Discouraging Over-Constrained Programs

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Motivation

• We are becoming concerned about the frequency of over-constrained programs resulting in scheduling conflicts
  • Delayed and missed science opportunities
  • Disappointed GO’s
  • Increased workload on planning and scheduling staff

• Today is an initial discussion to seek STUC input about future steps beyond Cycle 26 to manage the number of programs with demanding constraints and special requirements
New Requirement for Cy26

• Phase I proposals must itemize and briefly justify the special requirements that will be implemented in Phase II. Specifically, all visit-level special requirements and exposure-level special requirements must be justified (see HST Cycle 26 Preparation of the PDF Attachment).

• Our Intentions:
  • Cause proposers to think about the scientific need for imposing requirements
  • Patterned upon the existing approach for coordinated parallels
  • Reasonable burden upon TAC; tool for STScI staff to push back on Phase 2’s
  • Does not preclude or ration any science capability

• Follows Nov 2017 STUC Recommendation that “Scheduling and observational constraints should be clearly identified and justified in Phase I”
Phase 1 Justifications

• All visit-level and exposure-level special requirements must be itemized and justified in the Phase I proposal, including:
  • For Target-of-Opportunity (ToO) observations, estimate the probability of occurrence during Cycle 26, specify whether long-term status is requested, identify whether the ToOs are disruptive or non-disruptive, and state clearly how soon HST must begin observing after the formal activation.
  • CVZ observations.
  • Time-critical observations.
  • Early acquisition observations.
  • Coordinated Parallel observations.
  • Target acquisitions that use offsets.
  • Scheduling of STIS/MAMA and STIS/CCD observations (other than target acquisitions) in the same visit.
  • Requests for expedited data access.
  • Other special scheduling requirements (e.g., requests for non-SAA impacted observations, roll-angle constraints, etc.).
  • For observations in support of another NASA mission, proposers should identify the mission, describe how the HST observations complement the core mission science and indicate whether any coordination is required.
Example of Constrained Observations

- Specific timing constraints (when/ToO, after, cadence, etc.)
  - Difficult to plan for ToO and Exoplanets (actually any critically tight timing)
- Orientation: FOV, Slit -- limited scheduling opportunities due to solar array
  - Do programs really need same orient?
- Use of CVZ – constrains observation within 56 day precession period
  - Efficiency gain at the cost of scheduling constraint
- Coordinated Parallels
  - More data but may constrain ORIENT and impacts data volume (e.g. for CALs)
LRP: Current Status

High percentage of time-constrained science limits LRP flexibility

- ~20% of science visits in cycles 24/25 have timing constraints of a few orbits or less.
- Creates conflicts between science programs.
- Results in fewer flexible visits later in the plan that can be moved forward to fill schedule gaps.
- LRP group now builds templates of constrained visits in advance to identify conflicts early in the process.

Green line shows the achieved number of prime science orbits per week (decreases from 84 to 82 in Cycles 24&25)

BLUE <= 12 hour time constraints
Orange 12 to 36 hour time constraints
“Spikiness” in distribution mostly due to exoplanet visits waiting for plan windows.

- As before – can’t plan exoplanets accurately far into future.
  - Windows beyond predictive ephemeris (>10 weeks) have unstable/unreliable plan windows.
  - Exoplanets are “stored” late in cycle; potential spots checked weekly, pulled forward as possible.

Second set of mid-cycle programs (< 100 orbits) will be added soon

- 67 programs/434 orbits requested.
Impacts of Constrained Observations

• Schedule Impacts
  • “Must go” at a particular time may collide with another such program
  • Limits weekly and long term optimization of the HST schedule \(\rightarrow\) fewer “orbits” per year

• Impacts on GOs
  • Additional queries/iterations on Phase 2 proposals
  • Increase in numbers of visits whose LRP windows change

• Impacts on STScI
  • Additional work for LRP including manual intervention (priorities)
  • Resolution of Special Requirements with PI’s when observations will not schedule
  • Complex observing scenarios may require involvement of limited resource CS, PC, Eng staff

• Bottom Line
  • If we don't manage these time constraints up front (with the TAC), we wind up managing them in planning & scheduling.
  • Conflicts can delay or even preclude some science opportunities.
Cy25 Special Requirements Usage

• Most used Special Requirements at Visit Level
  • ORIENT, SAME ORIENT
  • AFTER, BETWEEN
  • SCHED

• Most used Special Requirements at Exposure Level
  • Pattern
  • POS-TARG
  • SEQ NON-INT
  • PAR WITH
  • SPATIAL SCAN
Cycle 25 Usage of Visit Level Special Requirements by PROPOSAL

Visit Level Special Requirements

Number of Proposals

Red = SCIENCE
Blue = CAL/ENG
Cycle 25 Exposure Level Special Requirements by VISITS

Exposure Level Special Requirements

Red = SCIENCE
Blue = CAL/ENG
Thoughts/Topics for Discussion

• Should we impose quotas?
  • Increase in TAC workload? Consistent with focus on “best science”?  
  • A priori balance (CVZ vs Spatial Scan??)

• Should we surcharge expensive/impactful programs (i.e. to reflect their overhead)
  • Force TAC and Panels to pay for efficiency impacts “up front”
  • Where do we set the science balance? And deal with its evolution?

• What is the balance between a stable LRP and science that disrupts it?
  • Relative value of tight timing constraints (e.g. Exoplanets) and ToOs?

• Should we live with the current situation?
  • Allocate somewhat fewer orbits per Cycle to keep size of tail constant?
  • Ultimately we are balancing quantity of science vs types of science
BACKUP SLIDES

ADDITIONAL STATISTICAL PERSPECTIVES
Cycle 25 Usage of Visit Level Special Requirements by VISIT

Visit Level Special Requirements

Number of Visits

0 100 200 300 400 500 600 700 800 900

AFTER | AFTER BY | BEFORE | BETWEEN | BRIGHT EARTH AVOID | COZ | DROP TO GYRO IF NECESSARY | GROUP WITHIN | GUD TOL | GYRO MODE | GYRO TRACK | NUMBER OF GYROS | ON HOLD | ON HOLD FOR | ORIENT | ORIENT FROM | ORIENT FROM NOMINAL | ORIENT RANGES | PAR | PCS MODE | PERIOD AND ZERO PHASE | SAME ORIENT | SCHED | SEQUENTIAL WITHIN | VISIBLE INTERVAL |
Cycle 25 Usage of Visit Level Special Requirements by ORBIT
Cycle 25 Exposure Level Special Requirements by ORBITS
Cycle 25 Exposure Level Special Requirements by EXPOSURE

Exposure Level Special Requirements

Number of Exposures

0 1000 2000 3000 4000 5000 6000 7000 8000

AFTER BY END ORBIT EXP EXPAND FORMAT GROUP-FGS WITHIN GS ACQ SCENARIO CS ACQ SCENARIO ESPAR INT ACQ LOW-SKY MAX DUR MIN DUR NEW ALIGNMENT NEW OBSE T NO SPLIT OBSE T ID ONBOARD ACQ PAR WITH PHASE PCS-TARC PRI ORY PRIMARY QelogSheet Qcorr QAS Qcitation QSelect QSS Req Corr Req Uplink RT Analysis SAA Contour SAME ALIGNMENT SAME GUIDE STARS SAME OBSE T SAME POS SAVE OFFSET SEO N-N INT SHADOW SPACIAL SCAN SINGLE-EXP SPEC COM USE OFFSET