FOWT 2025
Floating Offshore Wind Turbines

VAISALA

Scanning Wind Lidar for offshore wind farm projects

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Product Engineer – WindCube Scan

Vaisala, Instruments and intelligence for climate action

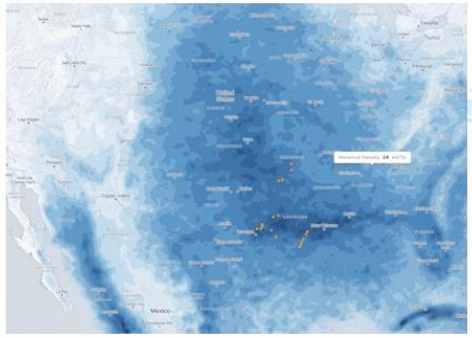
Radiosondes and sounding systems

Visibility and present weather sensors

Weather stations

Wind lidars

Weather radars



Data & forecasts

Our product categories

- ceilometers and lidar-based vertical atmospheric profilers
- visibility and present weather sensors
- lightning sensors
- road and surface state sensors
- air quality sensors
- pressure, temperature, wind, and humidity sensors
- weather stations
- wind lidars
- weather radars
- radiosondes and sounding systems
- weather and environmental data and forecasts

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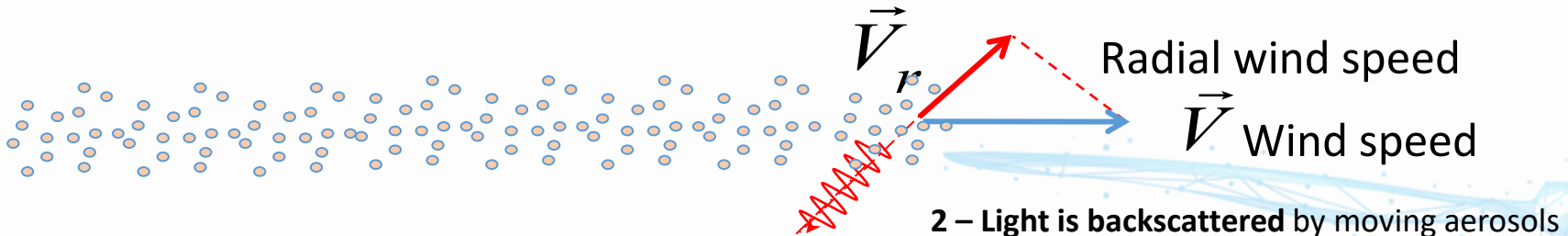
A key technology for offshore projects: Doppler Pulsed Lidar



2 – Light is backscattered by moving aerosols with Doppler shift

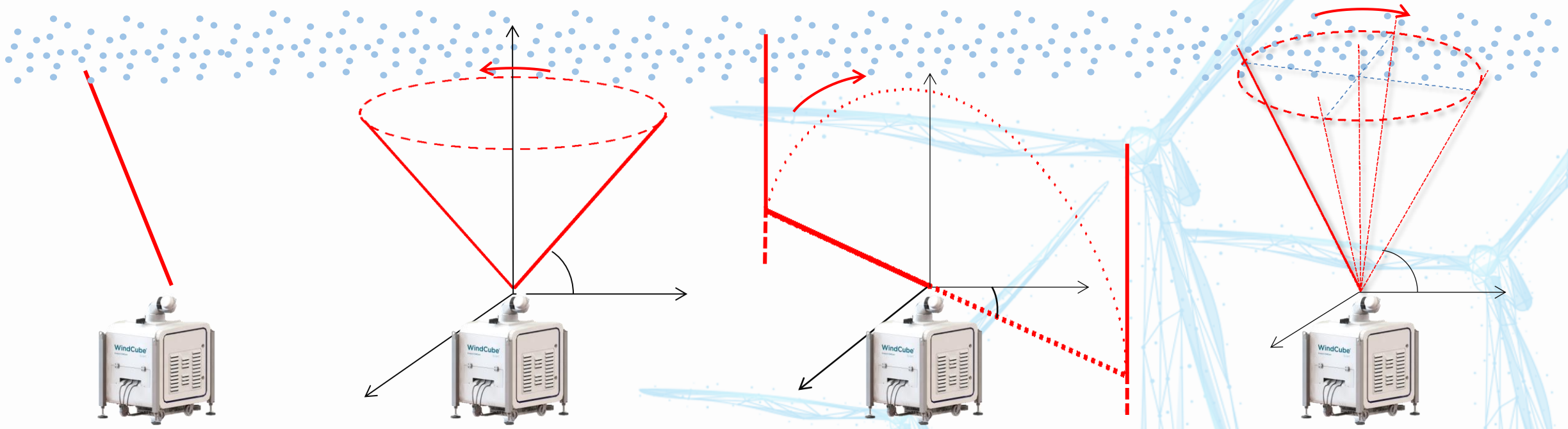
1 - LASER pulses sent in the atmosphere with reference frequency **f**

f + Δf

3 - Backscattered signal is processed
for all distances (range gates)
at the same time

