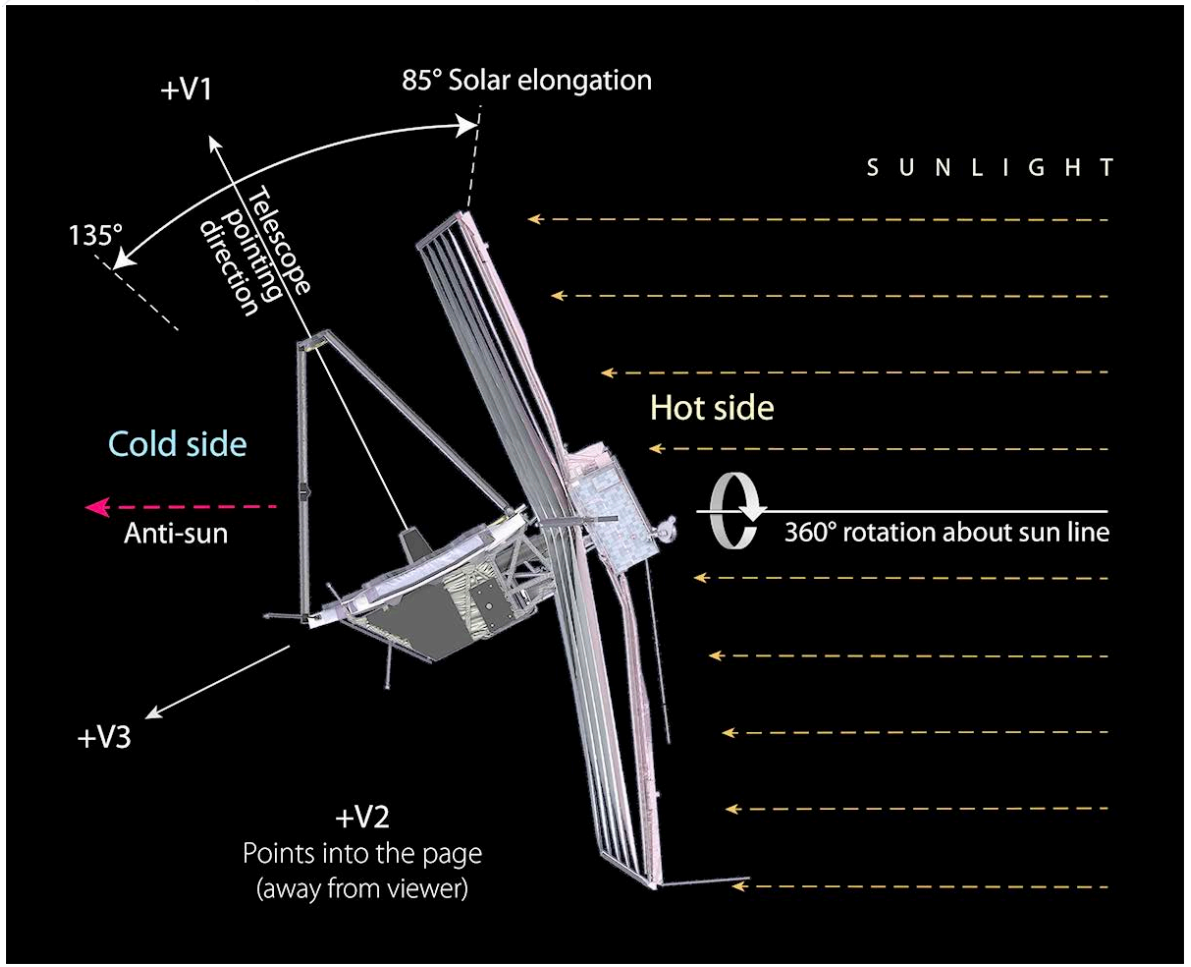
STScI | SPACE TELESCOPE SCIENCE INSTITUTE

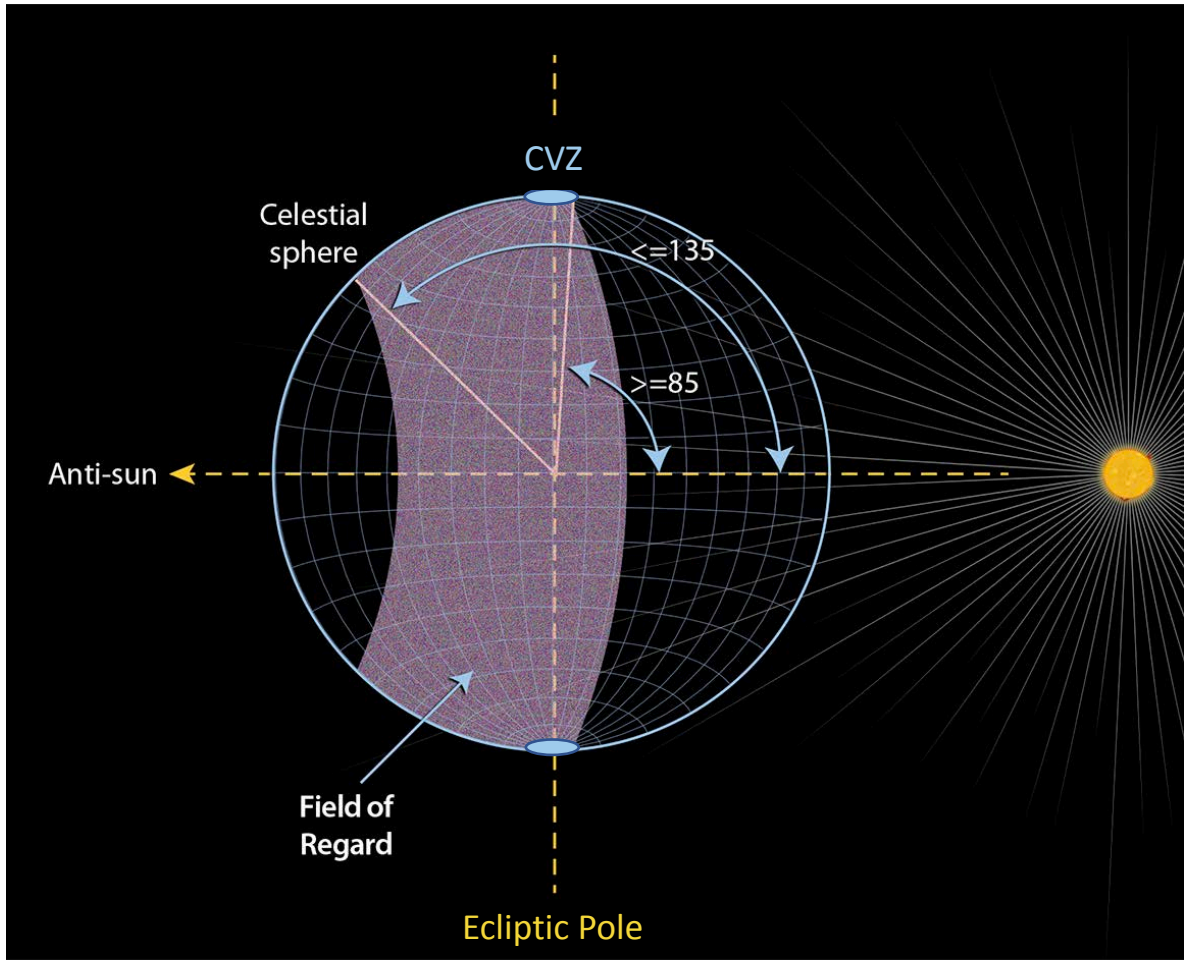
EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

JWST Observing Modes

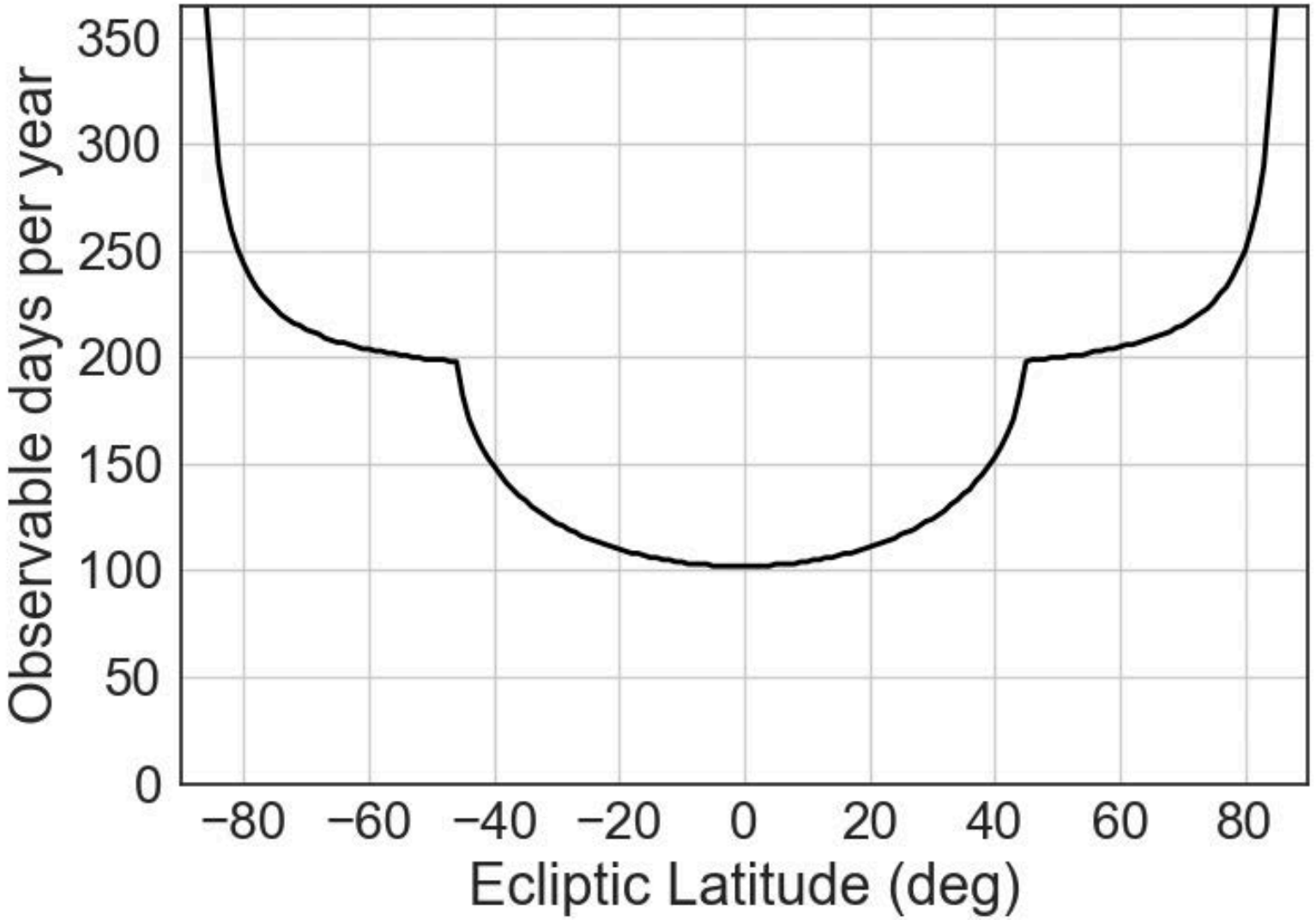
Massimo Robberto
JWST/NIRCam Team Lead

Instantaneous field of regard | Continuous viewing zone





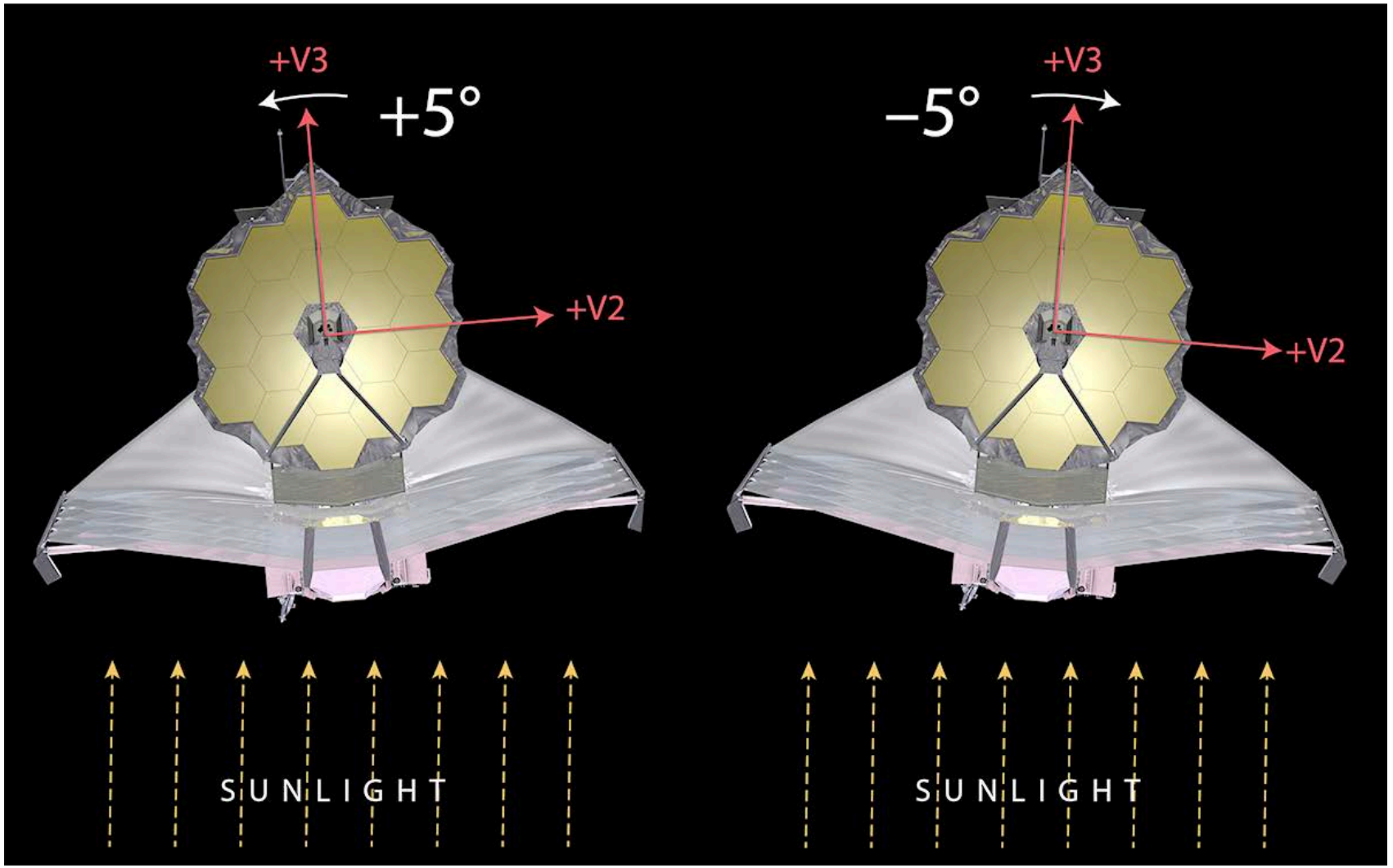
Days per year a target is in the field of regard



