Update on the LOFAR Two-metre Sky Survey (LoTSS)

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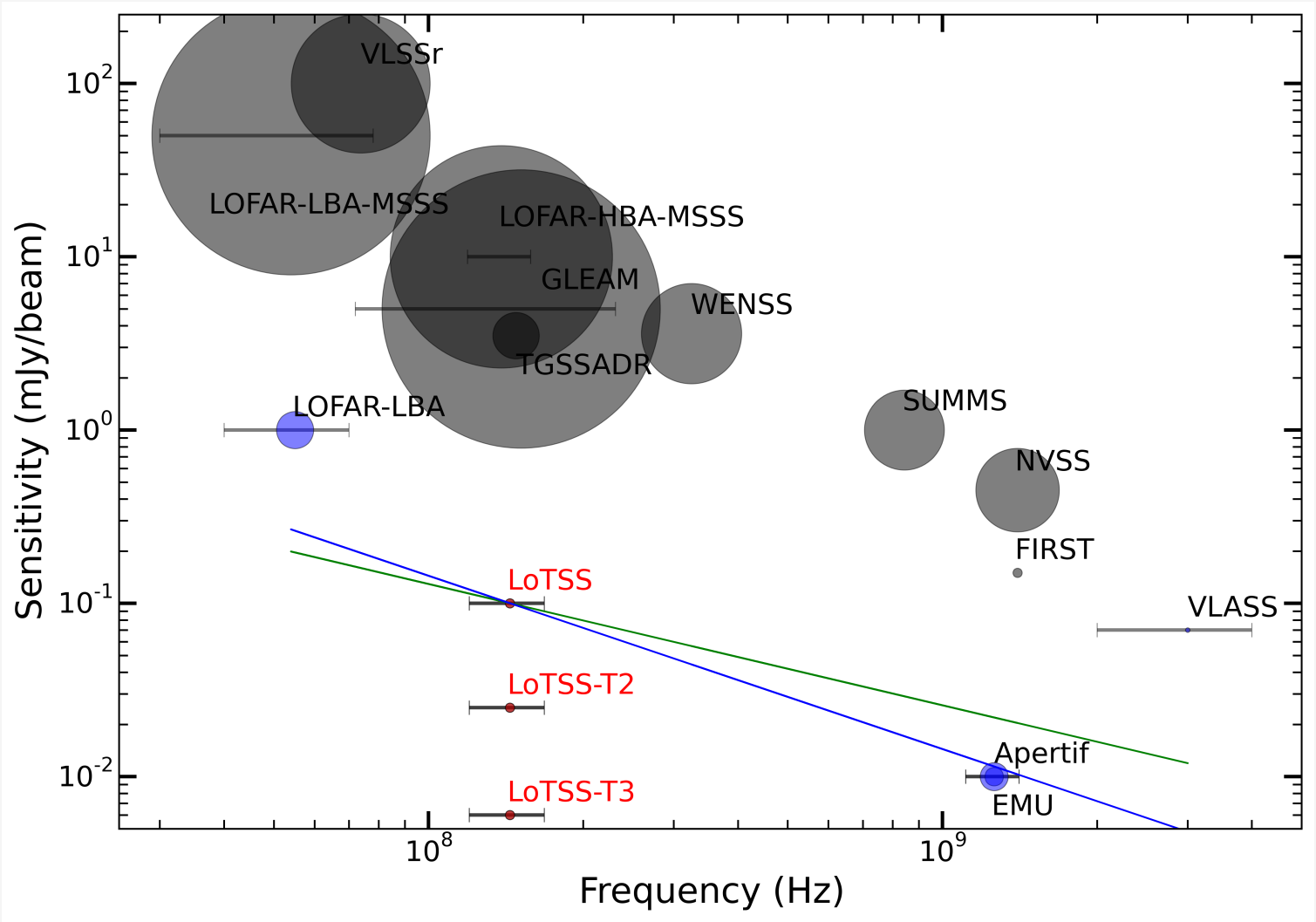
The scientific aims of LoTSS

