



Innovative modelling, assessment and reinforcement: the wooden dome of the Valentino Castle in Torino

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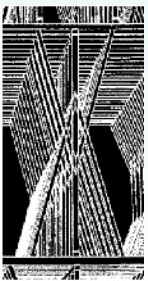
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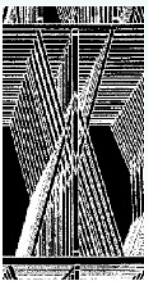
OUTLINE

- **Introduction**
- **Geometrical survey**
 - *Laser scanning*
 - *Orhophotograpy*
 - *Structural survey*
- **Materials characterization**
 - *Non destructive techniques*
- **Preliminary Finite Element Modelling**
- **Innovative reinforcement: vacuum impregnation**
- **Conclusions**

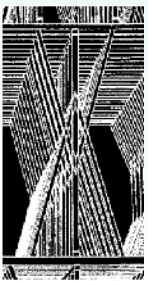
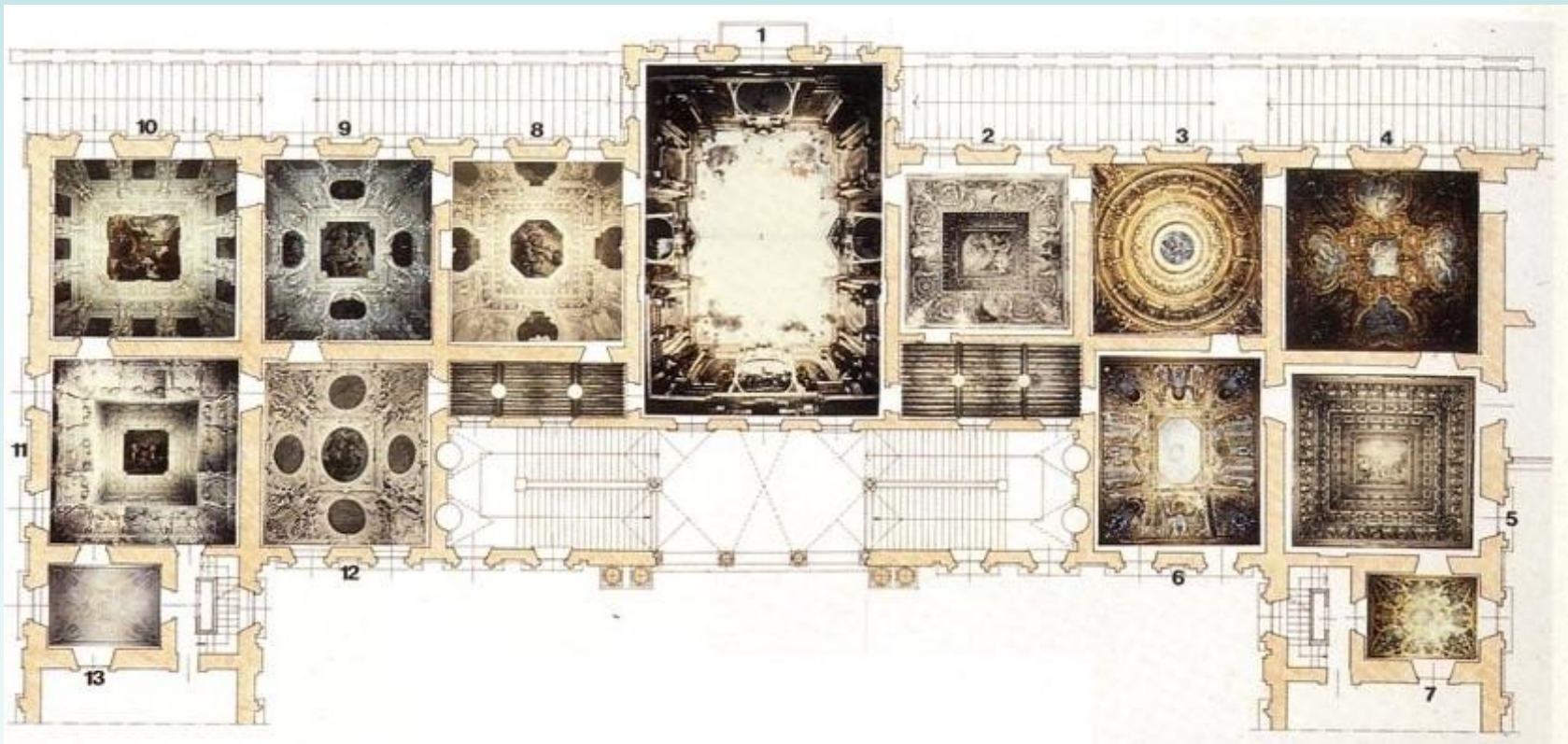




