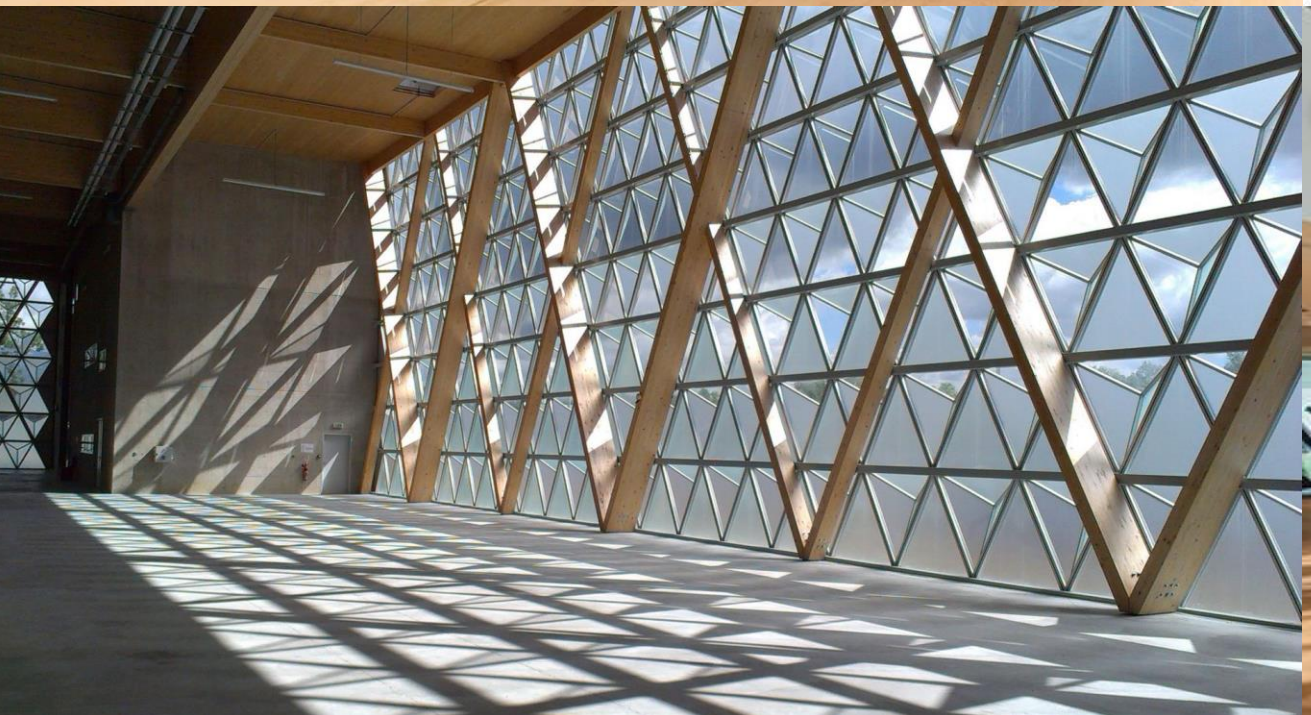
Project VETROLIGNUM

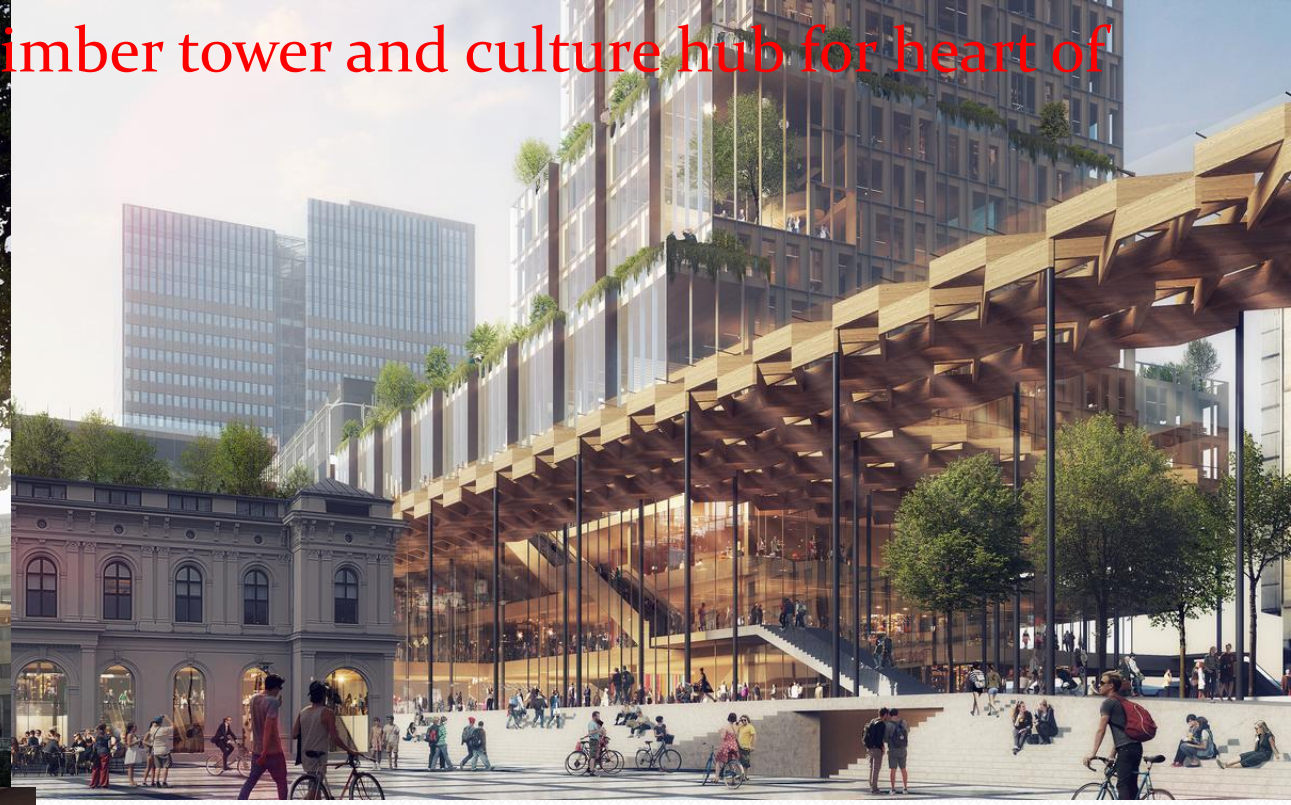
PROTOTYPE OF MULTIPURPOSE TIMBER - STRUCTURAL GLASS COMPOSITE PANEL

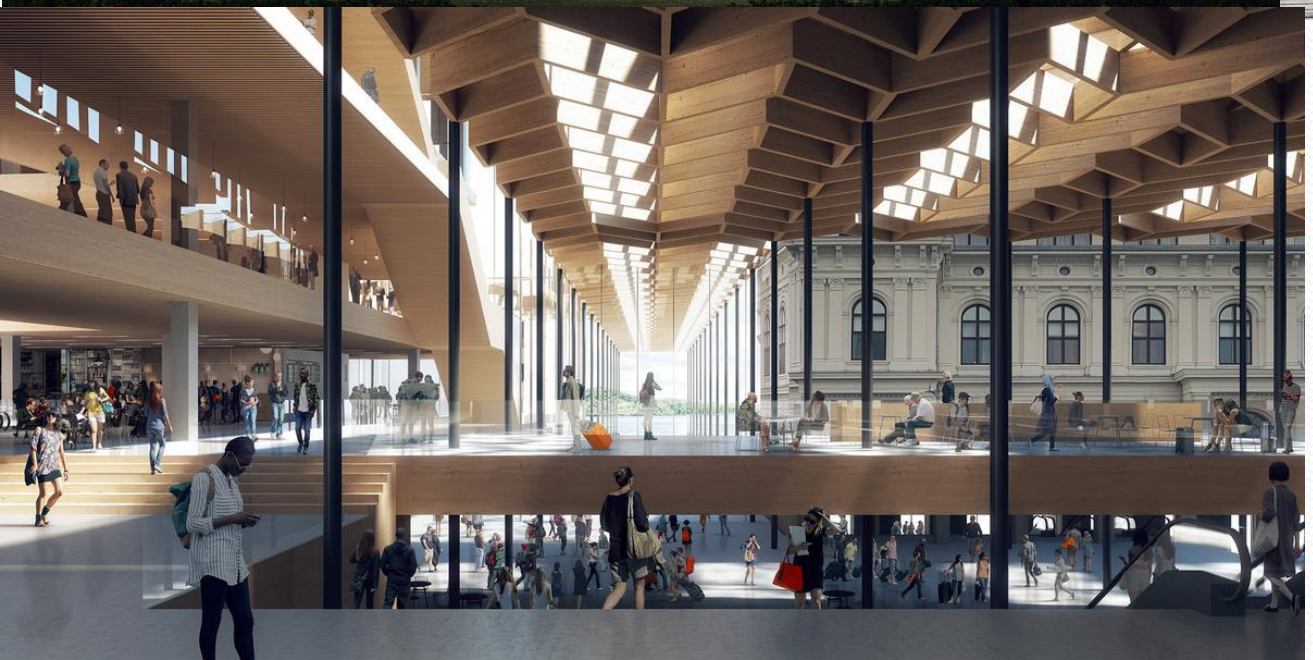
Vlatka Rajčić, University of Zagreb



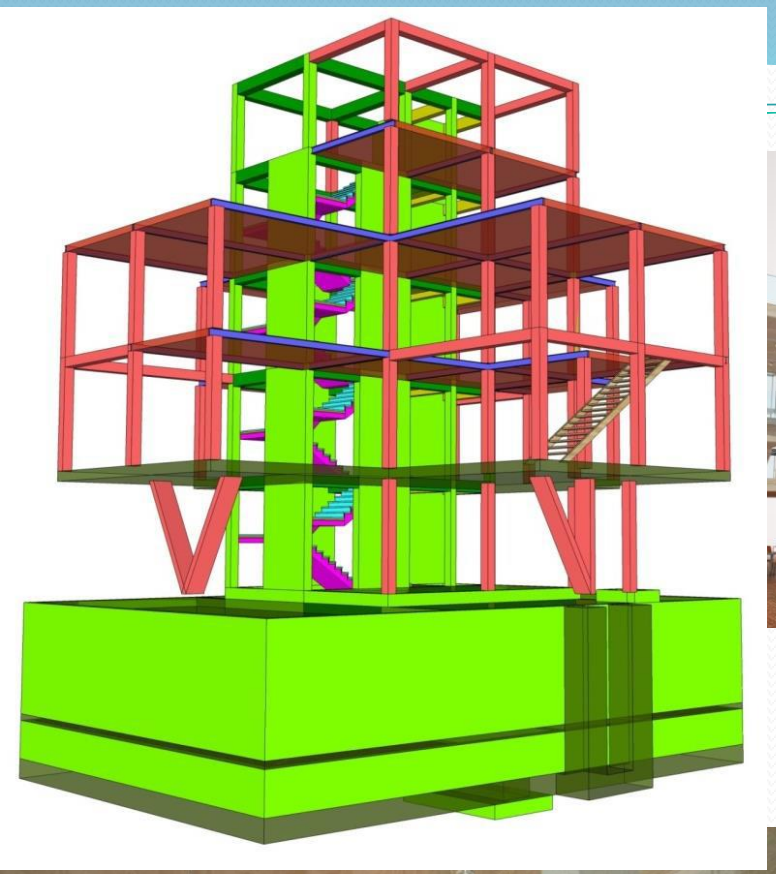
VETROLIGNUM Project
2nd Workshop, Zagreb 15 February 2019

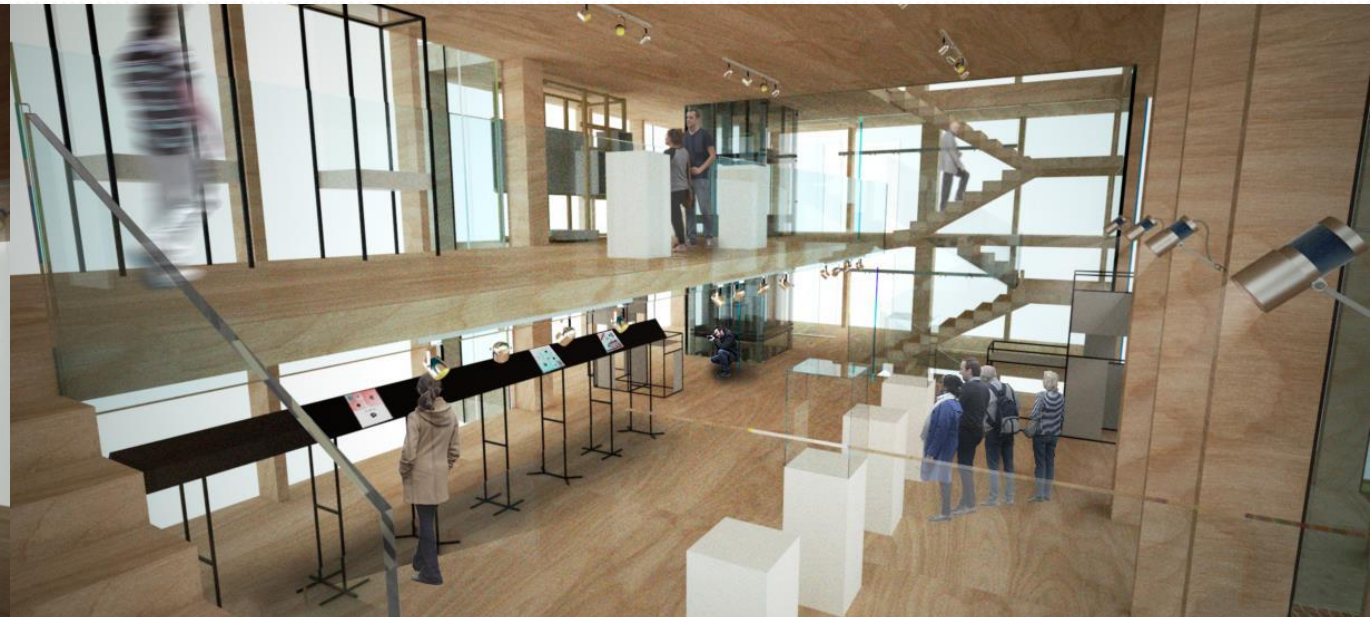
Reiulf Ramstad Arkitekter design landmark timber tower and culture hub for heart of Oslo





Ivica Plavec, arch: Museum dedicated to brothers Radić, Trebarjevo
Vlatka Rajčić, Jure Barbalić, structure





Contemporary timber-glass hybrid structures

- Contemporary architecture is developing in the direction of construction of timber-glass hybrid structures.
- The main challenge is to design and construct structural system that would resist sudden environmental impacts including heavy storms and earthquakes, influence of extreme climate actions
- The answer is to be found in experimentally supported research work, which can serve for the development of regulations for the design of structures from the structural glass (Eurocode 11) and timber (Eurocode 5), and in accordance with the requirements for construction regulations in earthquake areas (Eurocode 8)
- University of Zagreb and Ljubljana has started in this direction 10 years ago and the project VETROLIGNUM is a step forward to introduce the research results in construction practice

