Slitless spectroscopy with JWST
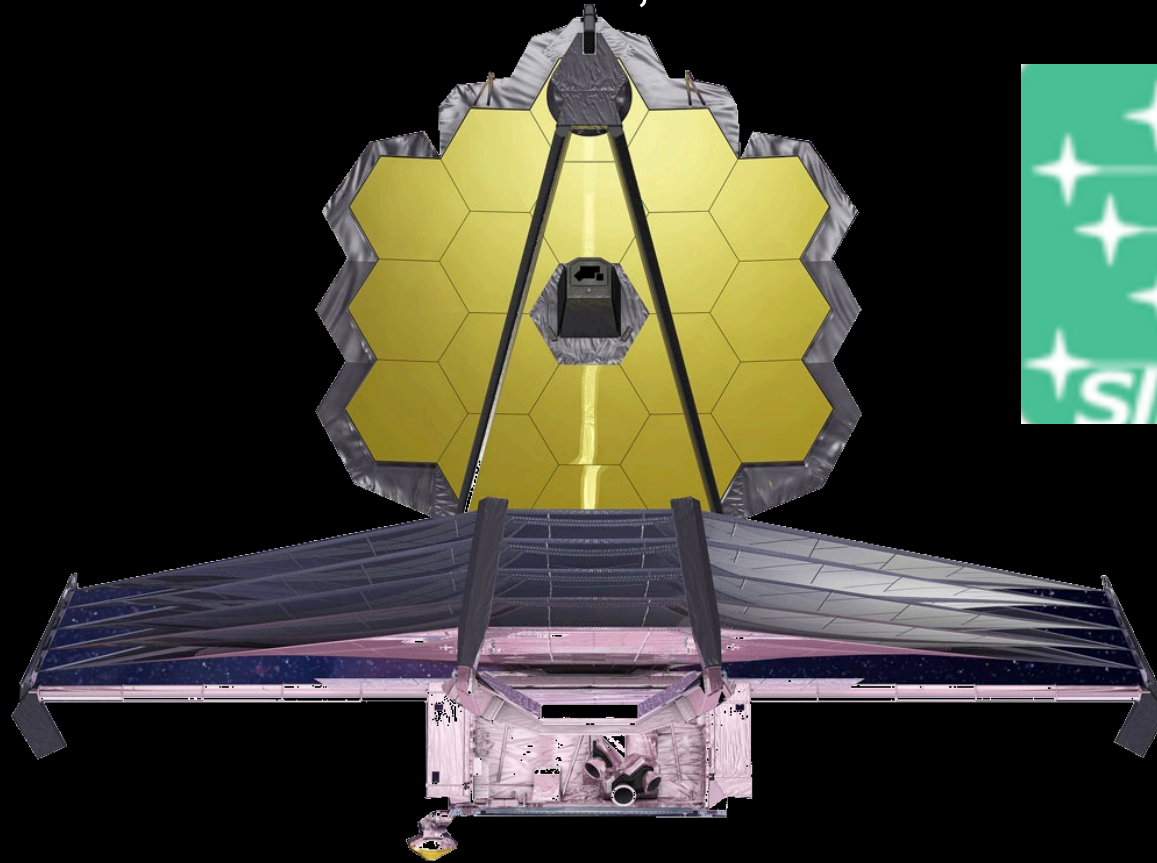
CSA webinar #6
Jan. 24th, 2018
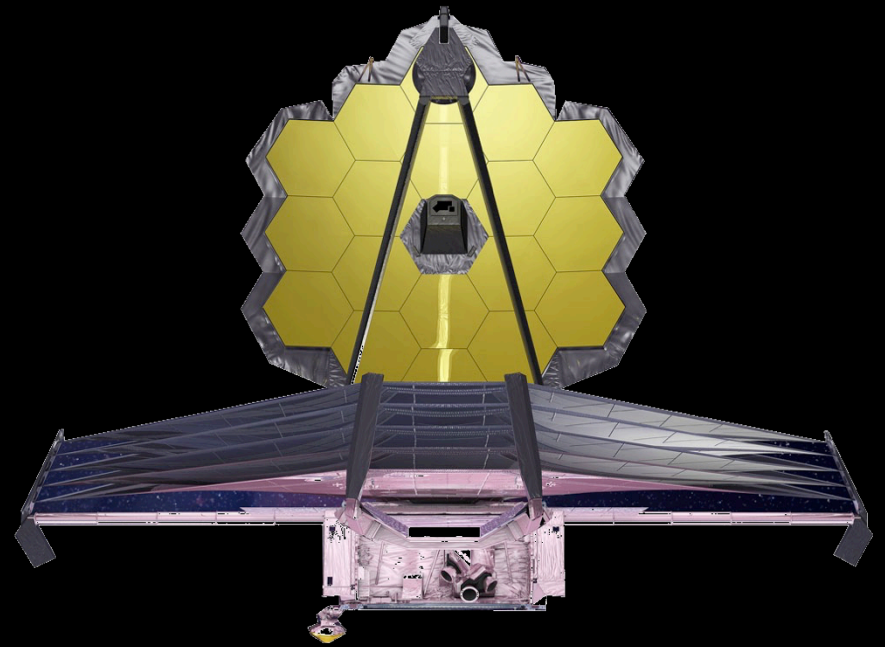
Outline

