FPCCD digitizer & ZH→llH

Asian physics and software meeting

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FPCCD digitizer

Status

Current Status

- The code of digitizer was almost fixed.

Problem

- TTree that have all information can not be saved in ROOT file.
- Now, TTree have only #PixelHits and #SimTrakcerHits.

Solution

- Add new collection for digitized hits and read REC_*.slcio file??

ZH→llH Analysis

Status

Previous

- Lepton ID was checked in Generator level.

- The distribution of "cone energy vs track energy" should be checked.

## Today

- Lepton ID was considered again using "cone enegy vs energy of PFO" distribution.

Well reconstructed event

We have to select good reconstructed events to check leptonID.

- $\chi_{1,2}^2 \equiv |E^{MC1,2}-E^{Rec}| + |P^{MC1,2}_x-P^{Rec}_x| + |P^{MC1,2}_y-P^{Rec}_y| + |P^{MC1,2}_z-P^{Rec}_z|$
  - least difference between MCParticle and each PFOs in each event

$\rightarrow$ The event $\chi_1^2 < 5$GeV && $\chi_2^2 < 5$GeV is selected as good rec. events.

The χ_1^2 distribution

ZH→eeH

ZH→μμH
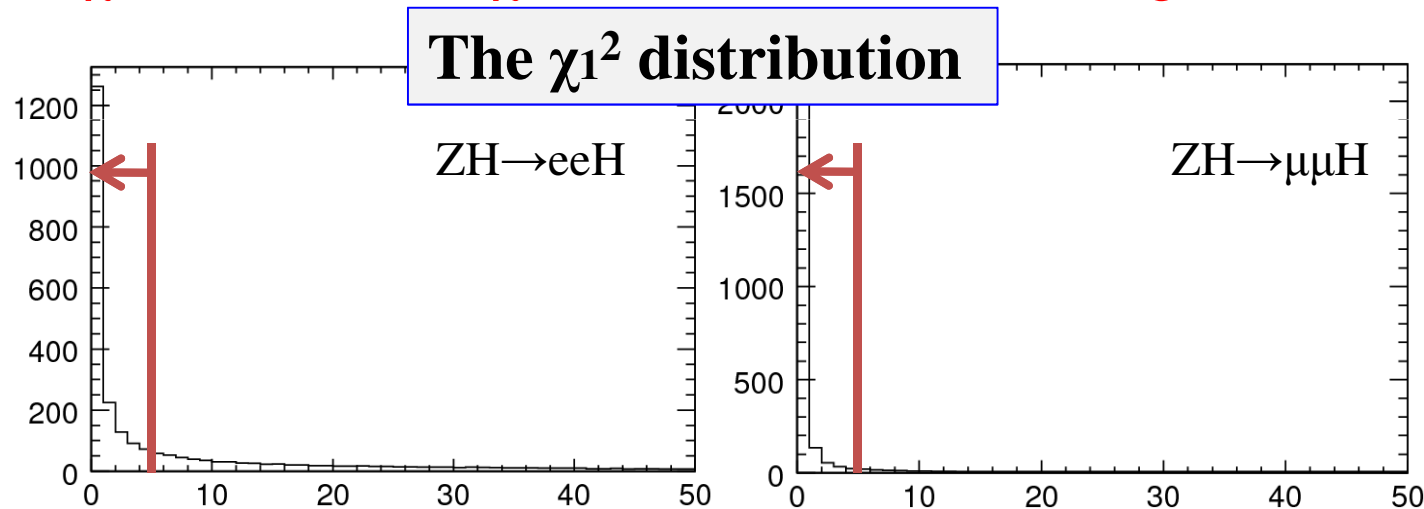
	e-channel		μ-channel	
#events	2777	1157	2601	2125
#lepton candidates	5554	2314	5201	4249
#PFOs	148938	61072	136522	111131

Cone energy vs Energy of PFO

The Cone energy and energy of PFO was checked.

- The Cone energy of lepton candidate is very small.
- The distribution of ZH→μμH is almost same as ZH→eeH.(→backup)

→Cone energy < 10GeV AND 20 < Energy < 90 GeV is selected.

