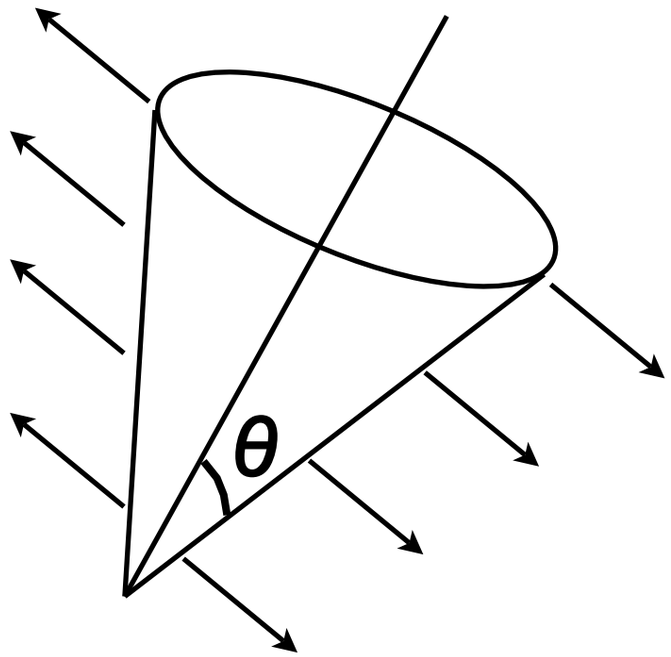
SSA Progress

22th December 2012

K.Kotera,
Shinshu University

Contents

Correction on seeking region



PandoraPFA seeks hits to make a cluster in a region which described with cone + factor x cell size

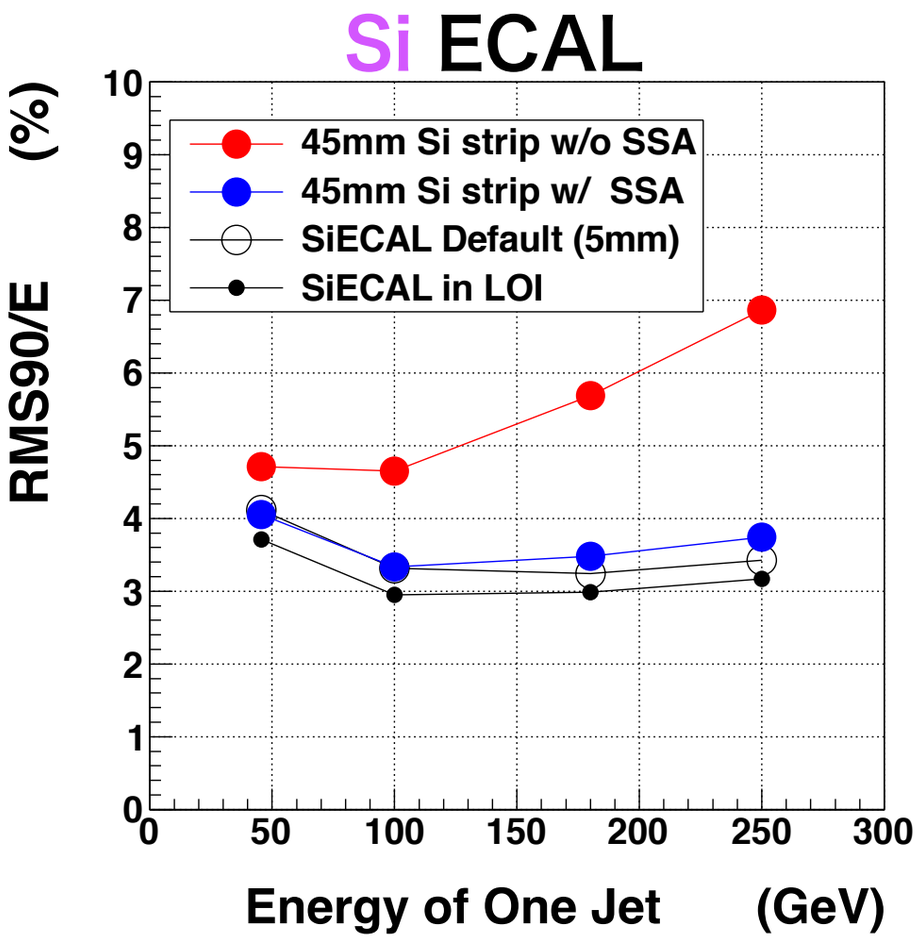
for ECAL $\tan\theta = 0.3$
1.5 x cell size (5 mm)

For 5 mm segmented ECAL, Pandora seeks hits in cone spread by 7.5 mm outer than cone.

- PandoraPFA estimates cell size using info. from gear file.
  $\sqrt{\text{cell length x cell width}}$
- for 45 mm strip ECAL, strip cell size remains in gear file.
  clustering procedure works 15 mm x 1.5 = 22.5 mm outer than cone. 90 mm strip ➡ 31.8 mm

Correction : cell size = cell width

After this correction (April)

