

# ATR-FTIR imaging: phenotyping at the cell wall level in poplar wood

**Clement Cuello, Paul Marchand, Francoise Laurans, Camille Grand-Perret, Veronique Laine-Prade, Gilles Pilate, Annabelle Dejardin**

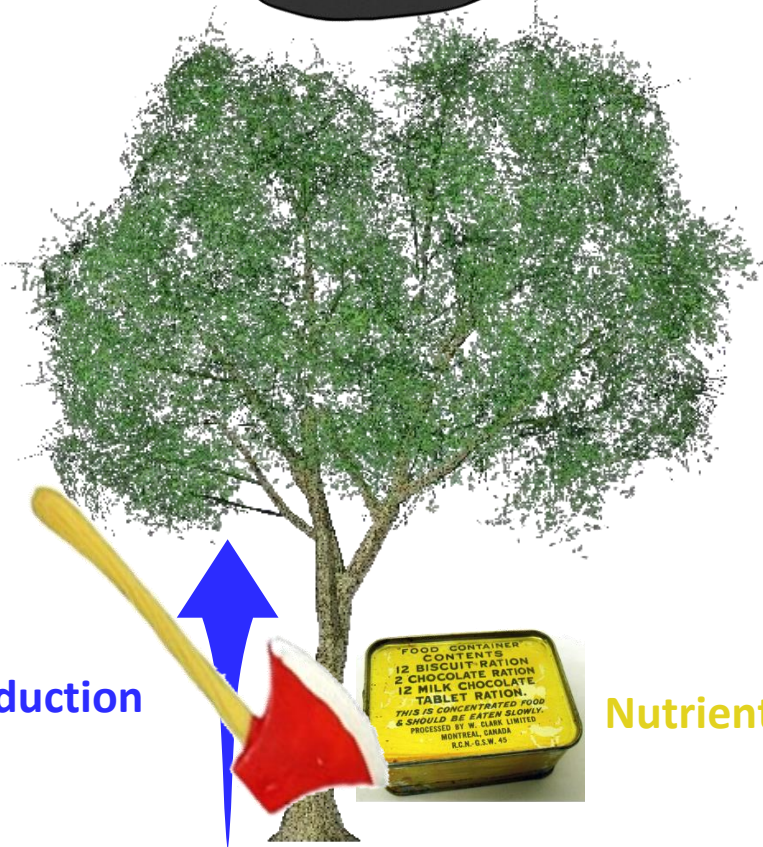
Paris Single Cell Day  
October 4<sup>th</sup>, 2018



