Applying the grid method to investigate crack appearance and propagation in notched wood beam used in individual houses in Europe

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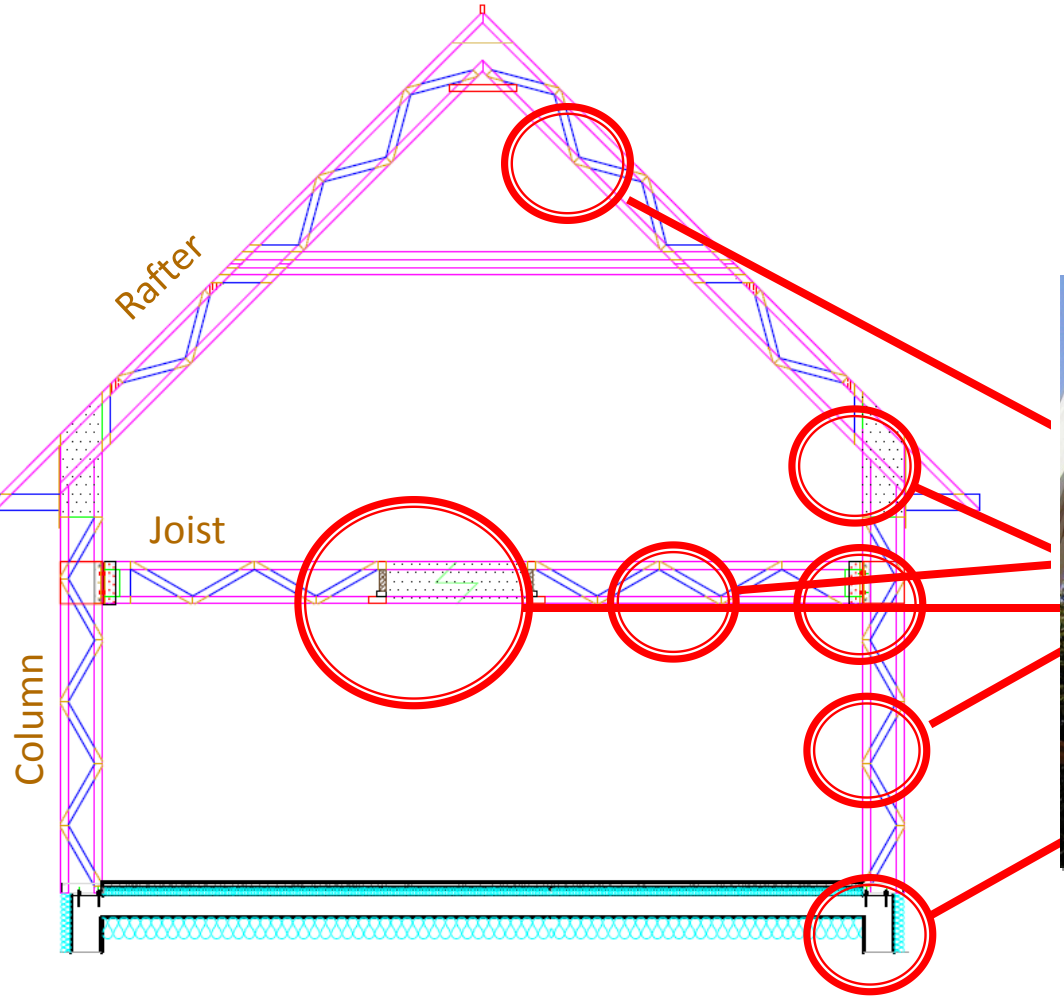
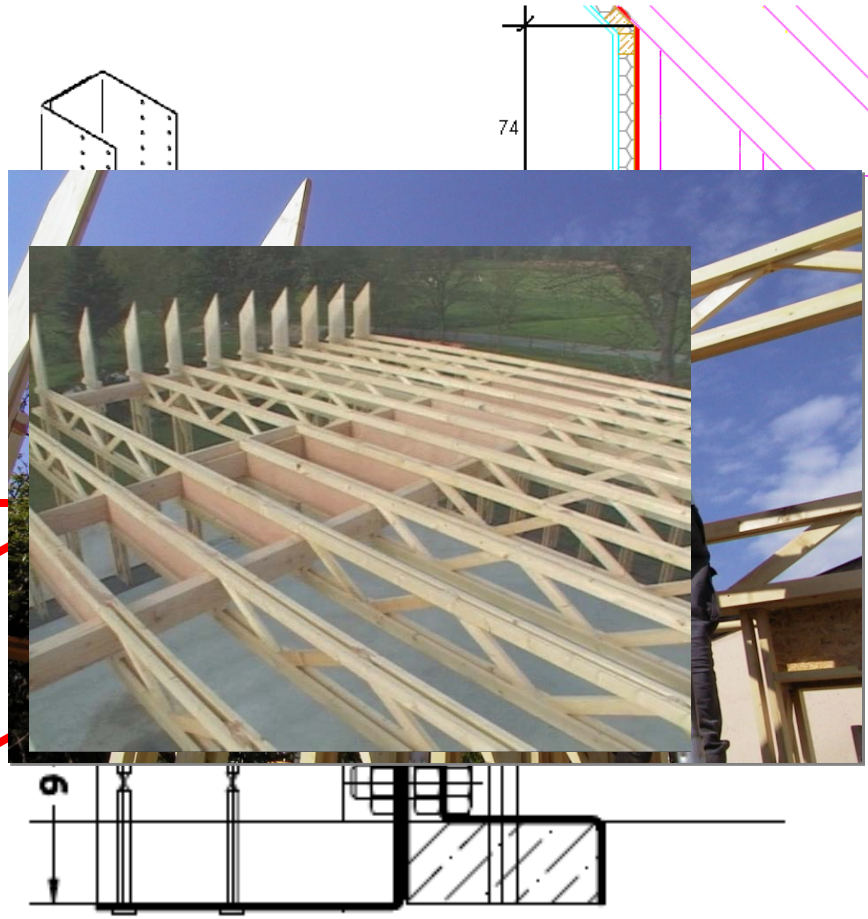
Performance and maintenance of bio-based building materials influencing the life cycle and LCA
October 23-24, 2014, Kranjska Gora, Slovenia.

