MiCROTEC®
INNOVATING THE WOOD

Konrad Tschurtschenthaler

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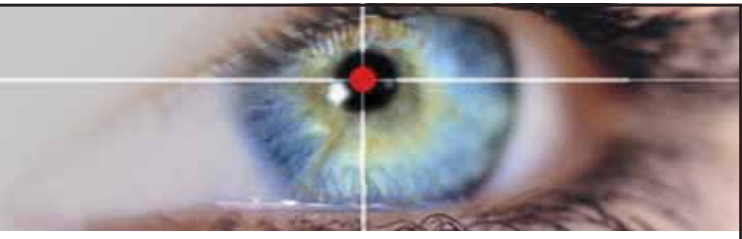

History of CT

- 1895, Wilhelm Conrad Röntgen
  - discovers X-Ray radiation
- 1917, Johann Radon
  - Solved formal inverse problem.
- 1958, Simeon Tetelbaum
  - Publishes valid inverse problem solution
- 1963, John Cormack
  - Experiment with cylindrical objects
- 1972,Godfrey Hounsfield
  - develops CT scanner
- 1979, Hounsfield and Cormack receive Nobel prize in Medicine

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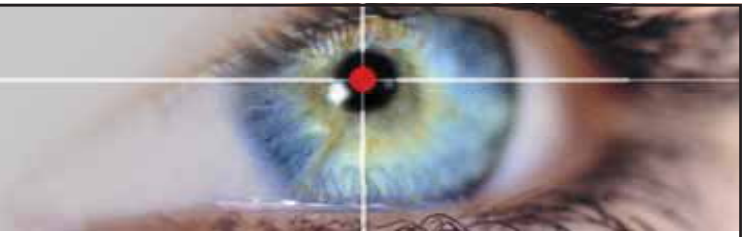

CT in the sawmill

- 1986, Imatron (California)
  first log in a CT Scanner
- 1994, Luisiana State University
  first full log scanned
- 1999, Invision (California)
  first test installation of CT Scanner in Sawmill
- 2007, Freiburg (Germany)
  MiCROTEC CT-Log for full CT installed

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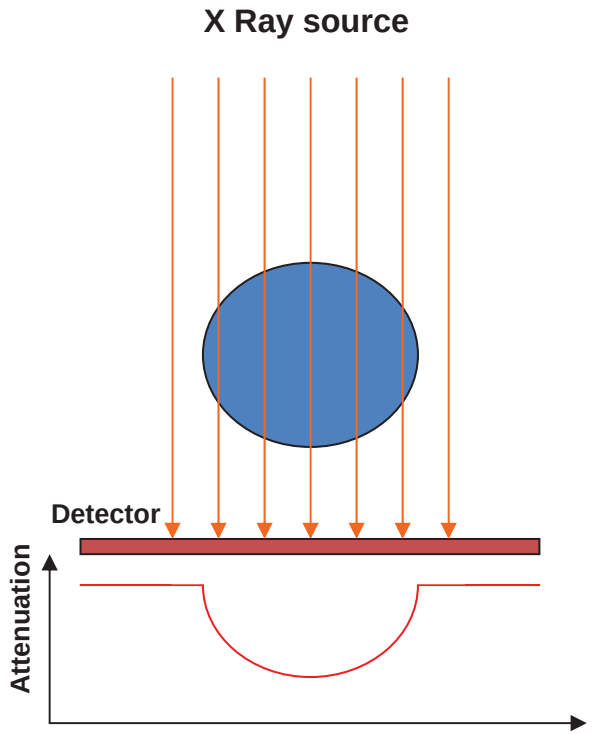
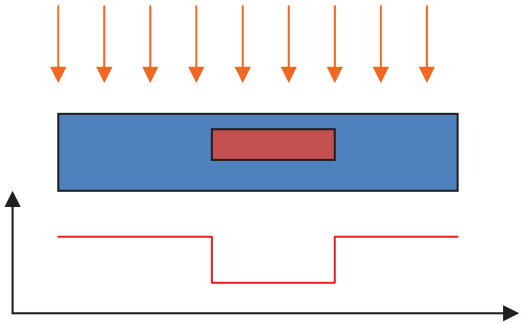
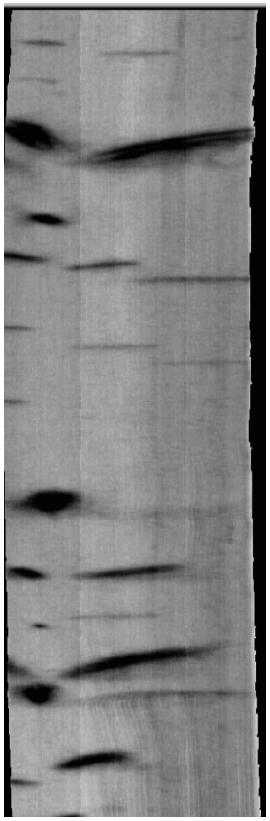
X-Ray properties

- X-Rays travel across the object in straight lines
- X-Rays are attenuated by the objects they pass through
- The amount of attenuation depends on the density of the object

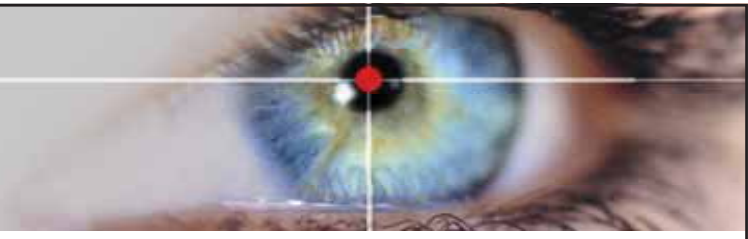


Single projection

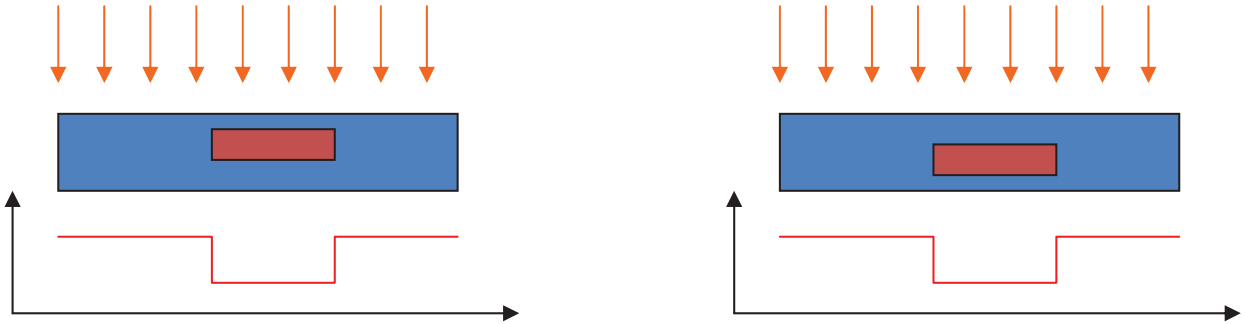




- With a single projection we can see different tissues inside the object
- We can not reconstruct the cross image

