



Fermi

Gamma-ray Space Telescope

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Users Group Meeting

Mission Status Update

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Observatory Status Highlights

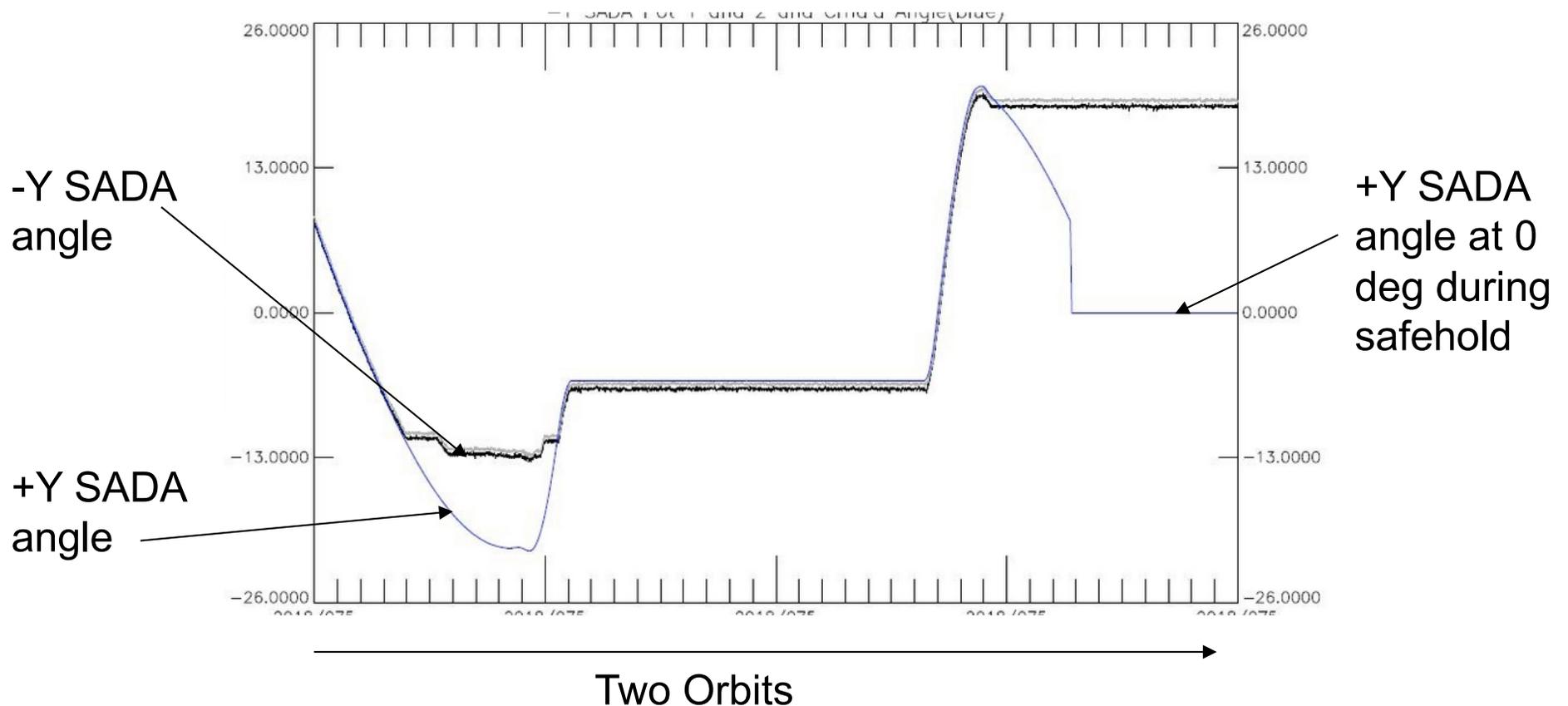
- **Observations:**
 - **Regular +/-50 deg sky survey with occasional ARR until April 2018**
 - **Modified survey following Solar Array Drive Anomaly in late March**
- **FOT/engineering activities**
 - **Transition to new FOT completed in March**
 - **Anomaly Review Team formed to study potential root 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**

