
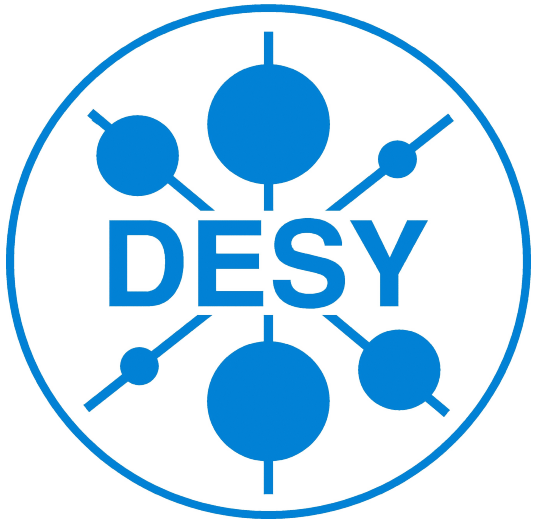


# Measurement of Lepton Efficiencies with early Run2 Data

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***CMS UHH-DESY Meeting, February 10th 2015***

# Introduction

- **LHC Running strategy in 2015**
  - **13 TeV, 50ns, L = $5x10^{33}$ $cm^{-2}s^{-1}$ (PU ~ 30), ~ 1/fb**
  - **13 TeV, 25ns, L = $7x10^{33}$ $cm^{-2}s^{-1}$ (PU ~ 20), ~ 5/fb**
  - **13 TeV, 25ns, L = $1.4x10^{34}$ $cm^{-2}s^{-1}$ (PU ~ 40), ~ 10/fb**
- **Higgs → ττ. Final states : μ+τ , e+τ, τ+τ, e+μ**
- **DESY group plans to analyze e+μ final state**
- **Triggers for the e+μ analysis**
  - **Early data (Run1 legacy triggers)**
    - **HLT_Mu8_Ele17_CaloIdT_CaloIsoVL_TrkIdVL_TrkIsoVL_v***
    - **HLT_Mu17_Ele8_CaloIdT_CaloIsoVL_TrkIdVL_TrkIsoVL_v***
  - **Bulk of data (25 ns, PU 40, 10/fb)**
    - **HLT_Mu8_TrkIsoVVL_Ele23_CaloIdL_TrackIdL_IsoVL_v1**
    - **HLT_Mu23_TrkIsoVVL_Ele12_CaloIdL_TrackIdL_IsoVL_v1**
- **This talk focuses on measurements of leptons efficiencies with early data (25 ns, PU 20, 5/fb)**

# Monte Carlo Study

- **“toy” study with Phys14 MC sample**

  **/DYJetsToLL_M-50_13TeV-madgraph-pythia8/Phys14DR-PU20bx25_PHYS14_25_V1-v1/AODSIM**
- **Number of generated events ~ 3M**
- **Cross section ~ 6000 pb**
- **Corresponding luminosity ~ 500 1/pb**
- **Analysis is done with CMSSW_722**
- **Physics objects used**
  - **reco::Muon**
  - **reco::egmGsfElectron**

# Electron ID and Isolation

- **Electron Id and isolation from Run1 analyses**

**https://twiki.cern.ch/twiki/bin/viewauth/CMS/HiggsToTauTauWorkingSummer2013**

- **no missing inner hits**
- **conversion veto**

```
bool has_match = ConversionTools::hasMatchedConversion(*(iter),
                                hConversions, beamspot->position(), true, 2.0, 1e-6, 0);
```

