



STScI | SPACE TELESCOPE
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

Specifying Observations in APT

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JWST Master Class Plenary

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The JWST Astronomer's Proposal Tool

The Astronomer's Proposal Tool (APT) is used to specify proposed observations for JWST and submit them for consideration by the Time Allocation Committee (TAC).

- The scientific justification PDF must be attached prior to submission.

APT is also a resource estimator.

- Need a resource estimate for the TAC.
- APT uses a system of overhead charges to make this resource estimate possible.
- Units are in decimal hours.



APT Basics

Observation – basic proposal design element specified by the user.

Observation Template – GUI form filled out by the user.

- Parameters depend on selection of instrument and mode.
- Contains the exposure specifications.

Visit – set of exposures (included overheads) obtained on a single guide star without scheduling interruptions. (This is the scheduling unit.)

- Observations are divided into one or more visits by APT.

Overhead – charged time for operations activities performed by the observatory.

- **Graphical Timeline** – provides a visual display of overheads for each visit.

Visit Planner – checks the schedulability of an observation (including guide star availability).

Smart Accounting – updates the full proposal's resource estimates and remove excess overheads prior to submission.



What is an APT Observation?

- User specified
- Single observing mode (template)
- All parameters for exposures and scheduling requests

The screenshot shows the configuration interface for a MIRI Medium Resolution Spectroscopy observation. The top section displays basic parameters: Instrument (MIRI), Template (MIRI Medium Resolution Spectroscopy), Target (3 HH-111), Splitting Distance (70.0 Arcsec), Number of Visits (1), Duration (secs) (448), Total Charged (5506), and Data Volume (1134 MB). Below this is a tabbed interface with 'MIRI Medium Resolution Spectroscopy' selected, followed by 'Mosaic Properties', 'Special Requirements', and 'Comments'. A large yellow box highlights the 'Target Acquisition Parameters' section, which includes fields for Acq Target (4 SOMESTAR), Acq Filter (F560W), Acq Readout Pattern (FAST), Acq Groups/Int (10), Acq Integrations/Exp (1), Acq Total Integrations (1), Acq Total Exposure Time (27.75), and Acq ETC Wkbk (99999). Another yellow box highlights the 'MRS Parameters' section, which includes Primary Channel (ALL), Dithers (1 dither type: 4-Point, optimized for EXTENDED SOURCE, direction NEGATIVE), and Simultaneous Imaging (YES, Imager Subarray FULL). A detailed table at the bottom lists detector configurations: IMAGER (Detector #1, Wavelength F1000W, Filter F1000W, Readout Pattern FAST, Groups/Int 5, Integrations 1, Exposure 1, Dither 1, Total Dithers 4, Total Integrations 4, Total Exposure 55.501), MRSLONG (Detector #1, Wavelength SHORT(A), Filter SHORT(A), Readout Pattern FAST, Groups/Int 10, Integrations 1, Exposure 1, Dither 1, Total Dithers 4, Total Integrations 4, Total Exposure 111.002), and MRSSHORT (Detector #1, Wavelength SHORT(A), Filter SHORT(A), Readout Pattern FAST, Groups/Int 10, Integrations 1, Exposure 1, Dither 1, Total Dithers 4, Total Integrations 4, Total Exposure 111.002).

Additional Resource: [JDox Article: APT Observations](#)



What is an APT Visit?

- A Visit is set of exposures and associated overheads that can be executed, without interruption, using a single guide star.
 - This is what makes Visits the “scheduling unit” used by the scheduling system.
- A typical Visit includes
 - Slew to guide star position
 - Instrument overheads
 - Guide star acquisition
 - Target acquisition (if needed)
 - Small Angle Maneuvers (SAMs)
 - Science exposures
- Add-on to the Visit duration
 - Observatory overheads
 - Station keeping
 - Momentum management
 - Direct scheduling overheads
 - Very tight timing constraints
 - Rapid turnaround of target of opportunities

Visit 3:1 Status:		UNKNOWN										
		Science	Instrument	Overheads	Slew	Observatory	Overheads	Direct	Scheduling	Overheads	Total	Charged
Visit Duration (secs)		448	2498		1800	760		0		5506		
Data Volume				1134 MB								

[Copy pointings to clipboard](#)

(Note: Gray boxes contain information reported by APT for user information only; cannot be edited directly.)



APT Visit Splitting Distance

- Users specify observation. APT splits an observation into one or more Visits using Visit Splitting Distance.
- This allowed distance for offsets within a visit is based on expected guide stars available, which drop off towards higher galactic latitudes.
- The Visit Splitting Distance used by APT is between 35"–80" depending on the Galactic latitude of the target.
 - 30" for moving targets
- The Visits of a multi-visit observation are not guaranteed to execute in a continuous manner unless a special requirement is specified.

Galactic Latitude	Pointing Change	Galactic Latitude	Pointing Change
$0^\circ \leq b < 10^\circ$	80"	$45^\circ \leq b < 50^\circ$	45"
$10^\circ \leq b < 15^\circ$	70"	$50^\circ \leq b < 60^\circ$	40"
$15^\circ \leq b < 20^\circ$	65"	$60^\circ \leq b < 65^\circ$	30"
$20^\circ \leq b < 25^\circ$	60"	$65^\circ \leq b < 70^\circ$	40"
$25^\circ \leq b < 35^\circ$	55"	$70^\circ \leq b < 80^\circ$	35"
$35^\circ \leq b < 45^\circ$	50"	$ b \geq 80^\circ$	45"

Target 10 M-82

Splitting Distance	Number of Visits
Visit Splitting: 50.0 Arcsec	1
Science	Total Charged
Duration (secs) 43	2841
Data Volume 217 MB	

Ex: Target is M-82, visit splitting distance 50.0"



APT Visit Splitting Example

M82: Visit splitting distance = 50"

MIRI Imaging FoV: 74"x113"

3x3 MIRI Imaging mosaic
using default tile overlap:

- 9 visits, 11.1 ks

Instrument: MIRI Template: MIRI Imaging

Coordinated Parallel:

Target: 2 M82

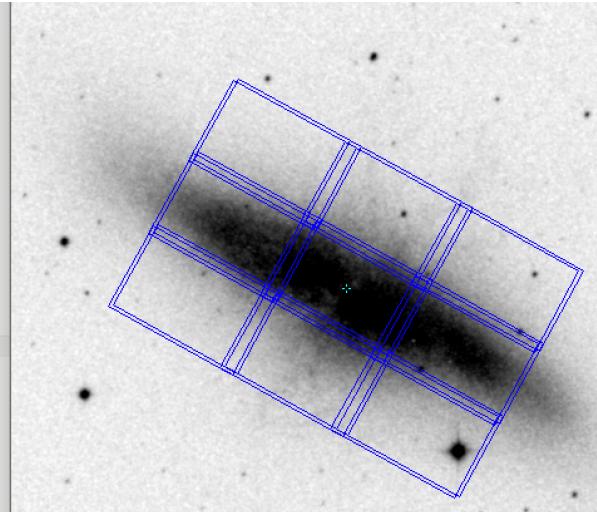
Visit Splitting: 50.0 Arcsec Number of Visits: 9

Duration (secs): 1512 Science: 11116 Total Charged: 1870 MB

Data Volume: 1870 MB

Mosaic Properties: Rows: 3, Columns: 3, Row Overlap %: 10.0, Column Overlap %: 10.0, Row shift: 0.0, Column shift: 0.0, Tile Order: DEFAULT

Comments: There are one or more visits for each tile so tile ordering has no effect



3x3 MIRI Imaging mosaic
using 45% column overlap:

- 6 visits, 9.8 ks

By increasing tile overlap, the tile separation has been reduced below the Visit Splitting Distance, thus reducing the number of APT visits from 9 to 6.

Instrument: MIRI Template: MIRI Imaging

Coordinated Parallel:

Target: 2 M82

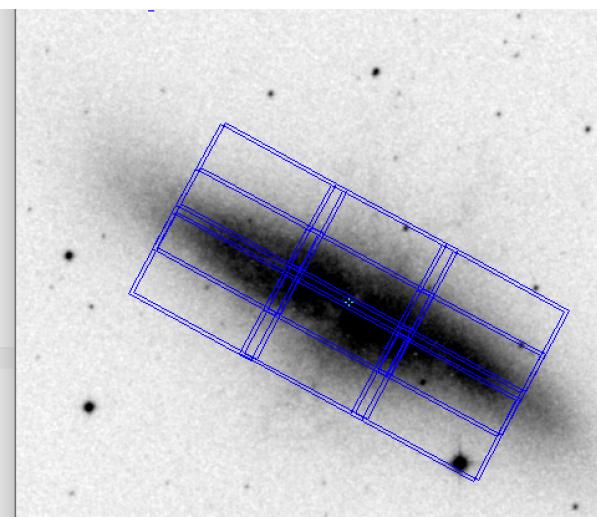
Visit Splitting: 50.0 Arcsec Number of Visits: 6

Duration (secs): 1512 Science: 9836 Total Charged: 1757 MB

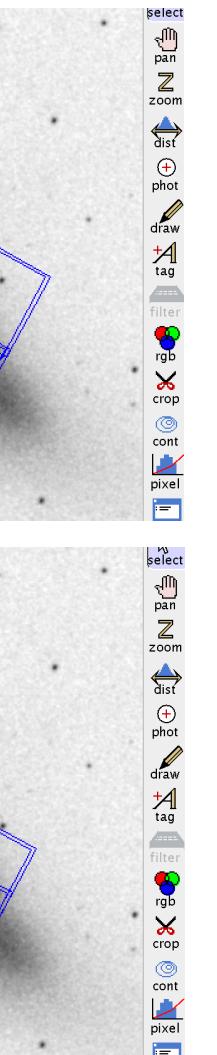
Data Volume: 1757 MB

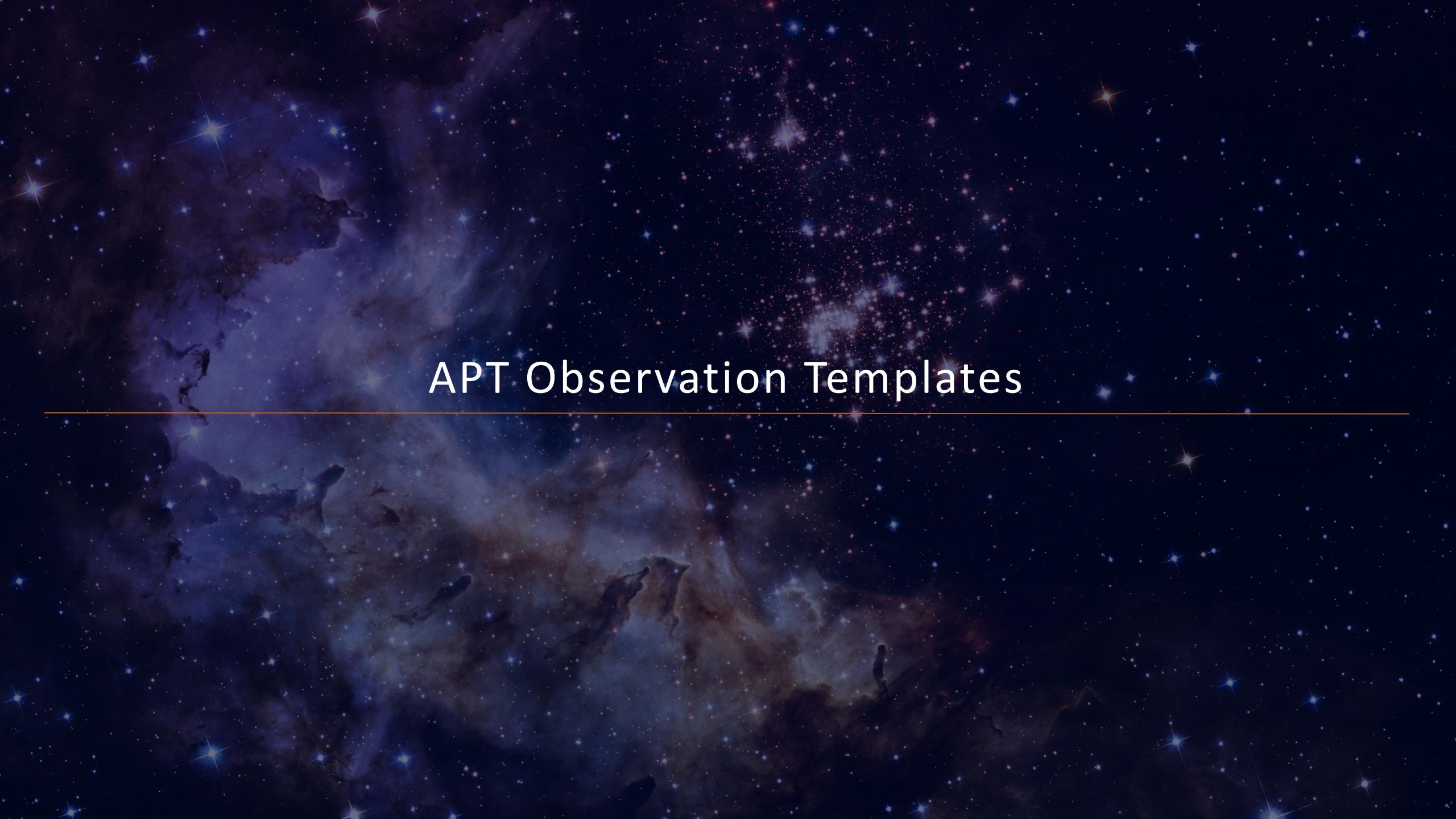
Mosaic Properties: Rows: 3, Columns: 3, Row Overlap %: 10.0, Column Overlap %: 45.0, Row shift: 0.0, Column shift: 0.0, Tile Order: DEFAULT

Comments: Default is HILBERT_CURVE



Additional Resource: [JDoc Article: APT Visit Splitting](#)



The background of the slide features a deep space scene with numerous small, glowing stars of varying colors (blue, white, yellow) scattered across a dark navy blue background. In the center-left, there is a prominent, large nebula with intricate, wispy structures in shades of blue, purple, and orange. A few bright, larger stars are visible, with some showing a slight lens flare effect.

