

GLAST Large Area Telescope:

Tracker, W.B.S 4.1.4

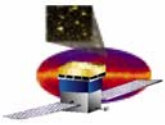
April Status Meeting

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Outline

- Tower Fabrication Status
 - 5 Tracker towers are at SLAC
- Tracker Production Status and Issues
 - Tray panel production
 - Ladder production
 - MCM production
 - Flight cable production
- Cost and Schedule Status



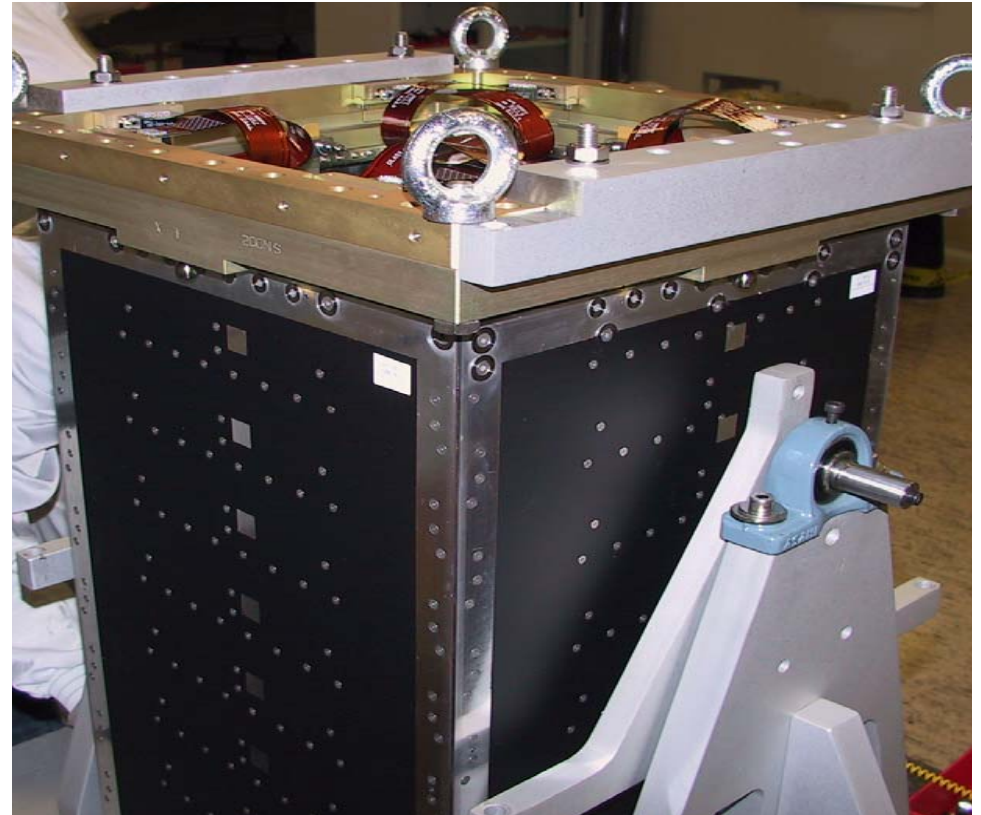
Tower-2 EMI/EMC Qual Test

- All tests were completed by COB April 22.
- All tests passed *except* for radiative emissions:
 - The requirements are so tight that it took a lot of extra effort at the facility to get the noise down low enough in their receivers.
 - The only failing frequencies were several harmonics of the 20 MHz clock, with the worst case over the limit by 14dB. Our intention is to get a waiver for these isolated deviations from the specification.
 - Most significantly, the tests passed in the bandpass of the GPS receiver and the S-band receiver.
- Radiative susceptibility just barely squeaked by for the lowest trays in the region of the Tracker amplifier bandpass (around 100 kHz), but it did pass (10^{-4} occupancy limit).
 - This was even with no attempt to close up the gap at the bottom of the tower, where the heat straps and flexures are.
 - Higher frequencies were no issue whatsoever.