INTRODUCTION

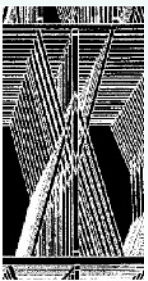


INTRODUCTION

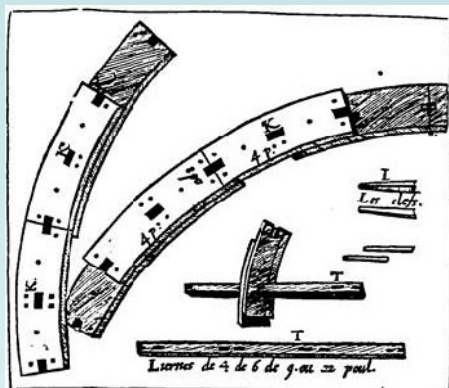




INTRODUCTION

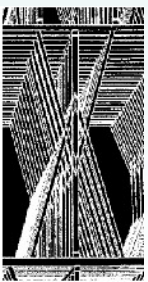
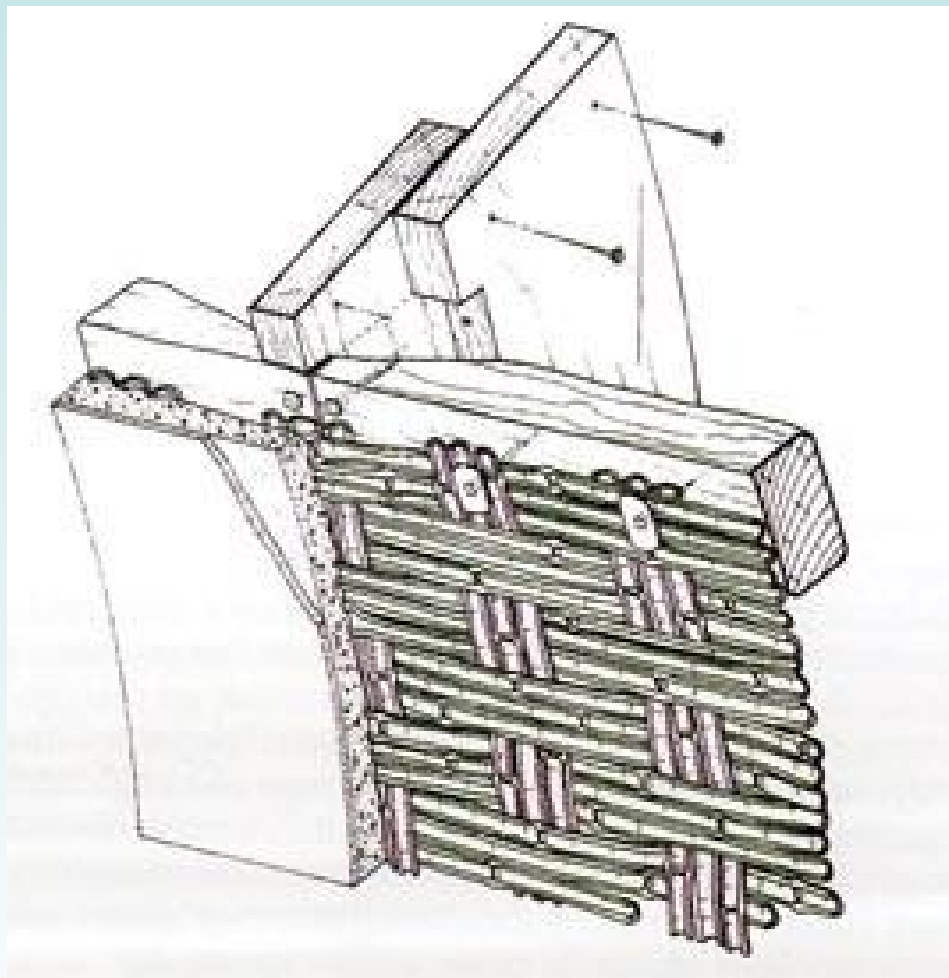
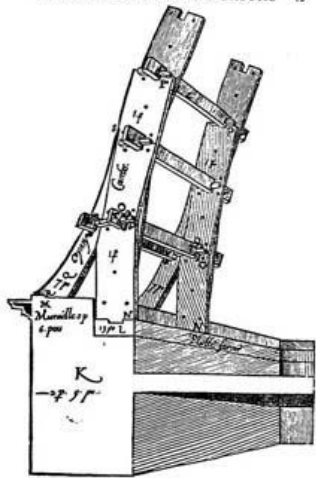


INTRODUCTION



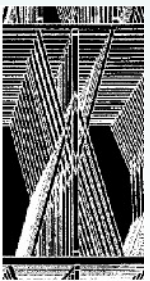
Comme les pièces des Courbes montrent quand elles
sont toutes assemblées en leur hémicycle avec leurs liernes.

INVENTIONS POUR BIEN BASTIR. 18





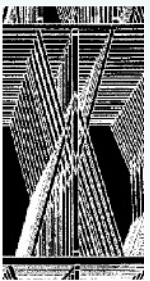
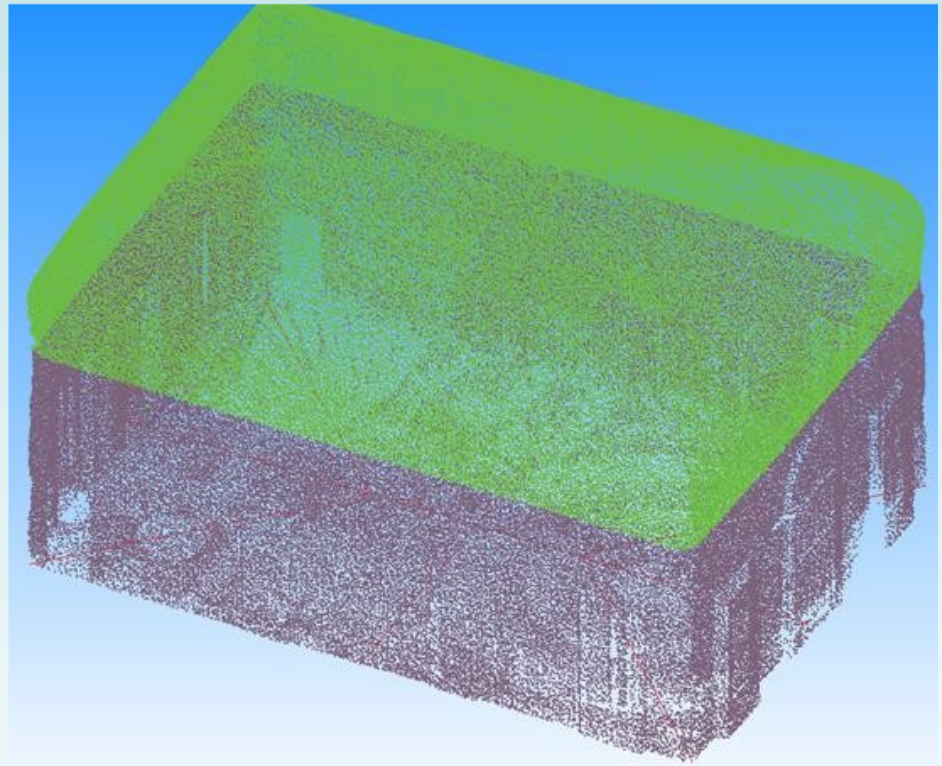
INTRODUCTION



