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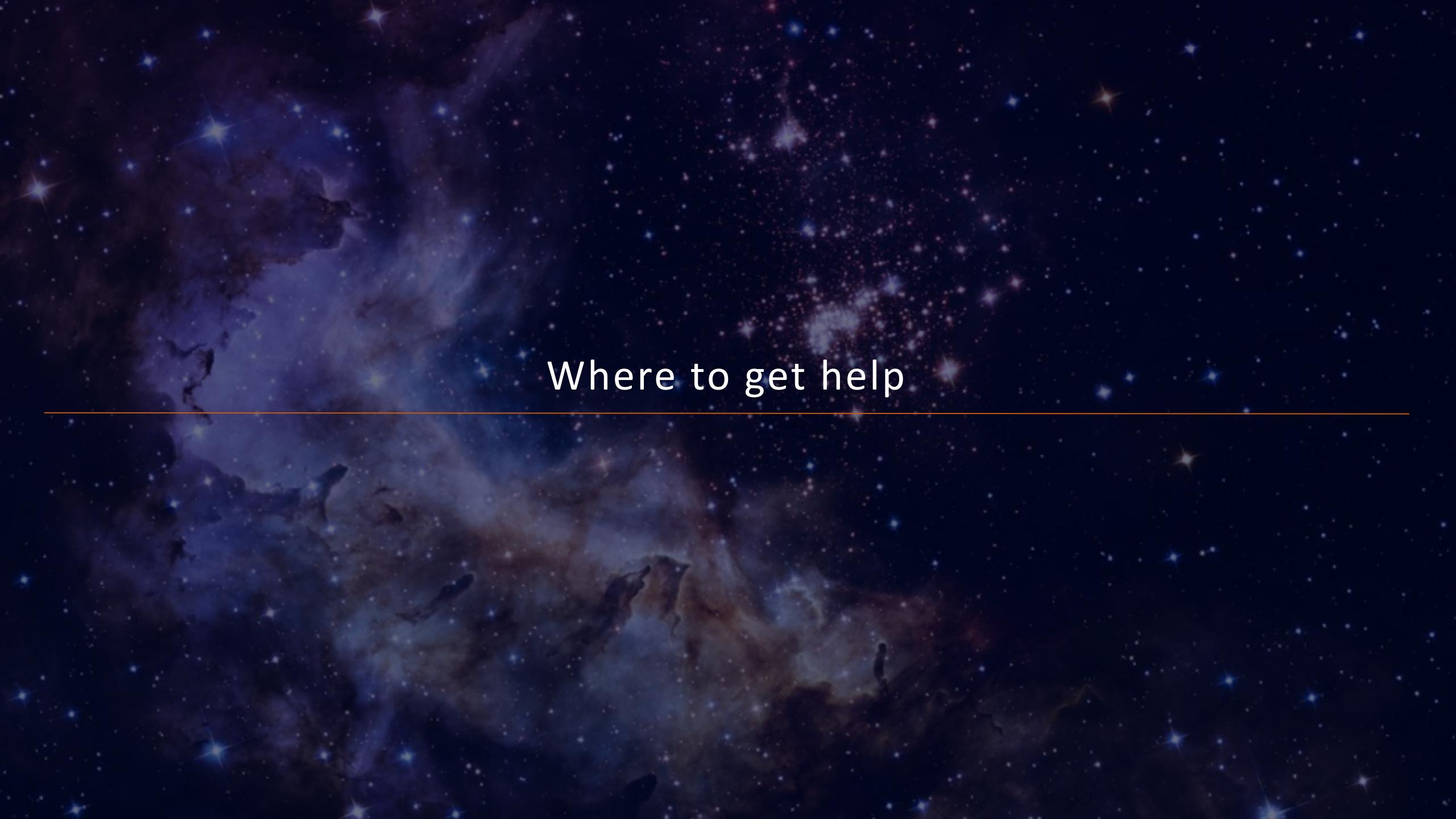
EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

Moving Targets Level 2

Blair Porterfield, Weston Eck, John Stansberry, and Bryan Holler

JWST Master Class

November 2019



A dark, star-filled space background featuring several nebulae and star clusters. The colors range from deep blues and purples to bright white and yellow stars. A prominent nebula is visible in the center-left, with a dense cluster of stars above it.

Where to get help



Where to go for help

JWST Documentation on Moving Targets (JDox)

Can be found at [JWST Moving Target Observations](#)

Context Sensitive Help in the APT

Hovering the cursor over the parameters in the form editor will display a question mark.
When clicked on it will bring up the relevant section of JDox.

Context Sensitive Help in the ETC

Blue question mark icons are present throughout the web application.
When clicked they will bring up the relevant section of JDox.

JWST Help Desk

Can be found at <https://stsci.service-now.com/jwst>

Requires a MyST account to submit questions (as does submitting a proposal)
Can search the knowledge database without an account



Where to go for help

Card specifically for moving targets

MIRI Support
Request assistance with the Mid-Infrared Instrument (MIRI)

NIRCam Support
Request assistance with the Near-Infrared Camera (NIRCam)

NIRISS Support
Request assistance with the Near-Infrared Imager and Slitless Spectrograph (NIRISS)

NIRSpec Support
Request assistance with the Near-Infrared Spectrograph (NIRSpec)

Office of Public Outreach
Contact the STScI Office of Public Outreach about JWST

Pipeline Support
Request assistance with the JWST pipeline

Solar System Observing
Ask questions about proposal writing for solar system targets with IM3CT

Time-Series Observations
Request assistance making time-series observations (e.g., transiting exoplanets)

WebbPSF / JWST Telescope
Request assistance with the WebbPSF tool or the Telescope optical system

JWST General Support
Request general JWST support for issues not covered by another category

MAST Archive Support
Request general Archive support for issues not covered by another category

Moving Target Visibility Tool (MTVT)



MTVT: Background

The MVT is a command line tool used to determine the time periods when a target of interest is in the JWST field of regard (FOR). It is a wrapper to the General Target Visibility Tool (GTVT).

The MVT was originally developed by Mike Kelley. Mees Fix is responsible for ongoing development and maintenance of the tool.



MTVT: Installation

- The MVT comes as part of a package with the General Target Visibility Tool (GTVT)

Installation and usage

One can download a .zip file or clone the repository for GTVT from the following GitHub link:

https://github.com/spacetelescope/jwst_gtvt

and install the tool inside the resulting "jwst_gtvt-master" directory (you should see a file called "setup.py" in this directory) with the command

```
python setup.py install
```

Alternatively, if you are familiar with "pip", you can install the tool directly with

```
pip install git+https://github.com/spacetelescope/jwst_gtvt.git
```

- Python package dependency: *astroquery*

```
conda install astroquery
```

Alternatively, if you are familiar with "pip", you can install the package with the following command:

```
pip install astroquery
```



MTVT: Documentation

[Home](#) / [Other Tools](#) / [Target Visibility Tools](#) / [JWST General Target Visibility Tool Help](#)

JWST General Target Visibility Tool Help



The JWST General Target Visibility Tool (GTVT) is a command-line Python tool that provides quick-look assessments of target visibilities and position angles for all JWST instruments.

[General Target Visibility Tool Help](#)

[Home](#) / [Other Tools](#) / [Target Visibility Tools](#) / [JWST Moving Target Visibility Tool Help](#)

JWST Moving Target Visibility Tool Help



The JWST Moving Target Visibility Tool (MTVT) is a command-line Python tool that provides quick-look assessments of moving target visibilities and position angles for all JWST instruments.

[Moving Target Visibility Tool Help](#)



MTVT: Usage

```
jwst_mtv [-h] --smallbody --v3pa V3PA --save_plot SAVE_PLOT  
--save_table SAVE_TABLE --instrument INSTRUMENT  
--name NAME --start_date START_DATE --end_date END_DATE  
desg [desg ...]
```

Only required argument: Target name or number

Example command line:
jwst_mtv --smallbody --v3pa --save_plot --name 134345
plots will be generated in the current directory

In JPEG format



MTVT: Demonstration

- Visibility of a planet
- Visibility of a satellite
- Visibility of an asteroid/NEA/Trojan/Centaur/KBO
- Visibility of a comet
- Visibility of an interstellar object



Moving Target Visibility Tool (MTVT): On-line Resources

JDox:

- JWST Field of Regard: [JWST Observatory Coordinate System and Field of Regard](#)
- JWST Orbit: [JWST Orbit](#)
- GTVT: [General Target Visibility Tool Help](#)
- MVT: [Moving Target Visibility Tool Help](#)

Other links:

- JPL/Horizons: <https://ssd.jpl.nasa.gov/horizons.cgi>
- Astroconda: <https://astroconda.readthedocs.io/en/latest/>
- Astroquery: <https://astroquery.readthedocs.io/en/latest/>

Exposure Time Calculator (ETC)



ETC: Moving Targets in the ETC

There are currently no unique features for moving targets in the JWST ETC.



