

Innovations in Wood Processing

Rado Gazo

Indiana's Primary Industry

(logging, sawmills, veneer, plywood, etc.)

- 601 firms in the primary industry of Indiana
- 21,692 individuals are employed by the primary industry
- \$563 million dollars in wages were paid by the primary industry



Indiana's Secondary Industry

(furniture, fixtures, etc.)

- 509 firms comprise the secondary wood products manufacturing industry in Indiana
- 69 of the 300 largest U.S. furniture, cabinet, and millwork manufacturers have plants in Indiana
- 10 of the largest kitchen cabinet manufacturers have headquarters or plants in Indiana
- 26,150 individuals are employed by the secondary industry
- \$666 million in wages were paid by the secondary industry



Secondary Wood Processing

Example: Cryogenic Treatment of Tools

The Effect Cryogenic Treatment on Tool Wear in Machining

70°F (21°C)

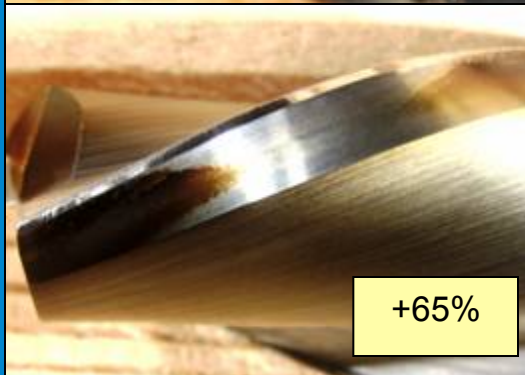
40°F (4.4°C)

20°F (-6.7°C)

Untreated



Treated



Estimated increase in tool life

Primary Wood Processing

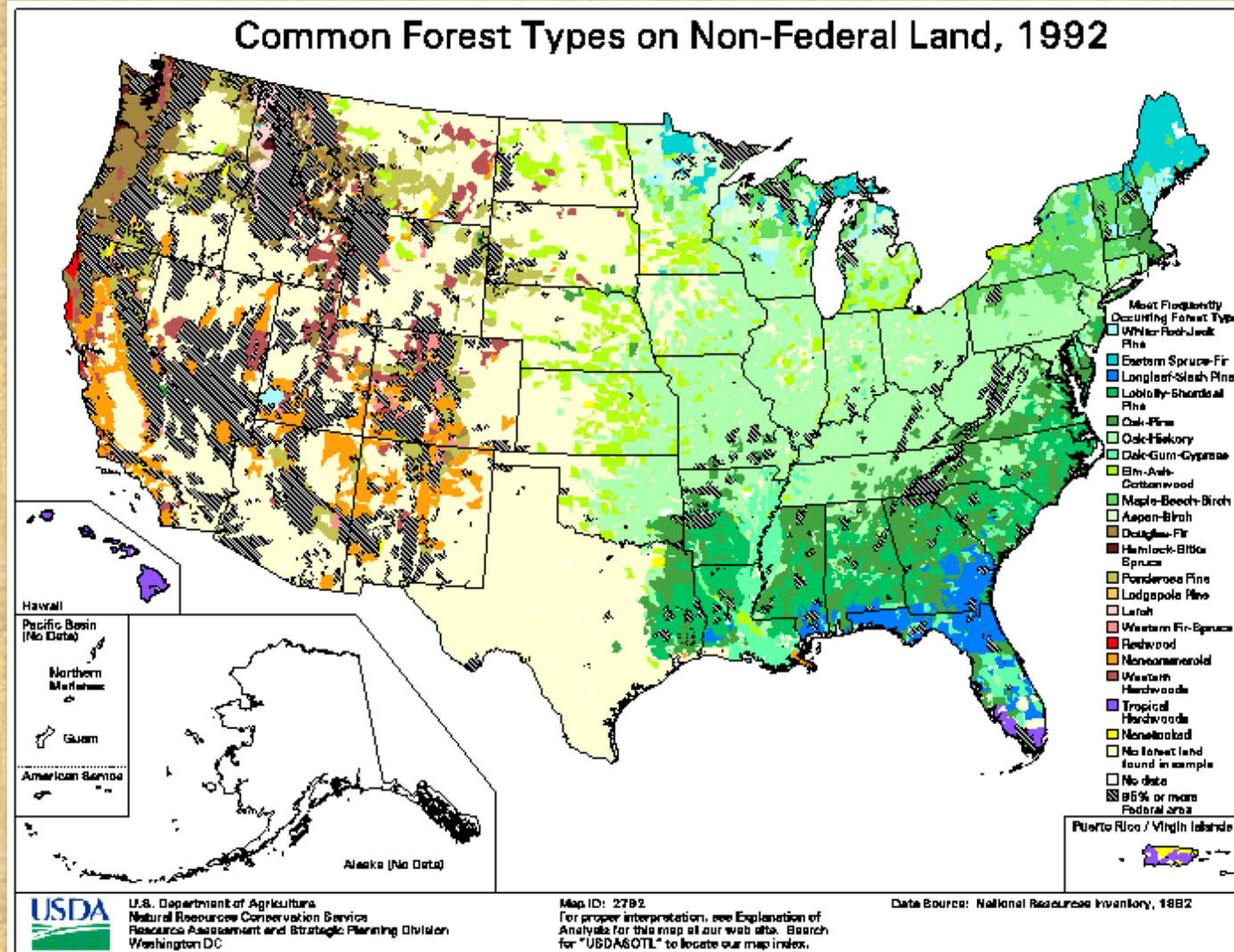
Example: CT Scanning of Logs

Past scanning studies

Numerous past research studies have examined log breakdown value improvements.

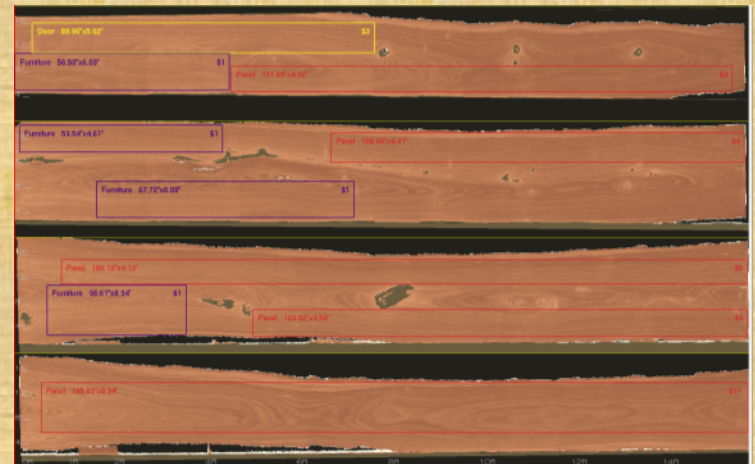
Year	Author	# of Logs	Species	% Improvement
1962	Peter	10	Southern Pine	3%
1967	Peter	50	Yellow Poplar	9%
1969	Tsolakides	6	Red Oak	21%
1975	Wagner and Taylor	10	Southern Pine	8%
1980	Richards <i>et al.</i>	320	Red Oak	11%
1989	Steele <i>et al.</i>	24	Red Oak	12%
1994	Steele <i>et al.</i>	6	Red Oak	10%
'94-'99	Chang and Guddanti	10	Red Oak	18% -28%

Softwood vs. Hardwood Log Processing



Softwood vs. Hardwood Log Processing

- Softwoods – grading system is based on prediction of strength of lumber.
- Production process is more automated and much faster.
- Hardwoods – grading system is based on appearance characteristics of lumber or sliced veneer.
- Production process relies heavily on experience and skill of operator (headrig, resaw, edger).



Hardwood Scanning Center Goal

- Help in development of Hardwood Log CT scanner
- Develop optimization software
- Assist in industry adoption of CT scanning technology

Proof of Concept

- 60 Logs
- 5 Species (Black Cherry, Yellow Poplar, Red Oak, White Oak and Hard Maple)
- 3 Log Grades (Grade 1, 2 and 3)
- 4 Logs (2 pairs) per grade
- Pair is a close match in diameter, length, location within a tree and defects
- Logs were 10' to 16' long and up to 16" in diameter

Proof of Concept



Proof of Concept



Results – Sawmill vs. CT Scanner

Gain (%)	Black Cherry	Hard Maple	Red Oak	White Oak	Yellow Poplar	Overall
All Grades	42	33	24	60	87	46

Results – Sawmill vs. CT Scanner

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All Grades	42	33	24	60	87	46
Grade 1	20	21	8	83	23	27

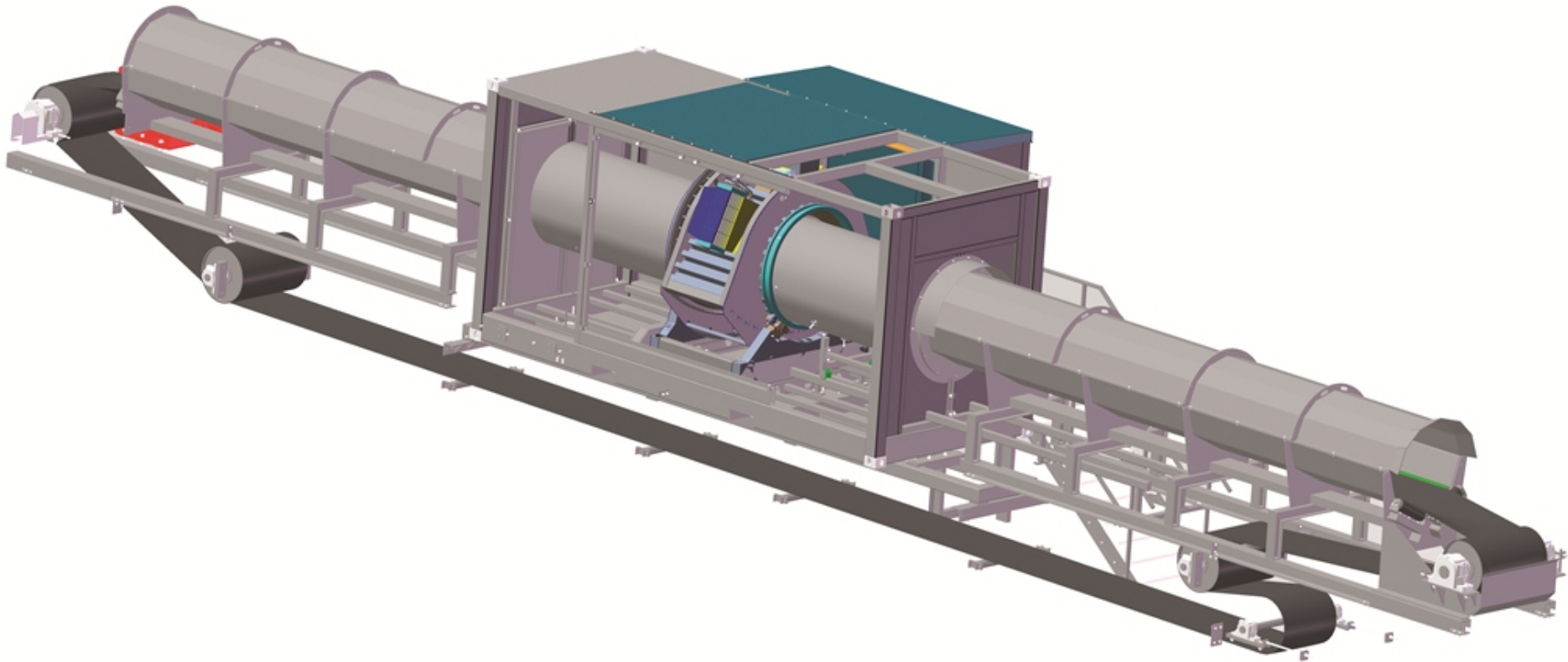
Results – Sawmill vs. CT Scanner

Gain (%)	Black Cherry	Hard Maple	Red Oak	White Oak	Yellow Poplar	Overall
All Grades	42	33	24	60	87	46
Grade 1	20	21	8	83	23	27
Grade 2	45	34	22	42	99	47

Results – Sawmill vs. CT Scanner

Gain (%)	Black Cherry	Hard Maple	Red Oak	White Oak	Yellow Poplar	Overall
All Grades	42	33	24	60	87	46
Grade 1	20	21	8	83	23	27
Grade 2	45	34	22	42	99	47
Grade 3	194	75	67	46	221	97

CT Scanner Development Medical vs. Security



MiCROTEC[®]
INNOVATING WOOD

CT.LOG

CT Scanner Development

- Log Length: No limit
- Max. Log Diameter: 700 mm
- Gantry aperture: 1200 mm
- Max Log speed: 60 m/min
- X–Y resolution: approx. 1mm





