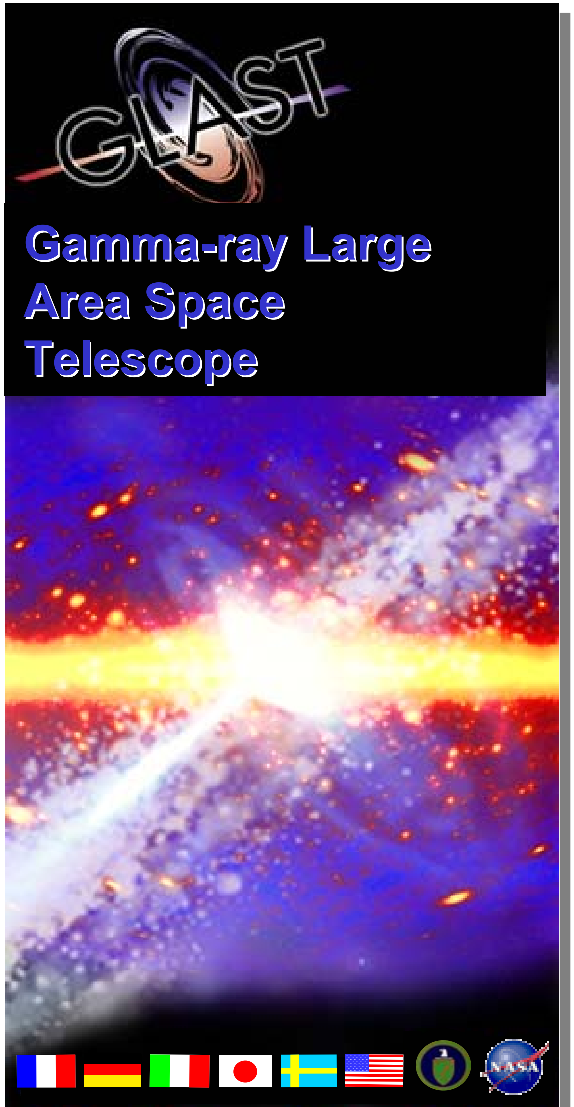


GLAST Large Area Telescope:

AntiCoincidence Detector (ACD)

EGSE, Performance Monitoring, and Calibration

Dave Thompson, Alex Moiseev, Bob Hartman
Performance Monitoring and Calibration
Bob Baker, Dave Sheppard
EGSE for Electronics Verification
Connie Houchens, Sharon Orsborne
ACD Subsystem EGSE

