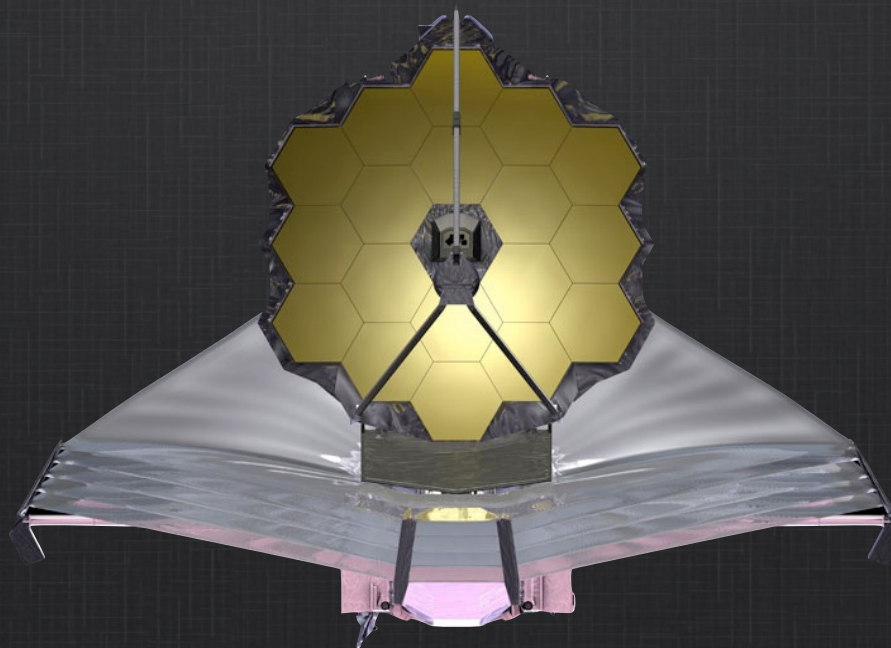


James Webb Space Telescope



Tom Donaldson, Jason Kalirai, Jeff Valenti

IVOA Northern Spring Interop, Cape Town



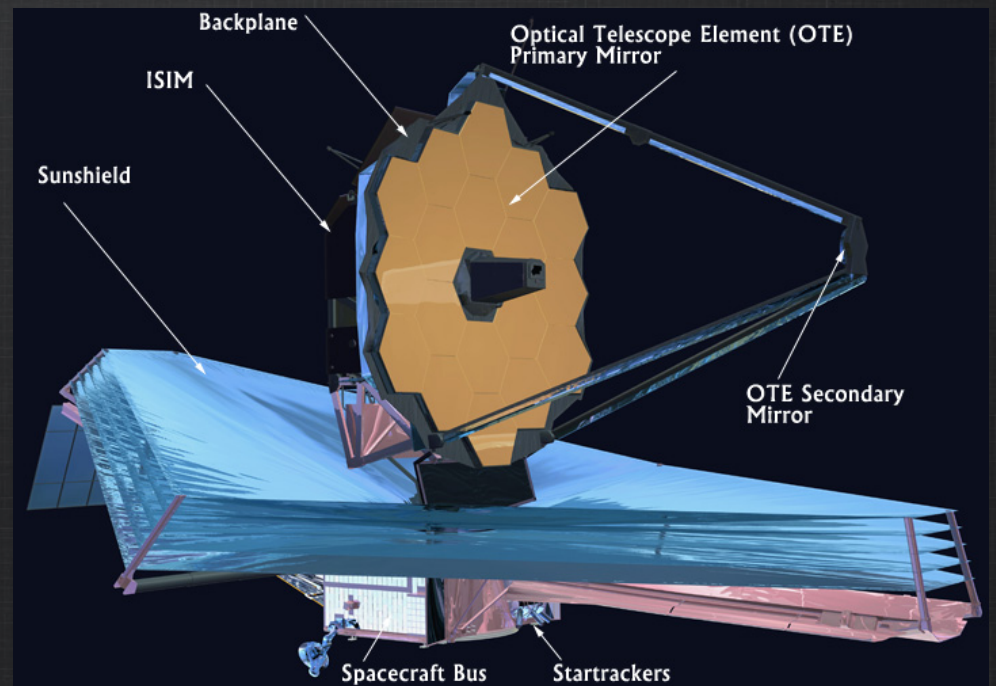
#JWST

On schedule for launch in October, 2018

- 5 year design lifetime
 - Nothing precludes 10 years



The Observatory