Project VETROLIGNUM

Prototype of multipurpose composite timber-load bearing glass panel

- Project no.: IP-2016-06-3811
- Financed by: The Croatian Science Foundation
- Duration: 36 months (01.03.2017. - 29.02.2020)
- Project funds: 749.350,00 HRK (99.800,00 EUR)
- Project coordinator: Prof. Dr. Vlatka Rajčić
- Core project team: Prof. Dr. Roko Žarnić, Dr. Mislav Stepinac, Jure Barbalić, Nikola Perković, Assoc. Prof. Dr. Adriana Bjelanović
- Partners: Doc. Ivica Plavec, arch., University of Zagreb: Assoc. Prof. Dr. Fabio Conato, arch., Valentina Frighi, arch. Dr. Silvia Brunoro, arch.University of Ferrara

Previous research

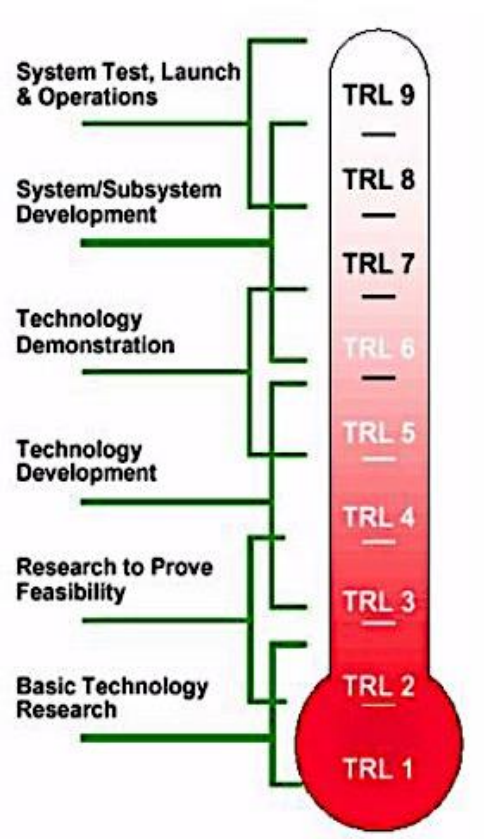
- Before the start of VETROLIGNUM project the The Ministry of Education and Science of the Republic of Croatia and the Ministry of Education, Science, Culture and Sport of the Republic of Slovenia financially supported the research.
- In the laboratory of University of Ljubljana, 50 samples in natural size were tested with a combination of constant vertical load and cyclic variable horizontal load to simulate earthquake induced loading.
- A simple box model in natural size was tested at the shaking table at IZIIS Institute in Skopje, which demonstrated the equality of the panel behavior mechanism during the cyclic loading with its response to the earthquake load.

VETROLIGNUM programme

- Detailed analysis of previous research
- Laboratory testing of glued-in rod CLT joints
- Racking test of optimized CLT-laminated glass hybrid panel
- Developing of numeric model of glued-in rod CLT joint
- Developing of numeric model of CLT-laminated glass hybrid panel
- Developing of simplified calculation model for codes
- Testing of CLT-laminated glass segment in thermal chamber
- Energy efficiency mock-up long term measuring campaign
- Testing properties of glass-wood panels: Air permeability according to test method EN 12153
- Static waterproofness according to the test method EN 12155
- Resistance to wind action according to test methods EN 12179
- Dynamic waterproofing test according to the test method EN 13050

Technology readiness level of hybrid system

Technology readiness levels (TRL) are a method of estimating technology maturity of Critical Technology Elements (CTE) of a program during the acquisition process.



Post VETROLIGNUM construction of pilot building

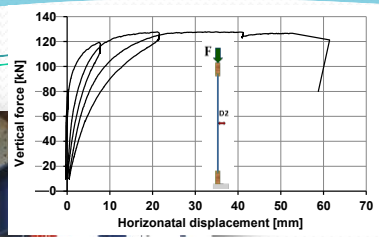
Completing the VETROLIGNUM Project 2020

Current stage of the VETROLIGNUM Project, completed in 2018

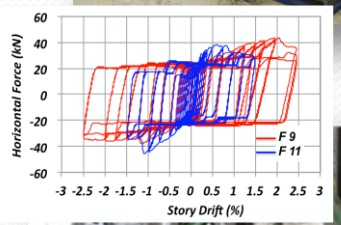
Start of the VETROLIGNUM Project in 2017

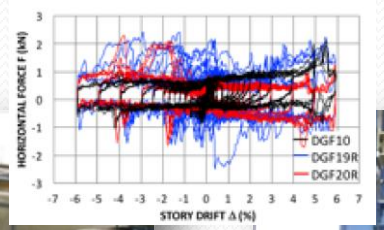
Start of hybrid system development in 2007