ETC: Useful Features for Moving Targets

Example Science Program and Sample Workbook

Create New Workbook Sample Workbooks ▾ Example Science Program Workbooks ▾

Select a Workbook User ▾

- NIRCam Target Acquisition Examples
- NIRISS AMI Examples
- NIRISS Target Acquisition Examples
- NIRSpec Target Acquisition Examples
- Slitless Spectroscopy Examples
- Slitted Spectroscopy (including NIRSpec MOS)
- Solar System Sample Workbook

Grant

Home / Near Infrared Spectrograph / NIRSpec Example Programs / NIRSpec IFU and Fixed Slit Observations of Near-Earth Asteroids



NIRSpec IFU and Fixed Slit Observations of Near-Earth Asteroids

Example Science Program #34

This example science program presents an application of the [Moving Target Roadmap](#), using NIRSpec IFU observations of Near-Earth Asteroids as an example. This article covers selection of fast moving targets and appropriate observing modes based on the targets' positional uncertainties. Proper determination of exposure parameters in the ETC and construction of an APT file are covered in separate linked articles.

Create New Workbook Sample Workbooks ▾ Example Science Program Workbooks ▾

Select a Workbook User ▾

- #22 NIRCam Deep Field Imaging with MIRI Imaging Parallels
- #23: NIRISS AMI Observations of Extrasolar Planets Around a Host Star
- #26: MIRI MRS and NIRSpec IFU Observations of Cassiopeia A
- #28: MIRI MRS Spectroscopy of a Late M Star
- #31: NIRISS SOSS Time-Series Observations of HAT-P-1
- #33: NIRISS WFSS and NIRCam Imaging of Galaxies Within Lensing Clusters
- #34: NIRSpec IFU and Fixed Slit Observations of Near-Earth Asteroids

<https://jwst-docs.stsci.edu/near-infrared-spectrograph/nirspec-example-programs/nirspec-ifu-and-fixed-slit-observations-of-near-earth-asteroids>



ETC: Useful Features for Moving Targets

Power-law flux distribution

Source Editor

ID Continuum Renorm Lines Shape Offset

Flat
2D Gaussian
Sersic (Effective Radius)
Sersic (Scale Radius)

Power Law

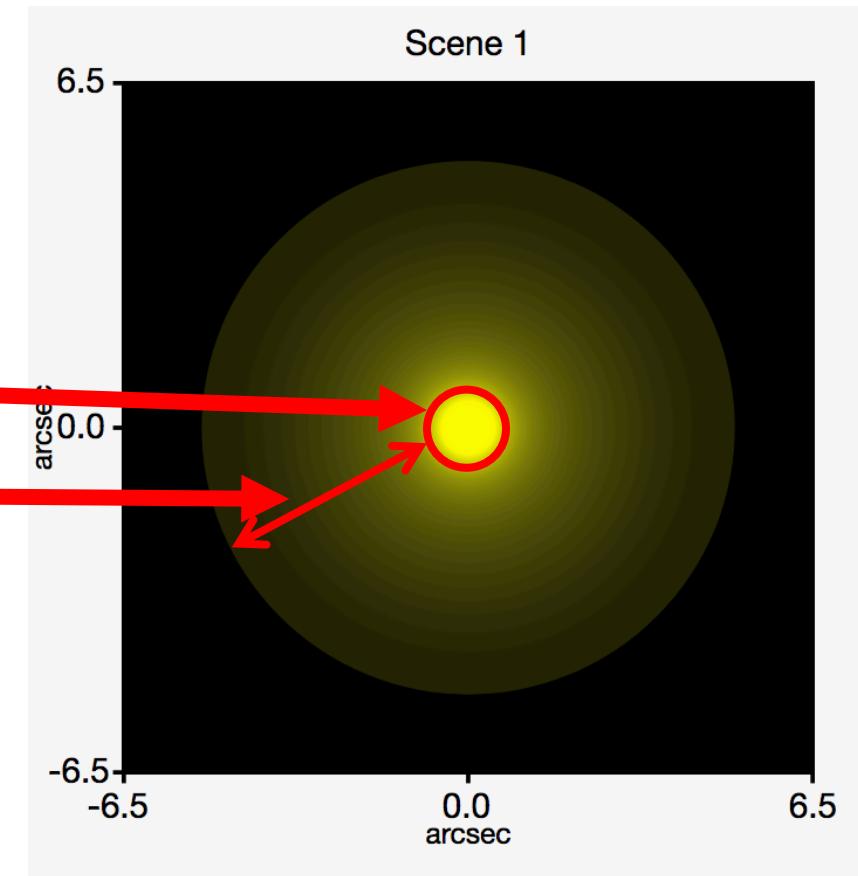
Normalization choices
per

Parameters

Core Radius arcsec

Power Law index

Source selected: 1





ETC: Useful Features for Moving Targets

Template spectra: G2V Phoenix stellar model & Blackbody

Source Editor ?

ID	Continuum	Renorm	Lines	Shape	Offset
----	-----------	--------	-------	-------	--------

Spectral Energy Distribution

Uploaded File

Select

- Analytic Spectra
- Flat Continuum
- Power-law Continuum
- Blackbody Spectrum
- Stellar Spectra
- Phoenix Stellar Models
- HST Standard Stars
- Extragalactic Spectra
- Galaxy Spectra from Brown et al. (2014)

Source selected: 1

Reset Save

	A5V 8250 4.0
	F0I 7750 2.0
	F0V 7250 4.0
	F5I 7000 1.5
	F2V 7000 4.0
	F5V 6500 4.0
	F8V 6250 4.5
	G0V 6000 4.5
	G0III 5750 3.0
	G2V 5750 4.5
	G5V 5750 4.5
	G0I 5500 1.5
	G8V 5500 4.5
	G5III 5250 2.5
	G5I 4750 1.0
	K0V 5250 4.5
	K0III 4750 2.0
	K2V 4750 4.5
	K0I 4500 1.0
	K5V 4250 4.5
	K5III 4000 1.5
	K7V 4000 4.5
	K5I 3750 0.5
	M0I 3750 0.0
	M0III 3750 1.5

Spectral Energy Distribution

Redshift

Extinction

Law

Milky Way R_V

0

J

Redshift

0

Extinction

Law

Milky Way R_V

0

Ext. Magnitude

0

Ext. Bandpass

J

Reset

Save



ETC: Demonstration

- Understand the workaround for modeling the flux from a giant planet
- Model scattered light from a giant planet for observations of a satellite
- Model a comet



ETC Moving Targets: On-line Resources

- JWST ETC web application: <https://jwst.etc.stsci.edu/>
- JWST ETC documentation: [Exposure Time Calculator Overview](#)
- Pandeia engine documentation: [JWST ETC Pandeia Engine Tutorial](#)
- Moving targets in the ETC: [JWST Moving Targets in ETC](#)

Specifying Moving Targets



New Moving Target

Screenshot of Astronomer's Proposal Tools Version 25.2.3 - JWST Draft Proposal (PROVO1.aptx) interface.

The left sidebar shows the project structure:

- JWST Draft Proposal (PROVO1.aptx)
 - Proposal Information
 - Targets** (selected)
 - Fixed Targets
 - 4 M-35
 - Solar System Targets
 - Observations
 - Observation Folder
 - Observation 1
 - Observation 2
 - Visit 2:1
 - Observation Links

The main window title is "Targets of JWST Draft Proposal (PROVO1.aptx)".

The main content area displays the "Targets" section with the following buttons:

- Fixed Target Resolver: Resolve a target name or position
- New Fixed Target: Create a new Fixed Target
- New Target Group: Create a new Target Group
- New Solar System Target: Create a new Solar System Target
- New Generic Target: Create a new Generic Target
- Import Targets...: Import Fixed Targets from whitespace, CSV, TSV, or V

At the bottom, there is a toolbar with buttons for "Edit PI: Mr. William Januszewski", "New", and "Edit Fixed Targets".

The status bar at the bottom right indicates "3 errors & warnings (Click for Details)".

Solar system targets
are fourth option
down



Moving Target Template

Astronomer's Proposal Tools Version 25.2.3 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop JWST What's New HST What's New Roadmap Feedback

New JWST Proposal | New Solar System Target

1 IO-SURFACE-FEATURE of JWST Draft Proposal (Unsaved)

Number: 1
Name in the Proposal: IO-SURFACE-FEATURE (unique within proposal)
Name for the Archive:
Keyword: Satellite
Description: Surface of Io
Extended: YES Recommended for spectroscopy (for advice to data reduction pipeline)

Level 1 Type: None Selected | Level 2 Type: None Selected | Level 3 Type: None Selected

Summary: No level information has been specified.

Comments:

Edit Solar System Targets | New | Edit Observations

5 errors & warnings (Click for Details)

Selecting Level 1 type allows user to select standard body or define a minor body



Moving Target Levels

Level 1 refers to a target in orbit about the Sun.

- Planets, Asteroids, and Comets.

Level 2 refers to a target whose motion is normally described with respect to a Level 1 object.

- Planetary Satellites, Surface features on Planets, offsets from Asteroid or Comet.

Level 3 refers to a target whose motion is normally described with respect to a Level 2 object.

