

A detailed 3D wireframe rendering of a particle detector's interior, showing complex structural elements, support beams, and various components. The perspective is from an elevated position looking down into the structure.

# Approval of single muon path efficiencies

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# Outline

- proposal to approve efficiency of the OR of HLT\_IsoMu20 and HLT\_IsoTkMu20 on the top of offline tight ID + isolation
- plots prepared by Kyeongpil Lee, Kyungwook Nam and Hwidong Yoo

# Samples

- data:
  - Collision data at 13 TeV and 50 ns bunch spacing
  - Prompt reconstruction, using startup calibration and alignment conditions
  - Using only certified data (golden JSON)
  - SingleMuon dataset
  - Integrated luminosity: 39.6 /pb
- MC:
  - Drell–Yan + Jets sample generated with madgraphMLM (LO)
  - Detector alignment and calibration conditions as expected after about 1 /fb of integrated luminosity
  - Re-weighting is applied to match the pileup distribution in data

# Method:

- Efficiency are computed respect to **reco muon passing Tight muon + Isolation**

## Tight Muon Id:

- ▶ Global muon
- ▶ Particle Flow muon
- ▶ `globalTrack.normalizedChi2 < 10`
- ▶ `globalTrack.numberOfMuonValidHits > 0`
- ▶ `numberOfMatchedStations > 1`
- ▶ `|dxy| < 0.2 cm`
- ▶ `numberOfValidPixelHits > 0`
- ▶ `trackerLayersWithMeasurement > 5`

## Isolation: PFIso(dBeta)

- ▶ relative combined PF isolation in a  $dR=0.4$  cone
- ▶ deltaBeta correction applied for PU mitigation
- ▶ `PFIso(dBeta) < 0.15`
- ▶ full definition of the isolation in backup ([slide 15](#))

*Plots with other isolation cuts are presented in back-up:*

- No isolation applied
- `PFIso(dBeta) < 0.25`

- Method = Tag and Probe selection on  $Z \rightarrow \mu\mu$

## Tag Muon:

- ▶ Tight muon
- ▶  $p_T > 25 \text{ GeV}$ ,  $|\eta| < 2.1$
- ▶ relat. comb. isolated ( $\text{deltaBeta, cone}=0.4$ )  $< 0.2$
- ▶ Matched with `HLT_IsoMu24_eta2p1`

## Probe muon:

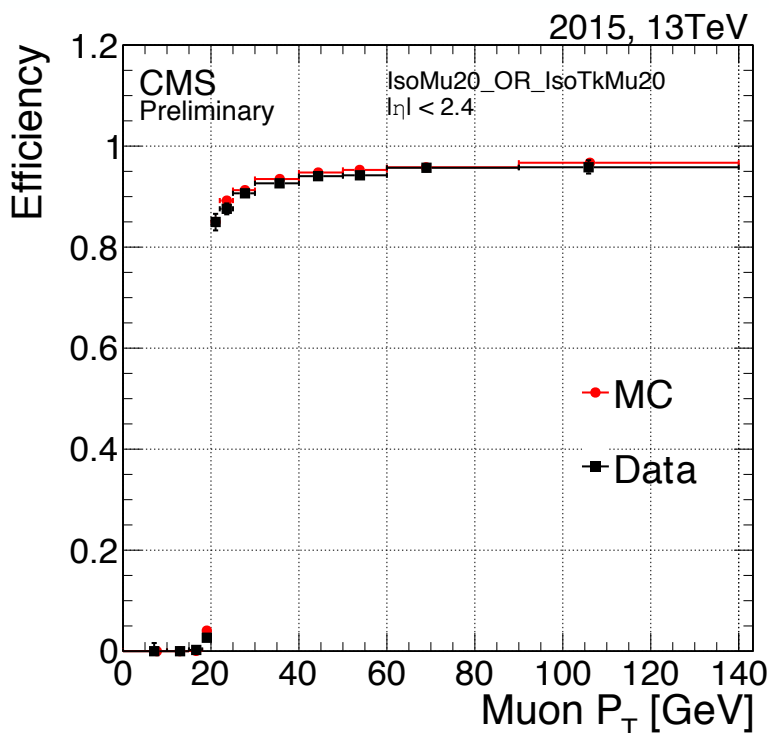
- ▶ reco muon passing tight ID + isolation
- ▶ acceptance cut depending of the plot

