

Background Suppression Strategy

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1 DY+Jets

DY Signature

- Two opposite-sign, same-flavor leptons (electrons, muons, or hadronic taus)
- For e^+e^- or $\mu^+\mu^-$: invariant mass consistent with Z boson, $70 < M_{ll} < 110$ GeV
- For $\tau^+\tau^-$ (with hadronic decays): visible mass in range $30 < M_{vis} < 80$ GeV
- Low MET: < 25 GeV for $e^+e^-/\mu^+\mu^-$; < 50 GeV for $\tau^+\tau^-$
- Minimal hadronic activity: jet multiplicity ≤ 2
- Third lepton candidate (if present) is likely fake (from jets or photon conversions)
- **Ref:** CMS DY $\rightarrow \tau\tau$ Measurement, arXiv:1801.03535

Suppression of Other Backgrounds

- **W+Jets**
 - Apply Z mass window: $70 < M_{ll} < 110$ GeV (for $e^+e^-/\mu^+\mu^-$)
 - Require exactly two tightly isolated leptons
 - Require MET < 25 GeV
 - MT of any extra lepton < 30 GeV
 - **Ref:** CMS W+Jets, arXiv:1610.04222
- **TTbar**
 - Veto events with b-tagged jets
 - Require low jet multiplicity (≤ 1 jet)
 - MET < 25 GeV
 - **Ref:** CMS $t\bar{t}$ Dilepton, arXiv:1603.02555
- **WZ and ZZ**
 - Require exactly two leptons
 - Veto third lepton with $p_T > 10$ GeV
 - **Ref:** CMS WZ/ZZ, arXiv:1406.0113, CMS WZ Study (Indico)
- **QCD Multijet**
 - Require dilepton mass near Z peak to reduce fake lepton combinatorics
 - MET < 25 GeV suppresses fake MET from jet mismeasurement
 - **Ref:** CMS AN-2016/242 (Fake Lepton Strategy)

2 W+Jets

W+Jets Signature

- One isolated high- p_T lepton (muon or electron)
- High MET due to neutrino from W decay
- At least one energetic jet

Suppression of Other Backgrounds

- **DY+Jets**
 - Veto second lepton with $p_T > 10$ GeV
 - Dilepton mass veto: M_{ll} not in $[70, 110]$ GeV
 - **Ref:** CMS Opposite-sign Dileptons, arXiv:1210.2422
- **TTbar**
 - Veto b-tagged jets
 - Restrict jet multiplicity to 1 or 2
 - **Ref:** CMS Top Cross Section, arXiv:1701.06228
- **WZ/ZZ**
 - Veto additional leptons with $p_T > 10$ GeV
 - MET < 100 GeV to suppress multi-lepton SUSY/ZZ-like events
 - **Ref:** CMS Same-sign Dileptons, arXiv:1611.06594, CMS WZ Study (Indico)
- **QCD Multijet**
 - Apply tight lepton isolation to reject fake leptons
 - Require $M_T > 50$ GeV to reduce mismeasured low-MET backgrounds
 - Require MET in range $30 < \text{MET} < 100$ GeV to avoid fake MET tails
 - QCD estimated via inverted isolation regions in data
 - **Ref:** CMS AN-2016/242 (Fake Lepton Strategy)