# Introduction to APT for JWST

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# JWST Astronomer's Proposal Tool (APT)

- **APT overview**
  - JWST planning in APT
  - APT templates
  - Scheduling and smart accounting
  - Auxiliary tools

- **Starting a proposal in APT**
  - The APT GUI
  - APT usage basics

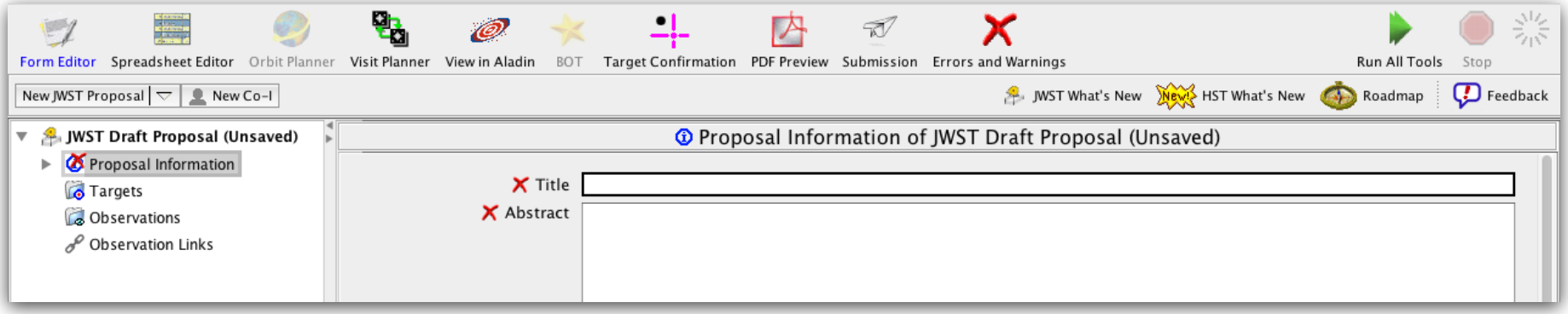
- **Instrument-specific examples**
  - NIRSpec IFS (Tim Rawle)
  - MIRI imaging (Maca Garcia Marin)
  - NIRCam mosaic imaging (Massimo Roberto)

  - NIRSpec MOS planning with MPT - see Giovanna's MPT talk later

# JWST planning in APT

- The **Astronomer's Proposal Tool** (APT) allows users to construct, validate and submit proposals for both HST and JWST

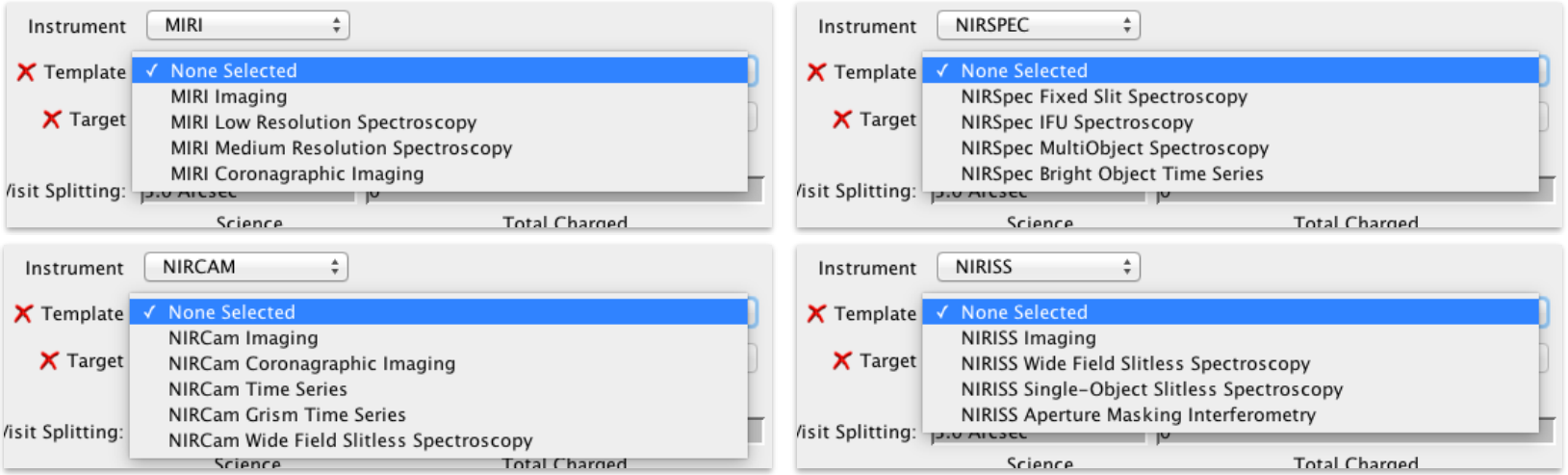
- Many of the higher level functions and characteristics of APT are common to both branches of the tool, and will be familiar to those who have previous submitted HST proposals
    - Look and feel of the user interface; entry of investigators; definition of targets; use of Aladin for visualisation; …




- However, the two missions have key differences which force APT to treat their proposals differently

# APT template approach

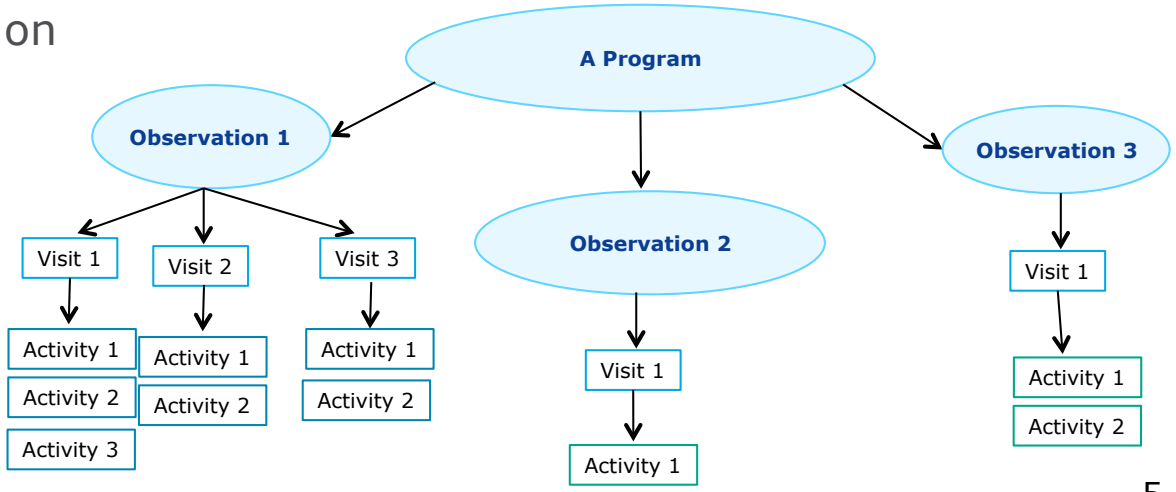
- **Observations** are entered into APT using **templates**
  - Each observing mode of each instrument has a specific template
  - Allows user to adjust all the relevant parameters
  - Hides any parameters that are not needed for that mode




- (Some) templates can be combined to allow parallel observations
  1) MIRI imaging / NIRCam imaging
  2) NIRCam imaging / NIRISS WFSS
  3) MIRI imaging / NIRISS WFSS
  4) NIRSpec MOS / NIRCam imaging (NIRSpec must be prime)
  5) NIRCam imaging / NIRISS imaging (NIRCam must be prime)

# APT terminology

- A program can contain several different **Observations**
- Each Observation can have one or more **Visits** (e.g. tiles of a mosaic)
- Each Visit contains one or more **Exposures** that can be obtained using a single **Guide Star**
  - If a new guide star is needed, then a new visit is created
  - A visit lasting more than 2 hours is split
- One visit can contain different activities
  - Each activity is "invoked" by a script
  - For instance, Target Acquisition is one activity, a set of dithered exposures in a single filter is another activity etc
- Users **do not** have control on how the visits are split
- Exposure time is limited to 10000s (except special cases: e.g. time series)
- Data volume also limited (APT gives warnings)



# Scheduling and "smart accounting"

- JWST schedules are based on the actual time required… not discrete viewing periods (e.g. HST orbits)
- JWST scheduling is **event driven**. User simply specifies the amount of time needed for their science
    - APT validates schedulability
    - APT calculates total science time and overheads

- The basic scheduling unit for planning are **visits**
    - APT automatically determines when to break the user-defined **observations** into multiple visits
    - Visits are not necessarily executed consecutively, but interleaved with activities from other programs in an optimised integrated timeline
    - Visits can be "linked" (either by the user, or in specific cases such as mosaics) to ensure that they do run back-to-back
    - User runs "**smart accounting**" prior to submission to update and optimise the overheads calculation based on the visits

- **APT Visit Planner** checks target visibility, guide star availability and any special requirements and gives feedback (warnings / errors) to the user prior to submission

# APT / ETC / MPT interfaces

- **Exposure Time Calculator (ETC)** is the primary tool users will need to calculate exposure specifications needed in APT
- Marco introduced ETC immediately prior to this presentation…
- No automatic transfer of values between APT / ETC (until at least Cycle 2)
- Preliminary planning in APT is recommended before finalising ETC calculations
    - ETC calculates at the "exposure level"; if APT observations includes dithers, need to use all exposures expected in ETC

- **MSA Planning Tool (MPT)** is the auxiliary tool for planning MSA configurations required for NIRSpec MOS observations
- Giovanna will introduce MPT after the next break
- MPT is loaded from, and automatically interfaces with, APT

# Target visibility tool

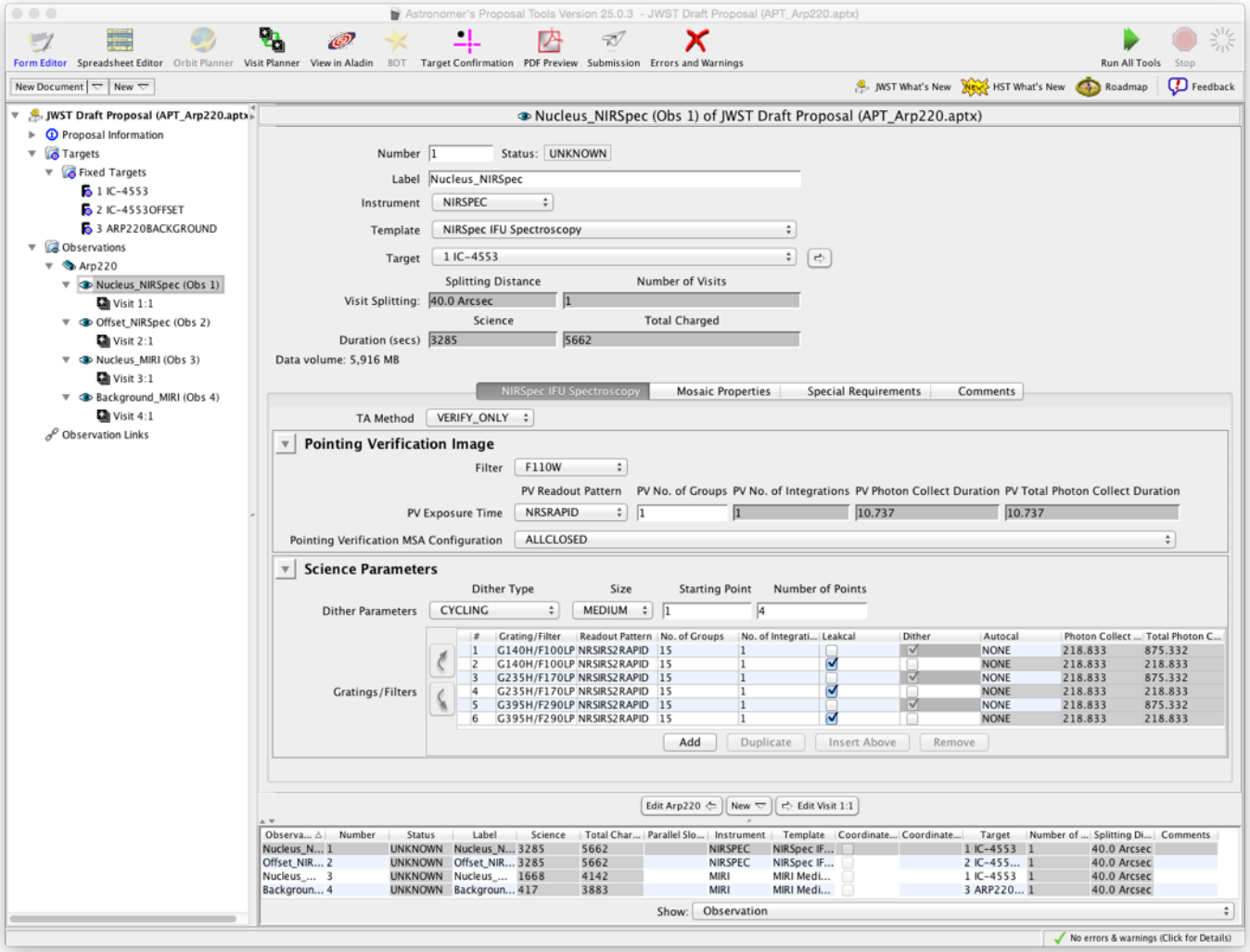
- APT does not give an overview of a target's visibility over time, or the availability of specific position angles
- For quick-look or pre-planning, stand-alone **target visibility tool** (TVT) provide
  - Visibility windows
  - Available position angles as a function of time

- Basic command line (python) tool distributed as part of STScI *AstroConda*

- Example usage:
  - After a ToO trigger, is the target visible to JWST now and how long can the monitoring last?
  - Scheduling possibilities for NIRCam pre-imaging and NIRSpec MOS
  - Feasibility of coronagraphic or long-slit observations that require specific angles and/or angular offsets
  - When planning a large mosaic, what position angles are possible?

