Testing the faceted mwimager for LOFAR

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2010-12-19

1. Setup

The objective of this test was to image a data set which was generated by BBS using its "predict" functionality. The .MS data set used was one sub-band (147) from the most recent observations of 3C196 with the stations beam server switched on.

Sub-band info:

# of visibilities: 2337075
# of flagged vis.: 191605
Phase center: +08:13:37.7, +48:13:26.3
Frequency range (MHz): 58.698 – 58.881
Wavelength range (m): 5.099 – 5.084
Observation time span: 2010-11-26T22:00:00 – 2010-11-27T08:00:01
Duration (hrs): 10.00
time bin / integration: 5.00695
# of channels: 1
channel width (KHz): 183.1
# of polarizations: 4
# of antennas: 25

The .skymodel file used with BBS for the predict run was:

Model generated for source 3C196
(Name, Type, Ra, Dec, I, Q, U, V, MajorAxis, MinorAxis, Orientation) = format
3C196, POINT, 08:13:36.062300, +48.13.02.24900, 130, 0,0,0
TEST1, POINT, 08:15:36.5, +48.11.00.0, 100, 0,0,0
TEST2, GAUSSIAN, 08:15:10.0, +48.10.01.05, 45, 0,0,0, 35.6, 20.0, -50.0

and the BBS .parset file for the same run (distributed by Reinout). DO ne just the predict step as stated above:

Strategy.Stations = []
Strategy.InputColumn = DATA
Strategy.TimeWindow = []
# Strategy.ChunkSize = 2500
Strategy.ChunkSize = 200
Strategy.UseSolver = F
Strategy.Correlation.Selection = CROSS
Strategy.Correlation.Type = []
Strategy.Steps = [predict]

Step.predict.Baselines.Station1 = []
Step.predict.Baselines.Station2 = []
Step.predict.Model.Sources = []
Step.predict.Model.Gain.Enable = F
Step.predict.Model.Phasors.Enable = F
Step.predict.Correlation.Selection = CROSS

Step.predict.Correlation.Type = []
Step.predict.Operation = PREDICT
Step.predict.Output.Column = DATA
Step.predict.Model.Beam.Enable = True
Step.predict.Model.Beam.Element.Type = HAMAKER_LBA
Step.predict.Model.Beam.Element.Path = $LOFARROOT/share
Step.predict.Model.Beam.StationConfig.Name = LBA_OUTER
Step.predict.Model.Beam.StationConfig.Path = /home/zwieten/StationConfig

The .parset file used for the mw imager (retained the default values from Bas, except for the columns and facet size):

dataset = 3C196.gds
Imager = casa
dde=True
datacolumn = DATA
residualcolumn = RESIDUAL_DATA
correctedcolumn = CORRECTED_DATA
uvrange = "¿2500m"
padding = 1.25
restore = True

threshold = 0.1
SNR_threshold = 10

#baseline = CS* & CS*

Images.stokes = [I]
Images.shape = [384, 384]
Images.cellSize = [10, 10]
Images.ra = 08:13:36.062300
Images.dec = +48.13.02.24900
Images.directionType = J2000
Images.nfacets = 3

Correct.Model.Beam.Enable=True
Correct.Model.Beam.Element.Type = HAMAKER_LBA
Correct.Model.Beam.StationConfig.Name = LBA_OUTER
Correct.Model.Ionosphere.Enable = False

Solver.type = Dirty
Solver.verbose = True
Gridder.type = WProject
Gridder.wmax = 15000
Gridder.nwplanes = 64
Gridder.oversample = 1
Gridder.maxsupport = 400
Gridder.limitsupport = 0
Gridder.cutoff = 0.001
Gridder.padding = 1.25

Weighting.type = natural

Since the maximum baseline was around 6 klambda, the resolution was around 30", and the beam is sampled optimally with these settings (10"). The settings for the width of the gaussian for the TEST2 source make it effectively a point source for this station setup.

The imager uses 9 facets to cover an image 384 pixels (3 x 128) on a side spanning about a degree on the sky centered on the location of 3C196.