## PDF shape:

- ▶ signal = sum of 2 Voigtians
- ▶ background = exponential

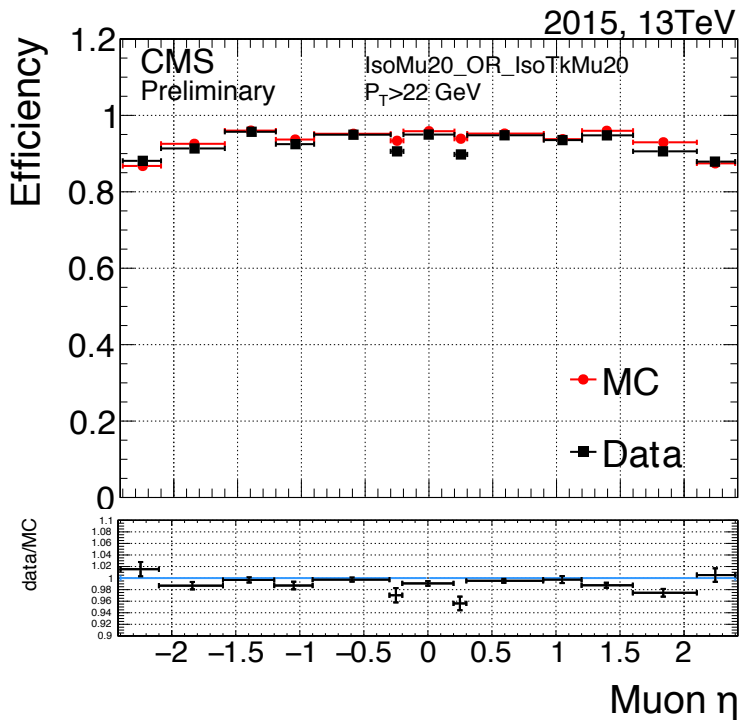
Z mass windows: [70, 130] GeV

# Efficiency on top of Tight ID + PFIso(dBeta) < 0.15 vs pT



Efficiency as a function of  $p_T$  for the OR of the HLT\_IsoMu20 and HLT\_IsoTkMu20 with respect to the offline reconstructed muon passing identification and isolation requirements. These two trigger paths require a muon reconstructed online with  $p_T > 20$  GeV as well as passing an isolation selection

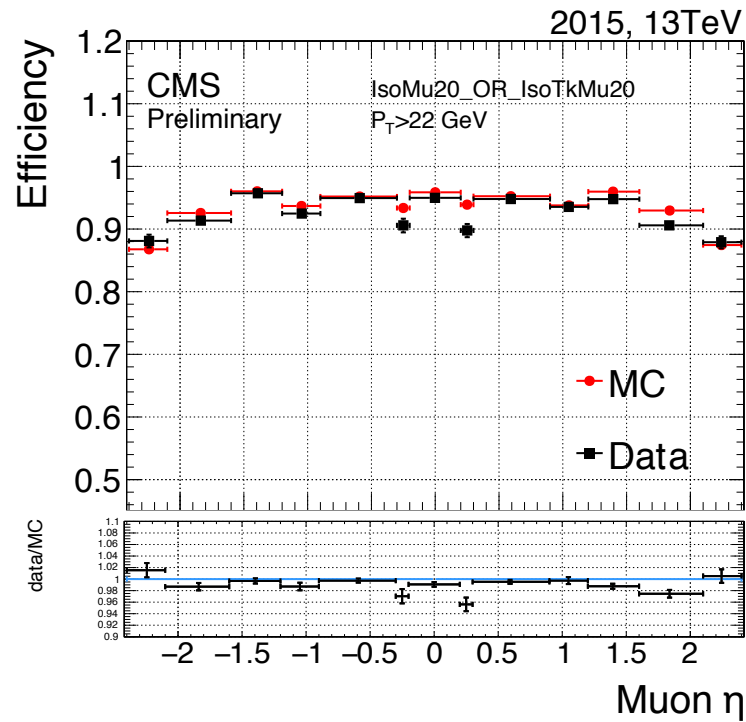
# Efficiency on top of Tight ID + PFIso(dBeta) < 0.15 vs eta