Use of the DOREAN's beam

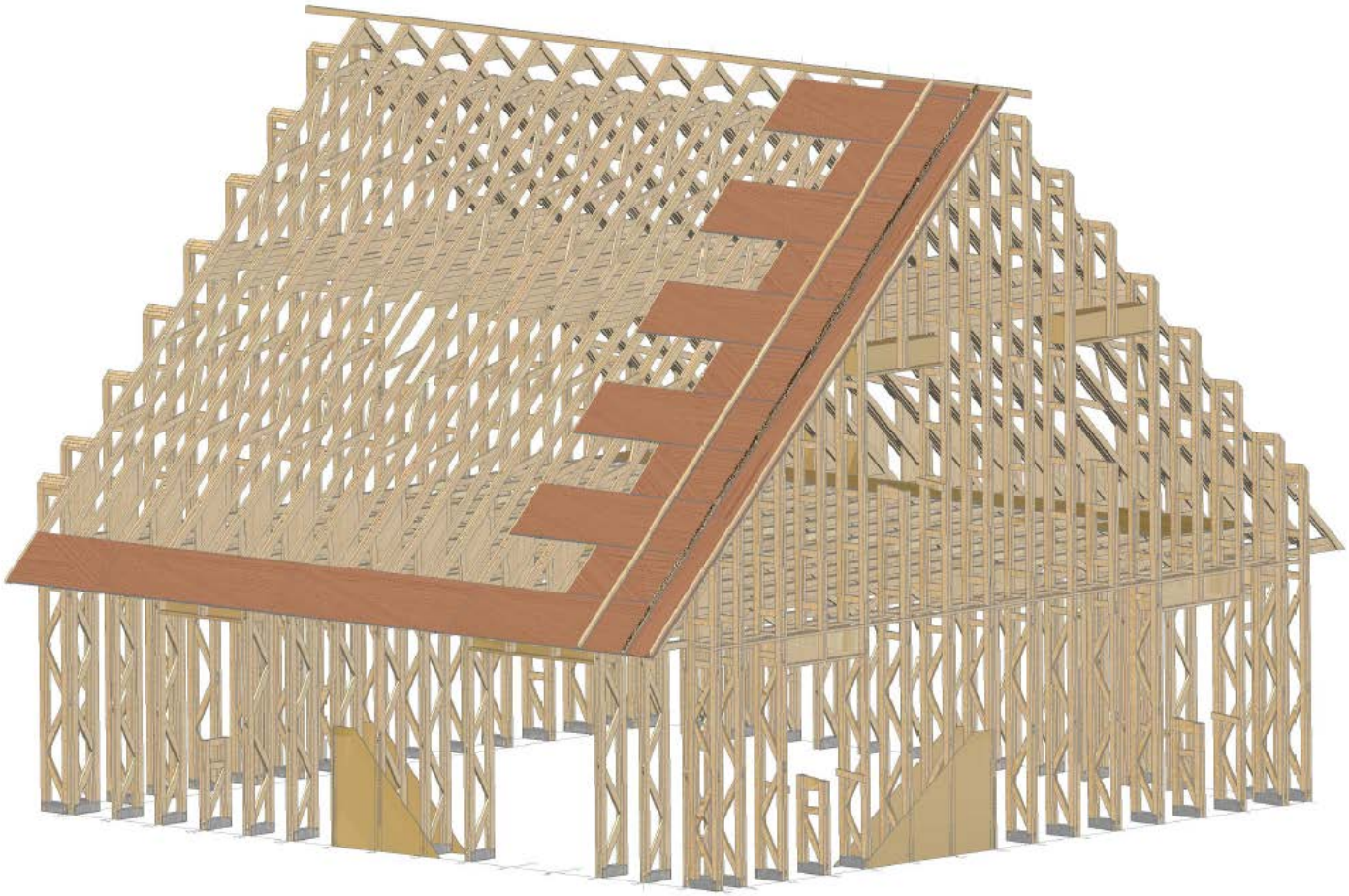


DOREAN® gantry

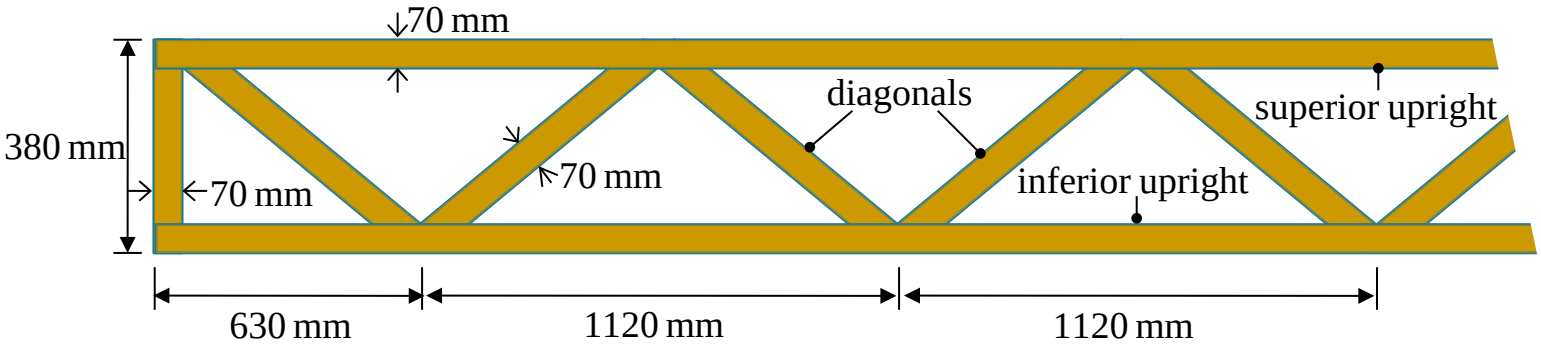


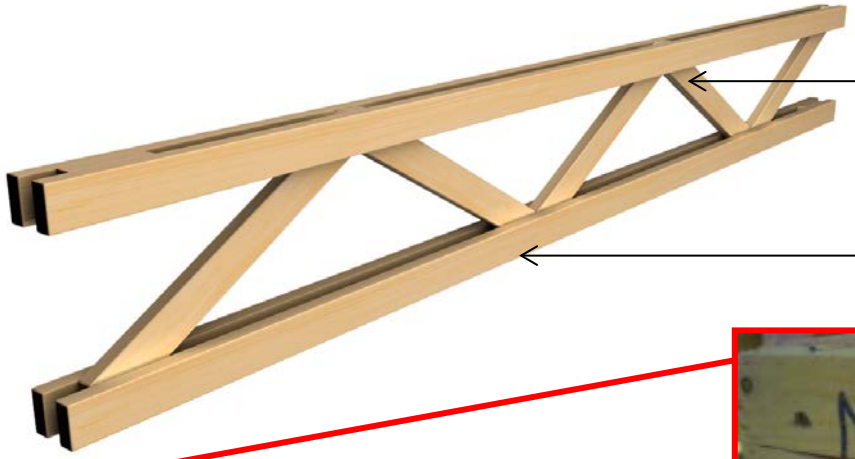
for solid wood

Use of the DOREAN's beam



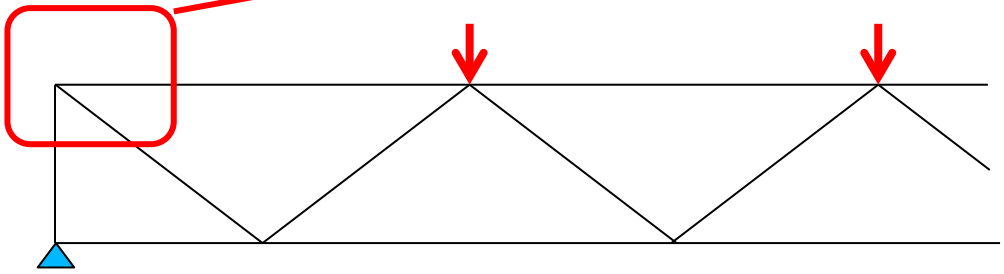
Framwork 3D view

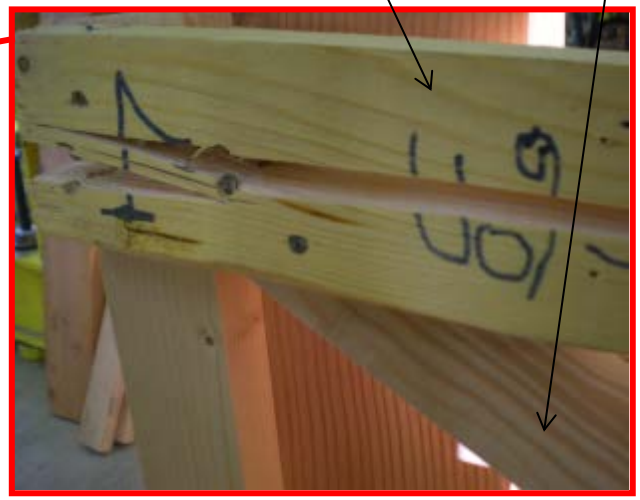

70 mm
380 mm
70 mm
70 mm
diagonals
superior upright
inferior upright
630 mm
1120 mm
1120 mm

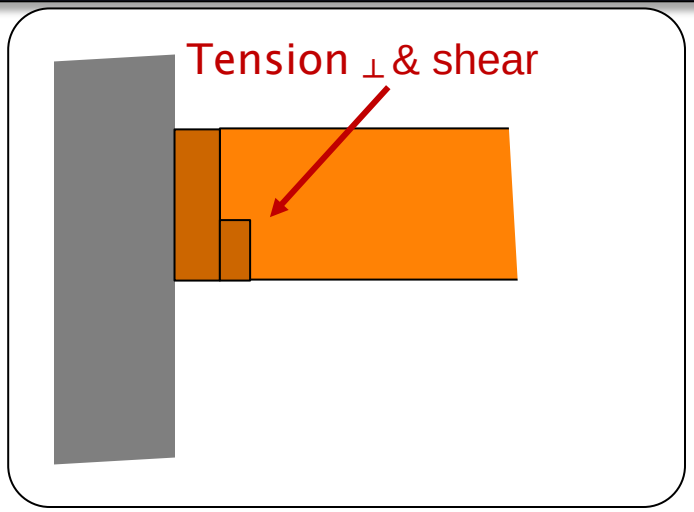


D

M

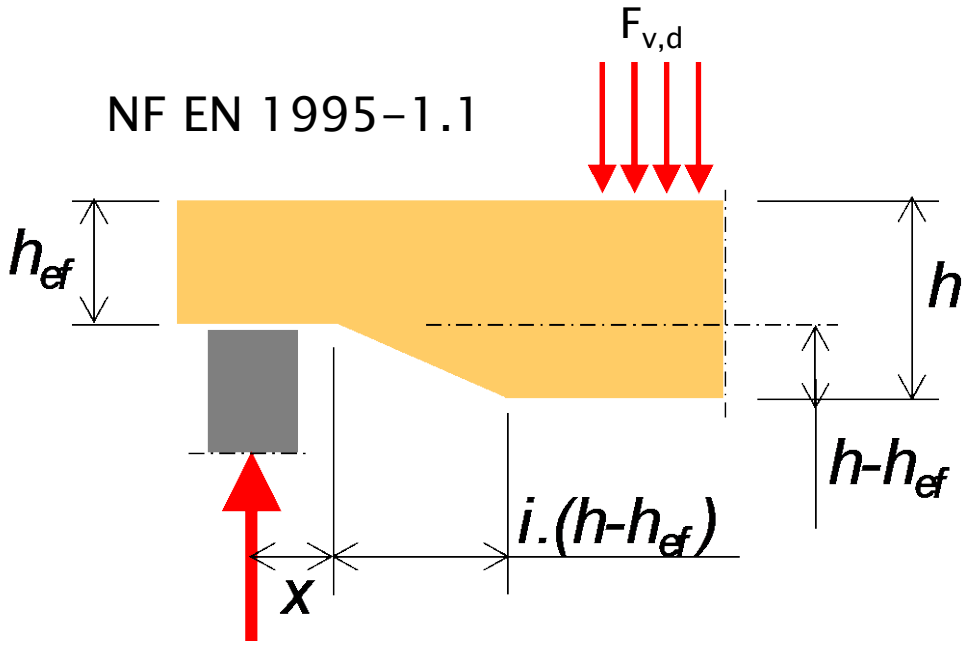






Taking into account the problem in the standard approach

NF EN 1995-1.1



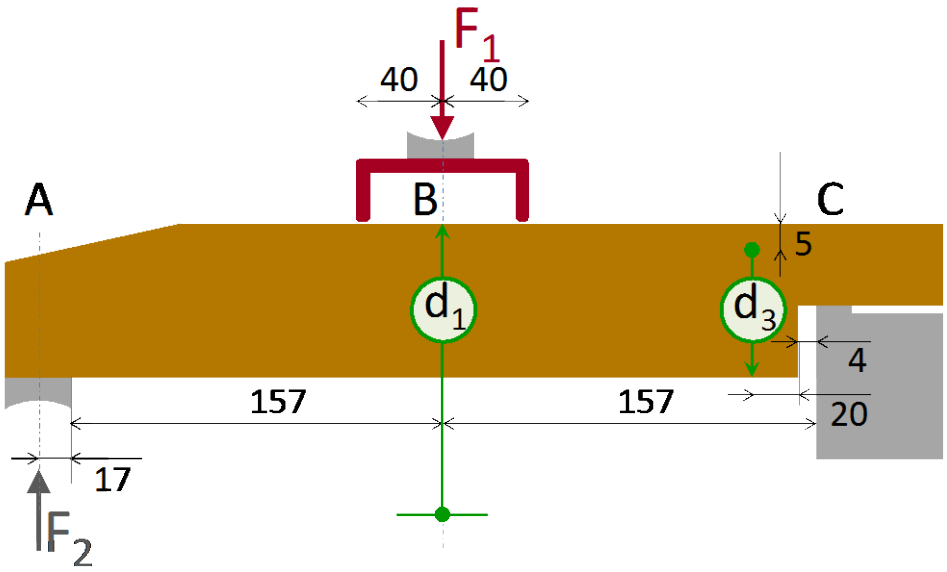
$$\tau_d = \frac{1{,}5V}{bh_{ef}} \leq k_v f_{v,d}$$

$$k_v = \min \cdot \left\{ \frac{1}{\frac{k_n\left(1 + \frac{1{,}1 i^{1,5}}{\sqrt{h}}\right)}{\sqrt{h}\left(\sqrt{\alpha(1-\alpha)} + 0{,}8\frac{x}{h}\sqrt{\frac{1}{\alpha} - \alpha^2}\right)}} \right.$$

