Metrology 4.0 & Reality Capture

Advanced Measurement Technologies and Digital Engineering Solutions

dogram

Precision Engineering. Trusted Results for the Wind Energy Industry.

Accurate dimensional data and high-fidelity digital models that enable confident decision-making based on verified and fully traceable information

Innovative Technology SME

ISO 9001

ISO 27001

Who We Are

Dogram is an engineering company specialized in Metrology 4.0, Reality Capture and Digital Engineering, leveraging advanced technologies to improve accuracy, efficiency and data-driven decision-making throughout industrial projects.

- Integrate Industry 4.0 technologies into measurement and inspection workflows
- Capture real-world geometry and transform it into accurate digital assets
- Develop project-specific methodologies tailored to client requirements
- Deliver reliable results with complete traceability and quality assurance

+13 Years

Industry Experience

100%

Tolerance Compliance

30% Faster

Verification Processes

+700

Projects Successfully Delivered

Industries We Serve

Precision Solutions for Complex Industrial Challenges

Oil & Gas

Nuclear

Heritage & Cultural Assets

Marine & Shipbuilding

Design Engineering

Manufacturing

Renewable Energy

Defense

Reality Capture & Digital Engineering

High-Accuracy Geometry Capture for Industrial Assets

Reality Capture enables the precise recording of facilities, structures and components using technologies such as laser scanning, photogrammetry and portable metrology systems. The resulting point clouds and digital models provide a reliable foundation for engineering analysis, reverse engineering, technical documentation and asset lifecycle management.

3D Laser Scanning

Rapid acquisition of dense point clouds in indoor, outdoor and confined-space environments with millimetre-level accuracy.

Photogrammetry

High-resolution 3D models with realistic textures generated from cameras and UAV platforms. Ideal for large-scale assets, heritage sites and external inspections.

Reverse Engineering

Creation of accurate digital models from existing components, enabling replication, redesign and lifecycle extension.

As-Built Surveys

Accurate documentation of existing conditions for engineering, refurbishment, claims management and operational planning.

Metrology 4.0

The Digital Evolution of Precision Measurement

Metrology 4.0 combines advanced measurement technologies with digital workflows to generate highly accurate dimensional data. Every methodology is tailored to project requirements, ensuring reliable results and actionable engineering insights.

Dimensional Inspection

Verification of parts, equipment and structures against design tolerances, including deviation mapping and statistical analysis.

Virtual Assembly Simulation

Digital simulation of connection points between critical components to verify physical fit, interface gaps, and exact alignment prior to real-world installation.

Tailored Methodologies

Selection of the most suitable technologies and workflows, from laser scanning to articulated arms and Laser Tracker systems.

Technical Consulting

Engineering support focused on maximizing the value of measurement data and improving project outcomes.

Technology Portfolio

Delivering the Right Technology for Every Challenge

Terrestrial 3D Laser Scanner

Long-Range Reality Capture

Rapid acquisition of dense point clouds in indoor and outdoor environments with millimetre-level accuracy up to 130 metres.

Easy-Laser E915 Flange

Precision Flange Flatness Verification

High-precision flange flatness measurement with immediate on-site evaluation.

Laser Tracker

High-Precision Alignment and Verification

Dimensional control and alignment of critical interfaces, assemblies and large-scale structures.

Point Clouds · 3D CAD Models · As-Built Documentation · QA/QC Reports

Technology Portfolio

Delivering the Right Technology for Every Challenge

Precision Articulated Arm

Portable Inspection

Flexible dimensional verification of parts and assemblies in workshop environments.

UAV-Based LiDAR & Photogrammetry

Aerial Data Acquisition

Safe and efficient capture of large structures and inaccessible areas without exposing personnel.

Total Station & Photogrammetry

Surveying and Asset Documentation

Topographic surveys, heritage documentation and large-area mapping projects.

Point Clouds · 3D CAD Models · As-Built Documentation · QA/QC Reports

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Representative Applications

Proven Experience

Metrology 4.0 for Offshore Wind Foundations

Dogram has participated in multiple offshore wind farm developments across Europe and the Atlantic region.

Our technical team provides dimensional control, quality assurance, advanced measurement services, and 3D reality capture throughout fabrication, installation, and decommissioning phases.

