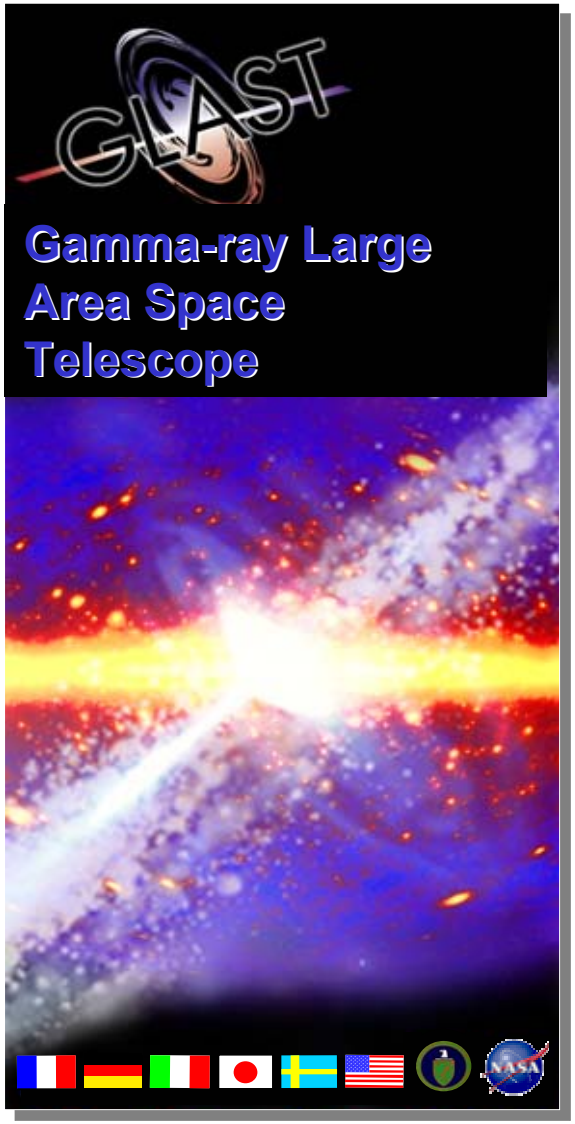

GLAST Large Area Telescope:

Electronics, Data Acquisition & Flight Software Overview
W.B.S 4.1.7

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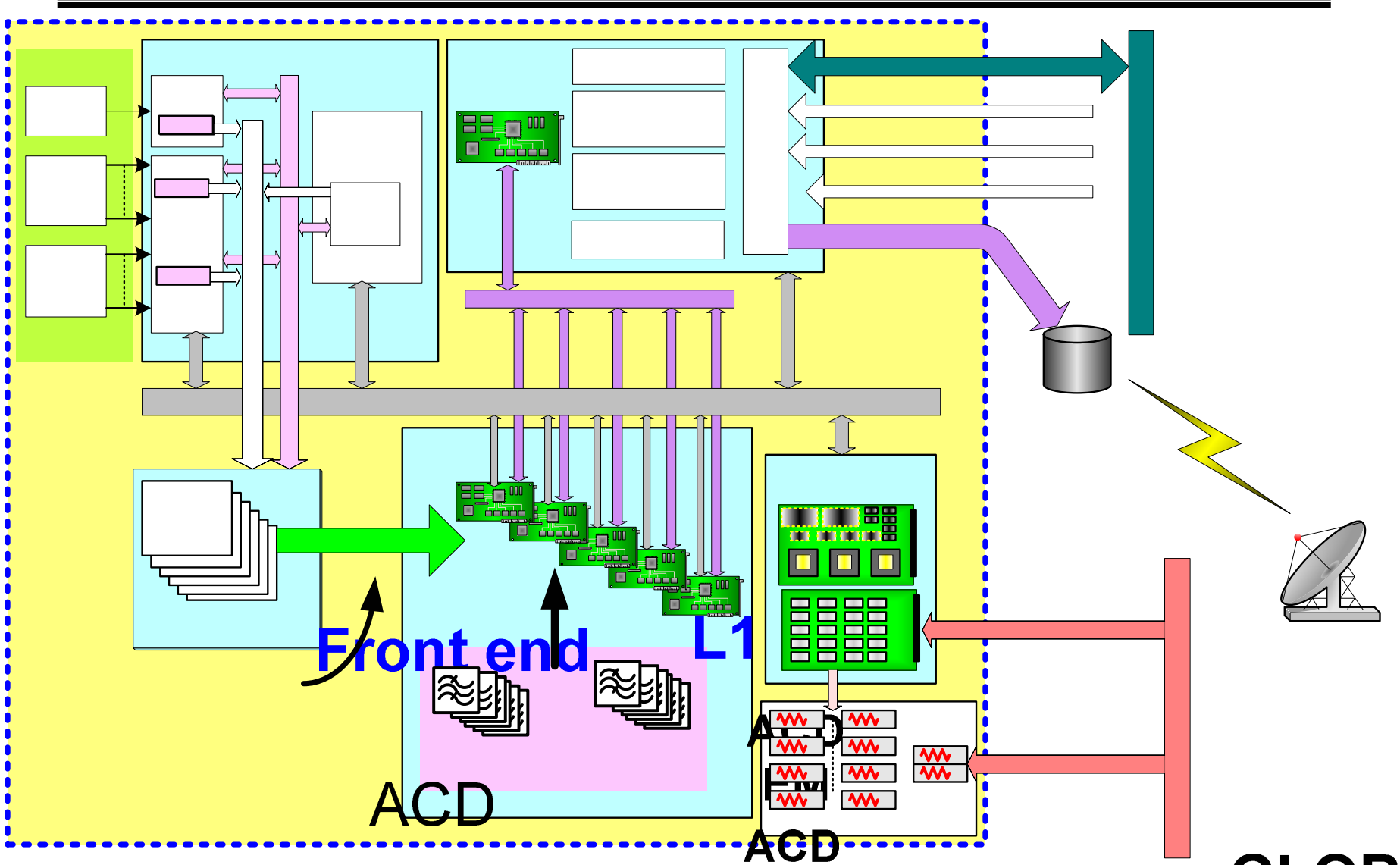
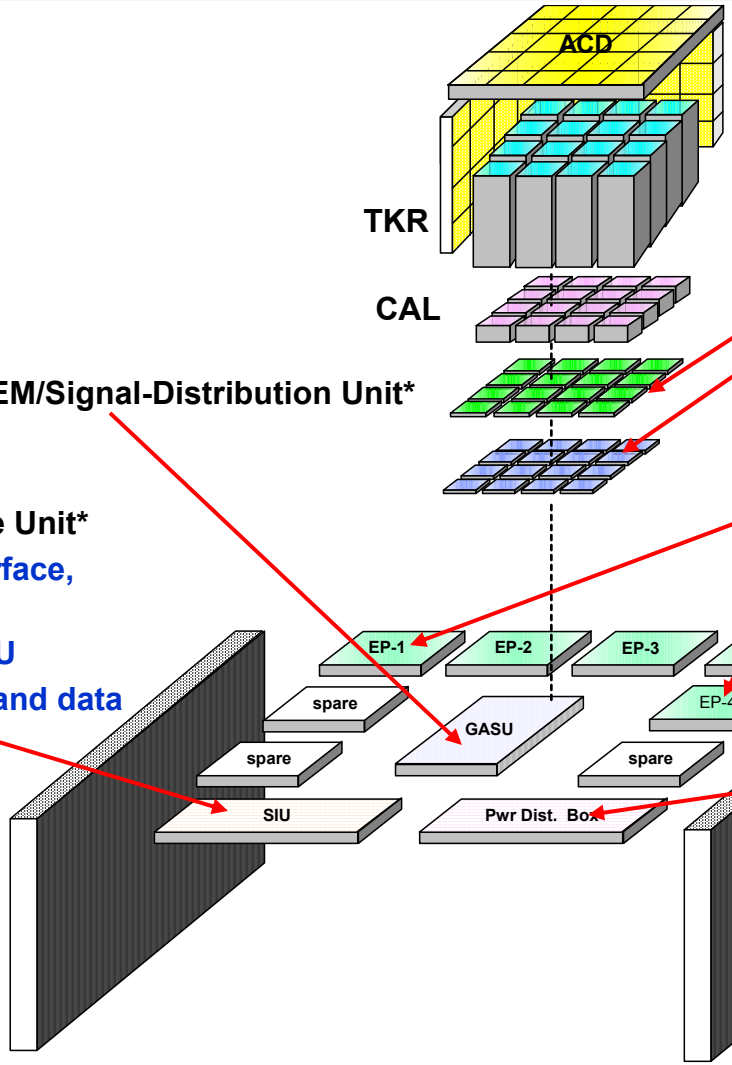
Outline

