

A WSRT mosaic of a nearby rich galaxy cluster.

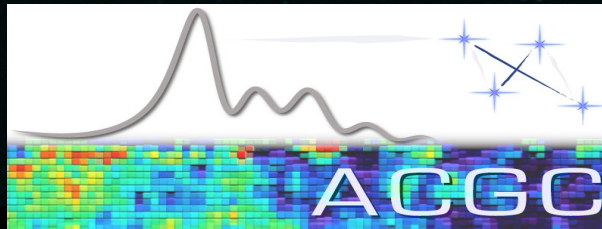
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Tom Jarrett, Wim van Driel, Trish Henning, Erwin de Blok.

RUG/UCT/ASTRON

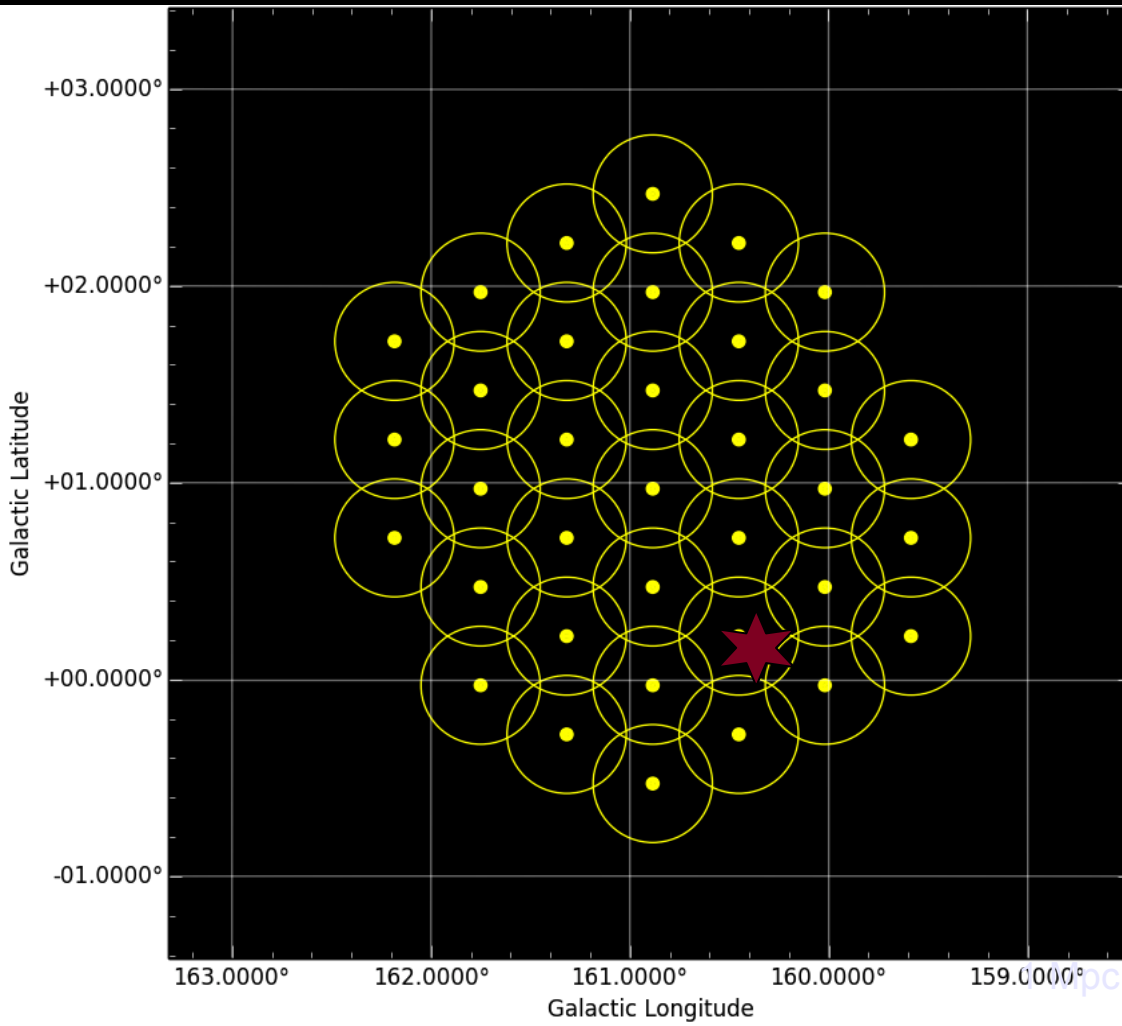


kapteyn astronomical
institute



ASTRON

A blind HI imaging of PPS in the ZoA



WSRT mosaic*:

35 x 12hr pointings,
Sep. 0.5° (~ 0.9 HPBW),
sky area ≈ 9.6 sq.deg.

8 (10 MHz) overlapping IF-bands
Vel. $\approx 2000 - 17000$ km/s
 $\Delta V = 8.25$ km/s $\rightarrow R = 16.5$ km/s
 $\Theta = 23'' \times 16''$ restoring beam.

Includes:

3C 129.1 - 0.94 Jy

3C 129 - 4 Jy

+ many other (strong) cont sources.

Lane et al., 2002

* Similar to a single AperTIF pointing but covers 22% of its redshift.

Goals.

A mini pilot study for AperTIF surveys.

Data cubes to test data handling algorithms.

- Pipeline reductions.
- Calibrations.
- Source finding and extraction of parameters.



