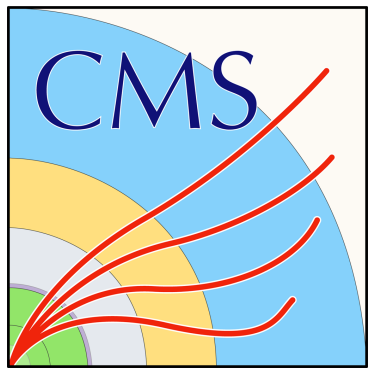
Electron variables for nanoAODplus

N. Z. Jomhari, A. Geiser

nano meeting
DESY Hamburg

October 24, 2019



Introduction

- Based on tentative list [1], my work is mainly on electron variables
- **Main goal**: to implement same/similar definition as official nanoAOD (Run 2)
- Started testing with JSON5 version but now have change to trigfix2 version
- There are already some electron variables in nanoAODplus validated from comparison to 2010 & 2011 Open Data example by Fabian [2] and Paula [3]
- My task is checking/adding new electron variables correspond to nanoAOD
- **Strategy**: testing on both Run1 and Run2 for each implemented variables
- There are **three different cases** to implement electron variables for nanoAODplus (Run1):
  - 1. the variable has the roughly same definition as nanoAOD
  - 2. the variable has different definition as nanoAOD
  - 3. variable extension for nanoAODplus

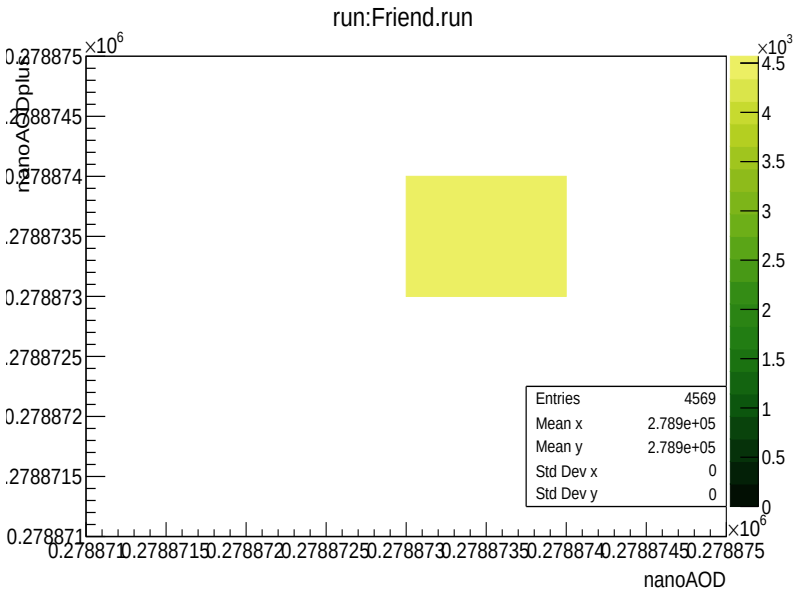
*same/different definition = the method to call the variable

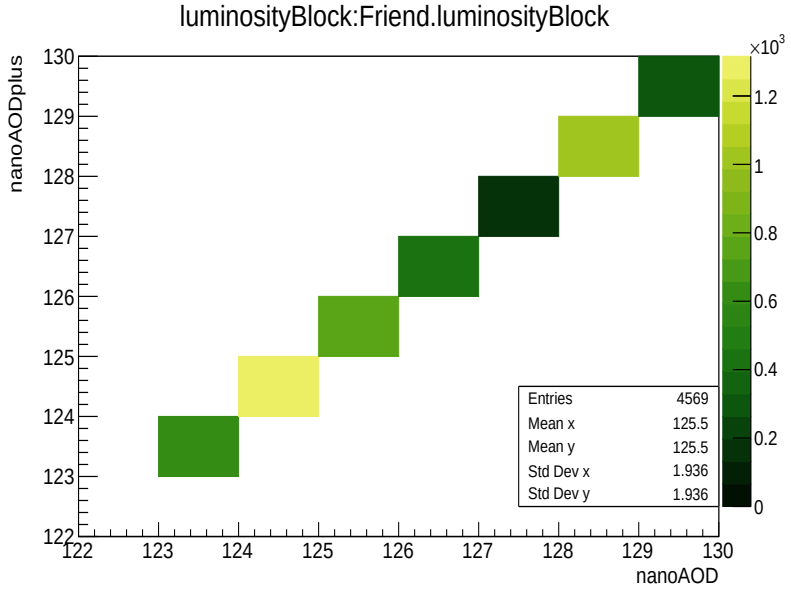
Run 2	nanoAOD	miniAOD	AOD
dataset	/DoubleEG/Run2016G-22Aug2018-v1/NANOAOD	/DoubleEG/Run2016G-17Jul2018-v1/MINIAOD	/DoubleEG/Run2016G-07Aug17-v1/AOD
GT	94X_dataRun2_v10	94X_dataRun2_v10	80X_dataRun2_2016LegacyRepro_v4
1 rootfile	F2217224-66CD-E811-911B-0025905A60B8.root	1C71A796-7999-E811-AC40-68CC6EA5BE82.root	5E3C9D63-16A1-E711-A76F-3417EBE2F0DF.root
Run #	278873	278873	278873
Lumi sec.	[123,129]	[123,129]	[123,129]
Purpose	Use to compare with nanoAODplus	For test: haven't done yet	For test: did on CMSSW_8_0_29

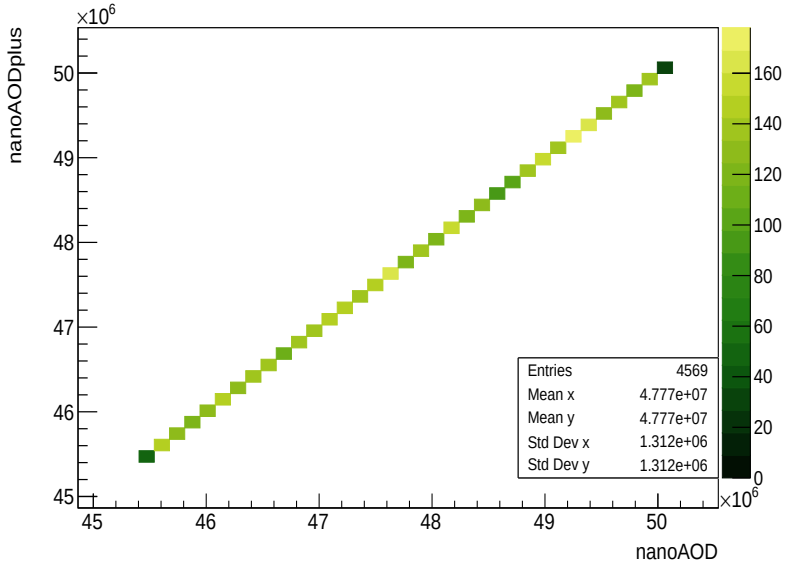
Run 1	2011	2010
dataset	/DoubleElectron/Run2011A-12Oct2013-v1/AOD	/Electron/Run2010B-Apr21ReReco-v1/AOD
GT	FT_53_LV5_AN1::All	FT_R_42_V10A::All
1 rootfile	root://eospublic.cern.ch//eos/opendata/cms/Run2011A/DoubleElectron/AOD/12Oct2013-v1/20000/003EF6D5-B83E-E311-8157-003048D42D92.root	root://eospublic.cern.ch//eos/opendata/cms/Run2010B/Electron/AOD/Apr21ReReco-v1/0000/000E4FCB-596E-E011-A0BB-00304867BF18.root
Run #	All events in that file that passed JSON	All events in that file that passed JSON
Lumi sec.	All events in that file that passed JSON	All events in that file that passed JSON
Purpose	For test: did on CMSSW_5_3_32	For test: did on CMSSW_4_2_8 in VM

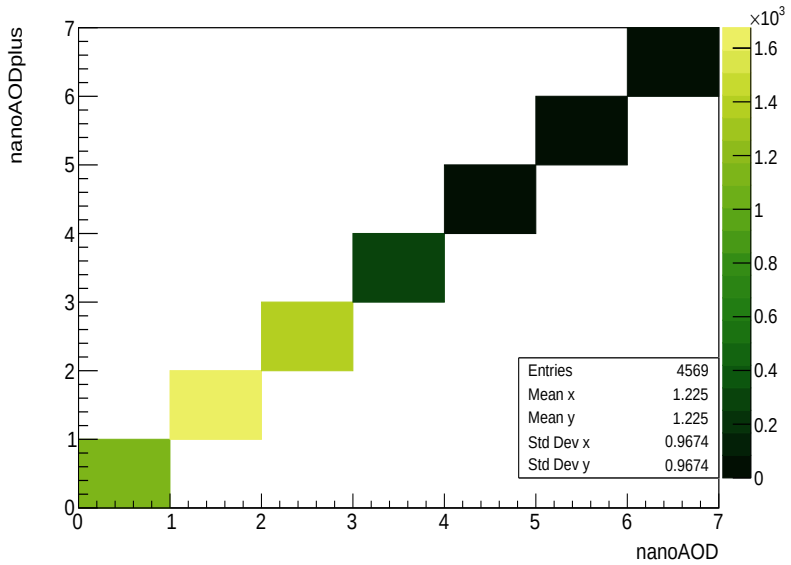
Current status

run, lumi, event, nElectron

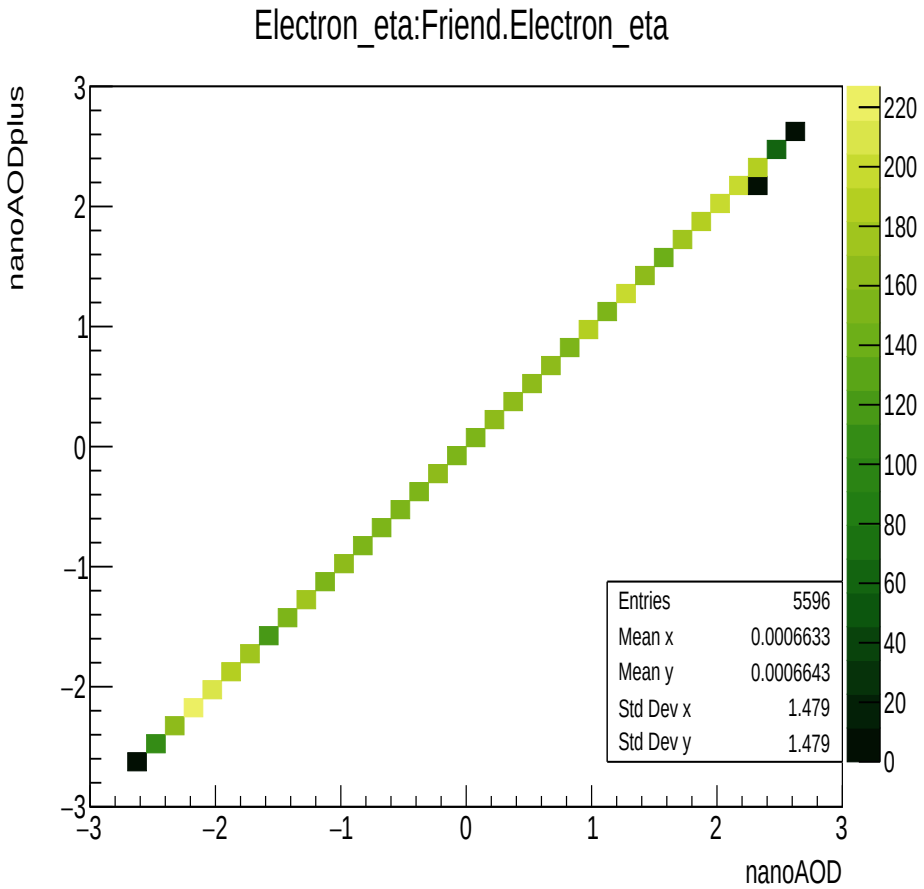




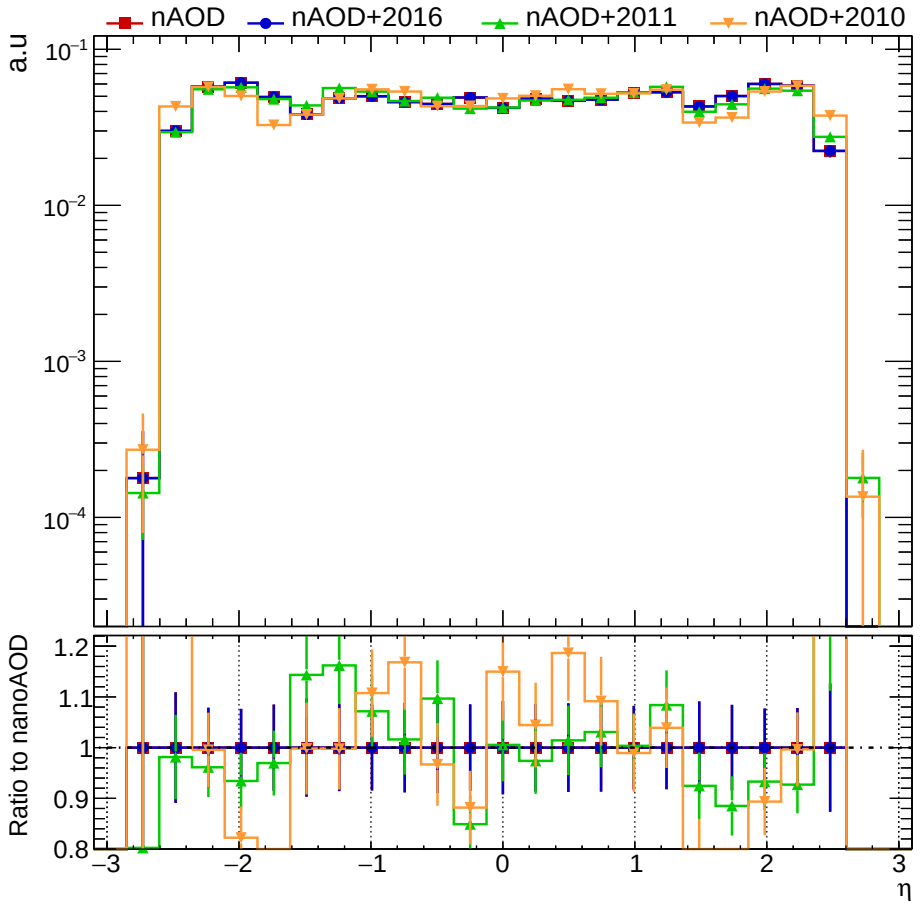




1^{st} case (roughly same definition) Eg. η

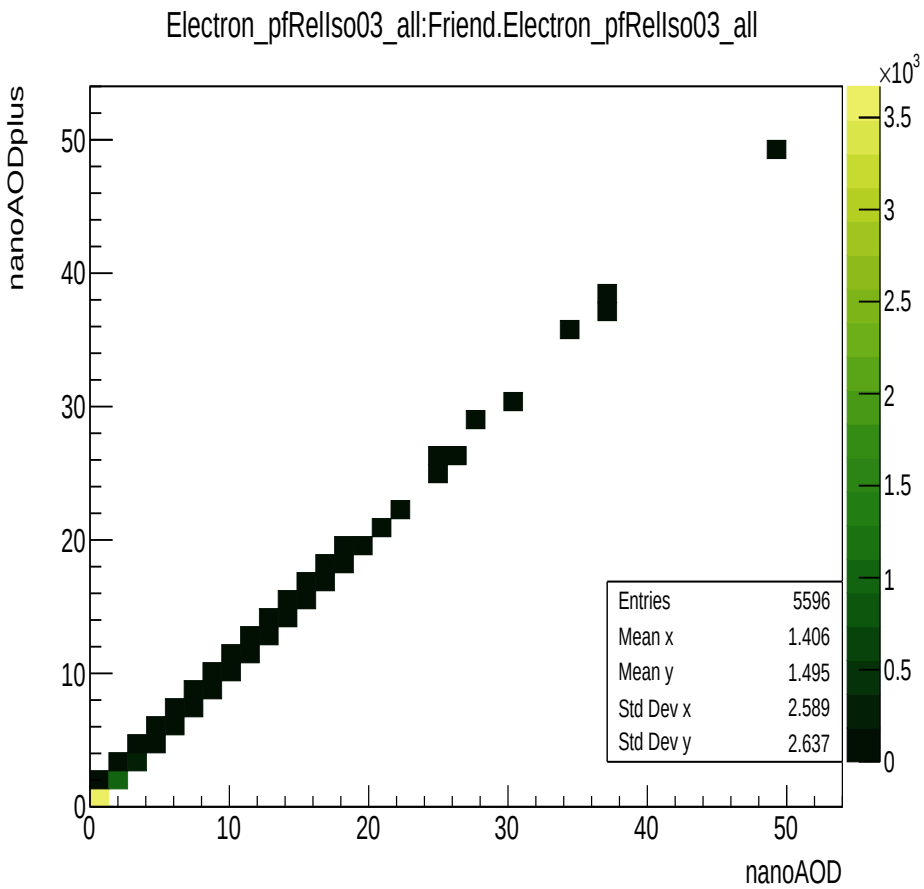


Event by event plot between nanoAOD and nanoAODplus Run2 agrees

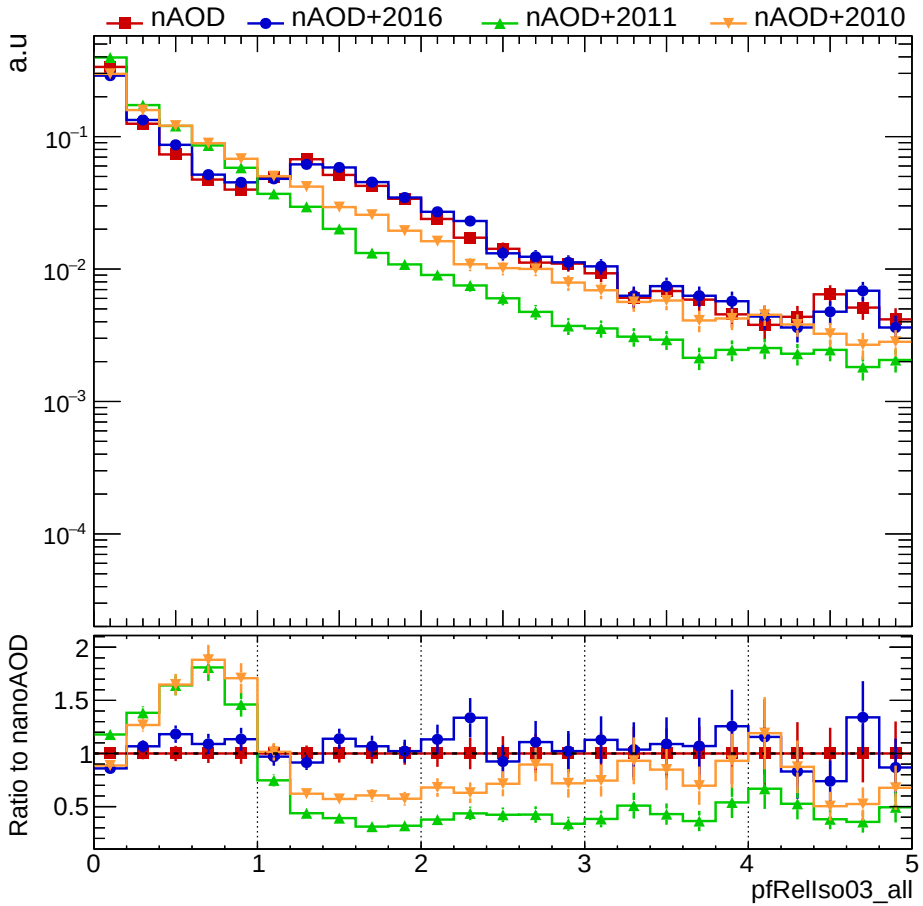


Shape comparison between nanoAOD and nanoAODplus Run2 & Run1. Uncer. large due to diff. in detector

