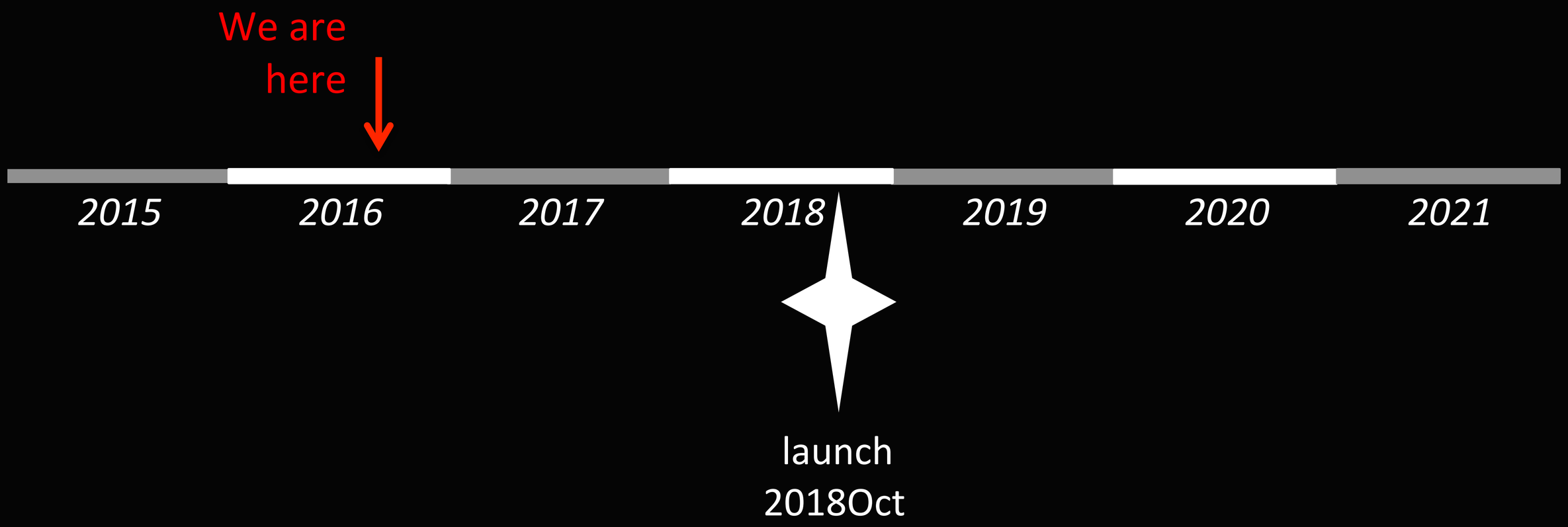
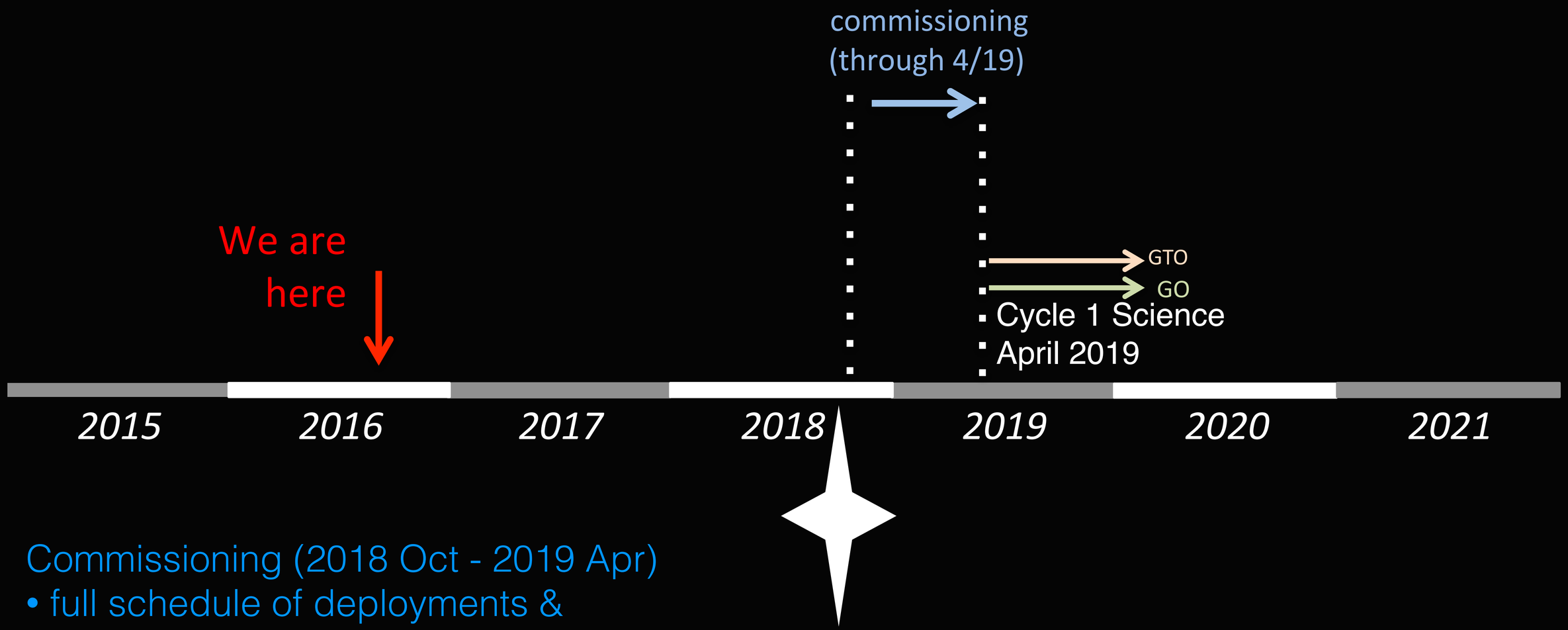
Preparing for JWST

Nikole K. Lewis
Space Telescope Science Institute



JWST Science Timeline

Current as of October 2016

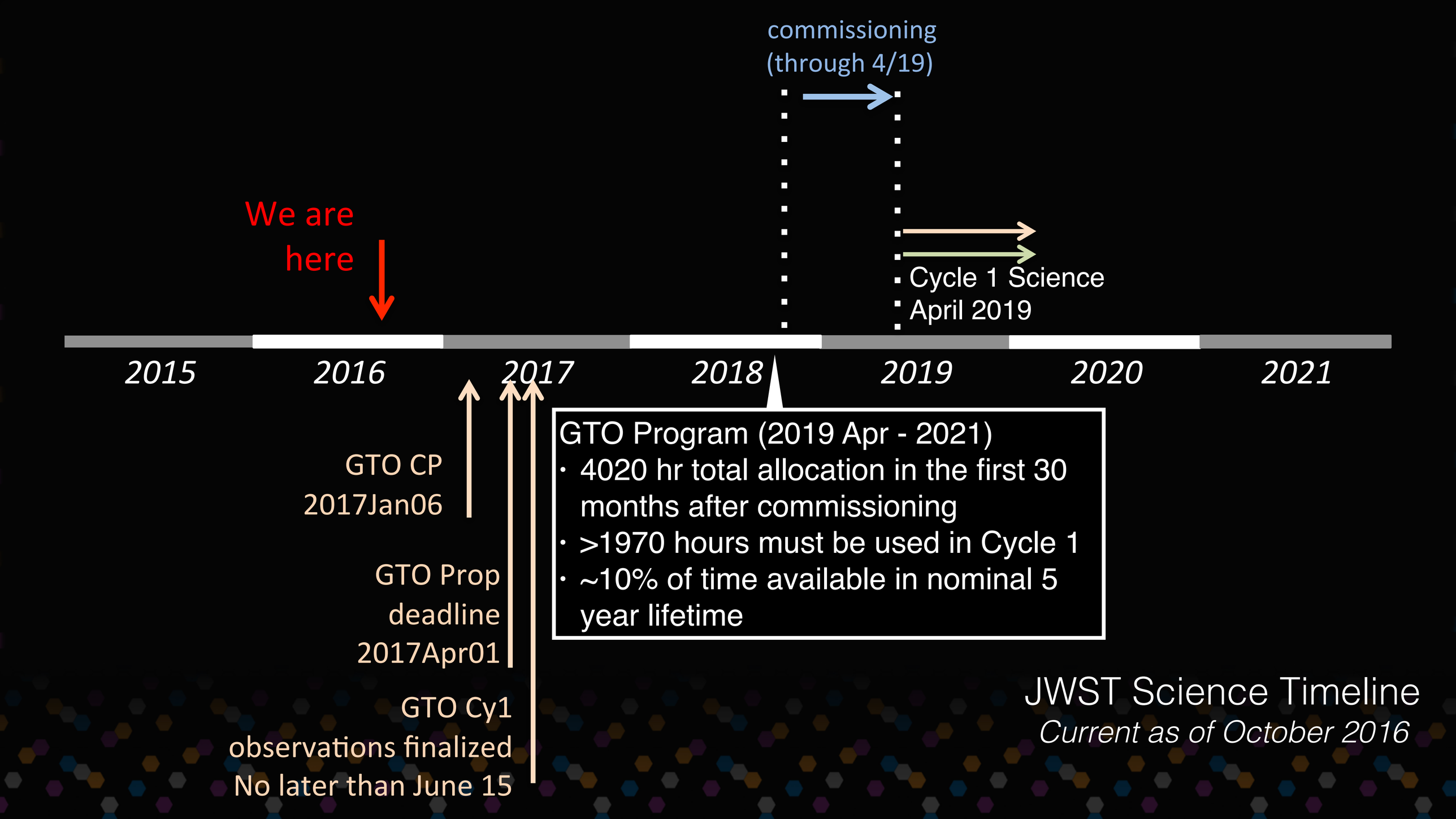


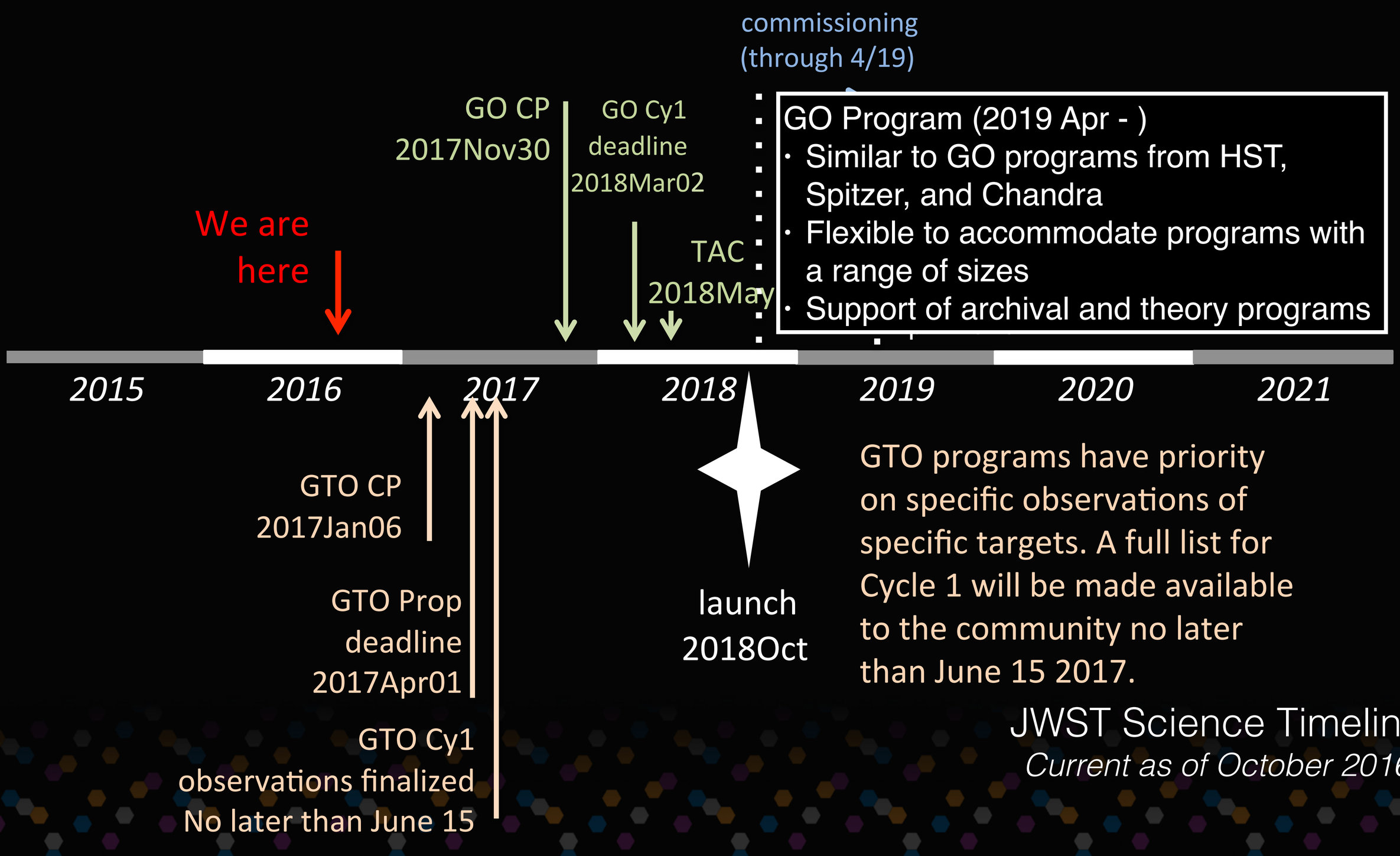
Commissioning (2018 Oct - 2019 Apr)

