

Development of a Log Scanner Best Practice Guideline



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Overview

- Objectives
- Background
- Description of study
- Results
- Conclusions/Recommendations



Objectives

- Determine who uses log scanners in Australia, what types of log scanners are used and how they are being used
- Determine the level of precision used for log scanner measurements and checks and calibrations, and the methods and frequency used to perform the checks and calibrations
- Propose a framework for an Australian log scanner best practice guideline

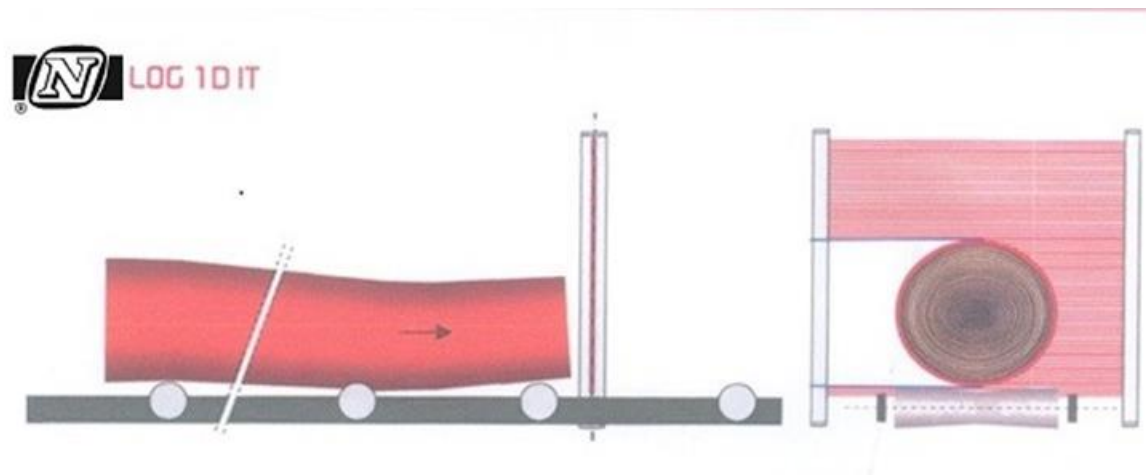
Background

- Log scanner
 - types
 - uses
 - accuracy
 - calibration

Types of log scanner

- Optical scanners
 - 1D
 - 2D
 - 3D
- X-ray scanners

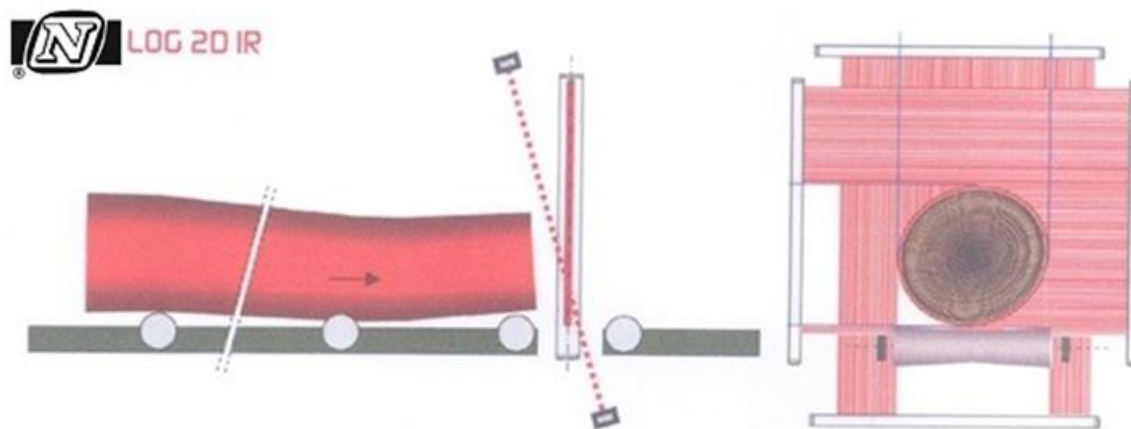
1D log scanners



www.nukor.co.za

Shadow scanner

2D log scanners



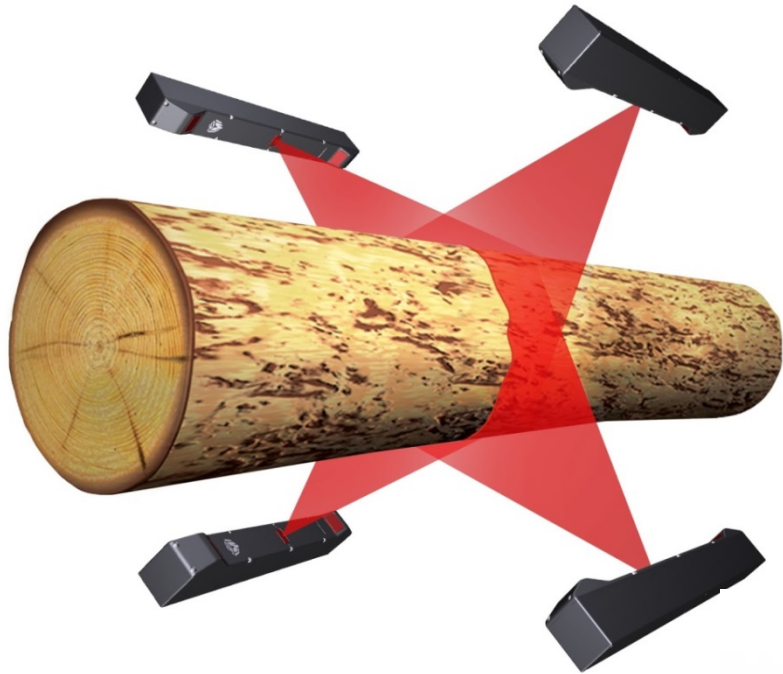
www.nukor.co.za

Shadow scanner

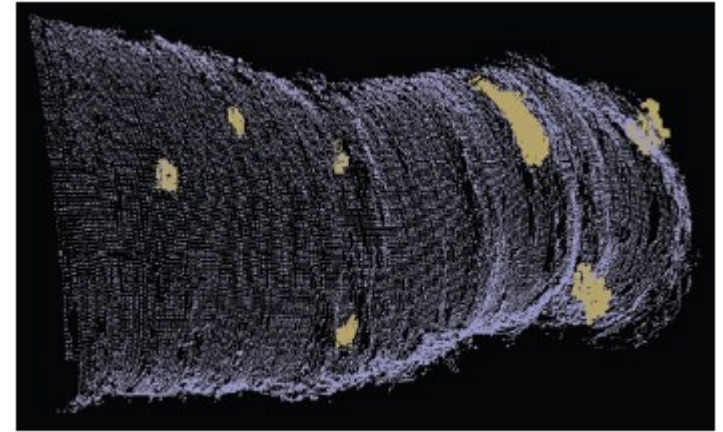


2D laser scanner

3D laser log scanners

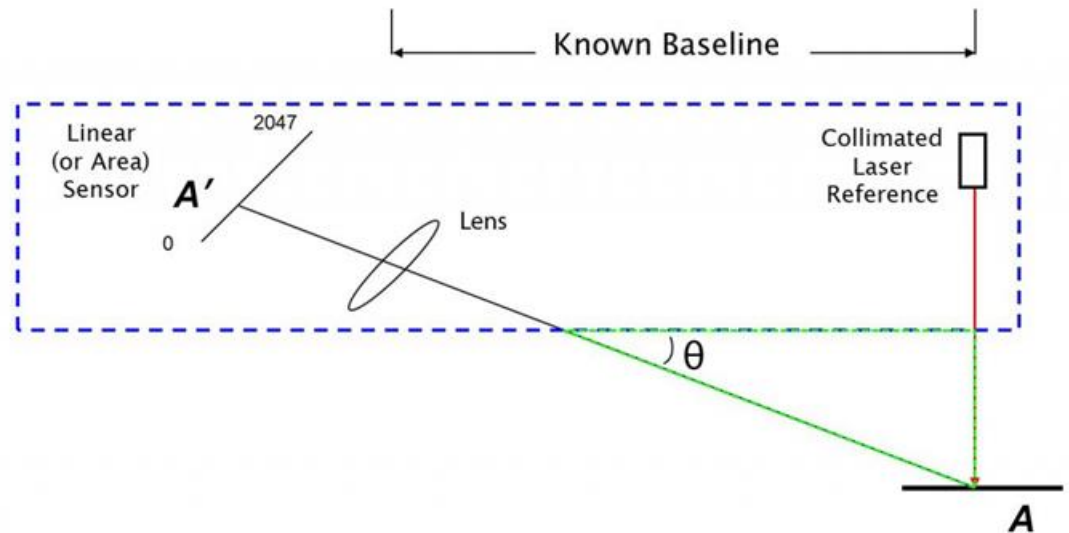


marketing.lmi3d.com



RAW LOG DATA

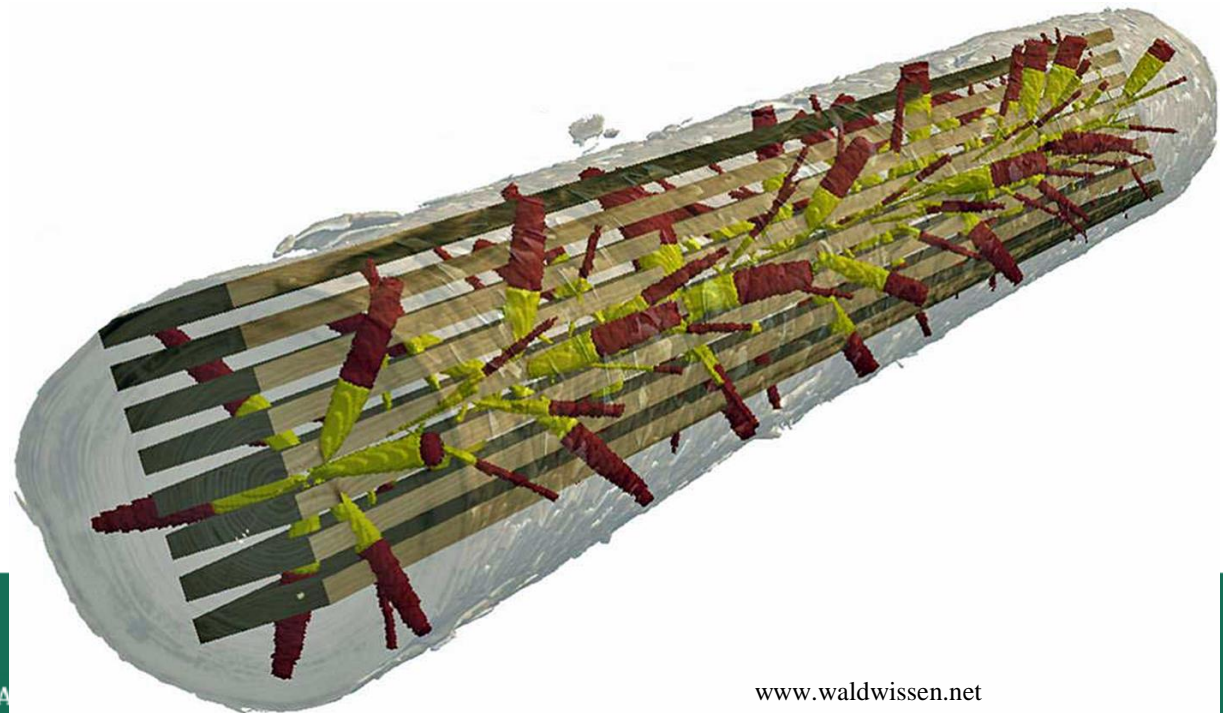
www.portereng.com



www.hermarmachinevision.com

X-ray log scanners

- X ray scanner
 - detect internal log features such as knots, decay, heartwood and foreign objects



Other log scanners

- Multispectral scanner – external defect detection
- Microwave scanner – internal features
- Acoustic scanner – log stiffness

Uses of log scanners

- Determine cutting pattern to maximise value (or volume) recovery
- Determine log grade
- Sorting logs into size classes
- Volume/price determination

Log scanner accuracy - 1

Theoretical accuracy of 3D log scanner measurements is $\pm 1-2$ mm for diameter and $\pm 10-20$ mm for length.

