

GLAST Calorimeter

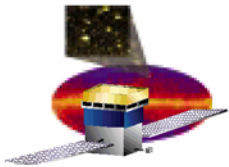
*Monthly Cost /
Schedule / Mission
April 2004*

Monthly Cost/Schedule/Mission Review

GLAST LAT Calorimeter April 27, 2004

**W. Neil Johnson
Naval Research Lab**





GLAST Calorimeter

Outline

*Monthly Cost /
Schedule / Mission
April 2004*

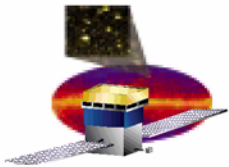
□ **Technical Status:**

- **Last Month's Accomplishments**
- **Near-term Milestones & Status towards them for next 3 months (from F2F)**
- **Drawing Release Plan & Status required to achieve production milestones**
- **Summary of issues & concerns**
- **Open Design/Engineering model/manufacturing issues and closure plan for them**
- **Status of Subsystem's Documentation & qualification program**

□ **Cost & Schedule**

- **Variances**
- **Actions required to retain zero schedule variance**





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Significant Accomplishments April 2004

Monthly Cost /
Schedule / Mission
April 2004

□ CDEs

■ Csl Crystals

- To date Kalmar has delivered ~1062 tested crystals to NRL. They have received ~1800 (out of 1950) from Amcrys-H. Approximately 100 crystals have been returned to Amcrys for non-compliance.
- NRL has corrected light taper on ~150 crystals that did not meet spec.

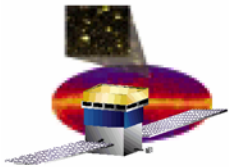
■ PIN Photodiode Assembly (PDA)

- ~ 3100 (out of 4800) flight PDAs have been manufactured, tested and delivered to Swales.

■ CDE Assembly Process

- ~670 CDEs have been bonded at Swales
- Wrapping, capping and acceptance testing is recovering from an early delay in availability of end caps.
- 540 have been wrapped and capped
- 380 have been tested and delivered to NRL
- The planned production 60 CDE per week is well within capabilities





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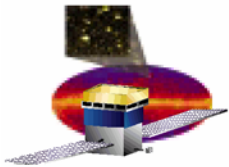
Significant Accomplishments

April 2004 (2)

*Monthly Cost /
Schedule / Mission
April 2004*

- ❑ **Composite Structure Manufacture – LLR Ecole Polytechnique**
 - Six flight structures have been manufactured (#3 - #8).
 - Five of these have successfully completed strength verification vibration test.
 - Two of these are at NRL, two more are in customs at Dulles.
- ❑ **Structure Assembly – NRL**
 - All machined parts are in hand with the exception of the titanium stand off for TEM/TPS.
 - Procedures for assembly of the mechanical structure have been tested and released.
 - Three mechanical structures have been assembled (1 test and 2 flight).
 - Extra set of structure machined parts has been manufactured and sent to France as second set of composite strength test MGSE.





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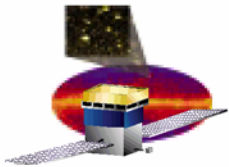
Significant Accomplishments

April 2004 (3)

*Monthly Cost /
Schedule / Mission
April 2004*

- ❑ **AFEE Electronics**
- ❑ **ASICs**
 - Post burn-in testing complete. No issues.
 - Qualification parts will be delivered to GSFC with documentation and test equipment this week.
 - Remaining radiation testing, Total Ionizing Dose, occurs this week.
- ❑ **Flight AFEE PCB (X & Y) are in manufacturing.**
 - Six of each board available this week for 1st article assembly and test.
 - Board assembly contract is in place
 - Kitting and documentation is underway for delivery of flight parts to assembly vendor.
- ❑ **AFEE-TEM interface cable.**
 - 16 copies of the AFEE-TEM cable have been received.
 - Interface tests have resulted in modifications to the design.
 - Issues are cable length and potential violation of CAL stay clear.
 - Handling and flexibility remain concerns.





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Significant Accomplishments

April 2004 (4)

*Monthly Cost /
Schedule / Mission
April 2004*

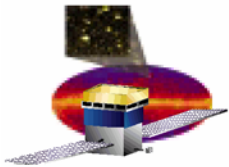
□ Integration and Test

- Three teams of technicians have been trained in the assembly of Pre Electronics Module (PEM)
- PEM for first flight module (FMA) has been completely assembled.
- PEM checkout electronics are being assembled on FMA for first muon calibration.
- Assembly of PEM for FMB has begun.

□ Facilities

- Improved humidity control (dryer) has been installed and is operational.