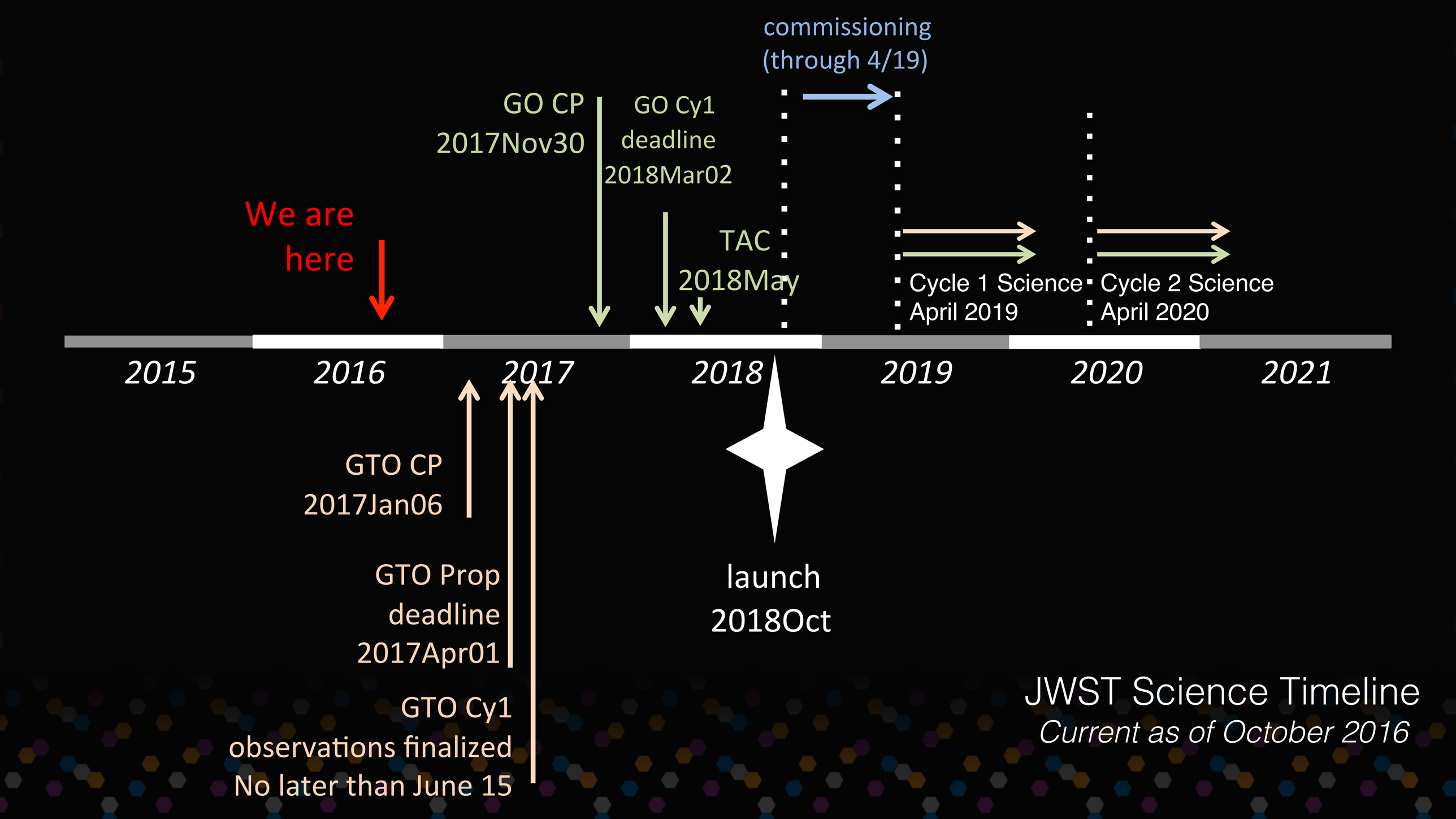
- full schedule of deployments & checkout activities
- limited set of science calibration observations possible

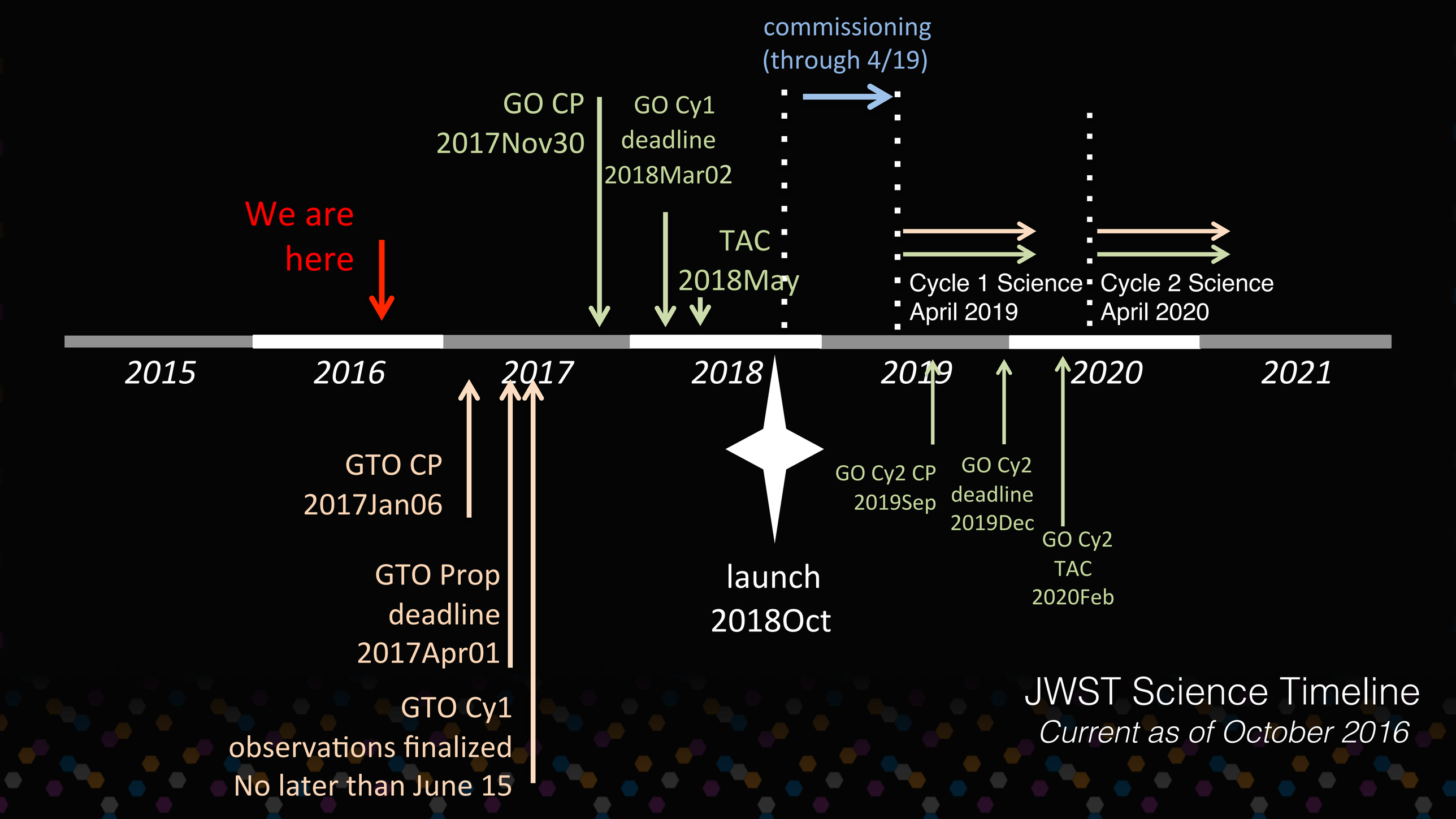
JWST Science Timeline

Current as of October 2016


commissioning
(through 4/19)
We are
here
Cycle 1 Science
April 2019
2015
2016
2017
2018
2019
2020
2021
GTO CP
2017Jan06
GTO Prop
deadline
2017Apr01
GTO Cy1
observations finalized
No later than June 15
GTO Program (2019 Apr - 2021)
• 4020 hr total allocation in the first 30 months after commissioning
• >1970 hours must be used in Cycle 1
• ~10% of time available in nominal 5 year lifetime
JWST Science Timeline
Current as of October 2016


commissioning
(through 4/19)
GO CP
2017Nov30
GO Cy1
deadline
2018Mar02
TAC
2018May
GO Program (2019 Apr -)
· Similar to GO programs from HST, Spitzer, and Chandra
· Flexible to accommodate programs with a range of sizes
· Support of archival and theory programs
We are
here
2015
2016
2017
2018
2019
2020
2021
GTO CP
2017Jan06
GTO Prop
deadline
2017Apr01
GTO Cy1
observations finalized
No later than June 15
launch
2018Oct
GTO programs have priority on specific observations of specific targets. A full list for Cycle 1 will be made available to the community no later than June 15 2017.
JWST Science Timeline
Current as of October 2016


commissioning
(through 4/19)
GO CP
2017Nov30
GO Cy1
deadline
2018Mar02
We are
here
TAC
2018May
Cycle 1 Science
April 2019
Cycle 2 Science
April 2020
2015
2016
2017
2018
2019
2020
2021
GTO CP
2017Jan06
GTO Prop
deadline
2017Apr01
GTO Cy1
observations finalized
No later than June 15
launch
2018Oct
JWST Science Timeline
Current as of October 2016


commissioning
(through 4/19)
GO CP
2017Nov30
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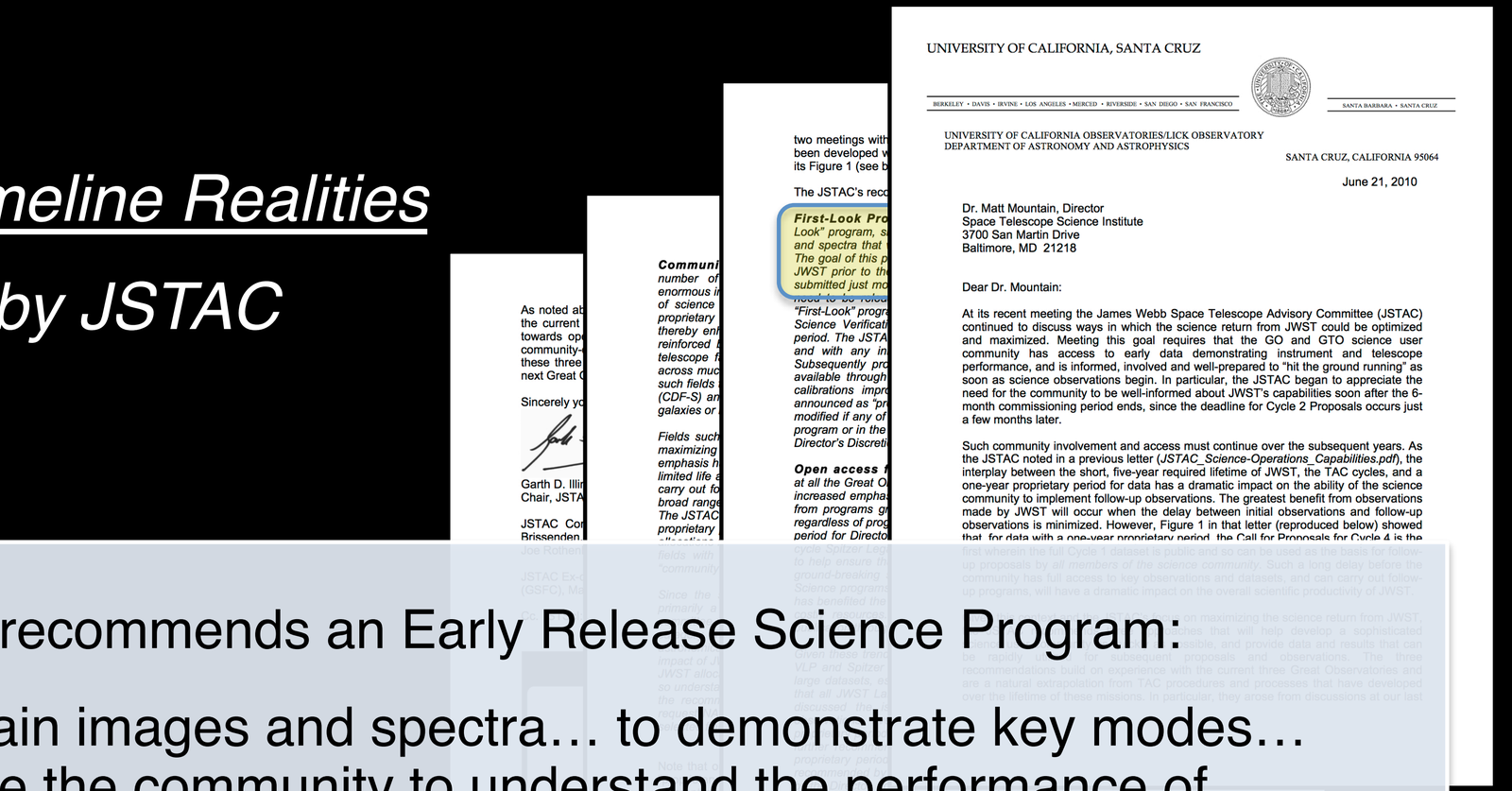
2018Mar02
We are
here
TAC
2018May
Cycle 1 Science
April 2019
Cycle 2 Science
April 2020
2015
2016
2017
2018
2019
2020
2021
GTO CP
2017Jan06
GTO Prop
deadline
2017Apr01
GTO Cy1
observations finalized
No later than June 15
launch
2018Oct
GO Cy2 CP
2019Sep
GO Cy2
deadline
2019Dec
GO Cy2
TAC
2020Feb
JWST Science Timeline
Current as of October 2016