Applicable Documents

ACD Performance Monitoring and In-Flight Calibration, LAT-TD-01206-D1

ACD Functional Test Plans (Comprehensive Performance Test), LAT-TD-01112-D1

ACD Gain Calibration Test with Cosmic Ray Muons, LAT-TD-00844-D1

GLAST-LAT SVAC Plan, LAT-MD-00446-02

GLAST LAT I&T Online Requirements Document – Level 3, LAT-SS-00456-02

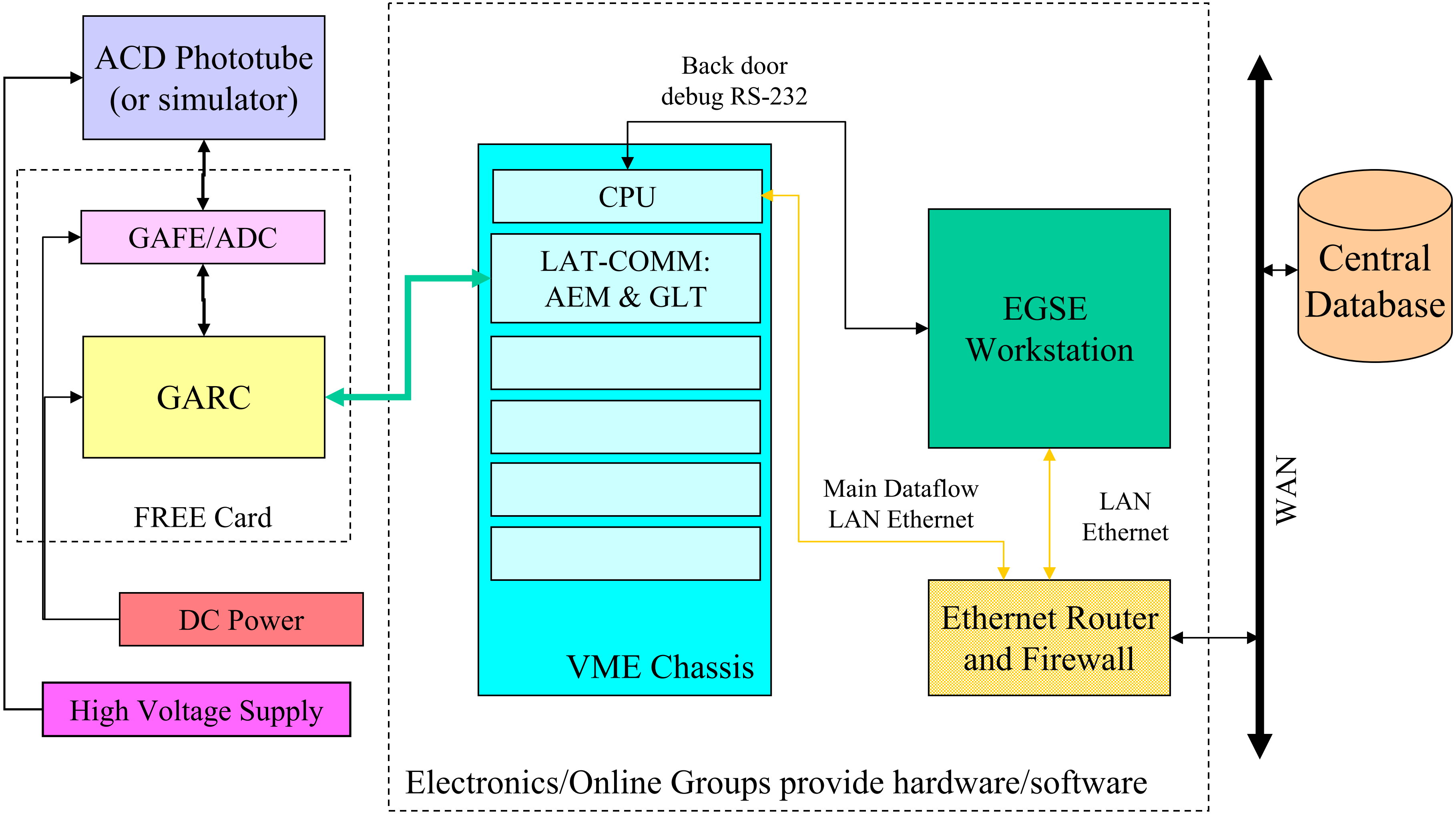
Electrical Ground Support Equipment - EGSE

Purpose: configure, command, exercise, and analyze the operation of the ACD, starting with the basic electronics and expanding to the full ACD, the LAT, and GLAST. The LAT I&T group often uses the term “Test Stand,” reserving EGSE for the computer portion of the set-up.

Approach:

- The LAT I&T group supplies ACD the EGSE computer and basic software package
- The LAT Electronics group supplies ACD the interface electronics
- The ACD team is responsible for writing test scripts and displays and for analyzing the results.

ACD Test Stand Configuration – One Version



EGSE Software

- LAT Project Programming Languages
  - Python : Object oriented scripting language
  - XML: Describes hardware configuration and data
  - Qt : Graphical user interface API
  - HippoDraw : Plotting/Drawing API

- ACD EGSE Software Development
  - Test Scripts to exercise hardware components (Python, XML)
  - GUI Application to display science data (Qt, HippoDraw)