- Overview
- Level III Requirements
- Status
- Past Review Recommendations
- WBS Interfaces
- Organization
- Schedule Milestones
- Cost Plan

Subsystem Overview



Subsystem Overview (con't)



16 Tower Electronics Modules
- DAQ electronics module (DAQ-EM)
- Power-supplies for tower electronics

Global-Trigger/ACD-EM/Signal-Distribution Unit*

5 Event-Processor Units (4 + 1 Reserve)
- Eventbuilder
- Event processing CPU

Spacecraft Interface Unit*
- Spacecraft interface, control & data
- LAT control CPU
- LAT command and data interface

Power-Distribution Unit (PDU)*
- Spacecraft interface, power
- LAT power distribution
- LAT health monitoring

* Primary & Secondary Units shown in one chassis

Requirements Documents

- Level III Requirements
  - LAT-SS-019 Level III Trigger & Dataflow Requirements
  - LAT-SS-136 Level III Power System Requirements
- Level IV Requirements
  - LAT-SS-284 Level IV Trigger Requirements
  - LAT-SS-285 Level IV Dataflow Requirements
  - LAT-SS-399 Level IV Flight Software Requirements
  - LAT-SS-183 Level IV Power Supply Requirements
- Other Requirements documents
  - 433-IRD Spacecraft Interface Requirements
  - LAT-SS-00010 LAT Instrument Performance Specifications

Level III Requirements Summary

Electronics

Ref: LAT-SS-00019

Parameter	Requirement	Verification	Expected Performance
Trigger			
Adjust Input timing resolution	<100 ns	Test	50 ns
	Trigger acknowledge output	Test/Demonstration	Meet Requirement
TACK latency	< 1.3 μs	Test	< 1.3 usec
Timing Jitter	< +/- 50 ns	Test	< 50ns
Dead-time contribution	< 5 μs	Test	< 200 nsec
	Acknowledge blocking	Test/Demonstration	Meet Requirement
	Dead time cause	Test/Demonstration	Meet Requirement
Event Deadtime Report	< 500 ns	Test	< 500 ns
	Event Data Contribution	Test/Demonstration	Meet Requirement
	Diagnostics Mode	Test/Demonstration	Meet Requirement
Control System			
	Verify commanding interface	Test/Demonstration	Meet Requirement
	GRB response	Test/Demonstration	Meet Requirement
Event Data			
	Readout and overwrite protection	Test/Demonstration	Meet Requirement
	Filtering functions	Test/Demonstration	Meet Requirement
	Pointing & coordinate system	Test/Demonstration	Meet Requirement
	Dead-time for average orbit condition < 5%	Test/Demonstration	< 5% for T&DF
	Buffering for burst up to 20,000 photon events	Test/Demonstration	tbr, depends on CPU memory
	Monitoring & calibration	Test/Demonstration	Meet Requirement
Volume	< 0.25 m^3	Inspection	< 0.25 m^3
Mass	< 188 kg	Inspection	< 188 kg
Power	< 142 W (dayly average)	Test	< 142 W (daily average)
	< 330 W (peak, average over 1 sec)	Test	< 330 W (average over 1 sec)

Level III Requirements Summary (2)

Power System

Ref: LAT-SS-00136

Parameter	Requirement	Verification	Expected Performance
Input Power	28 VDC +6/- 6V	Test	22 V to 37 V DC
	< 1000 Watts peak	Test/Analysis	< 750 W
	< 650 Watts (daily average)	Test/Analysis	< 650 W
	Impedance	Analysis	tbd
	Primary/Redundant input power source	Analysis	Meet Requirement
	Switching	Test	Meet Requirement
	8 primary power circuits of 14 A	Analysis	2 to 5 circuits
	Control	Test	Meet Requirement
Telemetry	Telemetry monitoring internal voltage, current, and temperature	Test	Meet Requirement
Output Power	Supply power to Tower Electronics	Test	Meet Requirement
	Supply power to EPU	Test	Meet Requirement
	Supply power to SIU	Test	Meet Requirement
	Supply power to GASU	Test	Meet Requirement

Electronics, DAQ & FSW Status

- Balloon-flight effort ended
- Requirement documents created
- Electronics system design completed
  - Final partitioning of functions into locations at bottom of LAT
  - Interface to all other sub-systems defined
- Data formats within LAT (most important on Tower Electronics Module) defined
- Buffer depths on TEM simulated
- Tower Electronics DAQ Module prototype in fabrication
- Conceptual Design of most units documented
- Ground-Support Equipment card designed, fabricated, and in use
- Processor choice baselined
- Wooden 1:1 model of LAT with electronics boxes built
- FEMA created

