

ECHO - LOG

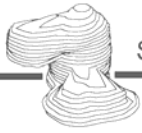
Harlingen BAS 4

3. survey (partial survey)

30.09.2008

081 608





**Results of the Cavity Survey
by means of Echo-Sounding
in the cavity**

Harlingen BAS 4

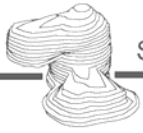
Date: 30.09.2008

Report No.: 081608

Customer: FRISIA Zout B.V.

Responsible for the survey:

Surveyor :
Leadership :
Interpreter :
Control :



Contents

Summary of results

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Diameter and radii (diagrams and lists)

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Logs



Summary of results

Well details

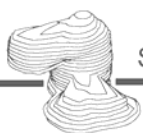
All depths are given as:	MD
Datum level for all depths:	surface
Shoe of the cemented 13 3/8"-casing:	2410.0 m
Shoe of the 11 3/4"- casing during the surveying:	2572.0 m
Shoe of the 7"- casing during the surveying:	2709.0 m
Reference depth for ECHO-LOG:	2410.0 m
Applied depth correction:	-2.6 m
Pressure at the cavity head:	71.0 bar

Details of survey equipment

Measuring vehicle used:	L 103
Tools used:	Echo tool BSE 13, BSE 13

General details

Number of runs:	2
Measured horizontal sections:	7
Measured tilted sections:	0
Lowest survey depth:	2574.0 m

**Maximum and minimum dimensions with ref. to the measuring axis****Reference direction:****magnetic north**

Determination out of 12 vertical sections derived from horizontally and tilted measured data at 5 degree intervals:

minimum radius:	0.0 m
depth:	2580.2 m
direction:	0°

maximum radius:	20.1 m
depth:	2574.0 m
direction:	0°

highest point of cavity:	2560.0 m
horizontal distance:	7.7 m
direction:	0°

lowest point of cavity:	2580.2 m
horizontal distance:	0.0 m
direction:	345°

lowest point in the measuring axis:	2580.2 m
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Determination out of 7 horizontal sections in the depths between 2560.0 m and 2574.0 m at 5° degree intervals:

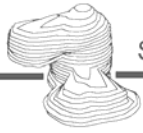
maximum radius:	20.4 m
depth:	2574.0 m
direction:	4°

maximum diameter:	38.5 m
depth:	2574.0 m
direction:	218 - 38°

Volume

volume:	7043.1 m³
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depth range:	2560.0 m <--> 2574.0 m
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Survey through the wall of the 11 3/4" and 7" - casing

Between 2560.0 m to 2574.0 m the shape of the cavity was determined by means of echo sounding through the wall of the casing. The directional orientation of these horizontal sections are not orientated.

Interpretation

In the case of recording several echoes along one trace of echo signals, the representative echo signal was selected according to the level of amplitude, transmission time, density of measured points and the shape of the cavity.

Horizontal sections

7 horizontal sections at following measured depths are included as graphical plots in this report:

2560.0 m 2562.5 m 2565.0 m 2567.0 m 2570.0 m 2572.5 m 2574.0 m

Tilted sections

0 sections recorded with tilted echo-transducer at following measured depths are presented in the vertical sections:

Vertical sections

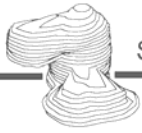
The shape of the cavity was determined by interpretation of all horizontally and tilted measured data and is presented by 12 vertical sections in this report.

Maximum plots (top view)

The maximum plot presents the largest extension of the cavity in a top view. The first picture shows the areas of all horizontal sections and the area resulting out of the vertical sections (hatched). The resulting total area is shown in the second picture (cross hatching) together with the largest single area.

In both pictures the total centre of gravity of the cavity is shown with its distance and its direction referring to the measuring axis.

The total centre of gravity is derived out of the envelope, which is the connection line of the largest cavity extension in every direction

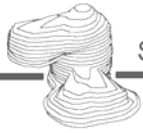
**Comparison with previously measured data**

If there are data of previous surveys available these are presented with a different line style to mark out for changes.

LOG - Data

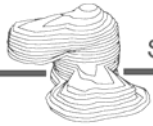
You will find the graphic representations of the following LOG data at the end of this report:

Parameter	from	to
Temperature:	2300.3 m	2577.1 m
CCL:	2300.0 m	2276. 9 m
Gamma-ray:	2300.0 m	2576.8 m



LEGEND

-  Measured point recorded with horizontal adjusted ultrasonic transducer
-  Measured point recorded with tilted or vertical orientated ultrasonic transducer
-  Interpolated point derived from the vertical sections
-  Connection line between two measured points in order to calculate the volume
-  Assumed connection line (in areas which are not sufficiently covered by measured points)
- N** Magnetic north determined with compass inside the tool
(magnetic compass in areas without tubing)
(fibre gyro compass in areas with tunings)
- (N)** Assumed north direction (for sections in magnetic disturbed surroundings without fibre gyro compass)
- a** Longest extension in section
(without considering of hidden leached pockets)
- b** Longest extension in section perpendicular to a
(without considering of hidden leached pockets)
- a/b** Ratio of longest extensions in section which are perpendicular to each other
- (+ xx m²)** Area in actual section resulting from hidden leached pockets
- r~** Average radius



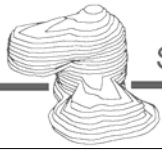
Volume list

Cavity: Harlingen BAS 4

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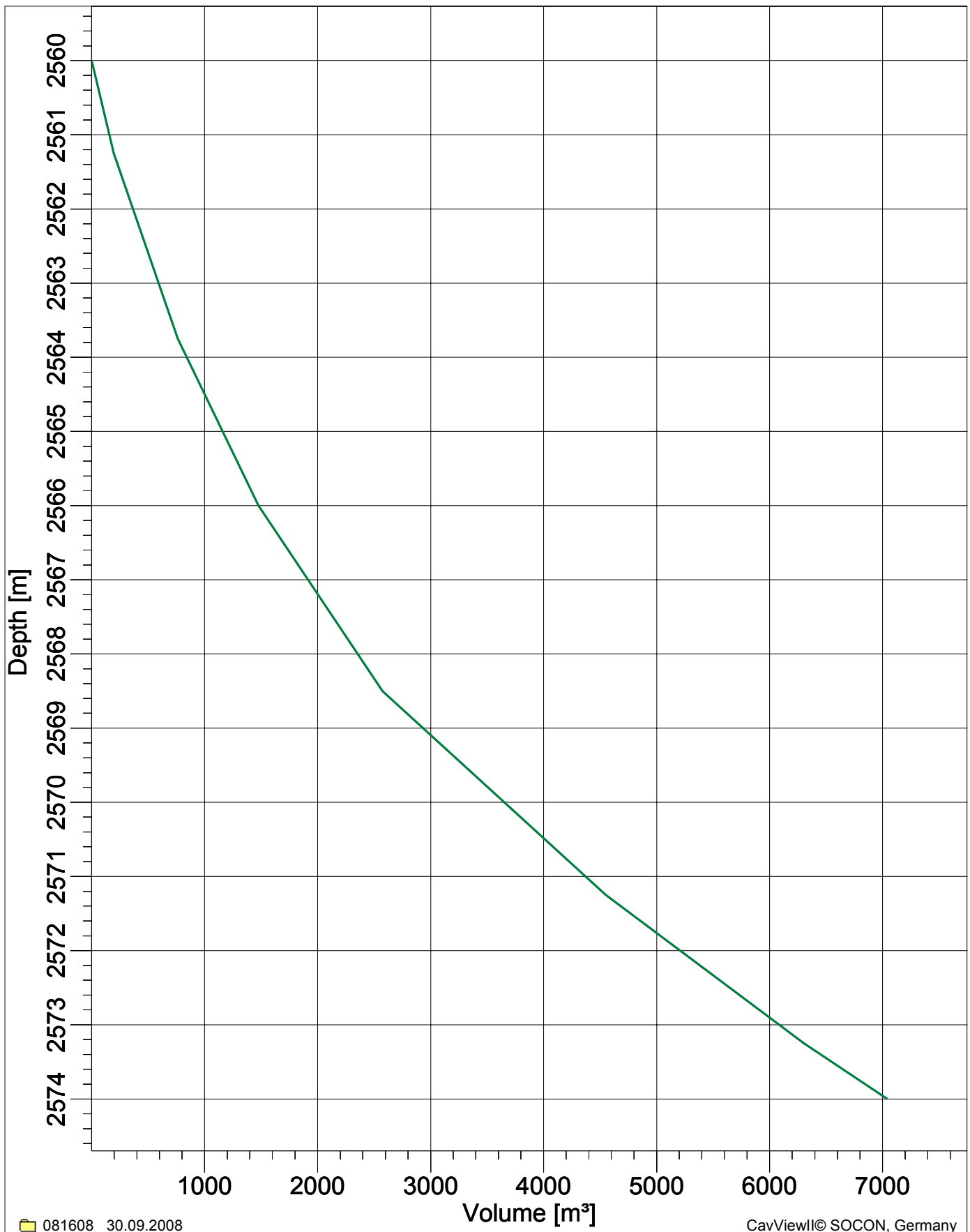
Depth [m]	Radius [m]	Area [m ²]	Depth range [m]		Volume [m ³]	
			from	to	partial	total
2560.0	7.1	156.6	2560.00	2561.25	195.7	195.7
2562.5	8.5	227.0	2561.25	2563.75	567.4	763.2
2565.0	10.0	316.6	2563.75	2566.00	712.4	1475.6
2567.0	11.8	439.5	2566.00	2568.50	1098.8	2574.3
2570.0	15.1	717.8	2568.50	2571.25	1973.9	4548.2
2572.5	16.7	877.3	2571.25	2573.25	1754.7	6302.8
2574.0	17.7	987.0	2573.25	2574.00	740.3	7043.1



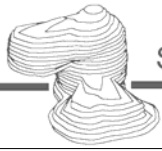
Harlingen BAS 4

TOTAL VOLUME

30.09.2008



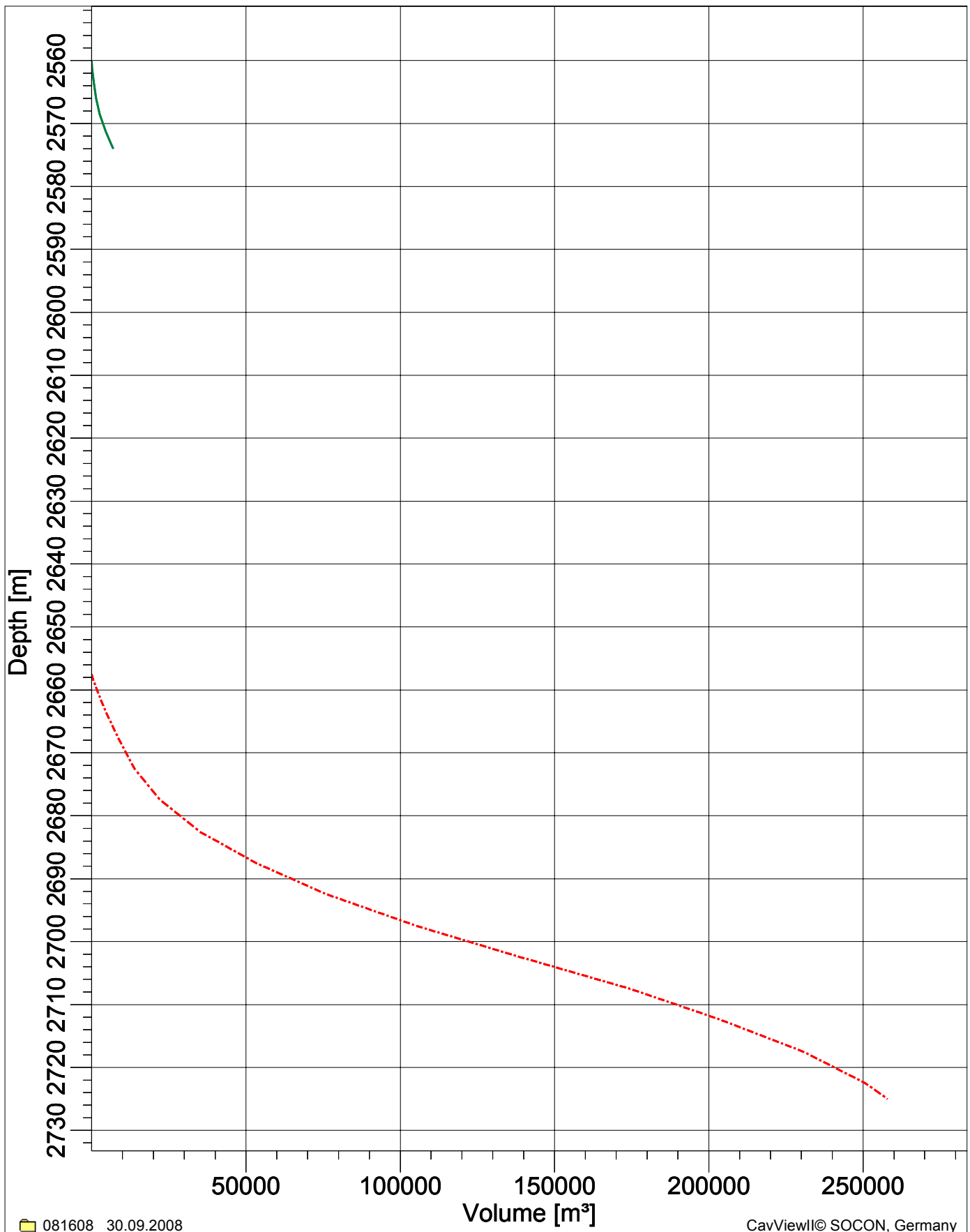
— Total volume = 7043.1 m³



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TOTAL VOLUME

30.09.2008

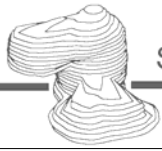


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— Total volume = 7043.1 m³

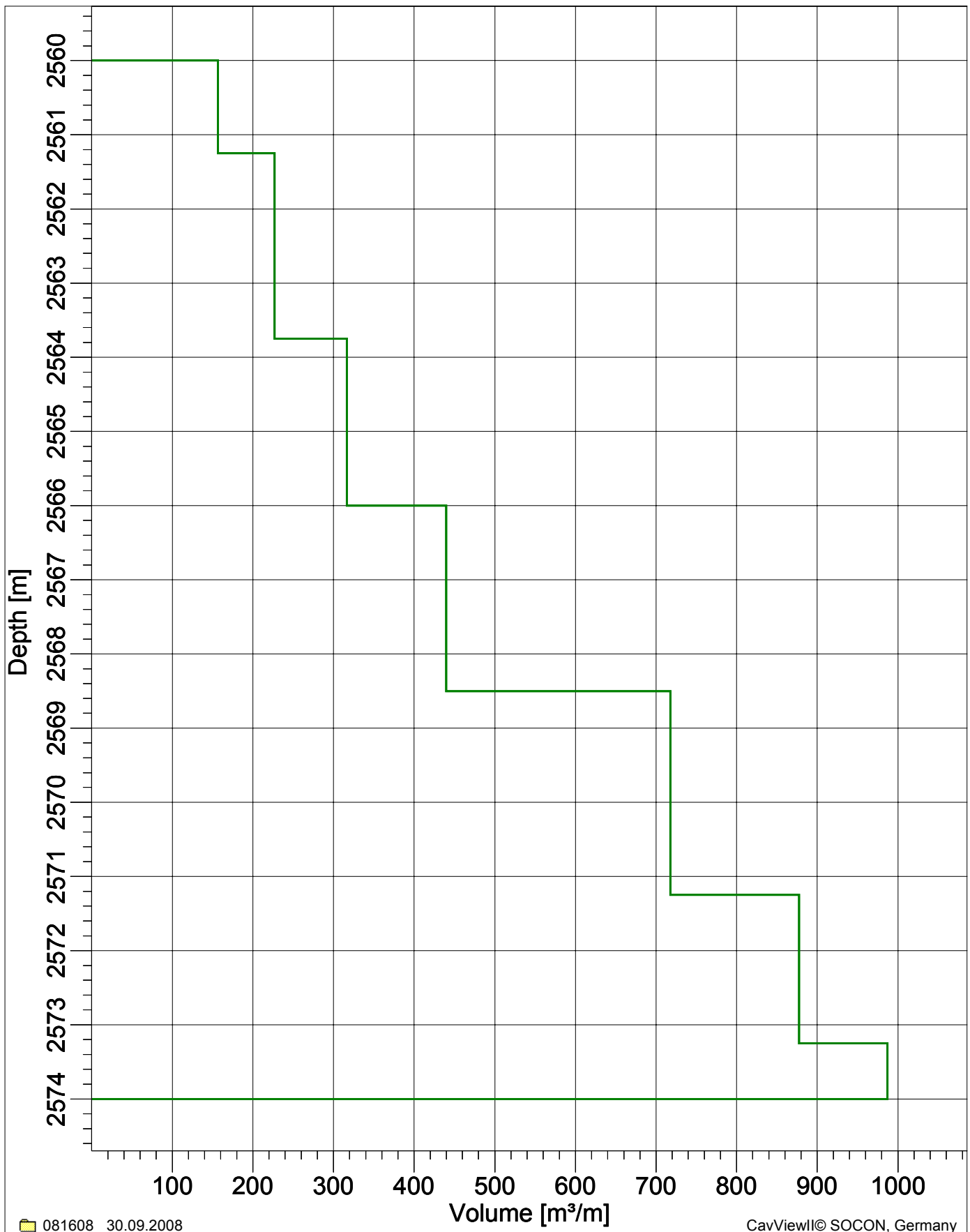
- - - Total volume = 257907.7 m³ (24.08.2007)



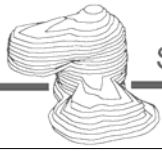
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PARTIAL VOLUME