- **New MVA Id (trained with Phys14 MC)**

**https://twiki.cern.ch/twiki/bin/viewauth/CMS/EgammaIDRecipesRun2**

- **Tight MVA Id (old WP)**

**https://twiki.cern.ch/twiki/bin/viewauth/CMS/HiggsToTauTauWorkingSummer2013**

  - **not yet optimized**

- **dxy < 0.02 cm, dz < 0.2 cm**
- **delta-beta corrected PFlow isolation**

  - **Relative Isolation < 0.15**

# Muon ID and Isolation

- **Muon Id and isolation from Run1 analyses**

https://twiki.cern.ch/twiki/bin/viewauth/CMS/HiggsToTauTauWorkingSummer2013

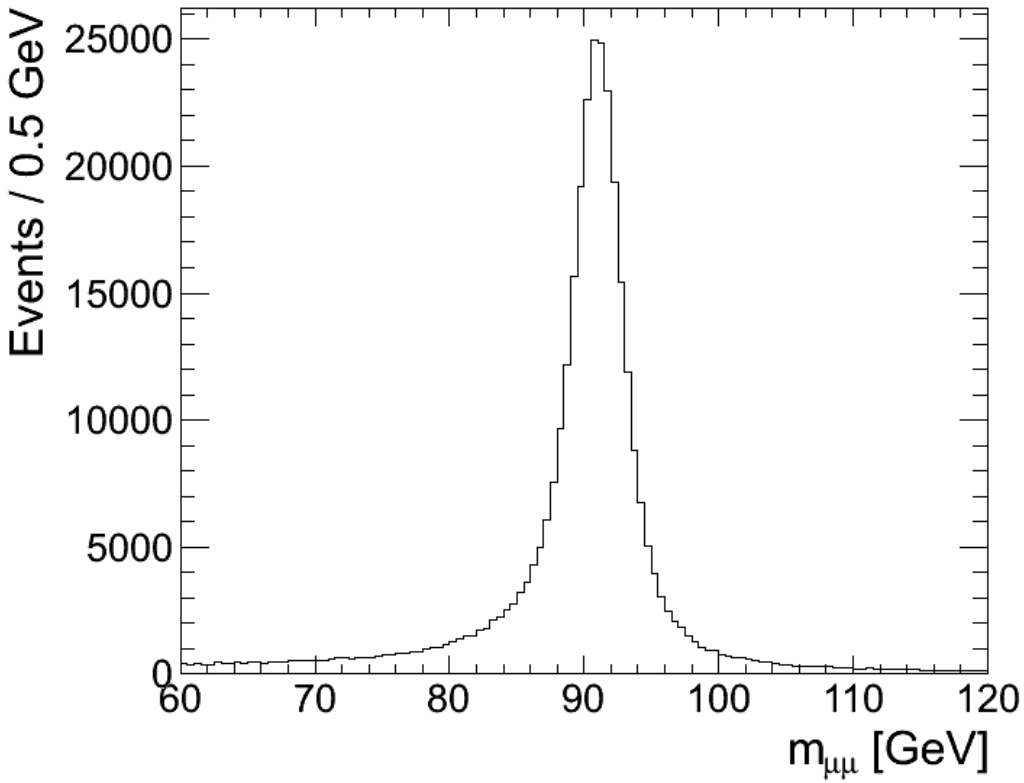
- **Tight Muon Id**
  - **PFlow && Global**
  - **Number of tracker hits ≥5**
  - **Number of pixel hits ≥1**
  - **Number of muon stations ≥2**
  - **Number of muon hits ≥1**
  - **Chi2 / ndof < 10**
- **dxy < 0.02 cm, dz < 0.2 cm**
- **delta-beta corrected PFlow isolation**
  - **Relative Isolation < 0.15**

# Measurements of Lepton Id and Iso

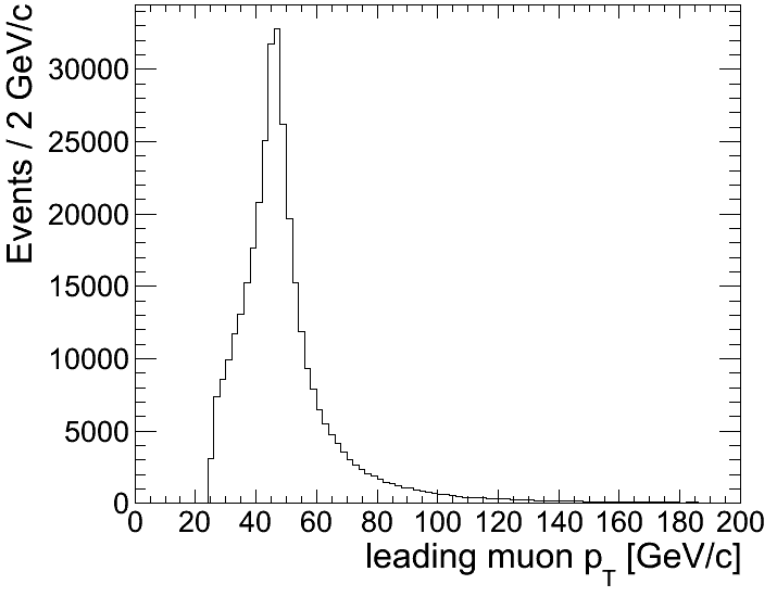
- **Tag-&-probe with Z → μμ**
- **Monitor trigger**
  - **HLT_IsoMu24_eta2p1_IterTrk02_v1**
- **Tag muon →**
  - **matches trigger object (dR<0.3)**
  - **Passes muon Id**
  - **pt > 25 GeV/c, eta < 2.1**
- **Tag-&-probe with Z → ee**
- **Monitor trigger**
  - **HLT_Ele27_eta2p1_WP85_Gsf_v1**
- **Tag electron →**
  - **Matches trigger object (dR < 0.3)**
  - **Passes tight electron Id**
  - **pt > 30 GeV/c, eta < 2.1**

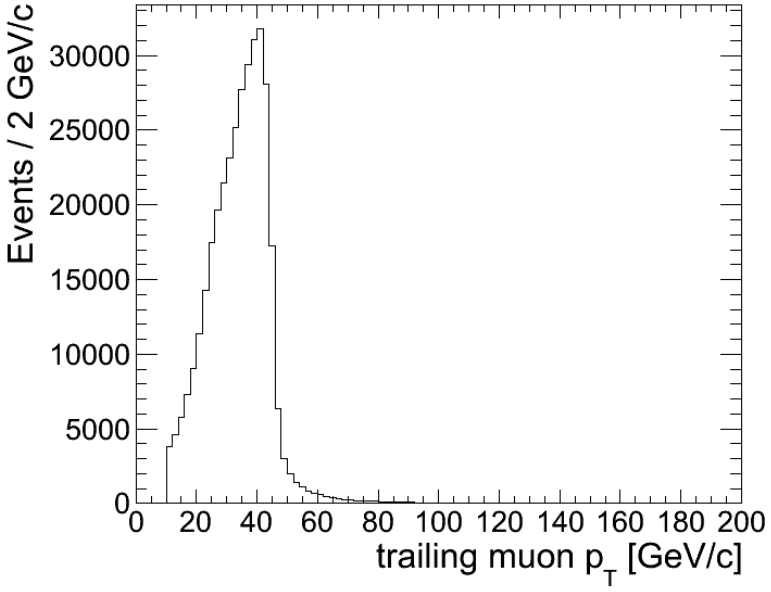
# Sanity checks (muons)