- Marco introduced TVT immediately prior to this presentation…

# APT GUI overview



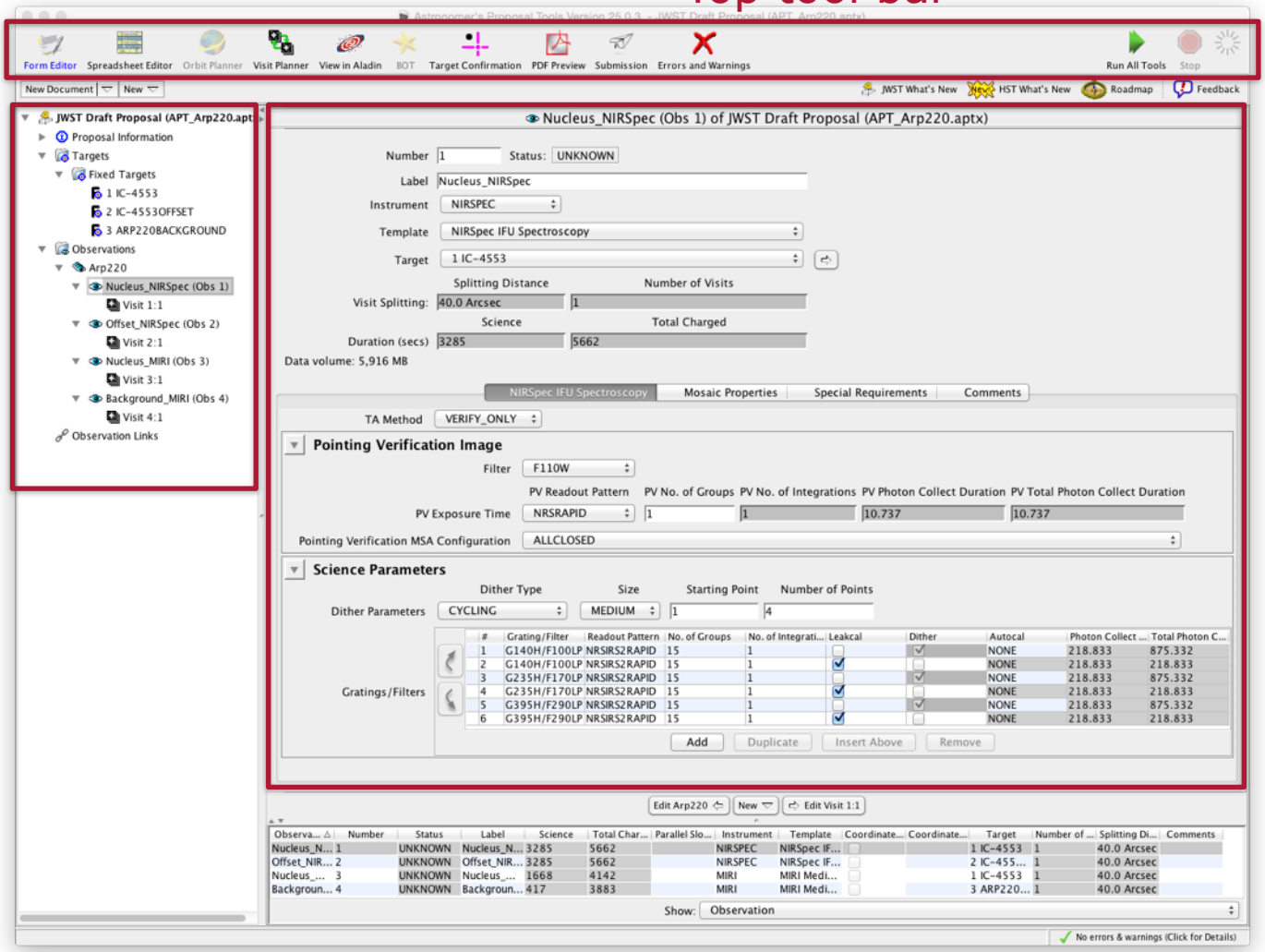

Download APT (current version 25.0.3): apt.stsci.edu

Help desk: jwsthelp.stsci.edu

# APT GUI overview

Top tool bar

Tree editor




Active GUI window

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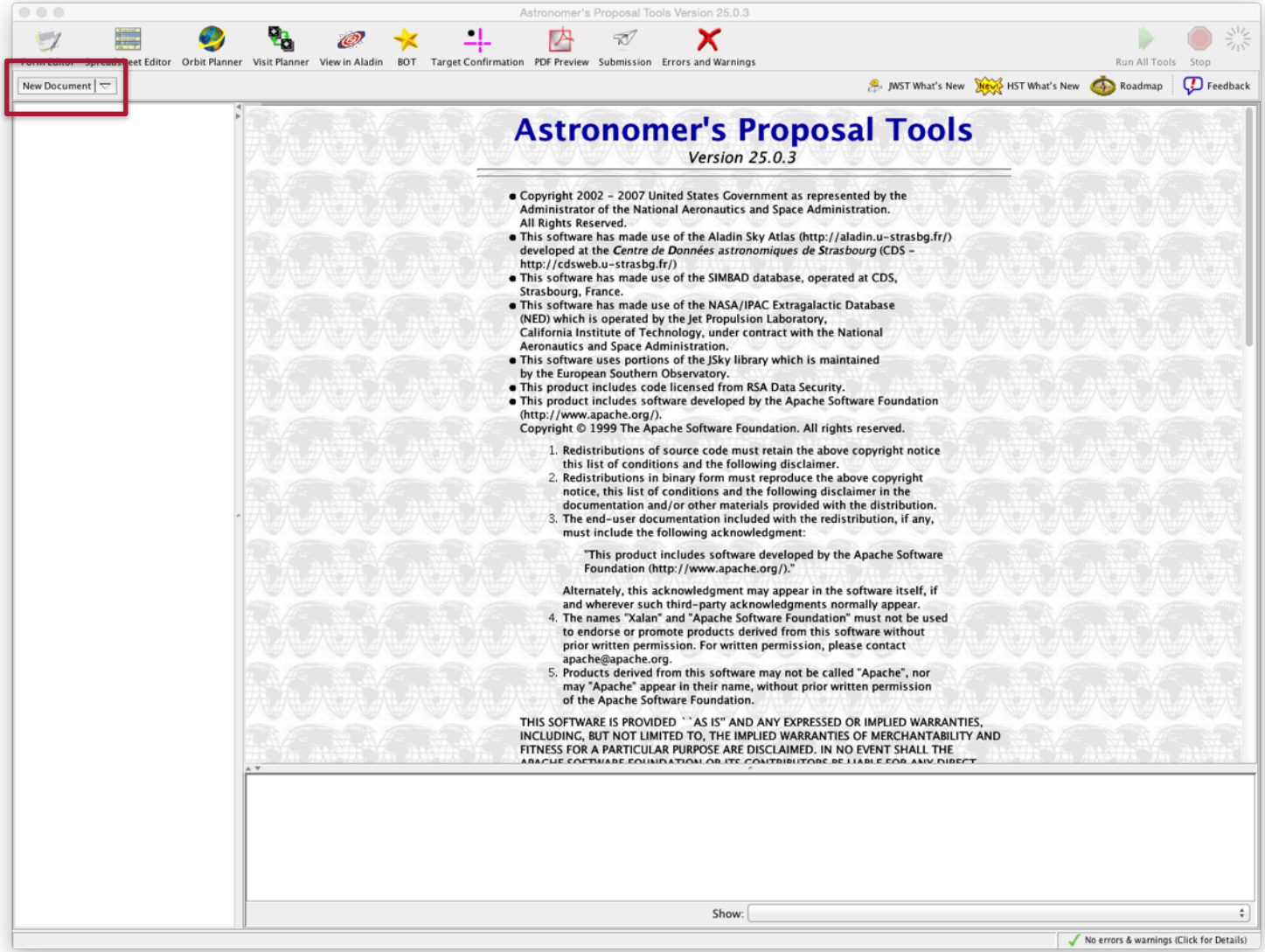
# Starting a JWST proposal in APT



