



InnoCrossLam = Innovative Solutions for Cross Laminated Timber Structures

Madrid, 29.9.2022

www.innocrosslam.zag.si

Innocrosslam

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773324



Project partners

- The Slovenian National Building and Civil Engineering Institute ([ZAG](#)) – leading partner



- Lund University, Sweden ([LU](#))



- Vienna University of Technology, Austria ([TUW](#))



- Technical University of Munich, Germany ([TUM](#))



- University of Navarra, Spain ([UNAV](#))



- Project duration: 01.03.2019 – 30.9.2022
- Total project budget: 1.31 mio€

Project partners



Introduction

Project objectives

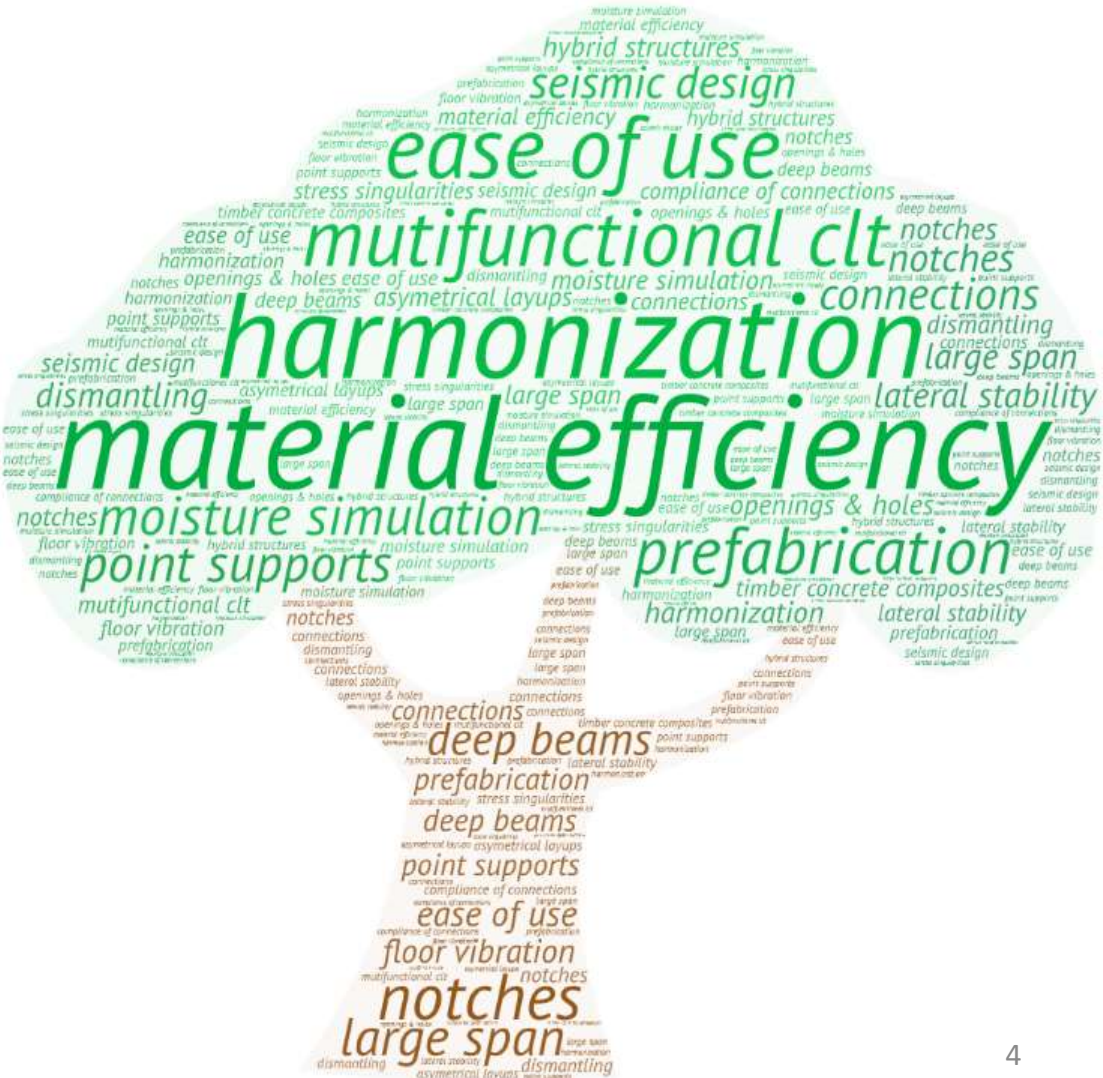
"...increasing the competitiveness of CLT ..."