Efficiency as a function of  $\eta$  for the OR of the HLT\_IsoMu20 and HLT\_IsoTkMu20 with respect to the offline reconstructed muon passing identification and isolation requirements. These two trigger paths require a muon reconstructed online with  $p_T > 20$  GeV as well as passing an isolation selection

The dips at  $|\eta| \sim 0.25$  correspond to the geometrical gaps either sides of the central wheel of the muon spectrometer

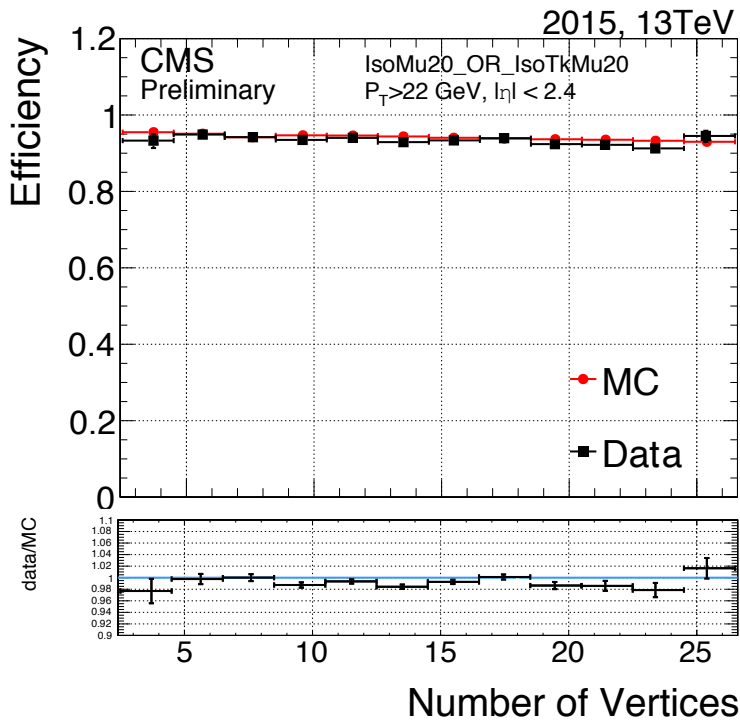
## ZOOMED VERSION



Efficiency as a function of  $\eta$  for the OR of the HLT\_IsoMu20 and HLT\_IsoTkMu20 with respect to the offline reconstructed muon passing identification and isolation requirements. These two trigger paths require a muon reconstructed online with  $p_T > 20$  GeV as well as passing an isolation selection.

The dips at  $|\eta| \sim 0.25$  correspond to the geometrical gaps either sides of the central wheel of the muon spectrometer

