Z + Jets analysis

miniAOD/nanoAOD crosscheck

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Plan for today

Introduction

Event selection & scale factors

Conclusions

Introduction

Why Z + jets?

- Massive production of Z+jets events
- Distinguishable decay channel: $Z \to l\bar{l}$
- Background for Higgs and various BSM processes
- Great test of perturbative QCD

miniAOD & nanoAOD

miniAOD:

- Introduced in spring 2014
- Common ”large ntuple”
- Size: 30 — 50kb/event

nanoAOD:

- A bare ROOT ntuple
- No tracks/ind. particle card
- Size: 1kb/event

Goal: Crosscheck existing analysis by Qun Wang based on miniAOD with nanoAOD

So far: Focus on the dimuon p_T spectrum

Event selection & scale factors

Step by step

- Event selection: triggers, leptons and jets
- Trigger and lepton ID efficiencies
- Rochester corrections to data and MC
- Pile-up reweight

Event selection: Triggers, leptons & jets

Triggers:

- EraBF: HLT_Mu17_TrkIsoVVL_Mu8, TkMu8_TrkIsoVVL, HLT_IsoTkMu24, HLT_IsoMu24
- EraGH/MC: HLT_Mu17_TrkIsoVVL_Mu8, TkMu8_TrkIsoVVL_DZ, HLT_IsoTkMu24, HLT_IsoMu24

Leptons:

- Leading muon $p_T > 25$ GeV, sub-leading muon $p_T > 20$ GeV
- $|\eta| < 2.4$
- Medium ID, medium ISO (< 0.15)
- Dimuon invariant mass: $76 < m_{\mu\mu} < 106$ GeV

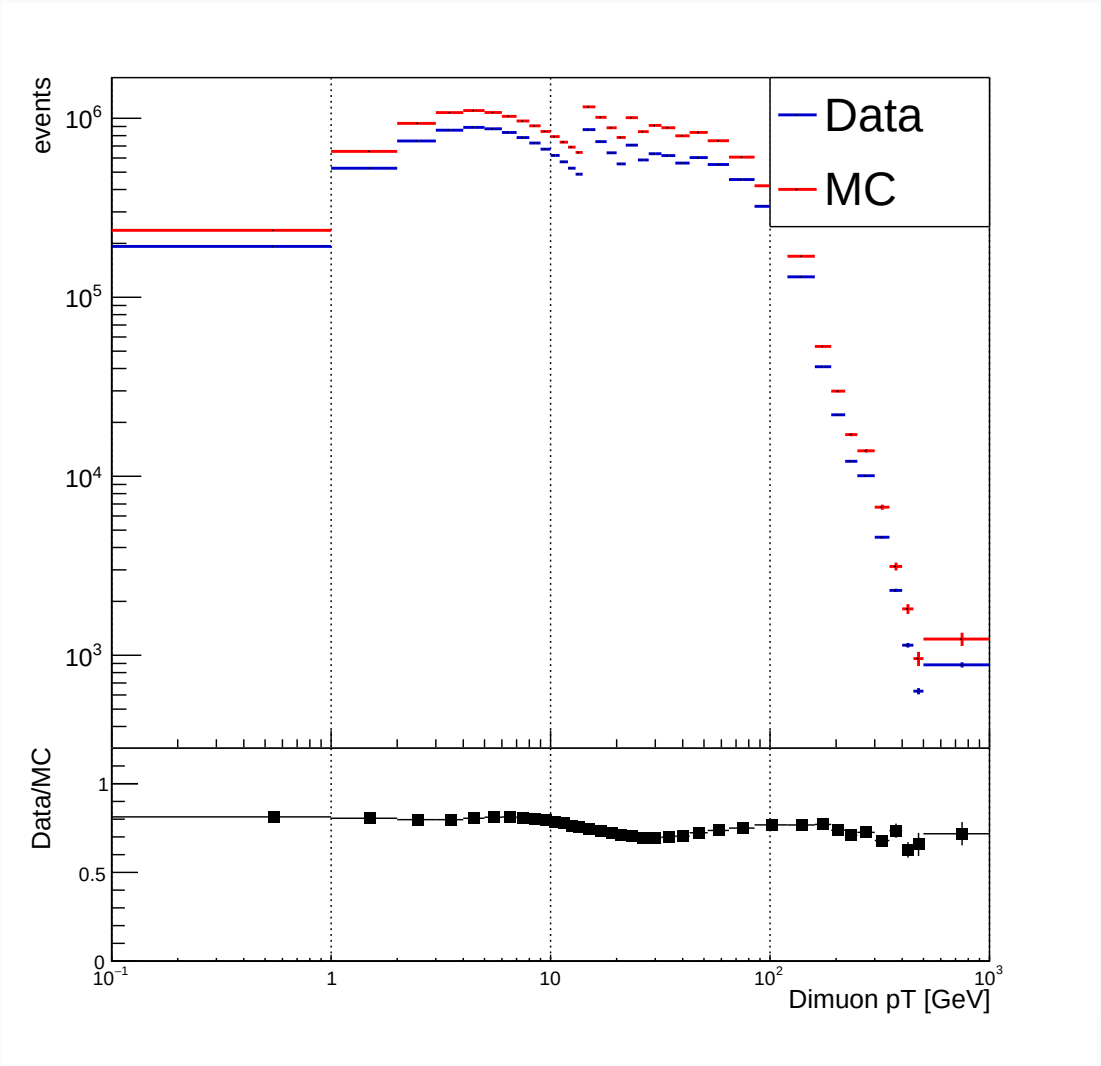
Jets:

- $p_T > 30$ GeV, $|\eta| < 2.4$
- AK4 jet
- Loose jet ID

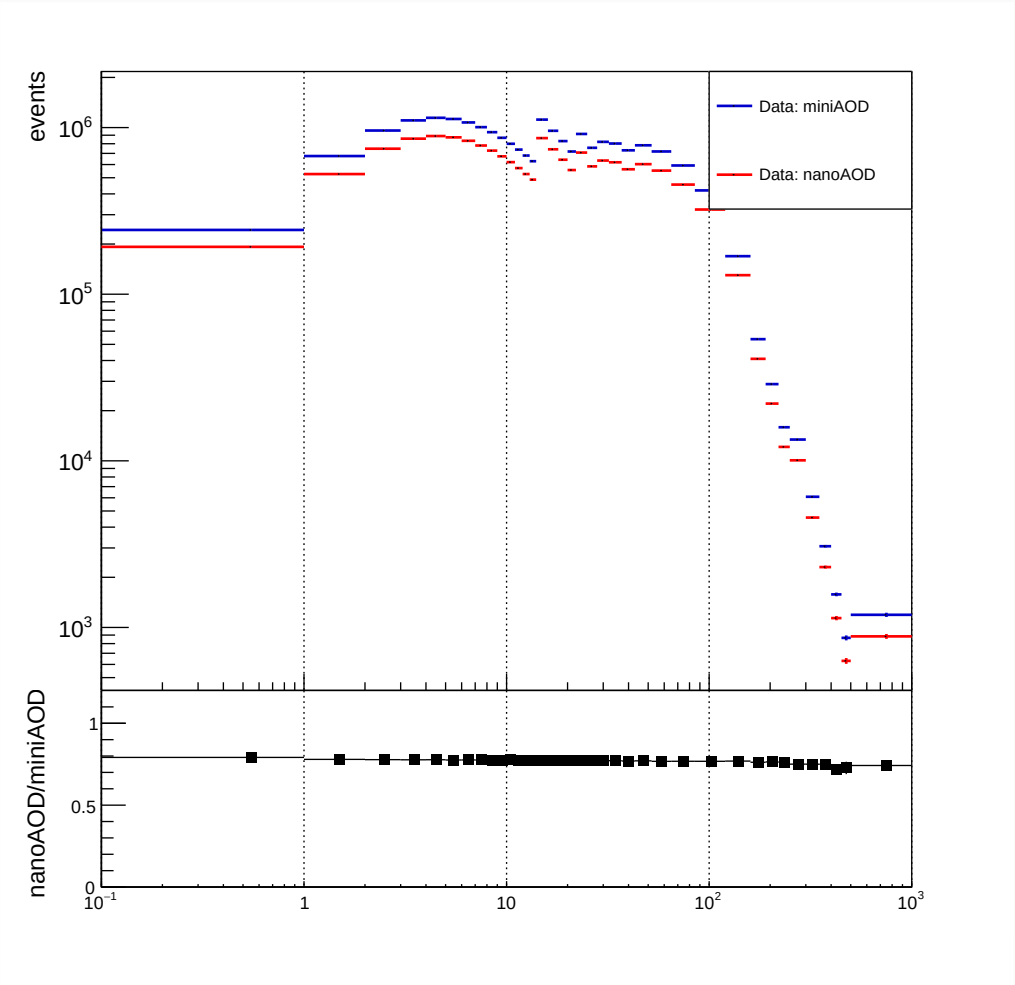
Event selection: Data vs MC (nanoAOD)

