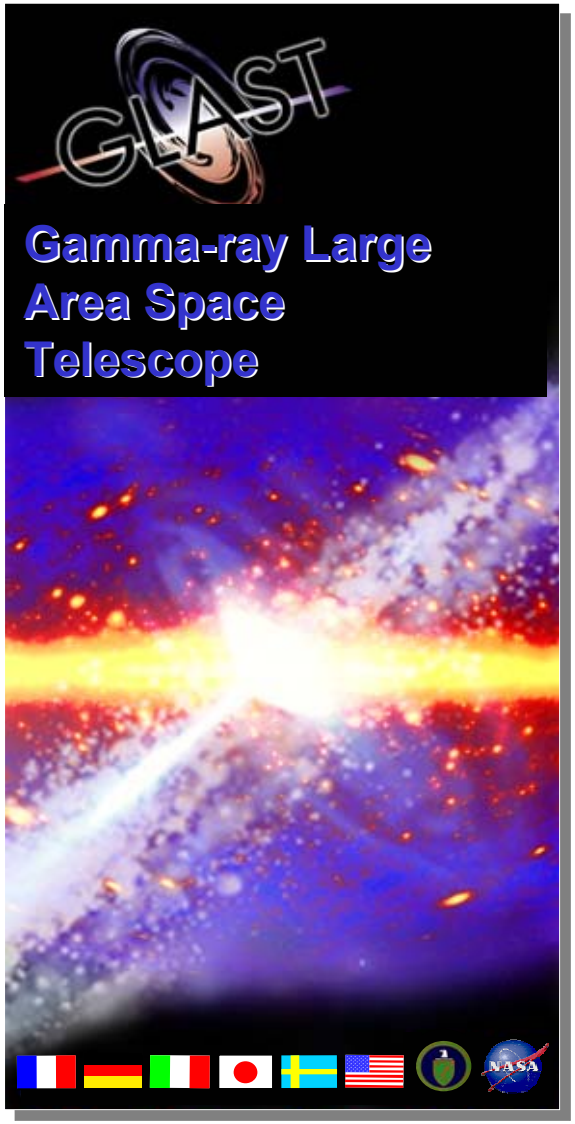


GLAST Large Area Telescope:

Project Status: Technical and Cost

Lowell Klaisner
Stanford Linear Accelerator Center
Stanford University
LAT Instrument Project Manager

klaisner@slac.stanford.edu
(650) 926-2726

Significant Changes since February 2003

1. CNES withdrew its financial support of the GLAST Project
2. Project Manager changed – organizational changes
3. Project Management prepared a rebaseline proposal
   a. Total of $17.2 million shared equally with DOE and NASA
   b. Project completion date delayed 3 months
   c. Passed all reviews – DOE signoff expected imminently
4. Successful CDR/CD-3 review
   a. Awaiting closure of open items and formal signoff
   b. Transition from design to construction of flight hardware
5. LAT Engineering model under test
   a. Tracker mini-tower, Calorimeter engineering model, and Tower Electronics Module engineering model
6. Next 6 months
   a. All subsystems fabricating flight hardware

Rebaseline Overview

- **Motivation for reviewing cost and schedule**
  - **CNES in France deciding to not fund LAT work**
  - **Completion of CDR/CD-3 Review**
    - **Design is mature**
    - **Construction of flight hardware beginning**
- **Proposal**
  - **LAT Funding increased by $17.2 million**
    - **Fabrication Phase (LAT construction project) increased by $11.7 million**
    - **Commissioning Phase increased by $5.5 million**

Proposed additions to budgets

Fabricate CDEs using US funds	$4.2
Tracker	$1.5
Anti-Coincidence Detector	$0.9
Electronics manufacturing costs	$0.8
Mechanical design / fabrication	$2.0
Schedule delay ("standing army")	$5.4
Increase in contingency	$2.4
Total	**$17.2**

All values in millions of dollars

Increases by system

- **Calorimeter $4.2 million**
  - CNES (French) funding for GLAST was terminated in May. This required adding the cost of the CDE manufacturing and some of the mechanical parts to the US costs.
- **Schedule $5.4 million**
  - The LAT schedule was delayed by the startup time required for CDE manufacturing. The other subsystems were reprogrammed to reduce risk. Delivery of the LAT moved from September 22, 2005 to December 1, 2005.
- **Tracker $1.5 million**
  - MCM circuit boards (fabrication and assembly), flex-circuit cables, bias circuits and ASICs cost more to complete the development than planned.
- **ACD $0.9 million**
  - BEA mechanical structure complexity increased over PDR
  - Both ASICs testing and ASICs qualification and screening efforts require significant additional investment

Increases by system

- **Electronics $0.8 million**
  - Power supply bids came in high, so chose to develop in-house.
  - Reduced risk through modification of Event Processor Unit by adding a Storage Interface Board.
  - Support of additional ASICs rounds (design as well as $100K procurement each time).
- **Mechanical $2.0 million**
  - Lockheed/Martin Phase II contract higher cost than planned (increased scope includes X-LAT final design work and more extensive testing of radiators and heat pipe).
- **Additional Contingency $2.4 million**
  - Additional funds to keep the available contingency at the same percentage of costs at risk.

Sources of Funding

- The LAT project is funded by:
  - A DOE Capital Equipment Project (MIE)
    - Funded through the Stanford Linear Accelerator Center (SLAC)
  - DOE Operating funds
    - Funded through SLAC
  - NASA GLAST Mission funds
    - Through a contract with Stanford University
  - Foreign Contributions
    - INFN Italy, Tracker Towers, Silicon Detectors
    - KTH Sweden, Cesium Iodide "logs"
    - JGC Japan, Silicon Detectors
    - IN2P3 France, Calorimeter support structure
  - Participation of the LAT Collaborating institutions

Fabrication Phase

- The Fabrication Phase of the LAT project is defined as all work on the LAT during the DOE Capital Equipment Project.
- The end of the DOE Capital Equipment Project occurs at the successful completion of the Critical Decision 4 review.
  - The revised criterion for CD-4 is the successful completion of the Pre-Environmental Test Review.
- Work in the Fabrication Phase is funded by:
  - The DOE Capital Equipment Project (MIE)
  - DOE Commissioning and Operating funds
  - NASA GLAST Mission funds
  - Foreign Contributions
  - Participation of the LAT Collaborating institutions

Commissioning Phase

- The LAT project enters the Commissioning Phase after the completion of the Fabrication Phase
- The work for the LAT project in this phase is:
  - Responsibility for the LAT environmental test
  - Pre-Shipment Review
    - After successful completion of this review the responsibility for the LAT instrument is accepted by the NASA GLAST Project Manger
  - Support of Observatory Integration
  - Support through launch and initial calibration on-orbit
- Funding for this phase comes from:
  - DOE Operating funds
  - NASA GLAST Mission funds
  - Participation by the LAT Collaborating institutions

Evolution of the IOC

- The Instrument Operations Center (IOC) is a deliverable of the LAT project.
- The original plan for LAT had the IOC implemented by the Hansen Experimental Physics Laboratory (HEPL) at Stanford, funded by NASA funds.
- During the detailed planning of the LAT the implementation of the IOC was transferred to the LAT project office, funded out of Fabrication Phase funds.
- The rebaseline funded the costs of implementing the IOC with DOE commissioning/operating funds.
  - The IOC manager remains funded from the Fabrication Phase to assure coordination with the rest of the project and to assure that the requirements of the deliverable are met