1^{st} & 2^{nd} case (different definition) Eg. pfRelIso03_all

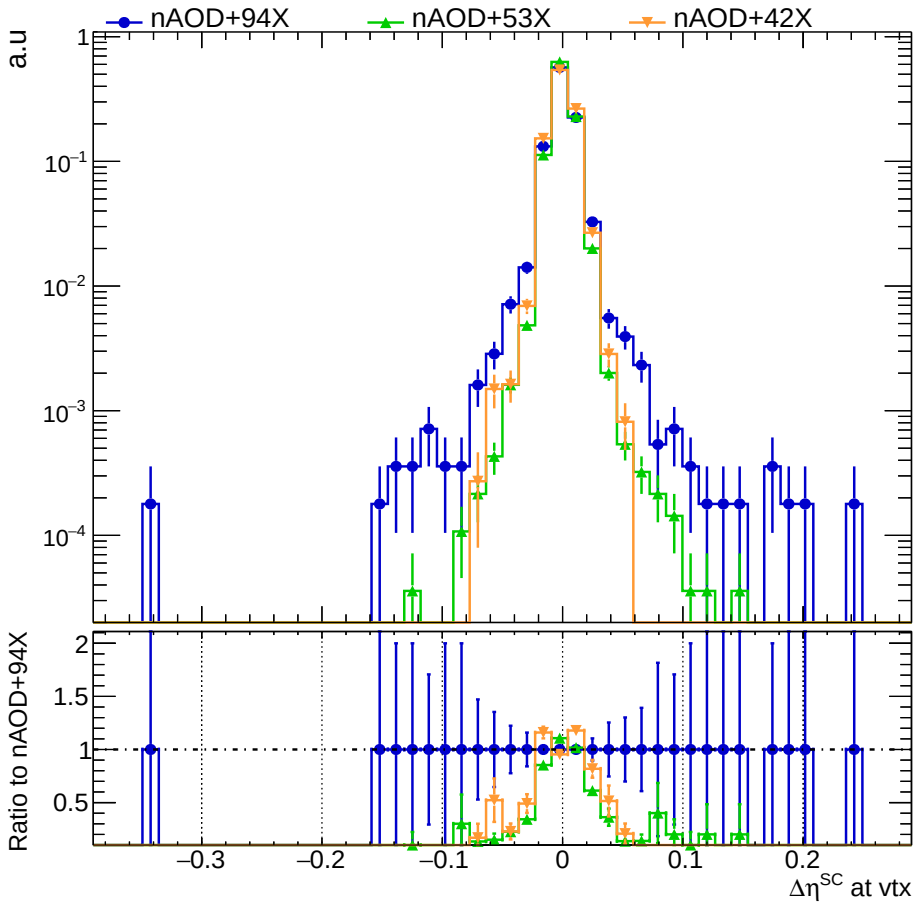


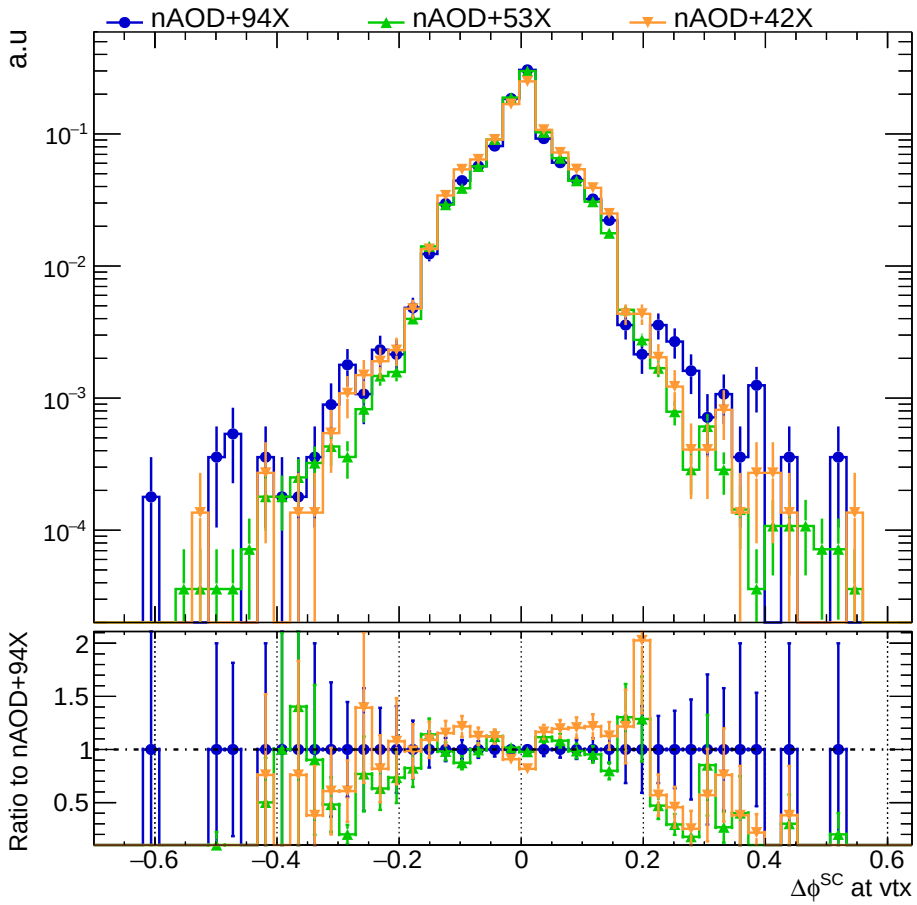
Event by event plot between nanoAOD and nanoAODplus
Run2 need to improve a bit (1^{st} case)



Shape in nanoAODplus Run1 differ due to diff. detector &
w/o EA PU correction

3^{rd} case (var extension) Eg. $\Delta\eta^{SC}$ & $\Delta\phi^{SC}$ at vertex





Variables $\Delta\eta^{SC}$ and $\Delta\phi^{SC}$ at vertex that are use as selection cut for some analysis

Check list

List of electron variables	Implemented and looks ok	Implemented but not ok	Not yet implement
Electron_charge	/		
Electron_cleanmask			/
Electron_convVeto		/	
Electron_cutBased		/	
Electron_cutBased_Fall17_V1			/
Electron_cutBased_HEEP			/
Electron_deltaEtaSC	/		
Electron_dr03EcalRecHitSumEt	/		
Electron_dr03HcalDepth1TowerSumEt	/		
Electron_dr03TkSumPt	/		
Electron_dr03TkSumPtHEEP			/
Electron_dxy	/		
Electron_dxyErr	/		
Electron_dz	/		
Electron_dzErr	/		
Electron_eCorr			/
Electron_eInvMinusPInv	/		
Electron_energyErr			/
Electron_eta	/		
Electron_genPartFlav			/
Electron_genPartIdx			/
Electron_hoe	/		

List of electron variables	Implemented and looks ok	Implemented but not ok	Not yet implement
Electron_ip3d		/	
Electron_isPFcand	/		
Electron_jetIdx			/
Electron_jetPtRelv2			/
Electron_jetRelIso			/
Electron_lostHits	/		
Electron_mass	/		
Electron_miniPFRelIso_all			/
Electron_miniPFRelIso_chg			/
Electron_mvaFall17V1Iso			/
Electron_mvaFall17V1Iso_WP80			/
Electron_mvaFall17V1Iso_WP90			/
Electron_mvaFall17V1Iso_WPL			/
Electron_mvaFall17V1noIso			/
Electron_mvaFall17V1noIso_WP80			/
Electron_mvaFall17V1noIso_WP90			/
Electron_mvaFall17V1noIso_WPL			/
Electron_mvaFall17V2Iso			/
Electron_mvaFall17V2Iso_WP80			/
Electron_mvaFall17V2Iso_WP90			/
Electron_mvaFall17V2Iso_WPL			/
Electron_mvaFall17V2noIso			/

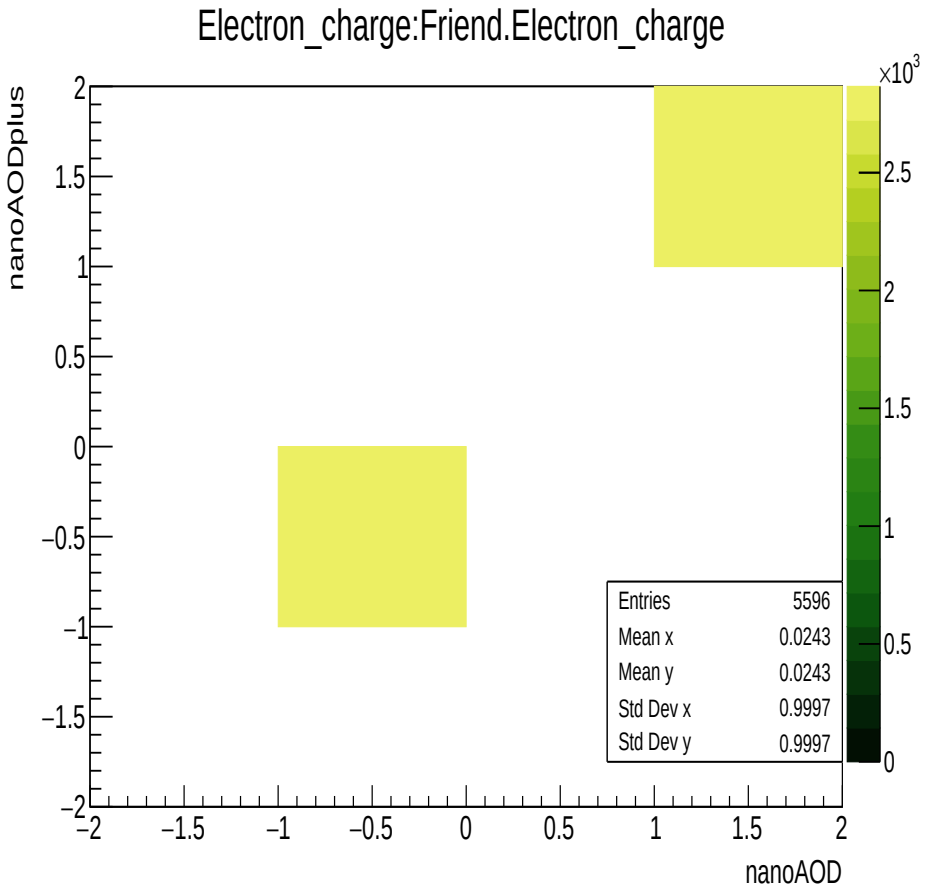
List of electron variables	Implemented and looks ok	Implemented but not ok	Not yet implement
Electron_mvaFall17V2noIso_WP80			/
Electron_mvaFall17V2noIso_WP90			/
Electron_mvaFall17V2noIso_WPL			/
Electron_mvaTTH			/
Electron_pdgId			/
Electron_pfRelIso03_all	/		
Electron_pfRelIso03_chg	/		
Electron_phi	/		
Electron_photonIdx			/
Electron_pt		/	
Electron_r9			/
Electron_seedGain			/
Electron_sieie	/		
Electron_sip3d		/	
Electron_tightCharge	/		
Electron_vidNestedWPBitmap			/
nElectron	/		
Total	**21**	**5**	**35**

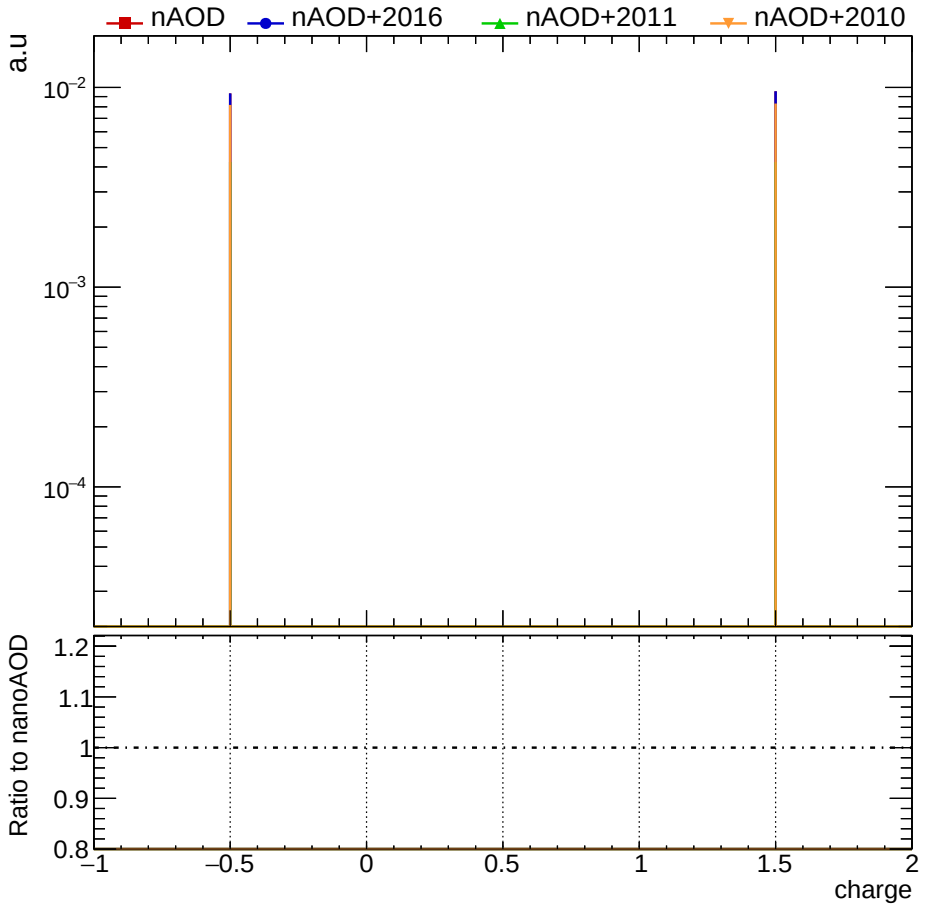
Conclusion & plan

- Almost half of electron variables has been implemented
- Next focus will be on implementing new variables like electron mva variables

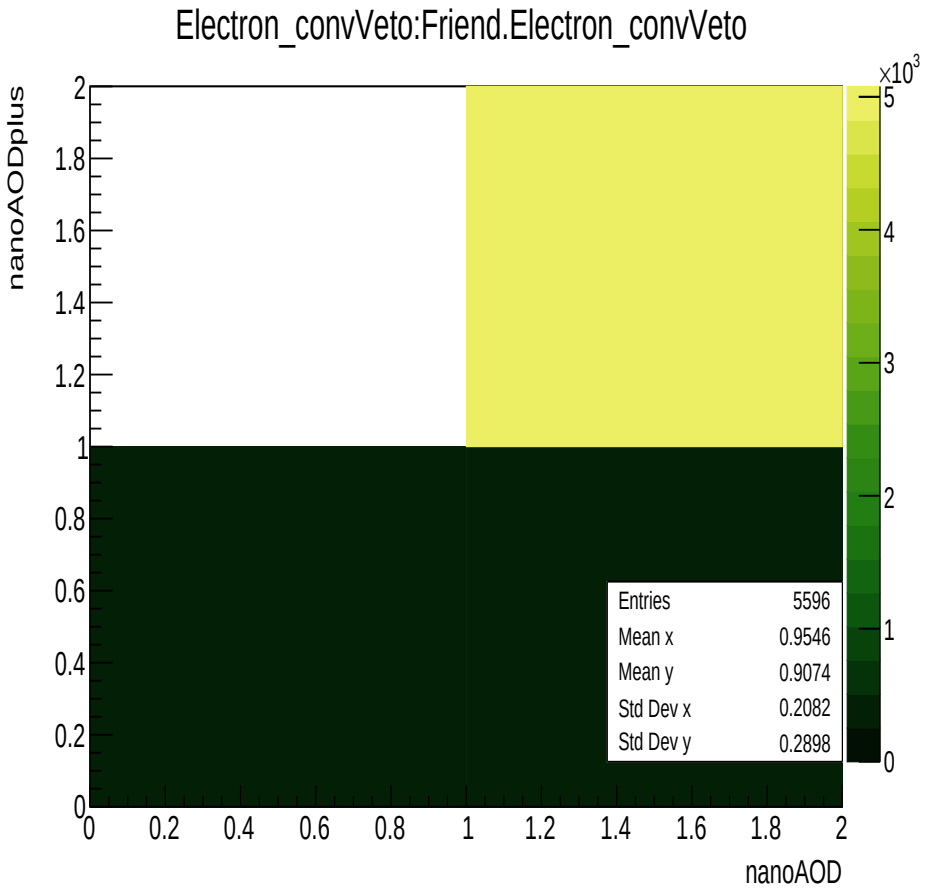
Backup

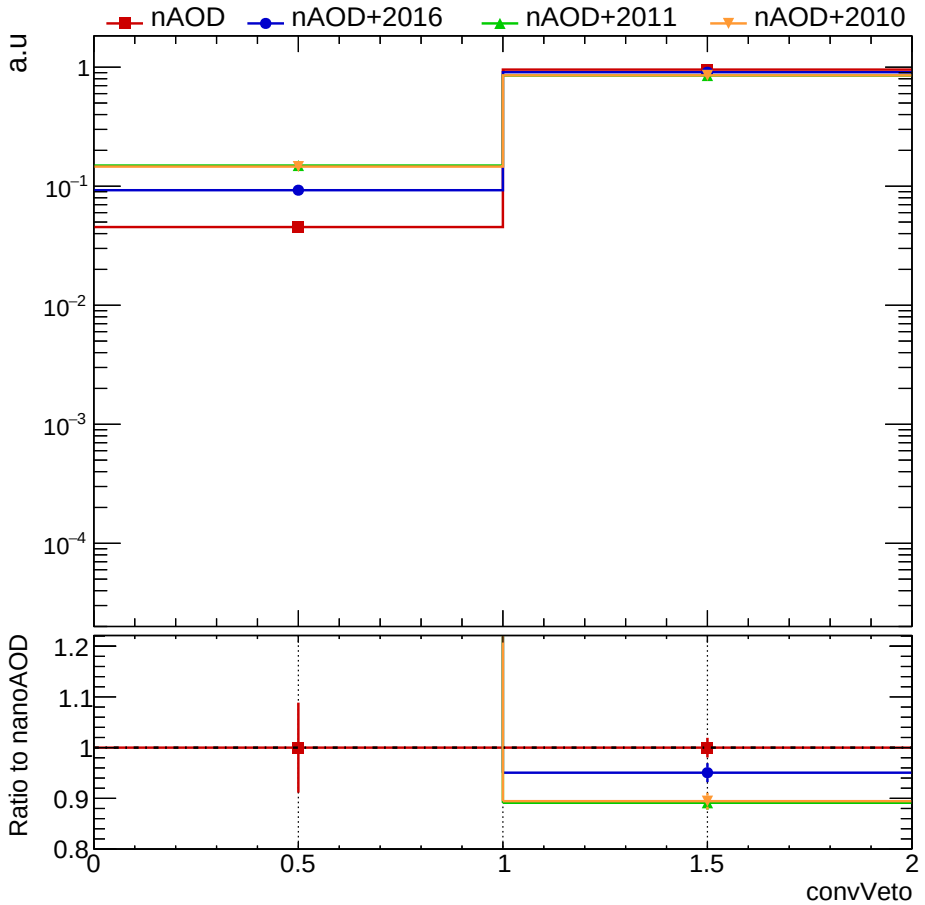
charge


Electron_charge:Friend.Electron_charge
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.0243
Mean y 0.0243
Std Dev x 0.9997
Std Dev y 0.9997

