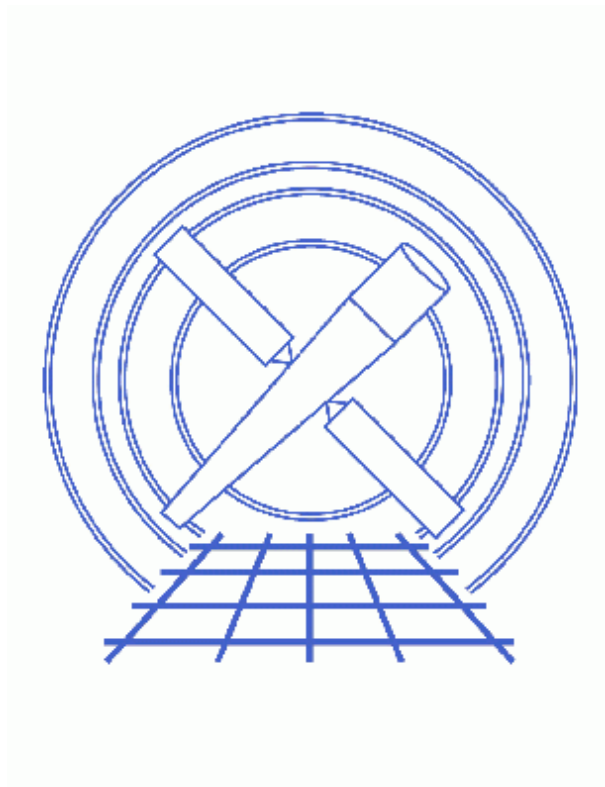


How to Classify Constrained Observations



POG Threads

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How to Classify Constrained Observations

Proposal Threads for

Classifying and Counting Constrained Observations

An observation is time constrained if there are any user-imposed limits on when it can be scheduled. Constrained observations are discussed in more detail in the [FAQ for Constrained and Coordinated Proposals](#) thread. Too many constrained observations impact Chandra's observing efficiency, and therefore must be limited. Prior to Cycle 9, the number of constrained observations was limited to about 15% of the total, without any regard for whether a constraint was difficult or easy to meet. Starting in Cycle 9, constrained observations will be classified as "Easy", "Average" or "Difficult". There are quotas for each category. The intent is to limit the most restrictive/difficult observations, while allowing more "easy" constraints to be approved.

Details of the grading scheme are given in the [Call for Proposals](#). In particular, Table 5.1 lists the "grading parameter" for all allowed constraints. These are:

- **Window** – the length of the time window in days
- **Phase** – the period in days
- **Uninterrupt** – the length of the exposure in ks
- **Observations coordinated with another observatory** – the length of the window (in days) within which both observatories must observe the source
- **Roll Angle** The nominal roll angle of Chandra changes with time. The grading parameter is the length of the time window (in days) for which the roll constraint is satisfied.
- **Monitor** – dimensionless parameter depending on the exposure time, spacing and tolerance of the monitor series.
- **Group** – dimensionless parameter depending on the time interval for the group and total number of observations.

In this thread, we apply the classification scheme outlined in the [Call for Proposals](#) to approved Cycle 8 proposals to determine the number/type of constrained observations for each program. Proposers are advised to have Table 5.1 to hand when reading through these examples!

Example 1. PHASE and UNINTERRUPT

This example is taken from proposal 08400908, *Measuring the Distance and Dust Distribution to Cen X–3 with X-Ray Halo Variability*

The science goal of this proposal is to provide information on interstellar grain properties along the line of sight to Cen X–3. The program consists of a single observation starting 5 ks before eclipse egress and ending 35 ks after eclipse egress. This observation has two constraints: it is phase constrained and it must not be interrupted. We must evaluate both constraints separately. The final classification will be that of the most difficult constraint.

How hard is the Phase Constraint?

According to Table 5.1 in the Call for Proposals, a phase constrained observation of a source whose period is less than 20 days falls in the "easy" category. The period of Cen X-3 is 2.087065 days, and hence the phase constraint is "easy".

How hard is the Uninterrupt Constraint?

The total length of the observation is 40ks, which puts it in the "Average" category for uninterrupted observations.

Final Classification

The resulting classification for this observation is *Average*. i.e. it counts as ONE Average observation against the Cycle 9 quota.

Example 2. MONITOR

This example taken proposal 08400113, *A Red Giant Companion for the Transient 7.8 s Pulsar XTE J1829-098 ?*

The primary science goal of this proposal is to determine an accurate position for the transient X-ray pulsar XTE J1829-098. The total observation time is 15ks. In order to maximize the probability that the source is detected in outburst, the proposers request that the 15ks be split into three 5ks observations to be separated by at least 2 months (a monitor constraint).

RPS parameters for the monitor

Required RPS parameters for a monitor observation are: number of observations, geometric factor, time interval, and tolerance (expressed as percentage of the requested monitoring period). For 3 observations to be separated by at least 2 months (60 days) we set the monitor parameters as follows:

- Geometric factor=1.0
- Number of observations=3
- Time interval=120 days
- Tolerance=50% (i.e. 60 days)

The above parameters result in a monitor series with each observation spaced by at least $120-60=60$ days. The maximum time between observations is $120+60=180$ days.

Evaluate the Constraint

The dimensionless monitor parameter is given by:

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$\frac{\text{Initial Interval} \times \text{Fractional Tolerance}}{\text{Total Duration of Single Observation}}$
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Note that interval and total duration are expressed in days. Values for this monitor series are:

- | |
|---|
| <ul style="list-style-type: none"> • Initial Value=120 • Fractional Tolerance=0.5 • Duration of single observation=5ks=0.0578 days |
|---|

The monitor parameter is 1,036, so that each of the three observations falls in the *Easy* category. This program would count as THREE *Easy* observations against the Cycle 9 quota.