Example Python Script

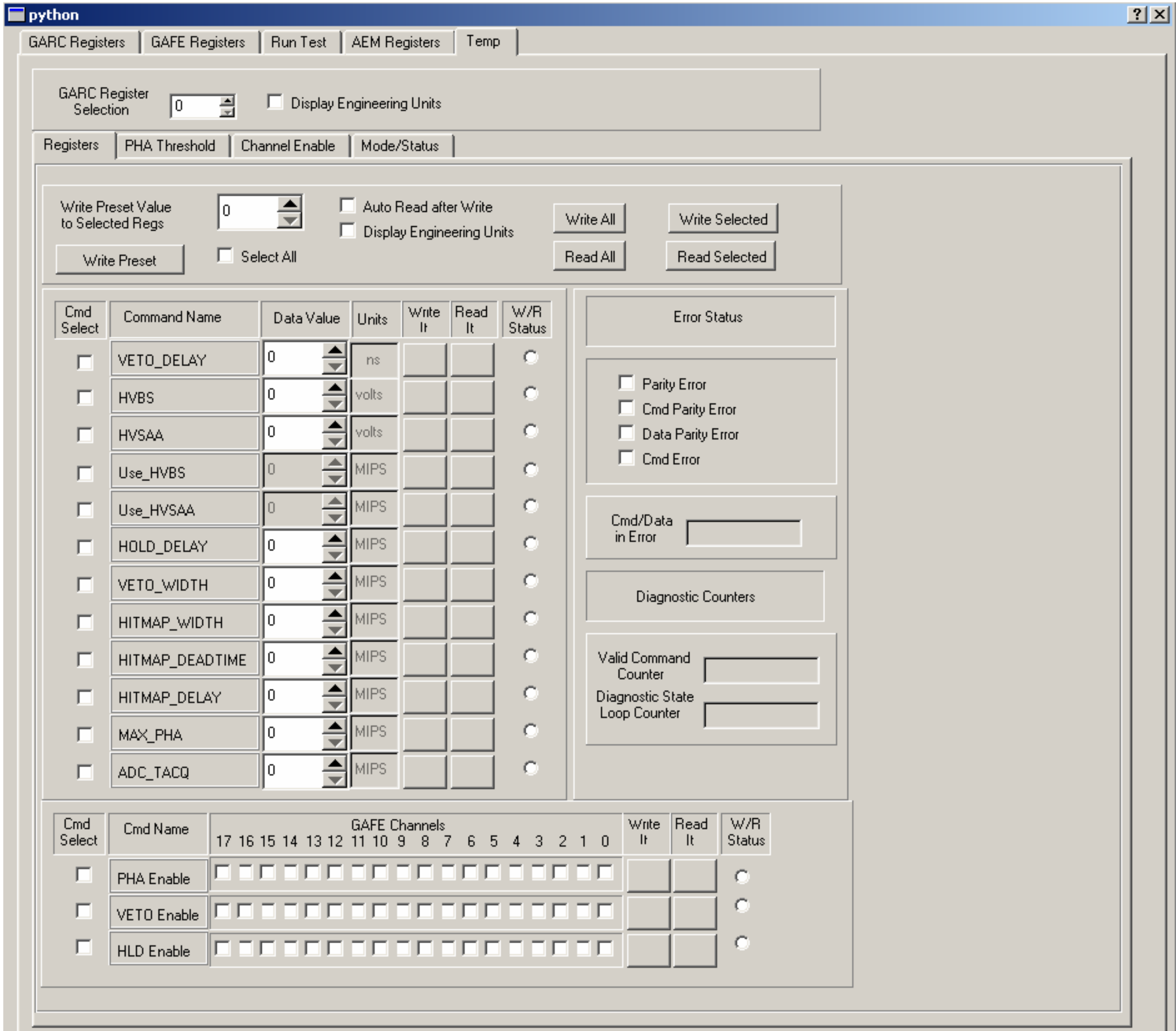

```
from gLAT           import *
from gSchemaConfig import *
from cmdCli         import *
from operator       import *

#AEM Test uses garcSchema.xml and TestConf.xml

 def MaxPhaReturn(cmd=None, disconnectOnExit=1, cfile=0):
""""
  global aem, glt, arc, afe
  if cmd == None:
    cmd = CmdCli(123)
    cmd.connect()
  lat = readSchema('garcSchema.xml')
  aem = lat.downAEM()
  arc = aem.downARC(0)
  aem.setCmd(cmd)

  arc.CMD_RESET=1
  arc.VETO_DELAY=150
```

