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USPOT Manual

Exported on 10/07/2022

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Changelog

To export the USPOT manual as a PDF, click on the three dots in the upper right, then choose "Export with Scroll PDF Exporter". In the Template drop-down menu, choose "Handbook Template", and then click "Export".

The following log includes the dates of publication and lists sections containing major updates for all current and past versions of the handbook. The current version is listed at the top in **bold** font.

v10.1.0 October 12, 2021 opened for Cycle 10 updates

v9.1.0 April 15, 2019 opened for Cycle 9 updates
v8.1.0 May 31, 2019 links updated for Cycle 8
v7.2.0 May 9, 2019 USPOT Manual adapted for all observing cycles
v7.1.1 Oct. 11, 2018 DCS link URLs updated
v7.1.0 June 1, 2018 USPOT Manual for Cycle 7 released

New versions of the USPOT Manual will follow the schedule of releases as demonstrated below, as demonstrated for Cycle 10:

USPOT Versions

Version	Coincides with
10.1.0	Call for Proposals
10.1.1	Update to Call for Proposals
10.2.0	Phase II begins
10.2.x	Phase II Concludes

Versions have the format (Observing Cycle).(Phase).(Revision). Intermediate revisions may be released until the conclusion of Phase II.

ii. Preface

> To export the USPOT manual as a PDF, click on the three dots in the upper right, then choose "Export with Scroll PDF Exporter". In the Template drop-down menu, choose "Handbook Template", and then click "Export".

The **U**nified **S**OFIA **P**roposal and **O**bservation **T**ool (USPOT) is used for both Phase I proposal preparation and submission, and Phase II Astronomical Observation Request (AOR) preparation and submission.

For Phase I, SOFIA requires users to submit a number of required fields via USPOT. Fields that are not required for Phase I will have default entries are automatically inserted. Proposers are able to edit these fields during the Phase II stage. Those who wish to do so may use the advanced Observation Planning capabilities of USPOT during Phase I to edit these Phase II details in their initial proposal submission, but this is not required.

The USPOT Manual is designed to guide users through the procedures for submitting SOFIA Observing Proposals, and Astronomical Observation Requests (AORs), and it contains specific instructions for each instrument. For more in-depth information on the functionalities of USPOT, detailed descriptions can be found on the USPOT Users Guide, which is distributed in the USPOT package. The USPOT Manual is meant to be used in conjunction with the Observer's Handbook—which, unlike the USPOT Manual, **is** specific to each observing cycle. The Observer's Handbook provides the details about each instrument's operating features and capabilities, while this manual provides instructions for how to use USPOT to prepare proposals and AORs.

1. Introduction

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The **U**nified **S**OFIA **P**roposal and **O**bservation **T**ool (USPOT) is a client-server multi-platform software designed to be the only tool needed by proposers to plan SOFIA observations, submit observing proposals, and modify approved observing programs. Astronomical Observing Templates (AOTs) provide common combinations of configurations and modes for specific instruments as selectable options within USPOT—the full details on instrument capabilities are available within the Observer's Handbook. **Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle.** Astronomical Observation Requests (AORs) are completed by filling out the template with the desired observing parameters. To aid in planning, USPOT incorporates features that overlay AORs on the estimated infrared background around a target to visualize how SOFIA will execute observations. Proposals may then be submitted via USPOT to the SOFIA Science Center, where they are stored and managed by the SOFIA Data Cycle System (DCS).

The SOFIA proposal process consists of two steps: Phase I and Phase II. Phase I requires the preparation and submission of a science justification, a feasibility analysis for the proposed program, and a high level description of the proposed targets and observations. The proposal consists of formatted information filled in via the form fields on USPOT (such as proposer information, scientific category, instrument, target, and exposure information) and two files containing the scientific justification and other information to be uploaded in PDF format. Note that to submit a proposal, one needs to have a registered DCS account, which can be created here.

The Phase I proposals will be peer reviewed, and based on the recommendations of the panel, proposals will be selected by the Science Mission Operations (SMO) Director. Proposals that are awarded observing time based on the evaluation process will subsequently be required to submit Phase II observation specifications following guidelines provided by the SMO Director. These submissions will provide the SMO staff with the detailed definition of each observation to be executed for the program. In addition, proposers affiliated with U.S. institutions will be invited to submit a budget, based on funding guidelines provided by the SMO Director.

The USPOT software is available for download from the SOFIA DCS website.

2. Setup

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2.1 Download and Installation

Navigate to USPOT Download and select **Download** for the appropriate platform. Please refer to the instructions relevant to your platform for installation details and known issues.

For quick start, refer to the USPOT Pocket Guide pdf that is packaged with the installer.

Always use the most current version of USPOT. For Cycle 10 proposals, this would be **version 4.4.1** - use of an older version would not allow one to submit or save their proposal. The best way to ensure that you are using the most current version is to select the **Options** drop-down menu, then make sure **Use** Automatic USPOT Version Update is checked by clicking on it from the drop-down menu.

Note: If an error window pop-up entitled "No Privilege for Auto-Update" displays, this is because the downloaded file is a DMG file that contains a read-only directory of the downloaded folder. To correct this, simply drag the downloaded folder (e.g., the folder "uspot441" for USPOT version 4.4.1) to a local directory, such as your Desktop. This will remove the read-only restrictions and you should now be able to select the Use Automatic USPOT Version Update option. A work-around for this, should it be necessary, is to delete the current version of USPOT downloaded on your local directory, then download the latest version of USPOT from the USPOT download webpage.

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2.2 Main Screen Toolbar and General Features

USPOT is composed of a main screen with tabs to toggle between the Proposal window and the Observations window (Section 3.1). The general features of the main AOR windows are discussed in Chapter 3. The following are icons are available on the USPOT main screen toolbar, directly beneath the title bar.

The first cluster of icons refer to general initial functions performed in USPOT.

:search: Search DCS Observing Plan Database Originated from GI
:open: Read in AORs from a file
:save: Write out one or all of your AORs to a local file
:upload: Upload one or all of your AORs to DCS and save a copy to local drive
:undo: Undo

The second cluster of icons are used to edit specific selected AORs. Icons marked with an asterisk are greyed out (i.e. deactivated) until AORs have been defined.

:create_aor: Create AOR
:delete_aor: *Delete the selected AORs
:modify_aor: *Modify the current AOR
:copy_aor: *Copy the current AOR
:draw_aor: *Draw current AOR footprints on images

The third cluster of icons are used to edit targets on a target list. Icons marked with an asterisk are greyed out (i.e. deactivated) until targets have been defined on the target list. Target lists are useful because they can be saved locally and uploaded into USPOT for use in future proposal cycles; individual targets from the target list may then be selected to more efficiently build AORs as desired. To save a target list locally, select the Save icon :Disk: which will launch the Save AOR(s) and Target(s) to Local File window; (if desired, define the name of the target list and the location of the file in the Save As box) then in the lower left corner of the window select **Save Target list** from the Save AOR or Target List frame, and finally select the **Files of type** drop-down menu at the bottom of the window.

:new_target: Create a new target of any type
:delete_target: *Delete the selected targets
:modify_target: *Modify the current target
:list_targets: Show a dialog with the list of targets

The next icon is the Set Visible Columns icon. The first time USPOT is launched, the Observations window displays all available column options (Label, Target, Position, Instrument, etc.) by default: don't panic. Show or hide any columns in the AORs Summary Table by selecting the Select Columns icon :column_editor: above the scroll bar in the in the upper right corner of the table's header or by using the Set Visible Columns icon :set_column: in the toolbar. Selections will be saved automatically as part of the user's preferences and display with the specified settings the next time USPOT is launched. To see all columns, simply select the icon and choose **Reset Table to Factory Setting**. Columns can also be rearranged by dragging the column header around.

:set_column: Set Visible Columns

The final cluster of icons in the toolbar are for the review and submission steps when completing Phase I.

:preview_pdf: Preview Program PDF
:varlidate_proposal: Validate Program
:submit_program: Submit Program

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3. Phase I: Proposal & Basic AOR Submission

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After launching USPOT, note the **Proposal** and **Observations** tabs at the bottom of the main screen which launch their independent sub-windows. Users may toggle between these two windows as needed until all necessary information is entered for submittal. The user should then validate their proposal using the **Validate** button (check mark icon). If the validation is successful, the user would then select the **Submit Proposal** button (paper plane icon). Note that to submit a proposal, one needs to have a DCS account, which can be created here. Upon successful submission, a successful message appears in a popup window, and a confirmation email is sent to the address provided in the proposal. **To check if the submission was received**, one can also log into DCS and go to the 'My Proposals' link, which shows all Approved/Pending/Declined proposals status for the logged in User (PI or Co-I). If you see your submitted proposal in “My Proposal” page, then the proposals has been received.

Resubmissions and duplications

Proposals that have been accepted to previous Calls for Proposals can be resubmitted using USPOT to the currently open Call, and labeled as a resubmission of the original proposal. Go to the File Tab and click on 'Import Program for Re-submission', then enter the program ID in the pop-up text field. The previously submitted AORS and PDF files will be uploaded, and USPOT will automatically recalculate overheads and durations. The ‘re-submission of program’ field will be automatically filled. Very limited edits are allowed, and the new proposal will get a new proposal ID and be identified as a resubmission. Please check compliance of the .pdf files with the compliance rules for the currently open Call (for example, Dual Anonymous Review).

Any past accepted proposal can be uploaded to USPOT from DCS , edited, and submitted as a new proposal which will not be considered a resubmission. Go to the File Tab and click on 'Download Program from DCS'. Then put your DCS credentials in the pop-up Login tab, and enter the program ID in pop-up Program tab. The previously submitted AORS and PDF files will be uploaded, and USPOT will automatically recalculate overheads and durations. You can now edit the program as desired (targets, map sizes, integration times, filters, ...). Please check compliance of the .pdf files with the compliance rules for the currently open Call (for example, Dual Anonymous Review). Then go to File-> Save as a new project.

Any past proposal (accepted or not) can be uploaded to USPOT from a local file, edited, and submitted as a new proposal which is not considered a resubmission. Go to the File Tab and click on ''Read program from a file''. Then browse to your desired aor file. The AORS and PDF files will be uploaded, and USPOT will automatically recalculate overheads and durations. You can now edit the program as desired (targets, map sizes, integration times, filters, ...). Please check compliance of the .pdf files with the compliance rules for the currently open Call (for example, Dual Anonymous Review). Then go to File-> Save as a new project.

Summary tables containing the reserved observations for each instrument are included as appendices in the Call for Proposals. Generally, these may not be proposed for in the upcoming observing cycle. Duplications of existing observations, or of observations approved for the currently ongoing observing cycle but not yet executed, need to be justified explicitly. Proposers should search the SOFIA Science Archive at IRSA for completed observations and the AOR Search Page in DCS (DCS account needed) for approved observations in the currently ongoing observing cycle to check for potential duplications.

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3.1 Creating Proposals

The Proposal window is accessed via the **Proposal** tab at the bottom of the main screen. Within the Proposal window are two tabs which require data entry: **Proposal Info** and **Investigators**.

- The **Proposal Info** tab contains several fields such as TAC Queue (DE for users affiliated to German institutions, US for everyone else), Cycle ID (to select between the currently open Call for Proposals or DDT). The Proposal type (Regular, Legacy, …). Note the new editable 're-submission of program' field for re-submission of previously accepted programs: If the user enters a previously approved program ID, USPOT will require a log in which verified the PI/CoI of the program, then display a warning. If the user presses yes, then the program will be downloaded into USPOT, replacing everything the user has already typed. Also note the 'Multi-cycle Monitoring Program' checkbox, for programs requiring target monitoring across cycles. The **Proposal Info tab** also contains several internal tabs where further information should be entered if applicable: **Proposal Abstract, Related Proposals, Status of Observations, and Special Instructions**. The **Related Proposals** tab should be used to list any active or pending proposals at SOFIA or other facilities that are directly related to the science objectives of the current SOFIA proposal. In the **Status of Observations** tab, include a brief description of the status of any accepted SOFIA proposals or SOFIA observations within the last two years that contain either the same PI as the current PI and/or relevant proposals where the current PI is a CO-I if directly relevant to the proposed science.
- The **Investigators** tab contains an Investigators blue folder, where the information for the **PI** and **CO-Is** must be completed (the blank PI form is populated within the Investigators blue folder by default; CO-Is may be added by selecting **Add CO-I** and completing the required fields). Note that USPOT does not offer the feature to reorder CO-I entries, so ensure that they are initially added in the desired order of appearance.

All entries required for an initial proposal submittal are denoted with a red asterisk. Attempts to submit proposals without this information will result in an error message listing the empty fields. One exception is the DCS User Account Email field, which is only required for the PI and *designated* CO-Is, and will not generate an error message if not completed for general (i.e., non-designated) CO-Is.

3.1.1 PDF Requirements

PDF requirements depend on the cycle the proposal is for and type of proposal submitted (i.e., regular proposals or SOFIA Legacy Program (SLP) proposals). Review the applicable Call for Proposals for your proposal to obtain the specific PDF requirements; make sure you are using the correct document for your proposal. Note that two PDF files are required per submission, one of them being the biography of the PI and coIs.

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3.2 Creating AORs

The Astronomical Observation Requests (AORs) window is accessed via the **Observations** button at the bottom of the main window. To create a new AOR, use the menu option **Observation** to select the desired AOT or select the **Create AOR** icon :copy_aor: in the toolbar to launch a window displaying all available AOTs and choose one. USPOT will create an AOR populated with default values defined in the AOT; *many of these values may be left as the default until Phase II: refer to the instrument specific pages in this document for a list of the required data for Phase I for individual instruments*.

After selecting an AOT, a main AOR window will launch. Specify the target by selecting **New Target** at the top of the main AOR window, which will launch the Target window. The Target window contains two tabs, **Fixed Single** and **Moving Single**, the latter of which contains tabs labeled **Standard Ephemeris** and **User Defined Ephemeris** (note that all fields in the User Defined Ephemeris box must be filled. use 0.0 is a value in unknown). **Moving single** must be used for non-sidereal sources (typically Solar System Objects). For all other sources, select **Fixed Single.** At the top of the Target window, enter the Target Name in the field and select **Resolve the Name** to search **SIMBAD** or **NED** for the target's known parameters.

Select **Ok** in the bottom right to add the AOR to the Observations window. Add more AORs if desired by the same method.

3.2.1 Editing AORs

Only one AOR can be edited at a time. To work on a different AOR, any currently opened AOR must first be closed. Double click on an AOR to bring up an AOR editor window to edit the filters, nod type, exposure time, and any other available fields (i.e., that are not grayed out). After editing, select the **OK** button for the changes to take effect.

To copy an AOR, select an AOR from the list and duplicate it using the **Copy AOR** icon :copy_aor: . A large number of new AORs can be created by selecting the **AOR Replication Tool...** function in the **Tools** drop-down menu. The newly created AORs will be assigned unique IDs when this set is saved and uploaded to the DCS server.

Use the **Target List** icon to add, modify, or delete a target (also accessible via the main menu option **Targets** then **Target List** from the drop-down menu).

USPOT automatically adds Guide Stars to each AOR whenever a new target is created or an existing target is modified. Occasionally USPOT cannot find an adequate Guide Star. This might present a problem for certain types of observations, such as slit spectroscopy. GO’s should contact the SMO to discuss whether the observations will be feasible. Otherwise guide stars will be selected in Phase II.

The Dither Offset frame in the AOR's editing window is activated by changing the Dither Patt... frame selection from **None** (the default) to any other option (that is, **3 point**, **5 point**, **9 point**, or **custom**). A list of offset positions will be automatically generated according to a specified pattern but all of them can be edited by double clicking except for the first point in the pattern, which remains at 0.0, 0.0. Note that in the FORCAST C2NC2 Chop/Nod style, the off position does not dither. For FIFI-LS, customized map positions can be loaded in some modes. An example map position definition file is included in the downloaded installer.

An AOR can be deleted by selecting it in the summary table then clicking the **Delete** icon in the toolbar or by using the menu option **Edit** then **Delete all AORs** from the drop-down menu. The latter command will clear the AOR summary table. Selecting the **Undo** icon in the toolbar will restore deleted AORs as long as they are not deleted by the **Delete all AORs** command.

To work on a set of AORs from a different .aor file saved on a local disk or downloaded from the DCS database, the current AOR summary table must first be cleared by selecting **Edit** then **Delete All AORs** from the drop-down menu, then load the new set of AORs into USPOT by selecting **File** then either the **Open** or **Download AORs from DCS** option. *Only AORs that have a status of New or Problem can be modified.* AORs that are Done, Pending, or Approved cannot be modified or deleted: USPOT will allow these to be opened in the detailed AOR dialog so that values may be altered and visualized—however, *USPOT will not allow any modifications to be uploaded to the DCS database and will discard any changes when the editing window is closed.* Note that an AOR that is not editable may be duplicated, and this duplicated AOR will be fully editable.

3.2.1.1 Edit Proposal after Submission

Proposals that have been submitted to the currently open Call for Proposal can be edited and resubmitted using USPOT at any time up to the proposal deadline. When resubmitted, the proposal will keep the same ID number. Note, however, that a resubmitted proposal replaces all previously submitted versions, and therefore only the most recent version will be saved by the SMO Director. The first time a proposal is saved, a dialogue window will appear with a prompt to choose a name and desired location for a local copy of the proposal as an .aor file. Submitting a proposal will automatically save a local copy to the last accessed folder. *After a proposal has been submitted, the title of the Proposal Window should always read "Proposal xx_xxxx (Pending)".* Once the proposal has been submitted, then it can be either downloaded from DCS server (recommended) or uploaded from a local file to make edits, and the Proposal Window should still read "Proposal xx_xxxx (Pending)"—if it does not, the result will be the user submitting multiple proposals.

To minimize errors resulting from file duplications, the following procedure is suggested:

Step 1: Complete the proposal and AORs, based on the instrument-specific fields required for Phase I.
Notice at this time the Proposal window simply reads as "Proposal".

Step 2: Save a local copy of the proposal.
The purpose of this step is to set the last accessed folder to one of your choosing. Notice that the Proposal window now reads "Proposal (New)" and there is no ID assigned at this time.

Step 3: Submit the proposal.
This will save a copy of the submitted proposal to the location and name chosen in Step 2, in addition to a xx_xxxx.pdf file. Notice that the Proposal Window now includes a proposal ID, reading "Proposal xx_xxxx (Pending)".

From this point on, the Proposal Window should always read "Proposal xx_xxxx (Pending)".

When you are ready to edit the submitted proposal:

Step 4: Go to the File Tab and click on 'Download Program from DCS'. Then put your DCS credentials in the pop-up Login tab, and enter the program ID in pop-up Program tab.
This will also save a local copy with the file name xx_xxxx_Downloaded_Proposal.aor, in addition to a xx_xxxx_propDoc.pdf file. As the downloaded version of the proposal is edited and manually saved, it will overwrite the existing xx_xxxx.aor file, and the xx_xxxx_Downloaded_Proposal.aor file can be kept as a backup in case it becomes necessary to revert to the previous version at a later time. If the .aor file is uploaded from a local file instead of downloaded from the DCS server, a xx_xxxx_backup.aor file will be produced instead of the xx_xxxx_Downloaded_Proposal.aor file.

Step 5: Edit the project as needed.

Step 6: Resubmit the proposal.
This will overwrite any existing xx_xxxx.aor and xx_xxxx.pdf files.

3.2.2 Tools

Estimations of exposure times for SOFIA instruments can be made using the SOFIA Instrument Time Estimator (SITE), a web-based tool that provides total integration time or S/N for a given instrument, filter(s), source type (point, extended, emission line) and water vapor overburden. Algorithms and assumptions used are given in the help link on the SITE webpage.

The atmospheric transmission as a function of wavelength may be obtained using the on-line tool ATRAN developed and kindly provided to the SOFIA program by Steve Lord. The use of ATRAN is necessary for planning SOFIA high-resolution spectroscopic observations.

The target visibility for SOFIA can be determined using the Visibility Tool (VT), which is now available both within USPOT and as a standalone tool as a Java Applet or for download. Note that the use of VT is not a requirement, since detailed flight planning is done by the SMO staff.

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3.3 Instrument-Specific AOTs and Required Fields

The following is a list of all currently available AOTs listed under the **Observation** drop-down menu:

- FORCAST Imaging
- FORCAST Grism
- FORCAST Acquisition
- GREAT Single Point
- GREAT Raster Mapping
- GREAT OTF Mapping
- GREAT OTF Array Mapping
- GREAT OTF Honeycomb Mapping
- EXES HIGH MED
- EXES Medium
- EXES HIGH LOW
- EXES Low
- FIFI-LS
- FIFI-LS OTF Mapping
- HAWC PLUS Total Intensity
- HAWC PLUS Polarization
- HAWC PLUS OFTMAP
- HAWC PLUS POLARIZATION OFTMAP
- FPI_PLUS

Specific requirements for required USPOT fields are listed under each respective instrument's chapter within this manual and are typically highlighted in USPOT with a red asterisk and bold black font. The full details on instrument capabilities are available within the Observer's Handbook, which is cycle-specific, so be sure you are using the correct version of the handbook.

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3.4 General Instructions for Common Phase I Fields

Table 3-1 provides general descriptions for some commonly required Phase I fields.

Table 3-1: Common Phase I Fields

Field Location	Field	Description
Main AOR Window	Unique AOR Label	Important for communication, so please make it descriptive.
	Specify Target	Select **New Target** and fill in the required information.

