# JWST User Tools

- Exposure Time Calculator (ETC)
  - Astronomer's Proposal Tool (APT)
    - MSA Planning Tool (MPT)

Documentation

Data Analysis Tools

Susan Kassin (Space Telescope Science Institute)

# Exposure Time Calculator (ETC):

## "Pandeia"

## JWST ETC: "Pandeia"

- 1. More functionality
  - model spatial and spectral directions simultaneously
  - set-up 2D "postage stamp scenes" and assign spectra to each source in them
  - uses realistic PSFs as a function of wavelength
- 2. User Interface
  - web-based
  - "copy & modify" flow, sensible defaults given
  - workbooks
    - each has a set of calculations and scenes
    - saved and persist for logged-in users
    - can share with collaborators

Development Version Available Later This Summer!

# Specifying "Sources" and "Scenes" scenes & Sources tab

Select a Source

s0 Calculation 35 st

s0 Calculation 35 s2

Plot Name

ID -

2 📖

0.5

### All your scenes listed here

Sources

1.2

loaded Spectra

# Calcs -

7

Scenes and Sources



Scene Sketch

-0.5-

-0.5

Calculations

ID - Name

Select a Scene

Scene

Scene 1 Scene 1 Scene shown here

0.0

arcsec



Delete

# Calcs -

Scenes

All your sources

listed here

New Scene from Source

Source Editor ID Continuum Renorm Shape Offset Lines template spectra Spectral energy distribution or read in your own Uploaded File ÷ Select Blackbody Spectrum at Teff 4500 с к No Continuum redshift it Redshift 0 0 Renormalization & lines applied after redshift

 Used in Calculations

 ID Name Scene 

 1
 nirspec\_fixed\_slit
 1

 2
 nirspec\_fixed\_slit
 1

 3
 nircam\_lw\_imaging
 1

 4
 miri\_imaging
 1

 5
 nirspec\_fixed\_slit
 1

 6
 nircam\_lw\_imaging
 1

 7
 nircam\_lw\_imaging
 1

Save

# Performing calculations with scenes

Calculations

Uploaded Spectra and Sources

MIRI -	NIRCa		ec -			
ID 🔺	Plot	Mode -	Scene -	(s) -	SNR -	æ
7		nircam lw_imaging	1	63.78	124.00	0
6		nircam lw_imaging	1	63.78	191.27	0
5		nirspec fixed_slit	1	458.40	125.67	0
4		miri imaging	1	277.50	1160.88	0
3		nircam lw_imaging	1	63.78	120.06	0
2		nirspec fixed_slit	1	458.40	22.64	0
1		nirspec fixed_slit	1	458.40	133.33	0
-	-		-			

### All your calculations listed here

Scene ★	Backgrounds	Instrument Setup	Detector Setup	Strategy
Subarrays			Readout patter	ns
S200 A1		•	NRS	•
Groups		Integrations		Exposures
10	¢	1	\$	1 2

### Calculation inputs specified here

Calculation selected: 1, Mode: nirspec fixed\_slit

Calculate





R	eports							
Ca	alculation s	selected: 7, M	ode: nircam	lw_imagir	ng			
	Report Warnings Errors Downloa							
In	strument F	ilter/Disperser	:		f323n/null			
E	xtraction Ap	perture Positio	n (arcsec):		[-0.10, 0.40]			
W Va	avelength (	of Interest use ons):	d to Calculat	e Scalar	3.24			
S	ize of Extra	ction Aperture	(arcsec):		0.1			
Т	otal Time R	equired for Ob	servation (se	econds):	63.78			
Т	otal On-Sou	urce Time (sec	onds):		63.78			
E	xtracted Flu	ux (e-/sec):			326.43			
Va	ariance in E	xtracted Flux	(e-/sec):		2.63			
E	xtracted Sig	gnal-to-Noise	ratio:		124.00			
In	put Backgr	round Surface	Brightness (	MJy/sr):	0.10			
To /s	otal Backgr ec):	ound Flux in E	xtraction Ap	erture (e-	8.62			
S /s	ky Backgro ec):	und Flux in Ex	traction Ape	rture (e-	0.12			
Fi Fi	raction of T rom Scene:	otal Backgrou	nd due to Sig	gnal	0.99			
					0.01			