SADA Anomaly

- 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

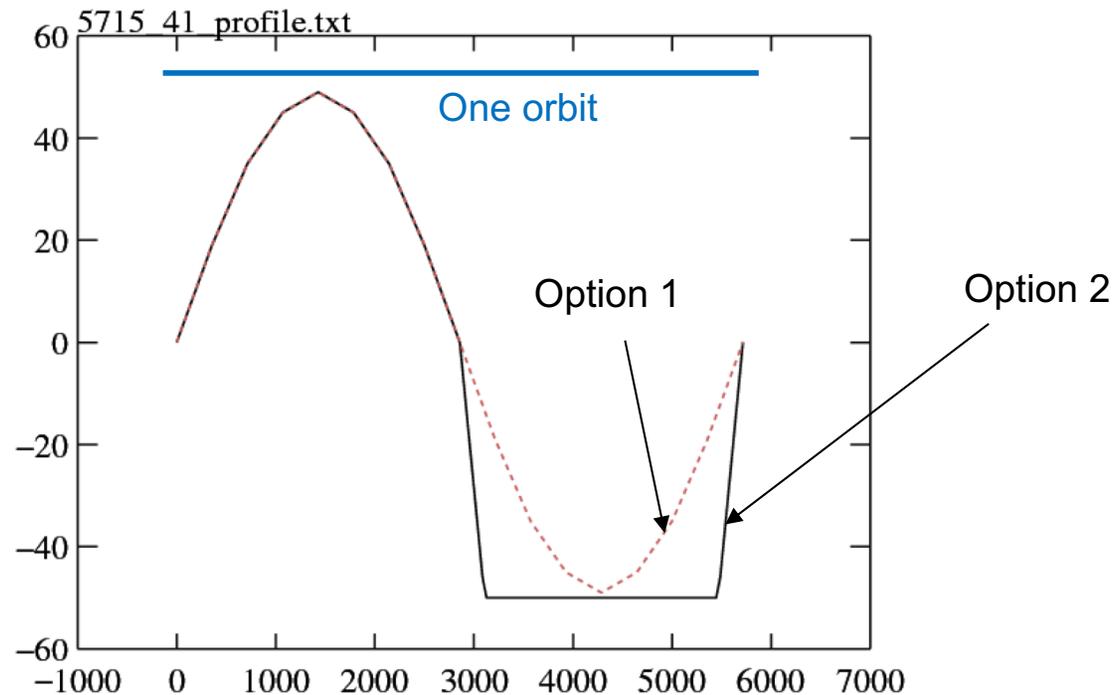
Observing strategies with stuck SADA

- **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 $90 \text{ deg} - \text{abs}(\beta)$, 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**