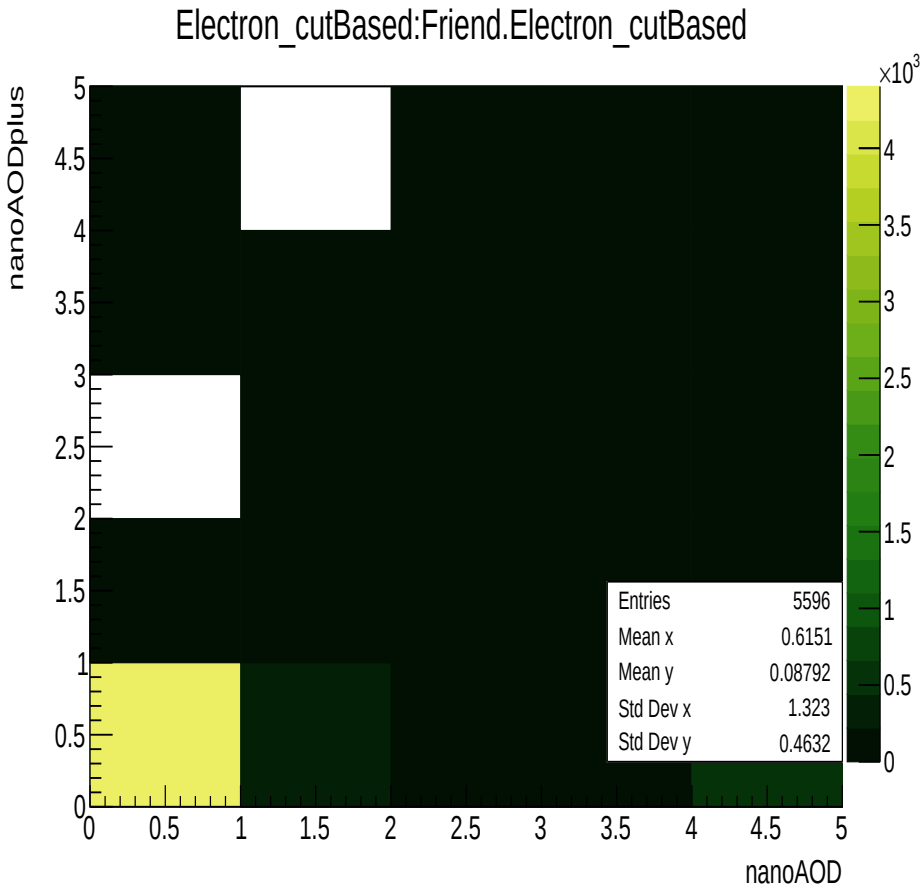

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
charge

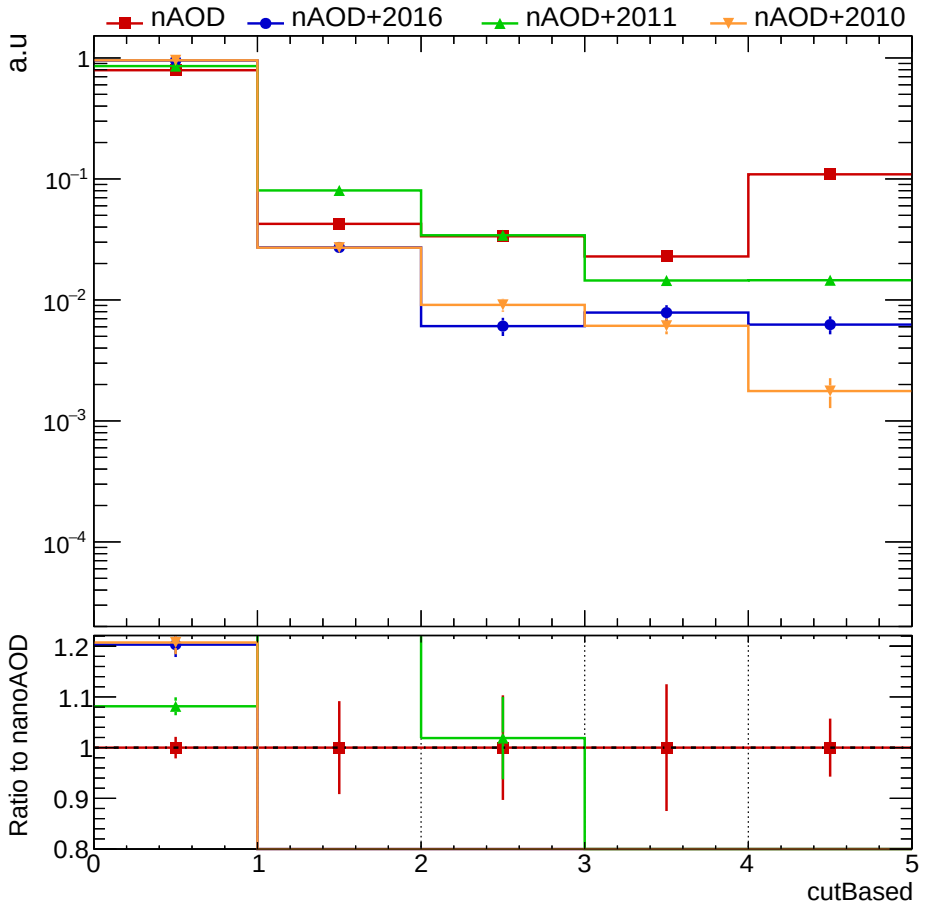
convVeto


Electron_convVeto:Friend.Electron_convVeto
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.9546
Mean y 0.9074
Std Dev x 0.2082
Std Dev y 0.2898

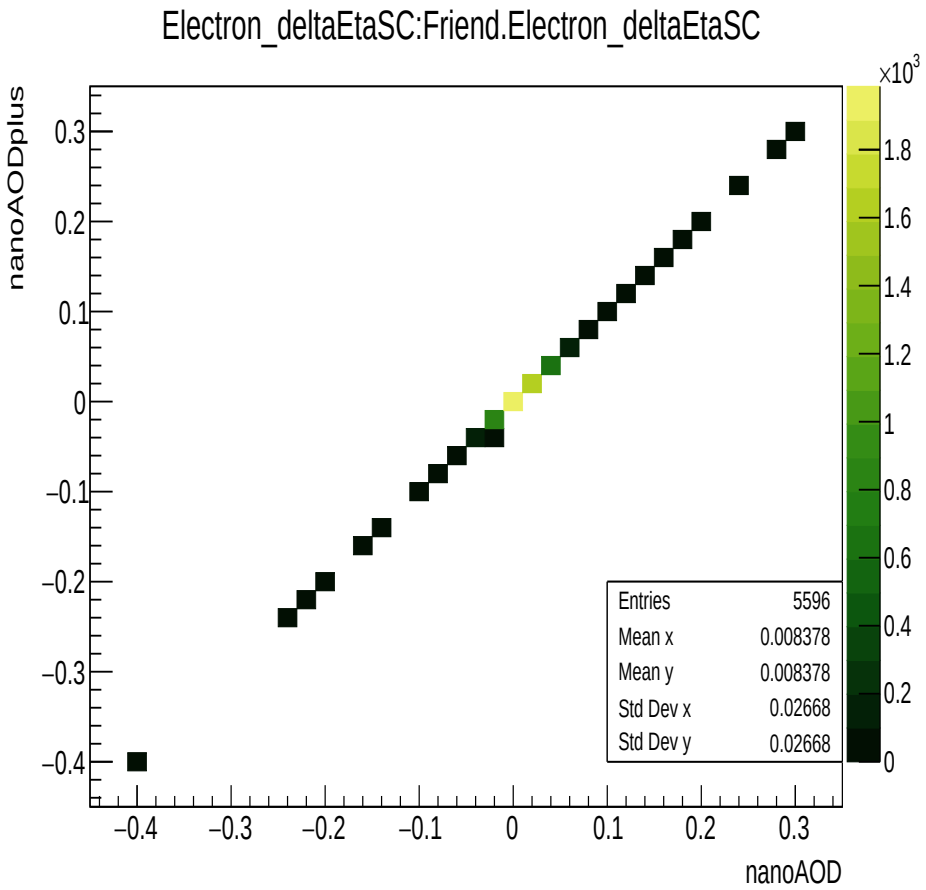

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
convVeto

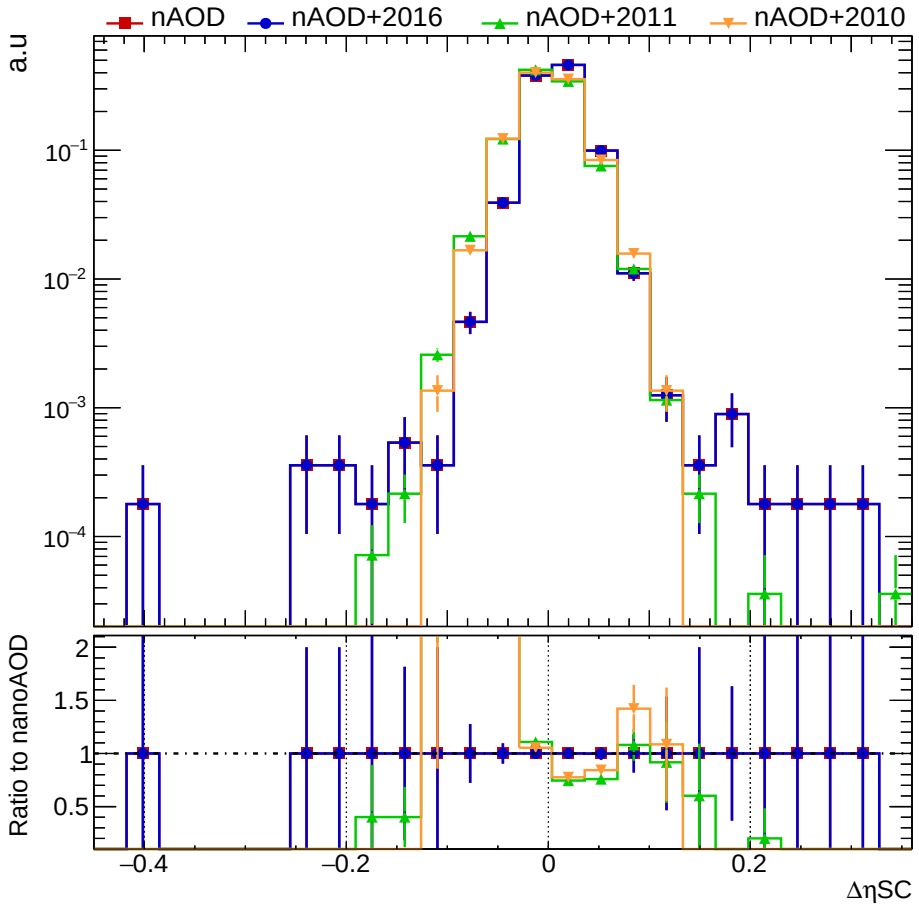
cutBased


Electron_cutBased:Friend.Electron_cutBased
nanoAODplus
nanoAOD
×10^3
Entries 5596
Mean x 0.6151
Mean y 0.08792
Std Dev x 1.323
Std Dev y 0.4632

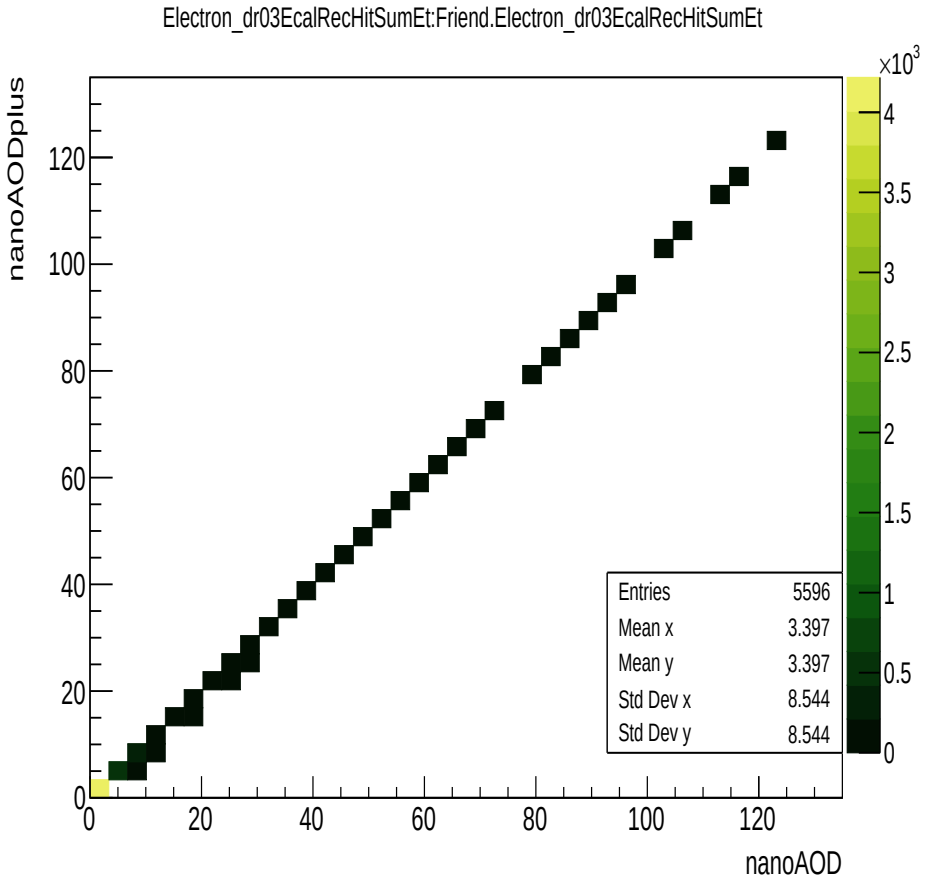

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
cutBased

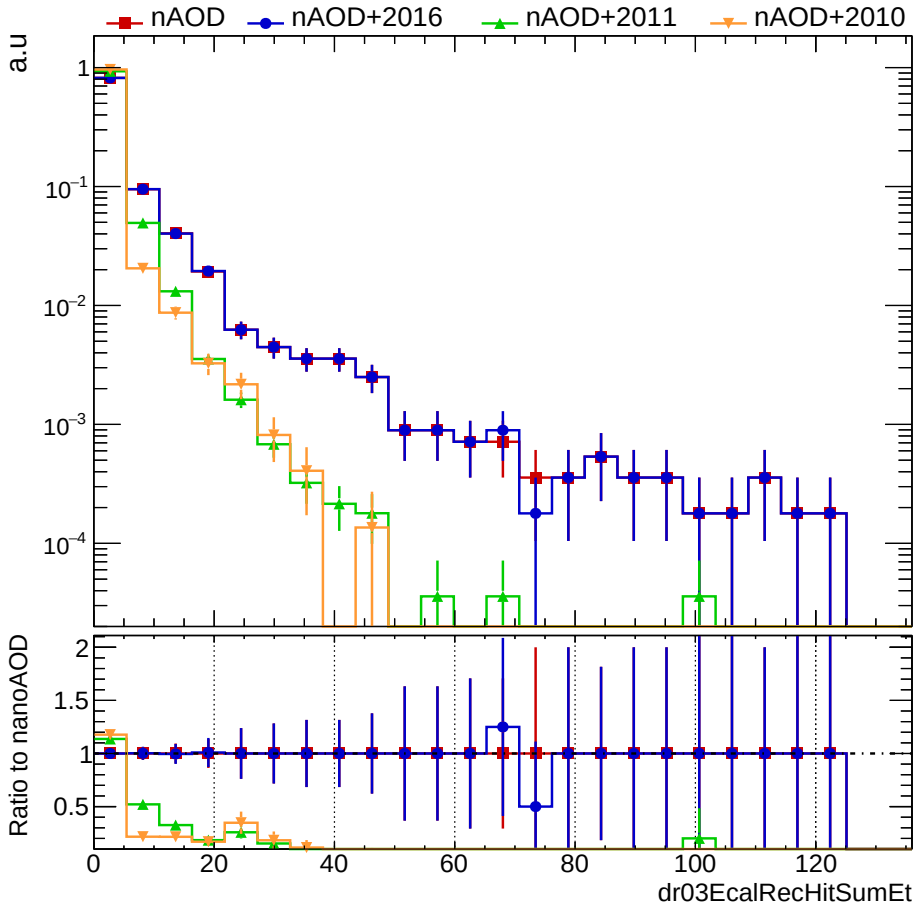
deltaEtaSC


Electron_deltaEtaSC:Friend.Electron_deltaEtaSC
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.008378
Mean y 0.008378
Std Dev x 0.02668
Std Dev y 0.02668

