Calibration of Electromagnetic Colorimeter on CEPC

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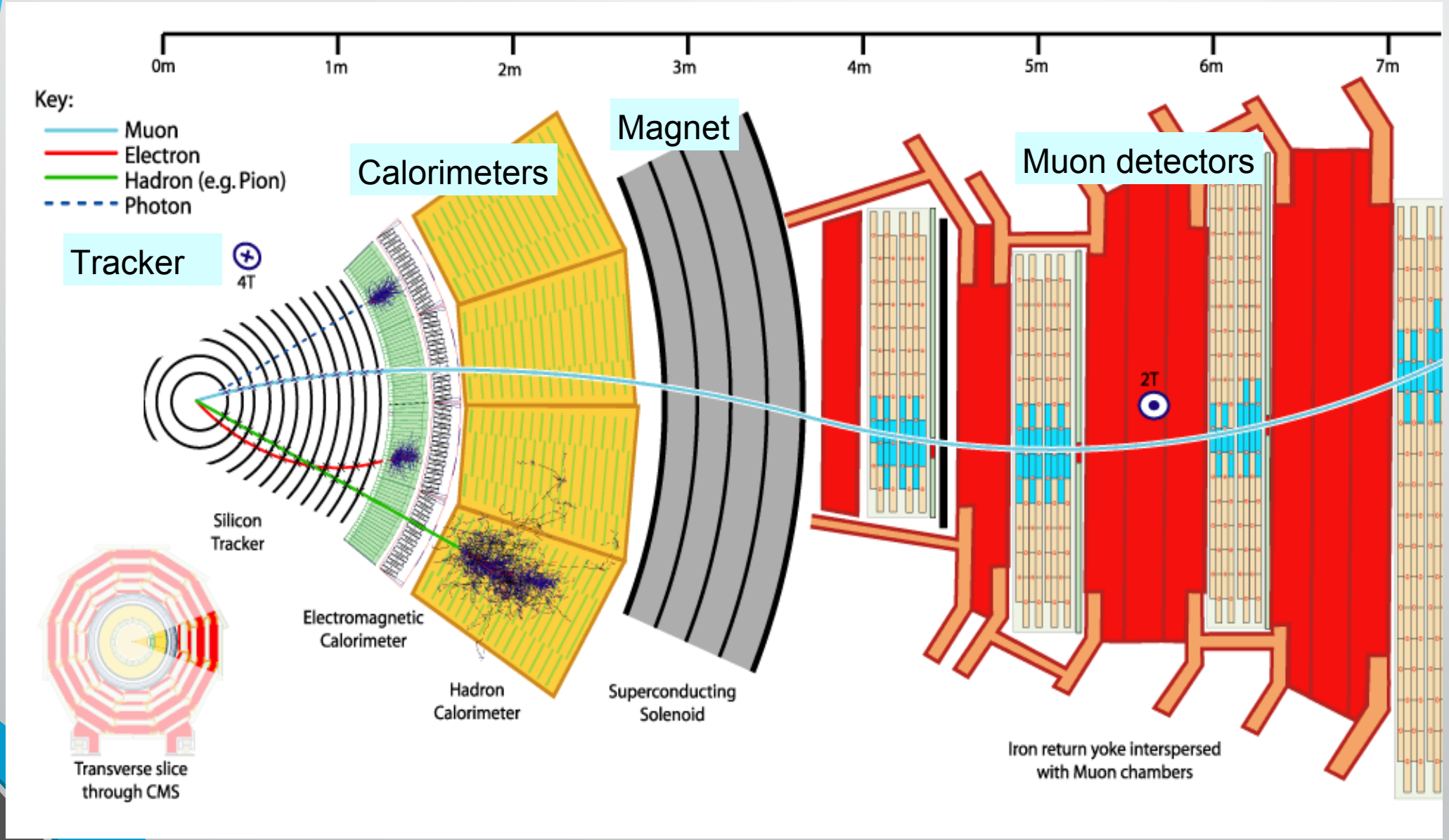
Calorimeters

Calorimeters measure the energy of particles;

An electromagnetic calorimeter (Ecal): to measure the energy of particles that interact primarily via the electromagnetic interaction ;

A hadronic calorimeter (Hcal): to measure particles that interact via the strong nuclear force.