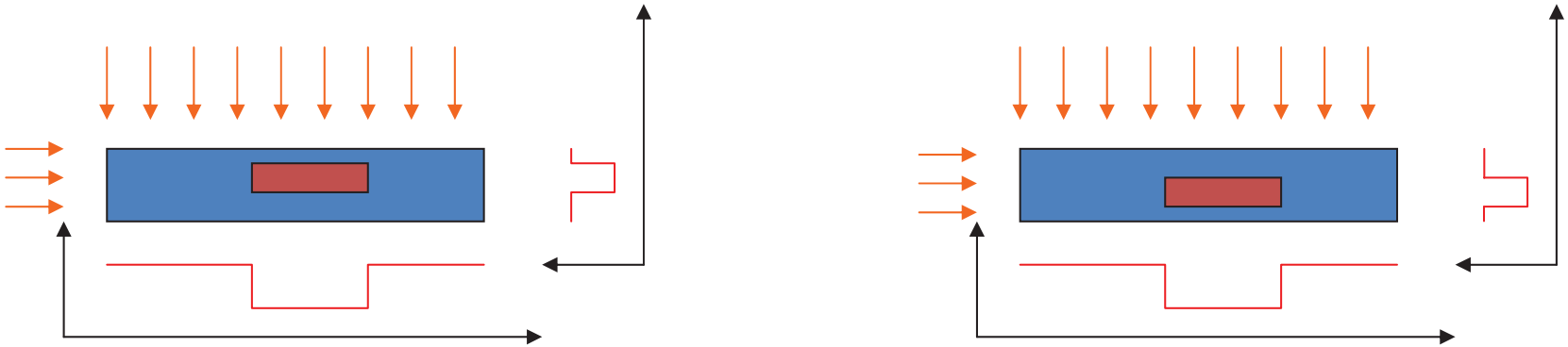


Lack of information



- The two objects generate the same projection
- We need more information

Adding more projections



- The second projection gives us the needed information
- Putting together the two projections we get the whole picture

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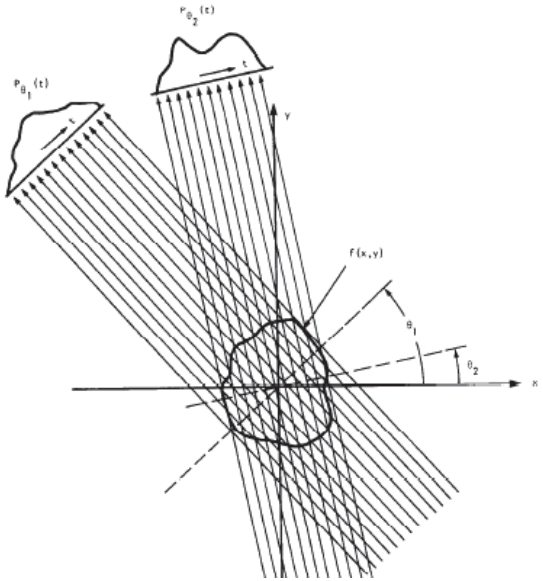
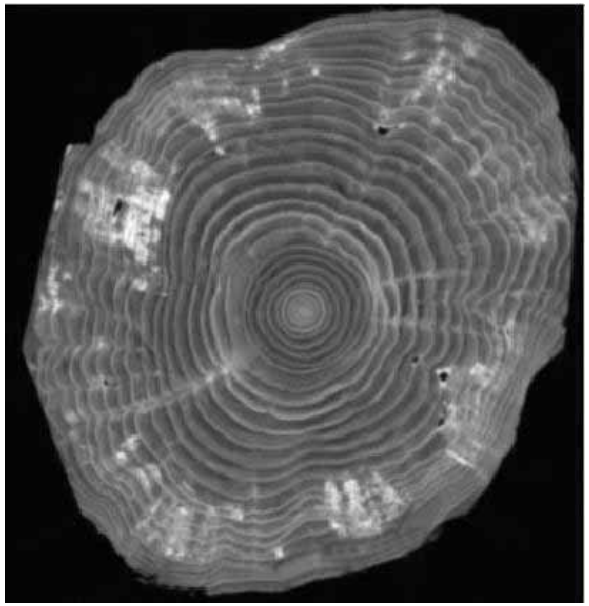
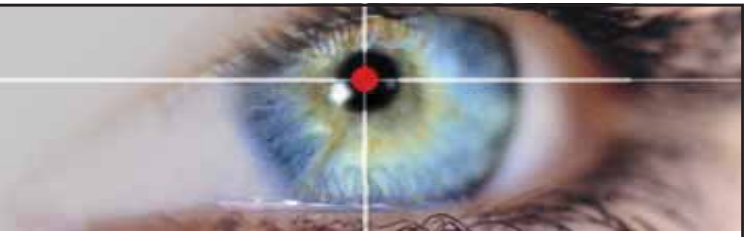
Tomography



Mathematics laid down by Radon

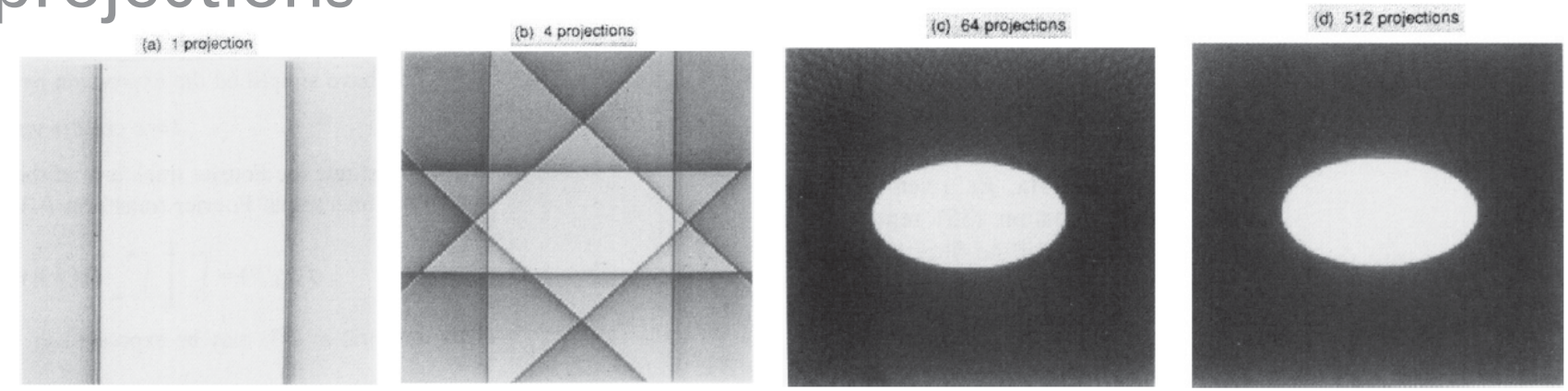


- Make projections from different angles
- Combine them together
- Reconstruct the image