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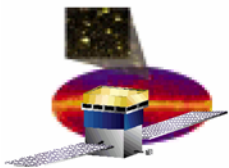
CAL Near Term Milestones

Monthly Cost /
Schedule / Mission
April 2004

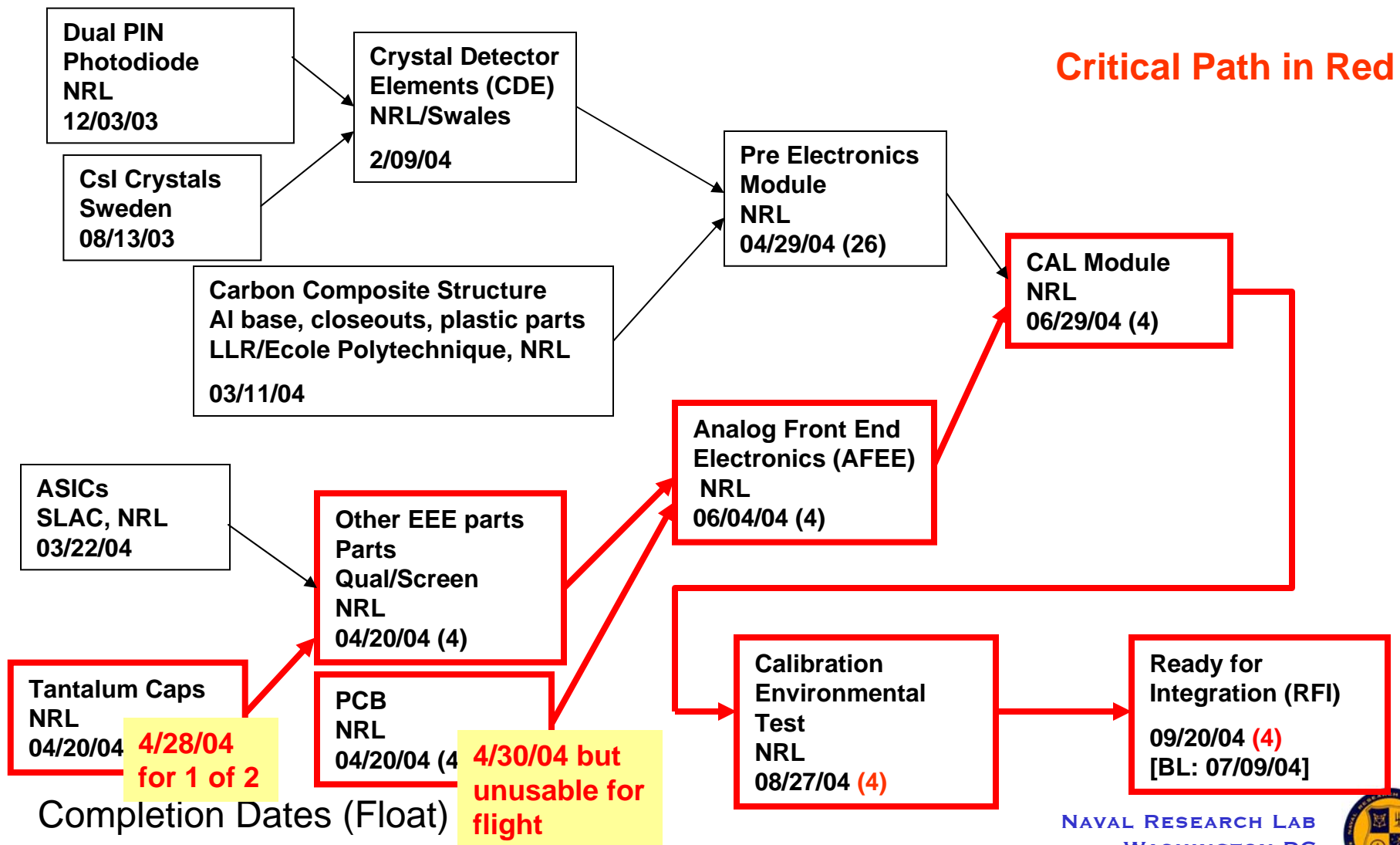
Production Pipeline in progress

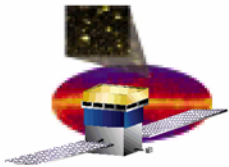
| Activity ID | Activity description | Total float | Early finish | Comment |
|-------------|---|-------------|--------------|------------------------|
| 5C62300200 | IN: Receive FM1 Mechanical Struct | 56 | 4/2/2004 | In customs |
| 5C52000381 | IA: FM12 CsI Crystals | 108 | 4/7/2004 | |
| 5C62300300 | IN: Receive FM2 Mechanical Struct | 56 | 4/16/2004 | In customs |
| 5C62300320 | IN: FM2 CDE | 53 | 4/16/2004 | |
| 5C52000401 | IA: FM13 CsI Crystals | 106 | 4/21/2004 | |
| 5C62300400 | IN: Receive FM3 Mechanical Struct | 59 | 4/28/2004 | |
| 5C62300420 | IN: FM3 CDE | 56 | 4/28/2004 | |
| 5C77300120 | ND: (5) EM2 TEM/PS for AFEE board ass'y & test | 31 | 04/09/04* | Received one, delay OK |
| 5C77300130 | ND: (5) CAL Test Stations for AFEE ass'y & test | 9 | 05/11/04* | Received one |
| 5C62300090 | IA: FMA PEM Ready | 26 | 4/29/2004 | |
| 5C62300190 | IA: FMB PEM Ready | 30 | 5/13/2004 | |
| 5C62300290 | IA: FM1 PEM Ready | 40 | 5/13/2004 | |
| 5C1140A | ND: EM2 TEM/PS/CTS FMA | 14 | 5/18/2004 | |
| 5C62300390 | IA: FM2 PEM Ready | 45 | 5/20/2004 | |
| 5C1161A | ND: EM2 TEM/PS/CTS FMB | 32 | 5/25/2004 | |
| 5C57000101 | IA: PDA Lot 6 (600) | 492 | 5/28/2004 | |
| 5C1183A | ND: EM2 TEM/PS/CTS FM1 | 60 | 6/2/2004 | |
| 5C76001120 | FMA AFEE Ready | 4 | 6/4/2004 | Not Likely |
| 5C76001140 | FMB AFEE Ready | 15 | 6/7/2004 | |
| 5C1203A | ND: EM2 TEM/PS/CTS FM2 | 59 | 6/9/2004 | |
| 5C76001180 | FM1 AFEE Ready | 20 | 6/14/2004 | |
| 5C76001200 | FM2 AFEE Ready | 29 | 6/15/2004 | |
| 5C76001240 | FM3 AFEE Ready | 34 | 6/22/2004 | |
