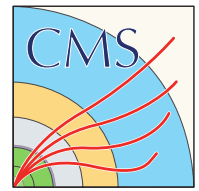
NanoAOD kinematic reconstruction

Jonas Rübenach
EXO Meeting
April 3, 2020

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES



Data and cuts

- 2018 data with 59.69 fb^{-1} (Golden JSON)
- Recommended triggers for MuonEG, SingleMuon, DoubleMuon, EGamma
- Recommended MET filters applied
- Electron and muon scale factors applied
- Electron ID: Isolation WP90
- Muon ID: Cut-based medium, loose iso
- Exactly two opposite sign leptons
- Leading lepton $p_T > 25$ GeV, Subleading > 20 GeV
- $M_{ll} > 20$ GeV
- Z window cut (from 76 GeV to 106 GeV)
- At least 2 jets
- Jet $p_T > 30$ GeV
- At least one b-tagged jet
- MET > 40 GeV in same flavor channels

$t\bar{t}$ kinematic reconstruction

using Sonnenschein's method

Want to know the four momenta of the two neutrinos
Inputs from NanoAOD:

- Four momenta of lepton and antilepton
- Four momenta of bottom quark and bottom antiquark
  - Use b-tagged jets
  - If not exactly two b-tagged jets: choose by most likely m_{lb}
- MET p_{T} and φ

Setup:

1. Set $m_{\nu} = m_{\bar{\nu}} = 0$
2. Set $m_{\mathrm{t}} = m_{\bar{\mathrm{t}}} = 172.5$
3. Set m_{W^+} and m_{W^-} randomly

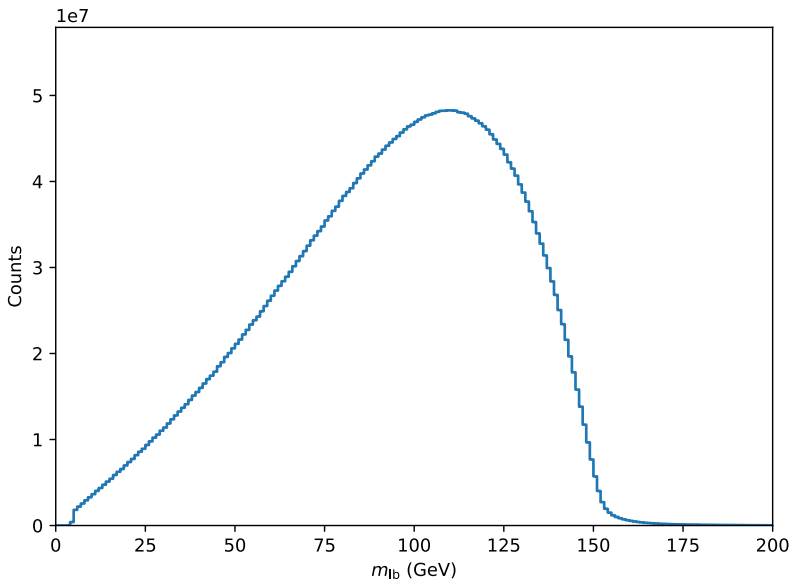
Algebra now yields 4 solutions, which may or may not have an imaginary part.

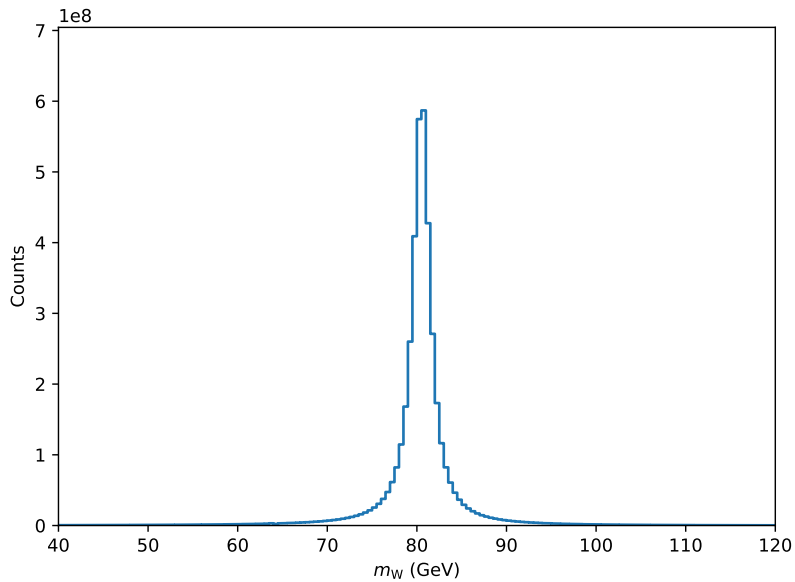
- Vary lepton and quark inputs within uncertainty: more real solutions

