Comparison between variables produced by HiggsDemoAnalyzer.cc and NanoAnalyzer_ele6.cc

($Z \to \mu\mu$ example)

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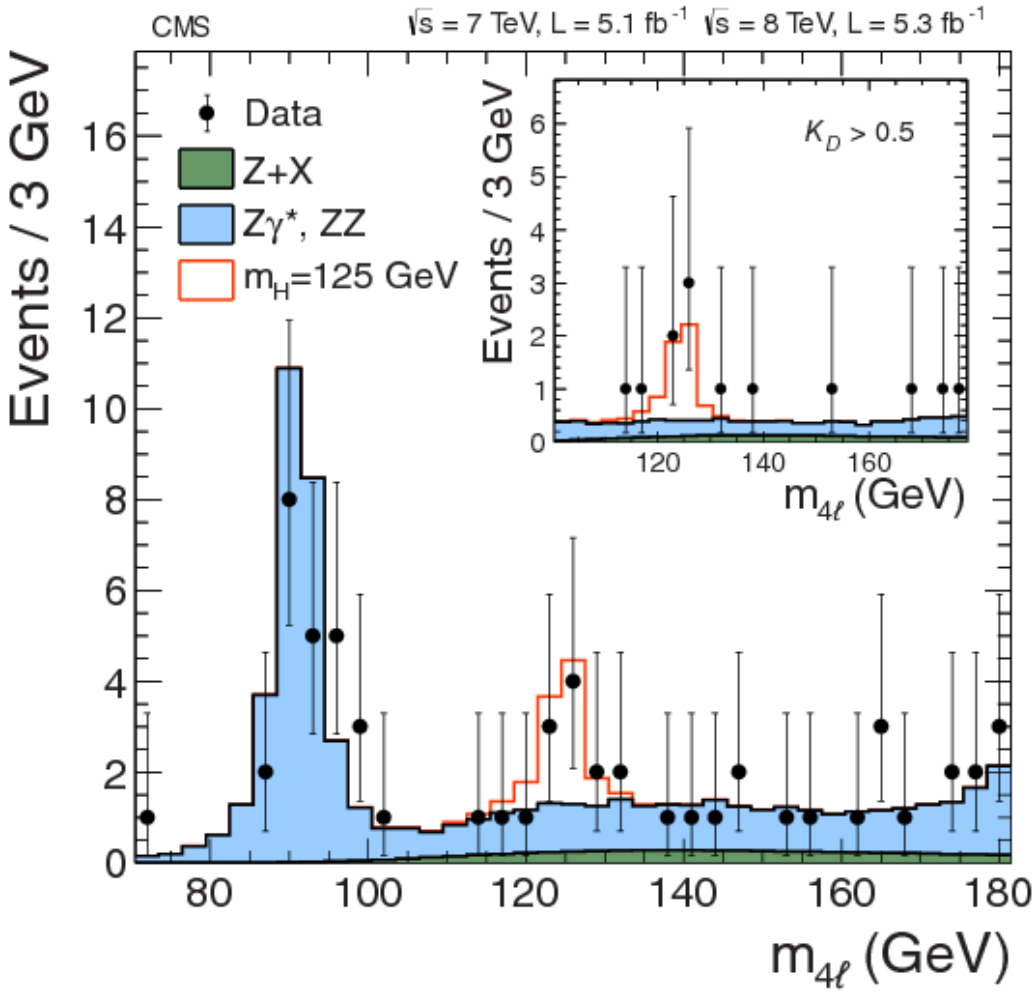
Introduction

- The higgs to four lepton example is already available in the CERN Open Data Portal, but it requires a CMSSW environment to be executed.
- In this context, the code in HiggsDemoAnalyzer.cc reads the data in AOD format to produce the histograms for the process.
- The next step is to do the same thing using the nanoAOD-like format instead of the AOD. This format is more compact and can be run through ROOT, without using a CMSSW environment.
- The file NanoAnalyzer_ele6.cc produces the nanoAOD-like data that we will use to plot the histograms.