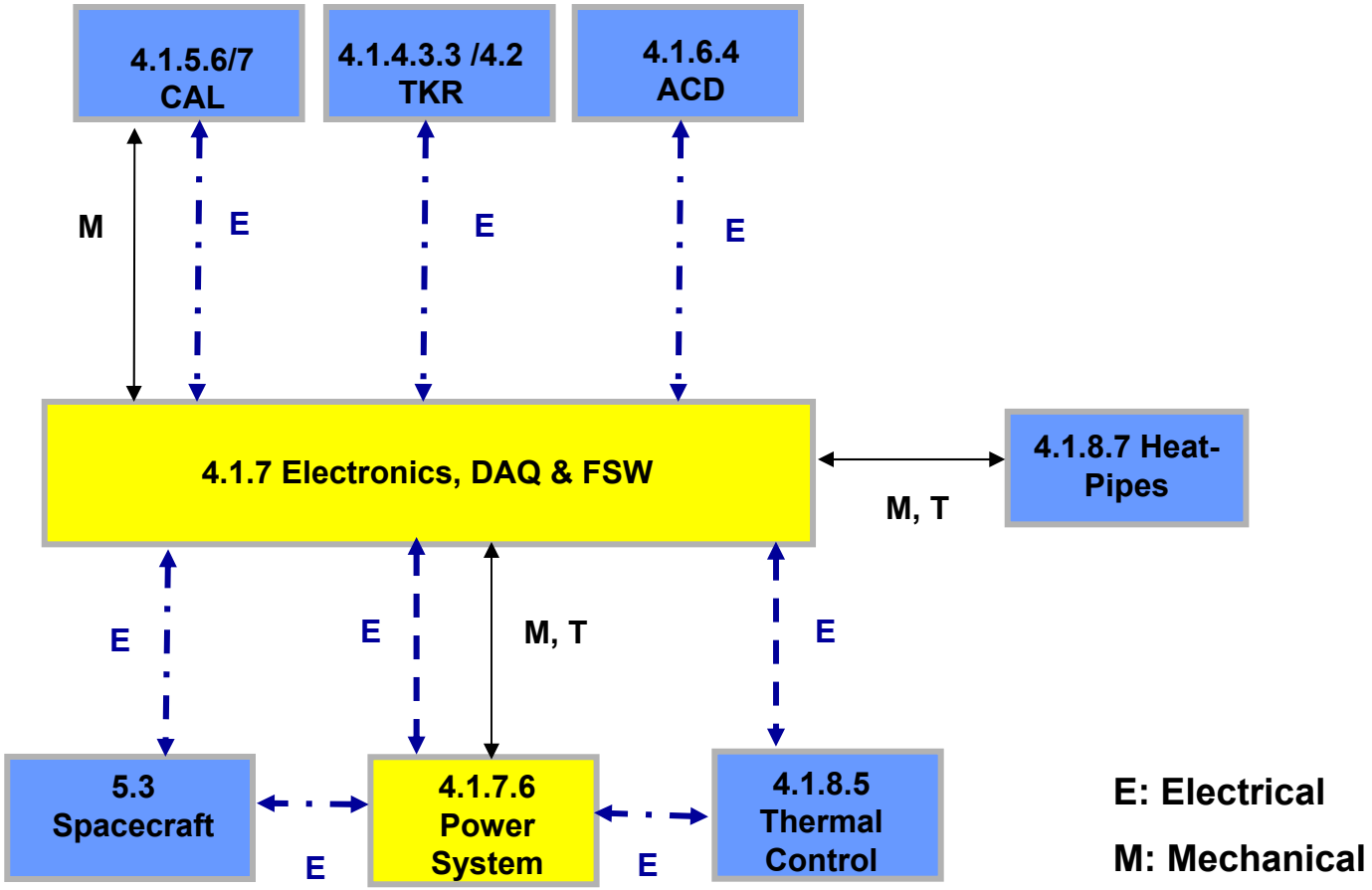
Electronics, DAQ & FSW Status (con't)