APT Observation Templates



APT Observation Templates

Template Form changes based on selection of instrument and observing mode.

Ex: Coronagraphy requires a number of parameters not needed by other modes, so this only shows up when coronagraphy templates are selected.

The screenshot shows the APT Observation Template form for the MIRI instrument. The 'Instrument' dropdown is set to 'MIRI'. The 'Template' dropdown is set to 'MIRI Coronagraphic Imaging', which is highlighted with a yellow box. An arrow points from the text above to this dropdown. The 'Target' dropdown is set to '6 BET-PIC'. Below these are sections for 'Visit Splitting' (Splitting Distance: 55.0 Arcsec, Number of Visits: 1), 'Duration (secs)' (Science: 959, Total Charged: 4566), and 'Data Volume' (730 MB). At the bottom of this section are tabs for 'MIRI Coronagraphic Imaging' (selected), 'Special Requirements', and 'Comments'. Below this is a section titled 'Target Acquisition Parameters' with fields for 'Acq Target' (Target ACQ: Same Target as Observation), 'Acq Filter' (FND), 'Acq Readout Pattern' (FAST), 'Acq Groups/Int' (6), 'Acq Integrations/Exp' (1), 'Acq Total Integrations' (1), 'Acq Total Exposure Time' (1.438), and 'Acq ETC Wl' (99999). Another arrow points from the text above to this section. At the bottom is a section titled 'Coron Parameters' with fields for 'Coron Mask/Filter' (Coron Filter: 4QPM/F1065C), 'Mask' (4QPM), 'Filter' (F1065C), 'Readout Pattern' (FAST), 'Groups/Int' (40), 'Integrations/Exp' (100), 'Exposures/Dith' (1), 'Total Dithers' (1), 'Total Integrations' (100), 'Total Exposure Time' (958.72), and 'ETC' (99999). The 'Dither Type' dropdown is set to 'NONE'.

Additional Resource: [JDox Article: APT Observation Templates](#)



APT Observation Templates

Other operations that can change based on selected Templates:

- Whether mosaicking is allowed
- Whether coordinated parallels are allowed (and choices available)

The screenshot shows the APT Observation Templates interface with two main configuration panels.

Mosaic Properties Panel:

- Instrument: NIRCam Imaging
- Rows: 1
- Columns: 1
- Row Overlap %: 10.0
- Column Overlap %: 10.0
- Row shift: 0.0
- Column shift: 0.0
- Tile Order: DEFAULT
- View in Aladin
- Mosaic Tiles:

Tile Number	Tile State	Visits
1	Tile Included	[8:1, 8:2, 8:3]
- Note: There are one or more visits for each tile so tile ordering has no effect.

Template Panel:

- Prime Instrument: NIRCAM
- Template: NIRCam Imaging
- Coordinated Parallel: NIRCam-MIRI Imaging
- Module: ALL
- Subarray: FULL
- Dither Parameters:
 - Primary Dither Type: FULL
 - Primary Dithers: 9
 - Subpixel Dither Type: 3-POINT-WITH-MIRI-F560W
- Note: FULL* dither types take large steps that result in variable depth over the imaged area. Review coverage in Aladin and compensate in ETC.
- Table:

#	Short Filter	Long Filter	Readout Pattern	Groups/Int	Integrations/...	Total Dithers	Total Integrations	Total
1	F200W	F444W	DEEP2	10	1	27	27	52



APT Observation Templates

Other operations that can change based on selected Templates:

- Whether Target Acquisition is needed (or not)
- Details of dithering and filter/grating selections available

The screenshot shows the APT Observation Templates interface for a MIRI Coronagraphic Imaging observation. The top section displays basic parameters: Instrument (MIRI), Template (MIRI Coronagraphic Imaging), Target (6 BET-PIC), Splitting Distance (55.0 Arcsec), Number of Visits (1), Duration (secs) (959), Total Charged (4566), and Data Volume (730 MB). Below these are tabs for 'MIRI Coronagraphic Imaging' (selected), 'Special Requirements', and 'Comments'. The main area contains several expandable sections: 'Target Acquisition Parameters' (highlighted with a yellow box), 'Coron Parameters' (highlighted with a yellow box), and 'Dither Type' (highlighted with a yellow box). The 'Target Acquisition Parameters' section includes fields for Target ACQ (Same Target as Observation), Acq Readout Pattern (FAST), Acq Groups/Int (6), Acq Integrations/Exp (1), Acq Total Integrations (1), Acq Total Exposure Time (1.438), Acq ETC Wk (99999), and Acq Quadrant (1). The 'Coron Parameters' section includes fields for Coron Filter (4QPM/F1065C, 4QPM/F1140C, 4QPM/F1550C, LYOT/F2300C, selected), Mask (4QPM), and Filter (F1065C). The 'Dither Type' section includes fields for Exposure Time (FAST), Groups/Int (40), Integrations/Exp (100), Exposures/Dith (1), Total Dithers (1), Total Integrations (100), Total Exposure Time (958.72), and ETC (958.72). Arrows from the left side point to each of these highlighted sections.



APT Target Acquisition

- Some templates have no target acquisition
- Some templates require a target acquisition
- Some templates, the target acquisition is optional

NOTE: If the target acquisition fails, the observation fails!

Users should obtain accurate target acquisition exposure information using the [JWST Exposure Time Calculator](#) and transfer to APT.

The screenshot shows the APT software interface. The 'Target Acquisition Parameters' section is highlighted with a yellow box. It contains fields for 'Acq Target' (set to '4 SOMESTAR'), 'Acq Filter' (set to 'F560W'), 'Acq Readout Pattern' (set to 'FAST'), 'Acq Groups/Int' (set to '10'), 'Acq Integrations/Exp' (set to '1'), 'Acq Total Integrations' (set to '1'), 'Acq Total Exposure Time' (set to '27.75'), 'Acq ETC Wkbk.Calc ID' (set to '99999'), and an 'ETC' button. Below this is the 'MRS Parameters' section, which is partially visible. A yellow annotation box highlights the 'Acq ETC Wkbk.Calc ID' field, and a blue arrow points from the text on the right to this field.

Note: optional annotation box, useful for documenting your calculation ID!

Additional Resources:

- [JDox Article: APT Target Acquisition](#)
- [JDox Article: APT to ETC Connectivity](#)



APT Observation Templates

Instrument NIRCAM

Template **NIRCam Imaging**

Coordinated Parallel

Target 1 M-51

Splitting Distance Number of Visits
Visit Splitting: 40.0 Arcsec 18

Science Total Charged
Duration (secs) 774 21119

Data Volume 7001 MB

NIRCam Imaging Mosaic Properties Special Requirements

Module ALL

Subarray FULL

Primary Dither Type Primary Dithers Subpixel
Dither Parameters FULL 3 STANDARD

FULL* dither types take large steps that result in variable depth over the imaged in ETC.

#	Short Filter	Long Filter	Readout P...	Groups/Int	Int...
1	F200W	F444W	RAPID	2	2

Filters

No Target Acquisition needed

Instrument MIRI

Template **MIRI Coronagraphic Imaging**

Target 6 BET-PIC

Splitting Distance Number of Visits
Visit Splitting: 55.0 Arcsec 1

Science Total Charged
Duration (secs) 959 4560

Data Volume 730 MB

MIRI Coronagraphic Imaging Special Requirements Comments

Target Acquisition Parameters

Acq Target	Acq Filter
Target ACQ Same Target as Observation	FND

Acq Readout Pattern	Acq Groups/Int	Acq Integrations/Exp	Acq Total Integrations	Acq Total
FAST	6	1	1	1.438

Acq Quadrant
1

Coron Parameters

Coron Mask/Filter	Mask	Filter
Coron Filter 4QPM/F1065C	4QPM	F1065C

Readout Pattern	Groups/Int	Integrations/Exp	Exposures/Dith	Total Dithers	Total Integration
Exposure Time FAST	40	100	1	1	100

Target Acquisition needed



APT Special Requirements



APT Special Requirements

Additional constraints placed on specific observations.

Applied at the observation level.

- Affects all visits within an observation

Explicit requirements: set by user

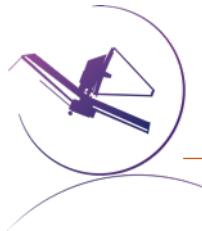
- Must be justified by the science goals
- Can decrease scheduling availability

Implicit requirements: set by APT and reported for your information.

	NIRCam Imaging	MIRI Imaging	Mosaic Properties	Special Requirements	Comments
Special Requirements				<p>Aperture PA Range 149.887474 to 149.887474 Degrees (V3 150.0 to 150.0)</p> <p>No Parallel</p>	
Implicit Requirements				<p>Group Visits within 53.0 Days</p> <p>Visits Same PA</p>	<p>Add...</p> <p>Remove</p> <p>Edit</p>

Additional Resources:

- [JDoc Article: APT Special Requirements](#)
- [YouTube Video Tutorial: APT Special Requirements](#)



APT Special Requirements

Mosaic Properties Special Requirements Comments

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

Properties Special Requirements Comments

Timing ► Remove
Position Angle ►
Offset
Time Series Observation
No Parallel
On Hold
Target Of Opportunity
Maximum Visit Duration
Background Limited

PA Range
PA Offset Link
Same PA Link

Timing requirements: Several options

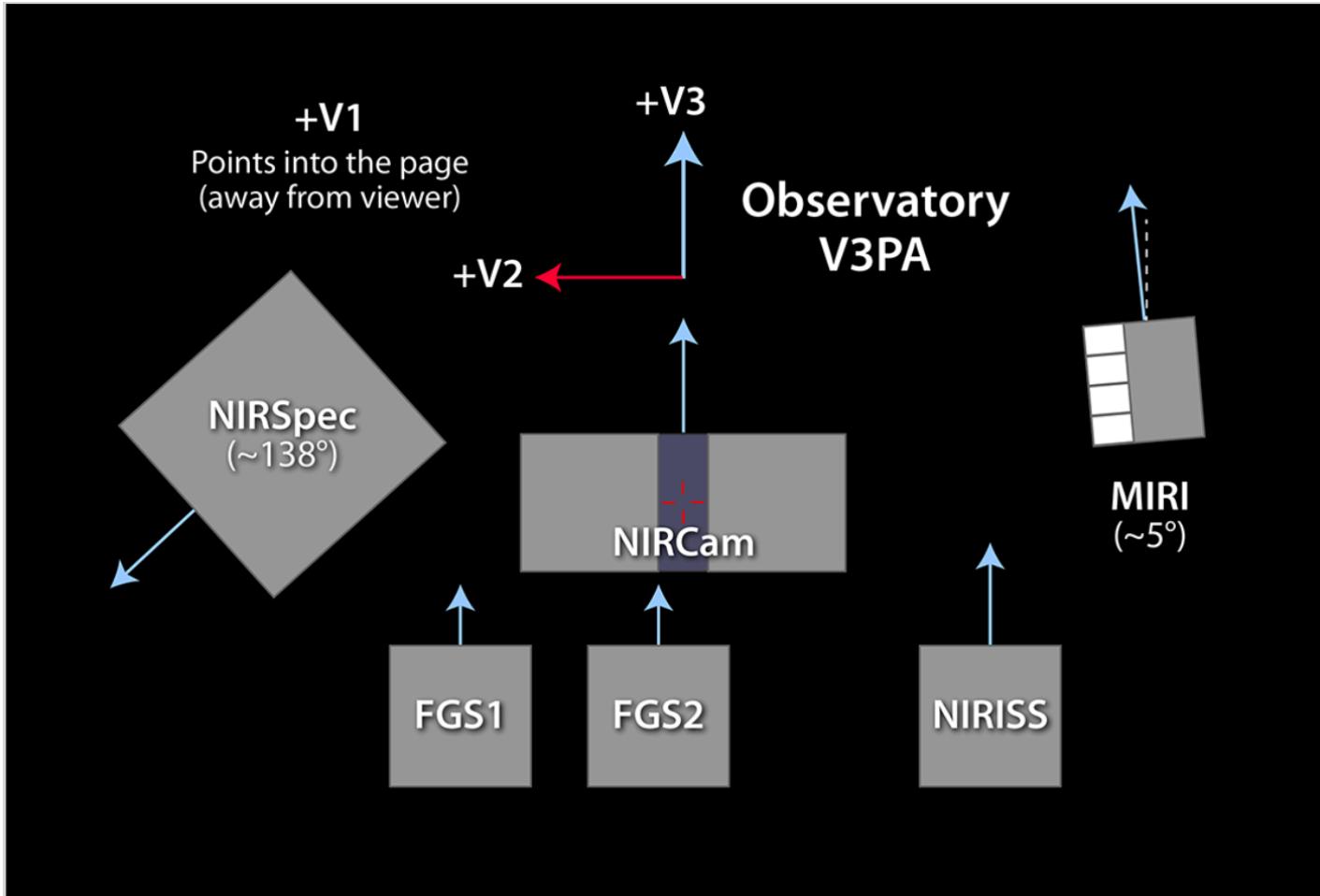
- Observation needs to execute at a particular time or time window.
- Observation needs to happen at some time relative to another observation.
- Several observations need to execute together without interruption.

