LAT Environmental Verification Testing

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Science Verification/Calibration Testing/Environmental Testing Cross-Overs

Regarding calibration, the question quickly moves beyond what exact functional modes to exercise (TBR) to how to make use of the data we collect during environmental test, especially regarding thermal sensitivity of calibration parameters.

First, we should have a way to connect cosmic ray muon calibration results with beam-test calibration results. I.e., how do/would they track each other? Certainly a beam-test calibration offers the best control and precision. We can then ask: How many muon events do we need to approach the fidelity of a beam-test calibration (or at least allow us to extend the calibration by muons given that we have a baseline beam-test calibration? Steve's memo suggests ~20 hr (per distinct config. step).

Possible Tests:

Full beam-test calibration at ambient temperature

Best control and precision to understand how to calibrate LAT, and affect of various operational status changes on calibration (e.g.: changes in line voltage).

Over-/under-temp beam-test calibration

Possibly limited beam test, once at a below-nominal and once above-nominal temperature (over as large a delta T as practical under beam-test conditions) to get a good idea of the thermal sensitivity of the calibration parameters with best possible control over input (i.e. beam/target spots).

Alternatively, we could run the beam test with introduced mechanical distortions. Thus, we would not rely on thermal distortions of a structure that behaves qualitatively differently than the flight Grid. With prescribed and externally-measured motions of towers, we could use the beam-test data to correlate changes in data to physical motion of the towers.

Collect cosmic ray muons at the same temperatures

Above/below nominal as used in the beam-test (perhaps during breaks in the beam-test, or even by collecting background via self-trigger in between beam spills?). This is primarily to learn how well a muon-only calibration agrees with a beam-test calibration, or at least how to connect the two methods at the same temperatures.

Collect cosmic ray mouns during thermal-vacuum testing

Test at low and high temperature extremes (20+ hours each step, during which time we need to hold temperature constant). Can we afford to hold constant temp. for 20 hours at each extreme?

Take distortion data during Qual Grid thermal-balance test

A Qual Grid will be tested with flight Radiators to thermally balance the system. During this test, we could monitor the distortion of the top of the Grid (or track tipping of simulated TKR modules). This adds understanding of LAT thermal-vacuum calibration tests, and helps correlate controlled-distortion beam-test with T-V calibration test.

If our methods and models are sound, we should be able to map the calibration coefficients over the entire operating range, be able to compute/select them based on instrument temperature readings, and track instrument changes over its lifetime using only muons. We should practice a muon calibration with GlastSim, inducing some misalignment and recovering coefficients from data only.

Performance Tests

Three levels of performance tests will be used to verify performance before, during, and/or after environmental tests. The tests are described below:

Aliveness Test:

The instrument functions, can receive commands and output data. There is no attempt to see that science data is meaningful, emphasis is more on housekeeping. This sort of test is often used when testing the S/V B side. A more complete test of the instrument is performed on the A side and then the vehicle is switched to B. Since nothing has changed with the instrument the interface is mostly what is under test. Typically what would be looked at would be housekeeping, nominal currents, voltages, temperatures, ability to receive commands, and ability to output a test pattern for the science data. The idea would be to be able to complete this test in 15-30 minutes.

Test Definition:

- Nominal analog measurements
- Receive commands
- Output simulated science data

LAT Status During Test

- Done in a controlled environment, possibly while boxed
- Cooling may not be required, if test is 15 minutes

Limited Performance Test (LPT):

All of the above plus get real science data. This is the workhorse test mode. The goal should be a test of a few hours duration. The test should verify the operation of each tracker tray, and probably calorimeter log and ACD tile. The test should probably provide an overall noise occupancy for the tracker at the nominal operation threshold. One would like to know that no major parts of the system are dead or buzzing.

Test definition—add the following:

- verify ability to configure each tower
- verify nominal background science data
- verify cal performance
- verify acd performance
- verify nominal tracker noise occupancy
- perform aliveness test on instrument B side

LAT Status During Test

- Done in a controlled environment
- Chill plates at Radiator mounts to maintain interface to 20-25 degC with city water available
- LAT leveled to 1 degree (TBR) so heat pipes are operational

Full Performance Test (FPT):

Verify all aspects of the instrument including: number of dead strips, number of hot strips, any cal diode problems, cal discriminator levels, tracker noise occupancy as a function of threshold setting, tower-to-tower alignment data. I'm probably forgetting something. How long would this sort of test take to run for each subsystem. Assume an automated test set and realtime data. How much difference there is between the limited and full performance tests depends a lot on how long the full-up test takes to run.