Detectors (LHC)



Motivation:

We want reconstructed energy close to input energy;

Read out energy is not equal to deposited energy;

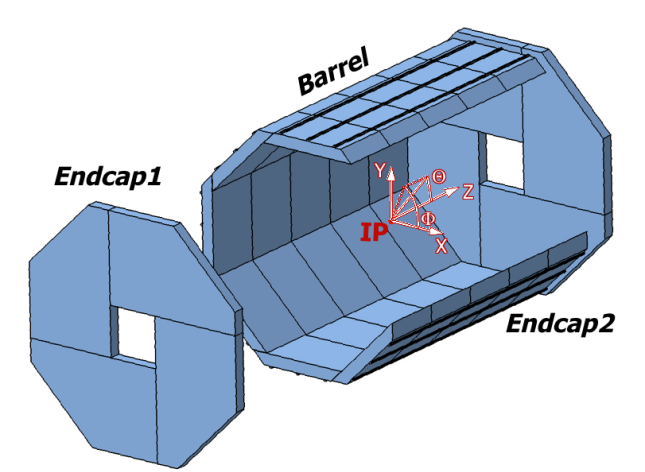
In practice, we change the number of layers while keeping the total thickness of absorber same, so we need to do this work under different geometry

The absorbers in rest layers have thickness 2t

Each absorber in the first 2n/3 lays of Ecal has thickness t

Total thickness of both parts equal, and they ad up to a constant; thus we expect the calibration constant , c , to be proportional to the inver of number of layers

