IML
Technical instruction

IML- RESI PD series

Content

- Technical handling
- Menu navigation
- Additional modules
- Exchange of drilling needle
- Exchange of telescope / chuck
- Data transfer to Computer
- Software-center PD Tools / Pro

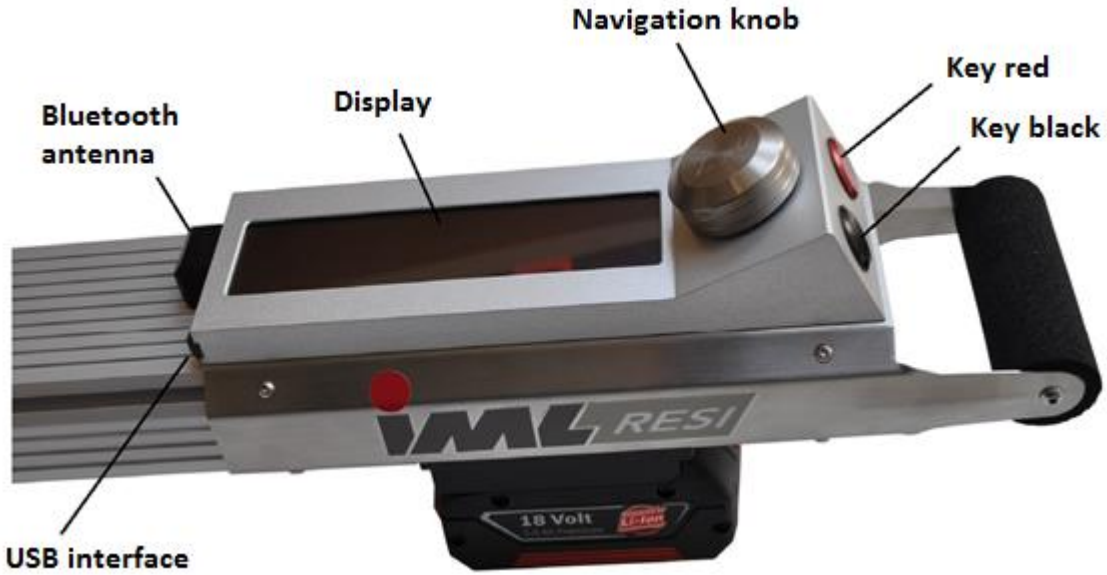
IML-RESI PD - series

- Feed speed up to 200 cm/min
- Resolution: 0,02 mm / 300 mm
- High battery capacity and low energy consumption for more drillings
- Display; Bluetooth printer optional
- Drilling curve and feed curve (optional) for better identification of incipient decay
- Optional: Several additional modules for better application (f.e. feed curve, scaling, inclination sensor, etc.)

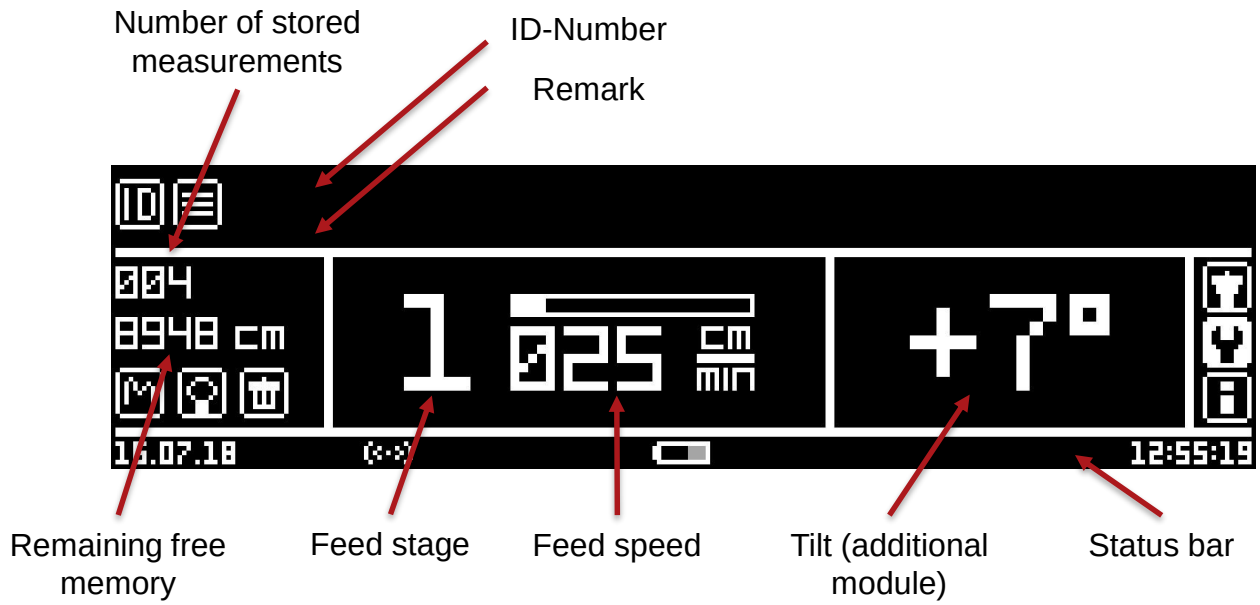
System components

- Total view:

- Control unit:



Main menu



- Changes the ID number (f.e. tree number)
- Shows measurement profile
- Deletes last / all measurements
- Displays needle /telescope exchange menu
- Shows complete data of last measurement
- Changes the remark
- Dispays system control menu
- Displays device information

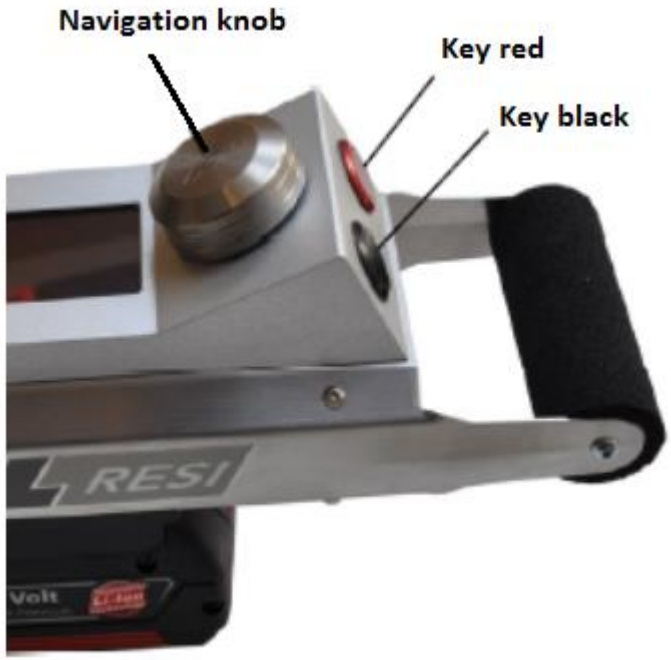
Main menu – status bar

- 1. Date
- 2. USB connection to computer
- 3. Bluetooth connection. Shaded symbol = no connection; Bright symbol = connection to computer exists; No signal = bluetooth is not activated
- 4. Simultaneous transmission (PD-TOOLS PRO). This symbol is shown if the simultaneous transmission to the computer is activated.
- 5. Adapter sleeve. If the adapter sleeve at the front is pressed
- 6: Preselected drilling depth. If maximal drilling depth is selected
- 7: Battery indicator. Is blinking, when the battery is very low
- 8: Connection to the instrument is interrupted or defective. Please contact the service.
- 9: Connection to the drilling unit is interrupted or defective. Please contact the service.
- 10: Optical sensor 1, 2, or 3 is soiled. Please contact the service.
- 11. Time

Function key

Black key:

- Press briefly to change the feed speed or rather the needle speed (advanced mode).
- Keep pressed to switch between the feed speed and the needle speed (advanced mode).



Red key:

- Press briefly to start a measurement.
- Keep pressed to display the drilling settings menu. On this the safety pin must not be pressed.

Navigation knob:

- Rotate and press to navigate through the menu

Switch On / Off device

Switch On:

- Long press the navigation knob until IML Logo appears in display

Switch Off:

- Long press navigation knob to switch off device. The device can only be switched off when the main menu is shown.

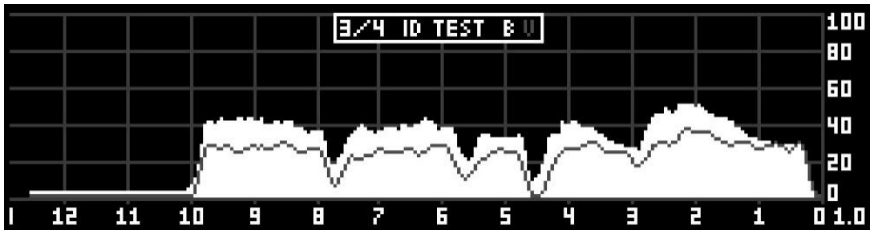
Start / stop measurement

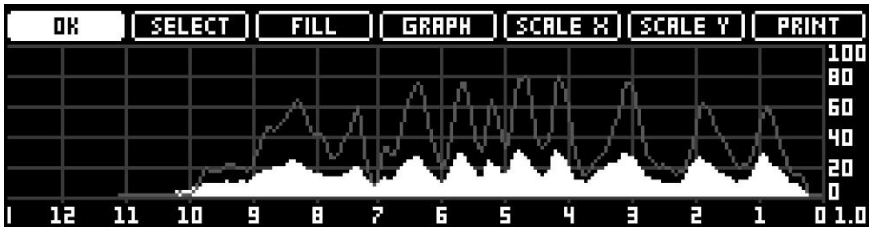
- Main menu must be shown
- Press device onto the tree / wood, so that the adapter sleeve is pressed (Symbol appears in the status bar of the main menu)
- Press red key shortly to start measurement

- The measurement is stopped by the following incidents:
  - Adapter sleeve is not pressed any more
  - Navigation knob is pressed (emergency stop)
  - Red or black key is pressed
  - Maximum drilling depth is reached
  - Preselected drilling depth is reached
  - Feed motor overload protection
  - Drilling motor overload

Show measurement

- Select the following symbol in the main menu to show the last measurement profile 



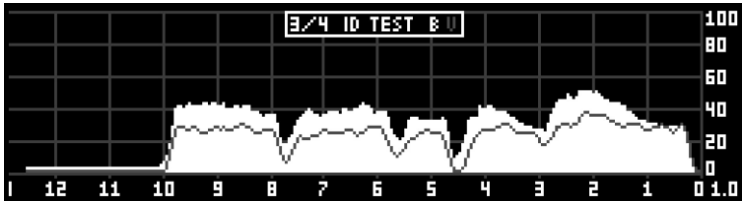


- The graph can be moved by the help of the navigation knob if the drilling profile depth does not completely fit on the display
- Browse through the measurements: Briefly press red or black key
- Keep pressed the black button to enter scale and print menu (SCL, PRT add-on module)
- Scaling of x-axis: Keep pressed either the red or the black button to change the x-axis scale. (add-on module SCL)
- External Bluetooth printer: Keep pressed both buttons in order to print out the displayed measurement on the Bluetooth printer. (add-on module PRT)

Showing a drilling profile

- Select measurement symbol and press navigation knob

- Press black or red key to change between measurement profiles



- Showing data from measurement profile

Changing feed speed

- In the main menu feed speed can be changed pressing the black key

- At the delivering, the following speeds are assigned to the feed stages:

Feed speed selection

- Select feed speed according to wood hardness. Amplitude of the drilling profile should be between 40-60% of the maximum value

  → Resistance curves dropdowns are better identified

- Common feed speeds:

  Broad leaved trees: Stage 2 (50 cm/min) – stage 4 (200 cm/min)

  Conifers: Stage 3 (100 cm/min) – stage 5 (200 cm/min)

  Utility poles: Stage 4 (150 cm/min) – stage 5 (200 cm/min)

- These values are approximate and may vary due to different wood quality and the degree of needle sharpness

Needle speed selection

- The needle speed can be selected in the advanged menu in 5 different stages

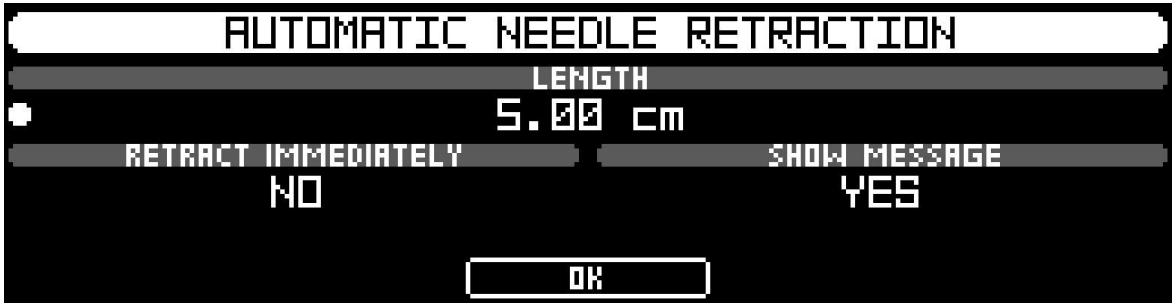
Tree inspection generally with 2500 RPM,

in exceptional cases (very hard wood) with 3000 RPM

- In extreme hard tropical timber use 5000 RPM
- For utility pole inspection and wooden playground inspection use 3000 RPM
- The needle speed influences the measuring sensitivity of the drilling device!

Automatic needle retraction

When needle enters a large cavity drilling needle might break when hitting the wood at the end of the cavity. Automatic needle retraction prevents needle breakage by retracting the needle automatically

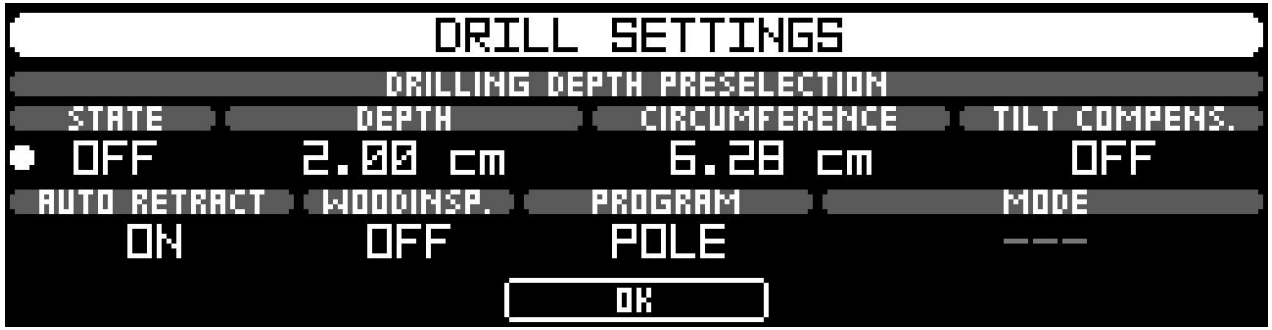


- Option LENGTH: determines which minimum length the cavity must have to activate the automatic needle retraction
- Option RETRACT IMMEDIATELY: „Yes“: retracts needle after 5cm of cavity; „ No“: the measurement will be stopped when the needle hits wood at the end of the cavity
- Option SHOW MESSAGE: If „Yes“ a message is shown in case a measurement is stopped through automatic needle retraction.

NOTE: Automatic needle retraction must be activated in the drilling settings (enter drilling settings by long pressing the red key) → Auto retract „ON“

Drilling depth preselection

- Can be used to set the drilling depth individually – needle will retract automatically when preselected drilling depth is reached
- Keep pressing the red key until the dialogue appears

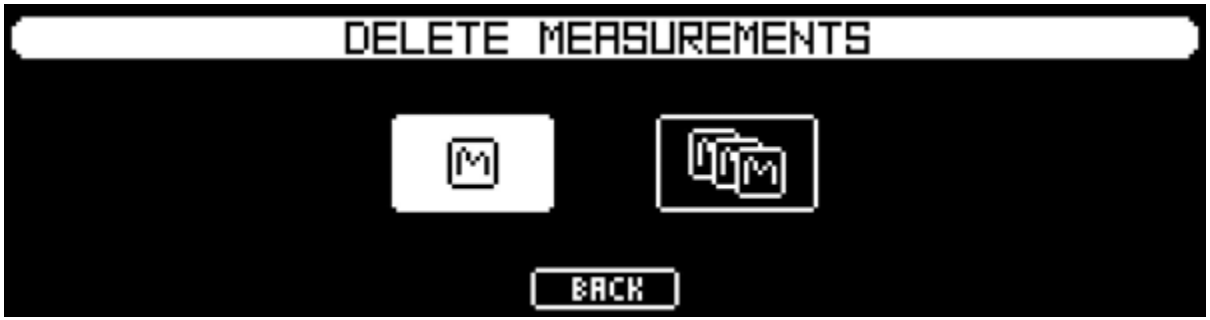


- Option STATE: switch the drilling depth preselection on or off. Wird die eingestellte Tiefe erreicht, so wird automatisch der Rückzug aktiviert.
- Option TILT COMPENS: if the compensation is enabled the penetration distance is always the same irrespectively of the tilt angle (TILT module necessary)

- Preselected drilling depth is shown in status bar of the main menu

Delete measurement(s)

In the main menu click on the following icon. 



- Deletes the last measurement after confirmation 
- Deletes all measurements after confirmation 

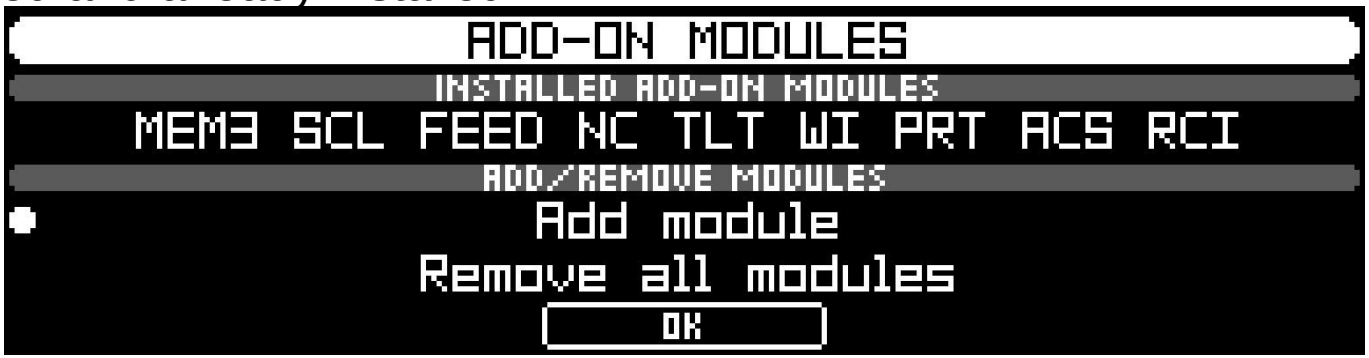
Data recovery

- The data recovery routine searches the complete memory for valid measurements and recovers them.

NOTE: New measurements will overwrite deleted old measurements

Add-on modules

- The menu item INSTALLED MODULES indicates the add-on options you have purchased and already installed.