| 5C57000111 | IA: PDA Lot 7 (600) | 504 | 6/28/2004 | |





Path to first flight CAL Module (FMA)





New Impact on FM A Delivery

□ EEE Parts

▪ Vendor failed to deliver Tantalum capacitors

- One of 2 part types in transit to NRL.
- Other part has been rescheduled for delivery in mid-May. Details are uncertain but appears that the lot was rejected by the manufacturer (Vishay, Israel).

□ AFEE PCB fabrication

▪ During inspection of 1st articles at PCB manufacturer, suspect bridge between copper pour and via was discovered.

- Similar, but different errors on both X and Y boards were confirmed.
- Currently investigating why net list and design rule check didn't find these errors during layout.
- Production run of 136 boards has been stopped while investigation continues.

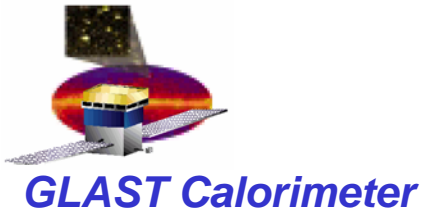
▪ First article boards can be repaired at NRL and will proceed with AFEE assembly process check and board testing.

▪ We have directed the board house to modify the gerbers to correct identified errors. Production run is on hold.

- We could proceed with production run assuming all errors have been found. \$50K at risk.
- In parallel, we are tracking down DRC failures and planning detailed net list verification.

▪ Potential for another 1 – 1.5 month schedule impact.





Drawing Release Summary

Monthly Cost /
Schedule / Mission
April 2004

Flight Hardware Drawings

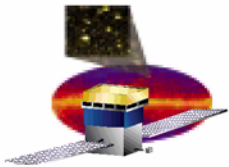
| Element | Total Dwgs | Completed Dwgs | Comments |
|--------------|------------|----------------|------------------------------------|
| Module Assy | 7 | 6 | Revise/design AFEE-TEM cable mount |
| CDE | 6 | 6 | |
| AFEE | 10 | 10 | |
| Structure | 16 | 16 | |
| TOTAL | 39 | 38 | 97% Complete |

All flight hardware drawings will be released by end of April.

