Monthly Mission Review

LAT System Commissioning

J. Eric Grove
Naval Research Lab
eric.grove@nrl.navy.mil

LAT performance

- LAT performance monitoring program during environmental test
  - Receiving CPT, Vibe LPTs, EMI LPTs
    - Subsystem and SE data reviews complete
  - Detector and DAQ performance is stable at NRL
    - ACD
      - Pedestals, gains, veto rates and thresholds
    - CAL
      - Pedestals, gains, linearity, threshold rates
    - TKR
      - Bad channel list, noise occupancy
        - » Bad channel count increased by <1.5% since TKR delivery
        - » We're learning more about noise flares. See later.
    - T&DF
      - Data integrity, transport errors, etc
  - Calibration prior to TVAC is in progress
    - ACD MIP peaks, CAL energy scale, TKR efficiency

Script and test status

- Liens against LAT CPT at PER
  - LAT-22x (Science Ops Demo)
    - Long-standing mystery resolved.
      - FSW bug prevents use of on-board filters simultaneously with periodic triggers. Will be fixed in next FSW delivery.
    - Work-around in place. Script now executes as expected.
  - LAT-23x (GRB Handling)
    - No change.
      - Tests existing FSW. Awaiting post-TVAC FSW deliveries.

- Other script news, former liens
  - LAT-15x, 16x (Thermal control)
    - Ambient test (15x) completed.
  - LAT-17x, 18x (EMI/EMC)
    - Test completed. See later discussion.
  - LAT-52x (Light Tight)
    - Test completed.
    - Prelim analysis: No issues, but still need reports from subsystems
  - LAT-8xx (Voltage margins, High rates)
    - Work-around used in LAT-22x will work here too. Test planned before TVAC.

Preliminary look at EMI test results

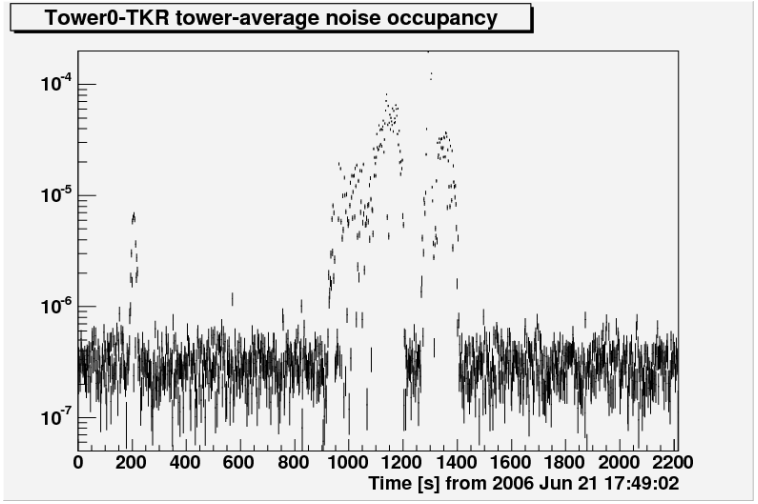
Detector subsystems

EMI/EMC analysis

- EMI/EMC test program completed
- Susceptibility pass criteria
  - No reproducible increase in transport errors, noise triggers
  - Detectors meet noise occupancy or noise floor specs
- Offline analysis
  - Offline reports for each run
    - ACD strip charts
      - Pedestal centroid and width (= noise floor)
      - Hit and veto occupancy
      - Conclusion: No issues
    - CAL strip charts
      - Pedestal centroid and width (= noise floor)
      - CAL-LO and CAL-HI trig request rate, by Tower
      - Conclusion: No issues
    - TKR strip charts
      - Hit occupancy and trig request rate, by Tower
      - Conclusion:
        - » Reproduced known 30-100 MHz susceptibility (RS103)
        - » Noise flares complicated the discussion

RS103 at low freqs

- Reproduced known TKR susceptibility at 30–200 MHz
  - Noise occupancy increases
    - ~33 MHz to ~100 MHz
  - Same effect observed at TKR tower-level tests
  - Noise occ can exceed spec
    - Retest at ~27C shown
    - First test at ~22C did not exceed spec
- Sources of <200 MHz emission
  - None on orbit
  - Ground radars
    - Transient effect on orbit



- Time series of noise occupancy in Tower 0
  - Frequncy logarithmically increasing with time
    - 200 sec ~ 33 MHz
    - 1350 sec ~ 100 MHz