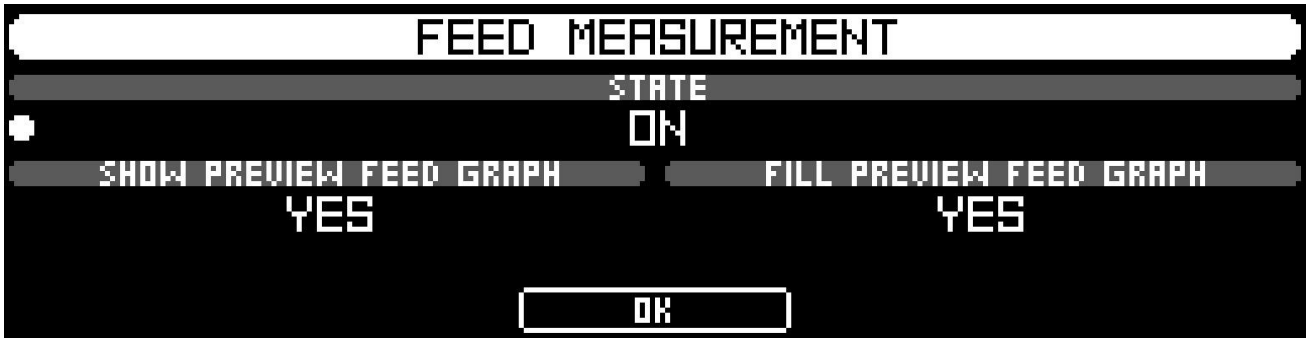


- **MEM1** Memory upgrade to 50/25m
- **MEM2** Memory upgrade to 100/50 m
- **MEM3** Memory upgrade to 180/90 m
- **SCL** Scaling package
- **FEED** Feed measurement
- **TLT** Tilt sensor
- **NC** Needle check
- **WI** Wood inspector
- **PRT** Bluetooth-Printer
- **ACS** Access control
- **RCI** Remote control interface

Note: An activation code is necessary to activate or deactivate add-on modules

Add-on module feed curve (FEED)

The feed curve gives additional information for better identification of incipient decay



- Option STATE: when activated feed curve is recorded
- Option SHOW PREVIEW FEED CURVE: Shows feed curve in display while drilling
- Option FILL PREVIEW FEED CURVE: Fills feed graph that is displayed while drilling

NOTE: If feed curve is activated recording length of memory is reduced by half.

Add-on module needle check (NC)

If needle check is enabled, the needle will be checked after every drilling and the needle state will be shown

- Option STATE: Activate needle check or not
- Option ACTIONS: The needle is checked and the result and the pullback length will be shown.

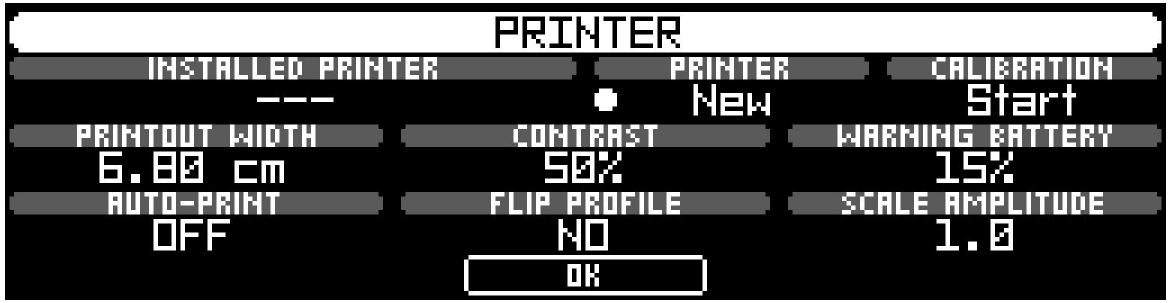
Add-on module inclination sensor (TILT)

Displays and records tilt angle of the drilling device

- Option ANGLE HORIZONTAL: Determines if the angle 0° or 90° is displayed when the device is aligned horizontally
- Option ANGLE A and ANGLE B: Define two angles; the device will emit an optical and/or acoustical signal if you hold in this angle

Add-on module external printer (PRT)

Measurement profile can be printed separately on bluetooth printer



- Option PRINTER Add: install a new printer; once installed the printer will be searched and installed automatically

Add-on module access control (ACS)

With the access control it is possible to protect all the functions of the instrument with a password.

- If you want to block the access to a function you have to select this function and press the navigation knob
- The function will be greyed and furthermore it is impossible to access this function without entering the password.

Add-on modules

- Add-on modules for IML PD series:

- IML software PD-Tools PRO (Analysis, print, save, export, etc.)
- Memory extension MEM1-3 (50-180m)
- WoodInspector (automatic analysis of utility poles and playground poles)
- Needle check NC
- Feed curve FEED
- Inclination sensor TILT
- Scaling SCL
- …

Recommended for tree inspection

Drilling needle change

- Select needle icon in the main menu and press navigation knob

- Select „A“- symbol – drilling needle will move out of device

- Hold needle with pliers and press OK, then remove old drilling needle

- Insert new needle, hold with pliers on the tip and press OK

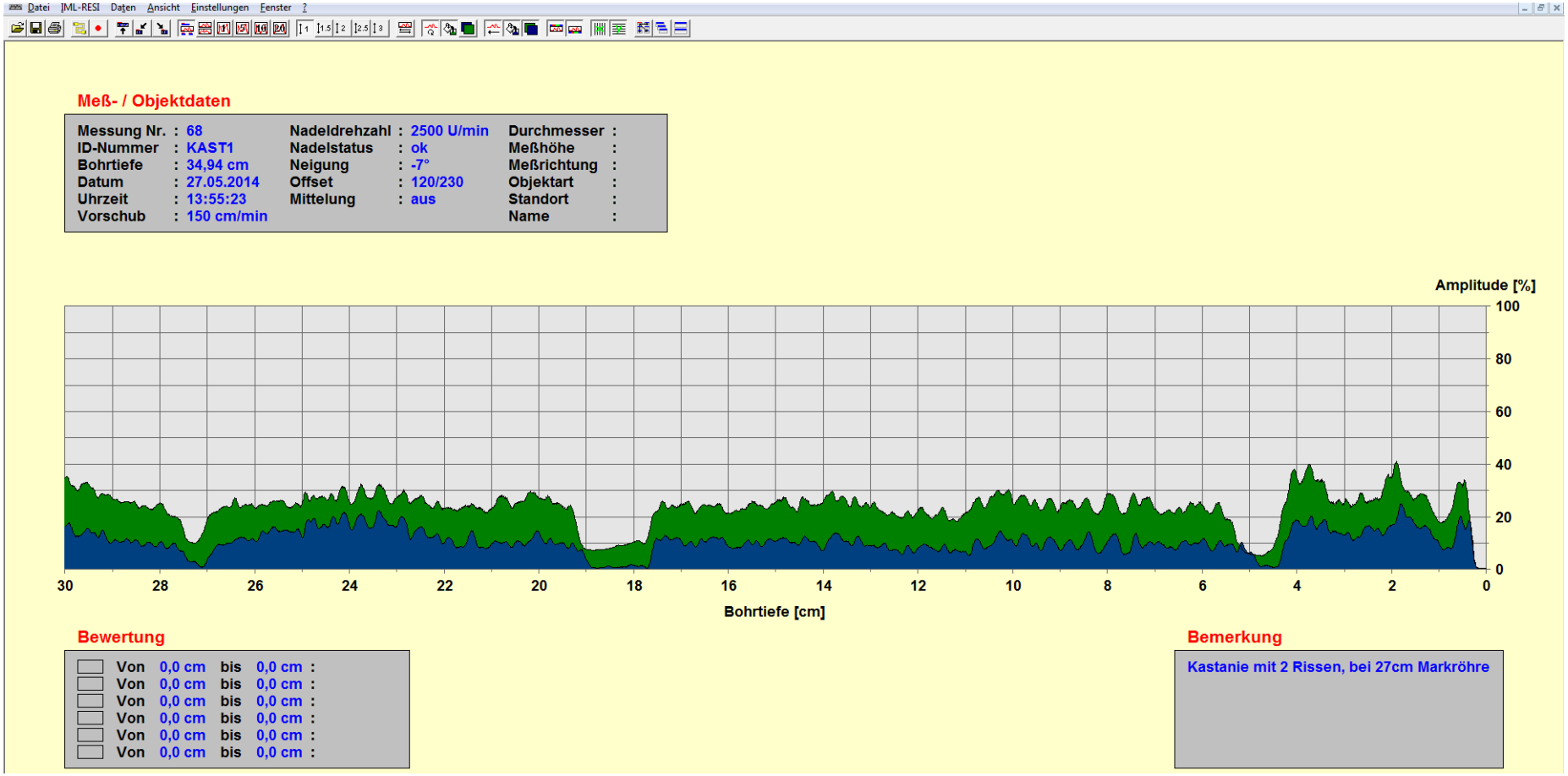
NOTE: When new needle is correctly exchanged then three short beep sounds are heard – when one longer beep sound is heard then new needle is not fixed correctly

Bluetooth transfer of profiles

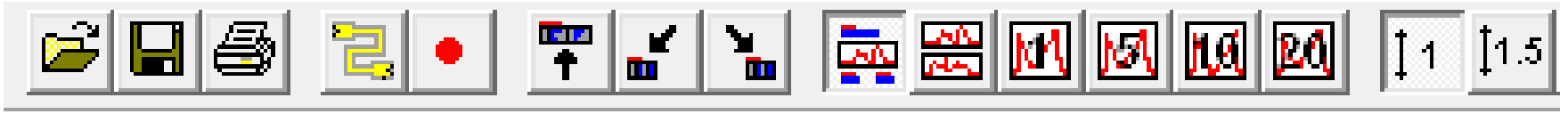
Transfer profiles via Bluetooth or USB cable to the computer

- Option STATE: Indicates if Bluetooth system is on or off
- Option MODE: allows choosing whether the computer or the IML-RESI will establish the Bluetooth connection.
  - Passive mode (default setting): Search for new Bluetooth devices in the Bluetooth menu on your computer and connect with code 0000
  - Active mode: IML-RESI will establish the connection to your computer . The device will also reconnect automatically if the connection was lost.

PD-Tools software



PD- Tools Software Symbolleiste



1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16.

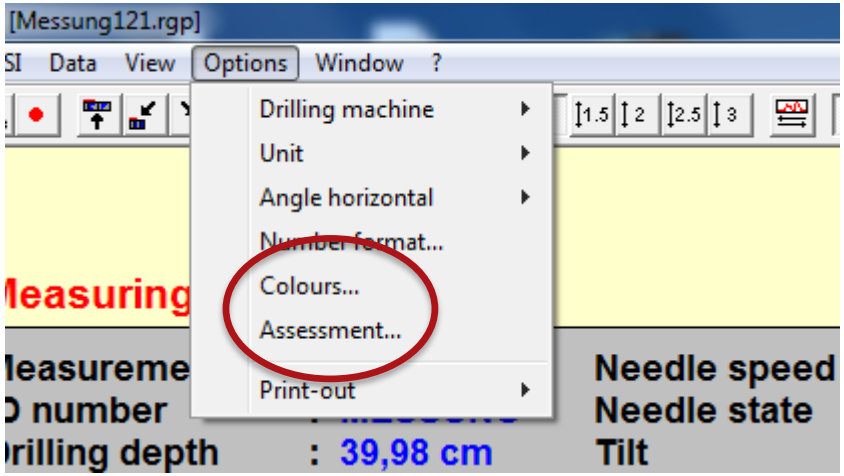
- 1. Open measurement curves
- 2. Save
- 3. Print
- 4. Transmit measurements from device to PC
- 5. Transmit Measurements simultaneously (PD-Tools Pro)
- 6. – 8. Measuring / object data, assessment and comment
- 9. – 14. Different views and zoom options of the opened measurement profiles
- 15. – 19. Amplitude (scaling of x-axis)

PD-Tools Pro tool bar

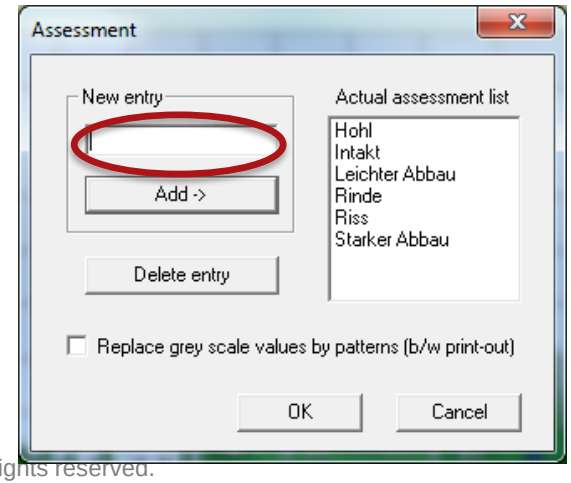
17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33.

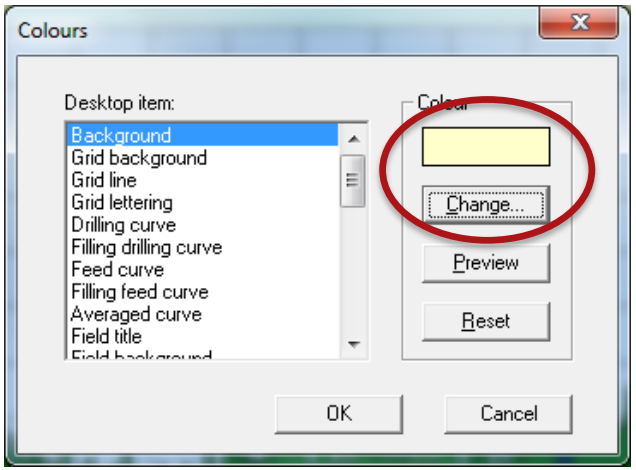
- 20. Mirror curve
- 21. Drilling curve
- 22. Fill drilling curve (color)
- 23. Position drilling curve to the front
- 24. Feed curve
- 25. Fill feed curve (color)
- 26. Position feed curve to the front
- 27. – 28. Assessment
- 29. – 30. Hilfslinien x- und y Achse
- 31. – 33. Window views

Assessment measurement profile



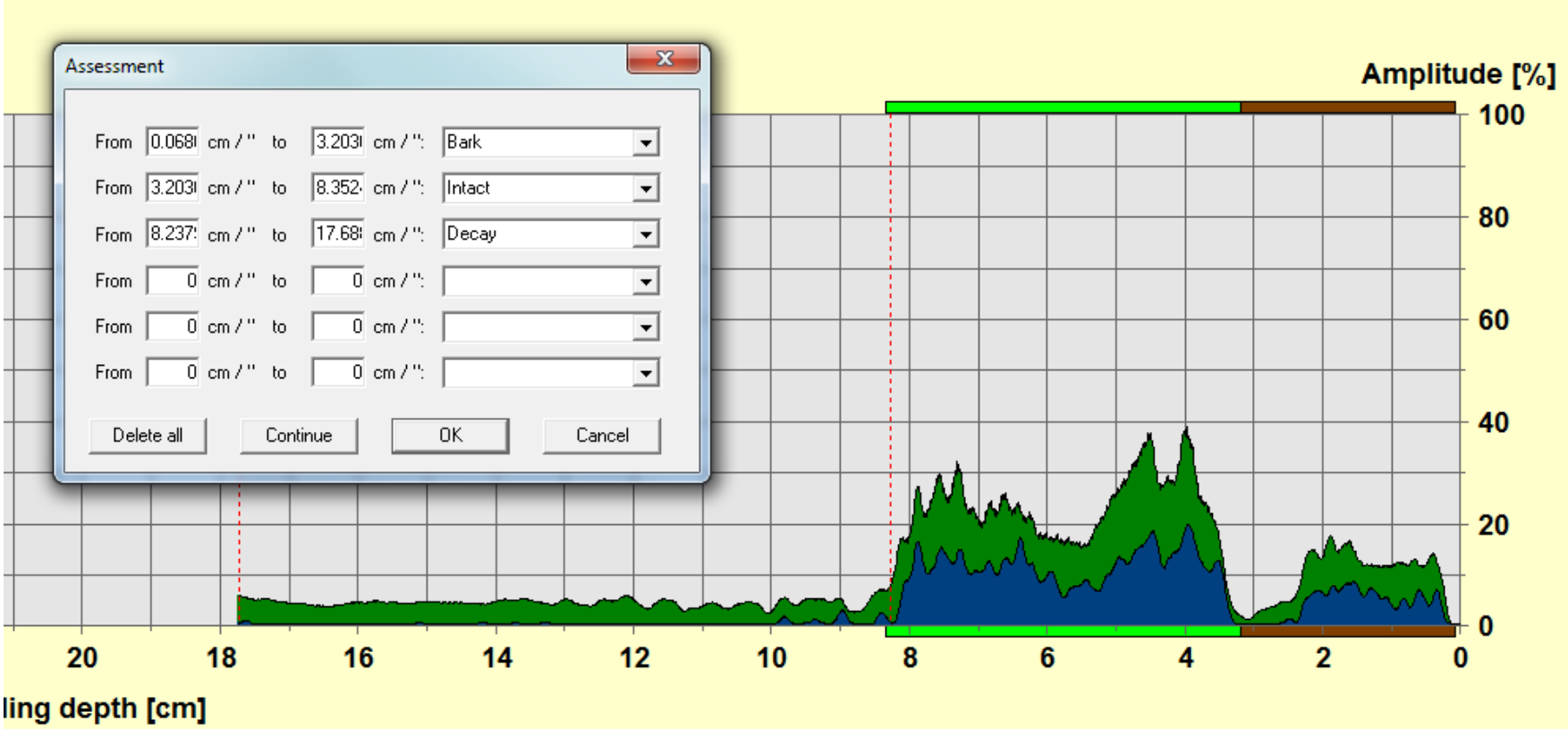
- Assessment: new assessment stages can be added (f.e. bark, intact, decayed, cavity)
- Colours: Colours can be defined according to assessment stages





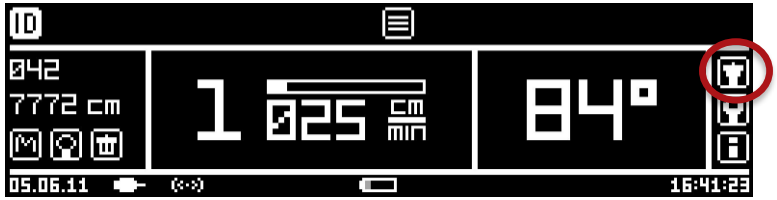
Assessment measurement profile

- Right click mouse button on graph – assessment window appears

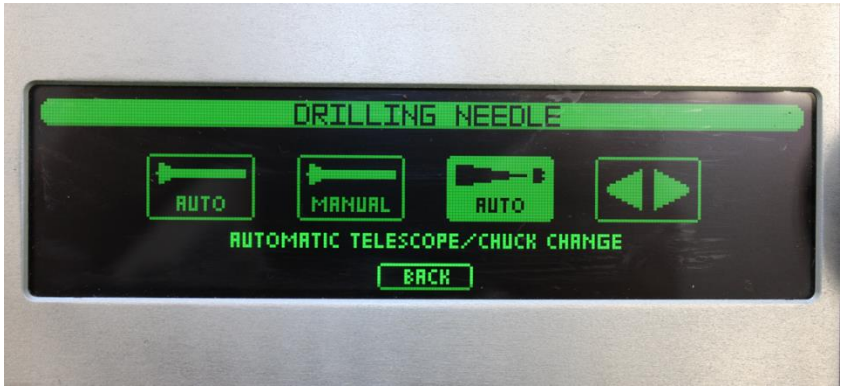


Telescope / chuck exchange

- Select needle icon to enter the needle / telescope exchange menu



- Step 1: Select the telescope icon (follow the instructions on the display)



- Step 2: Remove the drilling needle from the device following the instructions

Telescope / chuck exchange

- Step 3: Pull off 45° adapter (front sleeve) with special tool

Special tool
(inside the box)

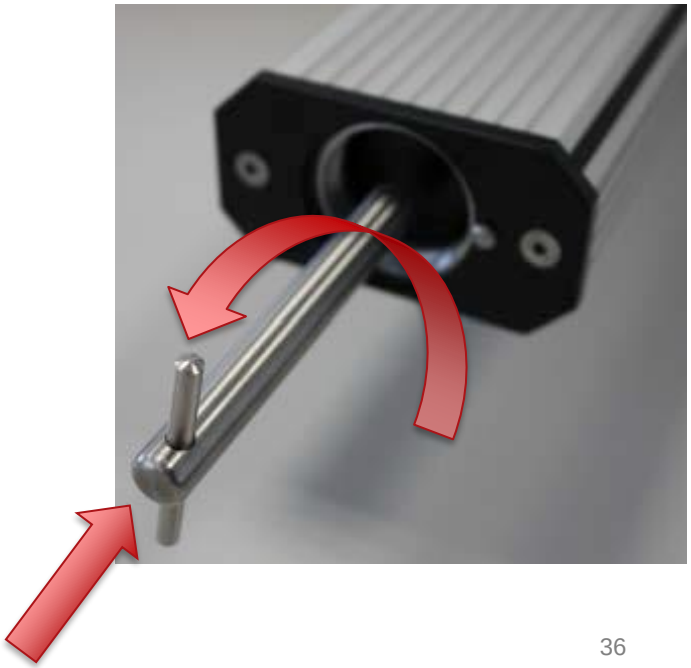
Telescope / chuck exchange

- Step 4: Pull out telescope carefully
- Step 5: Remove front sleeve from telescope and clean both parts with WD40
- If necessary remove and replace chuck (f.e. in the case that the needle broke off on the chuck) (see slides for chuck exchange)

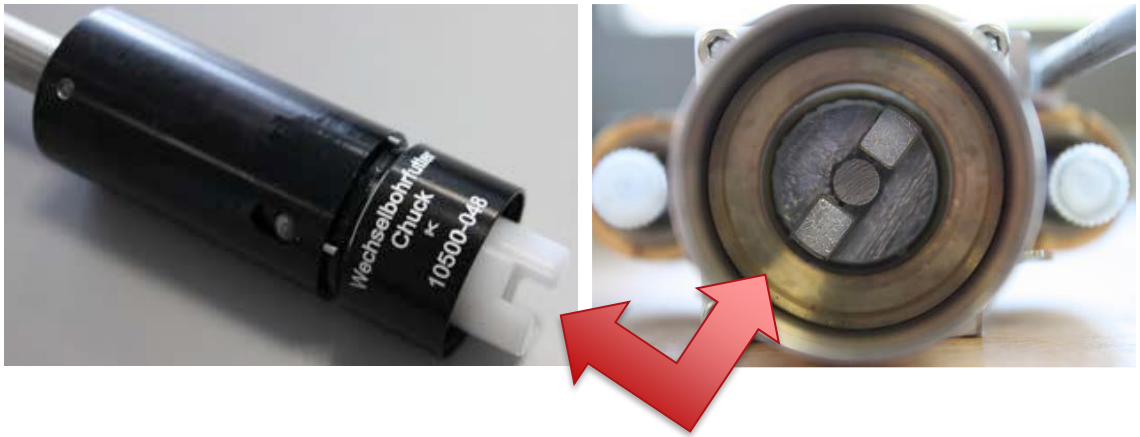
Totally removed telescope with guiding rings

Chuck exchange

Step 6: Please use the provided tool to change the chuck. This tool is inserted in the device pushed and turned. The chuck loses and sticks to the tool. Pull the tool with the chuck out of the device.