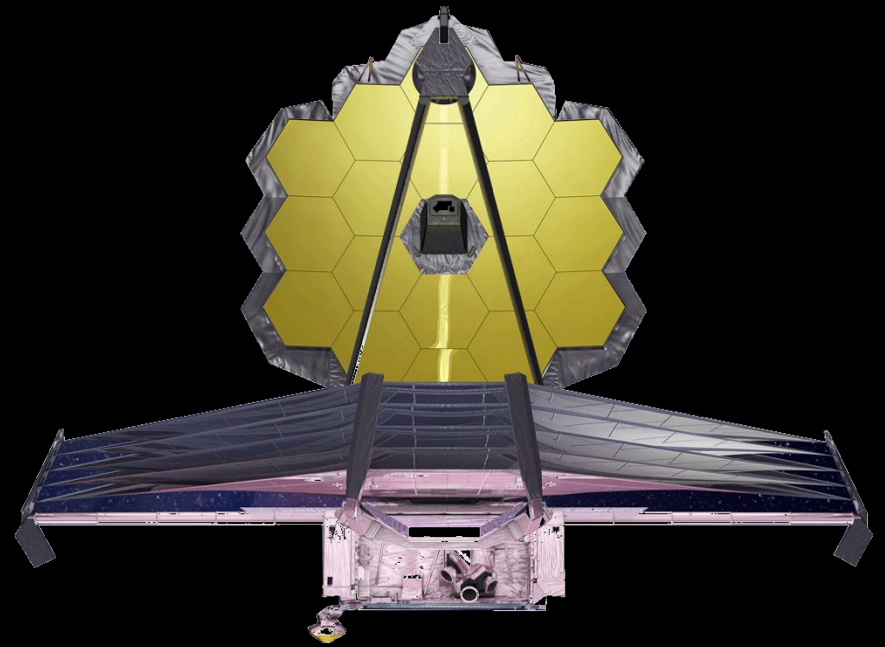Recap of JWST slitless modes

Demo with a science case
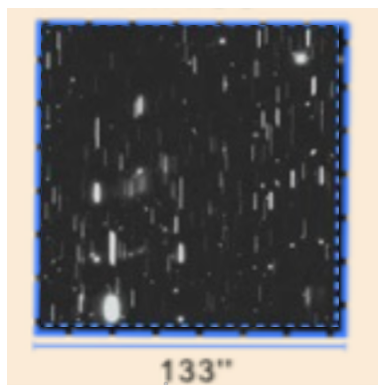
Outline

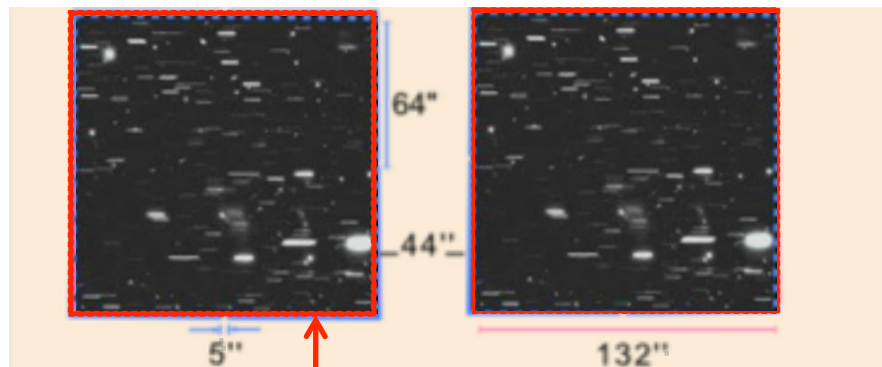Recap of JWST slitless modes

Demo with a science case

WFSS with NIRISS and NIRCAM

NIRISS
R~150
0.9-2.2 μm

NIRCAM
R~1500
2.4-5.0 μm

Long wavelength detector only

