



DiGeBaSt & HoBeOpt – increasing transparency in forest and wood supply chains

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Tree to Product, 08.04.2022



HoBeOpt - Optimization of the forest-saw mill supply chain



- 36 months project of 5 institutions (Fraunhofer, HNEE, AGR, KWF and FVA) aiming at increasing transparency and acceptance in the field of round wood measurement
- Development and validation of a simulation tool to analyse log piles (AGR, HNEE)
- Integrating Block Chain technologies in the supply chain (Fraunhofer)
- Critical rating of all methods to measure log volumes (FVA)
- **Development of new methods and algorithms to rate the quality parameter curvature in saw mill measurement (FVA)**

Gefördert durch:

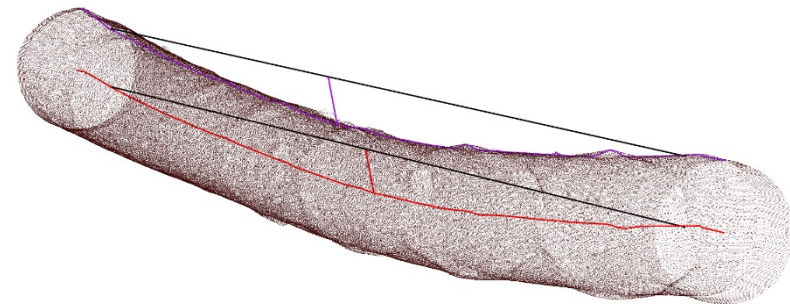
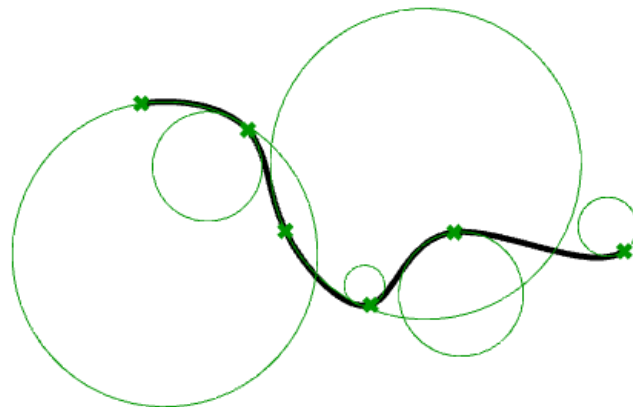


aufgrund eines Beschlusses
des Deutschen Bundestages



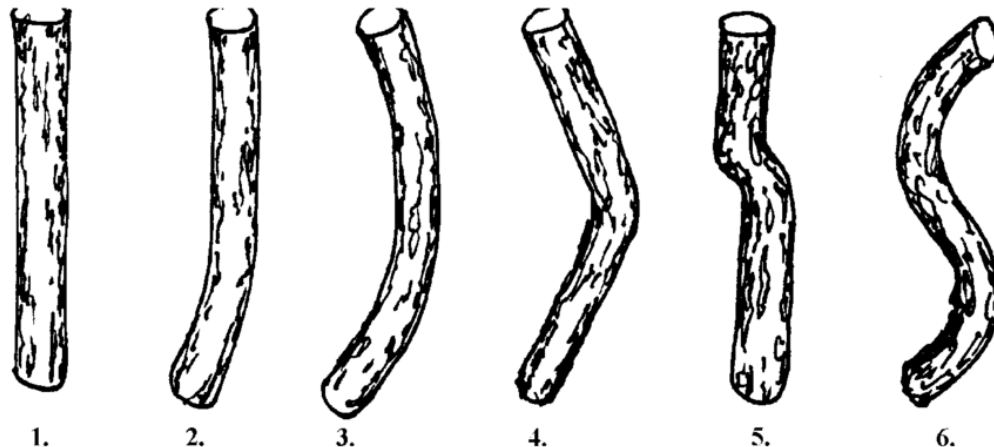
Curvature/sweep of logs

- one of the most important quality parameters regarding (volume-)yield of logs
 - should be described as exact as possible → resource efficiency
 - so far, different concepts and algorithms for the assessment of curvature exist → has to be considered in international timber trade
- which concept/method to describe the sweep of logs is the “best” or the “right” one (and should therefore be used for log grading)?
1. Development of 6 different approaches/algorithms
 2. Conceptual assessment and analysis of correlation between the approaches
 3. Yield simulations and modelling of multiple regressions with the different curvature approaches as (one of many) predictors

