Presentation for
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Developments in Scanning Technologies & Future Opportunities

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Scanning Overview:

- Laser Scanning:
  - Type (lines, dots)
  - Density
  - Speed
- Vision
- Other methods
Future Opportunities:

- Log Scanning
  - Speed
  - Vision Applications

- Board Scanning:
  - Speed
  - Vision Applications

- Other methods

Laser Scanning: Lines

Successive scans build the 3D log profiles.

Line based scanning use area cameras to view the complete line in the Field of View (FOV)
Laser Scanning: Lines

**Advantages**
- Higher Density Scanning (Density is based on the camera)

**Disadvantages**
- Higher power lasers required (80 – 100 mW vs 7 – 15 mW)
- Loss of one laser loses all the scan area for that laser.
- The laser power along the line cannot change to adjust for darker or lighter areas on the wood surface.
- Needs more complex camera technology; More difficult to achieve higher speeds.
- Lower scan rates (typically 60 Hz to 400 Hz)

**What’s New?**
- **Solid State** is the only way to go.
  Small size, longer life (lower heat), industry advancements
- Increases in power (80–100 mW vs 30-50 mW)
  detect darker wood or larger scan areas
- Increases in reliability and life
  Production of high powered lasers is millions per month

= higher reliability @ same or lower cost
5 years ++ is not unusual
Laser Scanning: Lines

What’s New? (cont’d)

• More wavelengths (635 nM visible is common)

  Red @ 630 – 685 nM -> Today’s CD/DVD players
  Blue @ 800 – 900 nM -> Tomorrow’s DVD players
  Green @ 510 – 570 nM

  = more wood characteristics to detect
  • highlight grain features
  • highlight rot, resin
  • stain (blue stain in Canada…)

Laser Scanning: Dots

3” Scan increments, Binocular Vision

1” Scan increments
Laser Scanning: Dots

• **Advantages**
  
  • Each laser’s power can be increased / decreased to adjust for the darker and lighter areas on the wood.
  
  • Very high scan rates can be achieved (2000 to 4000 Hz+ vs 200 to 1000 Hz)
  
  • Loss of a single laser dot is not as significant as a laser line.

• **Disadvantages**
  
  • Lower density scanning (3”, 1” vs line)

**What’s New?**

• *Solid State* has been available for years.

• Increases in power (30 – 100 mW vs 5 - 7 mW) detect darker wood or larger scan areas

• Increases in reliability and life
  
  Production of high powered lasers is millions per month

  = higher reliability @ same or lower cost

  5 years ++ is not unusual
Laser Scanning: Dots

• What’s New? (cont’d)

• More wavelengths (635 nM visible is common)
  - Red @ 630 – 685 nM -> Today’s CD/DVD players
  - Blue @ 800 – 900 nM -> Tomorrow’s DVD players
  - Green @ 510 – 570 nM

= finer shape / edge detection

Note the laser dot sizes.
Laser Scanning: Multiple Dots / Laser

**Advantages**
- Higher Density Scanning
- High scan rates can be achieved (2000 to 4000 Hz)

**Disadvantages**
- Higher power lasers required (80 – 100 mW vs 7 – 15 mW)
- Loss of one laser loses all the scan area.
- The laser power along the line cannot change to adjust for darker or lighter areas on the wood surface.

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Laser Scanning: Speed

**Line Laser Scanning**
Primary log lines are up to 750+ FPM / (225+ MPM)

To achieve a high Density profile along the log every:
- 1" requires a scan speed of 150 Hz
- ¼" requires a scan speed of 600 Hz
- 1 cm requires a scan speed of 225 Hz
- 0.5 cm requires a scan speed of 450 Hz

Why? …
Laser Scanning: Speed

• Line Laser Scanning

Why High Speed?

• detect knot shapes to improve cutting patterns
• detect knots to predict projection into the log toward the pith
• isolate areas of interest

What’s New?

• Log Infeeds

Continuous rotation and verification at 600 FPM moving to 750 FPM

Double Length Infeed at 600 FPM
What is Vision for Wood?

The use of digital cameras to capture images of the wood surface.

Why?

3D profile based optimization systems (Edgers/Trimmers) are achieving 98% recovery, what is left?

Added value to a cutting decision…

Ponderosa Pine (May 12 / 06 Random Lengths report)

Simple example:

Without Vision:

\[(1\times 4 - 16') \times 2\ & Btr + (1\times 6 - 16') \times 2\ & Btr = (12.8\text{bf}) = $2.64 + $4.64 = $7.28\]

With Vision:

\[(1\times 4 - 16') \times C\ & Btr + (1\times 6 - 16') \times 2\ & Btr = (12.8\text{bf}) = $7.01 + $4.64 = $11.65\]

Result = same board footage with a 160% increased value.

