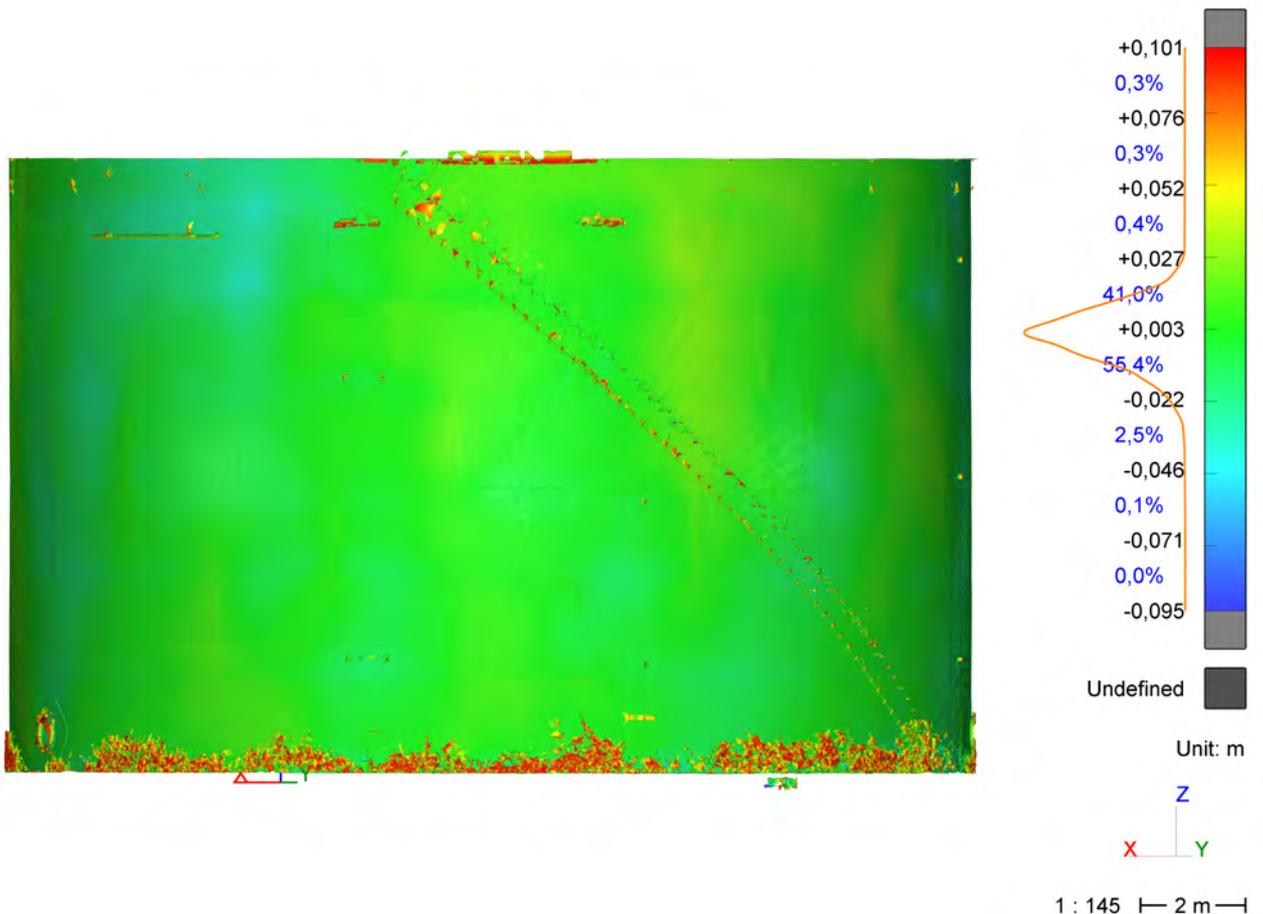


## Test Report - Laser Scanner 3d According to API 650/653 appendix B

Report done by CASCASI Giuseppe



**Cliente:**  
**Stabilimento:**  
**Item:** 380-S301 External Shell  
**Diametro Nominale:** 18,288 m **Altezza Nominale:** 12,802 m

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

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### **PREMESSA:**

Il rilievo dimensionale del serbatoio è stato eseguito utilizzando l'innovativo sistema di rilievo senza contatto con fascio laser ad alta velocità ed elevatissima precisione di scansione.

Lo scopo del lavoro è l'individuazione di eventuali zone di deformazione locale o generale che non rientrino nei criteri indicati dalle API 650/ API 653 appendix B.

### **STRUMENTAZIONE:**

Il rilievo è stato eseguito con una sofisticata strumentazione della LEICA modello P40.

### **PROCEDURA ADOTTATA:**

Tutte le scansioni sono state eseguite dall'esterno del serbatoio posizionando la strumentazione lungo la circonferenza ideale concentrica del serbatoio stesso. Si sono resi necessari 8 stazionamenti distribuiti lungo la circonferenza in modo da poter ottenere una visione totale del mantello e del trincarino, riducendo al minimo i coni d'ombra degli accessori, tubazioni, staffe, ecc... che si trovano all'esterno del serbatoio.

### **ORIENTAMENTO:**

Il modello è stato orientato a Nord, attraverso il posizionamento degli assi sulla saldatura del trincarino in asse con il passo d'uomo più vicino al nord geografico, si è presunta la quota del trincarino per il riferimento in elevazione. Il rilievo è stato realizzato unicamnete dall'esterno.

### **ANALISI DEI DATI RILEVATI:**

Mediante uno specifico Software appositamente realizzato in conformità alle API-650/API-653 è stato possibile generare un Best Cllinder ottimizzato secondo il migliore adattamento alla forma rela del serbatoio stesso. Una volta ottenuta la geometria di comparazione e stabilita la maglia di calcolo, si è lanciata l'analisi sulle deviazioni di forma e dimensione, tali da avere un immediato riscontro co le tolleranza ammesse.

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Tank Project

#### Tank definition

Elevation marker: X= 18,025 m ; Y= -7,161 m ; Z= 10,659 m

Orientation marker: X= 19,255 m ; Y= -9,516 m ; Z= -0,626 m

Tank height: 12,802 m

#### Best cylinder computation

Number of points: 13.874.306

Distance of worst point: 0,101 m

Standard deviation: 0,010 m

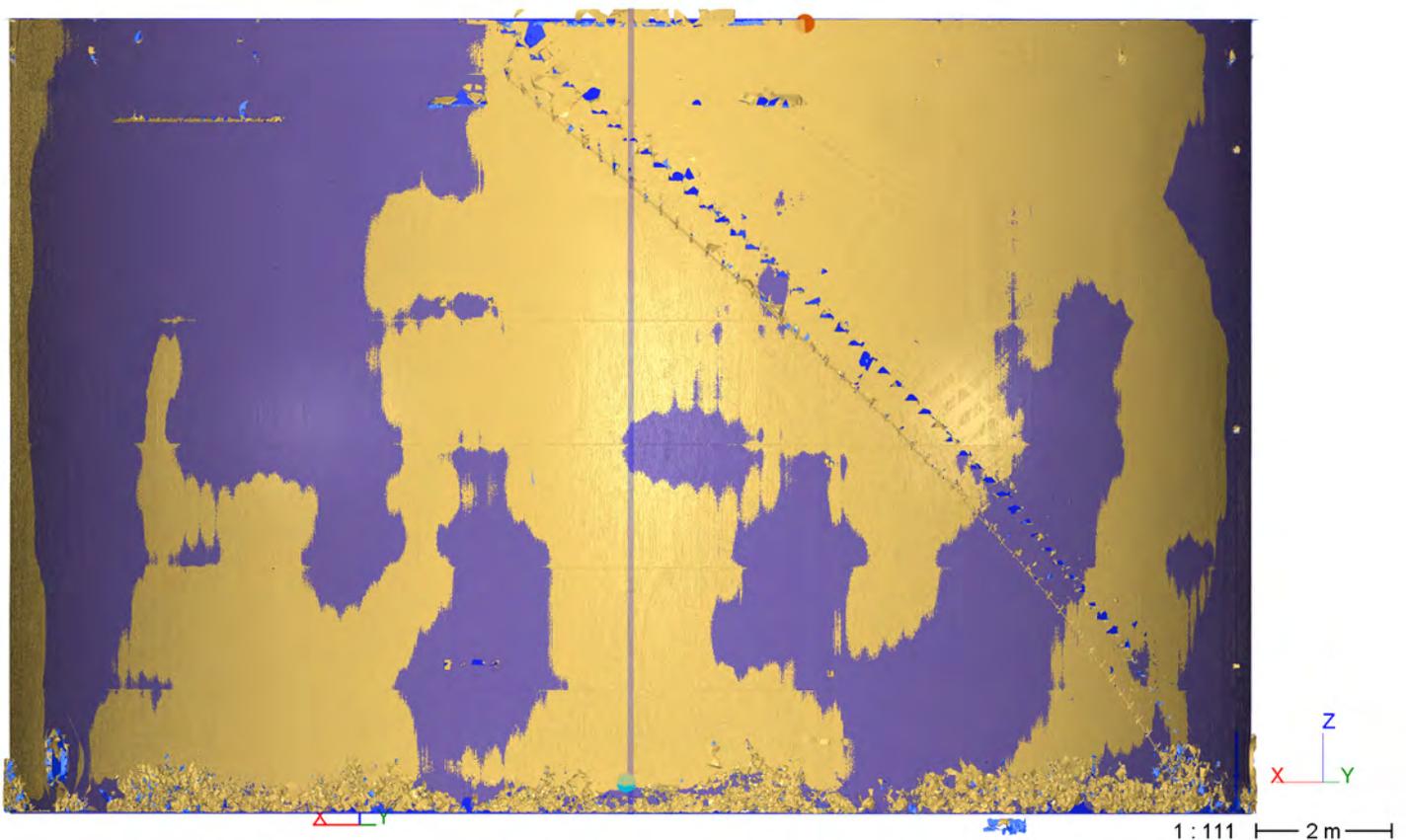
Cylinder axis: X= -0,001 ; Y= 0,000 ; Z= 1,000

Cylinder diameter: 18,313 m

#### Plumbness computation

Measured plumbness: 0,009 m

Tolerance: 0,127 m (according to API 653)



## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

Section Height (m)	Avg. Radius (m)	Min. Radius (m)	Max. Radius (m)	Min. Acc. Radius (m)	Max. Acc. Radius (m)
1,000	9,184	9,120	9,256	9,099	9,214
2,000	9,157	9,097	9,256	9,099	9,214
3,000	9,190	9,111	9,254	9,099	9,214
4,000	9,189	9,131	9,256	9,099	9,214
5,000	9,187	9,132	9,242	9,099	9,214
6,000	9,169	9,134	9,255	9,099	9,214
7,000	9,184	9,135	9,222	9,099	9,214
8,000	9,200	9,127	9,256	9,099	9,214
9,000	9,158	9,130	9,184	9,099	9,214
10,000	9,191	9,122	9,245	9,099	9,214
11,000	9,185	9,120	9,255	9,099	9,214
12,000	9,237	9,128	9,257	9,099	9,214

Tolerances are computed according to API653.

The level 0 passes through the point X= 10,625 m ; Y= -12,578 m ; Z= -1,393 m

The sections are perpendicular to the cylinder axis.



## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 2,000 m

**Position on cylinder axis:**

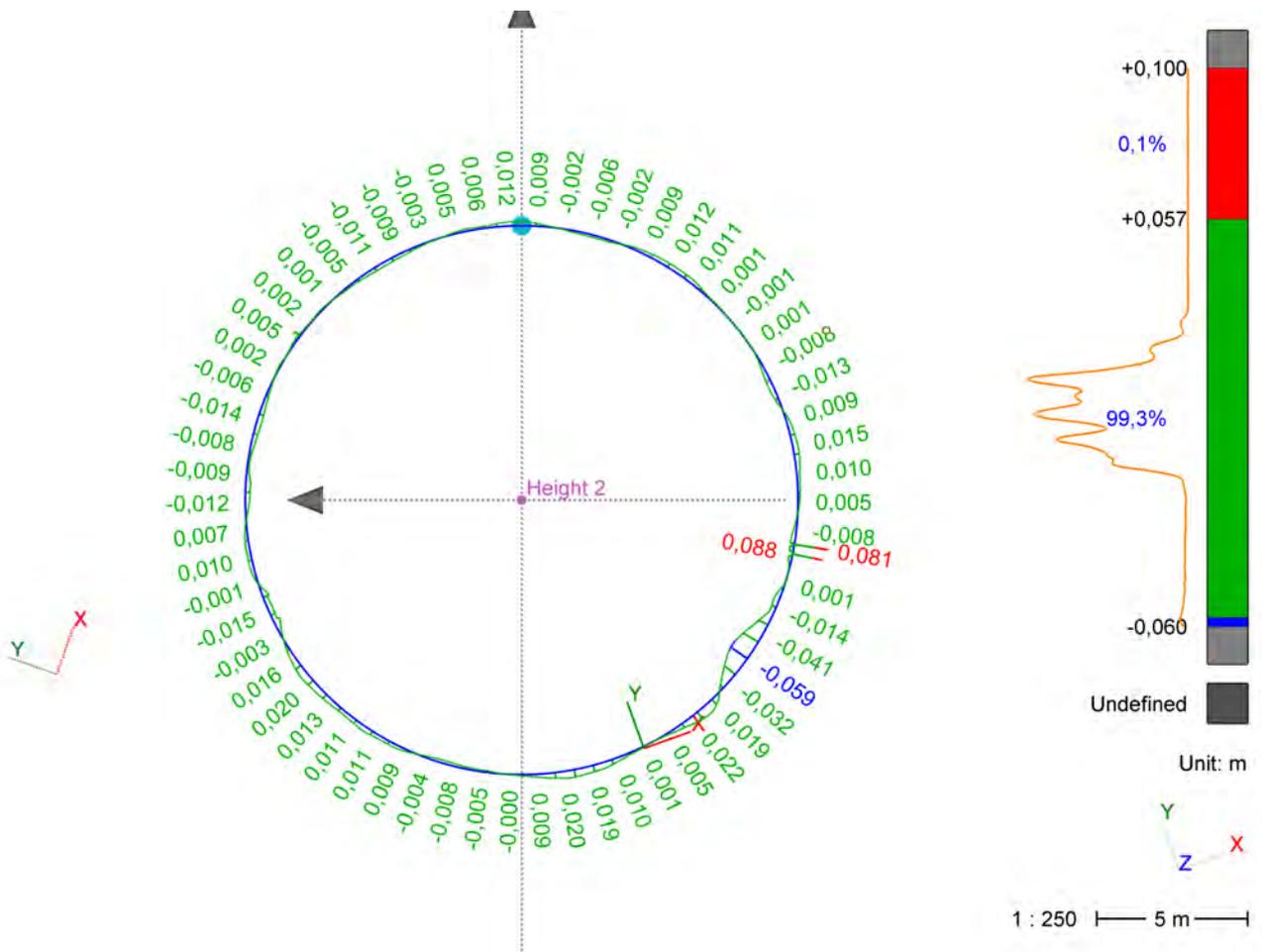
X= 10,624 m ; Y= -12,578 m ; Z= 0,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,097 m

**Maximum radius:** 9,256 m

**Average radius:** 9,157 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 3,000 m

**Position on cylinder axis:**

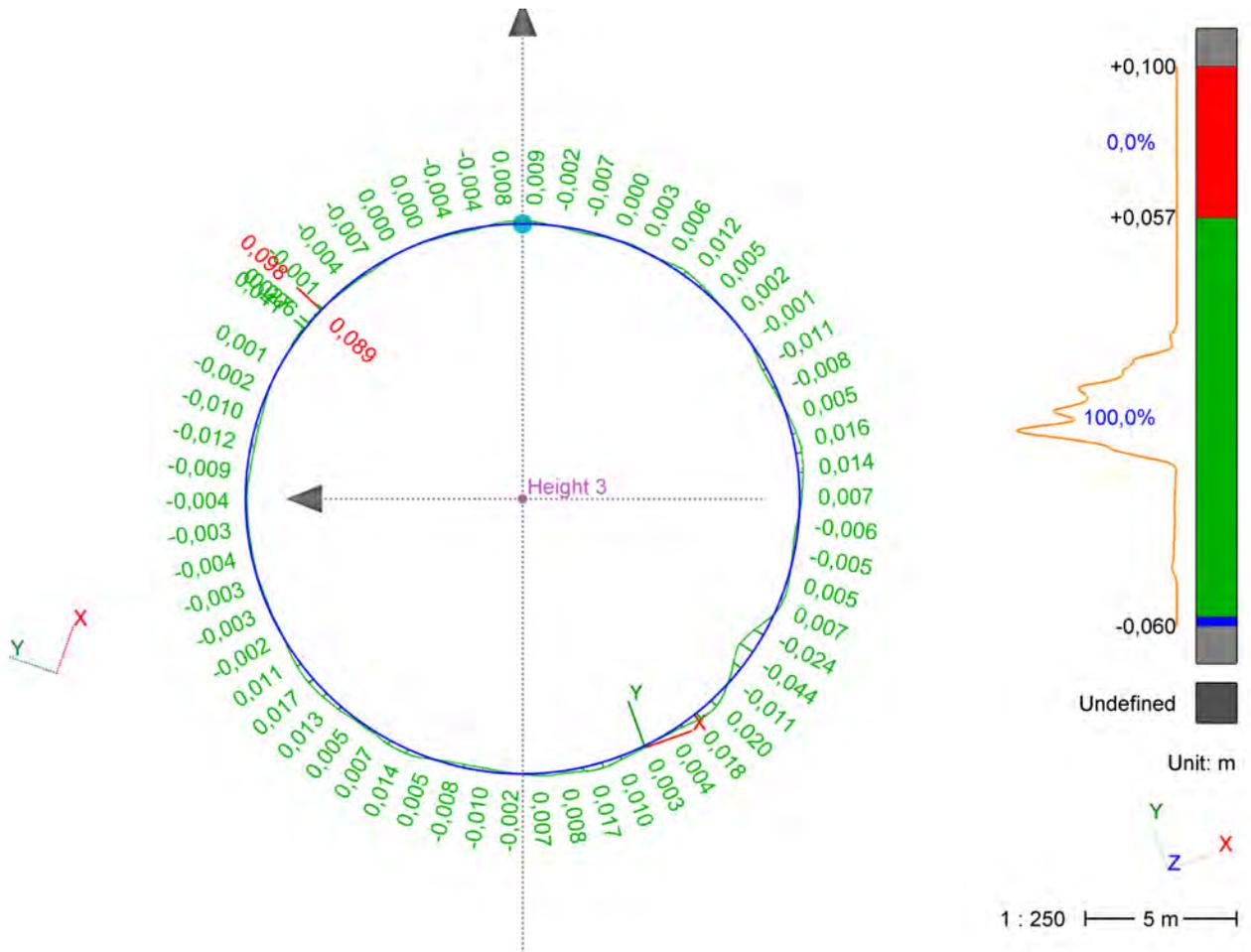
X= 10,623 m ; Y= -12,577 m ; Z= 1,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,111 m

**Maximum radius:** 9,254 m

**Average radius:** 9,190 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 4,000 m

**Position on cylinder axis:**

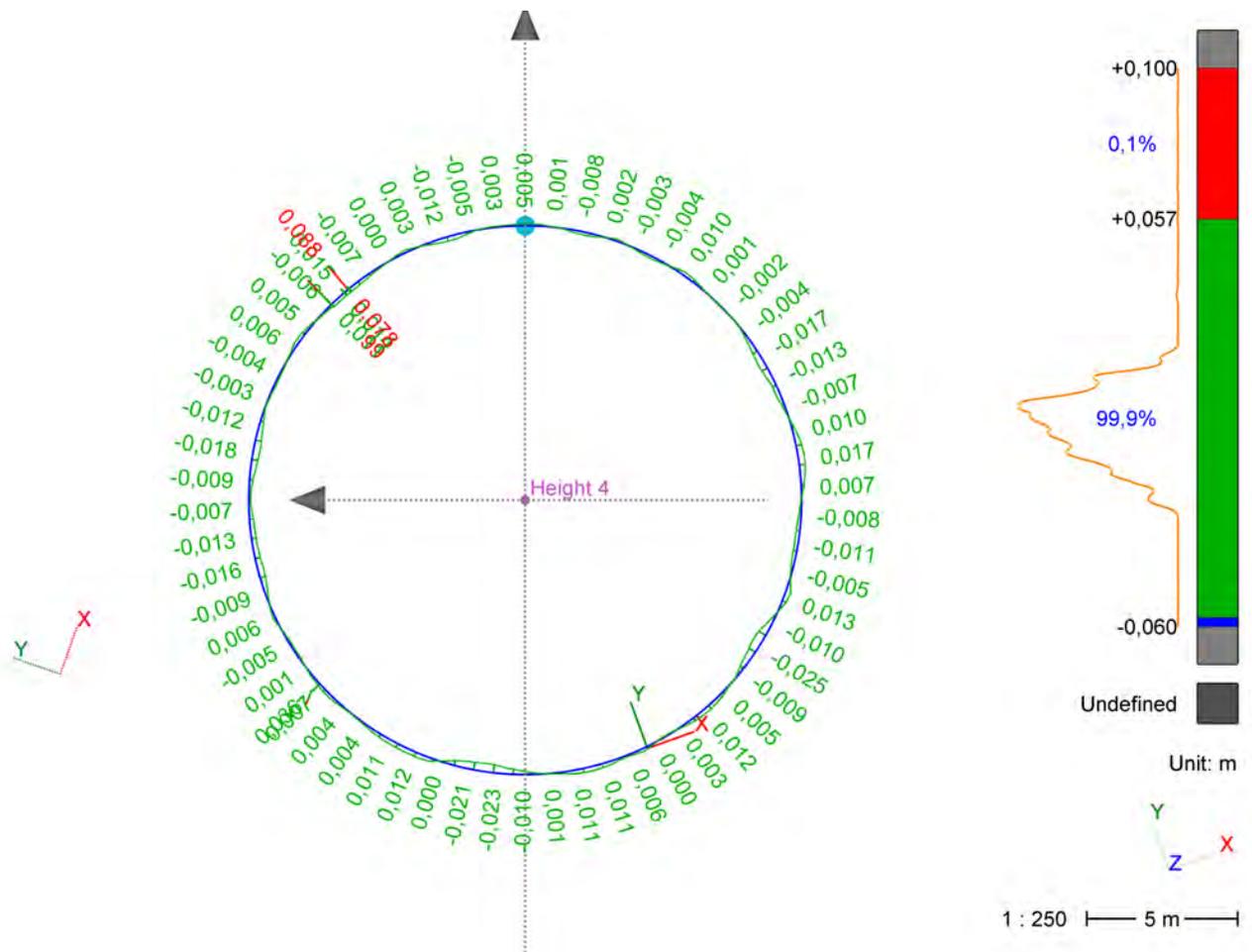
X= 10,623 m ; Y= -12,577 m ; Z= 2,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,131 m