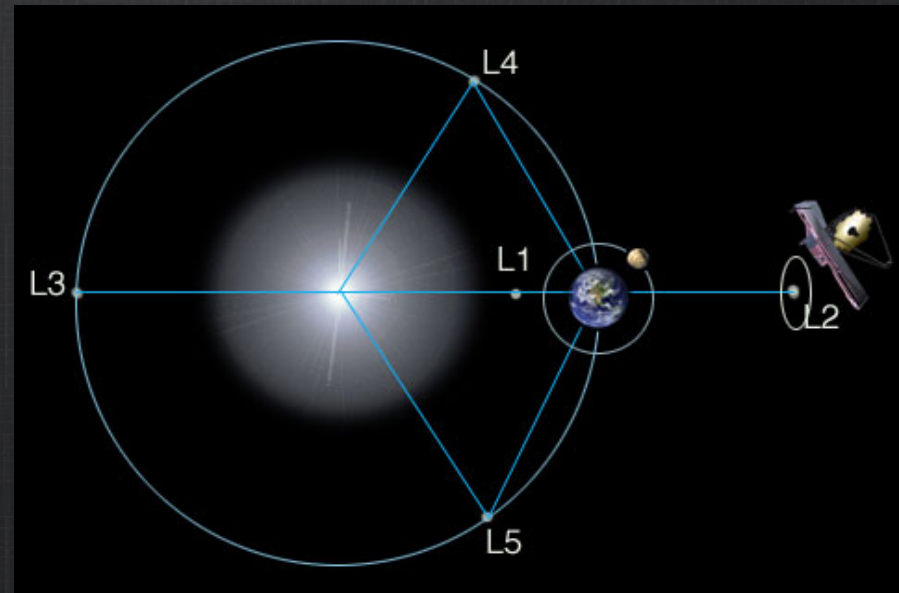
Mirror Revealed



Lead project scientist John Mather admires all 18 segments of the 6.5m mirror

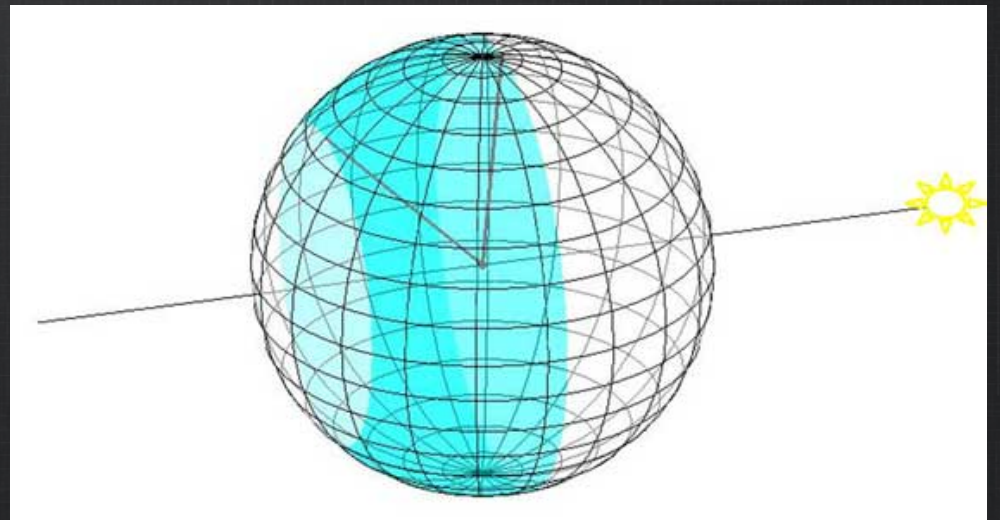
Orbit

- Orbit is around the 2nd Lagrange point (L2)
- About 1.5 million km from earth

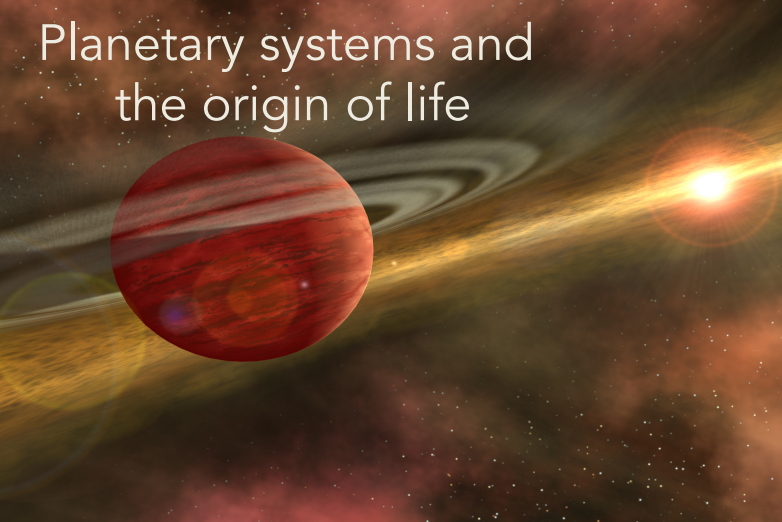
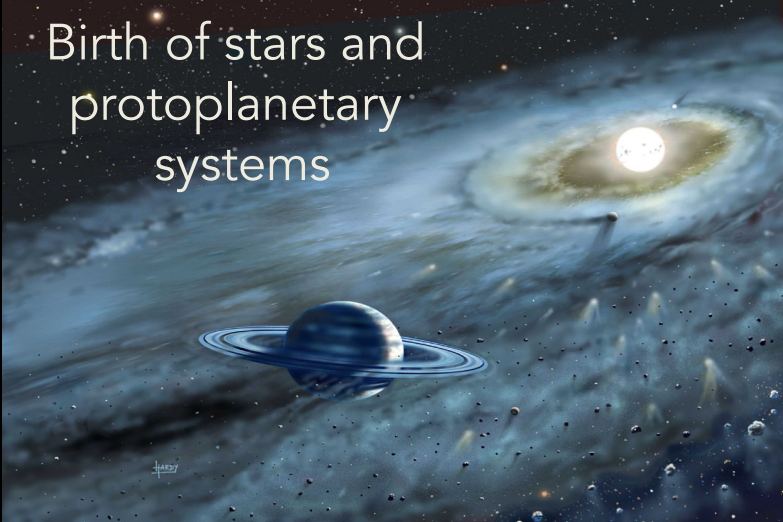


