



ViCTORIA project: the MeerKAT Virgo Cluster Survey

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ViCTORIA project

LBA Virgo Cluster Survey

- *Frequency range: 42-66 MHz
- *Resolution: 17 arcsec
- *Sensitivity: 1700 μ Jy/beam
- *N. of pointings: 9
- *Area: 166 deg²

HBA Virgo Cluster Survey

- *Frequency range: 120-168 MHz
- *Resolution: 7 arcsec
- *Sensitivity: 140 μ Jy/beam
- *N. of pointings: 9
- *Area: 132 deg²

MeerKAT Virgo Cluster Survey

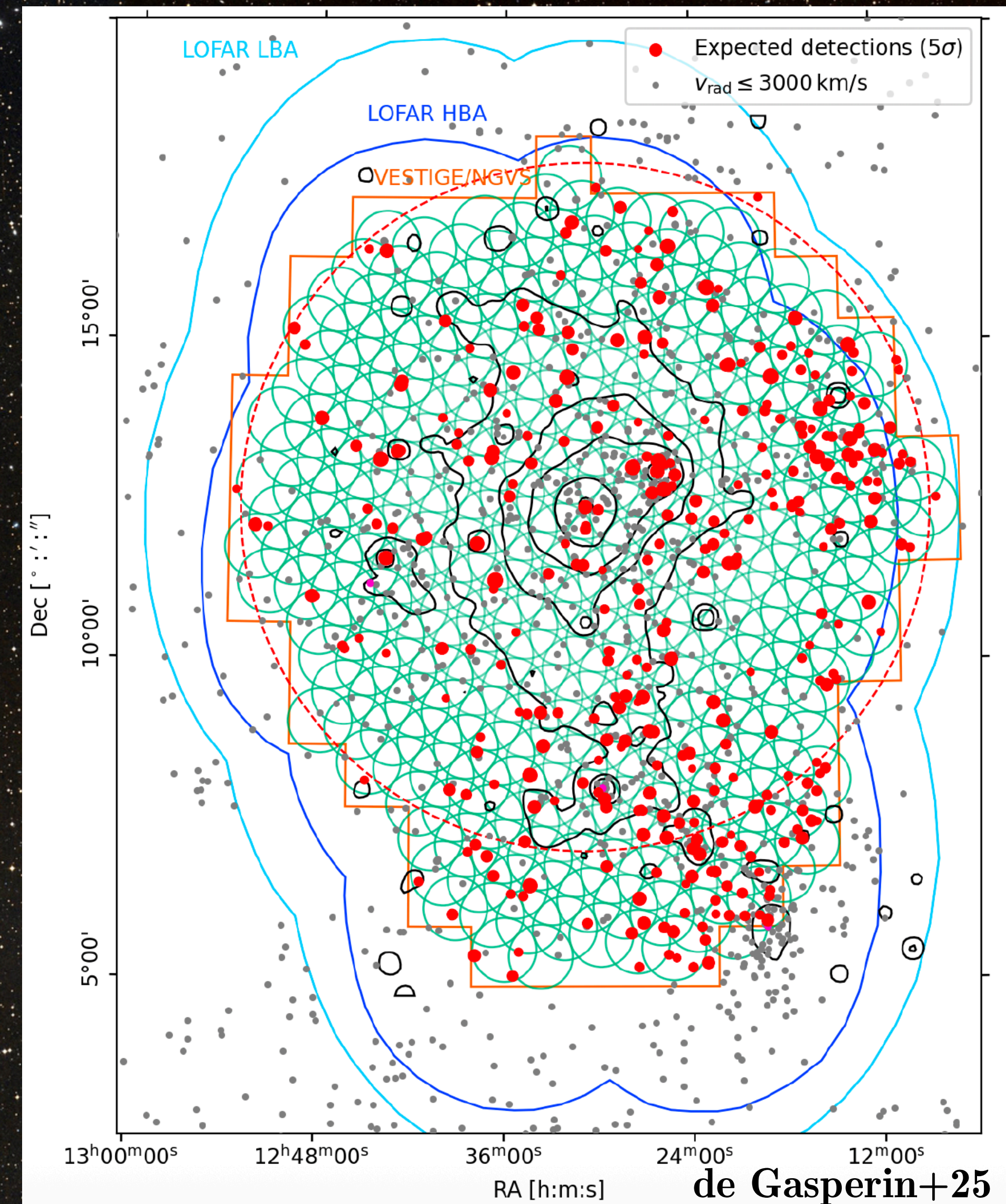
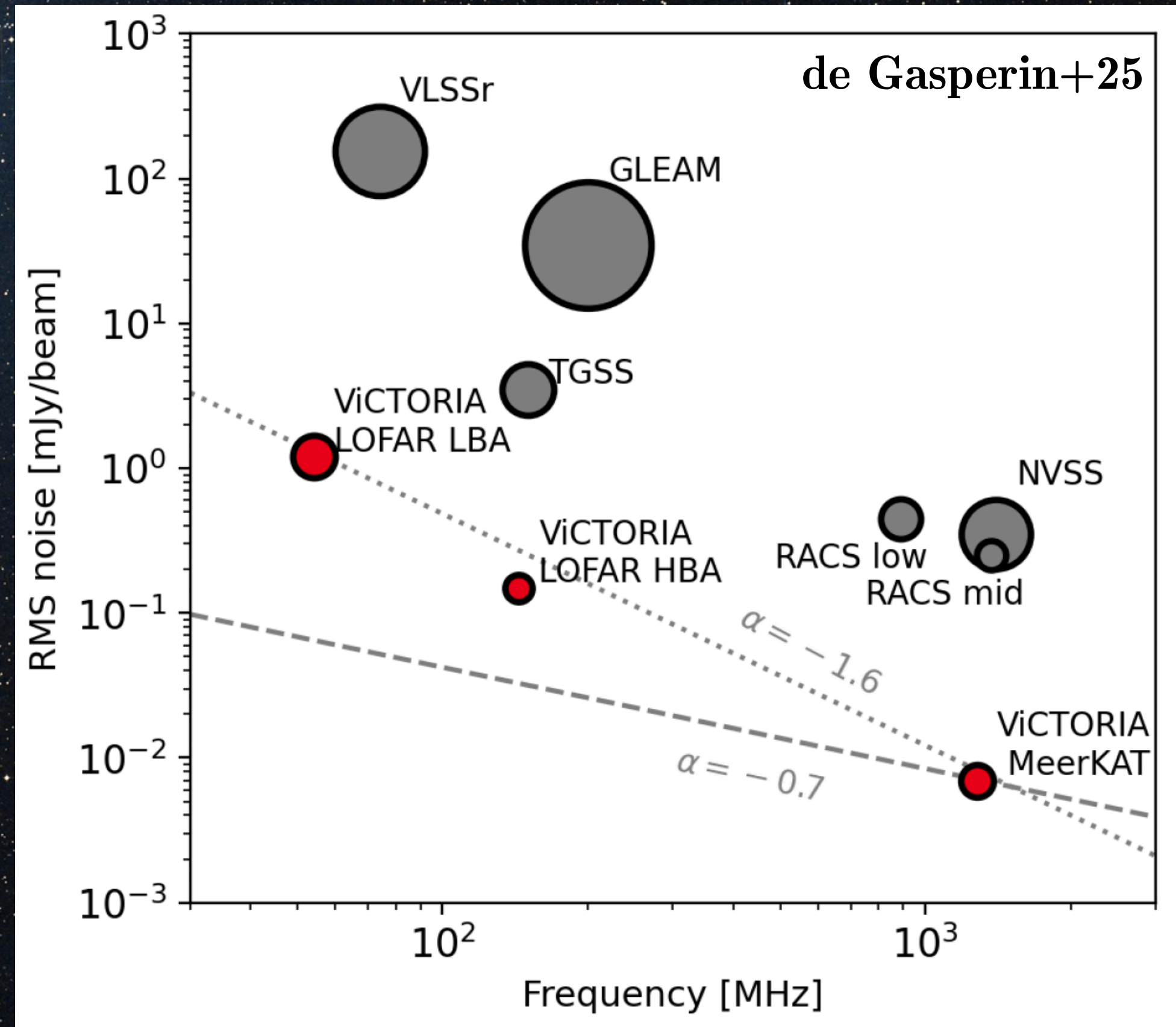
- *Frequency range: 856-1712 MHz
- *Resolution: 10 arcsec
- *Sensitivity: 7 μ Jy/beam
- *N. of pointings: 320
- *Area: 112 deg²