Towers 1 and 3

- Recall that Tower 1 had one bad tray removed after its 1st T/V test.
- Towers 1 and 3 were tested simultaneously in T/V (2nd test for Tower 1).
- Both towers used MCMs from last year's production, so there are some small losses of efficiency from wire-bond encapsulation delamination.
- Both give excellent performance nevertheless.





Tower 1 Efficiency

| Layer | Efficiency | (1-Eff) | Hits | Missing |
|--------------|---------------|--------------|---------------|-------------|
| Y0 | 98.7 % | 1.3 % | 17222 | 220 |
| X0 | 99.4 % | 0.6 % | 17294 | 109 |
| X1 | 99.7 % | 0.3 % | 18721 | 63 |
| Y1 | 99.6 % | 0.4 % | 18866 | 74 |
| Y2 | 99.8 % | 0.2 % | 20240 | 31 |
| X2 | 99.8 % | 0.2 % | 20191 | 42 |
| X3 | 99.5 % | 0.5 % | 19155 | 100 |
| Y3 | 98.2 % | 1.8 % | 19124 | 343 |
| Y4 | 99.4 % | 0.6 % | 18708 | 105 |
| X4 | 99.2 % | 0.8 % | 18655 | 151 |
| X5 | 99.3 % | 0.7 % | 18166 | 120 |
| Y5 | 99.7 % | 0.3 % | 18143 | 58 |
| Y6 | 99.6 % | 0.4 % | 17985 | 73 |
| X6 | 99.8 % | 0.2 % | 18004 | 41 |
| X7 | 99.7 % | 0.3 % | 17880 | 55 |
| Y7 | 99.6 % | 0.4 % | 17893 | 78 |
| Y8 | 99.8 % | 0.2 % | 18067 | 28 |
| X8 | 99.9 % | 0.1 % | 18104 | 25 |
| X9 | 99.9 % | 0.1 % | 18332 | 21 |
| Y9 | 99.4 % | 0.6 % | 18319 | 118 |
| Y10 | 99.9 % | 0.1 % | 18772 | 22 |
| X10 | 99.8 % | 0.2 % | 18825 | 37 |
| X11 | 99.8 % | 0.2 % | 19268 | 29 |
| Y11 | 99.8 % | 0.2 % | 19269 | 44 |
| Y12 | 99.8 % | 0.2 % | 19943 | 44 |
| X12 | 99.8 % | 0.2 % | 20000 | 48 |
| X13 | 99.8 % | 0.2 % | 20757 | 39 |
| Y13 | 99.8 % | 0.2 % | 20808 | 38 |
| Y14 | 99.8 % | 0.2 % | 21626 | 48 |
| X14 | 99.7 % | 0.3 % | 21694 | 66 |
| X15 | 99.8 % | 0.2 % | 22533 | 53 |
| Y15 | 99.9 % | 0.1 % | 22515 | 19 |
| Y16 | 99.9 % | 0.1 % | 20918 | 28 |
| X16 | 99.8 % | 0.2 % | 20830 | 41 |
| X17 | 98.5 % | 1.5 % | 19300 | 299 |
| Y17 | 98.8 % | 1.2 % | 19184 | 228 |
| Tower | 99.6 % | 0.4 % | 695311 | 2938 |

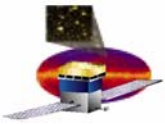
- Overall efficiency (as measured during the post-TV CPT) at the tower level is **99.6%**.



