BRAZILIAN DECIMETRIC ARRAY CONFIGURATION IN A NUTSHELL

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ABSTRACT

Here we present the proposed configuration for the second phase of the BDA, Brazilian Decimetric Array. The corresponding u-v coverage and synthesized beam are also presented as well as results obtained employing simulated solar images from the Nobeyama data.

INTRODUCTION

The final proposed configuration of the antenna array for the Brazilian Decimetric Array (BDA) is T-shaped. Phase I comprehended the BDA prototype, a line-array composed of the first 5 antennas that is already operational (Sawant et al, 2007). In phase II, 21 antennas will be added to existing ones forming a T-shaped array. Finally, in phase III, other 4 antennas will be added in each arm of the T. These latter antennas will be placed starting at a distance of 250 m from the central antenna of the array following the concept of a "fat T". A former random 26-antenna configuration was proposed (Faria et al., 2005), but abandoned, since the available terrain allows to employ a T-shaped configuration that presents good and more redundant coverage in the u-v plane. For instance, a Y-shaped configuration was not possible due to the terrain restrictions.

In the following section we describe the u-v coverage and synthesized beam for the 26-antenna BDA phase II T-shaped configuration, as well as results obtained for this configuration employing solar images from the Nobeyama data.

ANTENNAS CONFIGURATION FOR BRAZILIAN DECIMETRIC ARRAY - PHASE II

The main characteristics of the array are given in Table 1.

Table 1 - Principal Characteristics of BDA

Number of Antennas	26
Frequencies	1.2 – 1.7, 2.7 and 5.6 GHz
Time Resolution	~100 ms
Diameter of Antennas	4 m
Angular Resolution	~2.8', ~1.4' e ~0.8'
Maximum baseline	252 m
Minimum baseline	9 m
Field of View	40'
Sensibility (at 5.6 GHz with $\Delta t = 1$ s)	~ 360 Jy/beam (Sun) ~ 2170 mJy/beam (other sources)

PROPOSED CONFIGURATION FOR BDA PHASE II

In the first phase of the BDA project, named PBDA (Prototype of BDA), an east-west five-element interferometer was developed and installed at INPE, using 4-meter diameter parabolic dishes with alt-azimuth mount and complete tracking capability. PBDA operates in the frequency range of 1.2–1.7 GHz. In BDA phase II, it is planned to lay out new 17 antennas over the distance of 252 meters in the East-West direction and another 9 antennas over a distance of 162 meters in the North-South direction forming a T-shaped array (Faria et al., 2004a; Faria et al., 2004b). Figure 1 shows the array configuration suggested for BDA phase II.

The configuration presents a dense array near the intersection of the "T", with spacing of 9 meters between adjacent antennas. In each arm of the "T" this spacing is increased to 18 and 36 meters after the fourth and seventh antennas respectively.

Figure 2a shows the *UV coverage* and Figure 2b, the synthesized beam obtained with this configuration at the frequency of 1.4 GHz.

The one-dimensional profile is presented in Figures 3 and 4 for 1.4 and 2.8 GHz respectively. The gratting lobes are ~80 arc minutes from main lobe.