- Surface feature on planetary satellites, Pointing offset from planetary satellite.



Moving Target Template: Io

Astronomer's Proposal Tools Version 25.2.3 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop JWST What's New HST What's New Roadmap Feedback

New JWST Proposal New Solar System Target

JWST Draft Proposal (Unsaved)
Proposal Information
Proposal Description
PI: Mr. William Januszewski
Targets
Solar System Targets
1 Unnamed Target
Observations
Observation Links

1 Unnamed Target of JWST Draft Proposal (Unsaved)

Number: 1
(unique within proposal)

Name in the Proposal:
(standard resolvable name)

Keyword: None Selected

Description:

Extended: Unknown
Recommended for spectroscopy (for advice to data reduction pipeline)

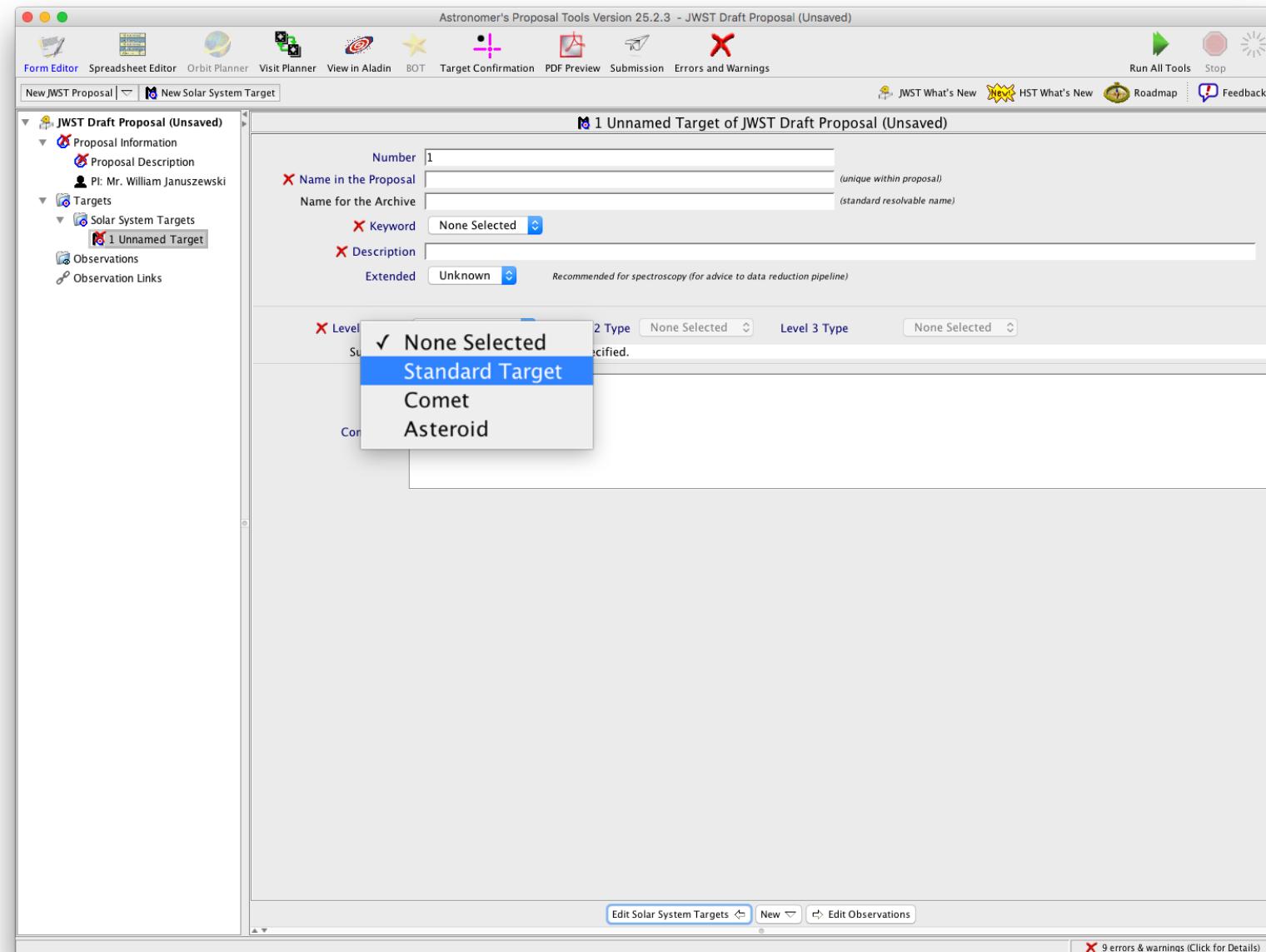
Level 1 Type: None Selected
Standard Target
Comet
Asteroid

Level 2 Type: None Selected

Level 3 Type: None Selected

Edit Solar System Targets New Edit Observations

9 errors & warnings (Click for Details)





Moving Target Template: Io

Astronomer's Proposal Tools Version 25.2.3 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop

New JWST Proposal | New Solar System Target JWST What's New HST What's New Roadmap Feedback

JWST Draft Proposal (Unsaved)

- Proposal Information
 - Proposal Description
 - PI: Mr. William Januszewski
- Targets
 - Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - STD Level 1 for 1 IO-SURFACE-FEATURE
 - Observations
 - Observation Links

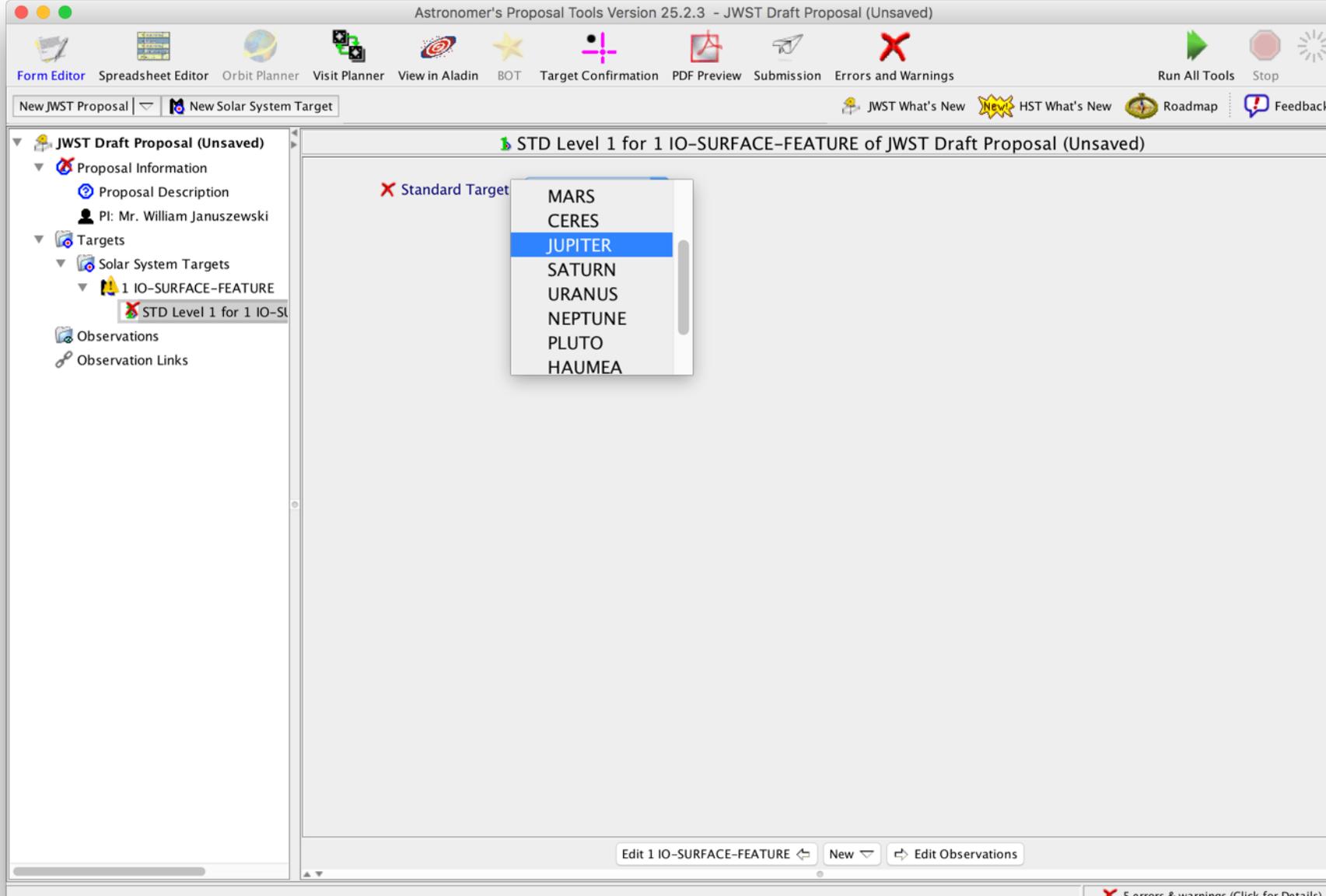
STD Level 1 for 1 IO-SURFACE-FEATURE of JWST Draft Proposal (Unsaved)