Introduction



Introduction

- The file HiggsDemoAnalyzer.cc produces the .root file DoubleMu11.root, which contains histograms.
- The file NanoAnalyzer_ele6.cc produces the .root file Data11_DoubleMuRunA_ele6.root. This is the nanoAOD-like used to produce histograms. To do so, we implement on it the same cuts as in HiggsDemoAnalyzer.cc.
- The aim at this stage is to see if a set of relevant histograms (variables) are the same or at least similar in the DoubleMu11.root file and in the one produced from Data11_DoubleMuRunA_ele6.root.

Variables and cuts

1. Names of the variables

variable	HiggsDemoAnalyzer.cc	NanoAnalyzer_ele6.cc
PF candidate	itMuon.isPFMuon()	Muon_isPFcand*
PF isolation valid	itMuon.isPFIsolationValid()	Not defined
Global track	(itMuon.globalTrack()).isNonnull()	Muon_isGlobal*
Impact parameter significance	SIP3d_mu***	Muon_sip3d*
Distance in xy to the vertex	(itMuon.globalTrack())− >dxy(point)**	Muon_dxy*
Distance in z to the vertex	(itMuon.globalTrack())− >dz(point)**	Muon_dz*
Relative isolation	relPFIso_mu	Muon_pfRelIso04_all*
Muon pT	itMuon.pt()	Muon_pt*
Muon eta	itMuon.eta()	Muon_eta*
Number of good muons	nGoodRecoMuon	defined during implementation of the cuts
Muon charge	muon.charge()	Muon_charge*

* Defined in Data11_DoubleMuRunA_ele6.root.

** point=primary vertex

*** Defined with only global muon information

Variables and cuts

2. Cuts (the cuts from HiggsDemoAnalyzer.cc are implemented in the variables defined in the nanoAOD to reproduce the histograms unless any cut inside NanoAnalyzer_ele6.cc is not compatible)

variable	HiggsDemoAnalyzer.cc	NanoAnalyzer_ele6.cc
PF candidate	true	none
PF isolation valid	true	none
Global track	true	none
Impact parameter significance	$\in [-4., 4.]$	none
Distance in xy to the vertex	$\in [-0.5, 0.5]$	none
Distance in z to the vertex	$\in [-1., 1.]$	none
Relative isolation	< 0.4	none
Muon pT	$> 5.$	none
Muon eta	$\in [-2.4, 2.4]$	none
Number of good muons	≥ 2	none
Muon charge	muon1.charge() + muon2.charge() = 0	none