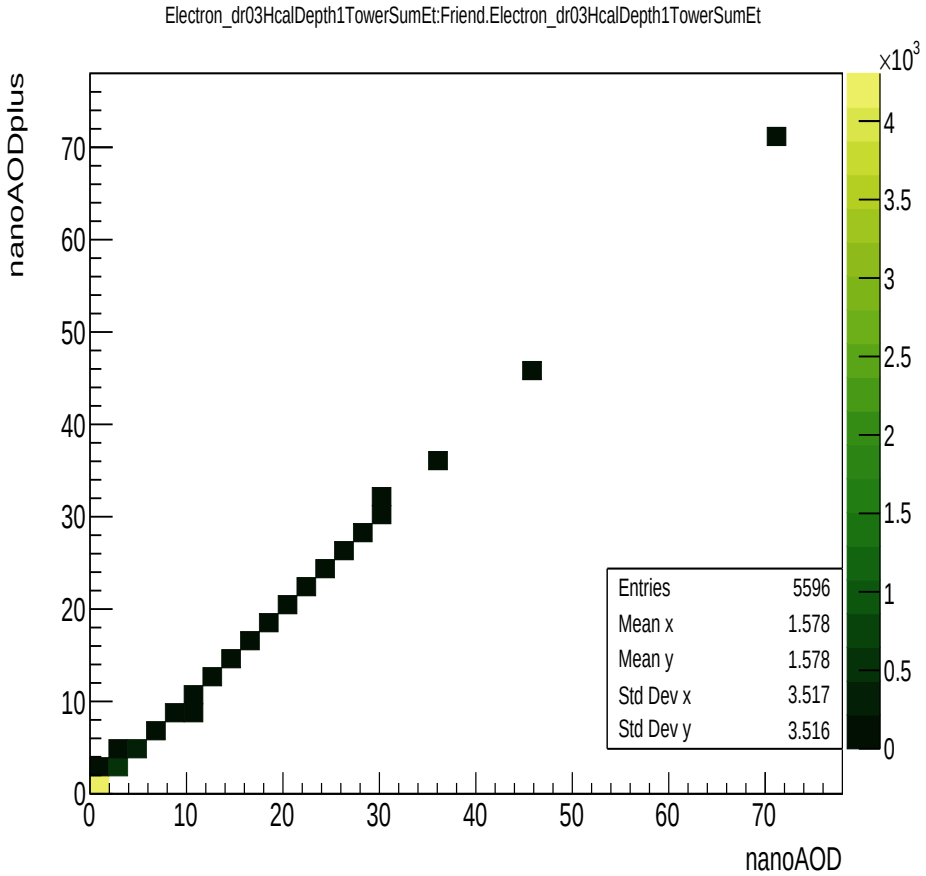

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
ΔηSC

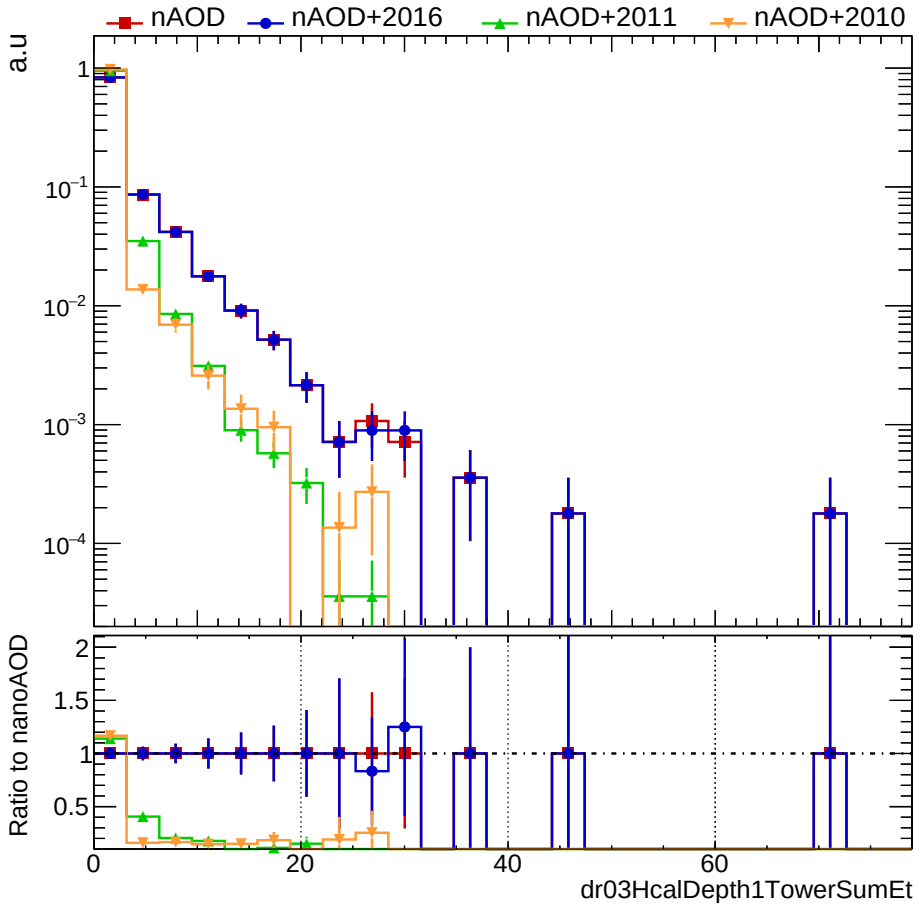
dr03EcalRecHitSumEt



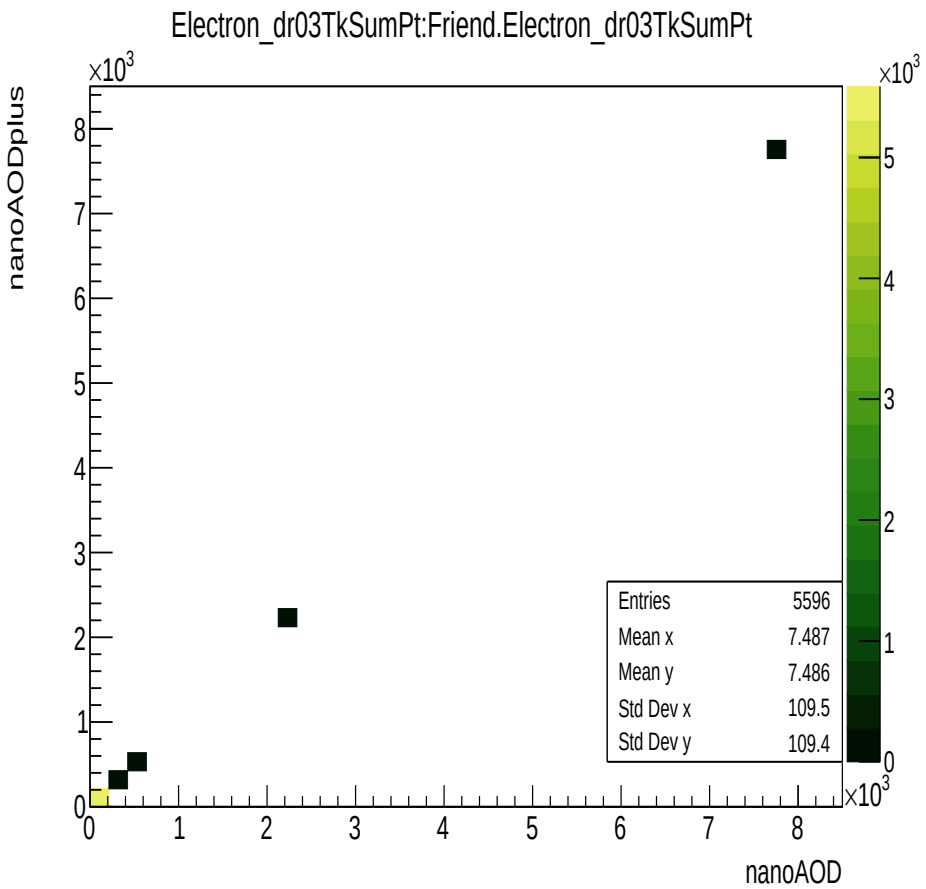


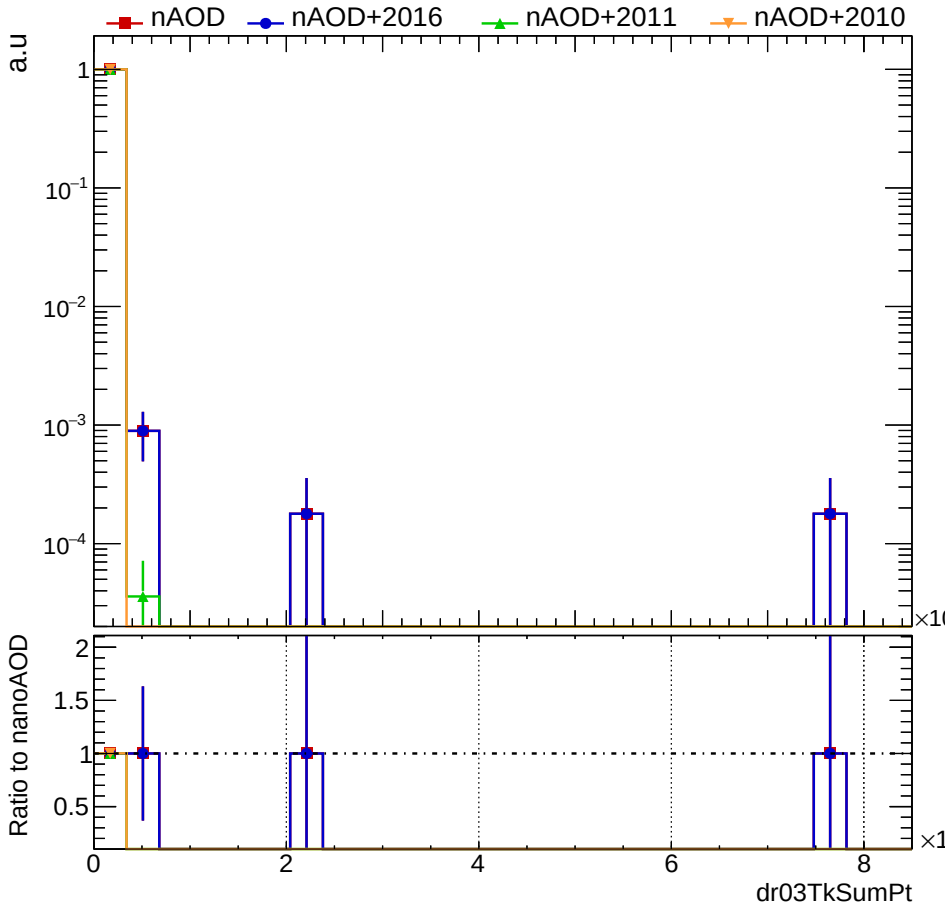
dr03HcalDepth1TowerSumEt



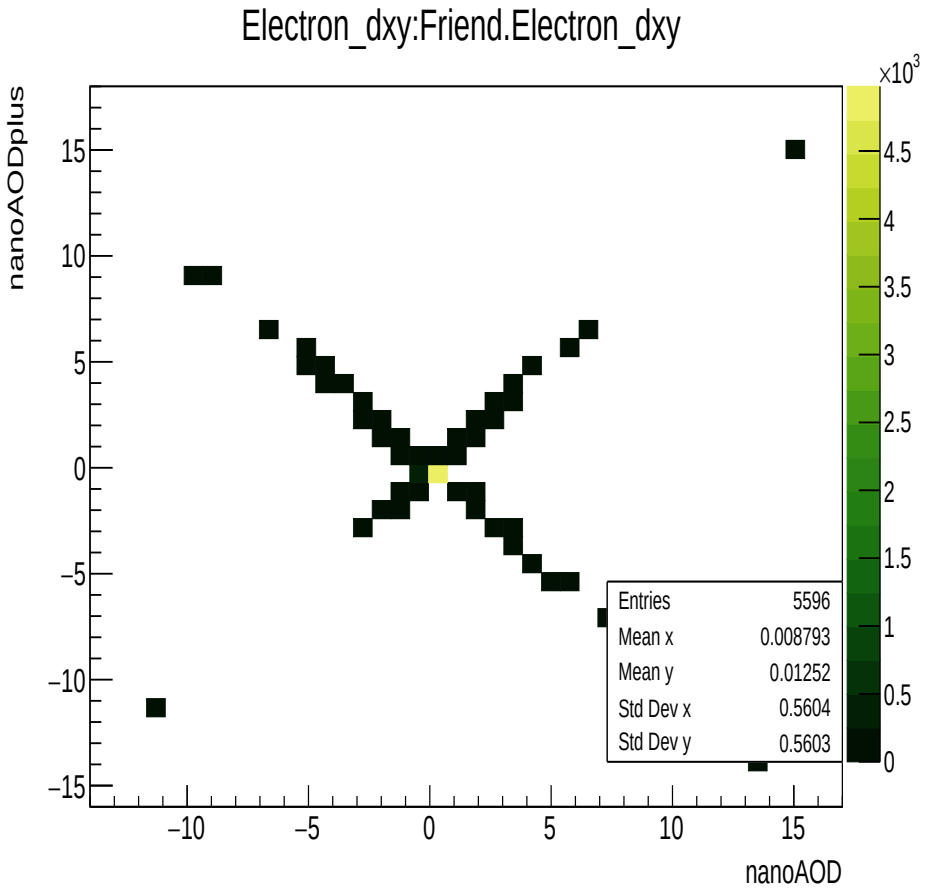


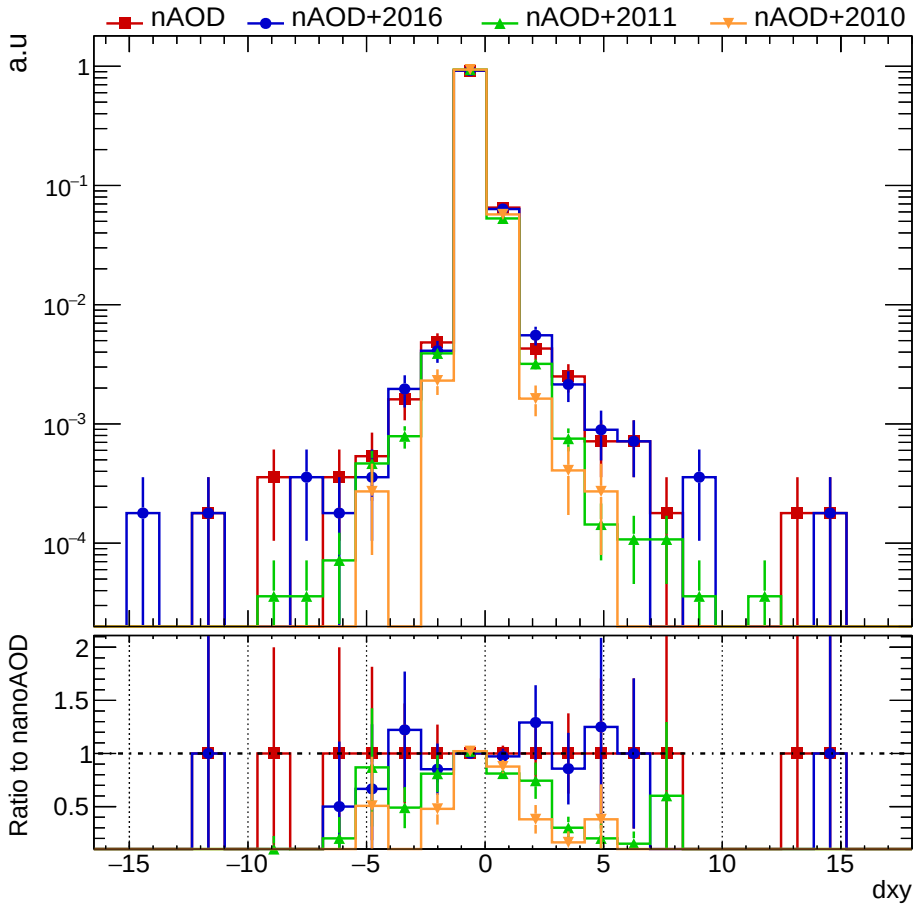
dr03TkSumPt



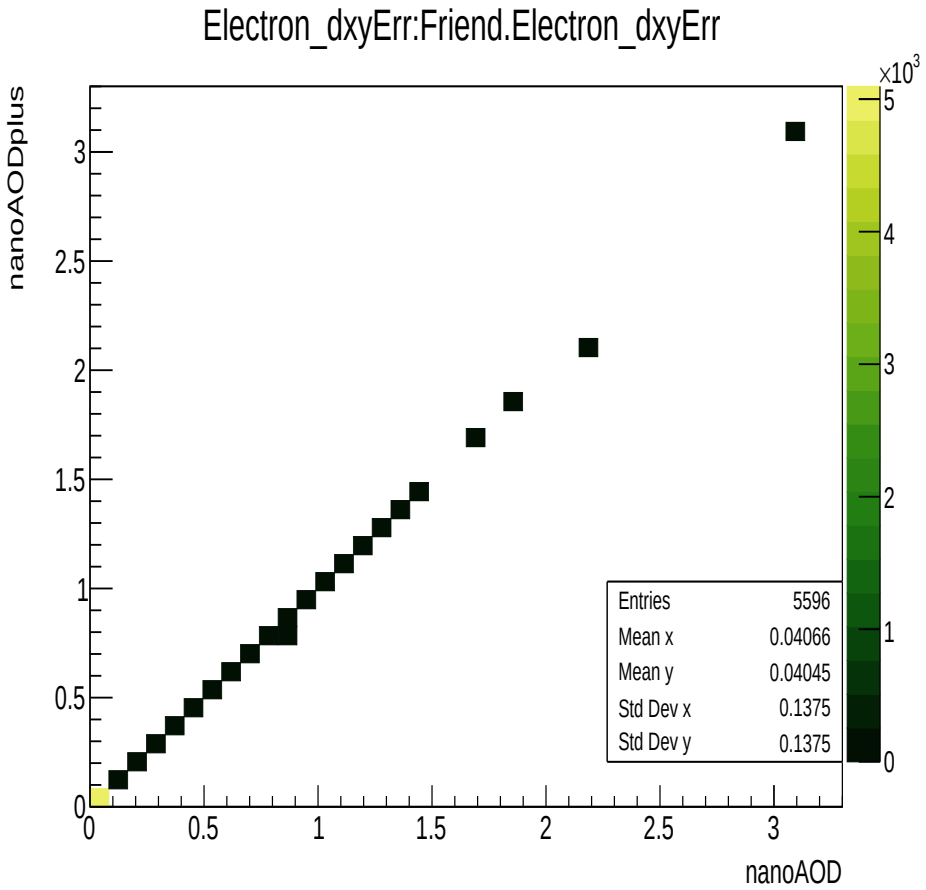


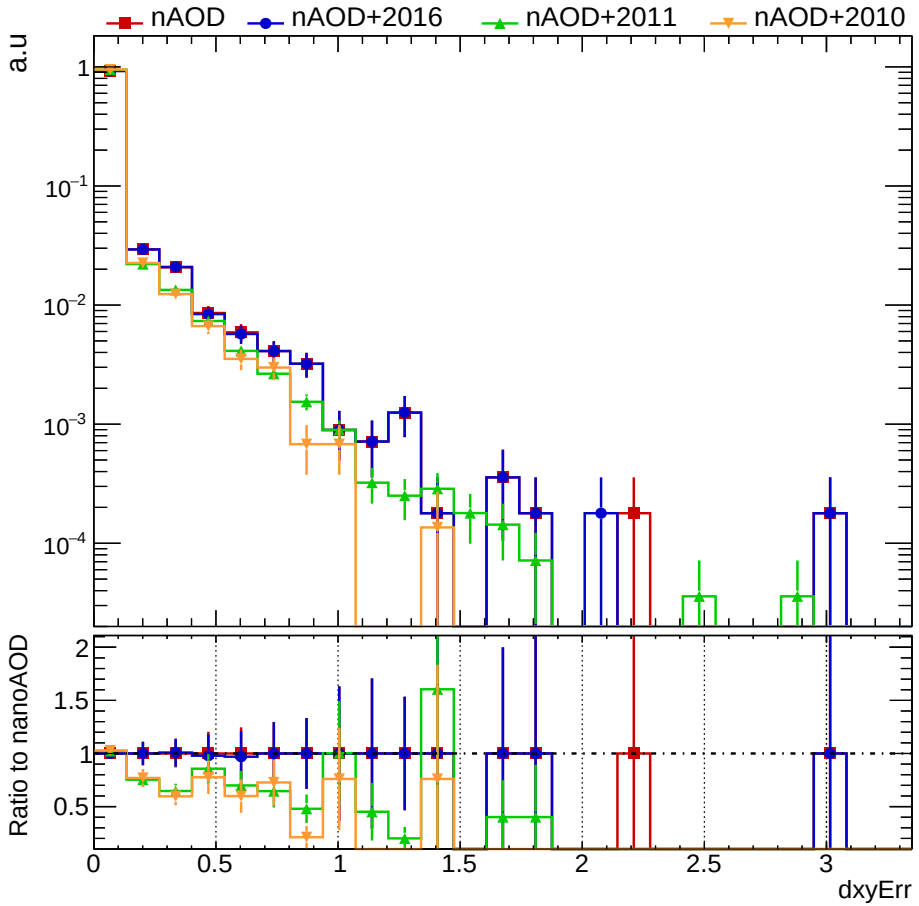
dxy


Electron_dxy:Friend.Electron_dxy
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.008793
Mean y 0.01252
Std Dev x 0.5604
Std Dev y 0.5603

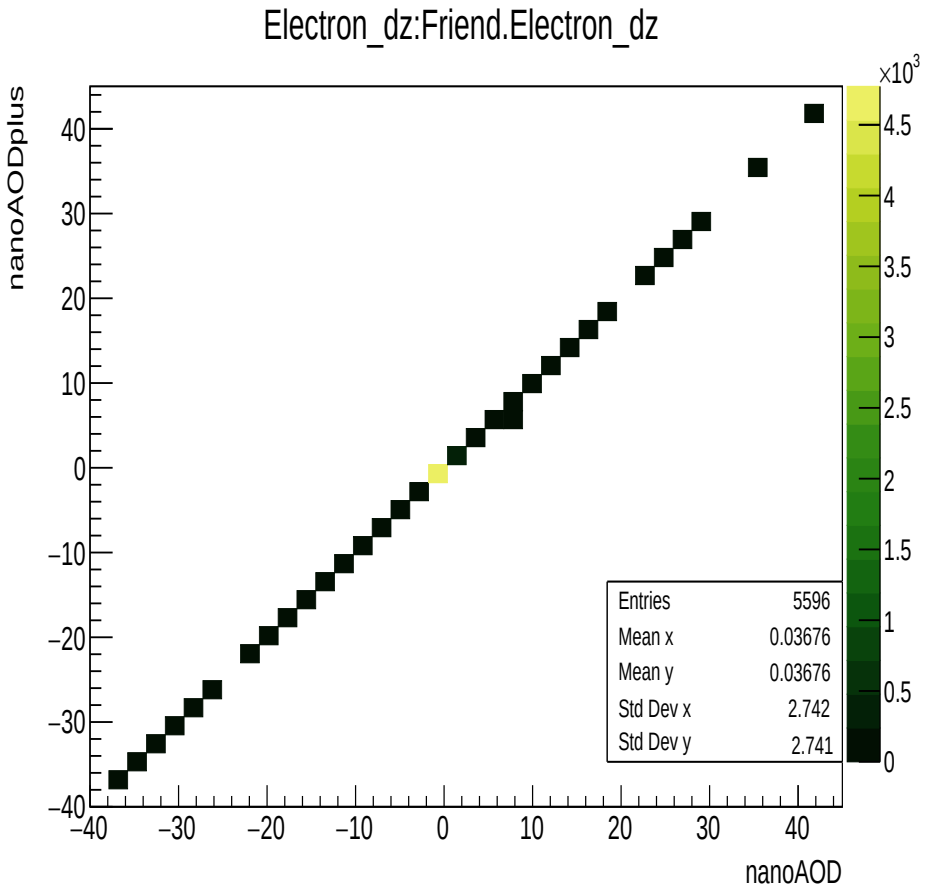

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
dxy

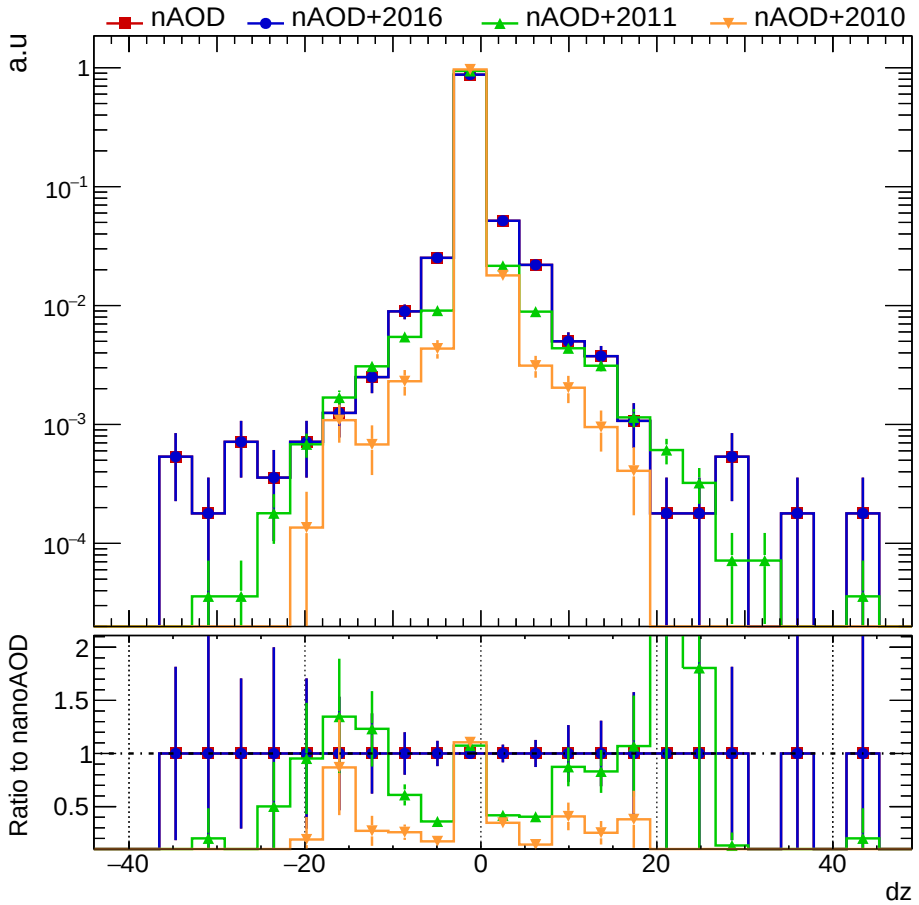