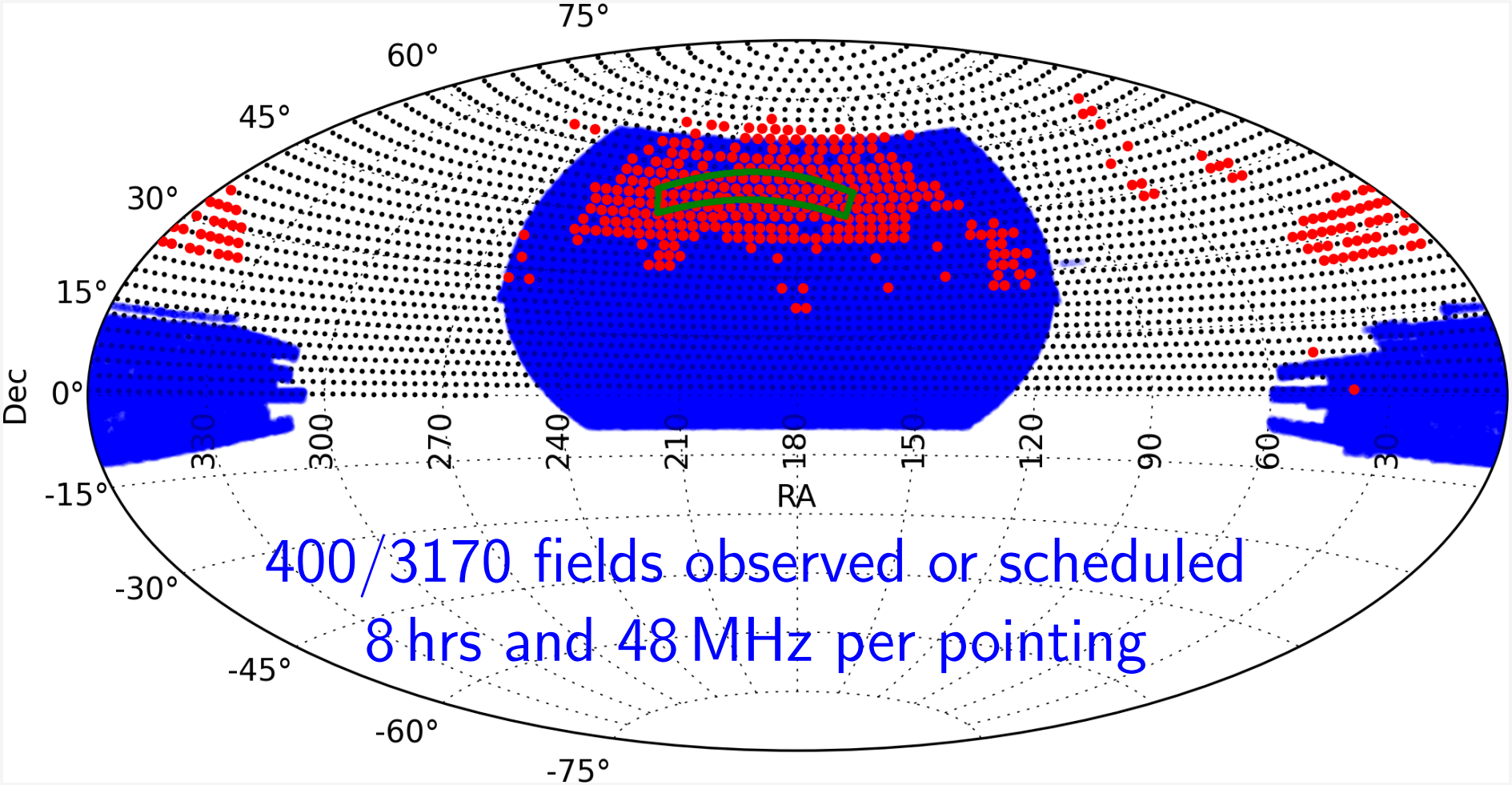
- PI: Huub Röttgering
- Highest redshift radio sources: George Miley
- Clusters: Gianfranco Brunetti & Marcus Brüggen
- Evolution of AGN and star forming galaxies: Philip Best
- Detailed studies of low-redshift AGN: Raffaella Morganti
- Nearby Galaxies: Krzysztof Chyzy & John Conway
- Gravitational lensing: Neal Jackson
- Galactic radio sources: Glenn White & Marijke Haverkorn
- Cosmological studies: Matt Jarvis
- 135 members from $\sim$50 institutions.
- Over 75 active projects

