



Overview of LaBoMaP's company-driven researches

Advances in timber manufacturing processes and grading

Edinburgh, October 2026

Wood Material and Machining team / Laboratory of materials and processes

AM VALOR
Arts et Métiers - Sciences et Technologies

LaBoMaP
LaBoratory of Materials and Processes

Arts et Métiers Sciences et Technologies

Outline

From people and context to research and industrial impact

01

MEET THE TEAM

The people and institutions behind the research

02

THE FRENCH LANDSCAPE

French forests and timber market

03

INSIDE THE LAB

Our expertise, methods and facilities

04

EXAMPLES OF INDUSTRIAL PARTNERSHIPS

Industrial partnerships, timber products and projects

Arts et Metiers Science & Technology



Key numbers

- 8 teaching campuses and 3 research institutes
- 1,100 general engineering graduates from Arts et Métiers per year
- 6,200 students from all courses
- 1100 staff Teachers, researchers, technicians and administrative staff

The Arts et Métiers engineer

- General Engineer (Mechanical, Energetic)
- Product and Production Systems Design and Production Engineer
- Pragmatic, versatile, with high technological and scientific competence
- **In Cluny: 15~20 engineers/year for timber industry (looking for internships!)**





Arts et Métiers Sciences et Technologies

Wood Materials and Machining team



Louis DENAUD
Full Professor
Head of LaBoMaP



Stéphane GIRARDON
Associate Professor
Manager teaching team BoMec



Caroline MARC
Associate Professor



Bertrand MARCON
Research Engineer



Guillaume POT
Associate Professor HDR
Manager of research team



Joffrey VIGUIER
Associate Professor
Wood Expertise Manager

Tenure researchers



Elisa BRANCHARD
PhD Student



Hugo CURIAL
PhD Student



Cyril KACHOUH
PhD Student



Paul KUFFER
PhD Student



Paul MAILLEFERT
PhD Student



Gaethan MOUGUOUE
PhD Student



Delin SOH MBOU
PhD Student



Jocelyn PONTVIANNE
PhD Student

PhD students and post-docs



Fabrice COTTIN
Engineer
Wood Workshop Manager



Gaël BRINGER
Assistant Engineer



Adèle GUISTI
Technician

Technical team



Fabrice VERJAT
Computer Engineer,
Project Development



Jocelyn PONTVIANNE
Instructional designer
Projet A2ForBois



Guillaume LACONDEMINE
Project Manager A2ForBois

Specific project engineers

Shared motivation:

Make a better use of wood to help tackle climate change.
Protect and create local, less physically demanding jobs.
Explore a living material that still surprises us.
Share laughs and good moments along the way.

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SECTION

02

CONTEXT

The French forest landscape

Resources, species and industrial context

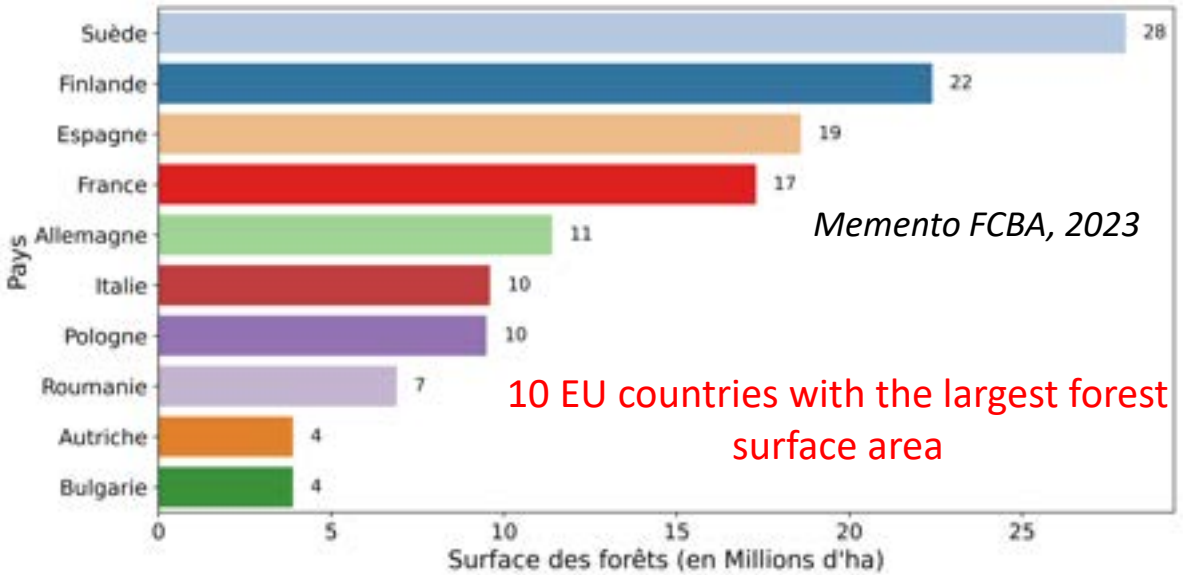
Arts et Métiers Sciences et Technologies

The French forest: vast and expanding

- 25.25 million hectares of forest in France
- Overseas departments ~ half of the metropolitan forest area, i.e. 8.25 million hectares.
- 17 million hectares of forests in metropolitan France
  - Afforestation rate: 32%
- 1985–2023: growing stock rose by over 50%, from 1.8 to 2.8 billion m³.
- Stock growth is slowing, especially in conifers, as tree growth falls and mortality and harvesting rise



