Top mass mesurement @ CEPC status

2025 ihep ttbar coupling weekly meetings

Xiaohu Sun, Leyan Li , Yuming Lin (Peking University, PKU)

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Outline

- Madevent settings update
- Delphes settings update & issues
- Systematic uncertainty envisage
- Summary

ISR & Beamstrahlung effect setting and Xsec check

```
launch
  shower=Pythia8
  0
  set nevents 50000
  set param_card mass 6 1.715000e+02
  set param_card decay 6 1.33
  set param_card sminputs 3 0.1184
  set ebeam1 171.37500
  set ebeam2 171.37500
  set lpp1 3
  set lpp2 -3
  set polbeam1 0
  set polbeam2 0
  set cut_decays False
  set bwcutoff 15
  set pdlabel fcce365ll
  set iseed 38967552
  0
exit
```

- add lpp_1 & lpp_2
- add set pdlabel fcce365ll

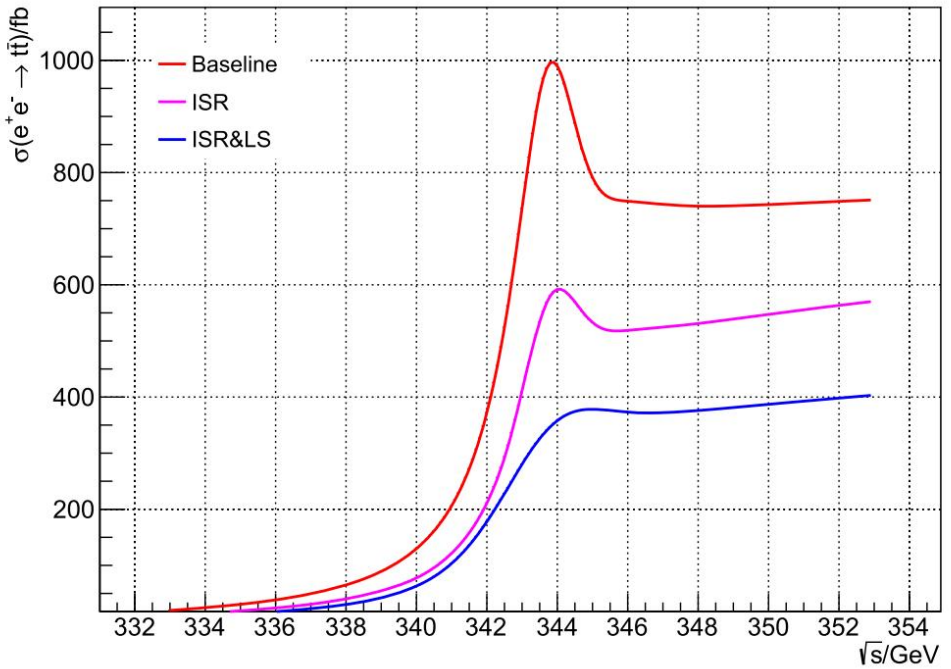


Fig. 2 The $t\bar{t}$ cross-section as a function of centre-of-mass energy calculated from QQbar_threshold including the cross-section values without ISR or LR (baseline), the ones with ISR only and the ones with both ISR and LS

Top quark mass measurements at the t\bar{t} thresholdwith CEPC

Lepton collisions in MadGraph5 aMC@NLO

Xsec check

ttbar hh process

add set pdlabel fcce365ll

- add lpp_1 & lpp_2
- add set pdlabel fcce365ll

job_id	hh (5w/per job)	hh_fcce365ll (5w/per job)	hh_fcce365ll lpp1=3 lpp2=−3 (10w/per job)
avg	0.03338 pb	0.03340 pb	0.01986 pb

ttbar lepton process

job_id	ll(5w / per job)	ll_fcce365ll (5w / per job)	ll_fcce365ll lpp1 = 3 lpp2 =−3 (5w /per job)
avg	0.00834pb	0.00834pb	0.00496 pb

