Telescope Time Allocation Tools

User's Guide

Contents

1 | Purpose of This Document

This document is intended to describe the functionality of the Telescope Time Allocation (TTA) Tools from the proposer's perspective of the proposal creation process. With this guide, a user can become familiar with the UI and create a proposal. As this is an early release of the tools, care is given in this guide to note the expected behavior and the limits of the application. The *Telescope Time Allocation: System Description* and *Telescope Time Allocation: Algorithms* documents are the authority on definitions and implementation details of the tools.

This document is applicable for the version 0.1 release and the internal review by the NRAO and GBO staff.

2 | Navigating This Document

Section 4 is a "Quick Start" guide, which provides a short step-by-step guide to creating a new *Proposal*. Section 5 offers an in depth description of the UI and the proposal creation process. It also contains snapshots of the UI with key elements indicated on the images. The images have continuity and show the creation of a *Proposal* from beginning to end.

Section A reviews auxiliary features that supports the user experience. Section B defines the unavoidable jargon of the TTA tools. Section C provides definitions to a select set of common UI iconography. Section D overviews known points of confusion and bugs, and Section E is the F.A.Q.

3 | Document Conventions

Several formatting conventions are used in this document for emphasis.

Structures within the system are *italicized*: *Solicitation*, *Facility*, *Capability*, *Proposal*, *Allocation Request*, *Capability Request*, *Capability Parameter Specifications*, *Observation Specification*, *Scan*, *Subscan*, etc.

When referring to a specific field or value in the structure, SMALL CAPITALS are used. For example, *Capability Parameter Specifications* are the parameters that make up a *Capability*. There are types of *Capability Parameter Specifications*, such as SPECTRAL SPECIFICATIONS. More examples that use this format include SOURCE, HARDWARE CONFIGURATION, FIELD SOURCE, CALIBRATION PARAMETERS, and PERFORMANCE PARAMETERS.

When referring to a UI page that corresponds to a structure, Title Case is used. For example, there is an Allocation Request editor, which is a view within the application, and it facilities the creation of one or more *Allocation Requests*. Similarly, the Spectral Specification editor facilitates the creation of one or more SPECTRAL SPECIFICATIONS.

When referring to a UI element that corresponds to a specific field or value in a structure, `monospace font` is used. For example, in the Spectral Specification editor, the user can enter a value for the `Center Frequency` associated with a SPECTRAL SPECIFICATION.

4 | Quick Start

Step 1: Create a New Proposal

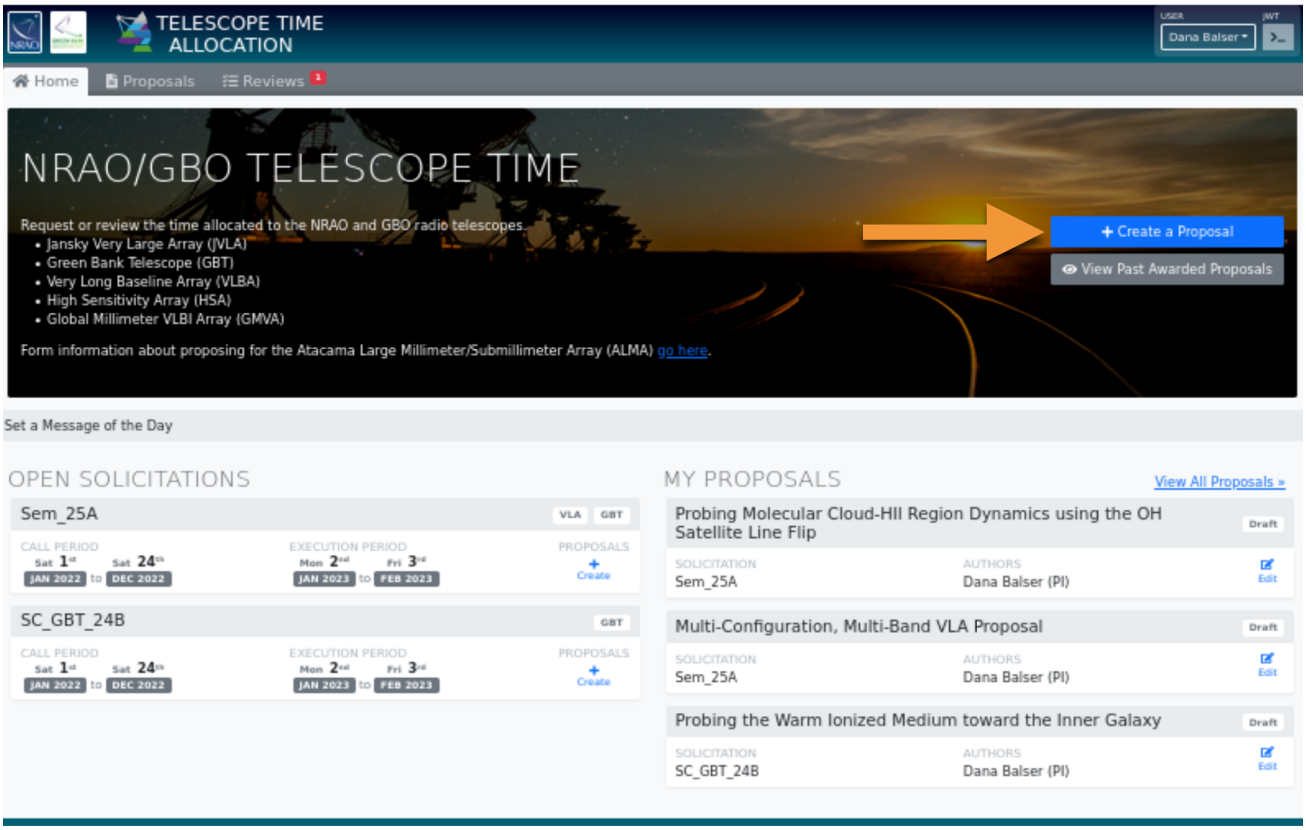


Figure 1: Home page: A new *Proposal* can be created through the Home page with the "Create a Proposal" button or through the Proposal page.

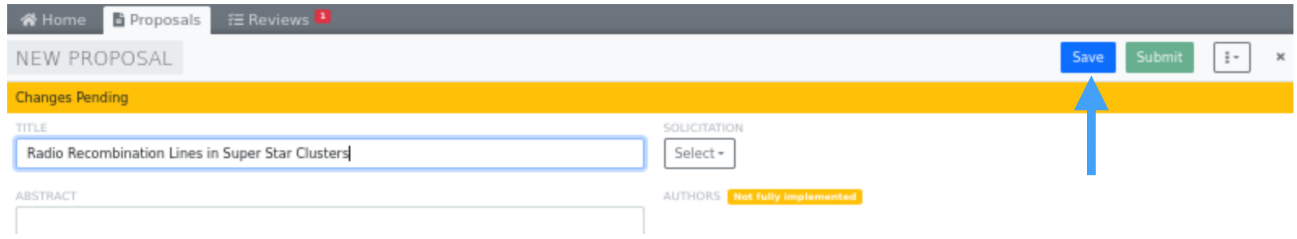
Important!

The *Solicitation* determines the *Capabilities* can be requested in a proposal, or more simply, the *Solicitation* sets the type of observation (e.g., Continuum, Spectral Line, Pulsar) that can be created. The *Solicitation* sets the available *Facilities* and the restrictions on frequency or hardware. Table 1 lists the frequency information associated with each *Capability* and *Solicitation*.

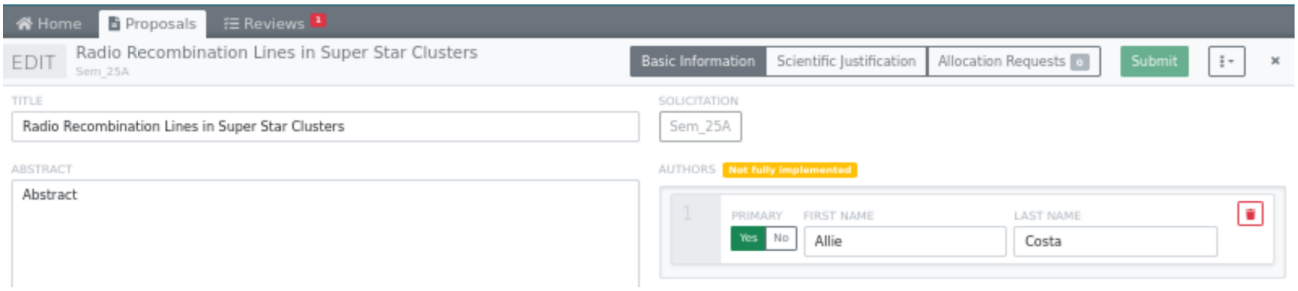
Table 1: Summary of the Frequencies available per *Capability* per *Solicitation*

Solicitation	*Capability*	Bands	
Sem_25A	GBT Spectral Line	L (1-2 GHz),	S (2-4 GHz),
Sem_25A	VLA Continuum	C (4-8 GHz),	X (8-12 GHz),
		Ku (12-18 GHz),	K (18 - 26.5 GHz),
		Ka (26.5-40 GHz),	Q (40 - 50 GHz)
SC_GBT_24B	GBT Spectral Line	L (1-2 GHz),	S (2-4 GHz),
		C (4-8 GHz)	

Step 2: Enter and Save Proposal Information



(a)



(b)

Figure 2: Basic Information: Enter a Title and Abstract and select a *Solicitation* from the drop-down menu. (a) When a modification is made, the Save button becomes available. Table 1 summarizes the details of the available *Solicitations*. When the Basic Information is successfully saved, additional navigational tabs become accessible; see (b).

Step 3: Upload a Scientific Justification

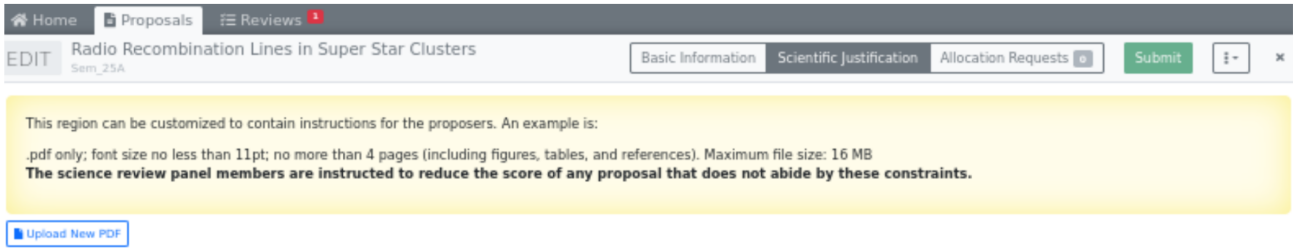


Figure 3: Scientific Justification: Upload a pdf of the Scientific Justification. This step is not necessary to complete until the *Proposal* is ready to be submitted.

Step 4: Select a Facility (Allocation Request)

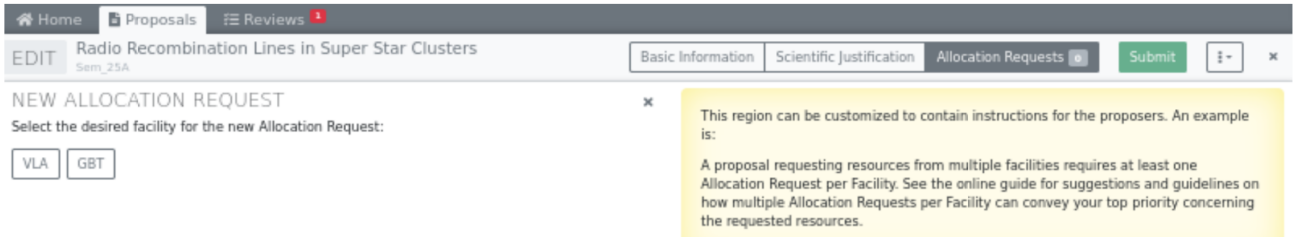


Figure 4: Allocation Request: Select a *Facility* for the *Allocation Request*. A *Proposal* requires at least one *Allocation Request*, and one *Facility* selection is allowed per *Allocation Request*.

Step 5: Add a Capability Request

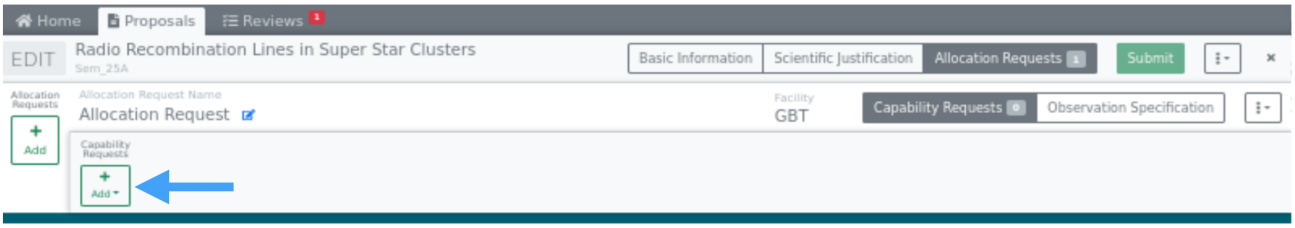


Figure 5: Allocation Request: Add a *Capability Request* to the *Allocation Request*.

Step 6: Select a Capability

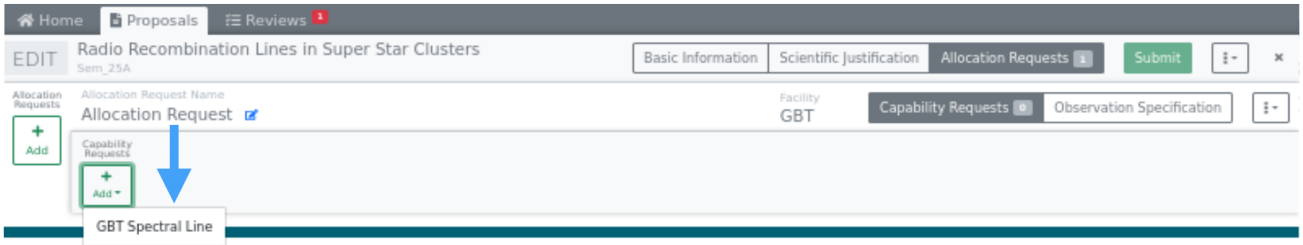
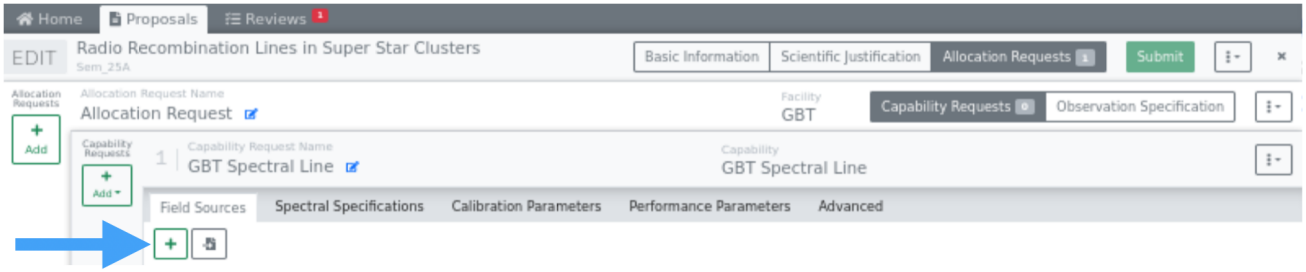


Figure 6: Capability Request: Select a *Capability* from the drop-down menu.