Field Location	Field	Description
	Observation Order	Used for prioritizing observations per target. In AORs for different targets, the number can be identical and the order is dictated by the observing schedule. However, for AORs with the same target, an order needs to be established. If identical numbers are used for Observation Order on the same target, USPOT will generate an error. This information helps the instrument scientist to prepare the observations for execution by defining the Observation Order.
	Exposure Time	Total duration of the scan.
	AOR Repeats	Number of times to repeat the full dither sequence. *Increase this number to increase the total exposure time.*
Observing Condition & Acquisition/ Tracking Window	Target Priority	The Target Priority field refers to the relative priority of a specific science target with respect to other science targets within the observing program. This is used by the flight planners to determine which observations to schedule if for some reason not all of the targets within the program can be observed. A target can be set as either **Low**, **Medium**, or **High** priority. If all of the targets within a proposal are of equal interest (as for, say, a survey of many dozens of targets), then they should all be set to **Medium** (the default). Setting all of the targets to **High** priority will not ensure that they all are observed. If **High** priority is used for some targets, other targets must be set to **Medium** and/or **Low** priority as well.

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3.5 Advanced User Instructions

As users submit their AOR required specifications for both Phase I and Phase II, advanced users (in other words, users who have previous experience with submitting AORs with SOFIA) can proceed to enter their technical details for Phase II in USPOT during Phase I. Instructions for Phase II can be found in Chapter 4 and its internal instrument-specific sections.

3.5.1 Visualizing Guide Stars

Four categories of guide stars are utilized by telescope operators (TOs): Wide Field Imager (WFI), Fine Field Imager (FFI), Focal Plane Imager - TO (FPI-TO), and Focal Plane Imager - Science (FPI-SCI). WFI has the widest field of view (FOV), followed by FFI and both FPI FOVs. WFI and FFI are therefore used by TOs to find the brightest guide stars with which to locate the observational object of interest, after which the FPI guide stars are used to track the object. FPI-TO and FPI-SCI have maximum brightness detecting capabilities of V = 14 and V = 16, respectively. USPOT can plot up to five of the brightest guide stars for each of the four categories. Overlaps occur when not enough guide stars are available with brightness characteristics unique to each category.

To view guide stars, first create an AOR and define the target. From the Images drop-down menu, select the desired background image (**WISE Image...**, for example). A pop-up window will allow the user to accept or adjust the default values, then select **Ok** to generate the image. (Note: to view WFI and FFI guide stars and the FFI FOV, the Size field may need to be increased in the pop-up window. USPOT will allow the Size parameter to vary between 0.010 and 1.500 degrees; other values will generate an error.)

Once the image has been produced, select **Options** followed by **Visualizations: Show Guide Stars**. Select the Draw current AOR on footprints images icon :draw_aor:

and choose the desired AORs to overlay. (Note: if the current AOR was drawn on the image prior to selecting **Visualizations: Show Guide Stars**, the user will need to enable the guide stars, then overlay the AORs again by simply reselecting the Draw current AOR on footprints images icon :draw_aor: .) The column on the right side of the window contains a toolbar frame for each layer displayed on the image: one for each AOR type (for example, one for FORCAST Imaging and another for GREAT Single Point, if both AORs were chosen to be mapped in the previous step) and one for the Base Image.

The icons below display for each AOR type.

:hide_show_layers: Hide/Show Layer
:delete_layer: Delete Layer
:pointing_table: Pointing Table
:configure_focal_plane: Configure the Focal Plane

Similarly, the following icons exist to alter the Base Image.

:hide_show_layers: Hide/Show Layer
:delete_layer: Delete Layer
:image_opacity: Show Image Opacity Control
:color_table: Change Color Table or Stretch
:pointing_table: View Fits Headers for Images

The **Configure Focal Plane** icon :configure_focal_plane: generates a pop-up window that allows different categories of image features to be toggled on/off, whereas the **Pointing Table** icon :pointing_table: launches a pop-up window that allows for individual image features to be toggled on/off and provides animation capabilities to assist with distinguishing between features on the image. Among others, these features include the WFI, FFI, FPI-TO, and FPI-SCI guide stars and their FOVs. For overlaps, multiple features may need to be toggled to add or remove the feature (e.g., the user would have to use the **Configure Focal Plane** icon :configure_focal_plane: to deselect both FPI-TO and FPI-SCI to toggle-off a guide star with a brightness value of V = 14).

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4. Phase II: Observation Preparation and Submission

> To export the USPOT manual as a PDF, click on the three dots in the upper right, then choose "Export with Scroll PDF Exporter". In the Template drop-down menu, choose "Handbook Template", and then click "Export".

The following instructions assume the proposer has submitted the information required for Phase I, that the proposal has been accepted, and that the proposer and now needs to access the previously submitted forms to alter the default values or make changes to other entries. Before preparing detailed observations in USPOT, please read the relevant instrument chapters of the Observer's Handbook. The Astronomical Observation Requests (AORs) should be created as described in Chapter 3 of this manual.

For all instruments, the instrument scientists will help the PIs to complete the Phase II portion of the AORs. The instrument scientists will be completing the Phase II portion of AORS, in addition to reviewing Phase I entries, and uploading these new drafts of the AORs into the DCS system for proposers to review. The proposal PIs will be notified by their support scientists when their AORs are available for review. Proposal PIs or designated CoIs should work directly with their support scientists to make necessary changes to their AORs.

Proposers only need to log in to the DCS to download saved .aor files from the DCS server in USPOT, which is the recommended approach for Phase II. After a proposal has been initially submitted, the title of the Proposal Window should always read “Proposal xx_xxxx (Approved)”. The proposal can then be either downloaded from the DCS server (recommended) or uploaded from a local file to make edits, in either case the Proposal Window should still read “Proposal xx_xxxx (Approved)”—if it does not, the result will be the user submitting multiple proposals.

To download a proposal from USPOT to make edits, select the Search DCS Observing Plan Database :search: icon to launch a popup window with the following frames: Get Proposal, Get Proposal List, and Proposal.

When the proposal was originally submitted, a local copy was saved to the user's last accessed folder; the file’s name was automatically generated to reflect the proposal ID in the format xx_xxxx.aor. This Proposal ID is used to search for the Proposal in USPOT. In the Get Proposal frame, enter the Proposal ID and select **Get Proposal**.

A pop-up window will appear requesting the users DCS account log-in credentials in order to search the observing plan. The login email and password are the same ones used to register with DCS. Proposal PIs have permission to see the details of only their own proposals; a Permission Denied message if will appear if the PI enters a proposal ID that is not tied to their credentials.

Open the tree on the right side of the chooser panel to see the details of the observing plan, click on the topmost node labeled **Proposal**, then select **Accept**. (The **Accept** button will only be enabled after selecting the **Proposal** node.) This will load the proposal in USPOT and also save a local copy with the file name xx_xxxx_Downloaded_Proposal.aor, in addition to a xx_xxxx_propDoc.pdf file. As the downloaded version of the proposal is edited and manually saved, it will overwrite the existing xx_xxxx.aor file, and the xx_xxxx_Downloaded_Proposal.aor file can be kept as a backup in case it becomes necessary to revert to the previous version at a later time. If the AOR file is uploaded from a local file instead of downloaded from USPOT, a xx_xxxx_backup.aor file will be produced instead of the xx_xxxx_Downloaded_Proposal.aor file.

Notice that the Total Duration time and Awarded time in the status bar located in the bottom-right corner of the main window do not match. The overhead for each AOR is recalculated using the extra information that has been filled out in the AOR editor window during Phase II, so the Total Duration time value is the most accurate. The estimated time may be marginally higher than the awarded time, in which case the value will be flagged and show up in red. However, the AORs may still be submitted. Contact the Instrument Scientists via the Help-Desk with any questions.

When the Proposal is ready to be resubmitted, any existing xx_xxxx.aor and xx_xxxx.pdf local files will be automatically overwritten with the submitted version of the proposal.

5. Instrument-Specific Instructions

> ⓘ To export the USPOT manual as a PDF, click on the three dots in the upper right, then choose "Export with Scroll PDF Exporter". In the Template drop-down menu, choose "Handbook Template", and then click "Export".

5.1 EXES

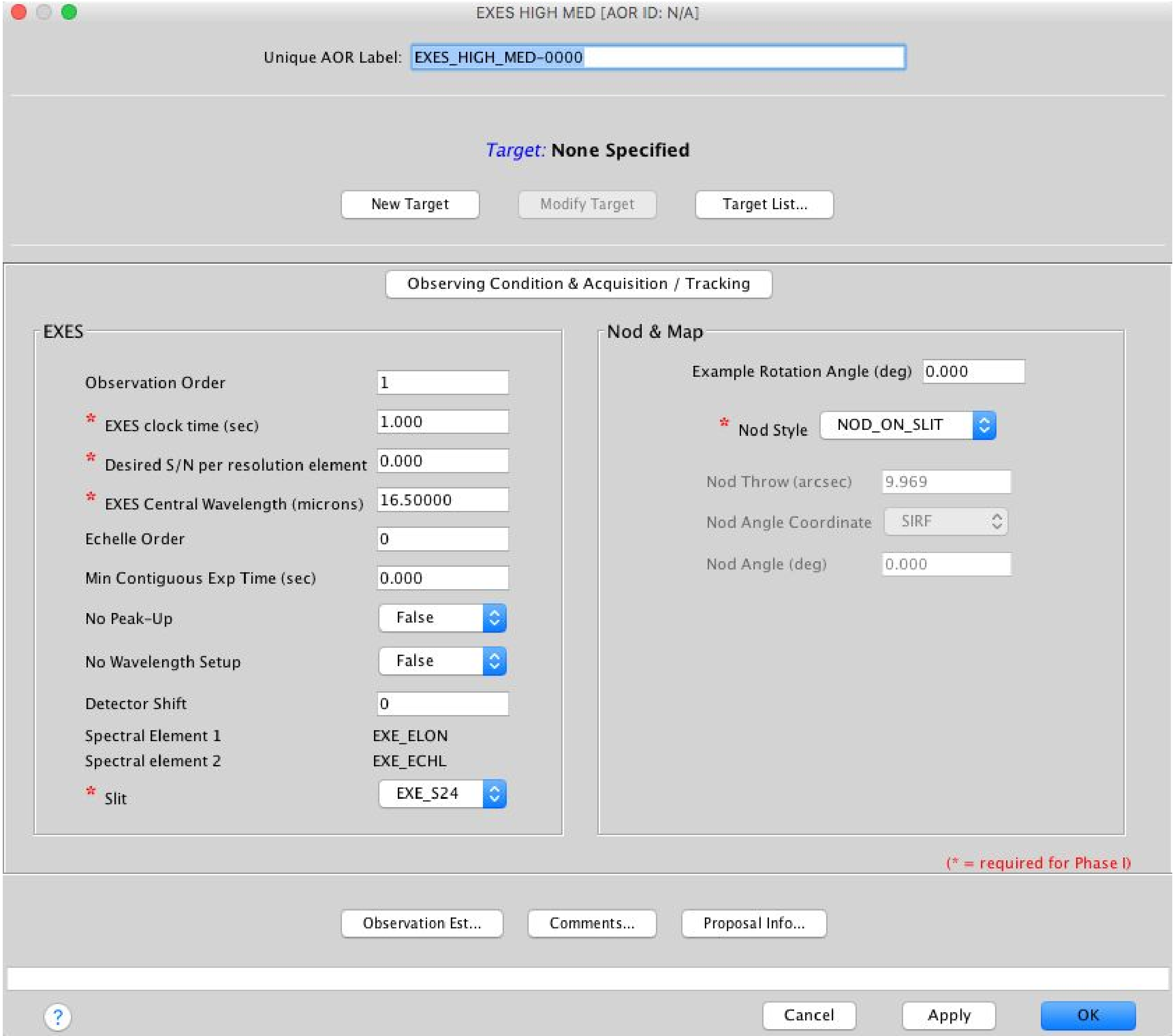
5.1.1 Overview of AOTs

EXES specific instructions and reminders of general issues are given in the following topics below. It is necessary to read the EXES chapter of the Observer's Handbook before preparing detailed EXES observations in USPOT. Astronomical Observation Requests (AORs) should be created as described in Chapter 3.

The USPOT **Observation** drop-down menu lists the four Astronomical Observation Templates (AOTs) available for EXES: **HIGH_MED**, **Medium**, **HIGH_LOW**, and **Low**. Refer to the Observer's Handbook for a complete description of available combinations of configurations and modes for EXES.

The USPOT EXES Main AOR Window contains several frames: EXES and Nod & Map. Figure 5.1-1 shows an example of the Main AOR Window of an EXES AOT. The instrument-specific fields are discussed in detail in this chapter. For instrument and calibration questions, contact the instrument PI. For USPOT related questions and any other questions, contact the Help-Desk.

Figure 5.1-1.



1 Figure 5.1-1. An example of an EXES AOT Main AOR Window, using the EXES HIGH_MED AOT.

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5.1.2 AOR Fields

Table 5.1-1 lists the required fields for Phase I and Phase II for all available EXES AOTs. Conditional fields (i.e., fields not editable unless certain parameters are specified) are denoted with a footnote, with a reference to the required field to activate the conditional field. Fields that are not listed in these tables fall under one of three categories: fields not directly editable in USPOT (but may be affected by updating other fields, which are required; for more information on how particular fields may be related, refer to the corresponding sections within the Observer's Handbook—denoted in Table 5.1-1 by OH followed by the appropriate section number), fields intended for use only by SOFIA Support Scientists only, or optional fields.

All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that

corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Table 5.1-1: Phase I Required Fields

Field Location	Field	Reference
New Target Window	Specify Target	Section 3.4
EXES Frame	EXES clock time	SITE; 5.1.2.1
	Desired S/N per resolution element EXES Central Wavelength	OH §2.2
	Slit	OH § 2.1.2.1
Nod & Map Frame	Nod Style	OH § 2.1.2.1
Nod & Map Frame, Map Tab	[1]Step Size X [1]Step Size Y [1]Num Steps	OH §2.2
Observing Condition & Acquisition/ Tracking Window	Is Calibrator	§ 3.4
	Is Time Critical	§ 5.1.2.1

Phase II Required Fields

Field Location	Field	Reference
Main AOR Window	Observation Order	§ 3.4
	Echelle Order Min Contiguous Exp Time	§ 5.1.2.1
	No Peak-Up No Wavelength Setup	§ 5.1.2.1; OH §2.2.3
	Detector Shift	§ 5.1.2.1
Reference Position Frame, Reference Position Tab	[1]Dedicated Refere... [2]RA Offset [2]Dec Offset	OH §2.2
Reference Position Frame, Map Tab	[1]X Position [1]Y Position [1]Rotation Angle Frame	OH §2.2

[1]For Nod Style = Map
[2]For Nod Style = Map and Dedicated Refere... = Yes

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5.1.2.1 EXES Frame

The latest EXES sensitivities are available using the exposure time calculator accessed through the SOFIA Instrument Time Estimator (SITE). It is the main source of information for determining instrument settings, most of which depend strongly on wavelength, including:

- available echelle orders
- available slit widths
- available single setting instantaneous wavelength coverage
- ability to nod on or off slit (at many wavelengths in the high resolution modes, the slit is too short to be able to nod on slit)
- EXES clock time

It is important to check in SITE whether an observational setup is supported, as the validation button in USPOT may not catch some unsupported settings combinations. The EXES clock time field (note that this is not the on-source time) includes overheads due to nodding and instrument inefficiencies. For each AOR, USPOT will add to the time request 15–23 minutes of peak-up, wavelength optimization, flux calibration, and flat field overheads to the clock time. If no peak-up is necessary (e.g., after a wavelength change on the same target, or if the source is extended, or if the continuum emission is too weak), the overheads can be reduced by setting the No Peak-Up field to **True**. Overheads can also be reduced if multiple sky positions are observed in the same wavelength setting. In this case, set the No Wavelength Setup field to **True**. Note however that the time on a given target on a single flight is limited to 90–180 minutes, so full overheads may be needed again once the sum of AOR times exceeds 90 minutes. Conversely, if a single observation takes more than 90 minutes, it may need to be split into multiple AORs, each with full overheads. Please consult the EXES and SOFIA staff in these cases.

The Min Contiguous Exp Time field is the minimum amount of clock time that must be observed in a single flight. Values smaller than the total clock time will improve the probability that the AOR will be scheduled. At Phase II, this field must not be left at 0 seconds. If the entry is larger than 5400 seconds, it will be very difficult to get the AOR scheduled.

The EXES Central Wavelength field of the line of interest should be corrected for heliocentric motions. If applicable, use the Time Critical fields under the **Observing Condition & Acquisition / Tracking** button to indicate the range of dates at which the emission/absorption line of interest is sufficiently well separated from any atmospheric lines (such as for corrections for the Earth's motion with respect to the Sun which are generally not important for the EXES Central Wavelength setting.)

For the Echelle Order field, select from the options listed in the exposure time calculator on SITE at the wavelength of interest. Note that in the exposure time calculator, the Echelle Order is referred to as the *observing order*—not to be confused with the Observation Order field in USPOT, which is the order in which this observation should be executed relative to others in the program (e.g., if you want certain wavelength settings done before others). This sets the wavelength coverage and slit length and thus, depending on the echelle order specified, determines whether on-slit nodding is possible.

In Observing Condition & Acquisition / Tracking Window (accessed via the **Observing Condition & Acquisition / Tracking** button in the AOR editing window), give all AORs for the same target the same priority in the Target Priority field. For each target specify the order in which the AORs should be scheduled (Observation Order in the main EXES frame). Enter any finer scheduling priorities in the AOR comments section. For the Medium and Low AOTs, partial detector read-outs may be required to avoid detector saturation, which will reduce the effective length of the slit to 30-60", depending on the echelle order and background. Please consult with the PI and Instrument Support Scientist if a long slit length is important to the observation strategy.

The Detector Shift field value in pixels can be determined by using exposure time calculator on SITE. High resolution configurations (above 19 µm) contain wavelength gaps between the echelle orders; these gaps can be covered by shifting the detector array.

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5.1.2.2 Nod & Map Frame

USPOT does not determine whether on-slit nodding (Nod Style = **NOD_ON_SLIT**) is possible given the slit length. For this, use the exposure time calculator on SITE and modify the Nod Style entry in USPOT accordingly.

If nodding off slit is needed (Nod Style = **NOD_OFF_SLIT**), check that the nod position is free from emission at the wavelength of interest. The AOR image overlay function may be useful. Adapt the nod throw (in arcseconds) accordingly. The nod throws are in the perpendicular and parallel directions relative to the slit in the SIRF coordinate system, and east and north (negative for west and south, respectively) in the SKY/ERF system.

In mapping mode (Nod Style = **MAP**), EXES observes a single stripe of slit positions. The Num Steps field is the number of slit positions on the sky. Note that multiple stripes must be defined in separate AORs and the stripe orientation on the sky cannot be controlled.

The flux calibration and correction for telluric absorption lines will be done using sky and blackbody measurements, which are accounted for in the standard overhead. Lines overlapping with sky lines may need a telluric calibrator. These calibrator observations must be defined in separate AORs and they will count against the allocated time. Because of the difficulty of scheduling a given telluric calibrator with the science target in a given flight, the specific calibrator will need to be chosen at the time of flight planning in consultation between the proposer, instrument PI, and SMO support scientist. For wavelengths below 8–10 µm this will most likely be a hot, bright star (e.g., Vega or Sirius) and at longer wavelengths an asteroid. Galilean moons will also be considered, provided they are well separated from Jupiter. In USPOT, a separate observation entry should be entered by selecting **New Target** with Target Name `Cal_target`, where *target* is the name of the associate science target (e.g. `Cal_IRC+10216`), and given the coordinates RA: `00:00:00`, Dec: `+00:00:00`. One must use the EXES exposure time calculator on SITE to estimate the clock time needed, assuming a continuum brightness of 100 Jy below 10 µm and 150 Jy above 10 µm for the HIGH_MED and HIGH_LOW AOTs. For the Medium AOT, a brightness of 50 Jy should be assumed, and for Low, 25 Jy at all wavelengths. One is urged to limit the EXES clock times on the telluric standard at a given wavelength and instrument configuration to less than about 30 minutes. Further improvement of the removal of telluric absorption features may be achieved by employing models of the Earth's atmospheric transmission.

The Example Rotation Angle field is meant only for visualization of the AOR on the sky. It will not set the EXES slit orientation during the observations. Additionally, the EXES slit orientation on the sky cannot be controlled, except when putting time constraints on the observation. Note that time constraints will reduce the probability that the AOR will be scheduled. SOFIA's Target Visibility Tool, now also included within USPOT, is intended to determine the EXES slit orientation on the sky at a given date and position on Earth.

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5.1.2.3 Comments Window

Enter the following information in the Comments section (accessed via the **Comments...** button at the bottom of the AOR editing window):

- The wavelengths of other important lines expected in the same setting.
- If a telluric or photometric calibrator must be observed, mention explicitly which AOR this corresponds to. Do the same in the notes of the calibrator AOR.
- Any information that will help with the target acquisition. Telescope acquisition and guiding is done in the optical (up to *z*-band). Mention if no guide stars brighter than 16th magnitude within a 9 arcmin radius are available. For accurate positioning of the slit, indicate if the target is extended or multiple at the wavelength of interest.

