

All About SNAPs

Information and Rules for Proposers and Observers

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May 15, 2001

ABSTRACT

This UIR describes SNAP programs, shows some basic statistics on SNAP programs and visits, and details the rules and procedures that proposers and observers need to follow when submitting their Phase 2 program or when requesting changes to their program. Some changes to SNAP programs are being made for Cycle 11, and they include the ability for the observer to specify priorities for SNAP targets and to adjust those priorities later, and a limited ability to use Special Requirements with SNAP visits.

1. Defining SNAP Programs

Ideally, the schedule of *Hubble Space Telescope* observations should be constructed in a way that leaves no useful time unexploited. In reality, there are inevitable gaps in the schedule that cannot be filled with exposures from GO programs. The SNAPshot programs were defined to take advantage of this opportunity, with the idea of providing a plethora of potential pointings distributed over the entire sky. Because SNAP exposures are added to the schedule after all possible GO visits are inserted, SNAPs need to have the fewest possible restrictions placed on them if they are to execute successfully. SNAP programs have these qualities:

- They provide many targets well distributed on the sky so that little slewing of *HST* is needed to go from a GO target to a SNAP target.
- SNAP targets are observed when convenient to the overall *HST* program, and so there is no guarantee that any particular SNAP target will be observed nor that we will be able to complete a specific fraction of a program's target list. However, STScI strives to complete as much of the SNAP program as possible within a given Cycle, and we ordinarily observe at least 50% of a program's SNAP targets.
- SNAP programs are not the primary focus of telescope usage, and so we do not ordinarily permit changes to SNAP programs after the Phase 2 program is submitted; this keeps the labor cost down. Only a very few Special Requirements may be specified for SNAP exposures so that the minimum possible effort is needed for implementation. If a SNAP exposure fails for any reason, it will not be repeated. Once a SNAP visit is placed on a calendar, it is no longer in the pool of potential SNAP visits and will not be placed back into that pool if the visit fails. (Note, however, that targets *are* put back in the pool in the case of a telescope safing.)

- SNAP targets are in the SNAP pool for one Cycle, although they are kept available for observing for an additional year at lower likelihood of execution. This is explained below. SNAP proposals can propose targets for only one Cycle at a time.

2. How SNAPs Get Scheduled

The schedule of *HST* observations is constructed in units that last seven days; these are called Calendars. A member of the Science Planning and Scheduling Team builds a Calendar using STScI-developed software tools to select the observations that will be executed. From the pool of unexecuted GO observations, the builder first fits in as many “Must Go” visits as possible – these are observations that are constrained to fall within that week. Next, the “Should Go” observations are fit in – these are also constrained to limited periods of time, but can validly occur within more than one Calendar. Finally, as many “Can Go” observations as possible are added, visits that can be executed within that week without violating any GO-specified constraints.

This process fills the Calendar with as many GO visits as possible. Once it is no longer possible to add any GO visits, then SNAP visits are inserted. SNAPs are added in the following priority order:

1. Current Cycle programs with less than 50% completion
2. Current Cycle programs with 50% or more completion
3. Previous Cycle programs with less than 50% completion
4. Previous Cycle programs with 50% or more completion.

The Calendar builder first constructs a list from the SNAP database of all visits that could potentially fit in the Calendar for programs in the current Cycle that have not yet reached a completion level of 50%. If any SNAP opportunities remain after this, the Calendar builder constructs a list of SNAP visits for current Cycle programs that have reached 50% completion and fits as many of those in as possible, and so on.

Formally we carry over unexecuted SNAP targets into one additional Cycle after that for which they were proposed, but from this process one can see that targets are very unlikely to be observed in that second Cycle.

3. Requested versus Realized SNAPs

In this section we illustrate some details about SNAP visits to show how exposure times are distributed and whether there is a spatial bias to SNAPs. The data shown are for SNAPs from Cycles 7 and 8 grouped together. Cycle 9 is in progress as this is written, and so cannot yet be analyzed. Note that the Cycle 7 SNAP pool included NICMOS exposures, and so these data should be reasonably representative of what will execute on *HST* in Cycle 11 and beyond.