Standard Target

- MARS
- CERES
- JUPITER
- SATURN
- URANUS
- NEPTUNE
- PLUTO
- HAUMEA

Edit 1 IO-SURFACE-FEATURE New Edit Observations

5 errors & warnings (Click for Details)





Moving Target Templates: Io

Astronomer's Proposal Tools Version 25.2.3 - JWST Draft Proposal (PROVO1.aptx)

New Document | New Solar System Target

JWST Draft Proposal (PROVO1.aptx)

- Proposal Information
 - Proposal Description
 - PI: Mr. William Januszewski
- Targets
 - Solar System Targets
 - 1 IO-SURFACE-FEATURE**
- Observations
- Observation Links

M 1 IO-SURFACE-FEATURE of JWST Draft Proposal (PROVO1.aptx)

Number: 1
Name in the Proposal: IO-SURFACE-FEATURE (unique within proposal)
Name for the Archive: JUPITER (standard resolvable name)
Keyword: Satellite
Description: Moon of Jupiter
Extended: YES Recommended for spectroscopy (for advice to data reduction pipeline)

Level 1 Type: Standard Target
Level 2 Type: ✓ None Selected
Summary: Level 1: STD=JUPITER
Comments:

Level 3 Type: None Selected

Standard Target
Planetographic
Planetocentric
Position Angle
Magneto
Torus
Satellite

Edit Solar System Targets | New | Edit STD Level 1 for 1 IO-SURFACE-FEATURE

1 errors & warnings (Click for Details)

Jupiter is specified as a Level 1 standard body

Io is specified as a Level 2 body



Moving Target Templates: Io

Astronomer's Proposal Tools Version 25.2.3 - JWST Draft Proposal (PROVO1.aptx)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop

New Document | New Solar System Target JWST What's New HST What's New Roadmap Feedback

JWST Draft Proposal (PROVO1.aptx)

1 IO-SURFACE-FEATURE of JWST Draft Proposal (PROVO1.aptx)

Number: 1
Name in the Proposal: IO-SURFACE-FEATURE (unique within proposal)
Name for the Archive: IO (standard resolvable name)
Keyword: Satellite
Description: Moon of Jupiter
Extended: YES Recommended for spectroscopy (for advice to data reduction pipeline)

Level 1 Type: Standard Target | Level 2 Type: Standard Target | Level 3 Type: None Selected

Summary: Level 1: STD=JUPITER
Level 2: STD=IO

Comments:

Features on a Level 2 target are specified at Level 3

None Selected
✓ None Selected
Planetographic
Planetocentric
Position Angle
Magneto
Torus
Satellite

Edit Solar System Targets | New | Edit STD Level 1 for 1 IO-SURFACE-FEATURE

1 errors & warnings (Click for Details)



Planetographic Template - Level 3

The screenshot shows the 'Astronomer's Proposal Tools Version 25.2.3 - JWST Draft Proposal (PROVO1.aptx)' window. The left sidebar displays a tree view of the proposal structure, including 'Proposal Information' (with 'PI: Mr. William Januszewski'), 'Targets' (with 'Solar System Targets' and '1 IO-SURFACE-FEATURE' selected), and 'Observations'. The main panel shows the 'PGraphic Level 3 for 1 IO-SURFACE-FEATURE of JWST Draft Proposal (PROVO1.aptx)' configuration page. It contains fields for 'Longitude (degrees)' (255.3), 'Latitude (degrees)' (18.7), 'Altitude (km)', 'Longitude Rate Of Change (degrees/day)', 'Latitude Rate Of Change (degrees/day)', 'Altitude Rate Of Change (km/day)', and 'Epoch'. A blue callout bubble points to the 'Longitude (degrees)' and 'Latitude (degrees)' fields with the text: 'Planetographic template allows user to define latitude and longitude'.



Defined Target for Io Surface Feature

Astronomer's Proposal Tools Version 25.2.3 - JWST Draft Proposal (PROVO1.aptx)

New Document | New Solar System Target

JWST Draft Proposal (PROVO1.aptx)

- Proposal Information
 - Proposal Description
 - PI: Mr. William Januszewski
- Targets
 - Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - STD Level 1 for 1 IO-SURFACE-FEATURE
 - STD Level 2 for 1 IO-SURFACE-FEATURE
 - PGraphic Level 3 for 1 IO-SURFACE-FEATURE
 - Observations
 - Observation Links

1 IO-SURFACE-FEATURE of JWST Draft Proposal (PROVO1.aptx)

Number: 1
Name in the Proposal: IO-SURFACE-FEATURE (unique within proposal)
Name for the Archive: IO (standard resolvable name)
Keyword: Satellite
Description: Moon of Jupiter
Extended: YES Recommended for spectroscopy (for advice to data reduction pipeline)

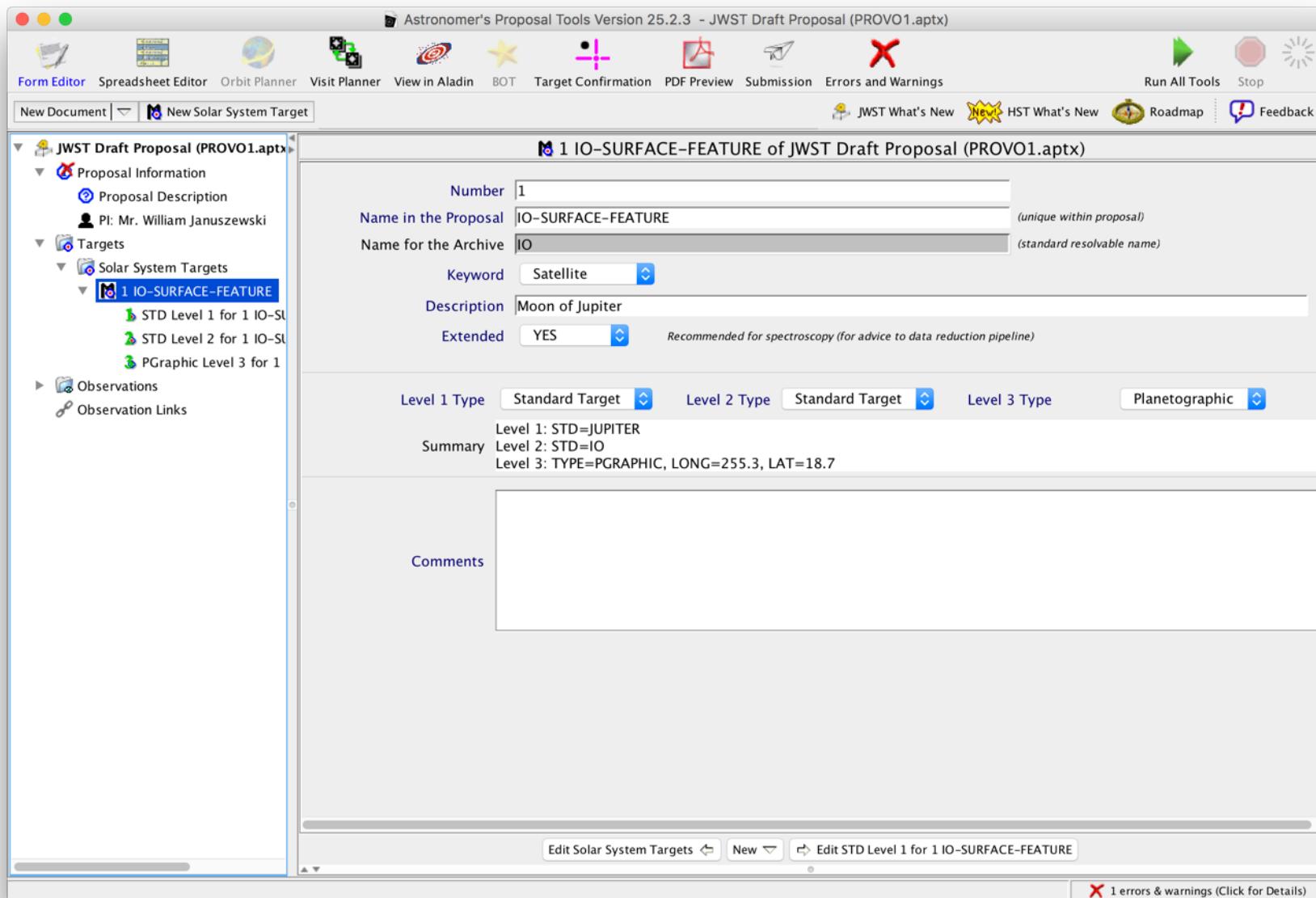
Level 1 Type: Standard Target | Level 2 Type: Standard Target | Level 3 Type: Planetographic

Summary:
Level 1: STD=JUPITER
Level 2: STD=IO
Level 3: TYPE=PGRAPHIC, LONG=255.3, LAT=18.7

Comments:

Edit Solar System Targets | New | Edit STD Level 1 for 1 IO-SURFACE-FEATURE

1 errors & warnings (Click for Details)





