The polarization degree measurement of the original solar radio emission

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The Chinese Spectral Radioheliograph (CSRH) is an aperture-synthesis telescope observing the Sun in ultra wide bandwidth. The relatively calm solar atmosphere can be violently disrupted by powerful explosions, filling the solar system with radio waves, X-rays, and gamma rays, another solar explosions, called Coronal Mass Ejections, throw billions of tons of corona gases into interplanetary space, and creating powerful gusts in the solar wind. Now, we begun to understand the detailed causes of Sun's explosive outburst and predict exactly when they will occur. CSRH will give solar radio images to explore these mysteries. This instrument contains two arrays CSRH-I and CSRH-II from 0.4 to 15GHz. CSRH-II array covers frequencies from 2 to 15GHz.

The feed used in CSRH-II is composed of four periodic arrays. In order to obtain ultra wideband performance, the cascaded folded wave dipoles are used in this array. At the same time, a wide band 3dB hybrid is added to get solar radio signals. CSRH-II radio interferometer could measure the polarization state of the waves by cross correlating all combinations of two orthogonal polarizations at each antenna. The relationship between the original polarization degree of the Sun and the observed polarization degree is also measured using a method for cross polarised delay in observing the Sun.

In this measurement, we use HC3 antenna observing the Sun. Assuming the original polarization degree of the solar radio emission is $Pold_{sun}$ and the intensity coming to the Right-polarization channel is P_{right}, the intensity coming to the Left-polarization channel is $L_{pol}* P_{right}$. Fig.1 shows the gain ratio of powers coming from right and left circular channels in these listed frequencies, the gain difference is less than 0.2. Hence, fig.1 shows the difference between the observing polarization degree and the original polarization degree varies with the original polarization degree, the true value of |pold(obs) – pold(sun)| is less than 0.094.

For every receiving band, the gain difference by comparing right- and left- handed polarization intensities of solar emission (assuming that the solar quiet emission has no polarization) is measured and in the following stages, the amplitude of the radio signals will be calculated according to measured data.

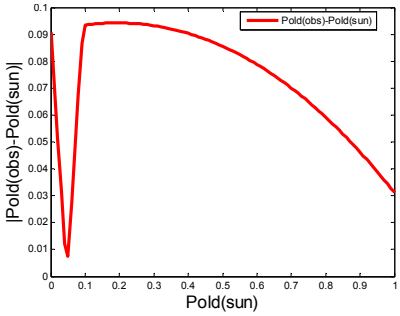

Fig.1 Exact relationship between |pold(obs) – pold(sun)| and pold(sun)