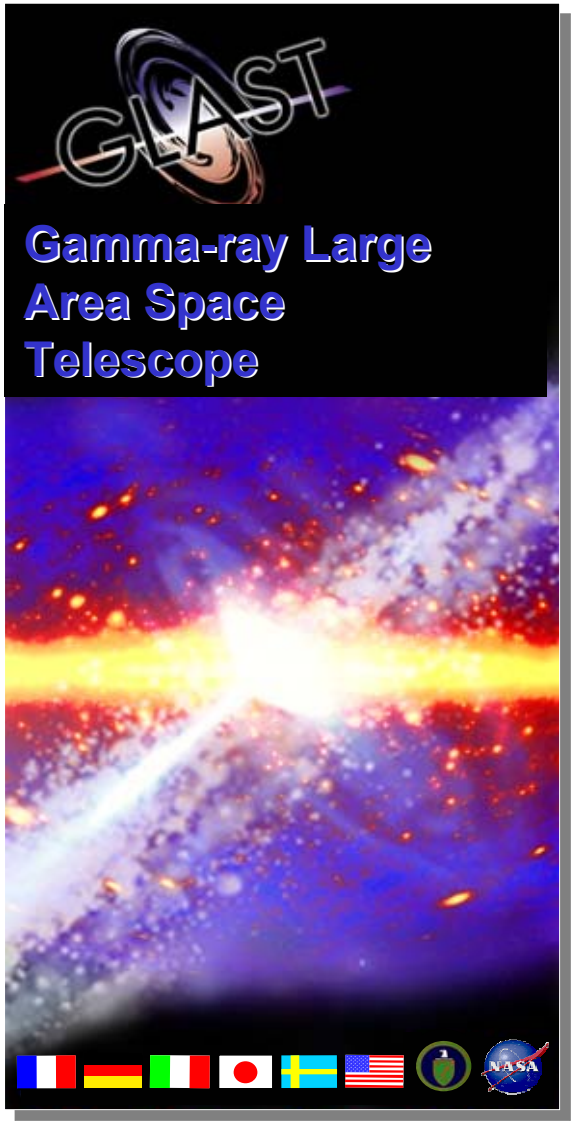


GLAST Large Area Telescope:

LAT Project Status

W. Althouse
Stanford Linear Accelerator Center
Stanford University
LAT Instrument Project Manager

wea@slac.stanford.edu
(650) 926-3249

LAT Project Status

Outline

- Scope
- Organization
- Schedule
- Funding
- Development Status
- Summary

LAT Project Phases

- LAT Instrument Fabrication Project (through September '05)
  - Develop and deliver LAT flight instrument
  - Develop and deliver supporting equipment, software
- LAT Commissioning Phase (Oct. '05 – Sept. '06)
  - Support integration and test of GLAST Observatory
  - Support launch
- LAT Operations and Data Analysis Phase (October '06 on)
  - Support LAT and mission operations
  - Process LAT data for monitoring, calibration and science
  - Analyze data and publish results

LAT Fabrication Project at a Glance

- **Cost**
  - Total project cost: $121.7M
  - Baseline (5/31/02): $100.0M budget at completion, $21.2M contingency
  - Cost status (2/28/03): $42.6M spent, $102.6M budget at completion
  - $19.1M contingency available (33% of $58.0M cost-at-risk)
- **Schedule**
  - LAT delivery scheduled for 9/22/05
    - Defined by acceptance of flight-ready LAT by GLAST Project Office for integration with spacecraft (triggers DOE CD-4)
  - Critical path analysis includes 17 weeks float to ship date
- **Full description of LAT project loaded into Project Management Control System (PMCS)**
  - Resource-loaded schedule is built, under configuration control, and being tracked

Highlights of Past Year

- **Reviews**
  - DOE review and certification of PMCS July 9-10, 2002
  - DOE Baseline (CD-2) and NASA Preliminary Design Review July 30-Aug 2, 2002
  - DOE External Independent Review Aug 2, 2002
  - Quarterly Reviews Nov. 12, 2002 and Jan 30, 2003
  - Subsystem peer reviews in preparation for LAT Critical Design Review (all in 2003):