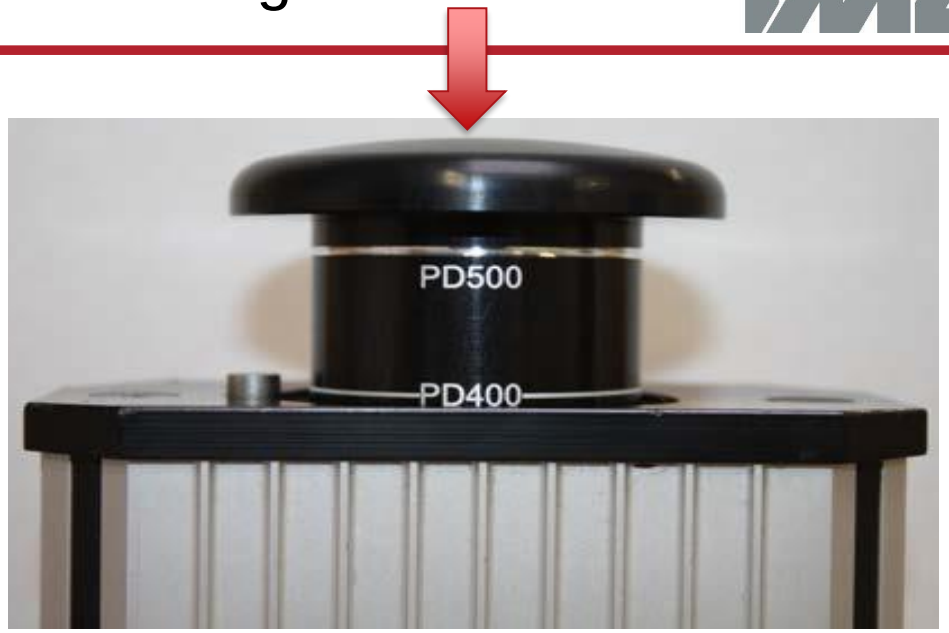


Chuck exchange



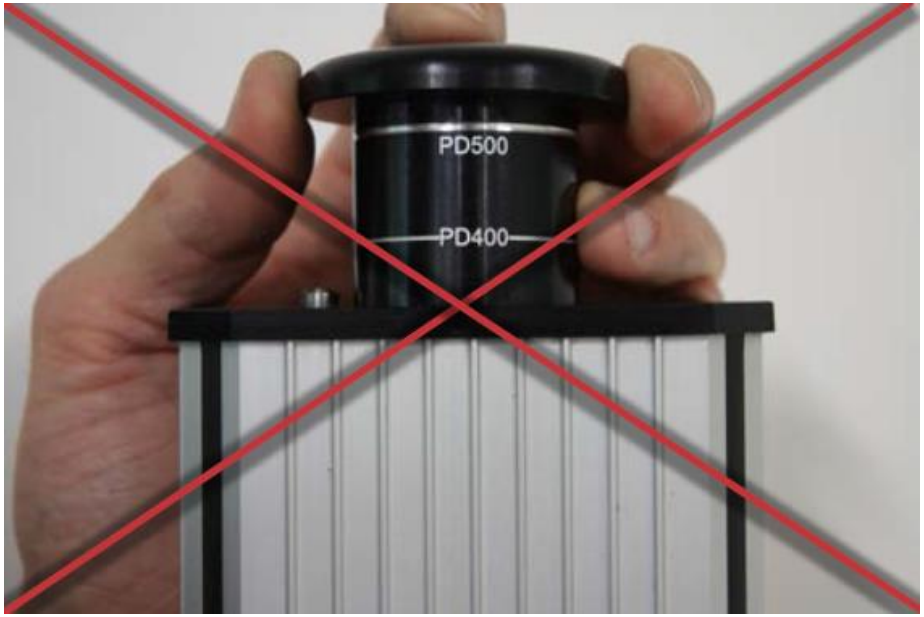
Step 7: Stick the new chuck on the tool. Before inserting the chuck watch the notch at the front of the chuck. The notch has to fit to the coupling in the device. The chuck is screwed with constant pressure to the coupling. Please fix the chuck hand-tight.

Telescope / chuck exchange



- Step 8: Push the telescope carefully in the device back again and push the tool for the telescope downwards so the white check mark (here PD400) is flush with the black front plate.

Chuck exchange / telescope exchange



Step 9: Please check once more if the telescope fits accordingly. The white check mark (here PD400) has to be flush with the black front plate (left picture).
The right picture shows a **wrong** fit of the telescope!

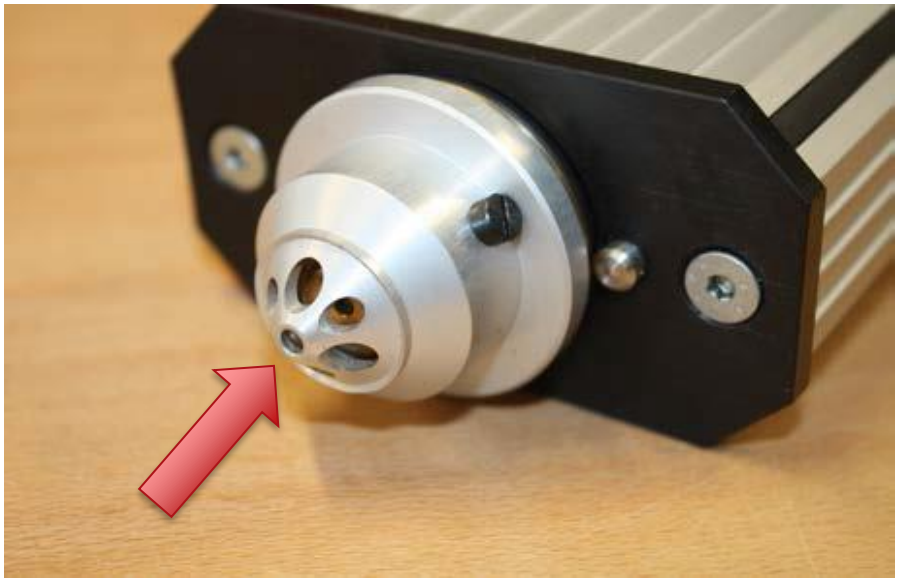
Teleskopwechsel / Bohrfutterwechsel

- Step 10: Screw needle guidance onto telescope and onto the device with special tool

Chuck exchange / telescope exchange

- Step 11: Insert drilling needle and follow the instructions on the display

- Step 12: Check functionality of safety switch. Press the front adapter and check if front adapter icon appears in the main menu



Service inspection

- To also obtain accurate measuring results you can rely on in the future, we would recommend a regular maintenance and calibration of your devices by our qualified service team.

- An inspection includes:
  - Complete function an safety test
  - The unit is disassembled, the functional parts precisely controlled and checked
  - All mechanical moving parts are cleaned and permanently lubricated with special LongLife oil
  - Implementation of test measurements and final calibration
  - Creation of a detailed service report and a calibration sheet/ test report

IML - training
Application and analysis

IML- RESI PD series

Content

- Method of drilling resistance
- Application IML RESI PD series
- Interpretation and analysis of drilling curves
- Analysis with software
- Interpretation of case examples
- Answer to individual questions

Application areas

- Tree inspection
- Utility pole inspection
- Inspection of playgrounds
- Inspection of old wooden framed buildings or constructions (f.e. frame houses, wooden bridges)

Wood rots

White rot

- Decomposition of lignin, the fibrous and viscous cellulose remains.
- Decayed wood bleaches and gets softer

Source: www.holzfragen.de

Source: www.waechtershaeuser.de

Wood rots

Brown rot

- Degradation of cellulose and hemicellulose of the lignified cell wall
- Strength properties greatly reduced by fragmentation of the cell wall
- In the final stage wood decomposes to brown powder because cellulose degraded completely.

Source: www.wsl.ch

Treerings of coniferous and ringporous trees

Treerings (TR) of conifers (f.e. spruce, fir, pine)

- Wide TR: % early wood (EW) > % late wood (LW)
- Narrow TR: % EW ± % LW (f.e. in dry years)
- Juvenile wood (first ca. 12 TR) → lower density → less drill resistance

Source: www.waldwissen.net (changed)

IMPORTANTE: The wider the TR of coniferous trees, the greater the proportion of early wood, the lower the wood density and drilling resistance of the wood.

Treerings of coniferous and ringporous trees

TR of rinporous trees (f.e. oak, chestnut)

- Wide TR in the first year rings (% LW > % EW)
- TR increment depend on climate and site quality
- Sapwood (water conduction) less dense than heart wood (stability)

Source: www.fh-eberswalde.de (changed)

IMPORTANT: The wider the TR of ringporous trees the higher the percentage of LW, the higher the wood density and drilling resistance!

TR of **diffuse porous trees** (f.e. maple, lime, beech) can be distinguished less precise since density differences inside the YR are less pronounced

Reaction wood

Free standing or trees detached only to the main wind direction form as protection from the wind induced power an specific wood tissue called reaction wood.

Compression wood in conifers

- Compression wood: higher percentage of lignin, reduced percentage of cellulose → higher density
- On the far side wind

Source: www.fh-eberswalde.de

Tension wood in broadleaved trees

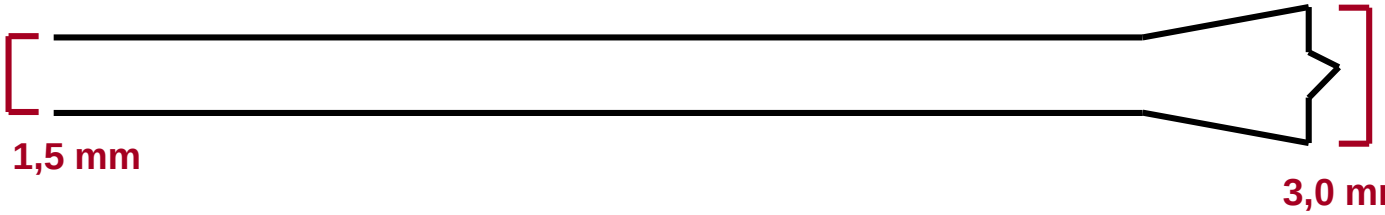
- Tension wood: higher proportion of cellulose than norma wood; difficult to identify visually on stem disc
- On the side facing windward

Wind exposed, free standing trees can have a up to 150% higher drilling resistance than sheltered trees!

Principle of drilling resistance

Measurement method:

- Drilling needle is driven into the wood and drilling resistance is measured
- Wood damage is marginal
- Wood chips remain in boring channel and ceal the drilling hole

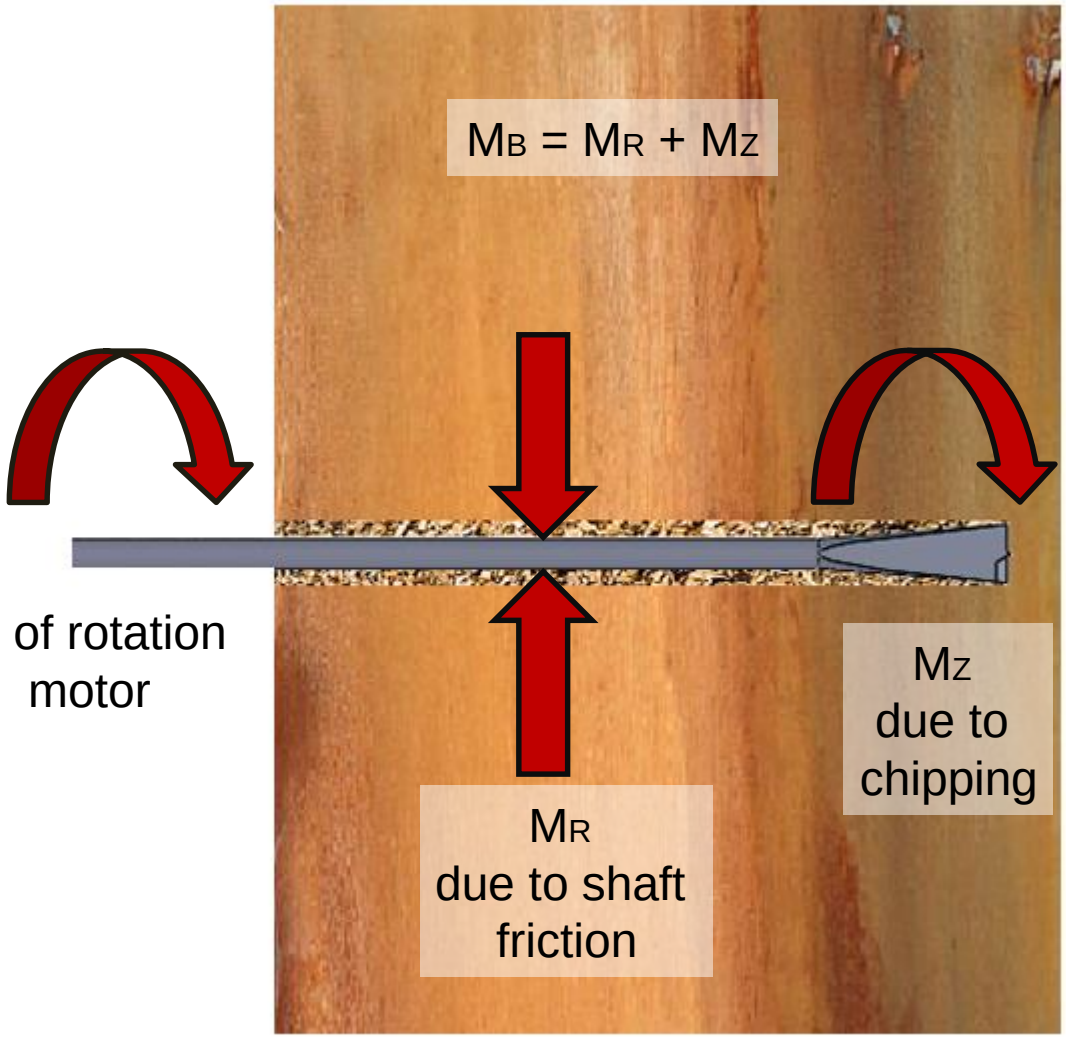


Standard drilling needle for all applications
except wooden utility poles

Torsion moments

- Variables of the IML RESI system

Fig.: Torsion moments



Shaft friction and drilling resistance

- Shaft friction (SF) and drilling resistance (DR) on the drilling needle

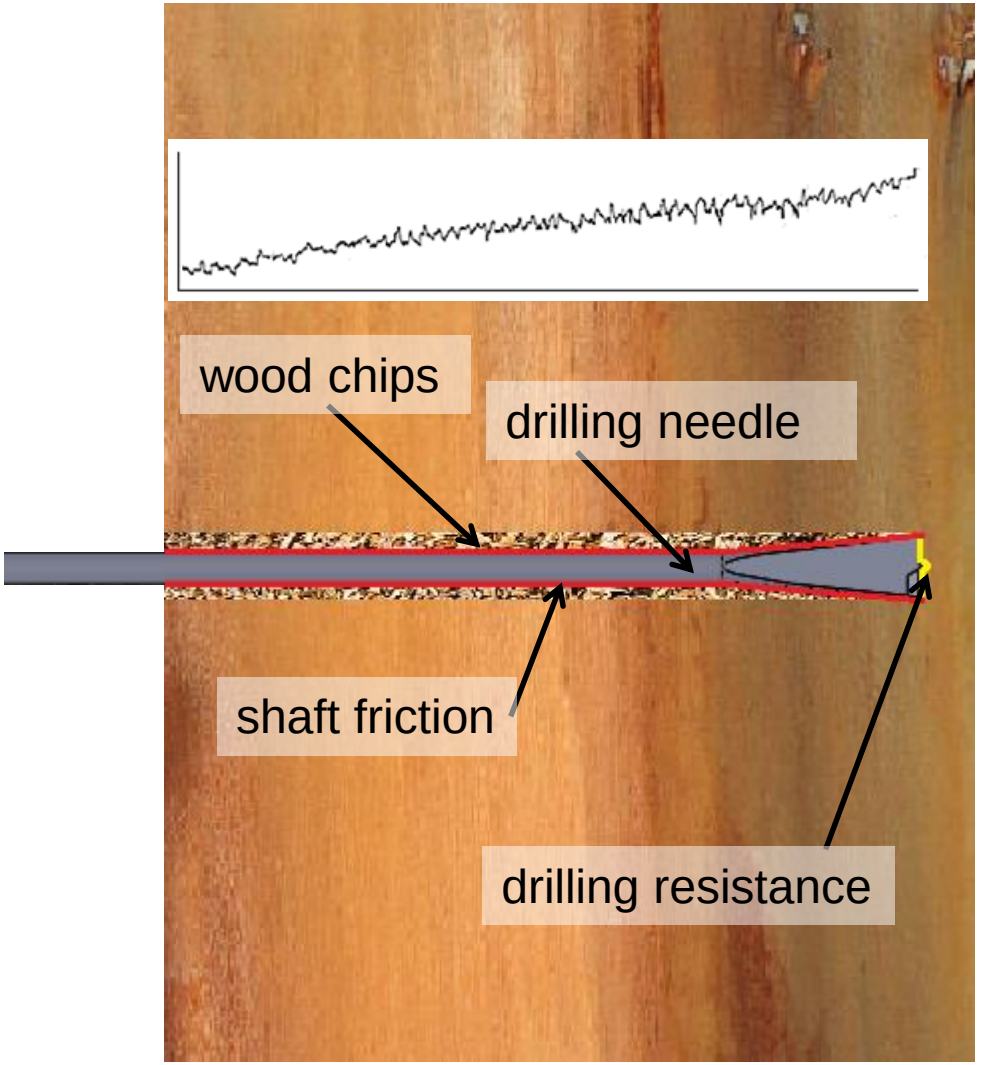
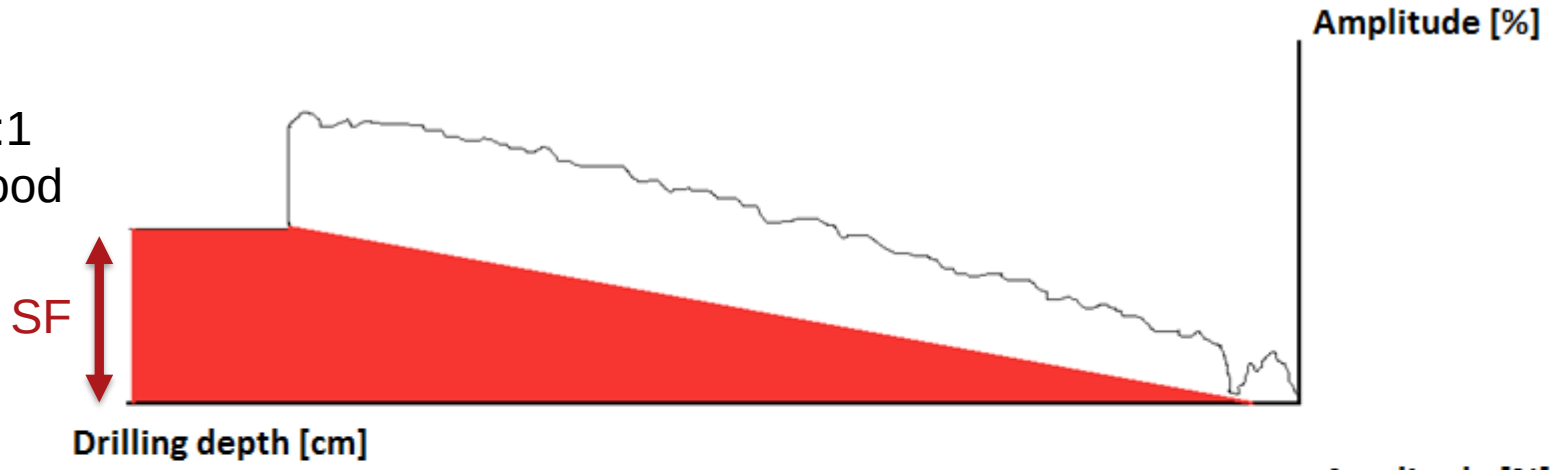


