LAT Verification Test Plans

Discussed at the GLAST Mechanical Systems Meeting
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at Goddard Space Flight Center

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Verification Philosophy

- Qualification and Validation
  - Test planning is based on incremental validation of models and qualification of processes
  - We are in-process on a three-step qualification process now
    - CAL and TKR prototypes being built and environmentally tested right now, to validate FEA models and work through fabrication processes
    - CAL, TKR, and Mech Systems plan high-fidelity EM models to be fabricated, assembled, and tested using processes planned for flight units
    - Actual qualification will be done bottom-up. This just make sense, especially given the production-line fabrication we will employ
- Acceptance and Verification Testing
  - Subsystems performance will be verified as part of the assembly process
    - Results provide immediate feedback for production line process control
    - With world-wide production effort, this clarifies responsibilities
    - Minimizes schedule and shipping risk if re-work is needed
  - Test as you build
    - MCM burn-in >> Tray thermal-cycle >> Module thermal-vac >> LAT thermal-vac
    - Uses modularity to our advantage, reducing risk of high-level failure/non-compliance

Verification Testing Process Flow

- Verification Process Flow Chart
  - Want to walk through our verification and validation plans
  - Process flow chart shows how bottoms-up flow of testing proceeds
  - Hope to focus on how early testing mitigates technical risk
  - Would like feedback on weak areas or holes in verification plan
- Environmental and Functional Verification Matrices
  - Do not adequately show progression of testing, so process flow is needed
- Test Plan Sequence
  - Detailed list of all expected tests will be guts of Environmental Test Plan
  - Too detailed to follow flow of verification steps

LAT Validation and Verification Process Flow

Martin Nordby

Rev Date: 9-Nov-00
Print Date: 9-Nov-00

Vibe	Random vibrate and/or sine sw	**T-C**	Thermal-cycle at 1 atmosphere	**Qual.**	Qualify design/process for flight
Ac	Acoustic	**Val.**	Validate an analytical model	**PFQ**	Proto-flight qual test levels
T-V	Thermal-vacuum	**Ver.**	Test that perf. is as expected	**Acc**	Acceptance test levels

TKR--Vibe, T-C EM Tray
Level: Qual
Results:
Qual design, processes
Validate tray FEA model
Verify functional performance

Comments:
Flight design, materials
Prototype processes
Probably acoustic(?)

TKR--Vibe, T-V EM Module
Level: Qual
Results:
Validate module FEA model
Verify struc, therm perf
Verify functional performance

Comments:
2-4 trays with working SSD's

TKR--Vibe, Ac Qual Tray
Level: PFQ
Results:
Qual design, processes
Validate tray FEA model
Verify functional performance

Comments:

TKR--T-V Qual Tray
Level: PFQ
Results:
Qual. Tray thermal design
Val. Tray thermal FEA model
Ver. Tray performance
Characterize SSD perf.
Comments:
Thermal-cycle instead?

TKR--Vibe Q1 Qual Module
Level: PFQ
Results:
Qual. Module struc design
Val. Module struc FEA model
Qual. Grid/TKR structural joint

Comments:
Acoustic not needed?

TKR--T-V Q1 Qual Module
Level: PFQ
Results:
Qual. Module thermal design
Val. Module thermal FEA model
Ver. Module thermal perf (dT/dz)
Qual. Grid/TKR thermal joint
Characterize functional perf.
Comments:

TKR--Q1 Module to Cal. Unit I&T

TKR--Vibe, T-C All Flt Trays
Level: Acc
Results:
Workmanship test
Ver. thermal, functional perf

Comments:
Only vibe sample, or none?
Only T-C for best work. test?

TKR--Vibe, T-V All Flt Modules
Level: Acc
Results:
Workmanship test
Verify performance
Comments:
Thermal-vac needed?
T-V only a sample?
Leakage current vs temp instead?

