Recovery from Oval Logs

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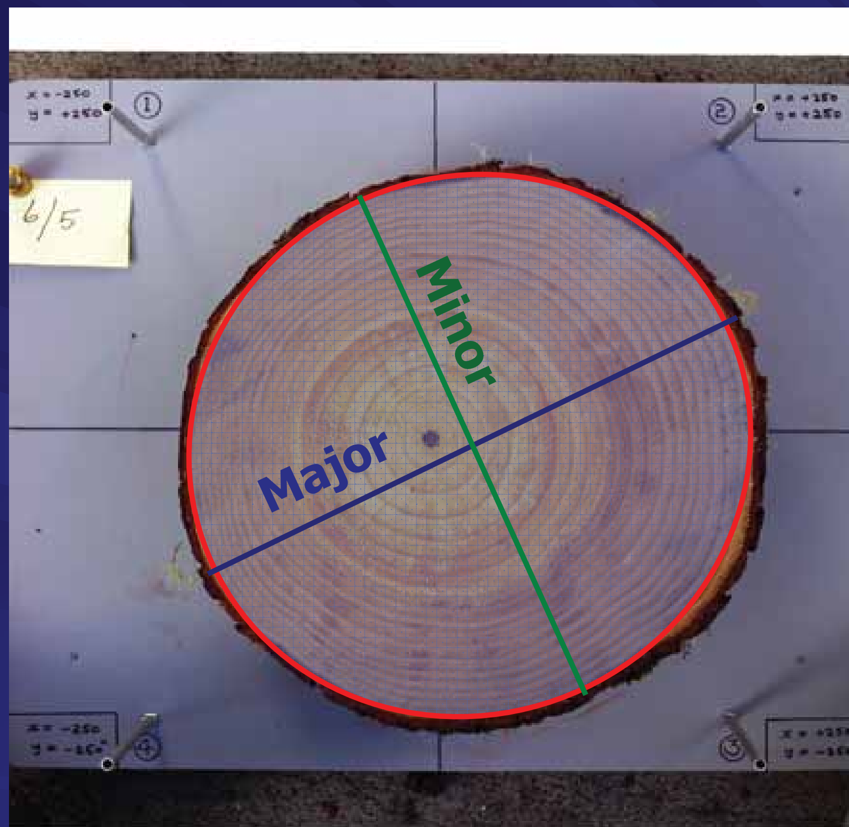
BUT.. log shape is not limited to sweep

- MOST logs have **non-circular** cross-sections

Cross-sectional ovality



$$\text{Ellipticity ratio} = \frac{\text{Minor}}{\text{Major}} = \frac{7.1}{7.5} = 0.95$$

Is ovality detrimental to yield?

"Loss in yield due to non-circularity"

Saint-André & Leban 2000

"Any deviation in shape from circularity will normally reduce the yield" **Skatter & Høibø 1998**

"Eccentricity has a negative impact on value recovery"

Maness & Donald 1994

"Log rotation produced significant benefits"
"Estimated benefits increased slightly with increasing eccentricity" **Maness & Donald 1994**

"When sawn in the correct position, the yield of an oval log is better than that of a round log of the same size"

Asikainen & Panhelainen 1970

Ovality by species

Douglas-fir	0.95 ± 0.04	Monserud 1979
Lodgepole pine	0.82 – 0.94	Koch et al. 1990
Norway spruce	0.72 – 1.00	Saint-André, Leban 2000
Radiata pine	0.84 – 0.99	Todoroki et al. 2006
Western hemlock	0.85 – 0.96	Kellogg, Barber 1981

Ovality of stems

- *Ellipticity ratio* range
  - (oval) 0.80 - 1.00 (circular)