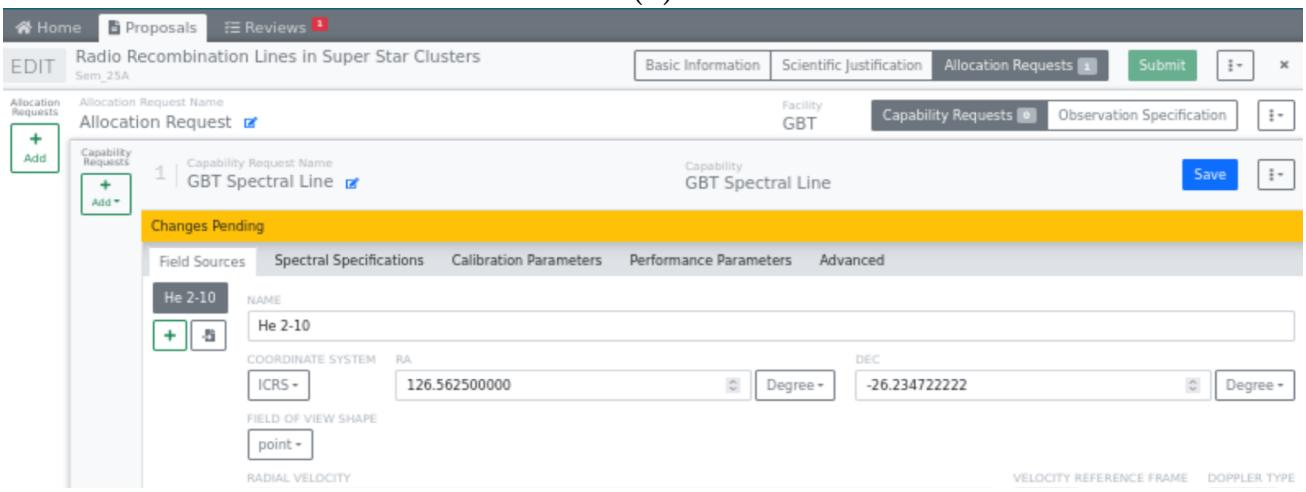
Important!

It is not necessary to save the form when navigating between the Field Sources, Spectral Specifications, Calibration Parameters, Performance Parameters, and Advanced editors within a single *Capability Request*. The Save button triggers the generation one or more *Observation Specifications* using the information in the *Capability Requests*.

■ Step 7: Enter a Field Source



(a)



(b)

Figure 7: Field Sources: Add a FIELD SOURCE. (a) At least one is required per *Capability Request*. Once one is added, an expanded form is available to enter FIELD SOURCE information. The expanded form is partially shown in (b).

■ Step 8: Enter Frequency Information (Spectral Specifications)

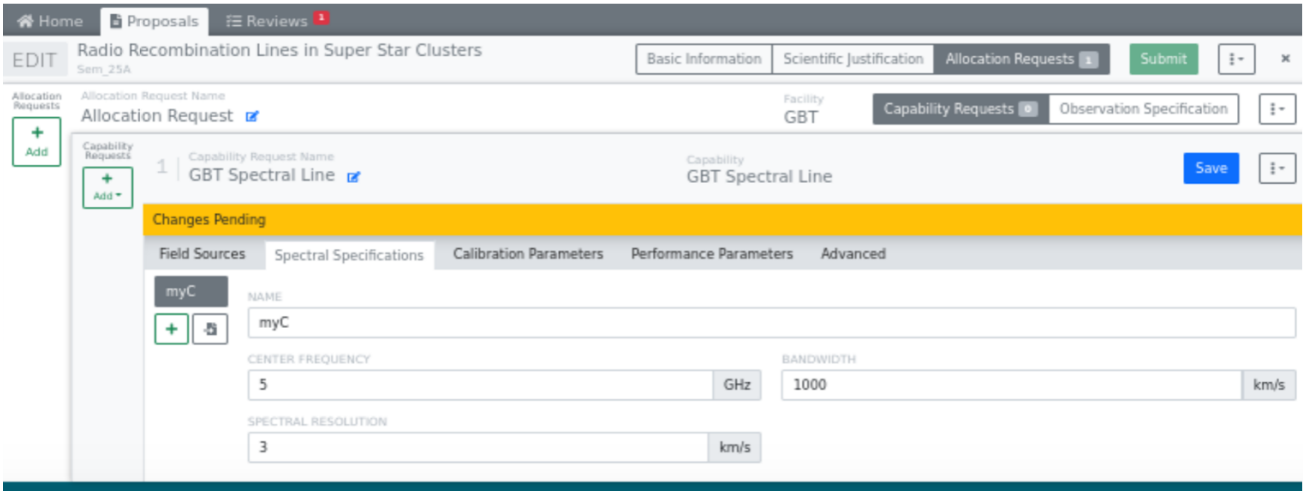


Figure 8: Spectral Specifications: Add a SPECTRAL SPECIFICATION. At least one is required per *Capability Request*. Once one is added, an expanded form is available to enter SPECTRAL SPECIFICATION information.

■ Step 9: Select Additional Calibration (Calibration Parameters)

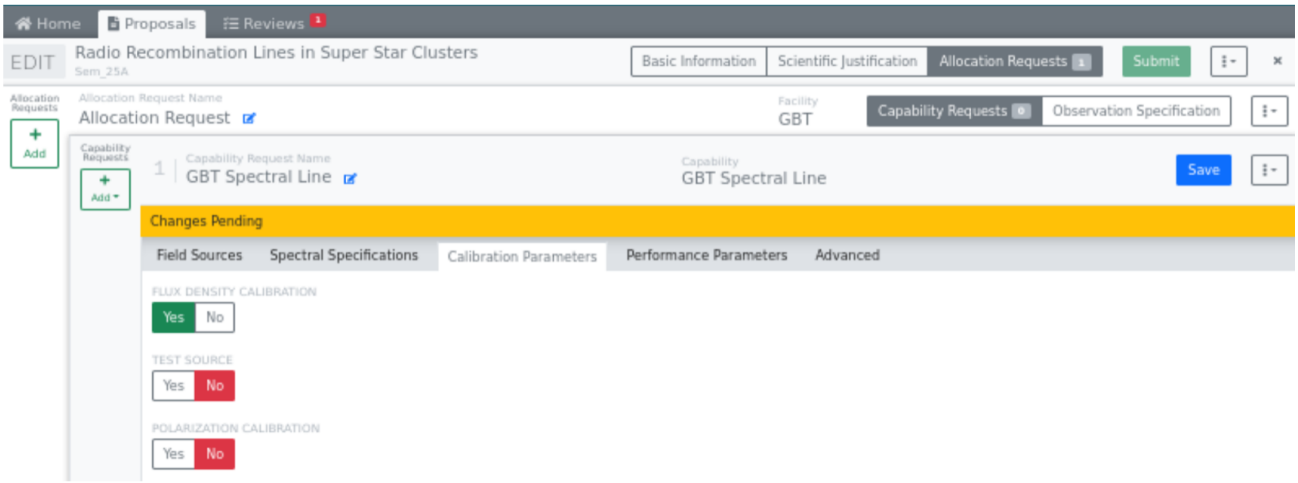


Figure 9: Calibration Parameters: Select the desired additional calibration parameters to apply to the FIELD SOURCES in this *Capability Request*.

■ Step 10: Enter Performance Information (Performance Parameters)

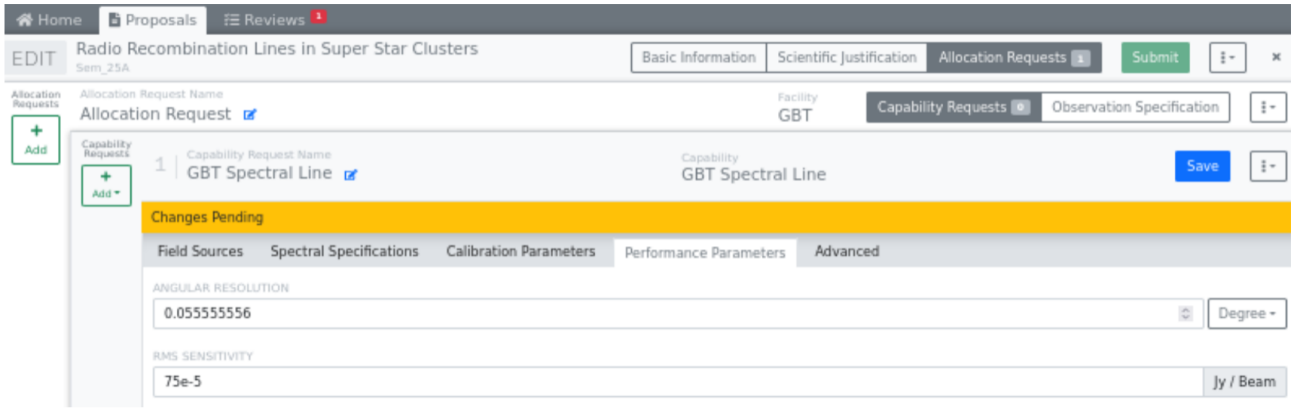


Figure 10: Performance Parameters: Enter resolution and sensitivity information. These parameters are applied only to the FIELD SOURCES in this *Capability Request*.

Step 11: Review Observation Specification

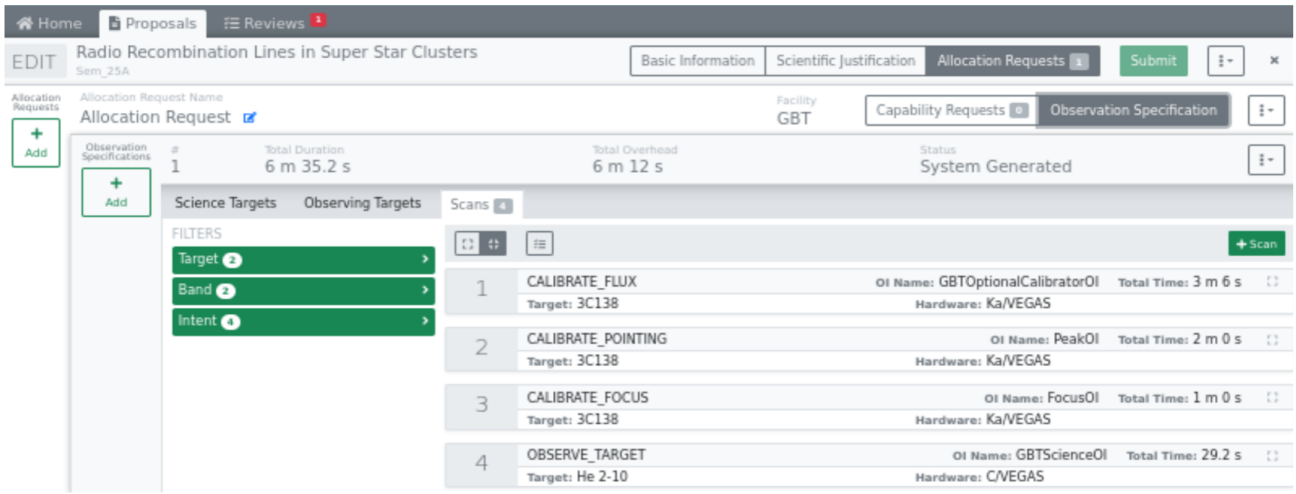


Figure 11: Observation Specification: Review the generated results of the *Capability Request*(s). An *Observation Specification* contains a Scan List and a summary of the total time requested.

Important!

A *Capability Request* can be modified after the *Observation Specifications* have been generated. However once a save is requested, all of the *Observation Specifications* associated with the *Allocation Request* will be regenerated, discarding any changes the user may have made to the *Observation Specifications*.

There is not a one-to-one mapping between the *Capability Request* and the *Observation Specifications*. As such, a save within any one *Capability Request* in an *Allocation Request* will (re-)generate all *Observation Specifications* for that *Allocation Request*.

5 | Detailed Guide

5.1 | Telescope Time Allocation Home Page

A user must be registered and logged in to utilize the TTA tools; the current version has pre-supplied accounts and no password is required. There are two kinds of users supported by the application: Registered Users, those who have an account and are logged in, and TTA Group Members, those who are Registered Users but have expanded access to the system.

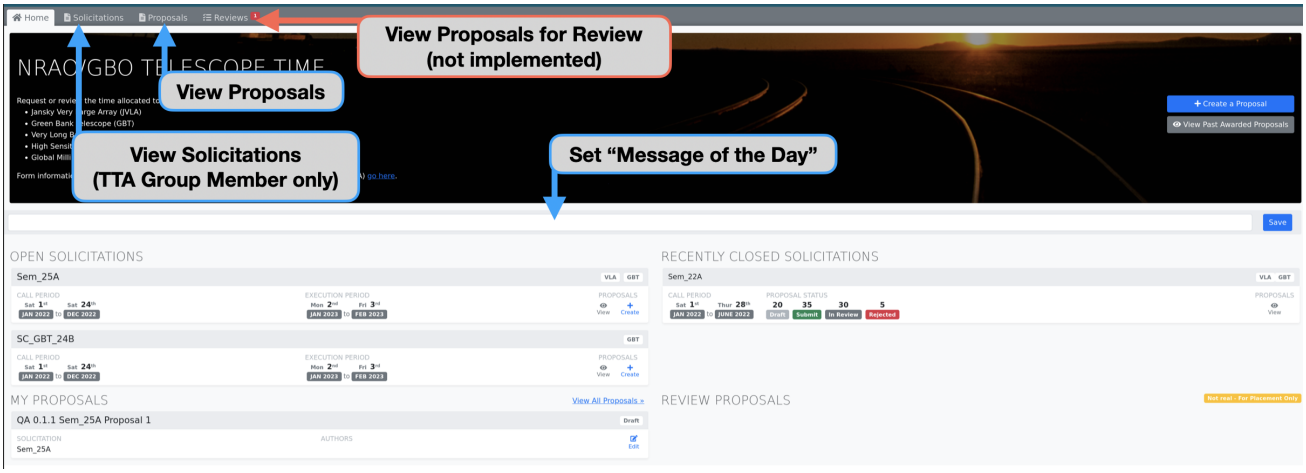


Figure 12: The Home page for logged in TTA Group Member.

Expected Behavior and Limitations

- A Registered User who is logged in can access the Proposals page, which displays a list of all the *Proposals* associated with that user. From there, a user can create a new *Proposal* or edit an existing *Proposal*.

  > **Note**
  >
  > The Reviews page is not accessible, as it is not implemented in this release. The small, red box in the Reviews tab is a placeholder for a notification system that is not yet implemented.

- For a TTA Group Member, the Solicitations tab is visible. For a Registered User, the tab in the UI is hidden.

- A TTA Group Member can set a “Message of the Day” using the text box directly above the “Open Soliciations” section. This message will be displayed to all users. Note, there is no feedback from the UI on a save to indicate it is successful.

