Introduction to the MSA Planning Tool (MPT)
A tool to specify MOS observations with NIRSpec’s Micro-Shutter Array (MSA)

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many slides courtesy Diane Karakla
2 Factors:

- To allow **scheduling flexibility**, most MOS programs will be **assigned an orient**.
- Most science with the MSA will require **very accurate relative astrometry** (~5 mas). **Pre-imaging with NIRCam** will be needed.

→ For **Proposal Submission**: To estimate observing time (inc. overheads), MPT can be used with **simulated or existing catalogs** to explore the effects of planning choices and observing strategies (e.g. dithering!) on target success rates. **It is highly recommended that you do this!**

→ At **Program Submission** MPT is used to prepare **detailed observing programs** at the assigned orient.
Observation Planning Challenges

The MSA is a **fixed grid** (with shutter bars that vignette light from sources)

- **Gap** between the 2 detectors → missing wavelengths.
- Source positions in MSA require knowledge of **optical distortions/velocity aberrations** at a planned Aperture Position Angle.
- The MSA has **Failed shutters, shorted rows/columns**. They do evolve!
- **Dither** to cover gap, mitigate detector artifacts, improve resolution, observe sources behind bars or mounting plate.
- **AND observe as many sources as possible at all dithers!**

**Solution → use MPT!**

- APT installer available from [http://apt.stsci.edu](http://apt.stsci.edu)

MPT will deliver optimal **pointings** and **MSA configurations**!
NIRSpec MSA Planning Tool Optimizes Observing Efficiency

An **MSA configuration** is a set of open and closed shutters that define **slitlets** to obtain spectra of many targets.

![Sketch of telescope “nodding”](image)

Larger dithers require an MSA re-configuration to re-observe the same sources.
NIRSpec MSA Planning Tool Optimizes Observing Efficiency

MPT implements algorithms to find pointings and configurations of open shutters that maximize the number of sources observed over a user-specified number of dithers. It includes additional user-specified constraints:

- Allowed location of source in shutter
- Slitlet shape
- Size of dither
- Target priorities
- Number of target sets

Deep Galaxy Redshift Surveys

Diane Karakla, Karoline Gilbert
Planning in MPT - Dithers

- In-slit “nods” – re-use same MSA configuration
- **Fixed** (finite) or **Flexible** (min or max) dither constraints

**Fixed dithers**: Translate the pattern of open shutters for new dither point.

**Flexible Dithers**: User specifies a min or max separation between dither points in spectral and/or spatial direction.

- This method handles **relative distortions** between dithers, so is appropriate for small or large dithers (e.g. across the detector gap)
- Multiple possible pointings are tested at each dither step, building **families of possible solutions**.
- The **best family** is chosen. (The one that observes the largest number of highly-weighted sources at all steps.)

Small dithers only! $\sim 10$ arcsec
Users click open shutters in the MSA on a sketch of the sky at a fixed pointing to form slits.
Will use the publicly available 25.0 Beta version of APT.

See Jan 13 e-mail from Janice for the link, or http://apst.stsci.edu/apt/documents/Installers/beta25.0/Latest/Web/install.html