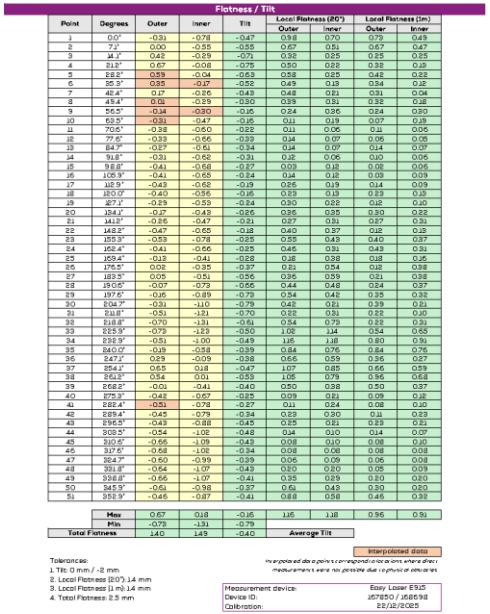
Complete data traceability, deliverables issued in less than 24 hours. Our results confirm that advanced metrology directly supports efficiency, safety, and reliability in offshore fabrication and installation.

Key references include:

- Saint-Brieuc OWF (Van Oord)
- Vineyard Wind 1 OWF (JV Avangrid & CIP)
- Baltic Eagle OWF (Iberdrola)
- East Anglia 2 & 3 OWF (Scottish Power)
- Baltic Power OWF (ORLEN Group / Northland Power)
- Vineyard Wind 1 OWF (JV Avangrid & CIP)
- Windanker OWF (Iberdrola)

