BIGCAT Scheduler User Guide (V4.0 – 09 June 2026)

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The BIGCAT Scheduler WebApp is designed to organise all of your scheduling material prior to observing with the ATCA. It allows you to group scheduling material by project (observing code) so that schedule materials can be easily shared between different members of a project team. To produce a schedule, you will use three main areas on the scheduler webpage:

- The target list – this displays the list of targets associated with a specific project.
- The correlator configuration – this allows you to specify the mode in which you want to observe (e.g. continuum, spectral line zooms, VLBI).
- The schedule file – this allows you to specify the order in which targets are observed, time on source, observing band etc. and it is what you will deploy to CAOBS prior to beginning your observations.

Below is an outline of how to get started with each component of the Scheduler.

Access the scheduler

The BIGCAT Scheduler can be accessed via this link: https://scheduler.bigcat.tools.atnf.csiro.au/

You will need to register and create an account. Use the sign-up option to sign-up for an account.

★ Note that the Scheduler username/account is NOT directly linked to your opal account or Unix account. However, in order to access schedules connected to your ATCA project (proposal code), you should use the same email address as you used to register for OPAL.

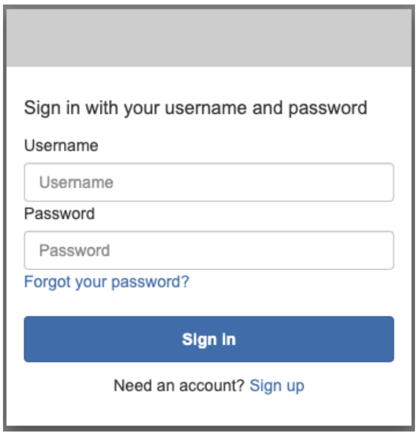

Figure 1: Logging in with your credentials

Create a new project

Once you login, you will be taken to the scheduler landing page, which will display options to either create a new project, open an existing project or import from a previously created project from your local machine. A project is a collection of files that can be used to generate a schedule for performing observations.

★ At this stage, you should see directories for each proposal code you are associated with in OPAL when selecting either 'Create Project' or 'Open Project'. If you *do not* see these directories, please log out and log in again to ensure that your scheduler account is successfully connected with your OPAL account.

To create a new project, click on "Create Project" and choose an appropriate name for the project (e.g., "HI-observations", "Spectral-line observations"). Note that you should see directories for all proposal codes you are associated with, plus a personal "workarea". The directories listed under proposal codes are shared with all members of that proposal, while your "workarea" is personal and only visible to you. Select the appropriate directory for the new project to reside in.

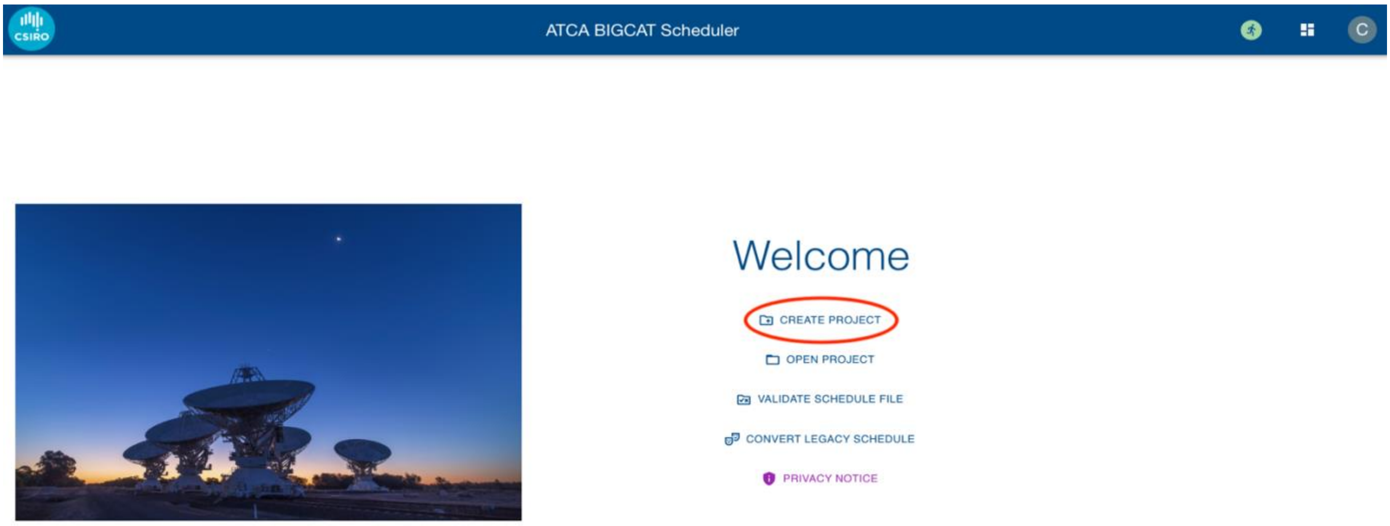

Figure 2: Landing page after logging in. You can create new projects or open existing ones.

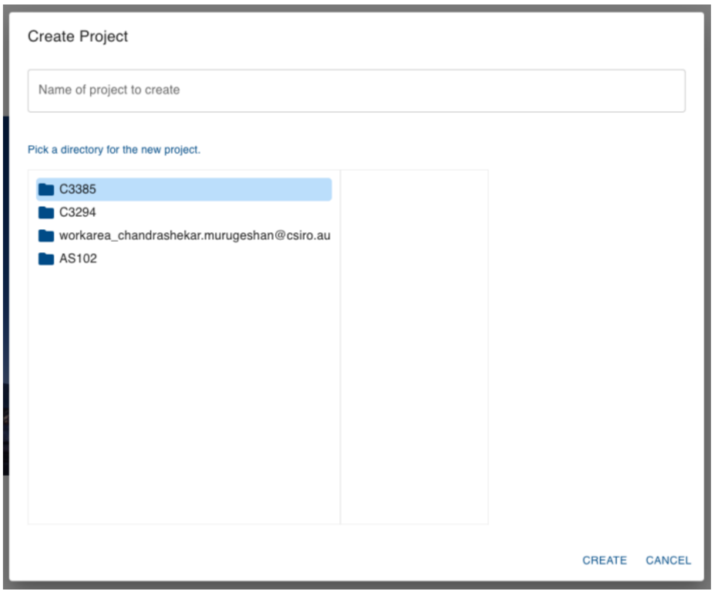

Figure 3: Name the project appropriately and select the directory where the project will reside.

Once you create a new project, you will be taken to a new project page, where you will find an empty target list. You can add your targets using the “ADD” button on the top right corner, or alternatively, you can also upload a CSV file from your local machine containing all the target sources using the format that you can find by clicking on ‘SAMPLE’.