TKR--F1-2 Modules to Cal. Unit I&T

TKR--F3-16 Modules to Flt LAT I&T

CAL--Vibe EM Module
Level: Qual
Results:
Qual design
Val. module structural FEA model

Comments:
Fully populated with CsI
Flight design, materials
Prototype processes

CAL--Thermal-Vac EM Module
Level: Qual
Results:
Validate thermal FEA model
Verify thermal perf
Calibration studies (light vs temp)

Comments:
Thermal design qual'd?

CAL--Vibe Q1 Qual Module
Level: PFQ
Results:
Qual. design, processes
Val. module structural FEA model
Qual. Grid/CAL structural joint

Comments:
Vibe Mech Module first?
Vibe Mech Module only?

CAL--T-V Q1 Qual Module
Level: PFQ
Results:
Qual thermal design, processes
Val. module thermal FEA model
Verify thermal performance
Qual. Grid/CAL thermal joint
Comments:
Thermal-cycle instead?

CAL--Q1 Module to Cal. Unit I&T

CAL--Vibe, T-C All Flt Modules
Level: Acc
Results:
Workmanship test
Verify performance

Comments:
Thermal-vac needed?
T-cycle only a sample?

CAL--F1-2 Modules to Cal. Unit I&T

CAL--F3-16 Modules to Flt LAT I&T

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Ac	Acoustic	**Val.**	Validate an analytical model	**PFQ**	Proto-flight qual test levels
T-V	Thermal-vacuum	**Ver.**	Test that perf. is as expected	**Acc**	Acceptance test levels

Mech--T-V EM Grid+Rad's
Level: Qual
Results:
Val. thermal FEA model
Val. Rad/Grid bolted joint model

Comments:
Qual bolted joint designs?

Mech--Vibe, Ac Flt Radiator's
Level: PFQ
Results:
Qual design, connections
Val. Rad. struc FEA model
Ver. struc performance

Comments:
Use SC mount models

Mech--T-V Flt Radiators
Level: PFQ
Results:
Qual thermal design
Val. Rad. thermal FEA model
Val. Rad/Grid bolted joint model
Ver. thermal performance
Comments:

Mech--Vibe Qual Grid
Level: PFQ w/Mass Models
Results:
Qual struc design
Val. struc FEA model
Val. Bolted joint models

Comments:

Mech--T-V Qual Grid + Flt Rad's
Level: Acc w/Therm Models
Results:
Qual Rad. mnt thermal design
Val. LAT thermal FEA model
Characterize thermal perf

Comments:
Includes thermal balance
Qual Grid, Flight Rad's
EM or flight Thermal Shield?
Test upside down

Mech--Rad's to Obs I&T

Mech--Load Test Flt Grid
Level: Proof
Results:
Qual struc joints
Qual. bonded joints

Comments:
T-C instead/also for better qual?
Vibe Qual. test not useful

Mech--Grid to Flt I&T

ACD--Vibe, Ac EM ACD
Level: Qual
Results:
Val. struc FEA model
Val. Tile connection method

Comments:
Dummy tiles?