LASER SURVEY

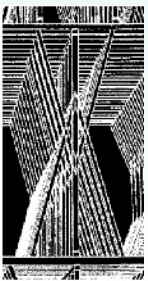
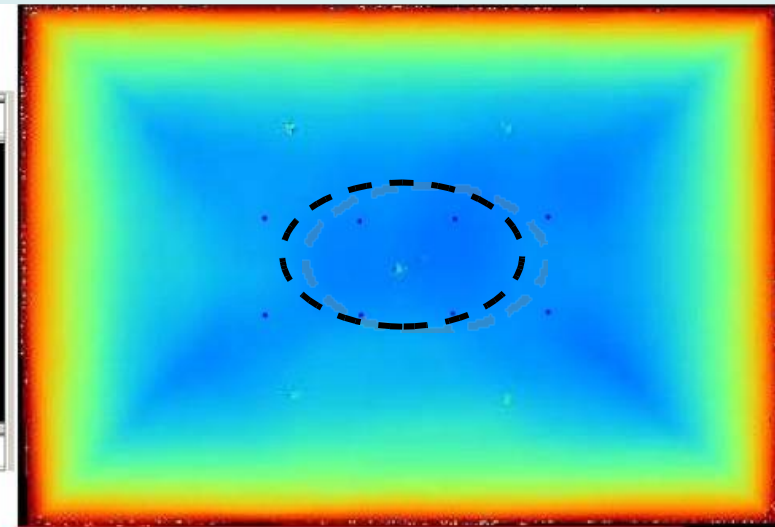
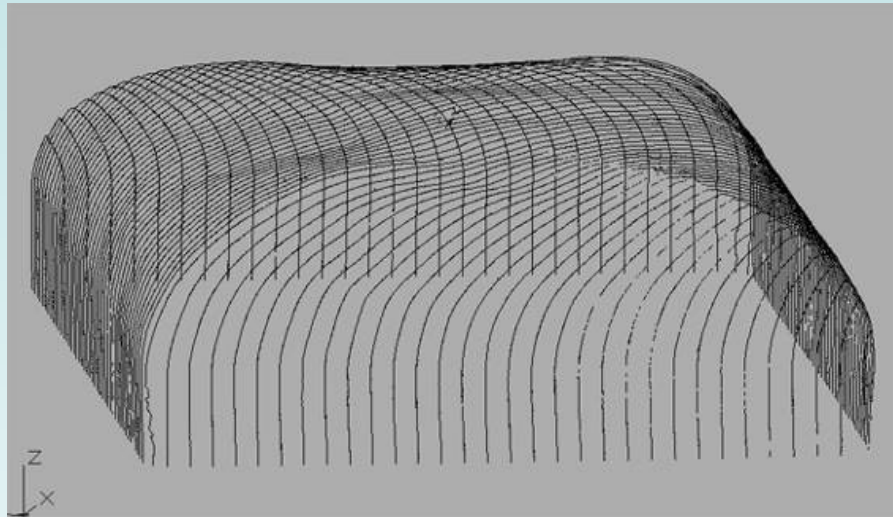


Laser scanner Leica HDS6100

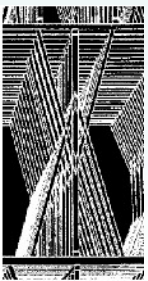
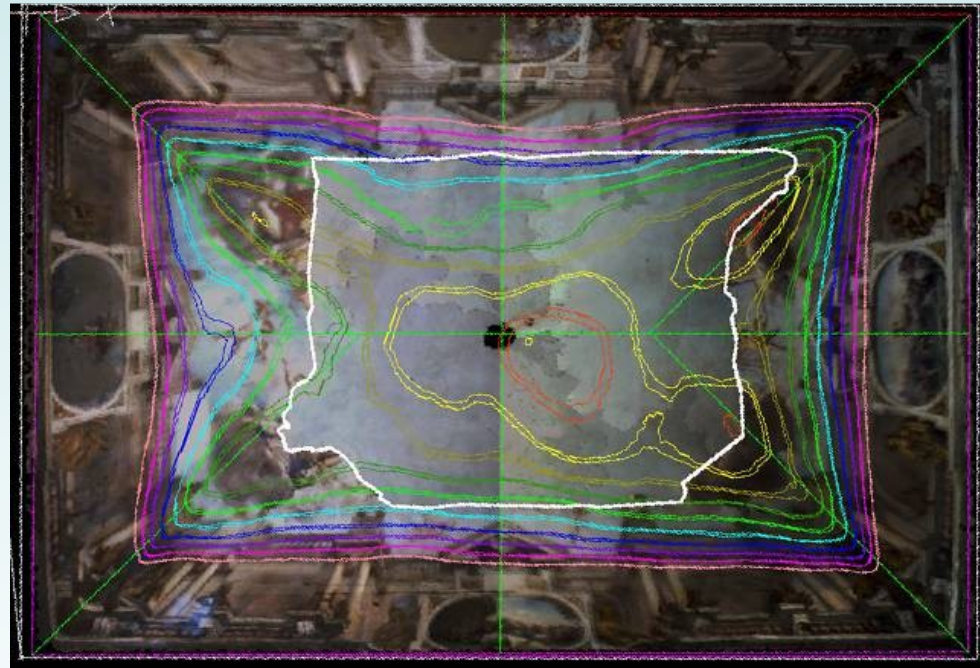
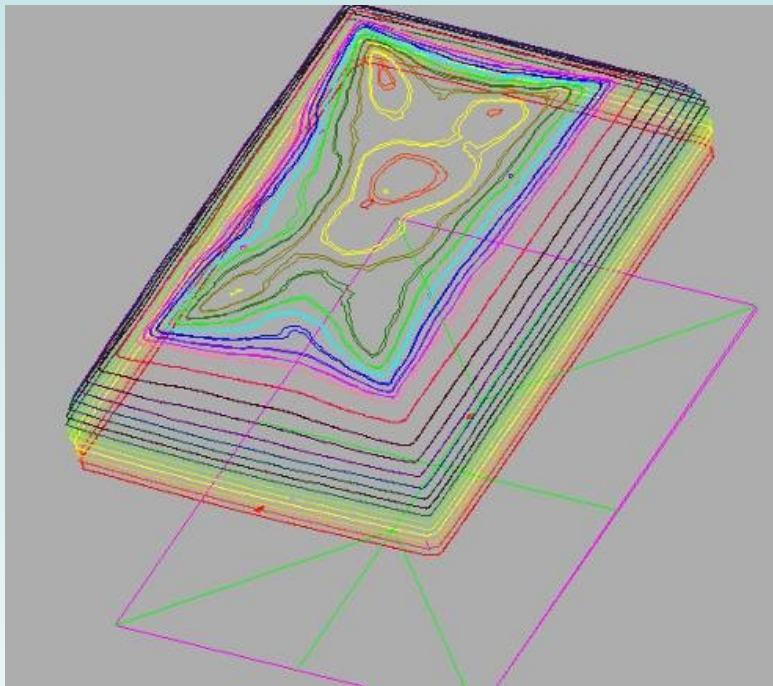




