SCAN TECH 2008

TECHNOLOGY ADVANCES in STEM SCANNING and OPTIMIZATION

Presented by Dick Komori
Merchandizing Systems

Fibre Supply

ScanTECH 2008
Merchandizer Systems
Stem Infeed System
Merchandizing Systems

Merchandizer

[Image of a merchandizing system with multiple saws and logs]

MPM  Bucking  Log Sorting  Rotation  Primary  Pattern  Controls  Lumber Sorting
Merchandizing Systems

Merchandizer Outfeed
Merchandizer Systems
Scanning Configurations

- No Scanning - Manual Bucking
- Cut to Length Logs delivered to processing plant
- Single or Dual Axis Scanning
- True Shape 3D Scanning – Geometric Only
- Enhanced 3D Scanning – Gray Scale and Tracheid
- X-Ray Internal Scanning
Merchandizing Systems
Lineal Scanner Arrangements

X-Y Scanner Arrangement

True Shape 3D Scanner
Merchandizing Systems
Transverse Scanner Arrangements

X-Y Scanner Arrangement

True Shape 3D Scanner
Merchandizing Systems
Comparison of Value Recovery

Range of performances: 2.49$/m^3

<table>
<thead>
<tr>
<th>Conveyor and scanner combinations</th>
<th>Value (in $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect</td>
<td>115.36</td>
</tr>
<tr>
<td>Lineal - TS</td>
<td>114.84</td>
</tr>
<tr>
<td>Lineal - Part TS</td>
<td>113.33</td>
</tr>
<tr>
<td>Transverse - AIxY</td>
<td>113.22</td>
</tr>
<tr>
<td>Transverse - TS</td>
<td>112.86</td>
</tr>
<tr>
<td>Lineal - XY - TwoBanks</td>
<td>112.44</td>
</tr>
<tr>
<td>Transverse - TS OneBank</td>
<td>112.36</td>
</tr>
</tbody>
</table>
Profile Log Scanning

Scanner Systems for all Types of Logs Utilizing a Variety of Scanners
Profile Log Scanning

Scanner Manufacturers

- Hermary Opto HDS Shadow Scanner
- Hermary Opto DPS 4024 S2/VE – 3D Log Scanner
- LMI PL2000 Series 3D Log Scanner
- LMI L4 - Multiprofile Log Scanner
- SICK/IVP Ruler E 1200 3D Scanner
- ScanMeg Type D – Shadow Scanner
- ScanMeg – Profile Scanner
- Joe Scan JS-20 True shape Scanner
- Tree D T261 - Profile Scanner
Profile Log Scanning

OEM Scanner Manufacturers

- USNR Tri Cam – Laser Profile Scanner
- Microtec
- Sprecher
- Newnes McGehee – LPL True Shape Scanner
- Comact C1 Scan - True Shape Scanner
Profile Log Scanning

*Hermary Opto HDS*

HDS 050 High Definition Scanner Head

*Hermary Opto Electronics Inc.*

**Sensing Solutions**
Profile Log Scanning
True Shape (3D) Scanner System
Profile Log Scanning

DPS 4024 Laser Profile Scanner Head

Hermary Opto Electronics Inc.
Sensing Solutions
Profile Log Scanning
*Hermary Opto DPS 4024 Scanner*

- Co-planar optical geometry
- Dual Cameras and Dual Lasers for S2 version
- Point density of 3 to 5 mm around the log
- High Scan rate of up to 1000 Hertz
- Factory calibrated to a resolution of +/- 0.06mm
- Excellent ambient light immunity
- Visible laser (class 2 laser)
- Self contained in a compact rugged enclosure
- Upgradeable to add Gray Scale Data with VE option
DPS-4024VE  Type VE & S2

Laser 0 is used for two geometric images and Laser 1 is used for two greyscale images

DPS-4024S2

Both Laser 0 and Laser 1 are used for geometric scanning
Cat Face Occlusions
DPS Advantage
DPS LOG SPLIT DETECTION
Profile Log Scanning
SICK/IVP Ruler Scan Head
Profile Log Scanning
*SICK/IVP Ruler E 1200*

- Laser/Camera based Scanner
- Typical 500mm X 1550 mm Field of View
- High Scan rate of up to 2,000+ Hertz
- Factory calibrated to 0.40 mm
- Excellent ambient light immunity
- Visible laser (Class IIIb laser)
- Self contained in a compact rugged enclosure
- Upgradeable to add Gray Scale and Laser Scatter (Tracheid) Data
Profile Log Scanning
SICK/IVP Scanner Arrangement
Profile Log Scanning
SICK/IVP Scanner Frame
Profile Log Scanning
*IVP Ruler Enhanced Images*