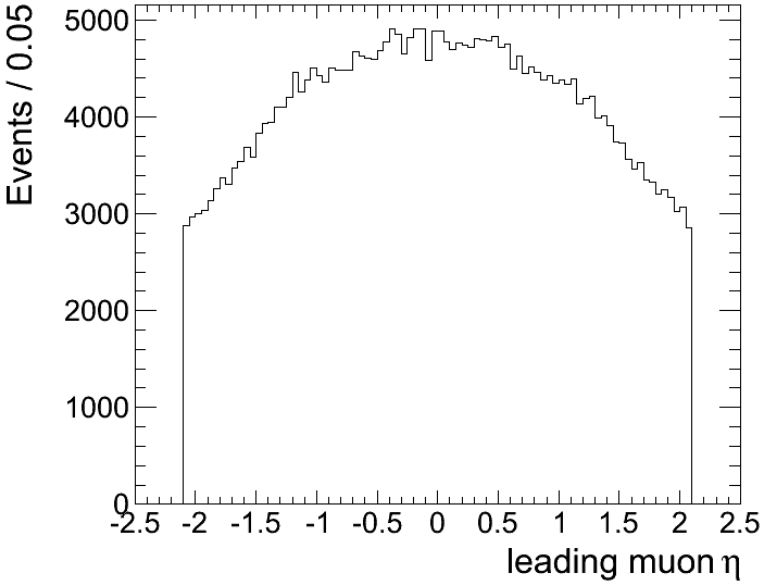
- **Leading muon pt > 25, eta < 2.1 matched trigger object, passes TighMuonId and Iso**
- **Trailing muon pt > 10, eta < 2.1, passes TightMuonId and Iso**

