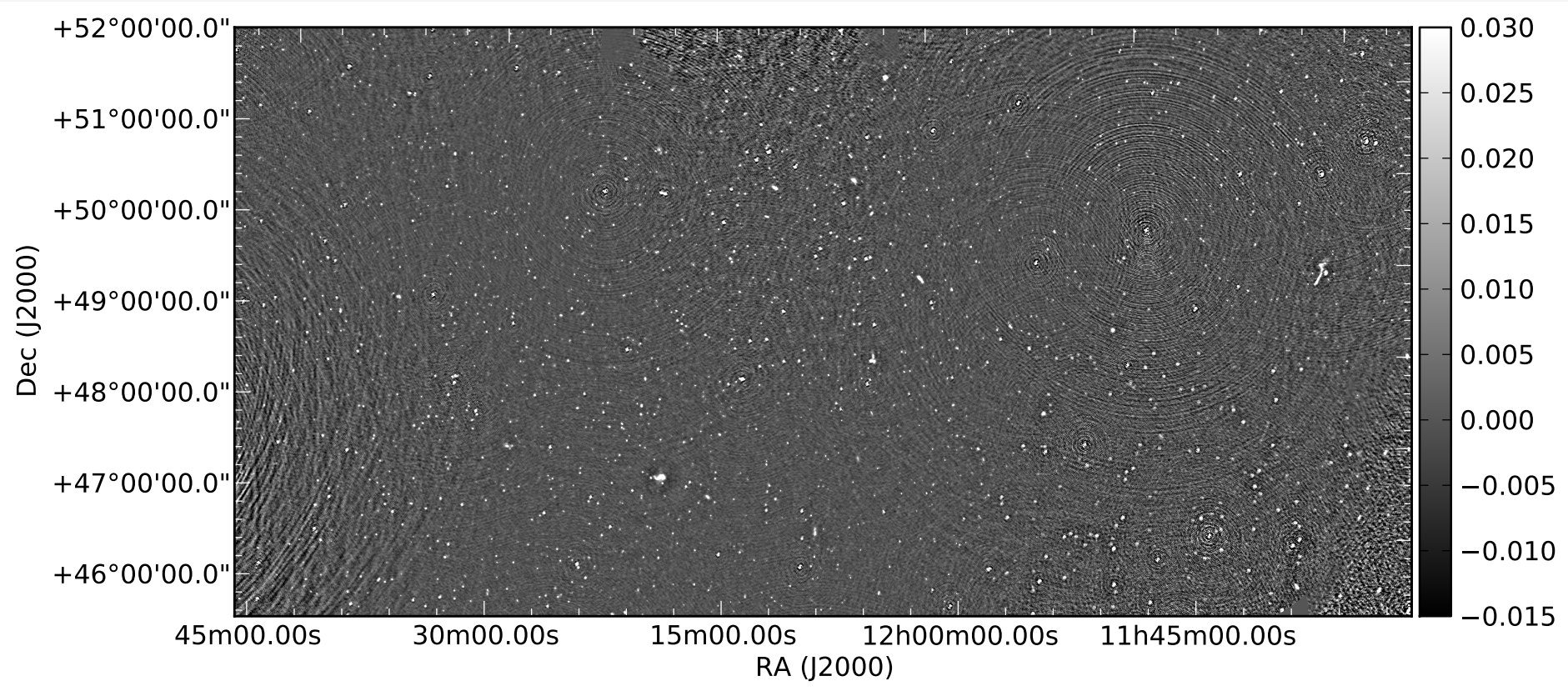
A preliminary LOFAR survey



Outline

1 HETDEX observations

2 Resolution

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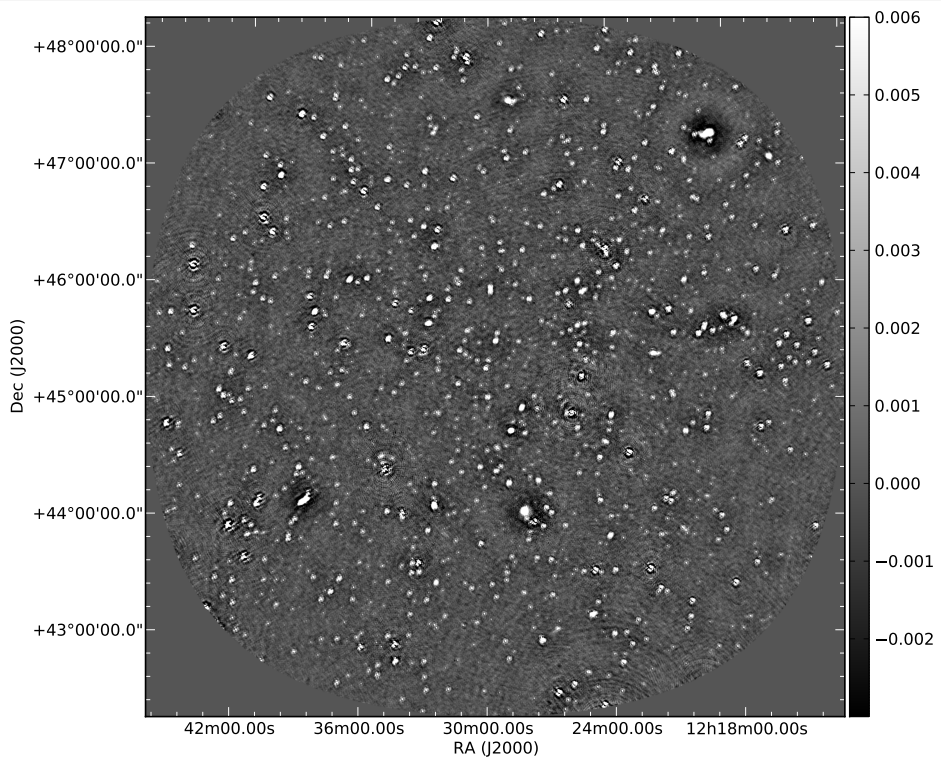
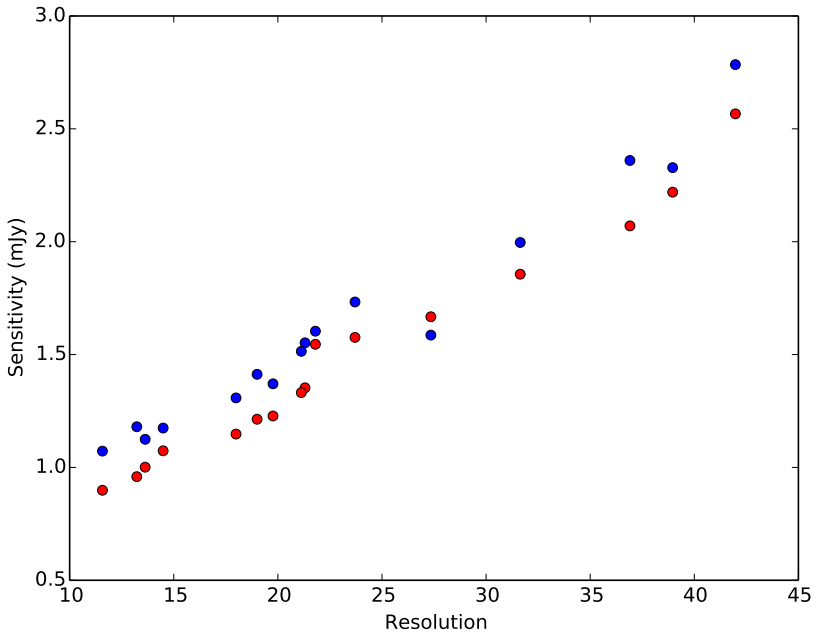
HETDEX observations

- 42 pointings observed
- 8 hrs per pointing
- 48 MHz bandwidth (244 sub bands) towards each pointing
- Baselines from 40 m to 120 km
- Direction dependent calibration is currently too computationally expensive for the entire survey.

