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FRAME

WOOD QUALITY

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What does it mean QUALITY ???

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What does it mean QUALITY ???

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term „QUALITY“

- „Purpose-oriented“ word, related to final product
- Characteristics important for industry
  and applications
- Among x within species (teak x eukalyptus)
- Appearance
- Strength, density, …
- Durability
- Defects occurrence

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Wood defects

defect = changes in appearance of wood, disturbances of its regular structure, abnormalities from common composition that influence negatively its **final utilization.**

Defects formation:

- living tree
- during felling and transportation
- during storage

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Impact of defects

Defect is an abnormality or irregularity affecting especially:

- processing
- strength
- durability
- appearance
- yield

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It is important to understand

- Nature of a defect
- Way it arises = to avoid it (if possible)
- Impact on properties / utilisation
- How to minimise an effect

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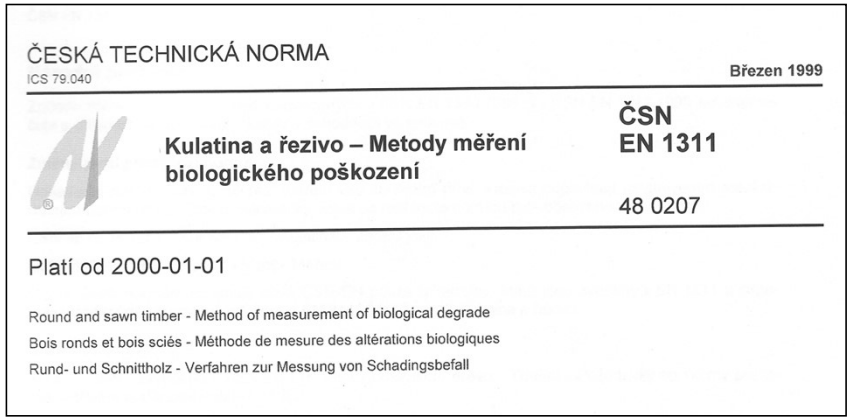
Defects description

- Rules, prescriptions, standards
- Description, terminology, way of measurement
- Forestry x industry
- Important for business
  (timber quality classes)



ČESKÁ TECHNICKÁ NORMA
ICS 79.040
Březen 1999

Kulatina a řezivo – Metody měření biologického poškození

ČSN EN 1311

48 0207

Platí od 2000-01-01

Round and sawn timber - Method of measurement of biological degrade
Bois ronds et bois sciés - Méthode de mesure des altérations biologiques
Rund- und Schnittholz - Verfahren zur Messung von Schadingsbefall

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Most serious defects

- Knots
- Shakes
- Decay
- Curvature
- Taper
- Insect damage
- …

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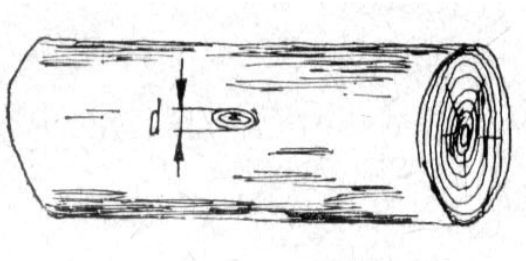
Knots (knottiness)

- Ingrown parts of branches surrounded by wood from trunk
- Most frequent
- Different size, amount,
  ….health state
- Cannot be avoided



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Knots - visibility

- Outer knots
- Intergrown nots

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Knots – health condition

- Sound
- Decayed

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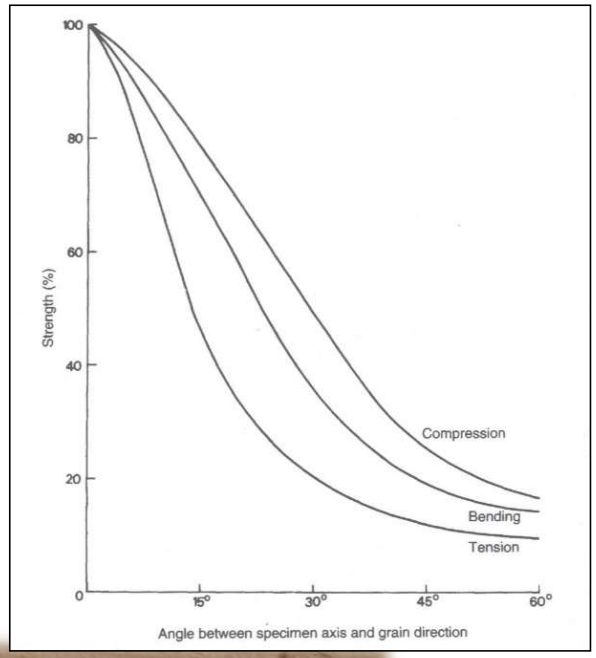
Knots - impact