dxyErr


Electron_dxyErr:Friend.Electron_dxyErr
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.04066
Mean y 0.04045
Std Dev x 0.1375
Std Dev y 0.1375

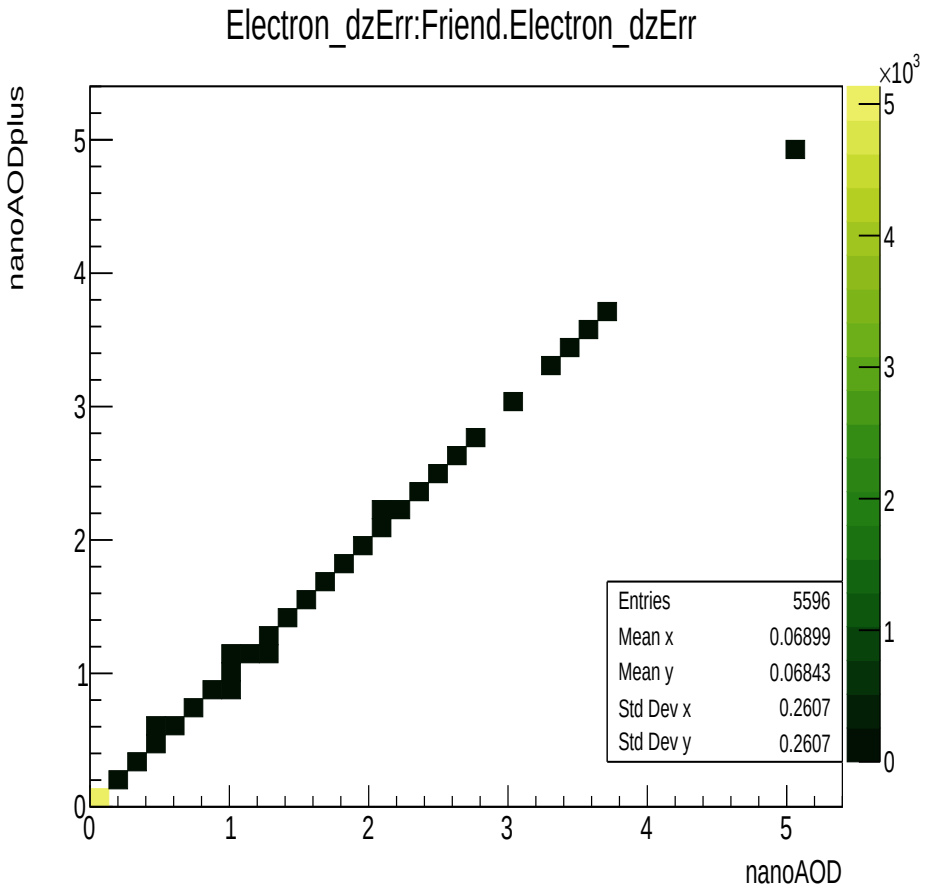

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
dxyErr

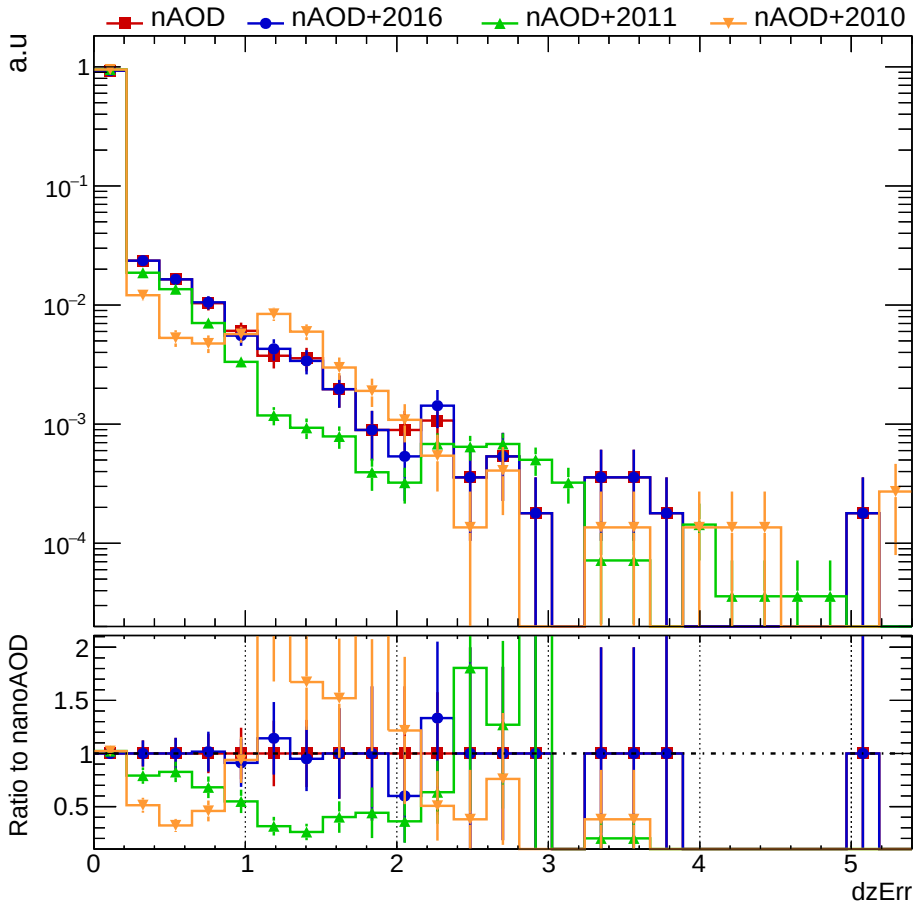
dz


Electron_dz:Friend.Electron_dz
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.03676
Mean y 0.03676
Std Dev x 2.742
Std Dev y 2.741

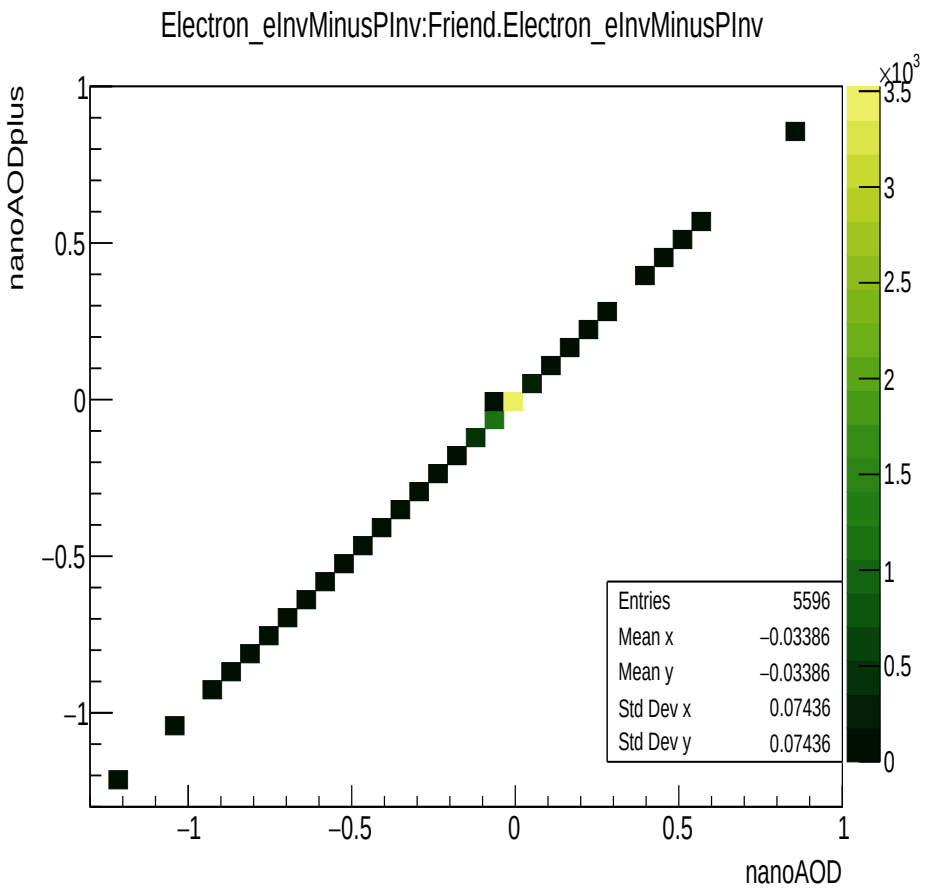

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
dz

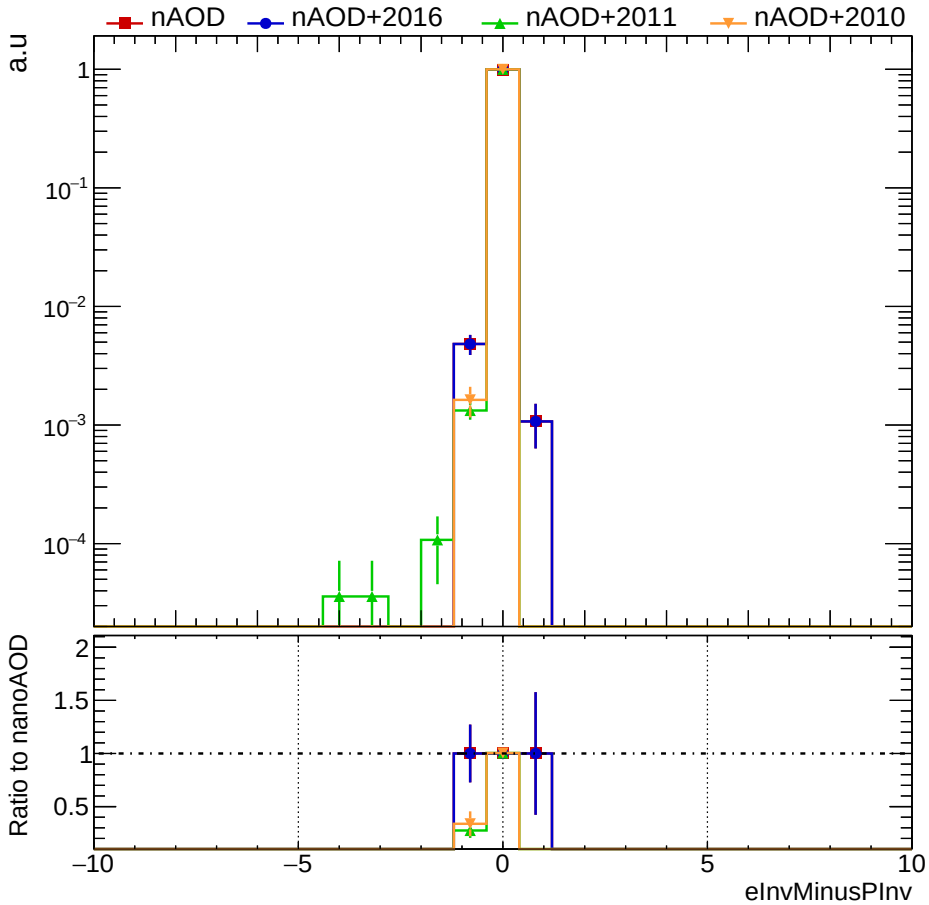
dzErr


Electron_dzErr:Friend.Electron_dzErr
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.06899
Mean y 0.06843
Std Dev x 0.2607
Std Dev y 0.2607

