sScale™
Measure, track and trade

Measure Track Trade

Manual for sScale™

With conformity-rated software
Versions 3.4.190X and versions 3.5.203X

As of 28/2/2018

DRALLE
LogTracking since 2002

Table of Contents

Contact:

Dralle A/S
Venlighedsvej 4
2970 Hørsholm
Denmark

info@dralle.dk
www.dralle.dk

A. Operating Instructions

1. System description

sScale™ is a photo-optical system for the measurement of woodpile face areas. It was developed to streamline and standardise the measurement of piles of wood. It consists of a pair of cameras, three LED floodlights and a computing unit. All system components are integrated in a camera box, which is mounted on a vehicle by means of an outer shell - the hangar. The control is carried out via a resistive touch screen mounted inside the vehicle.

To capture the woodpile face area, the vehicle is driven past and a sequence of pictures records the pile of wood. From this picture sequence, a polygonal course is derived, which describes the woodpile face with the outer contour. The photo-optic area measurement of the woodpile face is conformity-rated. In a further calculation step, the total volume of the woodpile can be calculated from the conformity-rated area, which is then no longer conformity-rated.

2. System components and menu interfaces

2.1. System components

sScale**™ consists of two high**-resolution cameras, three LED floodlights, a processing unit, as well as the antennas for GPS and GSM. These components are installed on the roof of the vehicle exterior, while the touchscreen for control is mounted inside the vehicl**e of the sScale™,** as shown in Figure 1 as an example.

*Figure 1**: Example of a sScale™, carrier vehicle with rooftop camera unit and touchscreen in the passenger area*

Table 1 shows the installed hardware components.

Table 1: Hardware components of the sScale™

Component	Function	Version 1	Version 2
Camera	Image capture	SVS-Vistek eco267MVGE	SVS-Vistek eco267MVGE
GPS antenna	GPS reception	USGlobalSat BU-353	USGlobalSat BU-353
GPRS antenna	GSM reception	Procom MU 901/1801/UMTS-MMS	Procom MU 901/1801/UMTS-MMS
GPRS modem	GSM communication	HCP Hit U8	HCP Hit U8
Motherboard	central processing unit	AAEON GENE-QM77 Rev. B	AAEON GENE-QM77 Rev. B
Hard drive	Data storage	Hitachi (HGST) Z5K500-320 (HDD)	Cactus KD64GFI-910S (SSD)
Monitor	Operation	G121XN01 V0	G121XN01 V0
LED floodlight	Lighting	Instrumented DRAL-LED	Instrumented DRAL-LED
Control motor	camera movement	Firgelli Technologies L12	Firgelli Technologies L16
Heating	Heating	---	Temperature-controlled heating module
Screen venti-lation	Anti-fog	---	Fans
Status display	Status display of vari-ous functions	---	Red: Heating operation Green: System warmed up Orange/yellow: Ventilation

The Figure 2 shows the block diagram of the hardware components and interfaces, Figure 3 **Schematic hardware structure of the sScale™.**
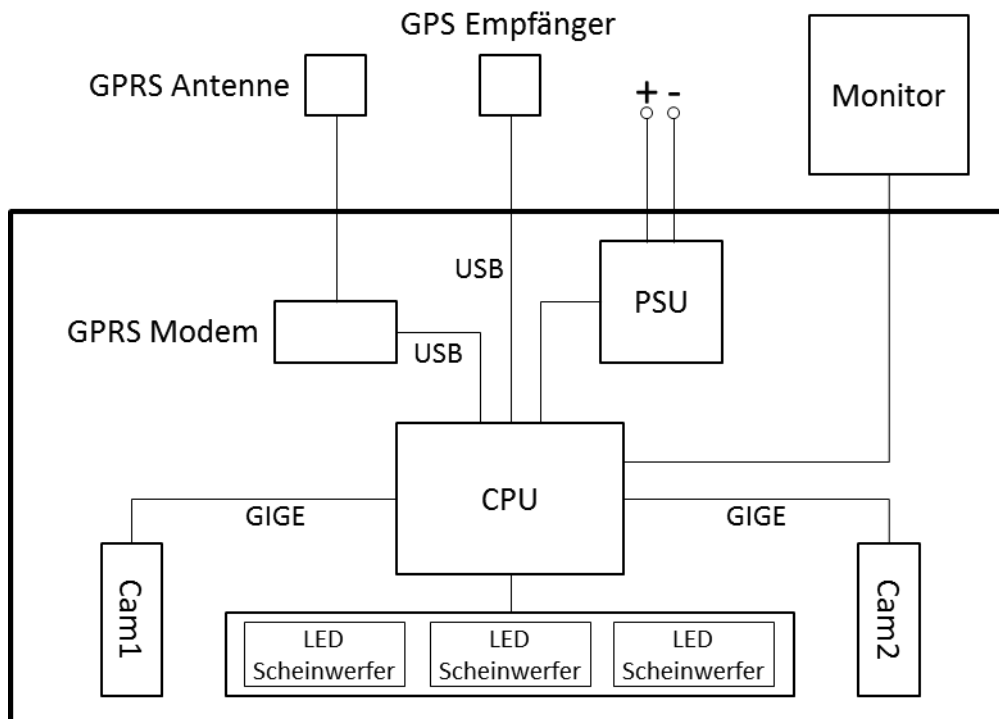
Figure 2: Block diagram of the hardware components and interfaces
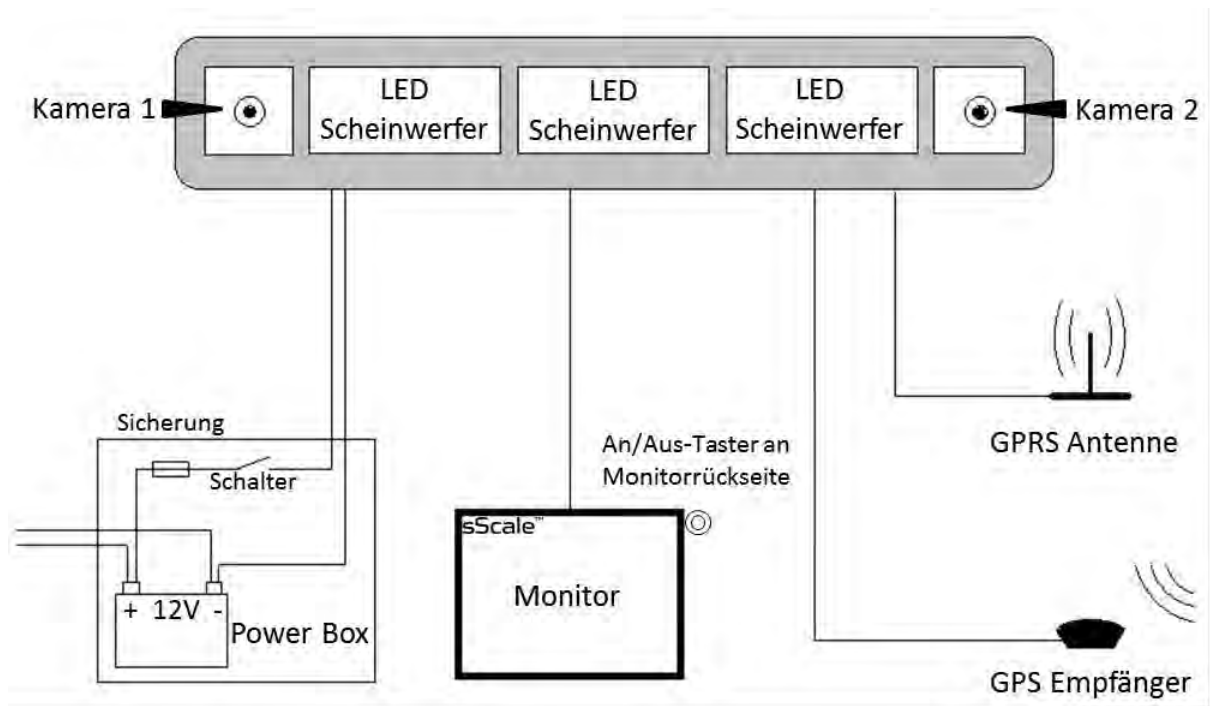
Figure 3: Schematic structure of the sScale™

2.2. Menu interfaces

sScale™ is divided into various menu interfaces. The following is an overview on all available menu items. You will find a detailed description in the chapters indicated.

2.2.1. *"Start screen" user interface*
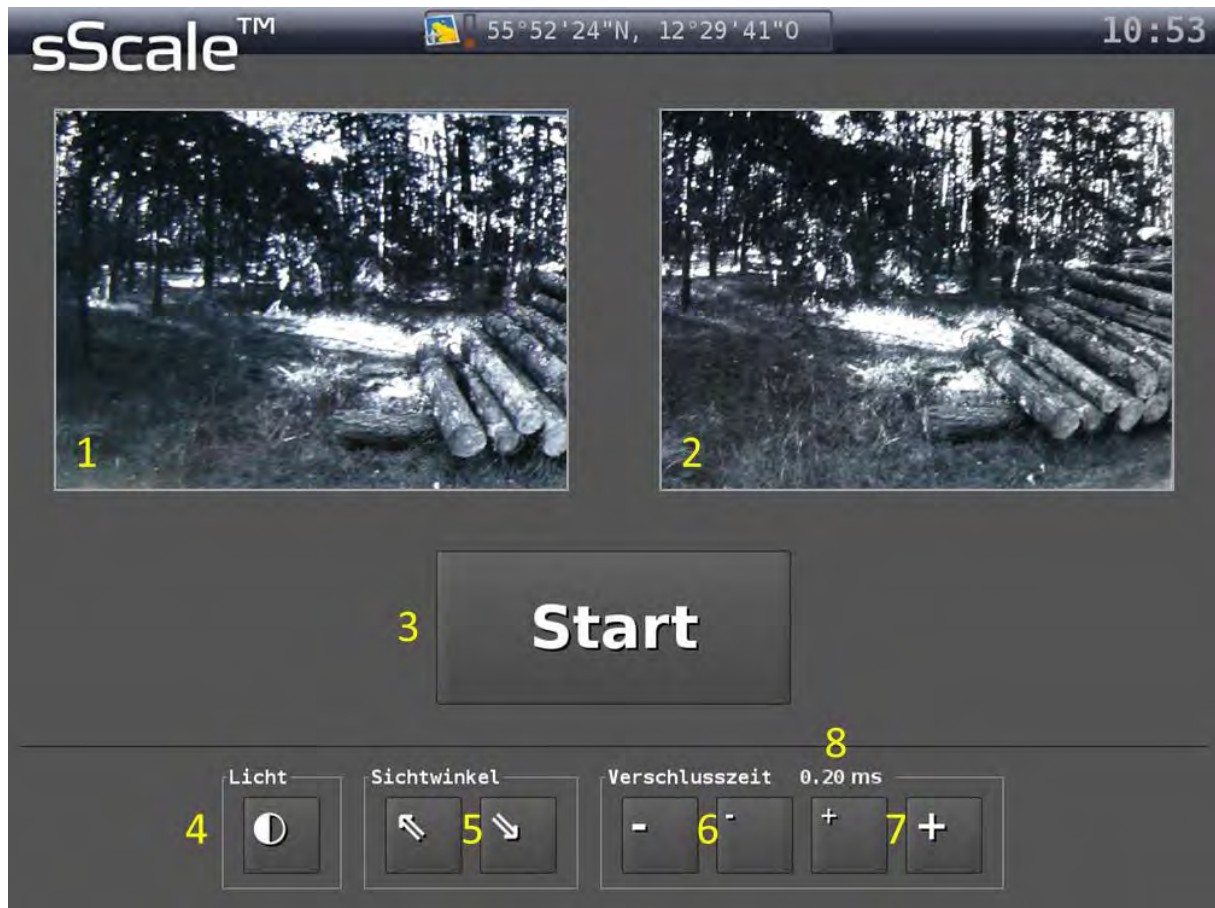
1   Picture of camera 1.
2   Picture of camera 2.
3   **Button to start photographing. While photographing the "Stop" button is displayed.** The frame around the camera images will flash and a progress bar below the camera images shows the capacity of the working-memory.
4   Button, to switch the LED floodlights on and off.
5   Button, to move the viewing angle of the camera up or down.
6   Button, to adjust the exposure time for brighter conditions.
7   Button, to adjust the exposure time for darker conditions.
8   Indication of the selected exposure time (will be displayed after the first touch of the buttons 6 or 7 - not directly after starting the system).

