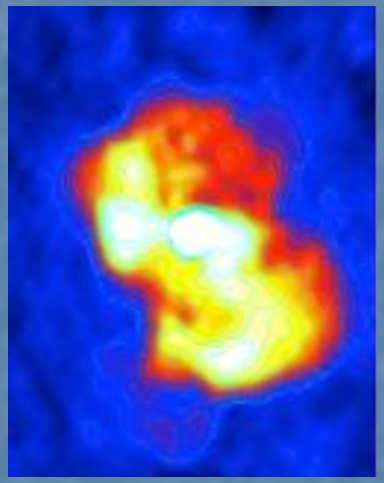
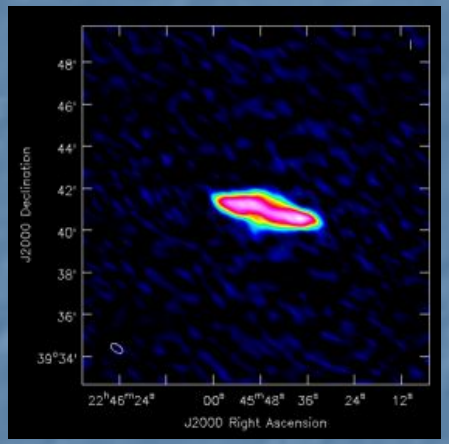
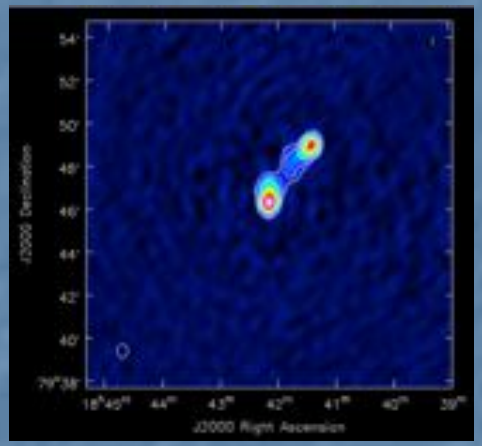
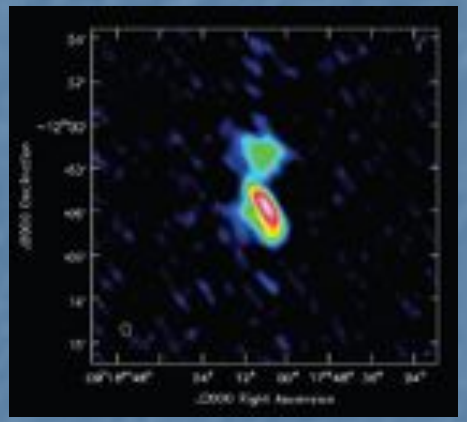
Report from Imaging Busy Week 11

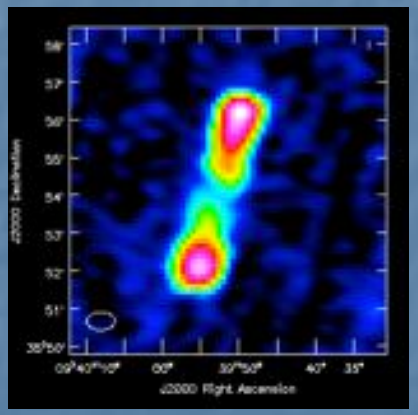
Lorentz Center, 2-6 May 2011

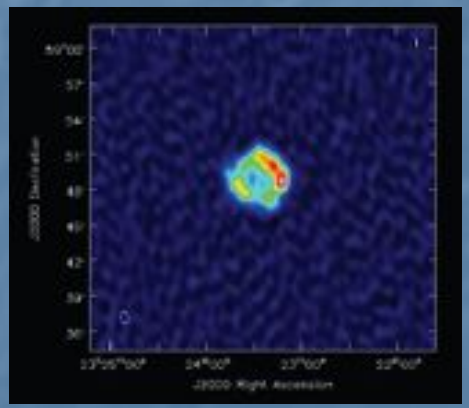


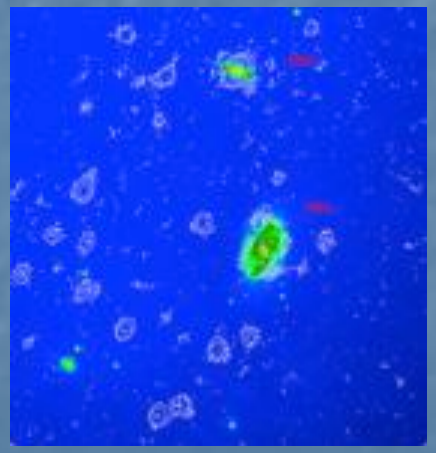


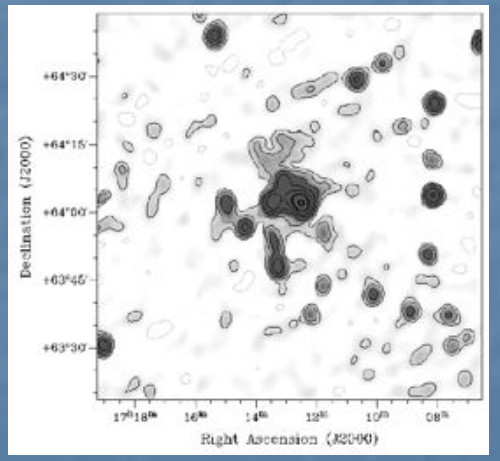












Roberto Pizzo, Huub Rottgering & John McKean

Imaging Busy Week 11

- 31 participants: @ the Lorentz Center and in remote through an EVO session

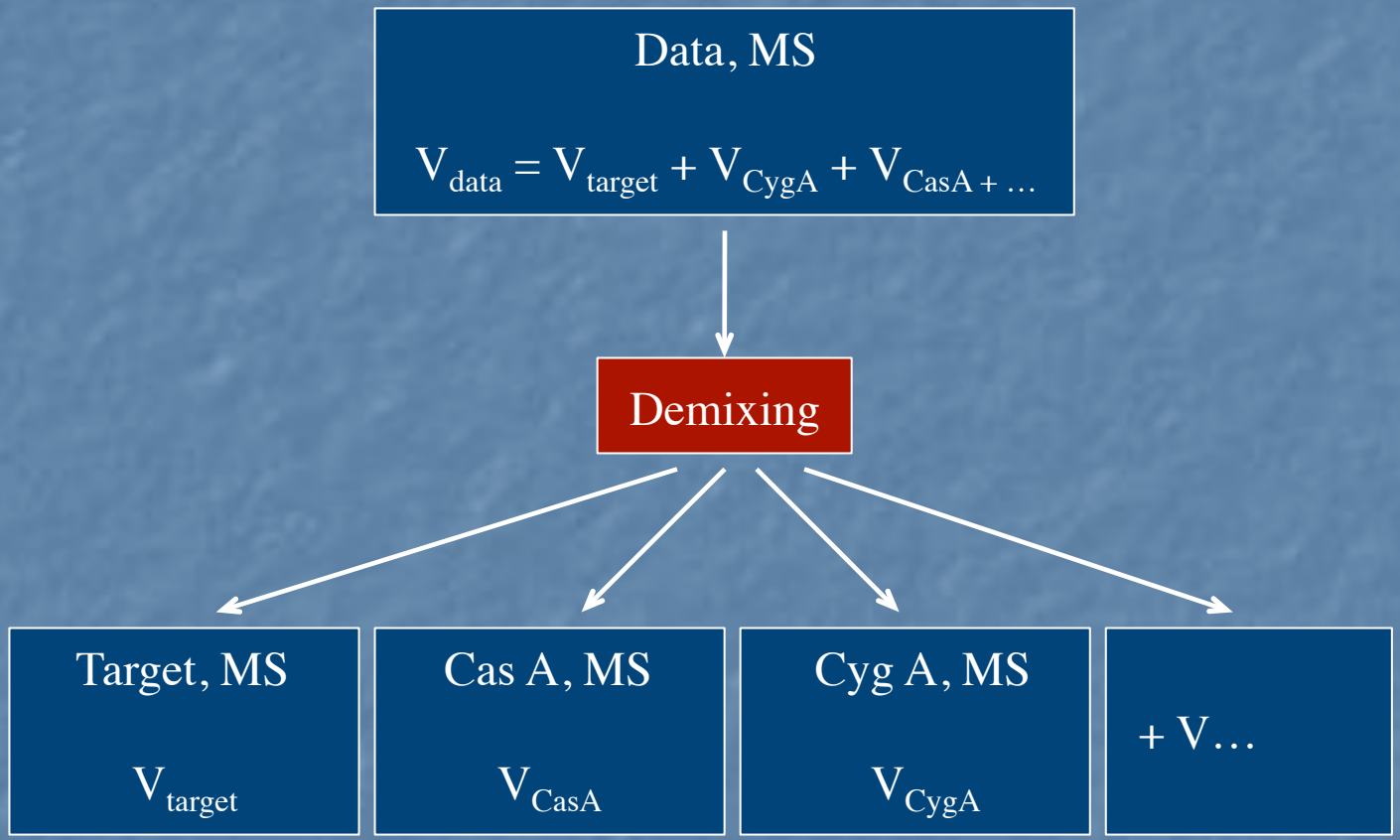
- Roberto Pizzo
- Huub Rottgering
- John McKean
- Arthur Bakker
- Fabien Batejat
- Laura Birzan
- Jess Broderick
- Christopher Conselice
- Francesco de Gasperin
- Gabriele Guglielmino
- George Heald
- Michael Hogan
- Marinus Israel
- Wojciech Jurusik
- Elzbieta Kuligowska
- Panos Lampropoulos
- Giulia Macario
- Tom Mauch
- Kim McAlpine
- Alexander Muller
- Kiz Natt
- Emanuela Orru'
- David Rafferty
- Niruj Ramanujam
- Aleksandar Shulevski
- Cyril Tasse
- Monica Trasatti
- Ilse van Bemmel
- Sebastiaan van der Tol
- Sjoert van Zwieten
- Vamsi Krishna Veligatia
- Wendy Williams
- Annalisa Bonafede

Imaging Busy Week 11

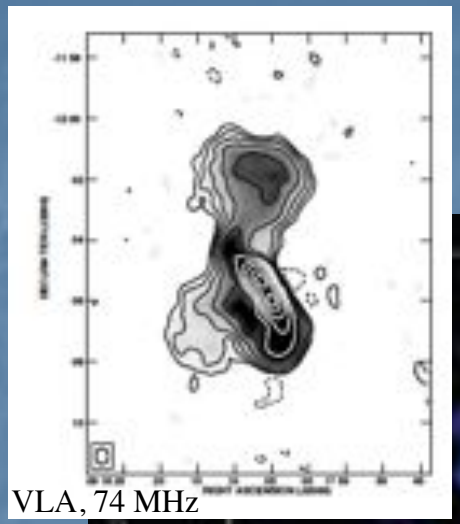
- 2 groups: ‘beginners’ and ‘experienced’ commissioners
- Beginners were initiated to Lofar data reduction under the supervision of John McKean
- The experienced commissioners worked on important commissioning tasks:
    - Testing the demixing on LBA (and HBA) datsets to subtract the A-team sources;
    - production of scientific quality images

RESULTS PRE-BW11
DEMIXING

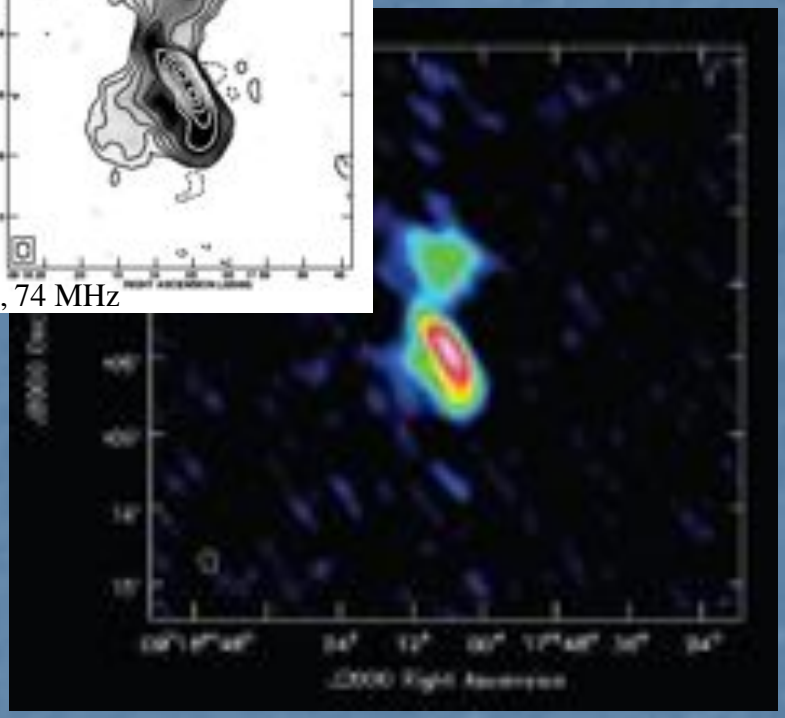
WHAT DOES IT DO?