5.2 FIFI-LS

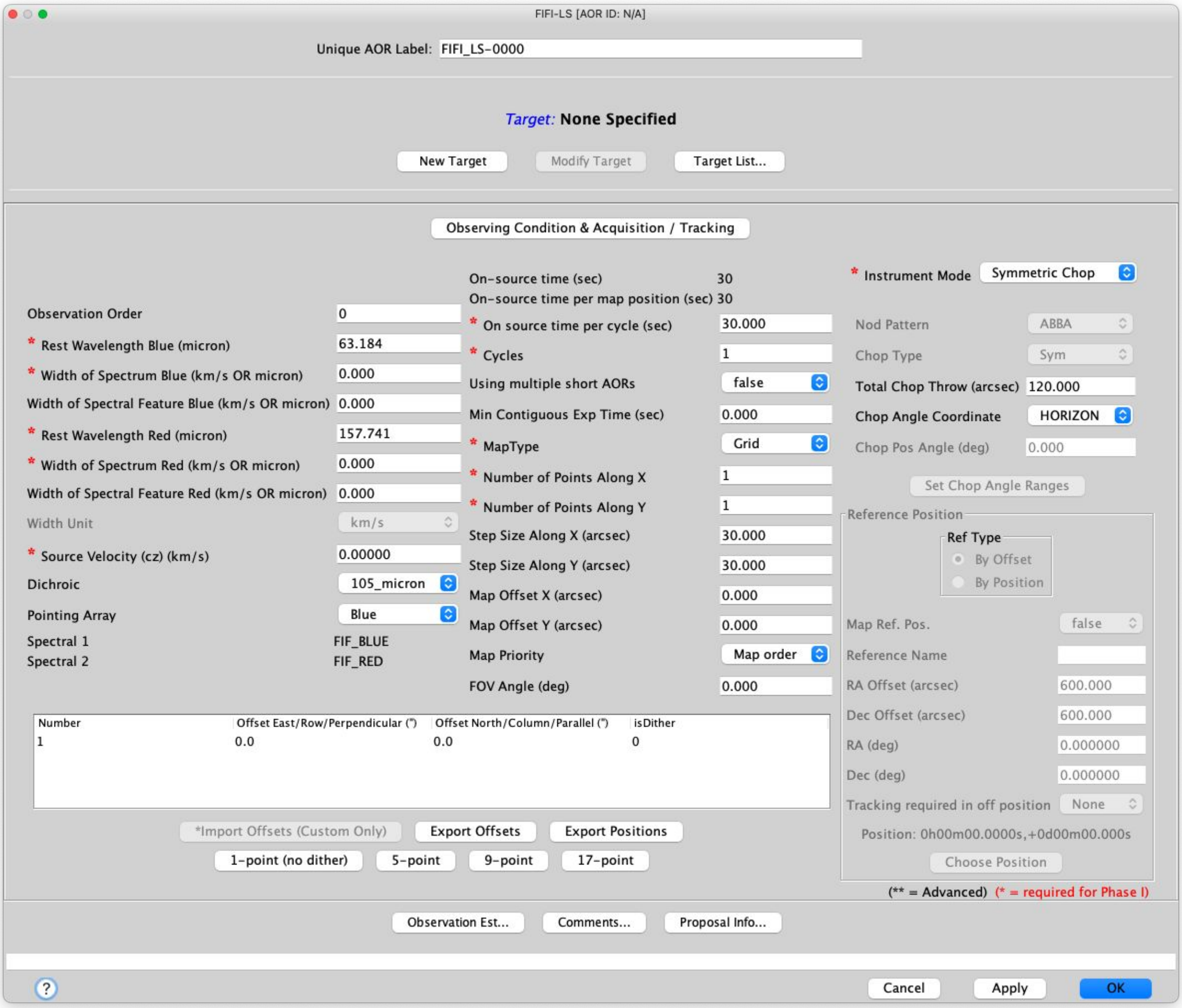
5.2.1 Overview of AOTs

FIFI-LS specific instructions and reminders of general issues are given in the following topics below. It is necessary to read the FIFI-LS chapter of the Observer's Handbook before preparing detailed FIFI-LS observations in USPOT. Astronomical Observation Requests (AORs) should be created as described in Chapter 3.

The USPOT **Observation** drop-down menu lists the two Astronomical Observing Templates (AOTs) available for FIFI-LS: FIFI-LS and FIFI-LS OTF Mapping. Refer to the Observer's Handbook for a complete description of available combinations of configurations and modes for FIFI-LS.

The USPOT FIFI-LS Main AOR Window is divided into three columns. Figure 5.2-1 shows an example of the Main AOR Window of the FIFI-LS AOT. The instrument-specific fields are discussed in detail in this chapter. Contact the Help-Desk with any questions.

Figure 5.2-1.



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5.2.2 AOR Fields

The FIFI-LS AOR editing window is divided into three columns. The AOR Fields for FIFI-LS are discussed in the sections below. Table 5.2-1 lists the required fields for Phase I and Phase II for the available FIFI-LS AOTs. Conditional fields (i.e., fields not editable unless certain parameters are specified) are denoted with a footnote, with a reference to the required field to activate the conditional field. Fields that are not listed in these tables fall under one of three categories: fields not directly editable in USPOT (but may be affected by updating other fields, which are required; for more information on how particular fields may be related, refer to the corresponding sections within the Observer's Handbook—denoted in Table 5.2-1 by OH followed by the appropriate section number), fields intended for use only by SOFIA Support Scientists only, or optional fields.

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 9. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Table 5.2-1: FIFI-LS AOT: Required Fields for Phase I

Field Location	Field	Reference
New Target Window	Specify Target	§ 3.4
Main AOR Window, First Column	Rest Wavelength Blue; Width of Spectrum Blue; Rest Wavelength Red; Width of Spectrum Red	§ 5.2.2.1
	Source Velocity (cz)	OH § 3.2.2
Main AOR Window, Second Column & Lower Panel	On source time per cycle; Cycles; MapType; [1]Number of Points Along X; [1]Number of Points Along Y; [2]Import Map Offsets	§ 5.2.2.2; OH § 3.2.4
Main AOR Window, Third Column	Instrument Mode	OH § 3.2.1
Observing Condition & Acquisition / Tracking Window	Target Priority	§ 3.4
	Is Time Critical	§ 5.2.2.4

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

FIFI-LS OTF Mapping AOT: Required Fields for Phase I

Field Location	Field	Reference
New Target Window	Specify Target	§ 3.4

Field Location	Field	Reference
Main AOR Window, First Column	Rest Wavelength Blue; Rest Wavelength Red	§ 5.2.2.1
	Source Velocity (cz)	OH § 3.2.2
Main AOR Window, Second Column & Lower Panel	MapType; [1]Number of Scans in Y direction; [1]Number of Points in X direction; Map Offset X; Map Offset Y; Map Angle; [1]Scanning speed in X; [1]Scanning speed in Y; [1]Scan Direction; [2]Scan Length; [2]Import Map Offsets	§ 5.2.2.2; OH § 3.2.4
Main AOR Window, Third Column	Instrument Mode	OH § 3.2.1
Observing Condition & Acquisition / Tracking Window	Target Priority	§ 3.4
	Is Time Critical	§ 5.2.2.4

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

FIFI-LS AOT: Required Fields for Phase II

Field Location	Field	Reference
Main AOR Window, First Column	Observation Order	§ 3.4
	Width of Spectral Feature Blue; Width of Spectral Feature Red; Dichroic; Pointing Array	§ 5.2.2.1; OH § 3.1.1.2
Main AOR Window, Second Column	Using multiple short AORs; Min Contiguous Exp Time; [1]Step Size Along X; [1]Step Size Along Y; [1]Map Offset X; [1]Map Offset Y; Map Priority; FOV Angle	§ 5.2.2.2; OH § 3.2.4

Field Location	Field	Reference
Main AOR Window, Third Column	[3]Nod Pattern; [4]Chop Type; [5]Total Chop Throw; [5]Chop Angle Coordinate; [5]Chop Pos Angle; [5]Set Chop Angle Ranges button	§ 5.2.2.3; OH § 3.2.1; OH § 3.2.4
Reference Position Frame	[6]Ref Type; [6]Map Ref. Pos.; Reference Name; [7]RA Offset; [7]Dec Offset; [8]RA; [8]Dec; [8]Choose Position button	§ 5.2.2.3; OH § 3.2

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

FIFI-LS OTF Mapping AOT: Required Fields for Phase II

Field Location	Field	Reference
Main AOR Window, First Column	Observation Order	§ 3.4
	Dichroic; Pointing Array	§ 5.2.2.1; OH § 3.1.1.2
Main AOR Window, Second Column	Min Contiguous Exp Time	§ 5.2.2.2; OH § 3.2.4
Main AOR Window, Third Column	[None]	
Reference Position Frame	[6]Ref Type; [6]Map Ref. Pos.; Reference Name; [7]RA Offset; [7]Dec Offset; [8]RA; [8]Dec; [8]Choose Position button	§ 5.2.2.3; OH § 3.2

[1]For MapType = **Grid** (FIFI-LS AOT) or **Tile** (FIFI-LS OTF Mapping AOT)

[2]For MapType = **Custom**; these observations also require maps to be imported via the **Import Map Offsets** button

[3]For Instrument Mode = **Asymmetric Chop** or **Spectral Scan**

[4]For Instrument Mode = **Spectral Scan**

[5]For Instrument Mode = **Symmetric Chop**, **Asymmetric Chop** or **Spectral Scan**

[6]For Chop Type = **Asym**

[7]For Ref Type = **By Offset**

[8]For Ref Type = **By Position**

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5.2.2.1 First Column: Selecting the Grating Parameters

The Observer's Handbook links below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

The first column is used to set the grating configuration. The parameters that can be set for the FIFI-LS OTF Mapping AOT are a subset of those for the FIFI-LS AOT.

The *rest* wavelengths for the blue (Rest Wavelength Blue field) and red (Rest Wavelength Red field) transition must be entered to be observed with this AOR. The rest wavelengths need to be accurate to 0.001 µm. Line lists are available at the MPE Garching. For both transitions also enter the width of the spectral feature of interest and the total width of the spectrum to be observed in km/s except for the Spectral Scan mode where the unit is microns.

The Width of Spectral Feature is only used by the instrument scientist together with the information in the proposal to judge whether there is enough baseline on both sides of the feature, when the observation returns a spectrum of the requested width. The value used in the execution of the AOR is the width of spectrum parameter. Both width parameters for each channel can be left at `0 km/s` for unresolved lines and a minimal spectral dither pattern will be executed, which will include slightly more than the bandwidth (see Section 3.1.2.2 of the Observer's Handbook). If a wider spectrum than the bandwidth is requested, the grating scan will be adjusted to include the specified spectrum width (the observing wavelength will be in the center of the spectrum). In the second column, adjust the observing time accordingly (factor ℓ in Section 3.1.2.3 of the Observer's Handbook).

Enter the radial velocity of the source in km/s in the optical (cz) velocity convention in the Source Velocity field. The radial velocity can be rounded to 100 km/s, since the spectrum will be at least 1000 km/s wide wide and the velocity resolution is at best ~200 km/s (note that this means differences between the topocentric, LSR and barycentric frames can be disregarded).

One of the two dichroics needs to be selected so that an observation of both lines is possible. Typically, the **105_micron** Dichroic is used unless a wavelength between 100 and 115 µm or shorter than 52.5 µm is observed (see Section 3.1.1.2 of the Observer's Handbook).

The choice in the Pointing Array field only affects the telescope pointing. It does not indicate a scientific priority. For most applications, the Pointing Array can be left at **Blue**. This choice will place the target coordinates (plus any mapping offsets, if applicable) on the center of the blue array. Ideally this would also be the center of the red array, but actually the red array is offset about 10 arcsec. This offset is reflected in the USPOT visualizations starting with version 3.4.2. Choosing the red array as the Pointing Array will put the target in the center of the red array but relatively close to the edge of the blue array. For the OTF Mapping AOT, the Pointing Array also controls the Step Size Along X and Step Size Along Y parameters (reported in the second column) as these are fixed by the size of the array.

Spectral 1 (**FIF_BLUE**) and Spectral 2 (**FIF_RED**) are fixed values.

For the OTF Mapping AOT, the maximum integration time per spaxel calculated from the inputs in column two (for MapType = Tile) is reported at the foot of column one.

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5.2.2.2 Second Column and Lower Panel: Setting the Integration Time and Map Type

The links below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

This section differs substantially between the FIFI-LS and FIFI-LS OTF Mapping AOTs.

For the FIFI-LS AOT:

Apart from the map parameters, the integration time is set in the second column. First, specify t_{nod} (On-source exp. time per cycle) per nod cycle. Since a nod cycle must not take too long, the maximum values are 30 s and 15 s for the symmetric and asymmetric chopping, respectively. *These values yield the best observing efficiency.* To achieve longer exposure times, increase the number of nod Cycles to reach the desired t_{on}, the on-source integration time per map position, as t_{on} = cycles x t_{nod}. The on-source exposure time t_{on} is derived by the FIFI-LS exposure time calculator on the SOFIA Instrument Time Estimator (SITE) (see also Section 3.1.2 of the Observer's Handbook).

If shorter integration times are sufficient, the maximum values might still be the best option as the observing efficiency goes down with smaller values for t_{nod} and the grating scan will get coarser (less spectral redundancy) as less time is available for it. The smallest t_{nod} in the **Symmetric Chop** Instrument Mode (Sym) is 20 s and 10 s in the **Asymmetric** Instrument Mode. For bright objects, where one chop cycle is already sufficient, i.e. t_{on} is 10 s or less, the **Asymmetric** Instrument Mode can be used with the ABA or AABAA Nod Pattern. These are more efficient because two or four map positions respectively are observed per reference position. The **Total Power** Instrument Mode always uses the ABA Nod Pattern and does not chop the secondary.

The overhead estimate for the **Spectral Scan** Instrument Mode is a rough estimate for this non-standard mode and will depend on the exact nature of the observation. This is only offered as an engineering mode, not for standard observing. Contact the Help-Desk for details.

The field On-source time per map position reports t_{nod} times the number of cycles. Multiplying this by the number of map positions gives the total on-source exposure time for the whole observation. More detail on the time estimate can be found by selecting the **Observation Est...** button to get the total on-source time, the overhead, and total observing time. The total duration includes a 300 s overhead to setup the observation. For observations that are composed of multiple short AORs (e.g. multiple spectral settings on a single target or mapping of a source using separate AORs for each map pointing) this can be reduced to 60 s by setting the field Using multiple short AORs to true.

The Min Contiguous Exp Time field can be left at `>0` s unless a long observation (>1 h) is requested that must not be split and scheduled on separate observing legs or flights. Set this value to the minimum duration required for an observing leg. See also Sect 4.1 of the Flight Planning White Paper.

The position angle of the FOV of FIFI-LS is specified via the FOV angle parameter (see also Section 3.1.1.3 of the Observer's Handbook). If the angle is 0, the FOV is aligned so that North is up on the array. This angle rotates the FOV *and any map offsets* counterclockwise.

Two types of maps are supported via the MapType parameter: **Grid** and **Custom**. If **Grid** is selected, a rectangular grid of map positions can be specified, including an offset of the center of such a grid from the target position. If **Custom** is selected, the map offsets for a custom map optimized for the source geometry can be read in from a two-column csv file containing the map offsets in arcseconds. Make sure that there are no empty lines in the file. For both types, the offsets are specified along the FOV axes.

The map position either from Grid or Custom maps can be exported as csv files either as offsets from the source coordinate or as absolute coordinates with the respective buttons. It can be useful to create a Grid map first, export the offsets, and trim it and/or create shifted extra coverage in an editor for csv files. After importing the edited csv file, the result can be checked in the overlay.

A dither pattern can be added to the map using the second row of buttons in the lower panel: 1-point (no dither) to use just the specified map positions; 5-point to add an X-shaped dither around the map position; 9-point for a square dither around the map position; and 17 point for two concentric square dithers around the map position. The dither positions are identified separately from the specified map positions by the 'isDither' column that can be seen at the right side of the panel displaying the map positions, allowing the dither pattern to be changed without affecting the specified map positions. Maps with dither positions can be exported, edited, and imported in the same manner as other maps. Dither positions are not needed in Phase I; it is perfectly fine to leave these unset and discuss them with your Contact Scientist in Phase II.

The parameter **Map Priority** informs the instrument scientists how to prioritize the map observation. If Map Order is selected, the order of the map positions is strictly followed as listed in USPOT. If for unforeseen circumstances the observing time is cut short during a flight, the last map positions might be missing but most of the map positions will have been observed for as long as planned. If **Coverage** is selected, the map is observed by looping through the map positions a few times, which ensures that the whole map is observed if the observing time is cut short but it will be (partly) less deep than planned. If the dither pattern buttons are used, this parameter is applied in the same way to determine how the dither positions are applied. If **Map Order** is selected, then the dither is automatically applied around each specified map position in order, with the dither around the first specified map position being completed before moving on to the second specified map position, etc. If **Coverage** is selected, then the first dither position for every specified map position is completed before moving on to the second dither position for every specified map position, etc.

For the OTF Mapping AOT:

The Min Contiguous Exp Time field can be left at >0 s unless a long observation (>1 h) is requested that must not be split and scheduled on separate observing legs or flights. Set this value to the minimum duration required for an observing leg. See also Sect 4.1 of the Flight Planning White Paper.

The MapType parameter is used to select whether the OTF maps are created using the Tile or Custom method. If Tile is selected, the number of scans in X and Y directions and the scanning speed in X and Y are set in this column and the start points of the scans are calculated by USPOT and displayed in the lower panel. In the Custom method, the start points, scan speeds and scan directions are read in directly from a csv file. In both modes the current scan parameters can be exported to a csv file, so it is possible to create a template using the Tile method, export it and edit it, then read it in as a Custom map. The Custom map also supports changing the Scan Length in seconds, which is fixed at 30s for the Tile map, although this can only be changed for the whole AOR rather than for each scan.

Both methods support offsetting the map center from the defined target position using the Map Offset X and Y parameters. These add with the offsets defined in a Custom map, with the result being reported in the lower panel – note that the offsets are reset to zero when a csv file is read in so must be re-applied after this. Both modes also support altering the angle of the map using the Map Angle parameter – this defines the angle of the map scans, the angle of the array is fixed relative to these scans to always give optimal coverage. If the angle is 0, the map is aligned so that North is up (Y direction); this angle rotates the map and any map offsets (both for the map center and for the individual scans) counterclockwise.

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5.2.2.3 Third Column and Reference Position Frame: Selecting the Chop and Nod Parameters

In the third column and the reference position frame, the instrument mode and the chop and nod parameters are set. For the FIFI-LS OTF Mapping AOT only the instrument mode (which is always set to **OTF Mapping**) and the nod parameters in the reference position frame are available.

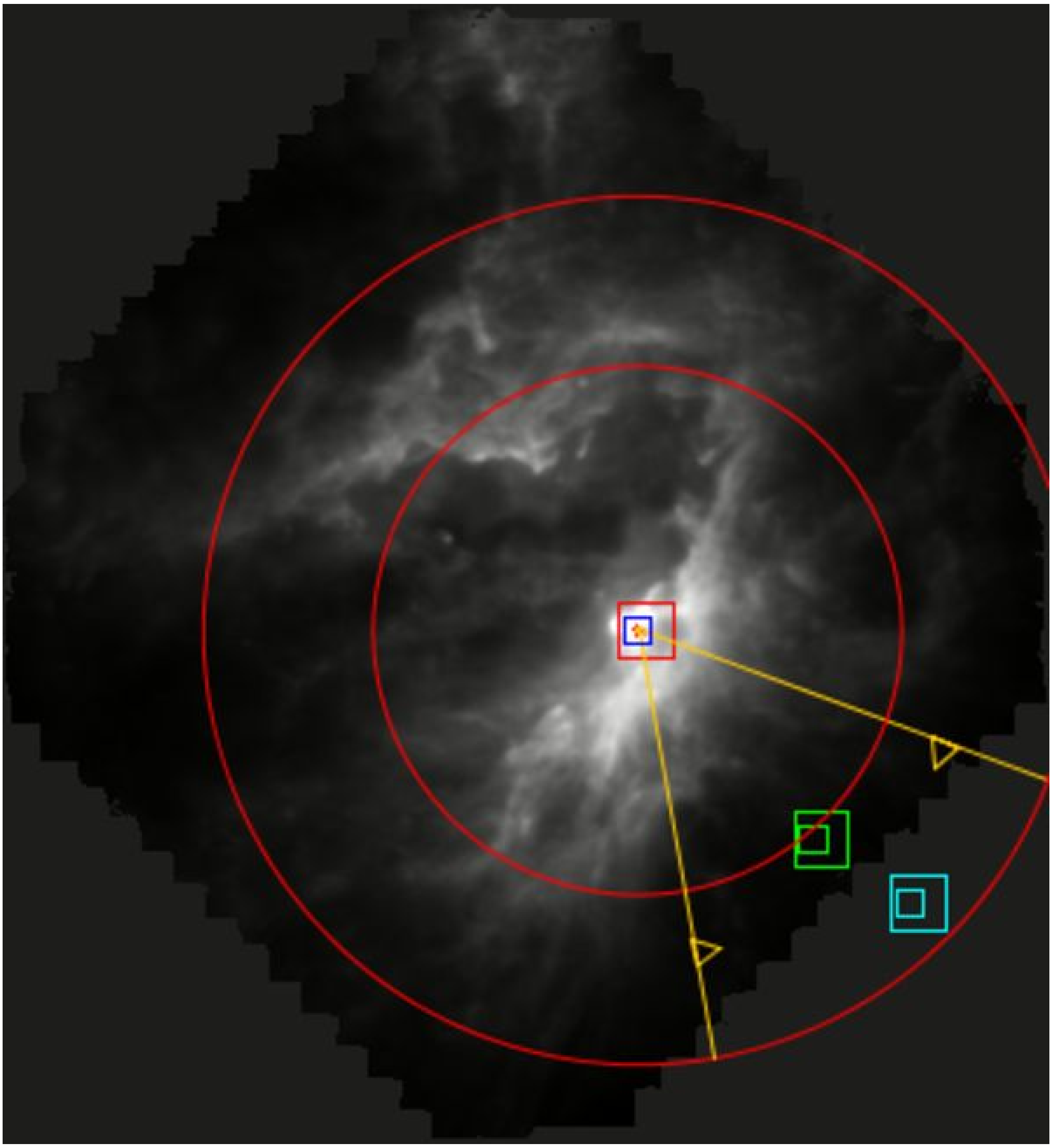
For the FIFI-LS AOT, the user chooses between the following Instrument Mode selections: **Symmetric Chop**, **Asymmetric Chop**, and **Total Power** (and, in engineering mode only, **Spectral Scan**). When either the **Asymmetric Chop** or **Spectral Scan** mode is chosen, the Nod Pattern can be chosen to be **ABA** (the default), **ABBA**, or **AABAA**; for Symmetric Chop mode this is fixed as **ABBA** and for Total Power it is fixed as **ABA**. When the Spectral Scan mode is selected, the Chop Type can be chosen to be either symmetrical (**Sym**) or asymmetrical (**Asym**). Otherwise, the Chop Type is fixed by the instrument mode selection.

