4th URSI AT-RASC, Gran Canaria, 19-24 May 2024

Recent progress on LOFAR2.0

Wim A. van Cappellen* (1), André W. Gunst (1), and Boudewijn Hut(1)
(1) ASTRON, Dwingeloo, the Netherlands; e-mail: cappellen@astron.nl; gunst@astron.nl; hut@astron.nl

The Low Frequency Array (LOFAR) telescope is preparing for a major upgrade, known as LOFAR2.0. In 2025 and 2026 all 16.000 receivers, the station digital beam formers, clock distribution system, data network, correlator/beam former and central processing cluster will be replaced. On top, two new stations in Italy and Bulgaria will be built and added to the telescope.

LOFAR is a pan-European phased array radio telescope consisting of more than 100.000 small antennas. The LOFAR2.0 upgrade mitigates the biggest bottleneck of the telescope by upgrading the telescope's digital beamforming systems, enabling the telescope to deliver more data, and increasing its scientific harvest. In particular, the LOFAR2.0 upgrade enables simultaneous full-resolution observing with all antennas in two frequency bands (10 – 80 MHz and 110-240 MHz). To keep up with the increased data rates, the data network is upgraded, as well as the GPU-based correlator and the postprocessing clusters.

The hardware and firmware design of the upgrade was completed in 2023. A LOFAR2.0 test station was realized as a qualification model to demonstrate compliancy of the design with the requirements. After the tests were successfully concluded, the hardware production for the full roll-out was started. In parallel, the white rabbit-based clock distribution system has been rolled-out to the first 5 LOFAR stations. Interferometric observations were run to measure the clock drift of all stations with respect to a reference station. The results show that the clock drift of the stations with white rabbit is reduced from 10s of nanoseconds to the order of 0.1 ns over 8 hours.

This contribution presents an overview of the LOFAR2.0 upgrade, its status, and measurement results of the test station and clock distribution system.