Considerations concerning replacement of TKR Tower A

September 30, 2007

Objective and Agenda

Meeting Objective: Evaluate pros and cons of changing the LAT I&T baseline to replace TKR Tower A

Agenda:

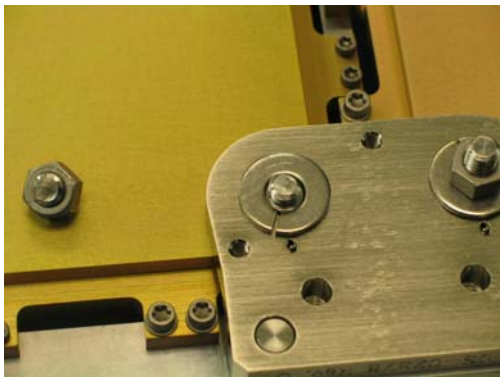
I&T impact assessment	Ken Fouts
Tower A performance and science impact assessment	Bill Atwood, Steve Ritz

TKR A Replacement Risk Assesment

Operation	Risk	H, M, L	Mitigation
Remove cable trays and shear plates	Damage to shear plate stud while removing discrepant nuts; requires disassembly of Cal and/or replace with spare	H	Use the nut splitter to mechanically break the nuts.
	Debris from Adhesive Removal; leading to on-orbit shorts, optical surface degradation	M	Use hepa-Vac during removal to minimize dust and debris. Clean external surfaces
Demate Cables	Connector damage; loss of harness or component (13 mates)	M	Use proper demate technique and be very cautious
Remove CAL/TEM/TPS	Lift fixture/crane ops errors damage to adjacent components; resulting further LAT degradation	L	Established procedures, fixture maintenance/inspection
Debond TKR Flex cables	Damage to Flex cables while removing adhesive bond.	H	Use technique developed previously for flex cable removal.
Remove TKR	Lift fixture/crane ops errors damage to adjacent components; resulting further LAT degradation	L	Established procedures, fixture maintenance/inspection

TKR A Replacement Schedule Impact

Replacement TKR received:	TKR Removal and Replacement	Schedule Impact
10/13/2005	Completed during off shifts.	Minimal
10/20/2005	Completed after Tower 14 installation.	5 days
After 10/20/2005	Completed on arrival	Day for day plus 5 days (will delay testing with ACD)

