环形正负电子对撞机
Circular Electron Positron Collider

Status of CEPC Calorimeter

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For the CEPC-Calo Group

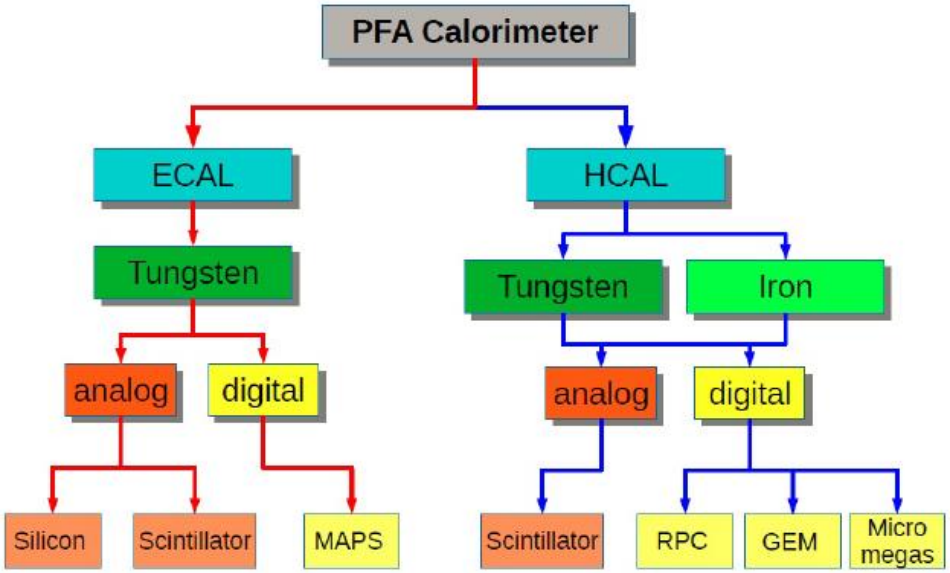
CEPC Physics and Detector Group Meeting

September 13, 2017

Calorimeter Options

- ECAL with Silicon and Tungsten (LLR, France)
- ECAL with Scintillator+SiPM and Tungsten (IHEP + USTC)
- SDHCAL with RPC and Stainless Steel (SJTU + IPNL, France)
- HCAL with ThGEM/GEM and Stainless Steel (IHEP + UCAS + USTC)
- HCAL with Scintillator+SiPM and Stainless Steel (IHEP)
- Dual readout calorimeters (INFN, Italy)

CALICE Calorimeter for ILC



https://twiki.cern.ch/twiki/bin/view/CALICE/CalicePapers

Outline of CEPC Calorimeters CDR

- General introduction of Calorimetry system
- PFA calorimeters (Tao Hu, Jianbei Liu, Haijun Yang)
  - Technology options for ECAL
    - Silicon + tungsten (Vincent Boudry ?)
    - Scintillator + tungsten (Zhigang Wang, Yunlong Zhang – in progress)
  - Technology options for HCAL
    - RPC (Imad Laktineh, Haijun Yang – in progress)
    - GEM (Jianbei Liu)
    - Scintillator (Boxiang Yu – in progress)
  - Performance of ECAL+HCAL with TB data (Vincent + Imad)
- Dual Readout calorimeter (Roberto Ferrari – in progress)
  - General design and performance (Roberto Ferrari)

Deadline for collecting input documents from subgroups: September 30
Deadline for merging and writing up a draft of CDR: October 31