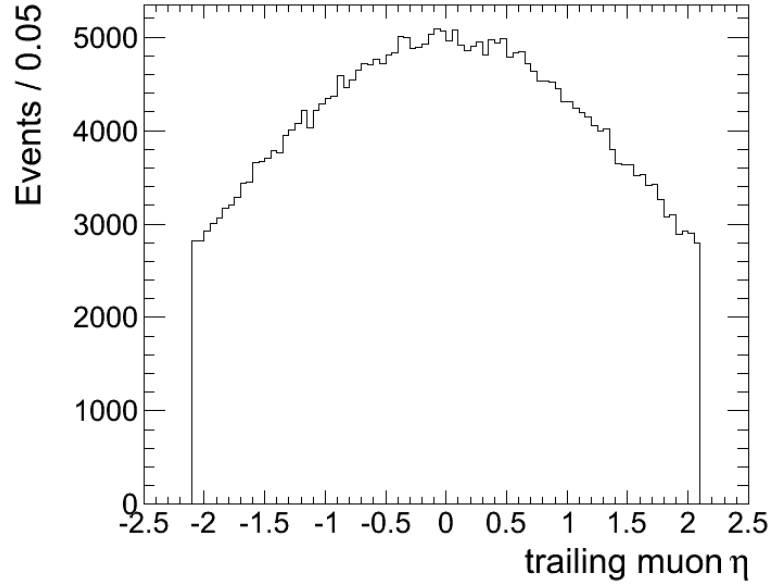


# Sanity checks (muons)



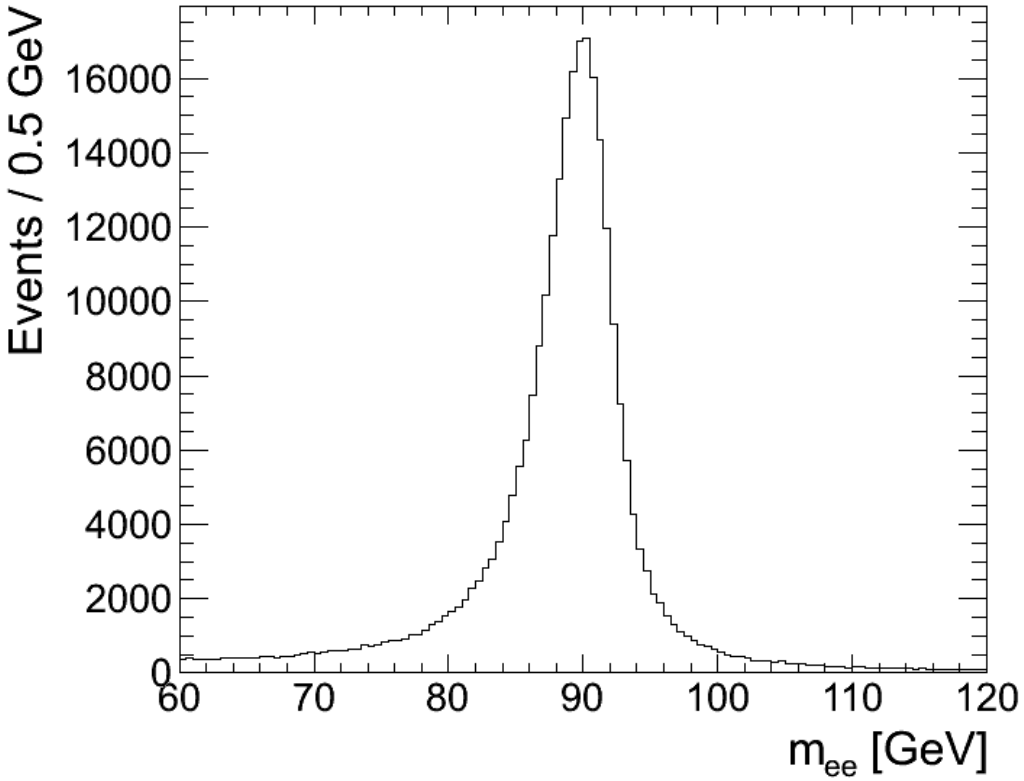



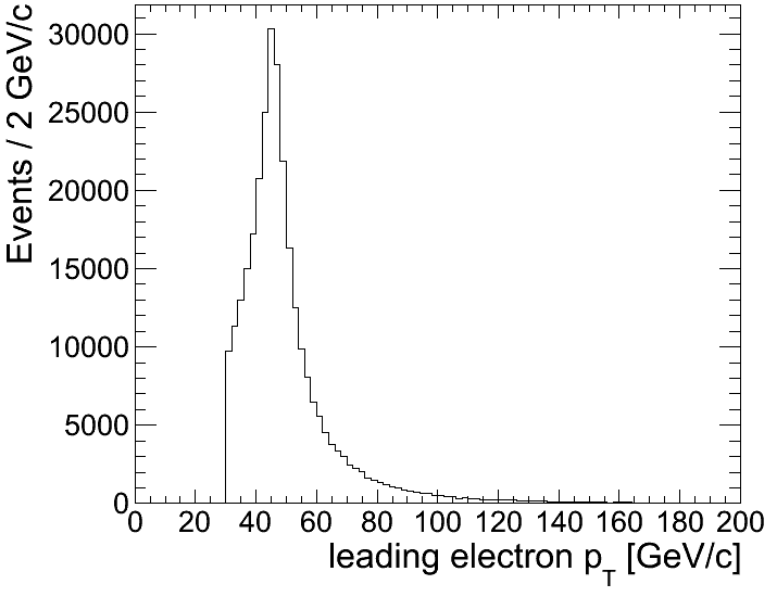



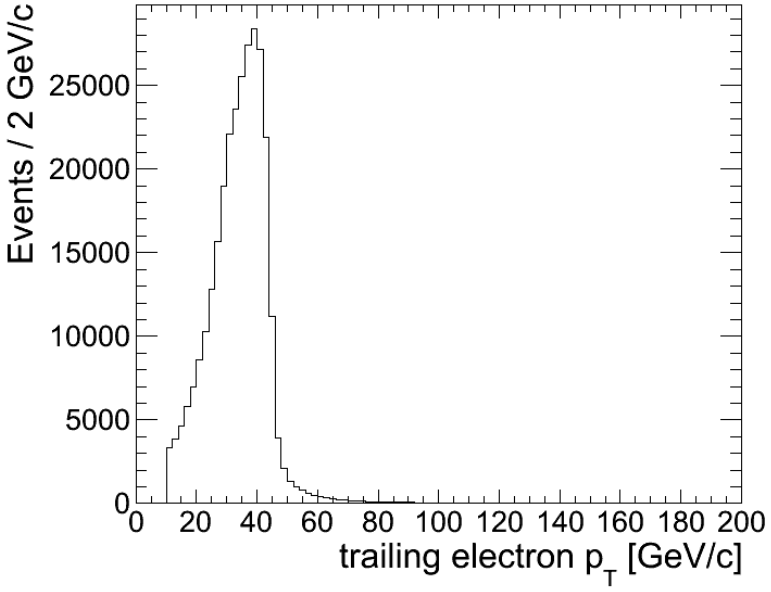
# Sanity checks (electrons)

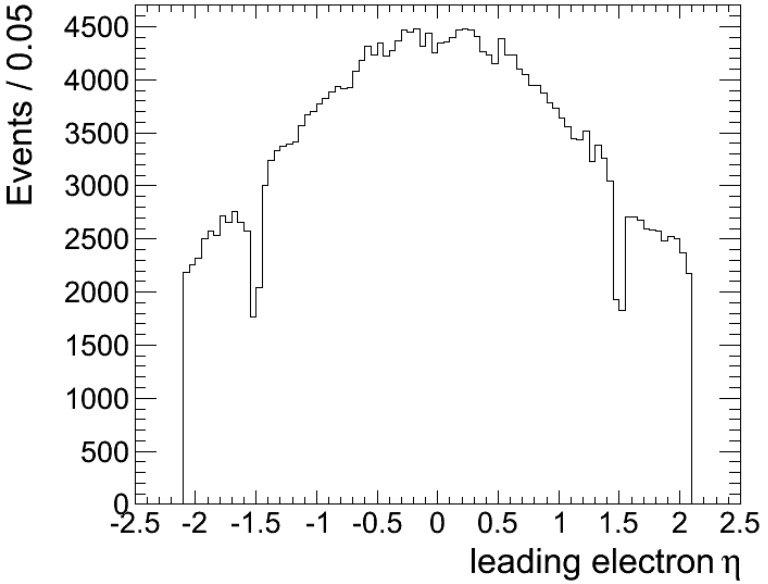
- **Leading electron pt > 25, eta < 2.1 matched trigger object, passes tight Electron Id and Iso**
- **Trailing electron pt > 10, eta < 2.1, passes Tight electron Id and Iso**