Position angle requirements: Several options

- Observation needs to execute at a particular PA or within some range.
- Observation needs to happen at an offset angle from another observation.
- Observation needs to happen at same angle as another observation



V3 Position Angle (V3PA) vs Aperture Position Angle (APA)



Instrument	Offset Angle from V3
NIRCam	0.0°
MIRI	4.45°
NIRISS	0.57°
NIRSpec	138.5°

V3PA is the observatory reference angle used by APT diagnostics and the scheduling system.

APA is specific to each instrument, and is the PA (degrees east of north as projected onto the sky) of the reference axes shown as light blue arrows at left.

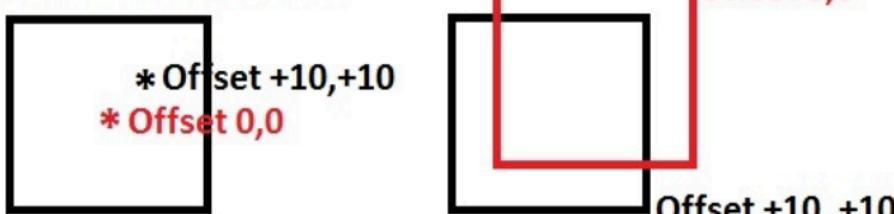
Additional Resource: [JDox Article: Position Angles, Ranges and Offsets](#)



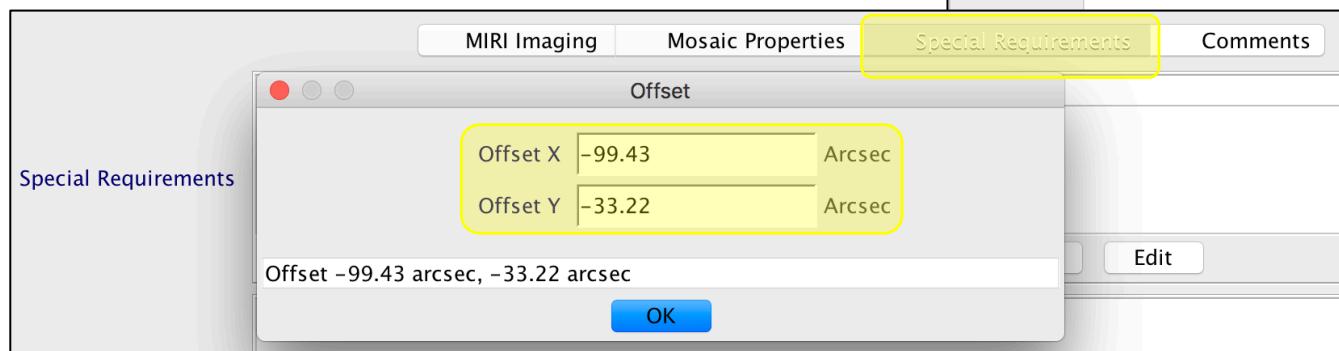
APT Special Requirement

An Offset specifies a non-default placement of the target, relative to the aperture fiducial point in the instrument field of view, which must be on an external target.

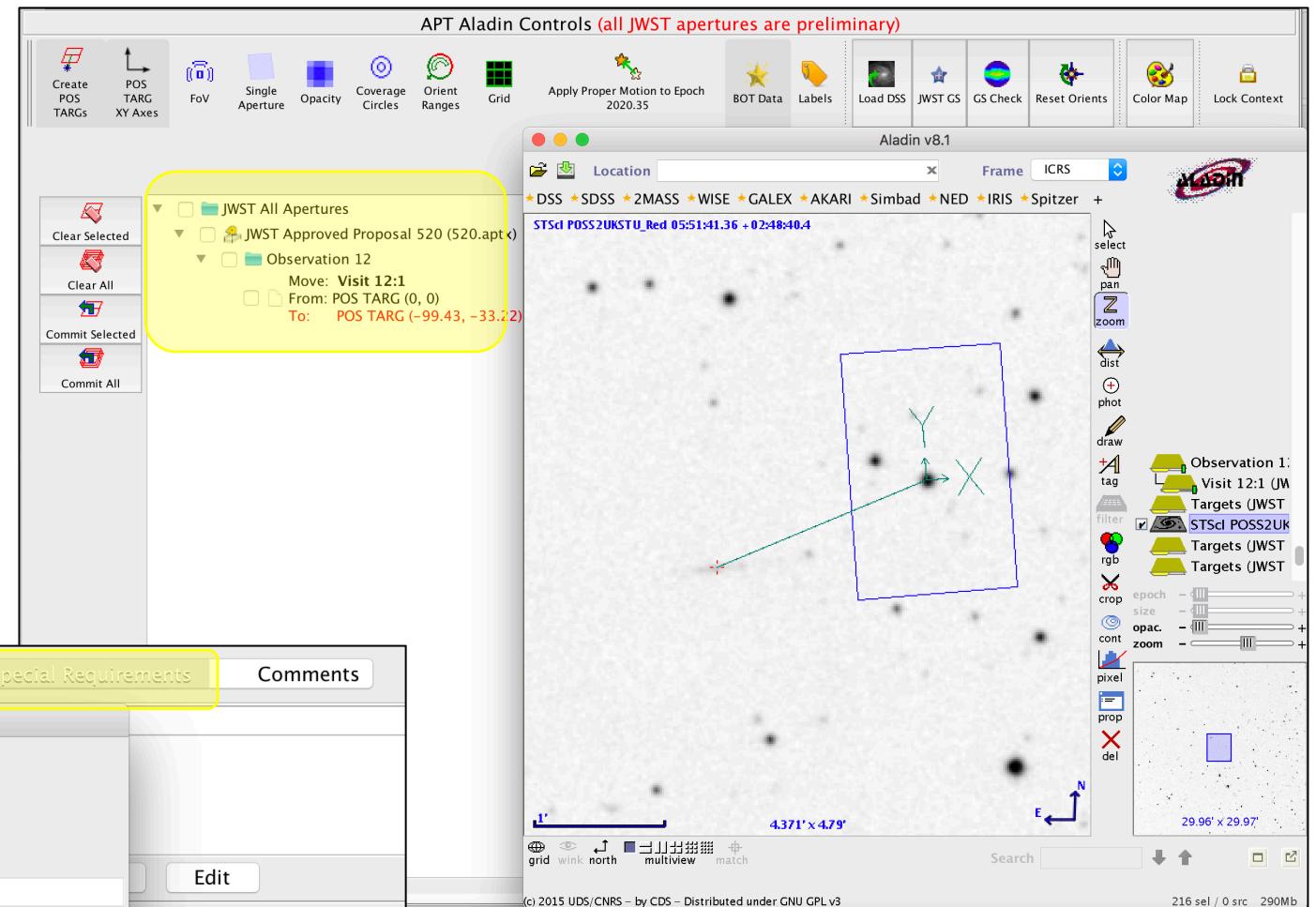
Two exposures overlaid



Two exposures previewed
on the sky



Ex: Offset special requirement





APT Visit Planner



APT Visit Planner

The APT visit planner performs a detailed check of the *schedulability* of the visits in observations, including visibility, constraint checking, and whether guide stars are available.

Diagnostic information is provided when scheduling checks fail. But interpreting this information can be tricky.

The following slides walk through a couple of example cases to give you a sense of how to use the available reports and graphs.

Additional Resources:

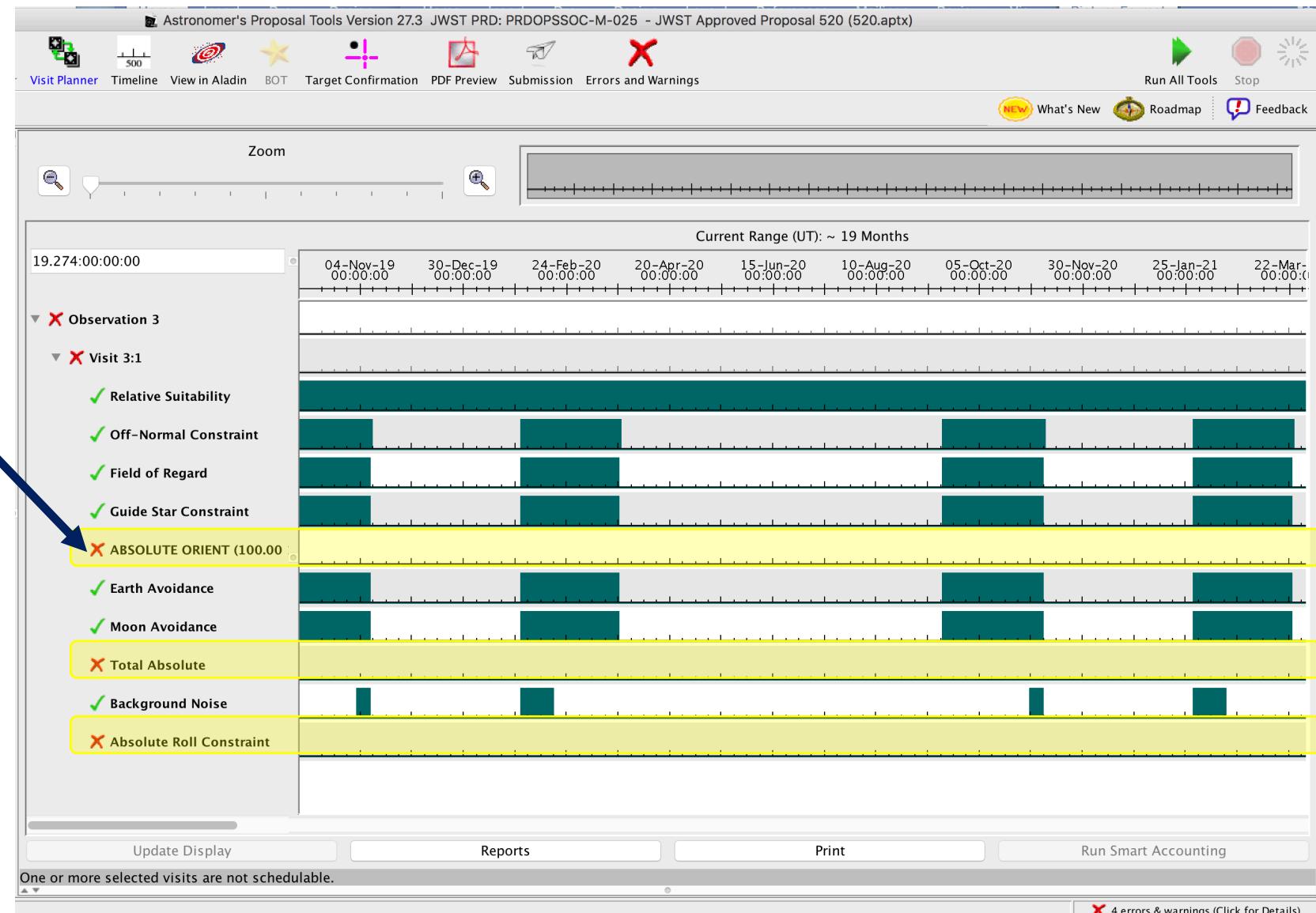
- [JDox Article: APT Visit Planner](#)
- [YouTube Video Tutorial: APT Visit Planner](#)