# Astronomer's Proposal Tool

# (APT)

http://www.stsci.edu/hst/proposing/apt

Astronome	r's Proposal Tool (APT)
Fore Film Spreadsheet Editor Orbit Planne	Astronomer's Proposal Tools Version 24.2 - JWST Draft Proposal (Unsa
New JWST Proposal V New V	
🔻 🏝 JWST Draft Proposal (Unsaved)	Observation 2 of JWST Draft Pro In Aladdin
<ul> <li>Proposal Information</li> <li>Proposal Description</li> <li>PI: Dr. Susan Kassin</li> <li>Unnamed Col</li> </ul>	Number     2     Status:     UNKNOWN       Label     Instrument     NIRCAM     All     INV/ST instruments     Instruments     Instruments
Targets     Fixed Targets	
INGC-3726      Goservations      Observation Folder	Target 1 NGC-3726 Splitting Distance Number of Visits
Source of the observation of the observation 1	Visit Splitting: 30.0 Arcsec 3
Observation 2	Science Total Charged
Usit 2:1	Duration (secs) 33 3753
🖾 Visit 2:2	Data volume: 252 MB
Uisit 2:3	NIRCam Imaging Mosaic Properties Special Requirements Comments
d <sup>PC</sup> Observation Links	Module ALL + Subarray FULL + Choose your NIRCam dither pattern
	Dither Parameters
	#     Short Filter     Lor     9       1     F090W     F33     3TIGHT       1     1     10.737     32.211
	Filters
	Edit Observation 1 (=) New マ) (=> Edit Visit 2:1)

# MPT: MSA\* Planning Tool



Demos by Diane Karakla

\*Micro-shutter array on NIRSpec

## The MSA Planning Tool (MPT) is part of APT

			a Astrono	omer's F	Proposal Tools Versio	on 24.2 - JW	/ST Draft Pro	oposal (Propos	alforTalks.aptx)			
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New Document $\nabla$ New $\nabla$									🍰 JWST What's Nev	HST What's New	🍈 Roadmap	🤛 Feedback
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### MPT is available now: http://www.stsci.edu/hst/proposing/apt

### Micro-Shutter Array (MSA)

#### 4 x 365 x 171 Shutters 9' square area





### shutters are 0.2" x 0.46"



## MPT (MSA Planning Tool) takes into account:

- 1. The MSA is a fixed grid
  - targets should not be placed behind bars
- 2. Failed shutters
  - stuck open, stuck closed, shorted rows and columns
- 3. Optical field distortion
- 4. Detector gap
  - part of your spectra might get lost here
- 5. Spectra falling off of edge of detector
- 6. Differential velocity aberration (DVA)



## Setting up MPT to Create Your Pointings

- Upload a catalog of:
  - primary sources with or without weights
  - filler sources
- Choose a slitlet shape
- Choose a centering
- Set-up your dithers
- Set exposures
  - number of groups & integrations
- Set size of search grid

	So Observation Folder of JWST Drait Froposal (Froposalion Talks.aptx)
	Observation Summary MSA Planning Tool
	Catalogs Planner Plans
Manual Planning	
Aperture PA	0.0 Degrees
True angle to target	193.45970071108675 Degrees
Candidate Lists	
Primary Candidate List	very high z galaxies \$
Filler Candidate List	high z galaxies (495 ‡
slit Setup	
Slitlet Dither Setup	3 Shutter Slitlet + Grand Source Centering Constraint
Nod in slitlet	✓ 3 exposures per configuration.
Dither Type	Fixed Dither         \$         Short dithers recommended.
	#     1     Dispersion=5 shutters, spatial=0 shutters.
Pattern	