ViCTORIA project

Main goals:

- *Produce images in **full polarisation** at different frequencies **~60 times deeper** than existing data
- *Perform a blind **HI survey** to map **7 times more galaxies** than previous experiments and without selection biases

ViCTORIA project



The Virgo Cluster

- * **Closest** rich galaxy cluster (~ 16.5 Mpc)

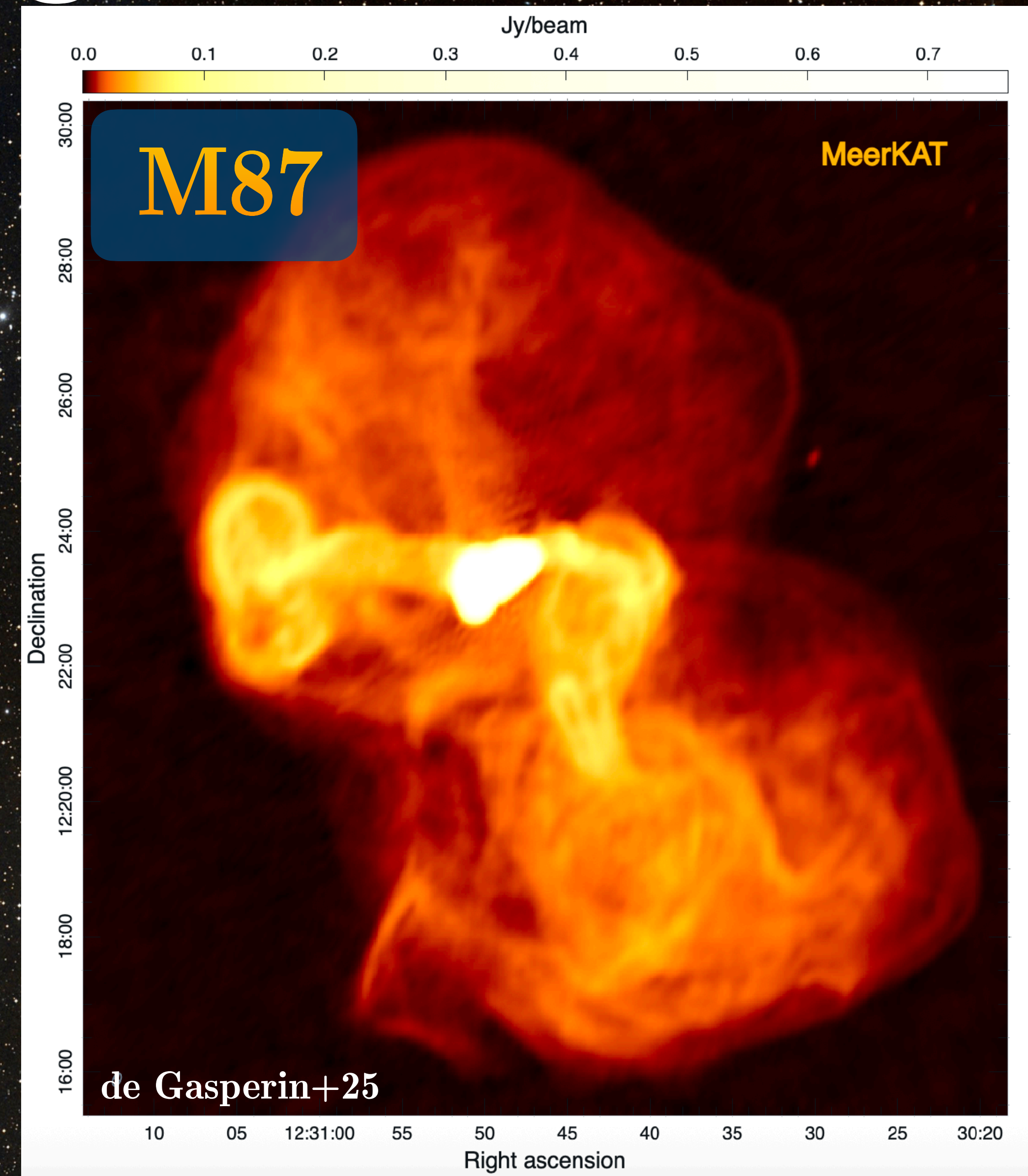
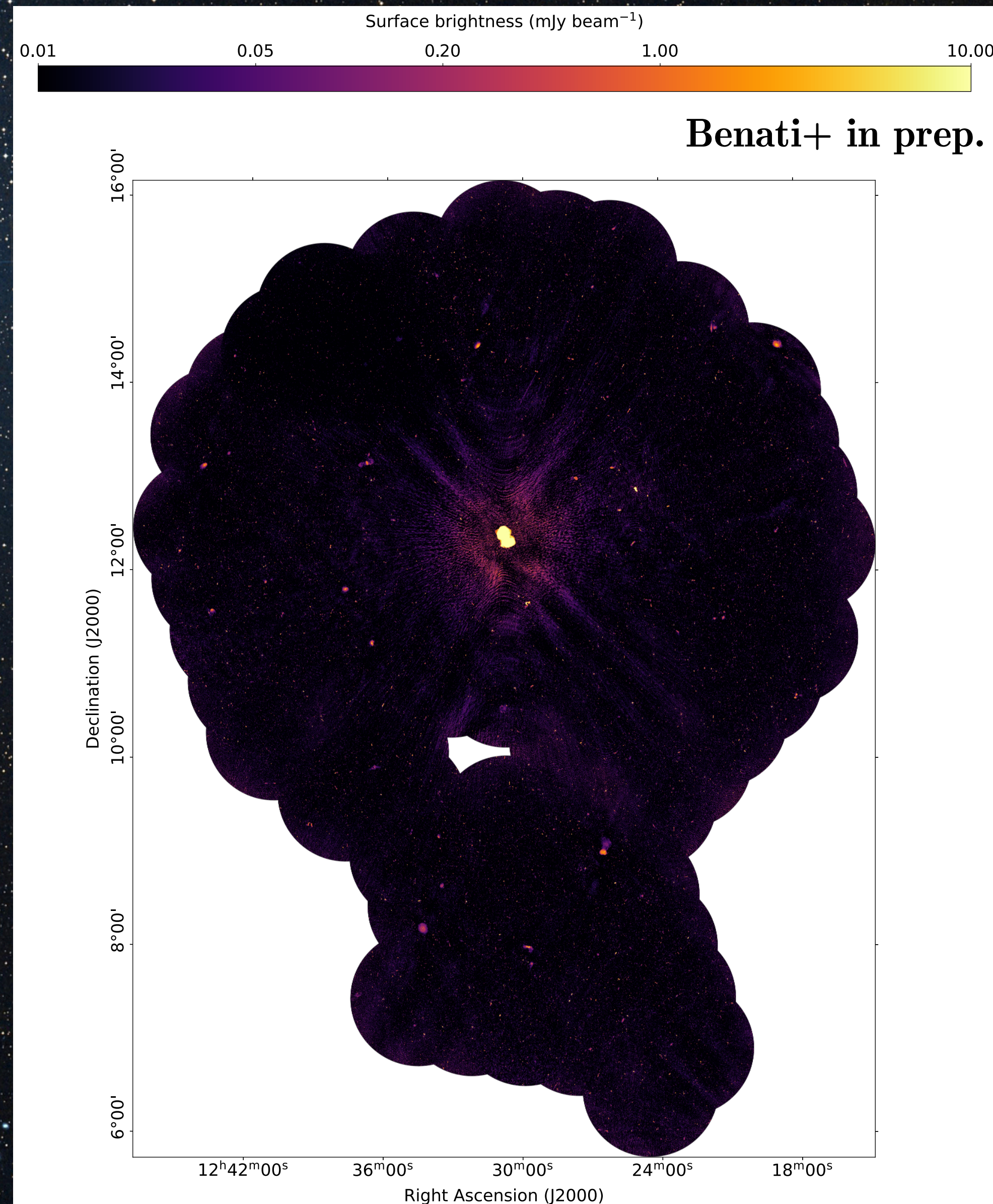
- * $R_{\text{vir}} \approx 3.3^\circ$ (974 kpc)