5.2 Solicitation Configuration

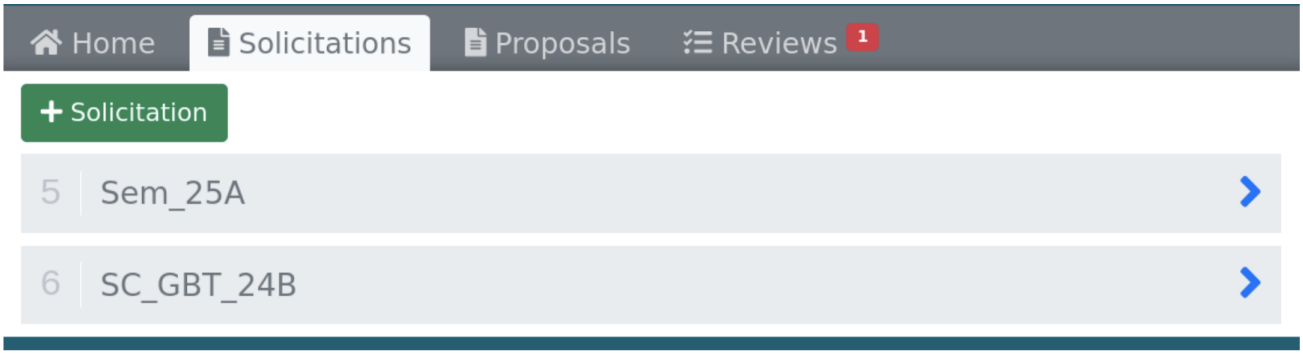


Figure 13: The Solicitation page. A TTA Group Member can create and view existing *Solicitations*. This page is only visible to TTA Group Members.

A TTA Group Member can view and access the Solicitations page. All *Solicitations* that exist are listed in the page, even if the call period has closed. Selecting a *Solicitation* shows the json file that specifies the *Solicitation*.

Important!

There are two *Solicitations* configured for this review. Table 1 lists the frequency information associated with each *Capability* and *Solicitation*.

- Sem_25A is a Semester-like *Solicitation*. It contains the GBT Spectral Line and the VLA Continuum *Capabilities*.
- SC_GBT_24B is a special call or a DDT-like *Solicitation*.

Expected Behavior and Limitations

- Multiple concurrent *Solicitations* with different *Capabilities* are supported.
- Many components of a *Solicitation* are configurable, though the details of this configurability are not in scope for this review.
- The history of *Solicitations* is stored and accessible to TTA Group Members. The interface is preliminary; a user-friendly interface is planned for a future release.

5.3 Proposals Page

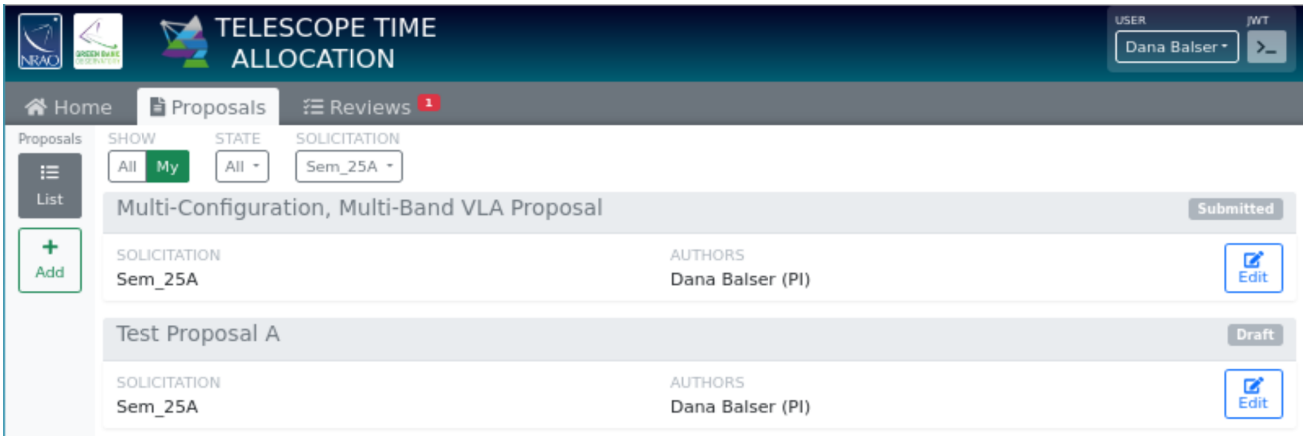


Figure 14: The Proposals page.

The Proposals page lists a summary view of *Proposals*. For a Registered User, only the *Proposals* associated with the user are in the list. A TTA Group Member can view and modify any *Proposal* however. The list can be filtered by Proposal Status[1] and by *Solicitation*. In this page, a user can create a new *Proposal* or edit an existing *Proposal*. Either option will navigate into the Proposal editor, which is described in the sections below.

Expected Behavior and Limitations

- There are profiles for Registered Users (e.g., "Firstname Lastname") and TTA Group Members, which have "_TTA" appended to the name. Despite the similar names, the profiles are not associated in the system. When sorting a list of proposals, "Firstname Lastname" and "Firstname Lastname_TTA" are independent accounts.
- Expanded filtering options are planned in future releases. Additionally, more proposal information is planned to be displayed in this view (e.g., Proposal ID).

[1]Formally, this is the Proposal State, which is either Draft, Submitted, In Review, Completed, or Withdrawn. See Section 2.2 of the System Description.

5.4 Proposal Creation

5.4.1 Basic Information

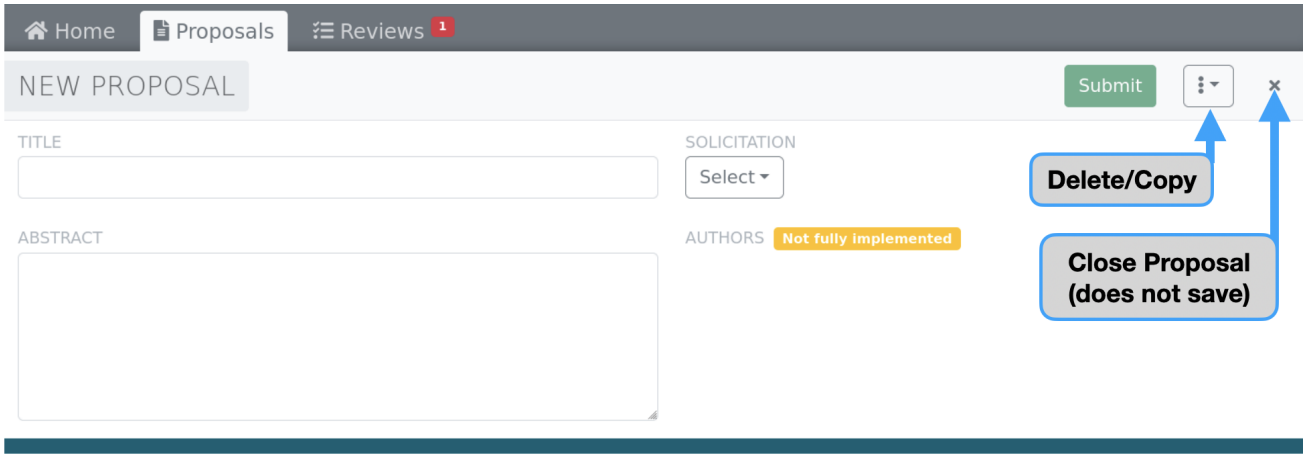


Figure 15: The Proposal editor prior to saving. A newly created *Proposal* must be saved with a valid Title, Abstract, and a *Solicitation* before more options become available in the interface.

The Proposal editor contains a *Proposal*'s Basic Information, which includes the Title, Abstract, Author list, and a *Solicitation*. For a new *Proposal* (Figure 15), a valid save is needed before a user can progress further in the proposal creation process.

Expected Behavior and Limitations

- The Title is required to be at least 20 characters and the Abstract must be at least 1 character. Validation is performed on these fields on a save. Both of these text fields can be modified after a save.
- A *Solicitation* must be selected. Once the form is saved, the *Solicitation* **cannot** be modified.
- When the form is saved, the Proposal editor acquires navigational tabs to the Science Justification and the Allocation Requests editors (see Figure 16).
- The drop-down menu next to the Submit button contains additional functionality such as copy and delete. However, the copy function is not implemented. The delete function is only available for TTA Group Members currently.
- The user will be set as the Primary Author by default. It is not currently possible to specify co-authors or change the Primary author of a *Proposal*. It is possible to delete the Primary Author, but it is not persisted and the field is repopulated with the user's information on a refresh or save.

> **Note**
>
> The Submit button is visible but inactive. Proposal Submission is not in scope for this release.

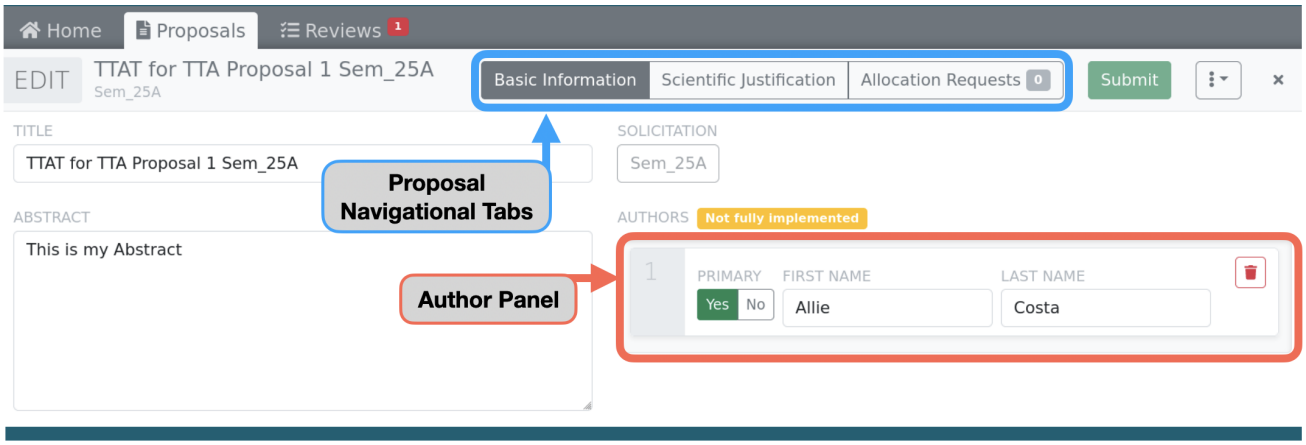


Figure 16: The Basic Information editor after a save. The proposal-level navigational tabs and author panel become available after the form is saved.

5.4.2 | Scientific Justification

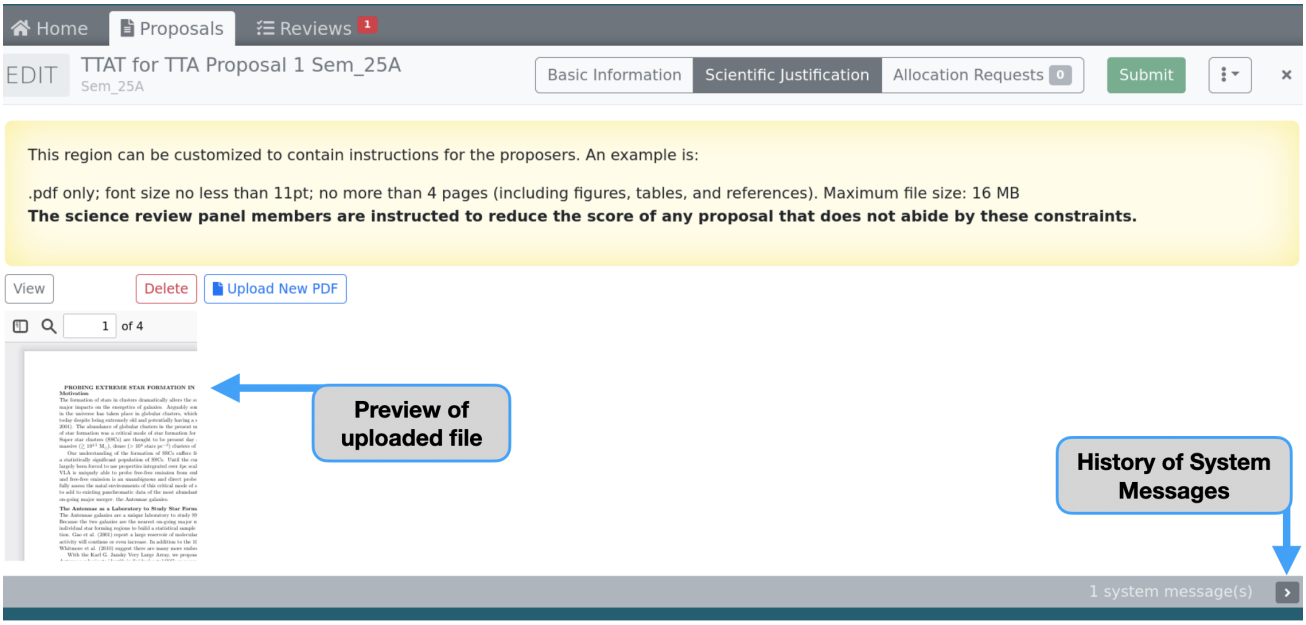


Figure 17: The Scientific Justification editor. A preview and the Delete and View options are available once a file is uploaded.

Once the information on the Basic Information editor is saved, the Scientific Justification editor is available for a user to upload their Scientific Justification. A Scientific Justification is not required to access the Allocation Request editor.

■ Expected Behavior and Limitations

- The user can upload a pdf, and it is saved automatically. Validation of the file is not in scope for this release.
- The user can delete an uploaded file or replace an existing one.
- A thumbnail preview is available of the file, and there is a View button, which opens the file in a new browser tab.

Note

For NRAO managed distributions of Firefox on macOS, there is not a thumbnail preview of the uploaded file and the View button prompts a download of the file instead of opening it in a new tab. This is controlled by a system preference that is managed by NRAO.

5.4.3 Allocation Requests

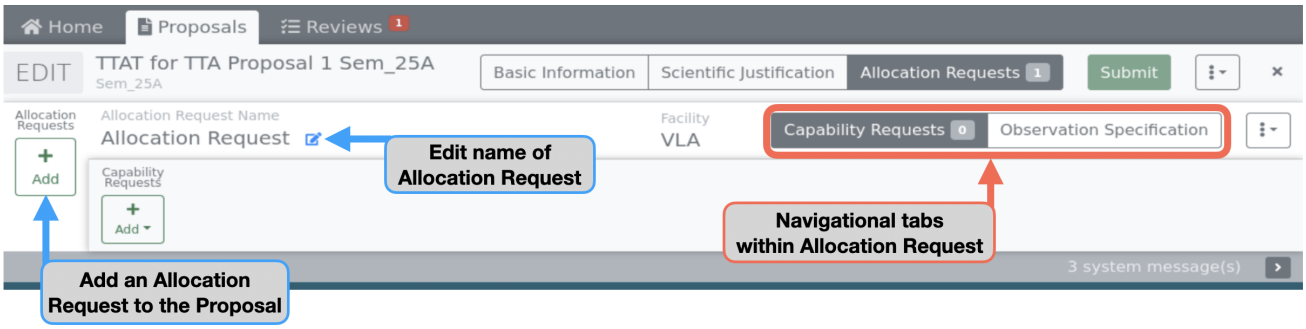


Figure 18: The Allocation Request editor. After a *Facility* has been selected, the *Allocation Request* editor is available.

