Tools for Mission and Observation Planning

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GLAST Scheduling

- The GSSC will use TAKO to create observation schedules ("science timelines"). These will contain both sky survey and pointed observations.
- TAKO is being used for Swift and Suzaku (Astro-E2) and is being tested for RXTE.
- GLAST-TAKO has had its second release and contains basic functionality.

Observation Proposal Submission

- Proposals will be submitted using standard RPS (Remote Proposal System) as used for RXTE, Suzaku, Integral.
- David Band will discuss RPS later today.
- RPS will be used for GI proposals and TOO requests.
- RPS will also be used for calibration requests by IOCs.
- Accepted proposals transferred from OGIP database to GSSC database.

Long- and Short-Term Schedules

- TAKO will be used for both long-term (a complete GI cycle) and short-term (weekly) scheduling.
- The same master database will contain all scheduling information. i.e. both long-term and short-term.
- TAKO can apply a variety of constraints such as time of day or periodic constraint such as binary phase.
- TAKO will combine together accepted proposals and Sky Survey observations to create a Long-Term Schedule.
- The time precision for the Long Term Schedule will be 5 minutes, but they will be saved in weekly “bins”.

Short-Term Scheduling Process (i)

- Because of TDRSS long lead time, the initial schedule (Preliminary Science Timeline) must be produced ~3 weeks ahead of being loaded to spacecraft.
- Initial version created and distributed to MOC, LISOC, and GIOC.
- MOC uses initial schedule to make TDRSS contact requests.

Short-Term Scheduling Process (ii)

- LISOC and GIOC send corresponding instrument commands to GSSC.
- GSSC examines instrument commands for effects on science observations:
  - If any conflicts found, inform IOCs who will provide revised commands where appropriate.
  - If no conflicts, GSSC creates combined timeline ("Observatory Timeline Package") including Final Science Timeline.

Short-Term Scheduling Process (iii)

- Although the Science Timeline is initially generated well in advance of upload, it may be changed within a few days before upload if:
  - (i) TDRSS contacts not affected or
  - (ii) MOC agrees to loss of contacts (TDRSS overscheduled as expect to lose contacts to TOOs or ARs anyway).
- Before upload to spacecraft a final review is done (open to GSSC, LISOC, GIOC, & Project Scientists).

Testing the Scheduling System

- Ground Readiness Test #2 (~June 28) included a basic test of scheduling scheme:
  - Initial distribution of TAKO generated schedule.
  - Reception of commands from LISOC/GIOC.
  - Transmission of Observatory Timeline Package to MOC.
- Continue to test scheduling in further GRTs.
  - GRT #3 in December will include more complete test of command/schedule flow between GSSC, IOCs, and MOC.
- RXTE planners are also evaluating TAKO and starting to use it for complicated scheduling.

Enhancements to TAKO in Progress

- Full implementation of 17 point rocking profile.
  - Currently TAKO deals with fixed pattern (e.g. rock north for one orbit, rock south for one orbit.)
  - 17 point profile gives capability for complicated rocking patterns.
- Display of instrument command times.
- Display of TDRSS contact times and warnings if TDRSS contacts would be lost by schedule change.

Availability of Schedules

- All schedules will be publicly available on the web.
- Includes:
  - Long Term (1 year) Schedule.
  - Most up-to-date version of Science Timeline. For every week goes from:
    - Preliminary -> Final -> As-Flown
  - As-flown may differ from Final due to TOOs, ARs, and any anomalies.
- Posting done by User Support tools which read information from the observation database.

Simulations ("Planning Tool")

- To (i) investigate sky coverage and (ii) simulate and test the scheduling process, a planning process has been designed:
  - Generate fake "proposals".
  - Ingest into TAKO and create schedule.
  - Make FT2 files from Science Timeline.
  - Make exposure maps and calculate statistics.
- Entire process will be run from GUI wrapper to make it easier to use.

TOO Submission/Execution (i)

- TOO requests start with RPS.
- GSSC alerted by paging system.
- GSSC provides assistance to Project Scientist in determining whether to carry out TOO.
  - Examine proposal
  - Look at review panel's comments for pre-approved TOO
  - Compare coverage of target obtained with current science timeline compared to TOO
- If decide to do TOO, send TOO order to MOC with RA, dec., duration, ARR-interruptible flag.
- GSSC software for evaluating and submitting TOOs will be wrapped together by a password protected "Duty Scientist's Assistant" web page to facilitate use at 3:00am

TOO Submission/Execution (ii)

- The Operations section will provide a message to User Support which will cause the GUS to notify the proposer of TOO acceptance or rejection.
- MOC nominally provide 3 response messages to GSSC:
  - Acknowledgement – TOO order received.
  - Notification – they're going to send TOO commands (or not).
  - Disposition - TOO commands sent to spacecraft.
- These will be available for posting to GSSC web page.

TOO Issues

- ARR-interruptible flag needs to be added to definition of TOO order.
- Unclear whether ARR-threshold can be included in TOO order.
  - i.e. don't allow AR interrupt by ordinary bursts, only by "burst-of-the-century" events.
- MOC question whether TOO "Notification" message is really necessary.

After TOOs & ARs (i)

- The GSSC will use the as-flown-timeline provided by the MOC to see what was actually observed.
- Two types of as-flown-timeline:
  - Definitive, delivered number of days later.
  - Immediate preliminary version available on MOC web page (gain speed at cost of potential gaps in timeline).
- As-flown timeline also posted to web by GUS.
- Automatically check for difference between AFT and science timeline caused by (e.g. ARRs and TOOs).

After TOOs & ARs (ii)

- Make decision whether to modify future science timelines because e.g. pointed observations were interrupted.
  - For urgent changes make early delivery of science timeline to MOC
  - For less urgent changes, modify observations in one or more subsequent weeks and deliver in usual way.
  - Or, where appropriate, make no changes to future science plans.