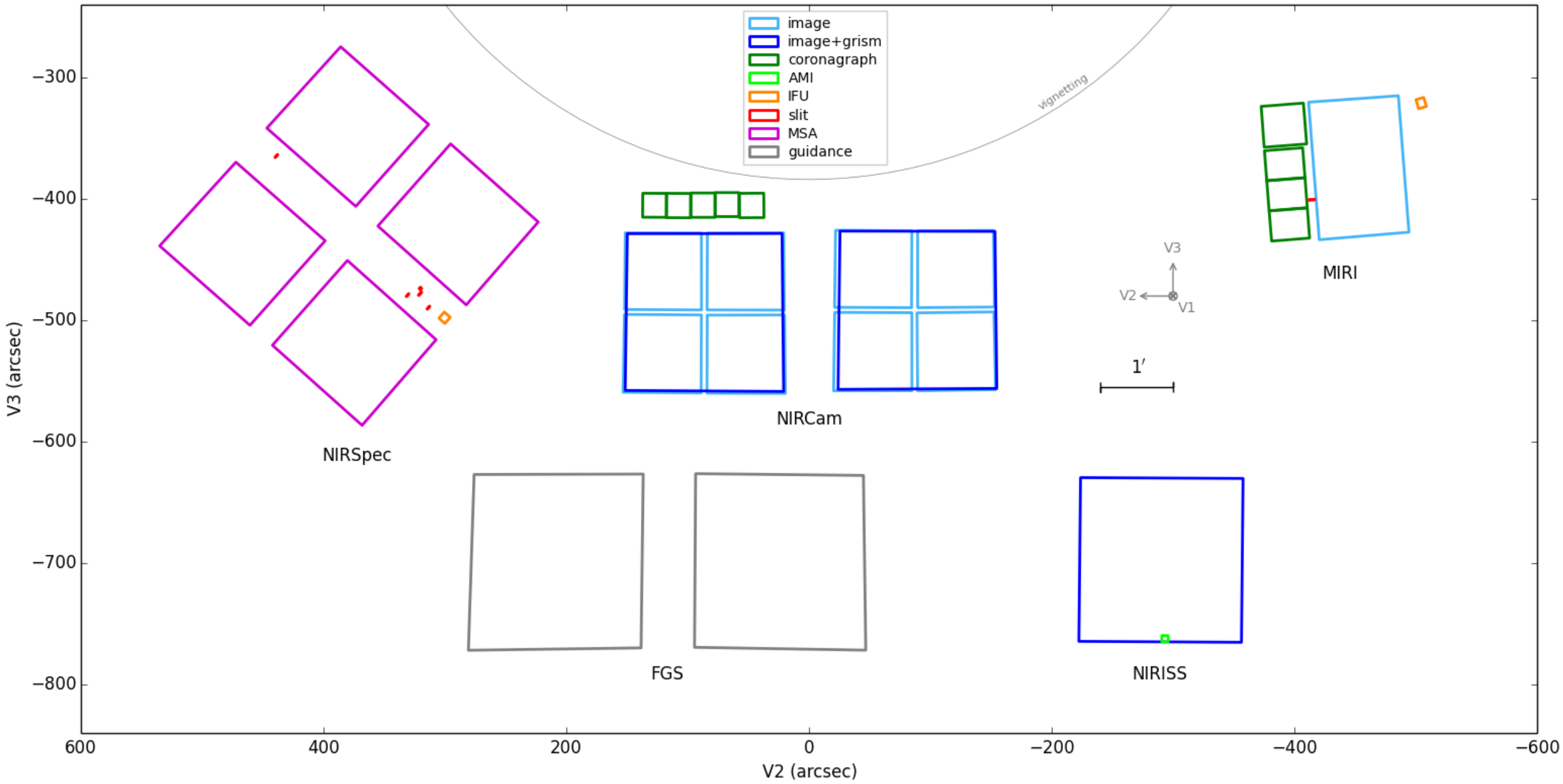
One long window per year

Two shorter windows

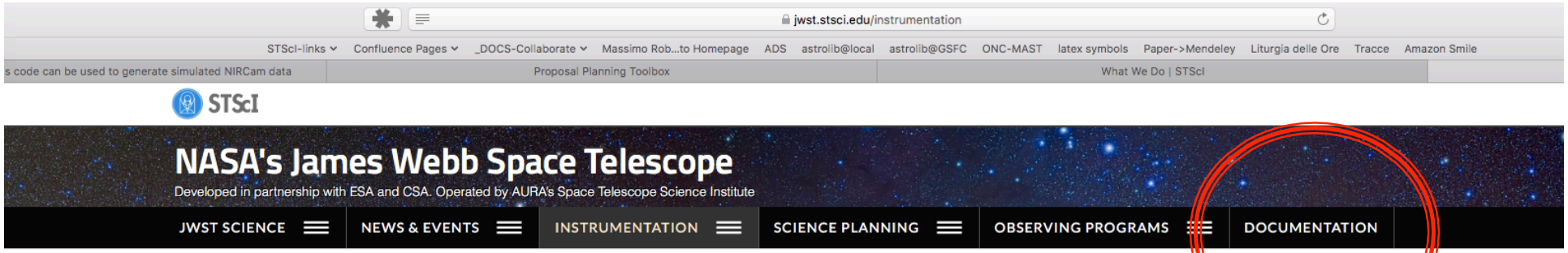
Narrow roll limits



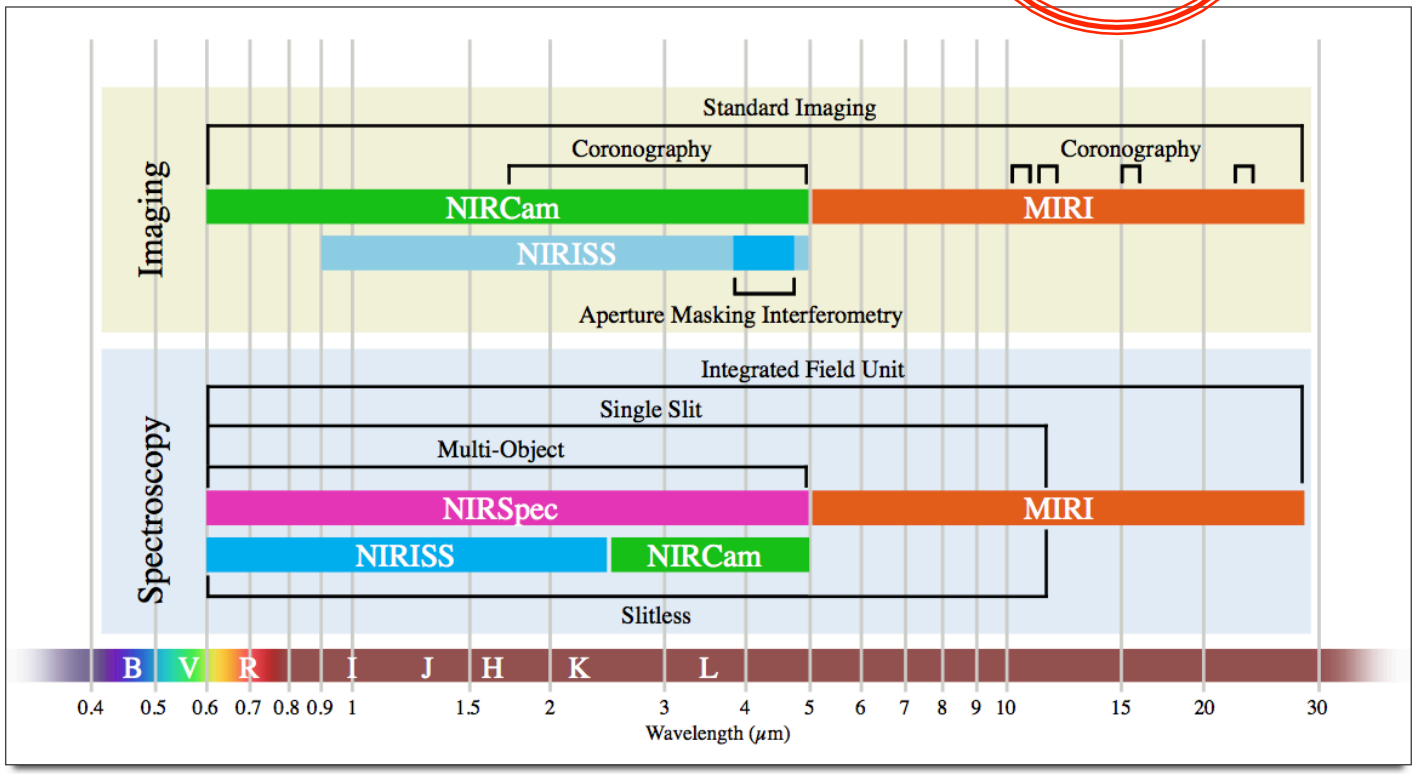
JWST Field of View



Main Source of Documentation



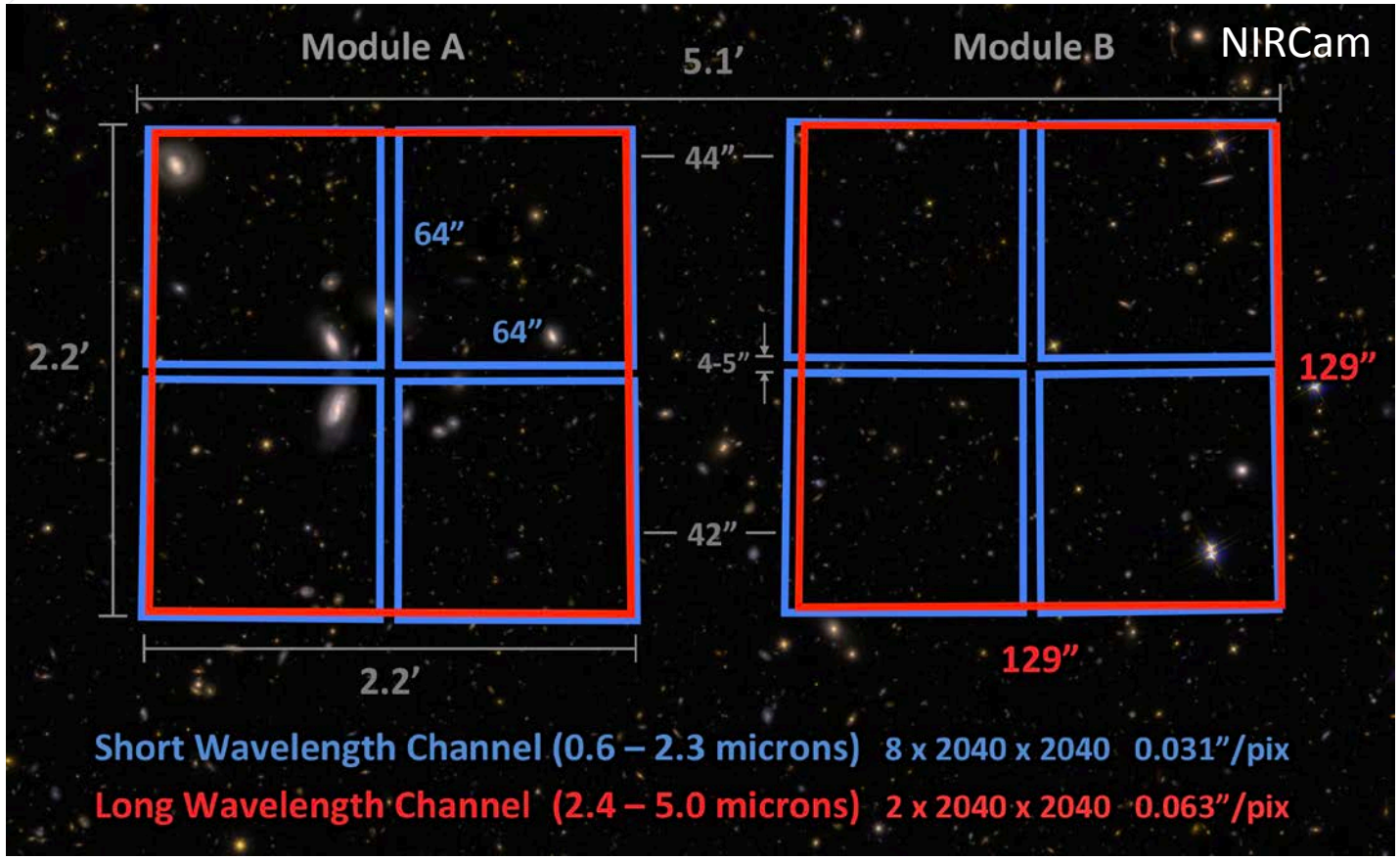
Instrumentation

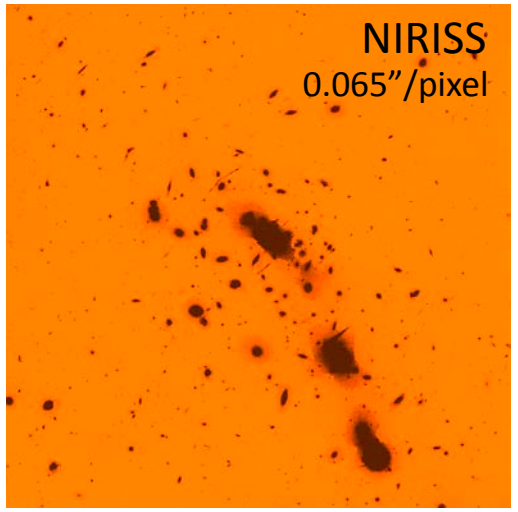


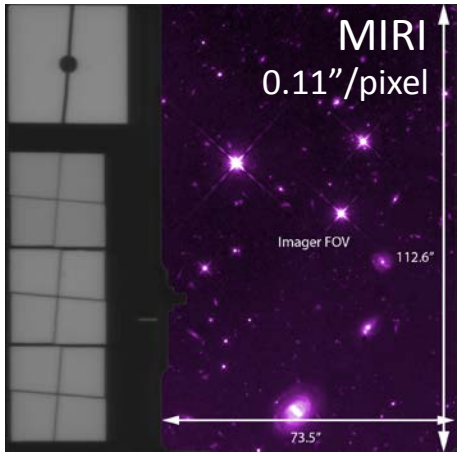
Observing modes

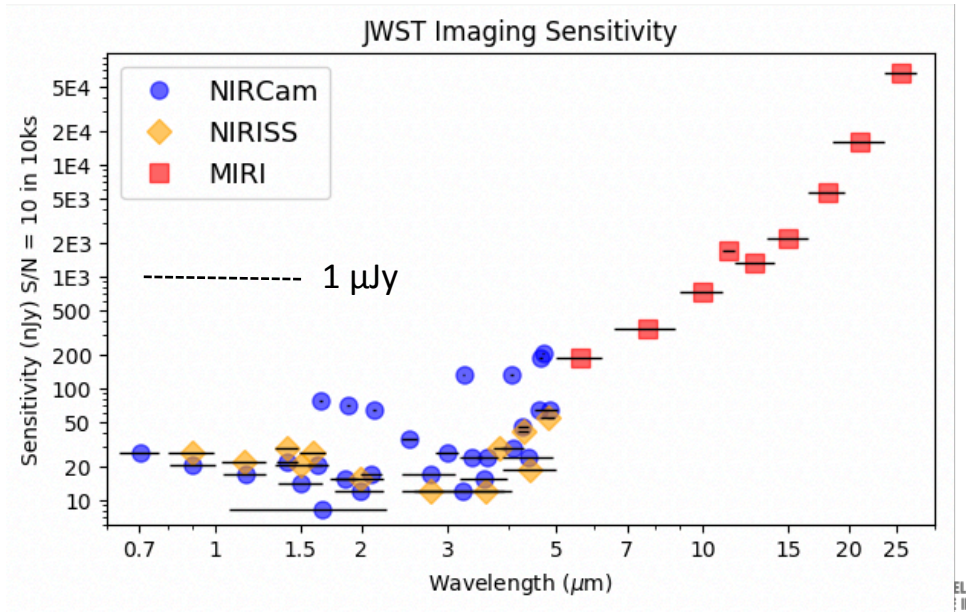
- Imaging
- Defocused photometry
- Coronagraphy
- Aperture masking interferometry
- Single-object slit spectroscopy
- Multi-object slit spectroscopy
- Single-object slitless spectroscopy
- Wide-field slitless spectroscopy
- Integral field unit spectroscopy
- Coordinated Parallel
- Pure Parallels
- Moving Targets
- Time Series
- Targets of Opportunity

