



Low energy (LE) timing cuts optimization

Erica Brondolin

How to proceed

- **Identify the problem**
 - Find and check datasample
 - Produce PFOs energy distributions
 - Define “figure(s) of merit”
- **Understand current approach**
 - Current documentation
 - Select variables needed
- **Improving**
 - Produce new correlation plots
 - Introduce new LE timing cuts
 - Evaluate the impact
 - Re-iterate if necessary
- **Outlook**



Work in progress

How to proceed

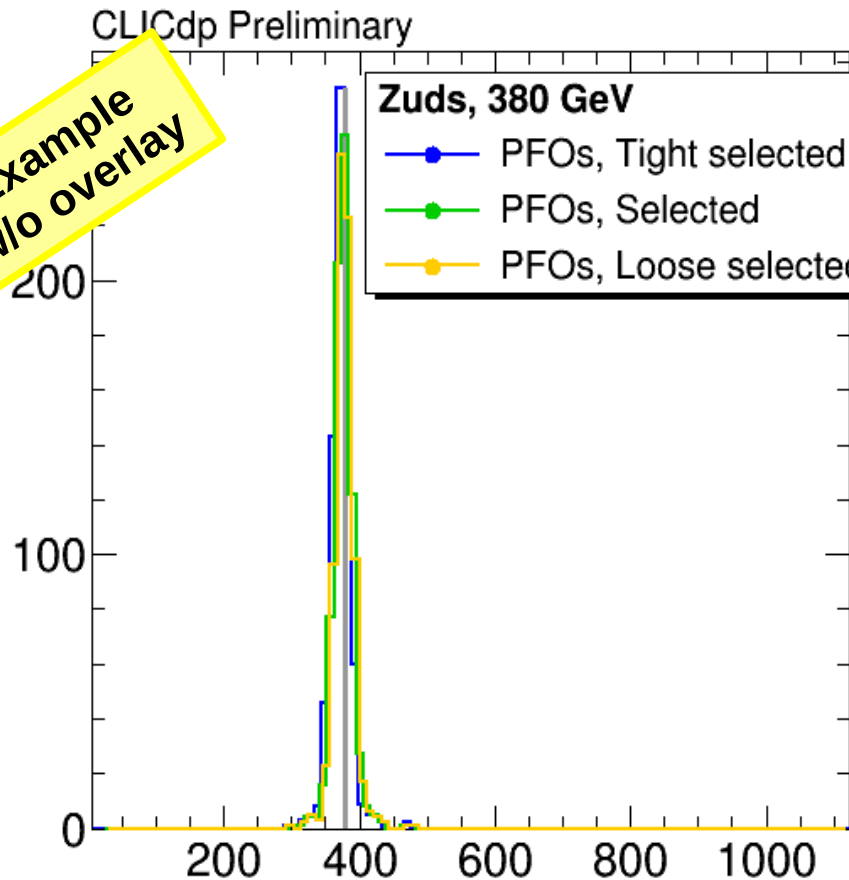
- **Identify the problem**
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Identify the problem: first steps

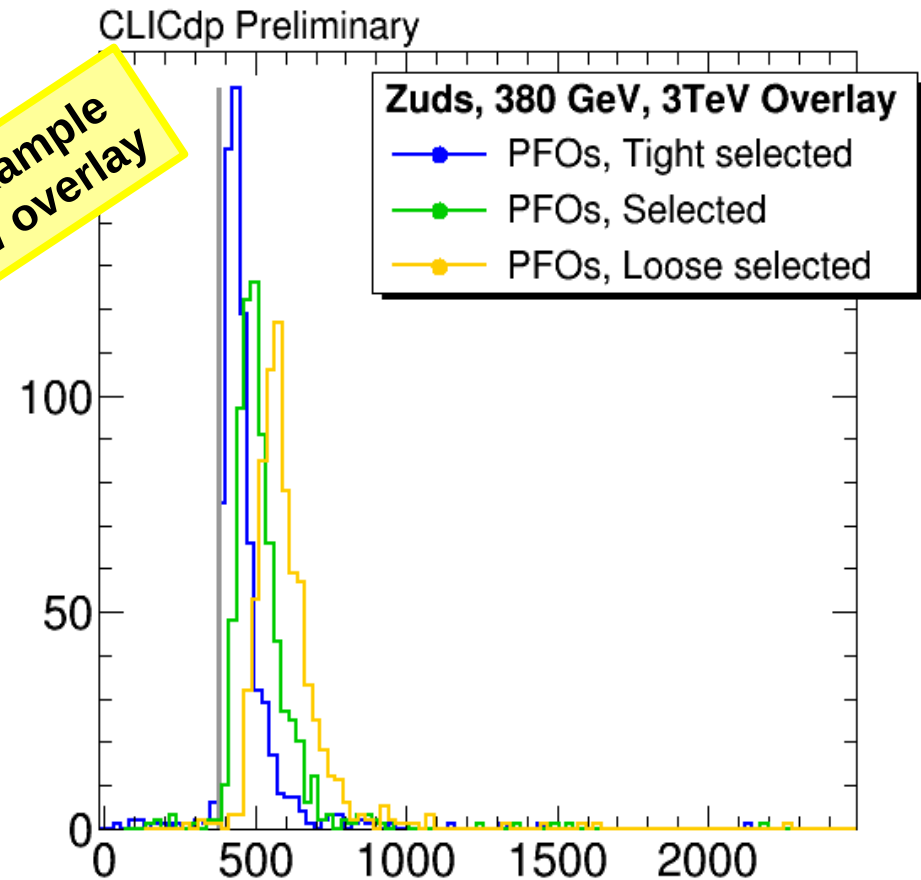
- **First sample used: $Z \rightarrow uds$**
 - Centre of mass energy = 380 GeV
 - Overlay = 3 TeV
 - Selections used: Loose, Selected, Tight

Nb. $\cos\theta$ is computed from the generated light quarks

- **Energy distribution for different $\cos\theta$ bins**



`h_energyPFO_0 <= costhetaMC && costhetaMC < 0.1`

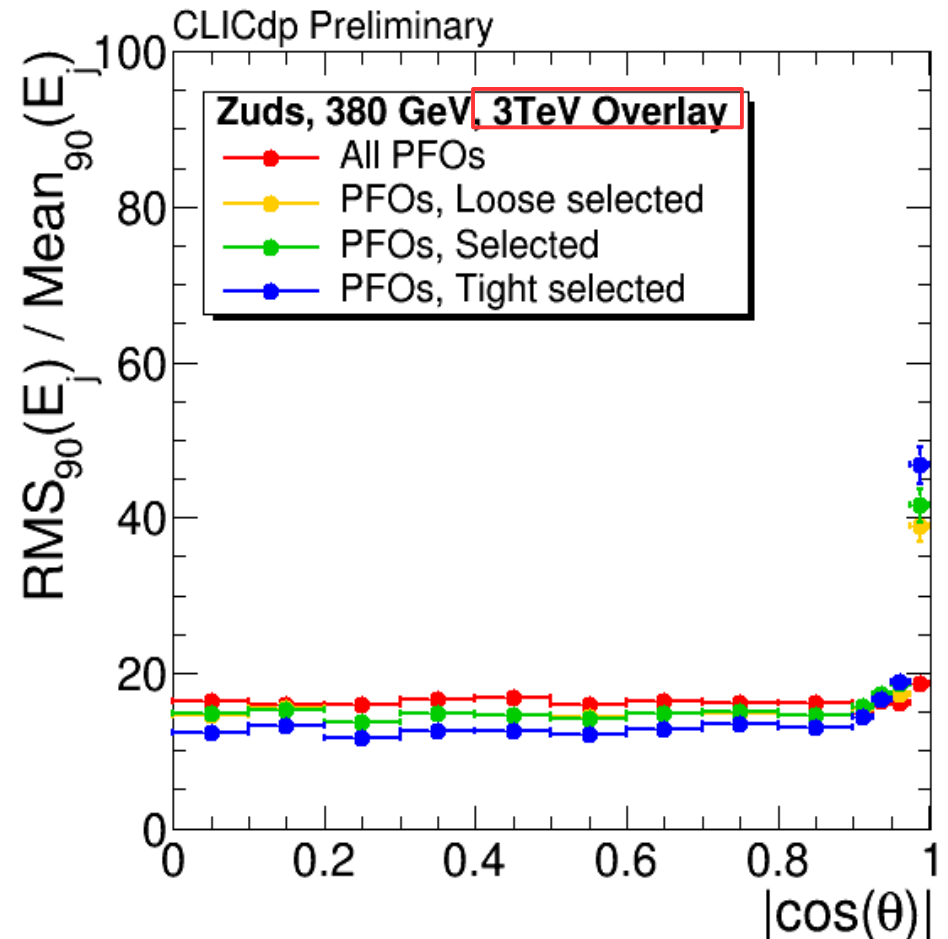
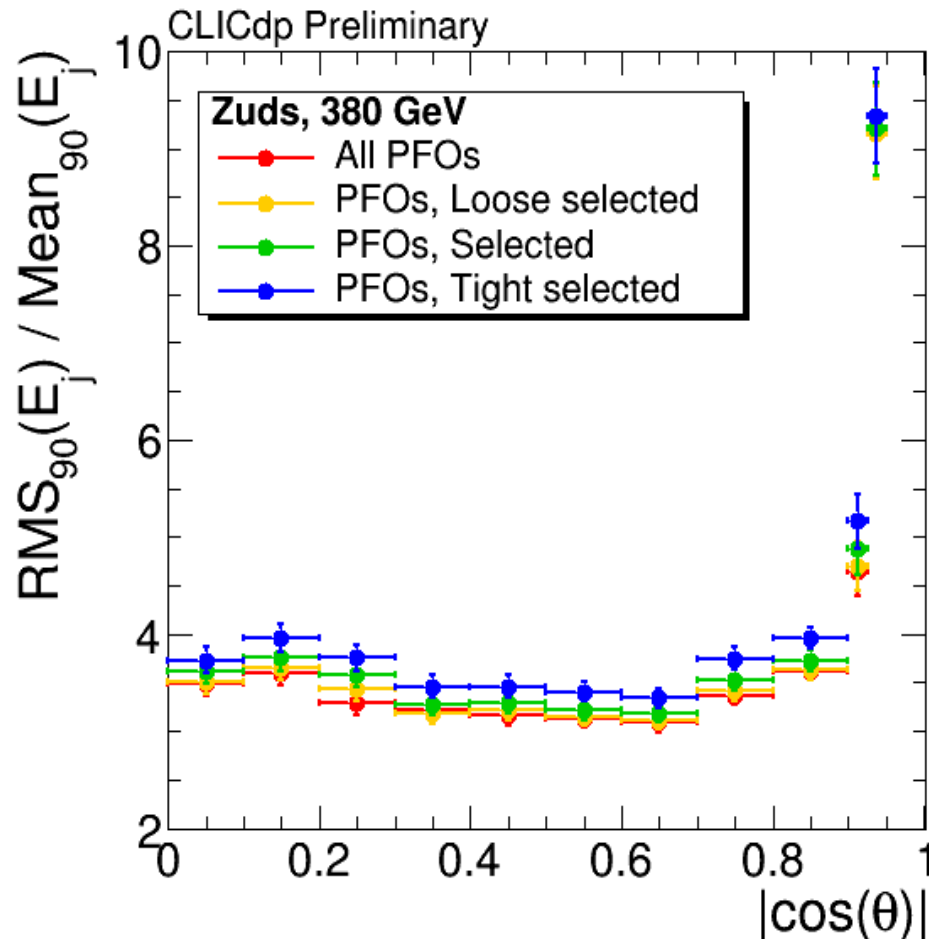


`h_energyPFO_0 <= costhetaMC && costhetaMC < 0.1`

Identify the problem: first steps

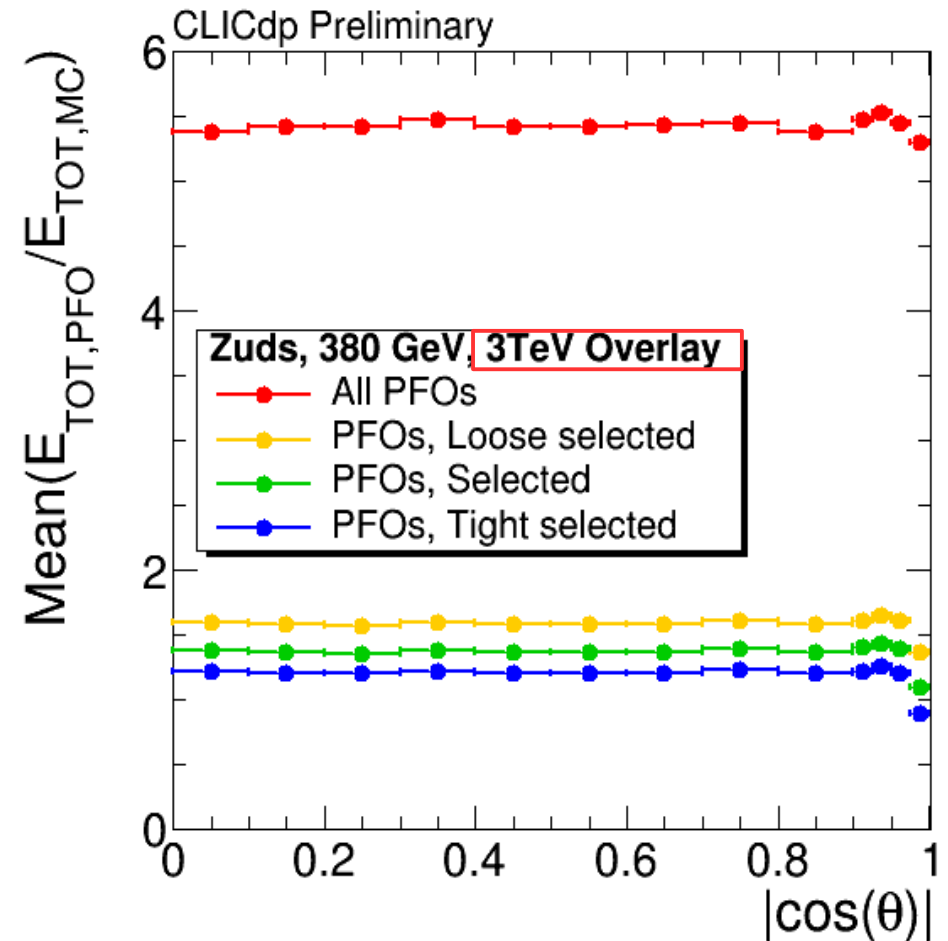
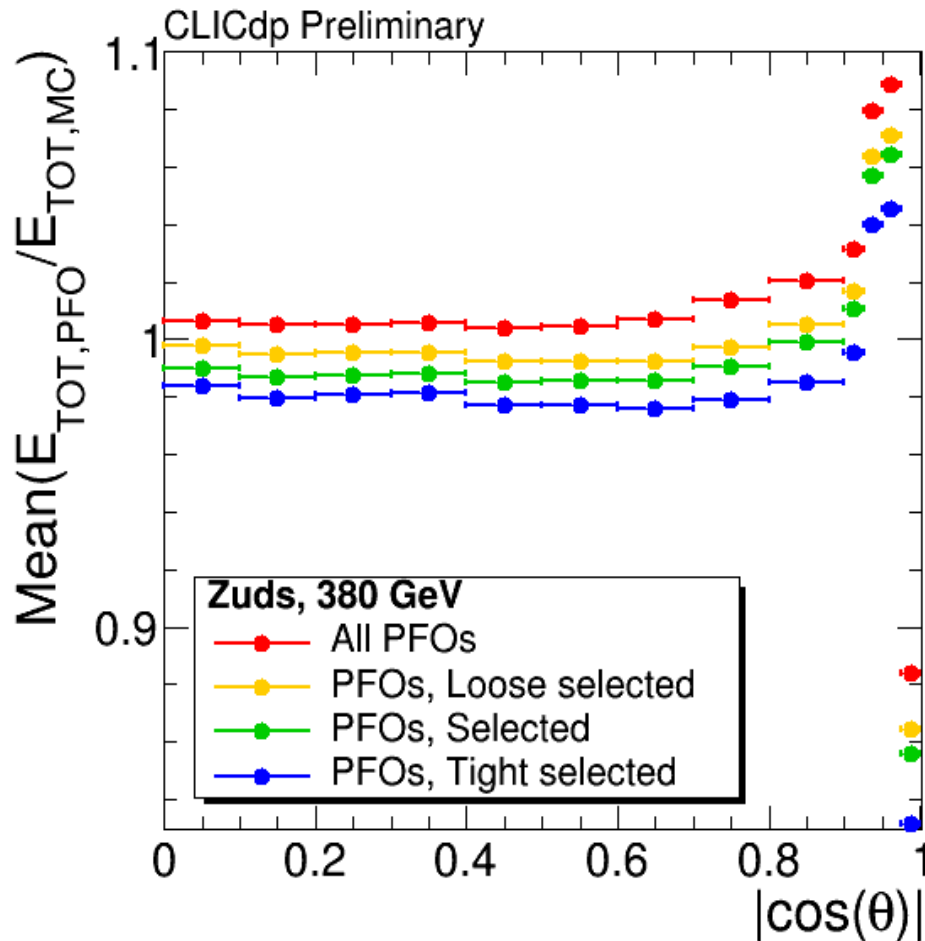
- **First sample used: $Z \rightarrow uds$**
 - Centre of mass energy = 380 GeV
 - Overlay = 3 TeV
 - Selections used: Loose, Selected, Tight