You can find more information in the Chapters A.3 and A.5.

User interface "Main menu"

1 **sScale™** Logo to enter the main menu
2 Current GPS vehicle position
3 Antenna symbol for GSM connection to the server, as well as icon for floodlight, when in operation
4 Current time
5 Version number and checksum of the installed Software (example)
6 Button, to view registrations
7 Button, to view archive
8 Button, to change user
9 Button, to check the transmission status of measurements
10 Button, to switch the LED floodlight on and off
11 Button, to use the system in demonstration mode (if installed)
12 Button, to shut-down the system
13 Button, to return to the start screen or the presentation of results

You can find more information in the Chapters A.4, A.5 and C.1.

2.2.3. User interface "Registrations" (Version 3.4.190X)

1 List of measurement jobs received by the server, sorted by distance (linear distance) to the vehicle.
2 Buttons, to scroll through the above-mentioned list.
3 Directional radar for orientation. The entry selected in the list above is highlighted in the directional radar.
4 Administrative data for the selected entry in the above-mentioned list.
5 Button, to reject the measurement job selected in the above list.
6 Button, to return to the start screen or the presentation of results.

You can find more detailed information in Chapter A.5.

2.2.4. User interface "Registrations" (Version 3.4.203X)

1. Map showing the received measurement jobs and own position
2. Button, to display the list view of the received measurement jobs
3. Administrative data for selected measurement job (also highlighted in the map)
4. QR code with deposited coordinates of the selected measurement job (viewable in Google Maps)
5. Button, to return to the start screen or the presentation of results

You can find more detailed information in Chapter A.5.

1 Date of the displayed list, with the quantity measured on that day.
2 Entry of a measurement. Further details can be accessed by clicking.
3 Buttons, to scroll through the above-mentioned list.
4 Button, to search for a specific measurement (a keyboard appears).
5 Button, to call up other days.
6 Button, to return to the start screen or the presentation of results.

You can find more information in the Chapters A.4 and A.5.

2.2.6. *User interface "Details of an archive entry"*

1. User created Woodpile ID
2. Table of the most important woodpile information
3. Addition woodpile information
4. Unique internal Woodpile ID
5. QR with stored woodpile index for use in StackSnap (see separate documentation)
6. Button, to return to the archive interface

You can find more detailed information in Chapter A.4

2.2.7. User interface "Picture sequence"

1   Picture sequence of camera 1.
2   Picture sequence of camera 2.
3   Picture sequence of the entire woodpile for quick navigation. The red line represents the current position within the woodpile.
4   Button, to accept pictures and to start the picture analysis.
5   Button, to discard pictures. After confirmation, **you return to the user interface "Start screen".**

You can find more detailed information in Chapter A.3.

1 User created Woodpile ID.
2 GPS position of the measured woodpile.
3 Selected user.
4 Overview of the most important results of the analysis, including the statutory calibration relevant woodpile face area.
5 Button, to create Woodpile ID.
6 Button, to manually record a photo-optically unmeasurable woodpile.
7 Button, to record the rear side of a woodpile.
8 View of the woodpile, with the polygonal course described woodpile face area and **unique, internal Woodpile ID. Clicking on the pictures calls up the user interface "Edit polygonal course".**
9 Button, to enter the woodpile depth.
10 Button, to enter the woodpile thickness.
11 Button, to enter the rejected amount.
12 Button, to enter the underlay amount.
13 Button, to select the tree species.
14 Button, to select the assortment.
15 Button, to enter an additional note.
16 Button, the select the seller/owner of the woodpile.
17 Button, to select the customer/buyer.
18 Button, to save the measured woodpile and to transfer to the central server.
19 **Button, to abort the woodpile measurement and to return to the "Start screen" user** interface.

You can find more information in the Chapters A.3, A.4 and A.5.

2.2.9. *"Edit polygonal course" user interface*
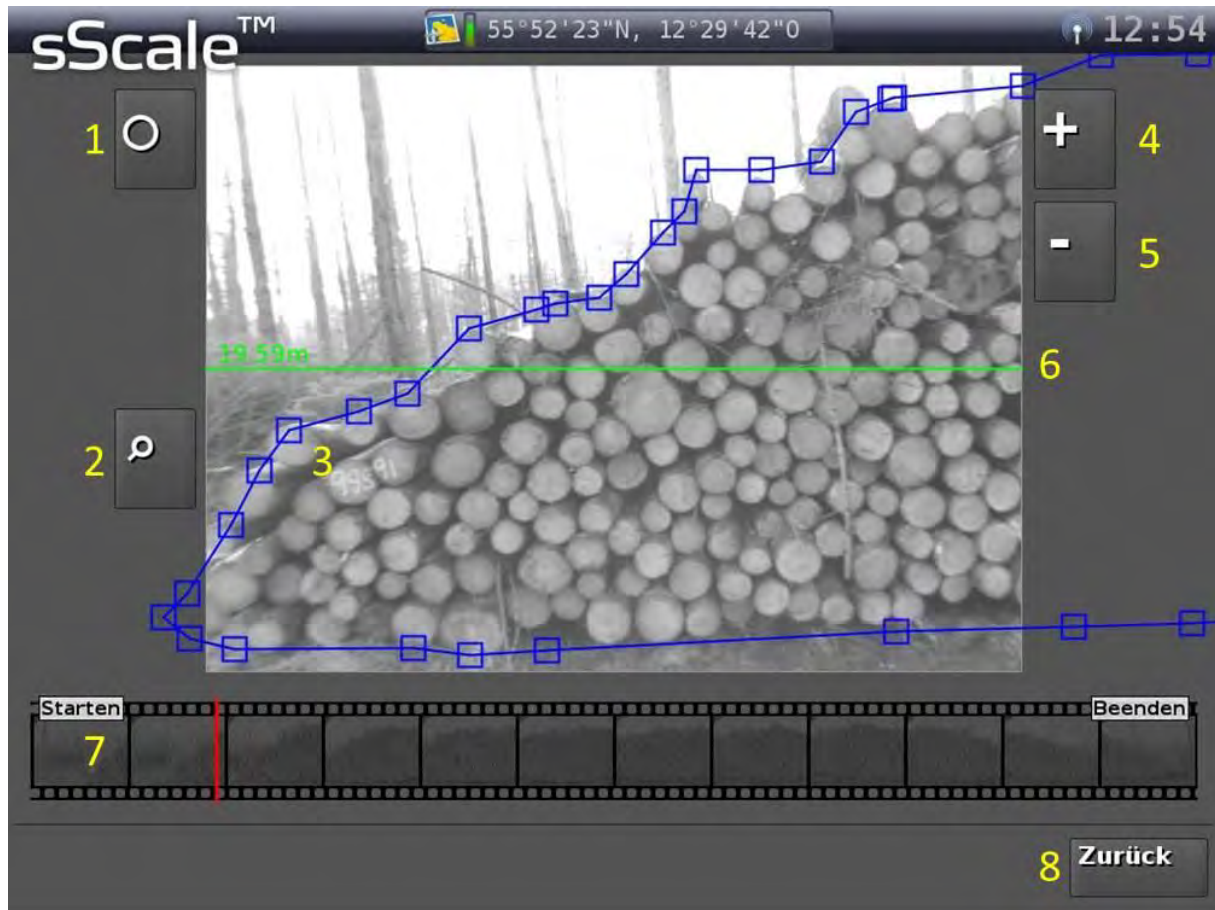
1. Button, to enter the diameter-editing mode.
2. Button, to enlarge the representation (zoom).
3. The blue line represents the polygonal course and the blue squares the editable polygon vertices.
4. Button, to enter additional polygon vertices.
5. Button, to remove excess polygon vertices.
6. Green line indicates the total length of the woodpile, defined by the first polygon vertex on the left side and the last polygon vertex on the right side.
7. Picture sequence of the entire woodpile for quick navigation. The red line shows the current position within the woodpile.
8. **Button, to return to the "Result" user interface.**

You can find more information in the Chapters A.3 and A.5.

2.2.10. **"Manual measurement" user interface**

1   List of the entered heights
2   Keyboard to enter the measured heights
3   Button, to move from one height to another
4   Overview of the necessary variables for calculating the woodpile face area
5   Button, to enter the length of the woodpile
6   Button, to enter the mean diameter of the woodpile
7   Button, to enter the number of logs in the woodpile
8   **Button, to save the entered data and return to the "Result" user interface**

You can find more information in the Chapters A.4 and A.5.

2.2.11. "Measurement of the rear side" user interface

1 List of the entered heights
2 Keyboard to enter the measured heights
3 Button, to move from one height to another
4 Overview of the necessary variables for calculating the woodpile rear side
5 Button, to enter the length of the woodpile
6 **Button, to save the entered data and return to the "Result" user interface**

You can find more detailed information in Chapter A.5.

3. Measurement

- Only woodpiles that comply with the woodpile requirements in Chapter B.2 may be measured!
- The user must have received a detailed briefing on the measurement system and knowledge of this Operating Instructions!
- **The weather conditions must allow a measurement with sScale™ (see Chapter B.1 and B.3).**

3.1. General procedure

You need to drive past the woodpile at a distance, which ensures that the entire woodpile height is visible in the monitor. Experience has shown that this is generally so when the distance corresponds approximately to the height of the woodpile. The minimum distance is 1.9 m.

After analysing the pictures, the polygonal course must be adapted to the outer contour of the woodpile face area and further administrative data entered.

The measurement results are then stored in the system and transferred to the separate **sScale™ server. After the transfer, changes to the measurement cannot be made to the sScale™ system in the forest nor the sScale™ server!**

NOTE:
Use a digitiser pen with a thin plastic tip for all work on the monitor. Using, for example, metal-tip pens results in damage to the monitor and significant costs to the customer if a monitor needs to be replaced.

3.2. Measurement step by step

3.2.1. Image capture

Preparations

Start the system with the on / off button on the back of the screen and wait until an image is visible in both camera windows and a GPS position is displayed. Drive to the highest point of **the woodpile to align the cameras with buttons 2.2.1.5 "Arrow" so that both the top and** bottom edges of the woodpile are visible in the camera images. If necessary, increase the distance from the woodpile face area (see Figure 4).

Figure 4: Too low, too high and correct camera alignment

Set the correct exposure at the same position (see Figure 5). If the woodpile is in both bright sunlight and dark shadows, adjust the exposure at the transition point to best cover both exposure situations.

Note a maximum exposure duration of 10.0 ms! At a higher exposure, the individual pictures may blur when driving too fast and the system may fail to perform the analysis successfully. Above an exposure time of 10.0 ms use the LED floodlight.
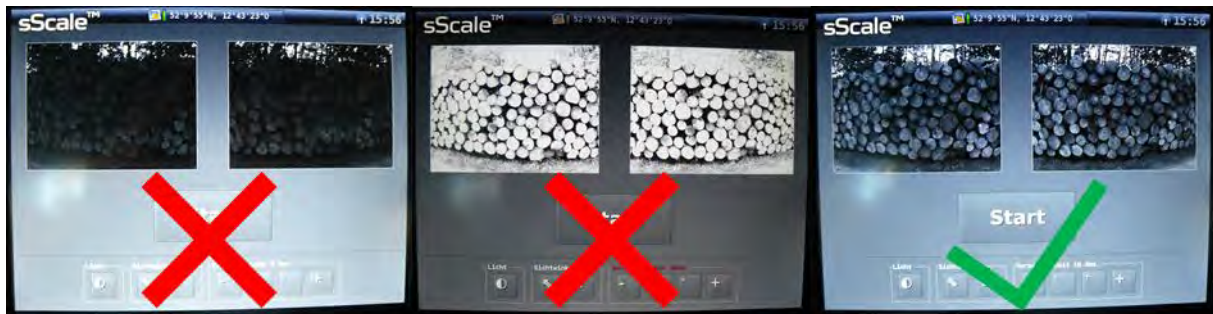
Figure 5: Too low, too high and correct exposure time

TIP: Even during the day, the use of the built-in floodlight can be helpful. Thus, for example, hard contrasts are reduced with only partially sunlit woodpiles. By pressing the button 2.2.1.4 **"Light" you can switch the light on and off again. However, if the light is switched on, it cannot** be switched off during measurement. You can find more detailed information concerning the LED floodlights in Chapter A.5.1.5

Image capture

After adjusting the viewing angle and exposure, drive to the start of the woodpile so that the woodpile does not exceed 30% of the camera picture. Begin taking pictures by pressing button **2.2.1.3 "Start" after you have started to move the vehicle. Drive past the woodpile at a constant, low speed. While taking the pictures, the caption changes on the "Start" button 2.2.1.3 to "Stop", the frames around the c**amera pictures flash and below the camera pictures a blue progress bar indicates the remaining capacity of the main memory.