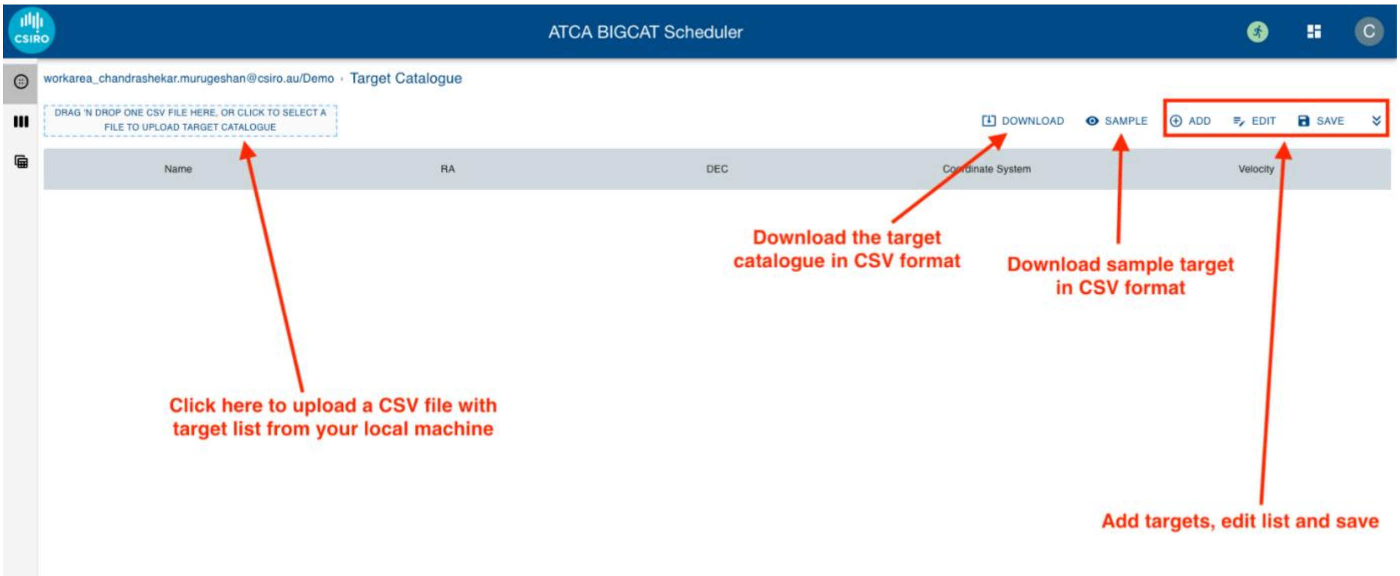

Figure 4: Layout of an empty project. One can add target sources manually or by uploading a targets list in CSV format.

The targets CSV file consists of information about the source such as its name, RA, Dec, coordinate system used (e.g., J2000, B1950, Galactic, AzEl) and (optionally) the radial velocity of the source (in km/s) in the LSR or Barycentric frames, using the radio or optical velocity convention or the redshift of the source.

★ If you want to upload your own CSV of targets, the values *must* be comma separated. Any lines beginning with a hash sign (#) will be read as comments and ignored by the scheduler. An example "targets.csv" file is shown in Fig. 5.

```
# coordinate system: J2000, B1950, AzEl, Galactic
#   J2000: RA (hh:mm:ss) Dec (dd:mm:ss)
#   B1950: RA (hh:mm:ss) Dec (dd:mm:ss)
#   Galactic: Long (dd.dd) Lat (dd.dd)
#   AzEl: Az (dd.dd) El (dd.dd)
#
# velocity (optional):
# km/s Frame (lsr/barycentric) Convention (radio/optical/z)
#
# name, ra, dec, coord_sys, velocity
1934-638, 19:39:25.026, -63:42:45.630, J2000, 32.72 lsr radio
0047-579, 00:49:59.473, -57:38:27.330, J2000, 12 lsr radio
test_b1950, 00:47:48.158, -57:54:47.166, B1950
test_galactic, 303.20059, -59.33453, Galactic
test_az_el, 67.02, 45.00, AzEl
```

Figure 5: An example targets list file.

Once you upload your CSV file, you will find that the project page is now populated by the target list. Note that you can "ADD" and/or "EDIT" the target list and save the progress anytime. This is shown in Fig. 6.

Figure 6: The project page now reflecting the populated targets list.

Choose the correlator modes

Next, you should specify the correlator configuration required for your observations. Click on the "Correlator Config" button on the top left (three vertical bars, highlighted in Fig. 7) to create new correlator modes. You can also upload pre-existing BIGCAT correlator configurations in JSON format.

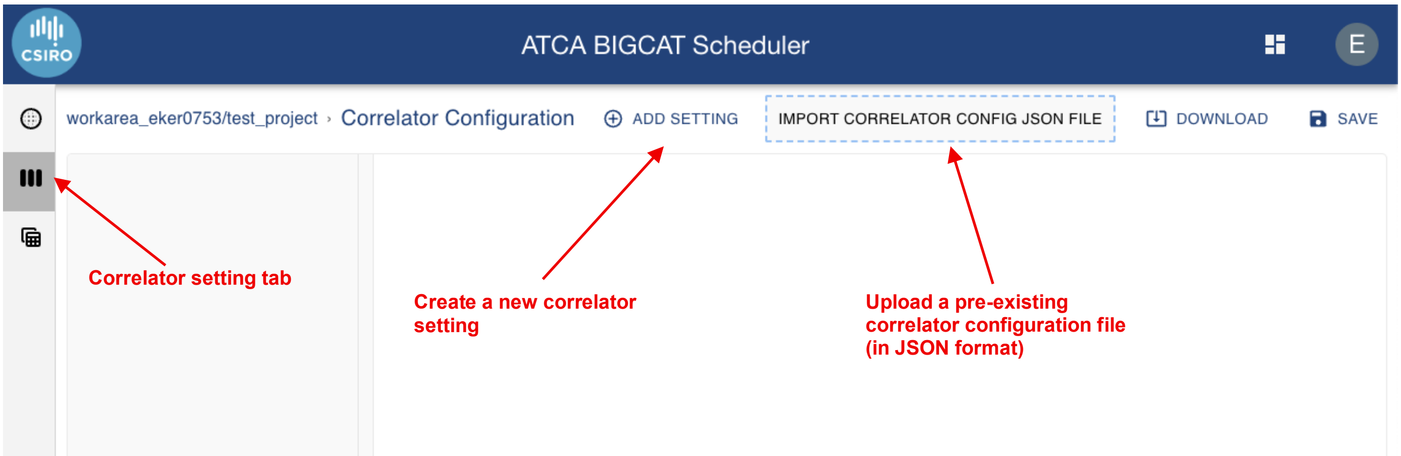

Figure 7: The correlator configuration page.

You can create several modes which can then be used in your schedule file later on. Just make sure to save any correlator configuration(s) before moving on to create the schedule.

The frequency bands supported are:

- 16cm: 1.0 – 3.3 GHz
- 4cm: 4.1 – 12.3 GHz
- 15mm: 15 – 25 GHz
- 7mm: 30 – 50 GHz
- 3mm: 83 – 105 GHz

Within each band, there are many possible configuration modes. For more information on these, click on the question mark symbol in the scheduler ? (see Fig. 8 below).

To create a new correlator configuration setting, click the "Add Setting" button. This will create a "blank" setting such as Fig. 8. Then choose a name (anything is suitable), select the receiver and then the correlator setting.

At this stage a default centre frequency will be chosen for your set up. If required, this can be changed for receivers with > 8 GHz bandwidth. For the 4cm receiver there are no tuning options, and the frequency is greyed out.

You can also select a "Band Setting" (to the right of the "Centre Freq" field) if you wish to specify the exact range of the receiver. However, this option can generally be ignored and defaults to "midlow". If you wish to tune to the very edge of the receiver range, you may need to change to an alternative.

★ If you wish to observe the 12.2 GHz methanol maser transition, the "Band Setting" needs to be set to "high".

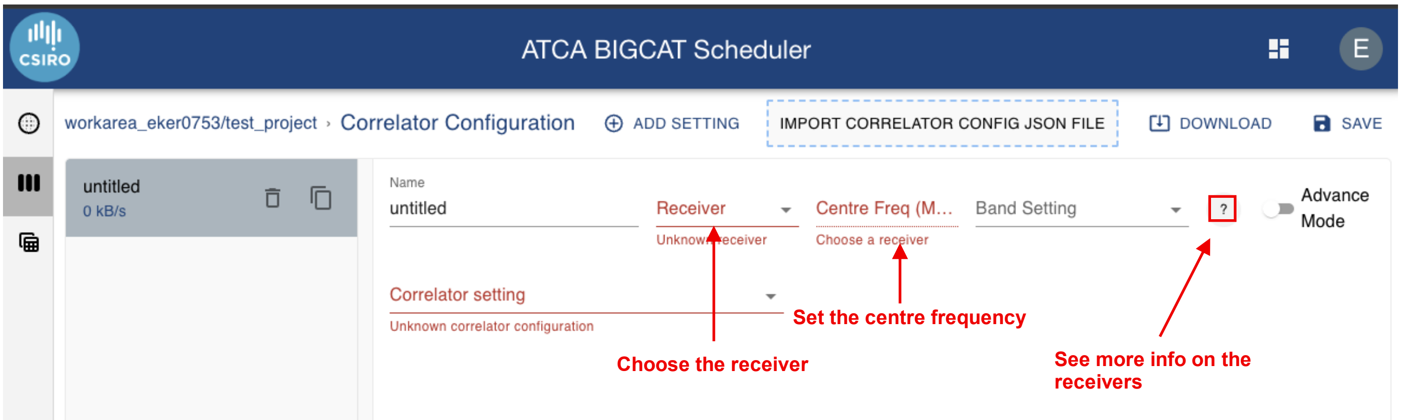

Figure 8: Setting-up a new correlator configuration for the observations.

