MIRI TSO updates

TrEx WG meeting, 7 May 2018

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Topics covered

I. MIRI exposure setup recommendations for bright source observations

II. MIRI Imaging TSO photometry for lightcurves

Bright source/TSO exposure recommendations for MIRI

- To be included in Jdox (Similar to the graphic on: https://jwst-docs.stsci.edu/display/JPP/MIRI+Generic+Recommended+Strategies

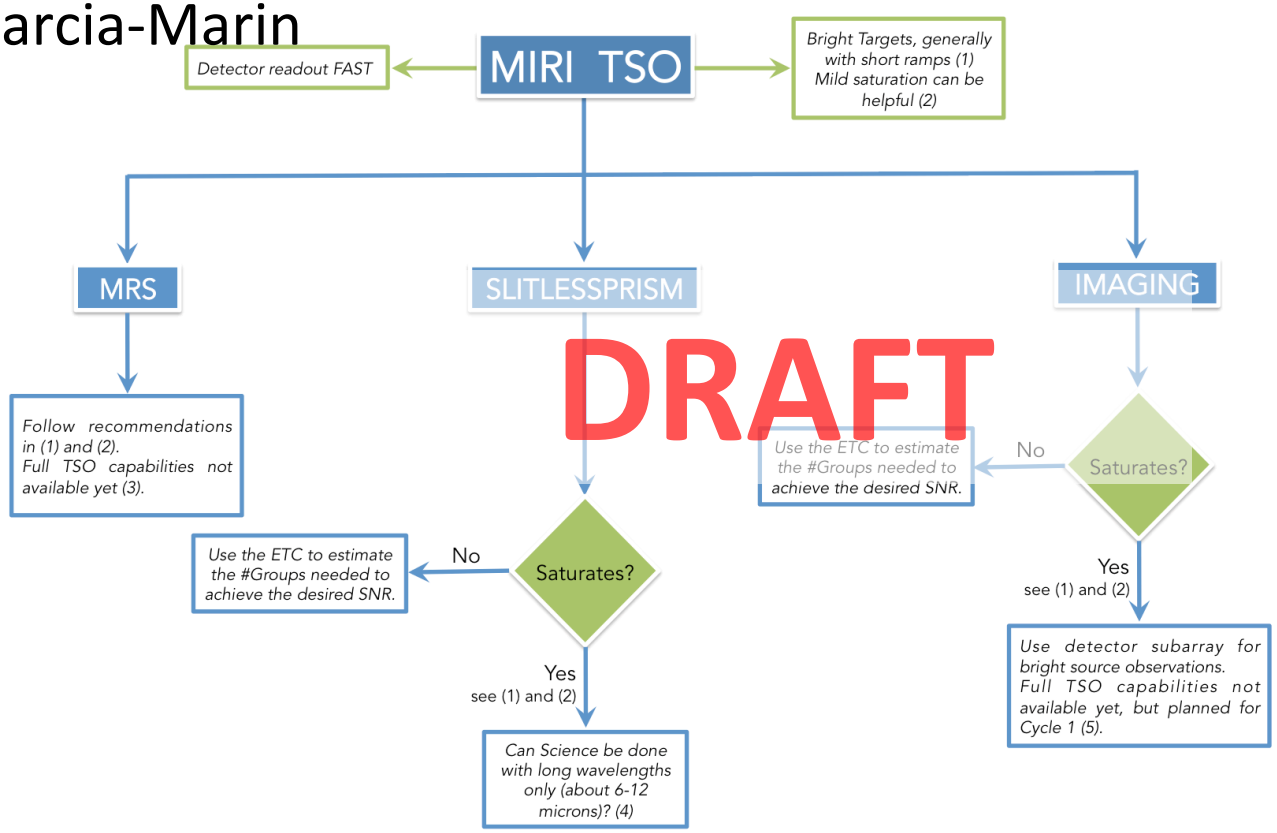
- Objective: a simple diagram showing possible MIRI mode choices & Exposure setup recommendations

- Focus on:
  - Choice of Ngroups
  - How to deal with saturation: good/bad? avoid/proceed with caution?

- Lead by Macarena Garcia Marin & will be included in the Jdox TSO strategies section for MIRI (managed by SK)

Recommendations for bright source exposures

Working on an advice flowchart with Maca Garcia-Marin



(1) 5 groups is the recommended limit to obtain good flux calibration with the pipeline.
3 non-saturated groups are the minimum for high-precision TSO.
Integrations 20-30% above the saturation limit as reported by the ETC should be usable, but by doing this observers are assuming a risk. Definite saturation limits will be known on-orbit.

(2) In this context mild saturation means that only few (one or two) groups at the end of the integration are saturated. Adding at least one extra group will help to recover information in the saturated pixels. It will also improve the SNR in the unsaturated regions. Saturating more than one group does not provide direct benefits, but it does not invalidate data on the initial part of the integration.
Observers should use the JWST Exposure Time Calculator and PandExo to judge saturation limits.

(3) The MRS offers TA and the No-dithers options. Exposures longer than 10000 seconds without moving the high gain antenna are not allowed at the moment. *Observations would not be flagged as TSO, and thus would follow the standard MRS STScI pipeline processing.*

(4) *Because of the stellar spectra and the low dispersion at short wavelengths, saturation is more likely be an issue in (approx.) the 4.6-6 microns wavelength range. This should not affect results on the 6-12 microns spectra.*

(5) Imaging Target Acquisition is not available yet, but will be implemented for Cycle 1.