- **Jet energy resolution for different $\cos\theta$ bins**



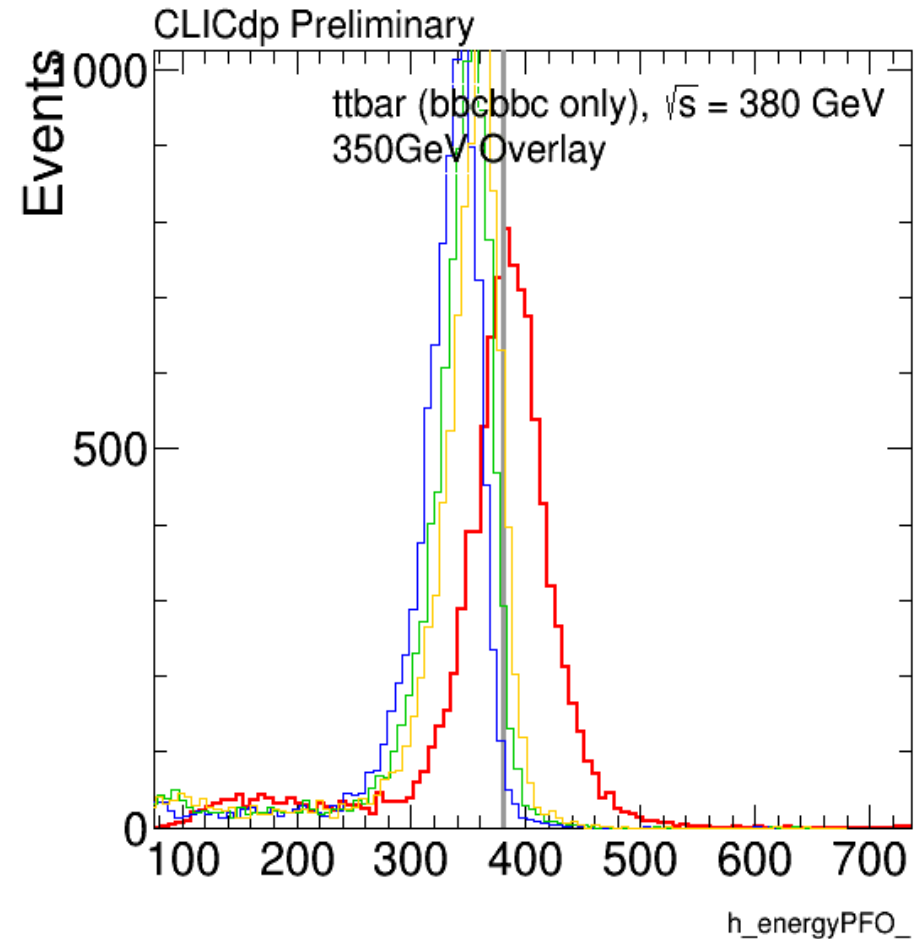
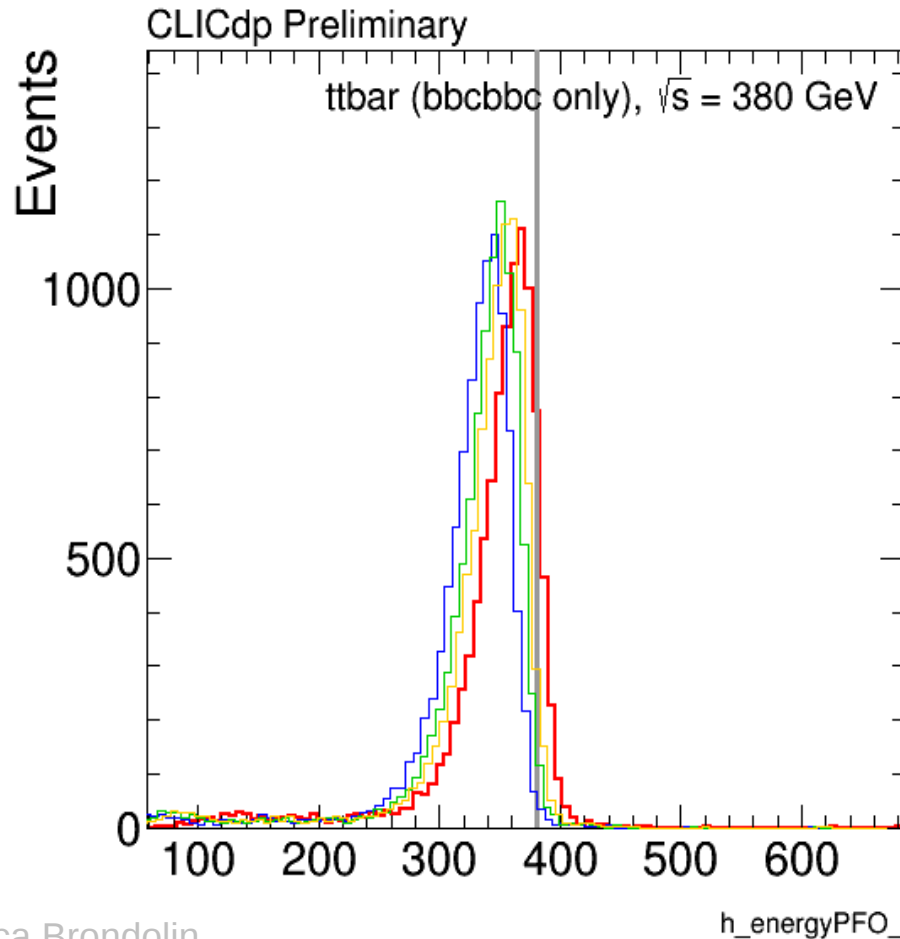
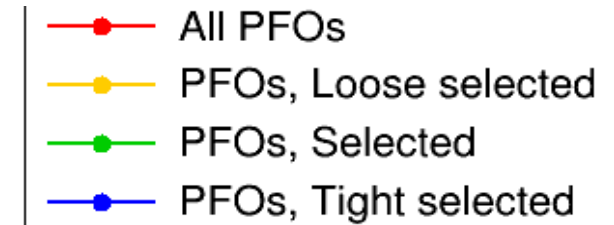
Identify the problem: first steps

- **First sample used: $Z \rightarrow uds$**
 - Centre of mass energy = 380 GeV
 - Overlay = 3 TeV
 - Selections used: Loose, Selected, Tight
- **Energy scale for different $\cos\theta$ bins**



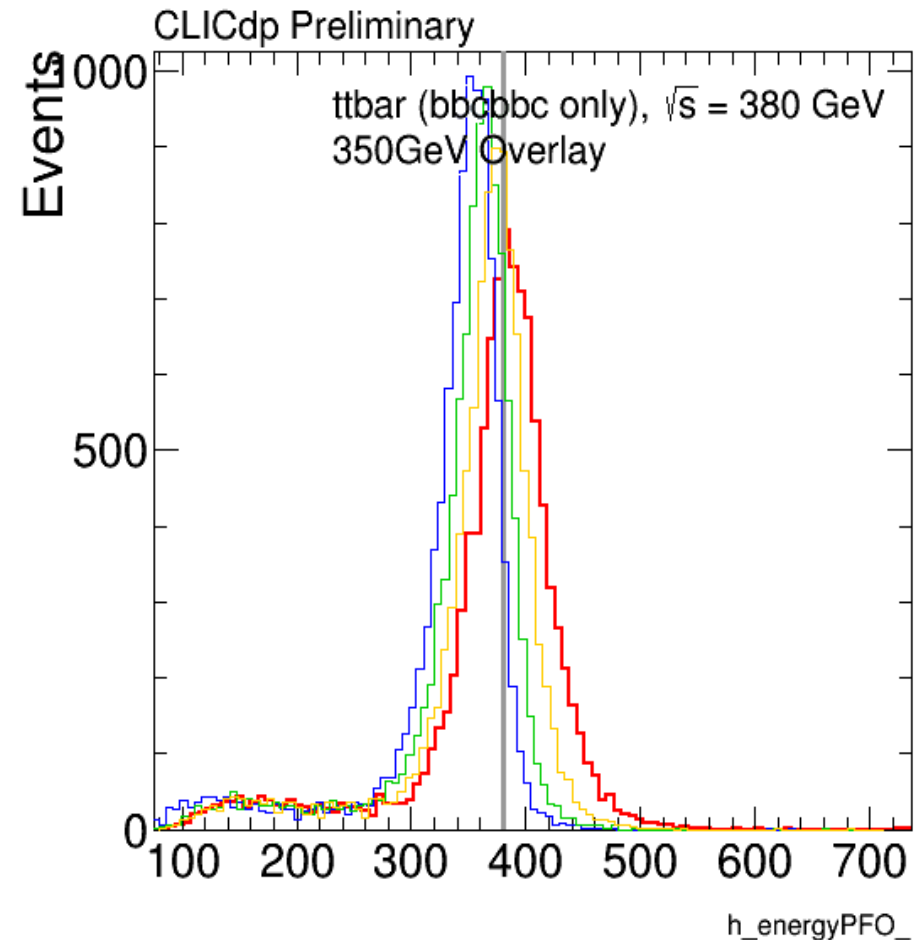
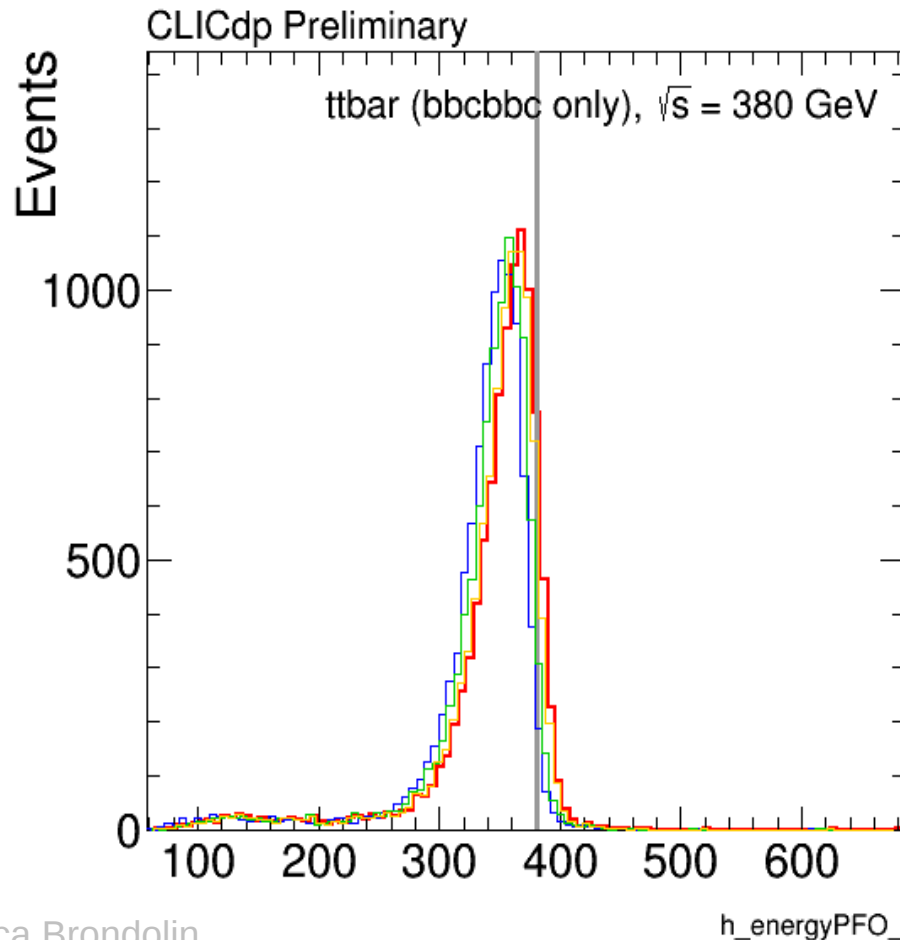
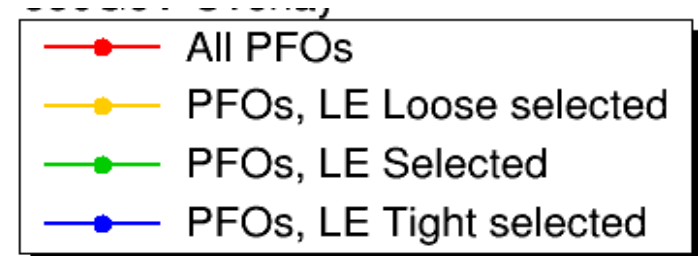
Identify the problem: ttbar (bbcbbc)

- **Second sample used: ttbar (bbcbbc)**
 - Centre of mass energy = 380 GeV + Overlay = 350 GeV
 - Selections used: Loose, Selected, Tight
- **Not possible to compute $\cos\theta$ easily because top is at rest**
- **Inclusive distribution**



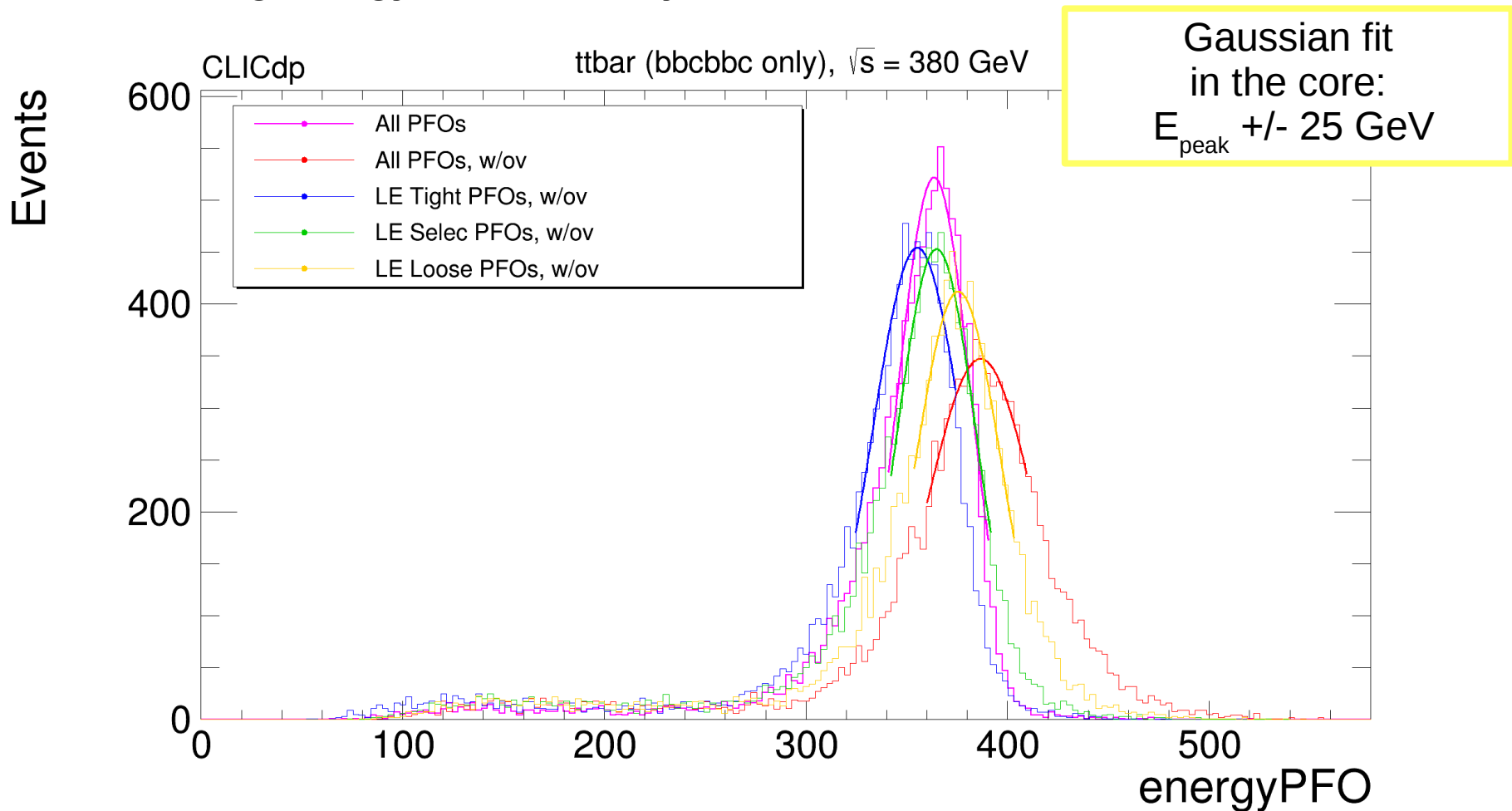
Identify the problem (2): ttbar (bbcbbc)

- **Second sample used: ttbar (bbcbbc)**
 - Centre of mass energy = 380 GeV + Overlay = 350 GeV
 - Selections used: LE Loose, LE Selected, LE Tight
- **Inclusive distribution**
- **LE timing cuts used**
 - differences between HE and LE cuts in backup



