GLAST Large Area Telescope
Calorimeter Subsystem

Functional / Performance Testing

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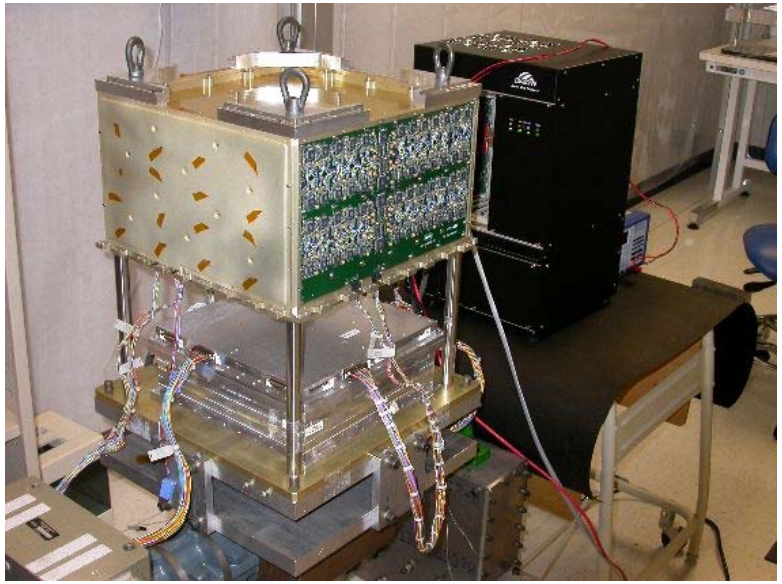
Functional Testing and Calibration

- Module-level functional and performance testing

EM CAL during Functional test



- Functional testing addressed in LAT-MD-01370
  - Defines comprehensive and limited tests (CPT, LPT)
- Calibration is addressed in LAT-MD-04187
  - Defines electronic (ECS) and muon calibration (MuC)

Functional Requirements and Traceability

- **Requirements**
  - Relevant, testable requirements extracted from Level III and Level IV specs
  - Verification matrix in LAT-MD-01374

- **Traceability**
  - Functional test suites generate test report summarizing results and compliance with relevant specifications
    - Pass/fail overall and by test element
  - Traceability maintained element-by-element through LAT-SS-01502

Functional Test Flow

- **Comprehensive Functional and Performance Test (CPT)**
  - **Test suite composed of 22 elements with following goals**
    - Verify full functionality of all CAL registers and proper communication with TEM
    - Measure pedestal centroids and widths
    - Verify stability of optical bonds for all CDEs
    - Measure electronic gain, linearity, and integral non-linearity of each GCFE
    - Characterize low and high energy (FLE and FHE) discriminators
    - Characterize zero-suppression (LAC) threshold DAC
    - Characterize auto-ranging (ULD) discriminator DAC
    - Estimate event dead-time
    - Test overload recovery circuitry
  - **Suite executes complete test sequence without user intervention**
    - Run time ~ 2 hours

Functional Test Flow (cont.)

- **Limited Functional and Performance Test (LPT)**
  - **Test suite composed of 6 elements with following goals:**
    - **Verify functionality of all CAL registers and proper communication with TEM**
    - **Measure pedestal centroids and widths**
    - **Verify stability of optical bonds for all CDEs**
  - **Suite executes complete test sequence without user intervention**
    - **Run time ~ 15 minutes**