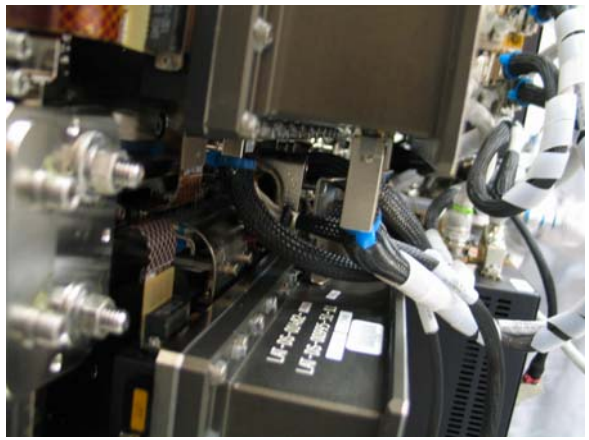


Broken stud on Grid 2

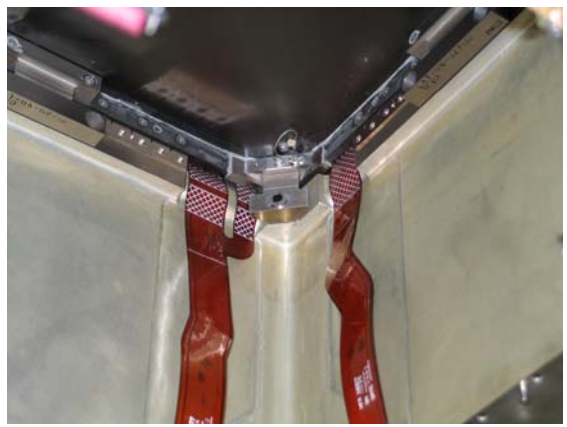
Nut splitting demo

After splitter was removed

Debris removal



Limited access between DAQ Boxes

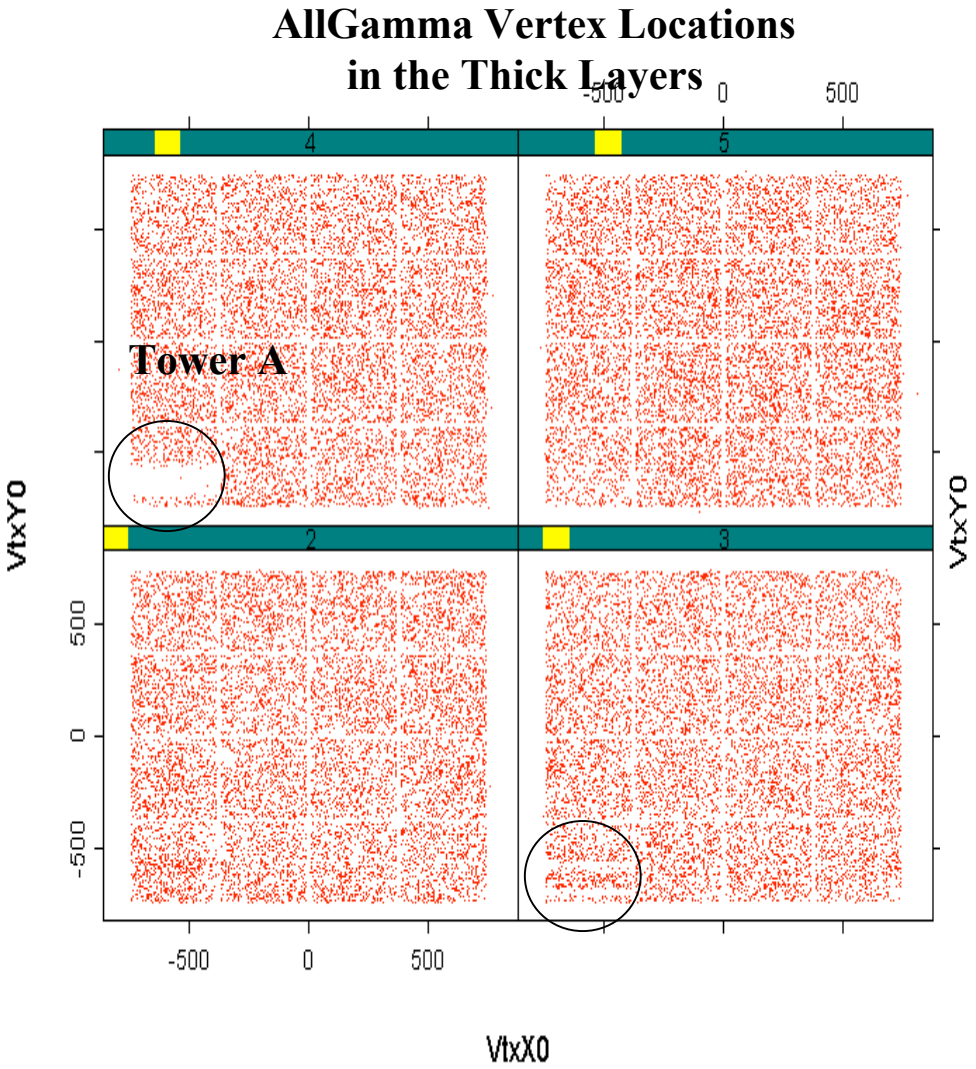


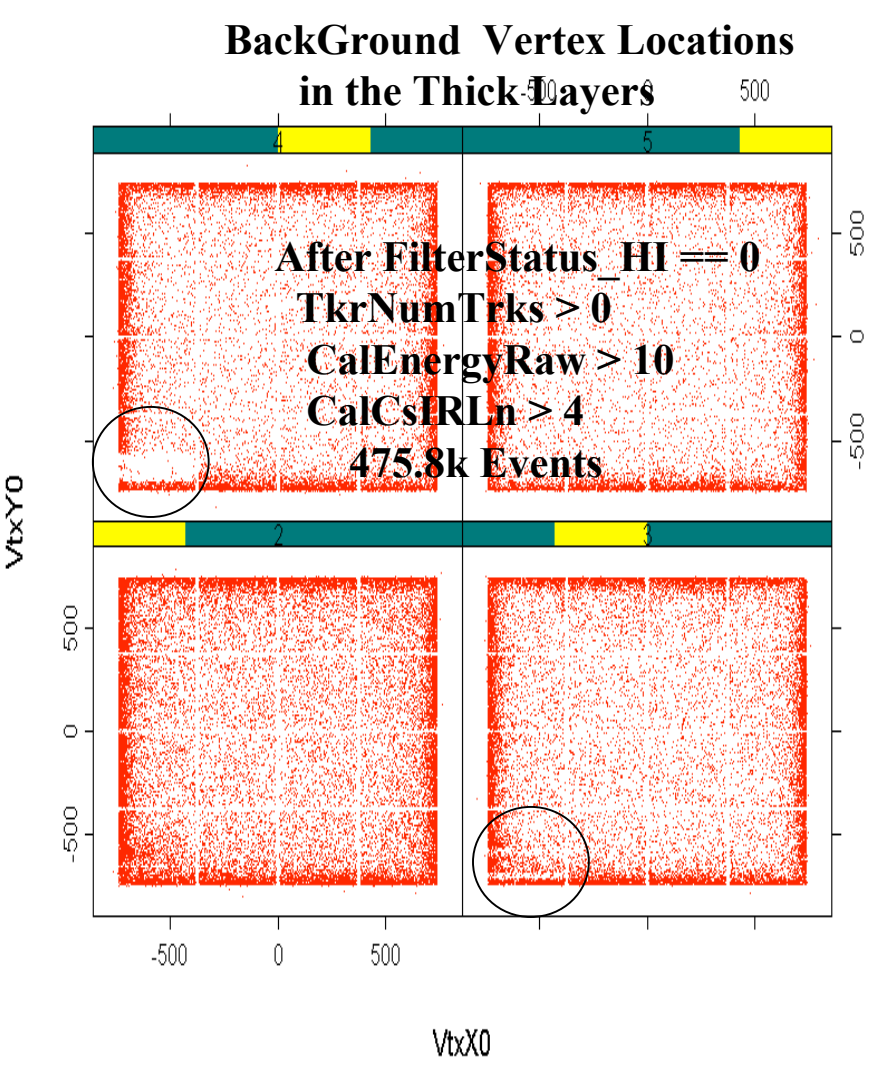
TKR cables after TEM CAL removal

Science Impacts of Tower A

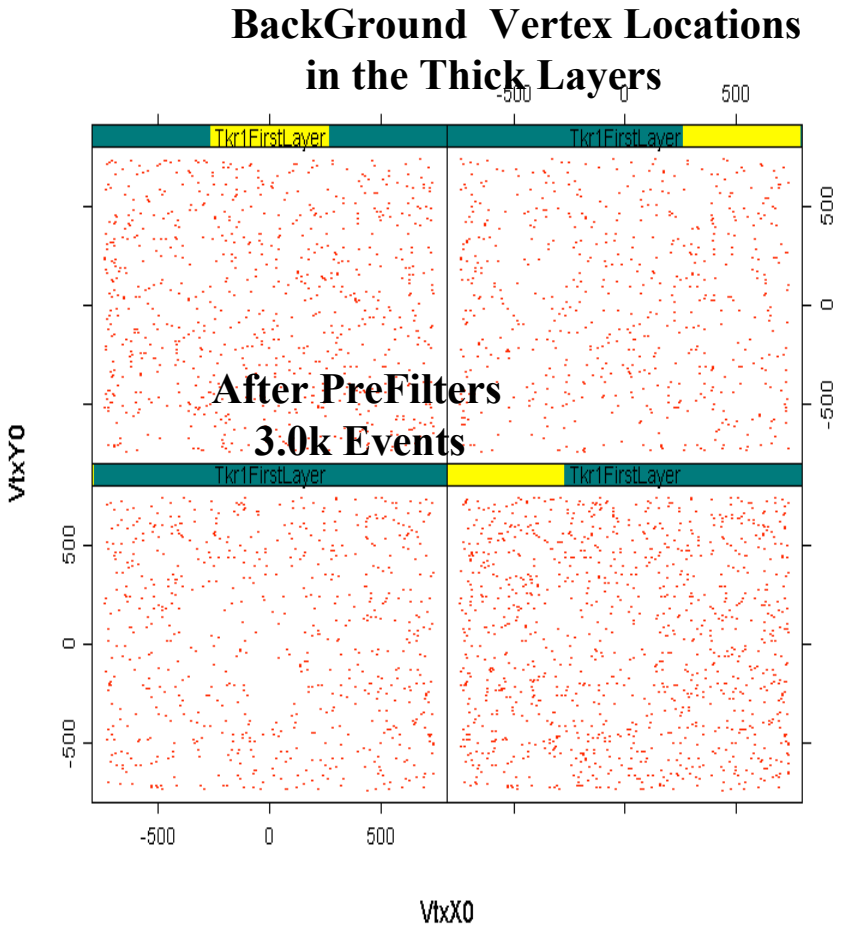
- Current bad channel list of Tower A is the baseline in the simulations.
- As usual, main impact can be parameterized with Effective Area:
  - Direct loss of photons from affected regions (poorly measured, so removed)
  - Indirect loss of photons due to additional background cuts required.
- Difficult to assess in detail the impacts of relatively small changes (few % of full LAT) in live volumes
  - Design is robust, with graceful degradation
  - Simulation has been "in the shop" for upgrades in advance of DC2 performance evaluations. Problem recently uncovered effectively makes the ACD inefficient, so we are hunting for a relatively small signal in a large baseline rate. [problem understood and is being fixed]. Independent of this issue, effects are small.
  - Incremental background due to dead regions of **today's** Tower A is visible, but not a huge concern (see following slides)
- So, the main concern has been one of stability. How bad can it get, and what are the impacts? (see following slides)

