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Whirlwind 1

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A new compact Doppler wind lidar

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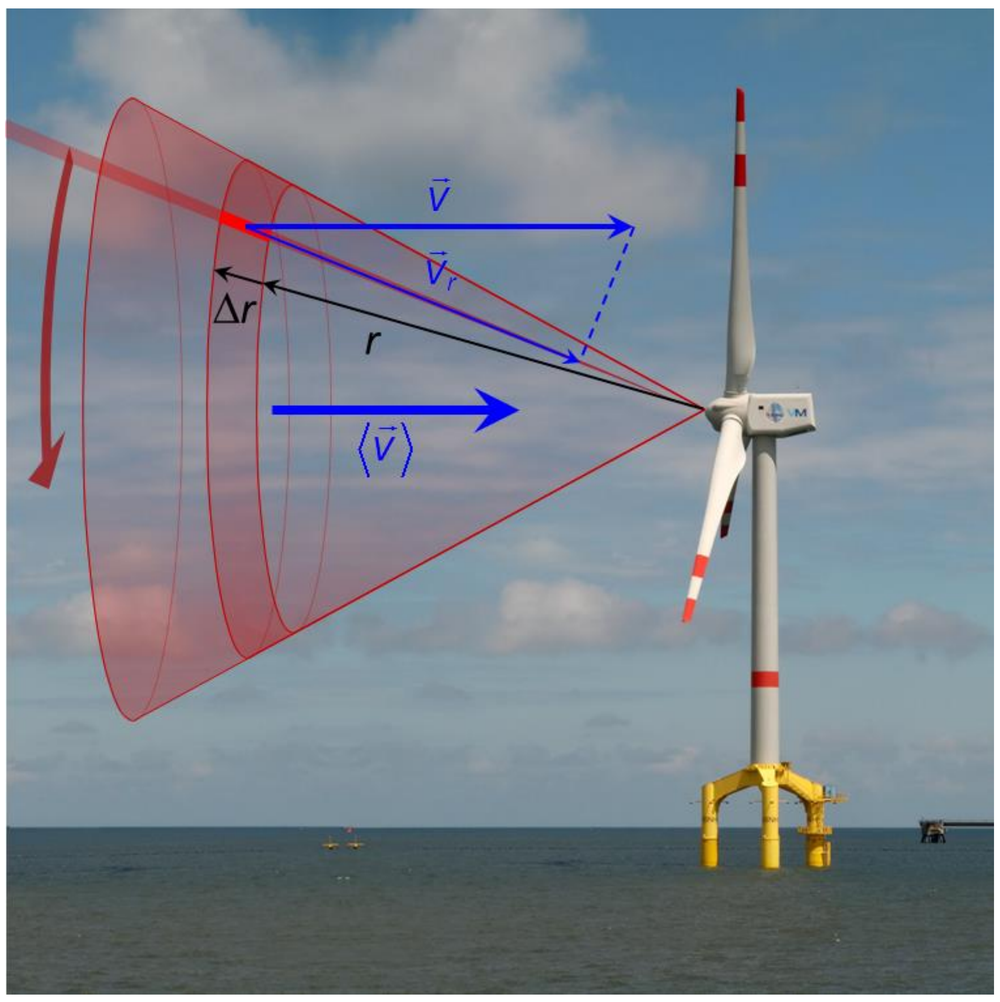
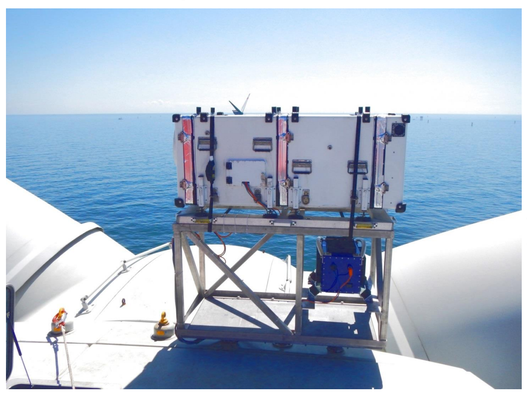
A coherent wind lidar installed on a wind turbine has the potential to improve the pitch control of the rotor blades by providing advance information on variations in the wind field. A single-beam lidar rotating with the spinner was developed.



Schematic diagram of a lidar used for predictive control in a wind energy system

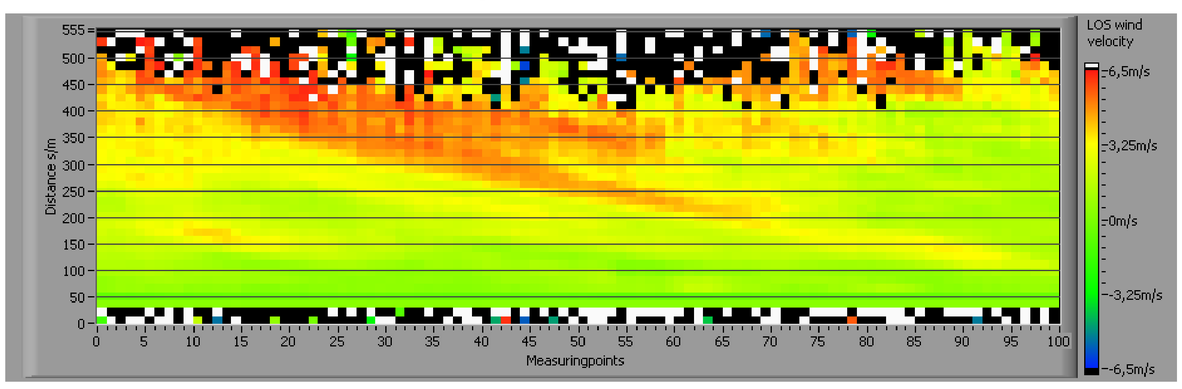


Test operation on a wind turbine in the Alpha Ventus test field, mounted below the Lidar Scanner of SWE Stuttgart