The 2D distribution of cone energy vs energy for ZH→eeH
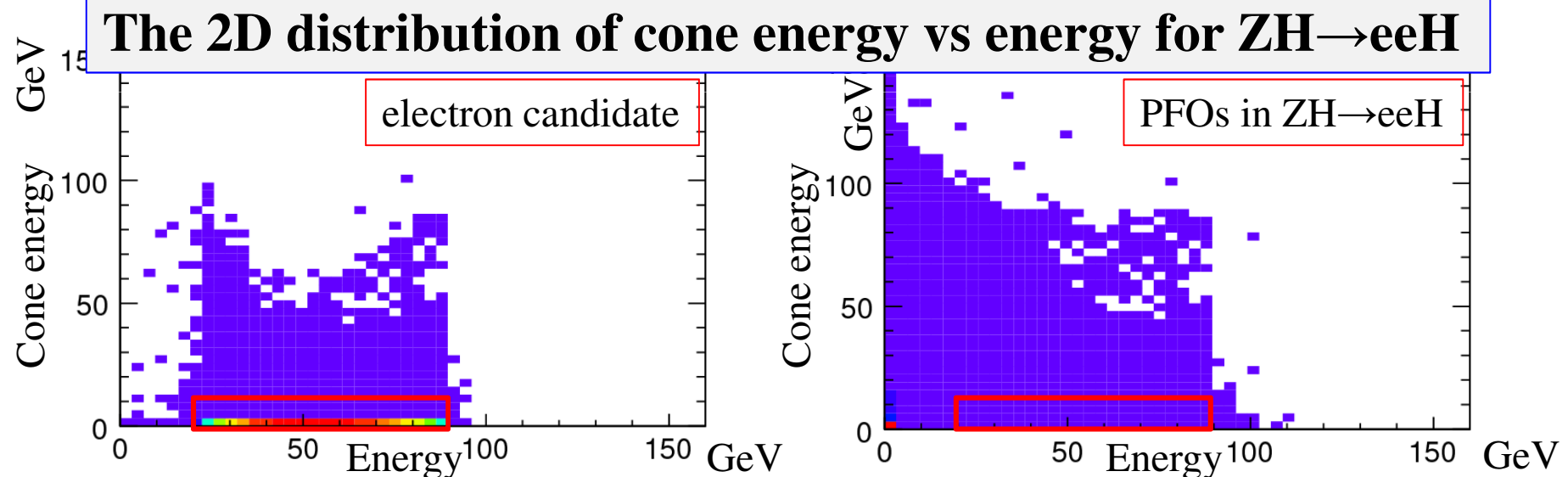
	e-channel		μ-channel	
#lepton candidates	2314 →	2249	4249 →	4183
#PFOs	61072 →	2423	111131 →	4509

Selection with Calorimeter(1)

Calorimeter Info. was checked to discriminate e and μ.

- (Ecal+Hcal ene)/mom was checked.
- 0.5 < (Ecal+Hcal ene)/mom < 1.15 (e-channel)
- (Ecal+Hcal ene)/mom <0.7 (μ-channel)

The Ecal+Hcal energy/momentum distribution

e-channel

electron candidate
PFOs in ZH→eeH
PFOs in ZH→ee,μμH
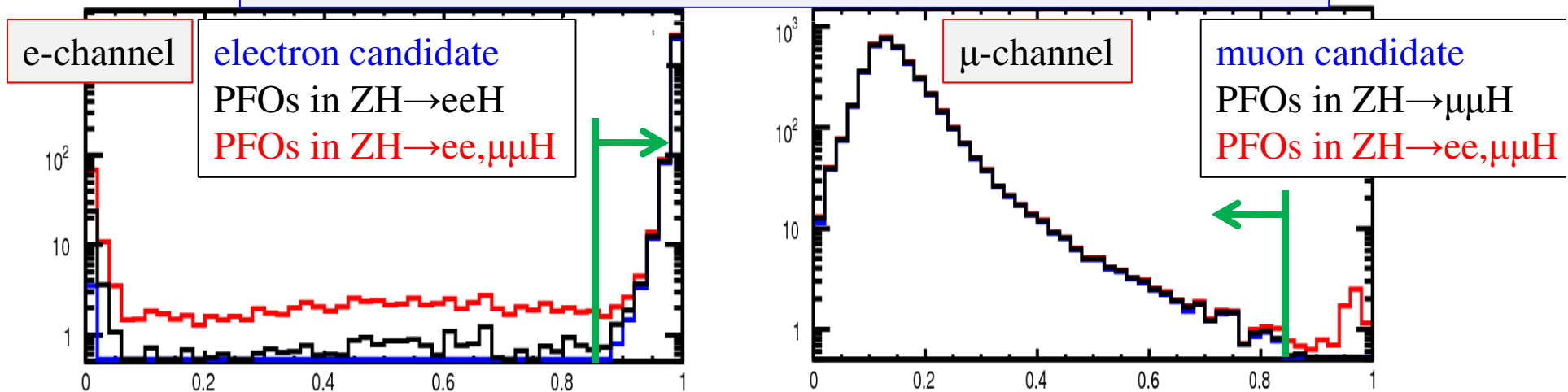
μ-channel

