3D Visualisation of Spiral Grain and Compression Wood in *Pinus Radiata* with Fluorescence and Circular Polarised Light Imaging

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Spiral Grain

~ Spiral grain and features.

~ New imaging technique with circular polarised light scanning.

~ Fluorescence imaging.

~ 3D visualisation of resin canals and spiral grain.

Spiral Grain

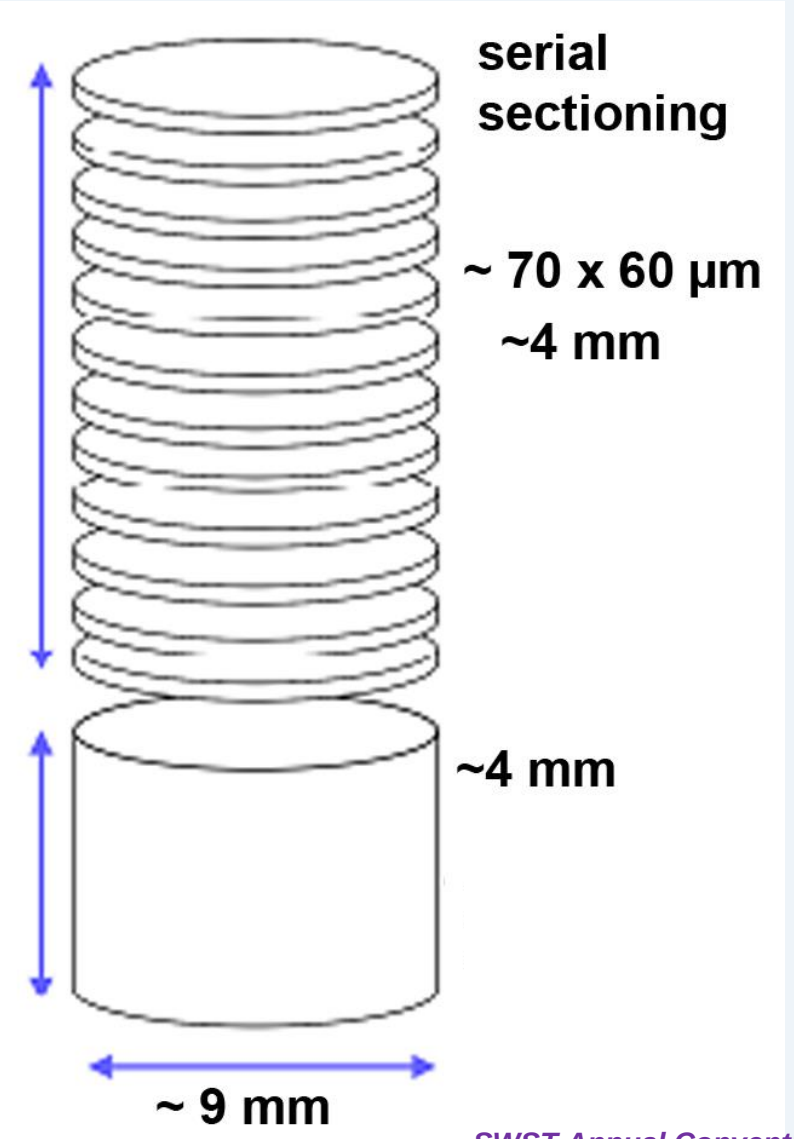
~ Inclination of tracheids to the tree's vertical axis.

~ Present in most trees, and a normal growth feature.

~ Significantly reduces strength, and causes twisting.

~ Huge economic loss.