*"...increasing predictability of CLT...**demanding design situations...**not covered by standards ..."*

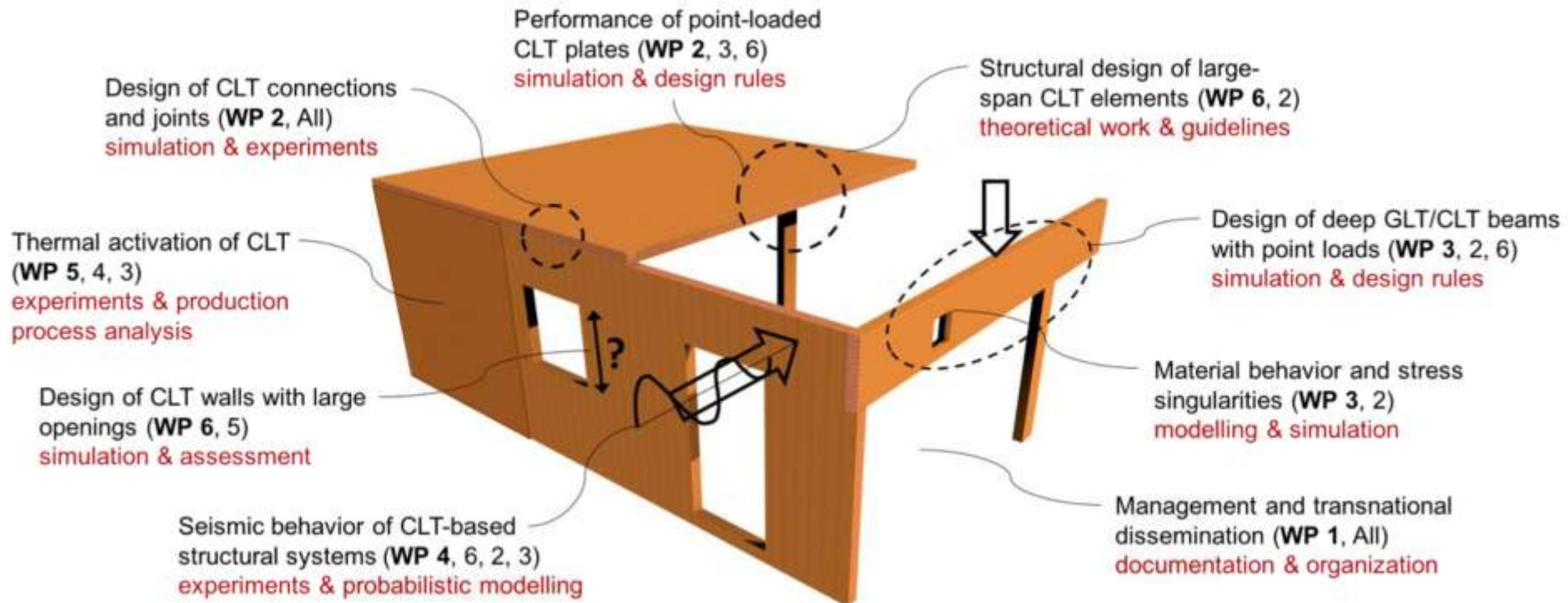
*"...further develop a ... **multi-functional use of CLT** in terms of its thermal activation*

Project topic area

*...timber engineering
(experimental, numerical...)*



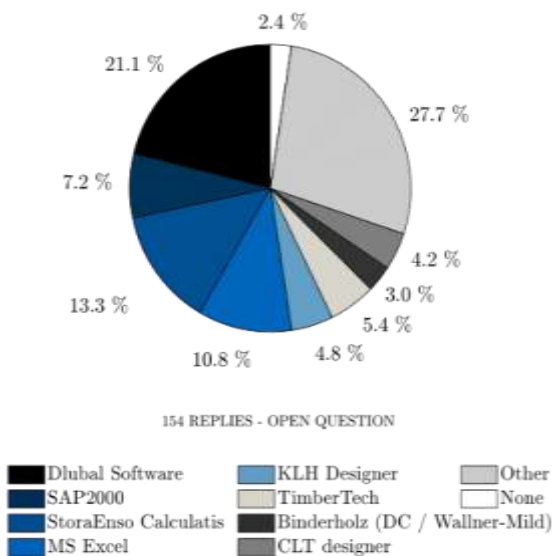
Results





Results

- General experience of the participants with CLT design
- Complex design situations: (a) challenges, (b) problems and (c) improvements