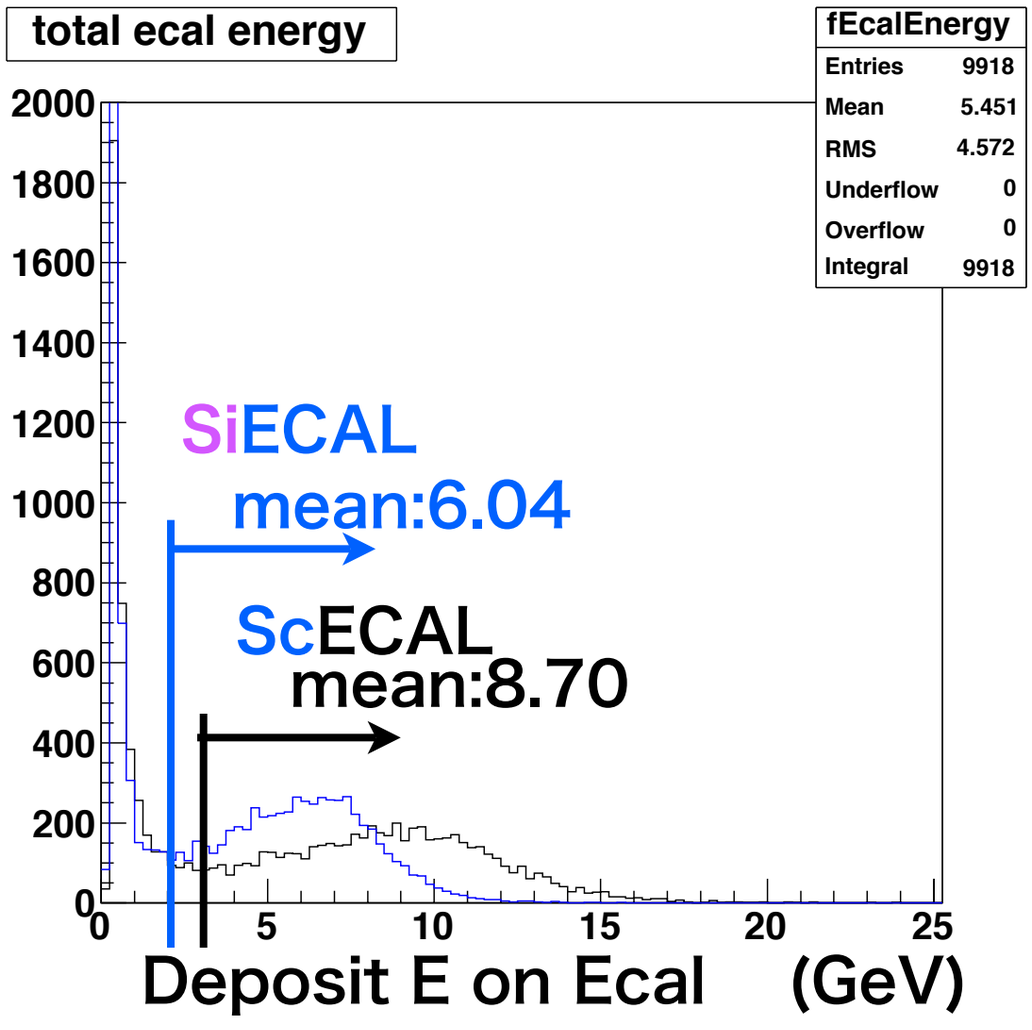


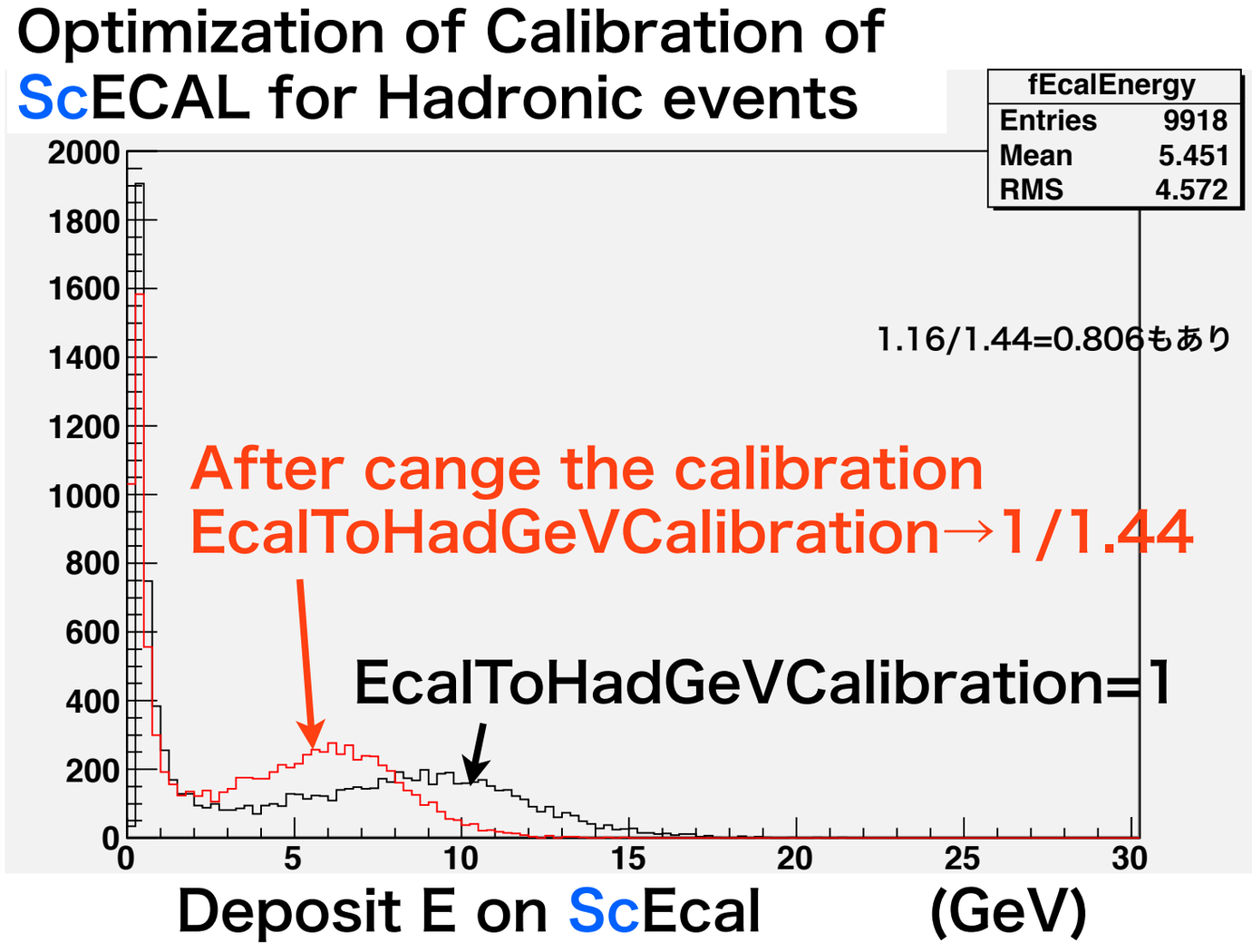
2.1 mm x 20 tungsten,
4.2 mm x 19 tungsten,
0.5 mm x 30 silicon ,
total 185 mm with other materials

- Strip Splitting Algorithm was tested by using a special ECAL model with Si-Strip readout in order to minimize effects of calibration in PandoraPFA,
- JER improves significantly, by SSA (● → ●) especially H.E.
- A little degradation of strip ECAL is seen at H.E (● →○).
- Systematic difference between LOI and this ECAL exists (● → •).
- JER of ScECAL at 45 GeV is 4%. Hope to be improved by tunings.
- Next step is to see Sc-strip ECAL

Large difference of energy deposit of hadronic events on ECAL

- After tune with 10 GeV photon
- π^+ 10 GeV (KL maybe O.K.)