Fully redundant modules A&B
4.4'x2.2'
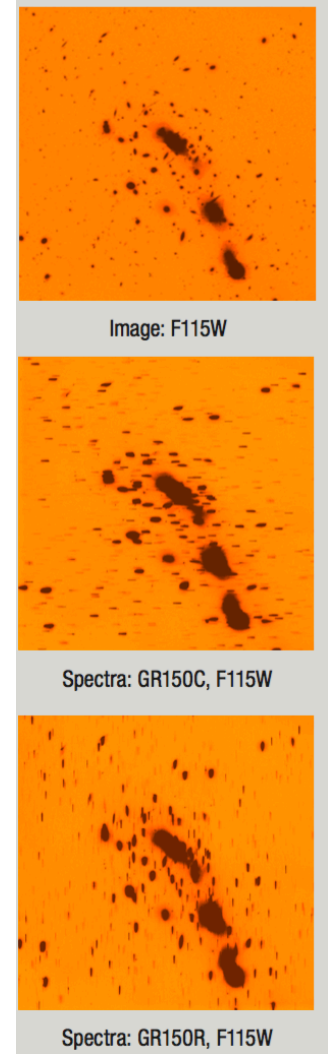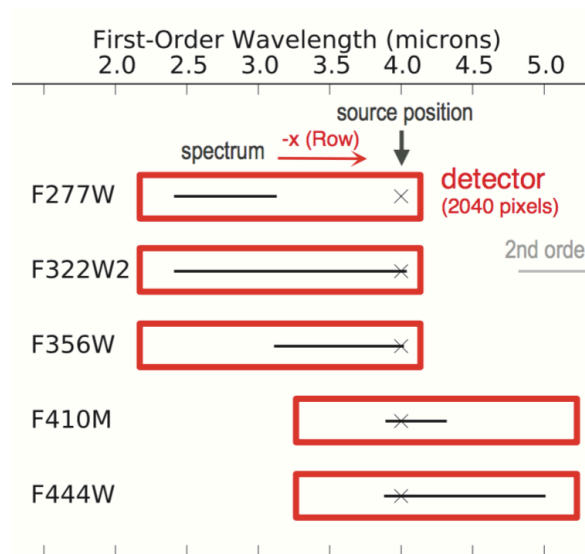
WFSS specifications

High multiplex factor on NIRISS

Two orthogonal grisms to mitigate contamination

No target acquisition

Pre-imaging recommended for source identification

NIRCAM spectra
are extended !
(simultaneous
SW imaging for free)

