

# Monthly Technical / Cost / Schedule Review GLAST LAT Tracker December 2003

### January 28, 2004 R.P. Johnson Santa Cruz Institute for Particle Physics University of California at Santa Cruz



### **New Draft Org Chart**





- □ Meetings Jan 13/14 in Pisa and Jan 16 at G&A near Rome.
- Reached agreement with our Italian colleagues on the design concept for the Tracker-Grid interface.
- Formulated a plan on how to proceed with MCM production and Tray assembly at G&A.
- □ Worked out a schedule leading up to a Tower-A delivery in July.



#### **GLAST Tracker**

Titanium machining & shipping	Jan 20	Mar 1
Bottom tray assembly tooling	Jan 19	Feb 27
Top/bottom tray fabrication, test, and bakeout	Mar 2	Mar 24
Mid tray fabrication, test, and bakeout	Feb 4	Mar 9
Flight male nano-connectors	now	Feb 9
MCM assembly, test, burn-in, and shipping	Feb 9	Mar 23
Tooling for integration of ladders & MCMs onto btm trays	Jan 19	Feb 27
Assembly of ladders onto trays	Mar 12	Mar 25
Tooling for mounting MCMs onto trays	Jan 19	Mar 19
Mounting MCMs onto trays and test	Mar 26	Apr 8
Tray thermal cycle and stacked tray test	Apr 9	Apr 28
Tower assembly and test	Apr 29	May 19
Tower environmental test, plus final comprehensive test	May 20	Jun 23
Need date for sidewalls		Apr 28
Need date for flex-circuit cables		Apr 1



#### **GLAST Tracker**

_						February		March			April		May		June		Jul
ID	10	Task Name	1/11	1/18	1/25	2/1 2/8	2/15 2	2/22 2/29	3/7	3/14 3/21	3/28 4/4	4/11 4/18 4/2	5 5/2 5/9	5/16 5/23	5/30 6/6	6/13 6	6/27
1		Titanium Parts				1											
2	Ē	Bottom Tray Tooling										_ Yesterda	ay Plyforr	n repol	rted tha	t	
3	1	Top/Bottom Tray Fab										they nee	d 1 mont	th to pr	epare		
4		Mid Tray Fab										the botte	m trav to	olina	which		
5		Male Nanoconnectors												, vonng, v	WINCH		
6		MCM Assembly & Burn-in										works if	they star	t now.			
7	<u>.</u>	Btm tray integration tooling															
8		Ladder Integration							4	]		- Info	from ves	sterdav	is that	INFA	1
9		MCM integration tooling				1						will	have 10	trove	vithout I	Man	
10		MCM integration										VVIII	nave iu	uays n		v and	
11	Ē	Flex-Circuit Cables										, Kaj	oton by ei	nd of F	ebruary	/.	
12		Tray Testing									l	-	1				
13		Sidewalls															
14		Tower Assembly & Test										Ĭ	•	_ <u>1</u>			
15	<u>.</u>	Environmental Test															

- Issues with this schedule:
  - Titanium parts first articles require 4 weeks ARO. We underestimated the work required to get the drawings finalized—it seems unlikely to be done by the end of this week.
  - Myriad of detailed actions to close to get MCM and Tray assembly started for flight articles—we are pushing hard, but the Feb 9 and Feb 4 dates are fast approaching!
  - Many parallel efforts in Italy; their manpower is oversubscribed, so it is imperative to get the new engineers on line.
  - The remaining EM test effort is going on in parallel, which exacerbates the manpower shortage in Italy. It is crucial to move any further mechanical tests on the interface and bottom tray back to California, using new manpower.



#### □ SLAC and INFN converged on a common concept:

- All 12 flexure bolted joints will be identical and employ dual concentric cones to allow adjustability.
- We will have capability to record the position of each cone.
- The Tracker group will align the tower onto its vibration fixture and verify by CMM that it is within the stay-clear above the fixture (including the tower geometric tolerance plus its mounting alignment tolerance), in conformance with the IDD.
- The Tracker group will record the orientations of the cones in the 3 corner flexures that define the reference of the tower to the Grid.
- When I&T removes the tower from the vibration fixture and mounts it to the Grid, they will maintain the cone orientations in those 3 flexures. The cones in the other 9 joints will be adjusted accommodate the Grid hole positions while minimizing induced stress in the Tracker.



- Tom Borden and BJ put together a complete set of drawings for the detailed concept.
- Martin Nordby and Mike Menning are taking over completion of the drawing details, tolerancing, and checking to prepare for titanium manufacture.
- Machining of the bottom tray closeout pieces at COI is also on hold pending Martin's review of those drawings.
- Martin is coordinating this effort with completion of the Tracker IDD. The IDD and Tracker bottom-tray/flexure drawings need to be signed off in the near future.
- Tom and Robert drafted a proposal for strength testing of the interface. This will be taken over by Mike Menning.
- Tom and Elliott Bloom are looking into ways to complete vibration testing of the interface/bottom tray and also to provide a fit check piece for I&T to work with.



#### □ Solution:

 Replace 100° countersink M2.5 screws by custom-made 120° screws, still with Torx+ heads.

#### □ Status:

- Testing of this concept was concluded and documented in LAT-TD-02809.
- No damage to the sidewall material is seen with 120° screws to above the original design torque of 80 N-cm.
- We are baselining this and modifying the sidewall drawings accordingly.
- Also decided to bond aluminum to both sides of sidewalls to balance the layup and to minimize the risk of loose carbon fibers.

