GLAST Large Area Telescope: EM/TKR Test Status Report

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Overview

- **EM/TKR characterization**
  - Gain
  - Noise
  - Noise Occupancy
  - Trigger timing

- **Problems**
  - GTRC time out error
  - GTRC failure
  - Detector Biasing
  - Cable mechanical interference
Gain

- Gain measurement involves threshold DAC, calibration DAC and calibration capacitor in addition to the gain itself.
- Average gain: 101 mV/fC
- Stability: <0.1% change after 10 days, 0.3% change with new TEM-PS
- “Gain” dispersion within GTFE chip: 4–7%
  - SPEC: < 10% (LAT-SS00152-2)
- Keep track of dead GTFE channel.
Noise

- Average Noise: ~1500 electrons (ENC)
- Stability: 0.5% change after 10 fays. 0.6% change with new TEM-PS.
- Effective way to find “open” channels.
  - Missing wire-bonds, broken pitch adapter traces.
  - Perfect match with pre-ship review data: Nothing new.
  - Fraction: 0.5% (SPEC: efficiency > 98%, LAT-SS-00017-5) 2.7% (includes mechanical problems with pitch adapter)

[Graph showing Gain vs Strip# (Layer Y3) and "Open" channels]
Noise Occupancy

- Hot channel is defined as occupancy > $10^{-4}$ (LAT-SS-00152-2)
- Fraction: <0.1%
  - 6.7% (includes dead/noisy ladders due to bias problems.)
- Stability:
  - 9/17: six hot channels.
    - Five hot channels are subset of pre-ship review list.
    - One new hot channel.
    - 15 hot channels disappeared from pre-ship review list.
  - 9/29: six hot channels.
    - All hot channels are subset of pre-ship review list.
    - 14 hot channels disappeared from pre-ship review list.
  - Occupancy for most of disappeared hot channels are less than $10^{-5}$. 
Timing Studies with Calibration Strobe

- Find optimum TACK (trigger acknowledge) delay for each strip.
- No significant propagation delay is observed.
- Large dispersion: ±0.5 µs
  - SPEC: peaking time = 1.5 ± 0.5 µs (LAT-SS-00152-2)
  - SPEC: trigger jitter < 0.25 µs (LAT-SS-00152-2)
- After TKR/CAL integration (TEM is also changed), 0.16 µs shift of optimum TACK delay is observed.
  - Further investigation.

![Optimum TACK delay vs. Strip # graph](24/0 split)
Trigger Timing Studies

Hit multiplicity vs TACK delay

TKR and CAL trigger timing difference is less than 0.2 μs.

Further timing delay due to GASU might affect strip efficiency.

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Issues

- GTRC time out error due to a bug in TOT.
  - Very rare with TOT disabled. (twice in 10 days.)
  - Further test with higher track rate.
- GTRC/GTFE testing.
  - One GTRC chip failed at 2.4V (SPEC: 2.5 ± 0.25 V)
- Broken wire bond for SSD bias at SLAC.
  - No handling issue.
  - Double or triple wire-bond for SSD bias pads.
  - Note no new broken wire-bond for strips observed.
- Cable mechanical interference.
- Test scripts are not ready for flight models.
  - Requires at least one month.