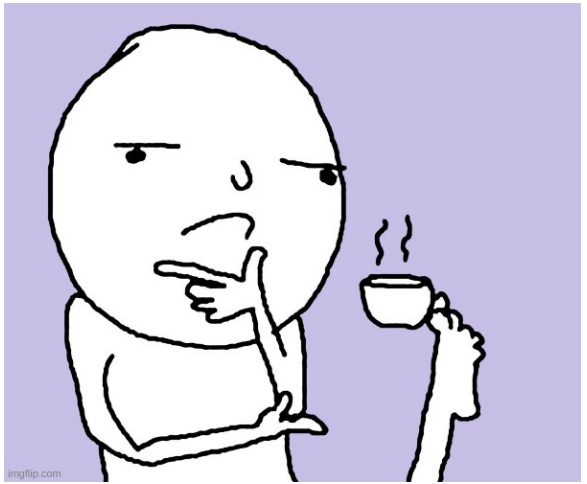
Imaging Extra

How parameter selection affects my image?



Ana Karla Díaz-Rodríguez
Adam Avison

EUROPEAN ARC
ALMA Regional Centre || UK

MANCHESTER 1824

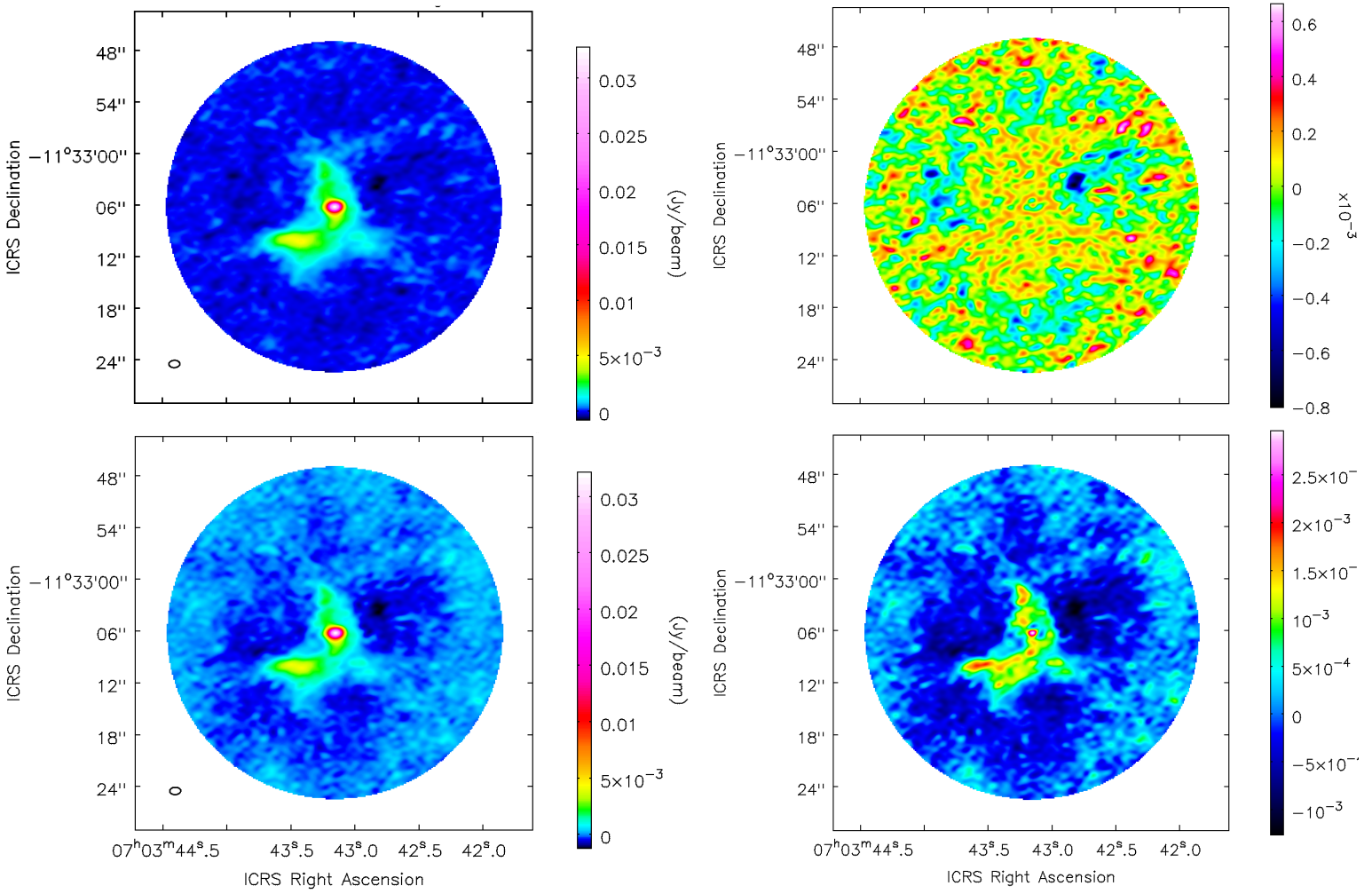
Number of iterations

threshold= '0.226mJy'
niter=10000
(actual niter=1169)

niter=50

Cleaned maps

Residual maps



Number of iterations

threshold= '0.226mJy'
niter=10000
(actual niter=1169)