Field of Regard

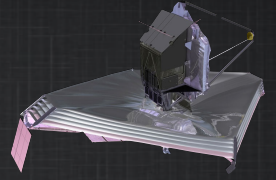
- ~40% of the sky at any one time
- Every point on the sky is visible for at least 100 days per year.



JWST science themes



Instrument Suite



NIRCam (Near-IR Camera)



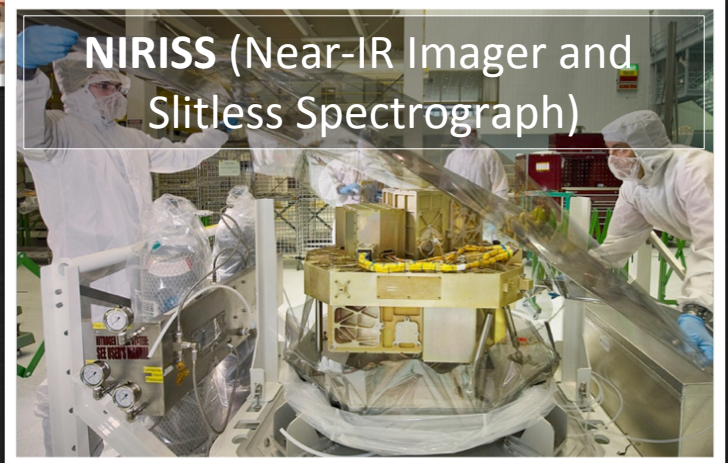
NIRSpec (Near-IR Spectrograph)