# Efficiency on top of Tight ID + PFIso(dBeta) < 0.15 vs number of offline Vertices

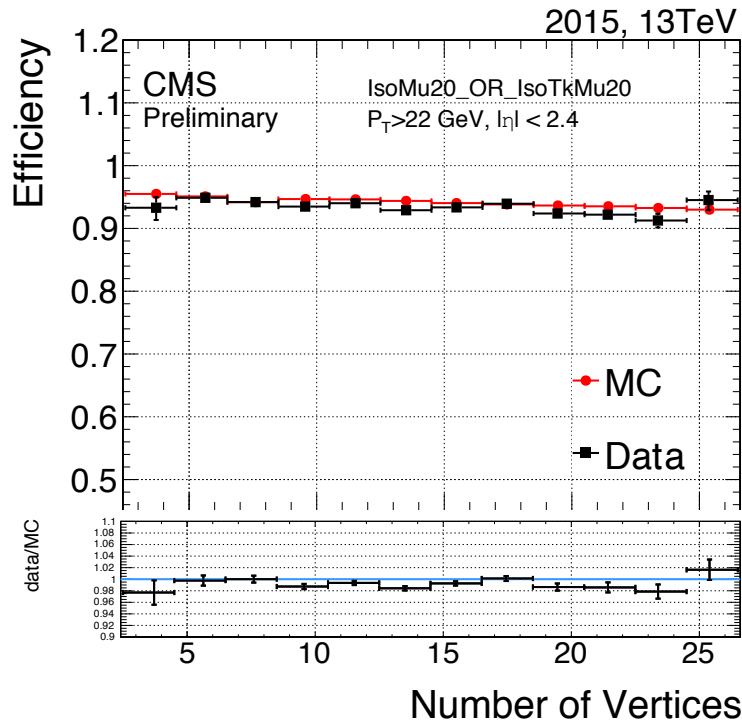


Efficiency as a function of the number of reconstructed vertices for the OR of the HLT\_IsoMu20 and HLT\_IsoTkMu20 with respect to the offline reconstructed muon passing identification and isolation requirements. These two trigger paths require a muon reconstructed online with  $p_T > 20 \text{ GeV}$  as well as passing an isolation selection.



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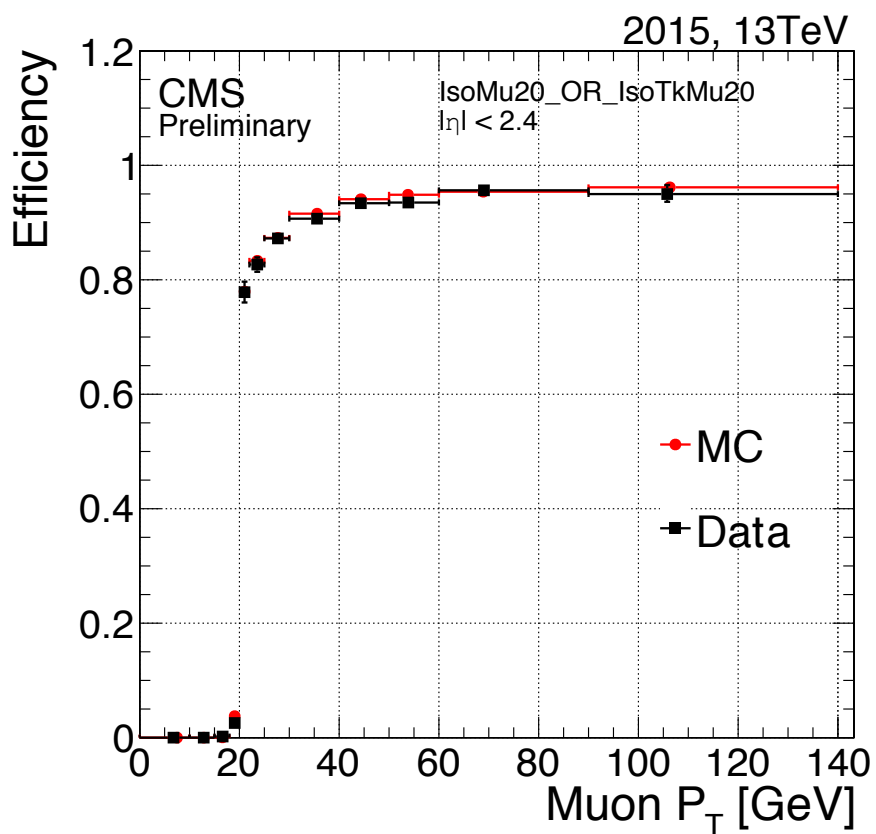