Loss of Area: Today's Tower A





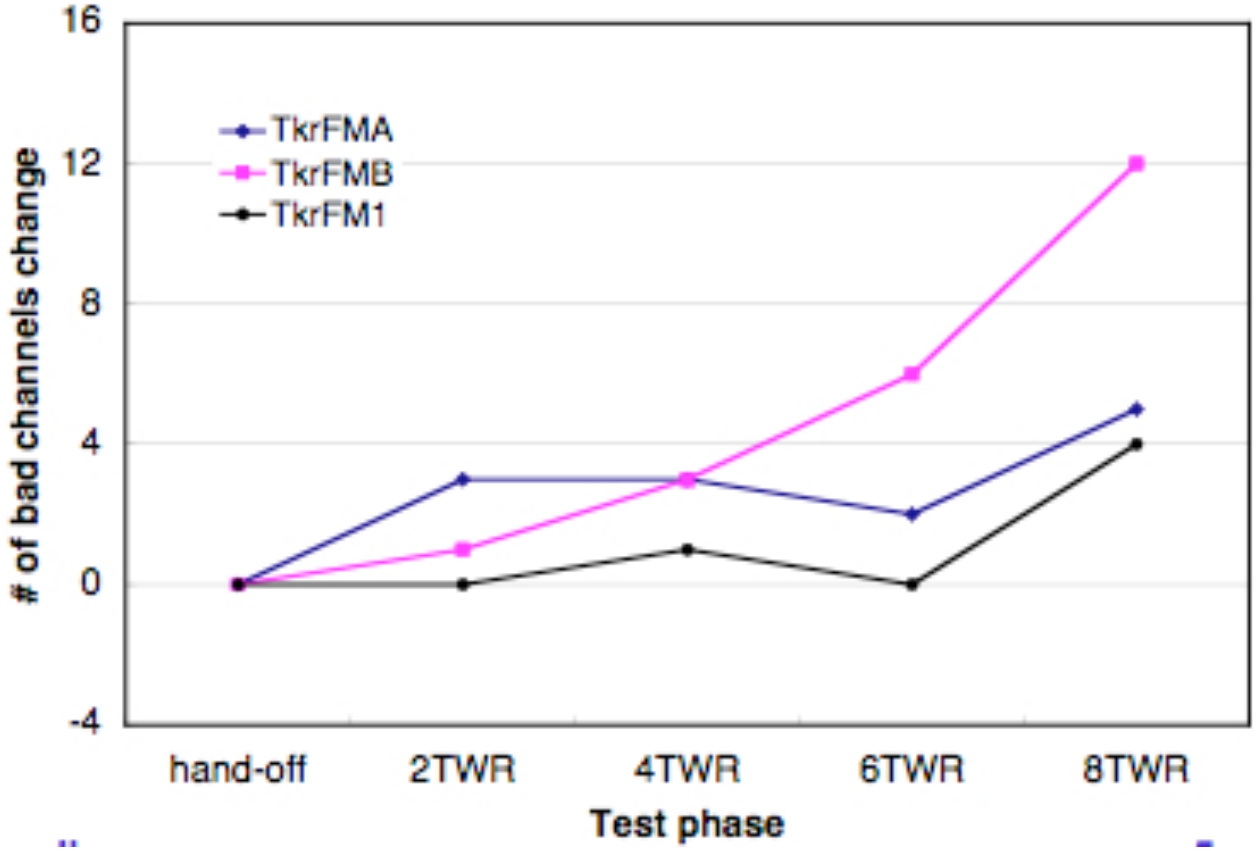
After cuts: Today's Tower A



Bottom line: no major background hot spots after cuts. Loss of Aeff ~ 1%.

What about Stability?