- Decrease strength
- Increase hetegeneous nature
- Difficult working
- Appearance



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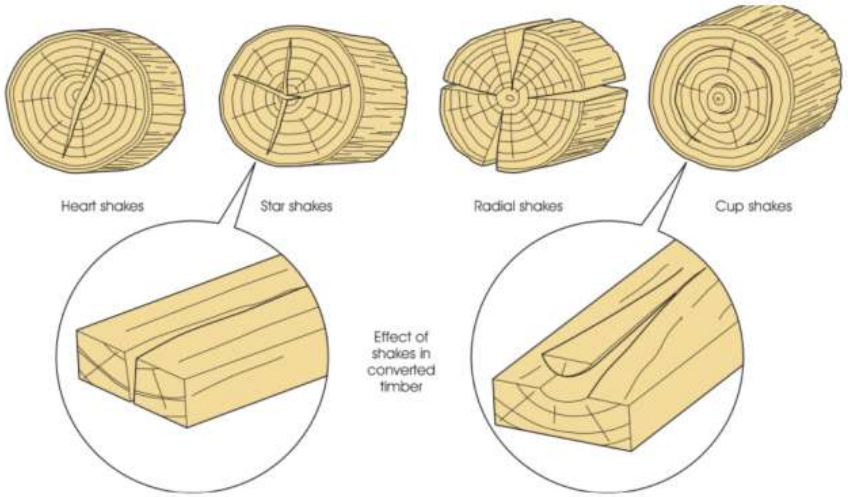
Shakes

- Wood rupture parallel to the grains
- Reduce integrity
- Different origin (living tree x storage)
- Different orientation
- Due to seasoning (shrinkage)



https://mfhwoodworking.wordpress.com/2021/01/13/timber-defects/

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Shakes - impact

- Reduce timber output
- Reduce mechanical strength
- Fungal attack (living tree)
- Proccess logs as soon as possible!!

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Fungal attack

- Different kinds of fungi
- Decomposition of lignin / cellulose
- Different stages:
  - 1 - discoloration
  - 2 - changes in structure + decreased strength
  - 3 - decomposition (no strength, holes)

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1 - discoloration

- 1st stage of fungal attack
- Sap stain
- False heartwood
- Affect appearance
- But no strength

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2 - decay (rot)

- Sapwood / heartwood
- Decomposition of cell walls
- Change in colour and strength
- Lower yield of cellulose

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3 - rotten wood

- Decomposed wood
- Holes
- No strength
- Utilization ???

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Decay - impact

- Aesthetical value (appearance)
- Mechanical strength
- Yield (cellulose)
- Amount of energy

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Moulds

- Issue of humidity (moisture content)
- No impact on quality (strength)

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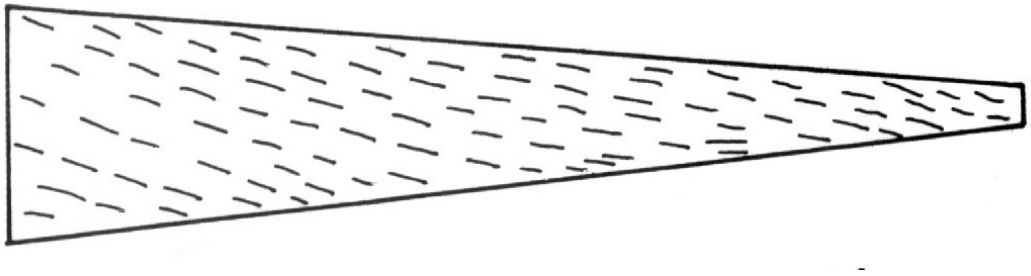
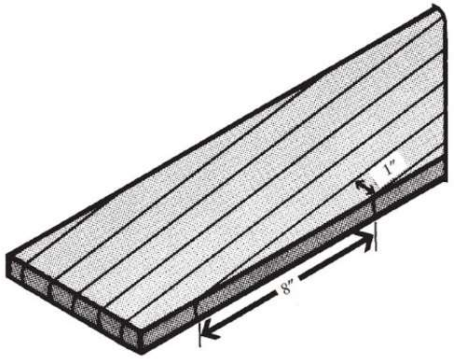
Taper