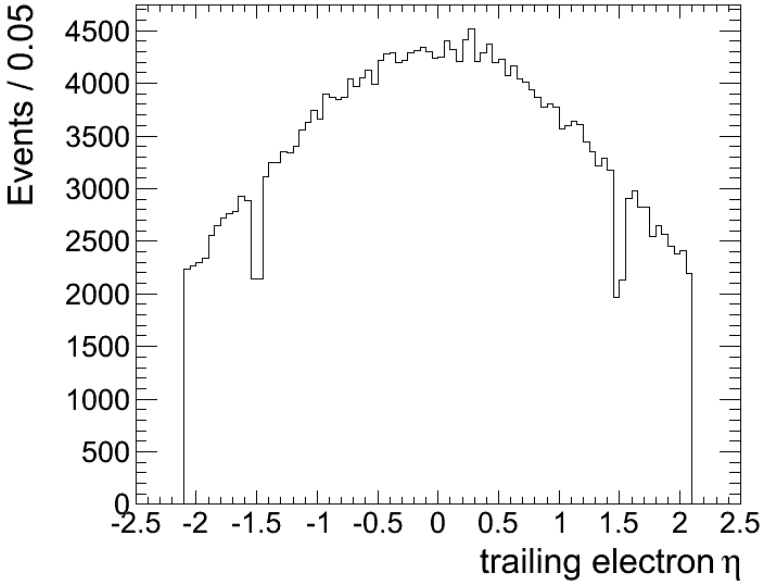


# Sanity checks (electrons)



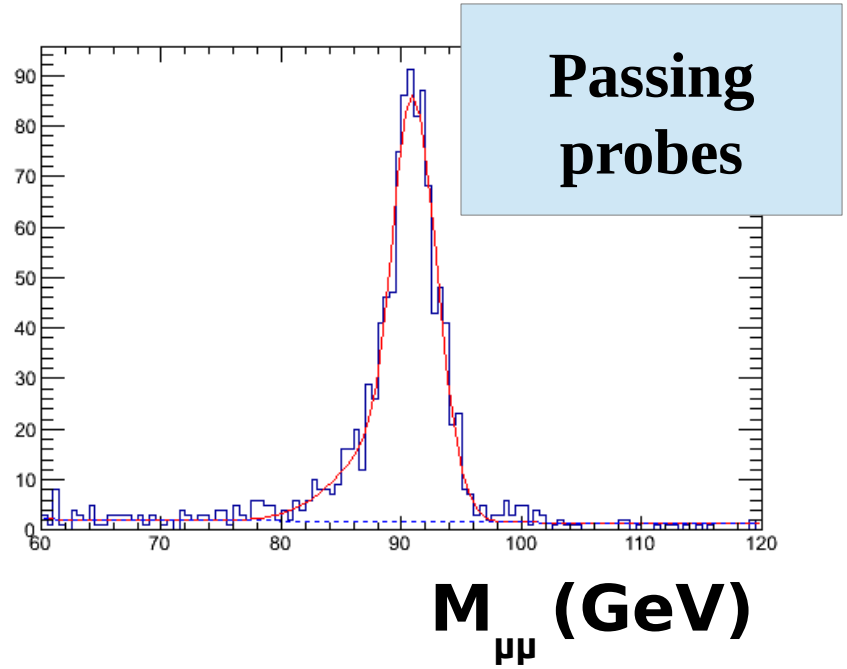



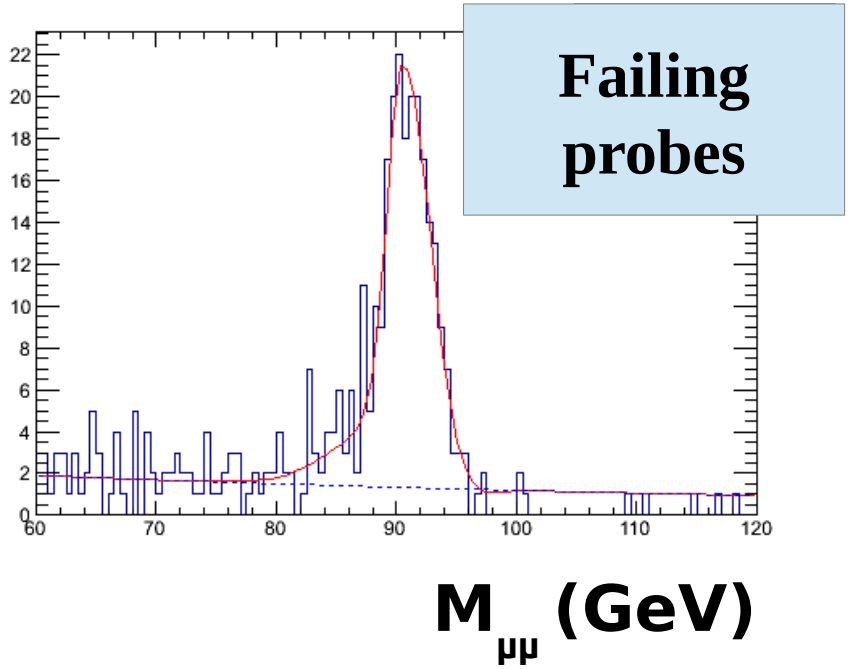
# Tag-and-probe measurements

**“Measuring” Muon Id + Iso efficiency**

**Probed Muon : 15 < pt < 20 