



In Cycle 3, how do I make a polarization observation?

Imported User 84 - 2024-10-08 - Early Science - Cycle 3

For Cycle 3, on top of the dual polarizations (XX, YY) and single polarization modes (XX), observations to measure the full intrinsic polarization (XY, YX) of sources will also be offered for TDM observations in Bands 3, 6 and 7. Only linear polarization is an accepted observing mode. While PIs will receive data which will allow them to generate circular polarization data, the quality and/or accuracy of that data at this time is not assured, and such data should not be used for scientific purposes.

When a Dual Polarization setup is used, separate spectra are obtained for each linear parallel-hand polarization of the input signal. This will give two largely independent estimates of the source spectrum that can be combined to improve sensitivity.

In Single Polarization mode, only a single input polarization (XX) is analyzed. For a given resolution, this provides $\sqrt{2}$ worse sensitivity than the Dual Polarization case, but one can use either a factor two more bandwidth for the same spectral resolution or a factor of two better spectral resolution for the same bandwidth.

Full Polarization measurements using only TDM mode will be offered in Cycle 3 for 12-m Array observations only in Bands 3, 6 and 7. This is a non-standard mode, limiting the total time available for such observations. Sources must be centred and have a user-specified largest angular structure that is less than one-third of the 12-m Array primary beam at the frequency of the planned observations. The expected minimum detectable degree of polarization is 0.1% for compact sources and 0.3% for extended sources. Observations shall be single-field, but measurements of individual sources within a 10-degree area on the sky are possible (one field per source; see below). Polarization is not offered in spectral scan mode. The frequency settings for continuum polarization measurements can be specified by the user, but the OT supplies default setups as detailed in Table A-6 of the Cycle 3 Proposer's Guide and Capabilities, reproduced below.

The ALMA correlators will process either linear parallel-hand polarizations (XX, YY) or single polarization (XX). Full intrinsic polarization (XY, YX) will be available in Cycle 2 for continuum observations in bands 3, 6, and 7 with some restrictions. Sources must be centered and have a user-specified largest angular structure that is less than one-third of the 12-m Array primary beam at the observing frequency in use. Observations must be single-field, but multiple sources within a 10 degree area on the sky are possible with one field per source.

Continuum polarization measurements are offered only for specific frequency settings listed

below:

Band	SPW1 (GHz)	SPW2 (GHz)	LO1 (GHz)	SPW3 (GHz)	SPW4 (GHz)
3	90.5	92.5	97.5	102.5	104.5
6	224.0	226.0	233.0	240.0	242.0
7	336.5	338.5	343.5	348.5	350.5

Note for the table: Fixed central frequencies for four TDM spectral windows, each of width 1.875 GHz, and the corresponding LO1 setting. Frequencies were chosen to optimize spectral performance, and they are centered in known low noise and low instrumental polarization tunings of receivers.

Full polarization observations require sufficient parallactic angle coverage for calibrations (about 3 hours). Science Goals with properties that lead to a total observing time estimate that is less than 3 hours will have the time estimate set to 3 hours to ensure sufficient parallactic angle coverage is obtained.