APT Visit Planner Diagnostics – Position Angle Problems

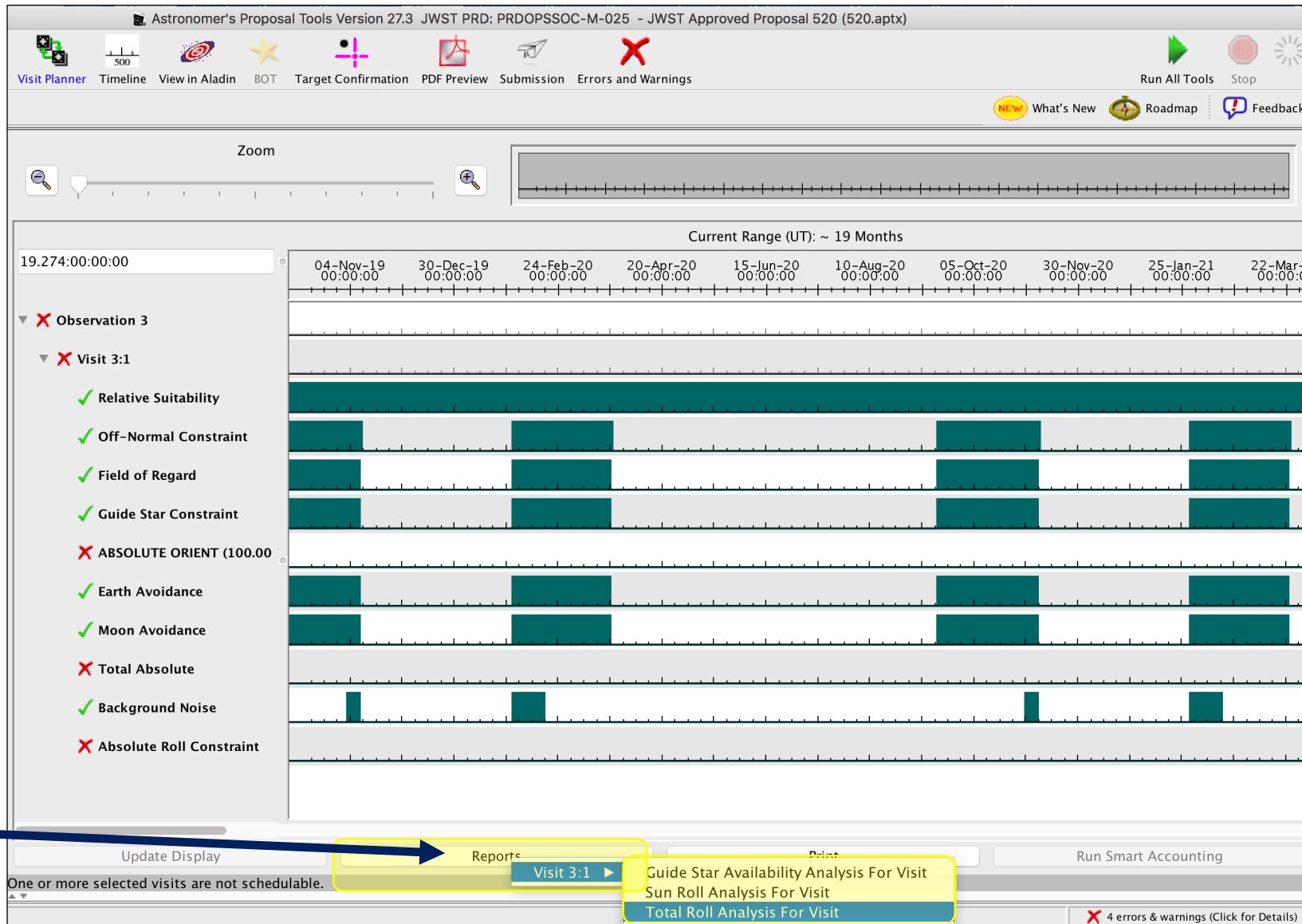
Observation fails scheduling check:
Issue with ORIENT (aka position angle)

Note: all constraints windows need to have a window of schedulability at the same time.





APT Visit Planner Diagnostics – Position Angle Problems

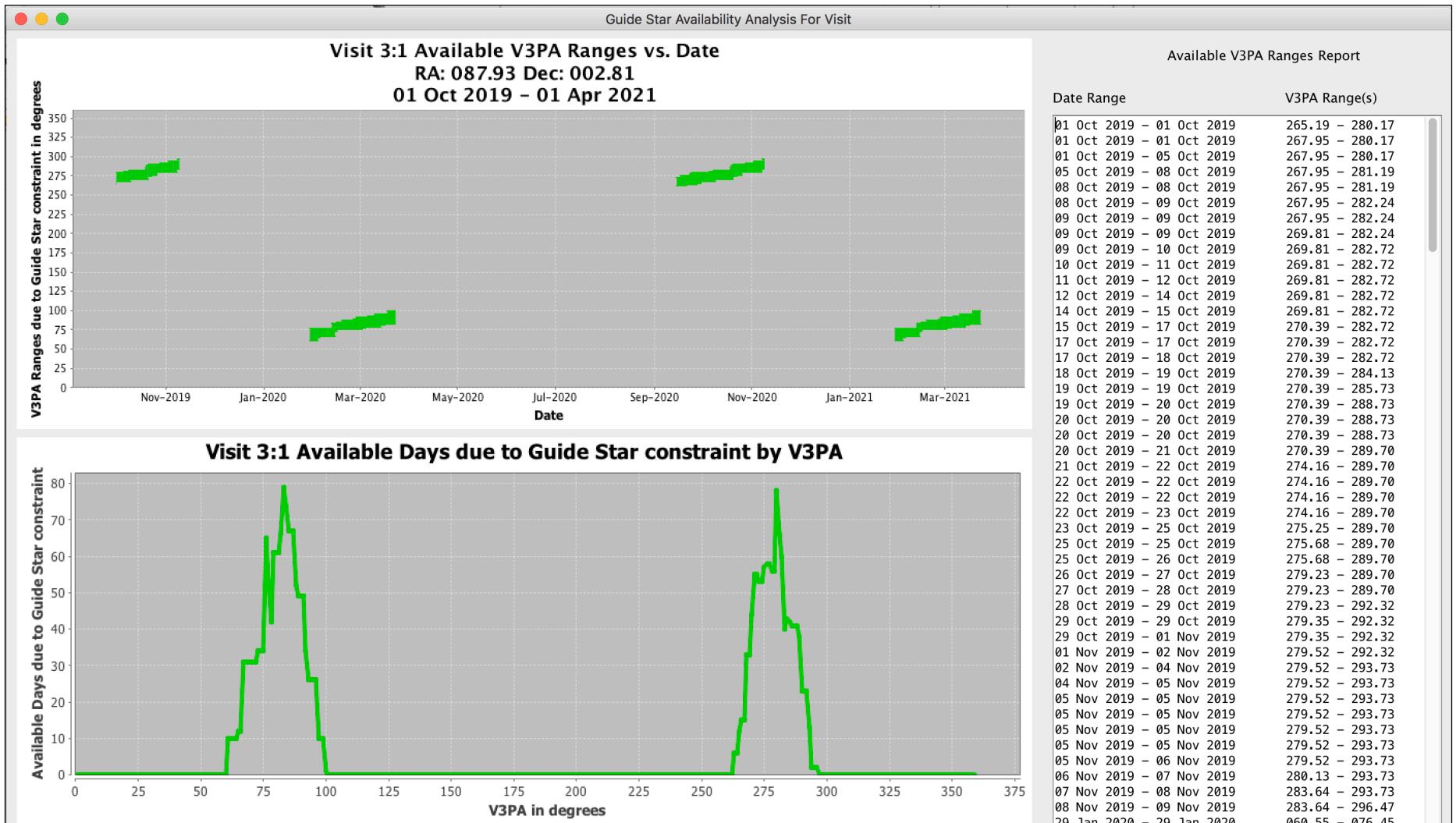


To review the
Roll Angle
Report/Graph



APT Visit Planner Diagnostics – Position Angle Problems

Graph shows range of V3 position angles available as a function of date.



Graph shows the number of days each V3 position angle is available.

Report of Available Date/Angle Ranges



APT Visit Planner Diagnostics – Position Angle Problems

Astronomer's Proposal Tools Version 27.3 JWST PRD: PRDOPSSOC-M-025 – JWST Approved Proposal 520 (520.aptx)

Timeline View in Aladin BOT Target Confirmation PDF Preview Submission Errors and Warnings

Observation 3 of JWST Approved Proposal 520 (520.aptx)

Number: 3 Status: UNKNOWN

Label:

Instrument: MIRI

Template: MIRI Medium Resolution Spectroscopy

Target: 3 HH-111

Visit Splitting: 70.0 Arcsec Number of Visits: 1

Science Duration (secs): 448 Total Charged: 5506

Data Volume: 1134 MB

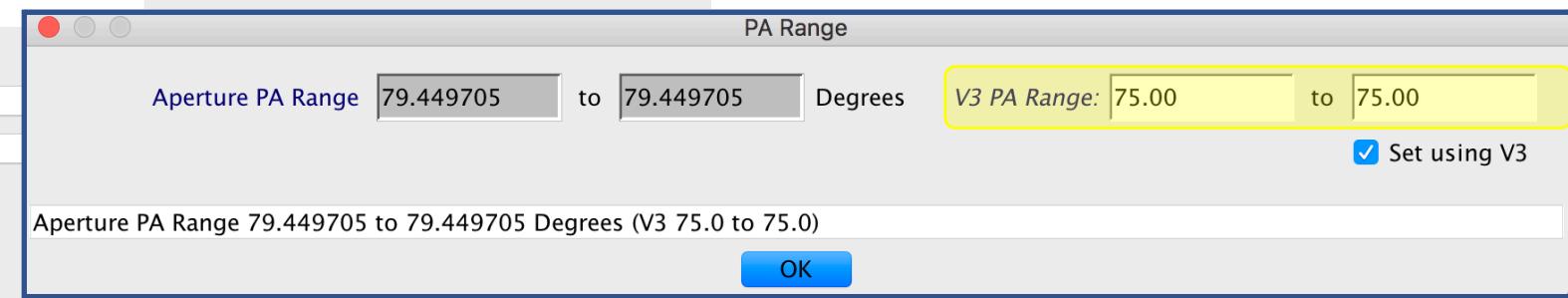
MIRI Medium Resolution Spectroscopy Mosaic Properties Special Requirements Comments

Background Limited. Background no more than 10% above minimum

Special Requirements

Implicit Requirements

Timing Remove ► it
Position Angle ► PA Range
Offset
Time Series Observation
No Parallel
On Hold
Target Of Opportunity
Maximum Visit Duration
Background Limited
PA Offset Link
Same PA Link

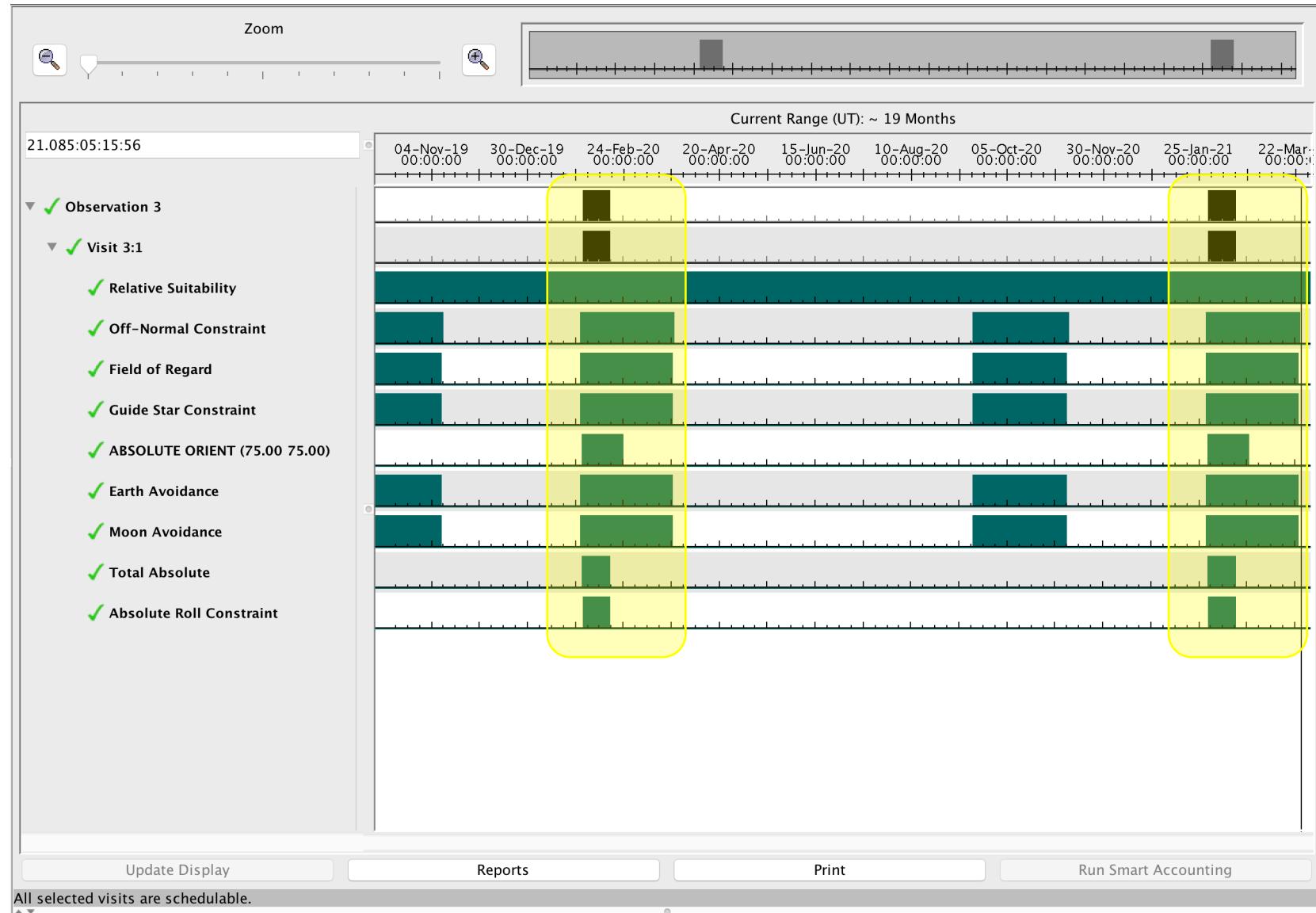


Go to the Special Requirements in template, edit the V3PA



APT Visit Planner Diagnostics – Position Angle Problems

Observation now passes scheduling check:
All constraints have green check marks and the constraint windows overlap.