    ACD: Jan 7–8 CAL: Mar 17–18 DAQ: Mar 19–20

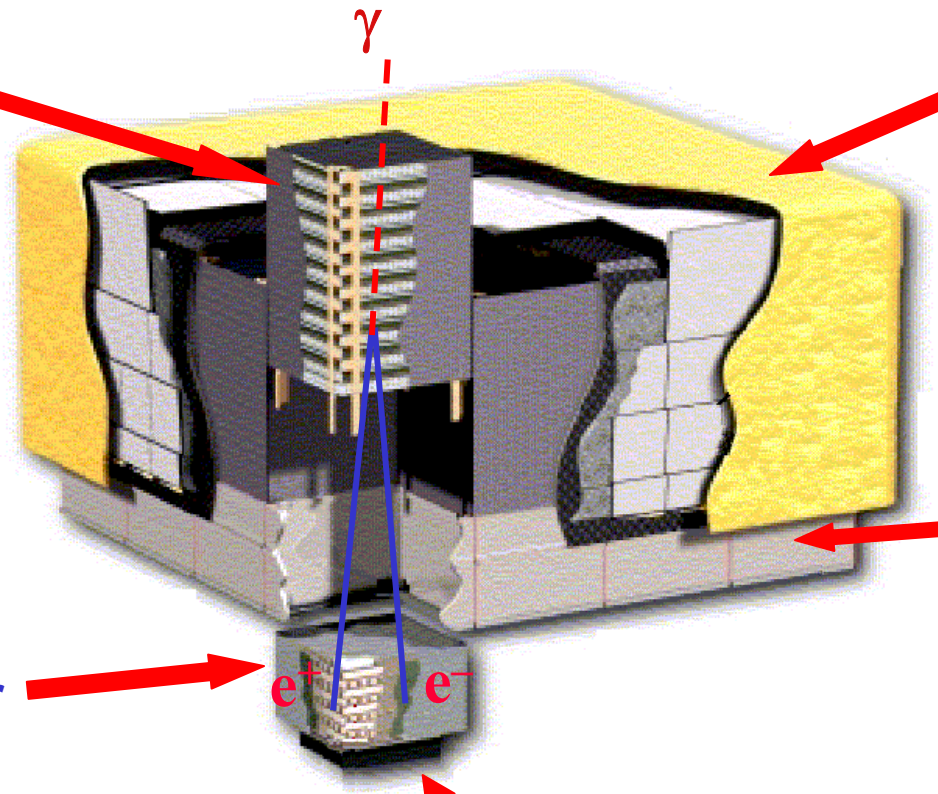
    TKR: Mar 24–25 Mech: Mar 26–27 I&T: Mar 28
- **LAT development**
  - Design and fabrication planning documentation near completion
  - Engineering models built and tested; some tests continuing
  - Long-lead parts ordered and long-lead fabrication initiated

Plans for Coming Year

- DOE CD-3 and NASA Critical Design Review
  May 12-17, 2003
- Fabrication of flight subsystems underway, first units completed
- Preparations for LAT integration completed

Organization

LAT Hardware Subsystems



Si Tracker

ACD

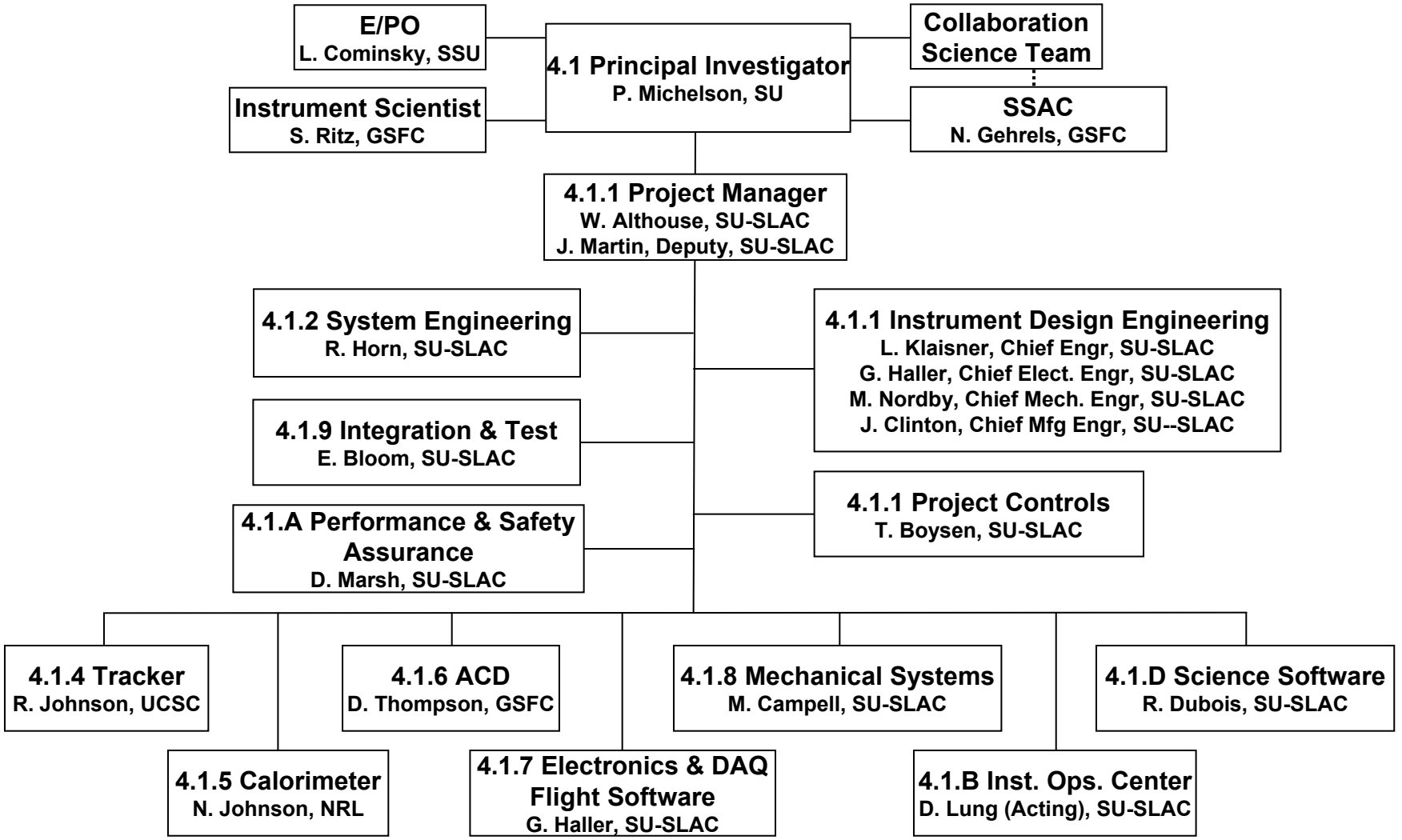
Grid (& Thermal Radiators)