CT LOG

MICROTEC

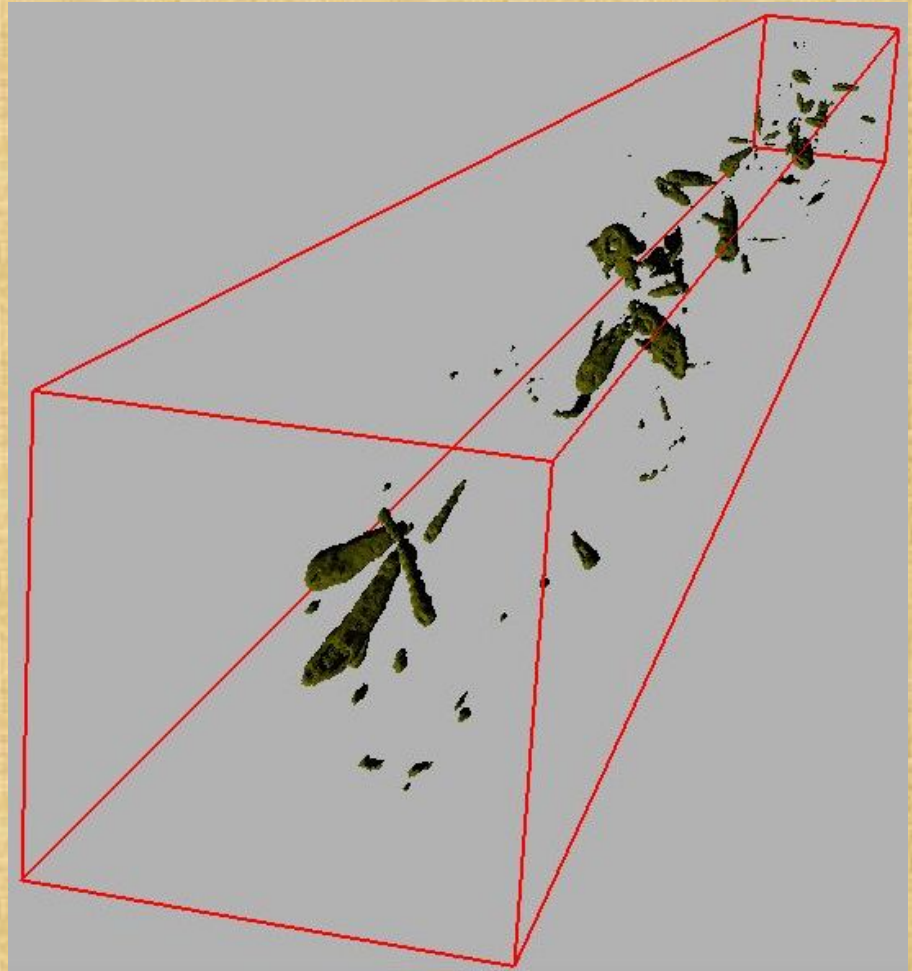
Software Development

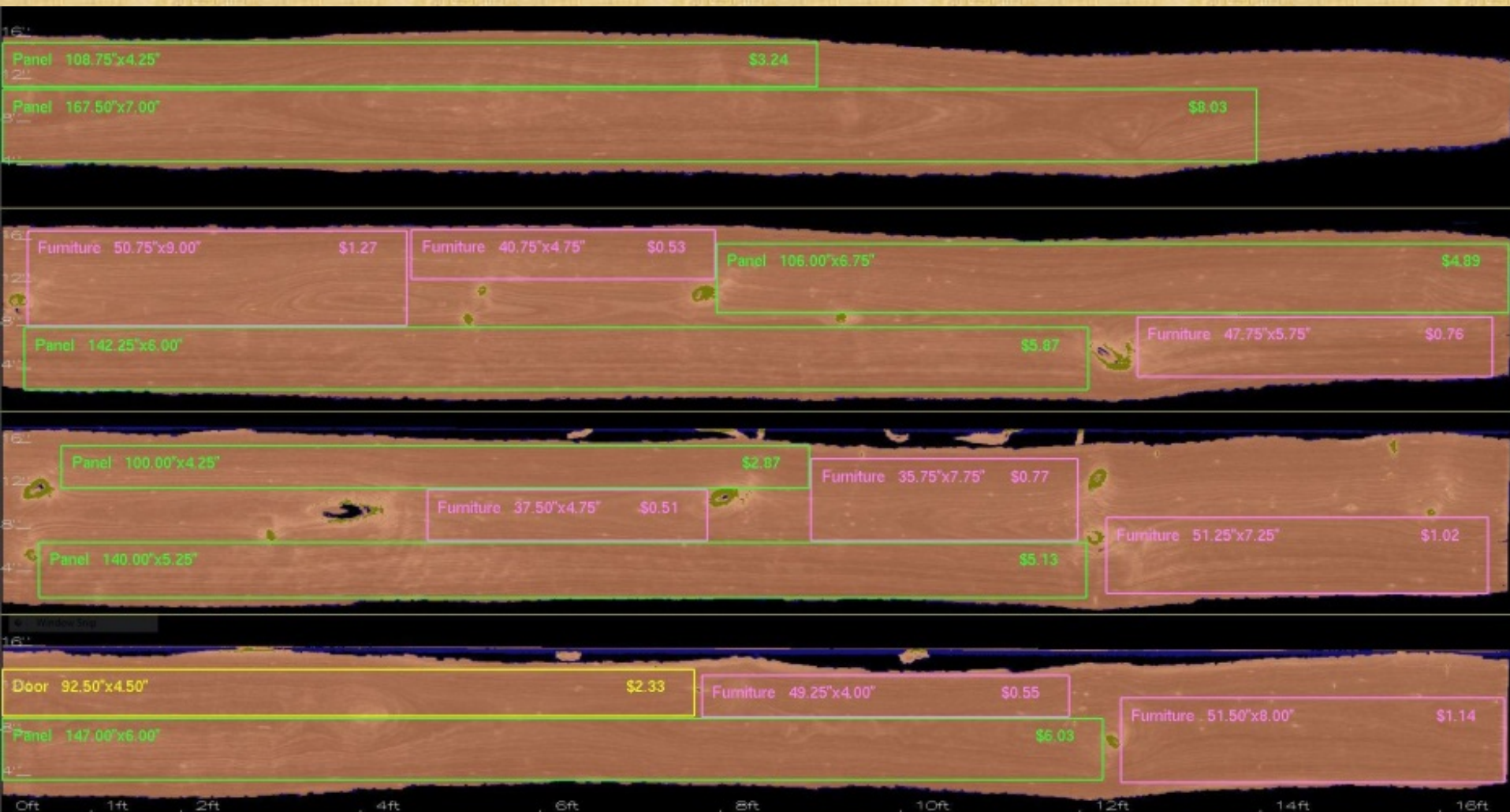
- LogView
 - Veneer (full optimization)
 - Sawmill (full optimization)
- Developed by Purdue University Hardwood Scanning Center
- Commercialized by LogView, LLC

Industry Adoption

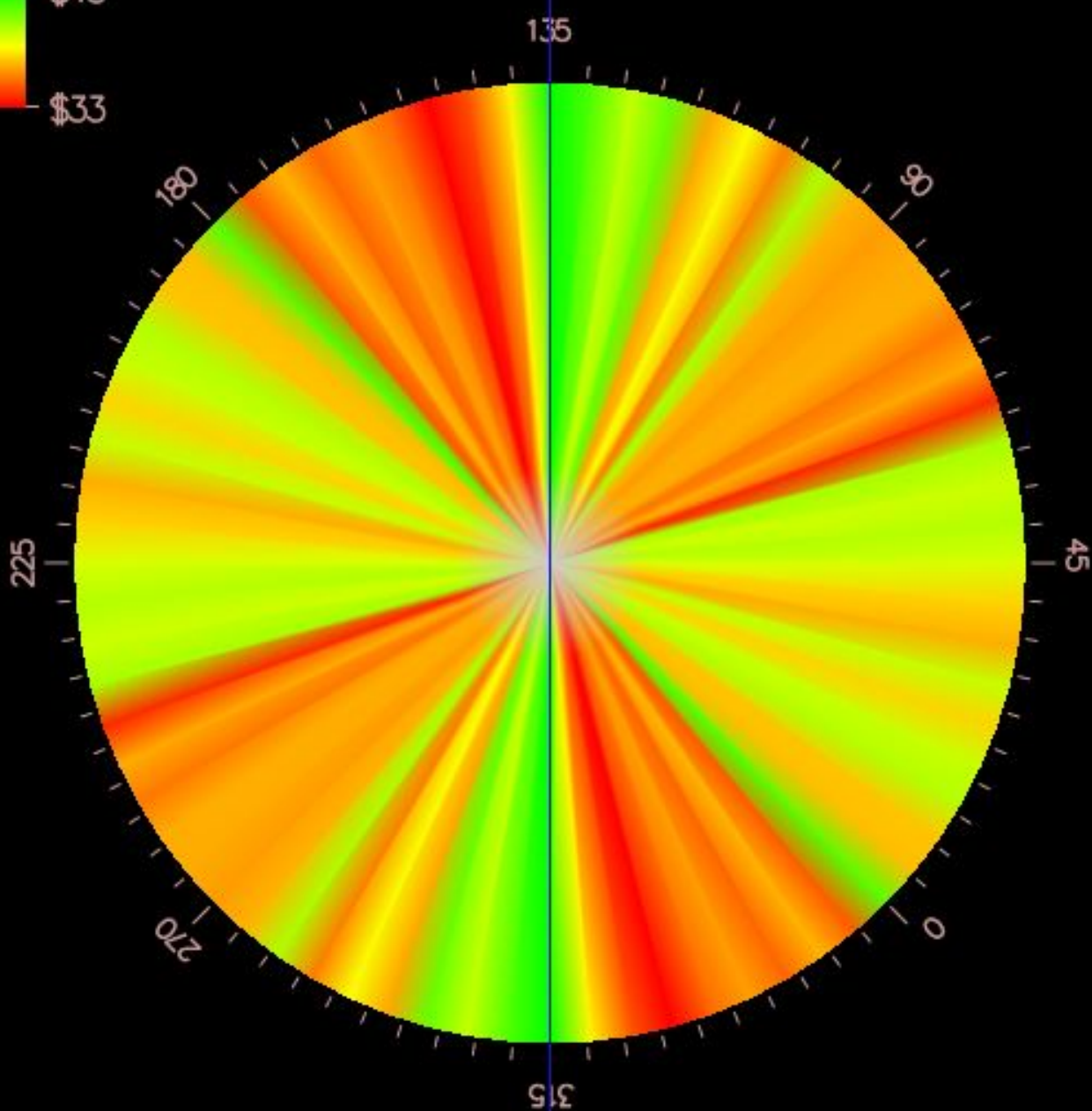
- Public test demonstration in selected mills
 - Veneer
 - Sawmill







Analysis Results



Selected Angle

Total Price [\$]

Improvement [%]

sq ft

Panel

Door

Desk

Furniture

Results By Method

- ☒ Value
- ☐ Volume
- ☐ Figure

Display Options

☐ Show Log Ends

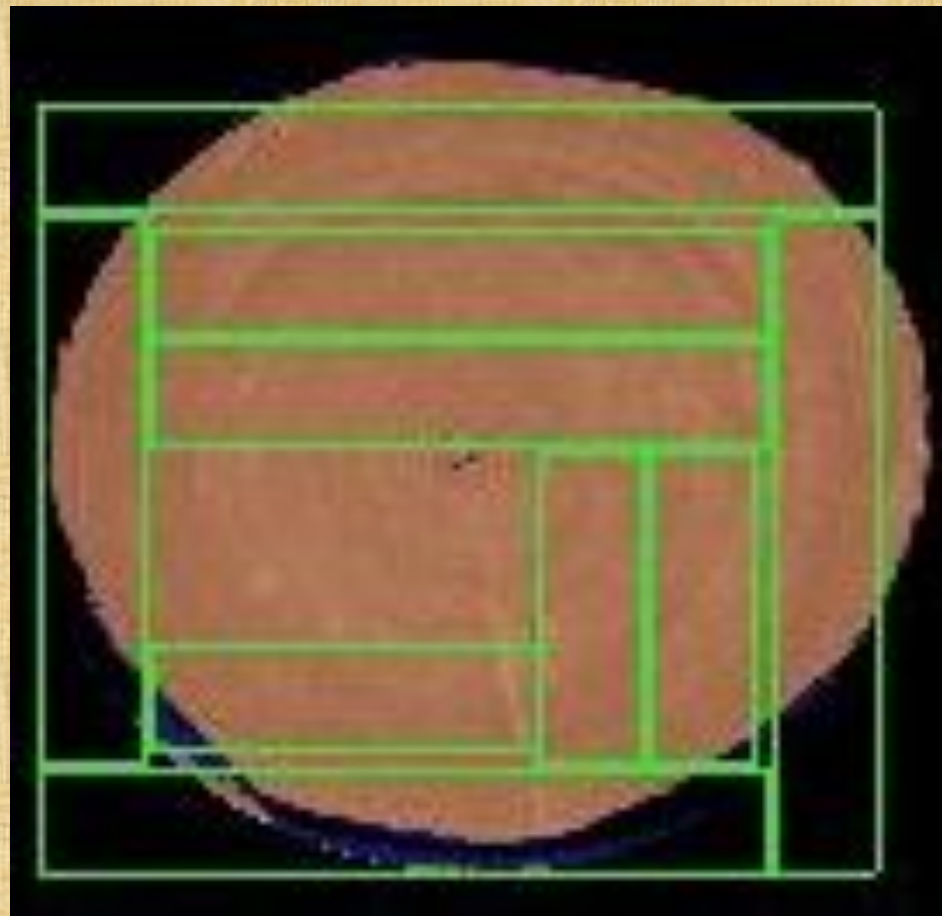
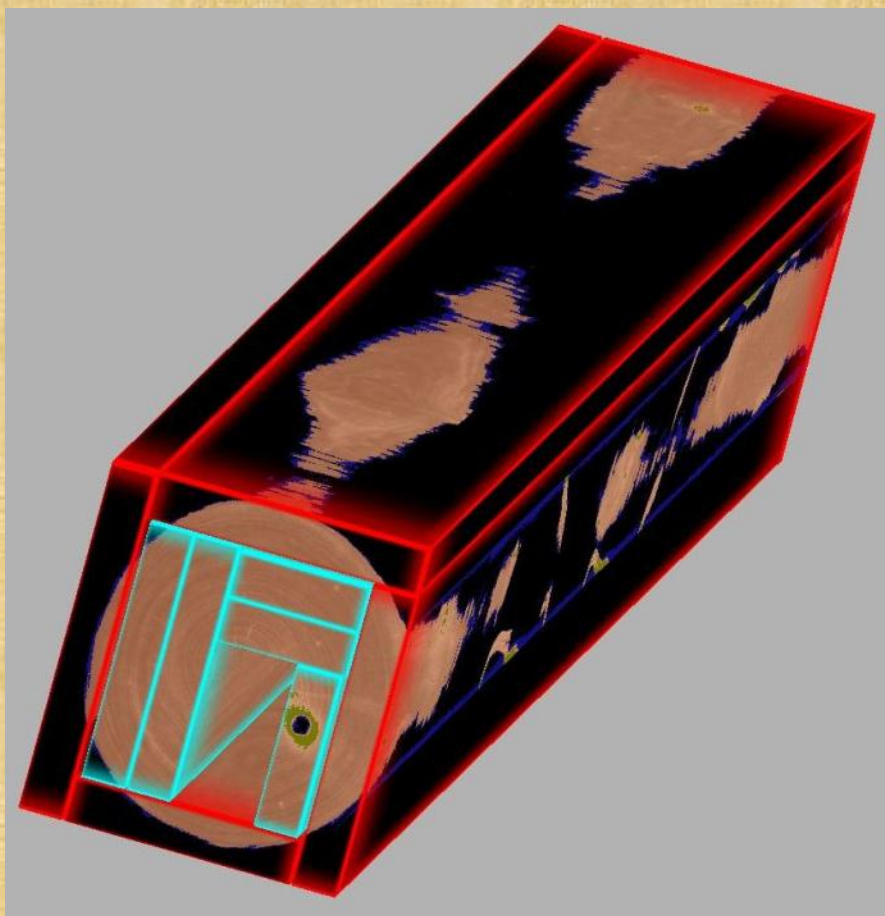
Active Results

Result 0

Select Best Angle

The log was analyzed in:

OK





How and Where Can This Technology Be Applied?