Contact Information

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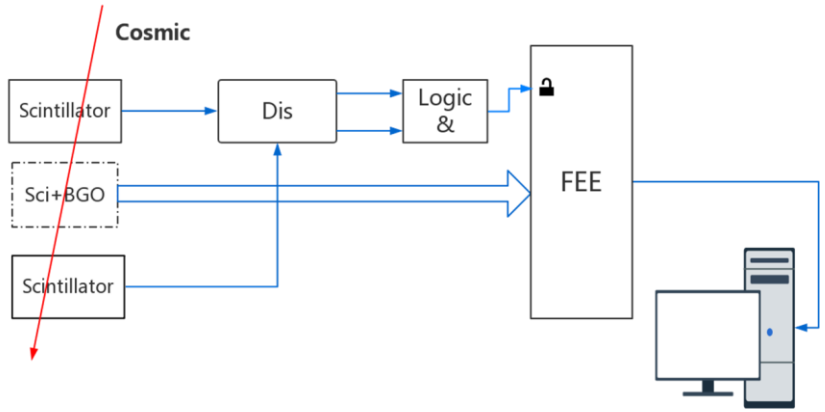
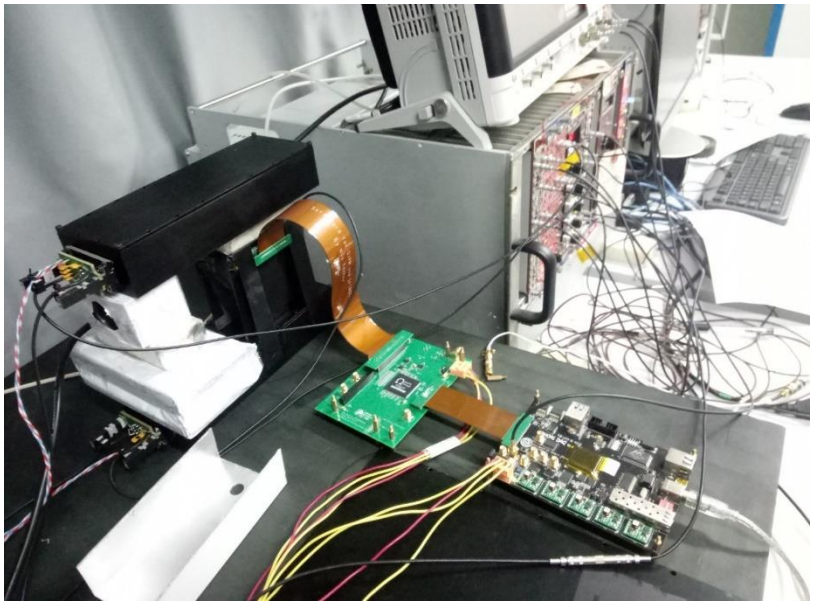
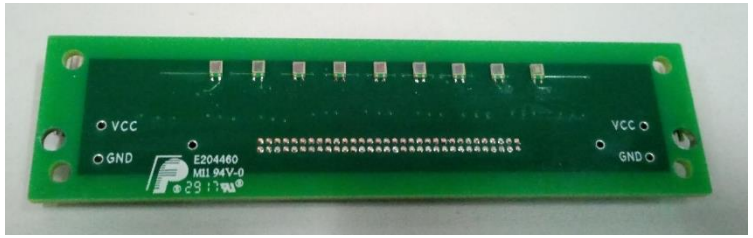
USTC: Scintillator + SiPM + SPIROC Test

- USTC group setup scintillator+SIPM+SPIROC test facility, using cosmic ray to test its performance.





- SiPM: S12571-010p(Hamamatsu)(9channel)
- Scintillator: PSD(4ch):$45mm \times 5mm \times 2mm$
  - BGO(1channel): $45mm \times 5mm \times 2mm$
  - New PSD(4ch): $45mm \times 5mm \times 1mm$