CsI Calorimeter

Electronics, Data Acquisition & Flight Software

GLAST LAT Organization

SU/SLAC Oversight: PI reports to SLAC Director & Stanford Vice Provost for Research



Work Breakdown Structure

WBS ELEMENT		SUBSYSTEM MANAGEMENT	CONTRIBUTING INSTITUTIONS
4.1	LAT Fabrication Project	P. Michelson, P.I.	SU
4.1.1	Management	W. Althouse, Proj. Mgr. J. Martin, Deputy Proj. Mgr.	GSFC/LHEA, SU-SLAC
4.1.2	System Engineering	R. Horn, S.E. Mgr.	SU-SLAC
4.1.3	(reserved)		
4.1.4	Tracker	R. Johnson, Mgr. R. Bellazzini, INFN Proj. Mgr.	INFN, JGC, SU-SLAC, UCSC
4.1.5	Calorimeter	N. Johnson, Mgr. D. Beverede, CEA Proj. 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.	NRL, SU-SLAC
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.	SSU
4.1.D	Science Analysis Software	R. Dubois, Mgr.	All

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)

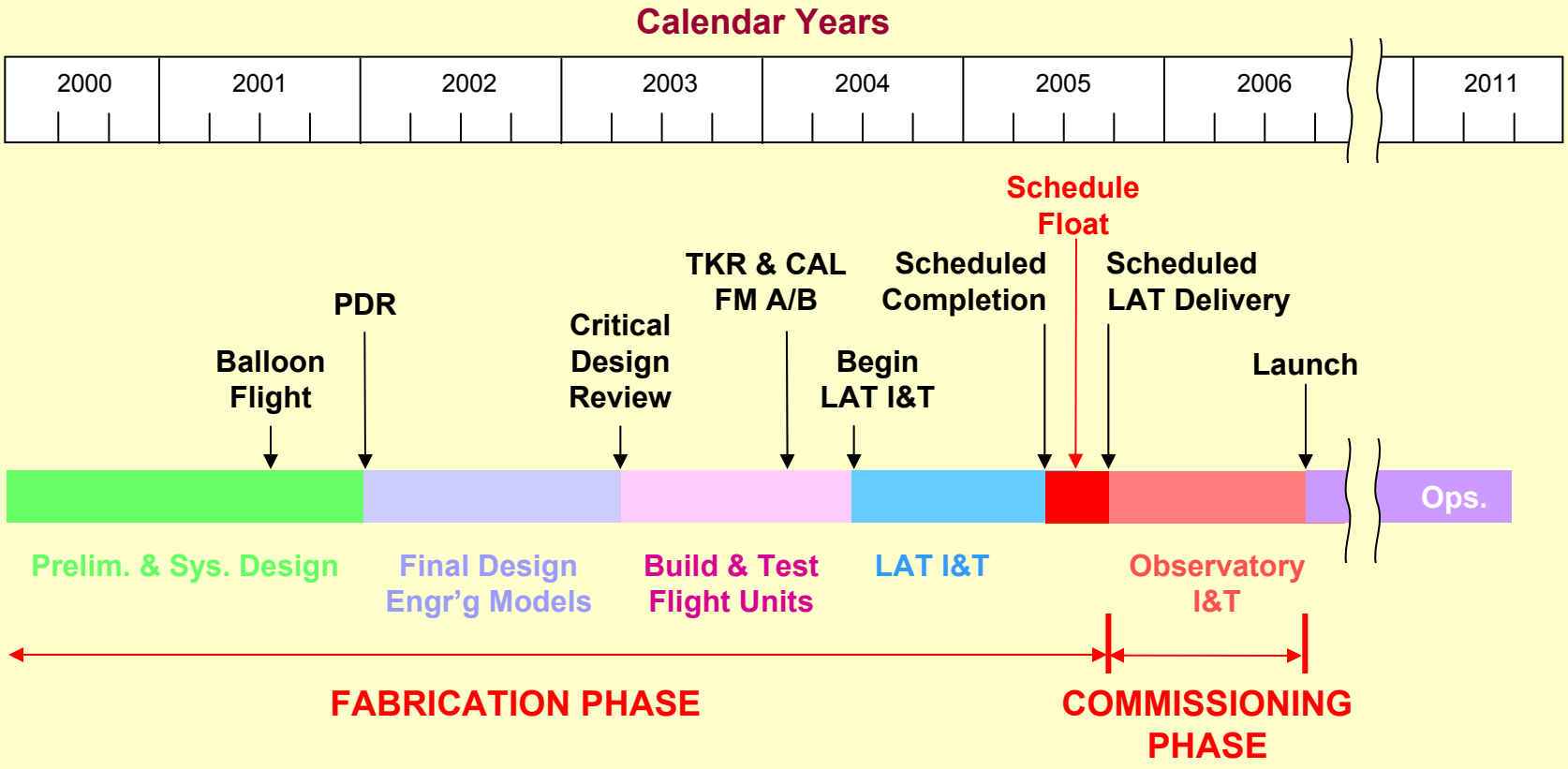
- Hiroshima University
- Institute for Space and Astronautical Science (ISAS)
- RIKEN

Swedish GLAST Consortium (SGC)