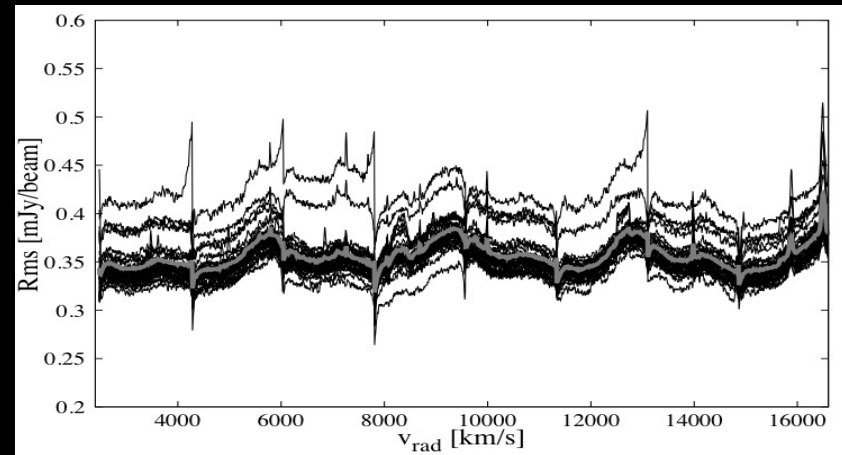
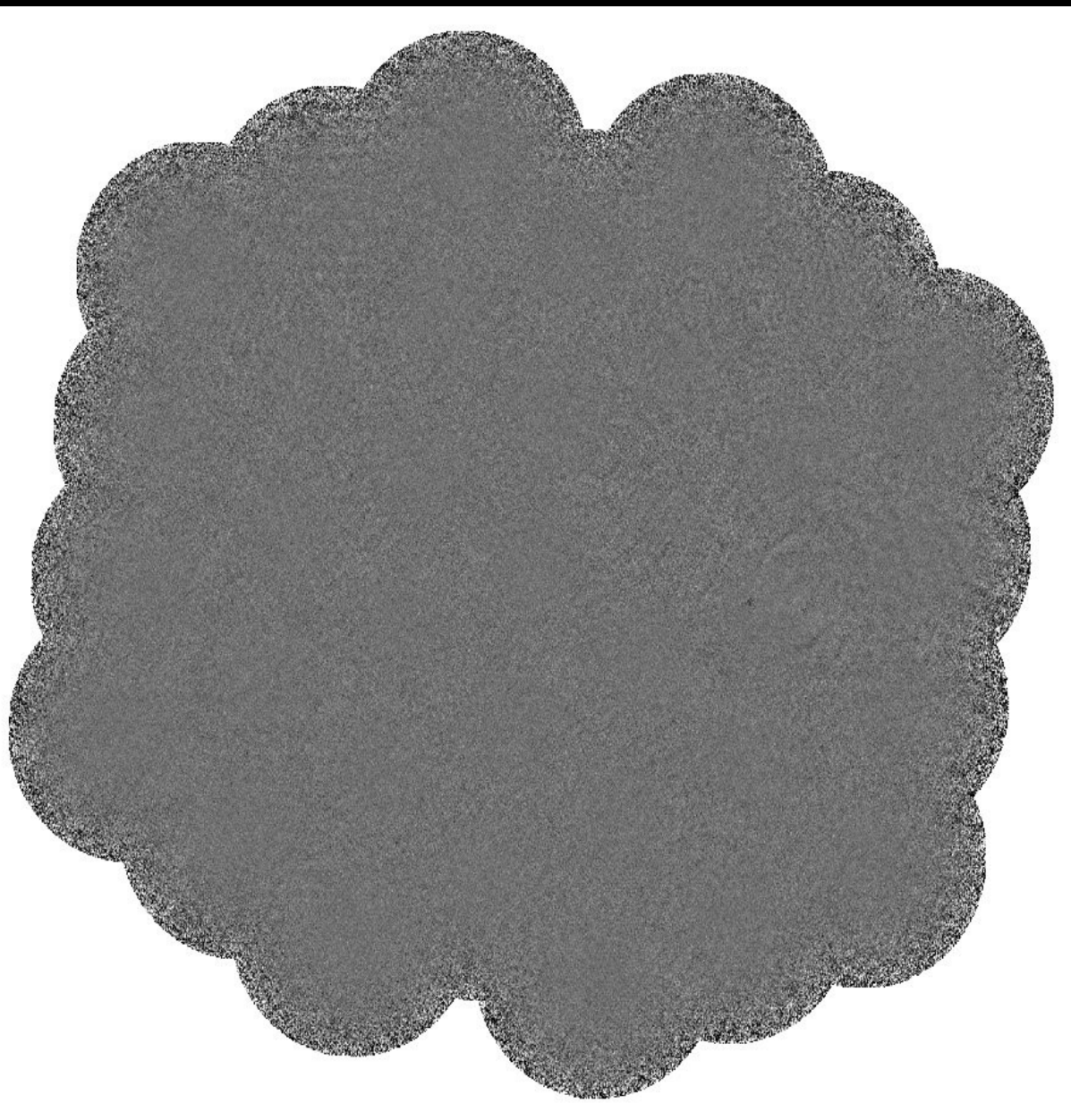
Science:

- Reveal structure behind the Galaxy, Environmental effects on HI properties, TF, Flow fields.

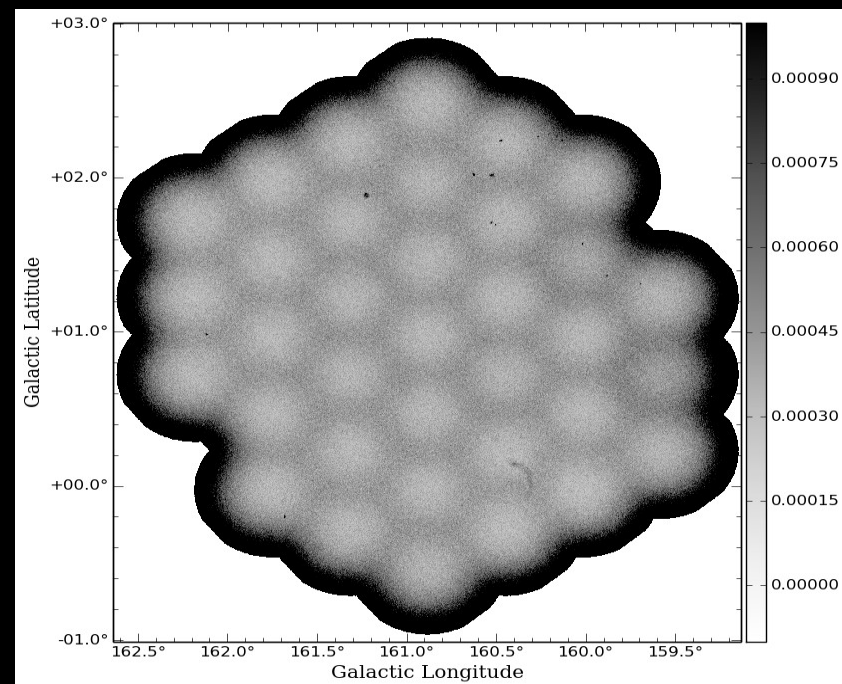
A blind HI imaging of PPS in the ZoA

2186 x 2036 pix, 1717 chans, ~ 30 GB

rms = 0.35 mJy/beam



> 20% spectral noise variation.



$M_{HI}^{\min} 6\sigma = 1.5 \times 10^8 M_{\text{sun}}$, $N_{HI}^{3\sigma} = 6.4 \times 10^{19} \text{ cm}^{-2}$

~ 16% spatial noise variation.