Fig.: SF and DR on the drilling needle

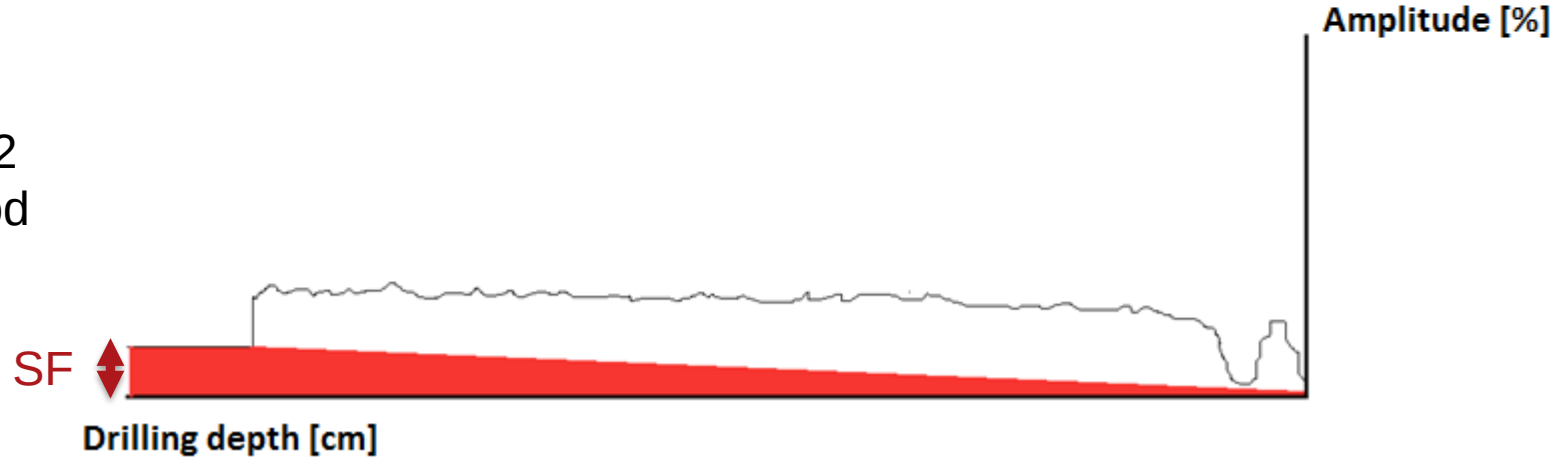
Drilling trend

Drilling trend due to drilling resistance (DR) and shaft friction (SF)

Graph.:1
Hardwood

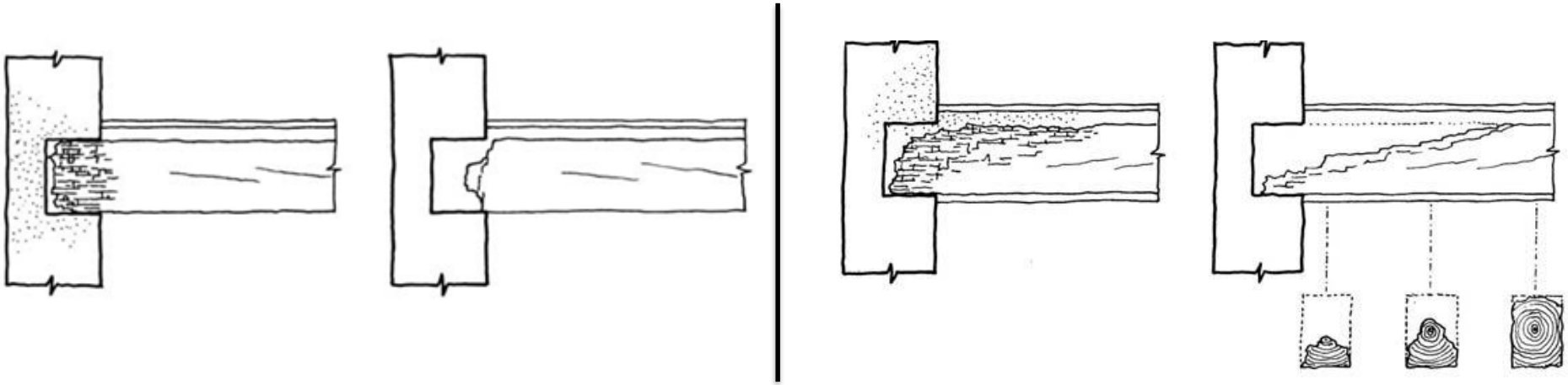


Graph.:2
Softwood



SF is only clearly determined when drilling needle emerges on the other side of the tree

Where to drill?



Source: http://www.portalbec.com/bec/comercial/egurtek/ponencias/4_tarde/arriaga

- Beam support connections: stability problem due to lack of cross section.
- Static important points in wooden constructions
- Areas with contact to walls,
- Areas with contact to humidity
- Areas with visually recognizable damages

Cross section of a decayed timber beam

Source: http://www.portalbec.com/bec/comercial/egurtek/ponencias/4_tarde/arriaga

IML-RESI PD-series drilling profile examples

- The following drilling profile examples are provided to illustrate the operation and interpretation of the IML-RESI PD series

  → the examples should not be used as a "reference catalog"!

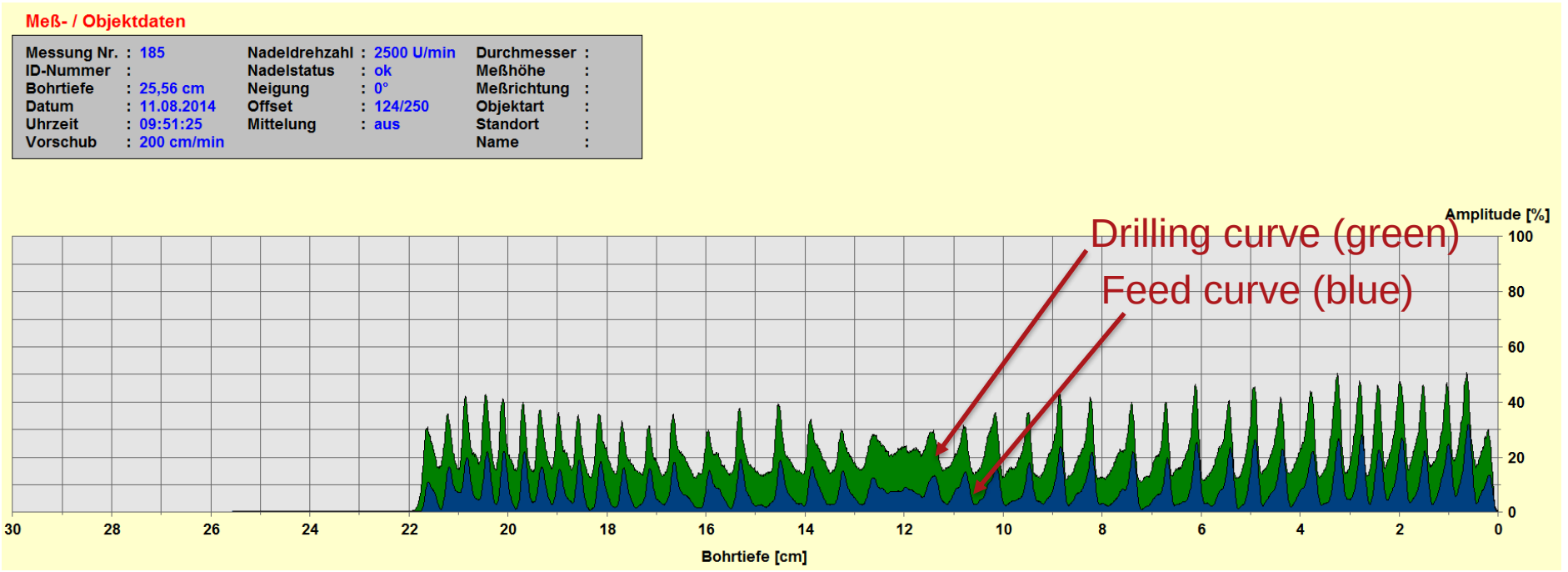
- Each tree has its “own” customized wood quality depending on site conditions, growing space, wind load, etc.
  - This influences sawn wood quality!

- In addition, factors such as severity of drilling needle, selection of feed stage influence measurement profiles significantly.

- If in doubt, reference drillings in a presumably intact area of the timber can provide additional information.

Intact conifer beam

Drilling resistance profile of an intact conifer beam

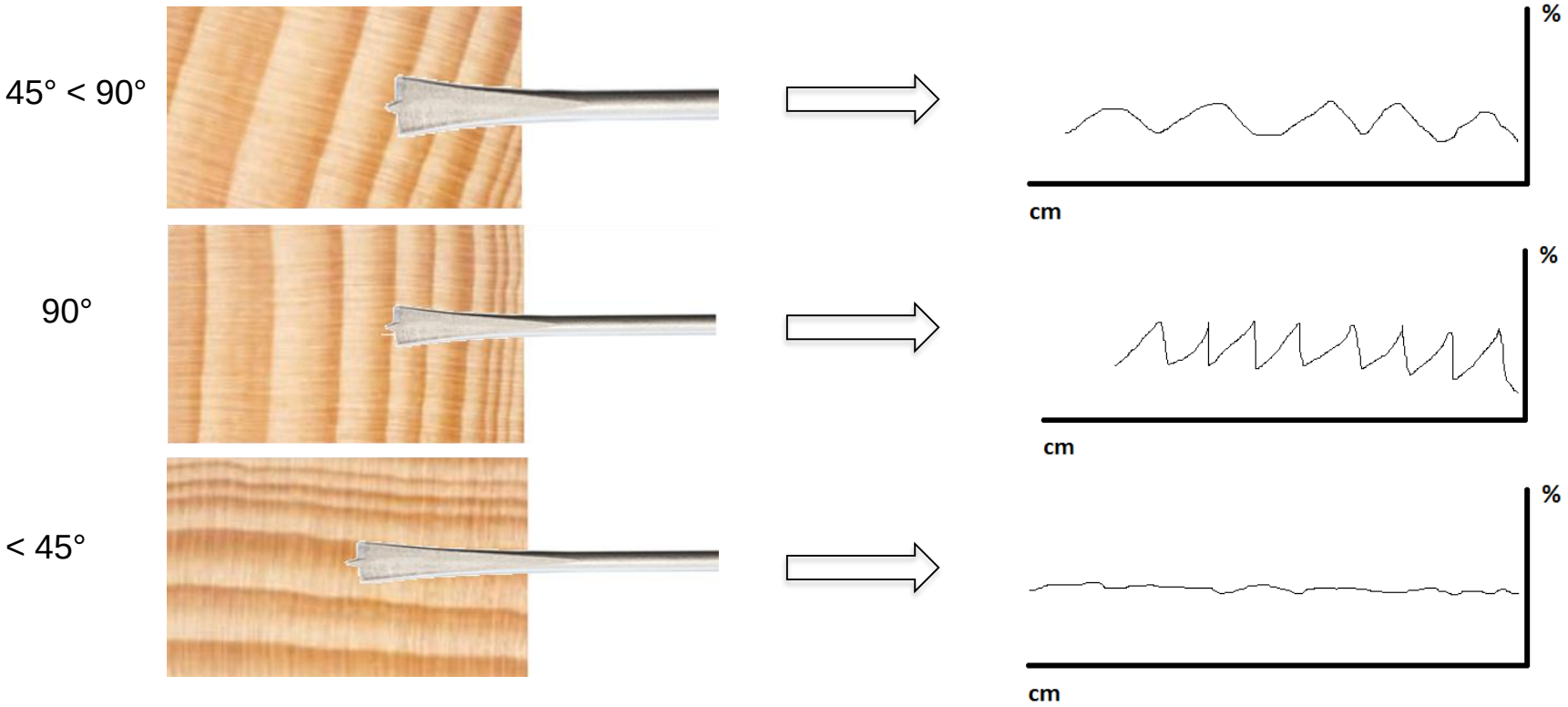


- Clear separation of tree rings by density variation between early and late wood
- Between 11 and 13cm drilling depth needle runs tangential inside the tree ring

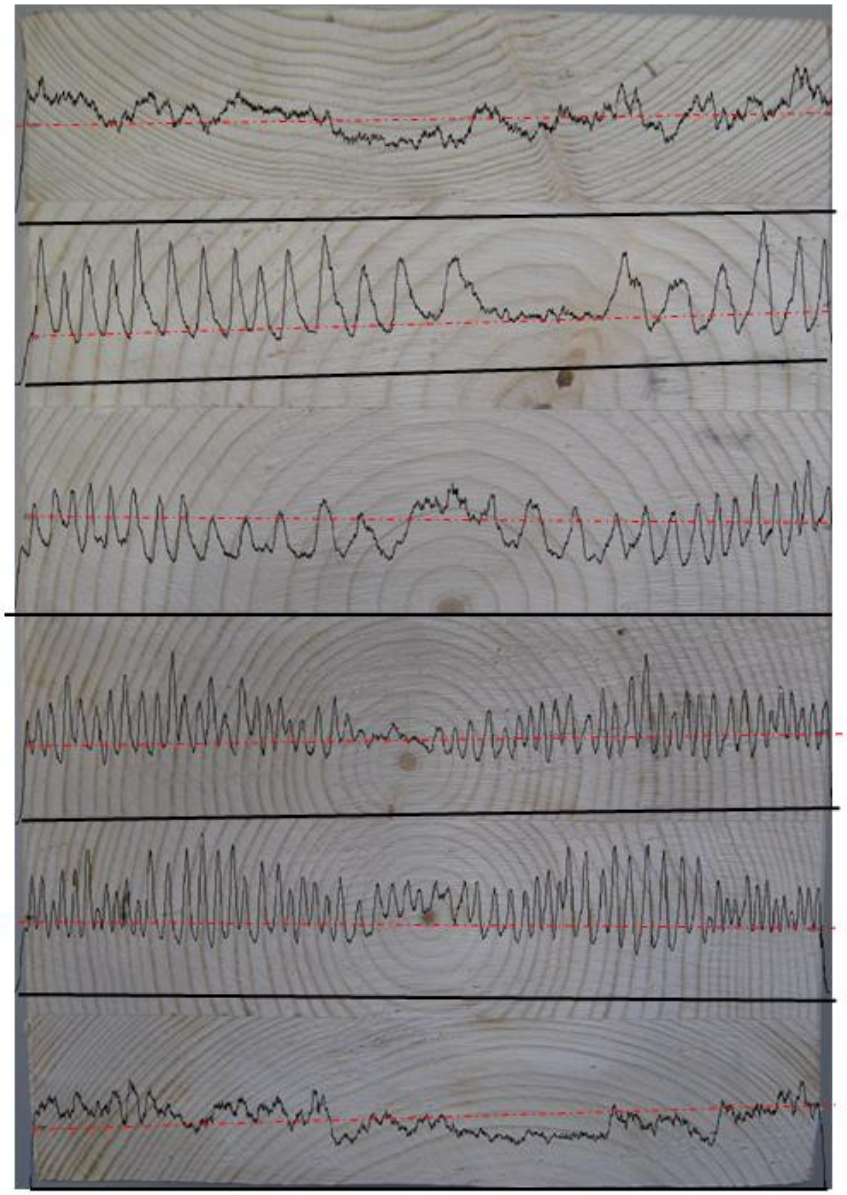
Radial and tangential drilling

Radial and tangential drilling (conifers)