Measurement Reporting & Traceability

Dimensional Inspection



Flatness / Tilt

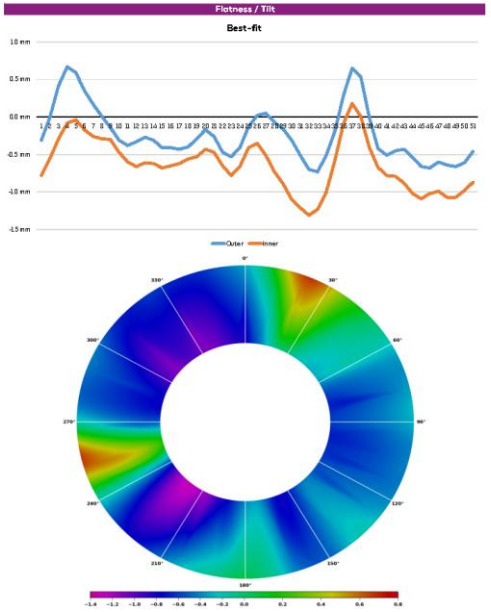
Point	Degrees	Outer	Inner	Tilt	Local Flatness (20°) Outer	Local Flatness (20°) Inner	Local Flatness (1m) Outer	Local Flatness (1m) Inner
1	0.0°	-0.31	-0.78	-0.47	0.98	0.70	0.73	0.49
2	7.1°	0.00	-0.55	-0.55	0.67	0.51	0.67	0.47
3	14.1°	0.42	-0.29	-0.71	0.32	0.25	0.25	0.25
4	21.2°	0.67	-0.08	-0.75	0.50	0.22	0.32	0.13
5	28.3°	0.59	-0.04	-0.63	0.58	0.25	0.42	0.22
6	35.3°	0.35	-0.17	-0.52	0.49	0.13	0.34	0.12
7	42.4°	0.17	-0.26	-0.43	0.48	0.21	0.31	0.04
8	49.4°	0.01	-0.29	-0.30	0.39	0.31	0.32	0.12
9	56.5°	-0.14	-0.30	-0.15	0.24	0.36	0.24	0.30
10	63.5°	-0.33	-0.47	-0.15	0.11	0.19	0.07	0.19
11	70.6°	-0.38	-0.60	-0.22	0.11	0.06	0.11	0.05
12	77.6°	-0.33	-0.66	-0.33	0.14	0.07	0.06	0.05
13	84.7°	-0.27	-0.61	-0.34	0.14	0.07	0.14	0.07
14	91.8°	-0.31	-0.62	-0.31	0.12	0.06	0.10	0.05
15	98.8°	-0.41	-0.68	-0.27	0.03	0.12	0.08	0.05
16	105.9°	-0.41	-0.65	-0.24	0.14	0.12	0.03	0.09
17	112.9°	-0.43	-0.62	-0.19	0.26	0.19	0.14	0.09
18	120.0°	-0.40	-0.56	-0.16	0.23	0.13	0.23	0.13
19	127.1°	-0.29	-0.53	-0.24	0.30	0.22	0.12	0.20
20	134.1°	-0.27	-0.43	-0.16	0.36	0.35	0.30	0.22
21	141.2°	-0.26	-0.47	-0.21	0.27	0.31	0.27	0.31
22	148.2°	-0.47	-0.65	-0.18	0.40	0.27	0.12	0.23
23	155.3°	-0.53	-0.78	-0.25	0.55	0.43	0.40	0.37
24	162.4°	-0.41	-0.66	-0.25	0.46	0.31	0.43	0.31
25	169.4°	-0.13	-0.41	-0.28	0.18	0.28	0.18	0.26
26	176.5°	0.02	-0.35	-0.37	0.21	0.54	0.18	0.38
27	183.5°	0.05	-0.51	-0.56	0.36	0.59	0.21	0.38
28	190.6°	-0.07	-0.73	-0.66	0.44	0.48	0.24	0.37
29	197.6°	-0.16	-0.89	-0.73	0.54	0.42	0.35	0.32
30	204.7°	-0.31	-1.10	-0.79	0.42	0.21	0.29	0.21
31	211.8°	-0.51	-1.21	-0.70	0.22	0.31	0.22	0.10
32	218.8°	-0.70	-1.31	-0.61	0.54	0.73	0.22	0.31
33	225.9°	-0.73	-1.23	-0.50	1.08	1.14	0.54	0.65
34	232.9°	-0.51	-1.00	-0.49	1.16	1.18	0.80	0.91
35	240.0°	-0.19	-0.58	-0.39	0.84	0.76	0.84	0.76
36	247.1°	0.29	-0.09	-0.38	0.66	0.59	0.36	0.27
37	254.1°	0.65	0.18	-0.47	1.07	0.85	0.66	0.59
38	261.2°	0.54	0.01	-0.53	1.05	0.79	0.96	0.68
39	268.2°	-0.01	-0.41	-0.40	0.50	0.38	0.50	0.37
40	275.3°	-0.42	-0.67	-0.25	0.09	0.81	0.09	0.12
41	282.4°	-0.51	-0.78	-0.27	0.11	0.24	0.08	0.20
42	289.4°	-0.45	-0.79	-0.34	0.23	0.30	0.11	0.23
43	296.5°	-0.43	-0.88	-0.45	0.25	0.21	0.23	0.21
44	303.5°	-0.54	-1.02	-0.48	0.14	0.10	0.14	0.07
45	310.6°	-0.66	-1.09	-0.43	0.08	0.10	0.08	0.10
46	317.6°	-0.68	-1.02	-0.34	0.08	0.08	0.08	0.08
47	324.7°	-0.60	-0.99	-0.39	0.06	0.09	0.06	0.08
48	331.8°	-0.54	-1.07	-0.43	0.20	0.20	0.05	0.09
49	338.8°	-0.66	-1.07	-0.41	0.35	0.29	0.20	0.20
50	345.9°	-0.61	-0.98	-0.37	0.61	0.43	0.20	0.20
51	352.9°	-0.46	-0.87	-0.41	0.88	0.88	0.46	0.32
	Max	0.67	0.18	-0.15	1.16	1.18	0.96	0.91
	Min	-0.73	-1.31	-0.79				
Total Flatness		1.40	1.49	-0.40	Average Tilt			

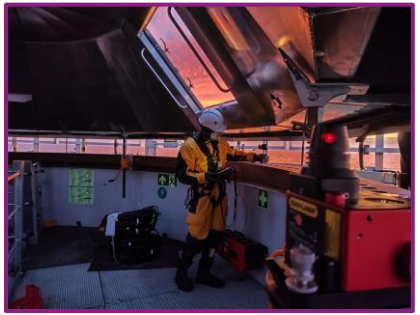
Interpolated data

Tolerances:
1. Tilt: 0 mm / -2 mm
2. Local Flatness (20°): 1.4 mm
3. Local Flatness (1 m): 1.4 mm
4. Total Flatness: 2.5 mm

Interpolated data points correspond to locations where direct measurement were not possible due to physical obstacles

Measurement device:	Easy Laser E915
Device ID:	157850 / 168698
Calibration:	22/12/2025





Clear and traceable reporting of measured features, reference systems, equipment, calibration status, results and deviations. Reliable QA/QC evidence for fabrication and installation decisions.

