Minimising growth-strain to improve processing

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Growth-strain

- Distortion and splitting of logs
- Low recovery
- Plantation eucalyptus only grown for low value chip market

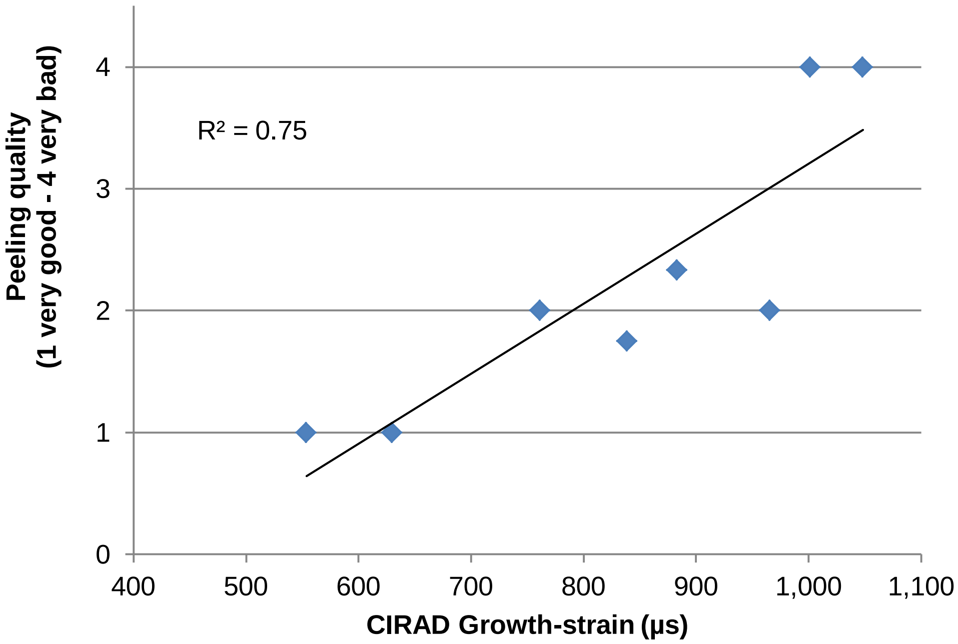
Peeling trial

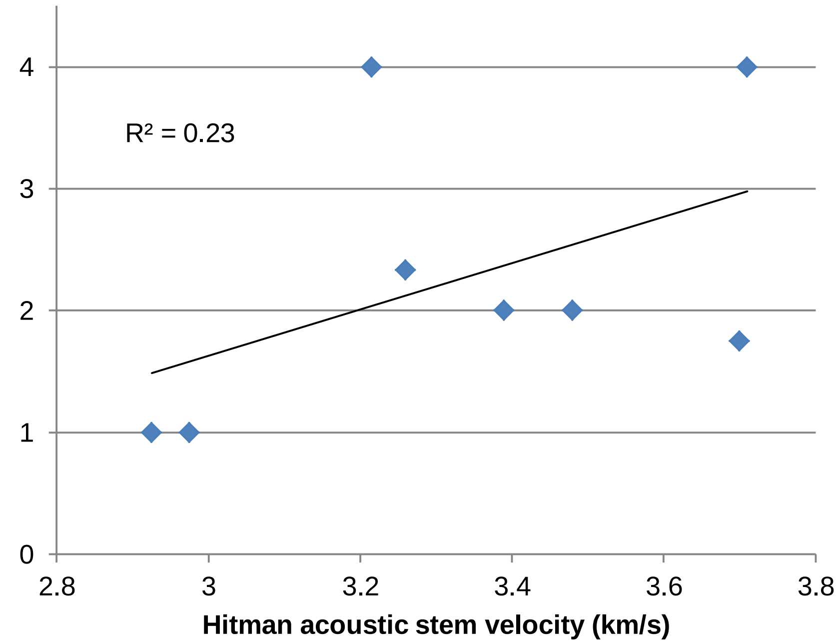
10 trees (26 logs) 30-year old *E. globoidea*

- Some logs yielded quality veneer
- Veneer from other logs showed splitting

Cause of veneer splitting

- Peeling quality correlated to growth-strain **not** acoustic velocity (MoE)





Reducing growth-strain

Breeding

- Will solve/reduce problem permeantly
- Only for the future resource

Segregation

- Segregating (low growth strain) logs suitable for solid wood processing from the chip resource
- For existing resource and potentially to identify problem logs in future resource
- Technology does not currently exist (non-destructive, fast and robust)

Processing

Reducing processing by heat, microwave or other treatment
→ ongoing cost, never made work economically

Obstacle

Measurement

- Releasing surface strains & assessing with strain-gauges
- 30 min per tree
- Destructive

Breeding

- Need to assess 10,000s of trees
- **Fast**, cheap

Segregation

- **Non-destructive**, fast

Breeding

SFF ‘Minimising growth-strain to improve processing’