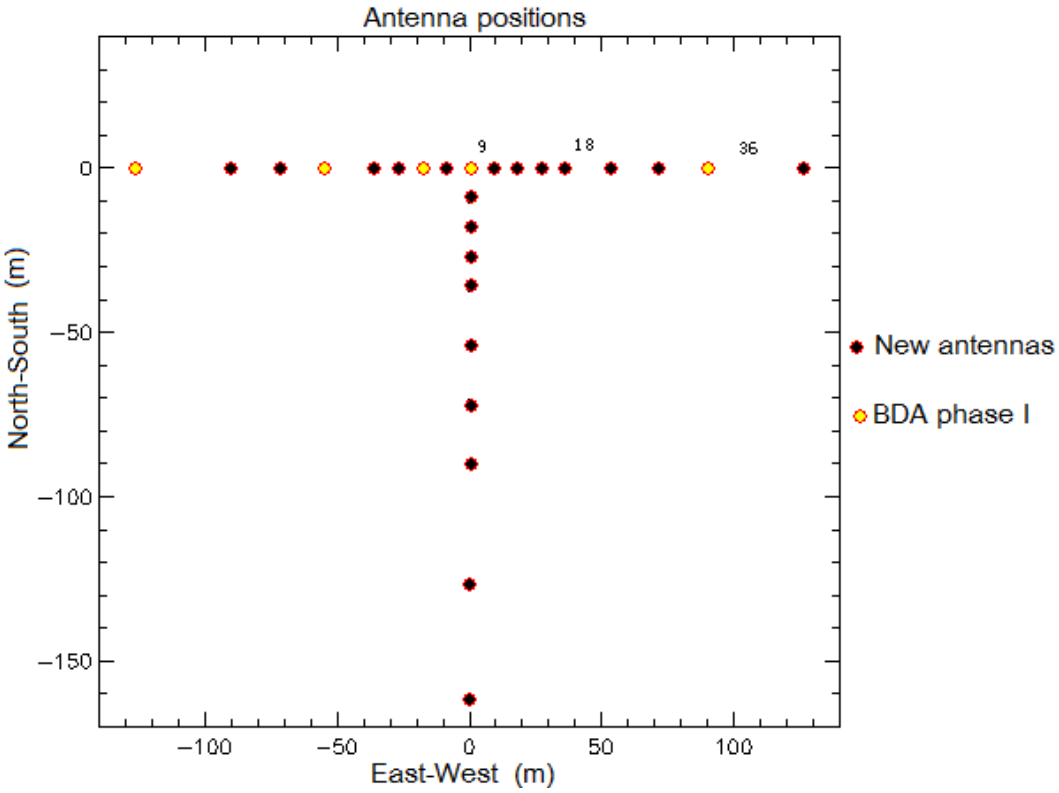
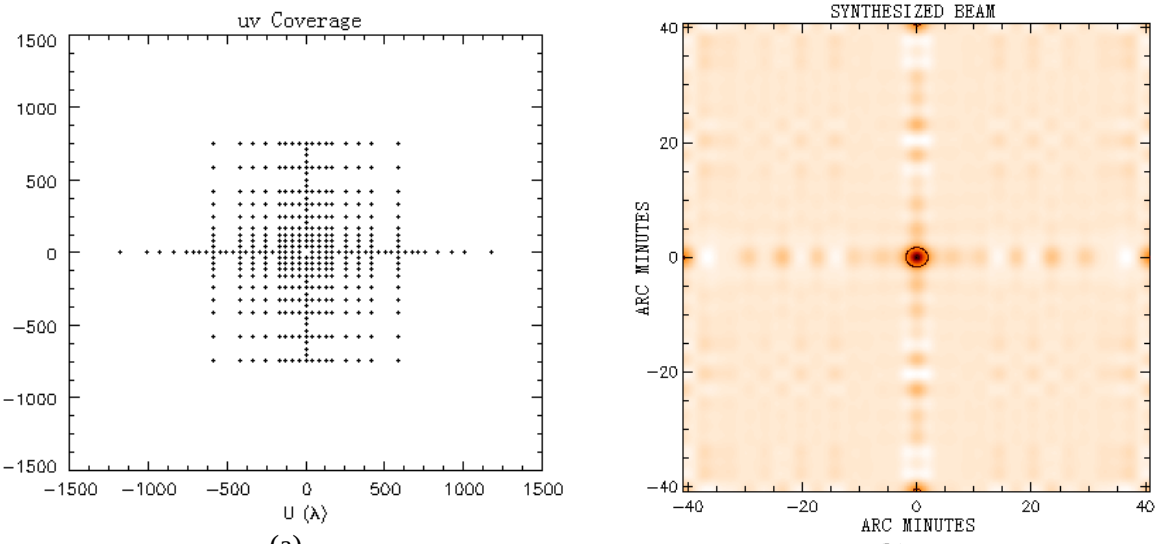