Quality of Reconstruction

- The quality depends on the number of available projections



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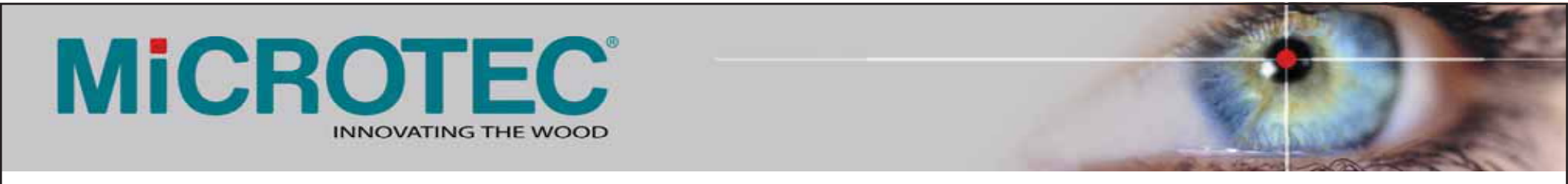
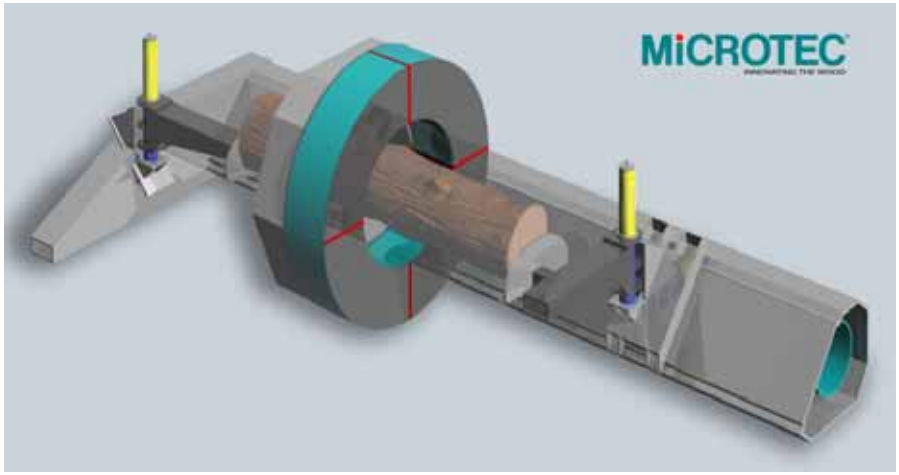
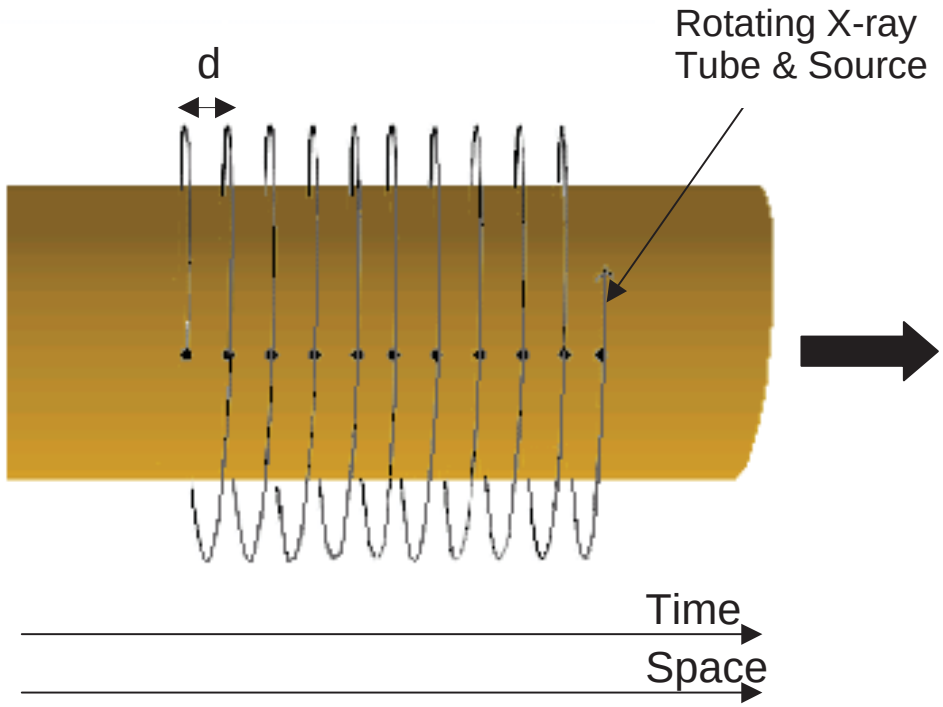


CT Scanner





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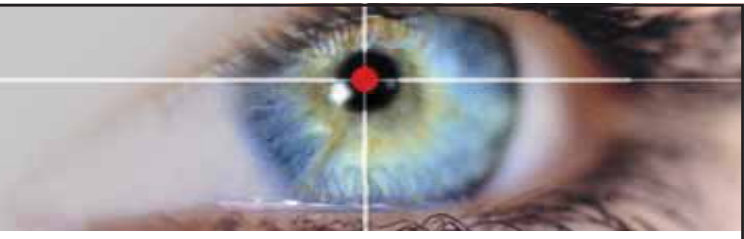

The Challenge

- Bring the CT Scanner into the sawmill

Special requirements

- Speed

  The scanner should not be a bottleneck in the production throughput

- Reliability

  The scanner is required to work 24/7

- Robustness

  The scanner must be designed to be installed in a demanding environment

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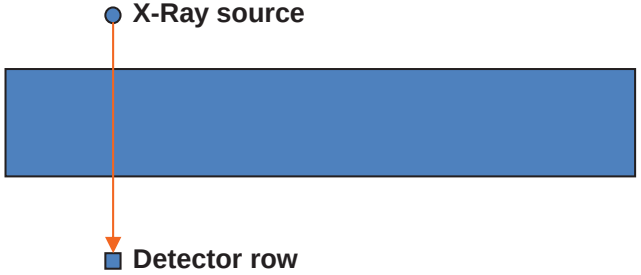
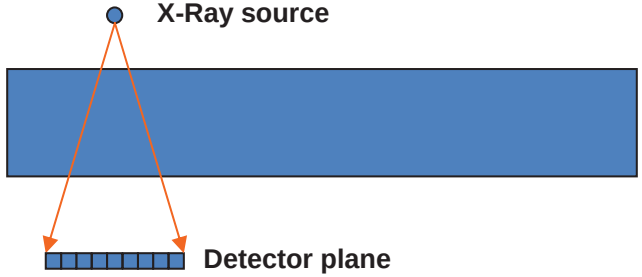
The Solution





- Advanced technics permit higher scan rates
- Experience in X-Ray technology over years yields high reliable and robust solutions

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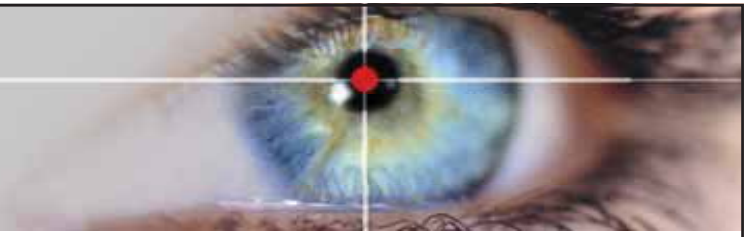

The first step in a long way

- The CT yields a series of cross sectional images
- The images will be visualized in a first step
- Automatic defect detection should follow
- Optimization programs use the data for calculating optimal cutting patterns

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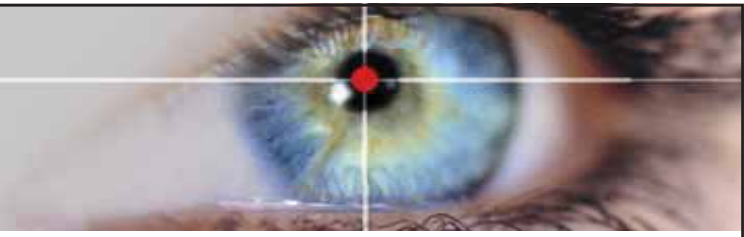

Detected wood properties

- We can detect the internal structure of the wood
- Regions with different density
- Depending on the number of projections the ability to see certain properties varies