When you have passed the woodpile, stop taking pictures by pressing the "Stop" button. The message "Postprocessing" appears briefly on the monitor.

CAUTION:
Adjust your driving speed according to the nature of the path and the length of the woodpile. Before starting the measurement, watch out for oncoming vehicles or persons!
The maximum possible vehicle speed is 20 km/h. For the prevention of accidents, however, it is recommended to drive past the woodpile at a speed of nor more than 15 km/h.

TIP:
First start taking pictures once you start to move, in this way the widths of the pictures will be more even.
TIP:
You can change the viewing angle of the camera while taking pictures. This may be necessary if the woodpile is not parallel to the road, or if the height varies considerably.
TIP:
If it is not possible to take pictures, check whether a GPS signal is being received. Without a known GPS position, taking a measurement is basically not possible. When attempting to start a measurement without GPS signals, a message appears stating that no GPS position is known.
TIP:
If the analysis is not successful, try changing the exposure time.

3.2.2. Check and crop the captured picture sequence

Checking

After successfully taking pictures, it is possible to examine the individual pictures and to check for any errors (for example, cropped woodpile areas if the woodpile is not parallel to the path). **To do this, you can scroll through the individual pictures in the "Picture sequence" user inter**face.

Cropping

Cropping the picture sequence reduces the number of pictures to be analysed and speeds up the analysis process. This step is not absolutely necessary for a successful analysis, but may be helpful in different situations (for example, when distracted by walkers at the end of the **picture taking: You forgot to press "Stop" and the picture taking continued, while the area was** cleared for the walkers or you started taking pictures a distance before reaching the woodpile). To crop the picture sequence in the front area, move to the location in the picture sequence where you want to start the analysis and drag in a vertical gesture through the picture sequence. To crop the picture sequence at the rear, proceed accordingly.
On the start pictures the woodpile should take a maximum of 50%, as should be the case with the last pictures of the sequence.
The pictures not taken into account will be gre**yed out and the "Start" and "Finish" marks will** move to the new positions in the overview bar at the bottom of the screen (see Figure 6).

Figure 6: Original picture sequence, cropped at the front and at the end

If you are sat**isfied with the pictures taken, press the button 2.2.6.3 "Start Analysis". If you want to repeat taking the pictures, press the button 2.2.6.4 "Discard". You must confirm the deletion of the pictures and return to the** "Start screen**" user interface.**

3.2.3. Editing of the polygonal course and entering the Woodpile ID

Editing the polygonal course

While the analysis is running, you will see a progress bar in the window of the user interface **2.2.7.8 "Result". After successful analysis, an overall picture of the** woodpile appears, with a polygonal course describing the woodpile face area and the unique, internal Woodpile ID assigned to the current measurement (see Figure 7).
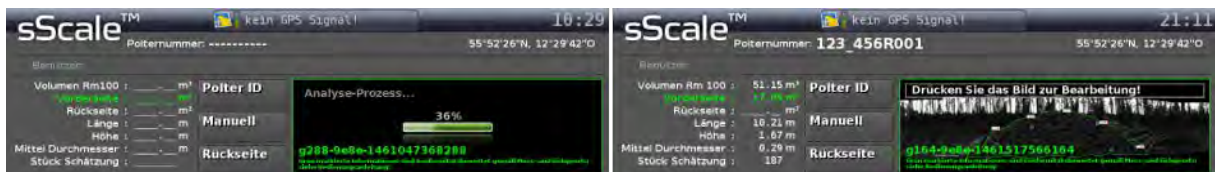
Figure 7: Current and complete analysis

To enter the edit mode of the polygonal course, press the woodpile picture. The polygonal course is shown as a blue line. Blue squares mark the polygon vertices. The polygonal course is defined by straight connections between the individual polygon vertices. You can move it by tapping and holding a polygon vertices.

You can add more polygon vertices by pressing the button 2.2.8.4 "Plus". This button remains active, until it is pressed again. If this button is activated, the red text "Add" appears in the upper left corner (see Figure 8). Now touch the polygonal course at the point where you need another polygon vertex and move the polygon vertex as needed.

You can delete excessive polygon vertices by pressing the button 2.2.8.5 "Minus". This button remains active, until it is **pressed again. If the button is activated, the red text "Delete" appears** in the upper left corner (see Figure 8). Touch the polygon vertex to be deleted.
If the function "Add" or "Delete" is activated, the polygonal course will be more transparent.
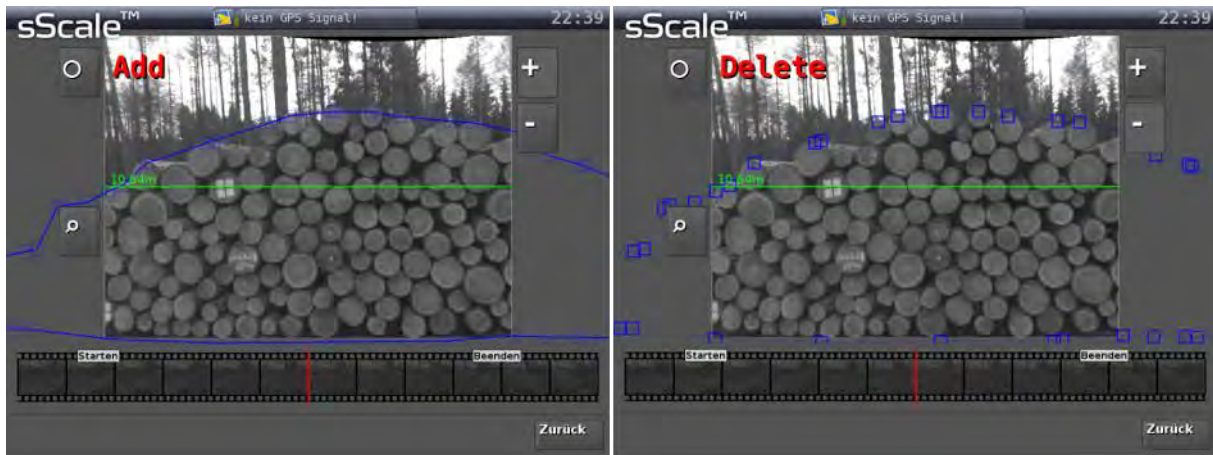
Figure 8: Adding and deleting polygon vertices

CAUTION:
The user of the system is responsible for ensuring that the minimum area of 2m² is maintained. This is indicated by the red colouring of the result. A woodpile with a smaller front surface than 2 m² must be measured manually for verifiable legal reasons (see Chapter 4.2 Manual measurement)

CAUTION:
The user of the system is responsible for ensuring that the woodpile face area demarcation is sufficient to be bounded by the polygonal course. Dralle A/S can only guarantee that the area indicated later, within the measurement uncertainty, corresponds to the area covered by the polygonal course.

TIP:
If necessary, use the zoom function to better identify details of the woodpile face. This is **achieved by pressing the button 2.2.8.2 "Magnifying glass".**

How precisely does the polygonal course need to be adjusted?

Generally, the polygonal course output by the system must be optimised. To guide you for the precision you need, the following illustrations show schematic polygonal courses and polygonal **courses created with the sScale™ system. It shows inadequately optimised polygonal courses,** overly optimised polygonal courses, and appropriately optimised polygonal courses.

The following rule describes the action of the polygonal course optimisation:

A gap in the woodpile cover is digitised out if one of the surrounding logs can fill in this gap. Gaps that can not be filled but still seem too big to be ignored are only digitised to half the depth.
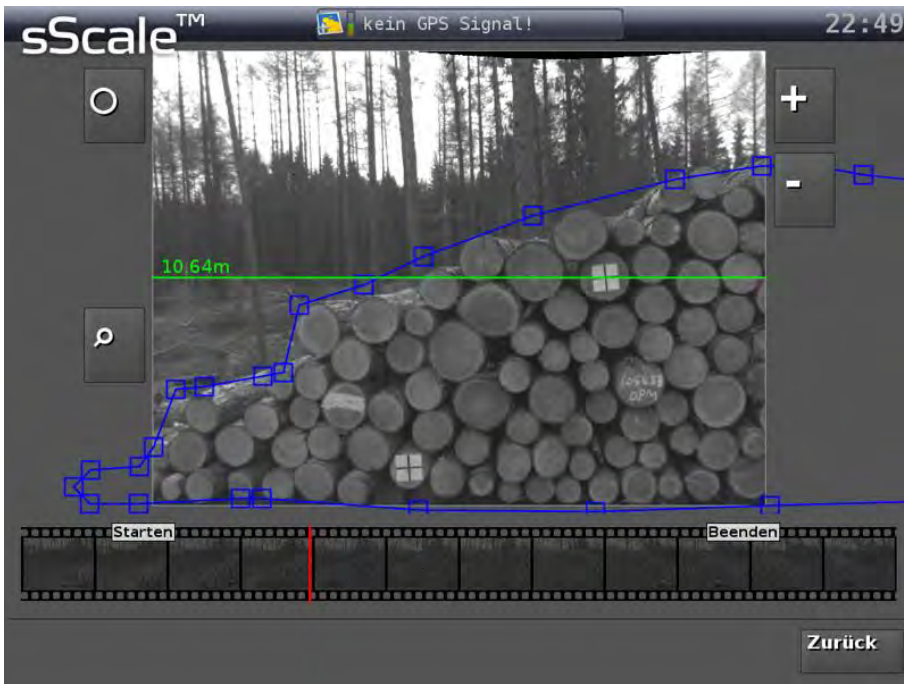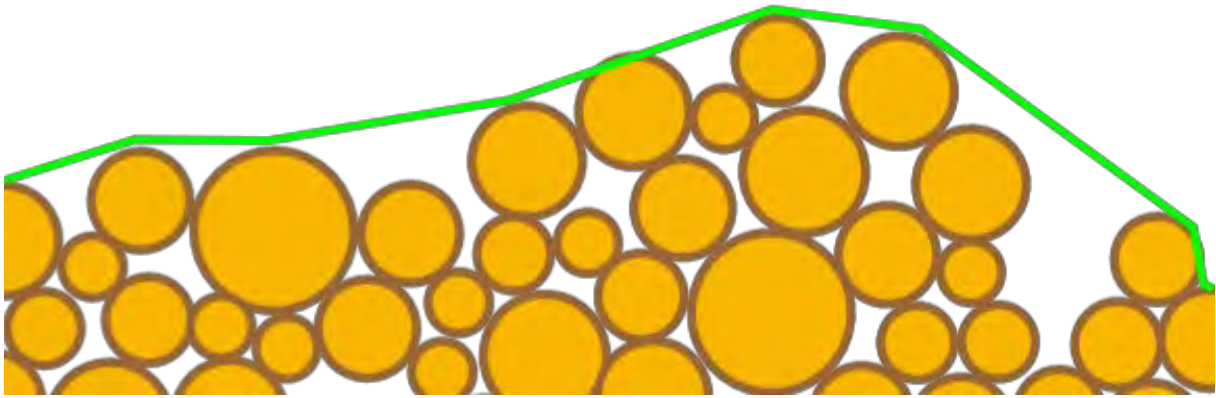
Figure 9: Automatic generated polygonal course, insufficient optimisation
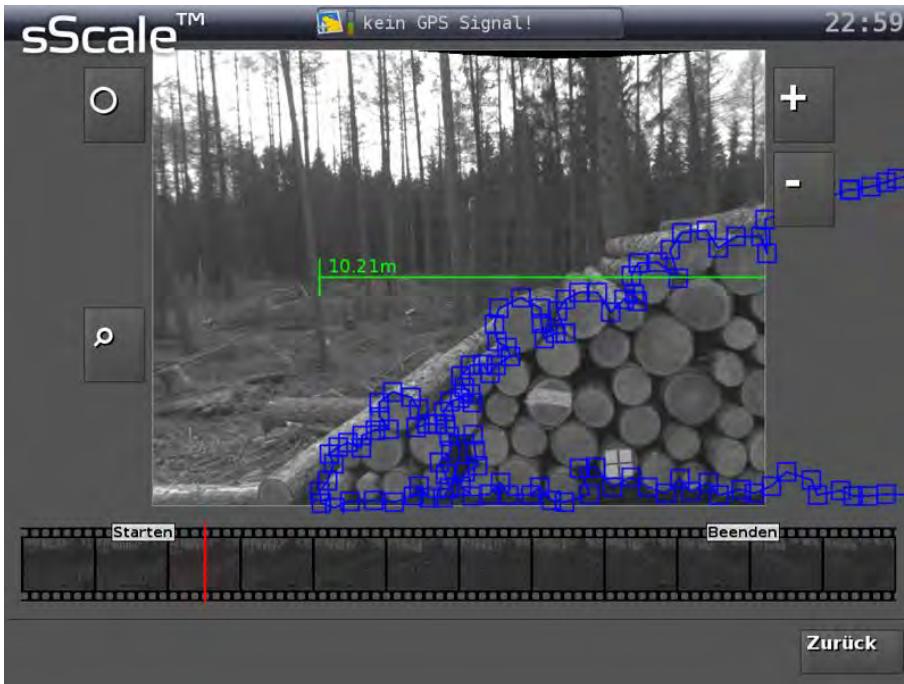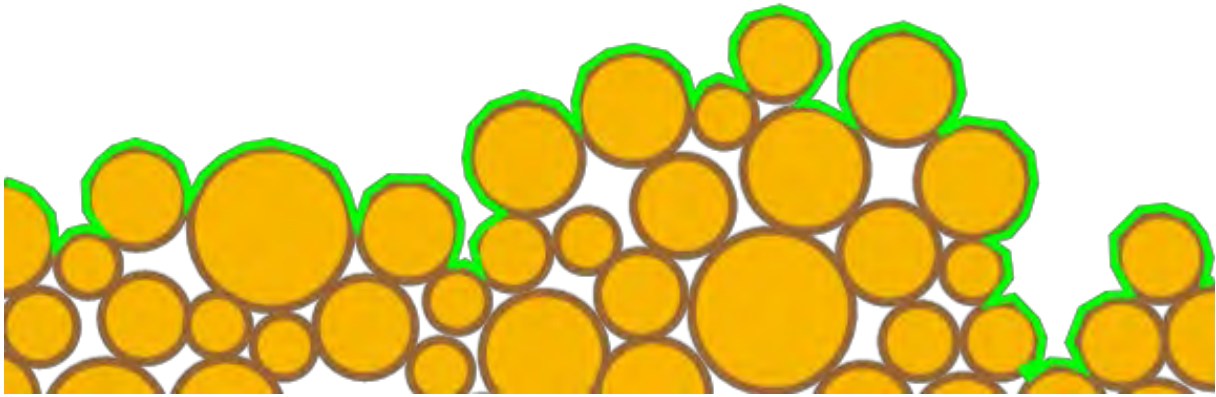
Figure 10: Edited polygonal course, excessive optimisation
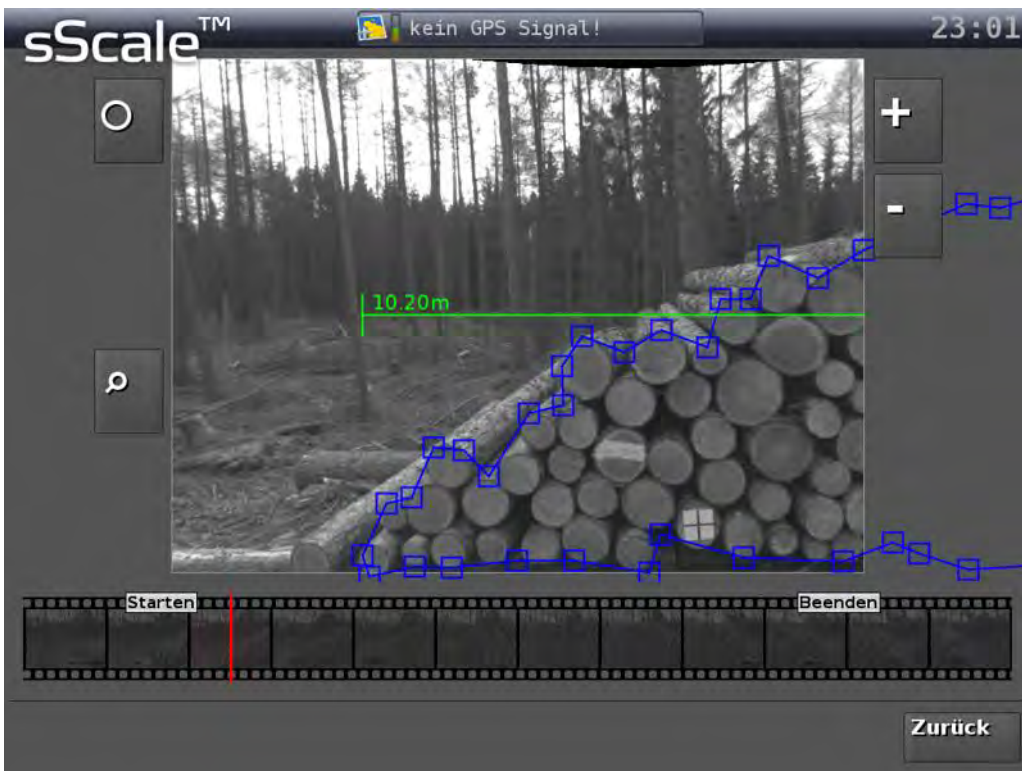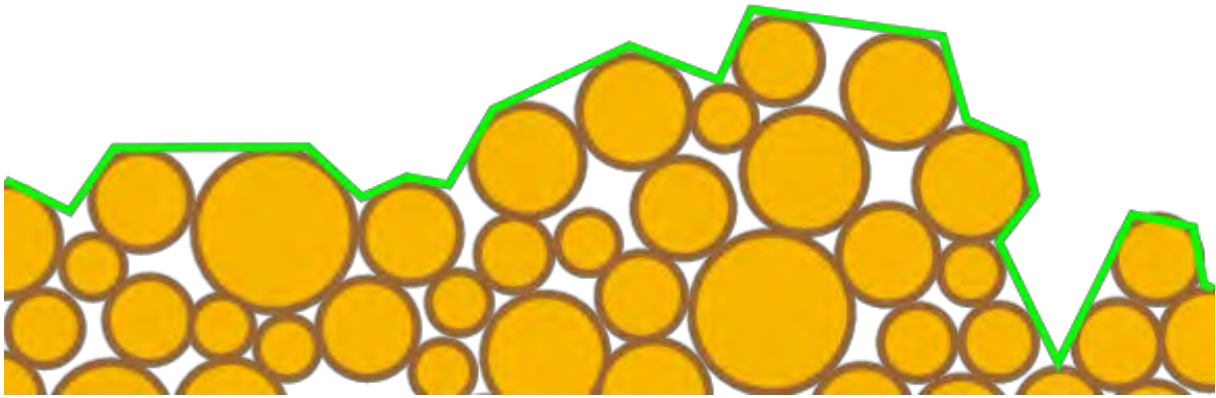
Figure 11: Edited polygonal course, adequate optimisation

CAUTION:
Since the picture in edit mode is a three-dimensional model, but displayed on a two-dimensional output medium, distortions can occur, on the edges of the pictures especially with a badly piled up woodpile. For this reason, editing the polygon should always be done in the middle of the picture. This area is highlighted in the following Figure 12.
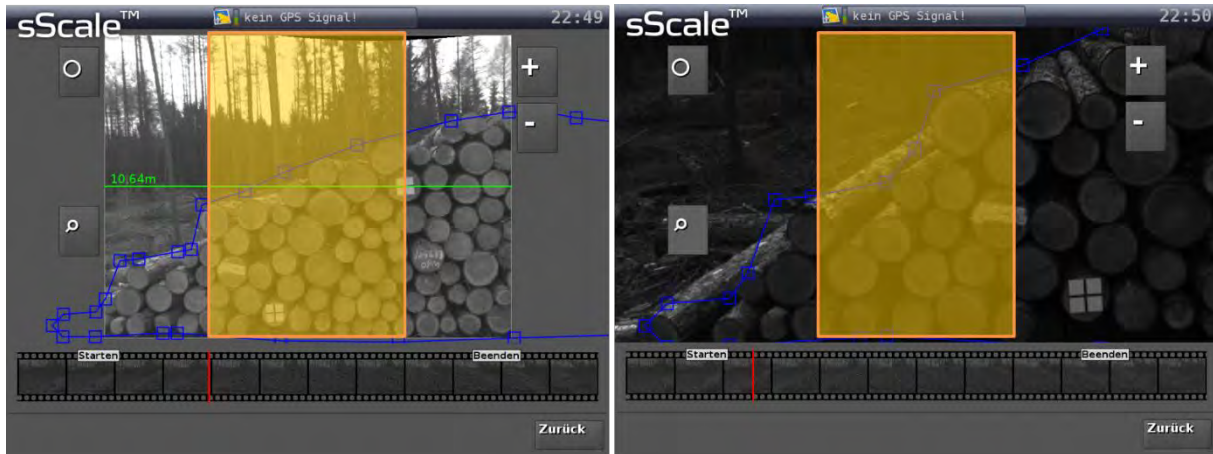
Figure 12: Editing area in the normal and the enlarged view

NOTE:
With the area of the edited polygonal course, the woodpile face area is described so that when multiplied by the grade length of the logs, a volume can be calculated. This volume corresponds to the container volume of logs and trapped air, the forestry industry traditionally refers to this as cubic measure. As a result, the outer position of the logs of the woodpile face contour have some air pockets inside (Figure 11). For this reason, no attempt should be made to detect **every single "gap" or surface irregularity with the polygonal course (see illustration in Figure 10).**

Entering the Woodpile ID

Only after a Woodpile ID has been entered by the user can a measurement be stored and sent **to the sScale™ server.** This Woodpile ID is independent of the internal, unique Woodpile ID. **Entering the Woodpile ID is done via button 2.2.7.5 Woodpile ID". After pressing the** button, **a QWERTY keyboard appears. By pressing the "ALT" button, further special characters can be** called up.

TIP:
First enter the Woodpile ID after you are sure you have edited all other fields. Since this field must be filled in, measurement without Woodpile ID cannot be accidentally completed.

NOTE:
If there are woodpile measurement jobs registered on the system, a corresponding selection **list appears after clicking on button 2.2.7.5 Woodpile ID". You can select a Woodpile ID from** this by clicking on it. Here there are usually more administrative woodpile data stored.

3.2.4. Completing and saving the measurement

Complete and save the measurement by pressing the 2.2.7.18 "Submit" button and then con-firming in the following pop-up window. The measurement is transferred to the long-term storage of the system and then sent to the central server.

After pressing **the button "Submit" the user interface "Start screen" appears automatically.**

NOTE:
After saving the measurement, no change to the measurement is possible. Neither the polygonal course, nor other parameters (e.g., density or assortment lengths) can be changed after saving.

NOTE:
After saving the measurement, the software is restarted. This takes place fully automatically and requires no intervention by the user. Note that there may be a short delay in receiving the GPS signal.

3.2.5. Discarding a measurement

If a picture analysis is not to be transmitted and deleted, you can cancel the measurement by **pressing button 2.2.7.19 "Discard". All data is deleted and the user interface "Start screen"** appears automatically.

3.3. Dividing a woodpile

3.3.1. Basics

With very narrow road conditions, it may occur that a woodpile cannot be measured as a whole, since the camera opening angle cannot cover the entire wood piling height. In this case, the woodpile can be divided into an upper and a lower part.

These are measured in two separate measuring runs, which leads to two separate woodpile measurement results. Both parts are stored separately and cannot be merged to form just one measurement. Therefore, it is important to internally agree on a common Woodpile ID extension for a split woodpile.

A general recommendation for the best possible extension cannot be given at this point, since the most diverse woodpile number concepts are used. Most of the time, however, you can use one of the following examples, where XYZ123 is the original number of the woodpile:

- XYZ123_1 and XYZ123_2
- XYZ123-1 and XYZ123-2
- XYZ123 (1) and XYZ123 (2)

In addition, a note can be stored in the note field (see Chapter A.5.2.9) so that the two amounts can be combined later.

3.3.2. Procedure

Use the cross-hair plates described in Chapter C.1 to mark the dividing line between the upper and lower woodpile part. Look for a suitable edge log on the relevant woodpile, so that the regular polygonal course crosses the cross-hair as directly as possible.