Test definition—add the following:

- verify ability to configure all elements
    - trigger mask
    - data mask
    - tray controllers
- verify detailed cal performance
- verify detailed ACD performance
- measure tracker noise occupancy vs threshold

perform limited functional test on instrument B side

LAT Status During Test

Done in a controlled environment

Dry air shroud with purge

Chill plates at Radiator mounts to maintain interface to 10-15 degC, with chilled water available

LAT leveled to 1 degree (TBR) so heat pipes are operational

Environmental Tests

Grey = requirement as-is from LAT Perf Spec
Yellow = change to req or verification
Red = remove or move req

Missing Requirements and Other Issues
LAT Performance in an EMI environment is not specified.
LAT operating temperature ranges must be specified, otherwise thermal requirements are meaningless.
For every requirement, the operating mode of the LAT must be specified.

Requirement: 5.3.2 Instrument Life
Parameter: >5 years
Verification Test Plan: A
Reliability analysis by System Engineering
Time: Before CDR.

Requirement: 5.3.3 Science Data Interface
Parameter: Optical serial interface (HSFSB) compliant with IEEE 1393 standard
Note: This is an old parameter. New one should be put in, with error rate and sustained data rate specified.
Verification Test Plan: D
Interface test using SC simulator from SC contractor, that looks like a solid state recorder. We verify that the data error rate is better than one in a million with a sustained data rate of TBR
Time: Before LAT env test
Facilities:
SC simulator from SC contractor

Requirement: 5.3.4 Data Services
Parameter: LAT-SC communication CTDB defined by SAE AS-1773
Note: This is an old parameter. New one should be put in, with error rate and sustained data rate specified.
Verification Test Plan: D
Interface test using SC simulator from SC contractor, that looks like a solid state recorder. We verify that the data error rate is better than one in a million with a sustained data rate of TBR
Time: Before LAT env test
Facilities:
SC simulator from SC contractor

Requirement: 5.3.6 Instrument Mass
Parameter: <3000 kg as allocated to each subsystem
Verification Test Plan: I
Weigh LAT in 3 parts. First, weigh integration frame and lifting fixture. During prep for delivery, weigh entire LAT (then subtract off GSE weight). Finally, weigh Radiators, which is the only flight hardware not integrated at SLAC.
Time: After integration, after final test
Facilities: Calibrated 5000 kg scale, accurate to TBD kg. This is done in SLAC integration clean room

Requirement: 5.3.7 CG Constraints
Parameter: Z-axis CG <= 0.246 m from interface plane.
Verification Test Plan: I
Measure X, Y coordinates of CG by setting on 3 points, the position of which have been surveyed. Set points, one at a time on a calibrated scale (2500 kg capacity).
Measure Z coordinate of CG by pivoting LAT on integration stand and measuring change in reaction torque, or reaction force at a given moment arm (which needs to be surveyed). This may reduce measurement error due to shaft rotational friction.

Measure CG of Radiators individually by weighing them on scales.
Calculate effective CG of entire LAT from inspection results

Time: After integration, when LAT is ready to be removed from integration stand.

Facilities:
Calibrated scales (2500 kg capacity)
Temporary supports to set the LAT on
Torque measuring device either on shaft/motor of integration stand, or independent

Requirement: 5.3.8 Envelope

Parameter: 1.8 m x 1.8 m x 3.15 m

Verification Test Plan: I

Survey LAT after integration is complete, while on integration stand. Survey location of hard targets on outside of ACD and Grid with respect to LAT fiducials, then run parallel line-of-sight offsets to find bounding dimensions of soft thermal shield.

Time: After integration

Facilities: Calibrated surveying equipment with pre-set coordinate system set up in clean room

Requirement: 5.3.9 Interface Structure

Parameter: SI to mount to the spacecraft via an interface structure, which is part of the spacecraft.

Verification Test Plan: I

Test interfaces to the Grid with a gauge from the SC contractor, before integration begins. Alternatively, inspect interface points as part of Grid QC inspection.

Check three-dimensional stay-clear for SC interface structure with 3-D template from SC contractor, to check interferences with TEM boxes. Alternatively, LAT underside envelope could be surveyed.

Time: Before integration for Grid inspection. After integration for LAT envelope surveying.