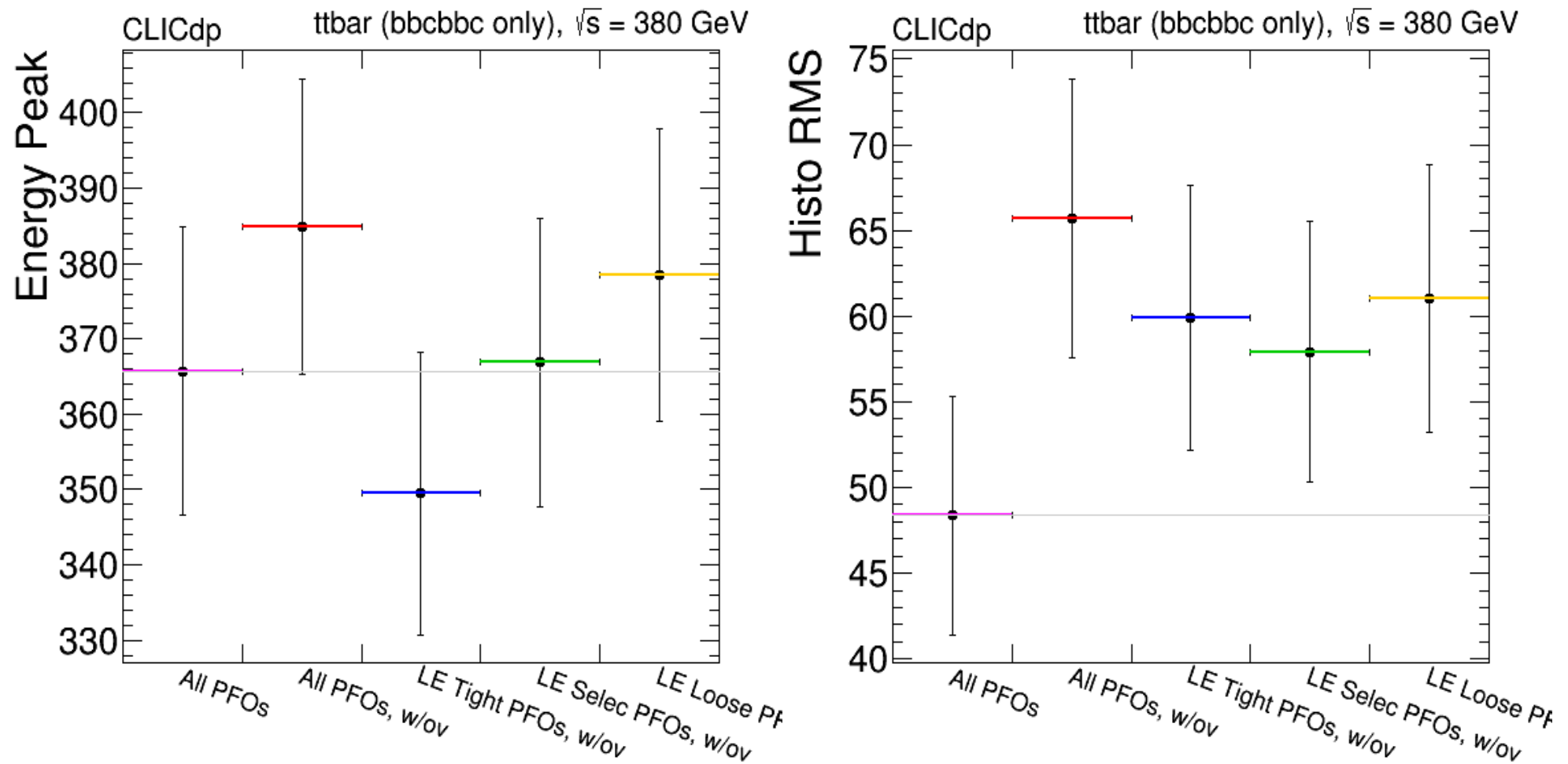
Identify the problem (2): ttbar (bbcbbc)

- **Second sample used: ttbar (bbcbbc)**
 - Centre of mass energy = 380 GeV + Overlay = 350 GeV
 - Selections used: Loose, Selected, Tight
- **Main idea:**
LE timing cuts w/overlay should reproduce “All PFOs” energy w/o overlay
- **Lot of missing energy due to the b-jets**



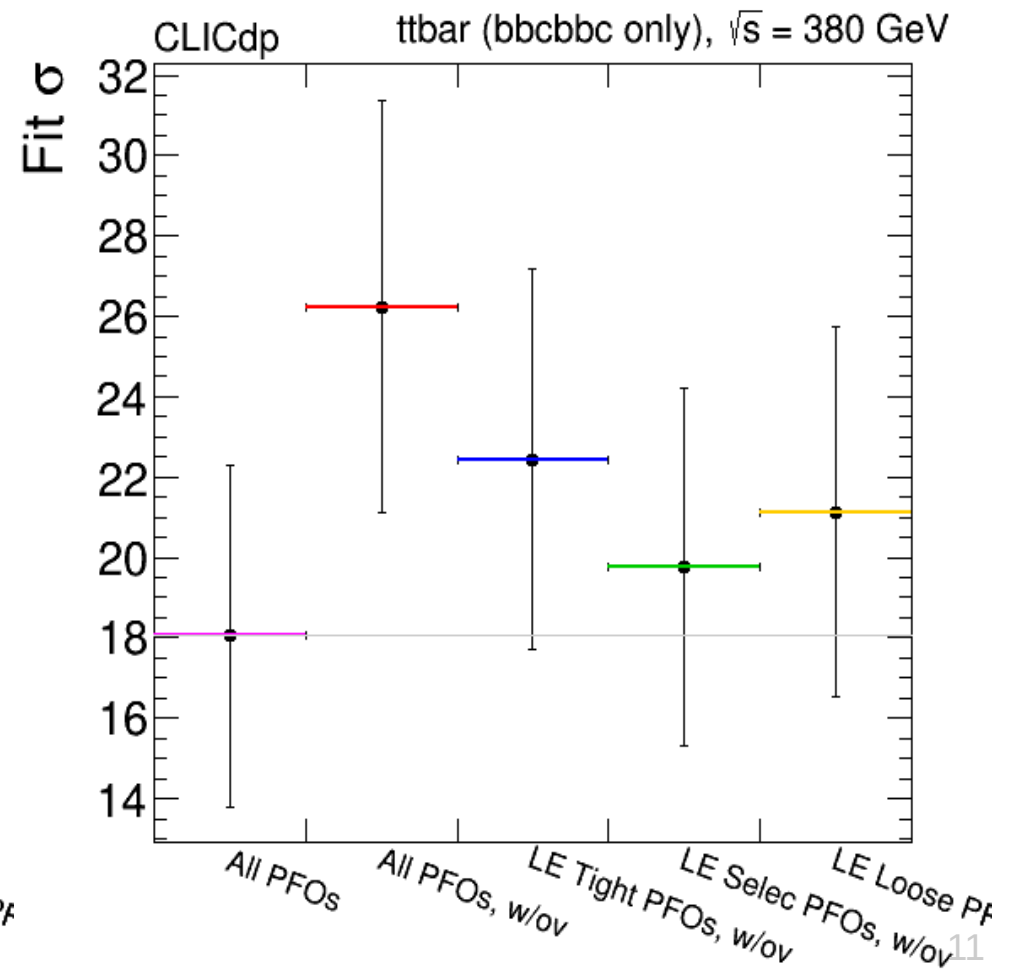
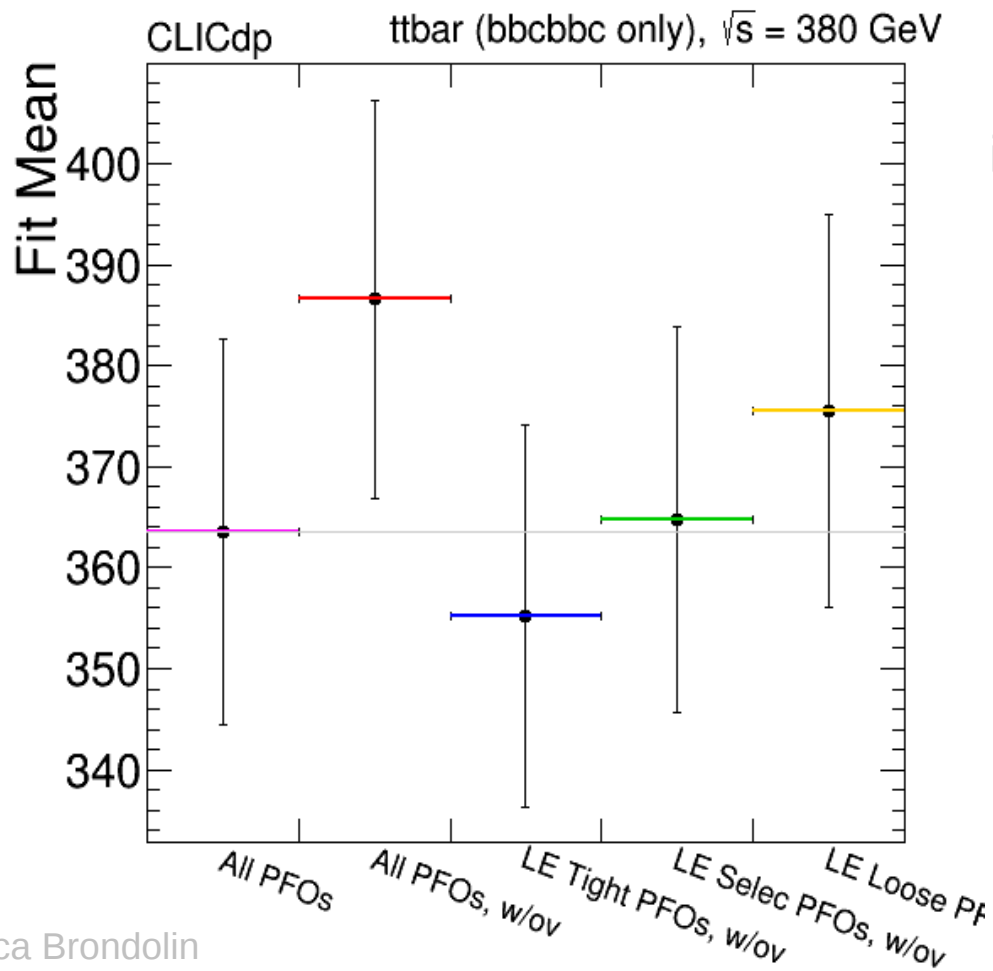
Identify the problem (2): ttbar (bbcbbc)

- **Second sample used: ttbar (bbcbbc)**
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Identify the problem (2): ttbar (bbcbbc)

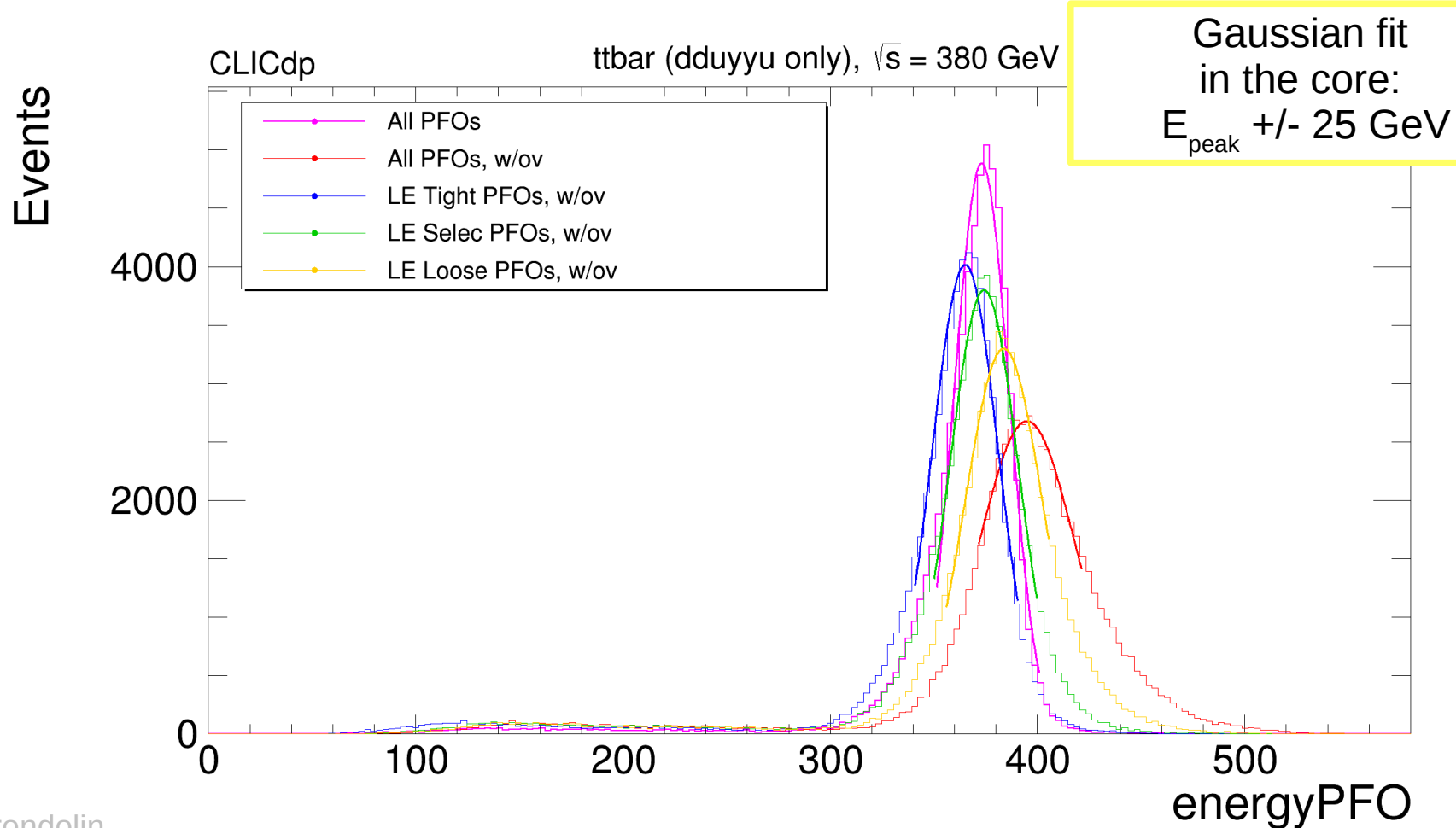
- **Second sample used: ttbar (bbcbbc)**
 - Centre of mass energy = 380 GeV + Overlay = 350 GeV
 - Selections used: Loose, Selected, Tight
- **Main idea:**
LE timing cuts w/overlay should reproduce “All PFOs” energy w/o overlay



Identify the problem (3): ttbar (dduyyu)

- **Third sample used: ttbar (dduyyu)**
 - Centre of mass energy = 380 GeV + Overlay = 350 GeV
 - More light quarks ($y = d,s,b$)
 - Selections used: Loose, Selected, Tight

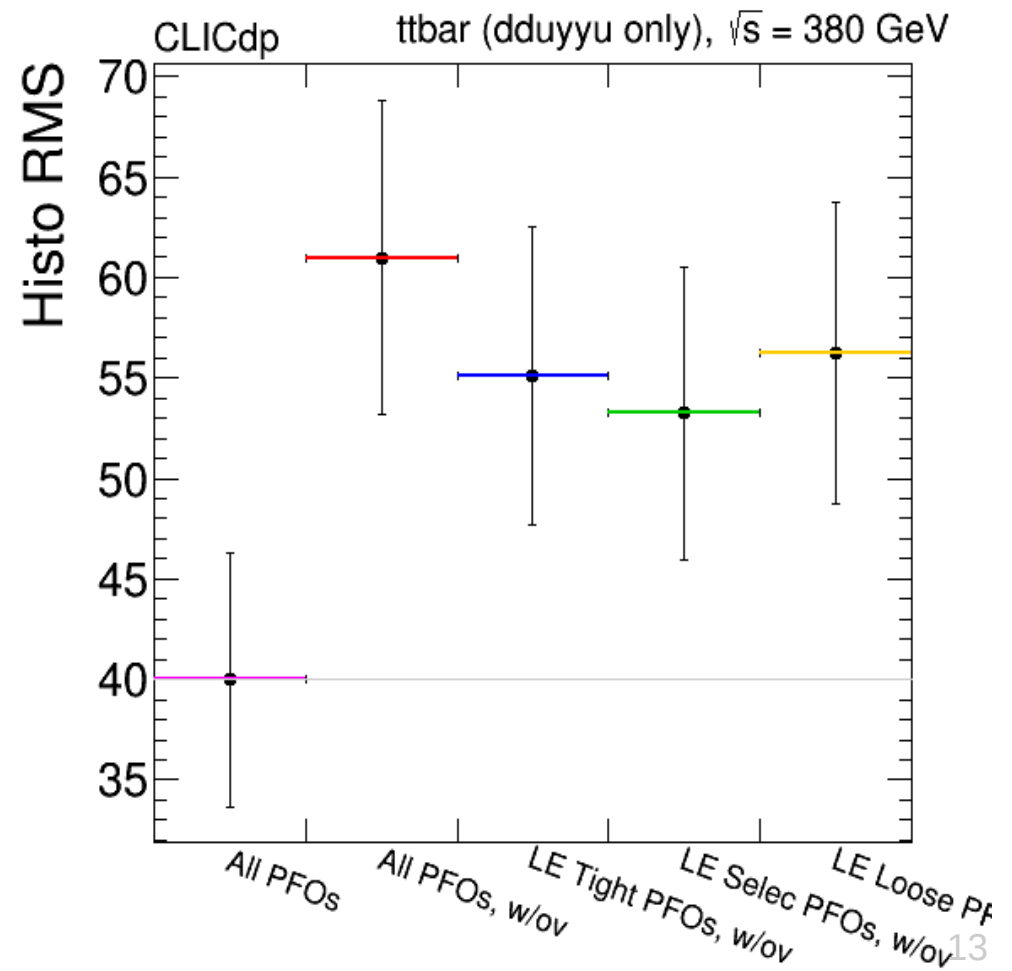
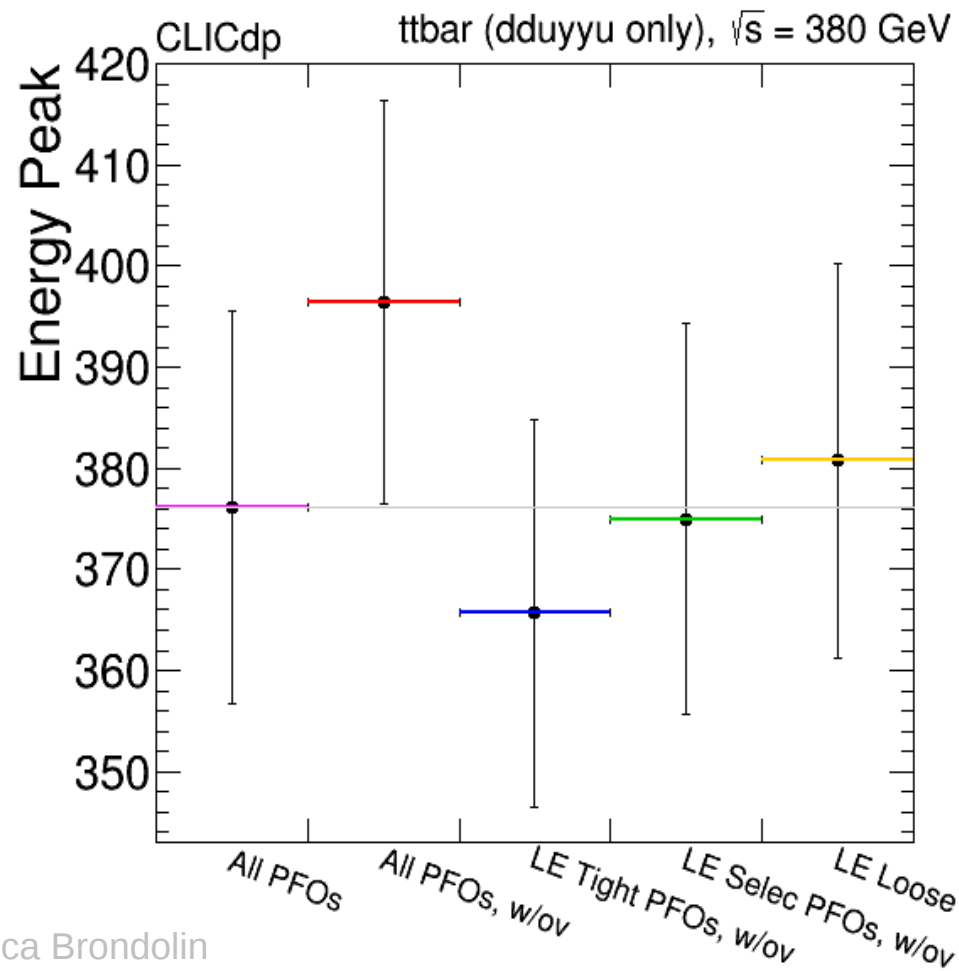
- **Main idea:**
LE timing cuts w/overlay should reproduce “All PFOs” energy w/o overlay