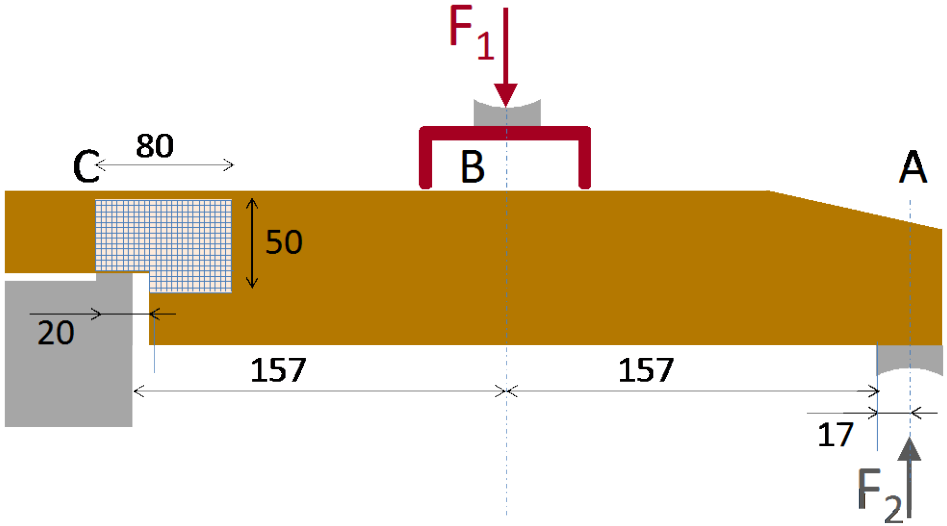
$$\alpha = \frac{h_{ef}}{h} \qquad k_n = 5 \quad \text{for solid wood}$$

Outline

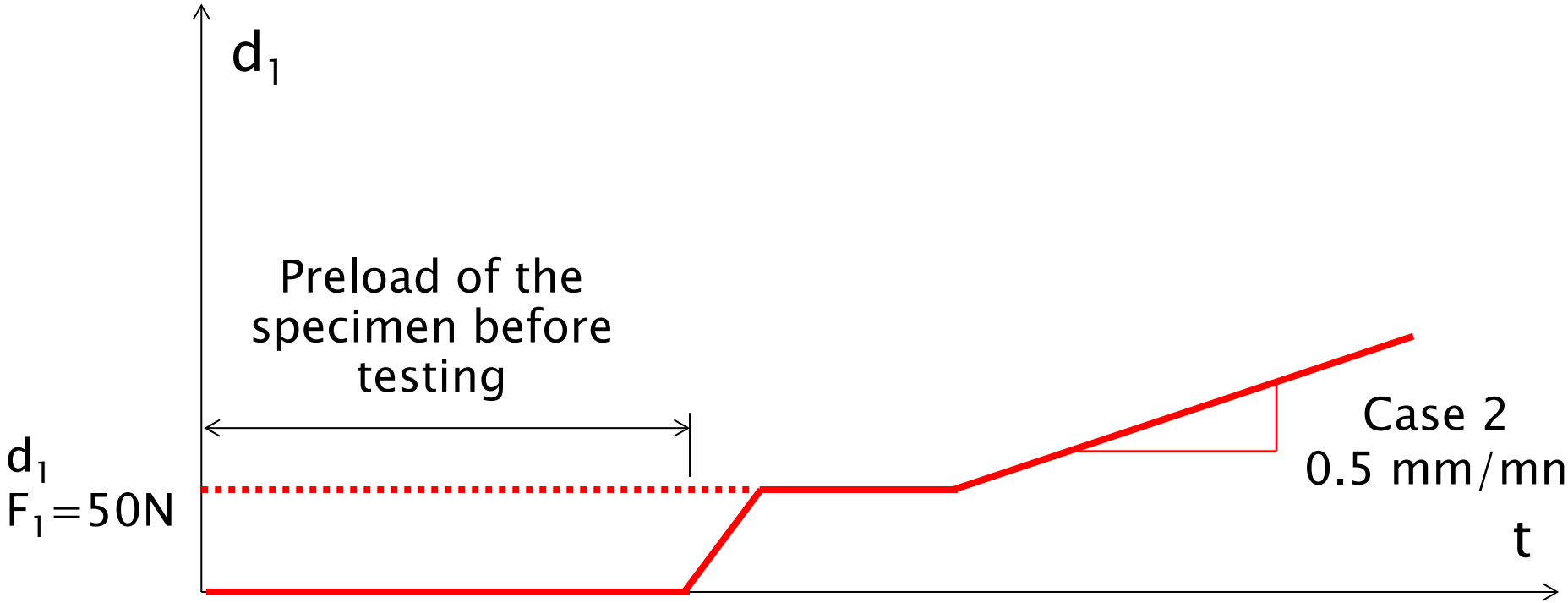
1. Scientific context
2. Experimental setup
3. Results and analysis
4. Conclusion and perspectives



One face with classic instrumentation

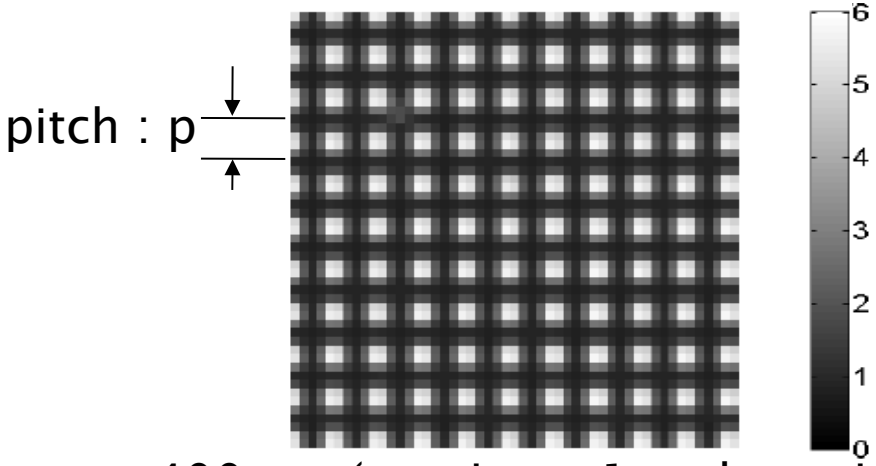


One face with full-field measurements with the grid method


d_1
Preload of the specimen before testing
d_1
$F_1 = 50N$
Case 2
0.5 mm/mn
t

Grid method

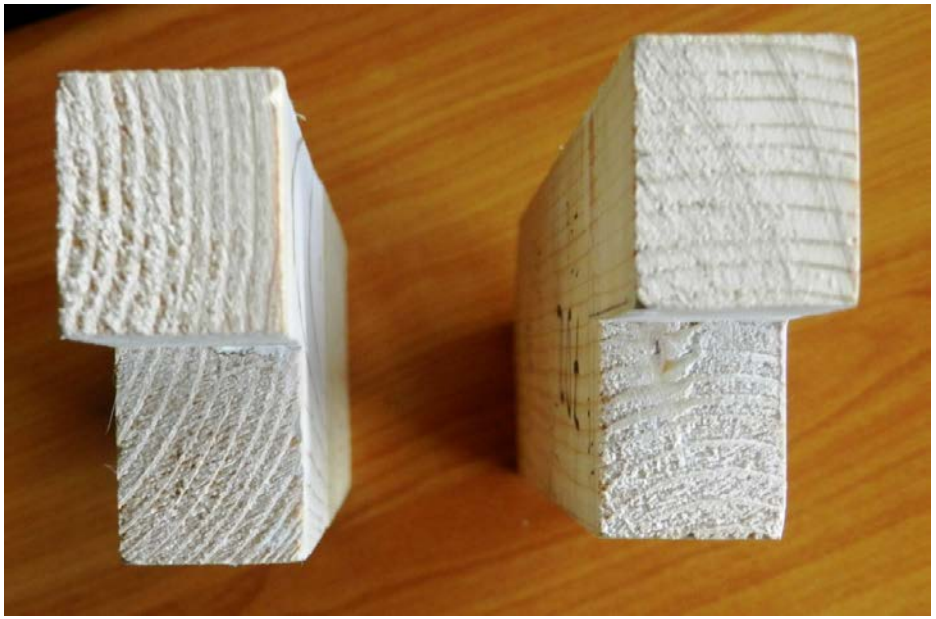
- crossed grid transferred on the specimen [1]
- encoding: 5 pixels/period