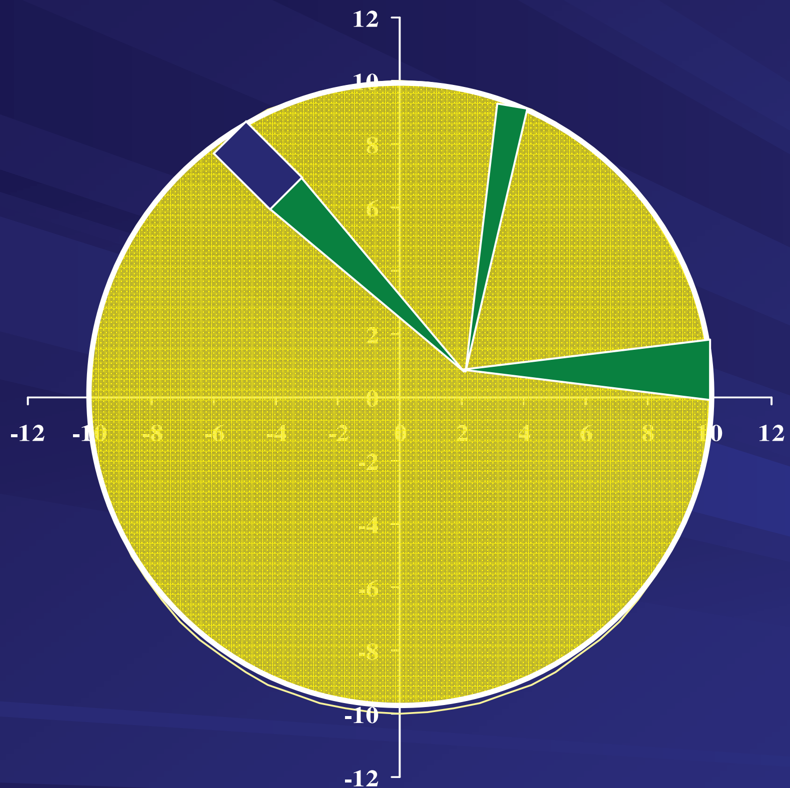
- Ovality decreases with increasing height
  - *Ellipticity ratio* increases (oval → circular)
- Ovality increases with increasing log size
  - *Ellipticity ratio* decreases (oval ← circular)

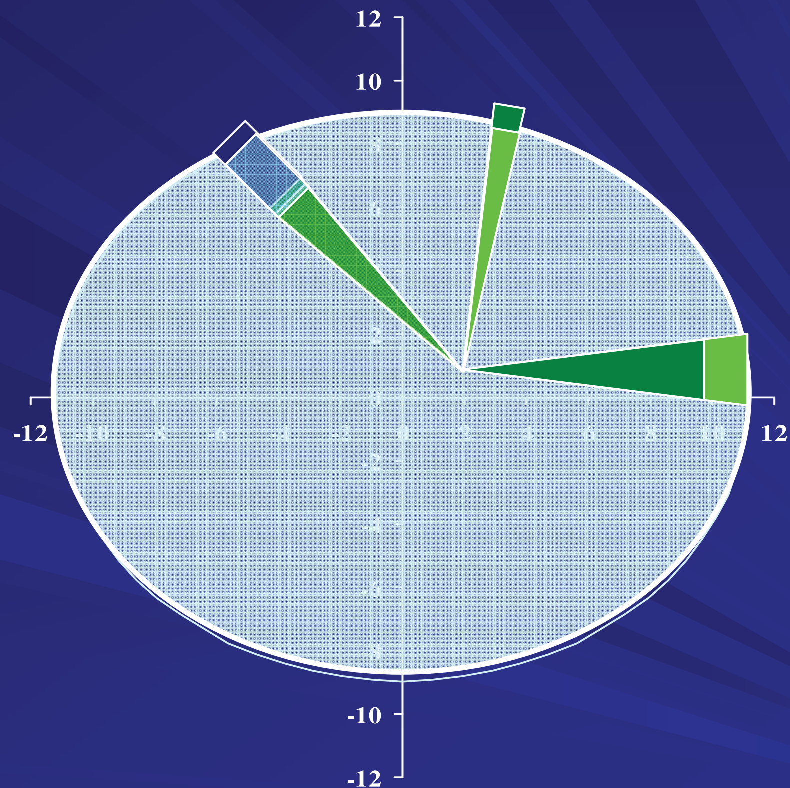
Purpose: To dispel myths & decipher fact about yield from oval logs

- 5 replicates of 52 Western hemlock logs
  - *Ellipticity ratio* : 1.00, 0.95, 0.90, 0.85, 0.80
  - Constant cross-sectional area & volume

- Geometric modeling with AUTOSAW
  - Constant sawing parameters
  - 5° rotations