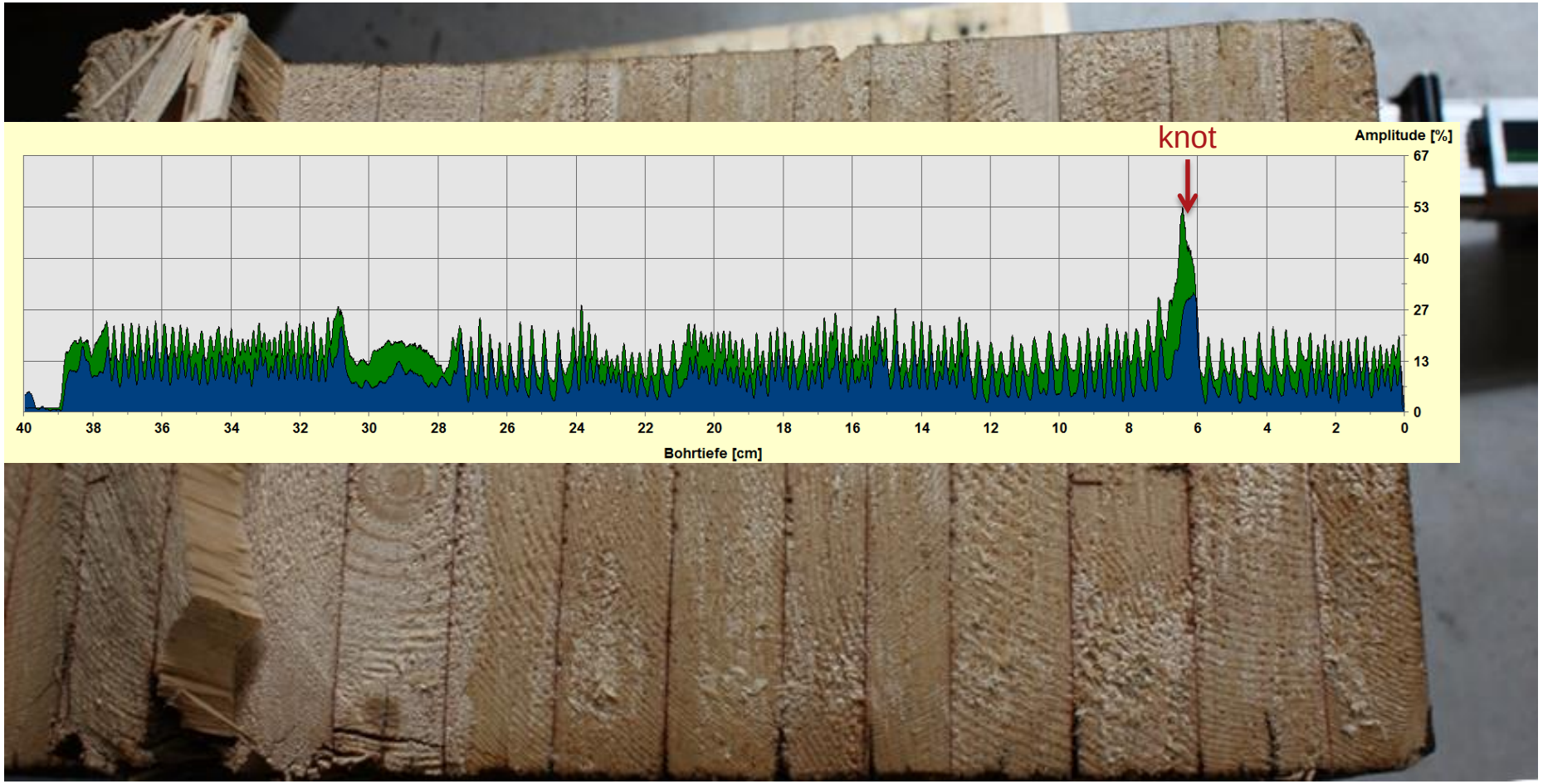
- Radial: drilling needle enters wood in a 90° angle perpendicular to the tree ring (good recording of earlywood and latewood)
- Tangential: drilling needle enters wood < 90° angle towards tree ring. Earlywood and latewood is cut simultaniously by drilling blade → less resitance variation



PD- drilling curves on laminated timber beam

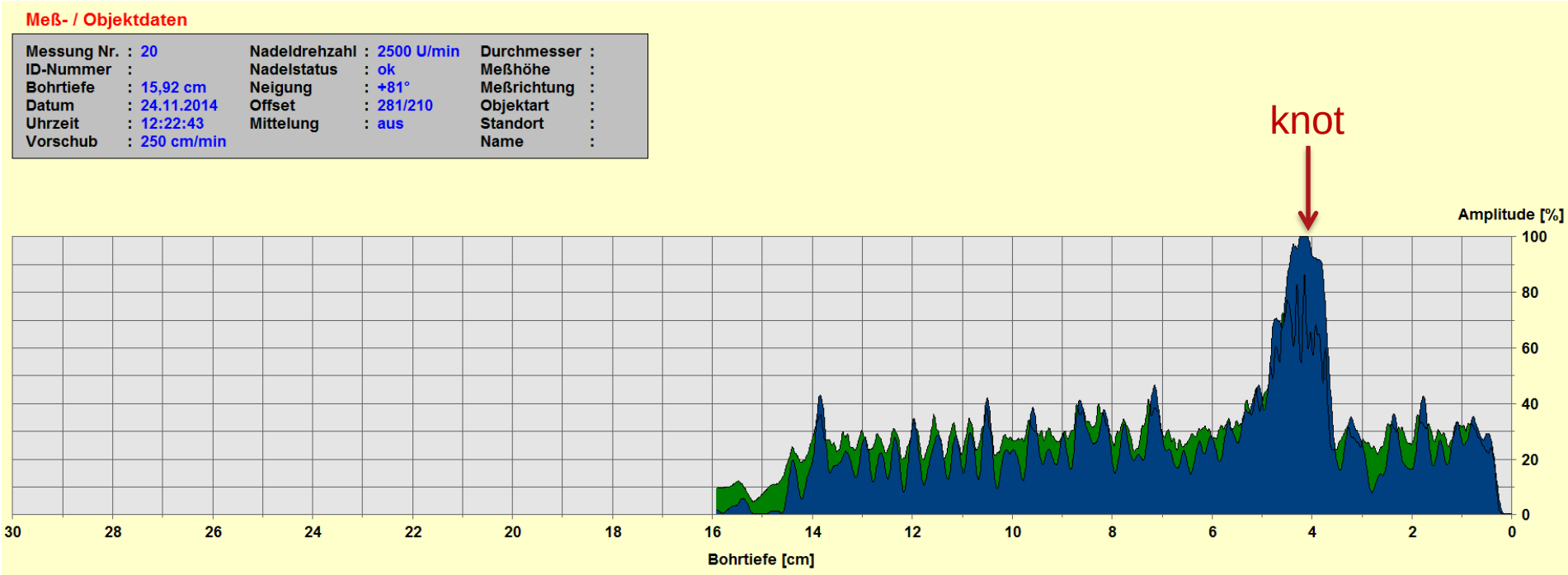


Drilling profile of a laminated timber beam



Drilling profile of conifer beam with knot

- Higher density and higher drilling resistance in knots

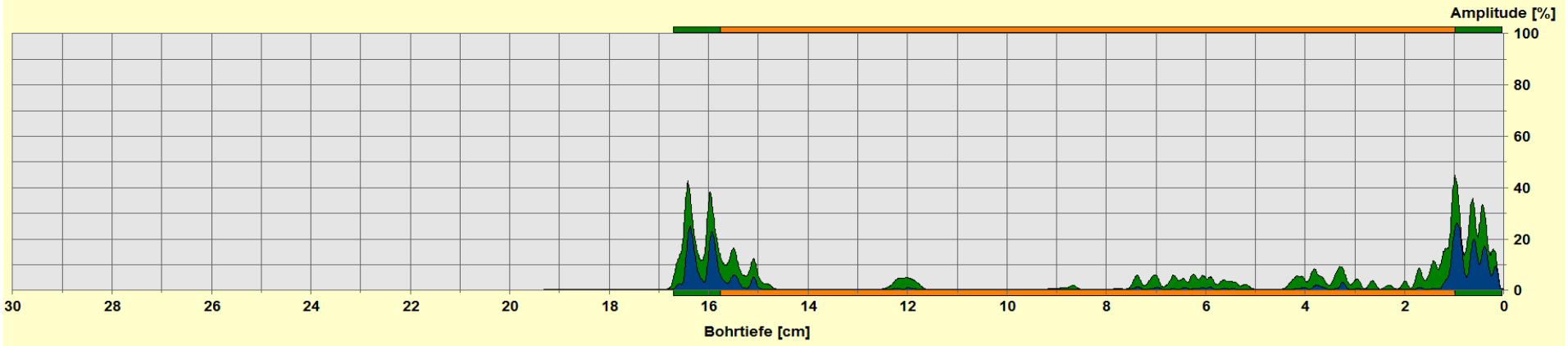


Conifer beam

Central decay – brown rot

Meß- / Objektdaten

Messung Nr.	: 120	Nadeldrehzahl	: 2500 U/min	Durchmesser	:
ID-Nummer	:	Nadelstatus	: ok	Meßhöhe	:
Bohrtiefe	: 19,32 cm	Neigung	: -8°	Meßrichtung	:
Datum	: 31.10.2014	Offset	: 125/238	Objektart	:
Uhrzeit	: 09:38:09	Mittelung	: aus	Standort	:
Vorschub	: 200 cm/min			Name	:

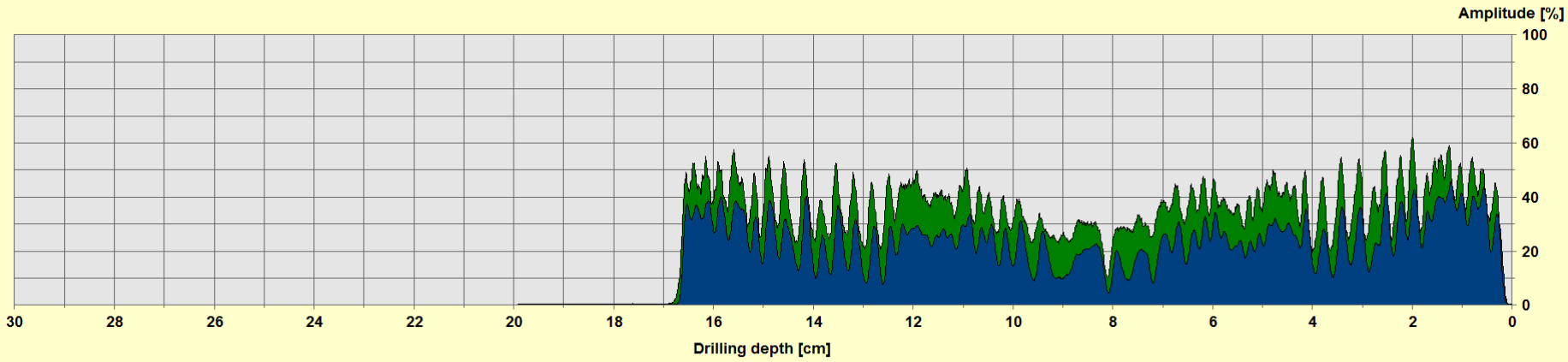


Measurement example

Intact wooden conifer pole

Measuring / object data

Measurement no.	: 243	Needle speed	: 2500 r/min	Diameter	:
ID number	:	Needle state	: ok	Level	:
Drilling depth	: 19,91 cm	Tilt	: -4°	Direction	:
Date	: 20.08.2014	Offset	: 135/253	Species	:
Time	: 10:31:20	Avg. curve	: off	Location	:
Feed speed	: 200 cm/min			Name	:

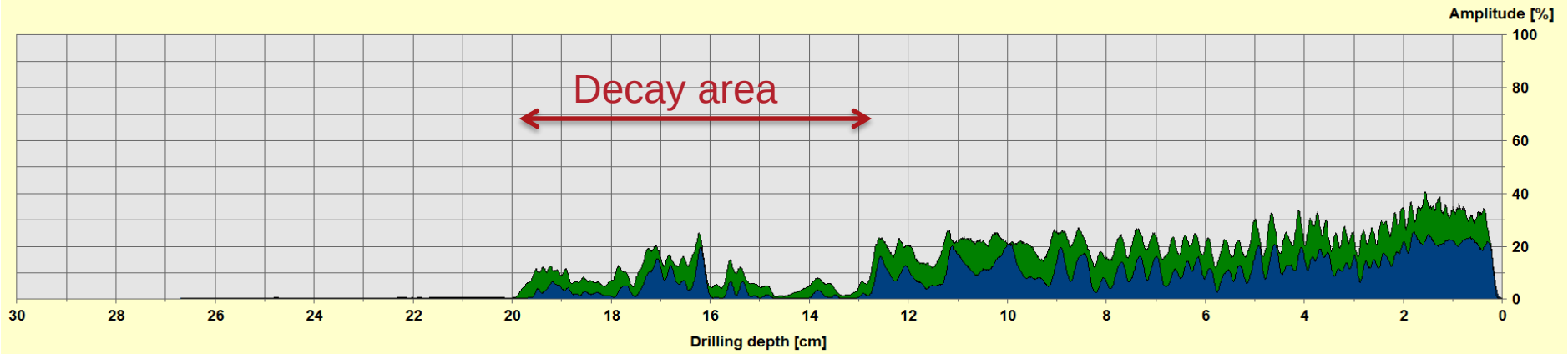


Measurement example

Wooden conifer pole with external decay

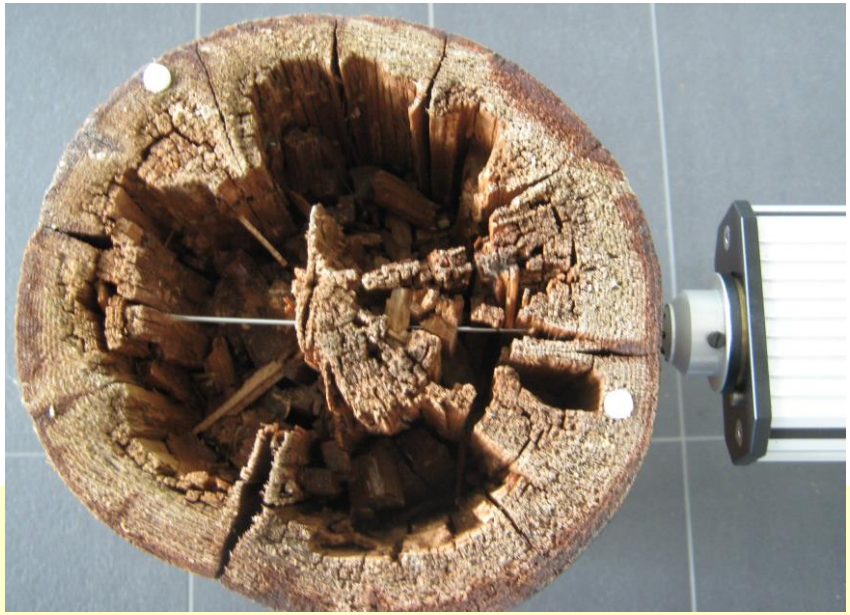
Measuring / object data

Measurement no.	: 251	Needle speed	: 2500 r/min	Diameter	:
ID number	:	Needle state	: ---	Level	:
Drilling depth	: 26,70 cm	Tilt	: -6°	Direction	:
Date	: 20.08.2014	Offset	: 111/247	Species	:
Time	: 10:36:45	Avg. curve	: off	Location	:
Feed speed	: 150 cm/min			Name	:



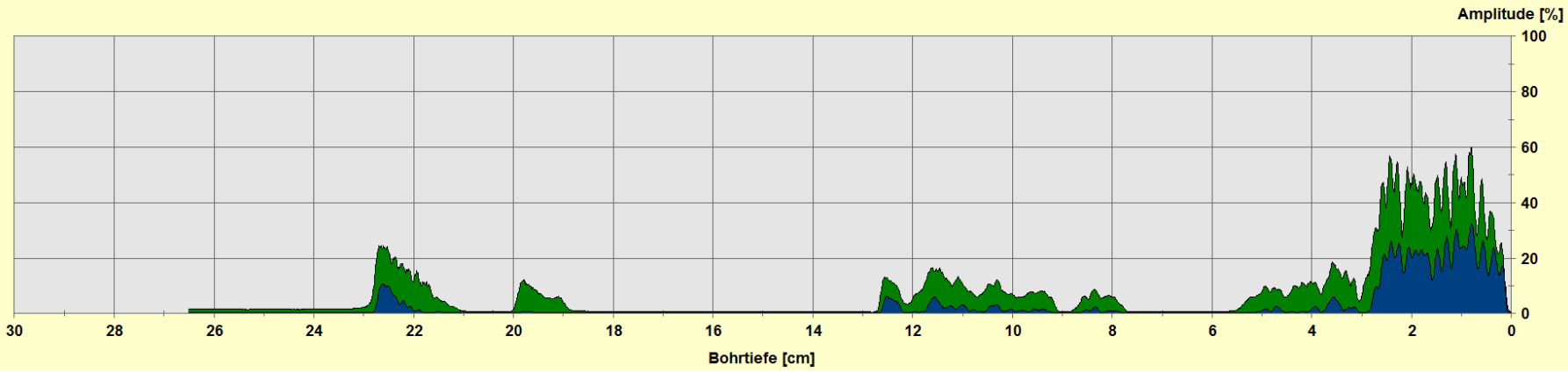
Measurement example

Wooden conifer pole with central decay



Meß- / Objektdaten

Messung Nr.	: 46	Nadeldrehzahl	: 2500 U/min	Durchmesser	:
ID-Nummer	:	Nadelstatus	: ok	Meßhöhe	:
Bohrtiefe	: 26,51 cm	Neigung	: -7°	Meßrichtung	:
Datum	: 08.09.2014	Offset	: 129/242	Objektart	:
Uhrzeit	: 11:13:03	Mittelung	: aus	Standort	:
Vorschub	: 200 cm/min			Name	:



Measurement example

Intact wooden pole

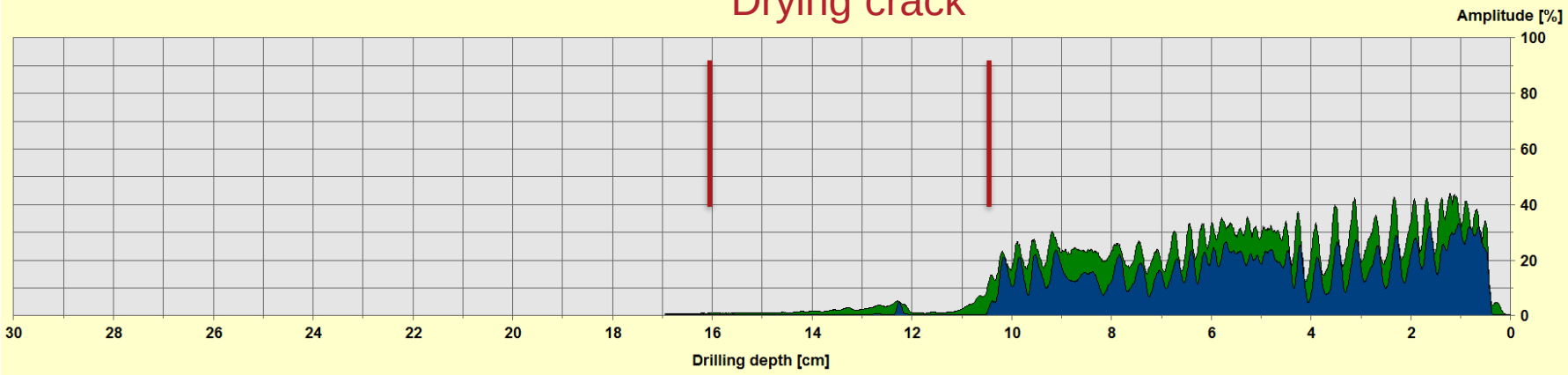
(needle exits in drying crack)

Perform drilling when possible in 90° from crack

Measuring / object data

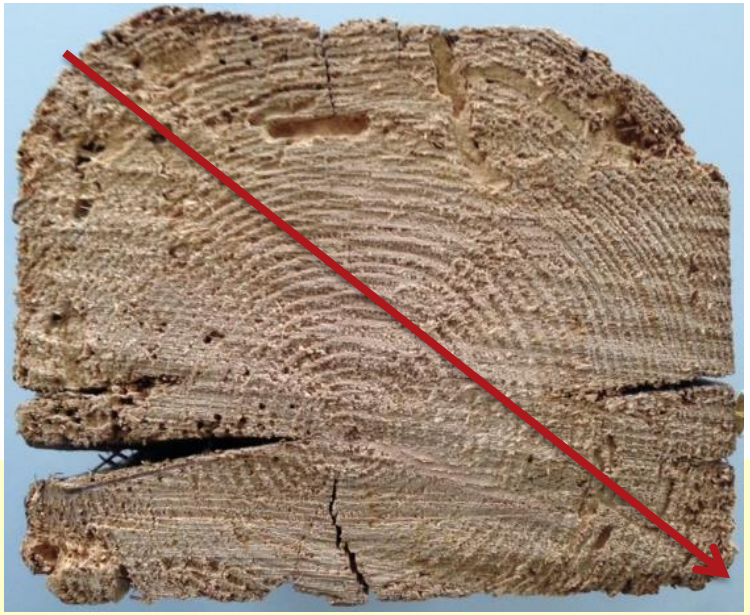
Measurement no.	: 249	Needle speed	: 2500 r/min	Diameter	:
ID number	:	Needle state	: ---	Level	:
Drilling depth	: 16,94 cm	Tilt	: -6°	Direction	:
Date	: 20.08.2014	Offset	: 108/246	Species	:
Time	: 10:34:37	Avg. curve	: off	Location	:
Feed speed	: 150 cm/min			Name	:

Drying crack



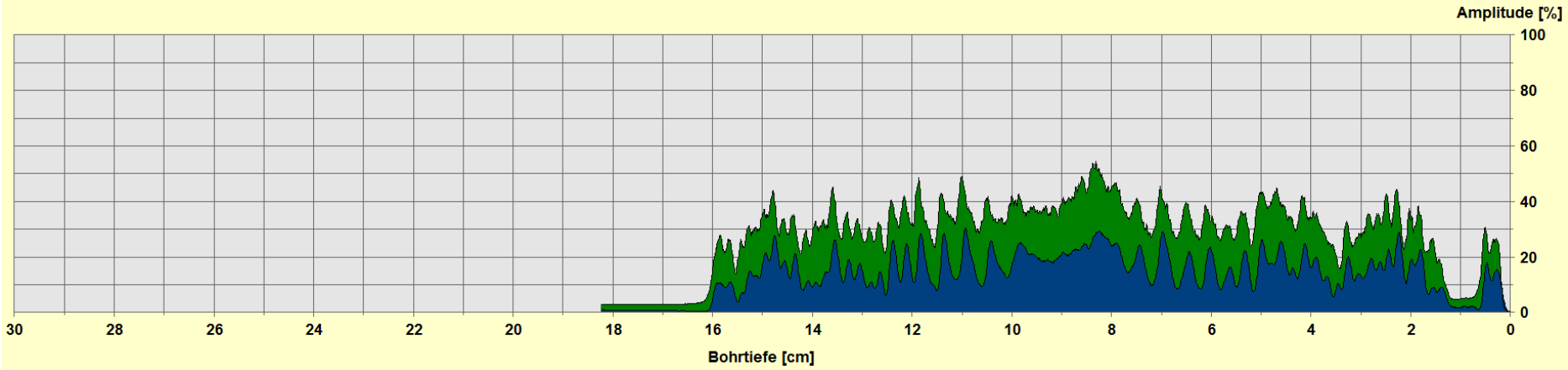
Measurement example

Conifer beam with insect attack
(Anobium punctatum)
(Hylotrupes, bajulus)

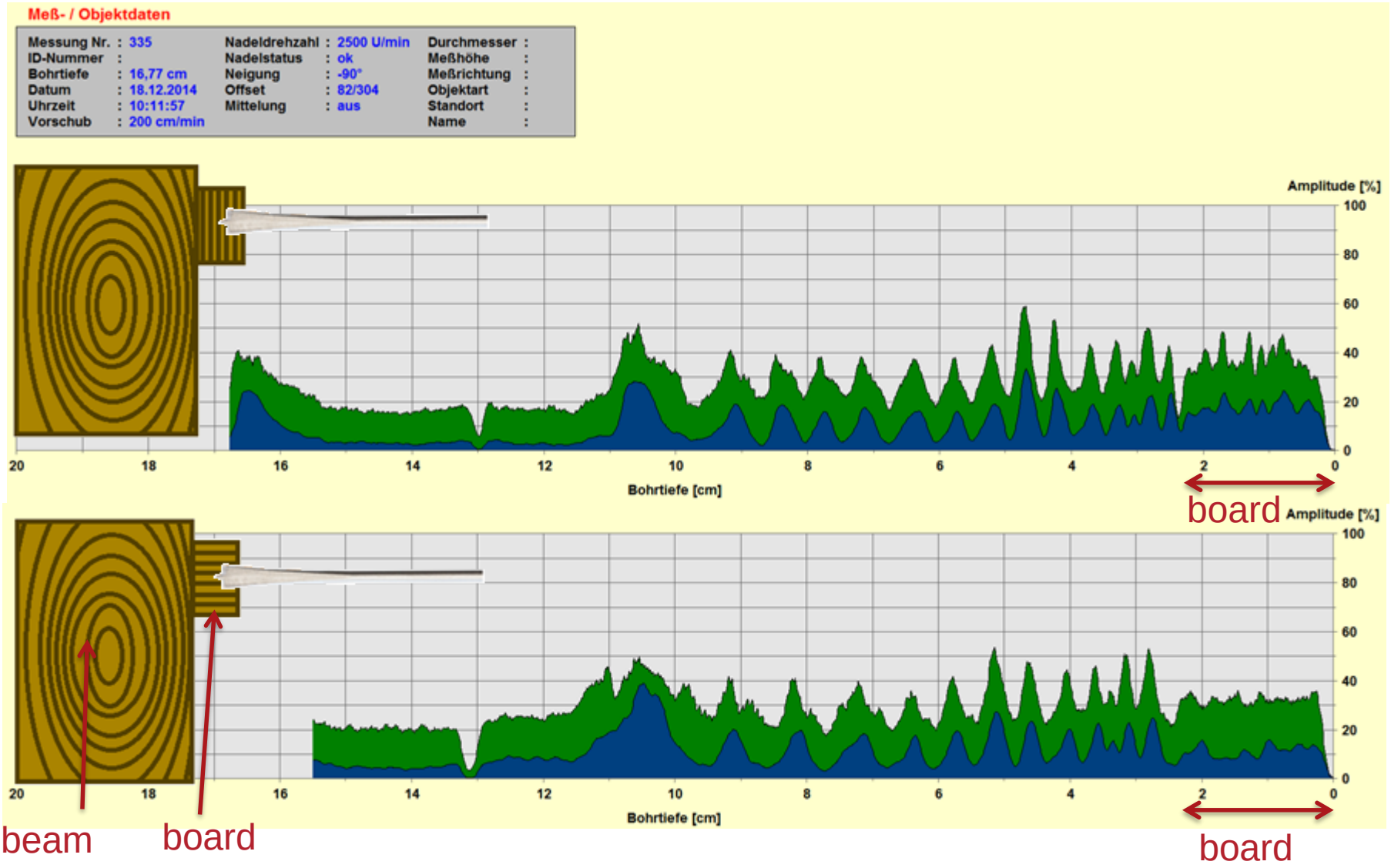


Meß- / Objektdaten

Messung Nr.	: 333	Nadeldrehzahl	: 2500 U/min	Durchmesser	:
ID-Nummer	:	Nadelstatus	: ---	Meßhöhe	:
Bohrtiefe	: 18,24 cm	Neigung	: -7°	Meßrichtung	:
Datum	: 12.12.2014	Offset	: 80/310	Objektart	:
Uhrzeit	: 11:35:05	Mittelung	: aus	Standort	:
Vorschub	: 150 cm/min			Name	:



Drilling of board attached to beam

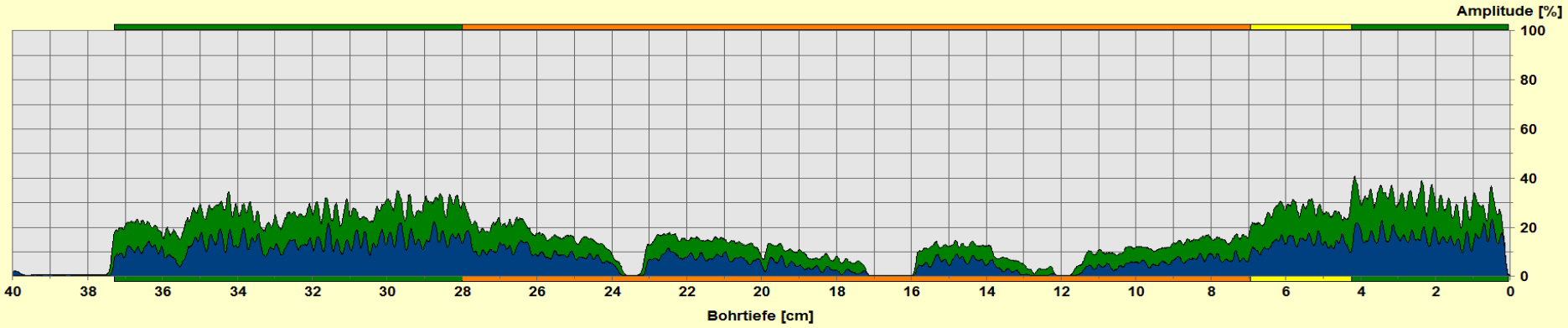


Oak beam of a church roof contruction

Brown rot decay with cracks

Meß- / Objektdaten

Messung Nr.	: 119	Nadeldrehzahl	: 2500 U/min	Durchmesser	:
ID-Nummer	:	Nadelstatus	: ---	Meßhöhe	:
Bohrtiefe	: 39,98 cm	Neigung	: -1°	Meßrichtung	:
Datum	: 31.10.2014	Offset	: 102/238	Objektart	:
Uhrzeit	: 09:33:40	Mittelung	: aus	Standort	:
Vorschub	: 100 cm/min			Name	:

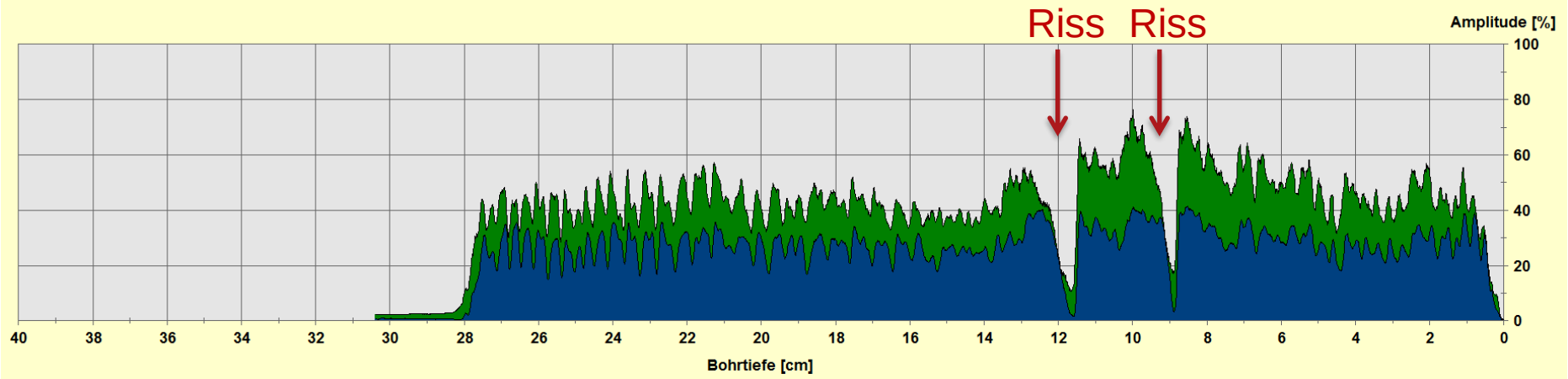


Intact oak beam with cracks

Oak beam with cracks

Meß- / Objektdaten

Messung Nr.	: 10	Nadeldrehzahl	: 2500 U/min	Durchmesser	:
ID-Nummer	:	Nadelstatus	: ok	Meßhöhe	:
Bohrtiefe	: 30,39 cm	Neigung	: -14°	Meßrichtung	:
Datum	: 13.04.2015	Offset	: 68/294	Objektart	:
Uhrzeit	: 13:51:50	Mittelung	: aus	Standort	:
Vorschub	: 100 cm/min			Name	:

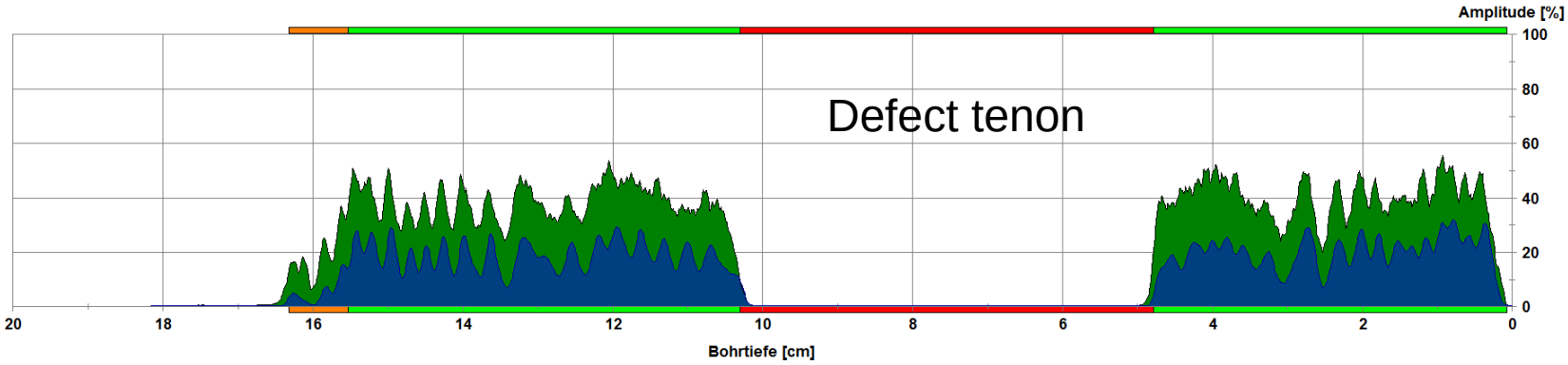


Traditional joinery with tenon

Traditional joinery with tenon

Meß- / Objektdaten

Messung Nr.	131	Nadeldrehzahl	2500 U/min	Durchmesser	
ID-Nummer	Nadelholz	Nadelstatus	ok	Meßhöhe	
Bohrtiefe	18,16 cm	Neigung	-5°	Meßrichtung	
Datum	08.12.2016	Offset	78/287	Objektart	
Uhrzeit	14:21:48	Mittelung	aus	Standort	
Vorschub	200 cm/min			Name	

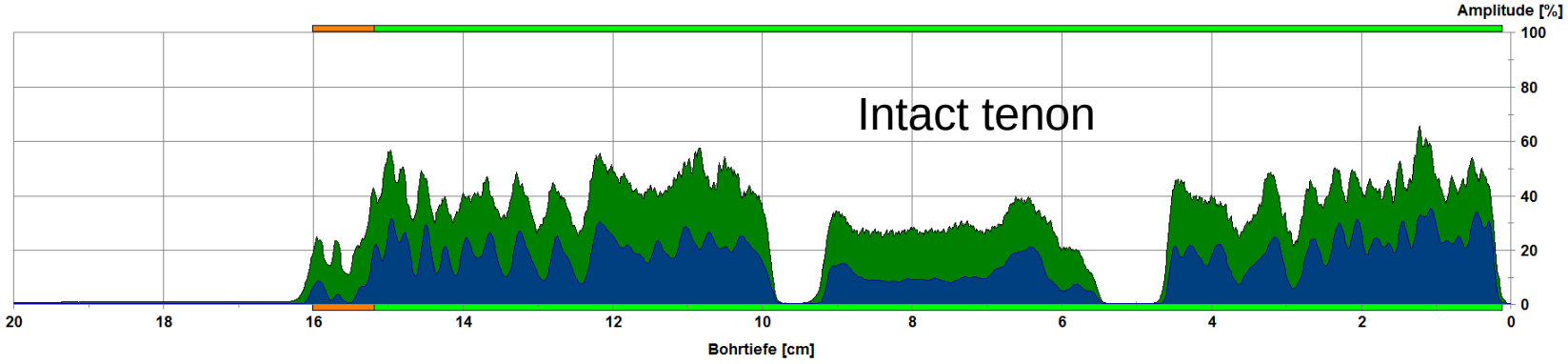


Bewertung

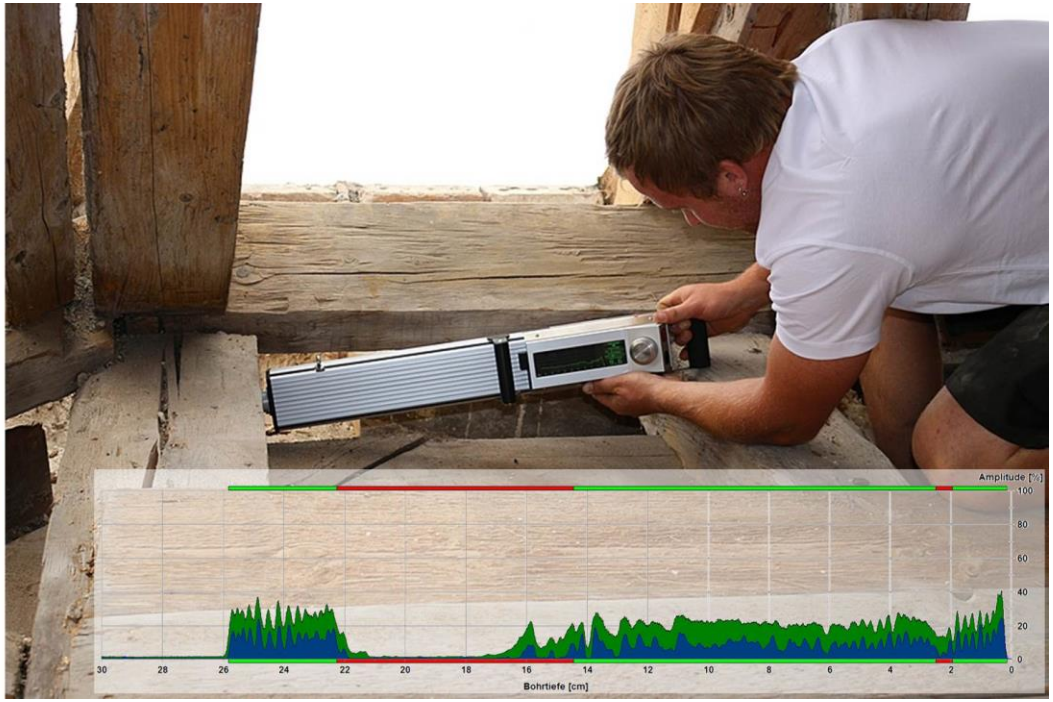
Von	0,1 cm	bis	4,8 cm	: Intakt
Von	4,8 cm	bis	10,3 cm	: Starker Abbau
Von	10,3 cm	bis	15,5 cm	: Intakt
Von	15,5 cm	bis	16,3 cm	: Außenfäule
Von	0,0 cm	bis	0,0 cm	:
Von	0,0 cm	bis	0,0 cm	:

Bemerkung

Zapfen nicht vorhanden
Bei 15,5 bis 16,5 Außenfäule

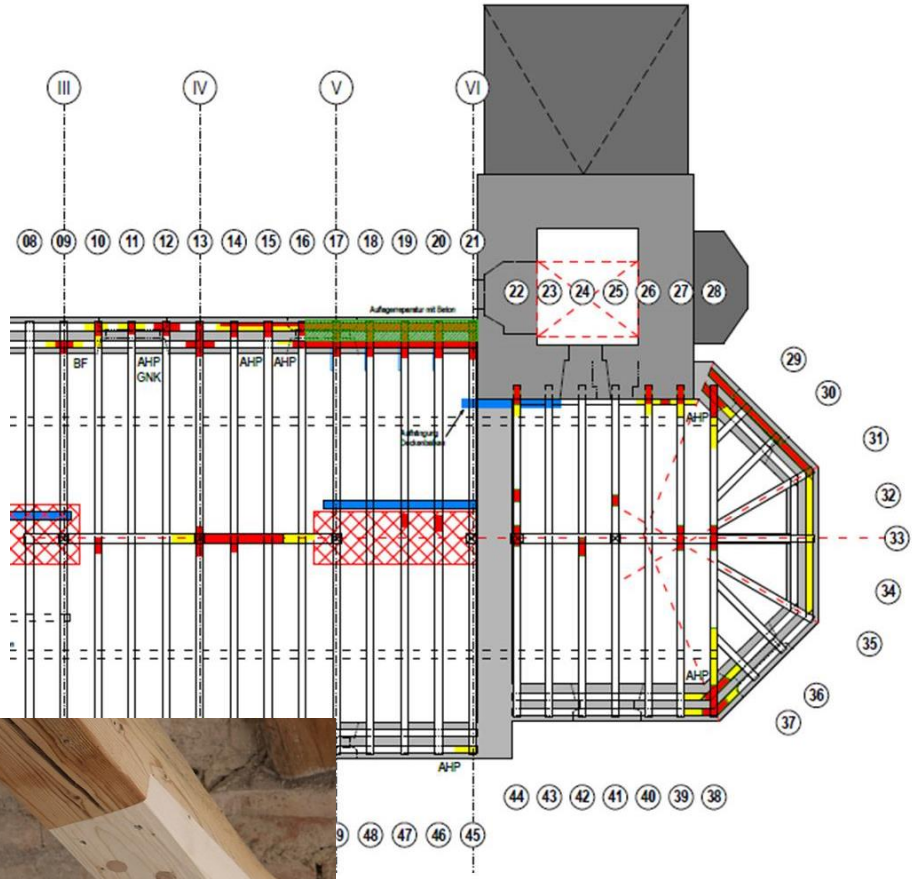


Rafter end with decay



Rafter end with decay: determining decay with drilling resistance measurement from the rafter end. Finding the transition of decayed wood to intact wood to maintain as much of the original rafters as possible.