- **Log merchandising and bucking**
- **Slicing vs. Peeling**
- **Hardwood Veneer Slicing – Optimize splitting log into flitches (off-line or in-line)**
- **Hardwood Sawmills - Optimize log “opening” at headrig to maximize yield of premium product (in-line between debarker and headrig)**

CT Log Scanning

Summary

- CT Technology exists today to see *inside* a log
- CT Technology can be applied at various points in the process to satisfy multiple applications

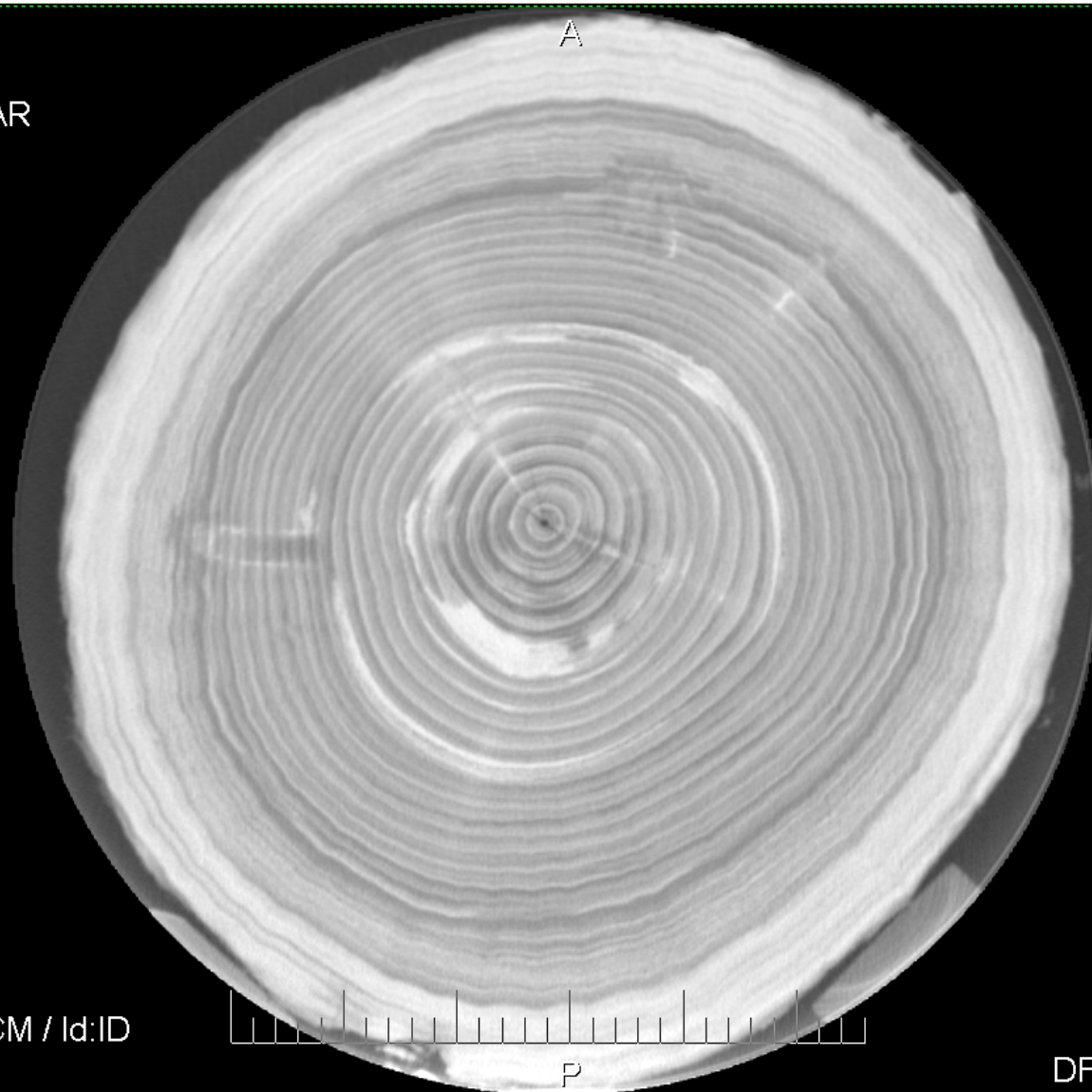
The Species

HiSpeed CT/i
Ex: 25
YELLOW-POPLAR
Se: 4/4
Im: 33/60
Ax: 1160.0

Mag: 1.6x

R

140.0 kV
200.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



HiSpeed CTi
CHERRY COOKIE
O 05-02-07CC
Acc:
2007 May 02
Acq Tm: 11:27:20

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Yellow Poplar

HiSpeed CT/i
Ex: 8714

Se: 7/2
Im: 1/330
Ax: S0.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

Purdue University at Pike Lumber
HARD MAPLE 13" 10'
O HM-67-1
Acc:
2007 May 23
Acq Tm: 14:17:02

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Hard Maple

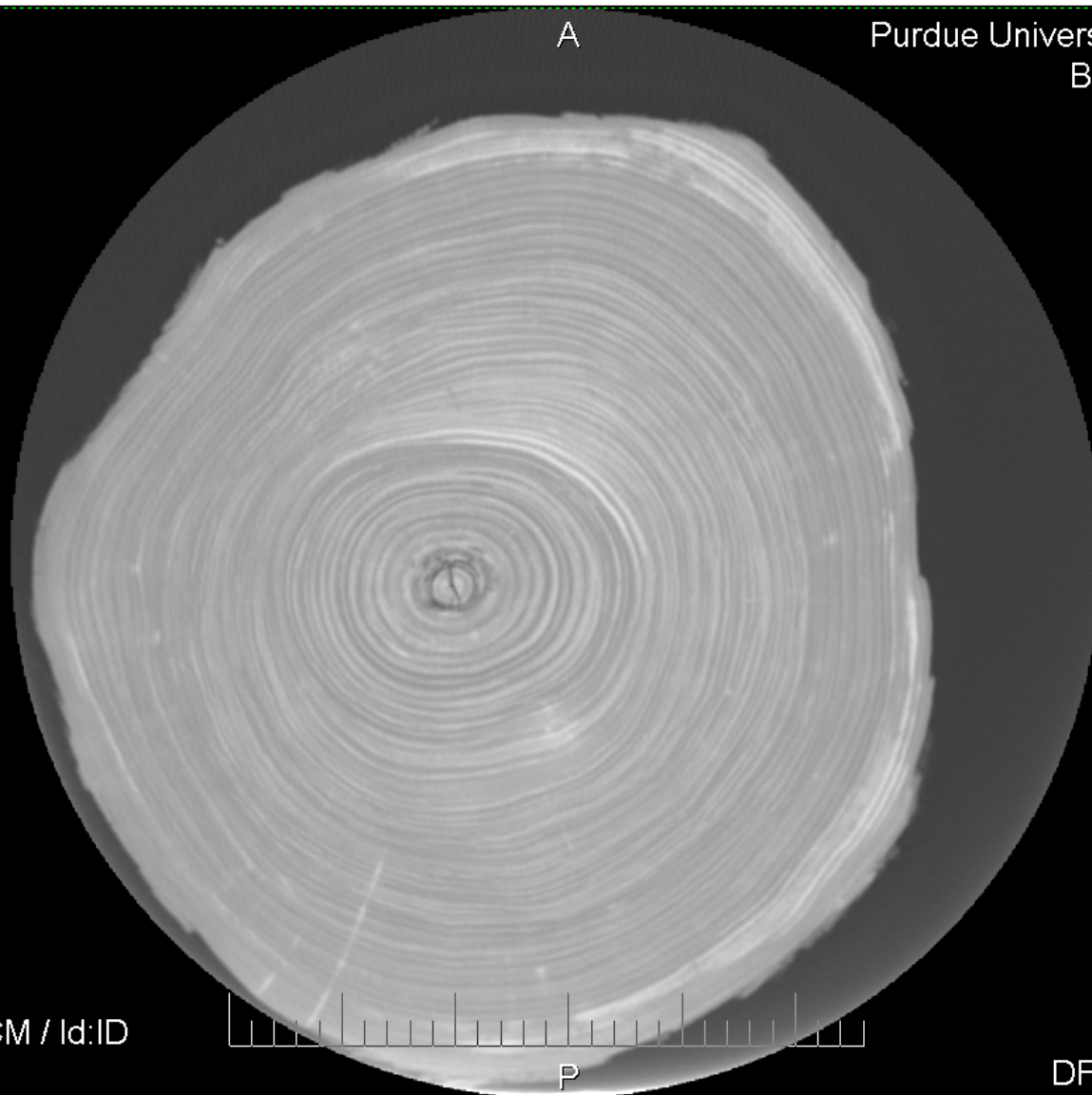
HiSpeed CT/i
Ex: 20514

Se: 1/1
Im: 231/320
Ax: 1250.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



Purdue University at Pike Lumber
Black Cherry 16" 16"
O BC-40-2
Acc:
2007 Jun 08
Acq Tm: 09:04:22

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Black Cherry

HiSpeed CT/i
Ex: 20532

Se: 2/2
Im: 679/735
Ax: 190.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

Purdue University at Pike Lumber
Red Oak 16" 12'
O RO-25-1
Acc:
2007 Jun 15
Acq Tm: 13:32:25

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Red Oak

HiSpeed CT/i
Ex: 20529

Se: 1/1
Im: 372/565
Ax: 155.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

Purdue University at Pike Lumber
White Oak 14" 16'
O WO-81-3
Acc:
2007 Jun 14
Acq Tm: 14:47:19

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

White Oak

**What can we see in
wood?**

We can see...

Knots & Voids

HiSpeed CT/i
Ex: 20510

Se: 1/1
Im: 134/300
Ax: 165.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1502 L:-600

Purdue University at Pike Lumber
Black Cherry 17" 14'
O BC-56-3
Acc:
2007 Jun 07
Acq Tm: 08:47:46

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Sound Knot in Black Cherry

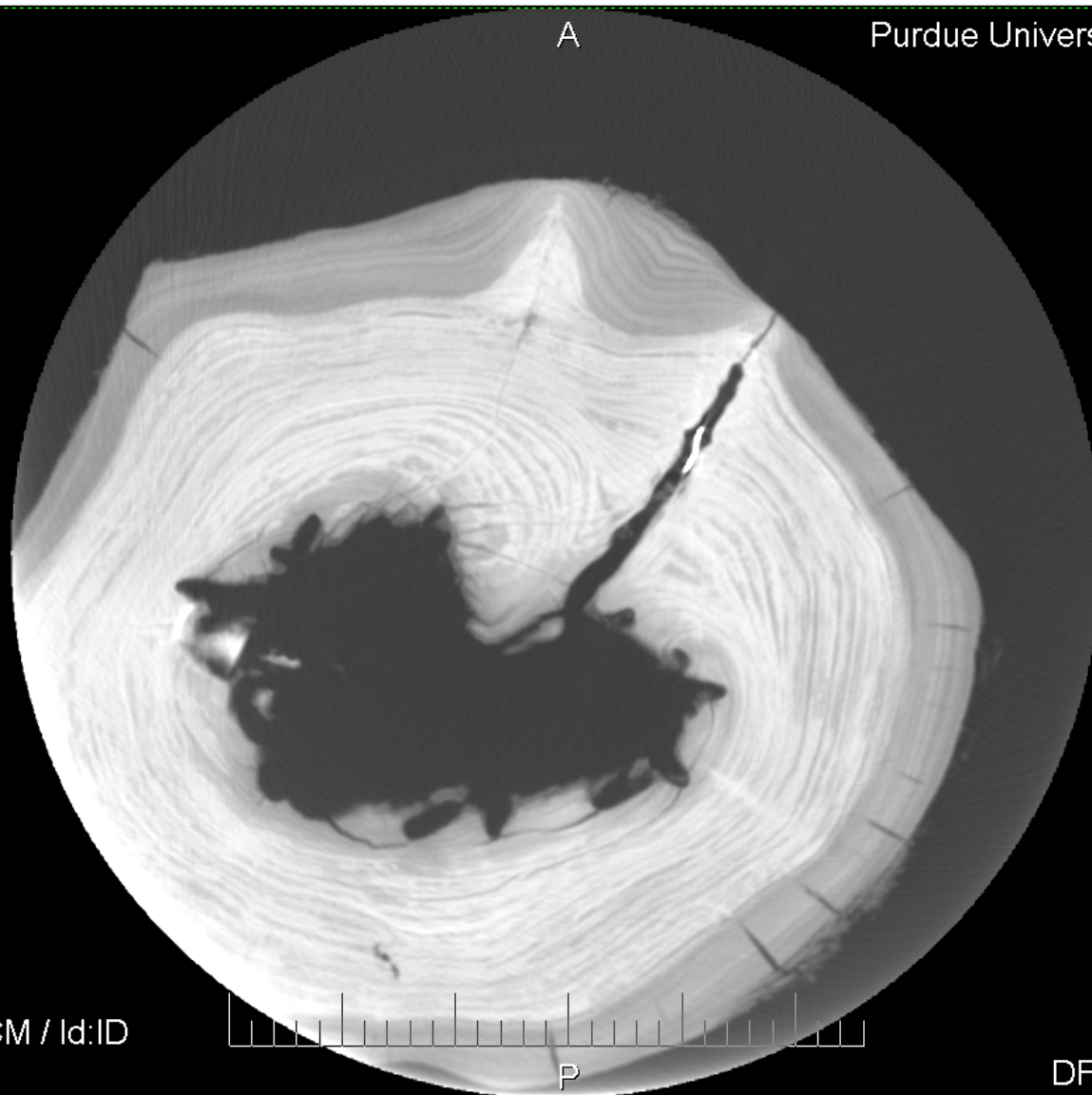
HiSpeed CT/i
Ex: 20534

Se: 1/1
Im: 171/185
Ax: 1250.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-599