- Steep decrease in the diameter along the stem axis
- Impacting strength (deflected fibres)
- Impacting timber output





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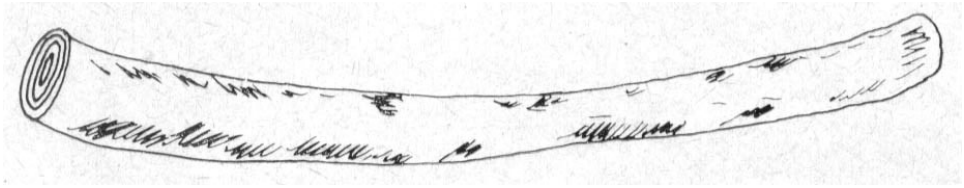
Curvature

- Stem axis is not a line
- Makes processing difficult
- Decreases yield of sawn wood (you must cut it to shorted logs)



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Burls

- Bulges on a stem
- Uncontrolled growth of tissues = irregular fibers
- Local defect = easy to remove
- No strength
- Attractive grain = decorative purposes

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Spiral grain

- Deflection of fiber direction from longitudinal axis
- Right-hand, left-hand or alternating
- Reasons are not clear
- Reduce mechanical strength
- Could be decorative (interlocked grain)

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Interlock grain

- Spiral-grained growing trees change directions (alternating between right-hand and left-hand spirals)
- A ribbon stripe figure
- Attractive appearance (veneers, furniture)
- Many tropical species (mahogany)

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Interlock grain

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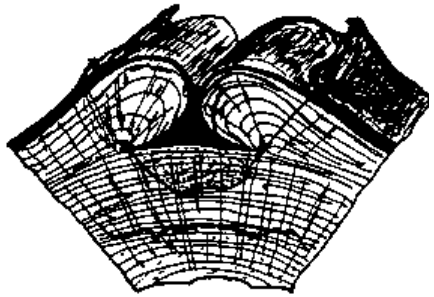
Side drought

- Dead outer part of a stem due to injury
- Higher risk of fungal attack
- Loss of mass
- Irregular shape (lower lumber yield)



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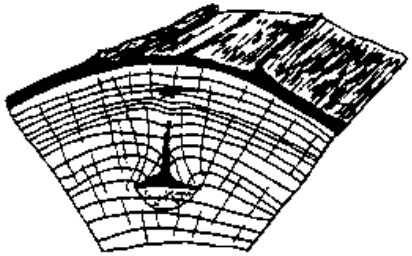
Inbark

- Dead wood partially or totally overgrown by wood
- Visible only on crosscuts
- Affects strength of timber
- Risk of fungal attack



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Insect damages

- Also another animals
- Holes of different sizes and extent

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Unnatural objects

- Usually metal parts (nails etc.)
- Destroy tools
- Injuries
- Detectors

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Coaling

- Climate change
- Growing risk of fires
- Limited possibilities of processing and usage

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Mechanical damages

- During felling and transportation
- Wrong way of processing (defects due humans activity)
- Bark abrasion, notch, rupture, …

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Evaluation of defects

- Visually
- Non-destructive methods
  - simple
  - more sophisticated (expensive and dangerous)