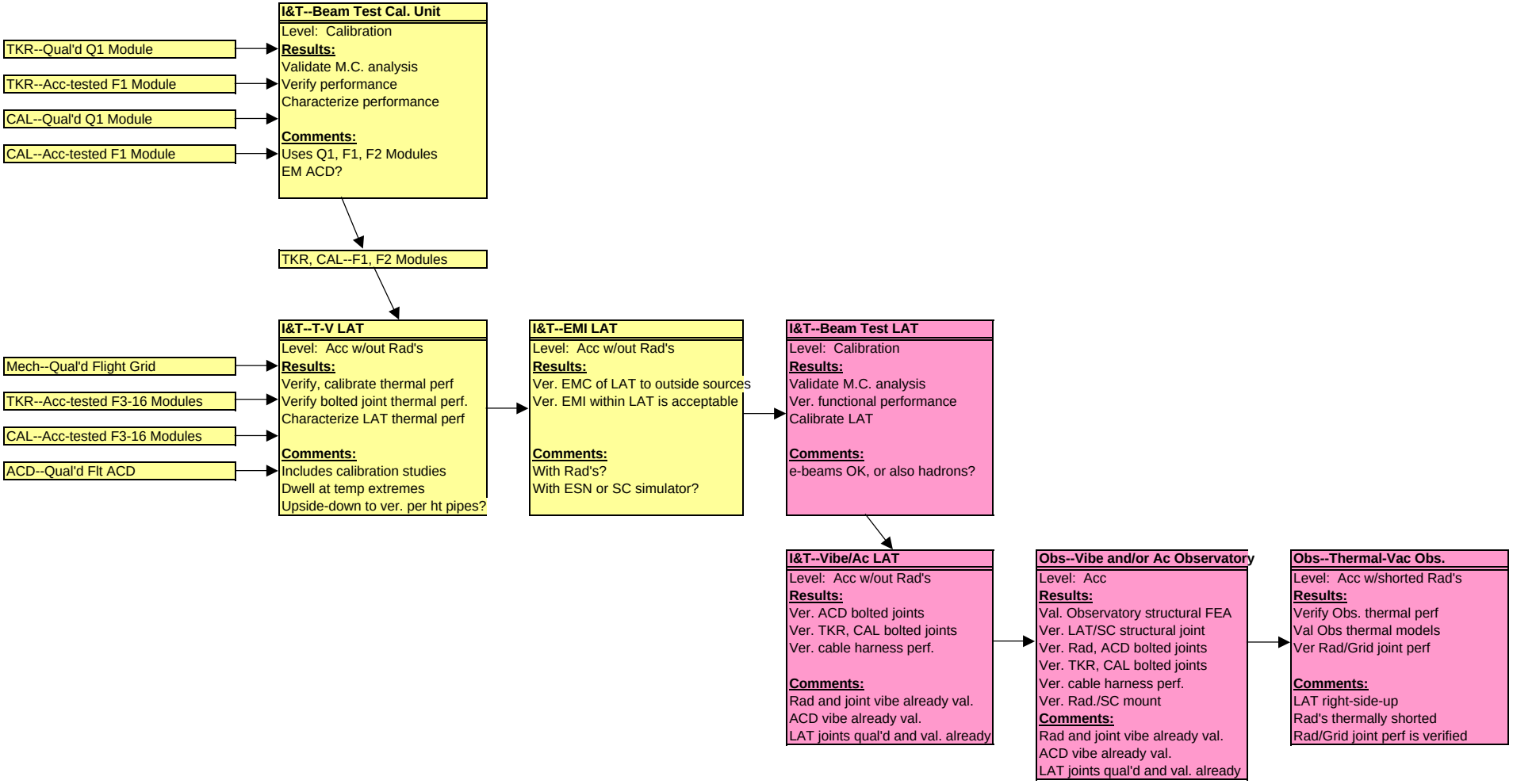
ACD--Vibe, Ac ACD/Shield
Level: PFQ
Results:
Qual. struc design, processes
Val. struc FEA model
Qual. Tile connection method
Qual. Grid/ACD joint
Comments:

ACD--T-V ACD/Shield
Level: PFQ
Results:
Qual. thermal design
Val. thermal FEA model

Comments:
Ver. thermal radiation model?

ACD--ACD to Flt LAT I&T

LAT Validation and Verification Process Flow	Rev Date: 9-Nov-00	Vibe	Random vibrate and/or sine sw	T-C	Thermal-cycle at 1 atmosphere	Qual.	Qualify design/process for flight
Martin Nordby	Print Date: 9-Nov-00	Ac	Acoustic	Val.	Validate an analytical model	PFQ	Proto-flight qual test levels
		T-V	Thermal-vacuum	Ver.	Test that perf. is as expected	Acc	Acceptance test levels