- **Balloon Flight**
  - Validated many elements of Flight Software Management Plan
    - Code development life cycle
    - Code building/distribution
    - Inline documentation generation
- **Dataflow Analysis**
  - Performed discrete event simulation
  - Designed/documented compact/efficient event format
    - More compact (nearly a factor of two smaller)
    - More "navigable" (easier for filter to read/process/span)
- **Filter Analysis**
  - Generated MC events
  - Processed events using trial algorithms (continuing effort)
    - Characterizing timing performance
    - Characterizing efficiency/purity
- **Hardware and software development on schedule**

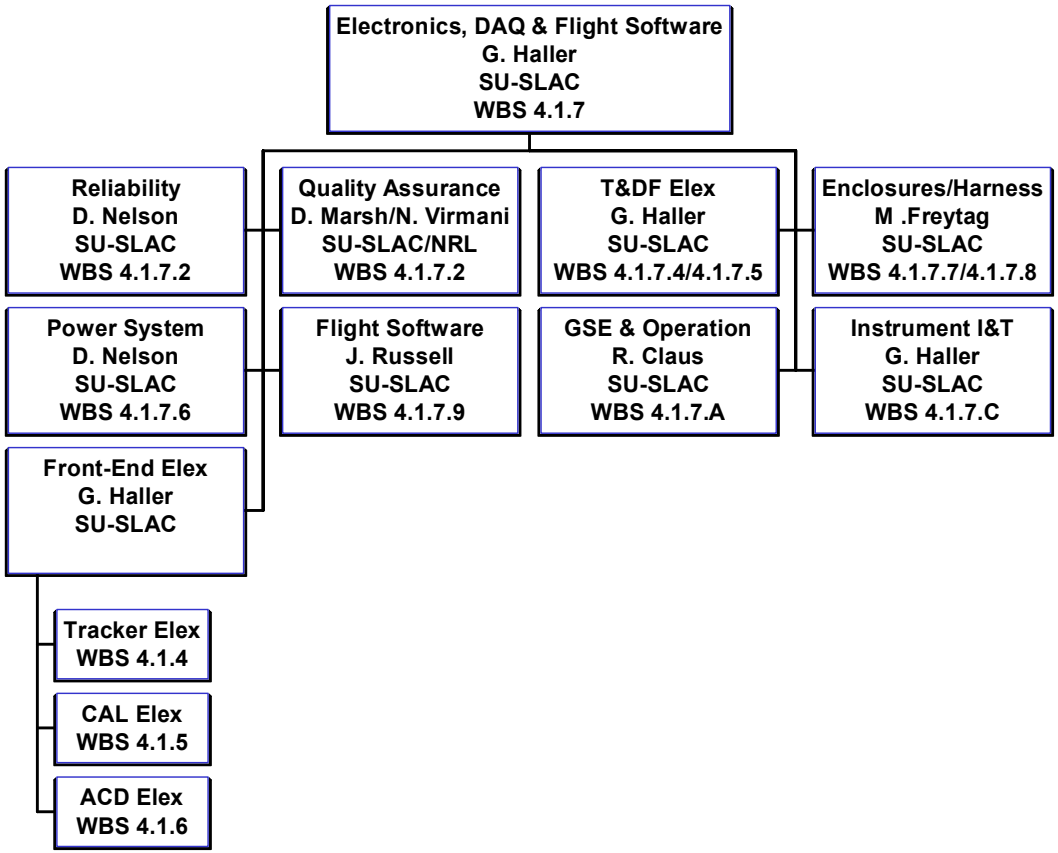
Recommendation from Feb 01 Review

- "Consider need for additional man-power to work on flight-software.."
  - Hired additional scientific programmer
  - FSW Team
    - JJ Russell (SU-SLAC, lead)
      - Curt Brune (SU-SLAC)
      - Mike Huffer (SU-SLAC)
      - Dave Lauben (SU-HEPL)
      - Tony Waite (SU-SLAC)
      - Dan Wood (NRL)
      - Dan Suson (Texas A&M)