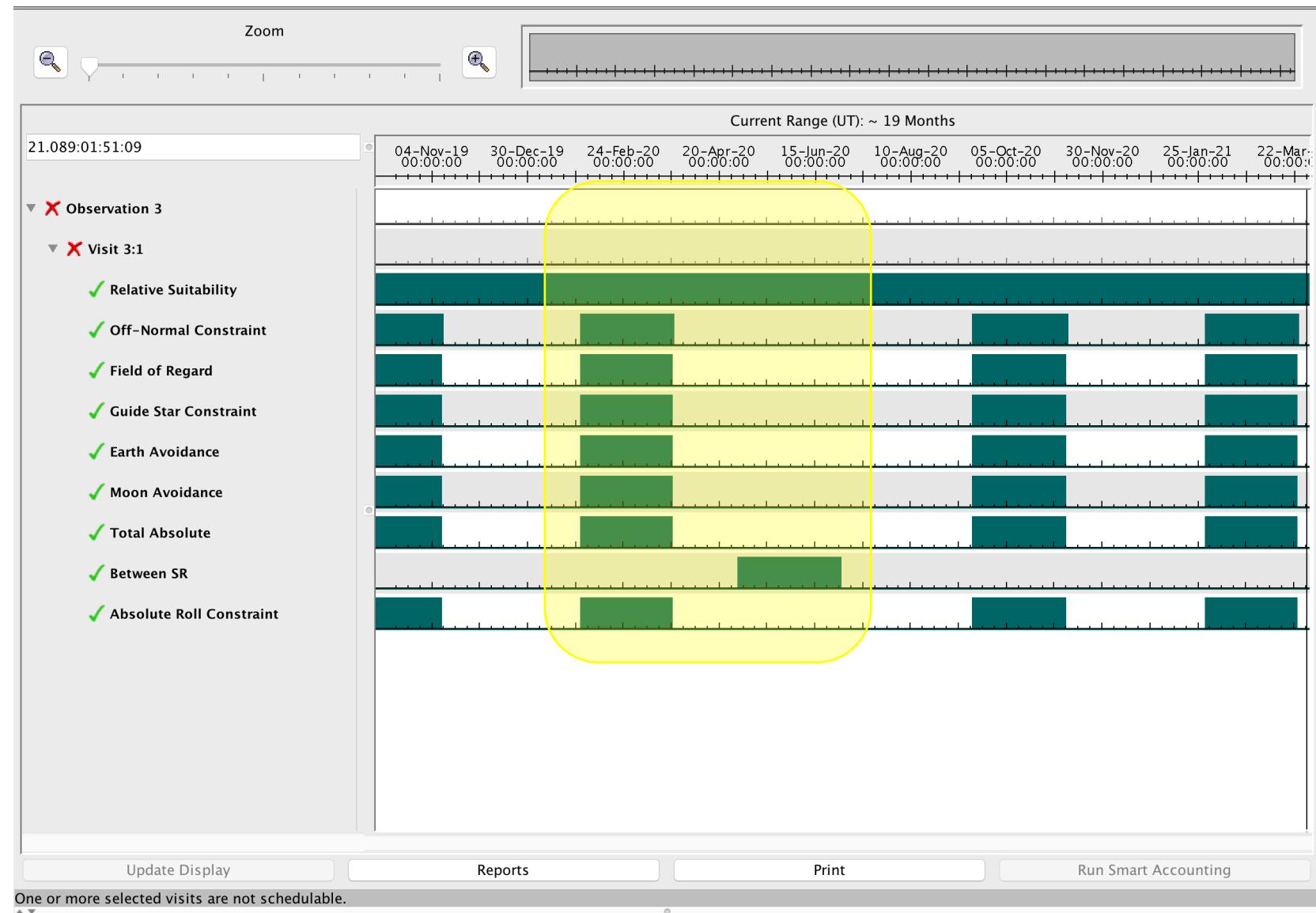




APT Visit Planner Diagnostics – Timing Problem

Observation fails scheduling check:
Timing constraint does not allow scheduling as specified.

Note: all constraints windows need to overlap for schedulability!



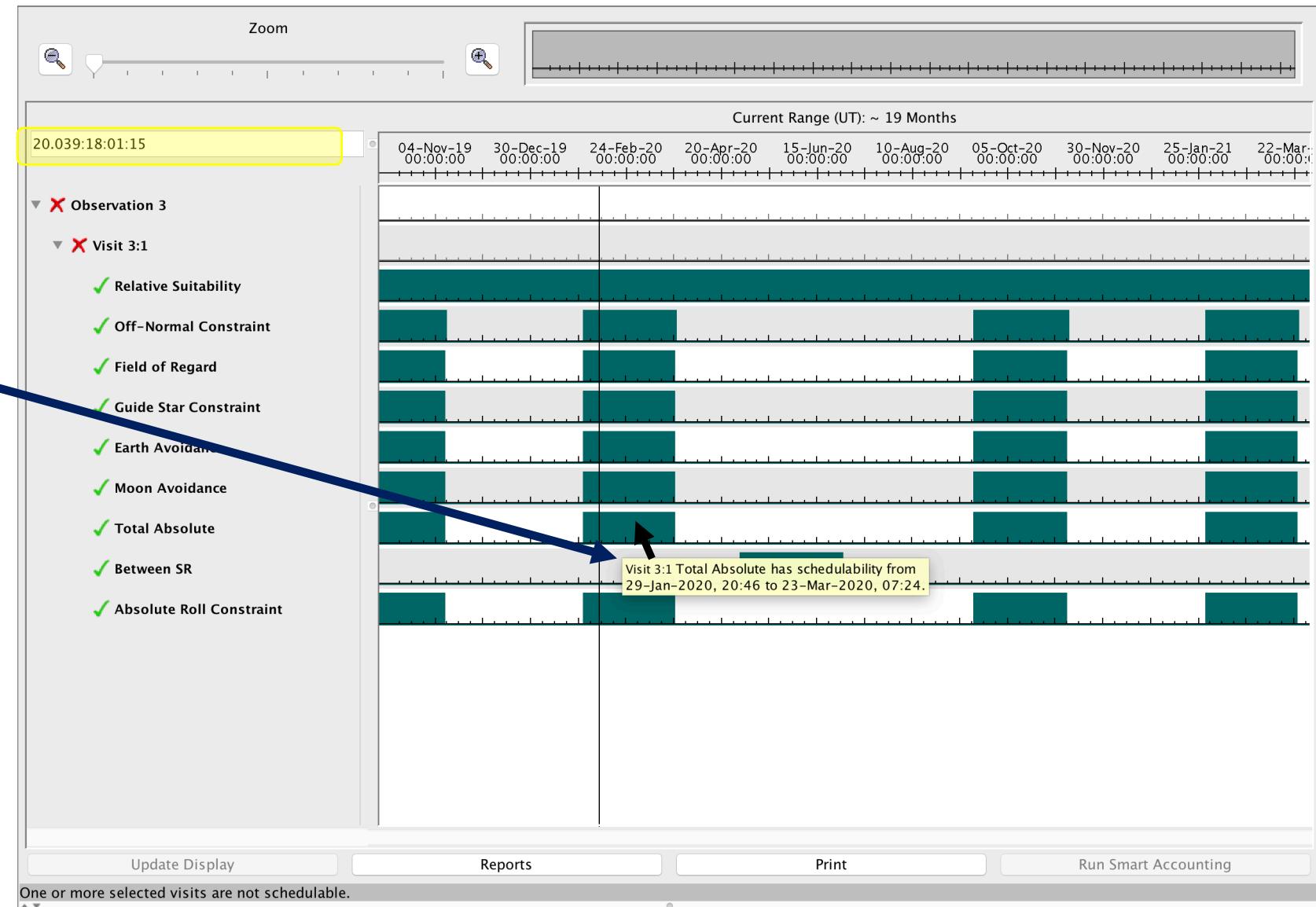


APT Visit Planner Diagnostics – Timing Problem

Examine the issue:
The requested
BETWEEN time is not
available.

Hover cursor over a
constraint window to
view schedulable time
range in pop up window.

The vertical slider bar
can be used to read
specific times, listed at
upper left (yellow
highlight).





APT Visit Planner Diagnostics – Timing Problem

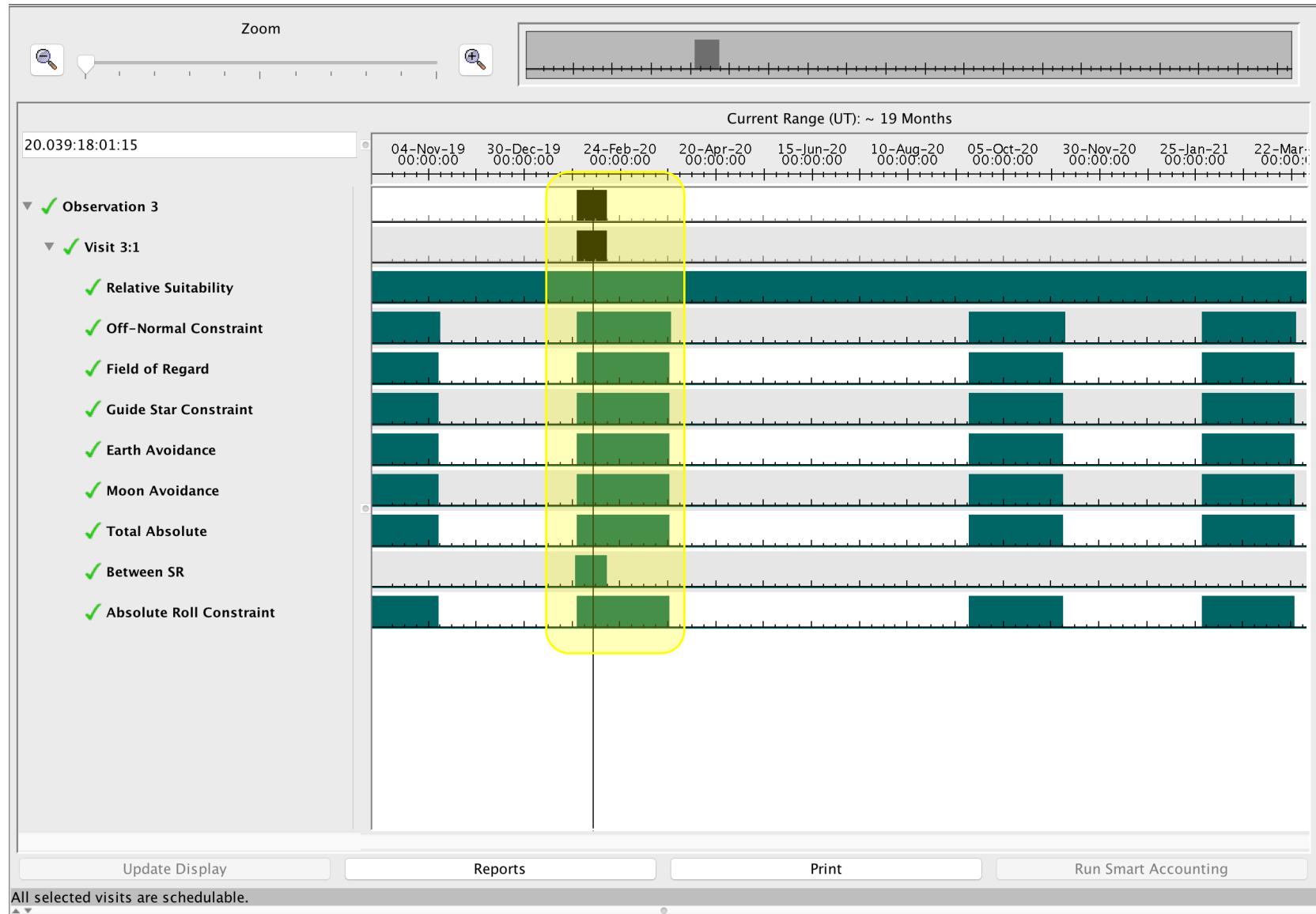
Go to the Special Requirements in template, enter a time constraint that will work.