Source detection.

- 23" × 16" (high-res) cubes smoothed to 30" × 30" (bs30).
- Smoothed (high res and bs30) to four velocity resolution elements.
 - Hanning smoothing (R2).
 - four channel smoothing (R4).
 - six channel smoothing (R6).
 - eight channel smoothing (R8).

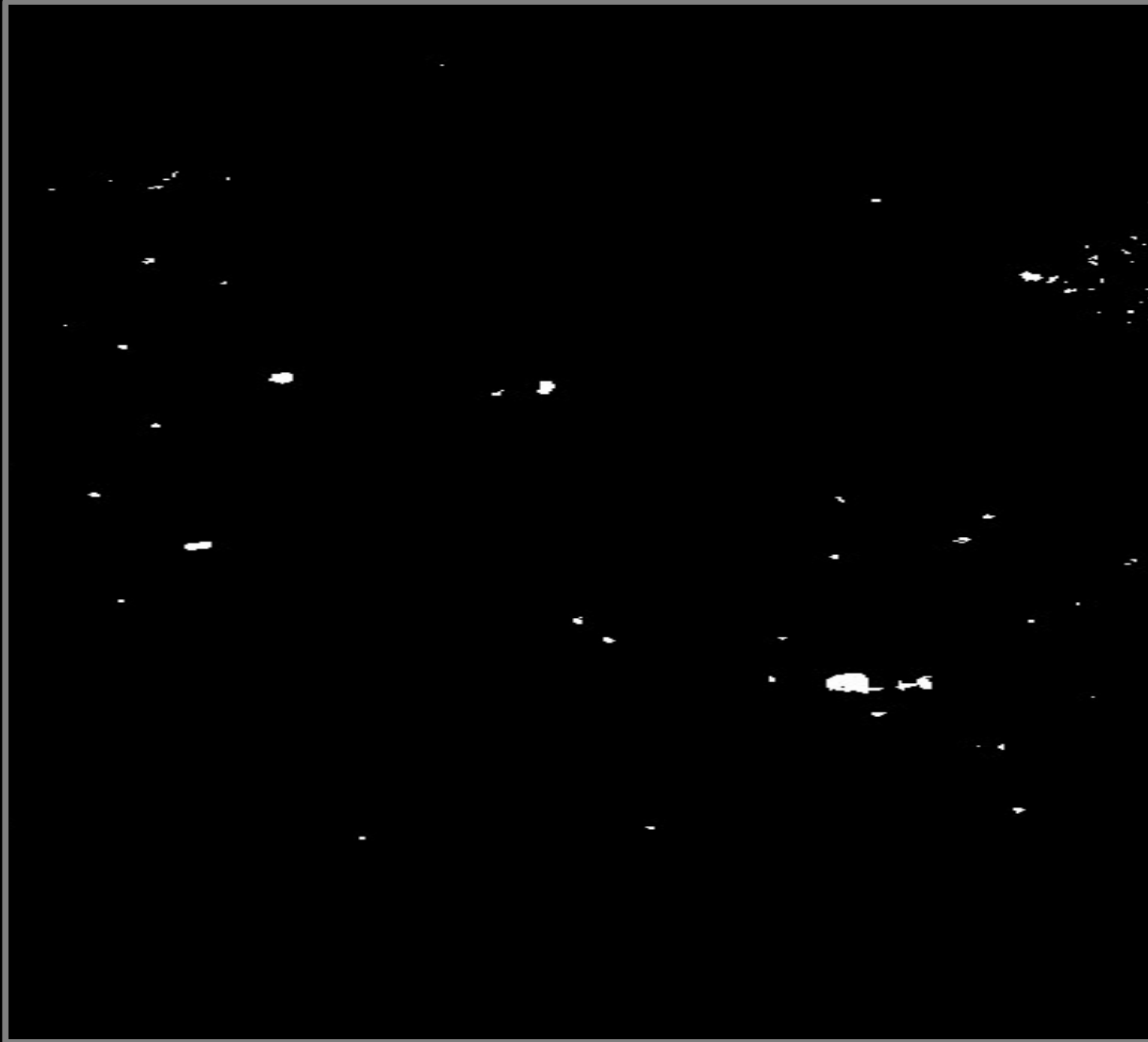
The cube was searched at 8 different angular/velocity resolution combinations.

- Accepted if:
 - 8 σ x1 velocity resolution element(s)
 - 5 σ x2 VRE
 - 4 σ x3 VRE
 - 3 σ x4 VRE

A total of 32 detection sub-masks were added to make a final detection mask.

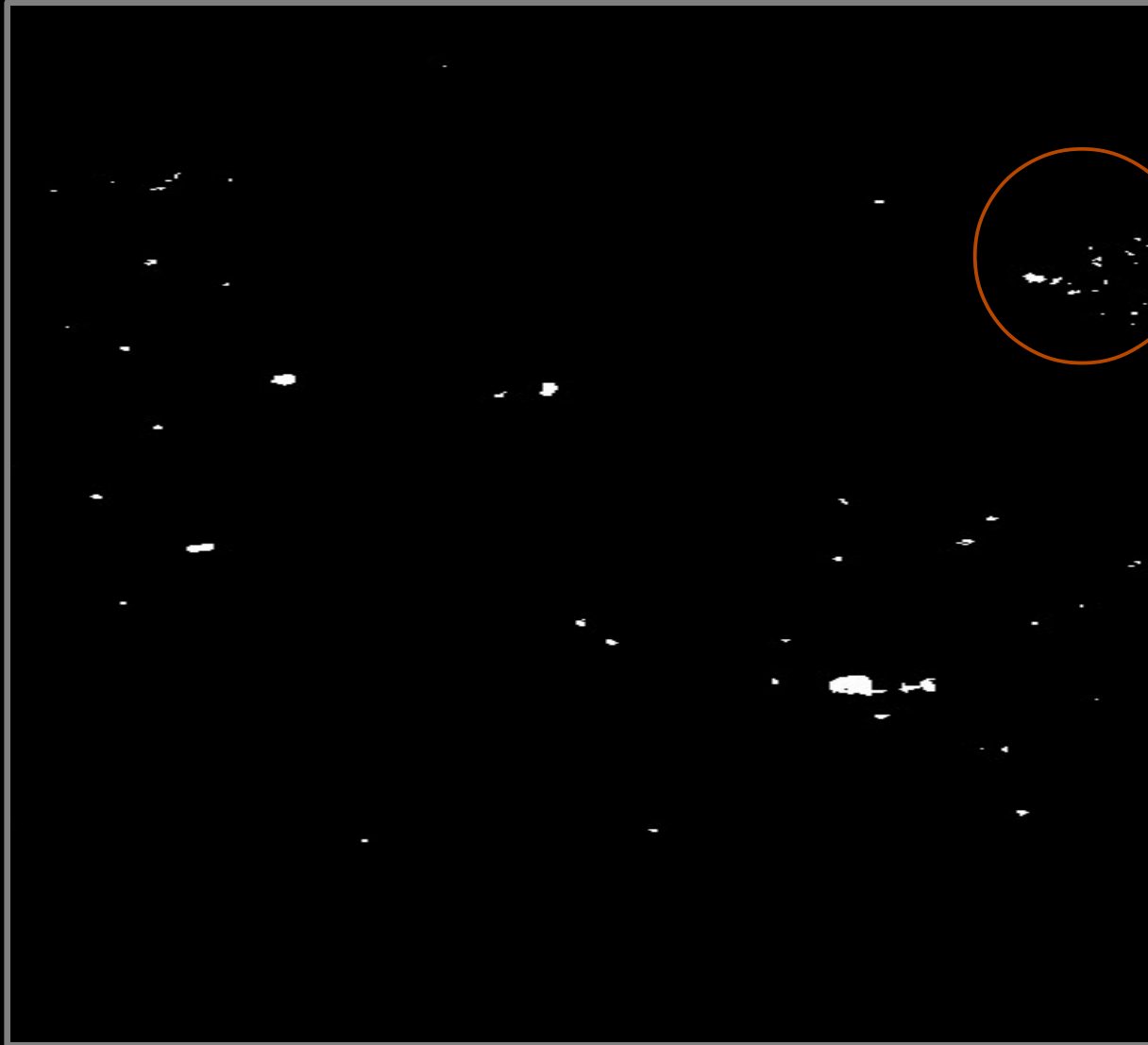
Source detection.