30.09.2008



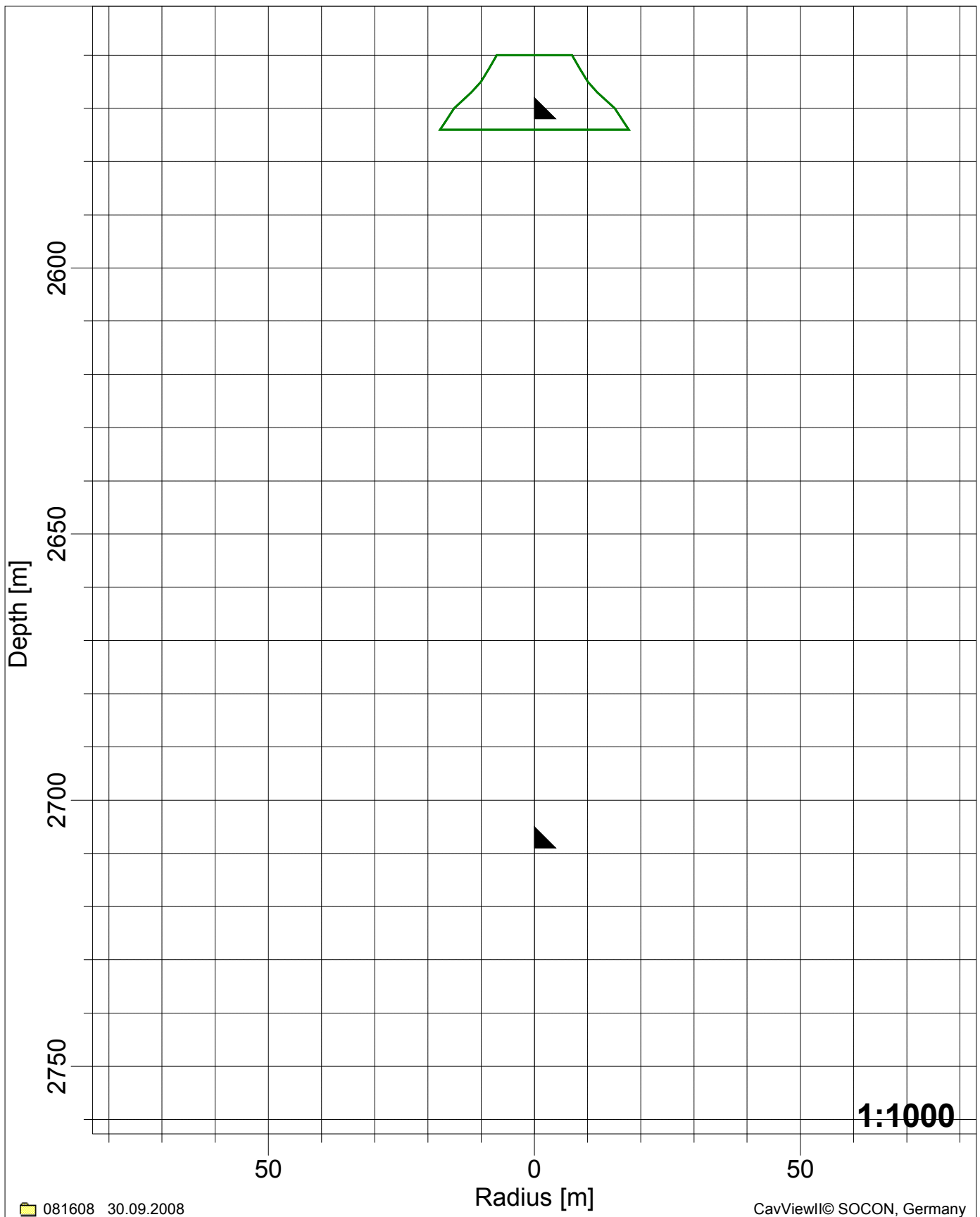
Partial volume



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AVERAGE RADIUS

30.09.2008

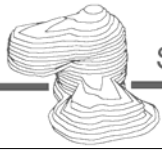


13 3/8" : 2410.0 m

11 3/4" : 2572.0 m

7" : 2709.0 m

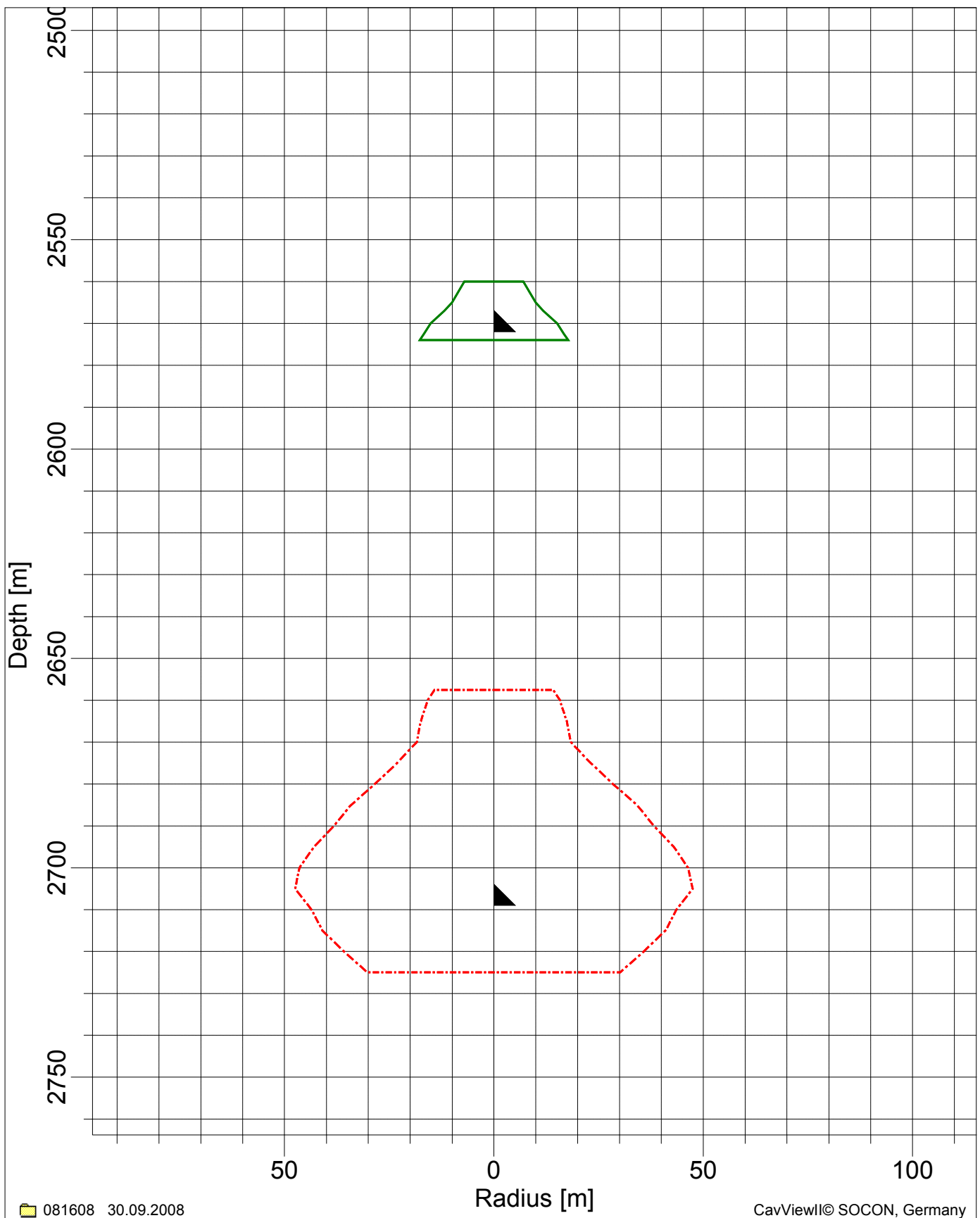
Average radius (30.09.2008)



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AVERAGE RADIUS

30.09.2008



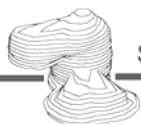
▲ 13 3/8" : 2410.0 m

▲ 11 3/4" : 2572.0 m

▲ 7" : 2709.0 m

— Average radius (30.09.2008)

- - - Average radius (24.08.2007)



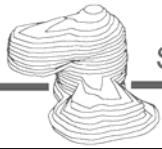
Radien- und Durchmessertabelle

Cavity: Harlingen BAS 4

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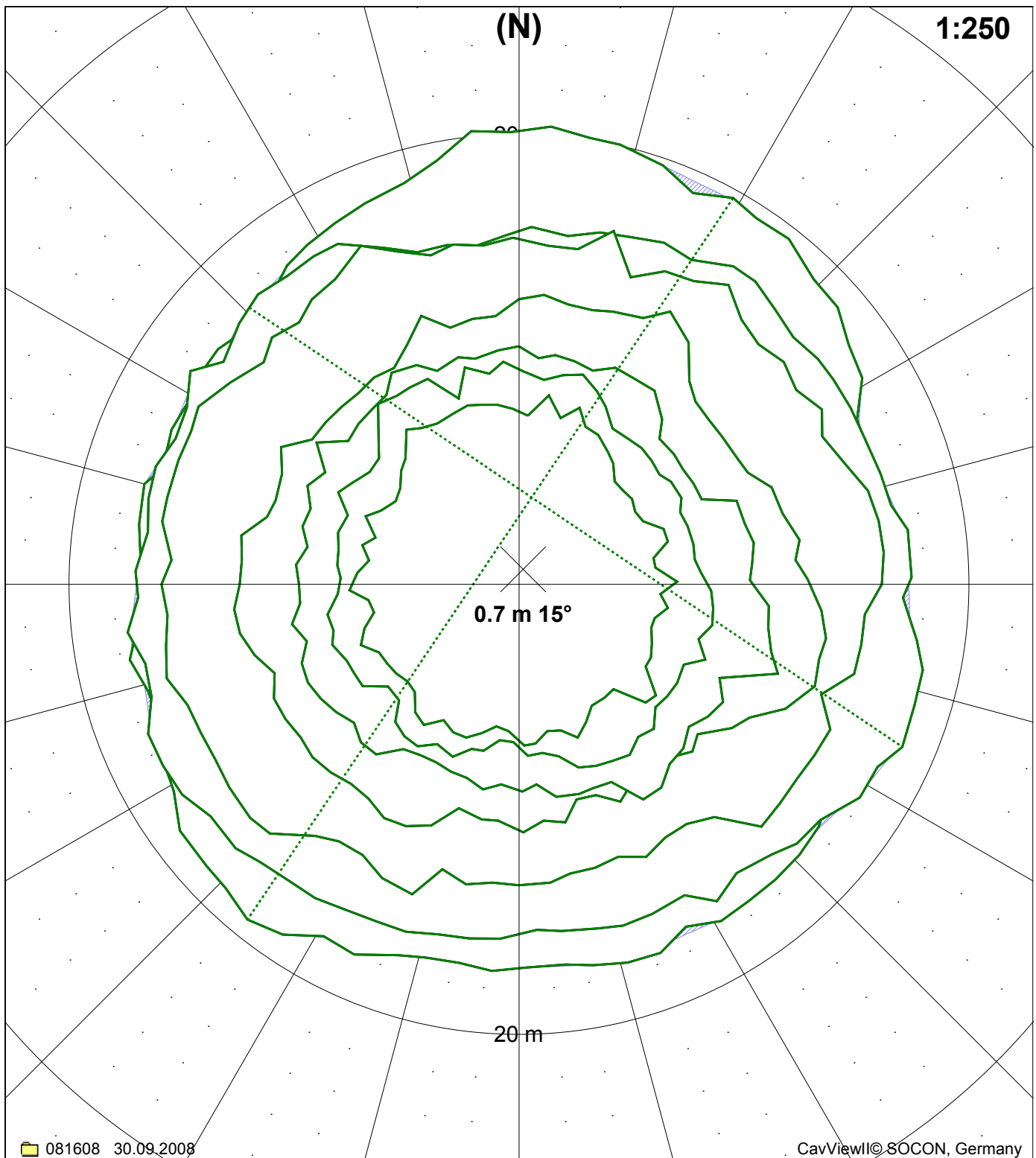
Tiefe [m]	Radius [MIN]		Radius [MAX]		Durchmesser [MIN]		[MAX]	
	[m]	[°]	[m]	[°]	[m]	[°]	[m]	[°]
2560.0	6.1	58	8.5	9	12.6	79 <-> 259	15.5	19 <-> 199
2562.5	7.0	187	10.2	322	15.3	52 <-> 232	19.0	147 <-> 327
2565.0	8.7	205	12.2	109	18.6	50 <-> 230	22.0	109 <-> 289
2567.0	9.9	165	13.9	109	21.2	150 <-> 330	26.4	100 <-> 280
2570.0	12.9	160	16.6	335	28.2	165 <-> 345	32.2	75 <-> 255
2572.5	15.2	353	18.5	113	30.7	173 <-> 353	35.3	108 <-> 288
2574.0	15.8	107	20.4	4	32.5	108 <-> 288	38.5	38 <-> 218



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MAXPLOT

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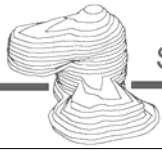
Vertical maximum plot

Horizontal sections

a/b

Center of gravity

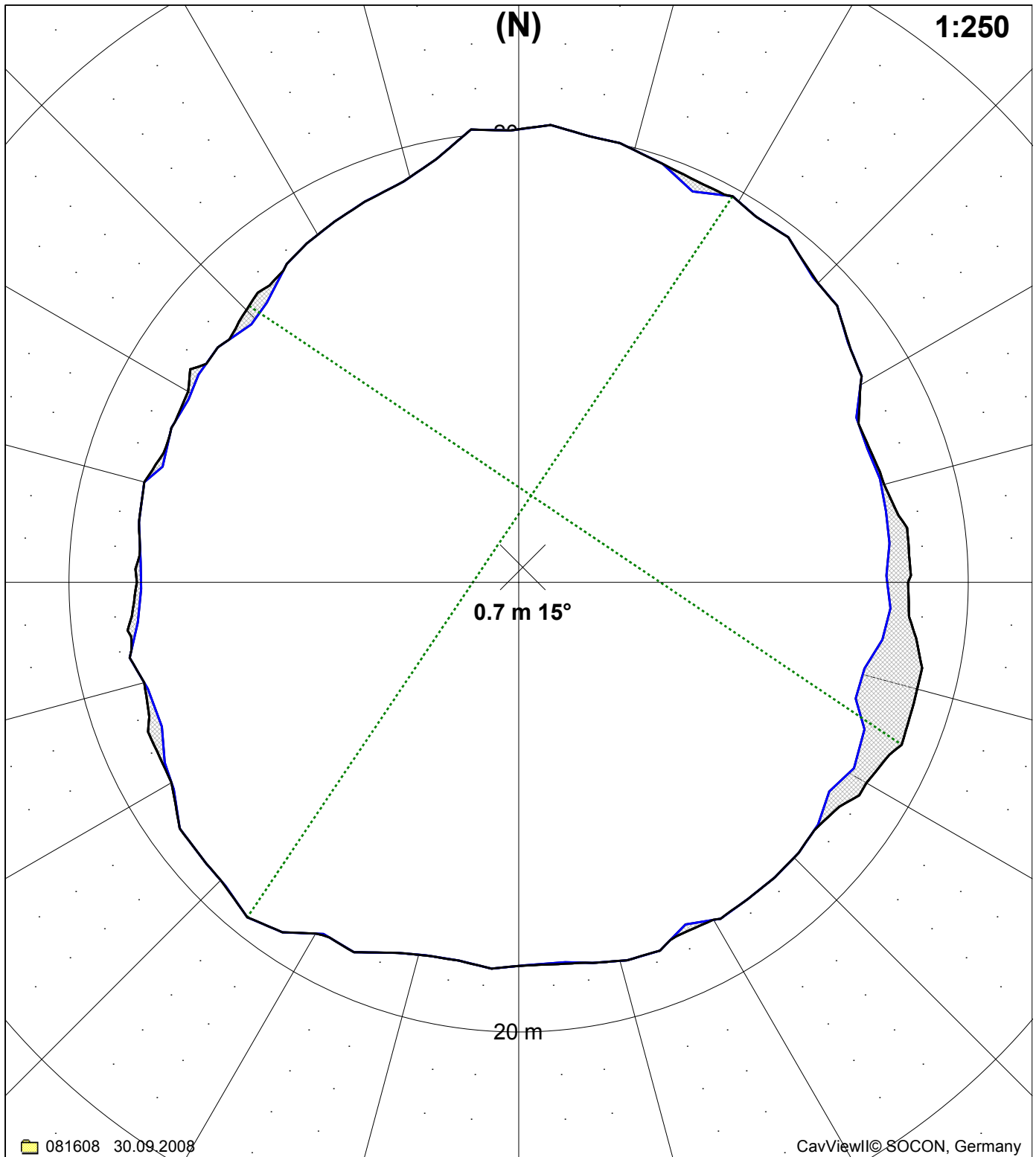
 $d_{\max}: 38.5 \text{ m } 218^\circ \leftrightarrow 38^\circ \quad r_{\min}: 16.7 \text{ m } \rightarrow 66^\circ \quad r_{\sim}: 17.9 \text{ m} \quad r_{\max}: 20.4 \text{ m } \rightarrow 4^\circ$ $a/b = 1.105 \quad a = 38.6 \text{ m } (28^\circ\text{-}219^\circ) \quad b = 35.0 \text{ m } (112^\circ\text{-}315^\circ)$ Area from vertical sections: 1002 m², Area from horizontal and vertical sections: 1011 m²



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MAXPLOT

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a/b

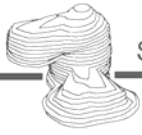
Center of gravity

Horizontal/vertical maximum plot

Largest single area

Horizontal/vertical maximum plot (24.08.2007)

 $d_{\max}: 38.5 \text{ m } 218^\circ \leftrightarrow 38^\circ$ $r_{\min}: 16.7 \text{ m } \rightarrow 66^\circ$ $r_{\sim}: 17.9 \text{ m}$ $r_{\max}: 20.4 \text{ m } \rightarrow 4^\circ$ $a/b = 1.105$ $a = 38.6 \text{ m } (28^\circ-219^\circ)$ $b = 35.0 \text{ m } (112^\circ-315^\circ)$ Largest single area: 987 m² in depth: 2574.0 m, Area from horizontal and vertical sections: 1011 m²



HORIZONTAL SECTIONS

Cavity: Harlingen BAS 4

Report No.: 081 608

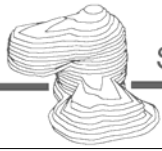
Utilized speed of sound.: 1830.0 m/s

Measuring date: 30.09.2008

Scale: 1 : 250

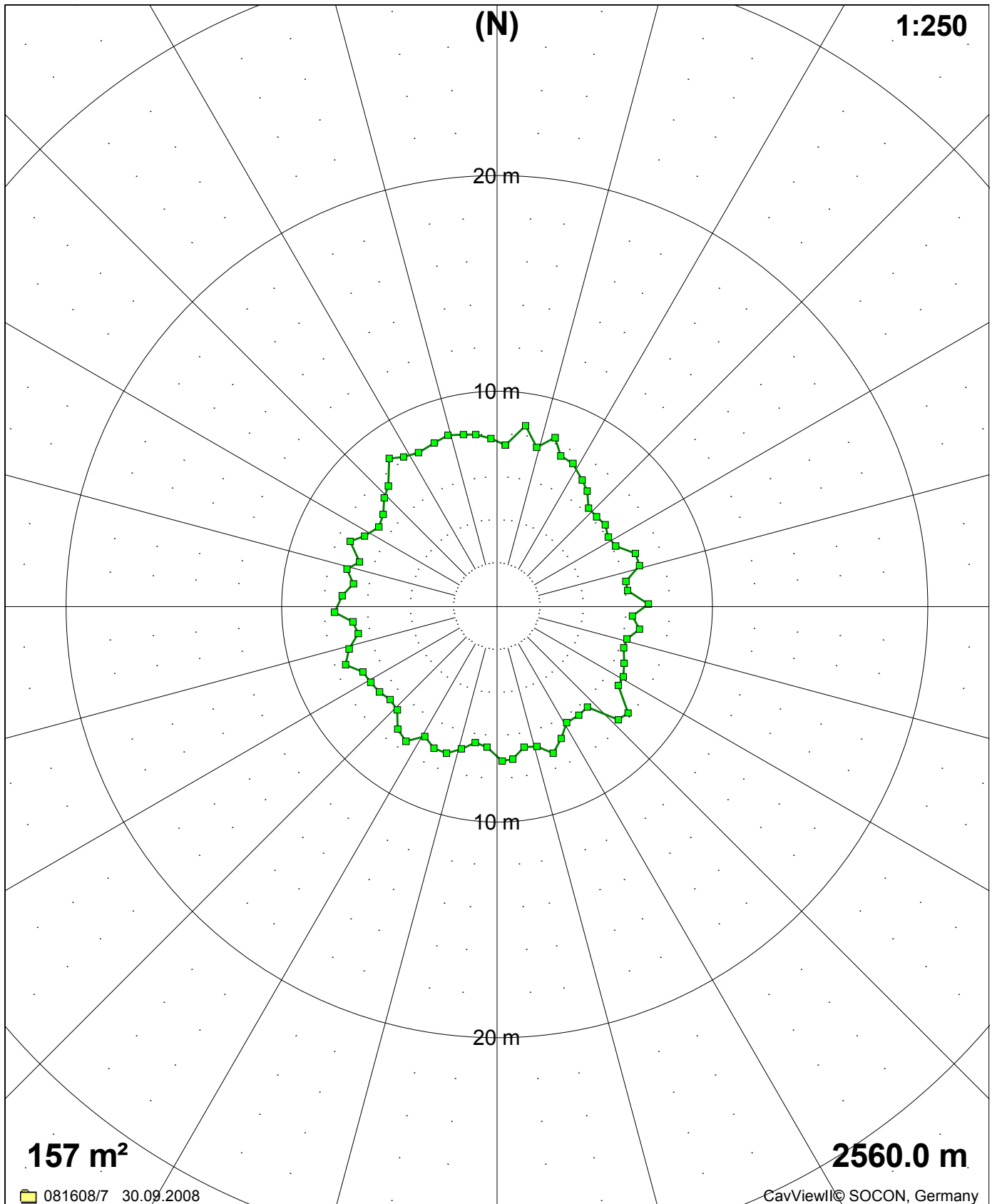
Horizontal sections measured at following depths:

2560.0 m 2562.5 m 2565.0 m 2567.0 m 2570.0 m 2572.5 m 2574.0 m



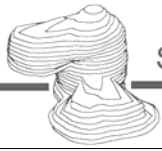
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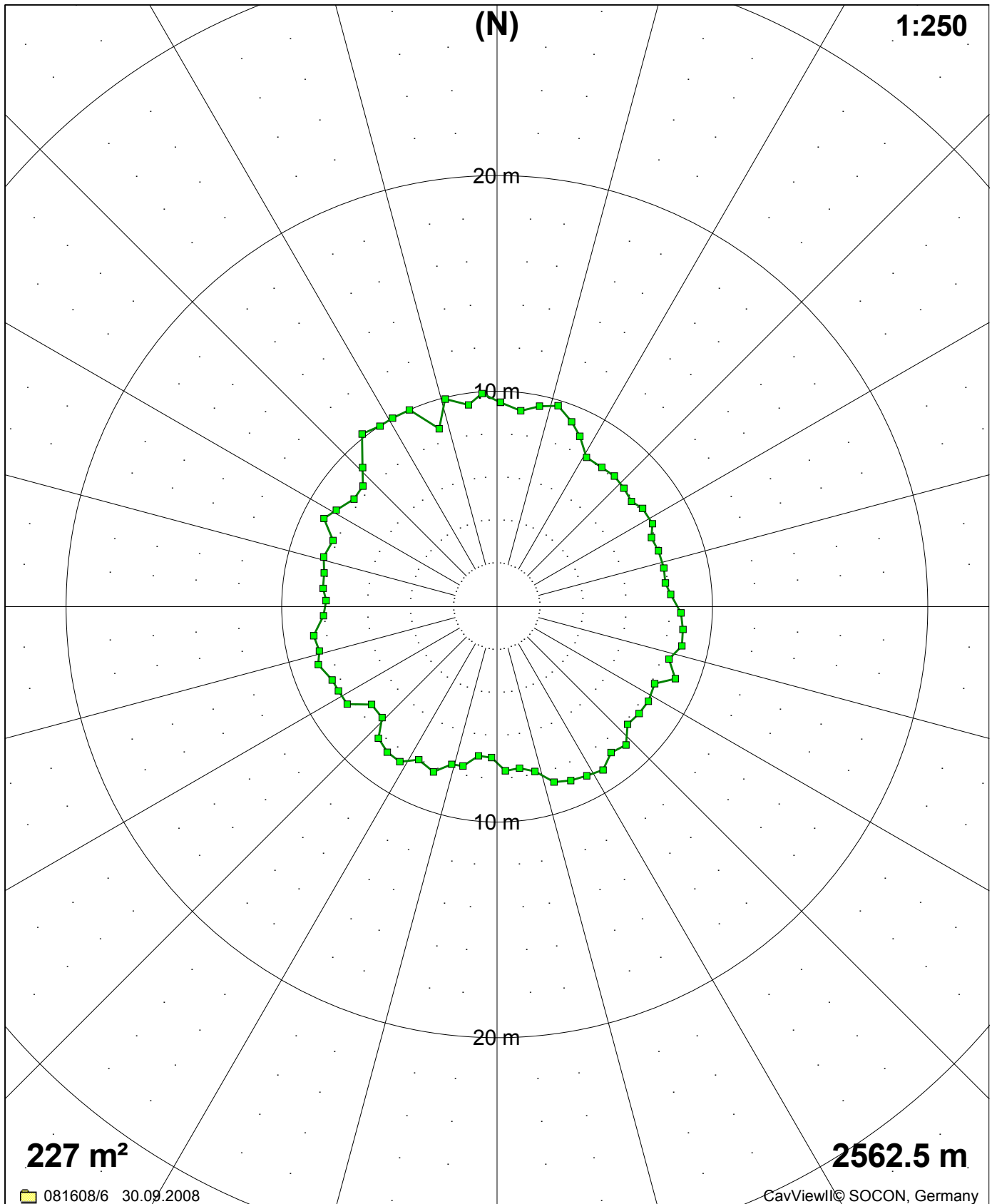
—■— (30.09.2008)

d_{max}: 15.5 m 19° <--> 199° r_{min}: 6.1 m -> 58° r~: 7.1 m r_{max}: 8.5 m -> 9°



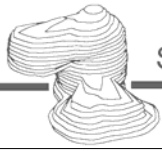
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30.09.2008



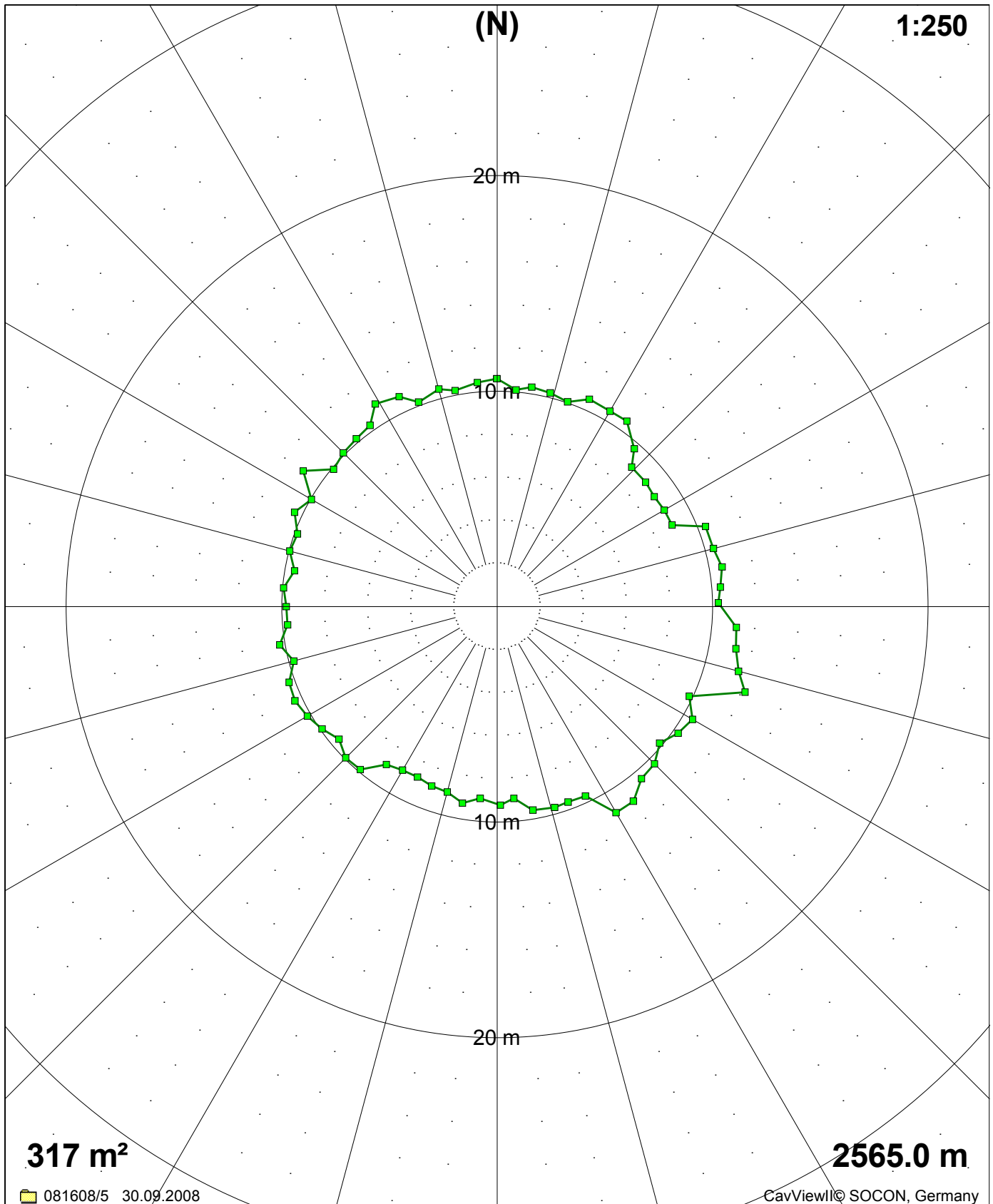
—■— (30.09.2008)

d_{max}: 19.0 m 147° <--> 327° r_{min}: 7.0 m -> 187° r~: 8.5 m r_{max}: 10.2 m -> 322°



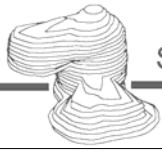
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30.09.2008



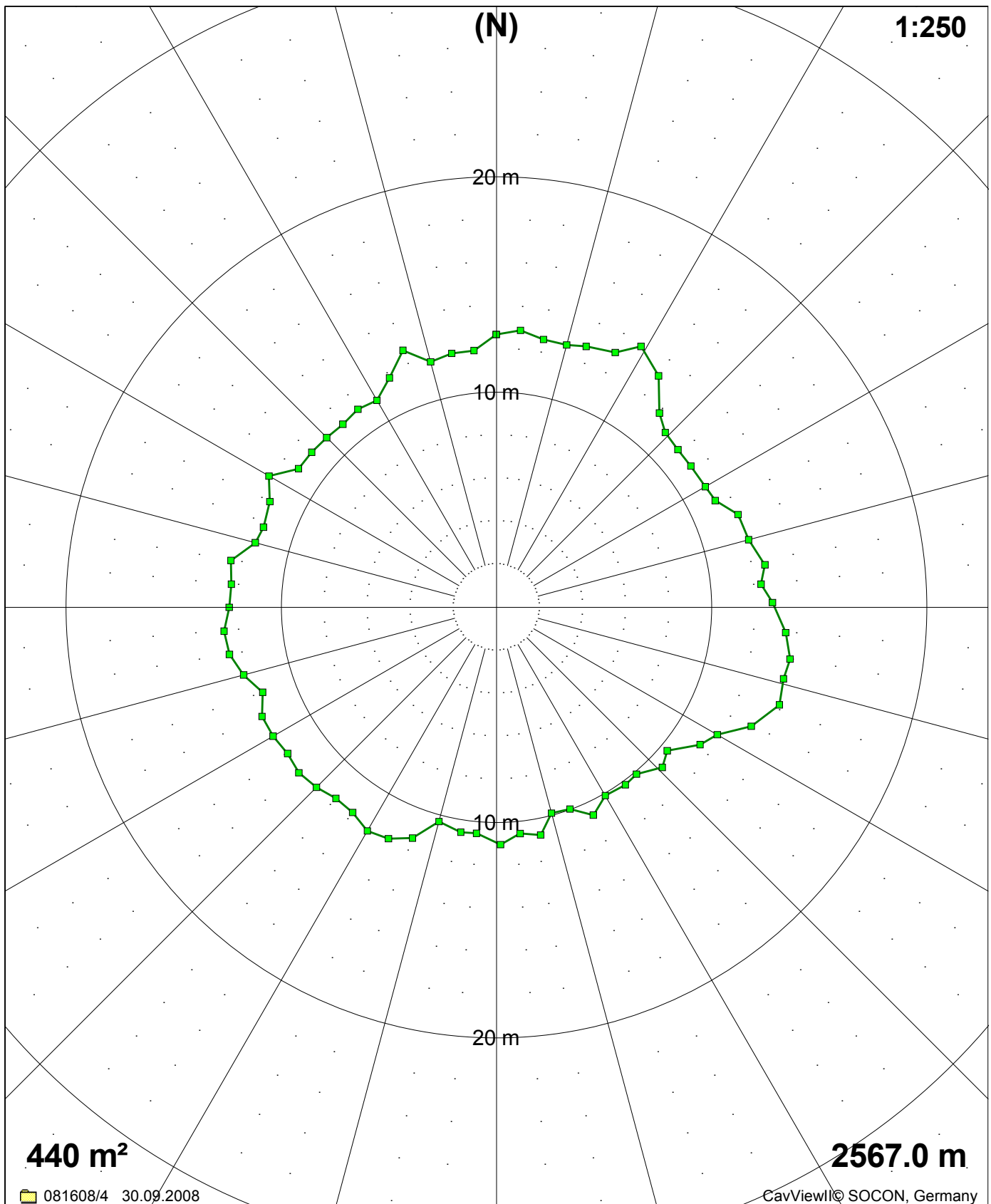
—■— (30.09.2008)

$d_{\max}$: 22.0 m 289° <--> 109° $r_{\min}$: 8.7 m -> 205° $r_{\sim}$: 10.0 m $r_{\max}$: 12.2 m -> 109°



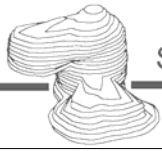
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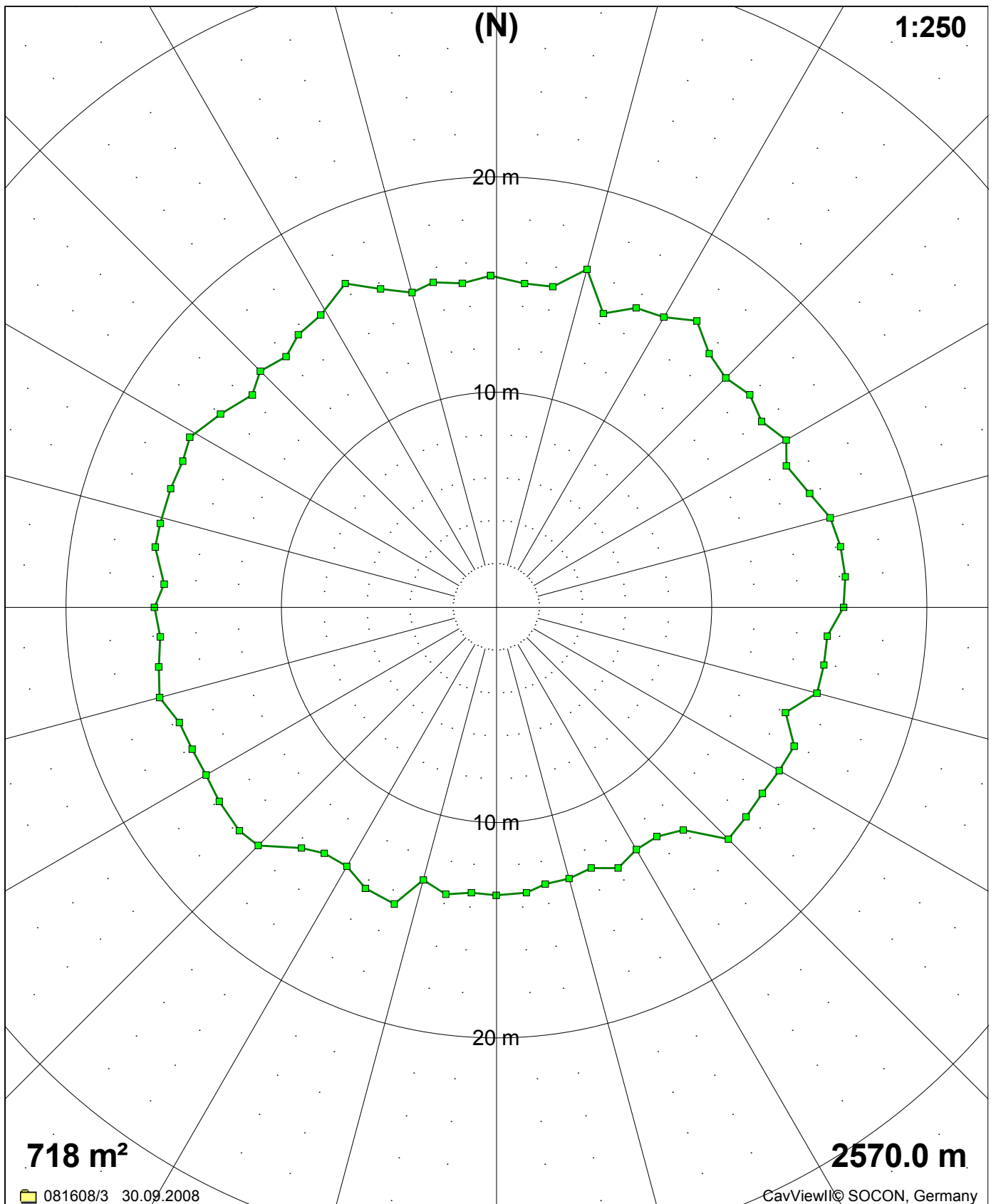
—■— (30.09.2008)

$d_{\max}$: 26.4 m 280° <--> 100° $r_{\min}$: 9.9 m -> 165° $r_{\sim}$: 11.8 m $r_{\max}$: 13.9 m -> 109°



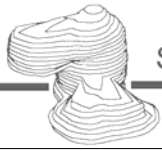
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30.09.2008



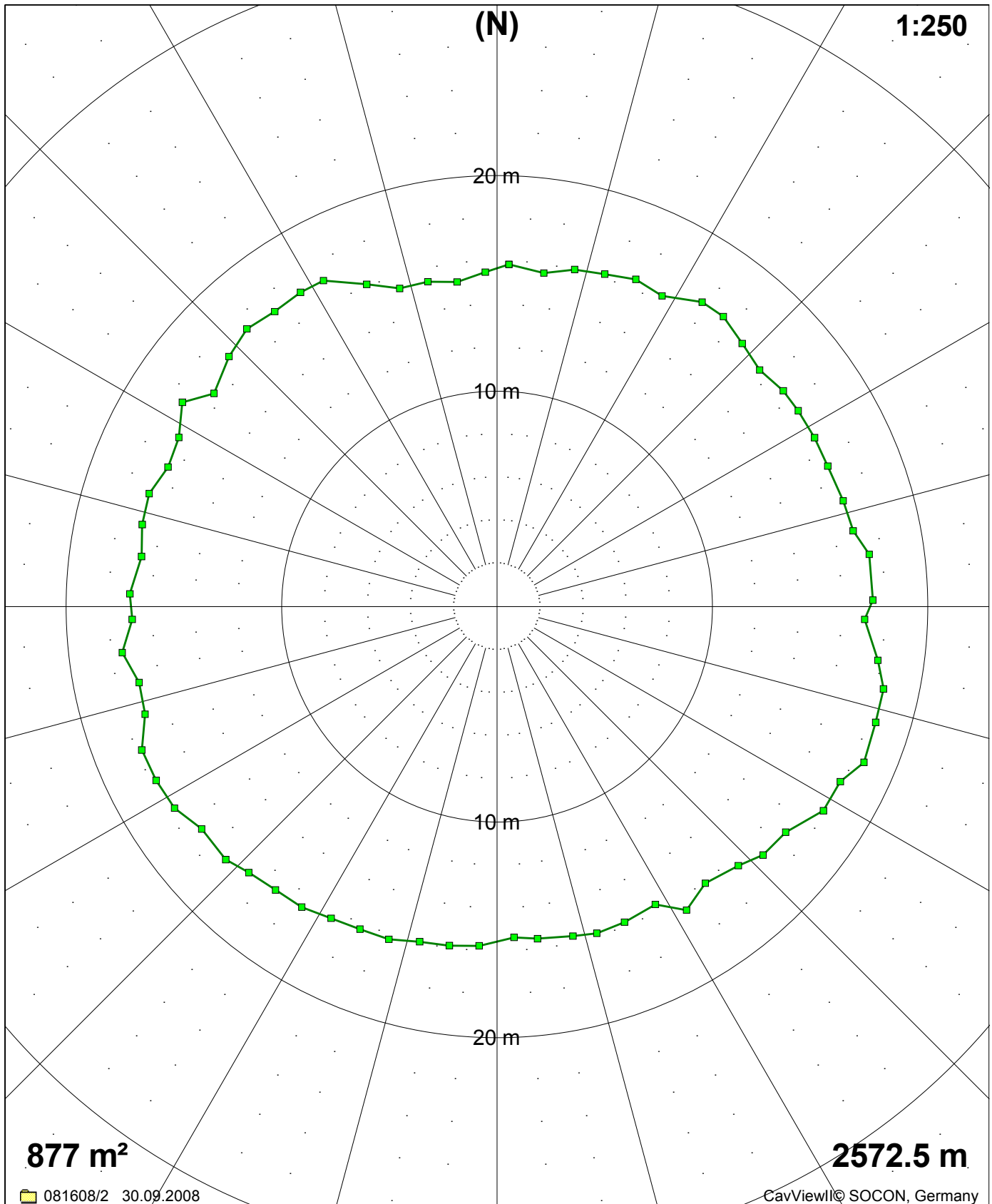
—■— (30.09.2008)

$d_{\max}$: 32.2 m 75° <--> 255° $r_{\min}$: 12.9 m -> 160° $r_{\sim}$: 15.1 m $r_{\max}$: 16.6 m -> 335°



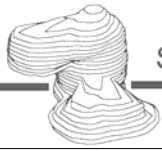
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30.09.2008