Qt Graphical User Interface



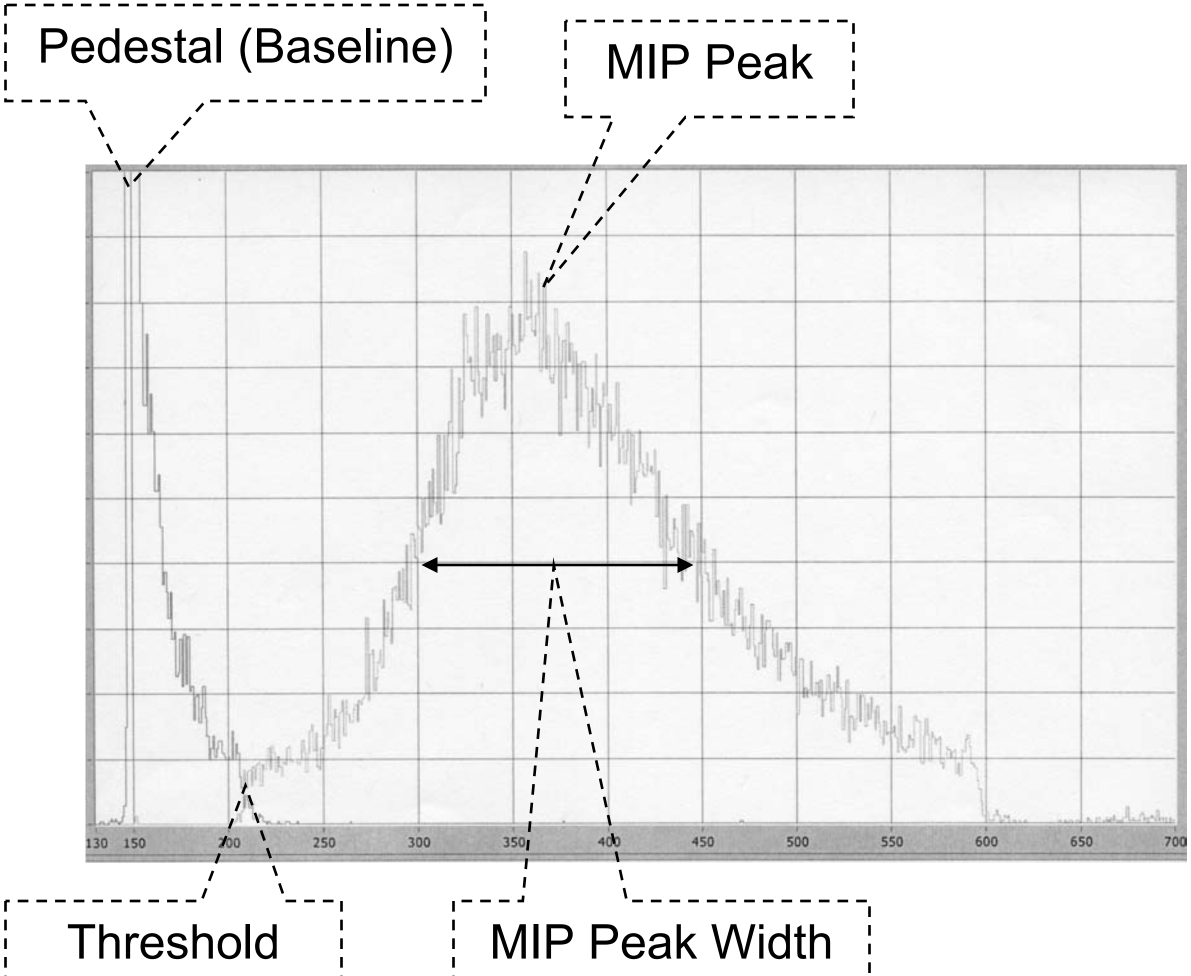
Performance Testing Status

- Hardware
  - "Home-built" EGSE for GAFE and GARC testing
  - First generation LAT Test Stand – limited testing for one FREE card
  - Next generation of LAT Test Stand due in April
  - Full flight-like interface needed for assembled ACD
- Test Plans
  - Test plans for GARC, GAFE, and FREE Card
  - Test procedure/script for GARC
  - Test plan for end-to-end test (scintillator to data out)
  - Functional Test Plan (Comprehensive Performance Test that includes notes for less complete functional tests); procedures to be built up from electronics and end-to-end test procedures plus system-unique tests