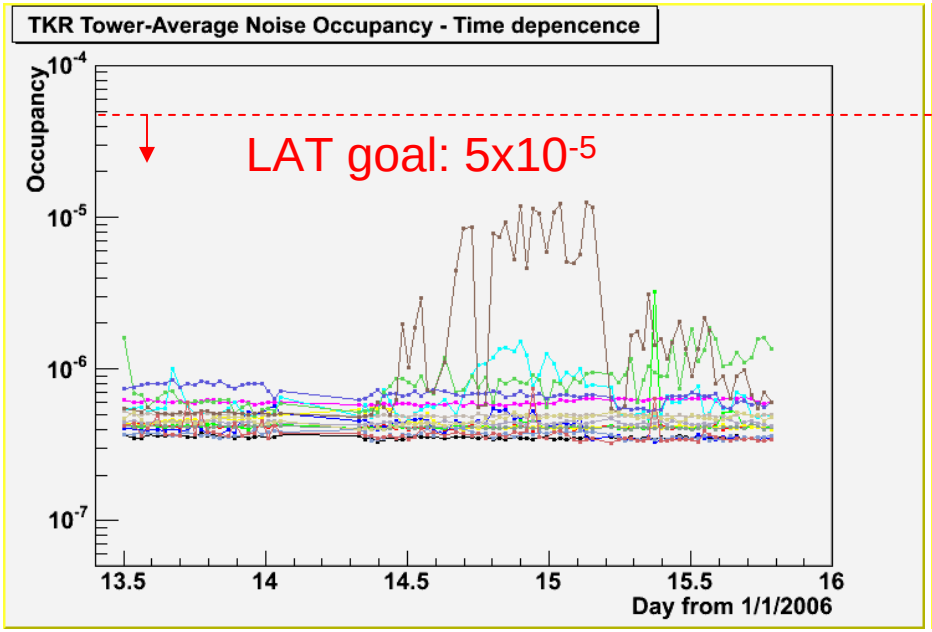
Tracker Noise Flares

From presentations and documents by Mutsumi Sugizaki

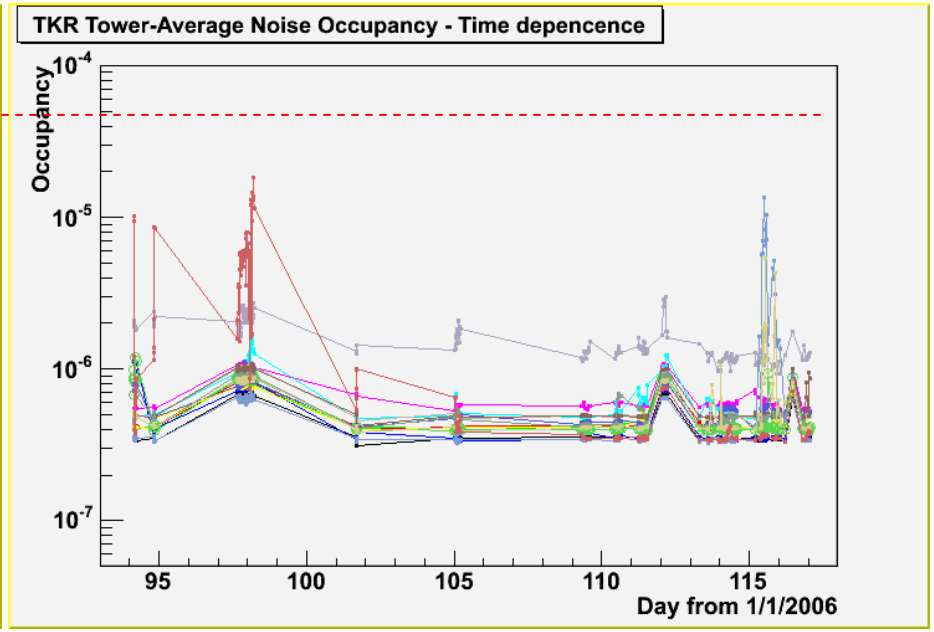
Long term trend of noise occupancy

Noise Occupancy of each runs averaged per tower

January 06 muon-run data



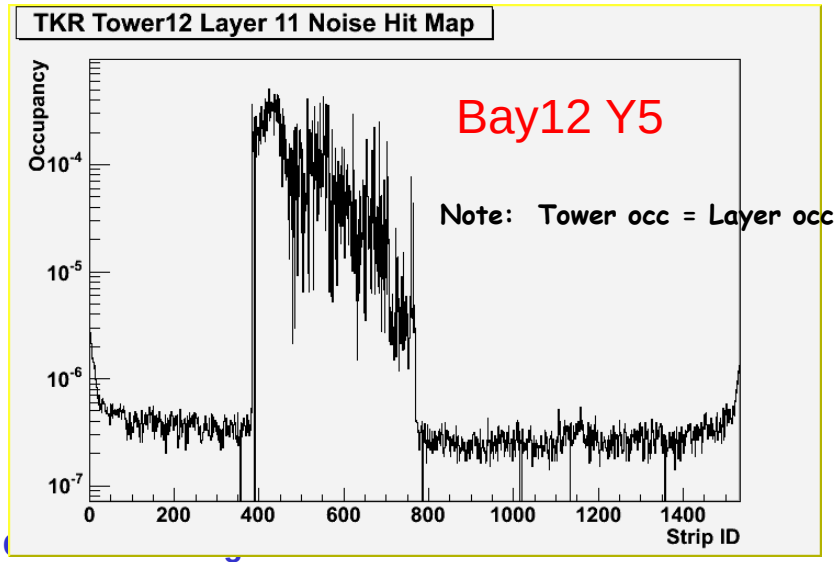
April 06 muon-run data

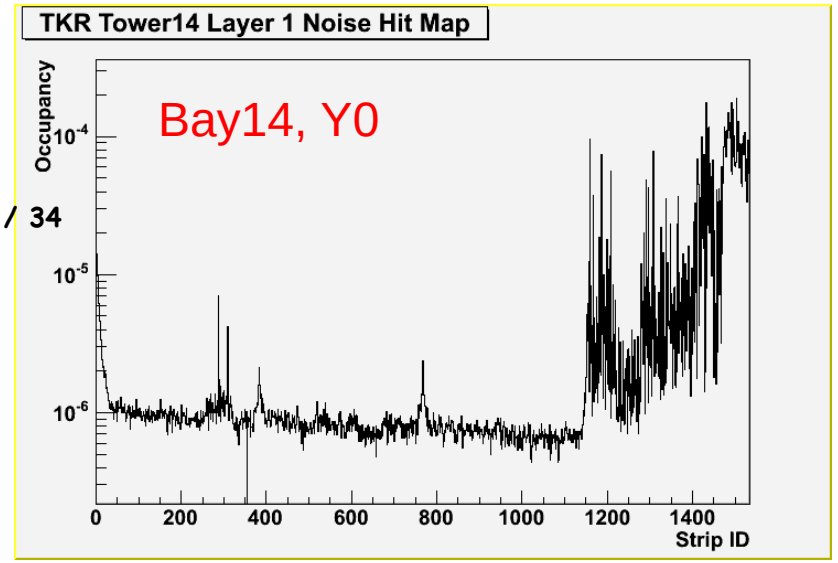


- LAT goal (< 5×10^{-5}) and spec (< 10×10^{-5}) are easily met.
- Large-variability towers are not same between January 06 and April 06.
- The large variability comes from a couple of marginal noisy strips *or* intermittent noise flares.

Noise flares

- Layers with noise flares
  - January 2006 – Four active examples
  - April 2006 – Eight active examples
    - Same four plus four new ones
  - June 2006 – Nine active examples
    - Three of above plus six new ones
- Why is the number increasing?
  - In part, just more run time, and we're looking harder
- Examples of noisy strip profile of April 06 flare layers