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Methodology & Report Review

Independent Technical Assessment

COMPARISON - BCD

Hole	Onshore	Offshore	Diff
1 - 79	7656.2	7639.3	3.1
2 - 80	7656.4	7658.5	2.1
3 - 81	7656.5	7657.8	1.3
4 - 82	7657.2	7657.2	0.0
5 - 83	7656.6	7656.5	-0.1
6 - 84	7656.9	7655.9	-1.0
7 - 85	7657.1	7655.3	-1.8
8 - 86	7657.1	7654.7	-2.4
9 - 87	7657.6	7654.2	-3.4
10 - 88	7657.1	7653.7	-3.4
11 - 89	7657.4	7653.2	-4.2
12 - 90	7657.3	7652.8	-4.5
13 - 91	7657.1	7652.3	-4.8
14 - 92	7657.4	7651.7	-5.7
15 - 93	7657.2	7651.2	-6.0
16 - 94	7656.9	7650.7	-6.2
17 - 95	7656.6	7650.0	-6.6
18 - 96	7656.4	7649.4	-7.0
19 - 97	7656.0	7648.8	-7.2
20 - 98	7655.9	7648.3	-7.6
21 - 99	7655.6	7647.8	-7.8
22 - 100	7655.1	7647.2	-7.9
23 - 101	7654.7	7646.9	-7.8
24 - 102	7654.6	7646.6	-8.0
25 - 103	7654.1	7645.3	-7.8
26 - 104	7653.6	7646.2	-7.4
27 - 105	7653.9	7646.8	-7.1
28 - 106	7653.2	7646.3	-6.9
29 - 107	7652.9	7646.4	-6.5
30 - 108	7652.7	7646.5	-6.2
31 - 109	7652.5	7646.6	-5.9
32 - 110	7652.2	7646.5	-5.7
33 - 111	7651.9	7646.5	-5.4
34 - 112	7651.7	7646.6	-5.1
35 - 113	7651.2	7646.8	-4.4
36 - 114	7651.5	7647.1	-4.4
37 - 115	7651.2	7647.6	-3.6
38 - 116	7651.0	7648.1	-2.9
39 - 117	7651.1	7648.7	-2.4

ONSHORE

Average BCD (7655 ± 2 mm)	7654.2	-0.8

	Hole	Degrees
Ø max	9 - 87	19.92° - 199.92°
Ø min	43 - 120	98.77° - 278.77°
Ovality	6.7	Tolerance = 15 mm

Hole	Onshore	Offshore	Diff
40 - 118	7651.8	7649.3	-1.9
41 - 119	7651.1	7650.2	-0.9
42 - 120	7650.9	7651.1	0.2
43 - 121	7650.9	7652.0	1.1
44 - 122	7651.3	7652.8	1.5
45 - 123	7651.2	7653.5	2.3
46 - 124	7651.1	7654.0	2.9
47 - 125	7651.0	7654.4	3.4
48 - 126	7651.1	7654.9	3.8
49 - 127	7651.4	7655.7	4.3
50 - 128	7651.3	7656.7	5.4
51 - 129	7651.9	7657.7	5.8
52 - 130	7651.9	7658.6	6.7
53 - 131	7652.0	7659.7	7.7
54 - 132	7652.2	7660.4	8.2
55 - 133	7652.4	7660.9	8.5
56 - 134	7652.6	7661.4	8.8
57 - 135	7652.7	7662.0	9.3
58 - 136	7653.1	7662.5	9.4
59 - 137	7653.6	7662.9	9.3
60 - 138	7653.6	7663.3	9.7
61 - 139	7654.0	7663.7	9.7
62 - 140	7654.2	7663.9	9.7
63 - 141	7654.6	7664.0	9.4
64 - 142	7654.6	7664.2	9.6
65 - 143	7655.1	7664.2	9.1
66 - 144	7655.0	7664.1	9.1
67 - 145	7655.2	7664.0	8.8
68 - 146	7655.6	7663.7	8.1
69 - 147	7655.3	7663.6	8.3
70 - 148	7655.6	7663.3	7.7
71 - 149	7655.8	7662.9	7.1
72 - 150	7655.8	7662.6	6.8
73 - 151	7656.1	7662.3	6.2
74 - 152	7656.1	7661.9	5.8
75 - 153	7656.1	7661.5	5.4
76 - 154	7656.2	7661.0	4.8
77 - 155	7656.4	7660.5	4.1
78 - 156	7656.3	7659.9	3.6