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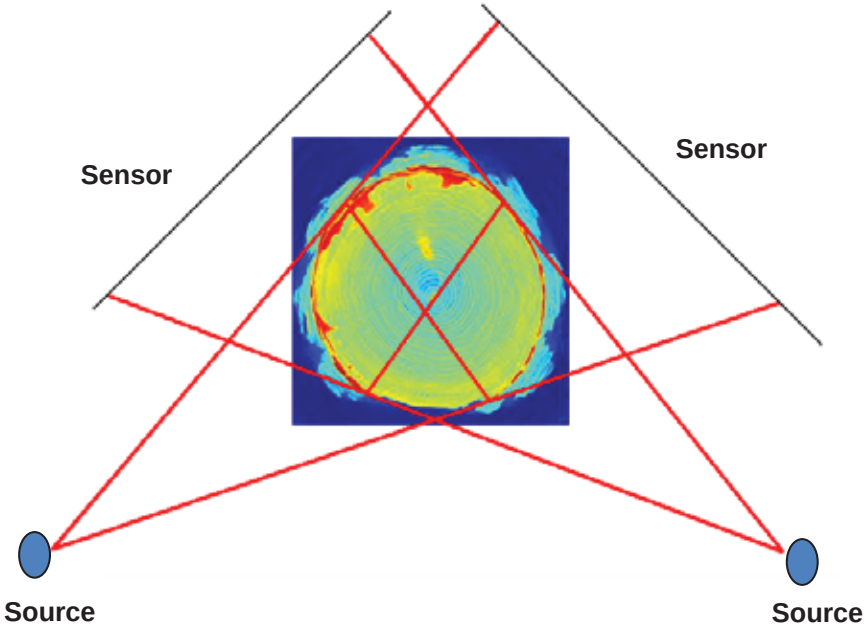
Tomolog

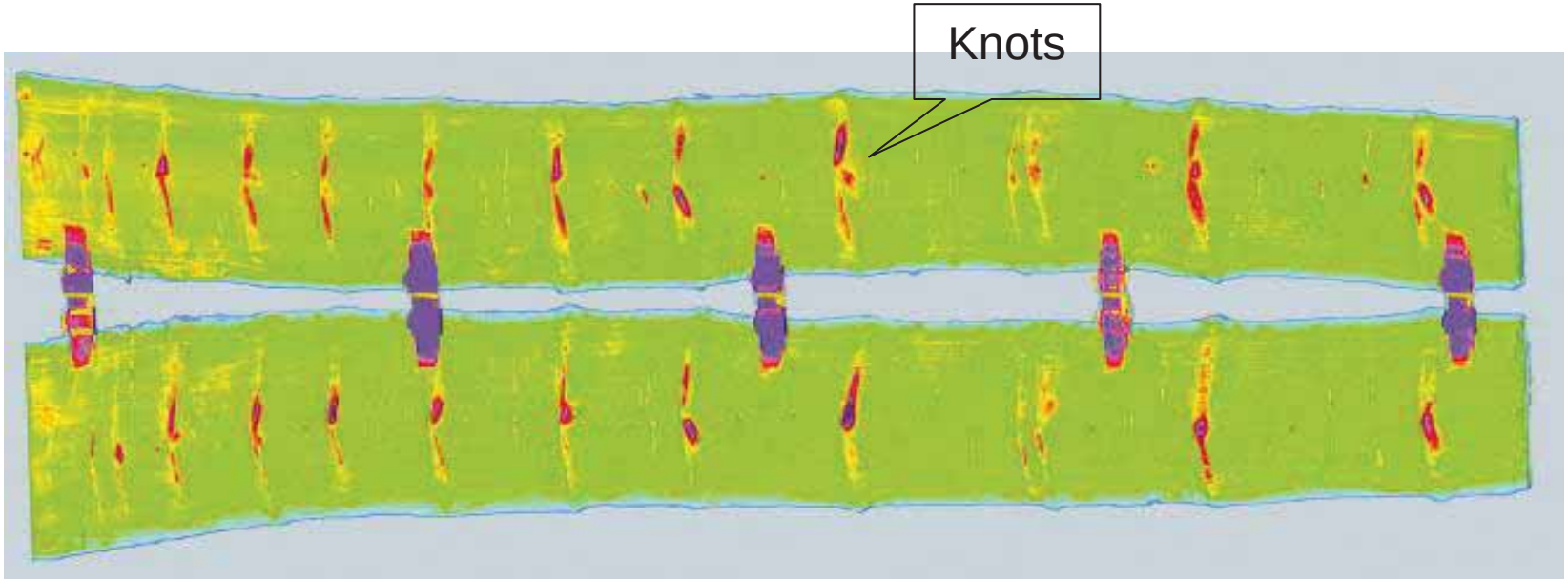
- Tomolog uses only a limited number of sources and detectors
- There are no rotating parts
- The mechanical design considerably simpler

Tomolog-Applications

- Diameter under bark
- Bark thickness



- Distance of knot clusters
- Number of knot clusters



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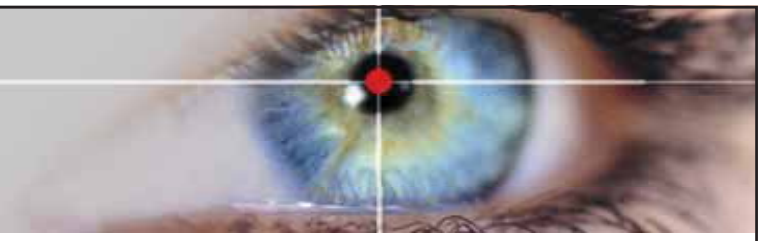
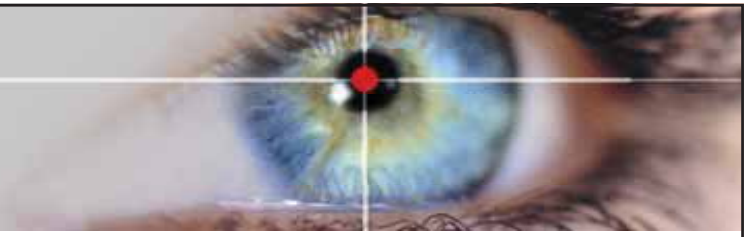


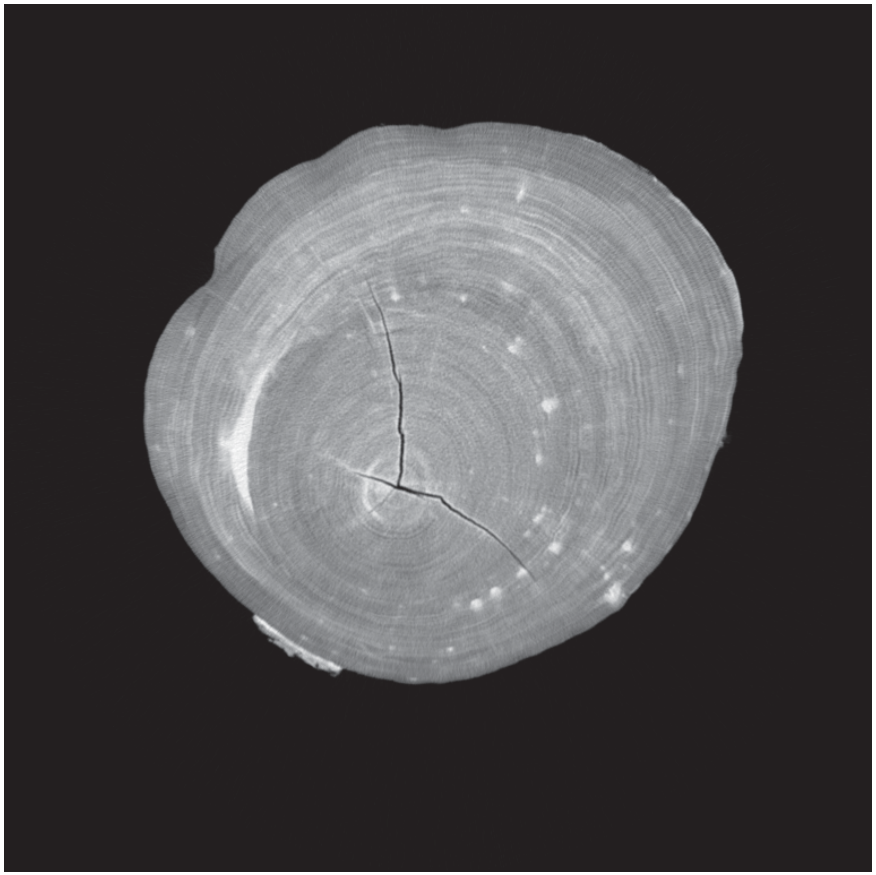
Tomolog: Stress grading

- Density estimation with Tomolog
- Frequency measurement with ViSCAN
- Together we can estimate the MOE