Purdue University at Pike Lumber
Walnut with Metal
O Walnut
Acc:
2007 Jun 15
Acq Tm: 17:21:58

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Carpenter Ants in Black Walnut

HiSpeed CT/i
Ex: 20521

Se: 2/2
Im: 632/745
Ax: 1155.0

Mag: 1.6x

R

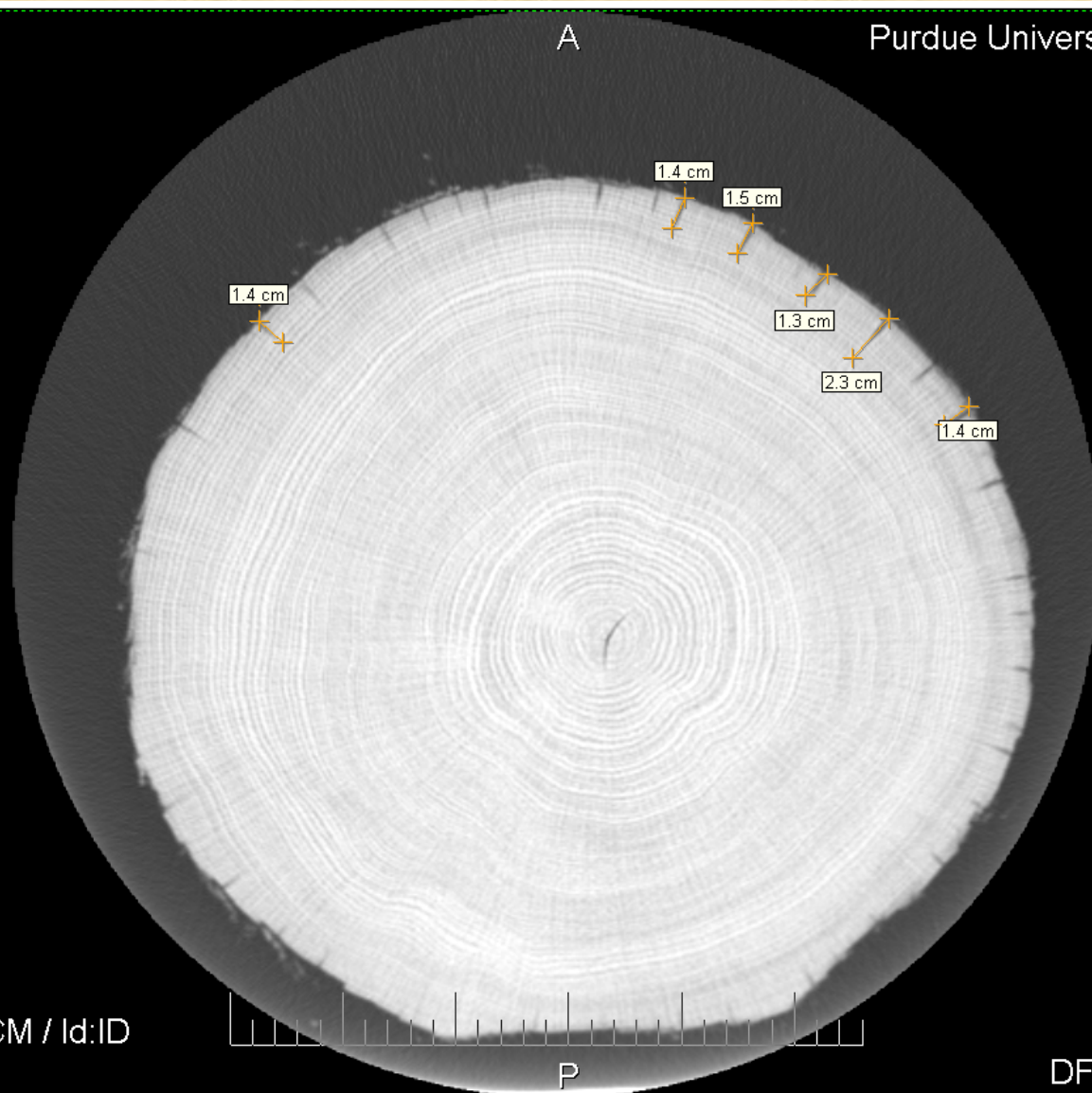
120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

Purdue University at Pike Lumber
White Oak 16" 12'
O WO-84-1
Acc:
2007 Jun 12
Acq Tm: 11:03:28

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm



Checking In White Oak

HiSpeed CT/i
Ex: 8721

Se: 2/2
Im: 580/805
Ax: 1195.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

Purdue University at Pike Lumber
Hard Maple 16" 16"
O HM-60-2
Acc:
2007 May 25
Acq Tm: 10:53:02

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Un-Sound Knot in Hard Maple

HiSpeed CT/i
Ex: 8713

Se: 2/1
Im: 44/660
Ax: 1215.0

Mag: 1.6x

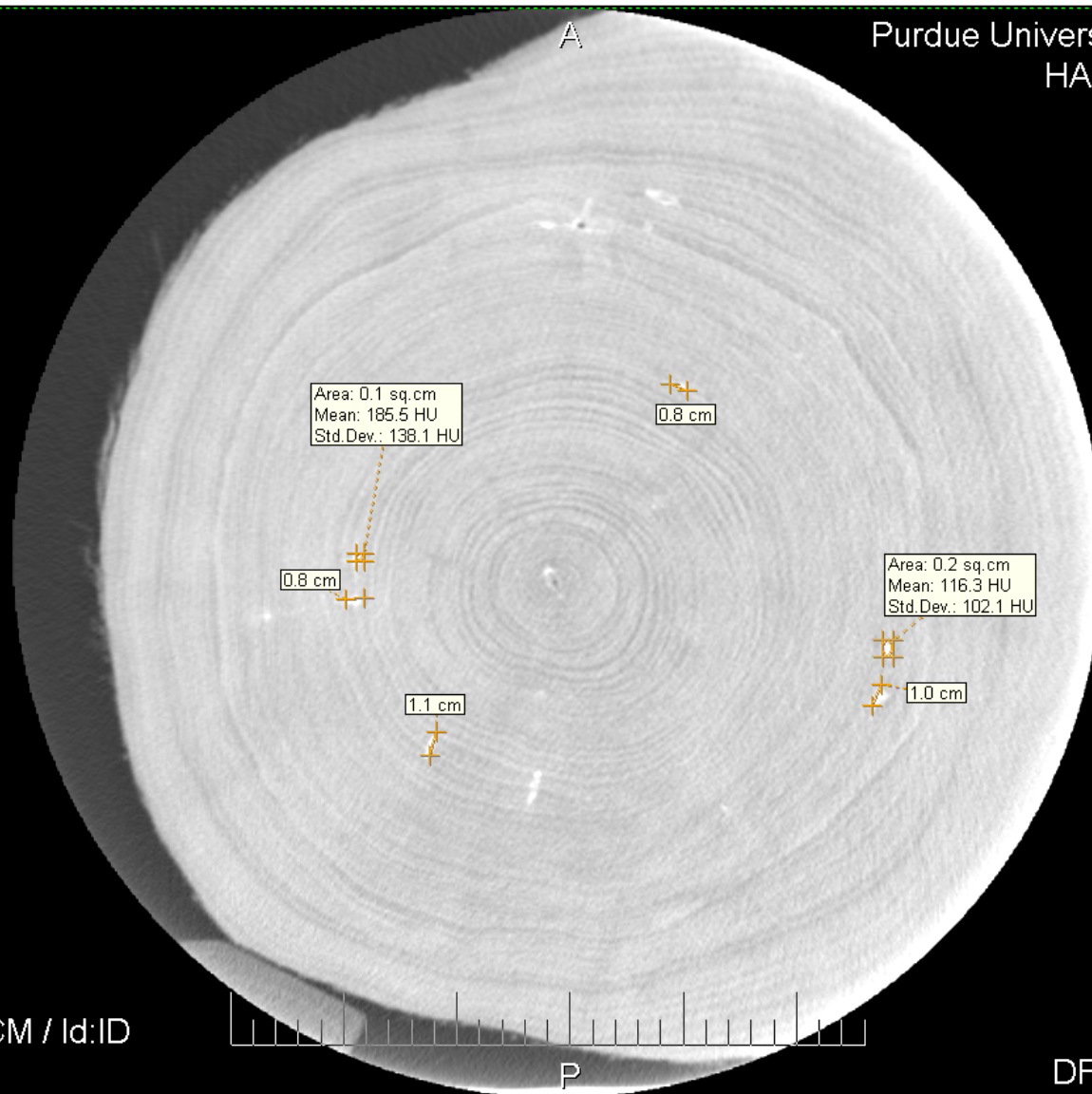
Purdue University at Pike Lumber
HARD MAPLE 15" 10'
O HM-68-4
Acc:
2007 May 23
Acq Tm: 09:11:13

512 x 512
STANDARD

R

L

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



DFOV: 47.9 x 47.9cm

Pin Knots in Hard Maple

We can see...