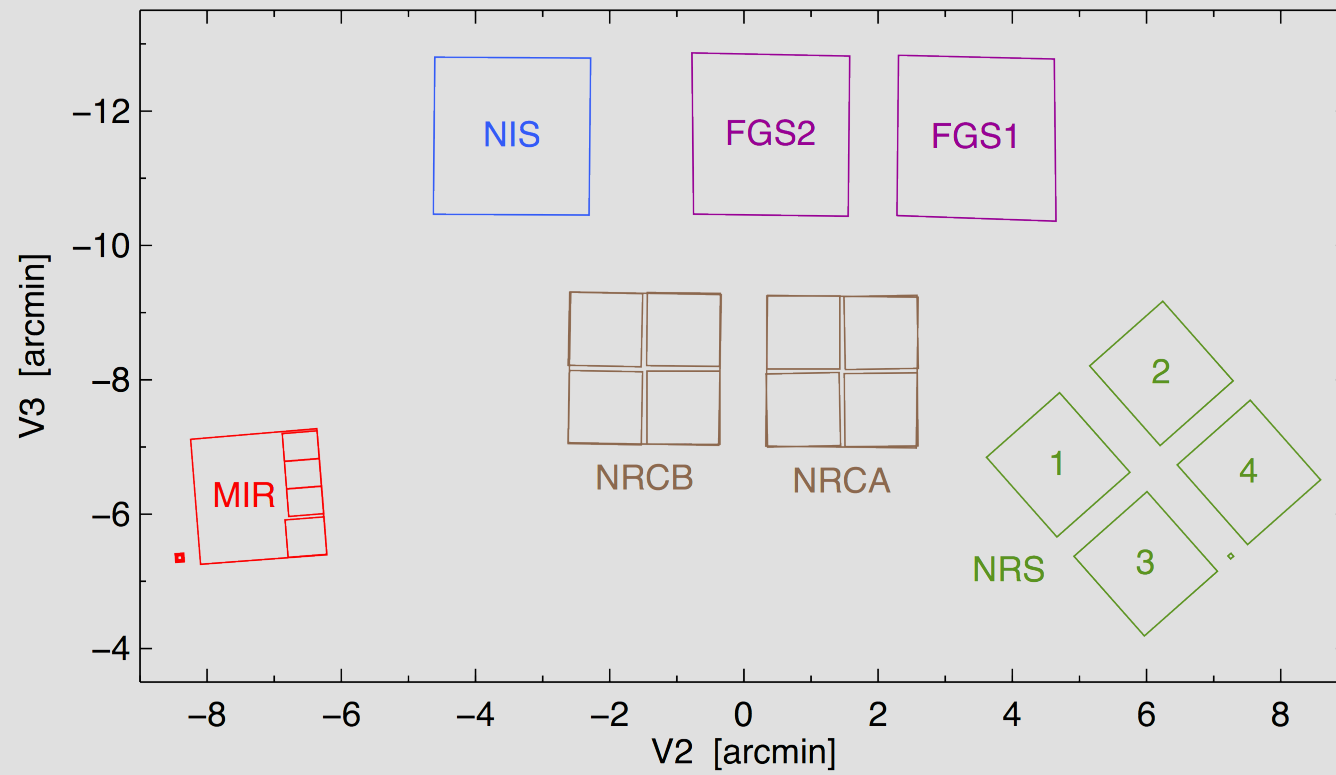
MIRI (Mid-IR Instrument)



NIRISS (Near-IR Imager and Slitless Spectrograph)



Field of View



Imaging Modes

Mode	Instrument	Wavelength (micron)	Pixel Scale (arcsec)	Field of View
Imaging	NIRCam	0.6-2.3	0.032	2.2x4.4'
		2.4-5.0	0.065	2.2x4.4'
	NIRISS	0.9-5.0	0.065	2.2x2.2'
	MIRI	5.0-28	0.11	1.2x1.9'
Coronagraphy	NIRCam	0.6-2.3	0.032	20x20"
		2.4-5.0	0.065	20x20"
	MIRI	10.65	0.11	4Q: 24x24"
		11.4	0.11	4Q: 24x24"
		15.5	0.11	4Q: 24x24"
		23	0.11	Lyot: 30x30"
Aperture Mask Interferometry	NIRISS	3.8-4.8	0.065	2.2x2.2'

