

The Handedness of Stokes V for the WAPPs at C-band

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Using helical antennae illuminating the feed through a hole in the 305-m reflector, circularly polarised tones were transmitted at 4800 MHz. These were recorded using the WAPP spectrometers and analysed using the AO IDL “corstokes” routine. The correlated cal diode (hcorcal) was used to calibrate the observations. Two power levels were transmitted, firstly a higher power and then a lower power (6 dB down). An ‘adjust power’ command was accidentally introduced between the cal and data signals for the lower power level readings. This has the potential to affect the results; this was not present for the higher power level.

The WAPPs were set up in dual-board mode with a bandwidth of 100 MHz, 3-level sampling and full Stokes recording. All of the eight boards were set to the same central frequency of 4800 MHz.

Results:

The Stokes V for each WAPP board is shown in Fig. 1 for the high power and in Fig. 2 for the lower power level. It can be seen that transmitting a right-hand circularly polarised tone gives a positive Stokes V, while transmitting a left-hand circular polarised tone gives a negative Stokes V. For astronomical sources there is an additional reflection off the dish, thus transmitting right-hand circular is equivalent to observing a left-hand circularly polarised source in the sky.

On the lower power level readings, the relative levels of the Stokes parameters are different from those expected. This is almost certainly due to the ‘adjust power’ command, and does not affect the sign of the resulting Stokes V. In all the readings, but particularly the higher power ones, ringing affects the results; the data were Hanning smoothed to remove most of this effect.

Conclusion:

For astronomical sources, positive Stokes V corresponds to left-hand circular polarisation from the sky, while negative Stokes V corresponds to right-hand circular polarisation.

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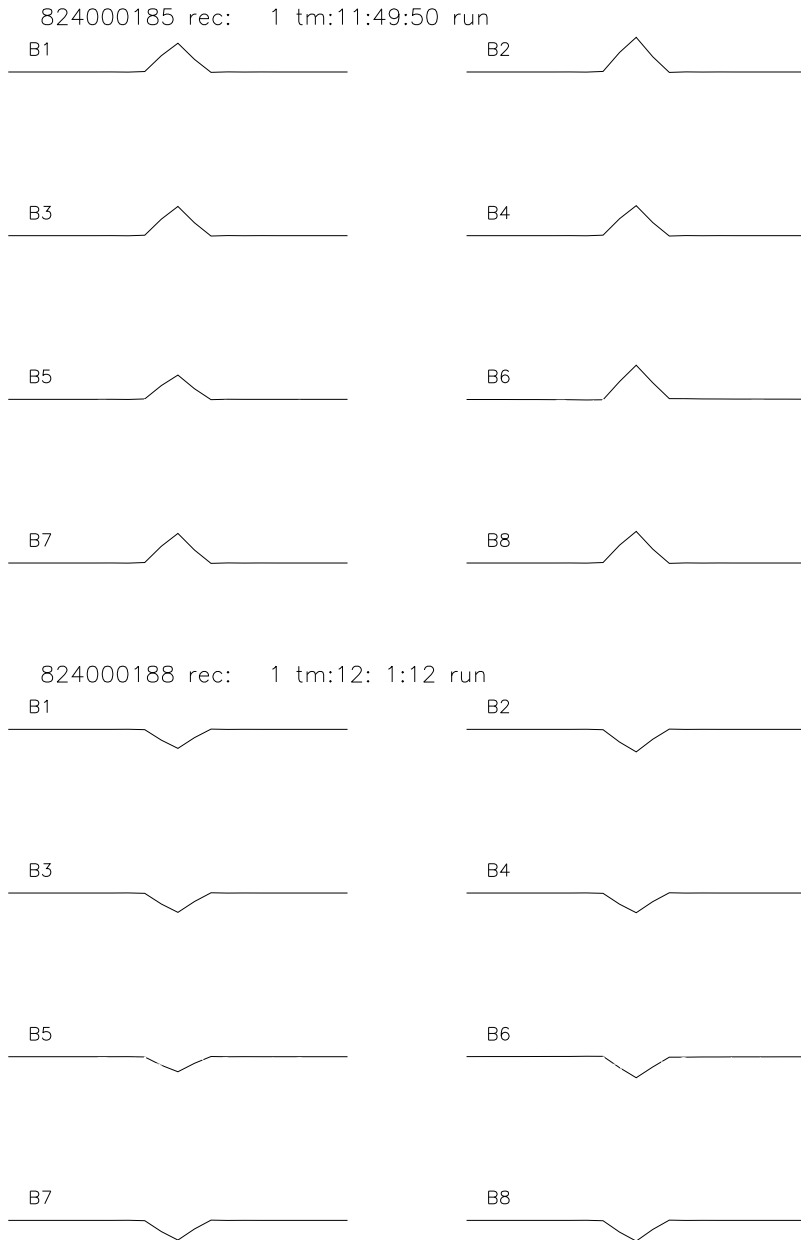