- * $M_{\text{vir}} \approx 1.05 - 1.42 \times 10^{14} M_\odot$

- * **Irregular** morphology

- * **Dynamically young** (still in the formation process)

The MeerKAT Virgo Cluster Survey



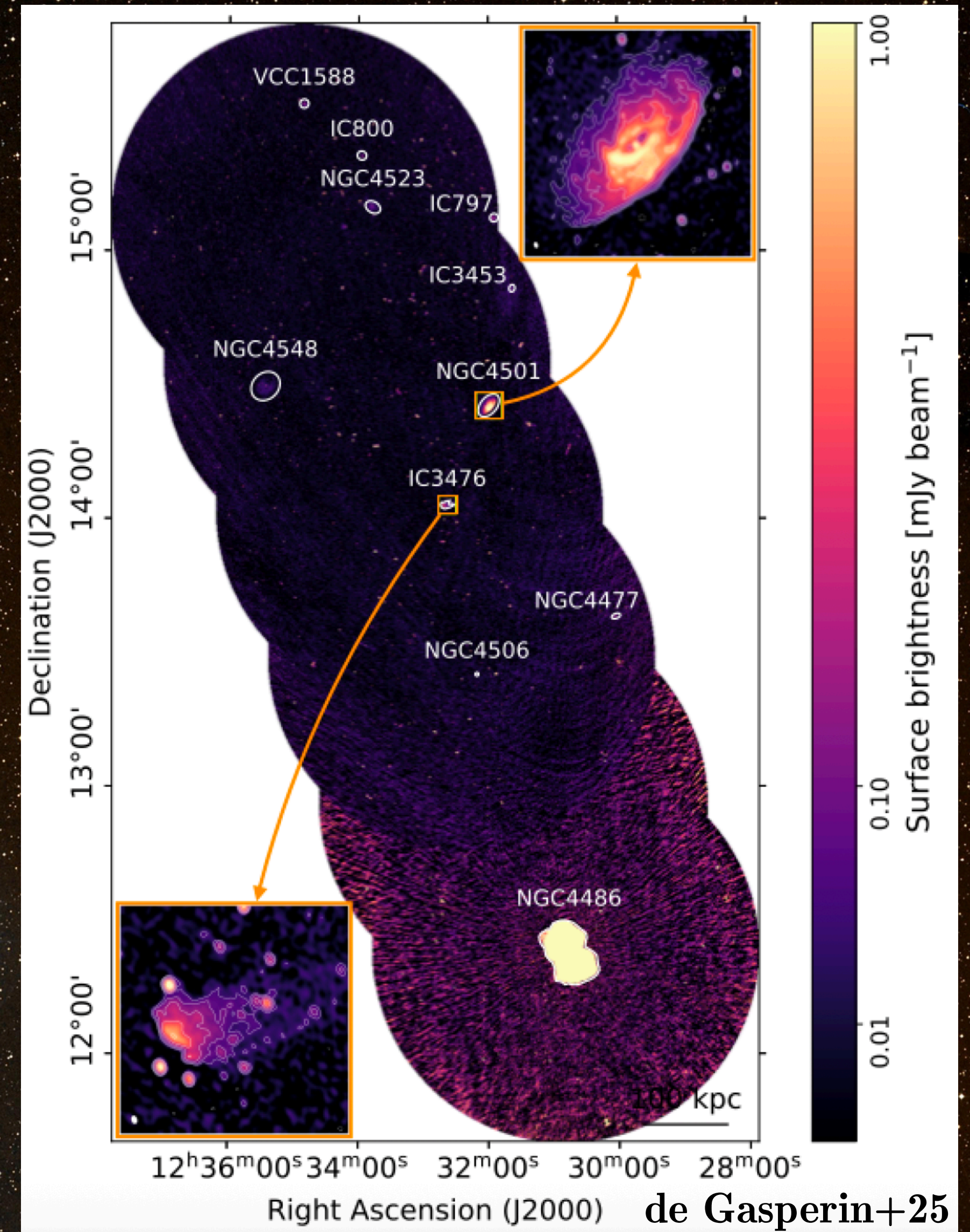
Pilot study

- *5 pointings moving away from **M87**

- ***Peeling** strategy

- ***Increased noise** level only **within 1°** from M87

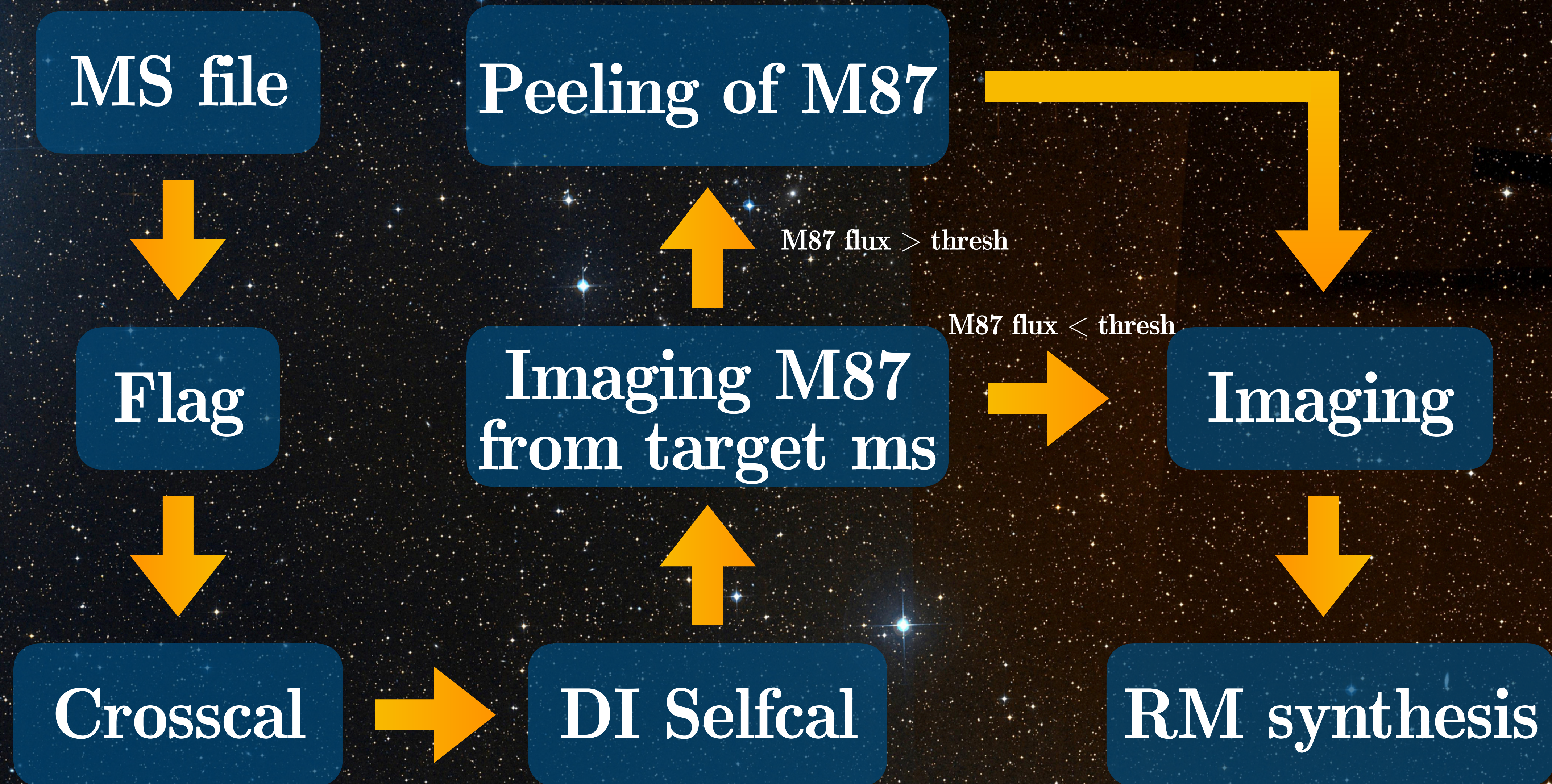
➔ Dynamic range **limitations** are **under control**