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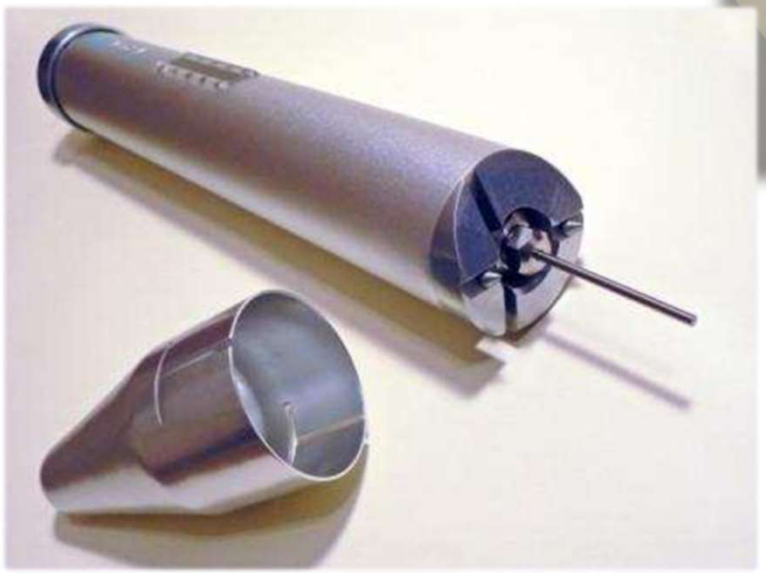
Non-destructive methods



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- There is mainly 2D scanning with the creation of a 3D model of the log.
- 3D is just the shape of the cutout, not the whole interior space.
- Metal detection is still often separated from scanning dimensions and quality.
- Scanners for logs and lumber are different (especially SW).
- Use of laser, infrared radiation, camera (high speed,…).

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„Q“ evaluation at FFWS

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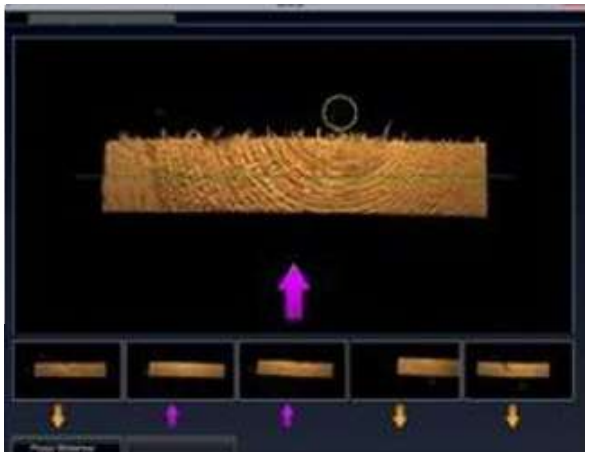
- Demonstration of scanners:

Raptor Integration Inc.



Output from lumber scanning

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- Demonstration of scanners:

AUTOLOG – Sawmill automation

Logs scanning – 2D

Output from logs scanning

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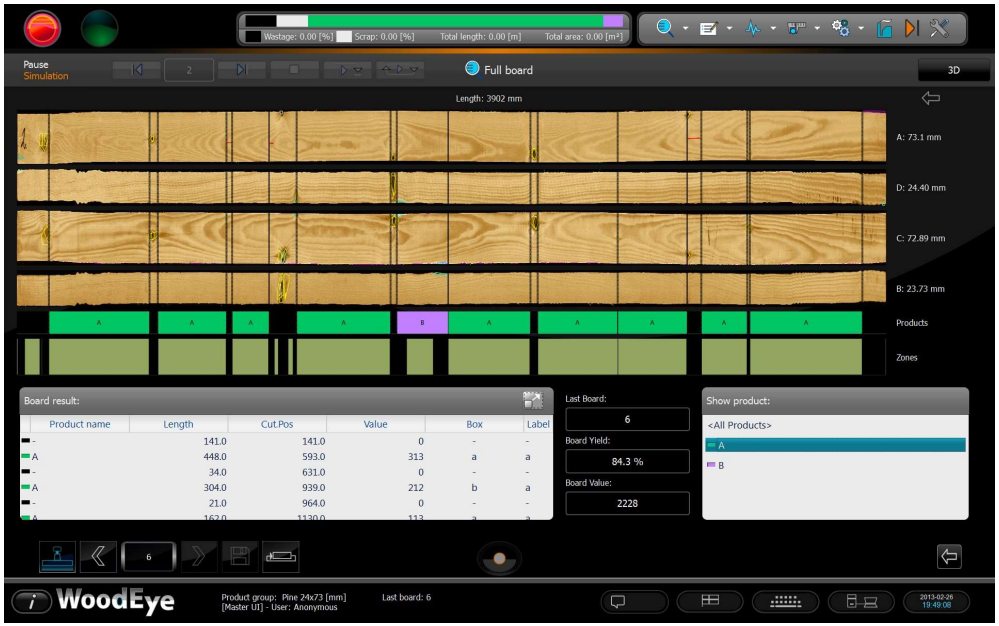
- Demonstration of scanners:

WoodEye

Lumber scanning – 2D



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- Scanning options today:
- Ultrasound - not enough to create a 3D model (rather defectoscopy)
- X-rays - accurate, higher acquisition costs, security problem (easy shielding)
- CT (computed tomography) - accurate, higher acquisition costs, security problem (more complex shielding)Today, this technology is supplemented by 2D scanners (no software is created for creating cutting diagrams, etc.)

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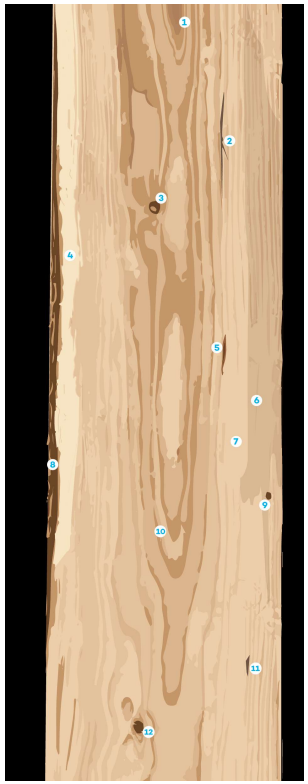
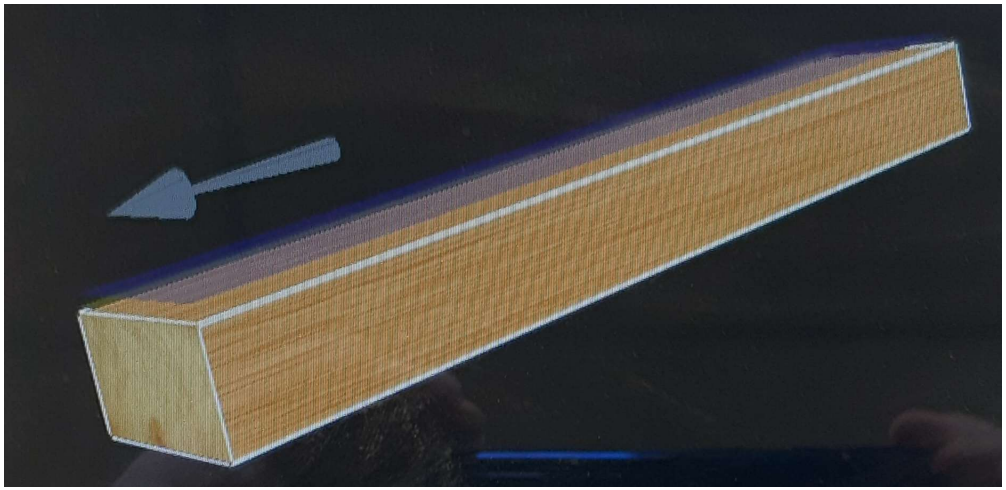
- Possibility of setting quality parameters and dimensional tolerances



