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VLBI observations of Jupiter with LOFAR prototype stations and the Nançay Decametric Array

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We demonstrated and tested the capability of the next generation of low-frequency radio telescopes to perform high resolution observations across intra-continental baselines. Jupiter's strong burst emission is used to perform broadband full signal cross-correlations on time intervals of up to hundreds of milliseconds. Broadband VLBI observations at about 20 MHz on a baseline of $\sim$50000 wavelengths were performed to achieve arcsecond angular resolution. LOFAR prototype stations, like LOFAR/ITS in The Netherlands and the Nançay Decametric Array (NDA) in France digitized the measured electric field with 12 bit and 14 bit in a 40 MHz baseband. The fine structure in Jupiter's signal was used for data synchronization prior to correlation on the time-series data. Strong emission from Jupiter was detected and detailed features down to microsecond time-scales were identified in dynamic spectra. Time-series cross correlations of Jupiter's burst emission returned strong fringes on millisecond time-scales over channels as narrow as hundred kilohertz bandwidth. Thus, long baseline interferometry is confirmed at low frequencies, in spite of phase shifts introduced by variations in ionospheric propagation characteristics. Phase coherence is preserved over

tens to hundreds of milliseconds with a baseline of $\sim$700 km. Adding remote stations to the LOFAR network at baselines up to thousand kilometers will provide it with a resolution down to an arcsecond.