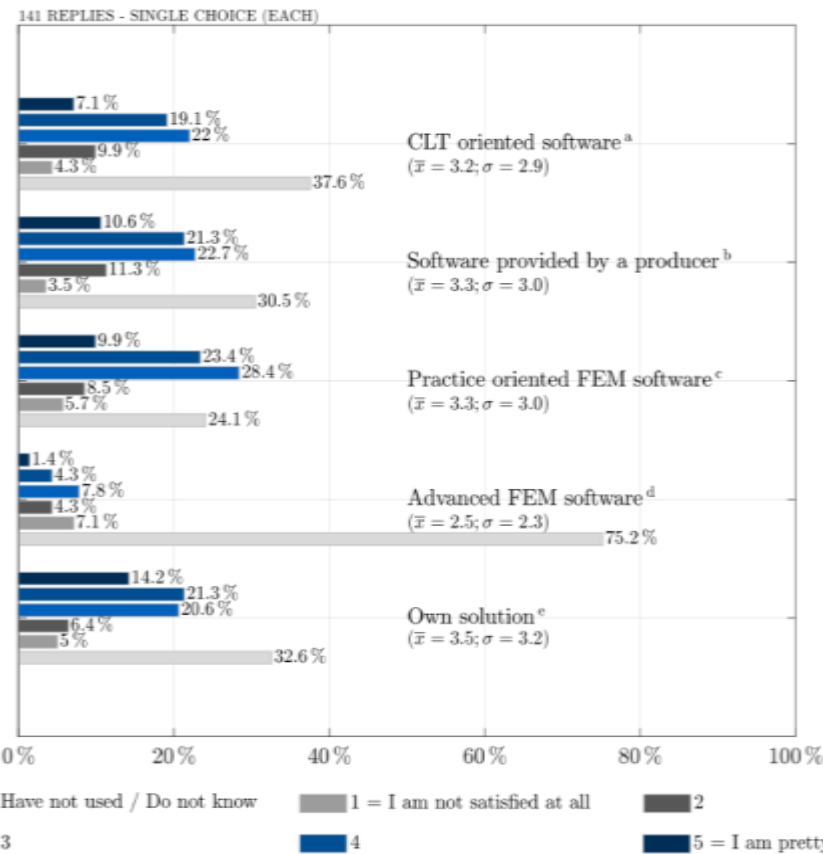
^a CLTdesigner, TimberTech, etc.

^b Binderholz (DC / Wallner-Mild), KLH Designer, etc.

^c Dlubal, SAP 2000, SOFISTIK, etc.

