JWST Cycle 1 Observation Mode Restrictions

Most observational modes will be available for Cycle 1 programs, however some have specific special restrictions for implementation.

NIRSpec Multi-Object Spectroscopy

The multiplexing capabilities offered by the NIRSpec Multi-Object Spectroscopy (MOS) modes, using the Micro-shutter Array (MSA), represent a major opportunity for JWST observers. NIRSpec MOS programs might involve observations of anywhere from a handful of sources to more than 100 targets. Larger-scale programs introduce significant complexities in planning, scheduling and implementing specific observations.

Orientations, optical distortions and target selection: The target selection process for NIRSpec MOS observations must take account of how objects are projected onto the micro-shutter array, and therefore depends on the orientation of the observations and the optical distortions present along the NIRSpec optical path. The flight optical distortion maps can only be measured after launch. The exact orientation for any observation will not be determined until that observation is placed on the Long Range Plan (LRP) for Cycle 1. Consequently, at the time of the Cycle 1 GO submission deadline, proposers will not be able to specify which of their targets will actually be observable. However, for the purposes of submitting an MSA proposal, proposers should run the Target Visibility Tool for their proposed field, and use a sample position angle of the telescope during a period of visibility to demonstrate to the TAC that multiple targets are visible for a given telescope orientation.

Catalog sizes: The number of targets within a given observing catalogue that can be observed during a single NIRSpec MOS observation is limited by the availability of suitably-positioned micro-shutters to accommodate the appropriate nod and dither patterns, and, if relevant, by the need to avoid overlapping spectra on the detector. Taking this into account, the NIRSpec team has conducted analysis to determine that up to ~190 objects can be targeted at low spectral resolution (R=100, no overlap) and ~55 at high spectral resolution (R~1000 and 2700, no overlap). This work also shows that approaching these asymptotic multiplex values requires a large input catalog with high target densities of ~720 sources arcmin^{-2} and 240 arcmin^{-2}, respectively, corresponding to ~7,000 and ~2,400 targets within the NIRSpec field of view. Thus, observers who wish to maximise the multiplex capabilities of NIRSpec MOS should provide catalogs that include many more targets than can actually be observed (Jakobsen et al. 2017). Conversely, in many cases a substantial number of potential targets will remain unobserved at the conclusion of a program.

These considerations lead to several operational consequences:

- In order to accommodate the full range of possible orientations and small pointing adjustments, observers should specify a potential target list covering an area of radius at least 3 arcminutes for any particular pointing. If possible, the catalogue should be oversized in the number of targets to maximize the NIRSPec MOS multiplexing; this will not be possible for all science cases.
- By policy, proposers do not reserve access to the field of view covered by a NIRSpec MOS observation. Consequently, proposers may not reserve the full list of targets associated with any accepted observing proposal. At the time of submission, proposers may assign weights for the preference of their targets, but there is no guarantee that any more than one priority target will be observed.
- By policy, proposals for MOS observations may be submitted with source catalogues that overlap with those of previously accepted proposals. Proposers must identify potential duplications with prior program s, and must provide an appropriate scientific justification and a demonstration that sufficient targets are available to justify the additional observations. If the Telescope Allocation Committee accepts such a proposal, the previously accepted proposal will have priority in target selection; thus, in JWST Cycle 1, GTO programs have priority in target selection over DD ERS programs, which have priority over Cycle 1 GO programs.
- Multiple proposals using overlapping source catalogues may be proposed and accepted by the Telescope Allocation Committee during the same cycle. In such cases, the TAC will provide a clear specification of the relative priority of those proposals with regard to target selection.

Duplicate observations with JWST are generally not allowed without an approved scientific justification. However, in order to maximize the scientific return, NIRSpec MOS observations may include a limited number of duplicate observations of individual targets without specific scientific justification. The latter sources may not exceed 10% of the total targets within a given NIRSpec MOS observation as implemented for execution. The final target lists will be reviewed for compliance and, if necessary, subjected to adjudication by the STScI Director.

NIRSpec observations that require the MSA-based Target Acquisition in fields with a high density of targets (>~1 star per sq. arcsec) or with many bright targets (<ABMag 19.1 at higher density than 1 star per 10 sq. arcsec) are not permitted.

Mechanism Usage

APT templates generally yield observations that minimize the use of mechanisms within the science instruments, while yielding the best observing efficiency. Nonstandard use of templates may overuse mechanisms. For example, mosaics with large overlap between tiles can use mechanisms far more than standard dithers. Accepted programs will be reviewed to ensure that mechanism usage is consistent with preserving mechanism lifetime. Exceptions must be strongly justified on grounds other than improved observing efficiency.

Data Volume and Rate Limitations

Some observations will generate a high data volume per visit, high data rates that may exceed limits in the storage capacity of the solid state recorder, the data write speed to the solid state recorder, or the instantaneous data rate limits in the instrument command and data handling subsystem (48 Mpbs). In some cases, APT has implemented limitations to avoid exceeding these limits, but other observing options enabled by APT could create problems. For example, APT will create an error if the visit exceeds the capacity of the solid state

recorder. If this is the case, the user is **required** to change the observing strategy to comply with solid state recorder storage limits. Users should keep in mind, however, that data volume and data rates issues can only be fully identified downstream and the Visit Scheduling Subsystem and the Visit Planning Subsystem are designed to take these issues into consideration. Proposers should be aware that accepted programs may have to be modified to comply with data volume and data rate limits.

To facilitate the scheduling of the observations, users are encouraged to keep the data volume under 28.2 Gbytes in a 12 hour period (0.654 MB/s). APT will generate a warning if the proposed data volume is too high. Please refer to APT documentation on how to obtain data volume and data rate information.

Next: JWST Cycle 1 Proposal Selection Process