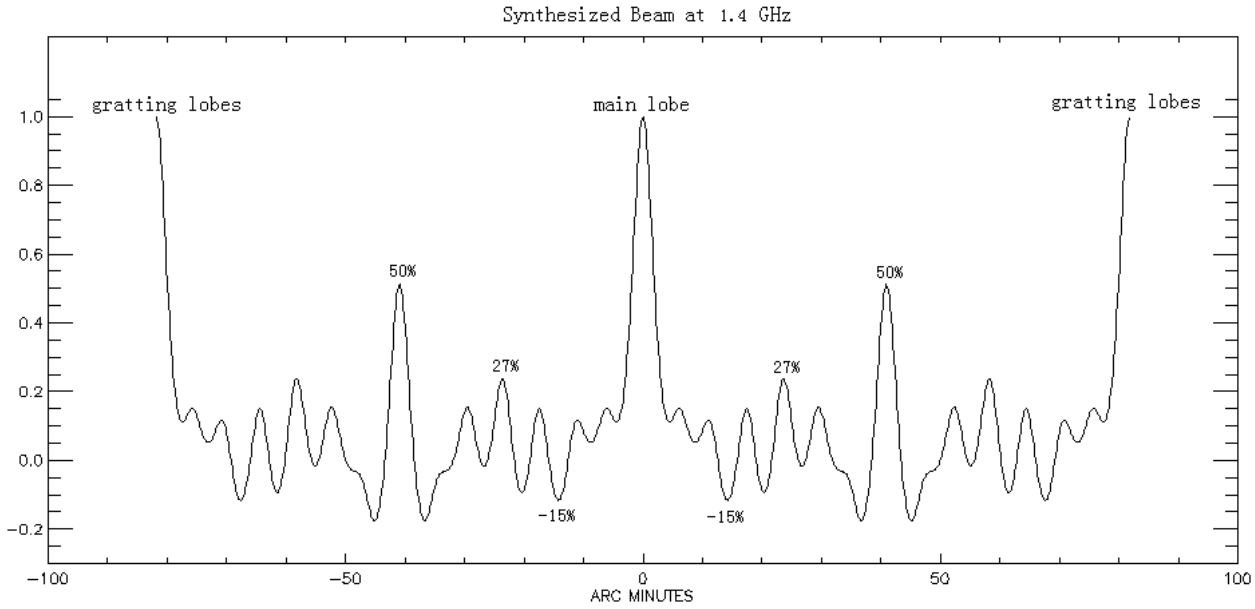