flux_1* = 42 mJy
flux_2* = 65 mJy
rms_3 = 0.13 mJy/beam

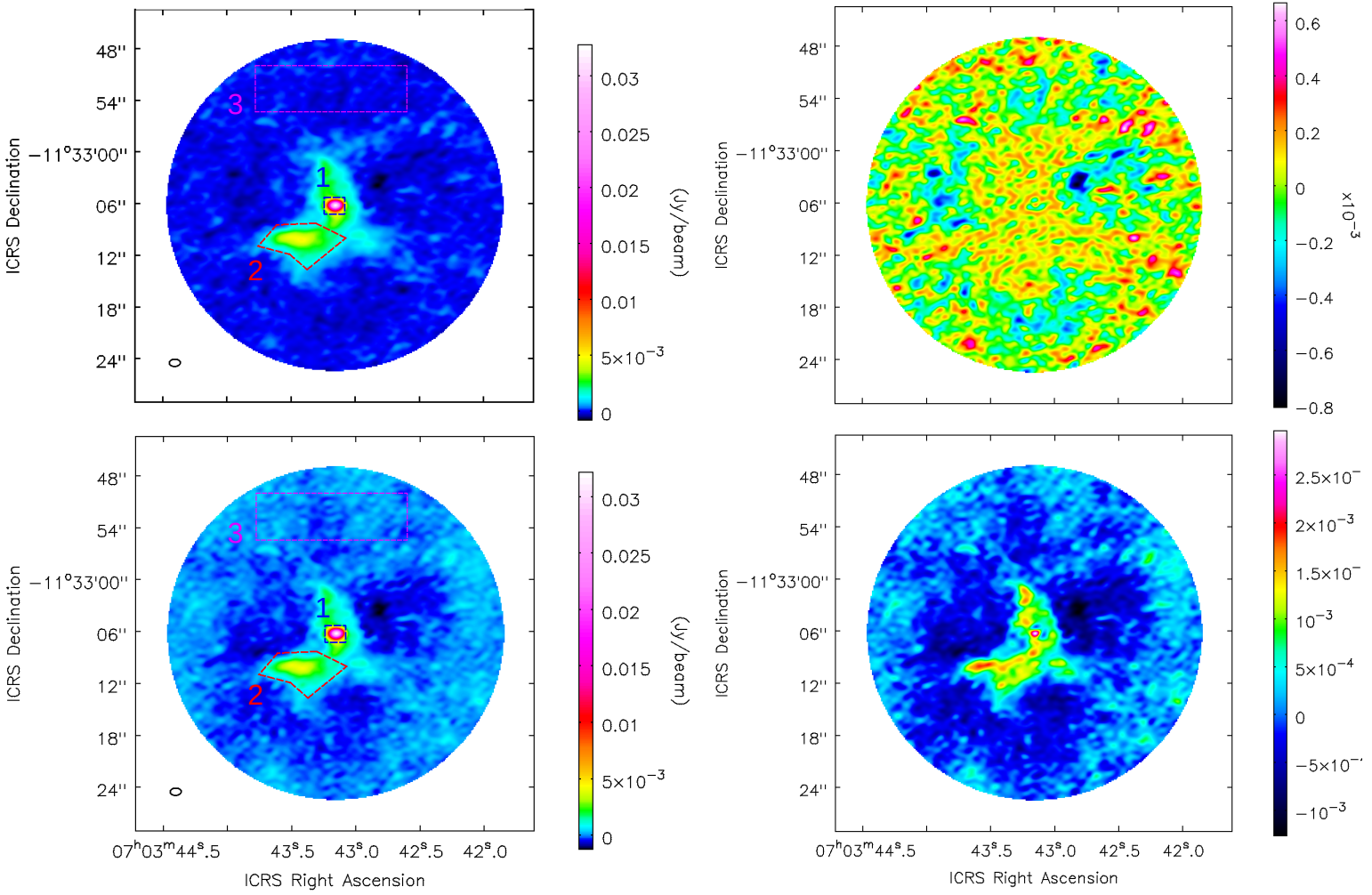
niter=50

flux_1* = 39 mJy
flux_2* = 46 mJy
rms_3 = 0.19 mJy/beam

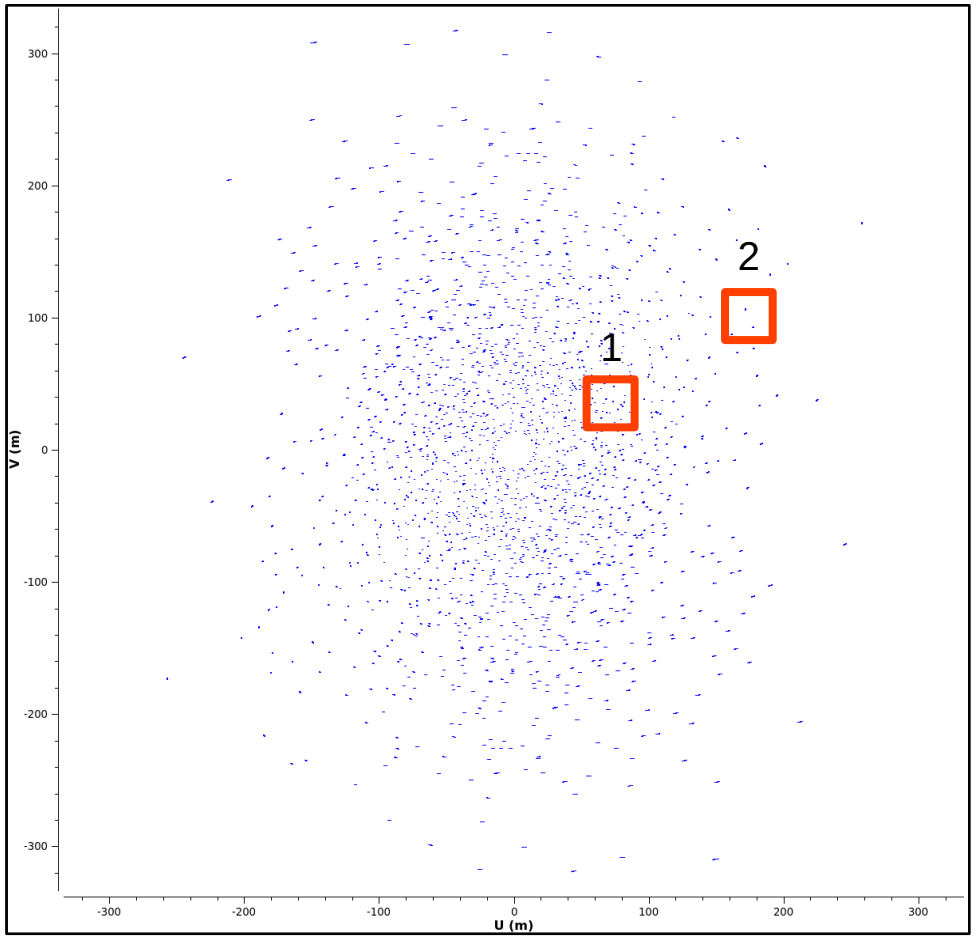
* meassured in PB-corrected maps

Cleaned maps

Residual maps



Weighting



Natural

Each visibility weights the same

↓

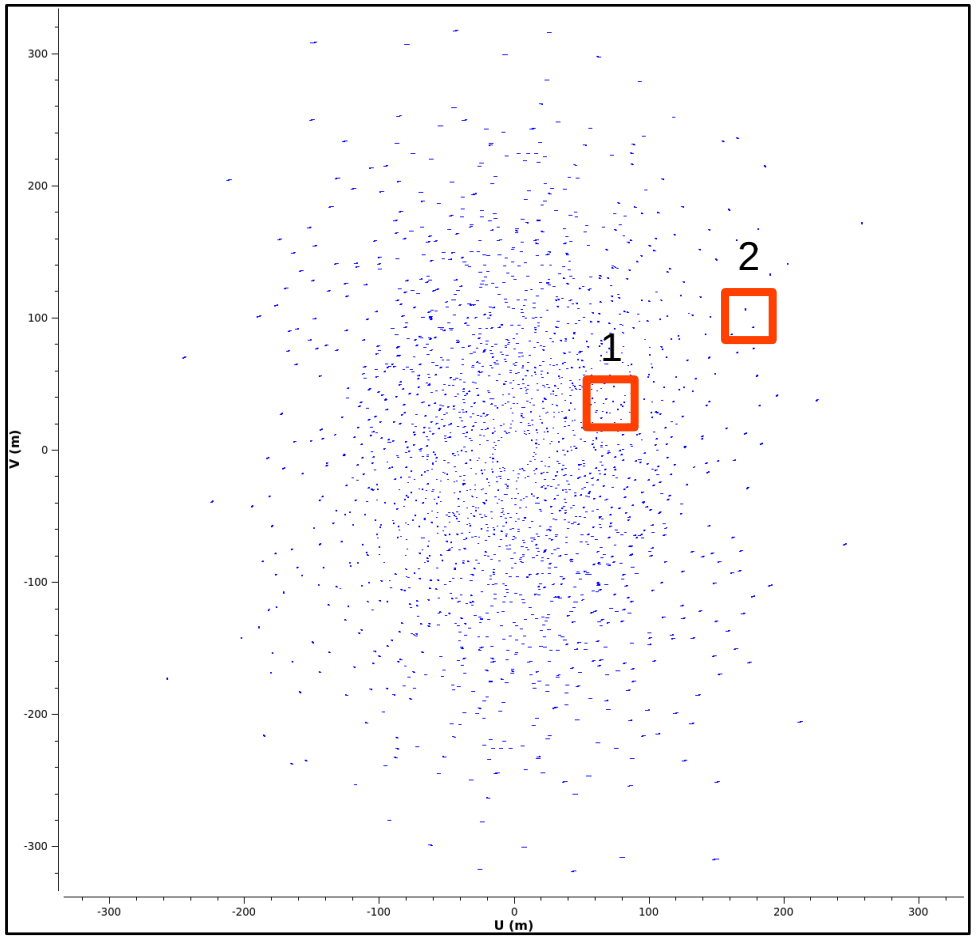
Cells with higher density of visibilities weight more
(weight_cell 1 > weight_cell 2)

Generally the shortest baselines are better sampled

↓

Produces poorest angular resolution and lowest noise

Weighting



Uniform

Each cell weights the same
(weight_cell 1 = weight_cell 2)

↓

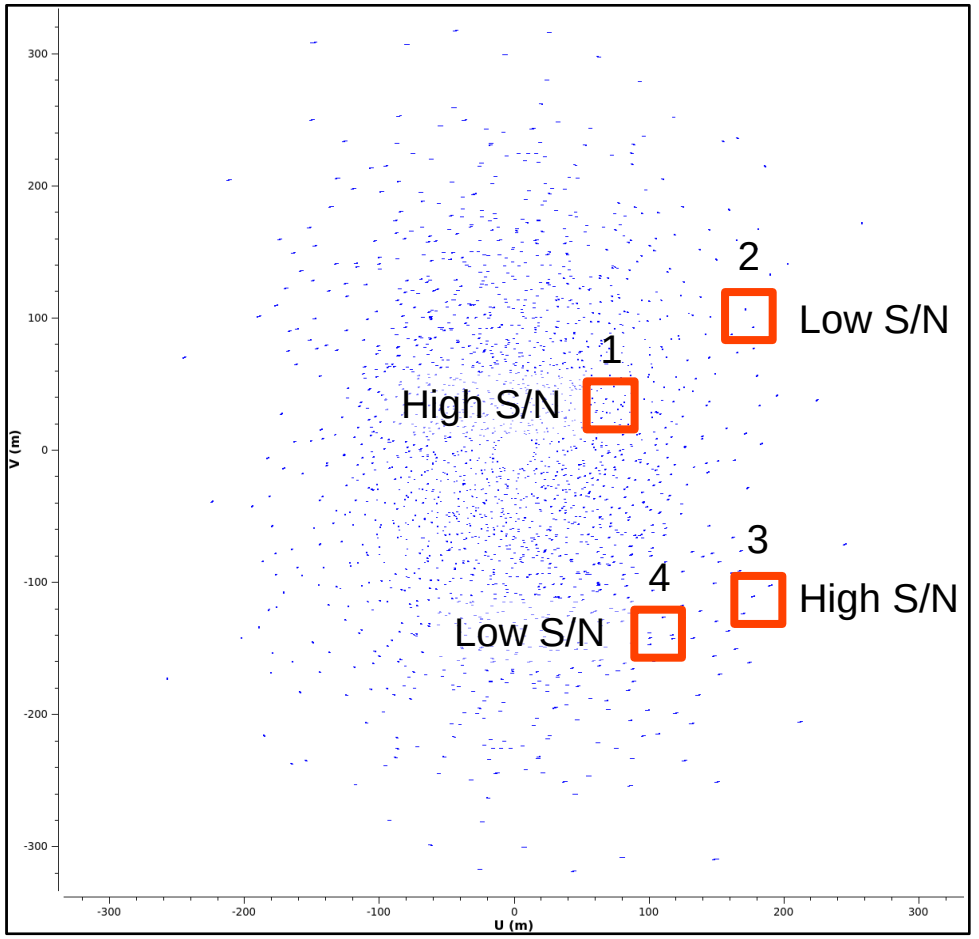
Visibilities in densely sampled regions of the uv-plane are down-weighted

Generally the shortest baselines are down-weighted

↓

Produces best angular resolution and higher noise

Weighting



Briggs (Robust)

Smoothly varies between
natural (robust = 2) and uniform (robust = -2)

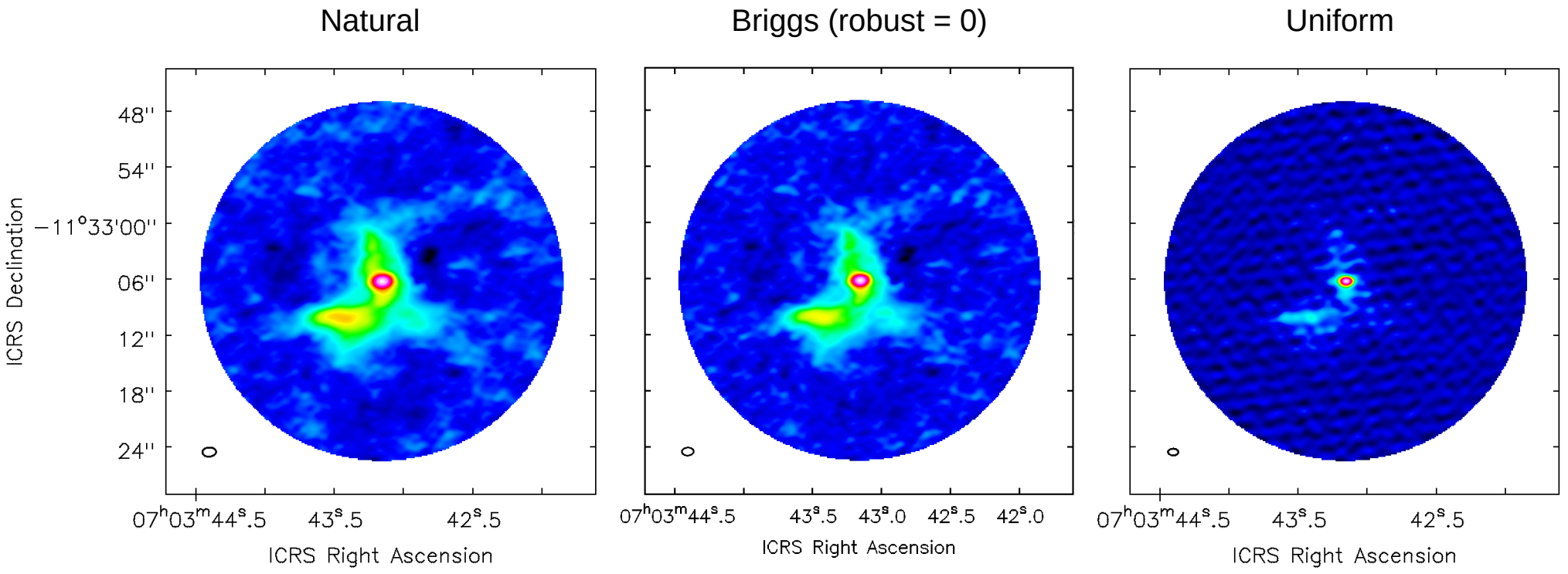
↓

Robust = 0 good trade-off between
angular resolution and sensitivity

High signal-to-noise samples are
weighted by sample density to
optimize for angular resolution, and
low signal-to-noise data are naturally
weighted to optimize for sensitivity