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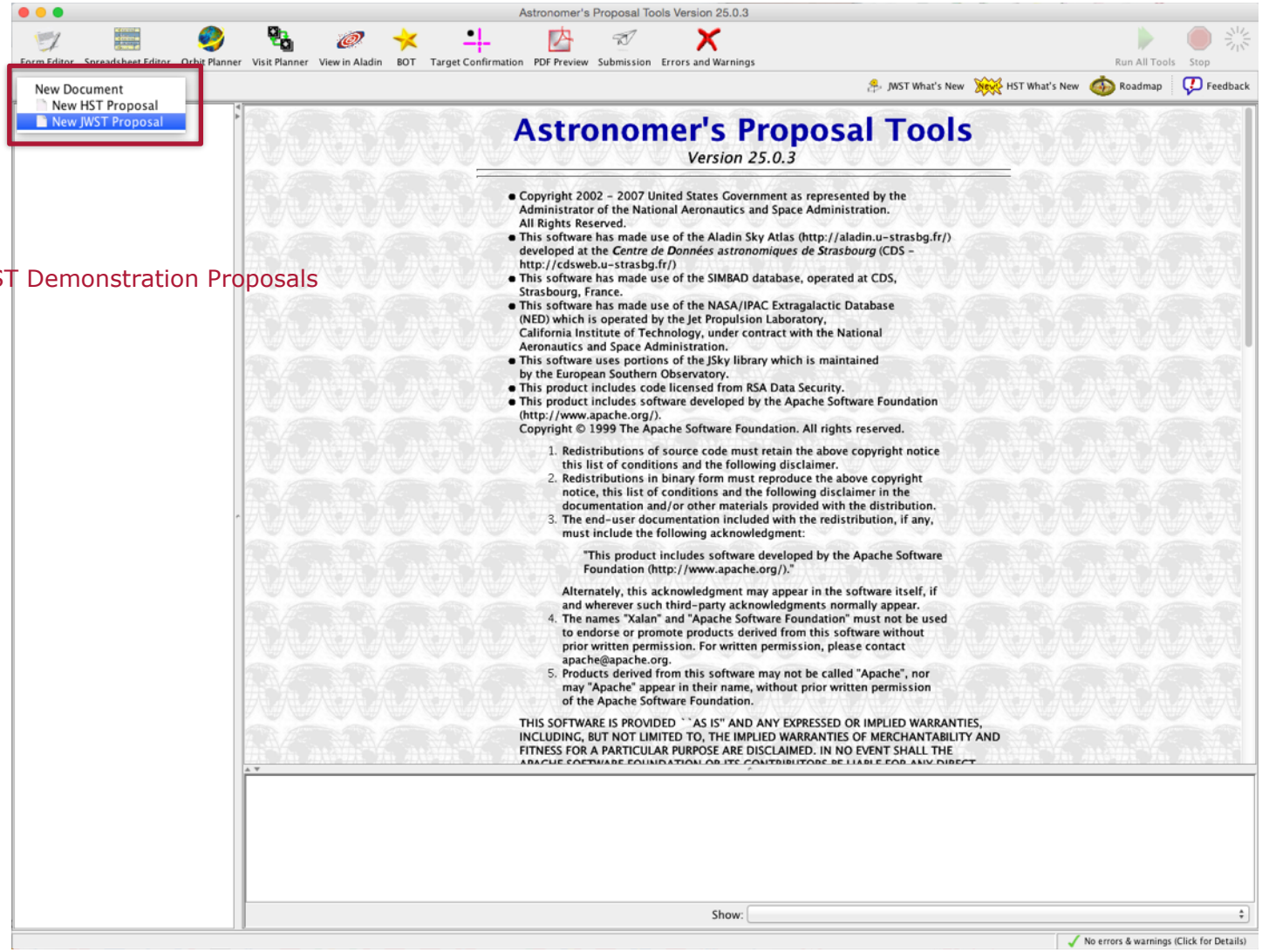
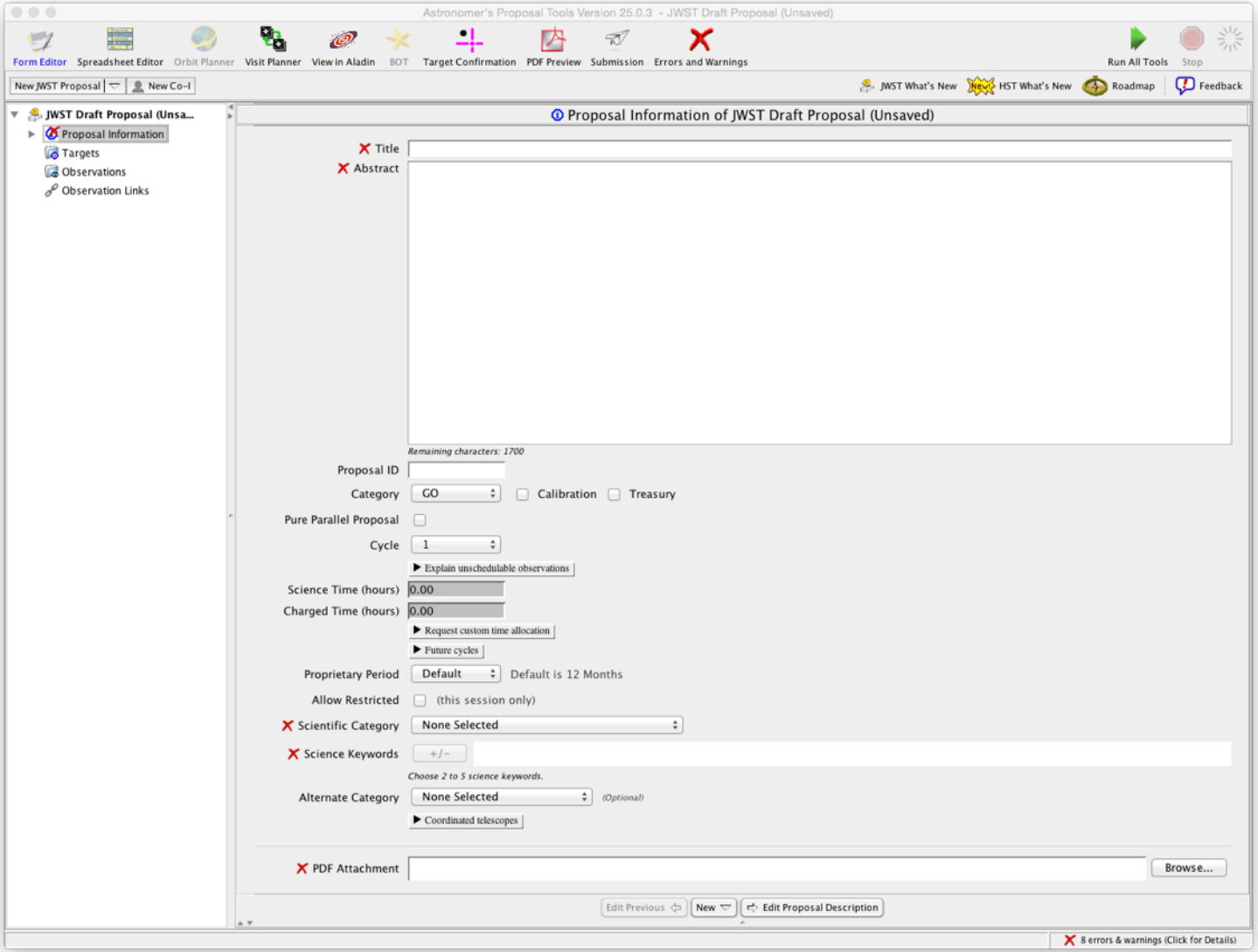



See also
File > JWST Demonstration Proposals

# Starting a JWST proposal in APT: proposal basics



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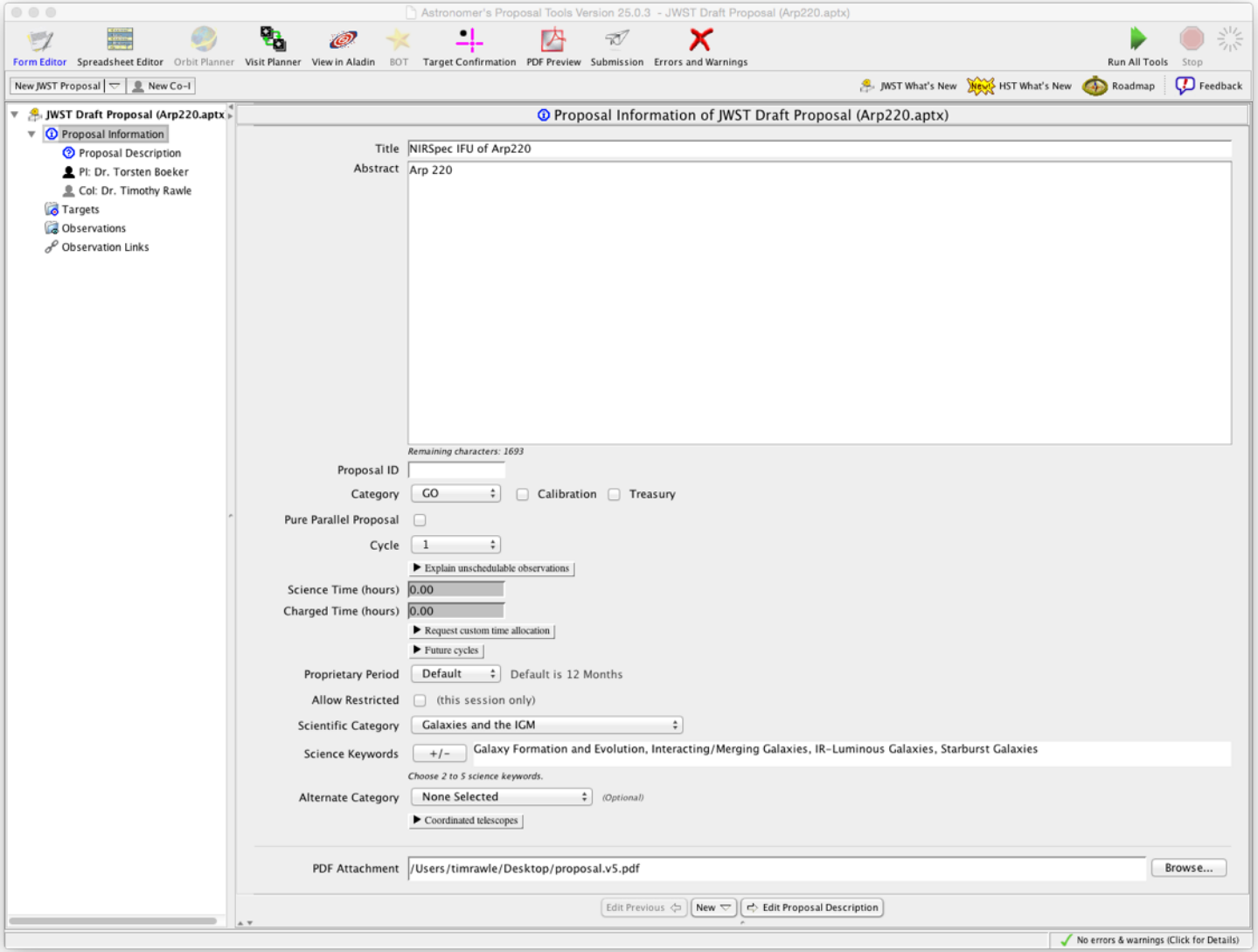
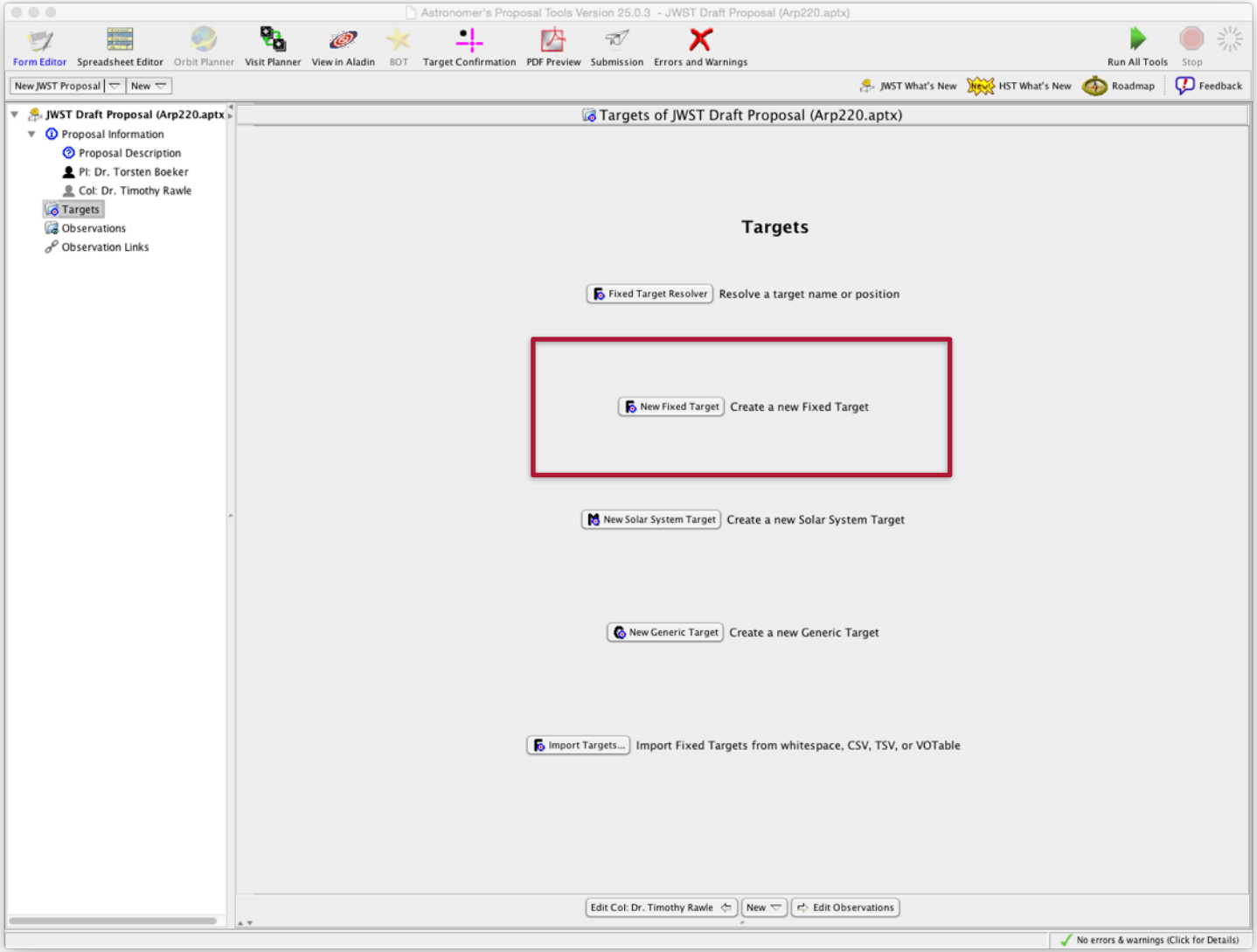