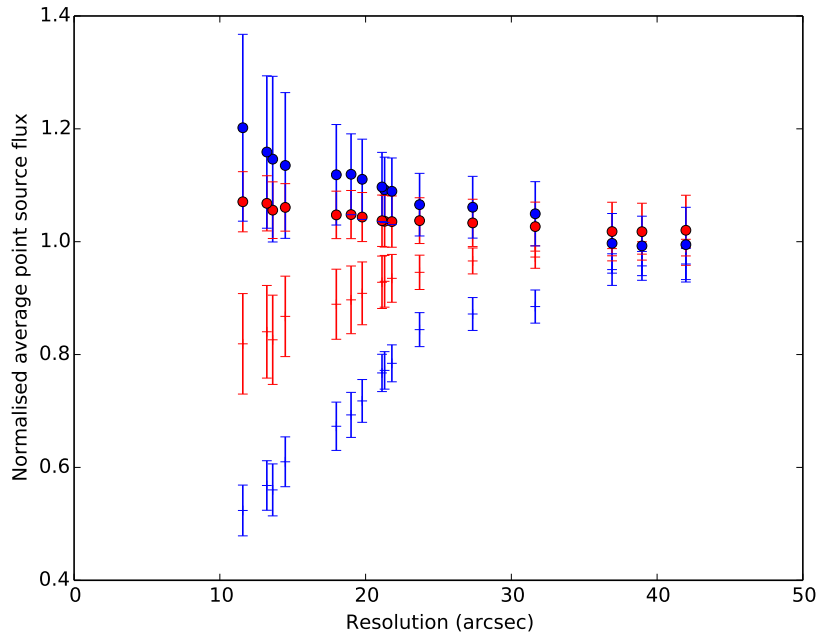


An image made from all the data of a HETDEX pointing. The resolution is 24arcsec and the sensitivity is 550μJy/beam.

Resolution



Selfcalibrated in red and GSM calibrated in blue.



Selfcalibrated in red and GSM calibrated in blue. o's are the integrated flux and +'s are the peak flux of isolated FIRST point sources.

Selfcalibration allows us to create better images especially at higher resolution. We lose peak flux at resolutions higher than 20arcsec but the integrated flux remains $\approx$ constant as a function of resolution.