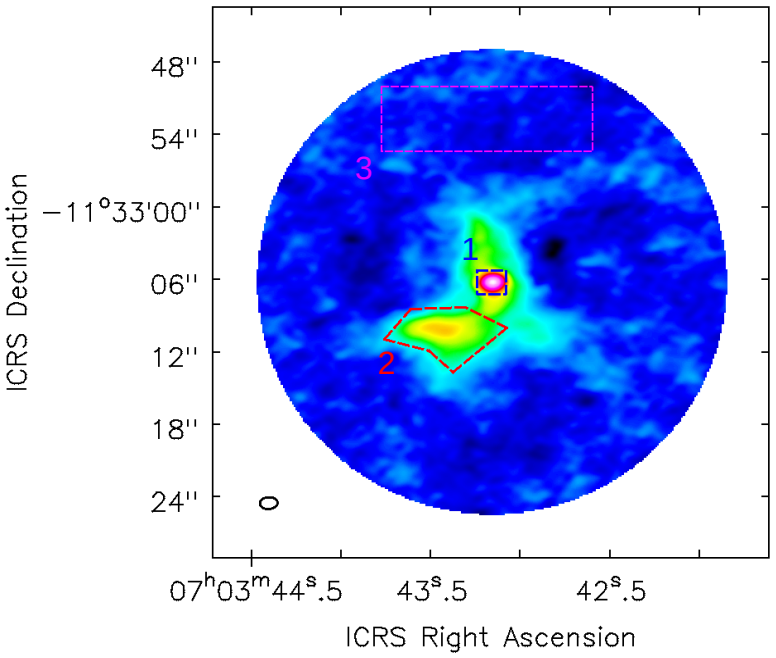
(weight_cell 1 = weight_cell 3
weight_cell 4 > weight_cell 2)

Weighting


Natural
Briggs (robust = 0)
Uniform
ICRS Declination
48''
54''
−11°33'00''
06''
12''
18''
24''
07h03m44s.5
43s.5
42s.5
43s.0
42s.0
ICRS Right Ascension

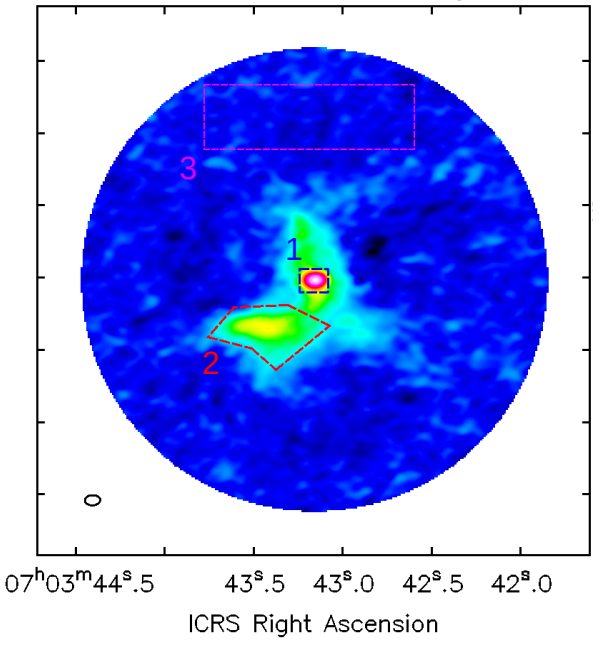
Weighting

Natural



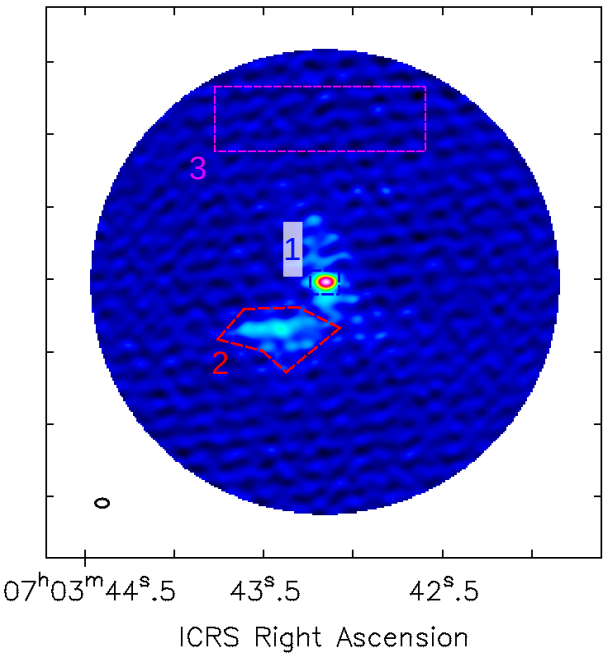
flux_1* = 41 mJy
flux_2* = 66 mJy
rms_3 = 0.16 mJy/beam
beam = 1.45”x0.98”; -86.33°

Briggs (robust = 0)



flux_1* = 42 mJy
flux_2* = 65 mJy
rms_3 = 0.13 mJy/beam
beam = 1.27”x0.85”; 87.71°

Uniform



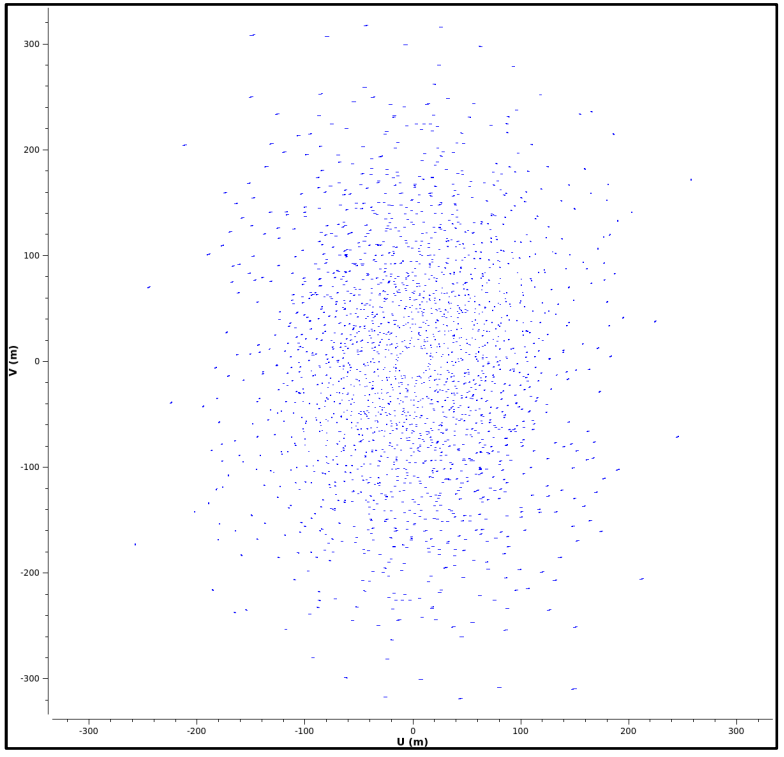
flux_1* = 42 mJy
flux_2* = 63 mJy
rms_3 = 0.54 mJy/beam
beam = 1.09”x0.72”; 89.40°

* meassured in PB-corrected maps

UV tapering

No uvtaper

Visibility weights defined by the weighting scheme used (natural, uniform, briggs)



UV tapering

uvtaper = x

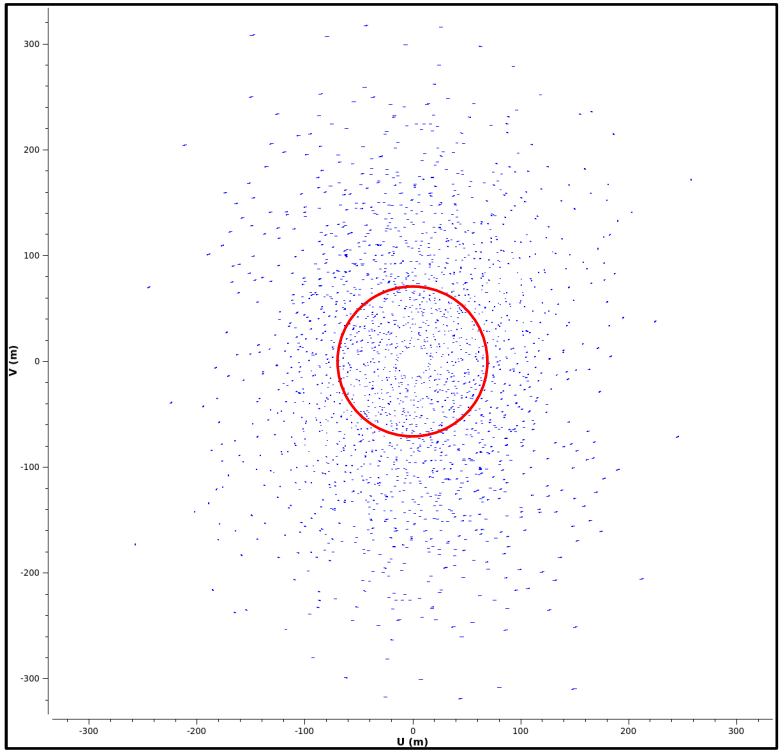
Visibility weights defined by the weighting scheme used (natural, uniform, briggs) are additionally multiplied by a Gaussian with HPBW = x