Test Environments and Plans

- Stand-alone tests for TDAs and phototubes
  - Use cosmic ray muons as source in laboratory testing
- Test boards for GAFE and GARC
  - All commands/verification, electronics performance such as linearity (GAFE test plan, GARC test plan)
  - Use charge injection as source
- End-to-end test (tile, fibers, phototube, GAFE, GARC, ADC, AEM/GLT)
  - Performance of electronics with real data, including pedestals, MIP peak, threshold (End-to-end test plan)
  - Use cosmic ray muons as source
- FREE card (up to 18 phototubes)
  - Performance of electronics with real data, including pedestals, MIP peak, threshold for multiple tiles
  - Functional testing (limited functional test)
  - Use cosmic ray muons as source
- ACD assembly (12 FREE cards, 194 phototubes)
  - Functional testing (all functional tests, including Comprehensive Performance Test) and calibration of each of the 194 channels.
  - Use cosmic ray muons as source
  - EGSE test scripts to be provided to LAT I&T
- LAT assembly, GLAST assembly, and post-launch
  - ACD testing folded into overall LAT testing

Performance Monitoring/Calibration



Other Parameters

Electronics response and linearity (use charge injection)

HV (read out)

Rate (read out)

Efficiency (calculated)

Calibration Source
Muons on ground, protons/electrons in flight

Performance Monitoring/Calibration

Calibration Tables

ACD Performance Monitoring and In-Flight Calibration, LAT-TD-01206-D1

Tile	Tube	Rate (Hz)	Pedestal	Elec. Resp.	MIP Pos.	MIP FWHM	Thresh. command	Thresh. (derived)	HV command	HV readout	Effic. (derived)
000	0	350	125	1000	1200	300	440	450	1050	1050	.9998
	1										
001	0										
	1										