# Wood: three major functions



Ever-increasing mass support

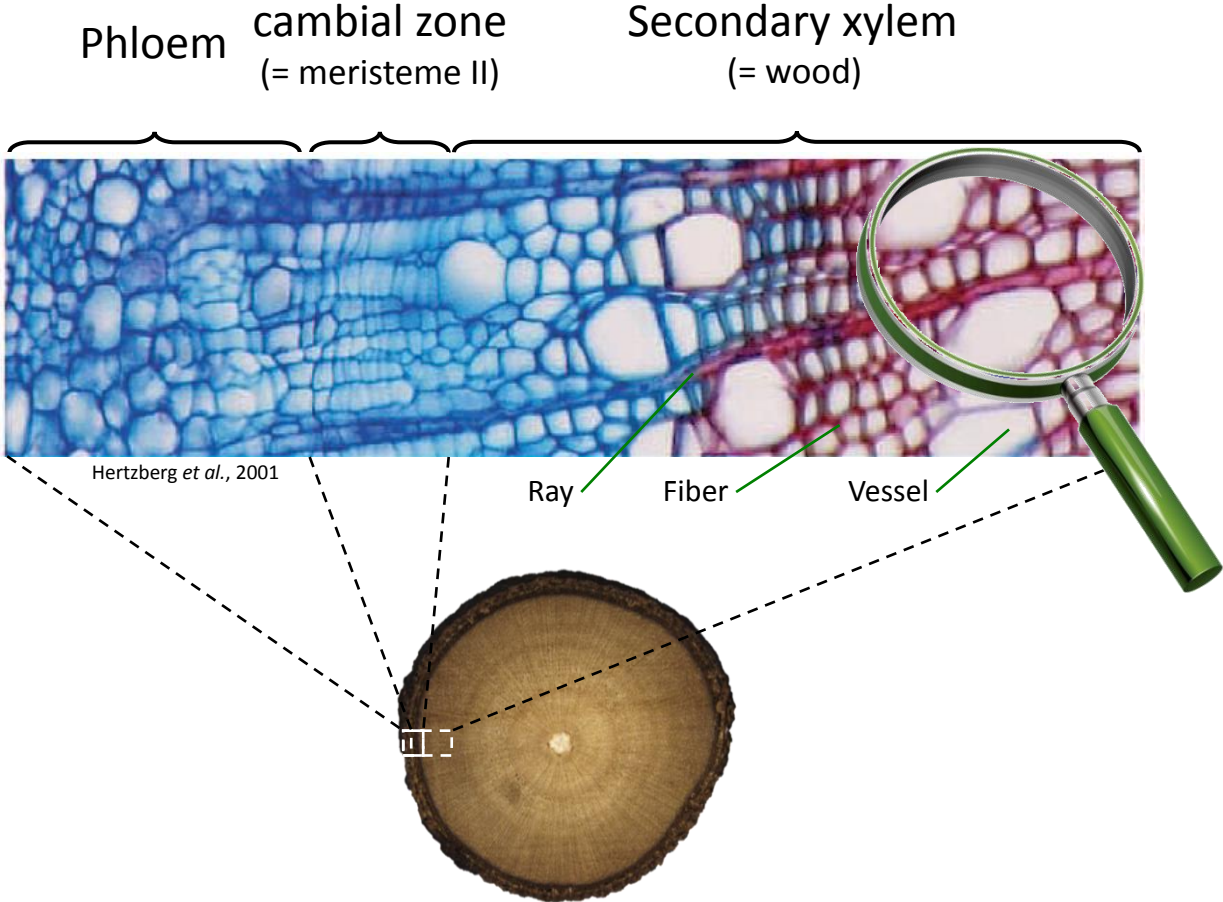


Water conduction

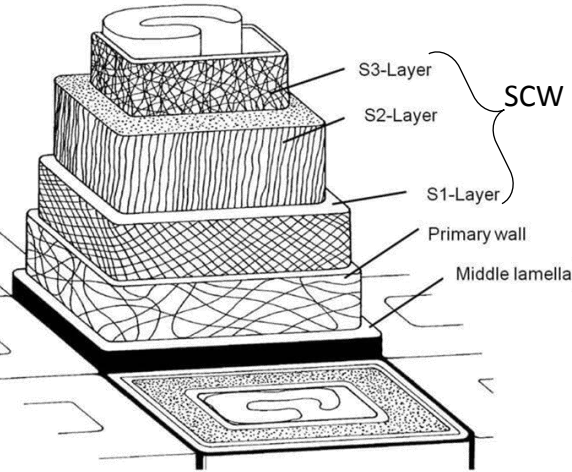


Nutrient storage

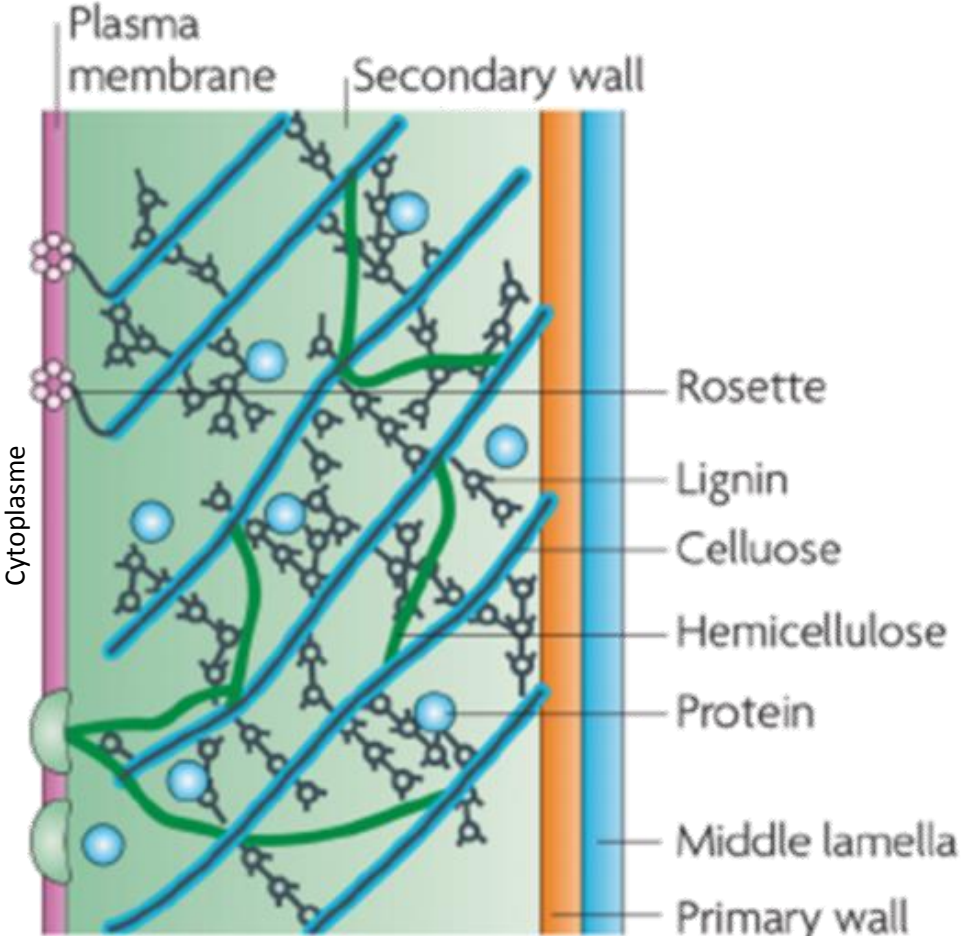
# Poplar wood: a heterogenous and complex biomass



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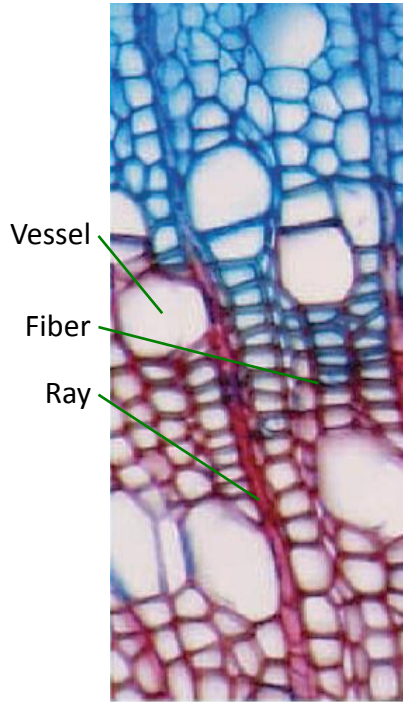
Niemz, 2006