First-Order Wavelength (microns)
2.0 2.5 3.0 3.5 4.0 4.5 5.0

Image: F115W

Spectra: GR150C, F115W

Spectra: GR150R, F115W

©Pocket guide

Dithering for pixel sampling, improved cosmetics and spatial resolution
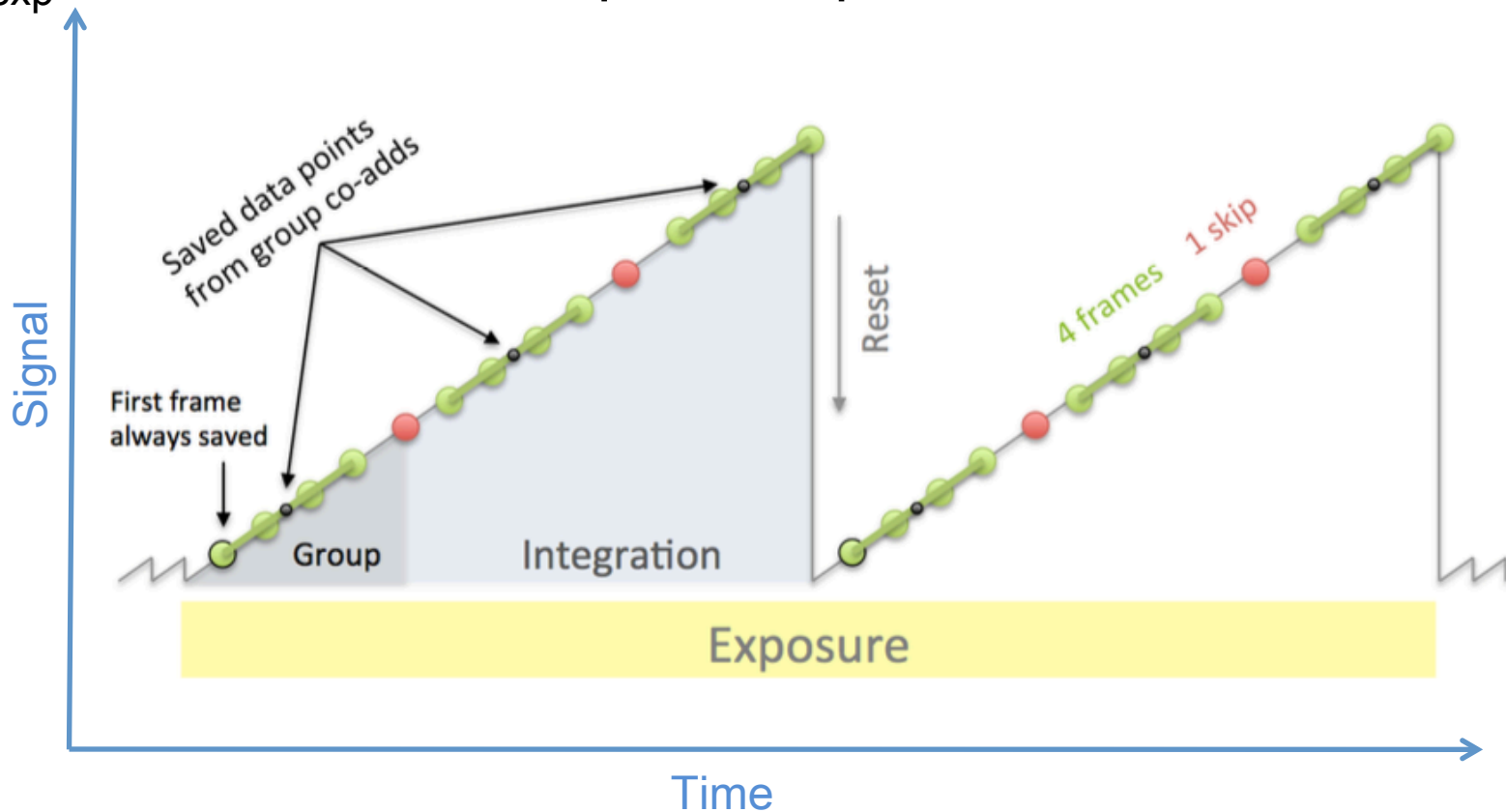
NIRCAM:
- primary dithers:
  ➡ fill in detector (INTRAMODULE) gaps
- secondary dithers
  ➡ improved pixel sampling