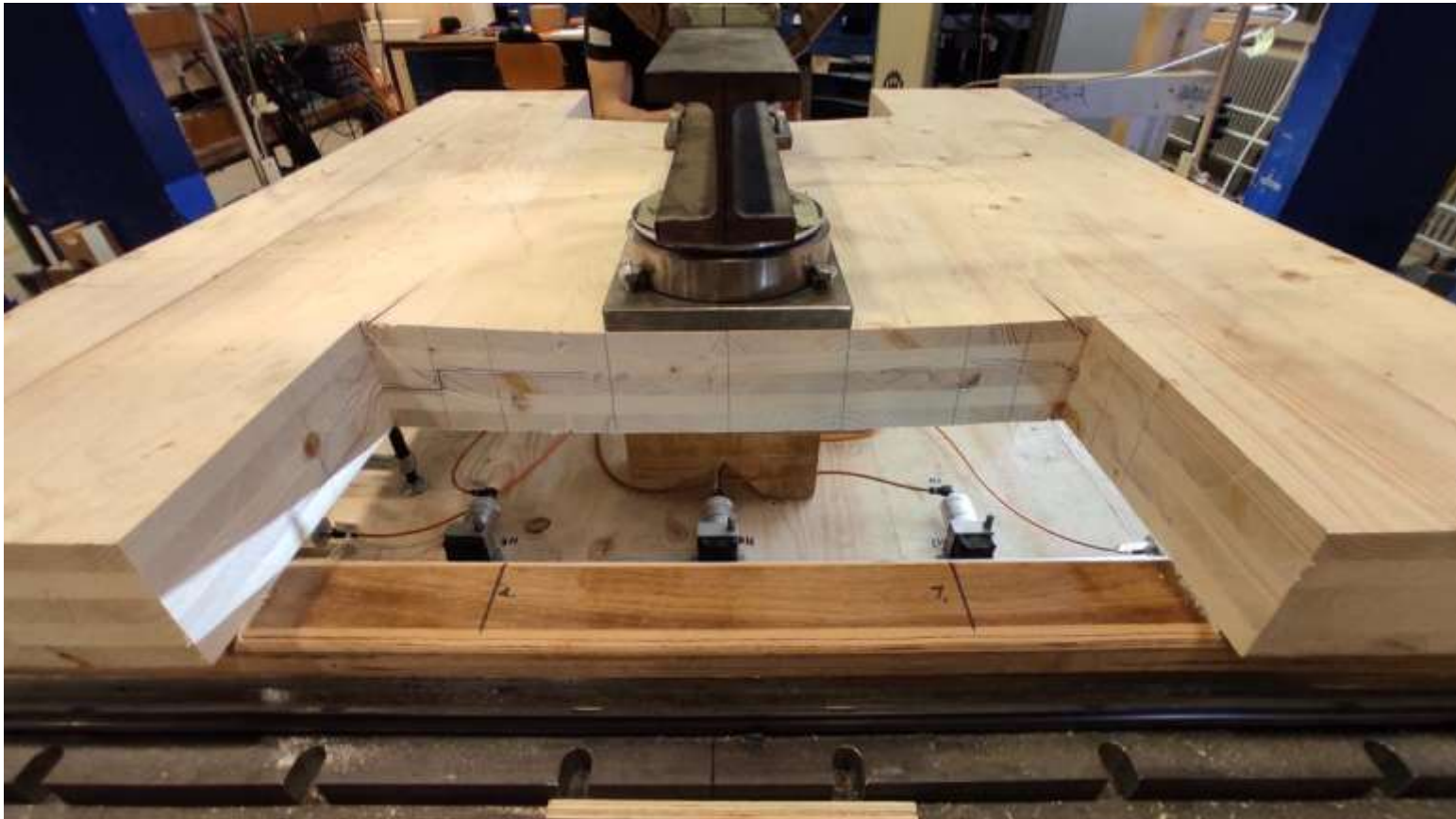
^d Abaqus, Ansys, etc.

^e MatLab, MS Excel, etc.



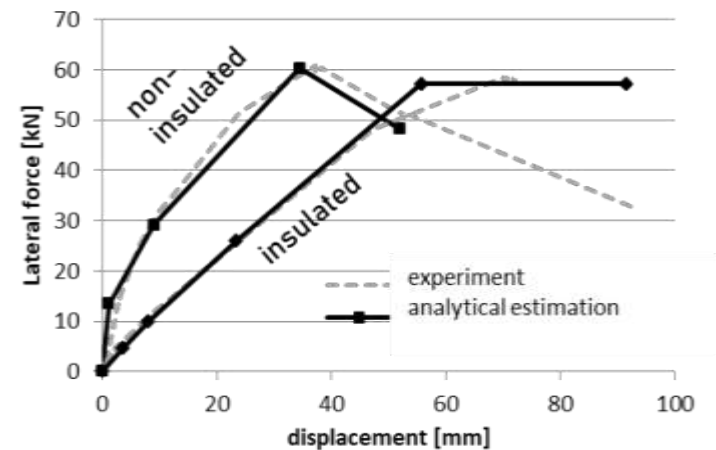
Results

- Various experimental investigations: *CLT with openings, CLT beams, CLT walls with sound insulation, brittle failure of CLT connections and other...*