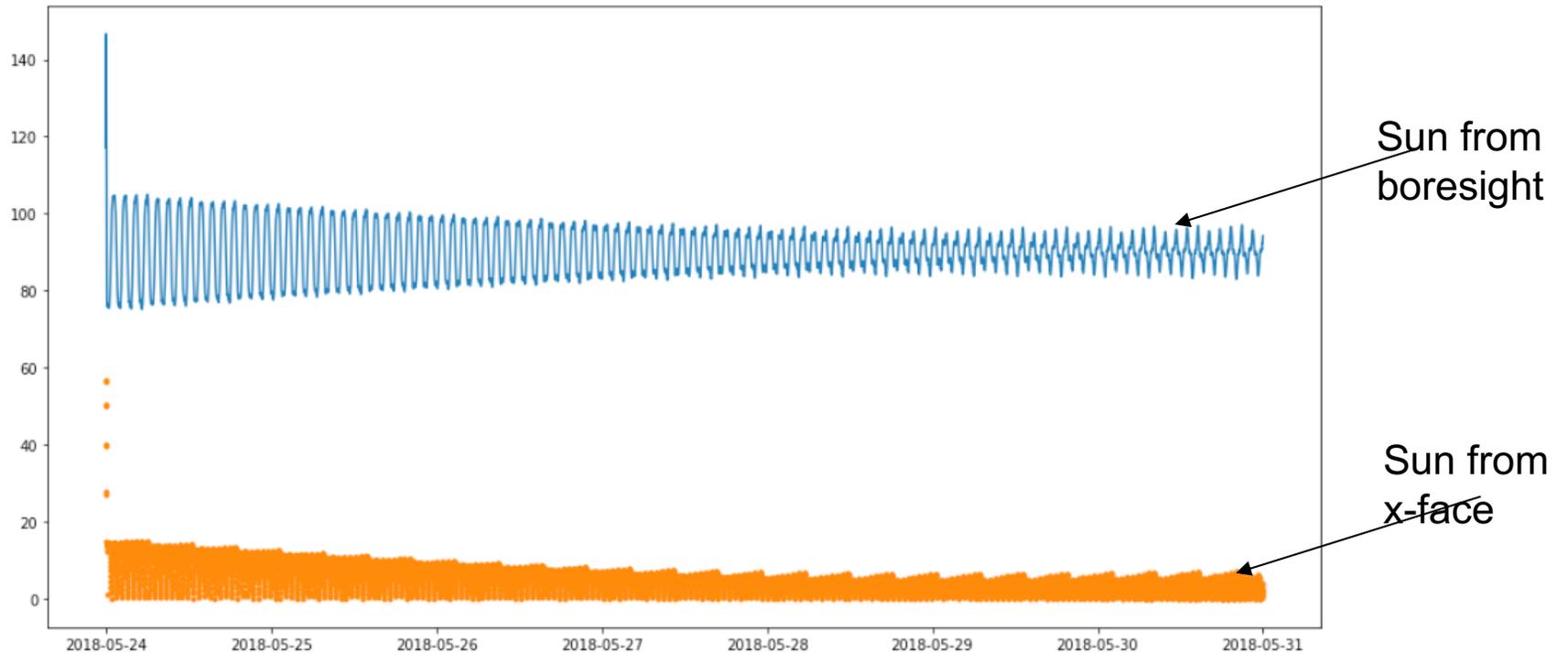
Comparing option 1 and option 2



**Amplitude
of sine
function is
 $90 - \text{abs}(\text{beta})$**

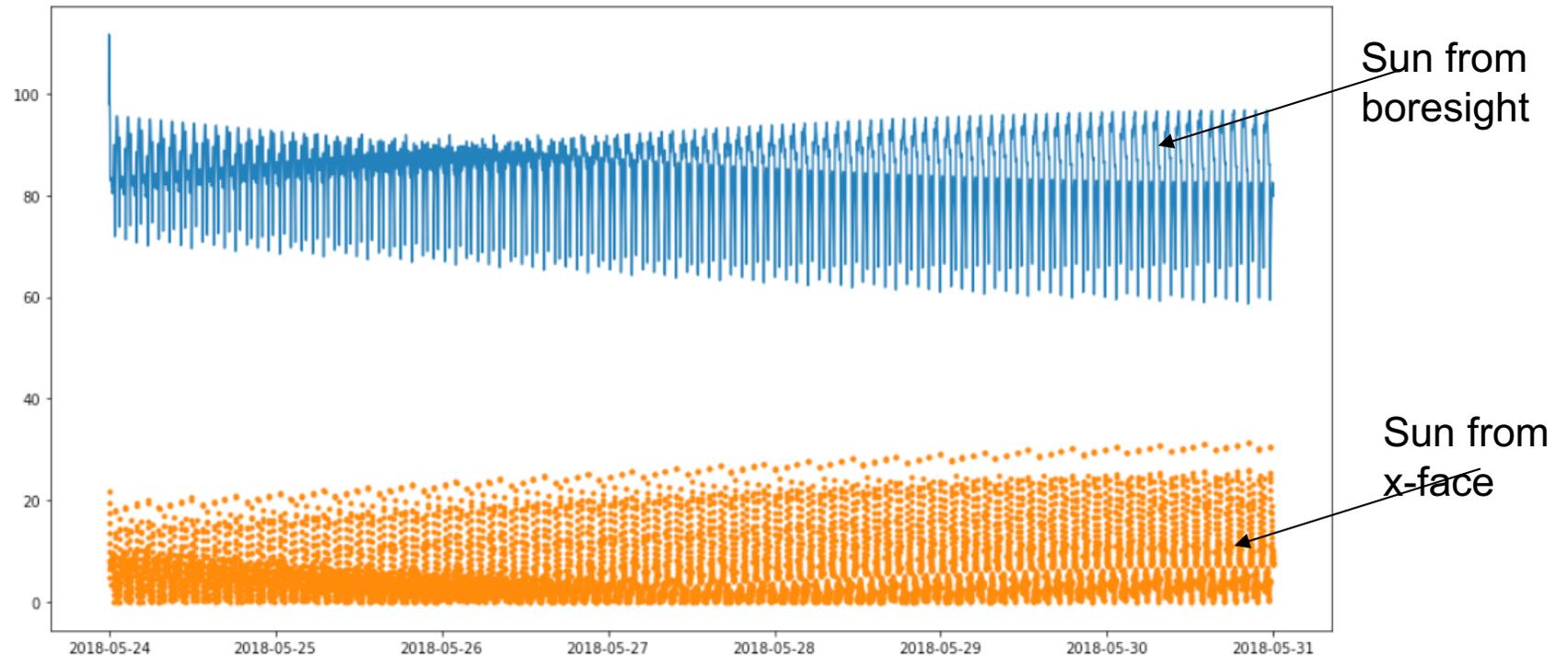
- **Rock between north and south every half orbit (i.e. twice as often compared with “normal” survey mode).**
 - **This keeps the LAT boresight away from both the sun and anti-sun direction (and keeps x-face toward sun)**
 - **Beta changes during the week, so x-face is not precisely to the sun for the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