The screenshot shows the APT Visit Planner interface. At the top, there are fields for Number (3), Status (UNKNOWN), Label, Instrument (MIRI), Template (MIRI Medium Resolution Spectroscopy), and Target (3 HH-111). Below these are sections for Visit Splitting, Duration (secs), and Data Volume. A modal dialog titled "Between Dates" is open, showing "After date" as 29-JAN-2020:00:00:00 and "Before date" as 23-MAR-2020:00:00:00. The "OK" button is visible at the bottom of the dialog. In the background, tabs for "MIRI Medium Resolution Spectroscopy", "Mosaic Properties", "Special Requirements", and "Comments" are visible. The "Special Requirements" tab is active. A context menu is open over the "Special Requirements" tab, with "Timing" selected. Other options in the menu include Position Angle, Offset, Time Series Observation, No Parallel, On Hold, Target Of Opportunity, Maximum Visit Duration, and Background Limited. To the right of the menu, buttons for After Date, Before Date, Between Dates, Phase, After Observation Link, and Group/Sequence Observations Link are shown. At the bottom of the interface, buttons for Edit HH111 spectroscopy, New, and Edit Visit 3:1 are present.



APT Visit Planner Diagnostics – Timing Problem

Observation now passes scheduling check:
All constraints have green check marks
and the constraint windows overlap.



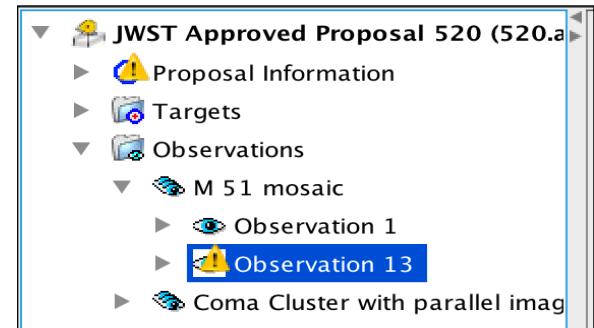
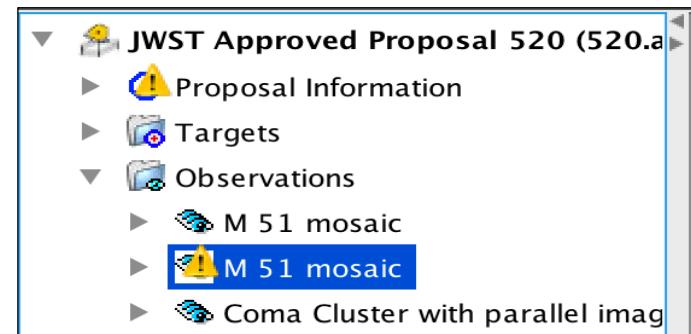
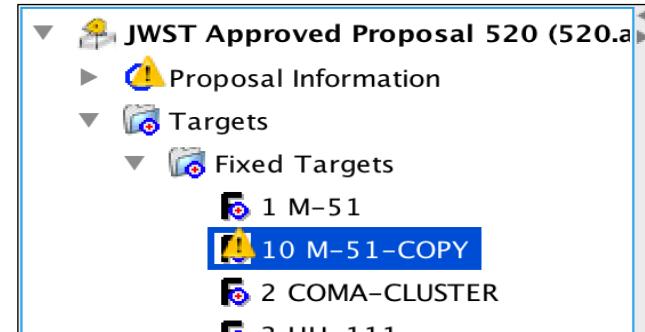
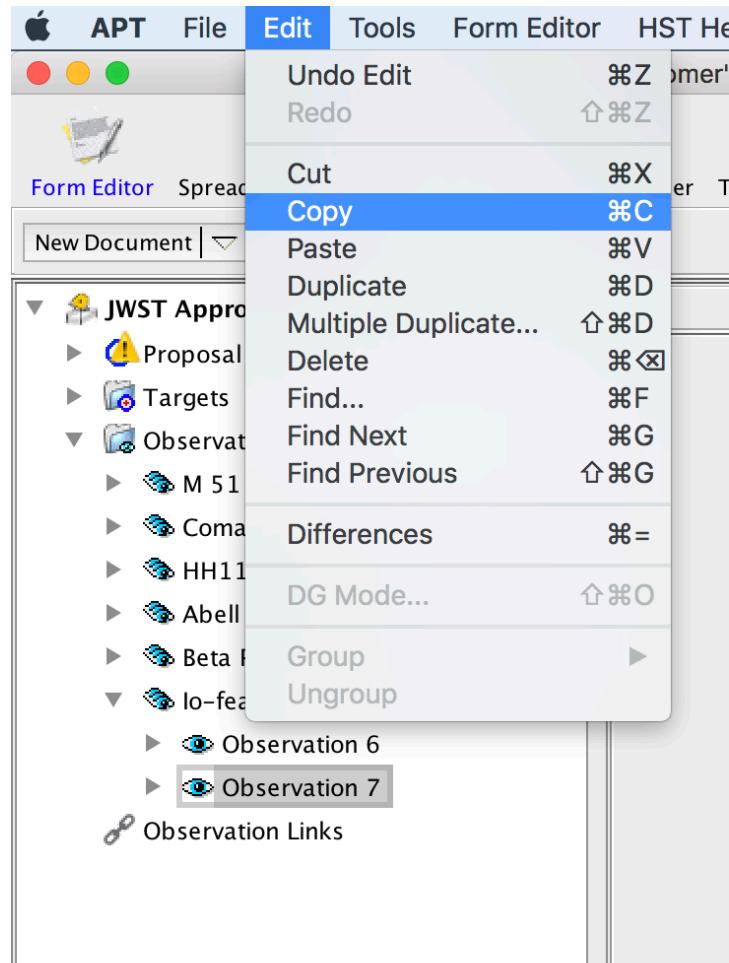
Other Useful APT Capabilities

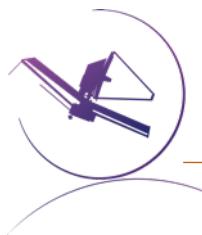


Other Useful APT Capabilities - Copy/Paste

Copy/Paste a target, observation folder, or observation within your proposal or into a separate proposal.

Important to revise a label to provide clear tracking within your proposal.

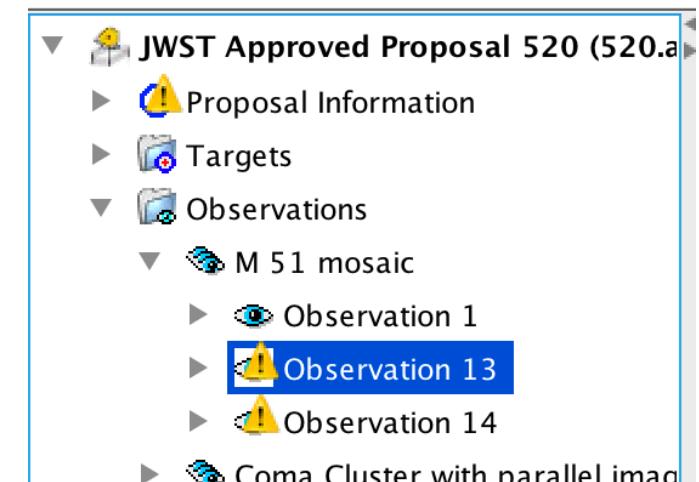
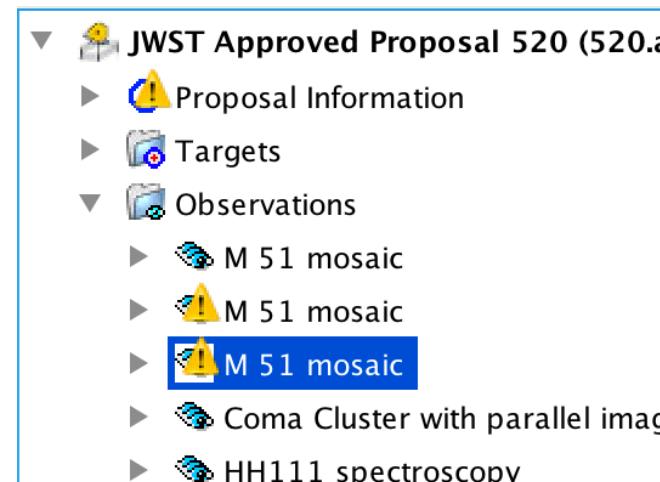
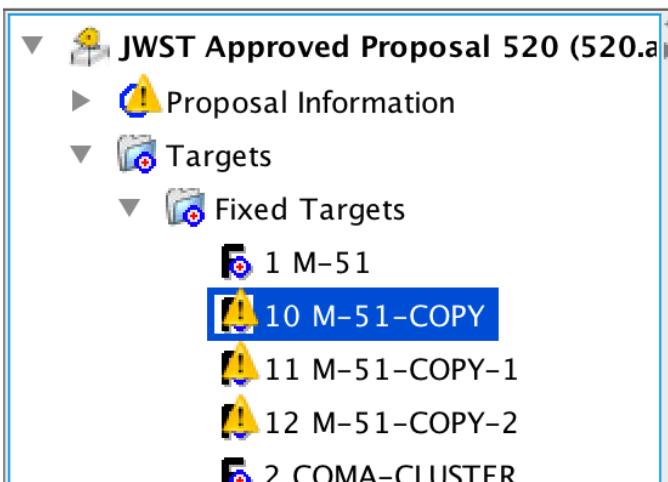
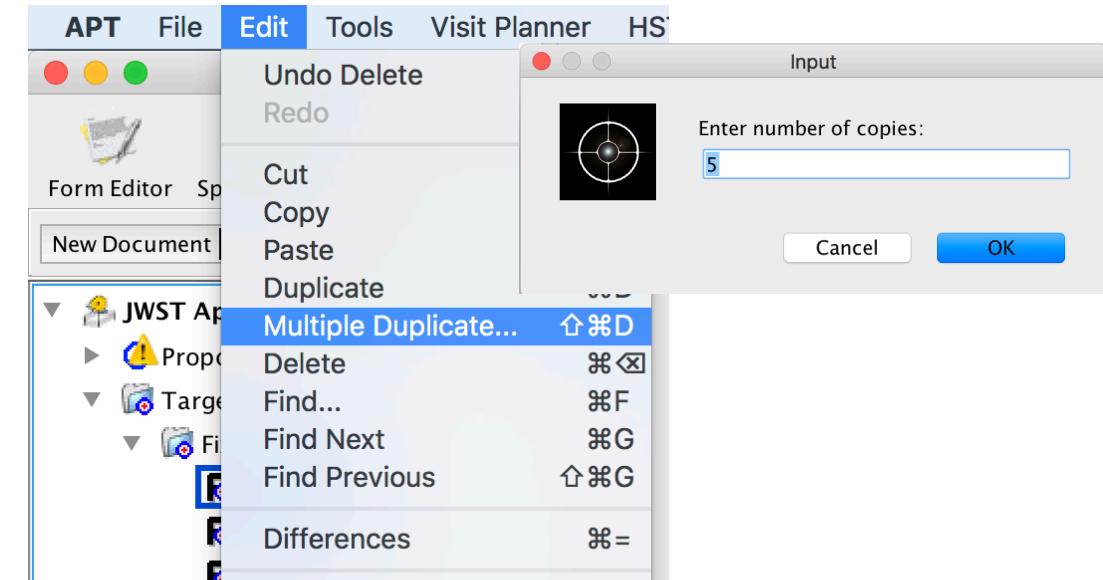
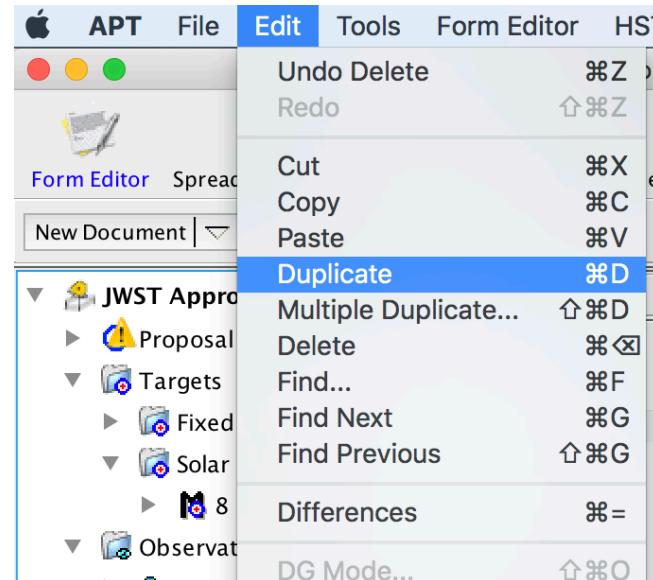


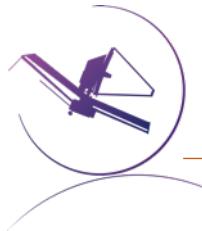


Other Useful APT Capabilities - Duplicate

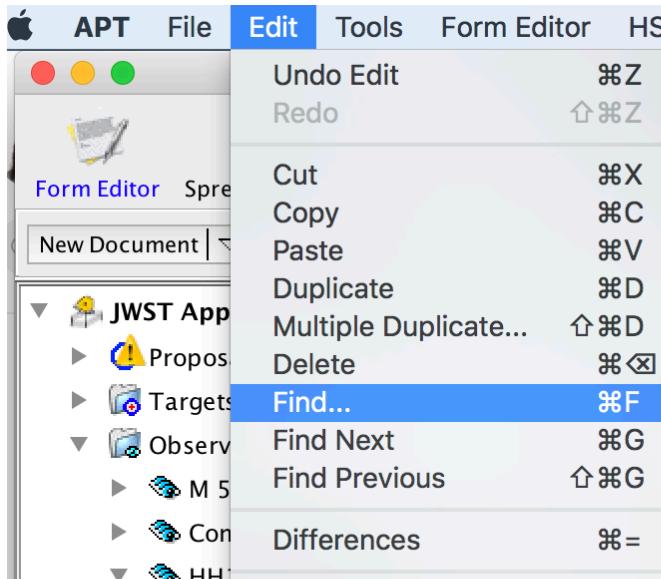
Duplicate/Multiple Duplicate
a target, observation folder
or observation

Important to revise a label
to provide clear tracking
within your proposal.