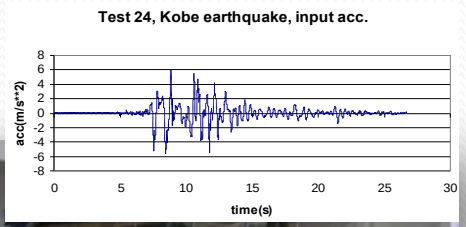
Previous research

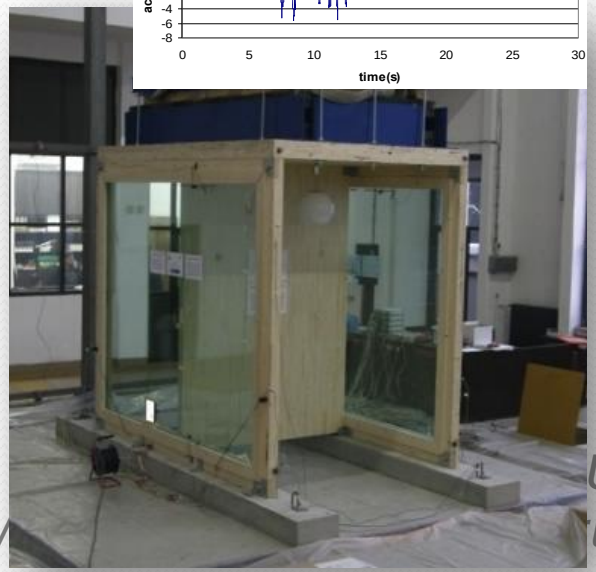


- Load bearing tests of laminated glass (3 tests)
- Cyclic tests of timber frame joints (30 tests)
- In-plane cyclic tests of laminated glass infilled timber frames (49 tests)
- Out-of-plane cyclic tests of laminated glass infilled timber frames (3 tests)
- Shake table test of box type structure (1 specimen, multiple test runs)