- Royal Institute of Technology (KTH)
- Stockholm University

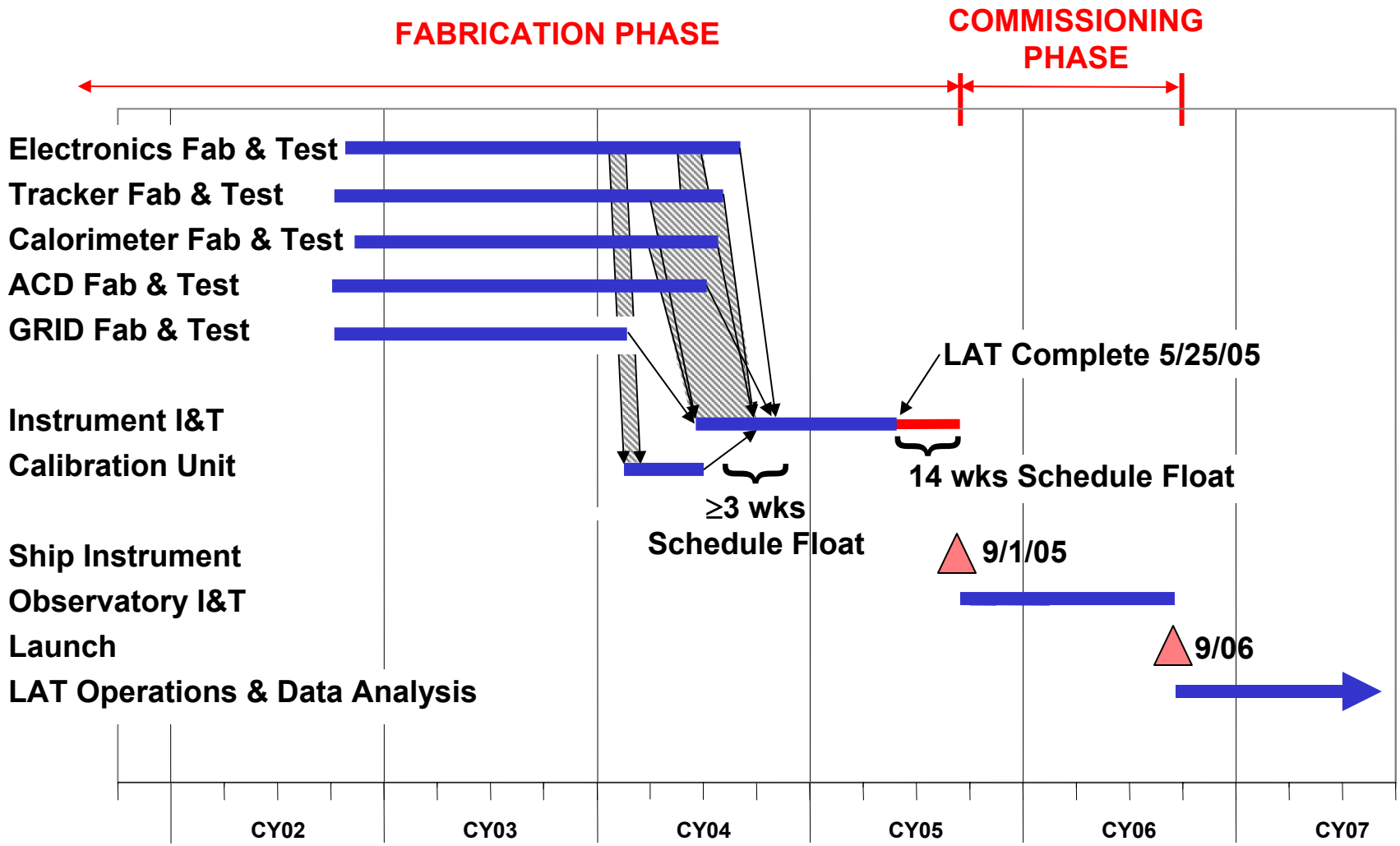
Schedule

Schedule Overview

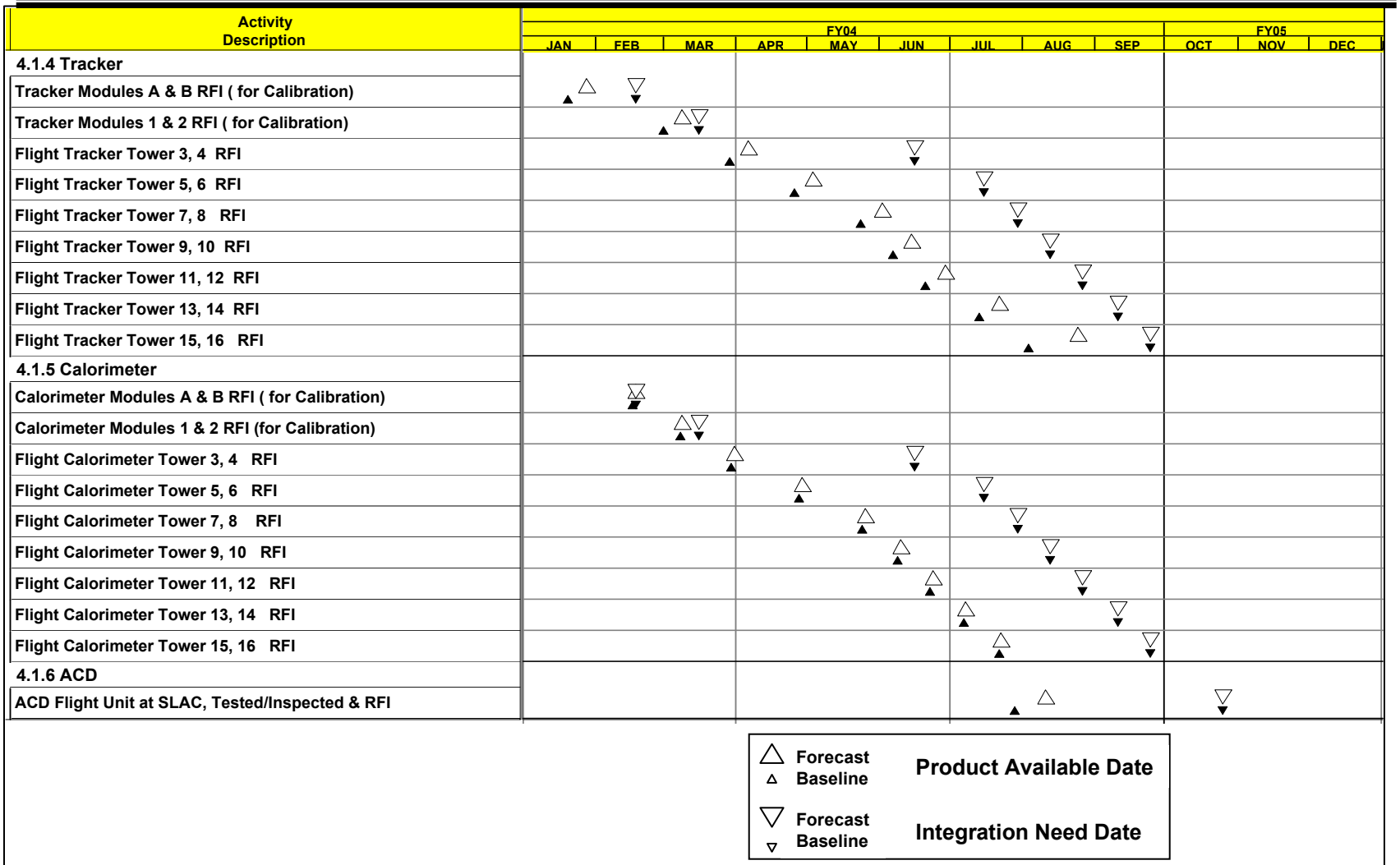


GLAST scheduled for launch in September 2006