Spectroscopic Modes

Mode	Instrument	Wavelength (micron)	Resolution ($R = \lambda / \Delta \lambda$)	Field of View
Single Slit Spectroscopy	NIRSpec	0.6-5.0	100, 1000, 2700	0.4x3.8" 0.2x3.3" 1.6x1.6"
	MIRI	5.0-12.0	100	0.6x5.5" slit
Multi-Object Spectroscopy	NIRSpec	0.6-5.0	100, 1000, 2700	3.4x3.4' 0.2x0.5" shutters
Slitless Spectroscopy	NIRISS	1.0-2.5	150	2.2x2.2'
		0.6-2.5	700	single object
	NIRCam	2.4-5.0	1700	2.2x2.2'
Integral Field Unit Spectroscopy	NIRSpec	0.6-5.0	100, 1000, 2700	3.0x3.0"
		5.0-7.7	3500	3.0x3.9"
	MIRI	7.7-11.9	2800	3.5x4.4"
		11.9-18.3	2700	5.2x6.2"
		18.3-28.8	2200	6.7x7.7"

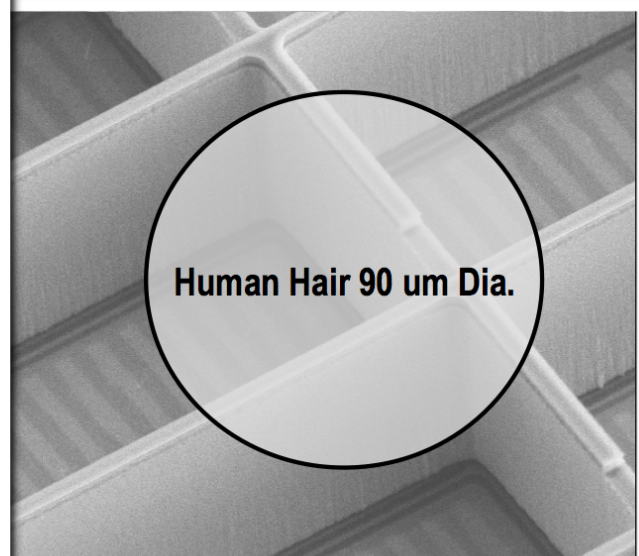
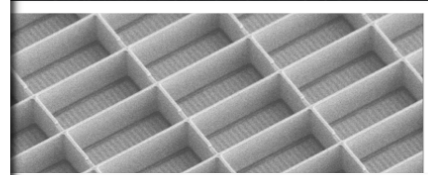
Multi-Object Spectroscopy in Crowded Environments