3.1 SNAP Exposure Times

Figure 1 shows the distributions of requested and executed exposure times for SNAPs. To be precise, what is shown is the visit duration, which includes the exposure time plus any instrument overheads.

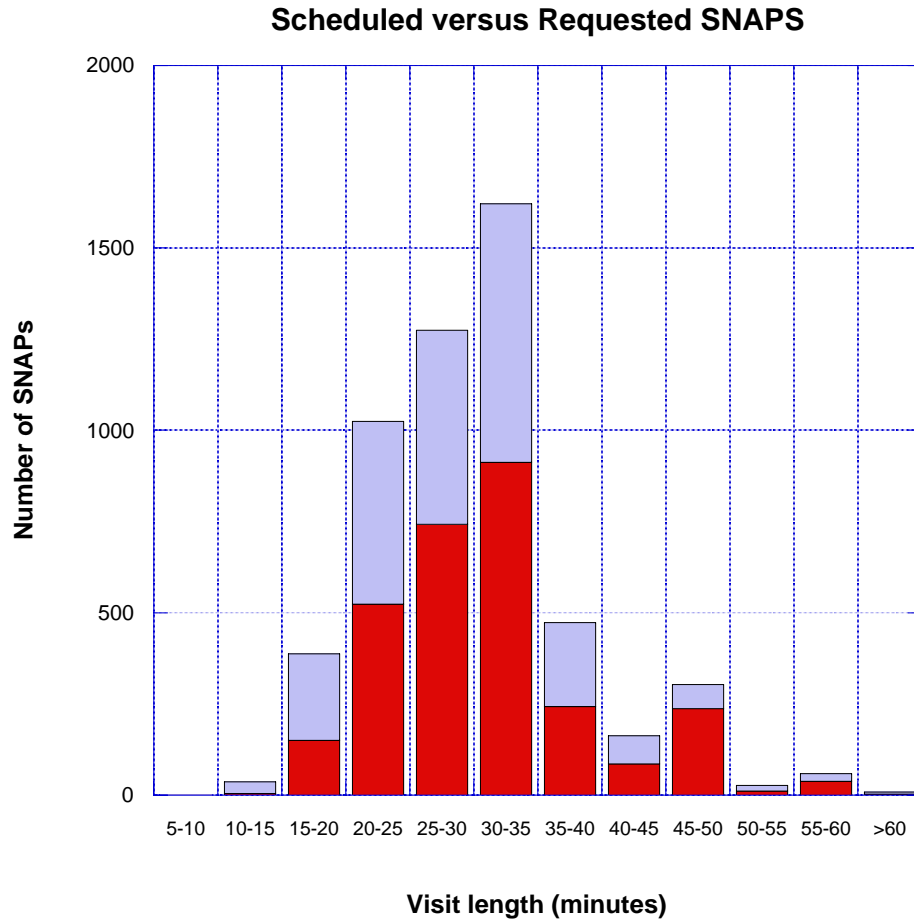


Figure 1: Histogram of the number of SNAP visits versus their duration. The shorter (red) bars are the numbers actually scheduled, while the longer (light blue) bars represent the numbers requested.