Environmental Verification Matrix

Martin Nordby

Revision Date: 9-Nov-00
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	Fit / Dim Check	Struc Strength	Mass, C.G.	Mass Properties	Sine sweep	Random Vibe	Acoustic	Mechanical shock	Thermal Balance	Thermal Cycling	Thermal-Vacuum	EMC	Alignment	Pressure	Flight Qt'y	Flight Spares
Tracker																
Qual Trays	M	Proof	M		PFQ	PFQ	PFQ			PFQ	PFQ		M			10
Qual Module (TKR #1)	M	Proof	M	M	PFQ	PFQ					PFQ	PFQ	M	Ana		1
Trays	M		M			Acc				Acc			M		304	28+20
Modules (TKR #2-18)	M		M		Acc	Acc					Acc	Acc	M		16	1
Calorimeter																
Qual Module (CAL #1)	M	Proof	M	M	PFQ	PFQ					PFQ	PFQ	M	Ana		1
Modules (CAL #2-18)	M		M		Acc	Acc					Acc	Acc			16	1
Anti-Coincidence Detector																
ACD Flight Unit	M	Proof	M	M	PFQ	PFQ	PFQ				PFQ	PFQ	M	Ana	1	
Mechanical Systems																
Grid Structure	M	Proof	M												1	1
Heat Pipes	M									PFQ				Proof	34	4
Radiators	M	Proof	M		PFQ	PFQ	PFQ			PFQ	PFQ				2	
Qual. Grid Assembly	M	Proof	M		PFQ, MM	PFQ, MM				PFQ, TM						1
Flight Grid Assembly	M	Proof	M												1	
Grid Ass'y w/ Radiators									PFQ, TM		PFQ, TM				1	
Electronic Systems																
TEM, SIU, ACD Units	M		M		PFQ	PFQ					PFQ	PFQ		Ana	20	3
Cable Harness	M		M													
LAT Flight Unit	M		M				Acc				Acc	Acc	M	Ana	1	
GLAST Observatory															1	

Ana:	Analysis	Acc:	Acceptance-level testing	M:	Measure or Inspect
MM:	Test, using Mass Models	PFQ:	Protoflight Qual-level testing	S:	Test on sample of total
TM:	Test, using Thermal Models	Qual:	Prototype Qual-level testing	Y:	Yes, this is performed
		Proof:	Test to Proof levels		

Functional Test Matrix

Martin Nordby

Revision Date: **7-Aug-00**
Print Date: **9-Nov-00**

	Parts Screening	Radiation/SEE	Visual, Dim.	Hi Temp Burn-In	Functional	Calibration	Special Testing	Flight Qt'y	Flight Spares
Tracker									
ASIC's	Y	Proof, S			Acc	Y		16128	2016+
EEE Parts	Y	Proof, S							
Front-End Boards				Proof	Acc			588	76+30
Silicon Detectors	Y		M, S				Leakage current, bad channels	9216	1152+518
Silicon Ladders			M, S				Leakage current, bad channels	2304	288+64
Qual Trays			M		Acc			10	
Qual Module (TKR #1)			M		Acc	Y		1	
Trays			M		Acc			294	38+10
Modules (TKR #2-18)			M		Acc	Y		15	2
Calorimeter									
ASIC's	Y	Proof, S			Acc	Y		3072	384+
EEE Parts	Y	Proof, S							
Front-End Boards				Proof	Acc			64	8
CsI Logs			M		Acc		Light output and uniformity	1536	192+24
Qual Module (CAL #1)			M		Acc	Y		1	
Modules (CAL #2-18)			M		Acc	Y		15	2
Anti-Coincidence Detector									
ASIC's	Y	Proof, S			Acc	Y		290	54
EEE Parts	Y	Proof, S							
Front-End Boards				Proof	Acc				
ACD Tiles, Fibers, PMT's			M		Acc		EMC testing on components	145	27
ACD Flight Unit					Acc	Y		1	
Mechanical Systems									
EEE Parts	Y	Proof, S							
Grid Assembly			M	Proof	Acc	Y	SC, GSE fit checks	1	
Electronic Systems									
ASIC's	Y	Proof, S			Acc	Y			
EEE Parts	Y	Proof, S							
TEM, SIU, ACD Boards				Proof	PFQ		Board-level EMC testing	62	10
TEM, SIU, ACD Units					Acc			20	3
LAT Calibration Unit					Acc	Y		1	
LAT Flight Unit					Acc	Y		1	

