Fermi
Gamma-ray Space Telescope

Users Group Meeting

Mission Status Update

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Observatory Status Highlights

• Observations:
  – Regular +50 deg sky survey with occasional ARR until April 2018
  – Modified survey following Solar Array Drive Anomaly in late March

• FOT/engineering activities
  – Transition to new FOT completed in March
  – Anomaly Review Team formed to study potential root cause

• LAT/FSSC operations
  – Transitioning tasks from SLAC/ISOC to FSSC/LAT collaboration
    • Going smoothly, no sharp changes expected at the time of final transition (Oct 2018)
    • Taking the opportunity to update/futureproof the software infrastructure
Science!

• Spectacular year
  – Major discoveries in multimessenger Astrophysics
    • GW and GRB with Fermi-GBM
    • Neutrinos and AGN with Fermi-LAT
On March 16, the -Y solar array drive assembly (SADA) encountered an anomaly, the observatory entered safehold when the array was at +18 deg.
SADA Anomaly

• On May 16, we tried moving the –Y SADA closer to zero, it moved -1.5 deg before no longer moving in either direction

• No clear mechanical or electrical/electronic root cause
  – Cannot rule out similar vulnerability for the +Y SADA
  – We have disabled +Y SADA tracking during eclipse

• Power Margin
  – Fermi has considerable power margin
    • We don’t max out the capacity of the solar array when charging the battery
    • We complete battery charging, and drop down to “trickle charge” before re-entering eclipse
  – We are looking at observing strategies that maintain full charging, so that the ”trickle charge” part of the cycle can provide margin
Observing strategies with stuck SADA

• Single sided rocking towards hemisphere that does not contain the sun
  – Power positive
  – Maintains observing efficiency
  – Losing all sky exposure on short timescales (but maintains full sky exposure on timescales of weeks)
  – Causes problems with battery temperatures when the beta angle (angle of the sun from the orbit plane) exceeds ~25 deg
  – Causes +Y SADA to track to large angles
Observing strategies with stuck SADA

• Option 1: Sine-function rocking profile (from Eric Stoneking and Sandy Calder)
  – Once-per-orbit sinusoid with amplitude equal to 90 deg minus \( \text{abs}(\beta) \) , and passing through zero at orbit 6am and 6pm
  – Phase set so the sign of the rocking angle on the daylight side of the orbit matches the sign of the beta angle
  – This puts the +Z axis on the plane perpendicular to the Sun over the whole orbit
  – Yaw steering should keep the Sun in the +X/Z plane as always

• Option 2: Sine-function during daylight part of orbit, 50 deg rock in night part
  – Turned out to be necessary, because current configuration of TDRSS scheduling software does not allow communication contacts during sine-function rocking profile
Comparing option 1 and option 2

- Rock between north and south every half orbit (i.e. twice as often compared with “normal” survey mode).
  - This keeps the LAT boresight away from both the sun and anti-sun direction (and keeps x-face toward sun)
  - Beta changes during the week, so x-face is not precisely to the sun for the whole week.

Amplitude of sine function is $90 - \text{abs}(\beta)$
Option 1 – sine profile

- X-face stays close to the sun, as required
- Sun stays ~90 deg from LAT boresight
Option 2

- Sun still remains fairly close to X-face (so limits motion in +Y SADA)
Mission Week 521

Observing efficiency higher for the sine-rocking profiles (reflecting smaller average rocking angle)

Exposure map uses: IRF=P8R2_SOURCE_v6, emin=100, emax=200000, and zmax=105. (from Joe Eggen)
Observation modes

- At high beta angles, both option 1 and option 2 provide better sky coverage and better observing efficiency than 50 deg one-sided rocking.
- Hole in coverage around the sun
  - Bad for solar observations
  - Good for multiwavelength synergies
- At low beta angles, the sine profile will have a magnitude of ~90 deg – very bad for observing efficiency.
  - We are exploring power performance of sine profiles with different magnitudes. Initial studies suggest that a sine profile with magnitude of 50 deg is power positive for all beta angles.
- We currently use option 2 when abs(beta)>25, and go back to one sided rocking when abs(beta)<25 deg.
- Working on addressing communication constraints (to allow pure sine profile) and more detailed description of rocking angle constrains.
Observation Planning Tools

• Due to the SADA anomaly, work on software/tools for user community to optimize observing strategies is moot
  – Engineering/lifetime considerations

• However, it is clear that we need to provide some help for users to do their own studies.
Guest Investigator program

• How to strike a balance between long term work/investment and new ideas?
• How to best engage the community in Fermi analysis and the Fermi GI program
  – More substantial awards at the
Senior Review News

• Periodic review to determine the fate of operating missions
  – Now every three years (used to be every two years)
  – Next review in 2019
    • Planning to focus on time domain astrophysics and multimessenger astrophysics
  – Need to collect science ideas/focus
    • discuss…
  – Technical initiatives
    • Reducing threshold for onboard GRB triggers (GBM)
    • …
Questions