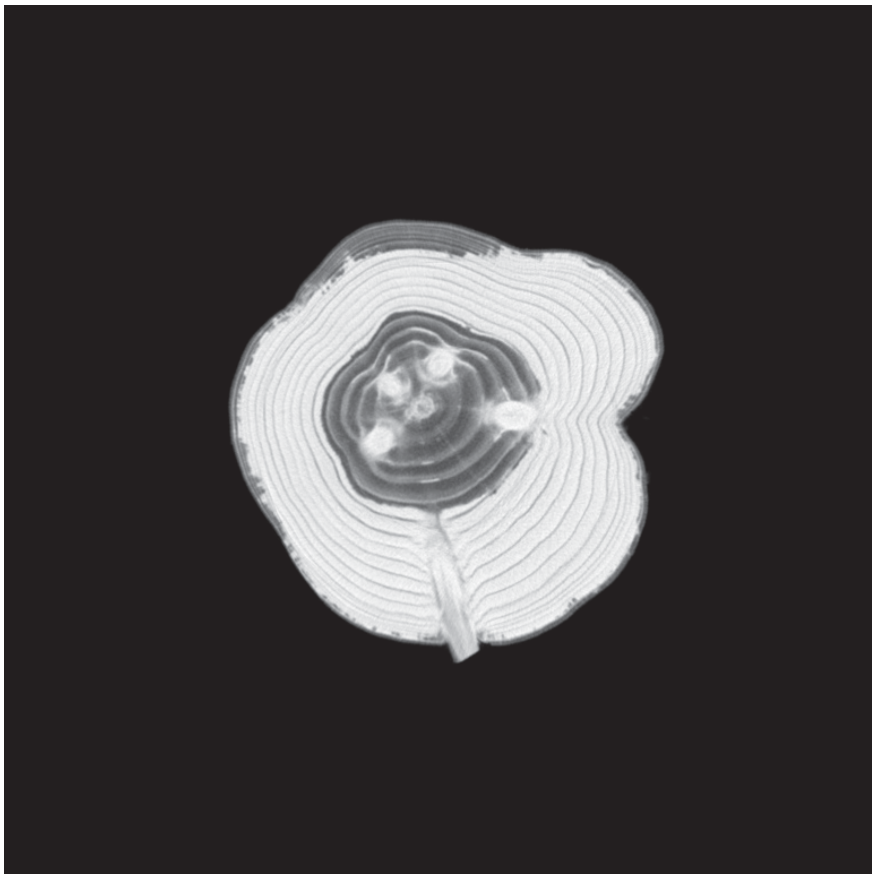
CT Capabilities

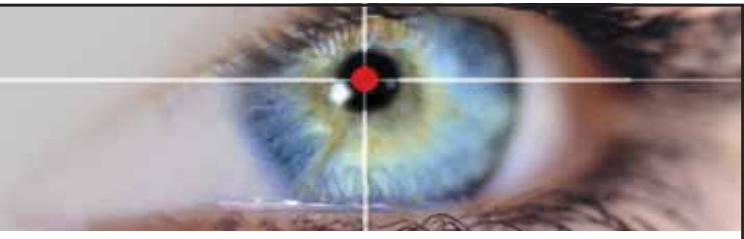
- Checks



CT Capabilities

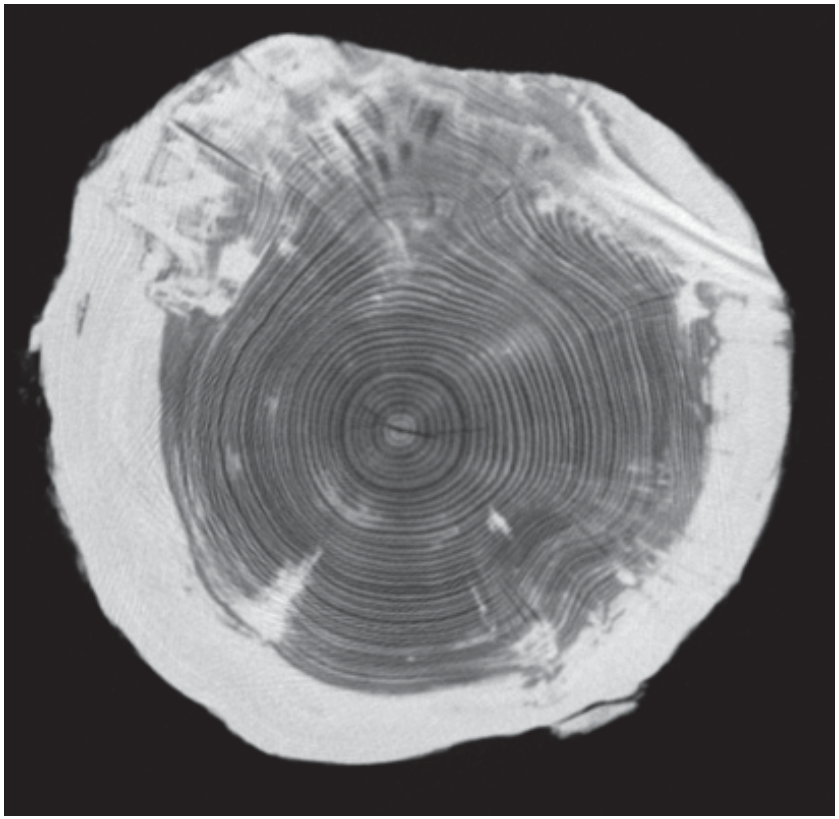
- Knots
- Heartwood/ Sapwood

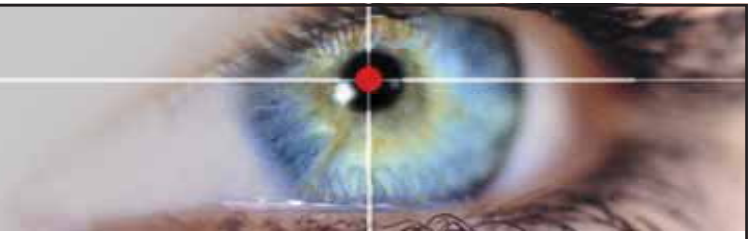




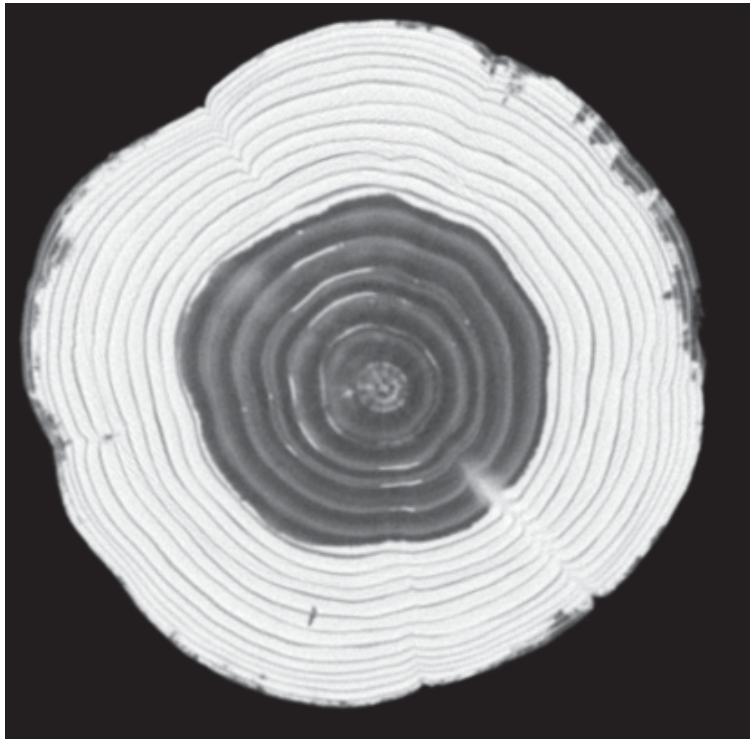
CT Capabilities

- Rot





- Resin pockets



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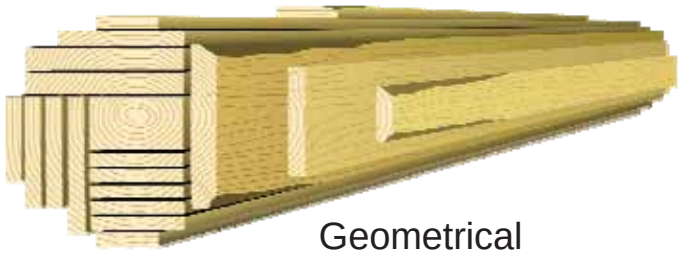
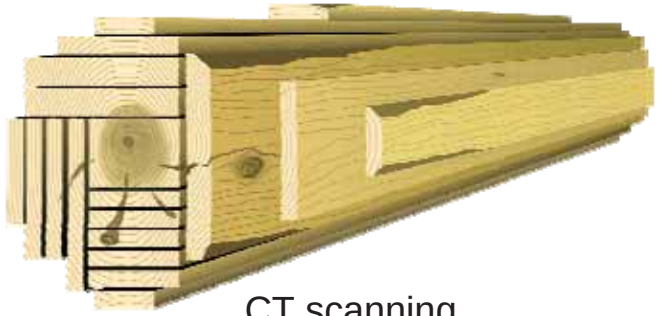
CT Applications

- CT images reveal the internal log structure before the cut