Figure 1: Stokes V response in different WAPP boards to right-hand (upper) and left-hand (lower) transmission at high power (0 dB). The horizontal scale is from 4799.5 MHz to 4800.5 MHz; the vertical scale is arbitrary.

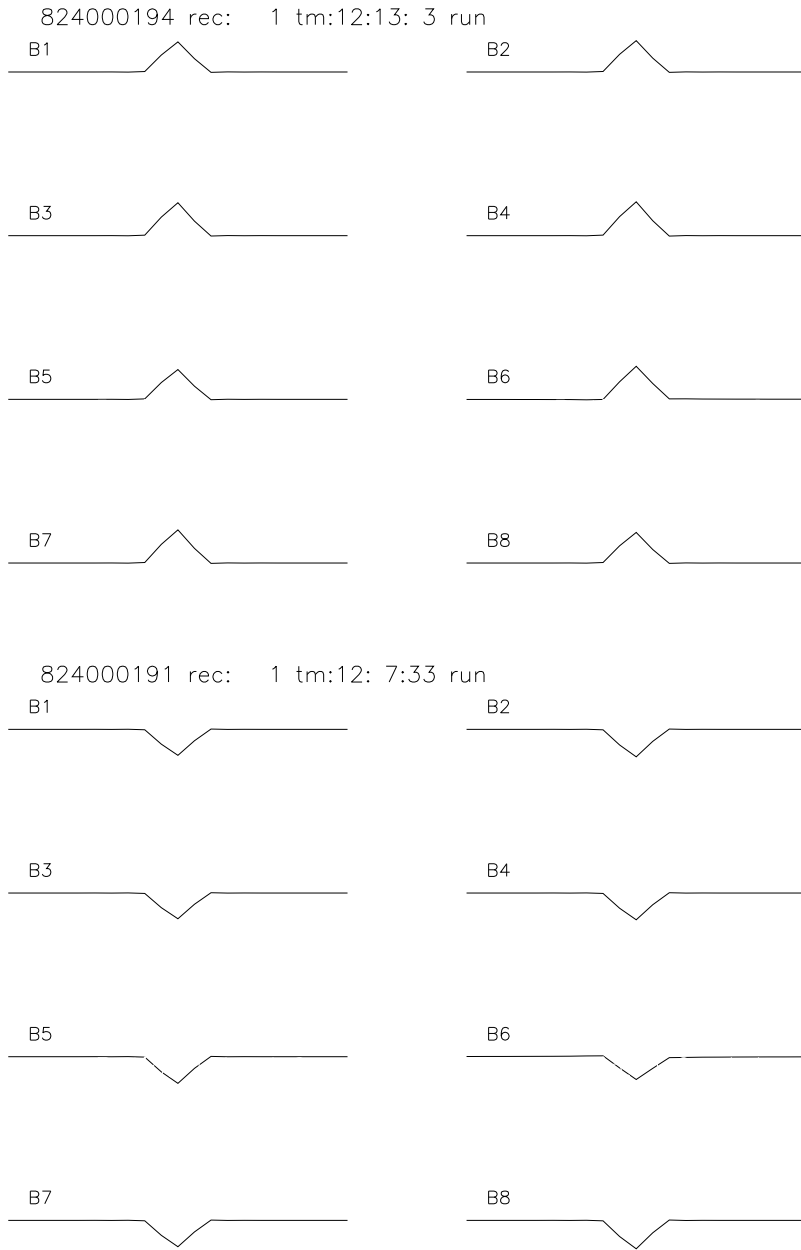


Figure 2: Stokes V response in different WAPP boards to right-hand (upper) and left-hand (lower) transmission at lower power (-6 dB). The horizontal scale is from 4799.5 MHz to 4800.5 MHz; the vertical scale is arbitrary.