## MPT Output

- MPT finds optimal pointings by summing source weights for each possible pointing, and choosing the pointings with the highest sums
- MPT visualizes each pointing as shown



sources (observed or not) shown on the MSA shutters



location of all sources in their shutters



# Data Analysis Tools

## JWST Post-pipeline data-analysis tools

- JWST data analysis will be in Python/Astropy
  - Basic capabilities familiar with users of IRAF, STSDAS, and IDL will be available (many already are)
- Visualization will be in Ginga & Glue





## Areas of current development

### Astropy

- Data formats, File I/O
- Tables, (parameter files)
- Units & quantities
- Models, fitting, filtering, statistics
- Coordinates, WCS, dates & times



### Workflows

- Jupyter (IPython) notebooks
- Linked datasets (Glue)

### Python libraries

- Numpy, scipy, matplotlib
- Sci-kits, Sympy, PANDAS....





## Areas of current development





### Visualization

- SpecViz, MOSViz, CubeViz
- Imexam, Ginga plugins

### Photutils

 Flexible, modular toolkit for detection, segmentation, measurement

## Multi-frame Analysis

- Simultaneous fits to multiple un-resampled images
  - Photometry, astrometry
  - Spectral modeling





Data Collection	🛪 Tab 1
Data Subsets	
Plot Layers	*
° Plot Options	Drag Data To Plot

## MOSViz

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		SC_discussion_notes.txt	1504.06284v1.pdf	Welker_thesis.pdf	Kassin
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# Documentation: "JDox"

# "JDox"

New JWST website will contain higher level mission information and JWST science content.

New documentation system motto: "Every page is page one" (Mark Baker)

- short articles
- self-contained, one-level information
- hyperlinked network

Think Wikipedia (but it's not a Wiki)

Searchable with Google

Multiple conceptual spaces:

- background articles
- planning cookbooks
- science policy
- engineering specs



First release of overview pages by end of summer, support for proposal planning in January.

### James Webb Space Telescope User Documentation

HOME INSTRUMENTATION -

Search

Draft JWST Observatory and Instrumentation Documentation / Mid-Infrared Instrument, MIRI

#### MIRI Overview INREVIEW PREPUBLICATION

The JWST Mid-Infrared Instrument (MIRI) provides imaging and spectroscopic observing modes from 5 to 28.5  $\mu\text{m}.$ 

#### Introduction

The JWST Mid-Infrared Instrument (MIRI) provides imaging and spectroscopic observing modes from 5 to 28.5  $\mu$ m. MIRI will extend the scientific wavelength range of JWST beyond 5  $\mu$ m. These wavelengths can be utilized for studies including, but not limited to: direct imaging of young warm exoplanets and spectroscopy of their atmospheres; identification and characterization of the first galaxies at redshifts >7; and analysis of warm dust and molecular gas in young stars and protoplanetary disks.

To achieve these goals MIRI offers a very broad range of observing modes, including:

- imaging
- low resolution slitted and slitless spectroscopy
- medium resolution integral field unit (IFU) spectroscopy
- coronagraphy

The MIRI focal plane is illustrated in Figure 1.





MIRI Mid-Infrared Instrument a.

#### Table of contents

- Introduction
- Observational capabilities
- Optical elements
  - Imager
  - Medium Resolution Spectrometer (MRS)
- Sensitivity and performance
- Data calibration and analysis
- Acknowledgements
- Related links
- References

#### Observatory and instrumentation

- Mid-Infrared Instrument, MIRI
  - MIRI Overview
  - MIRI Observing Modes
  - MIRI Instrumentation
  - MIRI Operations

# JWST User Tools

- Exposure Time Calculator (ETC)
  - Web-based
  - Development version by end of summer
  - flight version (ERS & GTO Cy1) at winter AAS
- Astronomer's Proposal Tool
   (APT) & MSA Planning Tool (MPT)
  - downloadable now
  - ERS & GTO Cy1 versions by May 2017

- Documentation
  - Web-based
  - Overview pages by end of summer
  - Support for proposal planning by January
  - Data Analysis Tools
    - v0.1 releases on GitHub and in Astropy
    - visualization tools in beta testing
    - bit.do/jwst