GeV/c, endcap**

**Statistics in plots corresponds to L = 0.5/fb**

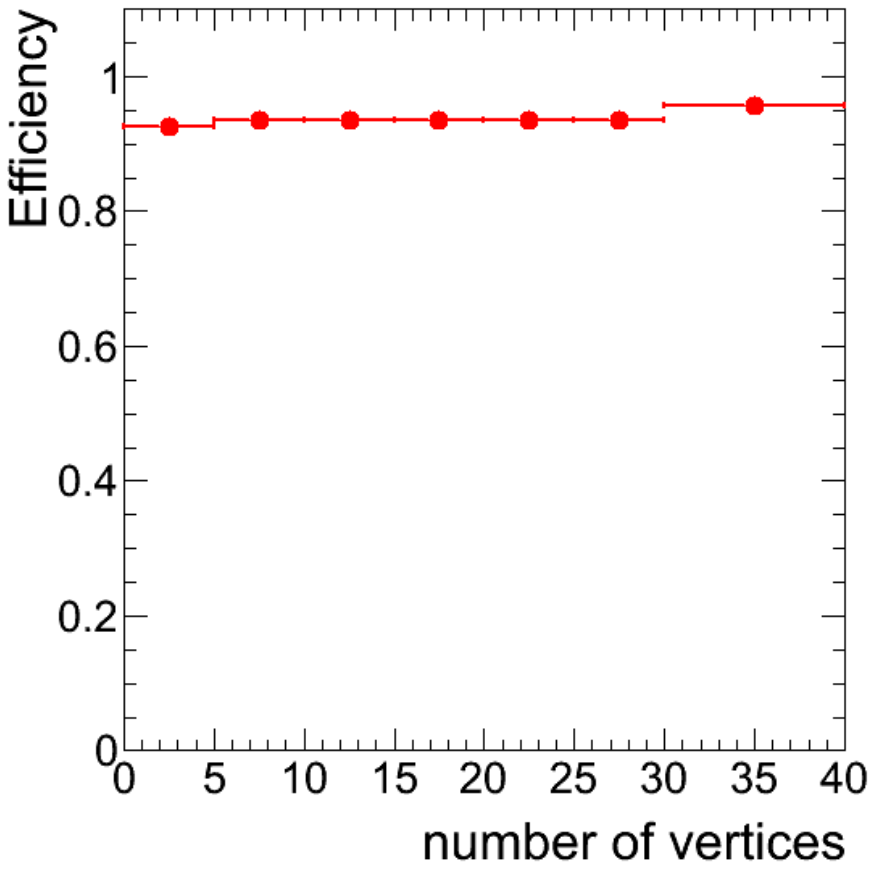


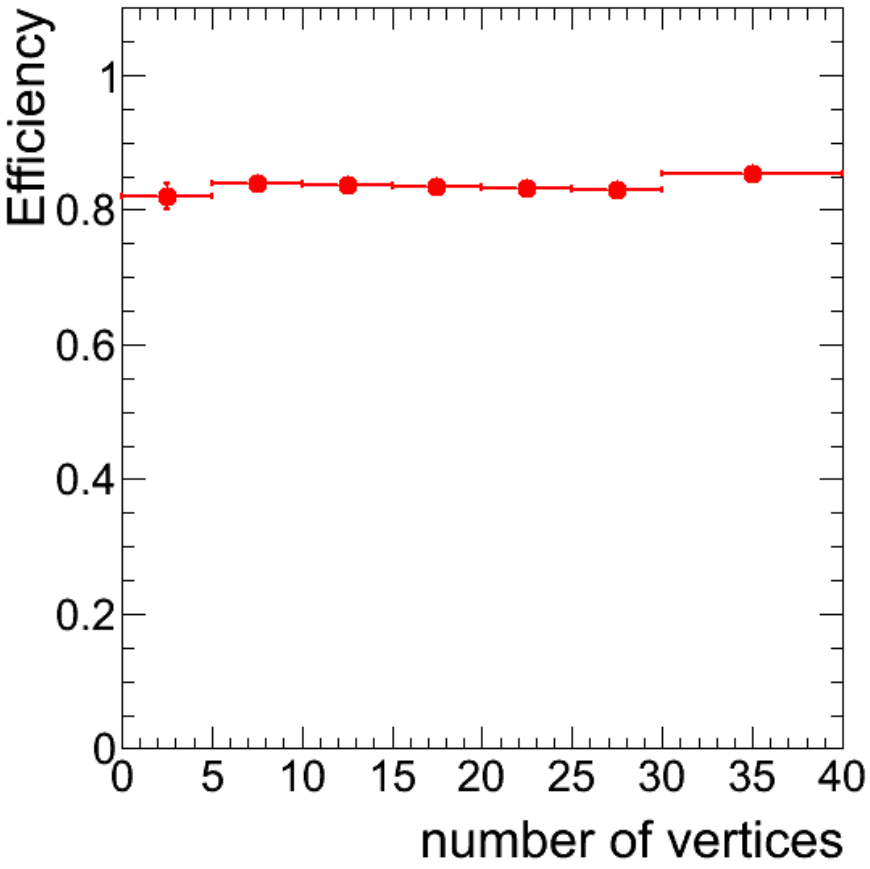

With luminosity of 5/fb efficiency can be measured with statistical accuracy better than 0.5% in all (pt,eta) bins