OFFSHORE

Average BCD (7655 ± 2 mm)	7655.0	0.0

	Hole	Degrees
Ø max	64 - 142	146.54° - 326.54°
Ø min	26 - 104	58.85° - 238.85°
Ovality	18.0	Tolerance = 15 mm

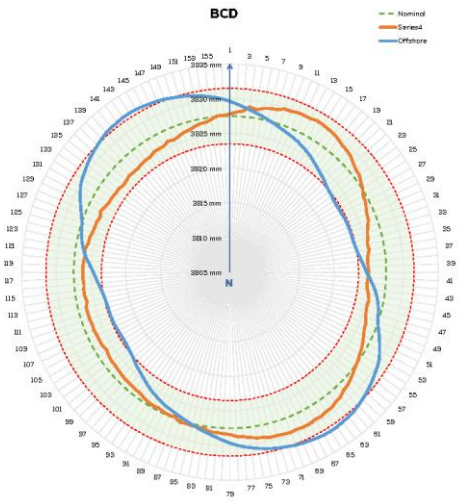
COMPARATIVE

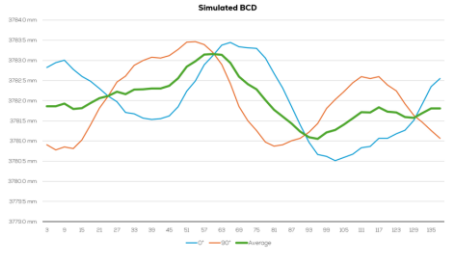
	Mean Dev	Min Dev	Mean Dev	Std Dev
BCD	9.7	-8.0	0.8	6.2

	Onshore	Offshore	Difference
Average BCD	7654.2	7655.0	0.8

	Onshore	Offshore	Difference
Ø max	7657.6	7664.2	6.6
Ø min	7650.9	7646.2	-4.7
Ovality	6.7	18.0	11.3

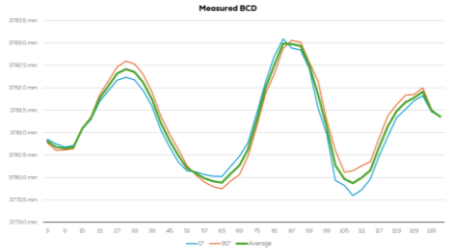
COMPARISON - BCD





Expected:

- Ovalisation-type deformation around the circumference.
- Characterised by a second-order harmonic pattern.
- Compensation between the initial and rotated measurement positions.



Observed:

- Measured profiles remain similar between both measurements.
- No clear compensating ovalisation or second-order harmonic behaviour is oberserved.
- The profiles do not show the anticipated rotation-dependent response.

Independent review of measurement procedures, calculation methods and third-party reports to identify inconsistencies, traceability gaps and non-reproducible results. Ensuring dimensional data is technically reliable before acceptance.

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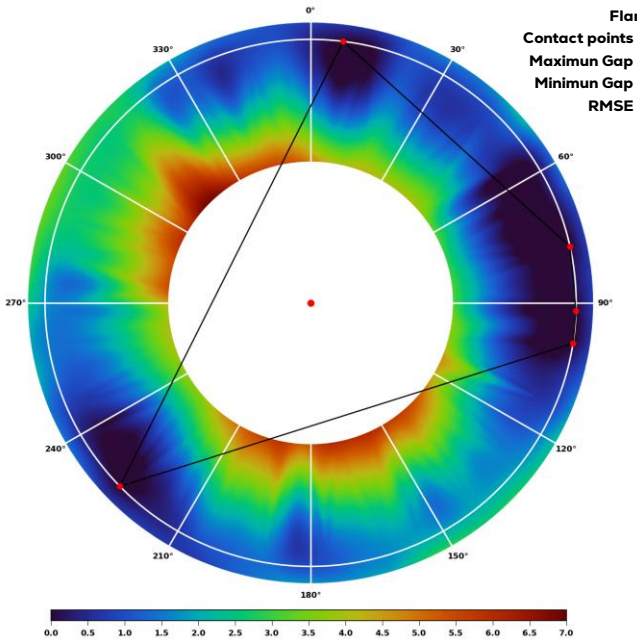
Flange Connection Analysis