NIRISS:
- 2 to 16 point patterns
- three amplitudes:
  small (0.3'') for sparse field and compact sources
  medium (0.6'') default for extragalactic studies
  large (1.2'') for large objects

Review your IR vocabulary

N_f is the number of frames averaged in a group
N_g is the number of groups in an integration (ramp)
N_{int} is the number of integrations (ramps)
N_{exp} is the number of exposures per visit

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NIRCAM Readout patterns

Choice depends on source flux and requested integration time
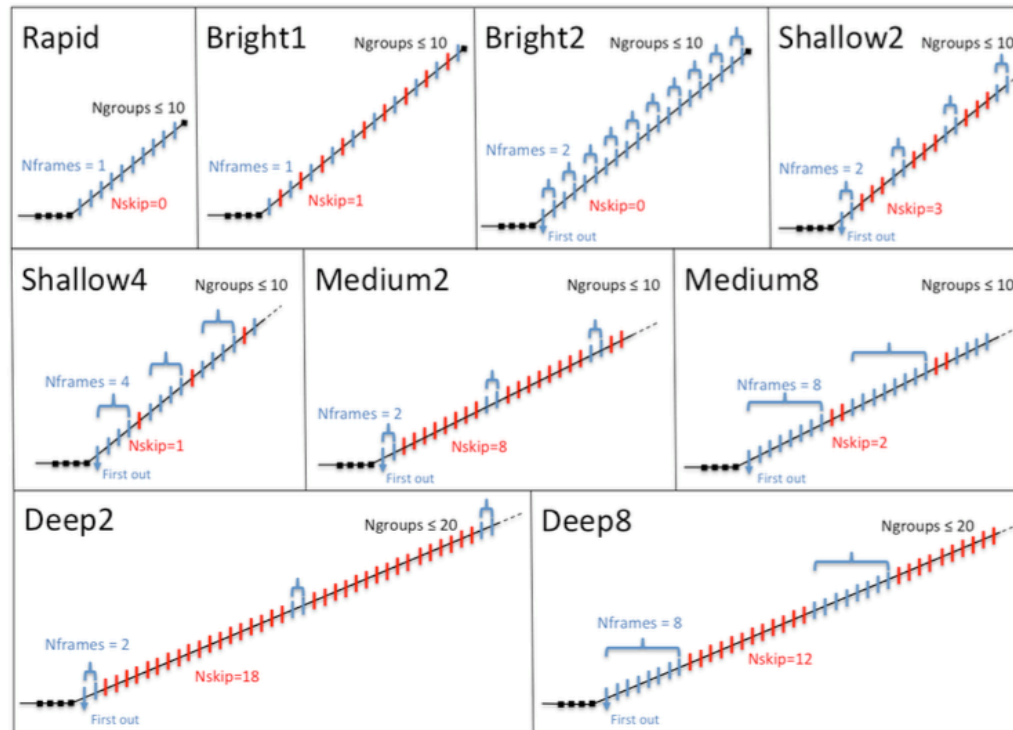
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See Robberto 2010 JWST-STScI-2128
"NIRCam Point Source SNR vs. Filter, Source Brightness and Readout Combinations"

NIRISS Readout patterns

NIRISS:
    - NISRAPID: $N_f=1$, $N_s=0$
    - NIS: $N_f=4$, $N_s=0$, $t_f=41.91s$