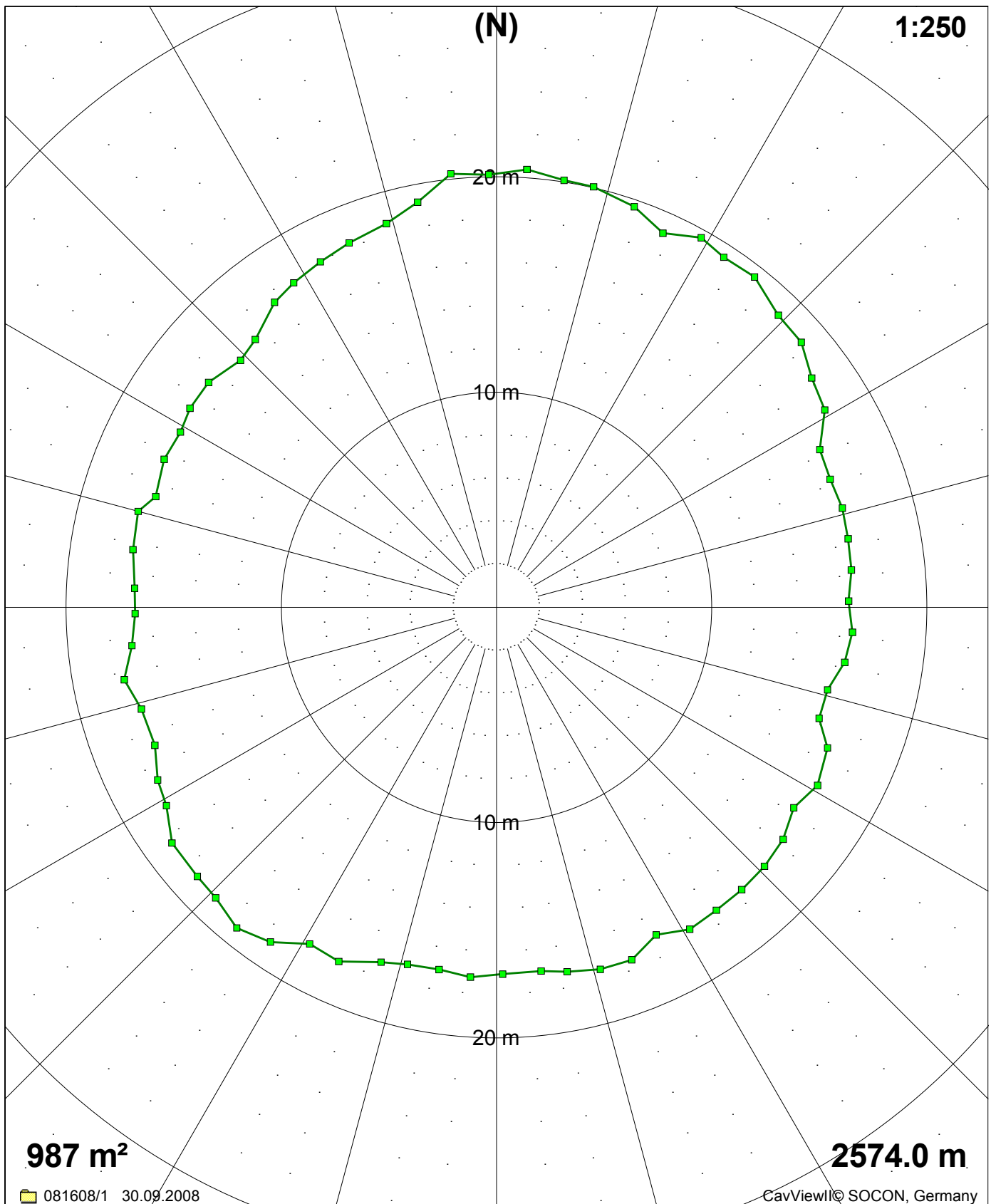
—■— (30.09.2008)

d_{max}: 35.3 m 288° <--> 108° r_{min}: 15.2 m -> 353° r~: 16.7 m r_{max}: 18.5 m -> 113°



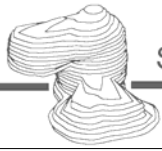
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30.09.2008



—■— (30.09.2008)

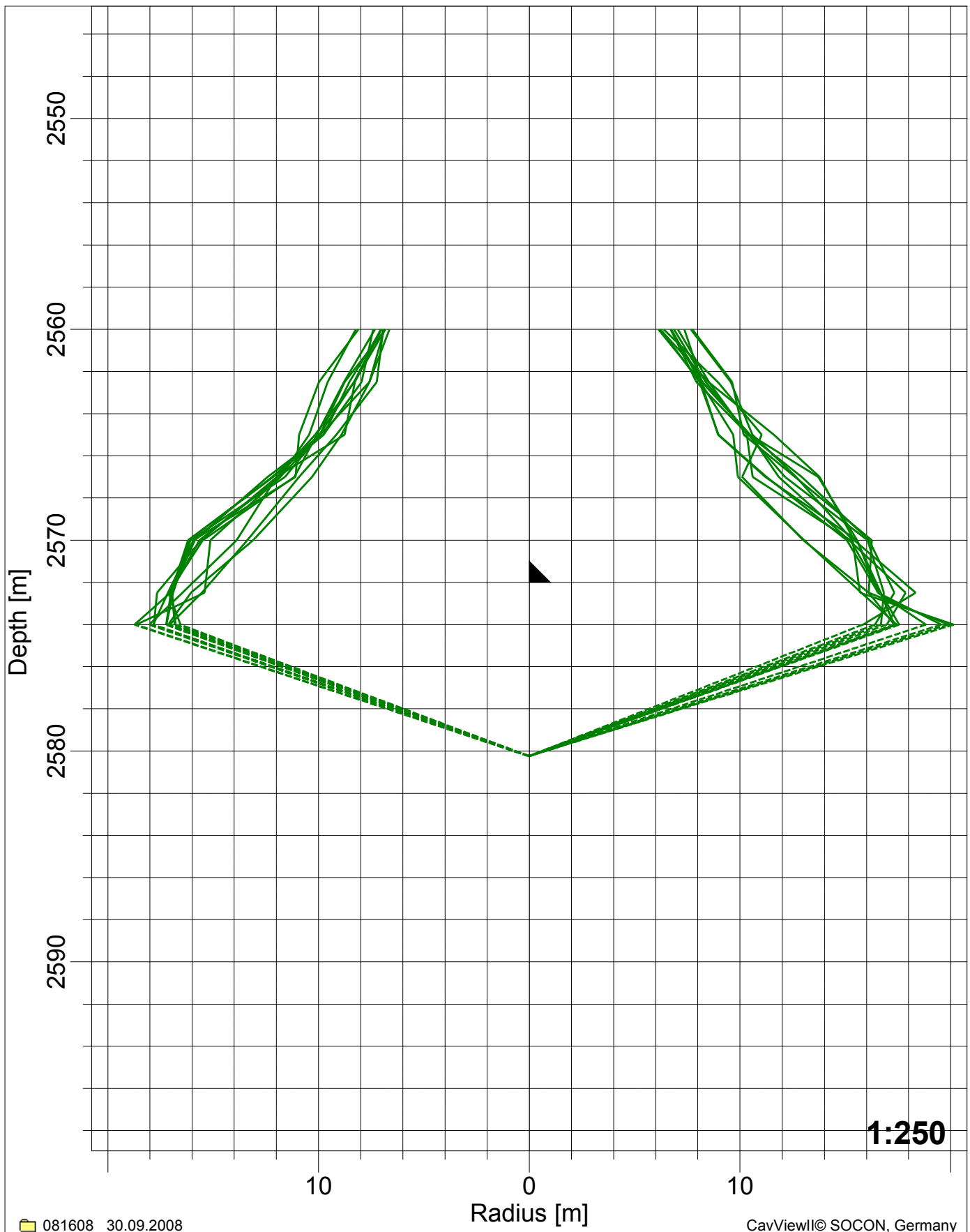
d_{max}: 38.5 m 218° <--> 38° r_{min}: 15.8 m -> 107° r~: 17.7 m r_{max}: 20.4 m -> 4°



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MAXPLOT

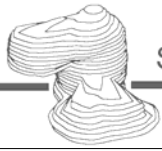
30.09.2008



13 3/8" : 2410.0 m

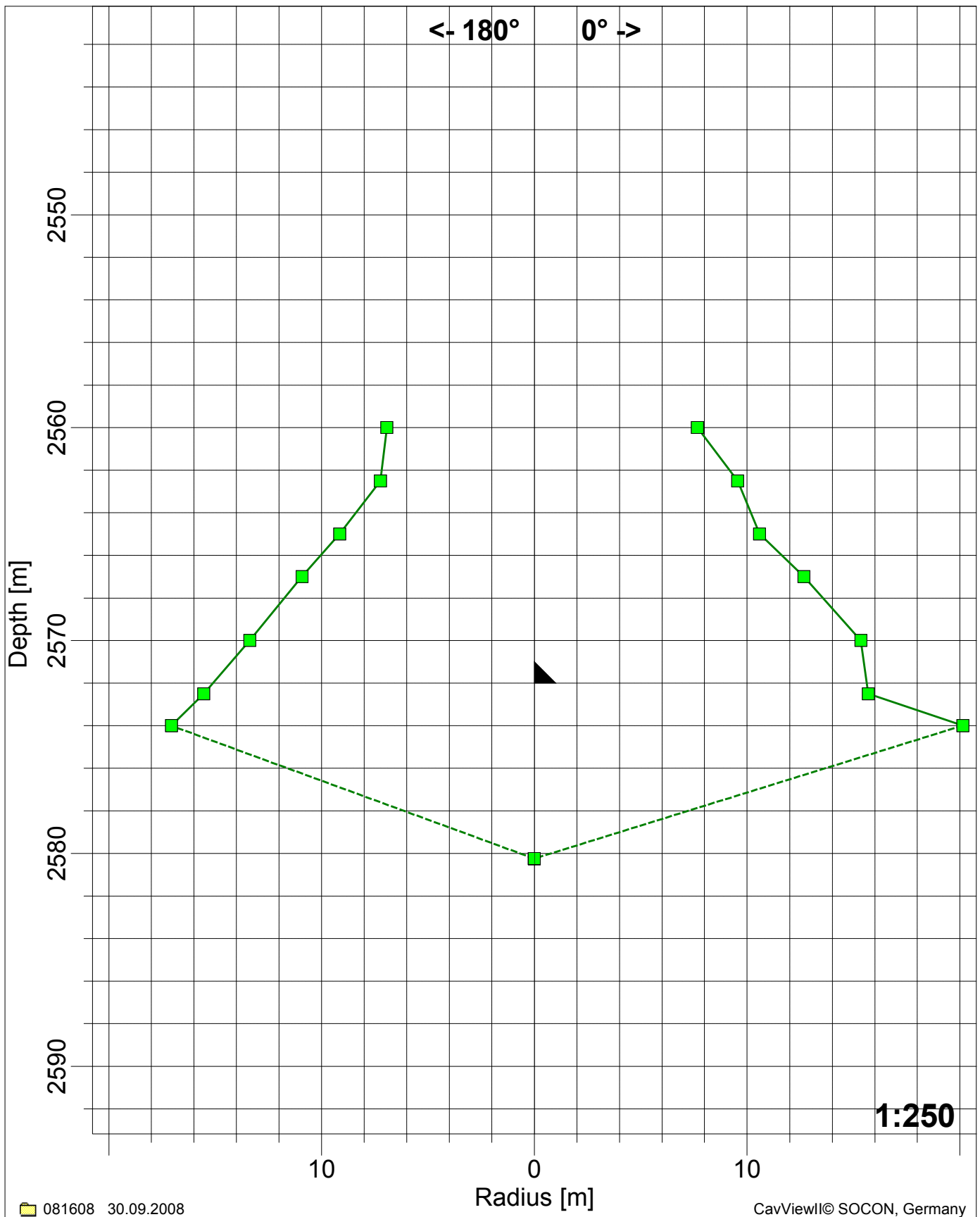
11 3/4" : 2572.0 m

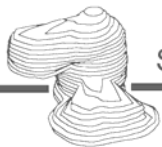
7" : 2709.0 m



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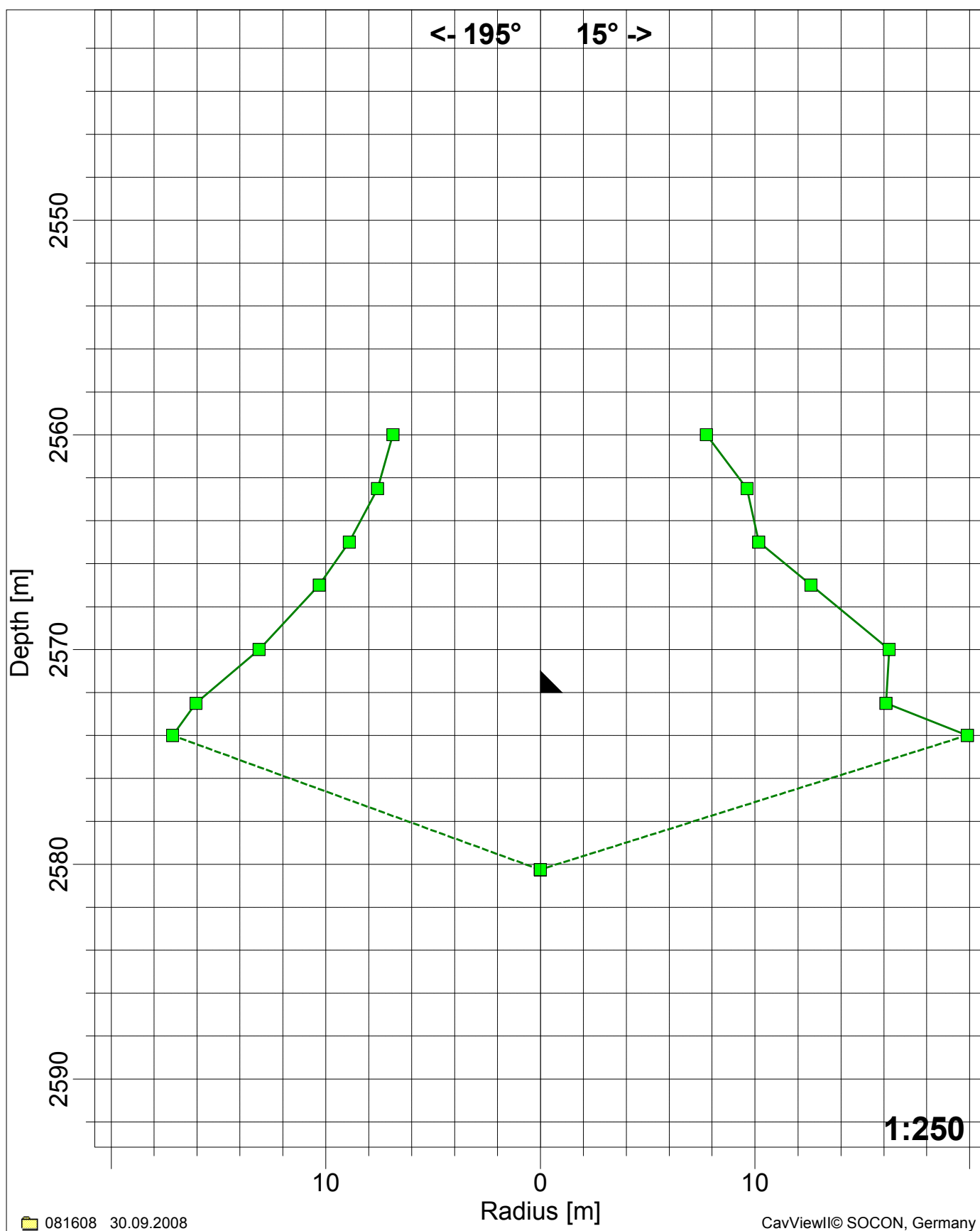
30.09.2008





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30.09.2008

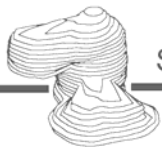


—■— (30.09.2008)

▲ 13 3/8" : 2410.0 m

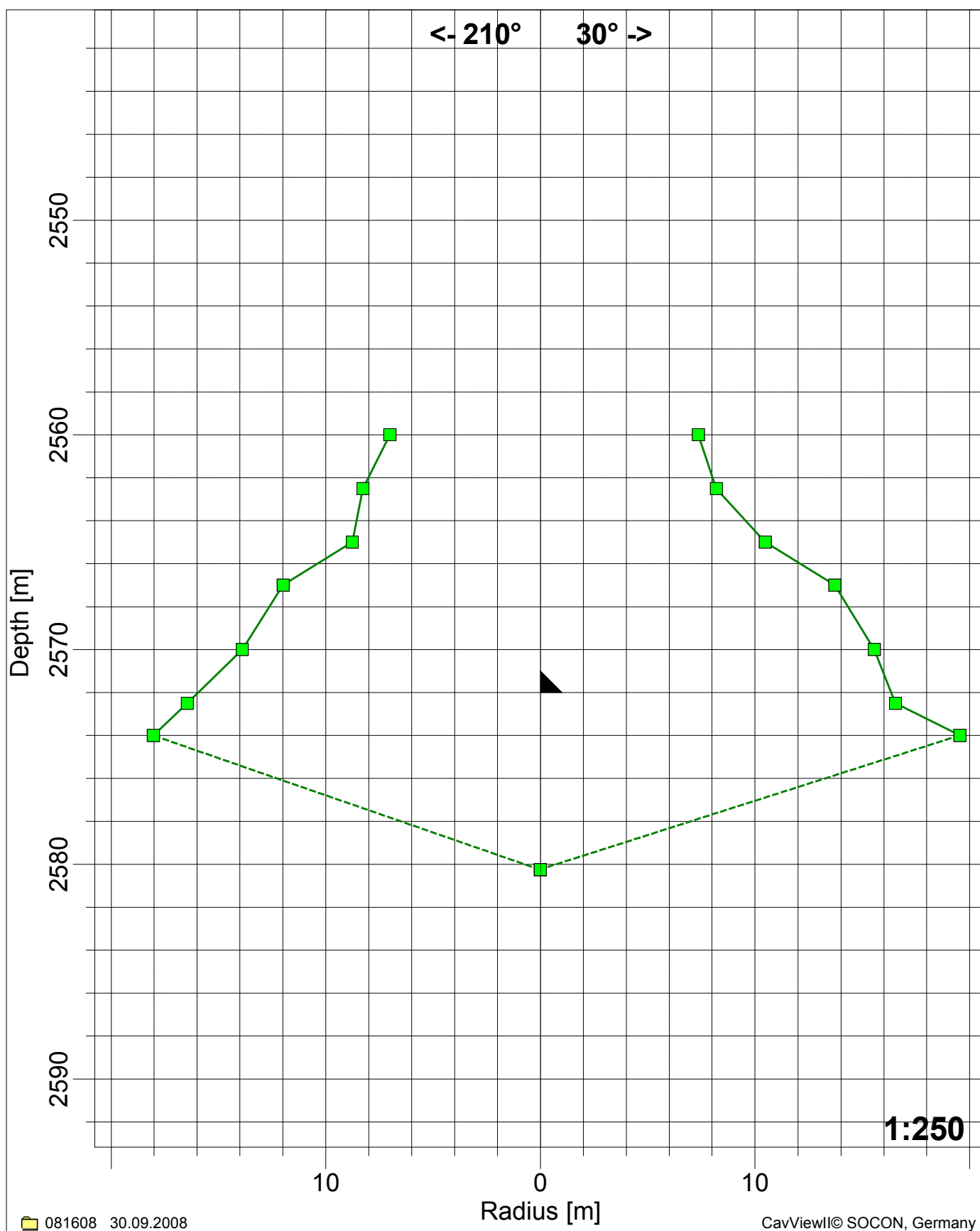
▲ 11 3/4" : 2572.0 m

▲ 7" : 2709.0 m



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30.09.2008

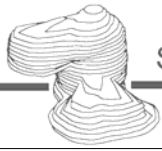


—■— (30.09.2008)