Depth

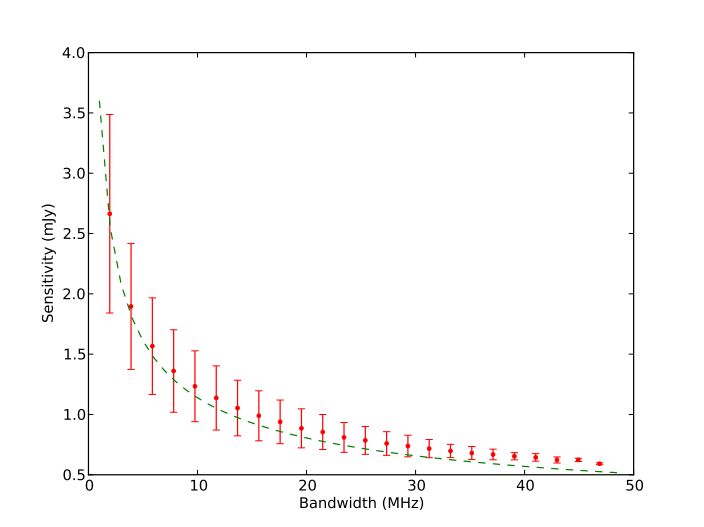


Image noise as a function of bandwidth

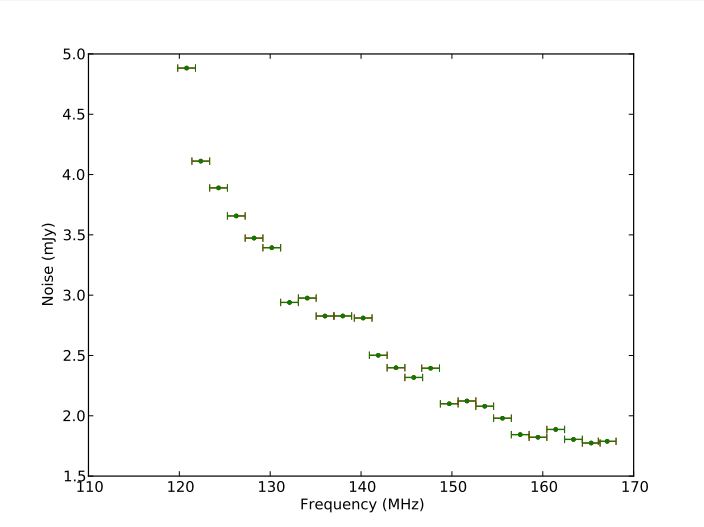
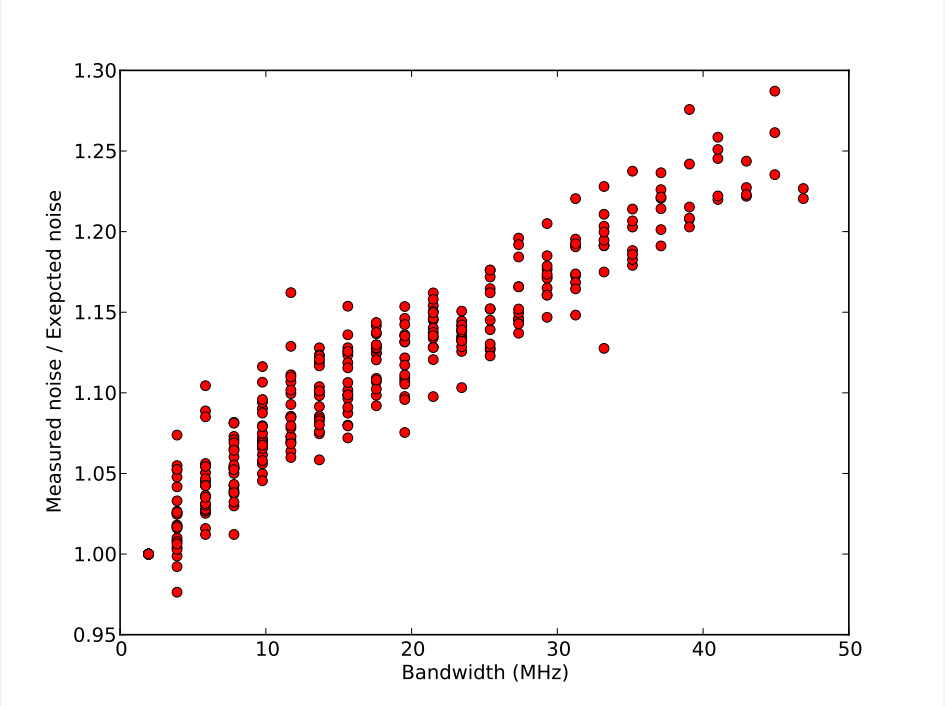


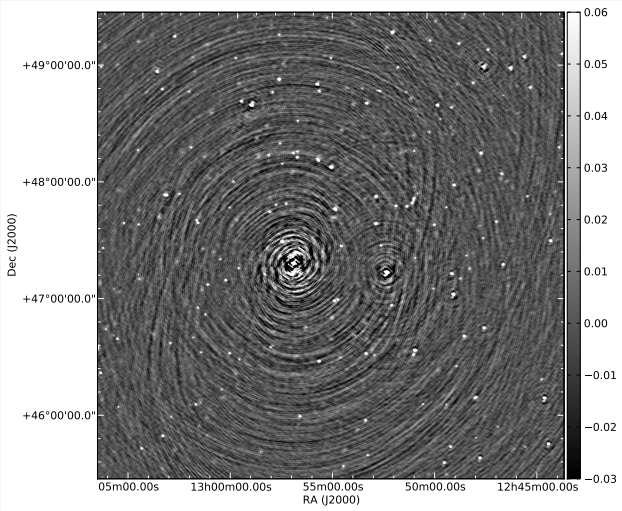
Image noise as a function of frequency.