Geometry



Model: CEPC_v1;
cell size =5mm*5mm

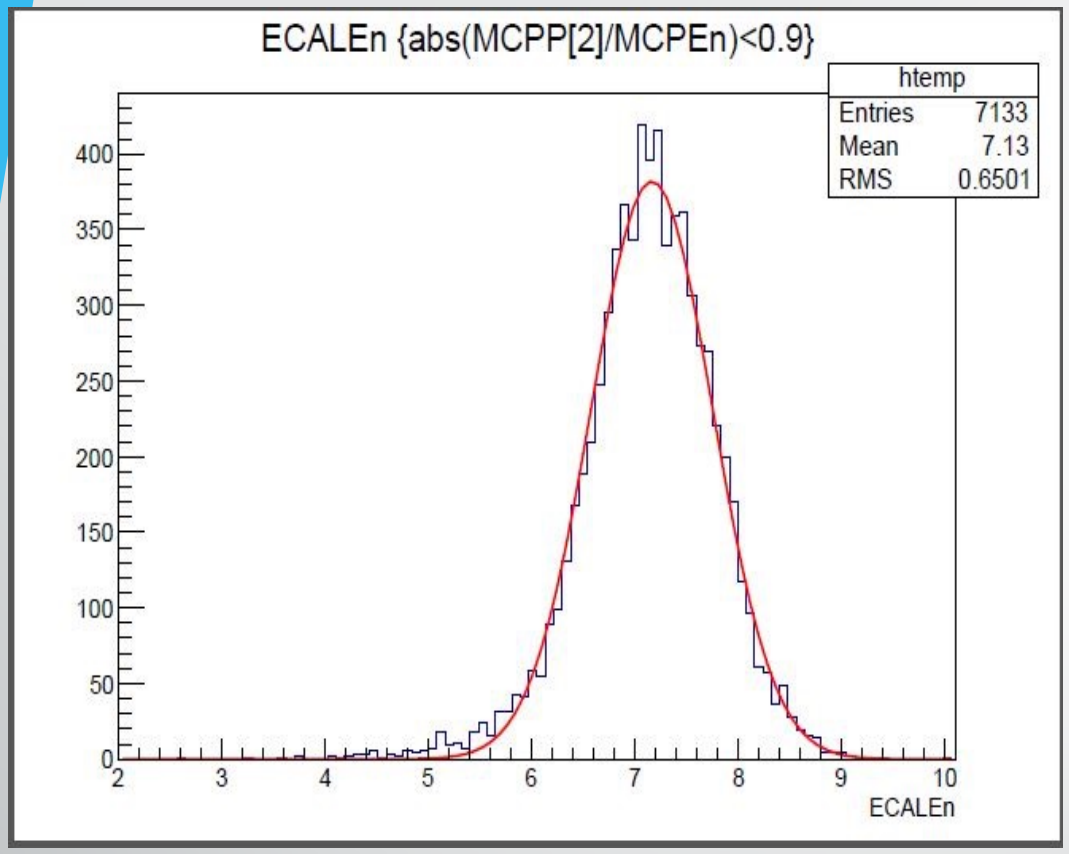
Variable: Number of layers

Input Particle: 10 GeV Photon

number of Si layers	W layers (1st section)	Thickness (mm)	W layers (2nd section)	Thickness (mm)
20	13	3.15	6	6.3
26	17	2.4	8	4.8
30	20	2.1	9	4.2

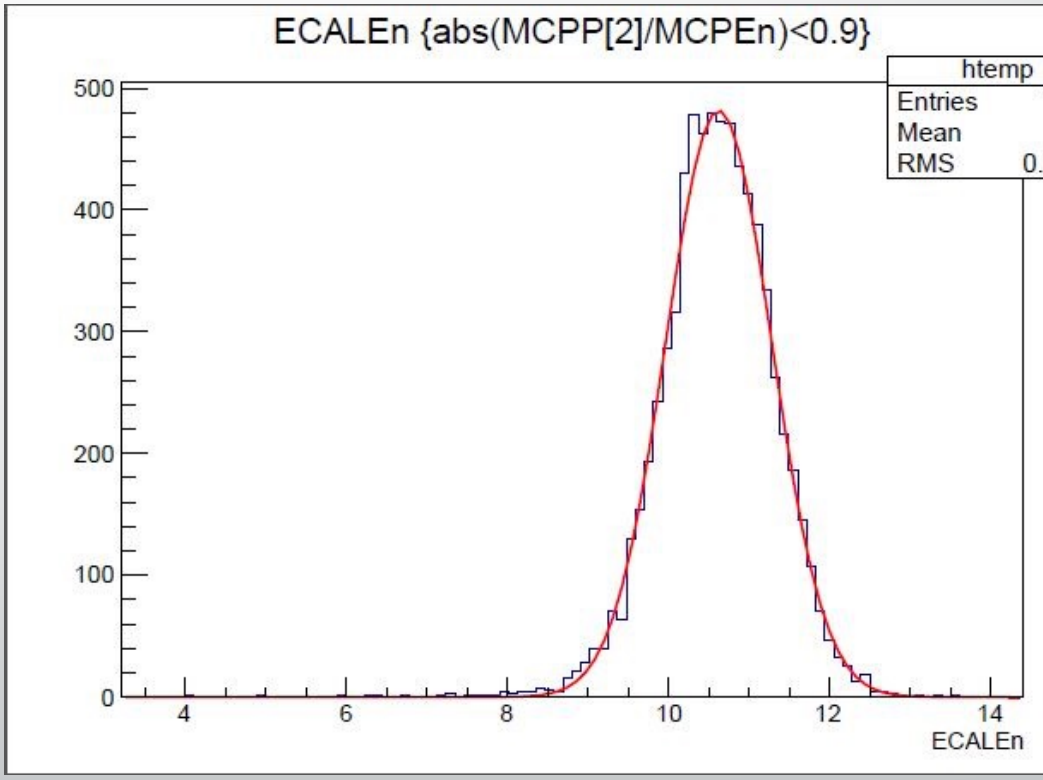
Before Collaboration:

- Event number =10,000; filtering out photon conversion cases;
- The calibration constant is temporarily set to 46 , which is mean to be used for 30 –layer case
- We would expect a Gaussian distribution with mean around 10Gev at 30-layer case; and 7.7GeV, 6.7GeV for 26 and 20-layer case, respectively.