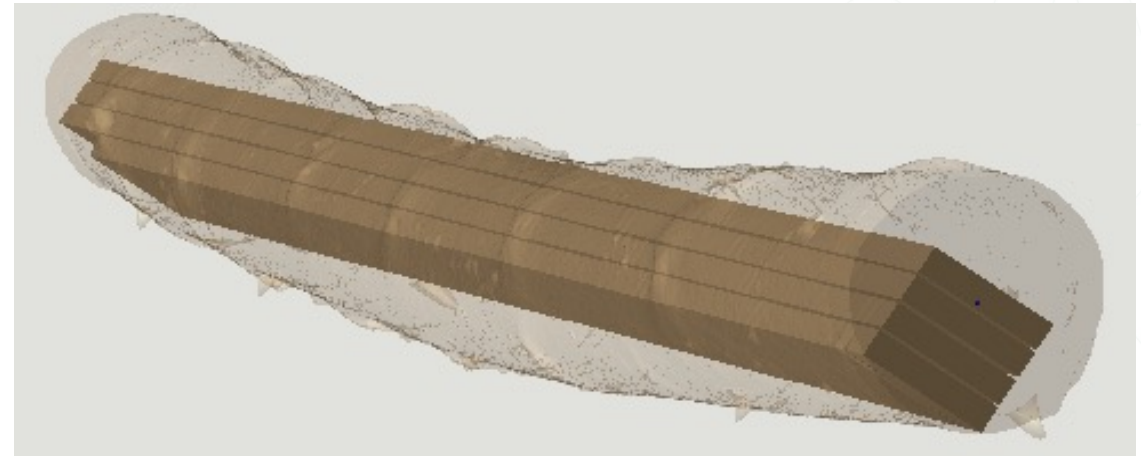


Yield simulation

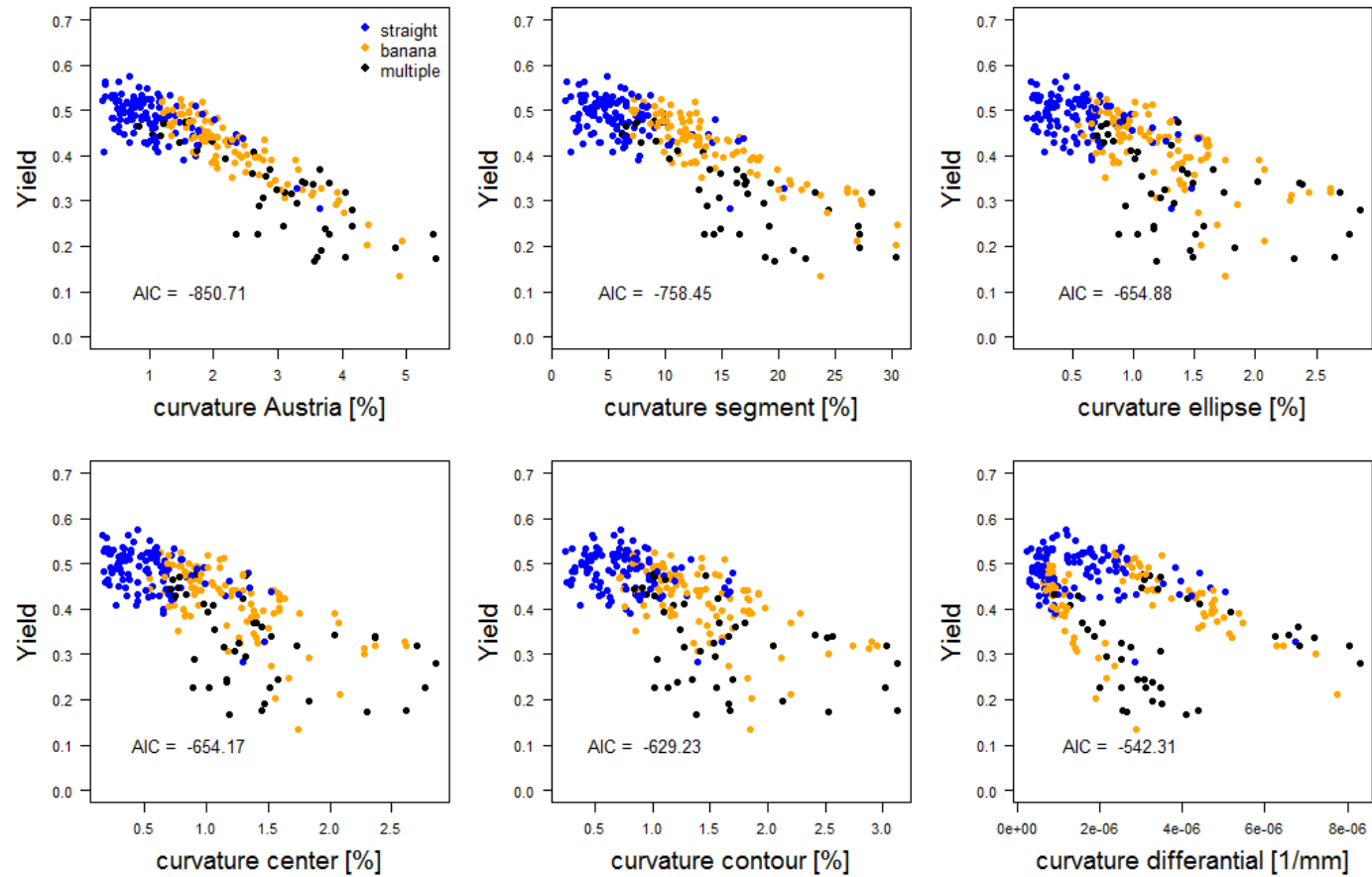
- measurement of 269 logs of 3 tree species (oak, pine and spruce) on 3D-Laser-system DiSHAPE (Microtec SE, Brixen, Italy)
 - current technological standard
- high resolution (~300.000 data points/log) scans
- yield simulation with 2 different scenarios (1 based on beams, 1 based on boards as end products) as an optimization problem
- $yield \sim curvature + taper + s.e.d + sweep type$



