

# uGMRT Primary Beam Correction: CASA tasks

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These are modifications of the CASA task “widebandpbcor” available in CASA.

## 1. For usage in CASA 6: task “ugmrtpb”

The task is available on github over here:

<https://github.com/ruta-k/uGMRTprimarybeam-CASA6>

Please follow the procedure to incorporate new task in CASA 6 given over here:

<https://casadocs.readthedocs.io/en/stable/api/casashell/buildmytasks.html>

Once the task is ready to be used, follow the examples given below to run the task for your image.

*Example 1:* Suppose test.ms is the visibility file containing 4 spectral windows (0, 1, 2 and 3) containing 20 channels each. An image with the name "target" (prefix) is produced using nterms = 2 in tclean. Following will be the inputs for the task.

```
vis = 'test.ms' # Name of measurement set.  
imagename = 'target' # Name-prefix of multi-termimages to operate on.  
nterms = 2 # Number of taylor terms to use  
threshold = " # Intensity above which to re-calculate spectral index  
action = 'pbcor' # PB-correction (pbcor) or only calc spectral-index (calcalpha)  
reffreq = " # Reference frequency (if specified in clean)  
pbmin = 0.1 # PB threshold below which to not correct  
field = " # Fields to include in the PB calculation  
spwlist = [0,1,2,3] # List of N spw ids  
chanlist = [10,10,10,10] # List of N channel ids weightlist = [1,1,1,1]
```

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*Example 2:* Suppose test.ms is the visibility file containing a single spectral window (0) containing 160 channels. An image with the name "target" (prefix) is produced using nterms = 2 in tclean. Given the width of the spectral window, you may choose to sample it at some n points to get the primary beam shape. In this example I have chosen n=5. Following will be the inputs for the task.

```
vis = 'test.ms' # Name of measurement set.  
imagename = 'target' # Name-prefix of multi-termimages to operate on.
```

```
nterms = 2 # Number of taylor terms to use
threshold = " # Intensity above which to re-calculate spectral index
action = 'pbcor' # PB-correction (pbcor) or only calc spectral-index (calcalpha)
reffreq = " # Reference frequency (if specified in clean)
pbmin = 0.1 # PB threshold below which to not correct
field = " # Fields to include in the PB calculation
spwlist = [0,0,0,0,0] # List of N spw ids
chanlist = [40,80,120,140] # List of N channel ids
weightlist = [1,1,1,1,1]
```

## 2. For usage in CASA versions < 6

The task is available on github over here:

<https://github.com/ruta-k/uGMRTprimarybeam>

Please follow the steps given below:

- Keep the task\_wbpbgmrt.py and wbpbgmrt.xml files in the same directory as your image and the visibility file.
- Start CASA in this directory.
- At the CASA prompt give the command `os.system('buildmytasks')` It produces a few new files in this directory; one of which is 'mytasks.py'.
- At the CASA prompt give the command `execfile('mytasks.py')` The task named wbpbgmrt is ready for use.
- The command 'inp wbpbgmrt' at CASA prompt will show the inputs to this task.
- vis = visibilities corresponding to the image which needs to be corrected for PB.
- imagename = provide the prefix of the imagename.
- chanlist = list of channel numbers across the band (see example below)
- spwlist and weightlist are lists of the same length as chanlist. For GMRT spwlist is a list of zeros and weightlist is a list of 1s. (see example)
- nterms = number of terms used in imaging with tclean/clean.
- Example: Images with prefix "selfcal" are created by tclean from the MS file file.ms. file.ms has 200 channels and nterms= 2 was used in imaging. `wbpbgmrt(vis = 'file.ms', imagename = 'selfcal', nterms = 2, action = 'pbcor', chanlist =[10, 50, 100, 150, 190], spwlist =[0,0,0,0,0], weightlist=[1,1,1,1,1])`
- Please make sure that the correction is made as expected by checking the flux densities of some bright sources in your field spread over the full imaged area.

### **3. For usage in CASA versions < 6 with updated polynomial for band-4**

This is a branch of the code described in Sec. 2.

<https://github.com/ruta-k/uGMRTprimarybeam/tree/b4order10poly>

The usage is the same as for Sec. 2.