Answers to the questions from scintillator ECAL

Questions on Subdetector Calibration and Alignment

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27Oct2016

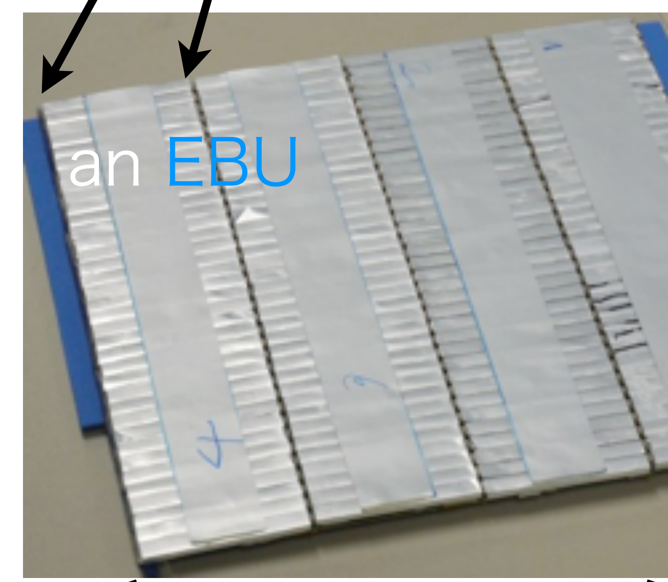
ILD meeting

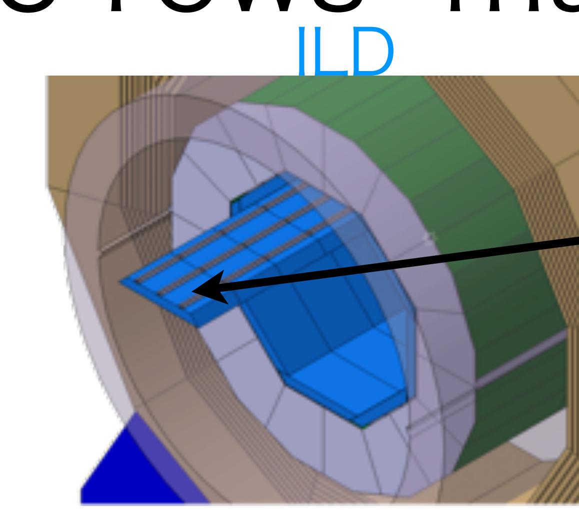
Questions

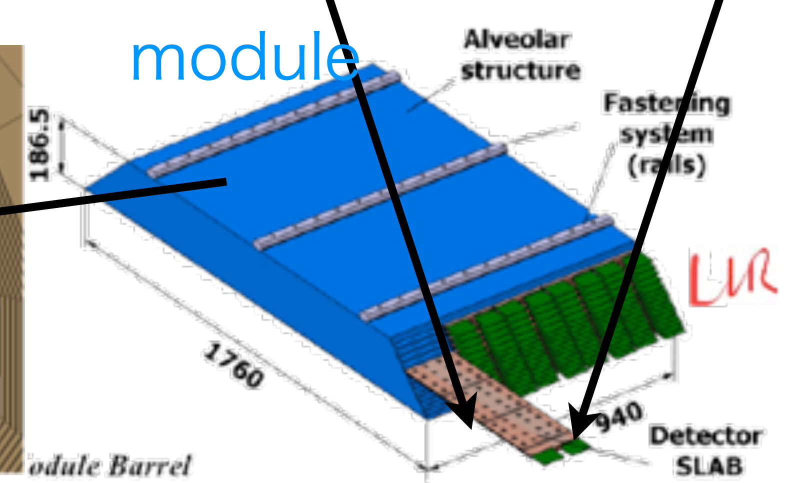
1. Outline the strategy for alignment and calibration of your subdetector.
2. What calibration and alignment parameters need to be measured with particles (either from collisions or cosmics) for your subdetector?
3. What precision is needed on the calibration and alignment parameters for your subdetector? What is the basis for this assessment?
4. How many usable particles per sub-detector element are needed to establish the calibration and alignment constants at the above level of precision?
5. What particles and kinematic criteria are needed?
6. What is the smallest solid-angle subtendedbyanindividualsub-detector element?
7. Does your subdetector plan to use power-pulsing?
8. Are cosmics useful for the alignment/calibration of your sub-detector?
9. Are beam halo muons useful for the alignment/calibration of your sub- detector?
10. If power-pulsing is used, what is the effective live-time percentage?
11. Is data with the magnetic field off needed for your sub-detector?
12. On which time-scales do you anticipate that the alignment and/or calibration of your sub-detector will be stable? In particular would it be reasonable to assume that data collected over multiple running periods in multiple years can be used collectively to refine the overall calibration or alignment?
13. Do you foresee particular challenges in the alignment and calibration of your subdetector?

scecal in ILD

- SCECAL consists of 10^7 **strips** (min. unit for measurement)
- base of calibration and alignment
- 144 strips make an **EBU**
- ~10 EBUs makes a slab
- 30 layers of slabs x 5 rows makes a **module**
- 40 modules in barrel