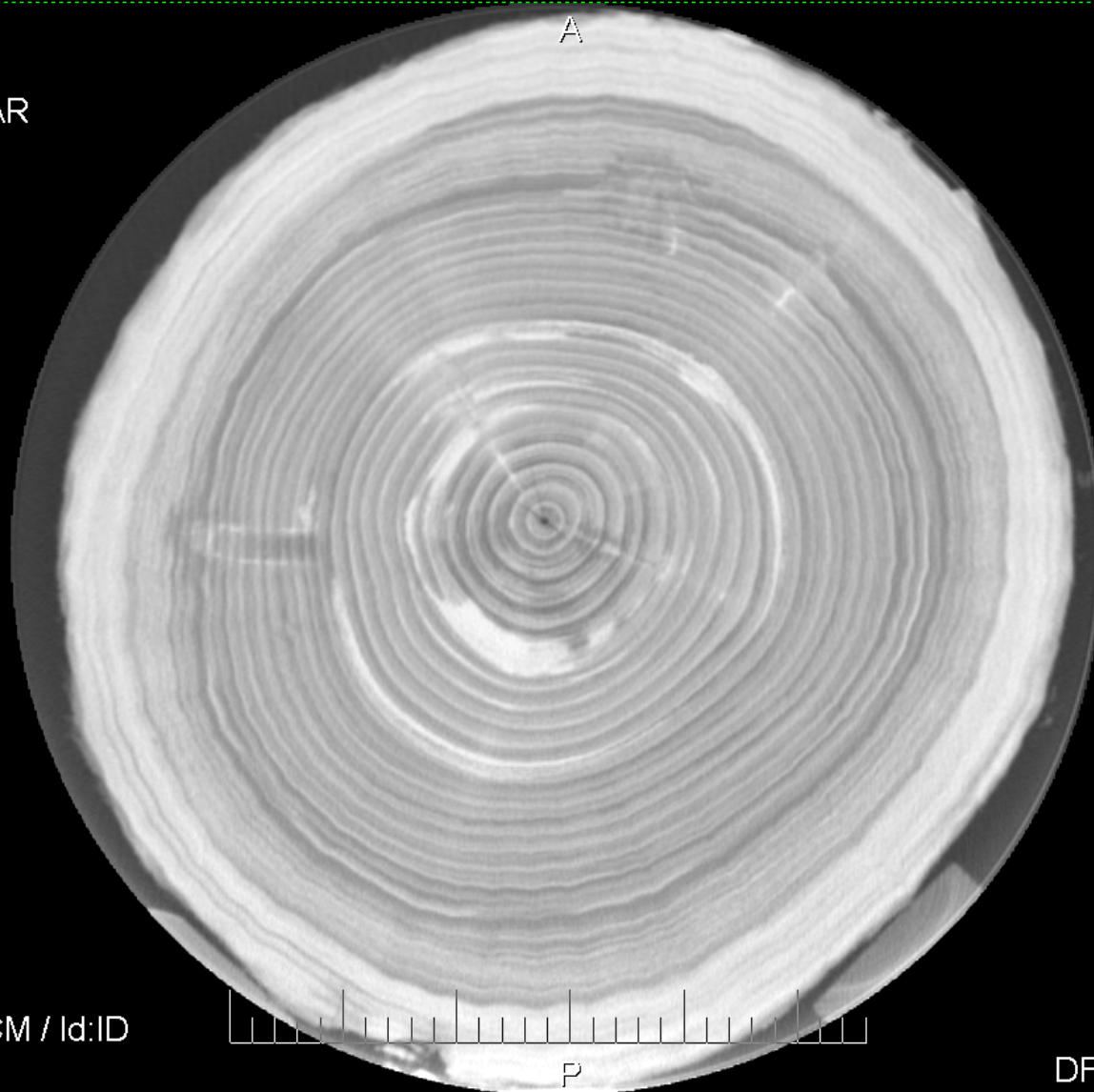
Sapwood vs. Heartwood

HiSpeed CT/i
Ex: 25
YELLOW-POPLAR
Se: 4/4
Im: 33/60
Ax: 1160.0

Mag: 1.6x

R

140.0 kV
200.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



HiSpeed CTi
CHERRY COOKIE
O 05-02-07CC
Acc:
2007 May 02
Acq Tm: 11:27:20

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

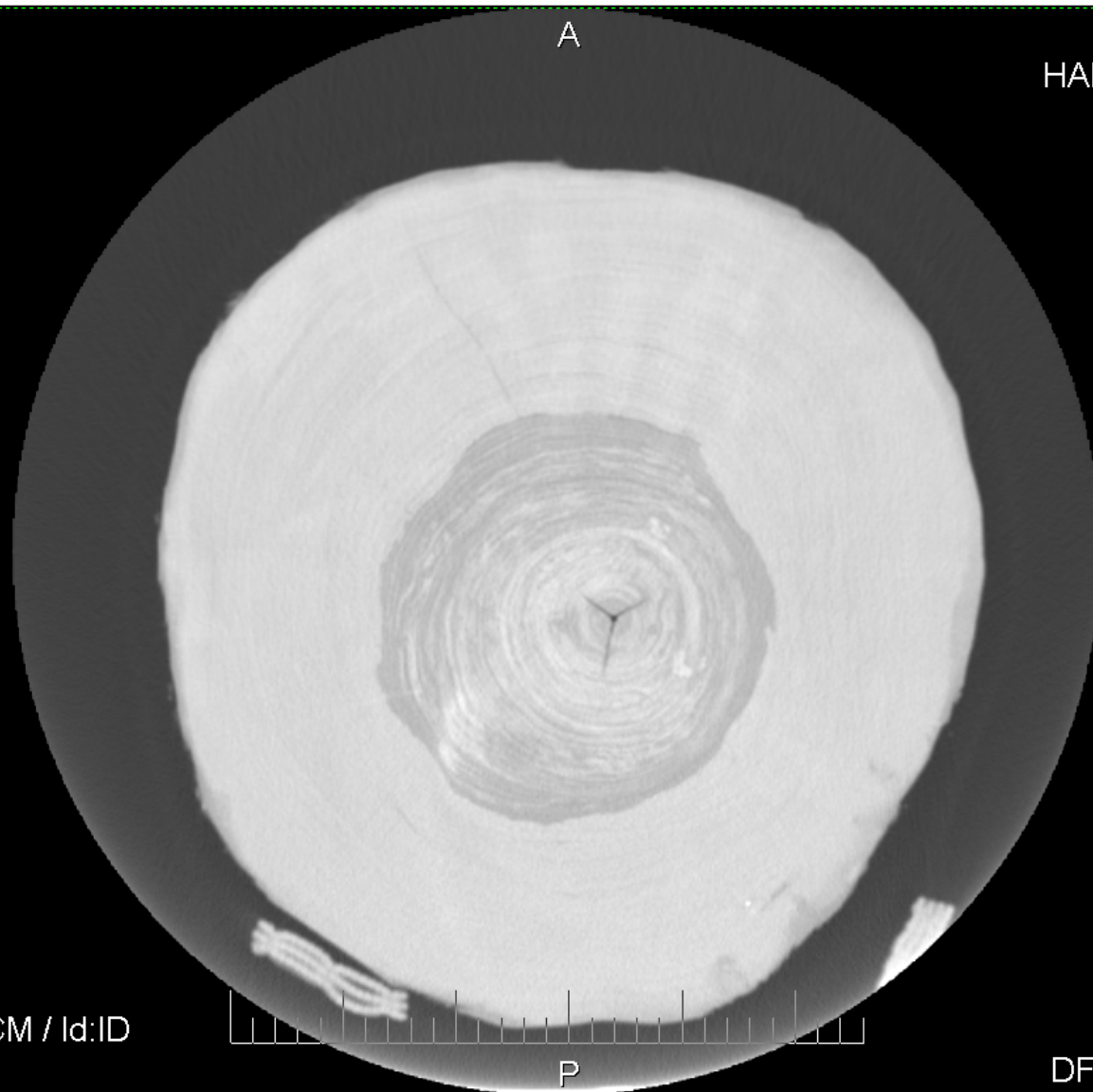
Sap vs. Heart in Yellow Poplar

HiSpeed CT/i
Ex: 1007
Helical Scan
Se: 5/1
Im: 216/660
Ax: 1175.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s/He
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



HiSpeed CTi
HARD MAPLE 14" 10'
O HM-65-1
Acc:
2007 May 17
Acq Tm: 12:26:03

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Sap vs. Heart in Hard Maple

HiSpeed CT/i
Ex: 20496

Se: 2/2
Im: 458/1000
Ax: 1185.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

A

Purdue University at Pike Lumber
Black Cherry 16" 16'
O BC-41-4
Acc:
2007 Jun 01
Acq Tm: 15:04:38

512 x 512
STANDARD

L

P

DFOV: 47.9 x 47.9cm

Sap vs. Heart in Black Cherry

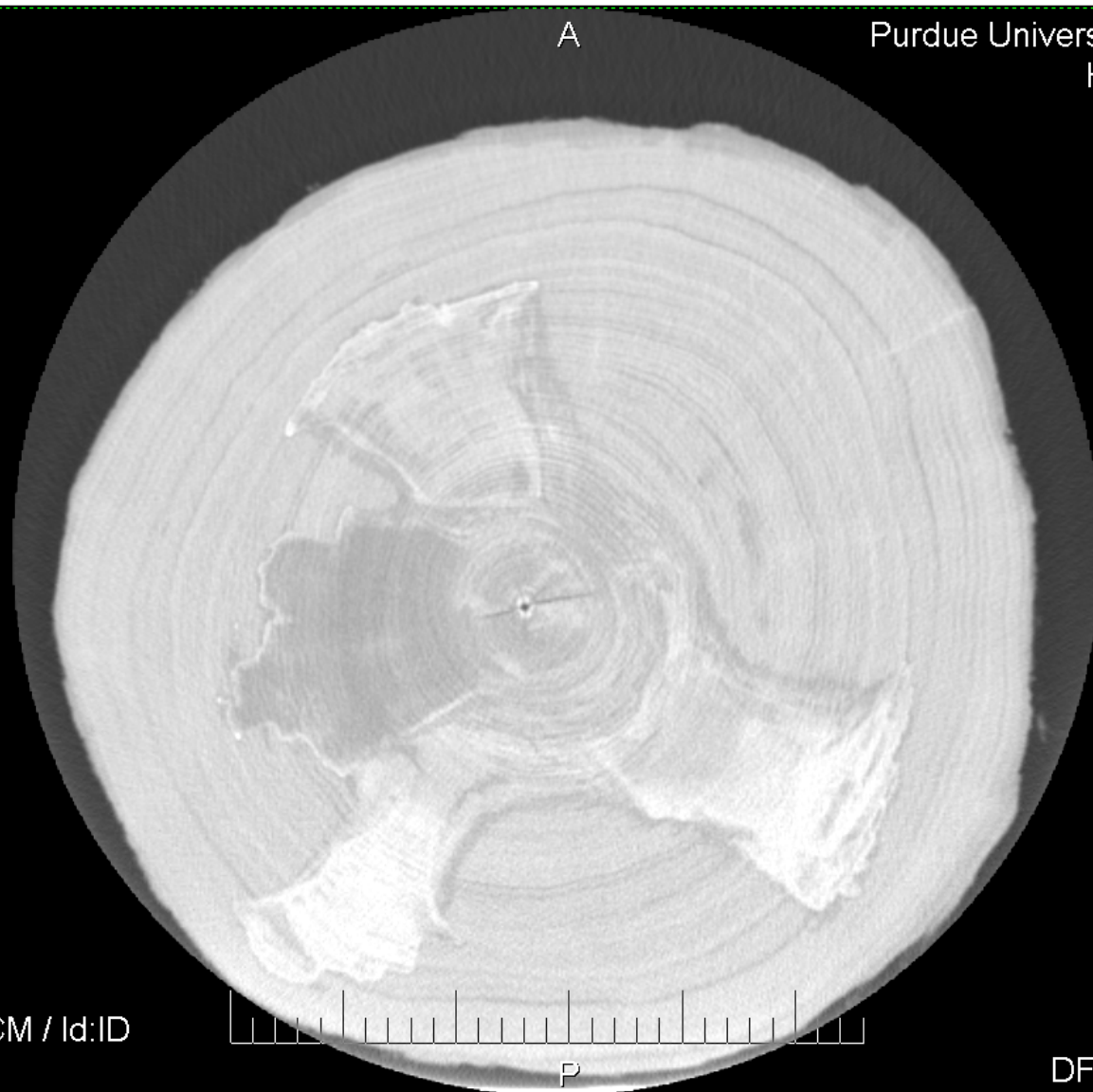
HiSpeed CT/i
Ex: 8723

Se: 2/2
Im: 54/315
Ax: 1265.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



Purdue University at Pike Lumber
Hard Maple 17" 16'
O HM-70-2
Acc:
2007 May 29
Acq Tm: 09:13:38

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Stain in Hard Maple

HiSpeed CT/i
Ex: 8723

Se: 2/2
Im: 302/315
Ax: 15.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

Purdue University at Pike Lumber
Hard Maple 17" 16'
O HM-70-2
Acc:
2007 May 29
Acq Tm: 10:08:43

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

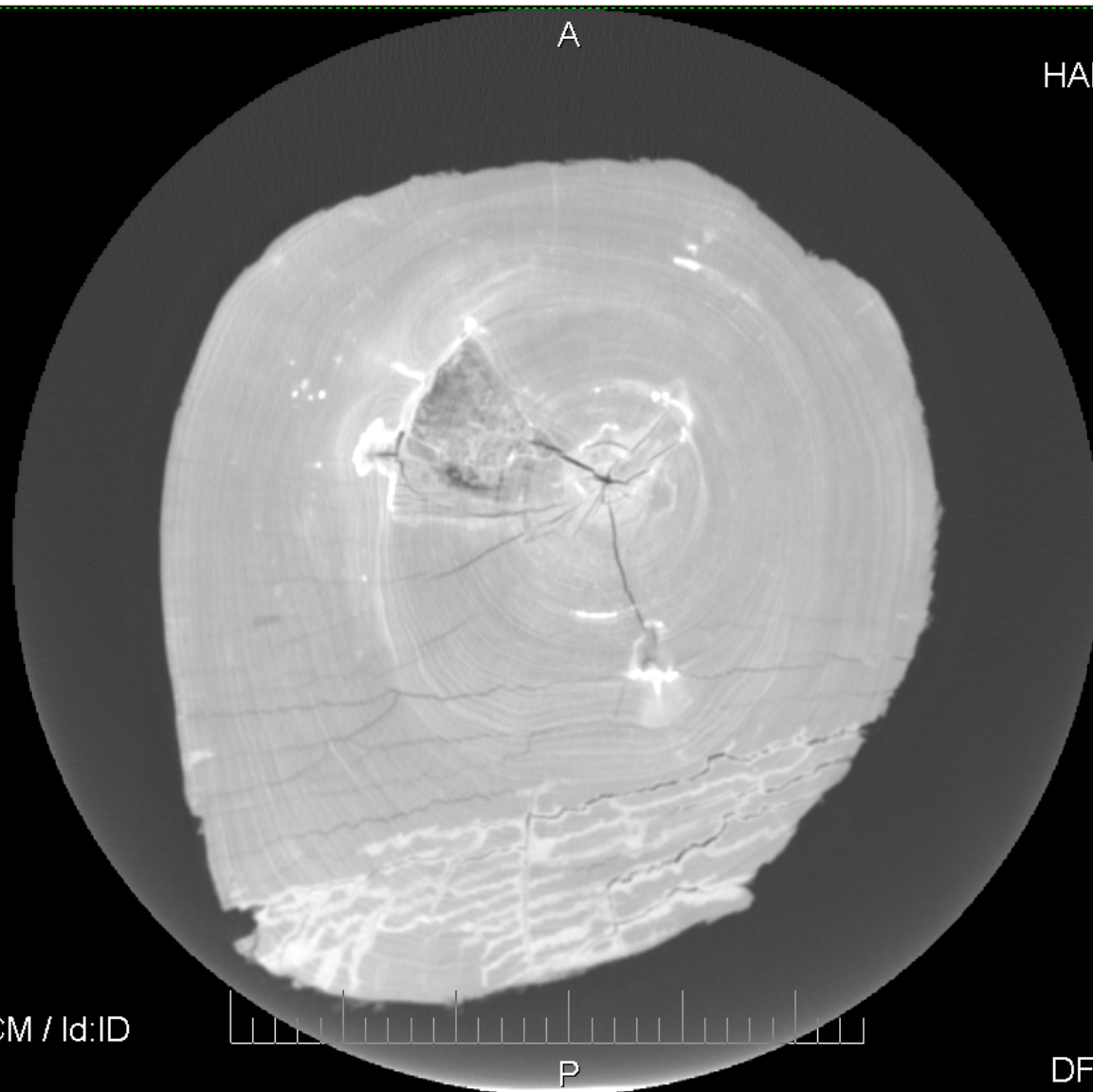
Stain in Hard Maple

HiSpeed CT/i
Ex: 1006
Helical Scan
Se: 2/1
Im: 621/633
Ax: 1100.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s/He
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



HiSpeed CTi
HARD MAPLE 14" 10'
O HM-69-1
Acc:
2007 May 17
Acq Tm: 11:09:04

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Stain in Hard Maple

HiSpeed CT/i

Ex: 24

HEAD

Se: 1/9

Im: 25/40

Ax: 1120.0

Mag: 1.6x

R

120.0 kV

250.0 mA

5.0 mm/1.0:1

Tilt: 0.0

1.0 s

Lin:DCM / Lin:DCM / Id:ID

W:1500 L:-600

A

HiSpeed CTi

OAK 1A

O 05-01-07-2

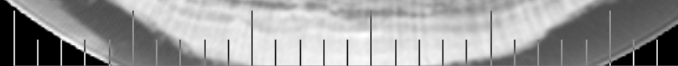
Acc:

2007 May 01

Acq Tm: 15:48:08

512 x 512
STANDARD

L



P

DFOV: 47.9 x 47.9cm

Stain in Red Oak

We can see...

Lumber Defects

HiSpeed CT/i
Ex: 20498

Se: 4/4
Im: 15/300
Ax: 170.0

Mag: 1.6x

R

120.0 kV
100.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-597

Purdue University at Pike Lumber

LUMBER

O LBR-1

Acc:

2007 Jun 01

Acq Tm: 17:39:09

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Pin Knot in Black Walnut Lumber

HiSpeed CT/i
Ex: 20498

Se: 4/4
Im: 46/300
Ax: 1225.0

Mag: 1.6x

R

120.0 kV
100.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-597

Purdue University at Pike Lumber

LUMBER

O LBR-1

Acc:

2007 Jun 01

Acq Tm: 17:39:09

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Powder Post Beetle in Red Oak Lumber

HiSpeed CT/i
Ex: 20498

Se: 4/4
Im: 65/300
Ax: 120.0

Mag: 1.6x

R

120.0 kV
100.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

Purdue University at Pike Lumber

LUMBER

O LBR-1

Acc:

2007 Jun 01

Acq Tm: 17:41:01

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Honeycomb in Red Oak & Black Walnut Lumber

We can see...