Assuming total production of 100,000 Bf/day or 20 MMBf / year; with 10% of Bf being improvement in value = 2 MMBf / year at increase of $820/Mbf = $1,640,000 per year.
Scanning: Vision

• How?

With the advancement in digital technology, digital vision sensors have …

• faster scan rates with
  • more information (i.e. more pixels)
  • more speed of data output

Advances in cameras have moved the whole industry forward.
(How many pixels is your current camera? 4, 6, 8 or the latest 12 Megapixels)

Scanning: Vision

• Advantages

  • Detect surface characteristics including knots, grain, stain.
  • Works together with other technologies to add value.

• Disadvantages

  • Large amounts of data to move and analyze. Solved through advancements such as Gigabit Ethernet, higher speed processors and multiple processors.

• Caution

  • Vision is a tool that is only as good as the optimization software. Understand the scope of what the complete system will provide.
Scanning: Vision

• **What’s New?**
  - Megapixel detectors = more detailed images
  - Higher speed and techniques to get the images off of the detectors = faster scanning
  - Larger dynamic range = better images over larger color ranges

• **Examples:**
  The good news:
  Vision is adding value to systems today.
  
  - Black & White images
  - Colour images
    - Sound Knot
    - Dry Knot
    - Encased
    - Blue Stain (Colour required)
  - ScanTech 2006

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Scanning: L.E.D.s

(L)ight (E)mitting (D)iodes …

**What’s New?**

- **Solid State** is becoming mainstream.
- High Power, Long Life, cooler operation, 85% less energy
- Many applications in industry and commercial uses.

**LightSORT™** is based on cutting-edge CCD camera and LED light-transmission technologies. The system pulses a specific LED light wave through the veneer. A highly sensitive CCD camera gathers the wave, which is then transferred through complex algorithms that determine the exact peak and average moisture content of each sheet — no matter what saturation, species and thickness. In basic terms: the higher the moisture content, the more light that passes through.
Scanning: Other

• **Tracheid**
  - The effect of the laser line of dot changing shape along the wood grain lines.
  - Adds to the information available together with vision.
  - Has been available for over 10 years.
  - Good for softwood; more difficult for hardwood
  - Can assist to verify characteristics; knots, grain direction

• **X-Ray**
  - Works by measuring the strength of x-rays passing through the wood.
  - Adds to the information available together with vision
  - Course detection area
  - Limited in speed on response
  - High moisture content can limit response
  - Log scanning from two companies
  - Board scanning from several companies
  - Safety > must be cautious; similar to airport scanners.
Scanning: Other

- **CT scanning**
  - Incredible detail but still in the lab
  - Too slow and complex for inline scanning
3D Log Scanning for Carriages, C-Frame, Sharp Chains Optimizers

- **1' profiles** using lasers lines for true 3D measurement.
- **Fast 16 ms scan rate** on all lasers in the system for fast synchronize snapshot profiles.
- **Fast 16 ms scanning** on all lasers can rapidly output a 3D profiles for a complete log scan on the fly.
- **Multiplexed sensors** allow for two sides scanning (front and back) scanning of the log on the carriage or C-frame.
- **4’ modules** for 8’ to 24’ single or double row systems with the same sensors.
Profile+Scan™ Products

- **PL2000** High Speed Lineal Log Scanner.
- **PL2500** Very High Speed Lineal Log Scanner

Chroma+Scan™ Products

- **CM3000** High Speed Transverse Board Scanner.

Profile+Scan™ PL2000/2500 benefits

- **Performance:**
  - High scan speeds for the needs of high production mills.
  - Highly Accurate 3D profiles for optimum log solutions. For example, log infeeds speeds of 800 fpm will provide 3D profiles every ¼" at 700 Hz and every 1/8" at 1400 Hz scan rate.

- **Data Reliability:**
  - Dual Triangulation cameras for an unobstructed view. The sensor is not blocked by the log flights on the infeed chain.

- **System Reliability:**
  - A single cable for power, data and sync signals to each sensor. All cable ends are environmentally sealed.
Profile+Scan™
PL2000/2500 benefits (con’d)

- **Ease of Installation /Use**
  - FireSync™ cables connect from the scanner hub to each sensor.
  - Easy system calibration functions built into the system. Full video back to the host for diagnostics and installation.
  - Gigabit Ethernet output to your host.
  - Complete 3D visualization of the log profile, in real time.

ScanTech 2006
Chroma+Scan™
CM3000

Multiple Scanning Functions in one head:

- True Color Vision +
- Light Curtain Profile +
- High Density 3D Profile
- Gigabit Ethernet output

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Summary:

In general, the wood industry needs to get more VALUE out of the same resources to be competitive.

Advances in scanning including higher speeds, more data, vision and other technologies COMBINE to achieve this higher value.

All with more

• performance,
• higher reliability resulting in …
• more value and faster payback.