LASER SURVEY

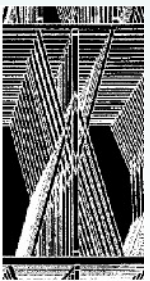
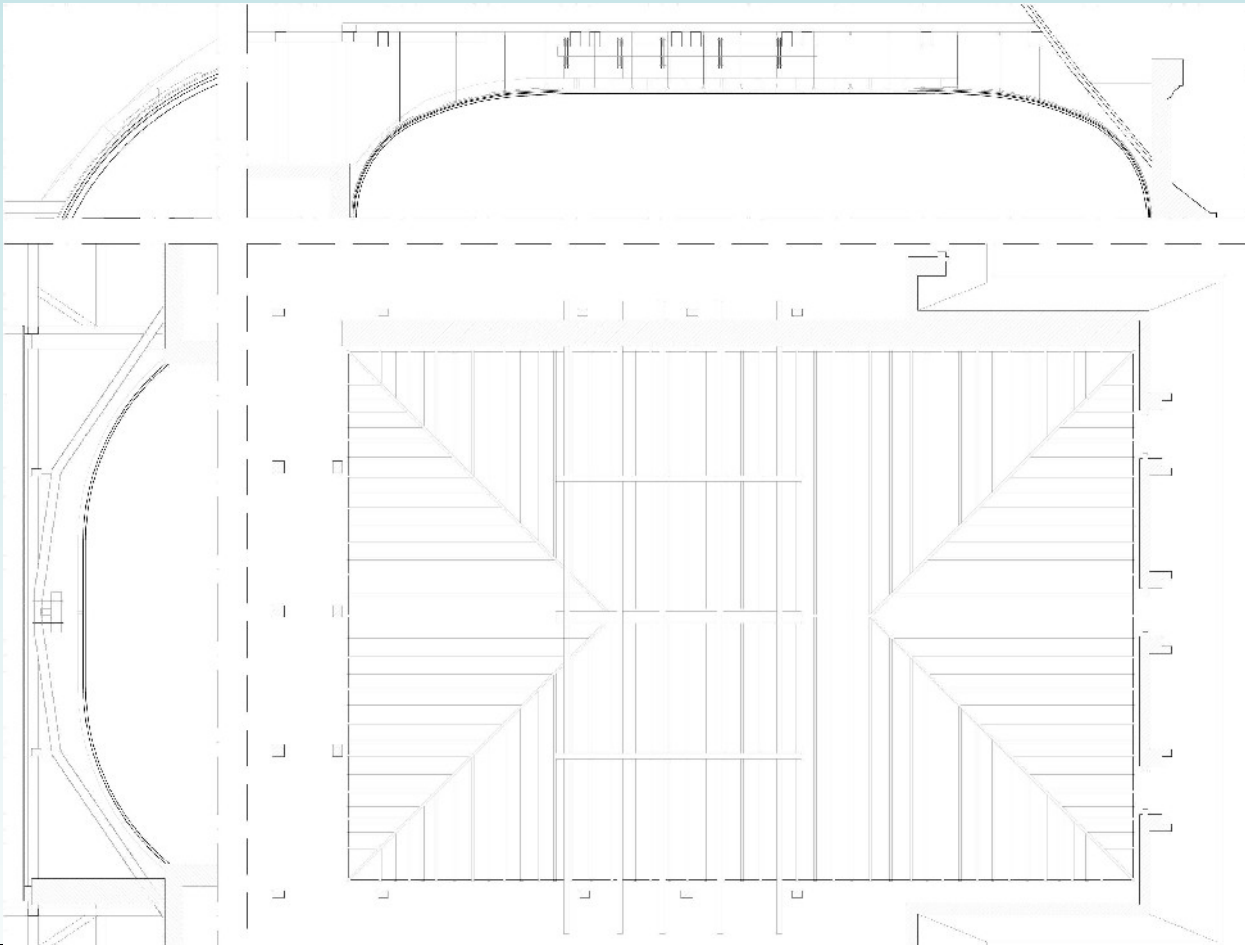


ORTHOPHOTOGRAPHY





STRUCTURAL SURVEY

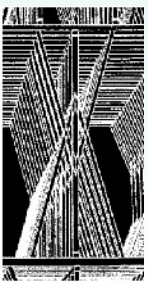


MATERIALS CHARACTERIZATION

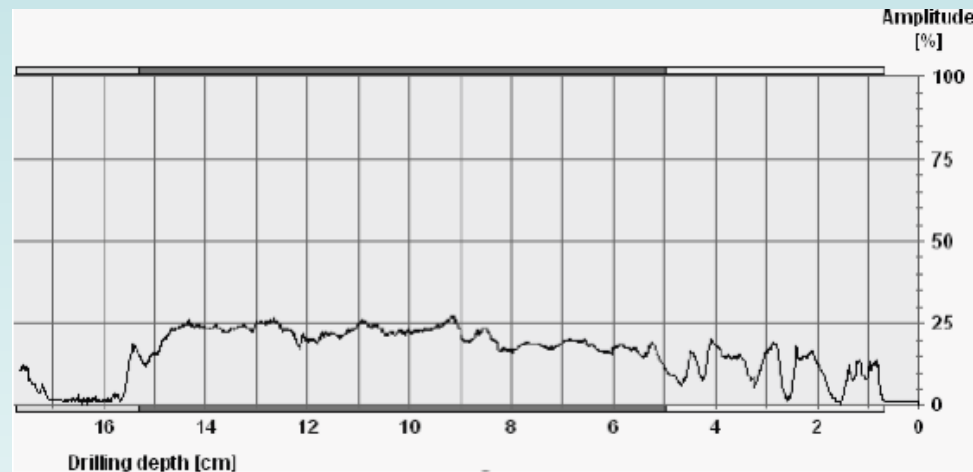
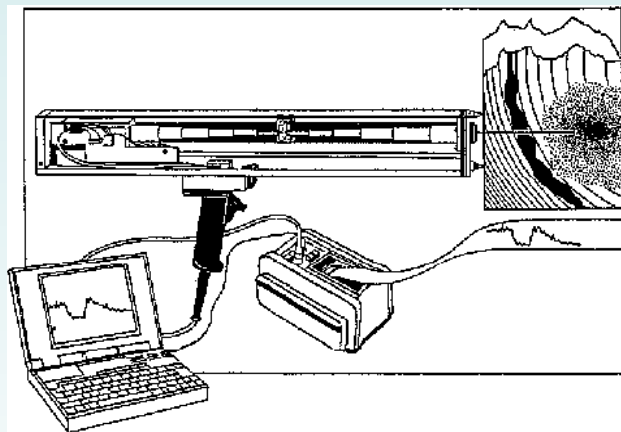
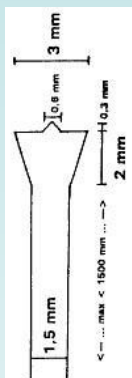


Figura xx: Campioni prelevati dall'estradosso della volta del Salone.