Now first perform the measurement of the lower woodpile part. Form the polygonal course basically as described in Chapter A.3.2.3, but delete all polygon vertices between the two cross-hairs, so that the two upper vertices are connected with a direct line (see Figure 13). After transmitting the lower part, measure the upper part accordingly, so that now the two lower corner points are connected with a direct line - without additional polygon vertices (see Figure 14).

In Figures 15 to 18 you can see detail sections of the areas in which the polygonal courses lie on the cross-hairs.

Figure 13: Polygonal course of the lower part of a divided woodpile

Figure 14: Polygonal course of the upper part of a divided woodpile

Figure 15, Figure 16, Figure 17 and Figure 18: Detail views in the area of the cross-hairs

CAUTION:

For woodpiles longer than 20 metres, it is necessary to place additional marking crosses along the dividing line, in addition to the two edge crosses. Woodpiles can also be divided and measured under unfavourable piling conditions (such as slight bends or bumps in the woodpile face).

For woodpiles over 20 metres in length, it is recommended to place a marker cross every 15 metres. The procedure of dividing the woodpile corresponds to the method already described. Just that existing polygon vertices are drawn on the additional marker crosses.

3.3.3. TwoStep-function

As of September 2018 a new function has been introduced, called 'TwoStep'. TwoStep allows for the merger of the measurements described in Chapter A.3.3.1. (max. 2 measurements). The procedure for this is the following:

- Take picture of part 1 of the stack
- Start the analysis
- **Under the 'give ID menu' push a button with a small scissor icon on it. Stak ID is au-tomatically called 'Combine'**
- In top left corner, just to the right of the sScale logo, this green icon appears :
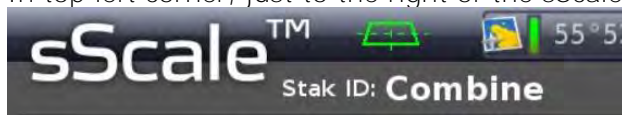
- Finish edit part 1 and push submit
- Take pictures of part 2 of the stack
- Start the analysis
- **Under the 'give ID menu', give/select the stack's id**
- **Finish the editing and push 'submit'**
- A box will pop up with two options:
    - Left/Right
    - Top/Bottom
- Choose the option that fits the stack
- Push submit in the pop up box.

The results will be a shown in Figure 19:
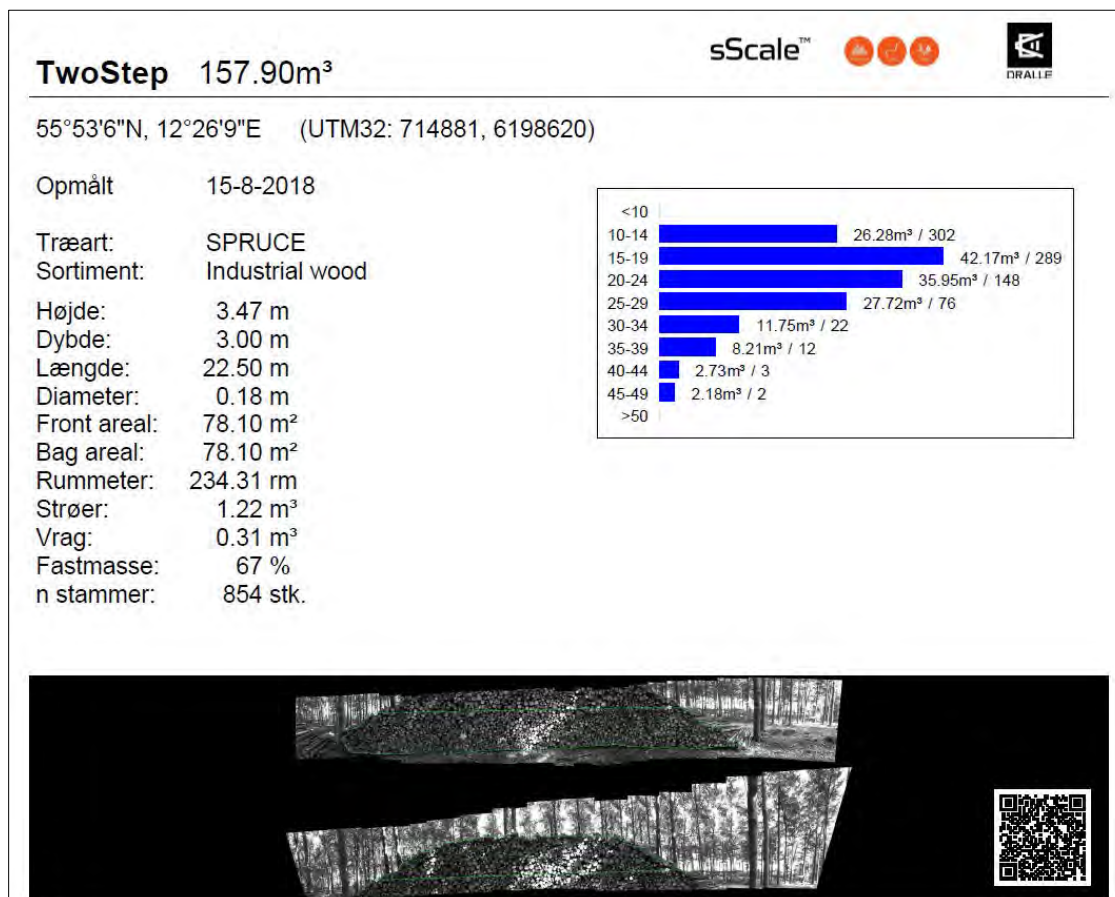
Figure 19: Presentation of the merger of two measuremetns by the 'TwoStep'-function

4. Presentation of results

4.1. Photo-optic measurement

The results of a photo-optic measurement are shown in different locations. Thus, in the user interface **"Result" (see Chapter A.2.2.7), conformity**-rated results can be found alongside other, non-conformity-rated results. While the conformity-rated results are presented in full, **the "Result" user interface provides only an excerpt of the main non**-conformity-rated results. Conformity-rated results are always displayed in green (see Figure 19), these are:

- the area of the woodpile contour enclosed by the polygonal course
- the polygonal course itself
- the woodpile picture with integrated, after saving non-changeable polygonal course
- the system-internal, unique Woodpile ID (Guid) as per template
  g<nnn> <xxxx> <mmmmmmmmmmmmm>

In addition, with photo-**optic measurement results there is the note: "Information highlighted** green is conformity-rated according to the Measurement and Verification Act; see Operating **Instructions!"**

*Figure 20: Result representation of a conformity-***rated measurement in the user interface "Result"**

Non-conformity-rated results are always shown white. These are:

- the woodpile volume in cubic metres (container volume, i.e. cubic metre)
- the area of the rear side in square metres (if recorded manually)
- the length of the woodpile in metres
- the average height of the woodpile in metres
- the average diameter of the individual logs
- an estimation of the number of logs in the woodpile

In the user interface "Details of an archive entry" (see Chapter A.2.2.5) you can find further data additionally to the sizes listed above. Here, too, the conformity-rated results are always highlighted green (see Figure 20).

*Figure 21: Result representation of a conformity-rated **measurement in the user interface "Details of an archive entry"***

Additionally displayed values:

- the depth of the woodpile (assortment lengths) in metres
- the density of the woodpile (ratio of wood volume to the complete volume in %)
- the volume of rejects (if entered) in cubic metres
- the volume of underlay (if entered) in cubic metres
- the main tree species of the woodpile
- the range of woodpile
- the seller of the woodpile
- the purchaser of the woodpile
- a note (if entered)

4.2. Manual measurement

Using sScale™, a manually measured woodpile can be entered and saved. You can find more detailed information in Chapter A.5.2.1.

CAUTION:
Results of manual measurements are non-conformity-rated

For this reason, the results of a manual measurement are always displayed in white only and the reference to conformity-**rated results is missing and/or is indicated by the following: "Man-ually measured" replaced (see Figure 21 and Figure 22).**
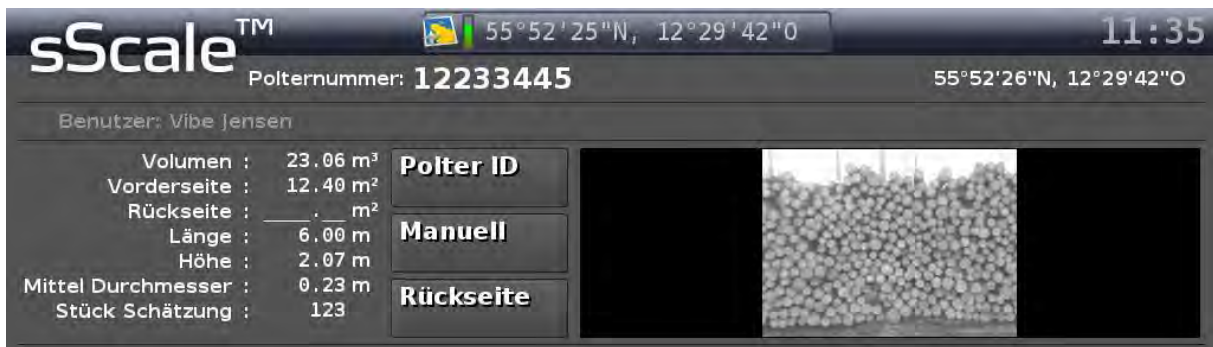
*Figure 22: Result representation of a <u>non</u>-conformity-***rated measurement in the user interface "Result"**
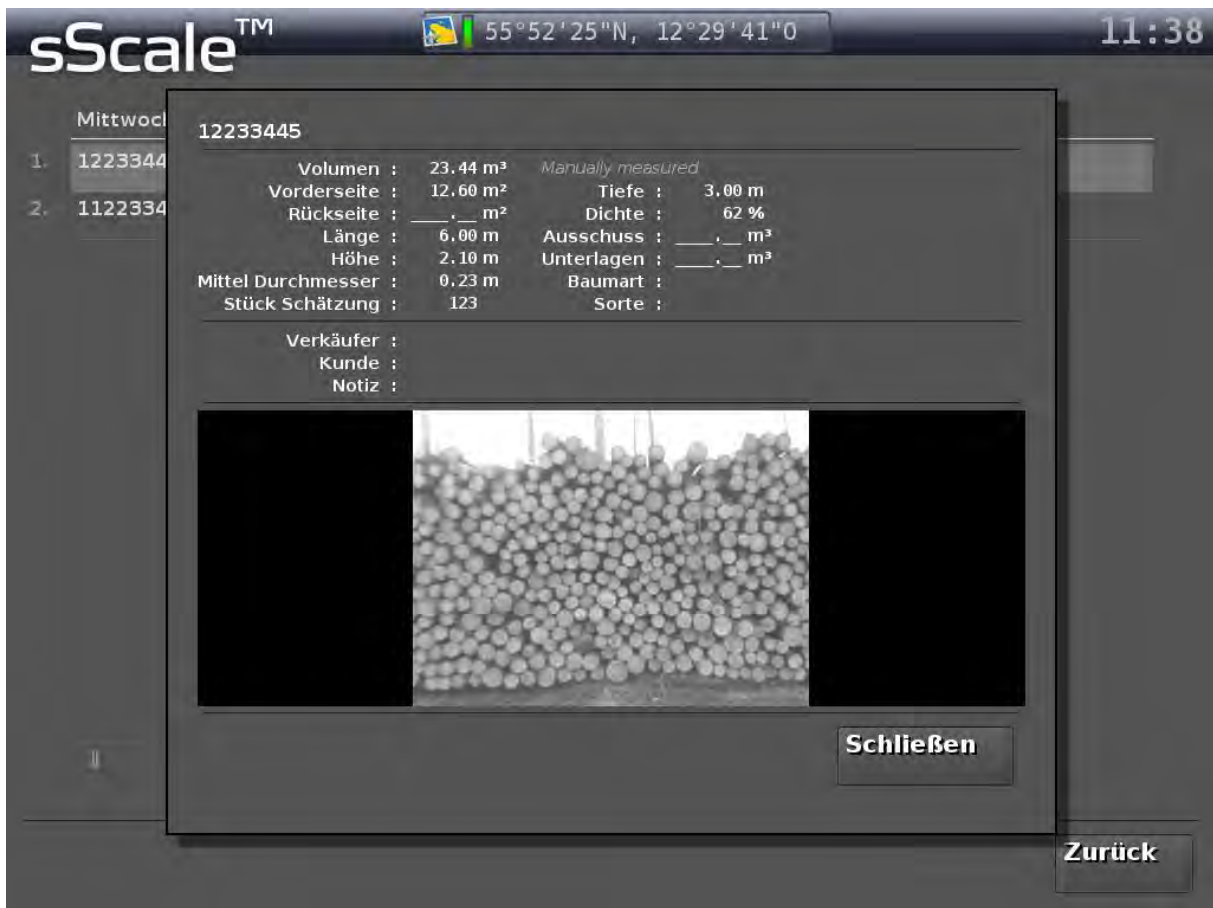
*Figure 23: Result representation of a <u>non</u>-conformity-***rated measurement in the user interface "Details of an archive entry"**

In most cases, a manual measurement is present if the woodpile could not be measured in a photo-optic manner (for example, repeated failure of the analysis because the woodpile is too small). Thus, no overall picture of the woodpile can be generated. Therefore, as a woodpile picture in the archive view, only a single picture of the picture sequence is stored and displayed to basically document the woodpile as a photo.