Imaging fields of view | Imaging sensitivity



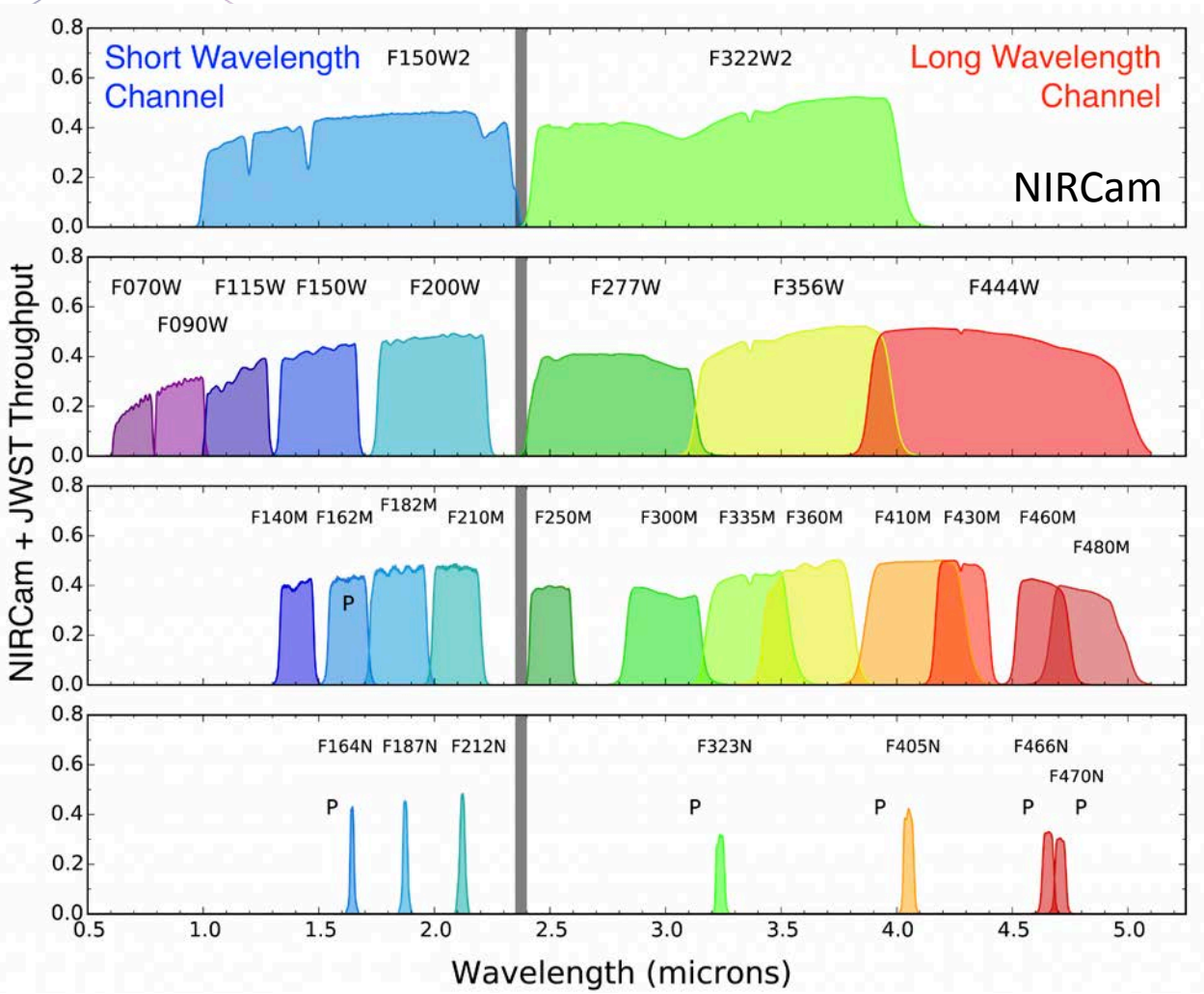


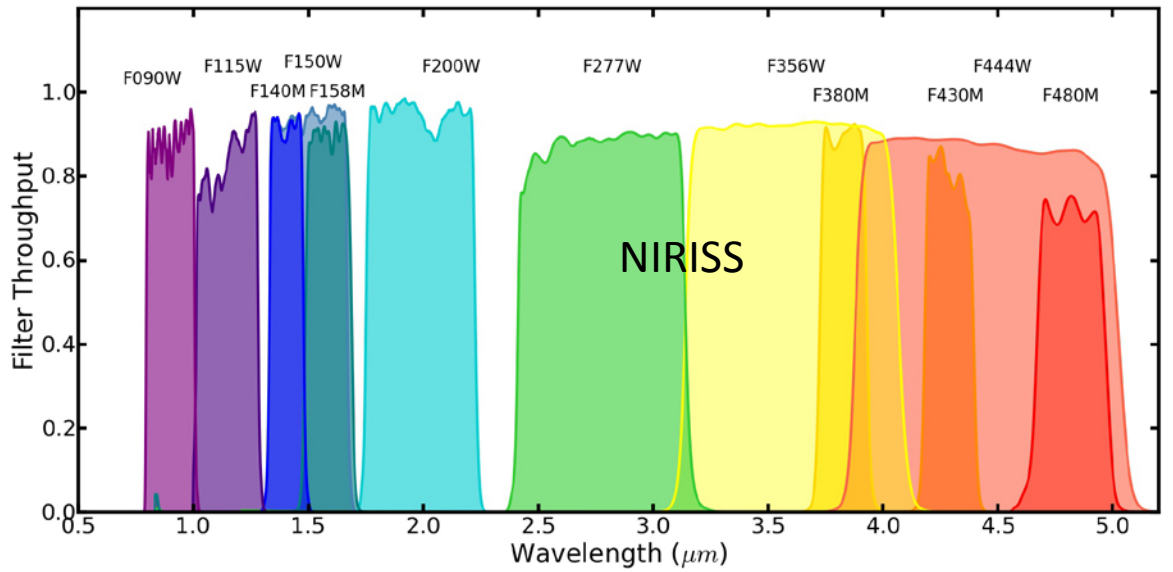


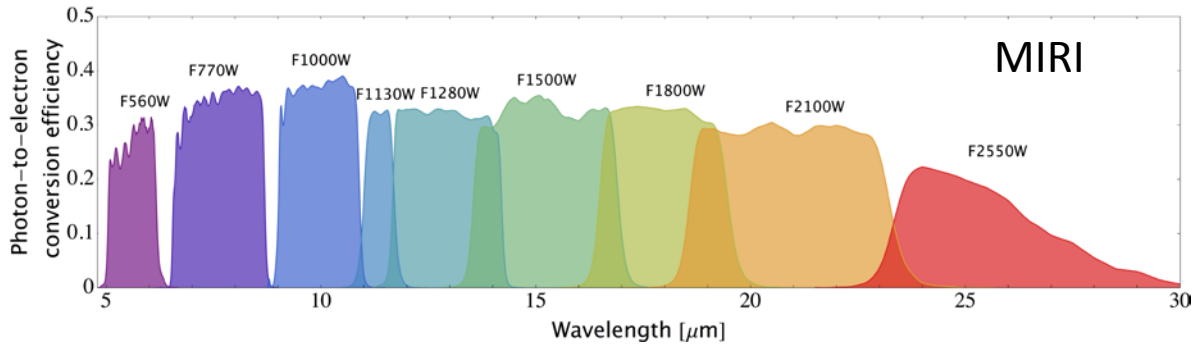


2 arcmin

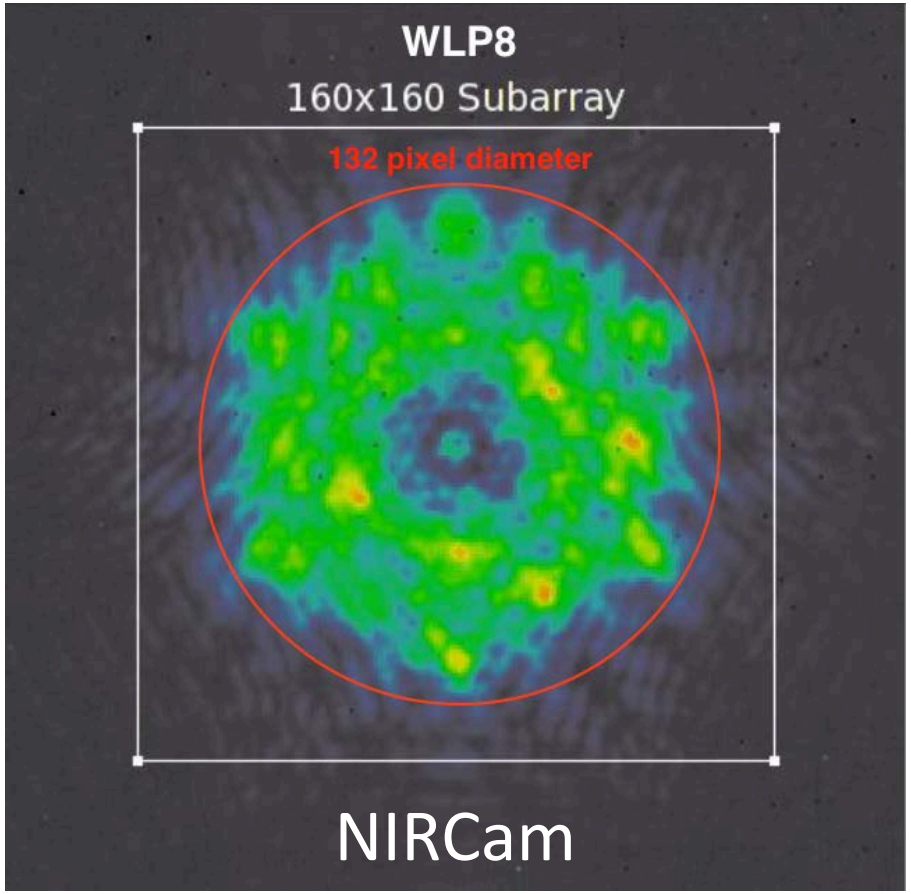
Imaging filters

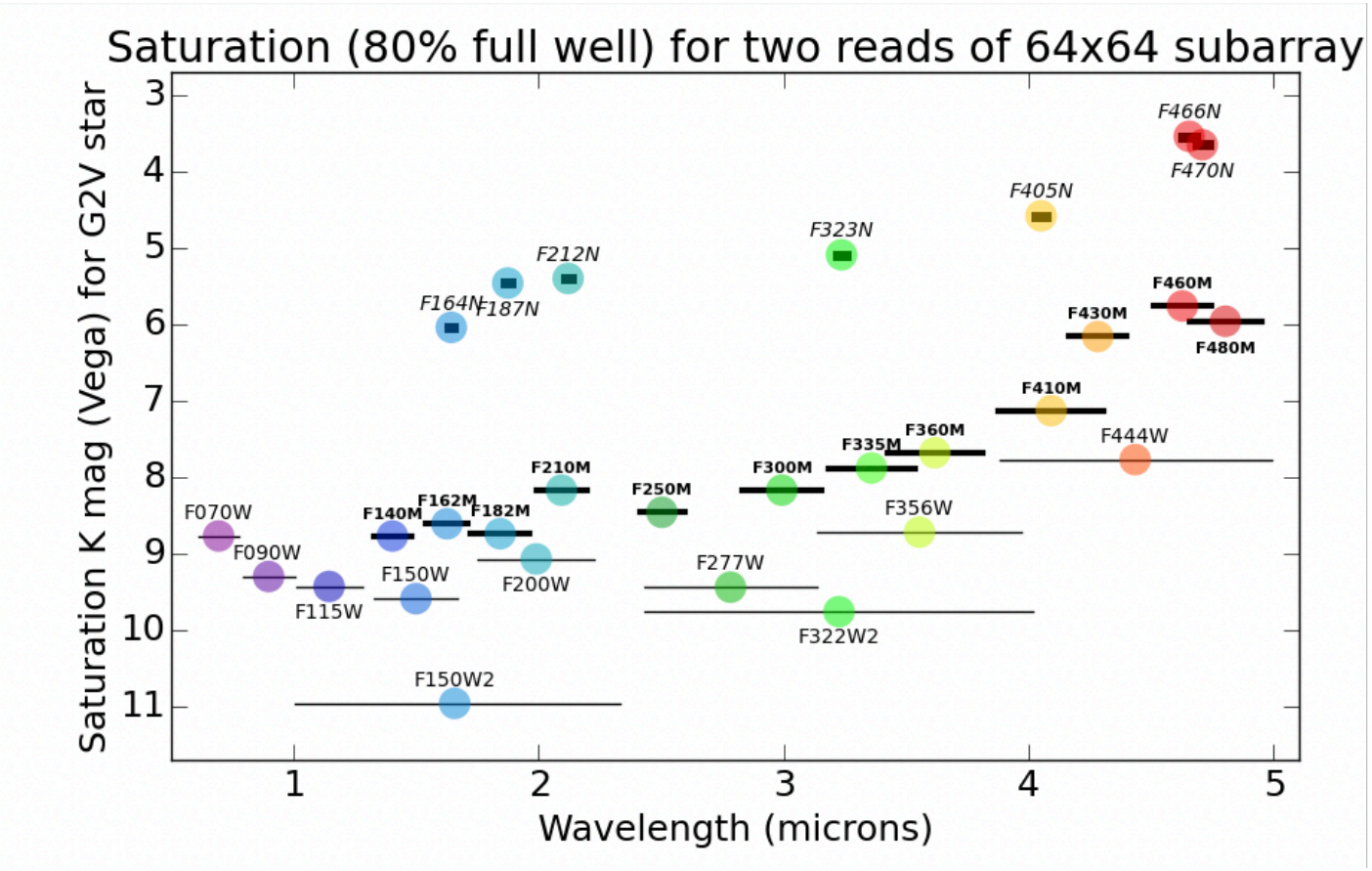






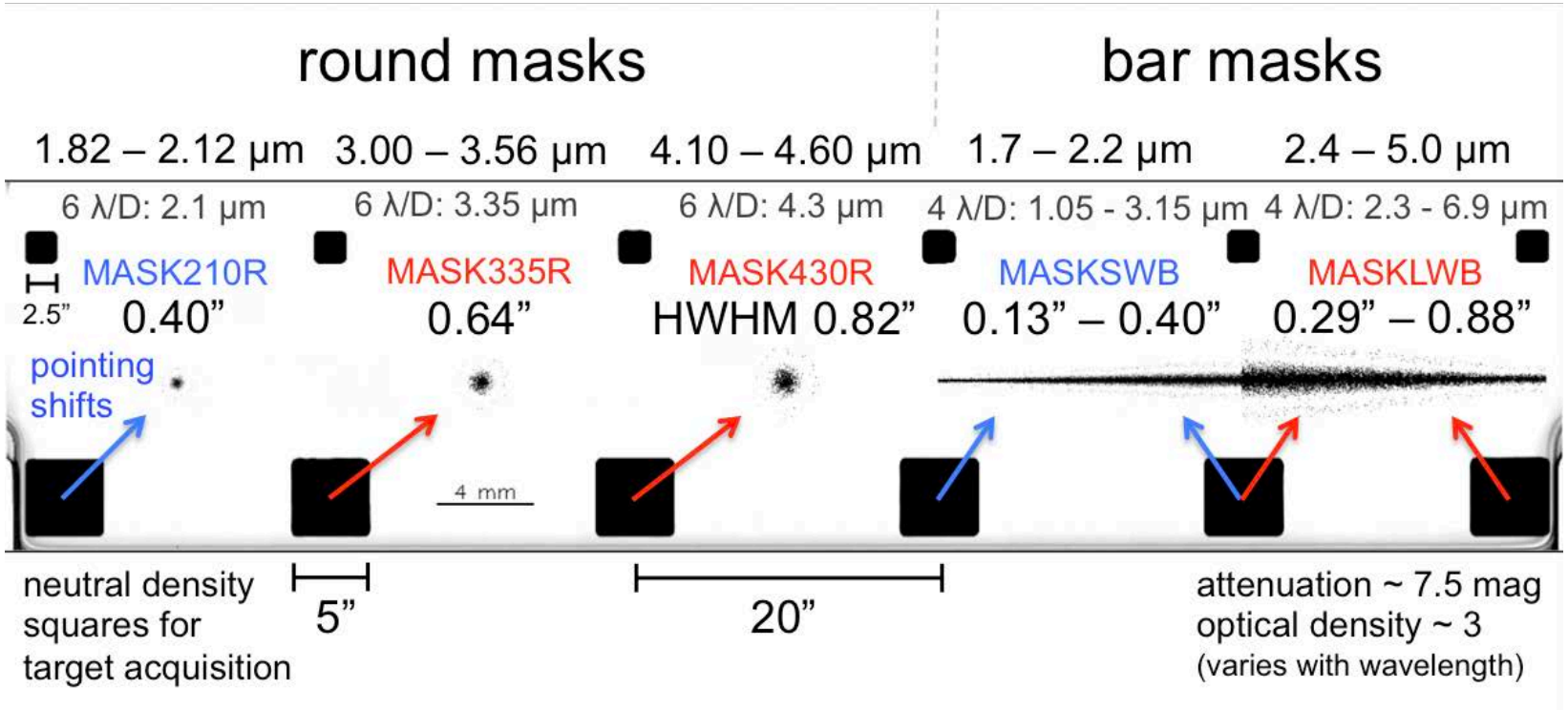
Defocused photometry | Weak lens | Saturation limits