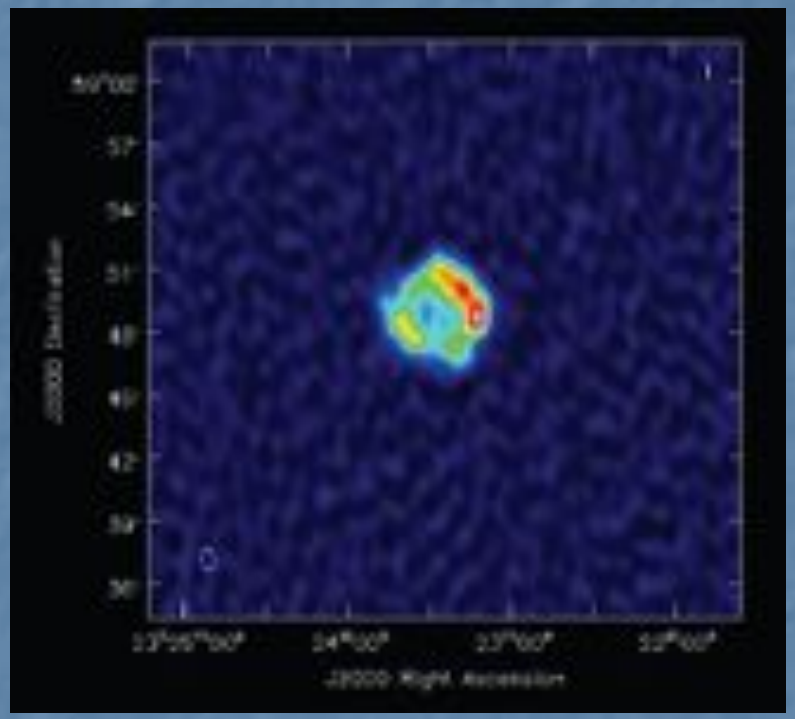
Demixing: Hydra A (LBA)



VLA, 74 MHz



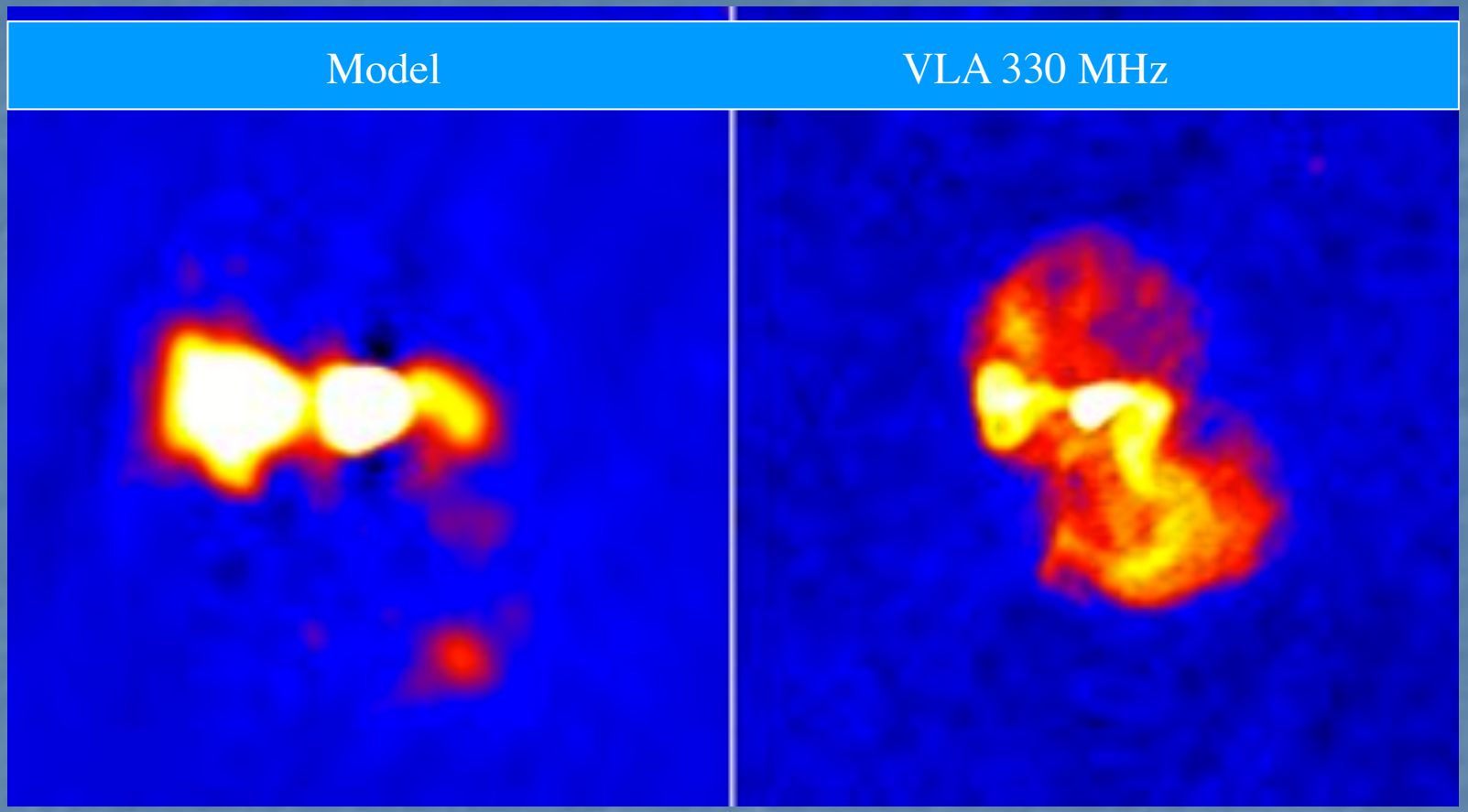
Hydra A, after demixing
-12 declination (!)



Courtesy of R. van Weeren

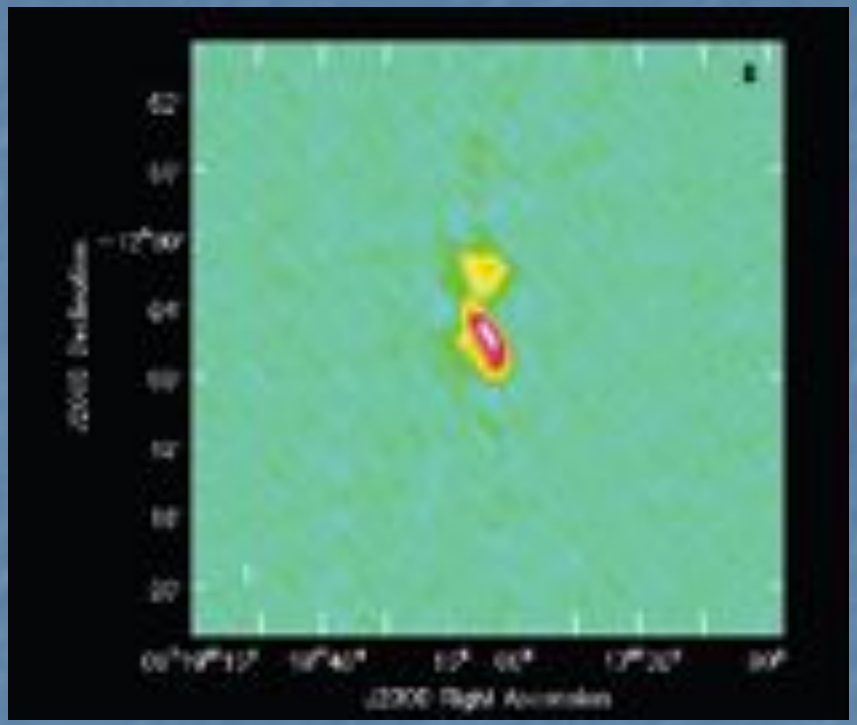
50 MHz 1 SB, 127° (!!)
from pointing center (Hydra A)

FROM BW10 AND BUSY WEDNESDAYS: PROBLEMS WITH GAUSSIAN DECOMPOSITION

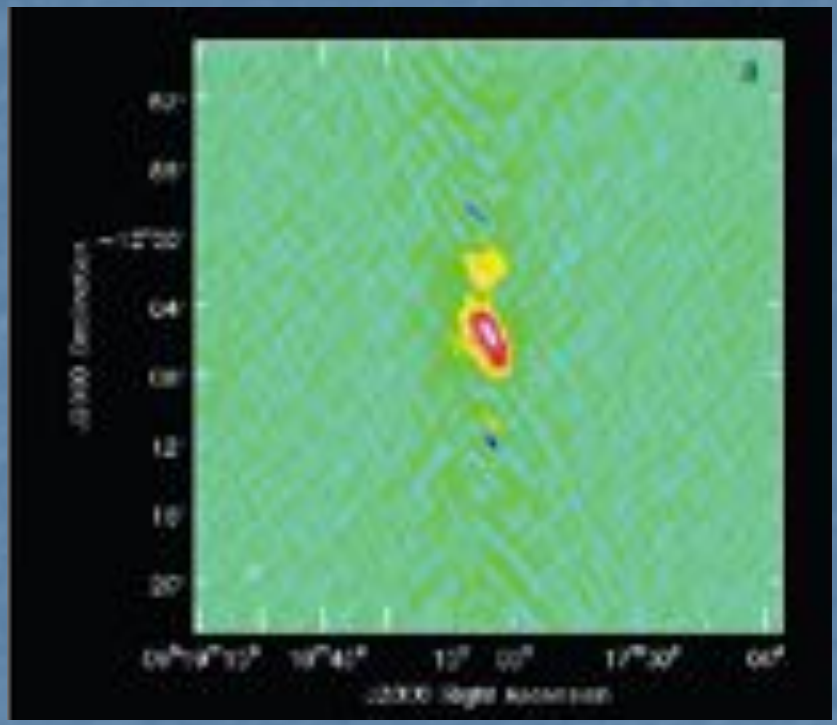


PyBDSM does not model properly the fine structure of radio sources
Better to not use it when dealing with complex sources

Source models when demixing



Using CC models



Using PyDBSM
(gaussian decomposition)

CC models show best performance, but are a bit slow....