Facilities:
Grid/SC interface gauge
3-D interface template

Requirement: 5.3.10.1 Average Power

Parameter: <= 650 W per 24 hour period (TBR)

Verification Test Plan: T and A

Average power will be verified using a voltage meter on LAT 28 volt bus and clamp on current meter to determine total average power. The LAT will be powered for 1/2 hour before tests start. The LAT will be taking cosmics for this test. The LAT shall be in the proper thermal and humidity environment. The 28 volts shall be varied to both upper and lower limit voltage.

Time: After LAT integration, while bench-testing

Facilities:
Temperature- and humidity-controlled environment for LAT
Heat-removal system for LAT
Voltage and current monitoring system

Requirement: 5.3.10.2 Peak Power

Parameter: <= 1000 W

Note: identify operating conditions which result in this power (running at peak trigger rate of 10 kHz).

Verification Test Plan: T and A

Peak power will be verified using a voltage meter on LAT 28 volt bus and clamp on current meter to determine total average power. The LAT will be powered for 1/2 hour before tests start. The LAT will be taking cosmics for this test, at the maximum rate using the calibration system. The event rate shall be 10KHz (TBR). The LAT shall be in the proper thermal and humidity environment. The 28 volts shall be varied to both upper and lower limit voltage.

Time: After LAT integration, while bench-testing

Facilities:
Temperature- and humidity-controlled environment for LAT
Heat-removal system for LAT
Voltage and current monitoring system

Requirement 5.3.10.3 Peak Power Duration
Parameter: Duration <= 10 minutes per orbit
Note: This is an operational requirement, based on expected science.
Verification Test Plan: A
Requirement can be verified by analysis, but there is no way to verify performance.

Requirement: 5.3.11.1 Heat Dissipation
Parameter Capable of dissipating up to 650 W power, due to internal power usage, in addition to on-orbit thermal fluxes
Note: This is a new, re-worded req, resulting from division of original 5.3.11 req
Verification Test Plan: T and A
Thermal analysis of LAT. Radiator thermal analysis. Thermal balance test of "Qual. LAT" with thermal models and flight radiators
Time: Concurrent with flight LAT integration
Facilities:
Thermal-vacuum chamber
Dummy thermal loads

Requirement: 5.3.11 Heat Load from Spacecraft
Parameter LAT shall be capable of dissipating up to 5 W conducted heat from the spacecraft
Note: This is a new, re-worded req, resulting from division of original 5.3.11 req
Verification Test Plan: T and A
Thermal analysis of LAT. Radiator thermal analysis. Thermal balance test of "Qual. LAT" with thermal models and flight radiators
Time: Concurrent with flight LAT integration
Facilities:
Thermal-vacuum chamber
Dummy thermal loads

Requirement: 5.3.12.1 Handling Vibration and Shock
Parameter: Instrument handled per controlled procedures
Note: this is not a performance spec, but a ground handling criterion. Put this in an I&T Requirements Specification.
Compliance Plan:
I&T Manager to review all LAT handling and transportation procedures prior to use. Accelerometers must be used for all transporting of the LAT.

Requirement: 5.3.12.2 Transportation Vibration and Shock
Parameter: Transportation environment shall be less severe than the launch environment and shall be monitored.
Note: this is not a performance spec, but a ground handling criterion. Put this in an I&T Requirements Specification.
Compliance Plan:
Accelerometers must be used for all transporting of the LAT. Log accelerometer data after every transport.

Requirement: 5.3.12.3.1 Non-Operating Ground Temperature Range
Parameter: LAT capable of tolerating indefinitely temperatures of 0 to 40 ºC (TBR), while off.
Verification Test Plan: T
Thermal-cycle test the LAT in dry air after integration, while off, then perform LPT. Temperature ranges are the same as the LAT survival temperatures.
Time: This would happen before shipping to the thermal-vacuum test, to assure that it will perform during T-V.
Facilities:
Tent over LAT to control relative humidity
Hot/cold plates to mount to the LAT to drive temperature
SIU GSE to monitor LAT temperatures
Test GSE to monitor test set-up, hot plate temperatures, and humidity

Requirement: 5.3.12.3.1 Storage/Transportation Temperature
Parameter: Storage/transportation GSE/procedures shall keep LAT in the temperature range of 0 to 40 ºC (TBR)
Note: this is not a performance spec, but a ground handling criterion. Put this in an I&T Requirements Specification.
Compliance Plan:
I&T Manager to review all LAT storage and transportation procedures prior to use. Temperature monitors must be used for all transports and storages of the LAT. Log temperature monitor data after every transport or storage. Perform LPT after every transport or storage.