Log models

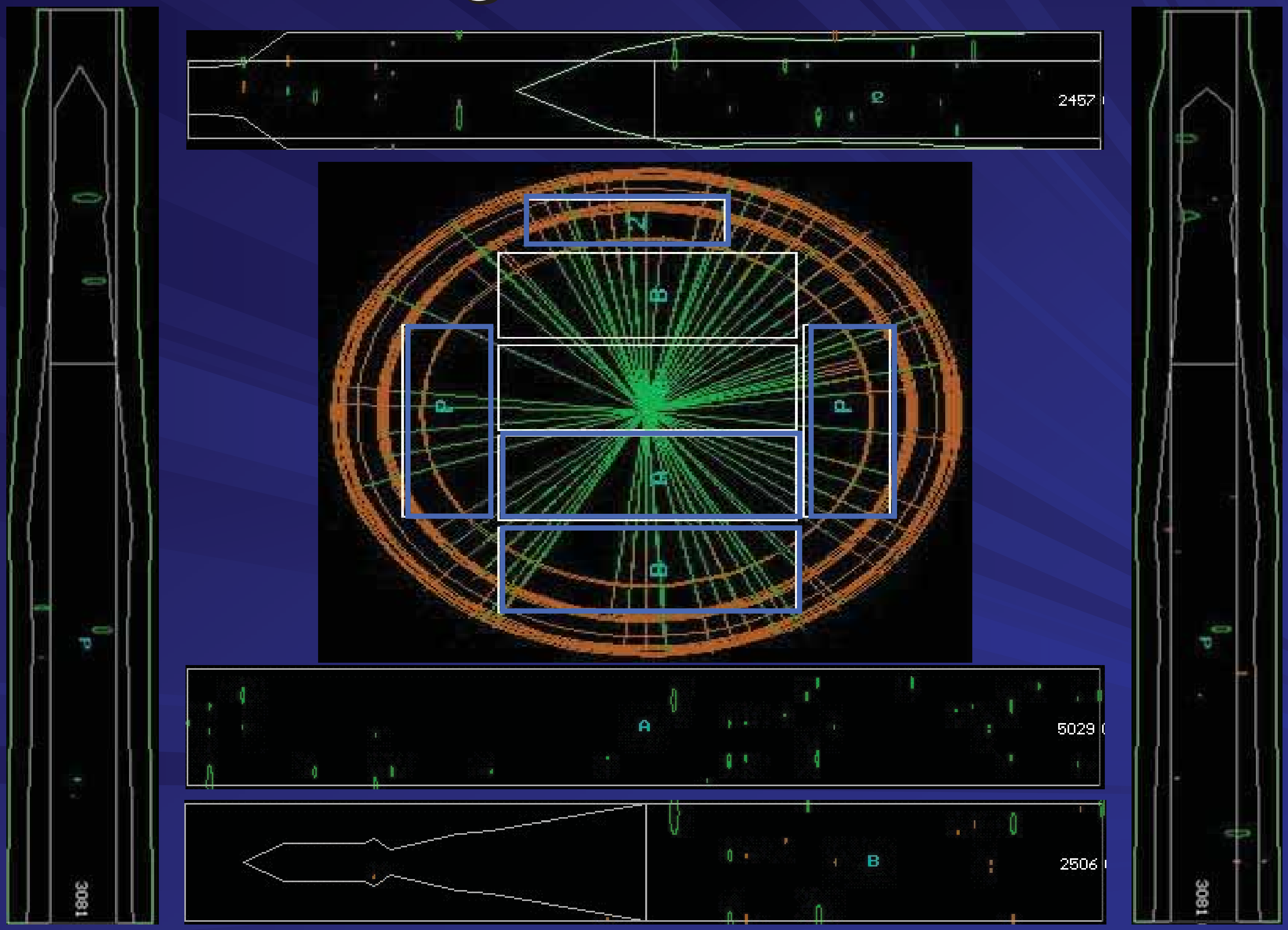




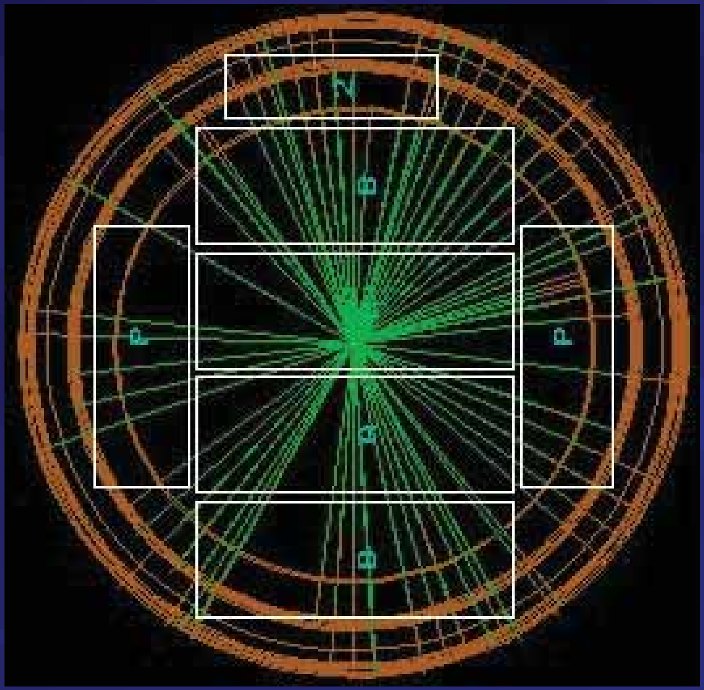
Area = Π r^2 = 100 Π

Area = Π ab = 100 Π
With b/a = 0.80, a = 10x1.118, b = 10x0.894

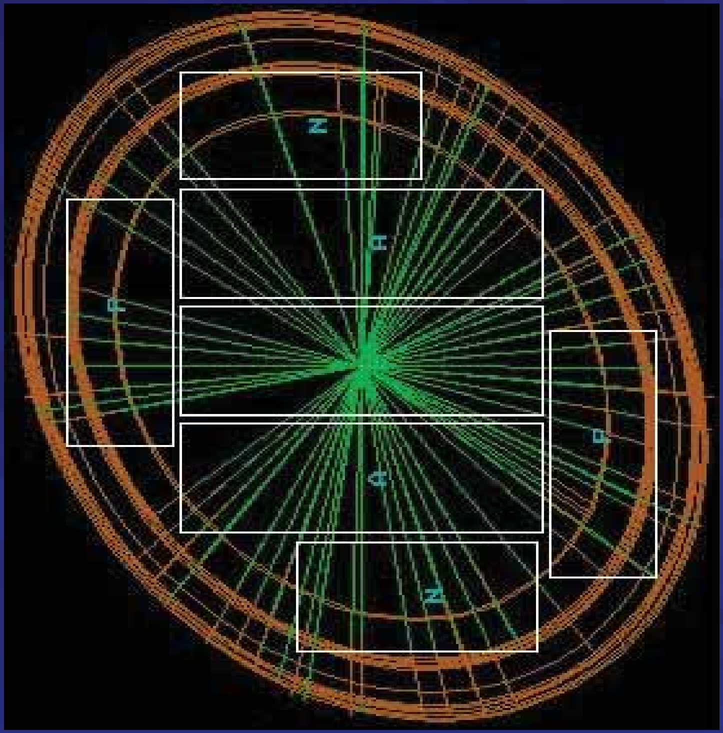
Sawing simulation, 0°



Sawing simulation

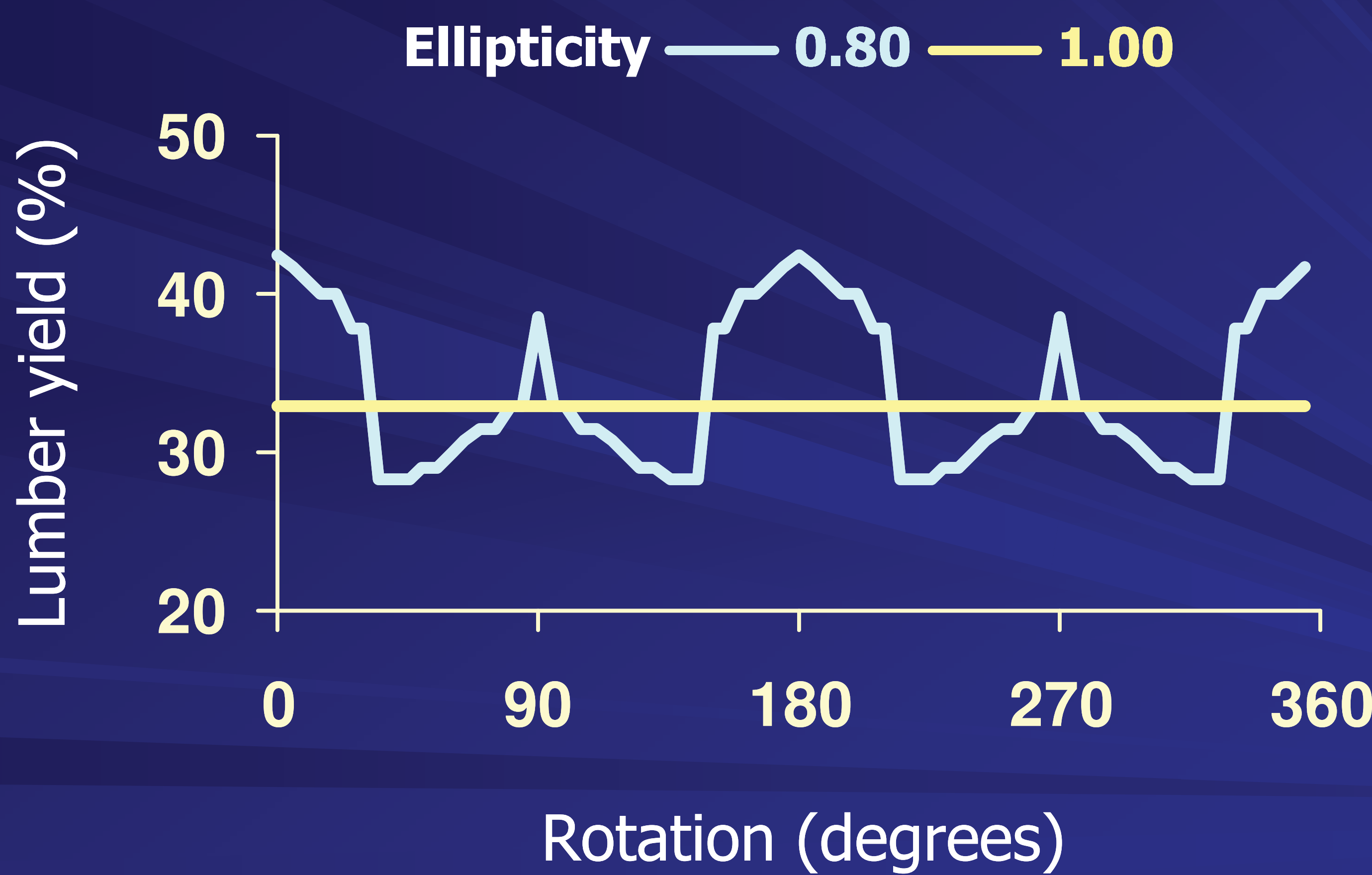


