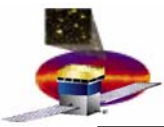


Midcourse Correction to the LAT Performance and Operations Test Plan for **partially populated** LAT Tests

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Mar 8, 2005



Outline

- **Introduction and Overview**
 - Motivation for midcourse correction
 - Review Process
 - Recommendations from E2E and I&T
 - Trigger tests
 - Electronic calibrations

- **Tower A tests**
 - Detailed description of
 - E2E Trigger and Data flow tests with cosmic rays
 - SVAC tests with cosmic rays

- **Two Tower (AB) tests**
 - Detailed description of additional
 - E2E Trigger and Data flow tests with cosmic rays
 - SVAC tests with cosmic rays

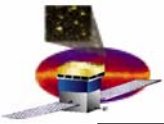
- **Multiple Tower Tests**
 - Detailed description of
 - SVAC tests with cosmic rays

- **Summary**



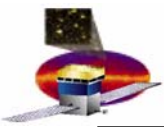
Main Reasons for a midcourse correction

- **Some tests in the Master Plan simply could not be performed**
 - **Since we wrote the plan, we acquired more experience and our knowledge of the hardware/software improved**
- **Some tests were unnecessarily duplicated in different phases of the program**
 - **Repetition has been eliminated in today's proposal**
- **The number of tests hours was long**
 - **Needed to adapt to current schedule pressures**
- **The number of tests configurations was large**
 - **We were worried that we would not be able to provide meaningful and timely feedback with the offline results**
 - **Note: PASS/FAIL criteria do not depend on offline analysis**



Contents of Presentations

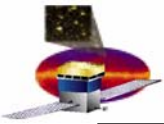
- **The Master Plan: LAT Performance and Operations Test Plan LAT-MD-02730**
 - **lengthy with pointers to many other documents (see back-up slides)**
- **This presentation is an attempt to summarize part of the test plan for 1 and 2 towers to**
 - **Provide everyone the opportunity to comment on the proposal**
- **8 am meeting (this presentation)**
 - **Discuss in detail only cosmic ray tests (muons)**
 - **Also present an overview of trigger and electronic calibrations and VDG tests**
- **1 pm meeting**
 - **Discuss in detail particle tests other than cosmic rays**



Documentation

For reference only
Not to be discussed in this talk

- Relevant documents are
 - **LAT-TD-04136**
 - *VG and CR Data Runs for LAT Integration (needs to be updated to reflect this proposal)*
 - **LAT-MD-00575-01**
 - *SVAC LAT Plan for LAT Integration at SLAC (needs to be updated to reflect this proposal)*
 - **LAT-MD-02730-01-D1**
 - *LAT Performance and Operations Test Plan (needs to be updated to reflect this proposal)*
 - **LAT-MD-03489-02**
 - *Report from Ad Hoc Committee on End-to-End Testing*



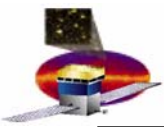
Review Process

- **Wednesday March 2 : (2h meeting)**
 - **First review of the proposal for the midcourse correction by I&T**
 - I&T feels proposal carries too much risk
- **Thursday March 3 : (1 ½ h meeting)**
 - **First review of the proposal for the midcourse correction by the E2E Committee**
 - Only cosmic ray tests were reviewed because of time limitations
 - Among recommendations there was a review of trigger tests
- **Friday March 4 : (2 h meeting)**
 - **I&T reviews E2E recommendations to the proposal**
 - Add a few previously deleted tests to alleviate I&T concerns
- **Monday March 7 : (1 h meeting)**
 - **Review of Trigger tests**
 - Verified that removal of tests duplications were justified



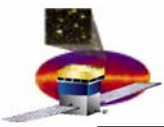
Recommendations from E2E Committee

- The Subsystem delivery of baseline calibrations and nominal settings need to be validated and/or updated after the subsystem is integrated with the flight TEM/TPS.
 - This is part of the SVAC tests, but may need to be replicated earlier in the program with an integrated tower outside the grid.
 - The current plan calls for redoing the calibrations for only Tower A outside the grid.
- Strong recommendations
 - to have the trigger tests reviewed ASAP
 - to have a calibration and configuration validation step before significant data taking.
 - to charge someone to ensure coherence among the various test plans (trigger, E2E, SVAC, ...).



