Task 4, Higgs to gammatautau

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26.04.2023

Summary of MC selection

- Found bug with beam energies, rerunning MC production...
- Settings – based on ATLAS and LHC Higgs WG defaults
- Example on slide 14
- Default Breit-Wigner cutoff is 15, using this (consistent with ATLAS selection)
- Minimum transverse momentum of the Higgs at the underlying Born level $= 0.26$

Pythia settings

- SpaceShower:pTmaxMatch = 2
- Always allow emissions up to the kinematical limit. This will simulate all possible event topologies, but may lead to double-counting. (Also known as power showers.)
- TimeShower:pTmaxMatch = 2
- Always allow emissions up to the kinematical limit (i.e. to half the dipole mass). This will simulate all possible event topologies, but may lead to double-counting. (Also known as power showers.)

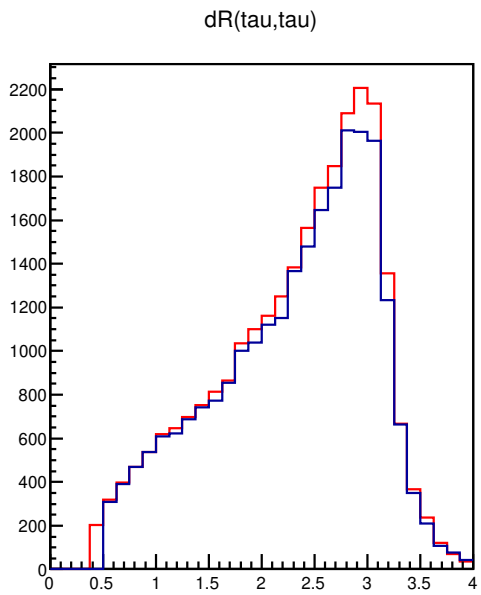
Pythia settings

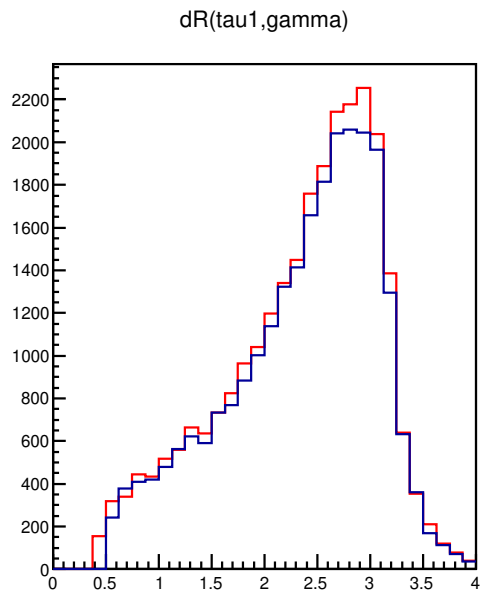
- BeamRemnants:primordialKThard = 1.74948
- SpaceShower:pT0Ref = 1.923589
- MultipartonInteractions:pT0Ref = 2.002887
- These are non-Pythia-standard selections, based on values used by ATLAS instead.