Many HI detections. (details a few slides later)



Source detection.

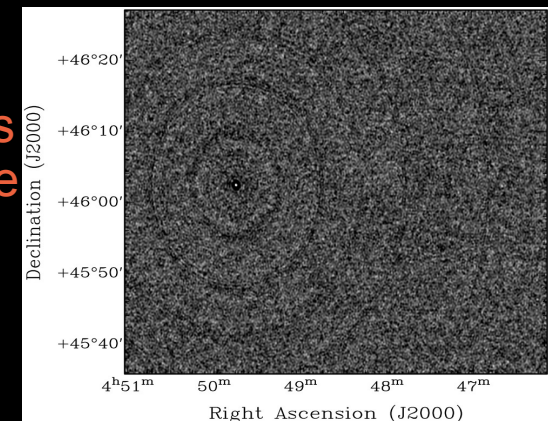
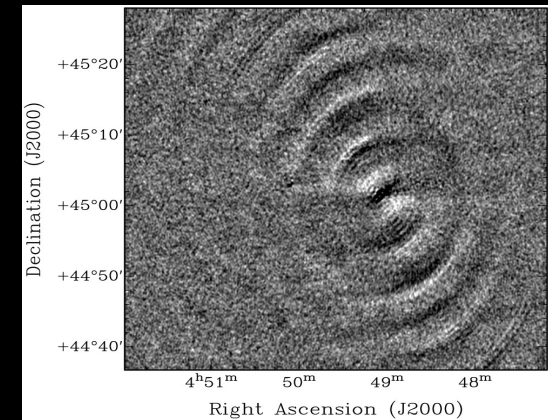
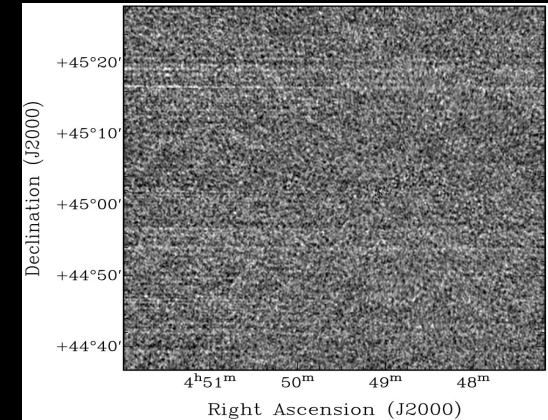
Many HI detections. (details a few slides later) + **Imaging artifacts**



Residual
RFI.

Amplitude
errors.

Bandpass
dip – affects
cont. source
removal.



*More robust source finding techniques needed.

Lessons learned

RFI flagging.

- Automated RFI flagging softwares work okay but still require a lot of human intervention.

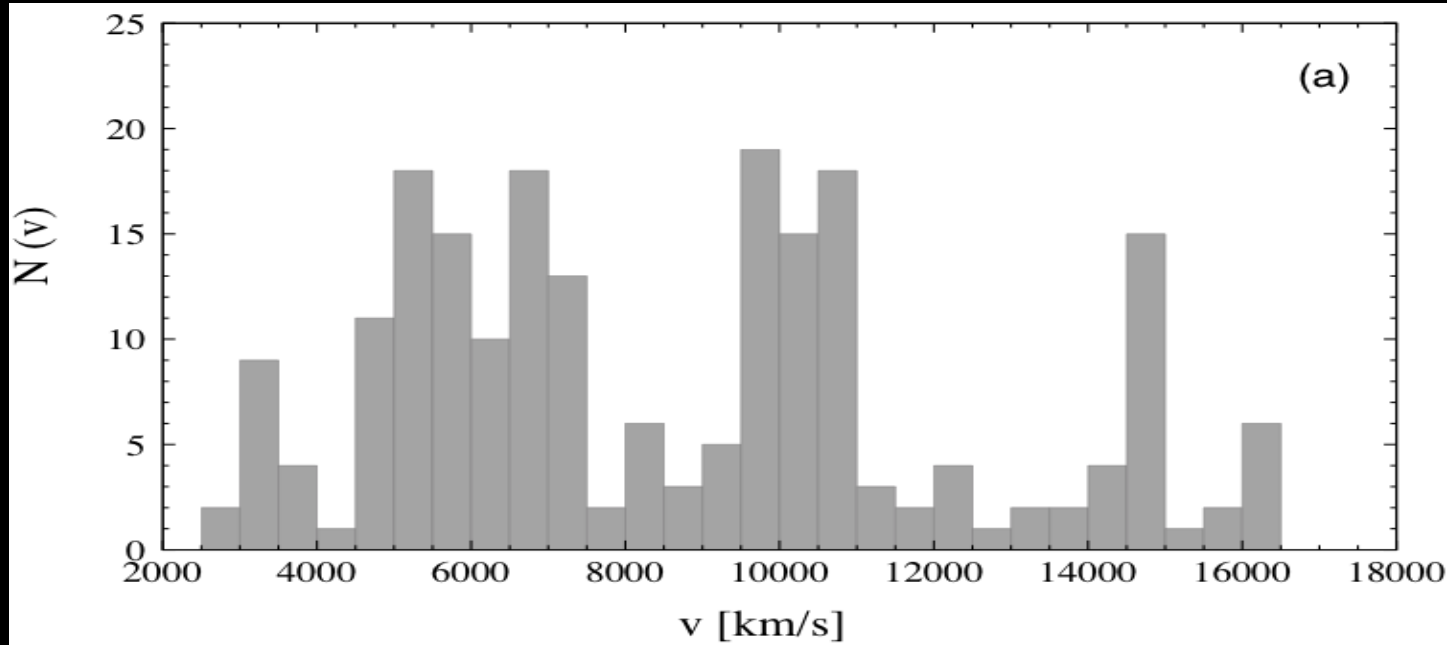
Source finding in imperfect very large data cubes is a challenge.