WFSS observing sequence

1. Select filter
2. Pre-imaging (for NIRISS only)
3. Select one of the two grism
4. Dithering
5. Post-imaging
6. Out-of-field imaging (for NIRCAM only)
7. Option: change filter and repeat 1-5
8. Option: select the other grism and repeat 1-6

JWST higher-level observations

Parallels (for Cycle 1)
    NIRISS WFSS+NIRCAM imaging
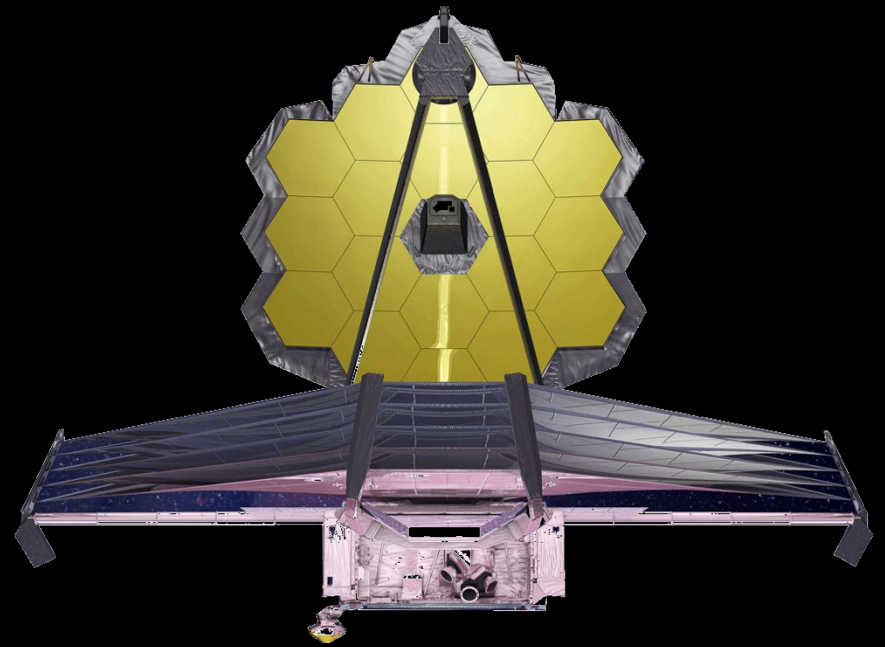   NIRISS WFSS+MIRI imaging

Dithering vs Mosaicking
    - mosaic patterns for areas >FoV
    - dithering with large patterns and steps
    can incur significant overheads