Identify the problem (3): ttbar (dduyyu)

- **Third sample used: ttbar (dduyyu)**
 - Centre of mass energy = 380 GeV + Overlay = 350 GeV
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 - Selections used: Loose, Selected, Tight

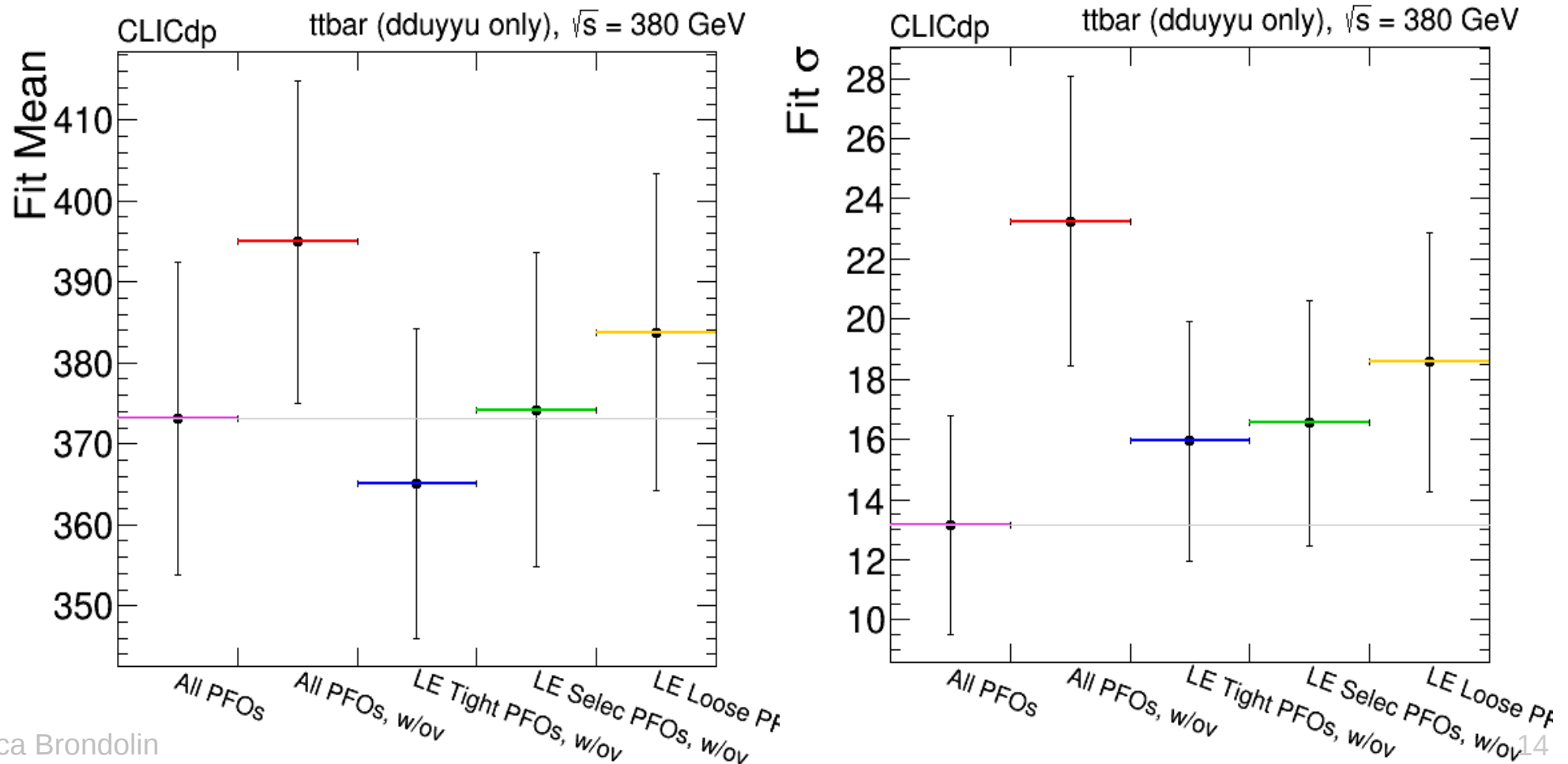
- **Main idea:**
LE timing cuts w/overlay should reproduce “All PFOs” energy w/o overlay



Identify the problem (3): ttbar (dduyyu)

- **Third sample used: ttbar (dduyyu)**
 - Centre of mass energy = 380 GeV + Overlay = 350 GeV
 - More light quarks ($y = d,s,b$)
 - Selections used: Loose, Selected, Tight

- **Main idea:**
LE timing cuts w/overlay should reproduce “All PFOs” energy w/o overlay



Identify the problem : summary

- **Sample:**
 - **ttbar**
 - Centre of mass energy = 380 GeV
 - Overlay = 350 GeV
 - More light quarks → **dduuyu** (with $y = d,s,b$)
 - REC ProdId #9762 #9763
- **Figure of merit:**
 - **Comparison (PFO energy without overlay) vs (PFO energy + cuts with overlay)**
 - **Look at histo distribution**
 - **Fit?**

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Current approach: documentation

- **Papers:**
“Performance of Particle Flow Calorimetry at CLIC”, arXiv:1209.4039
CDR, Appendix B
- **Useful presentations:**
https://indico.cern.ch/event/157476/contributions/1406549/attachments/174783/246032/Manchester_CLIC_Review_Oct2011_Thomson.pdf
https://indico.cern.ch/event/116322/contributions/71526/attachments/53288/76615/WG6_20110126.pdf
- **More updated documentation?**
- **In the code:**
MarlinReco/Analysis/CLICPfoSelector

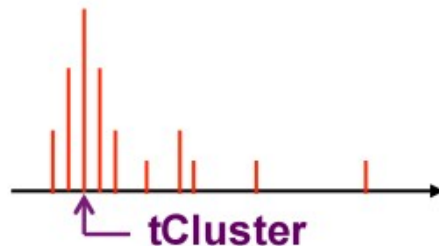
Current approach: documentation

- Main idea

Reconstruction in Time

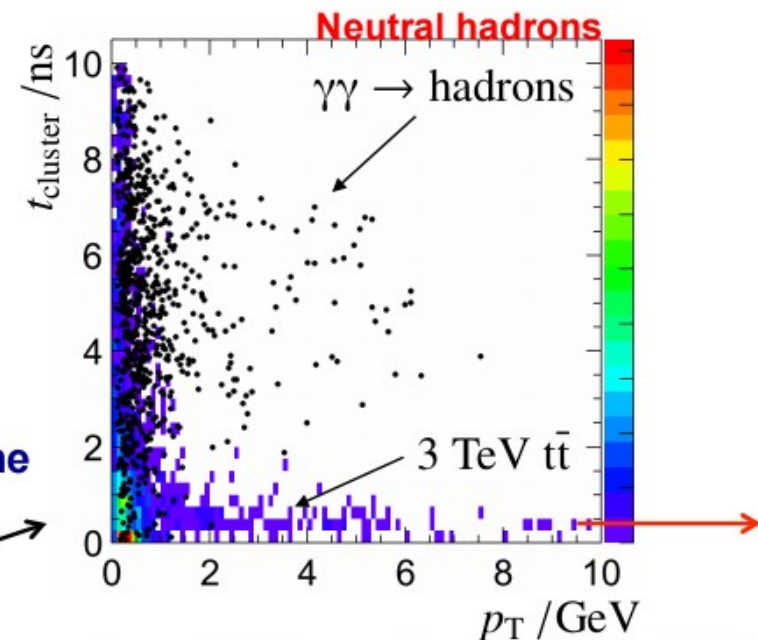


- ★ After reconstruction have a list of particles (PFOs):
 - charged particles – mostly matched to **clusters**
 - photons – EM **clusters**
 - neutral hadrons – **clusters**
- ★ High granularity calorimeter - even low energy clusters have many hits
 - calculate energy weighted truncated mean time of each **cluster**
 - calo hit times corrected for time-of-flight (straight-line)
 - sub-ns resolution



- use times to reject clusters
- also can reject associated tracks
 - account for helical propagation time

- ★ Reject PFOs from background
 - e.g. neutral hadrons in Endcap



Current approach: documentation

- Main idea

PFOSelection



- ★ Only apply to “low” p_T PFOs
- ★ Three sets of timing cuts applied in reconstruction
 - Loose, **Default**, Tight

Region	p_T range	time cut
Photons		
central	$0.75 \text{ GeV} \leq p_T < 4.0 \text{ GeV}$	$t < 2.0 \text{ ns}$
$\cos \theta \leq 0.975$	$0 \text{ GeV} \leq p_T < 0.75 \text{ GeV}$	$t < 1.0 \text{ ns}$
forward	$0.75 \text{ GeV} \leq p_T < 4.0 \text{ GeV}$	$t < 2.0 \text{ ns}$
$\cos \theta > 0.975$	$0 \text{ GeV} \leq p_T < 0.75 \text{ GeV}$	$t < 1.0 \text{ ns}$
neutral hadrons		
central	$0.75 \text{ GeV} \leq p_T < 8.0 \text{ GeV}$	$t < 2.5 \text{ ns}$
$\cos \theta \leq 0.975$	$0 \text{ GeV} \leq p_T < 0.75 \text{ GeV}$	$t < 1.5 \text{ ns}$
forward	$0.75 \text{ GeV} \leq p_T < 8.0 \text{ GeV}$	$t < 2.0 \text{ ns}$
$\cos \theta > 0.975$	$0 \text{ GeV} \leq p_T < 0.75 \text{ GeV}$	$t < 1.0 \text{ ns}$
charged particles		
all	$0.75 \text{ GeV} \leq p_T < 4.0 \text{ GeV}$	$t < 3.0 \text{ ns}$
	$0 \text{ GeV} \leq p_T < 0.75 \text{ GeV}$	$t < 1.5 \text{ ns}$

Table B.2

Current approach: documentation

- Translate into code

```
<group name="PfoSelector">
  <!--Selects Pfos from full PFO list using timing cuts-->
  <!--ChargedPfoLooseTimingCut-->
  <parameter name="ChargedPfoLooseTimingCut" type="float">3 </parameter>
  <!--ChargedPfoNegativeLooseTimingCut-->
  <parameter name="ChargedPfoNegativeLooseTimingCut" type="float">-1 </parameter>
  <!--ChargedPfoNegativeTightTimingCut-->
  <parameter name="ChargedPfoNegativeTightTimingCut" type="float">-0.5 </parameter>
  <!--ChargedPfoPtCut-->
  <parameter name="ChargedPfoPtCut" type="float">0 </parameter>
  <!--ChargedPfoPtCutForLooseTiming-->
  <parameter name="ChargedPfoPtCutForLooseTiming" type="float">4 </parameter>
  <!--ChargedPfoTightTimingCut-->
  <parameter name="ChargedPfoTightTimingCut" type="float">1.5 </parameter>
  <!--CheckKaonCorrection-->
  <parameter name="CheckKaonCorrection" type="int">0 </parameter>
  <!--CheckProtonCorrection-->
  <parameter name="CheckProtonCorrection" type="int">0 </parameter>
  <!--ClusterLessPfoTrackTimeCut-->
  <parameter name="ClusterLessPfoTrackTimeCut" type="float">10 </parameter>
  <!--CorrectHitTimesForTimeOfFlight-->
  <parameter name="CorrectHitTimesForTimeOfFlight" type="int">0 </parameter>
  <!--DisplayRejectedPfos-->
  <parameter name="DisplayRejectedPfos" type="int">1 </parameter>
  <!--DisplaySelectedPfos-->
  <parameter name="DisplaySelectedPfos" type="int">1 </parameter>
  <!--FarForwardCosTheta-->
  <parameter name="FarForwardCosTheta" type="float">0.975 </parameter>
  <!--ForwardCosThetaForHighEnergyNeutralHadrons-->
  <parameter name="ForwardCosThetaForHighEnergyNeutralHadrons" type="float">0.95 </parameter>
  <!--ForwardHighEnergyNeutralHadronsEnergy-->
  <parameter name="ForwardHighEnergyNeutralHadronsEnergy" type="float">10 </parameter>
  <!--HCalBarrelLooseTimingCut-->
  <parameter name="HCalBarrelLooseTimingCut" type="float">20 </parameter>
  <!--HCalBarrelTightTimingCut-->
  <parameter name="HCalBarrelTightTimingCut" type="float">10 </parameter>
  <!--HCalEndCapTimingFactor-->
  <parameter name="HCalEndCapTimingFactor" type="float">1 </parameter>
  <!--Input PFO Collection-->
  <parameter name="InputPfoCollection" type="string" lcioInType="ReconstructedParticle">PandoraPFOs </parameter>
  <!--KeepKShorts-->
  <parameter name="KeepKShorts" type="int">1 </parameter>
  <!--MaxMomentumForClusterLessPfos-->
```

- Entire list of parameters and values for HE vs LE in backup

Current approach: variables needed

- Event Num
- Num PFO tracks
- Num clusters

- PFO particle Id
- PFO charge
- PFO momentum components (px,py,pz,pT)
- PFO $\cos\theta$
- PFO energy
- PFO cluster time (*)

(*) if more than one clusters, take the one with min time

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Work in progress

Improving: correlation plots

- **Main idea:**

Creating new processor called 'CLICPfoSelectorAnalysis', which creates a TTree with the PFO variables used in the CLIC selection and produce scatter plots of PFO cluster time vs PFO pT for:

- different particle “class”:

Photons, charged particles, neutral hadrons

- different $\cos\theta$ regions:

central, forward

- **Prototype:**

<https://github.com/ebrondol/MarlinReco/tree/addCLICPfoSelTree>

- **Sample used:**

- ttbar

- Centre of mass energy = 380 GeV

- Overlay = 350 GeV

- More light quarks → dduyyu (with y = d,s,b)

- 100 events

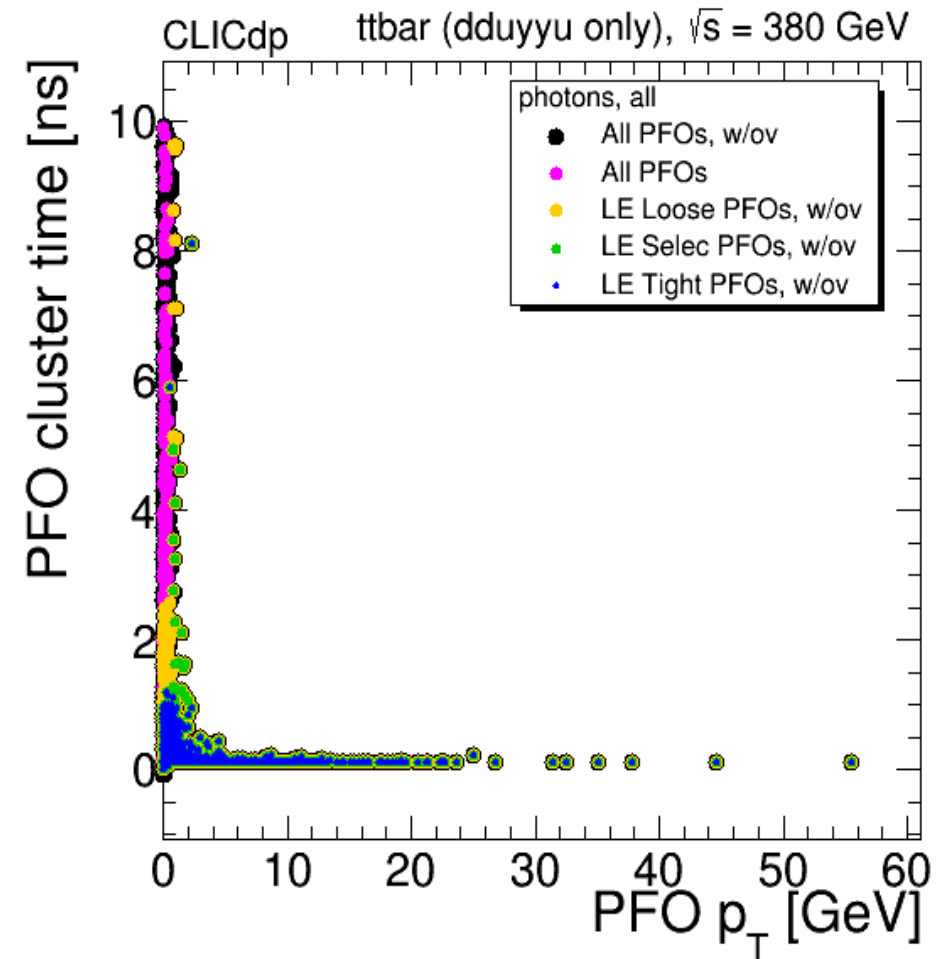
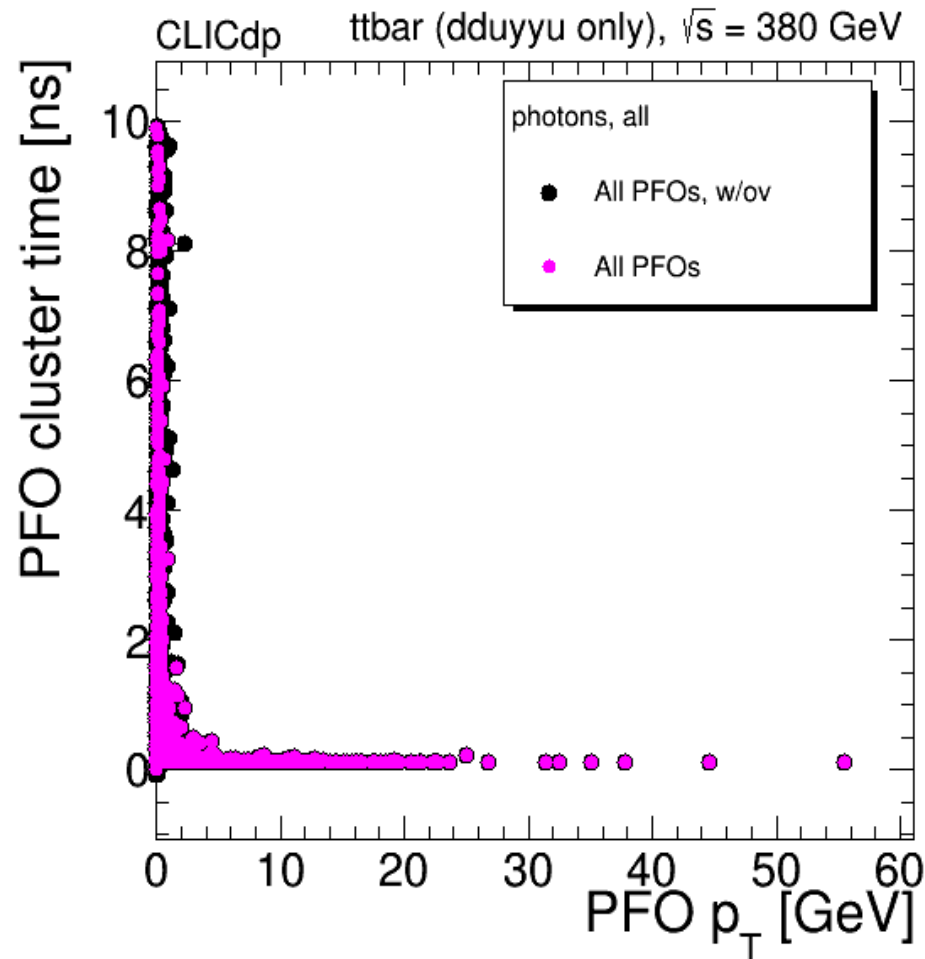
- This sample is particularly challenging!