The Doppler shift is proportional to the radial wind speed

Lidar Scanning Strategies



FIXED

PPI

- **PPI:** Plan Positioning Indicator
- **Constant** elevation, **changing** azimuth (360°)

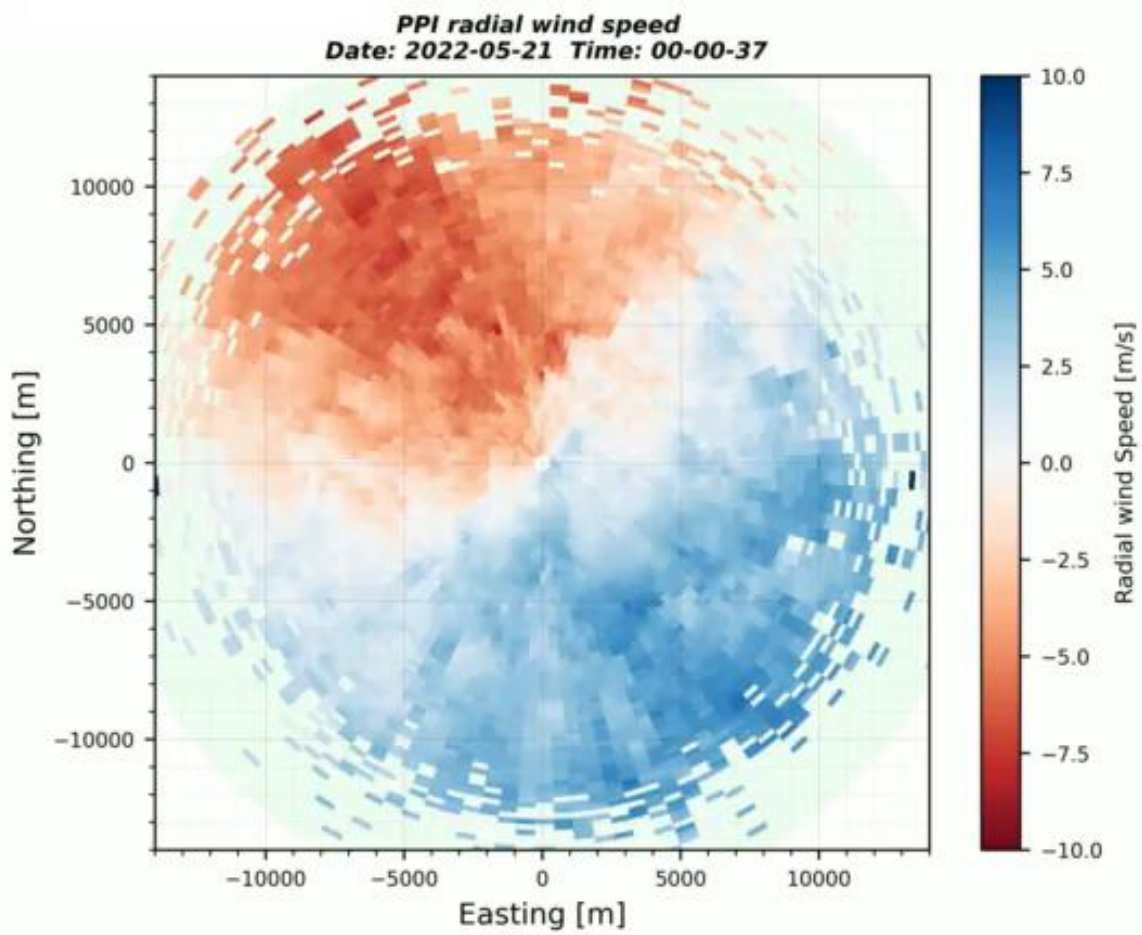
RHI

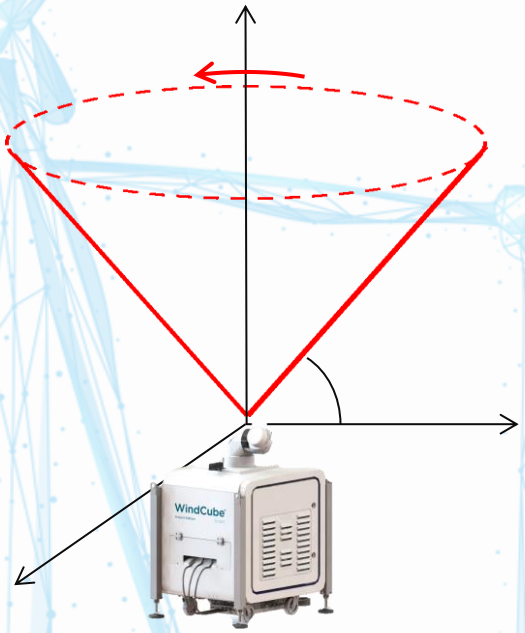
- **RHI:** Relative Height Indicator
- **Constant** azimuth, **changing** elevation (180°)

DBS/VAD

- **DBS**: Doppler Beam Swinging, 5 LOS
- **VAD**: Velocity Azimuth Display, 6-24 LOS

Scanning Lidars: remote measurements of Space-Time wind variations





Wind Resources Assessment – What is Dual Scanning Lidar (DSL)?

Two scanning lidars intersecting in the same location in space in a quasi-point measurement mode

Assumption of negligible projection of vertical wind speed onto the beams

Creation of one or multiple "virtual met mast" for a full wind profile picture

→ **Wind Speed and Direction**

→ **Turbulence intensity (TI)**

Dual Scanning Lidars have already achieved bankability in several WRA campaigns and enabled turbine selection

2 types of needs to support nearshore wind farm development

Large coverage to reduce vertical and horizontal uncertainties in WRA
higher bankability & project attractiveness for investors

Fine assessment of turbulence intensity for turbine suitability
cost savings due to reduced margin of error for Mechanical Load Assessment and foundation design

- High flexibility for measurement positions
- 1 to 5 virtual met mast locations