▲ 13 3/8" : 2410.0 m

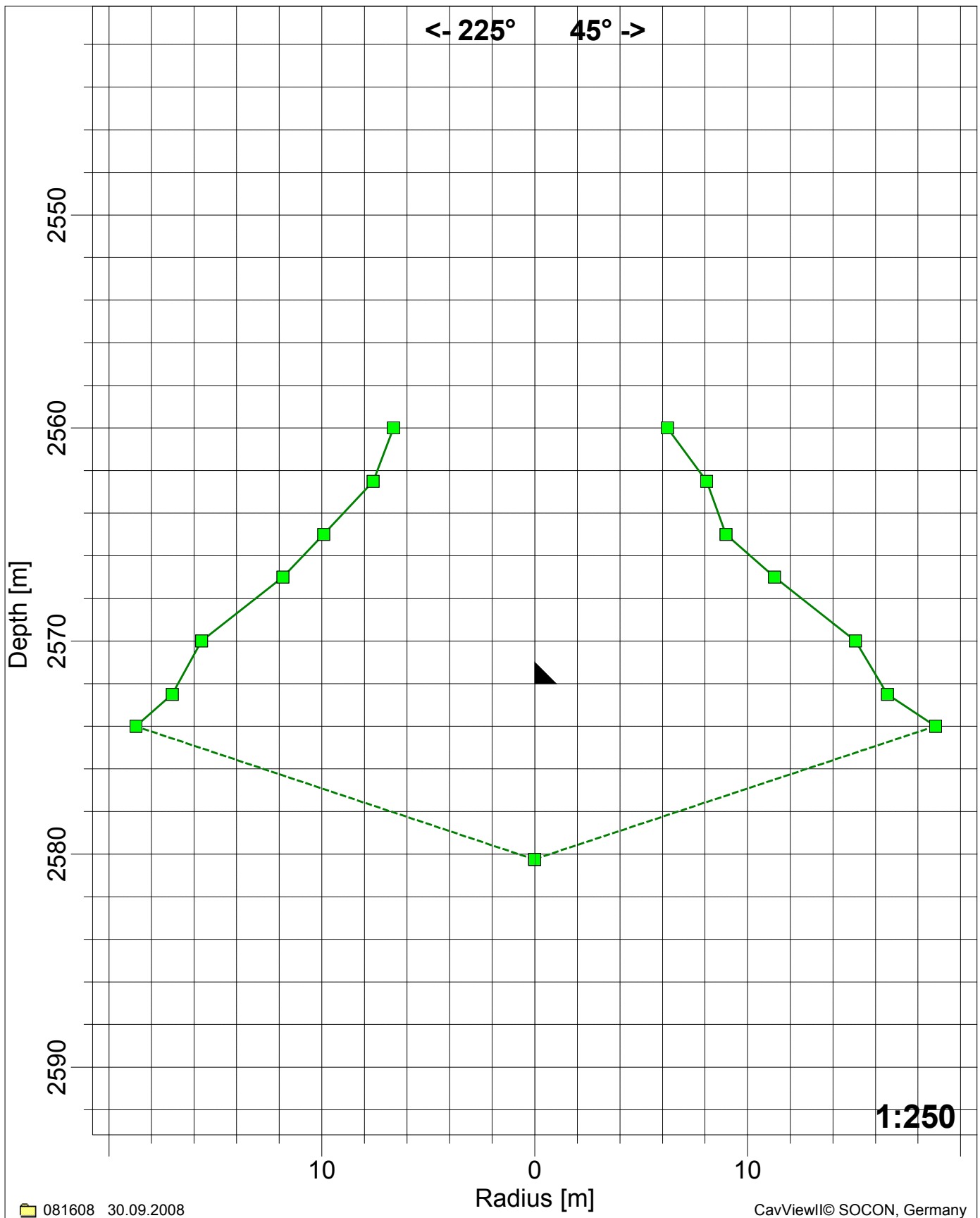
▲ 11 3/4" : 2572.0 m

▲ 7" : 2709.0 m



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30.09.2008



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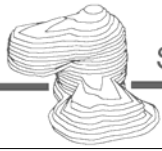
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— (30.09.2008)

▲ 13 3/8" : 2410.0 m

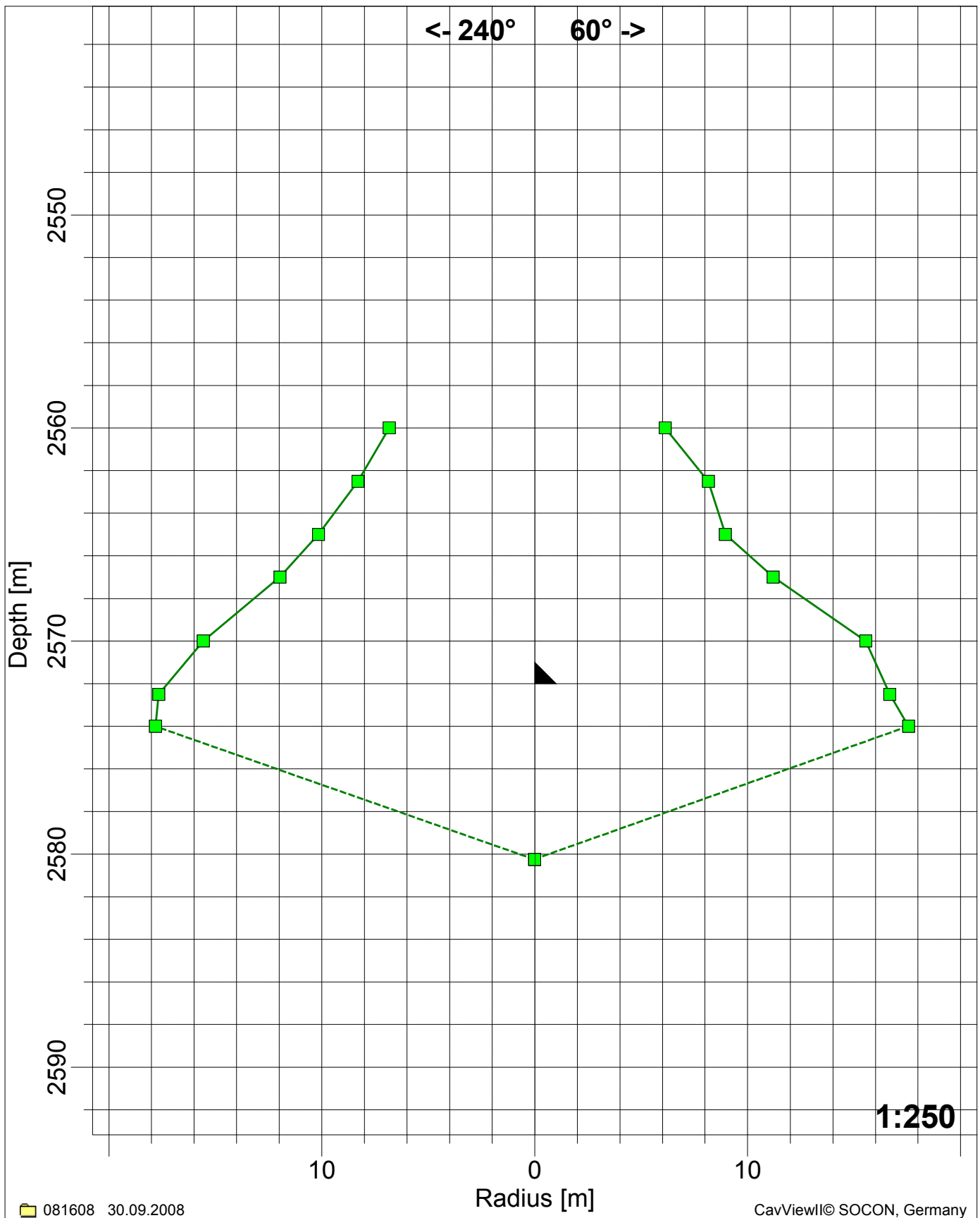
▲ 11 3/4" : 2572.0 m

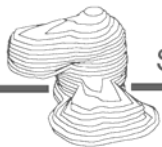
▲ 7" : 2709.0 m



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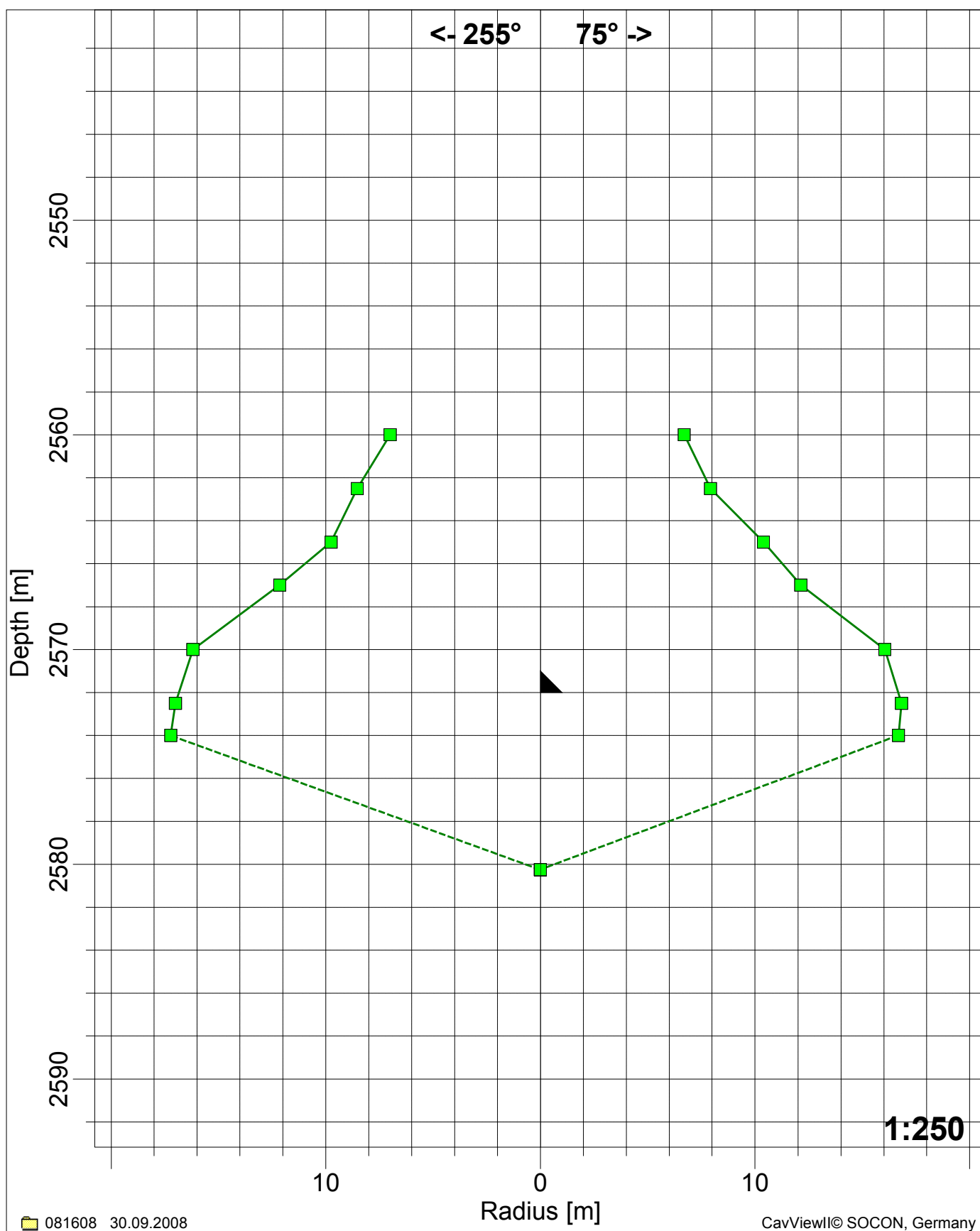
30.09.2008

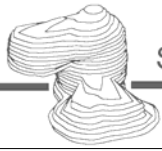




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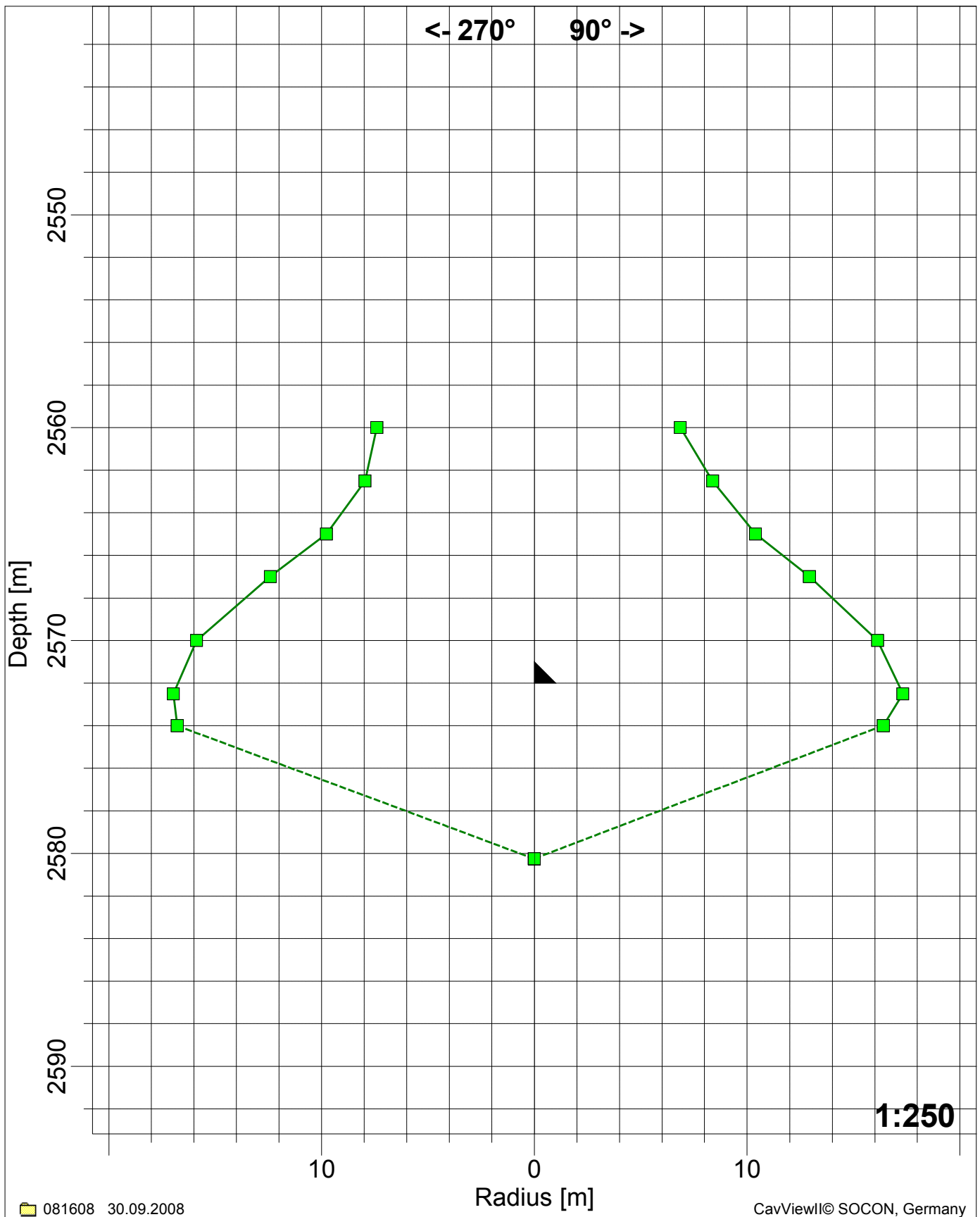
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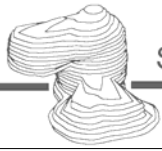




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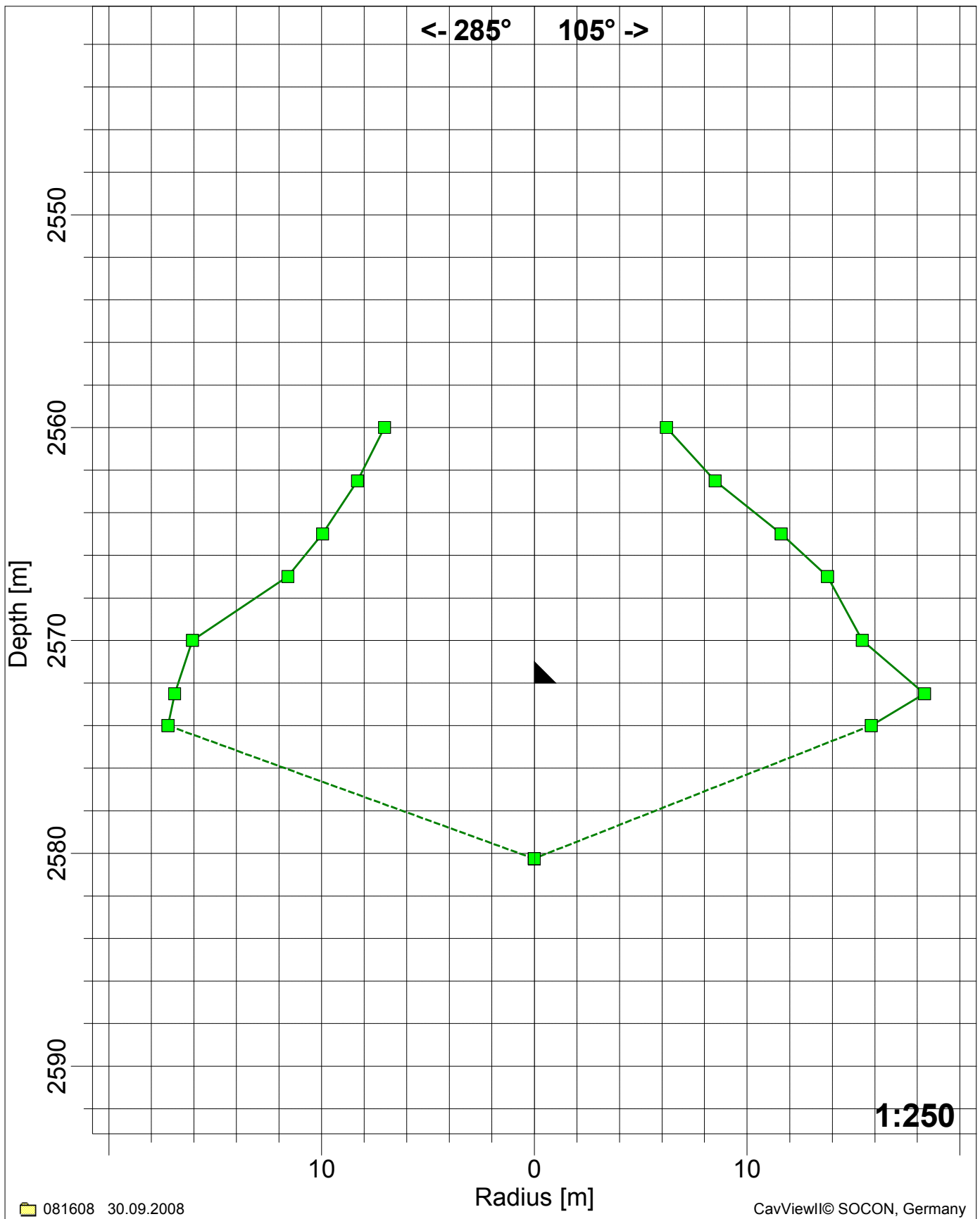
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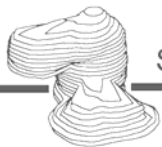


—■— (30.09.2008)