Memento IGN, 2024



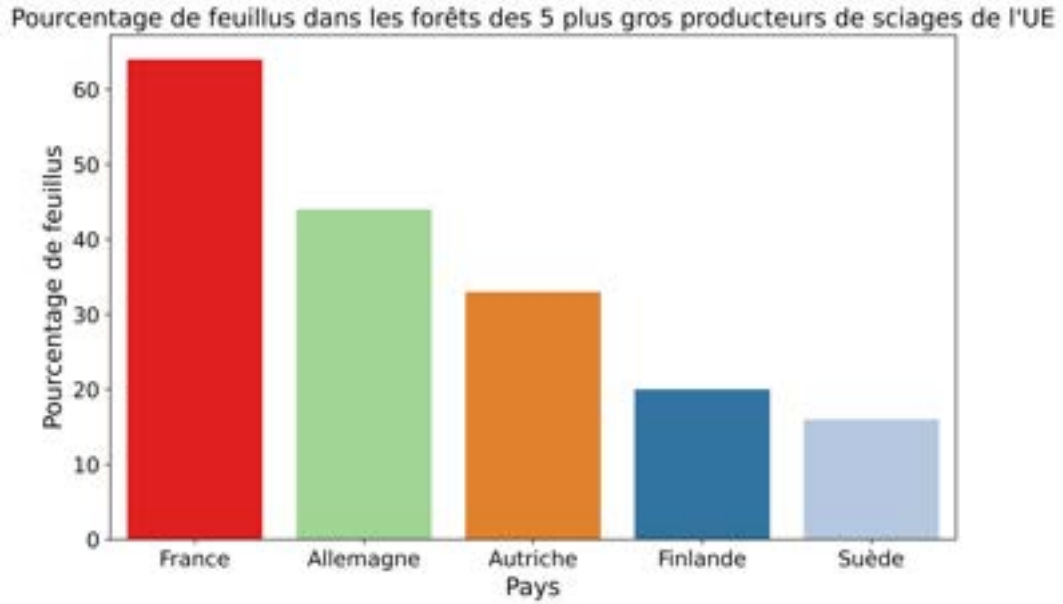
Memento FCBA, 2023

10 EU countries with the largest forest surface area

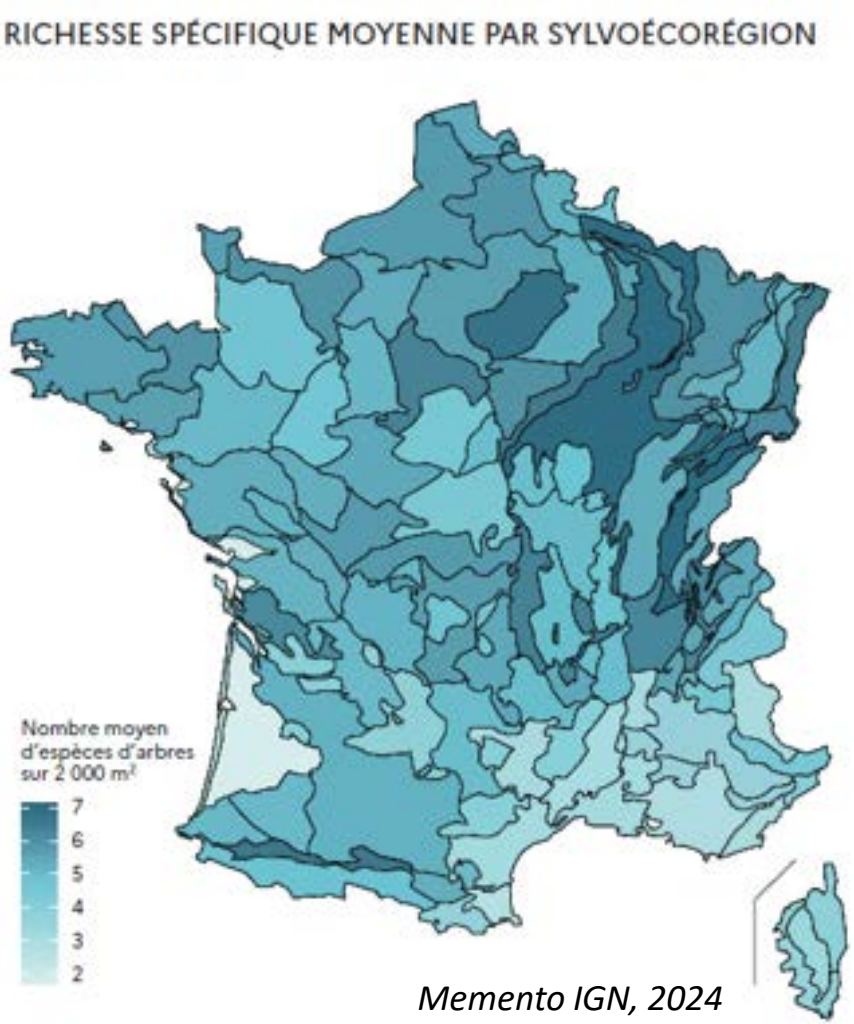
- Metropolitan France is 4th in the European Union in terms of forest area / 3rd in volume
- Sweden and Finland dominate with very high afforestation rates (62% and 66% respectively).
- France and Germany have afforestation rates very close to all the other countries mentioned (about 31%)

Specificities of the French forest

- Specificities of the French forest:
  - **Deciduous trees represent 65% of the volume** of wood in French forests



  - High species richness compared to other countries
    - France: **146 species**, top 4 represent 50% of the volume of standing wood (oak, beech, fir and spruce).
    - Germany: 51, top 4 account for 75% of the volume
    - Sweden: 26, top 3 account for 92% of the volume



Memento IGN, 2024

\+ Biodiversity and improved resilience to climate change

\- Difficulty of industrialization / adequacy with demand (high demand for softwoods)

The timber industry

- More jobs than the nuclear or aeronautics industry

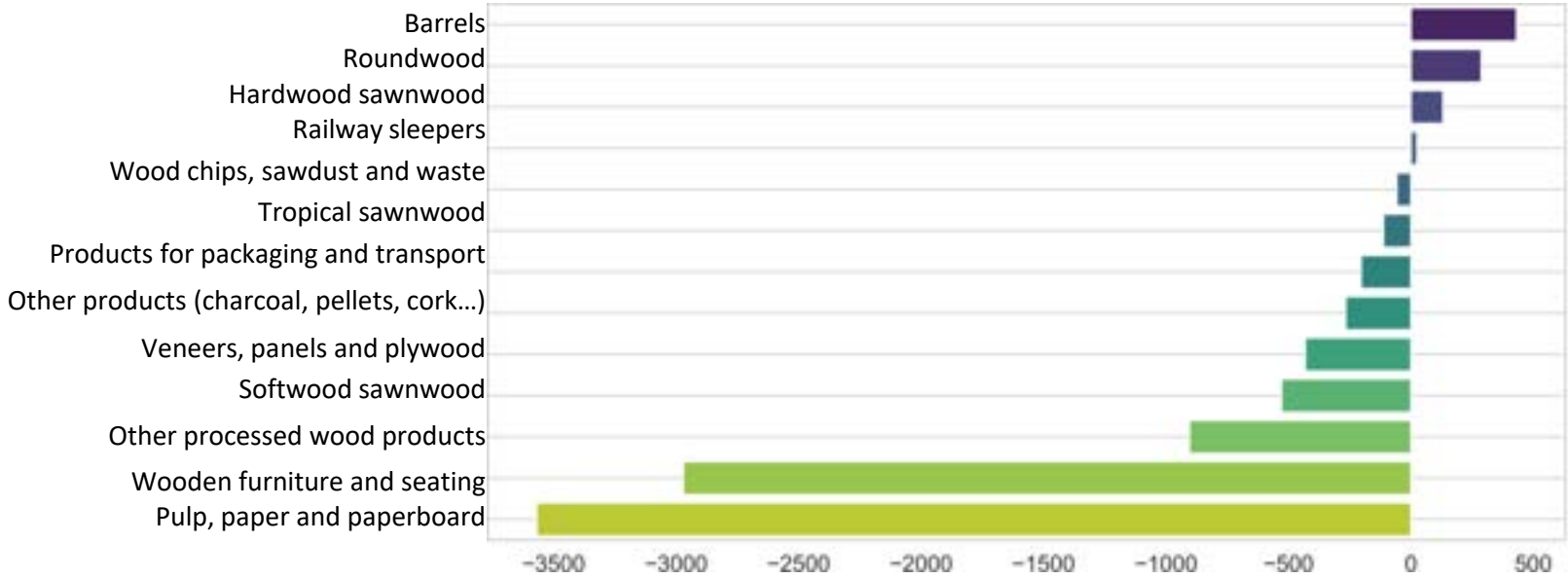




Manifesto of the forest and wood sector, 2022

But…

- The trade **deficit** if of **€8.5 billion** (2023)
- Only 4 surplus items (including roundwood exports)
- Imports of €1.6 billion of wood products for construction in 2021 (≈ 100% softwood) = 45% of consumption



Agreste, 2024

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France's commitments to carbon neutrality by 2050

National Low Carbon Strategy (SNBC3, June 2026)