Outline
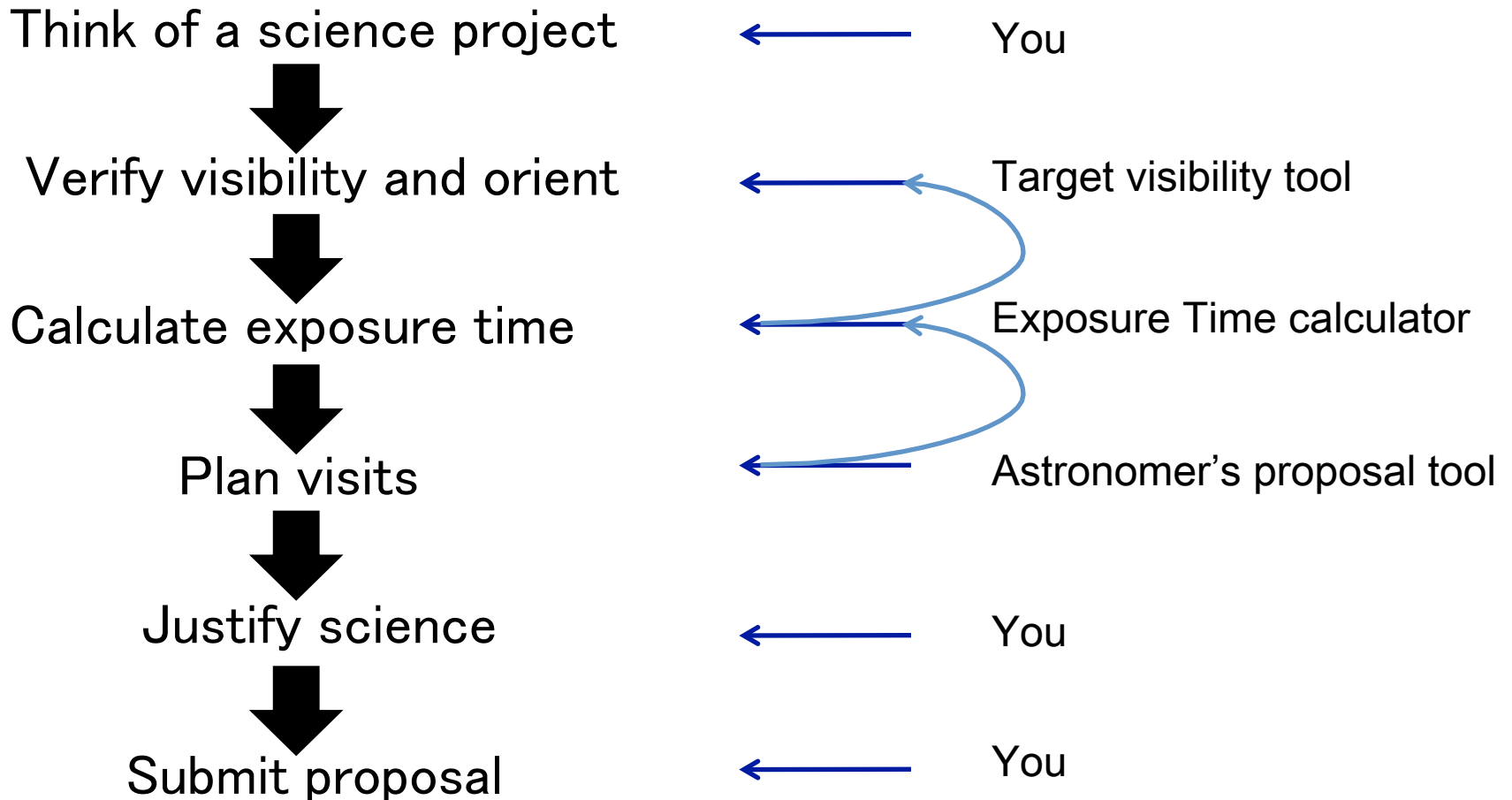
Recap of JWST slitless modes

Demo with a science case

JWST Cycle 1 proposals are due by Apr 6, 2018, in a single phase.

Think of a science project ←——— You

↓

Verify visibility and orient ←——— Target visibility tool

↓

Calculate exposure time ←——— Exposure Time calculator

↓

Plan visits ←——— Astronomer's proposal tool

↓

Justify science ←——— You

↓

Submit proposal ←——— You

Demo: NIRISS WFSS+NIRCAM Im.

CANUCS: The Canadian NIRISS Unbiased Cluster Survey

© ESAC Workshop (S. Ravindranath, C. Willott)

Goal: Detect and characterize galaxies within the reionization epoch and study the evolution of low-mass galaxies across cosmic time.

Method: NIRISS WFSS and NIRCAM parallel imaging to observe five strong-lensing clusters at 0.37<z<0.55 in 3.2 h/filter.

Source: Crowded field

Other useful informations

All JWST data will be reduced by the STScI pipeline (python)
Additional sets of tools are available for analysis
http://ssb.stsci.edu/doc/jwst/jwst/introduction.html

Simulated datasets are available for training
http://archive.stsci.edu/jwst/simulations/index.html

Everything you need to know
(observatory, planning, policies, data): JDox
jwst-docs.stsci.edu

Thank you

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