Specify the Total Chop Throw in arcseconds and the position angle for the chop (Chop Pos Angle). The position angle of the chop is specified as Chop Pos Angle relative to the chosen Chop Angle Coordinate system: **J2000** or **HORIZON** (the default). In **J2000**, the Chop Pos Angle runs counterclockwise from north. The choice of **HORIZON** selects to chop relative to the quasi-horizontal telescope coordinate system and the Chop Angle is fixed to `0` to achieve that. As Total Power is an unchopped mode, the chop parameters are not available in this mode.

If the Chop Type is asymmetric (**Asym**) or **none** (including Total Power and OTF Mapping modes), a reference (nod) position is required. This can be done by specifying an offset from the target position or by specifying an absolute position in the Ref Type box. If specifying an absolute position (Ref Type → **By Position**), the **Choose Position** button allows the user to enter sexagesimal numbers or to resolve object names. The map offsets in the second column will not be applied to the reference position unless Map Ref. Pos. (located in the third column, Reference Position frame) is set to **true**. A warning will be given for reference positions more than 1800” from the target position and an error for reference positions more than 2700” from the target position.

Use the visualization in USPOT to check the chop and nod parameters. *It is important to ensure there is no chopping/nodding into emission.* The best estimate for continuum emission may be Herschel/PACS-photometer maps which may be available at 70 μm, 100 μm, or 160 μm, which can be loaded into USPOT from a FITS-file. Figure 5.2-2 is a screen shot from USPOT visualizing the asymmetric chop with only one map position on a PACS 100 μm map. If the Chop Angle Coordinate system is selected to be **HORIZON**, the visualization in USPOT cannot know the corresponding position angle on the sky and plots the chop aligned with the FOV. Different position angles can be simulated by changing the FOV Angle in the third column.

Figure 5.2-2



2 Figure 5.2-2. The concentric red and blue squares are the FIFI-LS FOVs.The star in it denotes the source coordinates, which is in the center of the blue array because in this example the pointing array was set to blue. The green squares are the off-source chop separated from the target by 300 arcsec at a position angle of 220˚ (north is up here, but that depends on the orientation of the loaded background image). The turquoise squares are the reference position specified as a relative offset. A magenta square shows the off-chop for the reference position, but is outside of the image here. A chop angle range is specified and indicated by the yellow lines with triangles.

When chopping asymmetrically, the maximum chop amplitude varies with the position angle. The maximum chop throw varies between 250 and 600 arcsec. The range of position angles (PAs) where the maximum chop throw is below 600 arcsec is fixed with respect to the telescope. That means that the range of PAs with a limited chop throw is limited with respect to equatorial coordinates (J2000) depends on the rotation of field during the observation or in other words, when the observations is carried out. Since that is not known while the AORs have to be prepared, a range of possible chop angles must be specified if the chop throw is larger than 250 arcsec. Then the button **Set Chop Angle Ranges** is activated. Use it to open a dialog box to enter range(s) of possible chop angles. The visualization above shows a possible range from 190° to 250°.

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5.2.2.4 Observing Condition & Acquisition / Tracking Window

Observations that are time critical, i.e. have to be performed during a certain date range (other than due to ordinary visibility constraints that are already included in the flight planning), should be marked as such in the Observing Condition & Acquisition/Tracking Window and the appropriate date constraint should also be entered in the same window (these are grayed out until Is Time Critical is set to Yes).

5.3 FORCAST

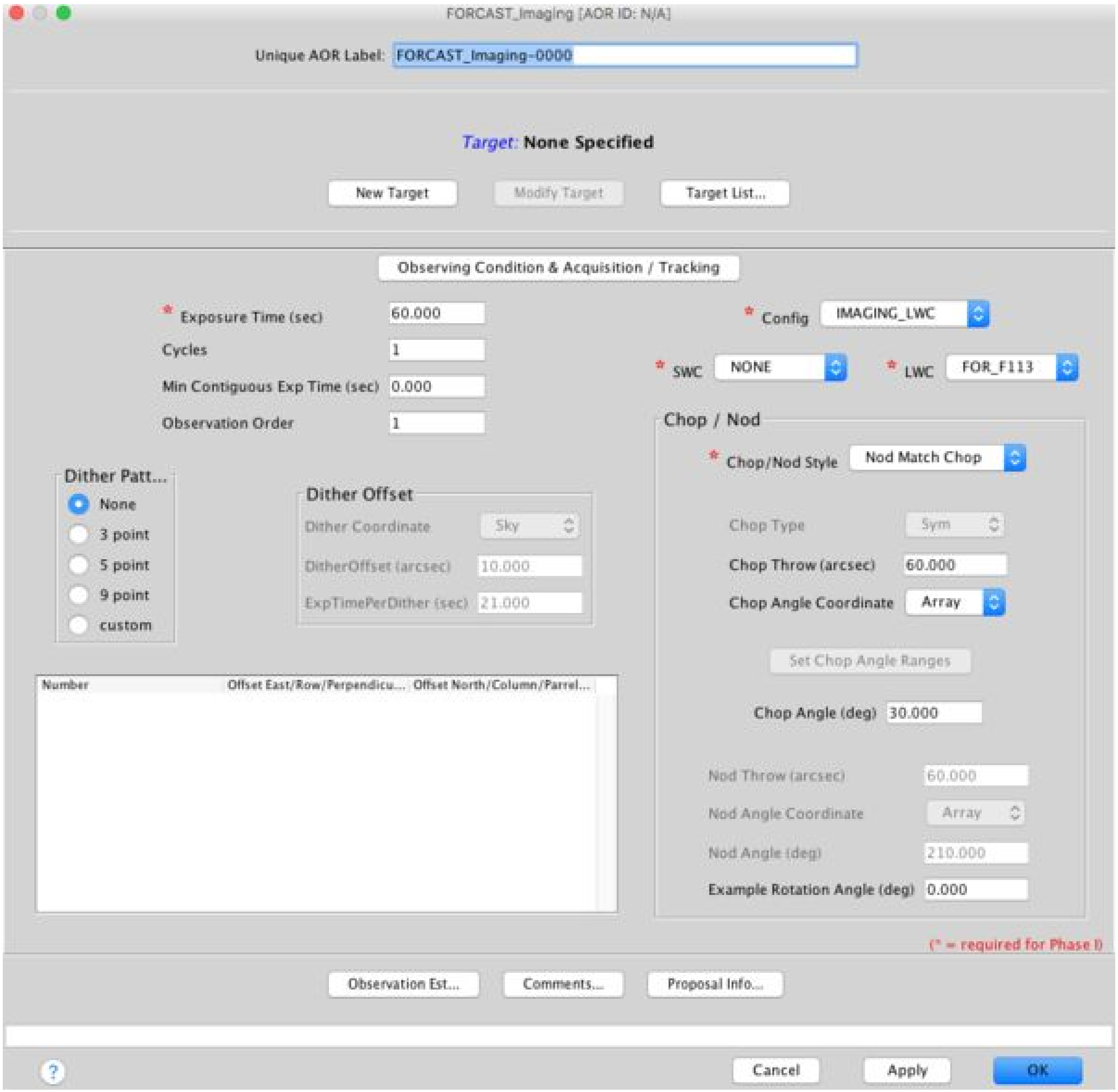
5.3 FORCAST AOR Fields

FORCAST specific instructions and reminders of general issues are given in the following topics below. It is necessary to read the FORCAST chapter of the Observer's Handbook before preparing detailed FORCAST observations in USPOT. Astronomical Observation Requests (AORs) should be created as described in Chapter 3.

The USPOT **Observation** drop-down menu lists the four Astronomical Observing Templates (AOTs) available for FORCAST: **Imaging**, **Grism** and **Acquisition**. Refer to the Observer's Handbook for a complete description of available combinations of configurations and modes for FORCAST.

The USPOT FORCAST Main AOR Window contains several frames: Chop / Nod, Dither Offset, Dither Patt..., and Exposure Set-Up (the latter of which applies only to Acquisition AORs). Figure 5.3-1 shows an example of the Main AOR Window of a FORCAST AOT. The instrument-specific fields are discussed in detail in this chapter. Contact the Help-Desk with any questions.

Figure 5.3-1



3 Figure 5.3-1. An example of a FORCAST AOT Main AOR Window, using the FORCAST Imaging AOT.

In order to ensure that the time requested on the proposal accurately reflects the time needed, consider the following checklist:

Note: The Observer's Handbook links below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

- Utilize WISE, Spitzer, MSX, or IRAS images to ensure chopping and nodding configurations are set up properly (i.e., that observations fall onto a clean sky).
- In order for the source to fit within the field of view of FORCAST given any rotation of field, the object must not be any bigger than 3.2 arcmin across in any dimension. If it does, observations must chop far enough such as that they are chopping off of the source--otherwise, a mosaic strategy must be specified. (See Section 5.3.1.2b)
- An Observing Priority must be set up if some targets are more important to observe than others. Of particular importance is ensuring that *all* AORs for a particular target have the same Observing Priority. Additionally, inidividual AORs for each target must also be prioritize by specifiying the preferred observation Order (Section 5.3.3.1b).

- Provide Comments for non-standard observations or special requests (Section 5.3.3.2).
- Proposers using C2NC2 or NXCAC mode with a Chop Throw >250 arcsec must specify as large a range of chop angles as possible.
- For the imaging or spectroscopy of extended and bright sources, dithers to mitigate array artifacts must be set up.
- For imaging mosaics of extended objects larger than the FORCAST field of view, the mosaic offsets must be set up such as that there is adequate overlap to ensure that there are no gaps in coverage regardless of the sky orientation at the time of observation. (See Section 5.3.1.2b)

Other help:

Why Chop and Nod with FORCAST
FORCAST Imaging Observing Modes Overview
FORCAST Grism Observing Modes Overview

Tables 5.3-1, 5.3-2, and 5.3-3 list the required fields for Phase I and Phase II for each available FORCAST AOT. Conditional fields (i.e., fields not editable unless certain parameters are specified) are denoted with a footnote, with a reference to the required field to activate the conditional field. Fields that are not listed in these tables fall under one of three categories: fields not directly editable in USPOT (but may be affected by updating other fields, which are required; for more information on how particular fields may be related, refer to the corresponding sections within the Observer's Handbook—denoted in Tables 5.3-1, 5.3-2 and 5.3-3 by OH followed by the appropriate section number), fields intended for use only by SOFIA Support Scientists only, or optional fields.

Table 5.3-1

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Imaging Phase I Required Fields

Field Location	Field	Reference
Main AOR Window	Specify Target	§ 3.4
	Exposure Time	SITE; OH § 4.2.1.1
	Config SWC LWC	OH § 4.1.2.4
Chop / Nod Frame	Chop/Nod Style	OH § 4.2.1
Observing Condition & Acquisition / Tracking Window	Is Time Critical	OH § 4.2

Imaging Phase II Required Fields

Field Location	Field	Reference
Main AOR Window	Min Contiguous Exp Time	§ 5.3.1.1b

Field Location	Field	Reference
	Dither Patt...	§ 5.3.1.1a; § 5.3.1.2
Dither Offset Frame	[1]Dither Coordinate	§ 5.3.1.2a
	[1]DitherOffset [1]ExpTimePerDither	§ 5.3.1.1a
Chop / Nod Frame	Chop Throw	§ 5.3.1.2
	[2]Chop Angle Coordinate	§ 5.3.1.2a
	Chop Angle	§ 5.3.1.2
Observing Condition & Acquisition / Tracking Window	Target Priority	§ 3.4

Table 5.3-2

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Grism Phase I Required Fields

Field Location	Field	Reference
Main AOR Window	Specify Target	§ 3.4
	Exposure Time	SITE; OH § 4.2.1.1
	Instrument Configuration	OH § 4.1.2.4
	Slit SWC LWC	
	Chop/Nod Style	§ 5.3.1.2; § 5.3.2.2
Observing Condition & Acquisition / Tracking Window	Target Priority	§ 3.4
	Is Time Critical	OH § 4.2

Grism Phase II Required Fields

Field Location	Field	Reference
Main AOR Window	Min Contiguous Exp Time	§ 5.3.2.1b
	Dither Patt...	§ 5.3.2.1a; § 5.3.2.2d
	[1]Dither Coordinate [1]DitherOffset	§ 5.3.1.2a
	[1]ExpTimePerDither	§ 5.3.1.2a
	Chop Throw	§ 5.3.2.2
	[2]Chop Angle Coordinate	§ 5.3.1.2a
	Chop Angle	§ 5.3.2.2
Observing Condition & Acquisition / Tracking Window	Target Priority	§ 3.4

Table 5.3-3

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Acquisition Phase I Required Fields

Field Location	Field	Reference
Main AOR Window	Specify Target	§ 3.4
	Config SWC LWC SLIT	OH § 4.1.2.4
	Exposure Time	SITE; OH § 4.2.1
	Chop/Nod Style	OH § 4.2.1
Observing Condition & Acquisition / Tracking Window	Is Time Critical	OH § 4.2

Acquisition Phase II Required Fields

Field Location	Field	Reference
Main AOR Window	Chop Throw	§ 5.3.2.2
	[2]Chop Angle Coordinate	§ 5.3.1.2a
	Chop Angle	§ 5.3.2.2
Observing Condition & Acquisition / Tracking Window	Target Priority	§ 3.4

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Return to: Table 5.3-1 | Table 5.3-2 | Table 5.3-3

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5.3.1 Imaging AOR Fields

5.3.1.1 Instrument Parameters

5.3.1.1a Exposure Time

The desired total on-source integration time should be determined by using the SITE on-line calculator and entered into the Exposure Time field. This value does not include overheads.

Selecting the **Observation Est...** button on the bottom of the main AOR panel will launch an information window that gives the total requested exposure time, overhead, and duration of the observation. One can therefore check the observation efficiency by configuring the observations and pressing this button. For example, if the AOR is set up in NMC (**Nod Match Chop** Chop/Nod Style) to have a 3-point dither pattern with an exposure time of 60 s per dither position and one cycle of dithers, the resultant total exposure time will be 180 s and the duration of the observation will be 371 s (including estimates for line-of-sight (LOS) rewinds). If the AOR is set up in NMC mode with a 9-point dither pattern, 10 s exposure time per dither position, and two cycles, the resultant total on-source exposure time is still 180 s, but the observation will take 458 s (about 25% longer). Since proposers are awarded time in duration, not exposure time, it is in their best interest to figure out how to use that time most efficiently. Note too that when one specifies multiple Cycles, the Exposure Time field only displays the on-source time for a single cycle. The total on-source exposure time is displayed in the window accessed via the **Observation Est...** button at the bottom of the AOR editing window.

If dithering only once through the pattern, the desired total on-source integration time must be divided by the number of dithers and this value entered in the ExpTimePerDither field in the Dither Offset frame. This will automatically update the Exposure Time field with the total on-source time. Likewise, if the dither pattern will be repeated multiple times, the desired total on-source integration time must be divided by the number of dithers *plus* the number of times the pattern is to be repeated. The number of times the dither pattern is to be repeated should then be specified in the Cycles field. USPOT calculates the actual duration of the observations based upon the chop-nod mode selected, exposure time, number of dithers, and number of cycles.

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5.3.1.1b Min Contiguous Exposure Time Field

In some cases, it is necessary to split an observation among multiple flight legs. The Min Contiguous Exp Time field should be used to provide flight planners with information on the minimum on-source exposure time that can be scheduled for a single flight leg to be scientifically useful. For example, if a program has been awarded 2 hours of time for imaging a faint target, it may be necessary to divide the observation over multiple flight legs. If the source is faint enough to require at least 45 minutes of on-source time in order to be able to accurately coadd the data from multiple flight legs, then this should be entered into the Min Contiguous Exp Time field.

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5.3.1.1c Filter Selection

The appropriate instrument configuration (the Config field) and filters (the SWC and LWC fields) must then be selected. All of the available FORCAST filters are listed, but there are some important considerations that must be made. First, the throughput with the 5.4 and 5.6 µm filters in Dual Channel configuration (Config = **IMAGING_DUAL**) is very poor. Thus, proposers are discouraged from using these filters in Dual Channel configuration unless they are observing a blue source. Second, though all of the filters available for use in FORCAST are listed, only 12 are available in the instrument during any single flight series. Filters that are not included in the non-standard filter set may not be available. If a program that includes non-standard filters has been awarded time, contact the Instrument Scientist directly to determine if the non-standard filters will be available during the period when the program is scheduled. If not, then alternative filters must be used. The nominal filter set for SWC includes 5.6, 6.4, 7.7, 8.8, 11.1, N' (broadband), 19.7, and 25.3 µm. The supplemental filter set includes 5.4, 6.6, 11.3, 11.8 µm. For LWC, the default filter set includes 31.5, 33.6, 34.8, and 37.1 µm, while the supplemental set includes the 24.2 and 25.4 µm filters. The N' broadband filter is only offered in single-channel mode.

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5.3.1.2 Chop / Nod Style

The available selections for the Chop / Nod Style field and their related parameters are discussed below. For observations dealing with extended objects larger than the FORCAST FOV, see Section 5.3.1.2b.

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5.3.1.2a Nod Match Chop

The Observer's Handbook links below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

The majority of sources imaged with FORCAST will be relatively compact (source diameters <120 arcsec) and lie in areas of the sky free from contaminating extended emission. For such observations, selecting the **Nod Match Chop** (NMC) in the Chop/Nod Style field is recommended. Because coma will increase with larger chop throw (1 arcsec of coma for every 60 arcsec of chop throw in NMC), the Chop Throw values should be configured to be as small as possible but large enough such as that it is obvious that chopping will occur off-source and onto clean sky. If there are clear chop reference areas all around the science source, then NMC mode should be configured with a chop angle of 30 degrees (which mitigates problems due to array artifacts) in the **Array** Chop Angle Coordinate field.

If the source is surrounded by extended emission, the Chop Throw and Chop Angle in the **Sky** Chop Angle Coordinate field must be configured to avoid contamination in the chop reference fields. This is discussed in more detail and with examples in Section 5.3.1.2b. This is also where you will find a discussion of using the **C2NC2** Chop/ Nod Style for imaging very large and extended objects.

Section 5.3.1.3 discusses the general rules of thumb for dithering with FORCAST.

When using the default **Nod Match Chop** selection for a compact or faint source, it is recommended to not employ dithers in the observation and, consequently, to leave the Dither Pattern field set to **None**. For observations that do not require dithering, the on-source integration time from SITE can be used in the Exposure Time field. For observations that do require dithering (such as an extended source observed using the default **Nod Match Chop** selection) there are two possible approaches: stepping through each position in the dither pattern once until the pattern is complete or looping through the dither pattern multiple times until the total on-source time is achieved. For NMC mode, it is better to only loop through the dither pattern once as this minimizes the overheads associated with the observation and maximizes the observing efficiency. In either case, the desired pattern must be selected in the **Dither Patt...** frame of the AOR editing window. This will update the dither offset parameters to the default values for a pattern with the selected number of positions. One can also define the dither offsets and whether to do these offsets in RA and Dec (Dither Coordinate = **Sky**) or in x and y pixel coordinates (Dither Coordinate = **Array**).

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5.3.1.2b C2NC2

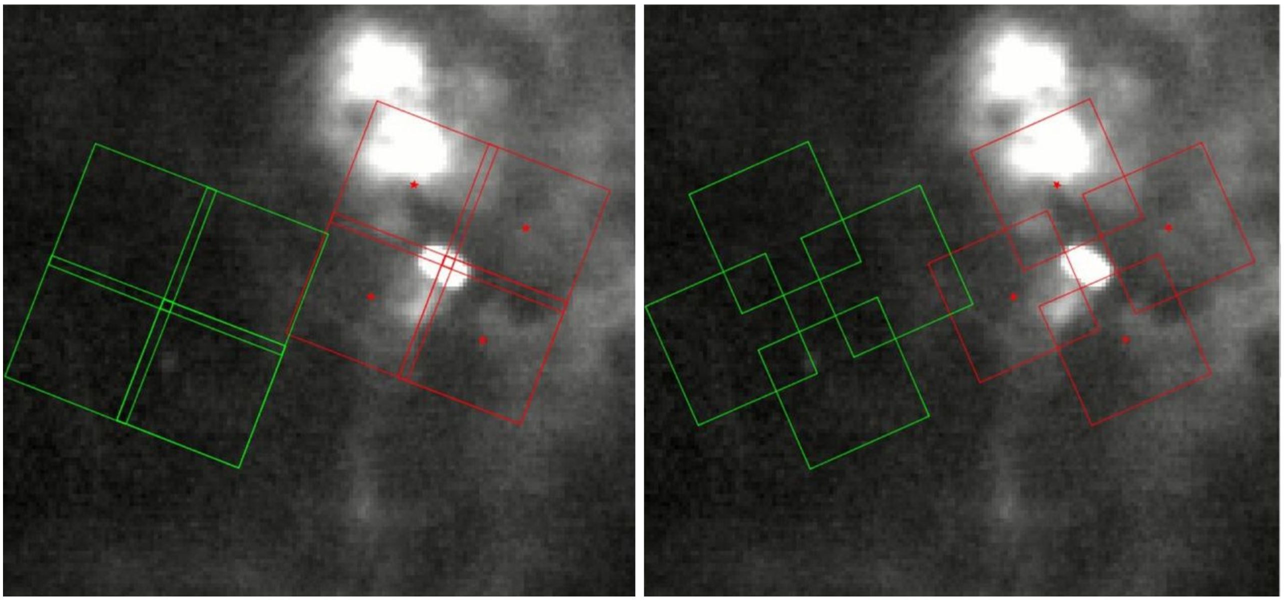
Observations with **C2NC2** chosen for the Chop/Nod Style field *must* be dithered. However, the dither parameters cannot be specified in USPOT. Instead, the support scientist will determine the best dither pattern and exposure time per dither position once the observations have been flight planned and the LOS rewind cadence is known. Only the total on-source exposure time required in the Exposure Time field is necessary. USPOT then provides an estimate for the total exposure time based upon a nominal rewind cadence and observing efficiency.

