Simulation Study of the Hybrid ECAL

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Motivation for the Hybrid ECAL

• One of the solution to make the ECAL with a reasonable cost while keeping the performance as much as possible would be mixture of the Silicon layers and Scintillator-strip layers.

→Hybrid ECAL

• We have started the simulation study in order to evaluate the Hybrid ECAL performance.



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Hybrid Configurations

• We have studied the following four hybrid configurations.



ECAL Parameters

- We have studied the Hybrid ECAL with the following parameters. We have also studied the ScECAL and SiECAL for comparison.
- Notice that the absorber thickness and number of layers are same for all ECAL and different from those of default values.

	Active Layer Thickness	Absorber Thickness	Number of Layers
Hybrid ECAL	Scintillator : 2.0mm Silicon : 0.5mm	2.1mm for inner 20 layers	27
ScECAL	Scintillator : 2.0mm	3.5mm for outer 7 layers	
SiECAL	Silicon : 0.5mm		

Calibration

- Calibration constants for Silicon layers and Scintillator layers should be determined separately.
- Calibration constants are determined by using 10 GeV photon.



ECAL Performances

- In order to check the calibration constants, we have evaluated the energy resolution and linearity of the ECALs by using 1~50GeV photons.
- The performances of all ECALs are almost same.
 - \rightarrow The calibration method works well.



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Study of Hybrid ECAL

- $Z \rightarrow$ qqbar events @ 91 GeV, 200 GeV, 360 GeV and 500 GeV.
- Reconstruction : PandoraPFANew + Strip Splitting Algorithm (SSA)
- Jet energy resolution is evaluated in the barrel region.
- Energy dependence and Si:Sc ratio dependence are studied.



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Energy Dependence



- Performance of the default SiECAL is much better than that of the SiW ECAL in this study probably due to the different absorber thickness and number of layer.
- The performances of the alternate structure are midway between that of the SiW ECAL and ScECAL in this study.

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Si:Sc Ratio Dependence



1: alternate structure

2:20 Si layers, 7 Sc layers

(3):13 Si layers, 14 Sc layers

4: 7 Si layers, 20 Sc layers

In these configurations, the performance does not degrade so much up to the layer ratio 50%.

Summary and Future

- Simulation study of the hybrid ECAL has been performed.
- The performances of the alternate structure are midway between that of the SiW ECAL and ScECAL in this study.
- In this study, the performance does not degrade so much up to the layer ratio 50%.
- Will try another configurations.