▲ 13 3/8" : 2410.0 m

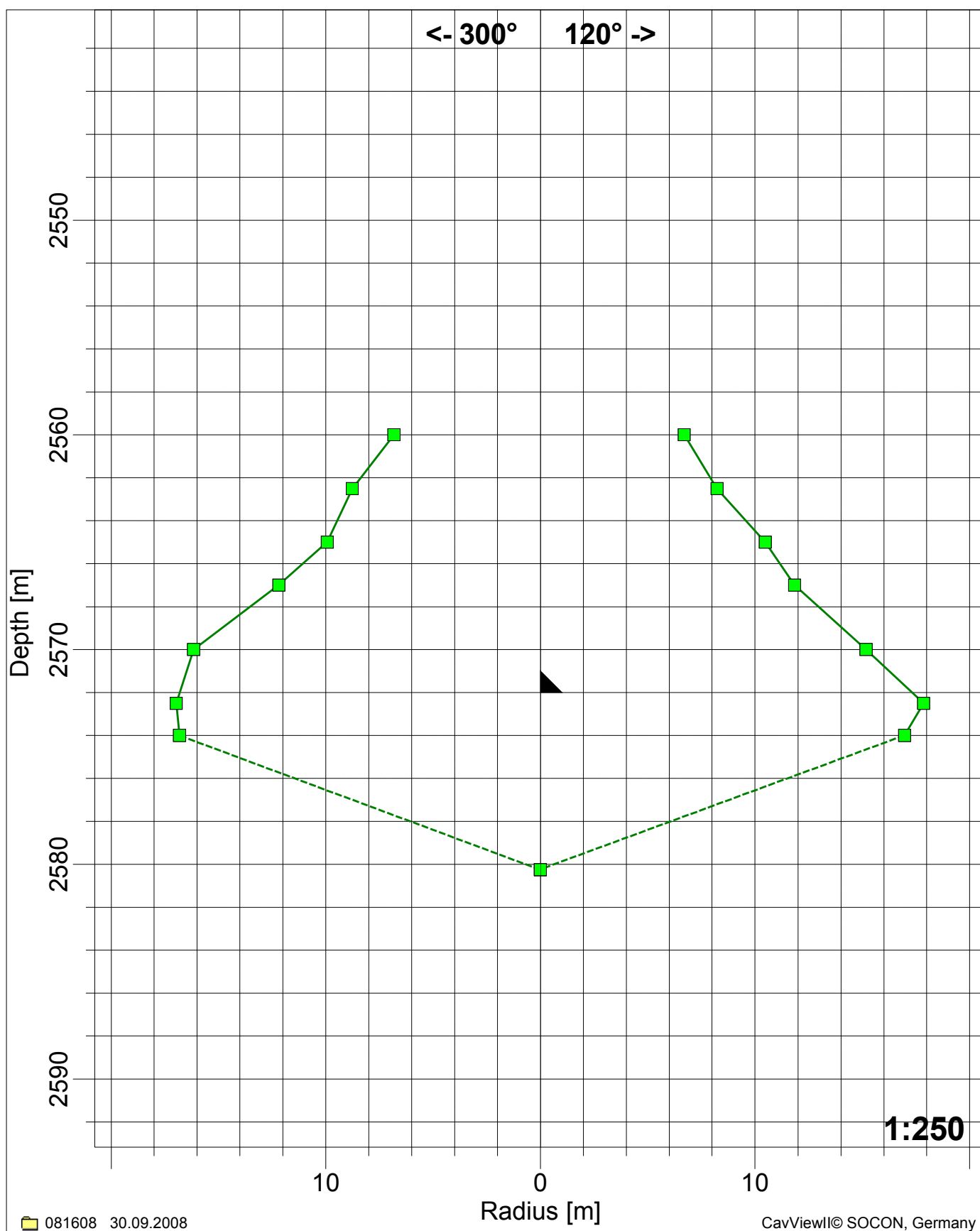
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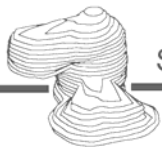
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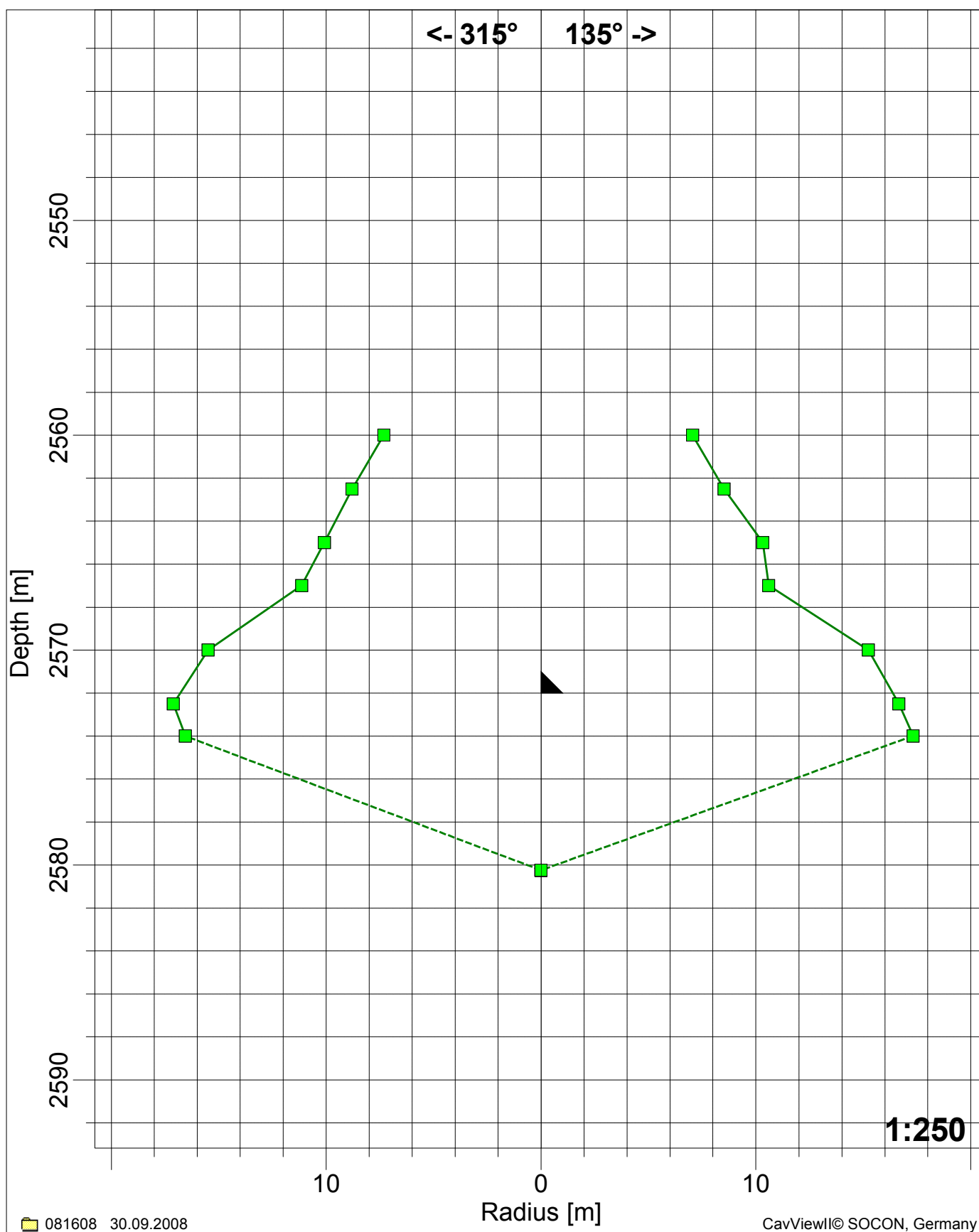
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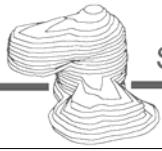




Harlingen BAS 4

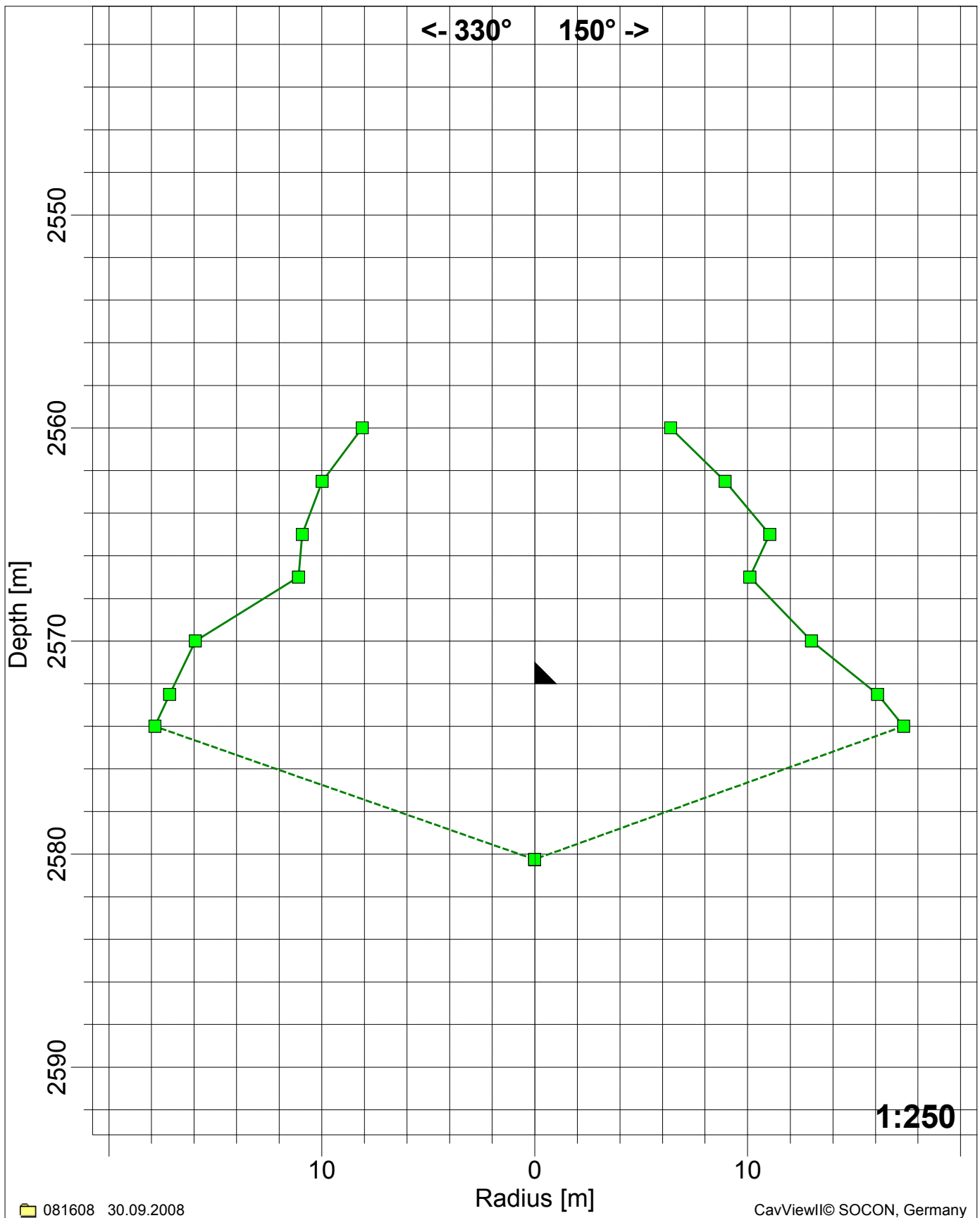
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30.09.2008

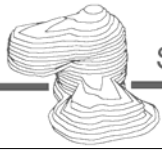


(30.09.2008)

13 3/8" : 2410.0 m

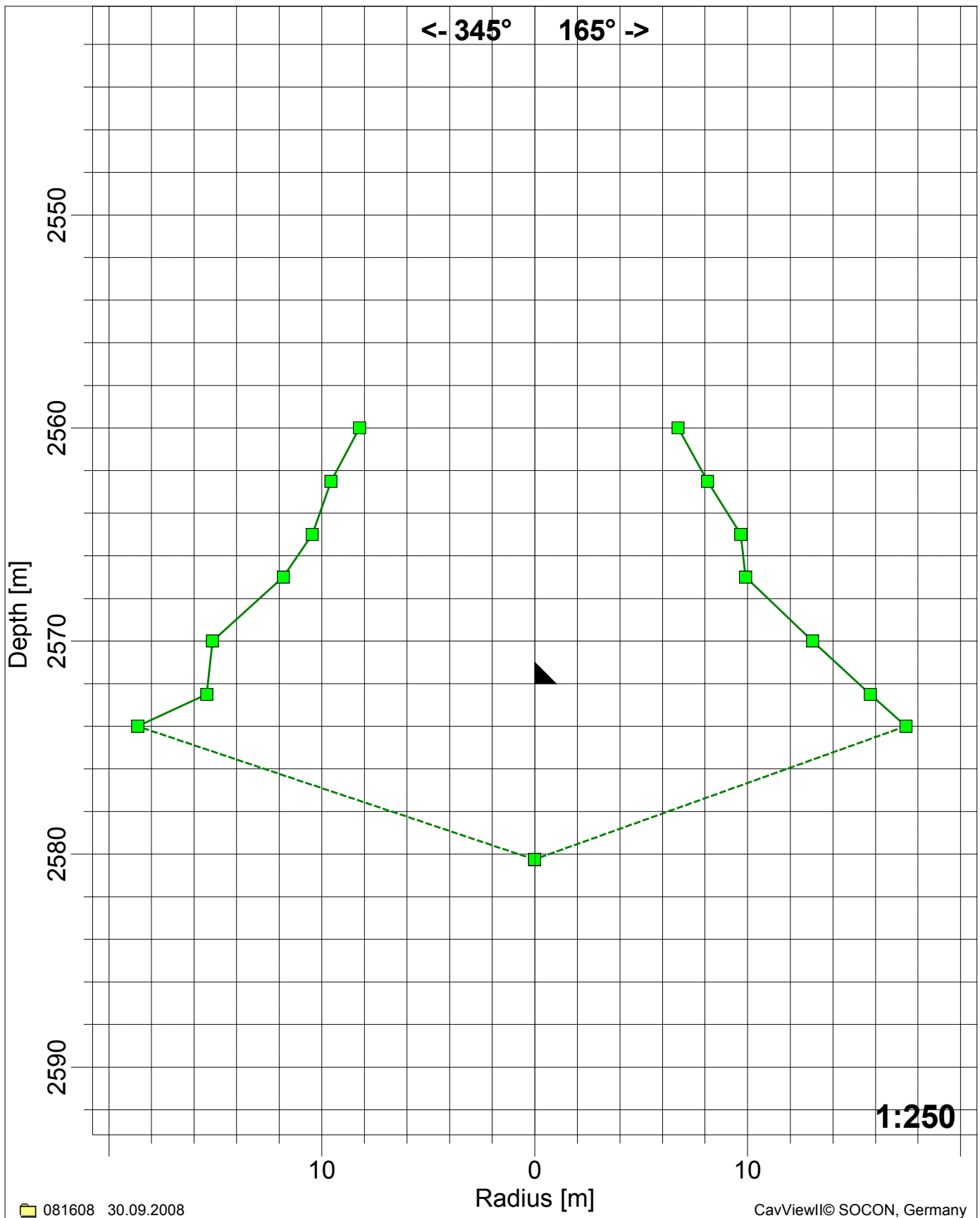
11 3/4" : 2572.0 m

7" : 2709.0 m



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30.09.2008

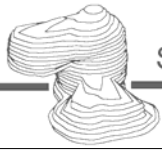


—■— (30.09.2008)

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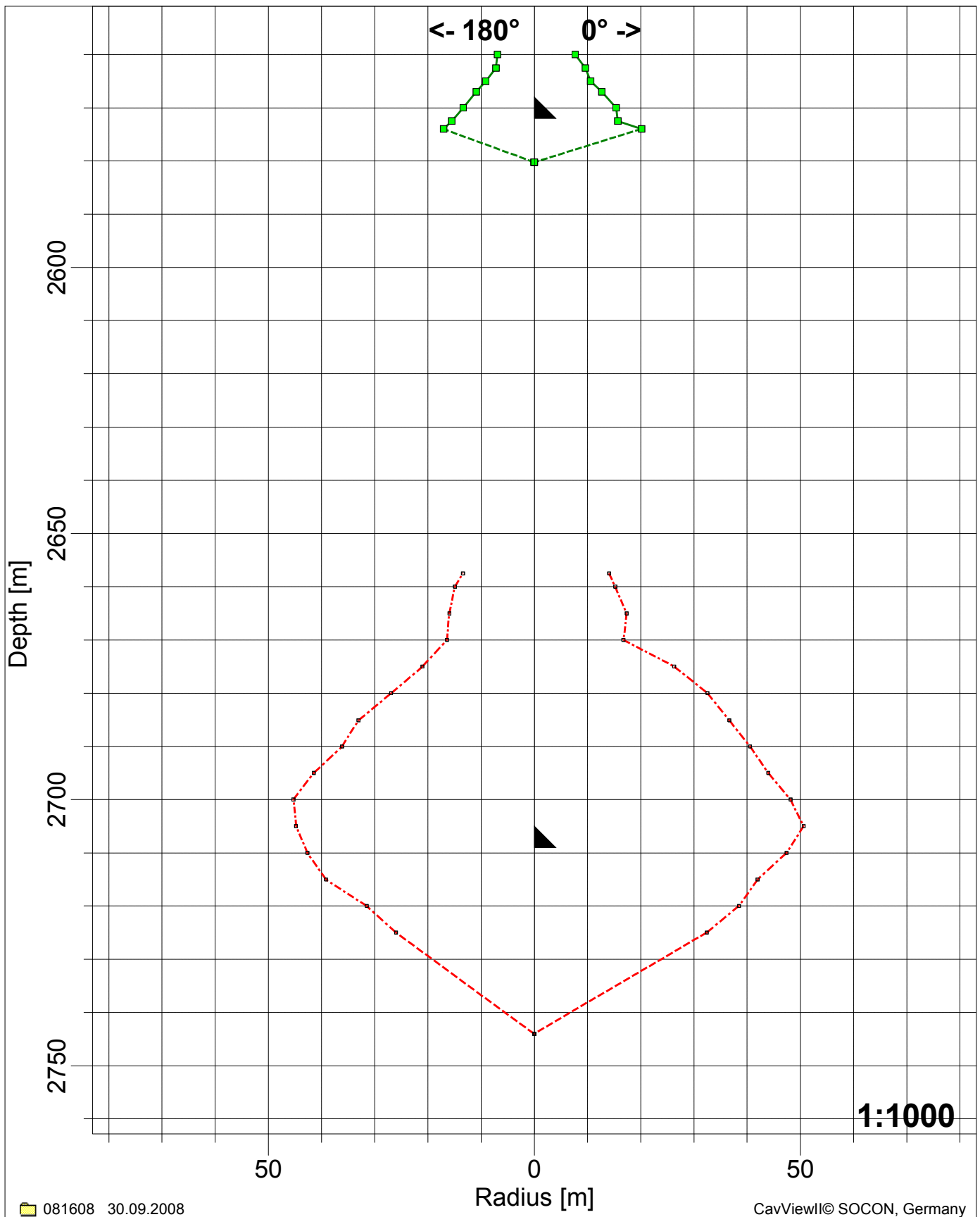
▲ 11 3/4" : 2572.0 m

▲ 7" : 2709.0 m



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30.09.2008



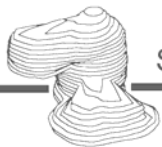
—■— (30.09.2008)

- - - (24.08.2007)

▲ 13 3/8" : 2410.0 m

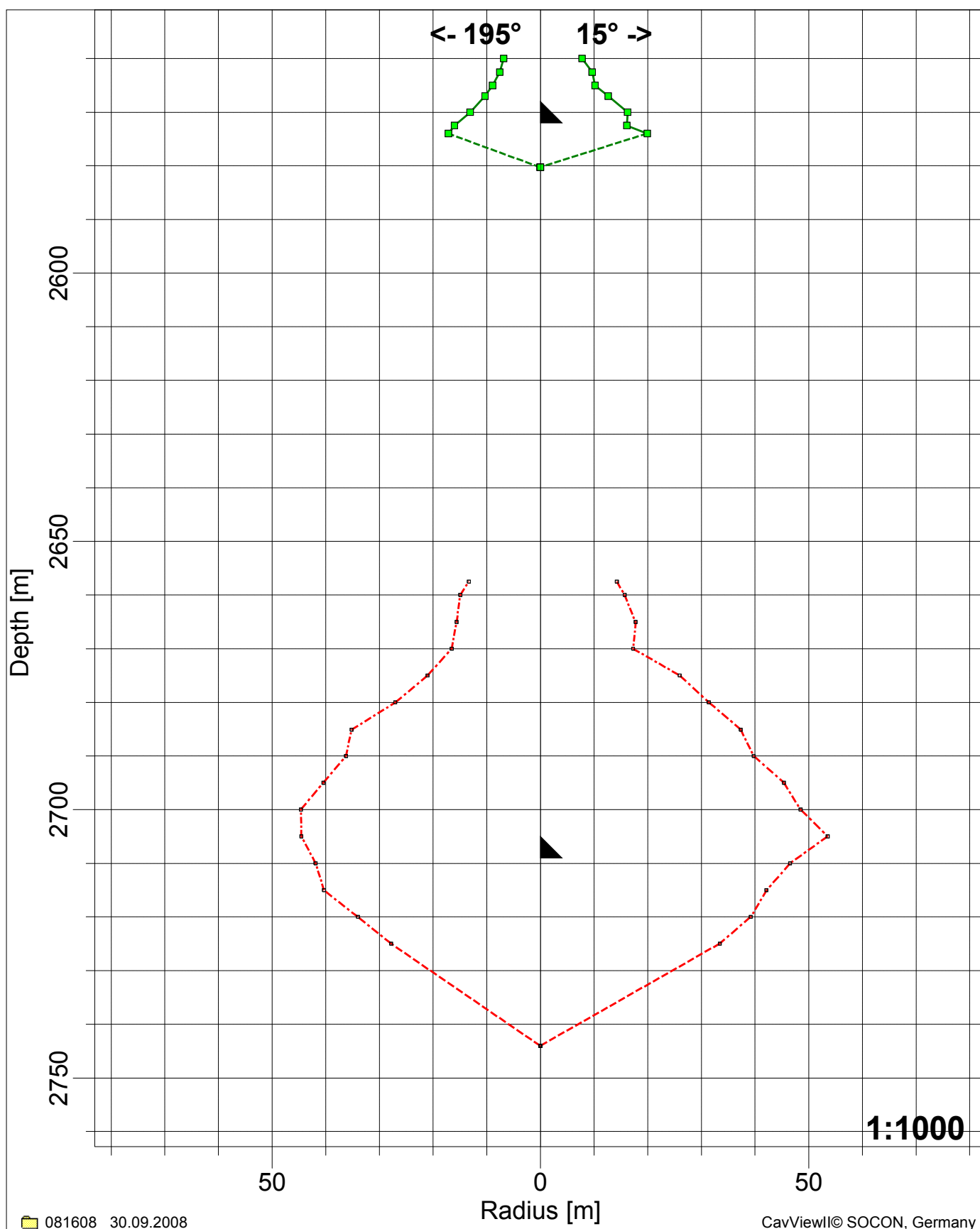
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▲ 7" : 2709.0 m