# Starting a JWST proposal in APT: targets



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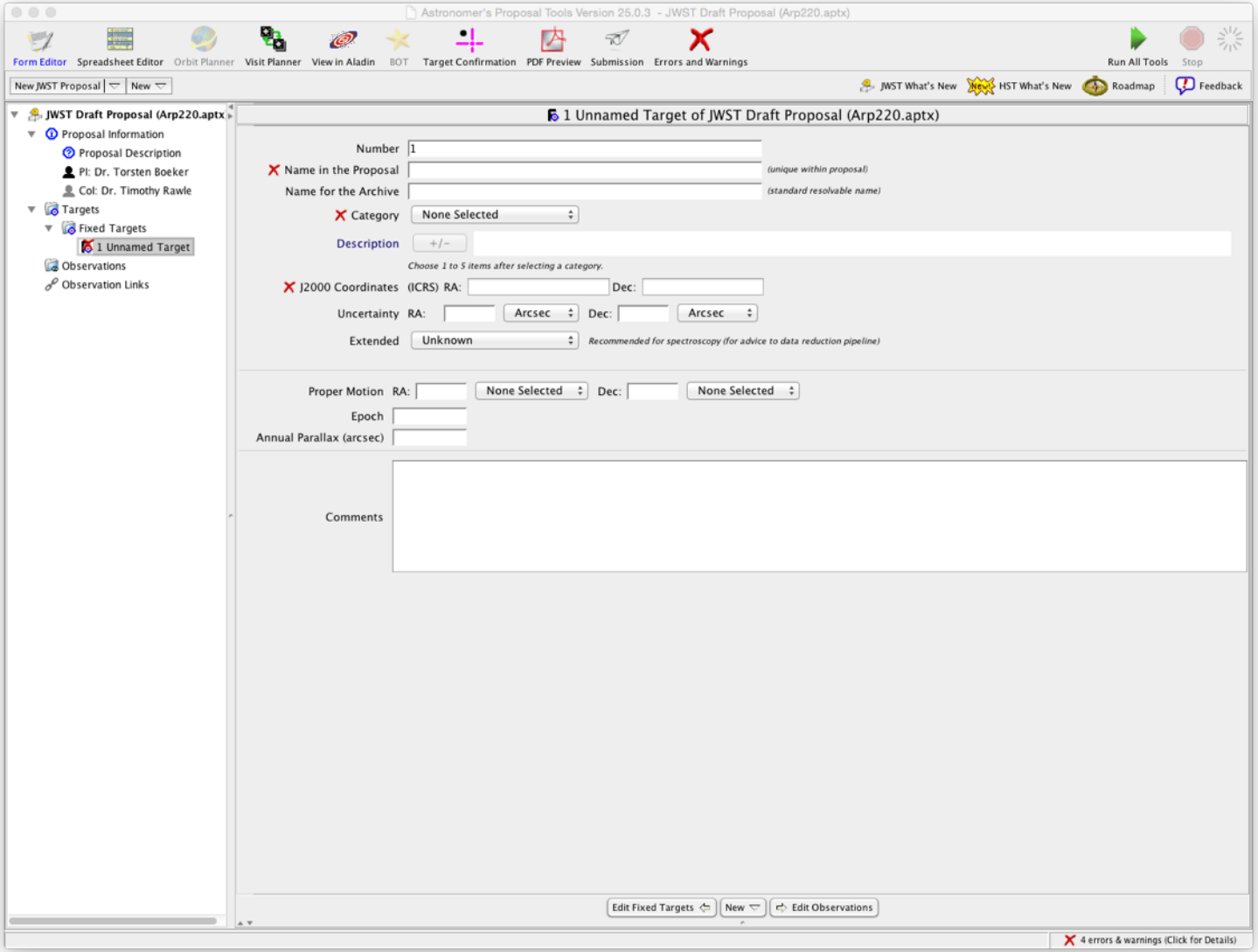

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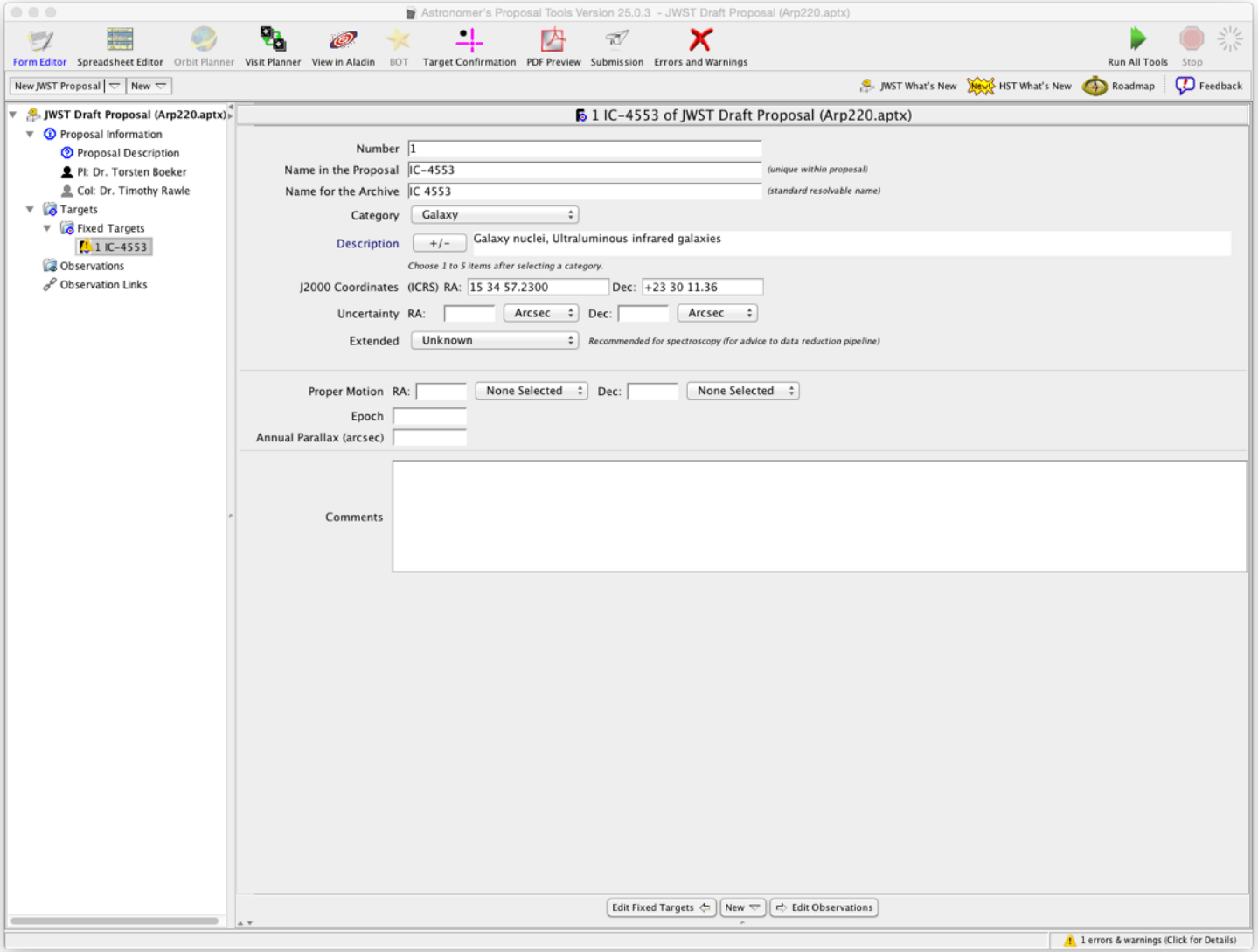
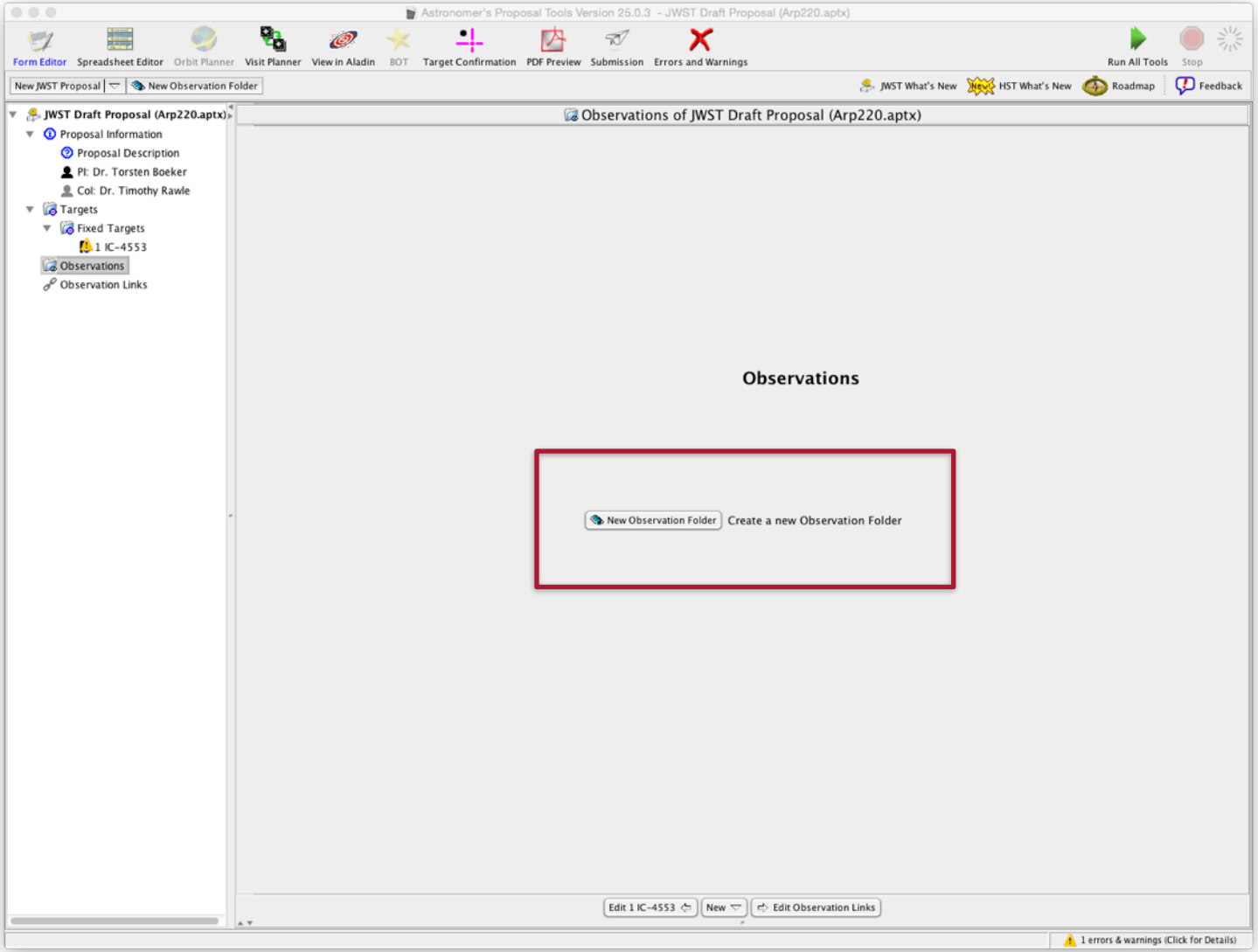