Multi-Object Spectroscopy in Crowded Environments

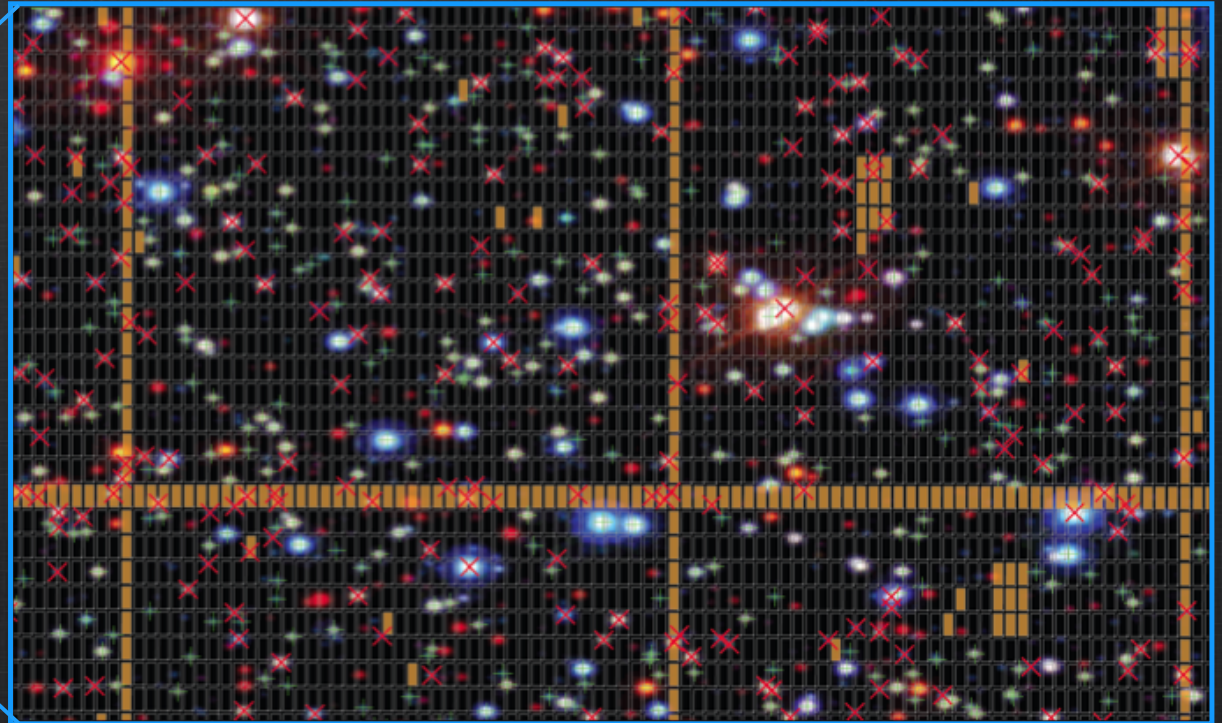
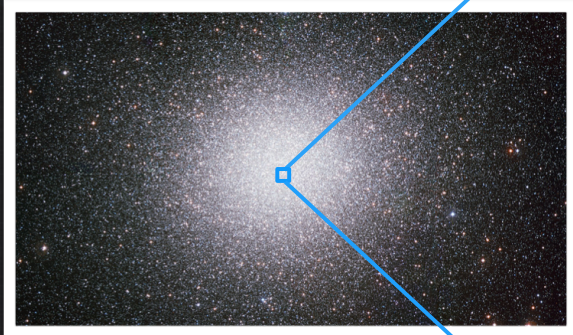


Micro-Shutter Assembly (MSA)
has 248,000 microshutters!



Human Hair 90 um Dia.

Multi-Object Spectroscopy in Crowded Environments



Each shutter covers $0.24'' \times 0.48''$
on the sky

+ Targets in Operable Shutters
x Targets Outside Shutters

JWST Products and Services

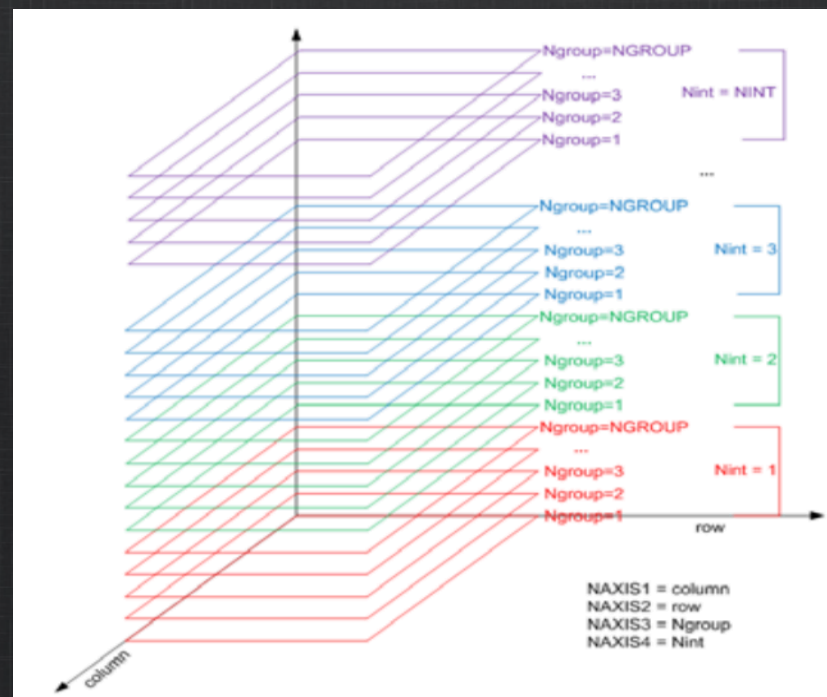
- JWST data processing and archiving done at STScI
- A variety of products and services will be provided:
 - Images
 - Spectra
 - Catalogs
 - Web-based user interfaces
 - Data Analysis Tools and Software
 - Mission documentation

Image Products

- Multiple levels of image products are created during processing. Publicly accessible data begins at level 1b.
 - 1a: Original FITS files
 - 1b: Uncalibrated FITS files
 - 2a: Ramp calibrated exposure FITS files
 - 2b: Fully calibrated exposure FITS files
 - 3: Calibrated combined (dithers, mosaics) FITS files
 - VO metadata clearly defined for combined products?
 - 4: Products resulting from additional analysis
- For each data product, a variety of calibration files and other artifacts must be publicly available to support custom processing.