Recommendations from I&T

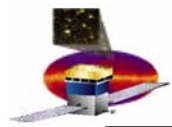
- We should continue to be aware of schedule pressures
 - I&T is trying to make the delicate balance between testing and schedule
- We should allow flexibility early on in the testing program
 - so that we can gradually acquire experience
- We should have an efficient feedback process
 - to allow new tests to be proposed to the LAT Test Program whenever necessary
- I&T should be able to propose independent tests
 - since it has final responsibility to demonstrate instrument capability prior to delivery
 - Obviously, working with subsystems



Overview of the Test Flow

- Subsystems verify functionality and performance of individual modules prior to their delivery to I&T
- I&T Repeat some of these tests when the instrument is integrated
 - **Single tower (current LPT and CPT tests), multiple towers, LAT**
 - Includes for example power –on sequencing, register tests, threshold settings and short muon data taking
- Once thresholds and operational settings are know
 - **Trigger group determines the nominal timing settings for the integrated instrument and study trigger properties (e.g. efficiencies)**
- Baseline calibrations and nominal settings are established for the integrated towers outside flight grid
 - **Currently for Tower A only**
- **Data Collection**
 - **Performs TD&F tests using muons**
 - **Performs calibrations of integrated tower using muons**
 - Charge injection tests are repeated to support offline calibrations when necessary
 - **Performs data analysis to assess overall instrument performance**
 - Also used to validate Monte Carlo simulations

This is the midcourse correction subjected to review today



Overview of Trigger Tests

Time (h)			Test Name	Description
26				
1	T	1	TREQ Alignment - TKR	Only TKR and EXT_MU can open window
1			TREQ Alignment - CAL	Only CAL and EXT_MU can open window
8	T	2	TACK Delay - TKR	Only TKR and EXT_MU can open window
8			TACK Delay - CAL	Only CAL and EXT_MU can open window
4	T	4	Trigger Efficiency	Enable TKR nominal OR CAL_LO near noise floor
4	T	5	Trigger Window Width	

- TREQ Alignment (GEM)

- To verify the timing alignment and jitter for each GEM trigger input

- TACK Delay Scan

- To determine the optimal trigger output (TACK) delay for each subsystem simultaneously

- FLE muon Scan (done by I&T tests C1 to C4)

- To find operational thresholds for CAL_LO to trigger on muons

- Trigger Efficiency

- To measure trigger efficiencies

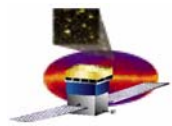
- Trigger Window Tests

- For a sample of good muon events what fraction of each trigger type is latched within the window for different window widths



Electronic Calibrations and Threshold Determination

- **Purpose**
 - Determine operational thresholds
 - Charge injections to support the SVAC offline calibrations with muons
 - We are doing these tests inside and outside the grid for Tower A
 - Baseline is to do these tests **once per tower** inside the grid
- **Duration**
 - Approximately 1 day (TBR)
- **Tests**
 - **TKR tests**
 - TE604 – Threshold Dispersion
 - TE601 – Threshold Calibrations
 - TE602 – TOT conversion parameter calibrations
 - **CAL test suites**
 - calibDAC – FLE/FHE characterization charge injection
 - calibGen – calibrations with charge injection
 - muTrig – FLE/FHE characterization with muons
 - » Done also by I&T tests C1 and C4 for Tower A
 - » Procedures will merge for 2 towers

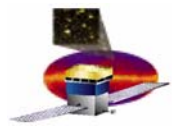


Tower A – E2E T&DF and SVAC Tests - muons

Time (h)			Test Name	Description
22				
2	1	1	Baseline Cosmic Rays (CR)	all settings nominal
1	2	3	Condition Scan CR	Change only TKR DAC to 22
1		6	Condition Scan CR	Read TKR from Right RC
1		7	Condition Scan CR	Read TKR from Left RC
1	3	1	Baseline CR Trigger	Only TKR is allowed to open trigger window
1		2	Baseline CR Trigger	Only CAL_LO set to 20 MeV is allowed to open window
1	4	1	Nominal CR Rate	Overlay rate of 1 kHz
1		2	Nominal CR Rate	Overlay rate of 5 kHz
1		3	Nominal CR Rate	Overlay rate of 10 kHz
1		4	Nominal CR Rate	Overlay rate of 20 kHz
1	5	3	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and change only TKR DAC to 22
1		6	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and and read TKR from Right RC
1		7	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and read TKR from Left RC
1	7	1	Baseline CR Data Volume	Zero suppression OFF
1	8	6	Nominal CR Data Volume	Overlay rate of 1kHz, CAL 4 range, Zero Suppression OFF
1		9	Nominal CR Data Volume	Overlay rate of 10kHz, CAL 4 range, Zero Suppression OFF
2	B	1	SVAC (Calibration,Performance,MC)	all settings nominal
2		9	SVAC (Calibration,Performance,MC)	CAL High Energy muon gain, four range readout
1		12	SVAC (Calibration,Performance,MC)	Zero suppression OFF , four range readout