AVAILABLE DATA

AVAILABLE DATA (I)

Source	Observation ID	Band	Δν (MHz)	Δt (h)	Beams	Status. processed with:
Cyg A	L2011_24921	HBA L	110-190	6	1	---
Vir A	L2011_24923	HBA L	110-190	8	1	AOF
	L2011_25455	LBA	30-90	8	1	NDP3(rfi)
A2255	L2011_25517	HBA L	110-190	6	1	NDP3(rfi)[5]
3C61.1	L2011_23644	HBA L	110-190	24	17	AOF+NDP3
NGC6251	L2011_25107	LBA	30-90	6	1	AOF+NDP3
M81/M82	L2011_25514	HBA L	110-190	6	1	NDP3(rfi)

[1]: AO flagger
[2]: NDPPP
[3]: LOW
[4]: HIGH
[5]: NDPPP with 'rficonsole' option

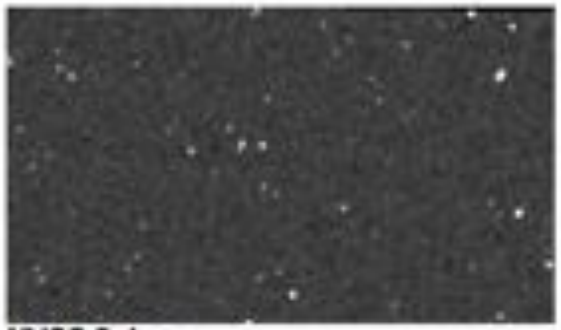
AVAILABLE DATA (III)

Source	Observation ID	Band	Δν (MHz)	Δt (h)	Beams	Status
3C390.3, 3C445, 3C452, 3C449, 3C388, 3C401, CIZA J2242…, 3C465	L2011_25888	LBA	30-90	6	8	NDP3(rfi)[1]
Lockman hole, 3C219, 3C227, 3C223, DA240, 3C236, B3 0559+422B, 4C55.16	L2011_25887	LBA	30-90	6	8	NDP3(rfi)
EGS, Bootes, Her A, Coma, 3C353, 3C338, 3C317, 4C06.53	L2011_25886	LBA	30-90	6	8	NDP3(rfi)

[1]: NDPPP with ‘rficonosle’ option

Lockman Hole

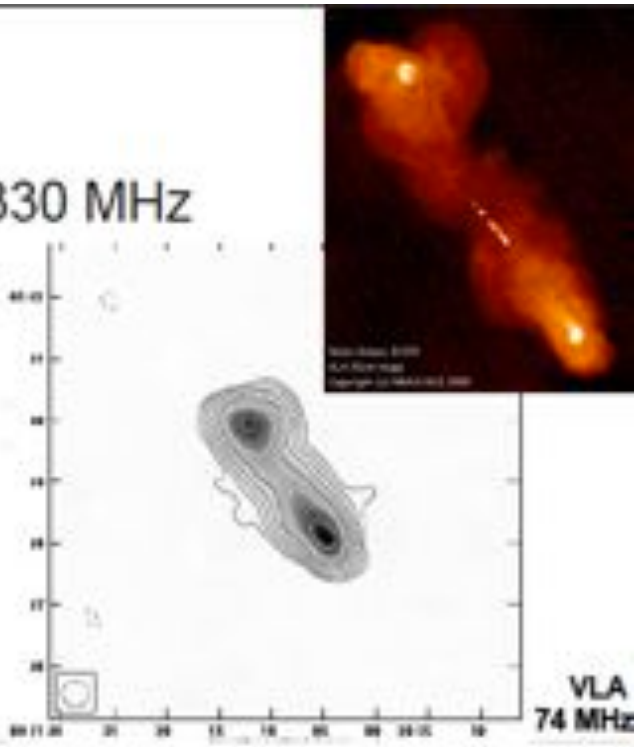
- Deep field



NVSS 2 deg

3C 219

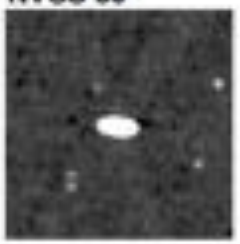
- VLA 74 & 330 MHz models
- FR II
- 190"



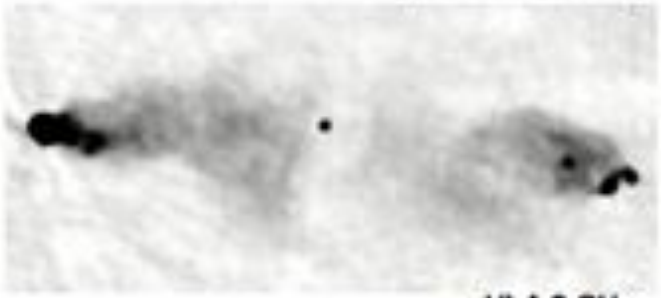
VLA 74 MHz

3C 227

- FR II
- ~200"



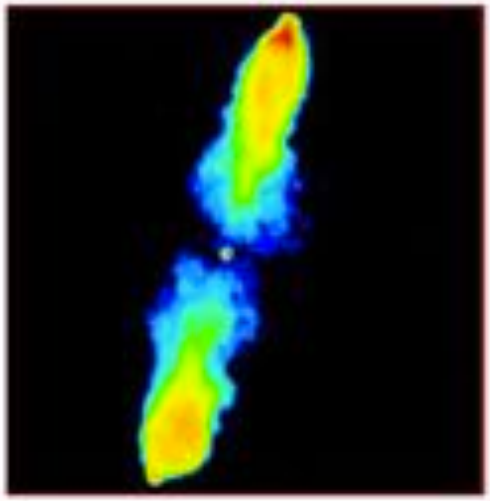
NVSS 30'



VLA 8 GHz

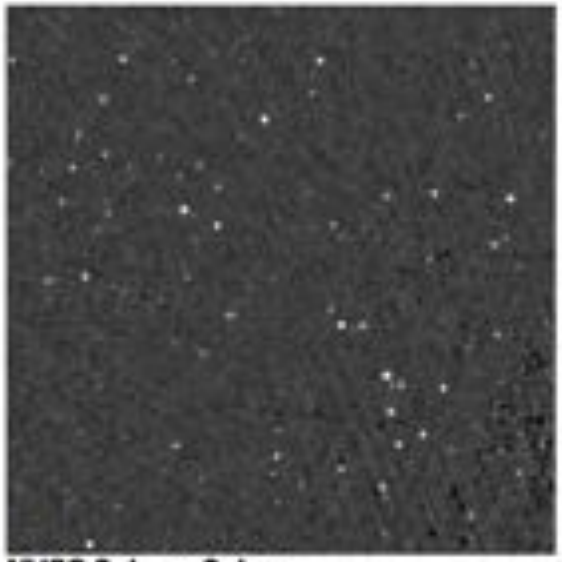
3C 223

- FR II
- 300"



EGS

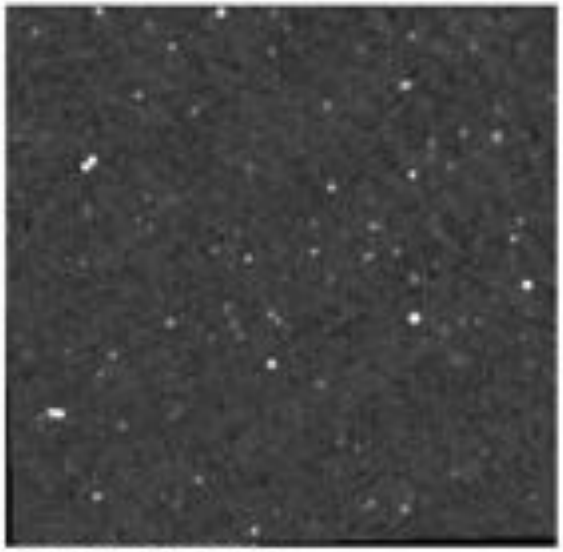
- Deep field



NVSS 2 deg x 2 deg

Bootes

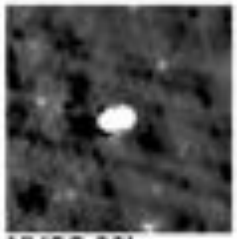
- Deep field



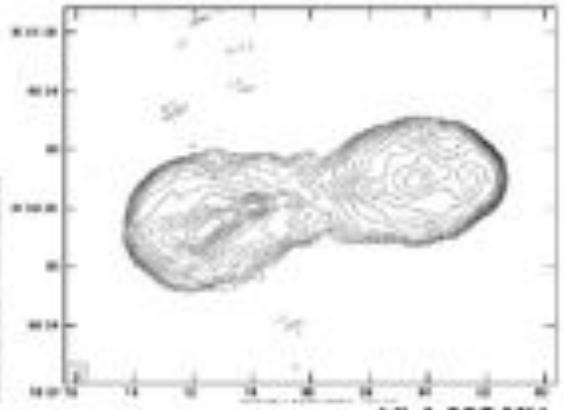
NVSS 2 deg x 2 deg

Hercules A

- FR 1.5
- 194"



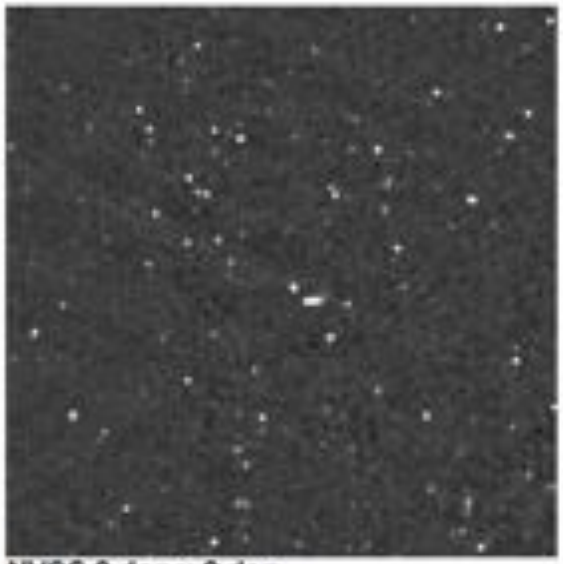
NVSS 30'



VLA 325 MHz

Coma

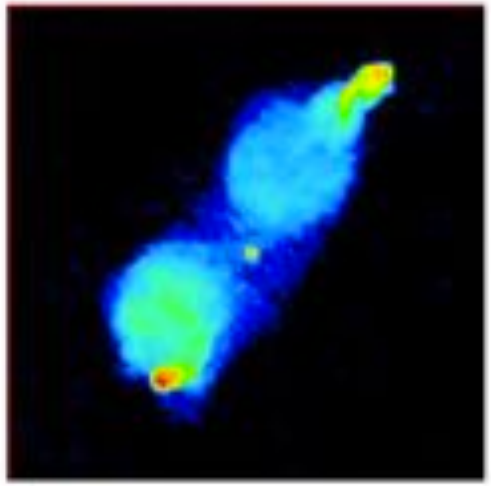
- cluster



NVSS 2 deg x 2 deg

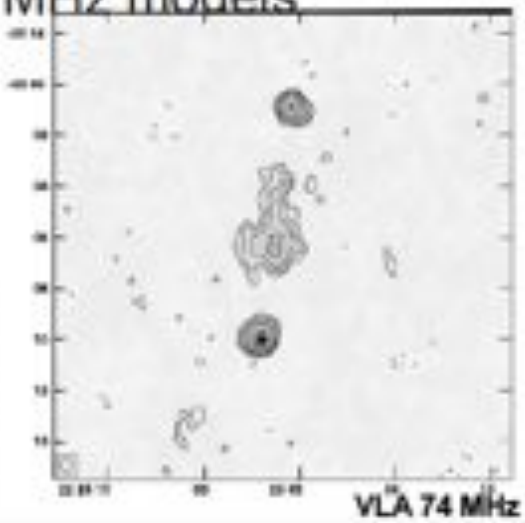
3C 390.3

- FR II
- 229"