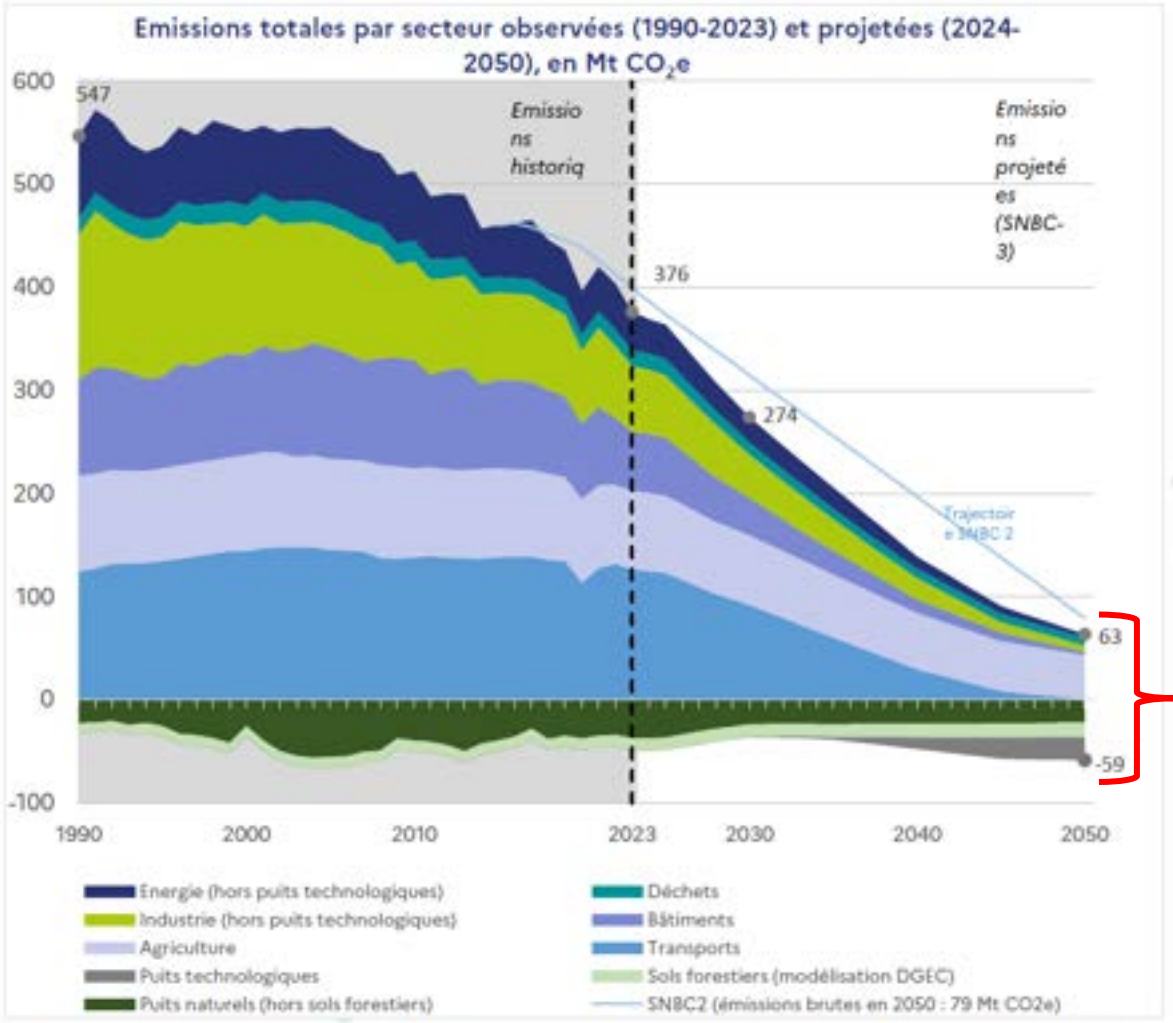
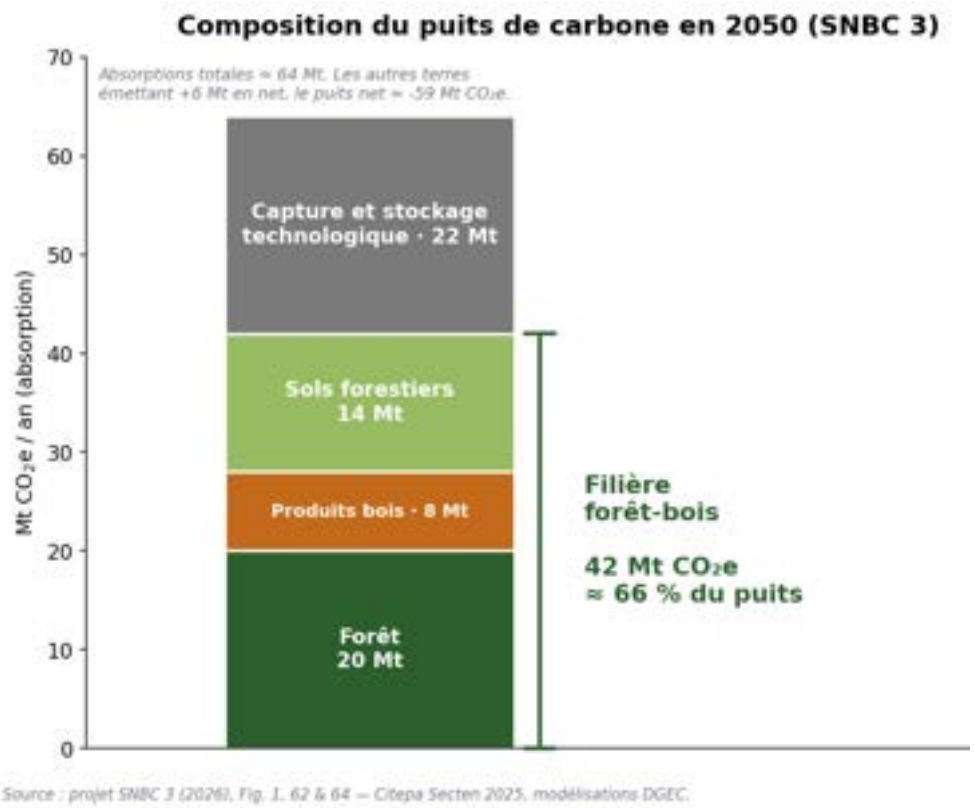


Figure 1 : Evolutions des émissions territoriales de gaz à effet de serre (Sources : inventaire national des émissions de gaz à effet de serre Citepa - Secten 2025, modélisations DGEC – AMS run 3)

Objectives for 2050



Fundamental role of the forest-wood sector in achieving carbon neutrality objectives by 2050, including **substitution by timber products**

Conclusion on the context and challenges of the valorization of french timber in construction

- Demand for wood products in construction needs to increase to meet carbon neutrality targets and new regulations
- France imports 45% of its wood consumption in construction (€1.6 billion in 2021)

Increased production capacity

- Increase in the volume of living wood

Threatened by climate change and mainly due to deciduous trees

- The French forest is mainly made up of deciduous trees
- The construction market is dominated by softwoods

Mismatch between resources and needs

A resource that is more difficult to transform

Standardisation favourable to softwoods/to be developed for hardwoods

Some key challenges we want to address:

- **Process efficiently lower-grade hardwood into construction products**
- **Precise and efficient quality assessment to optimise timber processing and use**

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SECTION

03

RESEARCH

Inside the lab

Facilities, methods and experimental capabilities

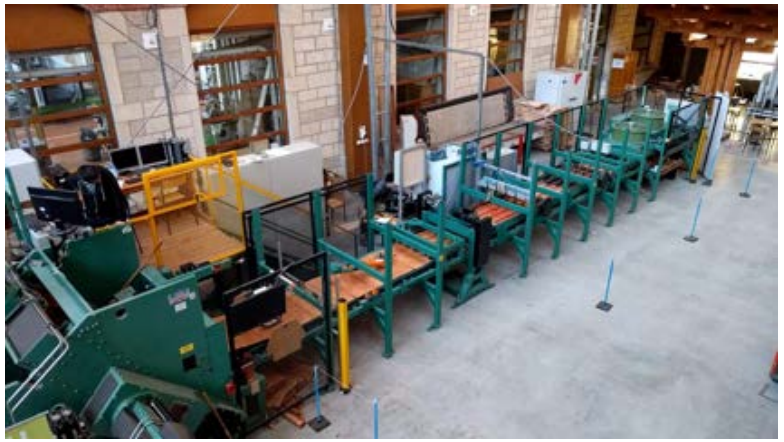
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LaboMaP Research activities

Main themes of study and research:

Context: Improving fast-growing species and lower-grade hardwood value

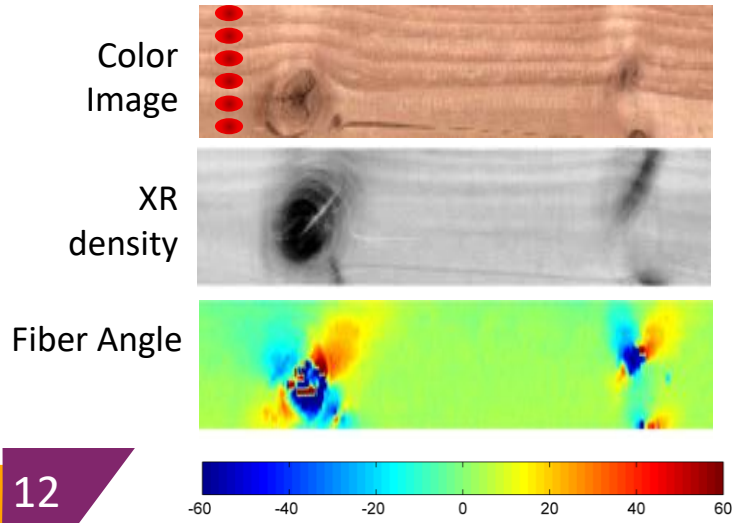
❑ Advanced manufacturing and material–process interactions