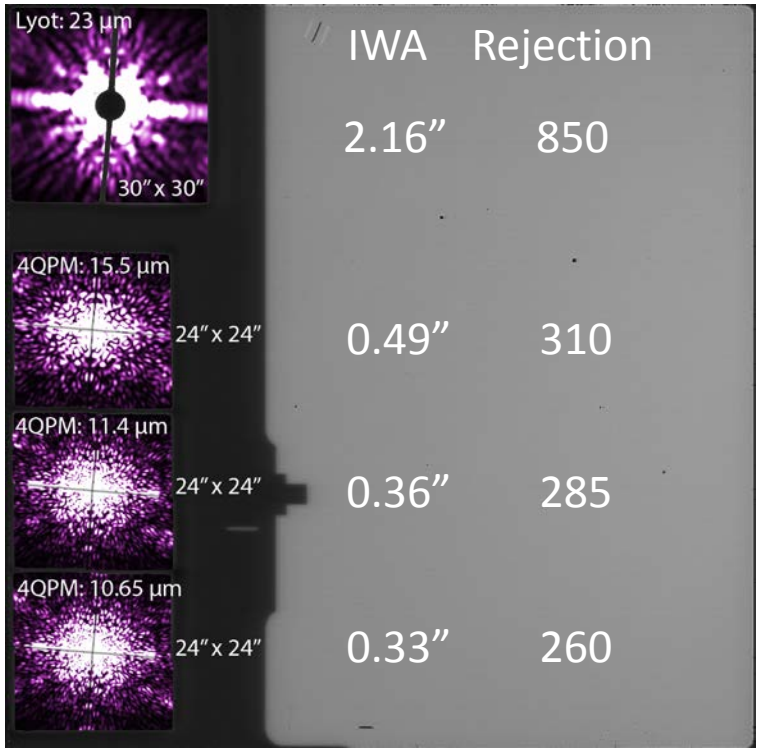




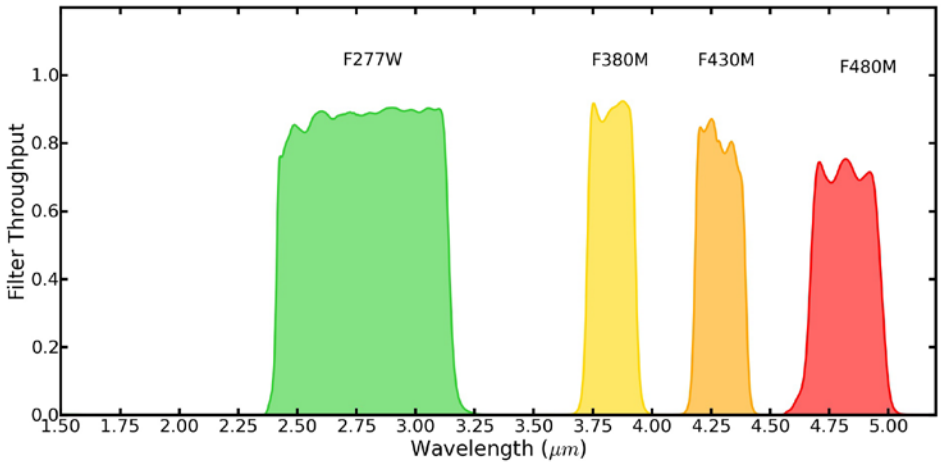
= Time series observation (e.g., monitoring a transiting exoplanet)

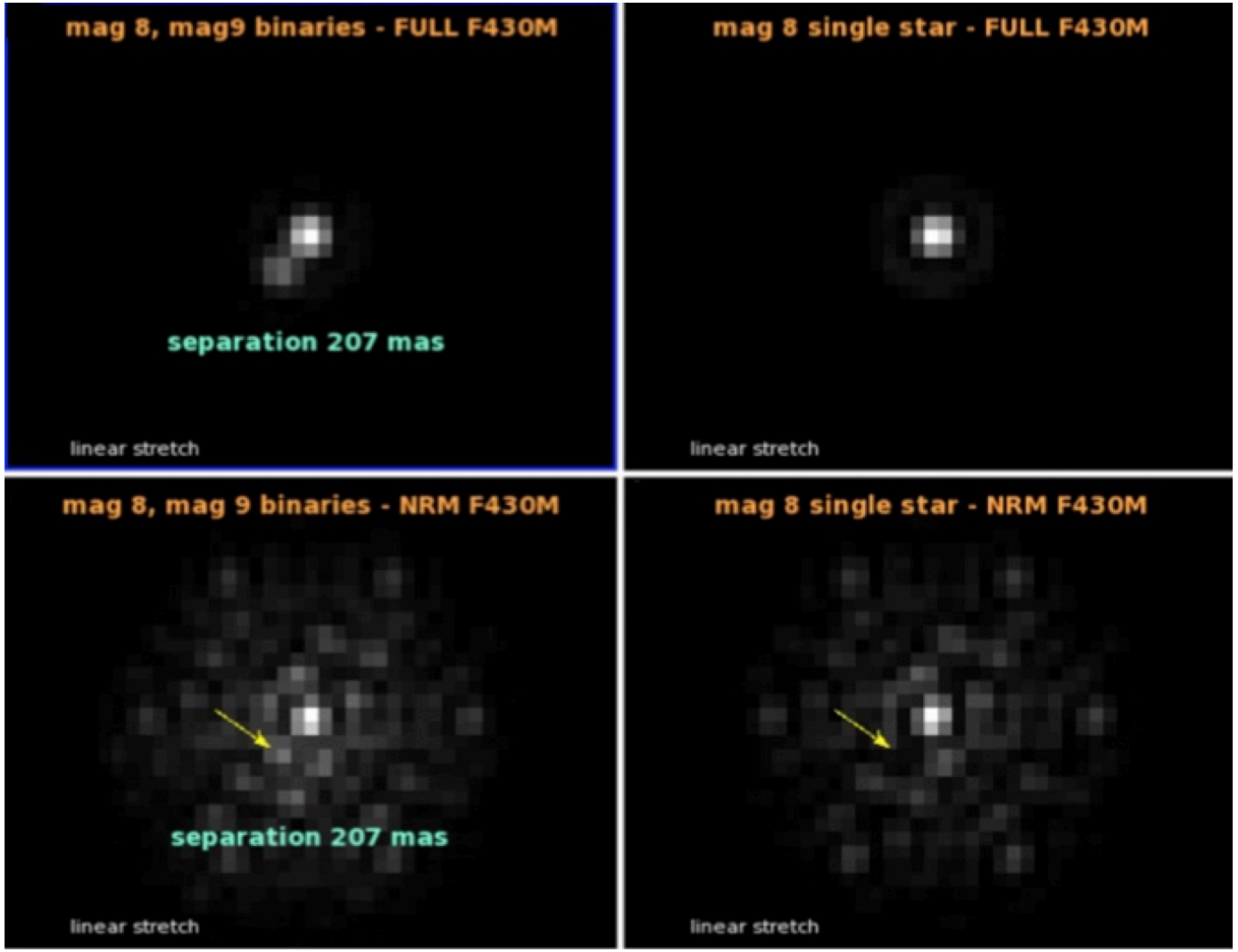
Coronagraphy | Inner working angle





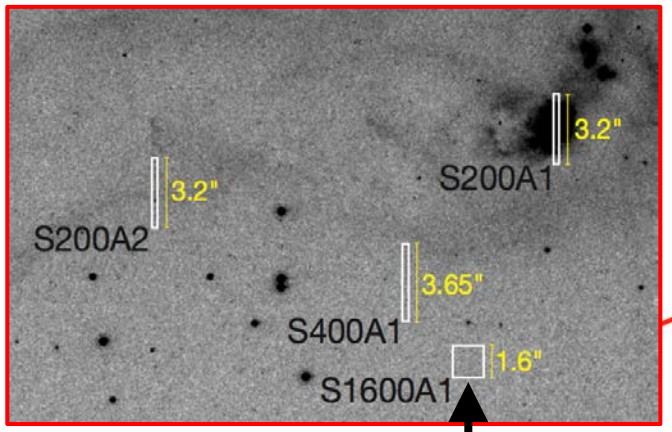
Aperture masking interferometry | Separations down to 0.07”