Mapping decay in wooden heritage constructions



Legende Zustandskartierung

Querschnitt überwiegend geschädigt und für eine sinnvolle Reparatur nicht ausreichend. Austauschen bzw. Ersatzkonstruktion

Querschnitt teilweise geschädigt. Restquerschnitt für eine sinnvolle Reparatur ausreichend. Bauteilquerschnitt ergänzen.

Querschnitt oberflächlich geschädigt. Ursprungsquerschnitt weitgehend vorhanden. Bauteiloberfläche überarbeiten.

Bauteil nicht zugänglich. Schädigung und Restquerschnitt nicht ermittelbar. Bauteil gg. freilegen.

Neuzeitliche Verstärkung bzw. Hilfskonstruktion.

Holzverbindung gelöst- nicht kraftschlüssig

Fehlendes Bauteil Anschlüsse bzw. Bauteilfragmente vorhanden

Firstpunkt geschädigt

Vorholz abgeschert / Sparren schiebt

Sparrenfuß zerstört

Holzzerstörende Pilze
BF Braunfäule
WF Weißfäule
EHS Echter Hausschwamm
WP Weißer Porenschwamm
BK Brauner Kellerschwamm
AHP Ausgebreiteter Hausporling

Holzzerstörende Insekten
GNK Gemeiner Nagelkäfer
HB Hausbock
GSK Gescheckter Nagelkäfer
TK Trotzkopf

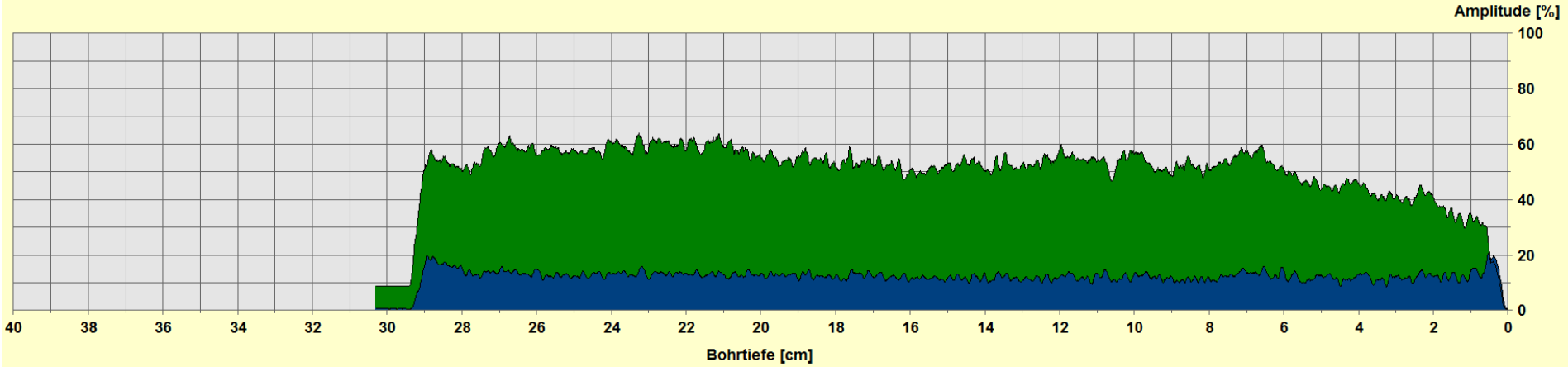
Repairs: retain as much of the original timber as possible.

Tropical wood

- Drilling profile of a Bongossi beam (gross density: 950-1150 kg/m³)

Meß- / Objektdaten

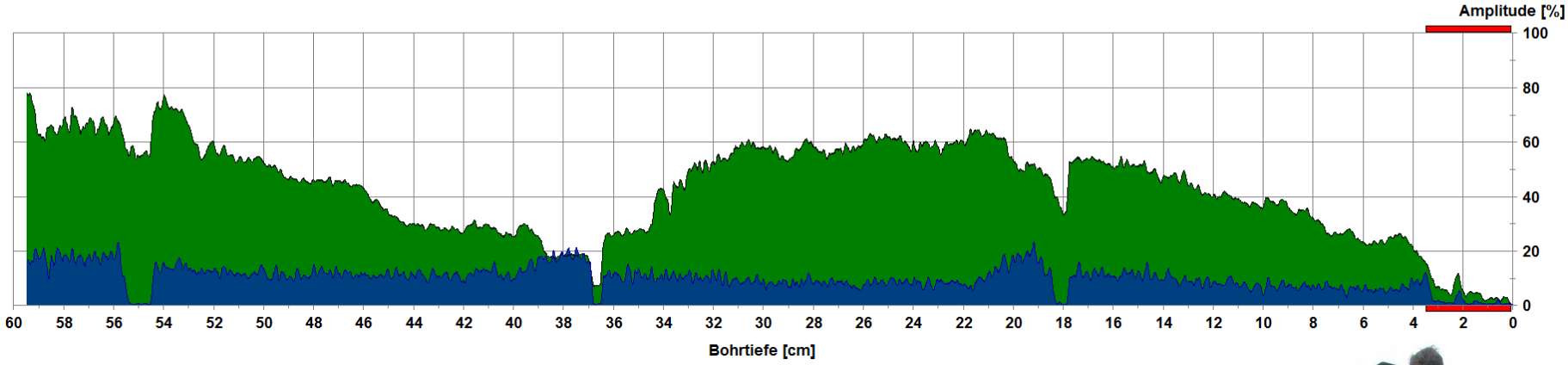
Messung Nr.	: 319	Nadeldrehzahl	: 5000 U/min	Durchmesser	:
ID-Nummer	:	Nadelstatus	: ---	Meßhöhe	:
Bohrtiefe	: 30,31 cm	Neigung	: -6°	Meßrichtung	:
Datum	: 04.12.2014	Offset	: 61/330	Objektart	:
Uhrzeit	: 08:39:45	Mittelung	: aus	Standort	:
Vorschub	: 50 cm/min			Name	:



Tropical wood

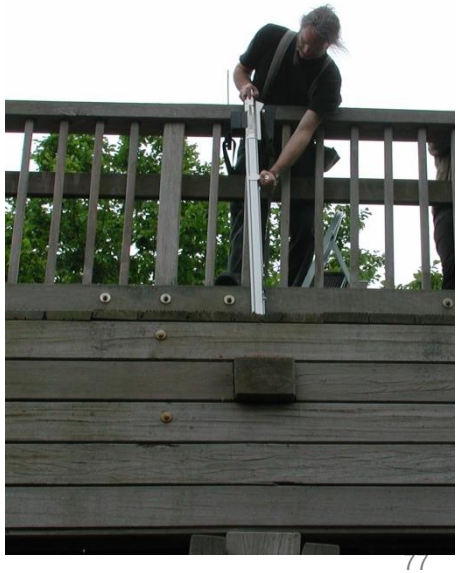
Meß- / Objektdaten

Messung Nr.	: 84	Nadeldrehzahl	: 5000 U/min	Durchmesser	:
ID-Nummer	: O 19 1	Nadelstatus	: ---	Meßhöhe	:
Bohrtiefe	: 59,46 cm	Neigung	: -90°	Meßrichtung	:
Datum	: 02.06.2015	Offset	: 44/297	Objektart	:
Uhrzeit	: 14:26:54	Mittelung	: aus	Standort	:
Vorschub	: 15 cm/min			Name	:



Bewertung

Von 0,1 cm bis 3,5 cm : Außenfäule



Bongossi bridge

Strong shaft friction on drilling resistance curve (green)

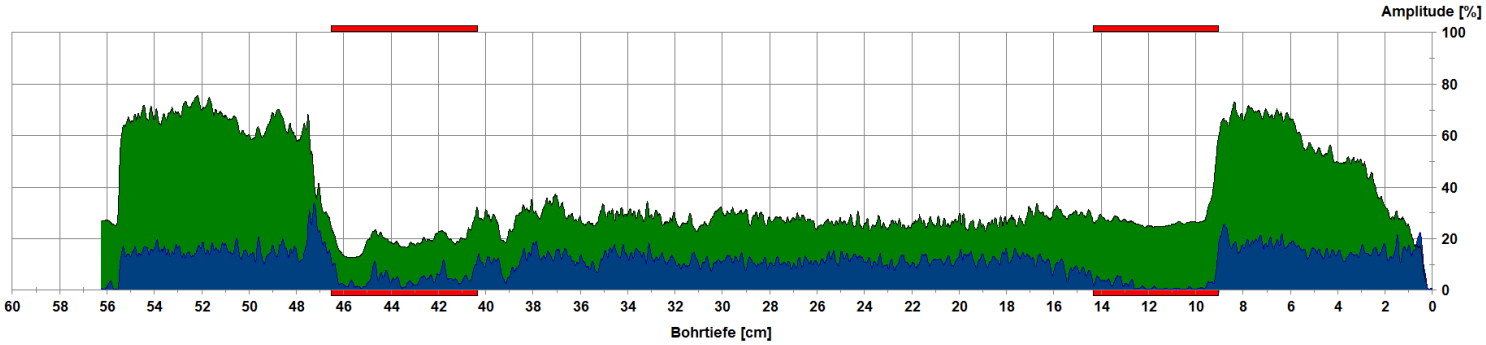
Tropical wood

Wooden construction of Angélique and Bongossi tropical timber

Advanced decay in the red colour marked area

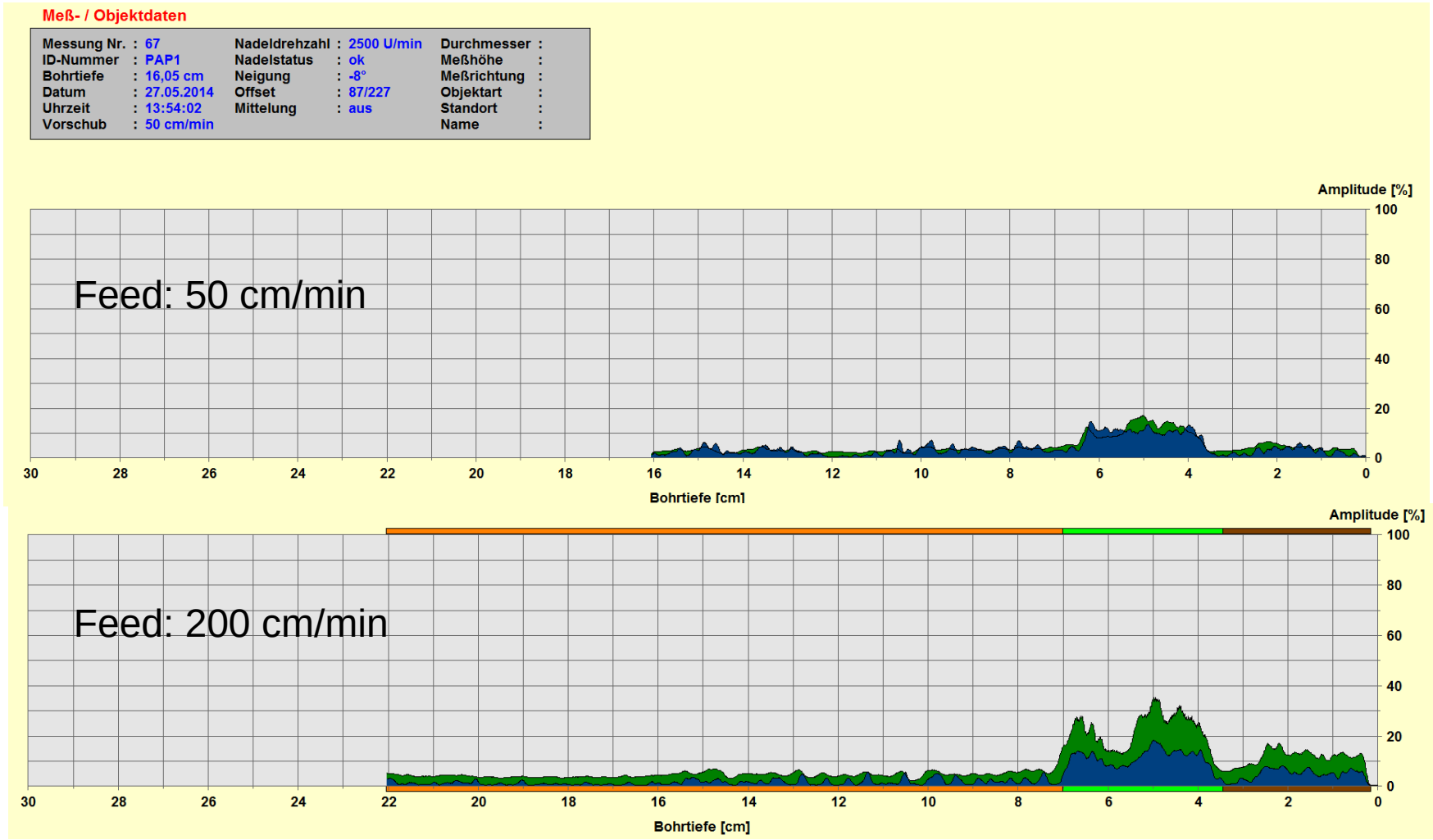
Meß- / Objektdaten

Messung Nr.	: 171	Nadeldrehzahl	: 5000 U/min	Durchmesser	:
ID-Nummer	: 21 W 1 STREB	Nadelstatus	: ---	Meßhöhe	:
Bohrtiefe	: 56,23 cm	Neigung	: 0°	Meßrichtung	:
Datum	: 16.06.2015	Offset	: 88/350	Objektart	:
Uhrzeit	: 12:49:27	Mittelung	: aus	Standort	:
Vorschub	: 50 cm/min			Name	:



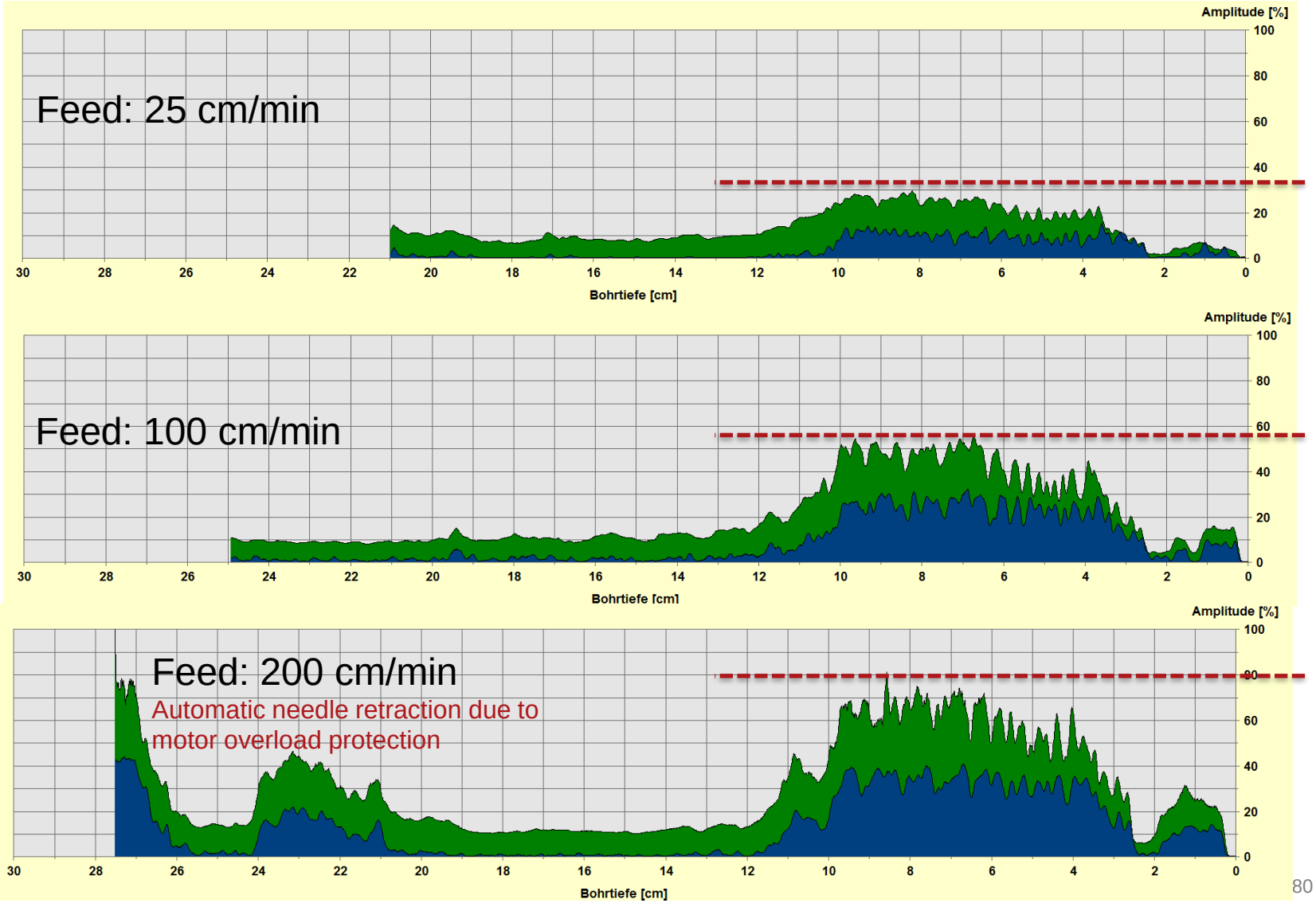
Comparison of different feed speeds

- Poplar with advanced decay drilled with different feed speeds



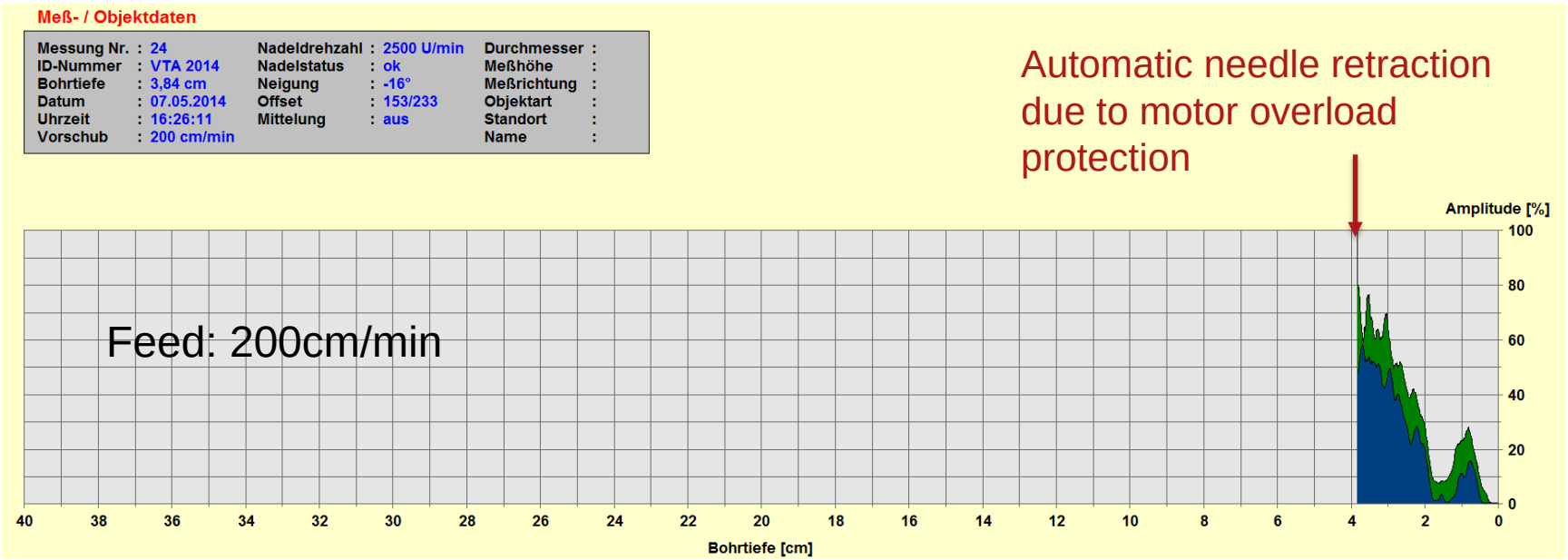
Comparison of different feed speeds

- Acacia drilled with different feed speeds



Feed speed to high – Motor overload protection

- Selected feed speed is to high

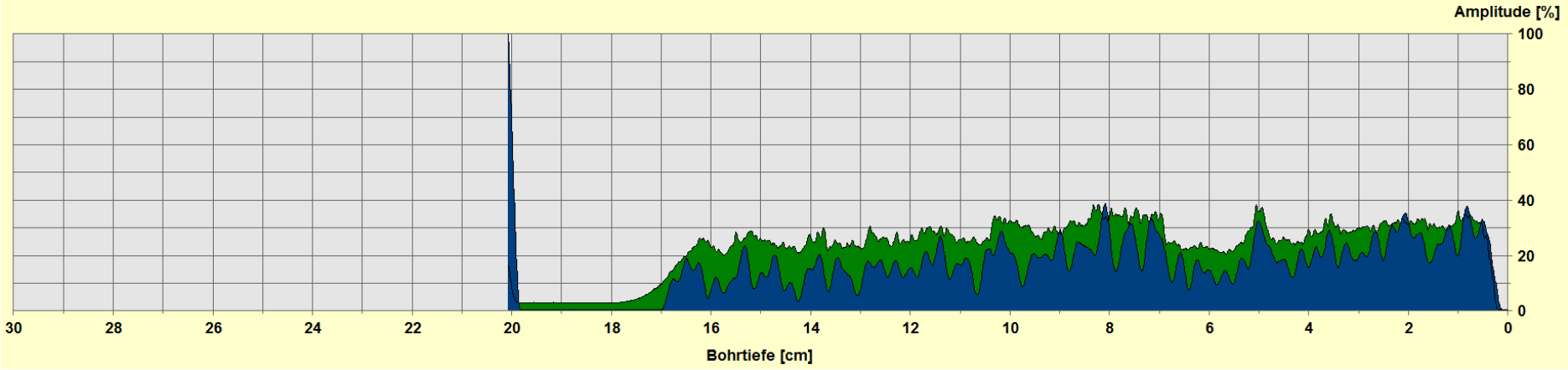


- In display appears advice: „Overload drill motor! Please reduce feed speed.“

Drilling against hard material (f.e. steel or stucco)

Meß- / Objektdaten

Messung Nr.	: 19	Nadeldrehzahl	: 2500 U/min	Durchmesser	:
ID-Nummer	:	Nadelstatus	: ok	Meßhöhe	:
Bohrtiefe	: 20,07 cm	Neigung	: +84°	Meßrichtung	:
Datum	: 24.11.2014	Offset	: 279/209	Objektart	:
Uhrzeit	: 12:20:58	Mittelung	: aus	Standort	:
Vorschub	: 250 cm/min			Name	:



Advise: Preselect drilling depth to diameter of wooden beam (see page 16)
→ needle will retract before hitting against hard material

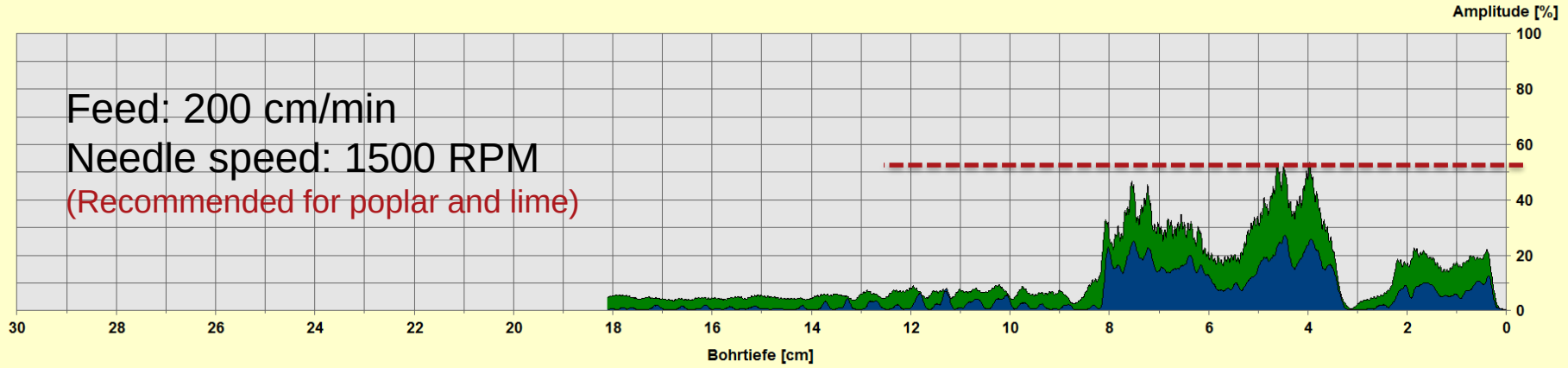
Different needle rotation speed

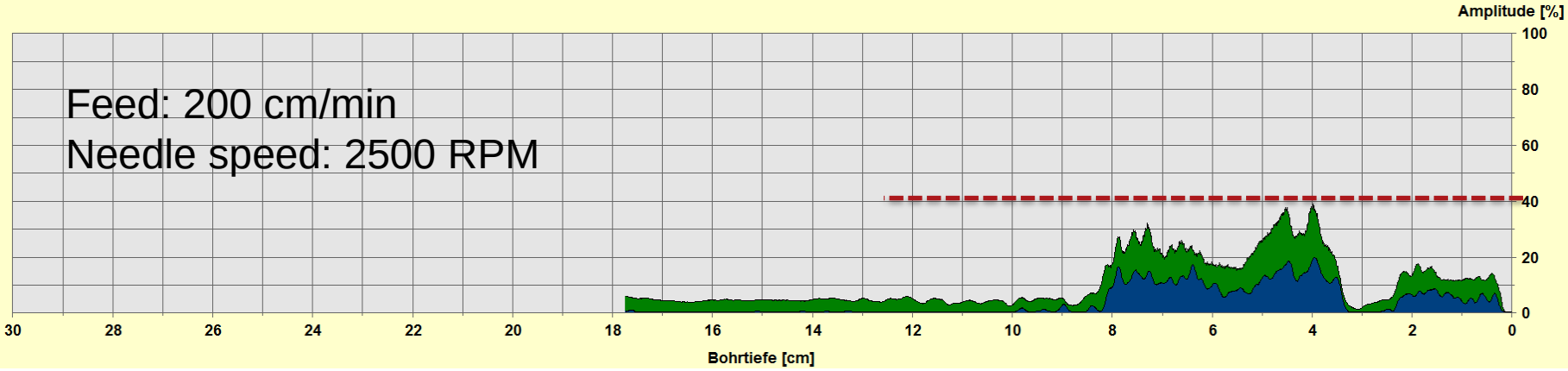
- Poplar tree drilled with different needle rotation speeds

Meß- / Objektdaten

Messung Nr.	: 69	Nadeldrehzahl	: 1500 U/min	Durchmesser	:
ID-Nummer	: KAST1	Nadelstatus	: ok	Meßhöhe	:
Bohrtiefe	: 18,11 cm	Neigung	: -14°	Meßrichtung	:
Datum	: 05.06.2014	Offset	: 146/268	Objektart	:
Uhrzeit	: 09:42:13	Mittelung	: aus	Standort	:
Vorschub	: 200 cm/min			Name	:

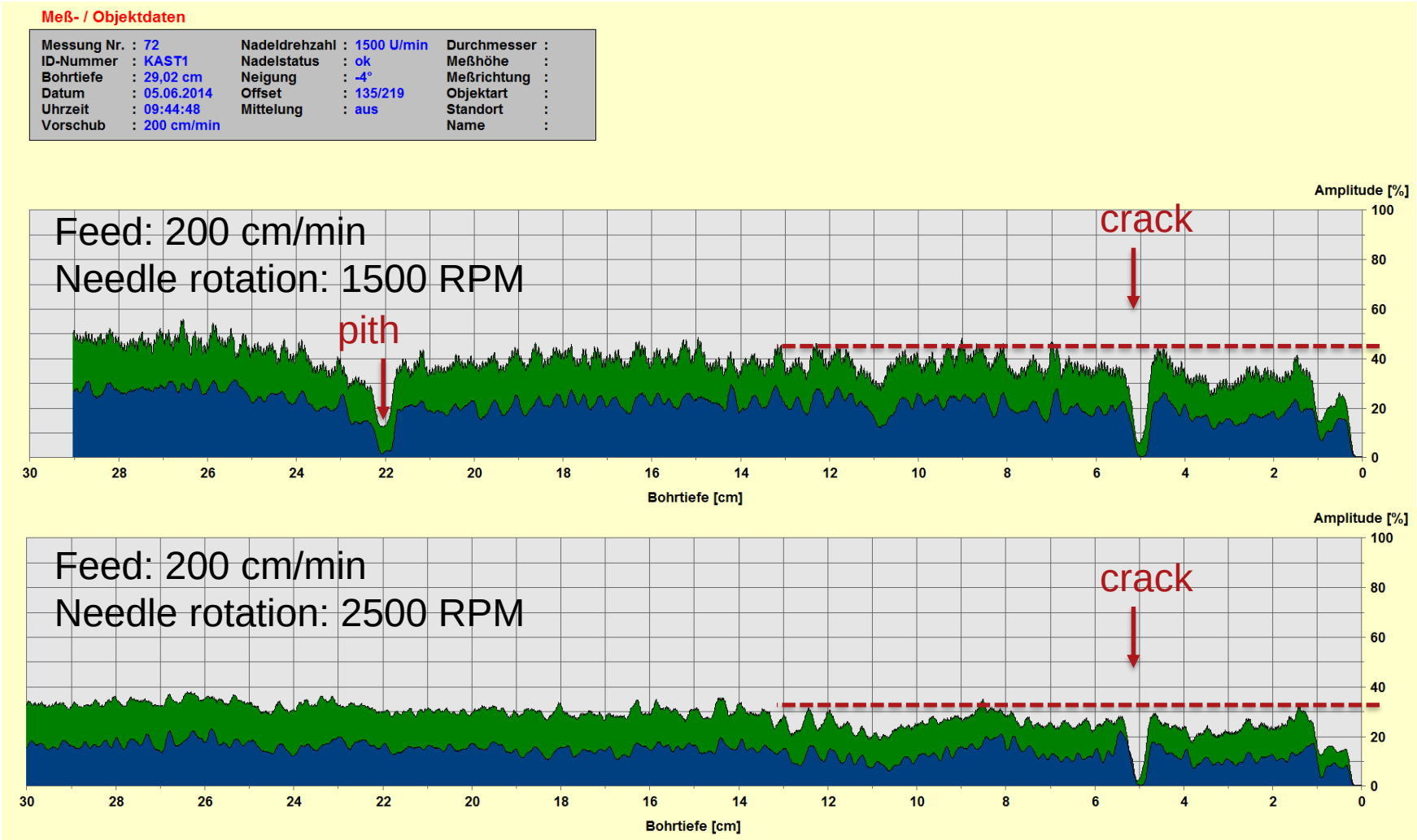
Soft wood f.e. poplar and lime should be drilled with 1500 RPM needle speed





Different needle speeds

- Chestnut tree drilled with different needle rotation speed

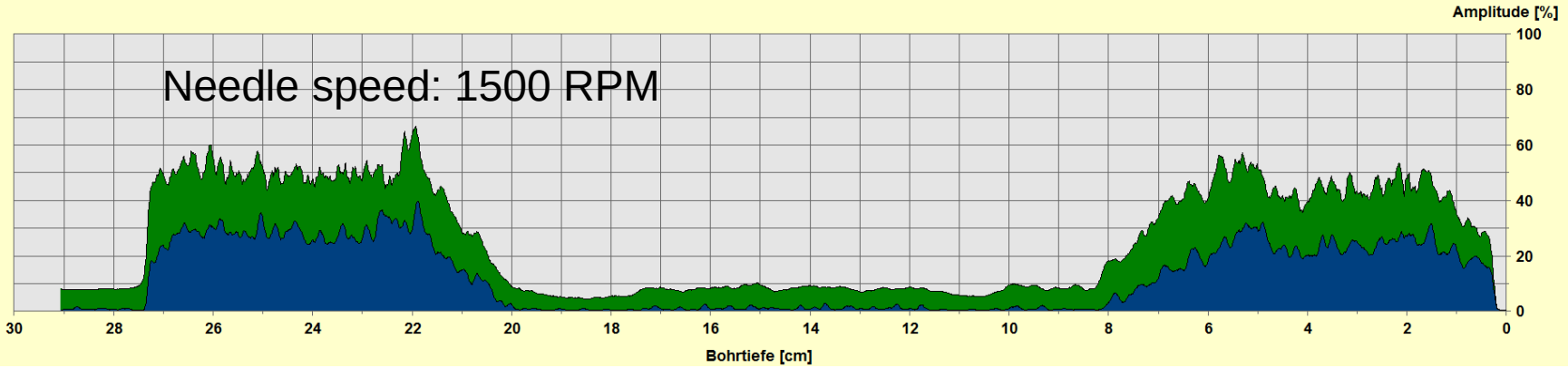


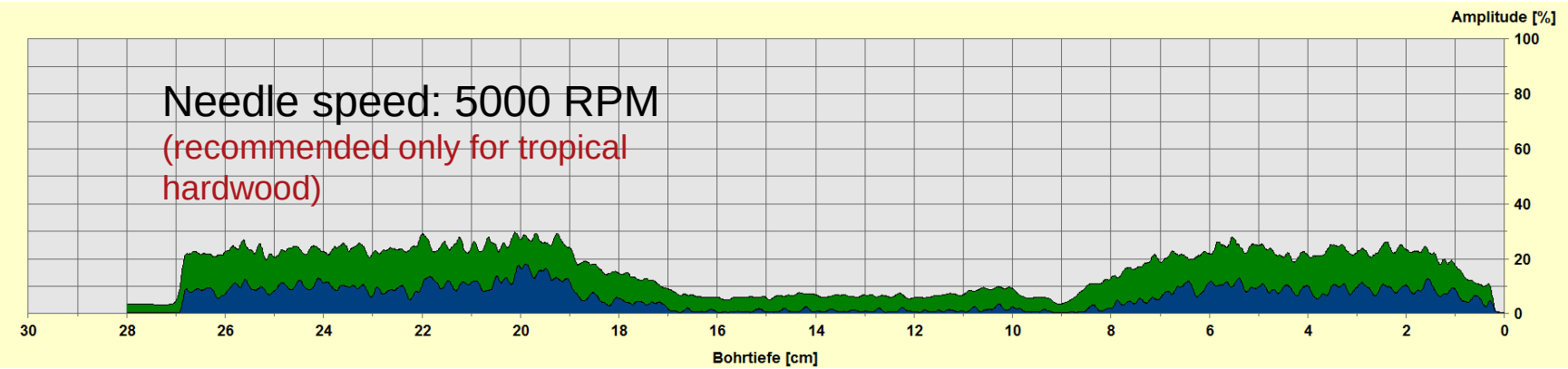
Different needle speeds

- Plane tree with advanced decay drilled with different needle speeds

Meß- / Objektdaten

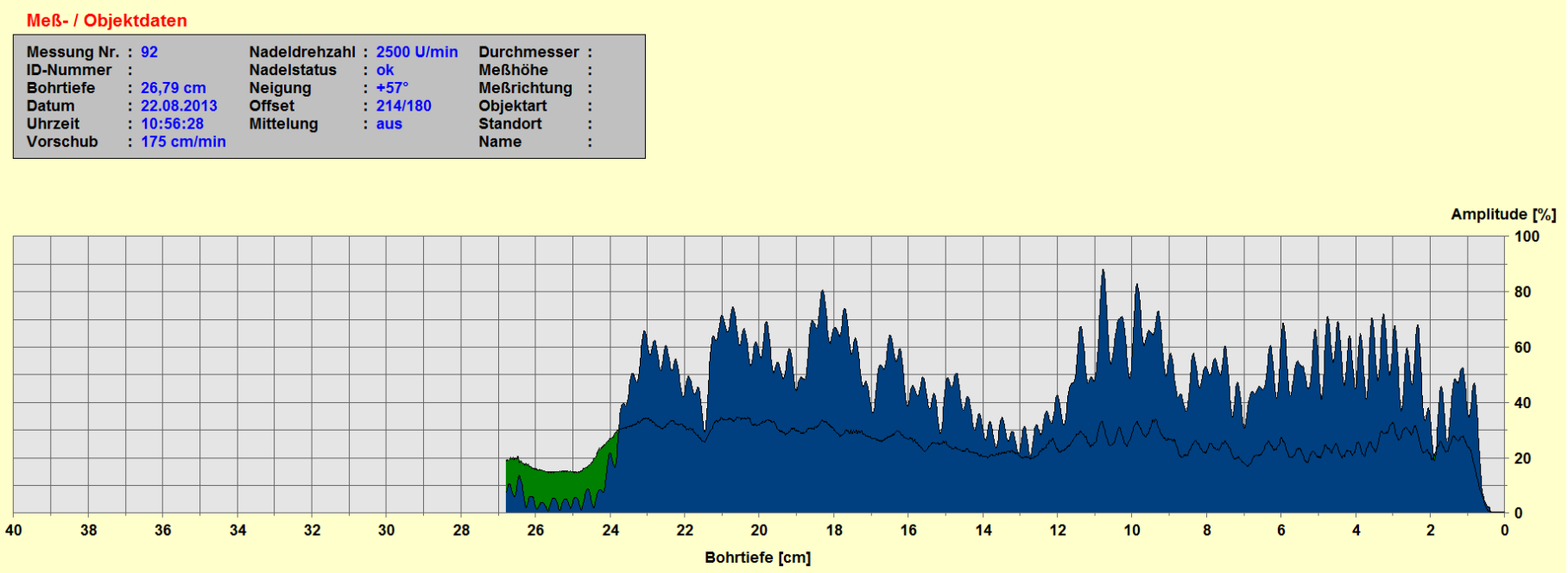
Messung Nr.	: 77	Nadeldrehzahl	: 1500 U/min	Durchmesser	:
ID-Nummer	: PLATANE	Nadelstatus	: ok	Meßhöhe	:
Bohrtiefe	: 29,07 cm	Neigung	: -51°	Meßrichtung	:
Datum	: 05.06.2014	Offset	: 110/219	Objektart	:
Uhrzeit	: 09:49:18	Mittelung	: aus	Standort	:
Vorschub	: 150 cm/min			Name	:





Dull drilling needle

- Drill resistance profile of a dull drilling needle



Indicator for a dull drilling needle: Feed curve (blue) overtops the drilling curve (green) over the entire drilling depth

Conclusions

- Timber constructions are to be inspected on points with static importance such as beam connection points
- Measurement curves must be interpreted correctly by trained personnel
- Perform reference drilling on intact area of the same wooden specimen for better interpretation
- Actions have to be taken after inspecting beams according to drilling profiles results

Thank you for your attention!

IML – Instrumenta Mechanik Labor System GmbH
Parkstraße 33
69168 Wiesloch

Telefon: +49 6222 6797-0
Fax: +49 6222 6797-10
E-Mail: info@iml.de
Web: www.iml.de