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30.09.2008



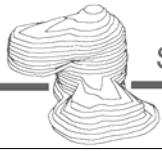
081608 30.09.2008

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—■— (30.09.2008)

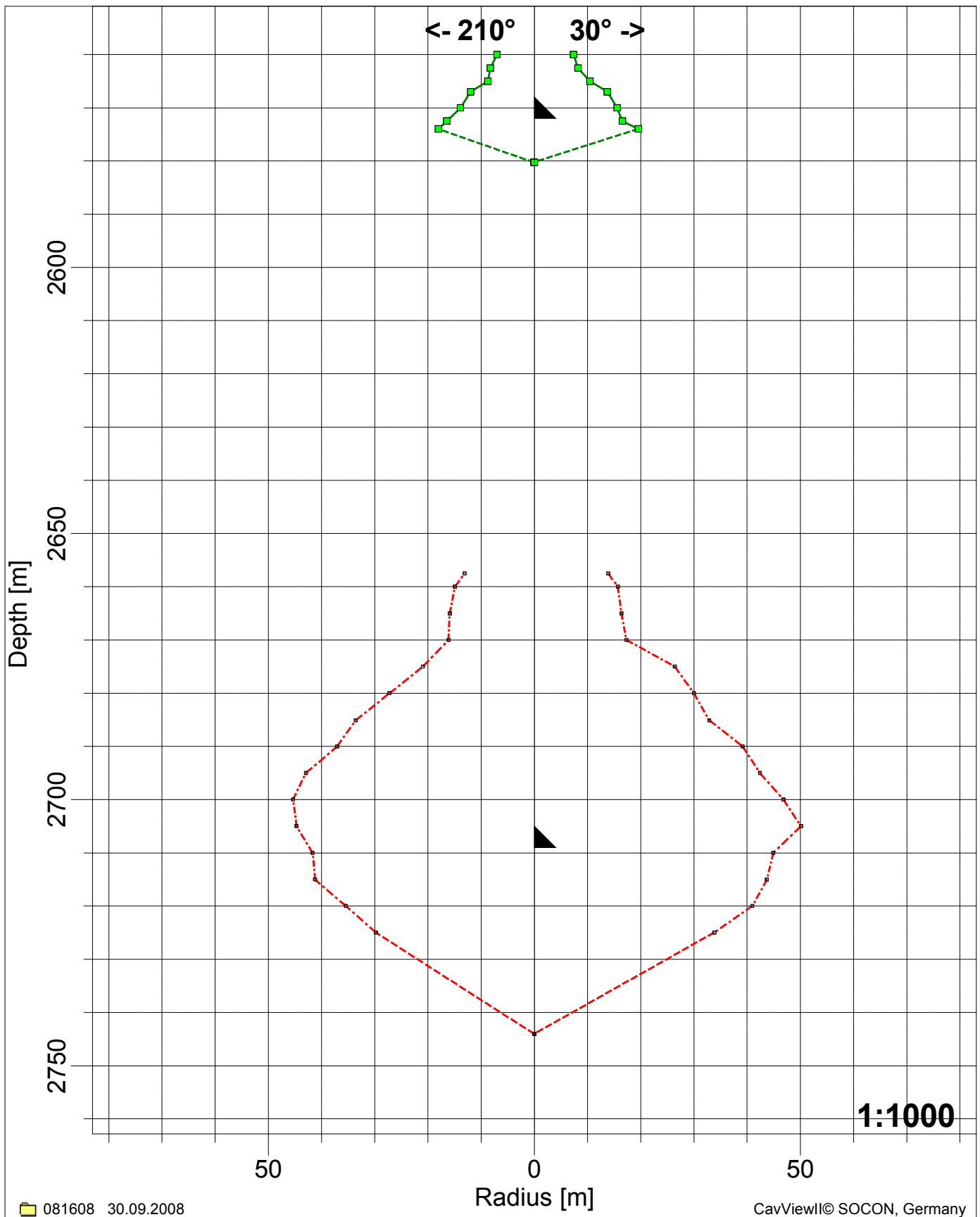
-.-.- (24.08.2007)

▲ $13\frac{3}{8}''$: 2410.0 m▲ $11\frac{3}{4}''$: 2572.0 m▲ $7''$: 2709.0 m



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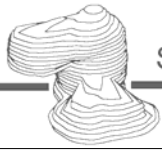
—■— (30.09.2008)

- - - (24.08.2007)

▲ 13 3/8''' : 2410.0 m

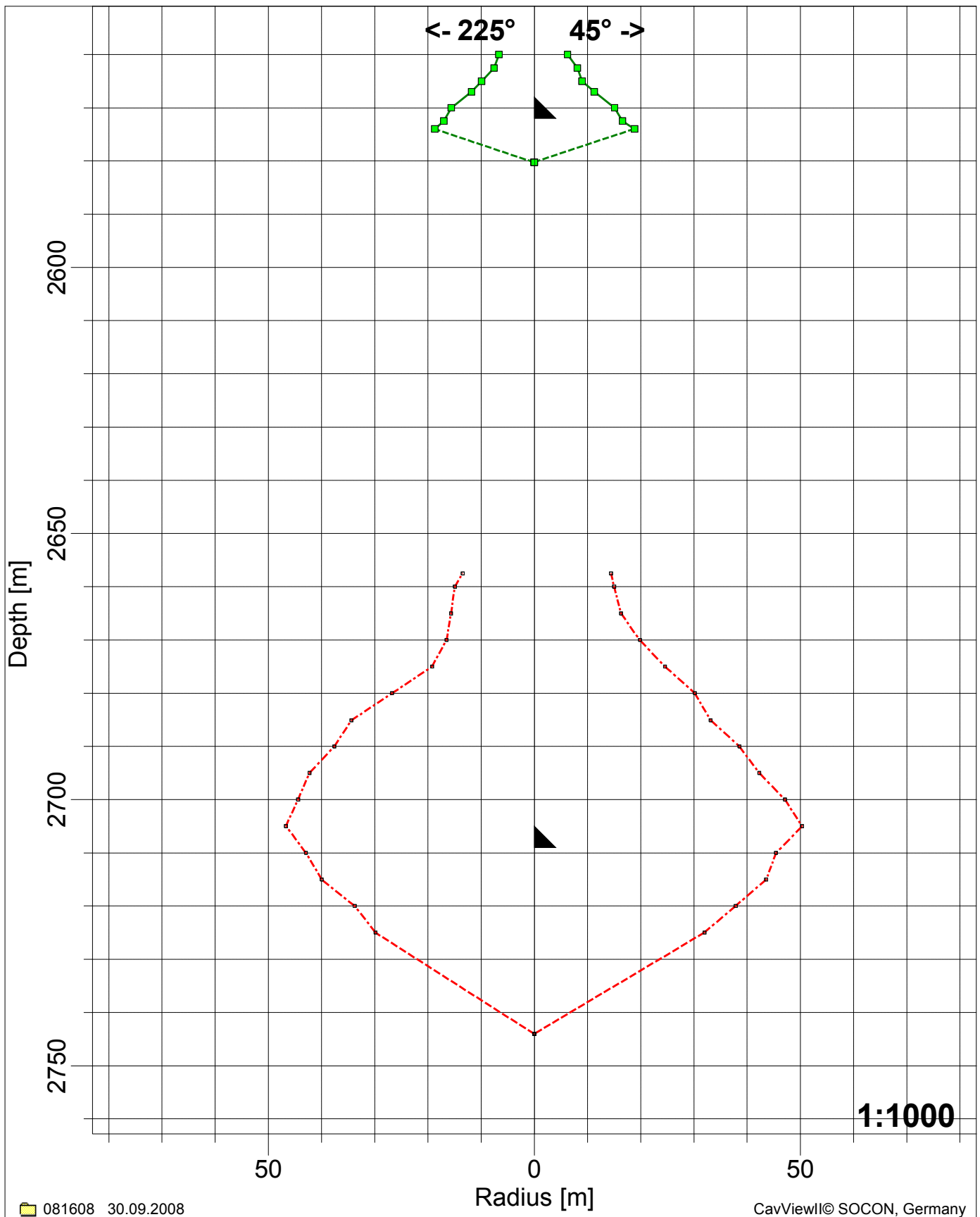
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▲ 7''' : 2709.0 m



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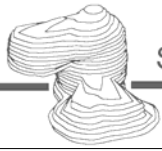
—■— (30.09.2008)

- - - (24.08.2007)

▲ 13 3/8" : 2410.0 m

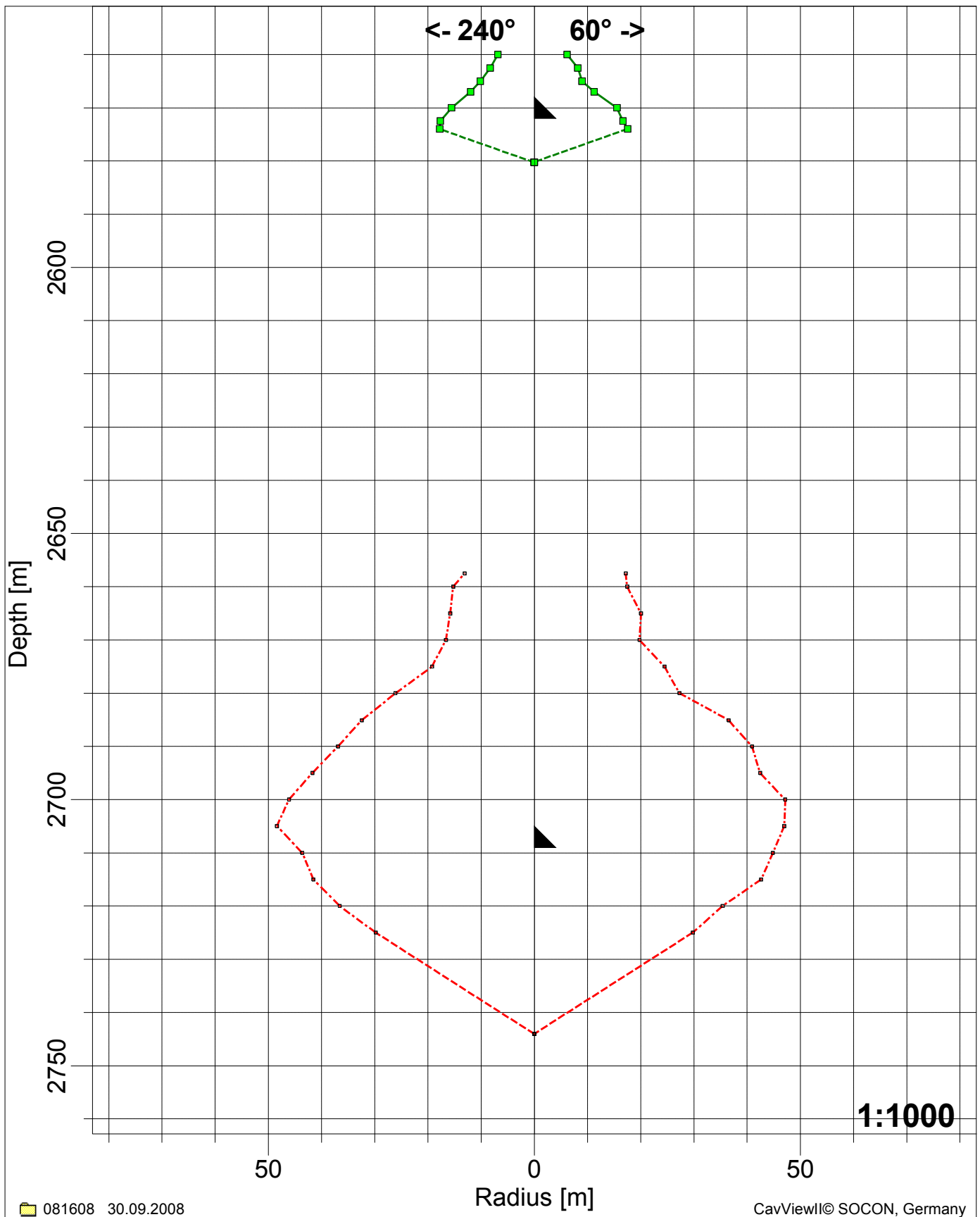
▲ 11 3/4" : 2572.0 m

▲ 7" : 2709.0 m



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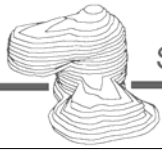
—■— (30.09.2008)

- - -■- (24.08.2007)

▲ 13 3/8''' : 2410.0 m

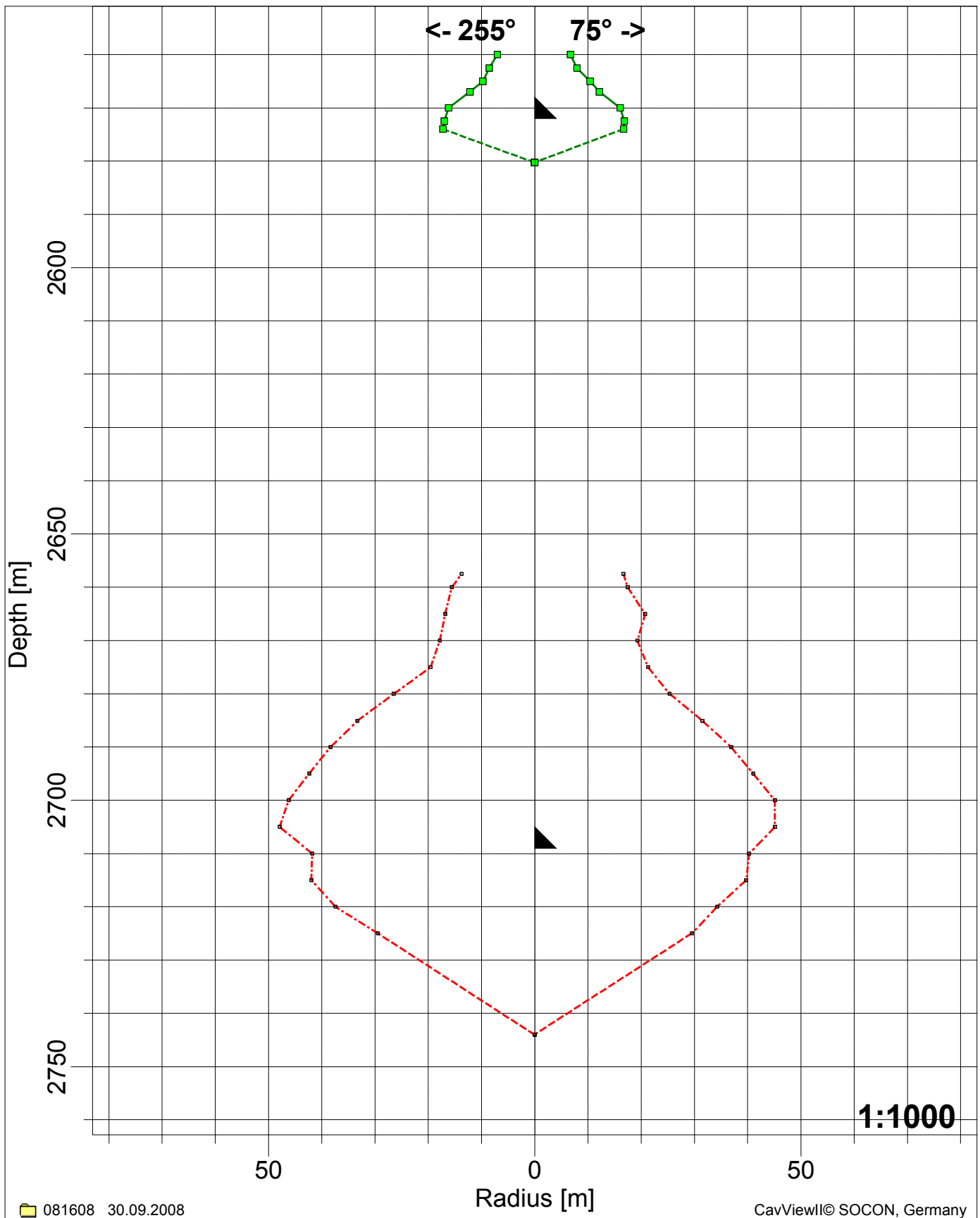
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▲ 7''' : 2709.0 m



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30.09.2008



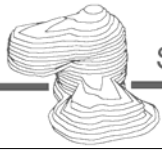
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- - -■- - (24.08.2007)

▲ 13 3/8''' : 2410.0 m

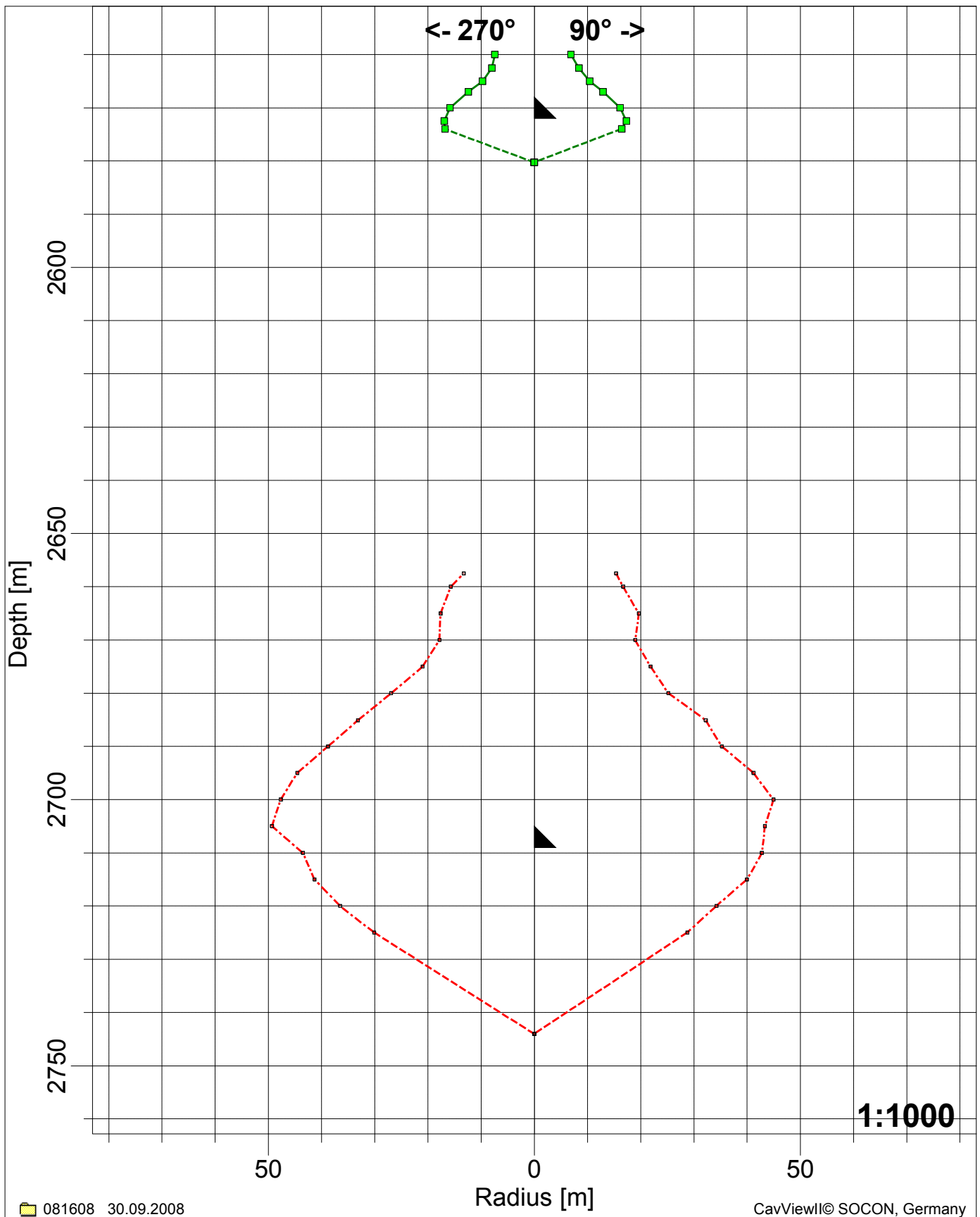
▲ 11 3/4''' : 2572.0 m

▲ 7''' : 2709.0 m



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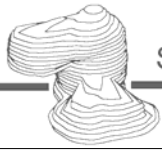
—■— (30.09.2008)