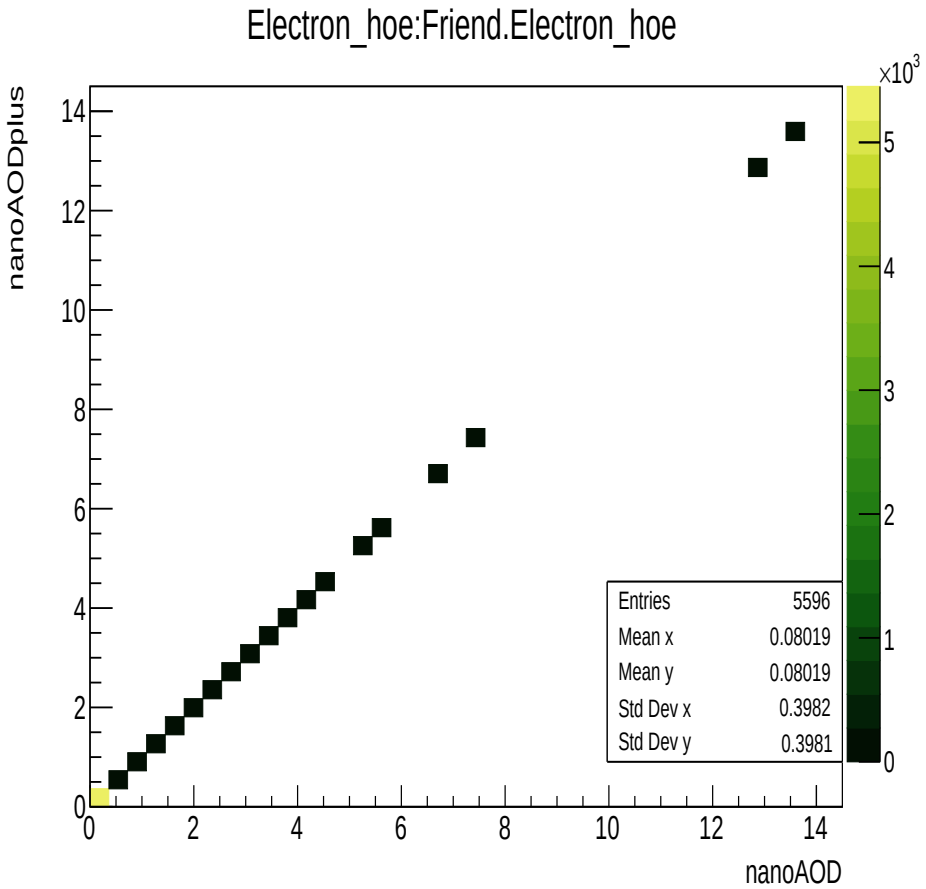

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
dzErr

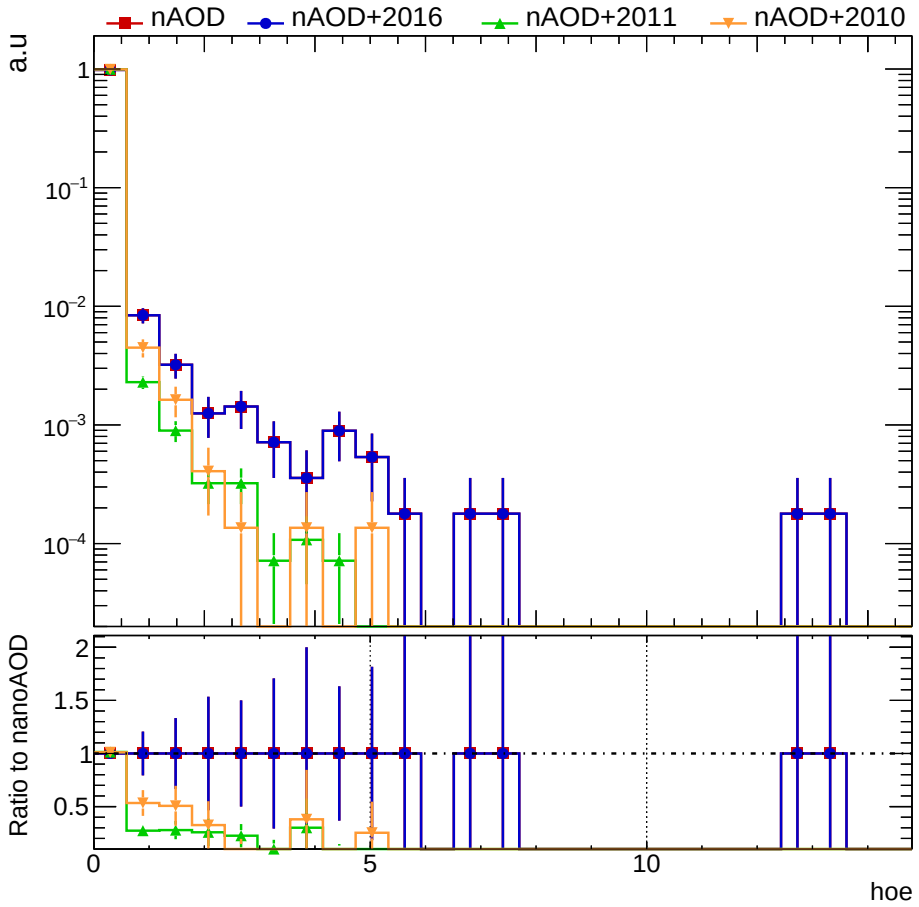
eInvMinusPInv



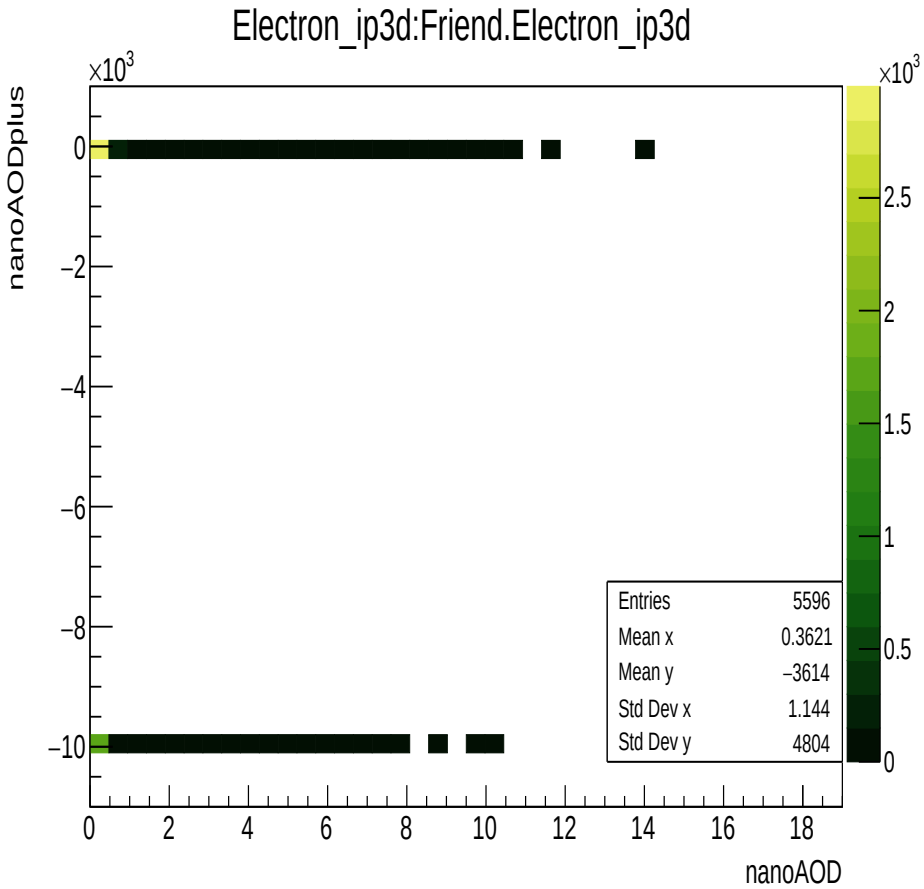


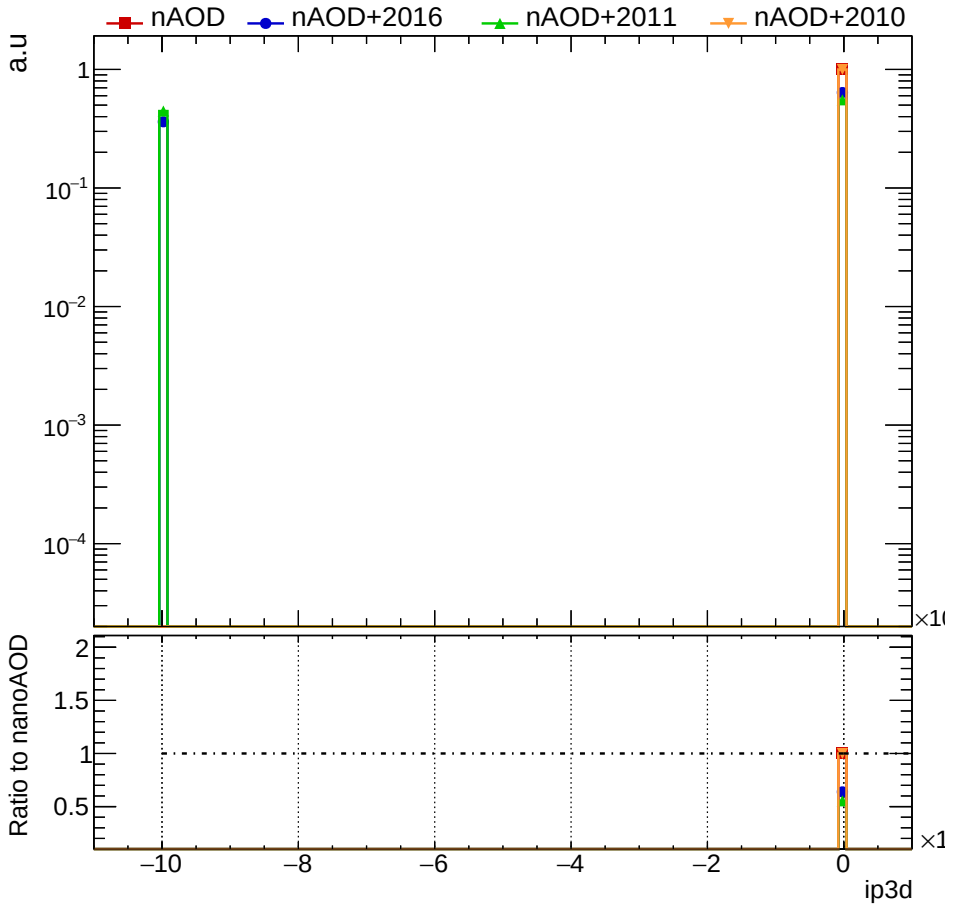
hoe


Electron_hoe:Friend.Electron_hoe
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.08019
Mean y 0.08019
Std Dev x 0.3982
Std Dev y 0.3981

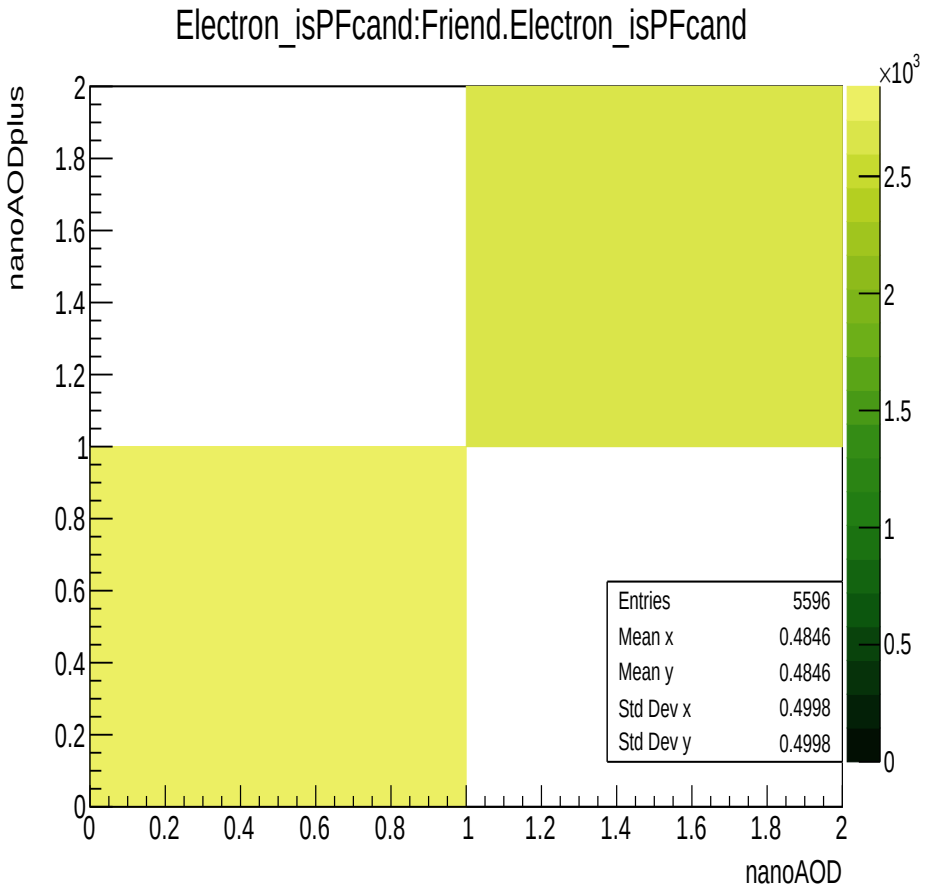

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
hoe

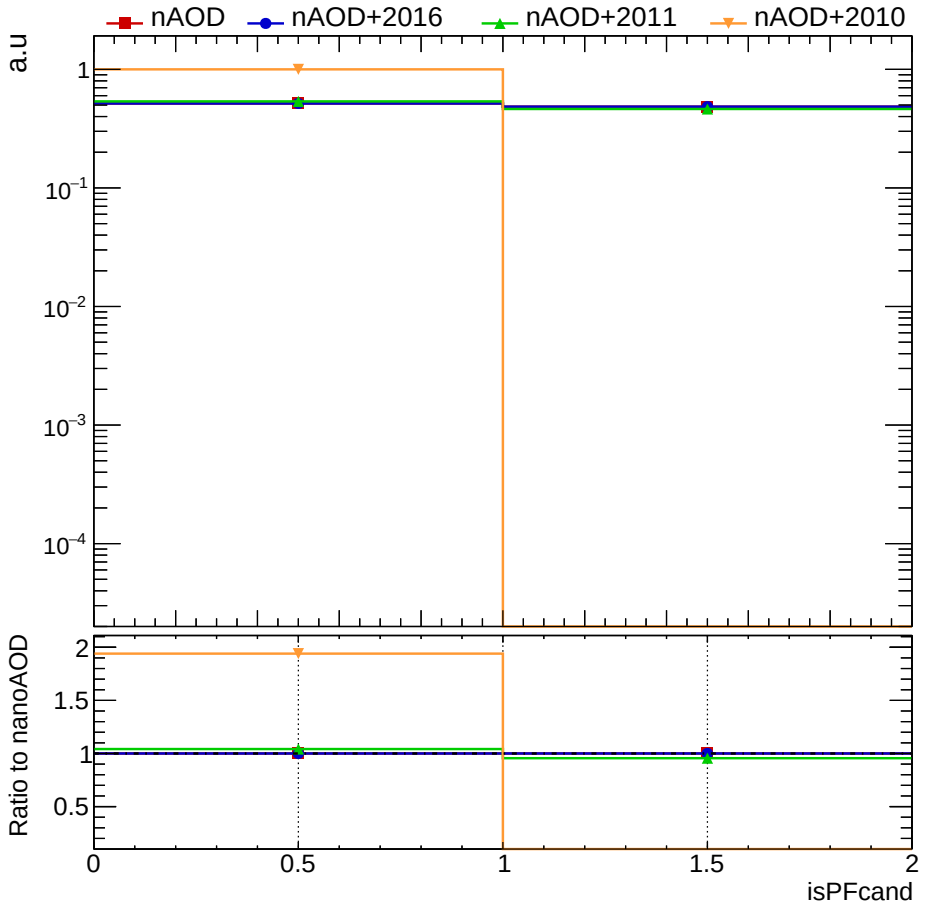
ip3d


Electron_ip3d:Friend.Electron_ip3d
nanoAODplus
nanoAOD
Entries 5596
Mean x 0.3621
Mean y −3614
Std Dev x 1.144
Std Dev y 4804