Subsystem WBS Interfaces



Electronics Organization Charts



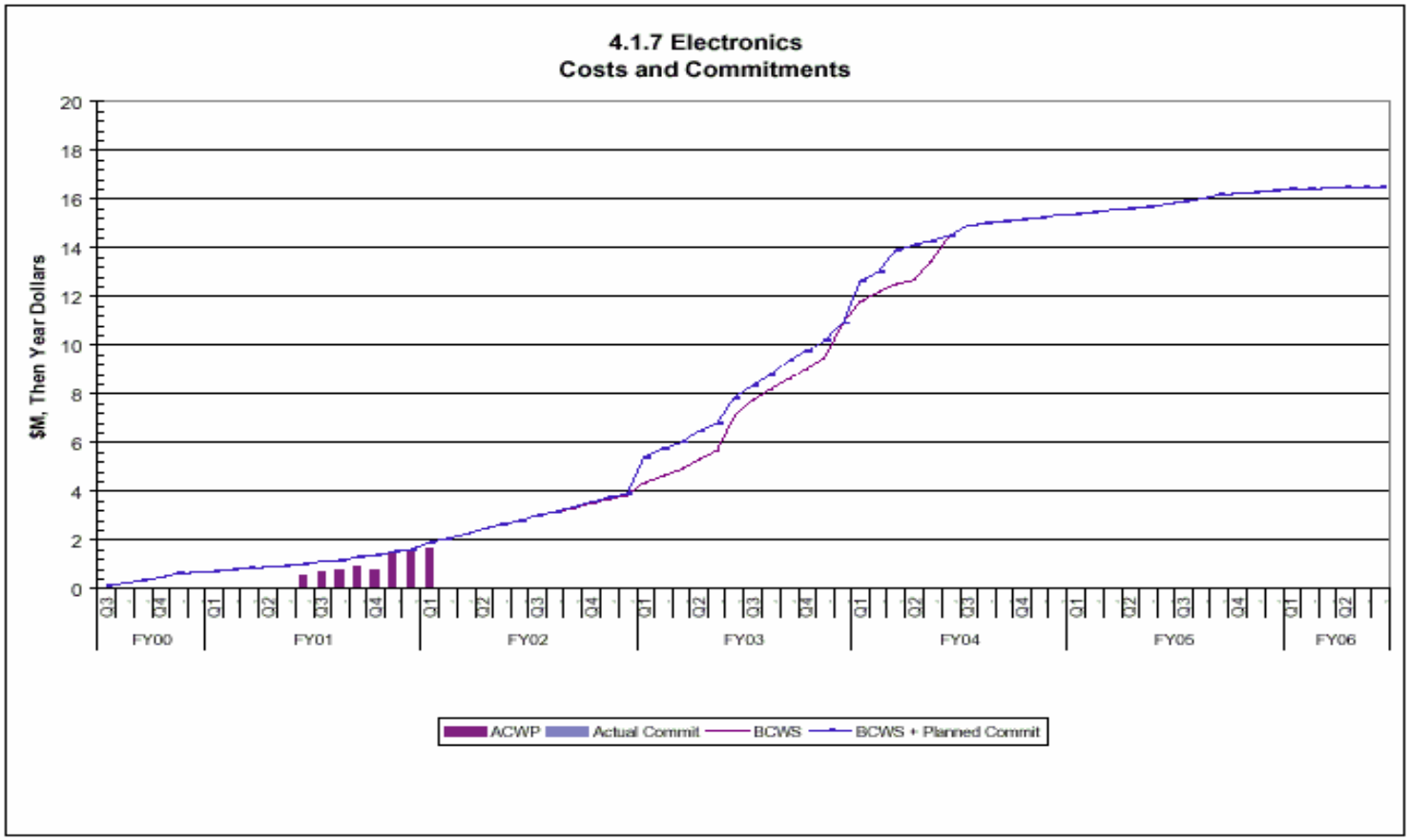
Key Level III Milestones

Electronics & DAQ Subsystem Requirements Review	04/25/01
Electronics & DAQ Pre-PDR	08/16/01
Tracker Elex - TEM System Test	02/07/02
Calorimeter Elex - TEM System Test	04/12/02
EGSE EM1 Release Available	04/22/02
ACD Elex - TEM System Test	07/01/02
Engineering Model 2 TEM to I&T	03/04/03
Engineering Model 2 System Test (HW & SW)	03/20/03
First Flight TEM to I&T	10/29/03
Full 16-Tower EM2 Test	11/15/03
Flight GASU/EPU/SIU/PDU/Harness to I&T	04/26/04

Key Level IV Milestones

Flight Software EM1, Complete Architecture	04/15/02
Global Trigger EM1 Available	05/15/02
Event Builder EM1 Available	06/15/02
Front-End Simulator Available	10/10/02
Spacecraft Interface Card Available	12/13/02
Global Trigger EM2 Available	01/31/03
Event Builder EM2 Available	03/20/03
Housekeeping Card EM2 Available	05/02/03
Multi-CPU Toolbox Flight-Software Complete	05/13/03

Electronics Cost & Commitments



Electronics Cost Type