Image Cubes

- Up-the-ramp data collection results in 4D cubes



Swade, et al., [2012ASPC..461..225S](#)

Time Series Images for Transits

- 2 day long exposure product may be stored in a single 35GB FITS file with time-tags as extension.
- Levels 1-3 data products would total 180GB
- Most transit observations will be shorter and have smaller products.

Spectral Data Products

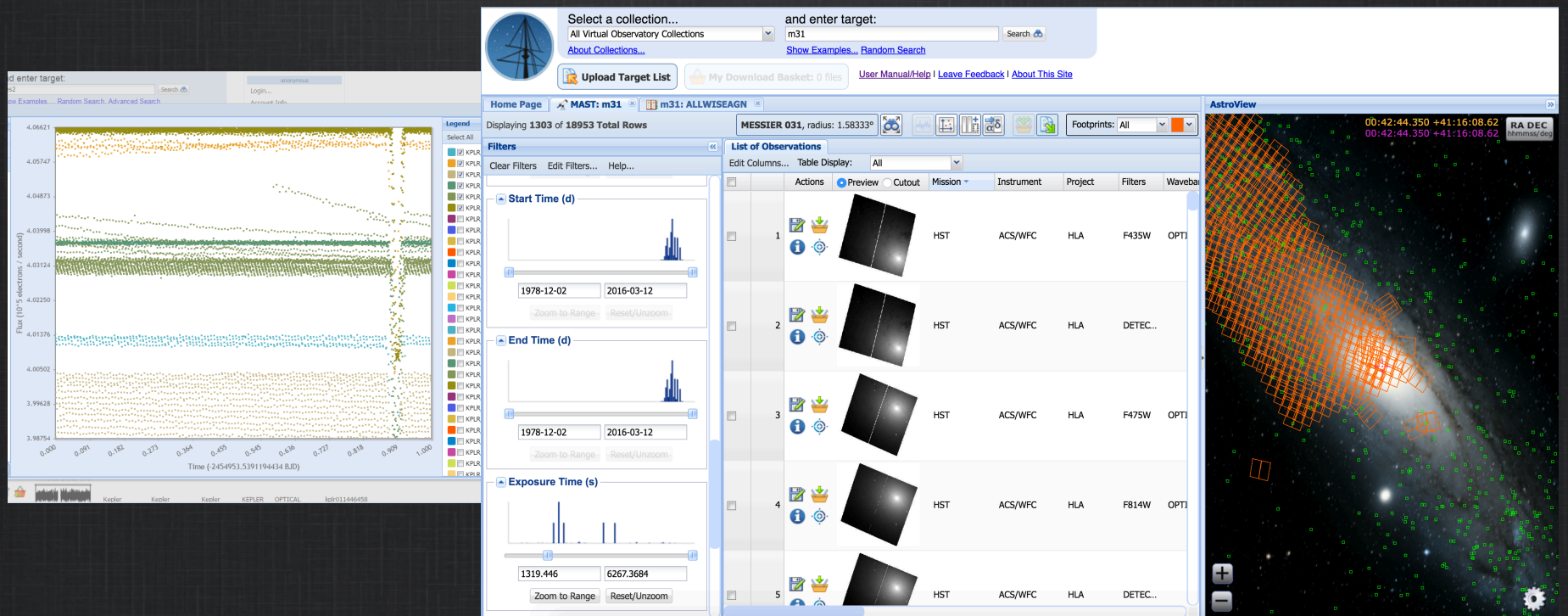
- 1D extracted per exposure/integration/NIRSpec background
- 2D for non-IFU spectra
- 3D for IFU data
- Combined level-3 1D and 2D spectra
 - MSA observations have complex dither strategies
- Separate MSA spectral product for each source

Catalogs

- Source catalogs extracted from each level-3 image
 - NIRCams catalogs needed for MSA observation planning
- JWST Source Catalog will be produced by combining catalogs from individual images.