IHEP: SiPM Response Curve Study

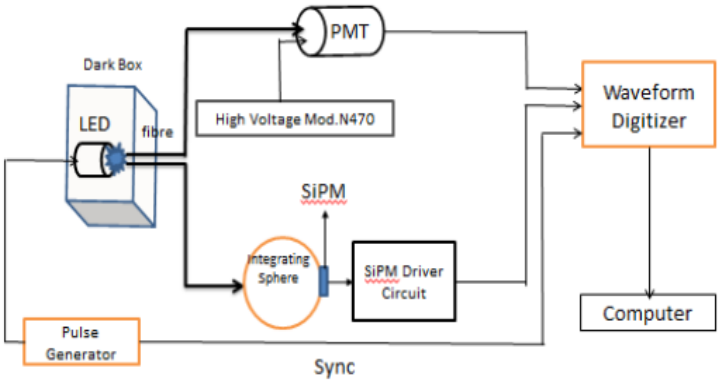
- The response curve of SiPM (1600 pixel) can be described by a function, the parameters varied with input light width.
- SiPM with 10k pixel will be investigated.

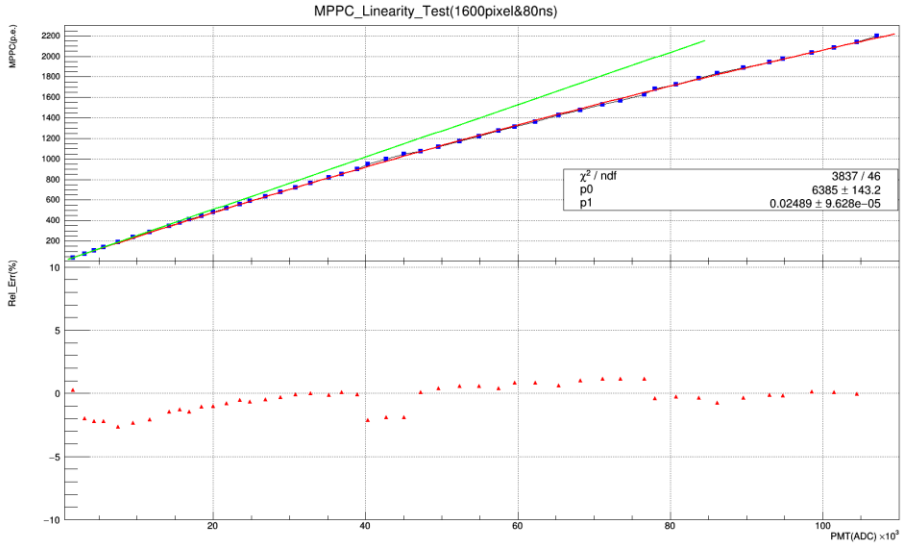
$$N_{fire} = N_{eff}(1 - e^{-\epsilon N_{in}/N_{eff}}) \quad (2)$$

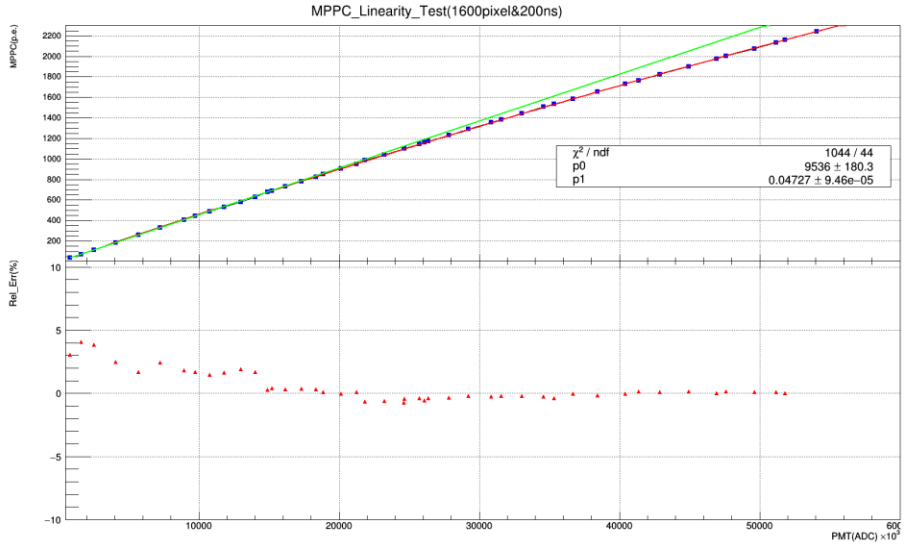
N_{eff}: the effective pixel number of pixels this SiPM has.