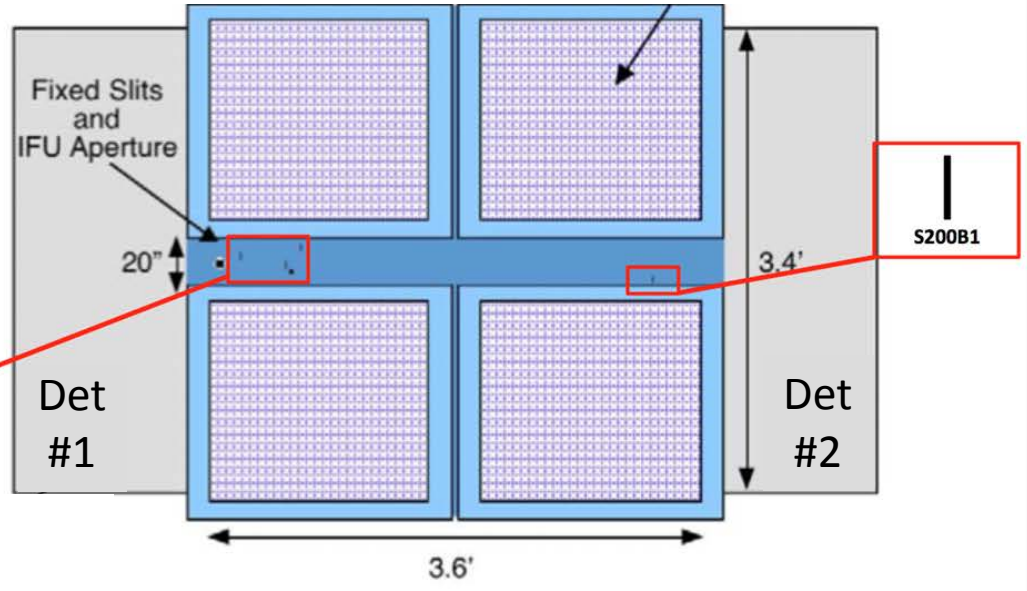


Single-object slit spectroscopy | Apertures

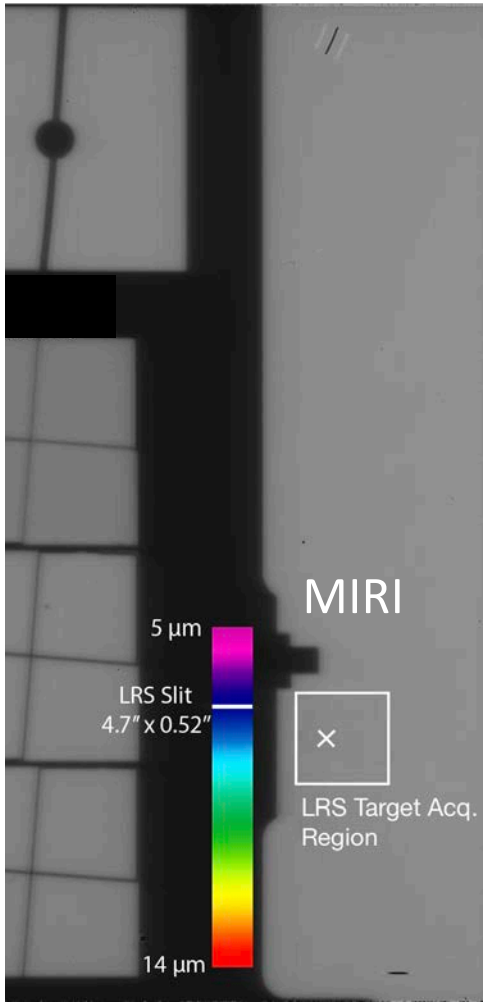
NIRSpec fixed slits



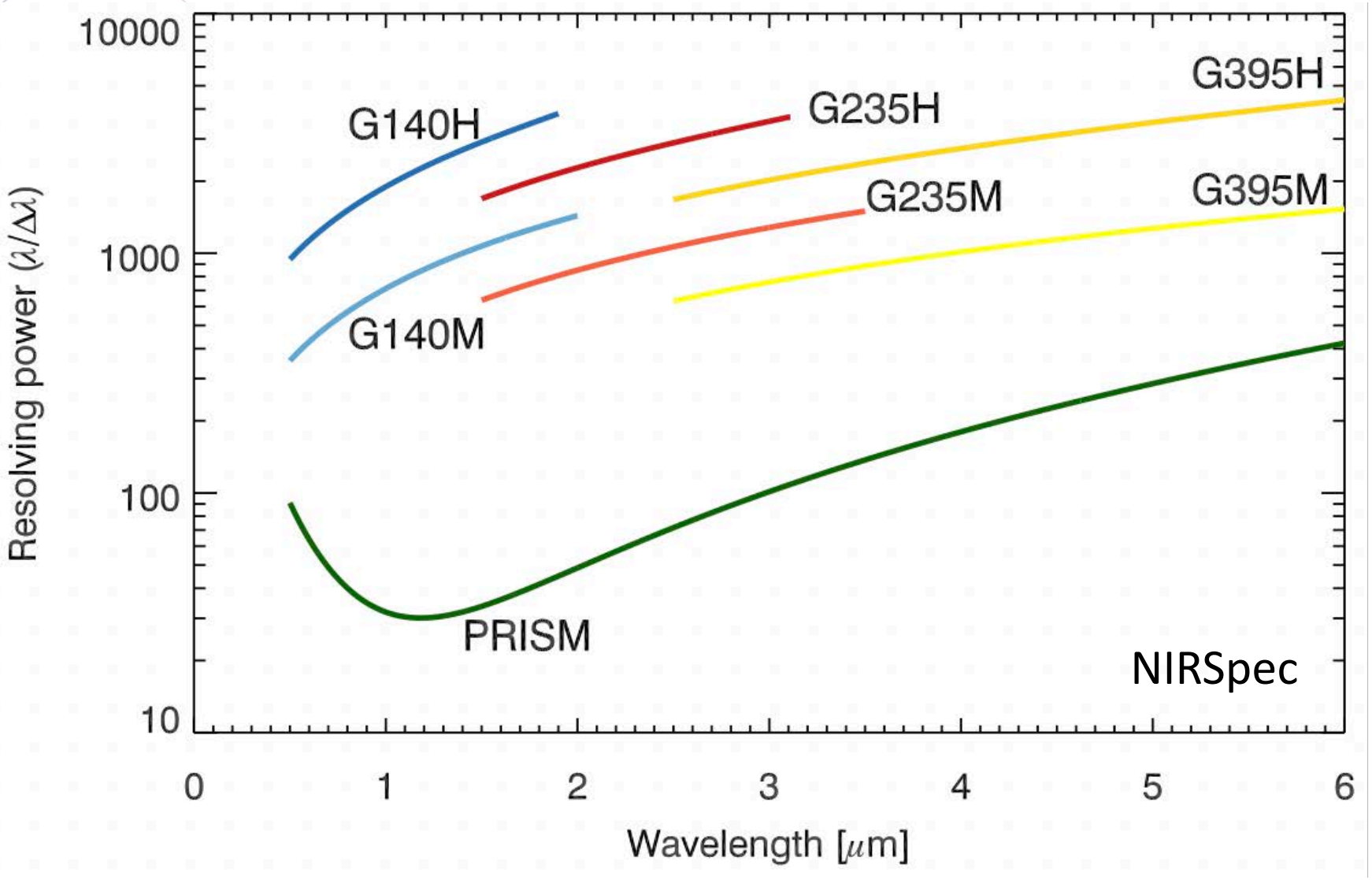
Target acquisition in wide aperture (WATA)