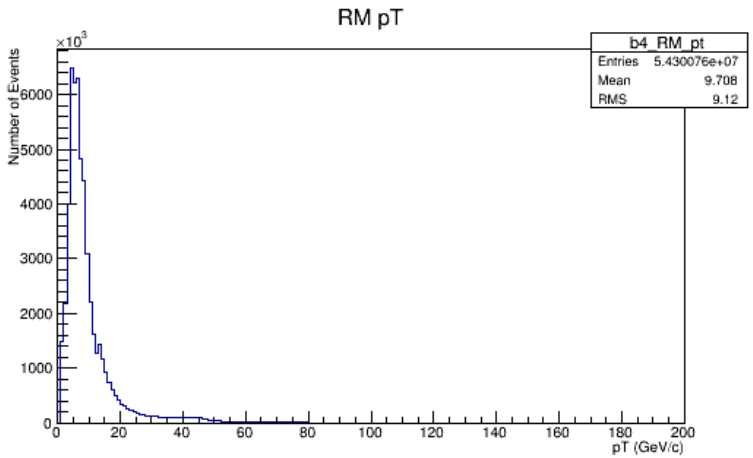
A cuts

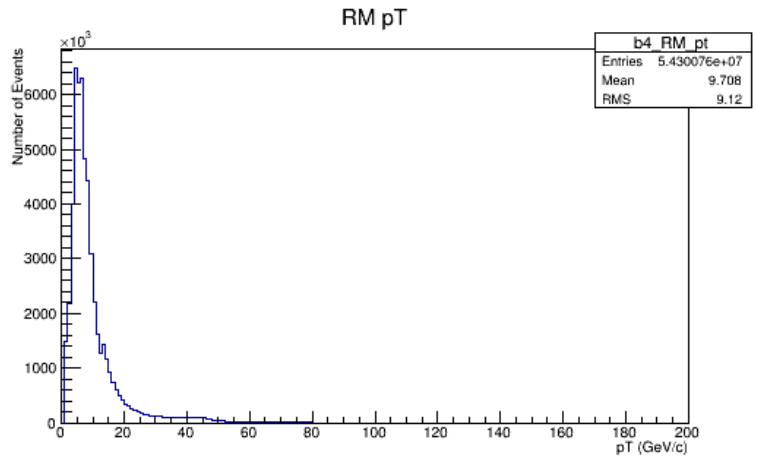
B cuts

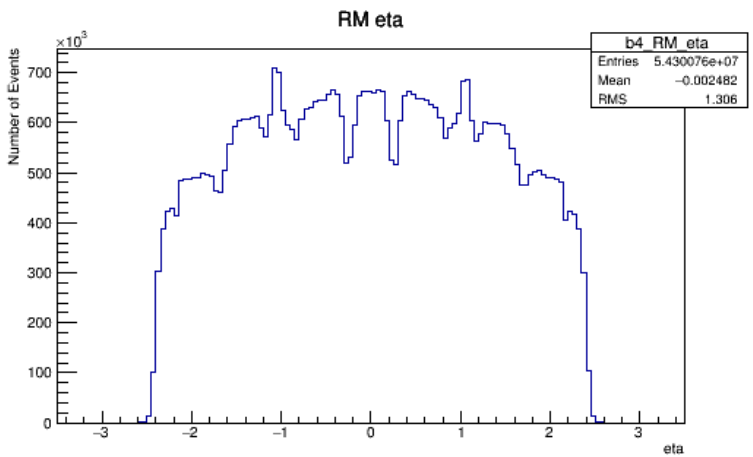
The muons are sorted from highest to lowest pT in all cases.

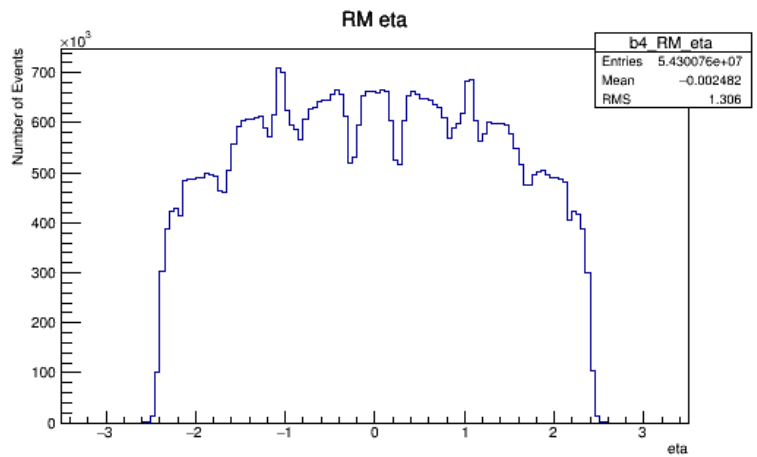
Results

Histograms from DoubleMu11.root (left) vs histograms from Data11_DoubleMuRunA_ele6.root (right) with the A cuts.