The Unpredictable

HiSpeed CT/i
Ex: 20510

Se: 1/1
Im: 108/300
Ax: 1235.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

A

Purdue University at Pike Lumber
Black Cherry 17" 14'
O BC-56-3
Acc:
2007 Jun 07
Acq Tm: 08:34:15

512 x 512
STANDARD

L

P

DFOV: 47.9 x 47.9cm

Gum in Black Cherry

HiSpeed CT/i

Ex: 25

HELICAL 10

Se: 1/4

Im: 46/60

Ax: 1225.0

Mag: 1.6x

R

120.0 kV

250.0 mA

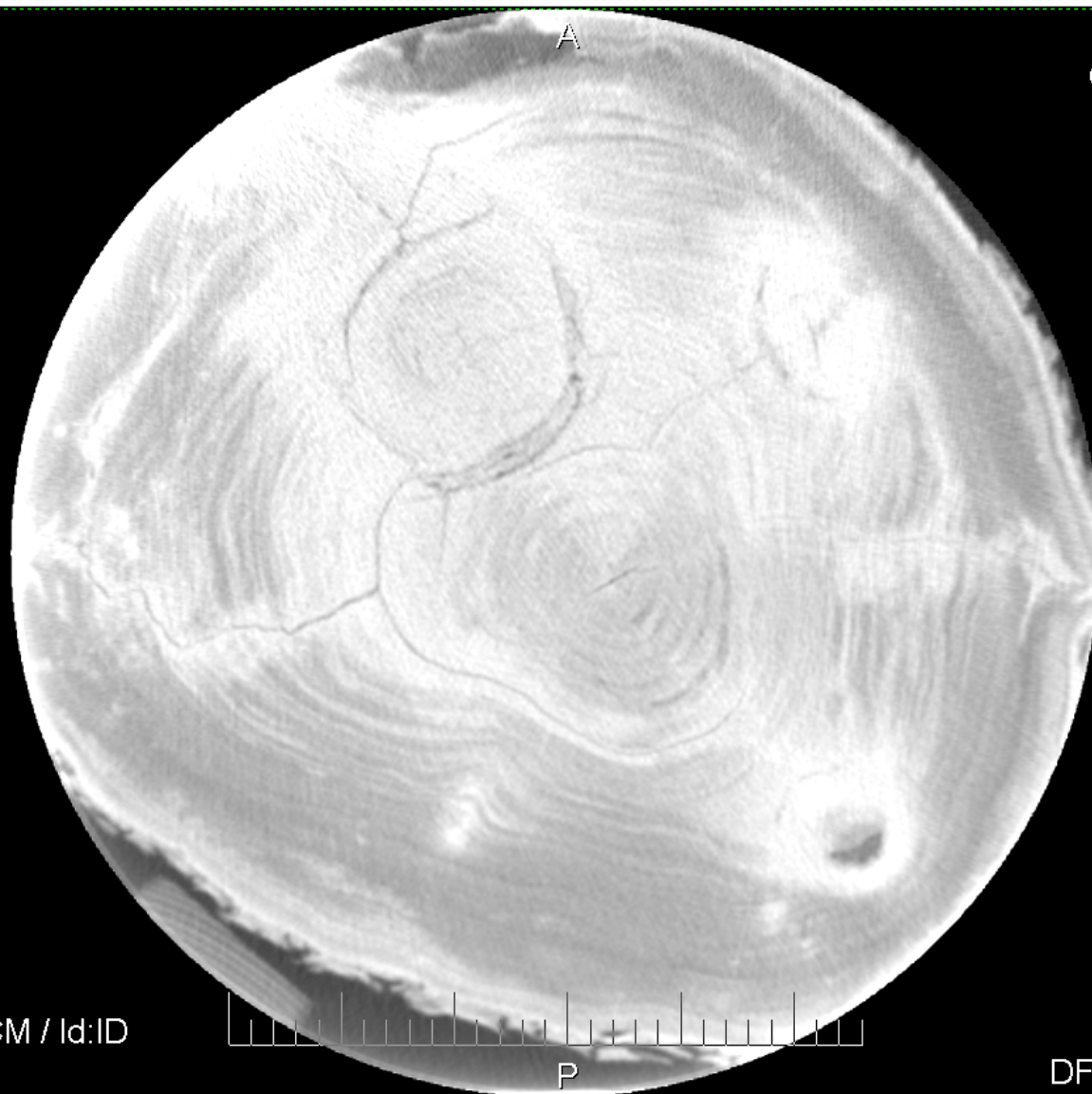
5.0 mm/1.0:1

Tilt: 0.0

1.0 s/He

Lin:DCM / Lin:DCM / Id:ID

W:1500 L:-600



HiSpeed CTi

CHERRY COOKIE

O 05-02-07CC

Acc:

2007 May 02

Acq Tm: 10:38:21

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Bark Inclusion in Hard Maple

HiSpeed CT/i
Ex: 20534

Se: 1/1
Im: 1/185
Ax: S0.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-599

Purdue University at Pike Lumber
Walnut with Metal
O Walnut
Acc:
2007 Jun 15
Acq Tm: 16:54:02

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Nail in Black Walnut

HiSpeed CT/i
Ex: 20534

Se: 1/1
Im: 16/185
Ax: 175.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-599

Purdue University at Pike Lumber
Walnut with Metal
O Walnut
Acc:
2007 Jun 15
Acq Tm: 16:54:02

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

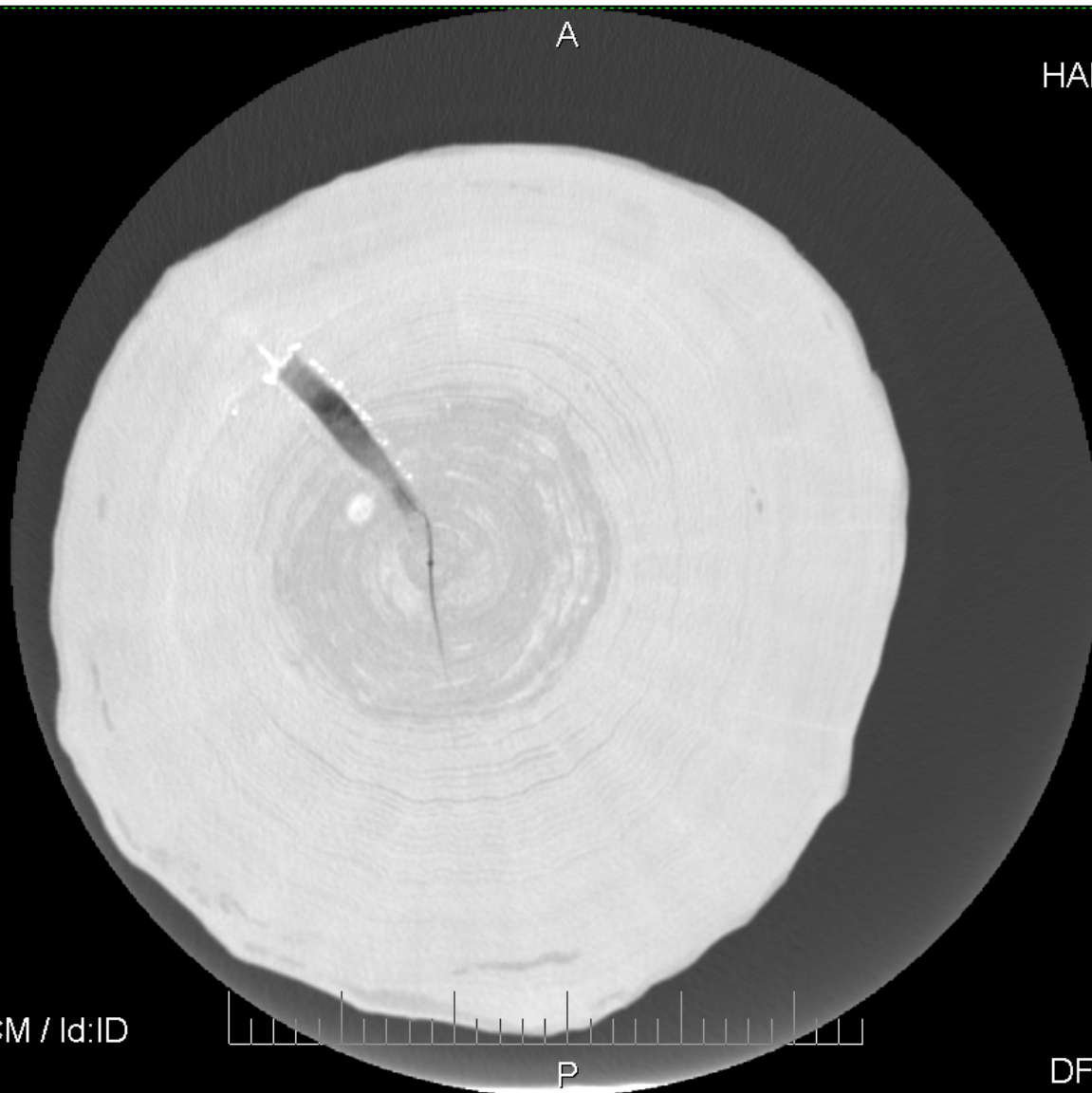
Nail in Black Walnut

HiSpeed CT/i
Ex: 1004
Helical Scan
Se: 5/1
Im: 185/880
Ax: 120.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s/He
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



HiSpeed CTi
HARD MAPLE 14" 14"
O HM-66-2
Acc:
2007 May 16
Acq Tm: 10:24:16

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

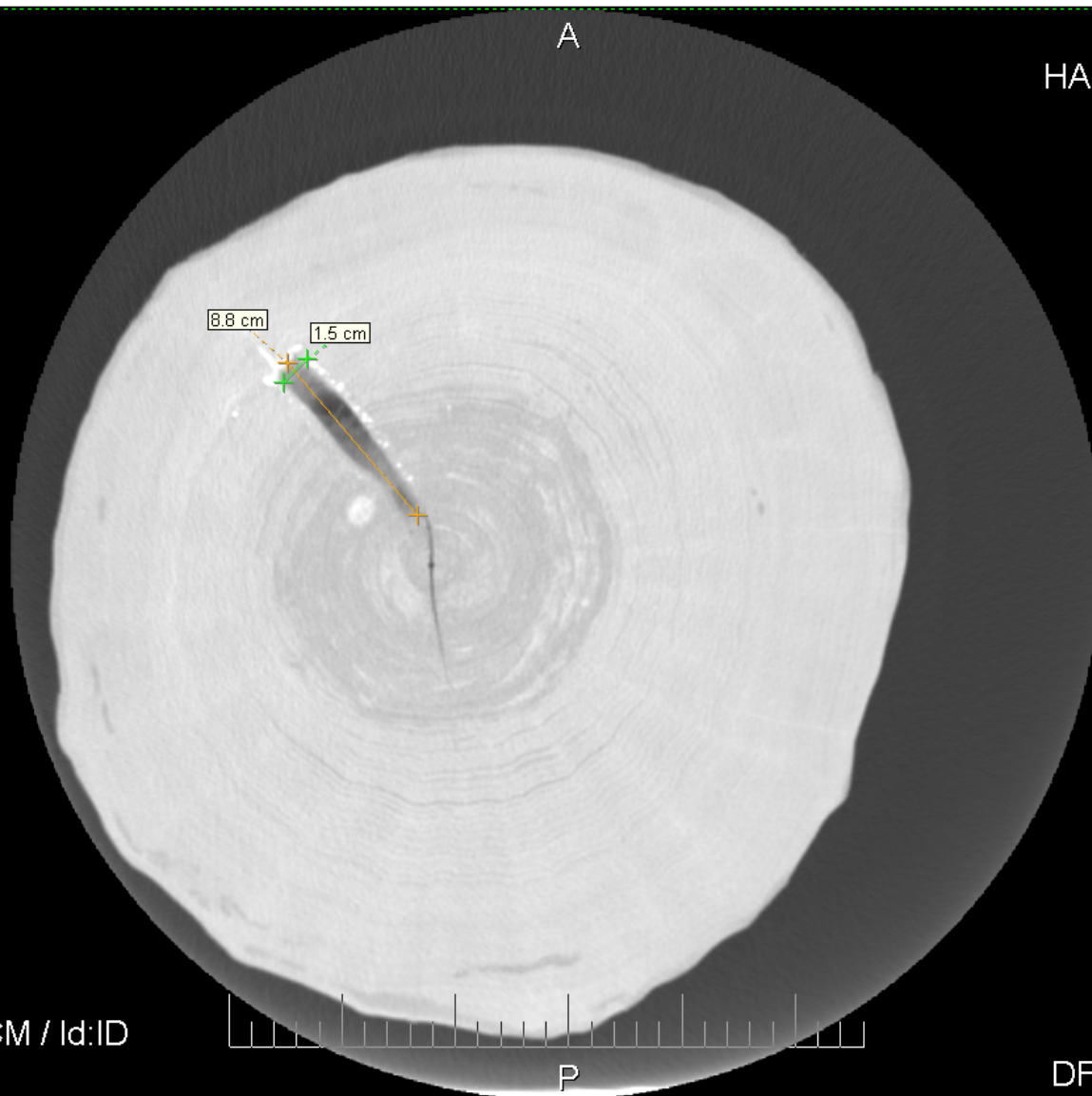
Tap Hole in Hard Maple

HiSpeed CT/i
Ex: 1004
Helical Scan
Se: 5/1
Im: 185/880
Ax: 120.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s/He
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