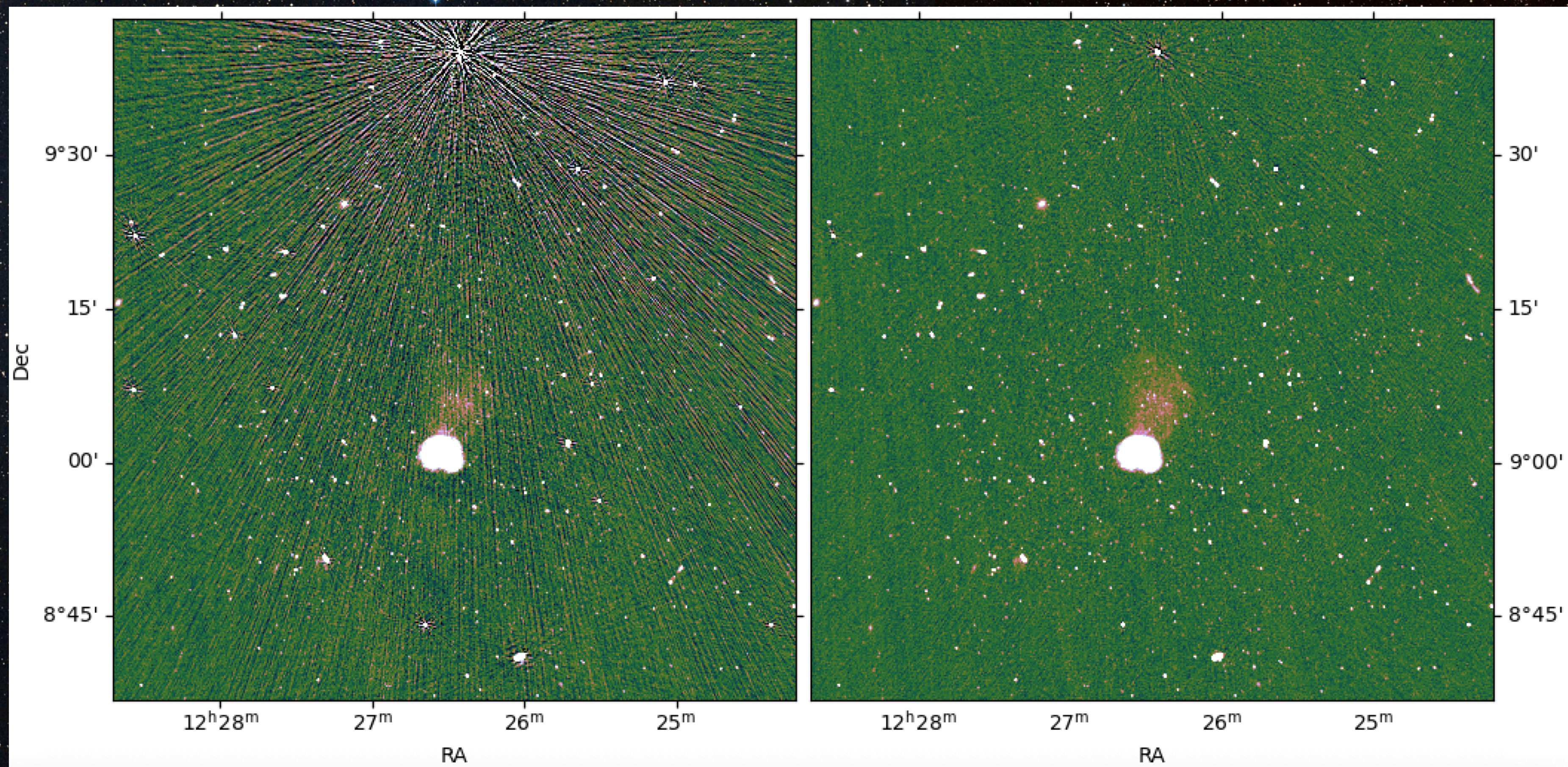
ViMS Pipeline

- * **ViCTORIA** MeerKAT Survey (**ViMS**) Pipeline
(github.com/a-benati/ViMS)
- * Custom pipeline for the **calibration** and **imaging**, both in **full polarisation**, of the data
- * **Softwares**: CASA, AOFlogger, WSClean, facetsselfcal (+ others)