Sticklen, 2008

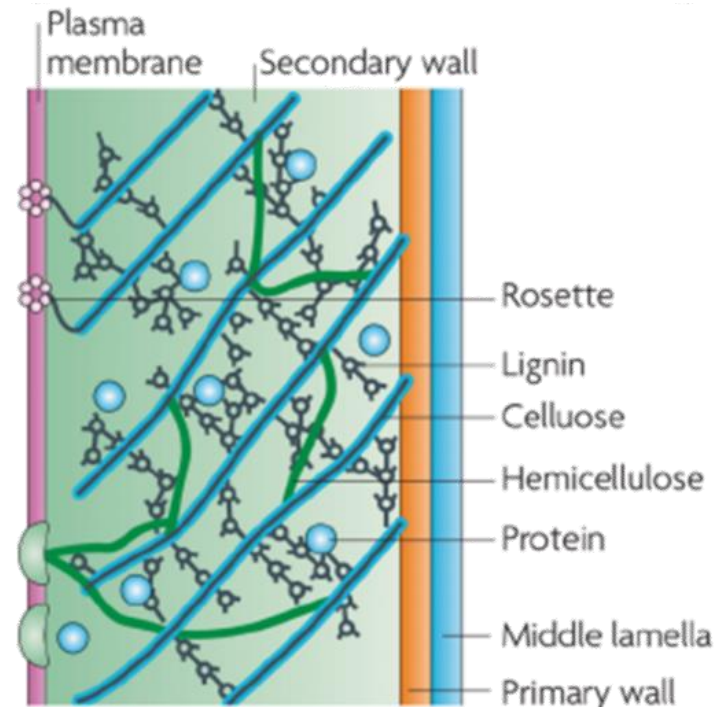
# Wood exhibits a great diversity in terms of...

... cells



Secondary xylem  
(= wood)

... molecules

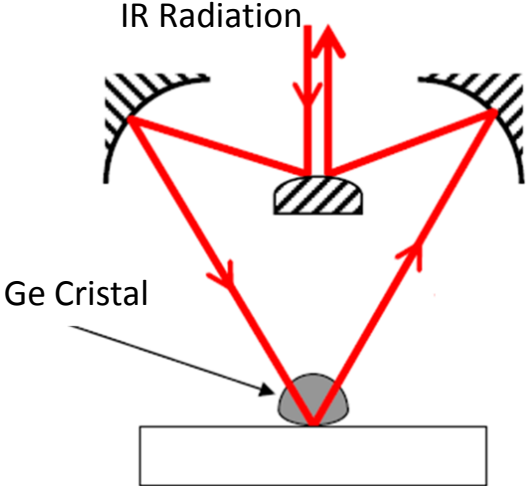
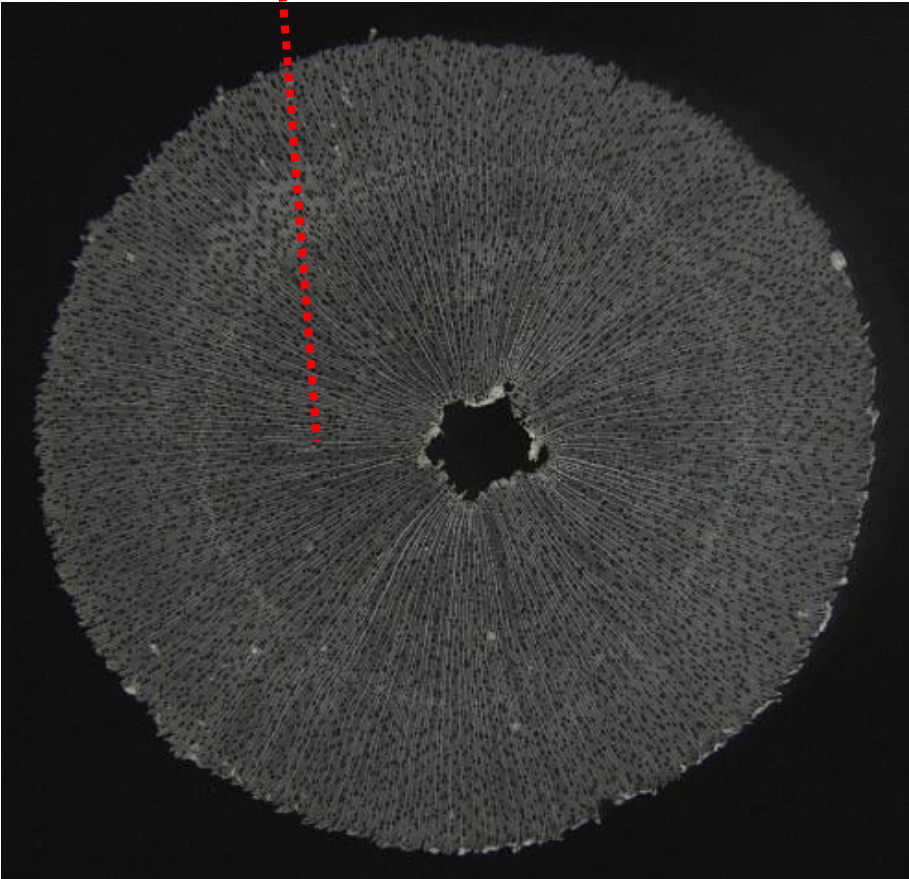


