Onboard Filter Status

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Status

- OnboardFilter is stable, but the gamma veto rate was high, especially at low energy
- Have looked at each veto cut in detail
  - Vetoes based on track finding were inefficient
    - Can be improved somewhat by relaxing track finding “tolerance”
  - Gammas vetoed vs. Energy distributions show where each veto does its damage
    - Looked at these for backgndavgpdr and all_gamma sources (to 180 GeV)
    - GLAST Mission providing LAT with a factor 4 increase in downlink data volume

The solution: let in 5% more background (factor ~2 in rate), and make some minor changes to the filter’s logic

Result: Dramatic improvements
Fraction of Gammas Vetoed vs. log10(McEnergy)

**TKR triggered events**

Before any changes to the filter

"goodEvents" – Rome cuts*

Before any changes to the filter

*does not include background cuts, just: goodCal && goodPSF && zdir_recon. (CalTotRLn>2.0&&CalEnergySum>5.0)&&((IMgoodCalProb>0.2)&&((IMcoreProb>0.2)&&((IMpsfErrPred<3.0)&&((Tkr1ZDir<-0.2))))
Which vetoes are killing the gammas?

- Vetoes 15 –18
- Vetoes 19 - 22
- Vetoes 23 - 26
- Vetoes 27 - 30

Black: TKR triggered events
Blue: TKR triggered and VETOED

Log10(McEnergy)
Same plot but for goodEvents only

Vetoes 15 – 18

Vetoes 19 - 22

Vetoes 23 - 26

Vetoes 27 - 30

Log10(McEnergy)

Black: goodEvents
Blue: VETOED
The worst offenders? (for any TKR triggered event)

- At low energy
  - Veto 15: no 2 track evidence below 350 MeV
  - Veto 16: track into the skirt region
  - Veto 17: no track found
  - Veto 21: no tracks into CAL with energy
  - Veto 22: CAL E layer 0/ETOT > 0.90
  - Veto 23: CAL E layer 0/ETOT < 0.01
  - Veto 28: Event has 0 energy + tile hit

- At high energy
  - Veto 18: Track - ACD Row 2 match
  - Veto 19: Track - ACD Row 0 or 1 match
  - Veto 20: Track – ACD Top match
  - Veto 26: Event has a splash veto
  - Veto 28: Event 0 energy + tile hit
Changing the filter logic

- Did several trials with different alterations of the filter
  - Removed some vetoes
  - Put energy cuts on a few others
  - Watched the background rate as vetoes were removed

Changes:
- Veto 15 removed
- Veto 17 only executed when Energy > 250 MeV
- Veto 18 only executed when Energy < 30000 MeV
- Veto 19 only executed when Energy < 100000 MeV
- Veto 20 only executed when Energy < 30000 MeV
- Veto 21 only executed when Energy > 100 MeV
- Veto 22 removed
- Veto 23 removed
- Veto 26 removed
- Track finding tolerance is relaxed: go from ± 32 strips to ± 192 strips

Note: “Energy” corresponds to the raw cal energy that the filter sees, not McEnergy

This number is being evaluated
Fraction of gammas vetoed **after** filter changes

Recall...

"goodEvents" – Rome cuts*

And after changes

*Big drop in fraction vetoed*

*without background cuts*
Impact on gamma and background rates

• Most improvement is at very low and very high energy
• The overall “goodEvent” fraction vetoed is between ~3-8%, but most of these will be likely be removed by background cuts (Bk_Veto)
  – An event display examination of the vetoed goodEvents supports this assertion
  – If necessary, may also make minor alterations to Vetoes 17 and 18 that would further reduce gamma vetoes

• With the altered filter, the backgndavgpdr veto rate dropped from ~95% to ~90%, increasing the event rate to ~340 Hz
  – This would be okay, as we can handle 400 Hz to the ground
• Just before this talk, added in the new albedo_gamma_upwards source into the background mix
  – This causes the background rate to rise to 470 Hz.
  – Now working on reducing rates again. The albedo gammas have little or no CAL deposition.
Summary

• Simple changes in the filter logic significantly lower the gamma veto rate, while doubling the amount of background that gets through
  – The logic can be altered by removing some vetoes, putting energy cuts on others, and relaxing the track finding tolerance

• The filter has a small impact on the events remaining after the Atwood cuts
  – Most of these will likely be removed anyway by background rejection cuts (not yet applied!). Update next meeting.

• Some additional changes are being tested
  – These are designed to improve the goodEvent efficiency, and the albedo_gamma_upwards rejection rate