- Traditional cutting pattern optimizers deal with geometric information only
- Taking into accout the CT-information it is possible to increase the economic recovery



Geometrical scanning



CT scanning

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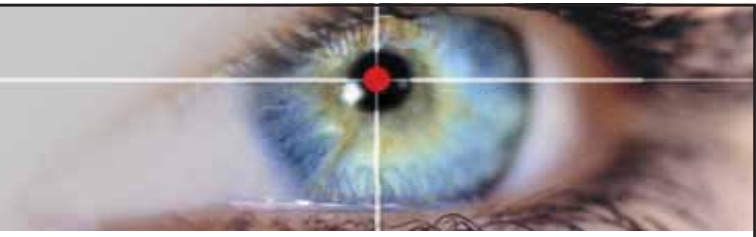
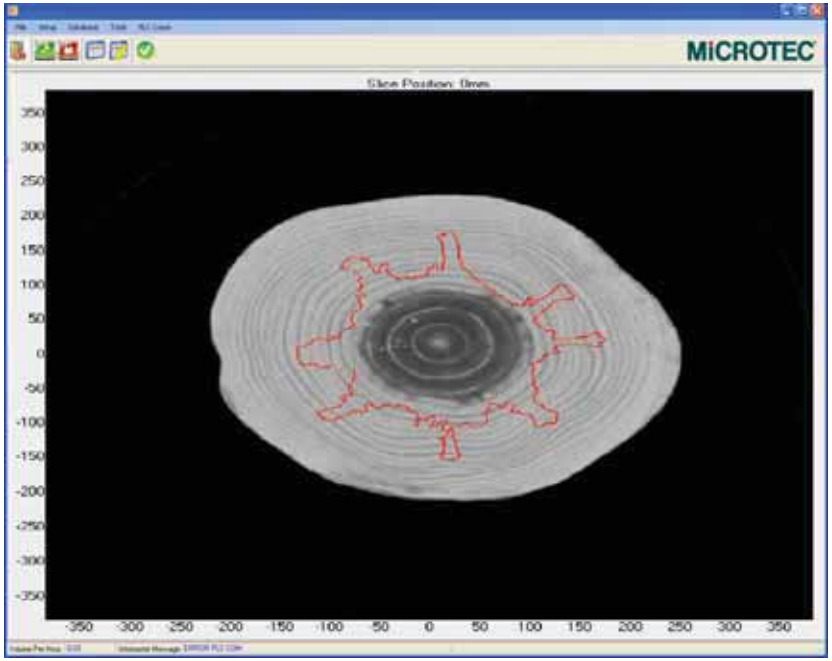


CT Applications

- Manual grading
- CT images help operators in the grading process



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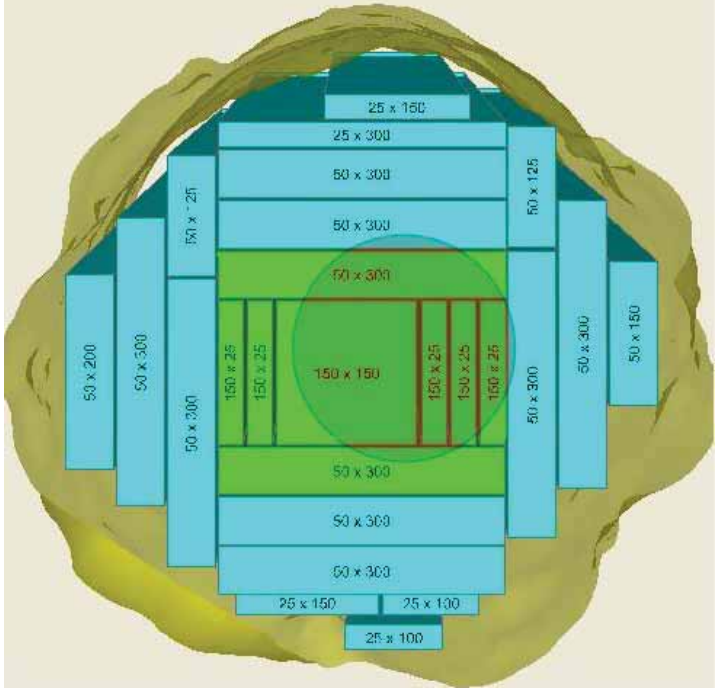
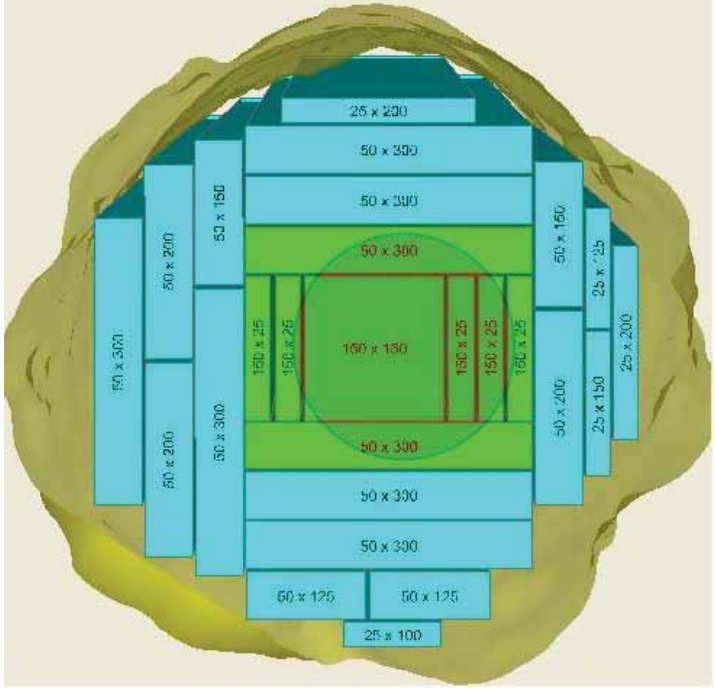
Sapwood/Heartwood