Input distributions

Mass of lepton/bottom-quark system and W bosons

Made from 2018 NanoAOD $t\bar{t} \rightarrow 2l2\nu$





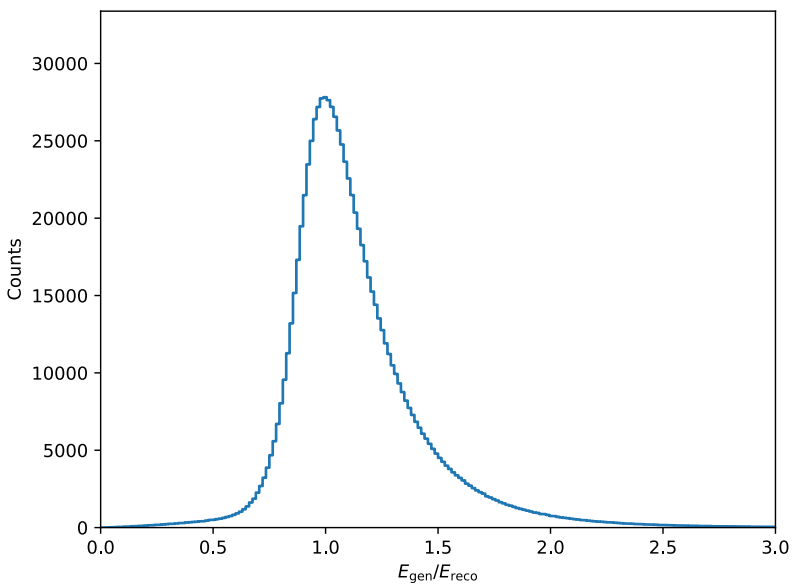
No problems observed here.

Input distributions

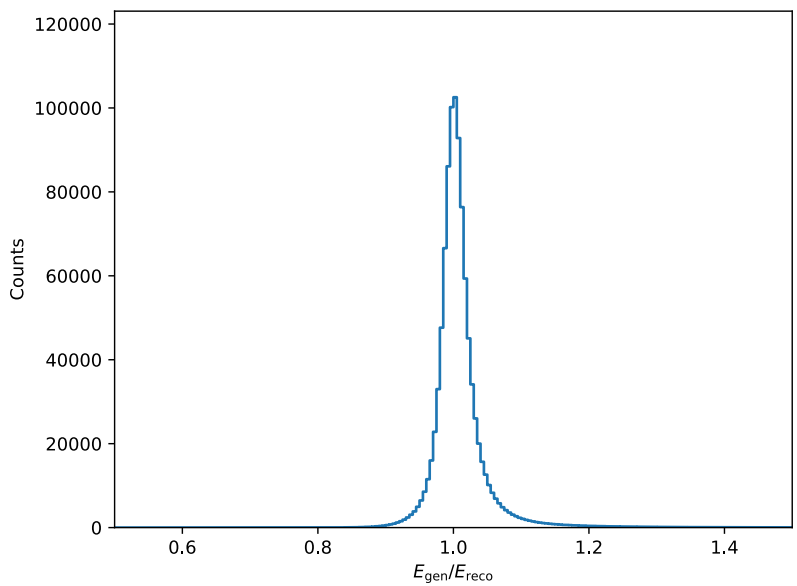
Energy variation factors

Made from 2018 NanoAOD $t\bar{t} \rightarrow 2l2\nu$
Matching between Gen and Reco done only by $\Delta R < 0.3$

