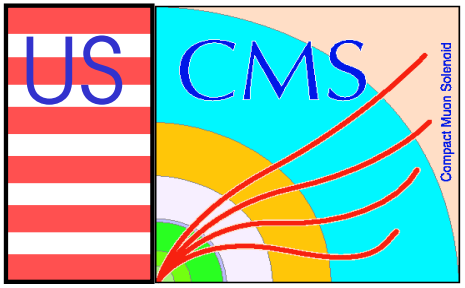
ALCT / AFEB Analog Test Results



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EMU Meeting

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01/10/2003

Outline

- Introduction.
- ALCT Threshold ADC Calibration.
- ALCT Threshold DAC Calibration.
- ALCT Test Pulse.
- AFEB Parameters (FAST site vs Stand).
- Summary.

Introduction

- Testing analog part of ALCT on CSC at UF FAST site (Proposal of Oct. 31, 2002).
- ALCT672, ALCT384 and ALCT288 , one board of each type (are the results the same?).
- ALCT672 and ALCT288 on ME2/1, ALCT384 on ME234/2.
- For each AFEB – threshold DAC settings and ADC readings.
- Test pulses for AFEBs and six Cathode Test Strips.
- AFEB thresholds and noise at UF FAST site and on CMU stand.

ALCT Threshold ADC Calibration

- Set all AFEB thresholds (U) with ALCT DAC of 0,5,10,50,100 and 200 .
- Measure U on AFEBs with multimeter and read back ADC (actp code, V.Barashko).
- Approximate U vs ADC count by the straight line drawn through the first point at DAC=0 (~30 mV) and the last point at DAC=200 (~960 mV).
- For all 3 types of ALCT the ADC calibration is (Fig. 1 – 2):
  - Offset = 0.0 + 1.2 – 0.9 mV
  - Slope = 1.197 +- 0.002 mV/count
  - Max. nonlinearity = 1 mV
- Recommended ADC calibration:
  - Offset = 0 mV
  - Slope = 1.2 mV/count

ALCT Threshold DAC Calibration

- Set all AFEB threshold U with ALCT DAC of 0,5,10,20,30,50,100,200 and 255.
- Measure U on AFEB by reading back calibrated ADC.
- Approximate U vs DAC count by the straight line drawn through the first point at DAC=0 (~30 mV) and the last point at DAC=255 (~1227 mV).
- For all 3 types of ALCT the threshold DAC calibration is (Fig. 3 – 4):
  - Offset = 30.7 +- 4 mV
  - Slope = 4.69 +- 0.02 mV/count
  - Max. nonlinearity = 3 mV
- Recommended DAC calibration:
  - Offset = 31 mV
  - Slope = 4.7 mV/count

ALCT Test Pulse for AFEB

- Scope traces of pulses at AFEB test inputs for DAC=0,25,100 (Fig. 5 – 6), fit for max. amplitude.
- Fit model and person dependent results (up to +- 10 mV).
- Small variation of max. amplitude from AFEB to AFEB at given DAC (Fig. 7a – c).
- Saturation of max. amplitude at DAC > 150 (Fig. 7d).
- FEB test pulse max. amplitude vs DAC calibration for DAC=0-100 (Fig. 8a – c):
  - Offset = 23 +- 3 mV
  - Slope = 4.5 +- 0.1 mV/count
  - Small nonlinearity of max. amplitude vs DAC at DAC = 25 (up to 10 mV)

ALCT Test Pulse for AFEB thru the Test Cathode Strips

- Scope traces of pulses at test cathode strip inputs for DAC=0,25,100 (Fig. 9a - b), fit for max. amplitude.
- Almost no variation of max. amplitude from plane to plane.
- Test pulse max. amplitude vs DAC calibration:
  - Offset = 21 +- 1 mV
  - Slope = 4.1 +- 0.1 mV/count

AFEB parameters at UF FAST site and on stand

- **Run test #13 (AFEB thresholds and noise) on ME2/1 (ALCT672) and ME234/2 (ALCT384).**
- **AFEB noise:**
  - **1.5 fC for ME234/2**
  - **0.9 fC for ME2/1 (smaller CSC)**
  - **1.3 – 1.5 fC at Cdet=180 pF on CMU/Fermilab AFEB test stand**
- **AFEB nominal threshold of 20 fC:**
  - **Use of certified Cint from AFEB Database is crucial**
  - **Better to use ADC readout instead of DAC settings (4 times more accurate) for comparison**
  - **Remaining difference is (Fig. 10a – b):**
    - **- 0.6 fC for ALCT672 on ME2/1**
    - **- 1.7 fC for ALCT384 on ME234/2**

Summary

- ALCT Reference Voltages (ADC, DAC) 1225 – 1227 mV.
- Measured Parameters:
  - Threshold ADC Offset = 0 mV, Slope = 1.2 mV/ADC count
  - Threshold DAC Offset = 31 mV, Slope = 4.7 mV/DAC count
  - Test Pulse Max. Amplitude vs DAC
    - AFEB Test Input: Offset = 23 mV, Slope = 4.5 mV/DAC count
    - Cathode Test Strip: Offset = 21 mV, Slope = 4.1 mV/DAC count
- The parameters of the analog part of 3 tested ALCTs are within the design specifications.
- The AFEB's thresholds and noise in the tests on the AFEB test stand and at UF FAST site agree within the tolerance of 10-15%.