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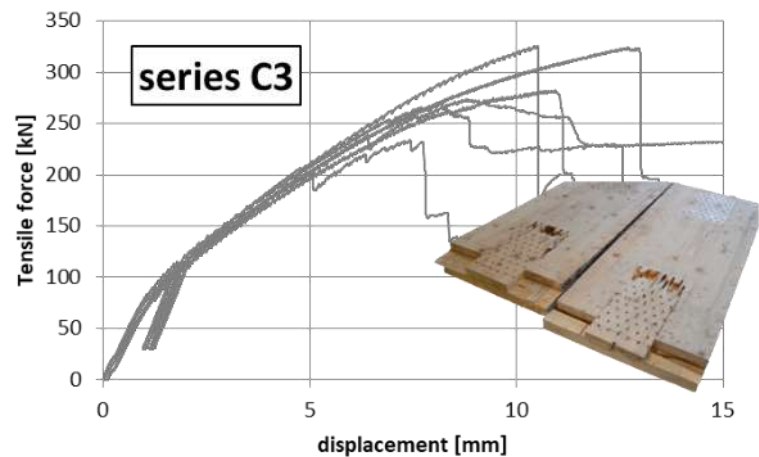


Results

- Various experimental investigations: *CLT with openings, CLT beams, CLT walls with sound insulation, brittle failure of CLT connections and other...*



failed connection



Results

Is thermal activation in solid timber structures applicable in practice at all?

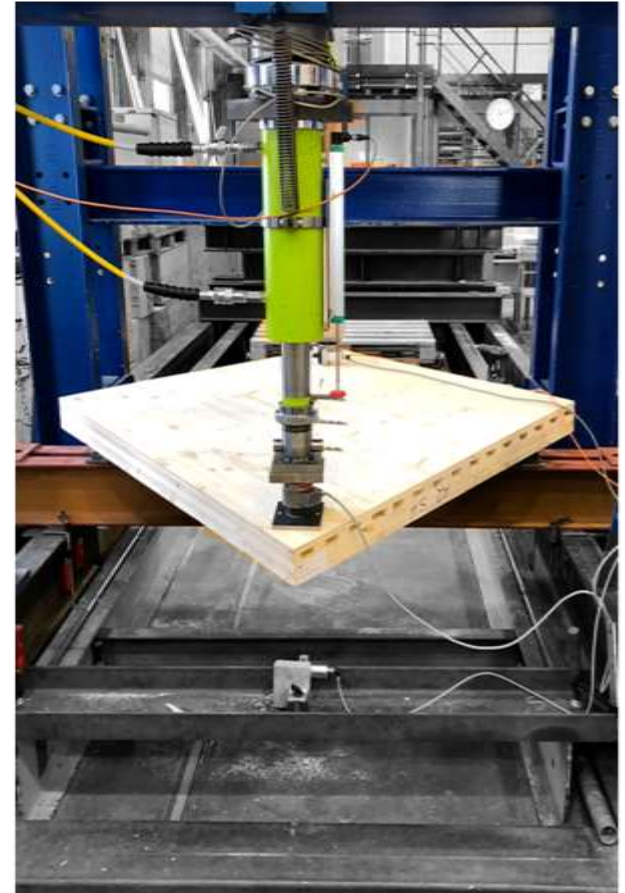
In-plane Shear Stiffness



Maximum Buckling Load



Torsional Stiffness





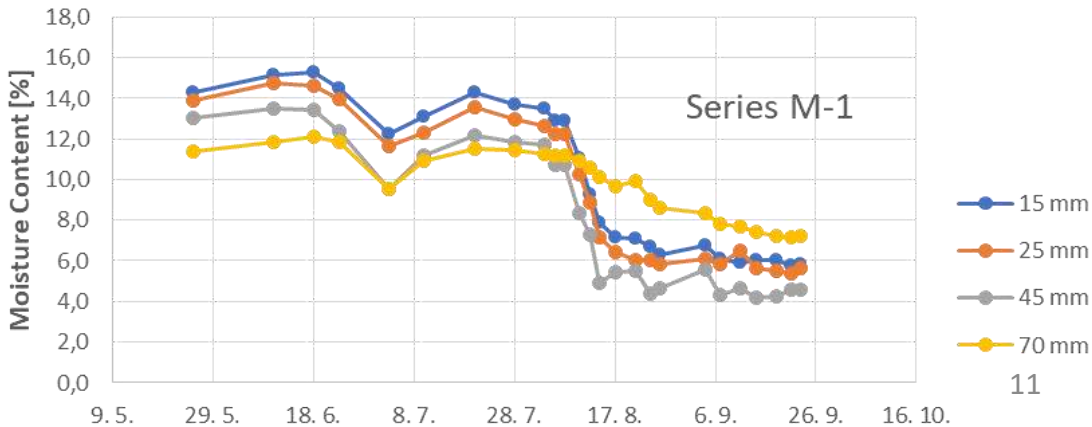
Results

Is thermal activation in solid timber structures applicable in practice at all?