# Muon Id + Isolation Efficiency

## Muon Iso efficiency



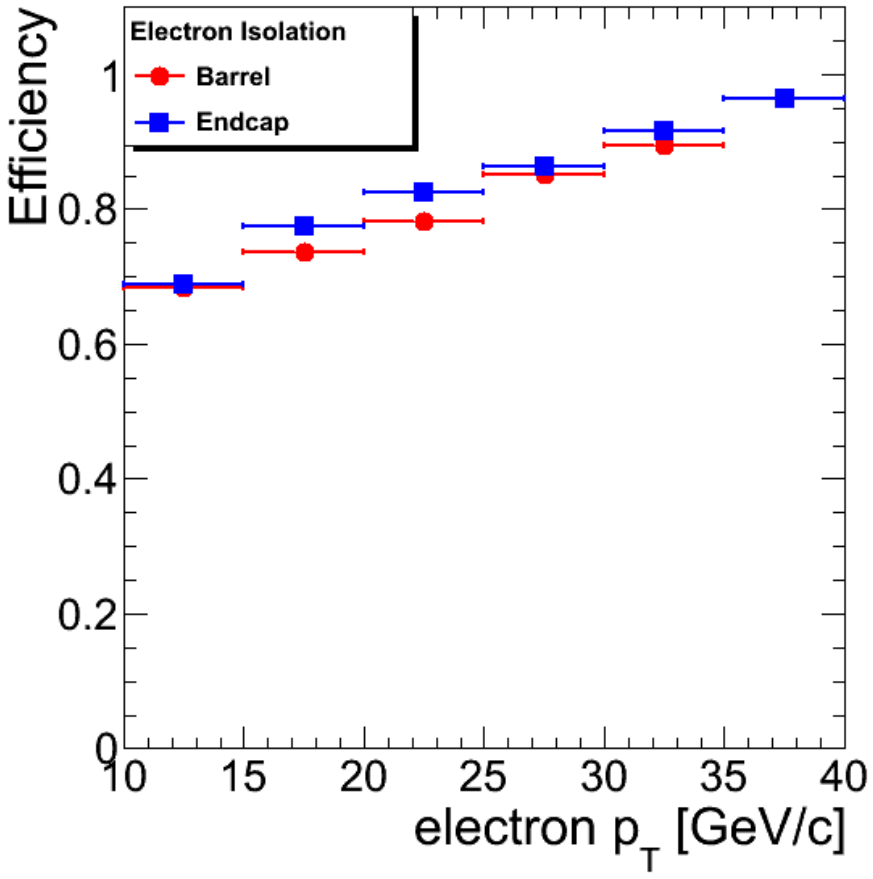

## Muon Id + Iso efficiency



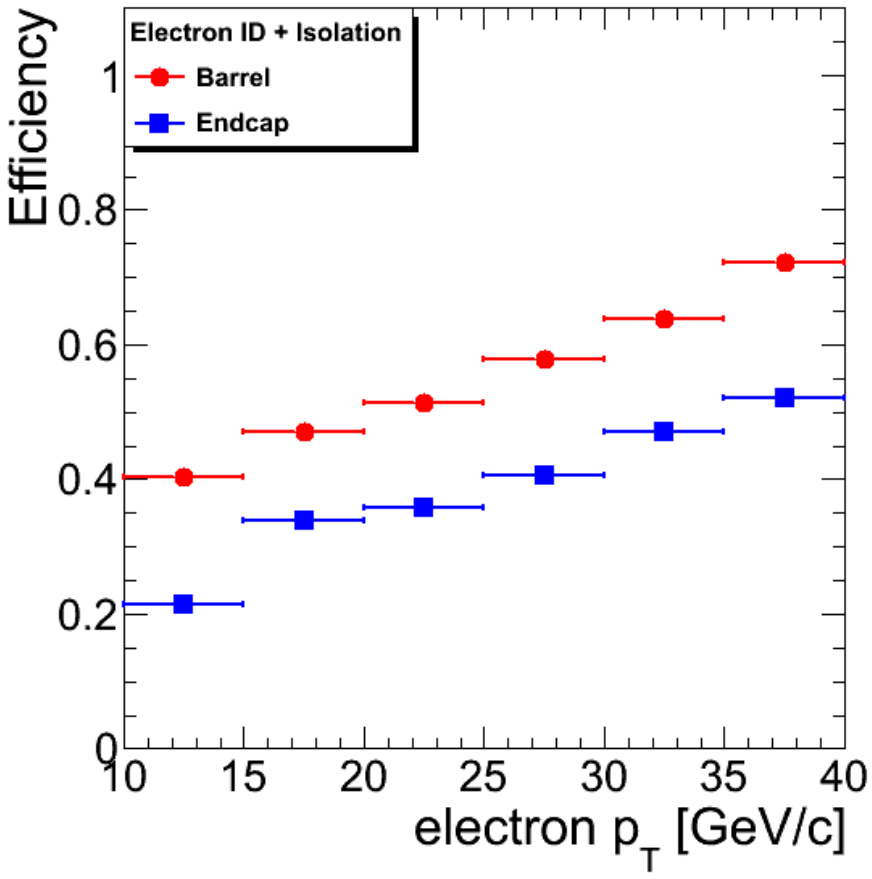

**Efficiencies comparable to those in Run2012ABCD**

# Electron Id + Isolation Efficiency

## Ele Iso efficiency



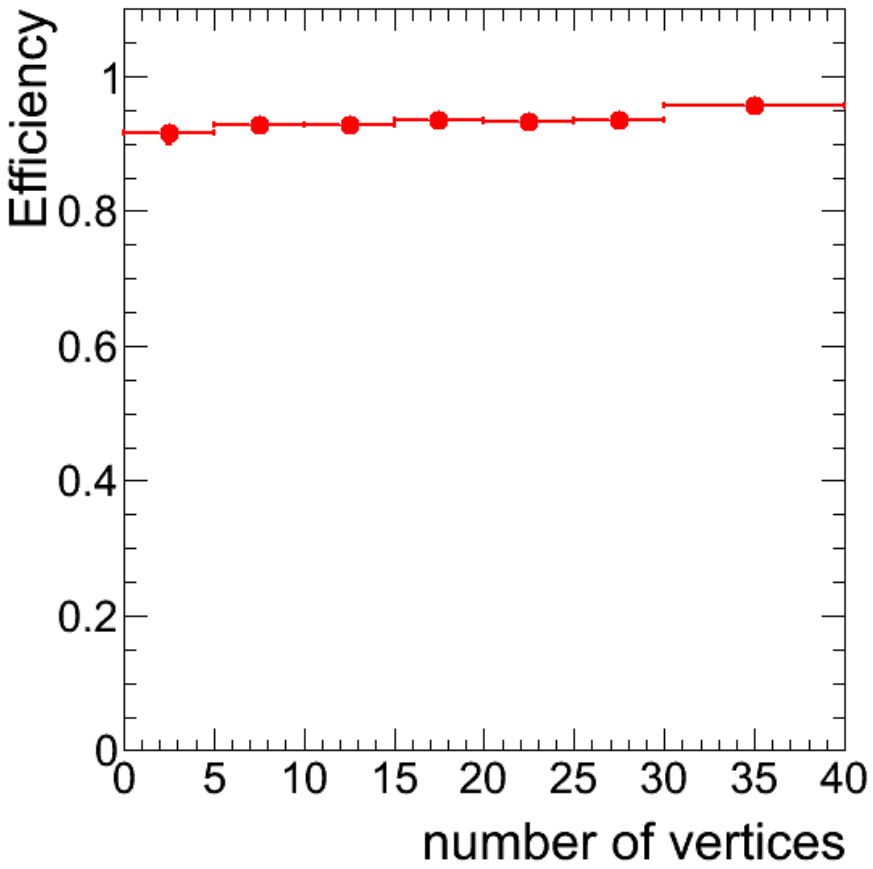