For even more details on the frequency setup, please see:
https://www.narrabri.atnf.csiro.au/observing/bigcat/bigcat_rf.html and
https://www.narrabri.atnf.csiro.au/observing/bigcat/bigcat_rf_calculator.html

★ Note that for the 7mm system, the 8 GHz IF cannot be tuned across the entire 30-50 GHz and is broken into a "LSB" and "USB" range. For the LSB, the tuning range of the ***centre*** frequency is 33 840-37 632 MHz and for USB the central tuning range is 44628-46158 MHz. The highest/lowest frequency covered is then +-3840 MHz from this frequency. For example, 40 000 and 42 000 MHz cannot be observed at the same time.

There are many pre-set configuration settings available, and these are being actively developed to reflect the needs of the community. Currently, the available modes are separated into 'Normal' and 'Advanced' settings. The Advanced settings can be accessed by toggling the tab on the right, as shown in Fig 9.

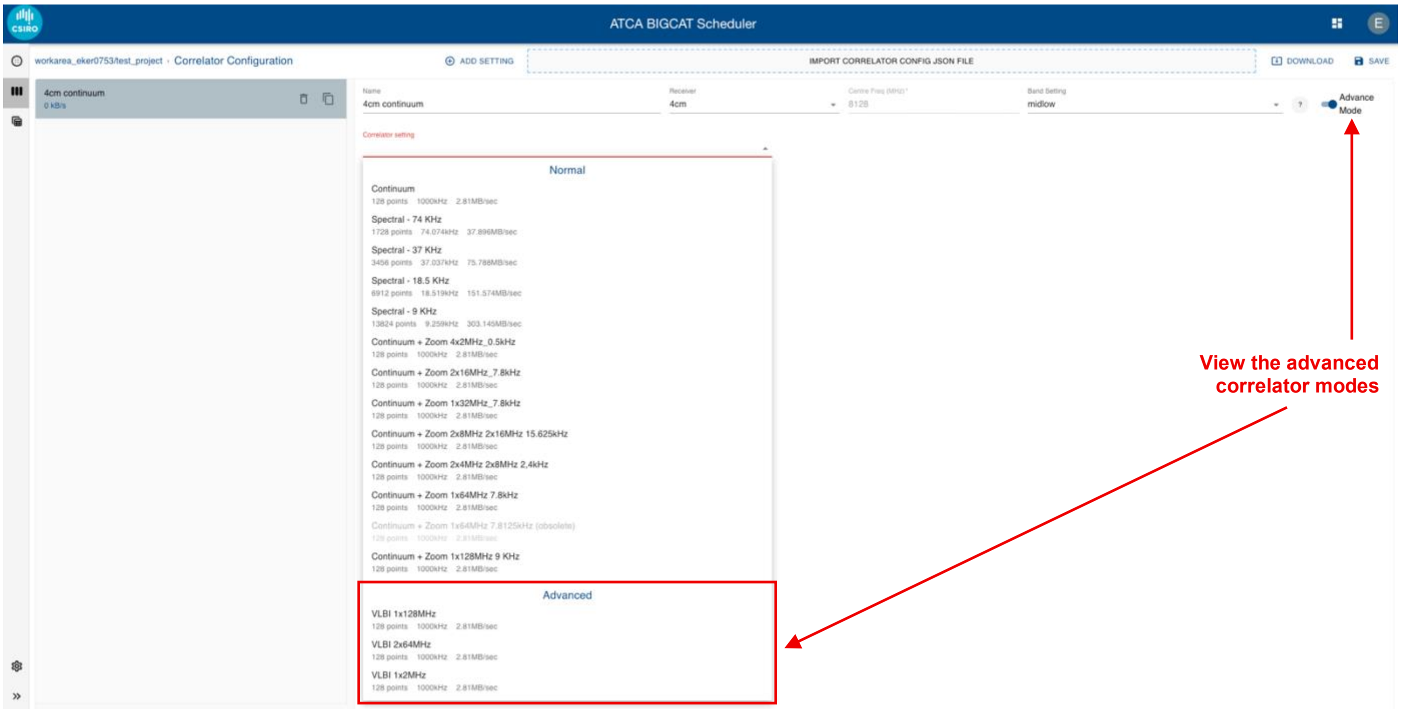

Figure 9: Showing advanced correlator settings.

The correlator modes currently available are given in Table 1, but these may be updated in the future. Note that the total number of zooms offered is *per 128 MHz subband,* so in theory you could have 60 zoom bands in a 'Continuum + 1 zoom' correlator mode (1 for each of the 60 subbands), but in practice it is unlikely that such a setup would be scientifically necessary. Furthermore, while there is no hard limit to the number of zooms, there are GPU resource limits. Each currently offered configuration is benchmarked to decide the total number of zooms per sub-band. There is also a total visibility data rate limit, so not every zoom will be active in general (i.e., some sub-bands may have all zooms active, but some only 1 or 2 and the rest none).

Mode	**Description**
Continuum	1MHz channels across the entire 128 MHz bandwidth
Spectral – 74 kHz	1,728 Channels per 128 MHz sub-band with a spectral resolution of 74 kHz.
Spectral – 37 kHz	3,456 Channels per 128 MHz sub-band with a spectral resolution of 37 kHz.
Spectral – 18.5 kHz **	6,912 channels per 128 MHz sub-band with a spectral resolution of 18.5 kHz. **Experimental – this mode is available in the Scheduler, but is still being tested and stability is not currently guaranteed.**
Spectral – 9 kHz **	13,824 channels per 128 MHz sub-band with a spectral resolution of 9 kHz. This mode is only available for observations in the 16 cm (L/S) band. **Not currently supported – this mode is available in the Scheduler, but is still being implemented by the observatory. It will eventually be made available for the 16cm band only.**
Continuum + Zoom 4 x 2MHz_0.5kHz	Continuum plus up to 4 zooms per 12 MHz sub-band, with zoom windows having a total bandwidth of 2 MHz and a spectral resolution of 0.5 kHz.
Continuum + Zoom 2 x 16MHz_7.8kHz	Continuum plus up to 2 zooms per 128 MHz sub-band, with zoom windows having a total bandwidth of 16 MHz and a spectral resolution of 7.8 kHz.
Continuum + Zoom 1 x 32MHz_7.8kHz	Continuum plus up to 1 zoom per 128 MHz sub-band, with zoom windows having a total bandwidth of 32 MHz and a spectral resolution of 7.8 kHz.
Continuum + Zoom 2 x 8MHz 2 x 16MHz 15.625kHz	Continuum plus up to 4 zooms per 128 MHz sub-band, with 2 zoom windows having a total bandwidth of 8 MHz, 2 with a bandwidth of 16 MHz and a spectral resolution of 15.625 kHz.
Continuum + Zoom 2 x 4MHz 2 x 8MHz 2.4kHz	Continuum plus up to 4 zooms per 128 MHz sub-band, with 2 zoom windows having a total bandwidth of 4 MHz, 2 with a bandwidth of 8 MHz and a spectral resolution of 2.4 kHz.
Continuum + Zoom 1 x 128 MHz 9kHz	Continuum plus up to 1 zoom per 128 MHz sub-band, with a total bandwidth of 128 MHz, and a spectral resolution of 9 kHz.
Advanced modes	
VLBI 1 x 128MHz	One spectral window of 128 MHz for VLBI science.
VLBI 2 x 64MHz	Two spectral windows of 64 MHz for VLBI science.
VLBI 1 x 2MHz	One spectral window of 2 MHz for VLBI science.

Table 1: Currently offered correlator modes.

★ When selecting a correlator mode the Scheduler provides estimates of the associated data rate per second. As expected, the 'Spectral' correlator modes have by far the highest data rates, as the high spectral resolution data is provided across the full 8 GHz bandwidth (2GHz with the 20cm receiver). In particular the 18.5 kHz and 9 kHz Spectral modes have data rates which exceed those for VLBI observations. **Please be mindful when selecting your correlator mode that you only choose a spectral resolution and bandwidth that is needed for your science case.**

Zoom modes

For correlator modes with the option of adding zooms, you can set-up the zoom windows using the "ADD ZOOM BAND" button to the right (see Fig. 10). This will add a new zoom window, and you can set the centre frequency of the zoom window.