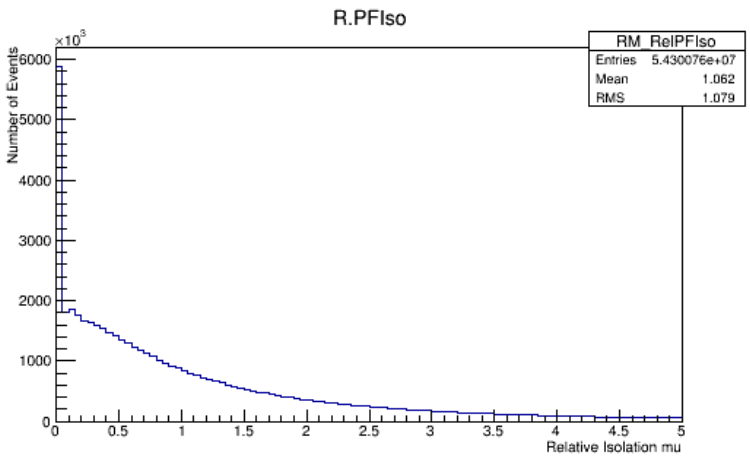


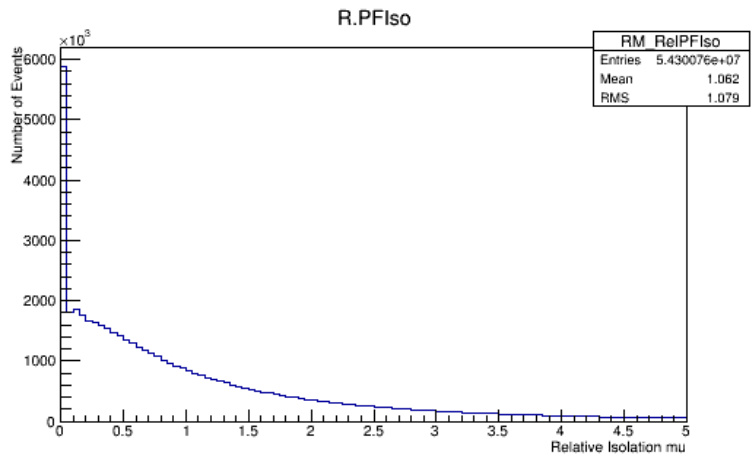




Results

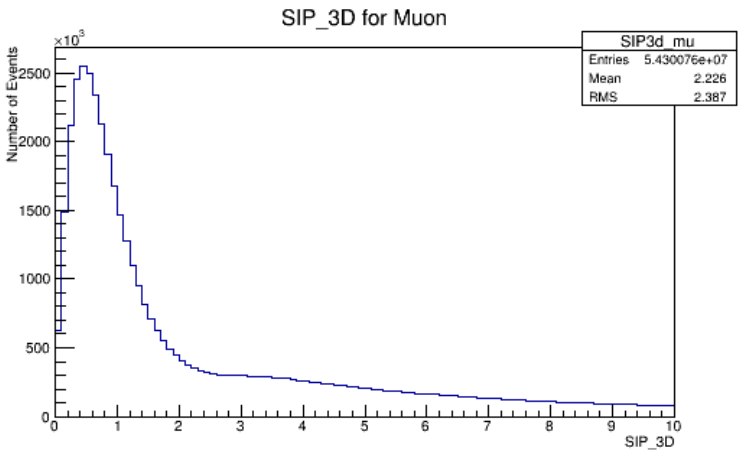
Histograms from DoubleMu11.root (left) vs histograms from Data11_DoubleMuRunA_ele6.root (right) with the A cuts.