-.-.- (24.08.2007)

▲ 13 3/8''' : 2410.0 m

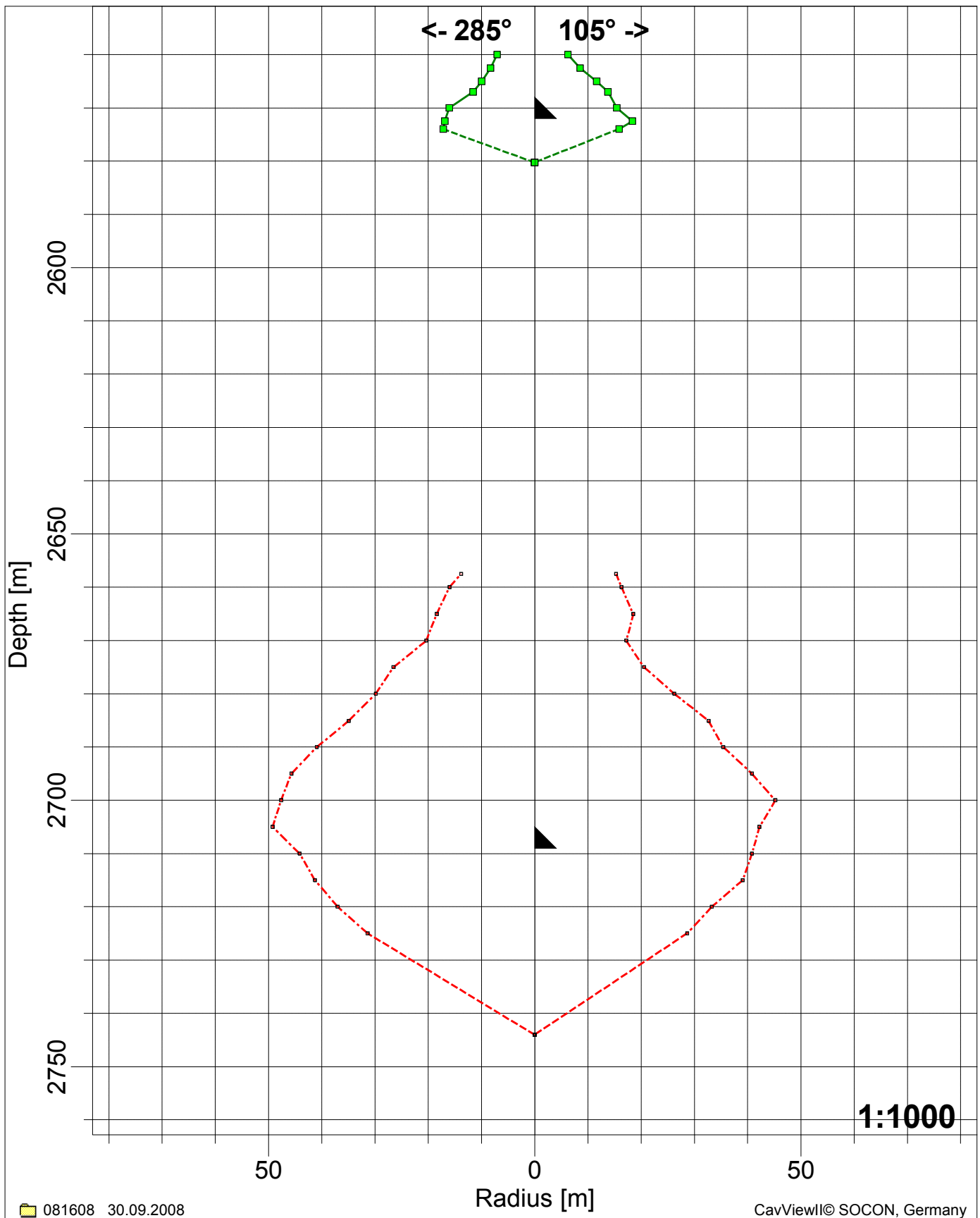
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30.09.2008



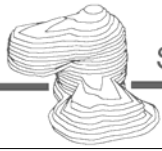
—■— (30.09.2008)

- - -■- - (24.08.2007)

▲ 13 3/8''' : 2410.0 m

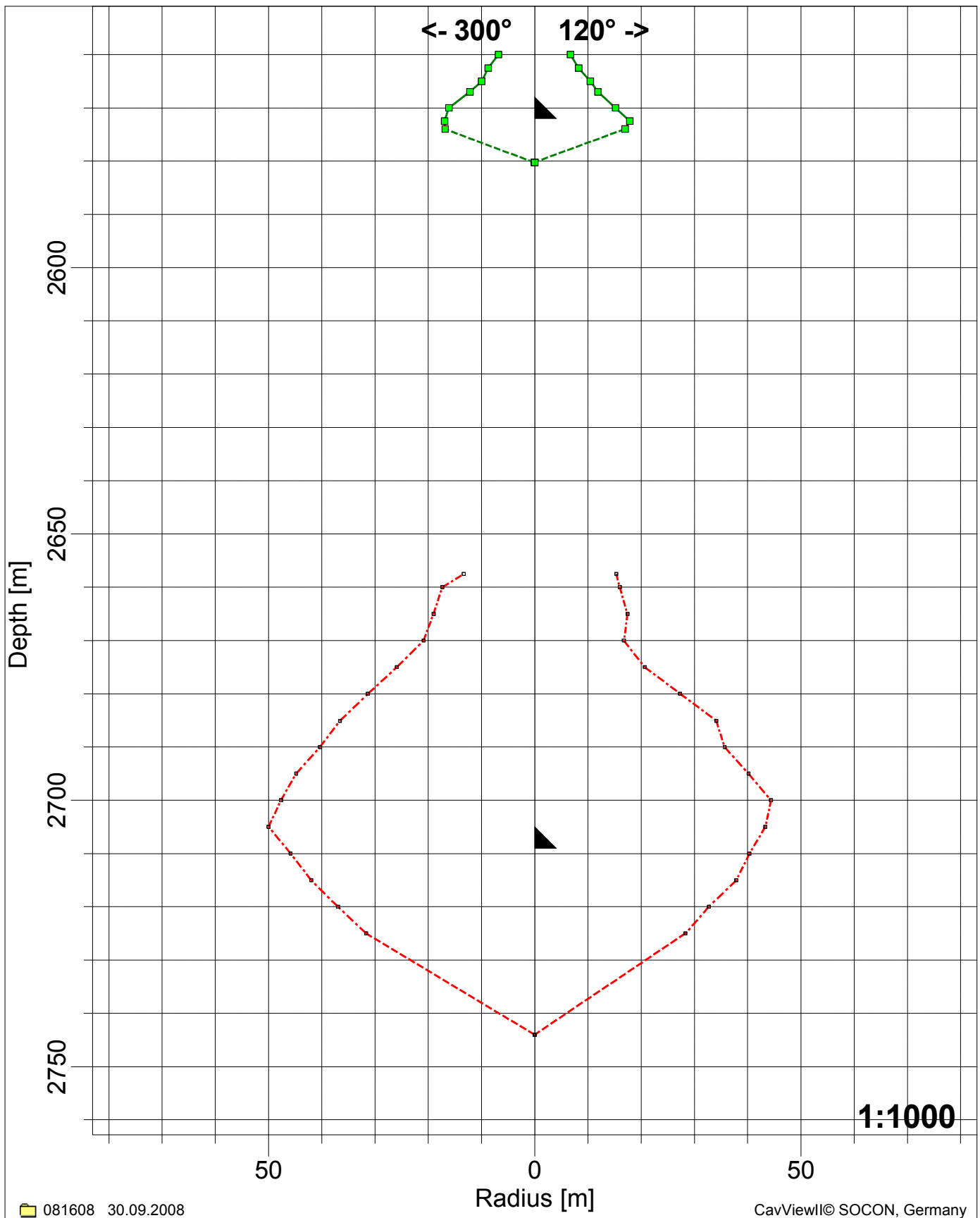
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▲ 7''' : 2709.0 m



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30.09.2008



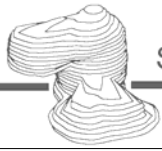
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- - -■- - (24.08.2007)

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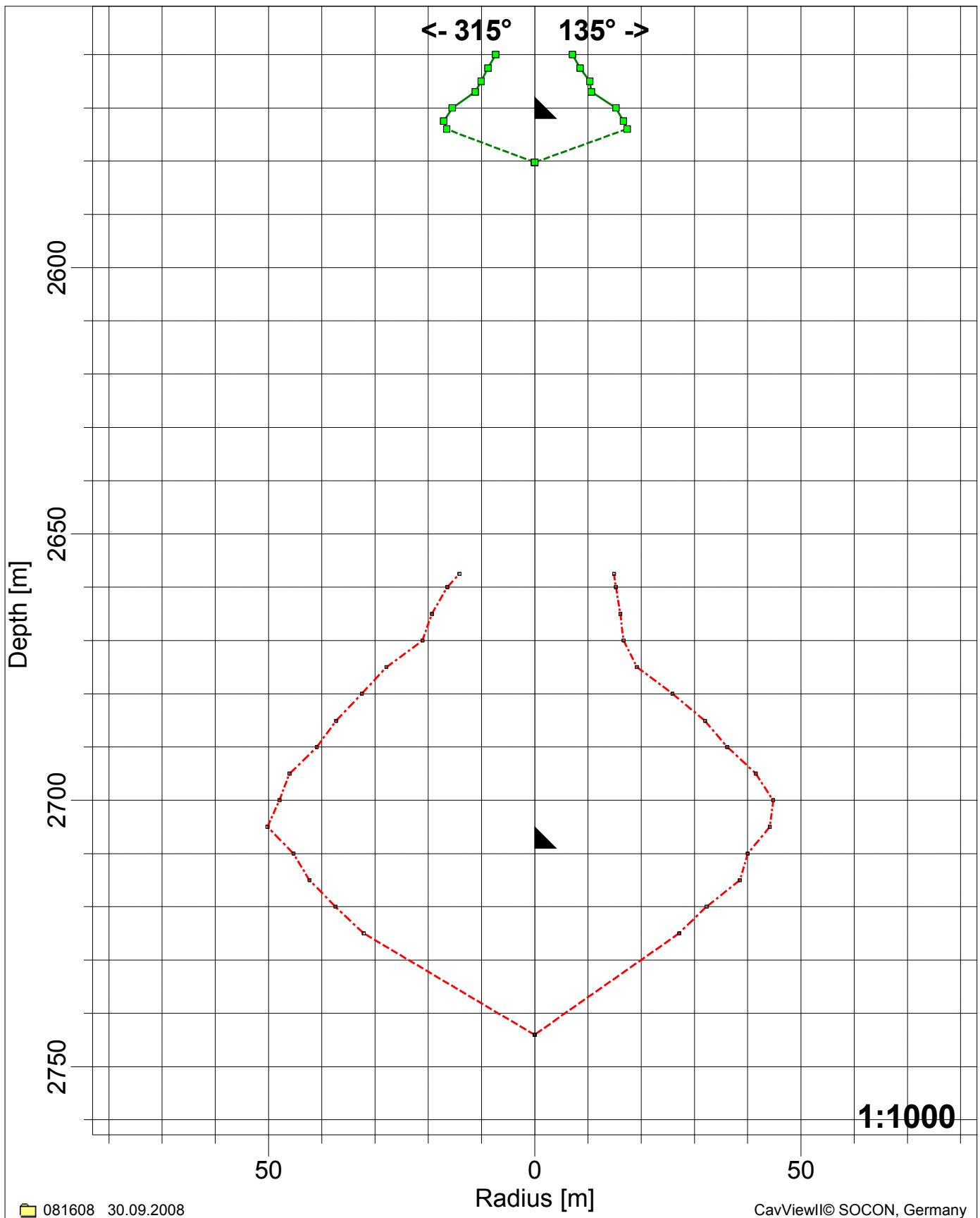
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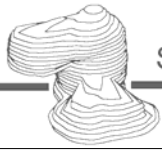
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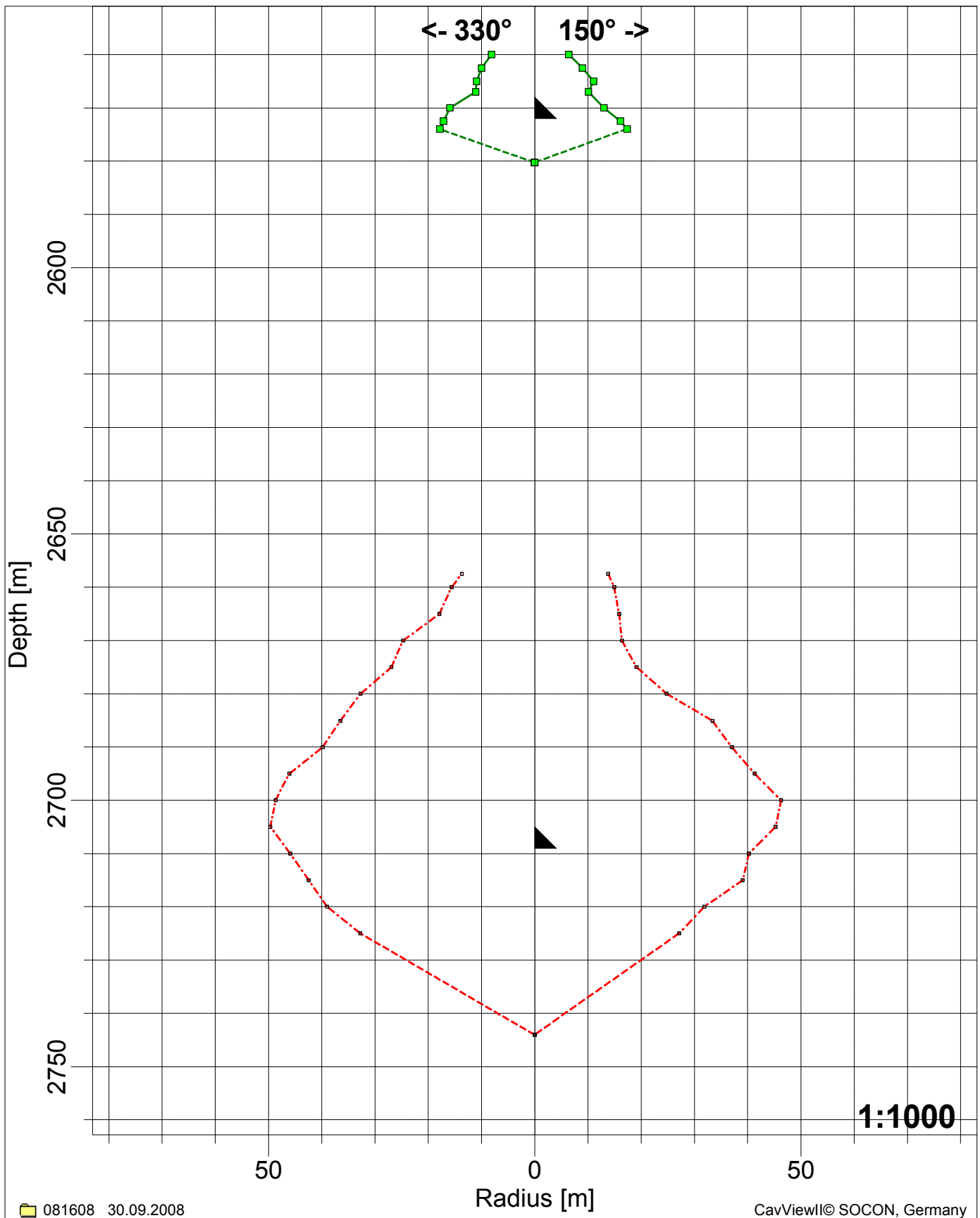
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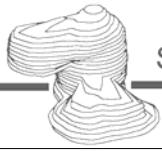
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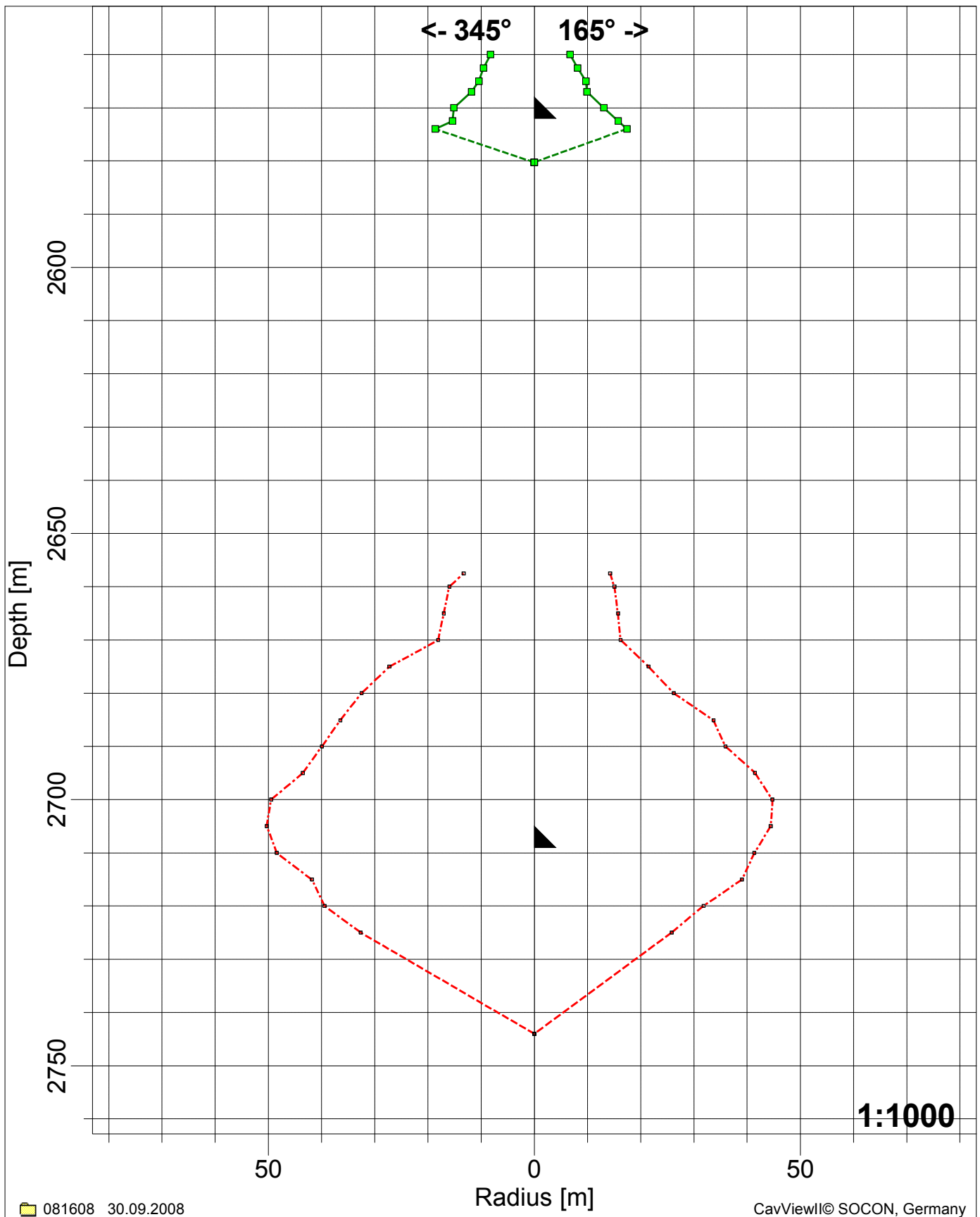
▲ 11 3/4''' : 2572.0 m

▲ 7''' : 2709.0 m



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—■— (30.09.2008)

- - -■- - (24.08.2007)

▲ 13 3/8" : 2410.0 m

▲ 11 3/4" : 2572.0 m

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