Verification Test Plan

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Revision Date: 9-Nov-00
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Type	Test	Tested on…	Place	Level	Range	Cycles	Env.	Req #1	Req #2
TKR Module #1 Parts Testing									
Perf	Temp cycle survival	FEE boards		Qual	-50 to +75 degC	4 cycles	atmos		
Perf	Radiation, SEE test	EEE parts		Proof					
Perf	Leakage current, bad channels	SSD's							
Perf	Load test	Mech parts		Qual					
TKR Tray #1-10 Qual Testing									
Perf	Mech fit-up test	Qual Trays	SLAC						
Perf	Weighing	Qual Trays	SLAC						
Perf	Functional elec test	Qual Trays	SLAC						
Env	Proof load test	Qual Trays	SLAC	Qual	1.25 x load limit	1 cycle		GEVS 2.4.1.4.1	
Perf	Pre-shake elec test	Qual Trays	SLAC						
Env	Sine sweep	Qual Trays		PFQ				?	
Env	Random vibe	Qual Trays		PFQ				GEVS 2.4.2	
Env	Acoustic	Qual Trays		PFQ				GEVS 2.4.2	
Perf	Post-shake elec test	Qual Trays	SLAC						
Env	Thermal cycling	Qual Trays	SLAC	PFQ	+/- 10 degC	4 cycles	atmos	?	
Env	Thermal-vacuum	Qual Trays	SLAC	PFQ	+/- 10 degC	4 cycles	10^-5 T	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	Qual Trays	SLAC						
TKR Module #1 Qual Testing									
Perf	Mech fit-up test	Qual Module	SLAC						
Perf	Weighing	Qual Module	SLAC						
Perf	Functional elec test	Qual Module	SLAC						
Env	Proof load test	Qual Module	SLAC	Qual	1.25 x load limit	1 cycle		GEVS 2.4.1.4.1	
Perf	Pre-shake elec test	Qual Module	SLAC						
Perf	Mass properties measurement	Qual Module						GEVS 2.4.7.1	
Env	Sine sweep	Qual Module		PFQ	5-50 Hz			GEVS 2.4.3.2	
Env	Random vibe	Qual Module		PFQ				GEVS 2.4.2	
Perf	Post-shake elec test	Qual Module	SLAC						
Env	Thermal-vacuum	Qual Module	SLAC	PFQ	+/- 10 degC	4 cycles	10^-5 T	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	Qual Module	SLAC						
Env	EMC	Qual Module	SLAC	PFQ				GEVS 2.5.1.2	
Perf	Post-EMC elec test	Qual Module	SLAC						
Perf	Mechanical survey	Qual Module	SLAC						
Perf	Electrical interface check	Qual Module	SLAC						
TKR Module #2-18 Parts Testing									