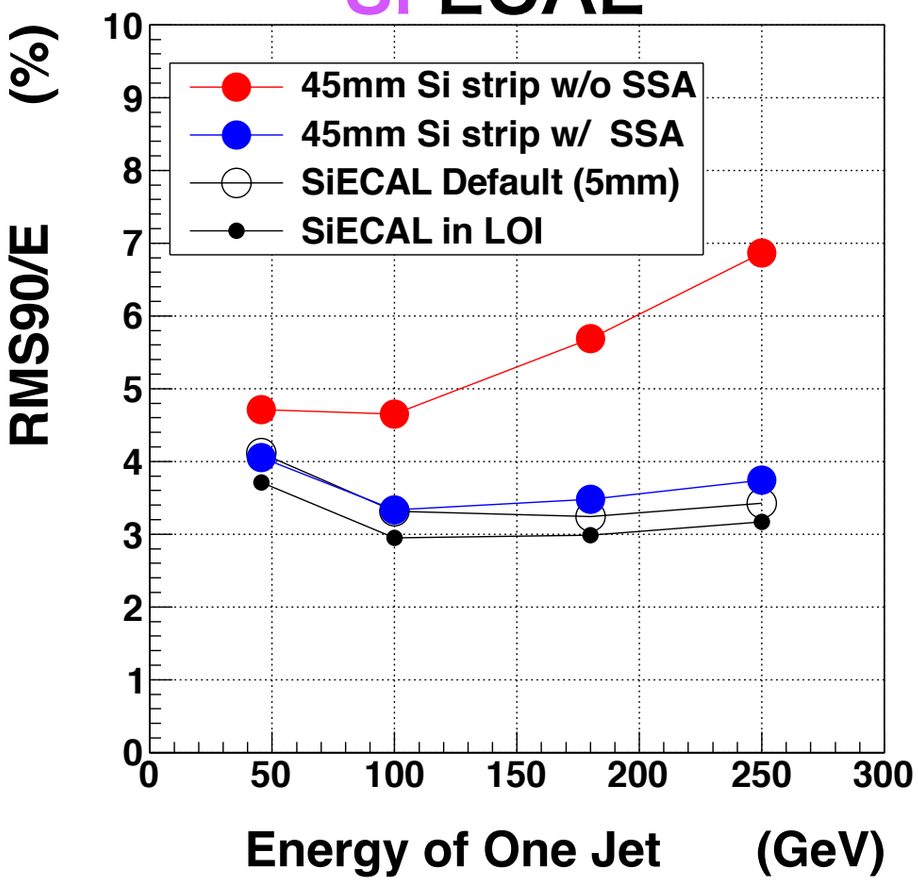




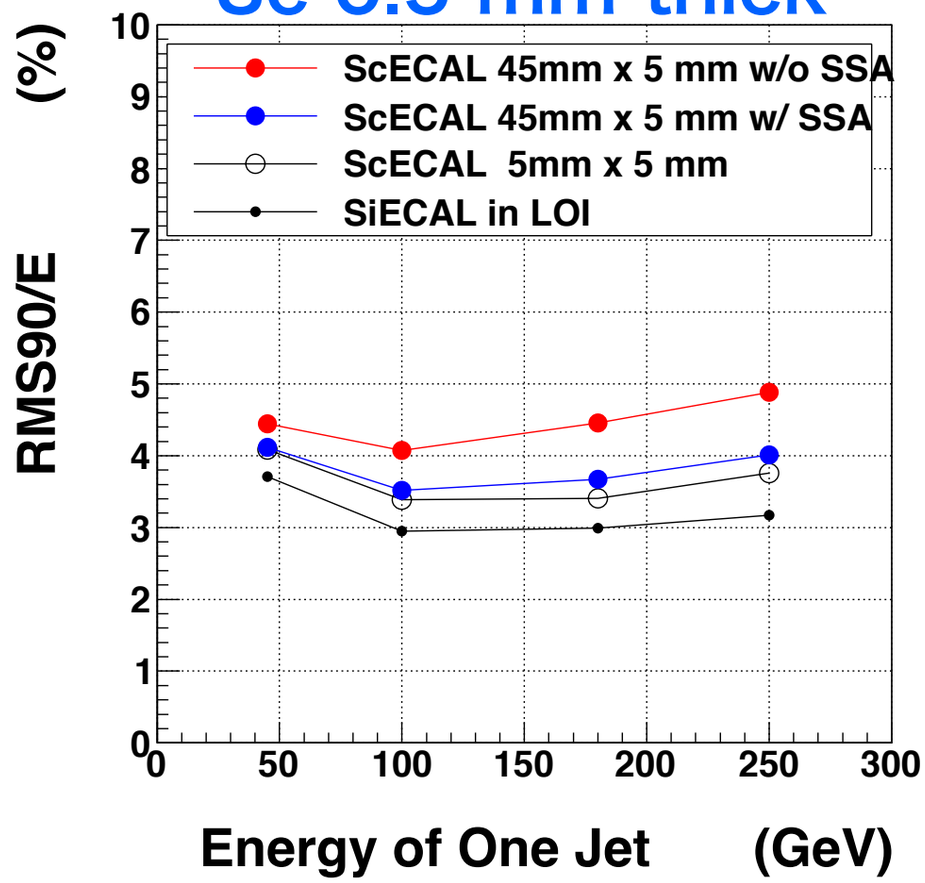
- ECAL has no one can be

Scintillator strip ECAL

Si ECAL

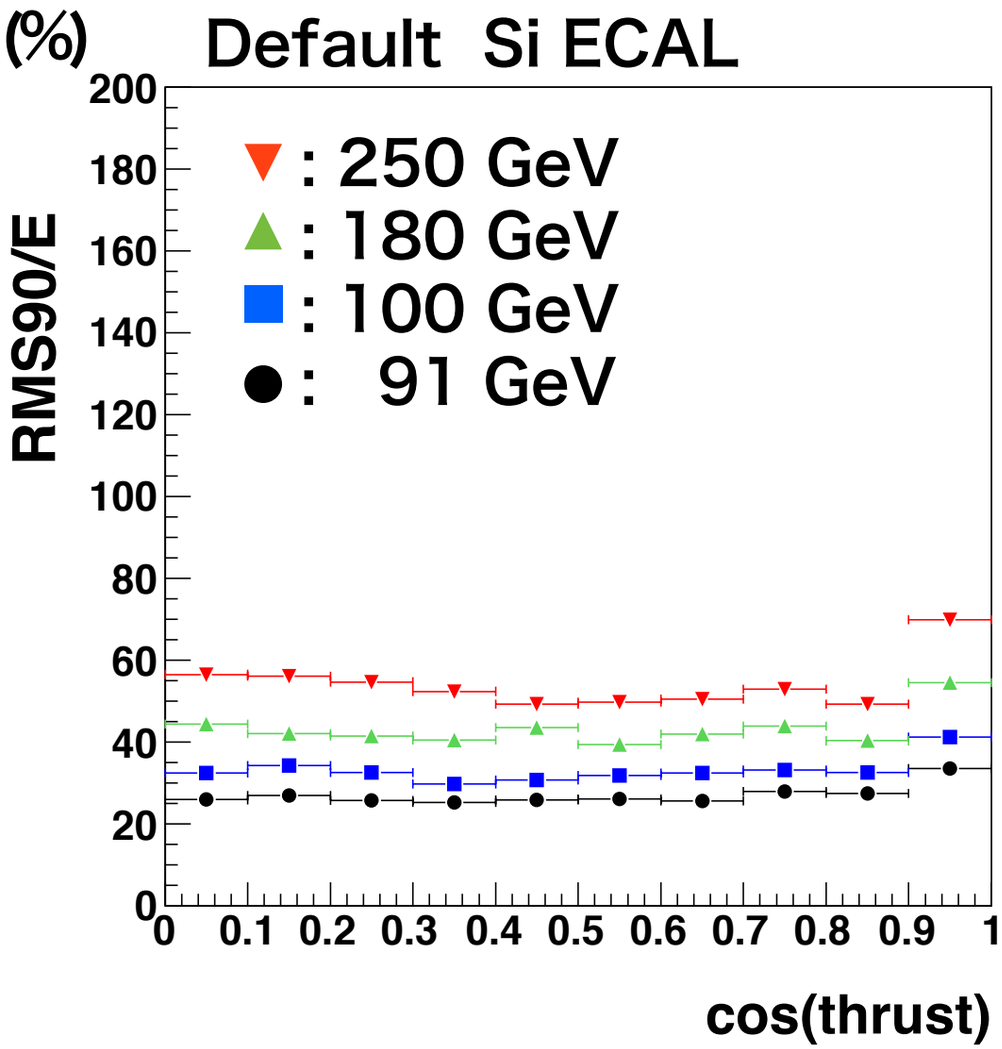


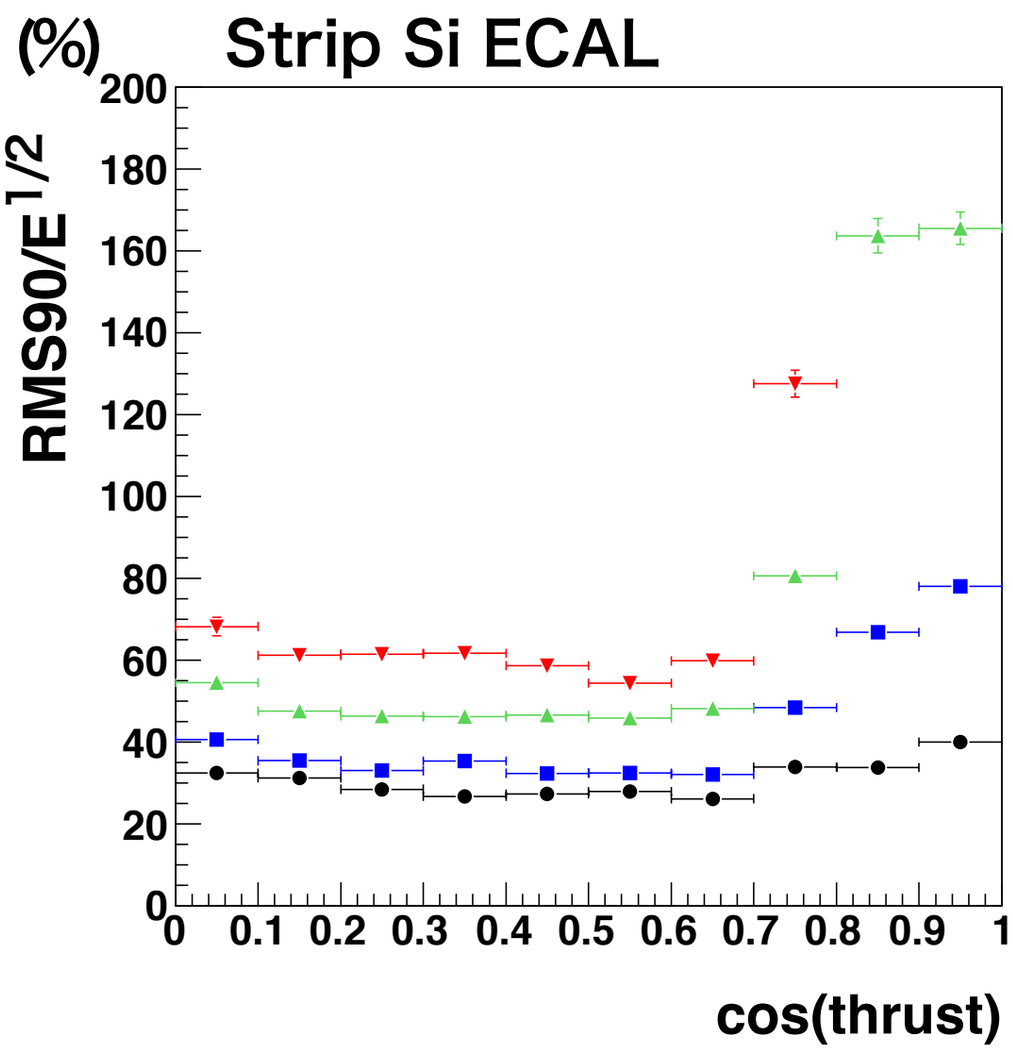
Sc 0.5 mm thick



- SSA works well also for Sc-Strip ECAL (right blue).
- Systematic difference between LOI and ScEACl increase, we expect that the detail tuning for hadronic interaction in ECAL (explain in later page).