During the heating and cooling process, temperatures between 15 and 45 degrees occur in the channels.

The change of the moisture profile over the cross-section and the overall curvature are measured.



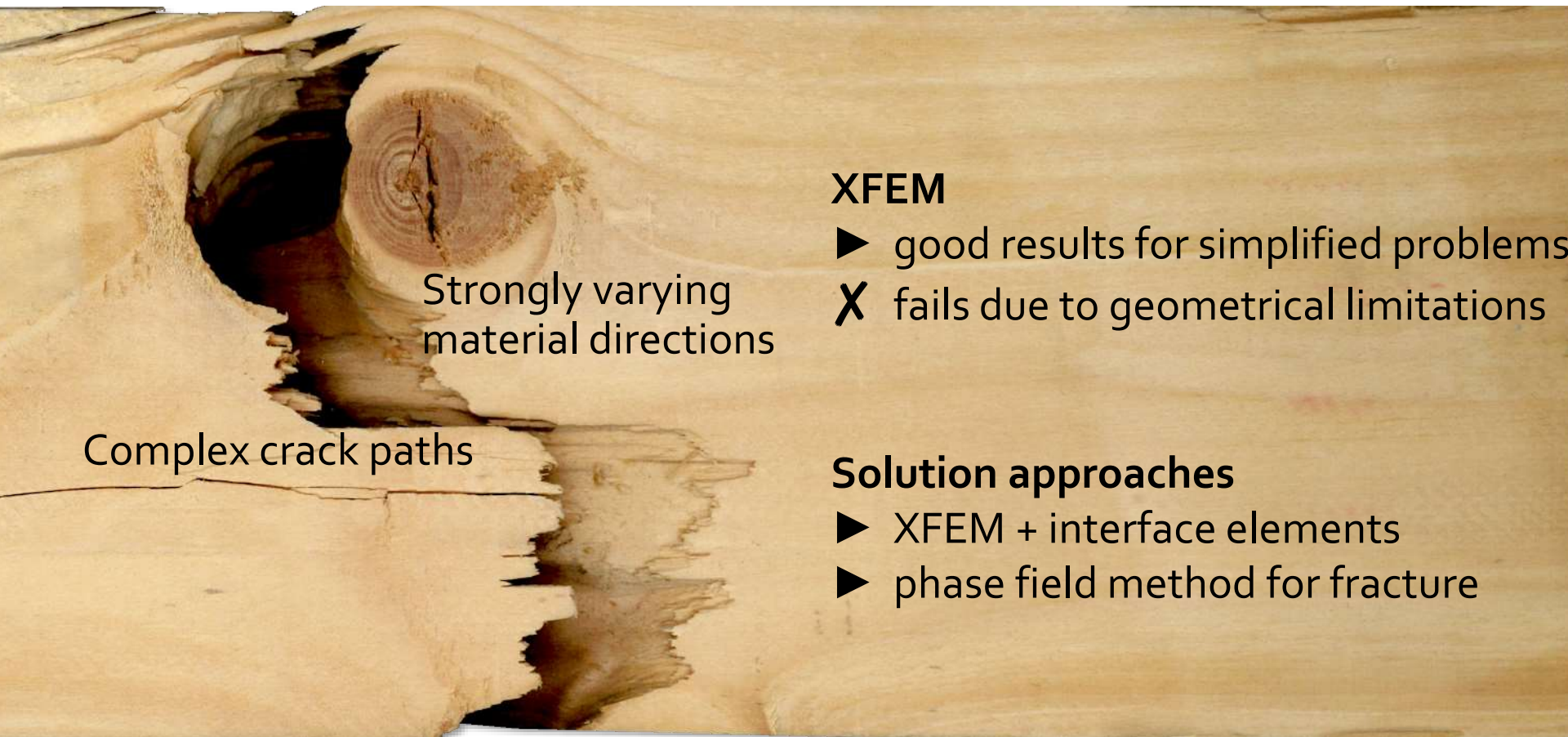
Results

Is thermal activation in solid timber structures applicable in practice at all?