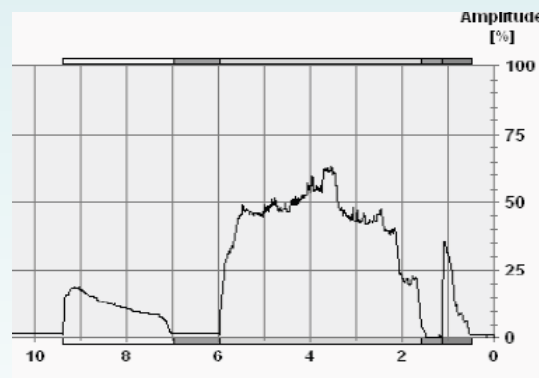
- a) Trave angolare B,
- b) Travetto 15,
- c) *Camorcanna* - strato di incannicciato.



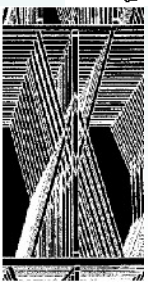
RESISTOGRAPH



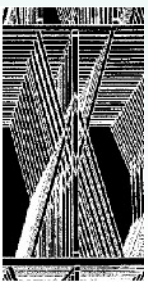
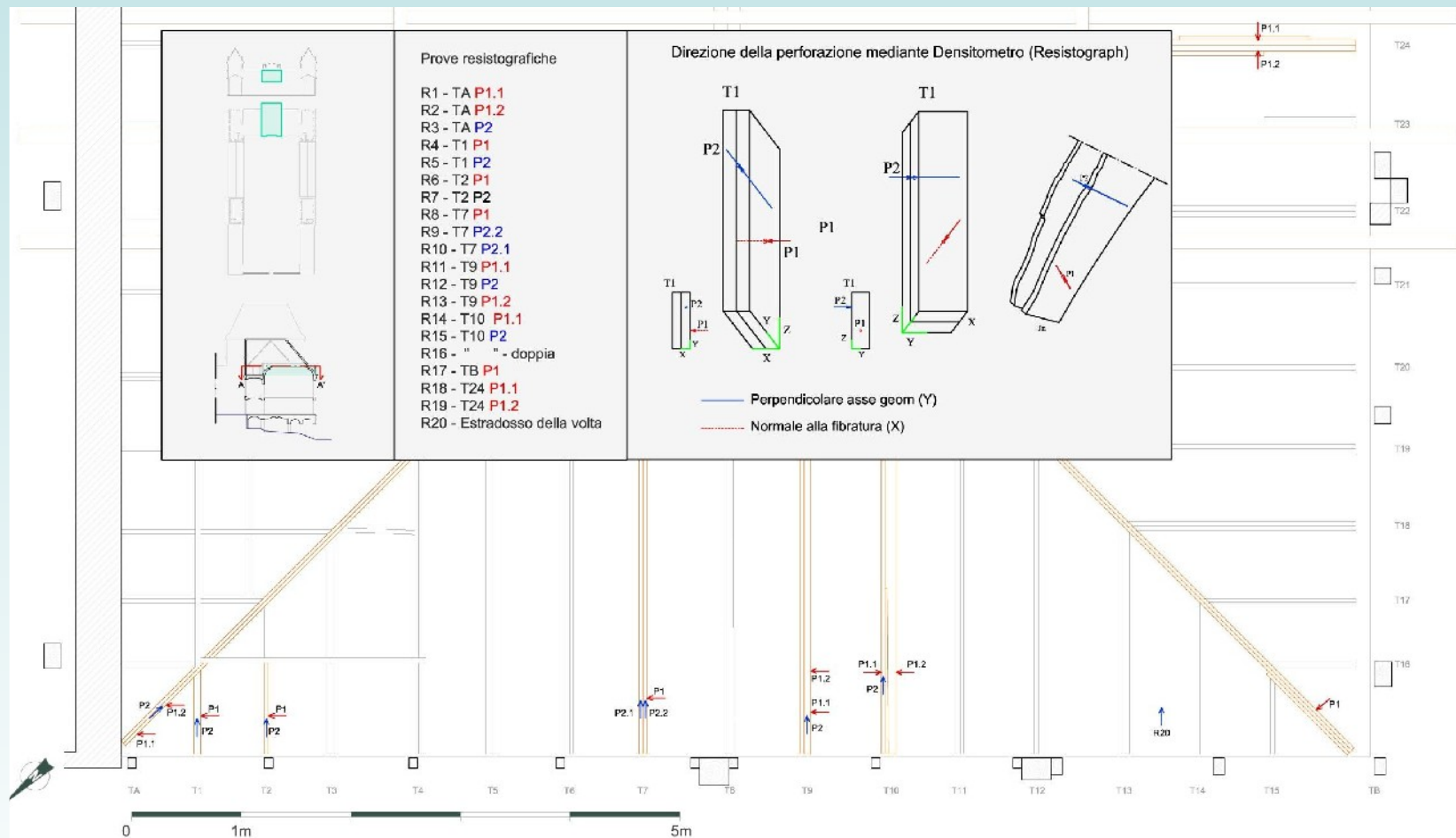
Rib height