- Gray Scale Image
- Laser Scatter (Tracheid Effect)
Profile Log Scanning

IVP Ruler Enhanced Images - Bark

Bark – Gray Scale Image
Profiles Log Scanning
LMI 2000 Series Scan Head

- Models PL 2010 / PL 2020 / 2040
- High Scan Rates 250hertz or 1000 hertz
- Dual Triangulation Cameras with Single Laser Line to Eliminate Shadowing Effect
- Gigabit Ethernet Communication
- Color Vision Sensors can be Added to Enhance Log Surface Feature Detection

DynaVision® SENSORS THAT SEE™
Profile Log Scanning
LMI 2000 Series Scan Head

DynaVision®
SENSORS THAT SEE™
Profile Log Scanning

LMI 2000 Series Scan Head
Profile Log Scanning

*LMI 2000 Series Scan Head*

![Image of Profile Log Scanning with LMI 2000 Series Scan Head]
Profile Log Scanning
JoeScan JS-20 Series Scan Head

- 200 hertz scan rate
- +/- 0.030” (0.75mm) resolution
- Visible Class IIIa Laser
- Laser is turned off whenever the scan conveyor is stopped
Profile Log Scanning
*JoeScan JS-20 Series Scan Head*
Profile Log Scanning

JoeScan JS-20 Series Scan Head
Profile Log Scanning

JoeScan JS-20 Series Scan Head
Log Bucking Optimizer

Greatly Increases Recovery by Determining Optimum Log Lengths
Log Bucking Optimizer

Optimization Features

- Product Fit Value based Optimization
- Optimization based on the Bucking system capabilities. (Fixed or Shifting Saws)
- Optimization based on Primary Breakdown Machinery Capabilities and Capacities
- Graphical User Interface for Display and Setup
- Reoptimization for Analysis and Troubleshooting
- Production Reports
Log Bucking Optimizer

*Enhanced Optimization Feature*

- Limit Product Fit of Lumber Products based on the Log Quality
- Optimization for Posts and Utility Poles
- Optimization for Plywood Blocks
- Optimization for Speciality Products
Log Bucking Optimizer

Typical Solution Display
Log Bucking Optimizer

Cat Face Detection
Log Bucking Optimizer

Optimized Solution with Grading
Log Bucking Optimizer

Optimization of Defects

- Bark Thickness Allowance
- Butt Flare
- Pistol Butts
- Sweep and Crook
- Broken Ends
- Defects
- Cat Face
- Nodal Swelling
Log Bucking Optimizer

Defects

Cutplan Properties

Options:
- Bunk
- Flop
- Broken end
- Polyp gap
- Defect
- Grading
- Nominal lengths
- Splits costs
- Breakdown machines
- ChipNGain

Enable detect detection

Detection:
- Minimum length from log end: 0.090 in
- Maximum length from log end: 3.000 in
- Detection diameter ranges:
  - From (in): 1.000
  - To (in): 3.500
  - Excessive: 3.000

Maximum number of defects per item: 3
Minimum length between defects: 18.000 in
Maximum minor defect score offset: 0.000 in

Resolution:
- Minimum ten length: 4.000 in
- Maximum ten length: 50.000 in

Help  OK  Cancel
Wood-X CT System
X-ray Computer Tomography System for Grading Logs, Timber and Boards

Courtsey of Dr. Antti Kari
© Copyright Bintec Oy
BINTEC - History

- Product Development from 1989 to 1994
- Trial Installations from 1995 to 1999
- First Installation sold in 2002
- Currently six (6) systems in operation with a 7th on order
- Feed Speeds to 240 m/min
- Log Diameters up to 500mm
- Spruce, Pine and Birch
Bintec – Four (4) Direction Xray
Bintec - Schematic of Scan Zone
Which Features should be measured?

Examples:
- Quality of knot groups
- Nails
- Diameters
- Year rings
- Stones
- Density
- Quality of knot groups

All Features: See Fig. 7
Visibility of Features
How many directions? 1-2 or 4

Fig. 1: One direction
These will be seen as equal size, cover each other

Fig. 2: Four directions

X-ray tube
Bintec - Visualization

Visualization of Features based on real measured data
Note quality of knots
## Bintec - Accuracy and Reliability

