MIRI LRS Recommended Strategies

Together with the MIRI Generic Recommended Strategies and TSO-specific guidelines for MIRI articles, this page helps the observer plan to use the MIRI LRS. Note that these are pre-launch recommendations (as of Novemebr 2017) that will be updated as the knowledge about the instrument optimal usage and calibration progresses.

Introduction

The MIRI Low-Resolution Spectrograph offers slitted and slitless spectroscopy from 5 to 12 μm. Observers are encouraged to follow the mode-independent and TSO guidelines described for MIRI. This page focuses on general aspects that are relevant for the LRS.

Dithering

In slit mode, dithering is reinforced for science observations (see MIRI Low Resolution Spectroscopy Template in APT). There are two different options:

- The "along slit mode" represents a two-point dither and it is recommended for point sources. This method allows for both redundancy and background subtraction. The user should verify whether sources nearby to the target can occupy the other dither position and defeat the dither strategy. If so, unfavorable roll angles should be avoided.
- The "mapping mode" allows the user to define a certain number of spectral and spatial steps and offsets, and it has been designed to allow for extended source mapping.

Note that, when defining a target in APT, users should specify if the target is spatially extended; the options are "Yes," "No," and "Unknown." The selected dither pattern should be consistent with the source definition. Deviations from these default options should be justified in the proposal. See more information about LRS dithers in this page.

In slitless mode, dithering is not allowed, as this option has been specifically designed to carry out Time Series Observations. Note that in slitless observations the target should be a point source.

Dwell Time (for how long should MIRI stay in a single dither position?)

At the wavelength range in which the LRS operates there are no restrictions on the length of an exposure for each dither position. Optimization of the detector Number of Groups per integration and number of integrations per exposure is discussed here.

Readout mode

The default readout mode is FAST. SLOW is an available option as well. Please follow the MIRI Generic Recommended Strategies to choose the optimal readout mode for your scientific program.

Target acquisition considerations

Performing Target Acquisition is mandatory in slitless mode as it is needed for Time Series Observations.

TA is optional for the LRS slit mode; the no-TA option is intended to be used mostly in extended sources. Observers should consider the JWST Pointing Performance (currently expected to be about 0.45", 1-σ radial error) and the impact in their science case. Given the slit dimensions: ~4.7" long (3.18 mm; 42.7 pixels) and ~0.51" wide (0.33 mm; 4.6 pixels), TA is highly recommended for point sources. Please read the MIRI Generic Recommended Strategies for details on how to select a TA source.

Background observations and their use in the pipeline

In slit observations, point and extended sources require different strategies:

- For point sources there is no need to obtain a separate background, that is accounted for in the dither strategy.
- For extended sources, a suitable background position/strategy is expected to be used. This can be either a separate background target or a mosaic.
- When a user assigns a background to a science target, that creates a formal association between them. By doing this the pipeline will automatically subtract background exposure from target exposure.

For slitless/TSO observations, that by default are no-dithered, separated background exposures are not recommended. They would not be representative or accurate enough to allow for subtraction. The current background strategy removal consists of removing the background by using the information from detector rows adjacent to the source.

References

Kendrew et al. 2015, PASP, 127, 623K
The Mid-Infrared Instrument for the James Webb Space Telescope, IV: The Low-Resolution Spectrometer

Glasse et al. 2015, PASP, 127, 686G
The Mid-Infrared Instrument for the James Webb Space Telescope, IX: Predicted Sensitivity