Tower 3 Efficiency

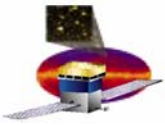
| Layer | Efficiency | (1-Eff) | Hits | Missing Hits |
|--------------|---------------|--------------|---------------|--------------|
| Y0 | 96.1 % | 3.9 % | 17187 | 663 |
| X0 | 99.5 % | 0.5 % | 17232 | 85 |
| X1 | 99.7 % | 0.3 % | 18770 | 55 |
| Y1 | 99.9 % | 0.1 % | 18836 | 27 |
| Y2 | 99.8 % | 0.2 % | 20262 | 38 |
| X2 | 99.6 % | 0.4 % | 20187 | 84 |
| X3 | 99.5 % | 0.5 % | 19281 | 101 |
| Y3 | 99.3 % | 0.7 % | 19217 | 135 |
| Y4 | 99.5 % | 0.5 % | 18615 | 87 |
| X4 | 99.5 % | 0.5 % | 18536 | 91 |
| X5 | 99.7 % | 0.3 % | 18094 | 61 |
| Y5 | 99.4 % | 0.6 % | 18071 | 114 |
| Y6 | 99.4 % | 0.6 % | 17833 | 102 |
| X6 | 99.6 % | 0.4 % | 17910 | 67 |
| X7 | 99.2 % | 0.8 % | 17839 | 134 |
| Y7 | 99.7 % | 0.3 % | 17884 | 49 |
| Y8 | 99.7 % | 0.3 % | 18034 | 47 |
| X8 | 99.7 % | 0.3 % | 18041 | 49 |
| X9 | 99.7 % | 0.3 % | 18260 | 47 |
| Y9 | 99.8 % | 0.2 % | 18241 | 40 |
| Y10 | 99.8 % | 0.2 % | 18652 | 30 |
| X10 | 99.9 % | 0.1 % | 18622 | 27 |
| X11 | 99.9 % | 0.1 % | 19154 | 22 |
| Y11 | 99.8 % | 0.2 % | 19122 | 34 |
| Y12 | 99.9 % | 0.1 % | 19839 | 28 |
| X12 | 99.2 % | 0.8 % | 19887 | 163 |
| X13 | 99.4 % | 0.6 % | 20590 | 122 |
| Y13 | 99.8 % | 0.2 % | 20628 | 34 |
| Y14 | 99.8 % | 0.2 % | 21438 | 45 |
| X14 | 99.6 % | 0.4 % | 21471 | 78 |
| X15 | 99.8 % | 0.2 % | 22309 | 36 |
| Y15 | 99.9 % | 0.1 % | 22316 | 27 |
| Y16 | 99.8 % | 0.2 % | 20802 | 39 |
| X16 | 99.8 % | 0.2 % | 20683 | 48 |
| X17 | 99.6 % | 0.4 % | 19106 | 81 |
| Y17 | 99.4 % | 0.6 % | 18993 | 115 |
| Tower | 99.6 % | 0.4 % | 691942 | 3005 |

- Overall efficiency (as measured during the post-TV CPT) at the tower level is **99.6%**.
- The only layer out of spec is the bottom tray (70 disconnected channels after tray thermal cycles).



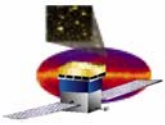
Tower 4 Status

- Completion of the tower assembly was delayed, to await 2 cables to replace those from panels with bad coupons.
- The tower is assembled now and is ready for environmental testing.
- The current plan is to test it in parallel with Tower 5.



Tower 5 Status

- All trays are assembled, and the last 2 are being tested at G&A today.
- Thermal cycles and stacked tray testing are being done at Terni.
- The trays will be in Pisa May 2 for tower assembly.
- It is critical that SLAC receive all Tower-5 cables from Parlex this week in order not to delay the schedule.
- Environmental testing of Towers 4 and 5 should begin May 10, and the Alenia facilities are reserved for that date. Late cable delivery will screw up this schedule.



Tray Panel Production

- INFN has a sufficient number of tray panels in hand to take us at least part way through Tower-7.
- Bottom trays are done through Tower-8, including static testing.
- Plyform is restarting tray panel production, with closeout machining and face-sheet fabrication in process.
- INFN believes that new trays will be ready in time so as not to delay Towers 7 and 8, but it is tight:
 - Mounting of MCMs on Tower-7 trays should begin around May 5, according to my project schedule.
 - Similarly, mounting of MCMs on Tower-8 trays should begin around May 16.
- More tungsten is in procurement for the last towers. GSFC will be required to etch and prime more tiles, starting around mid May.



Ladder Production

- 90 extra SSD wafers (from the HPK overstock) were recently sent to Pisa, where they will be tested.
- With the ASI contract in place, SSD ladder production at MIPOT can begin.
 - 300 ladders will be started there in May, after they build a few ladders first to make sure that their process is still good.