Science Timeline Realities

addressed by JSTAC in 2010


UNIVERSITY OF CALIFORNIA, SANTA CRUZ

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO

SANTA BARBARA • SANTA CRUZ

UNIVERSITY OF CALIFORNIA OBSERVATORIES/LICK OBSERVATORY
DEPARTMENT OF ASTRONOMY AND ASTROPHYSICS

SANTA CRUZ, CALIFORNIA 95064

June 21, 2010

Dr. Matt Mountain, Director
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218

Dear Dr. Mountain:

At its recent meeting the James Webb Space Telescope Advisory Committee (JSTAC) continued to discuss ways in which the science return from JWST could be optimized and maximized. Meeting this goal requires that the GO and GTO science user community has access to early data demonstrating instrument and telescope performance, and is informed, involved and well-prepared to "hit the ground running" as soon as science observations begin. In particular, the JSTAC began to appreciate the need for the community to be well-informed about JWST's capabilities soon after the 6-month commissioning period ends, since the deadline for Cycle 2 Proposals occurs just a few months later.

Such community involvement and access must continue over the subsequent years. As the JSTAC noted in a previous letter (*JSTAC_Science-Operations_Capabilities.pdf*), the interplay between the short, five-year required lifetime of JWST, the TAC cycles, and a one-year proprietary period for data has a dramatic impact on the ability of the science community to implement follow-up observations. The greatest benefit from observations made by JWST will occur when the delay between initial observations and follow-up observations is minimized. However, Figure 1 in that letter (reproduced below) showed that, for data with a one-year proprietary period, the Call for Proposals for Cycle 4 is the

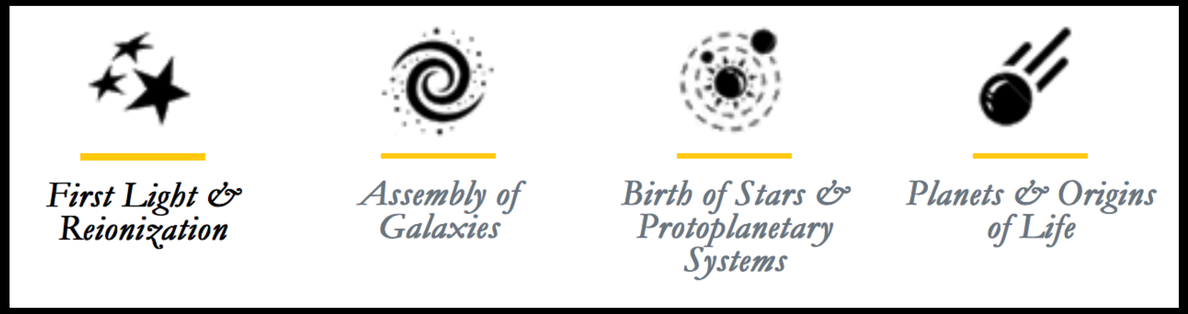
The JSTAC recommends an Early Release Science Program:

> "..to obtain images and spectra… to demonstrate key modes… to enable the community to understand the performance of JWST prior to the submission of the first post-launch Cycle 2 proposals that will be submitted just months after the end of commissioning."
>
> "The JSTAC recommends that… data be released both in raw form and with any initial calibrations as soon as possible; the key aspect is speed."

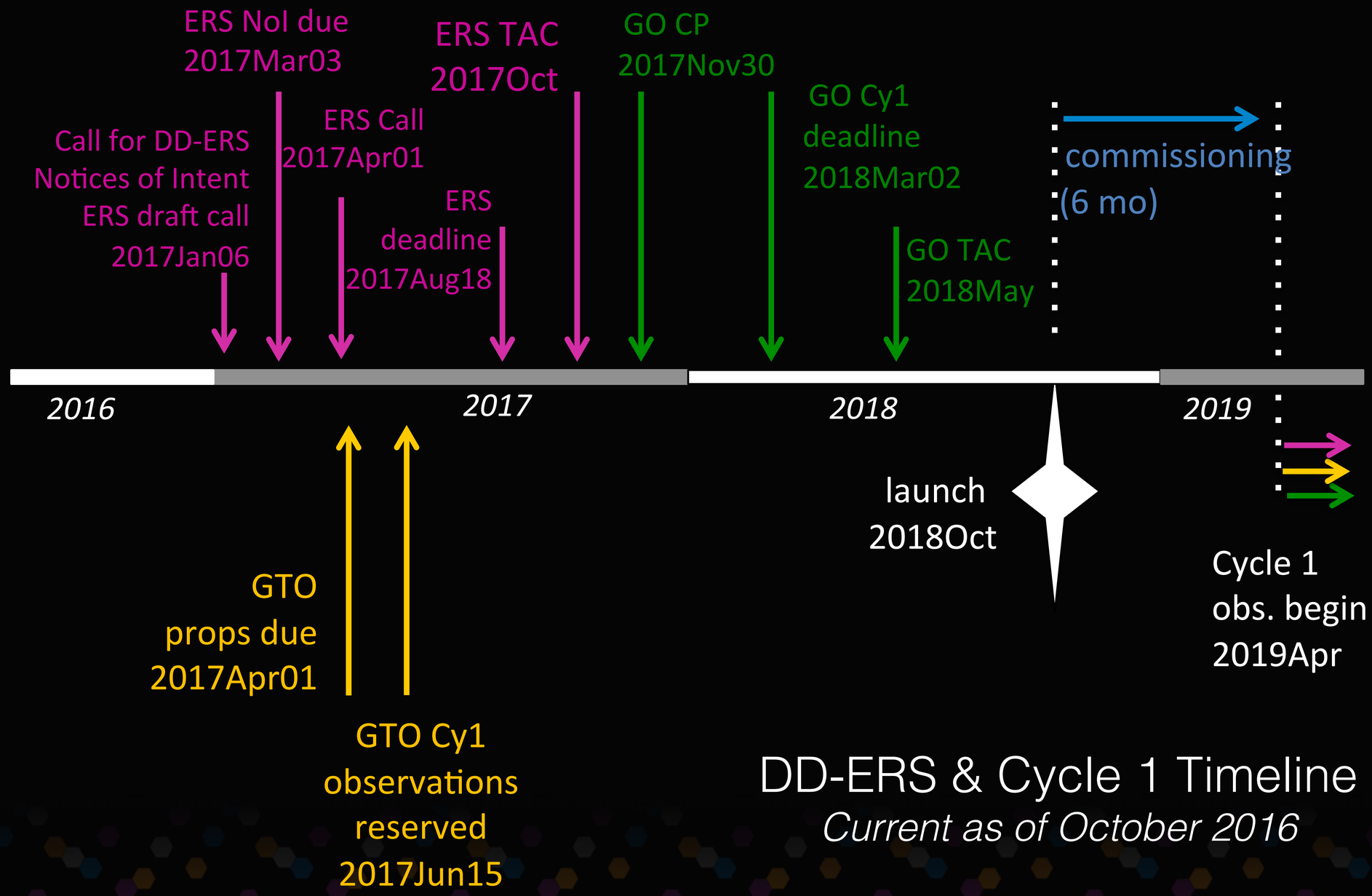
STScI Director Ken Sembach will allocate ~500 hours of Director's Discretionary time for Early Release Science (DD-ERS) to

- *accelerate the diffusion of JWST know-how, and*
- *expand early opportunities for the community to gain experience with JWST data and scientific analysis.*

Early resources are allocated to support up to 15 teams. Proposals will be selected in research areas spanning the science themes of JWST :



A multi-disciplinary committee of experts will recommend a suite of proposals that both fulfills the goals of the DD-ERS and makes optimal use of the available time for observation and funding.