All other results correspond to those listed in Chapter 4.1.

5. Other menu functions

5.1. **Functions of the user interface "Main Menu"**

All the following functions can be accessed by calling up the main menu. This is done by pressing the sScale™ logo at the top left of the screen and can be done from any user interface.

5.1.1. Registrations

By pressing the button 2.2.2.6 "Registrations" you reach the sub-menu "Registrations". Here is a list of received measurement jobs, a directional navigation, and detailed information about a selected measurement job. You can also reject measurement jobs and remove them from the registration list.

List of measurement jobs
The measurement jobs are sorted according to their distance to the location of the vehicle. This distance represents the distance as the crow flies and is given below the Woodpile ID. It is stated in meters or kilometres.
You can use the buttons 2.2.3.2 "Arrow" to scroll through the list. A page contains 13 measurement jobs.
By clicking on a measurement job, you can highlight it in the directional navigation, adjust the scale of the directional navigation to the distance to this measurement job, and view details about this measurement job.

Directional navigation
The centre of the "Radar" represents the vehicle. The directions are as usual (top north, right east, bottom south and left west). The measurement jobs in the list are displayed in relation to their location to the vehicle. The navigation scale will automatically change with the distance to the selected measurement job. All measurement jobs are displayed that are in the respective radius.

Job details
On the right side of the screen you will find details concerning the measurement job selected in the list on the left side.
In addition to the position of the woodpile, the seller and buyer, as well as tree species and assortment and a note of the applicant are displayed. All of this information was previously submitted via the sScale™ server (see separate documentation).
By pressing the button 2.2.3.5 "Reject" you can reject a measurement job. This may be necessary if, for example, the woodpile has already been measured.
Rejecting a woodpile requires justification and confirmation in the pop-up window that appears.

5.1.2. Archive

By pressing the button 2.2.2.7 "Archive" you reach the sub-menu "Archive". Here you will find all measurements made so far. The measurements are sorted by time and grouped by days.
By pressing the buttons 2.2.4.3 "Arrow" you can scroll through the measurements of a day and by pressing the buttons 2.2.4.5 "<> Day" you can switch between the days.
The overview list shows the Woodpile ID and the woodpile volume in m³ (cubic meters) for each measurement, as well as tree species, assortment, seller and buyer.
By clicking on an entry, you get to the detailed information of the measurement (see Chapter A.4).
In addition, the total amount measured on the respective day is displayed next to the date.

By pressing the button 2.2.4.4 "Search" you can search for a specific woodpile. A keyboard appears on which you can enter the corresponding woodpile number.

5.1.3. User

By pressing the button 2.2.2.8 "User" you reach the sub-menu "User". A list of all possible system users created on the server is displayed. Search for the suitable user in the list and click on this to save it to the next user choice in the system and to internally assign the produced measurement results to the selected user.
The selected user appears on the user interface "Result" (see Chapter A.2.2.7, point 3) Furthermore, this information is also transmitted to the customer server together with the measurement results.

5.1.4. Network status

By pressing the button 2.2.2.9 "Network status" you reach the sub-menu "Network status". Here you can see if there are still any measurements on the system that have not yet been transmitted to the customer server.

NOTE:
The measurement results are stored in the archive immediately after completion of the measurement and only then sent to the server. Even if the system is shut down with measurements that have not yet been sent, this data will not be lost.
Sending the results to the sScale ™ server may take some time, depending on your network connection.

5.1.5. Light

By pressing the button 2.2.2.10 "Light" you can switch the built-in LED floodlight on and off again. This is especially helpful at night when you want to detect sprayed woodpile numbers.

If you use the light during a measurement, the floodlight acts as a flash. These flashes are significantly brighter than the steady lights and are synchronised with the exposure of 10 ms.

CAUTION:
The floodlight is very bright in the flash mode! Do not look directly into the floodlight!

CAUTION:
Please note that the floodlight must not be in operation when driving on public roads!
Consider other road users when taking measurements in the vicinity of public roads at night. To avoid endangering them by glare, only leave the floodlight on for as long as you need its light.

5.1.6. Demo

By pressing the button 2.2.2.11 "Demo" you reach the sScale™ demo mode. The system is restarted and the picture sequence of an internal demonstration woodpile is loaded. The system can be used and demonstrated normally, but the measurement already starts at Chapter 3.2.2. With the "Discard" of a demo measurement or the "Submit", the normal measurement mode of the sScale™ restarts.

5.1.7. System shut-down

Pressing the button 2.2.2.12 "System shut-down", a system shut-down takes place.

CAUTION:
No follow-up query occurs. If you shut-down the system while a measurement is on-going, this data is lost and the measurement must be repeated.

5.1.8. Leaving the main menu

By pressing the button 2.2.2.13 "Return" you leave the main menu. You return to the user interface from which you accessed the main menu.

5.2. Functions of the user interface "Result"

The following functions can only be accessed after taking pictures and the start of an analysis.

5.2.1. Manual measurement

By pressing the button 2.2.7.6 "Manual" you reach the sub-menu for a manual measurement of the woodpile face based on random section heights. Since a return to a photo-optic measurement is not possible, you must confirm the switch to manual measurement in a query.
A manual measurement may be necessary if, for example, the woodpile is too small or if other woodpile requirements (see Chapter B.2) are not met for an sScale™ photo-optic measurement. You can also perform a manual measurement for woodpiles that cannot be reached with the vehicle. The manual measurement function is based on the section height method and essentially provides extended computational support for this method. In this way, a manually measured woodpile can be transferred into the IT structure of the user.
Measure the section heights of the front side of the woodpile according to your specifications and enter them into the mask using the keyboard at the upper right edge of the picture.
Measure the length of the woodpile and enter it using the button 2.2.9.5 "Length". Once you have determined the mean diameter, you can enter this via the button 2.2.9.6 "Diameter". You can enter the number of logs in the woodpile using the button 2.2.9.7 "Quantity".
The mean diameter and number of logs are not mandatory fields and can be left blank.
After entering all the measured quantities, complete the manual measurement by pressing the button 2.2.9.8 "Done" and return to the "Result" user interface.
For documentation purposes, a single picture of the picture sequence is saved with the data record.

NOTE:
Avoid switching to a manual measurement if there is a successful analysis. In rare cases, this can lead to a fault in the system.

CAUTION:
A manual measurement is non-conformity-rated according to Measurement and Verification Act!

5.2.2. A measurement of the rear side of a woodpile

By pressing the button 2.2.7.7 "Rear side" you reach the sub-menu the measurement of the rear side of a woodpile.

The measurement of the rear side of the woodpile must be carried out if thin and thick parts of the wood are placed together respectively in the woodpile, this is to compensate for the falling and rising of a woodpile in the volume calculation. Offsetting against the conformity-rated front side takes place by means of the arithmetic mean.

The measurement of the rear side is analogous to the measurement of the front side with manual measurement, but without considering the mean diameter and the number of logs.

Enter the heights using the keyboard and the length of the rear usi**ng the 2.2.10.5 "Length" button.**

After entering all the measured values, complete the measurement of the rear side by pressing **the button 2.2.10.6 "Done" and return to the "Result" user interface.**

CAUTION:
The result of the rear side measurement is non-conformity-rated according to Measurement and Verification Act!

5.2.3. Depth

Use the button 2.2.7.9 "Depth" to enter the depth of the woodpile (assortment length). A keyboard appears. The depth is used to calculate the container volume by multiplying it by the woodpile area.

5.2.4. Density

The system derives the possible density of the woodpile from various parameters. The density of the woodpile is the ratio of wood volume to container volume. However, because the system is unable to detect, for example, the woodpile quality or the curvature of the logs (especially in deciduous wood), the user has the option of manually overwriting the density. This is done **via the button 2.2.7.10 "density". The density is expressed as a percentage.**

NOTE:
Although the model stored is capable of learning so that every manual correction is included in the model, it is nevertheless the duty of the user to verify the displayed density and to correct this if need be.

NOTE:
Correct the density only after the polygonal course is adjusted and all other entries have been made, as the density is recalculated after each parameter change. This will prevent an uncorrected density from being saved and transmitted.

TIP:
The following table allows you to use the parameters determined by sScale™ to estimate the density of a woodpile relatively precisely, taking into account the parameters that cannot be **determined by sScale™.**

Startdichte maschinengesetzt	mit Rinde	ohne Rinde
Nadelhölzer		
Kiefer, Lärche, Douglasie	66	59
Fichte, Tanne	68	61
Laubhölzer		
Buche, Esche, Ahorn, Birke	61	53
Eiche	60	49

1. Anpassung an Aufarbeitungsqualität	0 bis -5

2. Anpassung an Schnee und Eis	0 bis -6

3. Anpassung an Krümmung	+/-
keine Krümmung	0
leichtere Krümmung	-1
leichte Krümmung	-2
stärkere Krümmung	-3 bis -8

4. Anpassung an Ø-Durchmesser	
< 10	-5
11	-4
12	-3
13	-2
14	-1
15	0
16	1
17	2
18 - 19	3
20 - 22	4
23 - 26	5
27 - 32	6
33 - 38	7
39 - 44	8
45 - 49	9
50 - 59	10

5. Anpassung an Polterqualität	Laubholz	Nadelholz
normal maschinengesetzt	-1	0
gute Polterung	0	1
sehr gute Polterung	1	2
schlechte Polterung	-2 bis -3	-1
sehr schlechte Polterung	-4 bis -5	-2

6. Anpassung an Poltertiefe (Stammlänge)	Laubholz	Nadelholz
6	-5	-3
5	-4	-2
4	-3	-2
3	0	0
2	4	3

7. Anpassung an Polterhöhe	+/-
über 2m auf 2/3 der Polterlänge	1
über 3m auf 2/3 der Polterlänge	2

The procedure is as follows:

Starting from the base density of a tree species (table block start density), additions or deductions are made for the density factor for various parameters.
The deductions of the blocks 1, 2, 3 and 5 must be estimated by the system user himself and are therefore rather soft parameters. For the additions and deductions of blocks 4, 6 and 7, **the quantities issued by sScale™ can be used.**

5.2.5. Entering rejects

If there are individual logs in the woodpile that are to be marked as reject, you can enter their **numbers via button 2.2.7.11 "Reject".**
The system then automatically calculates the number of logs with the mean diameter of the woodpile and the assortment length and subtracts the calculated volume from the total volume of the woodpile.

The mean diameter automatically used for the calculation can be corrected by the user if necessary.

5.2.6. Entering underlays

If the woodpile is lying on an underlay, you can enter their number via the button 2.2.7.12 **"Underlays".**
The system then automatically calculates the number of underlays with the mean diameter of the woodpile and the assortment length and ads the calculated volume to the total volume of the woodpile.
The mean diameter automatically used for the calculation can be corrected by the user if necessary.

5.2.7. Entering tree species

With the button 2.2.7.13 "Tree species" you can enter the tree species of t**he woodpile. A list** appears from which you can select the appropriate tree species. The tree species list is cus-tomer-**specific and is configured and maintained centrally via the sScale™ server.**

5.2.8. Entering the assortment

With the button 2.2.7.14 "Assortment" you can enter the assortment of the woodpile. A list appears from which you can select the appropriate assortment. The assortment list is cus-tomer-**specific and is configured and maintained centrally via the sScale™ server.**

5.2.9. Entering a note

With the butt**on 2.2.7.15 "Note" you can enter a note to the measurement. A QWERTY key-**board appears; **press the "ALT" key at the bottom right of the keyboard to call up more special characters. Pressing the "ALT" key again will take you back to the normal keyboard.**

TIP:
For example, enter notes for measurement, route conditions or access options for round timber trucks.