Other Useful APT Capabilities - Find



Find – can search on any part of the APT file (proposal info, target, observation, etc.)

Ex. find filter F1000W

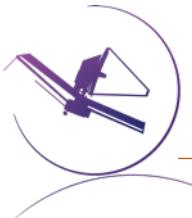
The screenshot shows the APT application interface for JWST Approved Proposal 520. The 'Edit' menu is open, and the 'Find...' option is selected. A 'Find' dialog box is overlaid on the main window, containing a search field with 'Find: F1000W' and a table of results:

Form	Field	Editor
Observation 3	Filter	F1000W
Observation 3	Filter	F1000W
Observation 3	Filter	F1000W
Observation 12	Filter	F1000W
Observation 6	Filter	F1000W
Observation 7	Filter	F1000W

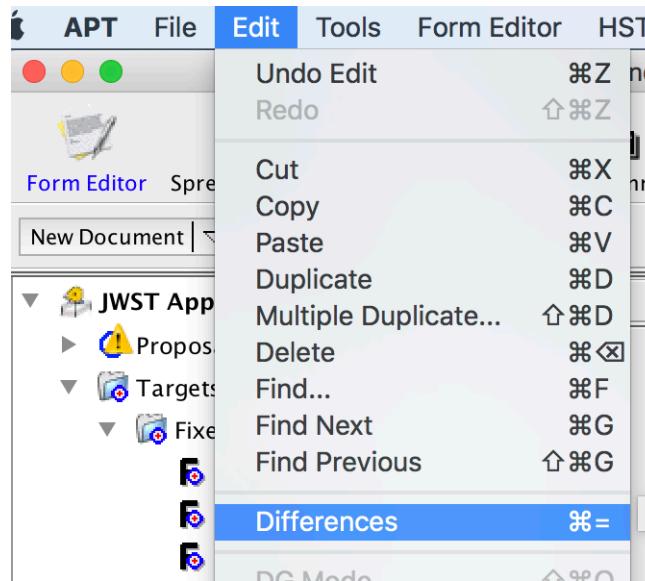
At the bottom of the dialog, it says 'Found 6 matches.'

The main window displays the 'Observation Parameters' for Observation 12, including Acq Target (4 SOMESTAR), Acq Filter (F560W), and Acq Readout Pattern (FAST). Below this, there is a table of imager subarray settings:

#	Detector	Wavelength...	Filter	Readout P...	Groups/Int	Integratio...	
1	IMAGER	MRSLONG	SHORT(A)	F770W	FAST	5	1
1	IMAGER	MRSLONG	SHORT(A)	F770W	FAST	10	1
2	IMAGER	MRSLONG	MEDIUM(B)	F770W	FAST	5	1
2	IMAGER	MRSLONG	LONG(C)	F1000W	FAST	10	1
3	IMAGER	MRSSHORT	LONG(C)	F1000W	FAST	5	1
3	IMAGER	MRSSHORT	LONG(C)	F1000W	FAST	20	1
3	IMAGER	MRSSHORT	LONG(C)	F1000W	FAST	20	1



Other Useful APT Capabilities – Differences



Differences – can difference two separate proposals, or on any part of the APT file (two parts of proposal info, two targets, two observations, etc.)

The screenshot shows the APT software interface with the title bar "Astronomer's Proposal Tools Version 27.3 JWST PRD: PRDOPSSOC-M-025 - JWST Approved Proposal 520 (520.aptx)". The main window displays the "Target Acquisition Parameters" and "MRS Parameters" for Observation 12. A yellow box highlights the "Differences" section in the "Diagnostic Browser" at the bottom, which lists five differences related to observation numbers and filter changes.

Element	Severity	Source	Description
Observation 3	Difference	Differences	Observation Number was changed from 3 in Observation 3 to 12 in Observation 12
Visit 3:1	Difference	Differences	JwstMosaicTile Visits was changed from [3:1] in Observation 3 to [12:1] in Observation 12
Observation 12	Difference	Differences	JWST Exposure Filter was changed from F1000W in Observation 3 to F770W in Observatio...
Visit 12:1	Difference	Differences	JWST Exposure Filter was changed from F1000W in Observation 3 to F770W in Observatio...
	Difference	Differences	JWST Exposure Filter was changed from F1000W in Observation 3 to F770W in Observatio...

Difference (Differences) Observation Number was changed from 3 in Observation 3 to 12 in Observation 12

Ex. Difference two observations

APT Overheads and Smart Accounting



APT Overheads

- JWST autonomous operations are complex.
 - There are many activities that need to occur to set up each observation. While most are fairly short, in the ensemble, the time can add up.
 - Slewing and settling take time, even for small motions.
- By policy, JWST amortizes the estimated time for calibrations and observatory and charges to each program.
 - Pre-launch estimate for this is 16%, which is included by APT.
- But to first order, overheads are what they are.
 - There is not too much you can do to lower your overhead charges by changing details in APT.
 - The Smart Accounting step in APT makes a reasonable attempt to lower artificially high overheads. (Covered below.)

*Our best advice to you is to concentrate on the science you want to do
and don't be overly concerned about overheads!*



APT Overheads, continued

- Direct overheads – activities directly associated with an observing program
 - major slews
 - mechanism motion times
 - guide star acquisition times
 - small angle maneuvers
 - target acquisitions
- Indirect overheads – activities performed for the general support of science observations (16%)
 - calibrations
 - momentum management
 - wavefront sensing and control
 - other observatory maintenance activities
- Instrument overheads – activities directly associated with each instrument
 - Filter/grating changes
 - detector readout
 - Instrument operations script compilation time

Additional Resource:

- [JDox Article: JWST Overheads and Time Accounting Overview](#)



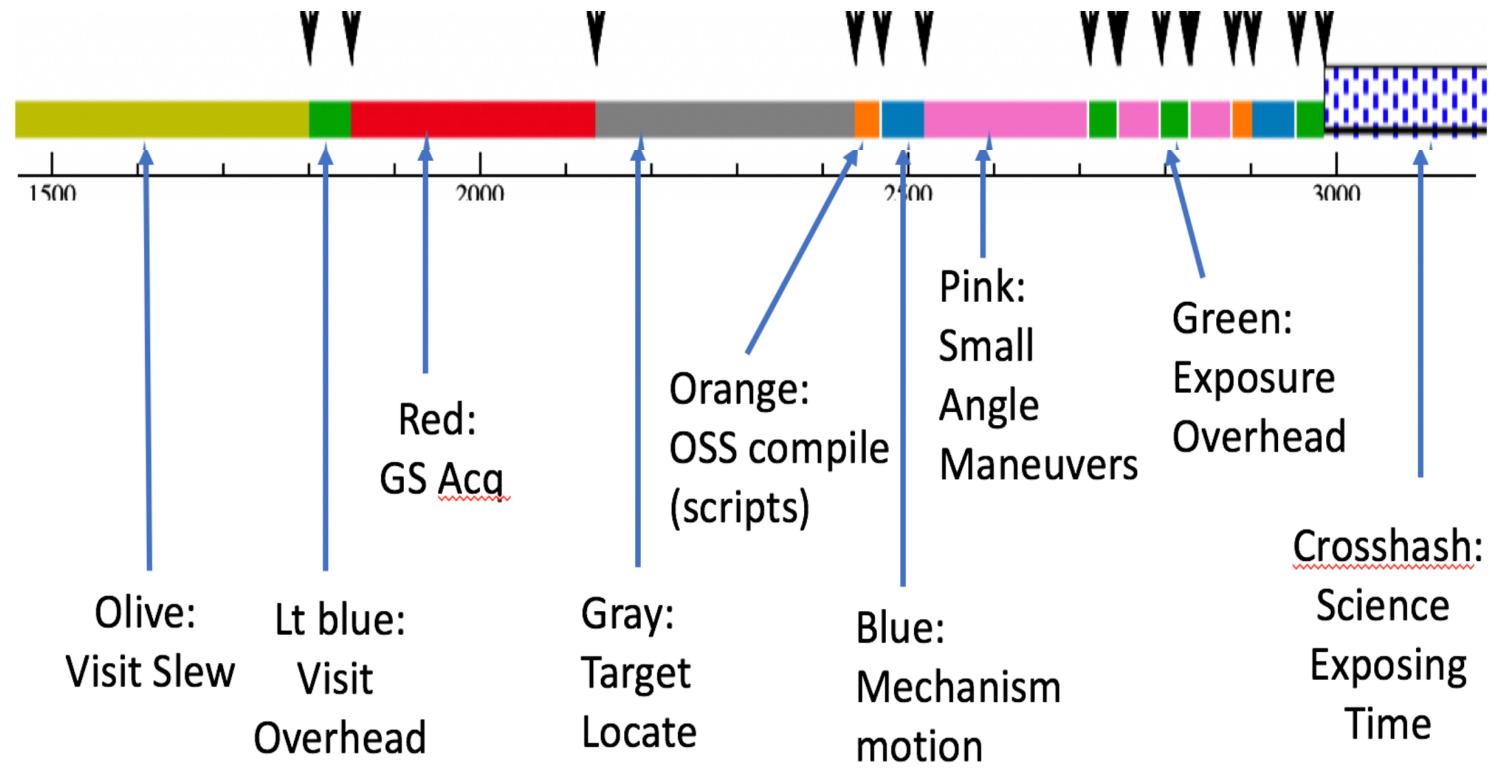
APT Overheads, continued

- Many overheads are known from ground testing, and can be applied deterministically (those occurring within a visit)
 - mechanism motions (filter or grating wheel rotations, other setup activities).
 - Small Angle Maneuvers (SAMs) (e.g., motions between dither steps or mosaic tiles).
 - target acquisition time (when needed).
- Statistical time estimates – assumed average time of activities that depend on the exact sequence of events when scheduled.
 - Ex: Initial slew time from previous observation to the first visit of your observation cannot be known by APT.
 - Scheduling studies indicate an average initial slew time of 1800 s.
 - This is charged once per observation, but see below (Smart Accounting)
- Some overheads are combinations!
 - Guide star acquisition time assumed includes a statistical estimate of how often initial failures and retries will need to be executed.
 - But then this fixed time is charged to each visit.



APT Graphical Timeline

- Shows a summary of various overheads affecting the proposed observations.
- Provides you with insight into the major steps that occur and the times accounted to each.
- Is not meant to represent the actual detailed set of events that occur in the onboard execution of the observation.