Requirement: 5.3.12.3.2 Non-Operating Ground Relative Humidity
Parameter: LAT capable of tolerating indefinitely relative humidities of 20% to 55% (TBR), while off.
Note: This range of relative humidity is bounded on the high side by the more stringent requirement of 5.3.12.3.6
Verification Test Plan: I
Verify this by collecting qualification test data from subsystems. This is adequate to assure performance of the LAT within the humidity range.
Time: Collect test results before subsystem modules are shipped.
Facilities:
None

Requirement: 5.3.12.3.2 Storage/Transportation Rel. Humidity
Parameter: Storage/transportation GSE/procedures shall keep LAT in the humidity range of 20% to 55% (TBR)
Note: this is not a performance spec, but a ground handling criterion. Put this in an I&T Requirements Specification.
Compliance Plan:
I&T Manager to review all LAT storage and transportation procedures prior to use. Humidity monitors must be used for all transports and storages of the LAT. Log humidity monitor data after every transport or storage. Perform LPT after every transport or storage.

Requirement: 5.3.12.3.3 Assembly & Integration Temperature
Parameter: LAT capable of operation in air at temperatures of 15 to 25 ºC (TBR)
Verification Test Plan: T
Thermal-cycle test the LAT in dry air after integration, then perform LPT. Temperature ranges are the same as the LAT survival temperatures.
Time: This would happen before shipping to the thermal-vacuum test, to assure that it will perform during T-V.
Facilities:
Tent over LAT to control relative humidity
Hot/cold plates to mount to the LAT to drive temperature
SIU GSE to monitor LAT temperatures
Test GSE to monitor test set-up, hot plate temperatures, and humidity

Requirement: 5.3.12.3.3 Assembly & Integration Facilities Temperature
Parameter: LAT I&T facilities shall be kept at temperatures of 15 to 25 ºC (TBR)
Note: this is not a performance spec, but a ground facilites criterion. Put this in an I&T Requirements Specification.
Compliance Plan:
I&T Manager to review all LAT I&T procedures prior to use. Monitor temperature of all facilities where LAT is. Log temperature monitor data.

Requirement: 5.3.12.3.4 Assembly & Integration Relative Humidity
Parameter: LAT capable of operation in relative humidity of 35% to 55% (TBR)
Verification Test Plan: I
Verify this by collecting qualification test data from subsystems. This is adequate to assure performance of the LAT within the humidity range.
Time: Collect test results before subsystem modules are shipped.
Facilities:
None

Requirement: 5.3.12.3.4 Assembly & Integration Relative Humidity
Parameter: LAT I&T facilities shall be kept at relative humidity of 35% to 55% (TBR)
Note: this is not a performance spec, but a ground handling criterion. Put this in an I&T Requirements Specification.
Compliance Plan:
I&T Manager to review all LAT I&T procedures prior to use. Monitor humidity of all facilities where LAT is, and during all thermal testing. Log temperature monitor data.

Requirement: 5.3.12.3.5 Launch Vehicle Temperature
Parameter: LAT able to tolerate LV environment of 13 to 27 ºC in any operation mode.
Note: This spec needs modification to state operation mode.
Verification Test Plan: T
Thermal-cycle test the LAT in dry air after integration, then perform LPT. Temperature ranges are the same as the LAT survival temperatures.
Time: This would happen before shipping to the thermal-vacuum test, to assure that it will perform during T-V.
Facilities:
Tent over LAT to control relative humidity
Hot/cold plates to mount to the LAT to drive temperature
SIU GSE to monitor LAT temperatures
Test GSE to monitor test set-up, hot plate temperatures, and humidity

Requirement: 5.3.12.3.6 Launch Vehicle Relative Humidity
Parameter: LAT able to withstand LV environment of 40% to 55% relative humidity in any operation mode.
Verification Test Plan: I
Verify this by collecting qualification test data from subsystems. This is adequate to assure performance of the LAT within the humidity range.
Time: Collect test results before subsystem modules are shipped.
Facilities:
None

Requirement: 5.3.12.3.7 Temperature Rate of Change
Parameter: LAT able to withstand 5 ºC/hour max rate of change in any operation mode.
Note: this refers to only during ground processing, but should be an overall spec, including on orbit. Also, this should refer to rate-of-change at Radiator interface, say, since it is ambiguous as stated. Change.
Verification Test Plan: T
Ramp LAT during thermal-cycle test at maximum rate of change. Do again during thermal-vacuum testing.
Time: During thermal-cycle and thermal-vacuum testing
Facilities:
Thermal-vacuum chamber
Hot/cold plates to provide sufficient power to drive LAT interface at this rate.