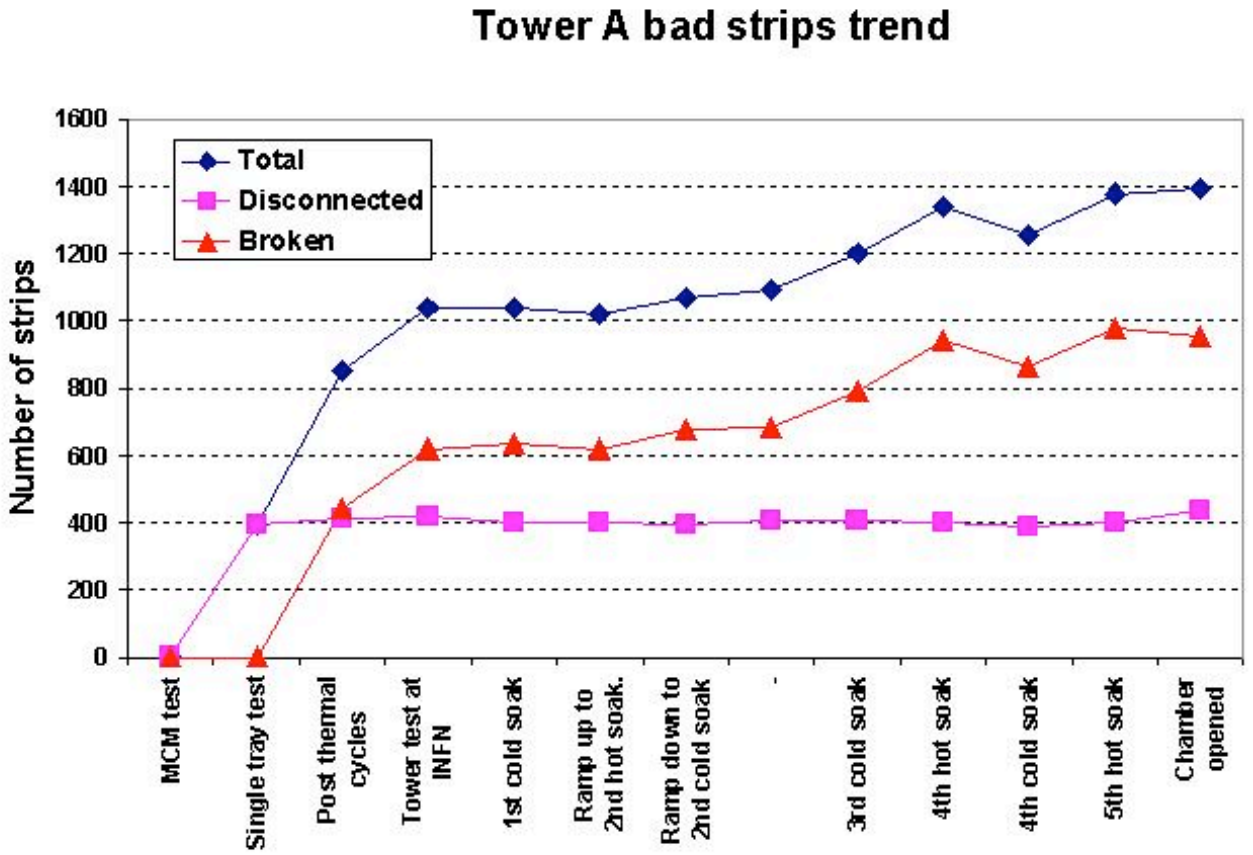
Analysis by H. Tajima and J. Cohen-Tanuji, since Tower A arrived at SLAC



Stable at room temperature.

Tower A Trend with Thermal Cycling

- **Analysis from Italy:**



Good news: MCMs stable!
Bad news: more strips on affected ladders are continuing to break

Impacts

- Trend difficult to project forward.
- Attempt to bound the problem: assume all the ladders in top and bottom planes of Tray 4 are dead. Simulation prepared by L. Rochester. Analyzed by Bill.
- Results for now:
  - No gaping holes. Finer details difficult.
  - Incremental 25 background events on top of ~400
    - Final background rejection would require at least a factor 4 reduction (next round). Present uncertainty is how many of the 25 will remain. Statistics also marginal.
    - Worst-case this represents a 25% increase in background.
  - Additional cuts likely needed to remove incremental background due to poorer event reconstruction. Educated guess is 6%-8% Aeff reduction based on previous experience (last residual background hardest to reject).
  - Direct loss of Aeff guaranteed (~few %)
- Bottom-line worst case: loss of 10% Aeff.

Summary

- **Primary impact of Tower A is a reduction in the margin on Aeff.**
  - **With today's Tower A, educated guess ~1% loss**
  - **If both planes lost, educated guess <10% loss worst case**
- **Current best estimate of peak Aeff is just under 10,000 cm^2 against a requirement of >8,000 cm^2.**
- **Losing the surrounding towers, or flying fewer than 16 towers, due to damage in replacing Tower A would be significantly worse!!**
- **Bottom line: a trade of risks.**
- **Recommendation: based mainly on the risk assessment from I&T, we recommend against replacing Tower A.**