- Xsec of both hh and ll processes has decreased by 40% of its original
- ISR and Beamstrahlung effect settings have taken effect
- LS effect need to consider it in the future

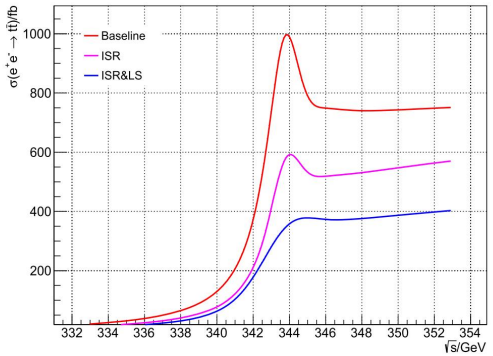


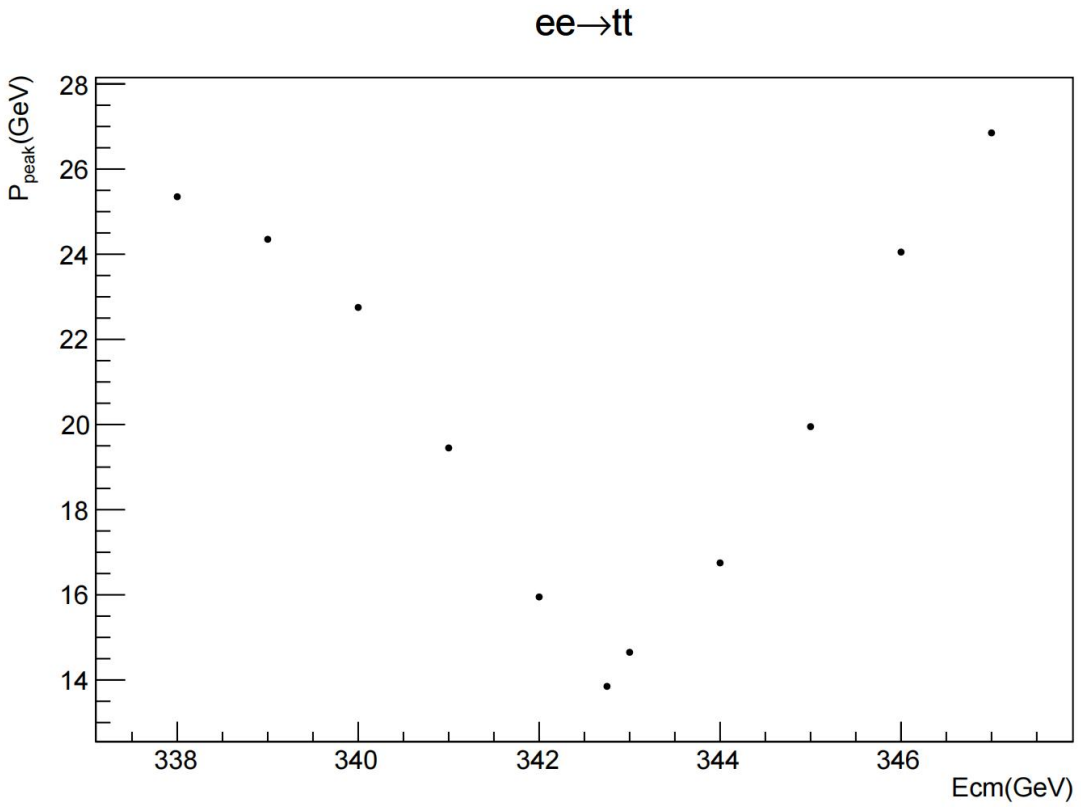
Fig. 2 The $t\bar{t}$ cross-section as a function of centre-of-mass energy calculated from QQbar_threshold including the cross-section values without ISR or LR (baseline), the ones with ISR only and the ones with both ISR and LS

Variables check in Truth level (Yuming Lin)