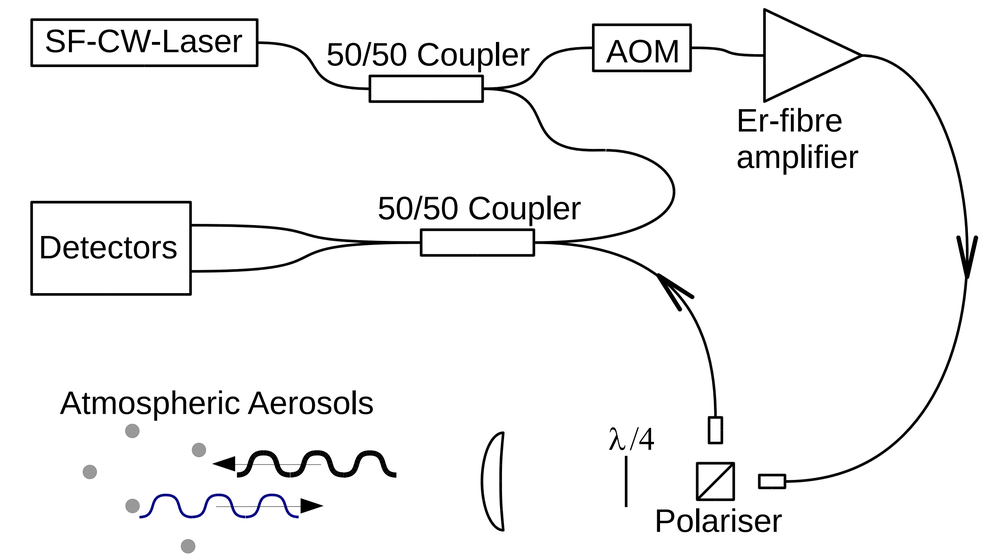
Environmental properties, among them the wind speed, can be measured remotely from great distances using *Light Detection and Ranging* (Lidar). Lidar mounted into the rotor hub or spinner of wind turbines enables wind profiles to be measured and hence, a prognosis of the wind field, before it reaches the rotor blades. The resulting data can be advantageously used for controlling the operation of wind turbines and their blade pitch.

Whirlwind 1 utilizes eye-safe infrared laser pulses of a fibre laser for measuring wind speeds of up to 85 m/s at 0.1 m/s resolution in the beam direction. Measuring points at equal distances of 15 m each can be recorded within a maximal range of approx. 400 m (for similar visual ranges). Incorporation into the rotor hub and selectable alignment allow the device to record wind fields across the whole rotor area. The quality of data is independent of daylight and is not substantially affected by rain.

A wind measurement at 1 Hz profiling rate is shown below with 10.000 shots (200 ms) averaged.



Continuous wind measurement at 1 Hz with 10.000 pulses averaged



Optical setup of the fiber laser of the pulsed lidar

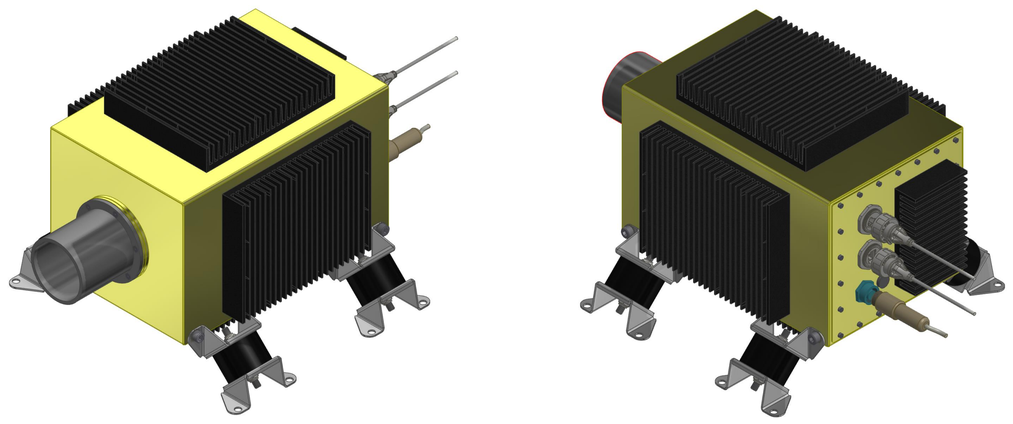
Whirlwind 1 has been designed and developed at the **ForWind** Center for Wind Energy Research within the scope of the project “Lidar II” and with financial support from the German Federal Ministry for Economic Affairs and Energy, Berlin, Germany.

A scanning ground-based version allows to assess wind resources for evaluating the profitability of new wind farm locations.

The instrument is now distributed by OpticSense GmbH

Whirlwind 1 Specifications

Dimensions (L×W×H): ca. 410 × 340 × 340 mm³
Mass: ca. 17 kg
Protection classification: IP65
Housing: AlMgSi 0,5
Voltage: nominally 24 V DC, 18...36 V DC
Current: ca. 4 A, Power consumption: ca. 100 W



Above: Construction layout of the wind lidar
Below: Photographs of the assembled Instrument

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