Rib thickness

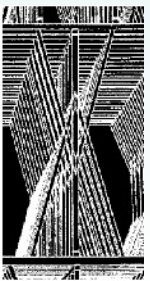
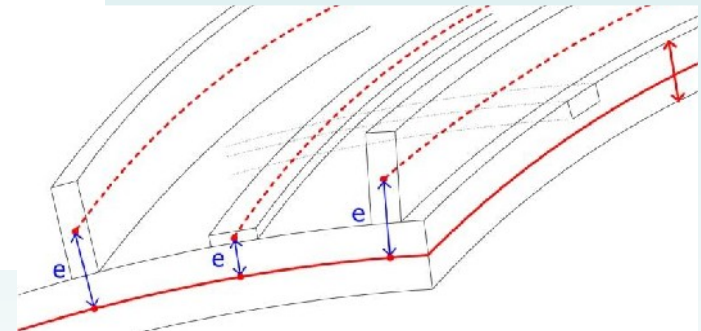
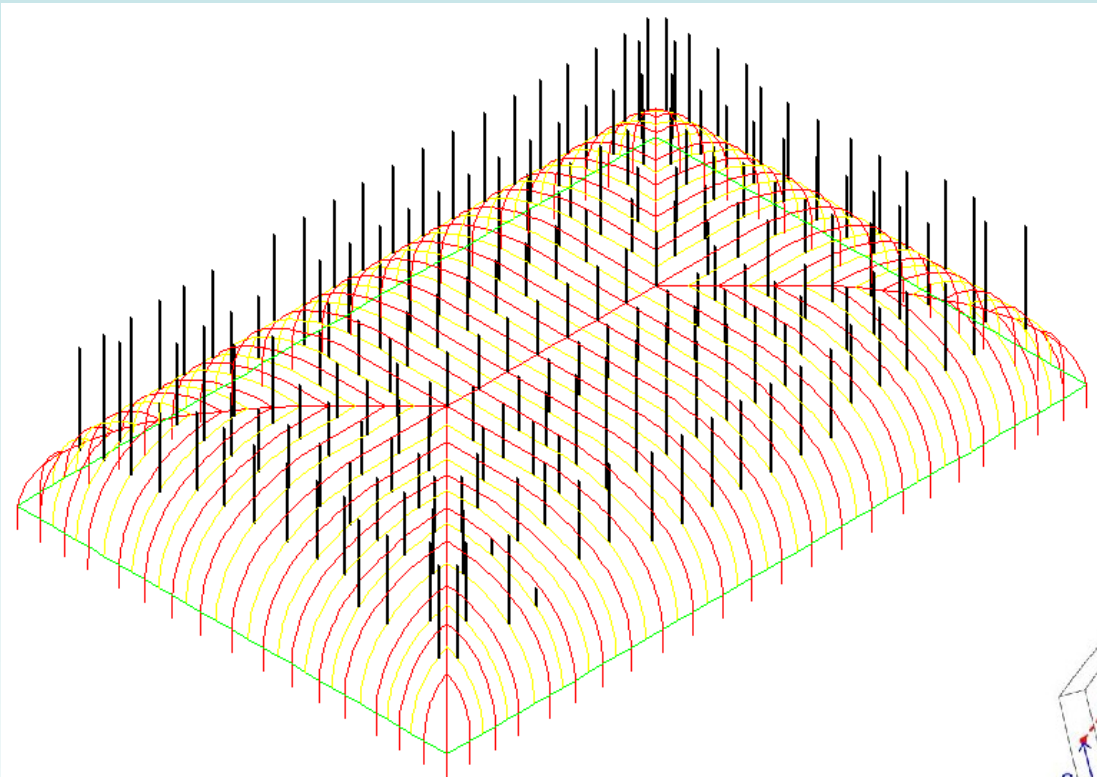


RESISTOGRAPH

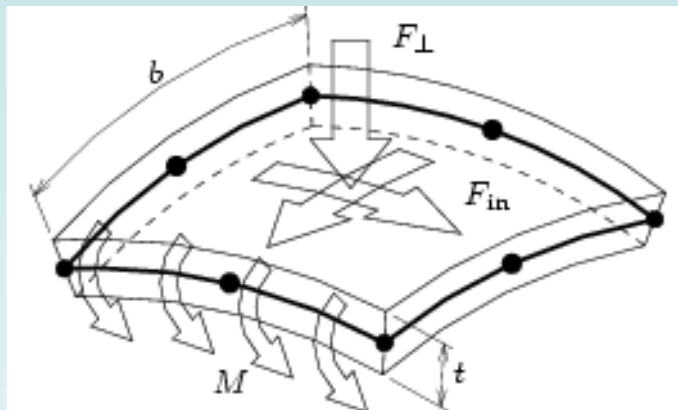




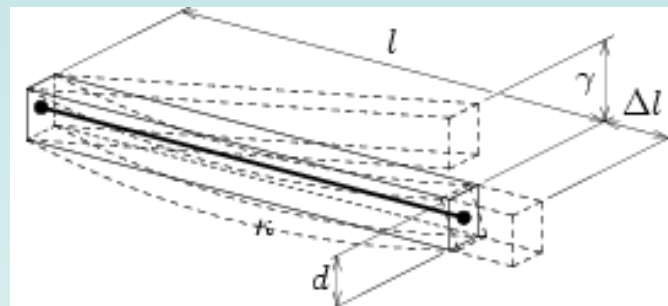
PRELIMINARY FE MODELLING



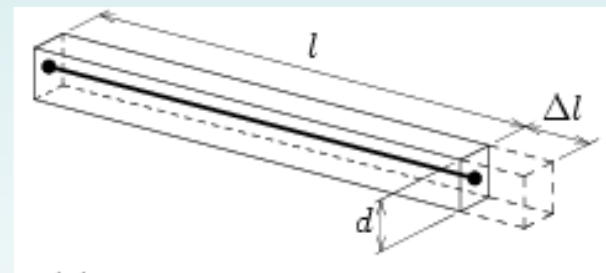
PRELIMINARY FE MODELLING



Curved shell

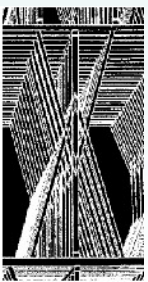


Beam

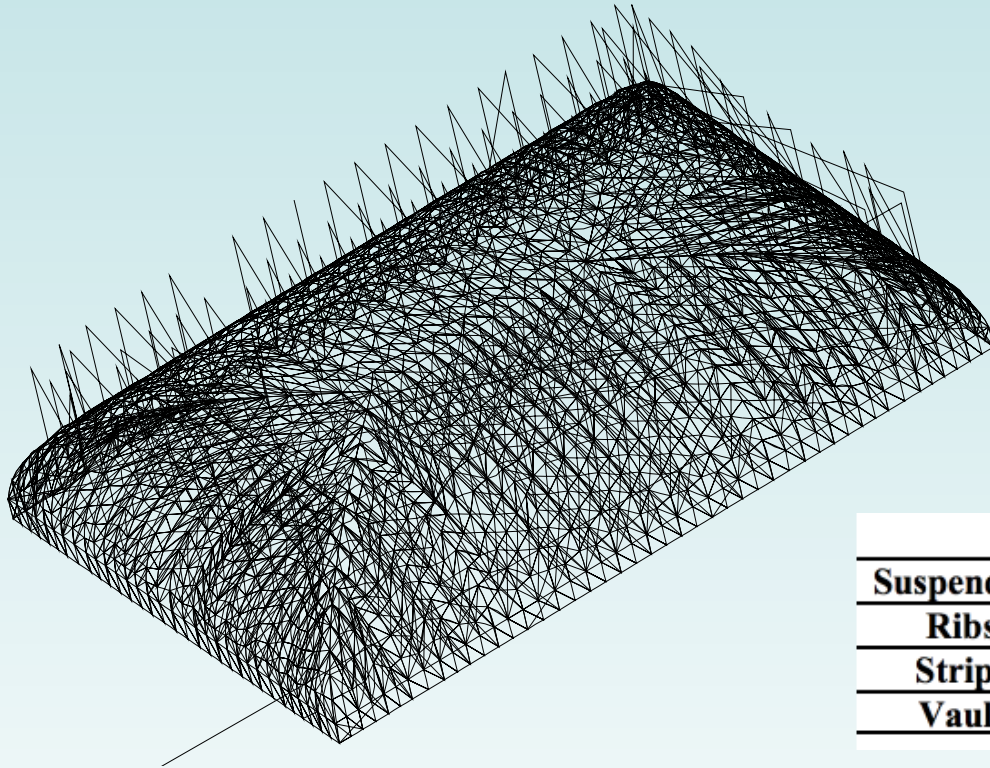


Truss

iDIANA (TNO, The Netherlands)