↓

Shorter baselines weight more than longer baselines

↓

Extended emission is better recovered

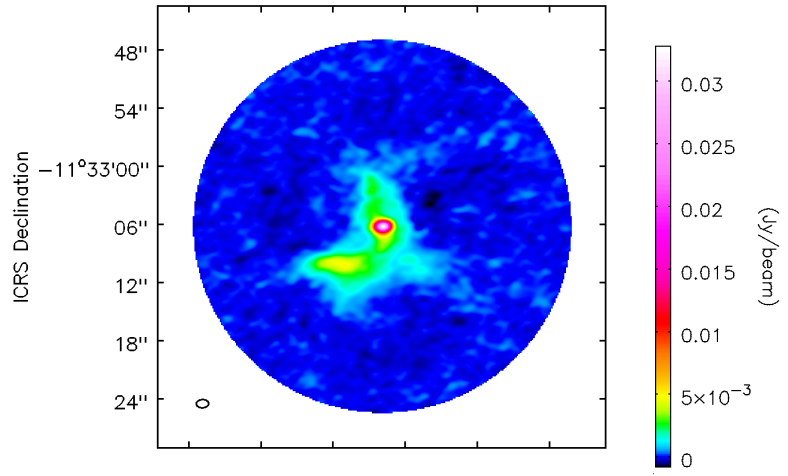


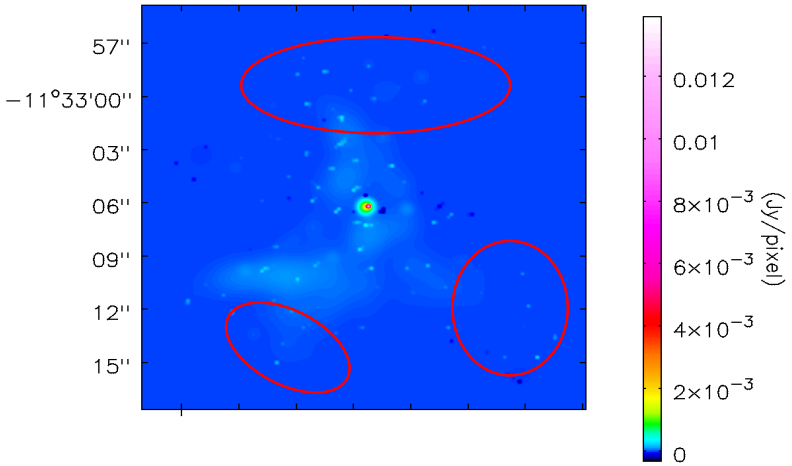
UV tapering

Cleaned maps

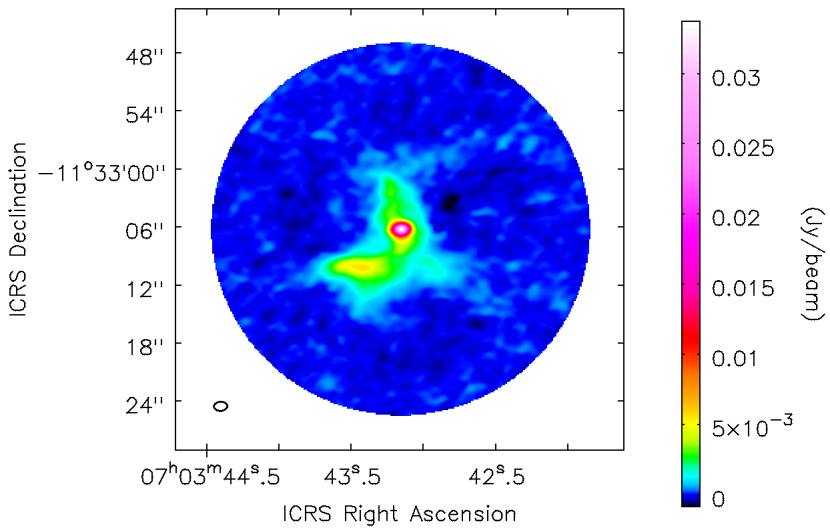
Models

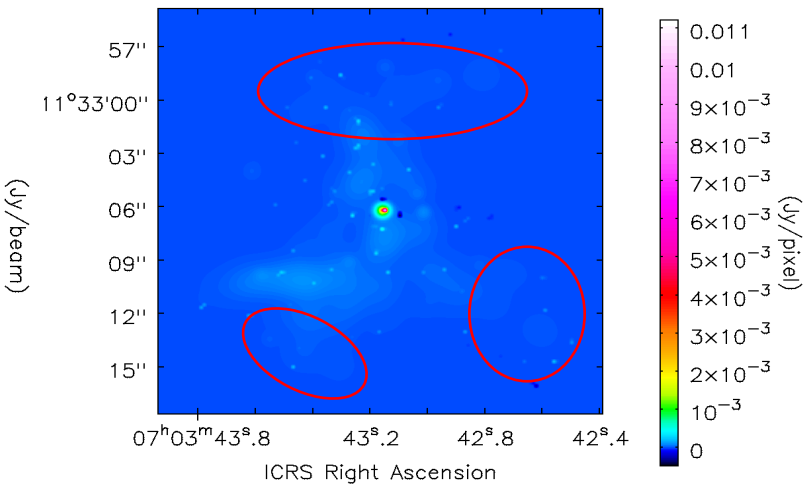
No uvtaper





uvtaper = 200 kl





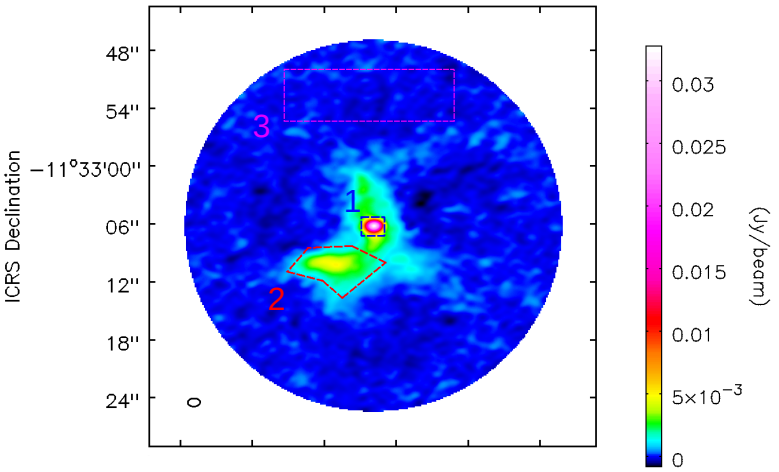
UV tapering

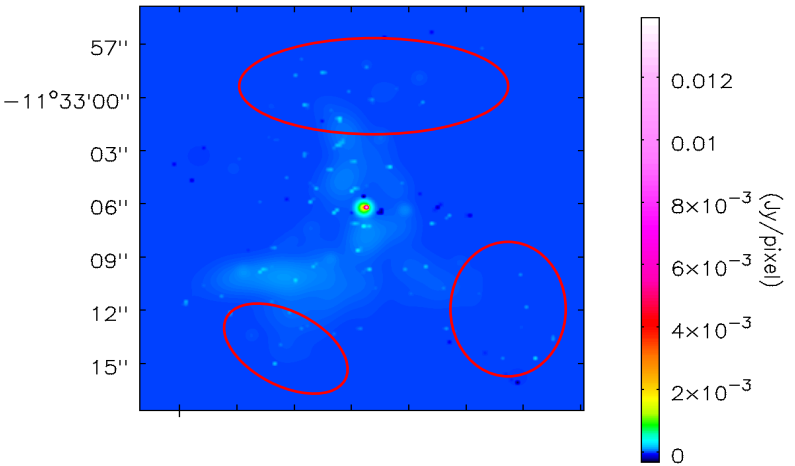
Cleaned maps

Models

No uvtaper

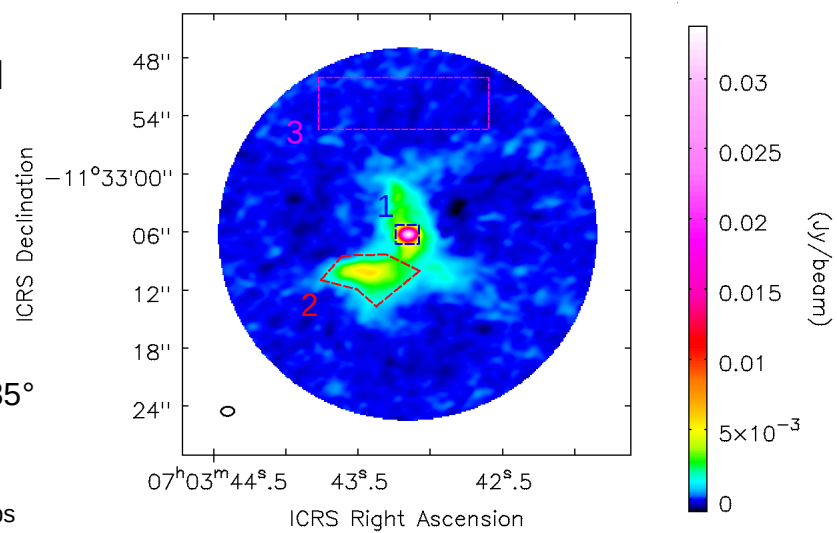
flux_1* = 42 mJy
peak_1* = 33 mJy/beam
flux_2* = 65 mJy
peak_2* = 5 mJy/beam
rms_3 = 0.13 mJy/beam
beam = 1.27”x0.85”; 87.71°

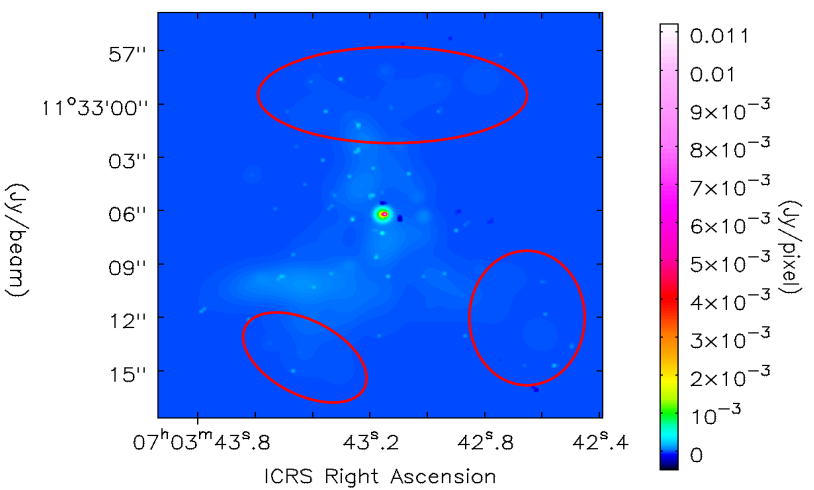




uvtaper = 200 kl

flux_1* = 41 mJy
peak_1* = 34 mJy/beam
flux_2* = 65 mJy
peak_2* = 6 mJy/beam
rms_3 = 0.14 mJy/beam
beam = 1.34”x0.95”; -87.35°