Endcap problem of strip ECAL (ILD meeting in Kyushu)

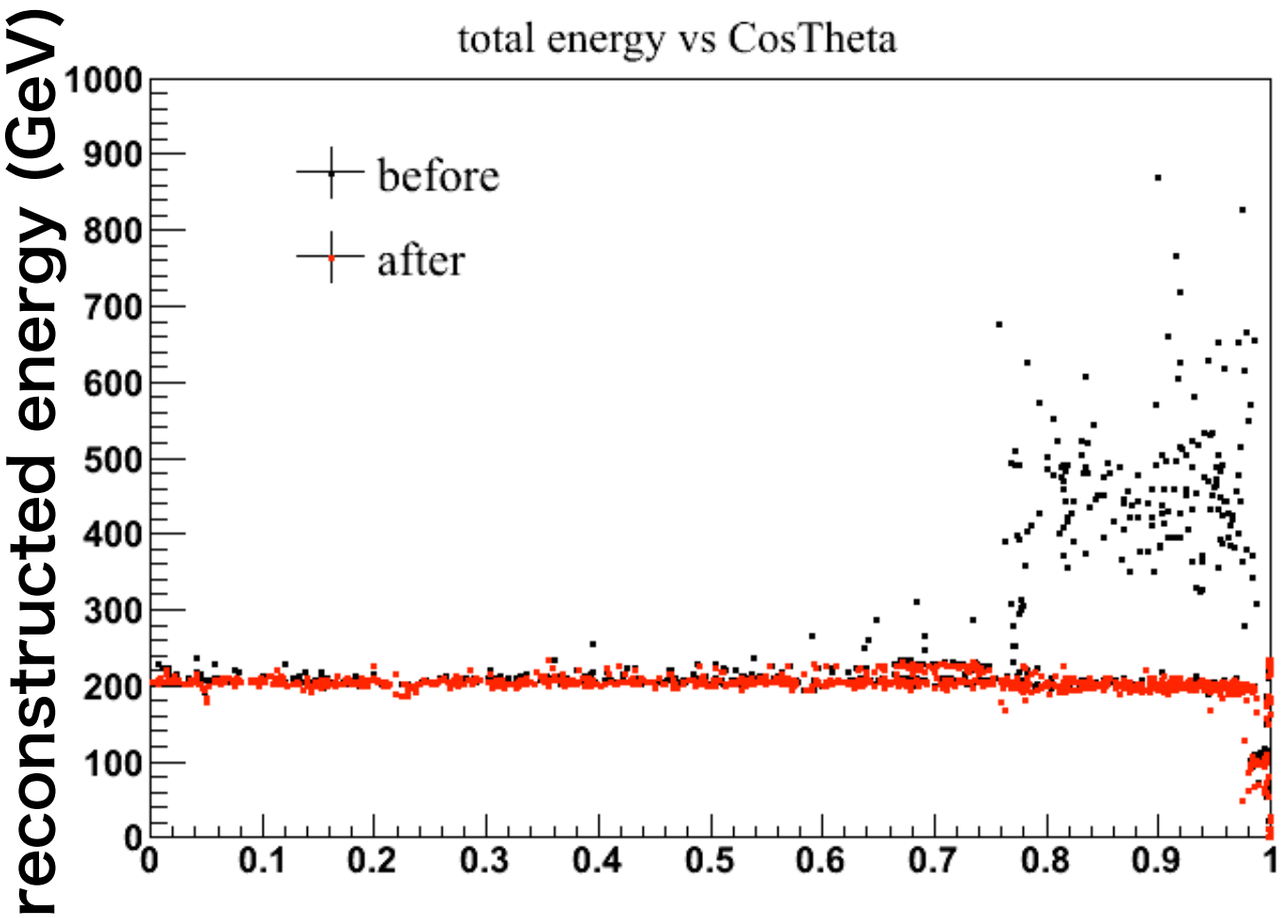




Energy conservation is violated on the Endcap

20 x 10 GeV photons (total 200 GeV) are injected simultaneously in completely the same direction (4π direction).

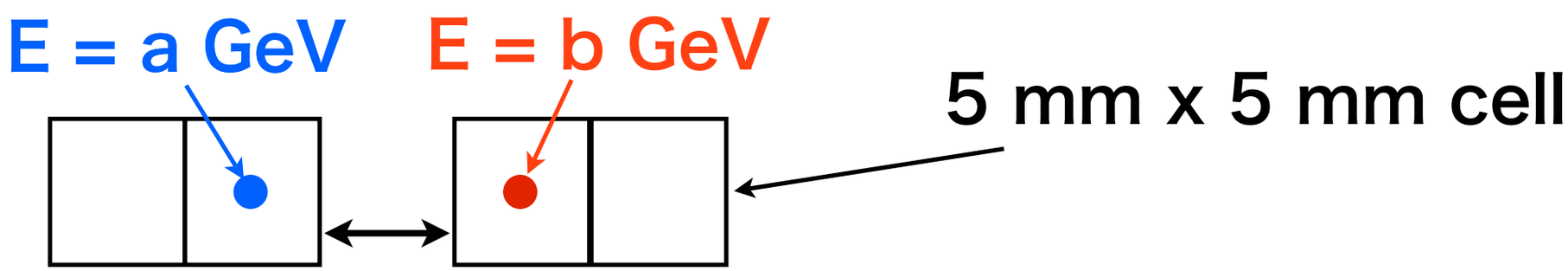
- before fix the problem some events have very large energy.
- After fix the problem energy conservation almost back



by T.Ogawa, Shinshu

What happens?

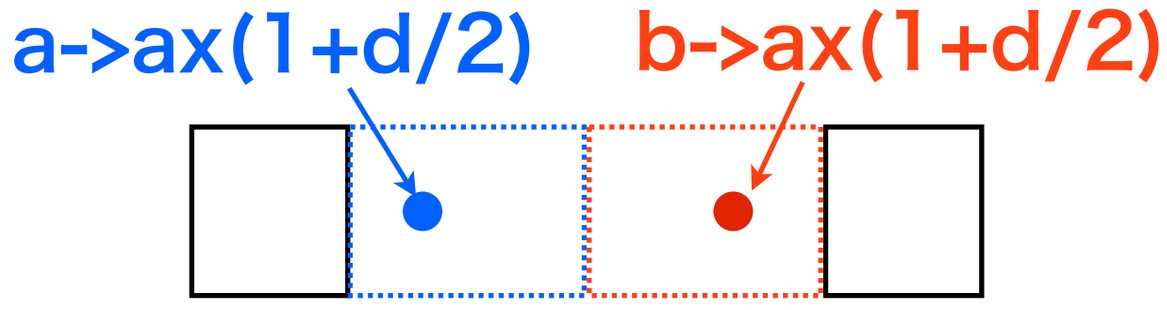
- In “NewLDCCaloDigi”, digitizer for ECAL does an energy correction for the cell gap.



d measured in cell unit

- It investigates every pair of hits

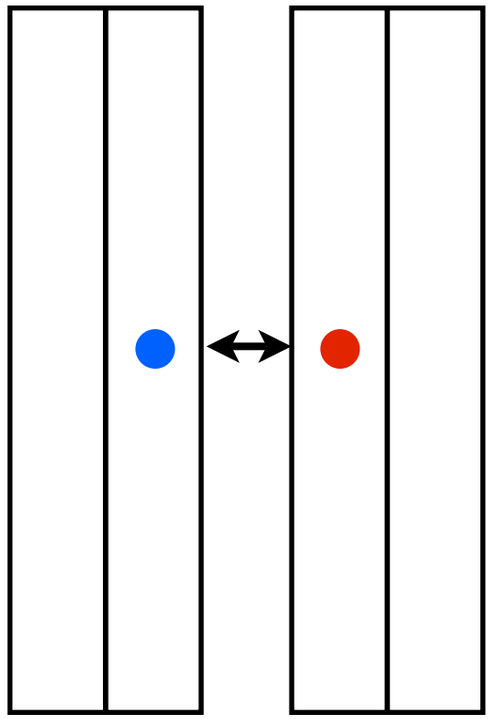
- If d < 1 (cell size), a and b is corrected to ax(1+d/2)



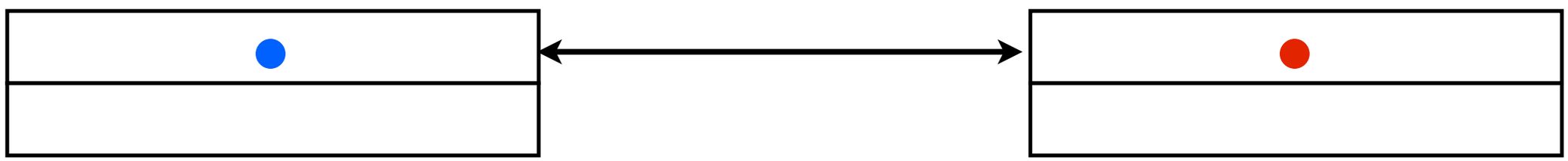
- actual criterion (definition) of a gap is:
  (cell size + 0.25 mm) < distance of hits < 2 x (cell size - 0.25 mm) in x or y.