Summary Schedule



Key Level 3 Milestones



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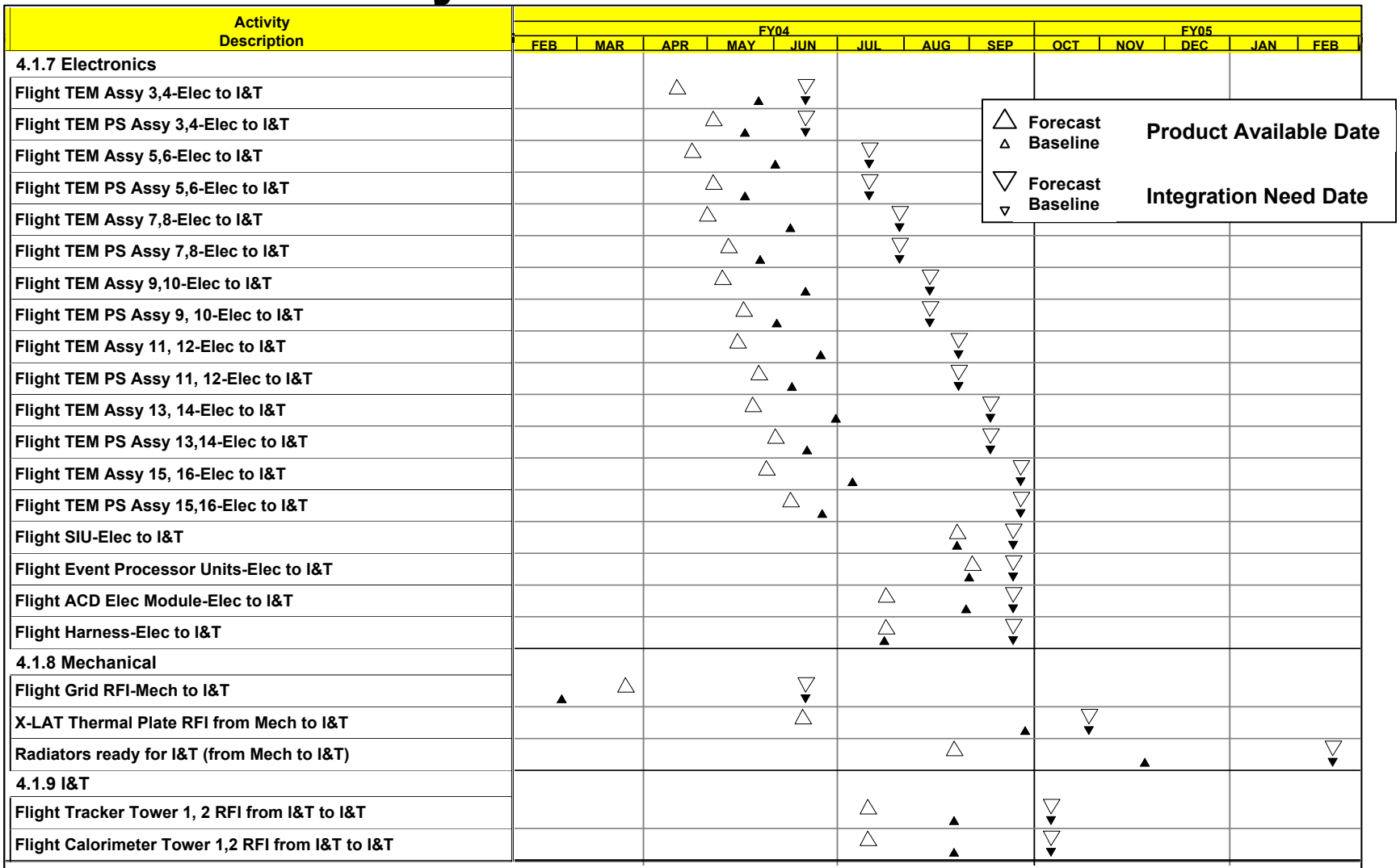
Data Date	03/01/03		Sheet 1
© Primavera Systems, Inc.			

