

Status of 4Top analysis

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Muon Isolation SF

- Ntuple from MUON POG
- Work on Spark package on [gitlab](#).
- The scale factors for muon MediumId is available.
- My task is to derive the muon minIso scale factor

$$SF = \frac{eff_{data}(minIso/mediumId)}{eff_{mc}(minIso/mediumId)}$$

N_{minIso} and $N_{mediumId}$ is derived by a S+B fit to $m_{\mu\mu}$ spectrum.

Tag and Probe definition

Tag selection

- $pT > 26 \text{ GeV}$
- $|d_{xy}| < 0.2, |dz| < 0.5$
- Tight ID
- $\text{PFReIsolation}(\Delta\beta) < 0.2$
- Match to HLT_IsoMu24 or HLT_IsoMu27

Probe selection

- Medium ID
- $\text{minIso} < 0.1$

Pair selection

- $70 < m_{\mu\mu} < 130$
- bin width 0.5 GeV

Signal Model

- Histogram template from $Z \rightarrow \ell\ell$ with a Gaussian resolution parameter.

Background Model

- RooCMSShape with pole position fixed to Z mass.

Systematics Shifts

Alternative Signal Model

- Use generator $m_{\mu\mu}$ distribution with Gaussian resolution parameter

Alternative Background Model

- Exponential function

Tag Isolation

- Nominal : Isolation($\Delta\beta$) < 0.2
- Up : Isolation($\Delta\beta$) < 0.3
- Down : Isolation($\Delta\beta$) < 0.1

Histogram binning

- Nominal : 0.5 GeV
- Up : 0.25 GeV
- Down : 1.0 GeV

Fit Window

- Nominal : $70 < m_{\mu\mu} < 130$
- Up : $75 < m_{\mu\mu} < 135$
- Down : $65 < m_{\mu\mu} < 125$

Mini Isolation

$$I = (minilso_{charged} + \max(0, minilso_{neutral} + minilso_{photon} - \rho A(\frac{R}{0.3})^2))/pt$$

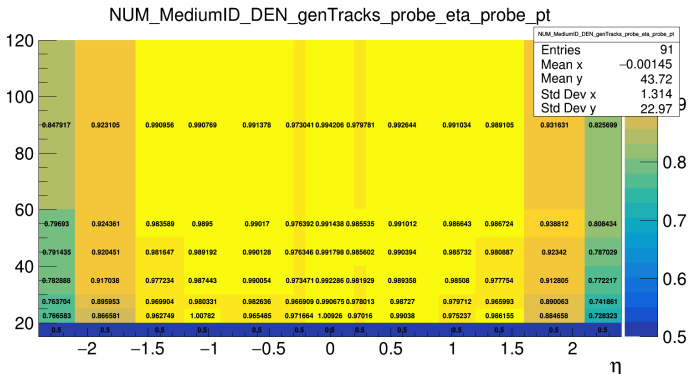
$ \eta $	[0,0.8]	[0.8,1.3]	[1.3,2.0]	[2.0,2.2]	[2.2,2.4]
effective area	0.0566	0.0562	0.0363	0.0119	0.0064

$$R = \frac{10}{\min(\max(pT, 50), 200)} \begin{cases} 0.2 & pT < 50 \\ 10/pT & 50 < pT < 200 \\ 0.05 & pT > 200 \end{cases}$$

$$\rho = fixedGridRhoFastjetCentralNeutral$$

UL2017 minilso SF from Z sample

- Preliminary results of UL2017 data.
- Need to understand pt bin [15,20].
- The pt range should extend to 10 GeV.



- RECO SF : NUM TrackerMuon, DEN generalTracks
 - SFs for pt in [2,40] GeV are derived from J/psi sample.
 - For higher pt muon, use the SF from [30,40] GeV.
- ID SF : NUM MediumId, DEN TrackerMuons
 - SFs for pt in [15,120] GeV are derived from Z sample.
 - For pt in [10,15] GeV, use the SF from [15,20] GeV.

- $genTtbarId$
 - xxx51: tt+b (one additional b jet containing a single b hadron)
 - xxx52: tt+2b (one additional b jet containing at least 2 b hadrons)
 - xxx53, xxx54, xxx55: tt+bb (at least two additional b jets, independent of the number of b hadrons in each)
- In preUL, I require $genTtbarId\%100 > 52$.
- Jan suggests to use $genTtbarId\%100 > 50$.
- The corresponding fraction of ttbb events ϵ needs to be updated.
- Just like FixedWP b-tagging SF, apply 1.2 on ttbb events and $(1 - 1.2 * \epsilon)/(1 - \epsilon)$ on non-ttbb events.

Backup

- parameter : $\alpha, \beta, \gamma, peak$

$$\begin{cases} 0 & u = \gamma(x - peak), u < -70 \\ e^{-\gamma(x - peak)} \frac{2}{\sqrt{\pi}} \int_0^{\beta(\alpha - x)} e^{-t^2} dt & u = \gamma(x - peak), -70 < u < 70 \\ 0 & u = \gamma(x - peak), u > 70 \end{cases}$$