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Type	Test	Tested on…	Place	Level	Range	Cycles	Env.	Req #1	Req #2
Perf	Temp cycle survival	FEE boards		Acc	-50 to +75 degC	4 cycles	atmos		
Perf	Load test	Mech parts		Acc					
Perf	Incoming screening	EEE parts		Acc					
Perf	Incoming inspection	Mech parts		Acc					
TKR Tray #2-362 Testing									
Perf	Mech fit-up test	Trays	INFN						
Perf	Weighing	Trays	INFN						
Perf	Functional elec test	Trays	INFN						
Perf	Pre-shake elec test	Trays	INFN						
Env	Random vibe	Trays	INFN	Acc				GEVS 2.4.2.5	
Perf	Post-shake elec test	Trays	INFN						
Env	Thermal cycling	Trays	INFN	Acc	+/- 0 degC	4 cycles	atmos	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	Trays	INFN						
TKR Module #2-18 Testing									
Perf	Mech fit-up test	Module	SLAC						
Perf	Weighing	Module	SLAC						
Perf	Functional elec test	Module	SLAC						
Perf	Pre-shake elec test	Module	SLAC						
Env	Sine sweep	Module		Acc	5-50 Hz			GEVS 2.4.3.2	
Env	Random vibe	Module		Acc				GEVS 2.4.2.5	
Perf	Post-shake elec test	Module	SLAC						
Env	Thermal-vacuum	Module	SLAC	Acc	+/- 0 degC	4 cycles	10^-5 T	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	Module	SLAC						
Env	EMC	Module	SLAC					GEVS 2.5.1.2	
Perf	Post-EMC elec test		SLAC						
Perf	Mechanical survey	Qual Module	SLAC						
Perf	Electrical interface check	Qual Module	SLAC						
CAL Module #1 Parts Testing									
Perf	Temp cycle survival	FEE boards		Qual	-50 to +75 degC	4 cycles	atmos		
Perf	Radiation, SEE test	EEE parts		Proof					
Perf	Light output and uniformity	CsI Logs							
Perf	Load test	Mech parts		Qual					
CAL Module #1 Qual Testing									
Perf	Mech fit-up test	Qual Module	NRL						

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Type	Test	Tested on…	Place	Level	Range	Cycles	Env.	Req #1	Req #2
Perf	Weighing	Qual Module	NRL						
Perf	Functional elec test	Qual Module	NRL						
Env	Proof load test	Qual Module	NRL	Qual	1.25 x load limit	1 cycle		GEVS 2.4.1.4.1	
Perf	Pre-shake elec test	Qual Module	NRL						
Perf	Mass properties measurement	Qual Module	NRL	Qual				GEVS 2.4.7.1	
Env	Sine sweep	Qual Module	NRL	PFQ	5-50 Hz			GEVS 2.4.3.2	
Env	Random vibe	Qual Module	NRL	PFQ				GEVS 2.4.2	
Perf	Post-shake elec test	Qual Module	NRL						
Env	Thermal-vacuum	Qual Module	NRL	PFQ	+/- 10 degC	4 cycles	10^-5 T	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	Qual Module	NRL						
Env	EMC	Qual Module	NRL					GEVS 2.5.1.2	
Perf	Post-EMC elec test	Qual Module	NRL						
Perf	Mechanical survey	Qual Module	NRL						
Perf	Electrical interface check	Qual Module	NRL						
CAL Module #2-18 Parts Testing									
Perf	Temp cycle survival	FEE boards		Acc	-50 to +75 degC	4 cycles	atmos		
Perf	Load test	Mech parts		Acc					
Perf	Incoming screening	EEE parts		Acc					
Perf	Incoming inspection	Mech parts		Acc					
CAL Module #2-18 Testing									
Perf	Mech fit-up test	Module	NRL						
Perf	Weighing	Module	NRL						
Perf	Functional elec test	Module	NRL						
Perf	Pre-shake elec test	Module	NRL						
Env	Sine sweep	Module	NRL	Acc	5-50 Hz			GEVS 2.4.3.2	
Env	Random vibe	Module	NRL	Acc				GEVS 2.4.2.5	
Perf	Post-shake elec test	Module	NRL						
Env	Thermal-vacuum	Module	NRL	Acc	+/- 0 degC	4 cycles	10^-5 T	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	Module	NRL						
Env	EMC	Module	NRL					GEVS 2.5.1.2	
Perf	Post-EMC elec test	Module	NRL						
Perf	Mechanical survey	Module	NRL						
Perf	Electrical interface check	Module	NRL						
ACD Parts Testing									
Perf	Incoming screening	EEE parts		Acc					