Delta Costs and Funding

Commissioning / Operating

	Total
Costs added to Commissioning / Operating	
LAT environmental test	$3.7
Instrument Operations Center	$1.8
Total	**$5.5**
Funding added to Commissioning / Operating	
NASA GLAST Mission Funds	$1.9
DOE Operating Funds	$3.6
Total	**$5.5**

Fabrication Phase

Net costs added to Fabrication Phase	
Total Costs Added to Fabrication Phase	$17.2
Costs identified as Operating/Comm.	$5.5
Difference	**$11.7**
Funding added to Fabriaction Phase	
NASA Glast Mission Funds	$6.7
DOE Capital Equipment Project (MIE)	$5.0
Total	**$11.7**

Total

Source of funds	
NASA	$8.6
DOE	$8.6
Total	**$17.2**

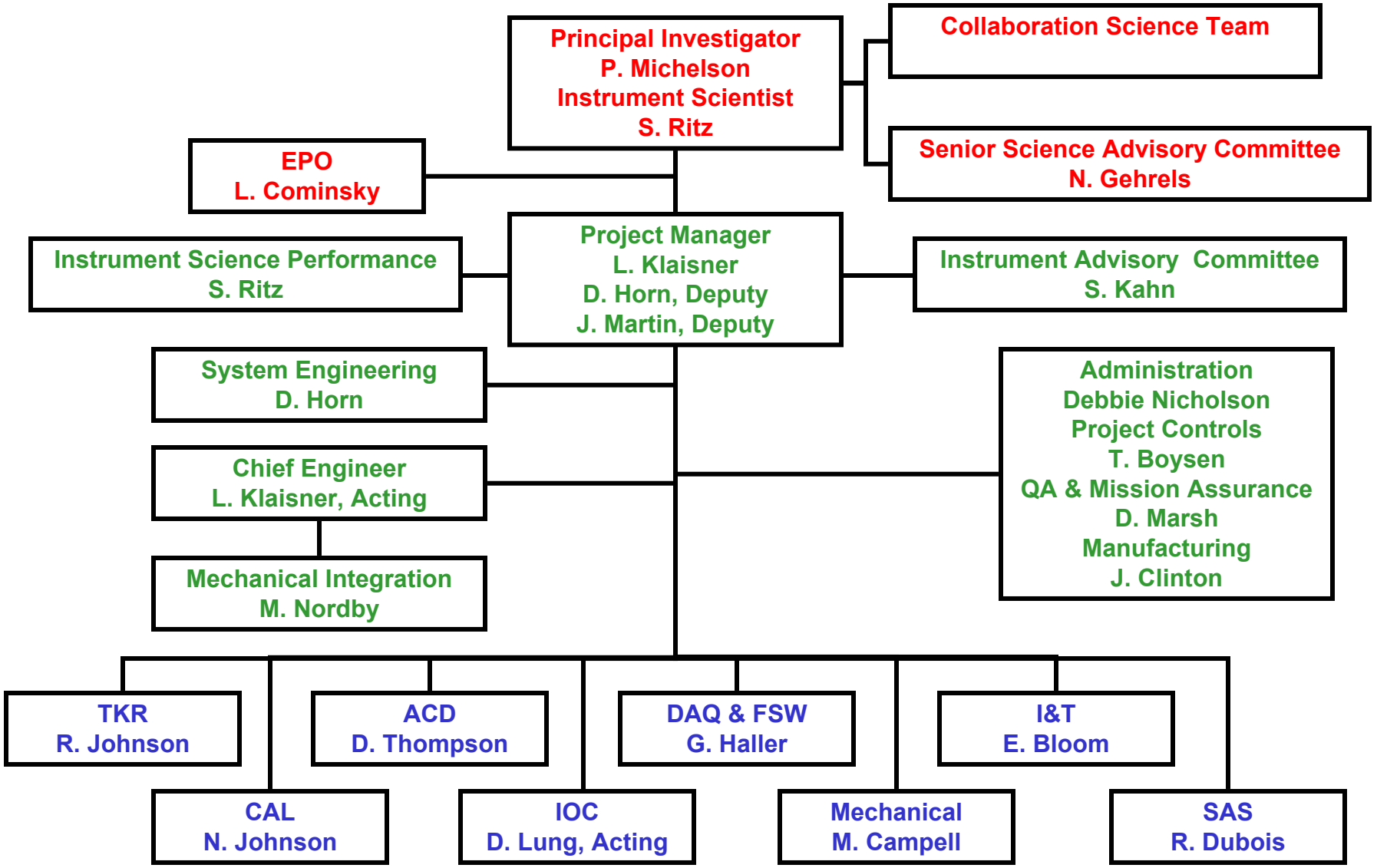
Total Fabrication Phase Cost and Funding

	Total
Baseline Fab Phase Cost	**$107.9**
Baseline Fab Phase Funding	**$121.7**
Baseline Fab Contingency	**$13.8**
New Fab Phase Cost	**$117.2**
New Fab Phase Funding	**$133.4**
New Fab Contingency	**$16.2**
Baseline cost at risk*	**$54.3**
Contingency as percent fo cost at risk	**25%**
with funded schedule float**	**33%**
New cost at risk*	**$63.7**
Contingency as percent fo cost at risk	**25%**
with funded schedule float**	**32%**

*Cost at Risk = Estimated cost to compete minus EPO costs

** The schedule has 14 weeks of schedule contingency funded at $3.9 million total when included the contingency becomes $17.7 million and $20.1 million respectively