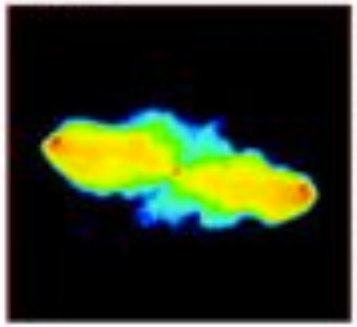
3C 445

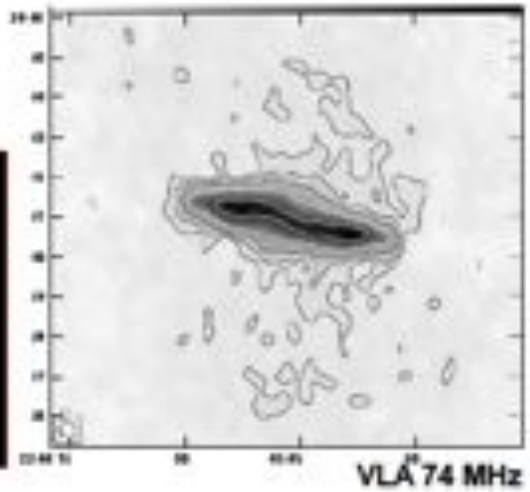
- VLA 74 & 330 MHz models
-



3C 452

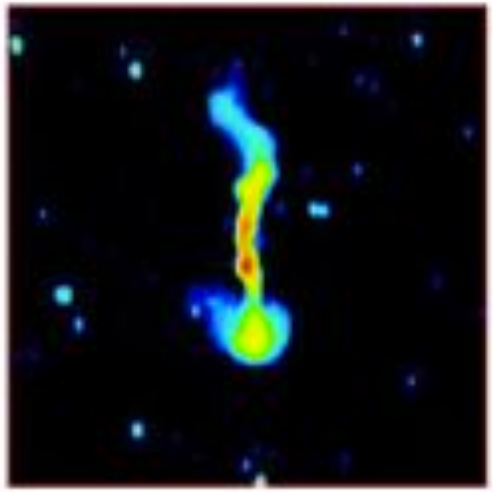
- VLA 74 & 330 MHz models
- FR II
- 278"





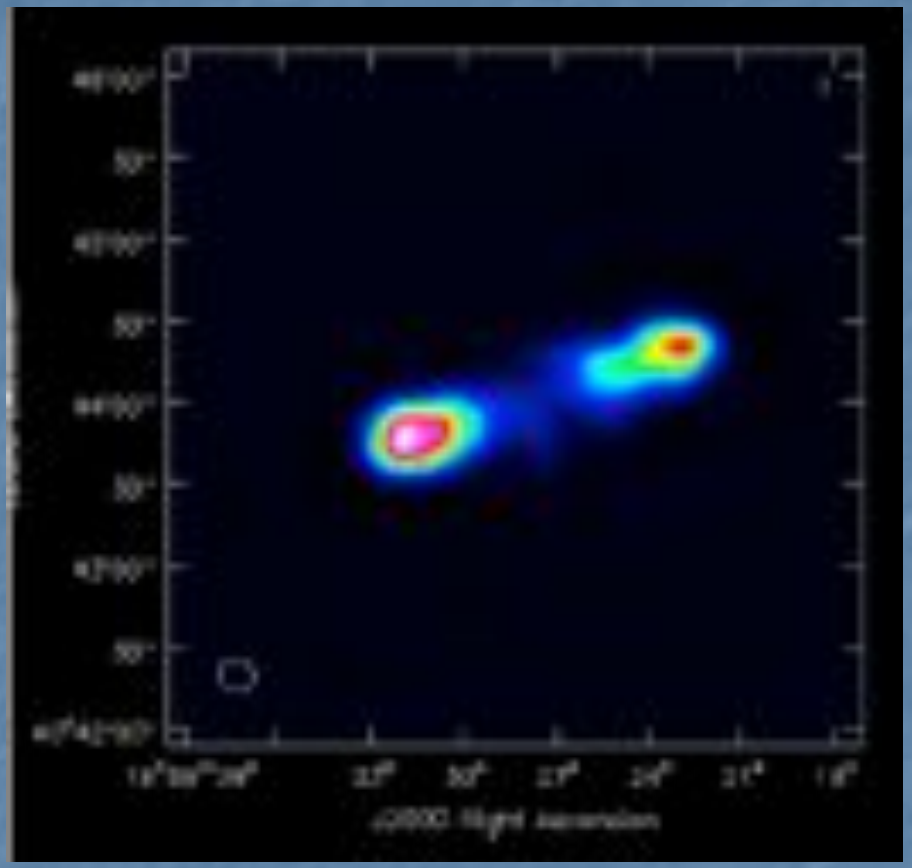
3C 449

- FR I
- 1500"



SOME RESULTS…

Cyg A in HBA (133 MHz)



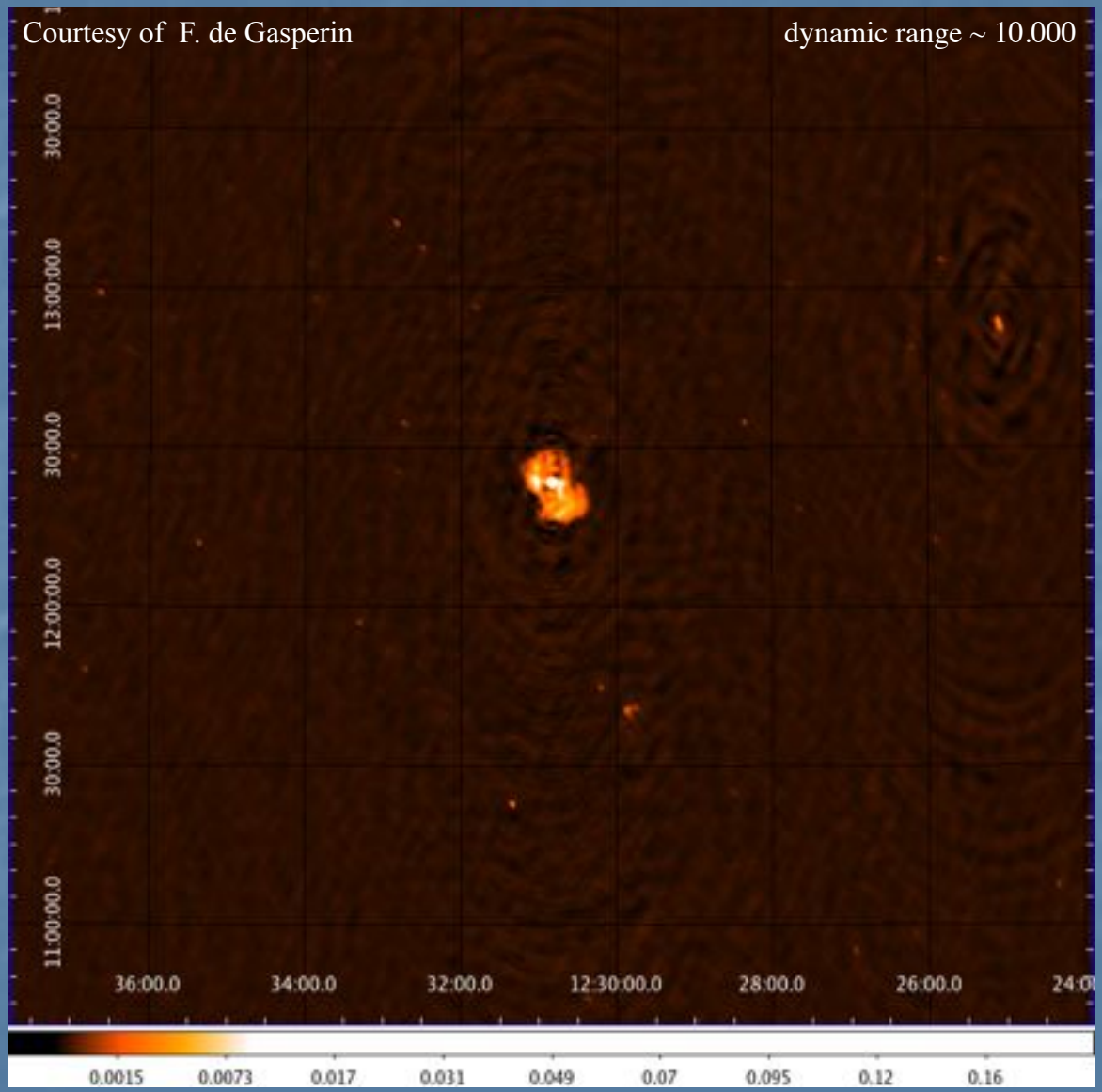
Example of map of Cyg A from the tutorial

The beginners started getting experience with LOFAR data reduction with Cyg A in HBA (L24921, 110-190 MHz).
They worked on 3 ‘training lce nodes’, where these data will be kept.

Supervised by John McKean, they successfully went through the steps of flagging, calibration (in BBS), imaging (in CASA), and selfcalibration.

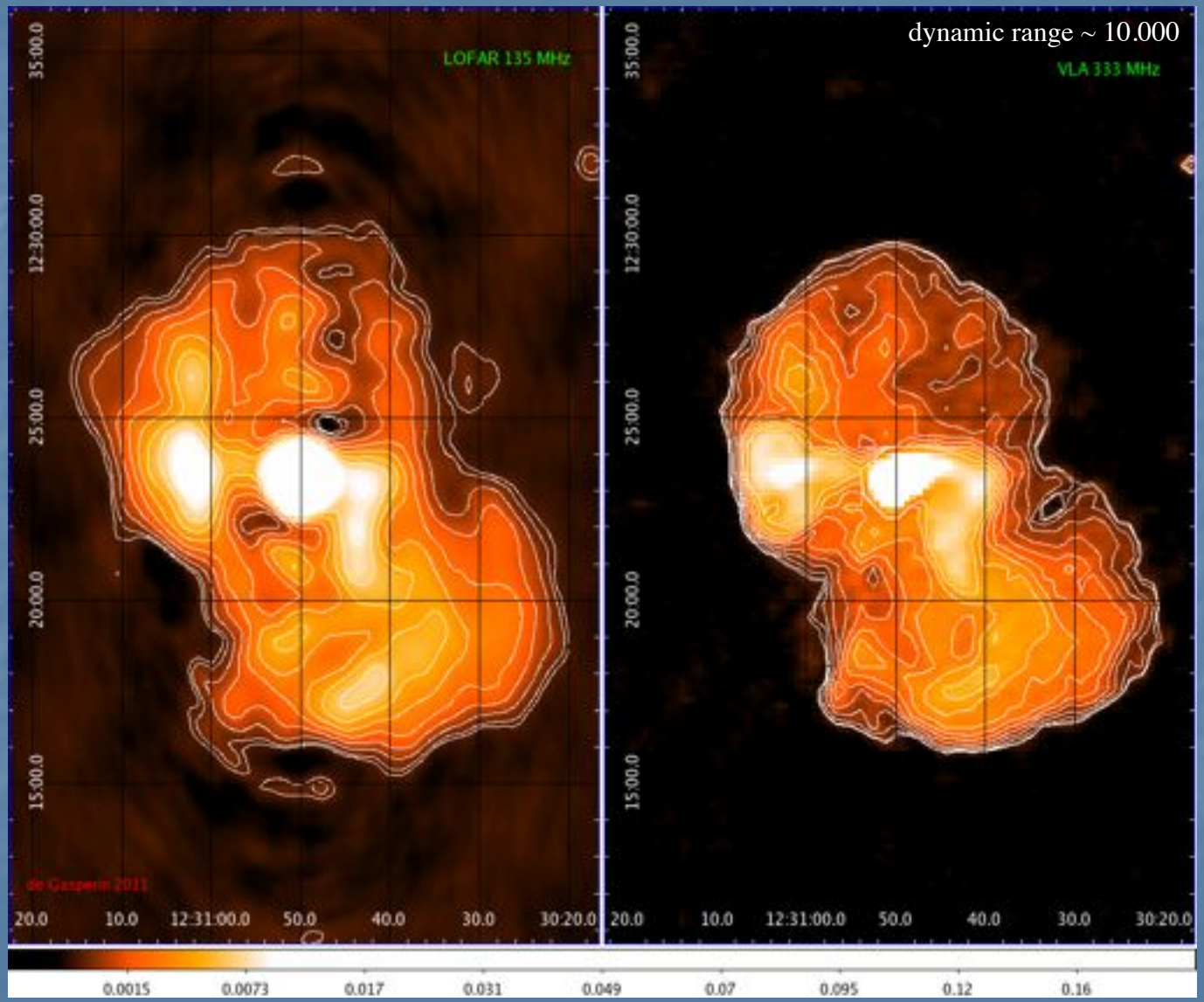
The tutorial is now a chapter of the Lofar Imaging Cookbook