Needs of cell-specific approaches coupled to fine characterization methods

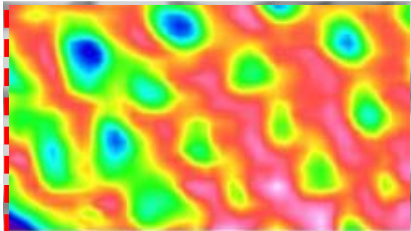
↳ ATR-FTIR imaging

# ATR-FTIR imaging: how does it work ?

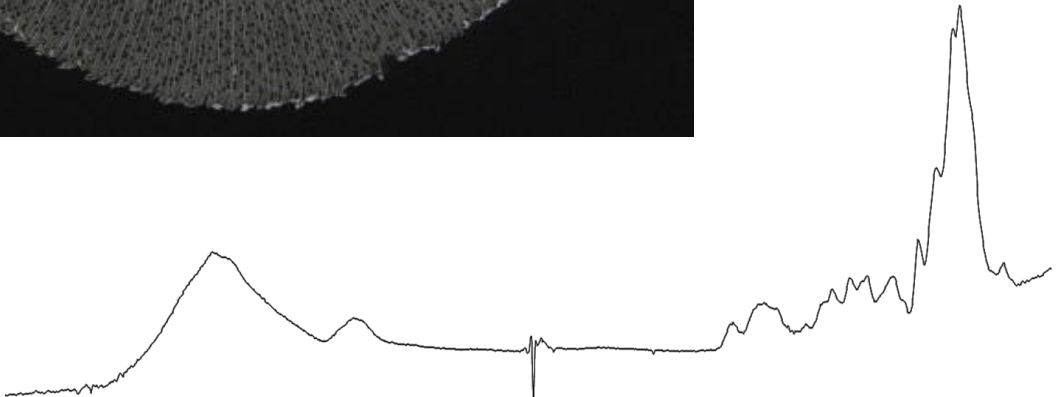
IR Radiation



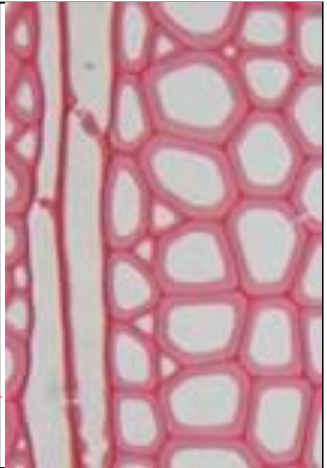
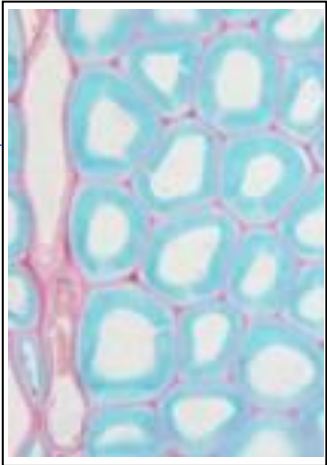
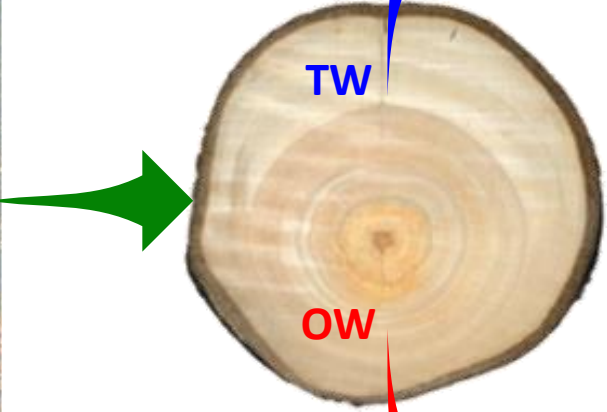
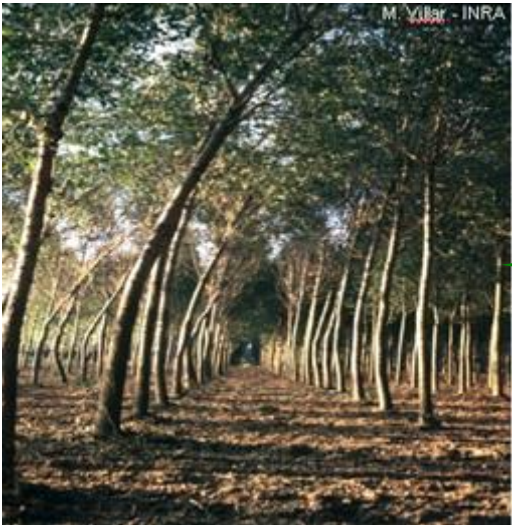
Kazarian, 2010