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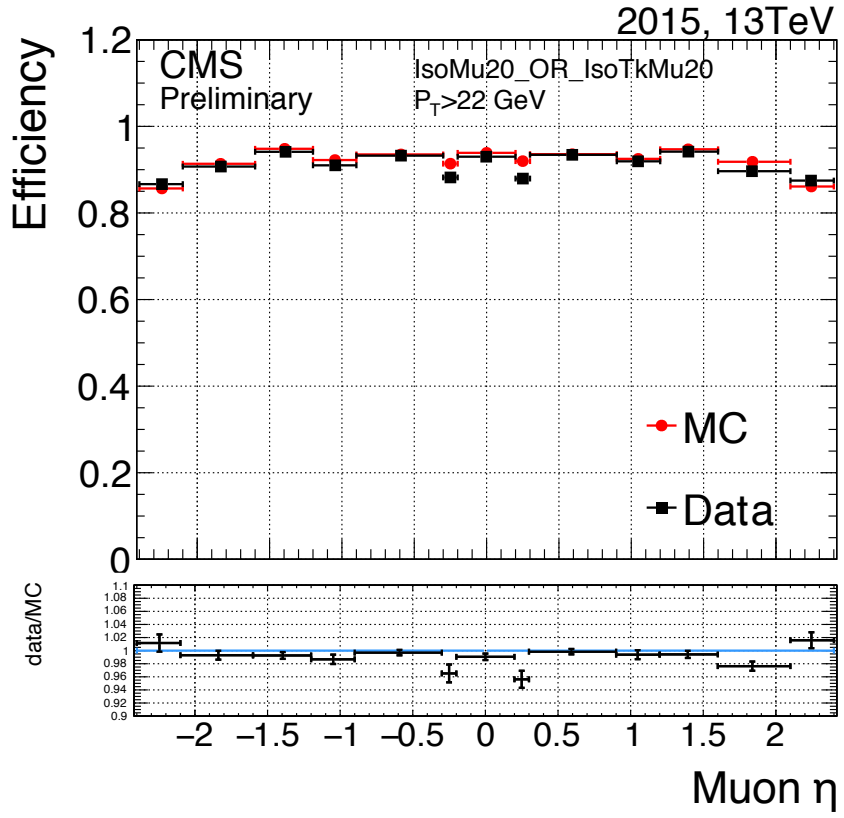