- Imaging artifacts.
- Non-gaussian noise.

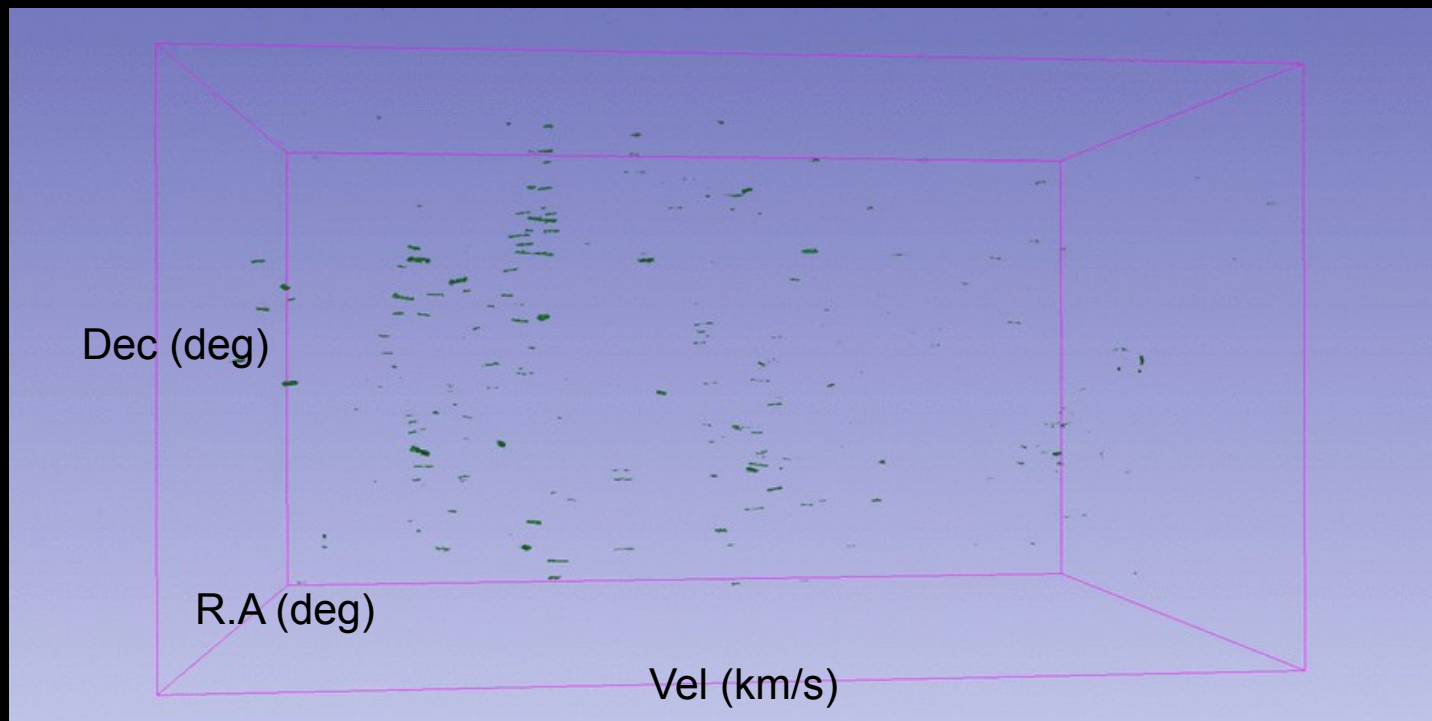
Visualisation softwares limited.

- cannot easily view large data cubes.

HI detections



~200 galaxies over the full velocity range - wide range of HI morphologies ($\log M_{\text{HI}} = 8.0 \dots 10.3 M_{\odot}$)



38% spatially resolved

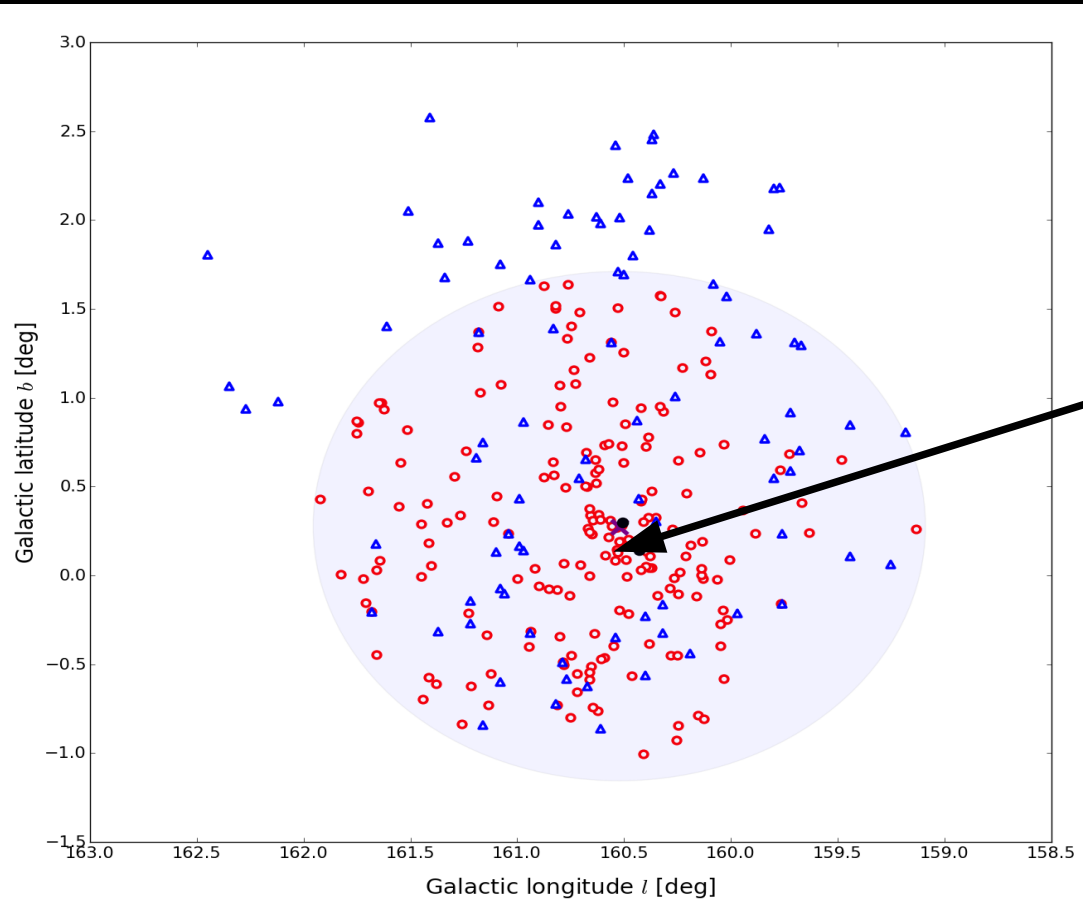
67% stellar counterparts.