Strip Case

- 45 mm x 5 mm scintillator ECAL



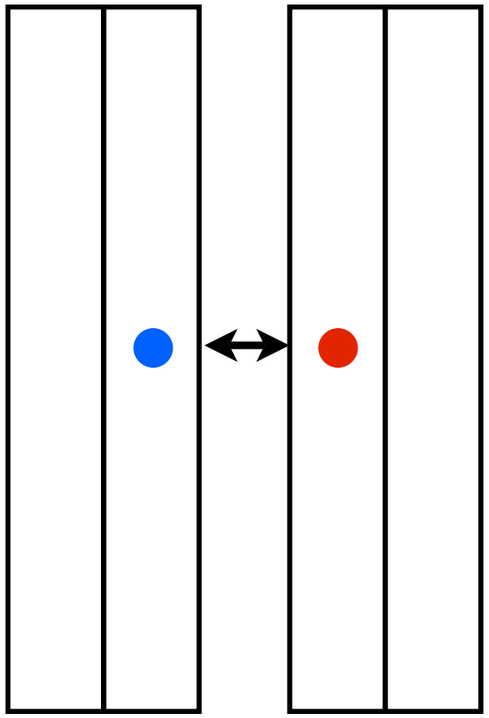
very large gaps can exist

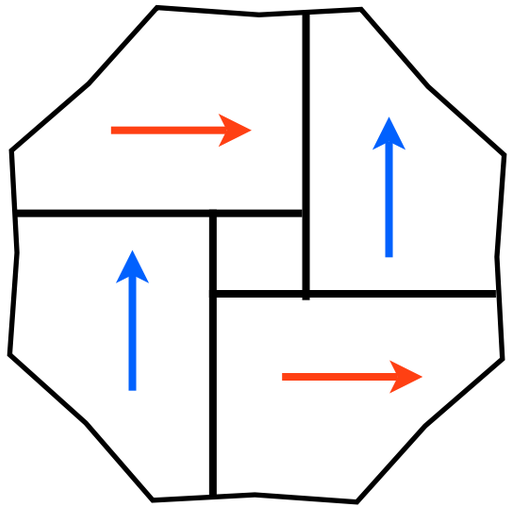


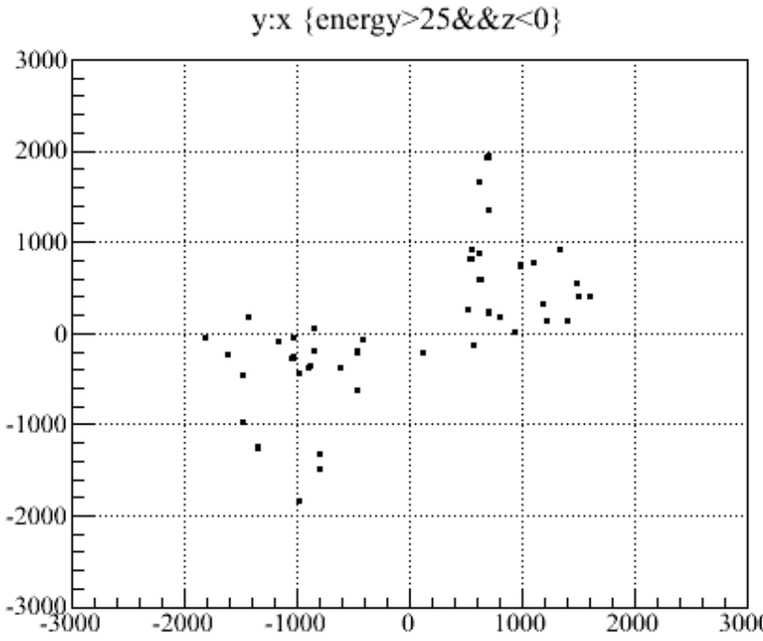
- Large gaps are allowed and this can make something wrong “gap”.
- When we prevent the gap size less than width of scintillator, energy conservation is kept.