■ 1,56 μm side



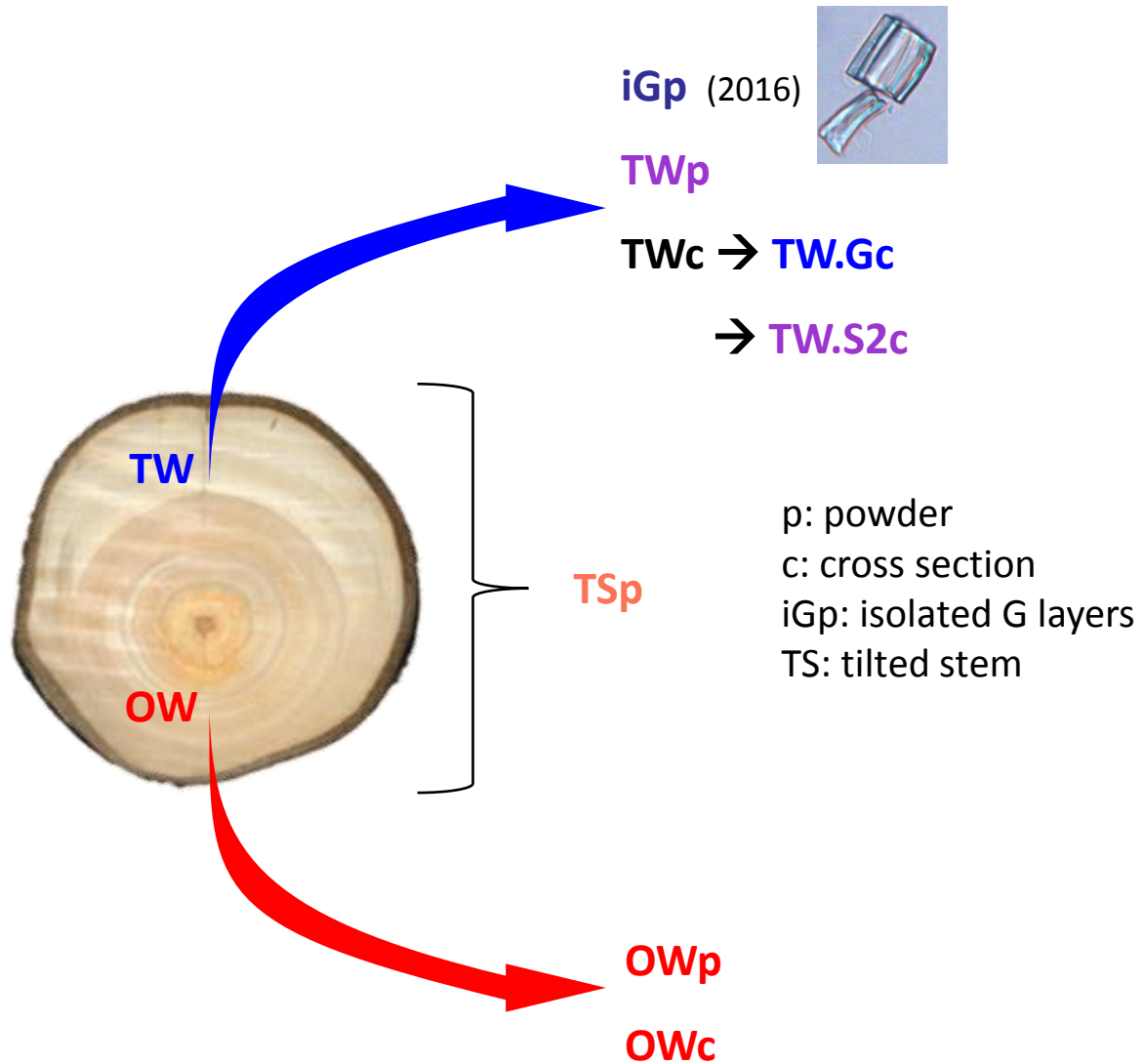
# Tension wood: a way to keep straight



TW: tension wood  
OW: opposite wood

# Plant material

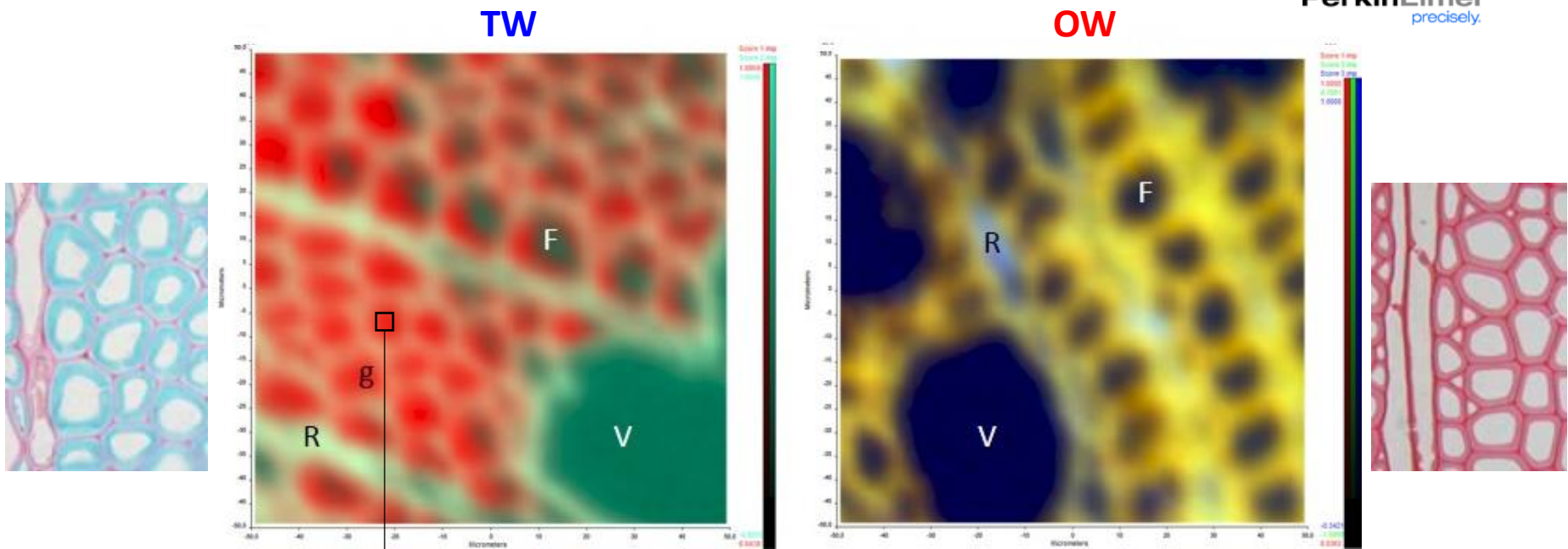
717-1B4 (*P. tremula* x *P. alba*)  
4 rep: 1 x 2012 et 2 x 2013 (3 months)  
1 x 2016 (6 months)



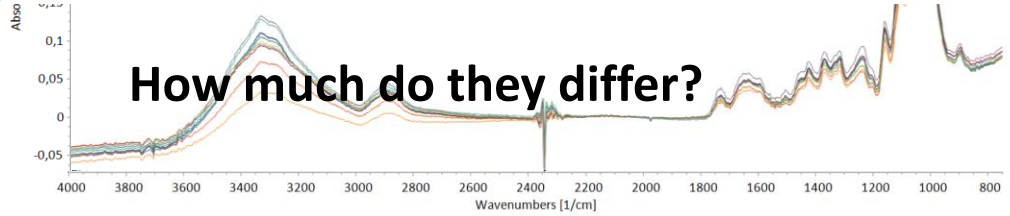
Spectrometer : PerkinElmer Spectrum 400  
Imaging : PerkinElmer Spotlight 200