ViMS Pipeline: structure



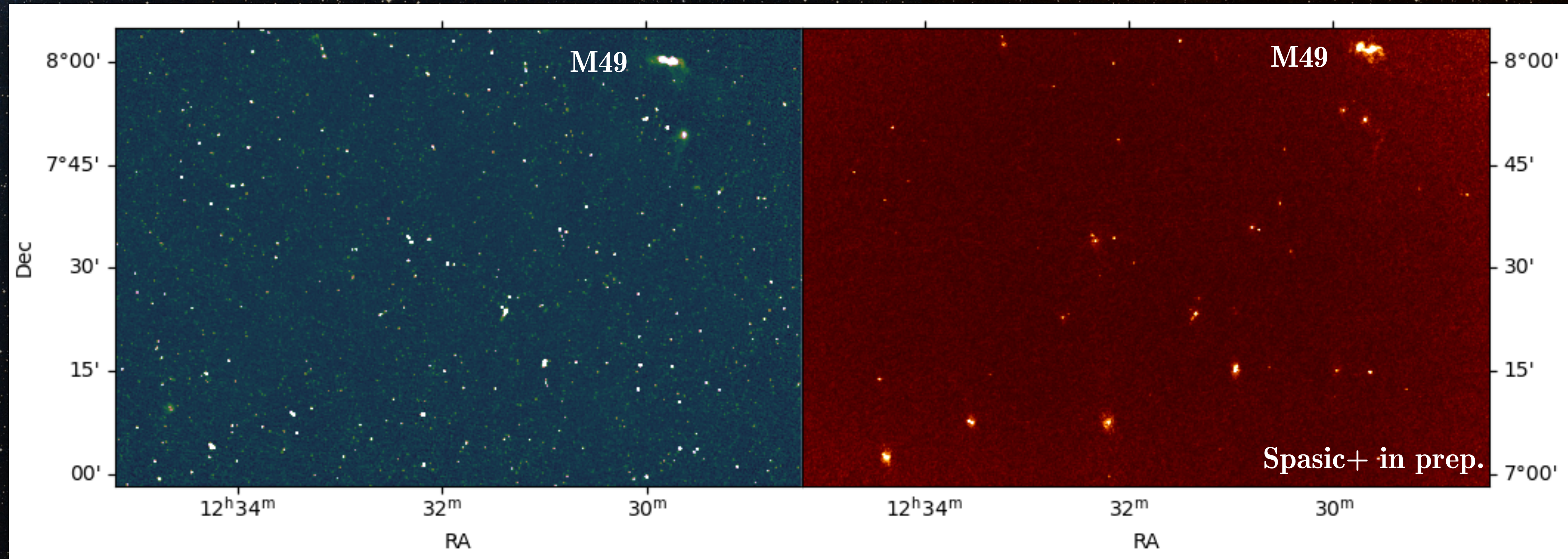
ViMS Pipeline: example



Before selfcal

After selfcal

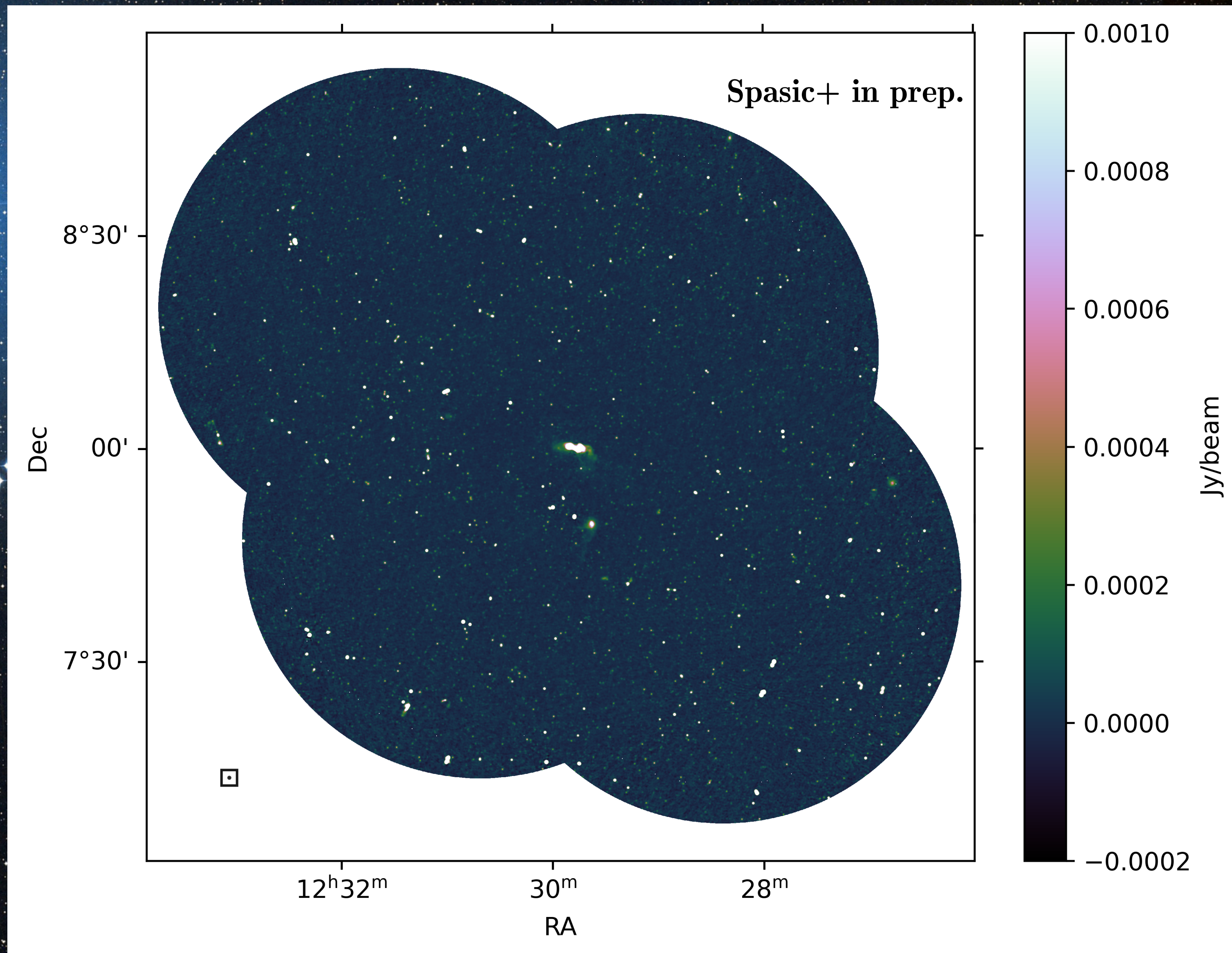