❑ Mechanical characterisation and modeling of timber for quality assessment





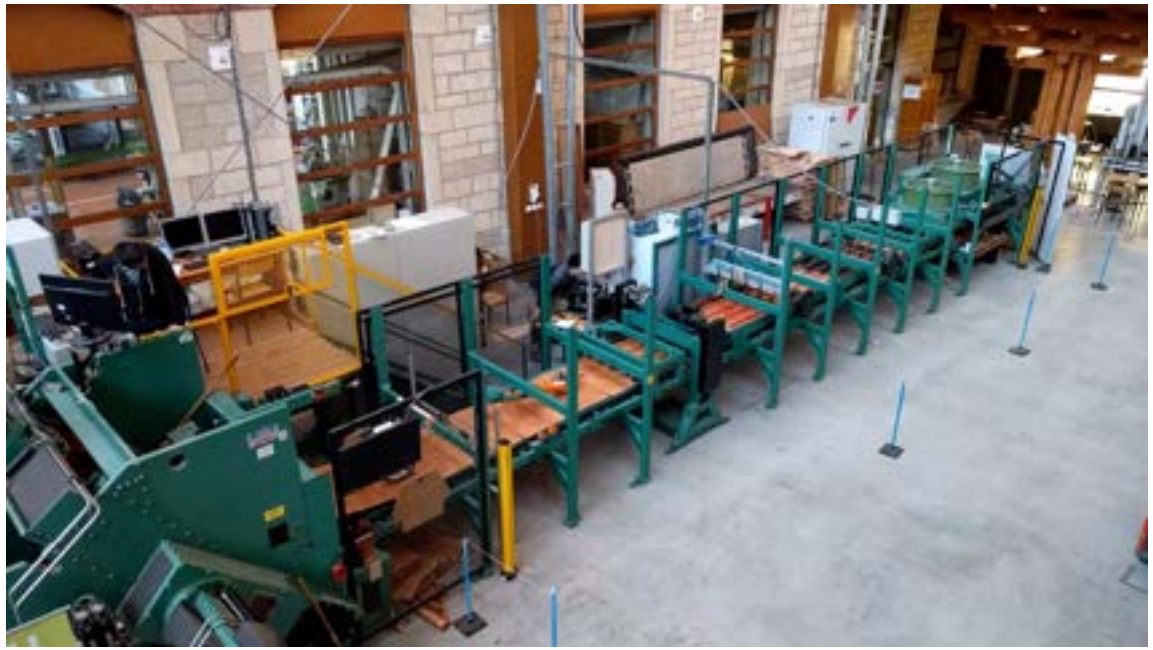


Experimental peeling platform

Instrumented peeling line and veneer-based product manufacturing platform

- Instrumented peeling line
- Dryer, gluing machine and hydraulic presses





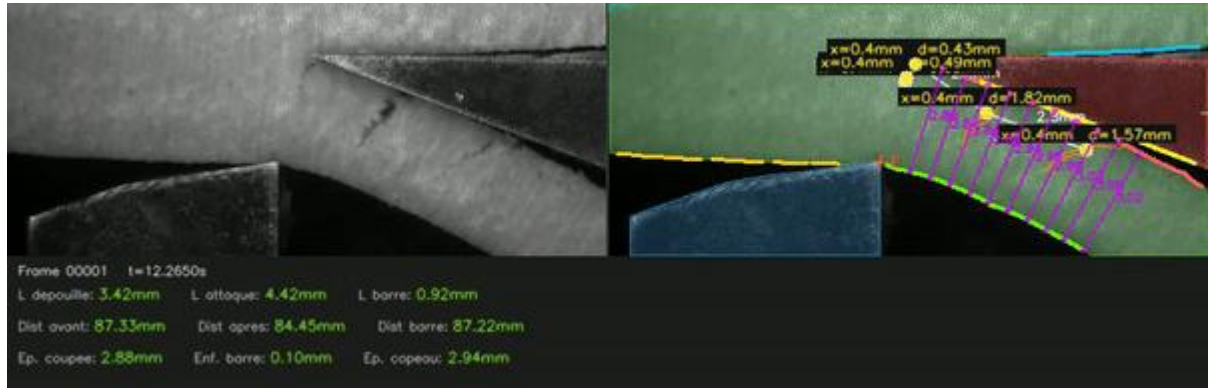






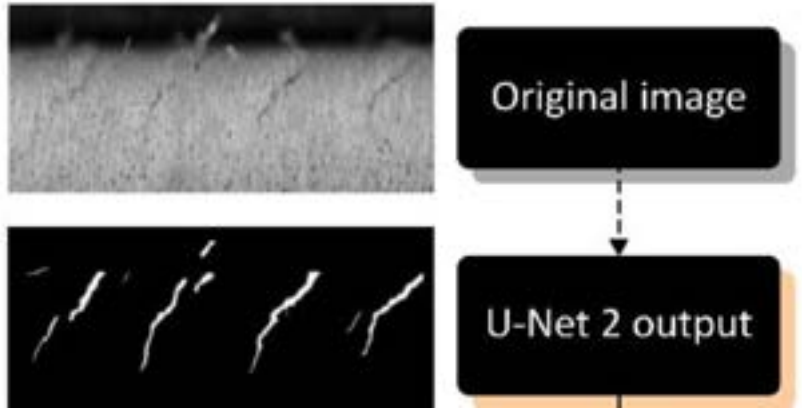
Experimental peeling platform

- In-situ Measurement of peeling Cutting Conditions by Image Analysis (Yolo v11)
  - Tool geometry, cut thickness, extra thickness, compression ratio...



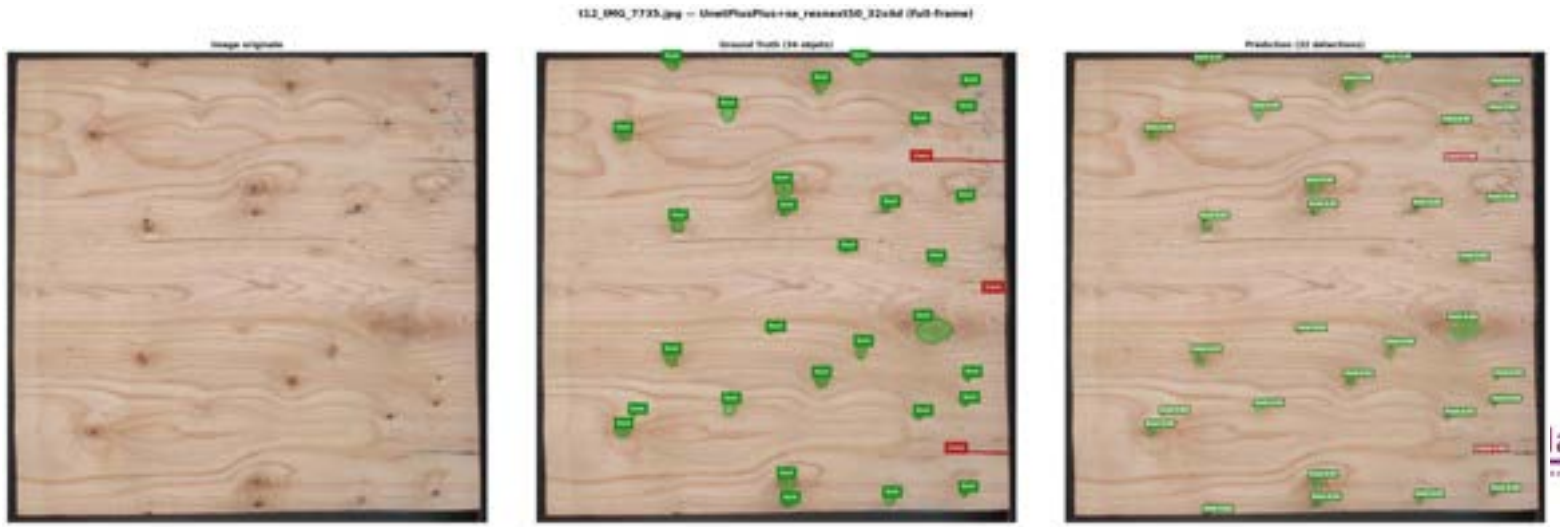
Curial, 2026

Automatic measurement of the morphology of peeling cracks by image analysis (U-net)



Marc, 2025

Automatic detection of knots and splits on wood veneers (ResU-net)