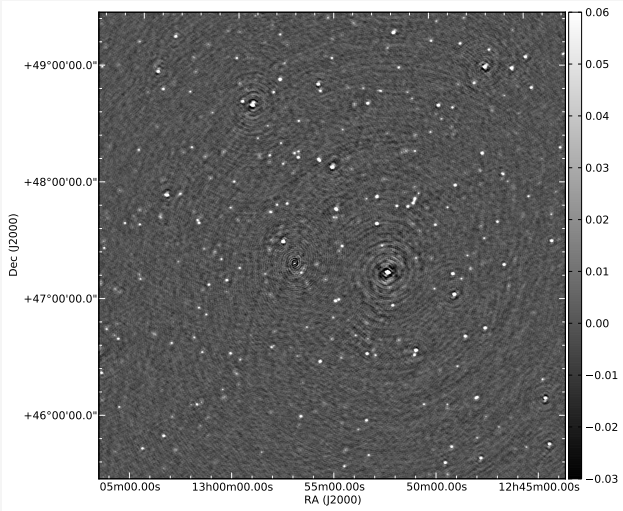
The ratio of image noise to the expected image noise as a function of bandwidth.

With 25arcsec imaging the noise continues to decrease with increased bandwidth but not as fast as expected.

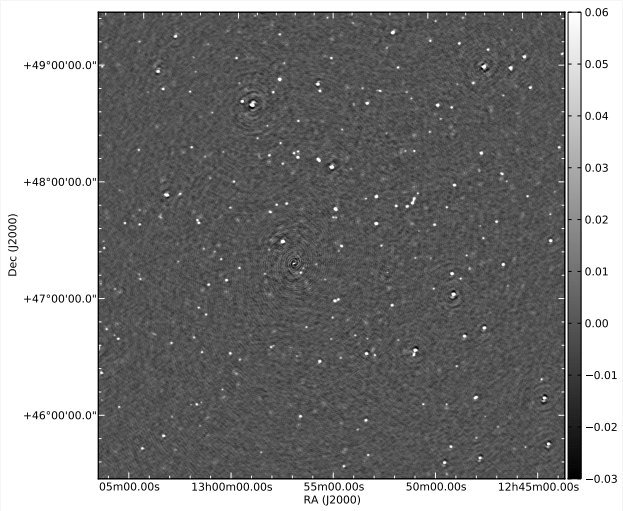
Dealing with bright sources



Prior to any source subtraction.



After subtraction of a 25Jy source.



After subtraction of a 25Jy source and a 5Jy source.

Strong residuals around bright sources can be significantly reduced with direction dependent calibration.

Computational requirements

Approximate reduction time for 10 subbands (8 processors).

- Downloading the data – 1hr
- Calibrating the calibrator – 20mins
- Flux calibrating the field – 2hrs
- Phase calibrating the field off the GSM – 24hrs
- Selfcalibrating the field to 20arcsec resolution – 48hrs
- Removing a bright source – 48hrs

Total time 3days (+2 for removing bright sources).

Approximate storage for 244 subbands.

- Raw data: 244×12GB (field) $+ 244 \times 250$MB (calibrator) $=$ 3TB
- Averaged data: 244×7.1GB (field) $+ 244 \times 150$MB (calibrator) $=$ 1.8TB

Conclusions

- Sensitivity continues to increase with bandwidth.
- Selfcalibration significantly improves the images.
- The peak flux of point sources begins to drop at resolutions better than 20arcsec.
- The integrated flux remains nearly constant (within 10%) down to resolutions of 10arcsec.
- The residuals associated with bright sources can be significantly reduced but at a large computational expense.
- New software should allow for a significant speed up in calibration.
- Many calibration and imaging parameters still need to be refined.

We now intend to reduce five pointings on the facilities that are available. The strategy for these initial reductions will be to include all 244 subbands and image at 10 and 20arcsec resolution.