Leptonic scale factors in the 4tops analysis

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September 15, 2021

Electron ID scale factor

- Our reconstruction criteria for electrons are:
  1. $|\eta| < 2.4$
  2. MVA electron ID
  3. ISO
  4. IP
- Centrally produced SFs exist for MVA electron ID
- We are using the MVA electron ID developed by the SUSY group

Electron ID scale factor

Cuts/Equations for MVA (2016 - MVANoIso94XV2)

[1]

Different from 2017/2018

Tight

Region	MVA value, 10<ePt<40	MVA value ePt>=40
$|\eta| < 0.8$	> 3.447 + 0.063(pt - 25)	> 4.392
$0.8 \leq |\eta| < 1.479$	> 2.522 + 0.058(pt - 25)	> 3.392
$1.479 \leq |\eta| < 2.5$	> 1.555 + 0.075(pt - 25)	> 2.680

VLoose

Region	ePt: 5-10	10<ePt<25	ePt>=25
$|\eta| < 0.8$	> 1.309	> 0.887 + 0.088(pt - 25)	> 0.887
$0.8 \leq |\eta| < 1.479$	> 0.373	> 0.112 + 0.099(pt - 25)	> 0.112
$1.479 \leq |\eta| < 2.5$	> 0.071	> -0.017 + 0.137(pt - 25)	> -0.017

VLooseFO

Region	ePt: 5-10	10<ePt<25	ePt>=25
$|\eta| < 0.8$	> -0.259	> -0.388 + 0.109(pt - 25)	> -0.388
$0.8 \leq |\eta| < 1.479$	> -0.256	> -0.696 + 0.106(pt - 25)	> -0.696
$1.479 \leq |\eta| < 2.5$	> -1.630	> -1.219 + 0.148(pt - 25)	> -1.219

cms.InputTag("electronMVAValueMapProducer:ElectronMVAEstimatorRun2Fall17NoIsoV2RawValues")

Electron ID scale factor

Electrons (Data/FullSim MC) SFs

Preliminary SFs for electrons using legacy 2016 data are available in ROOT file with stat+syst uncertainties. Please use these SFs on top of reco SFs provided by EGM POG here. Cut based IDs (no iso) are derived using Fall17V2 ID cuts without any cuts on relIso. For MVA ID working points please refer to these slides. Working points for LeptonMVA and MultiIso are same as Moriond17.

Data: Run2016*-17Jul2018*v1

MC: RunIISummer16MiniAODv3

GTs used to derive SFs (relevant for LeptonMVA and MultiIso which use JECs): 94X_dataRun2_v10, 94X_mcRun2_asymptotic_v3

- This SUSY TWiki has links to a ROOT file containing SFs for different working points
- I downloaded it and browsed it
- It seems like it's a η, p_T dependent scale factor
- **Remark**: TWiki says to apply these SFs on top of EGM POG SFs

Electron ID scale factor

Efficiencies and scale factors

The recommended ID for analysis looking at the three years is Fall17V2 ID. Egamma provides scale factors also for other previously approved (Fall17V1 for 2017 and 80X for 2016) and still in use IDs. For additional details see here

General guidelines to compute the scale factors using the Tag and Probe are given here ElectronScaleFactorsRun2

EGamma POG approved scale factors are provided as a TH2F histogram and can be in links below. The 2 dimensions are:
- x-axis: SuperCluster Eta
- y-axis: pT

The value can be access with usual GetBinContent and the recommended systematic is the error (GetBinError). The pT range is limited to 150GeV. For pT > 150 GeV the highest pT bin scale factor should be used.

Scale factors for ultra legacy (UL) datasets are (will be) available here : https://twiki.cern.ch/twiki/bin/view/CMS/EgammaUL2016To2018

Currently UL2017 SF are available. In next weeks/months, we will have UL2018 and UL2016 SF as well.

Below, you will find rereco18 , rereco17 and legacy16 SFs. The recommended ID is Fall17V2 for 2016, 2017 and 2018, for rereco and UL.

- This EGM POG TWiki has links to a ROOT file containing SFs for the Fall17V2 ID
  - Honestly, not 100% sure about what it is (Huiling remembers?)
  - It's what we are using though
- ROOT file contains another η, p_T dependent scale factor
- It seems that applying these two scale factors should do the job, it seems easy

Electron ID scale factor

- **Open question**: our electron identification criteria also involve electron ISO.
  - Do we need scale factors for this?
  - $t\bar{t}H$ multilepton AN has a section about corrections for "Identification **and isolation** efficiency of e and μ"
  - Can't find these scale factors for now

Other lepton scale factors

- Looking for muon ID and ISO scale factors
- I think I will find these kind of easily
- Already found DeepTau TWiki page
  - DeepTau SFs are very complicated
  - We may **need information** that we don't have currently
  - **Is it in miniAOD? Is it stored by BSM framework?**
  - Discuss with Huiling about this