Tracker Subsystem Report

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R.P. Johnson

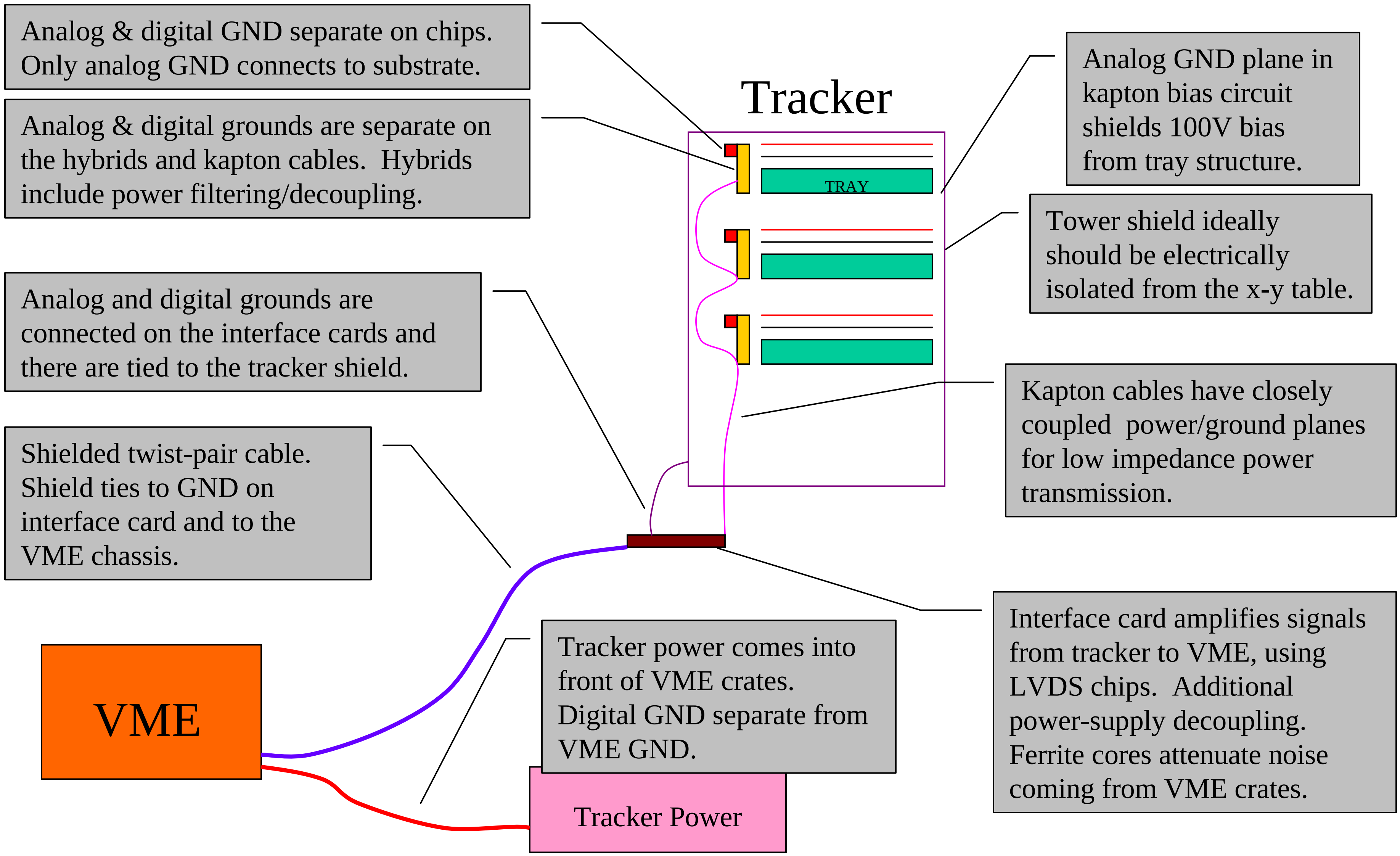
Santa Cruz Institute for Particle Physics

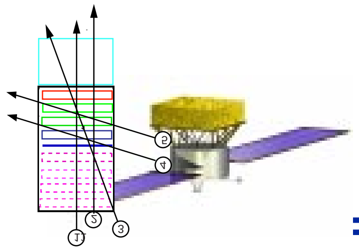
University of California at Santa Cruz

Prototype Tracker Tower Status

- TRAYS: Fabrication of the tray mechanical structure is somewhat delayed, due to problems with making the trays sufficiently square using existing fixtures. The first tray should be assembled (without electronics or detectors) the 1st week of July, with the last one completed in mid August.
- ASSEMBLY FIXTURES: Fabrication of a large number of assembly fixtures has been on the critical path. The situation appears to be well in hand now, with most completed or in the shop and the design of the last fixture (for detector alignment) close to being signed off.
- ELECTRONICS: All tray electronics components and detectors are in hand. Chips are being mounted and wire bonded onto the hybrids at Promex. Afterwards, they will be tested and burned in.
- LADDERS: 70 of 135 detectors ladders are completed, with more being completed at the rate of 10 to 15 per week.
- DAQ: A scheme for interfacing the tracker with the VME-based DAQ has been worked out. Stanford must iterate the VME board design. UCSC is making the cables and an interface board. A thorough grounding and shielding scheme has been worked out.
- ASSEMBLY:
  - Hybrids will be mounted onto trays from July 8 to August 25.
  - Detectors will be mounted onto trays from August 3 to September 1.
  - The tower should be completed and ready for testing by mid September.