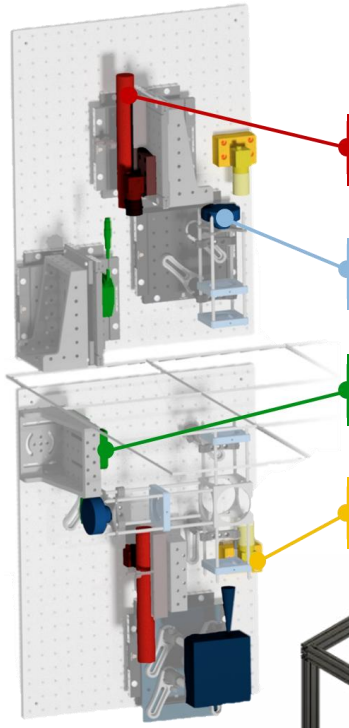


Increased performance on image analysis tasks

ADEME CHOC, 2026

Non-destructive testing and mechanical modeling

Laboratory scanner designed by LaBoMaP veneers / sawn timber
WENART = **W**ood d**EN**sity and fiber **A**nalyzer both in **R**eflection and **T**ransmission

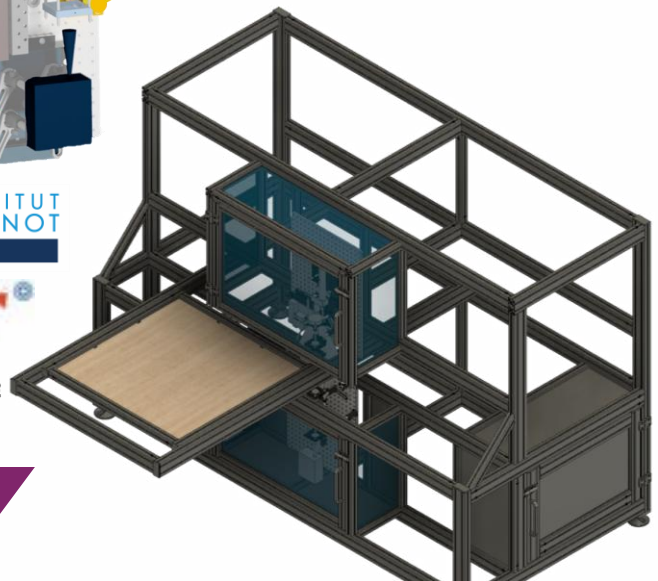


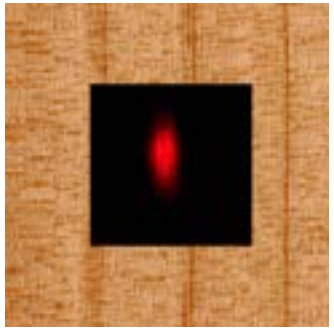
Fibers orientation

Local density (X-R, THz)

Thickness & waviness

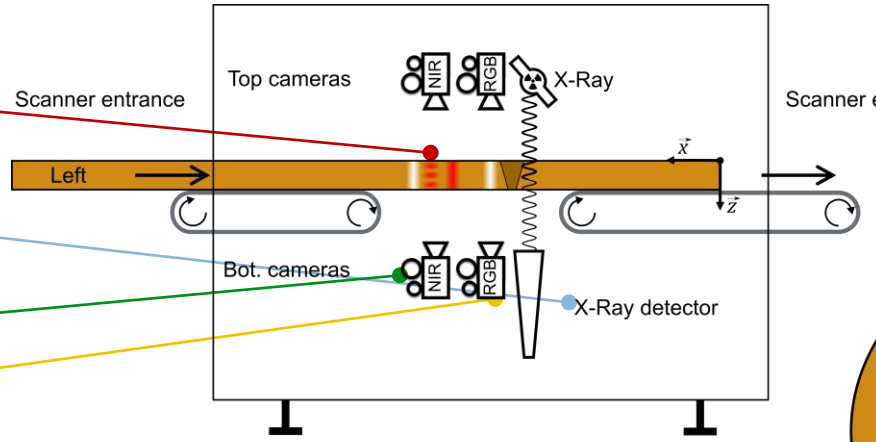
Color RGB cameras

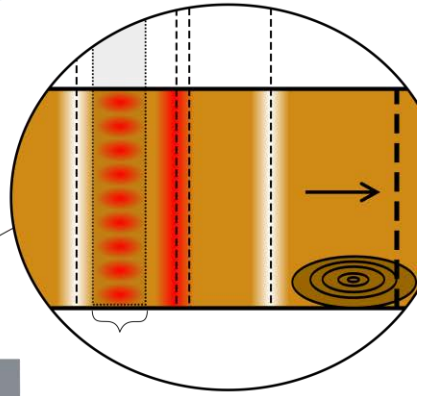


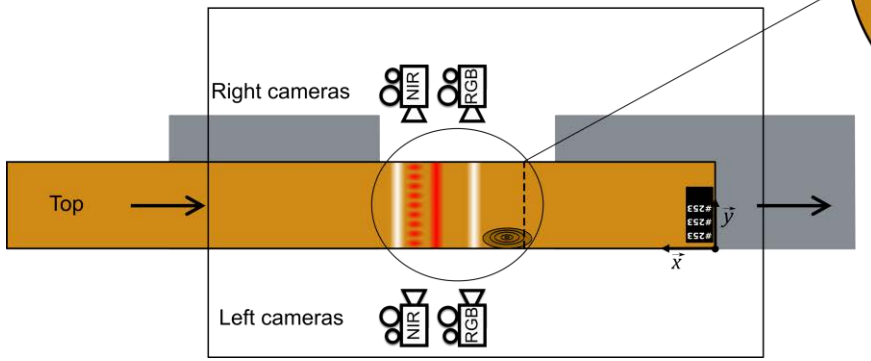


Industrial sawn timber scanner







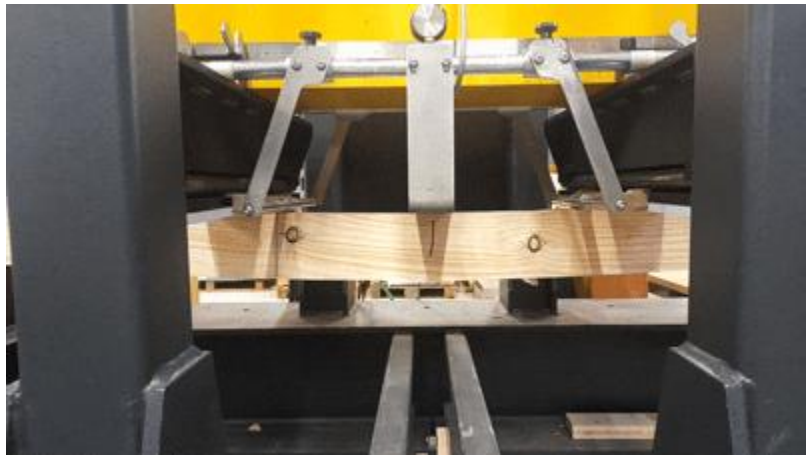


Non-destructive testing and mechanical modeling



Bending or tensile testing



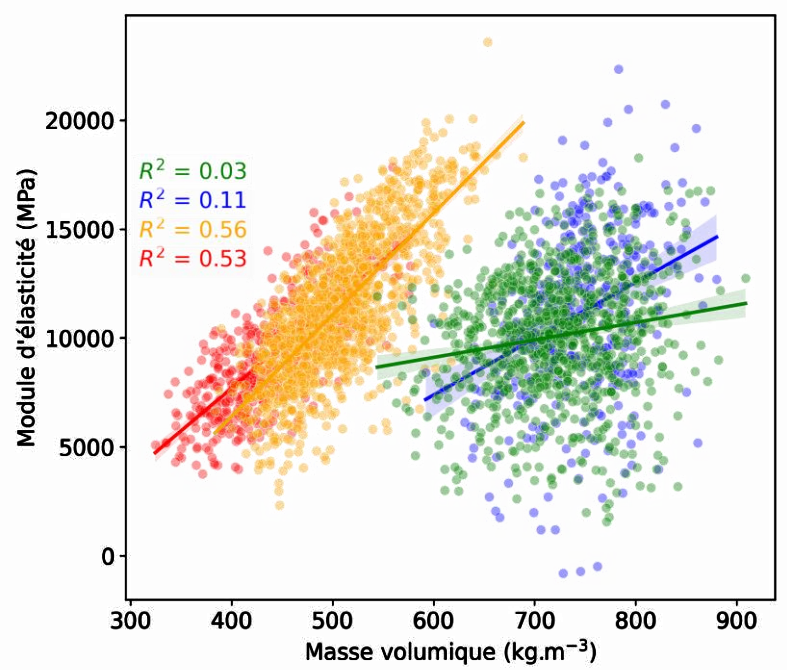


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Large dataset of scanner and mechanical test from different species