Virgo A in HBA (135 MHz)

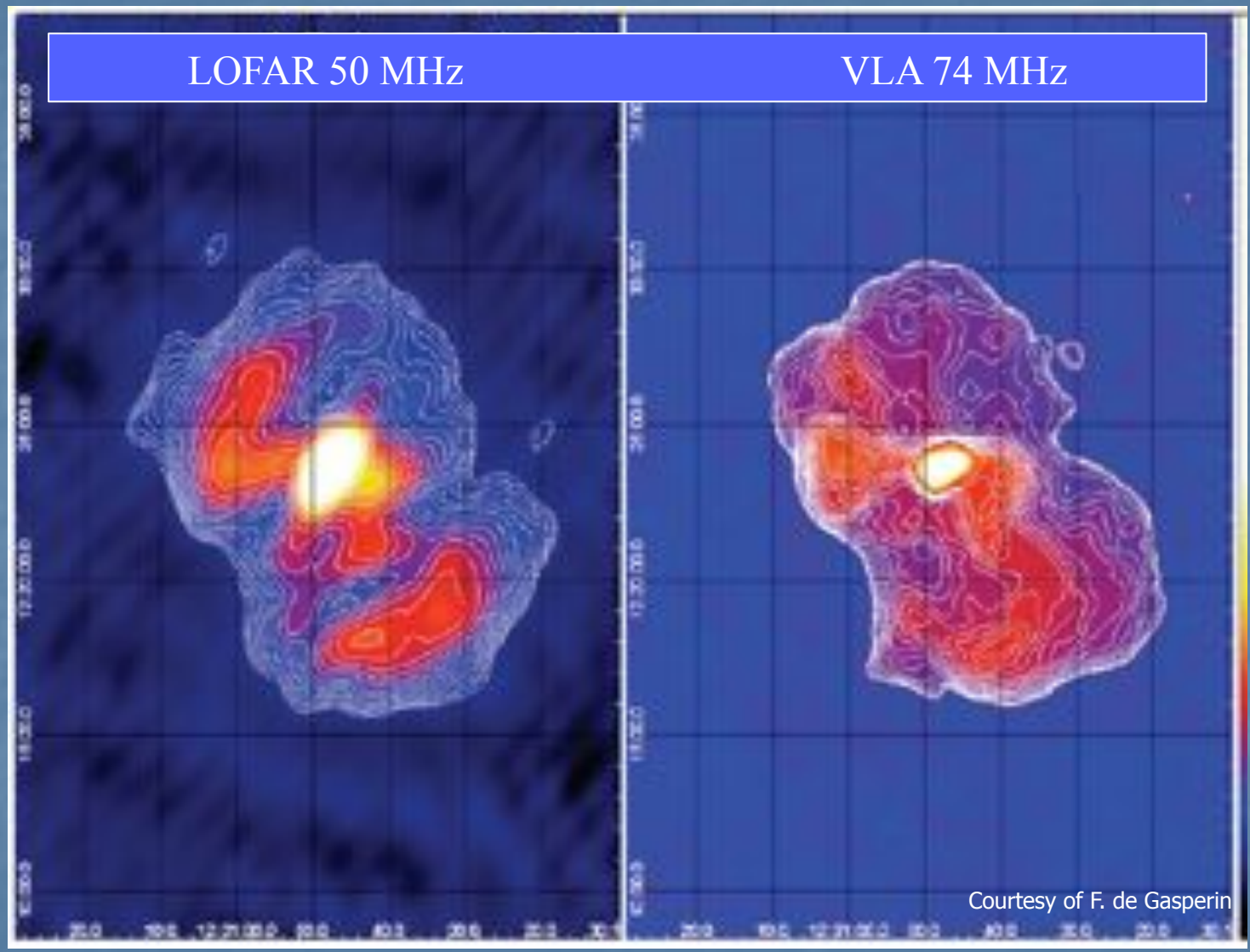


- Vir A and the other sources in the field.
- No subtraction of Cas A nor Cyg A
- Model extracted from VLA image at 330 MHz and containing only Vir A

Virgo A in HBA (135 MHz)

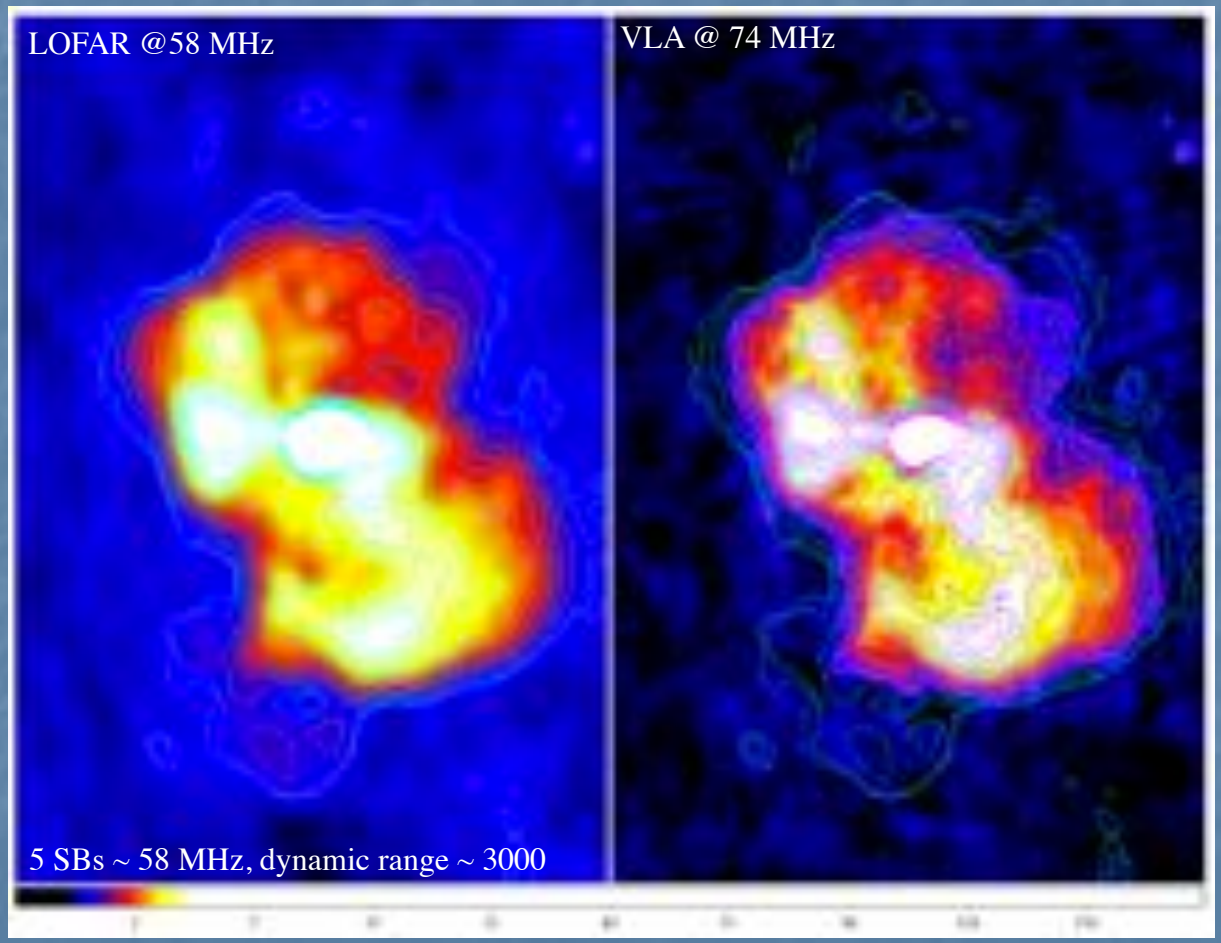


BW9: Virgo A (30-90 MHz)



Cas A and Cyg A not subtracted

Virgo A in LBA (50 MHz)

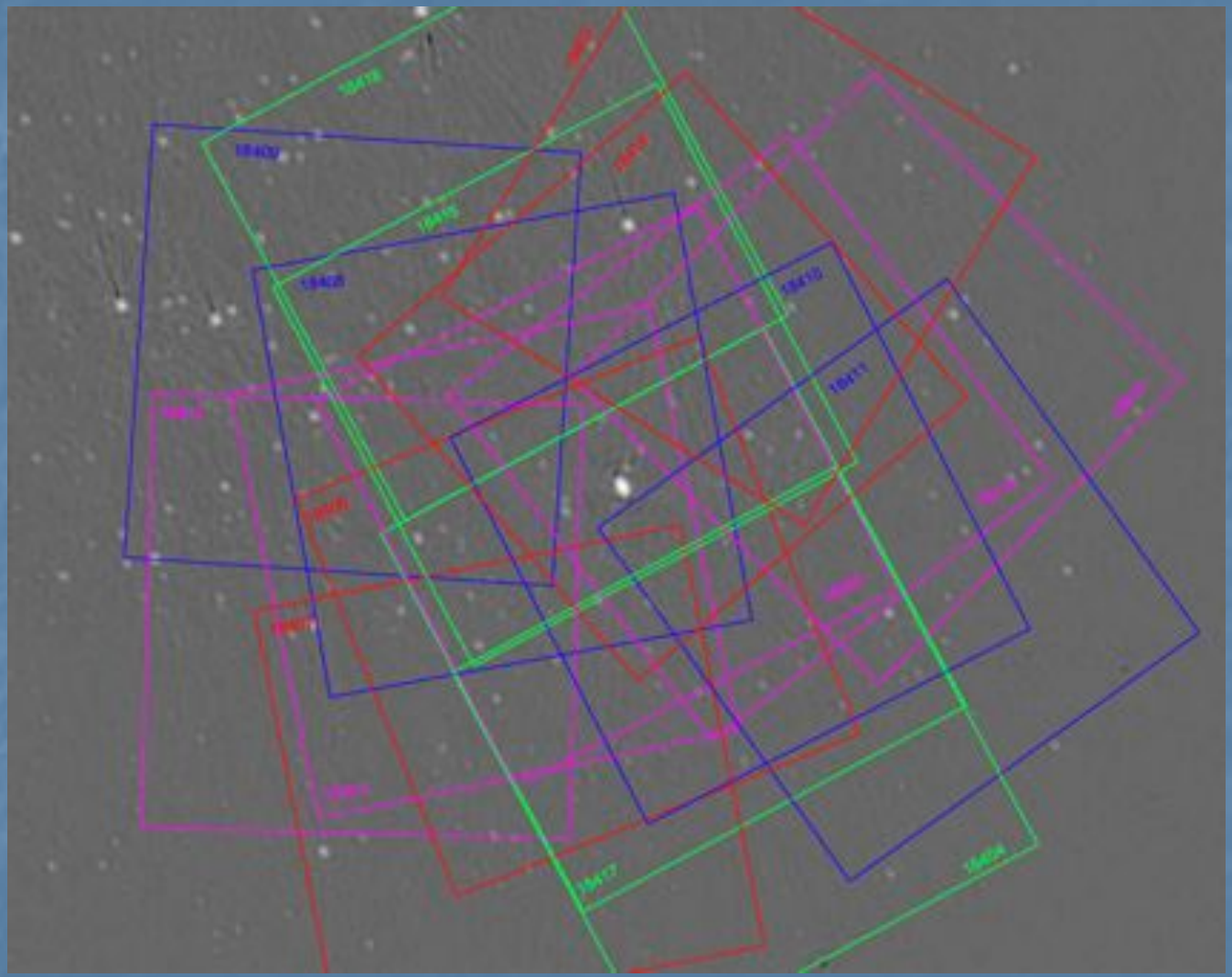


LOFAR contours in green

- Demixing applied
- CC models used to subtract Cas A and Cyg A
- calibration in BBS using 74 MHz map
- Noise is almost white (no artifacts)
- New features start popping up to the south-west and north-east edges of Vir A.