PRELIMINARY FE MODELLING



Mesh

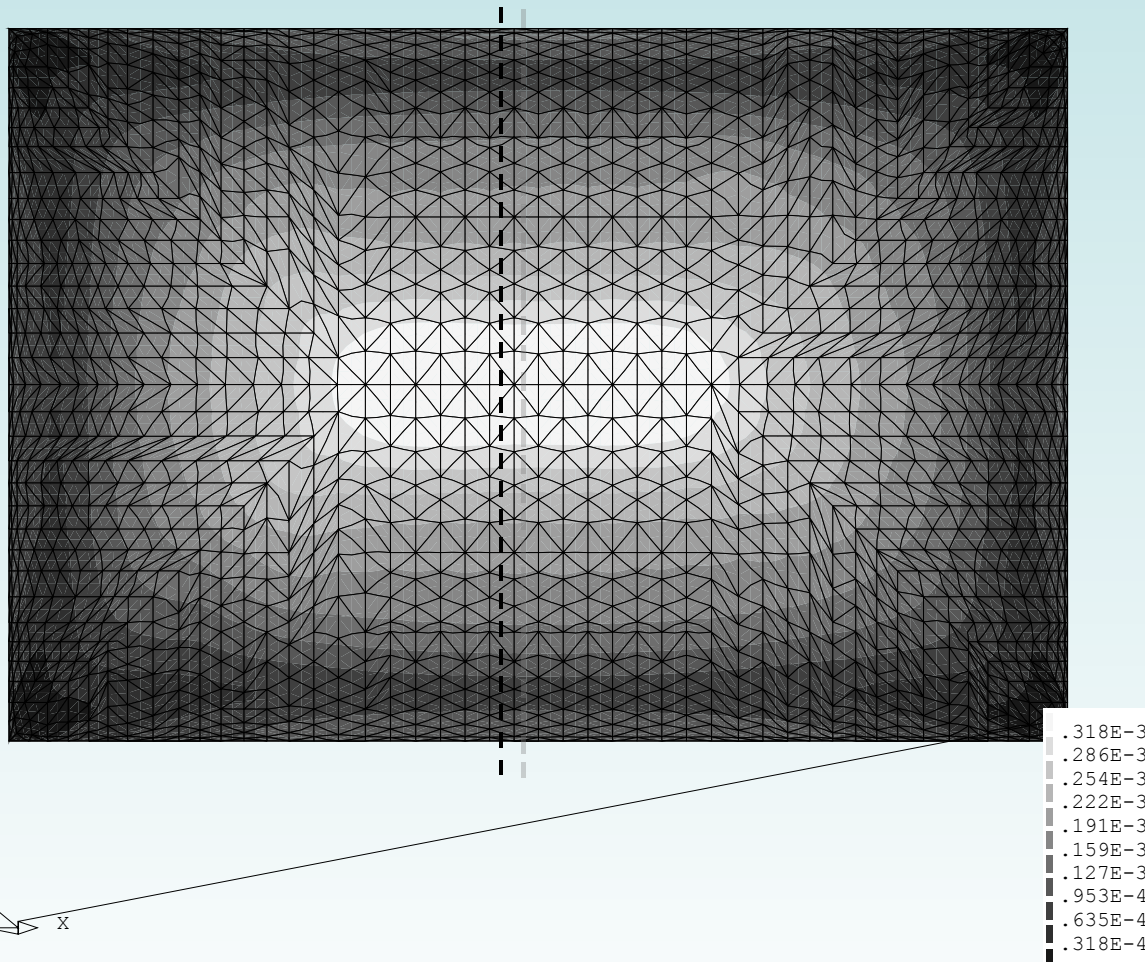
	E [Pa]	ν	ρ [kg/m ³]	type
Suspenders	2.1E+11	0.3	7850	truss
Ribs	8E+9	0.2	510	beam
Strips	2.1E+11	0.3	7850	beam
Vault	13E+9	0.3	1500	shell

Mechanical parameters



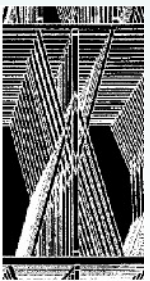
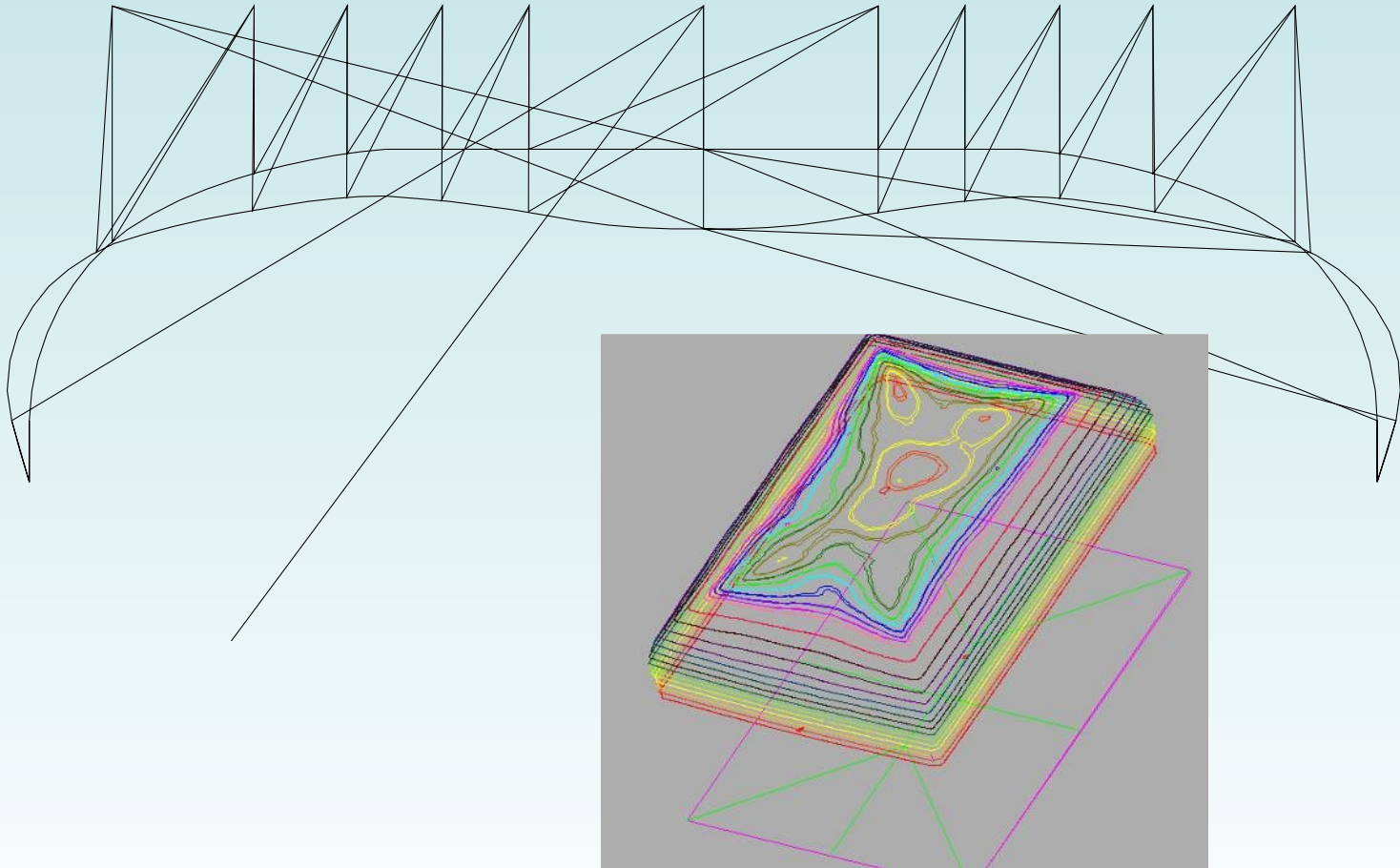