II. MIRI TSO Photometry

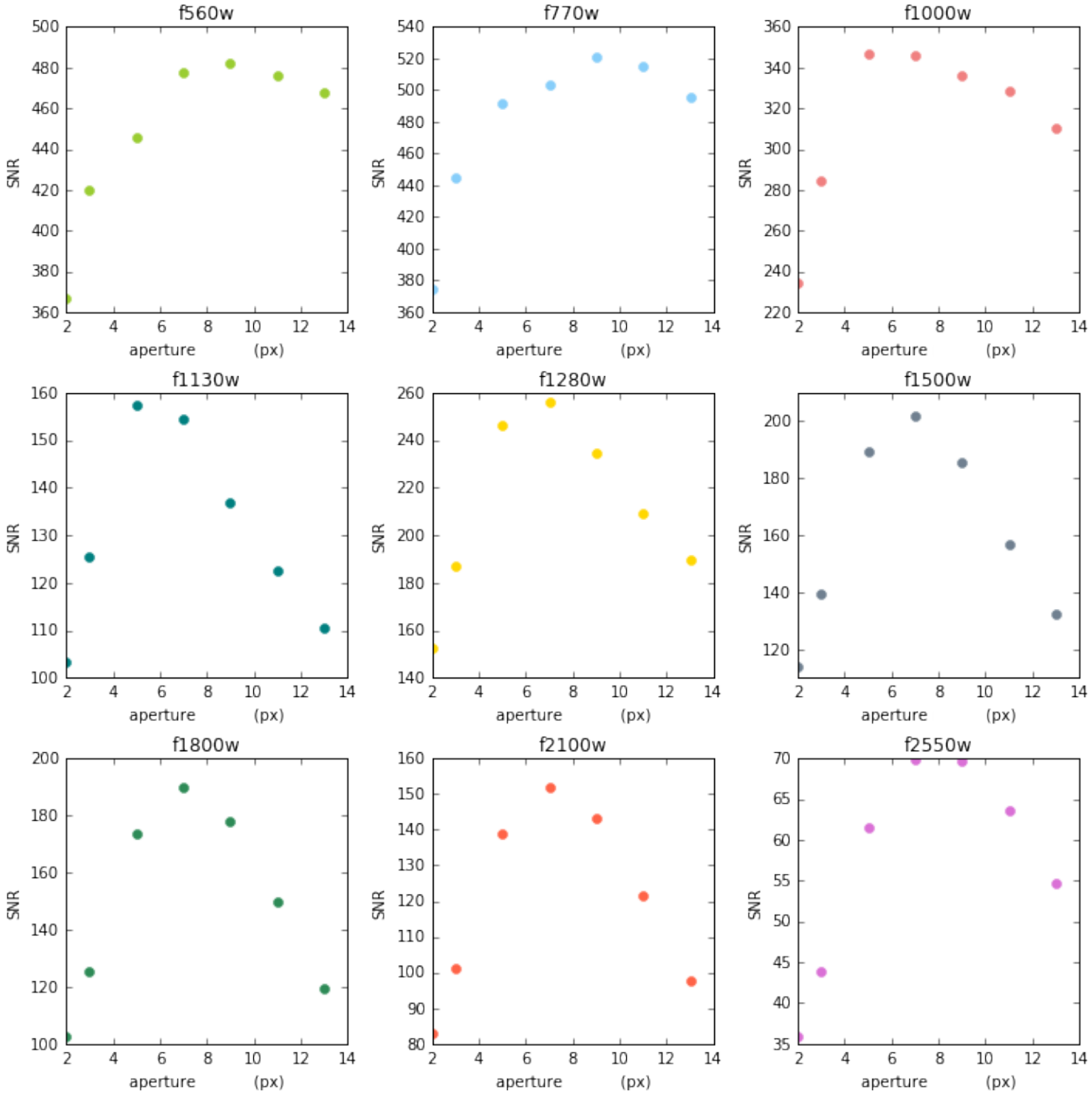
- Pipeline returns a lightcurve by performing aperture photometry
- What is the optimal aperture for MIRI Imaging that will work for a baseline pipeline?
- Performed Pandeia calculations to look at SNR as a function of aperture size and filter
  - Input source: star with V ~ 10.6
  - High background
  - ETC calculations such that SNR >300 for most filters (> 100 for $\lambda > 20$ μm)
  - Background annulus set to 1-1.2" size

DRAFT

MIRI FWHM sizes & pixel scale

Filter name	λ_0 (μm)	$\Delta\lambda$ (μm)	FWHM (arcsec)
F560W[1]	5.6	1.2	0.22
F770W	7.7	2.2	0.25
F1000W	10.0	2.0	0.32
F1130W	11.3	0.7	0.36
F1280W	12.8	2.4	0.41
F1500W	15.0	3.0	0.48
F1800W	18.0	3.0	0.58
F2100W	21.0	5.0	0.67
F2550W	25.5	4.0	0.82

- Pixel scale is 0.11”/px
- FWHM sampled by 2.0 to 7.45 px
- Undersampling limited to F560W


f560w
f770w
f1000w
f1130w
f1280w
f1500w
f1800w
f2100w
f2550w
SNR
aperture (px)

Notes on these results

- Seem to show quite consistent SNR vs aperture relationships across filters
- Code is in jupyter notebook hosted in STScI-MIRI Github space – happy to provide access
- Passed on recommendations of 7 x 7 px extraction box to SCSB team.