MC is scaled to luminosity $\frac{xs \cdot L}{\sum normgenweight}$: $normgenweight = \frac{genweight}{|genweight|}$

Plots are not normalised to bin-width



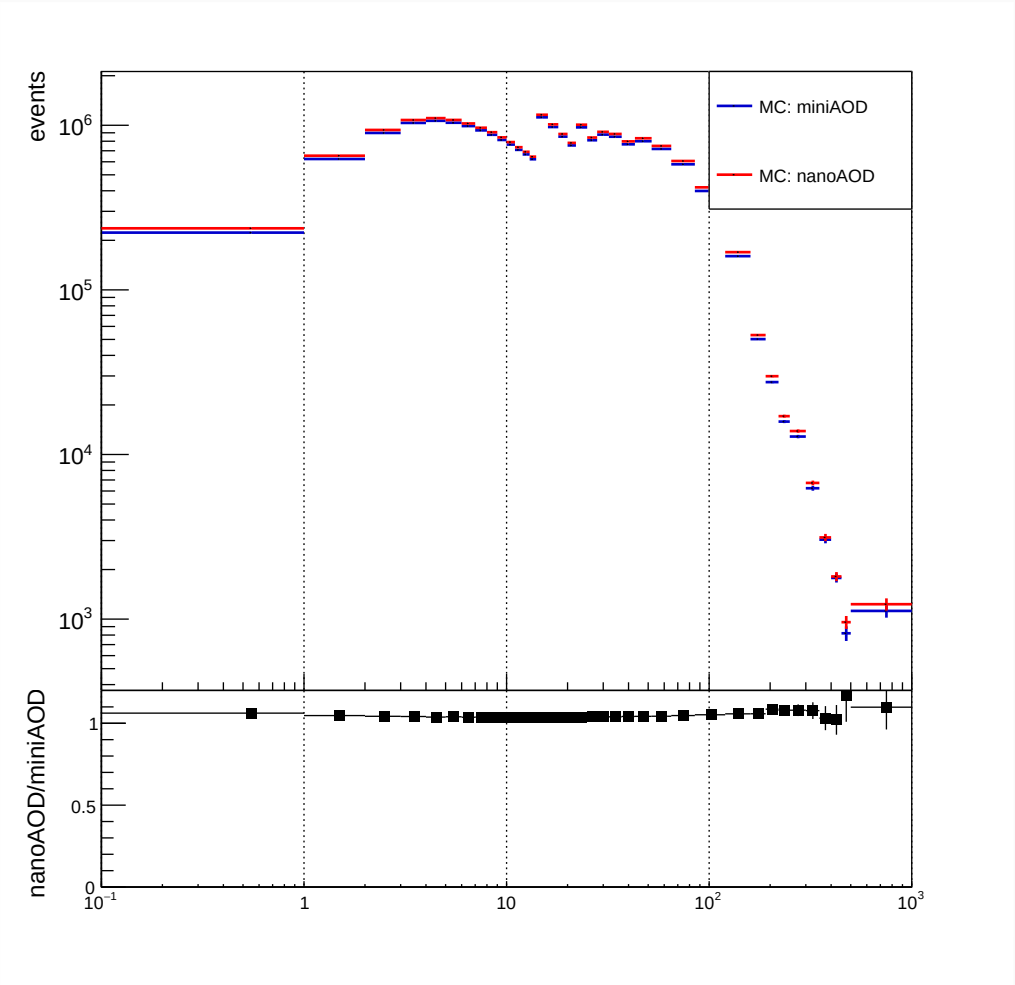
Event selection: miniAOD vs nanoAOD data



Around 20% ratio between nanoAOD and miniAOD data

Rochester corrections and pile-up need to be invested, as well as single muon data