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Perf	Radiation, SEE test	EEE parts		Proof					
Perf	Temp cycle survival	FEE boards		Acc	-50 to +75 degC	4 cycles	atmos		
Perf	EMC testing on tiles	Scintillators							
Perf	Incoming inspection	Mech parts		Acc					
Perf	Load test	Mech parts		Acc					
ACD Testing									
Perf	Mech fit-up test	ACD Unit	GSFC						
Perf	Weighing	ACD Unit	GSFC						
Env	Load test	ACD Unit	GSFC	PFQ	1.25 x load limit	1 cycle		GEVS 2.4.1.1.1	GEVS 2.4.1.
Perf	Functional elec test	ACD Unit	GSFC						
Perf	Pre-shake elec test	ACD Unit	GSFC						
Perf	Mass properties measurement	ACD Unit	GSFC	Acc				GEVS 2.4.7.1	
Env	Sine sweep	ACD Unit	GSFC	PFQ	5-50 Hz			GEVS 2.4.3.2	
Env	Random vibe	ACD Unit	GSFC	PFQ				GEVS 2.4.2.5	
Env	Acoustic	ACD Unit	GSFC	PFQ				GEVS 2.4.2	
Perf	Post-shake elec test	ACD Unit	GSFC						
Env	Thermal-vacuum	ACD Unit	GSFC	PFQ	+/- 10 degC	4 cycles	10^-5 T	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	ACD Unit	GSFC						
Env	EMC	ACD Unit	GSFC					GEVS 2.5.1.2	
Perf	Post-EMC elec test	ACD Unit	GSFC						
Perf	Mechanical survey	ACD Unit	GSFC						
Perf	Electrical interface check	ACD Unit	GSFC						
Grid, Radiator Parts Testing									
Perf	Incoming screening	EEE parts		Acc					
Perf	Incoming inspection	Mech parts		Acc					
Perf	Load test	Mech parts		Acc					
Perf	Temp cycle survival	FEE boards		Acc	-50 to +75 degC	4 cycles	atmos		
Perf	Over-pressure proof test	Heat pipes		Proof	2 x Max Design P	1 cycle		GSFC 731-0005-83	7.2.7.3.2.
Grid Assembly, Radiators									
Perf	Mech fit-up test	Qual. Grid	SLAC						
Perf	Weighing	Qual. Grid	SLAC						
Env	Load test	Qual. Grid	SLAC	Proof	1.25x load limit			GEVS 2.4.1.4.1	
Perf	Weighing	Qual. Grid	SLAC					GEVS 2.4.7.1	
Env	Sine sweep	Qual. Grid	SLAC	PFQ	5-50 Hz	w/mass models		GEVS 2.4.3.2	
Env	Random vibe	Qual. Grid	SLAC	PFQ		w/mass models		GEVS 2.4.2.5	