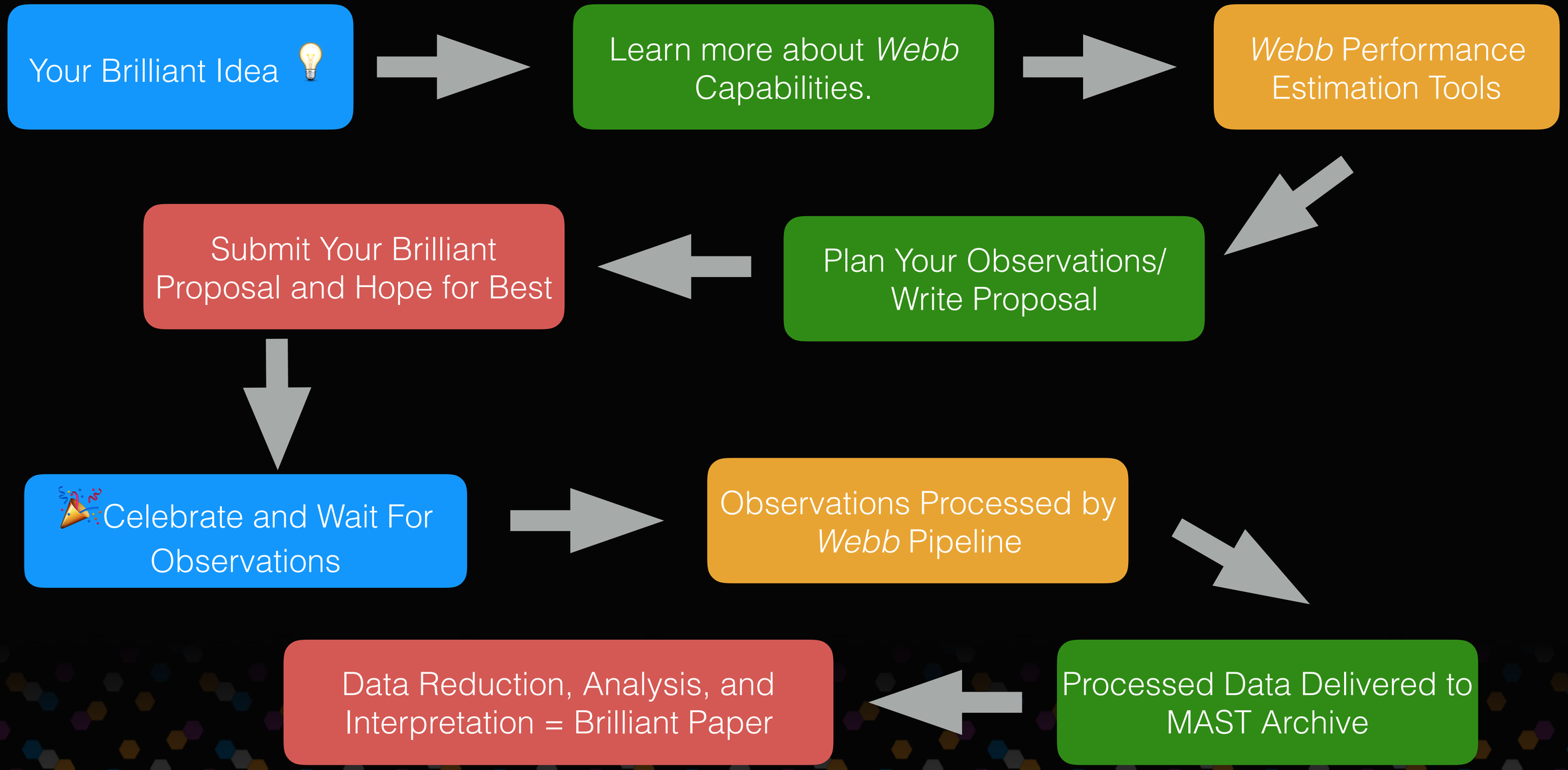


DD-ERS & Cycle 1 Timeline

Current as of October 2016

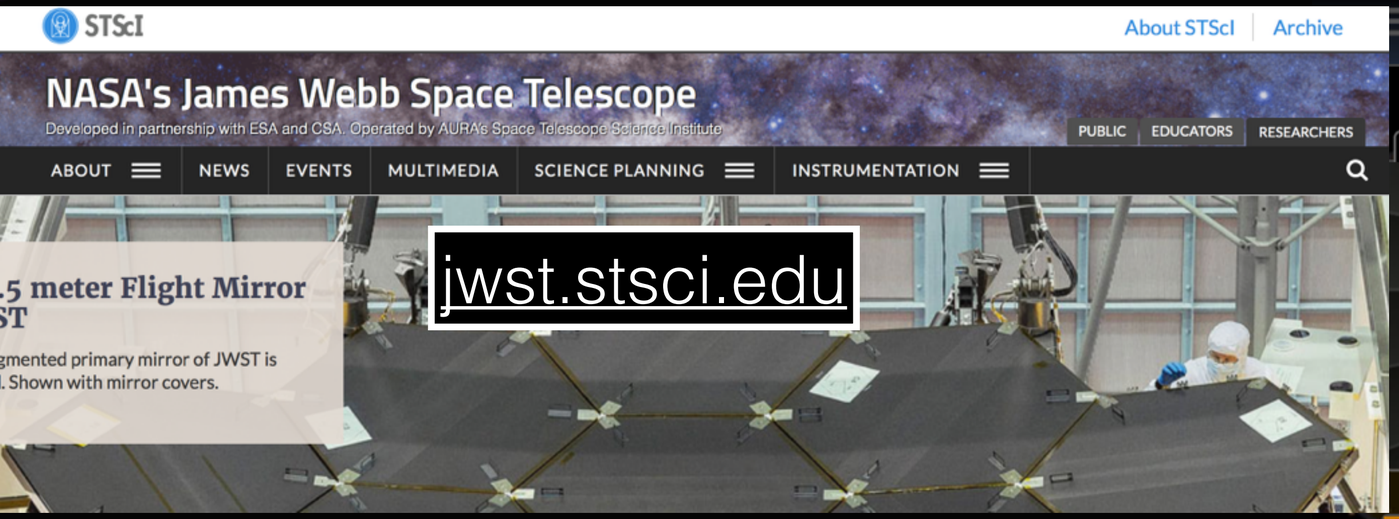
JWST Cycle 1 Calls for Proposals are Coming….

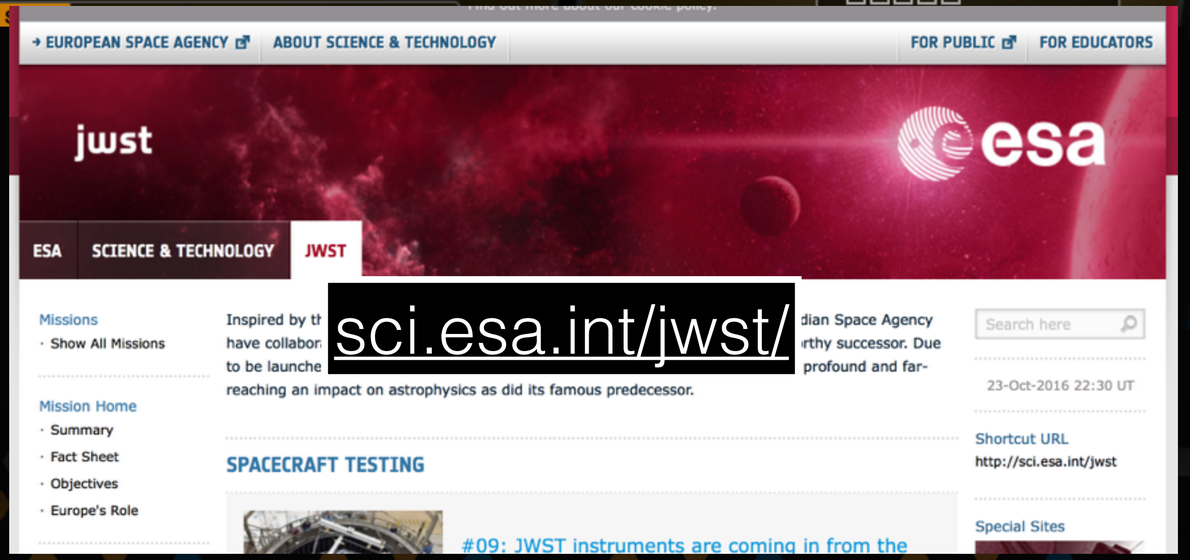
Life-cycle of your observations with *Webb*



Ultra Sensitive and High Resolution Imaging
Mid IR IFUs
Single Object and Wide-Field Slitless Spectroscopy
Big Bang
Radiation Era
Dark Ages
Reionization era
First galaxies form
Present
m=1
m=2
m=3
Space Based MOS
Your Brilliant Idea
Science Capabilities
Moving Target Support
Bright Object Modes
λ
JWST/NIRSpec 25 Transits
10x Earth mass (and hot)
Thick Atmosphere
Water & Methane
Water
Near IR IFUs
0.8″ ~ 5200 km
image at 0.94 microns (Cassini mission 2009)
exoplanet beta pictoris b
beta pictoris
NIR and MIR Coronagraphy

Learn more about *Webb* Capabilities.





Learn more about *Webb* Capabilities.

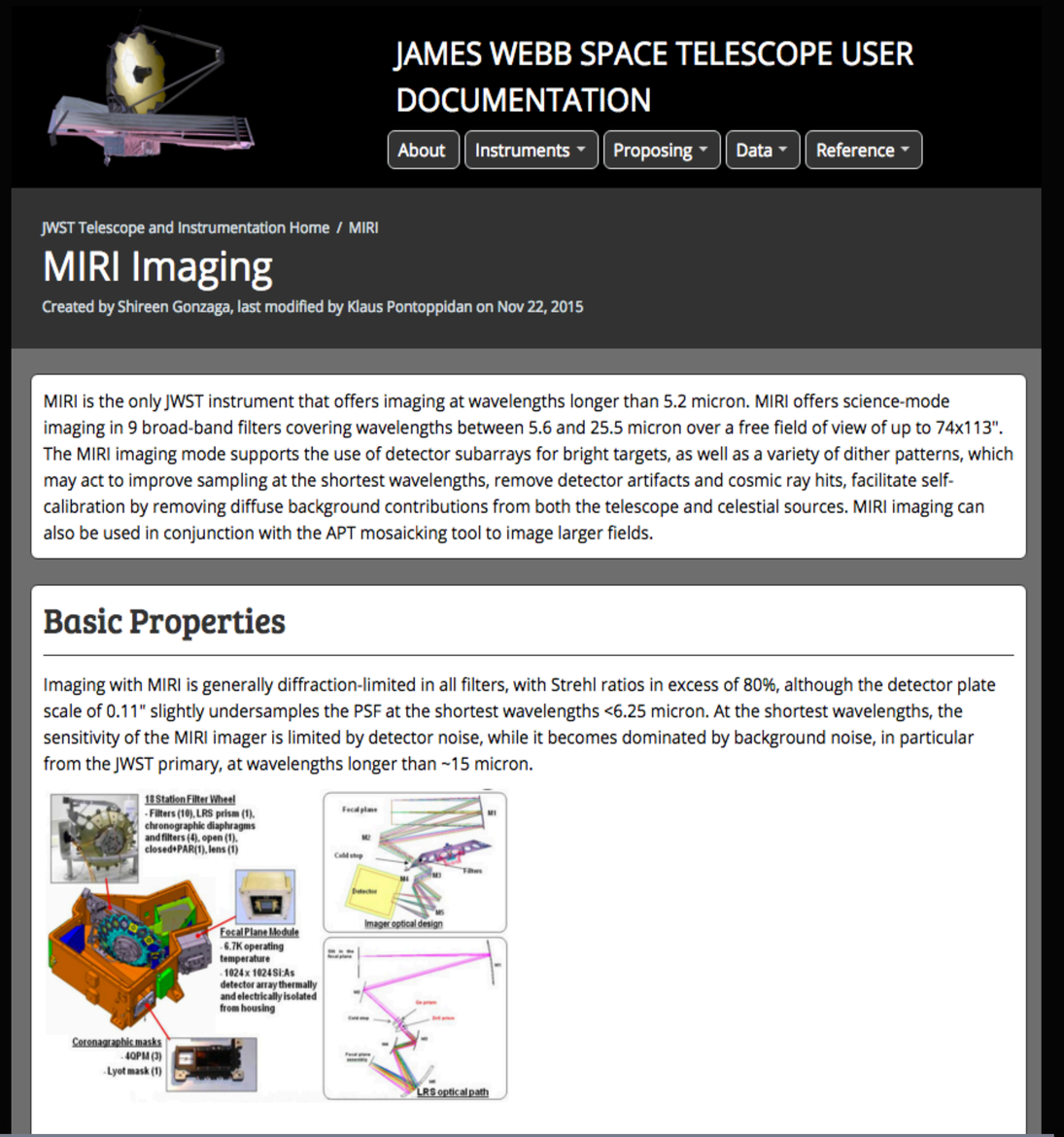
A New Paradigm for JWST User Documentation

New documentation system: “Every page is page one”
- Short articles
- Self-contained, one-level information
- Hyperlinked network rather than monolithic handbook

Think Wikipedia (but it’s not a wiki)

Multiple conceptual spaces: Background articles, planning cookbooks, science policy, engineering specs

Incremental releases (as articles are written and reviewed), beginning with instruments, APT, ETC articles



James Webb Space Telescope User Documentation

Webb Performance Estimation Tools

JWST Exposure Time Calculator (Pandeia)

Reference files
throughput, PSFs, noise parameters

Engine
General Python library

Server
Stores your calculations

User interface
Web application accessed through your browser

RELEASE SCHEDULE

ETC beta released
ETC flight release: January

Webb Performance Estimation Tools

JWST Exposure Time Calculator (Pandeia)

Exposure Time Calculator Edit Expand Klaus Pontoppidan Help

11		niriss wfss	1	425.20	152.46	
10		niriss wfss	1	425.20	162.05	
9		niriss wfss	1	425.20	123.13	
8		miri mrs	3	2497.50	240.46	
7		nirspec fixed_slit	1	1528.00	46.00	
4		nircam wfgrism	1	1934.66	97.75	
3		niriss wfss	1	425.20	116.46	
2		miri lrsslitless	1	6.55	2.96	
1	☑	miri mrs	2	3330.00	28.15	
-	-	---	-	--.-	--.-	-

2:

Normalize at wavelength: 10 mjy lambda 20 μm

Normalize in bandpass: 0.00001 flam at

JWST MIRI/IMAGING F560W

HST WFC3/IR F098M

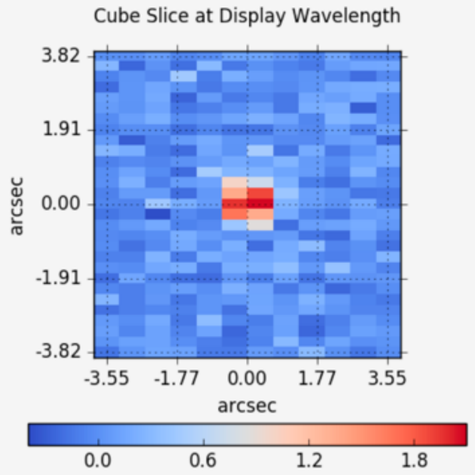
Other Bessel H

Calculation selected: 1, **Mode:** miri mrs Reset Calculate

Images

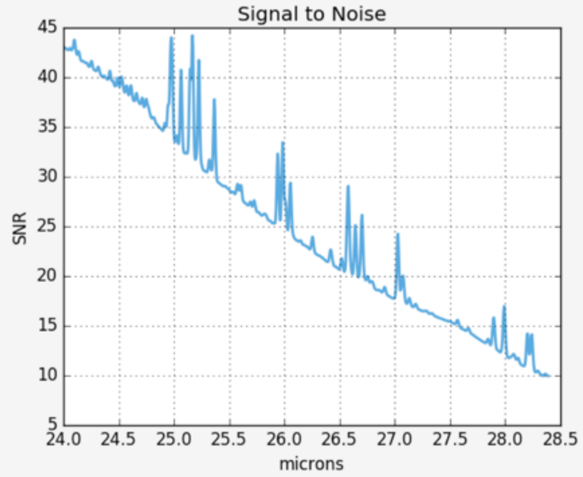
Calculation selected: 1, **Mode:** miri mrs