LAT Organization Chart



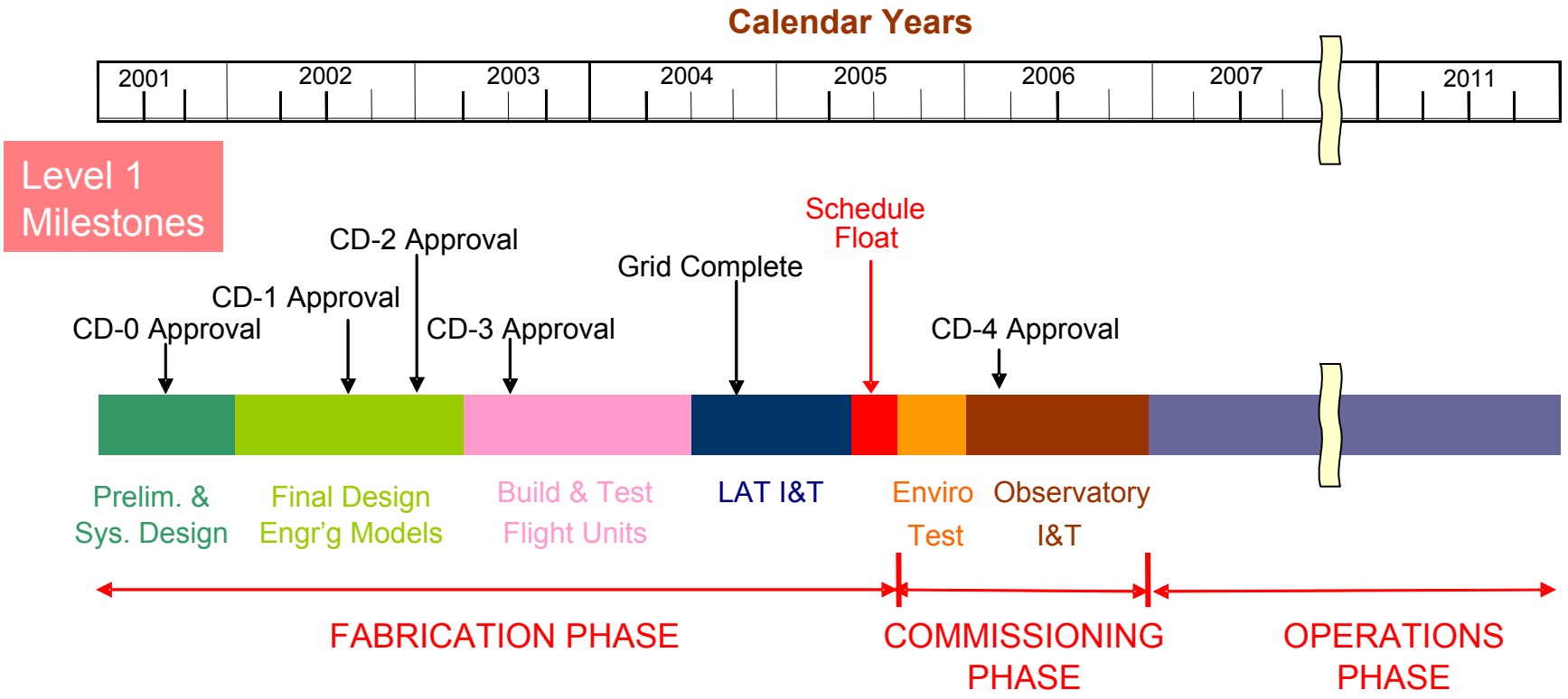
Added key personnel

- Mike Menning, Mechanical Engineering consultant focusing on the Cross LAT plate to electronics interface and the CAL-GRID interface.
- Nanda Menon, Providing an interface between the project and the effort in Italy. Helping the INFN personnel with test planning and execution.
- Hiroyasu Tajima, Physicist added full time to the Tracker group to assist with managing the start up of manufacturing.
- Eric Siskind, Experienced consultant working on DAQ system and detail designs.

Improved communications

- Putting in place milestones for each subsystem for the next 3 months
  - Review at weekly subsystem managers teleconference
- Daily 7:30 am management meeting with Michelson, Klaisner, Horn, Martin and Ritz to review priorities and assign action items
  - Focus on high priority issues and the path to closure
- Strong support by the GLAST Mission Office
  - Thermal and mechanical support
  - Monthly reviews with subsystem managers
    - Identifies areas that can use additional support
- Monthly face to face meetings of Subsystem Managers to discuss issues – particularly where one subsystem needs support from another subsystem

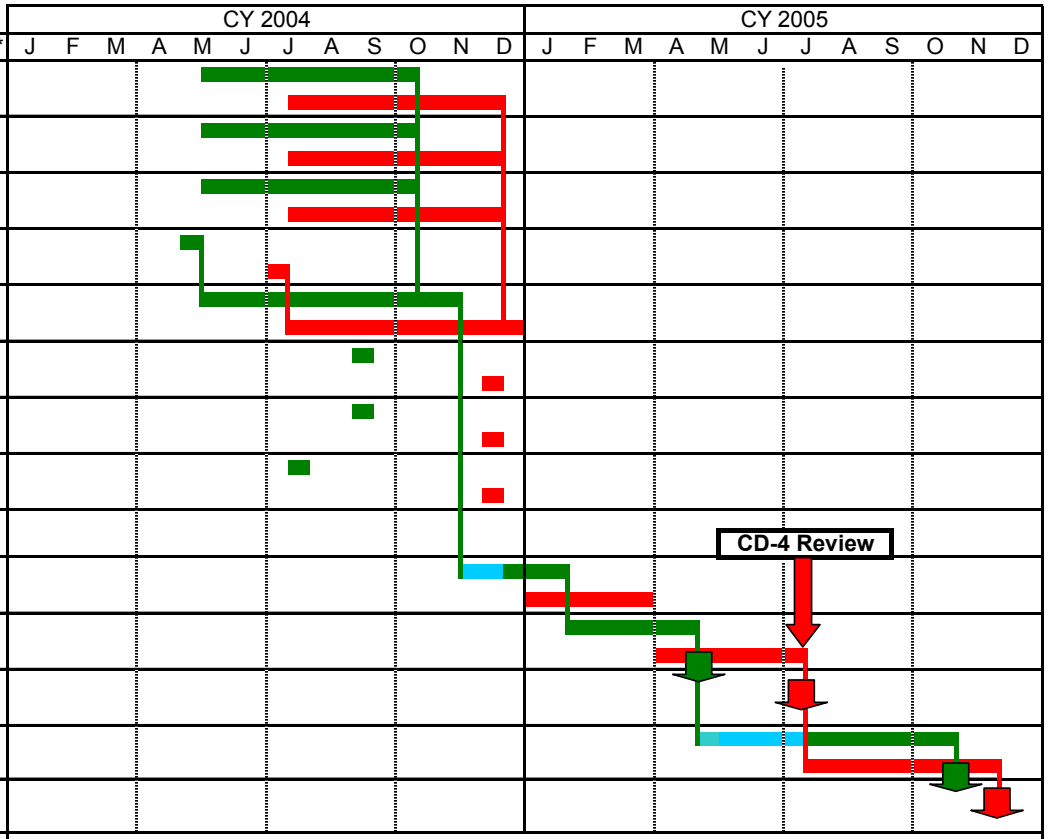
Overall Schedule



GLAST planned for launch in December 2006

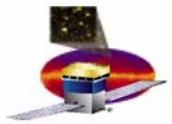
Planned dates and Milestones

		first unit	last unit	FLT*
Tracker	Planned	5/20/04	10/21/04	
	Milestones	7/14/04	12/17/04	8
Calorimeter	Planned	5/20/04	10/21/04	
	Milestones	7/14/04	12/17/04	8
TEM/TEMPS	Planned	5/20/04	10/21/04	
	Milestones	7/14/04	12/17/04	8
GRID Assembly	Planned		5/20/04	
	Milestones		7/14/04	8
Install Towers	Planned	5/20/04	11/11/04	
	Milestones	7/14/04	12/31/04	7
Anti-coincidence Detector	Planned		9/21/04	
	Milestones		12/17/04	12
Data Acquisition	Planned		9/10/04	
	Milestones		12/17/04	14
X-LAT Plate	Planned		8/2/04	
	Milestones		12/17/04	20
		Begin	**End**	
Install Global Items	Planned	12/9/04	1/20/05	
	Milestones	1/1/05	4/7/05	11
System Test	Planned	1/20/05	4/28/05	
	Milestones	4/7/05	7/14/05	11
Pre-envir. Test Review	Planned		4/28/05	
	Milestones		7/14/05	11
Environmental Test	Planned	7/14/05	11/3/05	
	Milestones	7/14/05	12/1/05	4
Pre-ship Review	Planned		11/3/05	
	Milestones		12/1/05	4



Planned early delivery dates
Milestone dates
Explict float imbeded in the plan

*FLT = weeks between planned completion and milestone



Level 1 and 2 Milestones

	Existing	Proposed	
Level 1 Milestones -- DOE/NASA Joint Oversight Group			
DOE Critical Decision (CD) 0 Approval	June 25, 2001	June 25, 2001	Actual
CD-1 Approval	July 1, 2002	July 23, 2002	Actual
CD-2 Approval	December 13, 2002	November 8, 2002	Actual
CD-3 Approval	July 15, 2003	August 31, 2003	
Flight Grid Complete	September 15, 2004	September 15, 2004	
CD-4 Approval	March 15, 2006	March 15, 2006	
Level 2 Milestones -- Federal Project Managers			
Launch Balloon Flight	August 1, 2001	August 1, 2001	Actual
Instrument Preliminary Design Review	January 8, 2002	January 8, 2002	Actual
Instrument Critical Design Review	April 30, 2003	May 16, 2003	Actual
TKR, CAL FMA,B Available for Calibration Unit	February 17, 2004	**See note:**	
Start LAT Integration	June 15, 2004	**August 24, 2004**	
Pre Enviornmental Review	February 15, 2005	**July 14, 2005**	
Instrument Pre-Ship Review (PSR)	July 7, 2005	**December 1, 2005**	