Extended Objects Larger than FORCAST FOV

In some cases, the target of interest will be quite large. Chopping beyond about 180 arcsec, the imaged sources will have significant coma (>3 arcsec). The **C2NC2** observing mode can be advantageous to employ in these cases. The **C2NC2** Chop/Nod Style selection allows for chop throws of up to 420 arcsec and yields images with no coma. However, these observations are much less efficient (almost 2 times longer duration than C2N modes), so if a proposer was awarded time for observations under the assumption that **Nod Match Chop** or **Nod Perp Chop** Chop/Nod Style would be used, but then found during Phase II that C2NC2 is required, then fewer filters would have to be used or less targets observed to still fit the C2NC2 observations within the awarded time.

Imaging an area much larger than the FORCAST FOV can be accomplished by creating a mosaic. Any mosaic with both dimensions larger than the FORCAST field of view should also be set up in **C2NC2** Chop/Nod Style (given the constraints on image quality due to coma when using large chop throws in **Nod Match Chop** Chop/Nod Style). See Figure 5.3-2 for an example. At present, there is no mapping mode available to create a mosaic automatically. Instead, the the RA and Dec coordinates for each position of the mosaic must be manually specified and entered as independent targets (and, consequently, independent AORs). However, the proposer cannot control the field orientation on the sky. This is determined by the object's position in the sky during the observing leg (i.e., by the flight plan) and this is not known until the specific observing leg is planned by the flight planners. The positions should be specified close enough to one another that they will overlap for *any* field orientation, allowing them to be combined into an uninterrupted map in the post-processing stages. This can be tested by changing the Example Rotation Angle in the AORs and reloading the AORs into the visualizer.

Figure 5.3-2.

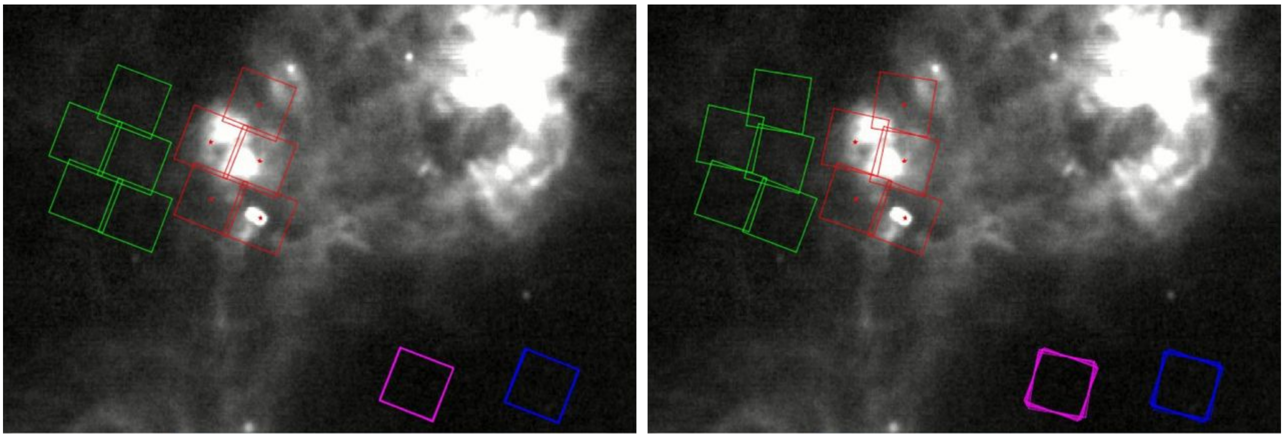


In order to freeze the target field on the detector, the telescope must rotate about its optical axis during an observation (neither SOFIA nor FORCAST have image rotators). Because of the construction of the telescope, there is a limit to the amount the telescope can rotate of +/- 3 degrees. Once the telescope reaches this limit, the observation must be stopped and the rotation angle of the telescope is reset (a.k.a., an LOS rewind). Then the source is required and a new observation is started. The speed of the field rotation is set by the location of the object in the sky and the location of the aircraft. Because of the rotation limit, long integrations or observations of sources in parts of the sky that rotate quickly, may need to be broken up into several observations, each of which will have a different rotation angle.

Therefore, for long integrations or for sources in parts of the sky that rotate rapidly, different elements of a mosaic may sample the source at different position angles. An example of this with a mosaic of W3 is shown in Figure 5.3-2. As in the previous example, the Chop Angle and Chop Throw were both kept the same for each element of the mosaic since there was adequate emission free space available near the science target, but the same nod position was used for each pointing (purple and blue boxes). If one needs to use different chop angles or throws for some positions, then the background nod positions will not align as in the example, but should be checked to ensure they are sampling empty sky.

In any case, assume that the left image in Figure 5.3-3 is the way the proposer has originally set up the observations. Note that, given the small overlap of these fields, it is likely the problem of not fully sampling the area will occur at certain field orientations. Assume that 10 minutes per position is needed to integrate down to the level required by the science and that, for this source, the sky is rotating rapidly enough that the telescope needs to perform an LOS rewind after every 10 minutes. In that case there would be an LOS rewind after *each* element is sampled in the mosaic. Assuming that this rotation is the maximum 3 degrees, the final sampling of the field will look more as is depicted in the right image of Figure 5.3-2. This again demonstrates why it is important for the proposer to ensure their mosaic fields will overlap enough that field rotation will not be a problem.

Figure 5.3-3.



4 Figure 5.3-3. An example of a FORCAST AOT Main AOR Window, using the FORCAST Imaging AOT.

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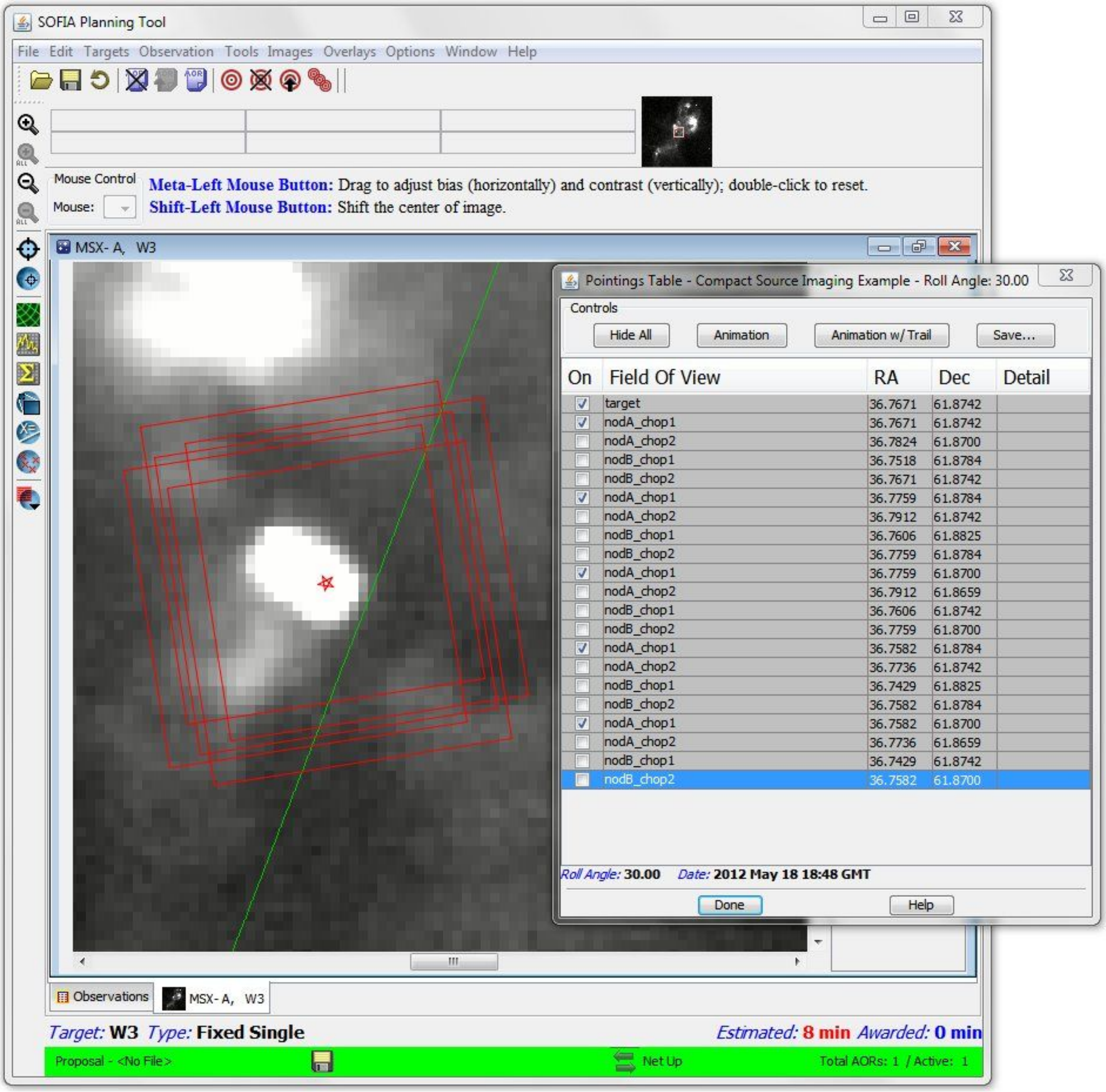
5.3.1.3 Dithering

The Observer's Handbook links below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

The FORCAST array is relatively clean cosmetically for most observations. For very bright extended sources, there can be some array artifacts present. Removal of some of these effects can be accomplished with dithering. Dithering refers to small movements (of the order of 10–15 arcsec) of the telescope which place the imaged object at different locations on the array. Typically one dithers 3 or 5 times. Shifting and then median combining these images can remove any patterns that are positionally dependent on the array. For faint sources (those not immediately detectable in a few minutes), it is best if no dithering is performed. Be aware, however, that dithering results in additional overheads that can be significant for short observations or observations with a large number of dither positions (see the example given in Section 5.3.1.1.a). These additional overheads are included in USPOT observation time estimates. Instructions for how to set up dithers is straight forward and given in Section 3.2.1. An example of what a 5-element dither with 10 arcsec offsets looks like can be seen in Figure 5.3-4. Here the field of interest (NodA-Chop1) with the 4 dither offsets are being visualized without the reference fields to show the dither offsets more clearly.

Figure 5.3-4.



On	Field Of View	RA	Dec	Detail
✓	target	36.7671	61.8742	
✓	nodA_chop1	36.7671	61.8742	
	nodA_chop2	36.7824	61.8700	
	nodB_chop1	36.7518	61.8784	
	nodB_chop2	36.7671	61.8742	
✓	nodA_chop1	36.7759	61.8784	
	nodA_chop2	36.7912	61.8742	
	nodB_chop1	36.7606	61.8825	
	nodB_chop2	36.7759	61.8784	
✓	nodA_chop1	36.7759	61.8700	
	nodA_chop2	36.7912	61.8659	
	nodB_chop1	36.7606	61.8742	
	nodB_chop2	36.7759	61.8700	
✓	nodA_chop1	36.7582	61.8784	
	nodA_chop2	36.7736	61.8742	
	nodB_chop1	36.7429	61.8825	
	nodB_chop2	36.7582	61.8784	
✓	nodA_chop1	36.7582	61.8700	
	nodA_chop2	36.7736	61.8659	
	nodB_chop1	36.7429	61.8742	
	nodB_chop2	36.7582	61.8700	

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5.3.2 Spectroscopic Observations: Acquisition and Grism AOR Fields

For each target (or observations of a target over multiple flights) a pair of **Acquisition** AORs must be established: the first with the Slit field set to **None** and the second with the Slit field set to **FOR_LS47**.

Since it is important for the acquisition image configuration to be the same as that of the science observations, one can select an AOR that has the appropriate configuration and import that into the acquisition AOR. This is done by selecting the desired AOR template from the Import Config from AORID dropdown menu within the FORCAST Acquisition AOR editing window. Only one set of acquisition AORs per target per slit used must be created. The recommended filter for acquisition is F111. However, one may choose to instead match the acquisition filter to the grism being used as follows: F077 for G063; F111 for G111; F197 for G227; and F315 for G329. If necessary, other filters may be used for acquisition after discussion with the Support Scientist. An estimation of the integration time necessary to achieve a S/N ≥ 5 in that filter should then be performed. It is assumed that for most spectroscopic targets, this will be on the order of 10–60 seconds. Every acquisition will add 5 minutes of duration to your program.

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5.3.2.1 Instrument Parameters

5.3.2.1a Exposure Time

The desired on-source integration time should be determined by using the FORCAST Grism Observation Calculator and is entered into the Exposure Time field. This value does not include overheads.

Though possible to dither along the slit in spectroscopy observations, it is recommended to only do so for bright sources and when the observer does not care about absolute flux levels. In this case, there are two possible approaches to conducting the observations: one can step through each position in the dither pattern once until the pattern is complete, or the dither pattern can be looped through multiple times until the total on-source time is achieved. In general, it is better to only loop through the dither pattern once as this minimizes the overheads associated with the observation (and maximizes the observing efficiency). However, in some cases it may be desirable to loop through the dither pattern. This can be specified with the Cycles field. The total on-source time will be the value entered into the Exposure Time field multiplied by the number of Cycles. Note that at this time, USPOT does not properly account for the additional overheads associated with looping through a dither pattern, and therefore this option should be discussed with the support scientist if required.

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5.3.2.1b Min Contiguous Exp Time Field

In some cases, it is necessary to split an observation among multiple flight legs. The Min Contiguous Exp Time field should be used to provide flight planners with information on the minimum amount of time that can be scheduled for a single flight leg to be scientifically useful. For example, if a program has been awarded 2 hours of time for imaging a faint target, it may be necessary to divide the observation over multiple flight legs. If the source is faint enough to require at least 15 minutes on-source in order to be able to accurately coadd the data from multiple flight legs, then this should be entered into the Min Contiguous Exp Time field.

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5.3.2.1c IR Source Type

When pipeline processing FORCAST spectroscopic data, it is useful to know whether or not the source is extended or point-like in the IR. Setting the IR Source Type to **Point Source**, **Extended Source**, or **Unknown** ensures that the proper extraction routines are used during processing of the science data.

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5.3.2.1d Instrument Configuration, Grisms, and Slit Fields

Finally, the appropriate Instrument Configuration, Grism (SWC and LWC), and Slit must be selected for the AOR. The options in the Instrument Configuration field includes both single channel configurations: **GRISM_SWC** and **GRISM_LWC**.

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5.3.2.2 Chop/Nod Style

The available selections for the Chop / Nod Style field and their related parameters are discussed below. For observations dealing with extended objects larger than the FORCAST FOV, see Section 5.3.2.2b.

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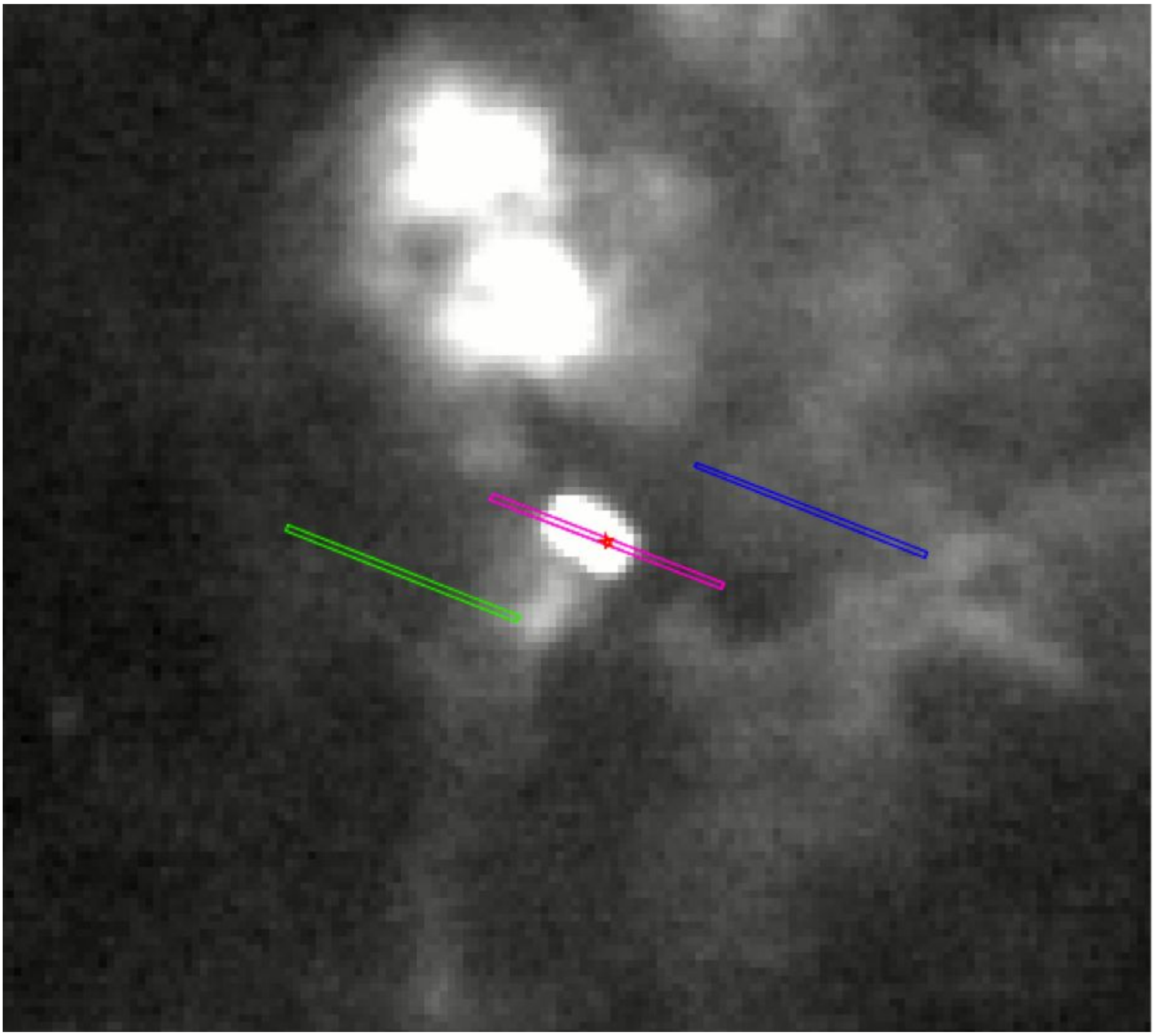
5.3.2.2a Nod Match Chop

As is the case for imaging observations, the majority of spectroscopic observations with FORCAST will involve objects that are relatively compact (source diameters <120 arcsec) and lie in areas of the sky free from contaminating extended emission. For such observations, using the **Nod Match Chop** (NMC) Chop/Nod Style is recommended. Because coma will increase with larger chop throw (about 1 arcsec of coma for every 60 arcsec of chop throw in NMC mode), chop throws should be configured to be as small as possible but large enough that they know they will be chopping off of their source and onto clean sky. If there are clear chop reference areas all around the science source, it is recommended that the NMC mode be used and configured with a Chop Angle of 30 degrees and in the **Array** Chop Angle Coordinate system for long-slit spectroscopic observations.

Figure 5.3-5 shows a long-slit spectroscopic observation using a NMC set up is shown on the bright elongated object at the center of W3. This chop/nod set-up is configured in **Sky** coordinates so that the chop/nod reference positions avoid the bright nearby emission to the north of this science target. However, there still appears to be extended diffuse emission contained in the reference slit positions (as seen in the MSX image). If the observations are short, the extended diffuse emission contained in the reference slit positions may not be a problem. The proposer must confirm that this emission is below FORCAST's detection level given the exposure time of the proposed observations and the wavelength dependence of the extended emission. However, if the proposer wants to perform deep observations of the region or is unsure if the extended emission in the reference fields will be a problem at the particular wavelengths to be observed, then he/she should try to chop and nod farther away. However, beyond about 180 arcsec, the chopped sources will have significant coma (>3 arcsec). Though image quality is less of an issue for spectroscopy than imaging, a large coma will decrease the effective brightness of the source by spreading out the flux, thus decreasing the expected S/N of a spectrum in a given amount of exposure time.

If very large throws are needed to reach clean sky, observations should be configured using **NXCAC** mode. Please note that these observations are much less efficient (about 3.5 times longer duration than C2N modes). Therefore, proposers who were awarded time for observations under the assumption that NMC mode would be used but find, during Phase II, that NXCAC will be required, will have to observe with fewer grisms or observe fewer targets to still fit the NXCAC observations within the awarded time.

Figure 5.3-5.



5 Figure 5.3-5. A long-slit spectroscopic observation using a NMC set up is shown on the bright elongated object at the center of W3. The long red rectangle shows the long slit centered on the source to be observed, while the long green rectangle and long blue rectangle show the chop/nod reference slit positions.