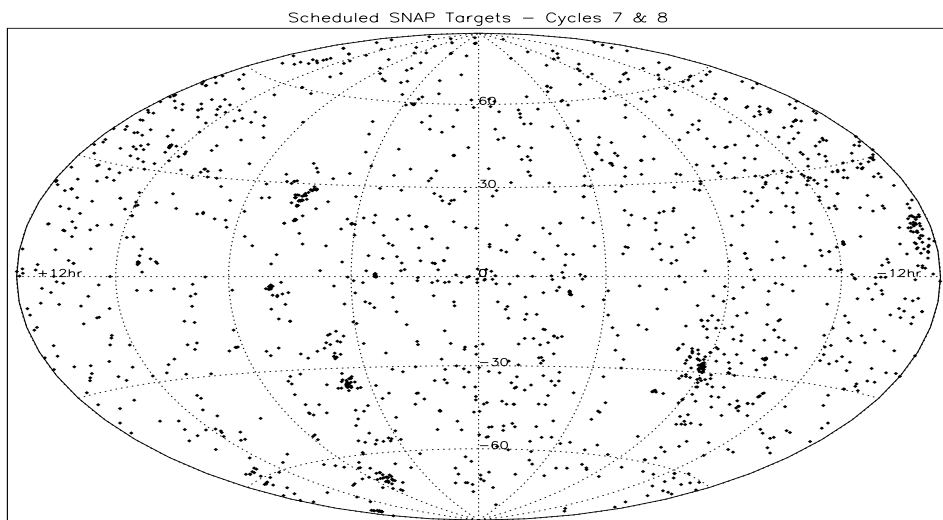
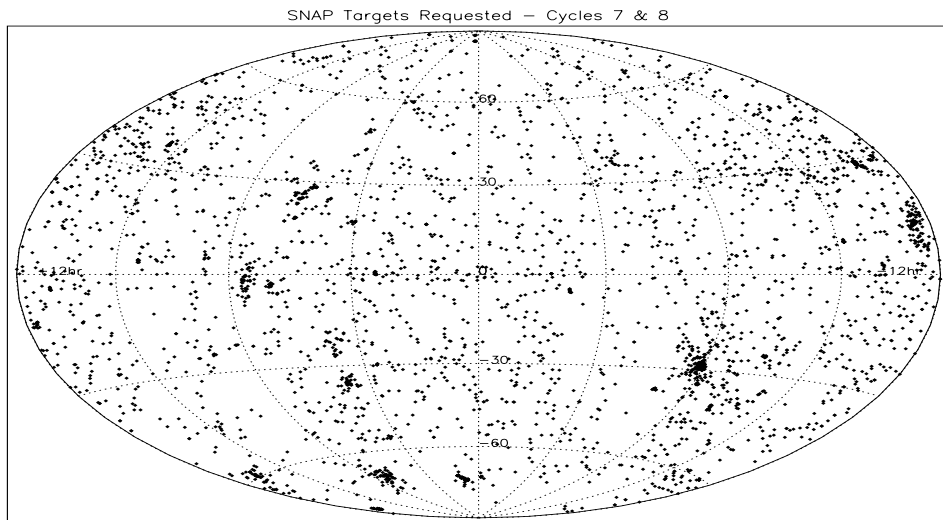
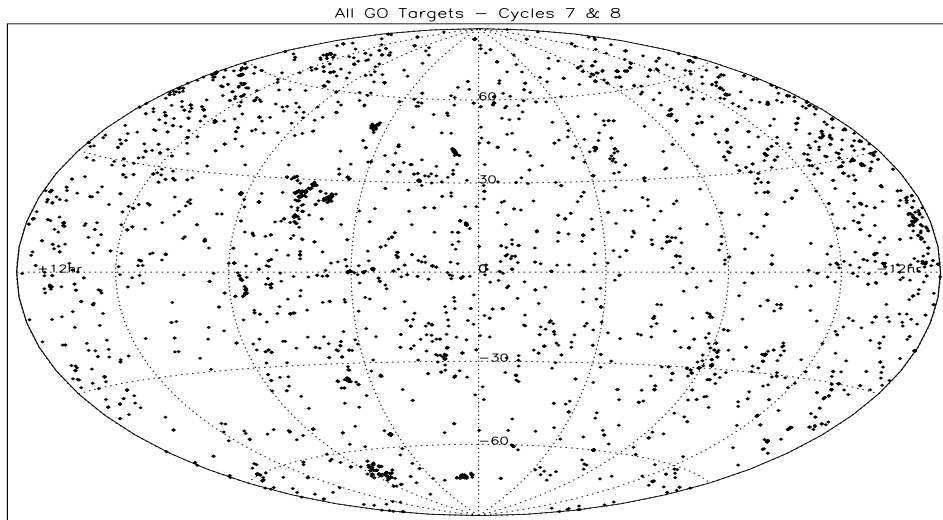
A comparison of the distributions indicates several important aspects of SNAPS:

- The median duration for successful SNAPS was approximately 30 minutes.
- Long-duration SNAPS can be executed. However, we discourage long SNAPS because there are few opportunities into which to fit them. They may have a fairly high success rate, but that is because few are requested.