Preliminary results



Stokes I

Polarised emission

Study case: M49



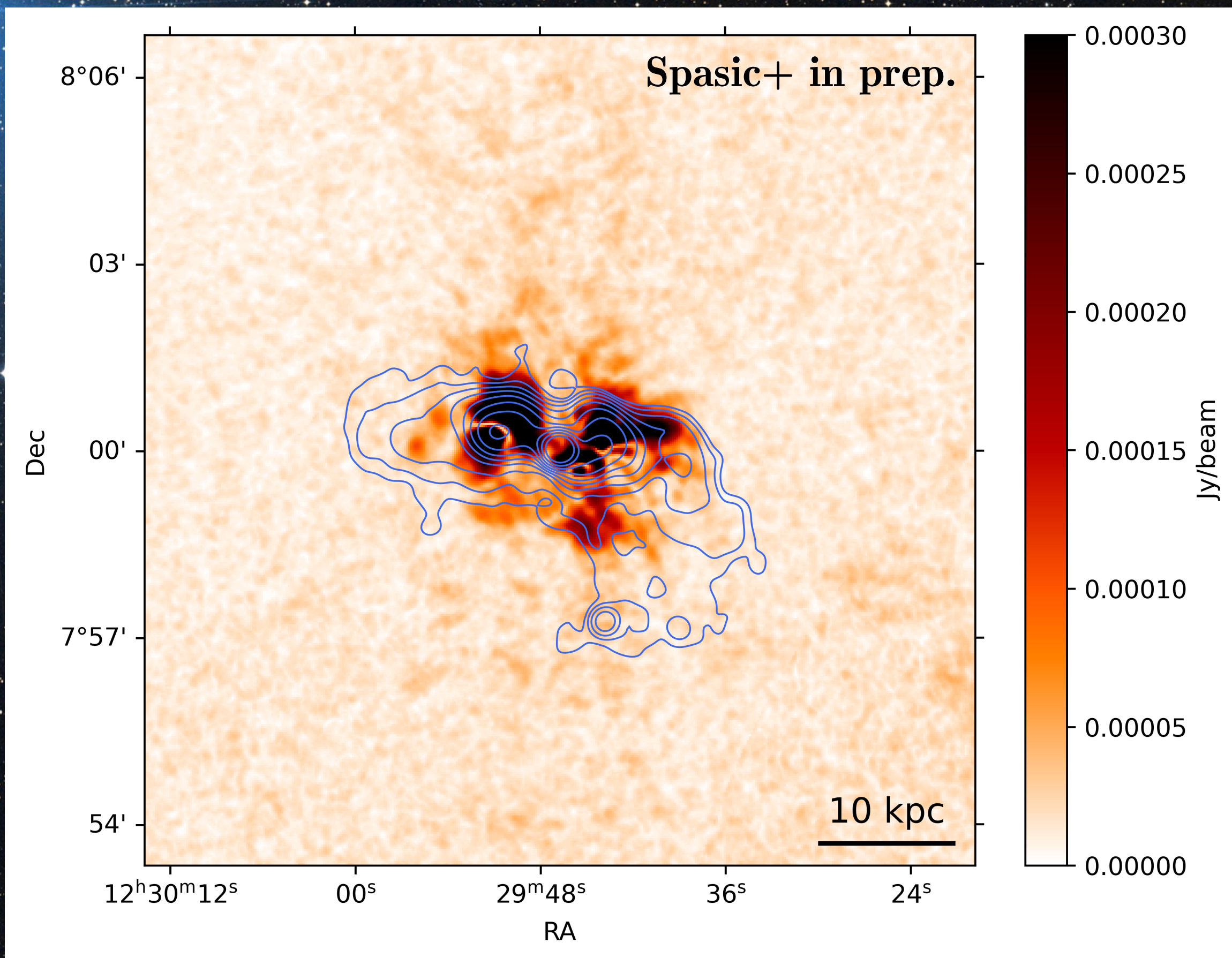
4 deg² field shows
~160 polarised
sources