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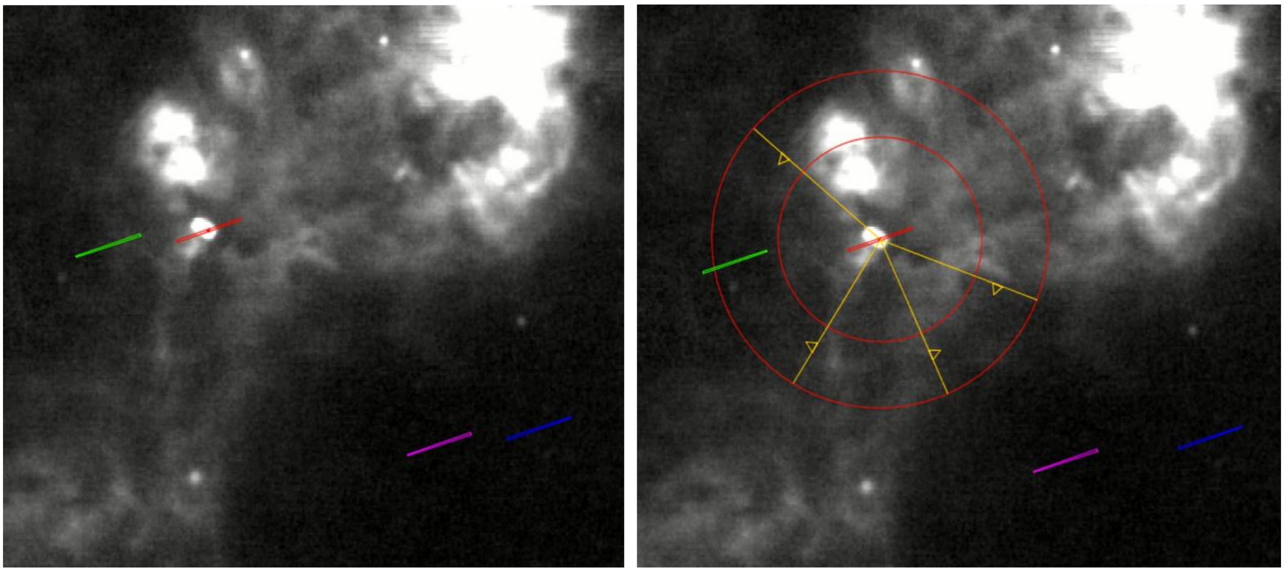
5.3.2.2b NXCAC

If very large throws are needed to reach clean sky, the observations should be configured using **NXCAC** mode. The **NXCAC** (Nod Unrelated to Chop/Asymmetric Chop) Chop/Nod Style is analogous to **C2NC2** Chop/Nod Style for imaging in that it is less efficient (about 3.5 times longer duration than C2N modes) but allows for large throws without negatively affecting image quality. Proposers who were awarded time for observations under the assumption that NMC mode would be used but find, during Phase II, that NXCAC will be required, will have to observe with fewer grisms or observe fewer targets to still fit the NXCAC observations within the awarded time.

If the source is surrounded by or has nearby extended emission, the Chop Throw and Chop Angle must be configured in the **Sky** Chop Angle Coordinate system to avoid contamination in the chop reference fields. An example is shown in the left image of Figure 5.3-6, which allows chop throws up to 8 arcminutes and nod throws up to 10 degrees. In this asymmetric chop mode, sources will have no coma and one can sample clean sky relatively far from sources. If one wishes to perform very deep spectroscopic observations on the source of interest (long red rectangle), the chop should be configured to be far away and at an angle that will get the chop reference slit positions on much cleaner sky (long green rectangle). The nod position is then chosen to be far enough away that there is no chance of background emission in those slit positions (long blue rectangle and long purple rectangle).

This set-up will work up to a chop throw of 250 arcsec. If chops larger than this are still necessary to reach a chop reference field of fainter background emission, then the NXCAC AOR setup must be configured with a preferred chop angle *and a range of other possible chop angles* in the likelihood that the preferred angle cannot be used (due to hardware limits involving the sky rotation angle at the time of observation) specified in the Chop Angle Range Set Up dialog window via the **Set Chop Angle Ranges** button. The right image in Figure 5.3-6 gives an example of this setup for W3. Notice these angles encompass the cleanest sky areas in the MSX image for this region, and thus are likely to be suitable for chop reference slit positions for very long integrations. At the time of observing, a chop angle will be chosen from these ranges if the preferred angle is not possible. It is in the PI's best interest to specify as large a range (or ranges) of chop angles as possible.

Figure 5.3-6.



Dithering observations along the slit may be advisable; Section 5.3.2.3 discusses the general rules of thumb for using dithers with FORCAST.

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5.3.2.2c Nod Perp Chop

Nod-Perpendicular-to-Chop (NPC; **Nod Perp Chop CAS** and **Nod Perp Chop NAS**) Chop/Nod Styles are offered in USPOT for the long-slit spectroscopy. Experienced IR observers wishing to use this mode must submit an appropriate justification for using this mode to be discussed this with the SOFIA Support Scientist. Two special NPC setups are available: Nodding Along the Slit (**Nod Perp Chop NAS**) or Chopping Along the Slit (**Nod Perp Chop CAS**). As is the case with imaging mode, and contrary to popular belief, *there is no sensitivity advantage in using one of these NPC modes over NMC mode*, as both modes yield the same S/N in the same exposure time (as discussed in Signal-to-Noise as a Function of Chopping and Nodding and Signal-to-Noise Estimates for Various Chop/Nod Techniques with FORCAST).

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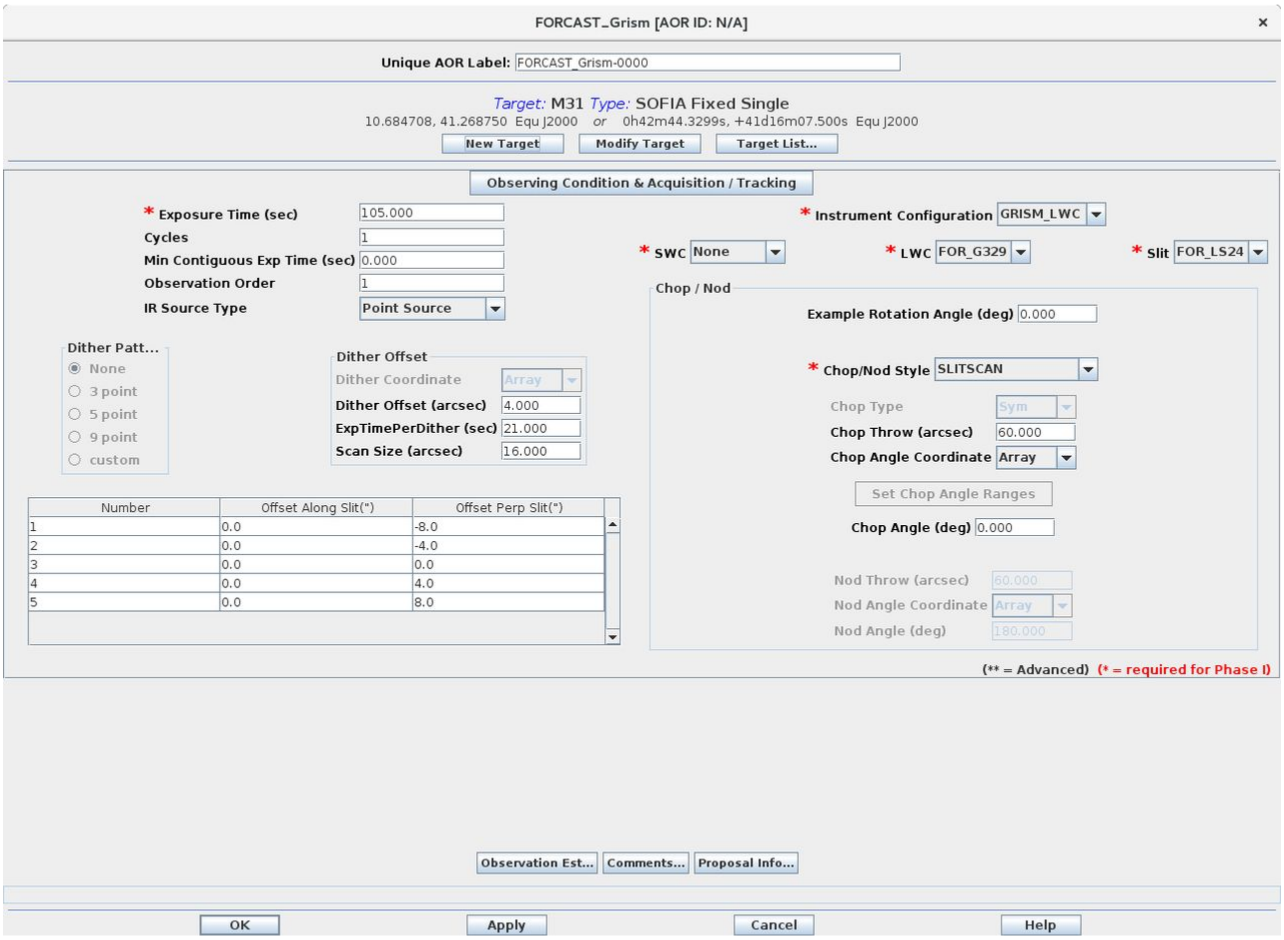
5.3.2.2d SLITSCAN

It is also possible to perform slit scan observations of extended sources with FORCAST grisms, wherein spectra are acquired at a number of positions across the source as defined by the PI. This mode is defined by specifying a set of dithers that offset the telescope perpendicular to the slit. Once **SLITSCAN_NMC or SLITSCAN_NXCAC** mode has been chosen, the default five position Dither Pattern is loaded into the dither panel. The default scan pattern is defined with the spacing between each consecutive slit position equal and with the scan pattern centered on the given source position. So, for example, if the proposer wants the slit scan to include five slit positions with overlapping coverage, then they might set the dither pattern as shown in Figure 5.3-7. Since the wide long slit is 4.7 arcsec wide, setting a dither offset of 4 arcsec will result in a slit overlap between consecutive slit positions. The number of positions in the scan cannot be explicitly set—instead, the number of discrete slit positions is determined by the user specified Dither Offset and Scan Size, i.e. the total length of the scan. The number of slit positions then is the scan size divided by the dither offset, rounded up, plus 1. Since the slit scan is performed perpendicular to the slit, this mode can only be performed in array coordinates. This means that the actual orientation of the scan on the sky will not be known until after flight planning.

Figure 5.3-7.



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5.3.2.3 Dithering

The FORCAST array is relatively clean cosmetically for most observations. For spectroscopic observations, a spectrum may lie across bad or hot pixels and could be misinterpreted in the extracted spectrum as a line. To mitigate this, we set up our calibration stars on the same pixel as the science targets, which means that the science spectra are dispersed over the same pixels of the array as the calibration spectra. Any pixel-to-pixel variation should therefore be removed when the science data are divided by the calibration data. For extended sources, the removal of such cosmetic issues can be accomplished with dithering. *Dithering* refers to small movements (of the order of 3–15 arcsec) of the telescope which place the imaged object at different locations along the slit and, therefore, place the spectra at different positions on the array. In spectroscopy, typically one dithers 3 or 5 times along the slit direction only. Shifting and then median combining these images can remove any patterns that are positionally dependent on the array. For faint sources (those not immediately detectable in a few minutes), it is best if no dithering is performed. If you are imaging a bright source and wish to dither, any of the spectroscopic observation modes discussed (NMC or NXCAC) can be performed with dithers along the slit included. Instructions for how to set up dithers is straight forward and given in the Observer's Handbook. Proposers who have a strong justification for dithering in this mode should discuss this with their support scientist. For observations in C2NC2 imaging mode, dithering is required but should not be set up by investigators during Phase I proposal submission. An appropriate C2NC2 dithering pattern will be chosen by the support scientist during Phase II.

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5.3.3 General AOR Fields

5.3.3.1 Observation Condition & Acquisition/Tracking Window

5.3.3.1a Visual Magnitude

It is important to check the visual magnitude of each science target. If the target is brighter than 14th magnitude and point-like (i.e., compact), then the magnitude and the reference wavelength (band V, B, or R) should be provided in the **Observing Condition & Acquisition Tracking** window. In this case, the telescope can guide on the source directly, which greatly decreases observation set-up overhead and translates to more time taking science data on the target during a scheduled flight leg. If the object is fainter than this, **Invisible** must be selected from the Visible Wavelength pull-down (any value in the Visible Magnitude field will then be ignored).

It is also a good idea to fill in the IR flux of the source at a reference wavelength close to the one being observed. This helps the observer to assess whether or not the observations are proceeding as expected.

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5.3.3.1b Observation Order

The most important parameter to set in terms of observation prioritization is given by the Observation Order parameter. This field allows the priority of their observations of a single target within an observing leg to be numerically listed. The length of an observing leg is rigidly defined during flight planning and cannot be extended in flight. If, for instance, acquisition takes an unusually long time or if there are any hardware/software failures during the observing leg for a particular target, it may be that not enough time will remain for all of the scheduled observations of the target to be performed. For this reason, observations should be prioritized.

If achieving the full exposure time in some filters or grisms over others is most important to a program, then the filters must be ordered serially (i.e. the first observation to be executed will be Order = `1`, the second will be Order = `2`, and so on). In this way, if time is cut short on an observing leg, all of the time in the observations with the lowest Order values will be achieved, but observations with the highest Order values may get little or no time. However, if it is better to get some time in all filters/grisms and any time lost is taken from all observations equally, then the observations of a single AOR should be separated into multiple, smaller AORs and prioritized using the Order parameter so that essentially all filters throughout the leg will be looped through.

Here is a simple FORCAST example that shows how breaking up AORs of a single target would be advantageous:

A proposer wants to observe Jupiter for 40 m with 20 m in the 37.1 μm filter and 20 m in the 7.7 μm filter. If the proposer gave the 37.1 μm filter Order = `1` and the 7.7 μm filter Order = `2`, and a 40 m leg is scheduled but an in-flight computer malfunction leads to a loss of 20 m on the leg, then the proposer will end up with a 20 m observation of Jupiter in the 37.1 μm filter, but no 7.7 μm observation. If, instead, the proposer splits each 20 m AOR into two 10 m AORs and gave the first 37.1 µm filter Order = `1` , the first 7.7 µm filter Order = `2` , the second 37.1 µm filter Order = `3` , and the second 7.7 µm filter Order = `4` , this would have the effect of looping twice through the filters with half the time in each visit. Therefore, during a 40 m leg with a 20 m time loss, the proposer would end up with about 10 m in both filters (or ~70% the S/N of 20m observations; however note that there is also some small additional loss of efficiency due to filters changes).

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5.3.3.1c Requested WV Overburden

Another common concern is whether extra sensitivity is needed for a particularly challenging observation. Generally, the higher the aircraft flies, the lower the water vapor overburden and the greater the sensitivity of FORCAST (especially at wavelengths >25 microns). If a target is particularly faint, the Requested WV Overburden may be changed from **Nominal**, to **Low** or **Very Low**. Though there is no guarantee that the observations will be taken under low water vapor conditions, a best effort will be made to accommodate such requests by scheduling the observations at the highest altitudes within the limitations of the flight plan.

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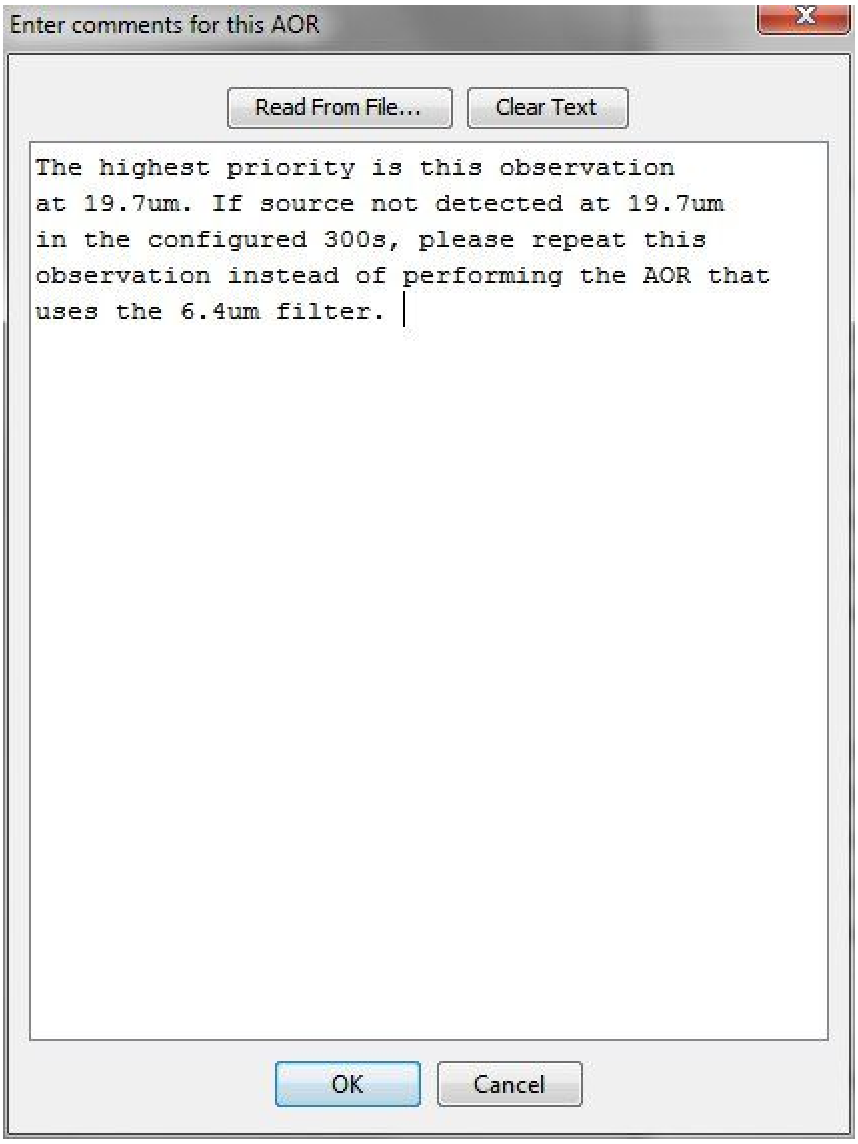
5.3.3.2 Comments

It is very likely that most or all of the PI's observations will be performed without them on board the aircraft. Therefore it is vitally important that any special requests or procedures be conveyed through the comment tool. These comments will be read by the observers in flight and will also be viewed by flight planners. Therefore any comments to either of these groups should be written in the text field of this pop-up window (see example in Figure 5.3-8). These comments will be reviewed by your support scientist during the Phase II process to ensure that they are thorough, clear, and understood.

Figure 5.3-8.



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5.4 GREAT

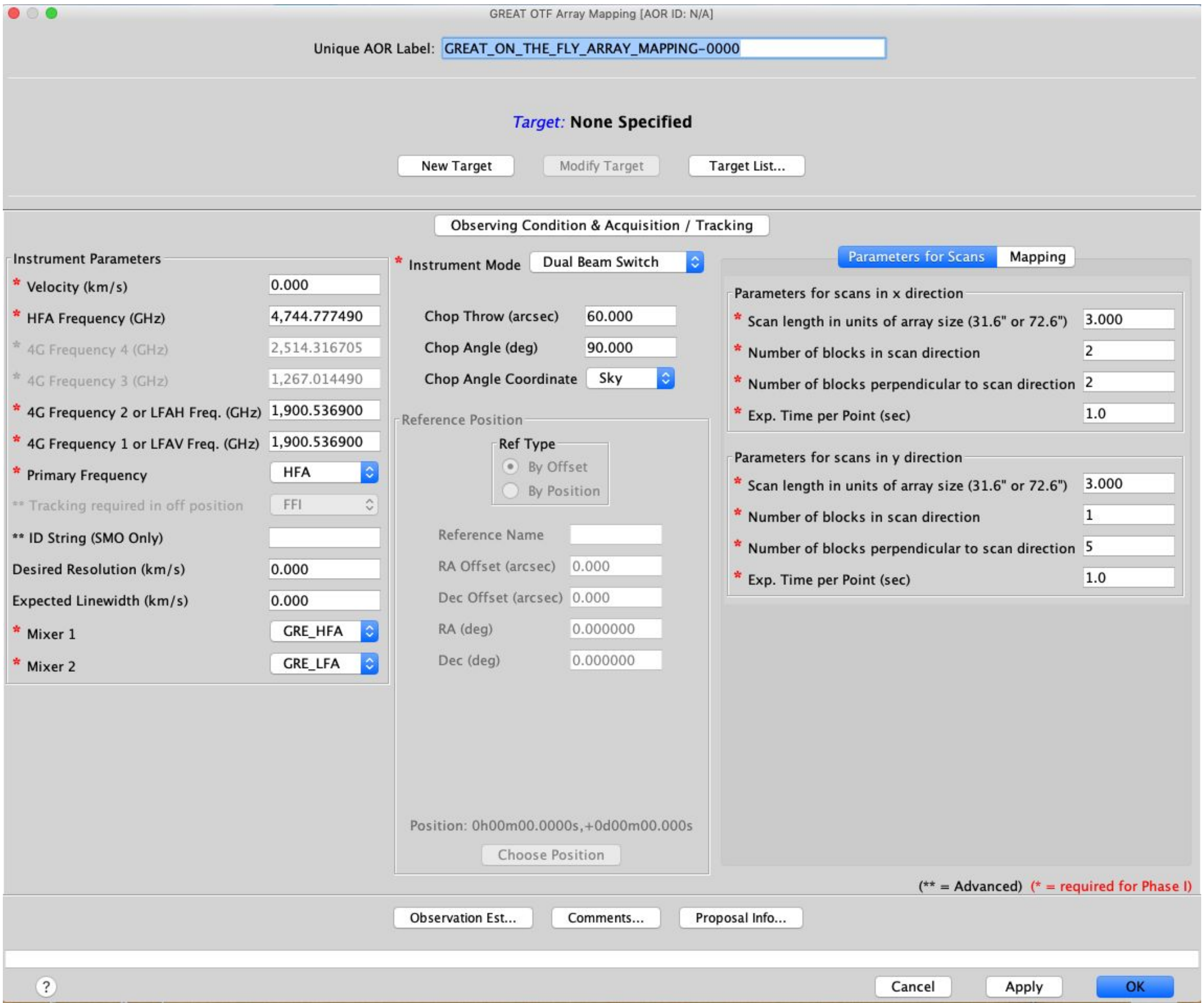
5.4.1 Overview of AOTs

GREAT specific instructions and reminders of general issues are given in the following topics below. It is necessary to read the GREAT chapter of the Observer's Handbook before preparing detailed GREAT observations in USPOT. Astronomical Observation Requests (AORs) should be created as described in Chapter 3.