5.2.10. Entering the seller

With the button 2.2.7.16 "Seller" you can enter the seller of the woodpile. A list appears from which you can select the appropriate seller. The seller list is customer-specific and is configured and maintained centrally via the sScale™ server.

5.2.11. Entering the buyer

With the button 2.2.7.17 "Buyer" you can enter the buyer of the woodpile. A list appears from which you can select the appropriate buyer. The buyer list is customer-specific and is config-ured and maintained centrally via the sScale™ server.

5.3. **Functions of the user interface "Edit polygonal course"**

In addition to optimising the polygonal course (see Chapter 3.2.3), you can also use this user interface to check the log diameter detected by the system and edit it if necessary.

5.3.1. *Checking the log diameter*

By pressing the button 2.2.8.1 "Circle" you can switch to the view of the face diameter. As shown in Figure 23, the diameters are displayed as yellow circles on the faces of the individual logs. The middle of the circle is the basis of the assessment.
As with editing of the polygonal course, you can use the navigation bar to traverse along the woodpile.
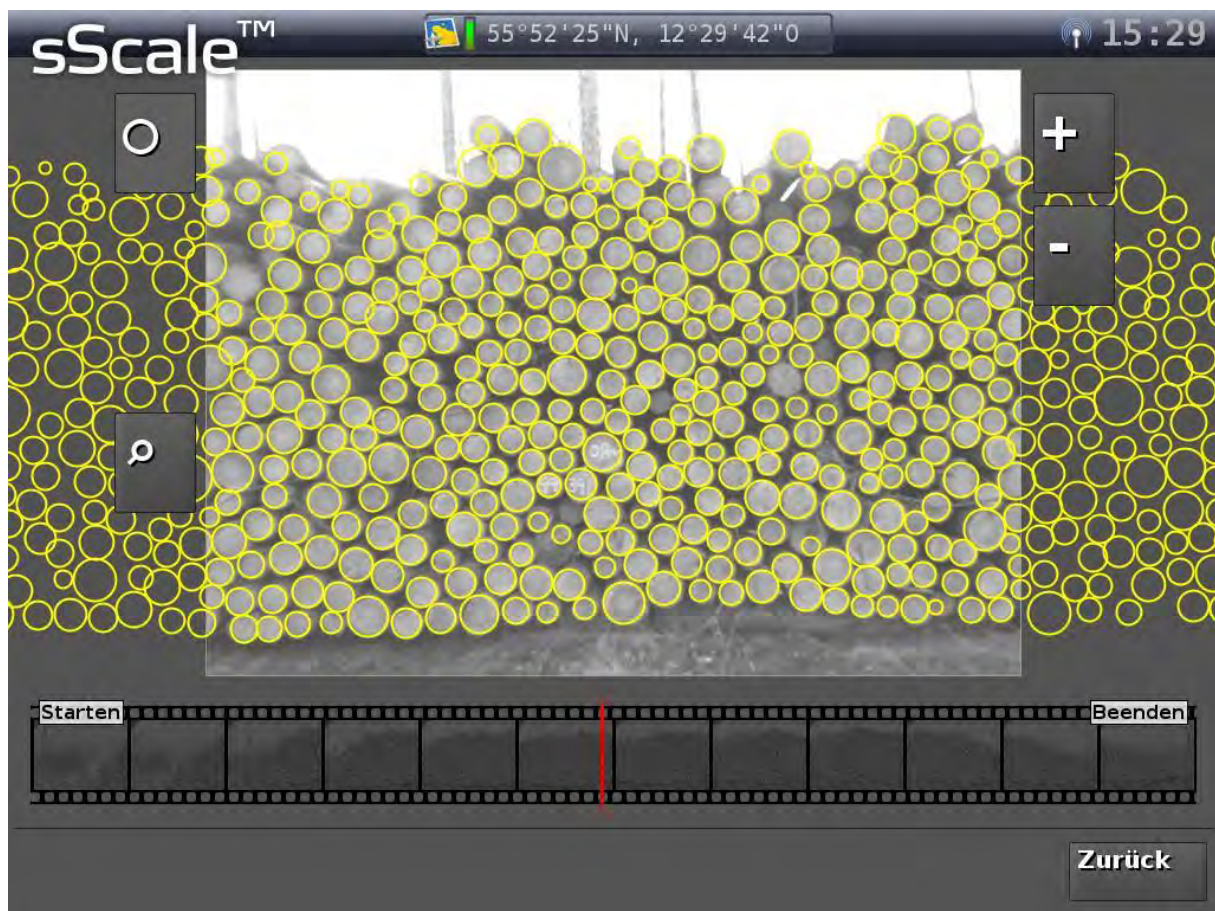

Figure 24: Viewing the diameter

5.3.2. Editing a log diameter

Log diameters that are too large or too small can be adjusted. To do this, click on the inside of the circle of the respective log. All other diameters will be hidden and the one to be edited will appear in green (see Figure 24).
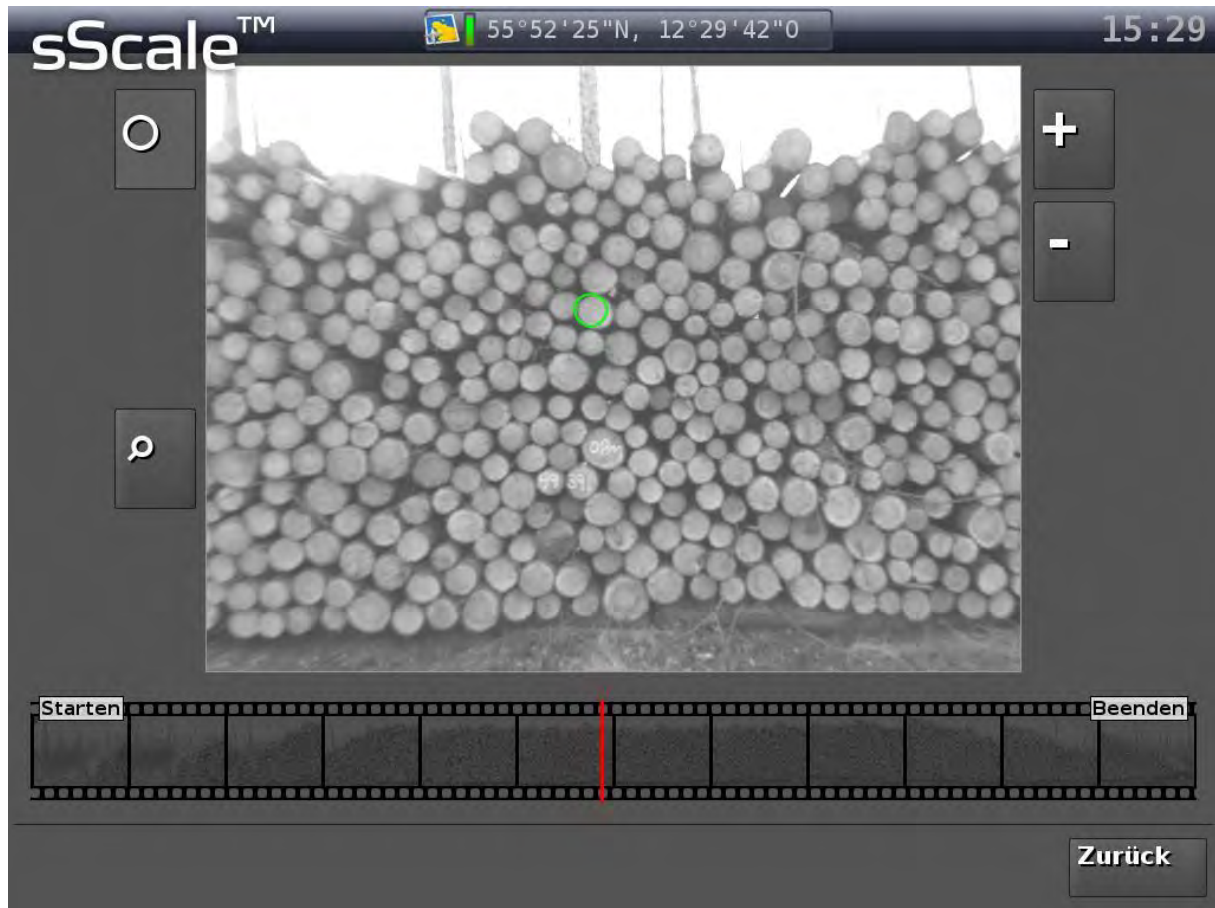
Figure 25: Representation of a selected diameter for editing

If you move the pen up and out of the circle on the monitor, the circle increases in size, move the pen down, the circle reduces in size.
After editing, click anywhere outside the circle to see all diameters again.
By clicking and holding a diameter, you can also move it to any position.

NOTE:
Make the pen movements slowly to allow delicate adjustment.

NOTE:
If you move the pen diagonally across the monitor, the circle is only changed by the respective vertical component of the movement.

5.3.3. Adding and deleting log diameters

If you notice that the system has not recognised logs when checking the log diameter, you **can add more logs after activating button 2.2.4.8 "Plus". Tap on the centre of the log not** recognised and the system adds another diameter circle.

NOTE:
Since a non-recognised face indicates that the software has difficulty recognising an end face on its own, it may be that the newly added diameter circle does not have the desired diameter. Then edit the diameter circle as described in Chapter 5.3.2.

Under unfavourable conditions, the software may inadvertently recognise log-like structures in the vicinity of the woodpile as a log, or detect multiple small logs (e.g. highly-defined cores) **within a single log face. To delete these, activate the button 2.2.4.9 "Minus" and touch the** inside diameter to be deleted.

NOTE:
Both the "Plus" button and the "Minus" button remain active until they are deactivated by clicking them again.

NOTE:
Diameters automatically recognised by sScale™ have a very high precision. However, since the monitor has a resolution of about 2 cm/px, the manually changed diameters always have a level of error. This can lead to slight shifts in the representation of the diameter distribution. To work around this, the following procedure is recommended:

- Delete all incorrect diameters.
- Activate the plug-**in "Pieces" (see separate docu**mentation).
- Add logs that have not been counted.

The system proportionally distributes the additionally counted logs to the different strength classes based on the automatically generated diameter distribution. This leads to a very precise diameter distribution.
Please note that the log ends found by the system are representative of the total woodpile.

6. Error messages

6.1. Analysis failure

Should the software not be able to derive a correct measurement from the picture material, the analysis is aborted. In the **user interface "Result" the message "Analysis failed!" and "Error!" appears instead of the woodpile picture with polygonal course. The previously green** progress bar is shown completely in red (see Figure 25).

Figure 26: Error message for incorrect and aborted analysis

Reasons for a failure of the analysis can be:

- Exposure is too low or too high.
- Picture taking is too quick.
- Visibility conditions are not sufficient.
- Woodpile requirements (see Chapter B.2) are not met (for example, large offset within the woodpile face area, wood piling around a curve, or woodpile size too small).

Repeat the measurement under changed conditions. However, if the failure of the analysis is based on woodpile properties, you can alternatively manually record the woodpile after passing through and failing the analysis (see Chapter 5.2.1).

6.2. System crash

If the system crashes due to an internal error (monitor freezes and stops responding), you can restart or shutdown the system using the on/off switch on the back of the monitor.
A restart occurs by briefly pressing the button; the shutdown is carried out by holding the button for a few seconds until the monitor turns black.

NOTE:
In addition to freezing the monitor, the English message "Crash detected**" may also appear.**

NOTE: Since it depends on the nature of the internal error, whether a restart is sufficient or a complete shut-down is necessary, first try to restart the system, if this does not succeed, shut down the system completely.

6.3. Damaged or manipulated data sets

If, contrary to expectations, a record is damaged during storage or manipulated by third parties **despite all the precautions taken by Dralle A/S, this is shown in the user interface 2.2.5 "Details of an archive entry" as shown in Figure 26. The lettering "DATA CORRUPTION!!!" appears** above the volume of the measurement.

