# FIRST RESULTS FROM THE GAURIBIDANUR RADIO HELIOGRAPH

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**Abstract.** Observations of the Sun at two frequencies (51 and 77 MHz) using the East-West arm of the Gauribidanur Radio heliograph are presented.

**Key words:** Heliograph – quiet Sun emission

## 1. Antenna system

A radio heliograph operating in the frequency range of 40 to 150 MHz has been constructed at Gauribidanur (Long.=77°26′126″, Lat.=13°36′126″N) by the Indian Institute of Astrophysics (Subramanian et al.1995). This radio heliograph will produce images of the solar corona at several frequencies in the above frequency range. The heliograph is in the form of letter "T" with the long arm along the East-West direction and the short arm along the South direction. This telescope consists of 192 antenna elements,128 in the East-West arm and 64 in the South arm. The basic element used in this array is a log periodic dipole designed to operate in the above frequency range with a VSWR $< 2$. These elements are linearly polarised in the East-West direction. In the East-West arm 128 log periodic elements are arranged with an interelement spacing of 10 meters and in the South arm 64 elements are arranged with an interelement spacing of 7 meters. The E-W arm is at present divided into 8 groups of 16 elements each. The RF signals from each group are brought to the laboratory and down converted to an IF of 10.7 MHz. A 64 channel digital correlator is used to get all possible correlations. The phase corrected outputs are used to synthesize the E-W one dimensional scans of the Sun.

In the completed heliograph, 128 elements in the E-W arm would be divided into 32 groups of 4 elements each and 64 elements of the South arm would be divided into 16 groups of 4 elements each. A 2500 channel digital correlator is being built to obtain all possible correlations of the 48 (32 E-W & 16 S) antenna outputs. Multi frequency operation would be achieved by making observations sequentially at 3 or 4 frequencies. The dwell time at each frequency would be approximately 100 milliseconds.

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## 2. Parameters of the Gauribidanur Radio Heliograph

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|---|---|
| Frequency of operation | 40 - 150 MHz |
| Instantaneous bandwidth | 1 MHz |
| Effective collecting area | 96 $\lambda^2$ |
| Sky coverage | $\pm$ 45° |
| Tracking in E-W direction | $\pm$ 2 hours |
| Sensitivity | $\approx$ 200 Jy at 150 MHz |
| Field of view | 3° $\times$ 4° at 150 MHz |
| Angular resolution | $4' \times 11'$ (R.A. $\times$ Dec.) at 150 MHz |

The field of view and the angular resolution are frequency dependent. Both of them scale inversely with frequency.

## 3. Observations

As mentioned above, the E-W arm is divided into 8 groups of 16 elements each for the present observations and the outputs of these groups are correlated in a 64 channel digital correlator. Phase corrected outputs from the 7 baselines are added together to synthesize one dimensional scans of the Sun at 51 and 77 MHz. The scans are CLEANed with the observed E-W beam on a point source. The Sun was relatively quiet and no transient burst activity was seen during the present observations. The radio source Tau-A was used as a calibrator. The variation of the gain of the array with zenith distance was determined by observing strong radio sources at different declinations. The integrated solar fluxes were corrected for this effect. The error in the measurement of the fluxes is estimated to be about 20 % at both the frequencies. Figures 1 & 2 show the synthesized scan of the undisturbed sun at 51 & 77 MHz on Jan 9, 1995. During the period Jan 5 to Jan 14, 1995 the observed flux densities varied from about 3900 Jy to 7600 Jy at 51 MHz and from 8400 Jy to 14400 Jy at 77 MHz. The E-W half-power diameter varied from about 48′ to 53′ at 51 MHz and from 38′ to 41′ at 77 MHz. The brightness temperature varied from about $0.3 \times 10^6$ K to $0.6 \times 10^6$ K at 51 MHz and from $0.5 \times 10^6$ K to $0.8 \times 10^6$ K at 77 MHz. The E-W half-power diameter and the flux densities of the Sun obtained by us agrees well with the values reported in the literature (Sheridan and McLean,1985).

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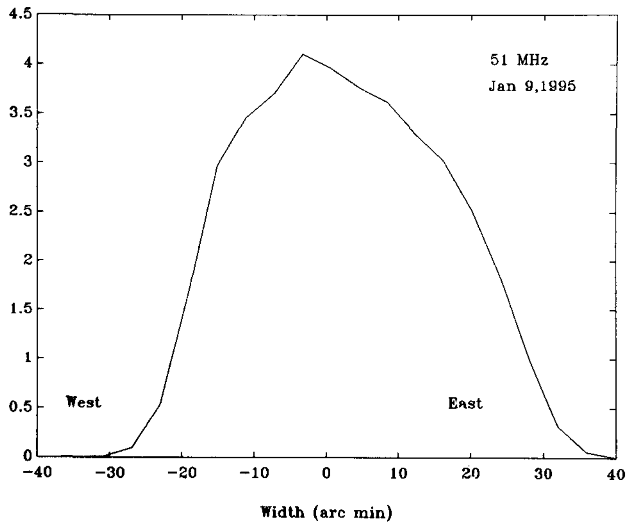


Fig. 1. E-W scan of the Sun on Jan 9,1995 at 51 MHz

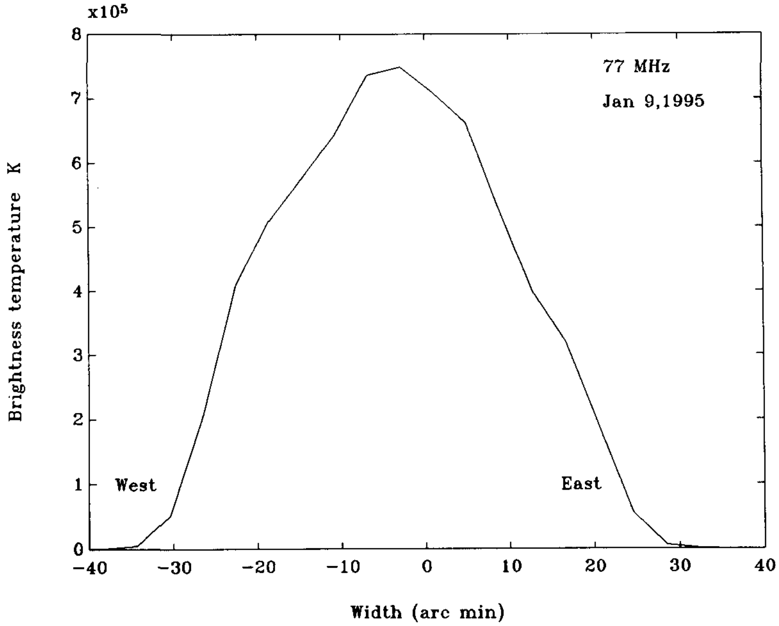


Fig. 2. E-W scan of the Sun on Jan 9,1995 at 77 MHz

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## 4. Discussions

The half-power widths of the observed scans remained approximately constant at both 51 and 77 MHz during the period Jan 5 to Jan 14, 1995. The variations in the brightness temperature and the variations in the integrated flux densities are correlated. There is no correlation between the variations in the brightness temperature and the half-power widths. We therefore believe that the observed variations in the brightness temperature are not due to the scattering of the radiation by coronal irregularities.

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