	120° screws	100° screws
Before Test Minimum Angle	119.8272°	97.4781°
Before Test Maximum Angle	120.6601°	99.0060°
After Test Minimum Angle	120.0780°	134.1325°
After Test Maximum Angle	120.4405°	136.1325°



#### □ MCM, pitch adapter pitch

- The Parlex parts show a shrinkage of about 100 microns on average, plus a 40 micron rms variation.
  - Complicates programming of the auto wire bonder for connecting to the SSDs
  - Causes some net misalignment between pitch-adapter, bias circuit, and SSDs, possibly resulting in crossed wire bonds
- Solution: SLAC will measure the existing parts and reject enough to keep the variation within one SSD to no more than 30 microns and keep the net shrinkage to no more than about 100 microns. This will reject about 50% of the parts. A drawing has been prepared in the past week for a fixture to expedite this screening.
- We will need to make more parts at Parlex and will want them to bias the photoplot to correct for the expected shrinkage.





#### MCM flatness on the wire-bonding edge

- Flatness and straightness along the length of the board appear to be okay, within ±100 microns.
- Perpendicularity: most, but not all, traces fall within an error of 4 degrees. The Teledyne gluing fixture cannot control or tweak this, so with that tooling we are probably stuck with what we get.
- G&A is confident that they can wire bond the parts, but there may be some impact on cost. They will measure and wire bond 10 preproduction MCMs to assess this.
- G&A started development of a new gluing fixture that is able to hold the flatness tolerances desired. SLAC or Teledyne will complete this development as a backup solution, in case the wire bonding does become a cost/schedule issue. 11





### **Issue: Nano-Connectors**

LAT Monthly Technical Review December 2003

#### □ Omnetics Nano-Connectors

- Omnetics has fixed the jack screw length.
- They completed testing of a surface preparation (bead blasting) to improve the adhesion of the metal shell to the plastic body.
- On the female connectors they are also modifying the metal shell to keep it from distorting when the jack screws are torqued.
- Male connectors for MCM production should be available the first of February.



#### □ ASIC procurement

- GTRC V7 production was completed on schedule, with wafers received at SLAC last Friday.
- The first GTRC-V7 wafer was probe tested at UCSC.
  - Thanks to the heroic efforts of Mutsumi Sugizaki, who worked until 5:00 am Monday night to get the system going on the new wafers.
  - The V7 chip functions and passes all of the test vectors, including the new vector introduced to catch the TOT error in the V6.
  - The wafer yield was greater than 90%, as expected.
  - More wafers are being tested, but just the first one is enough for >2 towers.
- The first wafer was delivered to GDSI Tuesday afternoon for grinding, dicing, inspection.
  - We should have diced chips next Tuesday.



- □ Next week: refit 3 existing non-encapsulated MCMs with V7 chips.
- Test each one with the full set of test vectors of the MCM production test system at the usual 14 MHz, 20 MHz, 22 MHz.
  - In addition, test one over all frequencies from 1 MHz to 25 or 30 MHz and over power supply voltages from 2.2 V to 3.0 V.
- □ Install the 3 MCMs in series in the burn-in system (SLAC EGSE).
  - Execute the full suite of tests programmed into this system.
  - Repeat the tests at fine intervals from 1 MHz to well above 20 MHz.
  - Test over the accessible range of power supply voltage.
  - Most of this can be completed by COB February 6.
- □ In parallel, inject some GTRC-V7 chips into the tail end of the Teledyne preproduction.
  - Execute the MCM qualification plan for these MCMs. This includes extensive thermal cycling and functional testing over a wide range of temperatures.
- Flight production, with cosmic-ray testing as soon as 3 trays are completed. Send relevant SLAC personnel to Italy for this (early April).



#### □ MCM Front-End Electronics

- MCM preproduction is in the home stretch, with Feb 6 the goal for completion of the Teledyne work.
- The thermal-cycle acceptance tests and burn-in procedure have been executed on 13 preproduction MCMs with no drop-out so far.
- 3 MCMs are at G&A, with 7 more to be shipped today.
- Feverishly working to get drawings, documents, and software completed in all details and put under configuration control for a PRR, hopefully next week, for a Feb 9 production start.

#### □ Flex-circuit cables

- I must have lied last month, because the drawings and design files are still not ready for production.
- The flow from 3-D model to fab drawings was found to be lacking in rigor and is being redone and rechecked.
- We discovered yesterday a hole in our MCM short-circuit protection scheme that requires us to put a resistor on the cable in series with the GTRC address lines.



# November Accomplishments & Status

LAT Monthly Technical Review December 2003

### □ Sidewalls

- A team including Ben Rodini is at Plyform this week reviewing coupon test results and so forth.
- Drawings are being slightly modified, as discussed earlier.
- I need to push soon for a definitive schedule for Tower-A sidewall production.

### Mid Tray Production

- We are pushing hard on getting the drawing reviews completed and hope to have a released drawing set by next week.
- SLAC QA and others are are Plyform this week closing documentation and procedure issues. First reports (yesterday) are very positive.
- LAT QA is at Plascore today inspecting new honeycomb cores.

#### □ Bottom Trays

- Closeout production is well advanced at COI and is not critical.
- Titanium parts are very critical.
- New assembly fixtures are being designed and made in Italy. I said the same thing last month but was mistaken. It is now critical.

R.P. Johnson



# November Accomplishments & Status

LAT Monthly Technical Review December 2003

#### □ EM Vibration Test

- A test report was produced by the Bari group but still needs some analysis added to close out the test.
- All 4 EM walls were removed and the bottom tray (and other trays and sidewalls) inspected. No discernable damage occurred during the vibration.
- Any further vibration of this hardware has been postponed to after the T/V testing because of the complications associated with finalizing the interface design and retrofitting it to the EM bottom tray.

#### **EM Thermal Vacuum Test**

- High priority.
- Working toward a start at the end of February or early March.
- Jack Goodman is traveling to Italy regularly and is pushing this forward.