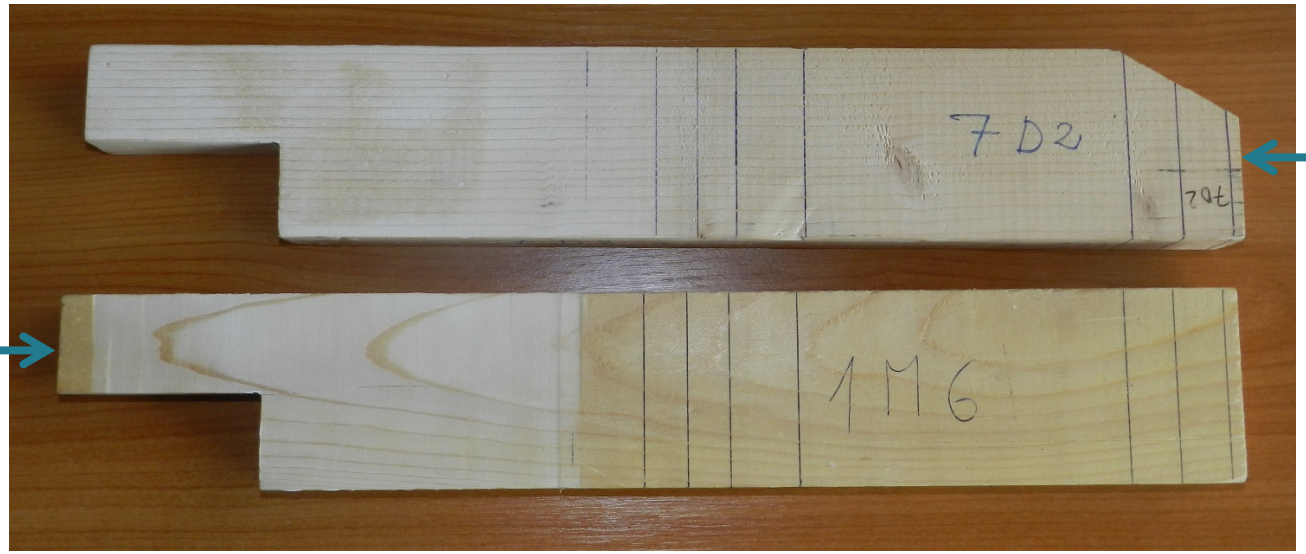
- p : 400 μm (specimen 1 and specimen 2)
- 2 sizes for the ZOI (size specimen 1 and specimen 2)
- images of the grid are captured before and during loading
- u and ϵ fields are deduced from the phases and phase derivatives [2]
- Sensicam camera 1040x1376 pixels, 12bit, cooled

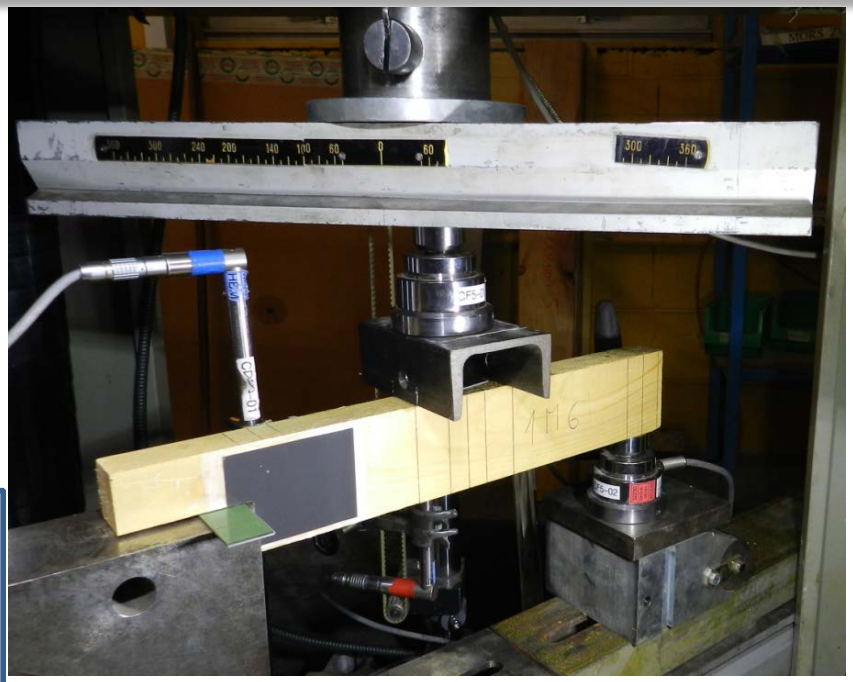
[1] Piro J.-L., Grédiac M., **Experimental Techniques**, 28(4):23-26, 2004
[2] C. Badulescu, M. Grédiac, J.-D. Mathias, **Measurement Science and Technology**, 2009

