

# NIRISS Single-Object Slitless Spectroscopy Template APT Guide

This article provides instructions for filling out the NIRISS single object slitless spectroscopy APT template.

## Introduction

*Main article: [NIRISS Single Object Slitless Spectroscopy](#)*

*See also: [NIRISS SOSS Recommended Strategies](#), [NIRISS SOSS Science Use Case](#), [NIRISS GR700XD Grism](#)*

[NIRISS Single-Object Slitless Spectroscopy](#) is one of four observing modes available with the [Near Infrared Imager and Slitless Spectrograph \(NIRISS\)](#). The SOSS mode uses a grism to generate three orders of cross-dispersed spectra of a single target in the wavelength range from 0.6 to 2.8  $\mu\text{m}$ . Spectral orders 1 and 2 are the usable orders. Order 1 covers the wavelength range 0.9 to 2.8  $\mu\text{m}$  at a resolving power (R) of 700. Order 2 covers the wavelength range 0.6 to 1.4  $\mu\text{m}$  at R=1400, while order 3 peaks at 0.6  $\mu\text{m}$ , largely outside the sensitivity range of the detector. The SOSS mode is optimized for spectroscopy of transiting exoplanet systems around nearby stars. A built-in lens provides mild defocus in the cross-dispersion direction, effectively raising the brightness limit for saturation.

A typical SOSS observation will consist of a single [target acquisition \(TA\)](#) followed by continuous spectroscopic exposures with the **GR700XD** grism. TA is required if a [subarray](#) is used in the exposure and strongly encouraged for full frame readout.

The observer will have control over: (1) target acquisition mode and exposure time (via number of groups), (2) choice of full frame readout or subarray for the **GR700XD** grism, and 3) SOSS [readout pattern](#) and [exposure time](#) (via number of groups and integrations).

## Step-by-Step APT instructions

### Generic

The following parameters are generic to all templates, and are not discussed in this article: [Observation Number](#), [Observation Label](#), [Observations Comments](#), [Target Name](#), [ETC Workbook Calculation ID](#), [Mosaic Properties](#), and [Special Requirements](#).

# Target acquisition parameters

## Target acquisition

*Main Article: [NIRISS Target Acquisition](#)*

*See Also: [JWST ETC NIRISS Target Acquisition](#)*

Target acquisition (TA) positions the centroid of the brightest object in the TA field of view on the location of the SOSS aperture used for science exposures. An observer can specify one of the 3 options for **ACQ TARG**: **NONE**, **SAME TARGET AS OBSERVATION**, or any source within the target list that is within 60" of the science target. TA is performed with the **F480M** filter in the [Filter Wheel](#).

TA is required if using a subarray, and *strongly encouraged* for full frame readout. SOSS data will be processed properly in the JWST calibration pipeline *only if a TA was performed*. The option of using SOSS in full frame readout *without* a TA will require self-calibration of the data, which is strongly discouraged in Cycle 1. This option is only useful in attempting to obtain spectra of a few sources at once, and users who wish to attempt this are encouraged to coordinate with the [JWST helpdesk](#) to ensure that their observations are feasible.

There are 2 options for **ACQ MODE**, based on the M-band magnitude of the target as specified in the [SOSS Template Parameters Page](#): **SOSSBRIGHT** and **SOSSFAINT**.

## Acquisition exposure time

*Main Article: [NIRISS Detector Readout Patterns](#)*

The only permitted **ACQ READOUT PATTERN** for **SOSSBRIGHT** is **NISRAPID**. Both **NIS** and **NISRAPID** are available readout patterns when the **ACQ MODE** is **SOSSFAINT**. The observer can specify the **ACQ NO. OF GROUPS** (**3, 5, 7, 9, 11, 13, 15, 17, 19**), where a group is defined by the number of frames in an integration (for **NISRAPID**) or by the number of frames in an integration divided by four (for **NIS**).

The ETC workbook identification number used to determine the exposure parameters for the TA can be entered in the **ETC WKBK. CALC ID** field. Though this input is optional, it is *strongly recommended* to provide this information so the TA can be assessed during technical reviews to ensure the observation can be executed correctly.

## SOSS parameters

### Subarray

*Main Article: [NIRISS Detector Subarrays](#)*

The **SUBARRAY** options are:

- **FULL:** full  $2048 \times 2048$  array is readout, achieving higher S/N for faint targets.
- **SUBSTRIP256:**  $256 \times 2048$  subarray which captures all 3 spectral orders.
- **SUBSTRIP96:**  $96 \times 2048$  subarray which only covers the first spectral order. This option allows faster readouts and thus has shorter integration times, enabling observations of brighter targets and those for which the science requires a high time resolution.

## Exposure time

Main Article: [NIRISS Detector Readout Patterns](#)

Specify:

- **READOUT PATTERN:**
  - **NISRAPID:** all frames are read and stored. Generally this can be used if the number of frames per integration is small and the data volume is not an issue. Only available option when using a subarray.
  - **NIS:** four frames are averaged. Used for producing a lower data rate for longer integrations of faint targets. Only supported for full frame readout.
- **GROUPS/INT:** the number of groups during an integration, equal to the number of frames read per integration (for **NISRAPID**), or the number of frames readout divided by 4 (for **NIS**).
- **INTEGRATIONS/EXP:** the number of integrations during an exposure, where an integration is the time between detector resets.
- **ETC WKBK. CALC ID:** the accompanying ETC workbook ID number for the calculation (optional).

The [Exposure Time Calculator Old](#) (ETC) should be used to determine the combination of **GROUPS/INT** and **INTEGRATIONS/EXP** necessary to achieve the required signal-to-noise.

## Other Tabs

## Special Requirements

A variety of observatory level [special requirements](#) may be chosen.