Usage of Arbor PID

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PID code implementation

- Arbor source code: /cefs/tmp_storage/binsong/job_arborv3/SPPC_CEPC Simple/Arbor_16_HGC
- Main PID function: ClusterFlag() in src/PluginMatch/ArborToolLCIO.cc
- usage of this function: in BushConnect.cc line 966 and 967

```
int LeptonID = ClusterFlag(b_Clu, Mom.Mag(), evtPP);
chargeparticle->setType(LeptonID);
```

How to get the PID in your analysis

- Use the getType() function:

```
ReconstructedParticle *a_RecoP = …….;
int PID = a_RecoP->getType();
```

Just for Charge particle now, get returned value could be 13,-13,11,-11,211,-211

For neutral particle, the value is always 22,

PID optimization package

- Path: /scratchfs/higgs/binsong/Soft/Personal/SinglePartAna/
- This toolkit give you all the parameters used in the PID.
- Macro: steer/DisSPPC.steer
- input: slcio files after reconstruction.
- Output root file: three branch(Evt, ChPFO, Hit)

```
[binsong@lxslc601 steer]$ root -l DiaSPPC.root
root [0]
Attaching file DiaSPPC.root as _file0...
root [1] .ls
TFile**         DiaSPPC.root
 TFile*         DiaSPPC.root
  KEY: TTree    Evt;1   Evt
  KEY: TTree    ChPFO;1 ChPFO
  KEY: TTree    Hit;1   Hit
```

```
root [2] Evt->Show(1)
======> EVENT:1
 EventNr            = 1
 Num                = 1
 ThetaMC            = 0.174969
 THEn               = 110.976
 TCEn               = 100.993
 LCEn               = 60.8151
 nCH                = 1
 nMIPs              = 0
 nEMs               = 0
 nHADs              = 1
 nMuPFOs            = 0
 nEPFOs             = 0
 nPiPFOs            = 1
```

PID in rec file

```
root [3] ChPFO->Show(1)
======> EVENT:1
 EventNr            = 1
 Num                = 1
 TrkEn              = 100.139
 Type               = 211
 ThetaMC            = 0.174969
 Charge             = 1
 EClu               = 100.993
 EE_Clu             = 88.6587
 EH_Clu             = 12.3347
 NH_ECAL            = 573
 NH_ECALF6          = 293
 NH_ECALL10         = 280
 NH_HCAL            = 133
 FD_ECAL            = 0.711763
 FD_ECALF6          = 0.890197
 FD_ECALL10         = 0.568771
 FD_HCAL            = 0.121027
 FD_all             = 0.541721
 minDepth           = 12.6499
 maxDepth           = 623.65
 CluFlagID          = 211
 CluDepth           = 648.558
 SDTheta            = 0.00305268
 avEnDisHtoL        = 18.9981
```

PID in the toolkit

- PID cut: DiaSPPC.cc line 442 to line 463

```
bool cutmus[6];

cutmus[1] = _FD_HCAL >= 0;

cutmus[2] = (_cluDepth > 600 || _TrkEn < 1.5);

cutmus[3] = _cluDepth/_EClu > 30;

cutmus[4] = _FD_HCAL/(_HcalNHit/_EClu) < -0.1*abs(_FD_ECALF6-_FD_ECALL10)/2.5+0.012+_TrkEn/3000.;

cutmus[5] = (_avEnDisHtoL*_TrkEn < 320 || _TrkEn > 50);

bool cutmu = cutmus[1] && cutmus[2] && cutmus[3] && cutmus[4] && cutmus[5];

bool cutes[4];
cutes[1] = _FD_all > 0.6/200.*_cluDepth;
cutes[2] = log10(_EcalNHitF6+2*_EcalNHitL10) > 1-0.3/_TrkEn;
cutes[3] = (_FD_ECALF6 > 0.4*(log10(_EcalNHitF6+2*_EcalNHitL10)-0.85) || _TrkEn > 80);

bool cute;

cute = cutes[1] && cutes[2] && cutes[3];
```

For different geometry, the cut may be different.

Usage of this package

- Copy the package to your own path.
- Compile by Hfcamke, cmake install
- Add the lib file to your marlin dll.
- Run: Marlin steer/DiaSPPC.steer