Strip Case

- 45 mm x 5 mm scintillator ECAL





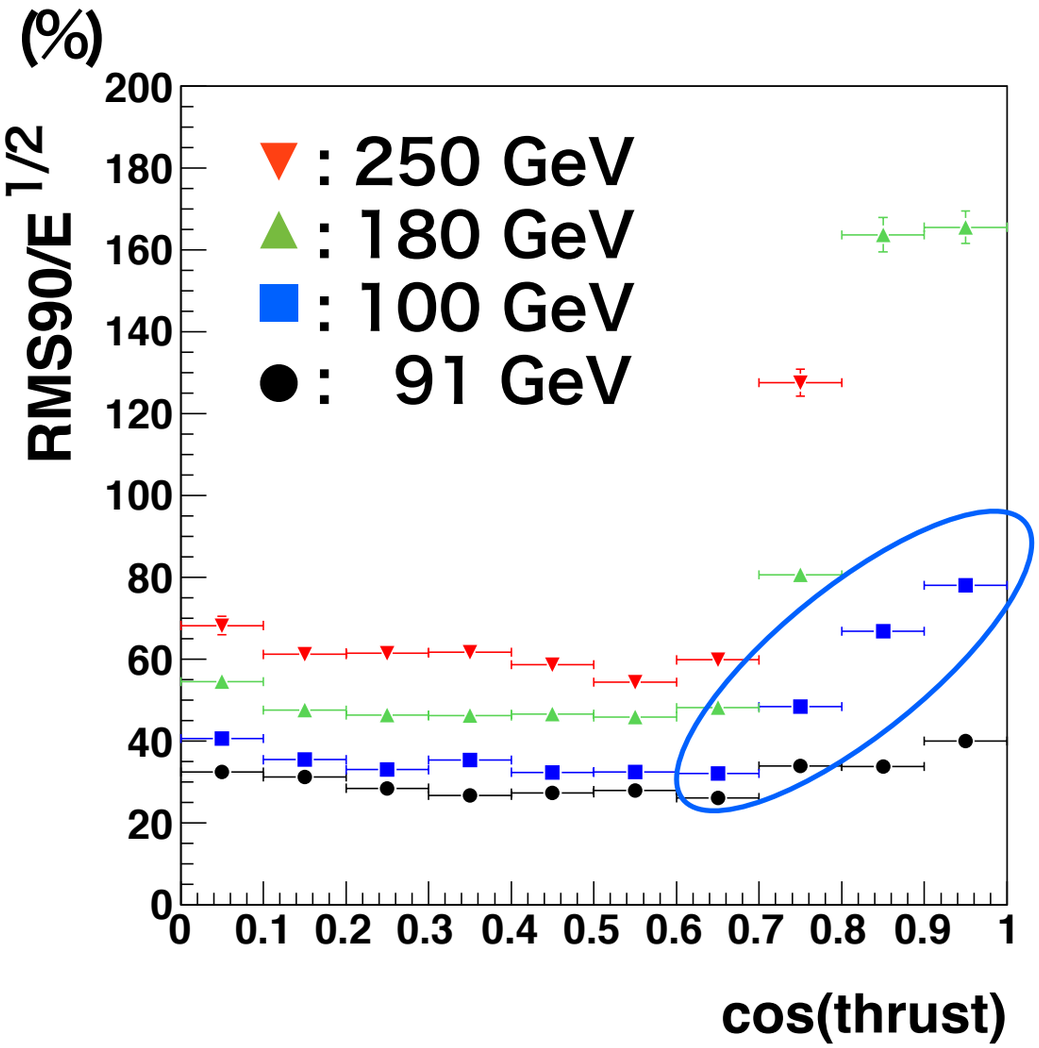


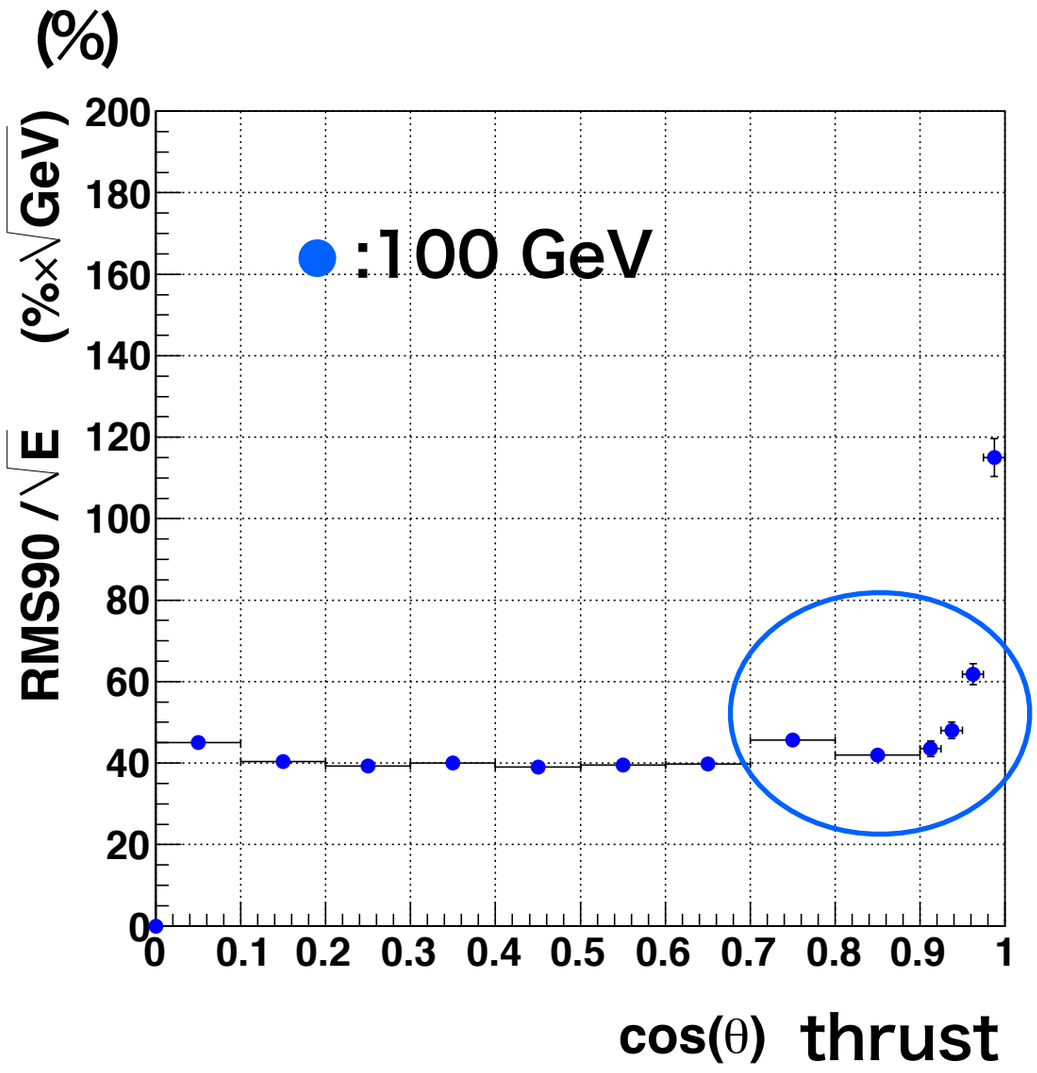
by T.Ogawa, Shinshu

very large gaps can exist

- Large gaps are allowed and this can make something wrong “gap”.
- When we prevent this case of correction, energy conservation is kept.

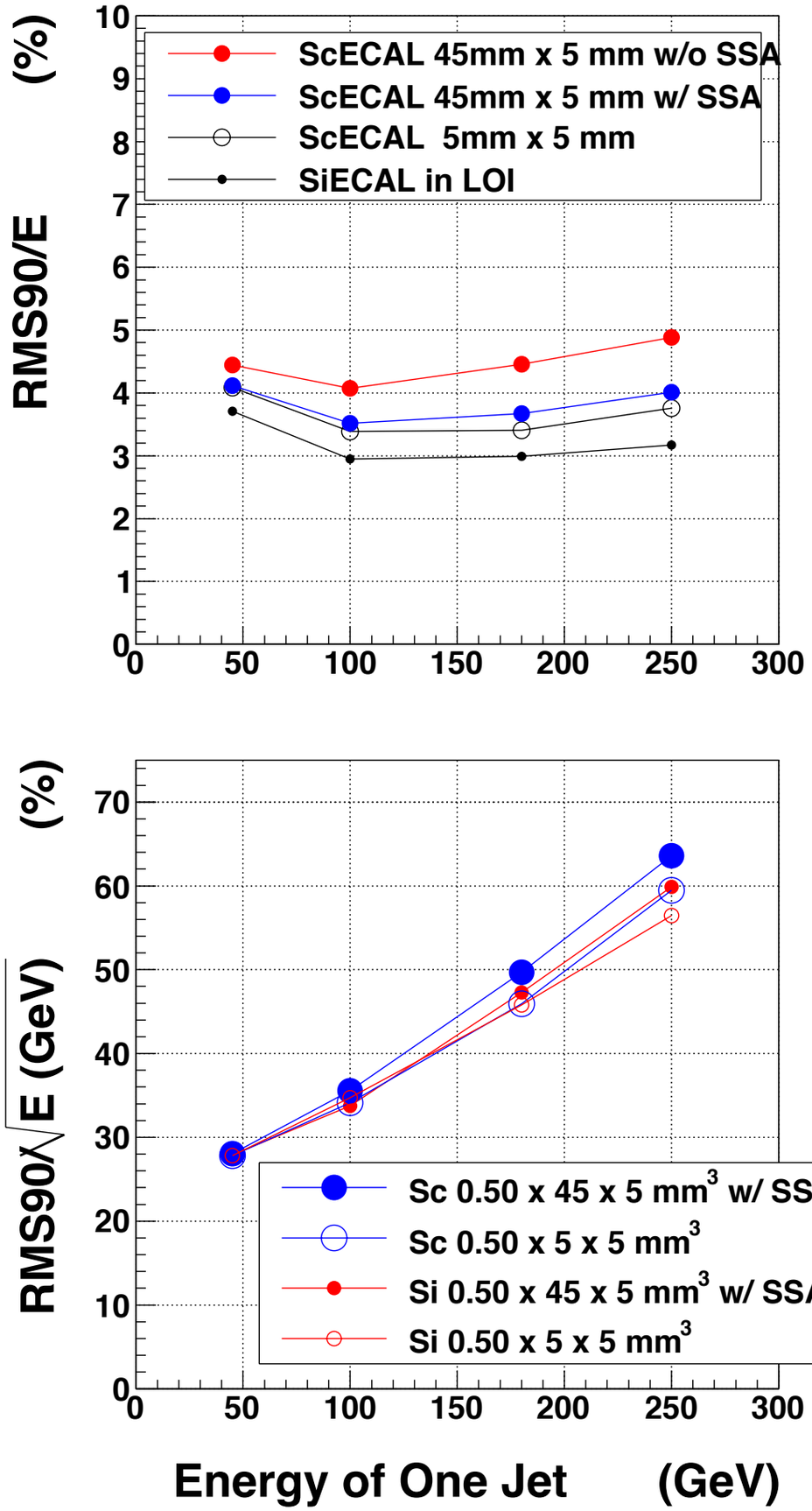
Endcap problem of strip ECAL (ILD meeting in Kyushu)