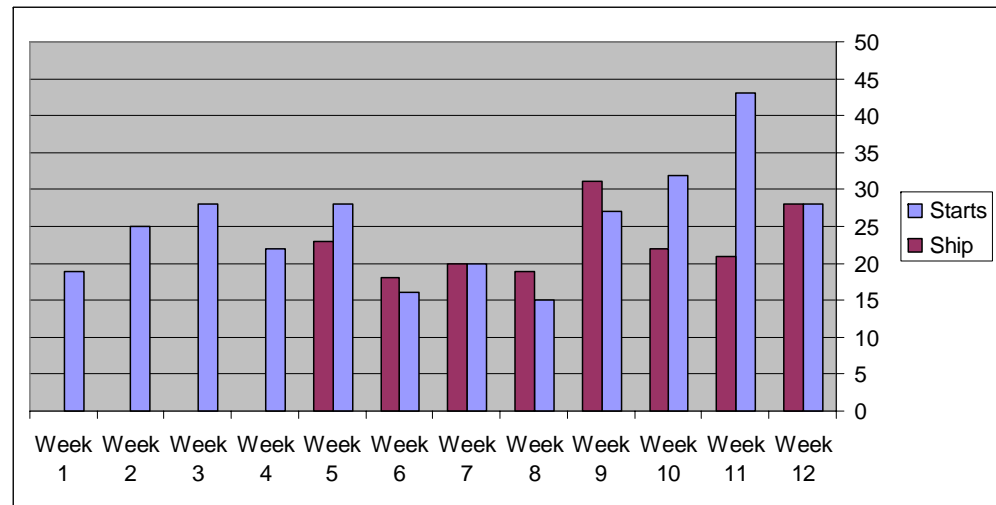
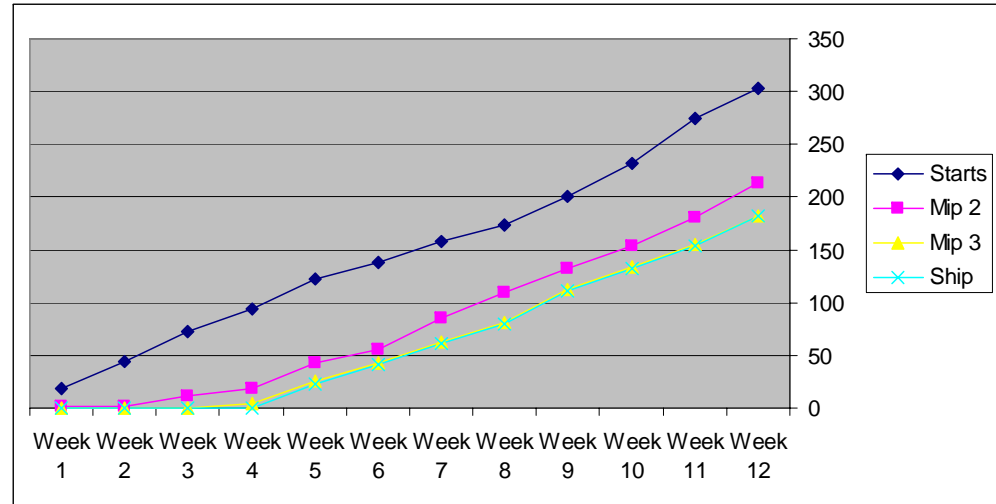


MCM Production Restart

The new bonding fixtures have dramatically increased the yield and throughput through MIP-1.

There are still occasional problems with pitch-adapter trace cracking. First indications are that the new Dyconex parts do not help but are worse.

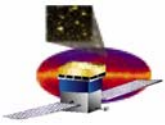
The present rates are just barely keeping up with tray assembly. We need to push closer to 30 MCMs/week, at least, but it is a struggle to get there.