<table>
<thead>
<tr>
<th>Features</th>
<th>Accuracy (225 kV system)</th>
<th>4D</th>
<th>2D</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ID of Butt, Middle or Top Log</td>
<td>based on specified features</td>
<td>&gt;95%</td>
<td>*</td>
</tr>
<tr>
<td>• ID of Log by Log</td>
<td>based on specified features</td>
<td>&gt;95%</td>
<td>*</td>
</tr>
<tr>
<td>• Diameter under bark</td>
<td>+/-1-1.5 mm</td>
<td>&gt;95%</td>
<td>70%</td>
</tr>
<tr>
<td>• Diameter of the heartwood</td>
<td>+/- 2 mm</td>
<td>&gt;95%</td>
<td>*</td>
</tr>
<tr>
<td>• Number of knot clusters</td>
<td>+/- 0</td>
<td>&gt;95%</td>
<td>85%</td>
</tr>
<tr>
<td>• Distance of the knot clusters</td>
<td>+/- 3-5 mm</td>
<td>&gt;95%</td>
<td>85%</td>
</tr>
<tr>
<td>• Knotless surface quality</td>
<td>0 - 10, worst/best</td>
<td>&gt;95%</td>
<td>*</td>
</tr>
<tr>
<td>• Knot volume</td>
<td>+/- 5 %</td>
<td>&gt;90%</td>
<td>*</td>
</tr>
<tr>
<td>• Knot volume in sectors, min/max</td>
<td>4 x 90°</td>
<td>&gt;90%</td>
<td>*</td>
</tr>
<tr>
<td>• Quality of knot clusters</td>
<td>0 - 10, worst/best</td>
<td>&gt;95%</td>
<td>*</td>
</tr>
<tr>
<td>• Ingrowth knots</td>
<td>position in length</td>
<td>&gt;90%</td>
<td>*</td>
</tr>
<tr>
<td>• Ring width</td>
<td>+/- 1-1.5 mm</td>
<td>&gt;90%</td>
<td>*</td>
</tr>
<tr>
<td>• Density</td>
<td>+/- 5 %</td>
<td>&gt;95%</td>
<td>*</td>
</tr>
<tr>
<td>• Strength grading parameters</td>
<td>f (knots, ring width, density)</td>
<td>&gt;95%</td>
<td>*</td>
</tr>
<tr>
<td>• Compression wood</td>
<td>position in length</td>
<td>&gt;80%</td>
<td>*</td>
</tr>
<tr>
<td>• Slope of grain</td>
<td>position in length</td>
<td>&gt;80%</td>
<td>*</td>
</tr>
<tr>
<td>• Pitch</td>
<td>position in length</td>
<td>&gt;90%</td>
<td>*</td>
</tr>
<tr>
<td>• Resin pockets</td>
<td>resin</td>
<td>&gt;85%</td>
<td>*</td>
</tr>
<tr>
<td>• Foreign objects</td>
<td>stones, metals</td>
<td>&gt;85%</td>
<td>*</td>
</tr>
<tr>
<td>• Rot</td>
<td>volume/rate</td>
<td>&gt;80%</td>
<td>*</td>
</tr>
<tr>
<td>• Cracks (open), depth and length</td>
<td>width &gt; 3 mm</td>
<td>&gt;80%</td>
<td>*</td>
</tr>
<tr>
<td>• Pine, spruce, birch</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Technical accuracy for all measuring +/- 1 mm

*) Measuring unreliable because of too few directions
Bintec – Log Grading Installation

OUTFEED CONVEYOR

OPERATOR BOOTH

INFEED CONVEYOR

AIR CONDITIONED BUILDING HOUSING BINTEC XGT AND GEOMETRIC SCANNERS
What Our Customers Say

• "The most modern and most efficient log grading technology in the world”

• "The productivity of our sawmill has improved by 10 %”

• "We are able to grade reliably up to 15 000 logs per shift”

• "Due to increased product quality our customers obtain the same output with 25-30% less lumber”
How can Computer Tomography system benefit your operation?

• What feature do you want to measure and how accurately?

• How reliable should the measuring feature by feature be?

=> Technical Measuring Accuracy and Need of Amount of Measuring Directions
Breakdown Optimization Modeling

Forintek's Sawing Optimization Model Optitek® has been adapted to consider internal defects in solutions.
Knot Data Collection Method
Sample Stems and Logs
### Summary

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Lumber volume, fbm/stem</th>
<th>Value recovery, $/stem, as % of Future X-ray</th>
<th>Optimum bucking solutions, ft Segm. 1,2,3,4, . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future X-ray (All knots are detected)</td>
<td>127.33</td>
<td>45.12 100%</td>
<td>12, 12, 14, 12</td>
</tr>
<tr>
<td>Current (Only external shape is scanned)</td>
<td>125.33</td>
<td>43.22 95.8%</td>
<td>12, 20, 16</td>
</tr>
<tr>
<td>X-Ray (A subset of knots are detected by the scanner)</td>
<td>127.33</td>
<td>45.05 99.8%</td>
<td>12, 12, 14, 12</td>
</tr>
</tbody>
</table>
Future CT X-Ray Images