Direction of dispersion



Single-object slit spectroscopy | Spectral resolution



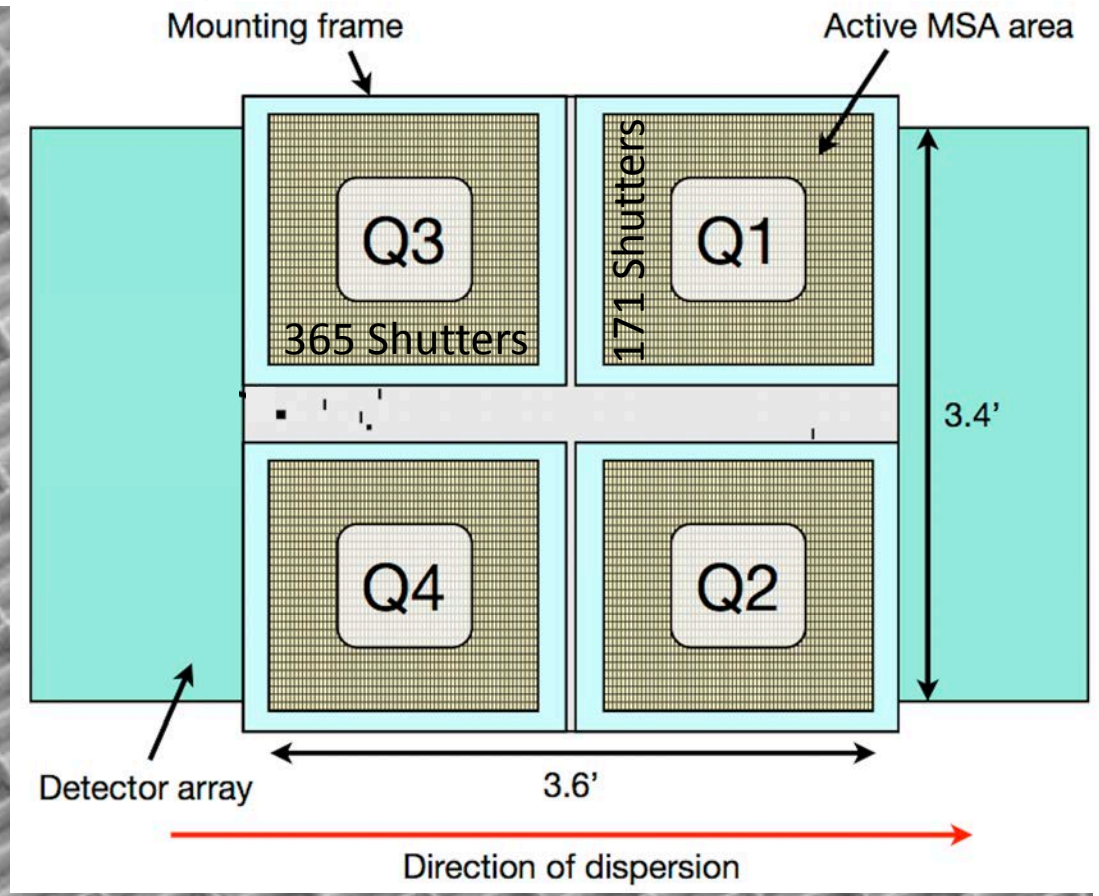
MIRI

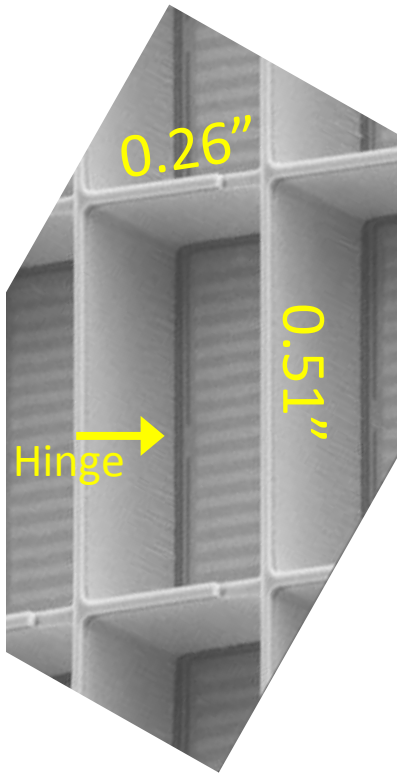
Low Resolution Spectroscopy

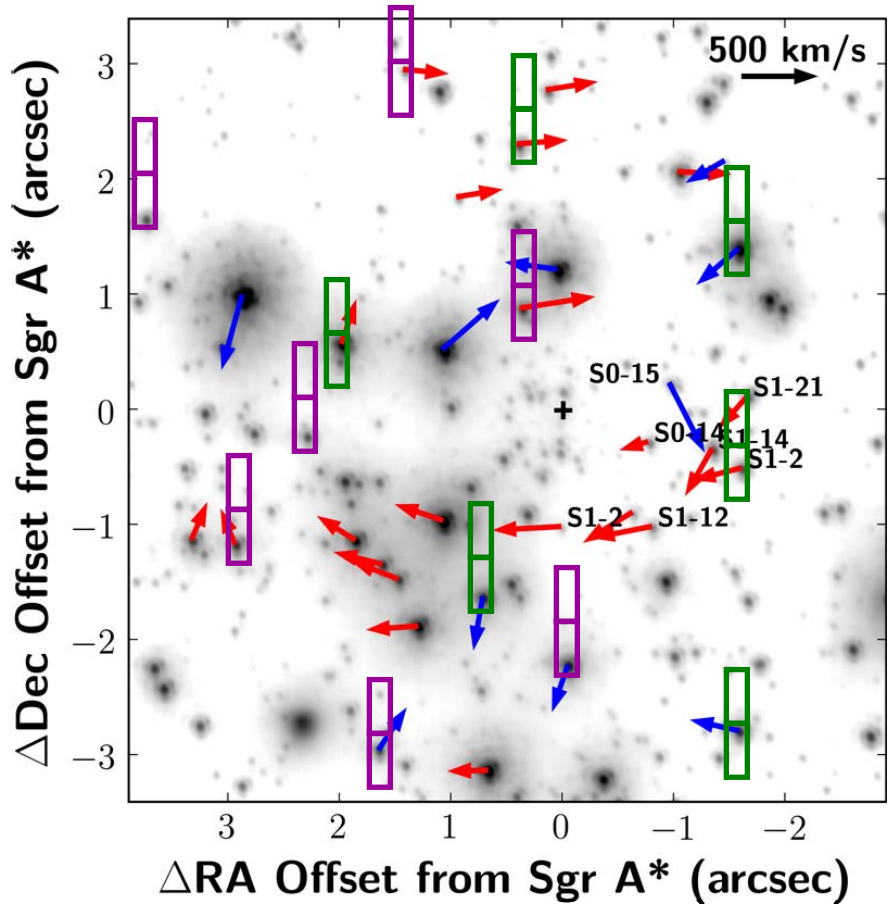
R = 40 @ 5 µm

R = 80 @ 10 µm

Multi-object slit spectroscopy | Quadrants | Shutters | Slitlets



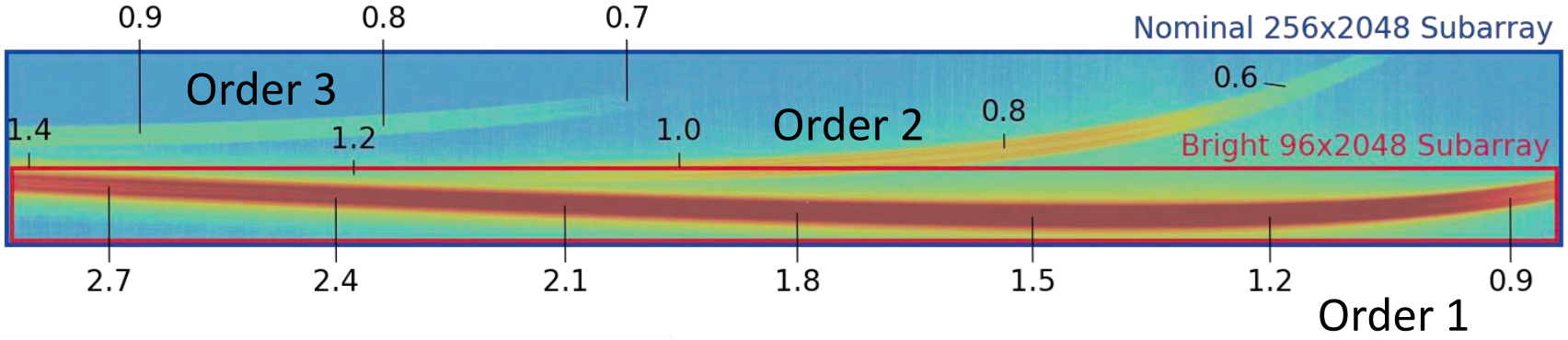


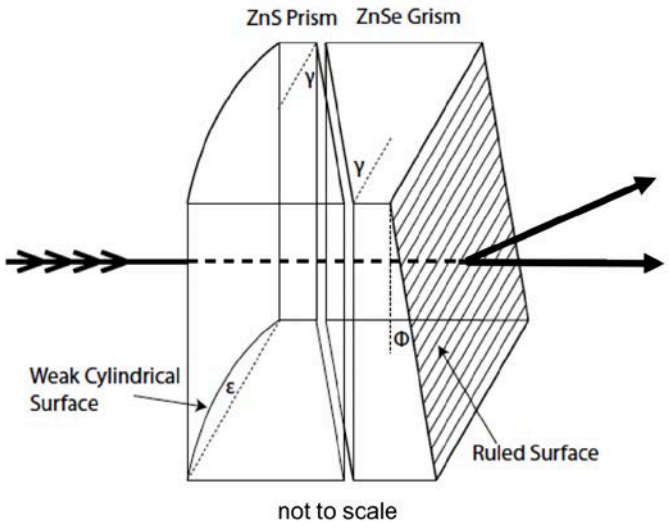


Microshutter array (MSA)

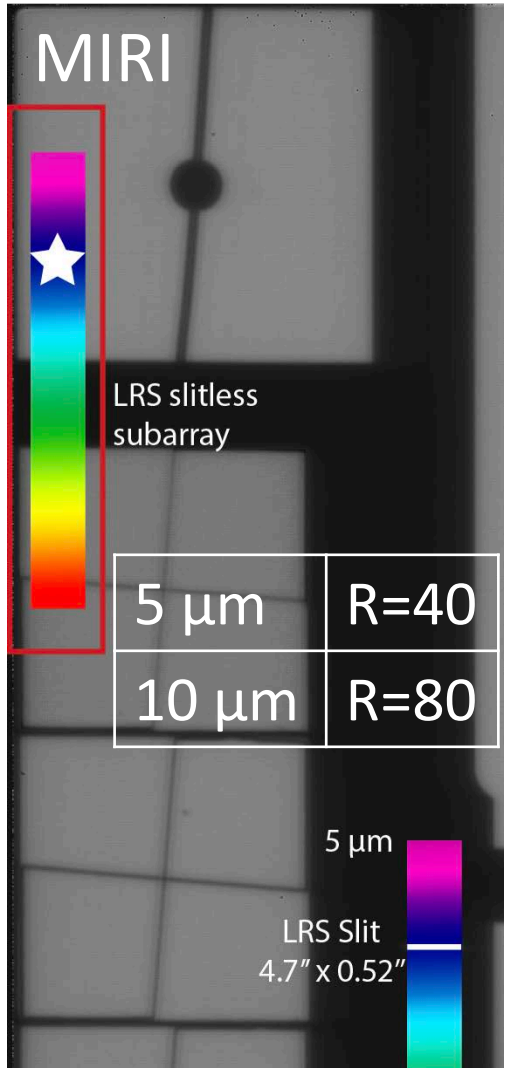
Same dispersers as NIRSpec fixed slit spectroscopy

Single-object slitless spectroscopy | Resolution

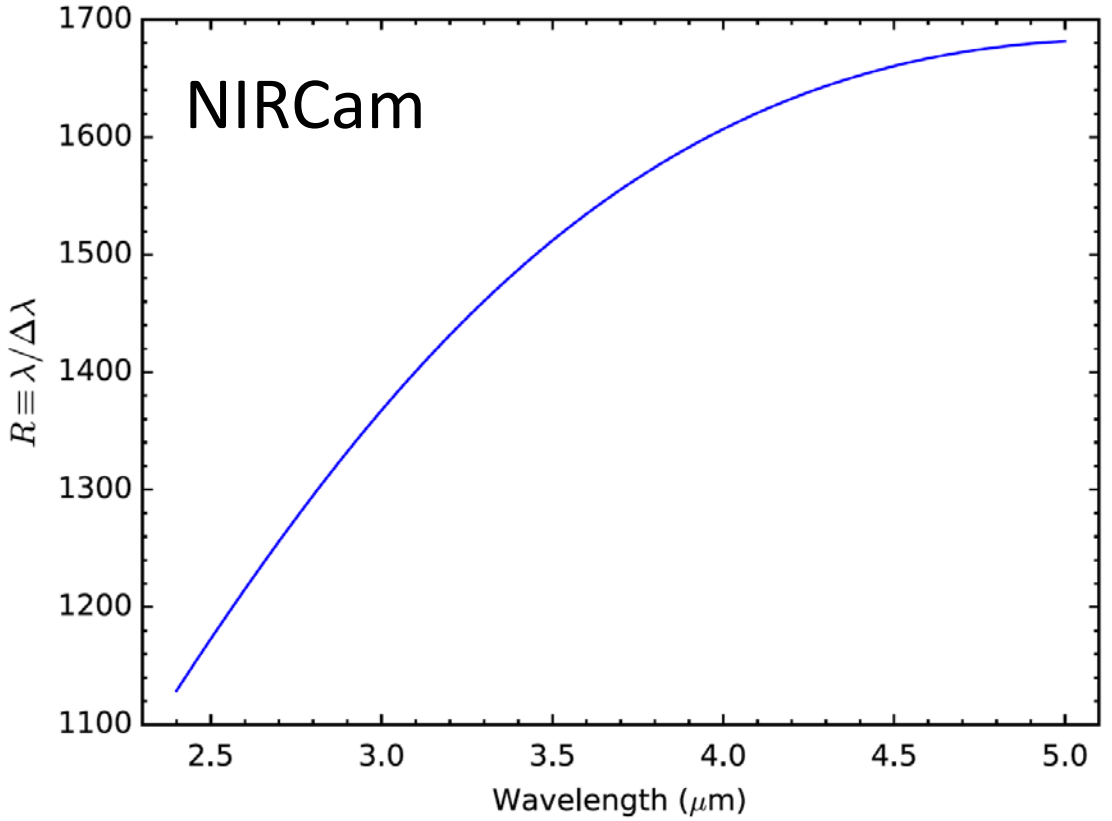




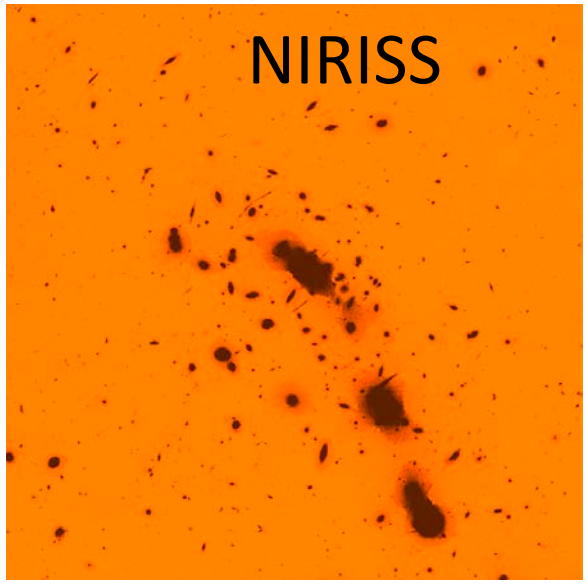
0.6 µm	R=400
1.4 µm	R=700
2.8 µm	R=1400



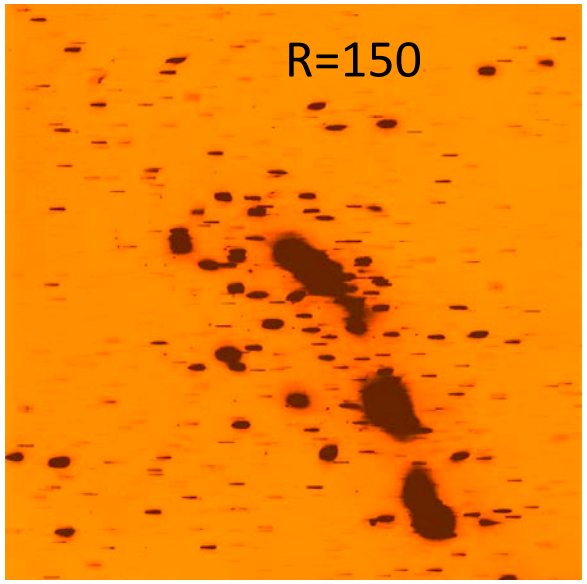
Single-object slitless spectroscopy | Resolution



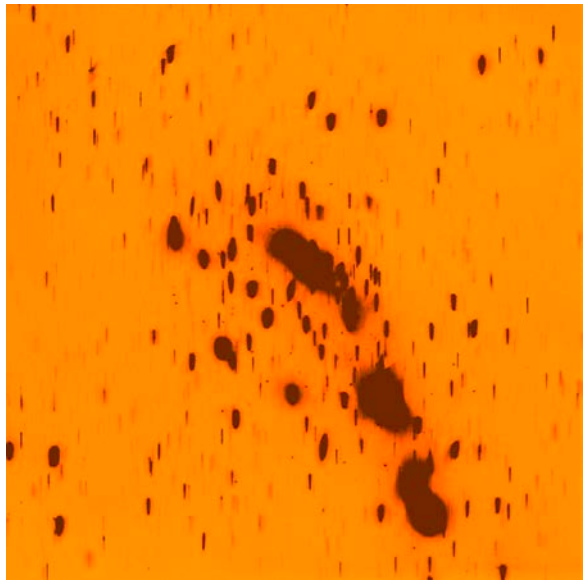
Wide field slitless spectroscopy | Direct image | Orthogonal dispersers



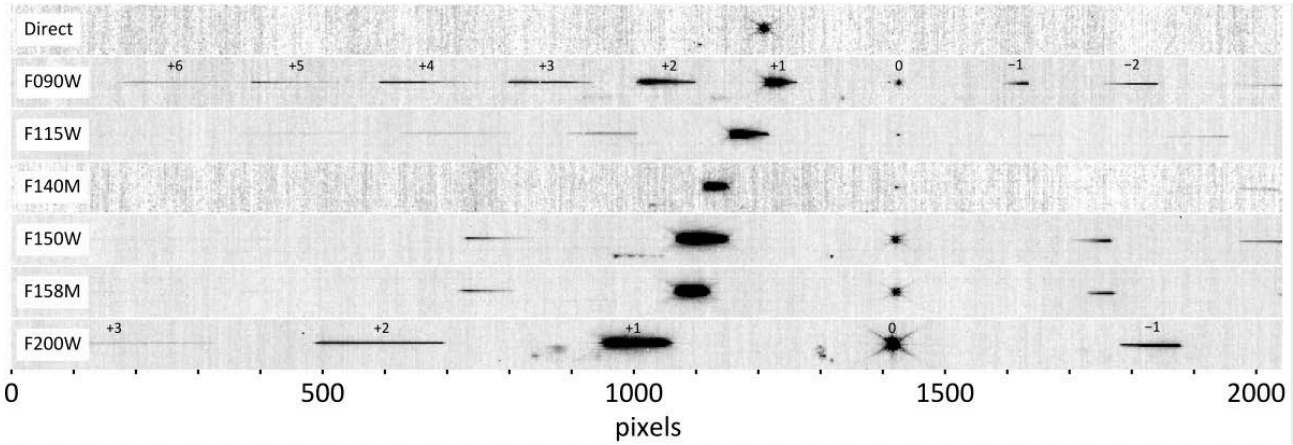
Direct image



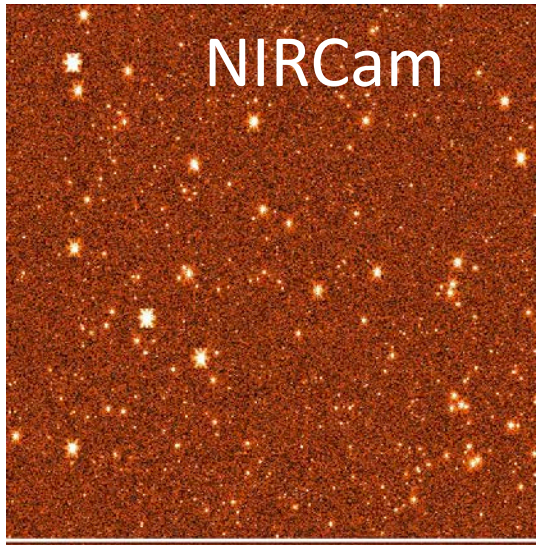
GR150C grism

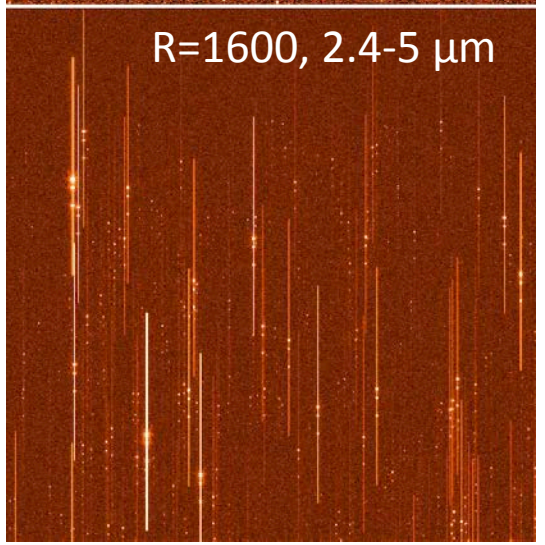


GR150R grism



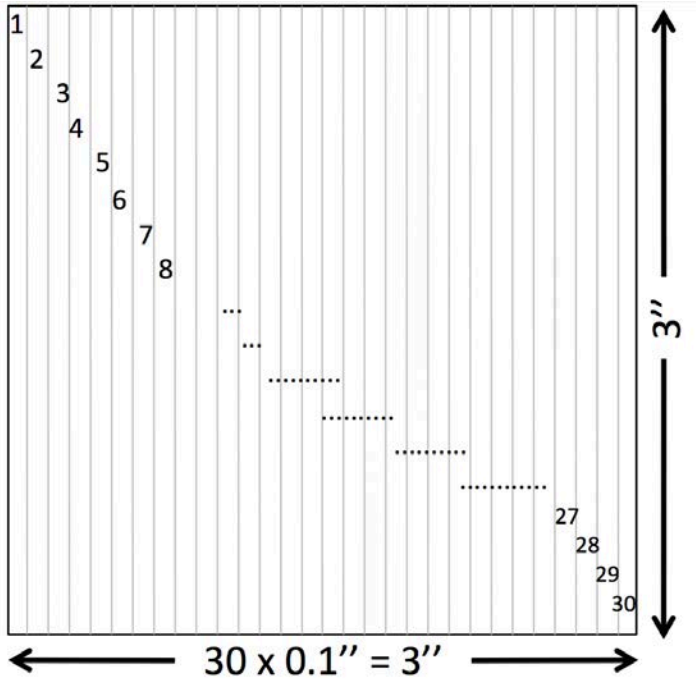
μm	Ly-α redshift
0.79 – 1.00	5.50 – 7.23
1.01 – 1.28	7.31 – 9.53
1.33 – 1.48	9.94 – 11.17
1.33 – 1.67	9.94 – 12.74
1.48 – 1.68	11.17 – 13.82
1.75 – 2.22	13.40 – 17.26