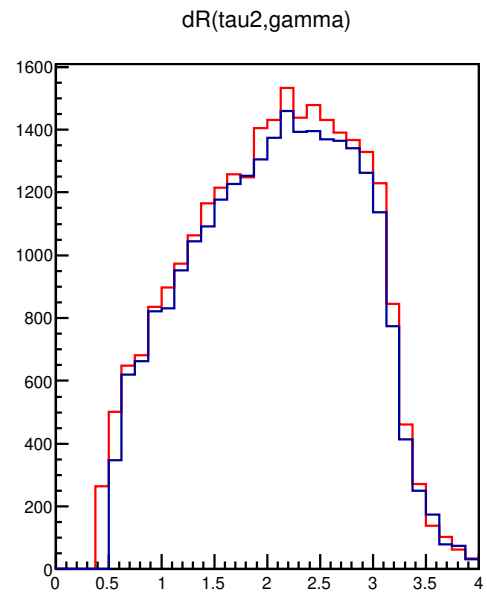
Delphes settings

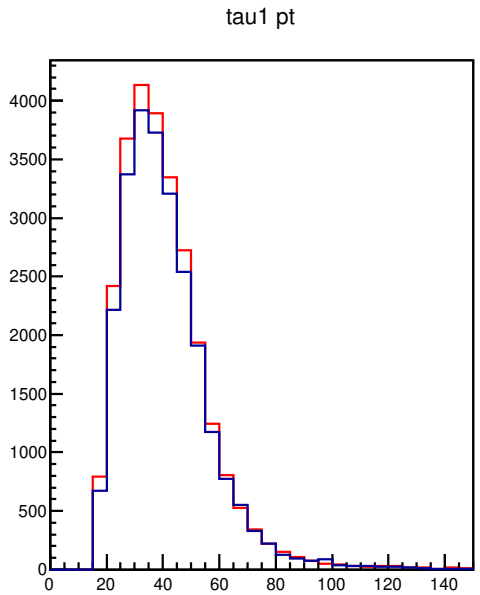
- Delphes is strange...
- CMS card uses jets (and all other objects) with deltaR = 0.5 by default, and JES is tuned for that
- (ATLAS card uses jets with deltaR = 0.6 in case you are wondering why we don't use it...)
- Easy to change deltaR for jets and taus definition, current standard is 0.4, this is what we are currently using
- But JES is wrong then (and TES is non-existent in Delphes to begin with...)
- Current (somewhat arbitrary) procedure: generator jets with pT $>$ 10 GeV, "reco" jets with pT $>$ 12 GeV, taus with pT $>$ 15 GeV