Requirement: 5.3.12.4.1 Thrust Axis Loads, Primary Structures
Parameter: LAT primary structures able to withstand static loads in thrust direction of 3.25/-0.8 g at liftoff/transonic, 6.0 ±0.6 g at MECO
Verification Test Plan: T and A
Sine-burst test in thrust direction during LAT vibration test. This test is combined with the verification test for 5.3.12.4.2, since 5.3.12.4.3 says that loads must be applied in all axes simultaneously.
Issue: This does NOT have to done at LAT level. This is a proof test, and could be done at the subsystem level, and on Qual Grid with mass models.
Time: After LAT T-V test
Facilities:
Large shake table
GSE to support LAT with same compliance as SC interface structure

Requirement: 5.3.12.4.2 Lateral Axis Loads, Primary Structures
Parameter: LAT primary structures able to withstand lateral static loads of ±4.0 g at liftoff/transonic and ±0.1 g at MECO

Verification Test Plan: T and A

Sine-burst test in both lateral directions during LAT vibration test. This test is combined with the verification test for 5.3.12.4.1, since 5.3.12.4.3 says that loads must be applied in all axes simultaneously.

Issue: This does NOT have to done at LAT level. This is a proof test, and could be done at the subsystem level, and on Qual Grid with mass models.

Time: After LAT T-V test

Facilities:

Large shake table

GSE to support LAT with same compliance as SC interface structure

Requirement: 5.3.12.4.3 Combined Loads, Primary Structures

Parameter: Thrust and lateral loads applied simultaneously and in all combinations

Note: This is not standard procedure for GSFC. Remove from IRD and LAT Perf Spec.

Note: This requirement is just a modifier of 5.3.12.4.1, .2 and should probably be

Verification Test Plan: I

Sine-burst test in each lateral direction and thrust direction simultaneously during LAT vibration test. Verification of this requirement is just to assure that verification tests for 5.3.12.4.1, .2 were done simultaneously.

Time: After LAT T-V test

Facilities:

None

Requirement: 5.3.12.4.4 Static Loads, Secondary Structures

Parameter: Secondary structures designed for limit load of ±12.0 g applied to each axis independently

Note: There are no secondary structures on the LAT. All are in subsystems, if that, so this requirement will be verified at the subsystem level, and probably does not belong in the LAT Performance Spec.

Note: Need better definition of a secondary structure, since most subsystem structures are considered primary.

Verification Test Plan: I

Subsystem tests to confirm this.

Time: At subsystem qualification module delivery.

Facilities:

None

Requirement: 5.3.12.5.1 Instrument Random Vibration

Parameter: LAT qualified for ASD vibration levels per GEVS Table D-6

Verification Test Plan: T and A

Run low-level sine-sweep test to verify natural frequencies and mode shapes of the LAT (without Radiators). Then run random vibration test at PFQ levels

Time: After LAT T-V test

Facilities:

Large shake table

GSE to support LAT with same compliance as SC interface structure

Plate to simulate stiffness of Radiators mounted to Grid

Requirement: 5.3.12.5.2 Component Evaluation Vibration

Parameter: Subsystems verified for vibration per GEVS Table 2.4-4

Note: This requirement will be verified at the subsystem level, and probably does not belong in the LAT Performance Spec.

Verification Test Plan: I

Subsystem tests to confirm this.

Time: At subsystem qualification module delivery.

Facilities:

None

Requirement: 5.3.12.6 Acoustic Loads

Parameter: LAT qualified for acoustic loads per GEVS Table D-3

Verification Test Plan: T

Acoustic test LAT after vibration (without Radiators).

Time: After LAT vibration test.
Facilities:
Acoustic chamber
GSE to support LAT with same compliance as SC interface structure
Plate to simulate stiffness of Radiators mounted to Grid

Requirement: 5.3.12.7 Shock
Parameter: LAT capable of normal operation after shock levels per GEVS Table D-8 or D-9, as applicable
Note: Finalize shock value at SC interface to LAT, not from GEVS
Verification Test Plan: A
Propose testing at Observatory level, only, since this is not a driving requirement. LAT-level verification would be Observatory FEA analysis of showing expected shock acceleration loads at SC interface of LAT, and how this is lower than the vibration requirement for the expected frequency
Time: After LAT delivery
Facilities:
None