* meassured in PB-corrected maps

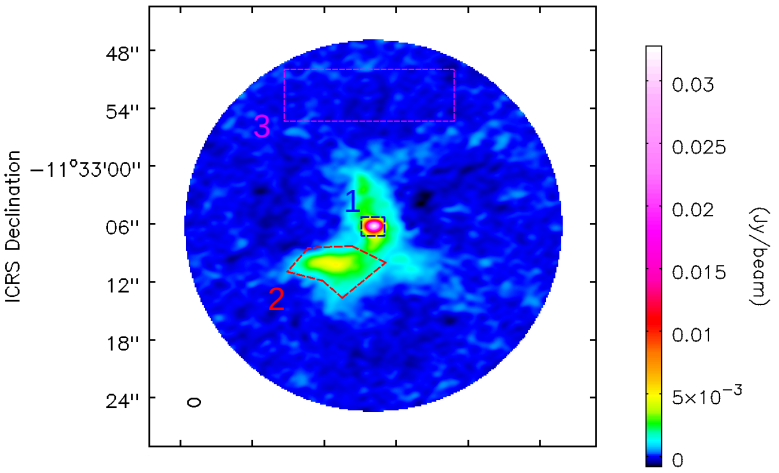
UV tapering

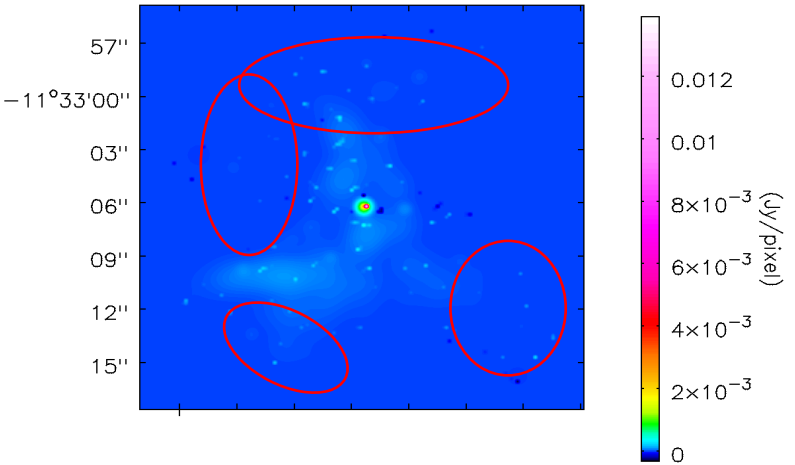
Cleaned maps

Models

No uvtaper

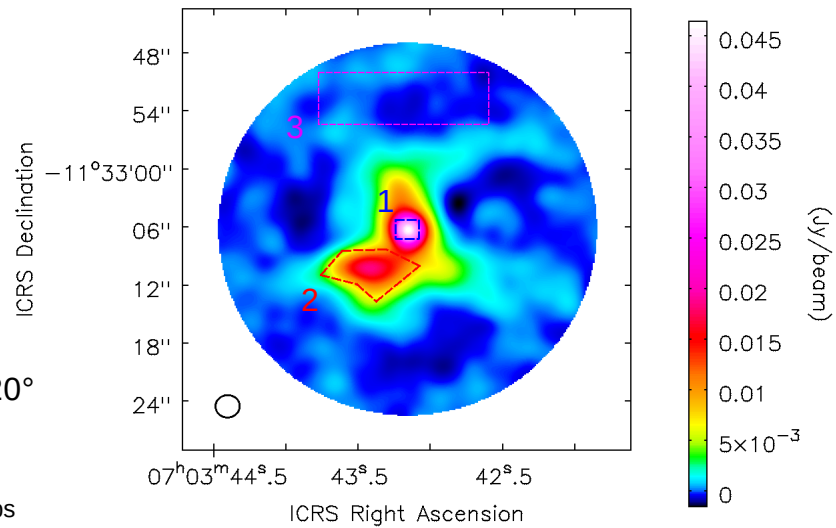
flux_1* = 42 mJy
peak_1* = 33 mJy/beam
flux_2* = 65 mJy
peak_2* = 5 mJy/beam
rms_3 = 0.13 mJy/beam
beam = 1.27”x0.85”; 87.71°

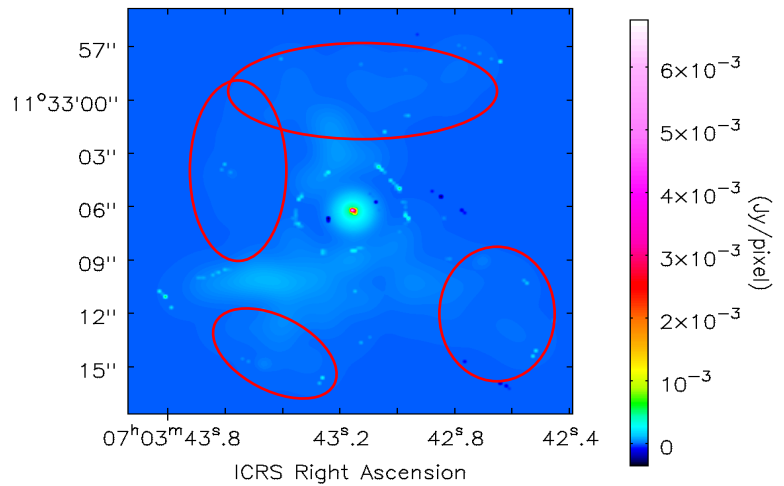




uvtaper = 40 kl

flux_1* = 27 mJy
peak_1* = 47 mJy/beam
flux_2* = 62 mJy
peak_2* = 21 mJy/beam
rms_3 = 0.35 mJy/beam
beam = 2.46”x2.31”; -85.20°