Note: The calibration test has been moved until after LAT integraion. Units FM A and B of the Tracker and Calorimeter will be installed in the

Proposed changes in Blue

LAT Collaboration Organizations

United States

- California State University at Sonoma (SSU)
- University of California at Santa Cruz - Santa Cruz Institute of Particle Physics (UCSC/SCIPP)
- Goddard Space Flight Center – Laboratory for High Energy Astrophysics (NASA/GSFC/LHEA)
- Naval Research Laboratory (NRL)
- Stanford University – Hanson Experimental Physics Laboratory (SU-HEPL)
- Stanford University - Stanford Linear Accelerator Center (SU-SLAC)
- Texas A&M University – Kingsville (TAMUK)
- University of Washington (UW)
- Washington University, St. Louis (WUStL)

France

- Centre National de la Recherche Scientifique / Institut National de Physique Nucléaire et de Physique des Particules (CNRS/IN2P3)
- Commissariat à l'Energie Atomique / Direction des Sciences de la Matière/ Département d'Astrophysique, de physique des Particules, de physique Nucléaire et de l'Instrumentation Associée (CEA/DSM/DAPNIA)

Italy

- Agenzia Spaziale Italiana (ASI)
- Istituto di Astrofisica Spaziale (IASF, CNR)
- Istituto Nazionale di Fisica Nucleare (INFN)

Japan GLAST Collaboration (JGC)

- Hiroshima University
- Institute for Space and Astronautical Science (ISAS)
- RIKEN

Swedish GLAST Consortium (SGC)

- Royal Institute of Technology (KTH)
- Stockholm University

Work Breakdown Structure

WBS ELEMENT		SUBSYSTEM MANAGEMENT	CONTRIBUTING INSTITUTIONS
4.1	LAT Fabrication Project	P. Michelson, P.I. S. Ritz	SU GSFC
4.1.1	Management	L. Klaisner, Proj. Mgr. D. Horn Deputy J. Martin, Deputy	SUSLAC
4.1.2	System Engineering	R. Horn, S.E. Mgr.	SU-SLAC
4.1.4	Tracker	R. Johnson, Mgr. R. Bellazzini, INFN Proj. Mgr.	INFN, JGC, SU-SLAC, UCSC
4.1.5	Calorimeter	N. Johnson, Mgr... H. Videau, IN2P3 Proj. Mgr.	CEA/DAPNIA, IN2P3, NRL, SGC,SU-SLAC
4.1.6	AntiCoincidence Detector	D. Thompson, Mgr.	GSFC/LHEA, WUStL
4.1.7	Electronics, Data Acquisition & Flight Software	G. Haller, Mgr.	SU-SLAC, NRL
4.1.8	Mechanical Systems	M. Campell, Mgr.	SU-SLAC
4.1.9	Instrument Integration & Test	E. Bloom, Mgr.	All
4.1.A	Performance & Safety Assurance	D. Marsh, Mgr.	All
4.1.B	Instrument Operations Center	D. Lung, Mgr. (Acting)	SU-SLAC
4.1.C	Education & Public Outreach	L. Cominsky, Mgr.	Sonoma State University
4.1.D	Science Analysis Software	R. Dubois, Mgr.	All

LAT Equipment Fabrication Funding

In Million US$

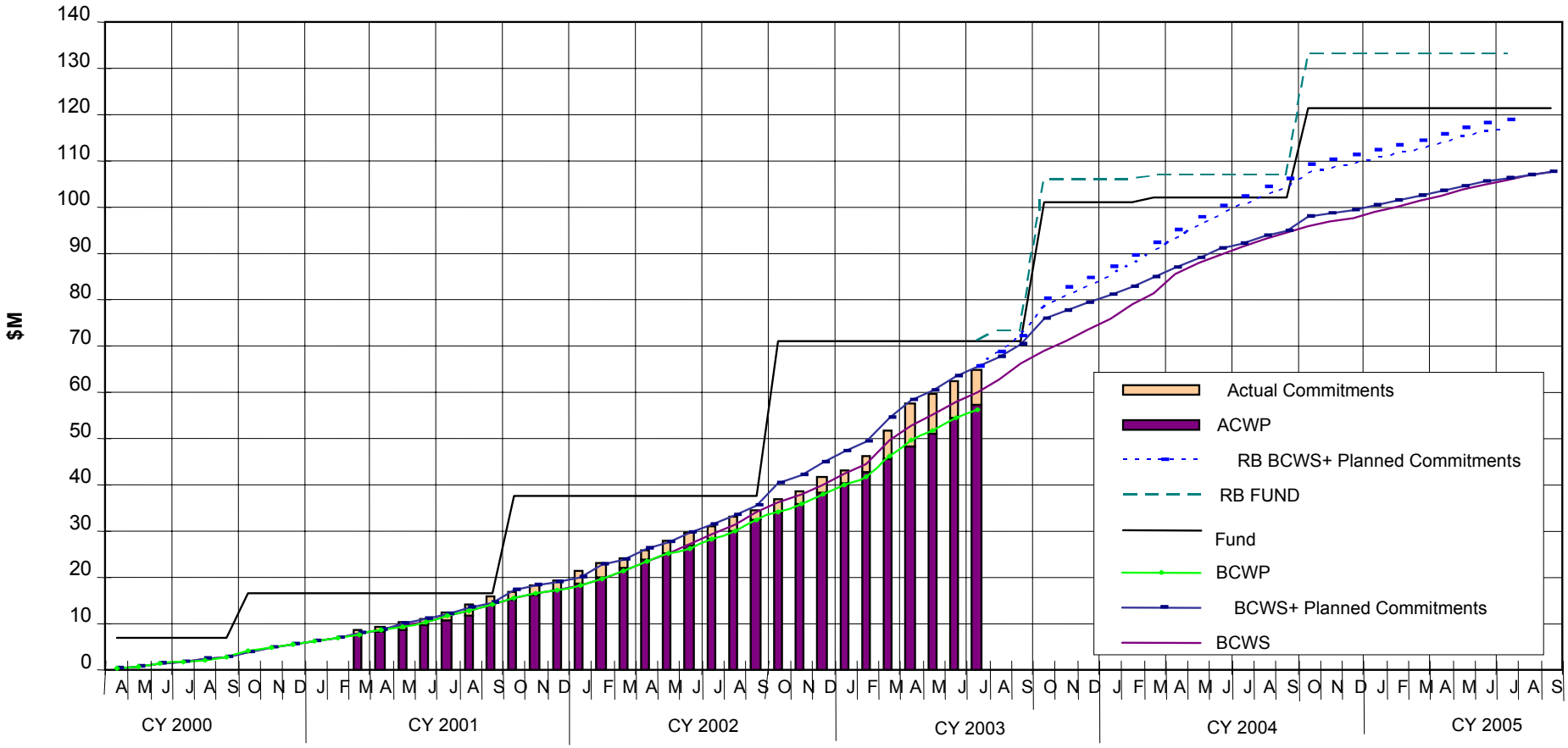
	Through CY02	CY03	CY04	CY05	TOTAL
USA (DOE)	19.0	8.7 8.7	6.8 8.0	2.6 6.3	37.0 42.0
USA (NASA)	26.1	22.1 27.6	23.3 23.2	11.8 13.2	83.3 90.0
France (CNES/IN2P3)	1.8 0.43	3.2 0.54	1.9 0.13	0.4 0.05	7.4 1.16
Italy (ASI/INFN)	3.3	4.8 4.7	1.0 0.7	0.5 0.0	9.6 8.7
Japan	2.0	1.0	1.0 TBD	1.0 TBD	5.0 TBD
Sweden	0.6	2.6 2.6	0.3 0.3	0.3 0.3	3.8 3.8