Observational aims



Green $\alpha = -0.7$. Blue $\alpha = -1.0$.

Observing progress



Two deep fields with over 100 hrs and a further 3 with more than 50 hrs.
Coobserving mode now established.

Observing challenges

About 13,000 hrs of observations are required – in 3.5 yrs only 17% of the survey has been observed.

WEAVE-LOFAR will begin observations in 2018/2019 and needs 2000 square degrees (1400 hrs or 350 pointings) of LoTSS maps per year.

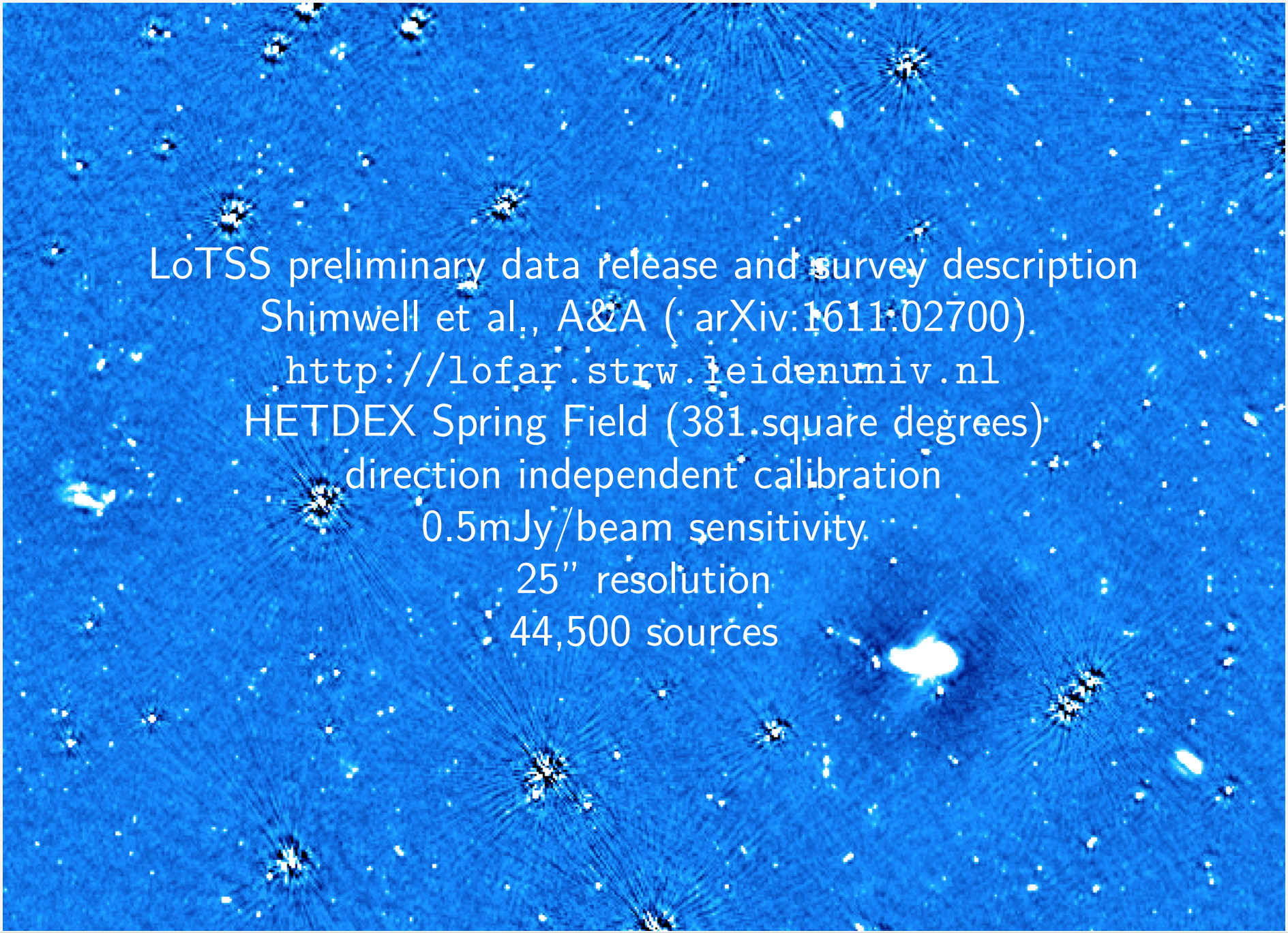
- We must identify limiting factors in our present observing speed.
- COBALT2.0 and LOFAR2.0 offer more opportunities (Hessels)