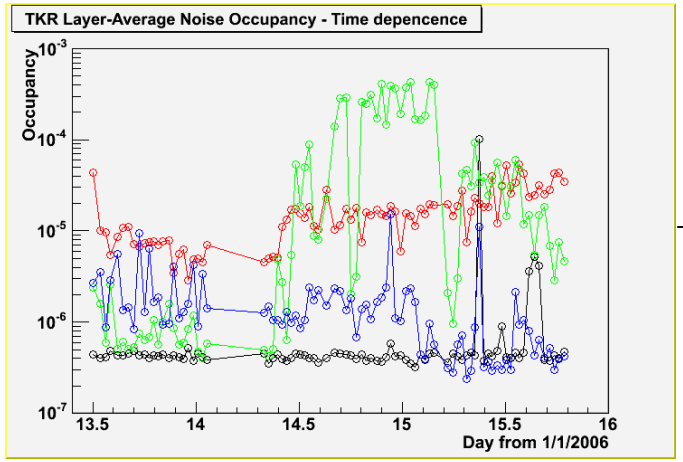


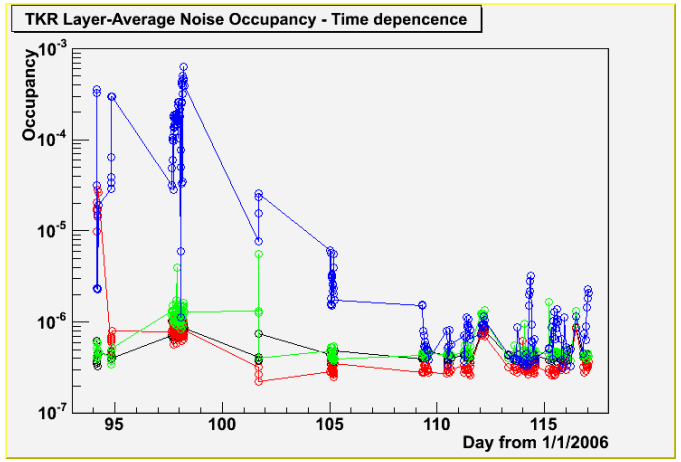


Long term activity of flaring layers

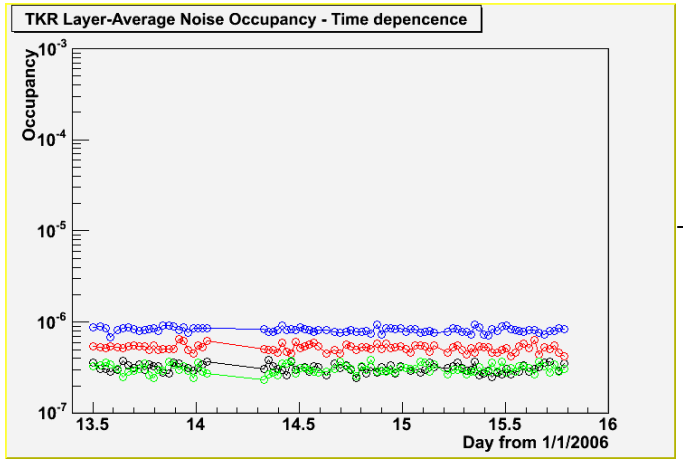
January 06 | April 06

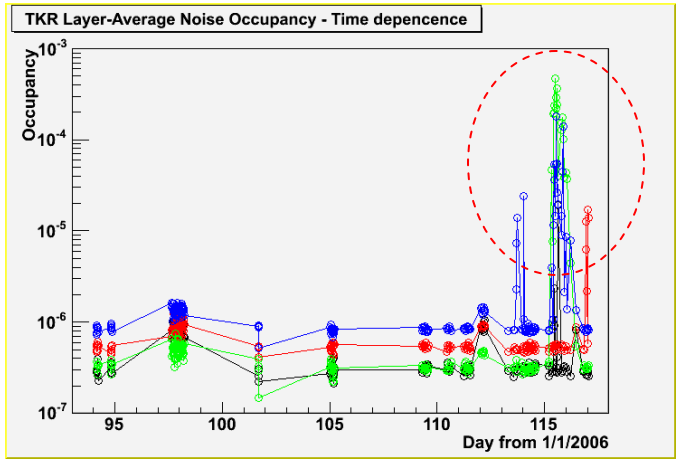
Flare layers seen in January
Bay2 Y8
Bay7 Y14
Bay10 X17
Bay15 X11





April Flare Layers
Bay7 X14
Bay10 Y4
Bay12 Y5
Bay14, Y0





Note: Tower occ = Layer occ / 34

Flaring layers can go active to inactive, inactive to active

Flaring duty cycle

- Peak flare activity is rare
  - Fraction of time Tower occupancy exceeds 50% of LAT spec is small
  - Two sample epochs shown in table from M. Sugizaki

			Test runs		
TKR ID	Grid Bay #	Layer ID	Receiving test	**LAT 16-Tower**	TkrFM8 long run
TkrFM7	Bay10	X5	4.1%	**0.0**	---
		Y6	1.4%	**0.0**	---
		X17	0.0	**12%**	---
TkrFM8	---	Y0	0.04%	---	0.0
TkrFM9	Bay11	Y0	0.75%	**0.0**	---
TkrFM11	Bay15	X11	2.3%	**0.23%**	---
TkrFM13	Bay7	Y14	0.0	**3.6%**	---
TkrFM14	Bay2	Y8	0.05%	**0.55%**	---

Effect on science performance

- But what does all this mean? What should we care about?
  - Data volume
    - Sustained periods > 10^{-4} noise occ in full LAT stress downlink
    - Not an issue
      - Average noise occupancy in LAT is much lower
  - Tracking efficiency
    - Not an issue
      - Noisy patches are not dead
      - Tracking algorithm is very efficient at rejecting noise
  - Trigger efficiency
    - Flaring can decrease trigger efficiency and increase chance coinc
      - Only if layer occupancy > 8%
    - Not an issue
      - Flaring layers and episodes are random
      - Layer occupancies during flaring are *far* below this threshold