2D SNR | Detector | Saturation



Plots

ApFlux | ApBackground | SNR | SNR (time) | Contrast



Reports

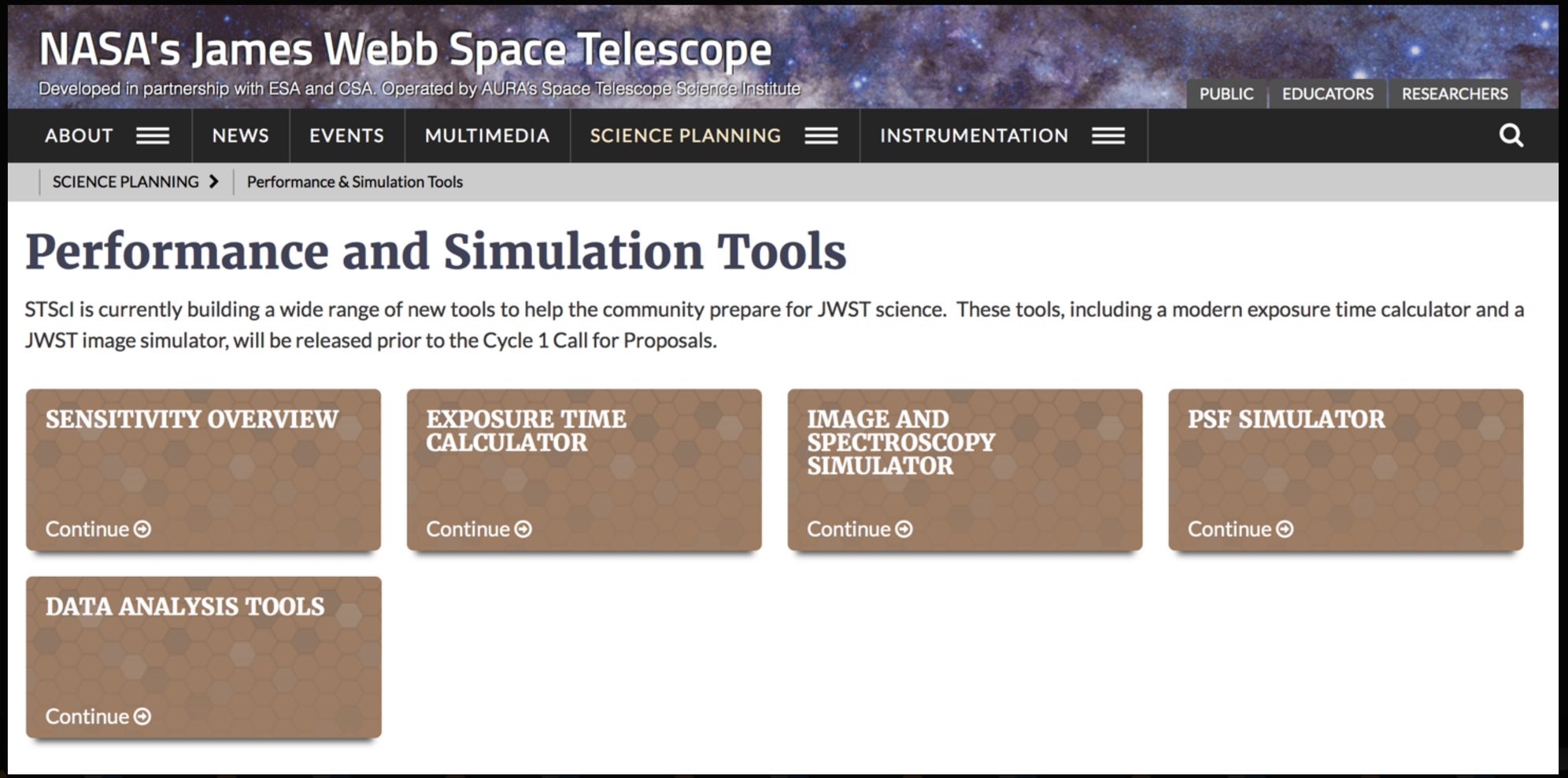
Calculation selected: 1, **Mode:** miri mrs

Report | Warnings | Errors | Downloads

Instrument Filter/Disperser:	null/long
Extraction Aperture Position (arcsec):	[0.00, 0.00]
Wavelength of Interest used to Calculate Scalar Values (microns):	26.00
Size of Extraction Aperture (arcsec):	1
Total Time Required for Observation (seconds):	6660.00
Total On-Source Time (seconds):	3330.00
Extracted Flux (e-/sec):	15.14
Variance in Extracted Flux (e-/sec):	0.54
Extracted Signal-to-Noise ratio:	28.15
Input Background Surface Brightness (MJy/sr):	1737.12
Total Background Flux in Extraction Aperture (e-/sec):	262.47
Sky Background Flux in Extraction Aperture (e-/sec):	262.47
Fraction of Total Background due to Signal From Scene:	0.00
Average Number of Cosmic Rays per Ramp:	0.04

Webb Performance Estimation Tools

Data Reduction, Analysis, and Interpretation = Brilliant Paper

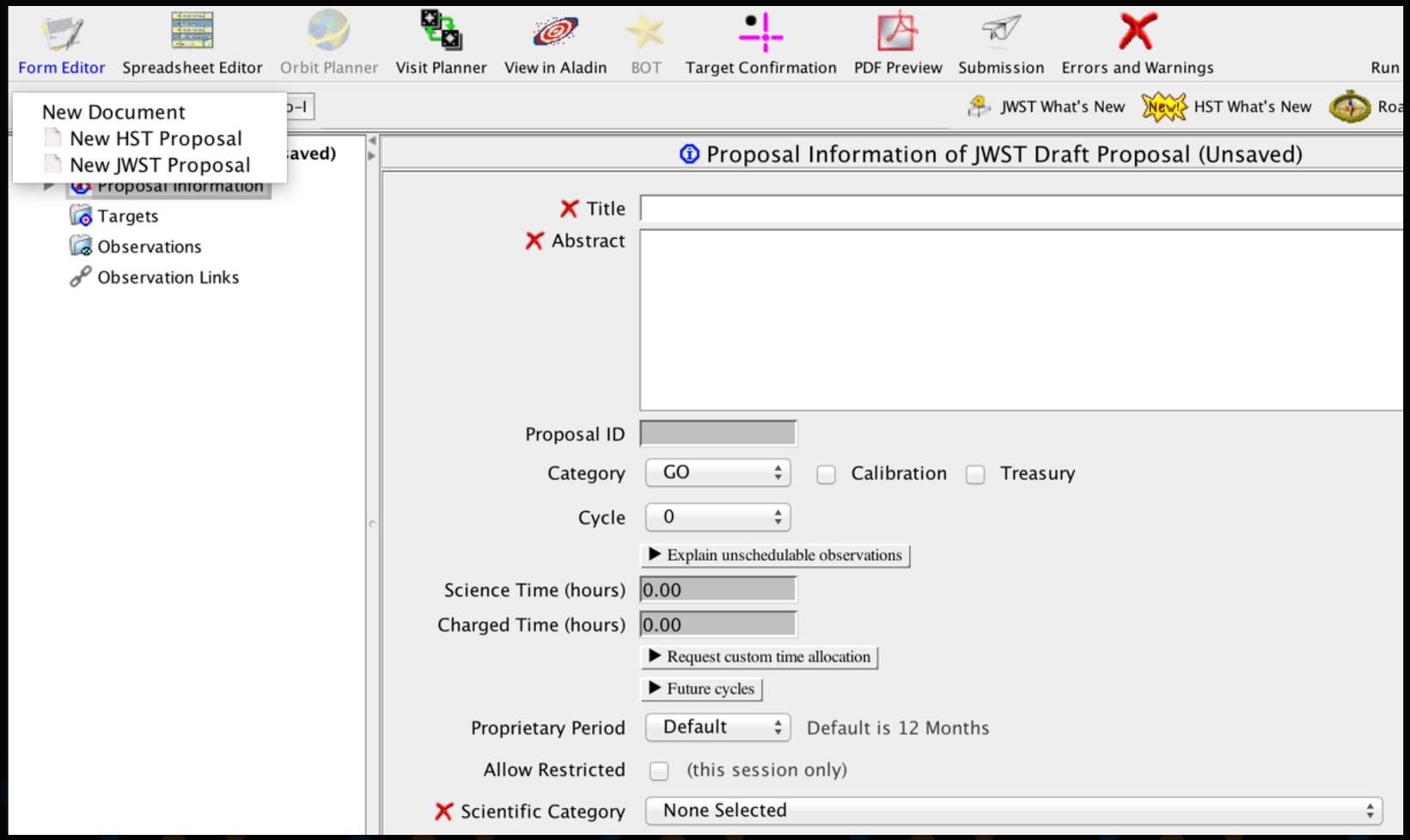


jwst.stsci.edu/science-planning/performance-and-simulation-tools

Plan Your Observations/
Write Proposal

The Astronomer's Proposal Tool (APT)

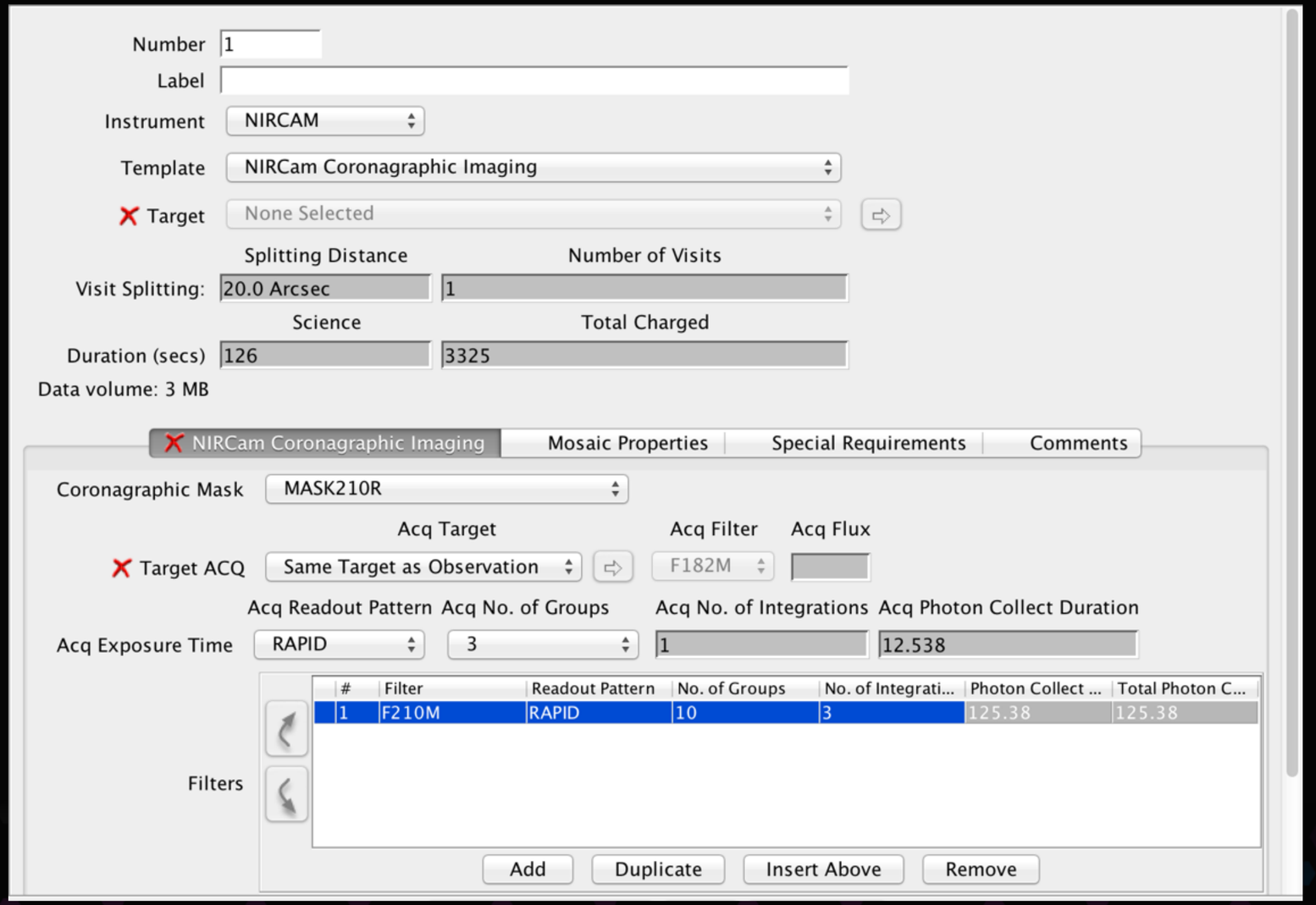
- Familiar to HST users
- To be used to define JWST observing programs and submit JWST proposals.
- Development releases of JWST APT available together with HST APT
  - http://www.stsci.edu/hst/proposing/apt