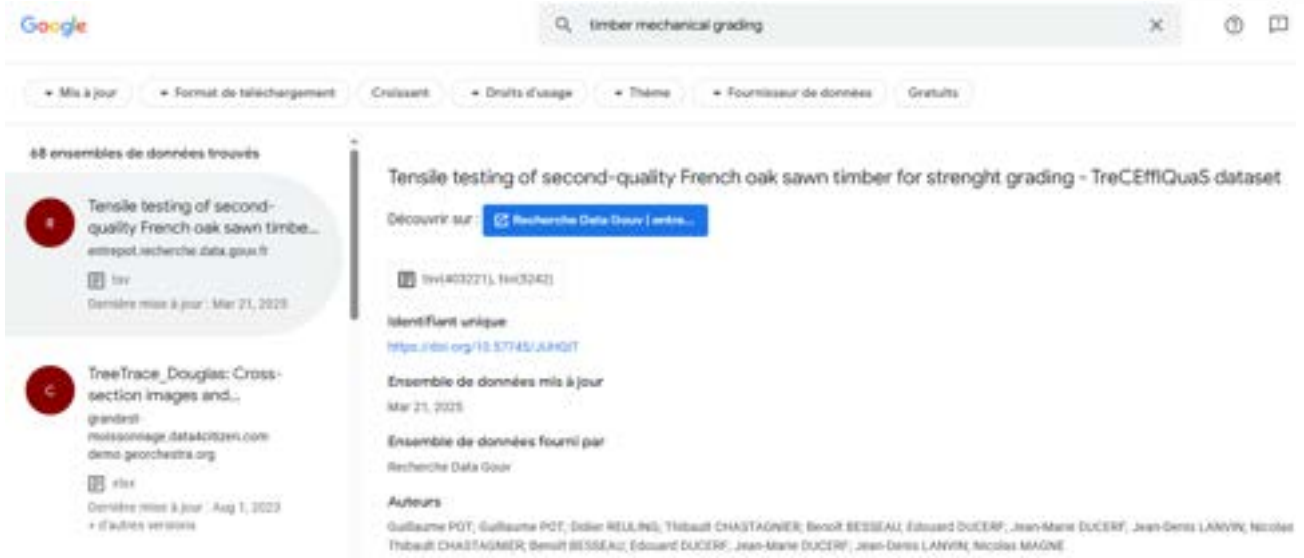
~7000 sawn boards tested in **bending** or **tension** and scanned by **industrial scanner** and vibrationnal method between 2011 and 2026

Project	Year	Species	Test Type	n
ClaMeB	2011-2016	Norway spruce	Bending	376
ClaMeB	2011-2016	Douglas fir	Bending	691
ClaMeB	2011-2016	Douglas fir (large diameters)	Bending	224
CDuBoBi	2014-2017	Sessile and pedunculate oaks	Bending	357
TreeTrace	2017-2022	Douglas fir	Bending	332
TreCEffiQuaS	2020-2024	Sessile and pedunculate oaks	Tensile	924
EffiQuass	2021-2026	Douglas fir	3D Angle + Bending	~30
CHOC	2023-2027	Hornbeam	Bending	~900
CHOC	2023-2027	Red Oak	Bending	~900
CHOC	2023-2027	Pubescent oak	Bending	~100
CHOC	2023-2027	Locust	Bending	~900
CHOC	2023-2027	Maple	Bending	~400
NZ	2025-2026	Radiata Pine	Bending	~360
				~7000



Spruce Bending
Douglas Bending
Oak Bending
Oak Tensile

Shared data →



SECTION

04

APPLICATIONS

Industrial partnerships, timber products and projects

From research results to industrial value

Arts et Métiers Sciences et Technologies

Veneer peeling and plywood companies in France



Industrial site of tebolvl



Veneer handling in BDA



Veneer peeling in BDA



Tebo lvl product

1.65 B€ Turnover

~15 Main industrial sites

4 Main species : poplar, pine, beech, spruce

20 B Wooden sticks

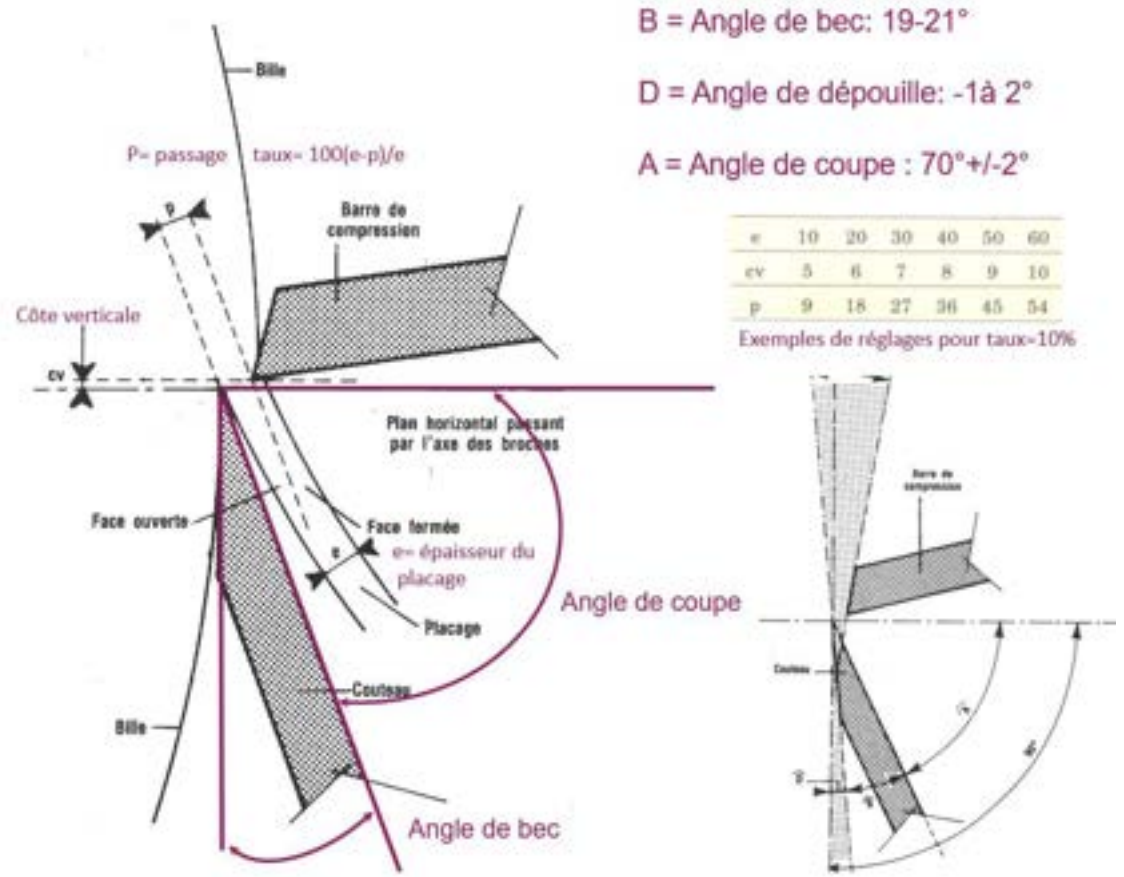
1 Research laboratory

LaBoMaP peeling competence center

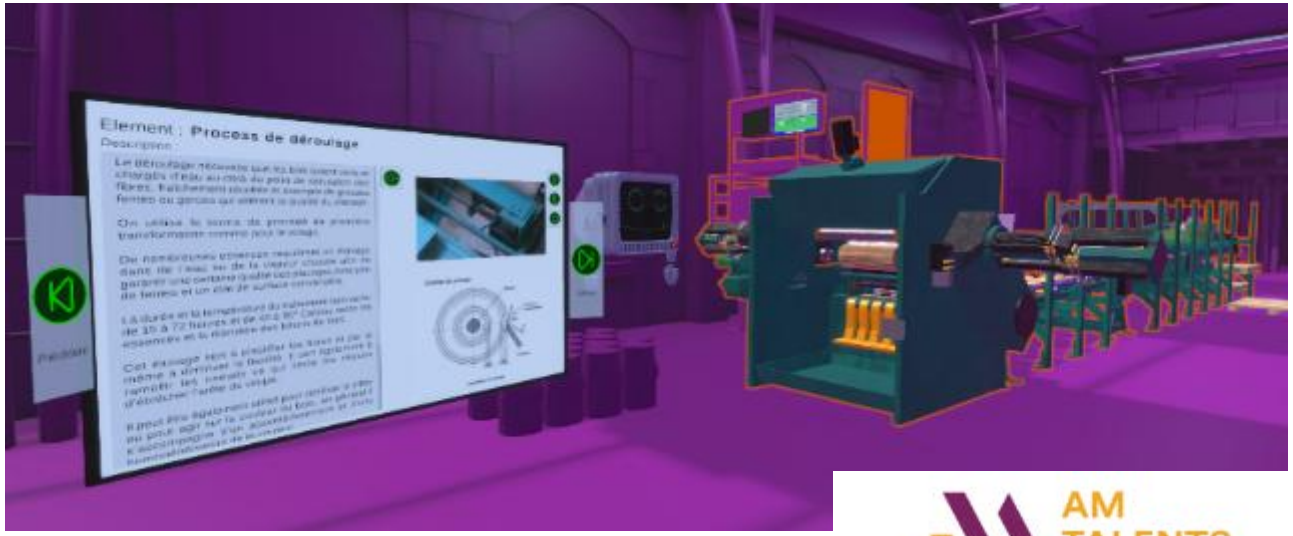
- Training school for technical employees of the major peeling companies (lot of employees turnover, coming from various industries)