Example 3. WINDOW

This example taken proposal 08100480, *X-Ray Observations of Jupiter in Support of the New Horizons Flyby*

The goal of this proposal is to obtain X-ray observations of Jupiter during the New Horizons Flyby. There are three components to this investigation: a time-variability study during approach, a multi-spectral morphology study near closest approach and a magnetotail dynamics study as NH heads to Pluto. Each of these components requires two 18ks (5 hour) observations (a total of 6x18 ks). The time windows for these observations are:

Observation	Start	Stop	Window Duration
1	Feb 24 2007 9:30PM	Feb 25 2007 2:30AM	5 hours
2	Mar 3 2007 5:00AM	Mar 3 2007 1:00PM	8 hours
3	Mar 7 2007 5:30AM	Mar 9 2007 2:30AM	45 hours
4	Mar 7 2007 5:30AM	Mar 9 2007 2:30AM	45 hours
5	Feb 8 2007 8:30AM	Feb 11 2007 1:00AM	64.5 hours
6	Feb 8 2007 8:30AM	Feb 11 2007 1:00AM	64.5 hours

Each of these 6 observations must be done in a time window which is less than 3 days. This program would count as 6 *Difficult* observations against the Cycle 9 quota.

Example 4. ROLL, UNINTERRUPT and PHASE

This example is taken from proposal 08400850, *A Chandra HETGS Study of LMC X-4 : Binary Disk and Wind Properties and Studies of Grain Distribution at Small Angles*

The goal of this proposal is to obtain a high resolution spectrum of LMC X-4 to study the disk, wind and ISM of this source. It is multiply constrained. There is a roll constraint to minimize flux contamination from LMC X-1, a phase constraint to ensure the source is in a medium to high flux state and an uninterrupted constraint.

The Roll Constraint

The roll constraint is for angles 0–40 degrees or 90–180 degrees. The nominal roll angle of Chandra changes with time. Therefore a roll constraint translates to a window constraint, and the ease with which the observation can be scheduled is dependent on the length of the corresponding time windows.

The time windows can be calculated using the web version of the ObsVis tool. Enter the coordinates of LMC X–1 (RA=05:32:49.80, Dec=–66:22:13.80) in the box labeled "Target Coordinates" and hit the "View Data" button. The resulting page is an ascii list of roll and pitch values as a function of time. The first column in the file is the Modified Julian Date, the second the nominal roll. Inspection of the file reveals that the roll constraints are satisfied as follows:

- Roll angles 0–40 between MJD 3815.5 and 3775.5
- Roll angles 90–180 between MJD 3725.6 and 3633.0

The duration of the corresponding windows are 40 and 93 days, for a total availability of 133 days. The roll constraint is classified as *Easy*.

The Phase Constraint

The period of the super–orbital phase of LMC X–1 is 30 days. The phase constraint is therefore *Average*

The Uninterrupt Constraint

The total exposure time is 150ks. The maximum exposure time depends on the pitch angle of a source (see the Proposers Guide for more details). For most locations in the sky, this will be at most 80ks. Therefore it will be necessary to split this observation into (at least) 2 segments of approximately 80ks and 70ks. This counts as 2 *Difficult* uninterrupt constraints.

Please note that the pitch angle of LMC X–1 is such that it will definitely be necessary to split the exposures into even smaller chunks. For the purposes of counting constrained observations at the peer review, we do not explicitly take pitch into account and so the final count is 2 *Difficult* constraints.

Final Count

The final category is that of the most restrictive (difficult) constraint. This observation counts as 2 *Difficult* constraints against the Cycle 9 total.

Example 5. TOO, MONITOR, COORDINATED

This example is taken proposal from 08501014, *Tiny Hiccups To Titanic Explosions: Tackling Transients in Anomalous X–ray Pulsars*

This is a series of observations to study the spectral and timing properties of an Anomalous X–ray Pulsar following a transient event (e.g. an outburst or flare). It consists of 4 observations: a fast Target of Opportunity

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Observation (TOO) followed by 3 observations spaced by 1–3 days. Ideally, these observations would be simultaneous with RXTE.

The TOO Observation

The first observation (the TOO trigger) occurs within 4 days of the PI notifying the CXC that an event has occurred. This observation does *not* count as a constrained observation. Instead, it counts against the quota of Very Fast TOOs.

The TOO Follow-ups

The three TOO follow-ups are part of a monitor series and count against the quota of constrained observations. Details of how to evaluate a monitor constraint are given in the MONITOR example above. For 3 observations separated by 1–3 days we obtain the following RPS parameters:

- Geometric factor=1.0
- Number of observations=3
- Time interval=2 days
- Tolerance=50% (i.e. 1 day)

The dimensionless monitor parameter is given by:

$$\frac{\text{Initial Interval X Fractional Tolerance}}{\text{Total Duration of Single Observation}}$$

Note that interval and total duration are expressed in days. Values for this monitor series are:

- Initial Value=2
- Fractional Tolerance=0.5
- Duration of single observation=20ks=0.231days

The monitor parameter is 4.3, so that each of the three observations falls in the *Average* category.

Coordination with RXTE

All of the observations should be simultaneous (exact overlap if possible) with RXTE. Thus the coordination window is less than 3 days. This requirement falls in the *Difficult* category.

Final Count

This program consists of ONE Very Fast TOO and 3 *Difficult* constrained observations.

History

15 Feb 2006 Initial Version

URL: http://cxc.harvard.edu/pog/threads/constrained_count/

Last modified: 15 February 2006