PRELIMINARY FE MODELLING



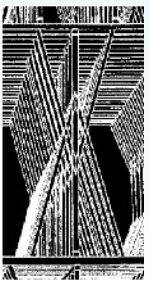


PRELIMINARY FE MODELLING





VACUUM IMPREGNATION





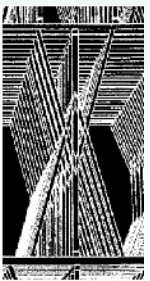
VACUUM IMPREGNATION

Regalrez 112

Acrylic Resin B-72

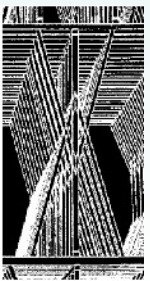
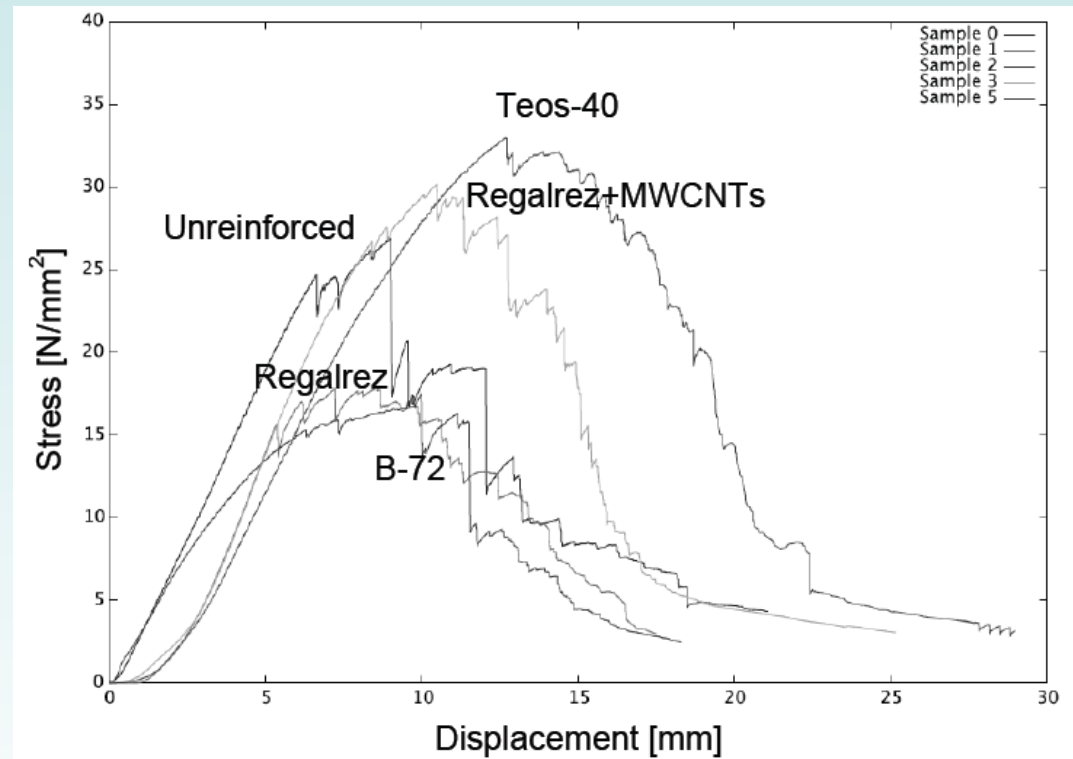
Teos-40

(MWCNTs) from Mistui®





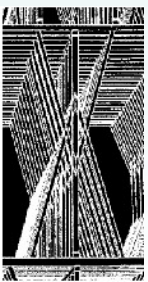
MECHANICAL TESTS





CONCLUSIONS

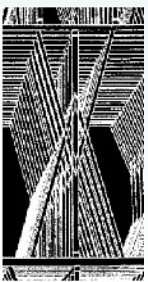
- The case study of the Hall of Honor of the Valentino Castle in Torino, Italy, is presented.
- The detailed laser survey, and ortophotography allowed for an accurate modelization of the vault geometry at the present state, and the localization of the main geometrical anomalies.
- This information is combined with some non-destructive analyses and with the structural survey of the extrados of the vault, according to the Italian standards.
- The preliminary finite element model is confirmed as far as the deformed shape is concerned, and also the loosen suspenders can be localized. The suggestion is NOT to provide tightening to the loosen suspenders.
- In addition, some results are put forward, about the possible use of reversible acrylic resins in combination with nanocomposites and vacuum impregnation.





REFERENCES

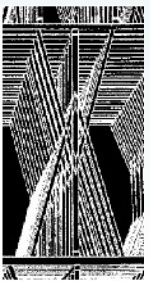
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The financial support provided by the Piedmont Region (Italy) to the POR-FESR Project “Nanomateriali per la Manutenzione ed i Recupero di Manufatti Lignei” (**M.A.N.**) is gratefully acknowledged.





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