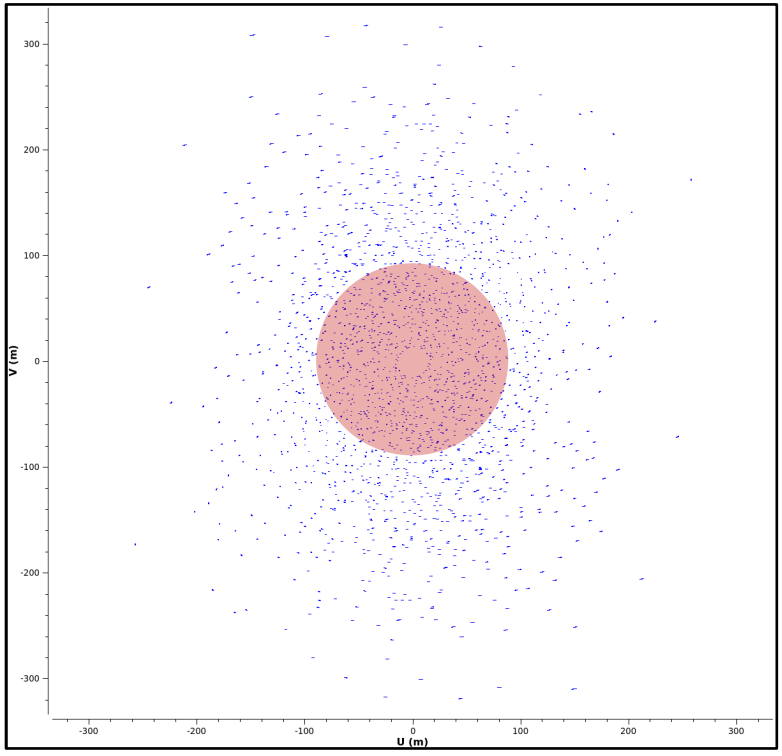




* meassured in PB-corrected maps

UV range

Use only visibilities in a certain range



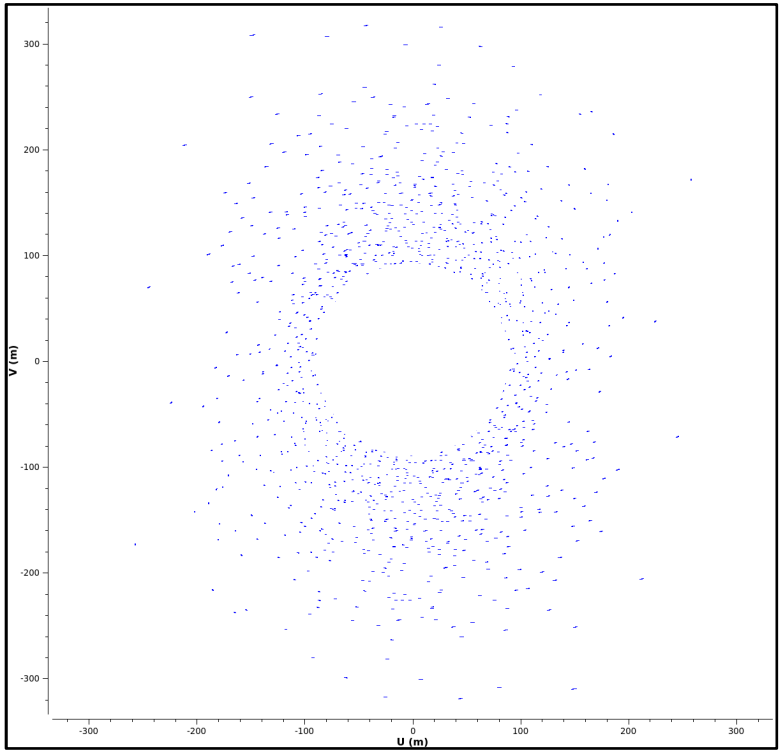
UV range

Use only visibilities in a certain range

Used to discard shorter baselines

↓

Extended emission is removed



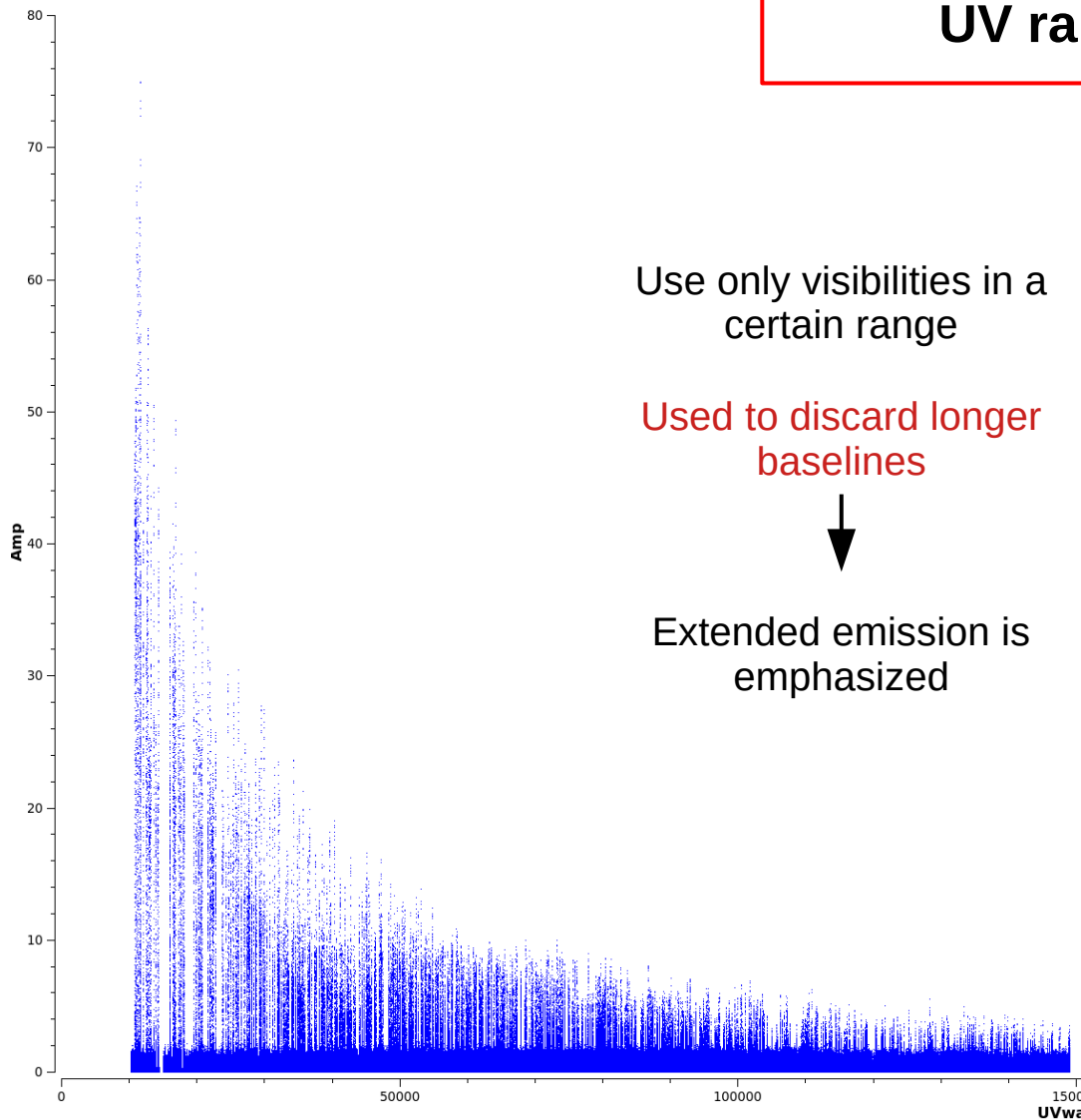
UV range

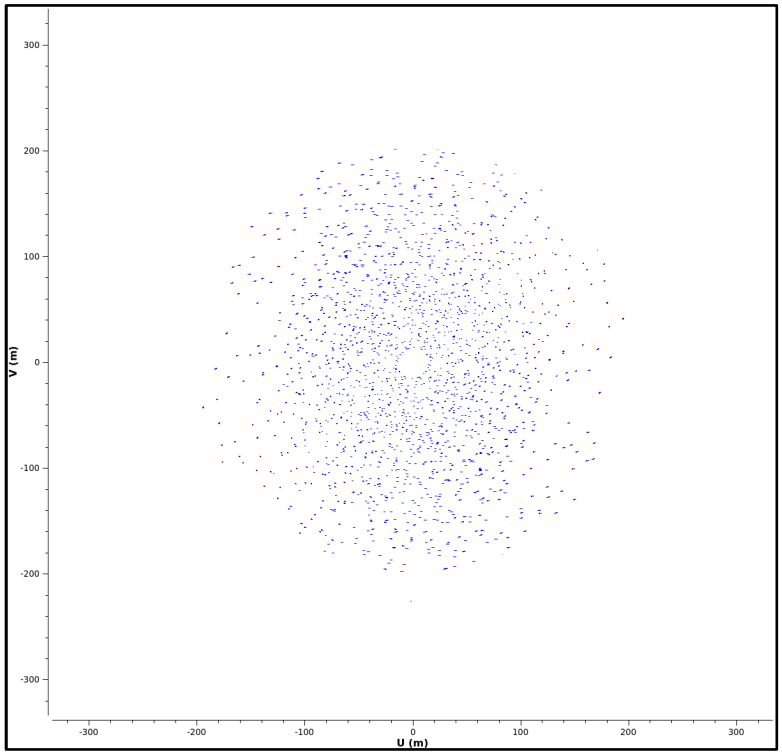
Use only visibilities in a certain range

Used to discard longer baselines

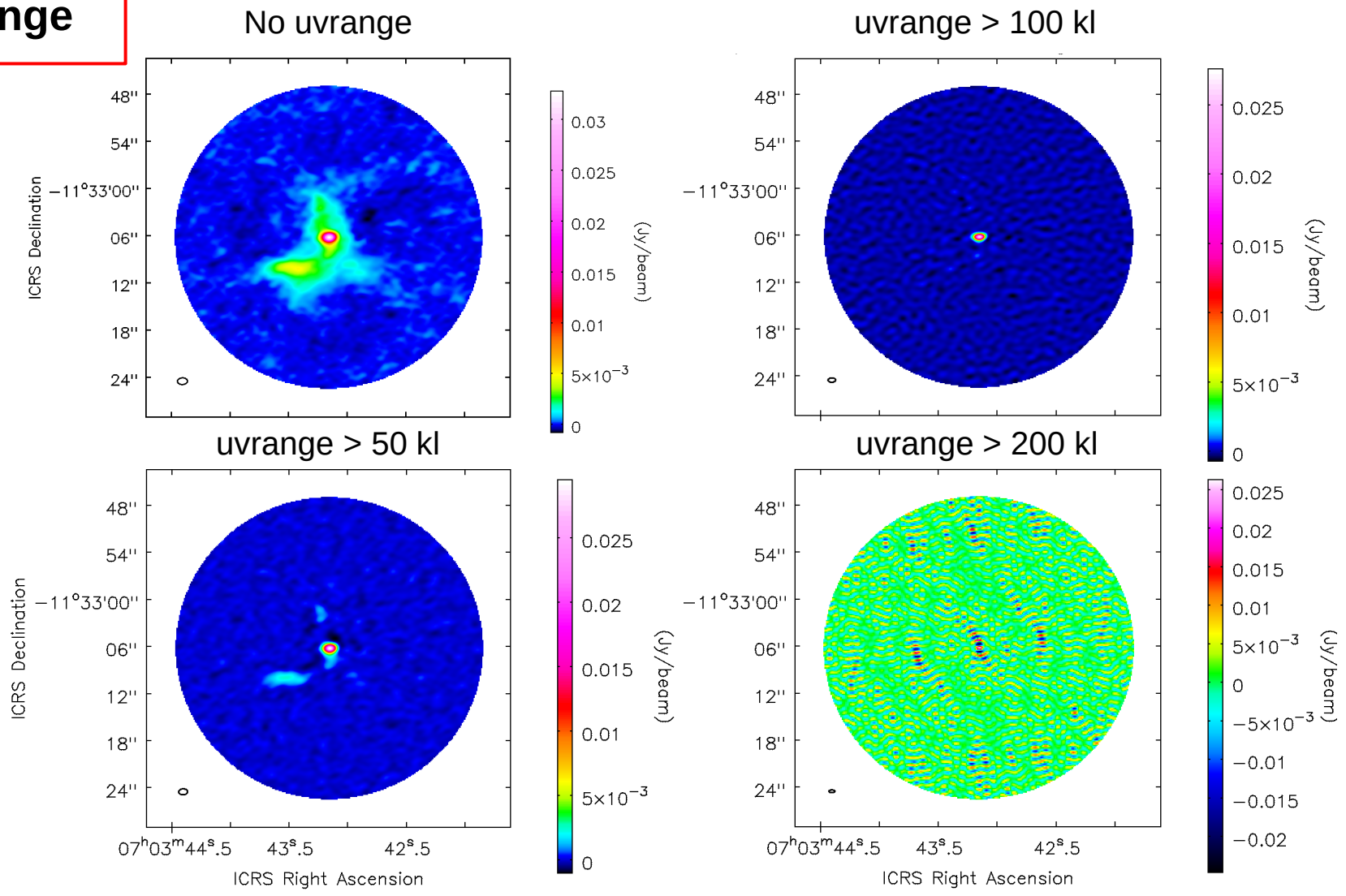
↓

Extended emission is emphasized



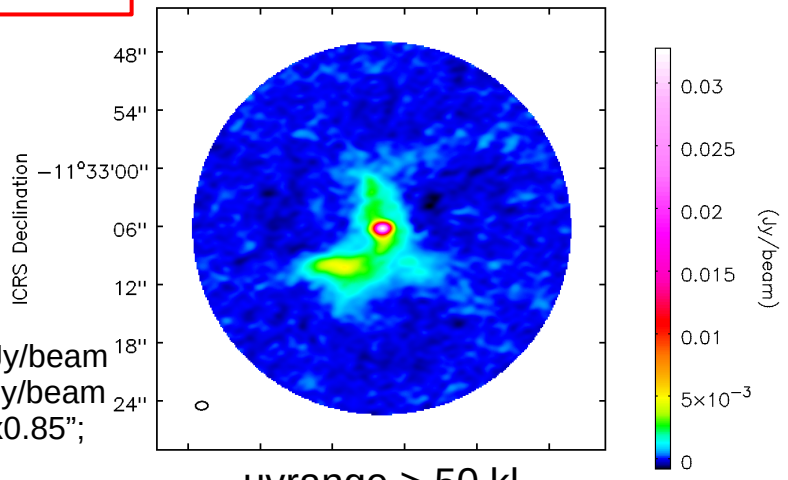


UV range


No uvrange
uvrange > 100 kl
uvrange > 50 kl
uvrange > 200 kl
ICRS Declination
ICRS Right Ascension
48''
54''
−11°33'00''
06''
12''
18''
24''
07h03m44s.5
43s.5
42s.5
(Jy/beam)
0.03
0.025
0.02
0.015
0.01
5×10−3
0
−5×10−3
−0.01
−0.015
−0.02

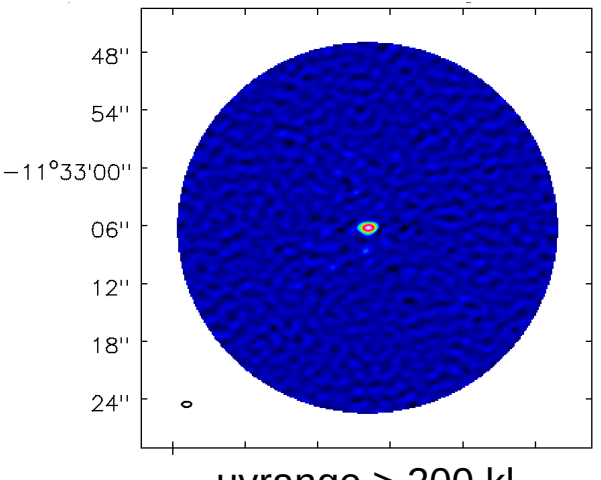
UV range

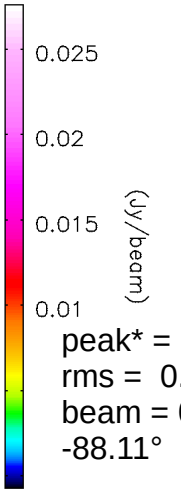
No uvrange



peak* = 33 mJy/beam
rms = 0.13 mJy/beam
beam = 1.27”x0.85”;
87.71°

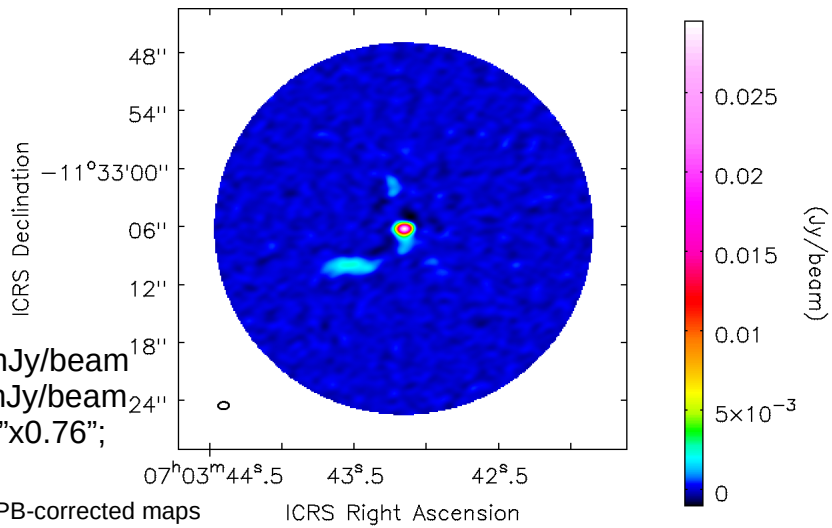
uvrange > 100 kl





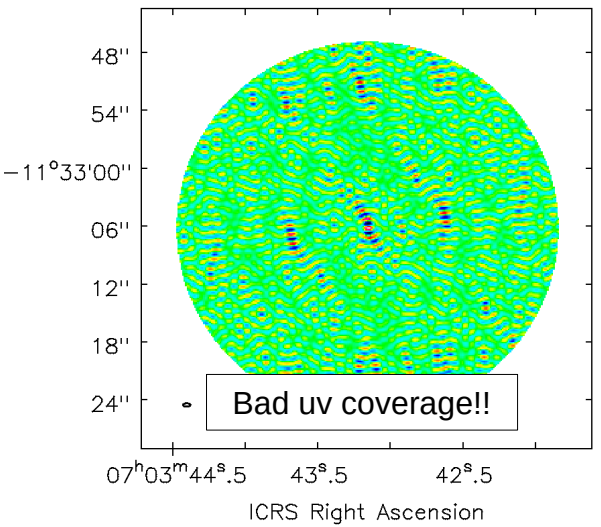
peak* = 28 mJy/beam
rms = 0.16 mJy/beam
beam = 0.95”x0.56”;
-88.11°