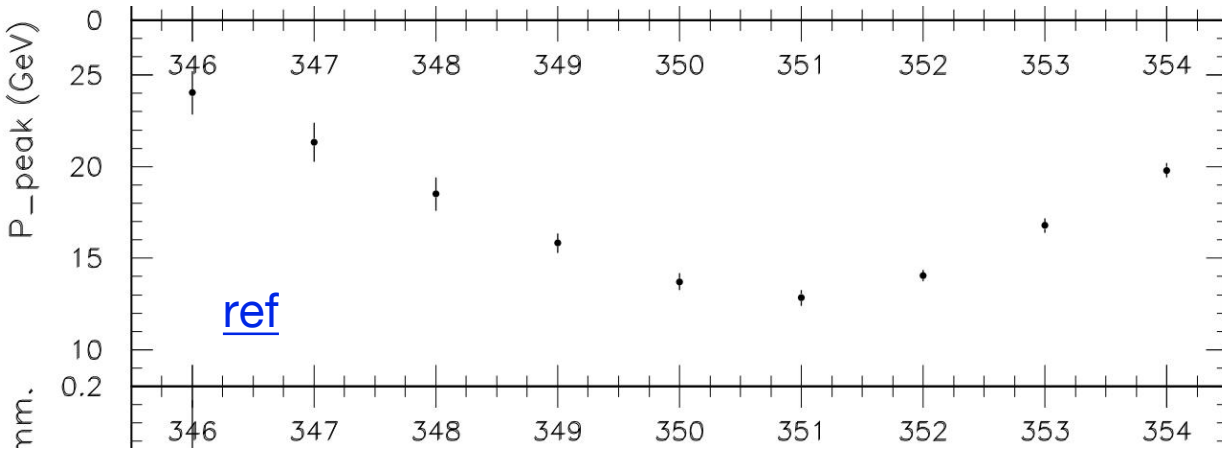
- We want to add some new variables in our top mass mesurement analysis
- top P-peak & FB charge asymmetry are new
- Verify at the LHE level compared to the ref
- Generate sl process at {338, 339, 340, 341, 342, 342.75, 343, 344, 345, 346, 347} gev

Multi-parameter fits to the $t\bar{t}$ threshold observables at a future e+e- linear collider