Once a save is successful in the Basic Information editor, the Allocation Request editor is available. An *Allocation Request* contains the details of the requested observatory resources. In the Allocation Request editor, a user can specify one or more *Allocation Requests*. An *Allocation Request* may have one *Facility*, but there may be many *Allocation Requests* in a *Proposal*.

Expected Behavior and Limitations

- When a new *Allocation Request* is created, the user must select a *Facility*. The *Solicitation* sets the available *Facilities*. Once selected, Allocation Request editor expands to allow the user to add *Capability Requests* to the *Allocation Request* (see Figure 18).
- An *Allocation Request* can be deleted and renamed. The copy function is not implemented.
- There are two navigational tabs available in the Allocation Request editor, which navigate to the Capability Requests and Observation Specifications editors.
- Additional *Allocation Requests* can be added to the *Proposal*; they are not required to share the *Facility* of the existing one(s), but they can. When added, a List button will display a summary view of the *Allocation Requests* and facilitate navigation between them.
- *Allocation Requests* are independent of each other, meaning that they do not have common *Observation Specifications* unless the user specifies identical *Capability Requests* in multiple *Allocation Requests*.

5.4.4 Capability Requests

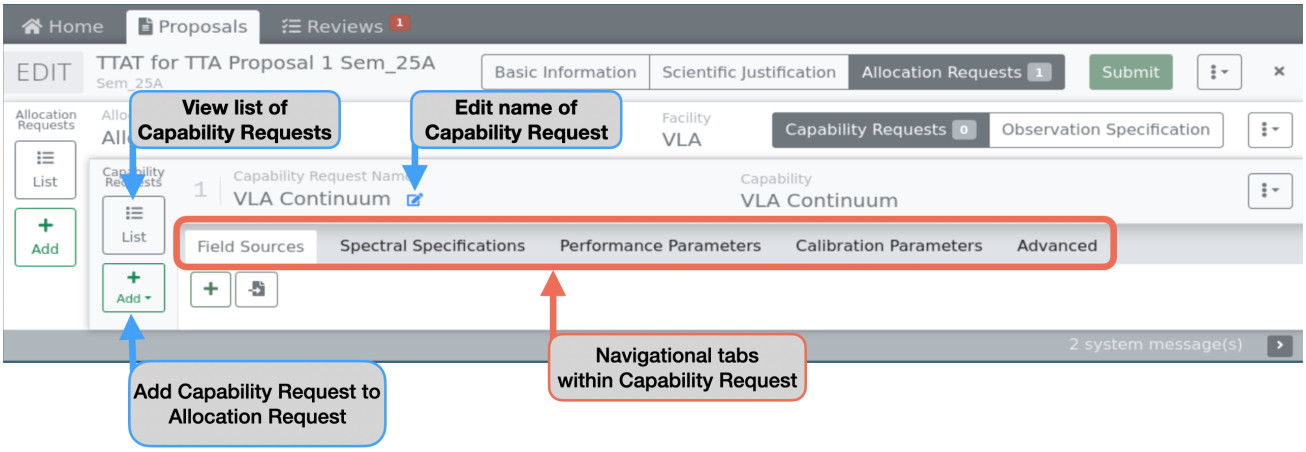


Figure 19: The Capability Request editor.

A *Capability Request* is composed of the information[2] required by a *Capability* to create the *Observation Specification*(s). One *Capability Request* is required per *Allocation Request*; additional ones may added to an *Allocation Request*. Figure 19 shows the interface of a newly added *Capability Request*.

Expected Behavior and Limitations

- The user can change the name of the *Capability Request*, or delete it. The copy function is not implemented.
- *Capability Requests* can be added to an *Allocation Request* with the Add button, which will display a drop-down menu of the *Capabilities* that are available in the *Solicitation*. When more than one *Capability Request* exists in an *Allocation Request*, the List button facilitates navigation between the *Capability Requests*.

  Bug

  The Save button becomes visible once an edit to a form is made; however, there is a bug that sometimes causes the Save button to not appear despite unsaved changes existing. The ways to trigger this include navigating between *Capability Requests* without saving first and deleting a *Capability Request* after *Observation Specifications* have been generated. The solution is to refresh; then if the button is still unavailable, make an inconsequential edit, such as to the name of the FIELD SOURCE. This will cause the Save button to reappear.

- There are four categories of information the user needs to provide in the *Capability Request*: FIELD SOURCE, SPECTRAL SPECIFICATION, PERFORMANCE PARAMETERS, and CALIBRATION PARAMETERS. Once a *Capability Request* is added to an *Allocation Request*, the editors containing these categories become accessible.
- When the form is saved, a prompt warns the user that saving will overwrite the *Observation Specification*(s). This prompt is triggered even if a valid *Observation Specification* is not available.

[2] In System Description, this information is called a *Capability Parameter Specification*.

Important!

It is not necessary to save when navigating between Field Source, Spectral Specification, Performance Parameter, Calibration Parameter, and Advanced editors within a single *Capability Request*. The system is designed to persist the information within a *Capability Request* without a save, as saving will trigger the creation of the *Observation Specification*(s). Unsaved changes to the *Capability Request* are not kept if navigated to other views like the *Observation Specification* or another *Capability Requests*. However, the UI does not warn the user of this consequence currently.

5.4.5 | Field Source

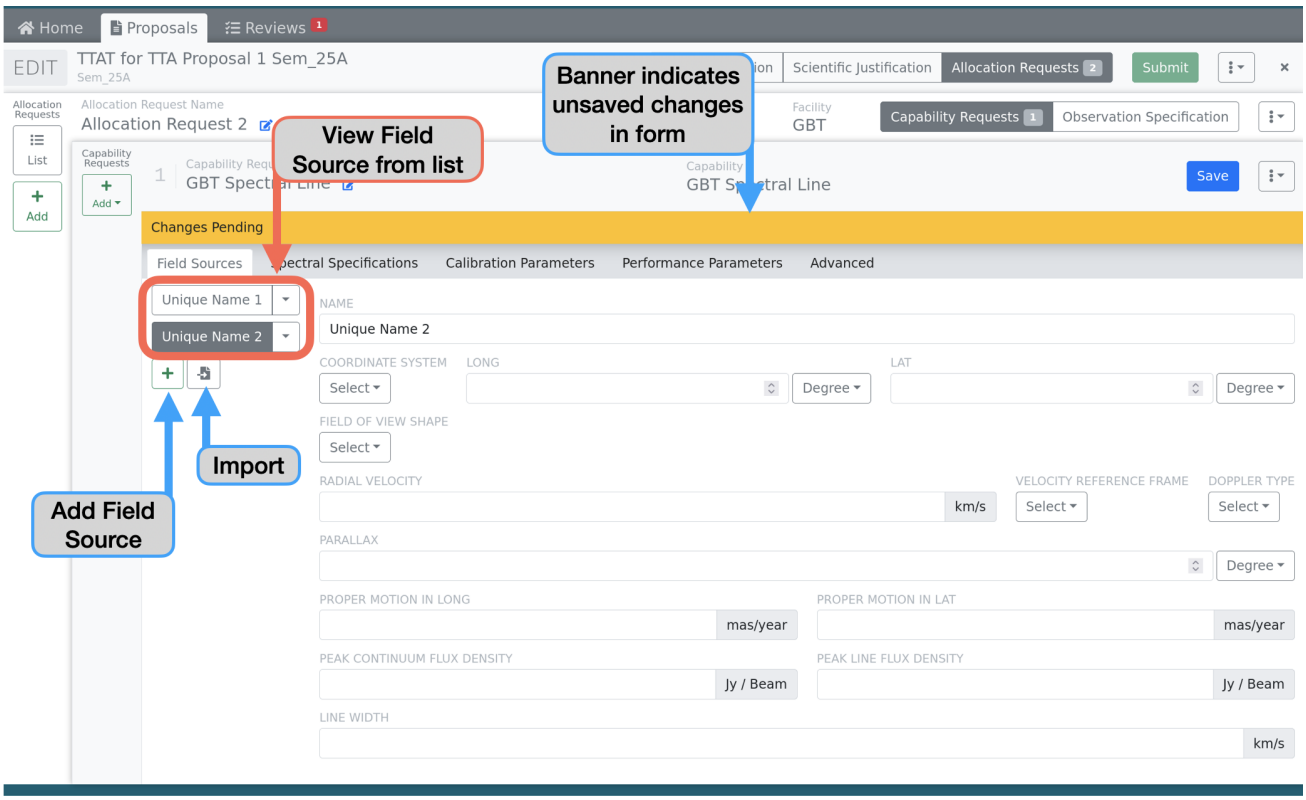


Figure 20: The Field Source editor. In this example, two FIELD SOURCES have been added to the same *Capability Request*. Only one FIELD SOURCE is visible at a time in the UI. The list of their names provides a way to switch the display to a different FIELD SOURCE.

A FIELD SOURCE holds the information specifying the astronomical object to be observed, which encompasses the position, the field of view, and the peak continuum flux density, for example. The requested information may depend on the *Capability*, and many of the prompts in the Field Source editor (Figure 20) are configurable in the *Solicitation*. One FIELD SOURCE is required per *Capability Request*; additional ones may be added.

■ Expected Behavior and Limitations

- A single FIELD SOURCE can be added with the add button. One or more FIELD SOURCES can be added with the file upload tool (see § A.2).
- A unique `Name` is required for each FIELD SOURCE.
- A drop-down menu is available to specify the `Coordinate System`, which will change the labels on some of the text fields. The position information is contained in the `Long` and `Lat`

text fields. The input format depends on the specified unit. The default unit is Degree.

- The `Field of View Shape` describes the area of interest and assumes the coordinate information specifies the center. The default is `point`. Specifying a `Field of View Shape` of `ellipse` or `rectangle` also requires specifying the `FOV in Long` and `FOV in Lat` fields, which are the extent of the field of view (FOV) in the longitude and latitude coordinate, respectively. The default unit is Degree.

  Bug

  The drop-down menus display all of the options supported by the algorithm, even if the parameter is not configured in the *Solicitation*. For example, the `Field of View Shape`s that the algorithm can support are `point`, `ellipse`, and `rectangle`. The GBT Spectral Line *Capability* is configured only for `point`, such that the `FOV in Long` and `FOV in Lat` fields are not available in this *Capability*. However, the drop-down menu still displays the full list.

- The default unit for `Radial Velocity` and `Line Width` is km s^{-1}. For `Proper Motion in Long` and `Proper Motion in Lat`, it is mas $year^{-1}$. For `Peak Continuum Flux Density` and `Peak Line Flux Density`, it is Jy $beam^{-1}$. Note in the future, the UI label for the latter two will have "per Synthesized Beam" appended.

- Only one FIELD SOURCE can be displayed at a time on the Field Source editor. Changing the display panel to a different FIELD SOURCE (if multiple ones exist) is facilitated through a list of their names.

- The unit drop-down menus are currently implemented for angle-like units. For version 0.1, the full array of angle-like units are available for any angle-like field, which means that non-standard units are available for some fields. For example, `parallax` is not typically specified in a sexagesimal format. In future releases, the units will be revised.

  Important!

  Unit conversions are available through the drop-down menus for some of the fields. The fields can be specified in any unit that is supported. However, once the form is saved or navigated away from, the displayed values and units will be converted to the defaults. This is not a desired feature; in a future release, the displayed values and units will reflect what the user specified.

  Coordinate Systems conversions are not supported.

- Simple validation on the type of entry for each field is performed on a save. If a field has an invalid entry, the field is outlined in red and an error message is displayed under the field. At this time, there is a default error message and it is cleared from the page promptly. This behavior is not desired and will change in a future release.

  Bug

  There are a few display bugs in the position information, such as the incorrect labels in the HMS format. Additionally, entering a negative Declination in the DMS format will cause the display to change systematically to the wrong value. Converting the unit to degree, however, shows that the value the user provided is persisted.

5.4.6 | Spectral Specification

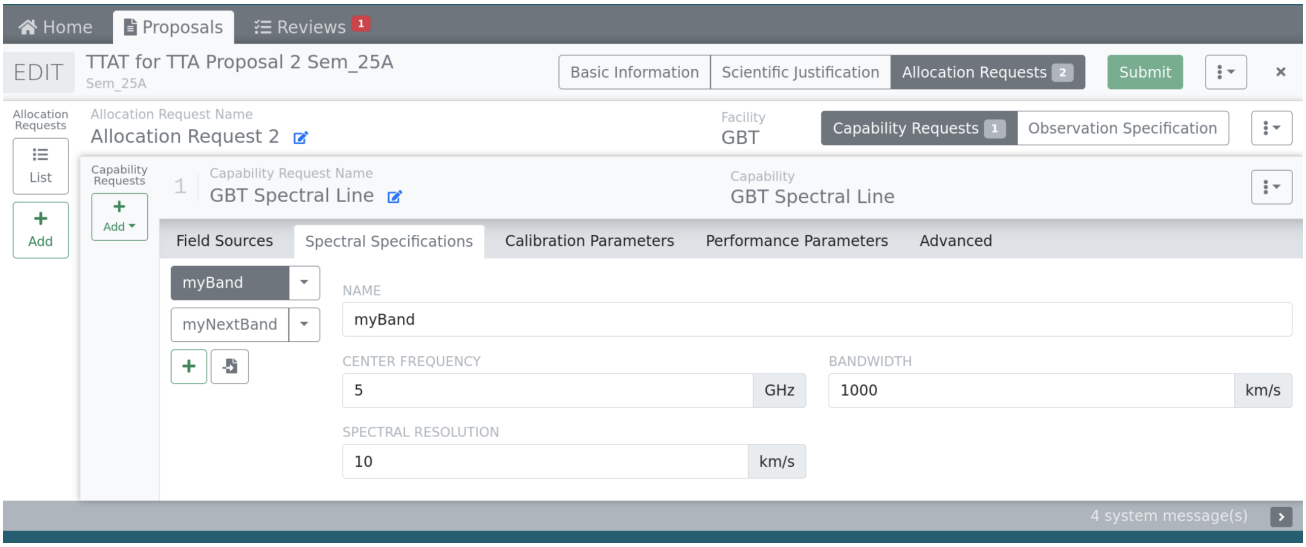


Figure 21: The Spectral Specifications editor.

A SPECTRAL SPECIFICATION contains the information that specifies the frequency information (e.g., bandwidth) for an observation. This information informs the selection of the HARDWARE CONFIGURATION, which describes the FRONT-END and BACK-END of a *Facility*. The requested information may depend on the *Capability*, and many of the prompts in the Spectral Specification editor (Figure 21) are configurable in the *Solicitation*. One SPECTRAL SPECIFICATION is required per *Capability Request*; additional ones may be added.

Expected Behavior and Limitations

- A single SPECTRAL SPECIFICATION can be added with the add button. One or more SPECTRAL SPECIFICATIONS can be added through the file upload tool (§ A.2).
- A unique `Name` is required for each SPECTRAL SPECIFICATION.
- The units are restricted to the defaults currently.
- The default unit for `Center Frequency` is GHz.
- For `Bandwidth` and `Spectral Resolution`, the default unit is km s^{-1}.