WEAVE will measure spectra for up to 10^6 LoTSS sources from the William Hershel Telescope starting in 2018 – Smith et al. 2016

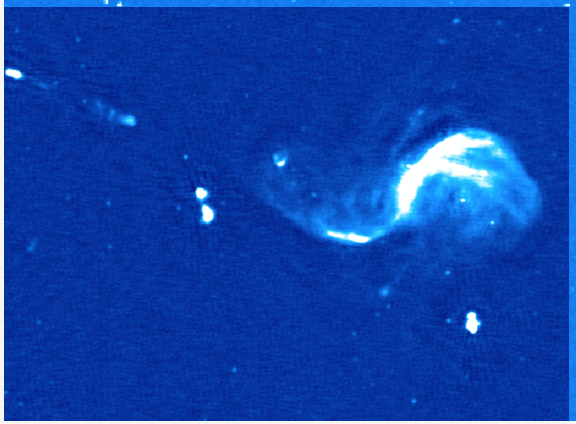
Calibration and imaging progress

- Direction independent calibration of over 110 datasets performed on LOFAR archive compute facilities
- Fast ($\sim$ 2.5-4 days) and automated calibration and imaging pipelines run on over 40 fields.

Calibration & imaging – Tasse, van Weeren, Hardcastle, Shimwell, Rafferty, Horneffer, Williams+;
GRID implementation – Mechev, Oonk, Shimwell.


LoTSS preliminary data release and survey description
Shimwell et al., A&A (arXiv:1611.02700)
http://lofar.strw.leidenuniv.nl
HETDEX Spring Field (381.square degrees)
direction independent calibration
0.5mJy/beam sensitivity
25” resolution
44,500 sources

LoTSS first full quality data release
Shimwell et al. 2017 in prep
HETDEX Spring Field (381 square degrees)
full direction dependent calibration
5 times deeper
20 times smaller synthesised beam
8 times more catalogued sources
source classification
Over 20 fields processed in last 20 days