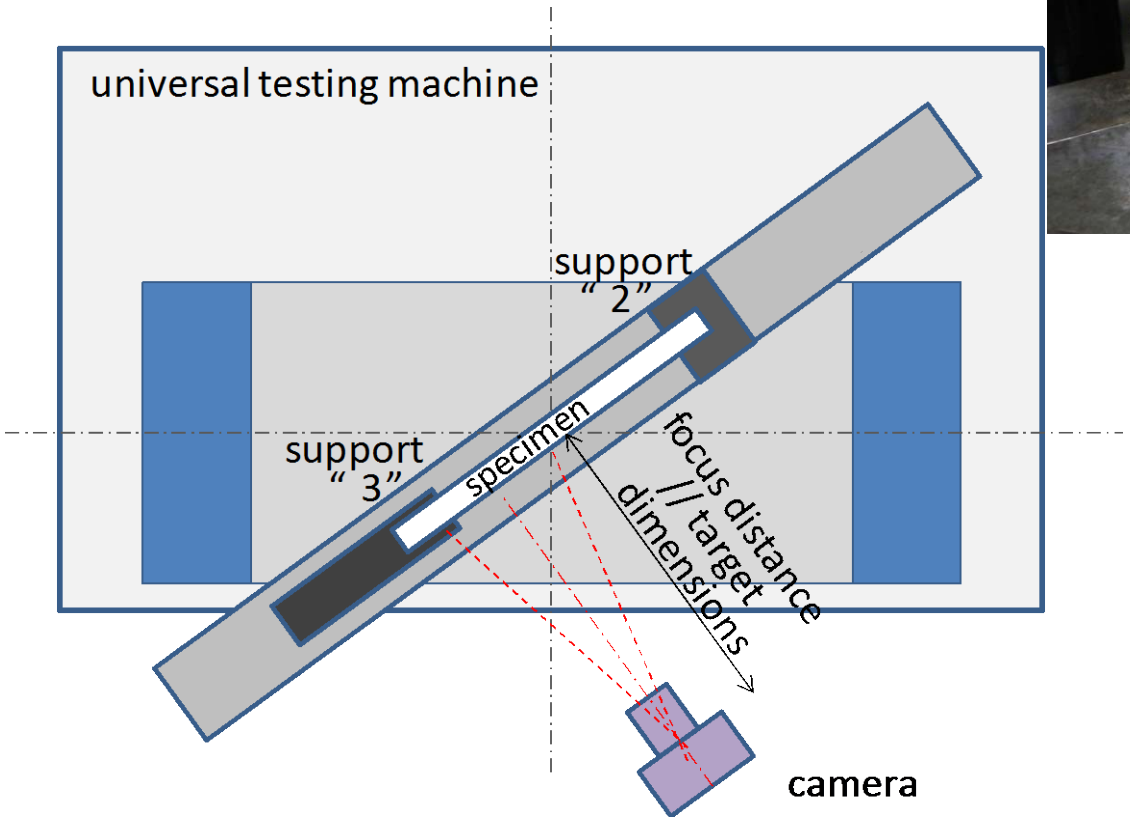
Specimen 1



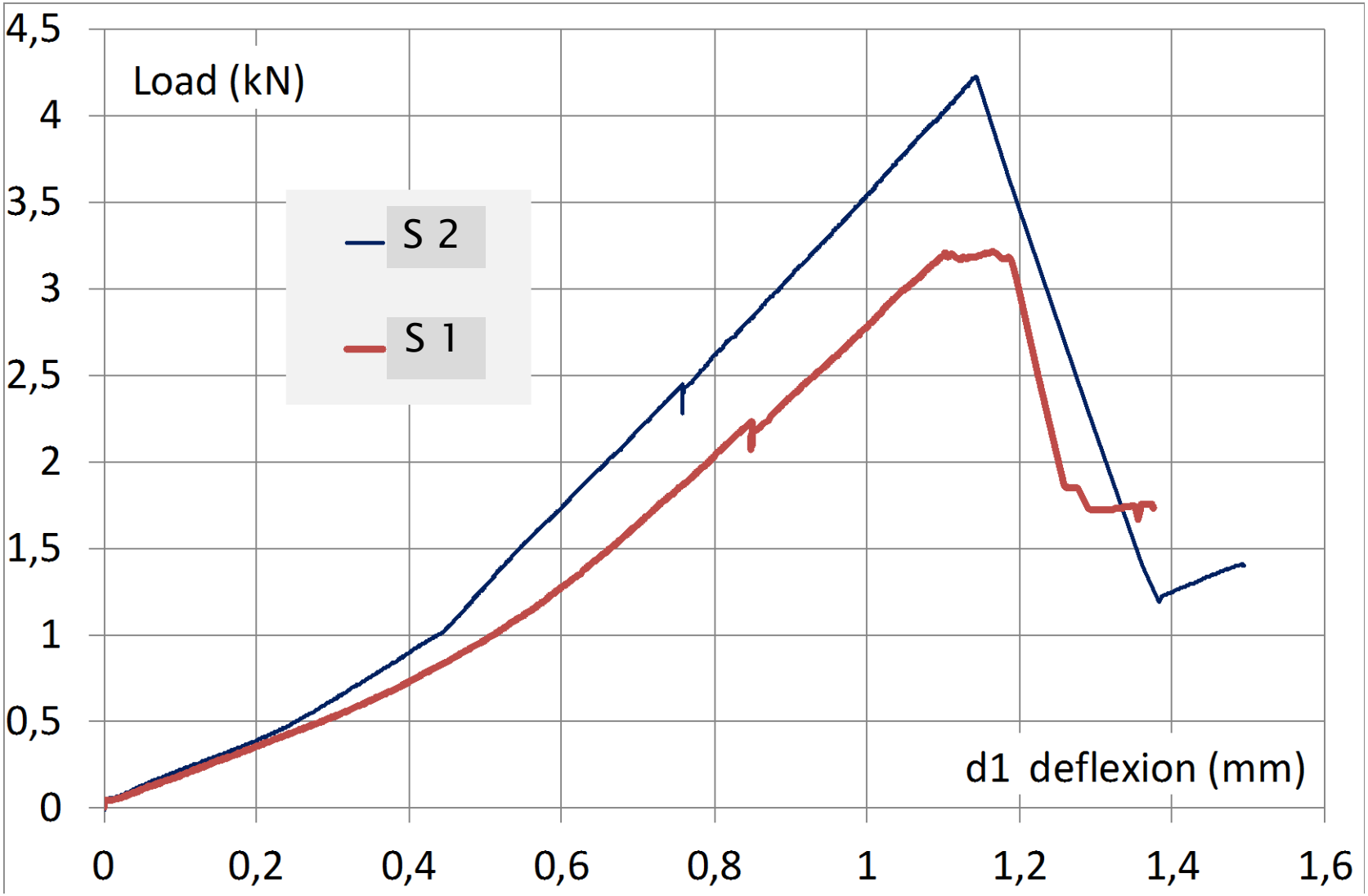
Specimen 2



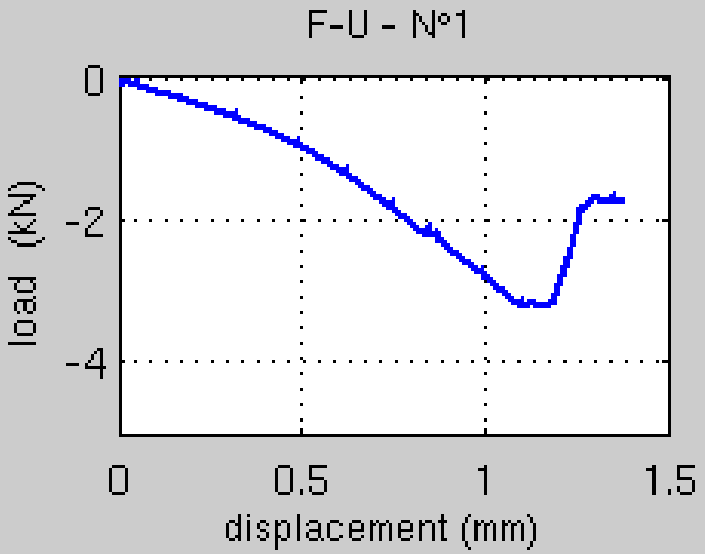



universal testing machine
support "2"
support "3"
specimen
focus distance // target dimensions
camera