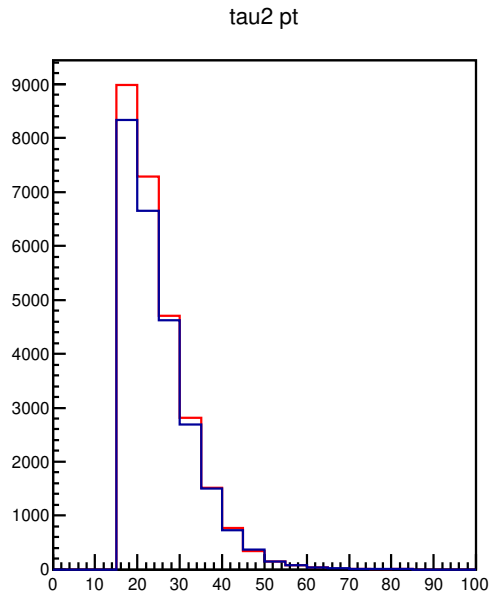
dR 0.4 and dR 0.5 objects comparisons

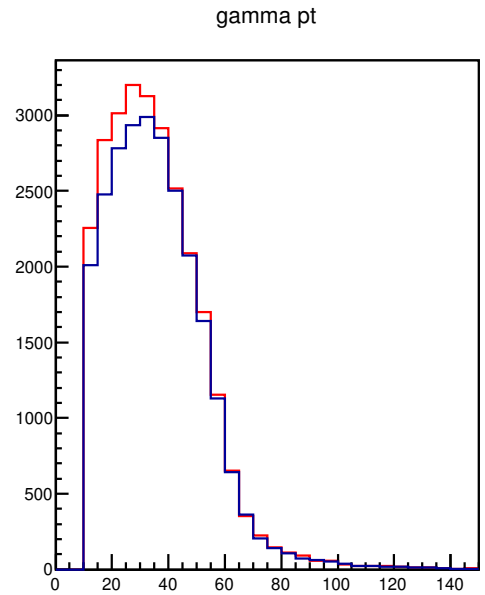




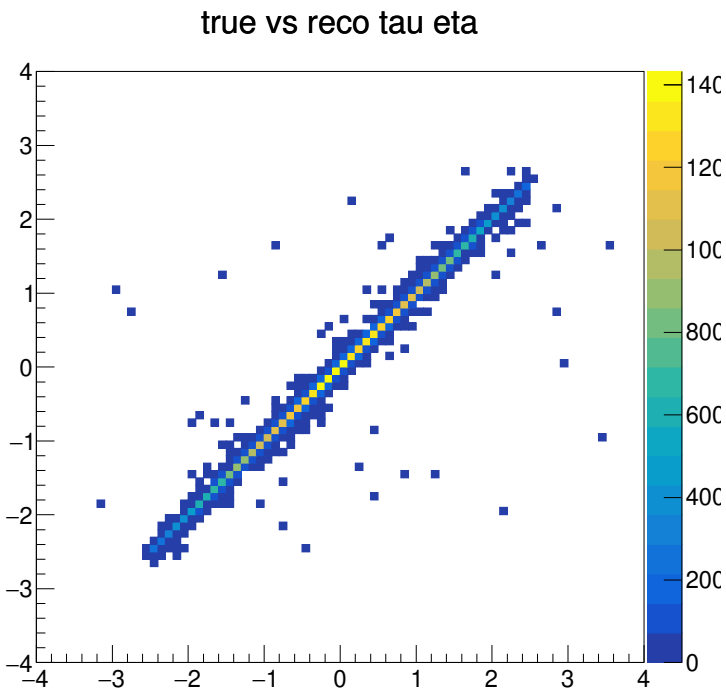


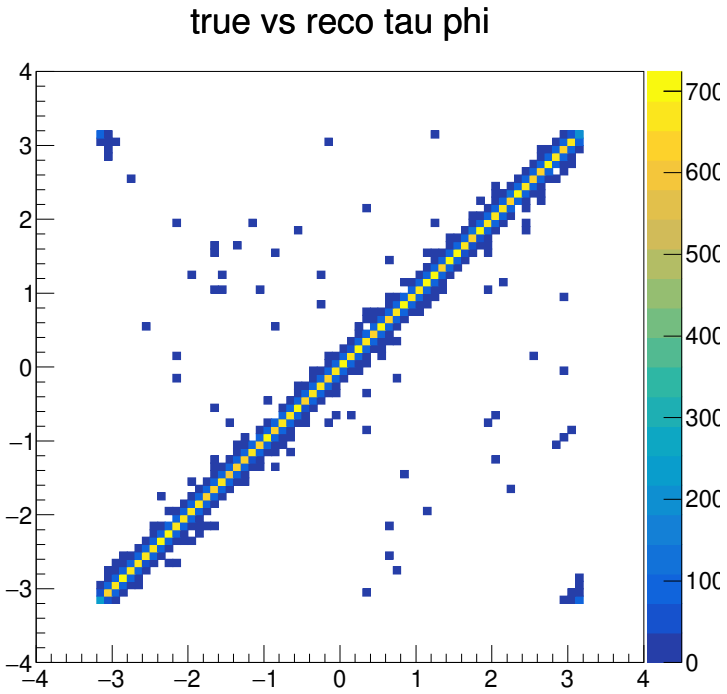






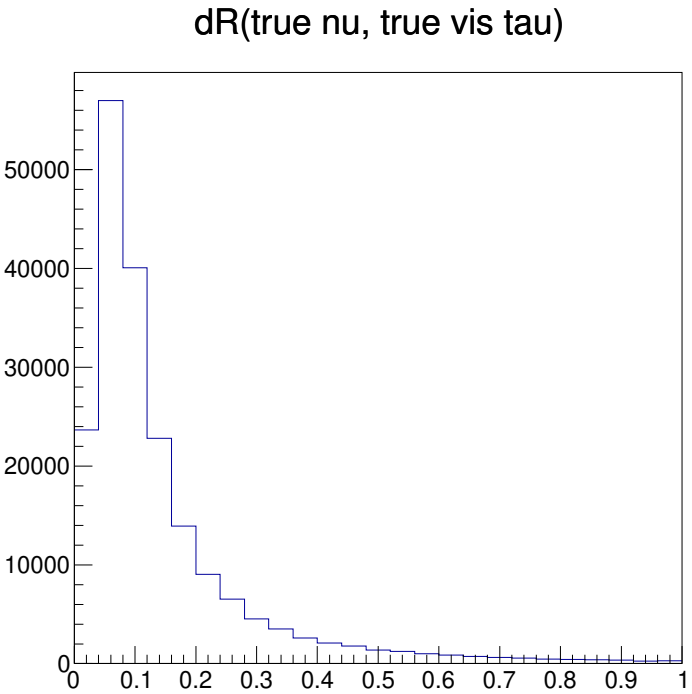
True vs reco taus

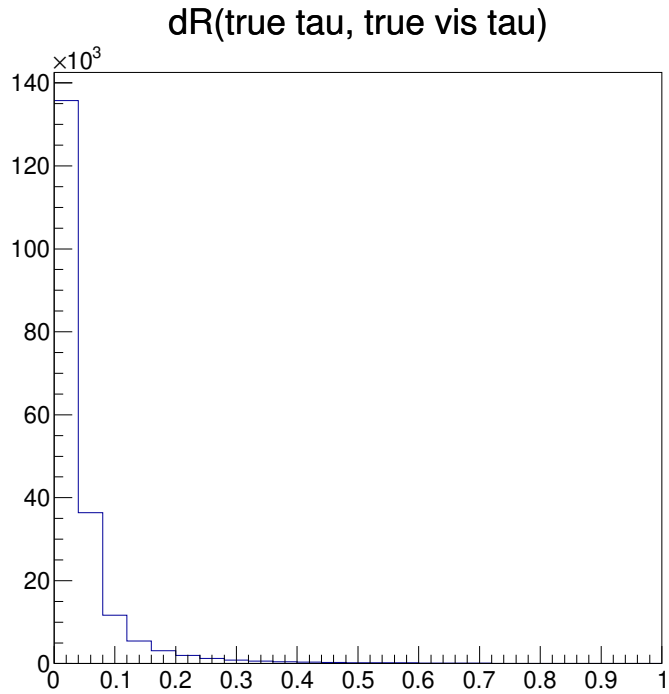




