MIRI LRS Slit Target Acquisition

The JWST MIRI low resolution spectrometer (LRS) slit requires target acquisition (TA) for point sources.

Introduction

Parent pages: MIRI Operations → MIRI Target Acquisitions

Calibration of MIRI LRS data requires accurate knowledge of the location of the target on the detector. To this end, users are advised to perform a target acquisition (TA) as part of their observation; this ensures that the target is placed with subpixel accuracy at the nominal slit or slitless position.

LRS slit and slitless modes each have their own custom TA procedure. For slit spectroscopy, TA is particularly important to avoid slit losses and wavelength calibration issues that can arise from off-center source placement. When using the slit, TA is highly recommended but optional. Mapping observations of extended targets may not need TA. (For slitless mode, TA ensures that different observations of the same target always fall onto the same detector pixels. Note that for LRS slitless observations, TA is mandatory.)

Pointing performance of the telescope is described in JWST Pointing Performance.

TA target

Typically the science target is used for TA. However, the procedure can also be carried out with a nearby bright star, which should be within 60" from the science target. Use of an offset target may be desirable if the science target is not a point source, or if the TA exposure would add an unacceptably long overhead to the observation (see "TA exposures" below).

TA filters

Main article: MIRI Filters and Dispersers

As in other MIRI modes, LRS has four filters available for TA:

- F560W
- F1000W

- F1500W
- FND (a neutral density filter)

As the TA exposures use the ***FULL***[1] imager array setting (as do all LRS science exposures), please refer to the MIRI Bright Source Limits page for relevant saturation limits.

> Users should always use the JWST Exposure Time Calculator (ETC) to help choose the best TA filter for their science.

[1] ***Bold italics*** font style is used to indicate parameters, parameter values, and/or special requirements that are set in the APT GUI.

TA exposures

> *See also: MIRI Detector Readout Fast*

TA exposure settings should be calculated using the ETC. The exposure should be carried out in a single integration, with a limit of approximately 1,000 s to avoid too many cosmic ray hits. The TA integration can contain a maximum of 99 groups. If sufficient SNR cannot be reached on the science target in this time (SNR > 20 is recommended), use of an offset target should be considered. The minimum number of groups in an integration for TA is three.