2. Results

All of the three test sources were imaged. The relevant facets are shown below.

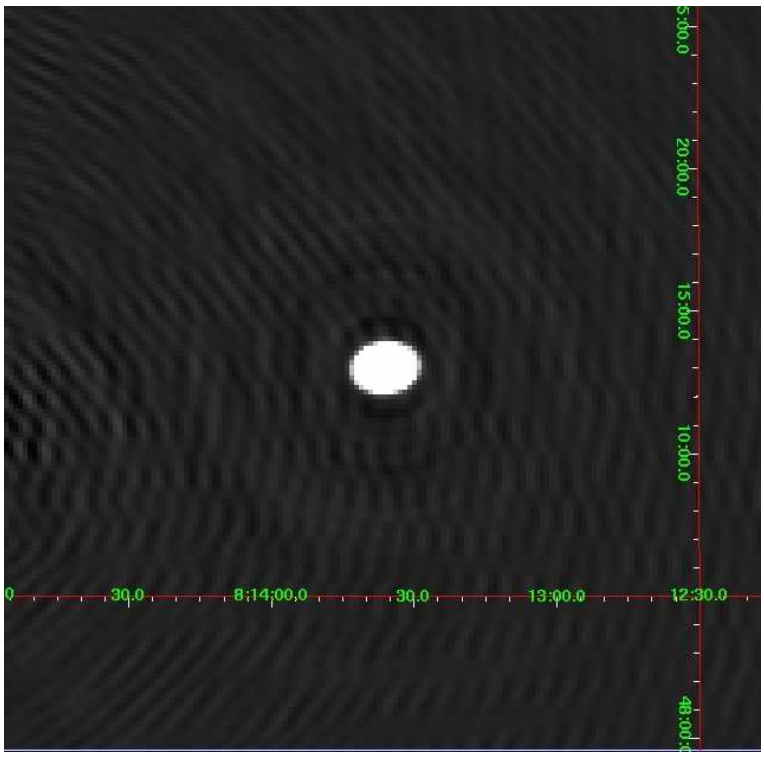

Figure 1. *3C196 map obtaned from the simulated data.*

In connection with Figure 2, we are giving the PSF and the residual for that facet:

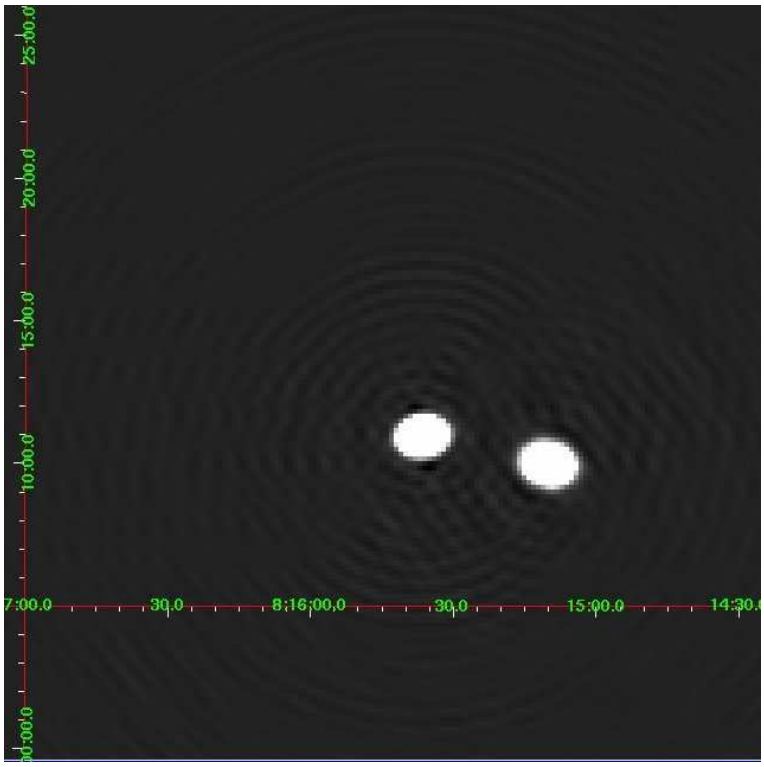

Figure 2. *The first and second test sources.*

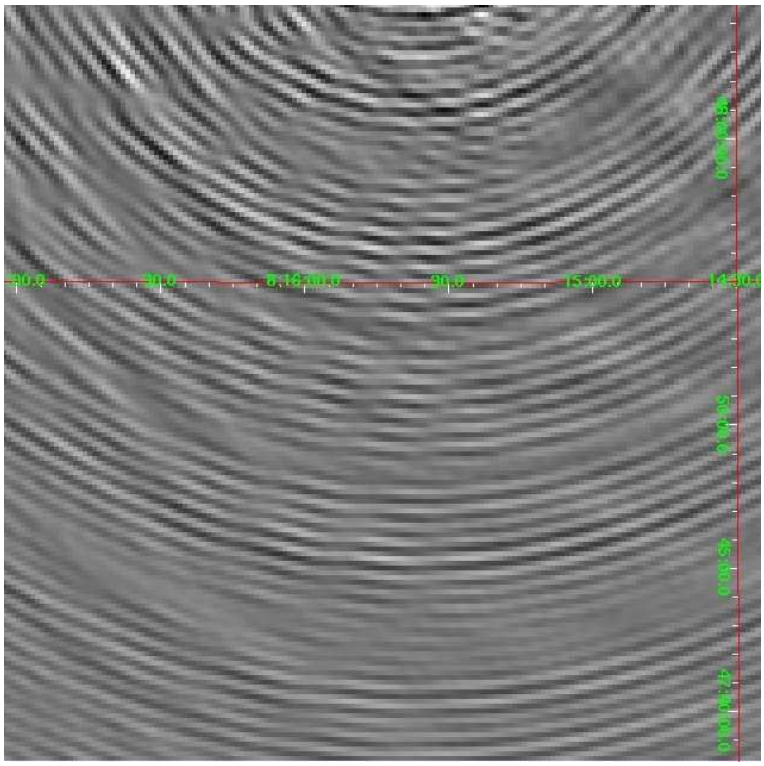

Figure 3. *First and second test sources just outside the upper edge of the facet.*