Projected value: 253.01



Cutting pattern optimization without knowing the knotty core position

Projected value: 251.68



Cutting pattern optimization knowing the knotty core position

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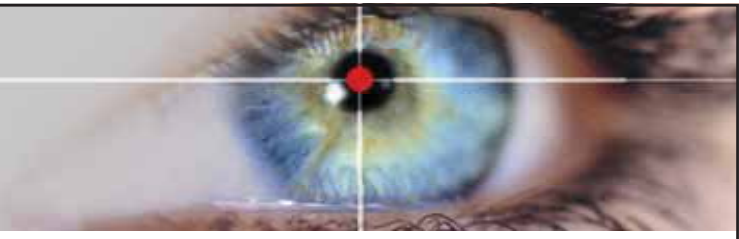

Sapwood/Heartwood

Optimization without knowing the knotty core position

Pieces	Width	Thickness	Length	Volume	Projected Value	Effective Value
1	150	150	3600	0,081	12,15	12,15
3	150	25	3600	0,041	6,08	6,08
2	150	50	3600	0,054	8,10	8,10
1	300	50	3600	0,054	20,25	8,10
1	300	50	3600	0,054	20,25	20,25
1	300	25	3600	0,027	10,13	10,13
1	150	25	3600	0,014	5,06	5,06
1	300	50	3600	0,054	20,25	20,25
1	300	50	3600	0,054	20,25	20,25
1	150	25	3000	0,011	4,22	4,22
1	100	25	3000	0,008	2,81	2,81
1	100	25	2700	0,007	2,53	2,53
1	300	50	3600	0,054	20,25	8,10
1	125	50	3600	0,023	8,44	8,44
1	300	50	3300	0,050	18,56	18,56
1	300	50	2400	0,036	13,50	13,50
1	300	50	3600	0,054	20,25	20,25
1	125	50	3600	0,023	8,44	8,44
1	300	50	3600	0,054	20,25	20,25
1	200	50	3000	0,030	11,25	11,25
Total					253,01	**228,71**

Optimization knowing the knotty core position

Pieces	Width	Thickness	Length	Volume	Projected Value	Effective Value
1	150	150	3600	0,081	12,15	12,15
3	150	25	3600	0,041	6,08	6,08
2	150	50	3600	0,054	8,10	8,10
1	300	50	3600	0,054	20,25	20,25
1	300	50	3600	0,054	20,25	20,25
1	200	25	3600	0,018	6,75	6,75
1	300	50	3600	0,054	20,25	20,25
1	300	50	3600	0,054	20,25	20,25
1	150	50	3000	0,023	8,44	8,44
1	150	50	3000	0,023	8,44	8,44
1	100	25	2700	0,007	2,53	2,53
1	100	25	3000	0,008	2,81	2,81
1	200	50	3600	0,036	13,50	13,50
1	150	50	3600	0,027	10,13	10,13
1	150	25	3300	0,012	4,64	4,64
1	125	25	3300	0,010	3,87	3,87
1	200	25	3000	0,015	5,63	5,63
1	300	50	3600	0,054	20,25	20,25
1	150	50	3600	0,027	10,13	10,13
2	200	50	3600	0,072	27,00	27,00
1	300	50	3600	0,054	20,25	20,25
Total					251,68	**251,68**

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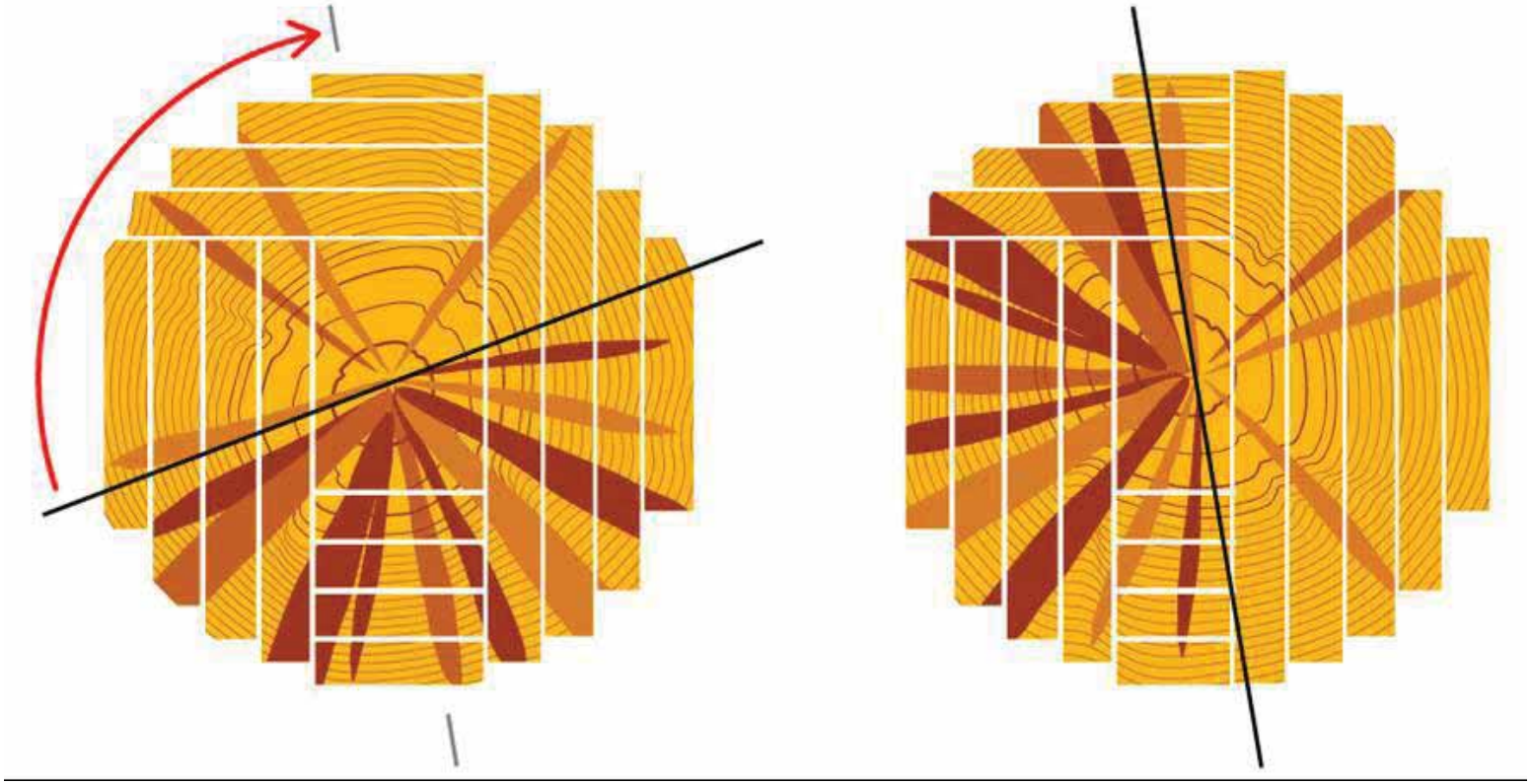
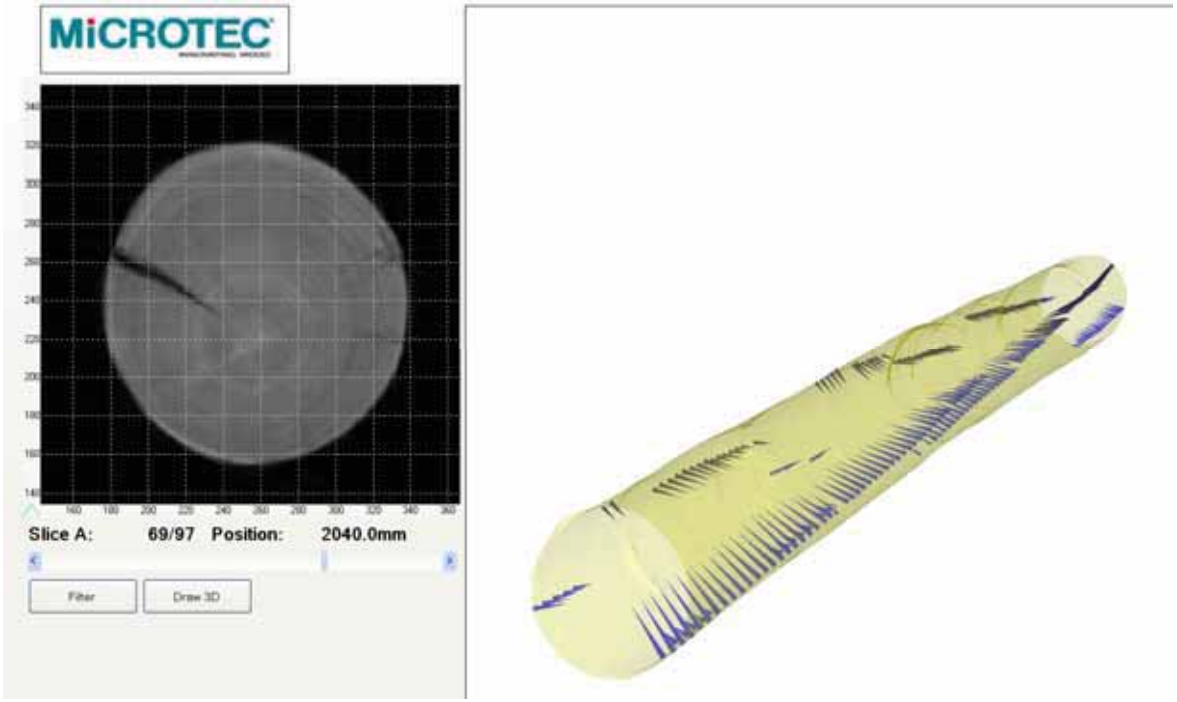
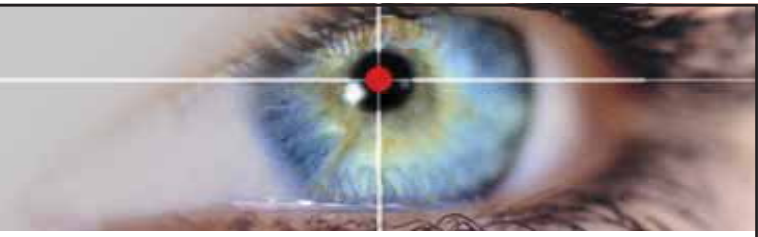
Optimizing for checks