A New Imaging Technique



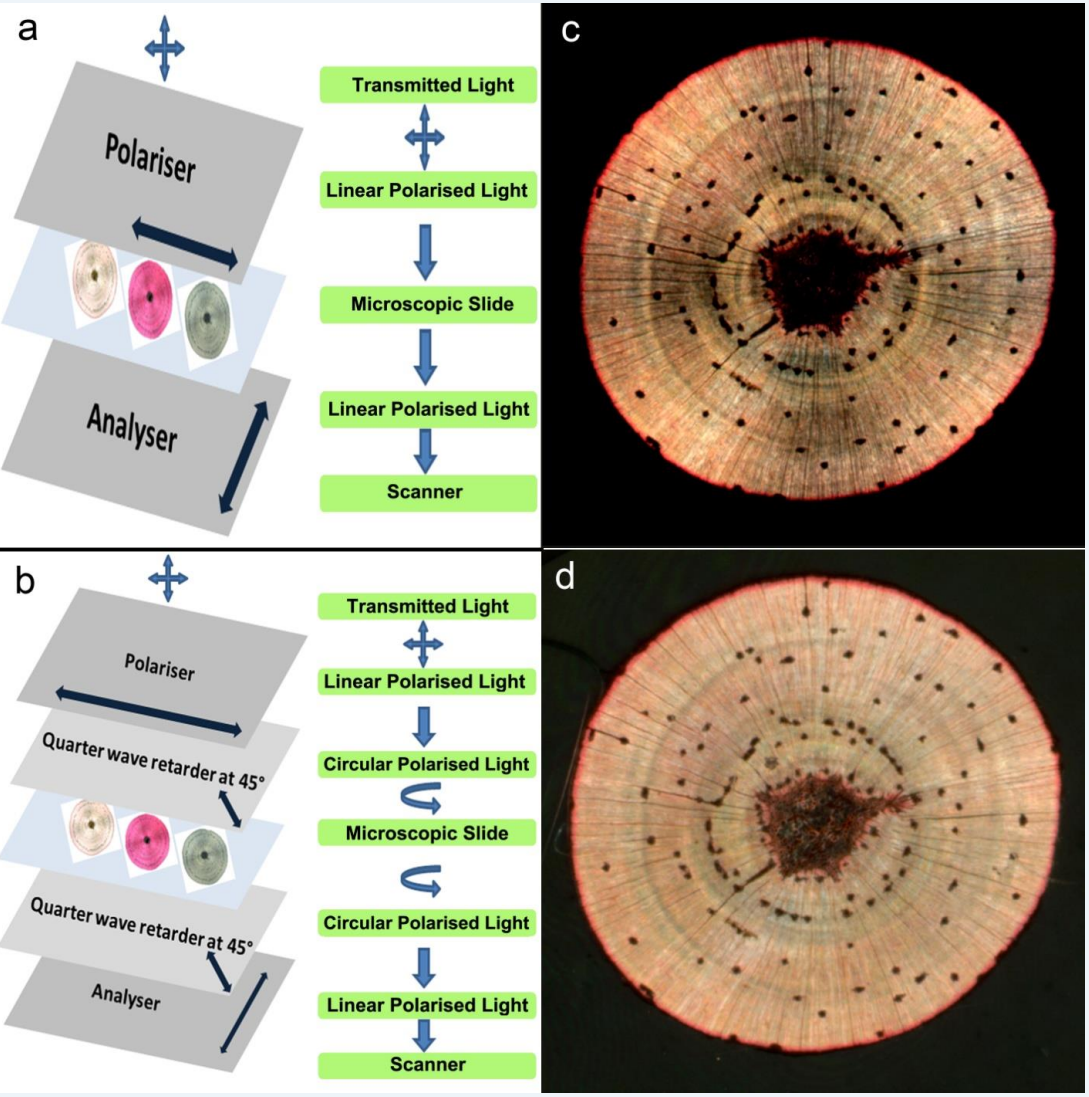
~ 8 month old plants.

~ 60 µm-thick, complete, transverse sections.

~ Scanned at 2400 dpi with a professional flatbed scanner.

~ Circular polarised light makes the resin canals (primary cell walls only) appear dark.