Variables check in Truth level : top P-peak

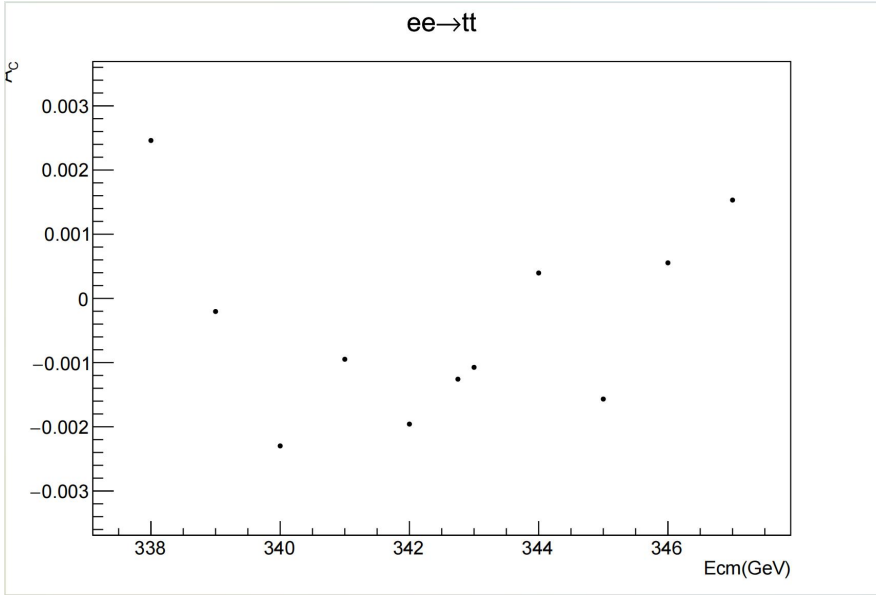


Vs

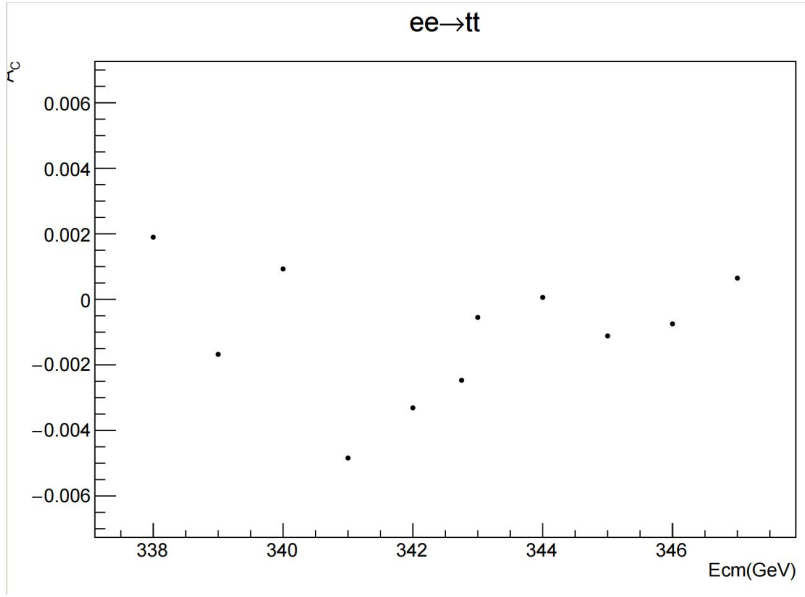


- This version did not take into account the ISR effect
- Lowest P_peak $\sqrt{s}$ is different from ref because of our seetings

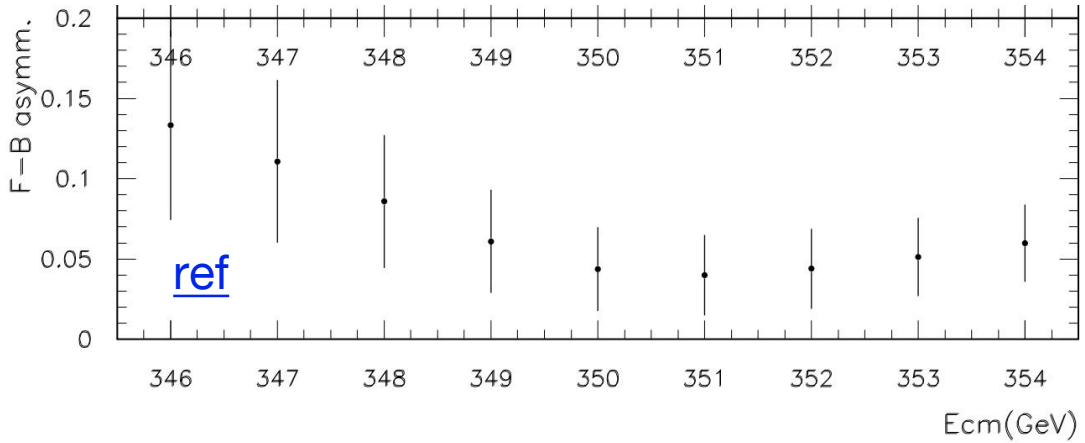
Variables check in Truth level : FB charge asymmetry