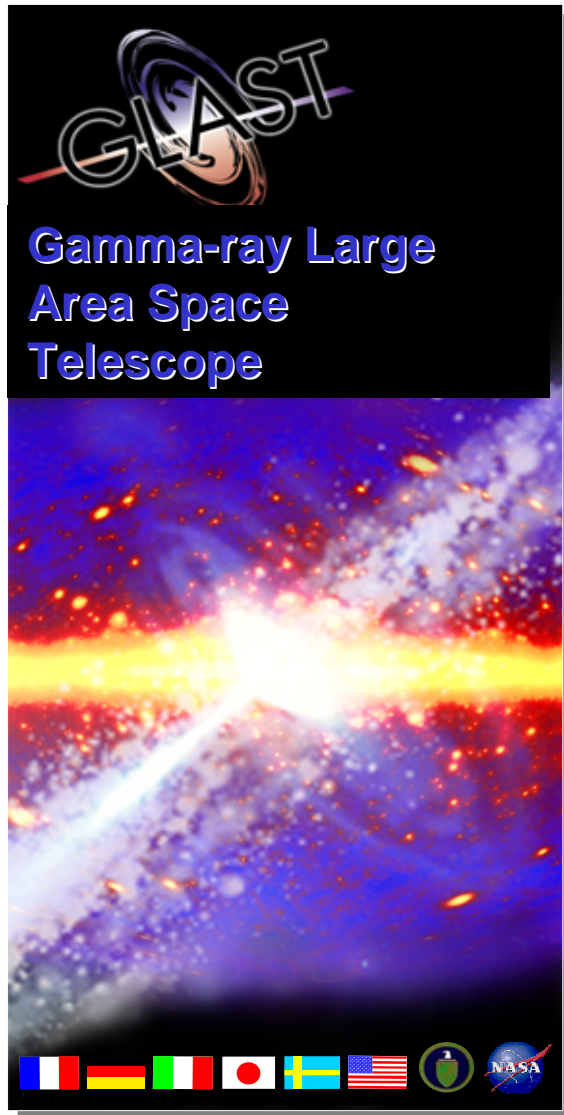
Tracker Flex-Circuit Cable Status

- Tower 5 Cables:
 - 4 of the cables are at SLAC.
 - C6 is supposed to ship today.
 - C3, C4, C5 are supposed to ship tomorrow or Thursday.
 - The C3 schedule seems dicey; Dave Rich will push on it.
- Major issue du jour:
 - Omnetics connectors crack too often during installation.
 - David Rich is flying to Parlex today to understand this issue and make sure that the Tower-5 cables ship.
 - Are the cracks serious enough that the connectors need to be replaced?
 - Why is the Parlex installation procedure causing cracking?

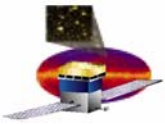


Alternate Source Investigation

- The PO has been placed with Pioneer.
- SLAC shipped engineering materials to Pioneer yesterday for prototype assemblies.
- Last-minute drawings issues have been getting resolved during the last couple of days.
- The MRR being scheduled, probably for next week.
- Deliveries are still expected to begin around mid June.