Wood structure



Peeling settings



Digital twin of the peeling

LVL manufacturing, mechanical testing and modelling

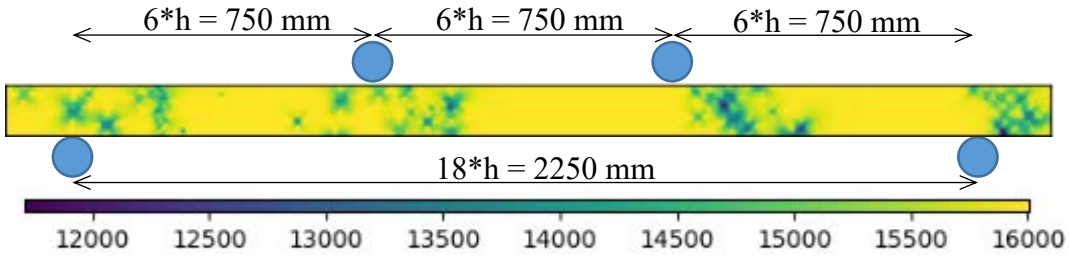
- Example of an industrial study for Douglas fir LVL (R. Frayssinhes PhD)
- Tracking of every veneer all along the process
- 2500 x 1250 x 45 mm panels sawn into 125 mm beams (N = 190)
- EN 408 mechanical testing
- Finite element mechanical modelling accounting for local knottiness and relative fibre deviation



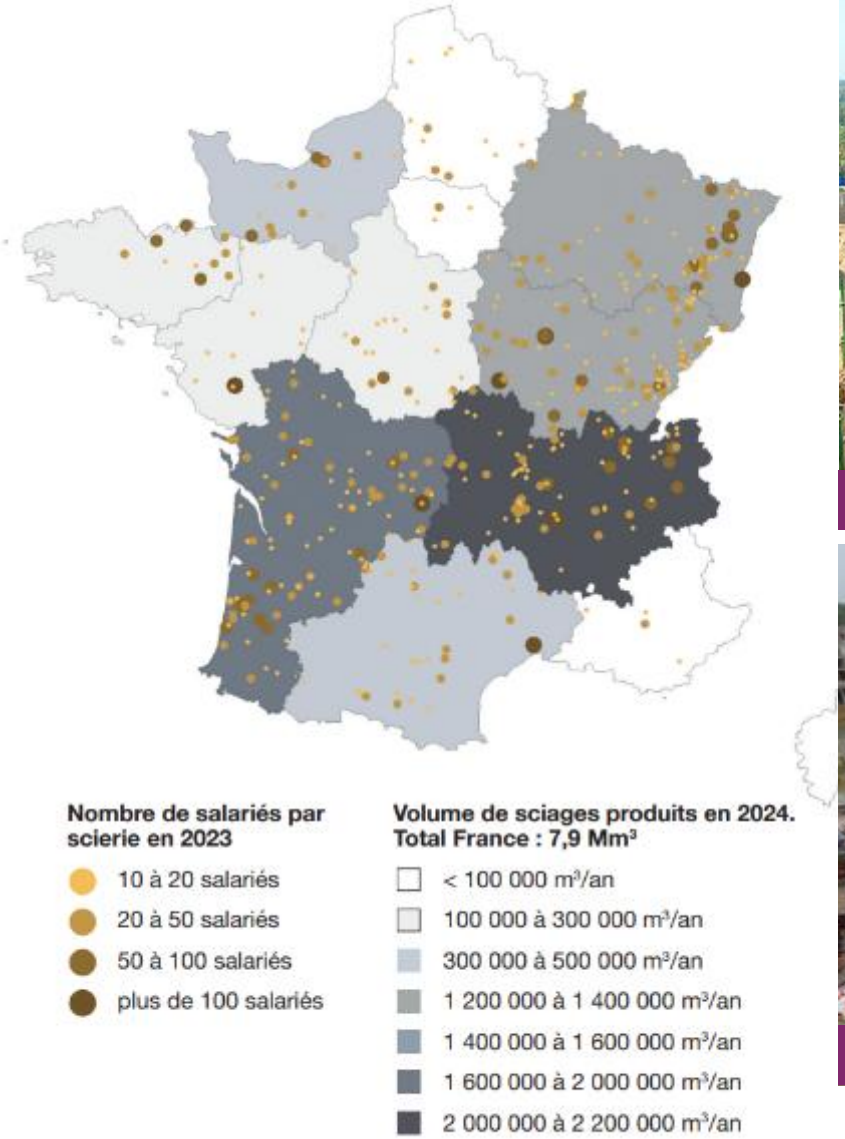








Sawmills and sawn products in France



Sources : Enquête annuelle de Branche – Exploitation forestière et Scierie – 2024, INSEE, FCBA 2025.



Piveteau's logyard



Carpentry made by Arbonis (aqualagon)

4 B€ Sawnboards turnover

2.4 B€ Joinery products turnover

0.9 B€ Carpentry turnover

8.4 Mm³ Sawnboards

82% Softwood

Oak timber processing since 1885







SAWNBOARDS

- Since 1885
- 40 000 m^3 of fresh logs per year
- 90% oak, 10% other hardwoods
- First sawmill to be certified PEFC in 2002

JOINERY

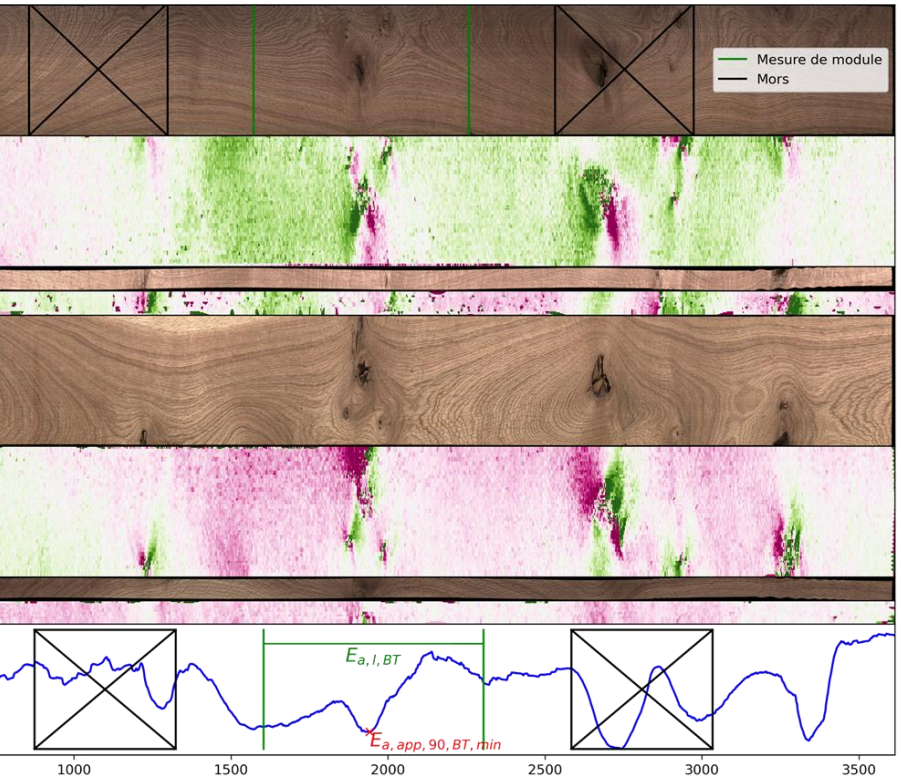
- Since 1962
- Finger jointing and panneling
- Panels, laminated scantling, cladding, decking boards