Moving Target Template: Jupiter N Pole

Astronomer's Proposal Tools Version 25.2.3 - JWST Draft Proposal (PROVO1.aptx)

New Document | New Solar System Target

JWST Draft Proposal (PROVO1.aptx)

- Proposal Information
 - Proposal Description
 - PI: Mr. William Januszewski
- Targets
 - Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - 2 JUPITER-N-POLE
- Observations
- Observation Links

M 2 JUPITER-N-POLE of JWST Draft Proposal (PROVO1.aptx)

Number: 2
Name in the Proposal: JUPITER-N-POLE (unique within proposal)
Name for the Archive: JUPITER (standard resolvable name)
Keyword: Planet
Description: North Pole of Jupiter
Extended: YES (Recommended for spectroscopy (for advice to data reduction pipeline))

Level 1 Type: Standard Target
Summary: Level 1: STD=JUPITER

Comments:

Level 2 Type: None Selected
Standard Target
Planetographic
Planetocentric
Position Angle
Magneto
Torus
Satellite

Level 3 Type: None Selected

Edit PGraphic Level 3 for 1 IO-SURFACE-FEATURE | New | Edit STD Level 1 for 2 JUPITER-N-POLE

2 errors & warnings (Click for Details)

Jupiter is specified as the Level 1 target

Coordinate system is specified at Level 2



Position Angle Template

A screenshot of the Astronomer's Proposal Tools Version 25.2.3 interface, showing the "PosAngle Level 2 for 2 JUPITER-N-POLE of JWST Draft Proposal (PROVO1.aptx)" window.

The left sidebar shows the project structure:

- JWST Draft Proposal (PROVO1.aptx)
 - Proposal Information
 - Proposal Description
 - PI: Mr. William Januszewski
- Targets
 - Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - 2 JUPITER-N-POLE
 - STD Level 1 for 2 JUPITER-N-POLE
 - PosAngle Level 2 for 2 JUPITER-N-POLE
- Observations
- Observation Links

Radius is measured in arcsec
from center of body

Position Angle is relative to
Reference axis in degrees

Reference axis of North is for
Celestial north



Minor Body Template

Astronomer's Proposal Tools Version 27.2 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop New JWST Proposal New Solar System Target What's New Roadmap Feedback

JWST Draft Proposal (Unsaved)

- Proposal Information
- Targets
 - Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - 2 JUPITER-N-POLE
 - 3 VESTA**
- Observations
- Observation Links

3 VESTA of JWST Draft Proposal (Unsaved)

Number: 3
 Name in the Proposal: VESTA (unique within proposal)
 Name for the Archive:
 Keyword: Asteroid
 Description: Large asteroid
 Extended: Unknown Recommended for spectroscopy (for advice to data reduction pipeline)

Level 1 Type: Asteroid Level 2 Type: None Selected Level 3 Type: None Selected

Summary: Level 1: TYPE=ASTEROID, A=, E=, I=, O=, W=, M=, EQUINOX=J2000, EPOCH=, EpochTimeScale=

Background Target
 Observations of this target require companion background observation(s)

Comments:

Edit PosAngle Level 2 for 2 JUPITER-N-POLE Edit Asteroid Level 1 for 3 VESTA

16 errors & warnings (Click for Details)



Minor Body Template

Astronomer's Proposal Tools Version 27.2 - JWST Draft Proposal (Unsaved)

New JWST Proposal | New Solar System Target

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run A... What's New Roadmap

JWST Draft Proposal (Unsaved)

Targets

Solar System Targets

1 IO-SURFACE-FEATURE

2 JUPITER-N-POLE

3 VESTA

Asteroid Level 1 for 3 VESTA

Observations

Observation Links

Asteroid Level 1 for 3 VESTA

Horizons Search

Resolve the NAIF name and ID of the minor body to enable automatic retrieval of the orbital elements.

Search (Name, NAIF ID, or Primary Designation)

Orbital Elements

A (SemiMajor Axis, AU)

E (Eccentricity)

I (Inclination, degrees)

O (Longitude of Ascending Node, degrees)

W (ArgPerihelion, degrees)

M (Mean Anomaly, degrees)

Equinox

Epoch (Osculation Time)

Source of Orbital Elements

Edit 3 VESTA New Edit Observations

16 errors & warnings (Click for Details)

Look up target in the Horizons Database

Enter orbital elements manually

11/21/19

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Horizons Interface

Astronomer's Proposal Tools Version 27.2 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop

New JWST Proposal New Solar System Target What's New Roadmap Feedback

JWST Draft Proposal (Unsaved) ▾

- Proposal Information
- Targets
- Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - 2 JUPITER-N-POLE
 - 3 VESTA
- Asteroid Level 1 for 3 VESTA

Observations Observation Links

Asteroid Level 1 for 3 VESTA

Horizons Search

Resolve the NAIF name and ID of the minor body to enable automatic retrieval of the orbital elements.

Search (Name, NAIF ID, or Primary Designation) vesta

Orbital Elements

Choose an Object

Object Name	NAIF ID	Primary Designation	Aliases
4 Vesta	2000004		

Cancel OK None Selected

Source of Orbital Elements

Edit 3 VESTA New Edit Observations

16 errors & warnings (Click for Details)

To retrieve elements from Horizons enter the name of the body



Horizons Interface

Astronomer's Proposal Tools Version 27.2 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop

New JWST Proposal | New Solar System Target What's New Roadmap Feedback

JWST Draft Proposal (Unsaved)

- Proposal Information
- Proposal Description
- Team Expertise
- Pl: Mr. Weston Eck
- Co: Blair Porterfield
- Targets
- Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - STD Level 1 for 1 IO-SU
 - STD Level 2 for 1 IO-SU
 - PGraphic Level 3 for 1
 - 2 JUPITER-N-POLE
 - STD Level 1 for 2 JUPIT
 - PosAngle Level 2 for 2
 - 3 VESTA
 - Asteroid Level 1 for 3 V
- Observations
- Observation Links

Horizons Search
Resolve the NAIF name and ID of the minor body to enable automatic retrieval of the orbital elements.

Search (Name, NAIF ID, or Primary Designation) vesta

NAIF Name 4 Vesta
NAIF ID 2000004

Use Horizons for Orbital Elements Retrieval Checking this box will make the orbital elements uneditable

Orbital Elements

X A (SemiMajor Axis, AU)	
X E (Eccentricity)	
X I (Inclination, degrees)	
X O (Longitude of Ascending Node, degrees)	
X W (ArgPerihelion, degrees)	
X M (Mean Anomaly, degrees)	

Equinox J2000

X Epoch (Osculation Time)

Source of Orbital Elements

Edit 3 VESTA New Edit Observations

12 errors & warnings (Click for Details)

Checking this box imports the orbital elements in APT



Horizons Interface

Astronomer's Proposal Tools Version 27.2 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop

New JWST Proposal New Solar System Target What's New Roadmap Feedback

JWST Draft Proposal (Unsaved)

- Proposal Information
- Proposal Description
- Team Expertise
- PI: Mr. Weston Eck
- CoI: Blair Porterfield
- Targets
- Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - STD Level 1 for 1 IO-SL
 - STD Level 2 for 1 IO-SL
 - PGraphic Level 3 for 1
 - 2 JUPITER-N-POLE
 - STD Level 1 for 2 JUPIT
 - PosAngle Level 2 for 2
 - 3 VESTA
 - Asteroid Level 1 for 3 V
- Observations
- Observation Links

Asteroid Level 1 for 3 VESTA of JWST Draft Proposal (Unsaved)

Horizons Search
Resolve the NAIF name and ID of the minor body to enable automatic retrieval of the orbital elements.

Search (Name, NAIF ID, or Primary Designation)

NAIF Name
NAIF ID

Use Horizons for Orbital Elements Retrieval Checking this box will make the orbital elements uneditable

Orbital Elements

Warning

This will replace your current orbital element values with updated orbital elements for 4 Vesta from Horizons.
This action is not undoable.

Source of Orbital Elements

Edit 3 VESTA New Edit Observations

12 errors & warnings (Click for Details)



Minor Body Template

Astronomer's Proposal Tools Version 27.2 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop

New JWST Proposal | New Solar System Target What's New Roadmap Feedback

JWST Draft Proposal (Unsaved)

- Proposal Information
 - Proposal Description
 - Team Expertise
 - PI: Mr. Weston Eck
 - CoI: Blair Porterfield
- Targets
 - Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - STD Level 1 for 1 IO-SL
 - STD Level 2 for 1 IO-SL
 - PGraphic Level 3 for 1
 - 2 JUPITER-N-POLE
 - STD Level 1 for 2 JUPIT
 - PosAngle Level 2 for 2
 - 3 VESTA
 - Asteroid Level 1 for 3 V
 - Observations
 - Observation Links

Asteroid Level 1 for 3 VESTA of JWST Draft Proposal (Unsaved)

Horizons Search
Resolve the NAIF name and ID of the minor body to enable automatic retrieval of the orbital elements.