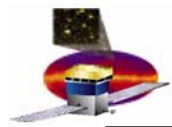
TEM Diag
OFF

TEM Diag
ON



Two- Tower (AB): E2E T&DF and SVAC Tests - muons

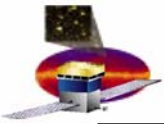
Time (h)			Test Name	Description
37				
2	1	1	Baseline Cosmic Rays (CR)	all settings nominal
1	2	1	Condition Scan CR	Set unregulated power supply to 29V - need PDU
		2	Condition Scan CR	Set unregulated power supply to 27V - need PDU
		3	Condition Scan CR	Change only TKR DAC to 22
1		6	Condition Scan CR	Read TKR from Right RC
1		7	Condition Scan CR	Read TKR from Left RC
1	3	1	Baseline CR Trigger	Only TKR is allowed to open trigger window
1		2	Baseline CR Trigger	Only CAL_LO set to 20 MeV is allowed to open window
1	4	1	Nominal CR Rate	Overlay rate of 1 kHz
1		2	Nominal CR Rate	Overlay rate of 5 kHz
1		3	Nominal CR Rate	Overlay rate of 10 kHz
1		4	Nominal CR Rate	Overlay rate of 20 kHz
1	5	3	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and change only TKR DAC to 22
1		6	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and and read TKR from Right RC
1		7	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and read TKR from Left RC
1	7	1	Baseline CR Data Volume	Zero suppression OFF
1	8	6	Nominal CR Data Volume	Overlay rate of 1kHz, CAL 4 range, Zero Suppression OFF
1		9	Nominal CR Data Volume	Overlay rate of 10kHz, CAL 4 range, Zero Suppression OFF
4	B	2	SVAC (Calibration,Performance,MC)	all settings nominal
15		10	SVAC (Calibration,Performance,MC)	CAL High Energy muon gain, four range readout
1		13	SVAC (Calibration,Performance,MC)	Zero suppression OFF , four range readout



Multiple Towers – SVAC Tests - muons

Time (h)			Test Name	Description
20				
4	B	2	SVAC (Calibration,Performance,MC)	all settings nominal
15		10	SVAC (Calibration,Performance,MC)	CAL High Energy muon gain, four range readout
1		13	SVAC (Calibration,Performance,MC)	Zero suppression OFF , four range readout

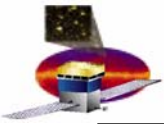
There is no requirement for E2E runs for multiple towers



VDG Runs

Will be presented in the afternoon !
Shown here for completeness only

- **Current Data Taking configurations (13h)**
 - **9/1 : VDG, Nominal settings (1h)**
 - No zero suppression
 - **9/2, 9/3, 9/4: VDG, Nominal settings, vary rates (3 x 1h =3h)**
 - Place target at 3 different positions (1", 2", 4" from topmost Si tray) use Zero suppression On
 - **9/5, 9/6: VDG, Nominal settings but add pulse generator(2x 1h = 2h)**
 - Overlay Pulse generator at 1 and 10 kHz on VDG triggers
 - **9/7: Flight configuration, horiz orientation and TEM diagnostics is ON (1h)**
 - » Only occurs for tower A when tested with VDG photons – shoot from angle below top layer of CAL
 - **9/8: Flight configuration, horiz orientation and TEM diagnostics is ON (1h)**
 - » Only occurs for tower A when tested with VDG photons – shoot from angle 10 cm above bottom of TKR
 - **B16: Flight configuration, horiz orientation and TEM diagnostics is ON (4h)**
 - » Only occurs for 2 towers when tested with VDG photons
 - **B11: same as B16 but with VDG OFF (1h)**
 - » Background estimation before tests with VDG photons



Summary

- We have reviewed extensively the test plan for cosmic rays
 - I&T is implementing the proposal presented in this talk
- There will be a discussion on this topic in the Instrument Analysis Workshop on March 10
 - To get collaborators ready to analyze these data
- Spin-offs from many hours of meetings...
 - We improved our review process prior to data taking
 - Added another layer of implementation details to address calibration and configuration validation.
 - Identified a need to revisit the trigger tests for two towers
 - Identified a need to create a process that will allow proposal of new tests to the LAT test program
 - Identified a need to charge someone to ensure coherence among the various test plans (trigger, E2E, SVAC, ...).