sl_m

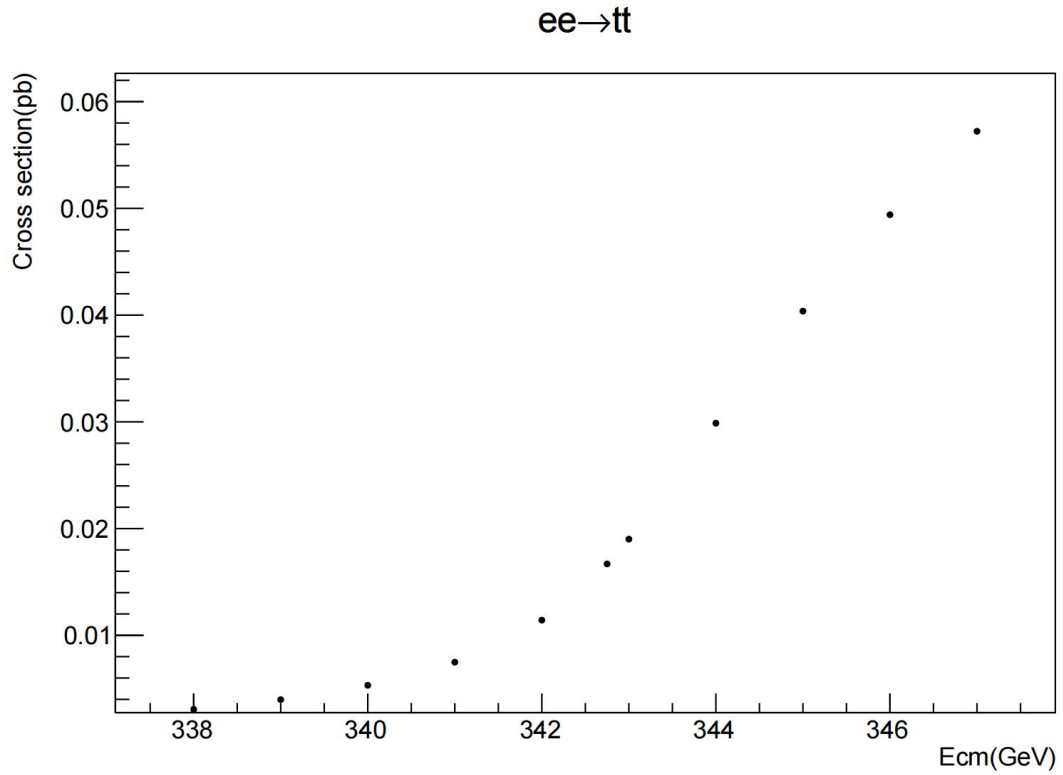


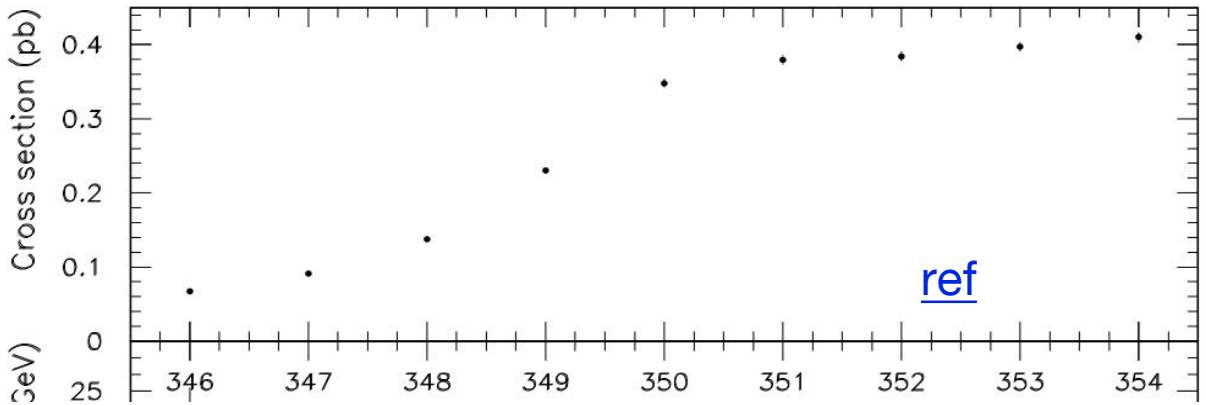
sl_p



- The situation that matches is not good
- need to do futher check

Variables check in Truth level : Cross Section





- Delphes settings update & issues

.Tcl card general introduction---fast jet finder

Ecal_Tracks + Ecal_photons + Hcal_hadrons

```
####################
# Energy flow merger
####################

module Merger EFlowMerger {
  add InputArray  Calorimeter/eflowTracks
  add InputArray  Calorimeter/eflowPhotons
  add InputArray  TimeOfFlightNeutralHadron/eflowNeutralHadrons
  set OutputArray eflow
}
```

```
847     add Branch EFlowMerger/eflow ParticleFlowCandidate ParticleFlowCandidate
```

```
##################
# ROOT tree writer
##################

# Tracks, towers and eflow objects are not stored by default in the output.
# If needed (for jet constituent or other studies), uncomment the relevant
# "add Branch ..." lines.

module TreeWriter TreeWriter {
    # add Branch InputArray BranchName BranchClass
    add Branch Delphes/allParticles Particle GenParticle
    add Branch TruthVertexFinder/vertices GenVertex Vertex

    #add Branch IdentificationMap/tracks Track Track
    #add Branch Calorimeter/towers Tower Tower

    #add Branch Calorimeter/eflowTracks EFlowTrack Track
    #add Branch Calorimeter/eflowPhotons EFlowPhoton Tower