Search (Name, NAIF ID, or Primary Designation)

NAIF Name NAIF ID

Use Horizons for Orbital Elements Retrieval Checking this box will make the orbital elements uneditable

Orbital Elements From Horizons
Click the "Update Orbital Elements From Horizons" button to request the latest orbital elements from Horizons.

Update Orbital Elements From Horizons

Horizons Solution Date	2017-Apr-04 16:32:33
Date Retrieved	2019-Sep-12 14:49:06
A (SemiMajor Axis, AU)	2.361017006168899
E (Eccentricity)	0.08940671368300425
I (Inclination, degrees)	7.135497649691238
O (Longitude of Ascending Node, degrees)	103.9831114166946
W (ArgPerihelion, degrees)	150.0028930287553
M (Mean Anomaly, degrees)	356.6858013642077
Equinox	J2000
Epoch (Osculation Time)	27-NOV-1992:00:00:00
Source of Orbital Elements	Horizons

Edit 3 VESTA Edit Observations

4 errors & warnings (Click for Details)



Minor Body Template

Astronomer's Proposal Tools Version 27.2 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop

New JWST Proposal New Solar System Target What's New Roadmap Feedback

JWST Draft Proposal (Unsaved)

- Proposal Information
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- Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - STD Level 1 for 1 IO-SL
 - STD Level 2 for 1 IO-SL
 - PGraphic Level 3 for 1
 - 2 JUPITER-N-POLE
 - STD Level 1 for 2 JUPIT
 - PosAngle Level 2
 - 3 VESTA
 - STD Level 1 for 3 VESTA

Asteroid Level 1 for 3 VESTA of JWST Draft Proposal (Unsaved)

Horizons Search
Resolve the NAIF name and ID of the minor body to enable automatic retrieval of the orbital elements.

Search (Name, NAIF ID, or Primary Designation)

NAIF Name

NAIF ID

Use Horizons for Orbital Elements Retrieval Checking this box will make the orbital elements uneditable

Orbital Elements From Horizons
Click the "Update Orbital Elements From Horizons" button to request the latest orbital elements from Horizons.

Update Orbital Elements From Horizons

Horizons Solution Date	2017-Apr-04 16:32:33
Date Retrieved	2019-Sep-12 14:49:06
A (SemiMajor Axis, AU)	2.361017006168899
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O (Longitude of Ascending Node, degrees)	103.9831114166946
W (ArgPerihelion, degrees)	150.0028930287553
M (Mean Anomaly, degrees)	356.6858013642077
Equinox	J2000
Epoch (Osculation Time)	27-NOV-1992:00:00:00 <input type="button" value=""/> TDB <input type="button" value=""/>
Source of Orbital Elements	Horizons

Edit 3 VESTA New Edit Observations

4 errors & warnings (Click for Details)

Retrieves an updated ephemeris if one is available



Minor Body Interface

Astronomer's Proposal Tools Version 27.2 - JWST Draft Proposal (Unsaved)

New JWST Proposal | New Solar System Target

JWST Draft Proposal (Unsaved)

- Proposal Information**
 - Proposal Description
 - Team Expertise
 - PI: Mr. Weston Eck
 - CoI: Blair Porterfield
- Targets**
 - Solar System Targets**
 - 1 IO-SURFACE-FEATURE**
 - STD Level 1 for 1 IO-SL
 - STD Level 2 for 1 IO-SL
 - PGraphic Level 3 for 1
 - 2 JUPITER-N-POLE**
 - STD Level 1 for 2 JUPIT
 - PosAngle Level 2 f
 - 3 VESTA**

Asteroid Level 1 for 3 VESTA of JWST Draft Proposal (Unsaved)

Horizons Search
Resolve the NAIF name and ID of the minor body to enable automatic retrieval of the orbital elements.

Search (Name, NAIF ID, or Primary Designation)

NAIF Name NAIF ID

Use Horizons for Orbital Elements Retrieval Checking this box will make the orbital elements uneditable

Orbital Elements From Horizons
Click the "Update Orbital Elements From Horizons" button to request the latest orbital elements from Horizons.

Update Orbital Elements From Horizons

Horizons Solution Date	2017-Apr-04 16:32:33
Date Retrieved	2019-Sep-12 14:49:06
A (SemiMajor Axis, AU)	2.361017006168899
E (Eccentricity)	0.08940671368300425
I (Inclination, degrees)	7.135497649691238
Omega (Longitude of Ascending Node, degrees)	103.9831114166946
W (ArgPerihelion, degrees)	150.0028930287553
M (Mean Anomaly, degrees)	356.6858013642077
Equinox	J2000
Epoch (Osculation Time)	27-NOV-1992:00:00:00
Source of Orbital Elements	Horizons

Edit 3 VESTA New Edit Observations

4 errors & warnings (Click for Details)

Unchecking this box allows the user to manually edit the fields



Solar System Target Windows



Solar System Target Windows

Astronomer's Proposal Tools Version 27.2 JWST PRD: PRDOPSSOC-L-023 - JWST Draft Proposal (PROVO1.aptx)

New Document | New | Run All Tools | Stop | What's New | Roadmap | Feedback

JWST Draft Proposal (PROVO1.aptx)

- Proposal Information
- Targets
 - Fixed Targets
 - Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - 2 JUPITER-N-POLE
 - 3 SEDNA
 - 5 Unnamed Target
- Observations
 - NIRCam Io Surface Feature
 - Observation 1
 - Observation 2
 - Observation 3
- Observation Links

Observation 1 of JWST Draft Proposal (PROVO1.aptx)

Number: 1 Status: UNKNOWN Duplication
 Label:
 Instrument: NIRCAM
 Template: NIRCam Imaging
 Coordinated Parallel
 Target: 1 IO-SURFACE-FEATURE
 Splitting Distance: 38.0 Arcsec Number of Visits: 1
 Visit Splitting: Science Total Charged
 Duration (secs): 7 2903
 Data Volume: 89 MB

Solar System Target Windows

DEFAULT WINDOW: NOT OCCULTATION OF IO-SURFACE-FEATURE BY IO FROM JWST
 DEFAULT WINDOW: NOT OCCULTATION OF IO-SURFACE-FEATURE BY JUPITER FROM JWST
 DEFAULT WINDOW: SEPARATION OF IO-SURFACE-FEATURE EUROPA FROM JWST GREATER THAN 10"
 DEFAULT WINDOW: SEPARATION OF IO-SURFACE-FEATURE GANYMEDE FROM JWST GREATER THAN 10"
 DEFAULT WINDOW: SEPARATION OF IO-SURFACE-FEATURE CALLISTO FROM JWST GREATER THAN 10"

Observing Windows

Add Observing Window... Remove Edit

MOSS Planning Start:
 MOSS Planning End:
 MOSS Show Windows:

Edit NIRCam Io Surface Feature New Edit Visit 1:1

10 errors & warnings (Click for Details)

In some cases default Solar System Windows will be added



Solar System Target Windows

Astronomer's Proposal Tools Version 27.2 JWST PRD: PRDOPSSOC-L-023 - JWST Draft Proposal (PROVO1.aptx)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop What's New Roadmap Feedback

New Document | New | Observation 1 of JWST Draft Proposal (PROVO1.aptx)

JWST Draft Proposal (PROVO1.aptx)

- Proposal Information
- Targets
 - Fixed Targets
 - Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - 2 JUPITER-N-POLE
 - 3 SEDNA
 - 5 Unnamed Target
- Observations
 - NIRCam Io Surface Feature
 - Observation 1
 - Observation 2
 - Observation 3
 - Observation Links

Number: 1 Status: UNKNOWN Duplication

Instrument: NIRCAM Template: NIRCam Imaging

Coordinated Parallel: Target: 1 IO-SURFACE-FEATURE

Visit Splitting: Splitting Distance: 38.0 Arcsec Number: 1

Science Duration (secs): 7 Data Volume: 2903 MB

NIRCam Imaging Mosaic Processing

Editing...
DEFAULT WINDOW: NOT OCCULTATION OF IO-SURFACE-FEATURE BY IO FROM JWST
DEFAULT WINDOW: SEPARATE
DEFAULT WINDOW: SEPARATE
DEFAULT WINDOW: SEPARATE
DEFAULT WINDOW: SEPARATE

Observing Windows Add Observing Window... Remove Edit

MOSC Planning Stage

OK

DEFAULT WINDOW: NOT OCCULTATION OF IO-SURFACE-FEATURE BY IO FROM JWST

10 errors & warnings (Click for Details)

Implicit Solar System Windows cannot be removed or edited



Solar System Target Windows

Astronomer's Proposal Tools Version 27.2 JWST PRD: PRDOPSSOC-L-023 - JWST Draft Proposal (PROVO1.aptx)

New Document New

JWST Draft Proposal (PROVO1.aptx)

- Targets
- Fixed Targets
- Solar System Targets
 - 1 IO-SURFACE-FEATURE
 - 2 JUPITER-N-POLE
 - 3 SEDNA
 - 5 Unnamed Target
- Observations
 - NIRCam Io Surface Feature
 - Observation 1
 - Observation 2
 - Observation 3
- Observation Links

Observation 1 of JWST Draft Proposal (PROVO1.aptx)

Number: 1 Status: UNKNOWN Duplication

Instrument: NIRCAM Template: NIRCam Imaging

Coordinated Parallel

Target: 1 IO-SURFACE-FEATURE

Visit Splitting: 38.0 Arcsec Number of Visits: 1

Duration (secs): 7 Total Charged

Data Volume: 89 MB

NIRCam Imaging Mosaic

DEFAULT WINDOW: NOT ECLIPSE P PARTIAL OF JUPITER-N-POLE BY IO FROM JWST

Within This Window? Not Within

Type (Penumbra/Umbra) Penumbral

Completeness Partial

Eclipsed Object 2 JUPITER-N-POLE

Eclipsing Object IO

Observer JWST

Default Eclipse Observing Window

This default window was provided because of your chosen level 1 and 2. Changing either of these will cause it to be deleted.