Plan Your Observations/
Write Proposal

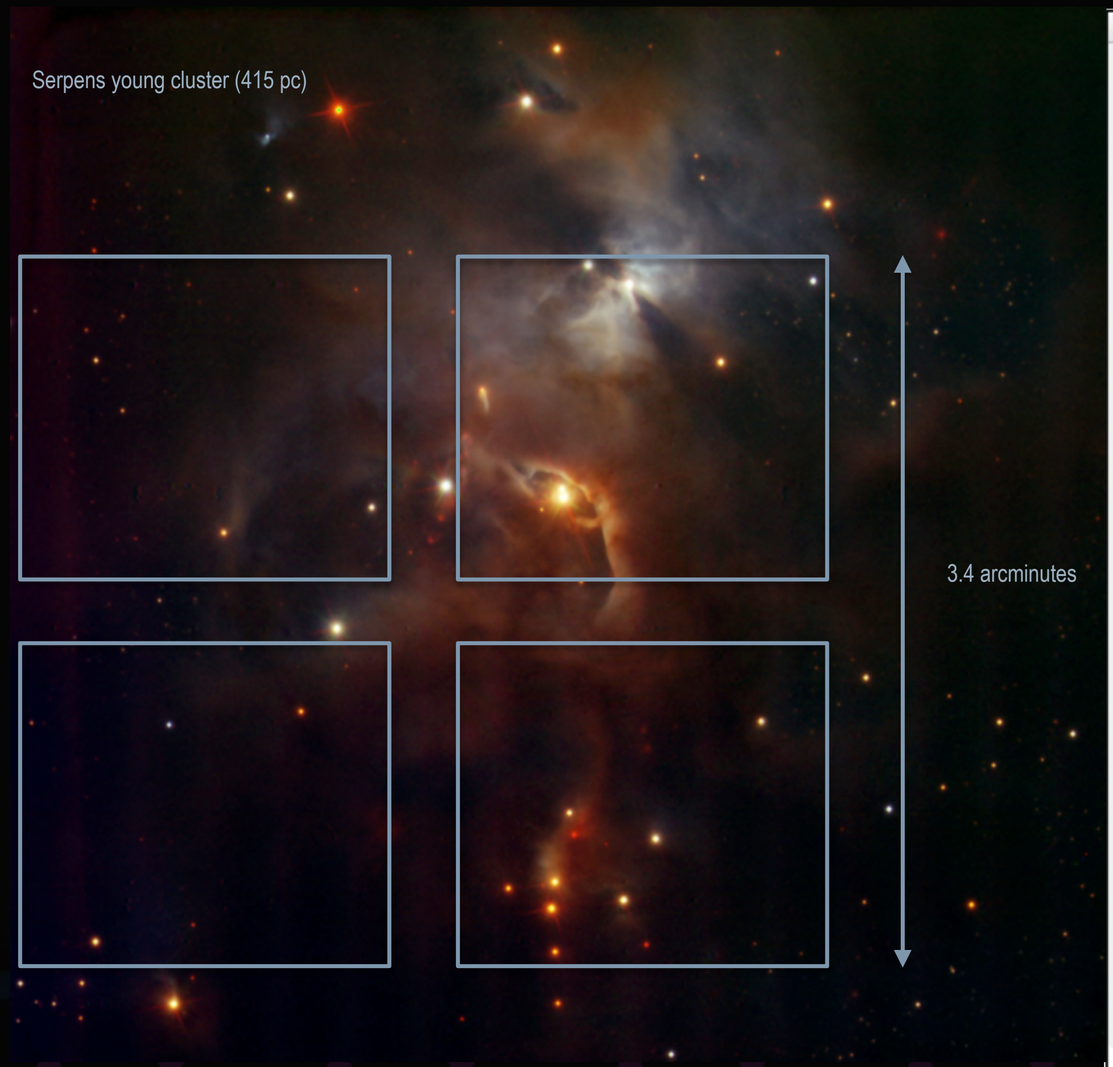
The Astronomer's Proposal Tool (APT)

- Similar to Spitzer, Herschel and Chandra (but unlike HST) JWST observations are defined by templates.
- Observing modes/strategies define the templates
  - e.g., MIRI imaging, NIRSpec IFU, NIRCam coronagraphy,...
- Requires only necessary information
- Automatically splits observations into visits (sequences using a single guide star) and exposures.



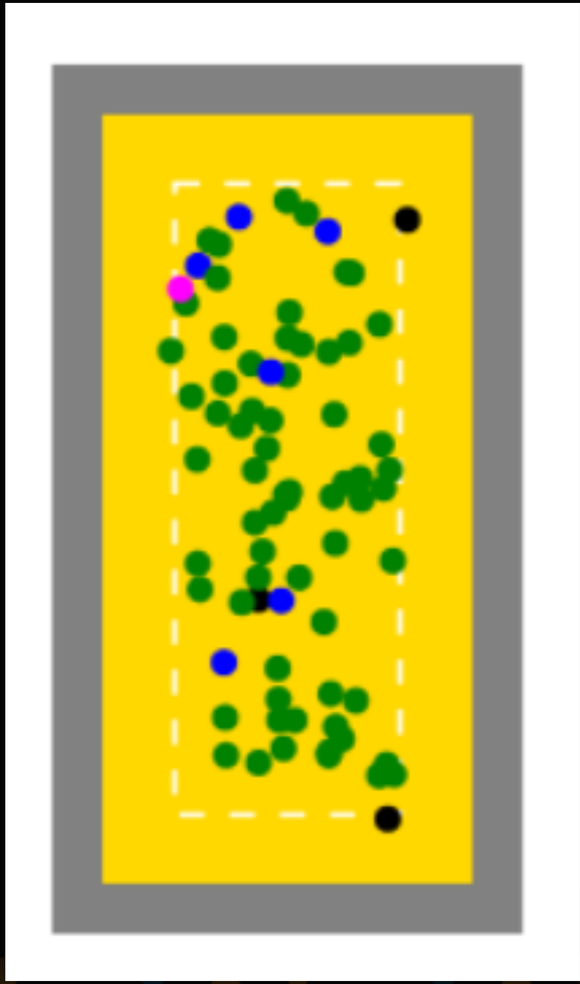
Plan Your Observations/
Write Proposal

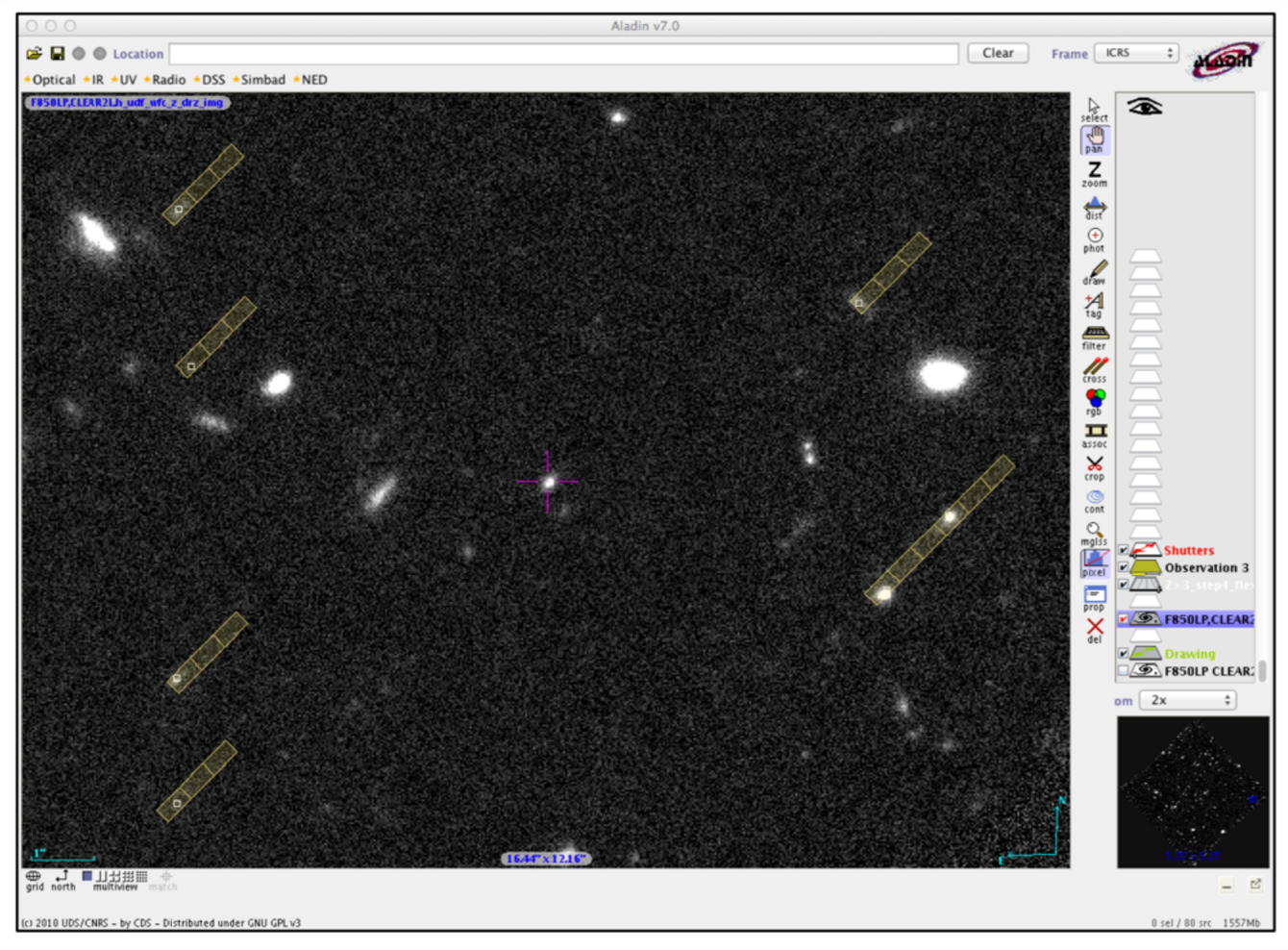
The Micro-shutter Arrays Planning Tool (MPT)



Plan Your Observations/
Write Proposal

The Micro-shutter Arrays Planning Tool (MPT)



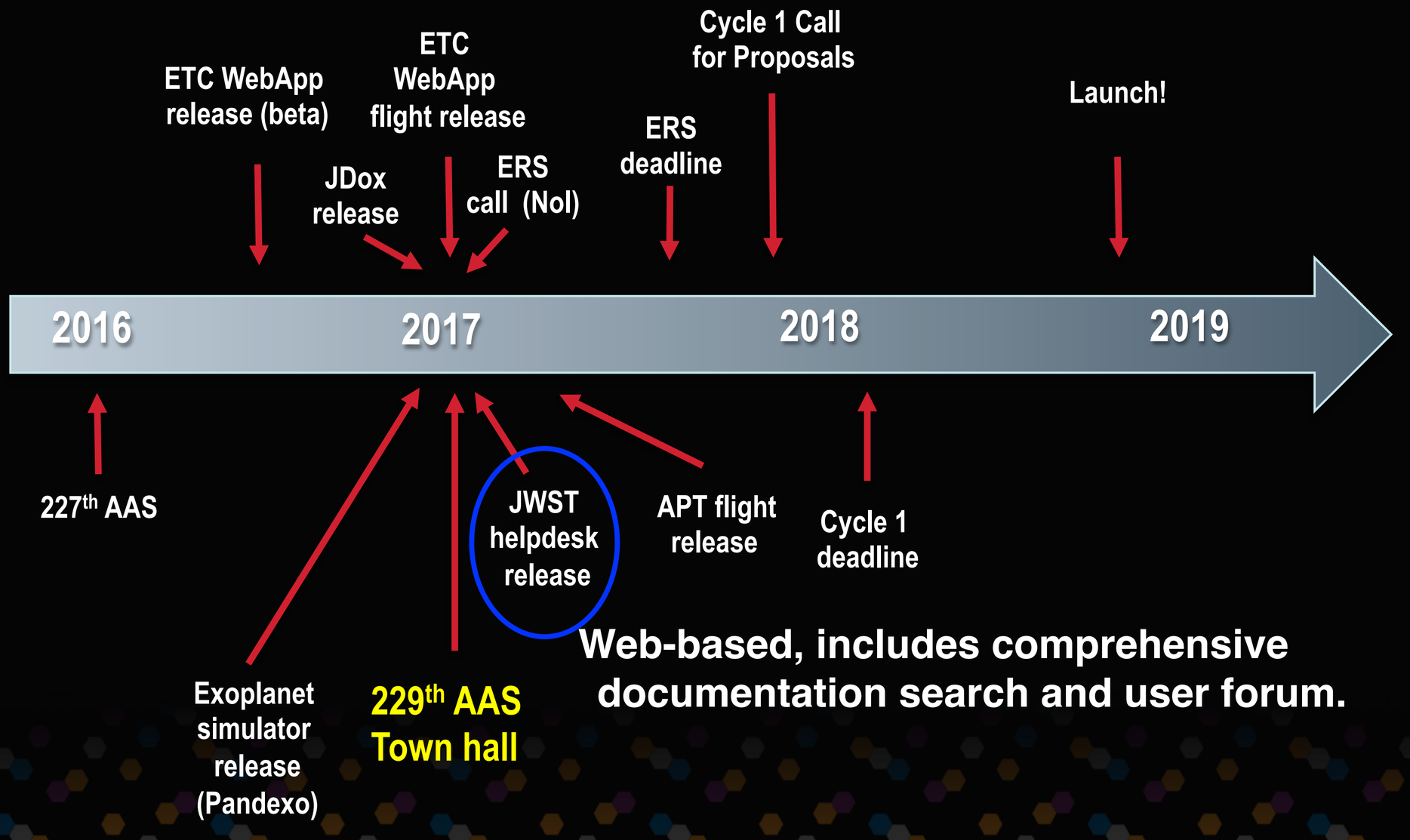


Learn more about *Webb* Capabilities.