    #add Branch TimeOfFlightNeutralHadron/eflowNeutralHadrons EFlowNeutralHad

    add Branch  EFlowMerger/eflow ParticleFlowCandidate ParticleFlowCandidate

    #add Branch Calorimeter/photons CaloPhoton Photon
    #add Branch PhotonEfficiency/photons PhotonEff Photon
    #add Branch PhotonIsolation/photons PhotonIso Photon
    #add Branch PhotonFilter/Photonpair Photonpair Photon

    #add Branch GenJetFinder/jets GenJet Jet
    #add Branch GenMissingET/momentum GenMissingET MissingET

    #add Branch FastJetFinder/jets Jet0 Jet
    add Branch JetEnergyScale/jets Jet Jet
```

Womuonpair

```
################
# Muon filter
################

module PdgCodeFilter MuonFilter {
  set InputArray EFlowMerger/eflow
  set OutputArray1 WoMuonPair
#  set Invert true
#  set PTMin      0.5
  set OutputArray2 MuonPair
  add EnMin   {15.0}
  add MassRes {91.18}
  add NP      {2}

  add PdgCode {13}
  add PdgCode {11}
}
```

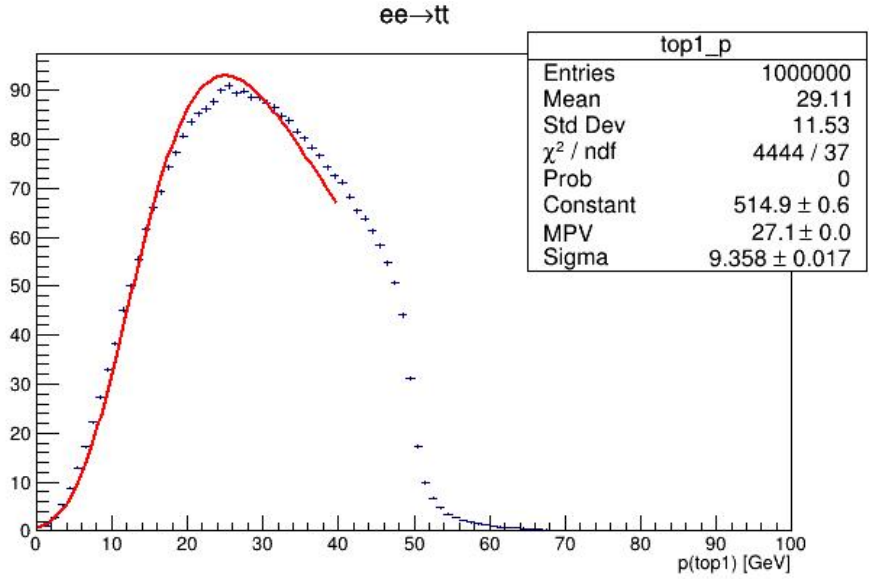
Njets == 6 for hh

```
###########
# Jet finder
###########

module FastJetFinder FastJetFinder {
  set InputArray MuonFilter/WoMuonPair
  set OutputArray jets
  set ExclusiveClustering true

  # algorithm: 1 CDFJetClu, 2 MidPoint,
  set JetAlgorithm 10
  #set ParameterR   1.5
  set ParameterP   1.0
  set NJets        6
  #set JetPTMin     0.0
}
```

