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LOFAR and wind turbine interference

Michiel A. Brentjens
ASTRON, the Netherlands Institute for Radio Astronomy, Postbus 2, 7990 AA, Dwingeloo, The Netherlands,
http://www.astron.nl

1 Extended Abstract

A large wind farm is projected to be built next to the core of the LOFAR radio telescope. The 45 3 MW turbines with a tip height of 200 m will negatively affect the LOFAR core's fairly radio-quiet area. In several experiments with existing wind turbines near remote LOFAR antenna stations, scattering of other interference off the wind turbines' blades, as well as intrinsic emission from wind turbines themselves have been observed.

To guard the LOFAR core area against crippling interference from the projected wind farm, a covenant has been signed in which the wind farm project developers and ASTRON have agreed on operating conditions that enable mutual co-existence. One aspect of the covenant is a set of increasingly relaxed restrictions on the wind farm operations as the wind turbines can be made more radio-quiet. These agreements are listed here:

Interference reduction compared to EN 55011 class A	Consequence
< 35 dB	No permission to build.
35 dB $\leq$ improvement $<$ 40 dB	56–62$\times$ 12 h wind farm idle.
40 dB $\leq$ improvement $<$ 50 dB	Reduced idle time, amount to be negotiated.
improvement ≥ 50 dB	No restrictions.

Note that the agreed-upon protection levels far exceed the recommendations in ITU RA-769 for LOFAR's frequency range because an instrument with LOFAR's architecture and sensitivity at 30 to 200 MHz was inconceivable when that recommendation was originally written.

To assess in which category a candidate wind turbine falls, a sensitive measurement protocol has been developed jointly by Agentschap Telecom (the Dutch radio regulations authority), ASTRON (operator of the LOFAR radio telescope), INAF (airborne calibration sources), and the wind farm project developers themselves. The expected interference from wind turbines is well below Galactic noise, requiring proper imaging and subtraction of celestial sources interfering with the wind turbine under test. The protocol therefore involves an imaging radio interferometer. It will be described briefly in this contribution.