Results – numerical modelling



Strongly varying
material directions

Complex crack paths

XFEM

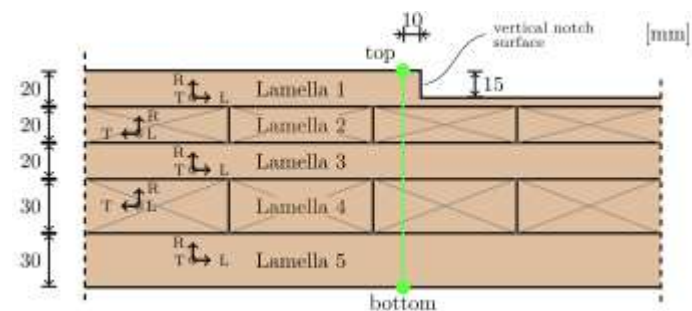
- ▶ good results for simplified problems
- ✗ fails due to geometrical limitations

Solution approaches

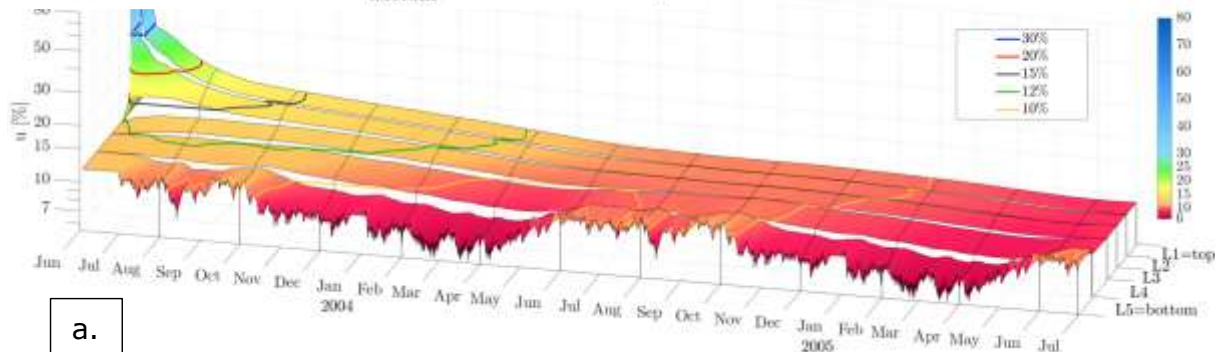
- ▶ XFEM + interface elements
- ▶ phase field method for fracture