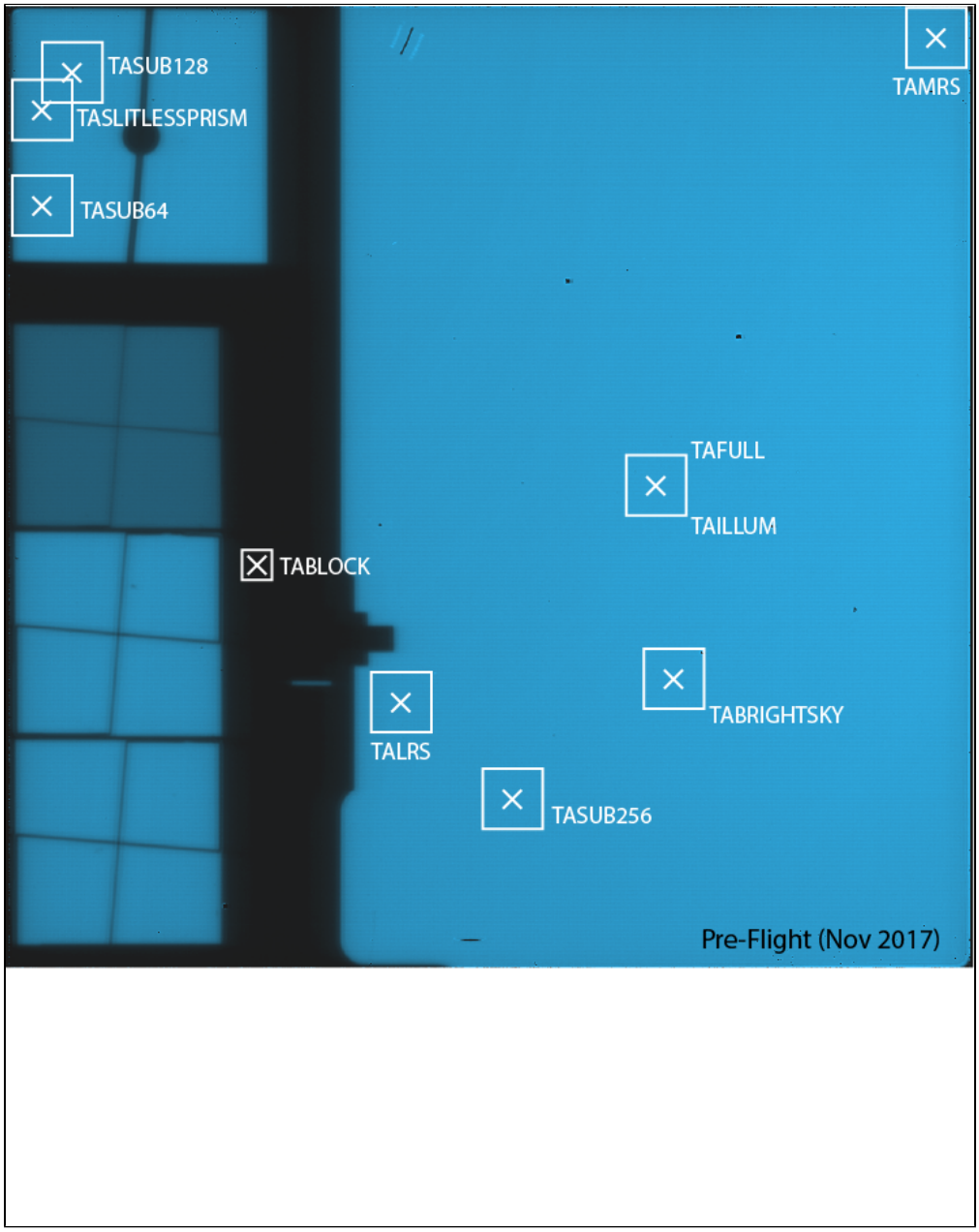
TA can be carried out with the ***FAST*** or ***FASTGRPAVG*** readout pattern. In the latter, each group represents the average of four reads; this mode can be used to increase the exposure time of the TA exposure without exceeding the 99 groups limit.

LRS region of interest

> *See also: MIRI Optics and Focal Plane*

The LRS slit target acquisition requires a region of interest (ROI) located as close to the LRS slit as possible. A 64 × 64 pixel (~7 × 7") ROI is located in the imager portion of the field of view, near the slit location. Note that the ROI is not a detector subarray; TA exposures are performed with ***FULL*** array read mode.

Figure 1. MIRI field of view showing LRS slit target acquisition region of interest



The box labeled "TALRS" in the imager region is where the LRS slit target acquisition 64 × 64 pixel region of interest (ROI) is located. The reference point is taken to be the midpoint of this ROI.

LRS slit TA sequence

See also: MIRI Filters and Dispersers

The target acquisition procedure begins with placing the TA target—the science target or a suitable offset star—in the ROI in the imager field of view. An exposure is taken according to the setup specified by the user in APT. This exposure must be limited to a single integration. A dedicated algorithm will perform centroiding on the resulting image to identify the location of the target centroid at subpixel accuracy. The images taken in TA will be available to the user.

After the centroiding algorithm has completed, the filter wheel will move from the TA filter position to the P750L location, which is the double prism. Following the filter wheel move, the telescope will perform a small angle maneuver (SAM) to place the target into the slit at the required position (at the slit centre, or the first nod position). The first science exposure can begin.

References

Gordon, K., 2008, JWST-STScI-001347 (PDF)
Mid-Infrared Instrument (MIRI) Low Resolution Target Acquisition for Faint Sources

JWST technical documents