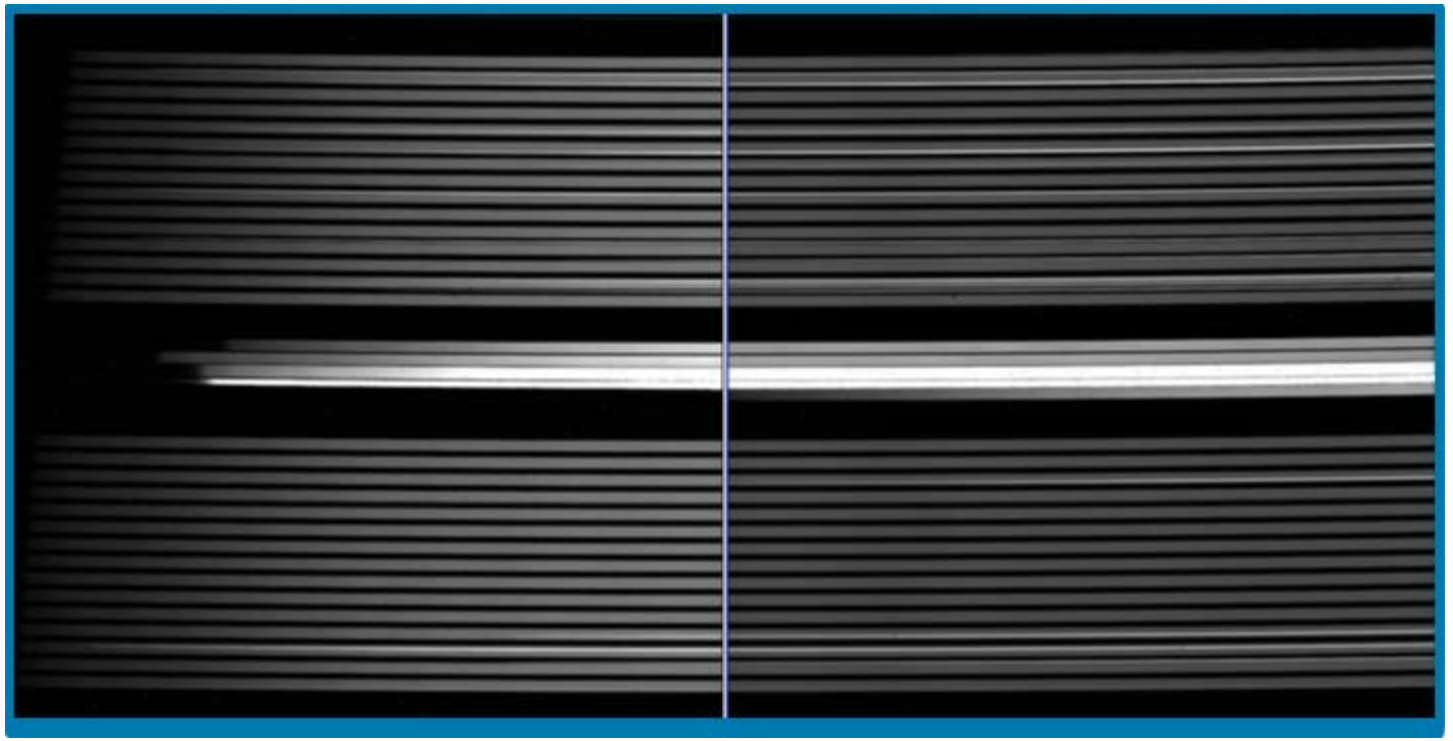




Integral field unit spectroscopy | Aperture | MSA leak calibration

NIRSpec



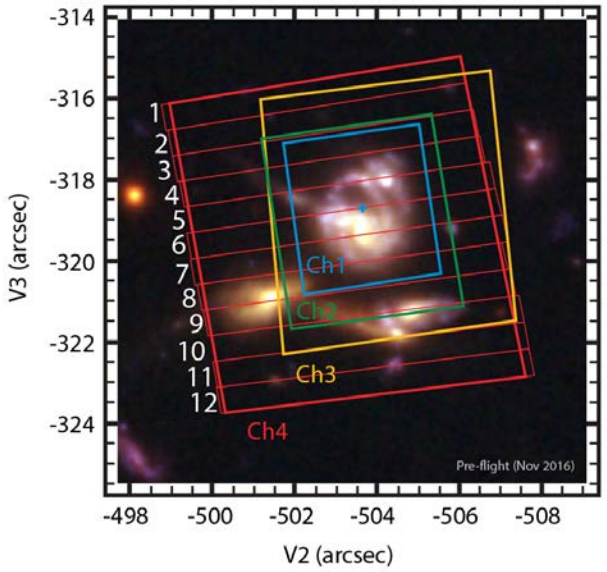


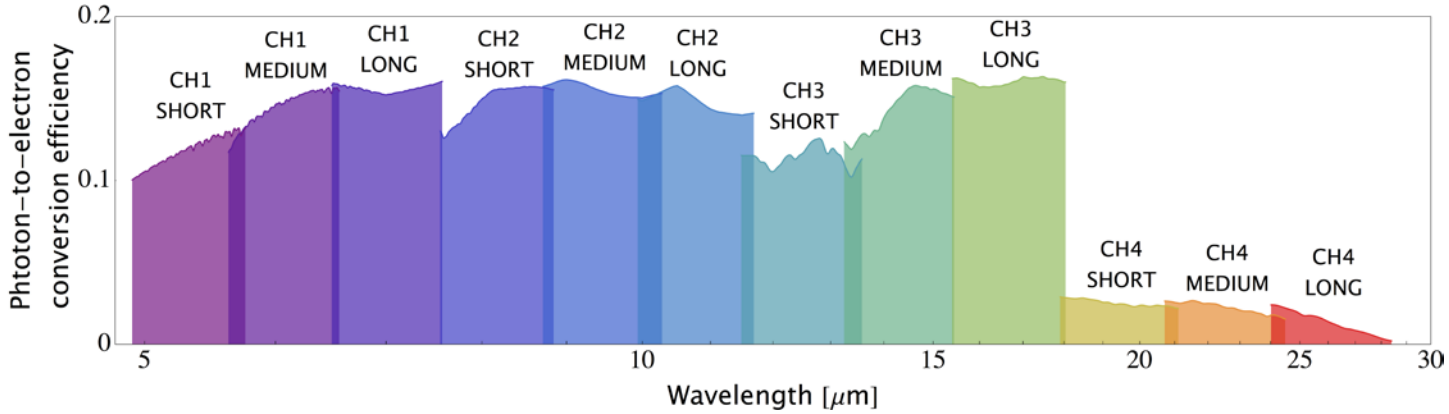
After Leak Subtraction

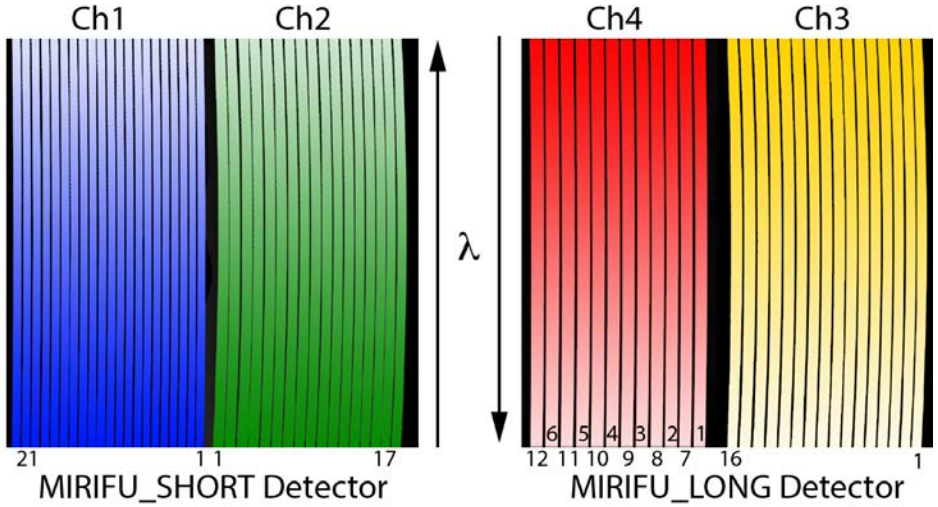
Same dispersers as NIRSpec MSA and fixed slit spectroscopy (R=100, 1000, 2700)

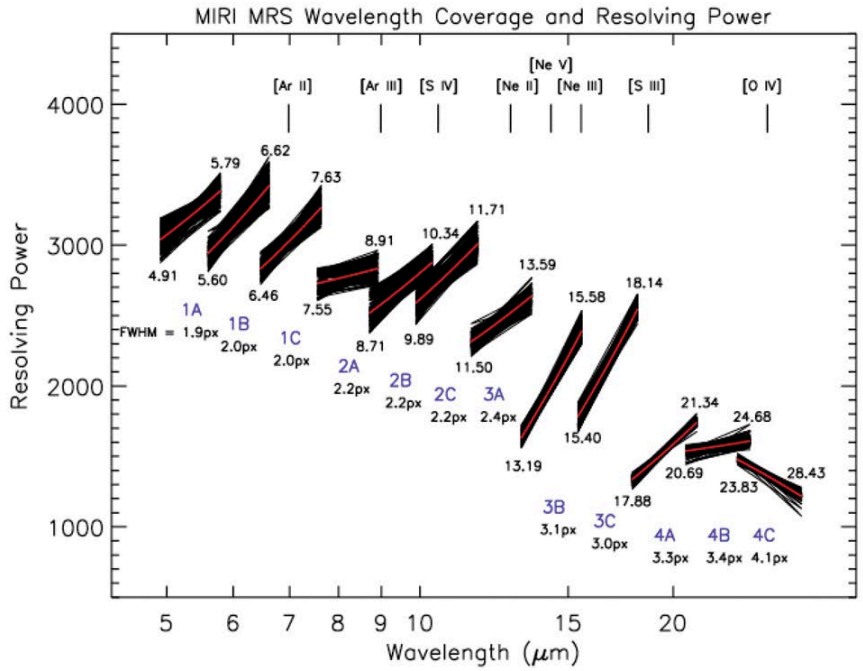
Integral field spectroscopy | Dichroics | Resolution | 3 settings