# Starting a JWST proposal in APT: observations



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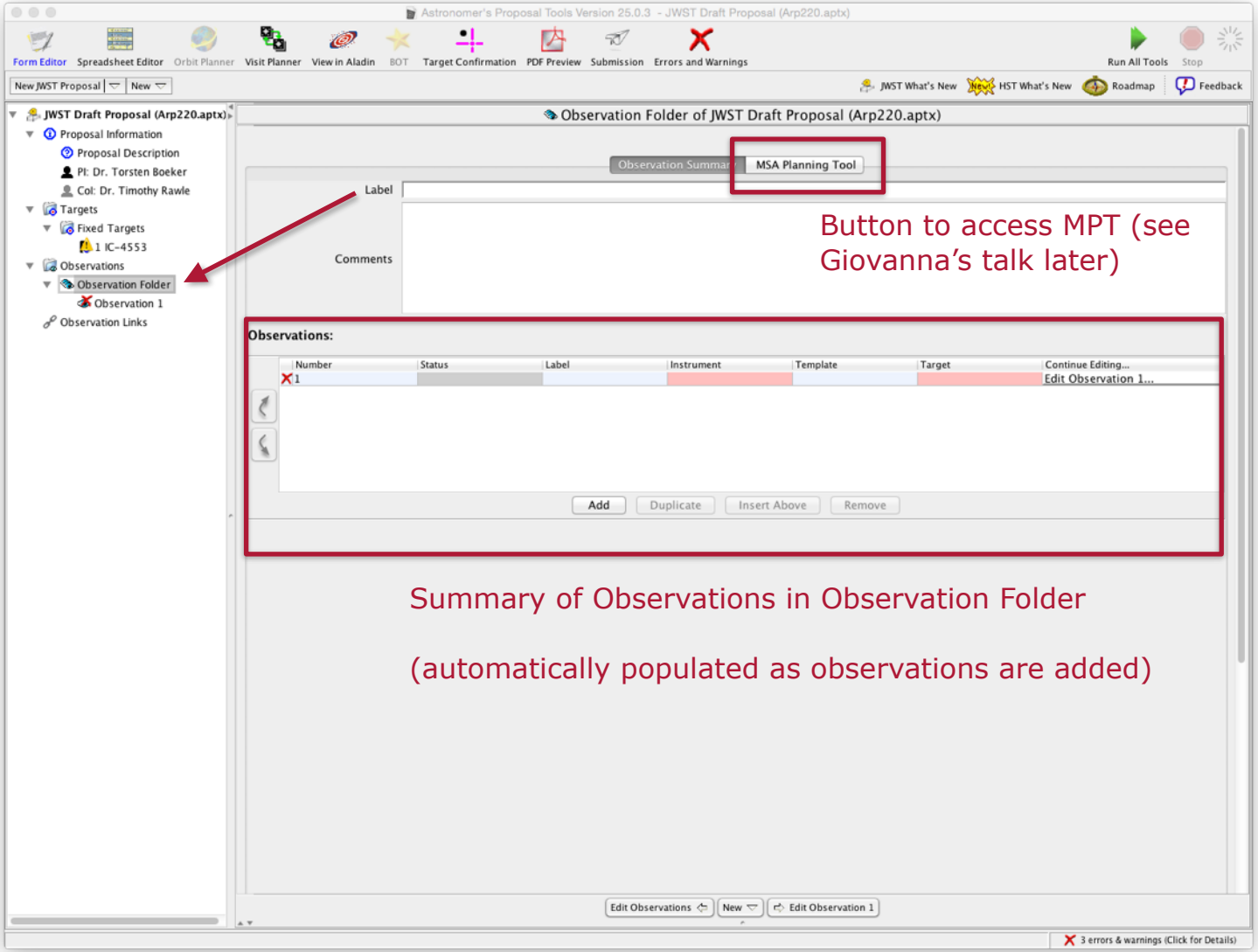
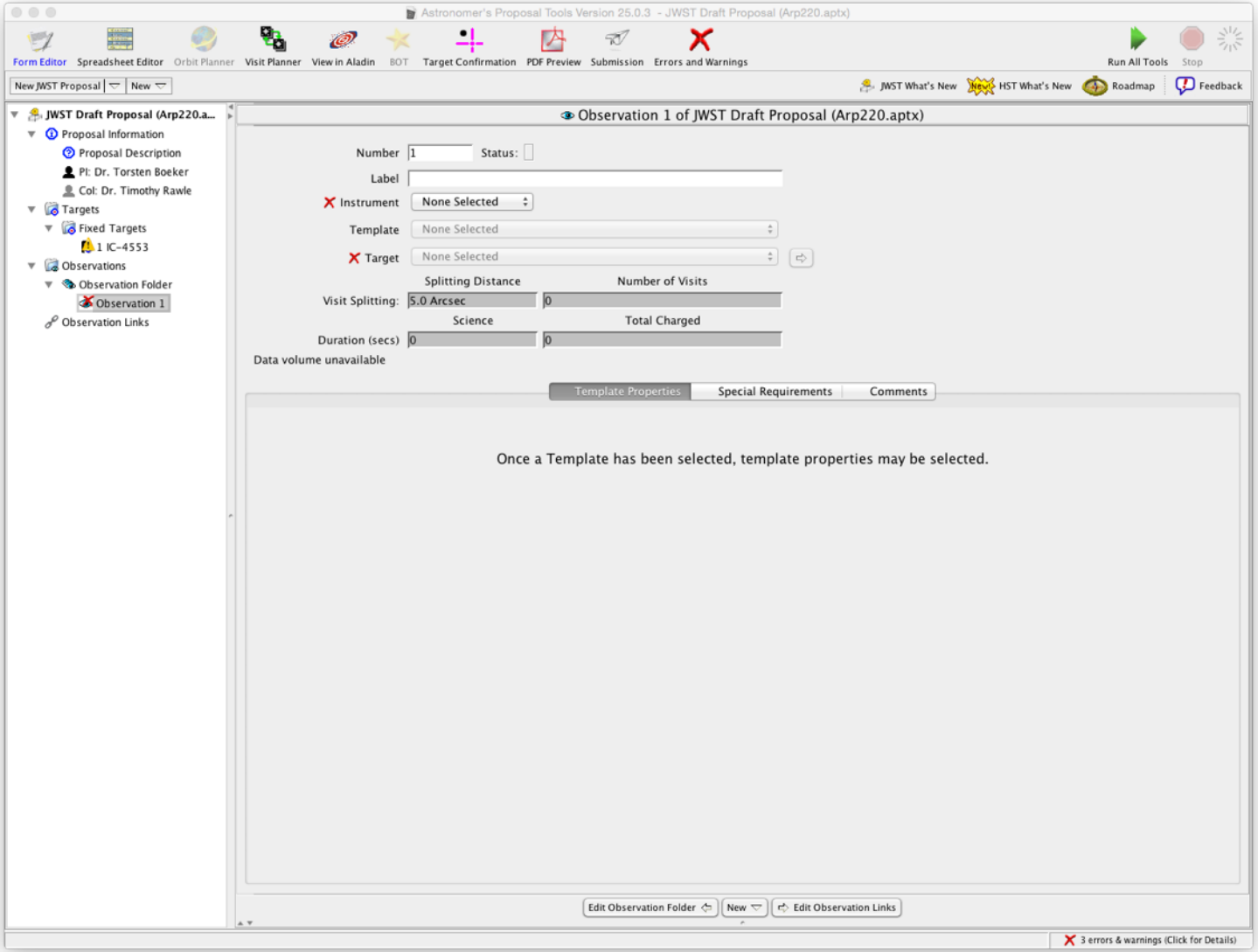


# NIRSpec IFU: observations



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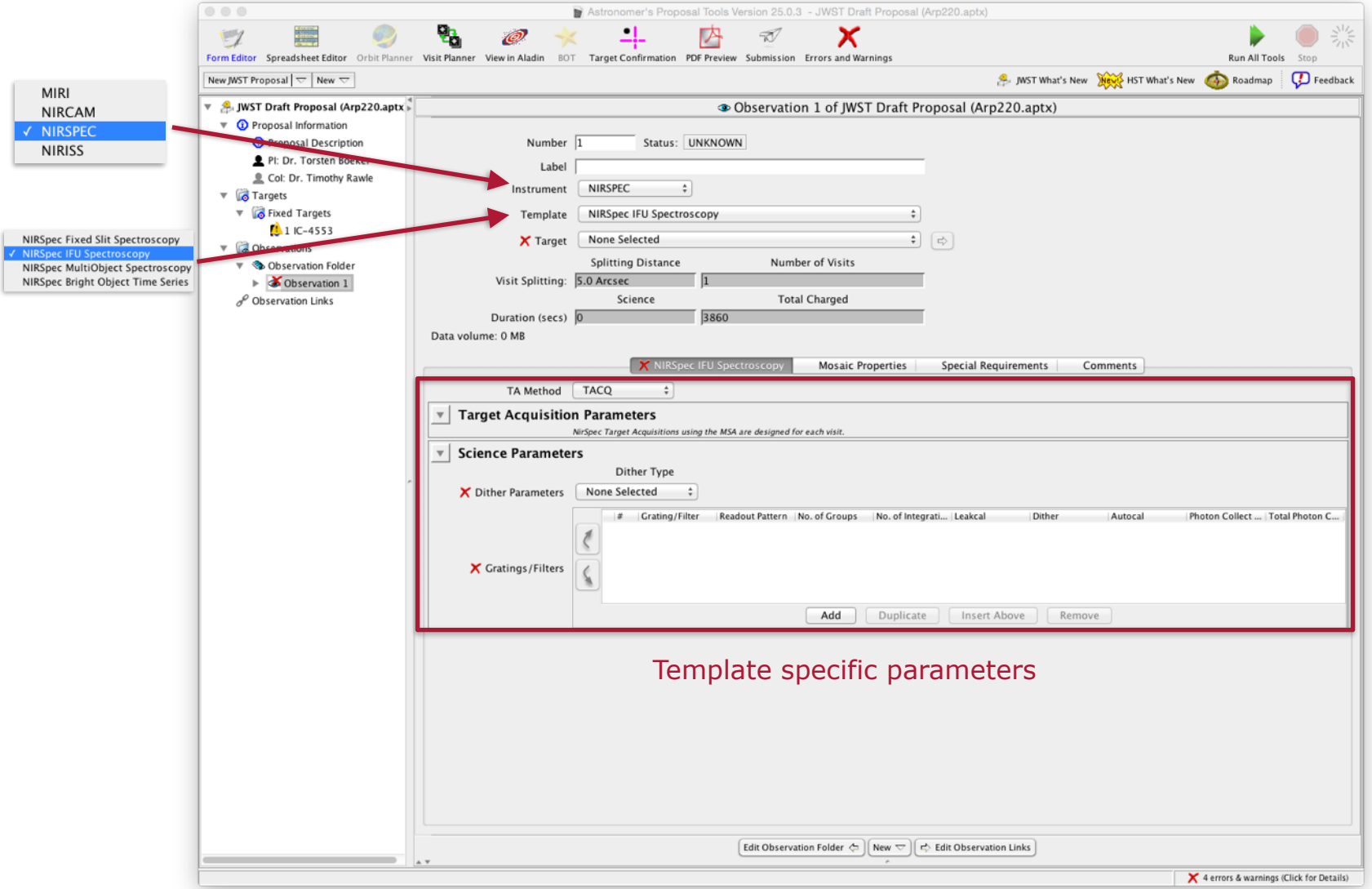
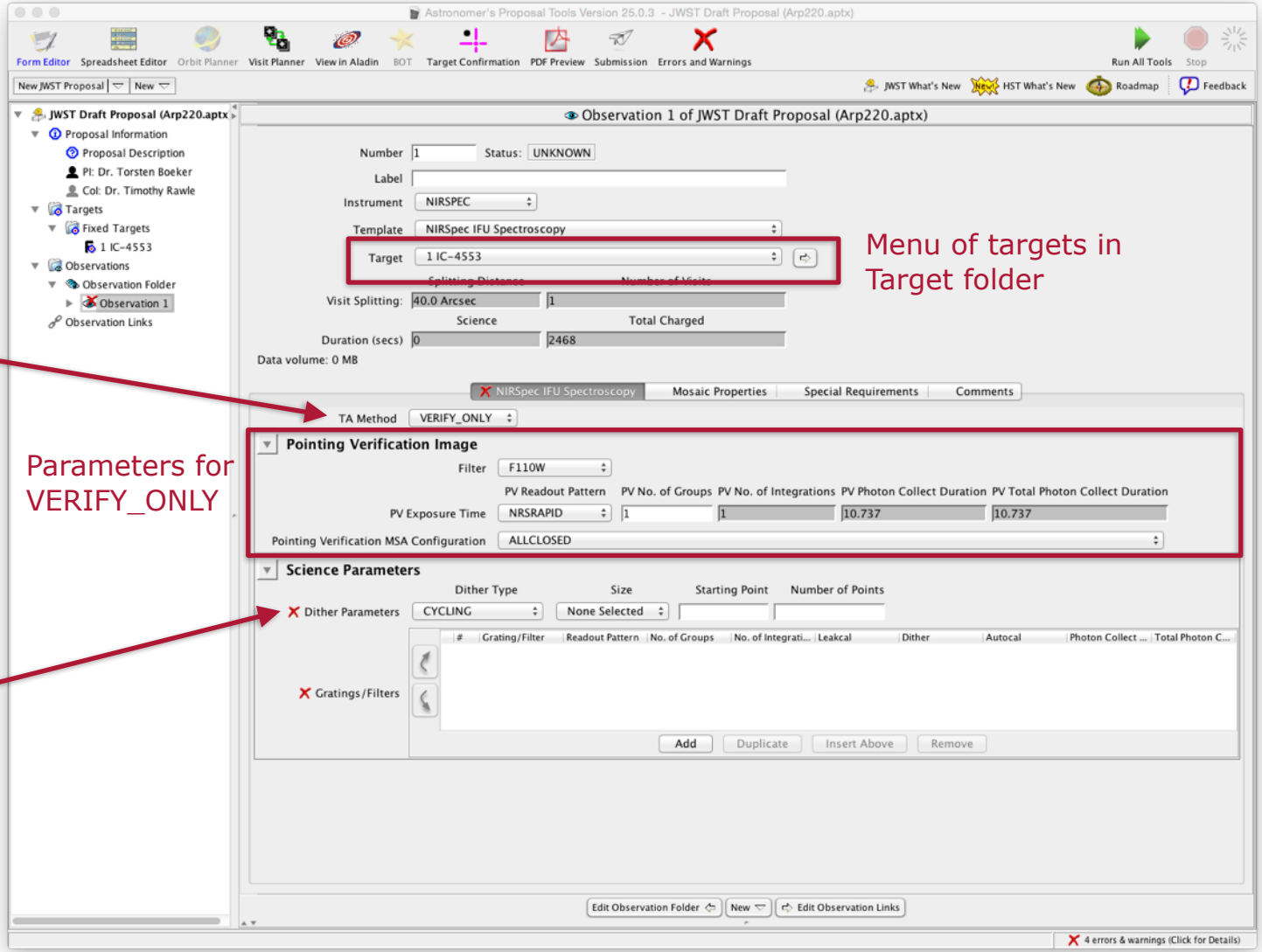