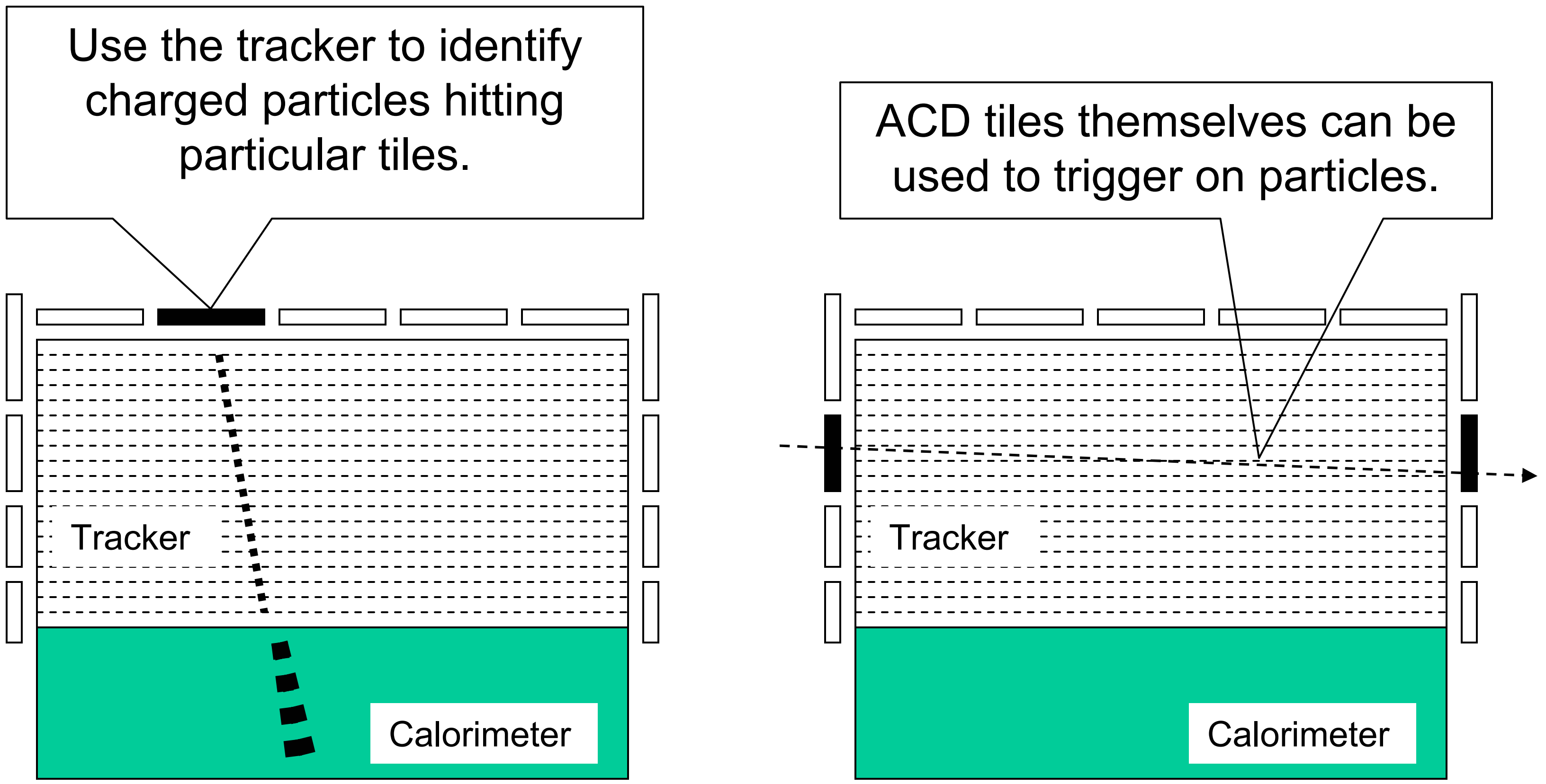
•
•
•

Linearity – Electronics Response v. Steps in Charge Injection

Tile	Tube	Step 0	Step 1	Step 2	Step 3	• • •	Step 61	Step 62	Step 63
000	0								
000	1								
001	0								

•
•
•

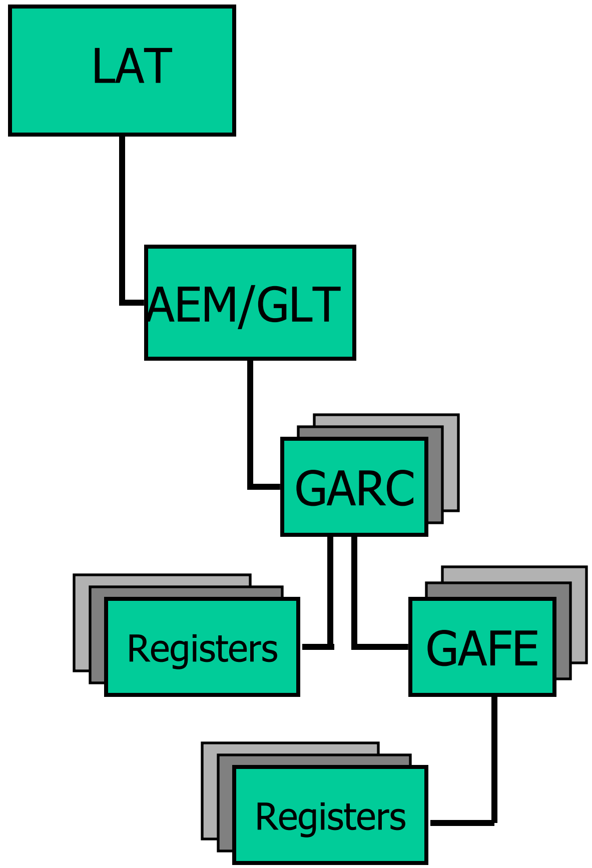
In-Flight Calibration Plan



Charge injection is used to calibrate the electronics response. Charged particles provide a self-calibration source for measuring light collection and phototube response (used to calculate efficiency).

- **BACKUP**

Hardware/Software Hierarchy



XML is used to describe hardware configuration