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Perf	Post-shake elec test	Qual. Grid	SLAC						
Perf	Mech fit-up test	Radiators	SLAC						
Perf	Weighing	Radiators	SLAC						
Env	Load test	Radiators	SLAC	PFQ	1.25x load limit			GEVS 2.4.1.4.1	
Env	Sine sweep	Radiators	SLAC	PFQ	5-50 Hz	w/mass models		GEVS 2.4.3.2	
Env	Random vibe	Radiators	SLAC	PFQ		w/mass models		GEVS 2.4.2.5	
Env	Acoustic	Radiators	SLAC	PFQ				GEVS 2.4.2	
Perf	Post-shake elec test	Radiators	SLAC						
Env	Thermal-vacuum	Radiators	SLAC	PFQ	+/- 0 degC	4 cycles	atmos		
Perf	Post-thermal elec test	Radiators	SLAC						
Perf	Pre-thermal elec test	Grid + Rad's							
Env	Thermal balance	Grid + Rad's		Acc			10^-5 T	GEVS 2.6.3	
Env	Thermal-vacuum	Grid + Rad's		PFQ	+/- 0 degC	4 cycles	10^-5 T	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	Grid + Rad's							
Perf	Mech fit-up test	Flight Grid	SLAC						
Perf	Weighing	Flight Grid	SLAC						
Env	Load test	Flight Grid	SLAC	Proof	1.25x load limit			GEVS 2.4.1.4.1	
Perf	Weighing	Flight Grid	SLAC					GEVS 2.4.7.1	
Electronics Parts Testing									
Perf	Incoming screening	EEE parts		Acc					
Perf	Radiation, SEE test	EEE parts		Proof					
Perf	Incoming inspection	Mech parts		Acc					
Perf	Load test	Mech parts		Acc					
Electronic Systems Testing									
Perf	Mech fit-up test	Elec boards	SLAC						
Perf	Weighing	Elec boards	SLAC						
Env	Load test	Elec boards	SLAC	PFQ	1.25 x load limit	1 cycle		GEVS 2.4.1.1.1	GEVS 2.4.1.
Perf	Temp cycle survival	Elec boards	SLAC	Acc	-50 to +75 degC	4 cycles	atmos		
Perf	Functional elec test	Elec boards	SLAC						
Env	Board level EMC test	Elec boards	SLAC					GEVS 2.5.1.2	
Perf	Board level funtional test	Elec boards	SLAC						
Perf	Mech fit-up test	Elec boxes	SLAC						
Perf	Weighing	Elec boxes	SLAC						

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Type	Test	Tested on…	Place	Level	Range	Cycles	Env.	Req #1	Req #2
Perf	Pre-shake elec test	Elec boxes	SLAC						
Env	Sine sweep	Elec boxes	SLAC	PFQ	5-50 Hz			GEVS 2.4.3.2	
Env	Random vibe	Elec boxes	SLAC	PFQ				GEVS 2.4.2.5	
Env	Acoustic	Elec boxes	SLAC	PFQ				GEVS 2.4.2	
Perf	Post-shake elec test	Elec boxes	SLAC						
Env	Thermal-vacuum	Elec boxes	SLAC	PFQ	+/- 10 degC	4 cycles	10^-5 T	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	Elec boxes	SLAC						
Env	EMC	Elec boxes	SLAC					GEVS 2.5.1.2	
Perf	Post-EMC elec test	Elec boxes	SLAC						
Perf	Electrical interface check	Elec boxes	SLAC						
LAT Calibration Unit									
Perf	Incoming module acceptance	TKR, CAL	SLAC	Acc					
Perf	Functional elec test	LAT	SLAC						
Perf	Mechanical survey	LAT	SLAC						
Perf	Bench-top calibration	LAT	SLAC						
Env	EMC	LAT	SLAC					GEVS 2.5.1.2	
Perf	Post-EMC elec test	LAT	SLAC						
Perf	Beamline calibration	LAT	SLAC						
Perf	Post-run survey	LAT	SLAC						
Perf	Post-run elec test	LAT	SLAC						
LAT Flight Unit									
Perf	Incoming module acceptance	TKR, CAL	SLAC						
Perf	Incoming interface check	TKR, CAL	SLAC						
Perf	Functional elec test	LAT	SLAC						
Perf	Weighing	LAT	SLAC						
Perf	Mechanical survey	LAT	SLAC						
Perf	Bench-top calibration	LAT	SLAC						
Perf	Pre-thermal elec test	LAT							
Env	Thermal-vacuum	LAT		Acc	+/- 0 degC	1 cycle	10^-5 T	GEVS 2.6.2.4.b.3	
Perf	Post-thermal elec test	LAT							
Env	EMC	LAT	SLAC					GEVS 2.5.1.2	
Perf	Post-EMC elec test	LAT	SLAC						
Perf	Mechanical survey	LAT	SLAC						
Perf	Bench-top calibration	LAT	SLAC						
Perf	Pre-ship functional test	LAT	SLAC						
Perf	Post-ship functional test	LAT	SC Contr						