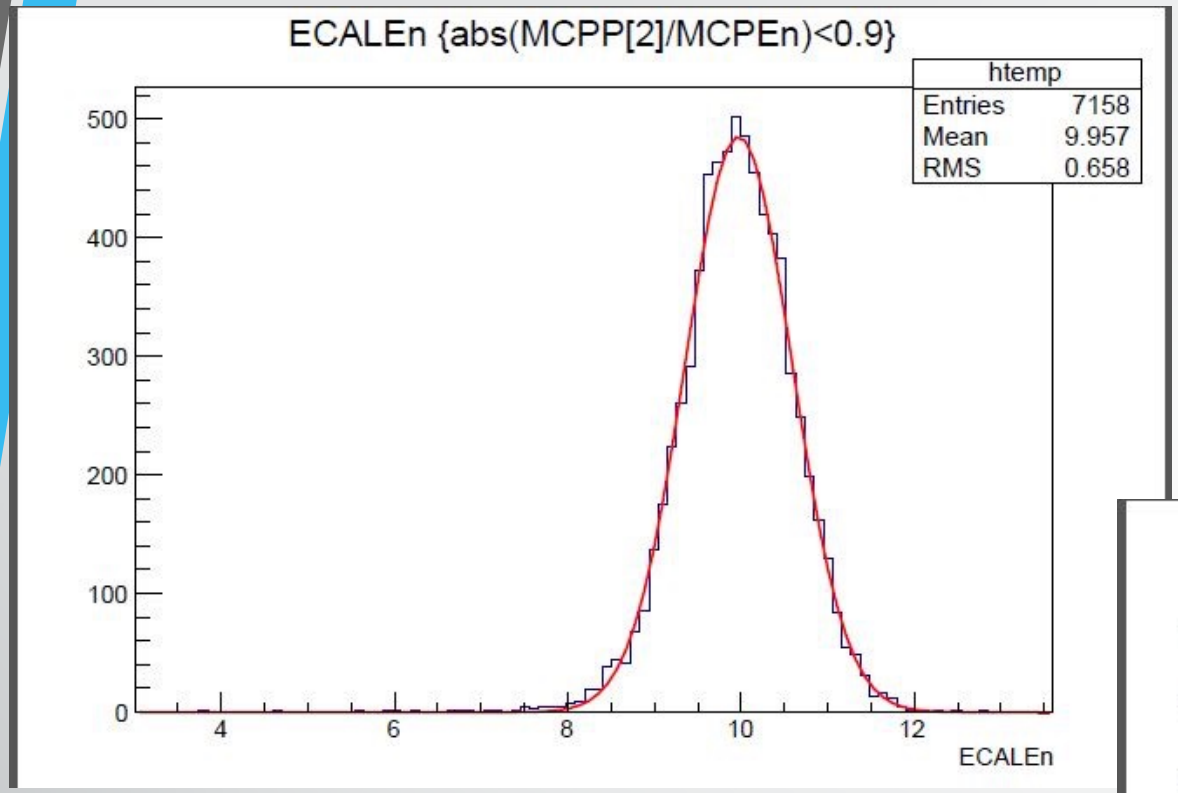
20 - layer

30-layer



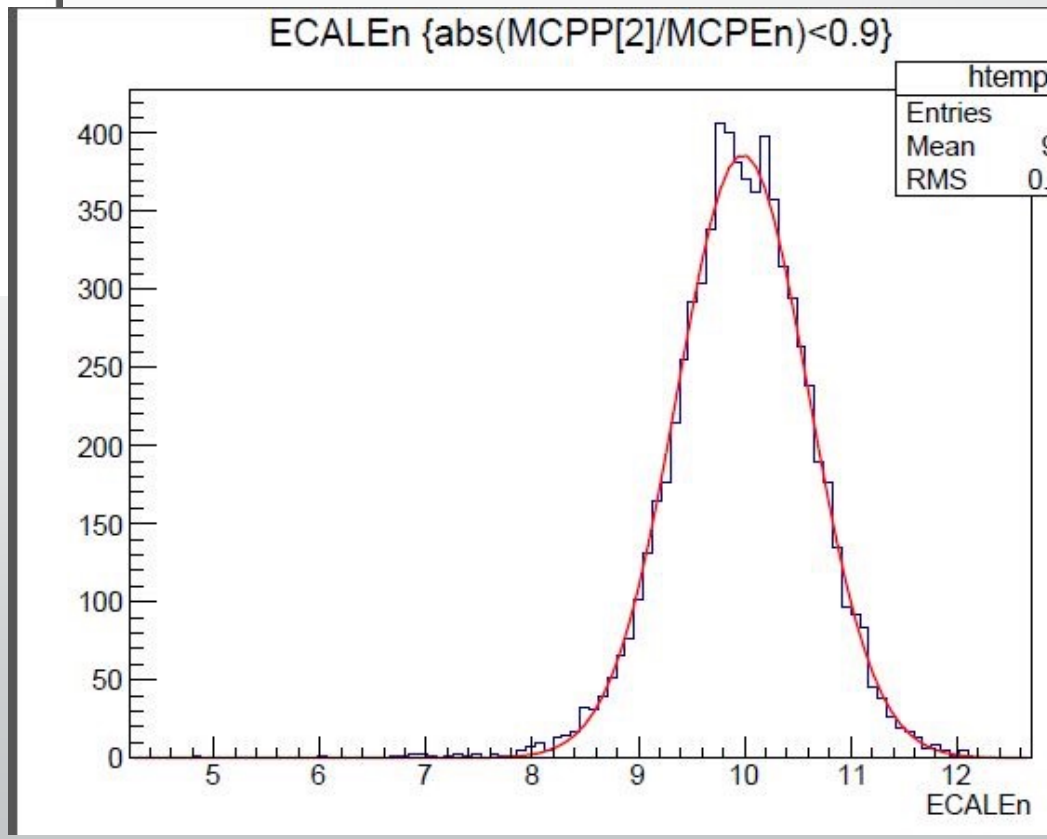
A list of results

# of layers (i)	20	26	30
Average E [GeV]	7.18	9.50	10.6
Relative factor to 10GeV	1.39	1. 05	0.94
Modified factor c_i	64.1	48.3	43.2
c_i/c_30	1.48	1.13	1