HiSpeed CTi
HARD MAPLE 14" 14"
O HM-66-2
Acc:
2007 May 16
Acq Tm: 10:24:16

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Tap Whole in Hard Maple

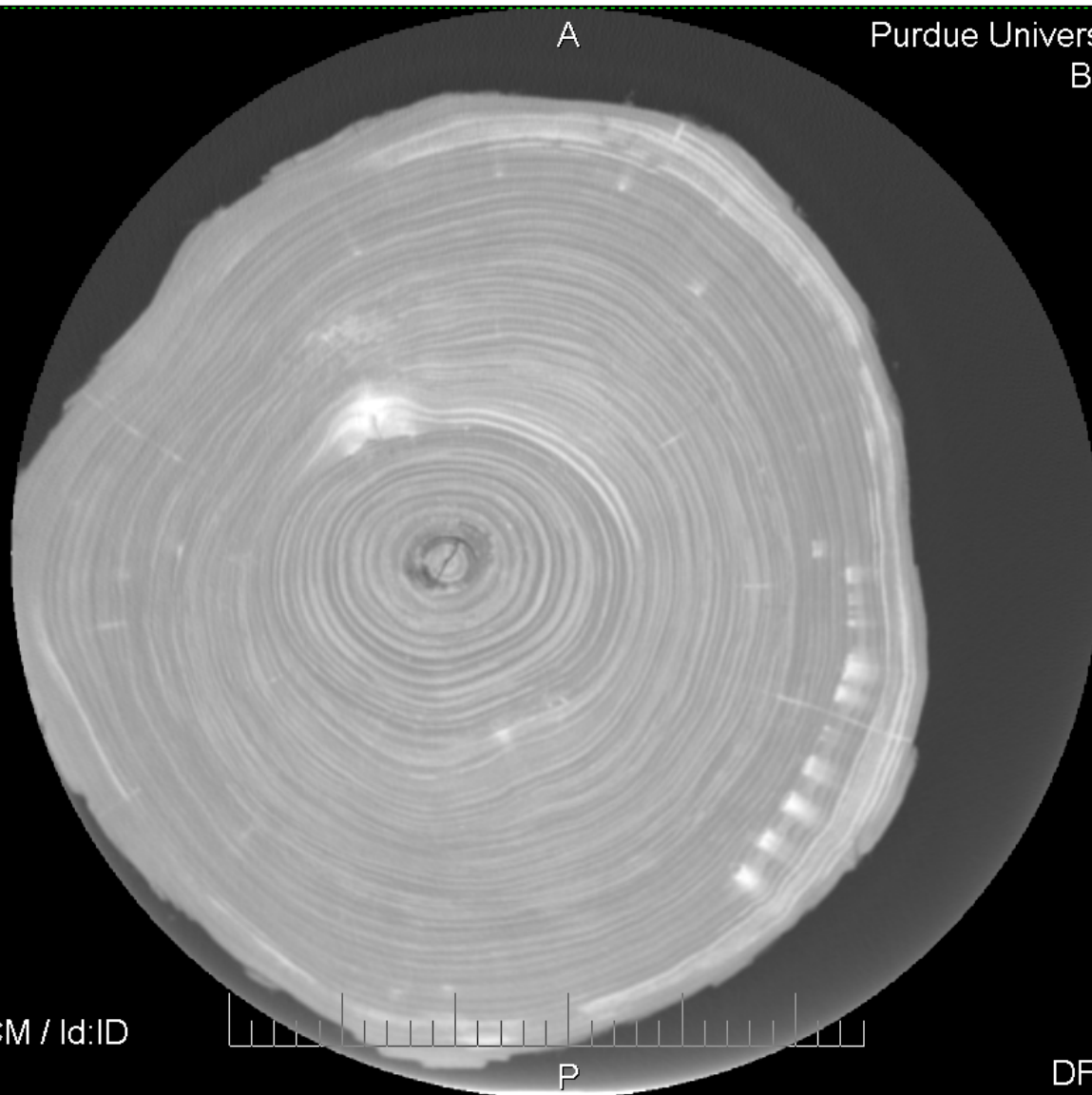
HiSpeed CT/i
Ex: 20514

Se: 1/1
Im: 198/320
Ax: 185.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



Purdue University at Pike Lumber
Black Cherry 16" 16"
O BC-40-2
Acc:
2007 Jun 08
Acq Tm: 09:04:22

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

? In Black Cherry

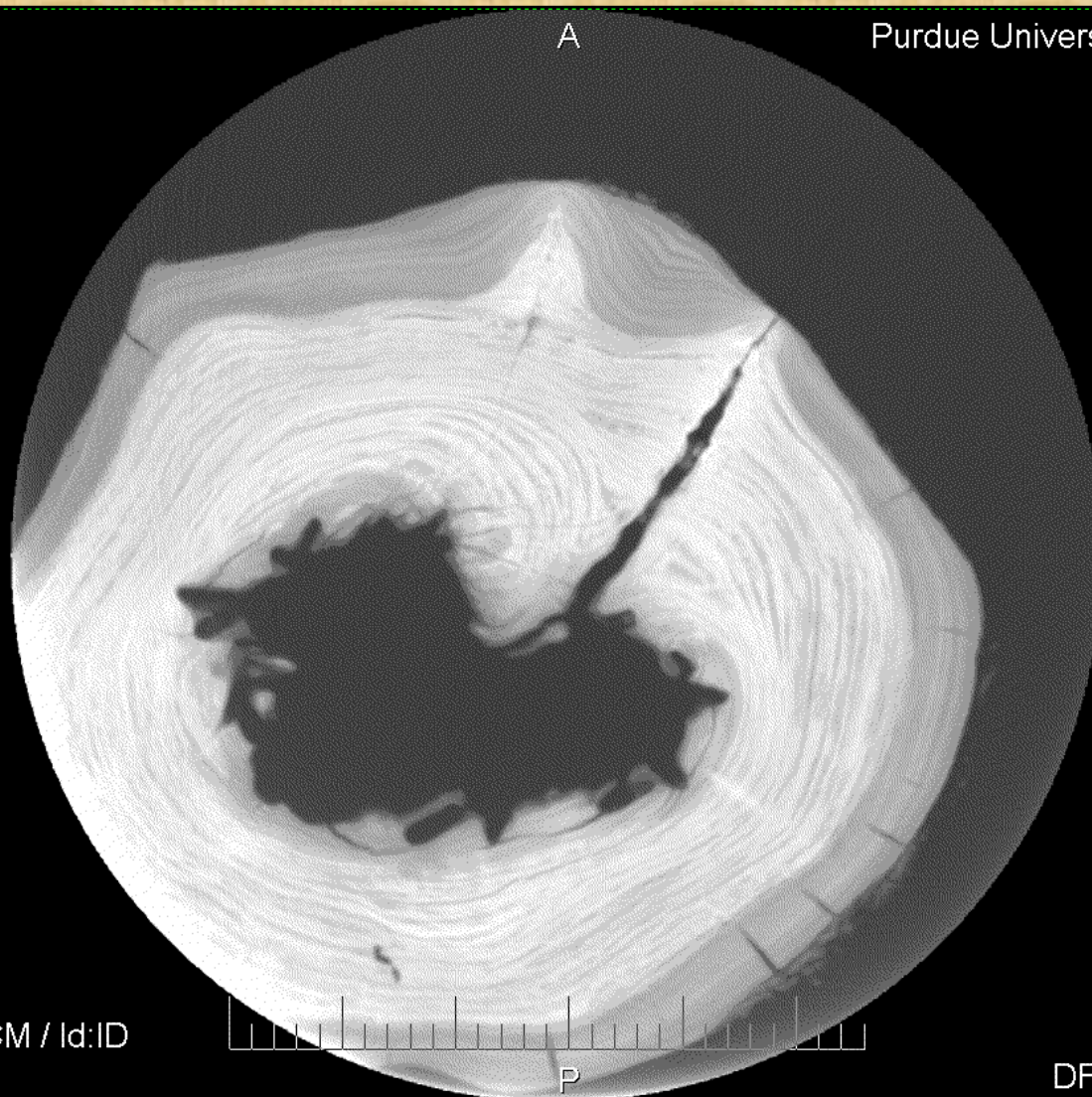
HiSpeed CT/i
Ex: 20534

Se: 1/1
Im: 170/185
Ax: 1245.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-599



Purdue University at Pike Lumber
Walnut with Metal
O Walnut
Acc:

2007 Jun 15
Acq Tm: 17:21:58

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Metal in Black Walnut

HiSpeed CT/i
Ex: 24
RED OAK 2
Se: 4/9
Im: 21/80
Ax: 135.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



HiSpeed CTi
OAK 1A
O 05-01-07-2
Acc:
2007 May 01
Acq Tm: 16:59:54

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

The Full Extent of Grubs in Red Oak

HiSpeed CT/i

Ex: 20498

Se: 4/4

Im: 1/300

Ax: S0.0

Mag: 1.6x

R

120.0 kV

100.0 mA

5.0 mm/1.0:1

Tilt: 0.0

1.0 s

Lin:DCM / Lin:DCM / Id:ID

W:1500 L:-597

A

Purdue University at Pike Lumber

LUMBER

O LBR-1

Acc:

2007 Jun 01

Acq Tm: 17:39:09

512 x 512

STANDARD

L

P

DFOV: 47.9 x 47.9cm

Lumber

Random

HiSpeed CT/i
Ex: 20537

Se: 2/2
Im: 20/180
Ax: 195.0

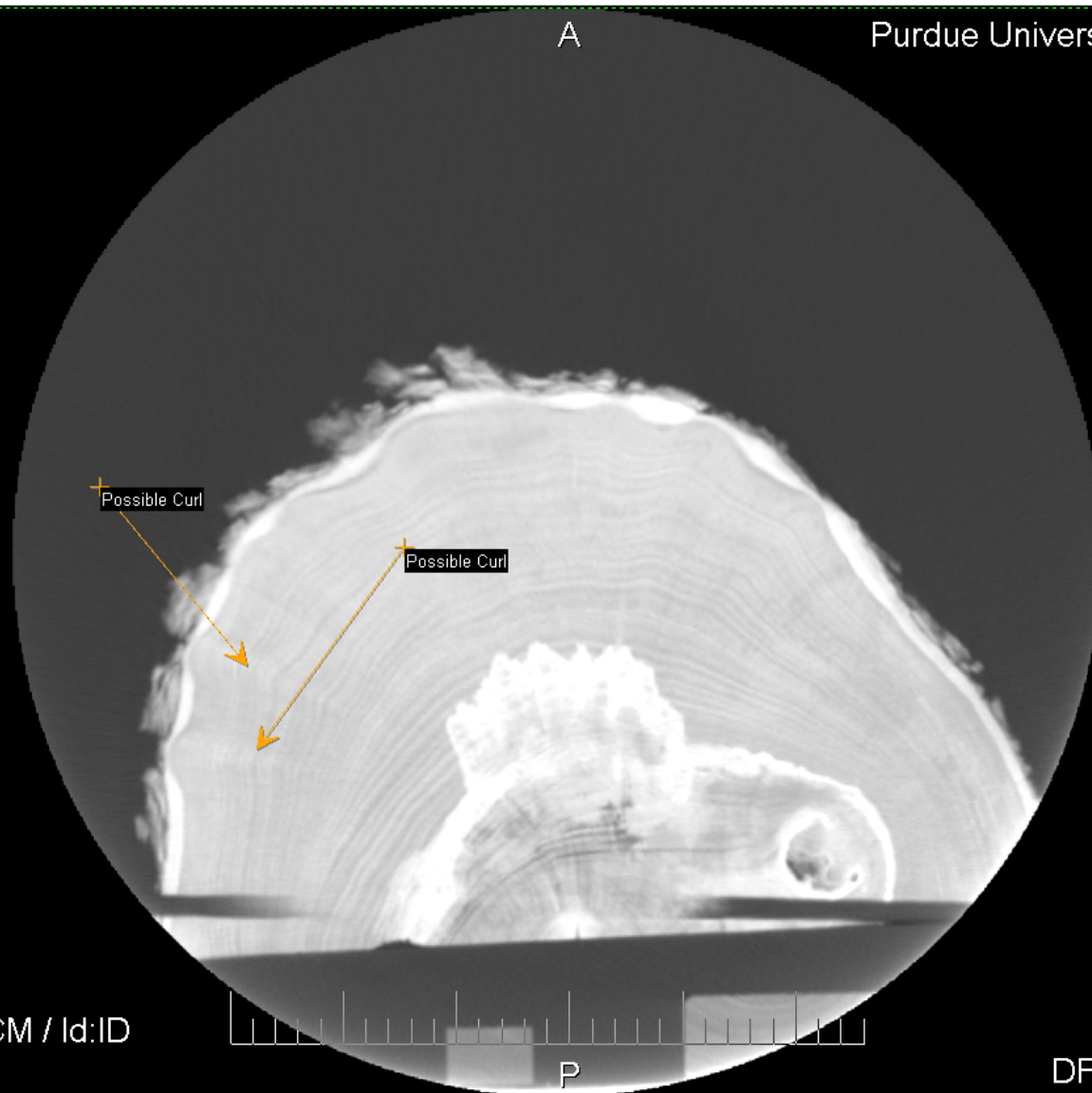
Mag: 1.6x

Purdue University at Pike Lumber
Hard Maple Burl
O HM-Burl
Acc:
2007 Jun 19
Acq Tm: 14:25:15

512 x 512
STANDARD

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



L

DFOV: 47.9 x 47.9cm

Curl

HiSpeed CT/i
Ex: 20537

Se: 2/2
Im: 20/180
Ax: 195.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

A

Purdue University at Pike Lumber
Hard Maple Burl
O HM-Burl
Acc:
2007 Jun 19
Acq Tm: 14:25:15