Fig. 1 – Antennas configuration for BDA phase II. The antennas in light colors represent the current configuration (BDA phase I).



(a) (b)

Fig. 2 - Resulting *uv* coverage (a) and synthesized beam (b) obtained with the proposed configuration.

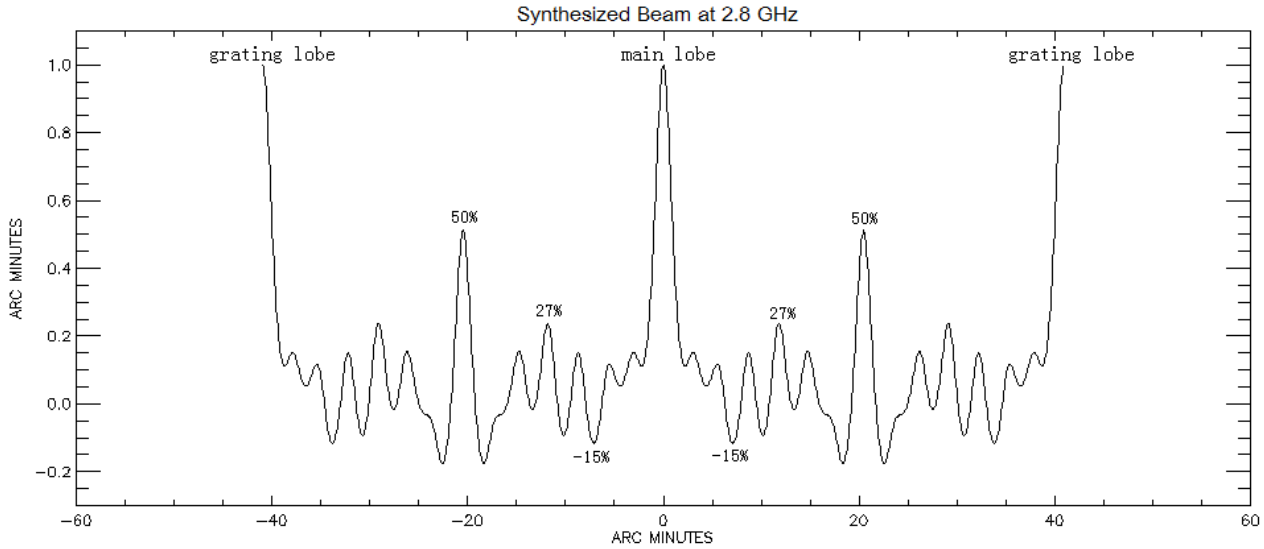


First gratting lobe at 82 arcminutes

Maximum side lobe on the 40 arc min = 27% of main lobe

Minimun side lobe within 40 arc min = - 15 % of main lobe

Fig. 3 – One-dimensional profile of the BDA phase II at 1.4 GHz.



First gratting lobe at 41 arcminutes

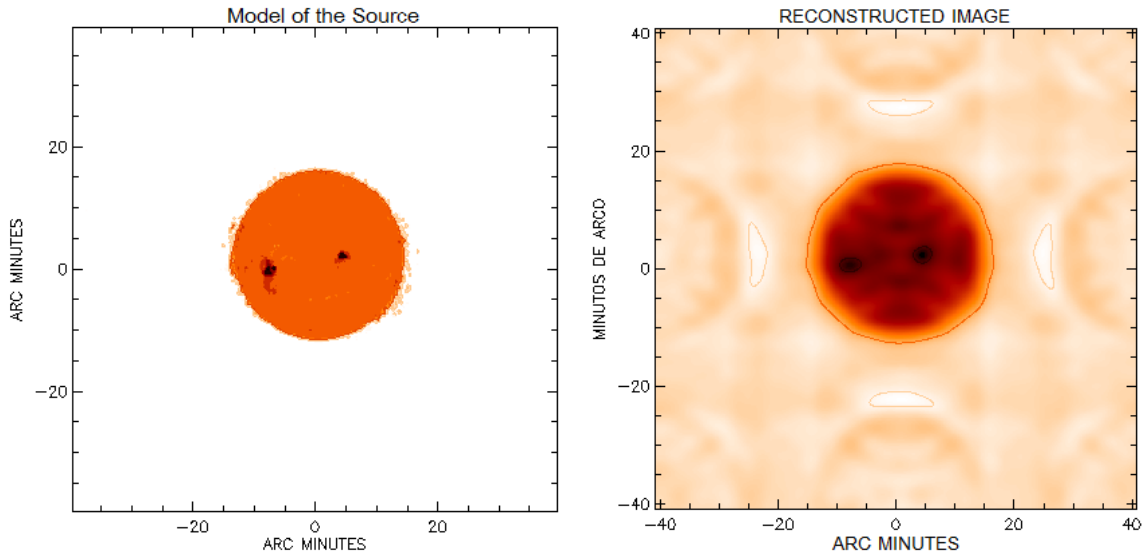
Maximum side lobe on the 40 arc min = 27% of main lobe

Minimun side lobe within 40 arc min = - 15 % of main lobe

Fig. 4 – One-dimensional profile of the BDA phase II at 2.8 GHz.

SIMULATION

In order to investigate the quality of the *uv* coverage of the BDA configuration on the radio imaging of the Sun, a simulation was performed using a Sun image synthesized by the Nobeyama Radio Heliograph at 1.7 GHz as a model of the source (Figure 5a). In this simulation, the position of the Sun is assumed at the zenith and the observation frequency is 1.4 GHz. The corresponding dirty image is showed in Figure 5b. The visibility data is assumed full calibrated.



(a) (b)

Fig. 5 - a) Image of Solar disc obtained from Nobeyama Radio Heliograph at 17 GHz that was used as a model of the Sun; (b) dirty image obtained with BDA configuration presented in Fig. 1.

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