- **Entire set of plots:**

<http://ebrondol.web.cern.ch/ebrondol/CLIC/EnergyStudies/ttbar/380GeV/dduyyu/>

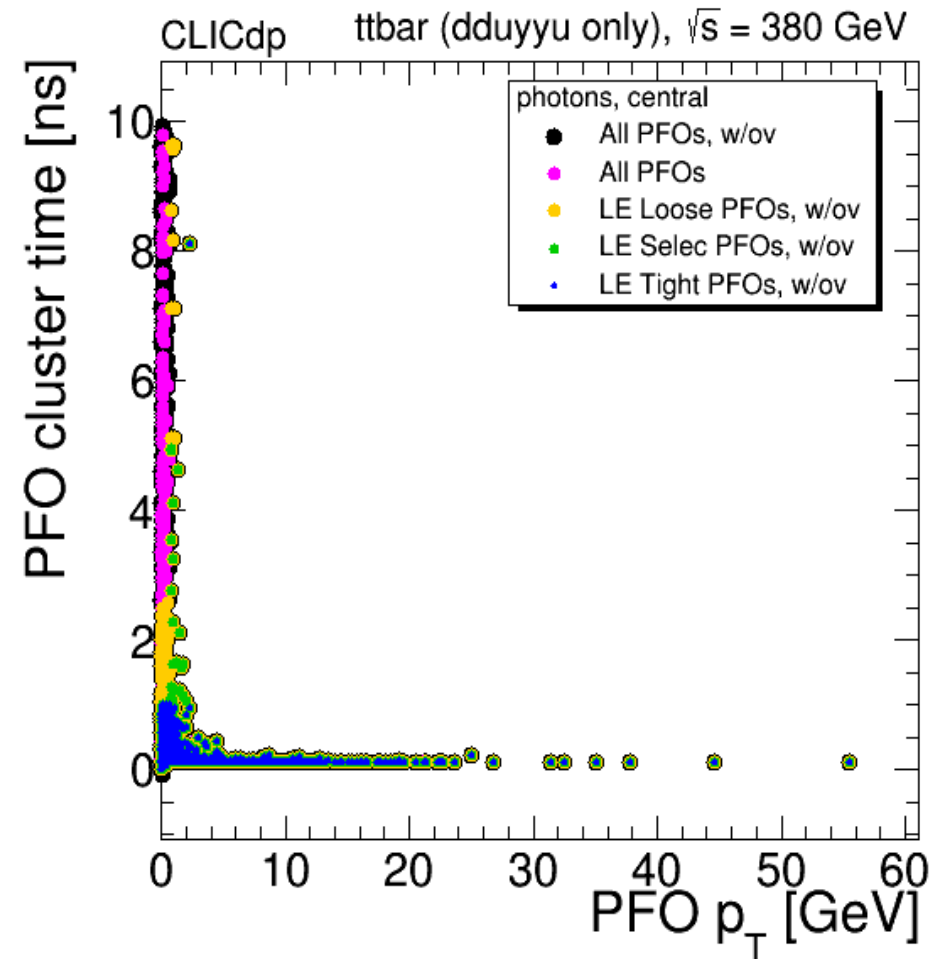
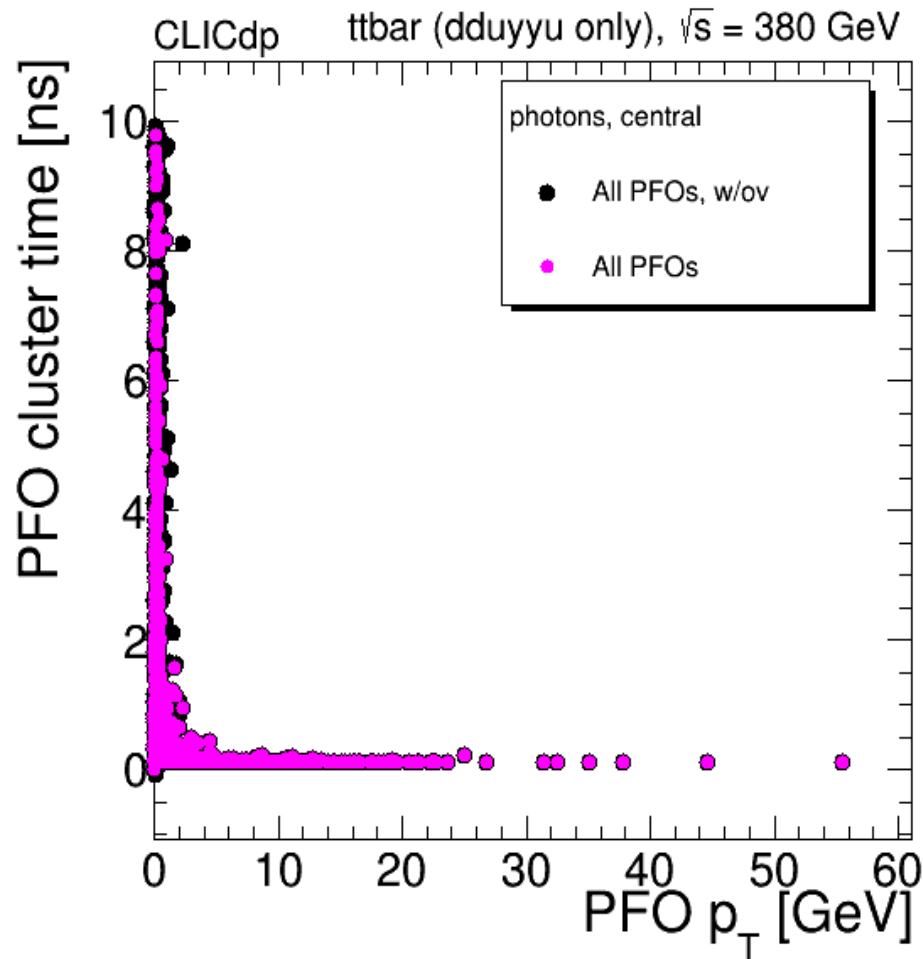
Improving: correlation plots

- Photons, all



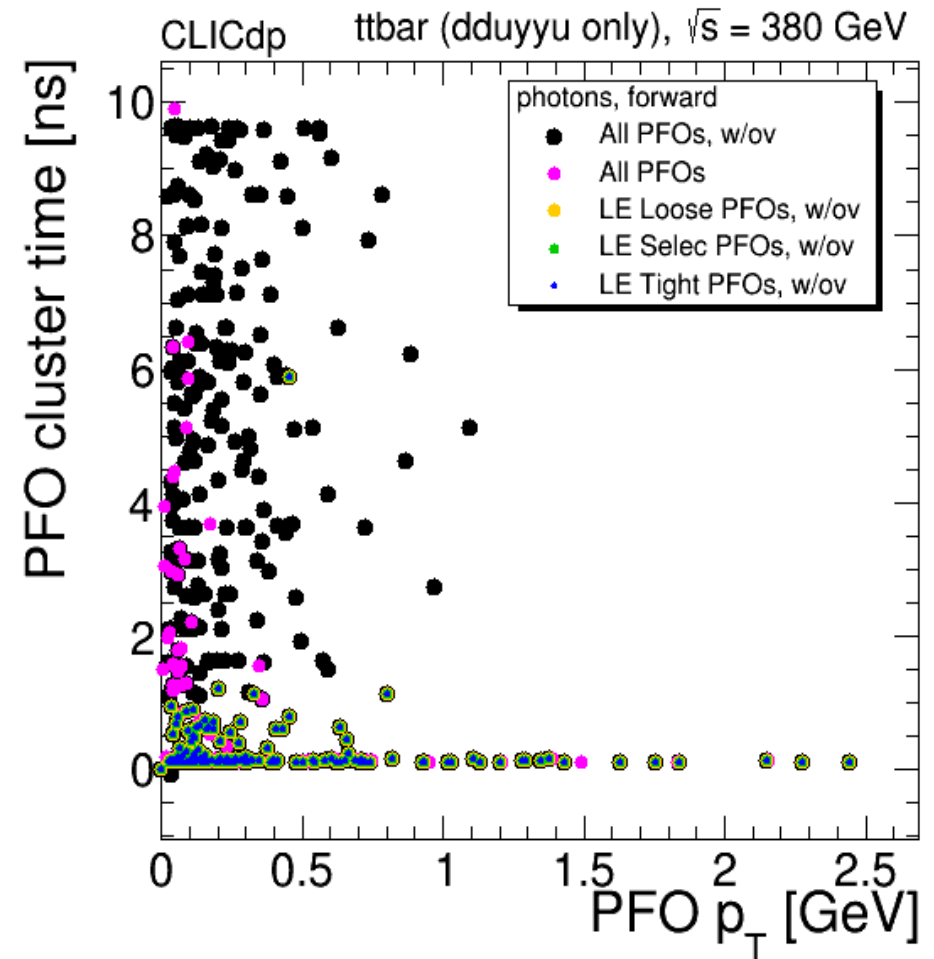
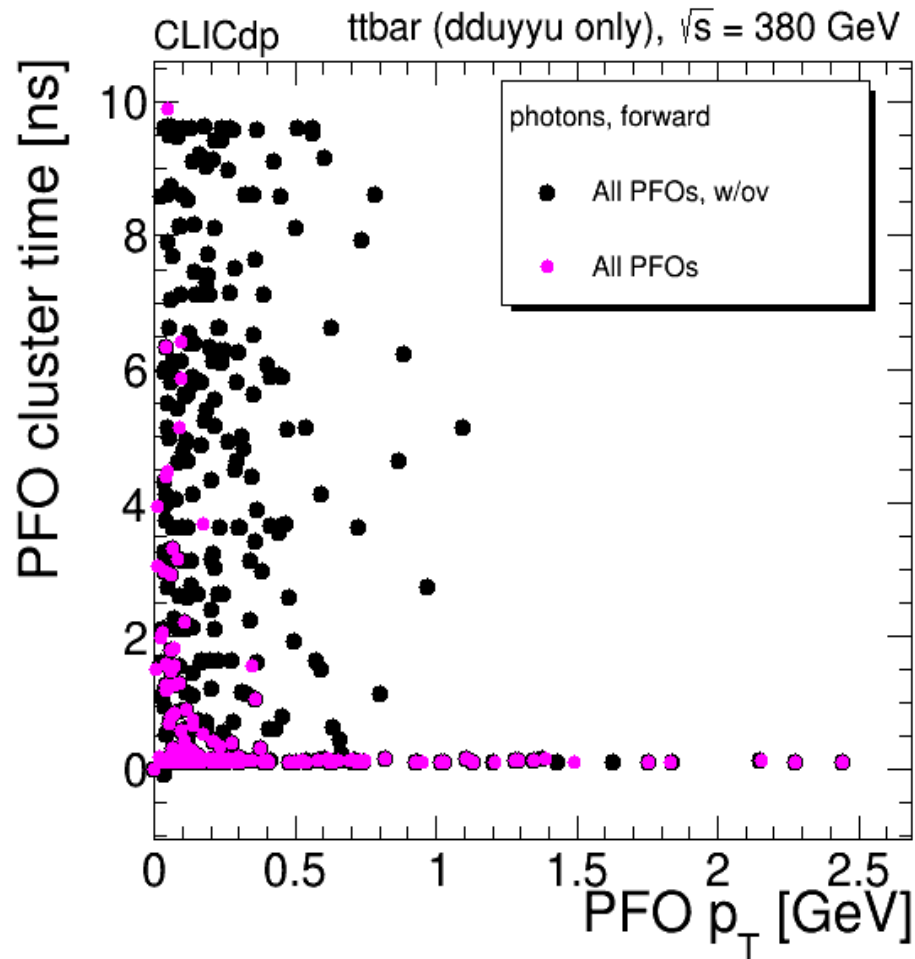
Improving: correlation plots

- Photons, $\cos\theta < 0.975$



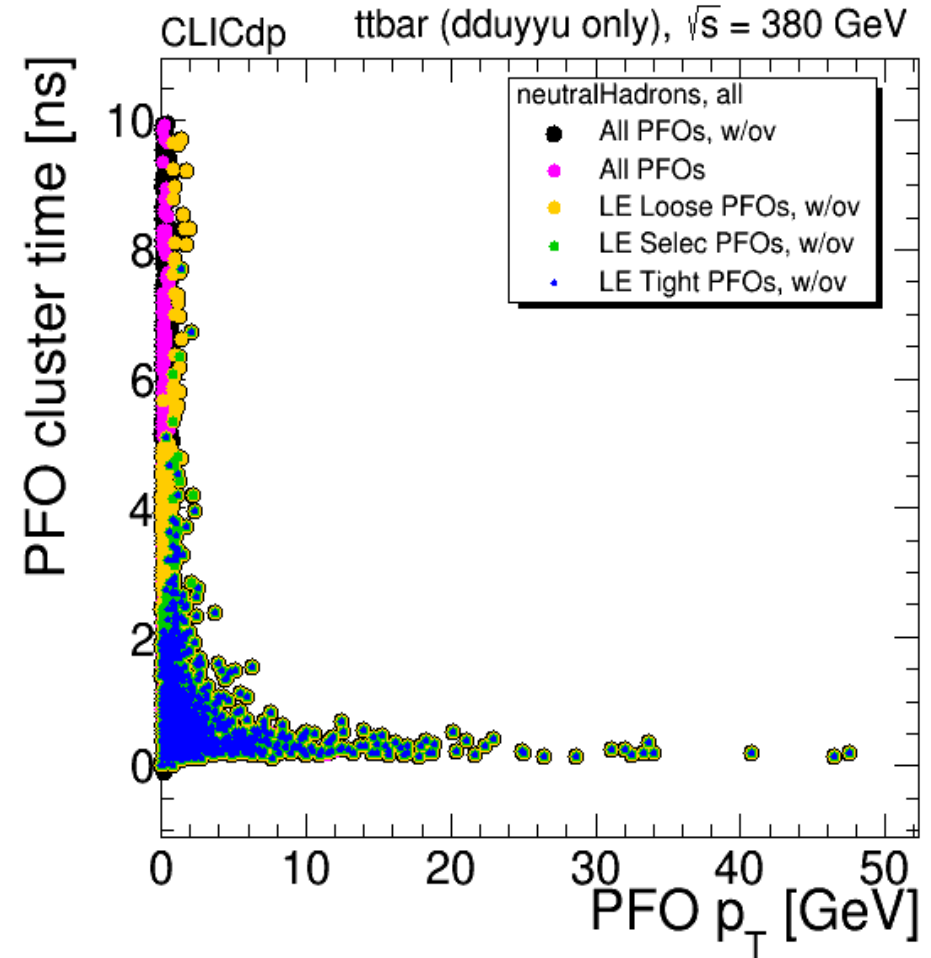
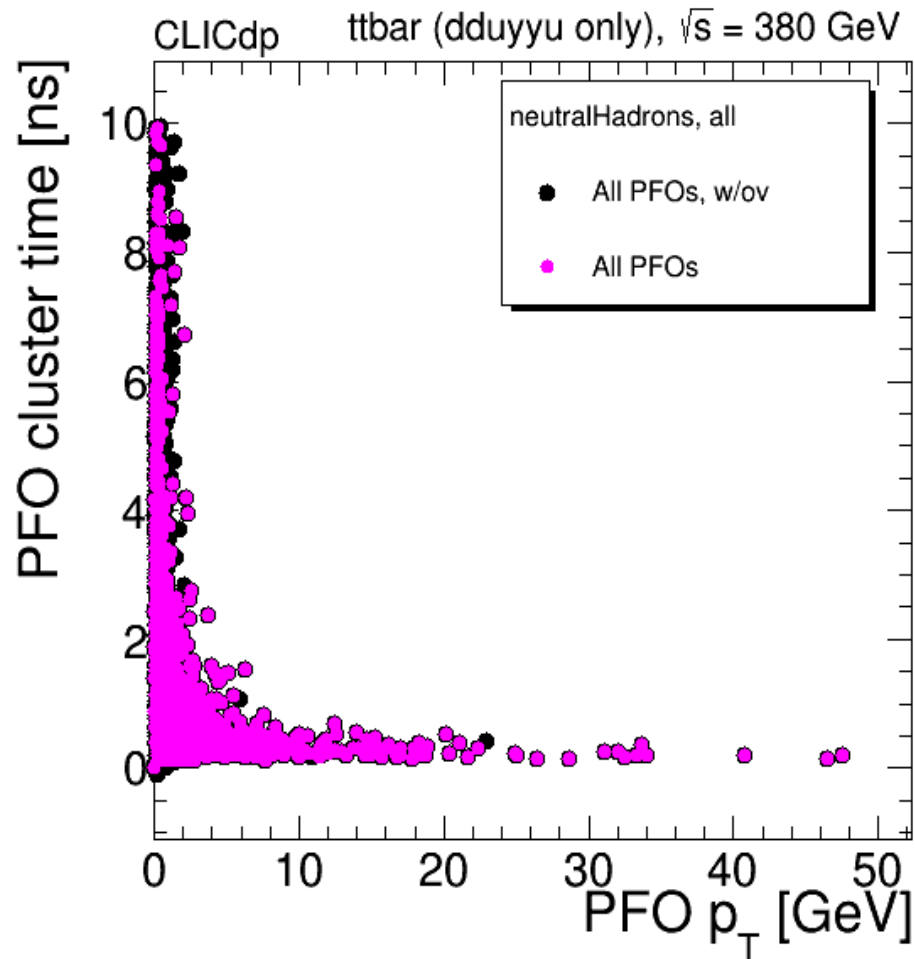
Improving: correlation plots

