DUAL SCANNING LIDAR

Wind-field reconstruction for offshore and remote sites

2EN designs and operates Dual Scanning LiDAR campaigns for wind resource assessment in areas where conventional measurement infrastructure is difficult or impractical.

DUAL-SCANNING PRINCIPLE

Two LiDARs • Cross-beam geometry

Virtual measurement points • Offshore from shore

2 LiDARs

Simultaneous line-of-sight measurements

Virtual

measurement points

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From line-of-sight measurements to wind-field reconstruction

Two simultaneous measurements are combined to reconstruct horizontal wind speed and direction.

01 2 LiDARs

Cross-beam measurement geometry

Two synchronized line-of-sight measurements form the basis of the reconstruction.

02 Virtual met mast

Wind vector at selected points

Beam intersections create virtual measurement points at selected locations and heights.

03 Offshore from shore

No instrument at the target point

Suitable onshore or coastal positions can extend measurements over offshore target areas.

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Campaign design, deployment and reconstruction

Geometry, alignment, timing and data quality are all part of the same measurement chain.

01 Plan the geometry

We define target points and heights, LiDAR locations, baselines and beam intersection geometry around the project area. The design also considers line of sight, range gate length, access, power, communications and suitable hard targets for alignment checks.

02 Deploy and align

We install and commission both systems, verify orientation and timing, perform hard-target tests and establish remote communications. For sites without grid connection, autonomous power solutions can support continuous field operation.

03 Monitor and reconstruct

We monitor system health, power, communications, signal quality and data availability. Line-of-sight measurements are processed to reconstruct horizontal wind speed and direction, with quality checks applied to the final dataset.

Geometry · Alignment · Timing · Monitoring · Reconstruction · Quality control

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Applications and data quality

The reconstructed dataset depends on both atmospheric conditions and measurement geometry.

01 Virtual met mast and spatial coverage

Crossing beams create virtual measurement points at selected locations and heights. Several points can be included in the scan strategy, providing wind information across the project area without installing an instrument at every target location.

02 Offshore and nearshore wind assessment

Systems installed at suitable coastal or onshore positions can measure wind conditions over offshore areas. Reconstructed data can support site characterisation, WRA and assessment of spatial variation across the area of interest.

03 Data quality and availability

Measurement geometry, CNR, atmospheric conditions, range, synchronization and range gate settings all affect the reconstructed dataset. We track these factors and apply documented quality control.

04 Verification and research

2EN has carried out dedicated verification work against reference meteorological mast measurements, supporting evaluation of accuracy, range gate effects and turbulence limitations.

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Verified against a reference met mast

Dedicated field verification under coastal atmospheric conditions.

FIELD VERIFICATION

- Northern Greece campaign, 19 March to 22 April 2025
- Two WindCube Scan 400S systems compared with a reference meteorological mast at 82 m
- Range gate lengths of 100 m and 200 m alternated under the same atmospheric conditions
- Beam intersection angle at the reference location: 66°
- Reconstructed wind speed and direction: R^2 0.995 for both range gate configurations
- Turbulence intensity was systematically underestimated and must be treated as a limitation beyond mean wind characterisation

VERIFICATION RESULT

R^2 0.995
wind speed & direction

100 m / 200 m
range gate length

Negligible
systematic bias

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Validation work and technical development

The verification campaign was presented internationally and published as a peer-reviewed paper.

VALIDATION WORK

Poster PO119

WindEurope Annual Event 2026, Madrid

“Validation of Dual Scanning LiDAR for Wind Field Reconstruction under Coastal Atmospheric Conditions”

Peer-reviewed paper

Wind, 2026, 6(3), 33

G. Kissas, G. Droukas and I. Panourgias

DOI: 10.3390/wind6030033

2EN SCANNING LIDAR CAPABILITY

- In-house tools for geometry and layout design
- Campaign monitoring, data processing and quality control
- Experience with coastal, offshore-oriented and remote campaigns
- Participation in IEA Wind Task 52 and technical activities related to Scanning LiDAR and IEC 61400-50-5

Verification · Peer-reviewed publication · In-house geometry tools · IEA Wind Task 52