Preliminary results.

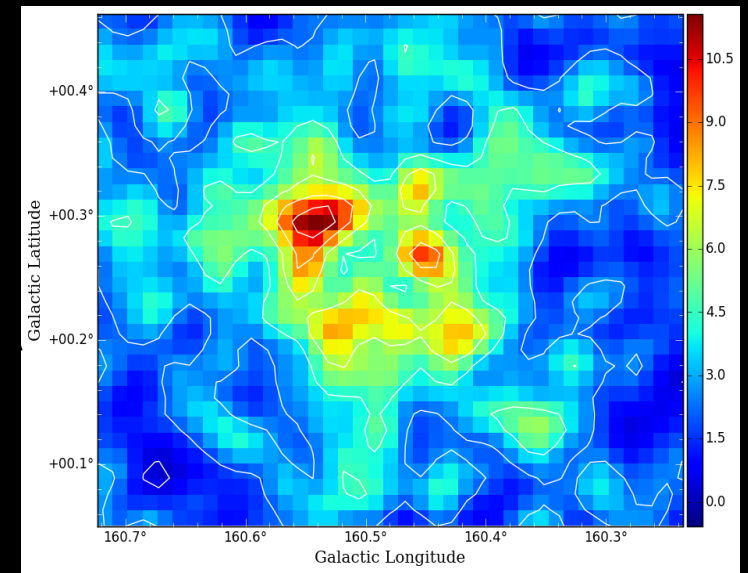
A (potentially) rich cluster nearby.

Blue points: 90 HI detections

Red: 201 not HI from UKIDSS.



0.1 – 2.4 keV X-ray $\sim 0.5^\circ$.



Leahy & Yin 2000

X ray emission from the hot ICM \rightarrow elongated

- Implying a non relaxed core.
- Post-merger signature.

$$M_{x_{500}} = 1.9 \times 10^{14} \text{ Msun}$$

$$L_{x_{500}} = 9.0 \times 10^{43} \text{ erg/s}$$

74% L_x Coma

82% L_x Norma

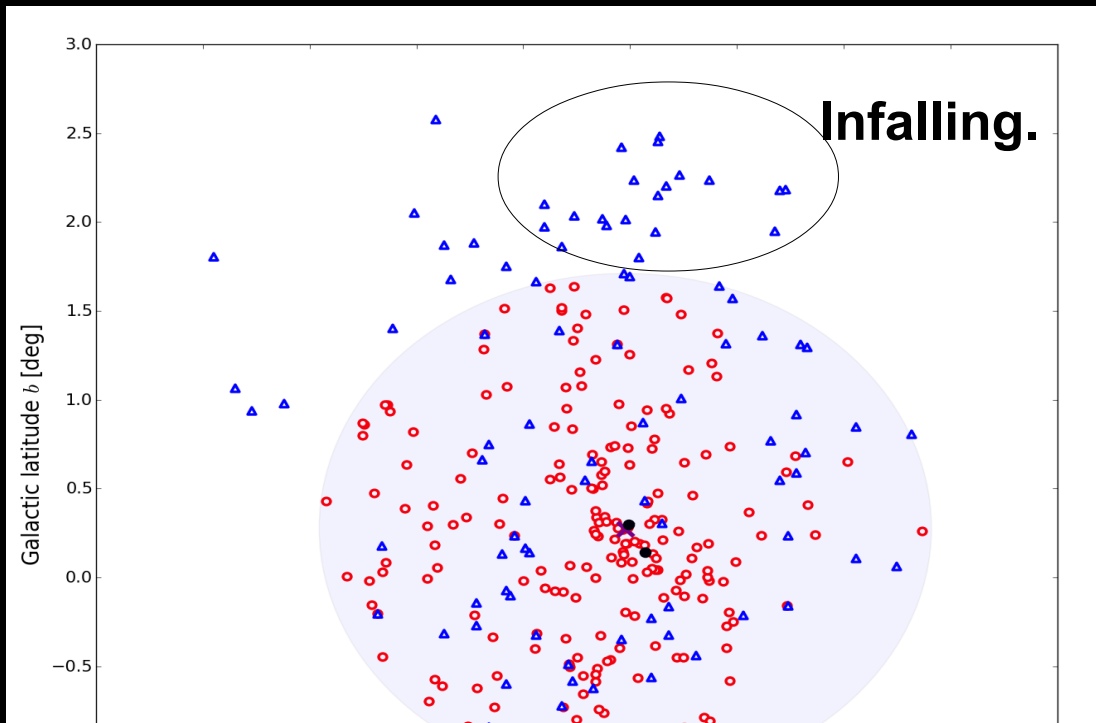
2x L_x Virgo

Preliminary results.