back-up: only for documentation,  
not for approval

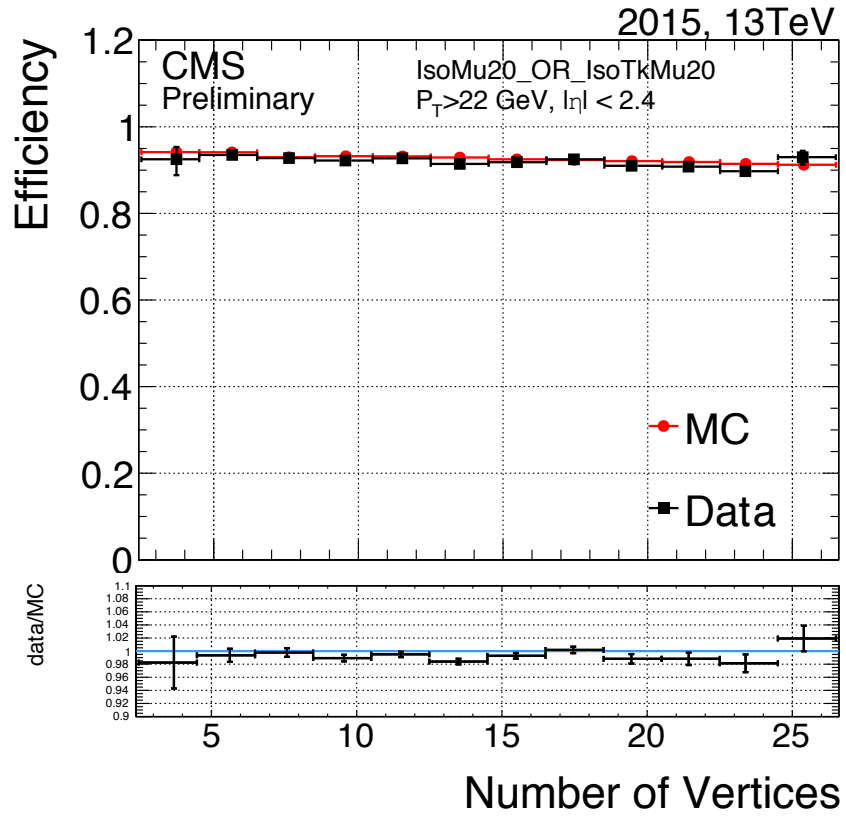
# Efficiency on top of Tight ID vs pT



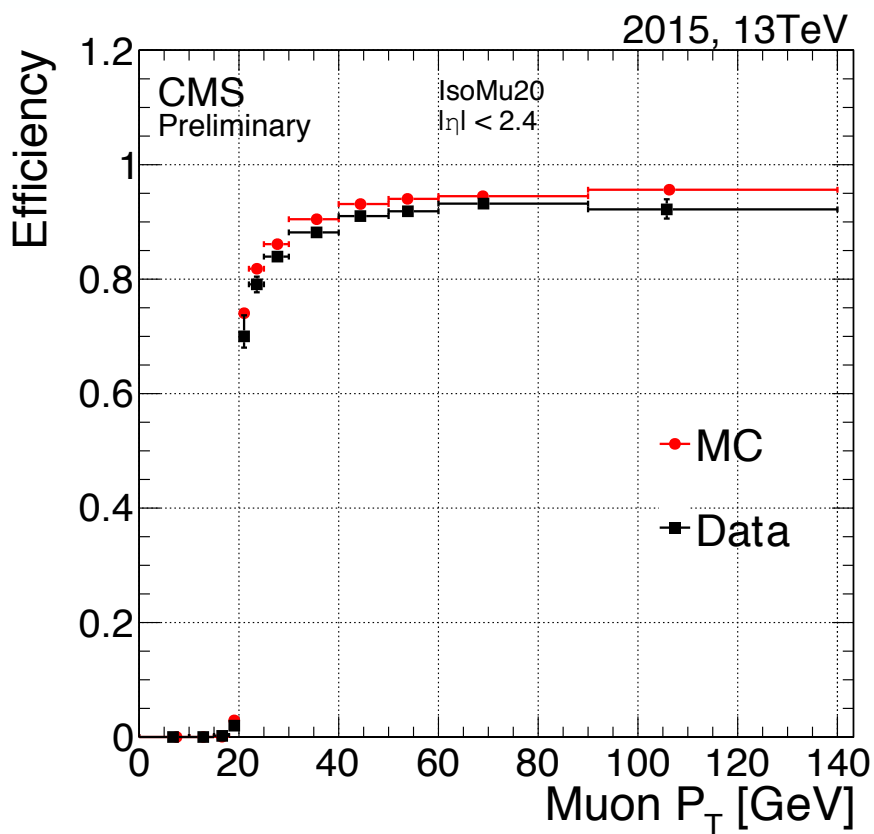
# Efficiency on top of Tight ID vs eta



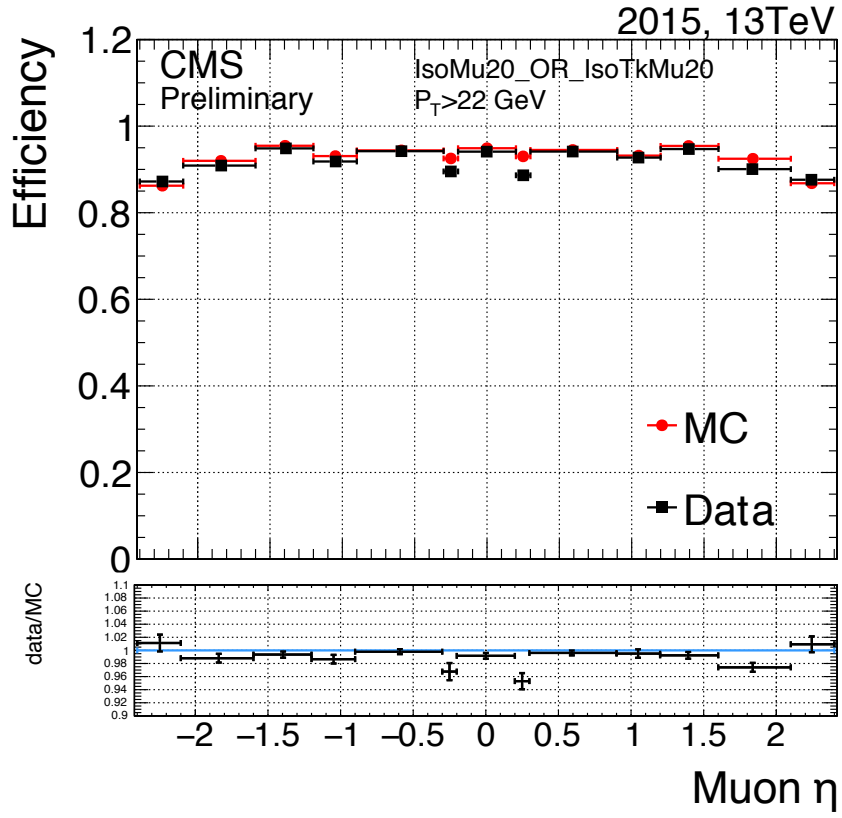
# Efficiency on top of Tight ID vs number of offline Vertices