Option 1 – sine profile



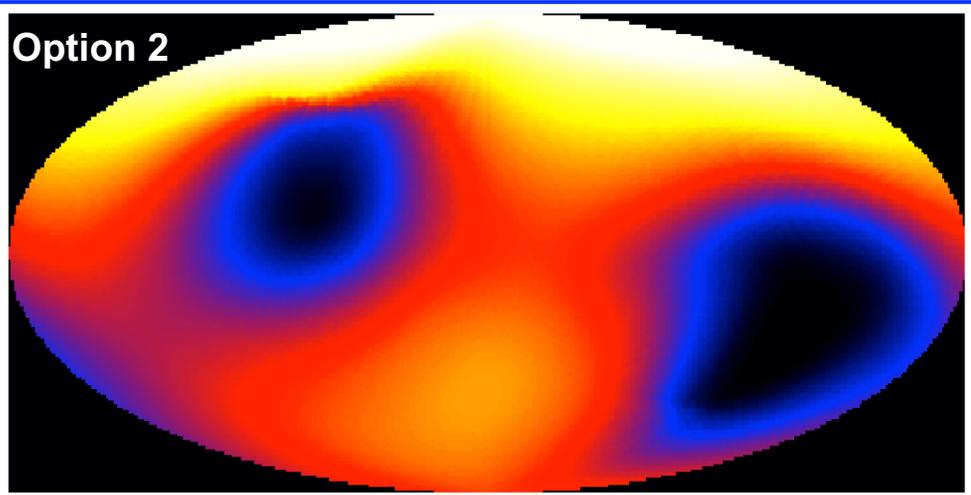
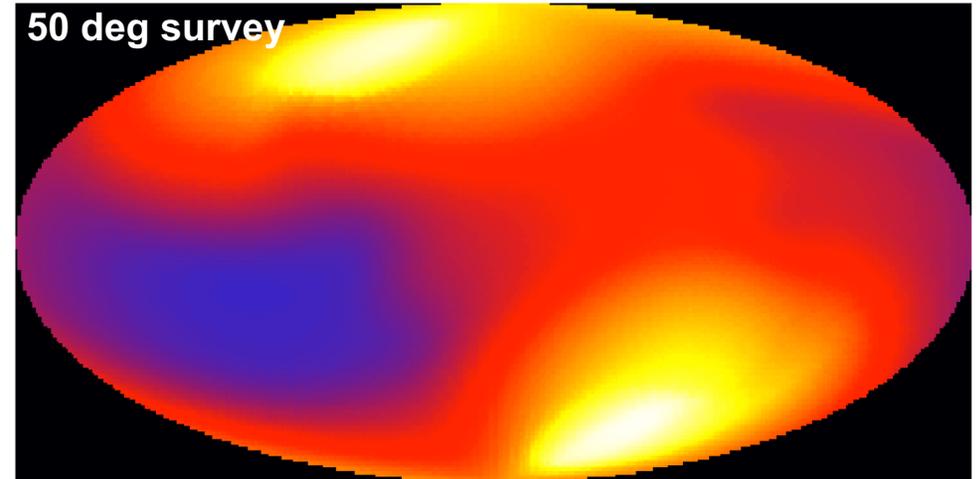
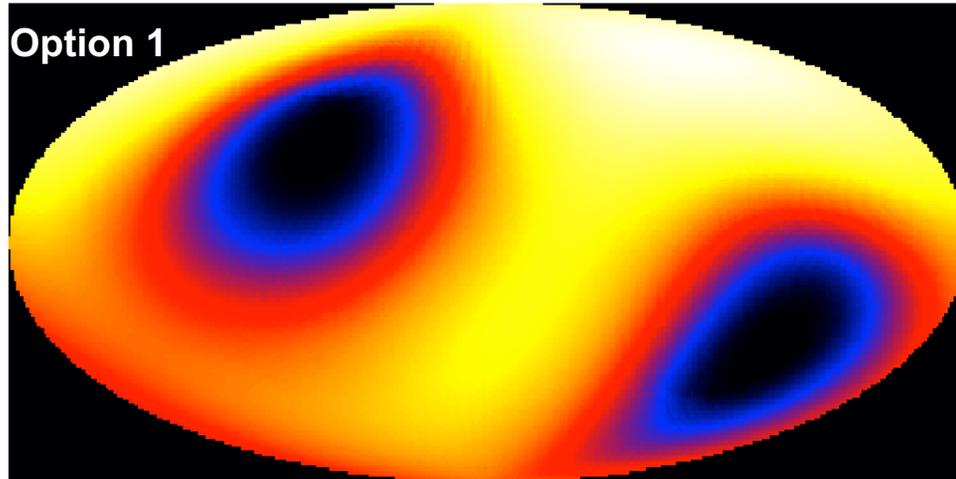
- **X-face stays close to the sun, as required**
- **Sun stays ~90 deg from LAT boresight**

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)

1.79e+08 3.68e+08 5.57e+08 7.46e+08 9.35e+08 1.12e+09 1.31e+09 1.50e+09 1.69e+09

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 $\text{abs}(\beta) > 25$, and go back to one sided rocking when $\text{abs}(\beta) < 25$ 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