In principle VERY good agreement between true and reco taus, is everything correct?

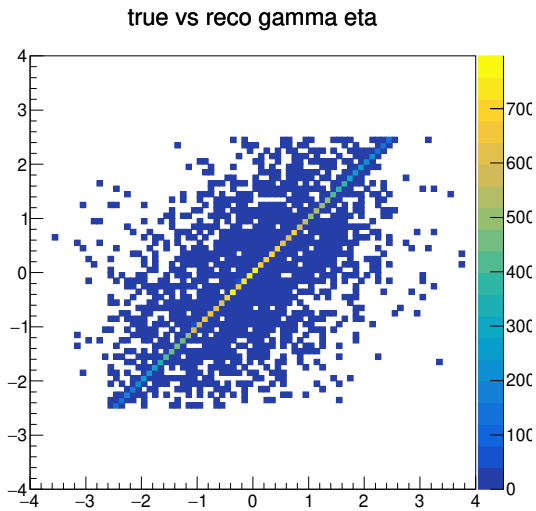
True taus and nu

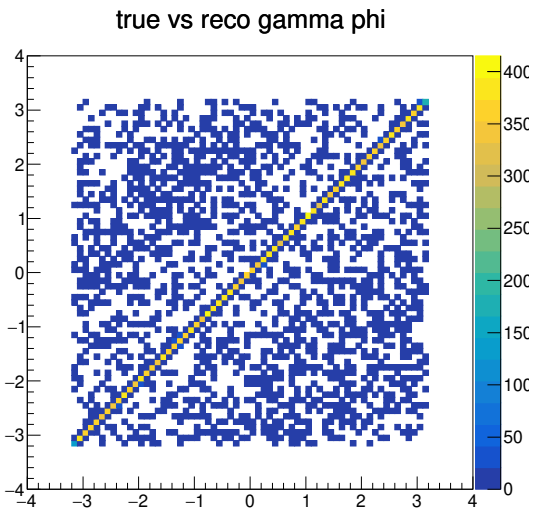


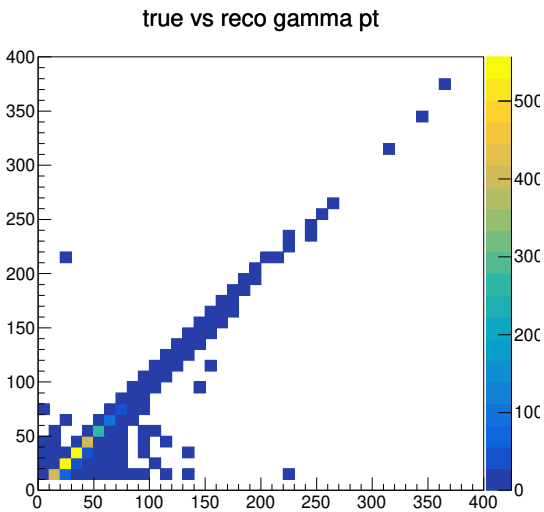


Neutrinos are collinear with visible parts of taus, but seem to be non-zero. So probably not a bug.