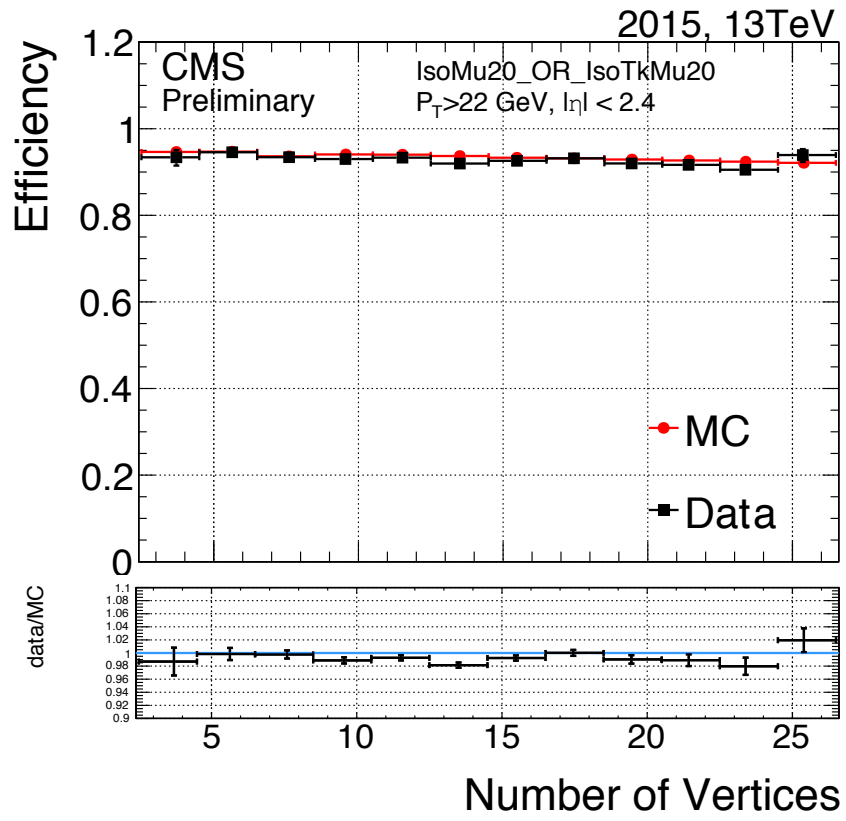
# Efficiency on top of Tight ID + PFIso(dBeta) < 0.25 vs pT