- Photons, $\cos\theta \geq 0.975$



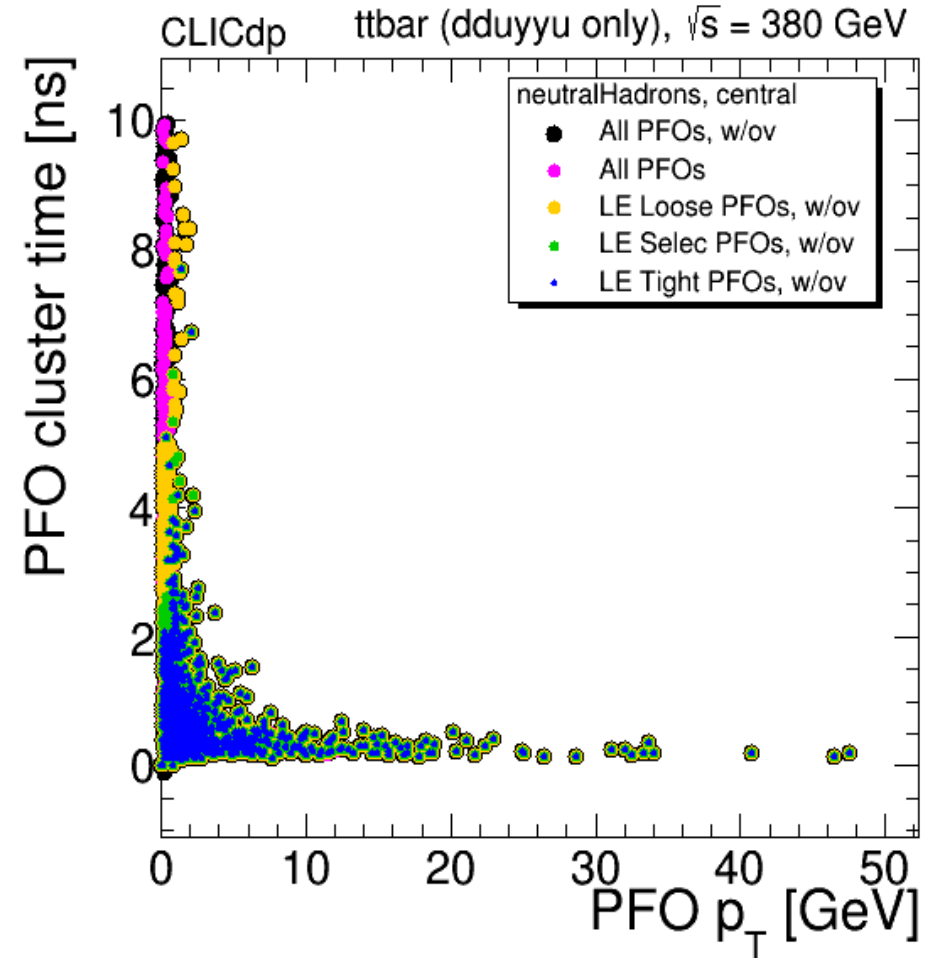
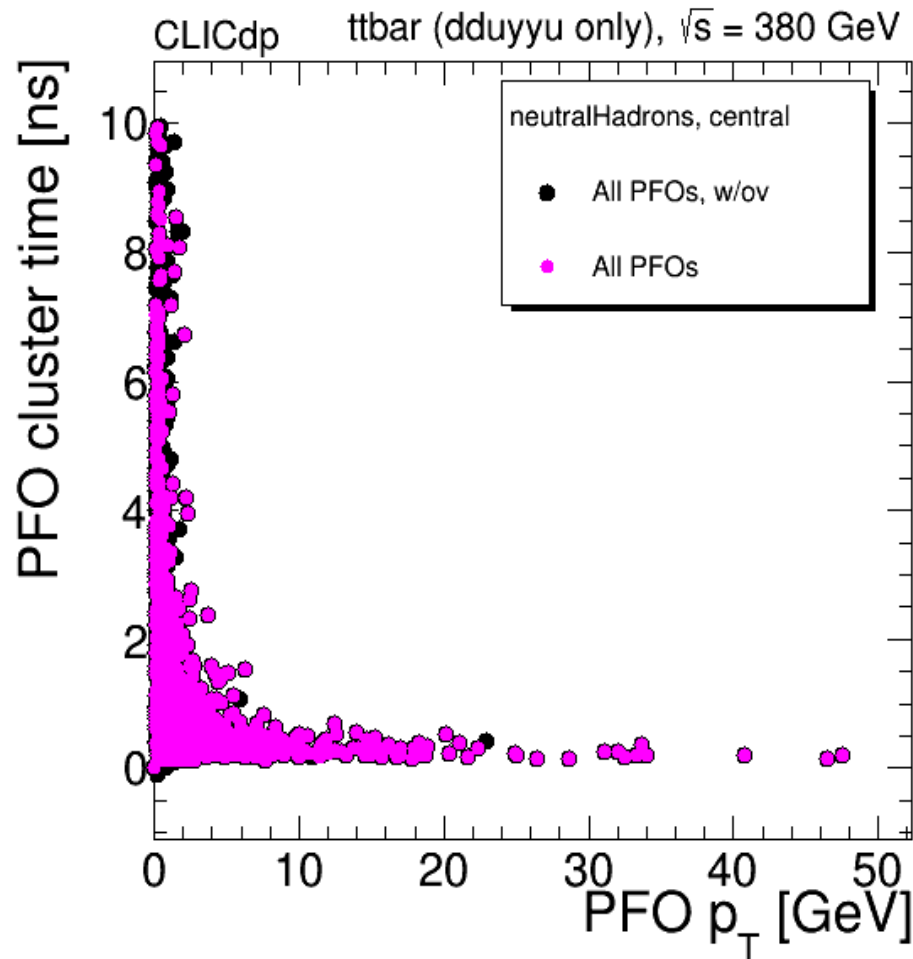
Improving: correlation plots

- Neutral hadrons, all



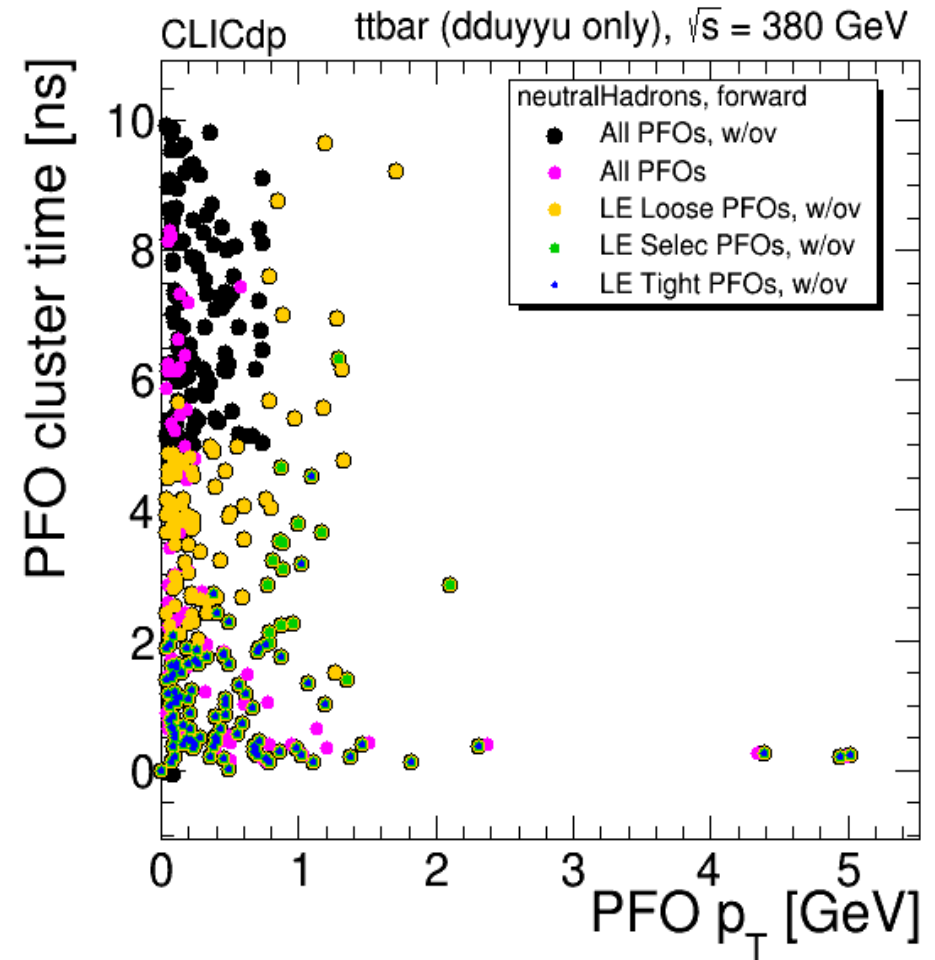
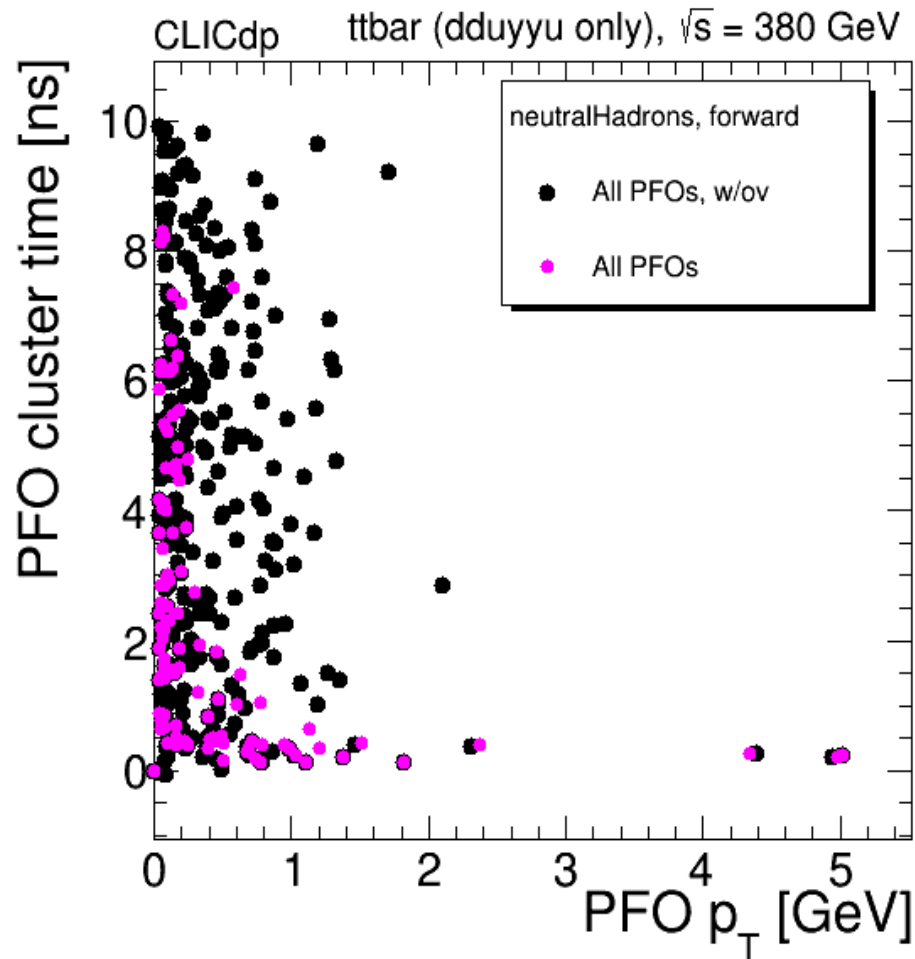
Improving: correlation plots

- Neutral hadrons, $\cos\theta < 0.975$



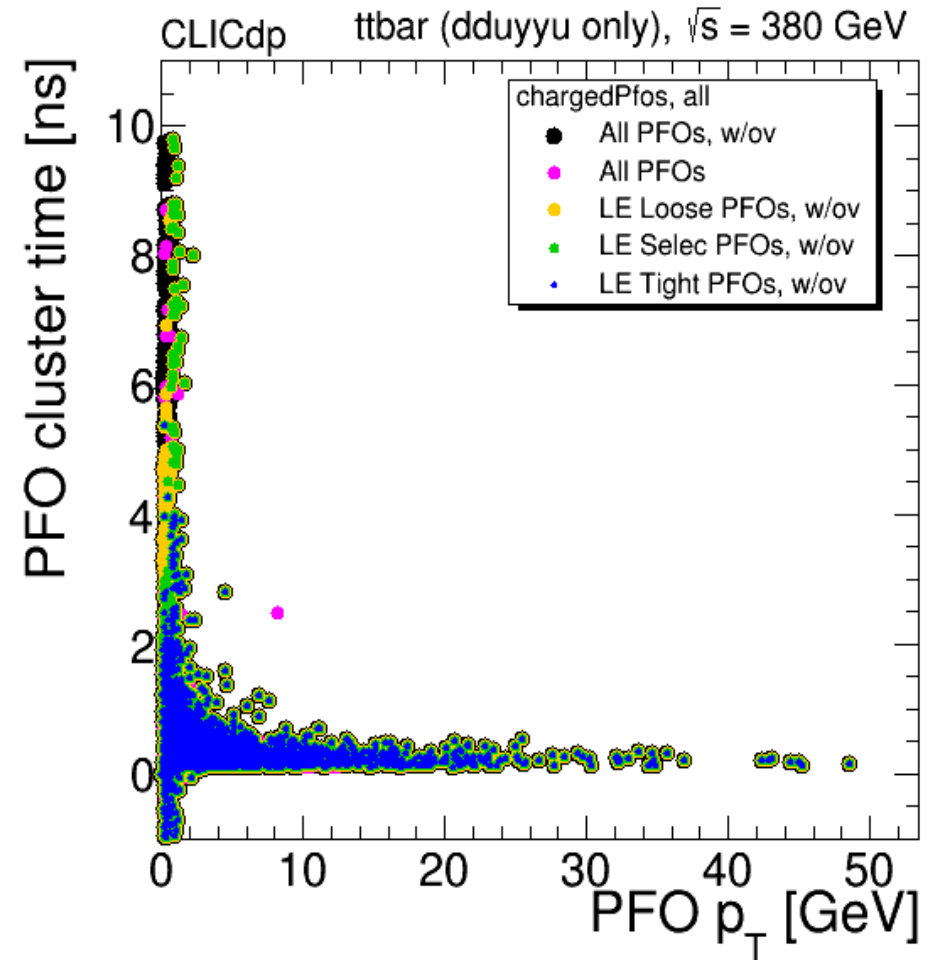
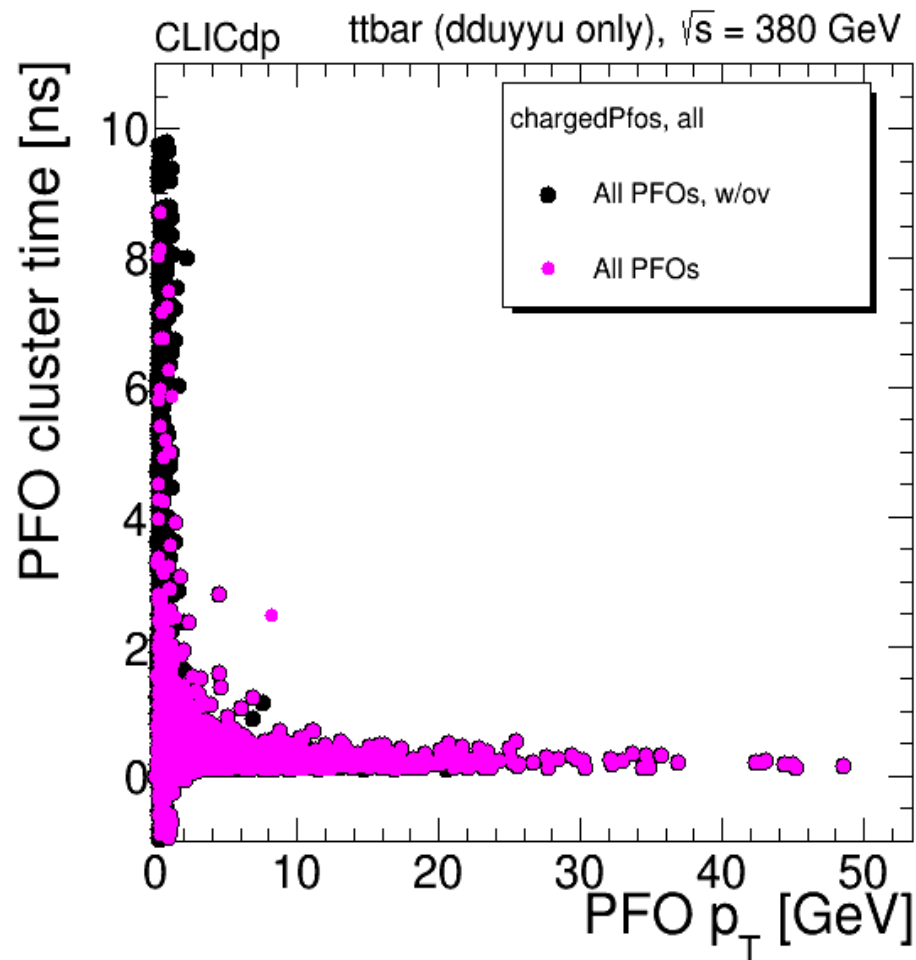
Improving: correlation plots