Outputs from X-ray



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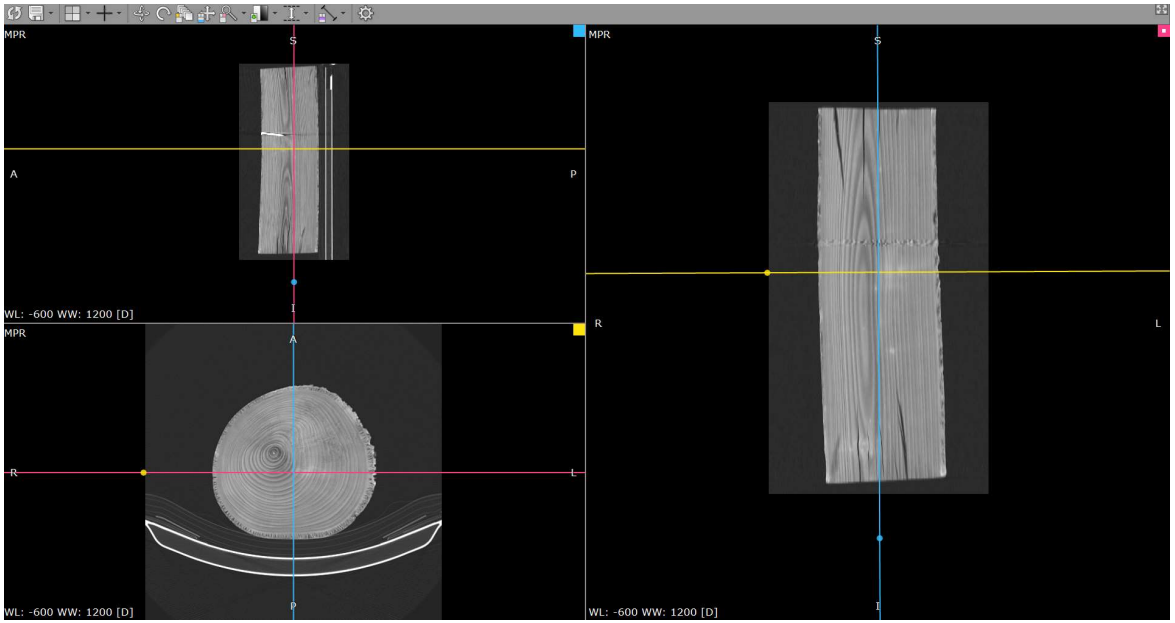
- We have a perfect 3D model of the piece.
- Possibility to evaluate the cut.
- There is no SW equipment for the woodworking industry.
- Detection of all defects and irregularities.



Outputs from CT

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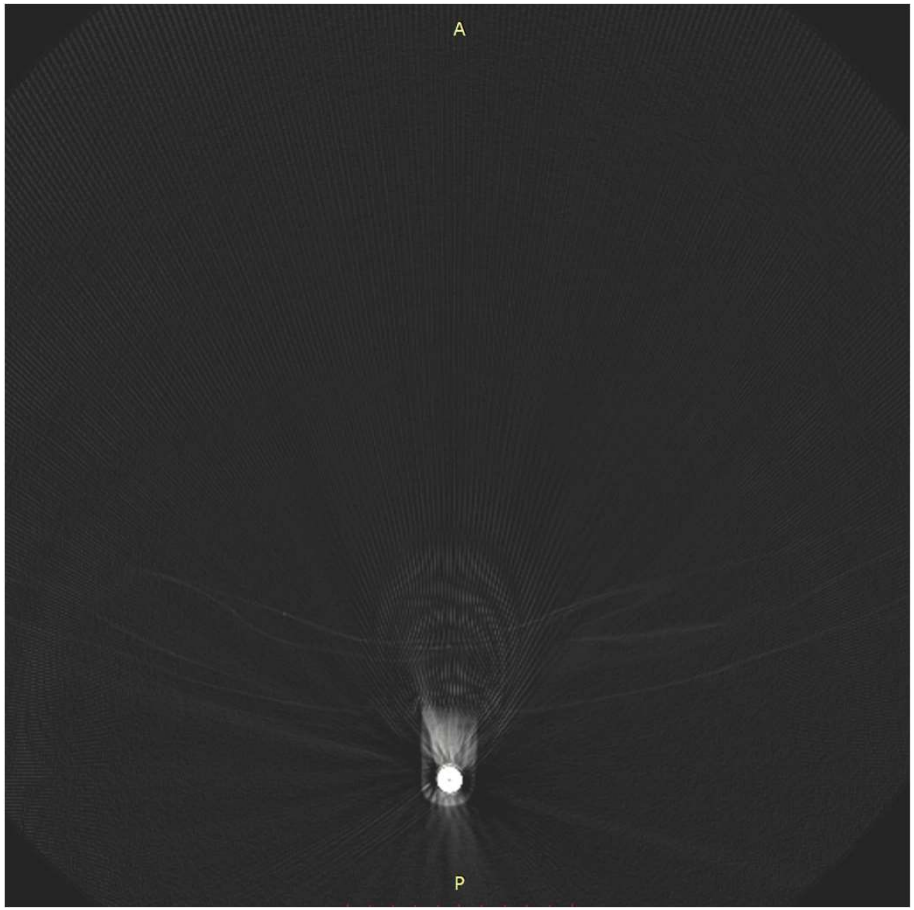