A New Imaging Technique



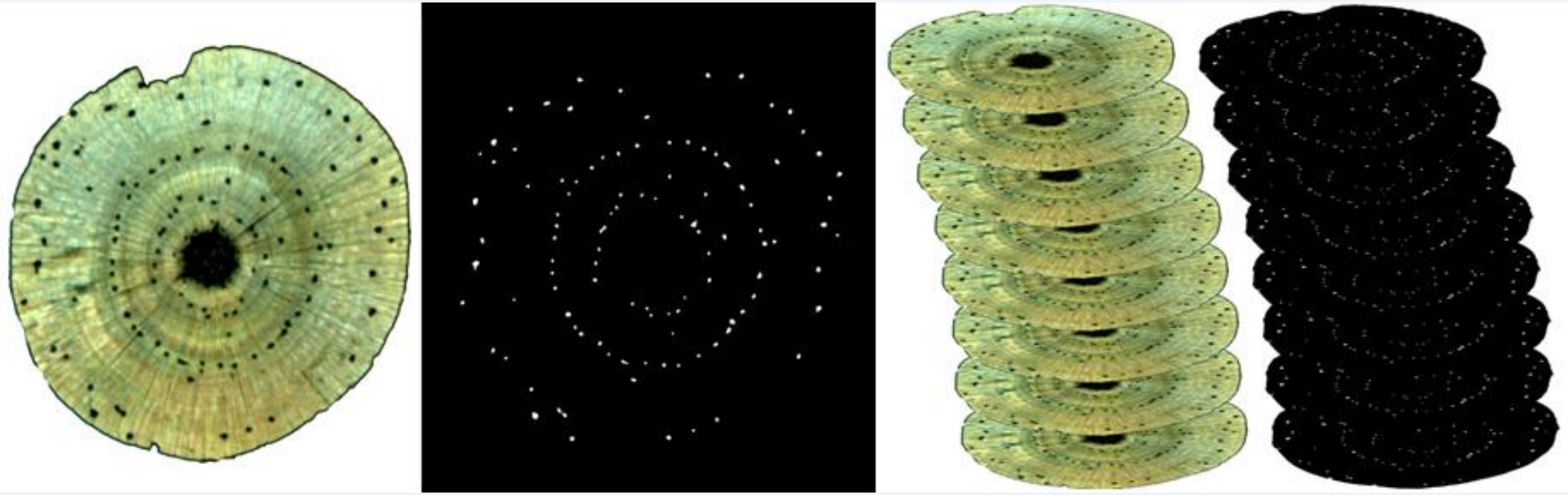
~ This novel approach replicates polarised light microscopy.

~ The high contrast images are suitable for image analysis.

~ Circularly polarised light eliminates the Maltese cross effect.

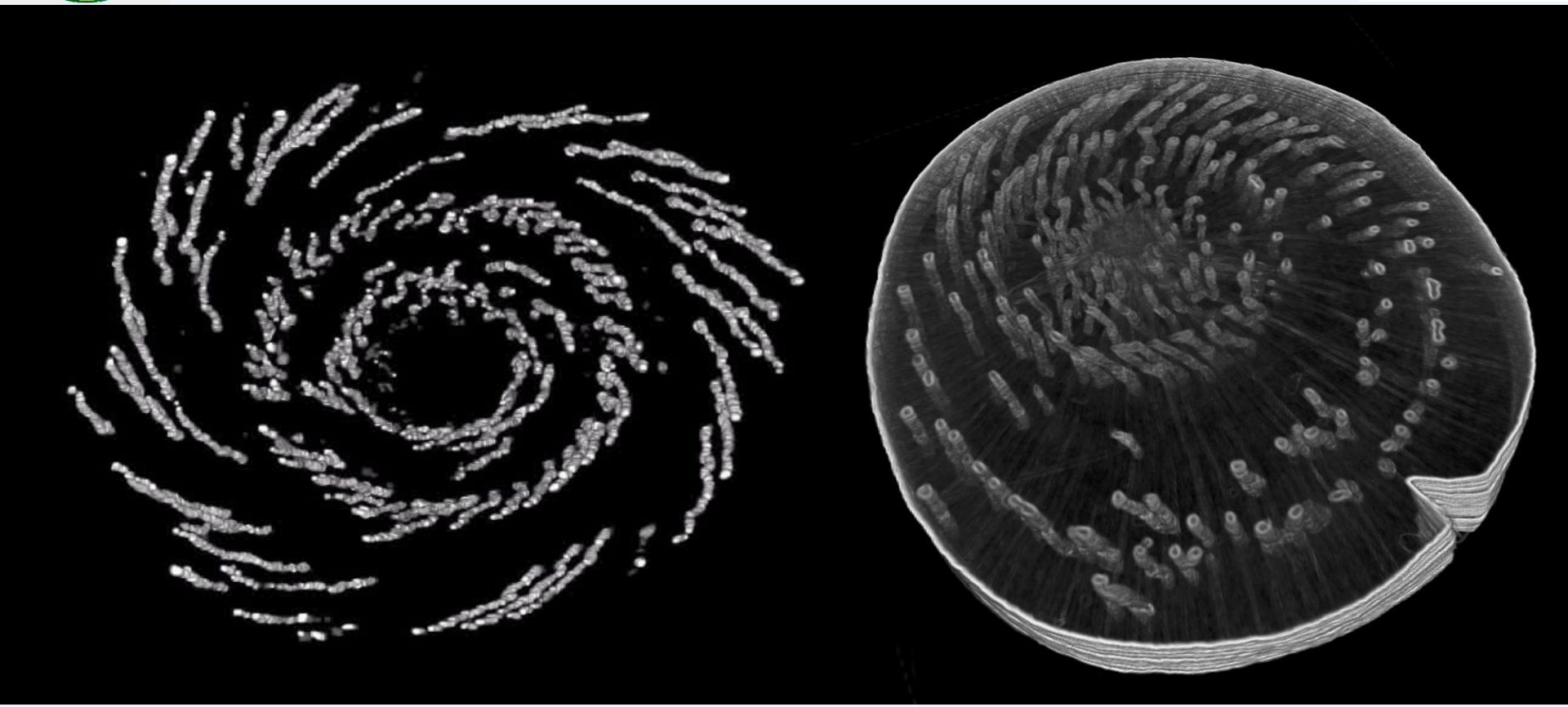
~ Rapid imaging of many slides / sections together.

