

Parallel Observations with HST

Information and Guidance for Proposers and Observers

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ABSTRACT

This UIR describes how HST Parallel observations will be specified and scheduled in Cycle 17.

1 Parallel Observing

The scientific instruments of the Hubble Space Telescope lie in a common focal plane. This feature allows more than one instrument to be operated in parallel. Parallel observing provides an opportunity to increase the scientific productivity of HST by taking advantage of the parallel instrument apertures that fall on scientifically interesting objects or regions of the sky. Since all of the instrument fields of view are fixed relative to one another in the focal plane, the pointing and orientation of the primary instrument on the sky dictate the specification of the parallel target position. Parallel observing provides an opportunity to increase the scientific productivity of HST by taking advantage of serendipitous views of the sky.

2 Pure and Coordinated Parallels

Proposers can specify parallel observations in two ways: as “Coordinated Parallels” or “Pure Parallels”. Coordinated Parallels are designed, implemented and executed as part of a specific Regular GO program that explicitly ties parallel exposures to its primary exposures. An example would be a program carrying out imaging of M31 using the Advanced Camera for Surveys(ACS). The large size of M31 means that other HST instruments have it within their fields of view as well, and the GO might propose that the ACS primary exposures have WFC3 exposures added as Coordinated Parallels. The alignment of the parallel instrument aperture on the sky will usually be determined explicitly by the PI as part of the design of their program.

Pure parallel proposals, by comparison, are defined independently of a particular Regular GO program. Since they are not *coordinated* with a primary program, they do not have specific predefined telescope pointings. Instead, they propose for generic regions of the sky over which they could obtain useful data if the telescope happened to be observing in that vicinity using a different instrument. A typical example would be fields at a Galactic latitude over 20 degrees. Pure Parallel visits are included in the observing schedule as that schedule is developed at the STScI.

3 Parallels in Cycle 17

The processes and ground rules for Coordinated Parallels have not changed for Cycle 17. All instruments and modes are available for Coordinated Parallels. Proposers need to be aware of the requirements for Bright Object protection for some of the Instrument modes and factor those

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requirements into their planning of Coordinated Parallels. Also, using multiple instruments can overload the on-board data paths. APT includes these considerations, so proposers can use it to determine whether Coordinated Parallel observations with multiple instruments and readouts can be carried out.

In order to take maximum advantage of the instrument complement after SM4, a modified pure parallel scheduling process is being implemented for Cycle 17. This process will focus on taking advantage of multi-orbit parallel opportunities that should be available during COS prime observations. The Phase I process for Pure Parallels will be the same as in the past. Regular GO observers will then complete their Phase II proposals via APT. STScI will identify the parallel observing opportunities provided by the Regular GO observations. PIs of accepted pure parallel proposals will then use APT to find opportunities that satisfy their pointing and exposure duration requirements. The Pure Parallel PI then submits a Phase II program that contains a list of parallel visits which define the exposures that are required to complete their observations. The submission will also include the list of the associated prime visits that support the pointing requirements of the parallel observations. The STScI will then use the overall pool of Pure Parallel visits to make assignments of Pure Parallel visits to prime observation visits. In this operating paradigm, Pure Parallels in effect become quasi-coordinated parallel observations.

4 The Characteristics and Availability of Parallel Opportunities

A parallel opportunity is represented by a set of one or more primary visits from a single Regular GO program. At least one defined orbit in these visits will satisfy the pointing and parallel instrument usage requirements of a parallel observation. Multi-orbit parallel observations will be possible since all primary visits with common pointing and instrument usage characteristics will be identified as a single opportunity. Because of this, it is also possible that more than one parallel observation may be satisfied by a single opportunity. All opportunities will provide *full* orbits for parallel observing, limited by the duration of the primary visit's orbit definition.

Since this is a new process, and to help ensure the successful definition and execution of all accepted pure parallel programs this cycle, STScI is restricting the opportunity for attaching parallel exposures to Regular GO visits where COS is the prime instrument. Likewise, opportunities will be limited to those Regular GO visits that specify a single uninterrupted primary exposure in an orbit. The exact numbers cannot be known at this time, but we believe that this process will provide at least 500 orbits for pure parallel observing in Cycle 17.

5 More on Defining and Scheduling Pure Parallel Observations

As in the past, a Cycle 17 Phase I Pure Parallel proposal will be defined as a set of Parallel Observations each of which has a generic pointing, passband (filter) and exposure duration requirement. This observation description will be used by a pure parallel PI in Phase II to provide input to a *parallel opportunity match selection process* that they will access via APT. This matching activity is the component of the new POPS (the Parallel Observation Processing System) that is visible to the pure parallel PI. This tool allows the PI to find prime GO visits to which their pure parallel observations may be attached. It uses the PIs observing parameters as input selection criteria for searching the list of parallel opportunities that have been identified by STScI as being available for pure parallel observing in Cycle 17. An opportunity is returned as a list of orbits from one or more prime GO visits that satisfies the input criteria. The pure parallel PI is asked to identify at least two opportunities for each of their observations if such opportunities exist. The multiple observing choices will be used by STScI to resolve conflicts between programs that compete for the same opportunity. In doing so, we aim to increase the probability of successfully completing each parallel observation that

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is submitted in Phase II. This process will also immediately tell PIs if no opportunities exist for one or more of their desired observations. In that case, PIs will have the option to modify their search criteria (i.e. – their observation) and repeat their opportunity search.

As a result of the parallel opportunity matching, APT will produce one or more Phase II visits for each pure parallel observation that describe how it will be executed. Each description will also include information about the prime visits to which the pure parallel visits must be attached in order to complete the observation. As mentioned, POPS will use this information to resolve opportunity usage conflicts between parallel programs. The set of parallel visits that represent the parallel observation will be readied for flight and scheduled simultaneously with their matched primary visits.

During the construction of each weekly calendar, the builder will schedule all prime and parallel GO science prior to adding the internal calibrations. In some cases there can be too few orbits of calibration time available to meet an instrument's needs as defined in the calibration plan. In this event, the builder will either reschedule the prime and parallel visits or remove parallels until critical calibrations can be fitted in. If that is necessary, STScI will attempt to re-assign the parallel observation to a new primary opportunity. The goal is to include all the parallel science observations without compromising calibrations that are critical for instrument characterization and monitoring.

6 Addendum to Cycle 17 Call for Proposals Policies for Parallel observations

The following parallel observing policy statements supplement those found in Section 4.2 of the Cycle 17 Call for Proposals. Please refer to that document for the other policy statements that pertain to parallel observations.

1. Coordinated parallel observations will ordinarily be given the same proprietary period as their associated primary observations. Pure parallel observations will be given the nominal 12-month proprietary period.
2. If a primary observation has an attached parallel and the primary fails, the parallel may be repeated if it does not interfere with scheduling the prime observation.

7 Further information and help

The process and tools for identifying pure parallel opportunities and creating a Phase II pure parallel program are in work at the time of this writing. This document will be updated with further details as necessary. Please also refer to the APT Help material and help@stsci.edu for assistance in developing a pure parallel program in Cycle 17 Phase I and Phase II.