ELAIS-N1 at sub-arcseconds
Towards a wide-field survey pipeline

Summary

We are working on acquiring the first sub-arcsecond resolution radio map of the ELAIS-N1 deep field at 144 MHz. By combining 4 different 8h observations, we obtain a sensitivity of ~18 µJy/beam at 0.3". Funded by the CORTEX project, we improve the wide-field International LOFAR Telescope (ILT) pipeline. As next steps, we will (i) automate the new pipeline in a robust and smart processing framework, and (ii) process the entire northern hemisphere observed with the ILT at 0.3".

Steps

Pre-ILT steps and calibration

Before we perform calibration with the long-baselines, we derive and apply direction-independent (DI) and direction-dependent (DD) corrections for the Dutch stations and reduce our field of view size by subtracting radio sources outside a 2.5°x2.5° box centered on the phase center.

Direction-independent calibration

The first main ILT calibration step is to find and solve for a bright compact calibrator near the phase center. The solutions from this calibration can then be applied on the data, such that we obtain our first initial solutions and can make DI images. **We are working on automating the calibrator selection.**
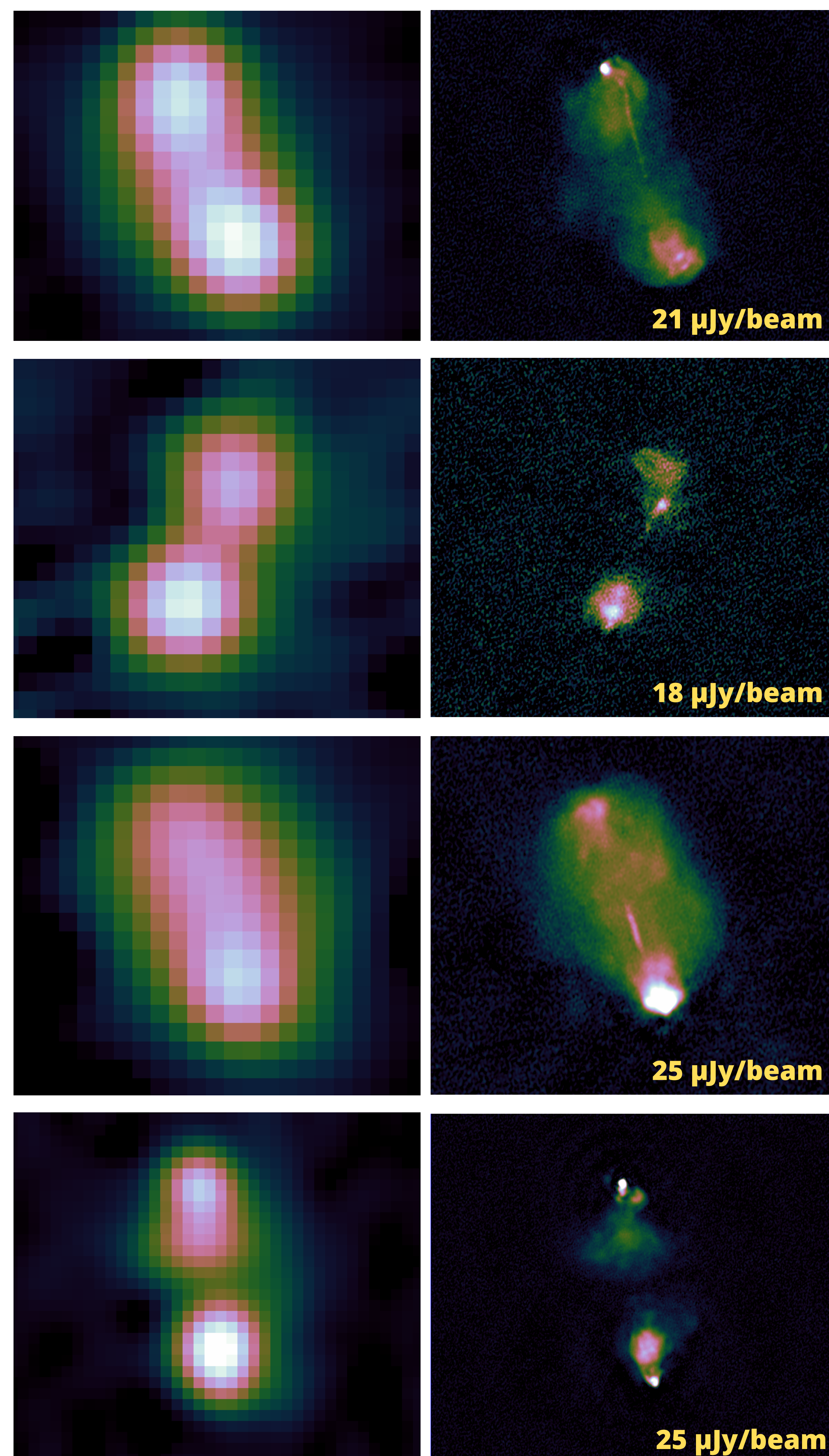
Direction-dependent calibration

