

How accurately do our imaging algorithms reconstruct intensities and spectral indices of weak sources ?

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29th Annual New Mexico Symposium, NRAO, Socorro, 17 January 2014



VLA Wide-band wide-field simulations : (LEFT) L-Band, C-config, 1-pointing , (RIGHT) C-band, D-config, 46 pointings

Simulation Parameters : One Pointing, L-Band (1-2 GHz), C-config

- Sky : ~8000 point sources within one deg^2 (SCube) Sources at pixel centers (+ compared with not)
- Intensity : between 1 micro Jy and 7 mJy. (+ one 100 mJy source for HDR test)
- Spectral indices : between 0.0 and -0.8.
- Observation : 16 channels/spws across 1-2 GHz One snapshot every 20 minutes, for 4
- hrs

(compare with one snapshot every 2 minutes, for 4 hrs)

Data Prediction: Visibilities were calculated using the Wideband A-Projection de-gridder. No noise.



PB (time)



PB (freq)

PB (pol)

+









Low dynamic range test (< 10⁴) – compare four methods



(Reconstructed / True) Intensity for different intensity ranges

Locate sources in true image. Plot all sources >1 micro Jy. (Brighter sources are more accurate)

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Spectral index for brighter sources are more accurate. Degrades quickly with lower intensity. (note different numbers of sources with alpha detections)





High dynamic range test (>10^4) - compare four methods





Details : validating simulations and testing algorithm limits









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Cube Imaging with a Joint Mosaic (Ap=F) and PBCOR per SPW



 $(Jy/beam) \times 10^{-5}$ 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 Intensity : Reconstructed / True 100 80 60 40 20



1.0

1.5

2.0

8.0

0.5



Cube Imaging with a Joint Mosaic (Ap=T) and PBCOR per SPW



(Jy/bearn) x10⁻⁵ 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8





Joint Mosaic with Wideband AW-Projection and MT-MFS (nt=2)



 $(Jy/bearn) \times 10^{-5}$ 0.2 0.4 0.6 0.8 Í1 1.2 1.4 1.6 1.8 0 Intensity : Reconstructed / True 450 All 1448 sources 400 S>5.0µJy (505) 350 $S > 20.0 \mu Jy (150)$ 300 250 200 150 100 50 8.0 1.5 2.0 0.5 1.0 Alpha : Reconstructed - True 180 All 505 sources 160 S>10.0µJy (297) 140 S>50.0µJy (33) 120 100 80 60 40

0.5, 1.0 1.5 2.0

20

-2.0 -1.5 -1.0 -0.5 0.0



Joint Mosaic with Wideband AW-Projection and MT-MFS (nt=2)



(Jy/bearn) x10⁻⁵ 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8





- Work in progress to con EN1DEEPOS. 3C465 IPOL 1515.000 MHZ - Wideband wide-field 3C 465 - Even in perfectly con²⁷ 10 VLA L-Band (from F.Owen) the astrophysical inte 08 Demonstrations on wide 06 - Single pointings : A2 04 Band, Pla 02 Mosaics : CTB80 field Centaurus-00 More simulations 26 58 Add calibration error 56 (Kara Kundert / underg 54 Add source polarizat (Preshanth Jagannatha 52 23 39 15 30 00 37 45 00 38 45 15 Right Ascension (USUUU)