OK

10 errors & warnings (Click for Details)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings Run All Tools Stop What's New Roadmap Feedback

Most solar system windows have “Within” and “Not Within” options



Special Requirements

Solar System Special Requirements are a powerful tool for defining what conditions are occurring for optimal science return

Just don't get carried away.

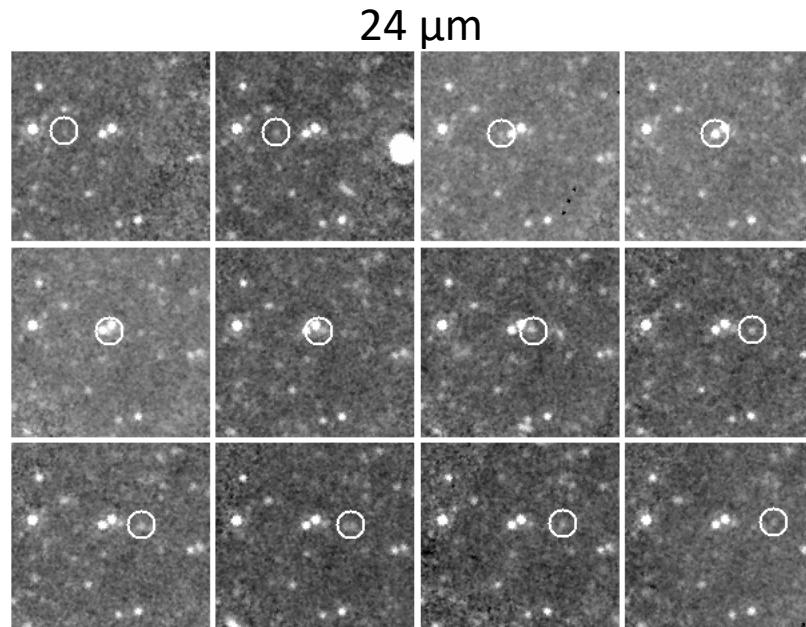
Use the windows you need to meet your science goals but keep in mind that each requirement restricts scheduling windows.



Special Requirements Example: Moving Follow-on

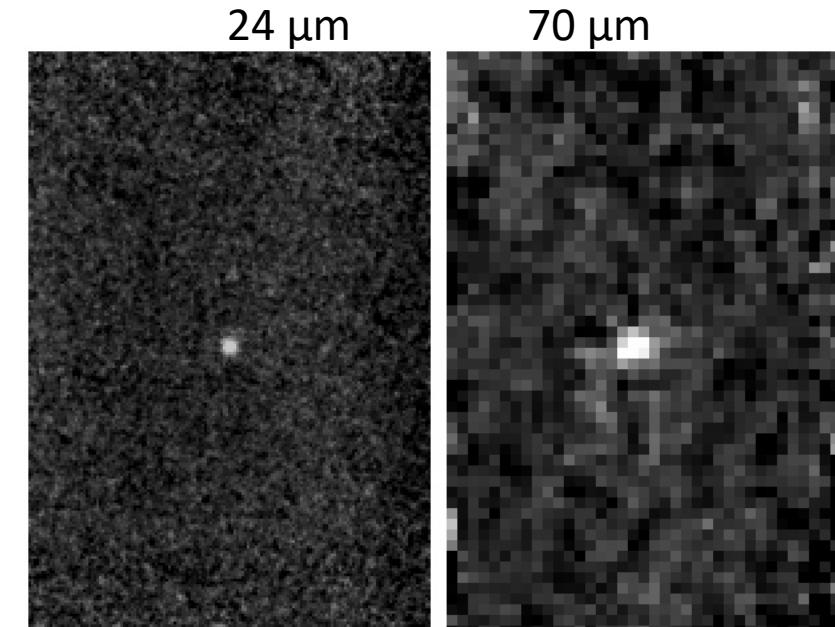
This strategy combines 2 or more observations of a target, taken close together in time, to remove most of the background objects from the data.

- This results in improved SNR for observations of targets that are comparable to the brightness of typical background objects (or fainter!).
- Many measurements made with *Spitzer* and *Herschel* would not have been possible had they not implemented moving follow-on constraints.



26308 (1998 SM165) - *Spitzer*

- 1) Co-add in sky coordinates
- 2) Subtract Sky from individual images
- 3) Coadd result in co-moving frame





Special Requirements Example: Moving Follow-on

For moving follow-on to work requires:

1. Target moves a significant distance relative to the PSF size (well-separated target observations).
2. Target moves significantly less than $\frac{1}{2}$ of the FOV of the individual observations.

APT Implementation:

1. Create 2 observations of the target.
2. Create a Special Requirement on the 2nd observation: *Timing -> After Observation* link.
 - Based on the apparent rate of motion (d''/dt) of the target, set the Min and Max Interval:
 1. Min: $d''/dt * \text{Min} > N * \text{FWHM}$ (where $N > 3$)
 2. Max: $d''/dt * \text{Max} < \text{FOV_size} * \text{Frac}$ (where $\text{Frac} < 0.3$)
 - 3. If the apparent rate of motion varies significantly during the observing window, create a *Solar System Target -> Angular Rate Observing Window* on one observation.
 1. You will have to choose to constrain the angular rate to be $>$ or $<$ your preferred rate.
 2. Choose a limiting rate that satisfies the After Observation conditions above while providing maximum scheduling flexibility.
 - 4. *Check your results in Visit Planner!!*



Special Requirements Example: Moving Follow-on

Astronomer's Proposal Tools Version 27.2 JWST PRD: PRDOPSSOC-L-023 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Check for Duplications Submission Errors and Warnings Run All Tools Stop

New JWST Proposal | New | What's New | Roadmap | Feedback

JWST Draft Proposal (Unsaved)

- Proposal Information
- Targets
 - Solar System Targets
 - 1 WEBB-JAMES-WEBB
 - Asteroid Level 1 for 1 WEBB-JAMES-WEBB
- Observations
 - Moving Follow-on Example
 - 1st Webb Observation (Obs 1)
 - 2nd Webb Observation (Obs 2)
- Observation Links

2nd Webb Observation (Obs 2) of JWST Draft Proposal (Unsaved)

Number: 2 Status: UNKNOWN Duplication

Label: 2nd Webb Observation

Instrument: NIRCAM

Template: NIRCam Imaging

Coordinated Parallel:

Target: 1 WEBB-JAMES-WEBB

Splitting Distance Number of Visits

Visit Splitting:	38.0 Arcsec	1
Science	Total Charged	
Duration (secs)	30	3099
Data Volume	108 MB	

NIRCam Imaging Mosaic Properties Special Requirements Solar System Target Windows Comments

Special Requirements include Timing options

Implicit Requirements

Timing ▶

- Position Angle ▶
 - Offset
 - Time Series Observation
 - No Parallel
 - On Hold
 - Target Of Opportunity
 - Maximum Visit Duration
 - Background Limited

After Date
Before Date
Between Dates
Phase

After Observation Link
Group/Sequence Observations Link



Special Requirements Example: Moving Follow-on

The After Observation specifies observation order and spacing in time.

Astronomer's Proposal Tools Version 27.2 JWST PRD: PRDOPSSOC-L-023 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Check for Duplications Submission Errors and Warnings Run All Tools Stop

New JWST Proposal | New

2nd Webb Observation (Obs 2) of JWST Draft Proposal (Unsaved)

Number: 2 Status: UNKNOWN Duplication

Label: 2nd Webb Observation

Instrument: NIRCAM

Template: NIRCam Imaging

Coordinated Parallel:

Target: 1 WEBB-JAMES-WEBB

Visit Splitting: 38.0 Arcsec Number of Visits: 1

Science	Total Charged
30	3099

Data Volume: 108 MB

NIRCam Imaging Mosaic Properties Special Requirements Solar System Target Windows Comments

Editing...