Measurement of diameter of 825 debarked *Picea abies* logs

Scanner type	Standard Error (mm)
1D	6
2D	3
3D	1

Cause of the differences was stem ovality



Log scanner accuracy - 2

Trial of 62 logs comparing manual and 3D scanner measurements

Measurement	Range	Maximum difference (cm)
Length	94% were within ± 5 cm	8
Diameter	98% were within ± 2 cm	3

Dyson, P. (2013) Log scanning trials: progress by Measurement Canada and the Canadian Standards Association (CSA) Technical Committee on Scaling on using scanners for scaling. Presented at the Timber Measurement Society Meeting, Bellingham Washington 10-12 April, 2013.

Calibration

- How are scanners calibrated?
 - Regular object, usually a pipe
 - Generally plastic but can be metal
- Why not use logs?
 - Difficult to compare manual and scanner measurements, particularly of diameter

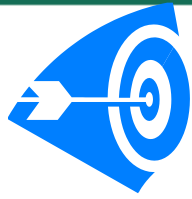


Study description

- Methodology
- Target groups
- Organisations contacted
- Conducting the survey

Study methodology

- Online survey
 - Ease of setup
 - Anonymous
 - Participants could start and stop survey
- Questions determined in consultation with an Industry steering committee



Target groups

- Two groups were targeted:
 - Sawmills and veneer plants with a capacity greater than 25,000 m³/year
 - Forest growers who were likely to have customers using log scanners.



List of mill owners contacted

Organisation	Location
AKD Softwoods	Colac
Australian Sustainable Hardwoods	Heyfield
AusWest Timbers	Bairnsdale
Carter Holt Harvey	Caboolture
Carter Holt Harvey	Morwell
Carter Holt Harvey	Mt. Gambier
Carter Holt Harvey	Myrtleford
Carter Holt Harvey	Tumut
Carter Holt Harvey	Yarram
D&R Henderson	Benalla
Dongwha Timbers	Bombala
Highland Pine Products	Oberon
Hyne Frame	Tuan
Hyne Frame	Tumbarumba
Mareeba Softwoods	Mareeba
Neville Smith Forest Products	Southwood
NF McDonnell	Mt. Gambier
SA Pine Pty Ltd	Kuitpo
Superior Wood	Imbil
Ta Ann	Southwood
Timber Marshalling Services	Yeppoon
Timberlink	Bell Bay
Timberlink	Tarpeena
Wespine	Dardanup
Whitehead TS	Mt. Gambier

List of forest growers contacted

Organisation

Forest Products Commission, WA

Forestry Corporation NSW

Forestry Tasmania

ForestrySA/One Forty One

Green Triangle Forest Products

Hancock Queensland Plantations

Hancocks Victorian Plantations

Timberlands Pacific

VicForests



Conducting survey

- Potential participants selected using:
 - AFORA/Steering committee contacts
 - LinkedIn/Company website information
- Emails/LinkedIn messages sent briefly explaining the purpose of the survey and with a link to the survey
- Participants given 2 weeks with a reminder near the end of that time

Study results

- Proportion of mills with a log scanner
- Types of scanner being used
- How were the scanners being used

Number of respondents



Target group	Responses	Percentage response
Sawmills and veneer mills	13 full, 1 partial	52% (56% incl. the partial response)
Forest growers	6 full, 1 partial	67% (78% incl. the partial response)

Log Scanner Numbers

Scanner type	Number of scanners
2D	3
3D	5
2D & 3D	1
2D & 3D & X-ray	2
Total	11

- Most responding mills use a log scanner (3 did not).
- No mills reported having a 1D scanner
- The majority of scanners reported were 3D scanners

Uses of Log Scanners

- Determine log value
 - 5 scanners, all 3D scanners
- Log quality (3D scanners)
 - Sweep (all), taper (several), ovality (one)
- Contractor payments