Requirement: 5.3.12.8 Launch Temperature
Parameter: LAT must withstand 0 to 30 degC temp range while off, during launch
Verification Test Plan: T and A
Included in LAT thermal-cycle verification testing for requirement 5.3.12.3.1
Time: After LAT integration
Facilities:
None

Requirement: 5.3.12.9 Launch Pressure
Parameter: LAT capable of tolerating pressure time rate of change per Delta II Payload Planner's Guide, Section 4.2.1, Fig 4.2 when off.
Verification Test Plan: A
Venting analysis of LAT for CDR.
Time: CDR
Facilities:
None

Requirement: 5.3.12.10 On-Orbit Thermal
Parameter: LAT capable of normal operation when exposed to thermal fluxes: The solar constant thermal flux is 1419 W/m2 in the hot case and 1286 W/m2 in the cold case. The Earth IR thermal flux is 265 W/m2 in the hot case and 208 W/m2 in the cold case. The albedo factors are 0.40 (hot) and 0.25 (cold).
Note: this requirement is not tied to any temperature range, so it in not specific enough. It is also too vague regarding where on the LAT can be exposed. Propose that this be DELETED, and REPLACED with new requirements (see below).
Verification Test Plan: T and A

Requirement: 5.3.12.10.1 Earth IR and Albedo Flux Environment
Parameter: LAT capable of normal operation while any exposed surfaces are subjected to the Earth IR loads of 265 W/m^2 (hot case), and 208 W/m^2 (cold case), plus Earth Albedo factor of 0.40 (hot case), and 0.25 (cold case). NEW REQUIREMENT
Verification Test Plan: T, A, I
Thermal-vacuum test of flight LAT (without Radiators). This verifies performance of LAT due to temperature changes brought about by these thermal loads.
Thermal-balance test of Qual Grid and flight Radiators, with external radiative heat sources to simulate earth heat loading. This verifies performance thermal control system of LAT under these (changing) loads. This is a subsystem level test (Mech Systems), so verification of this requirement involves checking test report.
Time: During flight LAT integration for Qual Grid. After LAT integration for flight LAT thermal-vacuum test.
Facilities:
Thermal-vacuum chamber with cold shroud, big enough for LAT without Radiators
Hot/cold plates to mount to the LAT in place of Radiators, to drive the LAT temperature

Maybe radiative heat source to verify thermal performance of thermal shielding

Requirement: 5.3.12.10.2 Solar Thermal Flux Environment
Parameter: In addition to the above thermal loading, exposed surfaces on the +Y side of the LAT shall be capable of normal operation under sustained exposure to the solar thermal flux environment of 1419 W/m^2 (hot case), and 1286 W/m^2 (cold case).
Verification: T, A

8.2.4 The Radiators and other exposed components on the +X and –X sides of the LAT shall be capable of tolerating a backloading from the solar panels of TBD watts/m^2 per side, with only one side exposed at a time.
Driving Req: IRD 3.2.3.1, LAT Ops Spec
Verification: T, A

8.2.5 During normal operation, a Radiator panel shall be exposed to a view angle of the sun of not more than 5 degrees (TBR) for sustained periods of time, with only one Radiator exposed at a time.
Driving Req: IRD 3.2.3.2.2, LAT Ops Spec
Verification: T, A

8.2.6 With the LAT off, a Radiator panel shall be capable of enduring sustained full exposure to the solar thermal flux environment of 1419 W/m^2 (hot case), and 1286 W/m^2 (cold case), with a maximum heat transfer to the Grid of 40 W (TBR).
Driving Req: IRD 3.2.3.2.2, LPS 5.3.12.10
Verification: T, A

Requirement: 5.3.12.11.1 Total Dose Radiation
Parameter: Instrument must withstand 5X total dose estimate given in GLAST MSS Section 3.2.4.1.2.1.1
Note: This is covered in the EEE Parts Plan, and will be verified by subsystem-level QA activities. REMOVE.

Requirement: 5.3.12.11.2 LET Spectrum
Parameter: Instrument must withstand LET spectrum given in GLAST MSS Section 3.2.4.1.2.1.3
Note: This is covered in the EEE Parts Plan, and will be verified by subsystem-level QA activities. REMOVE.

Requirement: 5.3.12.11.3 Single Event Effects
Parameter: Parts selected for immunity to single event effects, using LET of 8 MeV/mg/cm2 as guideline.
Note: This is covered in the EEE Parts Plan, and will be verified by subsystem-level QA activities. REMOVE.