Webb Performance Estimation Tools

Plan Your Observations/ Write Proposal

Timeline For JWST Tools Releases



Web-based, includes comprehensive documentation search and user forum.

Submit Your Brilliant Proposal and Hope for Best

Celebrate and Wait For Observations

STScI Operations Flow

Proposal Preparation

PPS

Proposal Selection

Science Planning

Operations Scheduling

Flight Operations

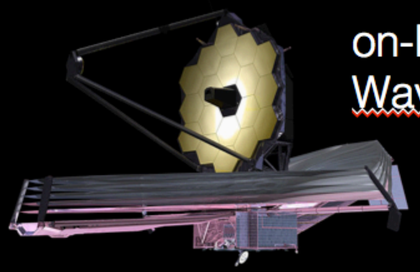
FOS

DMS

Data Processing and User Tools

Data Archiving

on-board scripts (OSS)
Wavefront sensing (WFSC)



Education and Public Outreach

Observations Processed by *Webb* Pipeline

The *Webb* Pipeline Architecture

Pipeline Availability

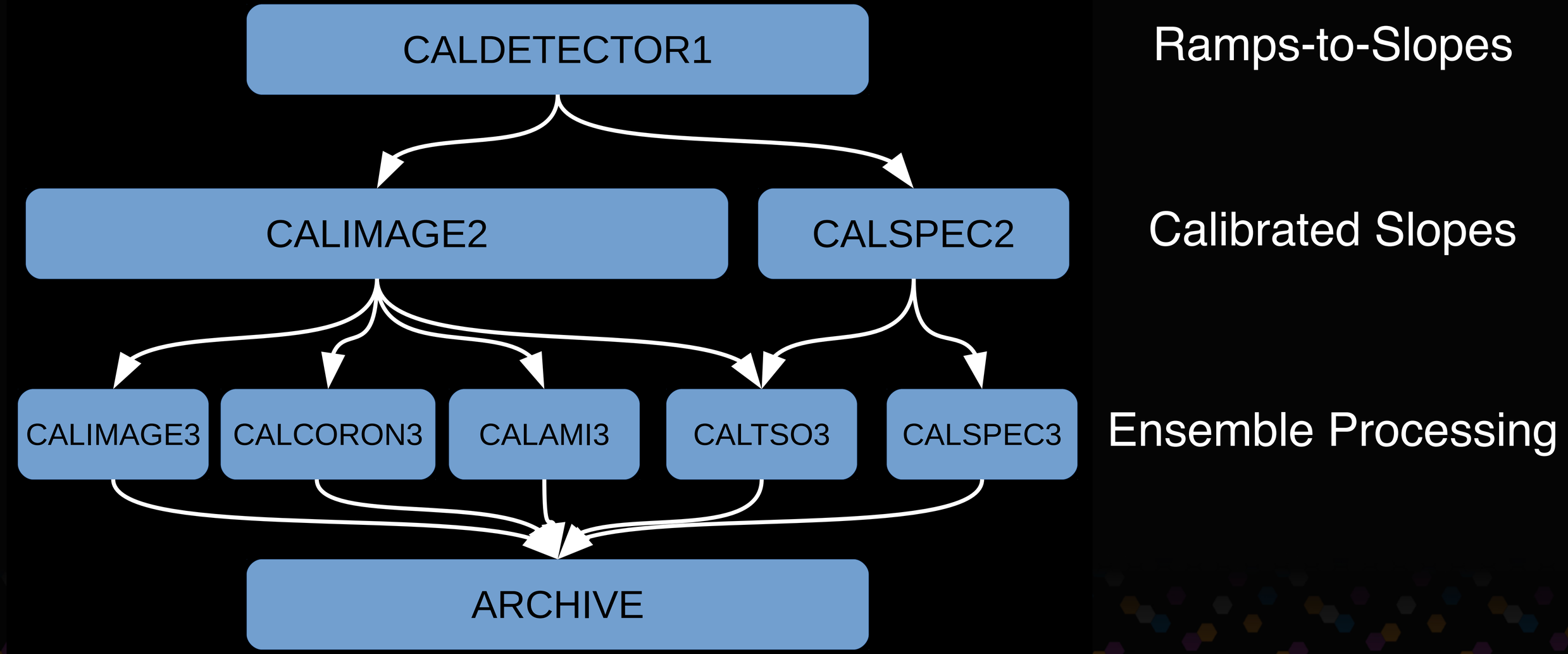
- Written in python
- Freely available
- Easily configurable
- Users can rerun all or part of the pipeline
- Users can replace specific modules
- Hosted on github
- Based on astropy

Data Products

- Raw data
- Intermediate stage data
- Final data
  - Best quality from an automated pipeline
  - “browse-quality” data in Spitzer-speak
  - Flux, wavelength, and position calibrated
- Any user can rerun the pipeline offline
  - Changed parameters to specific steps
  - Replace a step with a user written version

Observations Processed by *Webb* Pipeline

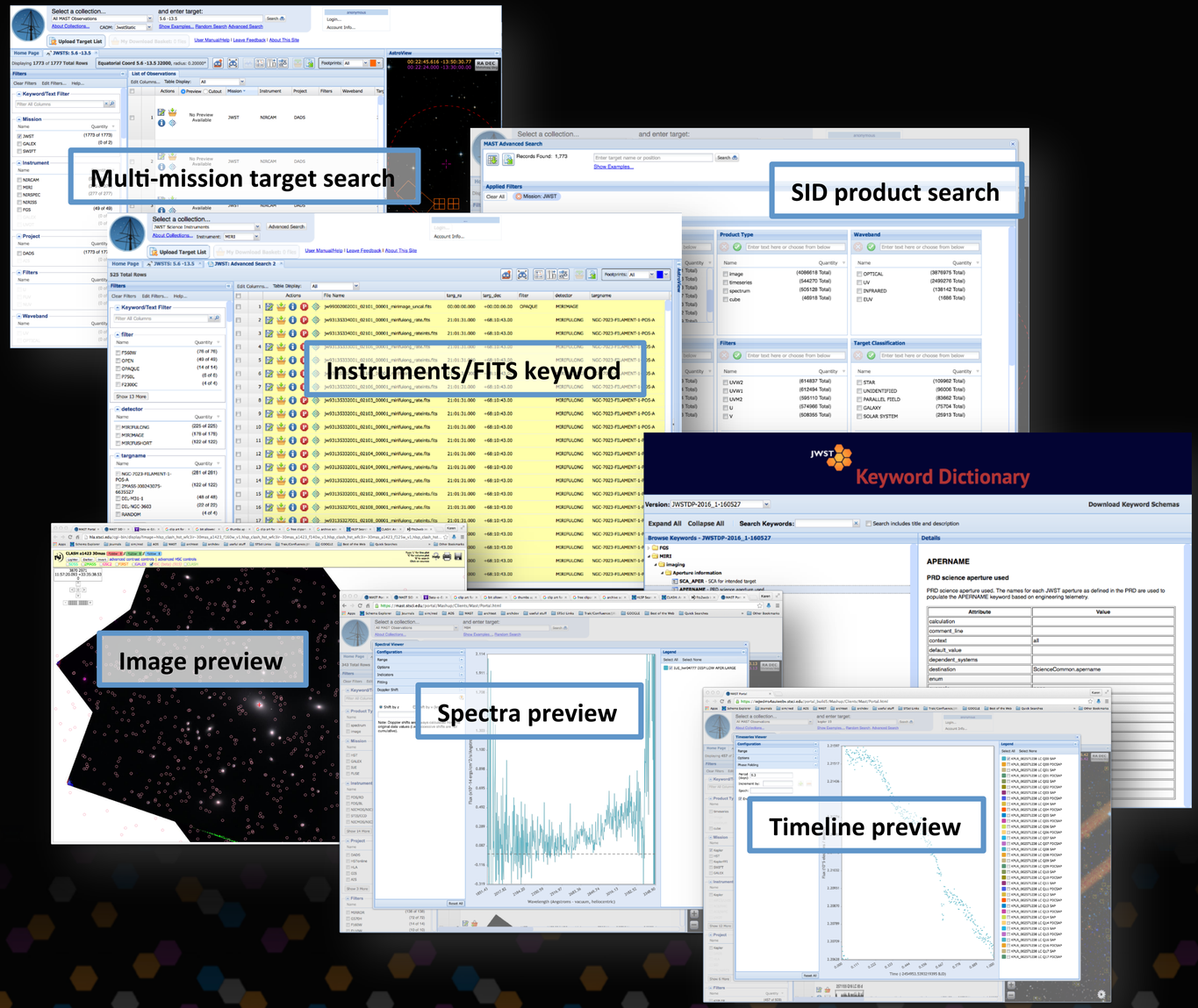
The *Webb* Pipeline Architecture



Processed Data Delivered to MAST Archive

The MAST Archive in the Era of JWST

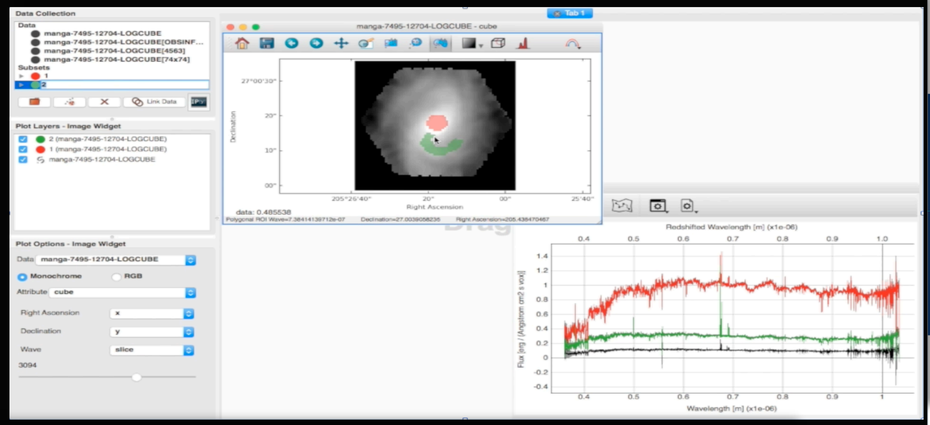
- Common Archive Observation Model (CAOM)
- JWST-specific views
- Distribution (URL & Curl-scripts)
- Subscription Service
- High Level Science Products (HLSP)
- Digital Object Identifier (DOI): Linking Data to Papers
  - Starting with AAS journals