Template specific parameters

# NIRSpec IFU: observations




TA options

TACQ
✓ VERIFY_ONLY

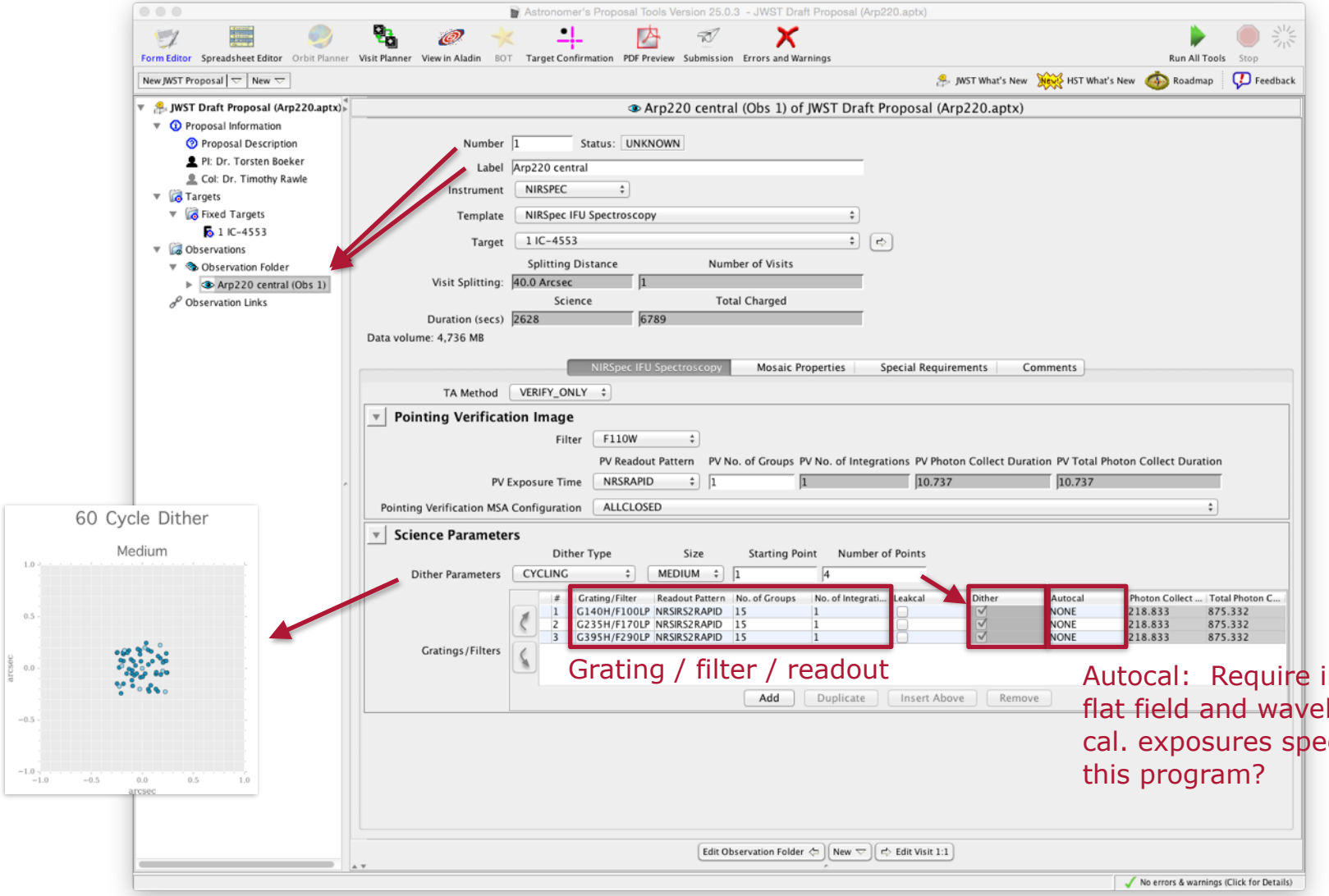
Menu of targets in Target folder

Parameters for VERIFY_ONLY

Dither options

✓ None Selected
NONE
2-POINT-NOD
4-POINT-NOD
4-POINT-DITHER
CYCLING
SPARSE-CYCLING

# NIRSpec IFU: observations



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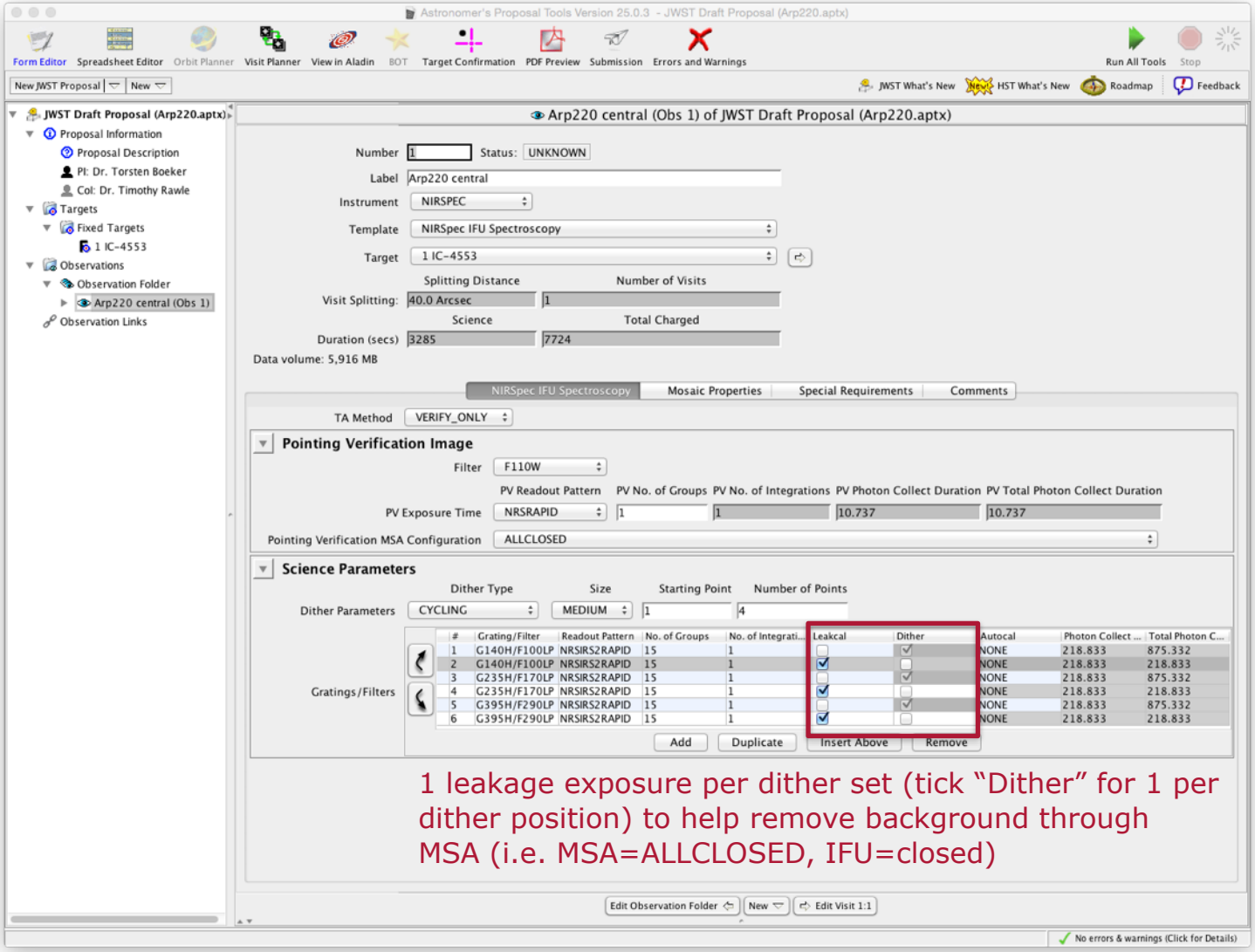
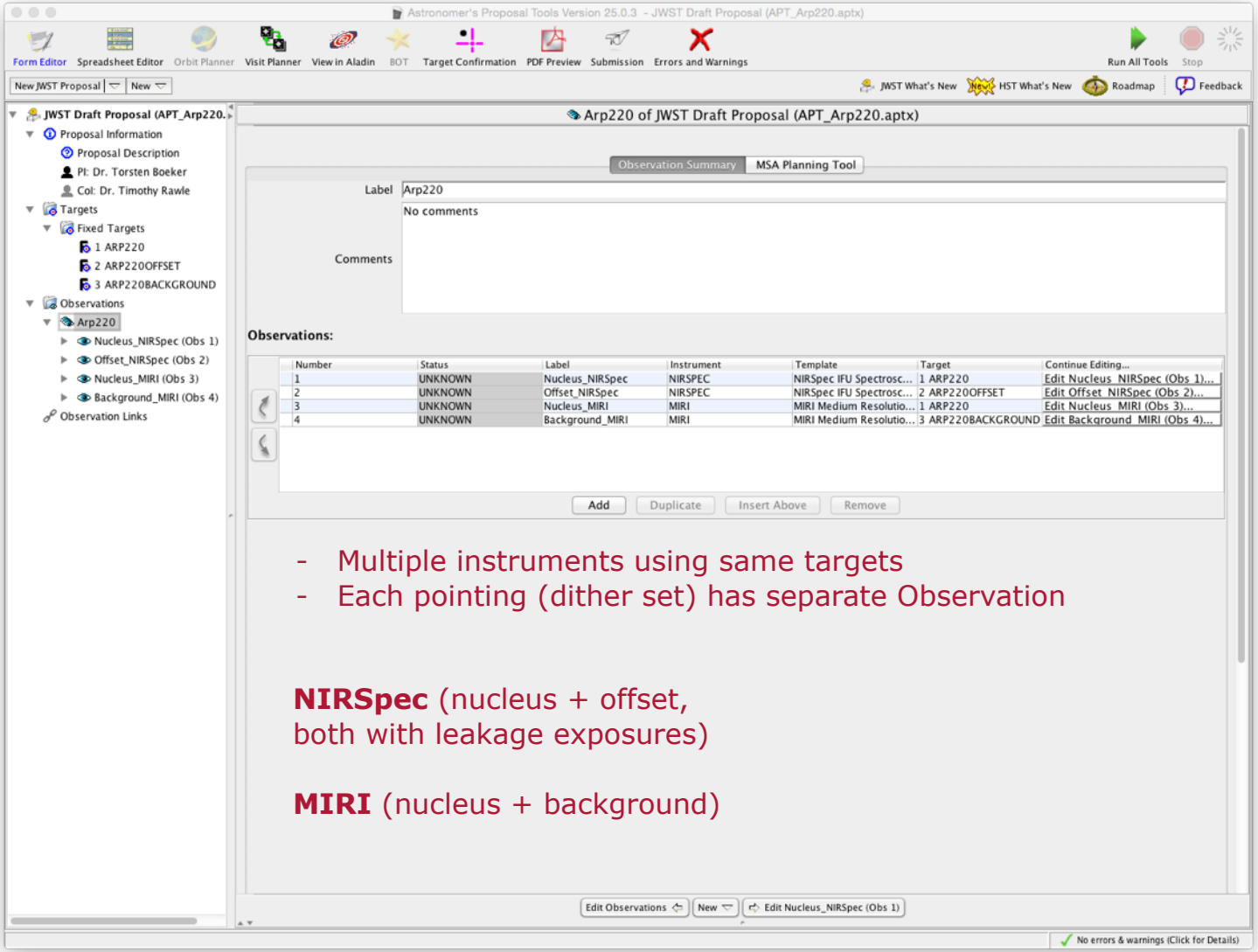