True vs reco gammas

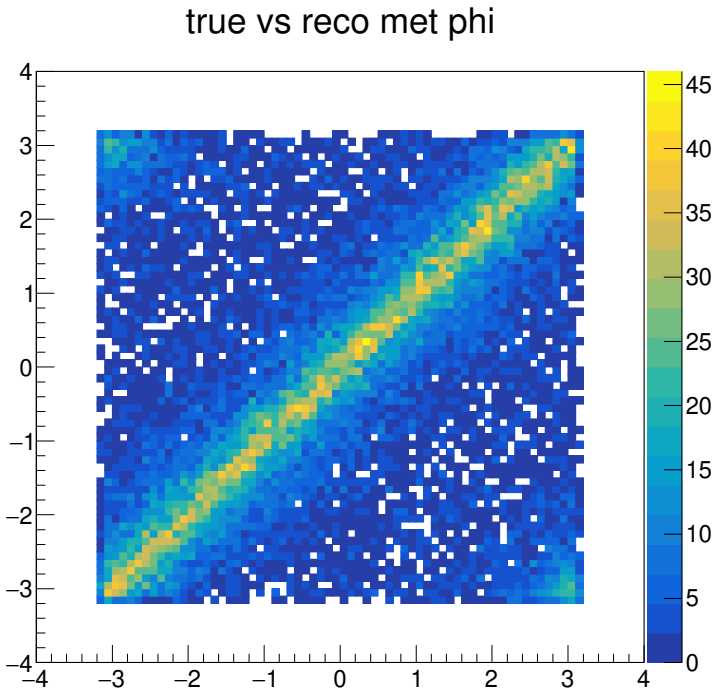


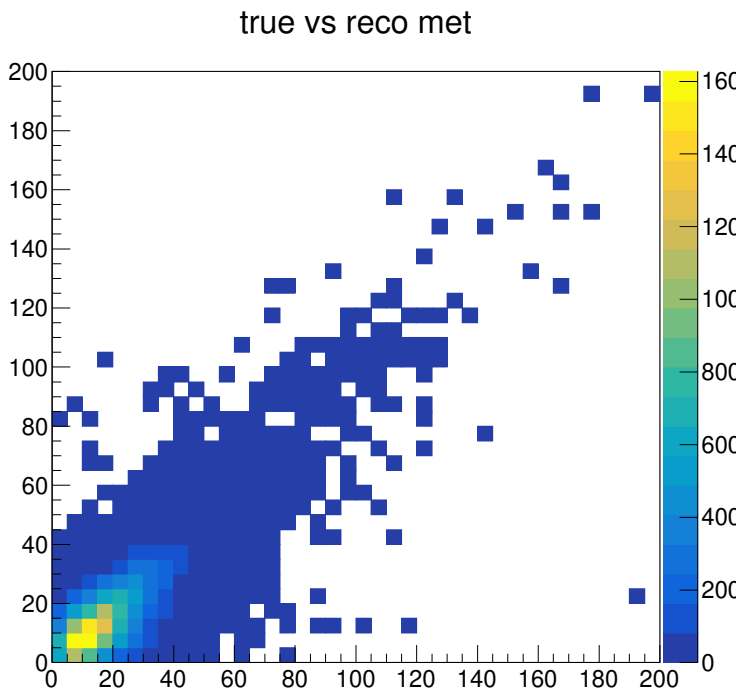




At above 200 GeV pT the agreement is VERY good. Likely due to the ECAL resolution formula Delphes uses.

True vs reco met





Good correlation between reco MET and sum of the two true neutrinos. This is good.