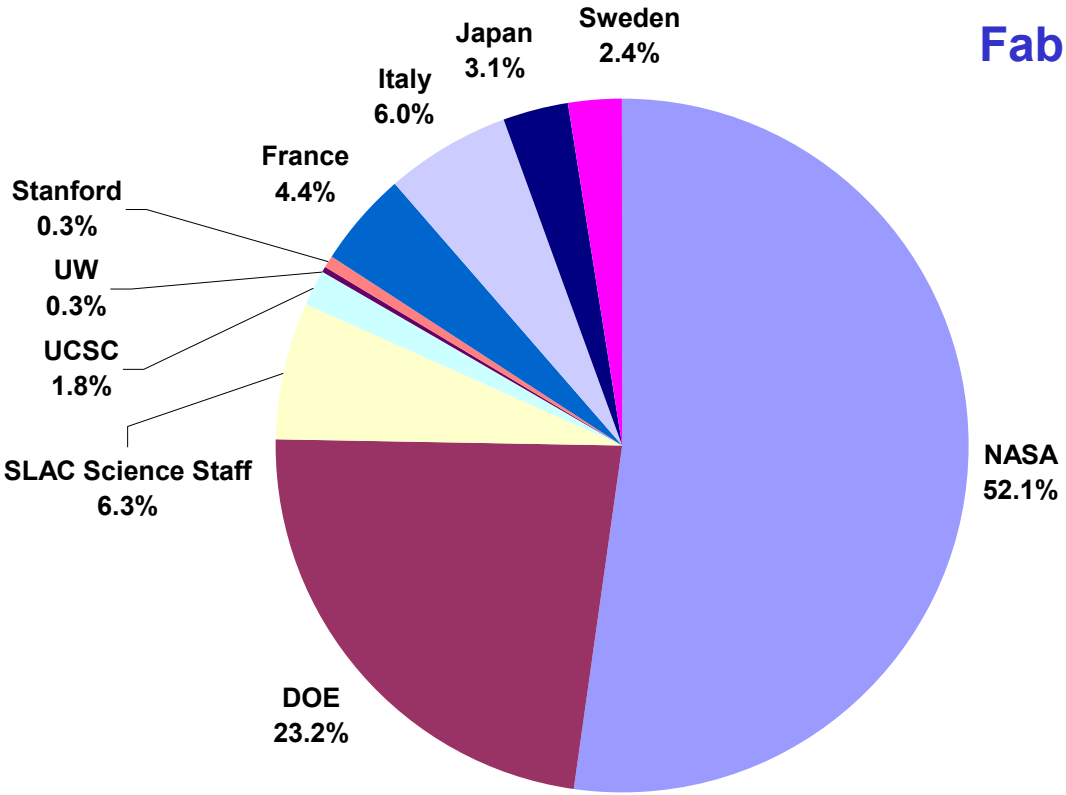
Key Level 3 Milestones



Run Date 03/24/03 13:31 Data Date 03/01/03 © Primavera Systems, Inc.	**GLAST LAT PROJECT** **AV: Float to** **Level 3 Milestones**	LT-D7: Level 3 to AV: FL-D3: Integration Milestones AV: Up Triangle, L3: Down Triangle Sheet 2

Funding

Fabrication Phase Funding Contributions



Fabrication Funding

TOTAL = $159.7M

DOE = $37.0M
NASA = $83.3M
US/Japan = $1.4M

Subtotal = $121.7M

Budgeted Fabrication Cost

Budgeted DOE + NASA Costs for Fabrication Phase

(escalated $M)

	Baseline	2/28/03
Budgeted Cost at Completion	100.0	102.6
Contingency	21.2	19.1
Total Estimated Cost (TPC=TEC[1])	121.2	121.7