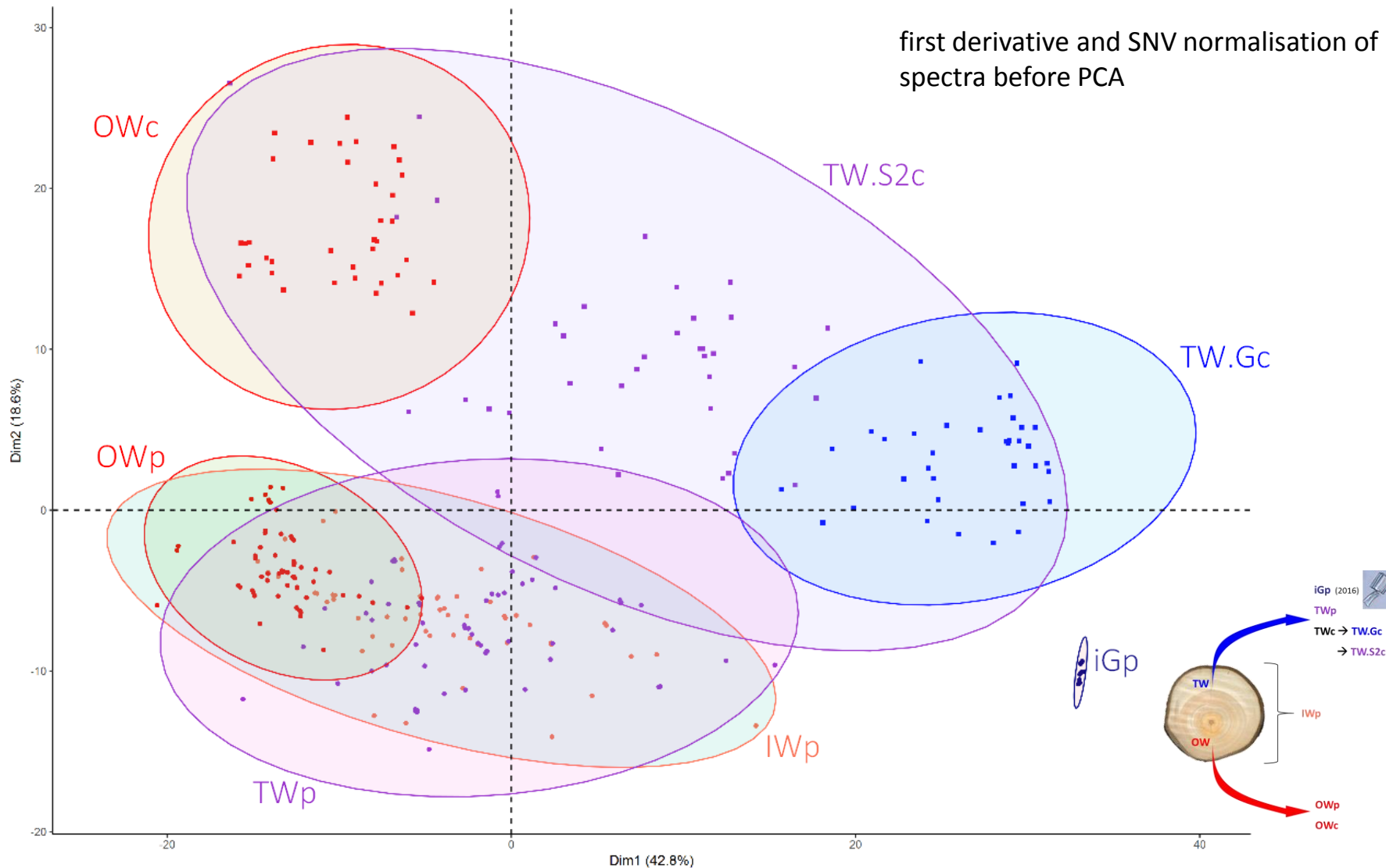
# Multivariate image analysis provide histological-type images with enriched information