Tracker Shielding and Grounding Scheme

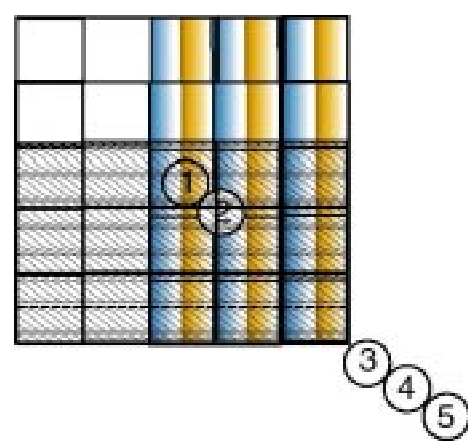




Prototype Tracker Tower Configuration

- 17 Trays, 16 x-y planes, with a total of 132 32-cm detector ladders.
- 32 readout sections, all fully instrumented (51,200 channels).

Tray	Number ladders each side	Pb Thickness	Number 4-in detectors	Number 6-in detectors
17	T: 0 B: 3	3.5%	15	
11–16	T: 3 B: 3	3.5%	180	
10	T: 3 B: 5	3.5%	40	
9	T: 5 B: 5	3.5%	25 (bottom)	15 (top)
8	T: 5 B: 5	3.5%		30
4,5,6,7	T: 5 B: 5	25%		120
2,3	T: 5 B: 5	0		60
1	T: 5 B: 0	0		15
Total: 17	Total: 132	Total: 135%	Total: 260	Total: 240



Silicon-Strip Detectors

- Preparations for detector procurement are progressing. One reliable vendor for detectors from 6-inch wafers (Hamamatsu Photonics) that claims to be able to do the entire production in 1 year (and at an attractive price). Micron has also made a few prototypes and could do part of the production. One other vendor in Italy will be investigated. Hartmut proposes 4-inch wafers as a backup.
- Eduardo do Couto e Silva at SLAC reported on QA of silicon-strip detectors. Progress is being made at SLAC to improve the detection of a large variety of potential problems. Data can be fed back to the manufacturer to improve production. Detailed records are being kept during the prototype tower construction to track defects and potential problems over the long term. Proposals were made for testing and QA during the flight-instrument construction.
- Yoshida from Hiroshima University reported on specifications of the detectors for the flight instrument and on the performance of the large detectors made by Hamamatsu Photonics. The performance generally far exceeds our specifications, even after radiation testing.

Tracker Mechanical Design

- Eric Ponslet of Hytec Inc showed results from a detailed analysis of the tracker tray design.
  - A detailed 3-D tray model can reproduce the measured resonant frequency (700Hz) for the two test trays that were subjected to vibration testing at GSFC in April.
  - The trays survived the test, but the model predicts that the silicon-strip detectors were taking 90% of the stress and the thin Al face sheets only 10%. Calculated stresses approach worrisome levels and will be nearly double in a tray with silicon on both sides.
  - Measured deflections have not yet been provided by GSFC, but the model predicts about a 5% probability of the deflections exceeding the allowed values (trays possibly hitting each other).
  - Thermal stresses also are an issue. The flight-instrument tray structure cannot be made from aluminum or beryllium. The CTE mismatch between Pb and Si can introduce unacceptable stress in the Si if the face sheets are too weak.
  - Recommendation is to greatly stiffen the face sheets (and core) to reduce the stress in the detectors and reduce the deflections. By using high-modulus fibers, the increase in radiation lengths can be kept to nearly negligible levels.
  - The tray closeout should be made from carbon fiber. Hytec has proposed a development program. The GLAST schedule for the “pathfinder” prototype demands that the work begin in earnest ***now***.

Other Tracker-Related Developments

- Front-end chip design: a test chip is nearly ready to submit to the HP 0.5 micron process. Space qualification issues still need to be fully addressed.
- Detector configuration: “SuperGLAST” (yesterday’s discussion). Are we going to test this in the beam test?
- Software: significant enhancements in the reconstruction software are in progress. The new pattern recognition and Kalman-filter fitting should in the long term improve the efficiency and background rejection and make the analysis more versatile.
- WBS: Feerick, Sadrozinski, Johnson made a first pass at a grounds-up tracker construction cost estimate, with costs spread over the construction period. There is a clear shortfall of funds in the 2001 time period.
- Martin Nordby is restructuring the WBS, putting in more detail, and mapping it more rigorously onto a schedule. This will make the numbers more reliable, but most likely the funding profile will still have problems in 2001.
- We will study the feasibility of compressing the construction schedule in 2002 and 2003. (*i.e.*, can 2, instead of 1, towers can be built per month?)
- Descoping option: reduce number of layers by 3?

GLAST Tracker WBS

- Feerick, Sadrozinski, Johnson made a first pass at a grounds-up tracker construction cost estimate, with costs spread over the construction period.
- Bottom Line (without contingency) for 18 towers of 18 planes:
  - ED&I and Labor: $9.4 M
  - M & S: $13.3 M
  - Total: $22.7 M
- Cost of one more tower: $700 K
- Cost of one more layer: $670 K
- Costs by year:

Very Preliminary!

2000	2001	2002	2003	2004	2005
$3.0 M	$7.4 M	$7.9 M	$3.1 M	$0.8 M	$0.5 M

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