If you are observing a spectral line, you can use this option to search the specific line using the "OPEN VELO" tab on the top right (see Fig. 10), select your target to figure out exactly where the zoom window should be placed.

★ Note that you will need to specify the UTC date of your intended observations in order for the scheduler to correctly calculate the sky frequency of the lines, as the Doppler correction changes throughout the year. This can be done using the 'UTC date' field.

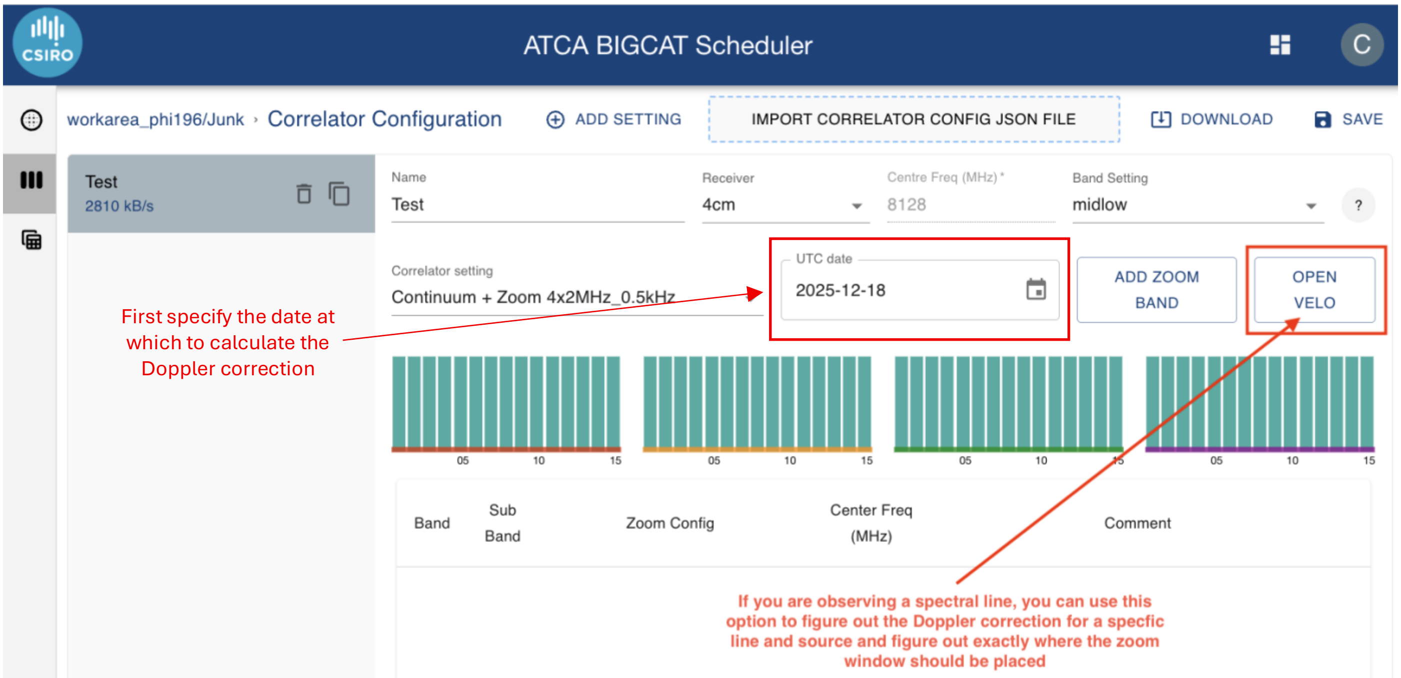

Figure 10: Adding the zoom windows and setting the appropriate centre frequencies for the zoom windows.

Select any of your sources from the dropdown "Targets" and select the rest frequencies of the lines you are interested in – either select from the default list or add the rest frequency (in MHz) by hand and click "Calculate". Any lines which are not covered by an existing zoom will be highlighted red. See Fig. 11.

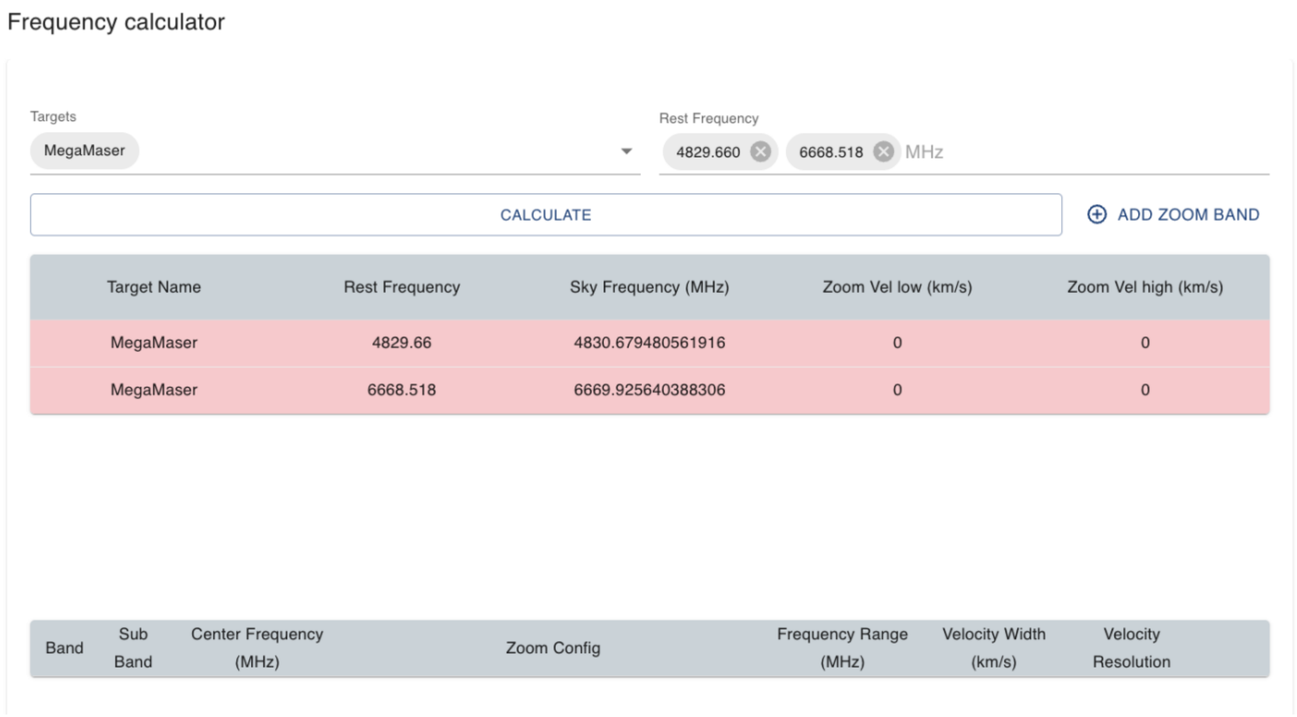

Figure 11: The velocity calculator

To add more zoom bands, click “Add Zoom band” and set the centre frequency of the zoom and the specific zoom you are adding. For settings which have one zoom per subband you can always select (for example) zoom1. Once you have added the zooms you want, click “Update”.