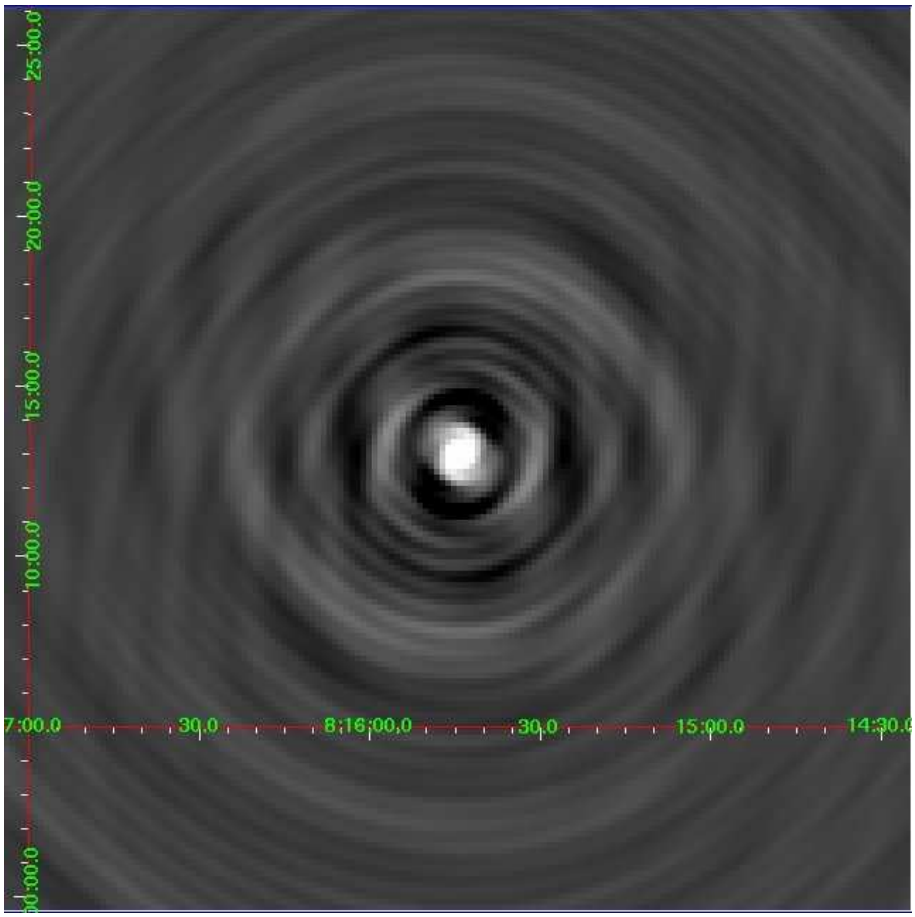

Figure 4. *The PSF for the Figure 2 facet.*

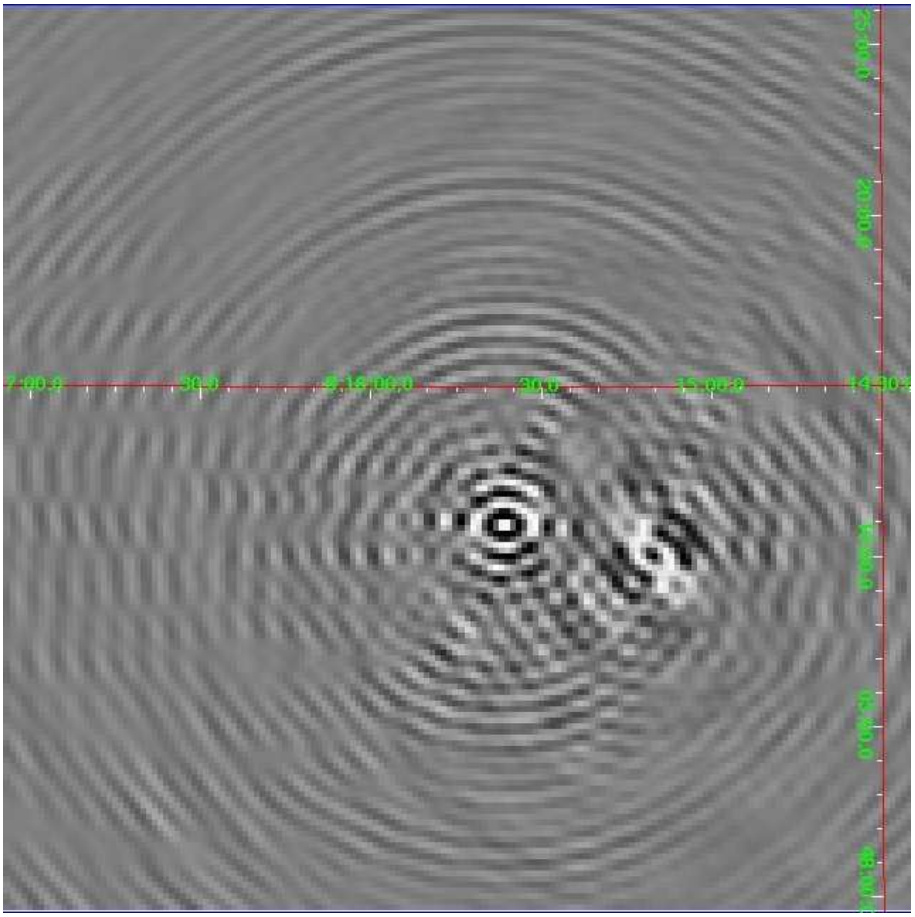

Figure 5. *The residual map for the Figure 2 facet.*

In conclusion, the positions of the simulated sources were recovered as entered in the sky model. In this respect, the imager performs as it should. The fluxes were also recovered as entered in the sky model file.

There was no time left for me to test various other settings of the imager (using no facets, just W projection for example or modifying the clean parameters).