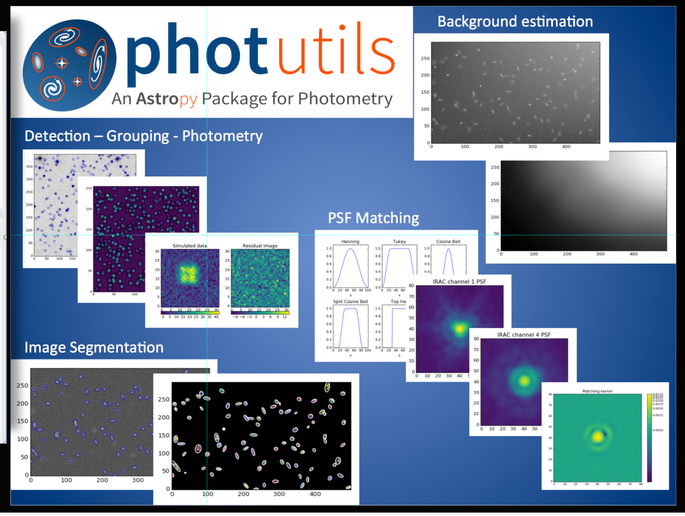


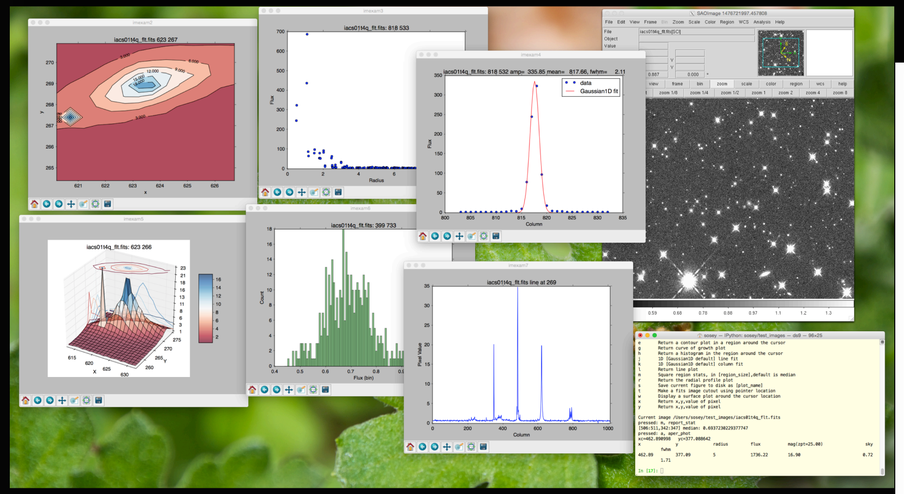
Data Reduction, Analysis, and Interpretation = Brilliant Paper

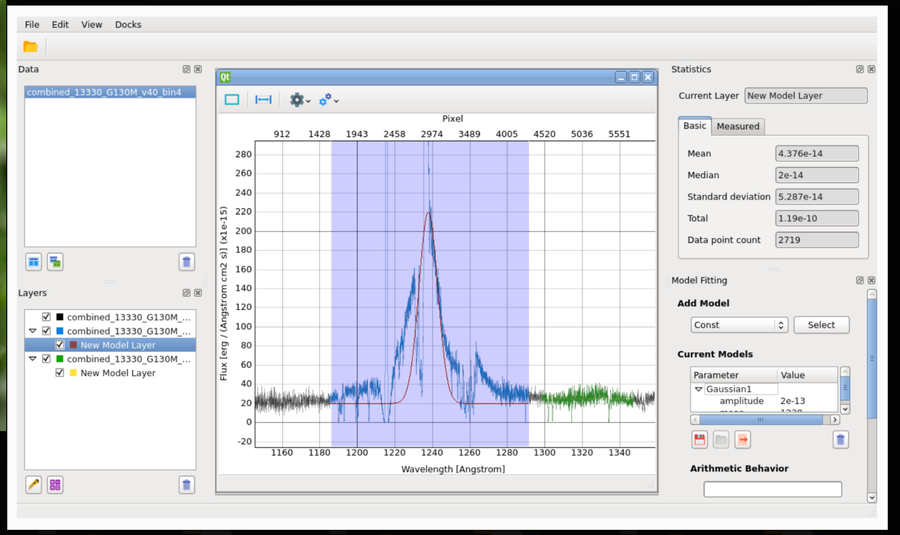
JWST Data Analysis Tools

- Flexible, Modular tools
- In Python
- Supporting JWST data structures
- Simple installation









Please take a short survey:
http://bit.do/jwstDA

Data Reduction, Analysis, and Interpretation = Brilliant Paper

JWST Data Analysis Tools

- Training workshops
  - STScI
  - AAS
- Easy installation with AstroConda
- Extensive online documentation

webcast.stsci.edu

User Training in JWST Data Analysis II

Training Workshop • November 8th

The second "User Training in JWST Data Analysis" workshop will be held on November 8-11, 2016 at the Space Telescope Science Institute (STScI). The purpose of this three-day meeting is to provide training in the the open-source data analysis tools being developed at STScI for use with the James Webb Space Telescope (JWST), as well as for many other optical/IR observatories.

Welcome to AstroConda's documentation!

AstroConda is a free software repository maintained by the Space Telescope Science Institute (STScI) in Baltimore, Maryland. This repository provides tools and utilities commonly used by the community.

How do I get ready for JWST? Participate in our training events!

Today!! -> jwst.stsci.edu/news

JWST Community Engagement: Navigating and Preparing for Cycle 1 DD-ERS and GO Proposals

Proposal Planning Workshops

Topical Science Workshops

Condensed 0.5-1 Day Add-on Workshops

Webinars & Video Libraries

Proposal Planning Workshops

Topical Science Workshops

Condensed 0.5-1 Day Add-on Workshops

- More than a dozen in-person workshops and events occurring between now and January 2018!
- All events to be webcast and/or recorded to enable remote participation.
- Some events will support ‘Ask-an-Expert’ help desk
- Opportunities at events for discussion of DD-ERS programs among community members

Full Schedule:
https://jwst.stsci.edu/science-planning

Issue 3: newsletter.stsci.edu

Proposal Planning Workshops

Topical Science Workshops

Condensed 0.5-1 Day Add-on Workshops

Just a Sample of Upcoming Events!

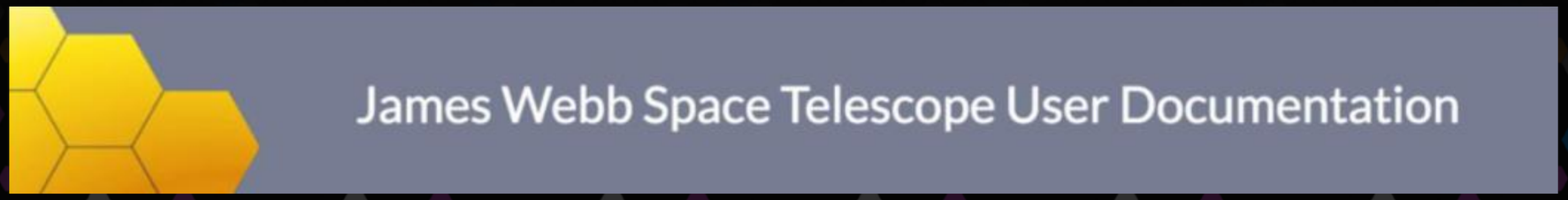
18-20 Jan 2017	JWST Nearby Galaxies Workshop (Pasadena, CA)	Capabilities; Proposal and Planning
20-24 Mar 2017	Science with Hubble and JWST V (Venice, Italy)	Capabilities; Proposal and Planning; Data Analysis
15-17 May 2017	JWST Proposal and Planning Workshop (Baltimore, MD)	Capabilities; Proposal and Planning; On-site help desk
4-8 Jun 2017	American Astronomical Society 230th Meeting (Austin, TX)	Proposal and Planning; Ask-an-expert
10-12 Jul 2017	Planning Transiting Exoplanet Science with JWST (Baltimore, MD)	Capabilities; Proposal and Planning
10-12 Jul 2017	Galaxies Throughout Cosmic Time with JWST (Baltimore, MD)	Capabilities; Proposal and Planning
4-6 Oct 2017	Mastering the Science Instruments and the Observing Modes of JWST: Get Set (location TBD)	Proposal and Planning; Ask-an-expert
15-20 Oct 2017	Division of Planetary Science 49th Meeting (Provo, UT)	Capabilities; Proposal and Planning; Ask-an-expert

Webinars & Video Libraries

Webinars (~1 hour) with both topical and tool specific focus are on going with many planned for Fall 2016 and beyond

https://confluence.stsci.edu/display/JWSTLC/JWST+Community+Lectures

- 1+ lectures per month
- Since announcement in early September, more than 170 individuals have subscribed
- Video recordings to be fully integrated with science planning website and JDOX



Webinars & Video Libraries

10/4/16 11 am ET	Christine Chen (STScI)	Imaging with the James Webb Space Telescope	Video Abstract Slides
10/18/16	Laurent Pueyo (STScI)	Preparing a JWST Coronagraph Proposal	Video Abstract Slides
11/1/16 11 am ET	David Law (STScI)	The NIRSpec and MIRI IFUs	Video Abstract Slides
11/15/16	Karl Gordon (STScI)	Absolute Flux Calibration	Video Abstract Slides
11/29/16	Jay Anderson (STScI)	Astrometric Calibration	Video Abstract Slides
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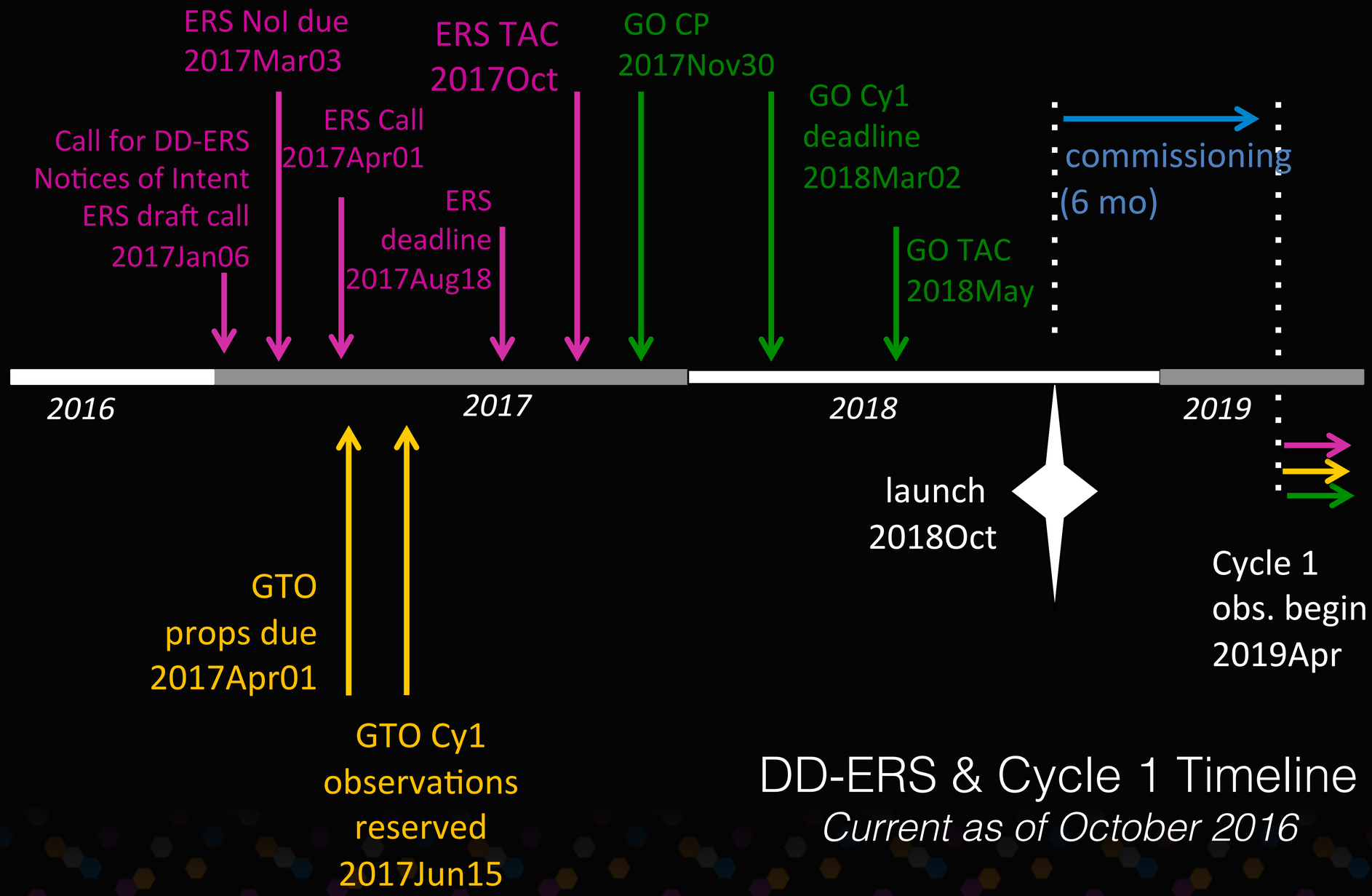

DD-ERS & Cycle 1 Timeline

Current as of October 2016