Plus significant management, science and laboratory manpower and expenses contributed by participating institutions

February 2003 IFC meeting numbers in black September 2003 in blue

LAT Rebaseline

Budget vs Actuals vs Performance
DOE + NASA Project Expenditures
4.1 LAT



Contingency Analysis

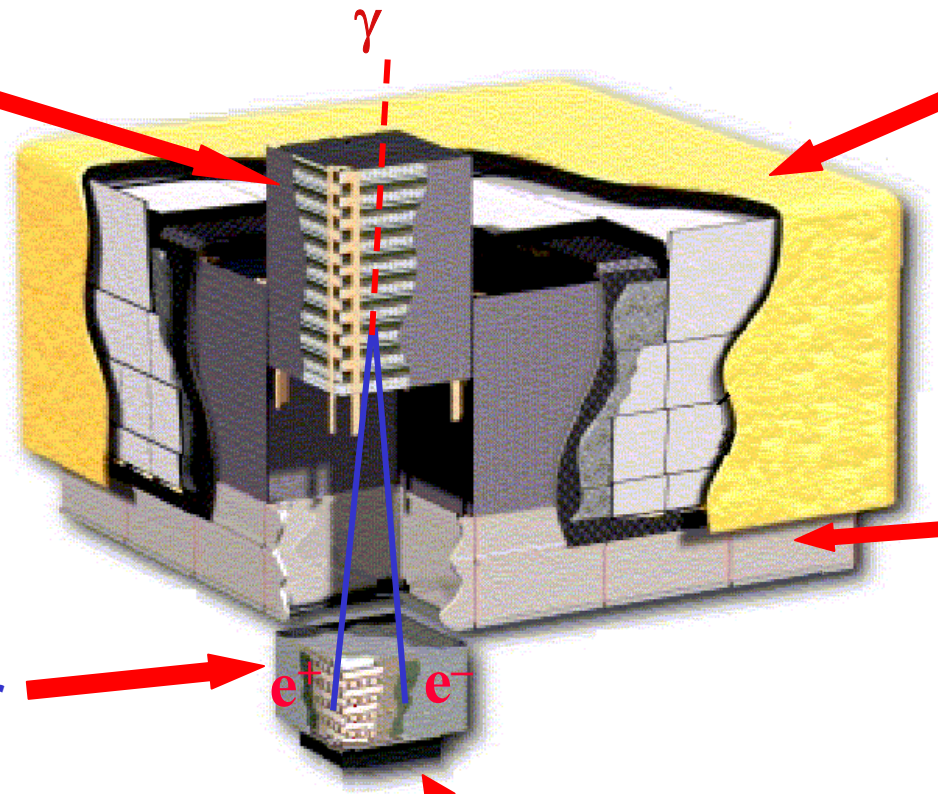
(Escalated K$) WBS Item	Project Estimate					
	To Date Cost*	To Go Cost	Total Cost	Contingency %	Contingency $	Total Cost Plus Cont.
4.1.1 Instrument Management	$ 8,197	$ 7,049	$ 15,246	13%	$ 911	$ 16,157
4.1.2 Systems Engineering	$ 3,599	$ 2,993	$ 6,592	12%	$ 366	$ 6,958
4.1.4 Tracker	$ 8,381	$ 4,091	$ 12,472	37%	$ 1,514	$ 13,986
4.1.5 Calorimeter	$ 8,965	$ 13,593	$ 22,558	22%	$ 3,019	$ 25,576
4.1.6 ACD	$ 7,090	$ 6,104	$ 13,194	30%	$ 1,806	$ 15,000
4.1.7 Electronics	$ 5,967	$ 11,932	$ 17,899	33%	$ 3,938	$ 21,837
4.1.8 Mechanical Systems	$ 4,961	$ 7,495	$ 12,456	30%	$ 2,249	$ 14,705
4.1.9 Instrument Integration & Test	$ 1,972	$ 4,836	$ 6,808	34%	$ 1,663	$ 8,471
4.1.A Performance & Safety Assurance	$ 1,149	$ 437	$ 1,586	18%	$ 77	$ 1,664
4.1.B Instrument Operations Center	$ 549	$ 485	$ 1,034	10%	$ 48	$ 1,082
4.1.C Education & Public Outreach	$ 934	$ 1,656	$ 2,590	0%	$ -	$ 2,590
4.1.D Science Analysis Software	$ 1,478	$ 2,009	$ 3,487	22%	$ 451	$ 3,938
4.1.E Suborbital Flight Test**	$ 1,321	$ 0	$ 1,321	0%	$ -	$ 1,321
Subtotal***	$ 54,563	$ 62,681	$ 117,243	26%	$ 16,041	$ 133,284
Unallocated Contingency					$ 116	$ 116
Total Project Estimate	$ 54,563	$ 62,681	$ 117,243	26%	$ 16,157	$ 133,400

*"To date cost" refers to cost through June 30, 2003. "To go cost" refers to cost after June 30, 2003.

**4.1.E Suborbital Flight Test is completed.

***Total contingency for project calculated against remaining costs at risk. Costs not at risk are costs to date and E/PO.

International Participation in the LAT



Si Tracker

ACD

Grid (& Thermal Radiators)

