AHCAL calibration parameters during CERN test beam '07

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Overview

- Status after CERN test beam '07
- Temperature stability of the gain
- dG/dT during test beam and at DESY
- ITEP data for dG/dV and dQ/dV
- Conclusion & Outlook

Status after CERN test beam '07

- There were four modules out of the 38 that could not be fully calibrated at CERN.
- Data and MIP calibration were taken with all modules, but gain and inter-calibration failed since LED system did not work.
- Reasons: defect hardware (lvds driver) wrong configuration (vcalib settings)
- All modules could be recovered at DESY and calibration runs for the four modules and an additional reference module have been taken.

Gain Calibration: CERN vs. DESY

• Module 18 was calibrated as reference.



• Gain temperature dependence of the SiPM visible (ΔT =5K).

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Determination of dG/dT



- Took several "ahcGain"-Runs at different temperatures
- Determined the gain for each of the 216 channels of module 18
- Made a fit to linear function: slope = temperature dependence

Gain difference corrected

• Transposition: $G \rightarrow G' = (1 + 1/G dG/dT \cdot \Delta T) \cdot G$



 Improves allot, but: How precise is dG/dT? Is G(T) really linear?

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Relative dG/dT at DESY and CERN



- Each evaluated with a different method by different persons.
- Direct comparison of dG/dT for module 18 possible.

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Module 18: dG/dT DESY vs CERN



• Good agreement of the two different methods.

Temperature per AHCAL layer

• Method 1: Take temperatures as read out



• Method 2: Fit T(z) to a 2nd Order Polynomial

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Gain voltage dependence (ITEP)



- dG/dV from ITEP shows two separate groups of SiPMs with different behavior.
- This also shows up in our dG/dT investigations.

Gain voltage dependence (ITEP)

Group A

Group B



- Group A: dG/dV = (2.7±0.3) % / 100mV
- Group B: dG/dV = (6.6±0.6) % / 100mV

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Response voltage dependence (ITEP)



- Group A: dQ/dV = (6.0 ± 0.8) % / 100mV
- Group B: dQ/dV = (13 ± 3) % / 100 mV

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Conclusion

- The modules that did not work could be recovered: gain and inter-calibration have been done.
- Because of <dG/dT>=1.9 % / K we have to correct for the temperature difference between CERN and DESY.
- G(T) can be determined and seems to be linear.
- For the gain calibration at DESY we have an uncertainty of less than 2%.

	ITEP	CERN	DESY
dG/dV A [% / 100mV]	2.7±0.3	2.6±0.2	
dG/dV B [% / 100mV]	6.6±0.6	5.4±0.4	-
dQ/dV A [% / 100mV]	6.0 ± 0.8	-	
dQ/dV B [% / 100mV]	13 ± 3	-	-
dG/dT [% / K]	-	-1.9 ± 1.6	-2.0 ± 1.4

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Outlook

• Temperature correction in the form

$$A(T) = \left(1 + \frac{1}{A(T_1)} \cdot \frac{dA}{dT} (T - T_1)\right) A(T_1)$$

also has to be applied to the MIP calibration $M(T) = \left(1 + \frac{1}{M(T_0)} \cdot \frac{dM}{dT} (T - T_0)\right) M(T_0)$

and also for comparison of different data sets after all MIP and saturation correction.

Positive dG/dT?



2007/12/19

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