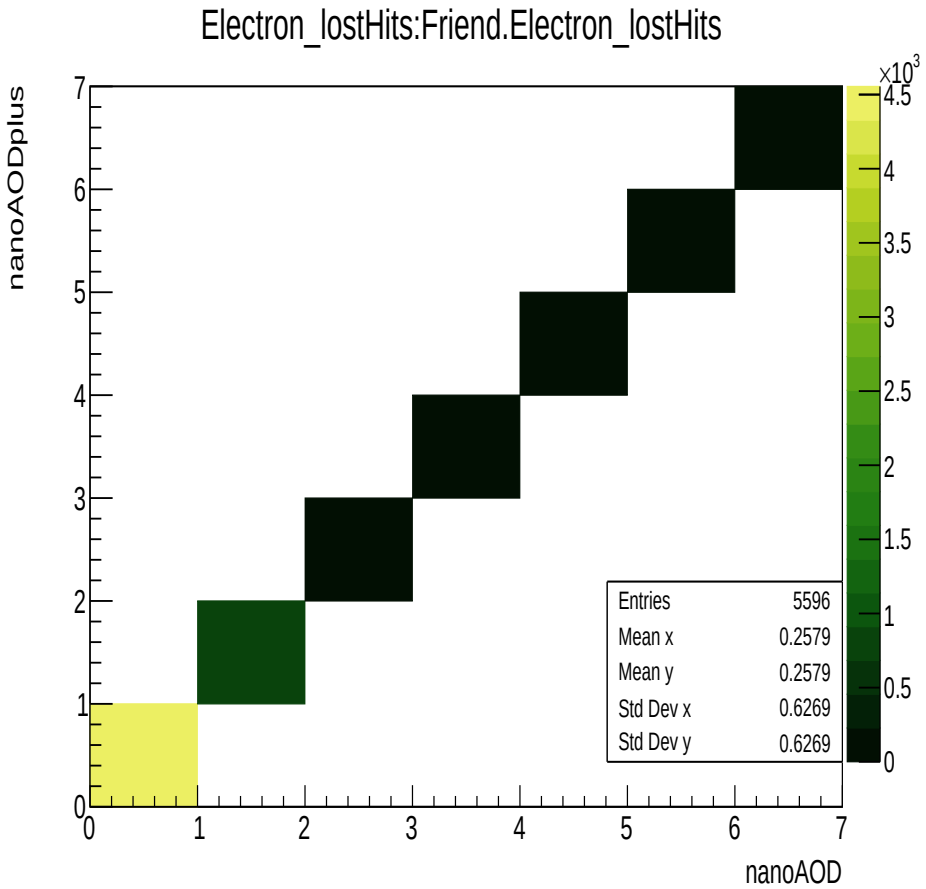

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
ip3d

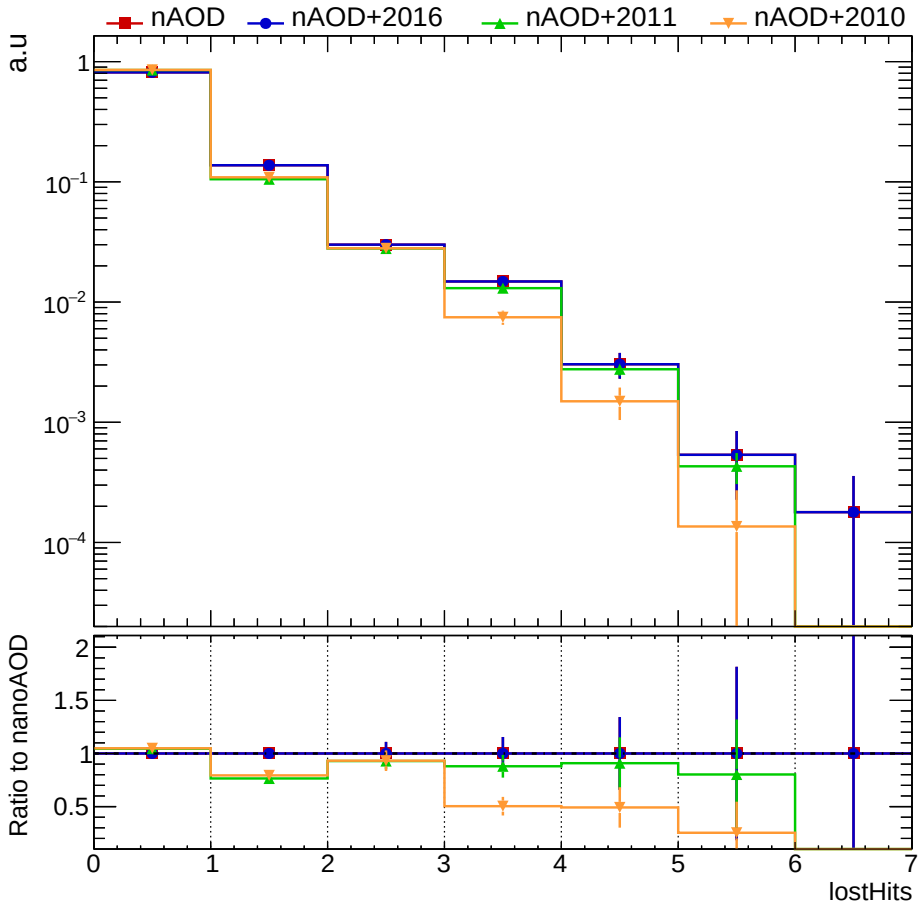
isPFcand


Electron_isPFcand:Friend.Electron_isPFcand
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.4846
Mean y 0.4846
Std Dev x 0.4998
Std Dev y 0.4998

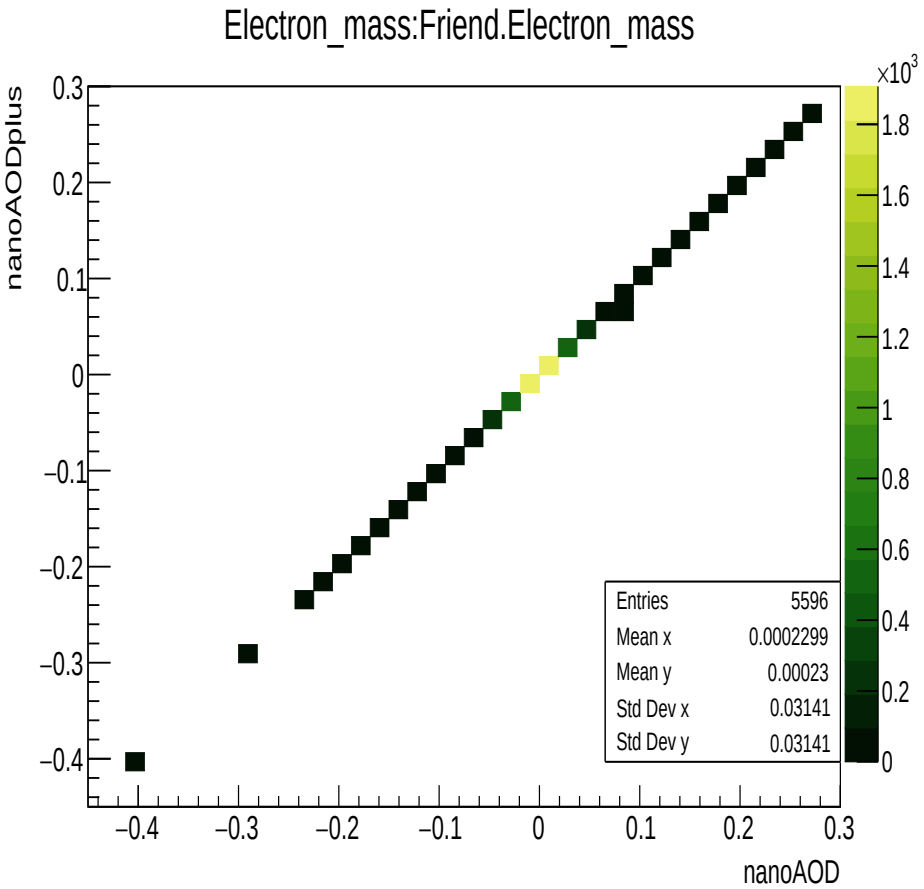

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
isPFcand

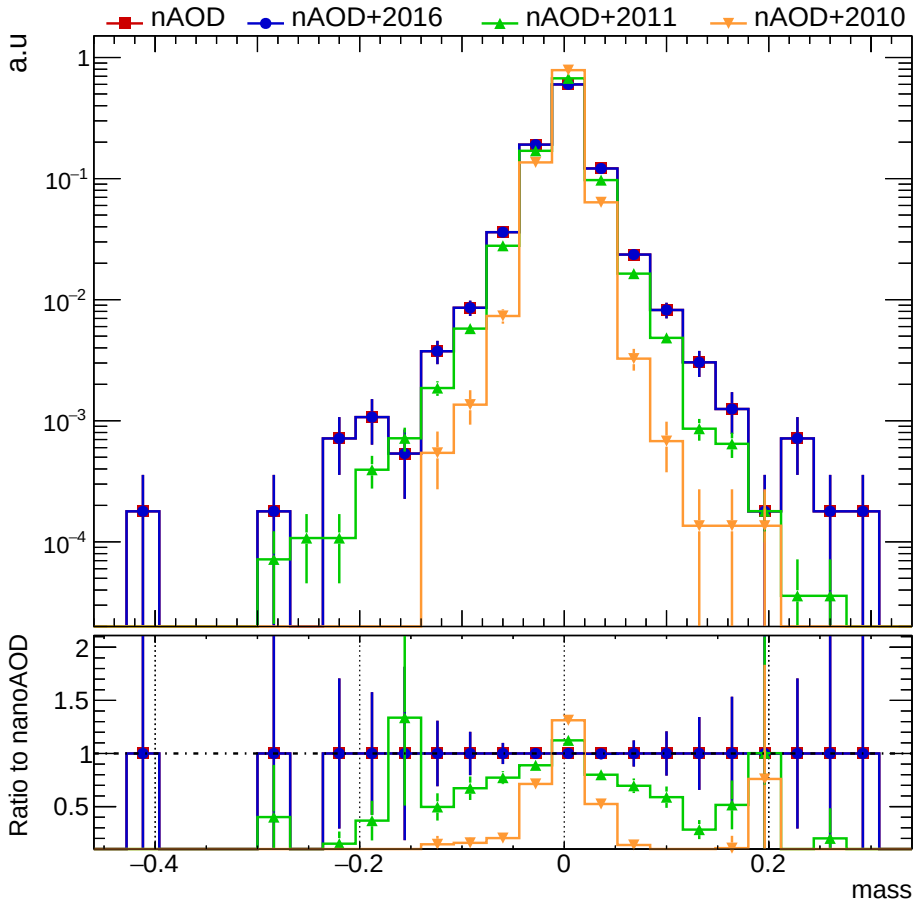
lostHits


Electron_lostHits:Friend.Electron_lostHits
nanoAODplus
nanoAOD
×10^3
Entries 5596
Mean x 0.2579
Mean y 0.2579
Std Dev x 0.6269
Std Dev y 0.6269

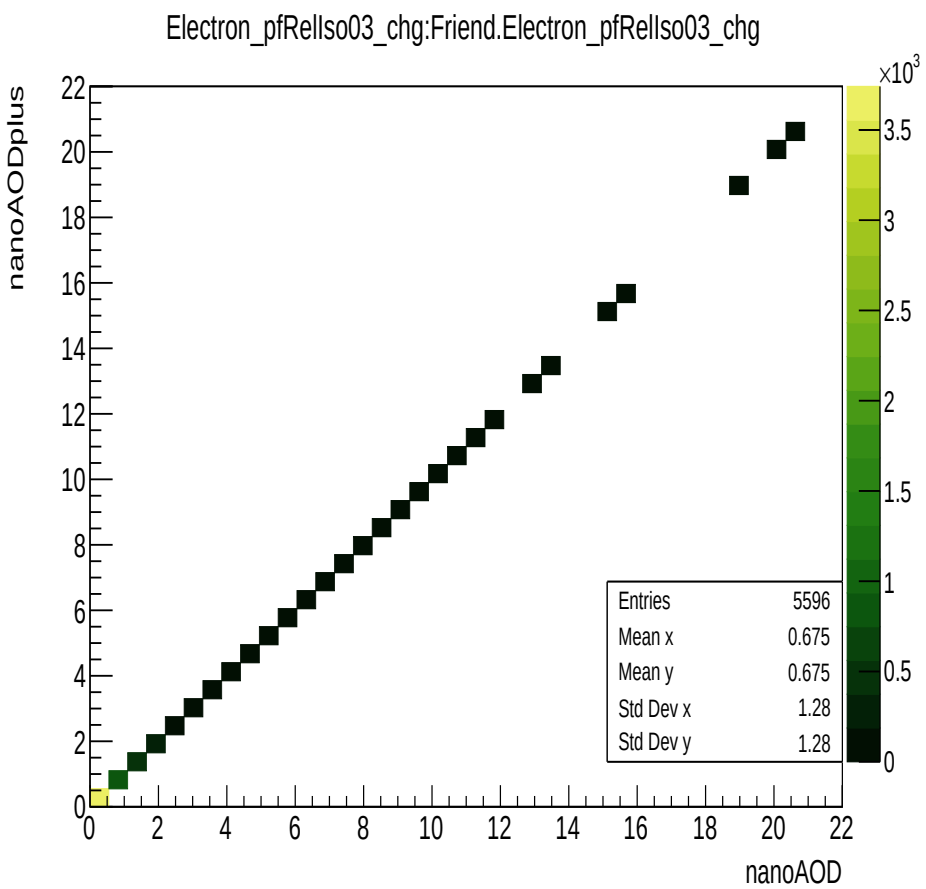

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
lostHits

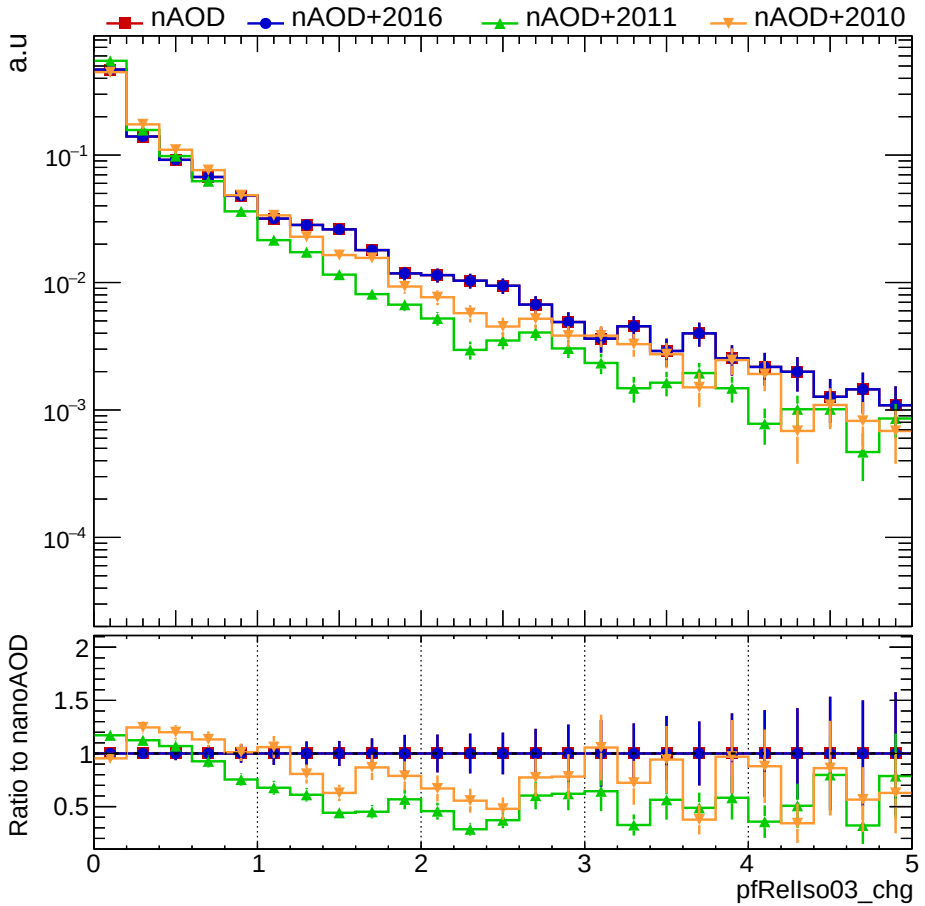
mass


Electron_mass:Friend.Electron_mass
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 0.0002299
Mean y 0.00023
Std Dev x 0.03141
Std Dev y 0.03141