**Maximum radius:** 9,256 m

**Average radius:** 9,189 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 5,000 m

**Position on cylinder axis:**

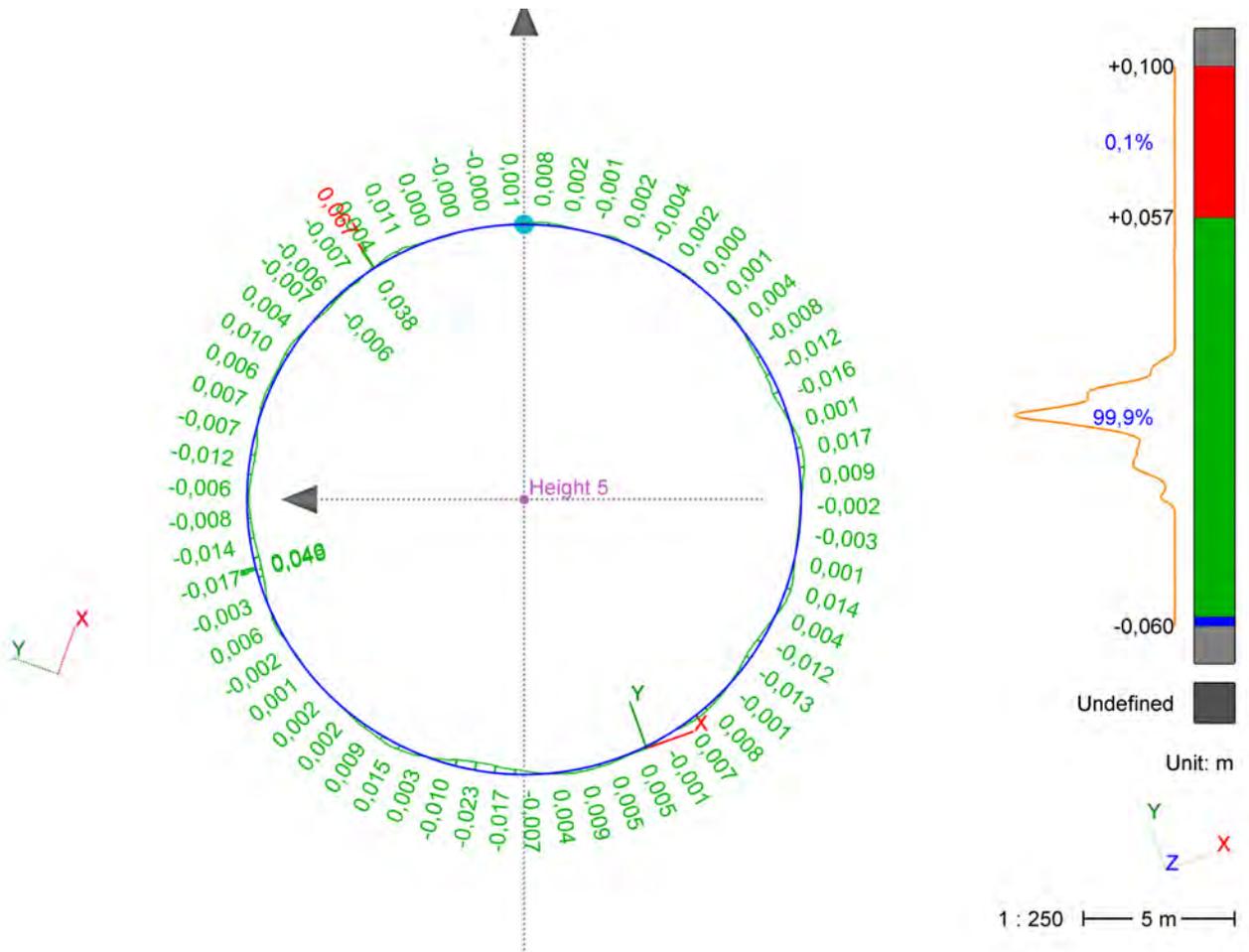
X= 10,622 m ; Y= -12,576 m ; Z= 3,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,132 m

**Maximum radius:** 9,242 m

**Average radius:** 9,187 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 6,000 m

**Position on cylinder axis:**

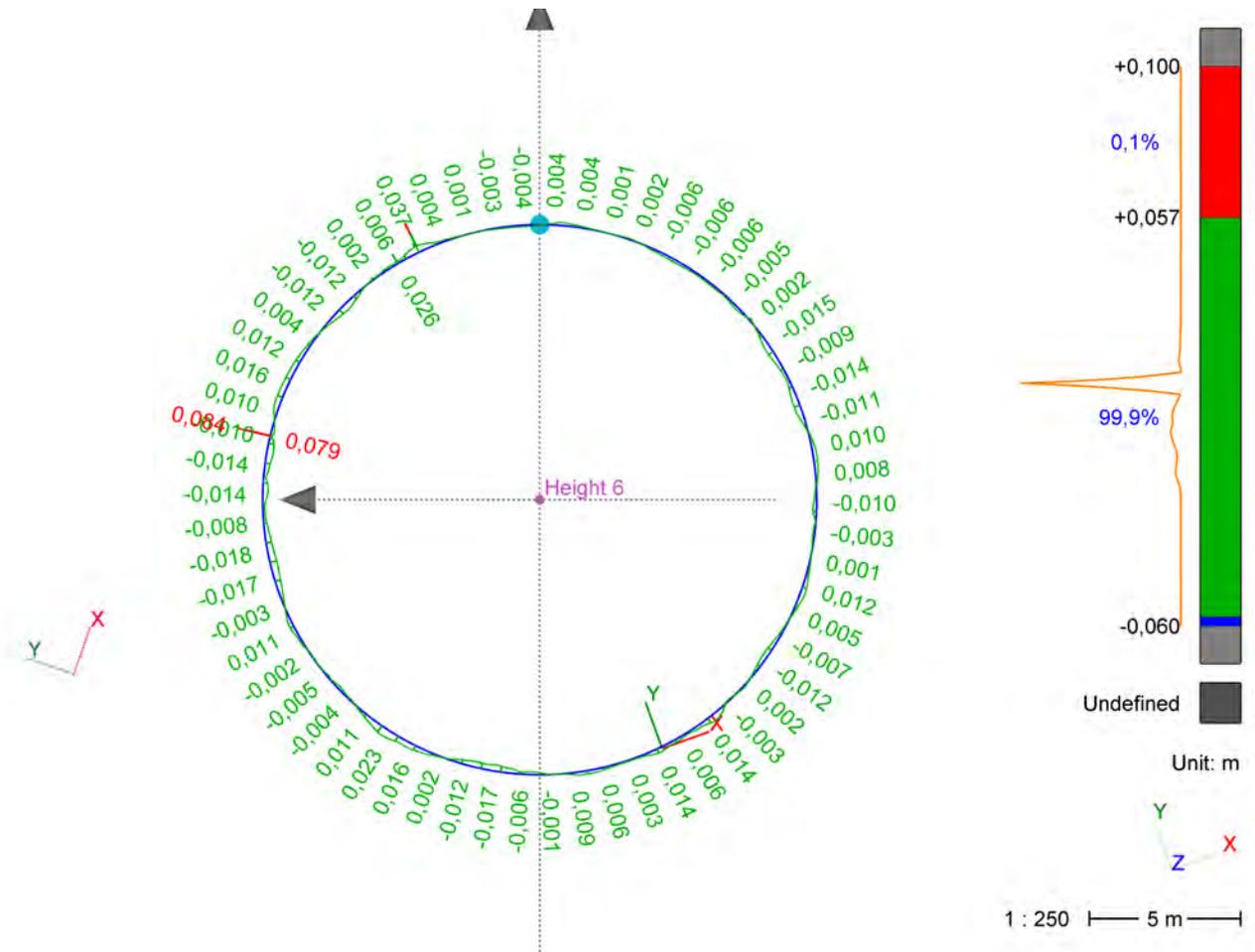
X= 10,621 m ; Y= -12,576 m ; Z= 4,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,134 m

**Maximum radius:** 9,255 m

**Average radius:** 9,169 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 7,000 m

**Position on cylinder axis:**

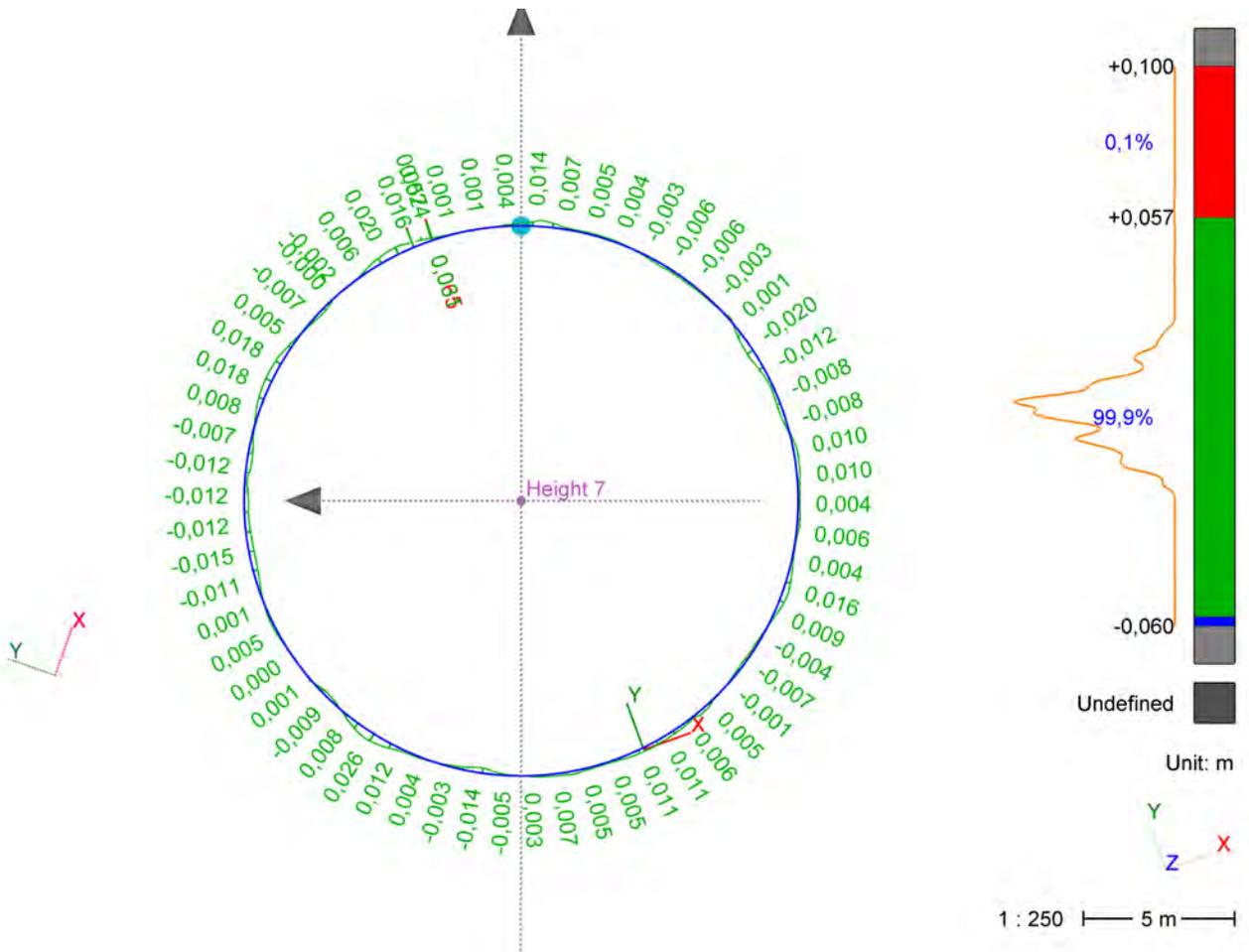
X= 10,621 m ; Y= -12,575 m ; Z= 5,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,135 m