CT scanner

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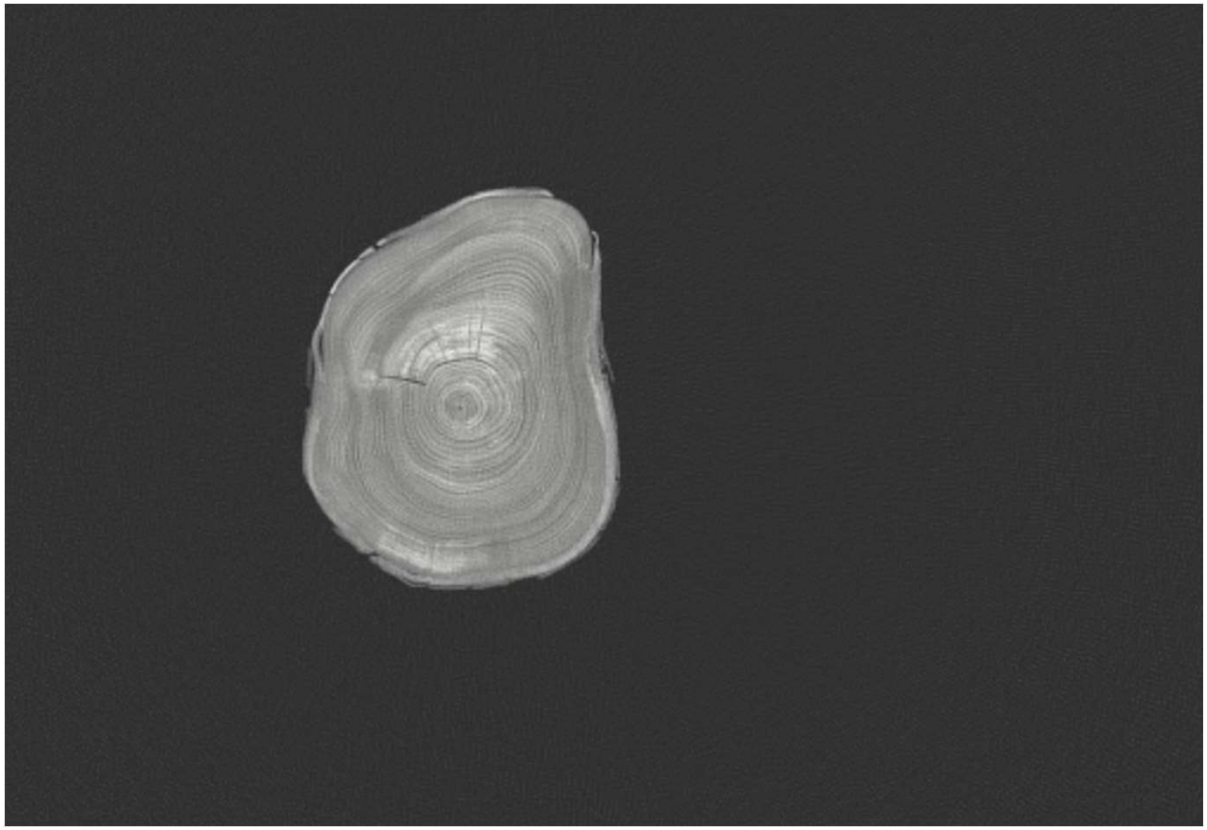

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Take-home message

- Defects impact quality seriously (money)
- Remove „defective“ trees
- Avoid mechanical injury
- Pay attention to storage