Bottom quarks



Leptons



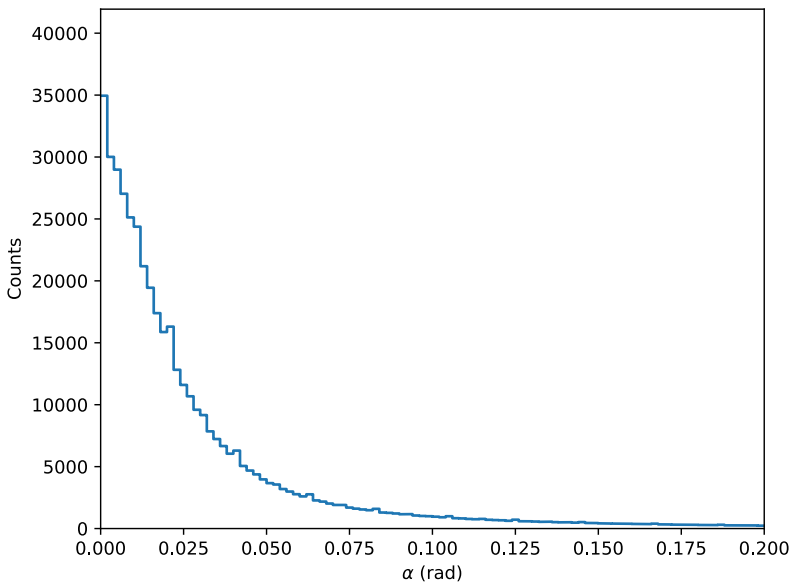
No problems observed here either.

Input distributions

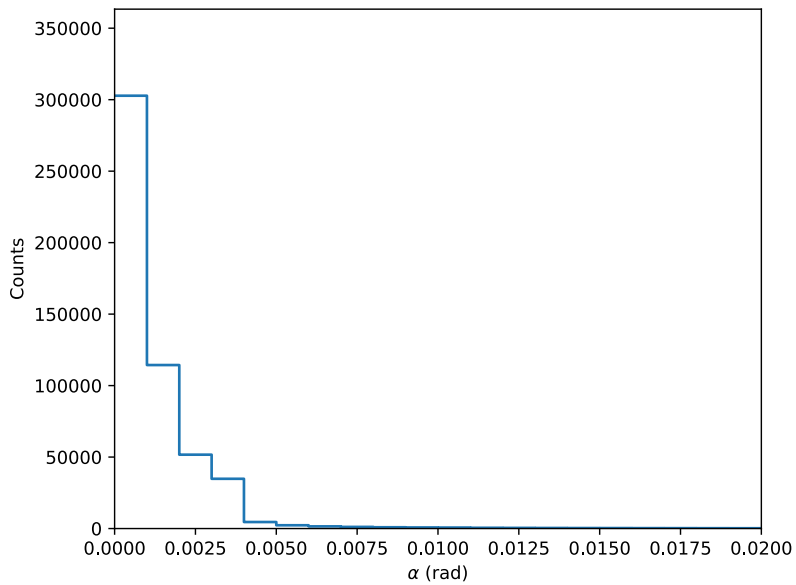
Angle variation factors

Made from 2018 NanoAOD $t\bar{t} \rightarrow 2l2\nu$
Matching between Gen and Reco done only by $\Delta R < 0.3$

Bottom quarks



Leptons



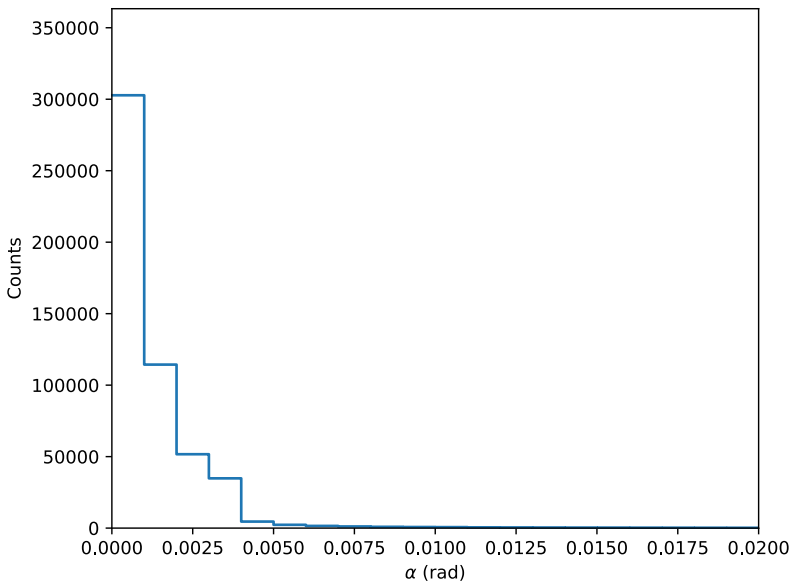
Would like to have finer binning for the lepton distribution