**Maximum radius:** 9,222 m

**Average radius:** 9,184 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 8,000 m

**Position on cylinder axis:**

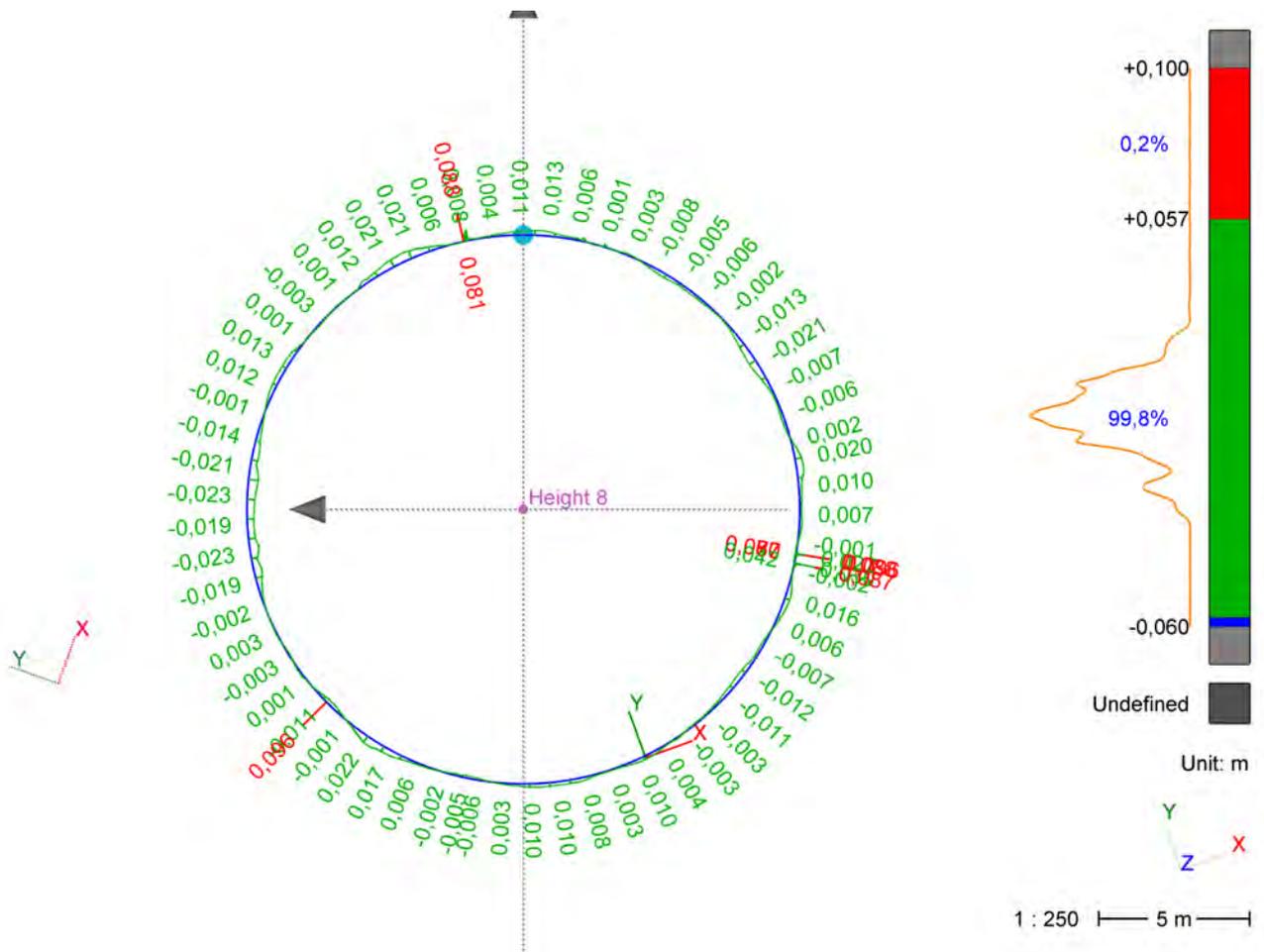
X= 10,620 m ; Y= -12,575 m ; Z= 6,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,127 m

**Maximum radius:** 9,256 m

**Average radius:** 9,200 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 9,000 m

**Position on cylinder axis:**

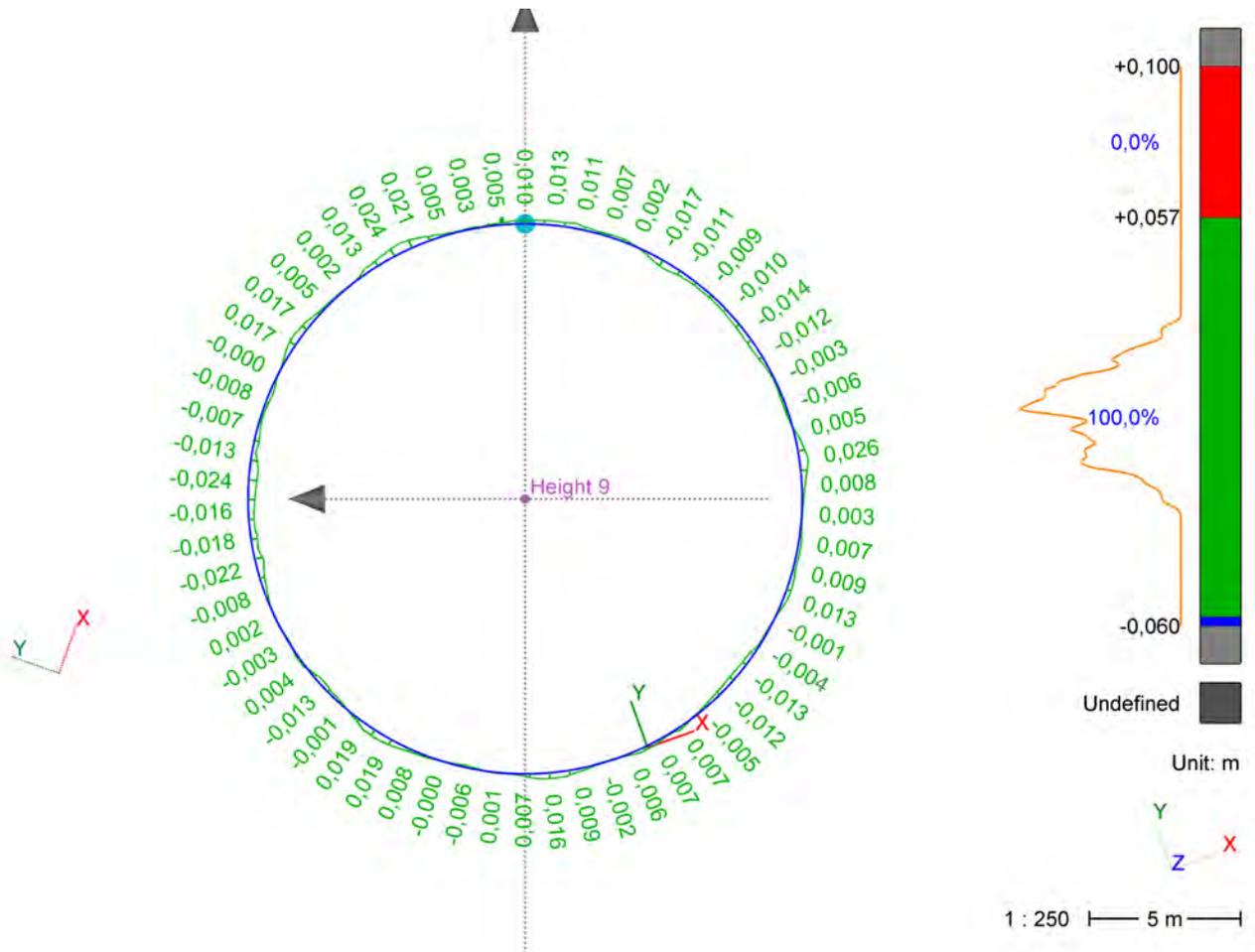
X= 10,619 m ; Y= -12,575 m ; Z= 7,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,130 m

**Maximum radius:** 9,184 m

**Average radius:** 9,158 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 10,000 m

**Position on cylinder axis:**

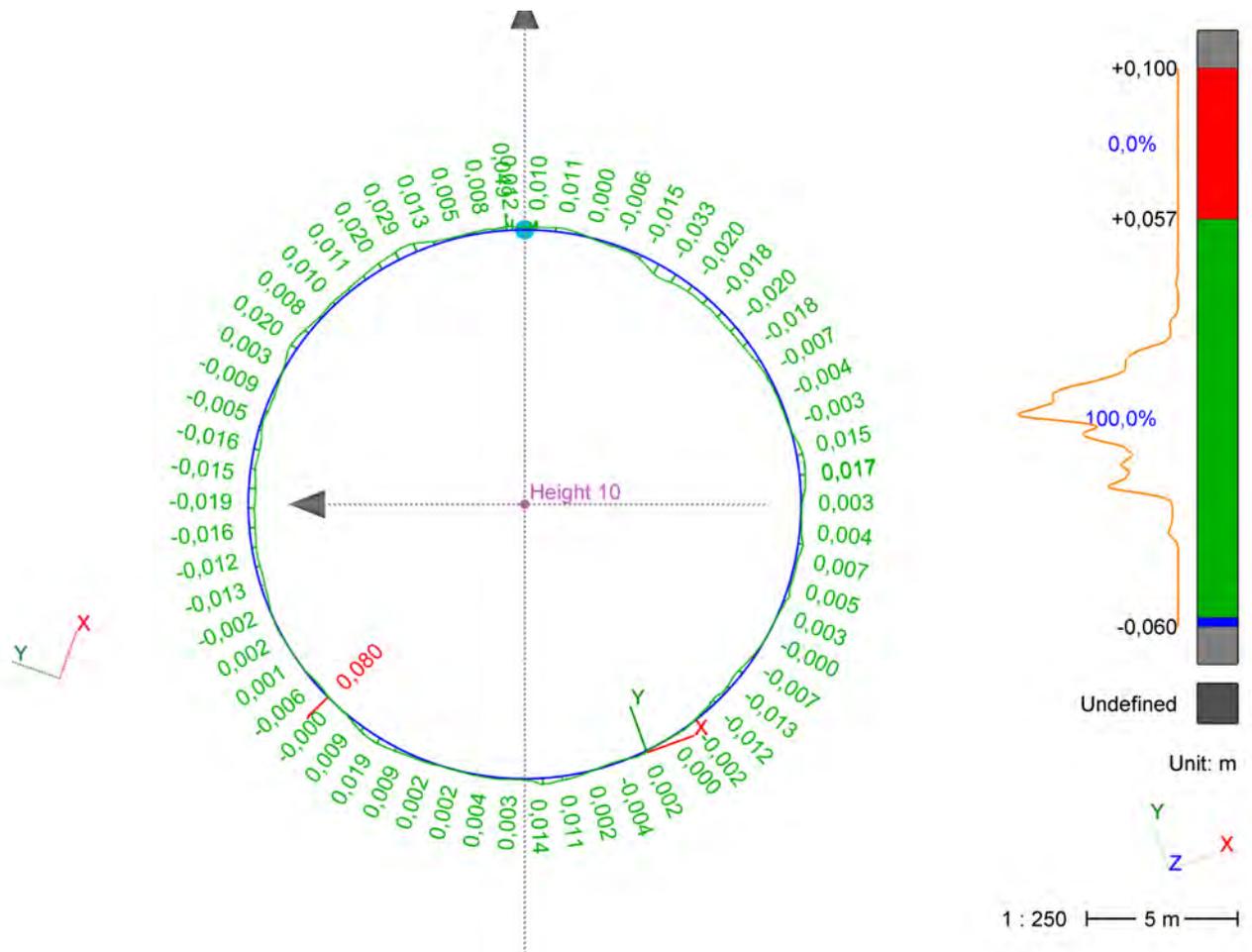
X= 10,619 m ; Y= -12,574 m ; Z= 8,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,122 m