The USPOT **Observation** drop-down menu lists the five Astronomical Observation Templates (AOTs) available for GREAT: **Single Point**, **Raster Mapping**, **OTF Mapping**, **OTF Array Mapping**, and **OTF Honeycomb Mapping**. Refer to the Observer's Handbook for a complete description of available combinations of configurations and modes for GREAT.

The USPOT GREAT Main AOR Window contains several frames: Instrument Parameters, Reference Position, and Mapping Parameters (available for Raster Mapping, OTF Mapping, OTF Array Mapping, and OTF Honeycomb Mapping AORs) with two additional tabs in the OTF Array Mapping AOT (**Parameters for Scans** and **Mapping**). Figure 5.4-1 shows an example of the Main AOR Window of a GREAT AOT. The instrument-specific fields are discussed in detail in this chapter. Contact the Help-Desk with any questions.

Figure 5.4-1.



6 Figure 5.4.1. An example of a GREAT AOT Main AOR Window, using the GREAT OTF Array Mapping AOT

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5.4.2 AOR Fields

Tables 5.4-1, 5.4-2, 5.4-3, 5.4-4, and 5.4-5 list the required fields for Phase I and Phase II for each available GREAT AOT. Conditional fields (i.e., fields not editable unless certain parameters are specified) are denoted with a footnote, with a reference to the required field to activate the conditional field. Fields that are not listed in these tables fall under one of three categories: fields not directly editable in USPOT (but may be affected by updating other fields, which are required; for more information on how particular fields may be related, refer to the corresponding sections within the Observer's Handbook—denoted in Tables 5.4-1, 5.4-2, 4.4-3, 5.4-4, and 5.4-5 by

OH followed by the appropriate section number), fields intended for use only by SOFIA Support Scientists, or optional fields.

Table 5.4-1.

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Single Point Phase I Required Fields for Phase I

Field Location	Field	Reference
New Target Window	Specify Target	§ 3.4
Instrument Parameters Frame	Velocity	OH § 6.1.1.1
	Mixer 1: HFA Frequency, Mixer 2: LFAV/LFAH Frequency, [1]Mixer 2: 4G Frequency 1–4	OH § 6.1.1.2
	On + Off Integration Time	Time Estimator; OH § 6.2.2
	Mixer 2	OH § 6.1.1.2
Main AOR Window	Instrument Mode	OH § 6.2.1
Mapping Parameters Frame	Cycles	§ 5.4.2.6

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Single Point Phase II Required Fields

Field Location	Field	Reference
Instrument Parameters Frame	Primary Frequency	OH § 6.1.1.2
	Array Rotation Angle	OH § 6.2.3.1
	Min Contiguous Exp Time	§ 5.4.2.5
	Target Offset RA, Target Offset Dec	OH § 6.2.3.1

Field Location	Field	Reference
	[5]Chop Throw	§ 5.4.2.1
	[5]Chop Angle Coordinate, [5]Chop Angle	OH § 6.2.3.1
Reference Position Frame	[2]Ref Type, [2]Reference Name, [3]RA Offset, [3]Dec Offset, [4]RA, [4]Dec, [4]Choose Position button	OH § 6.2.1
Observing Condition & Acquisition / Tracking Window	All fields required.	OH § 6.2

Table 5.4-2.

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Raster Phase I Required Fields

Field Location	Field	Reference
New Target Window	Specify Target	§ 3.4
Instrument Parameters Frame	Velocity (km/s)	OH § 6.1.1.1
	Mixer 1: HFA Frequency, Mixer 2: LFAV/LFAH Frequency, [1]Mixer 2: 4G Frequency 1–4	OH § 6.1.1.2
	Mixer 2	
Main AOR Window	Instrument Mode	OH § 6.2.1
Mapping Parameters Frame	Num Steps in the x-direction Num Steps in the y-direction	OH § 6.2.3
	On-source Exposure Time Per Point	Time Estimator; OH§ 6.2.2
	Cycles	§ 5.4.2.6

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Raster Phase II Required Fields for Phase II

Field Location	Field	Reference
Instrument Parameters Frame	Primary Frequency	OH § 6.1.1.2
	Array Rotation Angle	
Main AOR Window	[5]Chop Throw, [5]Chop Angle Coordinate, [5]Chop Angle	§ 5.4.2.1; OH § 6.2.1; OH § 6.2.3.1
Reference Position Frame	[2]Ref Type, [2]Reference Name, [3]RA Offset, [3]Dec Offset, [4]RA, [4]Dec, [4]Choose Position button	OH § 6.2.1
Mapping Parameters Frame	Map Offset RA, Map Offset Dec, MapAngle, Step Size in the x-direction, Step Size in the y-direction	OH § 6.2.3.1; OH § 6.2.3
	Number of map points per load	OH § 6.2.3
	Min Contiguous Exp Time	§ 5.4.2.5
Observing Condition & Acquisition / Tracking Window	All fields required.	OH § 6.2

Table 5.4-3.

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

OTF Mapping Phase I Required Fields

Field Location	Field	Reference
New Target Window	Specify Target	§ 3.4
Instrument Parameters Frame	Velocity (km/s)	OH § 6.1.1.1

Field Location	Field	Reference
	Mixer 1: HFA Frequency, Mixer 2: LFAV/LFAH Frequency, [1]Mixer 2: 4G Frequency 1–4	OH § 6.1.1.2
	Mixer 2	
Main AOR Window	Instrument Mode	OH § 6.2.1
Mapping Parameters Frame	[2]On-source Exposure Time Per Point, Cycles	§ 5.4.2.5
	Num Steps in the x-direction, Num Steps in the y-direction	OH § 6.2.3.1

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

OTF Mapping Phase II Required Fields

Field Location	Field	Reference
Instrument Parameters Frame	Primary Frequency, Array Rotation Angle	OH § 6.1.1.2
Main AOR Window	[5]Chop Throw, [5]Chop Angle Coordinate, [5]Chop Angle	OH § 6.2.1; OH § 6.2.3.1
Reference Position Frame	[2]Ref Type, [3]RA Offset, [3]Dec Offset, [4]Choose Position button	§ 5.4.2.1; OH § 6.2.3
Mapping Parameters Frame	Min Contiguous Exp Time	§ 5.4.2.5
	Map Offset RA, Map Offset Dec, ScanDirection, ScanDirectionVector, ScanOrder, MapAngle, Step Size in the x-direction, Step Size in the y-direction	OH § 6.2.3.1
Observing Condition & Acquisition / Tracking Window	All fields required.	OH § 6.2

Table 5.4-4.

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

OTF Array Mapping Phase I Required Fields

Field Location	Field	Reference
New Target Window	Specify Target	§ 3.4
Instrument Parameters Frame	Velocity	OH § 6.1.1.1
	Mixer 1: HFA Frequency, Mixer 2: LFAV/LFAH Frequency, [1]Mixer 2: 4G Frequency 1–4	OH § 6.1.1.2
	Mixer 2	OH § 6.1.1.2
	Primary Frequency	OH § 6.1.1.2
Main AOR Window	Instrument Mode	OH § 6.2.1
Mapping Tab	Cycles, Step size along OTF line	§ 5.4.2.6; OH § 6.2.3.3
Parameters for Scans Tab	[6]All Fields Required.	OH § 6.2.3.3

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

OTF Array Mapping Phase II Required Fields

Field Location	Field	Reference
Instrument Parameters Frame	Array Rotation Angle	OH § 6.2.3.1
Main AOR Window	[5]Chop Throw, [5]Chop Angle, [5]Chop Angle Coordinate	§ 5.4.2.1; OH § 6.2.1; OH § 6.2.3.1
Mapping tab	Number of OTF lines within one block, [2]Scan Lines Per Off, ScanDirection	§ 5.4.2.6; OH § 6.2.3.3

Field Location	Field	Reference
Reference Position Frame	[2]Ref Type, [3]RA Offset, [3]Dec Offset, [4]Choose Position button	§ 5.4.2.1; OH§ 6.2.3
Main AOR Window, Parameters for Scans Tab	Min Contiguous Exp Time	§ 5.4.2.5
	MapAngle, Map Offset RA, Map Offset Dec, [6]ScanDirectionVectorX, [6]ScanDirectionVectorY, [6] ScanOrderX, [6]ScanOrderY	OH § 6.2.3.3
Observing Condition & Acquisition / Tracking Window	All fields required.	OH § 6.2

Table 5.4-5.

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

OTF Honeycomb Mapping Phase I Required Fields

Field Location	Field	Reference
New Target Window	Specify Target	§ 3.4
Instrument Parameters Frame	Velocity (km/s)	OH § 6.1.1.1
	Mixer 1: HFA Frequency, Mixer 2: LFAV/LFAH Frequency, [1]Mixer 2: 4G Frequency 1–4	OH § 6.1.1.2
	Mixer 2	
Main AOR Window	Instrument Mode	OH § 6.2.1
Mapping Parameters Frame	On-source Exposure Time Per Point, Cycles	§ 5.4.2.5

All Observer's Handbook (OH) Reference links in the table below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

OTF Honeycomb Mapping Phase II Required Fields

Field Location	Field	Reference
Instrument Parameters Frame	Primary Frequency	OH § 6.1.1.2
Main AOR Window	[5]Chop Throw, [5]Chop Angle Coordinate, [5]Chop Angle	OH § 6.2.1; OH § 6.2.3.1
Reference Position Frame	[2]Ref Type, [3]RA Offset, [3]Dec Offset, [4]Choose Position button	§ 5.4.2.1; OH § 6.2.3
Mapping Parameters Frame	Min Contiguous Exp Time	§ 5.4.2.5
	Target Offset RA, Target Offset Dec, Pattern Angle	OH § 6.2.3.1
Observing Condition & Acquisition / Tracking Window	All fields required.	OH § 6.2

[1]For Mixer 2 = GRE_4G

[2]For Instrument Mode = Total Power

[3]For Instrument Mode = Total Power and Ref Type = By Offset

[4]For Instrument Mode = Total Power and Ref Type = By Position

[5]For Instrument Mode = Dual Beam Switch or Single Beam Switch

[6]For ScanDirection = x direction, all fields in the Parameters for scans in x direction Frame are required. For ScanDirection = y direction, all fields in the Parameters for scans in y direction Frame are required. For ScanDirection = x and y directions, all fields in the Parameters for scans in x direction Frame and Parameters for scans in y direction Frame are required. ScanDirection is located in the Parameters for Scans tab.

Return to: Table 5.4-1 | Table 5.4-2 | Table 5.4-3 | Table 5.4-4 | Table 5.4-5

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5.4.2.1 Instrument Mode

Depending on the AOT selected, the Instrument Mode field offers the options of **Total Power**, **Single Beam Switch**, and **Dual Beam Switch**.

In **Single Beam Switch** or **Dual Beam Switch** mode, a Chop Angle and Chop Throw must be specified in their respective fields. The Chop Angle is defined in the North through East direction. The Chop Throw refers to the angular separation between the source and reference positions. In **Dual Beam Switch** mode, there are two reference positions that are determined by (1) the Chop Throw and the Chop Angle and (2) the Chop Throw and the Chop Angle plus 180 degrees.

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5.4.2.2 Rest Frequency

After designating the specific mixers to use in the **Mixer 1** and **Mixer 2** fields, enter the rest frequencies of the line to be observed. For HFA-LFA configuration, HFA Frequency, LFAH Frequency, and LFAV Frequency should be entered. For the HFA-4GREAT configuration, HFA Frequency, and 4G Frequency 1-4 should be entered.

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5.4.2.3 Source Velocity

In the Velocity field, enter the source velocity in the local standard of rest frame (V_{LSR}). With this information, the flight team will decide the optimal local oscillator (LO) frequencies for observing these lines (upper side band (USB) versus lower side band (LSB), position of the line in the intermediate frequency (IF)), taking into account frequency-dependent system performance and atmospheric transmission. Specific requests, such as observing other lines in the same setting, must be noted in the comments section of the AOR (accessible via the **Comments...** button at the bottom of the AOR editing window).

Users searching for a line or uncertain about the line's strength or velocity should do at least one frequency shift. The easiest way to do this is to create a second AOR and to change the source velocity V_{LSR} by 10–20 km/s. The mixer will have to be retuned and a new calibration done, which involves a small cost in time (~2 minutes).

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5.4.2.4 Integration Time & Min Contiguous Exposure Time

For Single Point observations, the ON + OFF Integration Time per point on the sky must be entered. This should not be more than ~60 seconds in **Total Power** Mode (40 seconds for the HFA) or ~80 seconds for **Single or Dual Beam Switch** Mode. If longer exposures are needed, which is almost always the case, please increase the number of cycles.

For all other AOTs, the integration time per point on the sky must be entered in the On-source Exp. Time Per Point field. The OFF integration time will be calculated automatically depending on the observing mode and how the observations are set up. For maps, the Cycles field indicates the number of times the maps are repeated.

Plan each AOR so that one cycle does not take longer than about half an hour to execute. Instead of making a big OTF map, make it into a set of smaller maps. With the Min Contiguous Exposure Time field, users can specify the minimum acceptable observing time in case the observation has to be split over multiple parts for, e.g., efficient flight planning.

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5.4.2.5 Reference Position Frame

For **Total Power** observations, choose the Reference Position to be as close to the source as possible. It should be no farther away than half a degree and preferably within 10–15 arcmin of the source. A Reference Position more than half a degree away from the target is not likely to work and may result in poor baselines.

For **Beam Switching** observations, a Chop Throw of 100 arcsec or less should be sufficient. Large chop throws affect the pointing of the telescope, introduce coma into the beam, and degrade the data quality.

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5.4.2.6 Other OTF Common Mapping Parameters

USPOT refers to scan rows as along x-direction and column as along y-direction. If the map rotation angle is not zero (the default), however, the map is rotated with respect to the RA/Dec frame. If in doubt about the map orientation, use the **Overlays** to **Current AOR** option to plot the OTF coverage on a sky map.

All Observer's Handbook (OH) links below point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Common Mapping Parameters

Field	Specific Instructions
MapAngle (deg)	The angle of the x/y map coordinate system relative to the RA/Dec coordinate system. MapAngle is measured in the counter-clockwise direction. The map is rotated around the map center, as defined by the target and map offsets. The allowed values for MapAngle range from 0° to 360°.
Map Offset RA(arcsec)	The offset in Right Ascension of the map center from the specified target position.
Map Offset Dec (arcsec)	The offset in Declination of the map center from the specified target position
Number of OTF lines within one block	The number of scans that make up a single block. A value of 1 will result in an under-sampled map, a value of 2 is the minimum required for a fully sampled map, and a value greater than 2 will result in an over-sampled map (see Section 6.2.3.3 of the Observer's Handbook).
Step size along OTF line	The spacing between individual spectra (dumps) along the scan row (in arcseconds). The default value of 6 arcsec results in fully sampled maps.
Scan Lines Per Off	The number of map scans performed for each observation of the reference position. If the duration of a single scan is close to 30 seconds, this number should be 1. If the duration of a single scan is very short (e.g., 10 seconds), this can be increased to 2. Note, however, that longer scan durations result in higher on-source observing efficiency.
ScanDirection	The scan direction(s) that will be used in the map. The selection here (x and y directions, x direction, y direction) will determine the available fields in the Parameters for scans in x/y direction sections of the AOT.
Exposure Time per Cycle (sec)	The time, including overhead, to complete one repetition of the map. This is calculated automatically.

Field	Specific Instructions
Cycles	The number of repetitions desired for the map.
Number of blocks in scan direction	For the example in Figure 6-10 of the Observer's Handbook, this is 1.
Number of blocks perpendicular to scan direction	For the example in Figure 6-10 of the Observer's Handbook, this is 2.
On-source Exp. Time per Point (sec)	The amount of on-source integration time for each dump, in each scan. This value is typically between 0.3 and 2.0 seconds.
Scanning Duration	The maximum scanning duration for each observation of the reference position is 30 seconds. If the maximum duration exceeds 30 seconds, then one or more of the parameters in the above equation needs to be adjusted.

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5.5 HAWC+

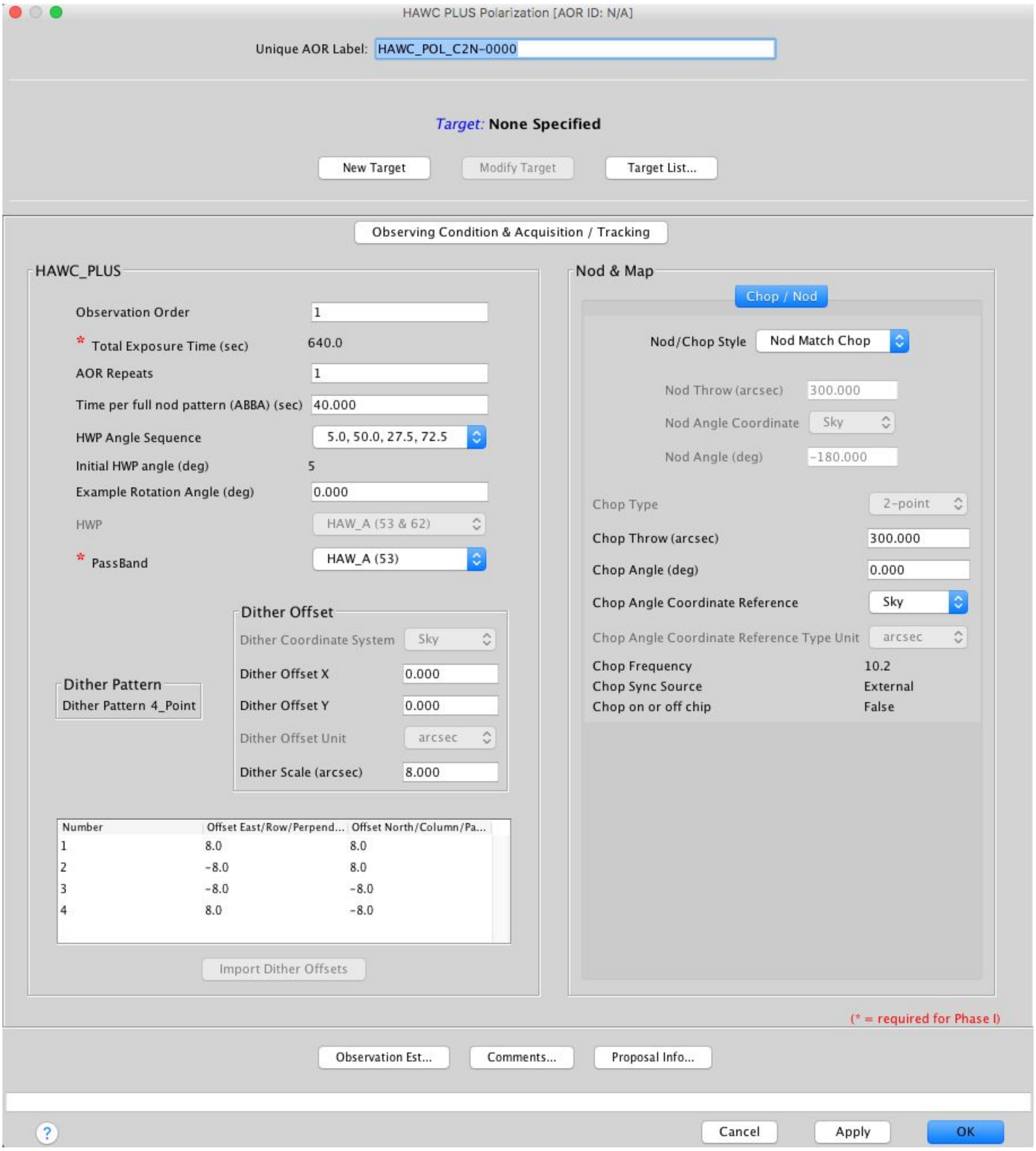
5.5.1 Overview of AOTs

HAWC+ specific instructions and reminders of general issues are given in the following topics below. It is necessary to read the HAWC+ chapter of the Observer's Handbook before preparing detailed HAWC+ observations in USPOT. Astronomical Observation Requests (AORs) should be created as described in Chapter 3.

The USPOT **Observation** drop-down menu lists the four Astronomical Observation Templates (AOTs) available for HAWC+: **Total Intensity**, **Polarization**, **OTFMAP**, and **Polarization OTFMAP**. Refer to the Observer's Handbook for a complete description of available combinations of configurations and modes for HAWC+.

The USPOT HAWC+ Main AOR Window contains several frames: HAWC_PLUS and Nod & Map. Figure 5.5-1 shows an example of the Main AOR Window of a HAWC+ AOT. The instrument-specific fields are discussed in detail in this chapter. Contact the Help-Desk with any questions.

