



Primary-beam shape parameters of the upgraded GMRT

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Extended abstract

Giant Metrewave Radio Telescope is the world's most sensitive low-frequency radio interferometer and it is in the final stage of the upgrade. One of the key objectives of this upgrade is to improve sensitivity along with obtaining near seamless frequency coverage from 100 to 1500 MHz. As a part of this upgrade, new wideband feeds and digital backend with 400 MHz bandwidth capability have been put in place.

Correction for the frequency dependent primary beam is fundamental to measure flux densities of sources detected in the images made with the wideband system. These radio images, if not corrected for the primary beam, would show an artificial steepening of the spectrum in addition to the drop in flux densities of sources as one moves away from the phase centre. Here, we present our preliminary measurements of the frequency dependent primary beam shapes for the new feeds of upgraded GMRT.

GMRT antennas: The GMRT antennas are 45 m in diameter and alt-azimuth mounted parabolic prime-focus dishes. While the dishes can go down to an elevation of 16°, at present, the elevation limit has been set at 17°, giving a declination coverage from -53° to +90°.

Primary beam: The coefficients of an eighth order polynomial fit to the antenna primary beam.

$$f(x, y) = 1 + (a / 10^3) r^2 + (b / 10^7) r^4 + (c / 10^{10}) r^6 + (d / 10^{13}) r^8$$

where r is in terms of separation from pointing position in arc-min times the frequency in GHz, a, b, c and

d are PBPARAM(3), PBPARAM(4), PBPARAM(5) and PBPARAM(6), respectively; with PBPARAM(1) = 0.1 and

PBPARAM(2) = 1. These PBPARAMs are coefficients used in Astronomical Image Processing Software to correct for the primary beam shape.

Table: Coefficients of an eighth order polynomial fit to the GMRT antenna primary beam.

Band (MHz)	Polynomial coefficients			
	a PBPARAM(3)	b PBPARAM(4)	c PBPARAM(5)	d PBPARAM(6)
Band-2 125 - 250				
Band-3 250 - 500	-2.939	33.312	-16.659	3.006
Band-4 550 - 850	-3.190	38.642	-20.471	3.964
Band-5 1050 - 1450	-2.608	27.357	-13.091	2.365