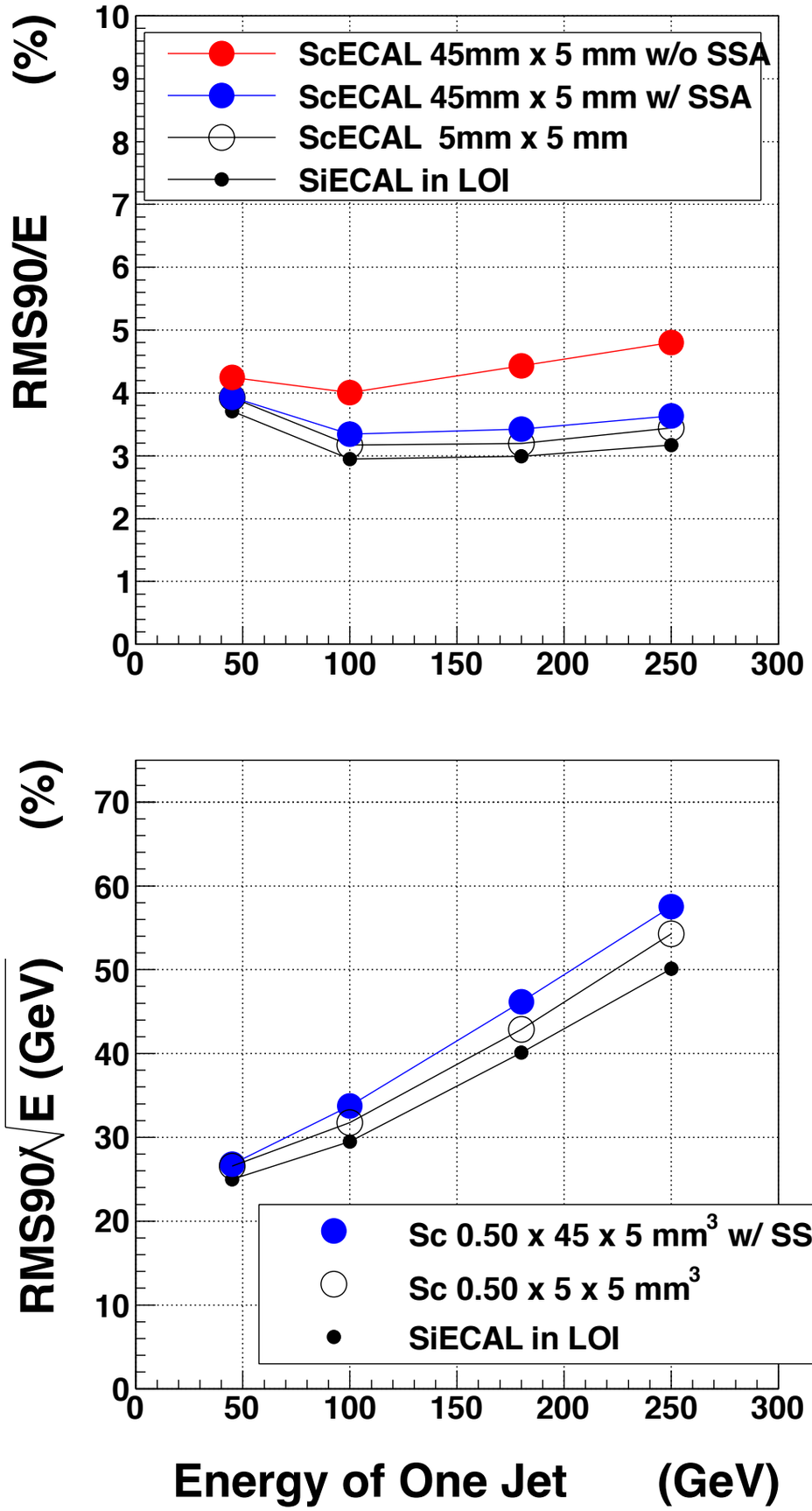




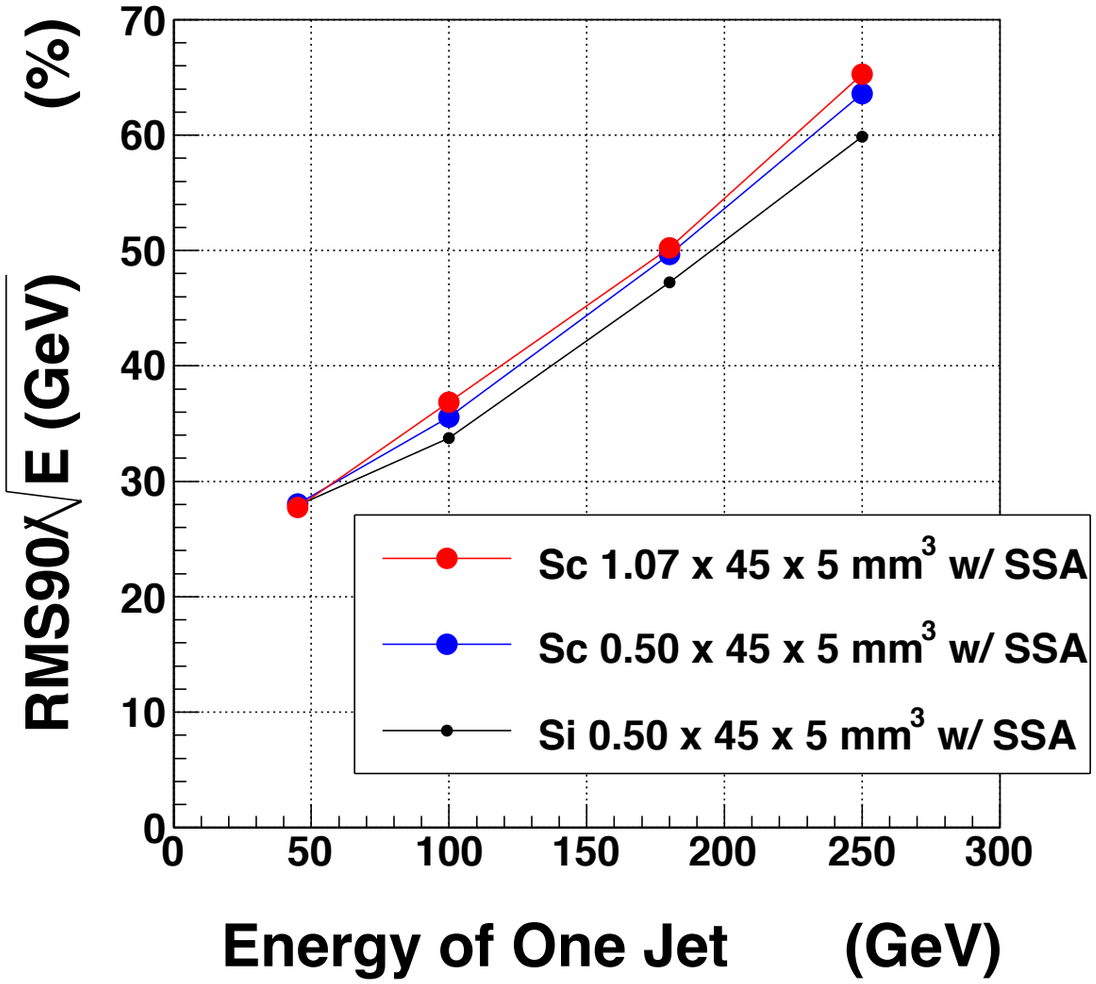
prevent the longitudinal gap correction

ILD_00 to ILD_o3-V05(DVD version)





1 mm thick scintillator



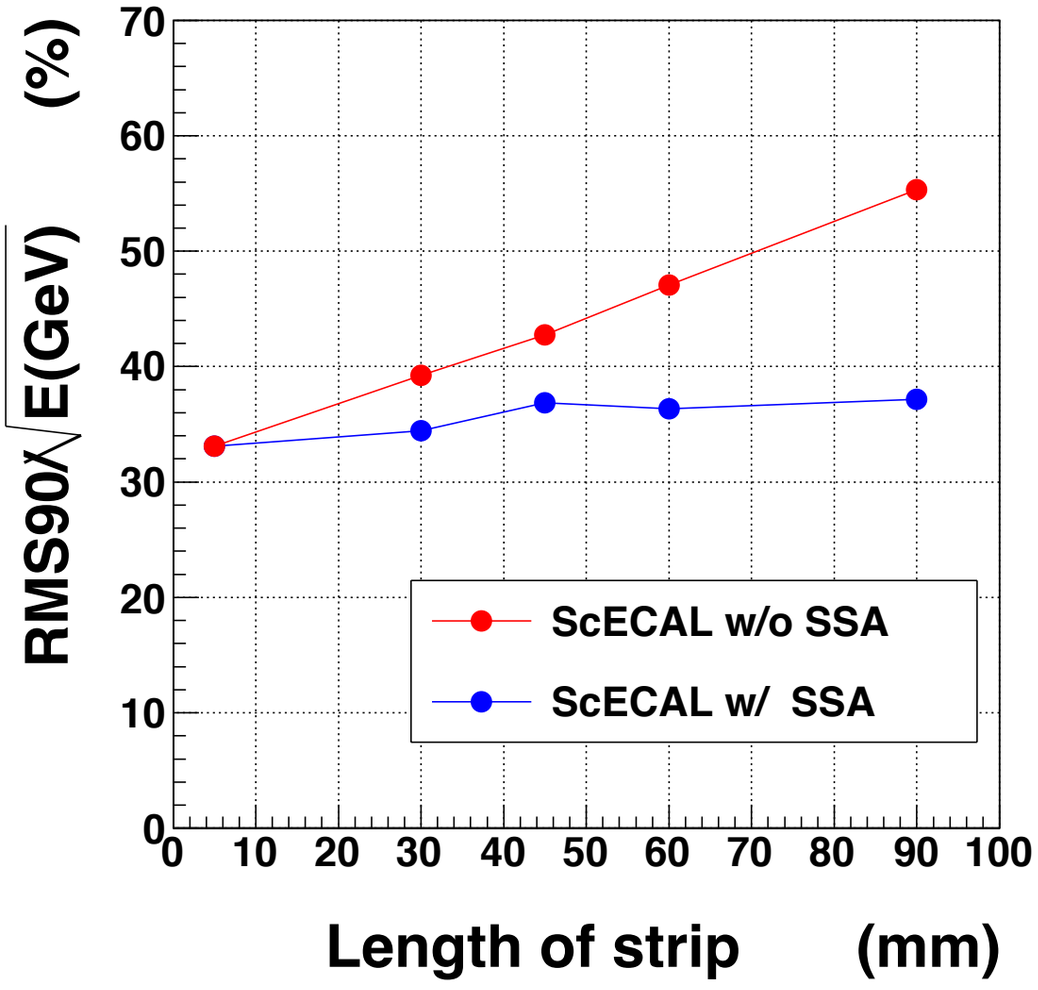
This study was done by using v0-09-02.

