

# MIRI Imaging APT Template

This page contains instructions for filling out the [APT MIRI imaging](#) template, including full field imaging, [subarray](#) imaging, and large imaging [mosaics](#).

## Introduction

*See also: [MIRI Imaging Recommended Strategies](#)*

[Imaging](#) is one of four [observing modes](#) available with the [Mid-Infrared Instrument \(MIRI\)](#). For standard imaging, the MIRI imager offers [nine broad-band filters](#) centered on wavelengths between 5.6 and 25.5  $\mu\text{m}$  over an unobstructed field-of-view of up to 74"  $\times$  113" and a detector plate scale of 0.11"/pixel. The MIRI standard imaging mode supports the use of detector [subarrays](#) for bright targets as well as a variety of [dither patterns](#), which may act to improve sampling at the shortest wavelengths, remove detector artifacts and cosmic ray hits, and facilitate self-calibration. The [APT mosaicking tool](#) can be used to design mosaic observations to image larger fields.

The observer will have control over four primary parameters for MIRI imaging:

- 1) [filter](#)
- 2) [dithering pattern](#)
- 3) [subarray](#)
- 4) [detector read out mode and exposure time](#) (via the number of groups, integrations, and exposures).

Allowed values are documented and maintained in the [MIRI Imaging Template parameters](#), but described below.

## 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](#).

## Imaging parameters - coordinated parallel

*See also: [JWST Parallel Observations](#), [MIRI Parallel Observations](#)*

MIRI imaging supports coordinated parallel observations with other JWST instruments:

1. *MIRI-NIRCam Imaging*
2. *MIRI Imaging-NIRISS WFSS*

Note that the default option is *None Selected*.

## Subarray

See also: [MIRI Detector Subarrays](#)

MIRI imaging supports the use of a pre-defined set of **SUBARRAYS** for observing targets bright enough to saturate the image in full-frame readout. Each subarray is associated with a [brightness limit](#), depending on the filter used, above which a point source will saturate in the shortest 2-group integration. A MIRI imaging observation can only support a single subarray. If the target must be imaged using another subarray, it is necessary to create a separate MIRI imaging observation.

**Table 1. MIRI subarrays**

Subarray	Size (pixels)	Usable size (arcsec)	Frame time (s)
<i>FULL</i>	1024 × 1032	74 × 113	2.775
<i>BRIGHTSKY</i>	512 × 512	56.3 × 56.3	0.865
<i>SUB256</i>	256 × 256	28.2 × 28.2	0.300
<i>SUB128</i>	128 × 136	14.1 × 14.1	0.119
<i>SUB64</i>	64 × 72	7 × 7	0.085

## Dithers

See also: [MIRI Imaging Dithering](#)

The **DITHERS** dialog box handles the creation of dither patterns, which must be created before defining your imaging sequence. Each **DITHER** is specified by setting several parameters: **DITHER TYPE**, **STARTING POINT**, **NUMBER OF POINTS**, **STARTING SET**, **NUMBER OF SETS**, **OPTIMIZED FOR**, **DIRECTION**, and **PATTERN SIZE**.

Note that the smallest subarrays are smaller than the largest dithers, so the choice of dither pattern may be constrained by the choice of subarray. The MIRI imaging template in APT will only display dither parameters that are valid for the selected subarray.

Table 2. MIRI dither patterns

Dither type	Use case	Number of dithers
CYCLING	Shallow, flexible imaging, optimized for self-calibration	3-311
REULEAUX	Deep imaging, optimized for self-calibration	12
2-Point	Fast nod, for snapshots	2
4-Point-Sets	Flexible dithers for user-optimized imaging of point and extended sources	Multiple of 4

Note that set number **6** of the **4-point-Sets** dither type is centered on the FOV of the chosen subarray.

Small-scale dithers are supported for imaging with **F560W** and **F770W**. To minimize overheads, small dithers are implemented using the telescope fine steering mirror (FSM). After slewing the telescope to each large dither, the small dither pattern will be executed in sequence, leading to a total of  $N_{\text{dithers}} = N_{\text{small}} \times N_{\text{large}}$  separate exposures.

The option for no dithers (**None**) is currently available for the **SUB64** subarray if the **Times Series Observation Special Requirement** is set. See the [MIRI Imaging TSOs](#) article for more information.

## Filters

See also: [MIRI Filters and Dispersers](#)

The **FILTERS** dialog box is used to create the entire imaging sequence for a single observation for each filter. Each MIRI imaging observation can consist of multiple sets of images, each using a unique filter, dither pattern, and exposure configuration. First, **Add a FILTER**. Note that image set definitions can be duplicated using the **Duplicate** button.

An imaging sequence must be completed by selecting an exposure configuration for each imaging filter (in the **FILTERS** dialog box). Each exposure configuration requires setting the [readout pattern and characteristics](#) parameters: **READOUT PATTERN**, **NUMBER OF GROUPS**, and **NUMBER OF INTEGRATIONS**. Finally, select a dither pattern from the list of **DITHERS** already defined for the observation. The exposures will be repeated at each dither position following an offset of the telescope to the new position. The number of exposures at each dither position is set by **NO. OF EXPOSURES**.

 Users should use the [Exposure Time Calculator \(ETC\)](#) to determine the best exposure configuration to optimize the signal to noise.

## Readout pattern

See also: [MIRI Detector Readout Overview](#)

MIRI offers two readout patterns for imaging:

1. [FAST](#) (default)
2. [SLOW](#)

The FAST readout pattern is the default pattern, and is recommended for MIRI imaging observations.

## Number of groups and integrations

The MIRI exposure configuration is defined by only two parameters:

1. **NUMBER OF GROUPS:** The number of groups during an integration, where a group is the time to cycle through and non-destructively read out all the pixels.
2. **NUMBER OF INTEGRATIONS:** The number of integrations during an exposure, where integration is defined as the time between detector resets (destructive reads).

## Other tabs

## Mosaic properties

*See also: [MIRI Mosaics Overview](#)*

The MIRI Imager may be used to obtain data for a region larger than their size by creating a MIRI imaging [mosaic pattern](#).

## Special requirements

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

## Comments

The comments field should be used only to record observing [notes](#).