Event selection: miniAOD vs nanoAOD MC



Around 5% ratio between nanoAOD and miniAOD MC

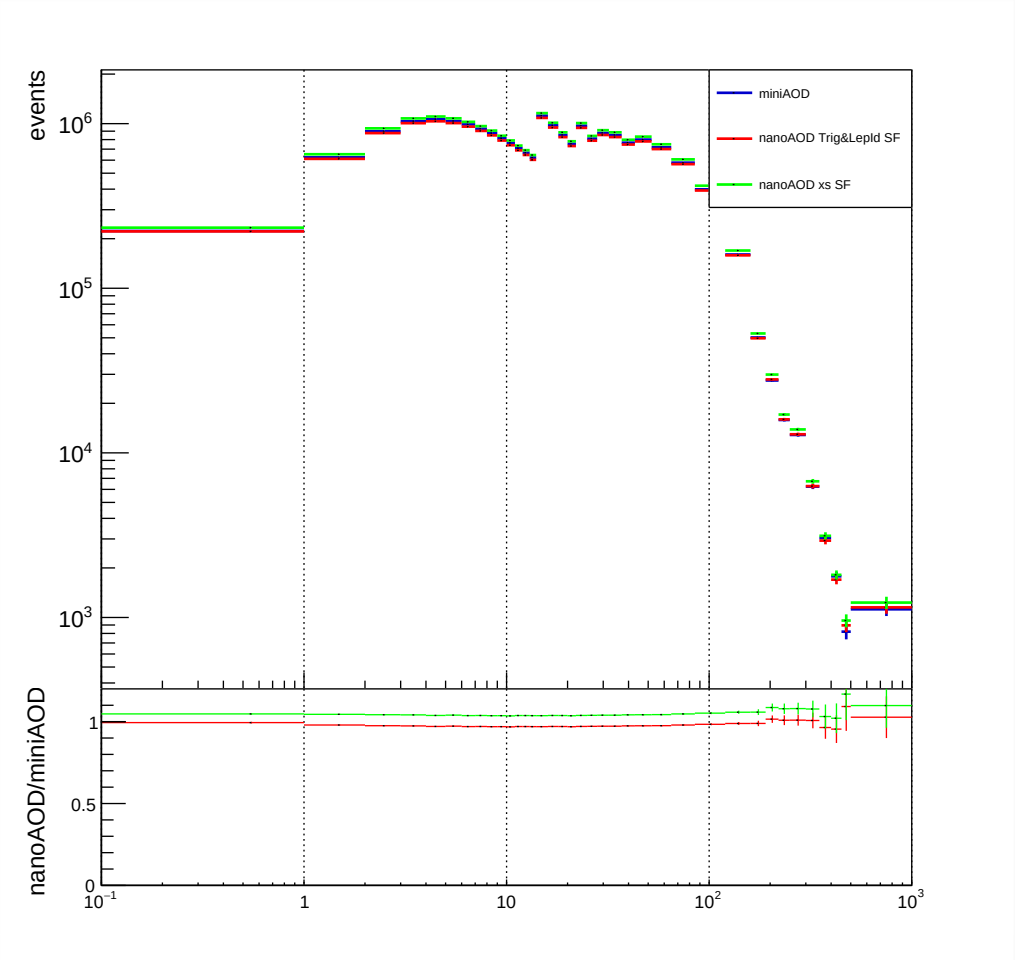
Trigger and lepton ID/ISO scale factors are not applied yet

Scale factors: Trigger & lepton ID/ISO efficiencies

Triggers and lepton IDs/ISO $\rightarrow$ efficiency issues

Trigger and lepton ID/ISO efficiency in MC is not the same as in data. Apply SF on MC to correct these differences

The efficiencies are computed using tag-probe method



Conclusions

Conclusions

- NanoAOD is a completely new data framework
- We achieved nice results with nanoAOD
- It shows agreement with miniAOD
- A tool for crosscheking miniAOD analyses

Coming soon...

1. Application of Rochester corrections (arXiv:1208.3710 [hep-ex])
   - Corrections applied only to muons
   - Improve lorentz vectors of muons
   - Better Z mass description
2. Pile-up reweight
3. Studies of jet multiplicities, ϕ distributions...
   - For a better understanding of nanoAOD
   - Crosscheck with the rest analysis performed by Qun