- 1-3 heights
- 10-min average

Replace 5 x Floating lidars with 1 x DSL

5 Measurement locations

Measurement zone

Dual Lidar benefits

Easy and cost-effective to install and maintain

Versatile & fast deployment

Improved TCO with low installation & operations costs

No (or little) specific permitting required

+ HSE risks reduced

Very low environmental impact, no impact on fishing activities

Accurate measurement

Accurate wind speed

+

Good spatial distribution thanks to multiple measurements

Accurate Turbulence Intensity measurement enables appropriate turbine selection

↘ Reduced cost & environmental impact

Reduced uncertainty & improved bankability

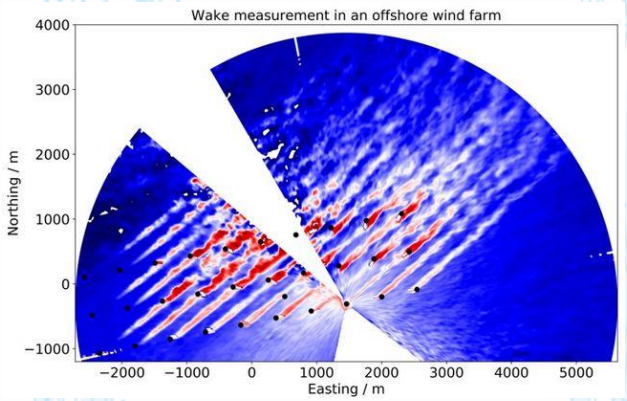
Improved risk profile & project bankability

Lower total uncertainty in AEP & improved P90/50 ratio

Improvement of P90/P50 ratio has a positive impact on the financial numbers

Scanning Lidar - Supporting every stage of offshore projects

Prospection & development	Construction & commissioning	Operations & Life Management	Research & Innovation
Site Prospection Site Suitability Wind resource assessment Farm extension ✓	Power curve verification Offshore ship and crane operations for build-up ✓	Wind farm optimization Offshore ship operations for maintenance Short term forecasting/gust detection ✓	Blocking effect Wake losses studies Wind farm wake effect ✓



Source: Lidar & Wakes // University of Oldenburg (uol.de)

Thank you!