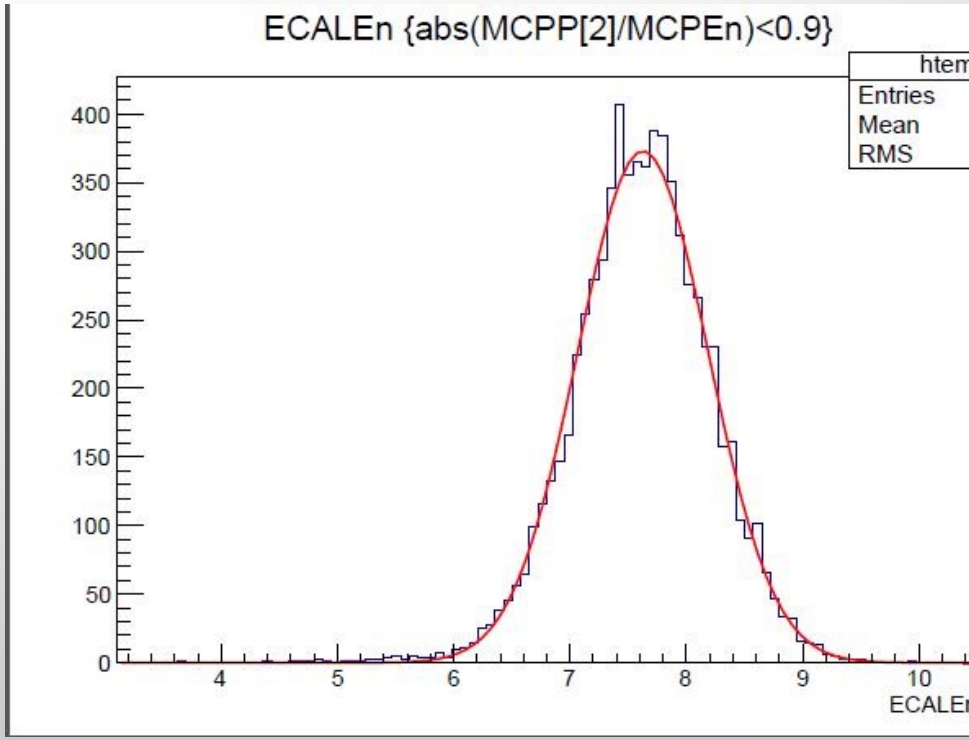
L=20
Fit mean=9.97GeV

L=30
Fit mean=9.98GeV

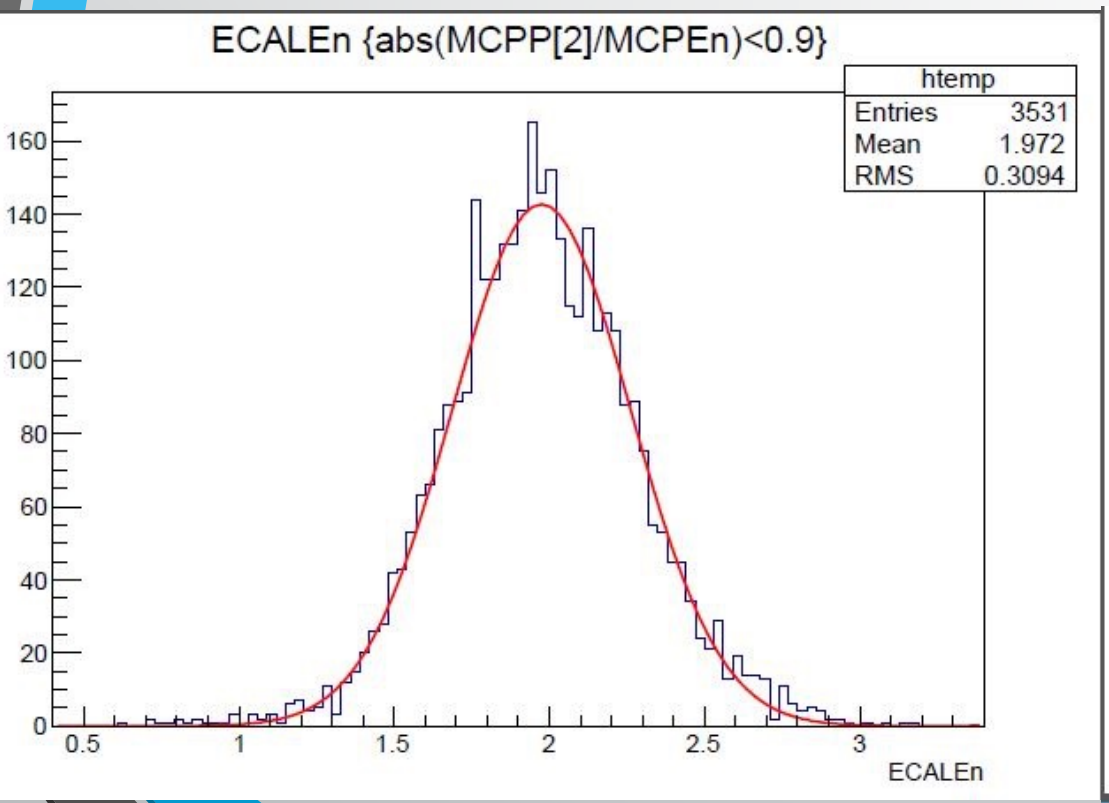


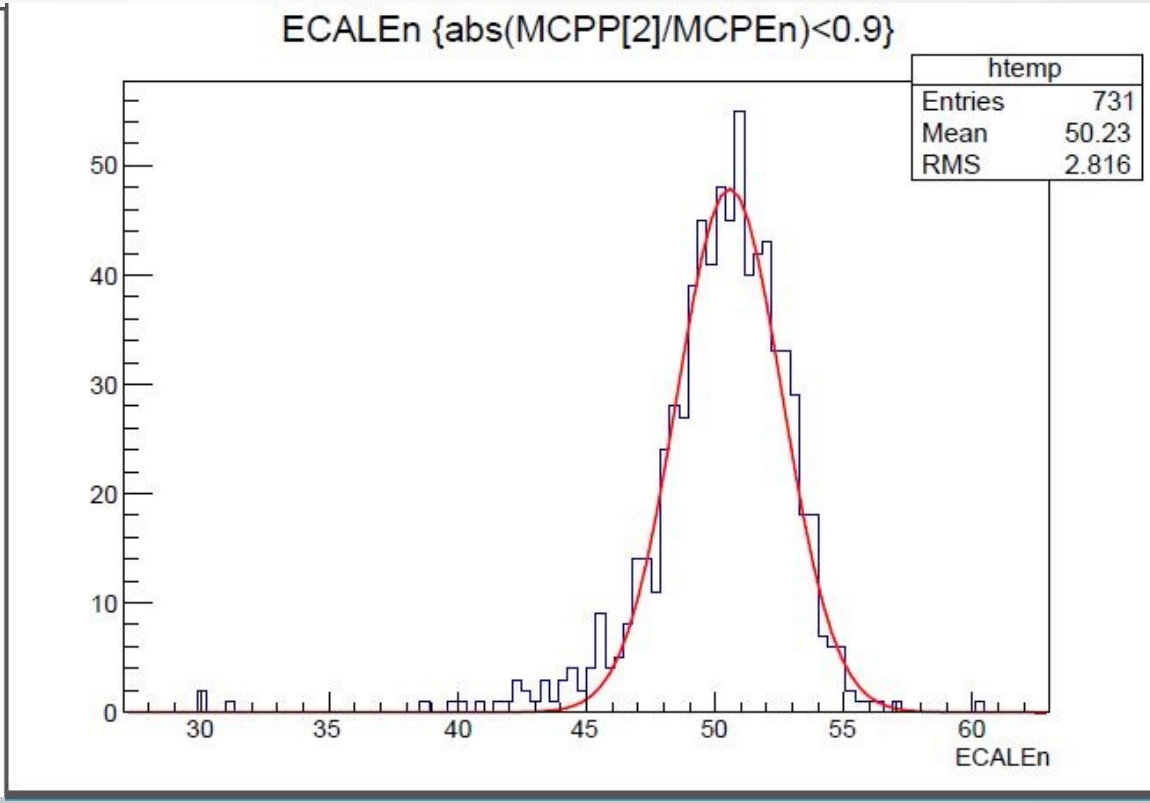
One More Step: Copper Shield

- Copper is used to in cooling system to prevent the detector from overheated;
- We have to redo the calibration because copper's thickness is not negligible!
- Controlling layer # =30;
- C is found to be 56.6



Cross-check with lower/higher energy





Summary

- Done:
  - ECAL calibration constant calibrated at different CEPC ECAL models
  - ECAL calibration constant got at 10GeV also works at other energies.
- To do：
  - HCAL calibration - to be calibrated with kaonoL

Thank you!!