5.4.7 Calibration Parameters

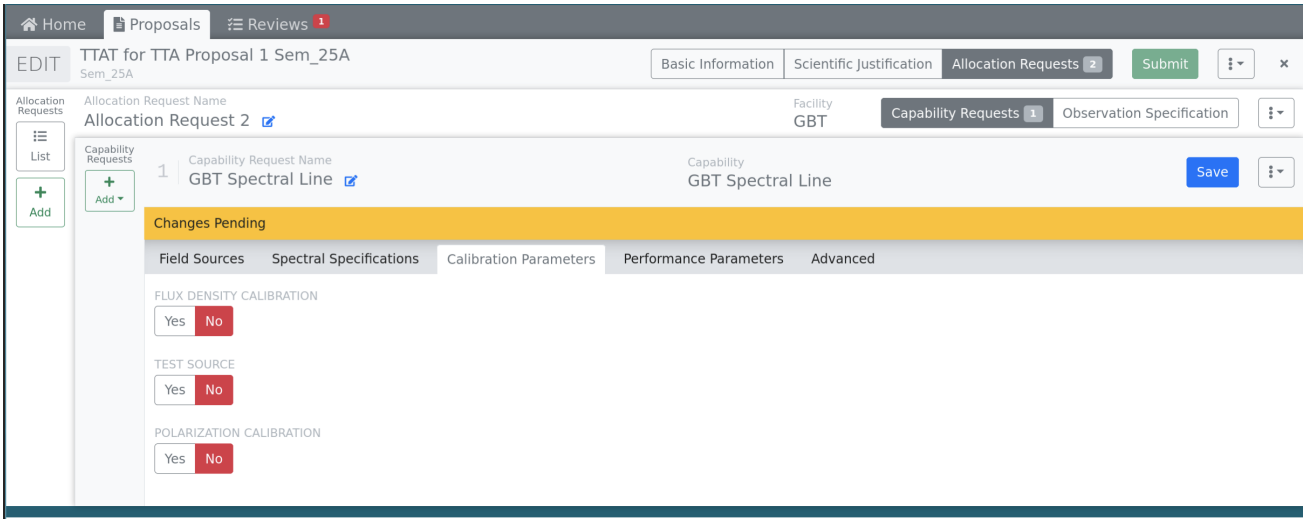


Figure 22: The Calibration Parameters editor for a GBT *Capability*. A VLA *Capability* can have a different set of parameters.

The CALIBRATION PARAMETERS represent queues to the algorithm to trigger specific *Calibration* and *Scheduling Strategies*. For example, if the `Polarization Parameter` is selected in Figure 22, the user has indicated that accurate polarization properties are required, and the algorithm would return *Observation Specifications* that satisfy this requirement. The CALIBRATION PARAMETERS can also trigger additional calibration for a *Capability* that are not included by default. For example, a Flux Density Calibration is not necessarily a standard calibration for all GBT *Capabilities*, but a user may request it anyway.

Expected Behavior and Limitations

- *Capabilities* can have different CALIBRATION PARAMETERS.
  - For the GBT Spectral Line *Capability*, the available parameters are `Flux Density Calibration`, `Test Source`, `Polarization Calibration`.
  - For the VLA Continuum *Capability*, `Polarization Calibration` is the available parameter.
- A CALIBRATION PARAMETER can be requested with by setting the button to "yes". By default, they are not requested.

5.4.8 Performance Parameters

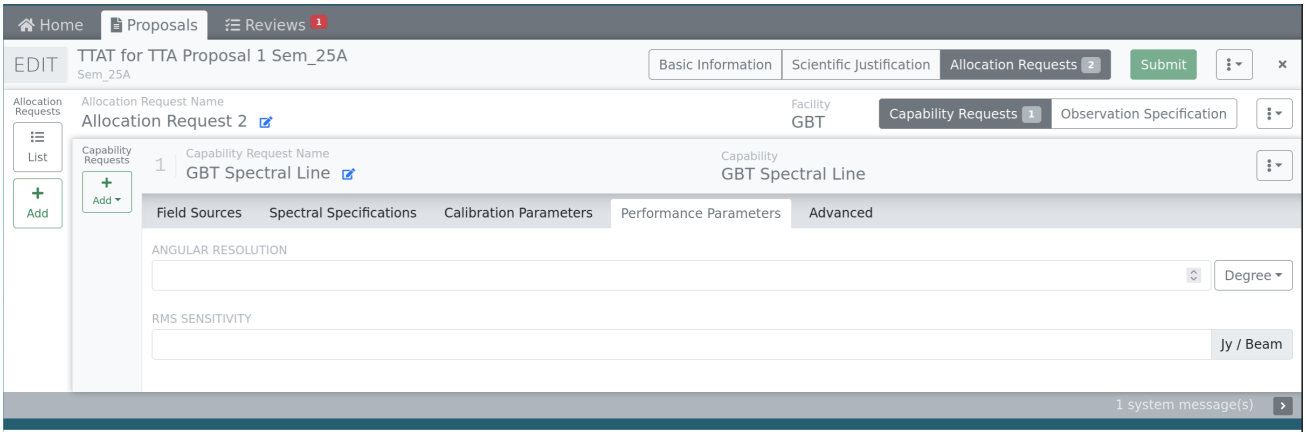


Figure 23: The Performance Parameters editor for a GBT *Capability*. A VLA *Capability* has the additional PERFORMANCE PARAMETER of `Largest Angular Resolution`.

PERFORMANCE PARAMETERS encompass the information needed to specify the performance (e.g., RMS sensitivity, angular resolution) of a *Facility*. The details depend on the *Capability*, and many of the prompts in the Performance Parameters editor are configurable in the *Solicitation*. There are two ways to specify the PERFORMANCE PARAMETERS, through the Performance Parameter editor and the Advanced editor.

Expected Behavior and Limitations

- *Capabilities* can have different PERFORMANCE PARAMETERS.
  - For the GBT Spectral Line *Capability*, the parameters are `Angular Resolution` and `RMS Sensitivity`, with the default units of Degree and Jy beam^{-1}, respectively.
  - For the VLA Continuum *Capability*, the parameters are `Angular Resolution`, `Largest Angular Scale`, and `RMS Sensitivity`, with the default units of Degree, Degree, and Jy beam^{-1}.
- If changes have not been made using the Update button in the Advanced editor, then changes in the Performance Parameters editor will affect the whole of the *Capability Request*. It is not necessary to specify a FIELD SOURCE or SPECTRAL SPECIFICATION prior to specifying the PERFORMANCE PARAMETERS in this case. Figure 23 shows the Performance Parameter editor for a GBT *Capability* for reference.

  Important!

  Once a modification is made to any entry in the Advanced editor, the changes made to the Performance Parameters editor will not affect the PERFORMANCE PARAMETERS. It is not currently indicated in the UI when the Performance Parameter editor is superseded by the Advanced editor.

- If at least one FIELD SOURCE and one SPECTRAL SPECIFICATION has been created for a *Capability Request*, then the Advanced editor displays a matrix of the pairs (see Figure 24). Each row displays a FIELD SOURCE and SPECTRAL SPECIFICATION pair, each represented by a user specified `Name`, and a text field for each PERFORMANCE PARAMETER. If the PERFORMANCE PARAMETERS have been specified in the Performance Parameter editor,

then the fields are prepopulated with those values; otherwise, they are blank. The functionality of this editor is to allow the user to fine-tune the parameters per FIELD SOURCE and SPECTRAL SPECIFICATION pair.

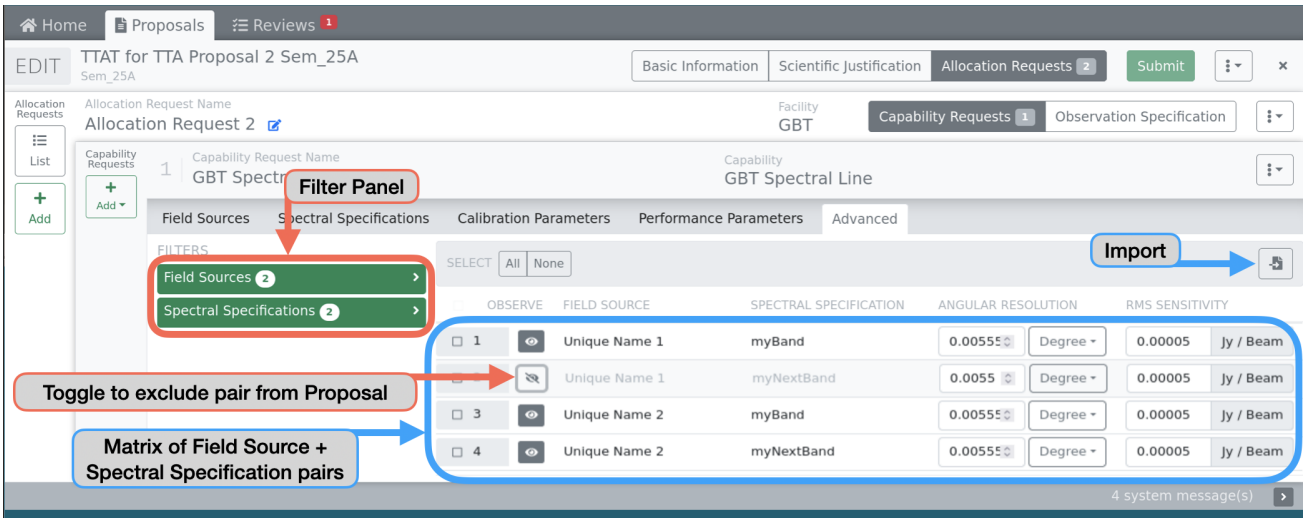


Figure 24: The Advanced editor for a GBT *Capability*. A VLA *Capability* will have the additional PERFORMANCE PARAMETER of `Largest Angular Resolution` in each row. The second row of the matrix has been marked to be excluded, and as such, it will ignored by the algorithm when generating the *Observation Specifications*.

- In the Advanced editor,
  - By default, all FIELD SOURCE + SPECTRAL SPECIFICATION pairs are translated to the *Observation Specifications*; however, a pair can be excluded from the *Observation Specifications* by deselecting the "Observe" button; see Figure 31 (h). Excluding a pair does not remove it from the *Capability Request*, as selecting the button again will undo the exclusion. This functionality allows the user to fine-tune the Science Targets in an *Observation Specification* with ease.
  - PERFORMANCE PARAMETERS can be updated for a pair by manually changing the text field.
  - When filtering, the pairs matching the filter are highlighted. These rows can be selected with the bulk selection options. With one or more rows selected, a bulk editor is available which applies the changes to the selected row(s) in the matrix. See Figure 25 for a guided example.
  - Bulk changes may also be performed by uploading a file (see § A.2). The user supplied `Names` of the FIELD SOURCES and the SPECTRAL SPECIFICATIONS are used to match the matrix pairs to the entries specified in the file. If the `Names` are not an identical match, the file upload tool will display a message stating which of the pairs it could not match. If a match is found, the values will be updated.

    Bug

    If any match fails, the displayed message indicates that all of the pairs have failed, even if there were successful matches. The changes are applied to the successful matches despite the message indicating a failure.

- There are static units for some PERFORMANCE PARAMETERS. The unit drop-down menus are currently implemented for angle-like units. As of version 0.1, the full array of angle-like

units are available all angle-like fields, which means that non-standard units are available for some fields.

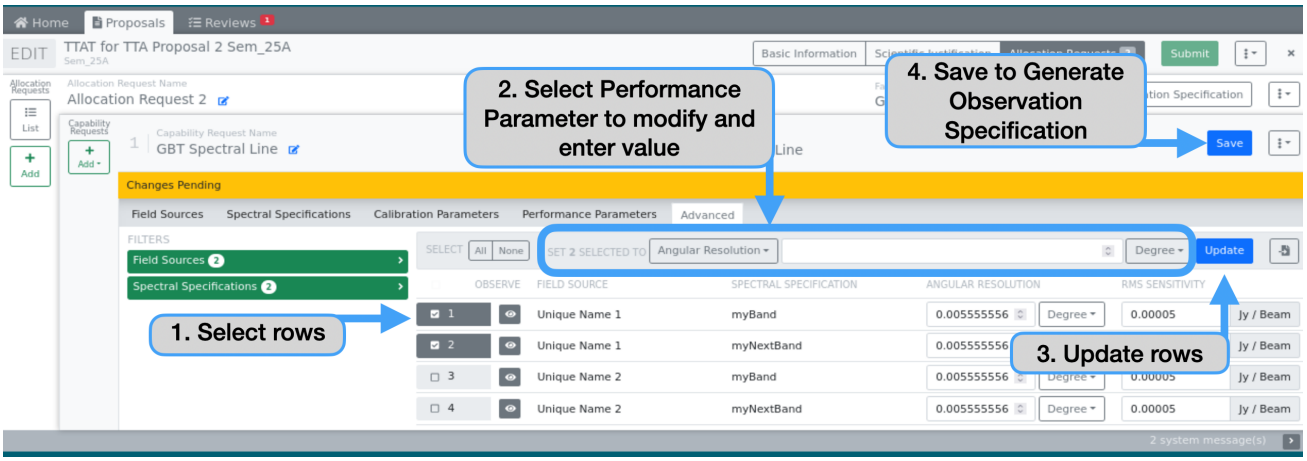


Figure 25: The Advanced editor for a GBT *Capability*. The enumerated boxes show the steps to update a single PERFORMANCE PARAMETER for multiple rows.

5.4.9 Generate Observation Specifications

Each time a *Capability Request* is saved, the algorithm processes all of the *Capability Requests* within an *Allocation Request* to translate the user's request into one or more *Observation Specifications*. The user is not exposed to this process however; they only view the final result, which are the *Observation Specifications*. The general transformation, shown in Figure 26, are described below with the disclaimer that the current implementation of the algorithm is a prototype and not fully realized.

Expected Behavior and Limitations

- When a *Capability Request* is saved, the *Observing Strategy* algorithm is called to process all of the *Capability Requests* in an *Allocation Request*. Within a *Capability Request*, the algorithm pairs each FIELD SOURCE with each of the SPECTRAL SPECIFICATIONS. This pairing is not performed across the *Capability Requests*. The pairs are associated with CALIBRATION PARAMETERS and PERFORMANCE PARAMETERS specified in that *Capability Request*. The algorithm then creates Science Targets based on the pairs.

  A Science Target is defined as a SOURCE, HARDWARE CONFIGURATION, and a `Requested Time`. The algorithm calls routines to determine these parameters using the information from the *Capability Request*. Currently many of the routines shown in Figure 26 are placeholders for more comprehensive routines that are under development.

  Note

  FIELD SOURCES that share common `Long` and `Lat` parameters are merged when the algorithm generates the Science Targets. The proprieties of the resulting Science Target reflect the first FIELD SOURCE of the pair. The resolution order to determine the first FIELD SOURCE is the order of the FIELD SOURCES in the Field Source editor and then the ordering of the *Capability Requests*. The positions must be an exact match to merge currently; the UI does not provide feedback to indicate that a merge has occurred.