1 leakage exposure per dither set (tick "Dither" for 1 per dither position) to help remove background through MSA (i.e. MSA=ALLCLOSED, IFU=closed)

# Multiple IFUs: complex observations



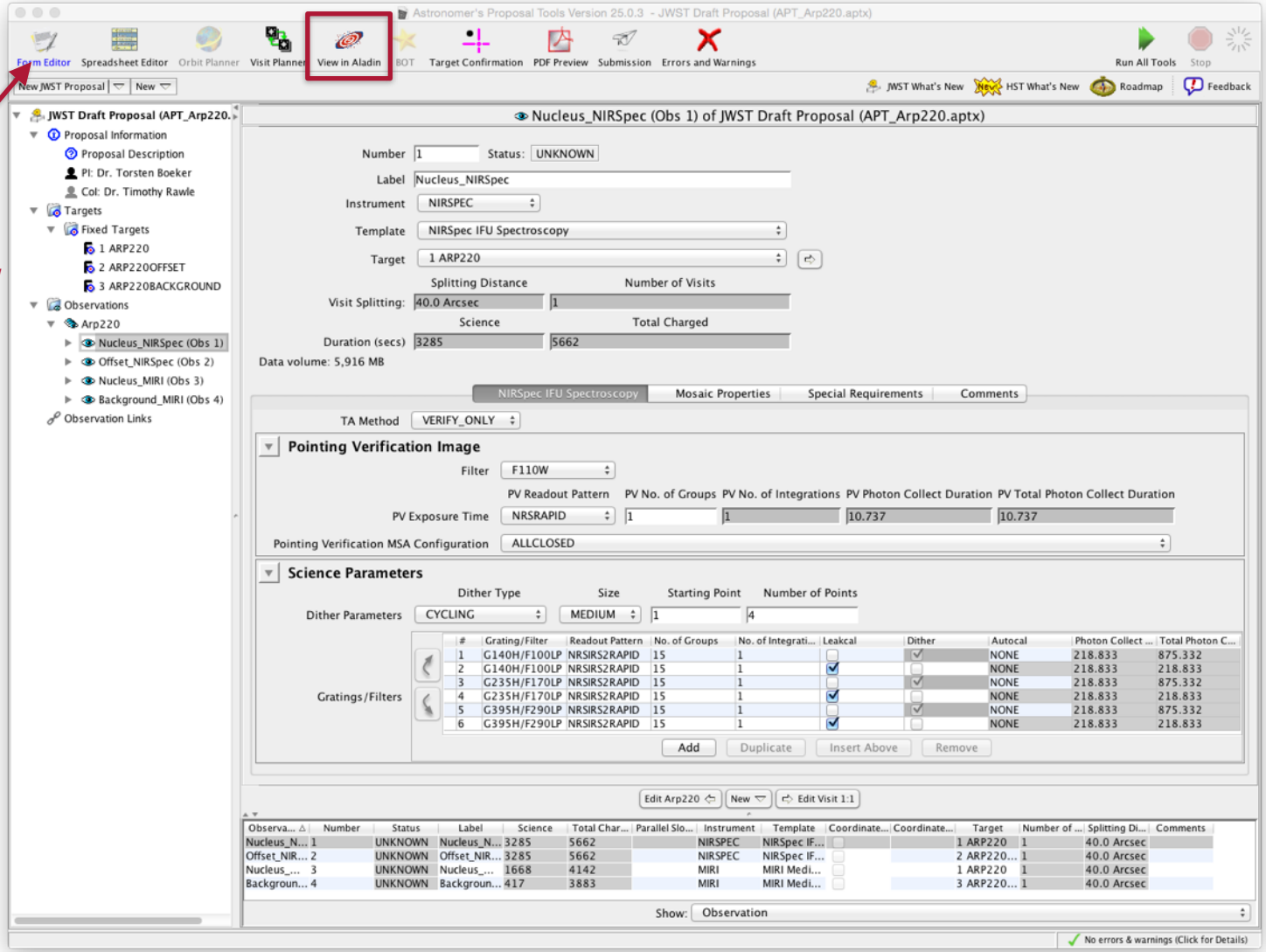

- Multiple instruments using same targets
- Each pointing (dither set) has separate Observation

**NIRSpec** (nucleus + offset,
both with leakage exposures)

**MIRI** (nucleus + background)

# APT Aladin viewer

To return to previous view



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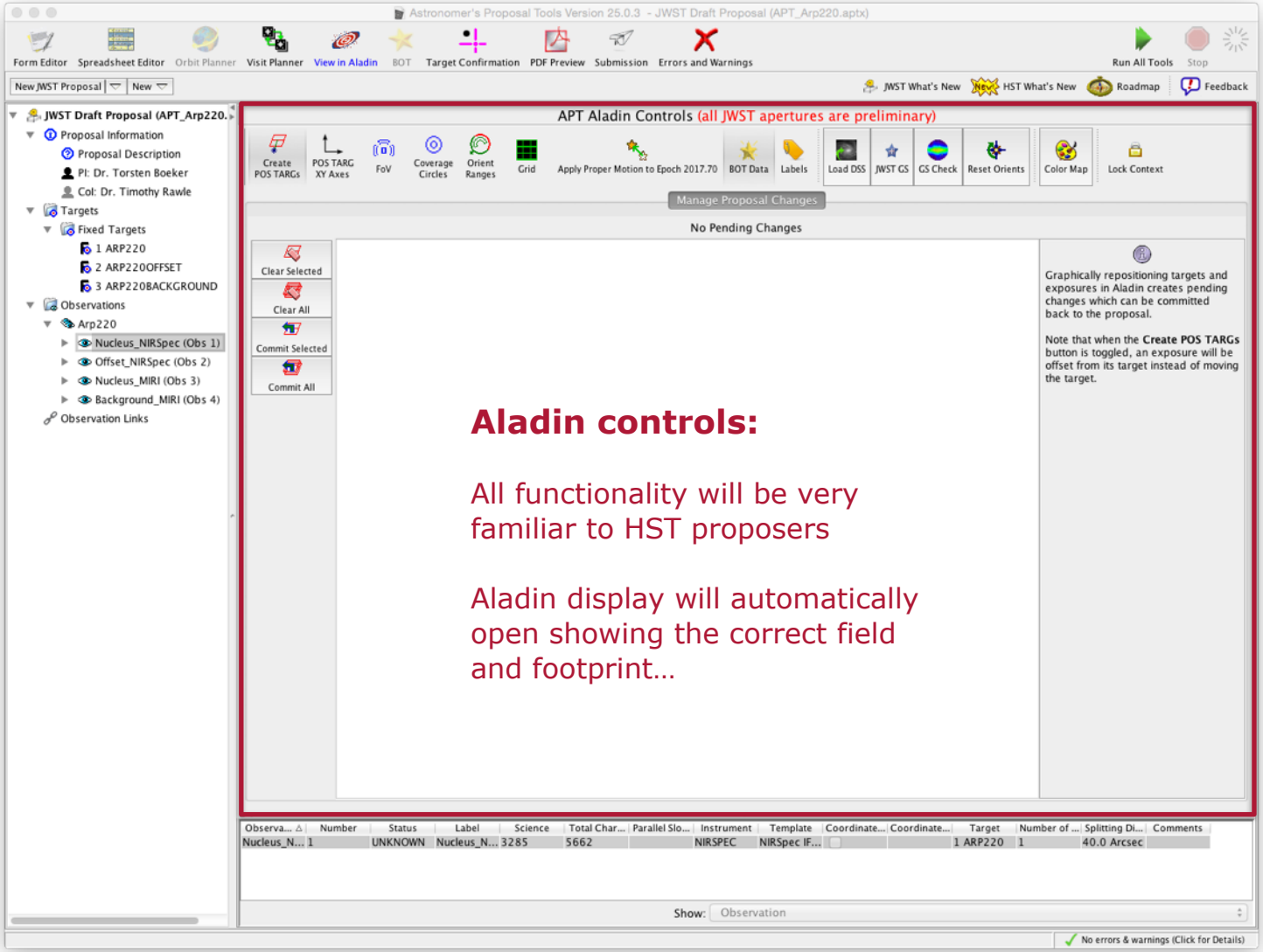
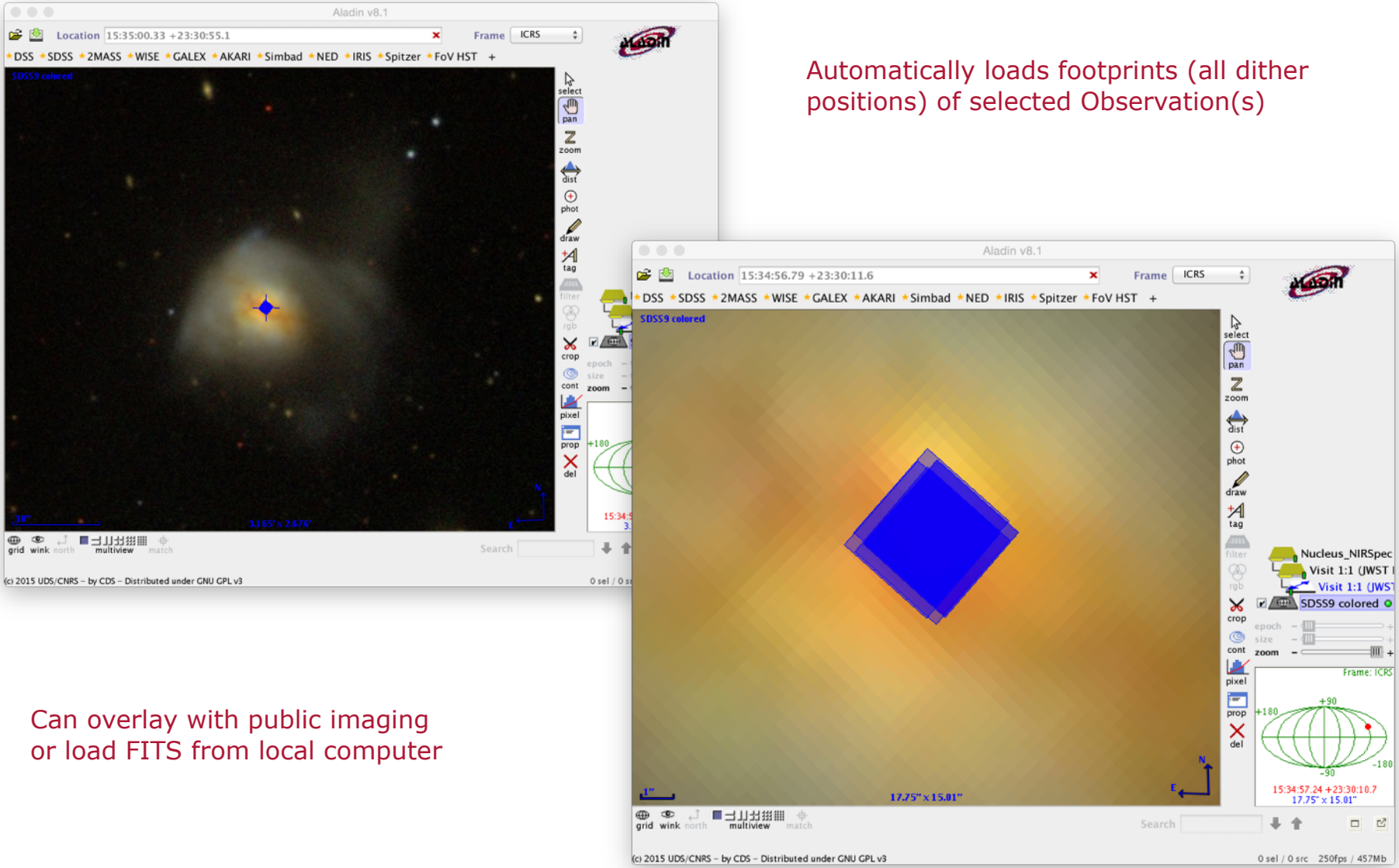