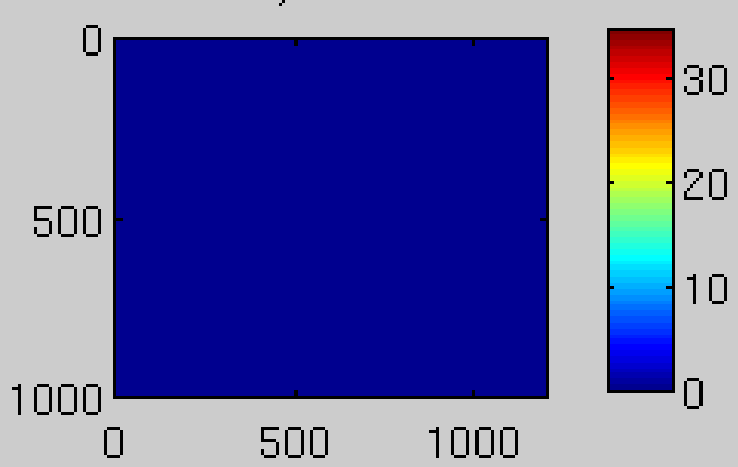
Notched beam deflection



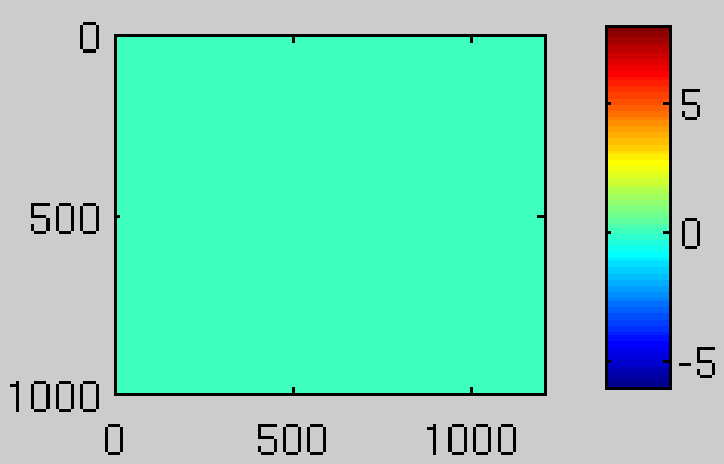
Specimen 1



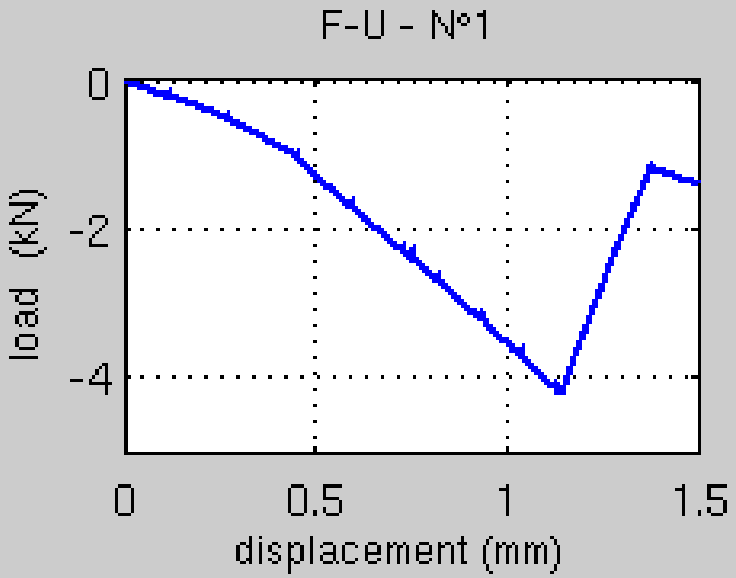
Displacement



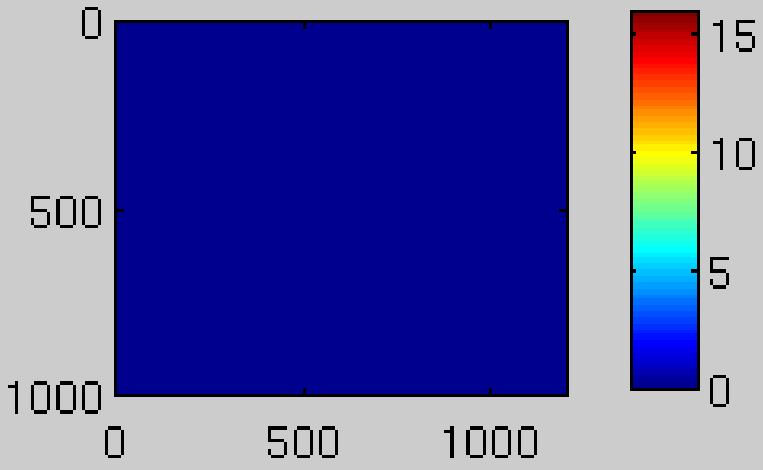
Displacement



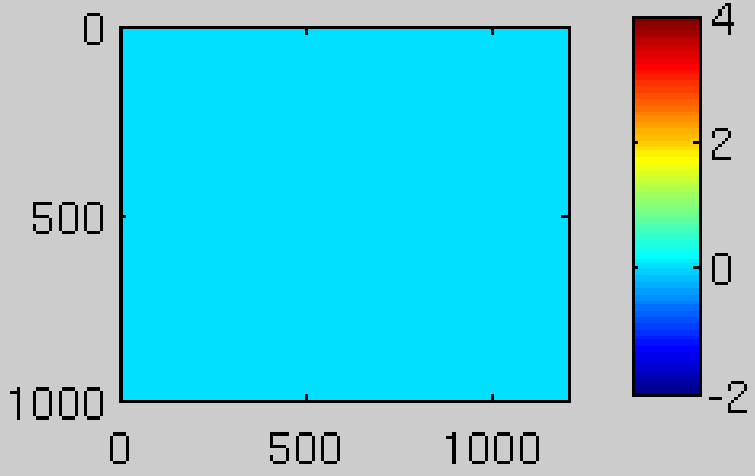
Specimen 2



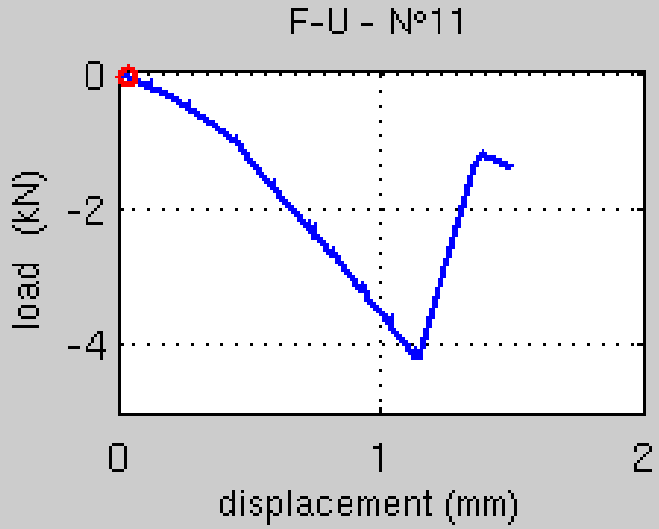
Displacement U_y - N°1



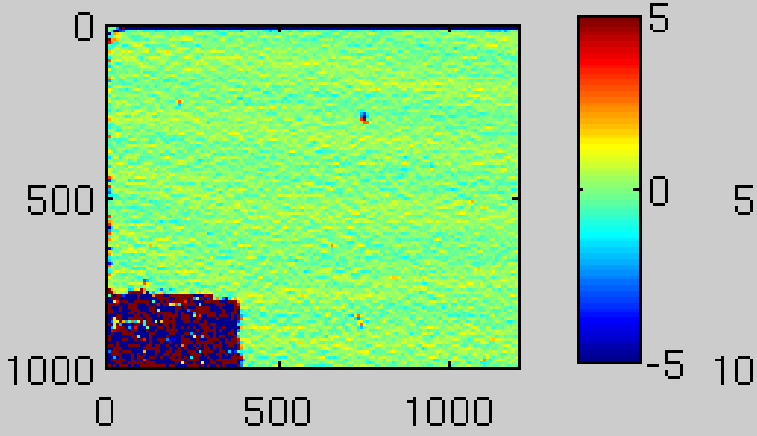
Displacement U_x - N°1



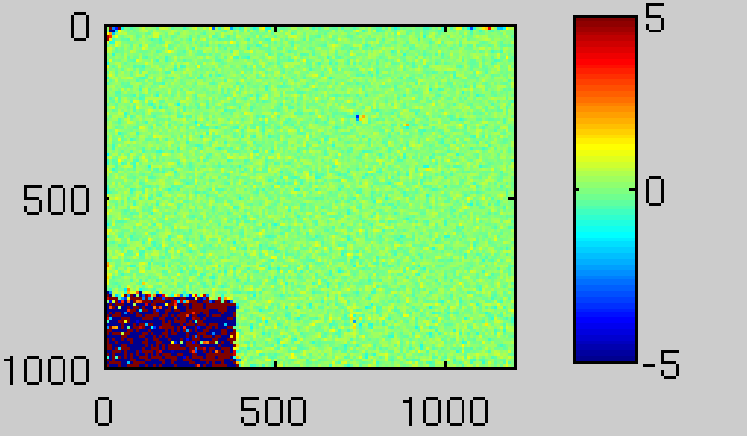
Specimen 1



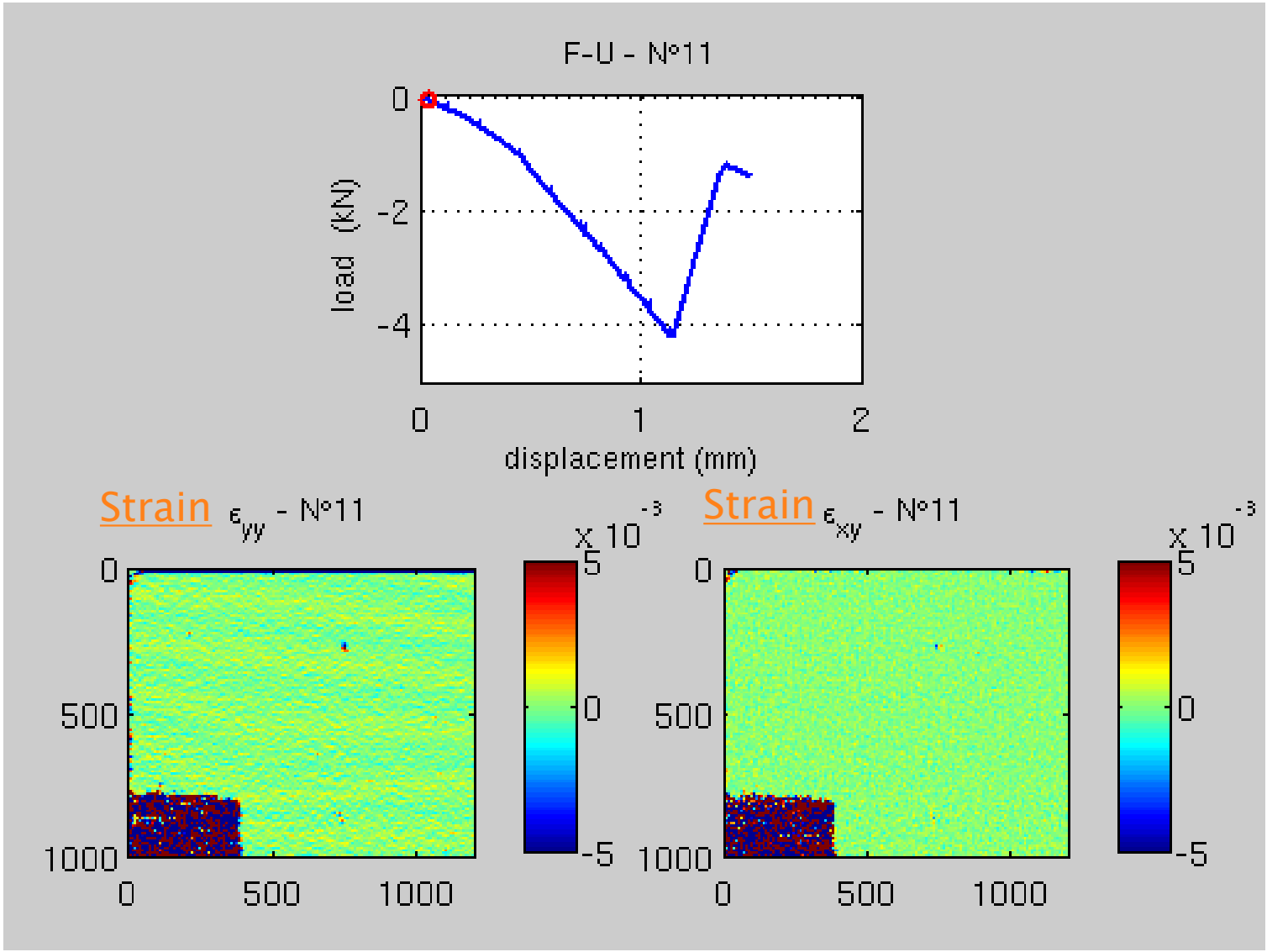
Strain ϵ_{yy} - N°11



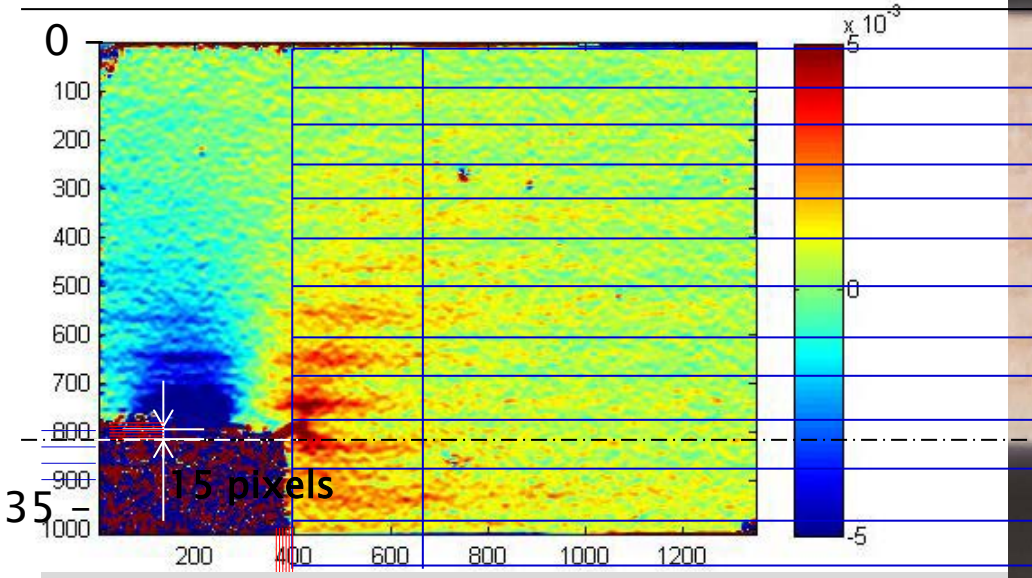
Strain ϵ_{xy} - N°11



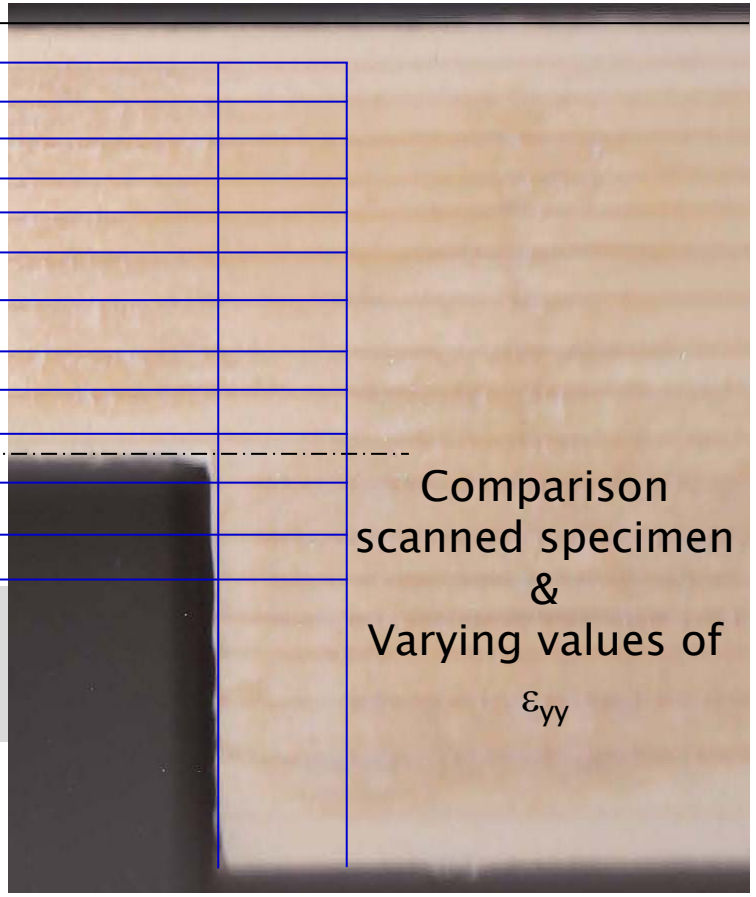
Specimen 2


F-U - N°11
load (kN)
displacement (mm)
Strain ϵ_{yy} - N°11
Strain ϵ_{xy} - N°11
x 10^-3