Courtesy of F. de Gasperin & E. Orru'

3C61.1 in HBA (143 MHz)



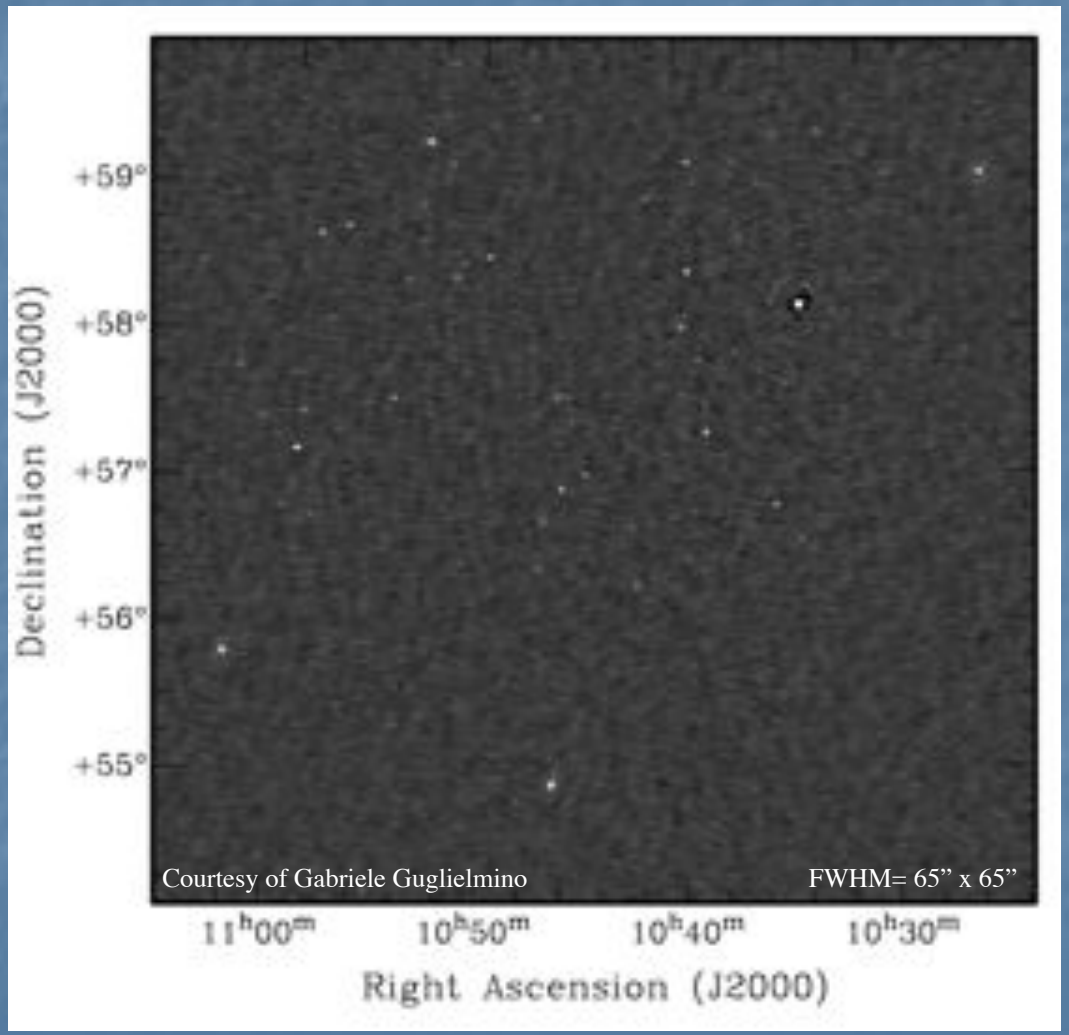
- Field observed with 17 beams.
- Goal: study the LOFAR beam shape by determining the fluxes of the same sources detected in different beams.

3C61.1 in HBA (143 MHz)

Courtesy of A. Shulevsky et al.

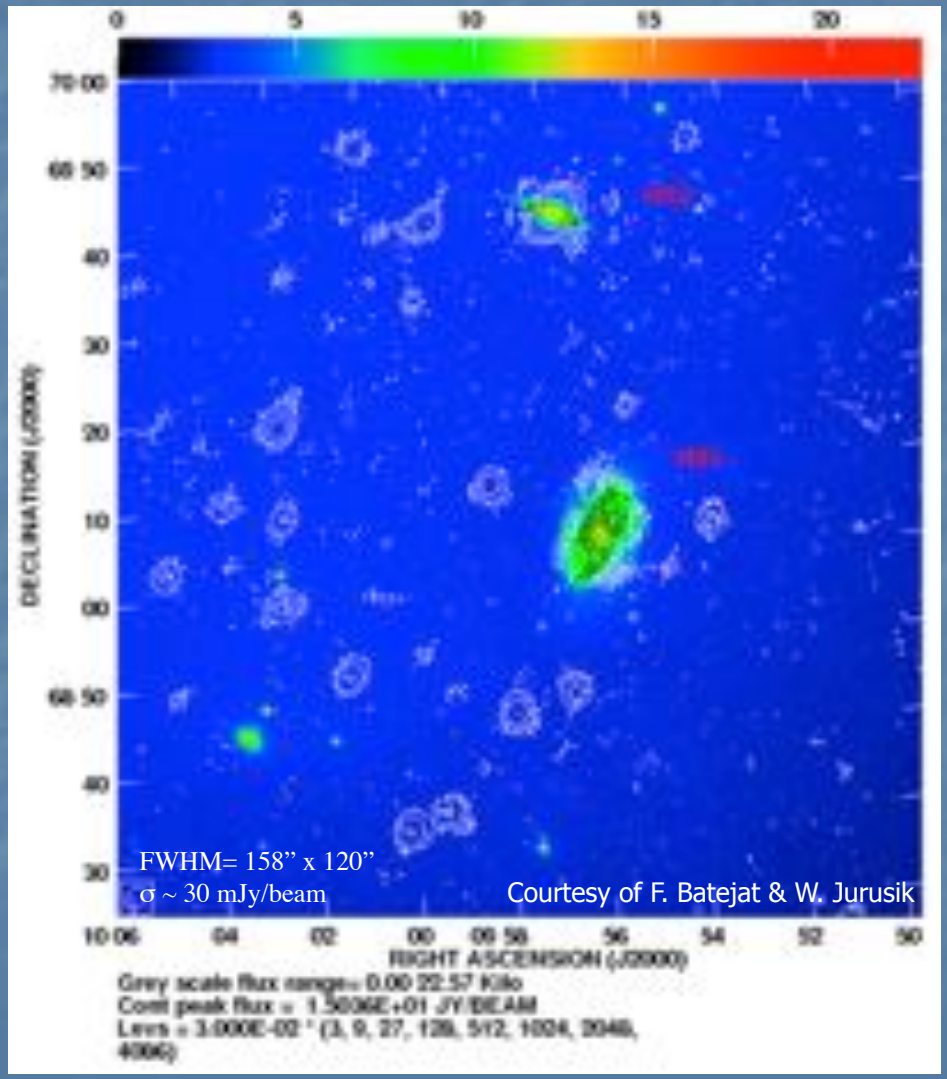
- calibration and imaging of all the beams
  - it is necessary to use Bas's imager
  - BBS solution comparison in progress

Lockman Hole in LBA



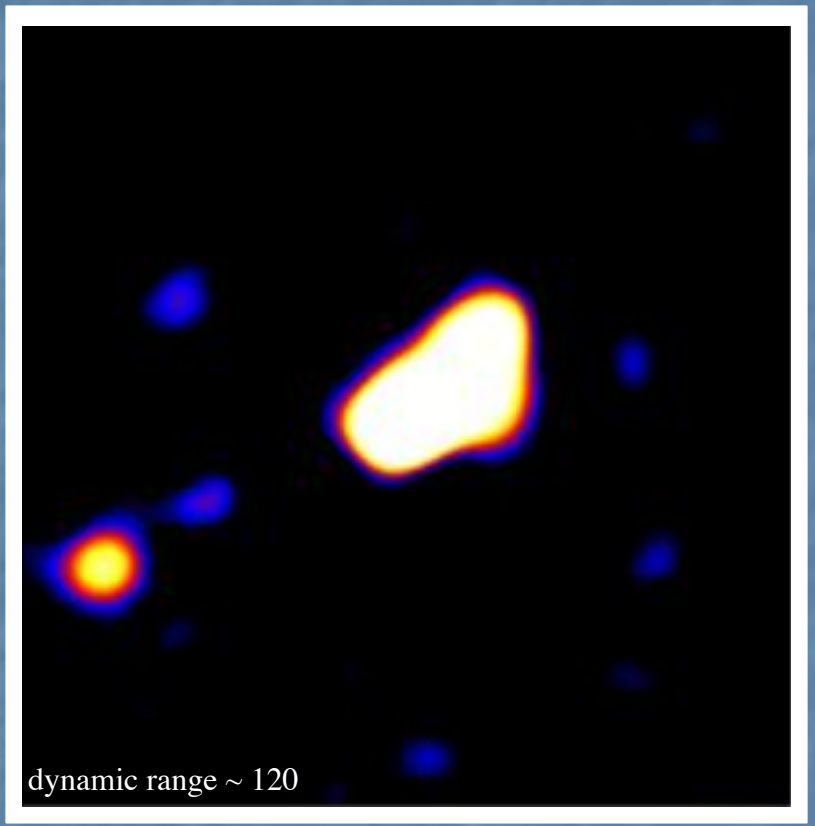
- 1 SB ~ 58 HZ
- Calibration with model extracted from VLSS
- $\sigma_{map} \sim 5\sigma_{therm}$
- Comparison with WSRT map in progress
- next steps: process more SBs
- Subract off-axis source

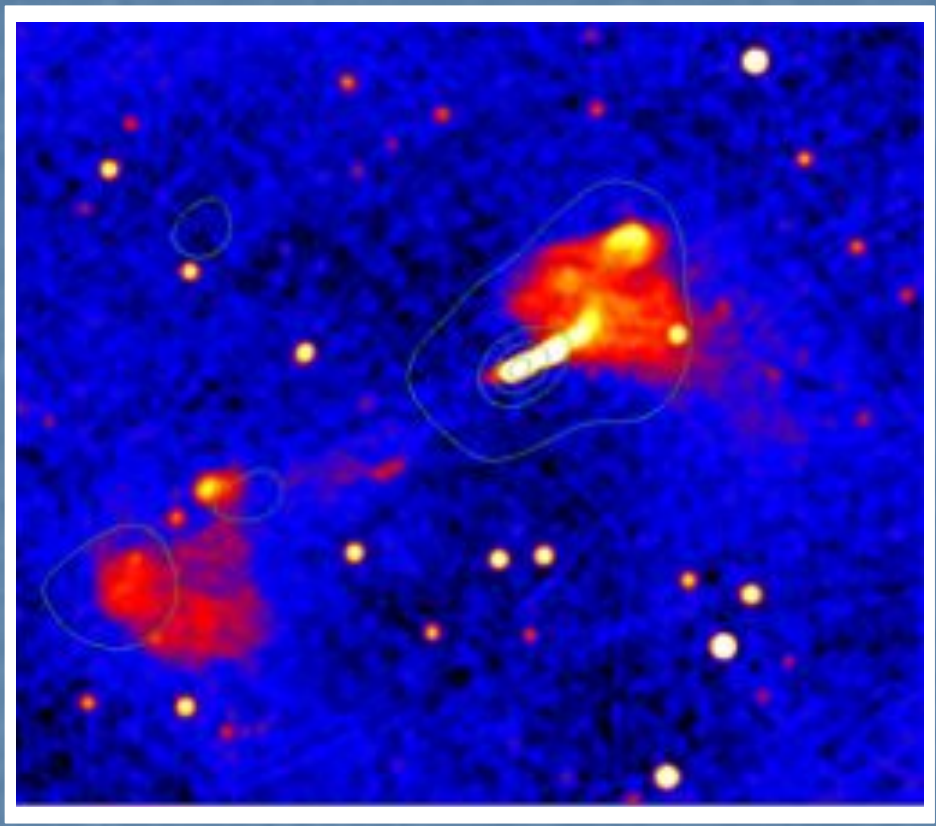
M81-82: HBA (142 MHZ)