0 degrees
lumber/log volume = 52%

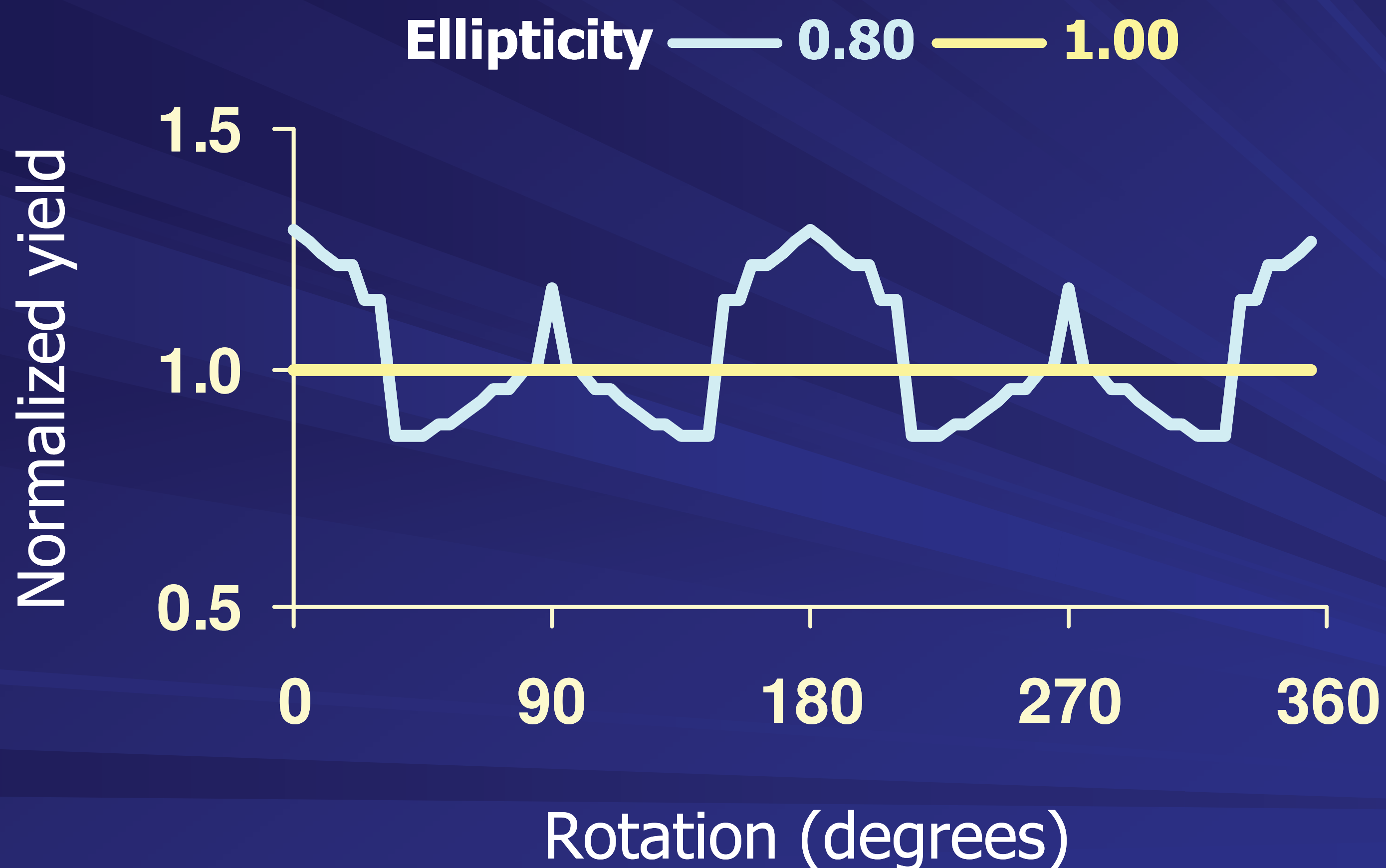


45 degrees
lumber/log volume = 49%

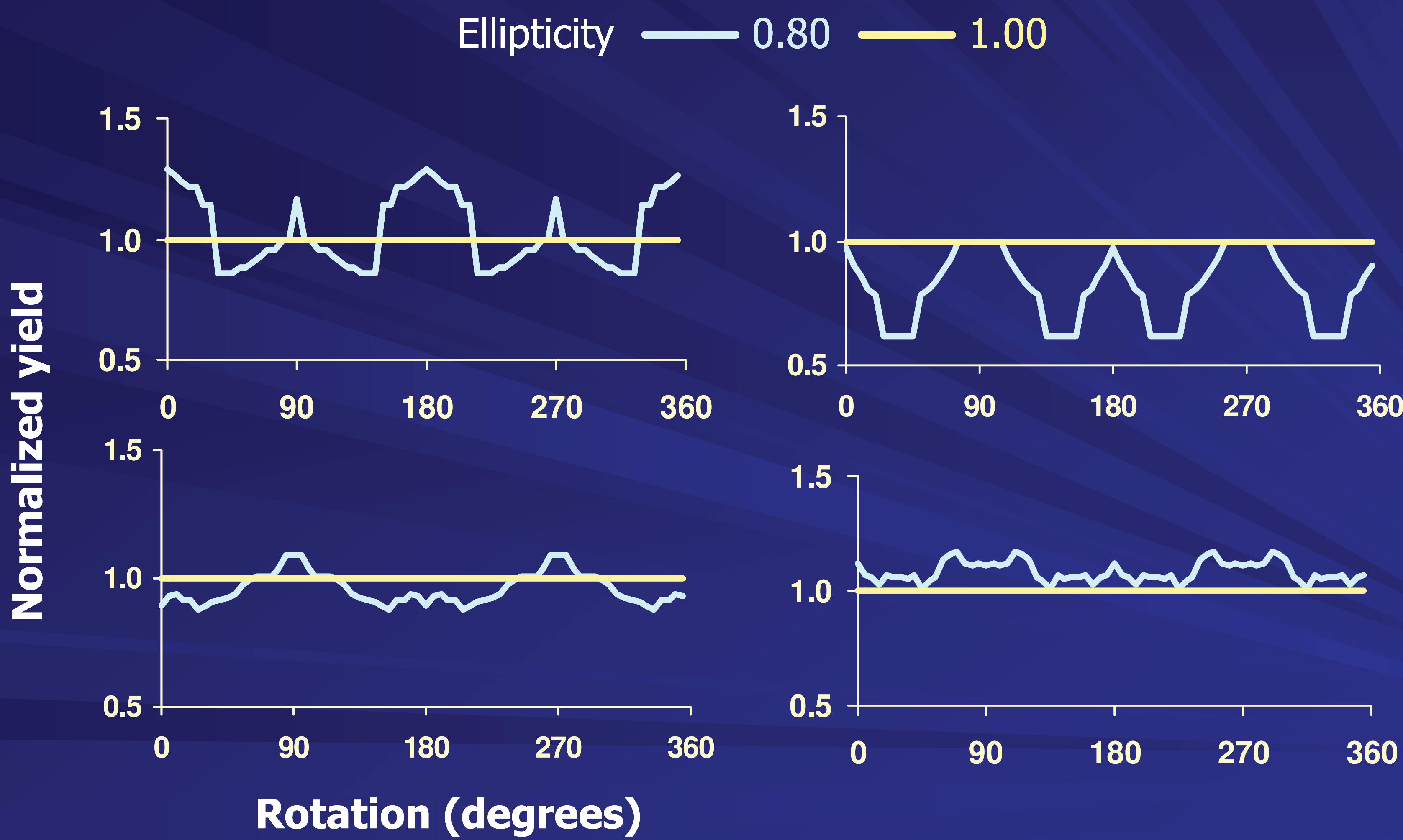
Yield under rotation, Log A



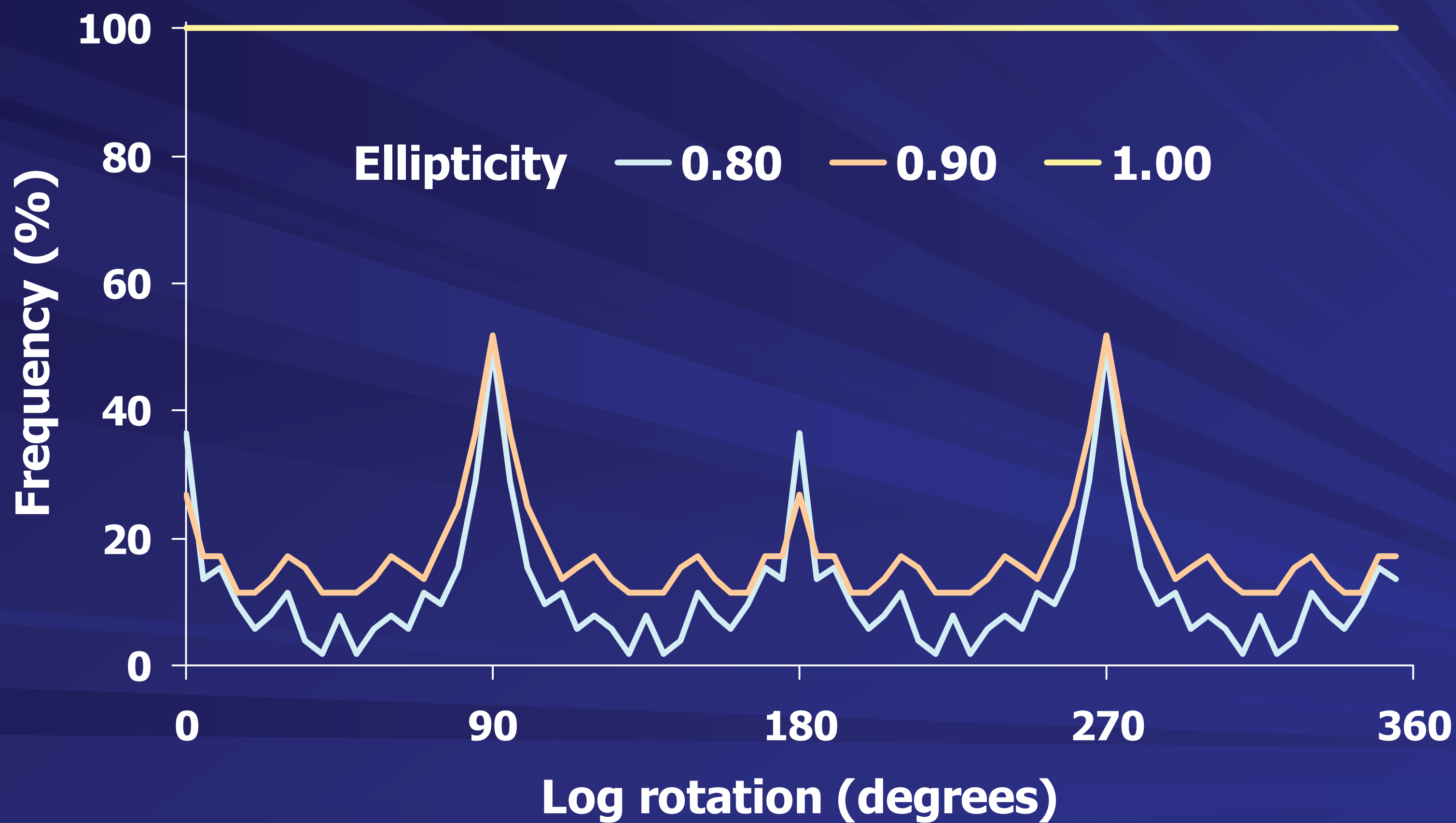
Normalized yield, Log A



Normalized Yield