**Maximum radius:** 9,245 m

**Average radius:** 9,191 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 11,000 m

**Position on cylinder axis:**

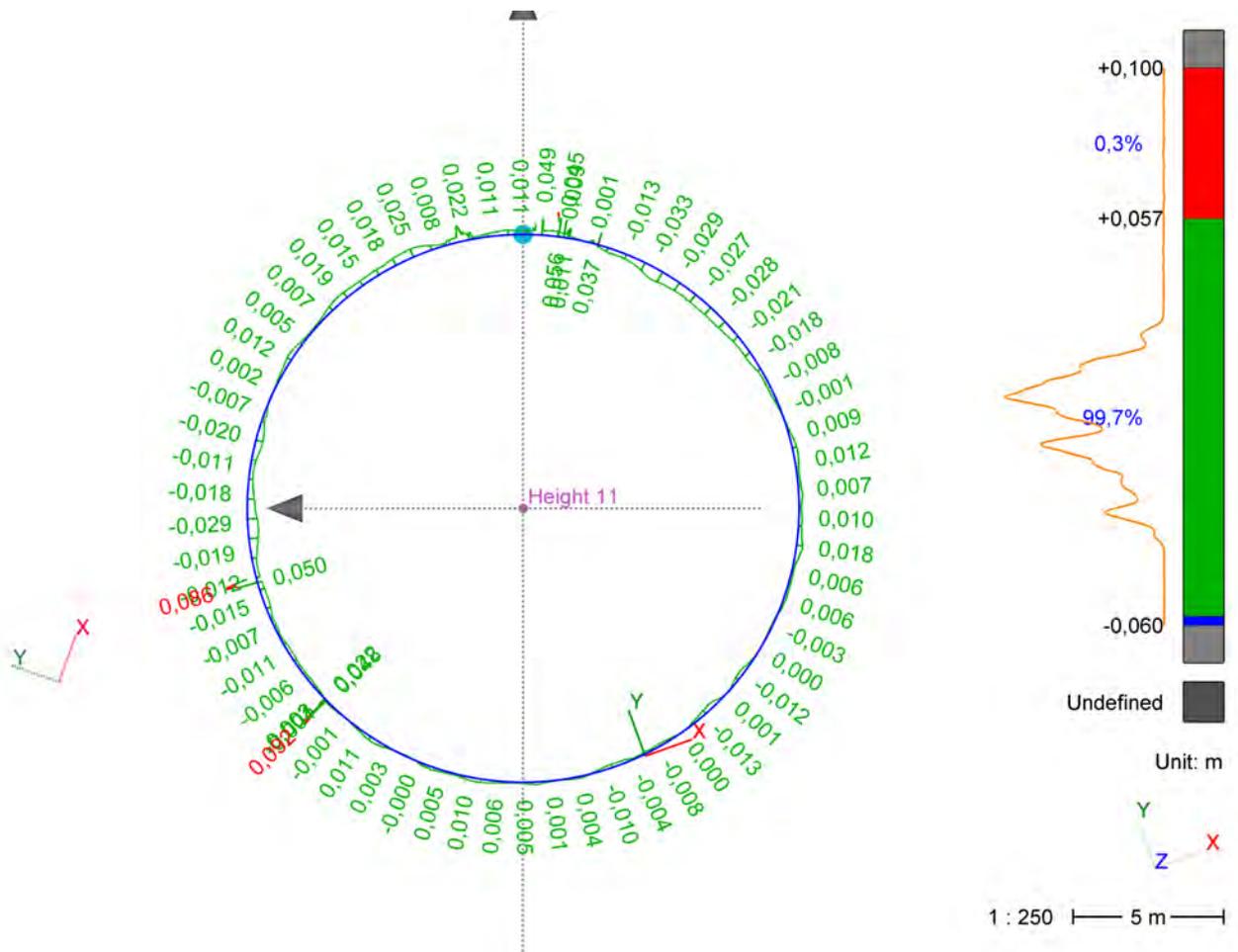
X= 10,618 m ; Y= -12,574 m ; Z= 9,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,120 m

**Maximum radius:** 9,255 m

**Average radius:** 9,185 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

### Section at 12,000 m

**Position on cylinder axis:**

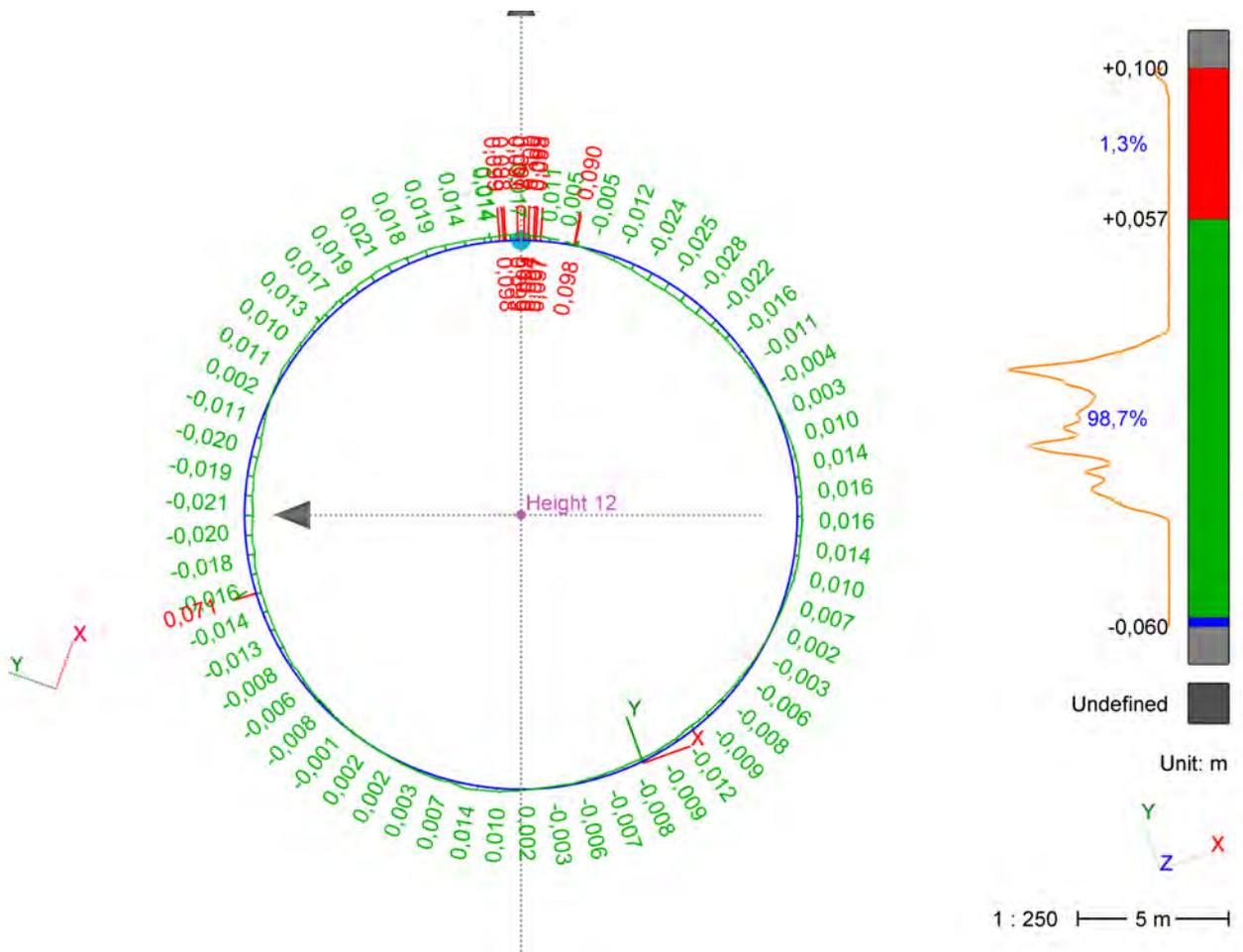
X= 10,618 m ; Y= -12,573 m ; Z= 10,607 m

**Acceptable radius:** [9,099 m;9,214 m]

**Minimum radius:** 9,128 m

**Maximum radius:** 9,257 m

**Average radius:** 9,237 m



Deviation magnification x11,430

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

Section Angle (°)	Avg. Radius (m)	Min. Radius (m)	Max. Radius (m)
0,000	9,187	9,135	9,256
10,000	9,187	9,136	9,256
20,000	9,181	9,084	9,257
30,000	9,178	9,120	9,257
40,000	9,186	9,122	9,257
50,000	9,181	9,104	9,254
60,000	9,175	9,100	9,254
70,000	9,157	9,109	9,256
80,000	9,158	9,122	9,257
90,000	9,179	9,126	9,255
100,000	9,146	9,126	9,255
110,000	9,189	9,137	9,254
120,000	9,183	9,137	9,256
130,000	9,160	9,144	9,255
140,000	9,160	9,151	9,257
150,000	9,166	9,119	9,257
160,000	9,140	9,115	9,256
170,000	9,164	9,113	9,257
180,000	9,179	9,141	9,257
190,000	9,162	9,136	9,257
200,000	9,160	9,140	9,256
210,000	9,200	9,141	9,256
220,000	9,177	9,140	9,254
230,000	9,185	9,114	9,253
240,000	9,164	9,098	9,256
250,000	9,148	9,103	9,250
260,000	9,173	9,065	9,221
270,000	9,183	9,131	9,256
280,000	9,192	9,142	9,254
290,000	9,194	9,137	9,253
300,000	9,164	9,136	9,250
310,000	9,189	9,121	9,256
320,000	9,179	9,115	9,256

330,000	9,173	9,117	9,257
340,000	9,190	9,131	9,257
350,000	9,193	9,135	9,257

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

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Tolerances are computed according to API653.  
**Acceptable radius:** [9,099 m;9,214 m]



## Test Report - Laser Scanner 3d

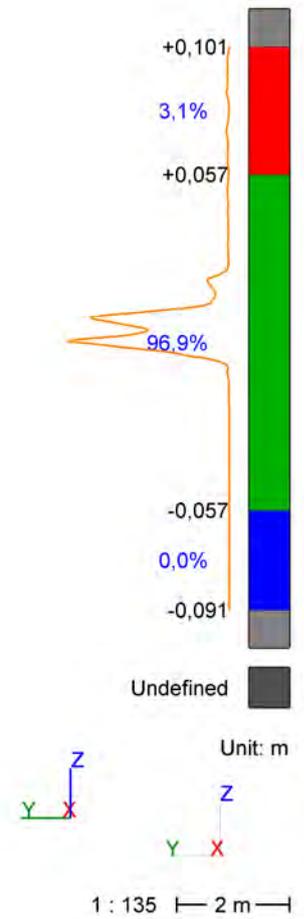
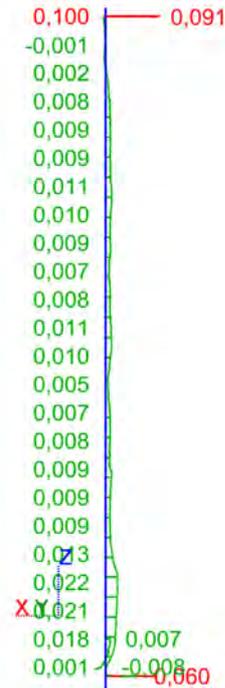
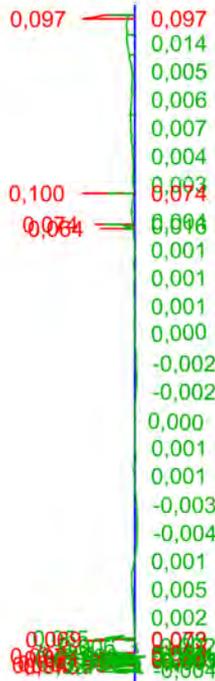
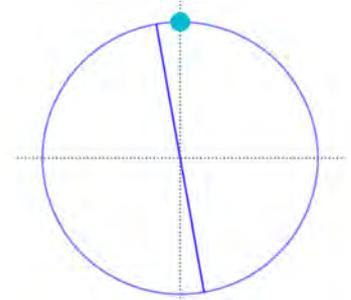
Customer: Customer  
Date: 18/07/2025