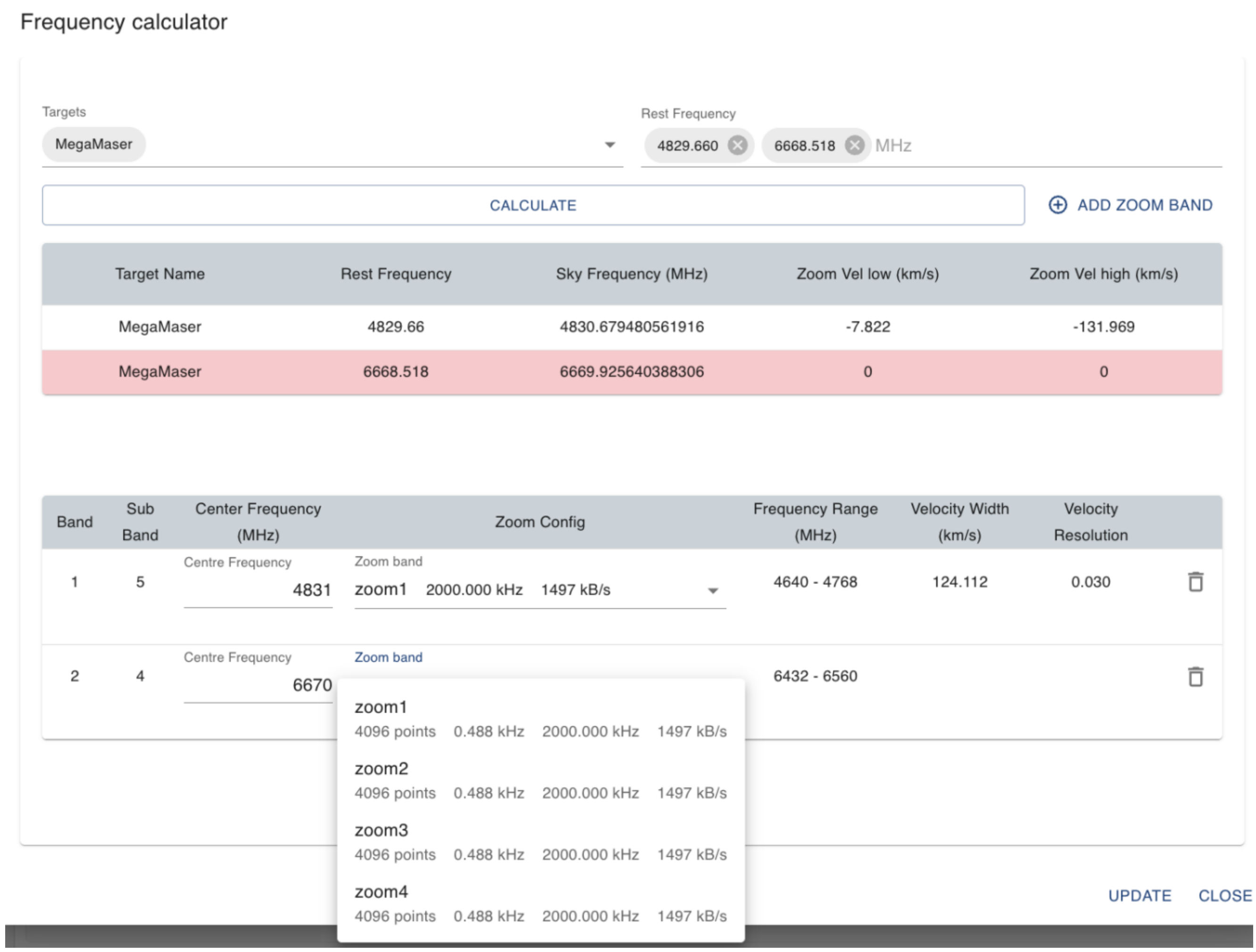

Figure 12: Adding zooms in the velocity calculator

Create schedule files

Once the correlator configurations have been set-up, you are now ready to make the schedule file for your observations. Click on the schedule file button on the left and select "New Schedule File" and give it an appropriate name. Fig. 13 below shows the layout of the scheduler page.

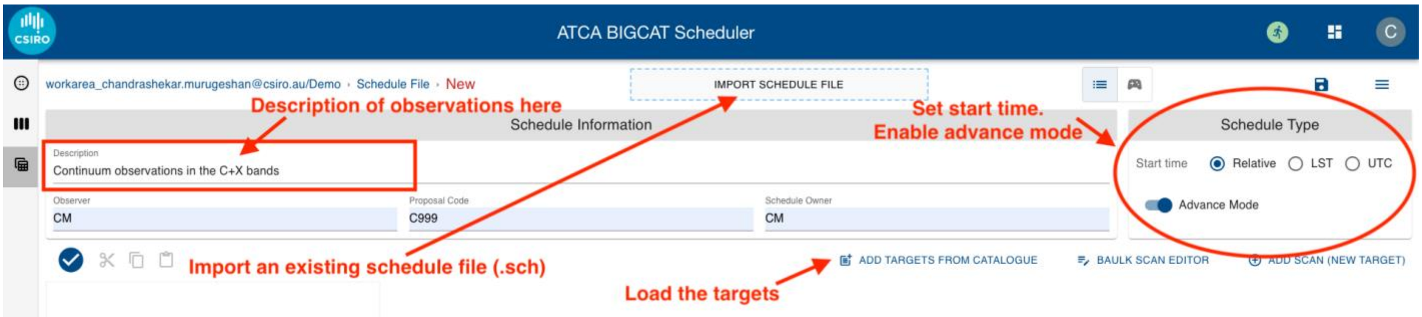

Figure 13: Creating a new schedule file.

At a minimum, you should enter a brief description of your observations in the "Description" field, and provide your project code in the relevant field. You should also add details of the observer and schedule owner, and enable the "Advanced Mode" option to give additional control over the scheduling (e.g. running commands between scans, specify the wrap).

To add targets, use the "ADD TARGETS FROM CATALOGUE" or "ADD SCAN" buttons on the right (see Fig. 14). Optionally, if you already have a schedule file (in .sch format), you can upload that to set-up the scheduler.

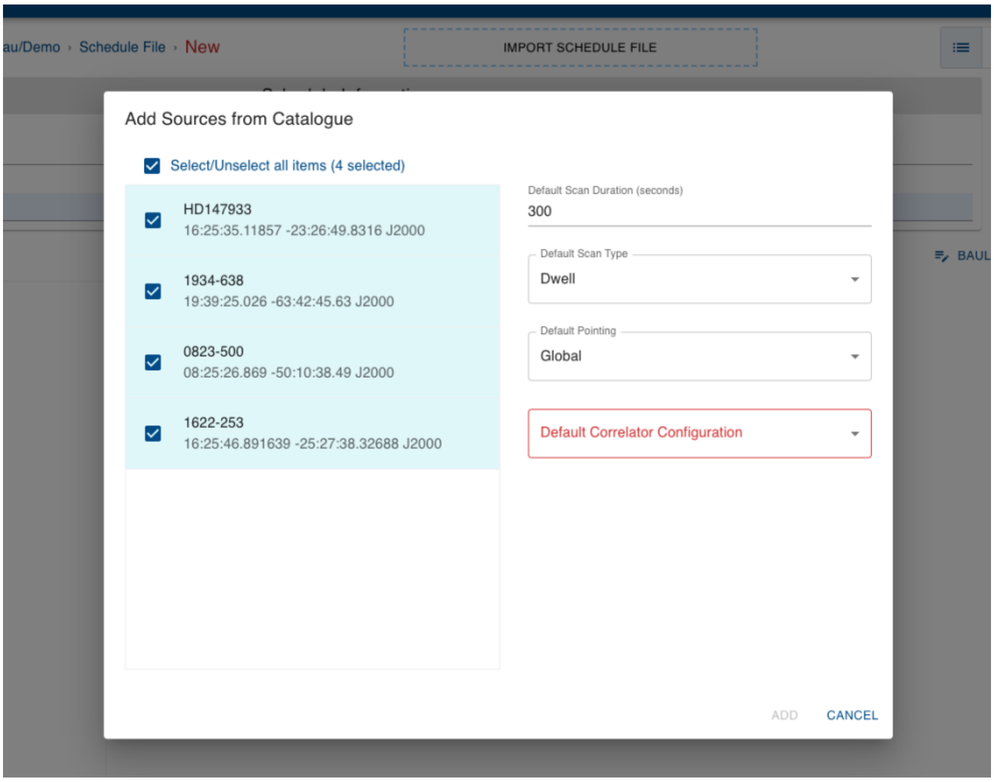

Figure 14: Adding sources from the catalogue into the schedule file.

Intents, scan types and correlator configuration

You can edit each target/scan to specify all the options that were previously available with CABB. This includes specifying the correlator configuration, the scan duration, the pointing type and the scan type. The BIGCAT scheduler introduces an additional field for "intents". This is described in more detail below, in contrast to the familiar "scan type" field.