Now that we have our first DI solutions, we can search for other bright sources in our field from which we can obtain DD solutions to solve for remaining ionospheric effects. **Currently, we are improving the source selection and optimize the solution interval determination and self-calibrations.**
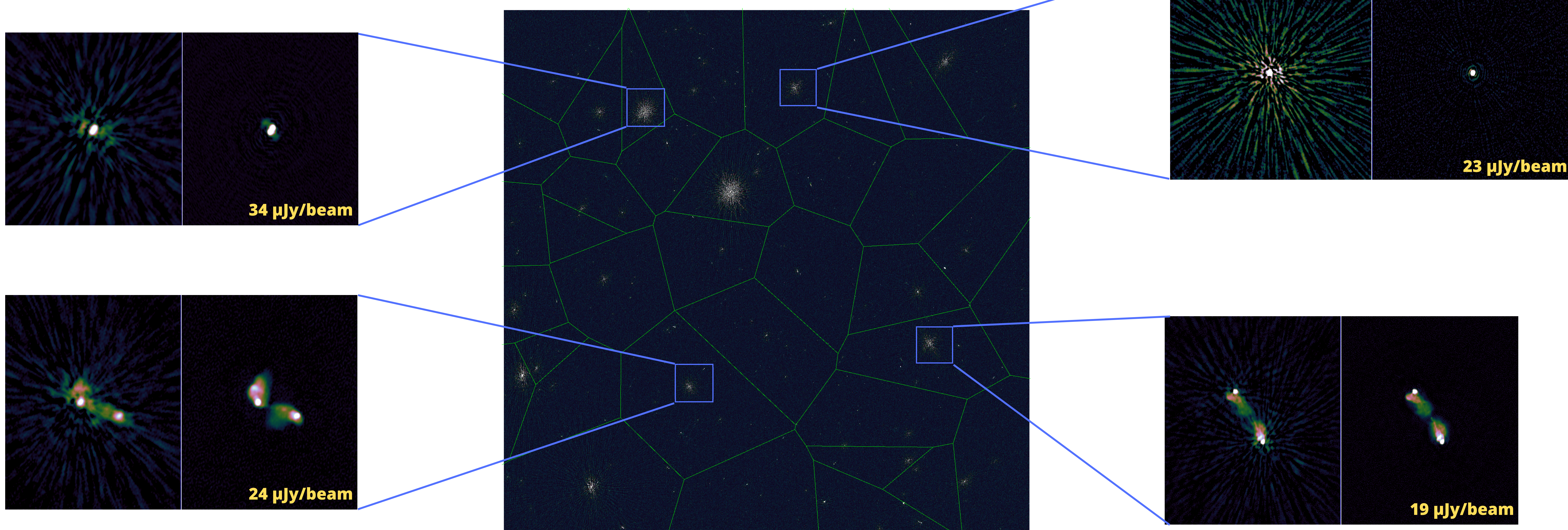
Imaging

After collecting all the solutions for the individual directions, we can split our field in facets and make a wide-field images at 1.2" and 0.3" resolution. **Through our collaboration with AMD we achieved a speedup of a factor 4 on AMD CPUs.**

From 6" to 0.3"

21 µJy/beam

18 µJy/beam

25 µJy/beam

25 µJy/beam

From DI to DD

34 µJy/beam

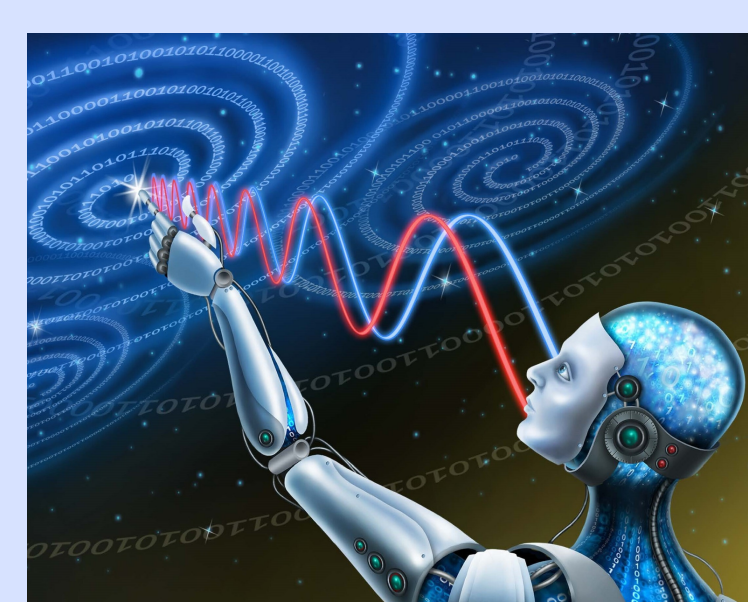23 µJy/beam

24 µJy/beam

19 µJy/beam

Contributors
J.M.G.H.J. de Jong, R.J. van Weeren, F. Sweijen, J.B.R. Oonk, H.J.A. Röttgering
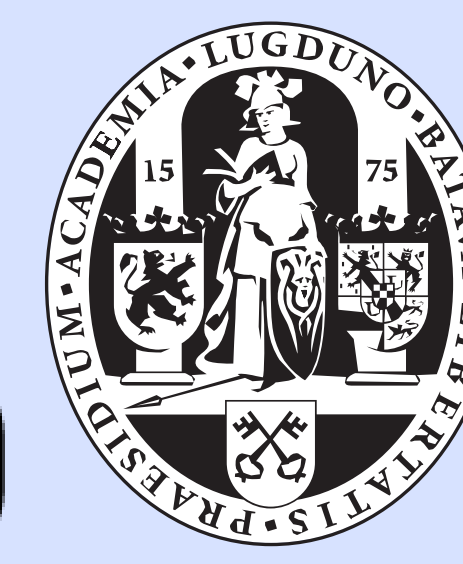
Affiliations
Leiden Observatory, Leiden University, PO Box 9513, 2300 RA Leiden, The Netherlands
SURF/SURFsara, Science Park 140, 1098 XG Amsterdam, The Netherlands
ASTRON, The Netherlands Institute for Radio Astronomy, Postbus 2, 7990 AA Dwingeloo, The Netherlands