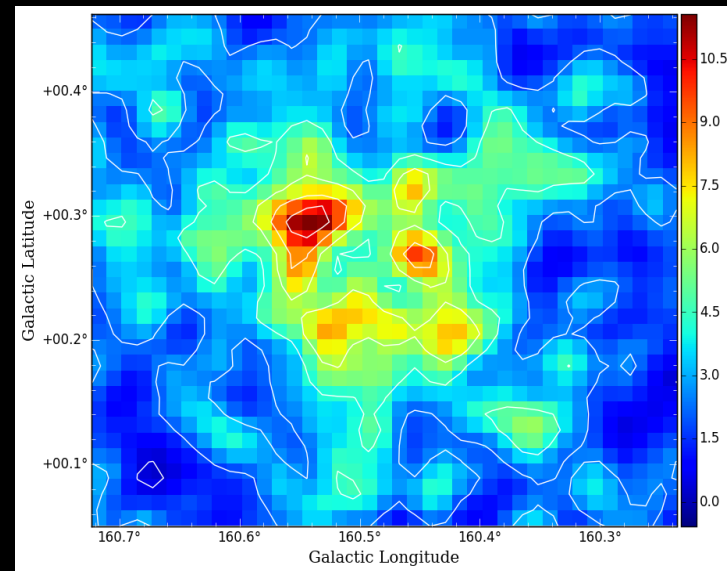
A (potentially) rich cluster nearby: The outskirts.

Blue points: 90 HI detections

Red: 201 not HI from UKIDSS.

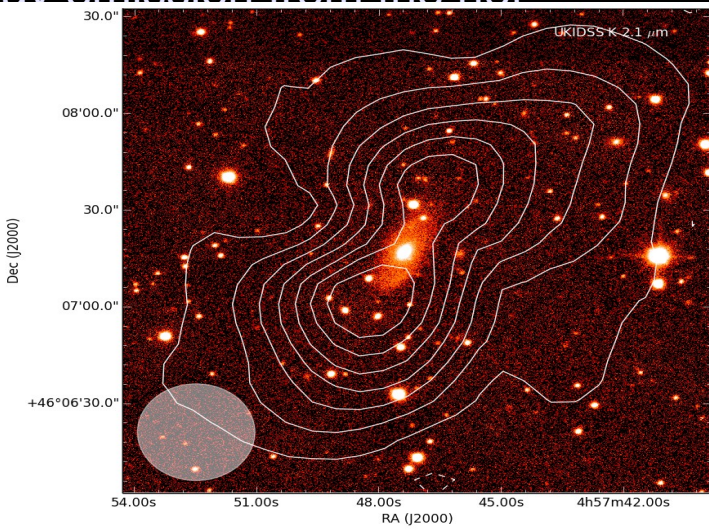
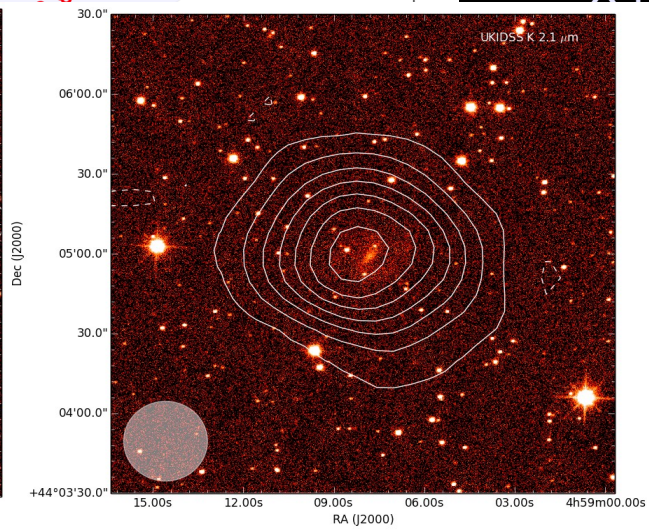
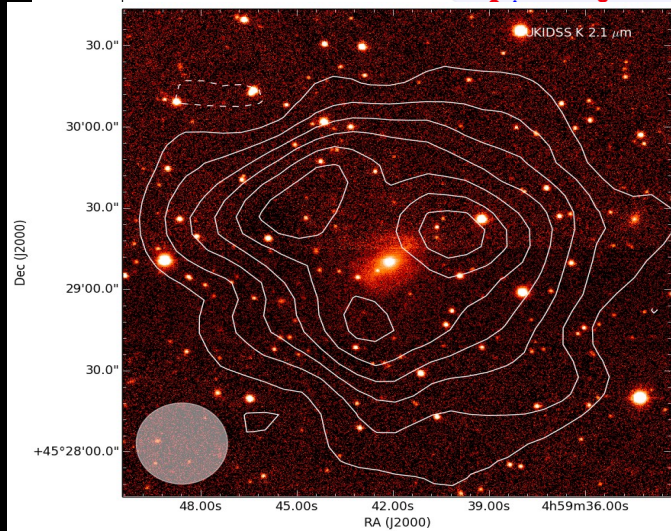


0.1 – 2.4 keV X-ray $\sim 0.5^\circ$.



Leahy & Yin 2000

X ray emission from the hot

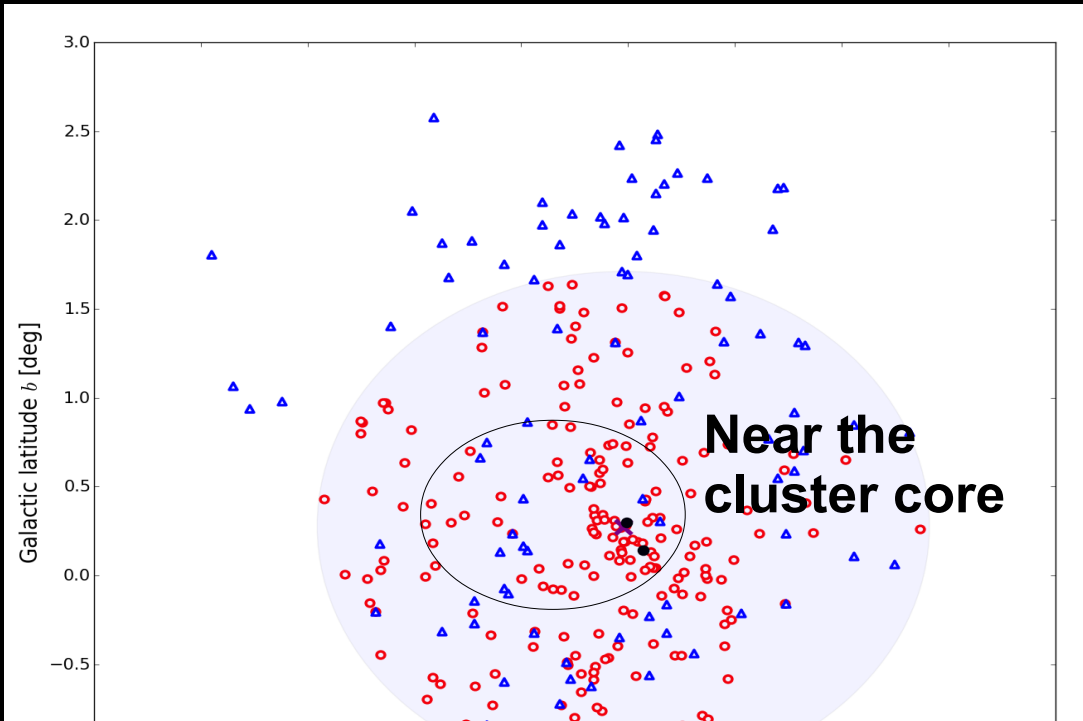


Preliminary results.