<u>Scan Type</u>: this field is used in the same way as in CABB schedules. The selection will determine how CAOBS performs observations of this target.

<u>Intent</u>: this field provides a number of check boxes, and you can select multiple options for each scan. The intents should be treated as metadata, they do not affect how observations are performed but can be used during data processing (note that scan intents can currently be parsed in CASA but not MIRIAD)

For "Correlator Configuration", only those configurations you created before in the correlator mode settings will be reflected in the options. This is shown in Fig. 15 below.

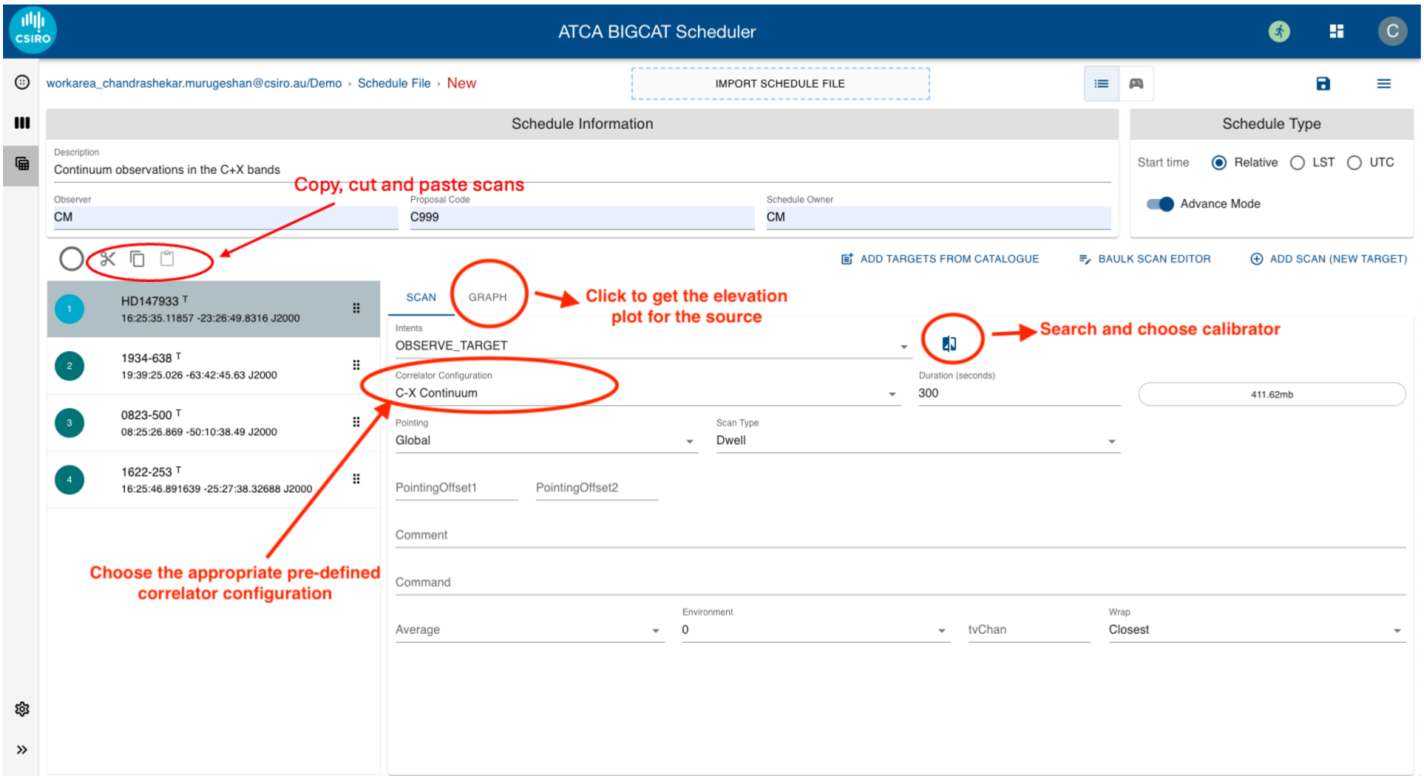

Figure 15: Once the targets have been added, we can choose appropriate calibrators and check the elevation plots for the selected sources as shown in the figure. Reorder the scans using copy/cut and paste if click and drag does not work.

To check the elevation plot for the selected source, click on "GRAPH" tab highlighted in Fig. 15.

★ To reorder scans, the scheduler does support "click and drag" but user feedback has shown this is not always reliable. Another alternative is to select a scan and then copy/cut and paste it to a different location in the schedule using the buttons above the list of scans, also shown in Fig.15.

Pointing and Paddle scans

Pointing and Paddle scans are required for high frequency observing with the mm receivers. The pointing scan updates the global pointing solutions of the telescope for more accurate positioning of targets at the centre of the primary beam, which becomes critical for mm observing since the primary beam shrinks in size. Paddle scans track the system temperature in the absence of an injected noise source. In general, the requirements are:

- 7mm receiver – pointing scan once per hour, and/or for every ~20° patch of the sky
- 3mm receiver – pointing scan (same cadence as above) and paddle scan as often as required based on the timescale of variations in Tsys (e.g. once per calibrator-target observing cycle). Once every 20 minutes is usually sufficient when weather conditions are good and stable, but more frequent paddle scans may be required under different circumstances.

To create a pointing scan, create a new scan of a bright (≥ 1 Jy) calibrator close (≤10°) to your target, set the 'Scan Type' to 'Point' and the 'Pointing' to 'Update', as shown in Figure 16 below. The scan intent should automatically update to 'CALIBRATE_POINTING'.

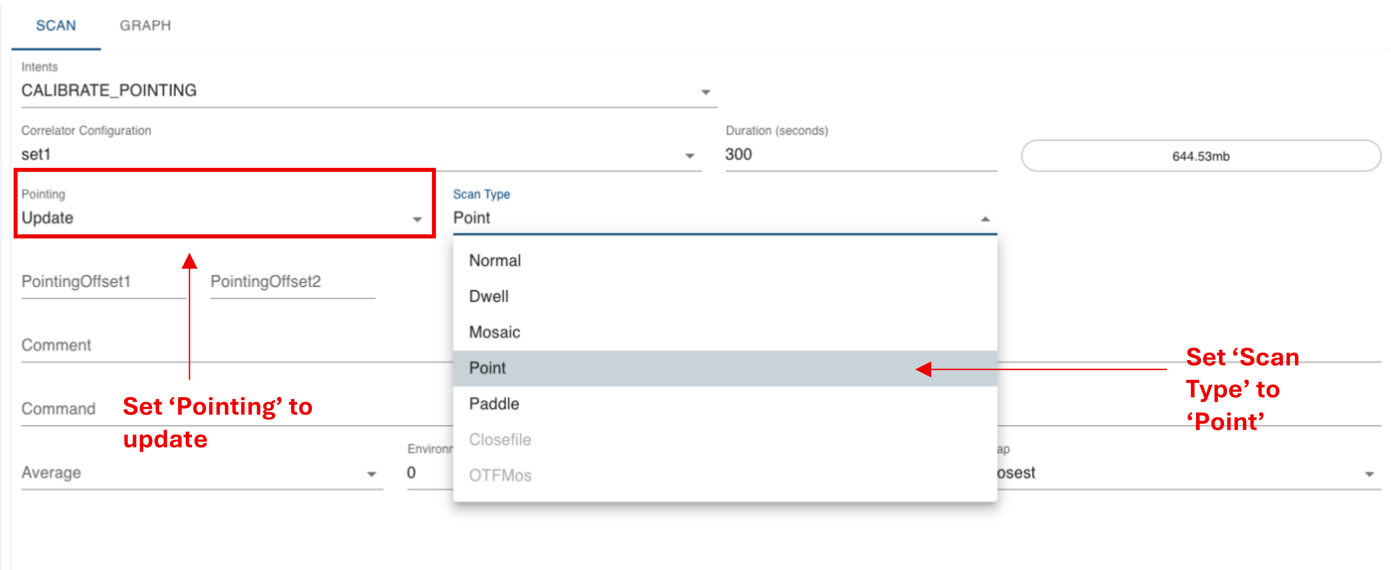

Figure 16: Creating a pointing scan.