After Observation Link

Schedule observation: 2nd Webb Observation (Obs 2)

After observation: 1st Webb Observation (Obs 1)

Min interval: 60 Mins

Max interval: 180 Mins

Exclusive Use Of Instrument:

2 After 1 by 60 Mins to 180 Mins

OK

Special Requirements Implicit Requirements



Special Requirements Example: Moving Follow-on

Astronomer's Proposal Tools Version 27.2 JWST PRD: PRDOPSSOC-L-023 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Check for Duplications Submission Errors and Warnings Run All Tools Stop

New JWST Proposal | New

2nd Webb Observation (Obs 2) of JWST Draft Proposal (Unsaved)

Number: 2 Status: UNKNOWN Duplication

Label: 2nd Webb Observation

Instrument: NIRCAM

Template: NIRCam Imaging

Coordinated Parallel:

Target: 1 WEBB-JAMES-WEBB

Visit Splitting: 38.0 Arcsec Number of Visits: 1

Science	Total Charged
30	3099

Duration (secs): 108 MB

NIRCam Imaging Mosaic Properties Special Requirements Solar System Target Windows Comments

Observing Windows

MOSS Planning Start

New Transit Observing Window
New Solar Phase Observing Window
New Distance Observing Window
New Radial Velocity Observing Window
New Orbital Longitude Observing Window
New Occultation Window
New Eclipse Observing Window
New Central Meridian Longitude Observing Window
New Angular Rate Observing Window
New Separation Observing Window
New Apparent Create a new angular rate observing window

Remove Edit

Angular Rate constraint is found under Solar System Target Windows



Special Requirements Example: Moving Follow-on

Parameter values depend on the FOV and PSF size, apparent rate of motion

Astronomer's Proposal Tools Version 27.2 JWST PRD: PRDOPSSOC-L-023 - JWST Draft Proposal (Unsaved)

Form Editor Spreadsheet Editor Orbit Planner Visit Planner Timeline View in Aladin BOT Target Confirmation PDF Preview Check for Duplications Submission Errors and Warnings Run All Tools Stop

New JWST Proposal | New ▾ What's New Roadmap Feedback

JWST Draft Proposal (Unsaved)

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- Observation Links

2nd Webb Observation (Obs 2) of JWST Draft Proposal (Unsaved)

Number: 2 Status: UNKNOWN Duplication

Label: 2nd Webb Observation

Instrument: NIRCAM

Template: NIRCam Imaging

Coordinated Parallel

Target: 1 WEBB-JAMES-WEBB

Splitting Distance: 38.0 Arcsec Number of Visits: 1

Science	Total Charged
Duration (secs): 30	3099
Data Volume: 108 MB	

NIRCam Imaging Mosaic Properties Special Requirements Solar System Target Windows Comments

Angular Rate Observing Window

Within This Window? Within

Object 1: 1 WEBB-JAMES-WEBB

Object 2 (optional): None Selected

Observer: JWST

Condition (>, <, Min, Max): LESS THAN

Rate (arcsec/sec): .0006

OK

MOSS Planning Start ANGULAR RATE WEBB-JAMES-WEBB FROM JWST LESS THAN



Visualization: Moving Target Proxy

Astronomer's Proposal Tools Version 27.2 JWST PRD: PRDOPSSOC-L-023 - JWST Draft Proposal (Unsaved)

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New JWST Proposal New

JWST Draft Proposal (Unsaved)

- Proposal Information
- Targets
 - Fixed Targets
 - 2 M-35
 - Solar System Targets
- Observations
 - Moving Follow-on Example
 - 1st Webb Observation (Obs 1)
 - 2nd Webb Observation (O
- Observation Links

1st Webb Observation (Obs 1) of JWST Draft Proposal (Unsaved)

Number: 1 Status: UNKNOWN Duplication

Label: 1st Webb Observation

Instrument: NIRCAM

Template: NIRCam Imaging

Coordinated Parallel: None Selected

Target: 2 M-35

Visit Splitting: 80.0 Arcsec 1

Science	Total Charged
30	2983

Duration (secs): 30 Data Volume: 64 MB

NIRCam Imaging Mosaic Properties Special Requirements Comments

Module: B Subarray: SUB400P

Primary Dither Type: Primary Dithers Subpixel Dither Type: Subpixel Positions

Dither Parameters: SUBARRAY_DITHER 2 STANDARD 1

#	Short Filter	Long Filter	Readout Patt...	Groups/Int	Integrations...	Total Dithers	Total Integr...	Total Expos...	ETC Wkbk.C...	ETC
1	F090W	F277W	RAPID	3	3	2	6	39.873		<input type="button" value="Edit"/>

Filters:

Edit Moving Follow-on Example New Edit Visit 1:1

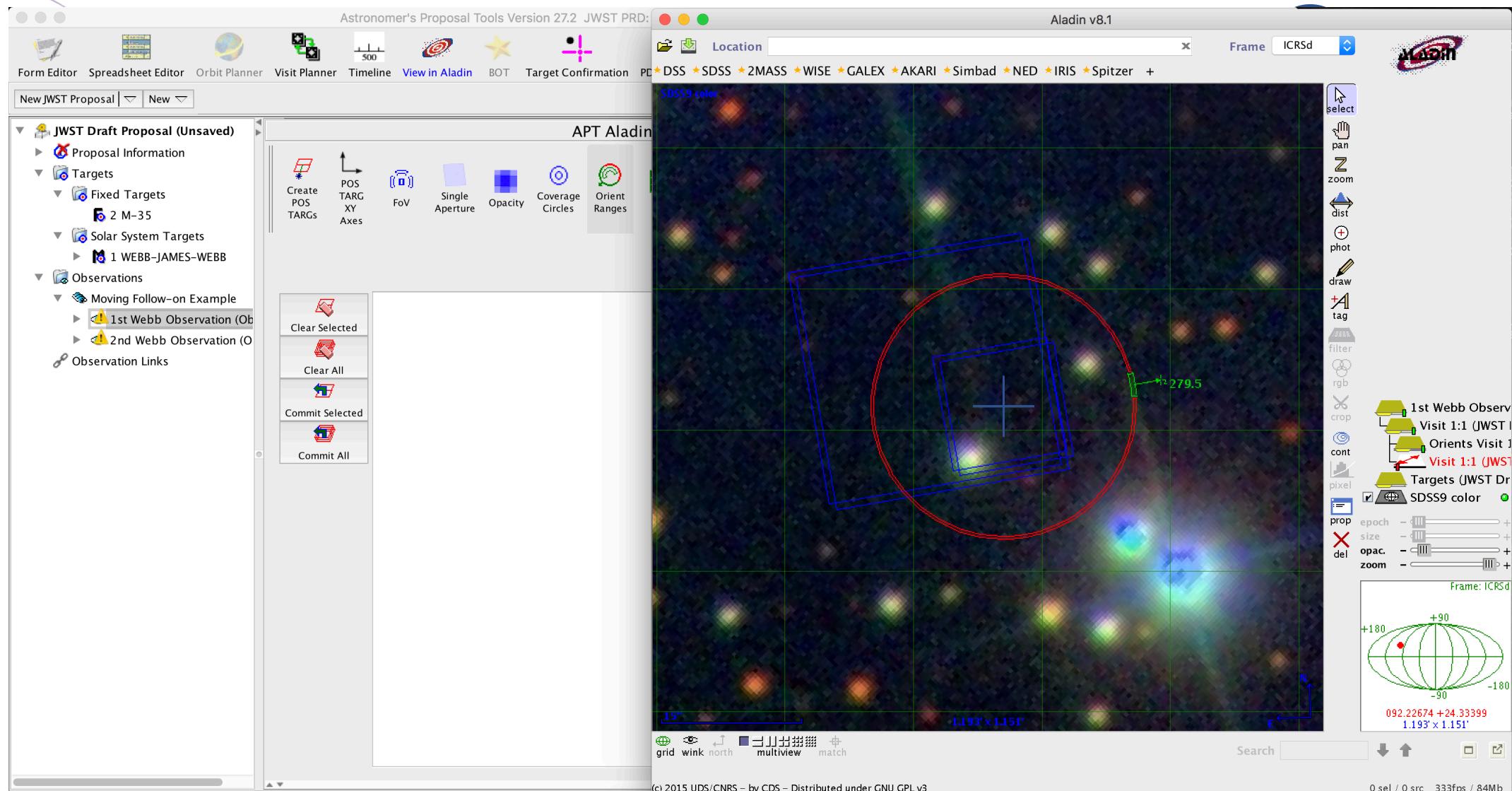
Observation Number Status Duplication Label Science Total Char... Data Volume Parallel Slo... Instrument Template Coordinate... Coordinate... Target N

Show: Observation

Use a fixed target as a proxy for your moving target



Moving Target Visualization: Proxy Fixed Target





APT Moving Targets: On-line JDox Resources

- Moving targets in APT: [Moving Targets in APT](#)
- APT Solar System Target Windows: [Solar System Special Requirements](#)
- Visualizing Moving Target Observations: [Tutorial on Visualizing Dithers of a Solar System Observation in APT](#)
- APT Special Requirements: [APT Special Requirements](#)
- ETC to APT interface: [ETC to APT Interface Support Information](#)
- APT Visit Planner: [APR Visit Planner](#)
- General APT documentation: [Astronomers Proposal Tool Overview](#)