Gjerdrum et al.2001



Results



Outlook and perspectives

- yield simulation is a promising tool/approach to quantify the effect of different quality parameters on log yield
- different approaches (including the ones currently used in Germany and Austria) lead to different ratings of the same logs
- the closer the relationship between a quality parameter and the (simulated) yield, the higher the acceptance for the quality assessment from both market partners

- further increase of the accuracy of curvature assessment through automatic detection of sweep types from 3D-point data (Machine Learning)
- yield simulation as a possible tool also for the reflection of other quality parameters (e.g. taper)



Strength of our approach:
Collaboration of different sectors to design and test the technology under real conditions from the wood harvest until the sawmill



GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung

Digital
GreenTech

Funding period:

01/04/2021 -
31/03/2023

Tracking of tree logs



Status Quo:

- Gap in tracking wood from the forest until the sawmill
- no consistent tracking method for individual tree logs in Baden-Württemberg, Germany or internationally
- Exception: in some cases precious wood is marked with number tags, spray color or RFID
- financial accounting and trade are based on conventional log measurement systems for determining wood volume
- no traceability, no proof of origin

Requirement for the implementation of a tracking system:

- easy to use, cheap, resistant to rough field conditions
- applicable across sectors from harvest via transport to the wood processing industry

Tracking via Fingerprint

- Wood log end faces are as unique as human fingerprints
 - shown by previous research on roundwood tracking using log end biometrics
Schraml, R., Charwat-Pessler, J., Entacher, K., Petutschnigg, A., & Uhl, A. (2016). Roundwood tracking using log end biometrics. Informatik in der Land-, Forst- und Ernährungswirtschaft 2016.
- digital fingerprints are marker free and no additional production step is required



Images of log ends of spruce stems with different diameters a few days after the harvest