CAUTION:
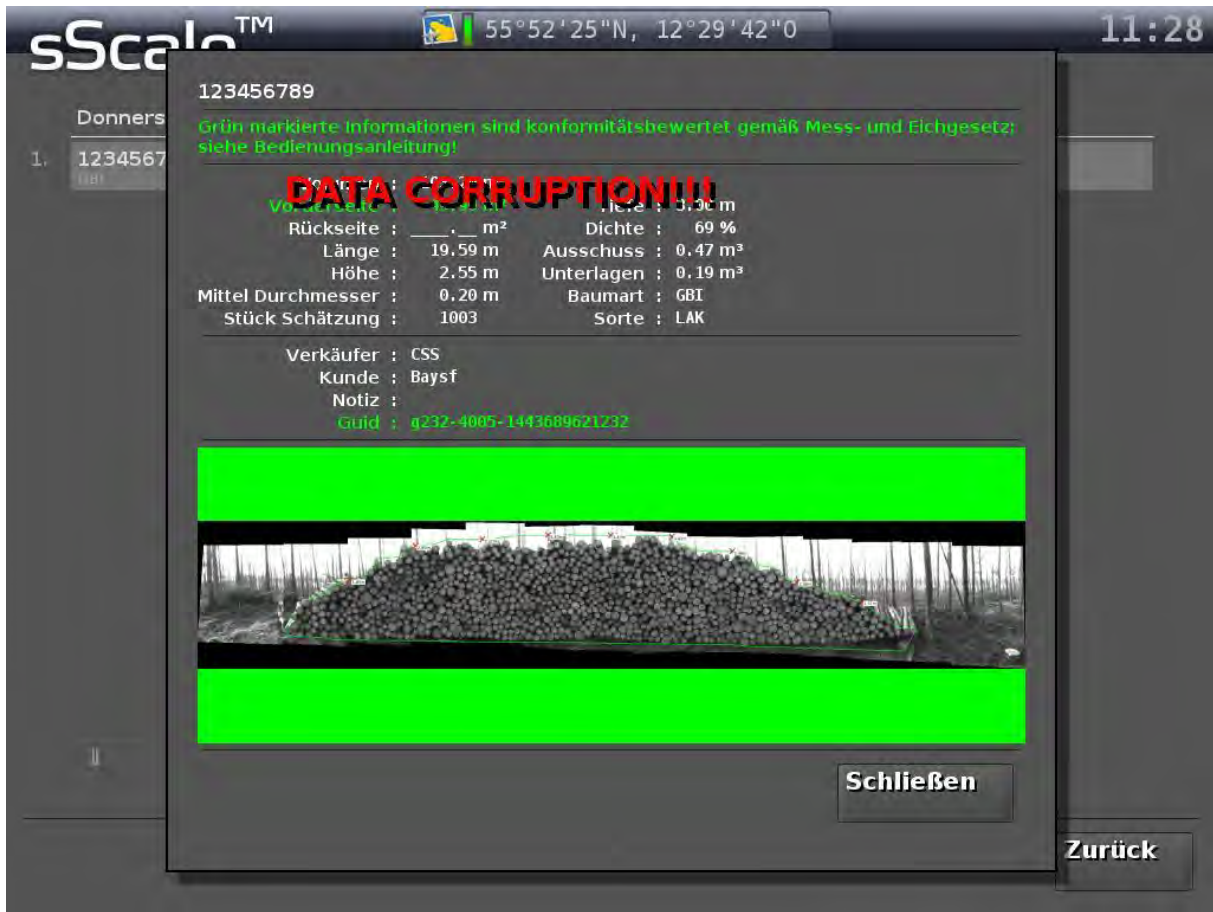If this happens, contact the manufacturer immediately!

Figure 27: Representation of a defective or manipulated data record

B. Scope

1. Rated operating conditions

1.1. Measuring size

Selected are on the picture of a woodpile, which is in a defined, fixed relation to the woodpile face area.
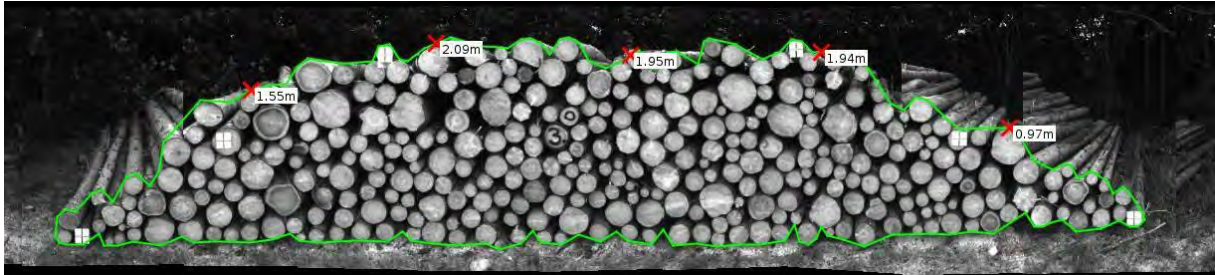

Figure 28: Exemplary representation of the picture of a data record with the front area describing green polygonal course

1.2. Measuring range

2 m² to 1000 m². The measurement area is limited by the maximum picture taking time of individual pictures within 60 seconds (versions 3.4.1900 and 3.4.1902) or 120 seconds (version 3.4.2031).

1.3. Resolution

The woodpile face area is calculated and stored with a resolution of ± 0.1 cm². The result is displayed with a resolution of 0.01 m².

1.4. Environmental conditions

Climatic environmental conditions
Temperature range: -25 ° C to +40 ° C
Humidity conditions: 20% to 90% rh; dew

Mechanical environmental conditions
Class M3

Electromagnetic environmental conditions
Class E2

2. Woodpile requirements

2.1. Requirements for the conformity-rated, indirect photo-optic detection of a woodpile face area

1. Woodpile face shaping: Course as equal-**sided trapezoidal shape with an angle α and β between 25 to 89 degrees, a minimum height of 1 m and a minimum width** of 2 m to a maximum of 130 m.
2. Woodpile orientation: With the end faces of the logs pointing to the removal path.
3. Ensuring a car can pass the woodpile face at a distance equal to the average height of the woodpile.
4. Unobstructed view of the front of the piles of wood, the lower log row must be completely visible, there must also be no obstructive growth.
5. Log diameter with at least 7 cm in a forest typical, species typical diameter distribution.
6. Fresh logs without weathering discolouration on the faces - type-specific end wood grain colour should be present.
7. No other pile of wood in the field of vision in the background.
8. Side by side storage of woodpiles must be clearly separable from each other. A distance of 2 m between individual woodpiles is desirable.
9. Wood piling should be flush (deviation of the front surfaces from the middle level not over ± 30 cm).
10. The stacking of the logs of the same length is performed so that a smooth, approximately vertical front surface results, which runs straight, without curves and bends (maximum curvature of the woodpile face of 0.1 m / running meter).

2.2. Additional requirements for the identification of a container volume

11. The length of the piled logs corresponds to the order length of the species.
12. Front and rear sides of the woodpile have a uniform surface form, so that there are no differences in area.
13. The stack must lie horizontally on horizontal surfaces in the cross profile - for this the logs are stored alternately with the thick and thin end to one side.
14. Wood piling separated according to tree species groups.
15. The proportion of identifiable ground logs must not exceed 50%.
16. Wood piling without branches or foreign material intermixed.

3. Environmental influences

In principle, it is possible to measure under all weather and lighting conditions, as long as in the picture sequence of the woodpile face area with the individual log ends is displayed in sufficient quality. The system can only analyse the photo-optically, which is also shown. Picture sequences or sequence areas with insufficient picture quality are not evaluated and the photo-optic measurement is not possible.

The environmental influences negatively affecting the picture quality are:

1) Darkness and twilight
2) Fog with visibility of less than 10 m
3) Back light in bright sunlight
4) The front surface obscuring obstacles, such as growth, pollution, and snow
5) Old and weathered faces

The following negative environmental influences can be reacted to as follows:

To 1) Use the built-in LED floodlight and increase the exposure time to the maximum possible in the situation. Drive at reduced speed at high exposure times.

To 2) If possible, you can reduce the distance to the woodpile if the total height of the woodpile is still detected by the cameras and the minimum distance is not less than 1.90 m. If this does not bring about any improvement, stop the measurement and continue later.

To 3) Use the built-in LED floodlight and reduce the exposure time to the minimum possible in the situation. If this does not bring about any improvement, it is usually sufficient to wait a few minutes, so that the sun moves a few degrees further or is briefly covered by a cloud.

To 4) Here only a removal of the obstacles is possible. In addition, internal rules of action must be found as to whether, for example, if there is snow, it is acceptable for the customer to refrain from correct piece counting and diameter distribution. The calculated area of the polygonal course coincides with the enclosed area, even if the woodpile face is partly covered.

To 5) The accuracy of the area is not adversely affected by poorly visible end faces, but rather the ability of the system to correctly identify faces. Therefore, internal rules of action must be found on how the user of the system has to deal with woodpiles that have weathered faces.

With insufficient environmental conditions, the analysis is aborted automatically, so erroneous measurements do not occur.

C. Test Routine

1. Brief description of the system test

According to the leaflet "Photo-optical Wood Measurement" of the PTB, the following must be checked when testing a photo-optic measuring system for wood measurement:

- Check whether the documentation allows a clear identification of the measuring instrument, i.e. verification of the serial number.
- Check whether the measures to protect against manipulation of the photo-optical measuring system for wood measurement (official calibration safety measures, for example in the form of seals) are present and unharmed.
- Comparison of version designation and software checksum with the target values. The version name and the software checksum are shown in the user interface A 2.2.**2 "Main menu".**

For further information please refer to the separate documentation "Marking Conformity Rating", which is included with the system.

Finally, it must be checked whether the measured quantity (woodpile face area) of the test object is measured with sufficient accuracy. The testing is divided into two parts.

1) Based on reference areas (see Figure 28) on woodpiles, it is checked under conditions that are representative of the entire area of application of the system, whether the measurements lie within the legal calibration error limits.
   For this purpose, irregular rectangles are marked according to the requirements on the woodpile face areas and the target reference area is calculated on the basis of the measurement of the distances of the vertices with returned test specimens. Finally, the reference areas are measured with the test specimen.

$$A = \frac{1}{4}\sqrt{4e^2 f^2 - \left(b^2 + d^2 - a^2 - c^2\right)^2}$$
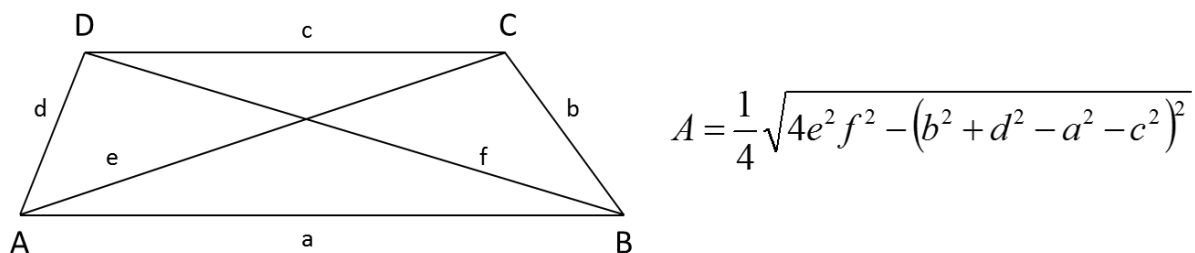
Figure 29: Reference area of an irregular rectangle - in the rough shape of a trapezoid with corners and side labelling. In addition the area calculation formula of the individual lengths

2) Reproducibility and measuring stability are also tested on real piles of wood. For this purpose, the woodpile is measured several times by one person according to the instructions of the manufacturer and once by someone else.

The results from both tests must be within the calibration error limit.

The measurement results are recorded in a test report, where multiple copies are with the system.

Detailed notices and instructions for practical implementation can be found in the separate **documentation "Checking the Conformity Rating", which is enclosed with the system.**

2. Necessity of a system test

Should there be any doubt concerning the measurement results after considerable external influences on the measuring system or the carrier vehicle (for example rear-end collision), the system should be checked. In addition to the detailed test described in Chapter C.1, another simpler solution is available for this purpose. Both can be performed by the user on-site in the forest.
The correct combination of the individual pictures in the context of the picture analysis can be checked by comparing a reference length (in the simplest case of the maximum woodpile length) with the result of the device measurement. The difference should not be more than 10 cm or 1% of the length.

CAUTION: If the test results of the reference area test are outside the conformity-rated tolerance or if the simple test is longer than 10 cm or 1% of the length, contact the manufacturer immediately.