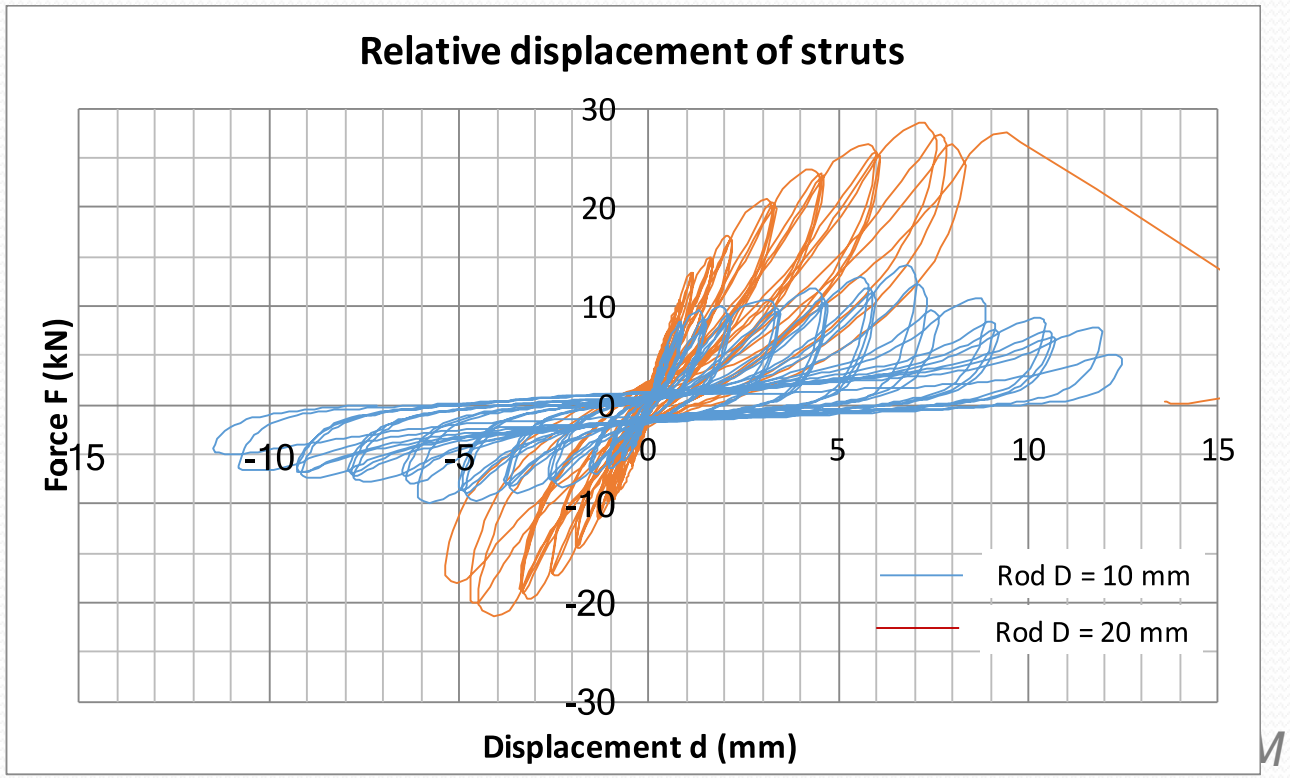




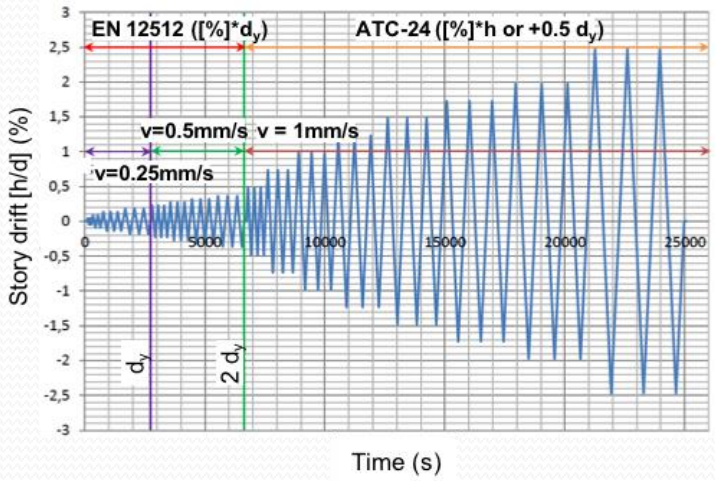


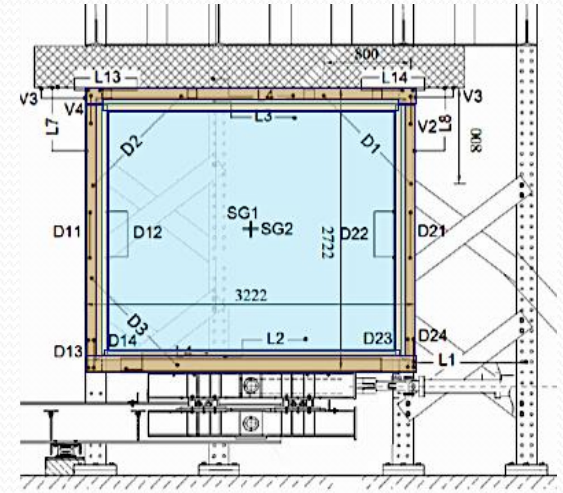
Laboratory testing of glued-in rod CLT joints

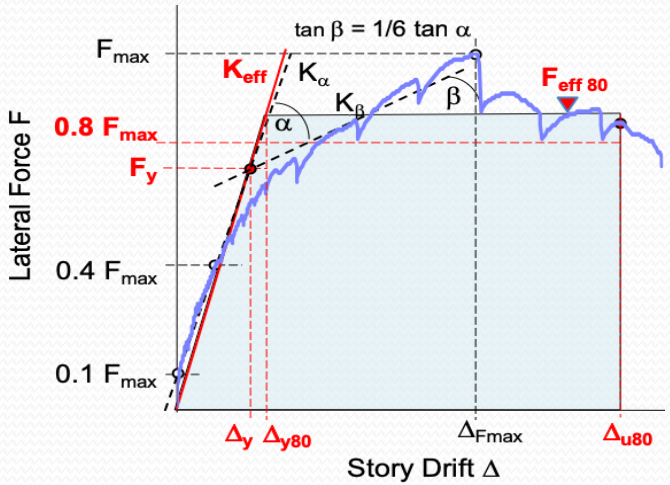
- Three rod dimensions: ϕ10, ϕ14, ϕ20
- Two stud support option