Cell wall types	OWp	OWc	TSp	TWp	TW.S2c	TW.Gc	iGp
Nb spectra	60	36	54	60	36	36	9

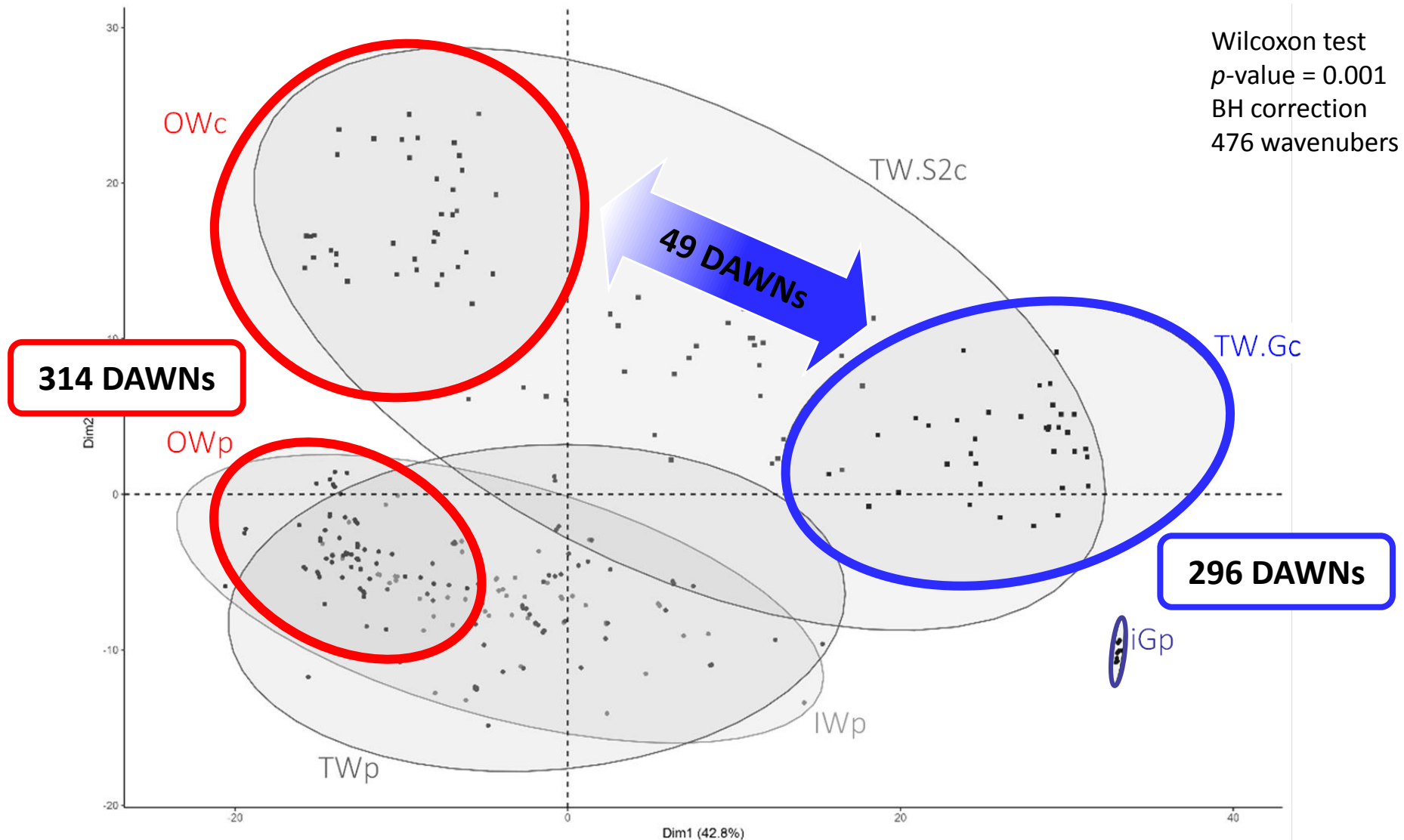


# PCA emphasizes different chemotypes



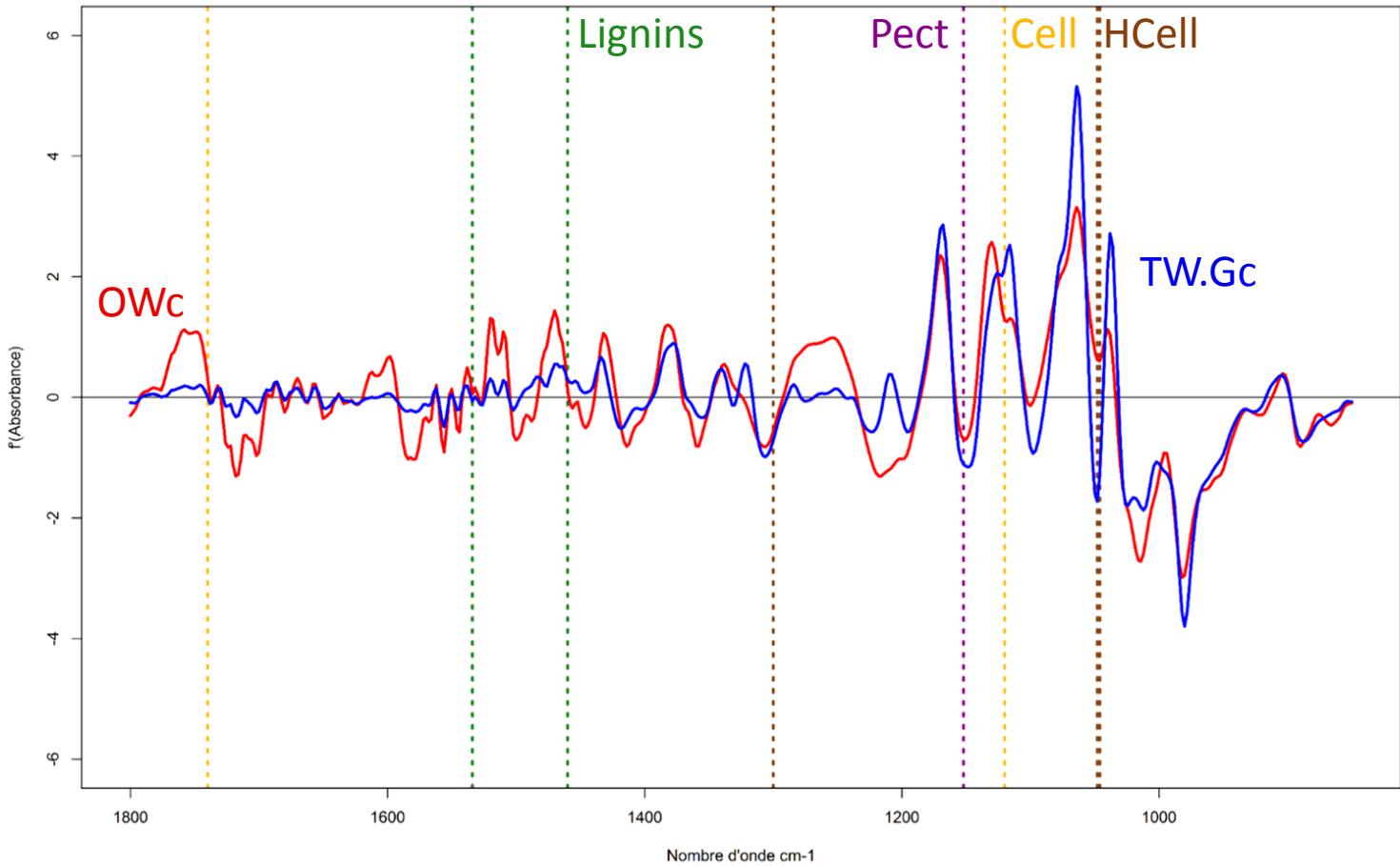
How can we explain those differences?