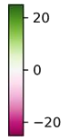


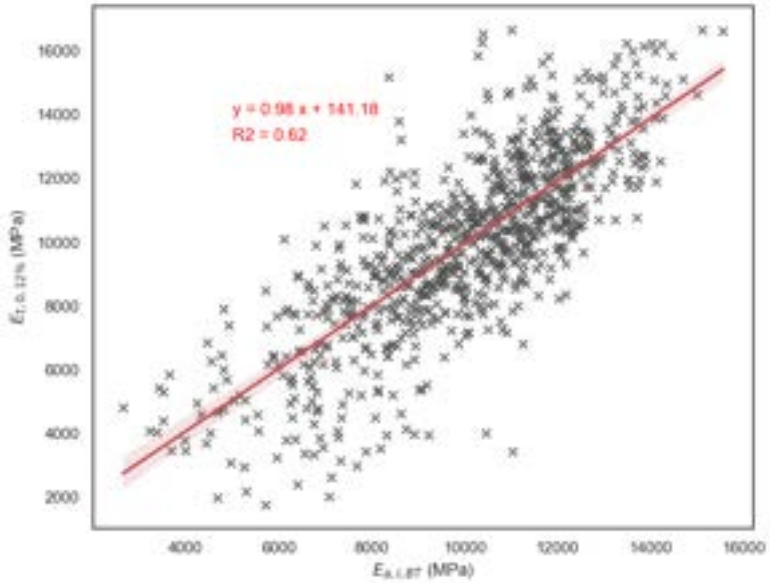
Long history of collaboration and innovation with ENSAM Cluny

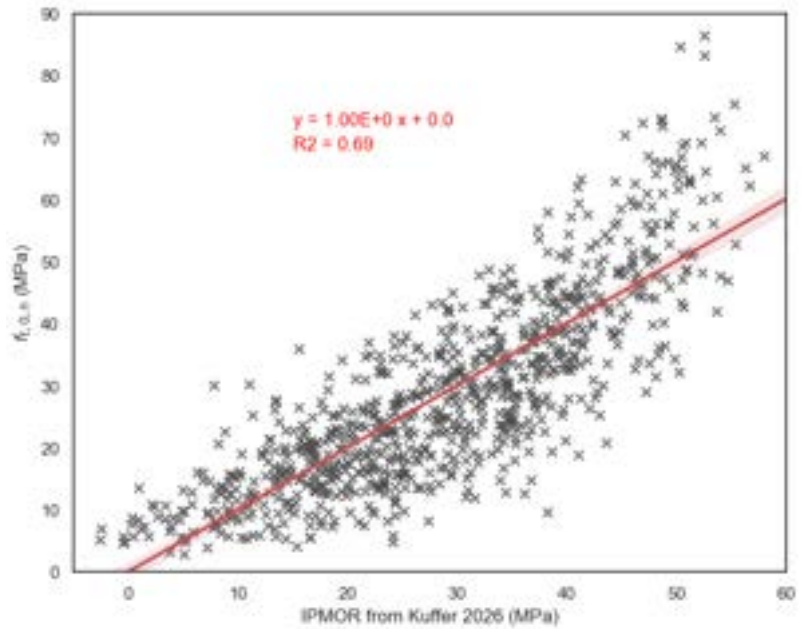
Improving mechanical models for predicting the mechanical and physical properties of sawn timber

ADEME TreCEffiQuaS project 2020-2024 = classification of secondary quality oak in traction









Model comparison / mechanical tests

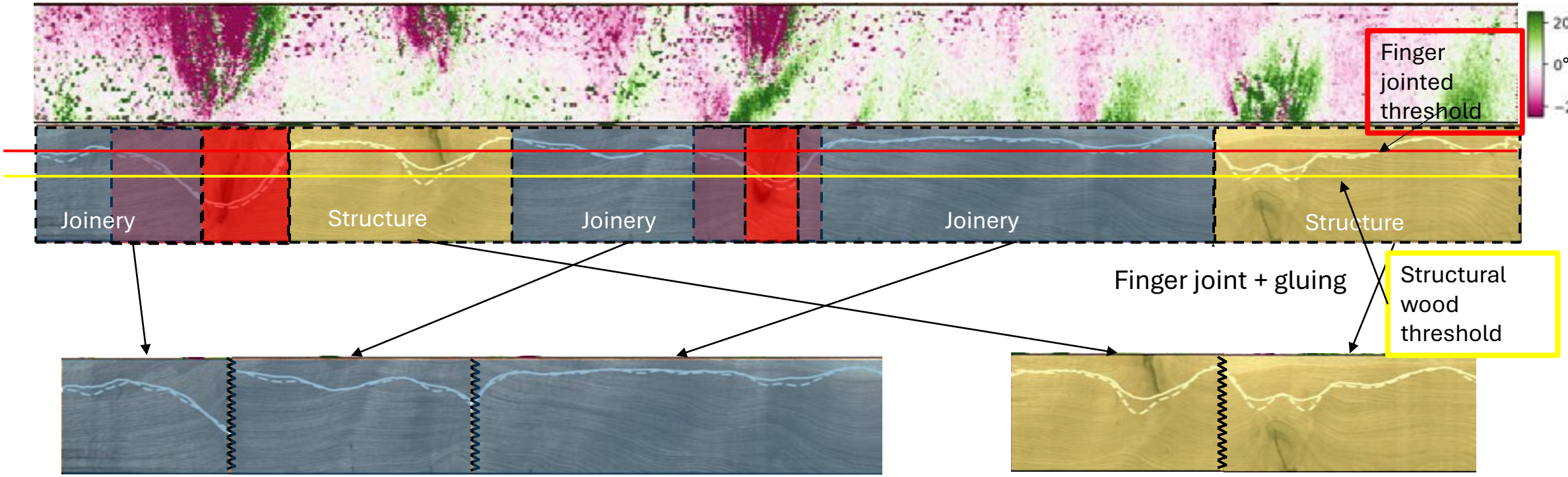


Calibration of a Grading Model for Product Manufacturing

PhD thesis Ducerf 2025-2028

Innovative industrialization of the transformation of oak into technical products for structural and non-structural uses for construction

Optimization of the manufacturing process of finger-jointed lamellae from wood with high knottiness



Joinery quality finger-jointed lamella

Structural finger-jointed lamella

Projects:

- **Material yield and economic optimization** in technical products for construction → industrial implementation (Cifre Ducerf thesis)
- **Automation of cutting** to ensure the strength of finger jointing from fiber orientation scanners → Propose the **integration of an average angle criterion for finger jointing in standards**
- Guaranteeing the **machining quality** of the joints according to the fiber orientation

Example of application : Oak CLT panel – Bois Croisés de Bourgogne

- Development of the manufacturing process
- Delamination, bending, rolling shear tests

BATI CHÊNE

14 sawmill partners, 2nd processing, specifiers











Arts et Métiers

Feuillus CHOC *

Developing the use Harwood in construction through a holistic, collaborative, and entrepreneurial approach

1. **Identification of species**
   - Harvesting potential
   - Quality
   - Accessibility

2. **Processing**
   - Peeling
   - Sawing

3. **Characterization**
   - Mechanical grading
   - Durability and fire resistance

4. **Market study and provision of use**

2 PhD Thesis on primary processing and relative products

Hardwood species of the study:
- Hornbeam
- Red oak
- Pubescent oak
- Black locust
- Maple

Peeling → Definition of **process parameters** → Production a and characterization of **veneers** → Gluing and characterization of **products**

Sawing → Improvement **mechanical models** → Process optimization for **finger-jointing** → **Grading**

Feuillus = Hardwood **FCBA**=Technological institute for Forest Cellulose Wood-Timber and Furnishing

Conclusion

More local timber in construction (substitution to reduce CO2 emissions)

Smarter processing of lower-grade timber

Reliable grading for the right end use

Applied research easy to implement in industrial partnerships (SME’s)





Arts et Métiers Institute of Technology

activites.bois.cluny@ensam.eu