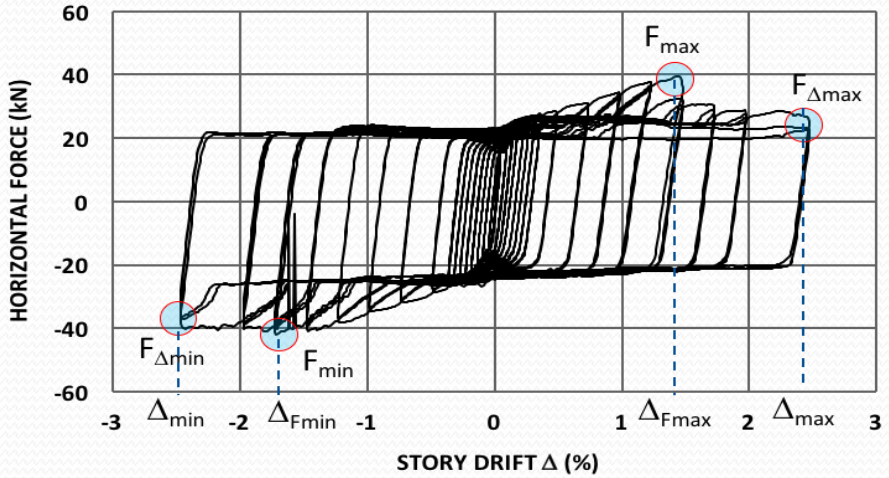


Racking test of the optimized CLT-laminated glass hybrid panel

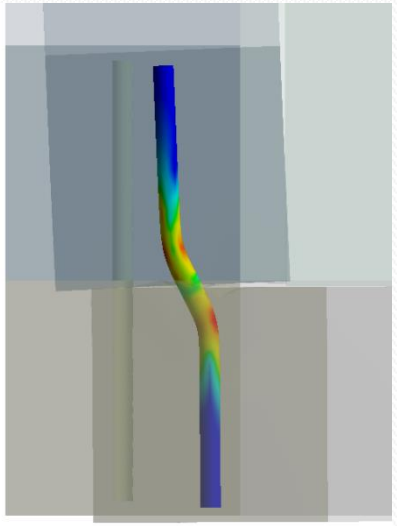


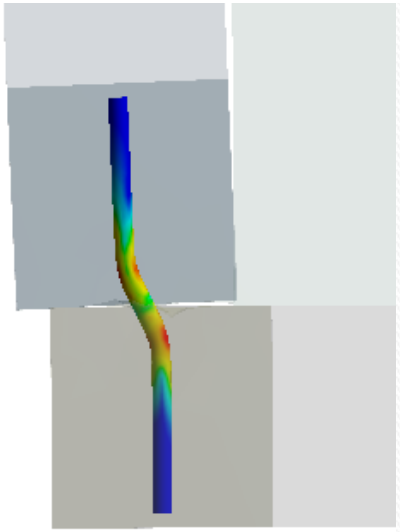


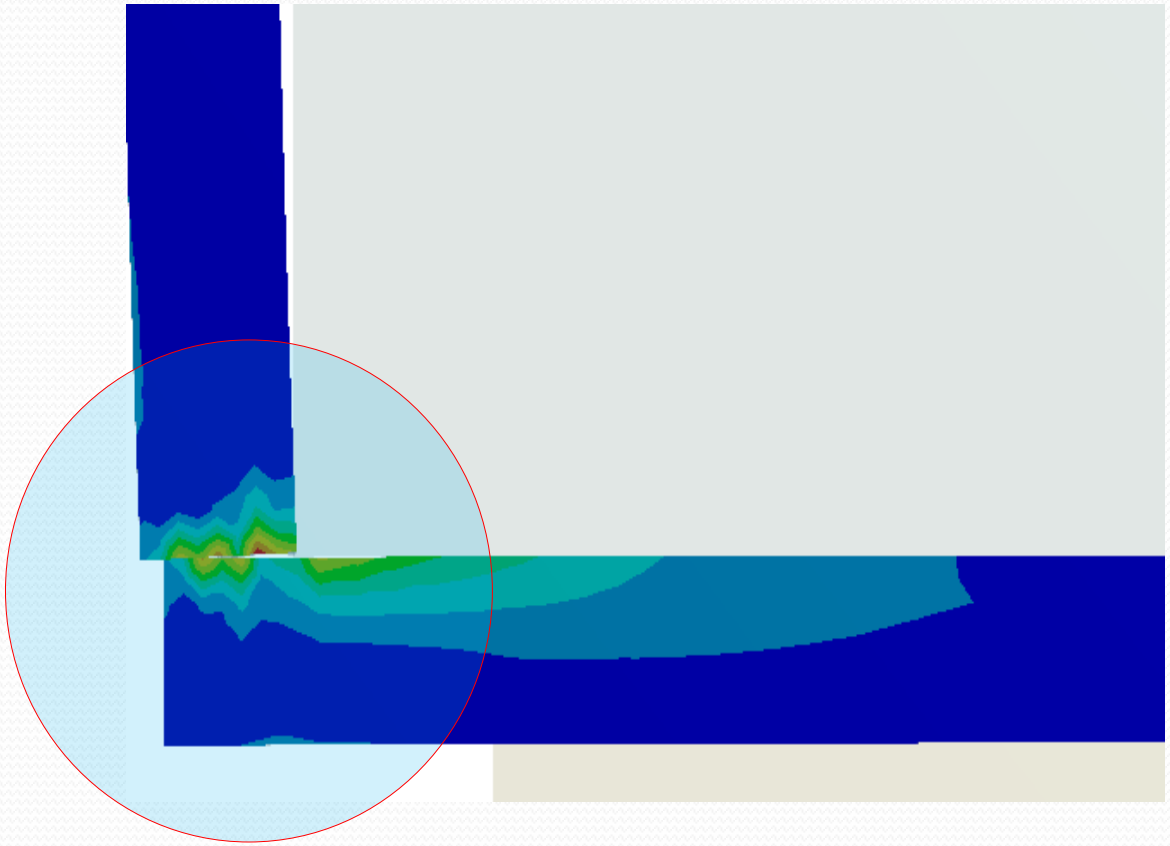




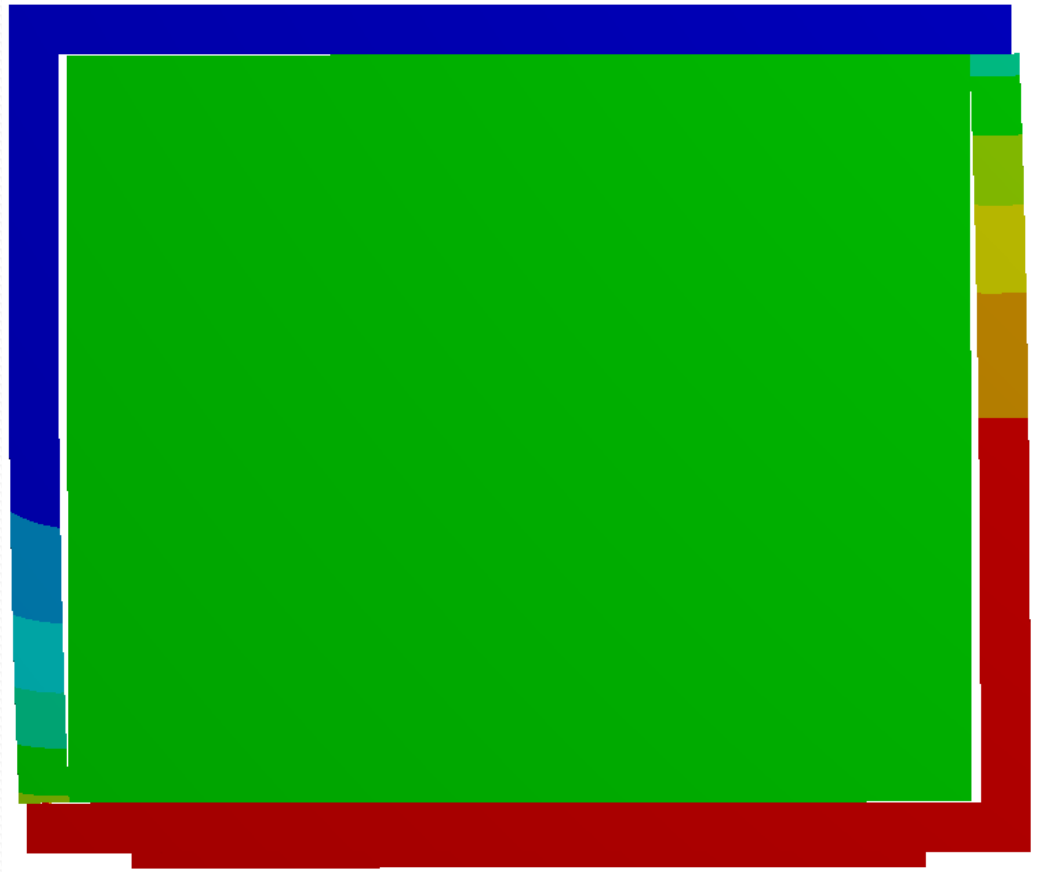
Developing of numeric model of ued-in rod CLT joint





