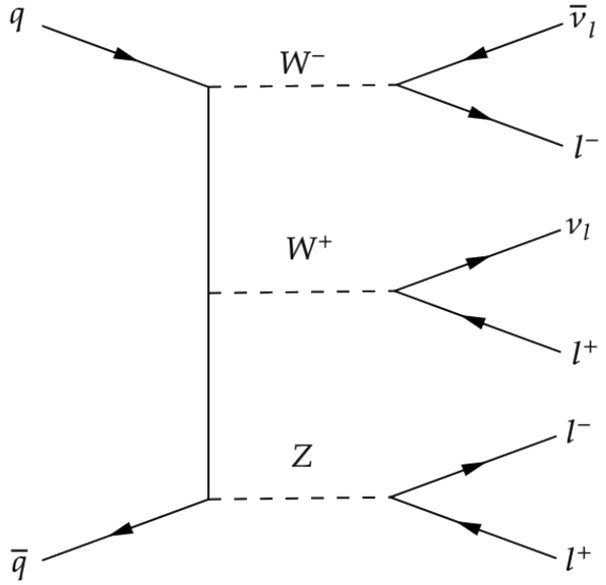
Methods

- Filters were applied to the WWZ and WWW event files to only show 4 lepton decay events above a p_T cutoff of 50 GeV for each lepton
- The Particle class was edited to obtain more individual particle information such as p_T, particle ID, and energy
- Individual particle information throughout the interaction was reintroduced, through the modification of existed code