## Ele Id + Iso efficiency



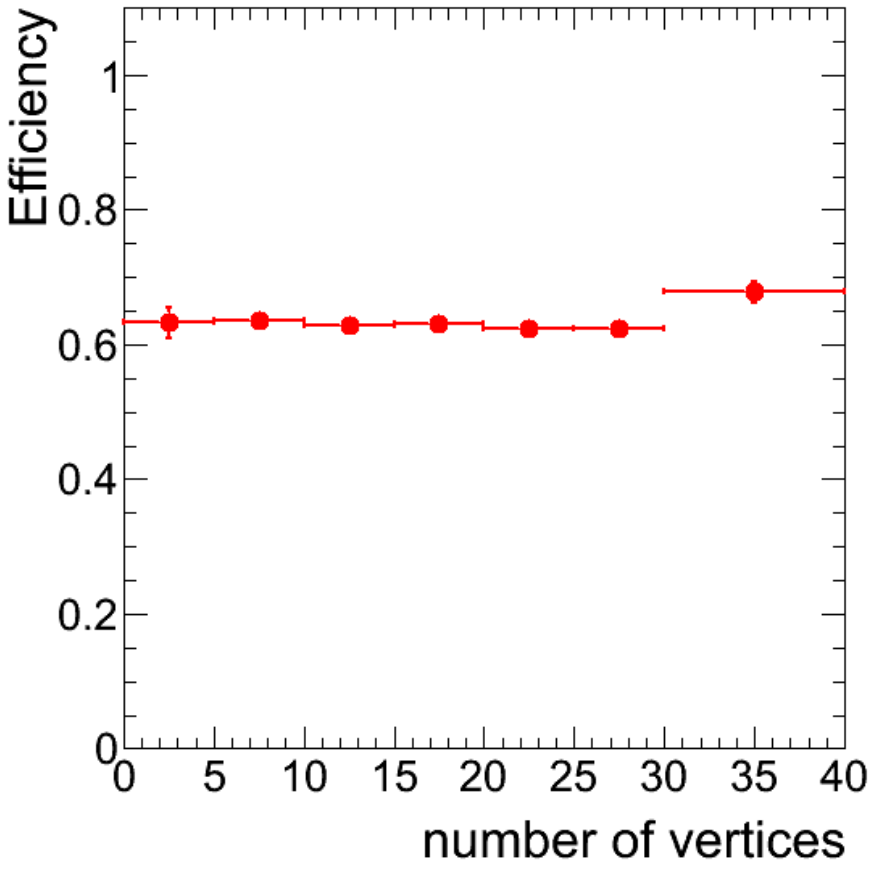

**Somewhat lower efficiency compared to Run2012ABCD (Note MVA Id not yet optimized)**

# Electron Id + Isolation Efficiency

## Ele Iso efficiency




## Ele Id + Iso efficiency

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