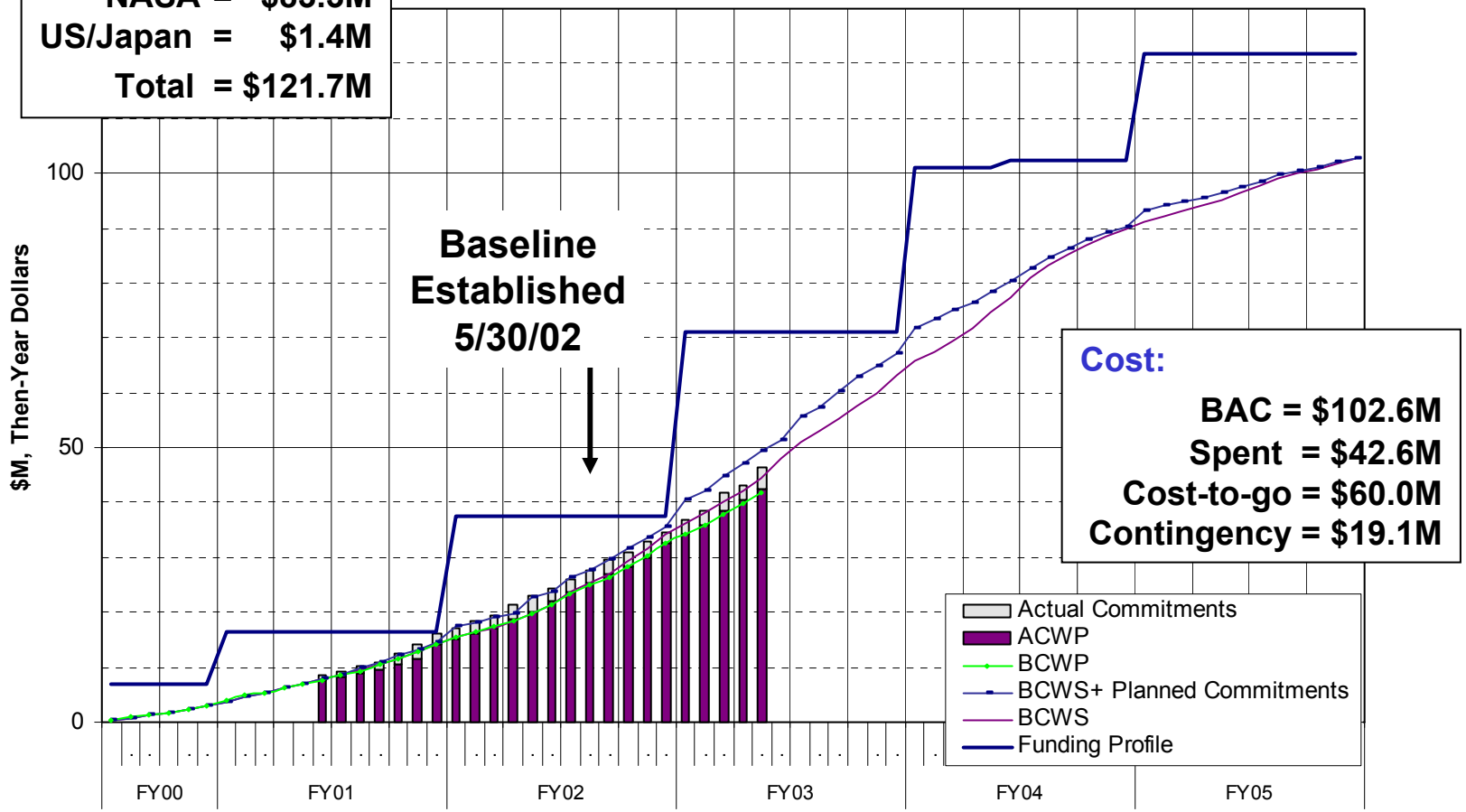
[1]As defined in the LAT Project Execution Plan

Funding, Estimated Cost

Funding:

DOE = $37.0M
NASA = $83.3M
US/Japan = $1.4M
Total = $121.7M

Budget vs Actuals vs Funding
DOE + NASA Project Expenditures



Cost:

BAC = $102.6M
Spent = $42.6M
Cost-to-go = $60.0M
Contingency = $19.1M

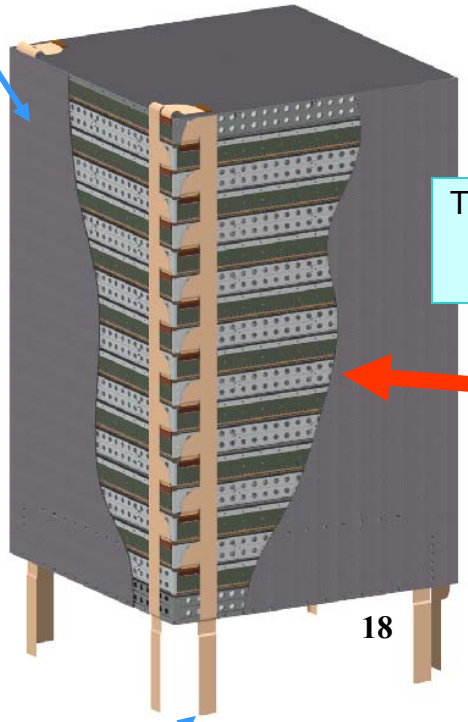
Summary

- Experienced management and technical team in place
- The transition from design to flight fabrication is underway
- Subsystem fabrication and testing plans in place
- Outstanding technical issues are being resolved in a timely fashion
- No unusual risks have been identified
- Aggressively managing schedule and cost to keep on track with acceptable technical risk

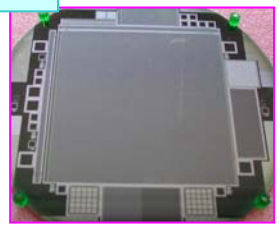
Backup slides

Tracker

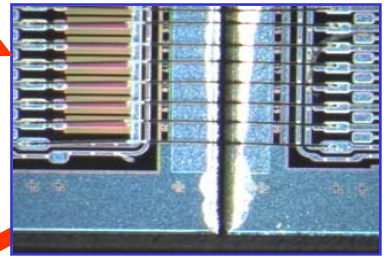
Tower Structure
Italy, SLAC



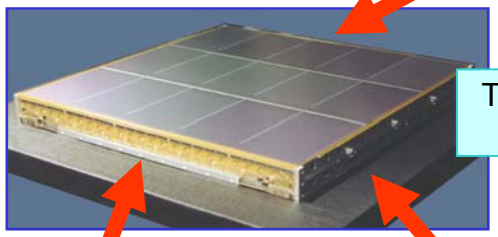
SSD Procurement, Testing
Japan, Italy, SLAC