Log scanner accuracy

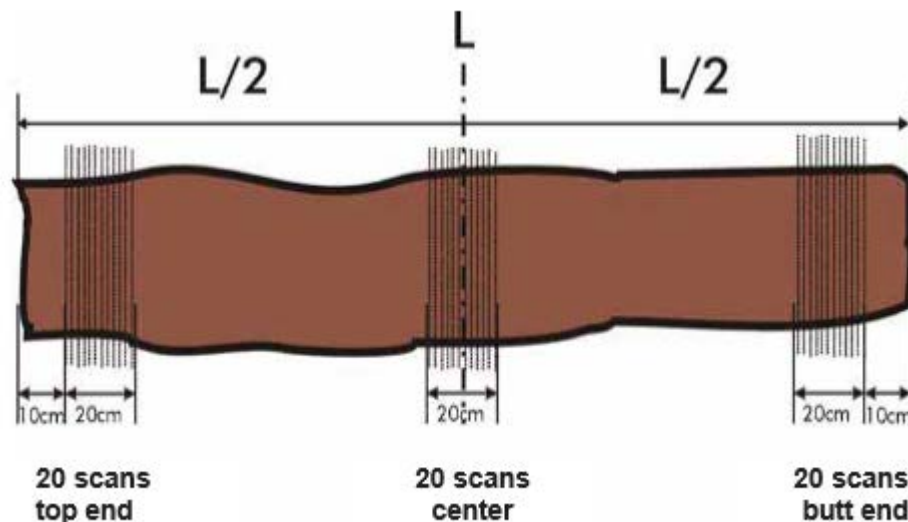
Trial at the Wespine sawmill of 15 radiata pine logs comparing manual and 3D scanner measurements

Measurement	Range	Maximum difference (cm)
Length	70% were within ± 3 cm	10
Diameter	80% were within ± 1 cm	1.8

- A previous trial found up to 9 cm difference in manual length measurements between sides of radiata pine logs
- Manual diameter measurements were taken with a d-tape

Volume estimation

- “Real” volume vs modelled volume (Hubers, Smalians, Newtons)
- Measured length vs. length class
- Diameter – where measured?



Calibration/measurement precision

Level of precision	Number of survey respondents			
	Measurement		Calibration	
	Length	Diameter	Length	Diameter
0.1 mm	-	3	-	3
mm	4	5	2	5
cm	6	1	7	2
Other	<2% variation over 3 test logs	<ul style="list-style-type: none"> • 5 mm • <2% variation over 10 test logs 	<ul style="list-style-type: none"> • 25 mm • <0.25% variation 	<0.25% variation

No consistency in frequency of check measurements and calibrations

Other issues

- How to price logs if the scanner fails?
 - Weighbridge + weight to volume conversion
- Tracking logs from delivery to scanner
 - to facilitate grower payments
- Reconciling log scanner measurements
 - Against harvester or logyard measurements

Conclusions

- Majority of respondents used a log scanner
- Majority of scanners used were 3D, closely followed by 2D
- Less than half of the respondents used their log scanner to value logs and in all cases 3D scanners were used
- For companies using their scanner measurements for log payments there was a range of responses about:
 - What log measurements were made
 - How volume was calculated
 - How log quality was assessed
- Check measurements and calibrations varied between companies in terms of:
 - How they were performed
 - How frequently they occurred
 - Acceptable precision levels

Log Scanner best practice guideline

- Minimum levels of precision for length, diameter and volume accuracy?
- What instruments should be used to conduct the accuracy/precision testing? E.g. steel or fibreglass tape, diameter tape, callipers or steel ruler.
- What dimensions and construction material should be used for test objects?
- What are the measurement check and calibration procedures?
- How frequently should measurement checks and calibrations occur?
- What fallback procedures would be put in place if the log scanner was not working?
- What data is to be supplied about scanner calibration/verification results to forest growers?

Acknowledgements

We acknowledge the:

- assistance and guidance of the Project Steering Committee (Islay Robertson HQ Plantations, Phil Lloyd Timberlink Australia, Shane Robertson Hyne Timber, Darrell Clark Timberlands Pacific).
- survey respondents.
- financial support from FWPA and the assistance of Wespine Industries P/L.



Thank-you

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