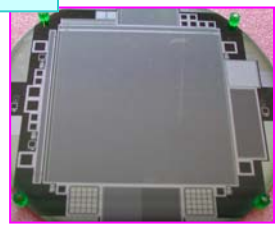
CsI Calorimeter

Electronics, Data Acquisition & Flight Software

Tracker

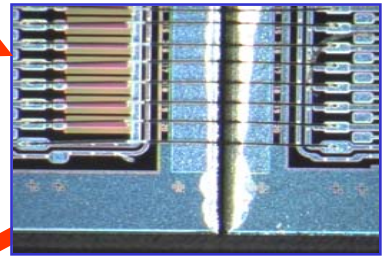
Tower Structure
Italy, SLAC

SSD Procurement, Testing
Japan, Italy, SLAC



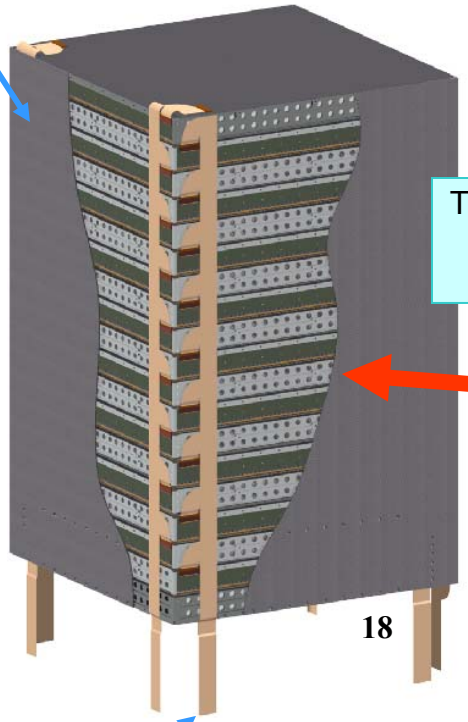
10,368

SSD Ladder Assembly
Italy

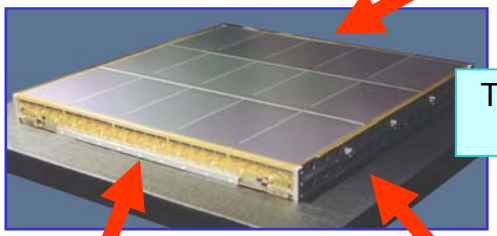


2592

Tower Assembly and Test (18)
Italy

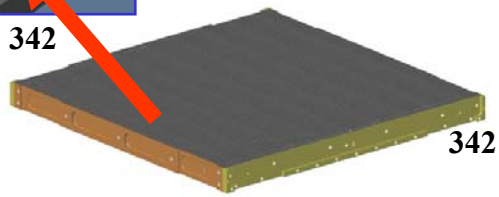


18



Tray Assembly and Test
Italy

342



342

Electronics Design, Fabrication & Test
UCSC, SLAC

648

Composite Panel & Converters
Italy, SLAC

Cable Plant
UCSC

16 flight modules + 2 spares

Tracker Responsibilities

- **INFN**
  - Provide 5000 silicon strip detectors
  - Test all silicon strip detectors
  - Provide composite panels, detector ladders
  - Assemble and test trays
  - Assemble and test modules
- **Japan GLAST Collaboration**
  - Provide 5000 silicon strip detectors
  - Oversee silicon strip detector production
- **SLAC & UC Santa Cruz**
  - Provide front end electronics
  - Provide cable plant

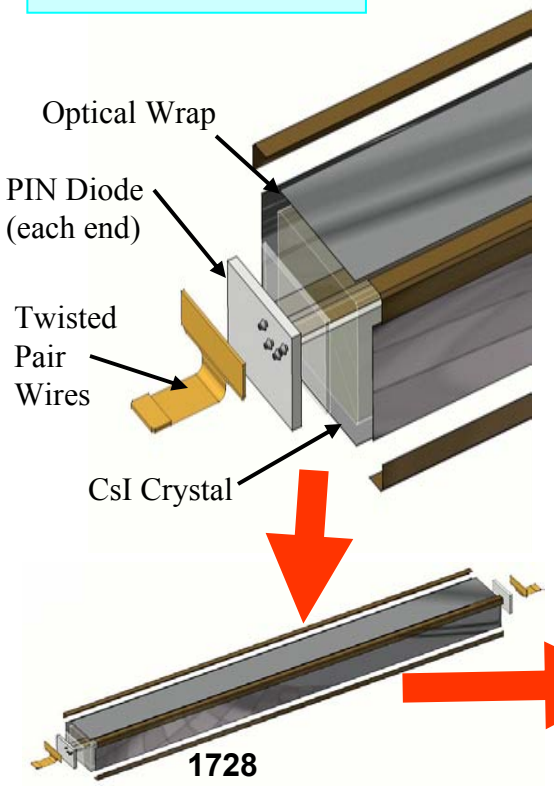
Tracker – ASI / INFN

- The Glast financial plan has was formally approved by ASI in July for 5.1 MEuros (4.5 for CY 2003 and 0.6 for CY 2004)
- The plan for spending this money is still under discussion in ASI (under ASI control or through an ASI-INFN contract)
- The ASI-INFN contract is preferred because this facilitates the spending of money in 2003 (as it is absolutely needed)
- The main items that will be covered with the ASI money are (in order of urgency):
  - Procurement of the last 2000 SSDs with Hamamatsu
  - Placing ladders on trays for towers A-B with G&A
  - Fabrication of the last one third of SSD ladders with MIPOT
  - Fabrication of the last one half of panel trays with Plyform
  - Placing ladders on the rest of trays with G&A
  - Environmental testing of 18 towers with Alenia

Calorimeter

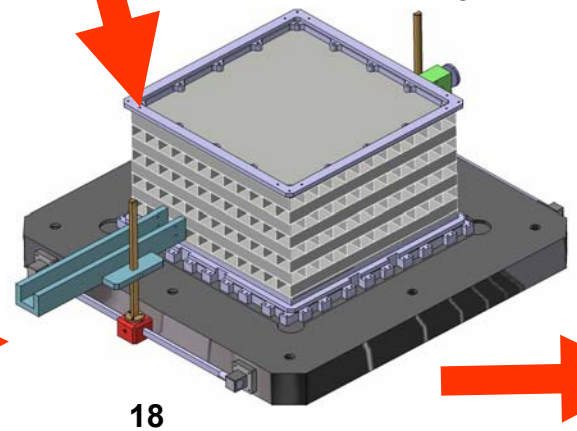
CsI Crystals
Sweden (KTH)

CDE Assembly
NRL



16 flight modules + 2 spares

Mechanical Structure
France (IN2P3/Ecole Polytechnique)

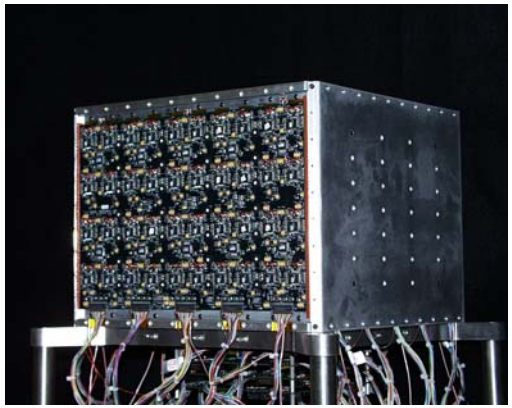


PEM Assembly
NRL

Front-End Electronics
NRL, SLAC

18

Module Assembly
and Test, **NRL+collab**



Calorimeter – CEA/Saclay

- Provided electrical GSE (test bench) to NRL for acceptance test of Dual PIN Photodiode.
- Provided electrical GSE to NRL for acceptance test of completed PIN Diode Assembly (PDA)
- Provided 32 shipping containers and 63 V-blocks to NRL for use in transport of CDEs.
- Offered CDE acceptance test bench but NRL had to decline since it required use of radioactive sources at Swales. This is not possible because of licensing requirements.
- Manufactured ~ 25 CDEs for Bordeaux to be used in CERN beam test this summer.

Calorimeter -- LLR/Ecole Polytechinque

- Completed tooling for manufacture of flight carbon composite structures.
- Fabricated structural model 1 (SM1) composite structure and participated in quality review of process and specifications.
- Supported revision of all Aluminum and Titanium machined parts drawings for conversion to English.
- Supported redesign of CAL base plate to address CAL - GRID interface changes.
- Began manufacture of flight elastic cords, end caps, and bumpers.
- Developed procedure for strength testing of each flight carbon structure and will cover costs of this testing.
- Support I&T testing of EM CAL at SLAC.
- Support of SAS software development.

Calorimeter -- CENBG/Bordeaux

- Developed and executed a beam test at CERN using an array of CDE and CDE-like crystals provided by CEA, NRL, and LLR.
- Continues to plan and organize for CAL EM beam test in heavy ions at GSI in Germany in Nov '03.
- Support of SAS software development.