Total Drawings – Flight hardware + fab tooling, GSE, Procedures

- Identified: 141
- Completed: 112 (79%)





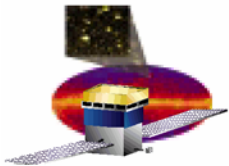
GLAST Calorimeter

Issues and Concerns

Monthly Cost /
Schedule / Mission
April 2004

- ❑ **Csl Processing in Sweden**
 - Care and accuracy of test results has been a problem requiring more work and rework at NRL.
 - Test facility at Kalmar must be moved at end of May.
 - Timely completion of work may be impacted by the move and release of critical personnel (cost savings).
- ❑ **EEE Parts**
 - Receive tantalum capacitors
 - Complete qualification of ASICs
- ❑ **AFEE Assembly**
 - Resolve errors and verify integrity of layout.
- ❑ **Current TVAC cycle time breaks budget (schedule/cost by ~40%)**
 - TVAC test plans are being reviewed.
 - Likely cost increase of \$130K (\$50K in FY04) required to cover additional duration of 8 TVACs.





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Open Design /EM /Manufacturing Issues

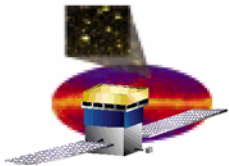
*Monthly Cost /
Schedule / Mission
April 2004*

EMI/EMC requirements, performance and test configurations

Progress has been made over last month, need to finalize requirements and plans

- **New test configuration has been proposed and discussed with LAT system engineering and Fred Blanchette**
- **New LAT and subsystem requirements allocations have been proposed by Fred which address issues of testing TEM/TPS along with CAL module.**
- **Related AFEE-TEM cable and mechanical support designs are in progress.**





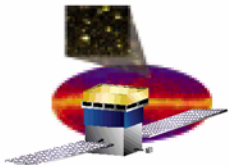
GLAST Calorimeter

Documentation and Qualification Program

*Monthly Cost /
Schedule / Mission
April 2004*

- ❑ CDE manufacture and test procedures – 100% complete
- ❑ Composite Structure manufacture and test procedures – 100% complete
- ❑ EEE qualification and screening procedures – 100% complete
- ❑ ASIC documentation – need GCFE9A schematic.
- ❑ AFEE PCB manufacture and assembly
 - Procurement specifications – 100% complete
 - Parts lists and assembly drawings – 100% complete
 - AFEE functional test procedure – 50% complete.
- ❑ PEM Assembly and Test – 100% complete
 - Some still in review/release cycle.
- ❑ Module Assembly and Qualification/Acceptance
 - EM versions of procedures exist from EM qualification program. Need modifications for flight protoflight/acceptance testing.





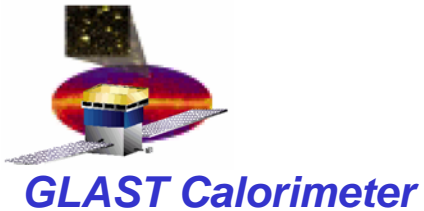
GLAST Calorimeter

PMCS - Jan '04 Cost Variances

Monthly Cost /
Schedule / Mission
April 2004

- **Cost Variance: + \$751 cum**
 - **+289: Mgmt, Eng, R&QA, ~ 1 FTE labor, rest travel**
 - **+324: CDE Manuf.**
 - PDA manufacturing - delays in invoicing.
 - CDE manufacturing labor underrun.
 - **+46: PEM**
 - Invoicing delay in facilities preparation
 - **-5: AFEE**
 - Much higher labor costs balanced by savings in GSE materials
 - **+75: Module Ass'y & Test**
 - Invoicing for mech and elect GSE handled as 50-50 tasks in PMCS.



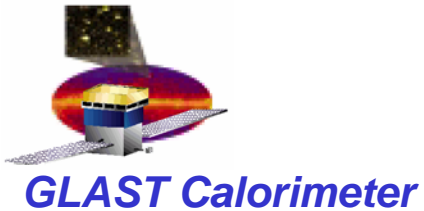


PMCS – Jan '04 Schedule Variances

Monthly Cost /
Schedule / Mission
April 2004

- **Schedule Variance: - \$483 cum (-22 for March)**
 - **- 87: CDE Manuf.**
 - Stopped bonding CDE for about 1 month due to lack of end caps to complete CDEs. Material storage problem. (No issue: CDE manufacturing is weeks off of the CAL critical path)
 - **- 100: PEM**
 - Delay in delivery of 1st composite structures.
 - **- 281: AFEE**
 - Delay in delivery of ASICs causing delay in screening and qualification work
 - Problems in manufacture of AFEE PCB.





Actions to obtain Zero Schedule Variance

Monthly Cost /
Schedule / Mission
April 2004

□ Proposal

- **Deliver FMA with incomplete environmental testing so that I&T can test single module tower configurations and other integration activities.**
 - Do not integrate it with the Grid, however.
 - FMB shows up one month later and is the first to be installed in the Grid.
 - FMA is returned to NRL and is environmentally tested after FM16, if required.

□ Less aggressive options

- **TVAC FMA by itself rather than waiting for FMB**
 - Recovers 1 - 2 weeks of float