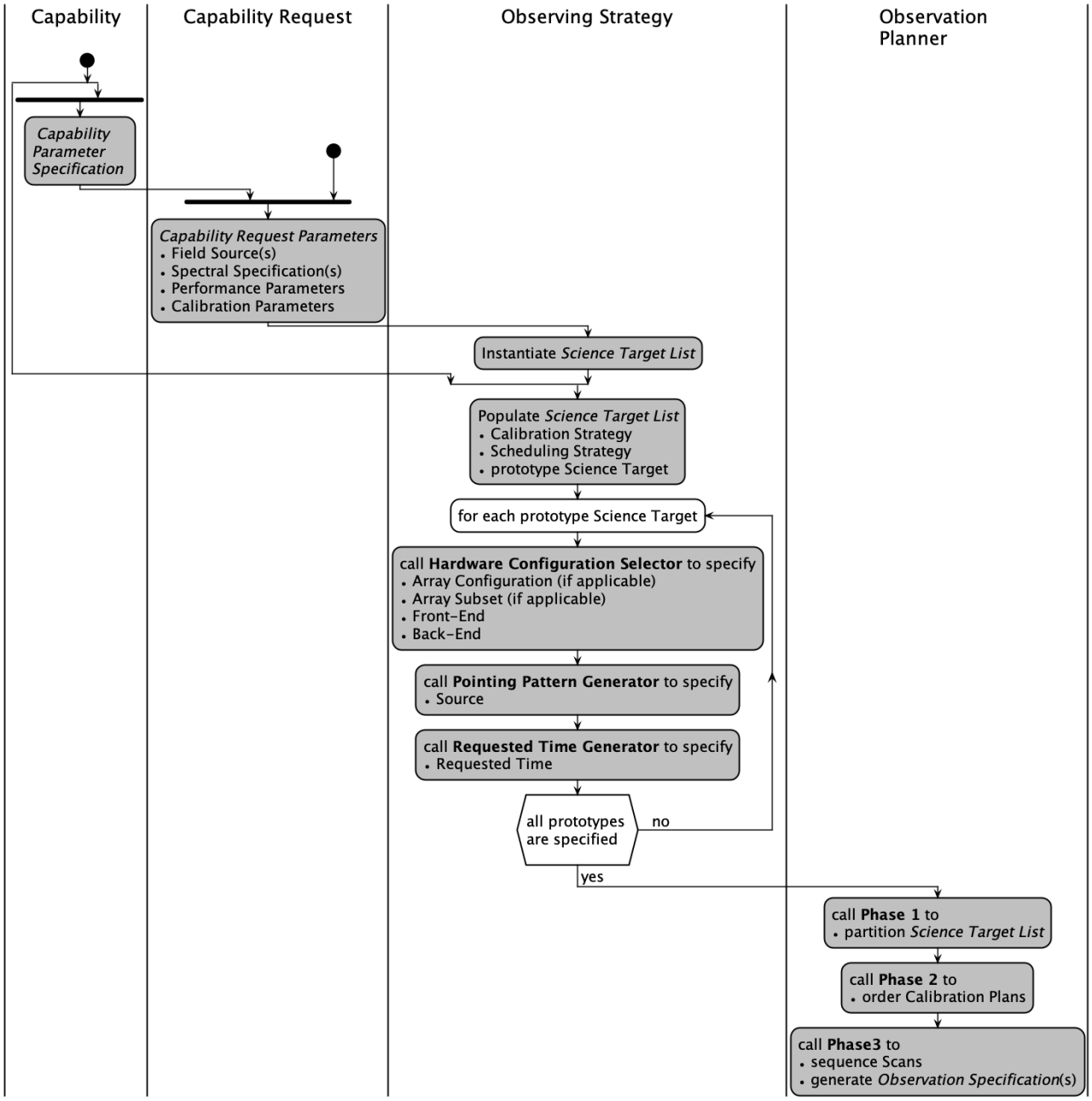


Figure 26: Overview of the algorithm that transforms *Capability Requests* to *Observation Specifications*. The black circle in the *Capability Request* column represents a user's point of interaction to provide the requested information (e.g., `Center Frequency`, `Radial Velocity`). The bold font indicates an intermediate routine that the algorithm performs. The details are available in the TTAT Algorithms document, but they are not in scope for this review.

- Currently, the `Requested Time` is calculated using the `RMS Sensitivity`, `Center Frequency`, and `Bandwidth` parameters.

  > **Note**
  >
  > The sensitivity calculations are simple placeholders for now, but they are *Capability* specific. Other considerations will affect the `Requested Time` calculation in the future.

- The determination of the HARDWARE CONFIGURATION is currently limited, such that the `Center Frequency` controls the selection of the FRONT-END. Table 1 lists the mapping

between frequency and the FRONT-ENDS. The BACK-END is either WIDAR for the VLA or VEGAS for the GBT.

- If a requested `Center Frequency` is not configured in a *Solicitation*, then *Observation Specifications* are not generated.

  Bug

  The UI does not provide feedback to indicate the cause of failure, as validation is not performed on the *Capability Request* currently. Furthermore, there is a bug in the generation that does not properly clear a previously generated *Observation Specification* if the new one is invalid. This can be replicated by first generating a successful *Observation Specification* and then by modifying the *Capability Request* in such a way that the changes generate an invalid *Observation Specification*. For example, changing the `Center Frequency` to a band that is not supported in the *Solicitation* will cause an invalid *Observation Specification* but the prior existing *Observation Specification* will still be shown.

- For each Science Target, the algorithm selects *Calibration Strategies* and a *Scheduling Strategies*, which together describe the necessary observational procedures needed for calibration and the ordering of the *Scan List*.

  A *Calibration Strategy* contains *Observing Instructions* (OIs), which are instructions detailing what calibrations are required for a Science Target and are designed to reflect current observing routines, such as those described in the GBT Observing Guide[3]. There are many types of OIs, which are described in the TTAT Algorithms document; however, there are a limited set available in the current version of the algorithm, and their current implementation is not the final design. We describe them briefly here for context in the UI.

  - GBTScienceOI creates one *Scan* with a `Scan Intent` of OBSERVE_TARGET, which contains two *Subscans*. Both *Subscans* have `Subscan Intents` of ON_SOURCE because a GBT Nod procedure was selected by the algorithm. Currently, that is the only scan type[4] the algorithm has knowledge of for the GBT.
  - FocusOI creates a *Scan* with a `Scan Intent` of CALIBRATE_FOCUS, which contains a single *Subscan*. The *Subscans* has a `Subscan Intent` of OFF_SOURCE.
  - PeakOI creates a *Scan* with a `Scan Intent` of CALIBRATE_POINTING, which contains 4 *Subscans*. The *Subscans* have `Subscan Intents` of OFF_SOURCE.
  - GBTOptionalCalibratorOI creates one or more *Scans*, each containing one or more *Subscans*. The details of the *Scans* and *Subscans* depends on the CALIBRATION PARAMETER specified in the *Capability Request* or standard routines for the *Facility* (e.g., Pointing).
  - VLACalibratorOI creates one or more *Scans*, each containing one or more *Subscans*. The details of the *Scans* and *Subscans* depends on the CALIBRATION PARAMETER specified in the *Capability Request* or standard routines for the *Facility* (e.g., Phase Referencing, Pointing).
  - VLAScienceTargetOI creates a *Scan* with a `Scan Intent` of OBSERVE_TARGET, which contains a single *Subscan*. The *Subscan* has a `Subscan Intent` of ON_SOURCE.

[3] GBT Observing Guide https://science.nrao.edu/facilities/gbt/observing/GBTog.pdf
[4] See Section 6.4.2.5. of the GBT Observing Guide.

- Once all of the Science Targets are constructed for an *Allocation Request*, the entire set of Science Targets are aggregated into one list, called the *Science Target List*. The *Observation Planner* algorithm is then called to act on the entire *Science Target List*.

  In *Observation Planner Phase 1*, the *Science Target List* is partitioned into clusters that have a one-to-one mapping with *Observational Specifications*. In *Phase 2*, the algorithm identifies the necessary *Observing Instructions* from the *Calibration Strategies*. In *Phase 3*, the scans are sequenced, producing a *Scan List* per *Observation Specification*.

- The *Calibration* and a *Scheduling Strategies* are not fully implemented in the algorithm, so a limited but predictable outcome is expected for any given *Science Target List*. Further criteria for partitioning, as such partitioning by CALIBRATION PARAMETER, and extended rules for frequency and spatial partitioning are under development. A prototype partitioning algorithm is described in the TTAT Algorithms document.
  - For the GBT Spectral Line *Capability*,
    - the *Science Target List* is partitioned into clusters. Currently, only spatial partitioning criteria is applied. The *Science Target List* is partitioned by RA such that the clusters have RAs in either the range of [0 – 14) hours or [14 – 24) hours. At most, two *Observation Specifications* are expected.
    - the *Calibration Strategy* orders a `Peak OI` and `Focus OI` per partitioned cluster. Currently, only one set of *Scans* with the `Scan Intents` of CALIBRATE_POINTING and CALIBRATE_FOCUS is generated per *Observation Specification*. The Observing Target associated with this `OI` is equal to the first *Scan* in the *Scan List*.

      Bug

      If the `Peak OI` or `Focus OI` is first, then it incorrectly displays "0th Scan" for the Target name.

    - the *Calibration Strategy* will select calibrators for each partitioned cluster and for each of the CALIBRATION PARAMETERS set to "yes" (True) in the Calibration Parameters editor.

      The `Flux Density Calibration` parameter maps to a *Scan* with the `Scan Intent` of CALIBRATE_FLUX and the `Test Source` parameter maps to OBSERVE_TARGET. The `Polarization Calibration` parameter maps to a *Scan* with the `Scan Intent` of CALIBRATE_POL_LEAKAGE.

      Note

      The spectral and coordinate information associated with calibrators is currently limited. The SOURCES are either 3C138, 3C84, or 3C286; the HARDWARE CONFIGURATION is always set to "Ka/VEGAS".
  - For the VLA Continuum *Capability*,
    - the *Science Target List* is partitioned into clusters and spatial and frequency partitioning is applied. The same spatial criteria as the GBT case is applied such that the RA ranges per partitioned cluster are either [0 – 14) hours or [14 – 24) hours.

Then, each unique HARDWARE CONFIGURATION is partitioned into a new partitioned cluster. There can be many *Observation Specifications* generated for an *Allocation Request*, with each *Observation Specifications* having one unique HARDWARE CONFIGURATION.

* the *Calibration Strategy* orders a `Phase Referencing OI` per *Observation Specification*. This will interleave *Scans* with `Scan Intents` of CALIBRATE_PHASE and CALIBRATION_AMPLITUDE with the Science Targets. Currently a placeholder SOURCE, J0228+673, always provides the coordinate information associated with these *Scans*. The `Hardware Configuration` is equal to that of the Science Targets.

* the *Calibration Strategy* will select calibrators for each partitioned cluster and for each CALIBRATION PARAMETERS set to "yes" (True) in the Calibration Parameters editor. The `Polarization Calibration` parameter produces two *Scans*, one with a `Scan Intent` of CALIBRATE_POL_LEAKAGE and one with CALIBRATE_POL_ANGLE. Currently a placeholder SOURCE, 3C84, always provides the coordinate information associated with these *Scans*. The `Hardware Configuration` is equal to that of the Science Targets.

> **Note**
>
> Currently, the spectral and coordinate information associated with the calibrators is limited. The SOURCES are either 3C138, 3C84, or 3C286; the HARDWARE CONFIGURATION is equal to that of the Science Targets.

- The `Requested Time` per Science Target is realized in a single *Scan List*. In practice, the user likely prefers *Observation Specifications* that repeat, which breaks up the Science Targets and the `Requested Time` into manageable blocks.

  For example, if the `Requested Time` is 18 hours, a single *Observation Specification* is likely not feasible. However, an *Observation Specification* with a `Repeat Count` of 9 and a `Total Duration` of 2 hours is likely feasible (and preferable).

  The algorithm does not yet implement this approach though, as a more sophisticated partitioning algorithm is needed. The consequence is that the *Scan List* is invariably long, so it has been intentionally truncated as to not overwhelm the display. The following restrictions are in place for generating *Scans*.

  – The minimum `Acquisition Time` of a *Subscan* is 1 second. In practice, this value is dependent on the *Facility*; however, it is currently the same for the GBT and the VLA.

  – For the VLA, if the `Requested Time` of a Science Target is larger than 90 seconds, then the time is equally distributed between three *Subscans* with `Subscan Intents` of ON_SOURCE. If the `Requested Time` is less than 90 seconds, the one *Subscan* has an `Acquisition Time` equal to the `Requested Time`.

  – For the GBT, there is one *Scan* per Science Target, and the *Scan* is composed of two *Subscans* with equally distributed time.

Bug

The displayed units for coordinate information in the Observation Specification editor are not consistent. For some calibrators, the RA unit should be hours instead of degrees. The filter panel does not have units associated with the coordinate information either. The display is also exclusively in ICRS.

It should be noted that many of the seemingly hard-coded details of the *Observation Specification* generation do not accurately reflect the flexibility of the system. Initially, the motivation for these details was driven by use cases of actual observations and a limited set were deconstructed to form this version.

5.4.10 | Review Observation Specification

The Observation Specification panel is available in the Allocation Request editor; however, it may not always contain *Observation Specifications*. If there are not valid ones, then it displays the message "No Observation Specifications were found". If more than one *Observation Specifications* exists, then a list of *Observation Specifications* is displayed and one can be selected to view. The list provides a minimal summary of an *Observation Specification*. Figure 27 shows a view of an *Observation Specification* for reference.

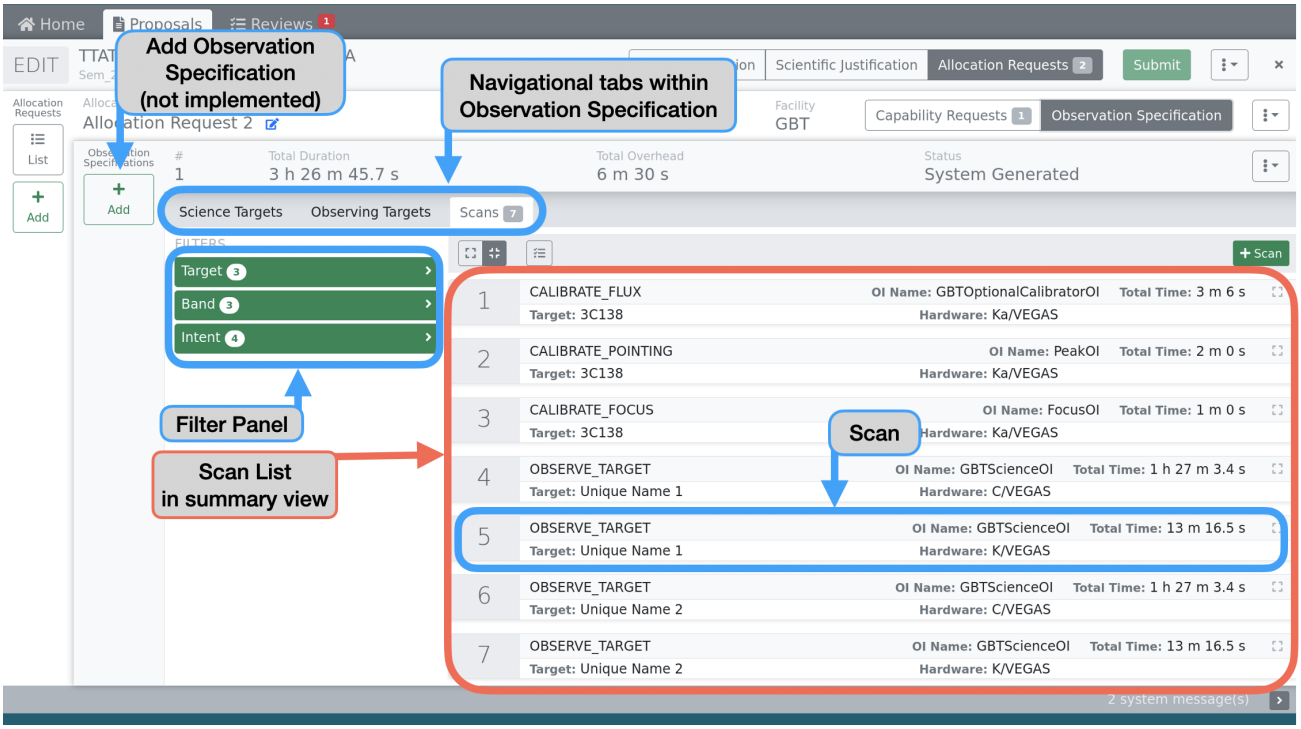


Figure 27: The Observation Specification panel. The default view is the Scan tab, which contains the *Scan List*.