### Section 10,000°

Minimum radius: 9,136 m  
Maximum radius: 9,256 m  
Average radius: 9,187 m

### Section 190,000°

Minimum radius: 9,136 m  
Maximum radius: 9,257 m  
Average radius: 9,162 m



Deviation magnification x9,552

## Test Report - Laser Scanner 3d

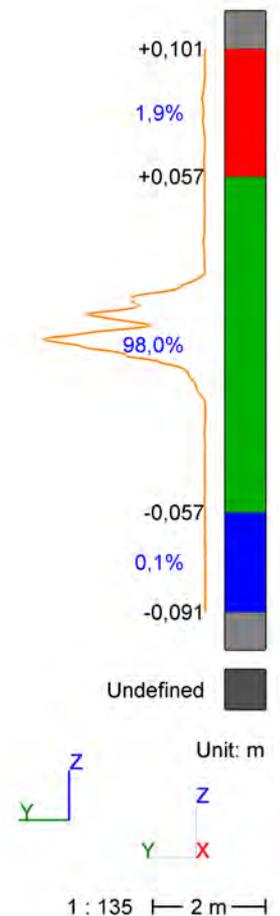
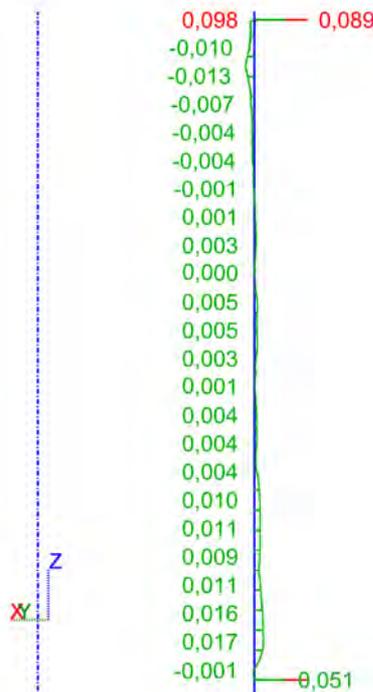
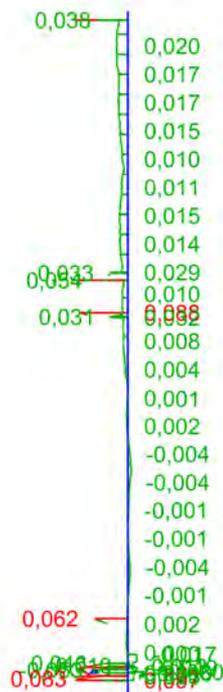
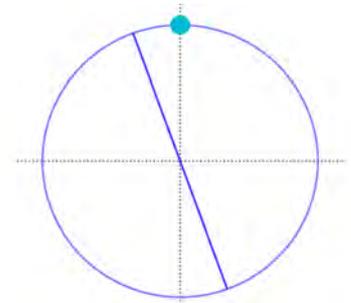
Customer: Customer  
Date: 18/07/2025

### Section 20,000°

Minimum radius: 9,084 m  
Maximum radius: 9,257 m  
Average radius: 9,181 m

### Section 200,000°

Minimum radius: 9,140 m  
Maximum radius: 9,256 m  
Average radius: 9,160 m



Deviation magnification x9,552

## Test Report - Laser Scanner 3d

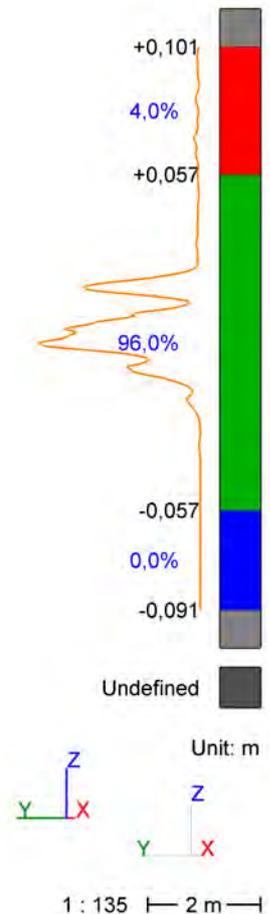
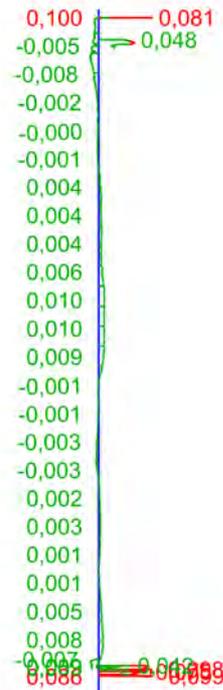
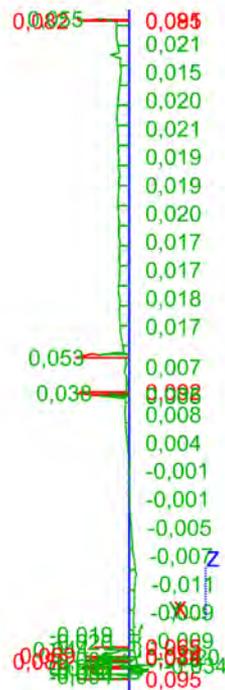
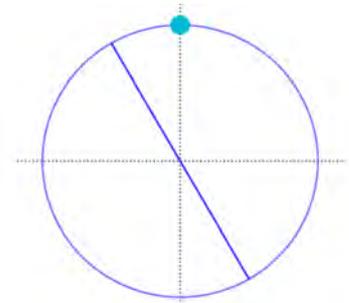
Customer: Customer  
Date: 18/07/2025

### Section 30,000°

Minimum radius: 9,120 m  
Maximum radius: 9,257 m  
Average radius: 9,178 m

### Section 210,000°

Minimum radius: 9,141 m  
Maximum radius: 9,256 m  
Average radius: 9,200 m



Deviation magnification x9,552

## Test Report - Laser Scanner 3d

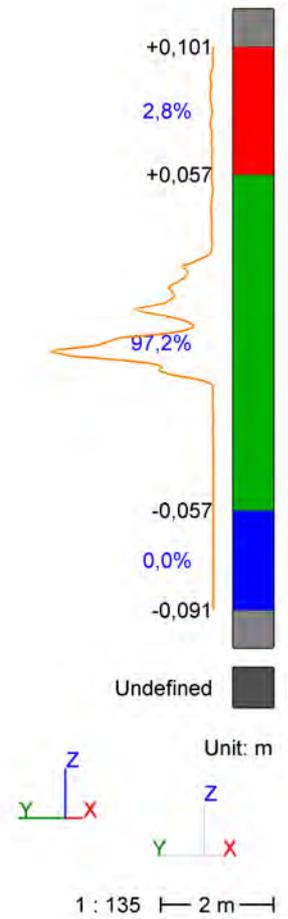
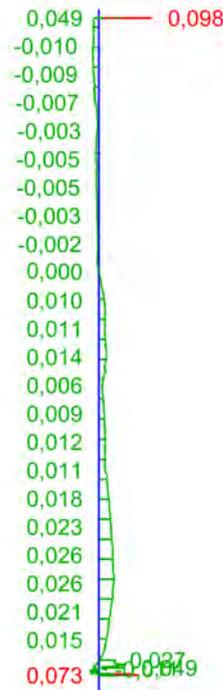
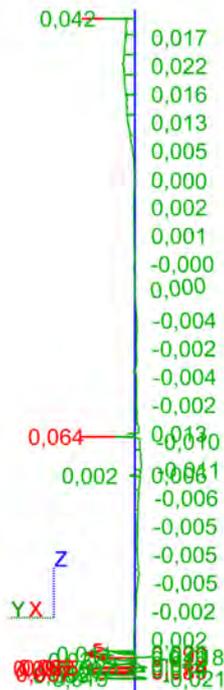
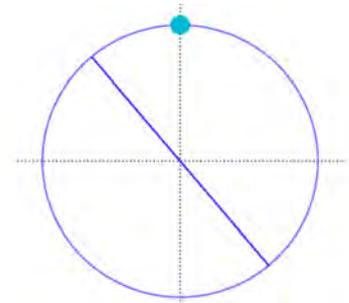
Customer: Customer  
Date: 18/07/2025

### Section 40,000°

Minimum radius: 9,122 m  
Maximum radius: 9,257 m  
Average radius: 9,186 m

### Section 220,000°

Minimum radius: 9,140 m  
Maximum radius: 9,254 m  
Average radius: 9,177 m



Deviation magnification x9,552

## Test Report - Laser Scanner 3d

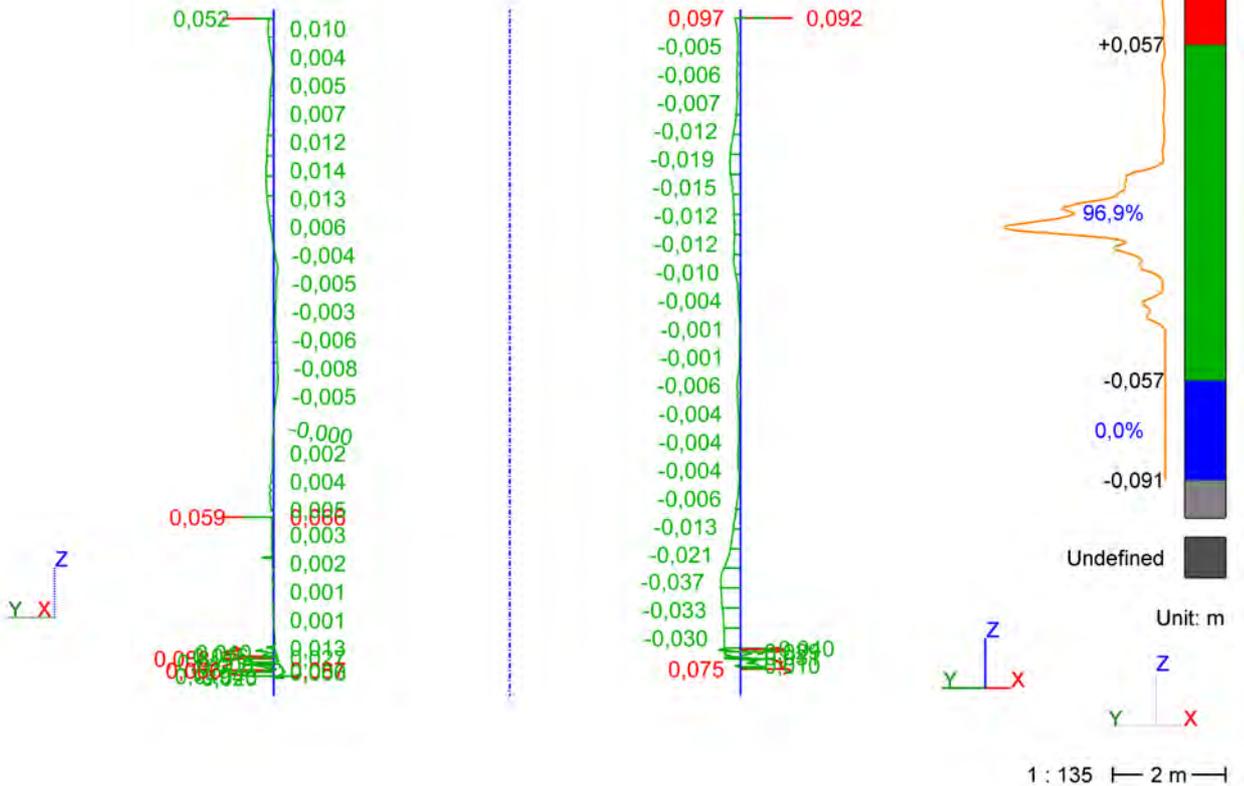
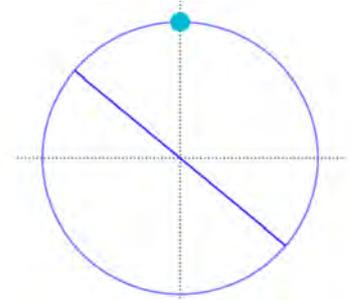
Customer: Customer  
Date: 18/07/2025