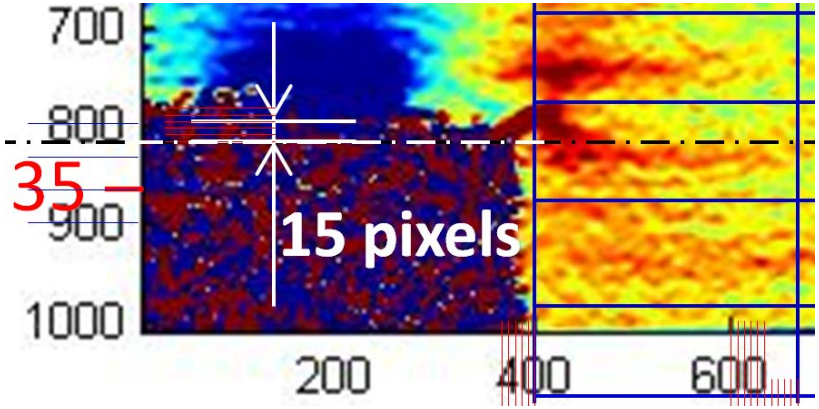
Specimen 2



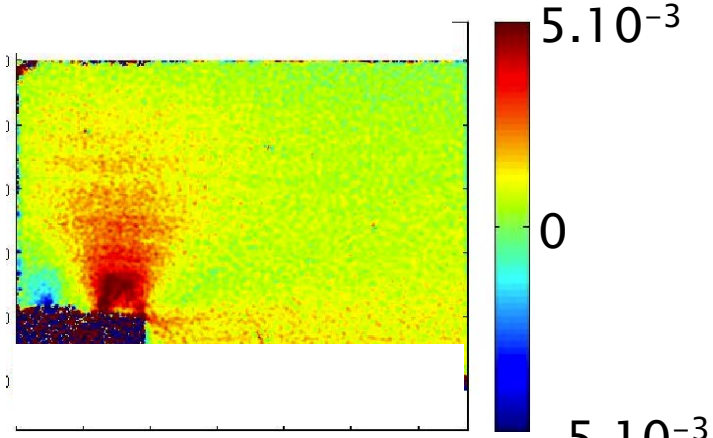
875 pixels ≡ 35 mm, ½ height specimen
15 pixels ≡ 0.6 mm ≡ 3 STD (½ Gaussian width of deformed computed field)