- Radio emission at 141.6 MHz (contours) overlaid on the DSS blue image. The first contour level corresponds to 3 sigma of the radio map.
- Emission from M81-82 clearly detected in 1 SB.
- $\sigma_{map} = 30x\ \sigma_{therm}$

NGC6251 in LBA (70 MHz)

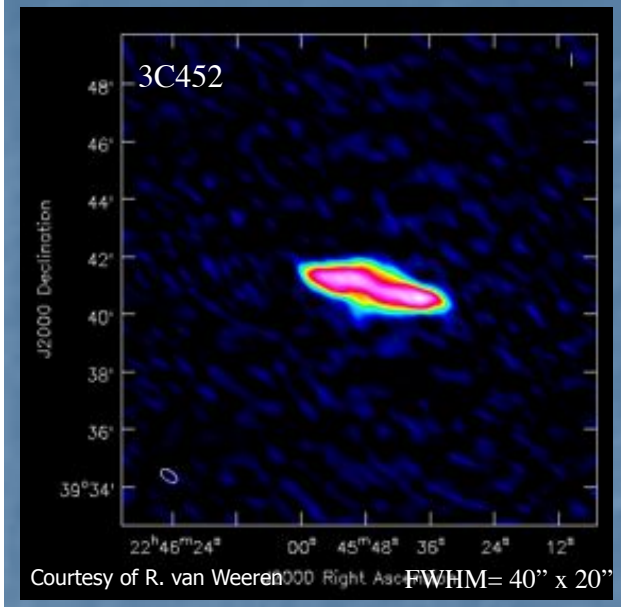


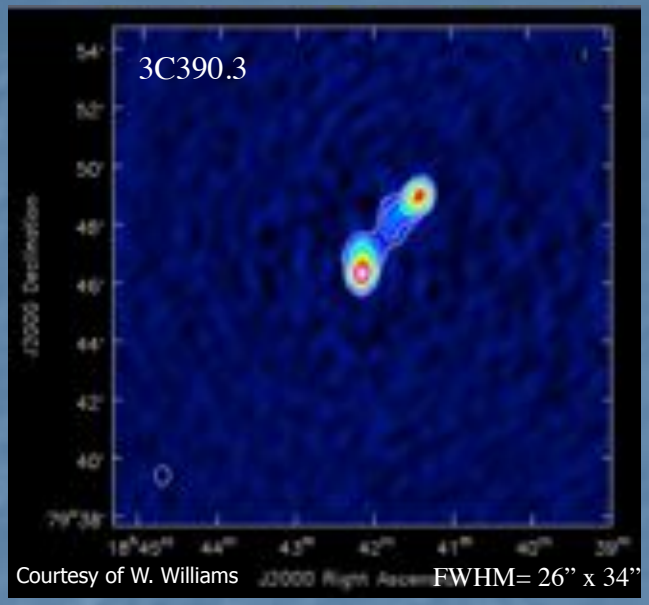


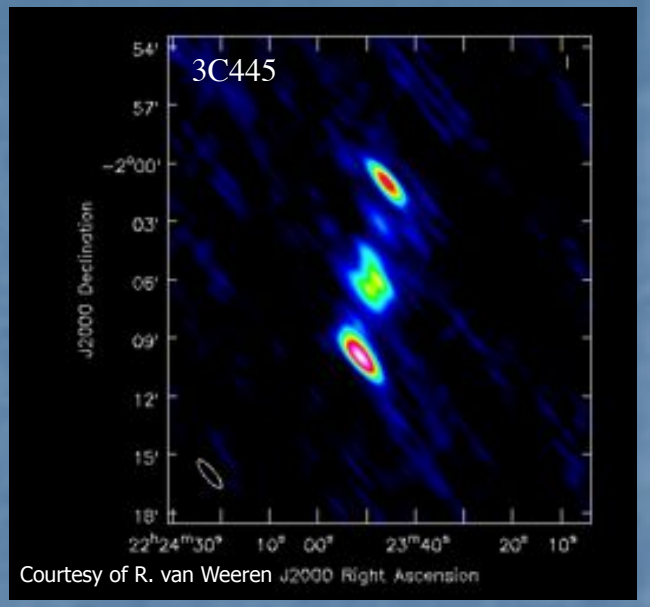
Courtesy of A. Shulevsky

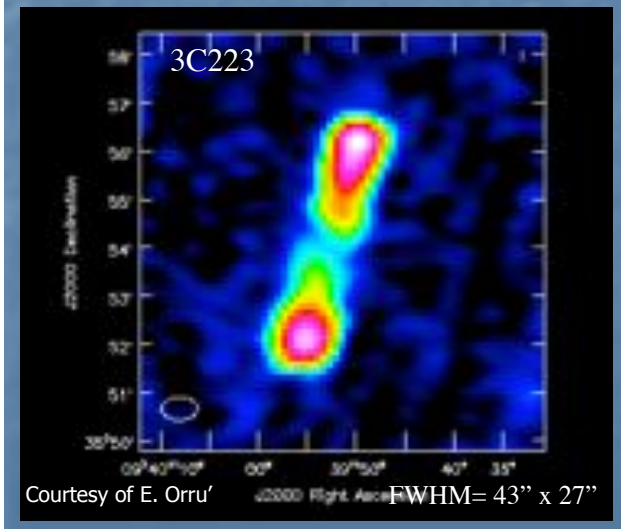
- Demixed Cas A and Cyg A
- Model of NGC6251 from WSRT image at 90 cm
- $\sigma_{map} \sim 10x\ \sigma_{therm}$
- Procedure was tried on a slightly averaged dataset
- exercise will be repeated on the raw data

3C SOURCES IN LBA AFTER DEMIXING





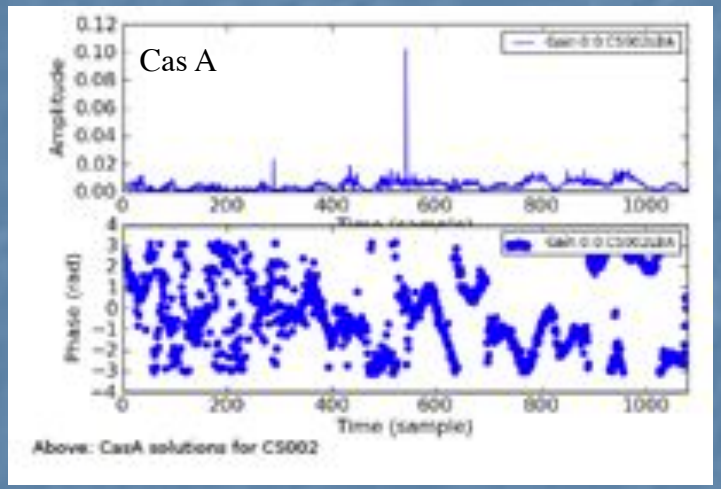


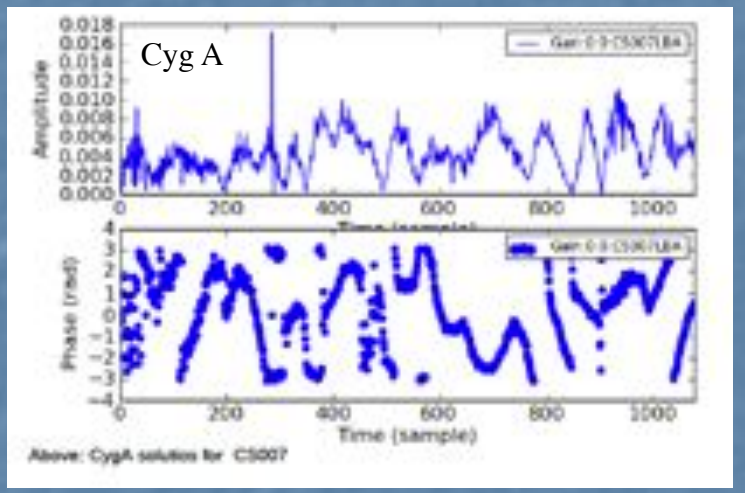


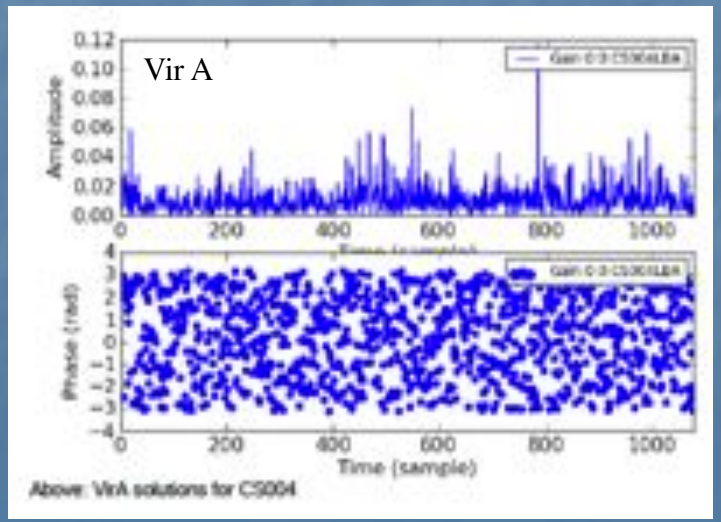
- CC models extracted from VLSS
- $\sigma \sim 250$ mJy/beam (10x σ_{therm})

COMA: LBA (58 MHZ)

- Cas A and Cyg A lie at 90^0 and 82^o. They have been successfully demixed.
- Vir A lies at 17^o. De demixing procedure does not work in this case.





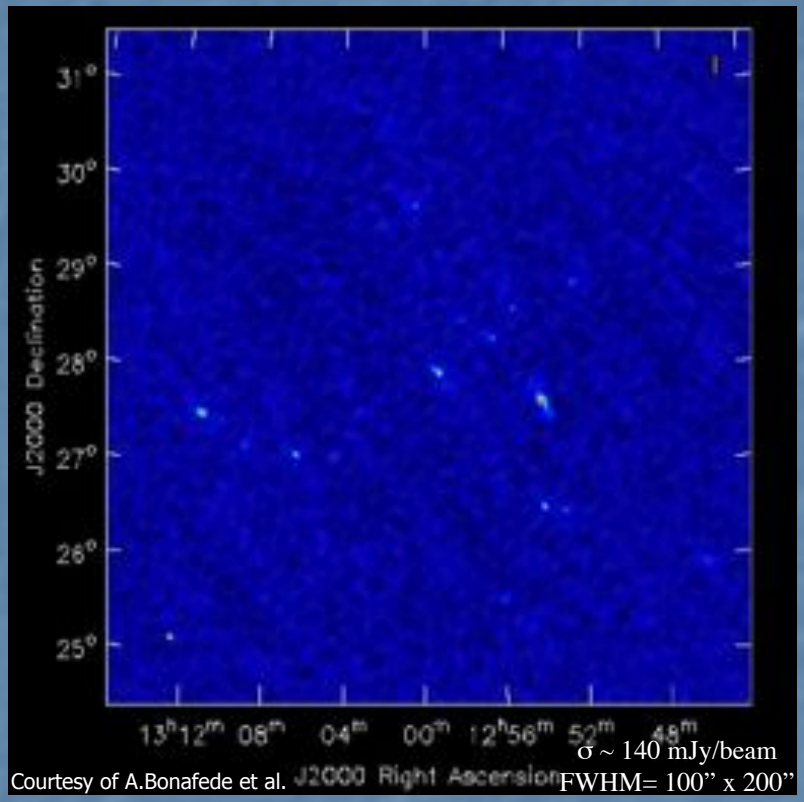


The final calibration of the field produced noisy solution -> VirA at 10°- 20° from the phase center must not be demixed, since it compromises the solutions for the target field.