Digital Fingerprint

markerfree tracking of tree logs from harvest to sawmill

Camera systems

Images of tree log ends at several stages: harvester, transport, sawmill

Fingerprint recognition

Recognition of individual logs based on fingerprint methods

Wood cloud

Data transfer between sectors and connection to log-specific information

Field campaign

Demonstration of the technology under real conditions

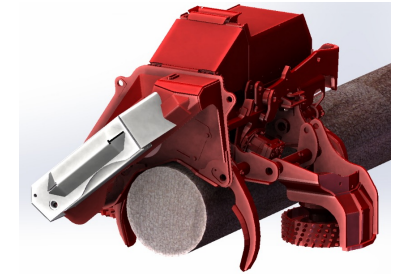
Technical components

Fingerprint Reader

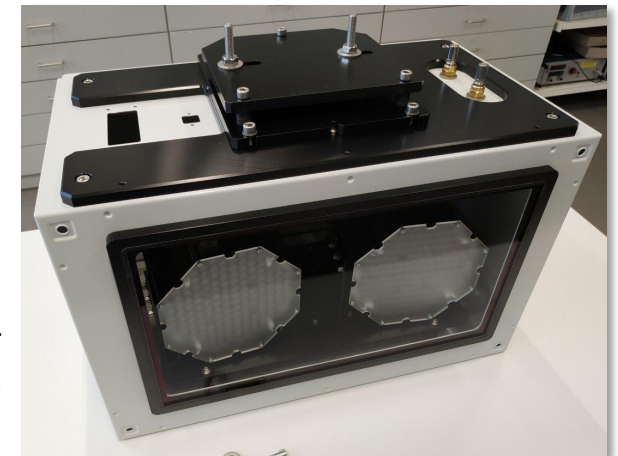
- quick and compact camera system
- integrated in forest machines