Optimal rotation for maximizing yield

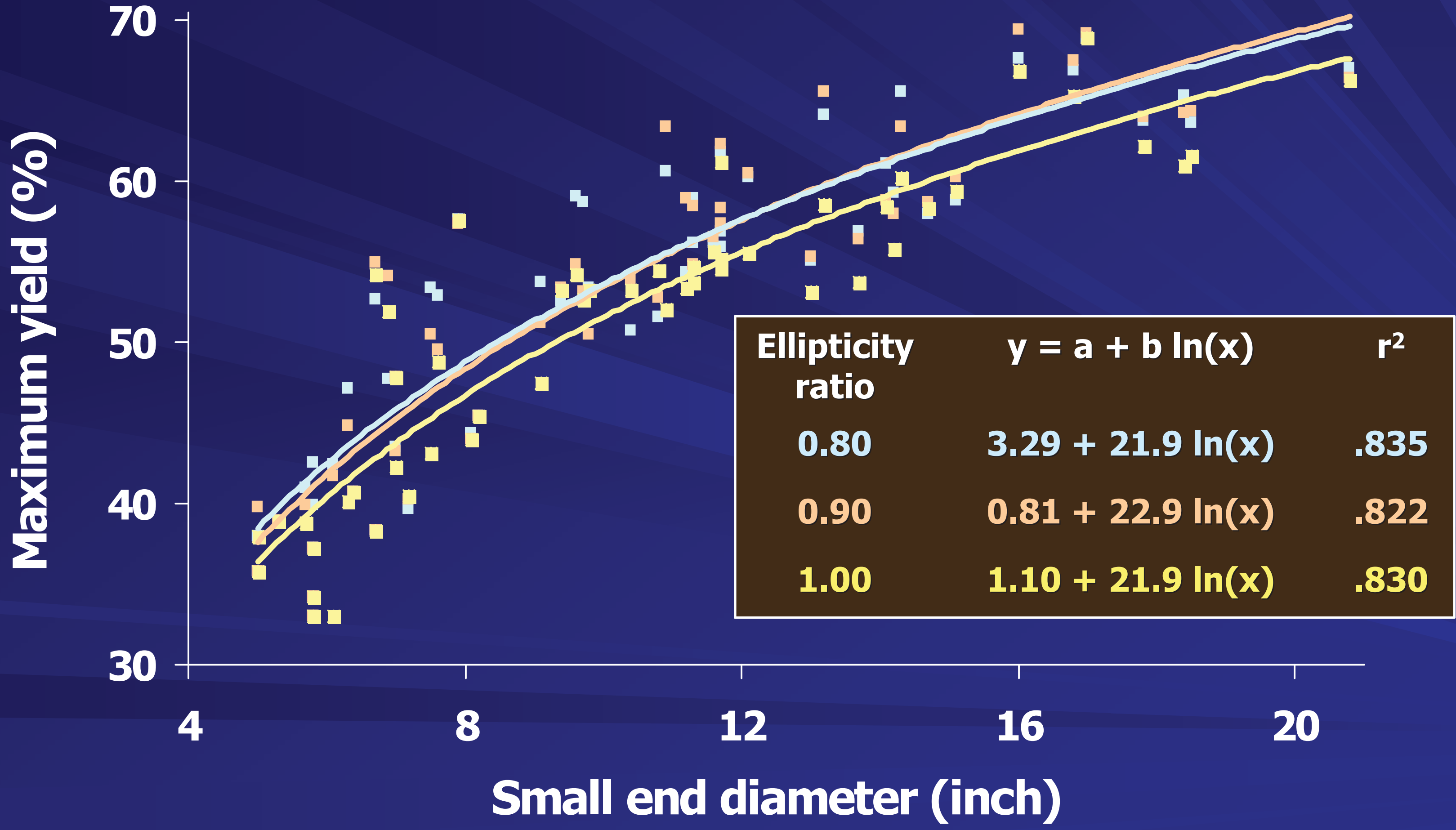


Difference in means between oval & circular logs, 95% CI

Normalized maximum yield

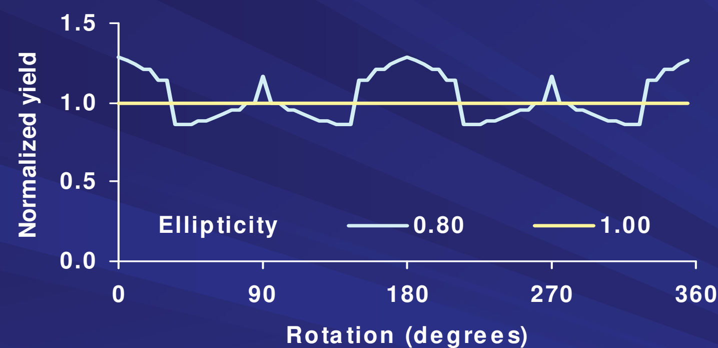
Ellipticity ratio	Mean	Standard deviation	lower & upper 95% limit
1.00	1.000	.000	
0.90	1.034	.057	1.018, 1.049
0.80	1.032	.078	1.011, 1.053

Max yield by ellipticity ratio



Myth busters

- ✗ "..any deviation in shape from circularity will normally reduce the yield" Skatter & Høibø 1998
- ✗ "..loss in yield due to the non-circular external log's shape" Saint-André & Leban 2000



- ✓ "Lumber yield from oval logs exceeds that of circular logs at optimal rotation" Maness & Donald 1994
- ✓ Rule of thumb: saw parallel to major axis, 90 or 270° in our simulations, Asikainen & Panhelainen 1970

Conclusions

- Yield from oval logs, at the optimal orientation, significantly exceeds that of circular logs (~3%)
- Rule of thumb for maximizing yield:
  - primary saw parallel to major axis

Citation:

- Todoroki, C.L, Monserud, R.A., and Parry, D.L. 2007. *Lumber volume and value recovery from elliptical logs.* **Forest Products Journal** 57(7/8): 76-82.

- -Thanks