1.Outline the strategy for alignment and calibration

- MIPs for alignment and calibration on each strips
- cosmic rays or charged pion tracks in collision events

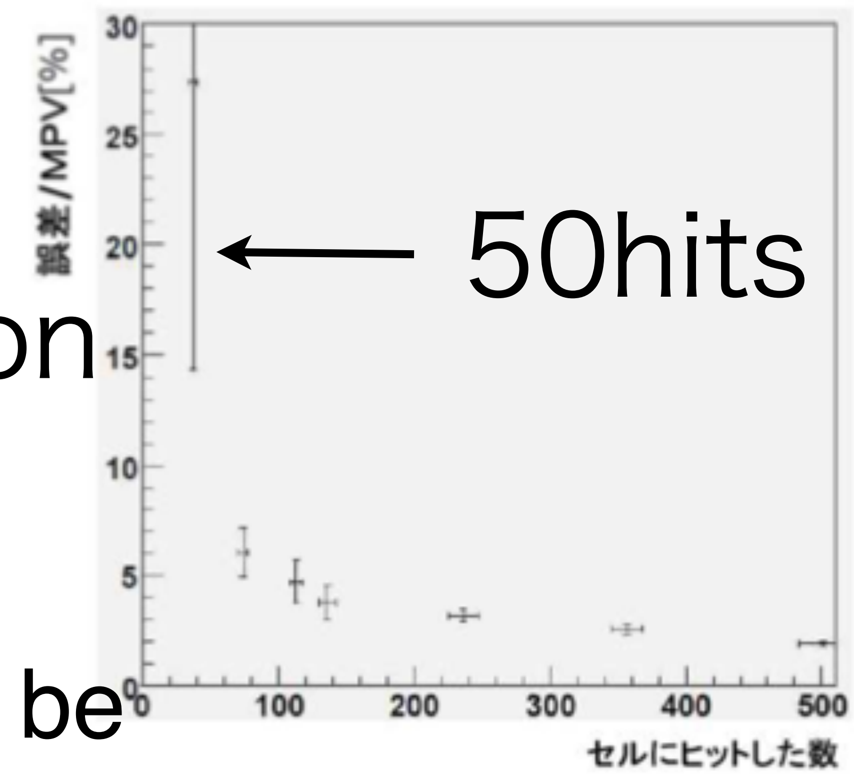
2. What calibration and alignment parameters need to be measured with particles (either from collisions or cosmics)

1. Calibration: parameters to be measured are;
   1 – MIP constant as a function of temperature,
   2 – Gain constant as a function of temperature,
   3 – Inter calibration constant (ratio of gain between high gain and low gain, determined
   with LED runs),
   4 – Scale factor between electromagnetic and hadron.
   5 – Those are determined with muons and charged pions in jet as MIP.

3. What precision is needed on the calibration and alignment parameters

1. • Alignment: A few hundred microns can be achieved by 50 strip=cell hits by calorimeter tracks.
2. • Calibration: Random cell-by-cell fluctuation of 20–30% is acceptable

4. How many usable particles per sub-detector element



- • Alignment: A few hundred microns can be achieved by 50 cell hits by calorimeter tracks.
- • Calibration:– Need 50 MIPs per cell for the cell-wise precision of 20%.

collision data

Table 2: Number of days to get 50 hits on a cell.

$\sqrt{s}$ (GeV)	luminosity ($\mathrm{cm^{-2}s^{-1}}$)	required days
91 GeV	4×10^{33}	1
200 GeV	2×10^{34}	200
500 GeV	2×10^{34}	1200

5. What particles and kinematic criteria are needed?

- cosmic MIPs and hadrons in jets.

6. What is the smallest solid-angle?

- Cell at z = 0: $0.045 \times 0.005/2.03^2$ = 0.05 milli-steradian.
- Cell on the endcap: $0.045 \times 0.005/2.4^2$ = 0.04 milli-steradian.
- Cell at the end of barrel: 0.016 milli-steradian.

7. power-pulsing? yes

- 8. Are cosmic useful for the alignment/calibration ?
- very much
-
  - Alignment:cell by cell alignment using cosmic.
- Calibration – 2000 MIPS/cell/day without power pulsing at surface

9. Beam halo muons

- • Alignment: we can do cell by cell alignment using halo muons.
- • Calibration:

– Very useful without the beam spoiler.
– Thick scintillator allows calibration in barrel either as well as EC.

10. If power pulsing is used, what is the effective live-time percentage?

• 0.5-1%

11. data with the magnetic field off needed ?

1. Not crucial but straight tracks may help alignment procedure.

12. On which time-scales do you anticipate that the alignment/calibration of your detector will be stable?

- No ageing effects of scintillators or SiPMs have been observed.

13. Do you foresee particular challenges ?

1.• Good S/N for readout electronics is necessary to cope with the lower gain of 10 μm pitch SiPM.