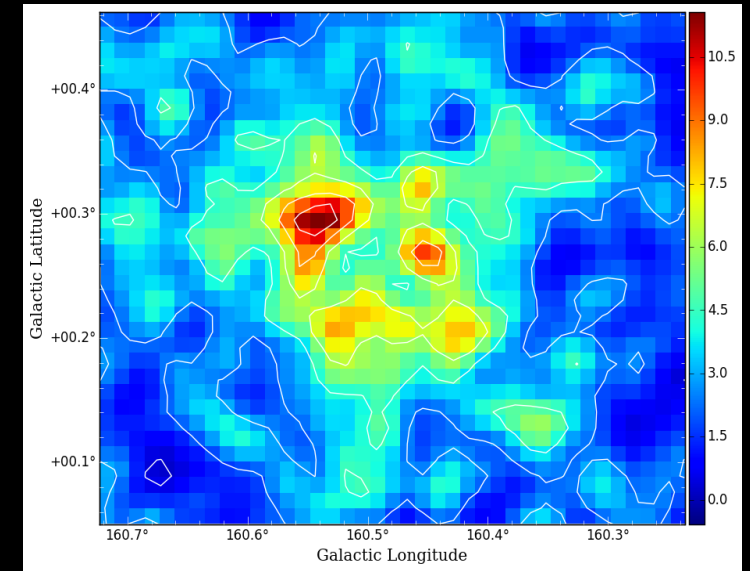
A (potentially) rich cluster nearby: The central regions.

Blue points: 90 HI detections

Red: 201 not HI from UKIDSS.

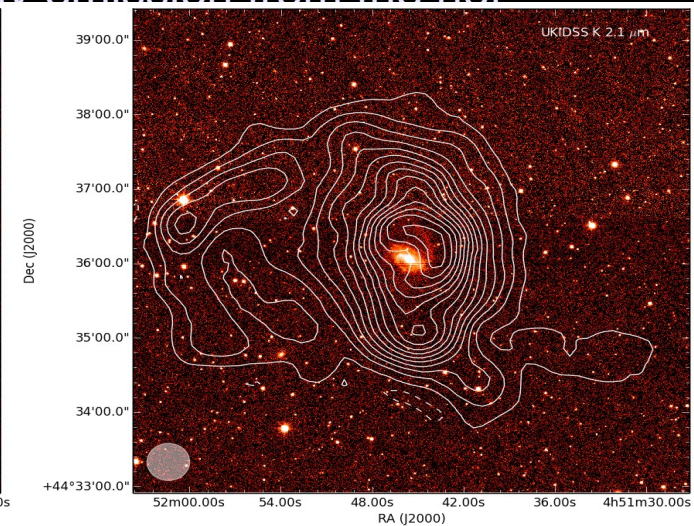
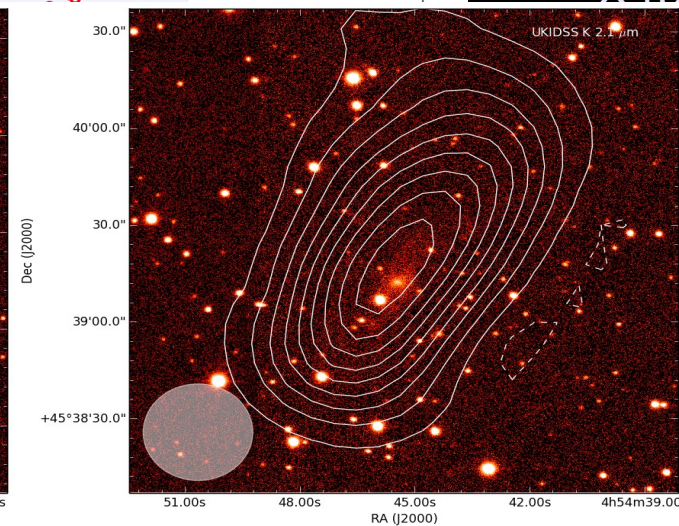
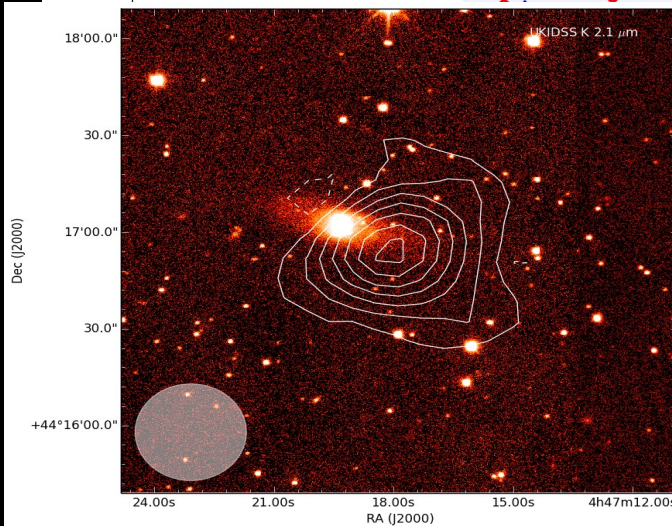


0.1 – 2.4 keV X-ray $\sim 0.5^\circ$.



Leahy & Yin 2000

X ray emission from the hot



Summary.

- Detected ~ 200 galaxies over the entire velocity range observed.
 - Presented in a catalogue + atlas of a recently submitted paper.
- Automated RFI algorithms work okay, but still requires a lot human interventions.
- Automated source finding algorithms need to be optimised to work on large and imperfect data cubes.
- Visualising large data cubes remains a computational challenge.

Future work:

- Test the automated Apertif data reduction pipeline.
- Compare source finding results with visual inspections.
- Continuum mapping.