Input distributions

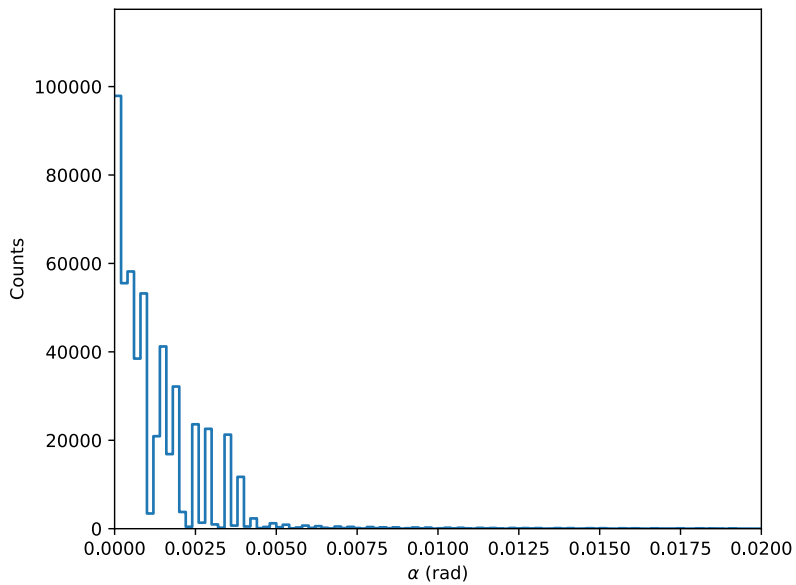
Angle variation factor for leptons

Increased binning to 100 bins. Got weird pattern in the distribution.