~5000 polarised
sources for the
whole mosaic

Study case: M49

Polarised emission with Stokes I contours



- *Image from **bandwidth averaged** Stokes Q and U

- ***Outer** Stokes I emission **not polarised**

- ***Center** is **depolarised** as expected

Conclusions

- * We developed the custom **ViMS pipeline**
- * We **applied** our pipeline to some **test fields**
- * From the test on the M49 field we expect to **detect** on the order of **5000 polarised sources**

Next steps

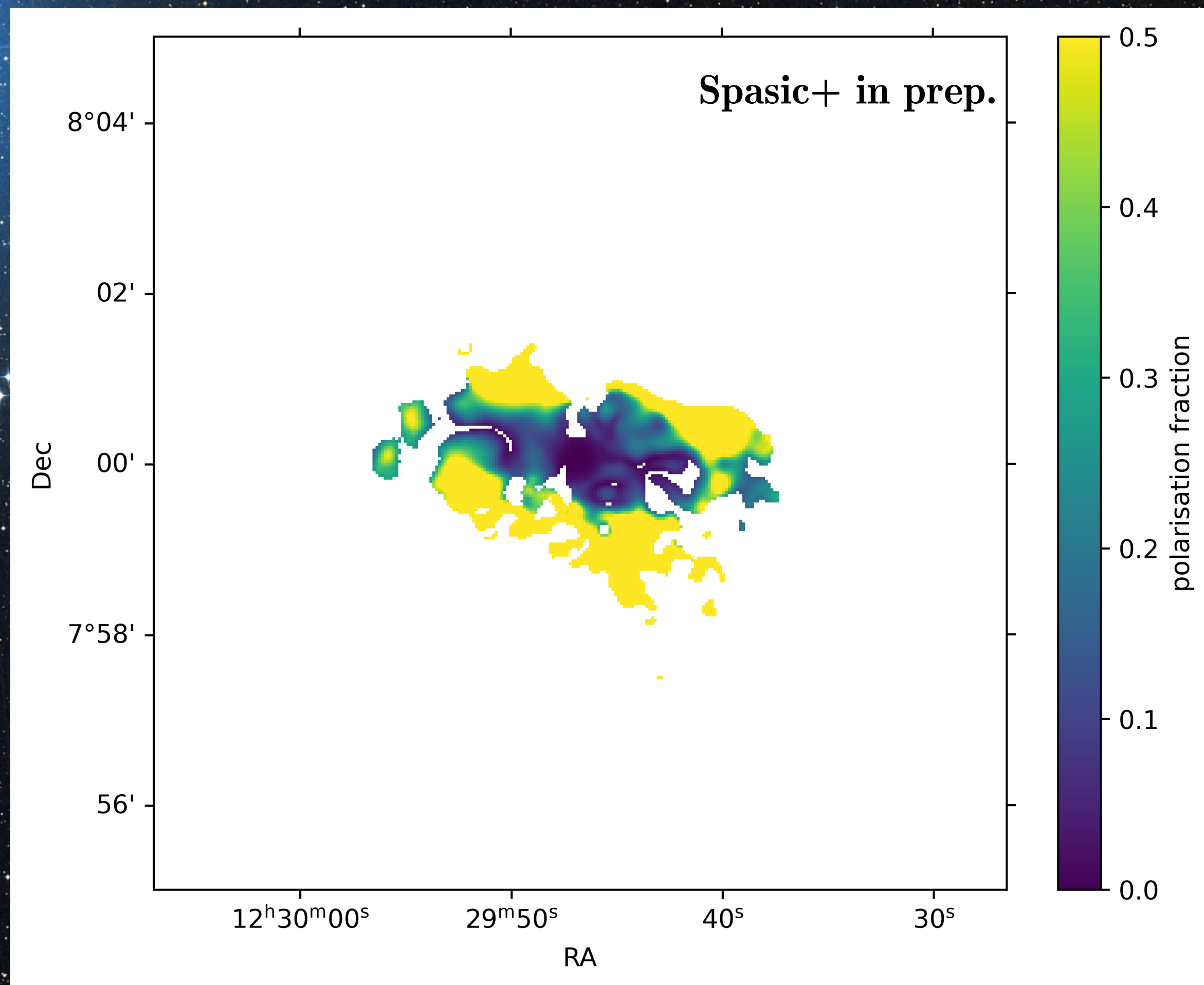
- * Apply the **calibration** to the **full dataset**
- * Perform **RM synthesis** on all the fields to build the **densest RM grid** of the Virgo cluster to date
- * Carry out a **spectral analysis** across the frequency range 42 - 1712 MHz



Thank you for the attention

Study case: M49

Polarisation fraction map



* **Inner** region
strongly
depolarised

* **Outer** parts
strongly **polarised**
(~40-50%)

Study case: M49

Polarised emission with
magnetic field lines