Expected Behavior and Limitations

- The Observation Specification panel has three tabs: Science Targets, Observing Targets, and Scans. All three have access to a filter tool, which functions similarly to the filter tool described in the Advanced tab (§ 5.4.8). The filter tool can filter by SOURCE (called Target in the UI), HARDWARE CONFIGURATION (called Band), and `Scan Intent` (called Intent).

- In the filter tool, it is possible to add, delete, and modify SOURCES and HARDWARE CONFIGURATIONS. A rudimentary Target (SOURCE) and Band (HARDWARE CONFIGURATION) can be specified in the filter tool. Deleting a Target or a Band will delete the *Subscans* it is associated with; however, it will not delete the *Scans* that contain the *Subscans*. See Figure 28 for a reference.

  > **Note**
  >
  > The add feature is limited, as the full functionality to support an advanced user is under development.

- The Scans tab contains the *Scan List*. There are a number of features available to facilitate viewing and editing *Scans* and *Subscans* and editing the *Scan List* itself (see Figure 28).
  - The initial view of the *Scan List* is a summary view. The information displayed for each row contains the user specified `Name` of the SOURCE, the `Scan Intent`, the HARDWARE CONFIGURATION, the `Total Time` of a scan, and the name of the *Observing Instruction* associated with the *Scan* (called OI Name in the UI; see § 5.4.9 for definitions of these terms). Each *Scan* has a Scan Number associated with it, which corresponds to the ordering in the *Scan List*, and an option to expand the *Scan* for more details.

    > **Note**
    >
    > If the *Subscans* within a *Scan* have non-unique SOURCES or HARDWARE CONFIGURATIONS, then the summary view displays the label of "Mixed".

  - The detailed view of a *Scan* displays the *Subscans* and provides further functionality for an advanced user (see Figure 29).
    - *Subscans* can be appended, reordered, or deleted within a *Scan*.
    - In the Subscan editor, the `Subscan Intent` (labeled Intent), SOURCE (called Target), HARDWARE CONFIGURATION (called Band), `Acquisition Time`, and `Setup Time` can be changed. The `Subscan Intent` drop-down menu is a preset list of labels. The drop-down menus for Target and Band are limited to the SOURCES and HARDWARE CONFIGURATIONS, respectively, associated with the *Observation Specification*. If either is added manually through the filter tool, then it is also available.
  - If the ordering of the *Scans* is modified, the original Scan Number appears as grayed-out text. The *Scans* can be reordered in two ways.
    - A *Scan* can be moved via a "click-hold-drag" mouse action.
    - One or more *Scans* can be moved in bulk by first clicking the Edit button, by then selecting the row(s), and by finally specifying the placement via the "Move" drop-down menu. This also can delete *Scans* in bulk.
  - New *Scans* can be appended to the end of the *Scan List*.

    > **Bug**
    >
    > Adding or editing *Scans* and *Subscans* to the *Observation Specification* does not update the time estimates; this will be addressed when the functionality is expanded for an advanced user.

- If the *Scan List* is modified, it must be saved, and the `Status` will change from "System Generation" to "User Modified" for that *Observation Specification*. Once the `Status` is "User Modified", the *Observation Specification* no longer directly represents the *Capability Requests*.
- It is not possible to add a new *Observation Specification* manually in this release.

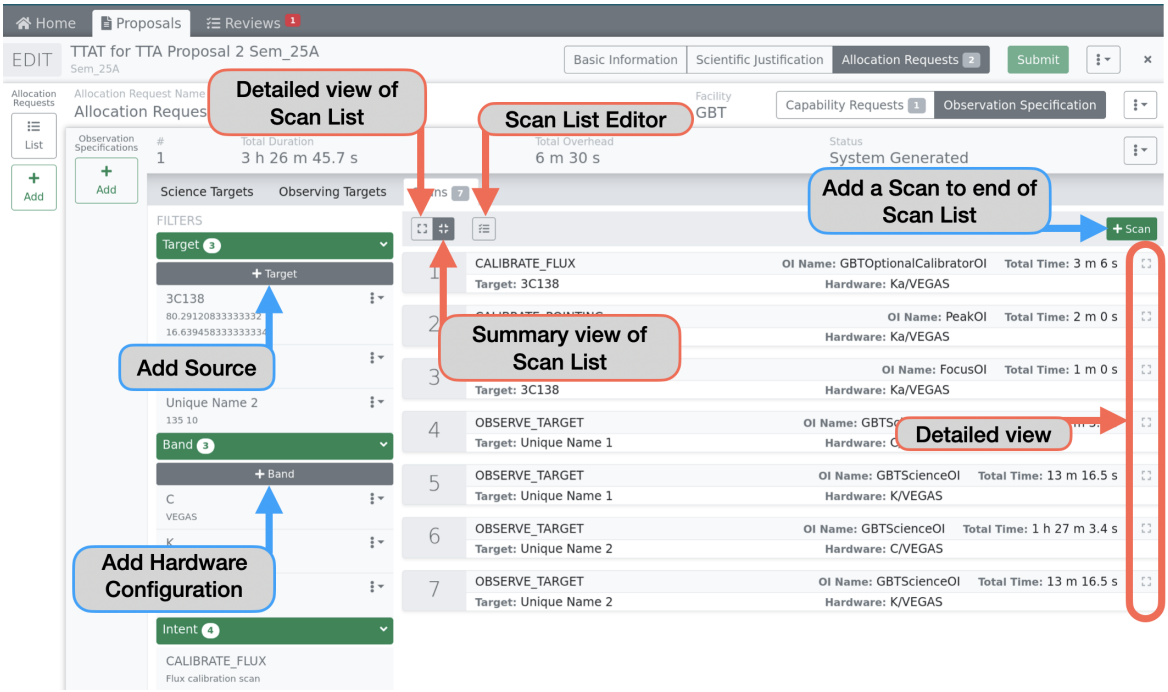


Figure 28: The Observation Specification panel. The filter panel lists the Targets (SOURCES), Bands (HARDWARE CONFIGURATION), and `Scan Intents` associated with the *Observation Specification*. SOURCES and HARDWARE CONFIGURATIONS can be manually added from within the filter panel.

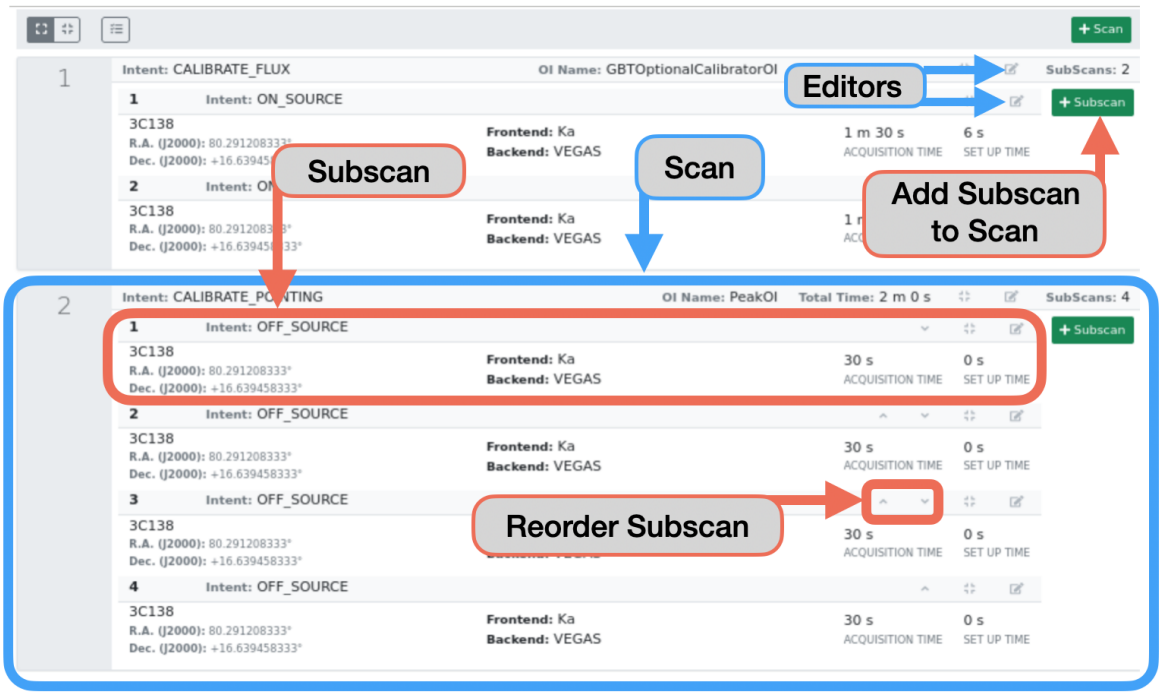


Figure 29: The Scan editor. *Scans* are composed of *Subscans*. The Scan editor allows access to the Subscan editor.

A | Auxiliary Features

A.1 | System Messages

There are different feedback mechanisms available to inform the user about the actions the application is taking.

- When a *Proposal* is saved in an editor (e.g., Basic Information editor, Capability Request editor, Observation Specification editor), a system message is displayed that either confirms the success of the action or gives an error message. On successful actions, a green banner is temporarily displayed at the top of the screen with the system message. If the action is unsuccessful, the banner is red. Within a *Proposal*, the history of the System Messages is maintained in an expandable list available on the bottom right of an editor; see Figure 17 for a reference.
- When a text field (e.g., `Radial Velocity`, `Center Frequency`) is modified within a *Proposal*, a yellow banner with the words "Changes Pending" and a blue Save button will appear and persist until either a save is successful via the Save button or the form is returned to the last saved state (e.g., the modifications are undone by the user). Figure 19 shows an example of the banner.
- Interactive prompts may pop-up that require the user to confirm an action.

A.2 | File Upload Tool

It is possible to upload files to specify FIELD SOURCES, SPECTRAL SPECIFICATIONS, and PERFORMANCE PARAMETERS. The file upload tool is available in the Field Source, Spectral Specification, and Advanced editors; the functionality is described below.

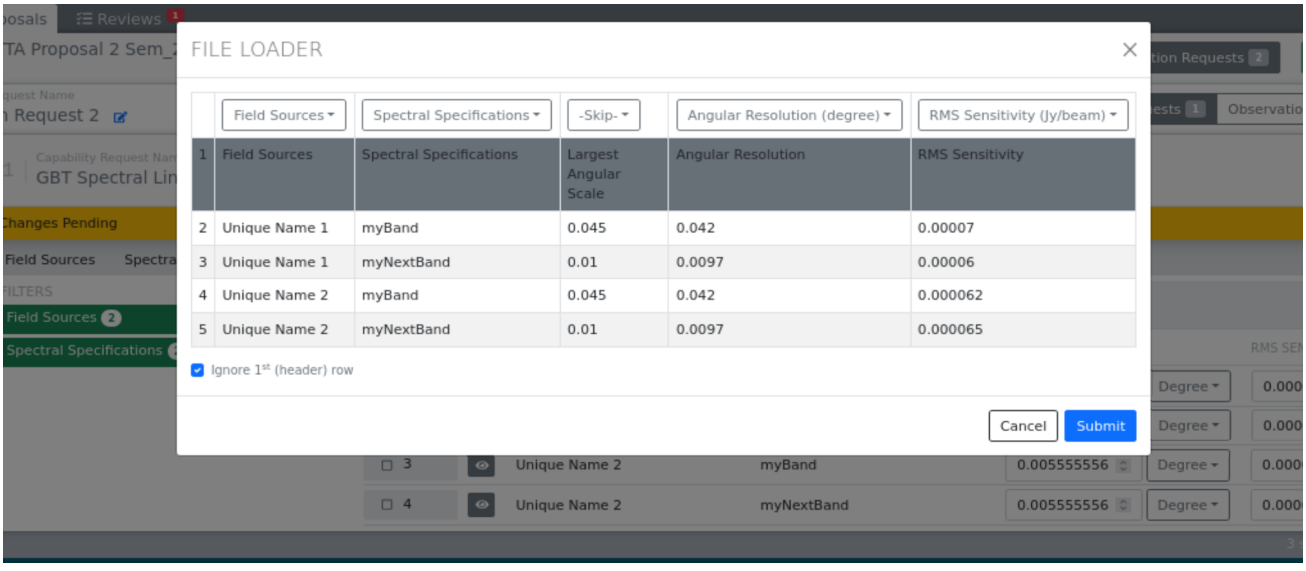


Figure 30: The file upload tool from the Advanced editor. The first row, which is a header in the file, will be ignored because the check box at the bottom left has been selected. In this example, the Advanced editor for a GBT *Capability* does not take the parameter of `Largest Angular Scale`, so the column is assigned the "Skip" keyword and will be ignored at upload. The other columns were automatically matched to the appropriate keyword.

- The uploaded file must be a CSV.

- The upload tool contains a row of drop-down menus that can be used to assign keywords to the file's columns. For a given editor (e.g., Field Source, Advanced), the drop-down menu contains a single set of keywords that map to the parameters in the UI for that editor. The set of keywords can depend on the domain of the editor (e.g., Field Source editor specifies parameters for the FIELD SOURCES), the *Capability*, and the *Facility*.

  Once a keyword is assigned to a column, it cannot be assigned to another one. It must be unassigned from a column in order to be reassigned to a different column. If a column is not matched or assigned to a keyword, it will be assigned as "Skip" and not uploaded. See Figure 30 for an example.

- The file can contain any number of columns, however the drop-down menu keywords are restricted to reflect the form entries in that editor. For example, only information corresponding to the FIELD SOURCE (e.g., `Coordinate Epoch`) will be uploaded by the tool associated with the Field Source editor, and SPECTRAL SPECIFICATION-like keywords are ignored.

- The first row of the uploaded file may be a header with the keywords the tool expects to assign. The upload tool will attempt to match the values of the file's first row to the expected set of keywords. If a match is found, the upload tool will automatically assign the keyword to the column. The user may then reassign the columns if needed. The keywords are listed below per *Capability*. Setting them as the header row in a file will ensure the columns are automatically assigned correctly on upload.