From the previous slide



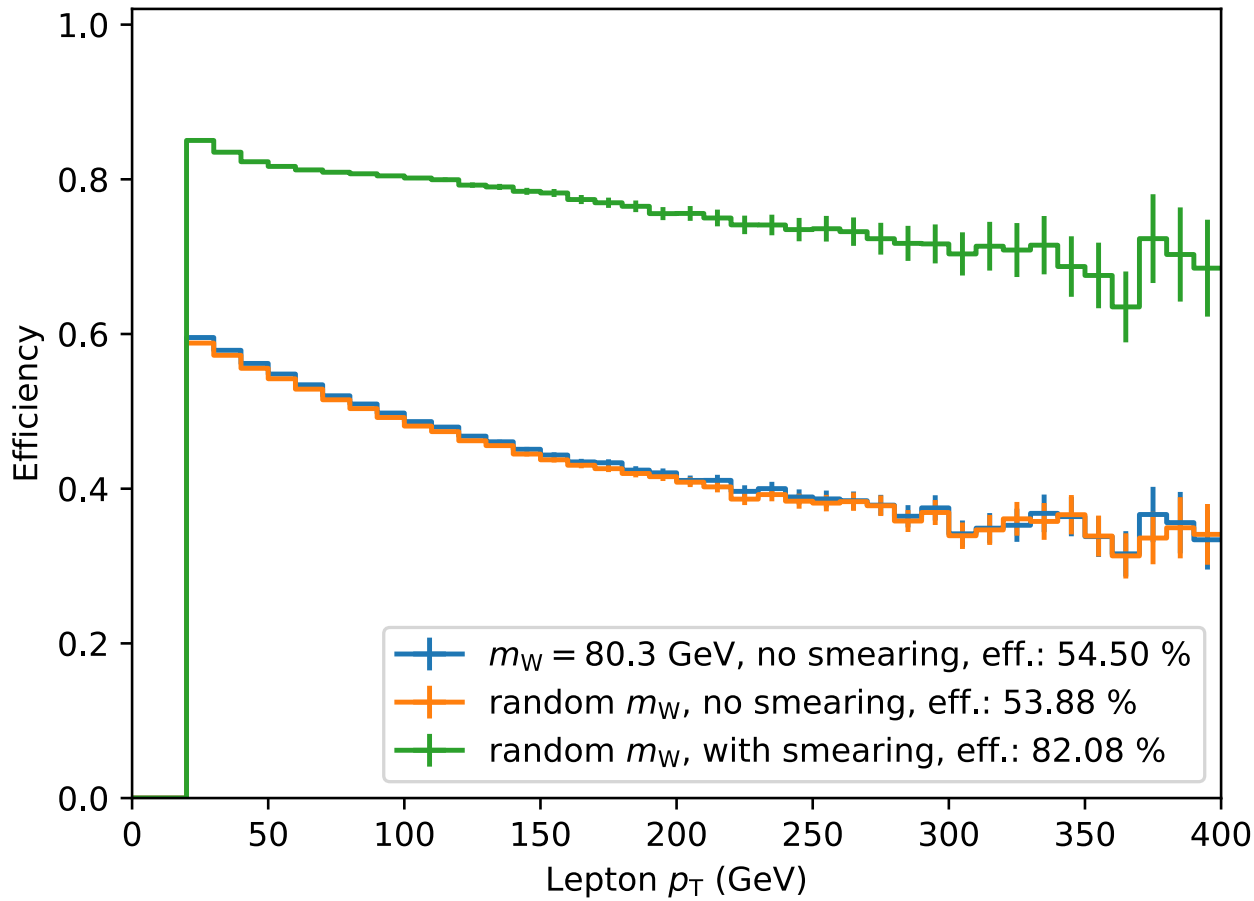
Finer binning



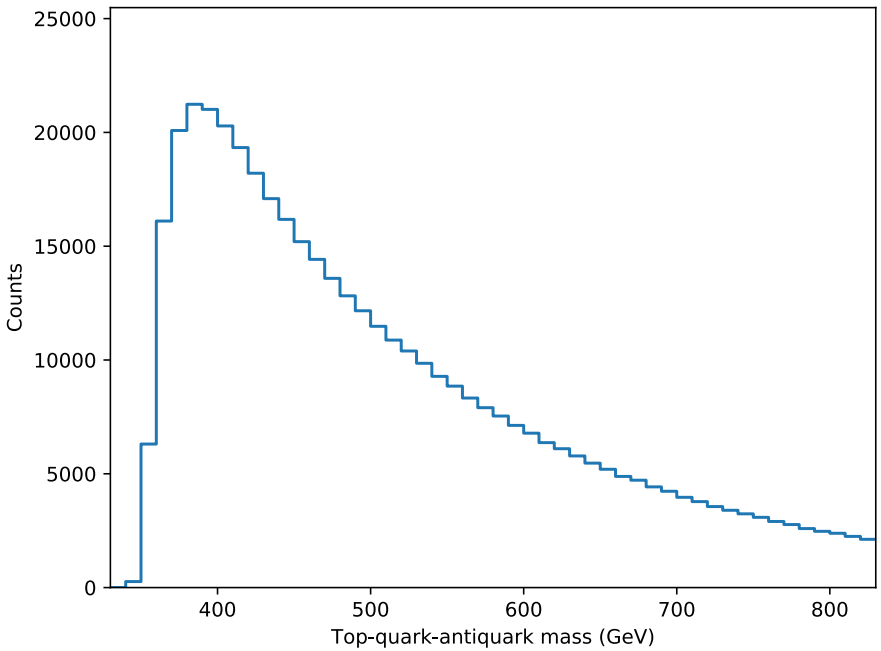
Probably due to limited precision in NanoAOD.

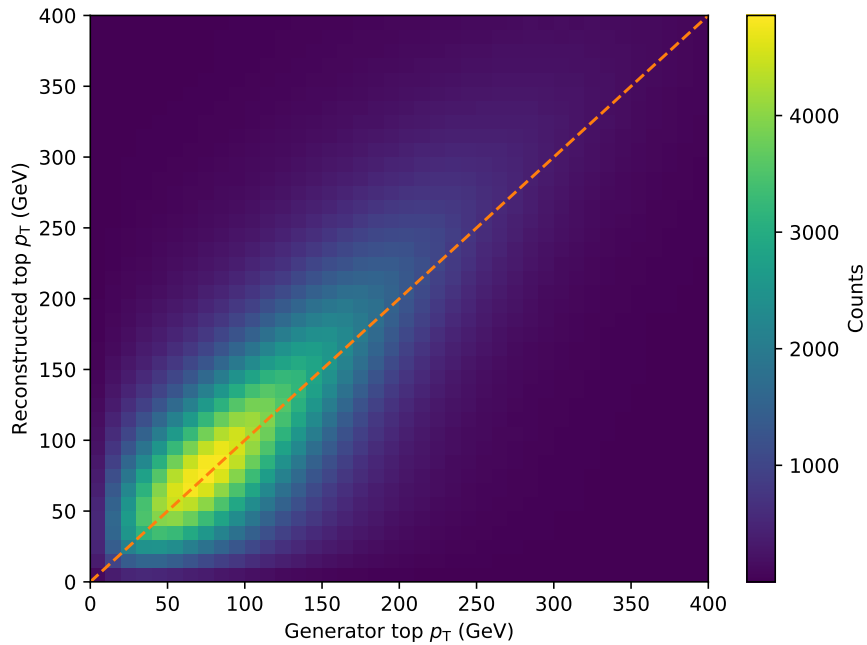
Reconstruction efficiencies

Efficiency: Number of events with real solution / Total number of events



Reconstructed top quantities





Reconstruction might have a slight tendency for higher p_T.

Thank you