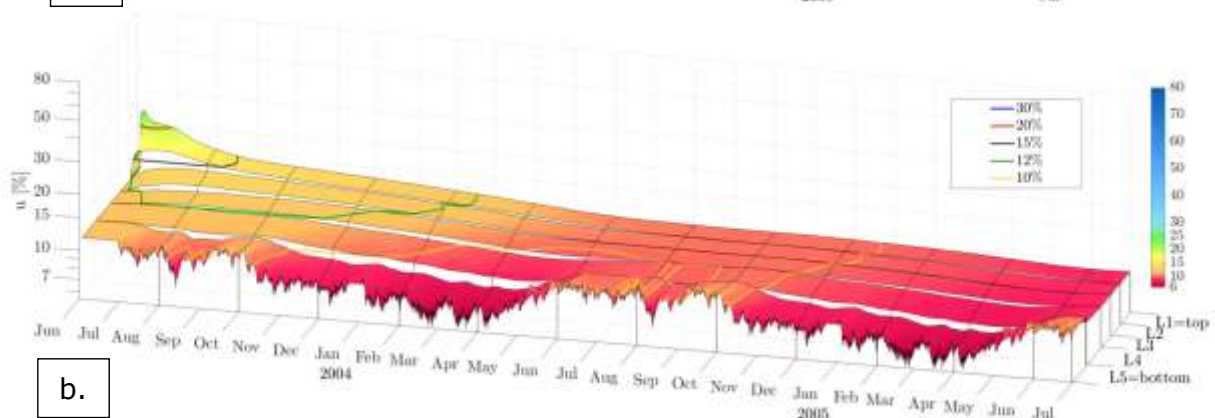
Results – numerical modelling



- Wood moisture content progression over the CLT board thickness

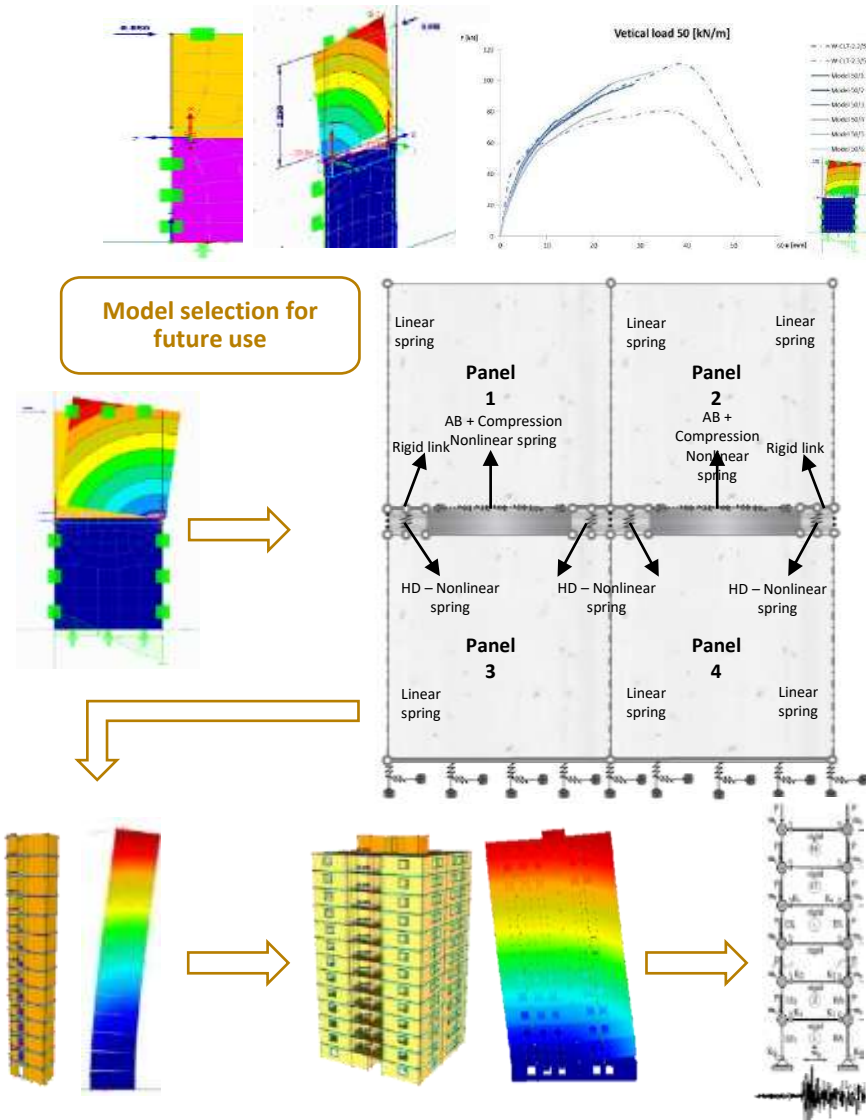


(a) partially sealed end-grain surfaces



(b) fully sealed end-grain surfaces

Results – numerical modelling





Impacts

- *Innocrosslam impacts a **wide range of stakeholders** in the wood processing industry, architecture, structural design, timber engineering research and other*
- *several scientific and professional publications where published and can be accessed on: <http://innocrosslam.zag.si/publications>*
- *implementing user-friendly **design rules** and modelling approaches*
- *increasing knowledge and feasibility of innovative mass timber products such as thermally activated CLT panel*
- ***future research** is needed on new types of CLT, design, and ease of use*



The value of scientific cooperation

- foundation to find consensus on standardisation topics → shortening the period from research to practice
- national infrastructure varies → several benefits from sharing resources
- innovation performance increased in countries which do not yet rank as innovation leaders
- combining competences in several scientific areas



Ljubljana, 22.5.2019



Unexpected peculiarities / barriers

- *Delays in specimen delivery and laboratory availability due to covid-19 prevention measures → **project extension***
- *Two-years without personal meetings, difficult to organize workshops for designers → sharing of research infrastructure, **online meetings***
- *Un-harmonized national rules proved difficult to assure the consortium agreement, also some partners started project **later than the official date***
- *All difficulties have been overcome for the most part, but some delay in final dissemination activities is to be expected*

Thank you!

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ForestValue

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