# Efficiency on top of Tight ID + PFIso(dBeta) < 0.25 vs eta



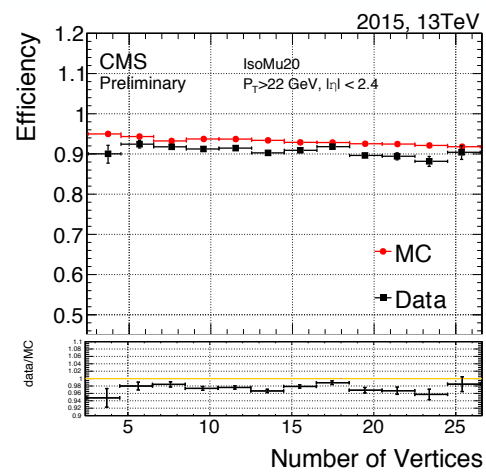
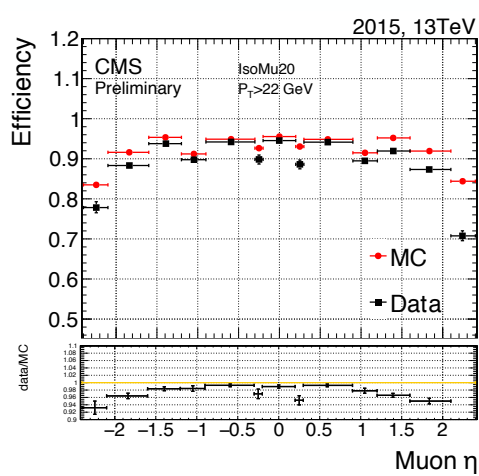
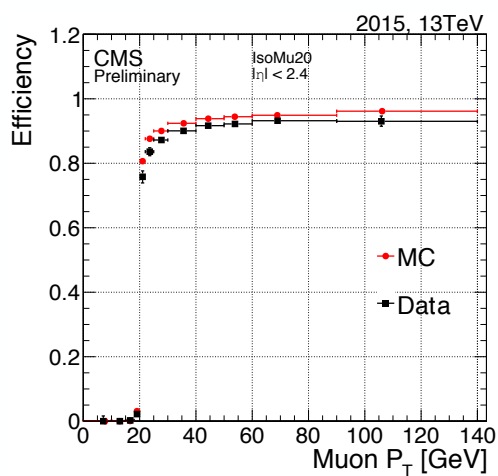
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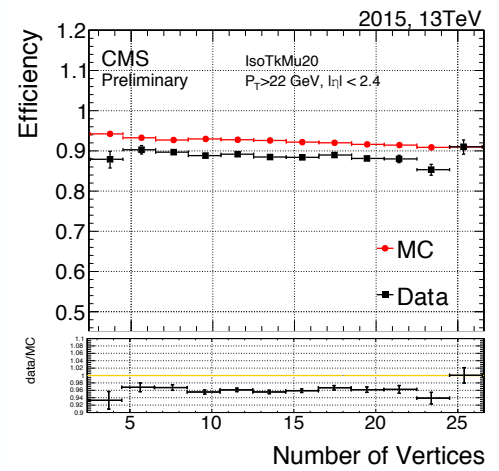
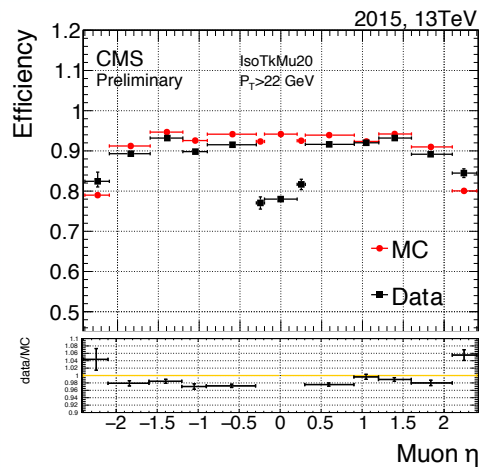
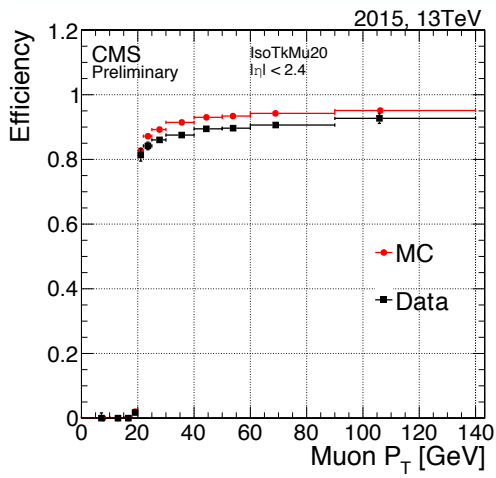


# Isolation definition:

- $\text{PFIso}(\text{dBeta}) = (\sum E_{T(\text{PF ch. had. from PV})} + \sum E_{T(\text{PF neutral had.})} + \sum E_{T(\text{PF photons})})/p_T + \text{deltaBeta correction}$
- $\text{deltaBeta correction}$  = Correction to the neutral component of the isolation, taking into account the charged particles in the cone of interest not originating from the primary vertex (PV), and the average of neutral to charged particles as measured in jets
- more details in CMS [DP-2013/009](#)



**Efficiency on top of Tight ID + PFIso(dBeta) < 0.15**



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