Calorimeter – Future French Participation

- **CEA/Saclay**
  - **Essentially all expected hardware-related contributions from are complete. Additional contributions are likely to be in I&T labor and science and science software.**
- **LLR/Ecole Polytechnique:**
  - **Strength test of SM1 in September.**
  - **Fab SM2 in October with participation from IPO and GSFC mission assurance.**
  - **Start flight structure fab in November.**
- **Bordeaux:**
  - **Execute GSI beam test in November.**

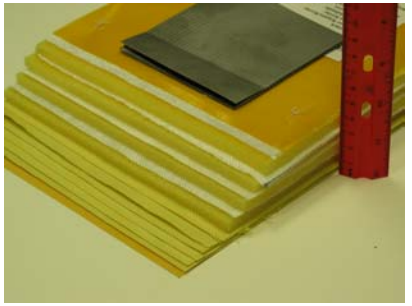
Status of the Subsystems

Anticoincidence Detector – ACD
Tracker – TKR
Calorimeter – CAL
Electronics and Flight Software
Mechanical and Thermal

ACD

- All flight PMTs received and testing/screening complete →
  - Excellent yields

- Other Flight Part procurements begun
  - PMT housings - July
  - Resistor Network PCBs - July
  - Tile Detector Assemblies – now in fabrication at Fermilab
  - Composite structure (shell) – panels in fabrication
  - Flight electronic parts – all ordered
  - Digital and analog ASICs – in fabrication
  - Clear fiber fabrication – materials received
  - Micrometeoroid shield/thermal blanket materials →
- PMT assembly facility ready (He-controlled environment)
- Base Electronics Assembly – start fabrication August 2003
- High Voltage Bias Supply assembly – start Oct 2003
- Front-end electronics assembly – start Nov 2003
- ASIC qual, screen and test plan in review



On schedule for October 2004 delivery

Tracker

- First Flight Tower forecast for 19 April 2004
- Ladder production has begun
  - Tooling performs well – excellent alignment results
  - ~600 manufactured so far
  - ~450 tested, excellent yield so far
- Tray panel fabrication to start in September
- Bonding of ladders to panels to start in October
- MCMs
  - Preproduction of 50 flight MCMs to start in September
- ASICs
  - Flight run complete
  - 75% tested so far – yield is well above 90%, enough for spares
  - Dicing imminent
- Reviewing plans to assure that a minimum number of silicon detectors are put at risk by a failure of other components (particularly latent design defects)

Calorimeter

- 350 CsI crystals delivered to Kalmar for acceptance testing
  - Excellent yield; 117 have been shipped to NRL
  - Total of 1920 required and will be delivered in 2003
- CDE flight production preparations progressing well
  - 12 copies of flight tooling in manufacture
  - Bonding testing with reprocessed EM crystals underway
    - 16 CDE have been manufactured and are being tested at NRL
  - CDE process qualification units start Sept 1st (bonding)
  - Flight Unit A planned to start early October
- Mechanical Structure
  - Calorimeter-GRID interface resolved
  - Finalizing drawings of base plate
  - Completed tooling/materials prep for composite structure
  - 1st Flight unit to be fabricated and tested in August
- Electronics
  - ASIC designs adequate for flight
  - Front end / Readout electronics board fabrication to start mid-October

Electronics –Status

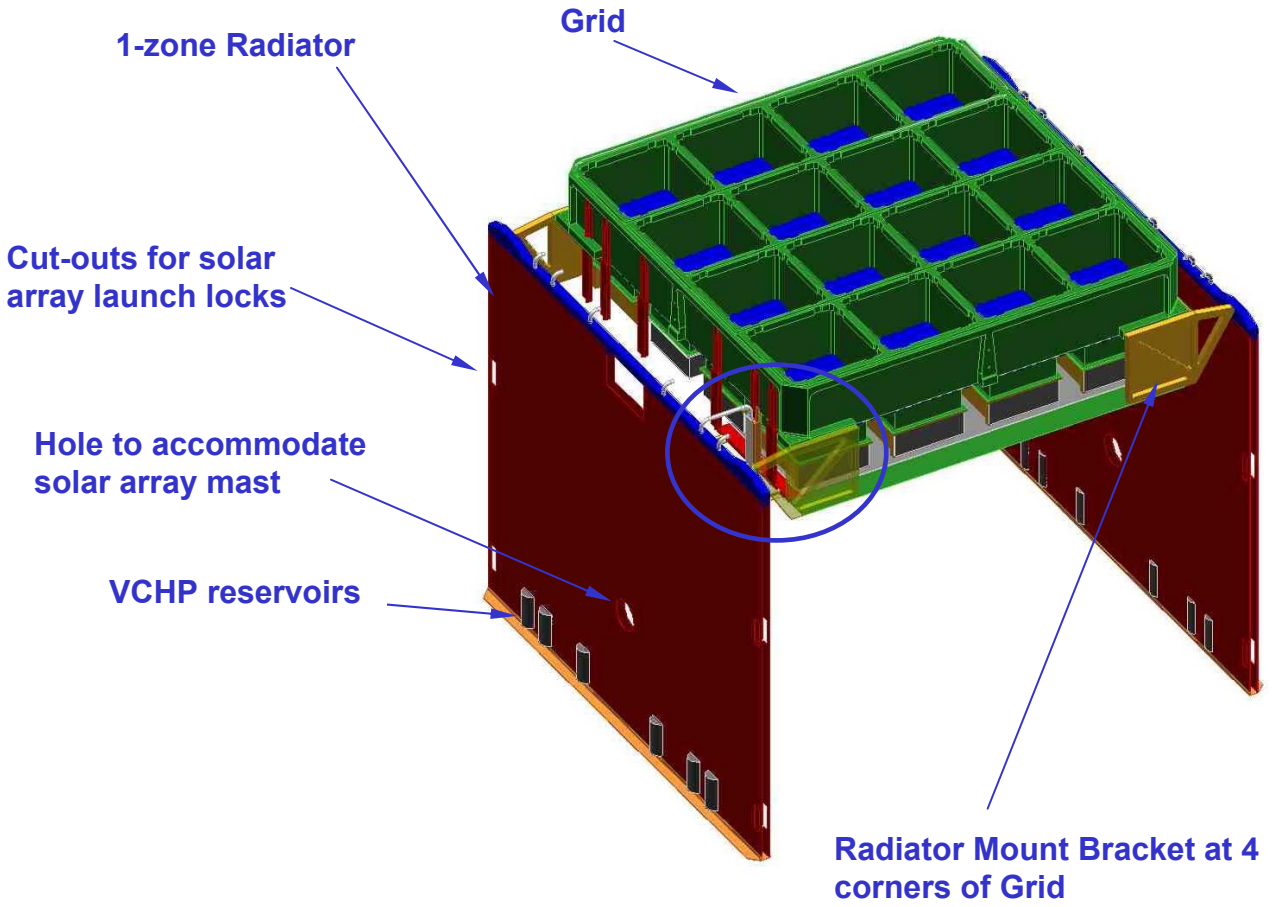
- ASICS
  - Final versions of ACD, CAL, and DAQ - delivery mid-September
  - Successful radiation tests of DAQ ASIC's
- Power Supplies
  - Alternative power supply design being simulated
  - Successful radiation tests of key components (DC/DC converters)
  - Power Distribution Unit board back from fabrication, loaded – EM in use by 1 Oct
- Global Trigger, ACD, DAQ and Signal Distribution Unit (GASU)
  - First breadboard complete
- Tower Electronics Module (TEM) – a prototype of the final design in use by 1 Oct
  - Engineering Models are in use at INFN, NRL, GSFC, UCSC, and SLAC
- LAT Communication Board (LCB) EM in use by 15 Sept
- Storage Interface Board EM in use by 15 Sept
- Crate back-plane – ready to test by 15 Sept
- EGSE TEM with ASICs – test-stands ready with EM1 Flight Software by 1 Oct