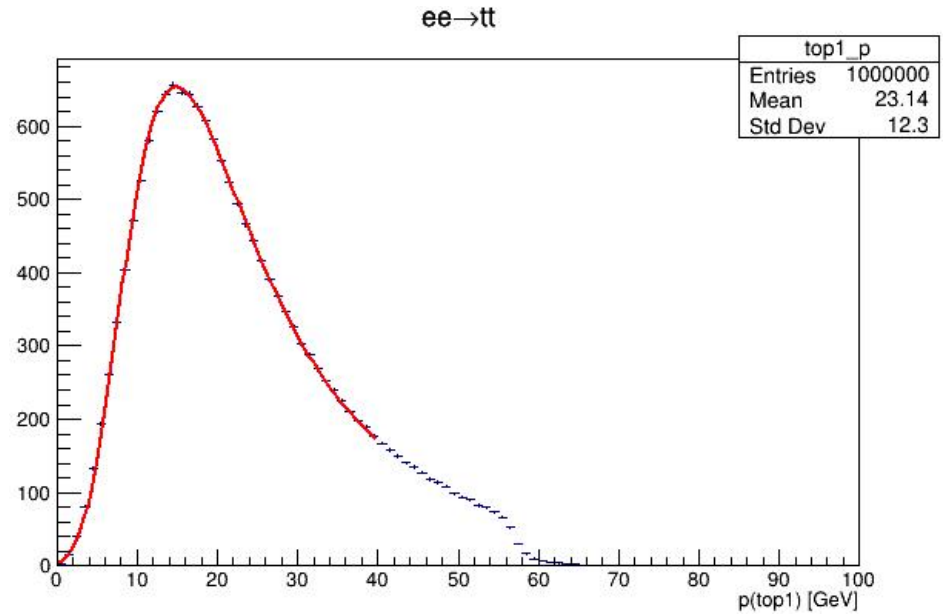
```
#################
# Jet Energy Scale
#################

module EnergyScale JetEnergyScale {
  set InputArray FastJetFinder/jets
  set OutputArray jets

  # scale formula for jets
  set ScaleFormula {1.0075}
}
```