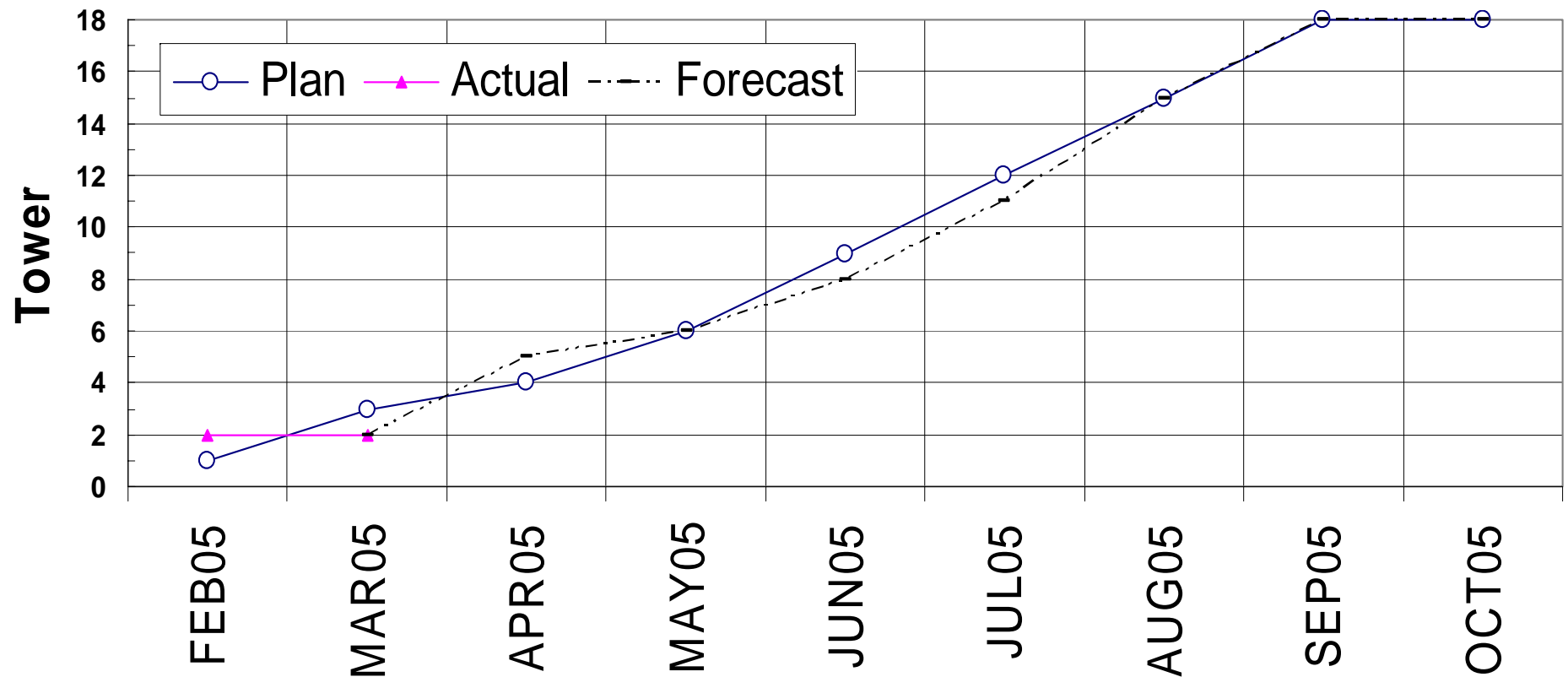


Cost/Schedule Reports for 4.1.4 Tracker Presentation March 2005 Month End



Level 3 Milestone Count

4.1.4 Tracker





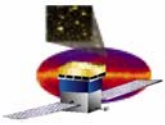
Level 3 Milestone List

| Activity Description | Baseline Finish | -1m Var | Bsln Var | Early Finish | Gantt Chart | | | | | | | | | | | |
|--|-----------------|---------|----------|--------------|-------------|----|----|----|----|----|------|----|----|----|----|---|
| | | | | | FY05 | | | | | | FY06 | | | | | |
| | | | | | FE | MA | AP | MA | JU | JU | AU | SE | OC | NO | DE | |
| Instrument Project Office (Level 3) | | | | | | | | | | | | | | | | |
| 4.1.4 Tracker | | | | | | | | | | | | | | | | |
| Flight Tracker Tower A RFI | 02/04/05 | 0 | 0 | 02/04/05A | ▼ | | | | | | | | | | | |
| Flight Tracker Tower B RFI | 03/02/05 | 4 | 4 | 02/24/05A | ▼ | ▼ | | | | | | | | | | |
| Flight Tracker Tower 1 RFI | 03/22/05 | -6 | -27 | 04/28/05 | | ▼ | ▽ | | | | | | | | | |
| Flight Tracker Tower 2 RFI | 04/20/05 | 8 | -2 | 04/22/05 | | | ▼ | ▽ | | | | | | | | |
| Flight Tracker Tower 3 RFI | 05/03/05 | 0 | 3 | 04/28/05 | | | | ▼ | ▽ | | | | | | | |
| Flight Tracker Tower 4 RFI | 05/16/05 | 0 | 0 | 05/16/05 | | | | | ▼ | ▽ | | | | | | |
| Flight Tracker Tower 5 RFI | 06/03/05 | 0 | 0 | 06/03/05 | | | | | | ▼ | ▽ | | | | | |
| Flight Tracker Tower 6 RFI | 06/16/05 | 0 | -4 | 06/22/05 | | | | | | | ▼ | ▽ | | | | |
| Flight Tracker Tower 7 RFI | 06/27/05 | -1 | -5 | 07/05/05 | | | | | | | | ▼ | ▽ | | | |
| Flight Tracker Tower 8 RFI | 07/06/05 | -1 | -5 | 07/13/05 | | | | | | | | | ▼ | ▽ | | |
| Flight Tracker Tower 9 RFI | 07/15/05 | -1 | -5 | 07/22/05 | | | | | | | | | | ▼ | ▽ | |
| Flight Tracker Tower 10 RFI | 07/26/05 | -1 | -5 | 08/02/05 | | | | | | | | | | | ▼ | ▽ |
| Flight Tracker Tower 11 RFI | 08/04/05 | -1 | -5 | 08/11/05 | | | | | | | | | | | | ▼ |
| Flight Tracker Tower 12 RFI | 08/15/05 | -1 | -5 | 08/22/05 | | | | | | | | | | | | ▼ |
| Flight Tracker Tower 13 RFI | 08/24/05 | -1 | -5 | 08/31/05 | | | | | | | | | | | | ▼ |
| Flight Tracker Tower 14 RFI | 09/02/05 | 0 | -4 | 09/09/05 | | | | | | | | | | | | ▼ |
| Flight Tracker Tower 15 RFI | 09/13/05 | -1 | -5 | 09/20/05 | | | | | | | | | | | | ▼ |