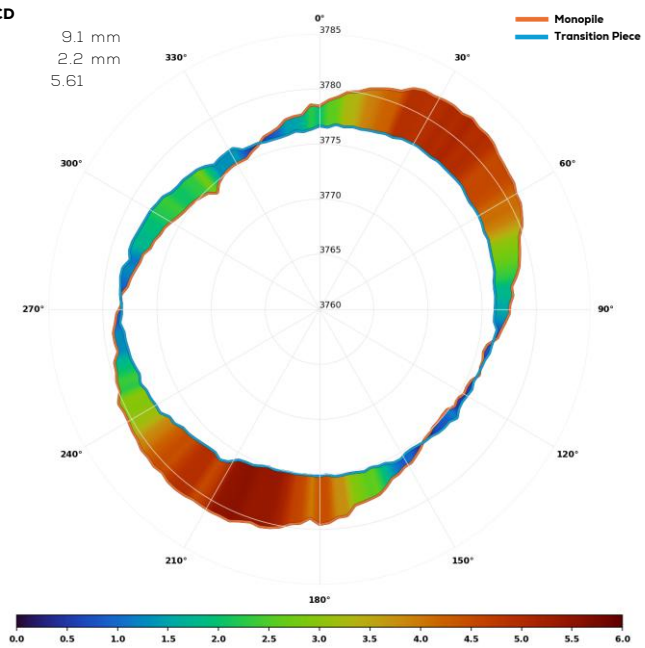
Interface Compatibility



Flange	
Contact points	5
Maximun Gap	6.9 mm
Minimun Gap	0.0 mm
RMSE	3.17

Rotation about Z-axis	0.192 °
Rotation about X-axis	-0.001 °
Rotation about Y-axis	0.004 °
X displacement	0.350 mm
Y displacement	0.057 mm

BCD	
Maximun Gap	9.1 mm
Minimun Gap	2.2 mm
RMSE	5.61



Analysis of the physical connection between measured MP and TP flanges, combining surface contact behaviour with bolt circle alignment. The assessment identifies the expected seating position, interface gaps, rotation and centre offset. Complete verification of flange compatibility before assembly.

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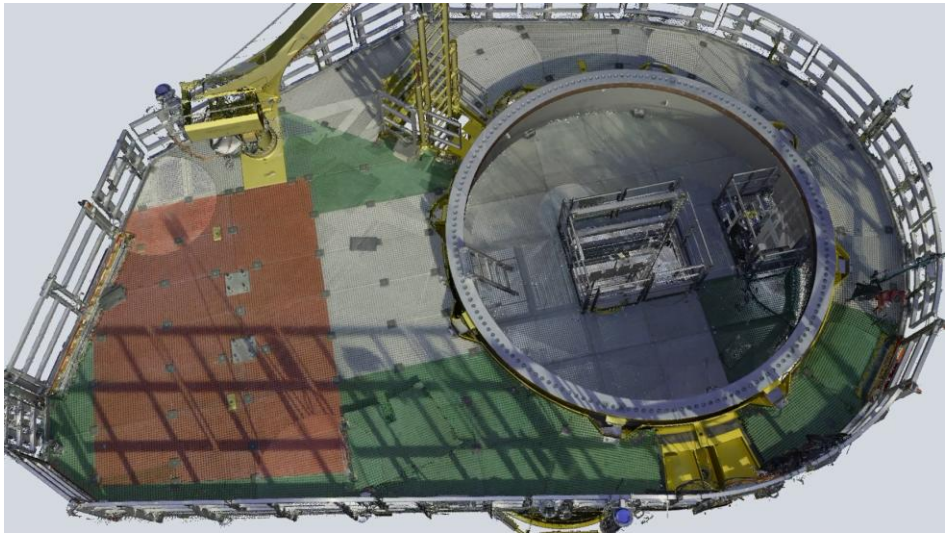
Accurate As-Built Data for Safe and Efficient Decommissioning

High-resolution 3D scanning provides reliable as-built data for informed decommissioning planning.



Ensures precise assembly, reliable structural connections, and safe installation of offshore foundations, using advanced metrology and offshore expertise for the successful commissioning of the wind farms.

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Ready to Transform the Way You Make Decisions?

Metrology 4.0, Reality Capture and Digital Engineering for Your Most Demanding Projects

- Proven experience in complex industrial environments
- Fast delivery of accurate, actionable data
- Full traceability and audit-ready documentation
- Engineering-focused approach, from data acquisition to decision-making

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