Additional Resources:

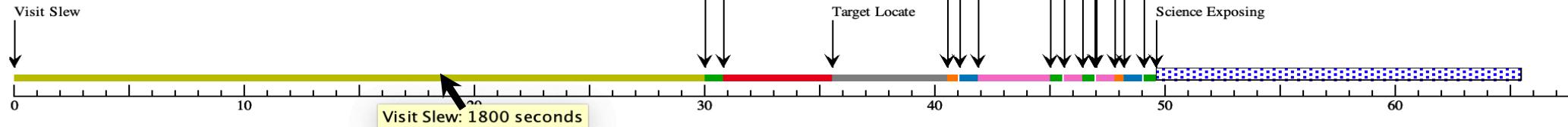
- [JDox Article: APT Graphical Timeline](#)
- [YouTube Video Tutorial: APT Graphical Timeline](#)



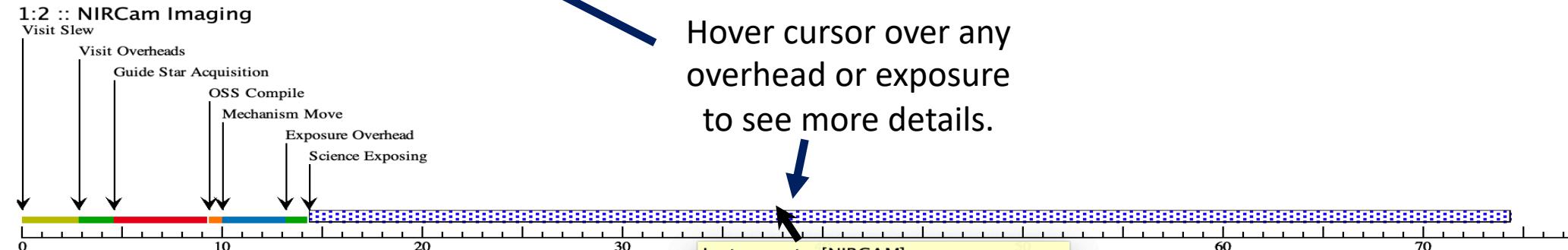
APT Graphical Timeline Examples

1:1 :: MIRI Coronagraphic Imaging

Initial visit,
relatively short
science exposure;
overheads
dominate



A second visit,
relatively fewer
overheads, long
science exposure



Hover cursor over any
overhead or exposure
to see more details.

Instruments: [NIRCAM]
Science Exposing: 3608 seconds
● NIRCAM [F115W, F277W] /FULL



APT Science Time and Total Charged Time

Science time and total charged time (including overheads) can be viewed in APT at the proposal level, the observation level, and visit level.

Visit
level

Visit 3:1 Status: IMPLEMENTATION

Science	Instrument Overheads	Slew	Observatory Overheads	Direct Scheduling Overheads	Total Charged
1794	1296	1800	783	0	5673

Data Volume 546 MB

Copy pointings to clipboard

Visit Duration (secs) 1794

Observations

- MIRI Imaging (Obs 1)
- MIRI LRS (Obs 2)
- MIRI MRS (Obs 3)
- MIRI Coronagraphy (Obs 4)

Observation Links

Observation
level

Number 3 Status: IMPLEMENTATION

Label MIRI MRS

Instrument MIRI

Template MIRI Medium Resolution Spectroscopy

Target 1 ACO-2163

Visit Splitting: 55.0 Arcsec | 1

Science	Total Charged
1794	5673

Data Volume 546 MB

Observations

- MIRI Imaging (Obs 1)
- MIRI LRS (Obs 2)
- MIRI MRS (Obs 3)
- MIRI Coronagraphy (Obs 4)

Observation Links

Total for
proposal

Proposal Information of JWST Approved Proposal 520 (520.ap)

Title MIRI template examples

Abstract For demonstrating different MIRI template examples. Updated and current for APT 25.4.2

Proposal ID 2 STScI Edit Number

Category GO Calibration

Pure Parallel Proposal

Cycle 1

Explain unschedulable observations

Science Time (hours)	Charged Time (hours)	Data Volume (MB)	Allocated Time (hours)
1.37	4.06	3822.32	10.00



Considerations for Minimizing Overheads

- Most large overheads are charged to visits and observations.
- Look for opportunities to reduce the number of visits, which reduces guide star acquisitions charges.
 - APT makes visits, so be aware of the Visit Splitting Distance.
 - Ex: Adjusting tile spacing on mosaics (as seen earlier).
 - Ex: Consider impact of dither selection.
- Don't specify "unnecessary" observations.
 - Seems obvious, but it is easy to do if you are not paying attention!
 - Ex: Observing same target with multiple filters; If you naively put each filter exposure in a separate observation, it gets expensive quickly.
 - Each observation incurs 1800 s initial slew charge.

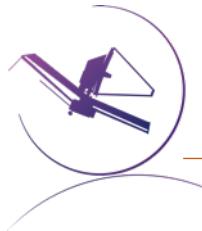


APT Overhead Charge Corrections (Smart Accounting)

- While designing and building an observing program, overheads can become overestimated as observations are added individually.
 - Ex: NIRCam and MIRI imaging requested on the same source, will likely be scheduled back-to-back.
 - Ex: Many targets closely spaced on the sky, will likely be scheduled in close succession.
 - In both cases, initial assumptions of a large 1800 s slew to start each observation are likely a significant overestimate.
- Running *Smart Accounting* on your finished observations searches for and removes extra initial slews and other smaller inefficiencies that may have crept in.
 - Some programs will see a significant correction while others will not.

Note: While Smart Accounting may reduce your proposal's total time request (which is good for you!), this adjustment is important in a larger sense, to provide the best estimate of overall observatory resource usage expected. So...

Always run Smart Accounting before submitting your proposal!



Where to find and run Smart Accounting in APT

Because of the importance of running *Smart Accounting*, APT provides several places where it can be invoked.

- From a button right on the Proposal Information page.

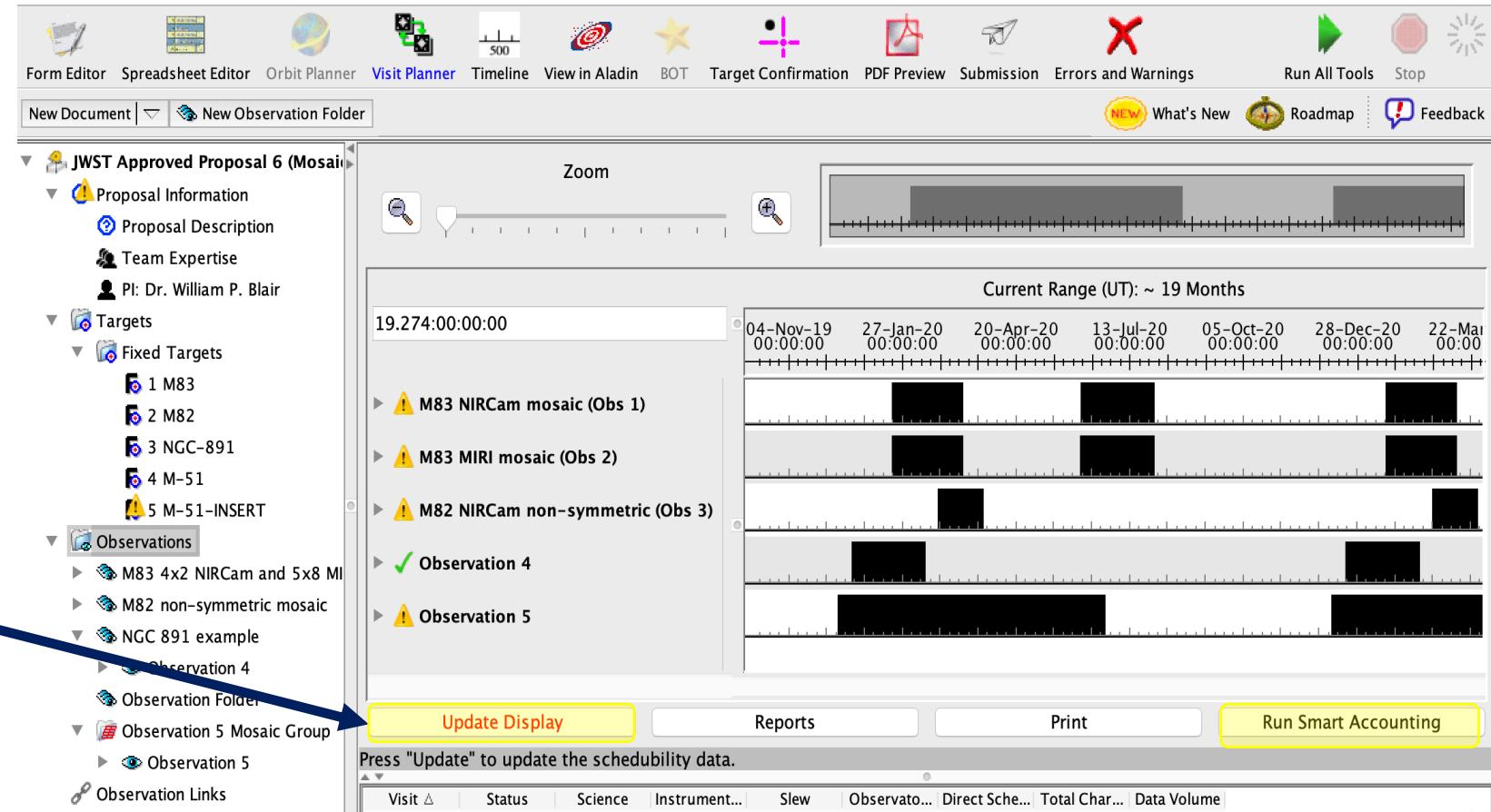
The screenshot shows the APT (Astro-PILOT) software interface. The top menu bar includes: Form Editor, Spreadsheet Editor, Orbit Planner, Visit Planner, Timeline, View in Aladin, BOT, Target Confirmation, PDF Preview, Submission, Errors and Warnings, Run All Tools, and Stop. Below the menu is a toolbar with icons for New Document, New Co-I, What's New, Roadmap, and Feedback. The main window displays the 'Proposal Information' for 'JWST Approved Proposal 6 (Mosaics_key.aptx)'. The left sidebar lists proposal details: Title (Mosaic Use Case Examples), Abstract (This program uses M83 and M82 as test cases for proposing simple mosaics. Obs 1: Simple NIRCam mosaic of M83; Obs 2: Simple MIRI mosaic of M83; Obs 3: Non-symmetrical Mosaic of M82 with NIRCam.), Proposal ID (6), STScI Edit Number (3), Category (GO), Calibration (unchecked), Treasury (unchecked), Pure Parallel Proposal (unchecked), Cycle (1), Explain unschedulable observations, Science Time (hours) (4.14), Charged Time (hours) (48.75), Run Smart Accounting (button highlighted with a yellow box), Data Volume (MB) (57395.80), Allocated Time (hours) (50.00), Proposal Size (MEDIUM). Buttons at the bottom include: Edit Previous, New, and Edit Proposal Description.



Where to find and run Smart Accounting in APT

Because of the importance of running *Smart Accounting*, APT provides several places where it can be invoked.

- From a button right on the Proposal Information page.
- From within the Visit Planner
 - By clicking the “Run Smart Accounting” button at lower right.
 - Or simply by selecting your entire observation folder in the tree editor and running the “Update Display” button in the Visit Planner.





APT Smart Accounting Hint

To see the impact of Smart Accounting, note the total charged time on the Proposal Information page prior to executing the task. Then compare to the result when the task completes.

Before Smart Accounting Run

Science Time (hours)	1.19
⚠ Charged Time (hours)	13.86
<input type="button" value="Run Smart Accounting"/>	

Note: This button only appears when APT thinks the accounting is out of date.

After Smart Accounting Run

Science Time (hours)	1.19
Charged Time (hours)	11.62

Additional Resource: [JDox Article: APT Smart Accounting](#)



APT Science Time and Total Charged Time -- Summary

Science time vs. Total Charged Time is just informational for the proposer.

- Proposals with short exposures will be dominated by overheads.
- Proposals with relatively long exposures will have more balance.
- That's just the way it is for JWST observations. BUT
- The Time Allocation Committee (TAC) only sees the total resource request.

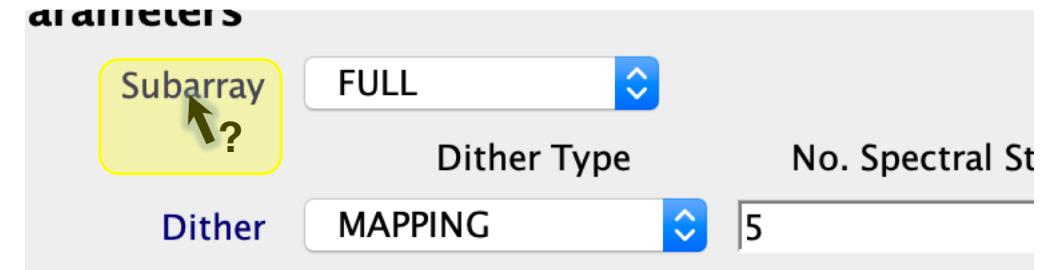
So don't obsess over the “efficiency” of your proposal. Just concentrate on proposing the best science you can!

- This is an important point to communicate in your own workshops.



Additional Resources for Help with APT

- JWST User Documentation Website <https://jwst-docs.stsci.edu/>, including
 - [The JWST Astronomer's Proposal Tool Overview](#) (and links therein)
 - [Help with Individual APT Templates](#)
 - [Example Science Programs](#), each of which has a specific APT step-by-step guide.
- YouTube Tutorial Videos <https://www.youtube.com/jwstobserver>, and in particular, the [Playlist of APT-specific Videos](#)
- Context Sensitive Help within APT
 - Clicking on Blue headings within APT opens a browser and points to relevant JDox support information.





Thanks for Listening - Questions?