Comparison scanned specimen & Varying values of ε_{yy}

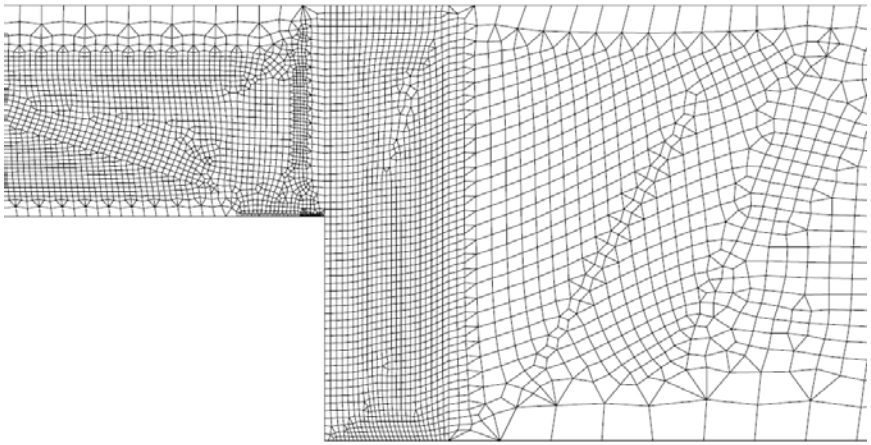


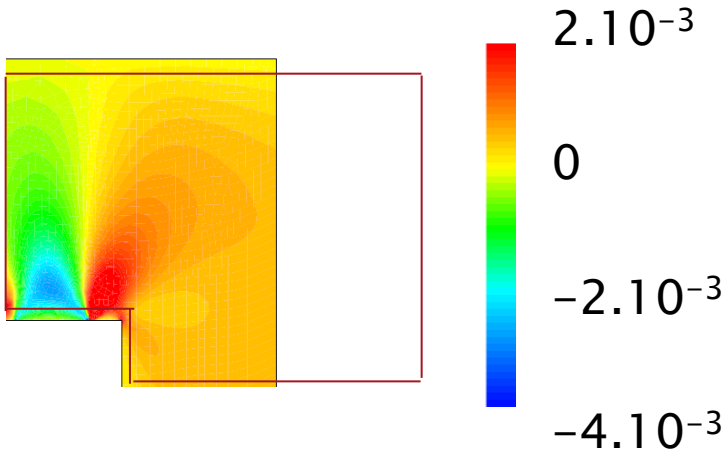
Specimen 2: comparison test/FEM



ε_{xy}

Experimental results

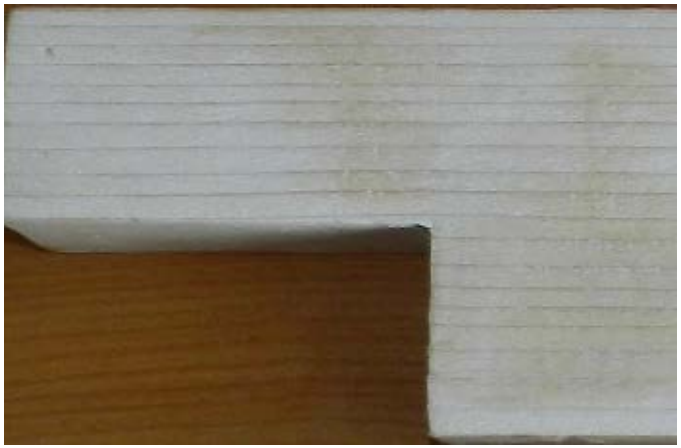


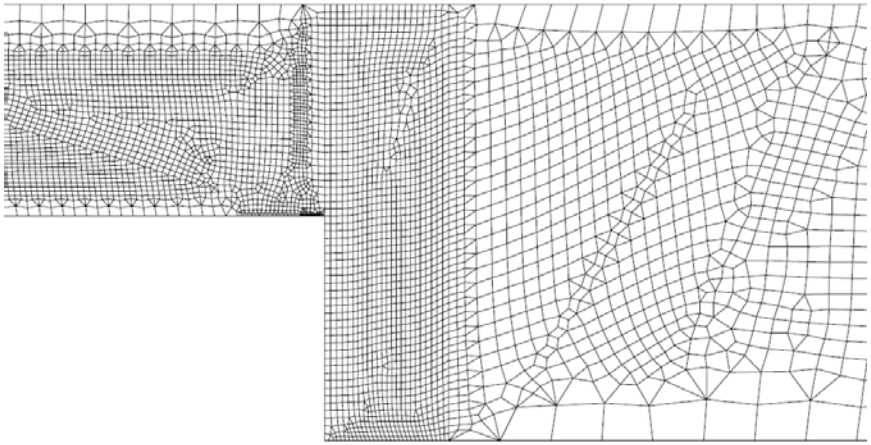


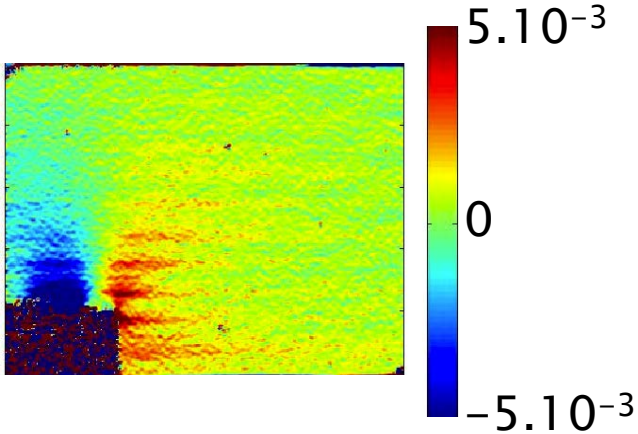
ε_{xy}

Numerical calculations

Specimen 2: comparison test/FEM

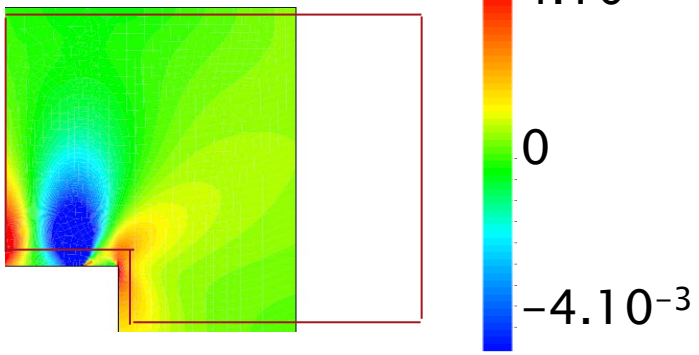






ε_{yy}

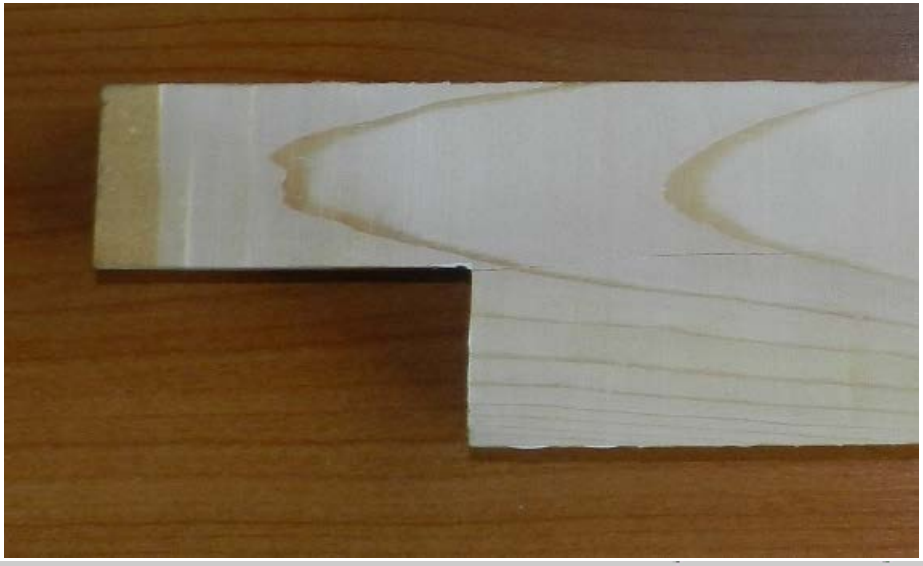
Experimental results

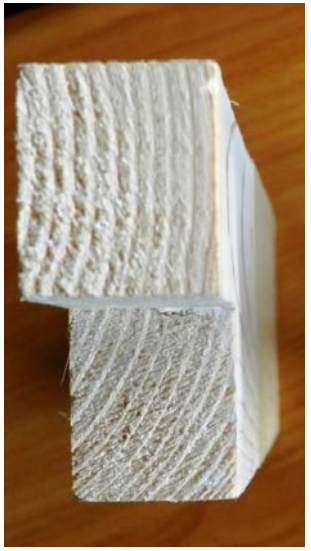


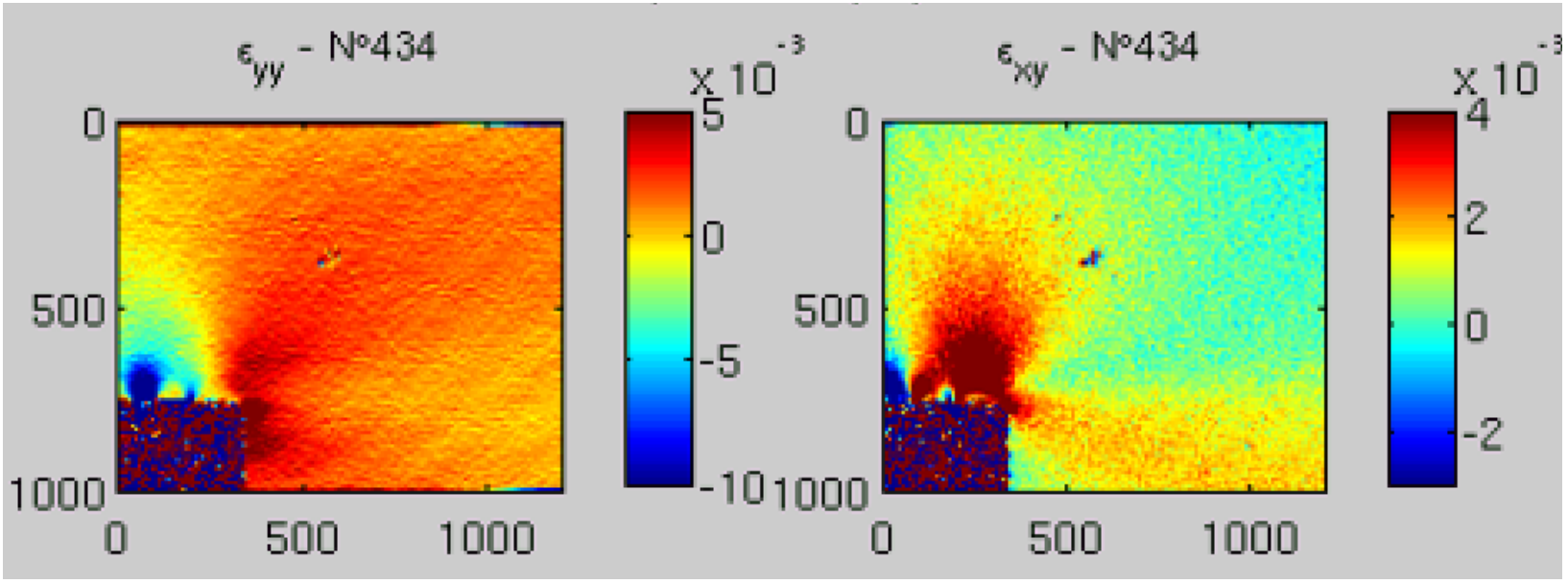
ε_{yy}

Numerical calculations

Specimen 1:






ϵ_{yy} - N°434
x 10^-3
5
0
-5
-10
0
500
1000
0
500
1000
ϵ_{xy} - N°434
x 10^-3
4
2
0
-2
0
500
1000
0
500
1000

- Experimental results on lattice elements
- Full-field displacement and strain measurements
- Comparison of experimental and numerical results

- Taking into account heterogeneities
- Modeling fracture process during the test
- Test of structures

Applying the grid method to investigate crack appearance and propagation in notched wood beam used in individual houses in Europe

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U. Peter, Lhoist, Belgium
V. Picandet, Université de Bretagne Sud, France
P. Walker, University of Bath, UK

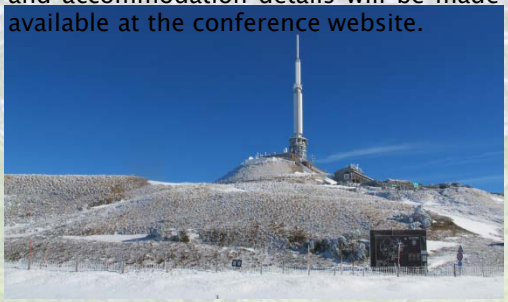
Abstracts and proceedings

Auth[illegible] pages abs[illegible]s and tabl[illegible]en in Eng[illegible]ewed. Abs[illegible]nically to 2[illegible]

Venue and accommodation

Located 400 km south of Paris and less than 200 km west of Lyon, Clermont Ferrand can be reached easily either by plane or by train. The most convenient transportation from Paris is the plane which departs either from airport Charles de Gaulle or Orly airport. You can also easily join Clermont Ferrand by train, from Bercy train station. It is a 3h trip from Paris to Clermont Ferrand and trains depart every hour during rush hours.

Delegates will have a wide choice of accommodation at special rates. World class hotels and guest houses are available close to the University. Hotel and accommodation details will be made available at the conference website.



Registration

The full delegate fee will be €600 which includes lunches, refreshments, welcome reception, conference dinner and proceedings. The RILEM delegate fee will be €400 which includes all the above. The student fee will be €350 which includes all the above. A day delegate fee will be €200 which includes lunch, refreshments and proceedings. Accompanying persons: €120, only for participation in the social events.

Conference website

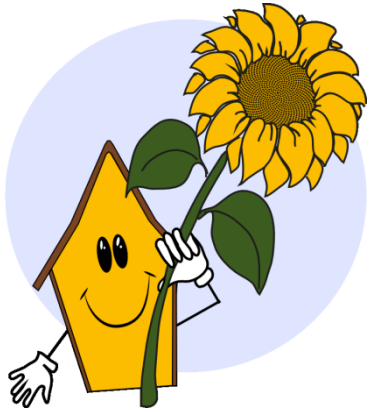
https://sites.google.com/site/ICBBM2015/

ICBBM

First International Conference on Bio-based Building Materials

June 21st - 24th 2015
Clermont-Ferrand, France

Announcement and Call for Papers



Your host

Clermont-Ferrand sits in the Massif Central and is surrounded by a major industrial area. The city is famous for the chain of volcanoes, the Chaîne des Puys surrounding it. The famous dormant volcano Puy-de-Dôme (10 km from the city) is one of the highest of these.

Clermont-Ferrand's most famous public square is *Place de Jaude*, on which stands a grand statue of Vercingétorix sitting imperiously on a horse and holding a sword. This statue was sculpted by Frédéric Bartholdi, who also created the Statue of Liberty.

Education is also an important factor in the economy of Clermont-Ferrand. The Université Blaise Pascal (named after the famous mathematician and philosopher) and Université d'Auvergne are located there and have a total student population of over 40 000, along with university faculty and staff.

The conference will take place in Polytech' Clermont-Ferrand, whose mission is to train well-rounded, highly skilled and innovative engineers experts at initiating and overseeing diverse international projects and with a high level in engineering sciences.

Scope

"We aim to be this century's leader in sustainable materials". Biomaterials are processed or engineered products obtained partially or fully from renewable biobased resources, including: natural fibre composites, bioplastics, biorubbers, biofoams, bioadhesives, bioinks, biobased paints and coatings.

The conference is expected to attract a wide range of academics, scientists, researchers, students, designers, policy makers and other industrialists from a wide variety of backgrounds, including fields of engineering, materials, sustainable, architecture, and ecological technologies, biomaterials, materials sciences, environmental engineering and government agencies, etc.

The ICBBM is an international forum for information dissemination and exchange, discussions and debates on research and practice related to innovative bio-construction materials and technologies with objectives for sustainable development.

Correspondence:

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24 Avenue des Landais - BP 206
F - 63174 AUBIERE Cedex (France)
Tel: +33 4 73 40 75 29
Email: 2015ICBBM@gmail.com

Conference topics

The general topics to be covered include:

- Natural fibres and materials
- Wood and bamboo
- Earthen ramped
- Mechanical performances of bio-based building materials
- Hygroscopic and hygrothermal properties of biomaterials
- Acoustic of bio-materials
- Eco-friendly binders with low CO_2-emission and low embedded energy
- Durability and performance of bio-construction materials
- Life-cycle assessment of materials
- Construction with low binder sprayed concrete on bio-based building materials
- Green and renewable energy applications in construction
- Construction materials and technologies for sustainability, energy efficiency
- Advances in research methodologies and bio-materials testing

Important dates

Submission of abstracts: <November 30 th 2014
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