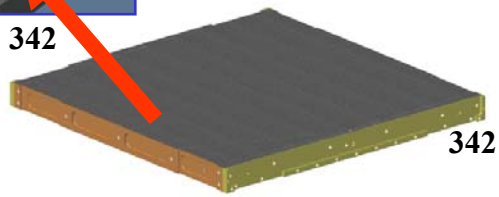
SSD Ladder Assembly
Italy



Tower Assembly and Test (18)
Italy



Tray Assembly and Test
Italy



Electronics Design, Fabrication & Test
UCSC, SLAC

Composite Panel & Converters
Italy, SLAC

Cable Plant
UCSC

16 flight modules + 2 spares

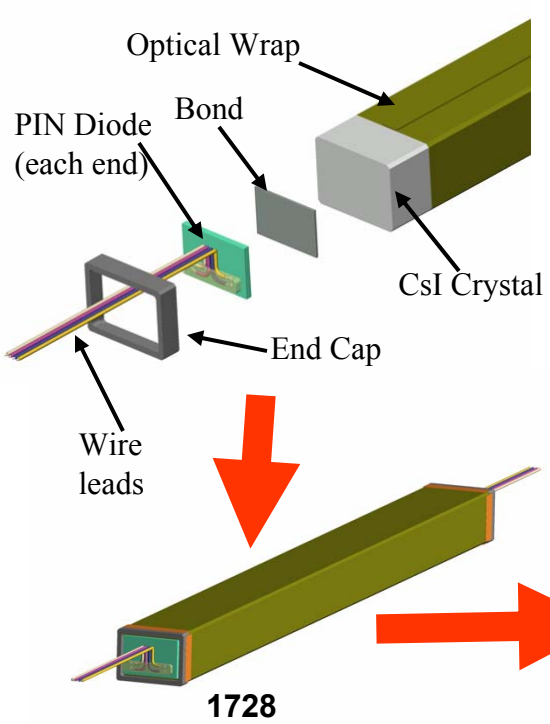
Tracker Status

- Technical design is mature
  - 4 tray, 3 layer “live” engineering model assembled, in test
  - Earlier mechanical EM showed problems with bottom tray attachment
  - Full size mechanical/thermal EM in fabrication with revised bottom tray design
  - Most outstanding issues will be retired at the completion of EM test program
  - Most design, fabrication and test documents complete
- Most elements ready for flight production
  - Technical risks are understood
  - Flight Silicon Strip Detectors (SSD) ~50% complete
  - Flight ASICs in hand
  - SSD ladder production started, 250 flight items completed
  - Bottom tray fabrication on hold awaiting EM verification

Calorimeter

CsI Crystals
Sweden (KTH)

CDE Assembly
France (CEA/DAPNIA)

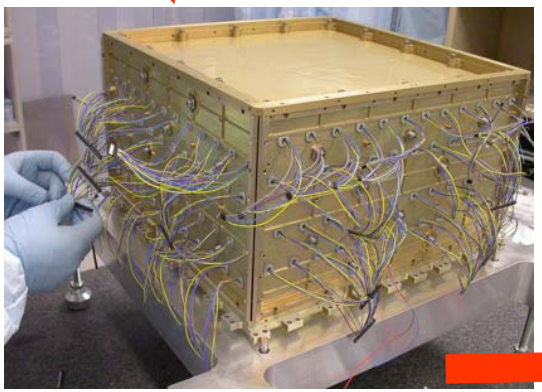


1728

16 flight modules + 2 spares

Mechanical Structure
France (IN2P3/Ecole Polytechnique)

18

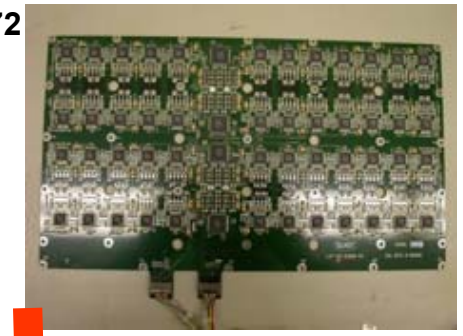


18

PEM Assembly
NRL

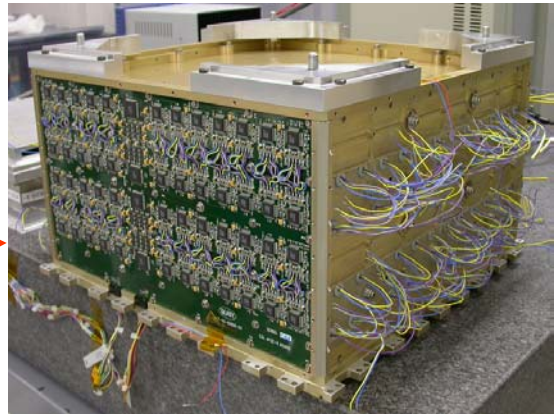
Front-End Electronics
NRL, SLAC

72



18

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



Calorimeter Status

- Technical design is mature
  - Most outstanding issues will be retired at the completion of EM test program in June
  - New PIN photodiode verification will complete as well in June
  - Updated ASIC versions in April
  - Most documents will be released before CDR
- Schedule is aggressive in meeting all Level 3 milestones with appropriate schedule contingency
  - Recently discovered problem in deliveries of CDE will be resolved to meet the baseline schedule
- Ready for flight production
  - Technical risks are understood
  - Schedule risk will be resolved

Anti-Coincidence Detector

Mechanical Mockup

ACD Status

- Technical design is mature
  - No full-up engineering model, not justified by risks
  - Full-scale mockup addresses complex packaging issues
  - Structural modeling and mechanical tests show design is adequate
  - Engineering tests of EM components completed
  - Updated 3rd generation ASICs will be verified in April
  - Most documents will be released before CDR
- Most elements ready for flight production
  - Technical risks are understood
  - Long-lead components on order;
  - ~50% of PMTs received and tested