Figure 5.5-1.



7 Figure 5.5-1. An example of a HAWC+ AOT Main AOR Window, using the HAWC+ Total Intensity AOT.

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5.5.2 AOR Fields

Tables 5.5-1, 5.5-2, and 5.5-3 list the required fields for Phase I and Phase II for each available HAWC+ AOT. Conditional fields (i.e., fields not editable unless certain parameters are specified) are denoted with a footnote, with a reference to the required field to activate the conditional field. Fields that are not listed in these tables fall under one of three categories: fields not directly editable in USPOT (but may be affected by updating other fields, which are required; for more information on how particular fields may be related, refer to the corresponding sections within the Observer's Handbook—denoted in Tables 5.5-1, 5.5-2 and 5.5-3 by OH followed by the appropriate section number), fields intended for use only by SOFIA Support Scientists only, or optional fields.

Table 5.5-1.

All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Total Intensity Phase I Required Fields

Field Location	Field	Reference
Target Window	Specify Target	§ 3.4
HAWC_PLUS Frame	PassBand	§ 5.5.2.2; OH § 7.1.2
Observing Condition & Acquisition/ Tracking Window	All Fields Required	§ 5.5.2.3; § 3.4

All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Total Intensity Phase II Required Fields

Field Location	Field	Reference
HAWC_PLUS Frame	Observation Order	§ 5.5.2.1; § 3.4
	AOR Repeats	§ 5.5.2.1
	Example Rotation Angle	OH § 7.2
Nod & Map Frame	Chop Throw Chop Angle Chop Angle Coordinate Reference	§ 5.5.2.1; OH § 7.1.2.2

Table 5.5-2.

All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Polarization Field Phase I Required Fields

Field Location	Field	Reference
Target Window	Specify Target	§ 3.4
HAWC_PLUS Frame	PassBand	§ 5.5.2.2; OH § 7.1.2
Observing Condition & Acquisition/ Tracking Window	All Fields Required	§ 5.5.2.3; § 3.4

All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Polarization Phase II Required Fields

Field Location	Field	Reference
HAWC_PLUS Frame	Observation Order	§ 5.5.2.1; § 3.4
	AOR Repeats	§ 5.5.2.1
	Example Rotation Angle	OH § 7.2.2
Main AOR Window, Nod & Map Frame	Chop Throw Chop Angle Chop Angle Coordinate Reference	§ 5.5.2.1; OH § 7.2.2

Table 5.5-3.

All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

OTFMAP Phase I Required Fields

Field Location	Field	Reference
Target Window	Specify Target	§ 3.4
HAWC_PLUS Frame	Half Wave Plate*	OH § 7.1.1.1
	PassBand	§ 5.5.2.2; OH § 7.1.2
Observing Condition & Acquisition/ Tracking Window	All fields required	§ 5.5.2.3; § 3.4

All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

OTFMAP Phase II Required Fields

Field Location	Field	Reference
HAWC_PLUS Frame	Observation Order	§ 5.5.2.1; § 3.4
	Example Rotation Angle	OH § 7.2
	Scan Type	§ 5.5.2.1; OH § 7.2.1
	Number of iterations	§ 5.5.2.1
	[1]Length of Linear Scan Element	§ 5.5.2.1; OH § 7.2.1.1b
	[2]Scan Amplitude(Elevation) [2]Scan Amplitude(Cross Elevation)	§ 5.5.2.1; OH § 7.2.1.1a
Nod & Map Frame	Chop Angle Coordinate Reference Chop Throw Chop Angle	§ 5.5.2.1; OH § 7.2

All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Polarization OTFMAP Phase I Required Fields

Field Location	Field	Reference
Main AOR Window	PassBand	§ 5.5.2.2; OH § 7.1.2
Observing Condition & Acquisition/ Tracking Window	All fields required	§ 5.5.2.3; § 3.4

[1]For Scan Type = Box
[2]For Scan Type = Lissajous

Return to: Table 5.5-1 | Table 5.5-2 | Table 5.5-3

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5.5.2.1 Special Instructions

Special instructions for some of the HAWC+ fields are given in Table 5.5-4.

Table 5.5-4.

Common Mapping Parameters

Relevant AOT	Field	Special Instructions
All	Observation Order	If the accepted proposal contains observations in several passbands, it should have a correspondingly lower observation order.
All	PassBand	See Table 5.5-5.
Polarization Total Intensity	Dither Scale	Distance (in arcseconds) from the object's coordinates to move for the dither positions. *Note: Changing the passband will change the default dither scale value appropriately, dithers should be no smaller than these default values to ensure enough source motion on the focal plane.*
Polarization Total Intensity	Chop Throw	The maximum chop throw is somewhat dependent on the observational field since a tracking source is required on the Focal Plane Imager (FPI) camera, but usually 400 arcseconds is routinely achievable.
Polarization Total Intensity	Chop Angle	SOFIA’s chop angle is counted from the north and increases in the direction of *decreasing* RA, which is the opposite of what an astronomer would be used to.
Polarization Total Intensity	Chop Frequency	Arbitrary chop frequencies are NOT supported for HAWC+: the chop frequency must be an integer multiple of the detector readout. Therefore, only 10.2 and 16.9 Hz are supported and *10.2 Hz is the default.*
OTFMAP	Scan Type	Choose **Box** for Raster or **Lissajous** for Lissajous.

Relevant AOT	Field	Special Instructions
OTFMAP	Number of Iterations	*For SOFIA Cycle 8: Must be greater than or equal to 3.*
OTFMAP (Raster)	Length of Linear Scan Element	Scan will always be square, so this is the length of one side of that square.
OTFMAP (Lissajous)	Scan Amplitude (Elevation)	Size varies per band to be comparable to the HAWC+ FOV in that band. *Defaults should be used.*
OTFMAP (Lissajous)	Scan Amplitude (Cross Elevation)	Size varies per band to be comparable to the HAWC+ FOV in that band. *Defaults should be used.*
OTFMAP (Lissajous)	Scan Rate	For amplitudes less than 100 arcseconds the scan rate should be less than 200 arcseconds/sec.

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5.5.2.2 Field of View (FOV)

All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

For polarimetry observations, HAWC+ does not have a second T polarization state array; as such, the field of view is reduced to approximately half in the detector's X direction (the first element of the Field of View row in Table 5.5-5). Total intensity observations are unaffected and can use the whole field of view via the R polarization state. To state it clearly, these are the available field of views for both **Total Intensity** and **Polarization** observations.
Figures 5.5-2 and 5.5-3 illustrate and underscore this difference. In both, the HAW_A, HAW_C, HAW_D, and HAW_E FOV's are shown by the pale blue, green, orange, and red boxes respectively.

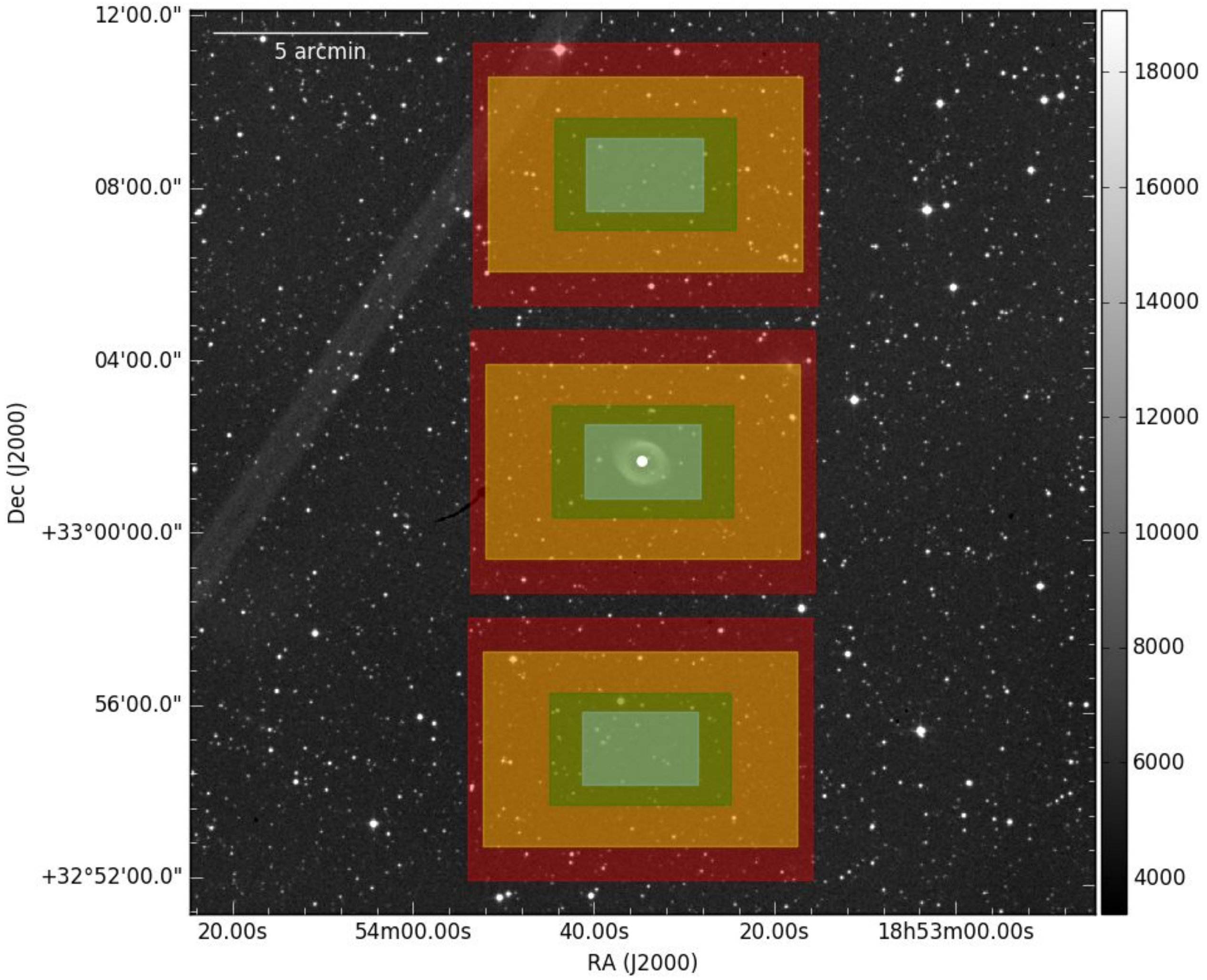
Table 5.5-5.

PassBand Characteristics

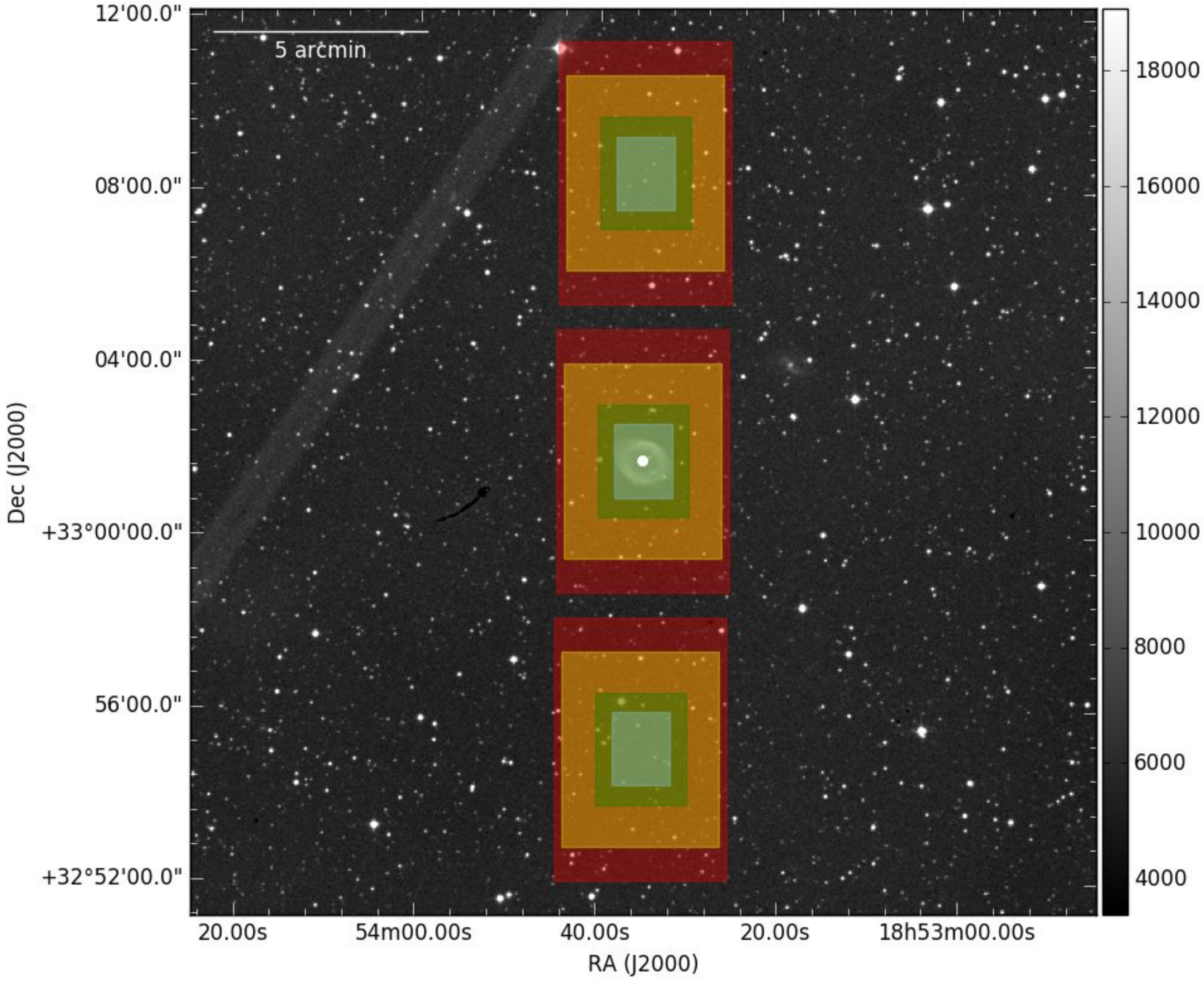
PassBand	Wavelength	Total Intensity FOV (arcmin)	Polarization FOV (arcmin)
HAW_A	53 μm	2.7x1.7	1.3x1.7
HAW_B	63 μm	2.7x1.7	1,3x1.7

PassBand	Wavelength	Total Intensity FOV (arcmin)	Polarization FOV (arcmin)
HAW_C	89 µm	4.2x2.6	2.1x2.6
HAW_D	154 µm	7.3x4.5	3.6x4.5
HAW_E	214 µm	8.0x6.1	4.0x6.1

Figure 5.5-2.



8 Figure 5.5-2. The available FOV in HAWC PLUS Total Intensity observations, using a chop throw of 400 arcsec at an angle of 0 degrees in a typical C2N/NMC observation.
Figure 5.5-3.



9 Figure 5.5-3. The available FOV in HAWC PLUS Polarization observations, using a chop throw of 400 arcsec at an angle of 0 degrees in a typical C2N/NMC observation.

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5.5.2.3 Observing Condition & Acquisition / Tracking

Complete the relevant details in the **Observing Condition & Acquisition / Tracking** window. Of particular importance and interest are the final six parameters in that window for tracking purposes; choose representative values for targets when possible. The visible wavelength will help support scientists quickly assess whether the source itself can be used as a tracking source for the SOFIA visible tracking cameras of if an alternate tracking star/ source will be necessary.

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5.6 FPI+

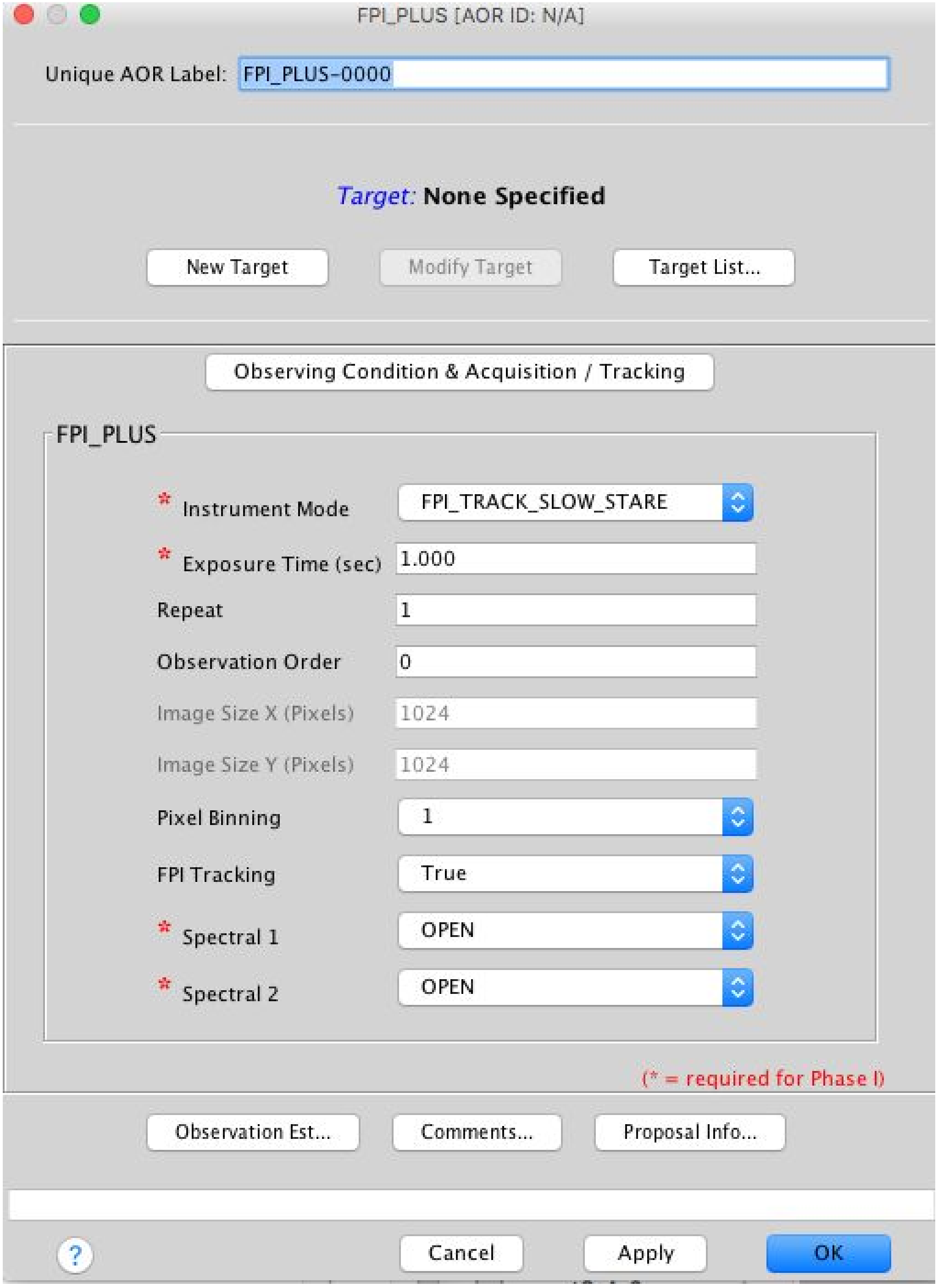
5.6.1 Overview of AOTs

FPI+ specific instructions and reminders of general issues are given in the following topics below. It is necessary to read the FPI+ chapter of the Observer's Handbook before preparing detailed FPI+ observations in USPOT. Astronomical Observation Requests (AORs) should be created as described in Chapter 3.

The USPOT **Observation** drop-down menu lists the Astronomical Observing Template (AOT) available for FPI+. Refer to the Observer's Handbook for a complete description of available combinations of configurations and modes for FPI+.

The USPOT FPI+ Main AOR Window is compiled into a single FPI+ frame. Figure 5.6-1 shows an example of the Main AOR Window of the FPI+ AOT. The instrument-specific fields are discussed in detail in this chapter. Contact the Help-Desk with any questions.

Figure 5.6-1.



10 Figure 5.6-1. An example of the FPI+ AOT Main AOR Window.

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5.6.2 AOR Fields

Table 5.6-1 lists the required fields for Phase I and Phase II for the available FPI+ AOT. Fields that are not listed in these tables fall under one of three categories: fields not directly editable in USPOT (but may be affected by updating other fields, which are required; for more information on how particular fields may be related, refer to the corresponding sections within the Observer's Handbook), fields intended for use only by SOFIA Support Scientists only, or optional fields.

Table 5.6-1.
All Observer's Handbook (OH) Reference links in the table point to the latest version of the Observer's Handbook—currently Cycle 10. Be sure you are using the version of the Observer's Handbook that corresponds to your observing cycle. The documentation for all cycles can be found on the Proposal Documents webpage.

Phase I Field Requirements

Field Location	Field	Reference
FPI+ Frame	Specify Target	§ 3.4
	Instrument Mode	OH § 5.1.2.3
	Exposure Time	SITE; OH § 5.2
	Repeat	OH § 5.2
	Spectral 1 Spectral 2	OH § 5.1.2.1
Observing Condition & Acquisition/ Tracking Window	Is Time Critical [1]After 1 UTDate [1]Before 1 UTDate Visible Magnitude Visible Wavelength	OH § 5.2

Phase I Field Requirements

Field Location	Field	Reference
FPI+ Frame	Image Size X Image Size Y Pixel Binning FPI Tracking	OH § 5.2.1
Observing Condition & Acquisition/ Tracking Window	Target Priority	OH § 5.2

[1]For Is Time Critical = Yes

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