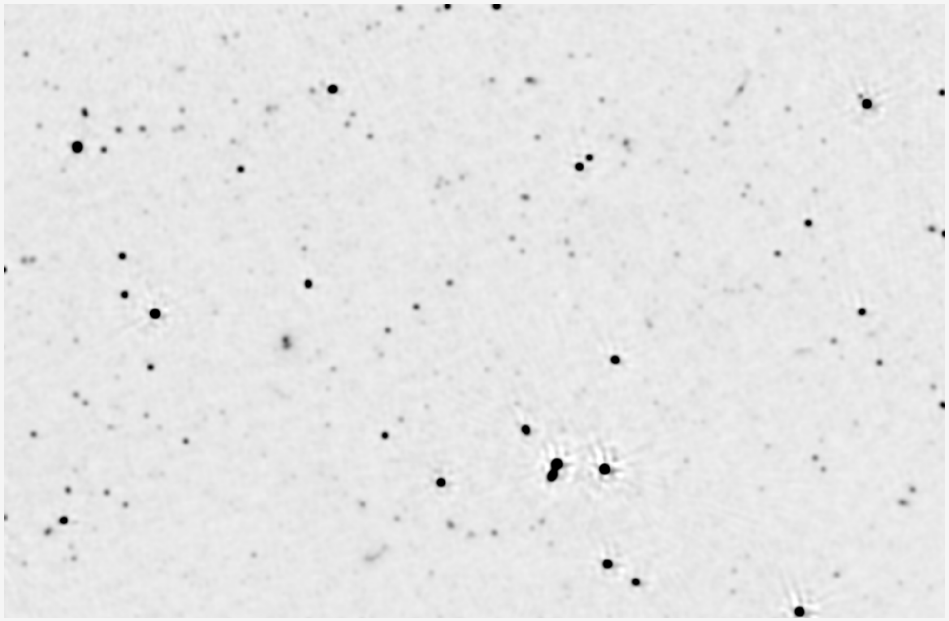


Calibration and imaging challenges

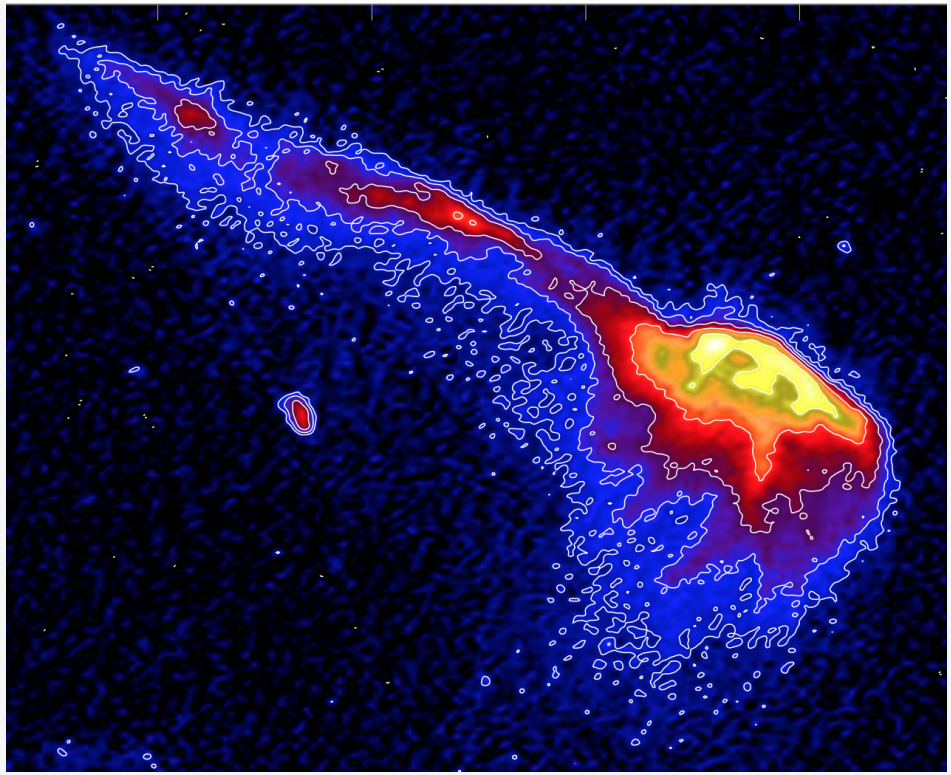
- Routine calibration and imaging of low-declination, exceptionally bright sources and complex galactic fields
- Moving towards Tier-2 and Tier-3 depth.
- Migrate all processing to archive computers
- Minimise processing issues (e.g. staging and data transfer issues, calibration errors)
- Processing existing pointings (400) and keeping up with ongoing observations (immediate aim to release fully calibrated HETDEX within collaboration)
- Further refining calibration and imaging algorithms.
- Full simulations to understand recovery of various sources.
- Increase understanding of variations in observing conditions.