# PCA emphasizes different chemotypes

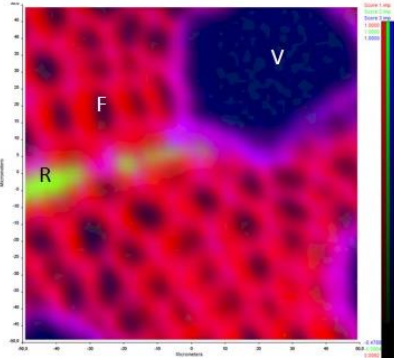


**Are they biologically consistent ?**

# G-layers are enriched in cellulose and deprive of lignins !

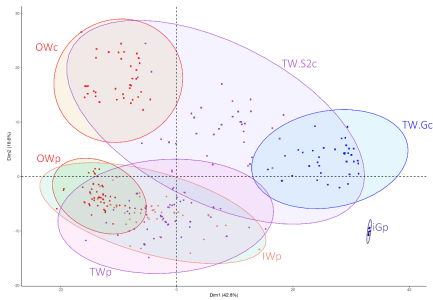


# Conclusion and perspectives



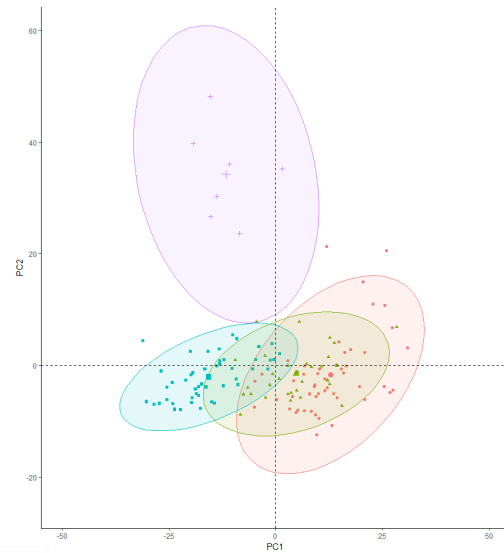
Multivariate image analysis provide histological-type images with enriched information

⇒ *Study at the cell – specific level*



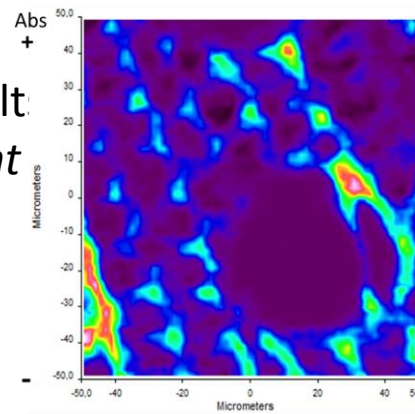
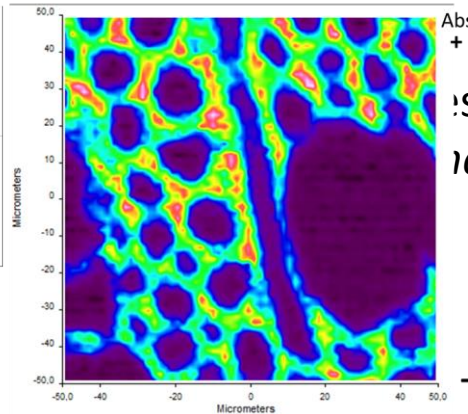
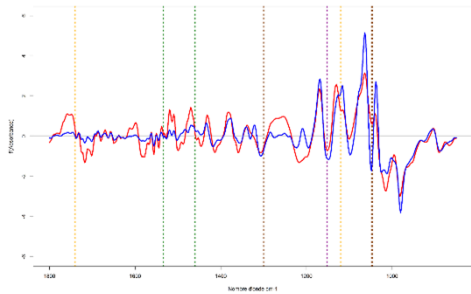
PCA emphasizes different chemotypes

⇒ *Discriminate between transgenic lines*



Opposite Wood

Tension wood



Abs +  
:sult  
ient

ality

# Acknowledgements



## « Molecular physiology of wood » team

**Annabelle Déjardin**  
**Françoise Laurans**  
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Marie-Claude Lesage-Descauses

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Camille Grand-Perret

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## Technical platform Génobois



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**Kévin Ader**

## UE GBFOR

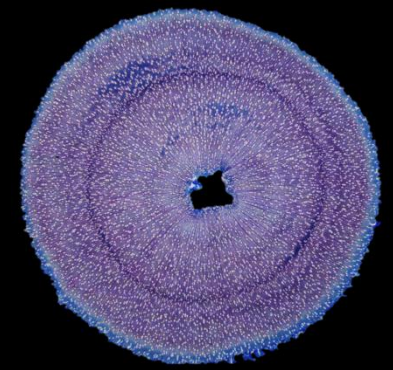
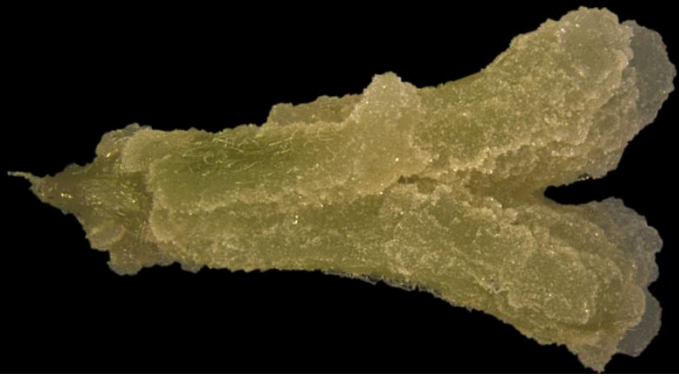
Patrick Poursat



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Centre Val de Loire Region (OPeNSPeNU)





Thank you for your attention !