★ If you are putting pointing scans in your schedule, make sure that any subsequent scans of calibrators and targets using the mm receivers have 'Pointing' set to either 'Offset' (use the most recent pointing solutions) or 'Offpnt' (use the best pointing solution available from the last 2 hours, useful if your targets are in different parts of the sky and you do multiple pointing scans across different regions). If you specify 'Global' at any point in your schedule and then want to switch back to 'Offset'/'Offpnt' pointings, you will need to do another pointing scan.

To create a paddle scan, do the same as above but set the 'Scan Type' to 'Paddle', and set 'Pointing' to 'Offset'.

Note that the duration you specify for a pointing and paddle scan is irrelevant at this stage – their length is fixed. A Paddle scan will always take 60 seconds, and a pointing scan 150 seconds, irrespective of what you enter into the 'Scan Duration' box. However, for the purposes of accurate simulations, it is recommended to enter these values into your schedule.
For more information on pointing and paddle scans, see the users guide:
https://www.narrabri.atnf.csiro.au/observing/users_guide/html/atug.html#observations-scheduling

Targets, calibrators and source names

If you have a list of science targets, but you have not yet chosen appropriate calibrators, you can find these from within the scheduler tool.

With a science target selected, click on the calibrator icon highlighted in Fig. 16. This will open a new window, which will display all calibrators within 20 degrees of the target and display the flux in each frequency band. The frequency band selected for the current observations will be highlighted in blue. Click on the + button on the right to select a calibrator. An example list of calibrators around a target is shown in Fig. 17, below.

- ★ For those observing with the 3mm/7mm receivers which require pointing and/or paddle scans, it is recommended to append P (for "point") or Pd (for "paddle") to scans of this type. Although appending to the scan names does not affect any observing procedures, you may find it makes data reduction easier since you will be able to easily separate these out from science-critical observations.


Calibrators near HD147933

				Flux Density (Jy)				
Distance	Name	RA	Dec	16cm	4cm	15mm	7mm	3mm
2.014°	1622-253	16:25:46	-25:27:38	1.160	2.031	1.566	1.095	2.170
4.818°	1643-223	16:46:04	-22:27:59	0.780	0.376	0.058	0.024	0.002
6.411°	1622-297	16:26:6	-29:51:26	1.959	1.667	0.961	0.870	1.577
7.595°	1602-174	16:05:02	-17:34:14	0.851	0.274	0.029	0.005	0.052
7.689°	1622-310	16:25:55	-31:08:08	1.042	0.537	0.227	0.178	0.085
8.003°	1550-269	15:54:02	-27:04:40	0.968	0.896	0.620	0.403	0.328
8.420°	1647-296	16:50:39	-29:43:46	0.487	0.271	0.810	0.339	1.353
8.464°	1657-261	17:00:53	-26:10:51	1.048	2.199	2.011	3.180	1.281

CLOSE

Figure 17: A list of calibrators for a target. The columns show the angular separation between the target and the calibrator, name, RA and Dec, and the flux densities in the various frequency bands.

Simulations

Once you have a draft schedule in place, you may wish to check its expected performance using the 'Simulation' tab in the scheduler. In order to run a simulation, you should first specify the date of your observations and the planned array configuration. At this stage you can initialise a simulation that exactly follows your schedule file by pressing 'RUN SIMULATION', or if you intend to follow a different observing strategy, you can enter the commands you would give CAOBS into the 'Instructions' text box. These elements of the simulator are shown in Figure 18.

★ Note that the first time you run the simulator it may be slightly slow (~10s of seconds), as it may need to download certain updates for the Astropy package it depends on.

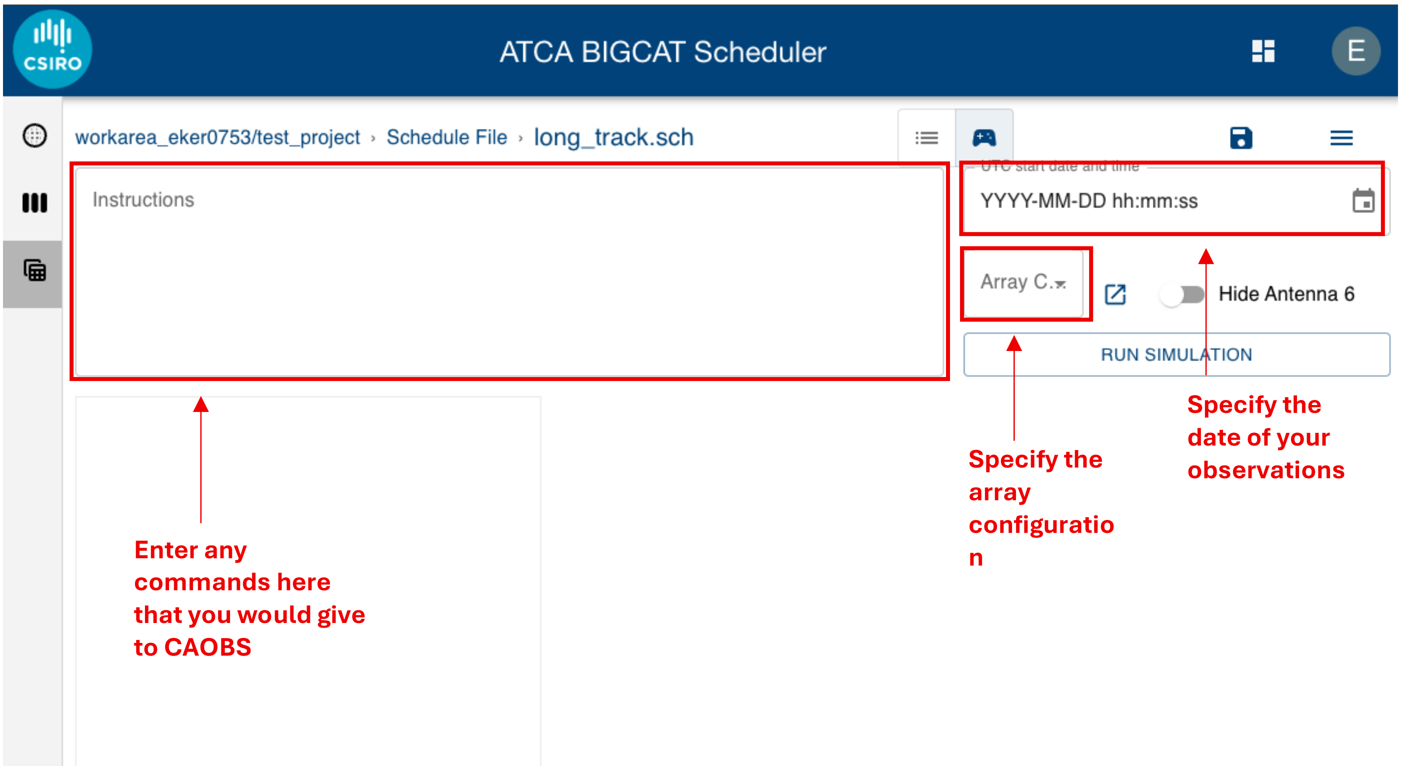

Figure 18: The simulator tab unpopulated with any data

Once you run a simulation, the tool will provide text output on the left which describes all of the movements performed by the telescope during the observation (slewing, tracking etc.) as well as the data volume produced by each scan. At the bottom of this output is some green text which provides a summary of the total time on source, and the total data volume for the observation. On the right several plots are produced including an elevation graph that tracks the elevation of each source in the observation during active observing, as well as plots showing the uv coverage of each unique target in the scan list. This output is shown in Figure 19.

★ For hybrid configurations, toggle the 'Hide Antenna 6' switch to see only the uv coverage provided by the compact 5 antennas.

