



**MWA**  
MURCHISON  
WIDEFIELD  
ARRAY

# Getting the MWA to produce the data you want

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AKA “Tips for a good observing proposal”

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# Introduction

- I only see your observing proposal after it's been accepted. My job is to take what you've put in the proposal, then turn it into observations that produce the data you want to get good scientific results.
- My job is easier if it's easy for me to read and understand your proposal, so I know exactly what you want the telescope to do.

# Most important – your source/s

- Unless you have lots of sources, put them in the proposal form!
- If they aren't in the form, put them in the instructions attachment, IN A TABLE, with name, coordinates, and any other data that's not the same for every source in the proposal.
- For source names, make sure that the exact strings you include in the proposal resolve correctly in a VizieR search (<https://vizier.u-strasbg.fr/viz-bin/VizieR>), don't abbreviate them.
- Include RA and Dec, with the RA in hours, not degrees, so it's easier for me to compare to LST when scheduling.
- If you want to include two nearby sources in the same observation, say what pointing you want to use (one source or the other, or midway in between).

# Calibration

- We carry out morning and evening calibrator observations every night, for eight commonly used channel sets:
  - GLEAM 69, 93, 121, 145 and 169 bands (coarse channels 57-80, 81-104, 109-132, 133-156 and 157-180, respectively).
  - The DUAL channel set – channels 57-68 and 121-132).
  - The PAIRS channel set – twelve 2.56 MHz wide bands (62;63, 69;70, 76;77, 84;85, 93;94, 103;104, 113;114, 125;126, 139;140, 153;154, 169;170, 187;188).
  - The PICKET channel set – twenty-four 1.28 MHz wide individual channels (62, 67, 73, 78, 84, 89, 95, 100, 106, 111, 117, 122, 128, 133, 139, 144, 150, 155, 161, 166, 172, 177, 183, 188).
- If you use one of these channel sets, you'll have these nightly calibration observations to use as well as ones scheduled with your observations, for more redundancy in case of problems.

# Frequency channels

- The proposal form allows you to specify predefined channel sets (GLEAM69, GLEAM93, GLEAM121, GLEAM145, GLEAM169, PAIRS, DUAL, PICKET), or any other custom channel set, either contiguous or non-contiguous.
- PLEASE enter any channel sets you want to use for your observations into the proposal form, even if you need to add additional information (specific channel sets for different times, dates, or sources) in the observing instructions.
- Note that the CENTRE frequency of any coarse channel is equal to the channel number times 1.28 MHz

# Suggest when you'd like your observations

- Tell me when your observations are possible, and when you would prefer them to be scheduled:
  - Work out roughly how many hours per day/night your source/s can be observed through the semester, and
  - Explain that in the observing instructions – eg “We request 100 hours of night-time observations of source A at an elevation  $> 45$  degrees. These observations are possible from early May to late July, but ideally, we would prefer 3 hours per night over transit, for  $\sim 30$  days centred around June 15<sup>th</sup>.”
- This is especially important for large time requests (more than a few nights).
- I can't promise to fulfill requests like that, but seeing when your observations are possible, and when you'd prefer them, helps me a lot.

# What order do you want? Does it matter?

- Suppose you want four hours, on each of 5 sources, at each of three frequencies, and there are 6 hours available per night. What ordering suits your science better for the 60 hours of observations? Eg:
  - For each of 10 nights, loop over all 5 sources, and for each source, loop over all 3 frequencies, and for each frequency, take one 120 second observation. Repeat 11 more times that night. Repeat for 10 nights.
  - Observe the first source for four hours at one frequency, then the first source for two hours at the second frequency. Over subsequent nights, continue to spend four or two hours continuously on each frequency, swapping to the next source in the list as required.
  - Spend two nights just observing the first source, looping over the three frequencies, then swap to the next source on the next two nights, etc.
- These are just examples – there are many possibilities.

# Things to consider:

- Consider how a telescope failure or a bad ionosphere (for a whole night, or a fraction of a night) would affect your results. Would you prefer to lose some integration time on every source/frequency, some of the frequencies for every source, or all the observations but only for some of your sources?
- Do you expect any time variability in your source/s, and if so, how would you prefer to sample it? Would you prefer your observations spaced out more widely, instead of on consecutive nights?
- Inside each single block of observations on a night, it's a lot easier for me to schedule observations that loop over pointing first, and for each pointing, loop over choice of frequency. The reverse is possible, if you need it.



# Day or Night observations?

- If your source isn't available to observe at night during the semester (and you should know this in advance), then your observations can be scheduled in the daytime.
- The same is true if there aren't enough night-time hours in the semester for all the accepted proposals at that RA range – some (or all) of your observations might be scheduled during the day.
- The scheduling software can optimise SNR by choosing a pointing that puts the Sun in a beam null without going too far off the source, but it only works well when both the source *and* the Sun are above around 30 degrees elevation.
- Keep this in mind when working out your suggested dates/times.

# Commensal Observing

- If your observations need to be scheduled around some other instrument (GMRT, Parkes, etc), then your observing instructions must state:
  - Roughly what dates/times you expect it to be, if known.
  - When you expect to learn the exact times allocated on the other instrument.
  - How closely aligned in time you would like the observations, and how closely aligned they *need* to be. Exactly overlapping? Partially overlapping? Within a few days? Do the alignment requirements vary by source or frequency choice?
- Remember that dishes can point closer to the horizon than the MWA, so consider that and longitude differences when scheduling joint observing.
- Finally, when you do get your time allocation results, please let me know dates/times (in UTC) as soon as possible, don't wait for me to chase you up and ask.

# Summary

- What I need to see, at a glance:
  - Source details (names, RAs, Decs)
  - Observing requirements (channels, number of hours)
  - Any constraints (commensal observing, observation spacing, etc)
- What you need to remember:
  - I'm not familiar with your research area – I'm not even a radio astronomer – so don't put any science justification in the observing instructions, and DON'T link to papers or source catalogues that I would need to look up.
  - The more you can tell me about when and how you'd like your observations (as soon as possible, when the source transits at midnight, in July, etc), the more likely I am to be able to schedule them that way.
- After I schedule your observations, I'll send you a link with a list of everything that I've scheduled. Please take the time to check it!