Calibration Flow

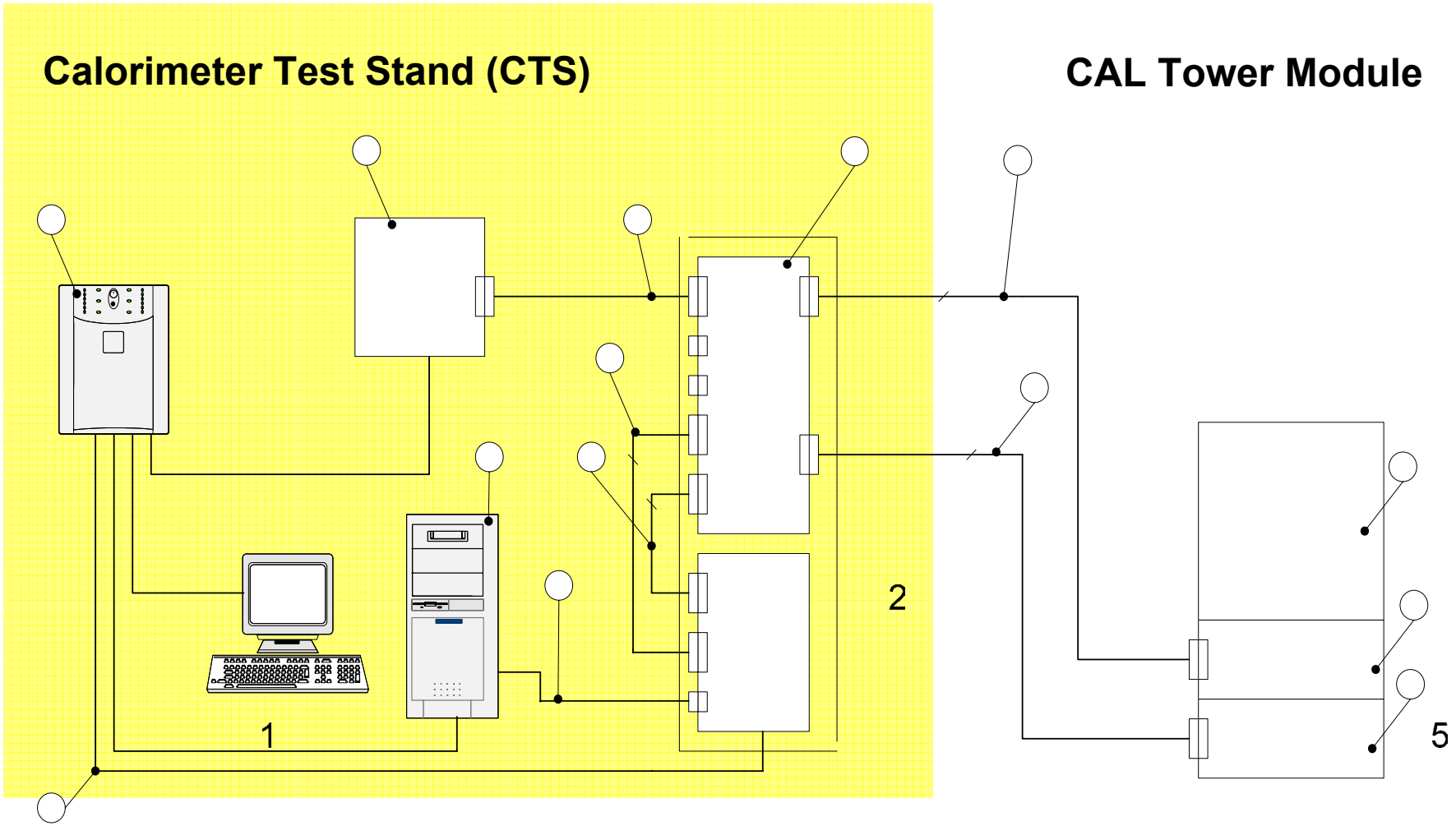
- **Electronic Calibration (ECS)**
  - **Test suite to give detailed calibrations of**
    - Electronic gain, linearity, and integral non-linearity of each GCFE
    - Low and high energy (FLE and FHE) discriminators
    - Zero-suppression (LAC) threshold DAC
    - Auto-ranging (ULD) discriminator DAC
- **Muon Calibration (MuC)**
  - **Calibrates "optical gain" of each CDE**
    - Optimizes time delay between trigger and peak hold
    - Verifies calibration (energy units) in FLE/FHE from ECS
    - Fits muon peak (with its known energy deposition), gives MeV/bin.
    - Maps light taper and light asymmetry in each CDE
- **These calibrations are run at start and end of environmental test program**
  - **Reference calibration just prior to shipment to SLAC**

Functional Testing to Date

- **Engineering Model CAL Module**
  - Full suite of functional tests and calibrations conducted through environmental test program
  - Gave opportunity to practice and/or redefine algorithms and flow of test suite
  - Demonstrated compliance with performance specifications

- **Flight Component Testing**
  - Flight AFEE board-level testing uses essentially identical test suite
  - Last opportunity to refine suite for Module-level test
  - Testing in progress

CAL Module Functional Test Configuration



Functional Test Facility Status

- TEM/TPS (version EM2)
  - How many?
    - 8 units exist at NRL for use with FM CAL Modules
      - 2 are verified for environmental test
      - 6 are under receiving/workmanship test
- Calorimeter Test Stand
  - How many?
    - 13 exist at NRL
      - 6 are in simultaneous use during nominal Module A&T program
      - 5 are in simultaneous use for TEM and AFEE testing
- Scenario
  - TEM/TPS attached to CAL Module
    - Ships to SLAC, but must return ASAP
  - CTS dedicated to each test area (e.g. vibe, TVAC)
    - CAL Tower Module moves in, tests, moves out
- Status
  - Ready to go

Test Software Status

- **Configuration Management**
  - LATTE 4 is controlled by LAT I&T at SLAC
  - CAL Scripts are configured at NRL (CVS) with releases to SLAC CVS
    - Script suites are in use at NRL
  - Documentation
    - LAT-MD-01370, CPT and LPT
    - LAT-MD-04187, ECS and MuC
    - LAT-TD-01502, test descriptions
- **Status**
  - CAL scripts run successfully under LATTE 3-02
  - CAL scripts still being verified against latest LATTE release
  - FMA test will proceed with LATTE 3-02

Known Risks and Limitations

- Functional test (and calibration) uses EM2 TEM and TPS
  - May not reflect actual performance of the flight TEM/TPS
  - Fewer TEM/TPS than CAL Modules
    - TEM/TPS must return to NRL for reuse

- LATTE and CAL package not yet frozen
  - LATTE current rev: 4-01
  - CAL runs at NRL with LATTE v. 3-02
    - NRL and SLAC have agreement to work together to get stable s/w system
  - NRL and SLAC s/w systems will be different for FMA

Functional Test Status

ITEM	STATUS
Requirements	Defined
Pass-Fail Criteria	Defined
Testing to Date	EM successful
Configuration	Defined
Handling/Installation	Defined
Facility Status	S/W scripts being verified against current rev of LATTE
Test Equipment	Ready
Risks and Limitations	1. Test and calibration use EM2 TEM/TPS 2. S/W not yet frozen
Procedures	Configured
Status	System is ready to execute tests