Image Analysis



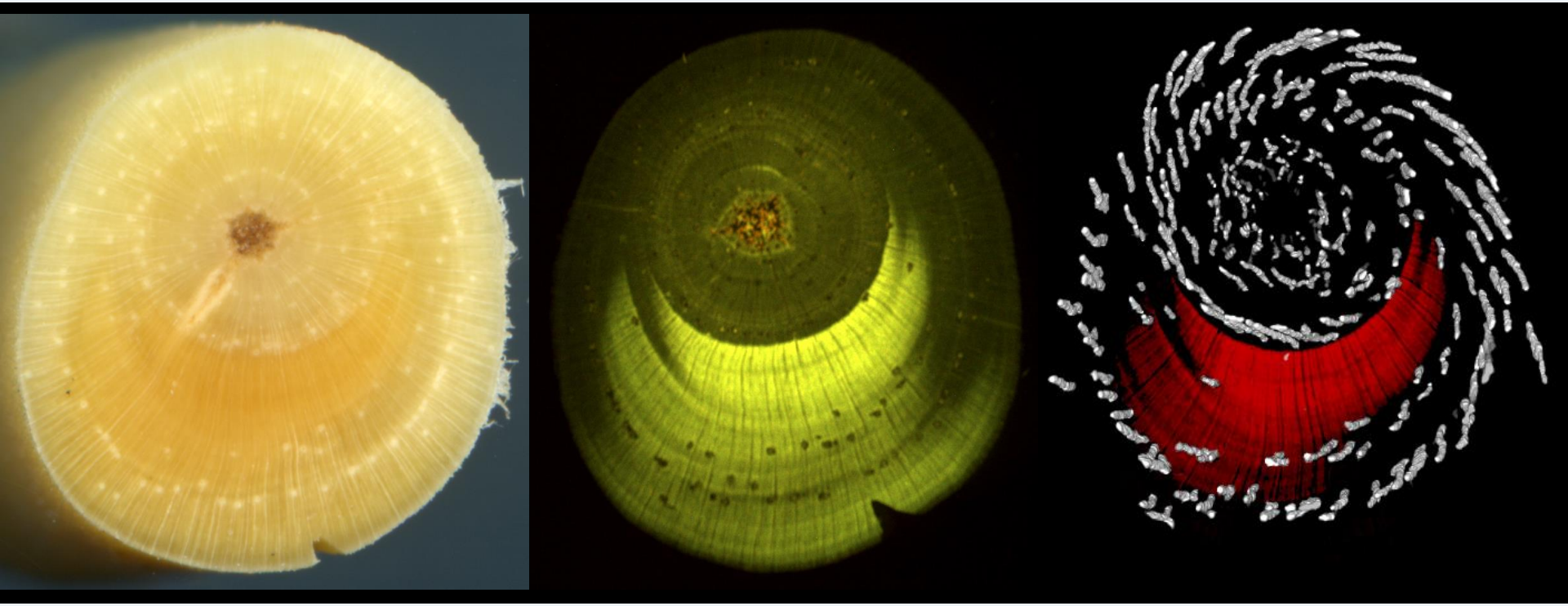
- ImageJ identified the resin canals in each section, and measured stack position and centroid.
- 3D Viewer plug-in.
- An algorithm in Matlab was used to measure grain angle.

3D visualisation



- Resin canals demonstrated increasingly left-handed grain in young stems.

Fluorescence imaging



- Fluorescence identifies compression wood, and suggests grain modifications may be associated with compression wood formation.

Conclusions

- New imaging technique using a document scanner and polariser films is novel.
- 3D visualisation of compression wood and spiral grain in young trees is now possible.
- Screening of pine clones on large number is now easy.

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