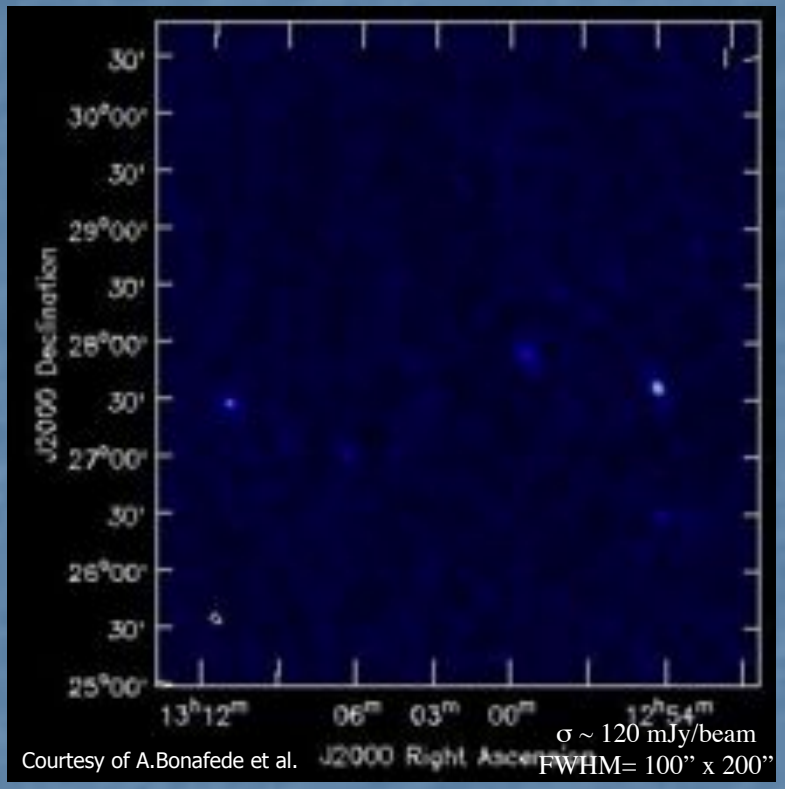
Plots: courtesy of A.Bonafede et al.

COMA: LBA (58 MHZ)

Demixing including only Cas A and Cyg A. Model for target field extracted from VLSS

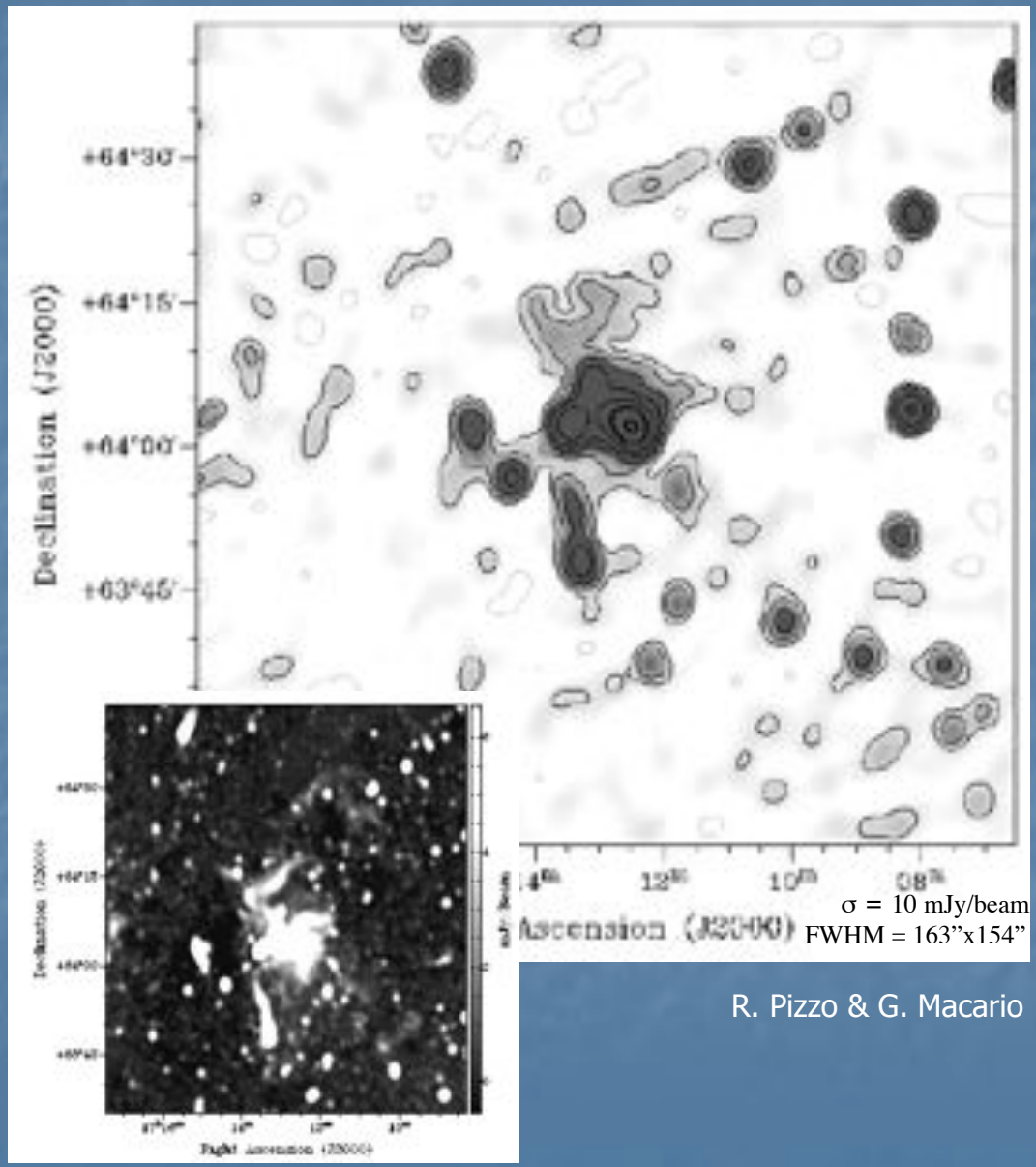


Coma after calibration with Global Solver (4 SBs), VirA "ignored".



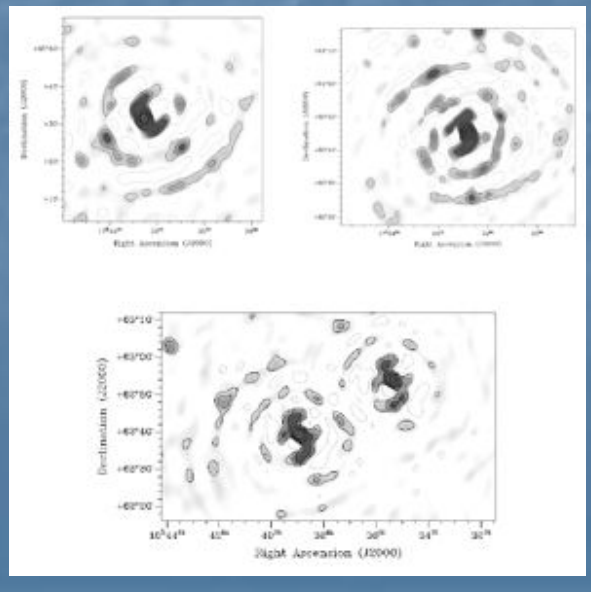
Coma, from calibration of Coma and VirA in the model after averaging data down to 2 channels (maybe too much?)

ABELL 2255: HBA (120 MHZ)



σ = 10 mJy/beam
FWHM = 163"x154"

- 12 SBs
- Calibration done using WENSS model with 350 components
- No subtraction of Cas A and Cyg A
- Calibration & imaging with CS only
- Test: applied the demixing and obtained sensible solutions for both Cas A and Cyg A. However the quality of the final map does not improve, due to the artifacts around strong off axis sources.
- $\sigma_{map} = 20x\ \sigma_{therm}$



R. Pizzo & G. Macario

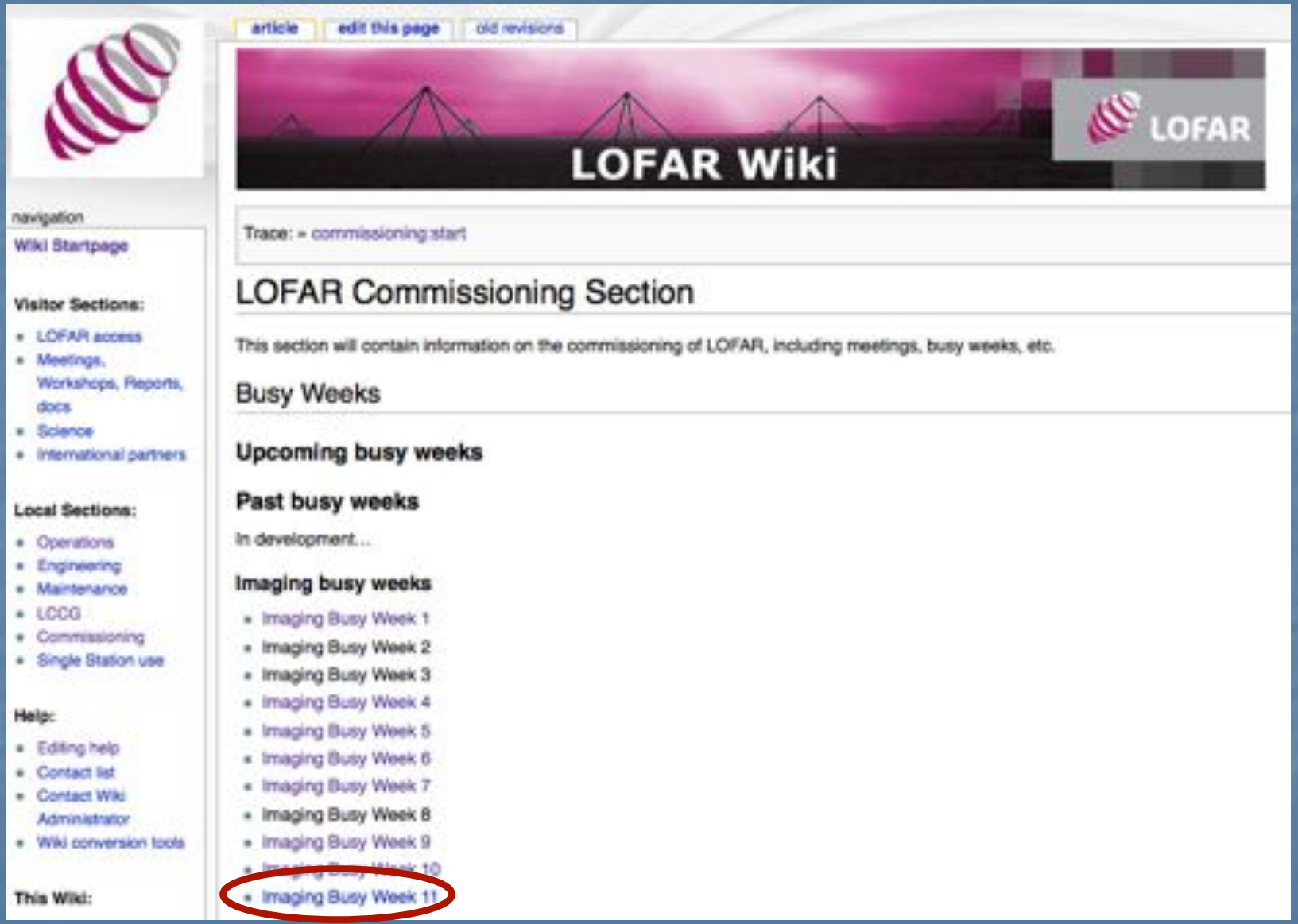
Summary

- Most of the times the demixing works and successfully subtract the contributions of the A-team from the visibilities. However, when the A-team source is close by the field center, the procedure is not successful. We do not understand where it goes wrong

- In many cases, the noise of the final maps is 30x higher than the thermal noise. In this case, we think that we are limited by deconvolution problems.

- When the noise is 10x the thermal, we don’t really know the dominant cause.

Commissioning section on the Wiki




Lofar Imaging BW 11
Stay tuned…