Conclusions



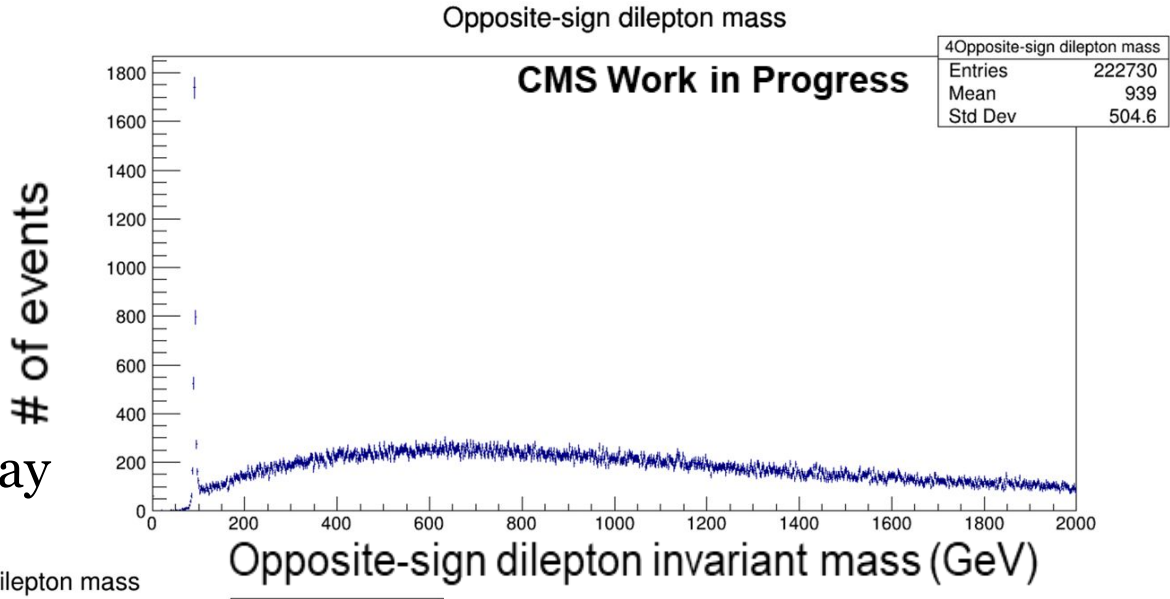
The main production mechanism of WWW

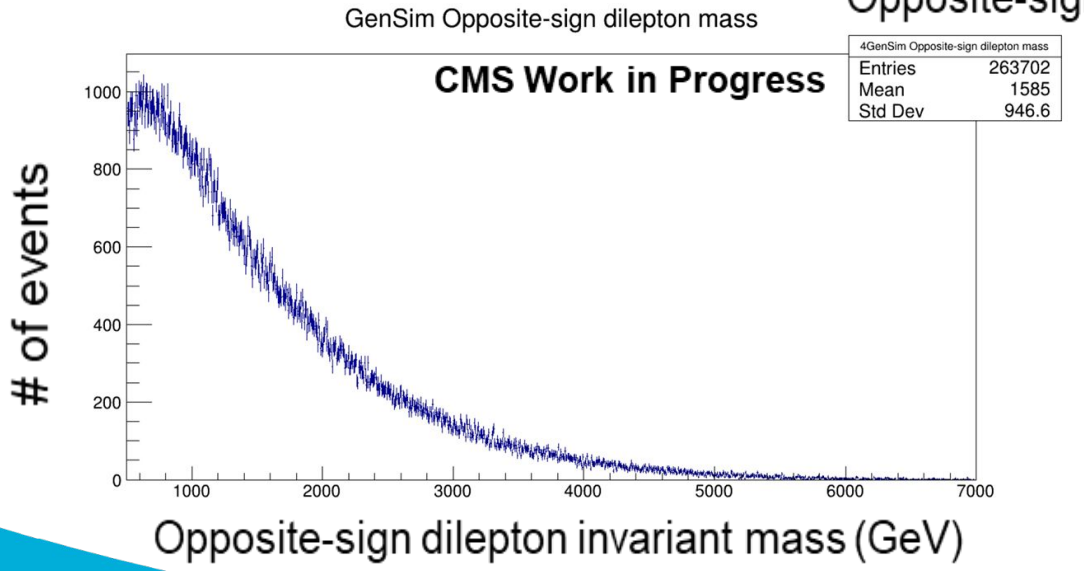


The main production mechanism of WWZ

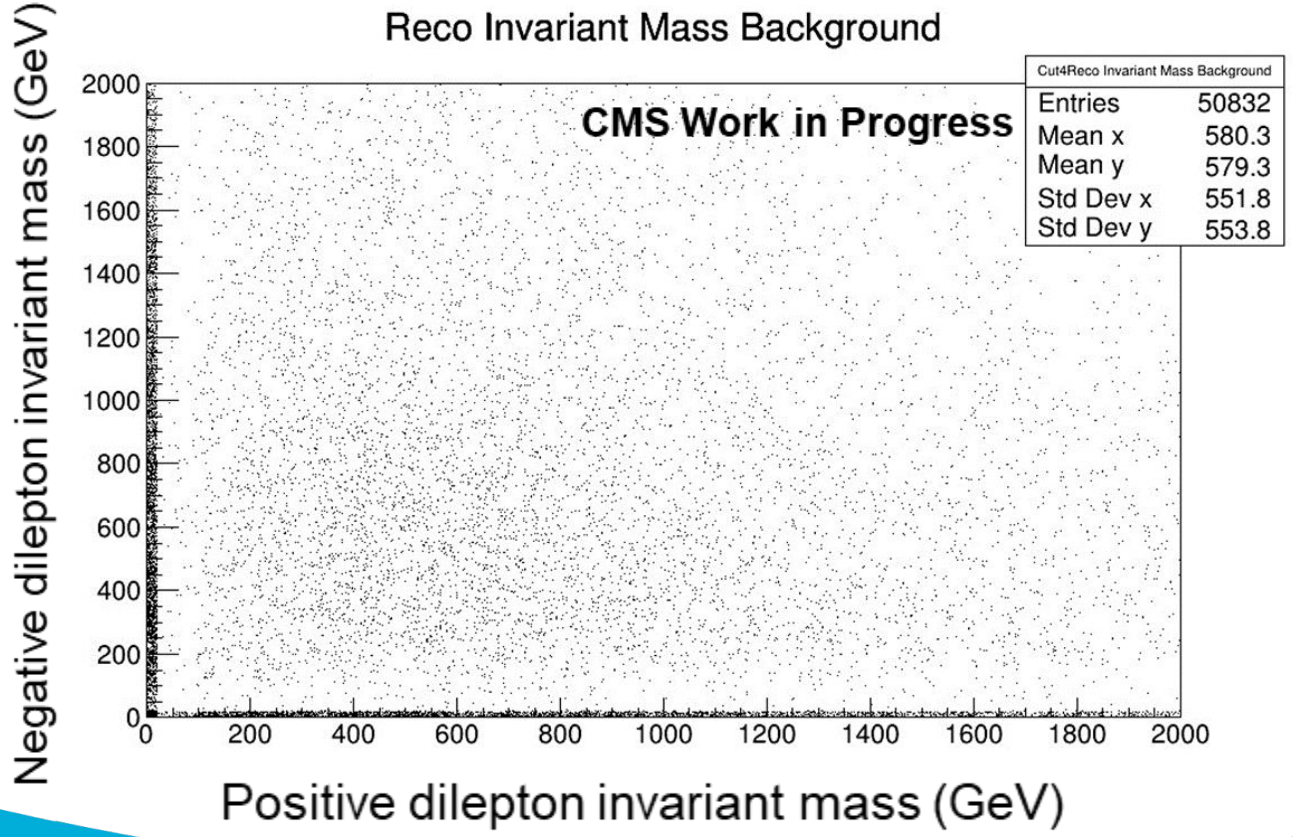
Data

Histograms of WWZ decay





More Data


Reco Invariant Mass Background
CMS Work in Progress
Cut4Reco Invariant Mass Background
Entries 50832
Mean x 580.3
Mean y 579.3
Std Dev x 551.8
Std Dev y 553.8
Negative dilepton invariant mass (GeV)
Positive dilepton invariant mass (GeV)
0
200
400
600
800
1000
1200
1400
1600
1800
2000

Summary

- Some tribosons (WWZ) can produce 4 final state leptons
- These are a background for Dark Photon and $H^{\pm\pm}$
- WWZ $\rightarrow l^{\pm}\, l^{\pm}\, l^{\pm}\, l^{\pm}$, appear at abnormally high invariant masses
- Plan to analyze other triboson decays in the future