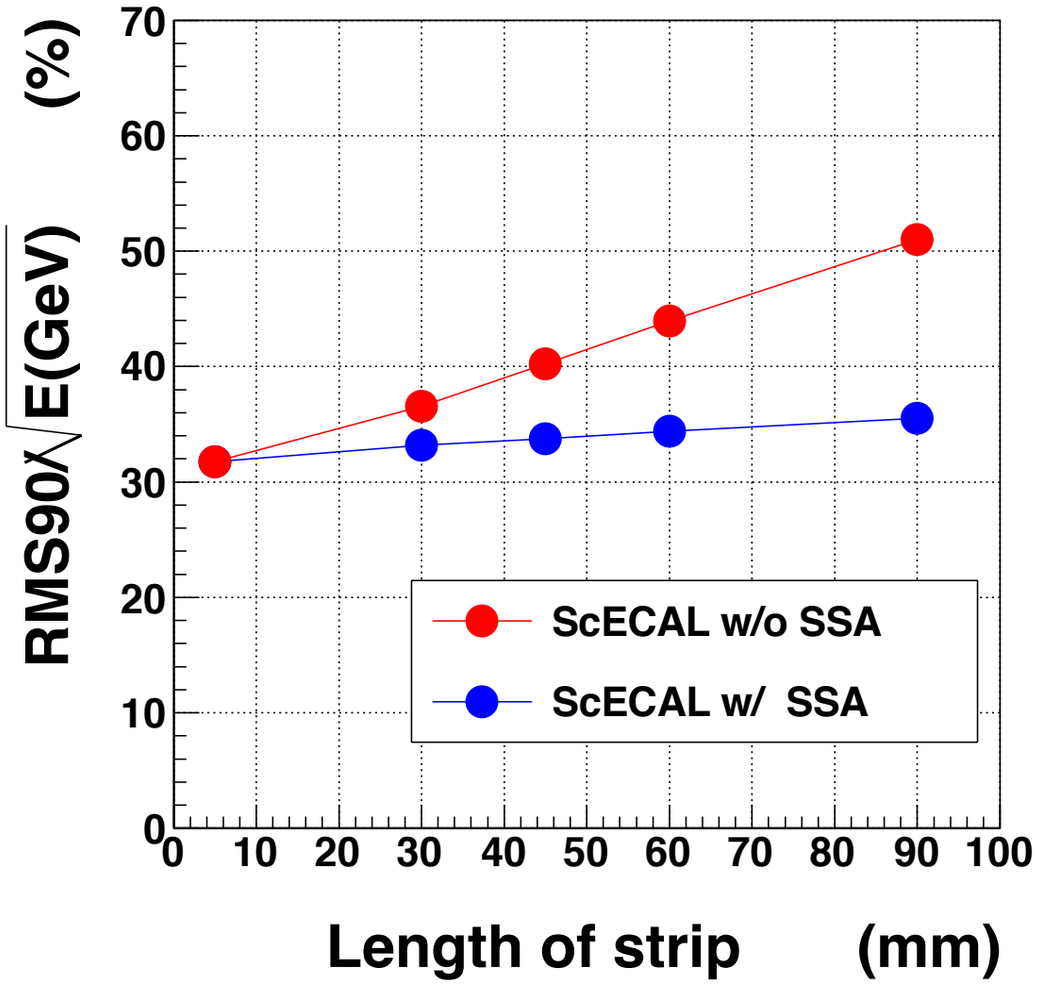
- Making 0.5 mm thick scintillator strip ECAL is not realistic.

Therefore;

- 1(.07) mm thick scintillator has been tested in Mokka-Marlin.
- JER with 1 mm thick scintillator is comparable with 0.5 mm sc.
- Energy deposit in 1 mm thick scintillator is close to one in 0.5 mm silicon.
- Total module thickness of Ecal becomes only 1.5 cm greater than default Si ECAL of 18.5 cm.

100 GeV JER depending on strip length





JER is improved for all conditions.

A little degrading of JER using 45 mm strips with SSA in previous study has gone.

Summary

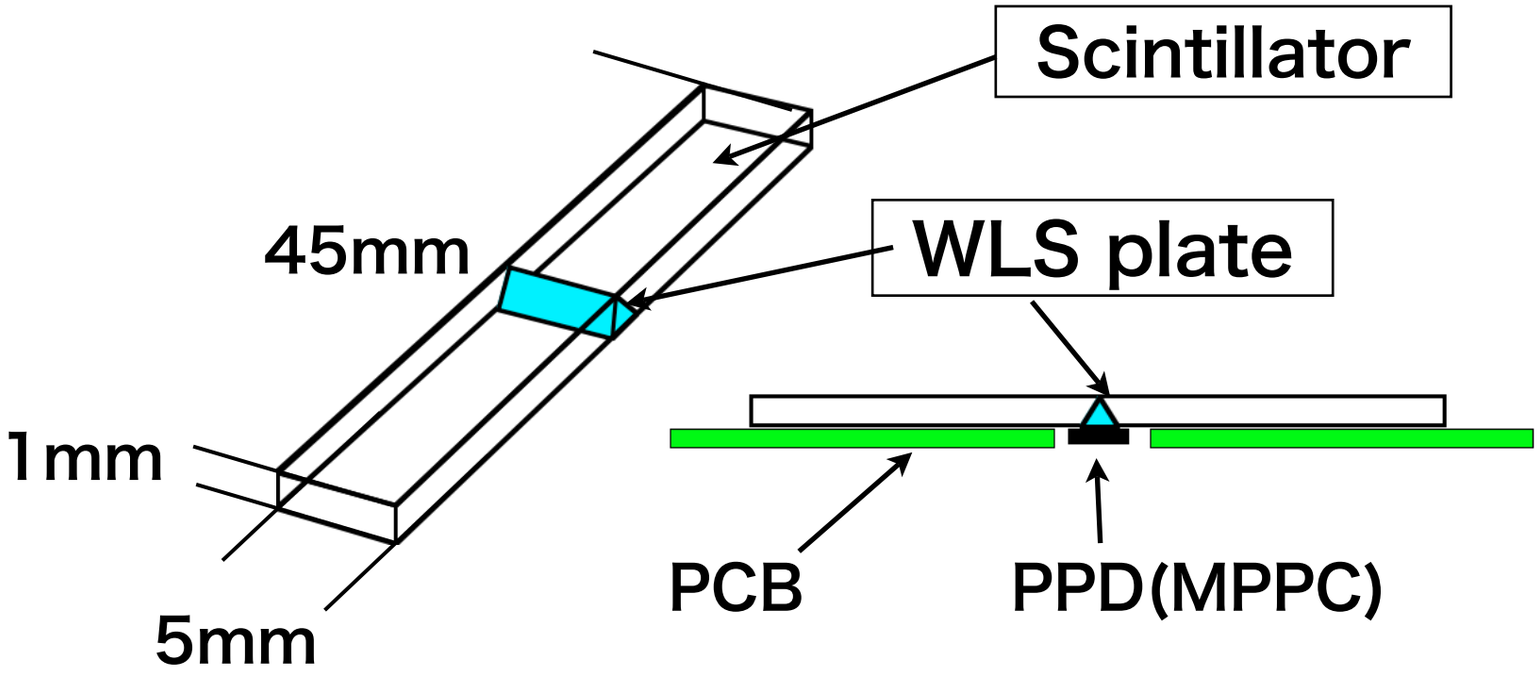
- We are developing a reconstruction tool for strip-segmented Calorimeter, called Strip Split Algorithm.
- Strip 45 mm ECALs have good JER with SSA.
- Moving to ILD_o3 model (DBD version) has already almost been done.
- Degrading problem on the endcap is understood and fixed.
- Cause of A little bit degrading from Silicon Default ECAL is under investigation.

To do

- Separation demonstration of tau decay into pi, rho, and a1 is ongoing.
- To show performance with some Physics mode.

Backup

Feasibility of 1mm thick Scintillator ECAL



- This is one of the various ideas to make 1 mm thick scintillator / PPD unit.
- We preparing to test this.
- We are developing various possible ways to make 1 mm thick scintillator/PPD unit be feasible.