User Interfaces

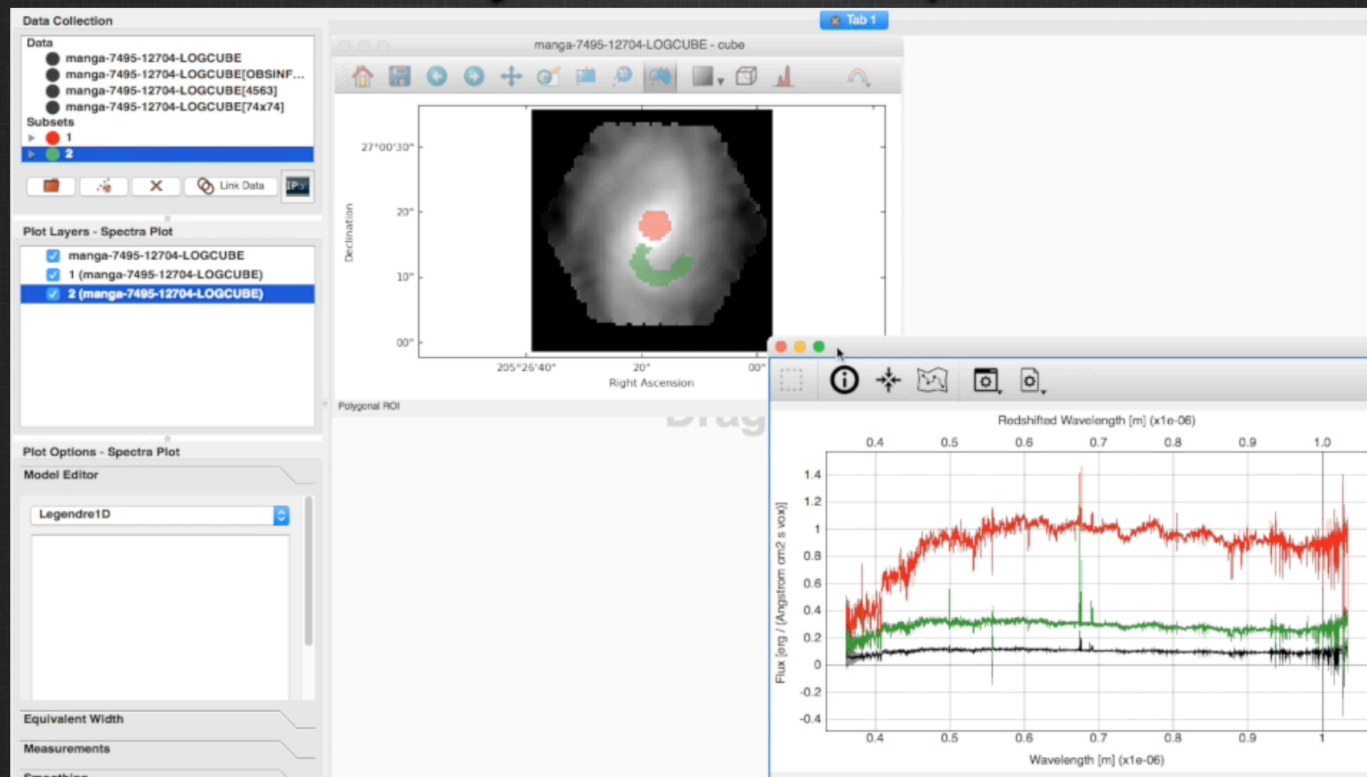
- Primary UI is the MAST Discovery Portal (mast.stsci.edu)



Data Analysis Tools and Software

- Processing pipeline software
- New interactive analysis tools
- Astropy features
- Server-side analysis (bringing code to the data)

Data Analysis Tool Example: Cube Viewer



Products and Services Summary

- Images
- Spectra
- Catalogs
- Web-based user interfaces
- Data Analysis Tools and Software
- Mission documentation

#JWST