Back Up

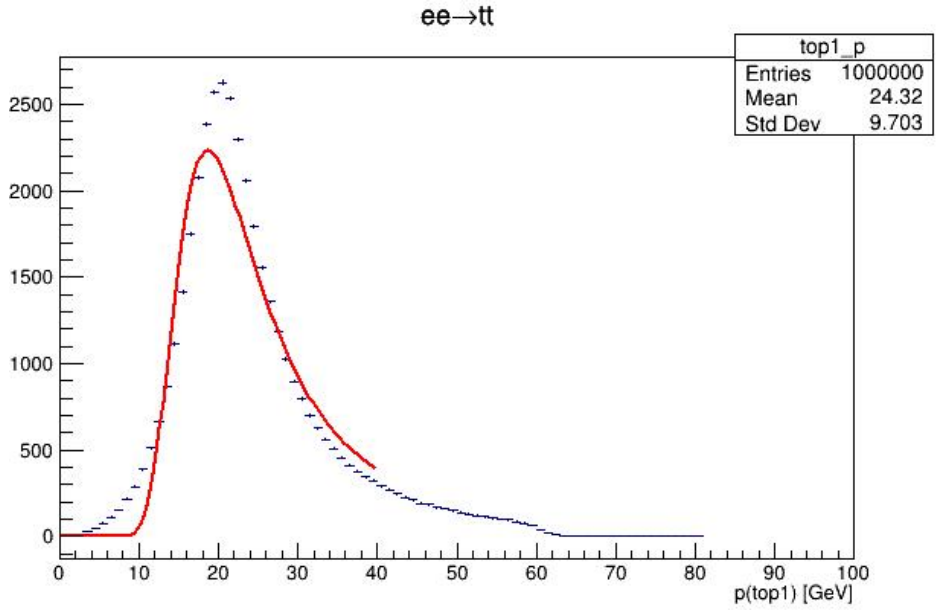
sl_m：momentum peak，landau fit



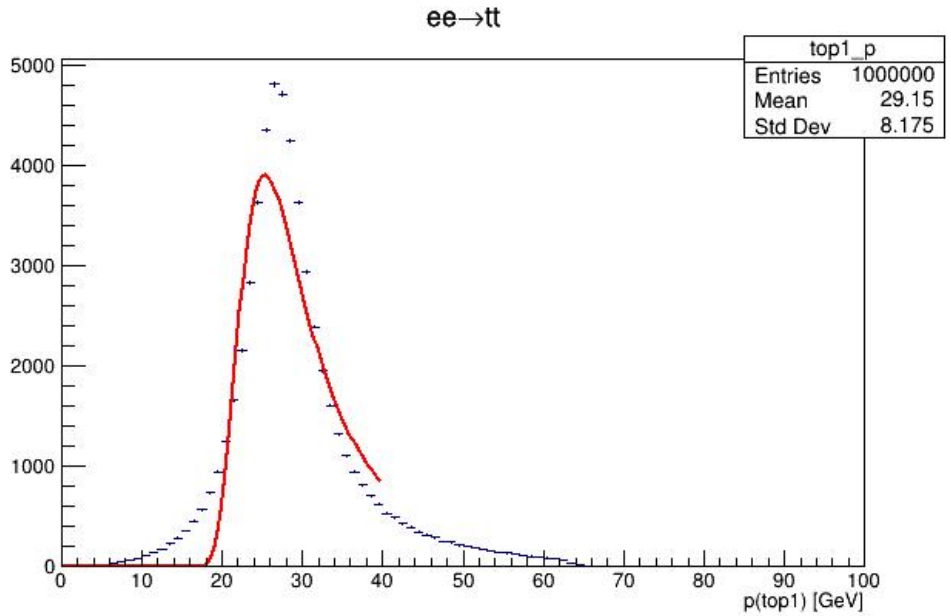
ECoM = 338GeV



ECoM = 342.75GeV



ECoM = 345GeV



ECoM = 347GeV

Backup

sl_m:
ECoM: [338.0, 339.0, 340.0, 341.0, 342.0, 342.75, 343.0, 344.0, 345.0, 346.0, 347.0]
Ac: [0.00246, -0.000204, -0.002298, -0.000948, -0.001958, -0.001258, -0.001074, 0.000396, -0.001568, 0.000554, 0.001532]
Ppeak_t: [27.37, 26.5, 25.39, 23.91, 22.09, 20.47, 20.01, 19.62, 21.84, 24.64, 27.46]
Ppeak_tbar: [27.37, 26.5, 25.39, 23.91, 22.09, 20.47, 20.01, 19.62, 21.84, 24.64, 27.46]

sl_p:
ECoM: [338.0, 339.0, 340.0, 341.0, 342.0, 342.75, 343.0, 344.0, 345.0, 346.0, 347.0]
Ac: [0.001898, -0.001678, 0.00093, -0.004842, -0.00331, -0.00247, -0.00055, 6e-05, -0.001116, -0.000748, 0.000648]
Ppeak_t: [27.38, 26.48, 25.37, 23.99, 22.09, 20.48, 19.99, 19.62, 21.83, 24.65, 27.45]
Ppeak_tbar: [27.38, 26.48, 25.37, 23.99, 22.09, 20.48, 19.99, 19.62, 21.83, 24.65, 27.45]