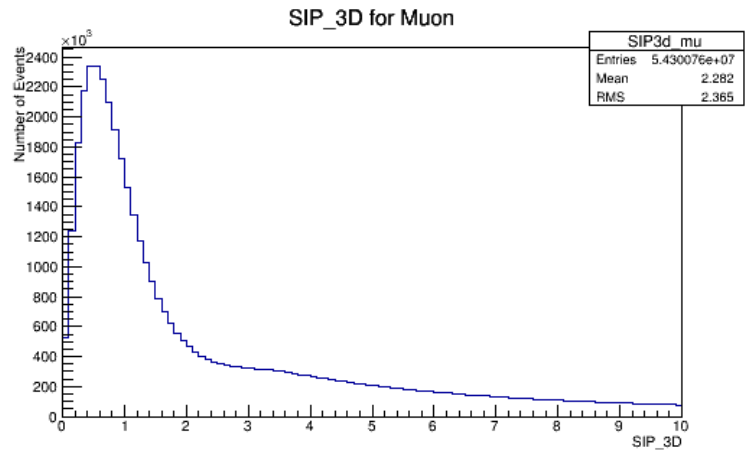


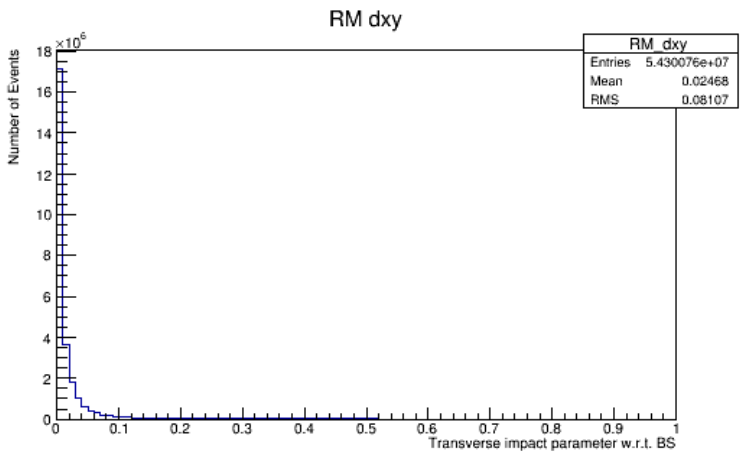


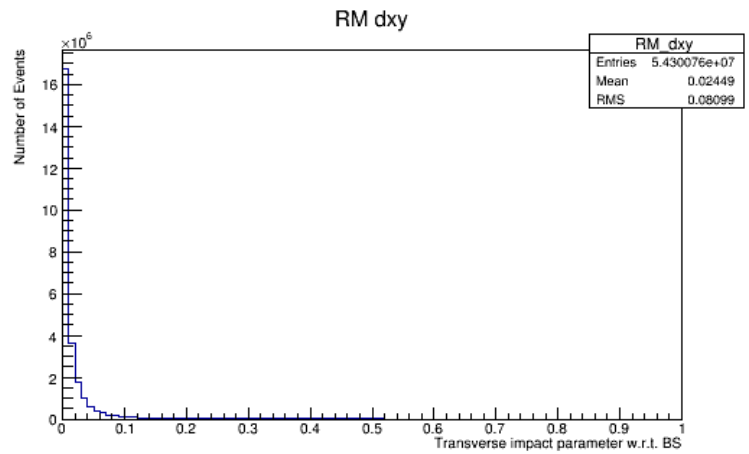
Results

Histograms from DoubleMu11.root (left) vs histograms from Data11_DoubleMuRunA_ele6.root (right) with the A cuts.