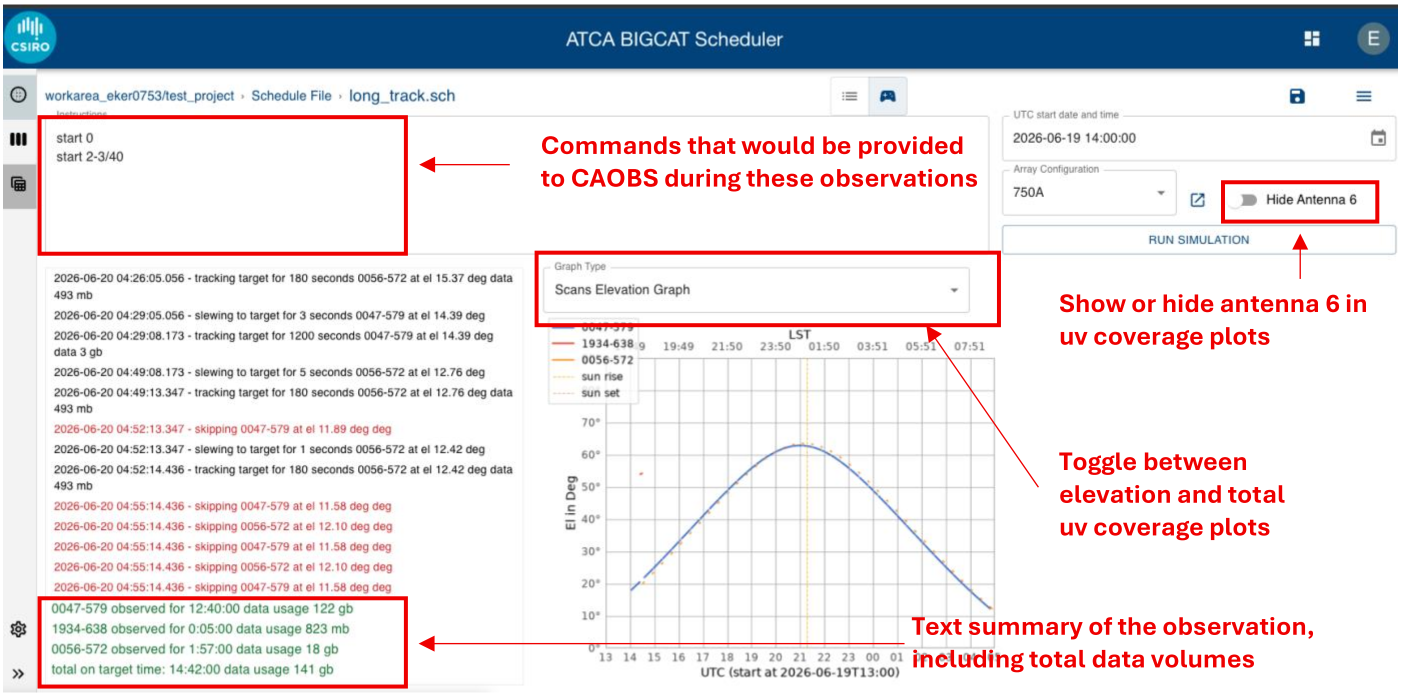

Figure 19: The simulator tab populated after running a simulation.

Saving and deploying schedules

Once you are happy with the scan details and ordering, you can save the schedule file by clicking on the menu button on the top right and entering an appropriate name for the schedule file, e.g., “C+X_continuum_C0000.sch”. Note that the file needs to end with a “*.sch*” file extension. You may find it useful to include the proposal code as part of the filename, to distinguish it from other similar schedule files.

You can find all the saved schedule files by clicking on the “Schedule Editor” button on the left.

You are now ready to deploy (or download) the schedule file. You will find the “Deploy” option in the drop-down menu to the top right (see Fig. 20). This will open a new window (see Fig. 21) with the schedule file in the JSON format, ready to be deployed to the CAOBS server.

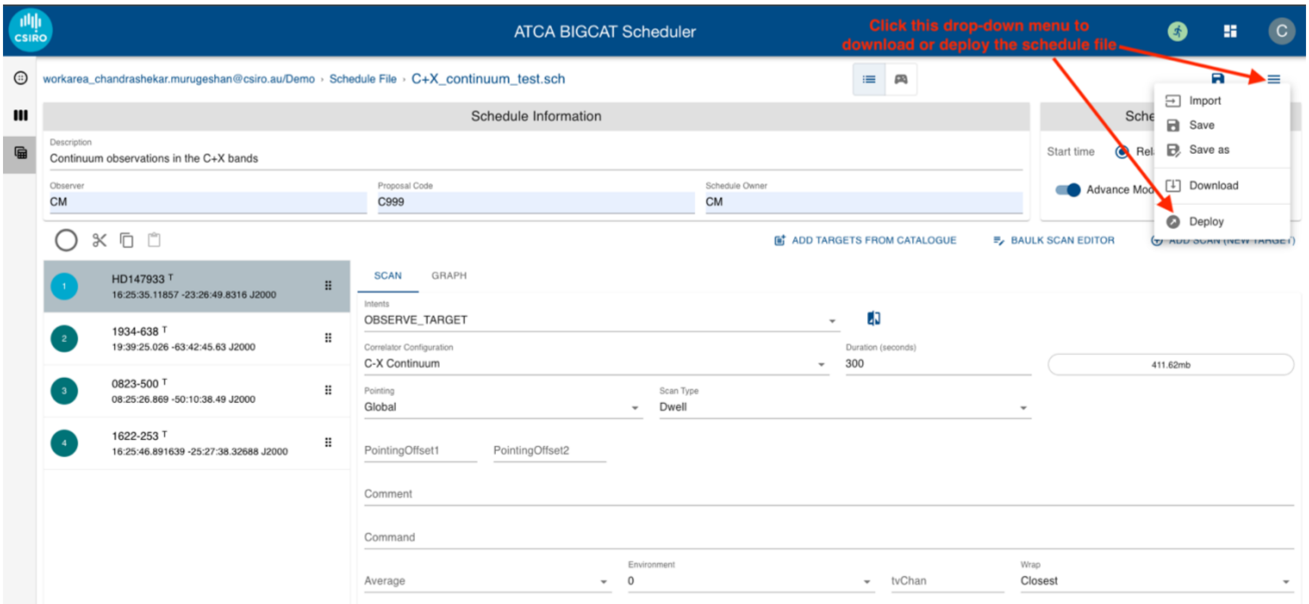

Figure 20: Deploying the schedule file.

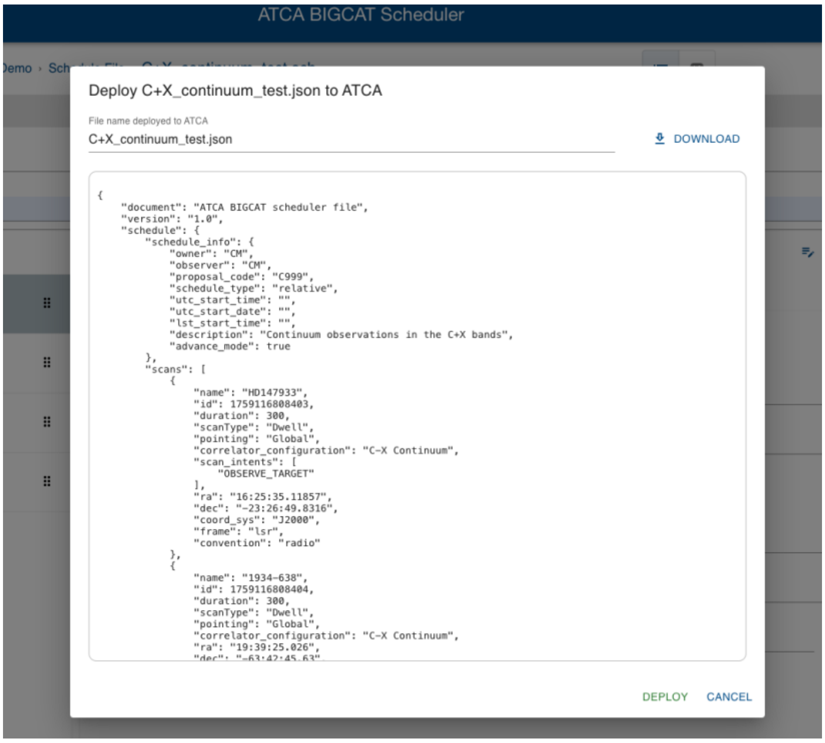

Figure 21: JSON format schedule file ready to be deployed or download for future use.