Run Date 04/12/05 13:10
 Data Date 04/01/05
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GLAST LAT PROJECT
Level 3 Milestones
Baseline Variance (Organized by Subsystem)

LT-DZ: Baseline Variance
 FL-D4: AV: Level 3 Milestones
 Report #10
 Sheet 1



Milestone Variance Explanation

- Tower 2 RFI is about 1 week later than indicated. EMI/EMC testing is complete, but the handoff test and final review are being held this week.
- Tower 4 RFI will be delayed a couple of weeks in order to combine its environmental test with that of Tower 5.
- Tower 14 RFI has not changed since last month. The biggest threat to this schedule at present is cable delivery.
 - INFN and SLAC are preparing the contingency plan to put in place in case cables are delayed. Towers would be assembled, tested, and then the sidewalls installed without cables, the CMM completed, and the tower stored in the Pisa cleanroom.



Cost Report

| Reporting Category | Cost Incurred | | | | Estimated Cost | | | Estimated Final Cost | | Unfilled Orders Outstanding |
|--|---------------|------------|---------------|---------------|----------------|------------|---------------------|----------------------|----------------|-----------------------------|
| | During Month | | Cum. to Date | | Detail | | Balance of Contract | Contractor Estimate | Contract Value | |
| | Actual | Planned | Actual | Planned | APR05 | MAY05 | | | | |
| 4.1.4 TRACKER | | | | | | | | | | |
| 4.1.4.1 TRACKER MANAGEMENT | 83 | 113 | 3,534 | 3,532 | 102 | 100 | 284 | 4,021 | 4,021 | |
| 4.1.4.2 RELIABILITY & QUALITY ASSURANCE | | | 4 | | | | -4 | | | |
| 4.1.4.3 TRAY SUB-ASSEMBLY | 205 | 366 | 11,769 | 11,932 | 452 | 398 | 501 | 13,120 | 13,120 | 809 |
| 4.1.4.4 TOWER STRUCTURE & ASSEMBLY | 266 | 317 | 2,687 | 2,668 | 204 | 234 | 683 | 3,808 | 3,808 | 778 |
| 4.1.4.5 TRACKER TEST & CALIBRATION | 18 | 45 | 86 | 166 | 17 | 17 | 149 | 268 | 268 | |
| 4.1.4.7 INSTRUMENT INTEGRATION & TEST (SLAC) | 5 | 12 | 54 | 59 | 11 | 11 | 23 | 99 | 99 | |
| CAPW[3]Totals: | 575 | 853 | 18,134 | 18,357 | 787 | 760 | 1,634 | 21,316 | 21,316 | 1,587 |



FTE Report (DOE/NASA-funded only)

4.1.4 Tracker FTEs

—▲— PLANNED
—■— ACTUALS

