Single-CAL Test and Calibration

J. Eric Grove
Naval Research Lab
7 March 2005
Motivation

- **What is CAL calibration?**
  - **CAL assy & test program gives**
    - Energy calibration for all CDEs
      - Derived from paddle-triggered muons and chg injection
    - Calibration for all configuration DACs
      - FLE, FHE, LAC, ULD
      - Derived from chg injection, tested with muons if possible
  - See ATDP for links to calib tables
    - e.g. see [CAL FM 104 ATDP](http://heseweb.nrl.navy.mil/glast/CAL_ATDP/FM104/CAL_FM104_ATDP-LAT-TD-05783-01.htm) for CAL in use by I&T

- **Why repeat at start of SLAC I&T?**
  1. **Switch to Flight TEM/TPS changed electronic performance slightly**
     - e.g. 20-bin shift in LEX8 pedestal
  2. **Single-Bay tests include configuring CAL, collecting “long” muon runs, reconstructing events, …**
     - E2E tests, NASA PR runs, …
Clarification

- Let me be clear about this
  - Before you set thresholds on CAL with intent to collect and analyze photons or muons, you need to recalibrate the DACs

- While the I&T program is
  - Mate flight TEM/TPS to CAL
  - Mate TKR to CAL + TEM/TPS
  - Run all sorts of configs, reconstruct events, etc etc
  - Then you do need to recalibrate DACs just after final mate

- When the I&T program truly becomes
  - Mate flight TEM/TPS to CAL
  - Mate TKR to CAL + TEM/TPS
  - Run Single-Bay CPT (or LPT)
  - Run Multi-Bay CPT (or LPT)
  - Move on to the next tower...
  - Then there is no need to recalibrate DACs until just before the multi-tower muon runs
    - CPT and LPT do not require updated DAC calibs
DAC calibration procedure

- **When?**
  - After mate with flight TEM/TPS and CAL CPT
  - With or without TKR
  - Before configuring CAL for serious data taking

- **What?**
  - Run two CAL suites in sequence
    - *calibDAC* (run time 2.5 hrs)
      - Chg-injection measurements of FLE, FHE, LAC, and ULD thresholds
      - Covers full dynamic range of each DAC
      - Analysis is built into online scripts
    - *muTrg* (run time 4 hrs)
      - Four 1-hr muon runs
        - Two FLE settings at each of two trigger masks
      - Analysis is offline in root, in CM at SLAC
      - Confession
        - Current v2 muTrg running only at NRL is longer (6 hrs)
        - Three chg injection ...singlex16 runs
        - Three FLE settings at each of two trigger masks

- Then you need use these results to build settings tables...
Building settings tables

- Need to build tables corresponding to desired settings
- Use existing v2 CAL sw, e.g.
  - `genLACsettings`
    - Inputs:
      - Desired threshold (MeV)
      - Desired gain setting (0-7, nom = 5)
      - Current LAC characterization table (`...lac2adc.fits`)
      - Current energy calibration (`...adc2nrg.xml`)
      - Current relative gain table (`...relgain.fits`)
    - Output
      - Time-tagged LAC settings table (`...lac.xml`)
  - `genFLEsettings`
  - `genFHEsettings`
Decoding existing DAC settings

- To understand current DAC settings, run v2 CAL tools
  - LACsettingstoMeV
    - Inputs
      - Settings table (...lac.xml)
      - Current LAC characterization table (...lac2adc.fits)
      - Current energy calibration (...adc2nrg.xml)
      - Current relative gain table (...relgain.fits)
    - Outputs
      - HTML report with DAC setting and corresponding energy
      - .csv table with DAC setting
  - FLEsettingstoMeV
  - FHEsettingstoMeV

- I’ll be happy to give these to Eduardo for incorporation into the pipeline
  - They need to be converted to standalone and pipeline environment
Energy calibration procedure

- **When?**
  - After mate with flight TEM/TPS and flight TKR
  - After DAC calibration and settings generation

- **What?**
  - Run two CAL suites in sequence
  - calibGen (run time $\frac{1}{2}$ hr)
    - Four chg-injection sweeps
      - LE channels in ground and flight gains
      - HE channels in ground and flight gains
    - Gives electronic linearity curves
  - I&T muon acquisition
    - Longer is better
  - Analysis of this pair is offline in root (calibGenCAL)
    - in CM at SLAC
Summary

- Before you set thresholds on CAL with intent to collect and analyze photons or muons, you need to recalibrate the DACs.

- To recalibrate the DACs, run two suites:
  - calibDAC
  - muTrg
    - And analyze off line

- To calibrate the CAL energy scale, run two suites/scripts:
  - calibGen
  - I&T long muon collection
    - And analyze off line