muon candidate
PFOs in ZH→μμH
PFOs in ZH→ee,μμH
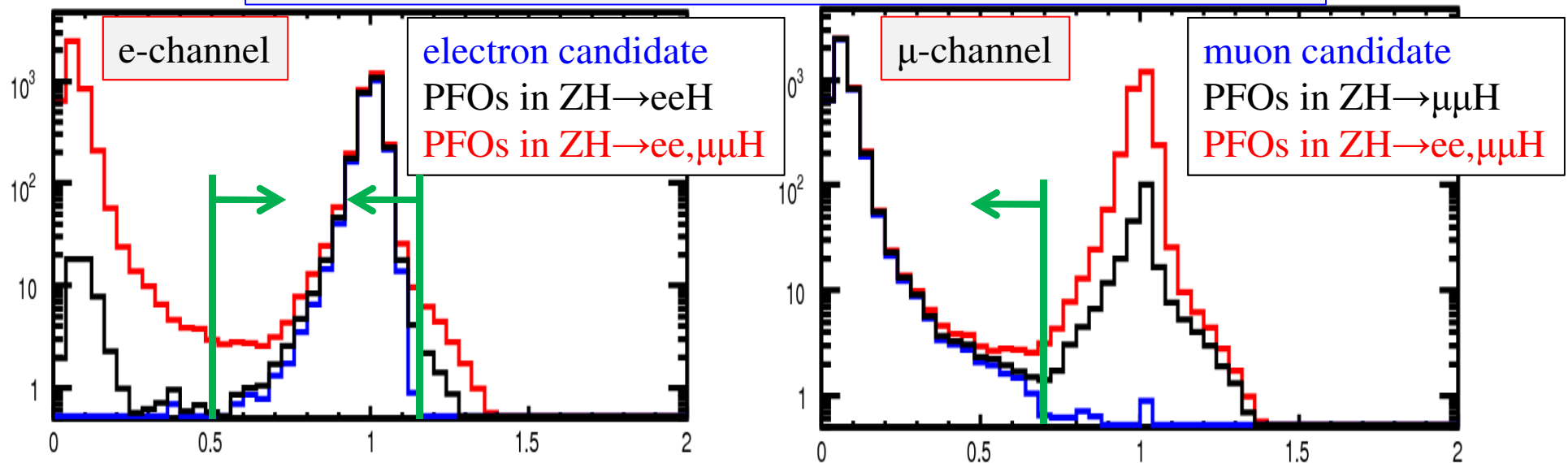
Selection with Calorimeter(2)

Another Calorimeter Info. was also checked.

- Ecal ene/(Ecal+Hcal ene) distribution was also checked.
- 0.85 < Ecal ene/(Ecal+Hcal ene) (e-channel)
- Ecal ene/(Ecal+Hcal ene) < 0.85 (μ-channel)

The Ecal energy/Ecal+Hcal energy distribution

e-channel

electron candidate
PFOs in ZH→eeH
PFOs in ZH→ee,μμH

μ-channel

muon candidate
PFOs in ZH→μμH
PFOs in ZH→ee,μμH

	e-channel		μ-channel	
#lepton candidates	2249	2240	4183	4175
#PFOs	2423	2308	4509	4269

#Candidates and #PFOs

#lepton candidates and #PFOs were checked.

	e-channel		μ-channel	
#lepton candidates	2314 →	2240	4249 →	4175
#PFOs	61072 →	2308	111131 →	4269
#PFOs in ZH→ee,μμH	172203 →	2437	172203 →	4321

- Efficiency
  - e-channel: 96.8%(=2240/2314)
  - μ-channel: 98.3%(=4175/4249)
- Purity?
  - e-channel: 97.1%(=2240/2308)
  - μ-channel: 97.8%(=4175/4269)

Summary

<u>Summary</u>

- LeptonID was considered with well reconstructed events.
  - procedure
    - cone E vs E cut
    - Selection with Calorimeter
  - Efficiency
    - e-channel: 96.8%
    - μ-channel: 98.3%

<u>PLAN</u>

- Efficiency should be revaluate with ALL reconstructed events including ZH$\rightarrow\tau\tau$H,qqH events.

No Problem

```
void FPCCDDigitizer::init(){
    define TTree;
}


void FPCCDDigitizer::processEvent(LCEvent* evt){
    for(int i=0; i<nSimHits; i++){
        "digitization";
    }
    TTree->Fill();
}


void FPCCDDigitizer::end(){
    RootFile is created;
    TTree->Write();
}
```

TTree can not be stored in RootFile

void FPCCDDigitizer::processEvent(LCEvent* evt){

    difine TTree;

    for(int i=0; i<nSimHits; i++){

        "digitization";

        TTree->Fill();

    }

    RootFile is created;

    TTree->Write();   ← Problem has occurreed!!

}

Cone energy vs Energy of PFO for μ

The 2D distribution of cone energy vs energy for ZH→μμH