Partners throughout the wood chain

- seed producers, nurseries, small &large growers, processors, end-users, state, university

Screening NZDFI breeding population for growth-strain

- *E. bosistoana*; *E. argophloia*; *E. tricarpa*; *E. quadrangulata*
- >300 families / ~20,000 trees

Establish improved breeding population via rooting of cuttings

- Possible early deployment of improved material


Splitting test

- Developed over the last 6 years
- Rapid test of growth-strain
- Direct assessment of the problem not indirectly a cause (i.e. surface growth-strain)
- Works in a breeding programme

Process

Heritability

81 families; 4032 trees

	Strain	Diameter	Density	Stiffness	Vol. shrinkage	Height	Ac. vel.
Growth-strain	0.24						
Diameter		0.58					
Density			0.67				
Stiffness				0.71			
Vol. shrinkage					0.40		
Height						0.72	
Ac. vel.							0.76

Correlations

	Strain	Diameter	Density	Stiffness	Vol. shrinkage	Height	Ac. vel.
Growth-strain	0.24	**0.00**	-0.09	**0.40**	-0.06	0.10	0.51
Diameter		0.58	-0.24	-0.28	-0.20	0.93	-0.21
Density			0.67	0.46	0.19	-0.17	0.14
Stiffness				0.71	-0.06	-0.15	0.94
Vol. shrinkage					0.40	-0.35	-0.16
Height						0.72	-0.08
Ac. vel.							0.76

Expected gain

New breeding population:

- Top 25 % - keeping broad genetic base (within-family selection)
- Selected mainly for growth-strain and diameter

	New breeding population multivariate	**Top 1%** univariate	**Mean**
Growth-strain (μs)	-108	-912	2072
Diameter (mm)	3.1	13.6	36
Density (kg/m^3)	-6.6	-88.5	815
Stiffness (GPa)	-0.42	2.6	11.2
Vol. shrinkage (%	-0.2	-4	20
Height (mm)	231	944	2,388
Ac. vel. (km/s)	-0.06	0.44	3.69

Segregation

Identifying low growth-strain trees in the existing/future resource

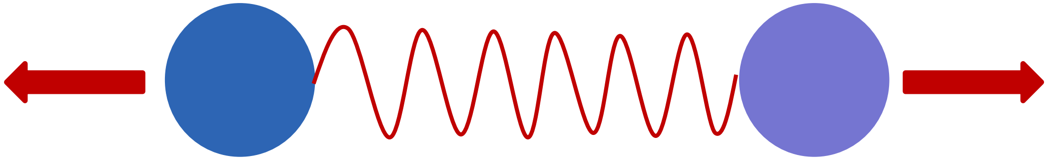
- In mill/in forest screening
- Better value recovery