Central Fingerprint Server

- fingerprint generation
- fingerprint management and matching

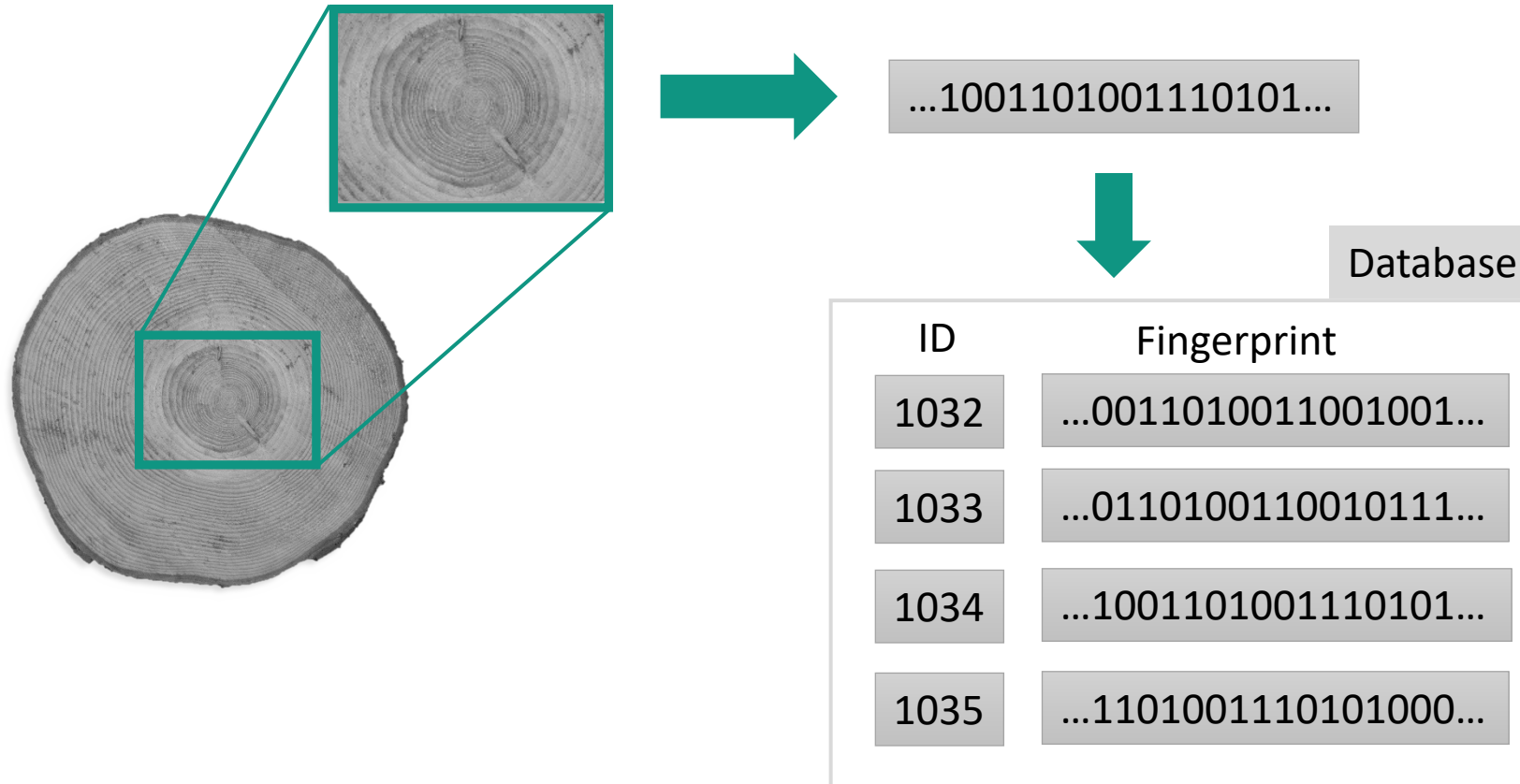


Design for integration at the harvester

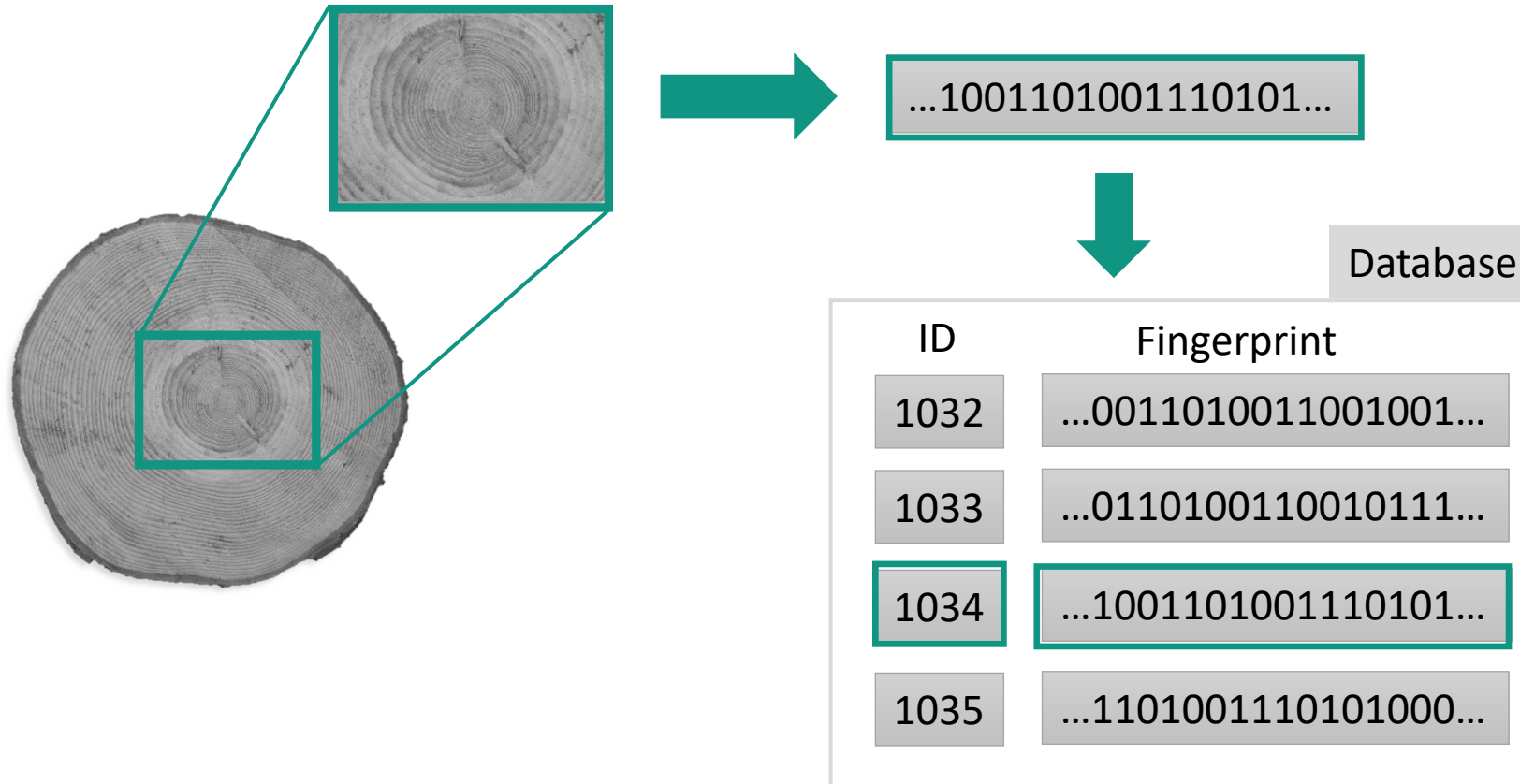


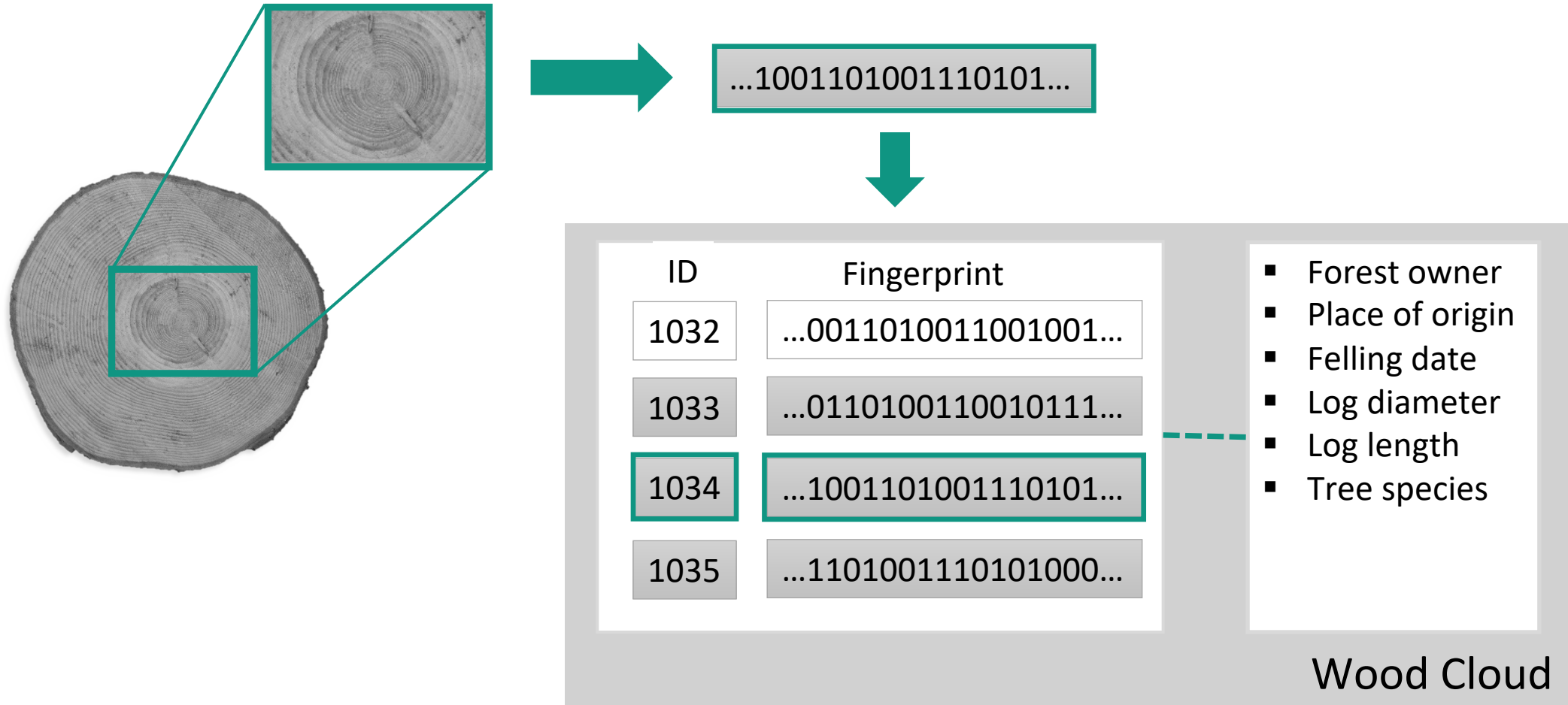
Design for integration in the sawmill

Wood fingerprint generation



Wood fingerprint matching





Gains for sustainability

- traceability: identification of log sections enables the connection of log-specific data with process data
 - thereby: Discovery of production errors und limitation of reclamations
 - prognosis of quality of sawn timber
 - data for sustainable forestry
 - transparent accounting of timber
 - traceability as key for sustainable quality guarantee and process optimization
- ➔ reliable “Proof of Origin”
- ➔ end-to-end chain of custody from the place of wood harvest until the sawmill



Alignment with the UN Sustainability Goals



9.4 Increased resource-use efficiency through clean and environmentally sound technologies



8.4 Resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation



15.7 Take urgent action to end trafficking of protected species of flora and address supply of illegal wildlife products

15.2 Sustainable management of all types of forests, halt deforestation, and substantially increase afforestation and reforestation



13.2 Integrate climate change measures into national policies, strategies and planning



Thank you for your attention!



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