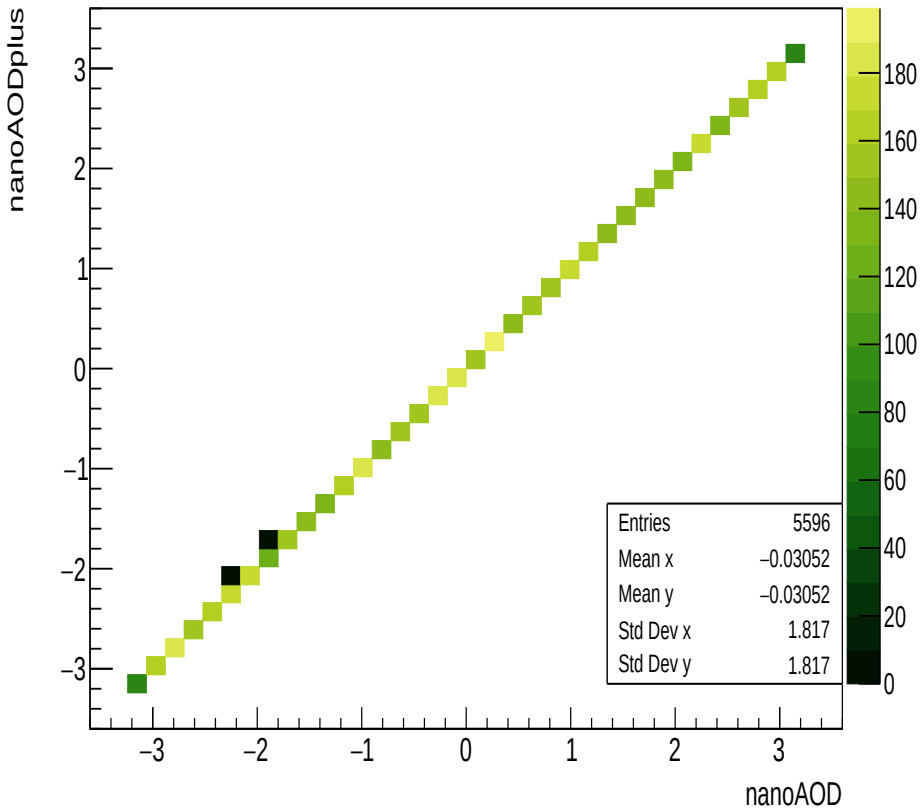

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
mass

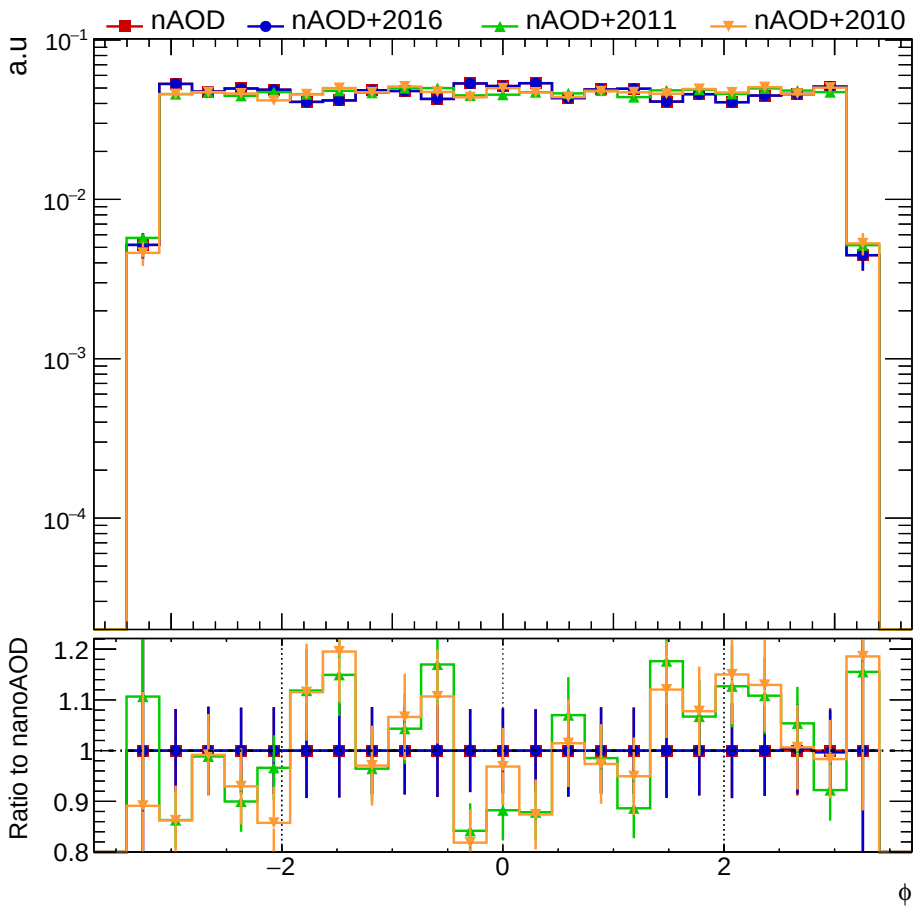
pfRelIso03_chg



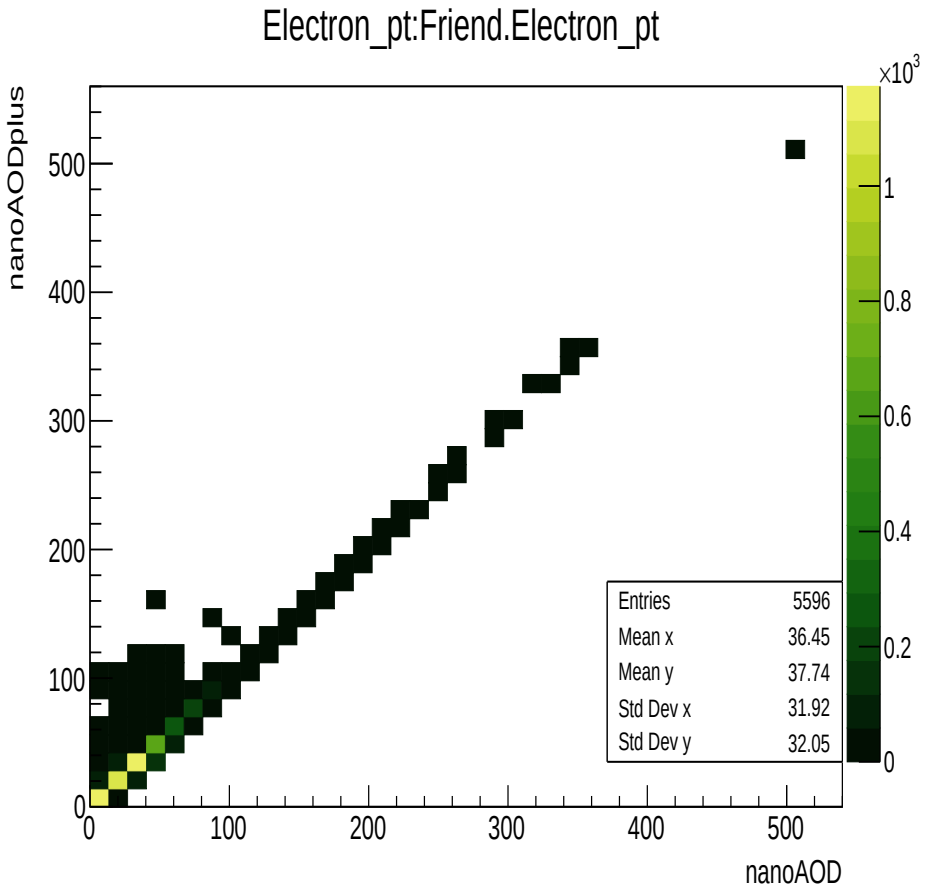


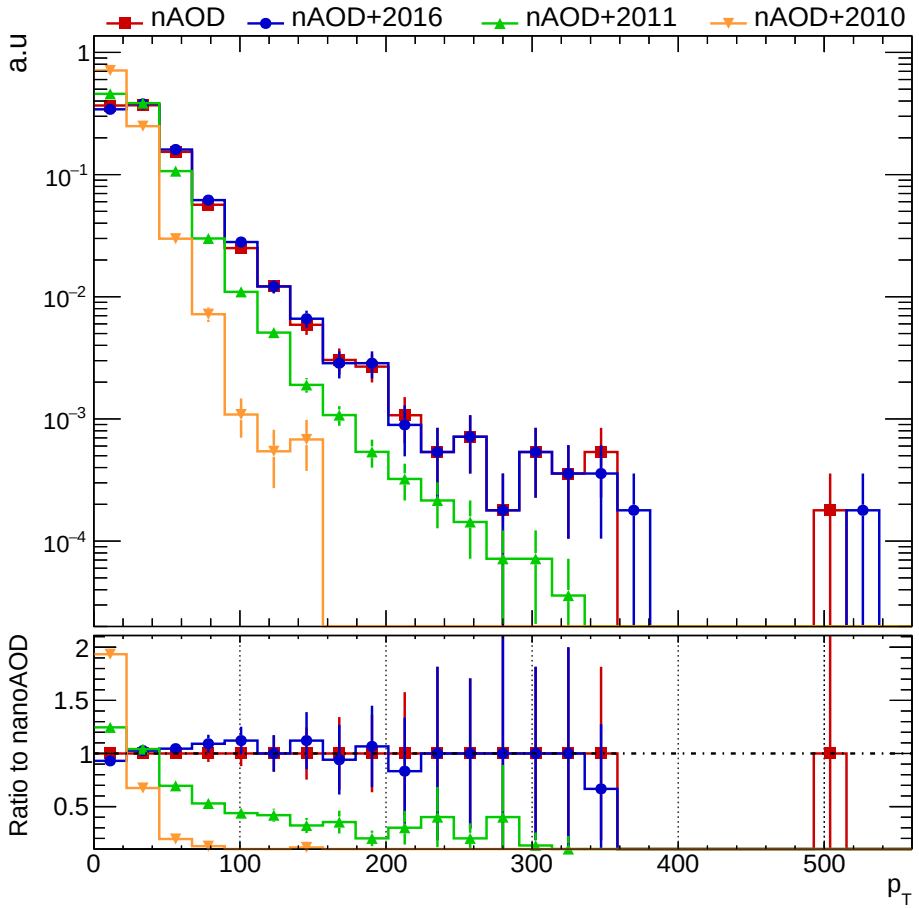
phi


Electron_phi:Friend.Electron_phi
nanoAODplus
nanoAOD
Entries 5596
Mean x −0.03052
Mean y −0.03052
Std Dev x 1.817
Std Dev y 1.817

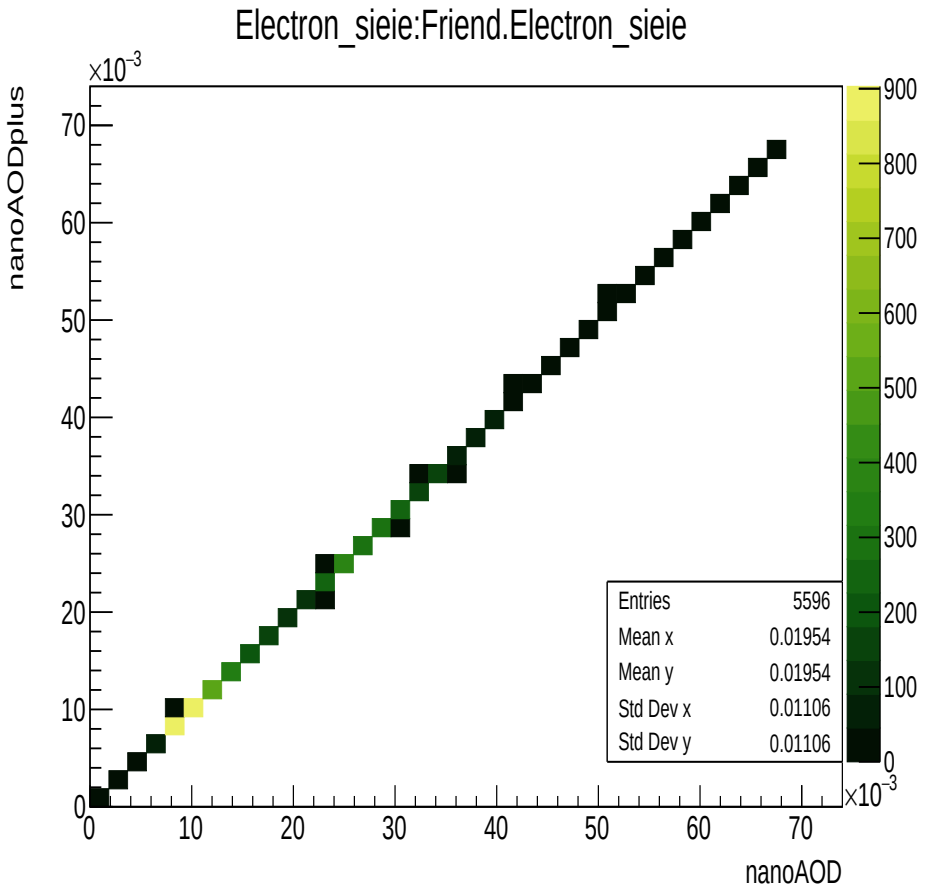

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
ϕ

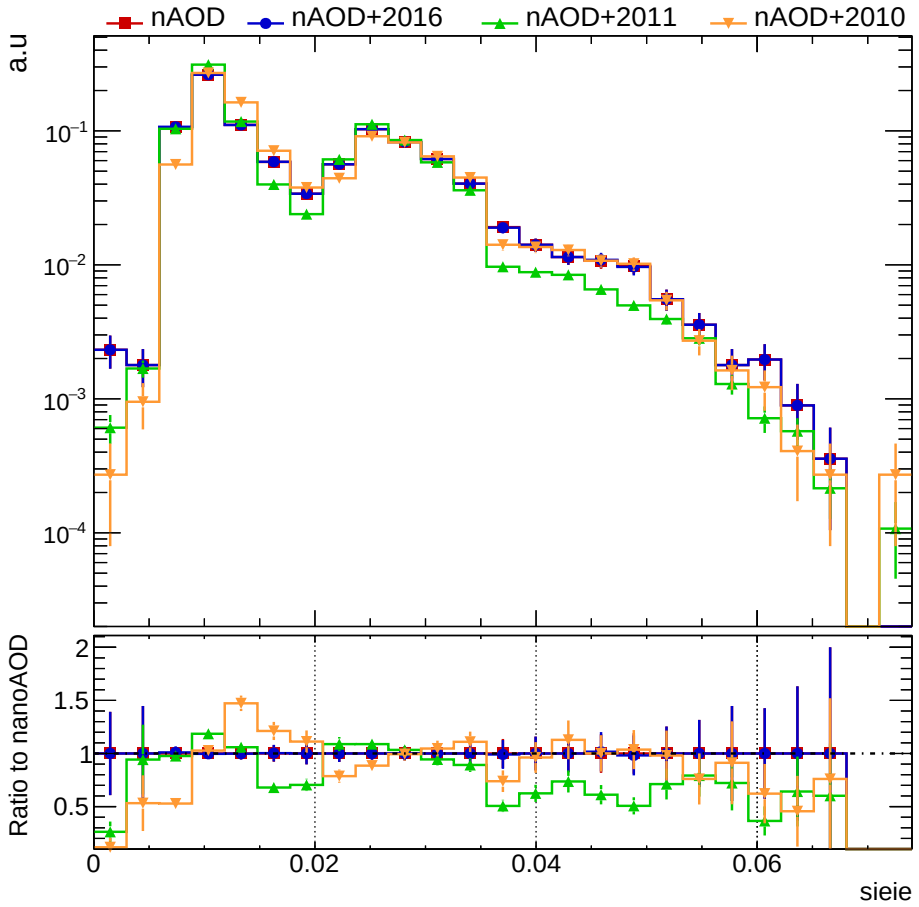
pt


Electron_pt:Friend.Electron_pt
nanoAODplus
nanoAOD
x10^3
Entries 5596
Mean x 36.45
Mean y 37.74
Std Dev x 31.92
Std Dev y 32.05

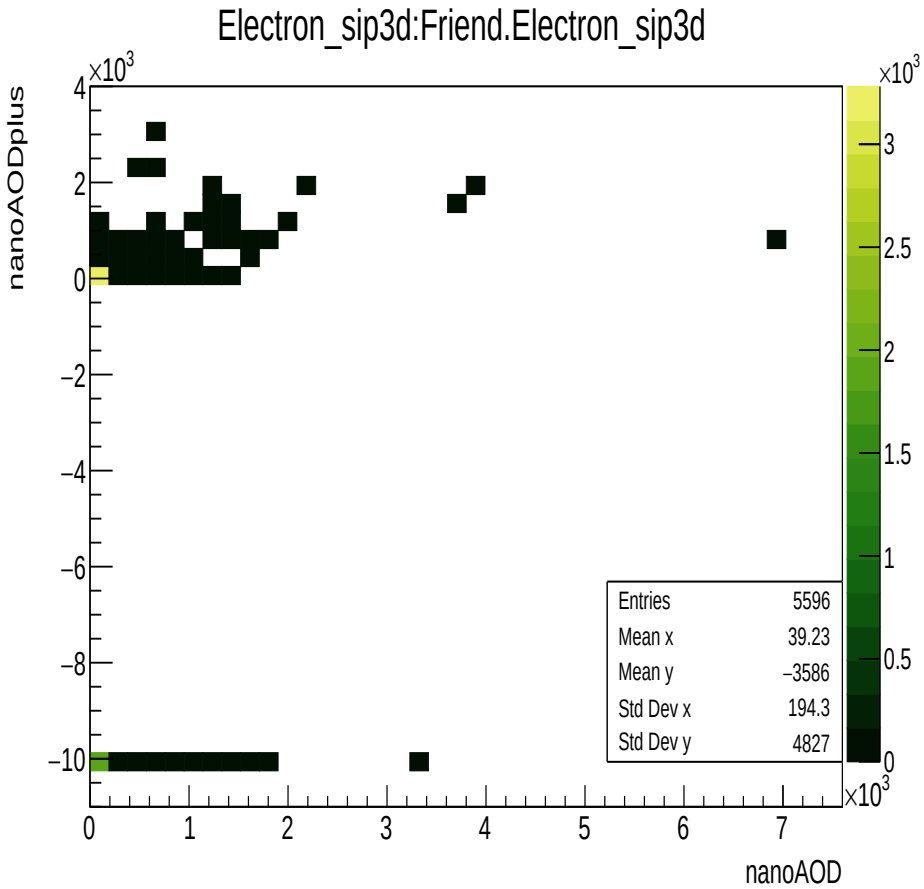

nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
p_T

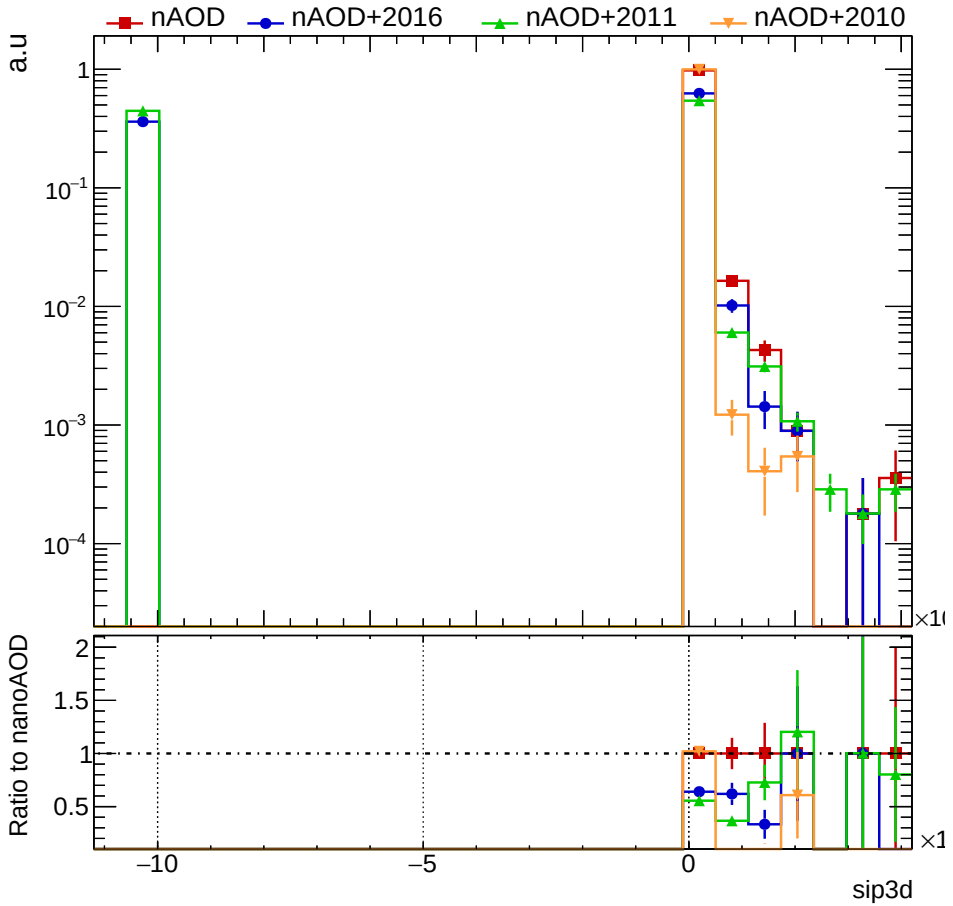
sieie


Electron_sieie:Friend.Electron_sieie
nanoAODplus
nanoAOD
Entries 5596
Mean x 0.01954
Mean y 0.01954
Std Dev x 0.01106
Std Dev y 0.01106


nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
sieie

sip3d


Electron_sip3d:Friend.Electron_sip3d
nanoAODplus
nanoAOD
×10^3
Entries 5596
Mean x 39.23
Mean y −3586
Std Dev x 194.3
Std Dev y 4827


nAOD
nAOD+2016
nAOD+2011
nAOD+2010
a.u
Ratio to nanoAOD
sip3d

tightCharge