  – Field Source: GBT Spectral Line

  ```
  Name, Coordinate System, Right Ascension, Declination, Field of View Shape,
      FOV in RA, FOV in Dec, Radial Velocity, Velocity Reference Frame,
     Doppler Type, Parallax, Proper Motion in RA, Proper Motion in Dec, Peak
      Continuum Flux Density, Peak Line Flux Density, Line Width
  ```

  – Field Source: VLA Continuum

  ```
  Name, Coordinate System, Right Ascension, Declination, Field of View Shape,
      FOV in RA, FOV in Dec, Radial Velocity, Velocity Reference Frame,
     Doppler Type, Parallax, Proper Motion in RA, Proper Motion in Dec, Peak
      Continuum Flux Density
  ```

  – Spectral Specification: GBT Spectral Line and VLA Continuum

  ```
  Name, Center Frequency, Bandwidth, Spectral Resolution
  ```

  – Advanced: VLA

  ```
  Field Sources, Spectral Specifications, Largest Angular Scale, Angular
     Resolution, RMS Sensitivity
  ```

  – Advanced: GBT

  ```
  Field Sources, Spectral Specifications, Angular Resolution, RMS Sensitivity
  ```

- If the first row of the file is a header, then it is necessary to select the "Ignore 1^{st} (header) row" check box. Otherwise, the tool will attempt to import the row.

- The upload tool does not enforce units, though the column headings in the tool displays units to inform the user of the expected input. The units should **not** be included in a file's header though. Any Coordinate System may be specified for the `Coordinate System`, but the labels are ICRS-centric in the tool. The expected units are as follows:

- Degree
  - `RA`, `Dec`, `FOV in RA`, `FOV in Dec`, `Parallax`, `Angular Resolution`, `Largest Angular Scale`
- GHz
  - `Center Frequency`
- km s^{-1}
  - `Radial Velocity`, `Line Width`, `Bandwidth`, and `Spectral Resolution`
- Jy $beam^{-1}$
  - `Peak Continuum Flux Density`, `Peak Line Flux Density`, `RMS Sensitivity`
- mas yr^{-1}
  - `Proper Motion in RA` and `Proper Motion in Dec`

B | Definitions and Concepts

- An *Allocation Request* contains the details of the requested observatory resources.
- A *Capability* describes the different ways a *Facility* may be operated.
- A *Capability Request* contains the information supplied by the proposer that specifies the observations being proposed.
- A FIELD SOURCE holds the information specifying the astronomical object to be observed, which encompasses the position, the field of view, and the peak continuum flux density, for example. The requested information may depend on the *Capability*.
- A SPECTRAL SPECIFICATION contains the information that specifies the frequency information (e.g., bandwidth) for an observation. This information informs the selection of the HARDWARE CONFIGURATION. The information requested may depend on the *Capability*.
- The CALIBRATION PARAMETERS represent queues to the algorithm to trigger specific *Calibration* and *Scheduling Strategies*. For example, if the `Polarization Parameter` is selected, the user has indicated that accurate polarization properties are required, and the algorithm would return *Observation Specifications* that satisfy this requirement. The CALIBRATION PARAMETERS can also trigger additional calibration for a *Capability* that are not included by default. For example, a Flux Density Calibration is not necessarily a standard calibration for all GBT *Capabilities*, but a user may request it anyway.
- PERFORMANCE PARAMETERS encompass the information needed to specify the performance (e.g., RMS sensitivity, angular resolution) of a *Facility*. The details depend on the *Capability*.
- A HARDWARE CONFIGURATION contains details of the FRONT-END, BACK-END, and *Facility* configurations. A FRONT-END describes the instruments that exist on a telescope that usually reside at the beginning of the signal path. Primarily this refers to the receiver. A BACK-END describes the instruments that exist on a telescope that usually reside at the end of the signal path. Primarily this refers to the detector, often a correlator.
- *Observing Instructions* (OIs) are instructions detailing what calibrations are required for a Science Target and are designed to reflect current observing routines, such as those described

in the GBT Observing Guide[5]. There are many types of OIs, which are described in the TTAT Algorithms document; however, there are a limited set available in the current version of the algorithm, and their current implementation is not the final design.

- An *Observation Specifications* contain a *Scan List* and *Facility* specific information. The Observation Specification page contains general information about the *Observation Specifications* in the *Proposal*.
- A *Scan* contains one or more *Subscans* that share a `Scan Intent`. *Subscan* is the specification of the shortest, contiguous block of time over which an antenna is taking data.
- A Science Target consists of a SOURCE, a HARDWARE CONFIGURATION, and a `Requested Time`. An Observing Target is a generalization of a Science Target to include calibrators (i.e., a SOURCE not derived from a FIELD SOURCE), such that all Science Targets are Observing Targets, but not all Observing Targets are Science Targets.
- A SOURCE is derived from a FIELD SOURCE or created for a CALIBRATOR. A SOURCE is a normalized data structure that has a name, a Pointing Pattern, a nominal position from the Pointing Pattern. A Pointing Pattern describes the trajectory of an antenna over the course of an observation of a FIELD SOURCE.
- The `Status` is specific to the Observation Specification page and is either "System Generated" or "User Modified". The later indicates that the *Observation Specification* has been modified by the user and is not generated by the algorithm.
- There are many concepts and definitions of time in the system. The few that are directly referenced in the *Observation Specification* are described here.
  - The `Acquisition Time` is the time an antenna spends taking data in a *Subscan*.
  - The `Setup Time` is the sum of the time the antenna spends preparing for a observation, e.g., slewing, settling, or changing receivers. This is determined by the algorithm. In the application, it is in the detailed view of a *Scan* in an *Observation Specification*.
  - The `Requested Time` is the time specified for a Science Target in the *Science Target List*. It is determined by the algorithm.
  - In the Science Targets tab or the Observing Targets tab in the *Observation Specification*, the `Integration Time` can be either
    - the sum of the `Acquisition Times` for all *Subscans* on a Science Target with `Subscan Intent` ON_SOURCE and associated with a `Scan Intent` of OBSERVE_TARGET. This is greater than or equal to the `Requested Time` when all of these *Subscans* are complete. This is formally called the `Science Target Integration Time`.
    - the sum of the `Acquisition Times` for all *Subscans* of an Observing Target.
  - The `Total Duration` is the total time of all the *Scans* in a *Scan List*.
  - The `Total Overhead` is the `Total Duration` - `Science Target Integration Time`.
  - The `Total Time` of a *Scan* is the duration of all the *Subscans*, which includes `Acquisition Time` and `Setup Time`.

[5]GBT Observing Guide https://science.nrao.edu/facilities/gbt/observing/GBTog.pdf

C | Common Icons in the UI

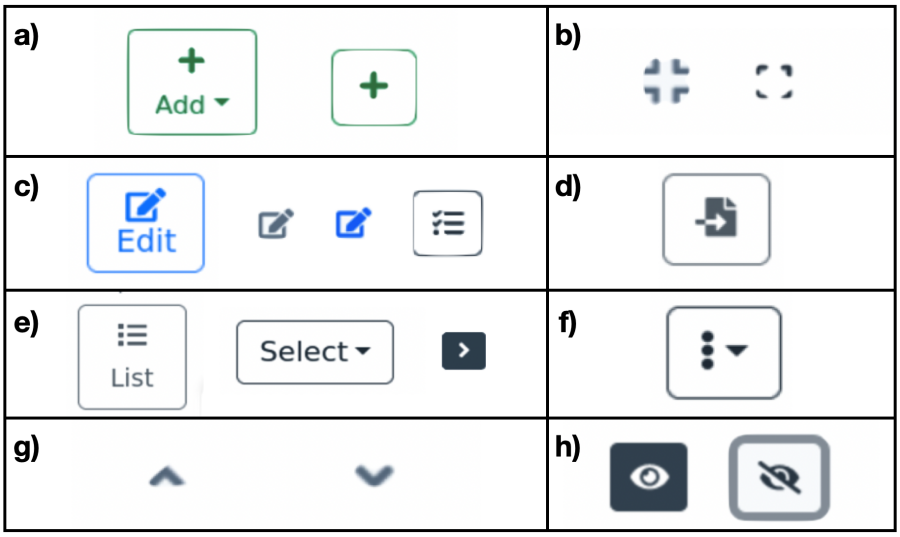


Figure 31: Common buttons in the UI. See text for the descriptions.

Figure 31 shows common buttons in the UI, which are described below.

a) Add an element to a *Proposal* e.g., *Capability Requests*, FIELD SOURCES, *Scan*.

b) Collapse or expand an element into a detailed or summary view e.g., *Scan*, *Subscans*.

c) Edit an element e.g., *Scan*, *Scan List*, name of *Capability Request*.

d) Upload a file.

e) Show (or expand) a list of elements.

f) Utility menu with functions such as delete and copy.

g) Move a *Subscan* up or down to reorder within a *Scan* (§ 5.4.10, Figure 29).

h) Toggle to include or exclude from the *Observation Specifications* (§ 5.4.8; Figure 24).

D | Potential Points of Confusion

There are known points for potential confusion, as well as bugs in the release. This section replicates important notes, warnings, and bugs that are called out within the main body of the document.

- There are two *Solicitations* configured for this review. Table 1 lists the frequency information associated with each *Capability* and *Solicitation*.
- The Reviews page is not accessible, as it is not implemented in this release. The small, red box in the Reviews tab is a placeholder for a notification system that is not yet implemented.
- There is no feedback from the UI on a successful save for the "Message of the Day".
- The Submit button is visible but inactive.

- For NRAO managed distributions of Firefox on macOS, there is not a thumbnail preview of the uploaded file and the View button prompts a download of the file instead of opening it in a new tab. This is controlled by a system preference that is managed by NRAO.
- Any form within the *Proposal* must be saved before navigating. Otherwise, changes are not persisted. However, it is not necessary to save when navigating between Field Source, Spectral Specification, Performance Parameter, Calibration Parameter, and Advanced editors within a single *Capability Request*. The system is designed to persist the information within a *Capability Request* without a save, as saving will trigger the creation of the *Observation Specification*(s). Unsaved changes to the *Capability Request* are not kept if navigated to other views like the *Observation Specification* or another *Capability Requests*. However, the UI does not warn the user of this consequence currently.
- The Save button becomes visible once an edit to a form is made; however, there is a bug that sometimes causes the Save button to not appear despite unsaved changes existing. The ways to trigger this include navigating between *Capability Requests* without saving first and deleting a *Capability Request* after *Observation Specifications* have been generated. The solution is to refresh; then if the button is still unavailable, make an inconsequential edit, such as to the name of the FIELD SOURCE. This will cause the Save button to reappear.
- There are a few display bugs in the position information, such as the incorrect labels in the HMS format. Additionally, entering a negative Declination in the DMS format will cause the display to change systematically to the wrong value. Converting the unit to degree, however, shows that the value the user provided is persisted.
- Once a modification is made to any entry in the Advanced editor, the changes made to the Performance Parameters editor will not affect the PERFORMANCE PARAMETERS. It is not currently indicated in the UI when the Performance Parameter editor is superseded by the Advanced editor.
- If any match fails, the displayed message indicates that all of the pairs have failed, even if there were successful matches. The changes are applied to the successful matches despite the message indicating a failure.
- The file upload tool does not enforce units, though the column headings in the tool displays units to inform the user of the expected input. The units should **not** be included in a file's header though. Any Coordinate System may be specified for the `Coordinate System`, but the labels are ICRS-centric in the tool.
- Unit conversions are available through the drop-down menus for some of the fields. The fields can be specified in any unit that is supported. However, once the form is saved or navigated away from, the displayed values and units will be converted to the defaults. This is not a desired feature; in a future release, the displayed values and units will reflect what the user specified.

  Coordinate Systems conversions are not supported.
- The drop-down menus display all of the options supported by the algorithm, even if the parameter is not configured in the *Solicitation*. For example, the `Field of View Shapes` that the algorithm can support are `point`, `ellipse`, and `rectangle`. The GBT Spectral Line *Capability* is configured only for `point`, such that the `FOV in Long` and `FOV in Lat` fields are not available in this *Capability*. However, the drop-down menu still displays the full list.
- Simple validation on the type of entry for each field is performed on a save. If a field has an

invalid entry, the field is outlined in red and an error message is displayed under the field. At this time, there is a default error message and it is cleared from the page promptly. This behavior is not desired and will change in a future release.

- FIELD SOURCES that share common `Long` and `Lat` parameters are merged when the algorithm generates the Science Targets. The proprieties of the resulting Science Target reflect the first FIELD SOURCE of the pair. The resolution order to determine the first FIELD SOURCE is the order of the FIELD SOURCES in the Field Source editor and then the ordering of the *Capability Requests*. The positions must be an exact match to merge currently; the UI does not provide feedback to indicate that a merge has occurred.
- The sensitivity calculations are simple placeholders for now, but they are *Capability* specific. Other considerations will affect the `Requested Time` calculation in the future.
- The UI does not provide feedback to indicate the cause of failure to generate an *Observation Specification*, as validation is not performed on the *Capability Request* currently.
- There is a bug in the generation of *Observation Specifications* that does not properly clear a previously generated *Observation Specification* if the new one is invalid. This can be replicated by first generating a successful *Observation Specification* and then by modifying the *Capability Request* in such a way that the changes generate an invalid *Observation Specification*. For example, changing the `Center Frequency` to a band that is not supported in the *Solicitation* will cause an invalid *Observation Specification* but the prior existing *Observation Specification* will still be shown.
- The displayed units for coordinate information in the Observation Specification editor are not consistent. For some calibrators, the RA unit should be hours instead of degrees. The filter panel does not have units associated with the coordinate information either. The display is also exclusively in ICRS.
- The add SOURCE and HARDWARE CONFIGURATION feature is limited in the *Observation Specification*, as the full functionality to support an advanced user is under development.
- Adding or editing *Scans* and *Subscans* to the *Observation Specification* does not update the time estimates; this will be addressed when the functionality is expanded for an advanced user.
- If the `Peak OI` or `Focus OI` is listed first in the *Scan List*, then it incorrectly displays "0th Scan" for the Target name.
- For the GBT, the spectral and coordinate information associated with calibrator scans is currently limited. The SOURCES are either 3C138, 3C84, or 3C286; the HARDWARE CONFIGURATION is always set to "Ka/VEGAS".
- For the VLA, the spectral and coordinate information associated with the calibrators is limited. The SOURCES are either 3C138, 3C84, or 3C286; the HARDWARE CONFIGURATION is equal to that of the Science Targets.
- If the *Subscans* within a *Scan* have non-unique SOURCES or HARDWARE CONFIGURATIONS, then the summary view displays the label of "Mixed".
- A *Capability Request* can be modified after the *Observation Specifications* have been generated. However, once a save is requested, all of the *Observation Specifications* associated with the *Allocation Request* will be regenerated, discarding any changes the user may have made to the *Observation Specifications*.

  There is not a one-to-one mapping between the *Capability Request* and the *Observation*

Specifications. As such, a save within any one *Capability Request* in an *Allocation Request* will (re-)generate all *Observation Specifications* for that *Allocation Request*.

E | F.A.Q.

The Save button is gone but the Observation Specification *does not reflect the current state of the Capability Requests.*

- This can occur when the form is navigated away from without saving. It can also occur if a *Capability Requests* is deleted after *Observation Specifications* have been generated. The solution is to refresh; then if the button is still unavailable, make an inconsequential edit, such as to the name of the FIELD SOURCE. This will cause the Save button to reappear.

Why won't an Observation Specification *generate?*

- Check that there is not an empty *Capability Request* in the *Allocation Request*. Delete it if there is.
- Check that there are not any blank FIELD SOURCES and SPECTRAL SPECIFICATIONS in a *Capability Request*.
- Check that the `Center Frequency` in each SPECTRAL SPECIFICATION corresponds to a band that is available to the *Solicitation*.

Why won't the file upload tool automatically detect the heading of my file?

- Compare the header to the list of keywords in Section A.2. Though the file upload tool's drop-down menus include units, the header should not include the units.