When the recovery time of each cell of SiPM is faster than the duration of one event, some of cell will contributing to an signal more than once. It makes the N_{pix} greater than the real number of pixels effectively.

N_{eff} functions as a fitting parameter when this equation is fitted to real data.



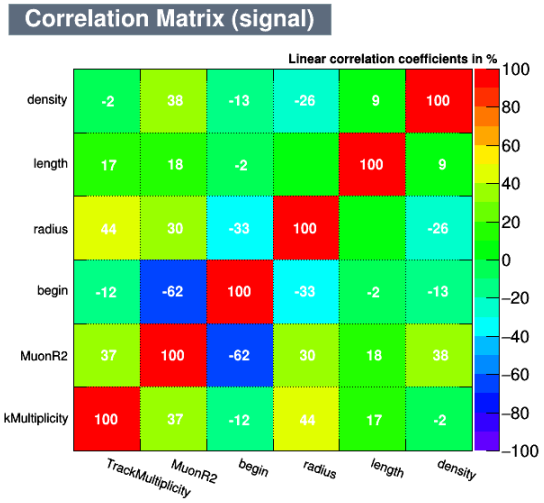


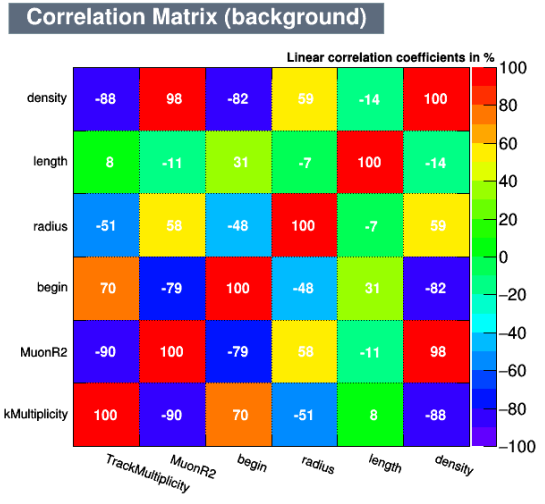


SJTU: SDHCAL Particle ID

- Tool: Traditional cuts, MVA
- TMVA Methods: BDT 6var
- Energy:10-80GeV
- Training and Test
  - Signal: 80000 pion events with energy 10,20,30,40,50,60,70 and 80GeV
  - Background:160000 electron events with E=10,20,30,40,50,60,70 and 80GeV
  - Background: 120000 muon events with energy 10,20,30,40,50,60,70 and 80GeV