512 x 512
STANDARD

L

P

DFOV: 47.9 x 47.9cm

Curl

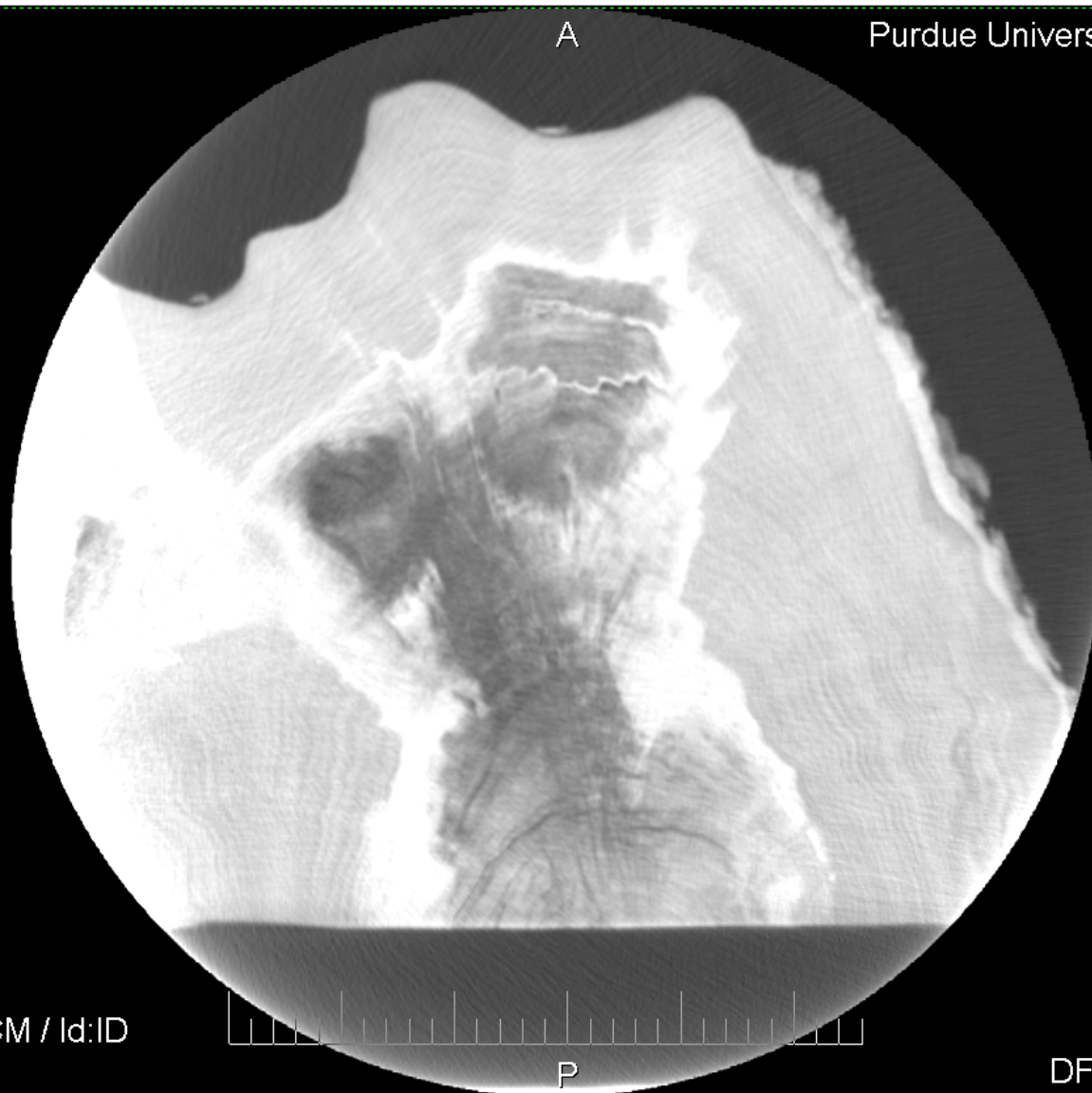
HiSpeed CT/i
Ex: 20537

Se: 2/2
Im: 55/180
Ax: 1270.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



Purdue University at Pike Lumber
Hard Maple Burl
O HM-Burl
Acc:
2007 Jun 19
Acq Tm: 14:25:15

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Spalting

HiSpeed CT/i
Ex: 24

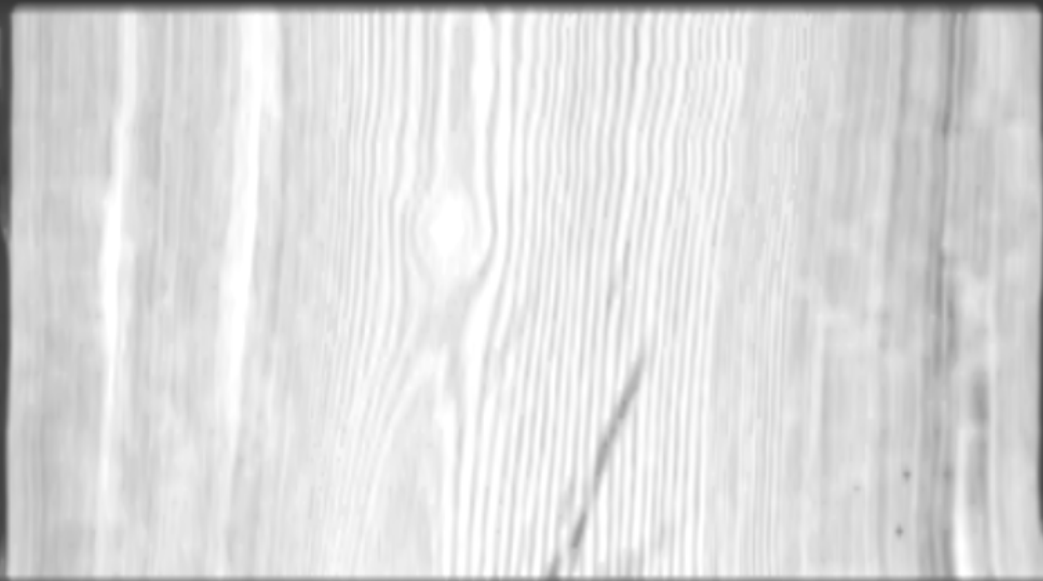
Se: 116/9
Im: 40/80
Cor: P31.4

Mag: 1.6x

R

120.0 kV
250.0 mA
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

S



HiSpeed CTi
OAK 1A
O 05-01-07-2
Acc:
2007 May 01
Acq Tm: 15:31:33

512 x 512
STANDARD

L

DFOV: 39.9 x 39.9cm

Oak Board

HiSpeed CT/i
Ex: 20536

Se: 2/2
Im: 69/240
Ax: 140.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

Purdue University at Pike Lumber
WalnutSycamoreBeechAsh
O SpeciesGallery

Acc:
2007 Jun 18
Acq Tm: 17:44:44

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Sycamore

HiSpeed CT/i
Ex: 20529

Se: 1/1
Im: 372/565
Ax: 155.0

Mag: 1.6x

R

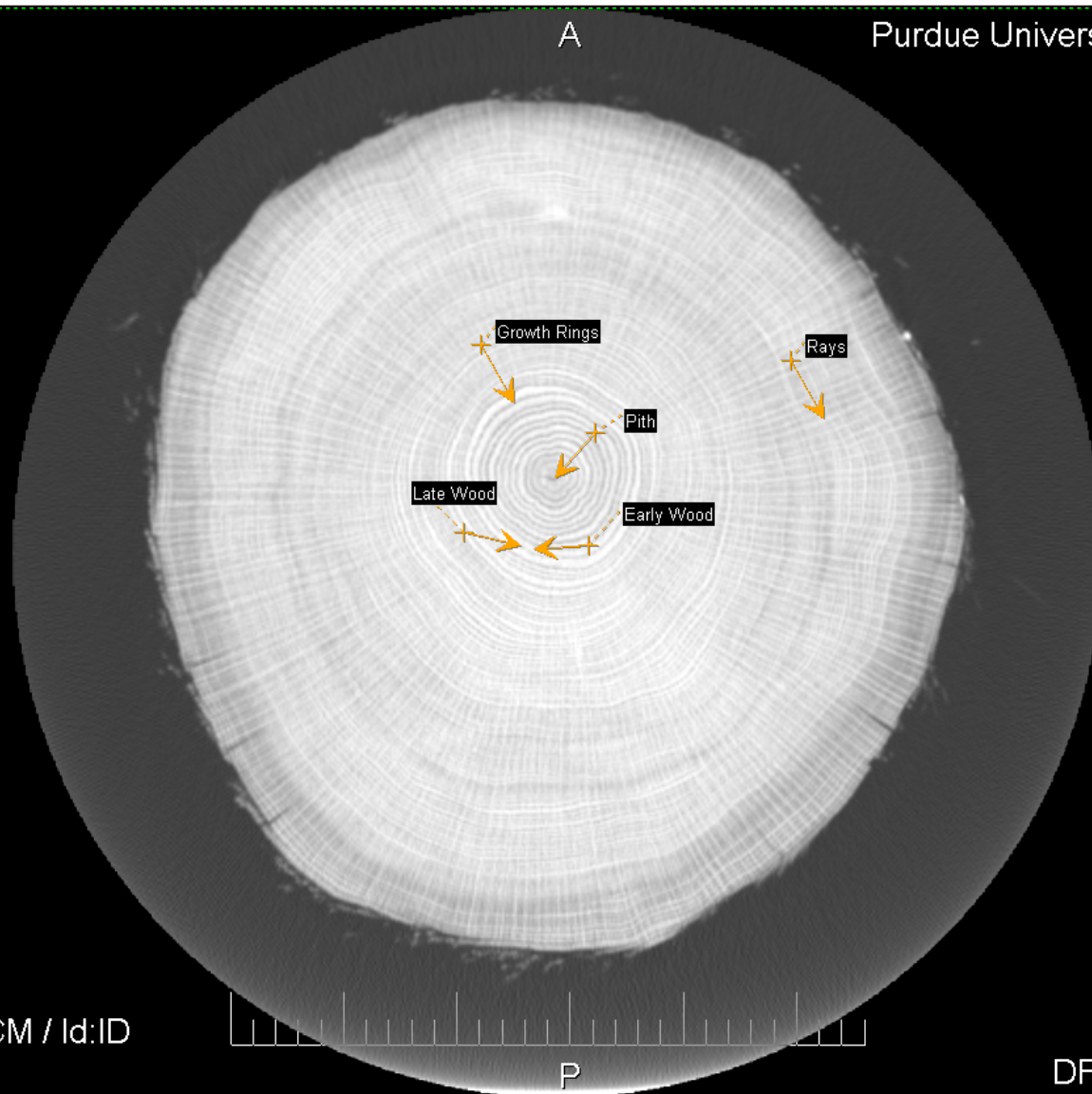
120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600

Purdue University at Pike Lumber
White Oak 14" 16'
O WO-81-3
Acc:
2007 Jun 14
Acq Tm: 14:47:19

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm



Features

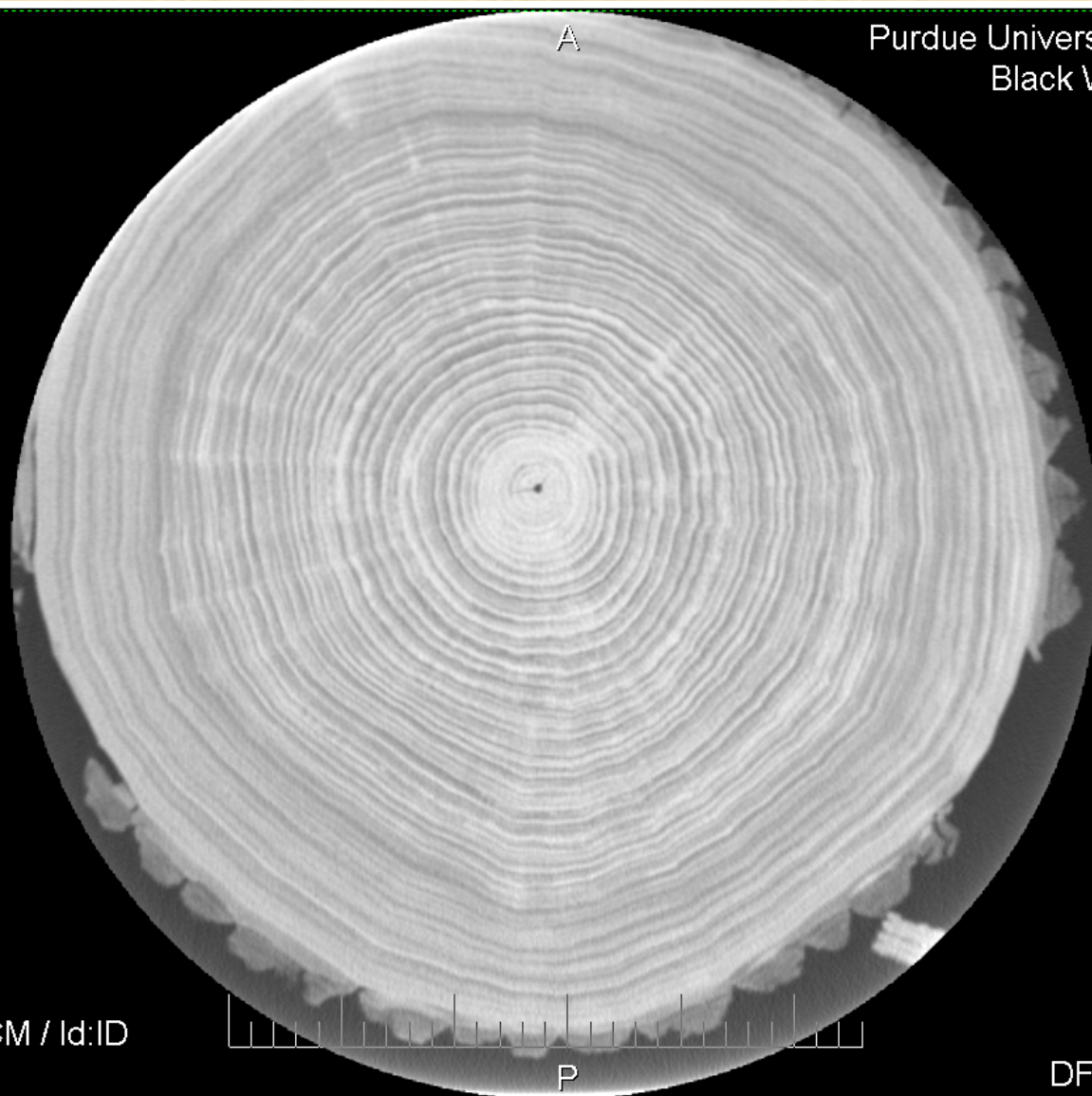
HiSpeed CT/i
Ex: 20538

Se: 3/3
Im: 347/600
Ax: 1230.0

Mag: 1.6x

R

120.0 kV
250.0 mA
5.0 mm/1.0:1
Tilt: 0.0
1.0 s
Lin:DCM / Lin:DCM / Id:ID
W:1500 L:-600



Purdue University at Pike Lumber
Black Walnut Veneer Log
O BW-V

Acc:
2007 Jun 19
Acq Tm: 17:14:31

512 x 512
STANDARD

L

DFOV: 47.9 x 47.9cm

Black Walnut