3.2 SNAP Targets on the Sky

The maps below show how SNAP targets are distributed on the sky. The coordinates are Right Ascension and Declination, and (0,0) is at the center, with RA increasing to the left. The observant observer will note concentrations of targets at the Galactic center, Magellanic Clouds, the Coma and Ursa Major clusters of galaxies.

Successful SNAPS are executed over the entire sky, and there appears to be no bias based on position.



4. New in Cycle 11: Target Priorities and Limited Restrictions

SNAPs will remain an important part of what is done with *HST* throughout the rest of its life. Recognizing that, we would like to ensure that their scientific utility is increased as much as it can be while maintaining the essential nature of SNAPs from a scheduling standpoint, which is the minimal effort needed to implement them.

For someone creating a schedule for *HST*, SNAPs form a large, easy-to-access pool of exposures that can be scheduled at any time. We also require that they be easy to implement, which means a bare minimum of Special Requirements may be imposed (see below) and that no changes to SNAP programs are permitted after the Phase 2 program has been submitted and accepted.

It is possible to maintain these essential qualities while easing restrictions somewhat, and starting in Cycle 11 we will allow observers the possibility of assigning target priorities and of using one of the Special Requirements.

4.1 Target Priorities

At present, all SNAP targets are considered to be equal in priority, but the software that creates the pool of potential SNAPs for Calendar builders can handle priority assignments. We anticipate that most programs will use the default priority of Medium for all targets, but High and Low may also be used, given the following rules:

- The average priority for a program must be Medium. Thus if one target is elevated in priority from Medium to High, another must be lowered to Low. This should make all programs be treated equally, on average.
- Priorities may be assigned or changed when the Phase 2 program is submitted and at most two other times during the Cycle. The assignments are done separately from the Phase 2 submission itself, via a communication to your Program Coordinator.
- Changes in priority are not as important as other work and may not get done if time is not available.

A possible way of using SNAP priorities is to imagine a supernova search done with one of the cameras. Three exposures each of twenty fields were requested in the proposal, say, and you have been awarded the 60 “targets” needed. You initially set all to Medium priority, but about halfway through the Cycle you note that first-epoch exposures have been done for 8 of the fields but not the other 12. You then request that the follow-on exposures for those 8 fields be raised to High priority to improve the chances of getting fields with two or more exposures. You would also need to lower the priority for 8 other fields to Low.

4.2 “Must-do” Exposures

Setting a SNAP priority to High improves the chances that it will be taken, but it doesn’t guarantee it. If there are exposures in your SNAP program that are essential for your program’s success (such as exposures of fields for comparing to previous observations), that can be achieved by submitting two proposals. The SNAP proposal would contain the SNAP targets, and the GO proposal would contain the exposures that must be done. Such a combination of proposals should be clearly spelled out as being coordinated.

4.3 Permitted Special Requirement: BETWEEN

SNAPs work as a way of improving *HST*'s efficiency because they have very few restrictions on them. That makes them easy to implement and easy to schedule. There are a few restrictions that can be imposed on them without getting too far from the spirit of the concept.

The one Special Requirement that will be permitted for SNAPs in Cycle 11 is BETWEEN. More specifically, BETWEEN must be specified in a way that allows the visit to execute at any time within one or more one-week calendars. In specifying BETWEEN for SNAPs, bear in mind that Calendars begin at 00:00 UT on Mondays. In building a given Calendar, there must be freedom to schedule a SNAP visit anywhere within it.

As an example, a program could obtain randomly-timed monitoring observations of an object by, say, requesting 26 "targets" in the proposal and then writing the Phase 2 program so that each visit fell within a two-week period. About half of those 26 would probably actually get taken. If BETWEEN had not been used, there would be nothing to prevent all 26 SNAPs from being done at the same time.

5. Final Comments

There are probably other ways in which the scientific utility of SNAPs could be increased without undue effort in implementation. If you have ideas, please communicate with us. E-mail may be sent to *help@stsci.edu*.