- Neutral hadrons, $\cos\theta \geq 0.975$



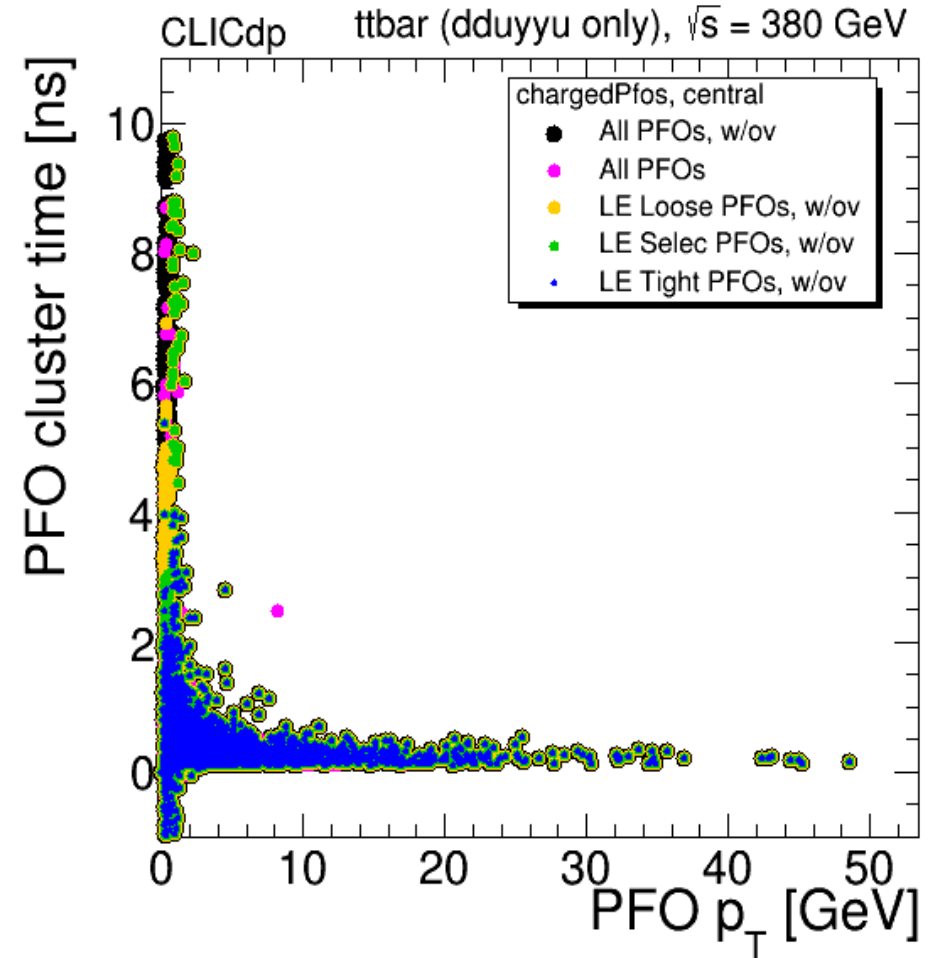
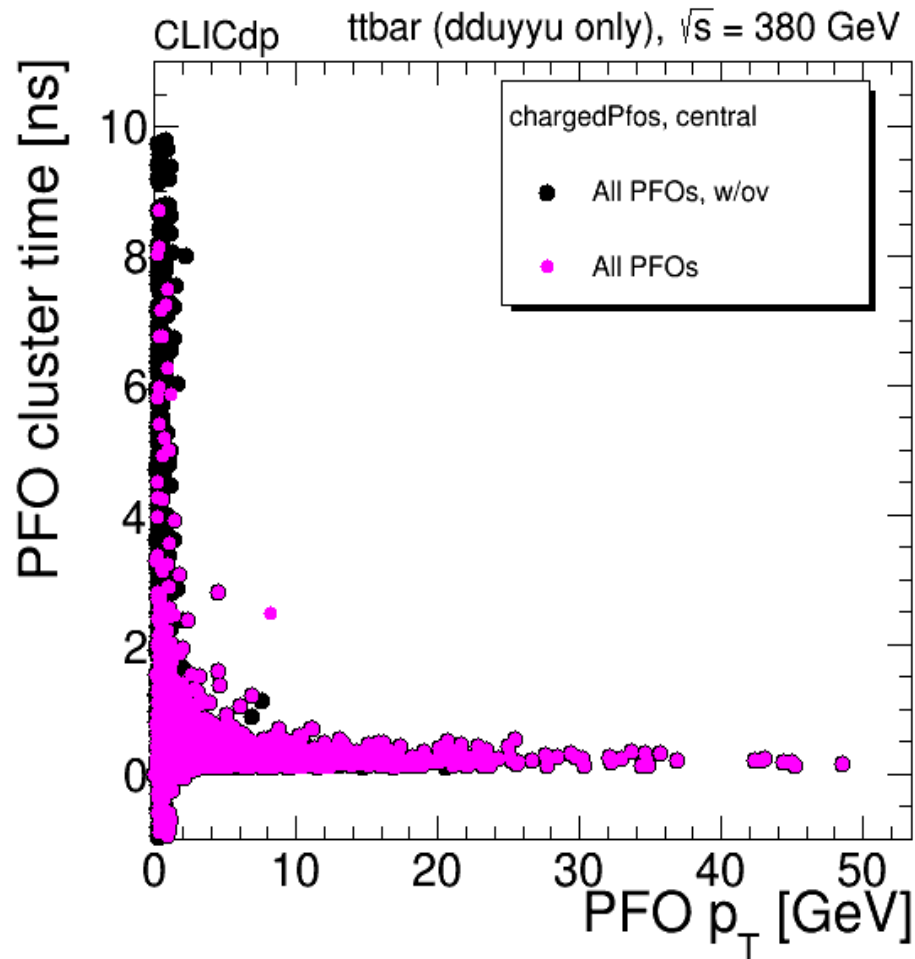
Improving: correlation plots

- Charged PFOs, all



Improving: correlation plots

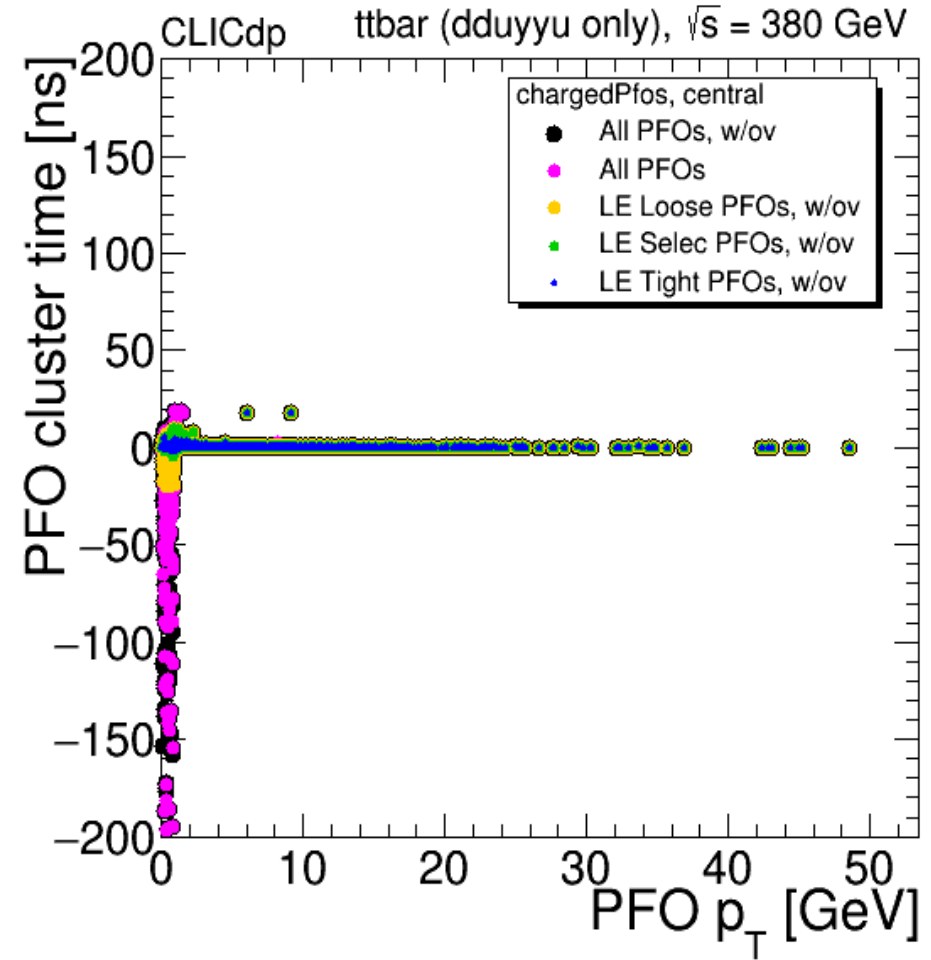
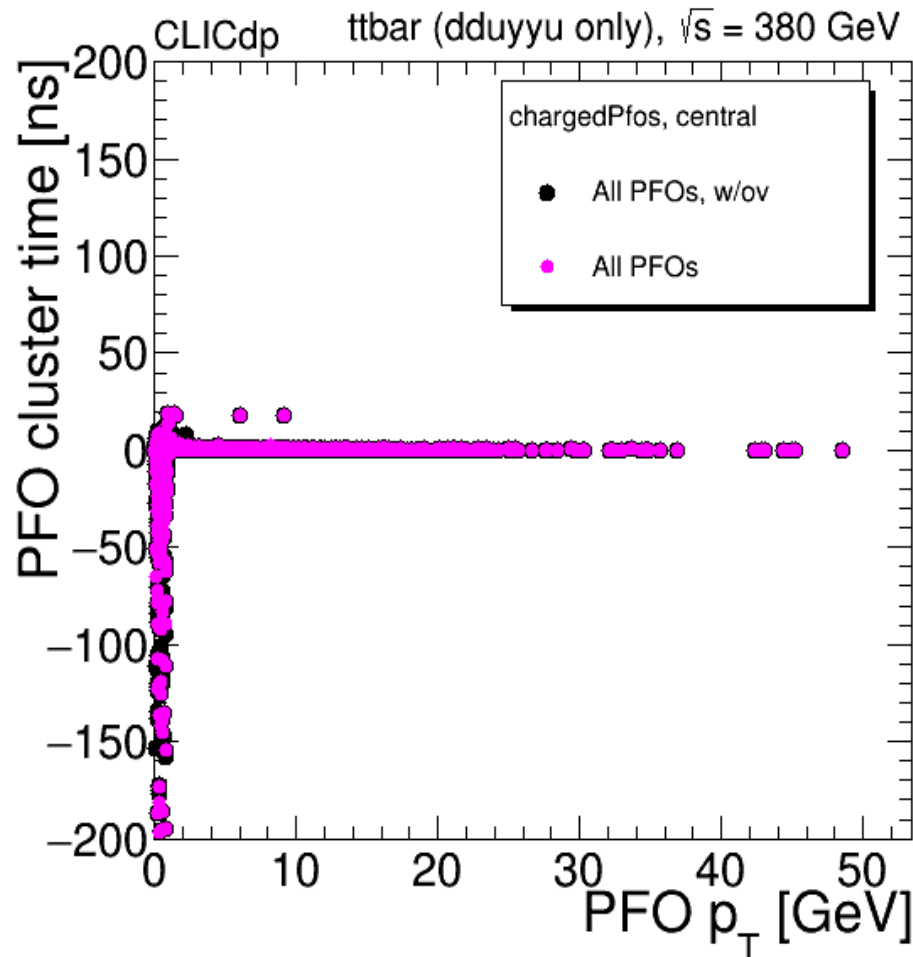
- Charged PFOs, $\cos\theta < 0.975$



... zooming out ...

Improving: correlation plots

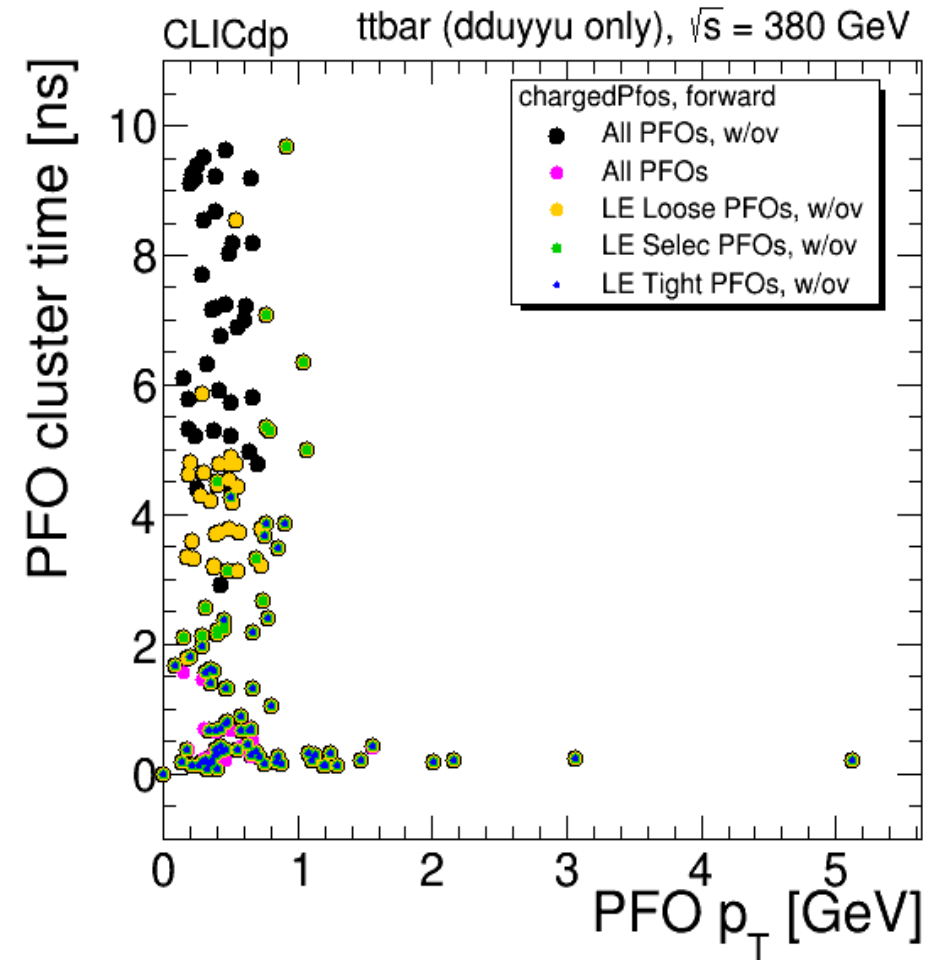
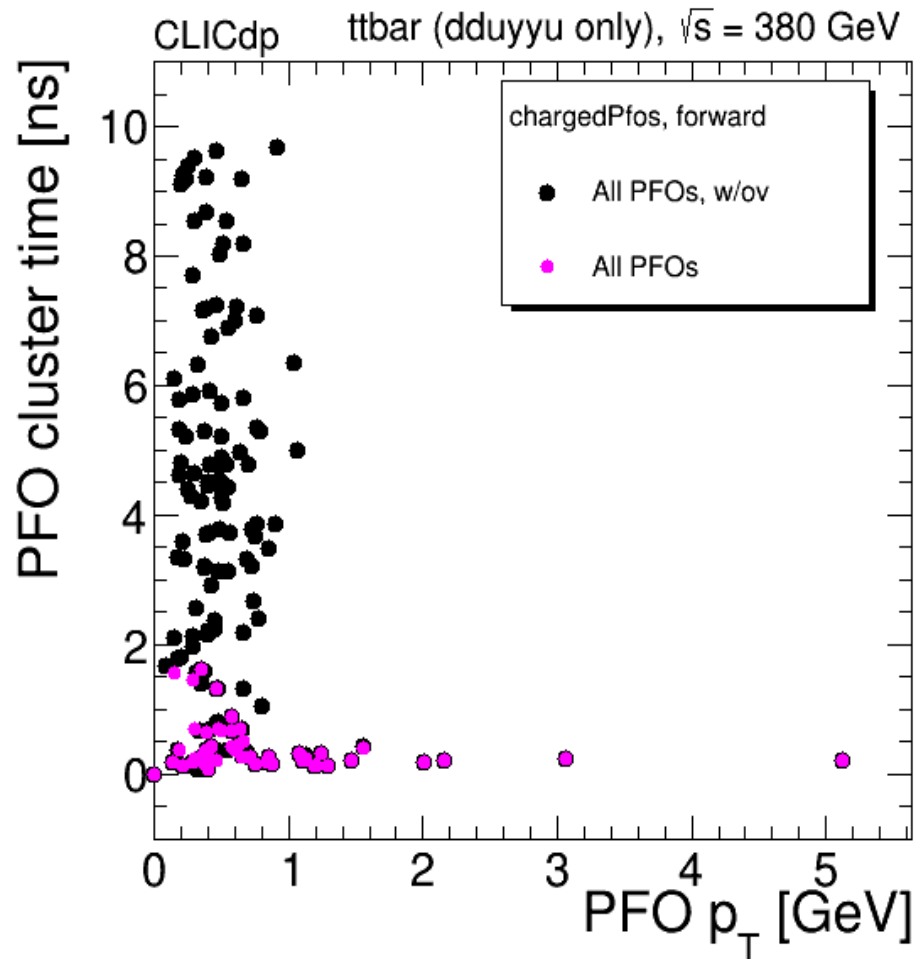
- **Charged PFOs, $\cos\theta < 0.975$**