Scientific exploitation progress

- First data release published
- First deep field papers published
- Many single object papers published
- Some calibration and imaging papers published



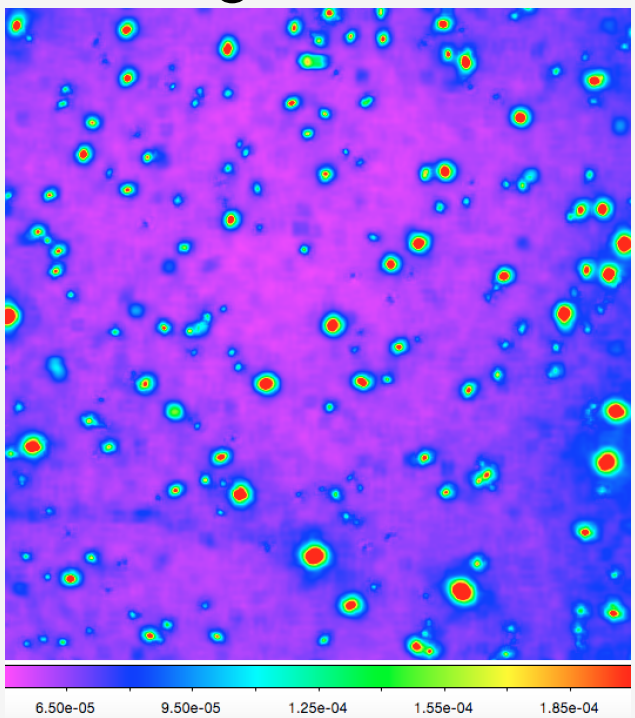
The Lockman Hole field (Mahony et al. 2016)



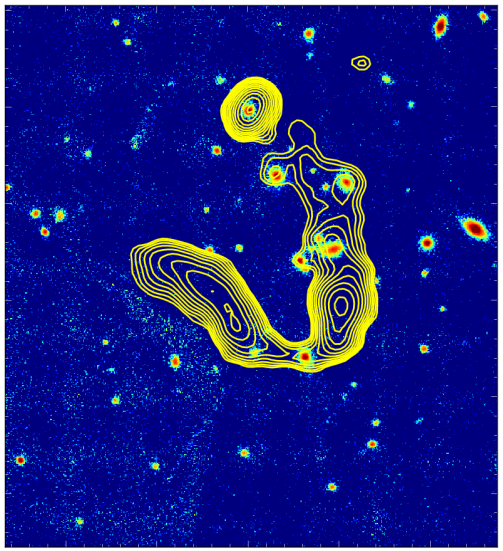
The Toothbrush cluster (van Weeren et al. 2016)

Scientific exploitation challenges

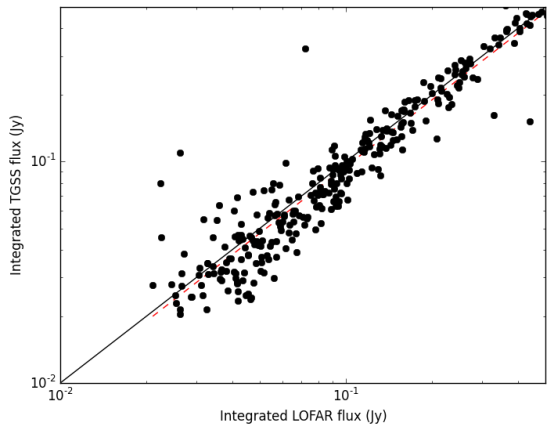
- Fully characterise LOFAR image properties
- Multi-wavelength aspect
- Facilitating statistical studies



Extracting sources and characterising noise variations



Cross matching with optical



Flux agreement with TGSS

Conclusions

- A production run is showing that data can be rapidly processed and the quality requirements for Tier-1 LoTSS can be met.
- Over 17% of the northern sky is observed but our main limitation is the observing speed.
- Need to demonstrate Tier-2 and Tier-3 depth.
- Need to show we can routinely handle galactic and low declination fields.