Optimizing for checks

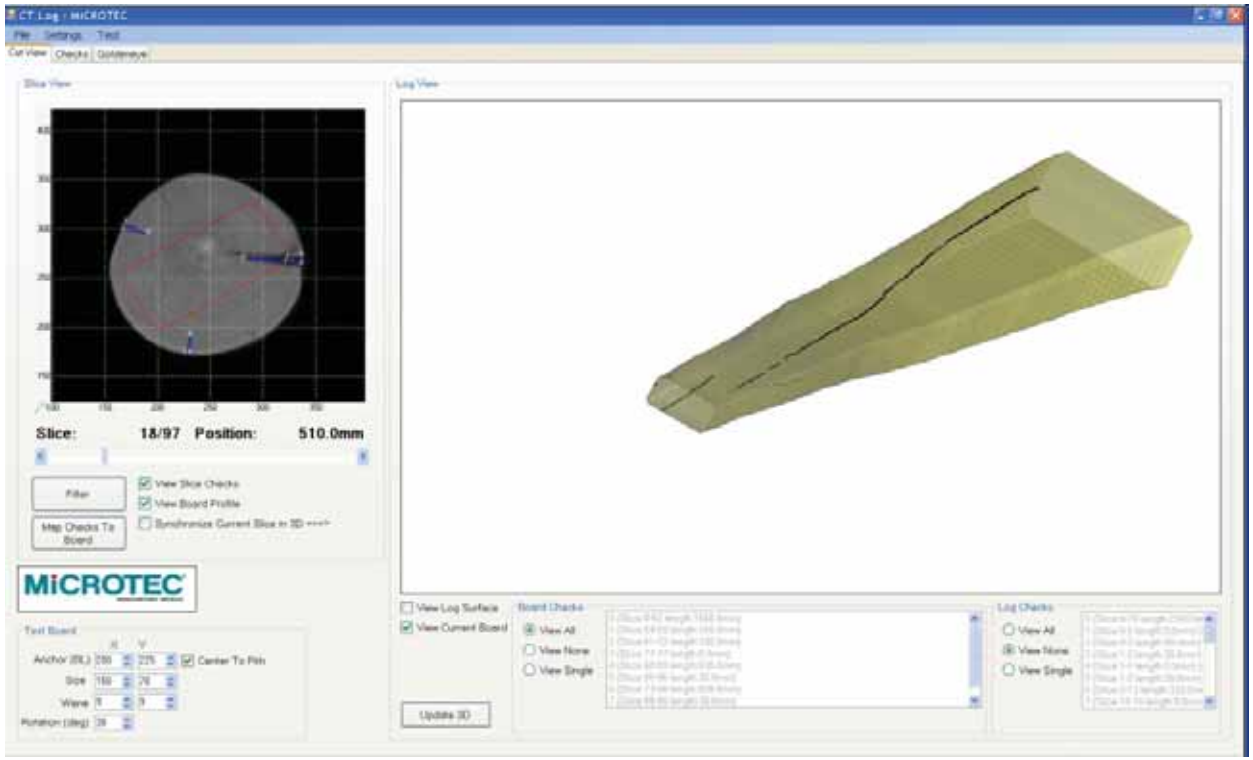
- Build a 3D model





Optimizing for checks

- Generate final products with virtual cuts



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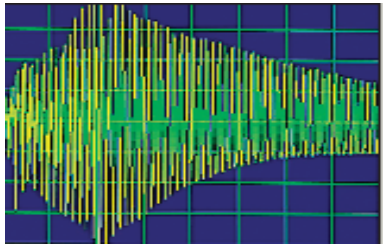
LOGEYE

- Gaining information with Multi Sensor Scanner System

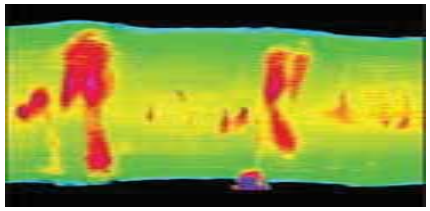
DiSHAPE

SCREENLOG

ViSCAN



CT.LOG



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Thank you!

info@microtec.eu

www.microtec.eu