### Section 50,000°

Minimum radius: 9,104 m  
Maximum radius: 9,254 m  
Average radius: 9,181 m

### Section 230,000°

Minimum radius: 9,114 m  
Maximum radius: 9,253 m  
Average radius: 9,185 m



Deviation magnification x9,552



## Test Report - Laser Scanner 3d

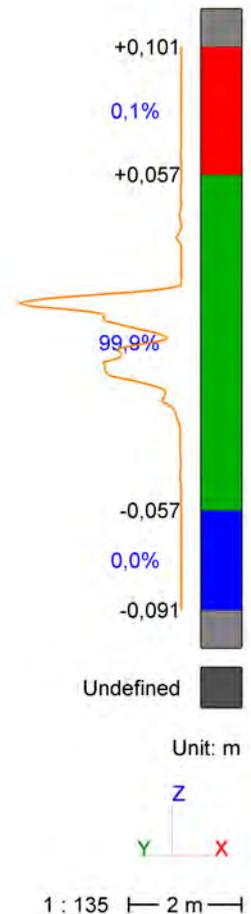
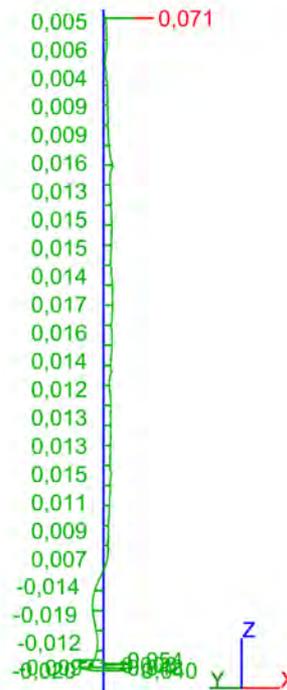
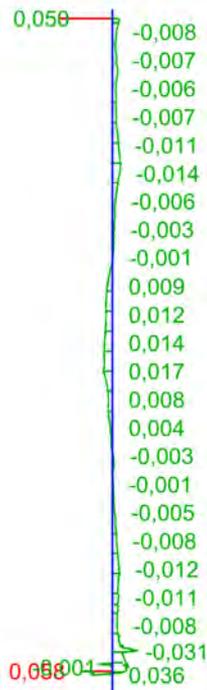
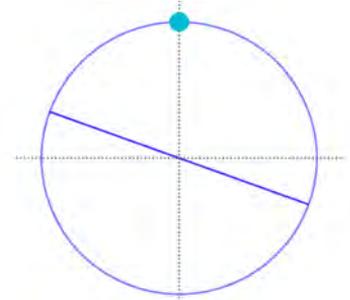
Customer: Customer  
Date: 18/07/2025

### Section 70,000°

Minimum radius: 9,109 m  
Maximum radius: 9,256 m  
Average radius: 9,157 m

### Section 250,000°

Minimum radius: 9,103 m  
Maximum radius: 9,250 m  
Average radius: 9,148 m



Deviation magnification x9,552

## Test Report - Laser Scanner 3d

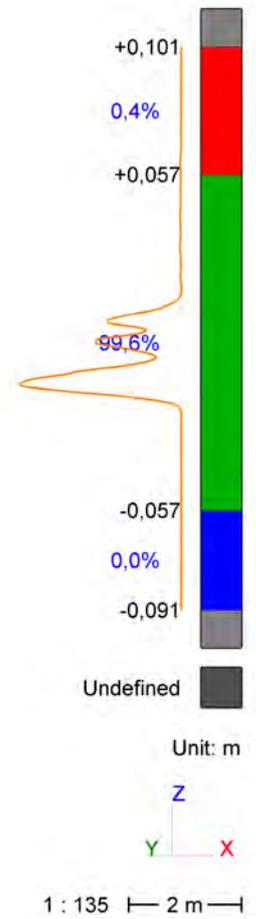
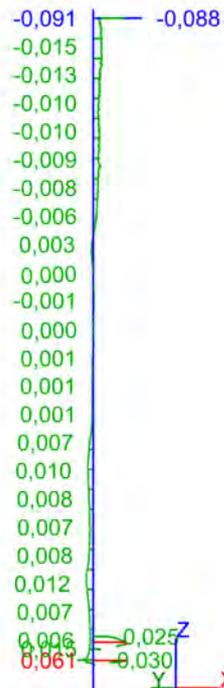
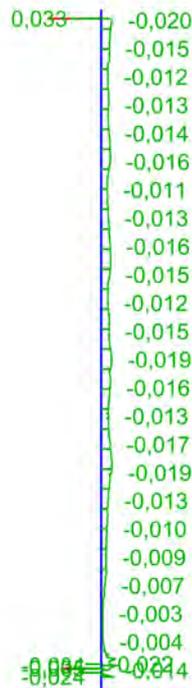
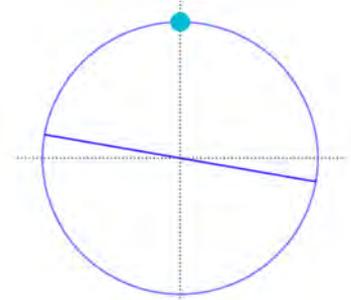
Customer: Customer  
Date: 18/07/2025

### Section 80,000°

Minimum radius: 9,122 m  
Maximum radius: 9,257 m  
Average radius: 9,158 m

### Section 260,000°

Minimum radius: 9,065 m  
Maximum radius: 9,221 m  
Average radius: 9,173 m



Deviation magnification x9,552

## Test Report - Laser Scanner 3d

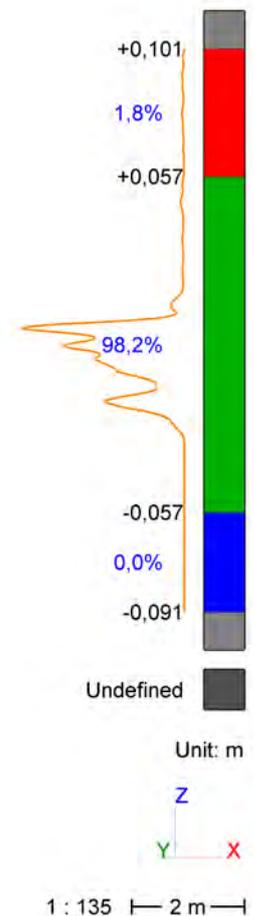
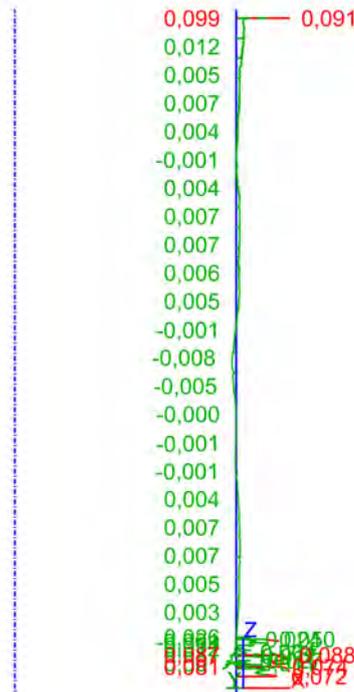
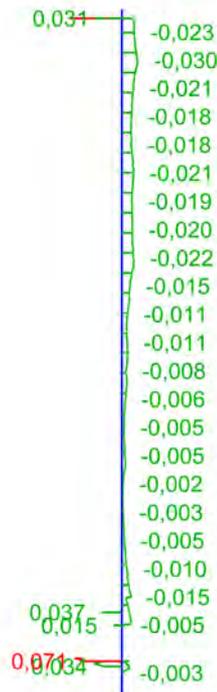
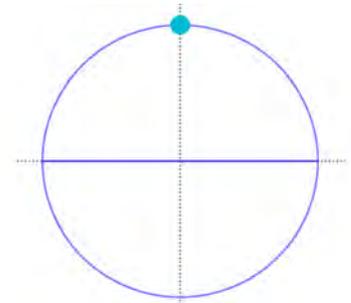
Customer: Customer  
Date: 18/07/2025

### Section 90,000°

Minimum radius: 9,126 m  
Maximum radius: 9,255 m  
Average radius: 9,179 m

### Section 270,000°

Minimum radius: 9,131 m  
Maximum radius: 9,256 m  
Average radius: 9,183 m



Deviation magnification x9,552





## Test Report - Laser Scanner 3d

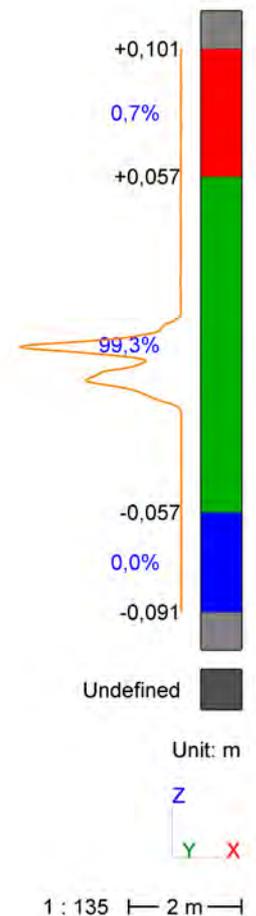
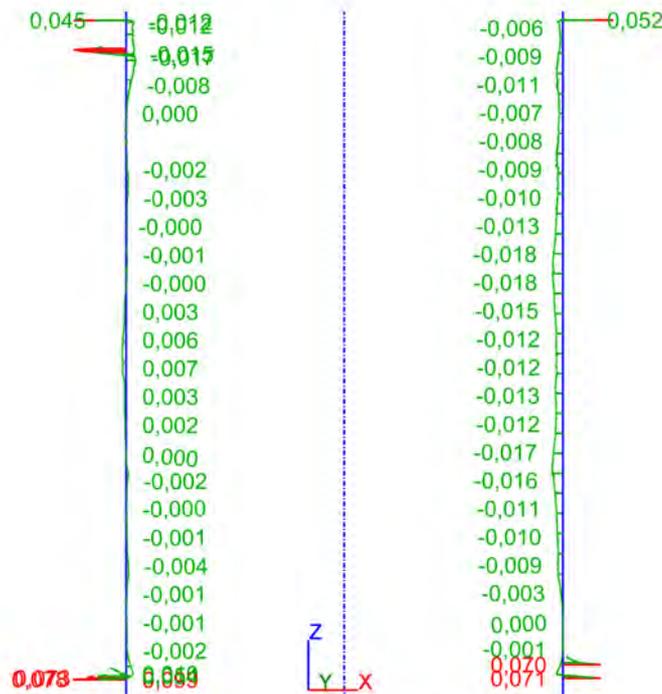
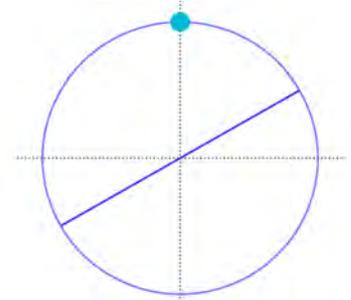
Customer: Customer  
Date: 18/07/2025