  Mixed Background
  - Ntraining:Ntest=1:1



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Rank : Variable          : Variable Importance
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   1 : Radius            : 2.113e-01
   2 : Density           : 1.863e-01
   3 : Begin             : 1.772e-01
   4 : MuonR2            : 1.614e-01
   5 : Length            : 1.521e-01
   6 : TrackMultiplicity : 1.117e-01
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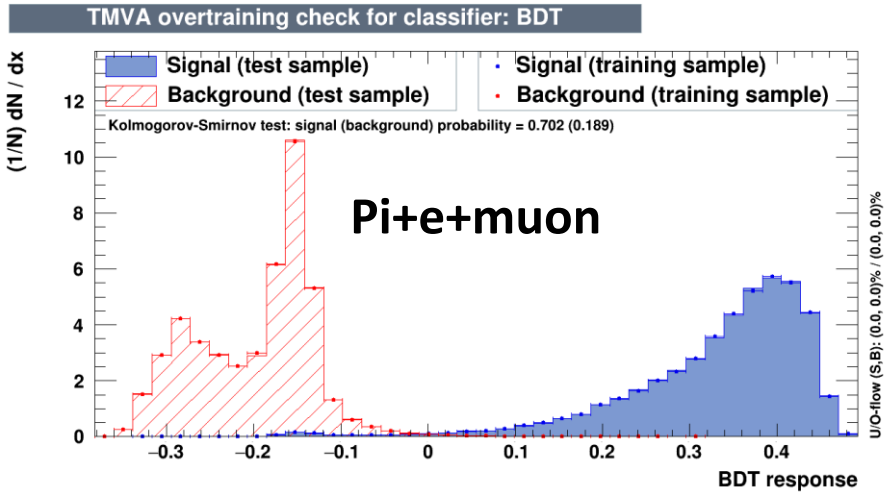
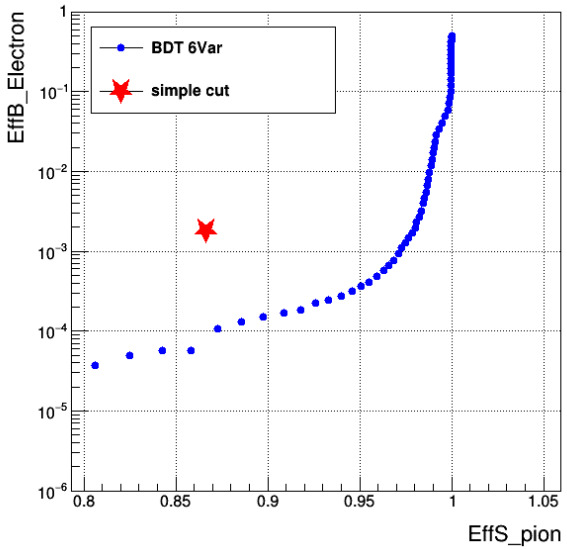
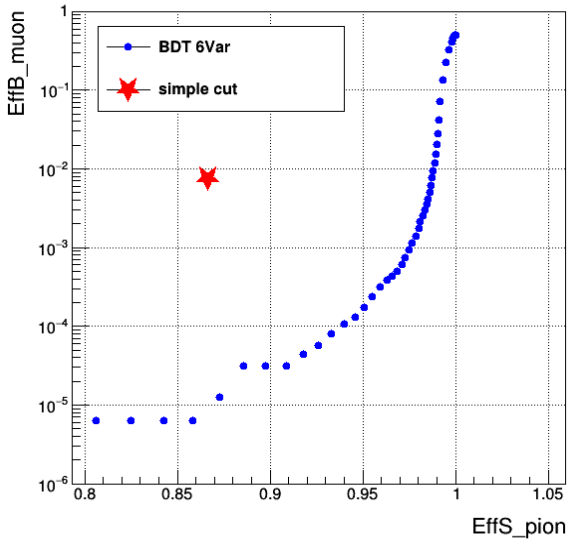


SJTU: SDHCAL Particle ID





Energy(GeV)	Pion eff(%)	Electron contamination (%)	Muon contamination (%)
10GeV Simple Cut	62.01	0.09	0.06
10GeV BDT	62.09	0.01	0.00
20GeV Simple Cut	77.02	0.05	0.23
20GeV BDT	77.15	0.00	0.00
30GeV Simple Cut	84.17	0.05	0.54
30GeV BDT	84.20	0.01	0.00
40GeV Simple Cut	90.07	0.20	0.69
40GeV BDT	90.16	0.04	0.00
50GeV Simple Cut	93.21	0.09	0.64
50GeV BDT	93.19	0.02	0.01
60GeV Simple Cut	94.89	0.23	0.79
60GeV BDT	94.86	0.07	0.00
70GeV Simple Cut	95.60	0.31	1.08
70GeV BDT	95.61	0.08	0.04
80GeV Simple Cut	96.22	0.37	1.13
80GeV BDT	96.21	0.02	0.05