- **Expected?**
 - Maybe worth a double check in the cluster time correction using tracks
- **Why not selected in any LE selection?**

Improving: correlation plots

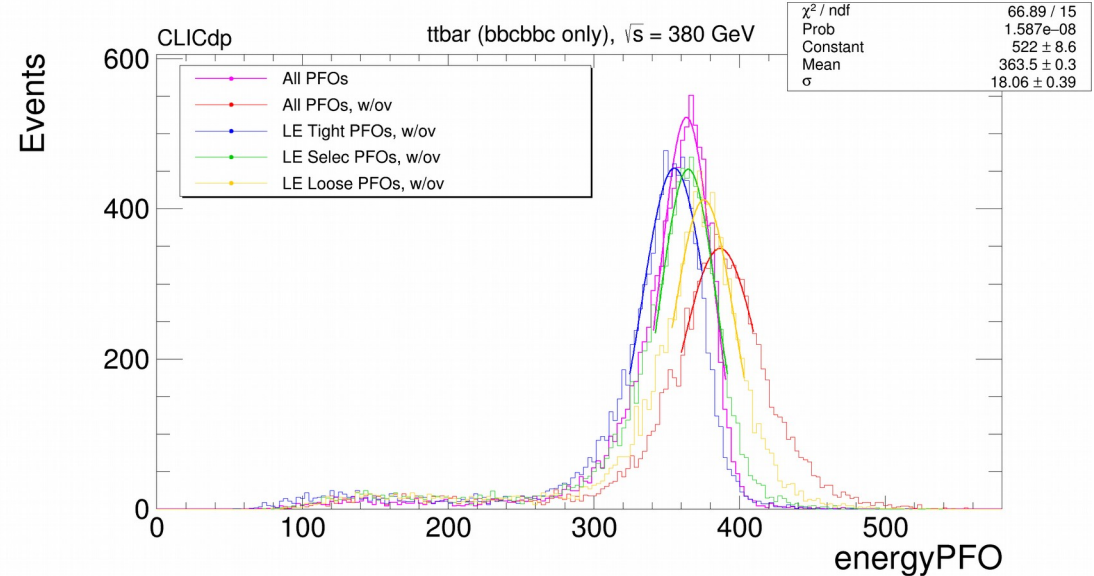
- Charged PFOs, $\cos\theta \geq 0.975$



- Tighter cut?

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Open to suggestions:

- Better Figure of merit?
- Other documentation?
- Input on new LE selection?
- More statistics? Less?



Thank you for the attention!

HE vs LE (Loose)

```
Applications Places System en Wed May 2, 12:08 PM Erica Brondolin
ericabro@pclcd40:/home/ericabro/CLICStudies/EnergyResolution/MarlinReco
ericabro@pclcd40:/home/ericabro/CLICStudies/EnergyResolution/MarlinReco 317x79
--- CLICPfoSelectorLoose HE -- parameters:
ChargedPfoLooseTimingCut: 3
ChargedPfoNegativeLooseTimingCut: -2
ChargedPfoNegativeTightTimingCut: -2
ChargedPfoPtCut: 0
ChargedPfoPtCutForLooseTiming: 4
ChargedPfoTightTimingCut: 1.5
CheckKaonCorrection: 0
CheckProtonCorrection: 0
ClusterLessPfoTrackTimeCut: 100
CorrectHitTimesForTimeOfFlight: 0
DisplayRejectedPfos: 1
DisplaySelectedPfos: 1
FarForwardCosTheta: 0.975
FarForwardCosThetaForHighEnergyNeutralHadrons: 0.95
ForwardHighEnergyNeutralHadronsEnergy: 10
HCalBarrelLooseTimingCut: 20
HCalBarrelTightTimingCut: 10
HCalEndCapTimingFactor: 1
InputPfoCollection: PandoraPFos
KeepKShorts: 1
MinMomentumForClusterLessPfos: 2
MinHCalHitsForTiming: 5
MinHCalEndCapHitsForTiming: 5
MinMomentumForClusterLessPfos: 0
MinPtForClusterLessPfos: 0.25
MinimumEnergyForNeutronTiming: 1
Monitoring: 1
MonitoringPfoEnergyToDisplay: 1
NeutralFarForwardLooseTimingCut: 2.5
NeutralFarForwardTightTimingCut: 1.5
NeutralHadronBarrelPtCutForLooseTiming: 3.5
NeutralHadronLooseTimingCut: 2.5
NeutralHadronPtCut: 0
NeutralHadronPtCutForLooseTiming: 0
NeutralHadronTightTimingCut: 1.5
PhotonFarForwardLooseTimingCut: 2
PhotonFarForwardTightTimingCut: 1
PhotonLooseTimingCut: 2
PhotonPtCut: 0
PhotonPtCutForLooseTiming: 4
PhotonTightTimingCut: 2
PtCutForTightTiming: 0.75
SelectedPfoCollection: LooseSelectedPandoraPFos new
UseClusterLessPfos: 1
UseNeutronTiming: 0
Verbosity: DEBUG
-----
--- CLICPfoSelectorLoose LE -- parameters:
ChargedPfoLooseTimingCut: 10
ChargedPfoNegativeLooseTimingCut: -0
ChargedPfoNegativeTightTimingCut: -0
ChargedPfoPtCut: 0
ChargedPfoPtCutForLooseTiming: 4
ChargedPfoTightTimingCut: 5
CheckKaonCorrection: 0
CheckProtonCorrection: 0
ClusterLessPfoTrackTimeCut: 5
CorrectHitTimesForTimeOfFlight: 0
DisplayRejectedPfos: 1
DisplaySelectedPfos: 1
FarForwardCosTheta: 0.975
FarForwardCosThetaForHighEnergyNeutralHadrons: 0.95
ForwardHighEnergyNeutralHadronsEnergy: 10
HCalBarrelLooseTimingCut: 20
HCalBarrelTightTimingCut: 10
HCalEndCapTimingFactor: 1
InputPfoCollection: PandoraPFos
KeepKShorts: 1
MinMomentumForClusterLessPfos: 5
MinHCalHitsForTiming: 5
MinHCalEndCapHitsForTiming: 5
MinMomentumForClusterLessPfos: 0
MinPtForClusterLessPfos: 0
MinimumEnergyForNeutronTiming: 1
Monitoring: 1
MonitoringPfoEnergyToDisplay: 1
NeutralFarForwardLooseTimingCut: 10
NeutralFarForwardTightTimingCut: 5
NeutralHadronBarrelPtCutForLooseTiming: 3.5
NeutralHadronLooseTimingCut: 10
NeutralHadronPtCut: 0
NeutralHadronPtCutForLooseTiming: 2
NeutralHadronTightTimingCut: 5
PhotonFarForwardLooseTimingCut: 2
PhotonFarForwardTightTimingCut: 1
PhotonLooseTimingCut: 10
PhotonPtCut: 0
PhotonPtCutForLooseTiming: 2
PhotonTightTimingCut: 2.5
PtCutForTightTiming: 0.75
SelectedPfoCollection: LE_LooseSelectedPandoraPFos new
UseClusterLessPfos: 1
UseNeutronTiming: 0
Verbosity: DEBUG
-----
CLICPfoSelectorLoose_HE.Log 49, 0-1 ALL CLICPfoSelectorLoose_LE.Log 49, 0-1 ALL
ericabro@pclcd40/ho...
```

HE vs LE (Default)

```
Applications Places System ericabro@pclcd40: /home/ericabro/CLICstudies/EnergyResolution/MarlinReco
ericabro@pclcd40: /home/ericabro/CLICstudies/EnergyResolution/MarlinReco 317x79
--- CLICPfoSelectorDefault HE - parameters:
ChargedPfoLooseTimingCut: 3
ChargedPfoNegativeLooseTimingCut: 1
ChargedPfoNegativeTightTimingCut: 0.5
ChargedPfoPtCut: 0
ChargedPfoPtCutForLooseTiming: 4
ChargedPfoTightTimingCut: 1.5
CheckKaonCorrection: 0
CheckProtonCorrection: 0
ClusterLessPfoTrackTimeCut: 10
CorrectHitTimesForTimeOfFlight: 0
DisplayRejectedPfos: 1
DisplaySelectedPfos: 1
FarForwardCosTheta: 0.975
ForwardCosThetaForHighEnergyNeutralHadrons: 0.95
ForwardHighEnergyNeutralHadronsEnergy: 10
HcalBarrelLooseTimingCut: 20
HcalBarrelTightTimingCut: 10
HcalEndCapTimingFactor: 1
InputPfoCollection: PandoraPF0s
KeepKShorts: 1
MinMomentumForClusterLessPfos: 2
MinEcalHitsForTiming: 5
MinHcalEndCapHitsForTiming: 5
MinMomentumForClusterLessPfos: 0.5
MinPtForClusterLessPfos: 0.5
MinimumEnergyForNeutronTiming: 1
Monitoring: 1
MonitoringPfoEnergyToDisplay: 1
NeutralFarForwardLooseTimingCut: 2
NeutralFarForwardTightTimingCut: 1
NeutralHadronBarrelPtCutForLooseTiming: 3.5
NeutralHadronLooseTimingCut: 2.5
NeutralHadronPtCut: 0
NeutralHadronPtCutForLooseTiming: 8
NeutralHadronTightTimingCut: 1.5
PhotonFarForwardLooseTimingCut: 2
PhotonFarForwardTightTimingCut: 1
PhotonLooseTimingCut: 0
PhotonPtCut: 2
PhotonPtCutForLooseTiming: 4
PhotonTightTimingCut: 1
PtCutForTightTiming: 0.75
selectedPfoCollection: SelectedPandoraPF0s_new
UseClusterLessPfos: 1
UseNeutronTiming: 0
Verbosity: DEBUG
-----
--- CLICPfoSelectorDefault LE - parameters:
ChargedPfoLooseTimingCut: 10
ChargedPfoNegativeLooseTimingCut: 5
ChargedPfoNegativeTightTimingCut: 2
ChargedPfoPtCut: 0
ChargedPfoPtCutForLooseTiming: 4
ChargedPfoTightTimingCut: 3
CheckKaonCorrection: 0
CheckProtonCorrection: 0
ClusterLessPfoTrackTimeCut: 10
CorrectHitTimesForTimeOfFlight: 0
DisplayRejectedPfos: 1
DisplaySelectedPfos: 1
FarForwardCosTheta: 0.975
ForwardCosThetaForHighEnergyNeutralHadrons: 0.95
ForwardHighEnergyNeutralHadronsEnergy: 10
HcalBarrelLooseTimingCut: 20
HcalBarrelTightTimingCut: 10
HcalEndCapTimingFactor: 1
InputPfoCollection: PandoraPF0s
KeepKShorts: 1
MinMomentumForClusterLessPfos: 5
MinEcalHitsForTiming: 5
MinHcalEndCapHitsForTiming: 5
MinMomentumForClusterLessPfos: 0
MinPtForClusterLessPfos: 0
MinimumEnergyForNeutronTiming: 1
Monitoring: 1
MonitoringPfoEnergyToDisplay: 1
NeutralFarForwardLooseTimingCut: 4
NeutralFarForwardTightTimingCut: 2
NeutralHadronBarrelPtCutForLooseTiming: 3.5
NeutralHadronLooseTimingCut: 5
NeutralHadronPtCut: 0
NeutralHadronPtCutForLooseTiming: 2
NeutralHadronTightTimingCut: 2.5
PhotonFarForwardLooseTimingCut: 2
PhotonFarForwardTightTimingCut: 1
PhotonLooseTimingCut: 5
PhotonPtCut: 0
PhotonPtCutForLooseTiming: 2
PhotonTightTimingCut: 1
PtCutForTightTiming: 0.75
selectedPfoCollection: LE_SelectedPandoraPF0s_new
UseClusterLessPfos: 1
UseNeutronTiming: 0
Verbosity: DEBUG
-----
CLICPfoSelectorDefault HE.log 49,0-1 ALL CLICPfoSelectorDefault LE.log 49,0-1 ALL
CLICPfoSelectorDefault LE.log 49, 1587C
ericabro@pclcd40: /home/ericabro/CLICstudies/EnergyResolution/MarlinReco
```

HE vs LE (Tight)

```
Applications Places System en Wed May 2, 12:09 PM Erica Brondolin
ericabro@pclcd40:/home/ericabro/CLICStudies/EnergyResolution/MarlinReco
ericabro@pclcd40:/home/ericabro/CLICStudies/EnergyResolution/MarlinReco 317x79
---- CLICPfoSelectorTight_HE - parameters:
ChargedPfoLooseTimingCut: 2
ChargedPfoNegativeLooseTimingCut: -0.5
ChargedPfoNegativeTightTimingCut: -0.25
ChargedPfoPtCut: 0
ChargedPfoCutForLooseTiming: 4
ChargedPfoTightTimingCut: 1
CheckKaonCorrection: 0
CheckProtonCorrection: 0
ClusterLessPfoTrackTimeCut: 10
CorrectHitTimesForTimeOffFlight: 0
DisplayRejectedPfos: 1
DisplaySelectedPfos: 1
ForwardCosTheta: 0.95
ForwardCosThetaForHighEnergyNeutralHadrons: 0.95
ForwardHighEnergyNeutralHadronsEnergy: 10
HCalBarrelLooseTimingCut: 20
HCalBarrelTightTimingCut: 10
HCalEndCapTimingFactor: 1
InputPfoCollection: PandoraPFOS
KeepKShorts: 1
MinMomentumForClusterLessPfos: 1.5
MinEcalHitsForTiming: 5
MinHCalEndCapHitsForTiming: 5
MinMomentumForClusterLessPfos: 0.5
MinPtForClusterLessPfos: 1
MinimumEnergyForNeutronTiming: 1
Monitoring: 1
MonitoringPfoEnergyToDisplay: 1
NeutralFarForwardLooseTimingCut: 1.5
NeutralFarForwardTightTimingCut: 1
NeutralHAdronBarrelPtCutForLooseTiming: 3.5
NeutralHAdronLooseTimingCut: 2.5
NeutralHAdronPtCut: 0.5
NeutralHAdronPtCutForLooseTiming: 8
NeutralHAdronTightTimingCut: 1.5
PhotonFarForwardLooseTimingCut: 2
PhotonFarForwardTightTimingCut: 1
PhotonLooseTimingCut: 2
PhotonPtCut: 0.2
PhotonPtCutForLooseTiming: 4
PhotonTightTimingCut: 1
PtCutForTightTiming: 1
SelectedPfoCollection: TightSelectedPandoraPFOS_new
UseClusterLessPfos: 0
UseNeutronTiming: 0
Verbosity: DEBUG
-----
---- CLICPfoSelectorTight_LE - parameters:
ChargedPfoLooseTimingCut: 4
ChargedPfoNegativeLooseTimingCut: 2
ChargedPfoNegativeTightTimingCut: 1
ChargedPfoPtCut: 0
ChargedPfoCutForLooseTiming: 3
ChargedPfoTightTimingCut: 2
CheckKaonCorrection: 0
CheckProtonCorrection: 0
ClusterLessPfoTrackTimeCut: 10
CorrectHitTimesForTimeOffFlight: 0
DisplayRejectedPfos: 1
DisplaySelectedPfos: 1
ForwardCosTheta: 0.75
ForwardCosThetaForHighEnergyNeutralHadrons: 0.95
ForwardHighEnergyNeutralHadronsEnergy: 10
HCalBarrelLooseTimingCut: 20
HCalBarrelTightTimingCut: 10
HCalEndCapTimingFactor: 1
InputPfoCollection: PandoraPFOS
KeepKShorts: 1
MinMomentumForClusterLessPfos: 5
MinEcalHitsForTiming: 5
MinHCalEndCapHitsForTiming: 5
MinMomentumForClusterLessPfos: 0
MinPtForClusterLessPfos: 0.75
MinimumEnergyForNeutronTiming: 1
Monitoring: 1
MonitoringPfoEnergyToDisplay: 1
NeutralFarForwardLooseTimingCut: 2
NeutralFarForwardTightTimingCut: 2
NeutralHAdronBarrelPtCutForLooseTiming: 3.5
NeutralHAdronLooseTimingCut: 4
NeutralHAdronPtCut: 0
NeutralHAdronPtCutForLooseTiming: 3
NeutralHAdronTightTimingCut: 2
PhotonFarForwardLooseTimingCut: 2
PhotonFarForwardTightTimingCut: 1
PhotonLooseTimingCut: 1
PhotonPtCut: 0
PhotonPtCutForLooseTiming: 2
PhotonTightTimingCut: 1
PtCutForTightTiming: 0.75
SelectedPfoCollection: LE_TightSelectedPandoraPFOS_new
UseClusterLessPfos: 1
UseNeutronTiming: 0
Verbosity: DEBUG
-----
CLICPfoSelectorTight_HE.log 49, 0-1 ALL CLICPfoSelectorTight_LE.log 49, 0-1 ALL
"CLICPfoSelectorTight_LE.log" 49L, 1633C
ericabro@pclcd40/ho... Desktop - File Browser
```