### Section 120,000°

Minimum radius: 9,137 m  
Maximum radius: 9,256 m  
Average radius: 9,183 m

### Section 300,000°

Minimum radius: 9,136 m  
Maximum radius: 9,250 m  
Average radius: 9,164 m



Deviation magnification x9,552



## Test Report - Laser Scanner 3d

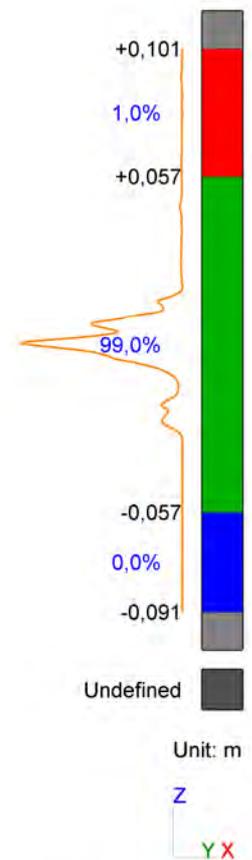
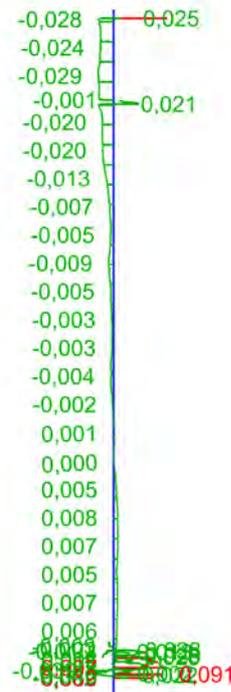
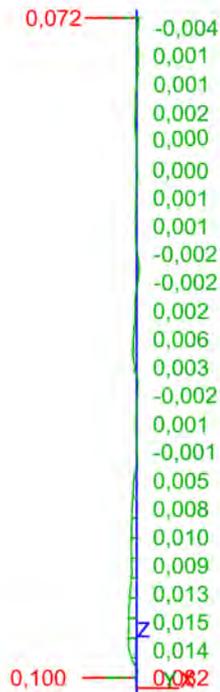
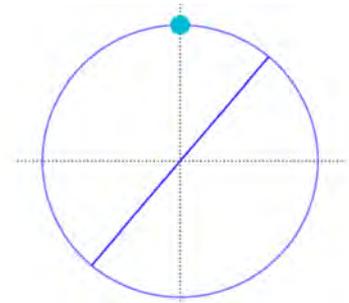
Customer: Customer  
Date: 18/07/2025

### Section 140,000°

Minimum radius: 9,151 m  
Maximum radius: 9,257 m  
Average radius: 9,160 m

### Section 320,000°

Minimum radius: 9,115 m  
Maximum radius: 9,256 m  
Average radius: 9,179 m



1 : 135 | 2 m

Deviation magnification x9,552

## Test Report - Laser Scanner 3d

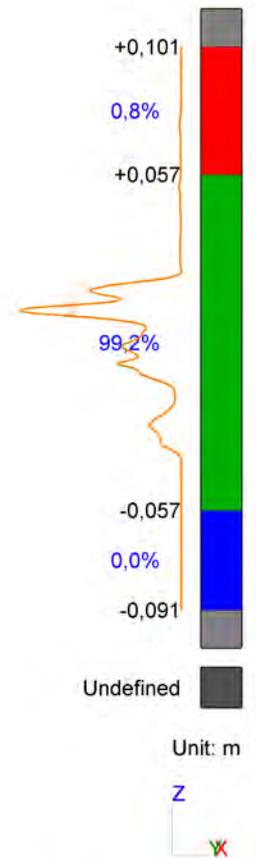
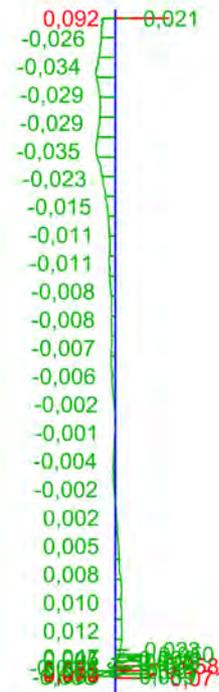
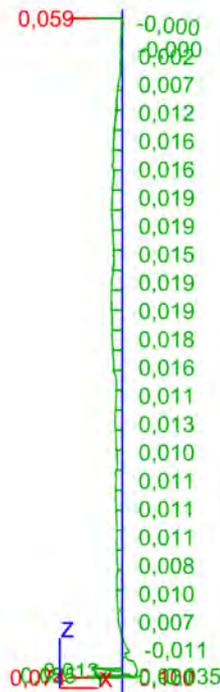
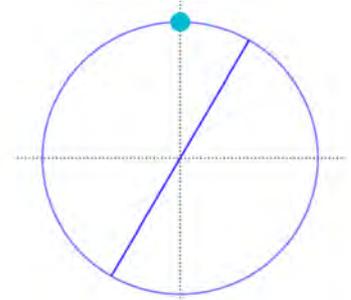
Customer: Customer  
Date: 18/07/2025

### Section 150,000°

Minimum radius: 9,119 m  
Maximum radius: 9,257 m  
Average radius: 9,166 m

### Section 330,000°

Minimum radius: 9,117 m  
Maximum radius: 9,257 m  
Average radius: 9,173 m



1 : 135 | 2 m

Deviation magnification x9,552

## Test Report - Laser Scanner 3d

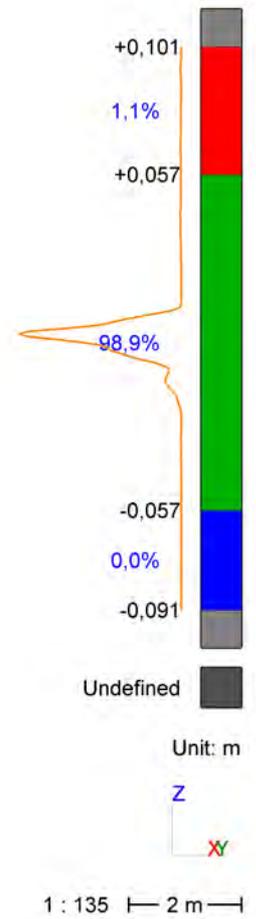
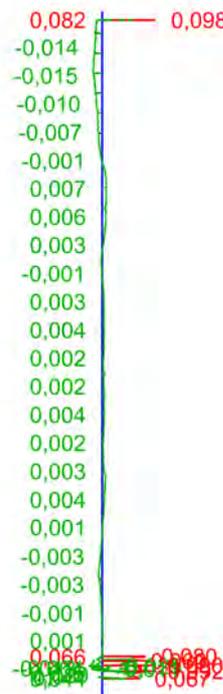
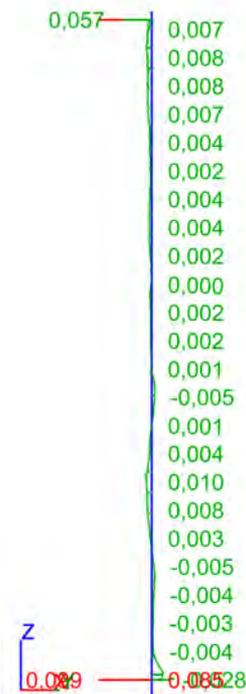
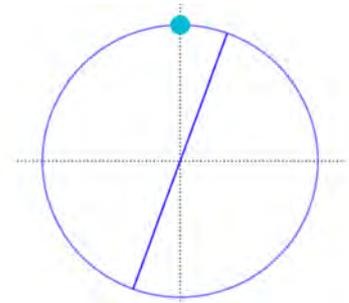
Customer: Customer  
Date: 18/07/2025

### Section 160,000°

Minimum radius: 9,115 m  
Maximum radius: 9,256 m  
Average radius: 9,140 m

### Section 340,000°

Minimum radius: 9,131 m  
Maximum radius: 9,257 m  
Average radius: 9,190 m



Deviation magnification x9,552

## Test Report - Laser Scanner 3d

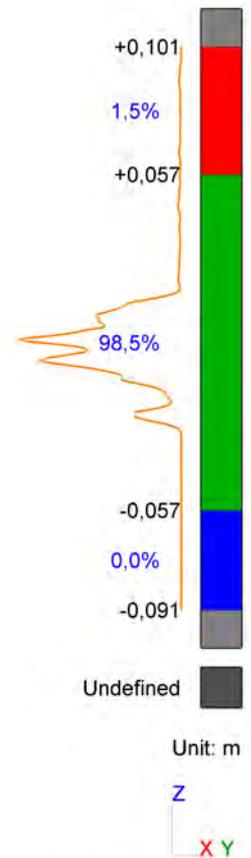
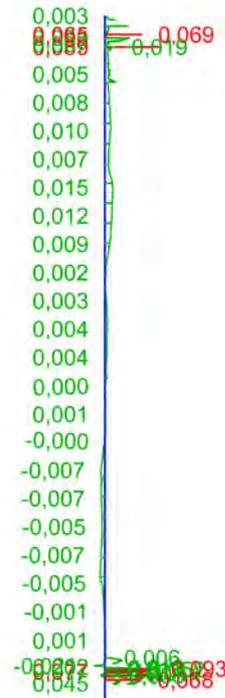
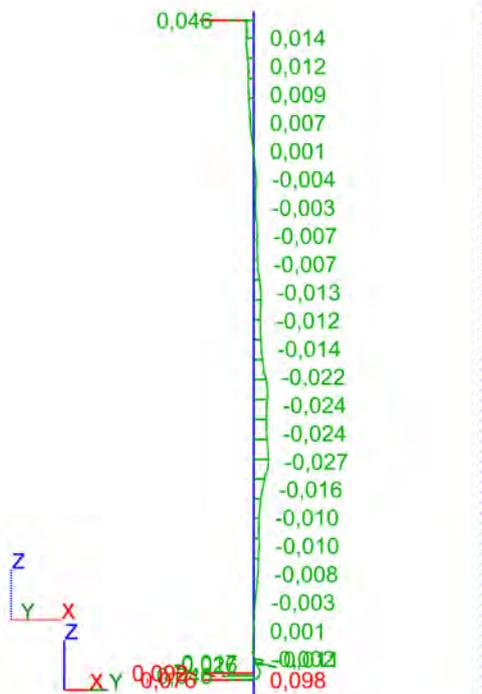
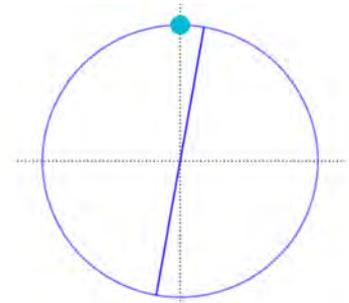
Customer: Customer  
Date: 18/07/2025

### Section 170,000°

Minimum radius: 9,113 m  
Maximum radius: 9,257 m  
Average radius: 9,164 m

### Section 350,000°

Minimum radius: 9,135 m  
Maximum radius: 9,257 m  
Average radius: 9,193 m



1 : 135 | 2 m

Deviation magnification x9,552

## Test Report - Laser Scanner 3d

Customer: Customer  
Date: 18/07/2025