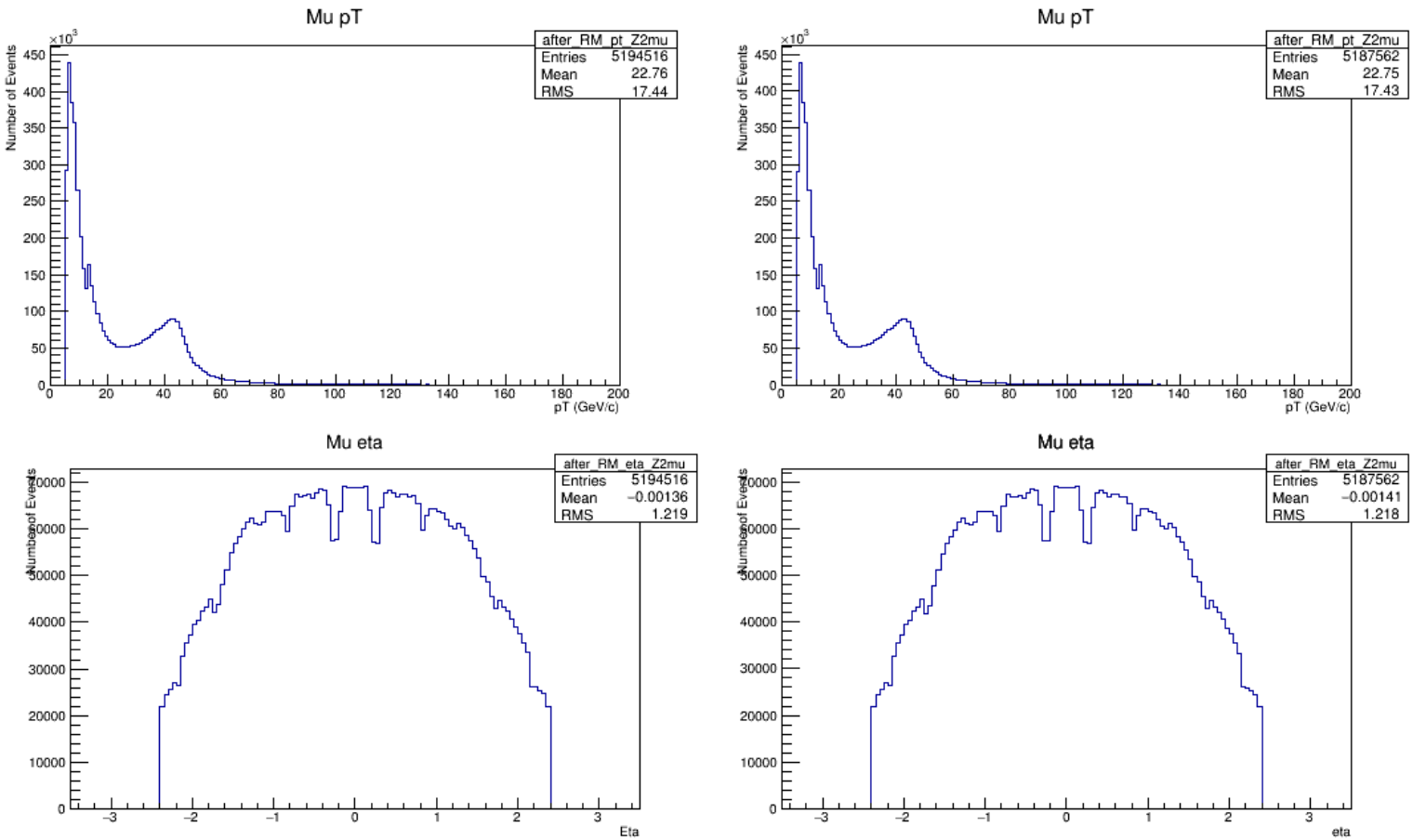






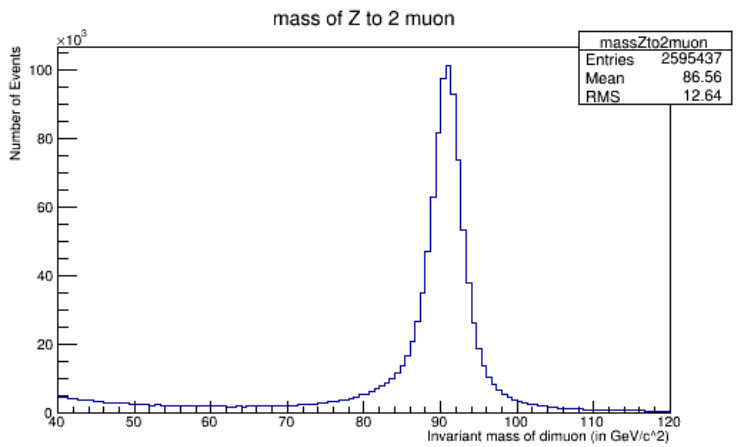
Results

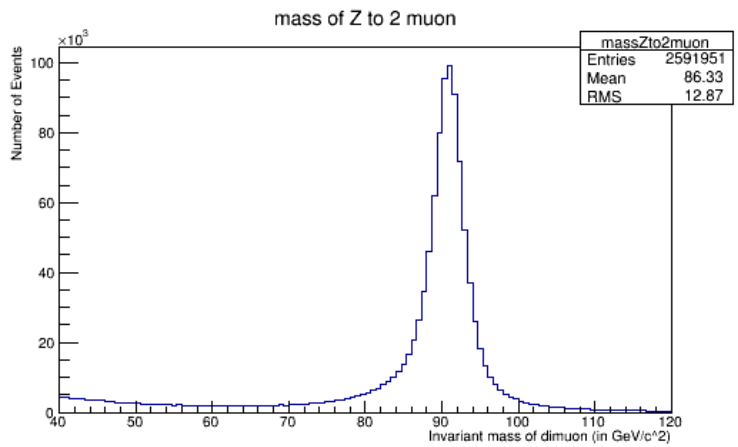
Histograms from DoubleMu11.root (left) vs histograms from Data11_DoubleMuRunA_ele6.root (right) with the A cuts and B cuts.



Results

Histograms from DoubleMu11.root (left) vs histograms from Data11_DoubleMuRunA_ele6.root (right) with the A cuts and B cuts.





Conclusions

- The cut in the variable itMuon.isPFIsolationValid() does not seem relevant since the pT, eta and relative isolation of both files after applying the A cuts match.
- The impact parameter significance and the distance in xy to the vertex are different in both sets of histograms. This can be due to the use of global muons in HiggsDemoAnalyzer.cc, which is not specified in NanoAnalyzer.cc. These variables are related to the B cuts, so the pT and eta after the cuts and the invariant mass of the two muons will not match.
- The histograms that do not match do not differ too much.