MIRI



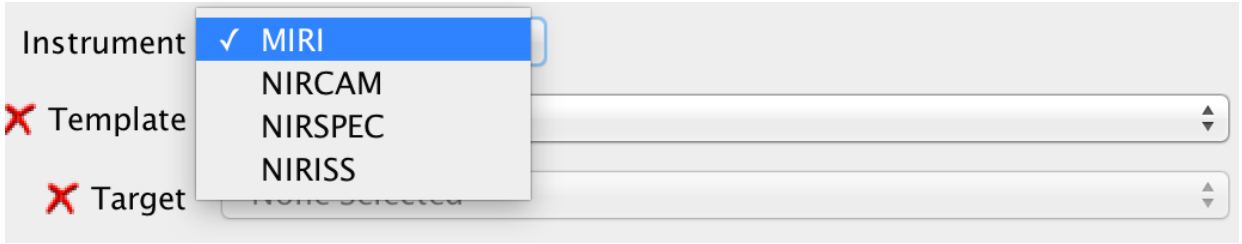


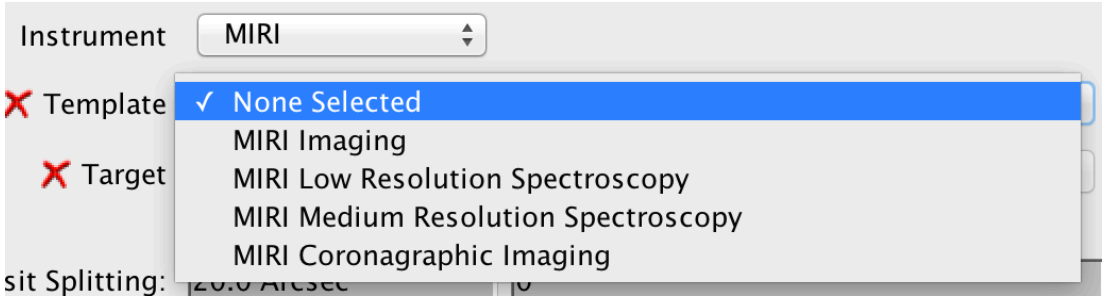


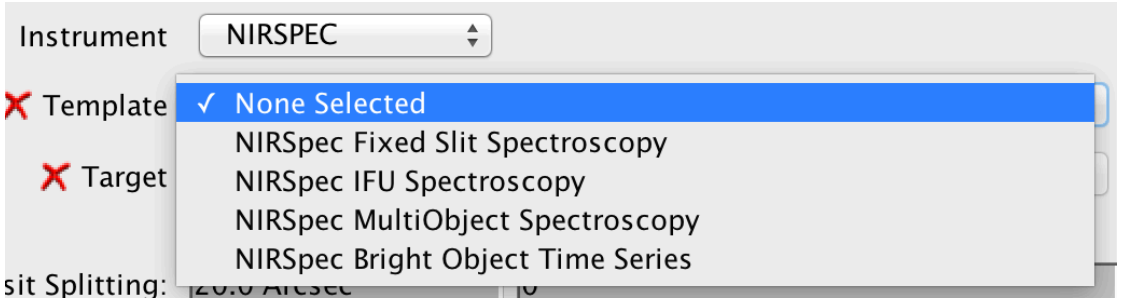


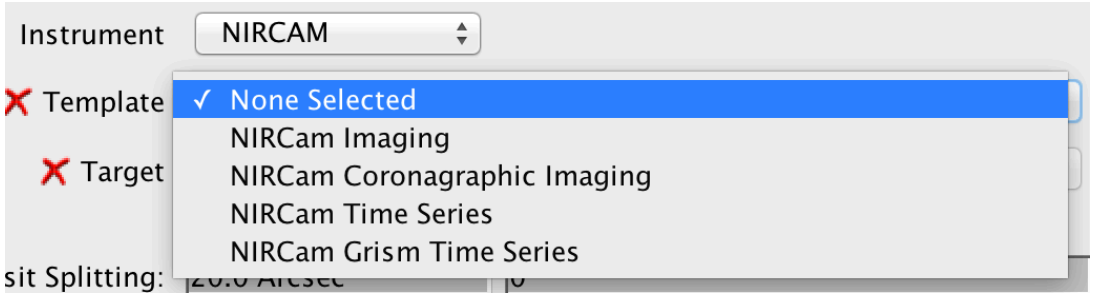
3 Settings
Short
Medium
Long

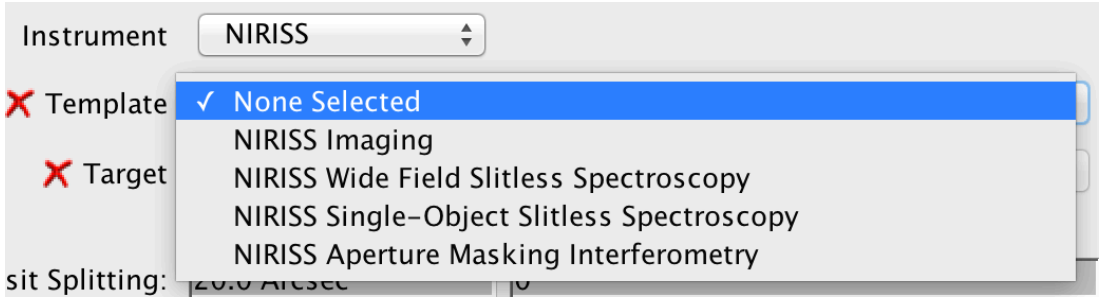
Templates in APT



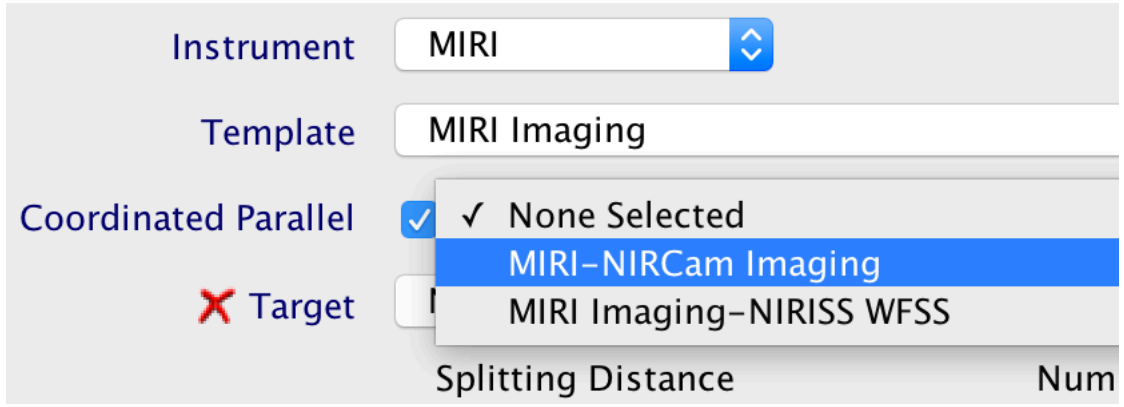


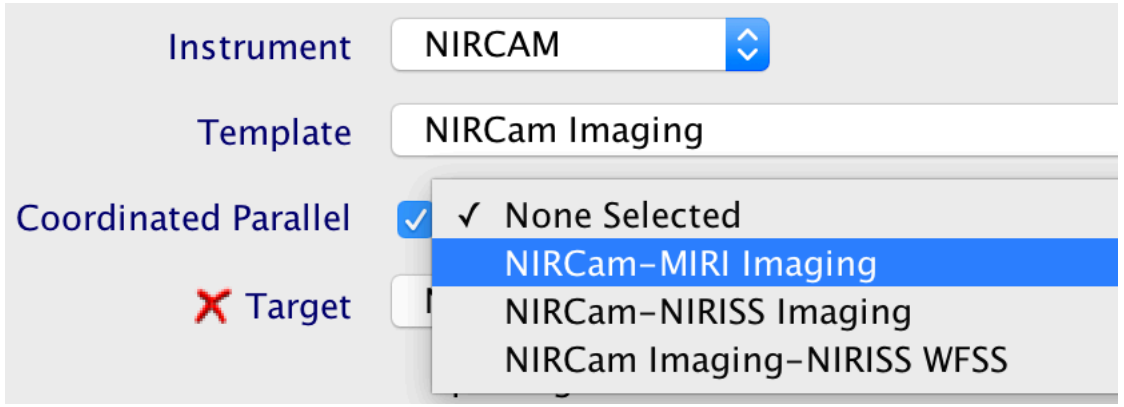


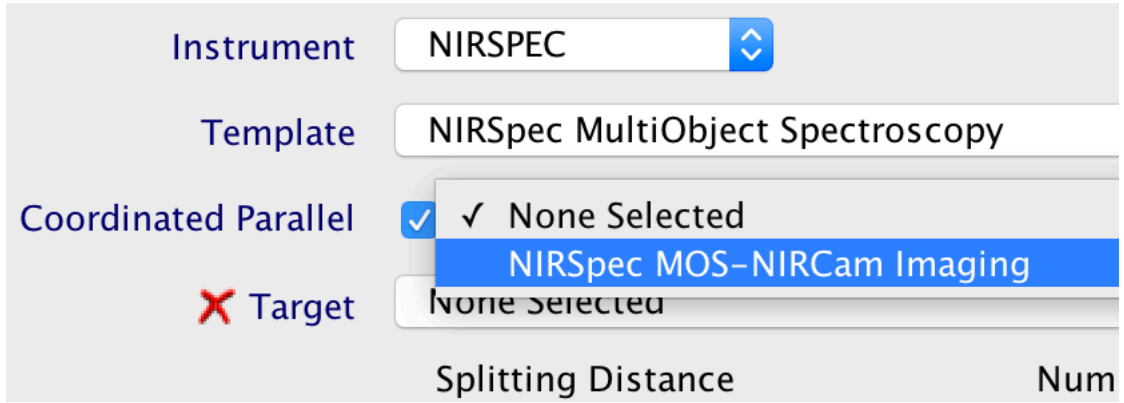


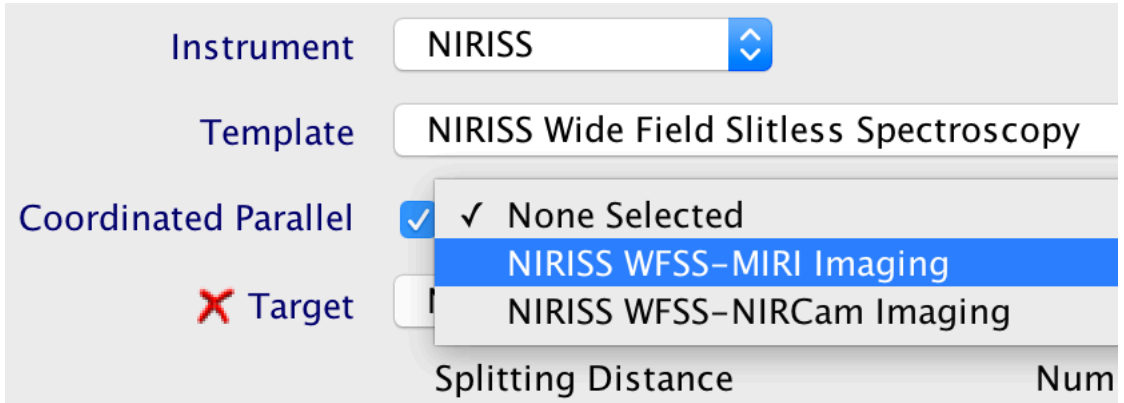


Coordinated parallels available in Cycle 1





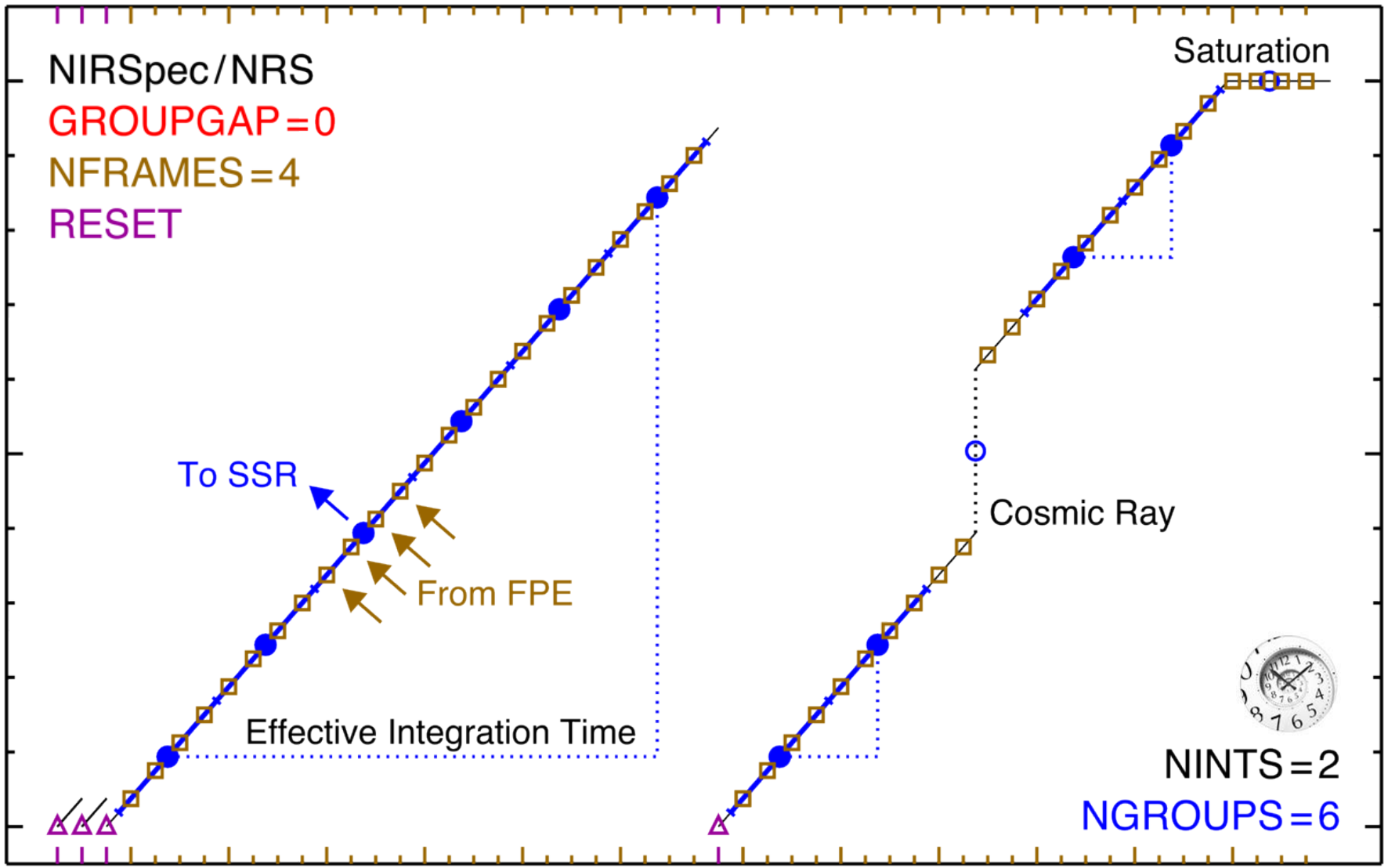




Can also propose for <u>pure</u> parallels (attach exposures to other programs)

- Imaging with MIRI, NIRISS, or NIRCam
- Wide field slitless spectroscopy with NIRISS or NIRCam (shared risk)

Detector readout pattern | Frame | Group | Integration | Exposure

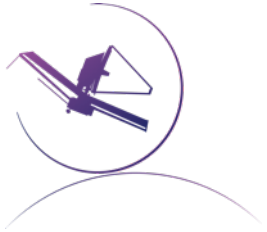


Observing modes

- Imaging
- Defocused photometry
- Coronagraphy
- Aperture masking interferometry
- Single-object slit spectroscopy
- Multi-object slit spectroscopy
- Single-object slitless spectroscopy
- Wide-field slitless spectroscopy
- Integral field unit spectroscopy

Other topics

- Field of regard
- Target visibility
- Roll limits
- Templates
- Parallels
- Exposure terminology



Backup slides

Template | Observation | Visit

- Template
  - Constrained observing strategy
  - Defines interface between subsystems
  - Reduces complexity, but still quite complicated
- Observation
  - Expresses a high-level observing task
  - An instance of a template
  - Can split into multiple visits
- Visit
  - Smallest scheduling unit
  - Begins with a guide star acquisition
  - Cumulative pointing offset less than 30-80 arcsec

Narrow roll limits