Requirements

- Non-destructive
- Fast
- Work in an industrial setting

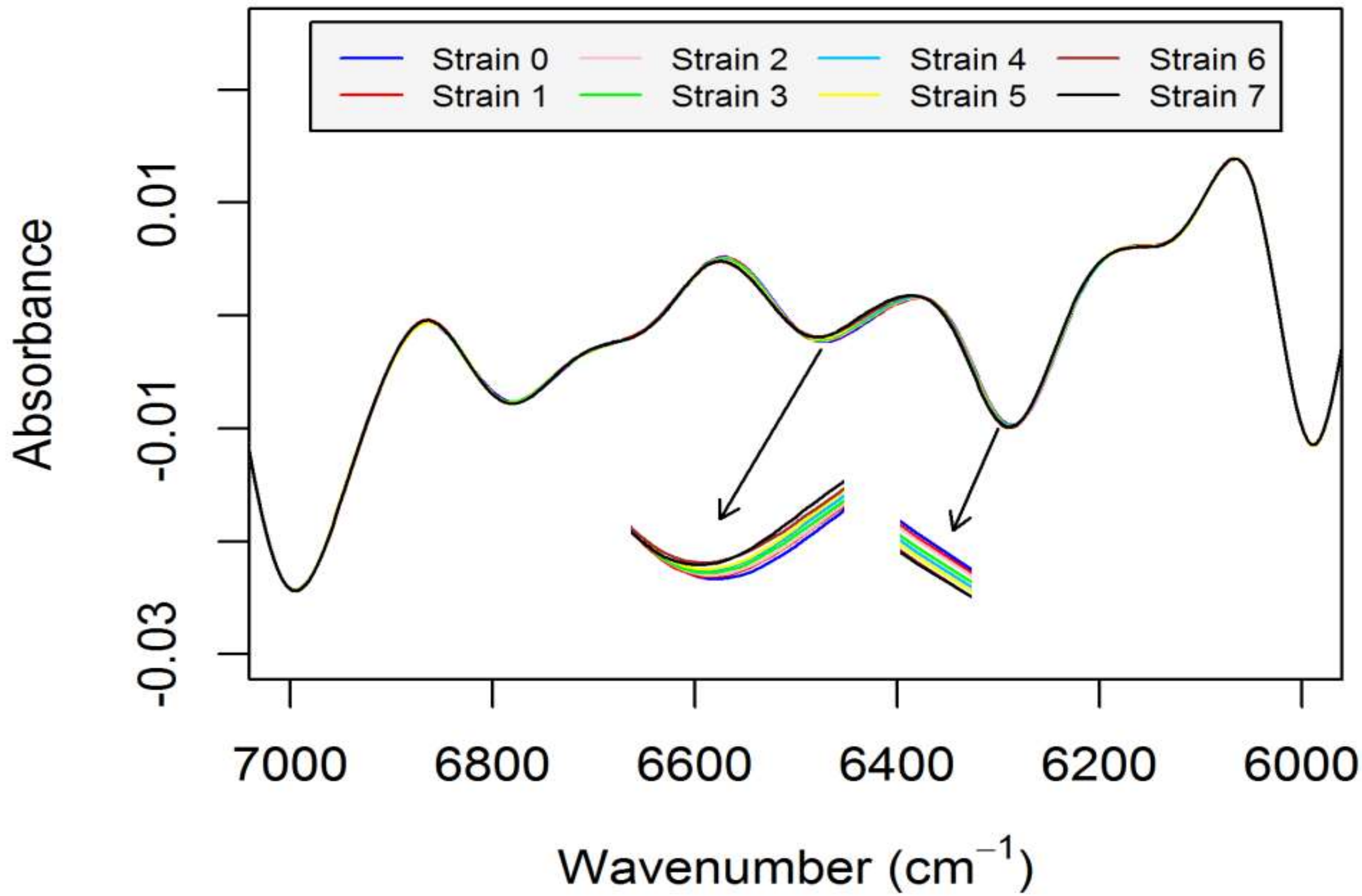
Molecular strain

- Macroscopic strain is reflected in molecular strain



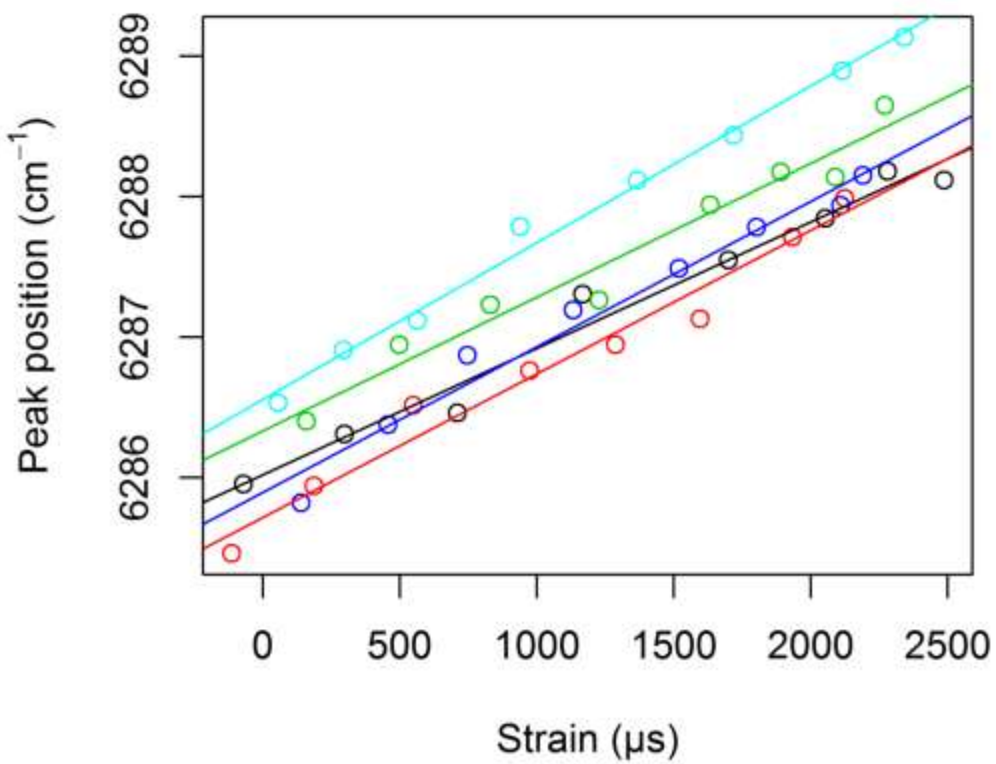
Effect of strain on NIR spectra

- Band shifts at 6465 cm^{-1} and 6286 cm^{-1}



Accuracy of NIR

dry wood – lab conditions



- Linear relationships between peak positions and strain levels
- Mean slope: 1.04×10^{-3} $cm^{-1}/\mu\varepsilon$
- Accuracy of measurement: ~0.3 cm^{-1}
- Expected band shift due to growth-stress: ~5 cm^{-1}