**Aladin controls:**

All functionality will be very familiar to HST proposers

Aladin display will automatically open showing the correct field and footprint…

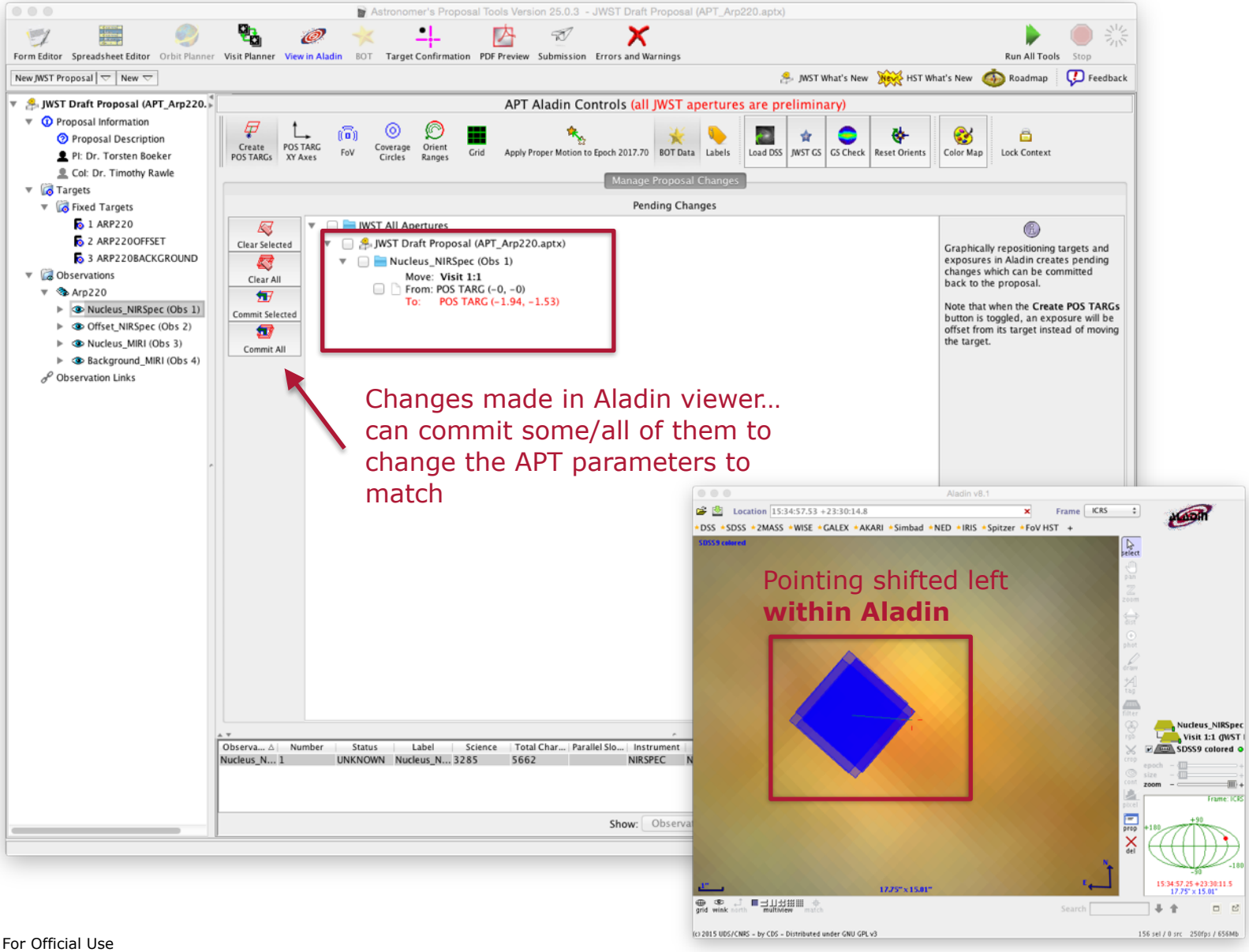
# APT Aladin viewer




Automatically loads footprints (all dither positions) of selected Observation(s)

Can overlay with public imaging or load FITS from local computer

# APT Aladin viewer



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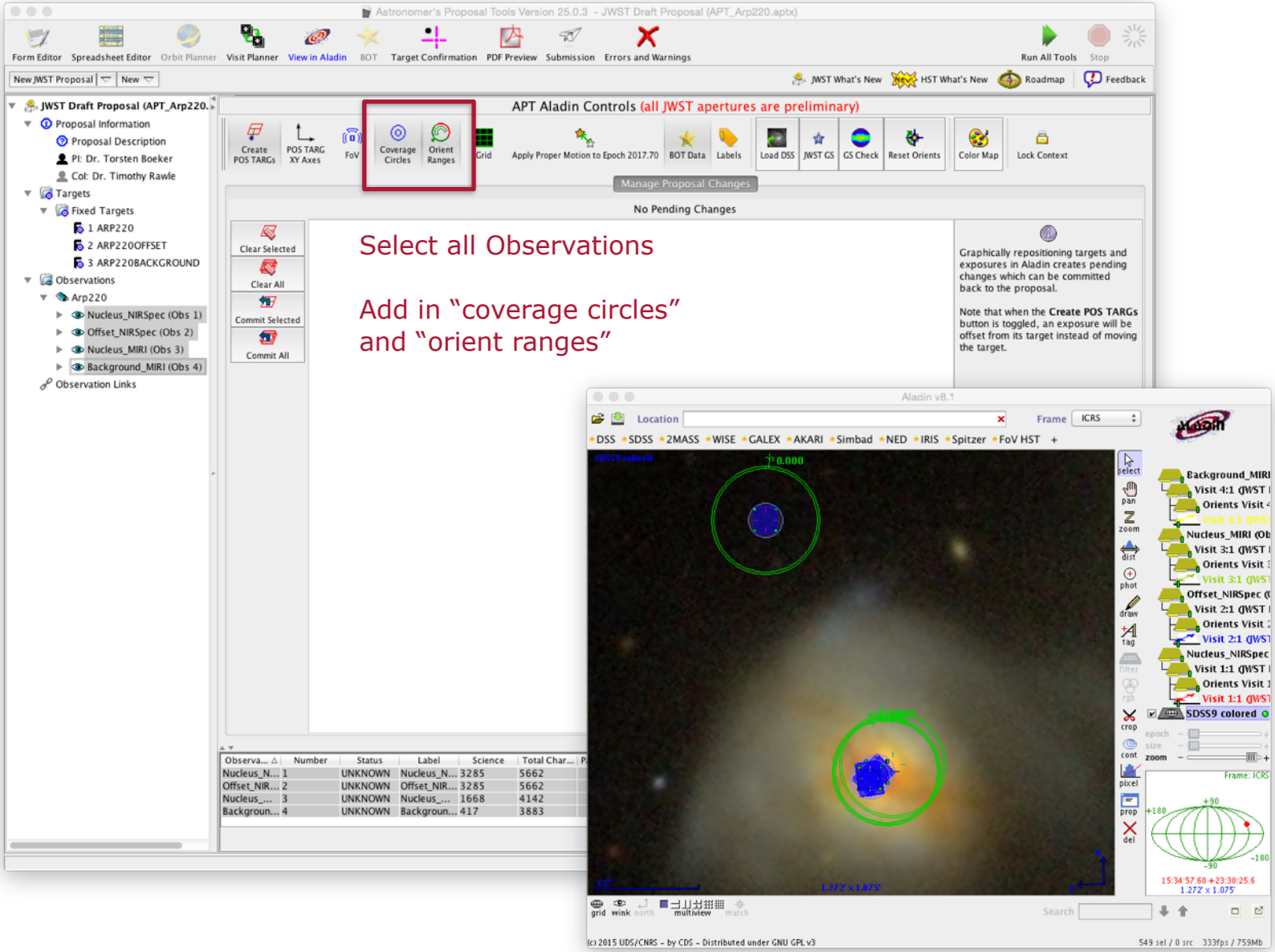
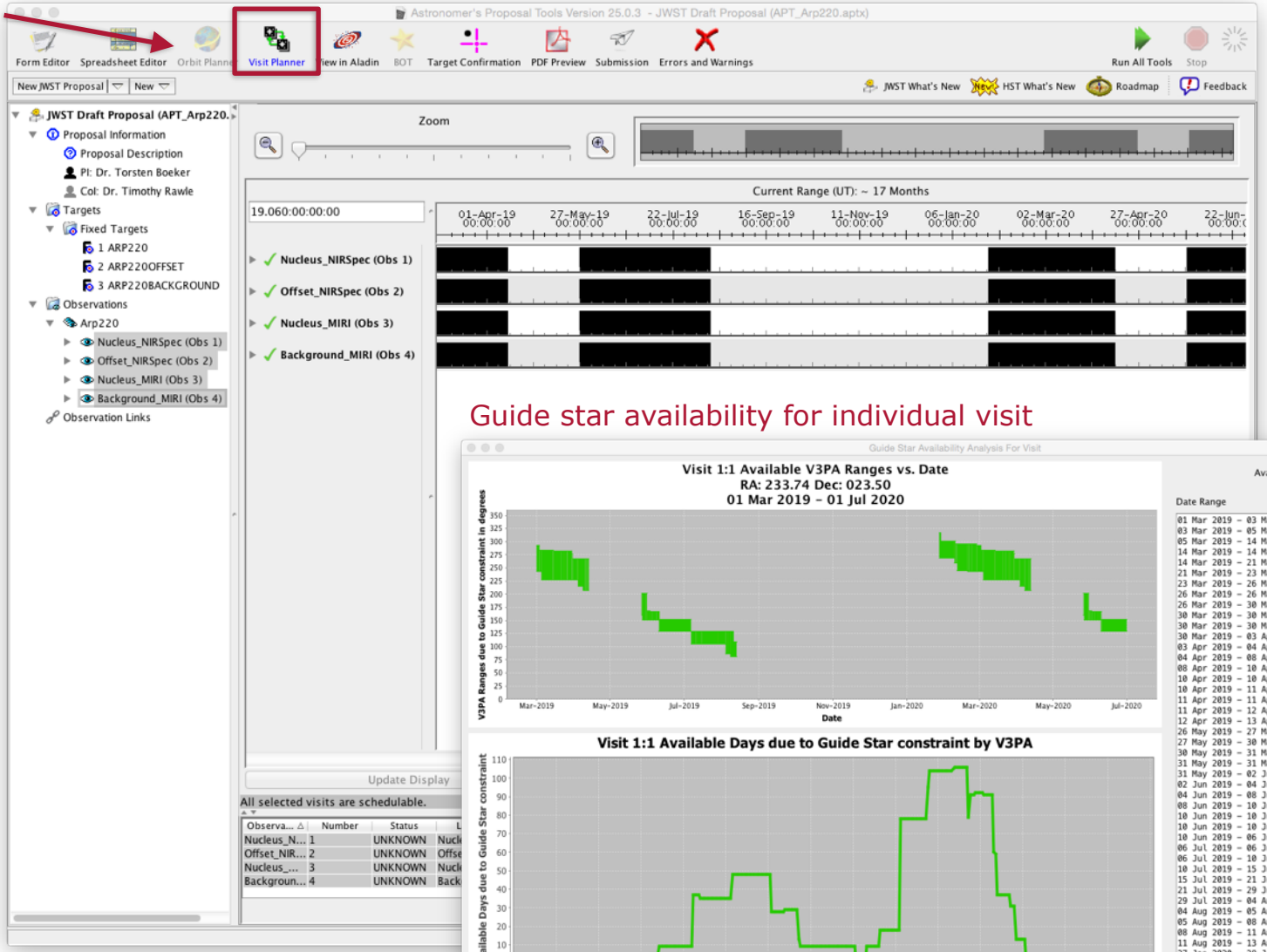


# APT visit planner

"Orbit planner" not available for JWST

"Visit planner" to check schedulability




Guide star availability for individual visit