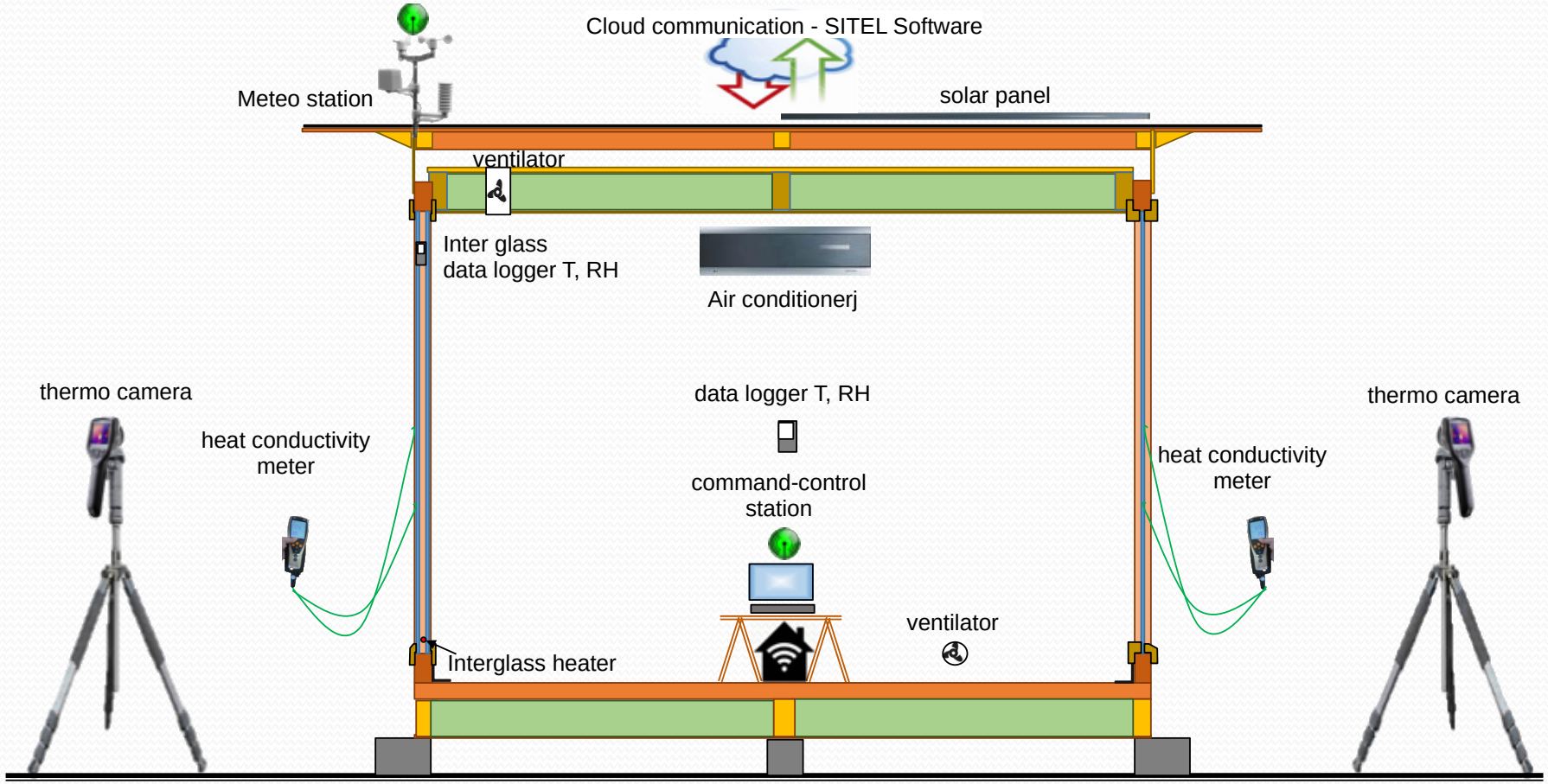


Development of numeric model of the hybrid panel



Mislav Stepinac, PhD

Energy efficiency mock-up campaign



Thank you for attention!