LOFAR Family Meeting 2023, 12-16 June 2023, Olsztyn Poland

Deep high resolution ELAIS-N1 radio map

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This work focuses on the calibration of 32 hours of long-baseline data obtained with the Low-Frequency Array (LOFAR) from the ELAIS-N1 deep field. The long baselines provide high angular resolution but are susceptible to delays induced by the ionospheric and instrumental effects that introduces calibration difficulties. To address this, we used the developed direction-indepenent calibration pipeline (Morabito et al. 2022) and implemented ways to improve the direction-dependent calibration and bookkeeping (de Jong et al. 2023 in prep.). Going from 1 night (8h) of observations to 4 (32h), increases the depth of the final radio map by a factor of 2. We produce wide-field radio maps at two resolutions: 1.2” and 0.4”. Our work introduces the next steps towards an automated pipeline that will eventually be able to calibrate for LOFAR’s longest baselines and produce images up to subarcsecond resolutions with a minimal amount of human interactions. These resolution improvements compared to the standard 6” resolution from LOFAR Two-metre Sky Survey (LoTSS), opens up a new parameter space, where we can study radio sources that have never been resolved. Eventually, this can advance the study of compact and distant sources, which will benefit for example the study of the formation and evolution of stars and AGN and particle acceleration processes in jets.