- Plan to complete requisitions for all flight-parts by mid-October

Flight Software (FSW) - Status

- Excellent progress on filter (output data compression)
- First boot code committed to SUROM on RAD750 and tested
- Communication software packages begun
- EM1 (all SW to support TEM-based test-stand including monitoring, filtering) by 1 Oct
- Mini-tower test support through October
- Spectrum Astro Inc. spacecraft interface simulator received

Mechanical and Thermal



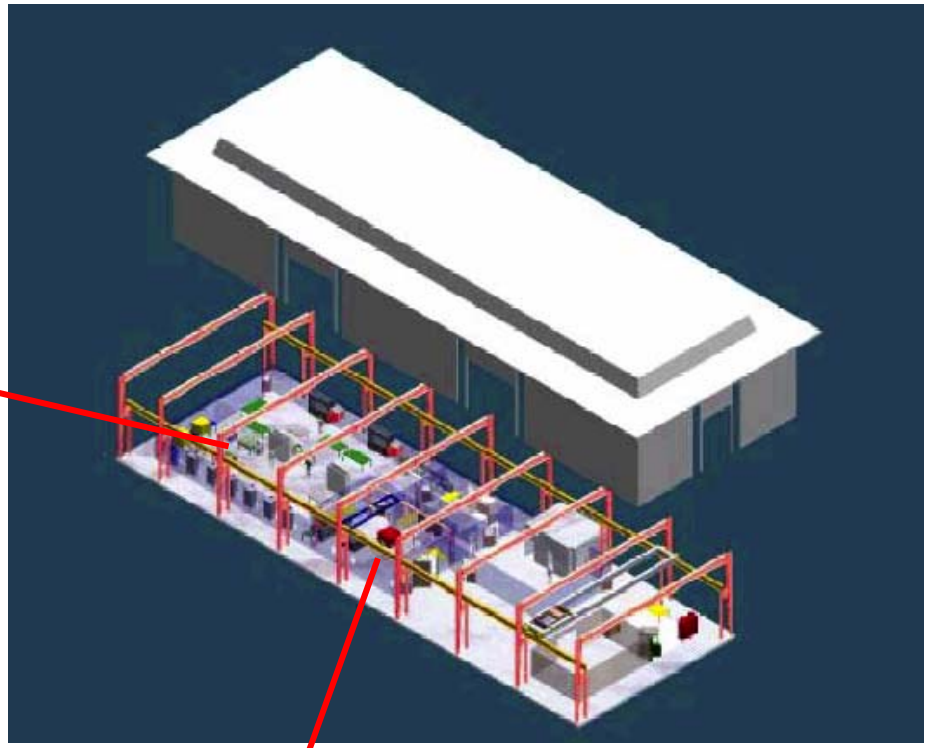
Mechanical - Status

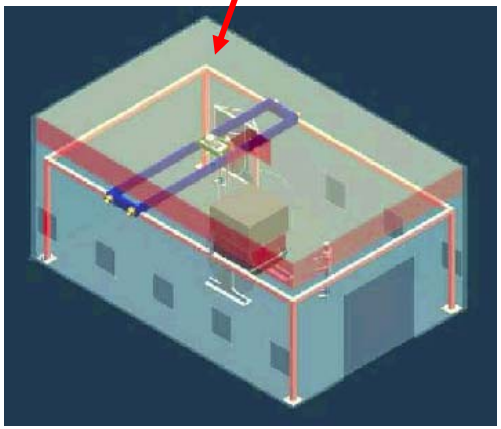
- GRID
  - 1X4 version for EM delivered to SLAC in August
    - Ready for I&T in September
  - Cal-GRID – detailed design being finalized now
  - X-LAT to Electronics boxes –detailed design completed in September
  - 4X4 on schedule for delivery to I&T in April 2004
    - Contract let to Tapemation – the same company that did the 1X4
    - Detailed stress analysis underway
    - Design Review planning underway – will complete by the end August
    - MRR scheduled for September
    - 1st Billet is ready to ship and the 2nd has a discrepancy under review

Thermal - Status

- X-LAT
  - Detailed design in September
  - Delivery to SLAC scheduled for Feb 2004, but must be reviewed
- Constant Conductance Heat Pipes
  - Manufacturing Readiness Review held on July 28, 2003
- Radiators and Variable Conductance Heat Pipes
  - EM efforts near completion
    - Heat Pipe bend development tests
    - Radiator insert strength tests
  - Thermal analysis near completion
  - Manufacturing Readiness Review planned for September
- Thermal Control System
  - Design underway – completion end of November
  - On schedule for delivery to Lockheed/Martin for thermal balance tests in June 2004

LAT I&T





I&T Facility
SLAC Bldg 33

LAT Engineering Model

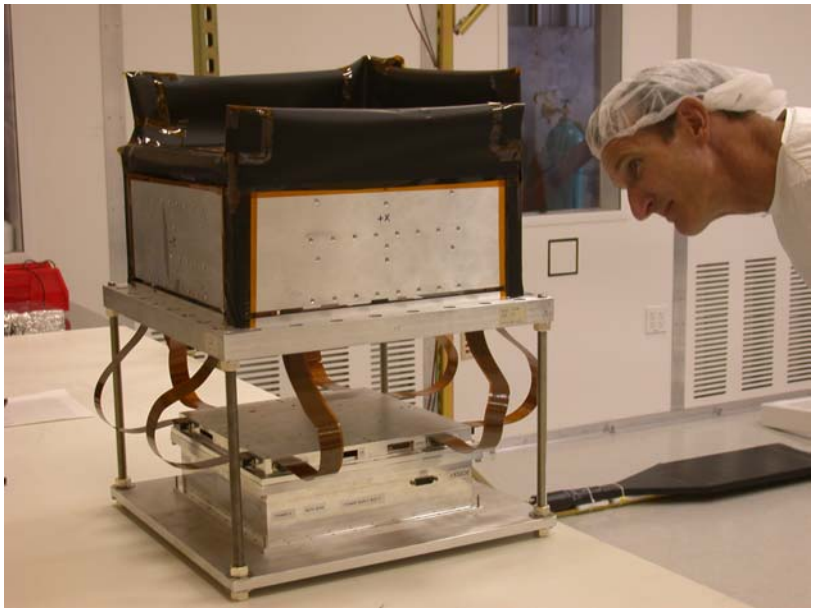
- Each subsystem has engineering models to reduce risk in the implementation of the flight hardware for that subsystem.
- The LAT Engineering Model consists of:
  - EM Grid
  - EM Calorimeter
  - Tracker mini-tower
  - EM TEM and TEM power supply
  - Flight software packages needed for cosmic ray readout and analysis
  - Associated Ground Support Equipment (GSE)
- The goals of LAT EM are:
  - Integrated system tests including measuring cosmic ray tracks through the Tracker and Calorimeter
  - Practice with assembly
  - Developing and testing flight and ground software

Engineering Models

1 X 4 Grid

Calorimeter EM

Tracker Minitower



Summary

- Project is starting fabrication of flight hardware
  - Completed the CD-3/CDR review
- Rebaselining close to formal approval
  - A review of cost and schedule indicates that the project needs $17.2M increase in funding
  - Also the project needs an additional 3 months of schedule
- Some reorganization of the LAT to better address this next phase
- Strong support by the NASA, DOE and SLAC management to assure resources are available
- The next 6 months is critical
  - Closing all design issues
  - First flight units complete and under test