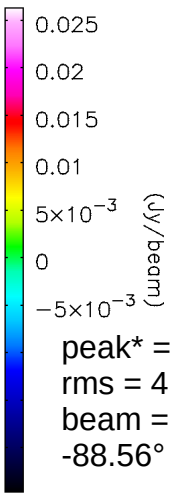
uvrange > 50 kl



peak* = 30 mJy/beam
rms = 0.13 mJy/beam
beam = 1.12”x0.76”;
-87.77°

uvrange > 200 kl





peak* = 26 mJy/beam
rms = 4 mJy/beam
beam = 0.74”x0.35”;
-88.56°

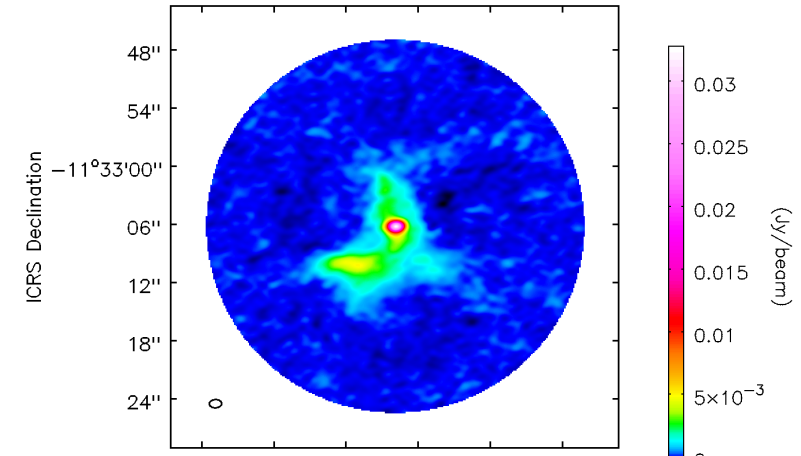
* meassured in PB-corrected maps

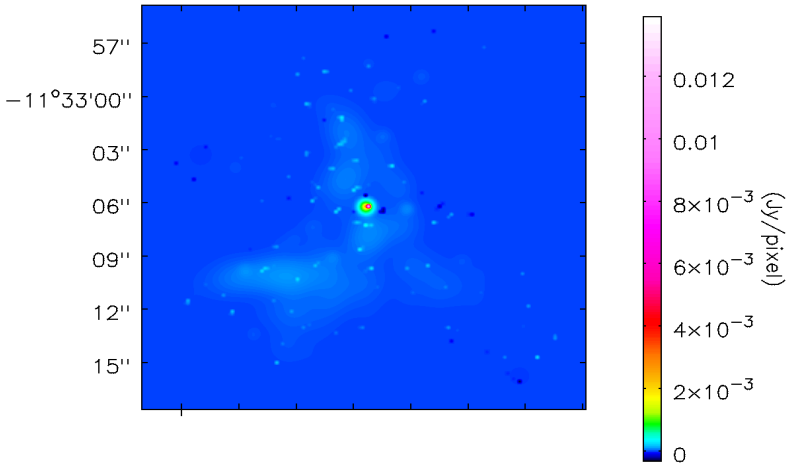
Deconvolver

Cleaned maps

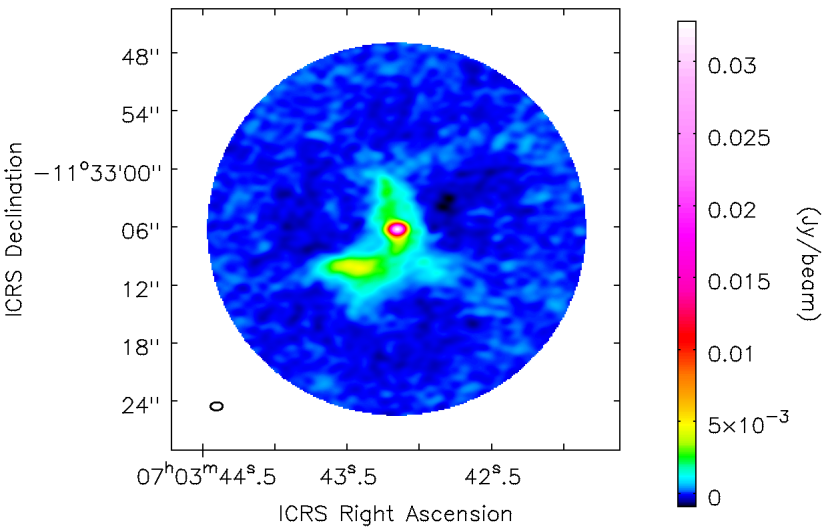
Models

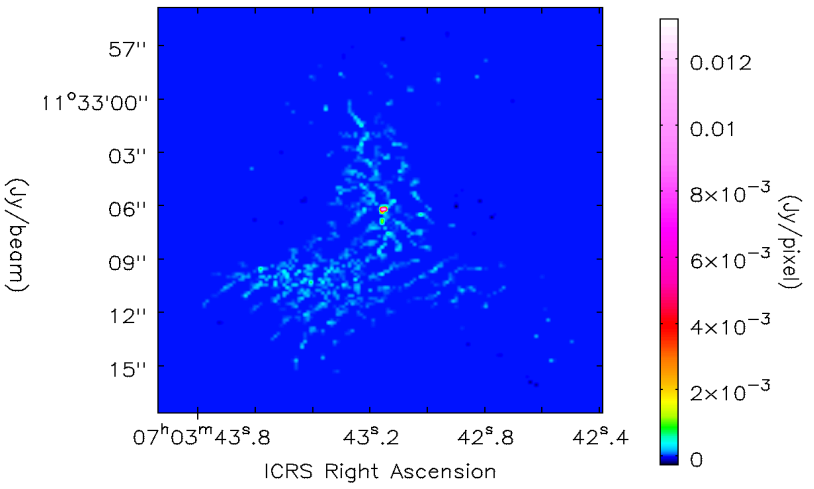
multiscale





hogbom





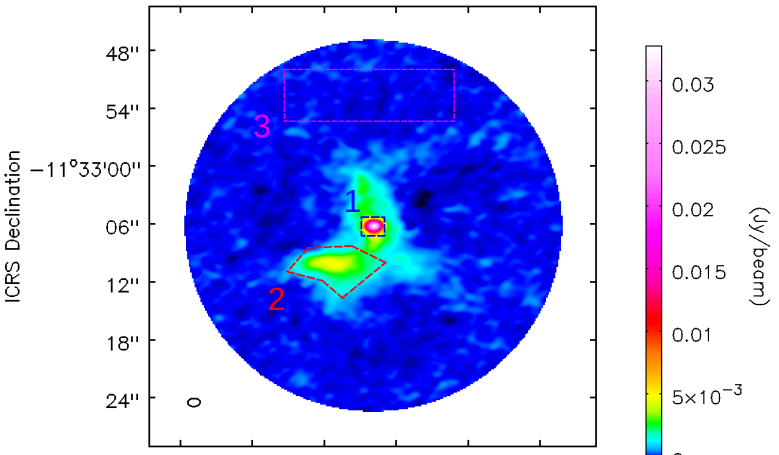
Deconvolver

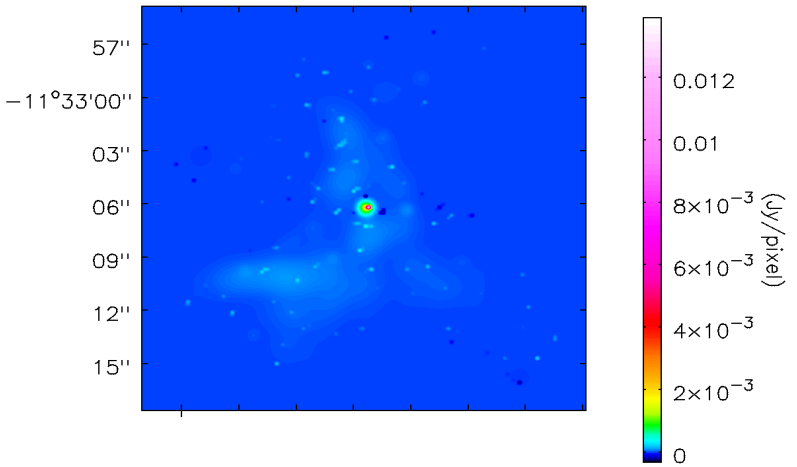
Cleaned maps

Models

multiscale

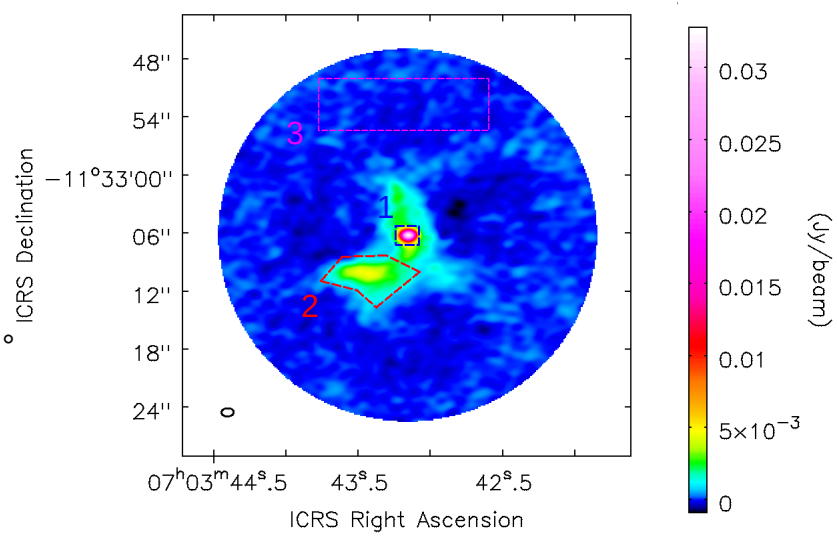
flux_1* = 42 mJy
flux_2* = 65 mJy
rms_3 = 0.13 mJy/beam
beam = 1.27”x0.85”; 87.71°

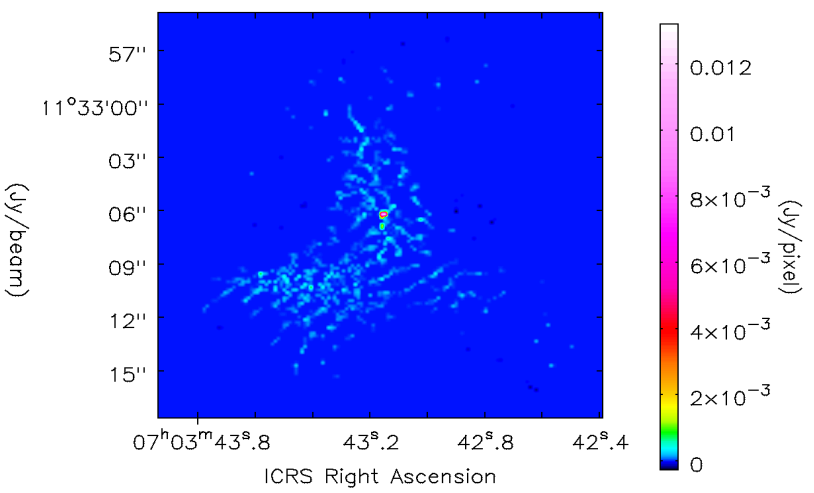




hogbom

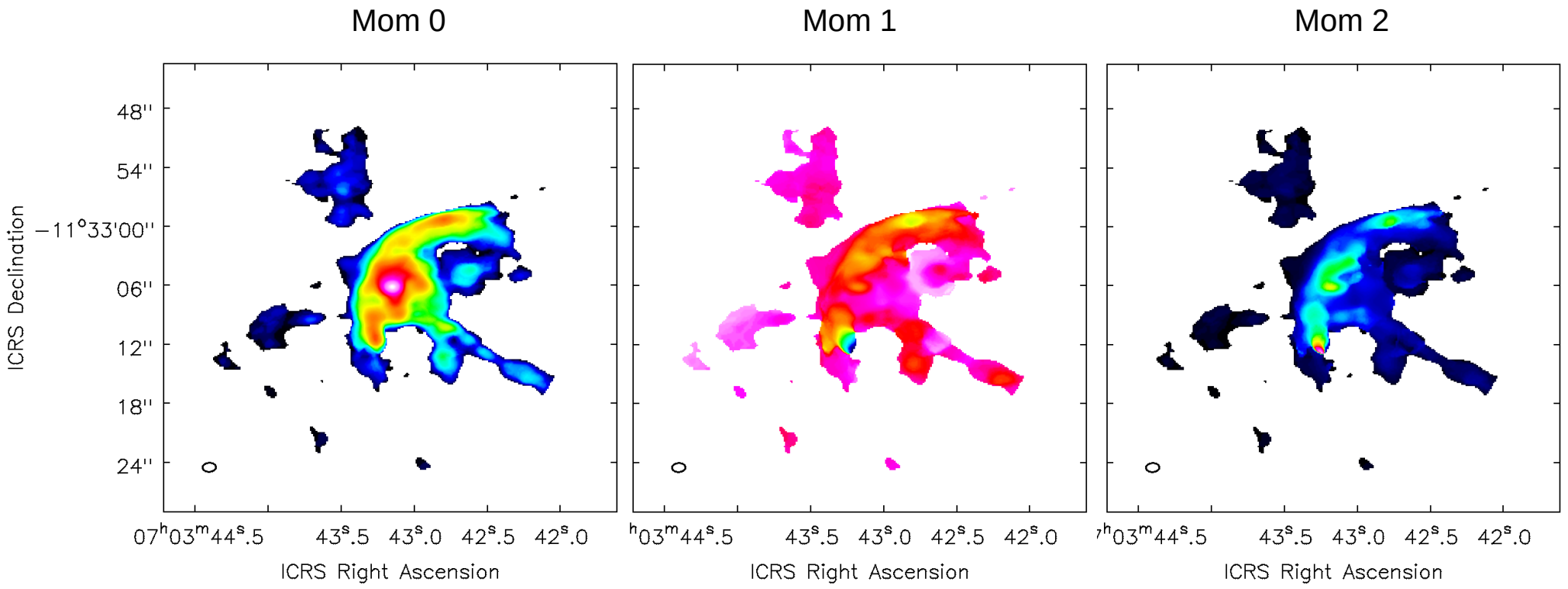
flux_1* = 41 mJy
flux_2* = 59 mJy
rms_3 = 0.13 mJy/beam
beam = 1.27”x0.85”; -87.71°





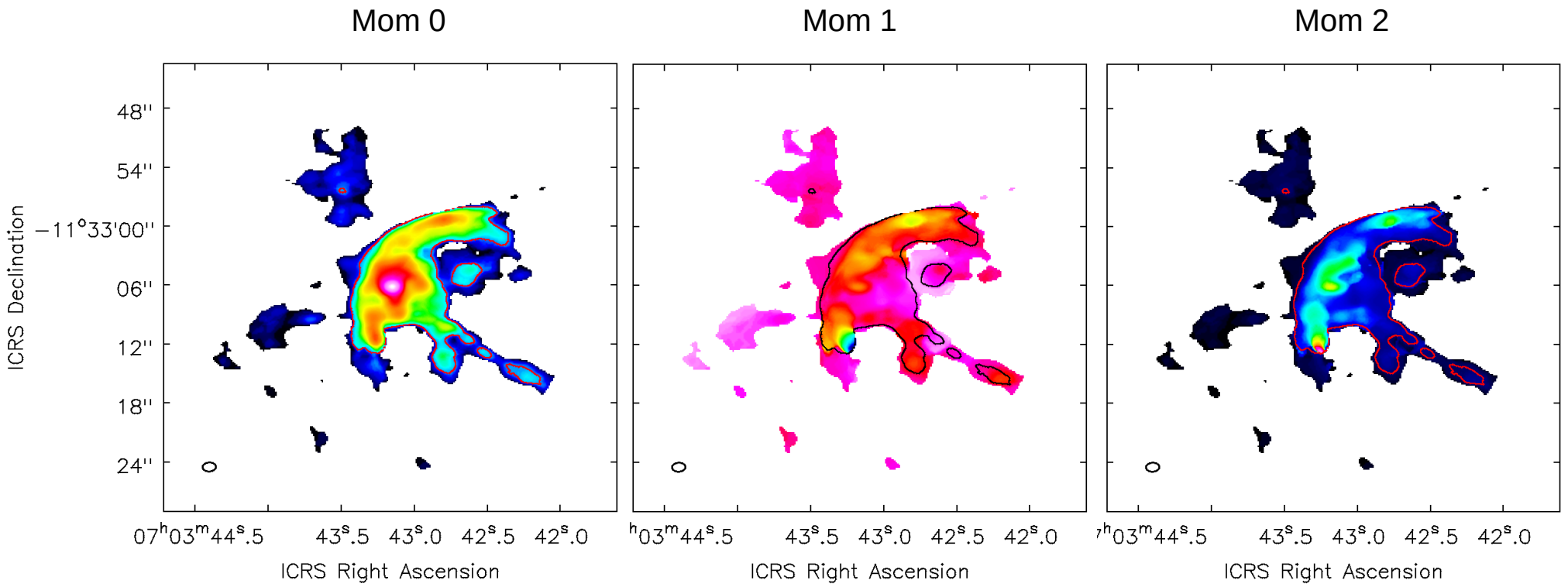
* meassured in PB-corrected maps

(Tip) Blanking



(blue channels)

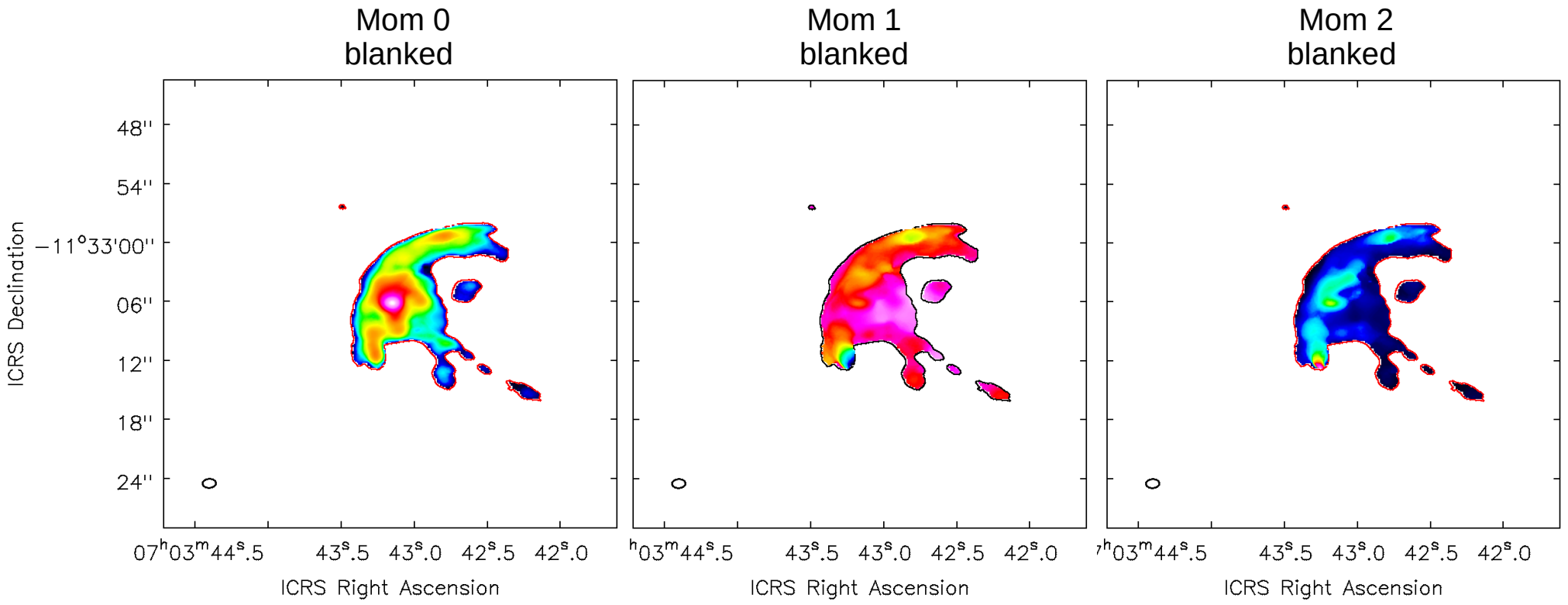
(Tip) Blanking



(blue channels)

(Tip) Blanking

task immath using a mask



(blue channels)